DEFENDANTS' INVALIDITY CONTENTIONS FOR U.S. PAT. 9,122,965

EXHIBIT A:

Kim-329, Vega, Keen, Yamazaki-454, Park-846, Park-589, Park-942, Matsuo, Kowalski, Gerstenberger, Wilson, Akaida, Florek-442, Florek-677, Honkanen, Hasegawa, Dachs, and Claessen

As demonstrated in the claim charts below, the claims of U.S. Patent No. 9,122,965 ("the '965 patent") are invalid (a) under 35 U.S.C. § 103 as obvious over each of U.S. Pub. No. 2008/0278329 ("Kim-329"), U.S. Pat. No. 6,282,407 ("Vega"), U.S. Pub. No. 2008/0194200 ("Keen"), U.S. Pub. No. 2008/0093454 ("Yamazaki-454"), K.R. 2004/0040846 ("Park-846"), U.S. Pub. No. 2005/0224589 ("Park-589"), K.R. 2007/0002942 ("Park-942"), U.S. Pub. No. 2007/0232232 ("Matsuo"), U.S. Pub. No. 2008/0245851 ("Kowalski"), D.E. 102007019272 ("Gerstenberger"), W.O. 2007/135434 ("Wilson"), U.S. Pub. No. 2005/0161508 ("Akaida"), W.O. 2010/128442 ("Florek-442"), U.S. Pub. No. 2010/0274677 ("Florek-677"), U.S. Pub. No. 2008/0309490 ("Honkanen"), J.P. 2008/008763 ("Hasegawa"), C. Dachs, NFC — the intuitive contactless technology becomes reality, 122 e & i Elektrotechnik und Informationstechnik 466 (2005) ("Dachs"), and U.S. Pub. No. 2008/0150687 ("Claessen") and (b) under 35 U.S.C. § 103(a) as obvious over Kim-329, Vega, Keen, Yamazaki-454, Park-846, Park-589, Park-942, Matsuo, Kowalski, Gerstenberger, Wilson, Akaida, Florek-442, Florek-677, Honkanen, Hasegawa, Dachs, and Claessen combined with the knowledge of a person of ordinary skill in the art, Applicant's Admitted Prior Art, and/or the additional prior art references discussed in Exhibits A and Exhibits A1–A5, the contents of which are hereby incorporated by reference into this chart. One of ordinary skill in the art, as of the priority date of the '965 patent, would have known to combine the prior art elements disclosed by the foregoing references using known methods, and to use these elements according to their established functions in order to achieve a known and predictable result.

Defendants have conducted the invalidity analysis herein based at least in part and in some instance entirely upon Plaintiff's apparent application of the claims of the '965 patent. By charting the prior art against the claims and limitations herein, Defendants are not admitting or agreeing to Plaintiff's application of the claims at issue in this case, and these charts should not be interpreted as an admission or concession by Defendants that any particular construction or application of any claim limitation by Plaintiff is correct or proper. Additionally, these charts provide representative examples of portions of the charted references that disclose the indicated limitations of the claims; additional portions of these references other than the representative examples provided herein may also disclose the indicated limitation(s) and Defendants contend that the asserted claims are invalid in light of the charted reference(s) as a whole in its or their entirety. Where a particular figure is cited, the citation should be understood to encompass the caption and description of the figure as well as any text relating to or describing the figure. Conversely, where particular text referring to a figure is cited, the citation should be understood to include the figure as well.

Claim Element	Exemplary Citations to Kim-329, Vega, Keen, Yamazaki-454, Park-846, Park-589, Park-942, Matsuo, Kowalski, Gerstenberger, Wilson, Akaida, Florek-442, Florek-677, Honkanen, Hasegawa, Dachs, and Claessen
1[pre]. A mobile device comprising:	Vega at Abstract, 3:28–45, 3:49–52, 4:26–28, and 5:26–68.

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Claim Element	Exemplary Citations to Kim-329, Vega, Keen, Yamazaki-454, Park-846, Park-589, Park-942, Matsuo, Kowalski, Gerstenberger, Wilson, Akaida, Florek-442, Florek-677, Honkanen, Hasegawa, Dachs, and Claessen
	Keen at Figure 2, Figure 5, Figure 7, [0003], [0004], [0007], [0010], [0013], [0026], [0048], [0067], [0083], [0084], [0088], [0091], [0093], [0101], [0102], and [0103]. *See also* Keen at Abstract, [0025], [0028], [0046], [0050], [0051], [0053], [0054], [0055], [0056], [0058], [0087], [0090], [0092], [0095], and [0098]. Yamazaki–454 at Abstract, Figure 2, Figure 6, Figure 10, Figure 13, Figure 26B, Figure 26C, Figure 26D, Figure 27A, Figure 27B, Figure 27C, Figure 27D, Figure 27E, [0012], [0033], [0065], [0067], [0069], [0117], [0140], [0275], [0276], [0277], [0278], [0279], [0280], [0281], [0282], and [0283]. *See also* Yamazaki–454 at [0056], [0057], [0071], [0105], [0115], [0119], [0137], and [0273]. Park–589 at [0036]. *See also* Park–589 at [0008] and [0087]. Matsuo at Abstract, Figure 1, Figure 2, Figure 3, Figure 4, Figure 5, Figure 7, Figure 10, Figure 11, Figure 12, Figure 13, Figure 14, [0005], [0010], [0011], [0012], [0015], [0033], [0034], [0035], [0036], [0037], [0038], [0039], [0040], [0041], [0042], [0047], [0049], [0051], [0053], [0055], [0057], [0058], [0062], [0063], [0064], [0066], [0067], [0068], [0069], [0070], [0075], [0077], [0078], [0081], [0082], [0083], [0086], [0087], [0088], and [0089]. Park–846 at Figure 6a, Figure 6b, [0009], [0025], [0039], [0065], [0066], [0067], [0068], and [0069]. Kowalski at Figure 5, Figure 6, Figure 8, Figure 9, Figure 28A, [0004], [0006], [0007], [0009], [0013], [0015], [0017], [0021], [0026], [0027], [0030], [0031], [0032], [0037], [0045], [0050], [0085], [0093], [0129], [0131], [0133], [0134], [0140], [0145], [0148], [0149], and [0152]. Gerstenberger at Abstract, Figure 7, [0001], [0002], [0003], [0004], [0007], [0008], [0018], [0035], [0040], [0042], [0043], and [0055]. Wilson at 1:6–13, 3:5–23, 9:26–10:19, 17:23–18:1, 18:9–19, 19:3–16, 20:27–21:8, 22:2–9, Figure 1, and Figure 3. Akaida at Figure 9, [0014], [0018], [0029], [0030], [0050], [0051], and [0052]. Florek–442 at Abstract, 1:7–15, 2:18–24, 3:10–19, 4:21–31, 4:32–5:6, 5:7–15, 5:16–28, 5:29–6:4, 6:11–22, 8:4–12, 9:1–16, 10:15–20, 10:29–11:6, 11:21–24, 12:24–13:2, 13:15–14:4, 14:16–29, 16:1–16, 16:17–22,

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Claim Element	Exemplary Citations to Kim-329, Vega, Keen, Yamazaki-454, Park-846, Park-589, Park-942, Matsuo, Kowalski, Gerstenberger, Wilson, Akaida, Florek-442, Florek-677, Honkanen, Hasegawa, Dachs, and Claessen
	16:31–17:4, 18:22–28, 18:29–34, 19:21–20:9, 20:10–29, 22:9–12, 22:20–26, 22:27–23:16, 24:2–11, 24:24–34, 25:14–29, 27:10–12, 27:13–17, Figure 2, Figure 5, Figure 6, Figure 7, Figure 8, Figure 10, Figure 11, and Figure 14. Hasegawa at Abstract, [0001], [0003], [0005], [0006], [0008], [0010], [0013], [0045], [0051], [0053], [0092], [0113], [0128], [0129], [0146], [0148], [0159], [0163], [0165], [0168], [0186], [0197], [0200], [0220], [0223], [0238], [0244], and [0261]. Honkanen at Figure 1, Figure 2b, Figure 3c, [0005], [0009], [0012], [0018], [0030], [0031], [0032], [0033], [0034], [0035], [0036], [0037], [0038], [0041], [0044], [0045], [0047], [0051], [0052], [0056], [0057], and [0118]. Park–942 at Abstract, Figure 17, 3–4, 4–5, 8–9, 9–10, 10–11, 12, 12–13, 13–14, 14, and 15. Dachs at Abstract, Figure 1, Figure 2, 467, 468, 468–469, 469, Figure 5, 470, 470–471, and Figure 7. Florek–677 at Abstract, Figure 1, Figure 2, [0001], [0003], [0004], [0006], [0008], [0010], [0012], [0020], [0023], [0024], [0025], and [0027]. Kim–329 at Figure 2, Figure 3, [0008], [0037], [0040], [0043], [0045], and [0046]. Claessen at [0002], [0013], [0026], and [0041].
[1a] a smartcard controller;	Vega at Figure 3, Figure 7, 5:26–68, 7:57–8:17, 8:18–45, 8:63–9:17, 9:30–60, 13:7–14:10, and 15:38–61. *See also* Vega at 7:14–56 and 15:20–37. Keen at Abstract, Figure 1, Figure 2, Figure 3, Figure 4, Figure 5, Figure 6, [0001], [0004], [0013], [0015], [0018], [0029], [0030], [0031], [0051], [0052], [0053], [0054], [0055], [0058], [0067], [0069], [0074], [0081], [0084], [0085], [0092], and [0102]. *See also* Keen at [0024], [0032], [0033], [0056], [0086], [0089], [0090], [0093], and [0098]. Yamazaki–454 at Figure 1, Figure 2, Figure 4, Figure 5, Figure 6, Figure 7A, Figure 7B, Figure 8, Figure 9, Figure 10, [0028], [0033], [0034], [0036], [0037], [0038], [0044], [0045], [0053], [0054], [0055], [0056], [0057], [0060], [0061], [0062], [0065], [0067], [0068], [0069], [0070], [0071], [0074], [0077], [0078], [0079], [0095], [0115], [0118], [0119], [0120], [0121], [0122], [0273], [0275], [0279], [0280], [0281], and [0282].

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Claim Element	Exemplary Citations to Kim-329, Vega, Keen, Yamazaki-454, Park-846, Park-589, Park-942, Matsuo, Kowalski, Gerstenberger, Wilson, Akaida, Florek-442, Florek-677, Honkanen, Hasegawa, Dachs, and Claessen
	See also Yamazaki–454 at [0018], [0023], [0024], [0029], [0030], [0031], [0032], [0035], [0064], [0066], [0073], [0075], [0090], [0094], [0102], [0105], [0112], [0114], [0137], [0150], [0268], and [0269]. Park–589 at Abstract, Figure 1, Figure 2, Figure 3, Figure 6, Figure 7, [0003], [0006]–[0007], [0008], [0009], [0010], [0011], [0016], [0017], [0018], [0019], [0020], [0021], [0031], [0032], [0033], [0035], [0036], [0040], [0042], [0043], [0045], [0046], [0047], [0048], [0049], [0051], [0052], [0055], [0056], [0058], [0059], [0060], [0062], [0063], [0064], [0065], [0068], [0069], [0070], [0071], [0072], [0073], [0074], [0076], [0079], [0080], [0081], [0082], [0084], [0085], [0086], [0087], [0088], [0089], [0090], [0091], [0092], claim 1, claim 2, claim 3, claim 4, claim 5, claim 6, claim 7, claim 8, claim 9, claim 10, claim 11, claim 12, claim 13, claim 14, claim 15, claim 16, claim 17, and claim 18. *See also* Park–589 at [0023], [0025], [0028], [0029], [0030], [0041], [0054], and [0061]. Matsuo at Figure 2, [0005], [0008], [0009], [0010], [0014], [0015], [0034], [0035], [0056], [0058], [0059], [0062], [0064], and [0070]. *See also* Matsuo at Figure 6. Park–846 at Figure 3a, Figure 3b, Figure 6b, [0018], [0020], [0034], [0037], [0038], [0065], [0066], [0067], [0068], [0069], and [0071]. Kowalski at Figure 5, Figure 6, Figure 8, Figure 9, Figure 28A, [0002]–[0003], [0004], [0006], [0009], [0015], [0017], [0083], [0100], [0102], [0103], [0108], [0134], [0145], and [0152]. Gerstenberger at Figure 1, Figure 3, Figure 4, Figure 5, Figure 6, Figure 7, [0001], [0002], [0004], [0009], [0012], [0014], [0017], [0018], [0024], [0035], [0040], [0043], [0044], [0050], [0051], [0055], and claim 26. *See also* Gerstenberger at [0041]. Wilson at 6:16–7:2, 8:28–9:3, 9:26–10:19, 10:20–29, 11:1–24, 13:14–27, 16:25–30, 17:23–18:1, 19:21–28, 19:29–20:18, 20:19–26, 20:27–21:8, Figure 1, Figure 2, and Figure 3. *See also* Wilson at 14:12–27 and 15:20–16:3. Akaida at Abstract, Figure 3, Figure 4, Figure 8, Figure 9, [0003], [0008], [0014], [0016], [0017], [0018], [0029], [0036], [0038], [0042], [0043], [0045], [0046], [0050], [0051], and [0052].

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Claim Element	Exemplary Citations to Kim-329, Vega, Keen, Yamazaki-454, Park-846, Park-589, Park-942, Matsuo, Kowalski, Gerstenberger, Wilson, Akaida, Florek-442, Florek-677, Honkanen, Hasegawa, Dachs, and Claessen
	Florek–442 at Abstract, 1:7–15, 1:33–2:12, 4:21–31, 4:32–5:6, 5:7–15, 5:16–28, 5:29–6:4, 6:11–22, 7:22–33, 8:4–12, 8:17–32, 9:1–16, 10:9–14, 11:7–20, 14:5–15, 15:18–30, 16:31–17:4, 18:11–15, 19:21–20:9, 21:5–11, 21:26–32, 22:20–26, 22:27–23:16, 27:10–12, Figure 1, Figure 2, Figure 3, Figure 4, Figure 12, and Figure 13. *See also* Florek–442 at 16:17–22. Hasegawa at [0005], [0013], [0092], [0113], [0148], [0165], [0168], and [0186]. Honkanen at Figure 2b, [0012], [0034], [0037], [0045], [0052], [0057], [0142], [0144], and [0151]. Park–942 at 3–4, 8–9, 10–11, 12, and 12–13. Dachs at Abstract, Figure 1, 467, 468, 469, Figure 5, 470–471, and Figure 7. Florek–677 at Abstract, Figure 1, Figure 2, [0006], [0010], [0020], and [0024]. Kim–329 at Abstract, Figure 3, Figure 6, [0043], and [0044].
[1b] an antenna; and	Vega at Figure 1, Figure 3, Figure 4A, Figure 4B, Figure 4D, Figure 7, Figure 8A, Figure 8B, 5:26–68, 6:34–52, 7:14–56, 7:57–8:17, 9:30–60, 12:60–13:6, 13:7–14:10, and 15:38–61. *See also* Vega at 8:18–45. Keen at Abstract, Figure 1, Figure 2, Figure 3, Figure 4, Figure 5, Figure 6, Figure 7, [0002], [0007], [0009], [0010], [0011], [0013], [0032], [0033], [0050], [0052], [0058], [0069], [0074], [0086], [0087], [0089], [0090], [0095], [0098], [0102], and [0103]. *See also* Keen at [0015], [0051], [0056], [0091], [0093], claim 8, and claim 14. Yamazaki–454 at Figure 5, [0008], [0009], [0013], [0020], [0025], [0026], [0055], [0061], [0064], [0070], [0071], [0074], [0111], [0114], [0121], [0137], [0167], [0271], and [0273]. *See also* Yamazaki–454 at Abstract, Figure 1, Figure 9, [0065], [0112], [0255], [0256], [0257], [0258], [0259], [0260], [0263], and [0279]. Park–589 at Abstract, Figure 1, Figure 5, Figure 6, Figure 7, [0019], [0020], [0027], [0032], [0034], [0047], [0052], [0054], [0055], [0056], [0058], [0059], [0060], [0073], [0075], [0081], claim 1, claim 6, claim 8, claim 11, claim 13, claim 14, claim 15, and claim 17.

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Claim Element	Exemplary Citations to Kim-329, Vega, Keen, Yamazaki-454, Park-846, Park-589, Park-942, Matsuo, Kowalski, Gerstenberger, Wilson, Akaida, Florek-442, Florek-677, Honkanen, Hasegawa, Dachs, and Claessen
	See also Park–589 at [0017]. Matsuo at Figure 6, [0008], [0015], [0047], [0048], [0053], [0054], [0055], [0056], [0059], [0060], [0061], [0063], [0066], [0067], [0068], [0069], and [0070]. *See also* Matsuo at Figure 2. Park–846 at Abstract, Figure 2, Figure 3a, Figure 3b, [0022], [0031], [0032], [0034], [0035], [0036], [0040], [0056], [0058], [0060], [0067], [0069], and [0071]. Kowalski at Abstract, Figure 5, Figure 6, Figure 8, Figure 9, Figure 28A, [0002]–[0003], [0009], [0012], [0015], [0016], [0017], [0026], [0030], [0032], [0037], [0050], [0083], [0085], [0091], [0094], [0095], [0100], [0101], [0102], [0103], [0108], [0110], [0112], [0114], [0115], [0118], [0122], [0124], [0127], [0133], [0136], [0145], and [0147]. Gerstenberger at Abstract, Figure 1, Figure 3, Figure 4, Figure 5, Figure 6, Figure 7, [0001], [0002], [0003], [0004], [0007], [0008], [0009], [0010], [0011], [0012], [0014], [0017], [0018], [0024], [0028], [0032], [0033], [0035], [0040], [0043], [0050], [0055], claim 21, and claim 37. *See also* Gerstenberger at [0041], [0044], and [0051]. Wilson at 1:6–13, 3:24–4:3, 5:19–24, 6:16–7:2, 7:3–12, 8:17–27, 8:28–9:3, 12:3–24, 13:14–27, 14:12–21, 15:20–16:3, 16:15–24, 16:25–30, 19:21–28, 19:29–20:18, 22:1–9, Figure 1, Figure 2, and Figure 3. Akaida at Figure 1, Figure 3, Figure 4, Figure 5, Figure 8, Figure 9, [0008], [0010], [0012], [0016], [0017], [0018], [0029], [0030], [0031], [0036], [0038], [0039], [0045], [0046], and [0056]. Florek–442 at 9:1–16, 18:11–15, 19:21–20:9, 22:9–12, 24:24–34, Figure 2, Figure 3, Figure 6, Figure 8, Figure 10, Figure 13, and Figure 14. Hasegawa at [0005], [0094], and [0186]. Honkanen at Figure 1, Figure 2b, Figure 3c, [0005], [0031], [0032], [0034], [0037], [0044], [0057], [0061], and [0144]. Park–942 at Abstract, 2, 3–4, 4–5, 5, 5–6, 9–10, 10–11, 11–12, 12, and 12–13. Dachs at 468, 469, Figure 5, and Figure 7.

Claim Element	Exemplary Citations to Kim-329, Vega, Keen, Yamazaki-454, Park-846, Park-589, Park-942, Matsuo, Kowalski, Gerstenberger, Wilson, Akaida, Florek-442, Florek-677, Honkanen, Hasegawa, Dachs, and Claessen
	Florek–677 at Figure 2, [0010], and [0023]. Kim–329 at Abstract, Figure 2, Figure 3, [0008], [0042], [0043], and [0044].
[1c] performance enhancement circuits coupled between the smartcard controller and the antenna, wherein the performance enhancement circuits include an amplifier and a load modulation circuit, and	Vega at Abstract, Figure 1, Figure 3, Figure 4A, Figure 4B, Figure 4D, Figure 4E, Figure 7, Figure 8A, Figure 8B, 3:28–45, 4:17–18, 5:8–25, 5:26–68, 6:1–22, 6:34–52, 7:14–56, 7:57–8:17, 8:18–45, 8:63–9:17, 9:30–60, 9:61–10:33, 10:34–52, 11:7–12:16, 12:60–13:6, 13:7–14:10, 14:11–44, 15:38–61, and 16:53–17:8. *See also* Vega at 15:20–37. Keen at Abstract, Figure 1, Figure 2, Figure 3, Figure 4, Figure 5, Figure 6, Figure 7, [0002], [0007], [0009], [0010], [0011], [0013], [0015], [0018], [0024], [0029], [0030], [0031], [0032], [0033], [0048], [0050], [0051], [0052], [0053], [0054], [0055], [0056], [0058], [0067], [0069], [0074], [0081], [0083], [0084], [0085], [0086], [0087], [0088], [0089], [0090], [0092], [0093], [0095], [0098], [0102], and [0103]. *See also* Keen at [0091], claim 8, claim 14, claim 17, and claim 18. Yamazaki–454 at Figure 1, Figure 2, Figure 4, Figure 5, Figure 6, Figure 7A, Figure 7B, Figure 8, Figure 9, Figure 10, [0008], [0009], [0013], [0020], [0025], [0026], [0028], [0033], [0034], [0036], [0037], [0038], [0044], [0045], [0053], [0054], [0055], [0056], [0057], [0060], [0061], [0062], [0064], [0065], [0067], [0068], [0069], [0070], [0071], [0074], [0077], [0078], [0079], [0095], [0110], [0111], [0112], [0114], [0115], [0119], [0120], [0121], [0122], [0137], [0150], [0167], [0271], [0273], [0275], [0279], [0281], and [0282]. *See also* Yamazaki–454 at Abstract, [0018], [0023], [0024], [0029], [0030], [0031], [0032], [0035], [0066], [0073], [0075], [0090], [0094], [0102], [0105], [0118], [0255], [0256], [0257], [0258], [0259], [0260], [0263], [0268], [0269], and [0280]. Park–589 at Abstract, Figure 1, Figure 3, Figure 4, Figure 5, Figure 6, Figure 7, [0016], [0017], [0019], [0020], [0021], [0027], [0032], [0033], [0034], [0035], [0040], [0042], [0043], [0045], [0046], [0047], [0048], [0049], [0051], [0052], [0054], [0055], [0056], [0058], [0059], [0060], [0062], [0063], [0064], [0068], [0069], [0070], [0071], [0073], [0074], [0075], [0076], [0080], [0081], [0085], [0092], claim 1, claim 2, claim 3, claim 4, claim 6, claim 8, claim 9, claim 11, claim 13, claim 14, claim 15, claim 16, claim 17, and claim 18. *See also* Park–589 at Figure 2, [0018], [0041], [0082], [0084], [0086], [0090], [0091], claim 7, and claim 10.

Claim Element	Exemplary Citations to Kim-329, Vega, Keen, Yamazaki-454, Park-846, Park-589, Park-942, Matsuo, Kowalski, Gerstenberger, Wilson, Akaida, Florek-442, Florek-677, Honkanen, Hasegawa, Dachs, and Claessen
	Matsuo at Figure 2, Figure 6, [0007], [0008], [0009], [0010], [0015], [0034], [0035], [0047], [0048], [0053], [0054], [0055], [0056], [0057], [0058], [0059], [0060], [0061], [0062], [0063], [0064], [0066], [0067], [0068], [0069], and [0070]. Park–846 at Abstract, Figure 2, Figure 3a, Figure 3b, Figure 4a, Figure 4b, Figure 5a, Figure 5b, Figure 6b, [0020], [0022], [0031], [0032], [0034], [0035], [0036], [0037], [0038], [0040], [0056], [0058], [0060], [0065], [0066], [0067], [0069], and [0071]. Kowalski at Abstract, Figure 5, Figure 6, Figure 8, Figure 9, Figure 28A, [0002]–[0003], [0004], [0009], [0012], [0015], [0016], [0017], [0026], [0030], [0032], [0037], [0050], [0083], [0085], [0091], [0094], [0095], [0100], [0101], [0102], [0103], [0108], [0110], [0112], [0114], [0115], [0118], [0122], [0124], [0127], [0133], [0136], [0145], [0147], [0149], and [0152]. Gerstenberger at Abstract, Figure 1, Figure 3, Figure 4, Figure 5, Figure 6, Figure 7, [0001], [0002], [0003], [0004], [0007], [0008], [0009], [0010], [0011], [0012], [0014], [0017], [0018], [0024], [0028], [0032], [0033], [0035], [0040], [0043], [0044], [0045], [0050], [0051], [0055], claim 21, claim 26, and claim 37. *See also* Gerstenberger at [0041]. Wilson at 1:6–13, 1:28–2:14, 3:24–4:3, 4:4–9, 5:19–24, 6:16–7:2, 7:3–12, 8:17–27, 8:28–9:3, 10:20–29, 11:1–24, 12:3–24, 13:14–27, 14:12–21, 15:20–16:3, 17:23–18:1, 19:21–28, 19:29–20:18, 20:19–26, 20:27–21:8, 22:2–9, Figure 1, Figure 2, and Figure 3. *See also* Wilson at 14:12–21, 14:22–27. Akaida at Abstract, Figure 1, Figure 3, Figure 4, Figure 5, Figure 8, Figure 9, [0003], [0008], [0010], [0012], [0016], [0017], [0018], [0029], [0030], [0031], [0032], [0036], [0038], [0039], [0042], [0043], [0045], [0046], [0050], [0051], and [0056]. *See also* Akaida at [0014]. Florek–442 at 1:33–2:12, 4:21–31, 6:11–22, 7:22–33, 8:4–12, 8:17–32, 9:1–16, 10:9–14, 11:7–20, 16:31–17:4, 18:11–15, 19:21–20:9, 21:5–11, 21:26–32, 22:9–12, 22:20–26, 22:27–23:16, 24:24–34, Figure 1, Figure 2, Figure 3, Figure 4, Figure 6, Figure 8, Figure 10, Figure 12, Figure 13, and Figure 14.

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Claim Element	Exemplary Citations to Kim-329, Vega, Keen, Yamazaki-454, Park-846, Park-589, Park-942, Matsuo, Kowalski, Gerstenberger, Wilson, Akaida, Florek-442, Florek-677, Honkanen, Hasegawa, Dachs, and Claessen
	Hasegawa at Abstract, [0003], [0005], [0006], [0013], [0021], [0045], [0051], [0053], [0057], [0059], [0092], [0094], [0113], [0128], [0129], [0148], [0163], [0165], [0168], and [0186]. Honkanen at Figure 1, Figure 2b, Figure 3c, [0005], [0006], [0012], [0031], [0032], [0034], [0035], [0037], [0044], [0045], [0052], [0057], [0061], [0142], [0144], and [0151]. Park–942 at Abstract, 2, 3–4, 4–5, 5, 5–6, 6–7, 7, 8–9, 9–10, 10–11, 11–12, 12, and 12–13. Dachs at 467, Figure 3, 468, 469, Figure 5, 470–471, and Figure 7. *See also* Dachs at Abstract, Figure 1, Figure 2, and 467. Florek–677 at Figure 1, Figure 2, [0010], [0020], [0023], and [0024]. Kim–329 at Abstract, Figure 2, Figure 3, Figure 6, [0008], [0042], [0043], [0044], and [0045]. Claessen at [0002], [0003], [0005], [0013], and [0026].
[1d] wherein the amplifier is coupled to amplify a signal received from the antenna and to provide an amplified signal to the smartcard controller.	Vega at Abstract, Figure 1, Figure 3, Figure 4A, Figure 4B, Figure 4D, Figure 7, Figure 8A, Figure 8B, 3:28–45, 5:8–25, 5:26–68, 6:1–22, 6:34–52, 7:14–56, 7:57–8:17, 8:18–45, 8:63–9:17, 9:30–60, 9:61–10:33, 11:7–12:16, 12:60–13:6, 13:7–14:10, and 15:38–61. *See also* Vega at 15:20–37. Keen at Abstract, Figure 1, Figure 2, Figure 3, Figure 4, Figure 5, Figure 6, Figure 7, [0002], [0007], [0009], [0010], [0011], [0013], [0015], [0018], [0029], [0030], [0031], [0032], [0033], [0050], [0051], [0052], [0053], [0054], [0055], [0058], [0067], [0069], [0074], [0081], [0084], [0085], [0086], [0087], [0089], [0090], [0092], [0095], [0098], [0102], and [0103]. *See also* Keen at [0024], [0056], [0091], [0093], claim 8, and claim 14. Yamazaki–454 at Figure 1, Figure 2, Figure 4, Figure 5, Figure 6, Figure 7A, Figure 7B, Figure 8, Figure 9, Figure 10, [0008], [0009], [0013], [0020], [0025], [0026], [0028], [0033], [0034], [0036], [0037], [0038], [0044], [0045], [0053], [0054], [0055], [0056], [0057], [0060], [0061], [0062], [0064], [0065], [0067], [0068], [0069], [0070], [0071], [0074], [0077], [0078], [0079], [0095], [0111], [0114], [0115], [0119], [0120], [0121], [0122], [0137], [0167], [0271], [0273], [0275], [0279], [0281], and [0282].

Claim Element	Exemplary Citations to Kim-329, Vega, Keen, Yamazaki-454, Park-846, Park-589, Park-942, Matsuo, Kowalski, Gerstenberger, Wilson, Akaida, Florek-442, Florek-677, Honkanen, Hasegawa, Dachs, and Claessen
	See also Yamazaki–454 at Abstract, [0018], [0023], [0024], [0029], [0030], [0031], [0032], [0035], [0066], [0073], [0075], [0090], [0094], [0102], [0105], [0112], [0118], [0150], [0255], [0256], [0257], [0258], [0259], [0260], [0263], [0268], [0269], and [0280]. Park–589 at Abstract, Figure 1, Figure 2, Figure 3, Figure 4, Figure 5, Figure 6, Figure 7, [0016], [0017], [0019], [0020], [0021], [0025], [0027], [0032], [0033], [0034], [0035], [0040], [0042], [0043], [0045], [0046], [0047], [0048], [0049], [0051], [0052], [0054], [0055], [0056], [0058], [0059], [0060], [0062], [0063], [0064], [0068], [0069], [0070], [0071], [0073], [0074], [0075], [0076], [0080], [0081], [0085], [0092], claim 1, claim 2, claim 3, claim 4, claim 6, claim 8, claim 9, claim 11, claim 13, claim 14, claim 15, claim 16, claim 17, and claim 18. *See also* Park–589 at [0018], [0041], [0082], [0084], [0086], [0090], and [0091]. Matsuo at Figure 2, Figure 6, [0008], [0009], [0010], [0015], [0034], [0035], [0047], [0048], [0053], [0054], [0055], [0056], [0058], [0059], [0060], [0061], [0062], [0063], [0064], [0066], [0067], [0068], [0069], and [0070]. Park–846 at Abstract, Figure 2, Figure 3a, Figure 3b, Figure 6b, [0020], [0022], [0031], [0032], [0034], [0035], [0036], [0037], [0038], [0040], [0056], [0058], [0060], [0065], [0066], [0067], [0069], and [0071]. Kowalski at Abstract, Figure 5, Figure 6, Figure 8, Figure 9, Figure 28A, [0002]–[0003], [0004], [0009], [0012], [0015], [0016], [0017], [0026], [0030], [0032], [0037], [0050], [0083], [0085], [0091], [0094], [0095], [0100], [0101], [0102], [0103], [0108], [0110], [0112], [0114], [0115], [0118], [0122], [0124], [0127], [0133], [0136], [0145], [0147], and [0152]. Gerstenberger at Abstract, Figure 1, Figure 3, Figure 4, Figure 5, Figure 6, Figure 7, [0001], [0002], [0003], [0004], [0007], [0008], [0009], [0010], [0011], [0012], [0014], [0017], [0018], [0024], [0028], [0032], [0033], [0035], [0040], [0043], [0044], [0045], [0050], [0051], [0055], claim 21, claim 26, and claim 37. *See also* Gerstenberger at [0041]. Wilson at 1:6–13, 3:24–4:3, 5:19–24, 6:16–7:2, 7:3–12, 8:17–27, 8:28–9:3, 10:20–29, 11:1–24, 12:3–24, 13:14–27, 14:12–21, 15:20–16:3, 16:15–24, 16:25–30, 17:23–18:1, 19:21–28, 19:29–20:18, 20:19–26, 20:27–21:8, 22:2–9, Figure 1, Figure 2, and Figure 3. *See also* Wilson at 14:12–21, 14:22–27.

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Claim Element	Exemplary Citations to Kim-329, Vega, Keen, Yamazaki-454, Park-846, Park-589, Park-942, Matsuo, Kowalski, Gerstenberger, Wilson, Akaida, Florek-442, Florek-677, Honkanen, Hasegawa, Dachs, and Claessen
	Akaida at Abstract, Figure 1, Figure 3, Figure 4, Figure 5, Figure 8, Figure 9, [0003], [0008], [0010], [0012], [0016], [0017], [0018], [0029], [0030], [0031], [0032], [0036], [0038], [0039], [0042], [0043], [0045], [0046], [0050], [0051], and [0056]. *See also* Akaida at [0014]. Florek–442 at 1:33–2:12, 4:21–31, 6:11–22, 7:22–33, 8:4–12, 8:17–32, 9:1–16, 10:9–14, 11:7–20, 16:31–17:4, 18:11–15, 19:21–20:9, 21:5–11, 21:26–32, 22:9–12, 22:20–26, 22:27–23:16, 24:24–34, Figure 1, Figure 2, Figure 3, Figure 4, Figure 6, Figure 8, Figure 10, Figure 12, Figure 13, and Figure 14. Hasegawa at [0005], [0013], [0021], [0059], [0092], [0094], [0113], [0148], [0165], [0168], and [0186]. Honkanen at Figure 1, Figure 2b, Figure 3c, [0005], [0012], [0031], [0032], [0034], [0037], [0044], [0045], [0052], [0057], [0061], [0142], [0144], and [0151]. Park–942 at Abstract, 2, 3–4, 4–5, 5, 5–6, 8–9, 9–10, 10–11, 11–12, 12, and 12–13. Dachs at 468, 469, Figure 5, 470–471, and Figure 7. *See also* Dachs at Abstract, Figure 1, and 467. Florek–677 at Figure 1, Figure 2, [0010], [0020], [0023], and [0024]. Kim–329 at Abstract, Figure 2, Figure 3, Figure 6, [0008], [0042], [0043], and [0044].
2. The mobile device of claim 1 wherein the antenna is tuned to operate at 13.56 MHz.	Vega at Figure 1, Figure 3, Figure 4A, Figure 4B, Figure 4D, Figure 7, Figure 8A, Figure 8B, 2:4–26, 5:26–68, 6:34–52, 7:14–56, 7:57–8:17, 9:30–60, 12:60–13:6, 13:7–14:10, and 15:38–61. *See also* Vega at 8:18–45. Keen at Abstract, Figure 1, Figure 2, Figure 3, Figure 4, Figure 5, Figure 6, Figure 7, [0002], [0003], [0007], [0009], [0010], [0011], [0013], [0028], [0030], [0032], [0033], [0050], [0052], [0058], [0069], [0074], [0083], [0086], [0087], [0089], [0090], [0095], [0098], [0102], and [0103]. *See also* Keen at [0015], [0051], [0056], [0067], [0084], [0091], [0093], claim 8, and claim 14. Yamazaki–454 at Figure 5, [0008], [0009], [0013], [0020], [0025], [0026], [0055], [0061], [0064], [0070], [0071], [0074], [0111], [0114], [0121], [0137], [0167], [0271], and [0273].

Claim Element	Exemplary Citations to Kim-329, Vega, Keen, Yamazaki-454, Park-846, Park-589, Park-942, Matsuo, Kowalski, Gerstenberger, Wilson, Akaida, Florek-442, Florek-677, Honkanen, Hasegawa, Dachs, and Claessen
	See also Yamazaki–454 at Abstract, Figure 1, Figure 9, [0065], [0112], [0255], [0256], [0257], [0258], [0259], [0260], [0263], and [0279]. Park–589 at Abstract, Figure 1, Figure 5, Figure 6, Figure 7, [0006]–[0007], [0019], [0020], [0027], [0032], [0034], [0047], [0052], [0054], [0055], [0056], [0058], [0059], [0060], [0073], [0075], [0081], claim 1, claim 6, claim 8, claim 11, claim 13, claim 14, claim 15, and claim 17. *See also* Park–589 at [0012], [0017], [0048], and [0049]. Matsuo at Figure 2, Figure 6, [0003], [0008], [0015], [0047], [0048], [0049], [0051], [0053], [0054], [0055], [0056], [0057], [0059], [0060], [0061], [0063], [0066], [0067], [0068], [0069], [0070], [0077], [0078], [0083], [0086], [0087], [0088], and [0089]. *See also* Matsuo at Abstract, [0005], [0034], [0037], [0038], and [0042]. Park–846 at Abstract, Figure 2, Figure 3a, Figure 3b, [0022], [0031], [0032], [0034], [0035], [0036], [0040], [0050], [0056], [0058], [0060], [0067], [0069], and [0071]. Kowalski at Abstract, Figure 5, Figure 6, Figure 8, Figure 9, Figure 28A, [0002]–[0003], [0009], [0012], [0015], [0016], [0017], [0026], [0030], [0032], [0037], [0046], [0050], [0083], [0085], [0091], [0094], [0095], [0100], [0101], [0102], [0103], [0108], [0110], [0112], [0114], [0115], [0118], [0122], [0124], [0127], [0133], [0136], [0145], and [0147]. Gerstenberger at Abstract, Figure 1, Figure 3, Figure 4, Figure 5, Figure 6, Figure 7, [0001], [0002], [0003], [0004], [0007], [0008], [0009], [0010], [0011], [0012], [0014], [0017], [0018], [0024], [0028], [0032], [0033], [0035], [0040], [0043], [0050], [0055], claim 21, and claim 37. *See also* Gerstenberger at [0041], [0044], and [0051]. Wilson at 1:6–13, 3:24–4:3, 5:19–24, 6:16–7:2, 7:3–12, 8:17–27, 8:28–9:3, 12:3–24, 13:14–27, 14:12–21, 15:20–16:3, 16:15–24, 16:25–30, 19:21–28, 19:29–20:18, 22:1–9, Figure 1, Figure 2, and Figure 3. Akaida at Figure 1, Figure 3, Figure 4, Figure 5, Figure 8, Figure 9, [0008], [0010], [0012], [0016], [0017], [0018], [0029], [0030], [0031], [0036], [0038], [0039], [0045], [0046], and [0056]. Florek–442 at 9:1–16, 13:15–14:4, 14:16–29, 18:11–15, 18:29–34, 19:21–20:9, 22:9–12, 24:24–34, 25:1–5, 27:13–17, Figure 2, Figure 3, Figure 6, Figure 8, Figure 10, Figure 13, and Figure 14.

Claim Element	Exemplary Citations to Kim-329, Vega, Keen, Yamazaki-454, Park-846, Park-589, Park-942, Matsuo, Kowalski, Gerstenberger, Wilson, Akaida, Florek-442, Florek-677, Honkanen, Hasegawa, Dachs, and Claessen
	See also Florek–442 at 1:7–15. Hasegawa at Abstract, [0003], [0004], [0005], [0051], [0094], and [0186]. Honkanen at Figure 1, Figure 2b, Figure 3c, [0005], [0006], [0031], [0032], [0033], [0034], [0037], [0044], [0057], [0061], and [0144]. Park–942 at Abstract, 2, 3–4, 4–5, 5, 5–6, 7, 9–10, 10–11, 11–12, 12, and 12–13. Dachs at Abstract, Figure 2, 467, Figure 3, 468, 469, Figure 5, and Figure 7. *See also* Dachs at Figure 1, 468, 468–469, and 470. Florek–677 at Figure 2, [0010], [0023], [0024], and [0025]. Kim–329 at Abstract, Figure 2, Figure 3, [0008], [0042], [0043], and [0044]. *See also* claim 1 above.
3. The mobile device of claim 1 wherein the antenna comprises an inductive element too small to draw enough power sufficient to operate the smartcard controller from an interrogating radio frequency (RF) field.	Vega at Figure 1, Figure 3, Figure 4A, Figure 4B, Figure 4D, Figure 7, Figure 8A, Figure 8B, 2:4–26, 2:27–40, 2:41–52, 2:66–3:9, 3:28–45, 4:51–5:7, 5:26–68, 6:34–52, 7:14–56, 7:57–8:17, 8:18–45, 8:63–9:17, 9:30–60, 9:61–10:33, 12:60–13:6, 13:7–14:10, and 15:38–61. *See also* Vega at Abstract, 5:8–25, 6:1–22, 15:20–37, and 16:53–17:8. Keen at Abstract, Figure 1, Figure 2, Figure 3, Figure 4, Figure 5, Figure 6, Figure 7, [0002], [0004]–[0005], [0007], [0009], [0010], [0011], [0013], [0015], [0018], [0029], [0030], [0031], [0032], [0033], [0050], [0051], [0052], [0053], [0054], [0055], [0056], [0058], [0067], [0069], [0074], [0081], [0084], [0085], [0086], [0087], [0089], [0090], [0091], [0092], [0095], [0098], [0102], and [0103]. *See also* Keen at [0024], [0093], claim 8, and claim 14. Yamazaki–454 at Figure 1, Figure 2, Figure 4, Figure 5, Figure 6, Figure 7A, Figure 7B, Figure 8, Figure 9, Figure 10, [0008], [0009], [0013], [0020], [0025], [0026], [0028], [0033], [0034], [0036], [0037], [0038], [0044], [0045], [0053], [0054], [0055], [0056], [0057], [0060], [0061], [0062], [0064], [0065], [0067], [0068], [0069], [0070], [0071], [0073], [0074], [0077], [0078], [0079], [0095], [0111], [0114], [0115], [0119], [0120], [0121], [0122], [0137], [0167], [0259], [0269], [0271], [0273], [0275], [0279], [0281], and [0282].

Claim Element	Exemplary Citations to Kim-329, Vega, Keen, Yamazaki-454, Park-846, Park-589, Park-942, Matsuo, Kowalski, Gerstenberger, Wilson, Akaida, Florek-442, Florek-677, Honkanen, Hasegawa, Dachs, and Claessen
	See also Yamazaki–454 at Abstract, [0018], [0023], [0024], [0029], [0030], [0031], [0032], [0035], [0066], [0075], [0090], [0094], [0102], [0105], [0112], [0118], [0150], [0255], [0256], [0257], [0258], [0260], [0263], [0268], and [0280]. Park–589 at Abstract, Figure 1, Figure 5, Figure 6, Figure 7, [0006]–[0007], [0016], [0017], [0019], [0020], [0021], [0027], [0032], [0033], [0034], [0035], [0040], [0042], [0043], [0045], [0046], [0047], [0048], [0049], [0051], [0052], [0054], [0055], [0056], [0058], [0059], [0060], [0062], [0063], [0064], [0068], [0069], [0070], [0071], [0073], [0074], [0075], [0076], [0080], [0081], [0085], [0092], claim 1, claim 2, claim 3, claim 4, claim 6, claim 8, claim 9, claim 11, claim 13, claim 14, claim 15, claim 16, claim 17, and claim 18. *See also* Park–589 at Figure 2, Figure 3, [0018], [0041], [0082], [0084], [0086], [0090], and [0091]. Matsuo at Figure 2, Figure 6, [0008], [0009], [0010], [0015], [0034], [0035], [0047], [0048], [0049], [0053], [0054], [0055], [0056], [0058], [0059], [0060], [0061], [0062], [0063], [0064], [0066], [0067], [0068], [0069], and [0070]. Park–846 at Abstract, Figure 2, Figure 3a, Figure 3b, Figure 6b, [0020], [0022], [0031], [0032], [0034], [0035], [0036], [0037], [0038], [0040], [0056], [0058], [0060], [0065], [0066], [0067], [0069], and [0071]. Kowalski at Abstract, Figure 5, Figure 6, Figure 8, Figure 9, Figure 28A, [0002]–[0003], [0004], [0009], [0012], [0015], [0016], [0017], [0026], [0030], [0032], [0037], [0050], [0083], [0085], [0091], [0094], [0095], [0100], [0101], [0102], [0103], [0108], [0110], [0112], [0114], [0115], [0118], [0122], [0124], [0127], [0133], [0136], [0145], [0147], and [0152]. Gerstenberger at Abstract, Figure 1, Figure 3, Figure 4, Figure 5, Figure 6, Figure 7, [0001], [0002], [0003], [0004], [0006], [0007], [0008], [0009], [0010], [0011], [0012], [0014], [0017], [0018], [0021], [0024], [0028], [0032], [0033], [0035], [0040], [0041], [0043], [0044], [0050], [0051], [0055], claim 19, claim 21, claim 26, and claim 37. *See also* Gerstenberger at [0049]. Wilson at 4:4–21, 15:20–16:3. Akaida at Abstract, Figure 1, Figure 3, Figure 4, Figure 5, Figure 8, Figure 9, [0003], [0008], [0010], [0012], [0016], [0017], [0018], [0029], [0030], [0031], [0036], [0038], [0039], [0042], [0043], [0045], [0046], [0050], [0051], and [0056].

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Claim Element	Exemplary Citations to Kim-329, Vega, Keen, Yamazaki-454, Park-846, Park-589, Park-942, Matsuo, Kowalski, Gerstenberger, Wilson, Akaida, Florek-442, Florek-677, Honkanen, Hasegawa, Dachs, and Claessen
	See also Akaida at [0014]. Florek–442 at 1:33–2:12, 4:21–31, 6:11–22, 7:22–33, 8:4–12, 8:17–32, 9:1–16, 10:9–14, 11:7–20, 16:31–17:4, 18:11–15, 19:21–20:9, 21:5–11, 21:26–32, 22:9–12, 22:20–26, 22:27–23:16, 24:24–34, Figure 1, Figure 2, Figure 3, Figure 4, Figure 6, Figure 8, Figure 10, Figure 12, Figure 13, and Figure 14. Hasegawa at [0005], [0013], [0092], [0094], [0113], [0148], [0165], [0168], and [0186]. Honkanen at Figure 1, Figure 2b, Figure 3c, [0005], [0012], [0031], [0032], [0034], [0037], [0044], [0045], [0052], [0057], [0061], [0142], [0144], and [0151]. Park–942 at Abstract, 2, 3–4, 4–5, 5, 5–6, 8–9, 9–10, 10–11, 11–12, 12, and 12–13. Dachs at 468, 469, Figure 5, 470–471, and Figure 7. *See also* Dachs at Abstract, Figure 1, and 467. Florek–677 at Figure 1, Figure 2, [0010], [0020], [0023], and [0024]. Kim–329 at Abstract, Figure 2, Figure 3, Figure 6, [0008], [0042], [0043], and [0044]. *See also* claim 1 above.
4. The mobile device of claim 1 wherein the smartcard controller is coupled to be powered by the mobile device.	Vega at Abstract, Figure 3, Figure 4A, Figure 4B, Figure 7, Figure 8A, Figure 8B, 3:28–45, 4:51–5:7, 5:8–25, 6:1–22, 7:14–56, 7:57–8:17, 8:18–45, 8:46–62, 8:63–9:17, 9:30–60, 9:61–10:33, 10:34–52, 10:53–11:6, 11:7–12:16, 12:60–13:6, 13:7–14:10, 15:20–37, 15:38–61, 16:36–48, and 16:53–17:8. Keen at Abstract, Figure 1, Figure 2, Figure 3, Figure 4, Figure 5, Figure 6, [0013], [0015], [0018], [0029], [0030], [0031], [0046], [0048], [0051], [0052], [0053], [0054], [0055], [0058], [0067], [0069], [0074], [0081], [0084], [0085], [0091], [0092], and [0102]. *See also* Keen at [0024], [0032], [0033], [0056], [0086], [0089], [0090], [0093], and [0098]. Yamazaki–454 at Figure 1, Figure 2, Figure 4, Figure 5, Figure 6, Figure 7A, Figure 7B, Figure 8, Figure 9, Figure 10, [0028], [0033], [0034], [0036], [0037], [0038], [0044], [0045], [0053], [0054], [0055], [0056], [0057], [0060], [0061], [0062], [0065], [0067], [0068], [0069], [0070], [0071], [0074], [0077], [0078], [0079], [0095], [0115], [0119], [0120], [0121], [0122], [0273], [0275], [0279], [0281], and [0282].

Claim Element	Exemplary Citations to Kim-329, Vega, Keen, Yamazaki-454, Park-846, Park-589, Park-942, Matsuo, Kowalski, Gerstenberger, Wilson, Akaida, Florek-442, Florek-677, Honkanen, Hasegawa, Dachs, and Claessen
	See also Yamazaki–454 at [0018], [0023], [0024], [0029], [0030], [0031], [0032], [0035], [0064], [0066], [0073], [0075], [0090], [0094], [0102], [0105], [0112], [0114], [0118], [0137], [0150], [0268], [0269], and [0280]. Park–589 at Abstract, Figure 1, Figure 6, Figure 7, [0016], [0017], [0019], [0020], [0021], [0032], [0033], [0035], [0040], [0042], [0043], [0045], [0046], [0047], [0048], [0049], [0051], [0052], [0055], [0058], [0062], [0063], [0064], [0068], [0069], [0070], [0071], [0073], [0074], [0076], [0080], [0081], [0085], [0092], claim 1, claim 2, claim 3, claim 4, claim 6, claim 8, claim 9, claim 11, claim 15, claim 16, claim 17, and claim 18. *See also* Park–589 at Figure 2, Figure 3, [0018], [0041], [0054], [0056], [0082], [0084], [0086], [0090], and [0091]. Matsuo at Figure 2, Figure 6, [0008], [0009], [0010], [0015], [0034], [0035], [0049], [0056], [0058], [0059], [0062], [0063], [0064], [0066], and [0070]. *See also* Matsuo at [0048] and [0068]. Park–846 at Abstract, Figure 2, Figure 3a, Figure 3b, Figure 4a, Figure 4b, Figure 5a, Figure 5b, Figure 6a, Figure 6b, [0018], [0020], [0031], [0032], [0034], [0037], [0038], [0039], [0056], [0065], [0066], [0067], [0069], and [0071]. Kowalski at Figure 5, Figure 6, Figure 8, Figure 9, Figure 28A, [0002]–[0003], [0004], [0009], [0015], [0027], [0100], [0102], [0103], [0112], [0145], and [0152]. Gerstenberger at Figure 5, Figure 6, [0009], [0043], [0044], [0050], [0051], [0055], and claim 26. *See also* Gerstenberger at [0042]. Wilson at 1:28–2:14, 9:11–14, 17:23–18:1, 19:3–16, 19:21–28, 19:29–20:18, and Figure 3. Akaida at Abstract, Figure 3, Figure 4, Figure 8, Figure 9, [0003], [0008], [0016], [0017], [0018], [0029], [0036], [0038], [0042], [0043], [0045], [0046], [0050], and [0051]. *See also* Akaida at [0014]. Florek–442 at 1:33–2:12, 4:21–31, 5:29–6:4, 6:11–22, 7:22–33, 8:4–12, 8:17–32, 9:1–16, 10:9–14, 11:7–20, 16:31–17:4, 19:21–20:9, 21:5–11, 21:26–32, 22:20–26, 22:27–23:16, Figure 1, Figure 3, Figure 4, Figure 12, and Figure 13.

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Claim Element	Exemplary Citations to Kim-329, Vega, Keen, Yamazaki-454, Park-846, Park-589, Park-942, Matsuo, Kowalski, Gerstenberger, Wilson, Akaida, Florek-442, Florek-677, Honkanen, Hasegawa, Dachs, and Claessen
	Hasegawa at [0005], [0013], [0092], [0113], [0148], [0165], and [0168]. Honkanen at Figure 2b, [0012], [0034], [0037], [0045], [0052], [0057], [0142], [0144], [0151], and [0176]. Park–942 at 8–9, 10, 10–11, 12, 12–13, and 14. Dachs at Figure 2, 468, 469, Figure 5, 470–471, and Figure 7. *See also* Dachs at Abstract, Figure 1, and 467. Florek–677 at Figure 1, Figure 2, [0020], and [0024]. Kim–329 at Abstract, Figure 3, Figure 6, [0043], and [0044]. *See also* claim 1 above.
5. The mobile device of claim 1 wherein the performance enhancement circuits are coupled to be powered by the mobile device.	Vega at Abstract, Figure 3, Figure 4A, Figure 4B, Figure 7, Figure 8A, Figure 8B, 3:28–45, 4:51–5:7, 5:8–25, 6:1–22, 7:14–56, 8:46–62, 9:30–60, 9:61–10:33, 10:34–52, 10:53–11:6, 11:7–12:16, 12:60–13:6, 13:7–14:10, 15:20–37, 15:38–61, 15:62–16:8, 16:36–48, and 16:53–17:8. Keen at Figure 1, Figure 3, Figure 4, Figure 5, [0046], [0048], [0091], and [0092]. Yamazaki–454 at [0061]. Matsuo at Figure 6, [0049], [0063], [0066], and [0068]. *See also* Matsuo at [0048]. Park–846 at Abstract, Figure 2, Figure 3a, Figure 3b, Figure 4a, Figure 4b, Figure 5a, Figure 5b, Figure 6a, Figure 6b, [0018], [0031], [0032], [0034], [0039], [0056], [0065], [0066], [0067], [0069], and [0071]. Kowalski at [0027] and [0112]. *See also* Kowalski at [0004]. Gerstenberger at Figure 5, Figure 6, [0043], [0051], and [0055]. *See also* Gerstenberger at [0042]. Wilson at 1:28–2:14, 9:11–14, 17:23–18:1, 19:3–16, 19:21–28, and Figure 3.

Claim Element	Exemplary Citations to Kim-329, Vega, Keen, Yamazaki-454, Park-846, Park-589, Park-942, Matsuo, Kowalski, Gerstenberger, Wilson, Akaida, Florek-442, Florek-677, Honkanen, Hasegawa, Dachs, and Claessen
	Florek–442 at 5:29–6:4 and 9:1–16. Hasegawa at [0005]. Honkanen at [0144] and [0176]. Park–942 at 10 and 14. Dachs at Figure 2. *See also* claim 1 above.
6. The mobile device of claim 1 wherein the mobile device comprises a mobile phone.	Vega at 1:37–50 and 3:10–24. Keen at Figure 7, [0004], [0026], [0101], [0102], and [0103]. *See also* Keen at [0001]. Yamazaki–454 at Figure 27B, [0273], [0279], and [0283]. *See also* Yamazaki–454 at [0067] and [0117]. Park–589 at [0036]. Matsuo at Figure 1, Figure 3, Figure 4, Figure 7, Figure 10, Figure 11, Figure 12, Figure 13, Figure 14, [0005], [0033], [0034], [0051], [0075], [0081], and [0086]. Park–846 at Figure 6a, Figure 6b, and [0067]. Kowalski at Figure 9, Figure 28A, [0004], [0006], [0007], [0009], [0013], [0015], [0021], [0026], [0032], [0093], [0129], [0131], [0133], [0134], [0140], and [0152]. Gerstenberger at Abstract, [0001], [0002], [0004], [0007], [0008], [0018], [0035], [0040], and [0055]. *See also* Gerstenberger at [0003] and [0043]. Wilson at 3:5–23, 9:26–10:10, and 18:9–19. Akaida at [0014] and [0051].

Claim Element	Exemplary Citations to Kim-329, Vega, Keen, Yamazaki-454, Park-846, Park-589, Park-942, Matsuo, Kowalski, Gerstenberger, Wilson, Akaida, Florek-442, Florek-677, Honkanen, Hasegawa, Dachs, and Claessen
	Florek–442 at Abstract, 1:7–15, 2:18–24, 3:10–19, 4:21–31, 4:32–5:6, 5:7–15, 5:16–28, 5:29–6:4, 8:1–3, 10:29–11:6, 13:15–14:4, 16:1–16, 18:22–28, 18:29–34, 19:21–20:9, 20:10–29, 22:9–12, 22:27–23:16, 24:2–11, Figure 5, and Figure 11. Honkanen at Figure 3c, [0005], [0009], [0018], [0030], [0036], [0037], [0041], and [0047]. Park–942 at 3–4, 8–9, 12, 12–13, and 15. Dachs at Abstract, Figure 1, 468, 468–469, 469, 470, and 470–471. Florek–677 at Figure 1, Figure 2, [0001], [0003], [0004], [0006], [0008], [0010], [0012], [0020], [0023], [0024], [0025], and [0027]. *See also* claim 1 above.
7[pre]. A mobile device comprising:	*See* above at 1[pre].
[7a] a smartcard controller;	*See* above at [1a].
[7b] an antenna; and	*See* above at [1b].
[7c] performance enhancement circuits coupled between the smartcard controller and the antenna, wherein the performance enhancement circuits include an amplifier and an active transmit driver circuit, and	Vega at Abstract, Figure 1, Figure 3, Figure 4A, Figure 4B, Figure 4D, Figure 7, Figure 8A, Figure 8B, 3:28–45, 4:14–16, 5:8–25, 5:26–68, 6:1–22, 6:23–33, 6:34–52, 7:14–56, 7:57–8:17, 8:18–45, 8:63–9:17, 9:30–60, 9:61–10:33, 10:34–52, 10:53–11:6, 11:7–12:16, 12:60–13:6, 13:7–14:10, 15:20–37, 15:38–61, 16:36–48, and 16:53–17:8. Keen at Abstract, Figure 1, Figure 2, Figure 3, Figure 4, Figure 5, Figure 6, Figure 7, [0002], [0007], [0009], [0010], [0011], [0013], [0015], [0018], [0024], [0029], [0030], [0031], [0032], [0033], [0050], [0051], [0052], [0053], [0054], [0055], [0058], [0067], [0069], [0074], [0081], [0083], [0084], [0085], [0086], [0087], [0088], [0089], [0090], [0092], [0093], [0095], [0098], [0102], and [0103]. *See also* Keen at [0056], [0091], claim 8, and claim 14.

Claim Element	Exemplary Citations to Kim-329, Vega, Keen, Yamazaki-454, Park-846, Park-589, Park-942, Matsuo, Kowalski, Gerstenberger, Wilson, Akaida, Florek-442, Florek-677, Honkanen, Hasegawa, Dachs, and Claessen
	Yamazaki–454 at Figure 1, Figure 2, Figure 4, Figure 5, Figure 6, Figure 7A, Figure 7B, Figure 8, Figure 9, Figure 10, [0008], [0009], [0013], [0020], [0025], [0026], [0028], [0033], [0034], [0036], [0037], [0038], [0044], [0045], [0053], [0054], [0055], [0056], [0057], [0060], [0061], [0062], [0064], [0065], [0067], [0068], [0069], [0070], [0071], [0074], [0077], [0078], [0079], [0095], [0111], [0114], [0115], [0119], [0120], [0121], [0122], [0137], [0167], [0271], [0273], [0275], [0279], [0281], and [0282]. *See also* Yamazaki–454 at Abstract, [0018], [0023], [0024], [0029], [0030], [0031], [0032], [0035], [0066], [0073], [0075], [0090], [0094], [0102], [0105], [0112], [0118], [0150], [0255], [0256], [0257], [0258], [0259], [0260], [0263], [0268], [0269], and [0280]. Park–589 at Abstract, Figure 1, Figure 3, Figure 4, Figure 5, Figure 6, Figure 7, [0016], [0017], [0019], [0020], [0021], [0027], [0032], [0033], [0034], [0035], [0040], [0042], [0043], [0045], [0046], [0047], [0048], [0049], [0051], [0052], [0054], [0055], [0056], [0058], [0059], [0060], [0062], [0063], [0064], [0068], [0069], [0070], [0071], [0073], [0074], [0075], [0076], [0080], [0081], [0085], [0092], claim 1, claim 2, claim 3, claim 4, claim 6, claim 8, claim 9, claim 11, claim 13, claim 14, claim 15, claim 16, claim 17, and claim 18. *See also* Park–589 at Figure 2, [0018], [0041], [0082], [0084], [0086], [0090], and [0091]. Matsuo at Figure 2, Figure 6, [0008], [0009], [0010], [0015], [0034], [0035], [0047], [0048], [0049], [0053], [0054], [0055], [0056], [0058], [0059], [0060], [0061], [0062], [0063], [0064], [0066], [0067], [0068], [0069], and [0070]. Park–846 at Abstract, Figure 2, Figure 3a, Figure 3b, Figure 4a, Figure 4b, Figure 5a, Figure 5b, Figure 6a, Figure 6b, [0020], [0022], [0031], [0032], [0034], [0035], [0036], [0037], [0038], [0040], [0056], [0058], [0060], [0065], [0066], [0067], [0069], and [0071]. Kowalski at Abstract, Figure 5, Figure 6, Figure 8, Figure 9, Figure 28A, [0002]–[0003], [0004], [0009], [0012], [0015], [0016], [0017], [0026], [0030], [0032], [0037], [0050], [0083], [0085], [0091], [0094], [0095], [0100], [0101], [0102], [0103], [0108], [0110], [0112], [0114], [0115], [0118], [0122], [0124], [0127], [0133], [0136], [0145], [0147], [0149], and [0152]. Gerstenberger at Abstract, Figure 1, Figure 3, Figure 4, Figure 5, Figure 6, Figure 7, [0001], [0002], [0003], [0004], [0007], [0008], [0009], [0010], [0011], [0012], [0014], [0017], [0018], [0021], [0024], [0028], [0032], [0033], [0035], [0040], [0041], [0042], [0043], [0044], [0045], [0046], [0047], [0049], [0050], [0051], [0055], claim 21, claim 26, and claim 37.

Claim Element	Exemplary Citations to Kim-329, Vega, Keen, Yamazaki-454, Park-846, Park-589, Park-942, Matsuo, Kowalski, Gerstenberger, Wilson, Akaida, Florek-442, Florek-677, Honkanen, Hasegawa, Dachs, and Claessen
	Wilson at 1:6–13, 1:28–2:14, 3:24–4:3, 5:19–24, 6:16–7:2, 7:3–12, 8:17–27, 8:28–9:3, 10:20–29, 11:1–24, 12:3–24, 13:14–27, 14:12–21, 15:20–16:3, 16:15–30, 17:23–18:1, 19:21–28, 19:29–20:18, 20:19–26, 20:27–21:8, 22:2–9, Figure 1, Figure 2, and Figure 3. *See also* Wilson at 14:12–21, 14:22–27. Akaida at Abstract, Figure 1, Figure 3, Figure 4, Figure 5, Figure 8, Figure 9, [0003], [0008], [0010], [0012], [0016], [0017], [0018], [0029], [0030], [0031], [0032], [0036], [0038], [0039], [0042], [0043], [0045], [0046], [0050], [0051], and [0056]. *See also* Akaida at [0014]. Florek–442 at 1:33–2:12, 4:21–31, 6:11–22, 7:22–33, 8:4–12, 8:17–32, 9:1–16, 10:9–14, 11:7–20, 16:31–17:4, 18:11–15, 19:21–20:9, 21:5–11, 21:26–32, 22:9–12, 22:20–26, 22:27–23:16, 24:24–34, Figure 1, Figure 2, Figure 3, Figure 4, Figure 6, Figure 8, Figure 10, Figure 12, Figure 13, and Figure 14. Hasegawa at [0005], [0013], [0021], [0059], [0092], [0094], [0113], [0148], [0165], [0168], and [0186]. Honkanen at Figure 1, Figure 2b, Figure 3c, [0005], [0012], [0031], [0032], [0034], [0037], [0044], [0045], [0052], [0057], [0061], [0142], [0144], [0151], [0155], [0158], and [0159]. Park–942 at Abstract, 2, 3–4, 4–5, 5, 5–6, 8–9, 9–10, 10–11, 11–12, 12, 12–13, and 13–14. Dachs at Figure 2, 467, 468, 469, Figure 5, 470–471, and Figure 7. *See also* Dachs at Abstract, Figure 1, 467, and Figure 3. Florek–677 at Figure 1, Figure 2, [0010], [0020], [0023], and [0024]. Kim–329 at Abstract, Figure 2, Figure 3, Figure 6, [0008], [0042], [0043], and [0044]. *See also* above at [1c].
[7d] wherein the amplifier is coupled to amplify a signal received from the antenna and to provide an amplified signal to the smartcard controller.	*See* above at [1d].

Claim Element	Exemplary Citations to Kim-329, Vega, Keen, Yamazaki-454, Park-846, Park-589, Park-942, Matsuo, Kowalski, Gerstenberger, Wilson, Akaida, Florek-442, Florek-677, Honkanen, Hasegawa, Dachs, and Claessen
8. The mobile device of claim 7 wherein the antenna is tuned to operate at 13.56 MHz.	Vega at 2:4–26. Keen at Abstract, [0002], [0003], [0028], [0030], and [0083]. *See also* Keen at [0067], [0084], and [0091]. *See also* Yamazaki–454 at Figure 1 and Figure 9. Park–589 at [0006]–[0007], [0047], [0052], and [0055]. *See also* Park–589 at [0012], [0017], [0048], and [0049]. Matsuo at Figure 2, [0003], [0047], [0048], [0049], [0051], [0057], [0066], [0067], [0077], [0078], [0083], [0086], [0087], [0088], and [0089]. *See also* Matsuo at Abstract, [0005], [0015], [0034], [0037], [0038], and [0042]. Park–846 at [0050]. Kowalski at [0002]–[0003], [0015], [0046], [0091], and [0101]. Gerstenberger at [0008] and [0009]. Wilson at 1:6–13, 3:24–4:3, 5:19–24, 6:16–7:2, 7:3–12, 8:17–27, 8:28–9:3, 12:3–24, 13:14–27, 14:12–21, 15:20–16:3, 16:15–24, 16:25–30, 19:21–28, 19:29–20:18, 22:1–9, Figure 1, Figure 2, and Figure 3. Florek–442 at 13:15–14:4, 14:16–29, 18:29–34, 19:21–20:9, 22:9–12, 25:1–5, 27:13–17, Figure 3, Figure 6, Figure 8, and Figure 13. *See also* Florek–442 at 1:7–15 and 9:1–16. Hasegawa at Abstract, [0003], [0004], and [0051]. Honkanen at [0005], [0006], [0031], and [0033]. *See also* Honkanen at [0061]. Park–942 at 7. Dachs at Abstract, Figure 2, 467, Figure 3, 468, 469, and Figure 5.

Claim Element	Exemplary Citations to Kim-329, Vega, Keen, Yamazaki-454, Park-846, Park-589, Park-942, Matsuo, Kowalski, Gerstenberger, Wilson, Akaida, Florek-442, Florek-677, Honkanen, Hasegawa, Dachs, and Claessen
	See also Dachs at Figure 1, 468, 468–469, and 470. Florek–677 at [0010], [0023], [0024], and [0025]. Kim–329 at [0042]. *See* above at claim 2. *See also* claim 7 above.
9. The mobile device of claim 7 wherein the antenna comprises an inductive element too small to draw enough power sufficient to operate the smartcard controller from an interrogating radio frequency (RF) field.	Vega at Figure 3, Figure 7, 2:4–26, 2:27–40, 2:41–52, 2:66–3:9, 3:28–45, 4:51–5:7, 5:26–68, 6:34–52, 7:14–56, 7:57–8:17, 8:18–45, 8:63–9:17, 9:30–60, 9:61–10:33, 12:60–13:6, 13:7–14:10, and 15:38–61. *See also* Vega at Abstract, 5:8–25, 6:1–22, 15:20–37, and 16:53–17:8. Keen at Abstract, Figure 1, Figure 2, Figure 3, Figure 4, Figure 5, Figure 6, [0002], [0004]–[0005], [0007], [0009], [0010], [0011], [0013], [0015], [0018], [0029], [0030], [0031], [0032], [0050], [0051], [0052], [0053], [0054], [0055], [0056], [0058], [0067], [0069], [0074], [0081], [0084], [0085], [0091], [0092], and [0102]. *See also* Keen at [0024], [0033], [0086], [0089], [0090], [0093], and [0098]. Yamazaki–454 at Figure 1, Figure 2, Figure 4, Figure 5, Figure 6, Figure 7A, Figure 7B, Figure 8, Figure 9, Figure 10, [0008], [0028], [0033], [0034], [0036], [0037], [0038], [0044], [0045], [0053], [0054], [0055], [0056], [0057], [0060], [0061], [0062], [0065], [0067], [0068], [0069], [0070], [0071], [0073], [0074], [0077], [0078], [0079], [0095], [0111], [0114], [0115], [0119], [0120], [0121], [0122], [0259], [0269], [0273], [0275], [0279], [0281], and [0282]. *See also* Yamazaki–454 at [0018], [0023], [0024], [0029], [0030], [0031], [0032], [0035], [0064], [0066], [0075], [0090], [0094], [0102], [0105], [0112], [0118], [0137], [0150], [0268], and [0280]. Park–589 at Abstract, Figure 1, Figure 6, Figure 7, [0006]–[0007], [0016], [0017], [0019], [0020], [0021], [0032], [0033], [0035], [0040], [0042], [0043], [0045], [0046], [0047], [0048], [0049], [0051], [0052], [0054], [0055], [0058], [0059], [0062], [0063], [0064], [0068], [0069], [0070], [0071], [0073], [0074], [0076], [0080], [0081], [0085], [0092], claim 1, claim 2, claim 3, claim 4, claim 6, claim 8, claim 9, claim 11, claim 15, claim 16, claim 17, and claim 18. *See also* Park–589 at Figure 2, Figure 3, [0018], [0041], [0056], [0082], [0084], [0086], [0090], and [0091].

Claim Element	Exemplary Citations to Kim-329, Vega, Keen, Yamazaki-454, Park-846, Park-589, Park-942, Matsuo, Kowalski, Gerstenberger, Wilson, Akaida, Florek-442, Florek-677, Honkanen, Hasegawa, Dachs, and Claessen
	Matsuo at Figure 2, Figure 6, [0008], [0009], [0010], [0015], [0034], [0035], [0048], [0049], [0053], [0054], [0055], [0056], [0058], [0059], [0060], [0061], [0062], [0064], [0066], [0069], and [0070]. Park–846 at Figure 3a, Figure 3b, Figure 6b, [0020], [0035], [0037], [0038], [0065], [0066], [0067], [0069], and [0071]. Kowalski at Abstract, Figure 5, Figure 6, Figure 8, Figure 9, Figure 28A, [0002]–[0003], [0004], [0009], [0012], [0015], [0017], [0026], [0030], [0032], [0037], [0050], [0083], [0085], [0091], [0095], [0100], [0101], [0102], [0103], [0110], [0114], [0115], [0118], [0122], [0124], [0127], [0133], [0136], [0145], and [0152]. Gerstenberger at Figure 5, Figure 6, [0003], [0006], [0009], [0010], [0021], [0032], [0040], [0041], [0043], [0044], [0050], [0051], claim 19, and claim 26. *See also* Gerstenberger at [0049]. Wilson at 4:4–21, 15:20–16:3. Akaida at Abstract, Figure 3, Figure 4, Figure 8, Figure 9, [0003], [0008], [0016], [0017], [0018], [0029], [0036], [0038], [0042], [0043], [0045], [0046], [0050], and [0051]. *See also* Akaida at [0014]. Florek–442 at 1:33–2:12, 4:21–31, 6:11–22, 7:22–33, 8:4–12, 8:17–32, 9:1–16, 10:9–14, 11:7–20, 16:31–17:4, 19:21–20:9, 21:5–11, 21:26–32, 22:20–26, 22:27–23:16, Figure 1, Figure 3, Figure 4, Figure 12, and Figure 13. Hasegawa at [0005], [0013], [0092], [0094], [0113], [0148], [0165], [0168], and [0186]. Honkanen at Figure 1, Figure 2b, [0005], [0012], [0031], [0032], [0034], [0037], [0045], [0052], [0057], [0061], [0142], [0144], and [0151]. Park–942 at Abstract, 2, 3–4, 4–5, 5, 5–6, 8–9, 9–10, 10–11, 11–12, 12, and 12–13. Dachs at 468, 469, Figure 5, 470–471, and Figure 7. *See also* Dachs at Abstract, Figure 1, and 467. Florek–677 at Figure 1, Figure 2, [0010], [0020], [0023], and [0024].

Claim Element	Exemplary Citations to Kim-329, Vega, Keen, Yamazaki-454, Park-846, Park-589, Park-942, Matsuo, Kowalski, Gerstenberger, Wilson, Akaida, Florek-442, Florek-677, Honkanen, Hasegawa, Dachs, and Claessen
	Kim–329 at Abstract, Figure 3, Figure 6, [0008], [0042], [0043], and [0044]. *See* above at claim 3. *See also* claim 7 above.
10. The mobile device of claim 7 wherein the smartcard controller is coupled to be powered by the mobile device.	*See* above at claim 4. *See also* claim 7 above.
11. The mobile device of claim 7 wherein the performance enhancement circuits are coupled to be powered by the mobile device.	*See* above at claim 5. *See also* claim 7 above.
12. The mobile device of claim 7 wherein the mobile device comprises a mobile phone.	*See* above at claim 6. *See also* claim 7 above.
13[pre]. A mobile device comprising:	*See* above at 1[pre].
[13a] a smartcard controller;	*See* above at [1a].
[13b] an antenna;	*See* above at [1b].
[13c] an amplifier coupled to amplify signals received at the antenna and drive the smartcard controller; and	*See* above at [1d].

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Claim Element	Exemplary Citations to Kim-329, Vega, Keen, Yamazaki-454, Park-846, Park-589, Park-942, Matsuo, Kowalski, Gerstenberger, Wilson, Akaida, Florek-442, Florek-677, Honkanen, Hasegawa, Dachs, and Claessen
[13d] a driver circuit to drive the antenna with data provided by the smartcard controller.	Vega at Abstract, Figure 1, Figure 3, Figure 4A, Figure 4B, Figure 4D, Figure 7, Figure 8A, Figure 8B, 4:14–16, 4:17–18, 5:8–25, 5:26–68, 6:1–22, 6:23–33, 6:34–52, 7:14–56, 7:57–8:17, 8:18–45, 8:63–9:17, 9:30–60, 9:61–10:33, 10:34–52, 10:53–11:6, 11:7–12:16, 12:60–13:6, 13:7–14:10, 15:20–37, 15:38–61, 16:36–48, and 16:53–17:8. *See also* Vega at 3:28–45. Keen at Abstract, Figure 1, Figure 2, Figure 3, Figure 4, Figure 5, Figure 6, Figure 7, [0002], [0007], [0009], [0010], [0011], [0013], [0015], [0018], [0029], [0030], [0031], [0032], [0033], [0048], [0050], [0051], [0052], [0053], [0054], [0055], [0056], [0058], [0067], [0069], [0074], [0081], [0083], [0084], [0085], [0086], [0087], [0088], [0089], [0090], [0092], [0093], [0095], [0098], [0102], [0103], claim 1, and claim 8. *See also* Keen at [0024], [0091], and claim 14. Yamazaki–454 at Figure 1, Figure 2, Figure 4, Figure 5, Figure 6, Figure 7A, Figure 7B, Figure 8, Figure 9, Figure 10, Figure 12, [0008], [0009], [0013], [0019], [0020], [0025], [0026], [0028], [0033], [0034], [0036], [0037], [0038], [0044], [0045], [0053], [0054], [0055], [0056], [0057], [0060], [0061], [0062], [0064], [0065], [0067], [0068], [0069], [0070], [0071], [0074], [0077], [0078], [0079], [0095], [0110], [0111], [0112], [0114], [0115], [0118], [0119], [0120], [0121], [0122], [0137], [0150], [0167], [0269], [0271], [0273], [0275], [0279], [0281], and [0282]. *See also* Yamazaki–454 at Abstract, [0018], [0023], [0024], [0029], [0030], [0031], [0032], [0035], [0066], [0073], [0075], [0090], [0094], [0102], [0105], [0255], [0256], [0257], [0258], [0259], [0260], [0263], [0268], and [0280]. Park–589 at Abstract, Figure 1, Figure 3, Figure 4, Figure 5, Figure 6, Figure 7, [0016], [0017], [0019], [0020], [0021], [0027], [0032], [0033], [0034], [0035], [0040], [0042], [0043], [0045], [0046], [0047], [0048], [0049], [0050], [0051], [0052], [0054], [0055], [0056], [0058], [0059], [0060], [0062], [0063], [0064], [0068], [0069], [0070], [0071], [0073], [0074], [0075], [0076], [0080], [0081], [0085], [0092], claim 1, claim 2, claim 3, claim 4, claim 6, claim 8, claim 9, claim 11, claim 13, claim 14, claim 15, claim 16, claim 17, and claim 18. *See also* Park–589 at Figure 2, [0018], [0041], [0082], [0084], [0086], [0090], and [0091].

Claim Element	Exemplary Citations to Kim-329, Vega, Keen, Yamazaki-454, Park-846, Park-589, Park-942, Matsuo, Kowalski, Gerstenberger, Wilson, Akaida, Florek-442, Florek-677, Honkanen, Hasegawa, Dachs, and Claessen
	Matsuo at Figure 2, Figure 6, [0007], [0008], [0009], [0010], [0015], [0034], [0035], [0047], [0048], [0049], [0053], [0054], [0055], [0056], [0057], [0058], [0059], [0060], [0061], [0062], [0063], [0064], [0066], [0067], [0068], [0069], and [0070]. Park–846 at Abstract, Figure 2, Figure 3a, Figure 3b, Figure 4a, Figure 4b, Figure 5a, Figure 5b, Figure 6a, Figure 6b, [0020], [0022], [0031], [0032], [0034], [0035], [0036], [0037], [0038], [0040], [0049], [0050], [0056], [0058], [0060], [0065], [0066], [0067], [0069], and [0071]. Kowalski at Abstract, Figure 5, Figure 6, Figure 8, Figure 9, Figure 28A, [0002]–[0003], [0004], [0009], [0012], [0015], [0016], [0017], [0026], [0027], [0030], [0032], [0037], [0050], [0083], [0085], [0091], [0094], [0095], [0100], [0101], [0102], [0103], [0108], [0110], [0112], [0114], [0115], [0118], [0122], [0124], [0127], [0133], [0136], [0145], [0147], [0149], and [0152]. Gerstenberger at Abstract, Figure 1, Figure 3, Figure 4, Figure 5, Figure 6, Figure 7, [0001], [0002], [0003], [0004], [0007], [0008], [0009], [0010], [0011], [0012], [0014], [0017], [0018], [0024], [0028], [0032], [0033], [0035], [0040], [0041], [0042], [0043], [0044], [0045], [0046], [0050], [0051], [0055], claim 21, claim 26, and claim 37. *See also* Gerstenberger at [0047]. Wilson at 1:6–13, 1:28–2:14, 3:24–4:3, 4:16–21, 5:19–24, 6:16–7:2, 7:3–12, 8:17–27, 8:28–9:3, 10:20–29, 11:1–24, 12:3–14, 13:14–27, 14:12–21, 15:20–16:3, 16:15–24, 16:25–30, 17:23–18:1, 19:3–16, 19:21–28, 19:29–20:18, 20:27–21:8, 22:1–9, Figure 1, Figure 2, and Figure 3. *See also* Wilson at 14:12–21, 14:22–27. Akaida at Abstract, Figure 1, Figure 3, Figure 4, Figure 5, Figure 8, Figure 9, [0003], [0008], [0010], [0012], [0016], [0017], [0018], [0029], [0030], [0031], [0036], [0038], [0039], [0042], [0043], [0045], [0046], [0048], [0050], [0051], [0052], and [0056]. *See also* Akaida at [0014]. Florek–442 at 1:33–2:12, 4:21–31, 6:11–22, 7:22–33, 8:4–12, 8:17–32, 9:1–16, 10:9–14, 11:7–20, 16:31–17:4, 18:11–15, 19:21–20:9, 21:5–11, 21:26–32, 22:9–12, 22:20–26, 22:27–23:16, 24:24–34, Figure 1, Figure 2, Figure 3, Figure 4, Figure 5, Figure 6, Figure 8, Figure 10, Figure 12, Figure 13, and Figure 14.

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Claim Element	Exemplary Citations to Kim-329, Vega, Keen, Yamazaki-454, Park-846, Park-589, Park-942, Matsuo, Kowalski, Gerstenberger, Wilson, Akaida, Florek-442, Florek-677, Honkanen, Hasegawa, Dachs, and Claessen
	Hasegawa at Abstract, [0003], [0005], [0013], [0045], [0053], [0057], [0092], [0094], [0113], [0128], [0129], [0148], [0163], [0165], [0168], [0186], and [0200]. Honkanen at Figure 1, Figure 2b, Figure 3c, [0005], [0012], [0031], [0032], [0034], [0035], [0037], [0044], [0045], [0052], [0057], [0061], [0142], [0144], [0151], [0155], [0158], and [0159]. Park–942 at Abstract, 2, 3–4, 4–5, 5, 5–6, 6–7, 7, 7–8, 8–9, 9–10, 10, 10–11, 11–12, 12, 12–13, and 13–14. Dachs at Figure 2, 467, Figure 3, 468, 469, Figure 5, 470–471, and Figure 7. *See also* Dachs at Abstract, Figure 1, and 467. Florek–677 at Figure 1, Figure 2, [0010], [0020], [0023], and [0024]. Kim–329 at Abstract, Figure 2, Figure 3, Figure 6, [0008], [0022], [0041], [0042], [0043], [0044], [0045], and [0046]. Claessen at [0005], [0013], and [0026].
14. The mobile device of claim 13 wherein the driver circuit comprises a load modulation circuit.	Vega at Abstract, Figure 3, Figure 4A, Figure 4B, Figure 4D, Figure 4E, Figure 7, Figure 8A, Figure 8B, 4:14–16, 4:17–18, 5:8–25, 6:1–22, 7:14–56, 7:57–8:17, 9:30–60, 9:61–10:33, 10:34–52, 11:7–12:16, 12:60–13:6, 13:7–14:10, 14:11–44, 15:38–61, and 16:53–17:8. *See also* Vega at 3:28–45, 6:23–33, 8:18–45, 10:53–11:6, 15:20–37, and 16:36–48. Keen at Abstract, Figure 1, Figure 2, Figure 3, Figure 4, Figure 5, Figure 6, [0011], [0013], [0015], [0018], [0024], [0029], [0030], [0031], [0032], [0048], [0051], [0055], [0056], [0067], [0074], [0083], [0084], [0085], [0086], [0088], [0089], [0090], [0092], [0093], [0098], [0102], and claim 1. *See also* Keen at claim 17 and claim 18. Yamazaki–454 at Figure 1, Figure 5, Figure 9, Figure 12, [0019], [0020], [0060], [0061], [0062], [0064], [0074], [0110], [0111], [0112], [0114], [0115], [0118], [0119], [0120], [0121], [0137], [0150], [0269], and [0275]. Park–589 at Figure 3, Figure 4, [0032], [0034], [0048], [0050], [0051], claim 6, claim 8, and claim 9. *See also* Park–589 at [0047], [0049], [0052], claim 7, and claim 10.

Claim Element	Exemplary Citations to Kim-329, Vega, Keen, Yamazaki-454, Park-846, Park-589, Park-942, Matsuo, Kowalski, Gerstenberger, Wilson, Akaida, Florek-442, Florek-677, Honkanen, Hasegawa, Dachs, and Claessen
	Matsuo at Figure 6, [0007], [0008], [0015], [0048], [0049], [0057], [0058], [0059], [0060], [0066], [0067], [0068], and [0070]. Park–846 at Abstract, Figure 2, Figure 3a, Figure 3b, Figure 4a, Figure 4b, Figure 5a, Figure 5b, Figure 6a, Figure 6b, [0031], [0032], [0034], [0036], [0037], [0049], [0050], [0056], [0058], and [0060]. Kowalski at Figure 8, Figure 9, [0002]–[0003], [0027], [0085], [0094], [0100], [0102], [0112], [0149], and [0152]. Gerstenberger at Figure 5, Figure 6, [0042], [0043], [0044], [0045], [0046], [0050], [0051], and [0055]. *See also* Gerstenberger at [0041] and [0047]. Wilson at 1:28–2:14, 3:24–4:3, 4:4–9, 11:1–24, 12:3–24, 13:14–27, 14:12–21, 15:20–16:3, 17:23–18:1, 19:21–28, Figure 1, Figure 2, and Figure 3. *See also* Wilson at 6:16–7:2, 7:3–12, and 19:29–20:18. Akaida at Abstract, Figure 1, Figure 4, Figure 5, Figure 8, Figure 9, [0008], [0010], [0012], [0016], [0017], [0018], [0030], [0031], [0036], [0038], [0042], [0043], [0048], and [0052]. Florek–442 at Figure 5 and Figure 13. Hasegawa at Abstract, [0003], [0005], [0006], [0013], [0045], [0051], [0053], [0057], [0092], [0113], [0128], [0129], [0163], [0165], [0168], and [0200]. Honkanen at Figure 1, Figure 2b, [0006], [0032], [0035], [0144], [0155], [0158], and [0159]. Park–942 at 5, 5–6, 6–7, 7, 7–8, 9–10, 10, 12, and 13–14. Dachs at Figure 2, 467, Figure 3, and Figure 5. Kim–329 at Figure 3, [0008], [0022], [0041], [0044], [0045], and [0046]. Claessen at [0002], [0003], [0005], [0013], and [0026]. *See* above at [1c]. *See also* claim 13 above.

Claim Element	Exemplary Citations to Kim-329, Vega, Keen, Yamazaki-454, Park-846, Park-589, Park-942, Matsuo, Kowalski, Gerstenberger, Wilson, Akaida, Florek-442, Florek-677, Honkanen, Hasegawa, Dachs, and Claessen
15. The mobile device of claim 13 wherein the driver circuit comprises an active transmit driver circuit.	Vega at Abstract, Figure 3, Figure 4A, Figure 4B, Figure 4D, Figure 7, Figure 8A, Figure 8B, 3:28–45, 4:14–16, 4:17–18, 4:51–5:7, 5:8–25, 6:1–22, 6:23–33, 7:14–56, 7:57–8:17, 8:18–45, 9:30–60, 9:61–10:33, 10:34–52, 10:53–11:6, 11:7–12:16, 12:60–13:6, 13:7–14:10, 15:20–37, 15:38–61, 16:36–48, and 16:53–17:8. Keen at Abstract, Figure 1, Figure 2, Figure 3, Figure 4, Figure 5, Figure 6, [0011], [0013], [0015], [0018], [0024], [0031], [0032], [0048], [0051], [0055], [0056], [0067], [0074], [0083], [0084], [0085], [0086], [0088], [0089], [0090], [0092], [0093], [0098], and claim 1. Yamazaki–454 at Figure 1, Figure 5, Figure 9, Figure 12, [0019], [0020], [0060], [0061], [0062], [0064], [0074], [0110], [0111], [0112], [0114], [0115], [0118], [0119], [0120], [0121], [0137], [0150], [0269], and [0275]. Park–589 at Figure 3, Figure 4, [0032], [0034], [0048], [0050], [0051], claim 6, claim 8, and claim 9. *See also* Park–589 at [0049]. Matsuo at Figure 6, [0007], [0008], [0015], [0048], [0049], [0057], [0058], [0059], [0060], [0066], [0067], [0068], and [0070]. Park–846 at Abstract, Figure 2, Figure 3a, Figure 3b, Figure 4a, Figure 4b, Figure 5a, Figure 5b, Figure 6a, Figure 6b, [0031], [0032], [0034], [0036], [0037], [0049], [0050], [0056], [0058], and [0060]. Kowalski at Figure 8, Figure 9, [0004], [0027], [0085], [0094], [0100], [0102], [0112], [0149], and [0152]. Gerstenberger at Figure 5, Figure 6, [0021], [0028], [0041], [0042], [0043], [0044], [0045], [0046], [0047], [0049], [0050], [0051], [0055], claim 21, and claim 37. Wilson at 1:28–2:14, 4:16–21, 11:1–24, 12:3–24, 13:14–27, 17:23–18:1, 19:3–16, 19:21–28, 19:29–20:18, Figure 1, Figure 2, and Figure 3. *See also* Wilson at 6:16–7:2, 7:3–12, 14:12–21, and 14:22–27. Akaida at Abstract, Figure 1, Figure 4, Figure 5, Figure 8, Figure 9, [0008], [0010], [0012], [0016], [0017], [0018], [0030], [0031], [0036], [0038], [0042], [0043], [0048], and [0052]. Florek–442 at Figure 5 and Figure 13.

Claim Element	Exemplary Citations to Kim-329, Vega, Keen, Yamazaki-454, Park-846, Park-589, Park-942, Matsuo, Kowalski, Gerstenberger, Wilson, Akaida, Florek-442, Florek-677, Honkanen, Hasegawa, Dachs, and Claessen
	Hasegawa at Abstract, [0003], [0005], [0013], [0045], [0053], [0057], [0092], [0113], [0128], [0129], [0163], [0165], [0168], and [0200]. Honkanen at Figure 1, Figure 2b, [0032], [0035], [0144], [0155], [0158], and [0159]. Park–942 at 5, 5–6, 6–7, 7, 7–8, 9–10, 10, 12, and 13–14. Dachs at Figure 2, 467, Figure 3, and Figure 5. Kim–329 at Figure 3, [0008], [0022], [0041], [0044], [0045], and [0046]. Claessen at [0005], [0013], and [0026]. *See* above at claim [7c]. *See also* claim 13 above.
16. The mobile device of claim 15 wherein the active transmit driver circuit is coupled to be powered by the mobile device.	Vega at Abstract, Figure 3, Figure 4A, Figure 4B, Figure 7, Figure 8A, Figure 8B, 3:28–45, 4:51–5:7, 5:8–25, 6:1–22, 7:14–56, 8:46–62, 9:30–60, 9:61–10:33, 10:34–52, 10:53–11:6, 11:7–12:16, 12:60–13:6, 13:7–14:10, 15:20–37, 15:38–61, 15:62–16:8, 16:36–48, and 16:53–17:8. Keen at Figure 1, Figure 3, Figure 4, Figure 5, [0046], [0048], [0091], and [0092]. Yamazaki–454 at [0061]. Matsuo at Figure 6, [0049], [0063], and [0066]. *See also* Matsuo at [0048] and [0068]. Park–846 at Abstract, Figure 2, Figure 3a, Figure 3b, Figure 4a, Figure 4b, Figure 5a, Figure 5b, Figure 6a, Figure 6b, [0018], [0031], [0032], [0034], [0039], [0056], [0065], [0066], [0067], [0069], and [0071]. Kowalski at [0112]. *See also* Kowalski at [0004] and [0027]. Gerstenberger at Figure 5, Figure 6, [0043], [0051], and [0055]. *See also* Gerstenberger at [0042].

Claim Element	Exemplary Citations to Kim-329, Vega, Keen, Yamazaki-454, Park-846, Park-589, Park-942, Matsuo, Kowalski, Gerstenberger, Wilson, Akaida, Florek-442, Florek-677, Honkanen, Hasegawa, Dachs, and Claessen
	Wilson at 1:28–2:14, 9:11–14, 17:23–18:1, 19:3–16, 19:21–28, 19:29–20:18, and Figure 3. Florek–442 at 9:1–16. *See also* Florek–442 at 5:29–6:4. Hasegawa at [0005]. Honkanen at [0144] and [0176]. Park–942 at 10 and 14. Dachs at Figure 2. *See* above at claim 11. *See also* claim 15 above.
17. The mobile device of claim 13 wherein the amplifier is coupled to be powered by the mobile device.	Vega at Abstract, Figure 3, Figure 4A, Figure 4B, Figure 7, Figure 8A, Figure 8B, 3:28–45, 4:51–5:7, 5:8–25, 6:1–22, 7:14–56, 8:46–62, 9:30–60, 9:61–10:33, 10:34–52, 10:53–11:6, 11:7–12:16, 12:60–13:6, 13:7–14:10, 15:20–37, 15:38–61, 15:62–16:8, 16:36–48, and 16:53–17:8. Keen at Figure 3, Figure 4, Figure 5, [0046], and [0091]. *See also* Keen at [0048]. Yamazaki–454 at [0061]. Matsuo at [0063] and [0066]. Park–846 at Abstract, Figure 2, Figure 3a, Figure 3b, Figure 4a, Figure 4b, Figure 5a, Figure 5b, Figure 6a, Figure 6b, [0018], [0031], [0032], [0034], [0039], [0056], [0065], [0066], [0067], [0069], and [0071]. Kowalski at [0112]. *See also* Kowalski at [0004] and [0027]. Gerstenberger at Figure 5, Figure 6, [0043], [0051], and [0055]. *See also* Gerstenberger at [0042].

Claim Element	Exemplary Citations to Kim-329, Vega, Keen, Yamazaki-454, Park-846, Park-589, Park-942, Matsuo, Kowalski, Gerstenberger, Wilson, Akaida, Florek-442, Florek-677, Honkanen, Hasegawa, Dachs, and Claessen
	Wilson at 1:28–2:14, 9:11–14, 19:3–16, and 19:21–28. Hasegawa at [0005]. Honkanen at [0144] and [0176]. Park–942 at 10 and 14. *See also* Dachs at Figure 2. *See also* claim 13 above.
18. The mobile device of claim 13 wherein the antenna is tuned to operate at 13.56 MHz.	*See* above at claim 2. *See also* claim 13 above.
19. The mobile device of claim 13 wherein the antenna comprises an inductive element too small to draw enough power sufficient to operate the smartcard controller from an interrogating radio frequency (RF) field.	*See* above at claim 3. *See also* claim 13 above.
20. The mobile device of claim 13 wherein the mobile device comprises a mobile phone.	*See* above at claim 6. *See also* claim 13 above.

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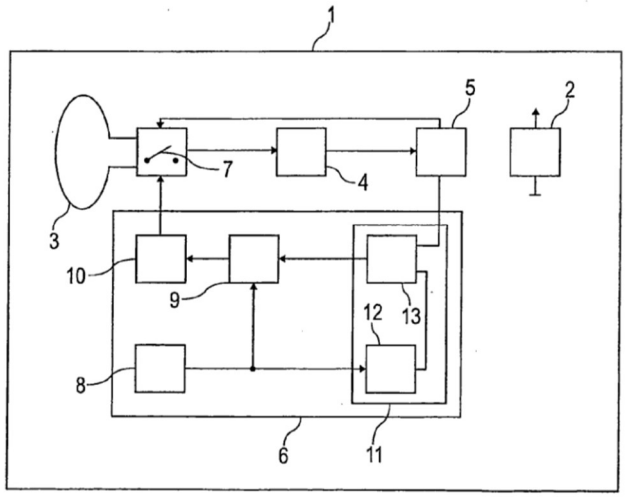
DEFENDANTS' INVALIDITY CONTENTIONS FOR U.S. PAT. 9,122,965

EXHIBIT A01: U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")

As demonstrated in the claim charts below, the claims of U.S. Patent No. 9,122,965 ("the '965 patent") are invalid (a) under one or more sections of 35 U.S.C. § 102 as anticipated by Finkenzeller and (b) under 35 U.S.C. § 103(a) as obvious over Finkenzeller standing alone and as set forth herein, and/or combined with the knowledge of a person of ordinary skill in the art, Applicant's Admitted Prior Art, and/or the additional prior art references discussed in Exhibit A and Exhibits A01–A05, the contents of which are hereby incorporated by reference into this chart. One of ordinary skill in the art, as of the priority date of the '965 patent, would have known to combine the prior art elements disclosed by the foregoing references using known methods, and to use these elements according to their established functions in order to achieve a known and predictable result.

Defendants have conducted the invalidity analysis herein based at least in part and in some instance entirely upon Plaintiff's apparent application of the claims of the '965 patent. By charting the prior art against the claims and limitations herein, Defendants are not admitting or agreeing to Plaintiff's application of the claims at issue in this case, and these charts should not be interpreted as an admission or concession by Defendants that any particular construction or application of any claim limitation by Plaintiff is correct or proper. Additionally, these charts provide representative examples of portions of the charted references that disclose the indicated limitations of the claims; additional portions of these references other than the representative examples provided herein may also disclose the indicated limitation(s) and Defendants contend that the asserted claims are invalid in light of the charted reference(s) as a whole in its or their entirety. Where a particular figure is cited, the citation should be understood to encompass the caption and description of the figure as well as any text relating to or describing the figure. Conversely, where particular text referring to a figure is cited, the citation should be understood to include the figure as well.

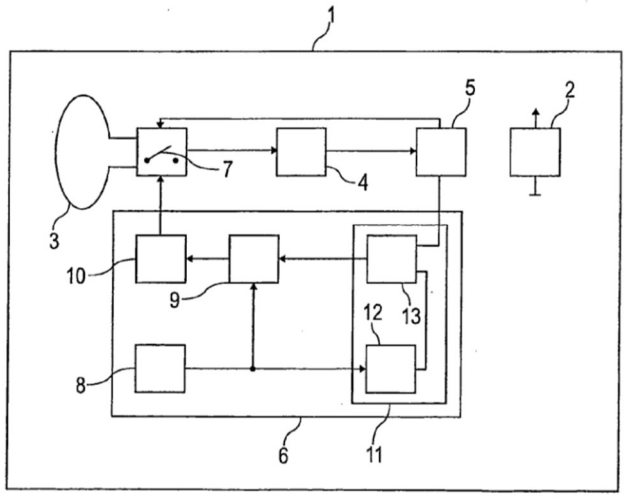
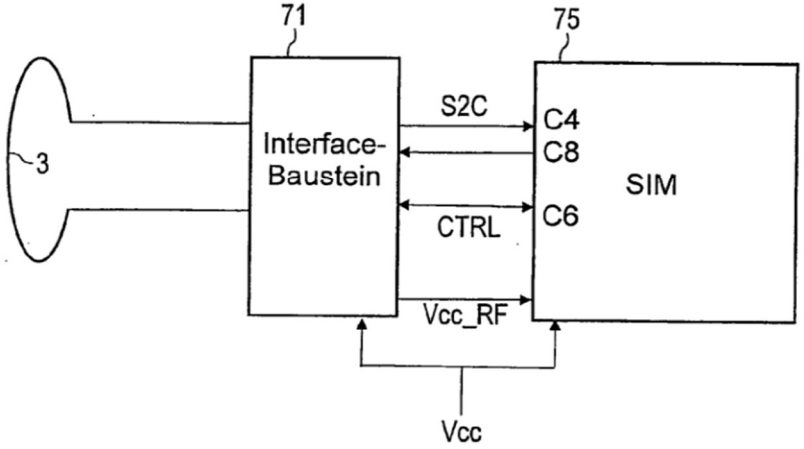
Claim Element	**Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")**
1[pre]. A mobile device comprising:	By providing this disclosure, Defendants do not take a position on whether the preamble is a claim limitation. Finkenzeller discloses or renders obvious "[a] mobile device." For example: Finkenzeller at Abstract The invention relates to a transponder unit (1) and to a method for data transfer between the transponder unit and a reading device (100). To increase the range of data transfer from the transponder unit (1) to the reading device (100), the transponder unit (1) has means integrated therein for actively sending a signal to the reading device (100) which can be evaluated by the reading device (100) like a modulation of its own field (110) by a transponder. Finkenzeller at Figure 2

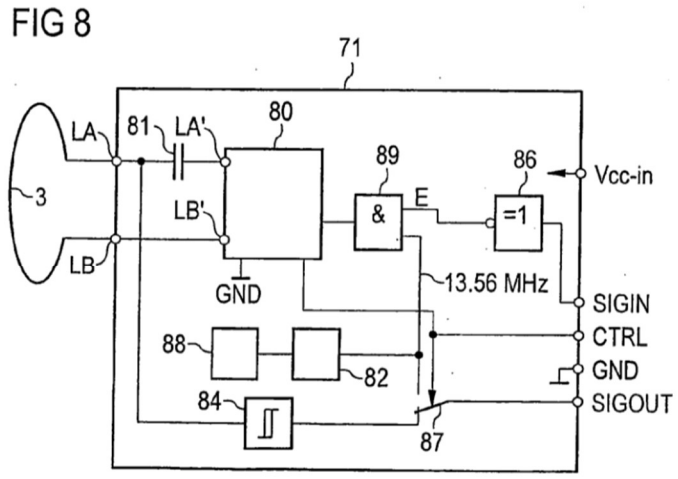
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	FIG 2  Finkenzeller at [0006] For simple and fast contactless communication between two devices, the companies Philips and Sony have developed an inductive transmission technology which is known as so-called near field communication (NFC). This technology is integrated for example in mobile telephones or PDAs to permit communication between the devices or with a computer. The coupling of the two devices is effected via coils, the carrier frequency being 13.56 MHz as in RFID systems. As described more closely in the NFC standard ECMA 340, NFC systems have an active communication mode and a passive communication mode. In the active mode, two NFC units alternately generate their own RF field as a signal carrier, thus switching back and forth, coordinated with each other, between transmit mode and receive mode as in a classic mobile phone system. In the passive mode, however, the two NFC units must agree on which unit acts as a reading device and generates a field which the other unit can then influence by means of load modulation. Primarily due to the small antenna diameters used, NFC systems only permit small communication ranges of up to 20 cm. Finkenzeller at [0027] The possibility of reading the inventive transponder unit over very large distances is not always desired, for example for privacy protection. It is therefore provided in one embodiment that the inventive circuit

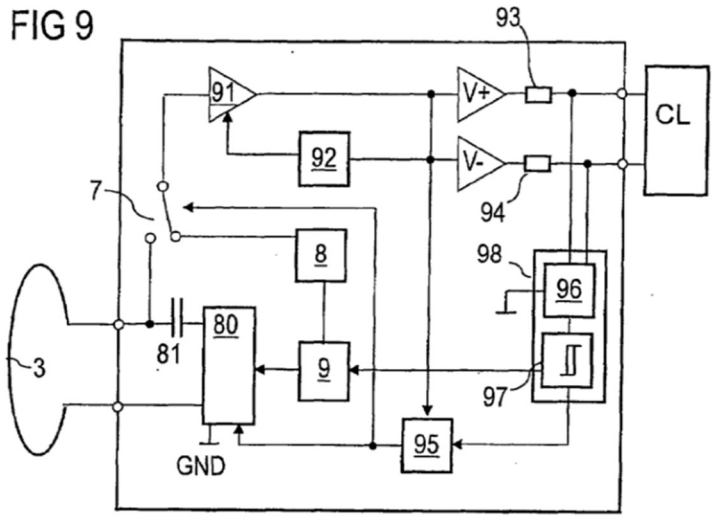
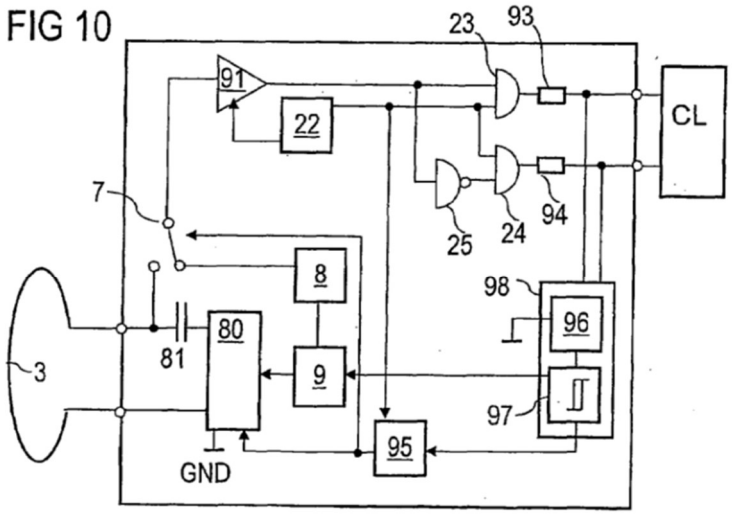
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	configuration can be activated manually if communication over a long range is explicitly desired. Otherwise, communication can be effected via a load modulator provided in the transponder unit, which is usable only for short distances. If no load modulator is provided in the trans-ponder unit, it can be provided for example that the transponder unit is activated for sending data only if the signal emitted by the reading device contains a predetermined code. Finkenzeller at [0028] The transponder unit can also be part of a mobile terminal, for example a mobile telephone. The transponder unit can have its own antenna or use an antenna of the terminal. Finkenzeller at [0032] The transponder unit is preferably integrated in a card or data carrier insertable into the mobile terminal. For example, the transponder unit can be integrated in a SIM card. The advantage is that the mobile terminal, for example a mobile phone or PDA, into which the card with the inventive transponder unit is inserted requires no additional (integrated) antenna to be usable as an RFID unit. Finkenzeller at [0047] Depending on a type of system used, data can be transferred from the trans-ponders 200, 300 to the reading device 100 either by means of load modulation (inductive coupling) or by means of modulated backscatter cross section (electromagnetic backscatter coupling). Embodiments will preferably be described hereinafter for systems that transfer data to the reading device on the principle of load modulation. However, the individual aspects of the embodiments are largely also applicable analogously to systems that work on the principle of modulated backscatter cross sections of the transponder unit. Finkenzeller at [0048] The transponder unit 1 sends for data transfer to the reading device 100 a signal which the reading device 100 can evaluate as a signal of a transponder which carries out a load modulation of the field 110 of the reading device 100. Unlike the conventional transponders 200, 300 which modulate the field 110 of the reading device 100 into a modulated reading device field 102, 103, the transponder unit 1 thus generates and sends its own modulated field 20 as the signal for data transfer. The transponder unit 1 thus uses its own energy for the purpose of data transfer. Finkenzeller at [0054]

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	Further, a mobile terminal comprising an inventive transponder unit could be used as a maintenance or monitoring unit for checking for operability, or remotely maintaining, a multiplicity of RFID reading devices, for example at the cash registers of a supermarket or an access system. Finkenzeller at [0055] FIG. 2 shows purely schematically the transponder unit 1, for example in the form of an inductively coupled chip card, which comprises the usual components not shown explicitly here. For simplification, only one inventive RFID transponder unit in a chip card is shown. The transponder unit has a battery 2, an inductive antenna 3 and an electronic circuit 4, 5, 6, 7. The electronic circuit consists substantially of three functional blocks, a receiver 4, a controller 5 and a transmitter 6. A switch 7 is used for switching the antenna 3 between the receiver 4 and the transmitter 6. Finkenzeller at [0065] The transponder unit 1 is operated in a first (active) operating mode as an actively sending transponder. In a second (passive) operating mode, however, the trans-ponder unit works like an ordinary passive transponder performing a load modulation on the field of the reading device. Finkenzeller at [0124] The interface module adapted to be coupled inductively and a further antenna connected thereto (see reference sign 3 in FIG. 10) can be disposed in a terminal. The range of an ordinary transponder can be increased with the help of such a terminal. The owner of a mobile telephone could for example set up a communication between his transponder and a reading device that is unfavorably disposed or inconvenient to reach for other reasons by holding the transponder against his mobile telephone provided according to the invention with an interface module adapted to be coupled inductively. Finkenzeller at [0129] Thus, an NFC unit could be adapted to behave according to the present solutions in its passive mode in the role ("being card") in which the NFC unit is to perform a load modulation. The NFC unit could for example always act as a component actively emitting its own field. Likewise, the NFC unit could also distinguish, and optionally switch, between a first submode corresponding to a conventional load modulation and an actively sending, second submode in which the load modulation is simulated. A thus improved NFC unit can also communicate with ordinary RFID reading devices over a higher range with the help of the changed passive operating mode. Since NFC units will already have certain units—such as an oscillator, an amplifier and a controller—for independent sending in their conventional active mode,

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	comparatively few modifications of an NFC circuit are required to realize a circuit according to the present application in an NFC unit. Finkenzeller at [0131] The individual functional components of the transponder unit—antenna, interface unit, chip and optionally voltage supply unit—can be disposed in all sorts of combinations separately from each other or integrated jointly in one unit. An inventive transponder unit can be formed for example as a specially designed transponder, in a portable data carrier, in particular a chip card, which optionally has a battery. A portable data carrier, in particular SIM card, with a chip and an interface unit can be connected in a mobile terminal to an external voltage source and/or an external antenna. The interface unit can be disposed in a terminal, connected to its own or an external antenna, and communicate with a chip which is disposed reversibly or firmly in the terminal or temporarily on the terminal. *See also* Finkenzeller at [0010], [0011], [0012], [0020], [0021], [0022], [0024], [0029], [0030], [0040], [0049], [0058], [0060], [0063], [0066], [0081], [0092], [0093], [0106], [0127], and claim 19. To the extent this limitation is not disclosed by Finkenzeller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Finkenzeller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[1a] a smartcard controller;	Finkenzeller discloses or renders obvious "a smartcard controller." For example: Finkenzeller at Figure 2

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	FIG 2  Finkenzeller at Figure 7 FIG 7 

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	Finkenzeller at Figure 8  Finkenzeller at Figure 9

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	FIG 9  Finkenzeller at Figure 10 FIG 10 

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	Finkenzeller at [0017] A special advantage of using the described modulators is their compatibility to the prior art, since they deliver an output signal to be sent to the reading device whose (frequency and amplitude) spectrum is very similar to that of a load or backscatter modulation, as described above. Therefore, no technical changes must be performed on conventional reading devices. The inventive transponder can thus be operated with commercially available RFID reading devices, the communication range being many times that of passive or even active transponders. For example, a commercially available ISO 14443 reading device which can communicate with an inductively coupled, contactless chip card according to the prior art over a distance of approx. 10 cm could communicate with an inventive transponder unit over many times this distance. Finkenzeller at [0020] The electronic circuit of the transponder unit further comprises in the usual way a receiver which is so designed that it can detect signals from a reading device. From said signals the receiver extracts data by means of a demodulation circuit, so that a data stream transferred from the reading device is available at the output of the receiver as a baseband signal (e.g. as an NRZ code, Miller code, etc.). For example, the data can be a simple instruction to activate the controller. However, the data may also contain a more complex instruction to the controller. The demodulated data are supplied to the controller in the electronic circuit. A data signal is thereupon generated in the controller, whereby the data signal can also be based on the extracted data. Finkenzeller at [0021] In a development, the inventive transponder unit has a load modulator according to the prior art, in addition to the above-described circuit having a receiver, a controller, an oscillator and a modulator. Finkenzeller at [0022] The voltage induced on the antenna of the transponder unit can be a problem for the operation of the inventive modulator circuits if the distance between trans-ponder unit and reading device is small and the induced voltage is therefore accordingly great. Therefore, the data to be sent to the reading device which are generated in the controller are supplied alternatively to the load modulator or to the inventive circuit configuration with a modulator. The switchover between the load modulator and the circuit configuration is preferably effected automatically, in dependence on the level of voltage induced on the antenna. The switchover is effected in such a way that the load modulator is used within the normal communication range, and the inventive modulator outside the normal communication range.

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	Finkenzeller at [0026] To avoid a quartz oscillator, which has a large mounting form, an improved embodiment of the invention has the oscillator coupled in phase lock to the signal received from the reading device via a phase locked loop (PLL) circuit when the trans-ponder unit is in the receive mode. In the transmit mode of the transponder unit, that is, during data transfer from the transponder unit to the reading device, the control voltage of the PLL circuit is kept constant so that the frequency of the oscillator is maintained as stable as possible. The PLL can also be referred to as tracking synchronization. The oscillator is so regulated that it follows in phase a reference signal, in the present case the timing signal of the reading device. The regulation circuit continuously compares the phase relationship of the two signals and adjusts that of the oscillator in case of an error signal. A PLL circuit is used primarily for frequency stabilization or synchronization of the oscillator. Additionally, it is possible to also supply the signal generated by the oscillator to the controller and use it as a timing signal relevant for timing. Finkenzeller at [0029] According to a first alternative, the circuit configuration for generating and modulating the subcarrier signal is a separate part of the mobile terminal. The trans-ponder unit then has a signal input for receiving the subcarrier signal modulated by means of the data to be sent from the circuit configuration. The signal input is connected via a suitable interface in particular to a chip, for example a smart card chip, which generates and modulates the subcarrier signal. Finkenzeller at [0030] According to a second alternative, the circuit configuration for generating and modulating the subcarrier signal is part of the inventive transponder unit itself. To then connect the transponder unit to a (smart card) chip of the terminal, which supplies data to be sent for example, an interface can be provided via which data are transferred in binary form. Finkenzeller at [0032] The transponder unit is preferably integrated in a card or data carrier insertable into the mobile terminal. For example, the transponder unit can be integrated in a SIM card. The advantage is that the mobile terminal, for example a mobile phone or PDA, into which the card with the inventive transponder unit is inserted requires no additional (integrated) antenna to be usable as an RFID unit. Finkenzeller at [0040]

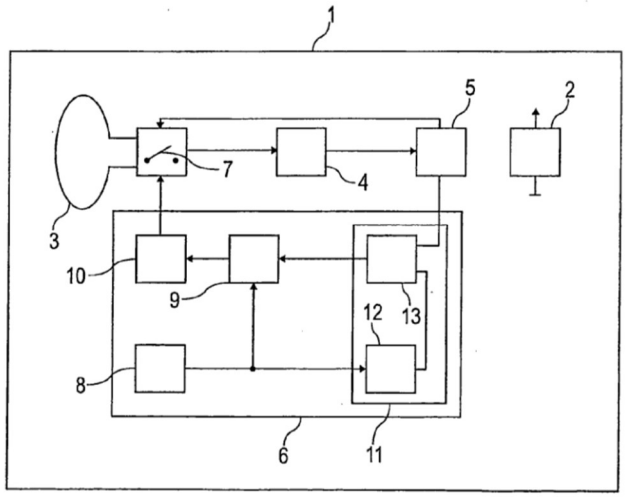
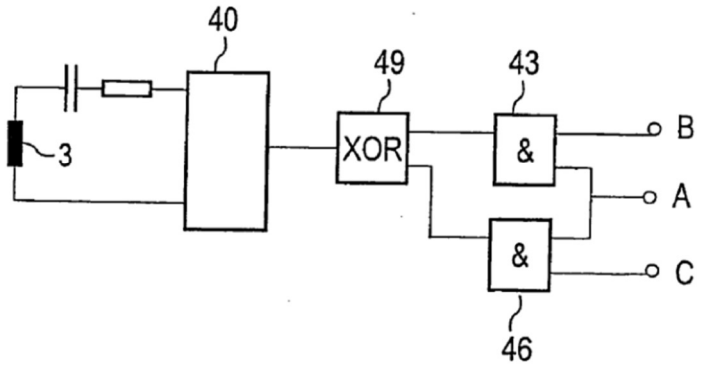
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	FIG. 7 a transponder unit in which a security module is connected to an interface module via an S^2C interface. Finkenzeller at [0055] FIG. 2 shows purely schematically the transponder unit 1, for example in the form of an inductively coupled chip card, which comprises the usual components not shown explicitly here. For simplification, only one inventive RFID transponder unit in a chip card is shown. The transponder unit has a battery 2, an inductive antenna 3 and an electronic circuit 4, 5, 6, 7. The electronic circuit consists substantially of three functional blocks, a receiver 4, a controller 5 and a transmitter 6. A switch 7 is used for switching the antenna 3 between the receiver 4 and the transmitter 6. Finkenzeller at [0056] The receiver 4 is provided for demodulating a signal transmitted from the reading device 100 to extract data therefrom. The extracted data are passed on to the controller 5 which processes them and generates data to be sent to the reading device 100. Furthermore, the controller 5 transmits a control signal to the switch 7 which switches between receive mode and transmit mode of the transponder unit. However, a separate antenna can instead be provided for sending. The controller 5 used can be for example a part of the operating system of a portable data carrier, such as a chip card. Finkenzeller at [0058] In the transponder unit shown in FIG. 2 it is provided that the assembly 11 divides the oscillator frequency by a certain factor by means of a frequency divider 12, for example by binary division. The resulting subcarrier signal is modulated with the data to be sent which are supplied to the assembly 11 by the controller 5. Finkenzeller at [0063] At the output of the ring modulator 9 an output signal is then available that contains the two modulation side bands and is identical (exactly enough) to a signal generated by load modulation or backscatter modulation. The output signal generated by the ring modulator 9 can then be optionally amplified by means of the amplifier 10, and be supplied to the antenna 3 for sending the data to be sent, via the switch 7 which is switched to the transmit mode of the transponder unit by a signal of the controller 5. Finkenzeller at [0066] For example, the receiver 4 can additionally be formed as a conventional load modulator driven by the controller 5. The controller 5 then either switches the transmitter 6 on and the load modulator off, or the

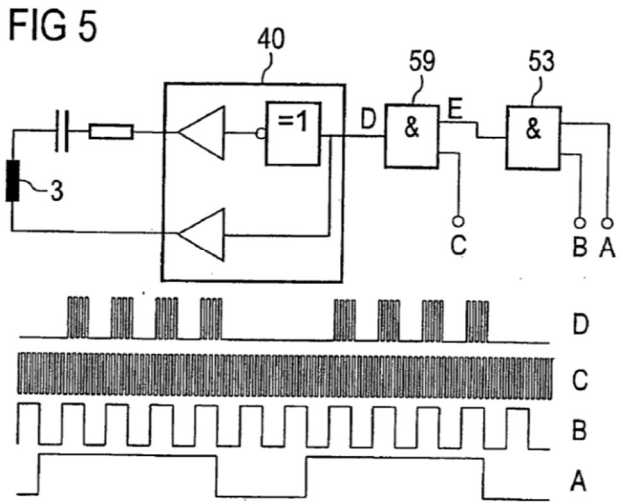
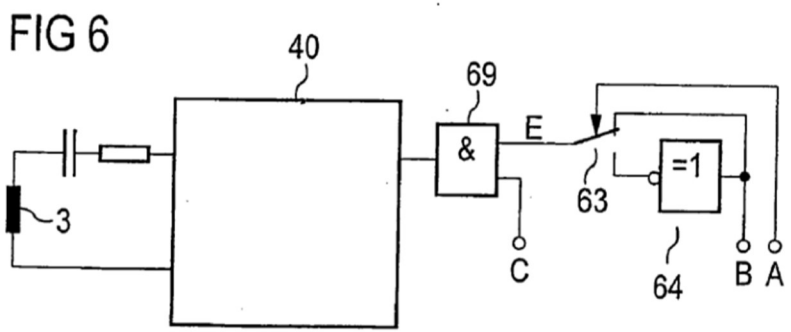
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	load modulator on and the transmitter 6 off. The switch 7 is switched accordingly. The criterion used for switching from a passive to an active operating state can be for example the received signal strength, the presence and/or sufficiency of an external voltage supply (on an optional connection Vcc not shown), or the sufficiency of an internal voltage supply (state of charge of the battery 2). It is thus for example possible to first operate a transponder unit 1 passively and switch it to an active operating mode if for example the distance from the reading device unintentionally increases. Finkenzeller at [0085] For an external HF interface—for example with the S2C interface described more closely below—an ASK modulator should preferably be used, since the power consumption is the lowest here. If the HF interface is integrated into a smart card chip, or an HF interface providing the signal (TF ∩MS) is used, the optimized ring modulator will preferably be used in case of sufficient energy. If energy is to be saved, however, the ASK modulator can be used here too. Finkenzeller at [0091] There are smart card chips having a so-called S^2C interface, defined by the company Philips, for connecting the smart card chip to an HF interface of an NFC device. Such smart card chips have hardware means for generating and decoding signals required on an ISO/IEC 14443 interface (Miller code, Manchester code, subcarrier 848 kHz). However, such a chip does not have an HF interface unit of its own. Finkenzeller at [0092] FIG. 7 shows schematically an inventive transponder unit, formed by an interface module 71 connected to an antenna 3, and a chip 75 with a suitable interface, for example an S^2C interface. Such a transponder unit can be formed for example in a mobile telephone with the help of the SIM card as chip 75, which is then preferably connected to the interface module 71 via one or more idle contact surfaces (C6 and/or C4, C8) of the SIM card. Finkenzeller at [0093] Both the interface module 71 and the chip 75 can draw their supply voltage from the device in which they are disposed preferably reversibly. The interface module 71 can act as an ordinary transponder in a second operating mode and supply the chip with an operating voltage Vcc_RF. Finkenzeller at [0094]

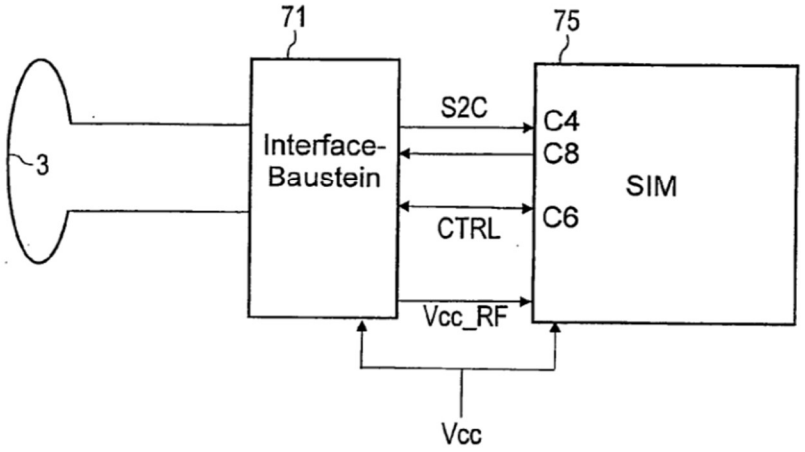
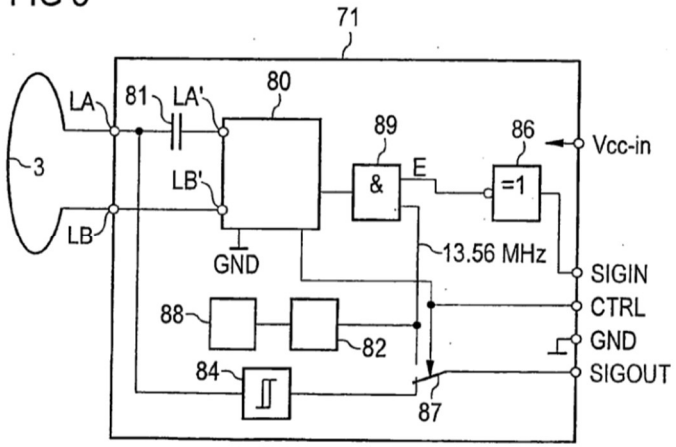
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	FIG. 8 shows schematically more exactly the structure of an interface module for a chip with an S^2C interface. Finkenzeller at [0095] The interface module 71 is equipped with a signal input SIGIN and a signal output SIGOUT for passing signals from the antenna to the chip (not shown) and from the chip, which generates the modulated subcarrier signal, to the antenna. A signal at SIGOUT consists of a 13.56 MHz TTL signal which optionally contains a modulation signal of a remote reading device. Finkenzeller at [0098] When the interface module is in the transmit mode, i.e. there is a contactless data transfer to an external reading device or an NFC device, a modulated subcarrier signal is fed in at the signal input SIGIN by the smart card chip and optionally inverted in an inverter 86. The inverted signal E is combined with a 13.56 MHz carrier frequency signal in the AND gate 89 as the carrier frequency modulator, and supplied to the amplifier 80. Finkenzeller at [0100] Further, the smart card chip can be supplied a constant 13.56 MHz timing signal from the oscillator 88 via the output SIGOUT in the transmit mode via the switch 87, if it requires such an (external) timing signal for operation to keep exact timing. As described above, this is necessary for communication according to the standard ISO 14443 type A. Finkenzeller at [0101] In the receive mode, the smart card chip is supplied a digitized received signal tapped from the antenna 1, via the switch 87 and the output SIGOUT. The signal shaper 84 acts here as an amplifier to be able to receive even weak signals, and as a threshold switch to provide a digital output signal at the output of the signal shaper. For example, the threshold switch used can be a Schmitt trigger which outputs a clear high or low level depending on the over- or undershooting of a predetermined threshold value. Finkenzeller at [0107] The transponder chip CL is a conventional RFID chip according to the prior art. It is normally connected at its connections with an antenna, e.g. in a chip card. Further, the transponder chip CL is so designed that data transfer from the transponder unit to a reading device is carried out by means of load modulation. This is almost always the case in usual RFID systems used at 13.56 MHz or also 125 kHz (e.g. ISO/IEC 14443, ISO/IEC 15693, ISO/IEC 18000-3).

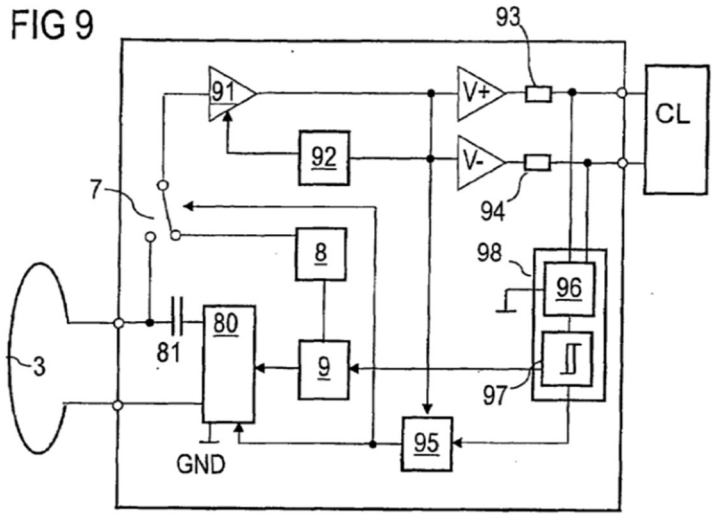
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	Finkenzeller at [0108] The transmit branch consists of a demodulation circuit 97, a modulator circuit 9, an oscillator 8 (e.g. 13.56 MHz), a controller 95, and a transmitter amplifier 80 connected to the antenna 3. The demodulation circuit 98 can consist for example of a rectifier 96 and a threshold switch 97. Finkenzeller at [0110] The output signal of the amplifier 91 is supplied to a further amplifier, preferably a push-pull amplifier (V+, V−). The output signal of the push-pull amplifier is supplied to the connections of the contactless RFID chip CL via (at least) one series resistor 93. The amplitude of the output signal of the push-pull amplifier V+/V− is so selected here that the RFID chip CL can be supplied with sufficient energy for operation by the output signal. Finkenzeller at [0114] The modulation signal reconstructed by the demodulation circuit 97 is also supplied to a controller 95. The latter switches the inventive circuit with the first edge of the modulation signal to a transmit mode without delay if possible, so that the data generated by the RFID chip CL can also be transferred to the remote reading device. For this purpose, the switch 7 is first switched from the antenna 3 to the oscillator 8 (13.56 MHz). This is necessary to be able to keep supplying the RFID chip CL with an alternating voltage of the right frequency. At the same time the amplifier 80 is activated by the controller 95. Finkenzeller at [0129] Thus, an NFC unit could be adapted to behave according to the present solutions in its passive mode in the role ("being card") in which the NFC unit is to perform a load modulation. The NFC unit could for example always act as a component actively emitting its own field. Likewise, the NFC unit could also distinguish, and optionally switch, between a first submode corresponding to a conventional load modulation and an actively sending, second submode in which the load modulation is simulated. A thus improved NFC unit can also communicate with ordinary RFID reading devices over a higher range with the help of the changed passive operating mode. Since NFC units will already have certain units—such as an oscillator, an amplifier and a controller—for independent sending in their conventional active mode, comparatively few modifications of an NFC circuit are required to realize a circuit according to the present application in an NFC unit. Finkenzeller at [0131]

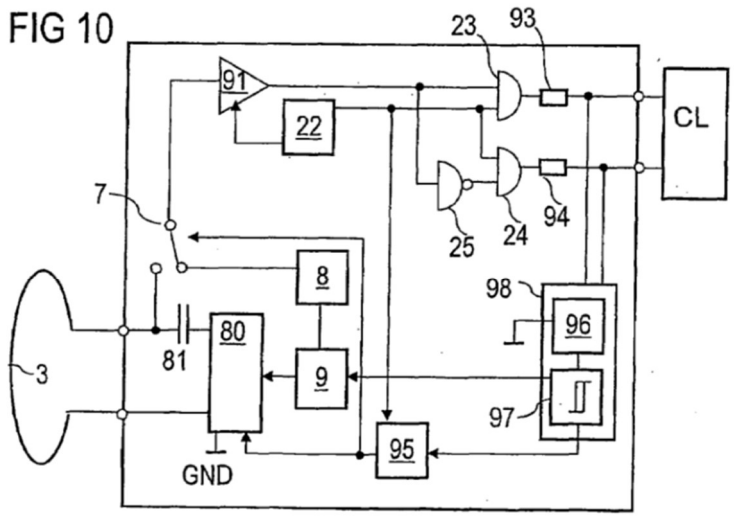
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	The individual functional components of the transponder unit—antenna, interface unit, chip and optionally voltage supply unit—can be disposed in all sorts of combinations separately from each other or integrated jointly in one unit. An inventive transponder unit can be formed for example as a specially designed transponder, in a portable data carrier, in particular a chip card, which optionally has a battery. A portable data carrier, in particular SIM card, with a chip and an interface unit can be connected in a mobile terminal to an external voltage source and/or an external antenna. The interface unit can be disposed in a terminal, connected to its own or an external antenna, and communicate with a chip which is disposed reversibly or firmly in the terminal or temporarily on the terminal. Finkenzeller at claim 35 35. The mobile terminal according to claim 32, comprising a smart card chip which is connected to the transponder unit via an interface. *See also* Finkenzeller at [0011], [0012], [0117], and [0118]. To the extent this limitation is not disclosed by Finkenzeller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Finkenzeller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[1b] an antenna; and	Finkenzeller discloses or renders obvious "an antenna." For example: Finkenzeller at Figure 2

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	FIG 2  Finkenzeller at Figure 4 FIG 4 

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	Finkenzeller at Figure 5  Finkenzeller at Figure 6  Finkenzeller at Figure 7

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	FIG 7  Finkenzeller at Figure 8 FIG 8 

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	Finkenzeller at Figure 9  Finkenzeller at Figure 10

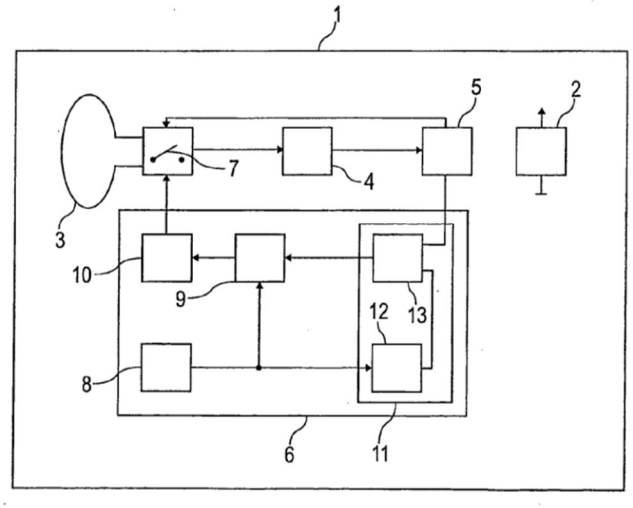
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	 Finkenzeller at [0002] Transponders are used for example in radio frequency identification (RFID) systems. Conventionally, both the energy supply to a transponder in an RFID system and the data interchange between the transponder and a reading device are effected using magnetic or electromagnetic fields. RFID transponders have an electronic circuit and, depending on the frequency domain, an antenna coil (e.g. 13.56 MHz) or an electromagnetic antenna (e.g. 868 MHz). Via the antenna the energy required for operating the transponder can be taken from the field of the reading device, as well as the data transfer carried out. Finkenzeller at [0011] In an advantageous embodiment, an inventive RFID transponder unit has its own energy supply, at least one antenna for transmitting signals from and/or to a reading device, and an electronic circuit. The electronic circuit of the inventive transponder unit comprises a transmitter consisting of an oscillator and a modulator. Finkenzeller at [0022]

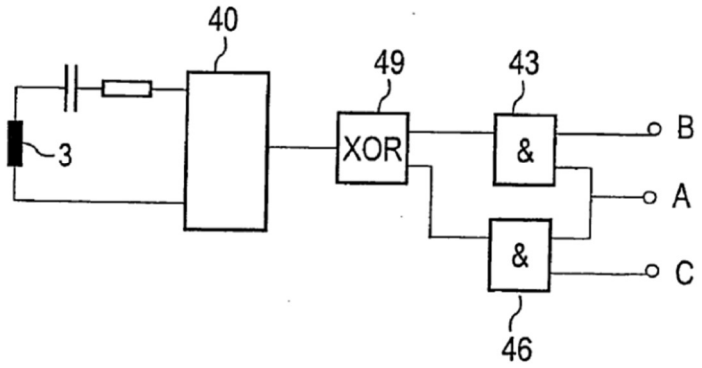
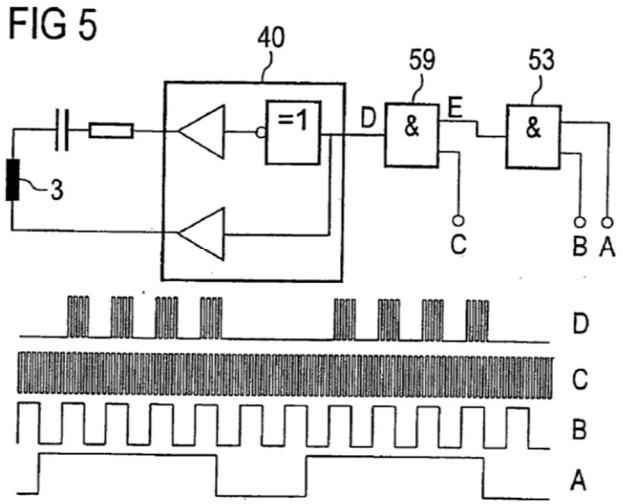
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	The voltage induced on the antenna of the transponder unit can be a problem for the operation of the inventive modulator circuits if the distance between trans-ponder unit and reading device is small and the induced voltage is therefore accordingly great. Therefore, the data to be sent to the reading device which are generated in the controller are supplied alternatively to the load modulator or to the inventive circuit configuration with a modulator. The switchover between the load modulator and the circuit configuration is preferably effected automatically, in dependence on the level of voltage induced on the antenna. The switchover is effected in such a way that the load modulator is used within the normal communication range, and the inventive modulator outside the normal communication range. Finkenzeller at [0028] The transponder unit can also be part of a mobile terminal, for example a mobile telephone. The transponder unit can have its own antenna or use an antenna of the terminal. Finkenzeller at [0055] FIG. 2 shows purely schematically the transponder unit 1, for example in the form of an inductively coupled chip card, which comprises the usual components not shown explicitly here. For simplification, only one inventive RFID transponder unit in a chip card is shown. The transponder unit has a battery 2, an inductive antenna 3 and an electronic circuit 4, 5, 6, 7. The electronic circuit consists substantially of three functional blocks, a receiver 4, a controller 5 and a transmitter 6. A switch 7 is used for switching the antenna 3 between the receiver 4 and the transmitter 6. Finkenzeller at [0056] The receiver 4 is provided for demodulating a signal transmitted from the reading device 100 to extract data therefrom. The extracted data are passed on to the controller 5 which processes them and generates data to be sent to the reading device 100. Furthermore, the controller 5 transmits a control signal to the switch 7 which switches between receive mode and transmit mode of the transponder unit. However, a separate antenna can instead be provided for sending. The controller 5 used can be for example a part of the operating system of a portable data carrier, such as a chip card. Finkenzeller at [0063] At the output of the ring modulator 9 an output signal is then available that contains the two modulation side bands and is identical (exactly enough) to a signal generated by load modulation or backscatter modulation. The output signal generated by the ring modulator 9 can then be optionally amplified by means of the amplifier 10, and be supplied to the antenna 3 for sending the data to be sent, via the switch 7 which is switched to the transmit mode of the transponder unit by a signal of the controller 5.

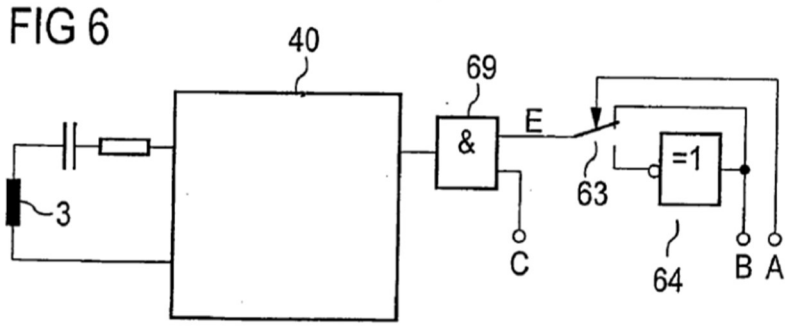
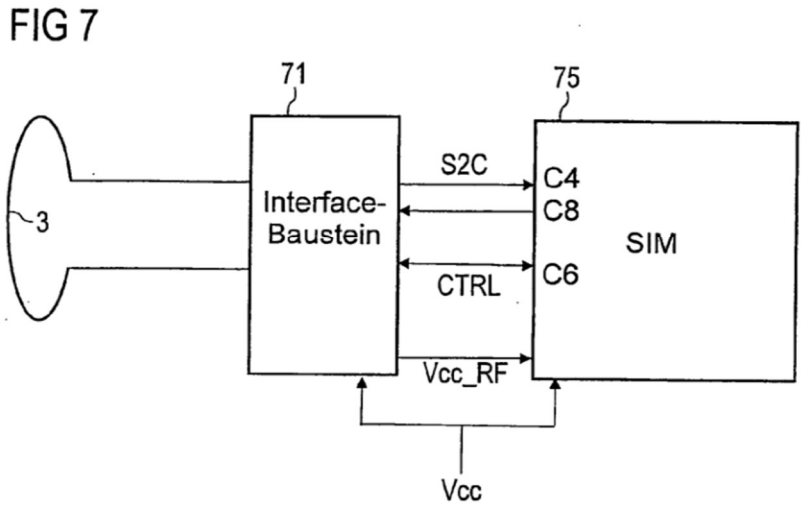
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	Finkenzeller at [0064] The direct connection of the ring modulator output to the antenna is likewise possible. However, it is then necessary to adapt the antenna accordingly, and take account of a possible reaction of the signal coupled in from the reading device on the ring modulator, since the same antenna is normally used for sending and receiving, and since the reading device sends continually. Finkenzeller at [0076] The signal D emitted by an antenna 3 to a reading device has a frequency spectrum that is like a frequency spectrum resulting by means of load modulation. The signal D can optionally be amplified by means of an amplifier 40. The amplifier 40 can be for example a push-pull amplifier with digital push-pull output amplifiers. Finkenzeller at [0095] The interface module 71 is equipped with a signal input SIGIN and a signal output SIGOUT for passing signals from the antenna to the chip (not shown) and from the chip, which generates the modulated subcarrier signal, to the antenna. A signal at SIGOUT consists of a 13.56 MHz TTL signal which optionally contains a modulation signal of a remote reading device. Finkenzeller at [0101] In the receive mode, the smart card chip is supplied a digitized received signal tapped from the antenna 1, via the switch 87 and the output SIGOUT. The signal shaper 84 acts here as an amplifier to be able to receive even weak signals, and as a threshold switch to provide a digital output signal at the output of the signal shaper. For example, the threshold switch used can be a Schmitt trigger which outputs a clear high or low level depending on the over- or undershooting of a predetermined threshold value. Finkenzeller at [0102] Via the control input of the push-pull amplifier 80 the push-pull outputs of the output drivers (see amplifier units in FIG. 5) are switched to GND, so that the antenna 3 and the capacitor 41 result in a parallel-resonant circuit. To save energy, the amplifier 80 can be switched to a power save mode in the receive mode of the interface module. Finkenzeller at [0106] The inventive active transponder unit has a receive branch and a transmit branch. The receive branch consists of an antenna 3, an input amplifier 91, an automatic gain control 92 and an amplifier which is

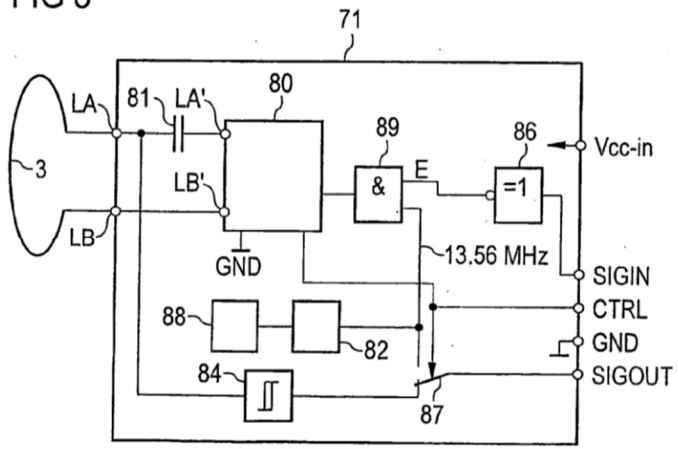
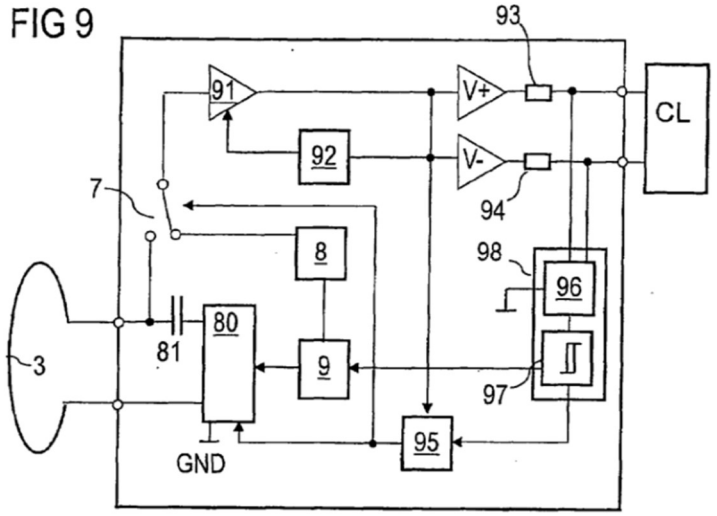
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	preferably designed as a push-pull amplifier (V+, V−). Further, a transponder chip CL is connected via its antenna connections to the push-pull amplifier. Finkenzeller at [0107] The transponder chip CL is a conventional RFID chip according to the prior art. It is normally connected at its connections with an antenna, e.g. in a chip card. Further, the transponder chip CL is so designed that data transfer from the transponder unit to a reading device is carried out by means of load modulation. This is almost always the case in usual RFID systems used at 13.56 MHz or also 125 kHz (e.g. ISO/IEC 14443, ISO/IEC 15693, ISO/IEC 18000-3). Finkenzeller at [0108] The transmit branch consists of a demodulation circuit 97, a modulator circuit 9, an oscillator 8 (e.g. 13.56 MHz), a controller 95, and a transmitter amplifier 80 connected to the antenna 3. The demodulation circuit 98 can consist for example of a rectifier 96 and a threshold switch 97. Finkenzeller at [0109] In the receive mode a voltage is induced in the antenna 3 by the magnetic field of a remote RFID reading device. Together with the capacitor 81 the antenna 3 forms a parallel-resonant circuit whose resonant frequency corresponds approximately to the transmitting frequency of the RFID reading device. The voltage thus available on the resonant circuit is supplied to the input amplifier 91 via the switch 7. Via a gain control 92 the gain factor of the input amplifier 91 is now so adjusted that the output amplitude of the voltage amplified by the input amplifier 91 remains largely constant. The time constant of the control is preferably so adjusted here that the output voltage of the amplifier 91 remains constant in case of varying distance from the reading device (i.e. different levels of induced voltage in the coil 3), but modulation signals (e.g. 10% ASK with 106 kbit/s) are not suppressed by excessively fast control. Finkenzeller at [0123] For an inductive coupling, the circuit has an additional antenna 29 which can be made to resonate with the working frequency (e.g. 13.56 MHz) by means of a capacitor 26. A transponder comprising a transponder chip CL and an antenna 28 is positioned in immediate proximity to the antenna 29, so as to obtain the best possible magnetic coupling between the antennas 28 and 29. A load modulation of the transponder chip CL can also be detected easily with this arrangement. Finkenzeller at [0124]

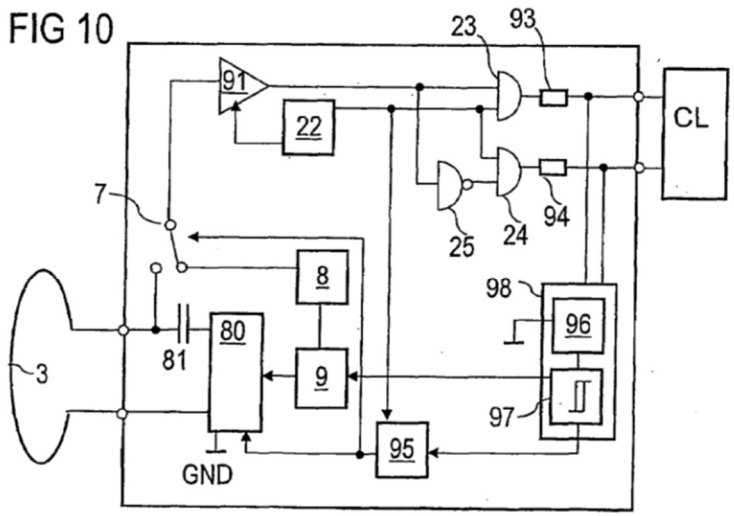
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	The interface module adapted to be coupled inductively and a further antenna connected thereto (see reference sign 3 in FIG. 10) can be disposed in a terminal. The range of an ordinary transponder can be increased with the help of such a terminal. The owner of a mobile telephone could for example set up a communication between his transponder and a reading device that is unfavorably disposed or inconvenient to reach for other reasons by holding the transponder against his mobile telephone provided according to the invention with an interface module adapted to be coupled inductively. Finkenzeller at [0127] It was ascertained that small antennas, e.g. in a SIM card with its own antenna (approx. 15×25 mm^2), obtain very low read ranges with a conventional load modulation. It is frequently even impossible to communicate with a contactless reading device when the SIM card with an antenna is disposed for example in a mobile telephone. If one of the inventive transmitters is used in a mobile terminal the range is not clearly increased. Moreover, it can be advantageously exploited that mobile terminals such as mobile telephones, PDAs, etc., have their own energy supply (battery) which can also be used for supplying an inventive circuit. Finkenzeller at [0131] The individual functional components of the transponder unit—antenna, interface unit, chip and optionally voltage supply unit—can be disposed in all sorts of combinations separately from each other or integrated jointly in one unit. An inventive transponder unit can be formed for example as a specially designed transponder, in a portable data carrier, in particular a chip card, which optionally has a battery. A portable data carrier, in particular SIM card, with a chip and an interface unit can be connected in a mobile terminal to an external voltage source and/or an external antenna. The interface unit can be disposed in a terminal, connected to its own or an external antenna, and communicate with a chip which is disposed reversibly or firmly in the terminal or temporarily on the terminal. *See also* Finkenzeller at [0006], [0007], [0015], [0021], [0024], [0025], [0049], [0073], [0080], [0092], [0096], [0099], [0114], [0115], [0126], [0129], and claim 19. To the extent this limitation is not disclosed by Finkenzeller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Finkenzeller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.

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[1c] performance enhancement circuits coupled between the smartcard controller and the antenna, wherein the performance enhancement circuits include an amplifier and a load modulation circuit, and	Finkenzeller discloses or renders obvious "performance enhancement circuits coupled between the smartcard controller and the antenna, wherein the performance enhancement circuits include an amplifier and a load modulation circuit." For example: Finkenzeller at Figure 2 FIG 2  Finkenzeller at Figure 4

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	FIG 4  Finkenzeller at Figure 5 FIG 5 

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	Finkenzeller at Figure 6  Finkenzeller at Figure 7  Finkenzeller at Figure 8

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	FIG 8  Finkenzeller at Figure 9 FIG 9 

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	Finkenzeller at Figure 10  Finkenzeller at [0002] Transponders are used for example in radio frequency identification (RFID) systems. Conventionally, both the energy supply to a transponder in an RFID system and the data interchange between the transponder and a reading device are effected using magnetic or electromagnetic fields. RFID transponders have an electronic circuit and, depending on the frequency domain, an antenna coil (e.g. 13.56 MHz) or an electromagnetic antenna (e.g. 868 MHz). Via the antenna the energy required for operating the transponder can be taken from the field of the reading device, as well as the data transfer carried out. Finkenzeller at [0006] For simple and fast contactless communication between two devices, the companies Philips and Sony have developed an inductive transmission technology which is known as so-called near field communication (NFC). This technology is integrated for example in mobile telephones or PDAs to permit communication between the devices or with a computer. The coupling of the two devices is effected via coils, the carrier frequency being 13.56 MHz as in RFID systems. As described more closely in the NFC

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	standard ECMA 340, NFC systems have an active communication mode and a passive communication mode. In the active mode, two NFC units alternately generate their own RF field as a signal carrier, thus switching back and forth, coordinated with each other, between transmit mode and receive mode as in a classic mobile phone system. In the passive mode, however, the two NFC units must agree on which unit acts as a reading device and generates a field which the other unit can then influence by means of load modulation. Primarily due to the small antenna diameters used, NFC systems only permit small communication ranges of up to 20 cm. Finkenzeller at [0007] Even with active transponders there is the problem that data transfer from the transponder to the reading device is limited by the signals becoming weaker with increasing distance between reading device and transponder. As a rule, ranges no longer than 1 to 2 m can therefore be obtained even with an active transponder for example in inductively coupled systems which transfer data to the reading device on the principle of load modulation. For RFID systems working on the principle of backscatter, however, communication ranges of 10 m are typically obtained. Finkenzeller at [0011] In an advantageous embodiment, an inventive RFID transponder unit has its own energy supply, at least one antenna for transmitting signals from and/or to a reading device, and an electronic circuit. The electronic circuit of the inventive transponder unit comprises a transmitter consisting of an oscillator and a modulator. Finkenzeller at [0012] In a first alternative, the modulator comprises a ring modulator. The oscillator is coupled with the battery and provided to deliver an oscillator signal to the ring modulator. Furthermore, the ring modulator is supplied via a second input the data signal which either is generated in a controller of the transponder unit or which the transponder unit feeds in externally. Before being supplied to the ring modulator, the data signal can be modulated with a subcarrier. It is characteristic of the ring modulator that it performs a DSB modulation (double side-band modulation) and is usable independently of the form of the data signal (analog or digital). Finkenzeller at [0020] The electronic circuit of the transponder unit further comprises in the usual way a receiver which is so designed that it can detect signals from a reading device. From said signals the receiver extracts data by means of a demodulation circuit, so that a data stream transferred from the reading device is available at

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	the output of the receiver as a baseband signal (e.g. as an NRZ code, Miller code, etc.). For example, the data can be a simple instruction to activate the controller. However, the data may also contain a more complex instruction to the controller. The demodulated data are supplied to the controller in the electronic circuit. A data signal is thereupon generated in the controller, whereby the data signal can also be based on the extracted data. Finkenzeller at [0021] In a development, the inventive transponder unit has a load modulator according to the prior art, in addition to the above-described circuit having a receiver, a controller, an oscillator and a modulator. Finkenzeller at [0022] The voltage induced on the antenna of the transponder unit can be a problem for the operation of the inventive modulator circuits if the distance between trans-ponder unit and reading device is small and the induced voltage is therefore accordingly great. Therefore, the data to be sent to the reading device which are generated in the controller are supplied alternatively to the load modulator or to the inventive circuit configuration with a modulator. The switchover between the load modulator and the circuit configuration is preferably effected automatically, in dependence on the level of voltage induced on the antenna. The switchover is effected in such a way that the load modulator is used within the normal communication range, and the inventive modulator outside the normal communication range. Finkenzeller at [0025] In particular for communication according to the standard ISO 14443 type A, exact timing is important. With conventional passive transponders, timing is ensured even in the transmit mode (load modulation) by the timing signal (13.56 MHz) continually received from the reading device. However, such a signal is no longer available in the transmit mode of an inventive circuit configuration. In one embodiment of the invention, an oscillator is therefore provided for example in the form of a quartz oscillator. Finkenzeller at [0026] To avoid a quartz oscillator, which has a large mounting form, an improved embodiment of the invention has the oscillator coupled in phase lock to the signal received from the reading device via a phase locked loop (PLL) circuit when the trans-ponder unit is in the receive mode. In the transmit mode of the transponder unit, that is, during data transfer from the transponder unit to the reading device, the control voltage of the PLL circuit is kept constant so that the frequency of the oscillator is maintained as stable as possible. The PLL can also be referred to as tracking synchronization. The oscillator is so regulated that it follows in phase a reference signal, in the present case the timing signal of the reading device. The

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	regulation circuit continuously compares the phase relationship of the two signals and adjusts that of the oscillator in case of an error signal. A PLL circuit is used primarily for frequency stabilization or synchronization of the oscillator. Additionally, it is possible to also supply the signal generated by the oscillator to the controller and use it as a timing signal relevant for timing. Finkenzeller at [0027] The possibility of reading the inventive transponder unit over very large distances is not always desired, for example for privacy protection. It is therefore provided in one embodiment that the inventive circuit configuration can be activated manually if communication over a long range is explicitly desired. Otherwise, communication can be effected via a load modulator provided in the transponder unit, which is usable only for short distances. If no load modulator is provided in the trans-ponder unit, it can be provided for example that the transponder unit is activated for sending data only if the signal emitted by the reading device contains a predetermined code. Finkenzeller at [0028] The transponder unit can also be part of a mobile terminal, for example a mobile telephone. The transponder unit can have its own antenna or use an antenna of the terminal. Finkenzeller at [0029] According to a first alternative, the circuit configuration for generating and modulating the subcarrier signal is a separate part of the mobile terminal. The trans-ponder unit then has a signal input for receiving the subcarrier signal modulated by means of the data to be sent from the circuit configuration. The signal input is connected via a suitable interface in particular to a chip, for example a smart card chip, which generates and modulates the subcarrier signal. Finkenzeller at [0030] According to a second alternative, the circuit configuration for generating and modulating the subcarrier signal is part of the inventive transponder unit itself. To then connect the transponder unit to a (smart card) chip of the terminal, which supplies data to be sent for example, an interface can be provided via which data are transferred in binary form. Finkenzeller at [0040] FIG. 7 a transponder unit in which a security module is connected to an interface module via an S^2C interface.

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	Finkenzeller at [0047] Depending on a type of system used, data can be transferred from the trans-ponders 200, 300 to the reading device 100 either by means of load modulation (inductive coupling) or by means of modulated backscatter cross section (electromagnetic backscatter coupling). Embodiments will preferably be described hereinafter for systems that transfer data to the reading device on the principle of load modulation. However, the individual aspects of the embodiments are largely also applicable analogously to systems that work on the principle of modulated backscatter cross sections of the transponder unit. Finkenzeller at [0055] FIG. 2 shows purely schematically the transponder unit 1, for example in the form of an inductively coupled chip card, which comprises the usual components not shown explicitly here. For simplification, only one inventive RFID transponder unit in a chip card is shown. The transponder unit has a battery 2, an inductive antenna 3 and an electronic circuit 4, 5, 6, 7. The electronic circuit consists substantially of three functional blocks, a receiver 4, a controller 5 and a transmitter 6. A switch 7 is used for switching the antenna 3 between the receiver 4 and the transmitter 6. Finkenzeller at [0056] The receiver 4 is provided for demodulating a signal transmitted from the reading device 100 to extract data therefrom. The extracted data are passed on to the controller 5 which processes them and generates data to be sent to the reading device 100. Furthermore, the controller 5 transmits a control signal to the switch 7 which switches between receive mode and transmit mode of the transponder unit. However, a separate antenna can instead be provided for sending. The controller 5 used can be for example a part of the operating system of a portable data carrier, such as a chip card. Finkenzeller at [0058] In the transponder unit shown in FIG. 2 it is provided that the assembly 11 divides the oscillator frequency by a certain factor by means of a frequency divider 12, for example by binary division. The resulting subcarrier signal is modulated with the data to be sent which are supplied to the assembly 11 by the controller 5. Finkenzeller at [0063] At the output of the ring modulator 9 an output signal is then available that contains the two modulation side bands and is identical (exactly enough) to a signal generated by load modulation or backscatter modulation. The output signal generated by the ring modulator 9 can then be optionally amplified by

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	means of the amplifier 10, and be supplied to the antenna 3 for sending the data to be sent, via the switch 7 which is switched to the transmit mode of the transponder unit by a signal of the controller 5. Finkenzeller at [0064] The direct connection of the ring modulator output to the antenna is likewise possible. However, it is then necessary to adapt the antenna accordingly, and take account of a possible reaction of the signal coupled in from the reading device on the ring modulator, since the same antenna is normally used for sending and receiving, and since the reading device sends continually. Finkenzeller at [0065] The transponder unit 1 is operated in a first (active) operating mode as an actively sending transponder. In a second (passive) operating mode, however, the trans-ponder unit works like an ordinary passive transponder performing a load modulation on the field of the reading device. Finkenzeller at [0066] For example, the receiver 4 can additionally be formed as a conventional load modulator driven by the controller 5. The controller 5 then either switches the transmitter 6 on and the load modulator off, or the load modulator on and the transmitter 6 off. The switch 7 is switched accordingly. The criterion used for switching from a passive to an active operating state can be for example the received signal strength, the presence and/or sufficiency of an external voltage supply (on an optional connection Vcc not shown), or the sufficiency of an internal voltage supply (state of charge of the battery 2). It is thus for example possible to first operate a transponder unit 1 passively and switch it to an active operating mode if for example the distance from the reading device unintentionally increases. Finkenzeller at [0076] The signal D emitted by an antenna 3 to a reading device has a frequency spectrum that is like a frequency spectrum resulting by means of load modulation. The signal D can optionally be amplified by means of an amplifier 40. The amplifier 40 can be for example a push-pull amplifier with digital push-pull output amplifiers. Finkenzeller at [0085] For an external HF interface—for example with the S2C interface described more closely below—an ASK modulator should preferably be used, since the power consumption is the lowest here. If the HF interface is integrated into a smart card chip, or an HF interface providing the signal (TF ∩MS) is used,

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	the optimized ring modulator will preferably be used in case of sufficient energy. If energy is to be saved, however, the ASK modulator can be used here too. Finkenzeller at [0091] There are smart card chips having a so-called S^2C interface, defined by the company Philips, for connecting the smart card chip to an HF interface of an NFC device. Such smart card chips have hardware means for generating and decoding signals required on an ISO/IEC 14443 interface (Miller code, Manchester code, subcarrier 848 kHz). However, such a chip does not have an HF interface unit of its own. Finkenzeller at [0092] FIG. 7 shows schematically an inventive transponder unit, formed by an interface module 71 connected to an antenna 3, and a chip 75 with a suitable interface, for example an S^2C interface. Such a transponder unit can be formed for example in a mobile telephone with the help of the SIM card as chip 75, which is then preferably connected to the interface module 71 via one or more idle contact surfaces (C6 and/or C4, C8) of the SIM card. Finkenzeller at [0093] Both the interface module 71 and the chip 75 can draw their supply voltage from the device in which they are disposed preferably reversibly. The interface module 71 can act as an ordinary transponder in a second operating mode and supply the chip with an operating voltage Vcc_RF. Finkenzeller at [0094] FIG. 8 shows schematically more exactly the structure of an interface module for a chip with an S^2C interface. Finkenzeller at [0095] The interface module 71 is equipped with a signal input SIGIN and a signal output SIGOUT for passing signals from the antenna to the chip (not shown) and from the chip, which generates the modulated subcarrier signal, to the antenna. A signal at SIGOUT consists of a 13.56 MHz TTL signal which optionally contains a modulation signal of a remote reading device. Finkenzeller at [0098] When the interface module is in the transmit mode, i.e. there is a contactless data transfer to an external reading device or an NFC device, a modulated subcarrier signal is fed in at the signal input SIGIN by the

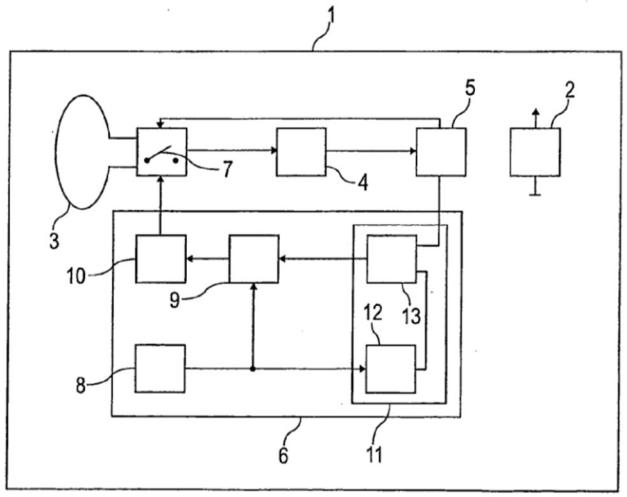
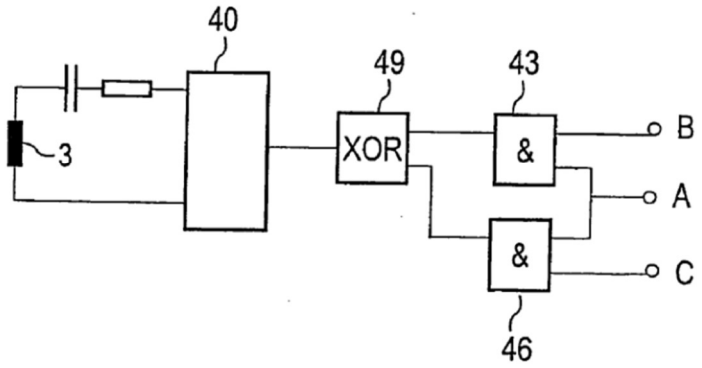
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	smart card chip and optionally inverted in an inverter 86. The inverted signal E is combined with a 13.56 MHz carrier frequency signal in the AND gate 89 as the carrier frequency modulator, and supplied to the amplifier 80. Finkenzeller at [0100] Further, the smart card chip can be supplied a constant 13.56 MHz timing signal from the oscillator 88 via the output SIGOUT in the transmit mode via the switch 87, if it requires such an (external) timing signal for operation to keep exact timing. As described above, this is necessary for communication according to the standard ISO 14443 type A. Finkenzeller at [0101] In the receive mode, the smart card chip is supplied a digitized received signal tapped from the antenna 1, via the switch 87 and the output SIGOUT. The signal shaper 84 acts here as an amplifier to be able to receive even weak signals, and as a threshold switch to provide a digital output signal at the output of the signal shaper. For example, the threshold switch used can be a Schmitt trigger which outputs a clear high or low level depending on the over- or undershooting of a predetermined threshold value. Finkenzeller at [0102] Via the control input of the push-pull amplifier 80 the push-pull outputs of the output drivers (see amplifier units in FIG. 5) are switched to GND, so that the antenna 3 and the capacitor 41 result in a parallel-resonant circuit. To save energy, the amplifier 80 can be switched to a power save mode in the receive mode of the interface module. Finkenzeller at [0106] The inventive active transponder unit has a receive branch and a transmit branch. The receive branch consists of an antenna 3, an input amplifier 91, an automatic gain control 92 and an amplifier which is preferably designed as a push-pull amplifier (V+, V−). Further, a transponder chip CL is connected via its antenna connections to the push-pull amplifier. Finkenzeller at [0107] The transponder chip CL is a conventional RFID chip according to the prior art. It is normally connected at its connections with an antenna, e.g. in a chip card. Further, the transponder chip CL is so designed that data transfer from the transponder unit to a reading device is carried out by means of load modulation. This is almost always the case in usual RFID systems used at 13.56 MHz or also 125 kHz (e.g. ISO/IEC 14443, ISO/IEC 15693, ISO/IEC 18000-3).

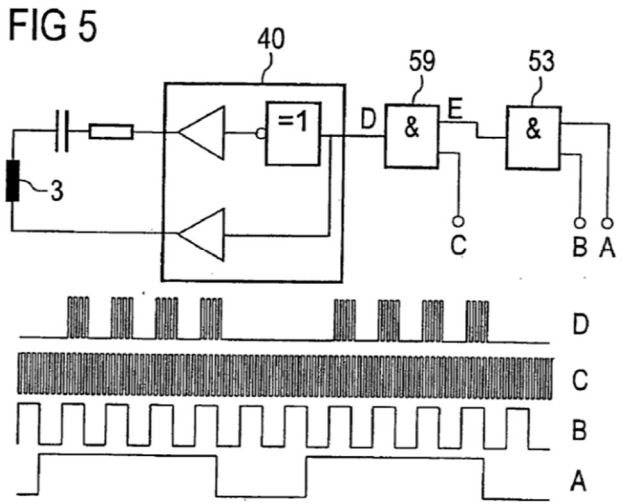
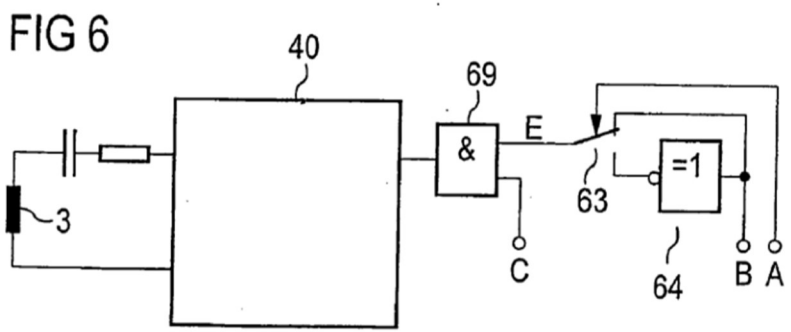
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	Finkenzeller at [0108] The transmit branch consists of a demodulation circuit 97, a modulator circuit 9, an oscillator 8 (e.g. 13.56 MHz), a controller 95, and a transmitter amplifier 80 connected to the antenna 3. The demodulation circuit 98 can consist for example of a rectifier 96 and a threshold switch 97. Finkenzeller at [0109] In the receive mode a voltage is induced in the antenna 3 by the magnetic field of a remote RFID reading device. Together with the capacitor 81 the antenna 3 forms a parallel-resonant circuit whose resonant frequency corresponds approximately to the transmitting frequency of the RFID reading device. The voltage thus available on the resonant circuit is supplied to the input amplifier 91 via the switch 7. Via a gain control 92 the gain factor of the input amplifier 91 is now so adjusted that the output amplitude of the voltage amplified by the input amplifier 91 remains largely constant. The time constant of the control is preferably so adjusted here that the output voltage of the amplifier 91 remains constant in case of varying distance from the reading device (i.e. different levels of induced voltage in the coil 3), but modulation signals (e.g. 10% ASK with 106 kbit/s) are not suppressed by excessively fast control. Finkenzeller at [0110] The output signal of the amplifier 91 is supplied to a further amplifier, preferably a push-pull amplifier (V+, V−). The output signal of the push-pull amplifier is supplied to the connections of the contactless RFID chip CL via (at least) one series resistor 93. The amplitude of the output signal of the push-pull amplifier V+/V− is so selected here that the RFID chip CL can be supplied with sufficient energy for operation by the output signal. Finkenzeller at [0112] As soon as the RFID chip CL has received and processed a command, it tries to send a response back to the remote reading device. For this purpose the RFID chip normally uses a load modulation, i.e. an additional parallel resistor in the chip is switched on and off in time with the modulation signal. This leads to measurable fluctuations in the voltage drop across the resistors 93, 94. In other words, the HF alternating voltage at the connections is modulated in amplitude. By the demodulator circuit 98 this amplitude-modulated alternating voltage signal is demodulated and the original modulation signal thus reconstructed again. Finkenzeller at [0114]

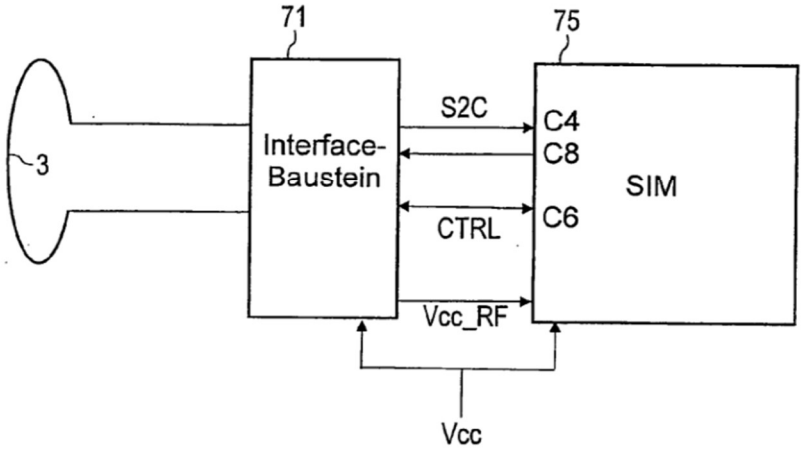
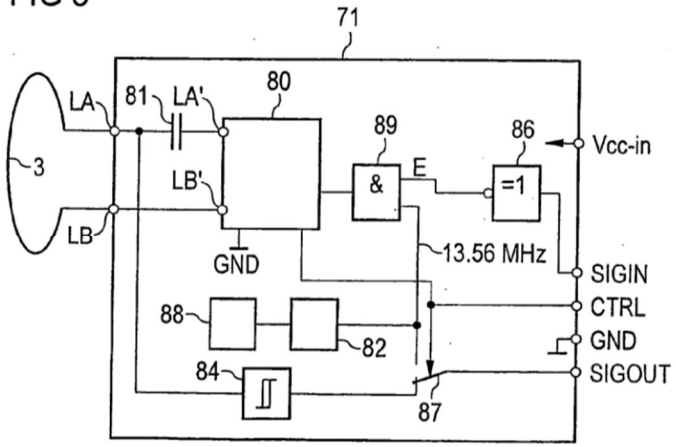
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	The modulation signal reconstructed by the demodulation circuit 97 is also supplied to a controller 95. The latter switches the inventive circuit with the first edge of the modulation signal to a transmit mode without delay if possible, so that the data generated by the RFID chip CL can also be transferred to the remote reading device. For this purpose, the switch 7 is first switched from the antenna 3 to the oscillator 8 (13.56 MHz). This is necessary to be able to keep supplying the RFID chip CL with an alternating voltage of the right frequency. At the same time the amplifier 80 is activated by the controller 95. Finkenzeller at [0115] The reconstructed modulation signal and the signal of the oscillator 8 are supplied to the modulator circuit 9. The exact function of such a circuit has already been described in detail. The output signal of the modulator circuit 9 is supplied to the amplifier 80 and sent via the antenna 3 to the remote reading device. Finkenzeller at [0117] An important role is played by the signal received by the controller 95 from the receive branch (91, 92 V+, V−). When a reading device sends data to the trans-ponder unit by means of an amplitude modulation of the emitted field (e.g. 150/IEC 14443-A: 100% ASK, ISO/IEC 14443-B: 10% ASK), this modulation is also passed on to the transponder chip CL. The demodulation circuit 98 can possibly not distinguish here between a modulation signal from a reading device and a load modulation of the RFID chip CL, since both are expressed as amplitude modulation of the HF signal on the connections of the RFID chip CL. Finkenzeller at [0118] However, a load modulation of the transponder chip CL is recognizable exclusively on the connections, but a modulation signal of the reading device already in the receive branch (91, 92, V+, V−) of the inventive circuit. It is therefore provided to switch the inventive circuit to the transmit mode only when a modulation signal (amplitude modulation) can be detected exclusively on the connections of the RFID chip CL and not in the receive branch, since only in this case is a load modulation involved. This is indicated in FIG. 9 by the signal fed into the controller 95 from the receive branch (91, 92, V+, V−). Finkenzeller at [0119] A second way of distinguishing is to evaluate the modulation depth of the signal on the connections of the RFID chip. By load modulation a modulation depth less than 100% is obtained. In the breadboard setup approx. 25% was determined, other values arise from combining different resistors 93, 94 with different RFID chips CL. It is therefore provided to distinguish between the load modulation and the modulation of the reading device by determining modulation depth with reference to given switching thresholds. If the strength of the modulation signal is above a first, high threshold, a signal from the reading device is

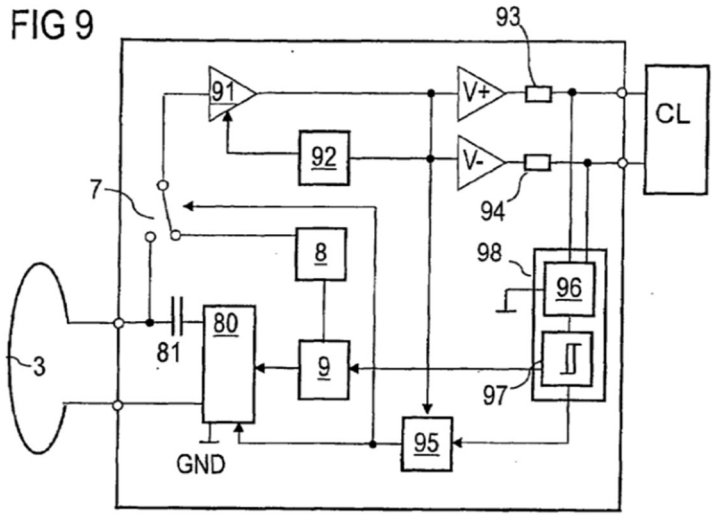
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	present. If the modulation signal is smaller than the first switching threshold and optionally greater than a second switching threshold, however, it is recognized that a load modulation is present. A switch-over to the transmit mode is effected if the modulation was caused by a load modulation. Finkenzeller at [0123] For an inductive coupling, the circuit has an additional antenna 29 which can be made to resonate with the working frequency (e.g. 13.56 MHz) by means of a capacitor 26. A transponder comprising a transponder chip CL and an antenna 28 is positioned in immediate proximity to the antenna 29, so as to obtain the best possible magnetic coupling between the antennas 28 and 29. A load modulation of the transponder chip CL can also be detected easily with this arrangement. Finkenzeller at [0124] The interface module adapted to be coupled inductively and a further antenna connected thereto (see reference sign 3 in FIG. 10) can be disposed in a terminal. The range of an ordinary transponder can be increased with the help of such a terminal. The owner of a mobile telephone could for example set up a communication between his transponder and a reading device that is unfavorably disposed or inconvenient to reach for other reasons by holding the transponder against his mobile telephone provided according to the invention with an interface module adapted to be coupled inductively. Finkenzeller at [0127] It was ascertained that small antennas, e.g. in a SIM card with its own antenna (approx. 15×25 mm^2), obtain very low read ranges with a conventional load modulation. It is frequently even impossible to communicate with a contactless reading device when the SIM card with an antenna is disposed for example in a mobile telephone. If one of the inventive transmitters is used in a mobile terminal the range is not clearly increased. Moreover, it can be advantageously exploited that mobile terminals such as mobile telephones, PDAs, etc., have their own energy supply (battery) which can also be used for supplying an inventive circuit. Finkenzeller at [0129] Thus, an NFC unit could be adapted to behave according to the present solutions in its passive mode in the role ("being card") in which the NFC unit is to perform a load modulation. The NFC unit could for example always act as a component actively emitting its own field. Likewise, the NFC unit could also distinguish, and optionally switch, between a first submode corresponding to a conventional load modulation and an actively sending, second submode in which the load modulation is simulated. A thus improved NFC unit can also communicate with ordinary RFID reading devices over a higher range with

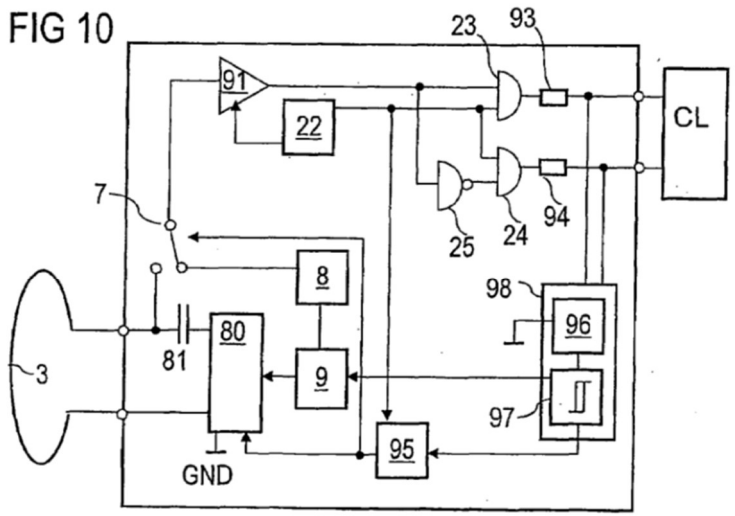
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	the help of the changed passive operating mode. Since NFC units will already have certain units—such as an oscillator, an amplifier and a controller—for independent sending in their conventional active mode, comparatively few modifications of an NFC circuit are required to realize a circuit according to the present application in an NFC unit. Finkenzeller at [0131] The individual functional components of the transponder unit—antenna, interface unit, chip and optionally voltage supply unit—can be disposed in all sorts of combinations separately from each other or integrated jointly in one unit. An inventive transponder unit can be formed for example as a specially designed transponder, in a portable data carrier, in particular a chip card, which optionally has a battery. A portable data carrier, in particular SIM card, with a chip and an interface unit can be connected in a mobile terminal to an external voltage source and/or an external antenna. The interface unit can be disposed in a terminal, connected to its own or an external antenna, and communicate with a chip which is disposed reversibly or firmly in the terminal or temporarily on the terminal. *See also* Finkenzeller at [0015], [0024], [0049], [0073], [0080], [0096], [0099], [0126], claim 19, and claim 35. To the extent this limitation is not disclosed by Finkenzeller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Finkenzeller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[1d] wherein the amplifier is coupled to amplify a signal received from the antenna and to provide an amplified signal to the smartcard controller.	Finkenzeller discloses or renders obvious "wherein the amplifier is coupled to amplify a signal received from the antenna and to provide an amplified signal to the smartcard controller." For example: Finkenzeller at Figure 2

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	FIG 2  Finkenzeller at Figure 4 FIG 4 

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	Finkenzeller at Figure 5  Finkenzeller at Figure 6  Finkenzeller at Figure 7

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	FIG 7  Finkenzeller at Figure 8 FIG 8 

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	Finkenzeller at Figure 9  Finkenzeller at Figure 10

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	 Finkenzeller at [0002] Transponders are used for example in radio frequency identification (RFID) systems. Conventionally, both the energy supply to a transponder in an RFID system and the data interchange between the transponder and a reading device are effected using magnetic or electromagnetic fields. RFID transponders have an electronic circuit and, depending on the frequency domain, an antenna coil (e.g. 13.56 MHz) or an electromagnetic antenna (e.g. 868 MHz). Via the antenna the energy required for operating the transponder can be taken from the field of the reading device, as well as the data transfer carried out. Finkenzeller at [0011] In an advantageous embodiment, an inventive RFID transponder unit has its own energy supply, at least one antenna for transmitting signals from and/or to a reading device, and an electronic circuit. The electronic circuit of the inventive transponder unit comprises a transmitter consisting of an oscillator and a modulator. Finkenzeller at [0020]

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	The electronic circuit of the transponder unit further comprises in the usual way a receiver which is so designed that it can detect signals from a reading device. From said signals the receiver extracts data by means of a demodulation circuit, so that a data stream transferred from the reading device is available at the output of the receiver as a baseband signal (e.g. as an NRZ code, Miller code, etc.). For example, the data can be a simple instruction to activate the controller. However, the data may also contain a more complex instruction to the controller. The demodulated data are supplied to the controller in the electronic circuit. A data signal is thereupon generated in the controller, whereby the data signal can also be based on the extracted data. Finkenzeller at [0021] In a development, the inventive transponder unit has a load modulator according to the prior art, in addition to the above-described circuit having a receiver, a controller, an oscillator and a modulator. Finkenzeller at [0022] The voltage induced on the antenna of the transponder unit can be a problem for the operation of the inventive modulator circuits if the distance between trans-ponder unit and reading device is small and the induced voltage is therefore accordingly great. Therefore, the data to be sent to the reading device which are generated in the controller are supplied alternatively to the load modulator or to the inventive circuit configuration with a modulator. The switchover between the load modulator and the circuit configuration is preferably effected automatically, in dependence on the level of voltage induced on the antenna. The switchover is effected in such a way that the load modulator is used within the normal communication range, and the inventive modulator outside the normal communication range. Finkenzeller at [0026] To avoid a quartz oscillator, which has a large mounting form, an improved embodiment of the invention has the oscillator coupled in phase lock to the signal received from the reading device via a phase locked loop (PLL) circuit when the trans-ponder unit is in the receive mode. In the transmit mode of the transponder unit, that is, during data transfer from the transponder unit to the reading device, the control voltage of the PLL circuit is kept constant so that the frequency of the oscillator is maintained as stable as possible. The PLL can also be referred to as tracking synchronization. The oscillator is so regulated that it follows in phase a reference signal, in the present case the timing signal of the reading device. The regulation circuit continuously compares the phase relationship of the two signals and adjusts that of the oscillator in case of an error signal. A PLL circuit is used primarily for frequency stabilization or synchronization of the oscillator. Additionally, it is possible to also supply the signal generated by the oscillator to the controller and use it as a timing signal relevant for timing.

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	Finkenzeller at [0028] The transponder unit can also be part of a mobile terminal, for example a mobile telephone. The transponder unit can have its own antenna or use an antenna of the terminal. Finkenzeller at [0029] According to a first alternative, the circuit configuration for generating and modulating the subcarrier signal is a separate part of the mobile terminal. The trans-ponder unit then has a signal input for receiving the subcarrier signal modulated by means of the data to be sent from the circuit configuration. The signal input is connected via a suitable interface in particular to a chip, for example a smart card chip, which generates and modulates the subcarrier signal. Finkenzeller at [0030] According to a second alternative, the circuit configuration for generating and modulating the subcarrier signal is part of the inventive transponder unit itself. To then connect the transponder unit to a (smart card) chip of the terminal, which supplies data to be sent for example, an interface can be provided via which data are transferred in binary form. Finkenzeller at [0040] FIG. 7 a transponder unit in which a security module is connected to an interface module via an S^2C interface. Finkenzeller at [0055] FIG. 2 shows purely schematically the transponder unit 1, for example in the form of an inductively coupled chip card, which comprises the usual components not shown explicitly here. For simplification, only one inventive RFID transponder unit in a chip card is shown. The transponder unit has a battery 2, an inductive antenna 3 and an electronic circuit 4, 5, 6, 7. The electronic circuit consists substantially of three functional blocks, a receiver 4, a controller 5 and a transmitter 6. A switch 7 is used for switching the antenna 3 between the receiver 4 and the transmitter 6. Finkenzeller at [0056] The receiver 4 is provided for demodulating a signal transmitted from the reading device 100 to extract data therefrom. The extracted data are passed on to the controller 5 which processes them and generates data to be sent to the reading device 100. Furthermore, the controller 5 transmits a control signal to the switch 7 which switches between receive mode and transmit mode of the transponder unit. However, a

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	separate antenna can instead be provided for sending. The controller 5 used can be for example a part of the operating system of a portable data carrier, such as a chip card. Finkenzeller at [0058] In the transponder unit shown in FIG. 2 it is provided that the assembly 11 divides the oscillator frequency by a certain factor by means of a frequency divider 12, for example by binary division. The resulting subcarrier signal is modulated with the data to be sent which are supplied to the assembly 11 by the controller 5. Finkenzeller at [0063] At the output of the ring modulator 9 an output signal is then available that contains the two modulation side bands and is identical (exactly enough) to a signal generated by load modulation or backscatter modulation. The output signal generated by the ring modulator 9 can then be optionally amplified by means of the amplifier 10, and be supplied to the antenna 3 for sending the data to be sent, via the switch 7 which is switched to the transmit mode of the transponder unit by a signal of the controller 5. Finkenzeller at [0064] The direct connection of the ring modulator output to the antenna is likewise possible. However, it is then necessary to adapt the antenna accordingly, and take account of a possible reaction of the signal coupled in from the reading device on the ring modulator, since the same antenna is normally used for sending and receiving, and since the reading device sends continually. Finkenzeller at [0066] For example, the receiver 4 can additionally be formed as a conventional load modulator driven by the controller 5. The controller 5 then either switches the transmitter 6 on and the load modulator off, or the load modulator on and the transmitter 6 off. The switch 7 is switched accordingly. The criterion used for switching from a passive to an active operating state can be for example the received signal strength, the presence and/or sufficiency of an external voltage supply (on an optional connection Vcc not shown), or the sufficiency of an internal voltage supply (state of charge of the battery 2). It is thus for example possible to first operate a transponder unit 1 passively and switch it to an active operating mode if for example the distance from the reading device unintentionally increases. Finkenzeller at [0073] Just as in the structure according to FIG. 2, the binary data signal A is combined with a subcarrier signal B by an AND gate 43. The combined signal is available at a ring modulator 49. The digital ring modulator

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	49 used can be an XOR element. Departing from the structure of the transmitter in FIG. 2, a carrier signal C is not applied directly to the input of the ring modulator 49. Instead, the carrier signal C is first combined with a data signal A in an AND gate 46. This arrangement obtains better efficiency, as to be described more closely below. The output signal of the ring modulator 49 is amplified in an amplifier 40 before being emitted via the antenna 3 as the field of the transponder unit. The signal types A to C will hereinafter be described more closely by way of example with reference to FIG. 5. Finkenzeller at [0076] The signal D emitted by an antenna 3 to a reading device has a frequency spectrum that is like a frequency spectrum resulting by means of load modulation. The signal D can optionally be amplified by means of an amplifier 40. The amplifier 40 can be for example a push-pull amplifier with digital push-pull output amplifiers. Finkenzeller at [0085] For an external HF interface—for example with the S2C interface described more closely below—an ASK modulator should preferably be used, since the power consumption is the lowest here. If the HF interface is integrated into a smart card chip, or an HF interface providing the signal (TF ∩MS) is used, the optimized ring modulator will preferably be used in case of sufficient energy. If energy is to be saved, however, the ASK modulator can be used here too. Finkenzeller at [0091] There are smart card chips having a so-called S^2C interface, defined by the company Philips, for connecting the smart card chip to an HF interface of an NFC device. Such smart card chips have hardware means for generating and decoding signals required on an ISO/IEC 14443 interface (Miller code, Manchester code, subcarrier 848 kHz). However, such a chip does not have an HF interface unit of its own. Finkenzeller at [0092] FIG. 7 shows schematically an inventive transponder unit, formed by an interface module 71 connected to an antenna 3, and a chip 75 with a suitable interface, for example an S^2C interface. Such a transponder unit can be formed for example in a mobile telephone with the help of the SIM card as chip 75, which is then preferably connected to the interface module 71 via one or more idle contact surfaces (C6 and/or C4, C8) of the SIM card. Finkenzeller at [0093]

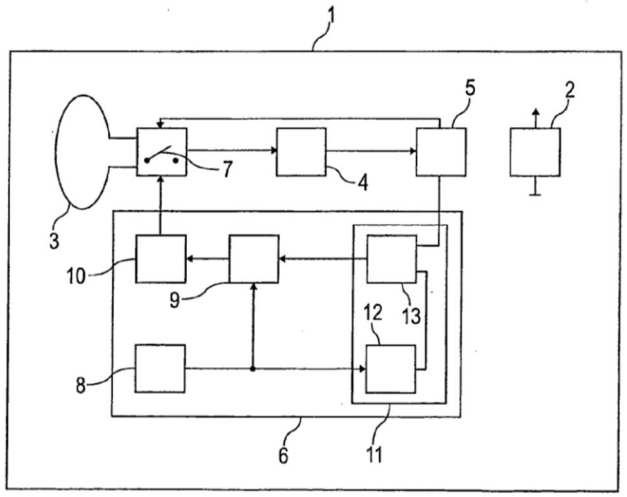
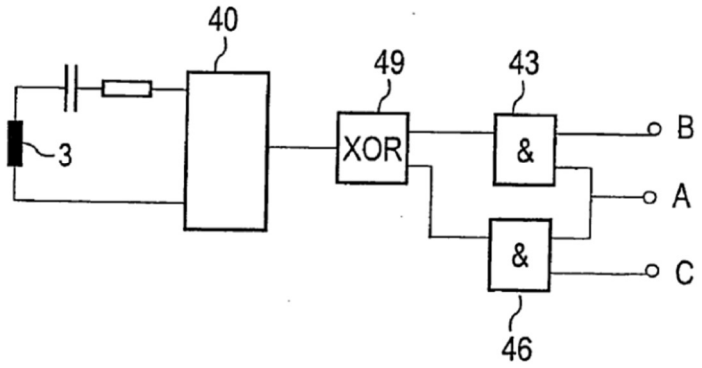
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	Both the interface module 71 and the chip 75 can draw their supply voltage from the device in which they are disposed preferably reversibly. The interface module 71 can act as an ordinary transponder in a second operating mode and supply the chip with an operating voltage Vcc_RF. Finkenzeller at [0094] FIG. 8 shows schematically more exactly the structure of an interface module for a chip with an S^2C interface. Finkenzeller at [0095] The interface module 71 is equipped with a signal input SIGIN and a signal output SIGOUT for passing signals from the antenna to the chip (not shown) and from the chip, which generates the modulated subcarrier signal, to the antenna. A signal at SIGOUT consists of a 13.56 MHz TTL signal which optionally contains a modulation signal of a remote reading device. Finkenzeller at [0096] The interface module 71 comprises an amplifier 80, an AND gate 89, an oscillator 88, a frequency divider 82, a signal shaper 84 and a switch 87. The amplifier 80 can be for example a push-pull amplifier with (digital) push-pull output amplifiers (not shown). The interface module also has two antenna connections LA and LB and a series capacitor 81. Furthermore, the interface module 71 has connections Vcc-in and GND for energy supply and a control input CTRL for switching between a transmit mode and a receive mode of the interface module by means of the switch 87. Finkenzeller at [0098] When the interface module is in the transmit mode, i.e. there is a contactless data transfer to an external reading device or an NFC device, a modulated subcarrier signal is fed in at the signal input SIGIN by the smart card chip and optionally inverted in an inverter 86. The inverted signal E is combined with a 13.56 MHz carrier frequency signal in the AND gate 89 as the carrier frequency modulator, and supplied to the amplifier 80. Finkenzeller at [0099] The antenna 3 and the series capacitor 81 form a series-resonant circuit which is connected to the outputs LA′ and LB′ of the amplifier 80, so that the HF current flowing in case of resonance is limited in the antenna resonant circuit only by the ohmic resistances in the lines and in the amplifier 80. This obtains a greatest possible transmit power of the interface module.

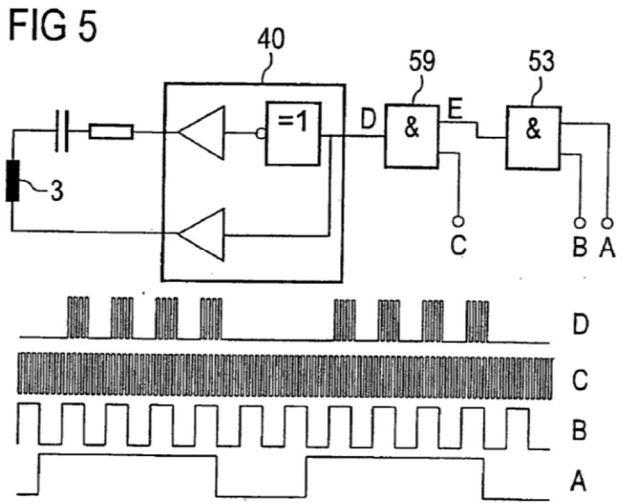
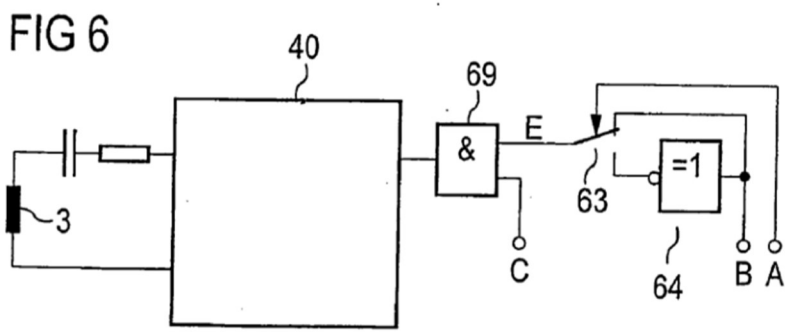
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	Finkenzeller at [0100] Further, the smart card chip can be supplied a constant 13.56 MHz timing signal from the oscillator 88 via the output SIGOUT in the transmit mode via the switch 87, if it requires such an (external) timing signal for operation to keep exact timing. As described above, this is necessary for communication according to the standard ISO 14443 type A. Finkenzeller at [0101] In the receive mode, the smart card chip is supplied a digitized received signal tapped from the antenna 1, via the switch 87 and the output SIGOUT. The signal shaper 84 acts here as an amplifier to be able to receive even weak signals, and as a threshold switch to provide a digital output signal at the output of the signal shaper. For example, the threshold switch used can be a Schmitt trigger which outputs a clear high or low level depending on the over- or undershooting of a predetermined threshold value. Finkenzeller at [0102] Via the control input of the push-pull amplifier 80 the push-pull outputs of the output drivers (see amplifier units in FIG. 5) are switched to GND, so that the antenna 3 and the capacitor 41 result in a parallel-resonant circuit. To save energy, the amplifier 80 can be switched to a power save mode in the receive mode of the interface module. Finkenzeller at [0106] The inventive active transponder unit has a receive branch and a transmit branch. The receive branch consists of an antenna 3, an input amplifier 91, an automatic gain control 92 and an amplifier which is preferably designed as a push-pull amplifier (V+, V−). Further, a transponder chip CL is connected via its antenna connections to the push-pull amplifier. Finkenzeller at [0107] The transponder chip CL is a conventional RFID chip according to the prior art. It is normally connected at its connections with an antenna, e.g. in a chip card. Further, the transponder chip CL is so designed that data transfer from the transponder unit to a reading device is carried out by means of load modulation. This is almost always the case in usual RFID systems used at 13.56 MHz or also 125 kHz (e.g. ISO/IEC 14443, ISO/IEC 15693, ISO/IEC 18000-3). Finkenzeller at [0108]

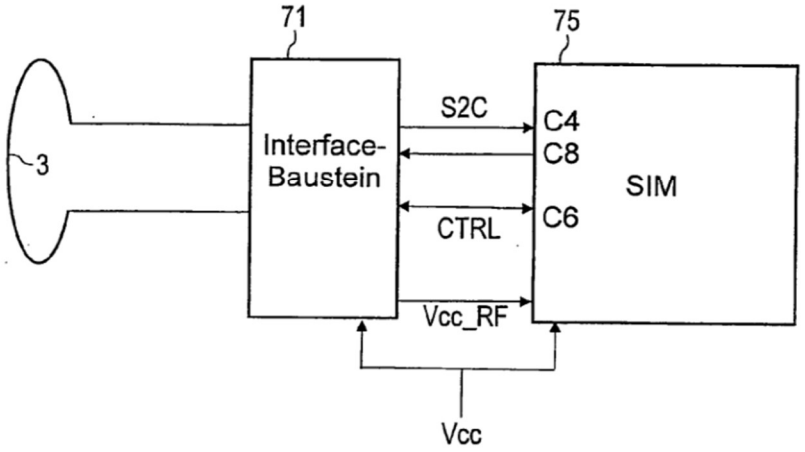
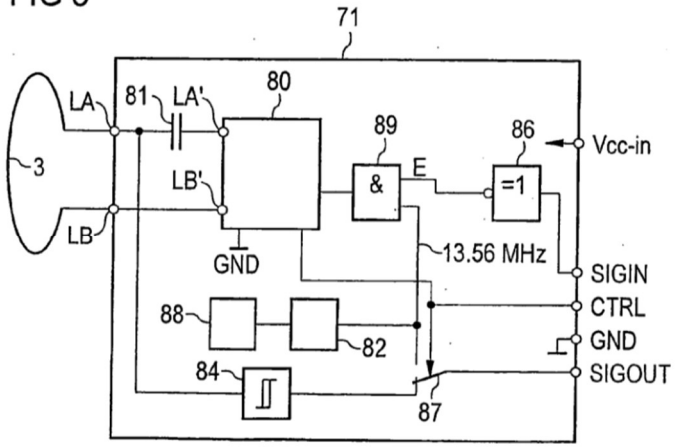
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	The transmit branch consists of a demodulation circuit 97, a modulator circuit 9, an oscillator 8 (e.g. 13.56 MHz), a controller 95, and a transmitter amplifier 80 connected to the antenna 3. The demodulation circuit 98 can consist for example of a rectifier 96 and a threshold switch 97. Finkenzeller at [0109] In the receive mode a voltage is induced in the antenna 3 by the magnetic field of a remote RFID reading device. Together with the capacitor 81 the antenna 3 forms a parallel-resonant circuit whose resonant frequency corresponds approximately to the transmitting frequency of the RFID reading device. The voltage thus available on the resonant circuit is supplied to the input amplifier 91 via the switch 7. Via a gain control 92 the gain factor of the input amplifier 91 is now so adjusted that the output amplitude of the voltage amplified by the input amplifier 91 remains largely constant. The time constant of the control is preferably so adjusted here that the output voltage of the amplifier 91 remains constant in case of varying distance from the reading device (i.e. different levels of induced voltage in the coil 3), but modulation signals (e.g. 10% ASK with 106 kbit/s) are not suppressed by excessively fast control. Finkenzeller at [0110] The output signal of the amplifier 91 is supplied to a further amplifier, preferably a push-pull amplifier (V+, V−). The output signal of the push-pull amplifier is supplied to the connections of the contactless RFID chip CL via (at least) one series resistor 93. The amplitude of the output signal of the push-pull amplifier V+/V− is so selected here that the RFID chip CL can be supplied with sufficient energy for operation by the output signal. Finkenzeller at [0114] The modulation signal reconstructed by the demodulation circuit 97 is also supplied to a controller 95. The latter switches the inventive circuit with the first edge of the modulation signal to a transmit mode without delay if possible, so that the data generated by the RFID chip CL can also be transferred to the remote reading device. For this purpose, the switch 7 is first switched from the antenna 3 to the oscillator 8 (13.56 MHz). This is necessary to be able to keep supplying the RFID chip CL with an alternating voltage of the right frequency. At the same time the amplifier 80 is activated by the controller 95. Finkenzeller at [0115] The reconstructed modulation signal and the signal of the oscillator 8 are supplied to the modulator circuit 9. The exact function of such a circuit has already been described in detail. The output signal of the modulator circuit 9 is supplied to the amplifier 80 and sent via the antenna 3 to the remote reading device.

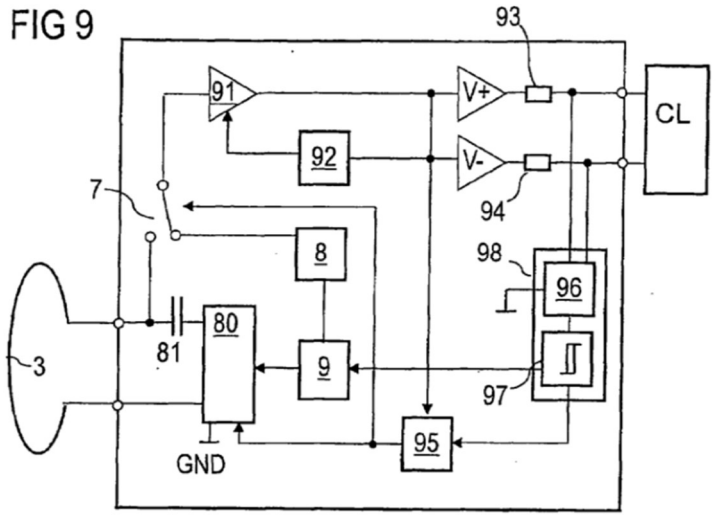
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	Finkenzeller at [0123] For an inductive coupling, the circuit has an additional antenna 29 which can be made to resonate with the working frequency (e.g. 13.56 MHz) by means of a capacitor 26. A transponder comprising a transponder chip CL and an antenna 28 is positioned in immediate proximity to the antenna 29, so as to obtain the best possible magnetic coupling between the antennas 28 and 29. A load modulation of the transponder chip CL can also be detected easily with this arrangement. Finkenzeller at [0124] The interface module adapted to be coupled inductively and a further antenna connected thereto (see reference sign 3 in FIG. 10) can be disposed in a terminal. The range of an ordinary transponder can be increased with the help of such a terminal. The owner of a mobile telephone could for example set up a communication between his transponder and a reading device that is unfavorably disposed or inconvenient to reach for other reasons by holding the transponder against his mobile telephone provided according to the invention with an interface module adapted to be coupled inductively. Finkenzeller at [0127] It was ascertained that small antennas, e.g. in a SIM card with its own antenna (approx. 15×25 mm^2), obtain very low read ranges with a conventional load modulation. It is frequently even impossible to communicate with a contactless reading device when the SIM card with an antenna is disposed for example in a mobile telephone. If one of the inventive transmitters is used in a mobile terminal the range is not clearly increased. Moreover, it can be advantageously exploited that mobile terminals such as mobile telephones, PDAs, etc., have their own energy supply (battery) which can also be used for supplying an inventive circuit. Finkenzeller at [0129] Thus, an NFC unit could be adapted to behave according to the present solutions in its passive mode in the role ("being card") in which the NFC unit is to perform a load modulation. The NFC unit could for example always act as a component actively emitting its own field. Likewise, the NFC unit could also distinguish, and optionally switch, between a first submode corresponding to a conventional load modulation and an actively sending, second submode in which the load modulation is simulated. A thus improved NFC unit can also communicate with ordinary RFID reading devices over a higher range with the help of the changed passive operating mode. Since NFC units will already have certain units—such as an oscillator, an amplifier and a controller—for independent sending in their conventional active mode,

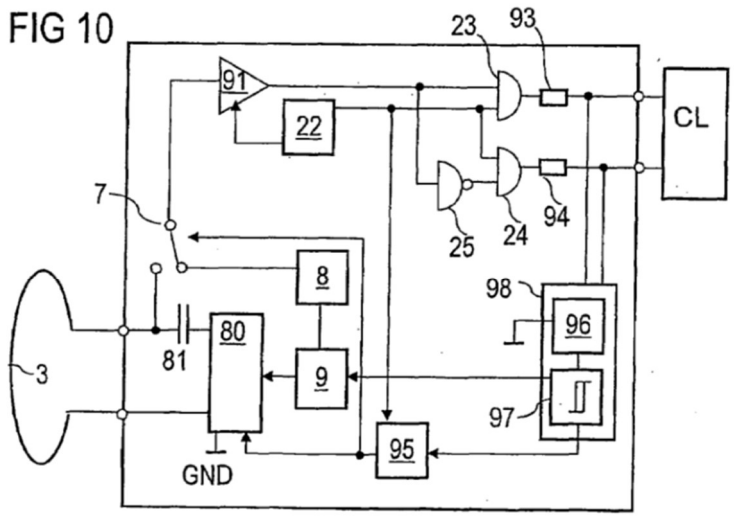
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	comparatively few modifications of an NFC circuit are required to realize a circuit according to the present application in an NFC unit. Finkenzeller at [0131] The individual functional components of the transponder unit—antenna, interface unit, chip and optionally voltage supply unit—can be disposed in all sorts of combinations separately from each other or integrated jointly in one unit. An inventive transponder unit can be formed for example as a specially designed transponder, in a portable data carrier, in particular a chip card, which optionally has a battery. A portable data carrier, in particular SIM card, with a chip and an interface unit can be connected in a mobile terminal to an external voltage source and/or an external antenna. The interface unit can be disposed in a terminal, connected to its own or an external antenna, and communicate with a chip which is disposed reversibly or firmly in the terminal or temporarily on the terminal. *See also* Finkenzeller at [0006], [0007], [0012], [0015], [0024], [0025], [0049], [0080], [0117], [0118], [0126], claim 19, and claim 35. To the extent this limitation is not disclosed by Finkenzeller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Finkenzeller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
2. The mobile device of claim 1 wherein the antenna is tuned to operate at 13.56 MHz.	Finkenzeller expressly or inherently discloses "[t]he mobile device of claim 1 wherein the antenna is tuned to operate at 13.56 MHz." For example: Finkenzeller at Figure 2

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	FIG 2  Finkenzeller at Figure 4 FIG 4 

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	Finkenzeller at Figure 5  Finkenzeller at Figure 6  Finkenzeller at Figure 7

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	FIG 7  Finkenzeller at Figure 8 FIG 8 

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	Finkenzeller at Figure 9  Finkenzeller at Figure 10

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	 Finkenzeller at [0002] Transponders are used for example in radio frequency identification (RFID) systems. Conventionally, both the energy supply to a transponder in an RFID system and the data interchange between the transponder and a reading device are effected using magnetic or electromagnetic fields. RFID transponders have an electronic circuit and, depending on the frequency domain, an antenna coil (e.g. 13.56 MHz) or an electromagnetic antenna (e.g. 868 MHz). Via the antenna the energy required for operating the transponder can be taken from the field of the reading device, as well as the data transfer carried out. Finkenzeller at [0006] For simple and fast contactless communication between two devices, the companies Philips and Sony have developed an inductive transmission technology which is known as so-called near field communication (NFC). This technology is integrated for example in mobile telephones or PDAs to permit communication between the devices or with a computer. The coupling of the two devices is effected via coils, the carrier frequency being 13.56 MHz as in RFID systems. As described more closely in the NFC standard ECMA 340, NFC systems have an active communication mode and a passive communication mode. In the active mode, two NFC units alternately generate their own RF field as a signal carrier, thus

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	switching back and forth, coordinated with each other, between transmit mode and receive mode as in a classic mobile phone system. In the passive mode, however, the two NFC units must agree on which unit acts as a reading device and generates a field which the other unit can then influence by means of load modulation. Primarily due to the small antenna diameters used, NFC systems only permit small communication ranges of up to 20 cm. Finkenzeller at [0011] In an advantageous embodiment, an inventive RFID transponder unit has its own energy supply, at least one antenna for transmitting signals from and/or to a reading device, and an electronic circuit. The electronic circuit of the inventive transponder unit comprises a transmitter consisting of an oscillator and a modulator. Finkenzeller at [0022] The voltage induced on the antenna of the transponder unit can be a problem for the operation of the inventive modulator circuits if the distance between trans-ponder unit and reading device is small and the induced voltage is therefore accordingly great. Therefore, the data to be sent to the reading device which are generated in the controller are supplied alternatively to the load modulator or to the inventive circuit configuration with a modulator. The switchover between the load modulator and the circuit configuration is preferably effected automatically, in dependence on the level of voltage induced on the antenna. The switchover is effected in such a way that the load modulator is used within the normal communication range, and the inventive modulator outside the normal communication range. Finkenzeller at [0025] In particular for communication according to the standard ISO 14443 type A, exact timing is important. With conventional passive transponders, timing is ensured even in the transmit mode (load modulation) by the timing signal (13.56 MHz) continually received from the reading device. However, such a signal is no longer available in the transmit mode of an inventive circuit configuration. In one embodiment of the invention, an oscillator is therefore provided for example in the form of a quartz oscillator. Finkenzeller at [0028] The transponder unit can also be part of a mobile terminal, for example a mobile telephone. The transponder unit can have its own antenna or use an antenna of the terminal. Finkenzeller at [0055]

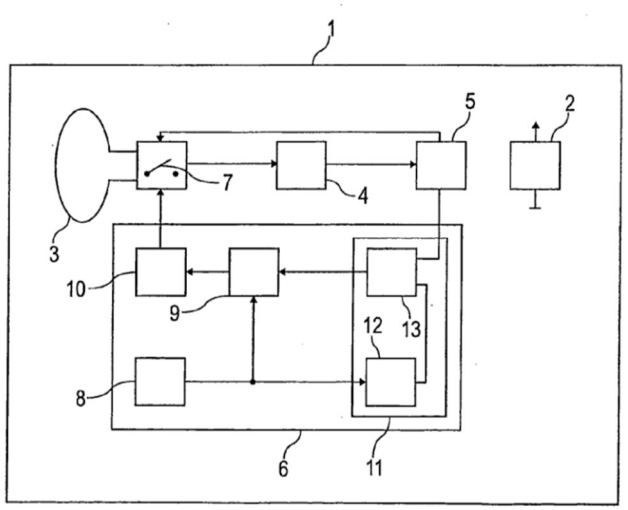
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	FIG. 2 shows purely schematically the transponder unit 1, for example in the form of an inductively coupled chip card, which comprises the usual components not shown explicitly here. For simplification, only one inventive RFID transponder unit in a chip card is shown. The transponder unit has a battery 2, an inductive antenna 3 and an electronic circuit 4, 5, 6, 7. The electronic circuit consists substantially of three functional blocks, a receiver 4, a controller 5 and a transmitter 6. A switch 7 is used for switching the antenna 3 between the receiver 4 and the transmitter 6. Finkenzeller at [0056] The receiver 4 is provided for demodulating a signal transmitted from the reading device 100 to extract data therefrom. The extracted data are passed on to the controller 5 which processes them and generates data to be sent to the reading device 100. Furthermore, the controller 5 transmits a control signal to the switch 7 which switches between receive mode and transmit mode of the transponder unit. However, a separate antenna can instead be provided for sending. The controller 5 used can be for example a part of the operating system of a portable data carrier, such as a chip card. Finkenzeller at [0063] At the output of the ring modulator 9 an output signal is then available that contains the two modulation side bands and is identical (exactly enough) to a signal generated by load modulation or backscatter modulation. The output signal generated by the ring modulator 9 can then be optionally amplified by means of the amplifier 10, and be supplied to the antenna 3 for sending the data to be sent, via the switch 7 which is switched to the transmit mode of the transponder unit by a signal of the controller 5. Finkenzeller at [0064] The direct connection of the ring modulator output to the antenna is likewise possible. However, it is then necessary to adapt the antenna accordingly, and take account of a possible reaction of the signal coupled in from the reading device on the ring modulator, since the same antenna is normally used for sending and receiving, and since the reading device sends continually. Finkenzeller at [0069] The input HF of the ring modulator 9 is fed with the high-frequency output signal of the oscillator 8. The frequency of the oscillator signal preferably corresponds exactly to the transmitting frequency of the reading device 100 (e.g. 13.56 MHz). The input NF of the ring modulator 9 is fed with a data signal in the baseband (e.g. for Felica system) or with a modulated subcarrier (e.g. for ISO 14443, ISO 15693), as described above.

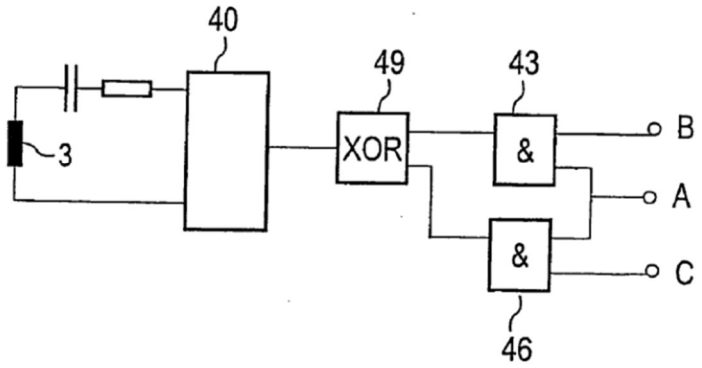
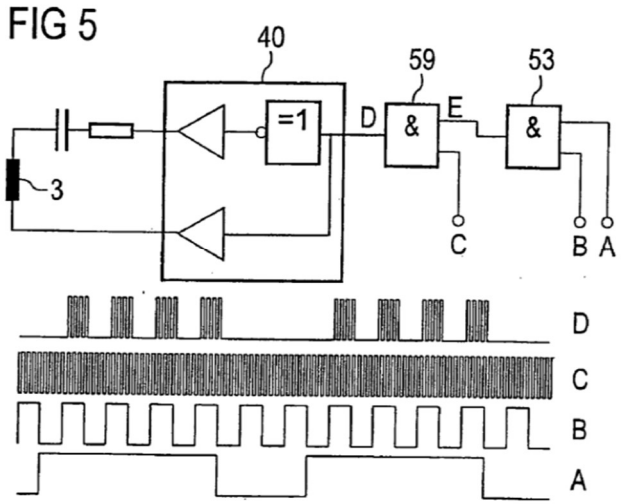
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	Finkenzeller at [0076] The signal D emitted by an antenna 3 to a reading device has a frequency spectrum that is like a frequency spectrum resulting by means of load modulation. The signal D can optionally be amplified by means of an amplifier 40. The amplifier 40 can be for example a push-pull amplifier with digital push-pull output amplifiers. Finkenzeller at [0078] In the transmitter according to FIG. 5 an amplitude-modulated subcarrier signal is generated, while the transmitter shown in FIG. 6 generates a phase-modulated subcarrier signal. This transmitter, like the transmitter of FIG. 5, is preferably used in an inventive transponder unit only when the data signal A is a binary signal. Correspondingly, the transmitter shown generates a BPSK signal (2-PSK, binary phase shift keying). A subcarrier signal B (e.g. 848 kHz for ISO/IEC 14443) and a carrier signal C (e.g. 13.56 MHz for ISO/IEC 14443) are thereby ANDed by means of the circuit 69. The data signal A in the baseband (e.g. NRZ or Manchester signal) switches the subcarrier signal B between an inverted and a non-inverted state with the help of a switch 63 and an inverter 64. This has an effect corresponding to a phase modulation by 180° (BPSK, binary phase keying). Finkenzeller at [0080] The following table shows a survey of logic operation on signals, electricity consumption and range for different digital modulation circuits (carrier frequency TF=13.56 MHz; subcarrier frequency HT=868 kHz and modulation signal MS in the baseband, Manchester 106 kbit/s). Finkenzeller at [0081] Upon data transfer from a transponder to the reading device an ASK-modulated subcarrier (OOK, on-off keying: HT r>MS) is used according to ISO/IEC 14443-3/type A at the initialization bit rate of 106 kbit/s. When this signal is simulated actively according to the inventive method, the required side bands can be generated most effectively with a ring modulator. The resulting double side band modulation (DSB) should show the best results with regard to communication range, since the carrier frequency (13.56 MHz) is suppressed and the available energy is provided in the side bands. Finkenzeller at [0095] The interface module 71 is equipped with a signal input SIGIN and a signal output SIGOUT for passing signals from the antenna to the chip (not shown) and from the chip, which generates the modulated

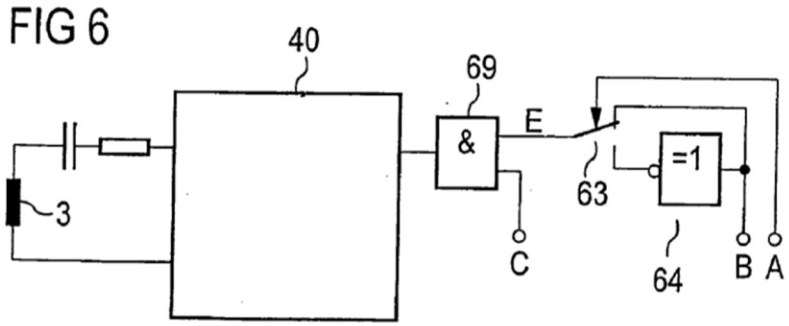
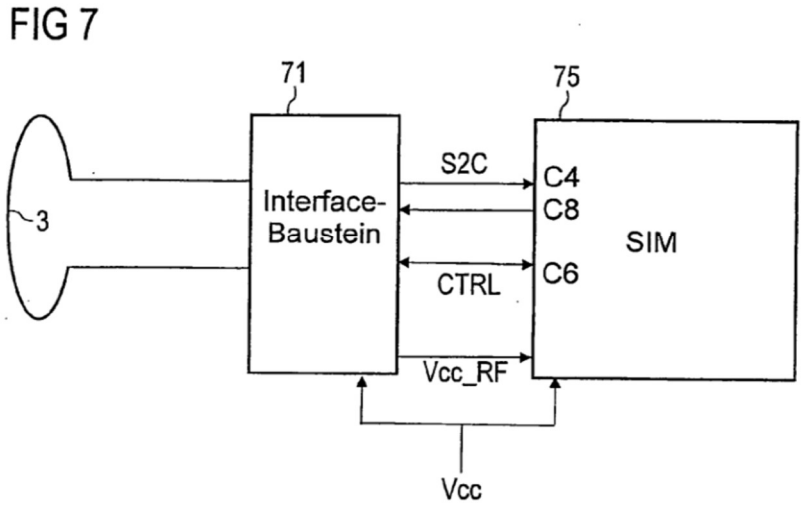
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	subcarrier signal, to the antenna. A signal at SIGOUT consists of a 13.56 MHz TTL signal which optionally contains a modulation signal of a remote reading device. Finkenzeller at [0098] When the interface module is in the transmit mode, i.e. there is a contactless data transfer to an external reading device or an NFC device, a modulated subcarrier signal is fed in at the signal input SIGIN by the smart card chip and optionally inverted in an inverter 86. The inverted signal E is combined with a 13.56 MHz carrier frequency signal in the AND gate 89 as the carrier frequency modulator, and supplied to the amplifier 80. Finkenzeller at [0100] Further, the smart card chip can be supplied a constant 13.56 MHz timing signal from the oscillator 88 via the output SIGOUT in the transmit mode via the switch 87, if it requires such an (external) timing signal for operation to keep exact timing. As described above, this is necessary for communication according to the standard ISO 14443 type A. Finkenzeller at [0101] In the receive mode, the smart card chip is supplied a digitized received signal tapped from the antenna 1, via the switch 87 and the output SIGOUT. The signal shaper 84 acts here as an amplifier to be able to receive even weak signals, and as a threshold switch to provide a digital output signal at the output of the signal shaper. For example, the threshold switch used can be a Schmitt trigger which outputs a clear high or low level depending on the over- or undershooting of a predetermined threshold value. Finkenzeller at [0102] Via the control input of the push-pull amplifier 80 the push-pull outputs of the output drivers (see amplifier units in FIG. 5) are switched to GND, so that the antenna 3 and the capacitor 41 result in a parallel-resonant circuit. To save energy, the amplifier 80 can be switched to a power save mode in the receive mode of the interface module. Finkenzeller at [0103] The oscillator 88 generates the 13.56 MHz carrier frequency signal required in the transmit mode. If the oscillator cannot be switched off in the receive mode since its building-up transient might last too long, the oscillator is operated in the receive mode of the interface module preferably at a multiple N of the carrier frequency signal (e.g. 27.120 MHz) so as not to disturb the possibly weak received signal by

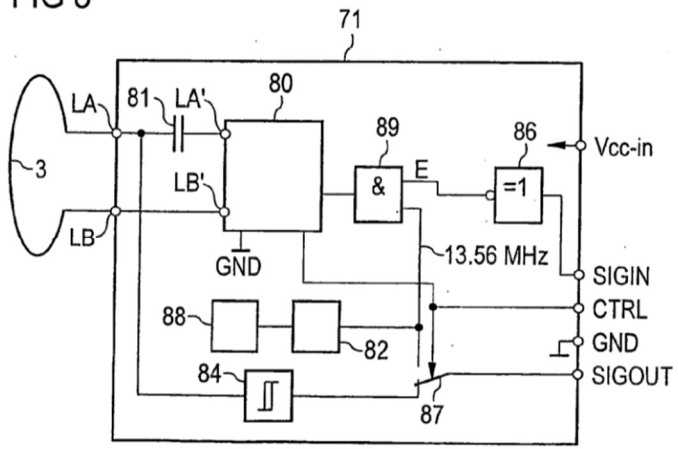
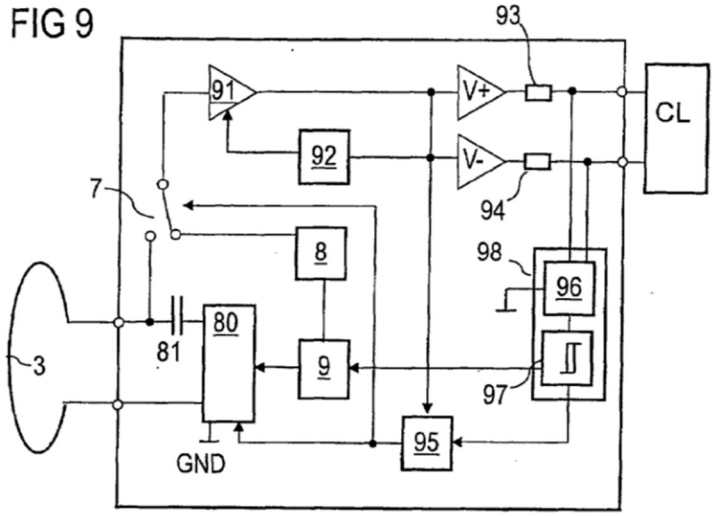
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	crosstalk. In the transmit mode the required 13.56 MHz signal can then be generated by dividing the oscillator signal by N by means of an optional divider 82. Finkenzeller at [0106] The inventive active transponder unit has a receive branch and a transmit branch. The receive branch consists of an antenna 3, an input amplifier 91, an automatic gain control 92 and an amplifier which is preferably designed as a push-pull amplifier (V+, V−). Further, a transponder chip CL is connected via its antenna connections to the push-pull amplifier. Finkenzeller at [0107] The transponder chip CL is a conventional RFID chip according to the prior art. It is normally connected at its connections with an antenna, e.g. in a chip card. Further, the transponder chip CL is so designed that data transfer from the transponder unit to a reading device is carried out by means of load modulation. This is almost always the case in usual RFID systems used at 13.56 MHz or also 125 kHz (e.g. ISO/IEC 14443, ISO/IEC 15693, ISO/IEC 18000-3). Finkenzeller at [0108] The transmit branch consists of a demodulation circuit 97, a modulator circuit 9, an oscillator 8 (e.g. 13.56 MHz), a controller 95, and a transmitter amplifier 80 connected to the antenna 3. The demodulation circuit 98 can consist for example of a rectifier 96 and a threshold switch 97. Finkenzeller at [0109] In the receive mode a voltage is induced in the antenna 3 by the magnetic field of a remote RFID reading device. Together with the capacitor 81 the antenna 3 forms a parallel-resonant circuit whose resonant frequency corresponds approximately to the transmitting frequency of the RFID reading device. The voltage thus available on the resonant circuit is supplied to the input amplifier 91 via the switch 7. Via a gain control 92 the gain factor of the input amplifier 91 is now so adjusted that the output amplitude of the voltage amplified by the input amplifier 91 remains largely constant. The time constant of the control is preferably so adjusted here that the output voltage of the amplifier 91 remains constant in case of varying distance from the reading device (i.e. different levels of induced voltage in the coil 3), but modulation signals (e.g. 10% ASK with 106 kbit/s) are not suppressed by excessively fast control. Finkenzeller at [0114] The modulation signal reconstructed by the demodulation circuit 97 is also supplied to a controller 95. The latter switches the inventive circuit with the first edge of the modulation signal to a transmit mode

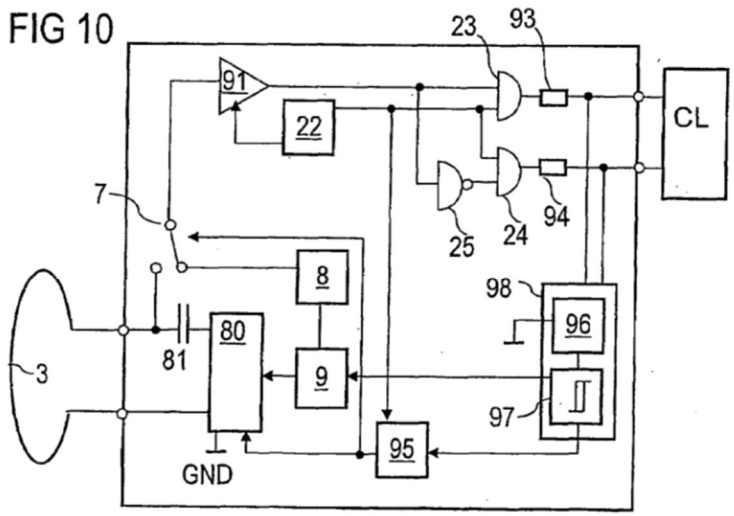
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	without delay if possible, so that the data generated by the RFID chip CL can also be transferred to the remote reading device. For this purpose, the switch 7 is first switched from the antenna 3 to the oscillator 8 (13.56 MHz). This is necessary to be able to keep supplying the RFID chip CL with an alternating voltage of the right frequency. At the same time the amplifier 80 is activated by the controller 95. Finkenzeller at [0123] For an inductive coupling, the circuit has an additional antenna 29 which can be made to resonate with the working frequency (e.g. 13.56 MHz) by means of a capacitor 26. A transponder comprising a transponder chip CL and an antenna 28 is positioned in immediate proximity to the antenna 29, so as to obtain the best possible magnetic coupling between the antennas 28 and 29. A load modulation of the transponder chip CL can also be detected easily with this arrangement. Finkenzeller at [0124] The interface module adapted to be coupled inductively and a further antenna connected thereto (see reference sign 3 in FIG. 10) can be disposed in a terminal. The range of an ordinary transponder can be increased with the help of such a terminal. The owner of a mobile telephone could for example set up a communication between his transponder and a reading device that is unfavorably disposed or inconvenient to reach for other reasons by holding the transponder against his mobile telephone provided according to the invention with an interface module adapted to be coupled inductively. Finkenzeller at [0127] It was ascertained that small antennas, e.g. in a SIM card with its own antenna (approx. 15×25 mm^2), obtain very low read ranges with a conventional load modulation. It is frequently even impossible to communicate with a contactless reading device when the SIM card with an antenna is disposed for example in a mobile telephone. If one of the inventive transmitters is used in a mobile terminal the range is not clearly increased. Moreover, it can be advantageously exploited that mobile terminals such as mobile telephones, PDAs, etc., have their own energy supply (battery) which can also be used for supplying an inventive circuit. Finkenzeller at [0131] The individual functional components of the transponder unit—antenna, interface unit, chip and optionally voltage supply unit—can be disposed in all sorts of combinations separately from each other or integrated jointly in one unit. An inventive transponder unit can be formed for example as a specially designed transponder, in a portable data carrier, in particular a chip card, which optionally has a battery. A portable data carrier, in particular SIM card, with a chip and an interface unit can be connected in a

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	mobile terminal to an external voltage source and/or an external antenna. The interface unit can be disposed in a terminal, connected to its own or an external antenna, and communicate with a chip which is disposed reversibly or firmly in the terminal or temporarily on the terminal. *See also* Finkenzeller at [0007], [0015], [0021], [0024], [0049], [0073], [0075], [0092], [0096], [0099], [0115], [0126], [0129], and claim 19. To the extent this limitation is not disclosed by Finkenzeller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Finkenzeller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 1 above.
3. The mobile device of claim 1 wherein the antenna comprises an inductive element too small to draw enough power sufficient to operate the smartcard controller from an interrogating radio frequency (RF) field.	Finkenzeller expressly or inherently discloses "[t]he mobile device of claim 1 wherein the antenna comprises an inductive element too small to draw enough power sufficient to operate the smartcard controller from an interrogating radio frequency (RF) field." For example: Finkenzeller at Figure 2 FIG 2  Finkenzeller at Figure 4

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	FIG 4  Finkenzeller at Figure 5 FIG 5 

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	Finkenzeller at Figure 6  Finkenzeller at Figure 7  Finkenzeller at Figure 8

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	FIG 8  Finkenzeller at Figure 9 FIG 9 

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	Finkenzeller at Figure 10  Finkenzeller at [0002] Transponders are used for example in radio frequency identification (RFID) systems. Conventionally, both the energy supply to a transponder in an RFID system and the data interchange between the transponder and a reading device are effected using magnetic or electromagnetic fields. RFID transponders have an electronic circuit and, depending on the frequency domain, an antenna coil (e.g. 13.56 MHz) or an electromagnetic antenna (e.g. 868 MHz). Via the antenna the energy required for operating the transponder can be taken from the field of the reading device, as well as the data transfer carried out. Finkenzeller at [0004] The range within which communication is possible in the system by data transfer can be increased by using active transponders, that is, transponders with their own energy supply. The energy supply of the active transponder, for example in form of a battery, operates its electronic circuit. Conventional transponders without their own energy supply are referred to as passive transponders, in contrast.

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	Finkenzeller at [0006] For simple and fast contactless communication between two devices, the companies Philips and Sony have developed an inductive transmission technology which is known as so-called near field communication (NFC). This technology is integrated for example in mobile telephones or PDAs to permit communication between the devices or with a computer. The coupling of the two devices is effected via coils, the carrier frequency being 13.56 MHz as in RFID systems. As described more closely in the NFC standard ECMA 340, NFC systems have an active communication mode and a passive communication mode. In the active mode, two NFC units alternately generate their own RF field as a signal carrier, thus switching back and forth, coordinated with each other, between transmit mode and receive mode as in a classic mobile phone system. In the passive mode, however, the two NFC units must agree on which unit acts as a reading device and generates a field which the other unit can then influence by means of load modulation. Primarily due to the small antenna diameters used, NFC systems only permit small communication ranges of up to 20 cm. Finkenzeller at [0007] Even with active transponders there is the problem that data transfer from the transponder to the reading device is limited by the signals becoming weaker with increasing distance between reading device and transponder. As a rule, ranges no longer than 1 to 2 m can therefore be obtained even with an active transponder for example in inductively coupled systems which transfer data to the reading device on the principle of load modulation. For RFID systems working on the principle of backscatter, however, communication ranges of 10 m are typically obtained. Finkenzeller at [0011] In an advantageous embodiment, an inventive RFID transponder unit has its own energy supply, at least one antenna for transmitting signals from and/or to a reading device, and an electronic circuit. The electronic circuit of the inventive transponder unit comprises a transmitter consisting of an oscillator and a modulator. Finkenzeller at [0020] The electronic circuit of the transponder unit further comprises in the usual way a receiver which is so designed that it can detect signals from a reading device. From said signals the receiver extracts data by means of a demodulation circuit, so that a data stream transferred from the reading device is available at the output of the receiver as a baseband signal (e.g. as an NRZ code, Miller code, etc.). For example, the data can be a simple instruction to activate the controller. However, the data may also contain a more

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	complex instruction to the controller. The demodulated data are supplied to the controller in the electronic circuit. A data signal is thereupon generated in the controller, whereby the data signal can also be based on the extracted data. Finkenzeller at [0021] In a development, the inventive transponder unit has a load modulator according to the prior art, in addition to the above-described circuit having a receiver, a controller, an oscillator and a modulator. Finkenzeller at [0022] The voltage induced on the antenna of the transponder unit can be a problem for the operation of the inventive modulator circuits if the distance between trans-ponder unit and reading device is small and the induced voltage is therefore accordingly great. Therefore, the data to be sent to the reading device which are generated in the controller are supplied alternatively to the load modulator or to the inventive circuit configuration with a modulator. The switchover between the load modulator and the circuit configuration is preferably effected automatically, in dependence on the level of voltage induced on the antenna. The switchover is effected in such a way that the load modulator is used within the normal communication range, and the inventive modulator outside the normal communication range. Finkenzeller at [0024] Furthermore, the transponder unit of the present invention can have a voltage limiter which is provided for limiting the voltage induced on the antenna by the reading device. This makes it possible, among other things, to avoid the above-described problem of overload when the transponder unit and the reading device are disposed a small distance apart. The voltage limiter used can be for example a shunt regulator. Finkenzeller at [0026] To avoid a quartz oscillator, which has a large mounting form, an improved embodiment of the invention has the oscillator coupled in phase lock to the signal received from the reading device via a phase locked loop (PLL) circuit when the trans-ponder unit is in the receive mode. In the transmit mode of the transponder unit, that is, during data transfer from the transponder unit to the reading device, the control voltage of the PLL circuit is kept constant so that the frequency of the oscillator is maintained as stable as possible. The PLL can also be referred to as tracking synchronization. The oscillator is so regulated that it follows in phase a reference signal, in the present case the timing signal of the reading device. The regulation circuit continuously compares the phase relationship of the two signals and adjusts that of the oscillator in case of an error signal. A PLL circuit is used primarily for frequency stabilization or

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	synchronization of the oscillator. Additionally, it is possible to also supply the signal generated by the oscillator to the controller and use it as a timing signal relevant for timing. Finkenzeller at [0028] The transponder unit can also be part of a mobile terminal, for example a mobile telephone. The transponder unit can have its own antenna or use an antenna of the terminal. Finkenzeller at [0029] According to a first alternative, the circuit configuration for generating and modulating the subcarrier signal is a separate part of the mobile terminal. The trans-ponder unit then has a signal input for receiving the subcarrier signal modulated by means of the data to be sent from the circuit configuration. The signal input is connected via a suitable interface in particular to a chip, for example a smart card chip, which generates and modulates the subcarrier signal. Finkenzeller at [0030] According to a second alternative, the circuit configuration for generating and modulating the subcarrier signal is part of the inventive transponder unit itself. To then connect the transponder unit to a (smart card) chip of the terminal, which supplies data to be sent for example, an interface can be provided via which data are transferred in binary form. Finkenzeller at [0040] FIG. 7 a transponder unit in which a security module is connected to an interface module via an S^2C interface. Finkenzeller at [0049] To obtain a better signal-to-noise ratio, in an inductive system with a carrier frequency f_T of the RFID reading device of for example 13.56 MHz a subcarrier f_H with $f_H<f_T$, for example f_H=212 kHz, is used in the known way. The load resistance in the transponder unit is switched on and off at the frequency f_H, so that two subcarrier signals spaced $+/-f_H$ arise in the signal spectrum besides the strong signal of the carrier frequency f_T of the reading device. When the subcarrier is now modulated in the transponder unit 1 according to the data to be transferred, the modulation side bands carrying the information arise in the spectrum below and above the two subcarriers. The data to be transferred are thus contained equally in the side bands of the sub-carriers which are disposed on both sides of the two corresponding spectral lines in each case. Data transfer is effected here by ASK, FSK or PSK modulation of the sub-carrier in time with the data flow. In contrast to load modulation without a subcarrier, by which data are transferred in side

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	bands around the carrier frequency of the reading device, the subcarrier signal can be filtered out and demodulated better in the reading device to thereby retrieve the data. Finkenzeller at [0055] FIG. 2 shows purely schematically the transponder unit 1, for example in the form of an inductively coupled chip card, which comprises the usual components not shown explicitly here. For simplification, only one inventive RFID transponder unit in a chip card is shown. The transponder unit has a battery 2, an inductive antenna 3 and an electronic circuit 4, 5, 6, 7. The electronic circuit consists substantially of three functional blocks, a receiver 4, a controller 5 and a transmitter 6. A switch 7 is used for switching the antenna 3 between the receiver 4 and the transmitter 6. Finkenzeller at [0056] The receiver 4 is provided for demodulating a signal transmitted from the reading device 100 to extract data therefrom. The extracted data are passed on to the controller 5 which processes them and generates data to be sent to the reading device 100. Furthermore, the controller 5 transmits a control signal to the switch 7 which switches between receive mode and transmit mode of the transponder unit. However, a separate antenna can instead be provided for sending. The controller 5 used can be for example a part of the operating system of a portable data carrier, such as a chip card. Finkenzeller at [0058] In the transponder unit shown in FIG. 2 it is provided that the assembly 11 divides the oscillator frequency by a certain factor by means of a frequency divider 12, for example by binary division. The resulting subcarrier signal is modulated with the data to be sent which are supplied to the assembly 11 by the controller 5. Finkenzeller at [0063] At the output of the ring modulator 9 an output signal is then available that contains the two modulation side bands and is identical (exactly enough) to a signal generated by load modulation or backscatter modulation. The output signal generated by the ring modulator 9 can then be optionally amplified by means of the amplifier 10, and be supplied to the antenna 3 for sending the data to be sent, via the switch 7 which is switched to the transmit mode of the transponder unit by a signal of the controller 5. Finkenzeller at [0064] The direct connection of the ring modulator output to the antenna is likewise possible. However, it is then necessary to adapt the antenna accordingly, and take account of a possible reaction of the signal coupled

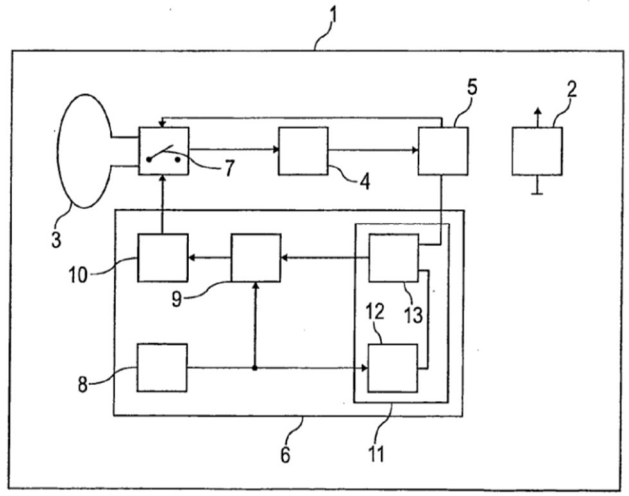
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	in from the reading device on the ring modulator, since the same antenna is normally used for sending and receiving, and since the reading device sends continually. Finkenzeller at [0066] For example, the receiver 4 can additionally be formed as a conventional load modulator driven by the controller 5. The controller 5 then either switches the transmitter 6 on and the load modulator off, or the load modulator on and the transmitter 6 off. The switch 7 is switched accordingly. The criterion used for switching from a passive to an active operating state can be for example the received signal strength, the presence and/or sufficiency of an external voltage supply (on an optional connection Vcc not shown), or the sufficiency of an internal voltage supply (state of charge of the battery 2). It is thus for example possible to first operate a transponder unit 1 passively and switch it to an active operating mode if for example the distance from the reading device unintentionally increases. Finkenzeller at [0076] The signal D emitted by an antenna 3 to a reading device has a frequency spectrum that is like a frequency spectrum resulting by means of load modulation. The signal D can optionally be amplified by means of an amplifier 40. The amplifier 40 can be for example a push-pull amplifier with digital push-pull output amplifiers. Finkenzeller at [0085] For an external HF interface—for example with the S2C interface described more closely below—an ASK modulator should preferably be used, since the power consumption is the lowest here. If the HF interface is integrated into a smart card chip, or an HF interface providing the signal (TF ∩MS) is used, the optimized ring modulator will preferably be used in case of sufficient energy. If energy is to be saved, however, the ASK modulator can be used here too. Finkenzeller at [0091] There are smart card chips having a so-called S^2C interface, defined by the company Philips, for connecting the smart card chip to an HF interface of an NFC device. Such smart card chips have hardware means for generating and decoding signals required on an ISO/IEC 14443 interface (Miller code, Manchester code, subcarrier 848 kHz). However, such a chip does not have an HF interface unit of its own. Finkenzeller at [0092]

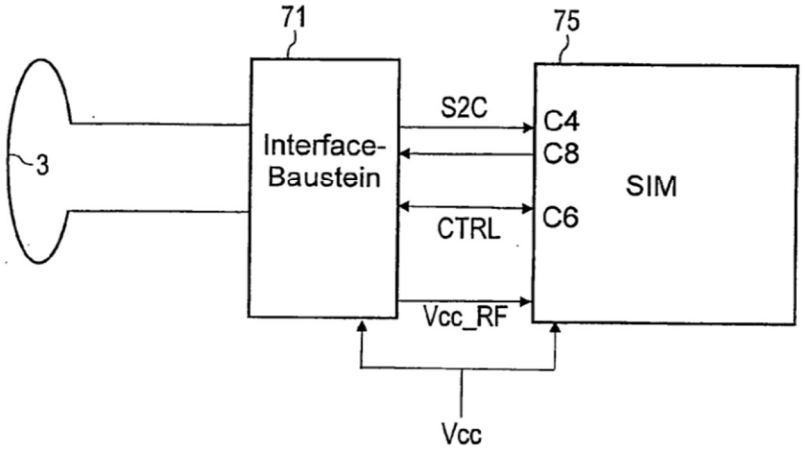
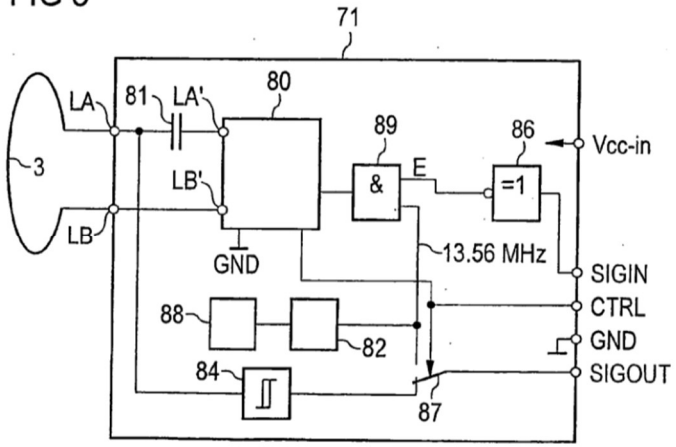
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	FIG. 7 shows schematically an inventive transponder unit, formed by an interface module 71 connected to an antenna 3, and a chip 75 with a suitable interface, for example an S^2C interface. Such a transponder unit can be formed for example in a mobile telephone with the help of the SIM card as chip 75, which is then preferably connected to the interface module 71 via one or more idle contact surfaces (C6 and/or C4, C8) of the SIM card. Finkenzeller at [0093] Both the interface module 71 and the chip 75 can draw their supply voltage from the device in which they are disposed preferably reversibly. The interface module 71 can act as an ordinary transponder in a second operating mode and supply the chip with an operating voltage Vcc_RF. Finkenzeller at [0094] FIG. 8 shows schematically more exactly the structure of an interface module for a chip with an S^2C interface. Finkenzeller at [0095] The interface module 71 is equipped with a signal input SIGIN and a signal output SIGOUT for passing signals from the antenna to the chip (not shown) and from the chip, which generates the modulated subcarrier signal, to the antenna. A signal at SIGOUT consists of a 13.56 MHz TTL signal which optionally contains a modulation signal of a remote reading device. Finkenzeller at [0098] When the interface module is in the transmit mode, i.e. there is a contactless data transfer to an external reading device or an NFC device, a modulated subcarrier signal is fed in at the signal input SIGIN by the smart card chip and optionally inverted in an inverter 86. The inverted signal E is combined with a 13.56 MHz carrier frequency signal in the AND gate 89 as the carrier frequency modulator, and supplied to the amplifier 80. Finkenzeller at [0100] Further, the smart card chip can be supplied a constant 13.56 MHz timing signal from the oscillator 88 via the output SIGOUT in the transmit mode via the switch 87, if it requires such an (external) timing signal for operation to keep exact timing. As described above, this is necessary for communication according to the standard ISO 14443 type A. Finkenzeller at [0101]

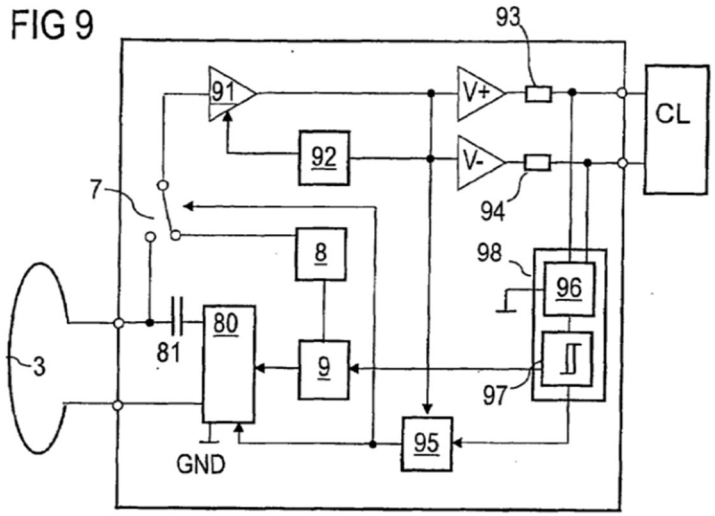
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	In the receive mode, the smart card chip is supplied a digitized received signal tapped from the antenna 1, via the switch 87 and the output SIGOUT. The signal shaper 84 acts here as an amplifier to be able to receive even weak signals, and as a threshold switch to provide a digital output signal at the output of the signal shaper. For example, the threshold switch used can be a Schmitt trigger which outputs a clear high or low level depending on the over- or undershooting of a predetermined threshold value. Finkenzeller at [0102] Via the control input of the push-pull amplifier 80 the push-pull outputs of the output drivers (see amplifier units in FIG. 5) are switched to GND, so that the antenna 3 and the capacitor 41 result in a parallel-resonant circuit. To save energy, the amplifier 80 can be switched to a power save mode in the receive mode of the interface module. Finkenzeller at [0106] The inventive active transponder unit has a receive branch and a transmit branch. The receive branch consists of an antenna 3, an input amplifier 91, an automatic gain control 92 and an amplifier which is preferably designed as a push-pull amplifier (V+, V−). Further, a transponder chip CL is connected via its antenna connections to the push-pull amplifier. Finkenzeller at [0107] The transponder chip CL is a conventional RFID chip according to the prior art. It is normally connected at its connections with an antenna, e.g. in a chip card. Further, the transponder chip CL is so designed that data transfer from the transponder unit to a reading device is carried out by means of load modulation. This is almost always the case in usual RFID systems used at 13.56 MHz or also 125 kHz (e.g. ISO/IEC 14443, ISO/IEC 15693, ISO/IEC 18000-3). Finkenzeller at [0108] The transmit branch consists of a demodulation circuit 97, a modulator circuit 9, an oscillator 8 (e.g. 13.56 MHz), a controller 95, and a transmitter amplifier 80 connected to the antenna 3. The demodulation circuit 98 can consist for example of a rectifier 96 and a threshold switch 97. Finkenzeller at [0109] In the receive mode a voltage is induced in the antenna 3 by the magnetic field of a remote RFID reading device. Together with the capacitor 81 the antenna 3 forms a parallel-resonant circuit whose resonant frequency corresponds approximately to the transmitting frequency of the RFID reading device. The voltage thus available on the resonant circuit is supplied to the input amplifier 91 via the switch 7. Via a

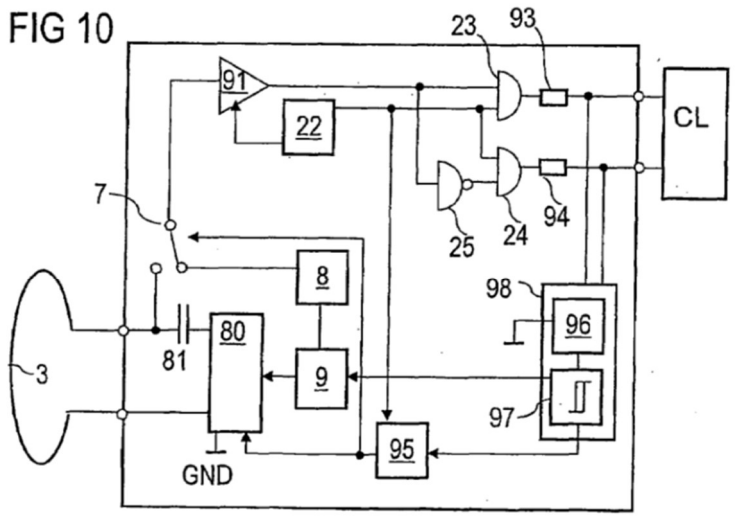
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	gain control 92 the gain factor of the input amplifier 91 is now so adjusted that the output amplitude of the voltage amplified by the input amplifier 91 remains largely constant. The time constant of the control is preferably so adjusted here that the output voltage of the amplifier 91 remains constant in case of varying distance from the reading device (i.e. different levels of induced voltage in the coil 3), but modulation signals (e.g. 10% ASK with 106 kbit/s) are not suppressed by excessively fast control. Finkenzeller at [0114] The modulation signal reconstructed by the demodulation circuit 97 is also supplied to a controller 95. The latter switches the inventive circuit with the first edge of the modulation signal to a transmit mode without delay if possible, so that the data generated by the RFID chip CL can also be transferred to the remote reading device. For this purpose, the switch 7 is first switched from the antenna 3 to the oscillator 8 (13.56 MHz). This is necessary to be able to keep supplying the RFID chip CL with an alternating voltage of the right frequency. At the same time the amplifier 80 is activated by the controller 95. Finkenzeller at [0123] For an inductive coupling, the circuit has an additional antenna 29 which can be made to resonate with the working frequency (e.g. 13.56 MHz) by means of a capacitor 26. A transponder comprising a transponder chip CL and an antenna 28 is positioned in immediate proximity to the antenna 29, so as to obtain the best possible magnetic coupling between the antennas 28 and 29. A load modulation of the transponder chip CL can also be detected easily with this arrangement. Finkenzeller at [0124] The interface module adapted to be coupled inductively and a further antenna connected thereto (see reference sign 3 in FIG. 10) can be disposed in a terminal. The range of an ordinary transponder can be increased with the help of such a terminal. The owner of a mobile telephone could for example set up a communication between his transponder and a reading device that is unfavorably disposed or inconvenient to reach for other reasons by holding the transponder against his mobile telephone provided according to the invention with an interface module adapted to be coupled inductively. Finkenzeller at [0126] As can be seen from the table, long communication ranges are achieved with the inventive method even with very small antennas. Finkenzeller at [0127]

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	It was ascertained that small antennas, e.g. in a SIM card with its own antenna (approx. 15×25 mm^2), obtain very low read ranges with a conventional load modulation. It is frequently even impossible to communicate with a contactless reading device when the SIM card with an antenna is disposed for example in a mobile telephone. If one of the inventive transmitters is used in a mobile terminal the range is not clearly increased. Moreover, it can be advantageously exploited that mobile terminals such as mobile telephones, PDAs, etc., have their own energy supply (battery) which can also be used for supplying an inventive circuit. Finkenzeller at [0129] Thus, an NFC unit could be adapted to behave according to the present solutions in its passive mode in the role ("being card") in which the NFC unit is to perform a load modulation. The NFC unit could for example always act as a component actively emitting its own field. Likewise, the NFC unit could also distinguish, and optionally switch, between a first submode corresponding to a conventional load modulation and an actively sending, second submode in which the load modulation is simulated. A thus improved NFC unit can also communicate with ordinary RFID reading devices over a higher range with the help of the changed passive operating mode. Since NFC units will already have certain units—such as an oscillator, an amplifier and a controller—for independent sending in their conventional active mode, comparatively few modifications of an NFC circuit are required to realize a circuit according to the present application in an NFC unit. Finkenzeller at [0131] The individual functional components of the transponder unit—antenna, interface unit, chip and optionally voltage supply unit—can be disposed in all sorts of combinations separately from each other or integrated jointly in one unit. An inventive transponder unit can be formed for example as a specially designed transponder, in a portable data carrier, in particular a chip card, which optionally has a battery. A portable data carrier, in particular SIM card, with a chip and an interface unit can be connected in a mobile terminal to an external voltage source and/or an external antenna. The interface unit can be disposed in a terminal, connected to its own or an external antenna, and communicate with a chip which is disposed reversibly or firmly in the terminal or temporarily on the terminal. *See also* Finkenzeller at [0012], [0015], [0025], [0073], [0080], [0096], [0099], [0110], [0115], [0117], [0118], claim 19, and claim 35. To the extent this limitation is not disclosed by Finkenzeller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Finkenzeller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	See also claim 1 above.
4. The mobile device of claim 1 wherein the smartcard controller is coupled to be powered by the mobile device.	Finkenzeller expressly or inherently discloses "[t]he mobile device of claim 1 wherein the smartcard controller is coupled to be powered by the mobile device." For example: Finkenzeller at Figure 2 FIG 2  Finkenzeller at Figure 7

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	FIG 7  Finkenzeller at Figure 8 FIG 8 

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	Finkenzeller at Figure 9  Finkenzeller at Figure 10

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	 Finkenzeller at [0011] In an advantageous embodiment, an inventive RFID transponder unit has its own energy supply, at least one antenna for transmitting signals from and/or to a reading device, and an electronic circuit. The electronic circuit of the inventive transponder unit comprises a transmitter consisting of an oscillator and a modulator. Finkenzeller at [0020] The electronic circuit of the transponder unit further comprises in the usual way a receiver which is so designed that it can detect signals from a reading device. From said signals the receiver extracts data by means of a demodulation circuit, so that a data stream transferred from the reading device is available at the output of the receiver as a baseband signal (e.g. as an NRZ code, Miller code, etc.). For example, the data can be a simple instruction to activate the controller. However, the data may also contain a more complex instruction to the controller. The demodulated data are supplied to the controller in the electronic circuit. A data signal is thereupon generated in the controller, whereby the data signal can also be based on the extracted data. Finkenzeller at [0021]

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	In a development, the inventive transponder unit has a load modulator according to the prior art, in addition to the above-described circuit having a receiver, a controller, an oscillator and a modulator. Finkenzeller at [0022] The voltage induced on the antenna of the transponder unit can be a problem for the operation of the inventive modulator circuits if the distance between trans-ponder unit and reading device is small and the induced voltage is therefore accordingly great. Therefore, the data to be sent to the reading device which are generated in the controller are supplied alternatively to the load modulator or to the inventive circuit configuration with a modulator. The switchover between the load modulator and the circuit configuration is preferably effected automatically, in dependence on the level of voltage induced on the antenna. The switchover is effected in such a way that the load modulator is used within the normal communication range, and the inventive modulator outside the normal communication range. Finkenzeller at [0026] To avoid a quartz oscillator, which has a large mounting form, an improved embodiment of the invention has the oscillator coupled in phase lock to the signal received from the reading device via a phase locked loop (PLL) circuit when the trans-ponder unit is in the receive mode. In the transmit mode of the transponder unit, that is, during data transfer from the transponder unit to the reading device, the control voltage of the PLL circuit is kept constant so that the frequency of the oscillator is maintained as stable as possible. The PLL can also be referred to as tracking synchronization. The oscillator is so regulated that it follows in phase a reference signal, in the present case the timing signal of the reading device. The regulation circuit continuously compares the phase relationship of the two signals and adjusts that of the oscillator in case of an error signal. A PLL circuit is used primarily for frequency stabilization or synchronization of the oscillator. Additionally, it is possible to also supply the signal generated by the oscillator to the controller and use it as a timing signal relevant for timing. Finkenzeller at [0029] According to a first alternative, the circuit configuration for generating and modulating the subcarrier signal is a separate part of the mobile terminal. The trans-ponder unit then has a signal input for receiving the subcarrier signal modulated by means of the data to be sent from the circuit configuration. The signal input is connected via a suitable interface in particular to a chip, for example a smart card chip, which generates and modulates the subcarrier signal. Finkenzeller at [0030]

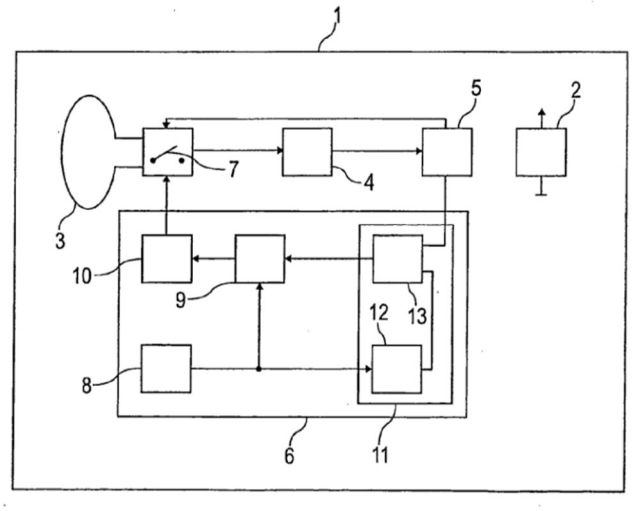
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	According to a second alternative, the circuit configuration for generating and modulating the subcarrier signal is part of the inventive transponder unit itself. To then connect the transponder unit to a (smart card) chip of the terminal, which supplies data to be sent for example, an interface can be provided via which data are transferred in binary form. Finkenzeller at [0040] FIG. 7 a transponder unit in which a security module is connected to an interface module via an S^2C interface. Finkenzeller at [0048] The transponder unit 1 sends for data transfer to the reading device 100 a signal which the reading device 100 can evaluate as a signal of a transponder which carries out a load modulation of the field 110 of the reading device 100. Unlike the conventional transponders 200, 300 which modulate the field 110 of the reading device 100 into a modulated reading device field 102, 103, the transponder unit 1 thus generates and sends its own modulated field 20 as the signal for data transfer. The transponder unit 1 thus uses its own energy for the purpose of data transfer. Finkenzeller at [0055] FIG. 2 shows purely schematically the transponder unit 1, for example in the form of an inductively coupled chip card, which comprises the usual components not shown explicitly here. For simplification, only one inventive RFID transponder unit in a chip card is shown. The transponder unit has a battery 2, an inductive antenna 3 and an electronic circuit 4, 5, 6, 7. The electronic circuit consists substantially of three functional blocks, a receiver 4, a controller 5 and a transmitter 6. A switch 7 is used for switching the antenna 3 between the receiver 4 and the transmitter 6. Finkenzeller at [0056] The receiver 4 is provided for demodulating a signal transmitted from the reading device 100 to extract data therefrom. The extracted data are passed on to the controller 5 which processes them and generates data to be sent to the reading device 100. Furthermore, the controller 5 transmits a control signal to the switch 7 which switches between receive mode and transmit mode of the transponder unit. However, a separate antenna can instead be provided for sending. The controller 5 used can be for example a part of the operating system of a portable data carrier, such as a chip card. Finkenzeller at [0058]

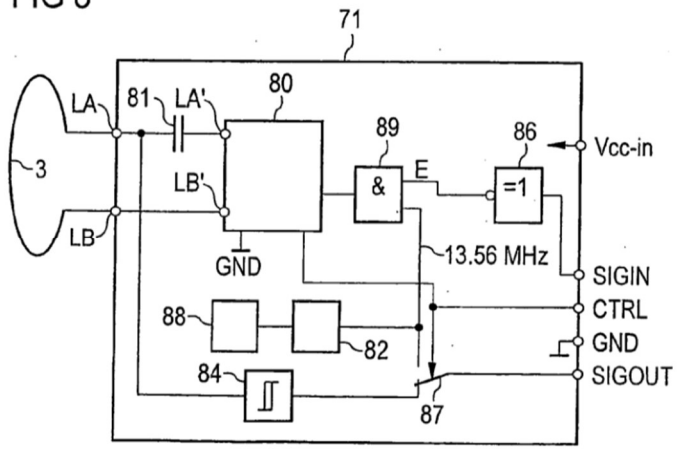
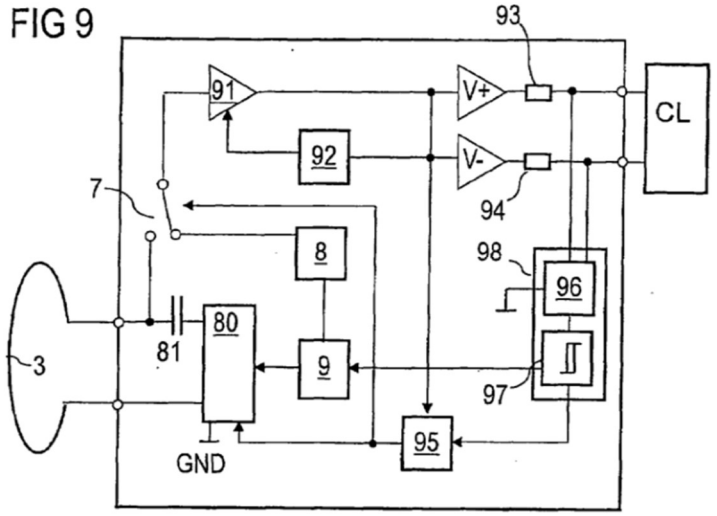
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	In the transponder unit shown in FIG. 2 it is provided that the assembly 11 divides the oscillator frequency by a certain factor by means of a frequency divider 12, for example by binary division. The resulting subcarrier signal is modulated with the data to be sent which are supplied to the assembly 11 by the controller 5. Finkenzeller at [0060] To supply the active components of the transponder unit at least partly with energy and to increase the energy range between the transponder unit 1 and the reading device 100, the inventive transponder unit has a battery 2. Finkenzeller at [0063] At the output of the ring modulator 9 an output signal is then available that contains the two modulation side bands and is identical (exactly enough) to a signal generated by load modulation or backscatter modulation. The output signal generated by the ring modulator 9 can then be optionally amplified by means of the amplifier 10, and be supplied to the antenna 3 for sending the data to be sent, via the switch 7 which is switched to the transmit mode of the transponder unit by a signal of the controller 5. Finkenzeller at [0065] The transponder unit 1 is operated in a first (active) operating mode as an actively sending transponder. In a second (passive) operating mode, however, the trans-ponder unit works like an ordinary passive transponder performing a load modulation on the field of the reading device. Finkenzeller at [0066] For example, the receiver 4 can additionally be formed as a conventional load modulator driven by the controller 5. The controller 5 then either switches the transmitter 6 on and the load modulator off, or the load modulator on and the transmitter 6 off. The switch 7 is switched accordingly. The criterion used for switching from a passive to an active operating state can be for example the received signal strength, the presence and/or sufficiency of an external voltage supply (on an optional connection Vcc not shown), or the sufficiency of an internal voltage supply (state of charge of the battery 2). It is thus for example possible to first operate a transponder unit 1 passively and switch it to an active operating mode if for example the distance from the reading device unintentionally increases. Finkenzeller at [0085] For an external HF interface—for example with the S2C interface described more closely below—an ASK modulator should preferably be used, since the power consumption is the lowest here. If the HF

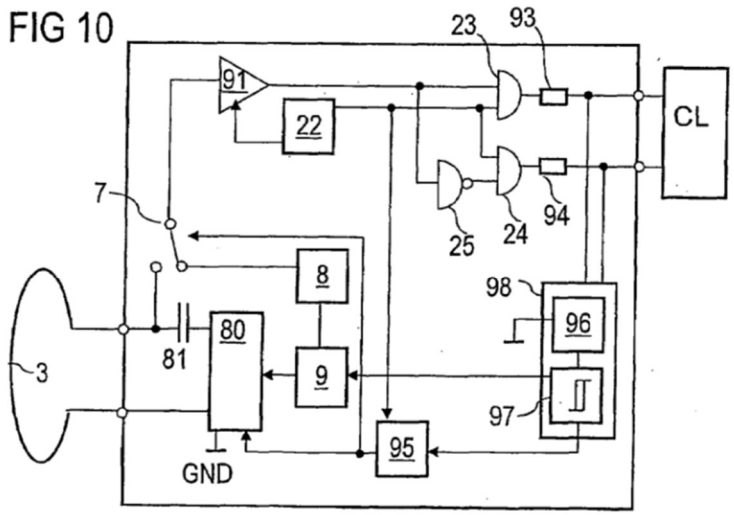
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	interface is integrated into a smart card chip, or an HF interface providing the signal (TF ∩MS) is used, the optimized ring modulator will preferably be used in case of sufficient energy. If energy is to be saved, however, the ASK modulator can be used here too. Finkenzeller at [0091] There are smart card chips having a so-called S^2C interface, defined by the company Philips, for connecting the smart card chip to an HF interface of an NFC device. Such smart card chips have hardware means for generating and decoding signals required on an ISO/IEC 14443 interface (Miller code, Manchester code, subcarrier 848 kHz). However, such a chip does not have an HF interface unit of its own. Finkenzeller at [0092] FIG. 7 shows schematically an inventive transponder unit, formed by an interface module 71 connected to an antenna 3, and a chip 75 with a suitable interface, for example an S^2C interface. Such a transponder unit can be formed for example in a mobile telephone with the help of the SIM card as chip 75, which is then preferably connected to the interface module 71 via one or more idle contact surfaces (C6 and/or C4, C8) of the SIM card. Finkenzeller at [0093] Both the interface module 71 and the chip 75 can draw their supply voltage from the device in which they are disposed preferably reversibly. The interface module 71 can act as an ordinary transponder in a second operating mode and supply the chip with an operating voltage Vcc_RF. Finkenzeller at [0094] FIG. 8 shows schematically more exactly the structure of an interface module for a chip with an S^2C interface. Finkenzeller at [0095] The interface module 71 is equipped with a signal input SIGIN and a signal output SIGOUT for passing signals from the antenna to the chip (not shown) and from the chip, which generates the modulated subcarrier signal, to the antenna. A signal at SIGOUT consists of a 13.56 MHz TTL signal which optionally contains a modulation signal of a remote reading device. Finkenzeller at [0098]

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	When the interface module is in the transmit mode, i.e. there is a contactless data transfer to an external reading device or an NFC device, a modulated subcarrier signal is fed in at the signal input SIGIN by the smart card chip and optionally inverted in an inverter 86. The inverted signal E is combined with a 13.56 MHz carrier frequency signal in the AND gate 89 as the carrier frequency modulator, and supplied to the amplifier 80. Finkenzeller at [0100] Further, the smart card chip can be supplied a constant 13.56 MHz timing signal from the oscillator 88 via the output SIGOUT in the transmit mode via the switch 87, if it requires such an (external) timing signal for operation to keep exact timing. As described above, this is necessary for communication according to the standard ISO 14443 type A. Finkenzeller at [0101] In the receive mode, the smart card chip is supplied a digitized received signal tapped from the antenna 1, via the switch 87 and the output SIGOUT. The signal shaper 84 acts here as an amplifier to be able to receive even weak signals, and as a threshold switch to provide a digital output signal at the output of the signal shaper. For example, the threshold switch used can be a Schmitt trigger which outputs a clear high or low level depending on the over- or undershooting of a predetermined threshold value. Finkenzeller at [0107] The transponder chip CL is a conventional RFID chip according to the prior art. It is normally connected at its connections with an antenna, e.g. in a chip card. Further, the transponder chip CL is so designed that data transfer from the transponder unit to a reading device is carried out by means of load modulation. This is almost always the case in usual RFID systems used at 13.56 MHz or also 125 kHz (e.g. ISO/IEC 14443, ISO/IEC 15693, ISO/IEC 18000-3). Finkenzeller at [0108] The transmit branch consists of a demodulation circuit 97, a modulator circuit 9, an oscillator 8 (e.g. 13.56 MHz), a controller 95, and a transmitter amplifier 80 connected to the antenna 3. The demodulation circuit 98 can consist for example of a rectifier 96 and a threshold switch 97. Finkenzeller at [0114] The modulation signal reconstructed by the demodulation circuit 97 is also supplied to a controller 95. The latter switches the inventive circuit with the first edge of the modulation signal to a transmit mode without delay if possible, so that the data generated by the RFID chip CL can also be transferred to the

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	remote reading device. For this purpose, the switch 7 is first switched from the antenna 3 to the oscillator 8 (13.56 MHz). This is necessary to be able to keep supplying the RFID chip CL with an alternating voltage of the right frequency. At the same time the amplifier 80 is activated by the controller 95. Finkenzeller at [0127] It was ascertained that small antennas, e.g. in a SIM card with its own antenna (approx. 15×25 mm^2), obtain very low read ranges with a conventional load modulation. It is frequently even impossible to communicate with a contactless reading device when the SIM card with an antenna is disposed for example in a mobile telephone. If one of the inventive transmitters is used in a mobile terminal the range is not clearly increased. Moreover, it can be advantageously exploited that mobile terminals such as mobile telephones, PDAs, etc., have their own energy supply (battery) which can also be used for supplying an inventive circuit. Finkenzeller at [0129] Thus, an NFC unit could be adapted to behave according to the present solutions in its passive mode in the role ("being card") in which the NFC unit is to perform a load modulation. The NFC unit could for example always act as a component actively emitting its own field. Likewise, the NFC unit could also distinguish, and optionally switch, between a first submode corresponding to a conventional load modulation and an actively sending, second submode in which the load modulation is simulated. A thus improved NFC unit can also communicate with ordinary RFID reading devices over a higher range with the help of the changed passive operating mode. Since NFC units will already have certain units—such as an oscillator, an amplifier and a controller—for independent sending in their conventional active mode, comparatively few modifications of an NFC circuit are required to realize a circuit according to the present application in an NFC unit. Finkenzeller at [0131] The individual functional components of the transponder unit—antenna, interface unit, chip and optionally voltage supply unit—can be disposed in all sorts of combinations separately from each other or integrated jointly in one unit. An inventive transponder unit can be formed for example as a specially designed transponder, in a portable data carrier, in particular a chip card, which optionally has a battery. A portable data carrier, in particular SIM card, with a chip and an interface unit can be connected in a mobile terminal to an external voltage source and/or an external antenna. The interface unit can be disposed in a terminal, connected to its own or an external antenna, and communicate with a chip which is disposed reversibly or firmly in the terminal or temporarily on the terminal.

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	See also Finkenzeller at [0012], [0110], [0117], [0118], and claim 35. To the extent this limitation is not disclosed by Finkenzeller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Finkenzeller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 1 above.
5. The mobile device of claim 1 wherein the performance enhancement circuits are coupled to be powered by the mobile device.	Finkenzeller expressly or inherently discloses "[t]he mobile device of claim 1 wherein the performance enhancement circuits are coupled to be powered by the mobile device." For example: Finkenzeller at Figure 2 FIG 2  Finkenzeller at Figure 8

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	FIG 8  Finkenzeller at Figure 9 FIG 9 

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	Finkenzeller at Figure 10  Finkenzeller at [0004] The range within which communication is possible in the system by data transfer can be increased by using active transponders, that is, transponders with their own energy supply. The energy supply of the active transponder, for example in form of a battery, operates its electronic circuit. Conventional transponders without their own energy supply are referred to as passive transponders, in contrast. Finkenzeller at [0011] In an advantageous embodiment, an inventive RFID transponder unit has its own energy supply, at least one antenna for transmitting signals from and/or to a reading device, and an electronic circuit. The electronic circuit of the inventive transponder unit comprises a transmitter consisting of an oscillator and a modulator. Finkenzeller at [0048] The transponder unit 1 sends for data transfer to the reading device 100 a signal which the reading device 100 can evaluate as a signal of a transponder which carries out a load modulation of the field 110 of the

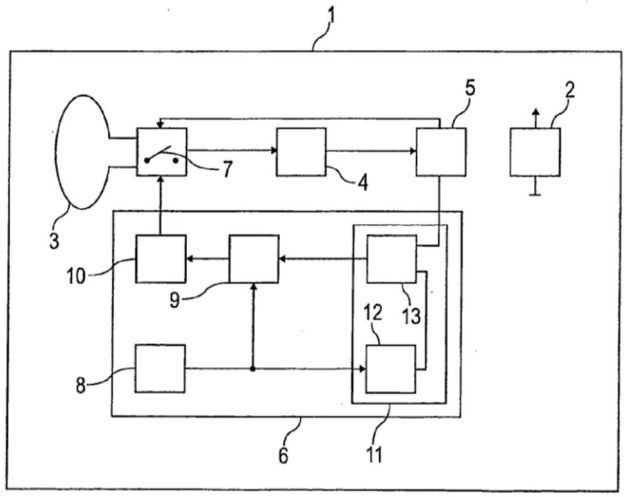
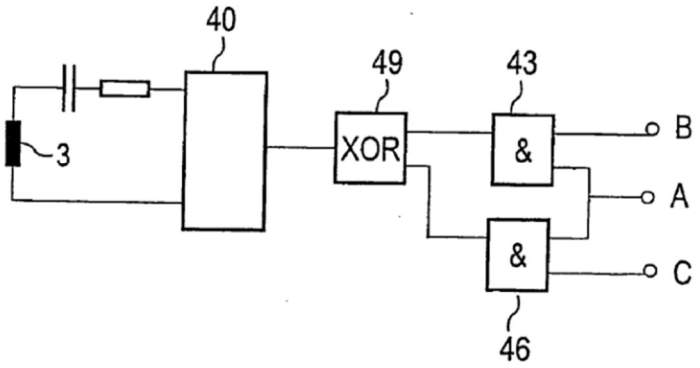
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	reading device 100. Unlike the conventional transponders 200, 300 which modulate the field 110 of the reading device 100 into a modulated reading device field 102, 103, the transponder unit 1 thus generates and sends its own modulated field 20 as the signal for data transfer. The transponder unit 1 thus uses its own energy for the purpose of data transfer. Finkenzeller at [0055] FIG. 2 shows purely schematically the transponder unit 1, for example in the form of an inductively coupled chip card, which comprises the usual components not shown explicitly here. For simplification, only one inventive RFID transponder unit in a chip card is shown. The transponder unit has a battery 2, an inductive antenna 3 and an electronic circuit 4, 5, 6, 7. The electronic circuit consists substantially of three functional blocks, a receiver 4, a controller 5 and a transmitter 6. A switch 7 is used for switching the antenna 3 between the receiver 4 and the transmitter 6. Finkenzeller at [0060] To supply the active components of the transponder unit at least partly with energy and to increase the energy range between the transponder unit 1 and the reading device 100, the inventive transponder unit has a battery 2. Finkenzeller at [0063] At the output of the ring modulator 9 an output signal is then available that contains the two modulation side bands and is identical (exactly enough) to a signal generated by load modulation or backscatter modulation. The output signal generated by the ring modulator 9 can then be optionally amplified by means of the amplifier 10, and be supplied to the antenna 3 for sending the data to be sent, via the switch 7 which is switched to the transmit mode of the transponder unit by a signal of the controller 5. Finkenzeller at [0065] The transponder unit 1 is operated in a first (active) operating mode as an actively sending transponder. In a second (passive) operating mode, however, the trans-ponder unit works like an ordinary passive transponder performing a load modulation on the field of the reading device. Finkenzeller at [0066] For example, the receiver 4 can additionally be formed as a conventional load modulator driven by the controller 5. The controller 5 then either switches the transmitter 6 on and the load modulator off, or the load modulator on and the transmitter 6 off. The switch 7 is switched accordingly. The criterion used for switching from a passive to an active operating state can be for example the received signal strength, the

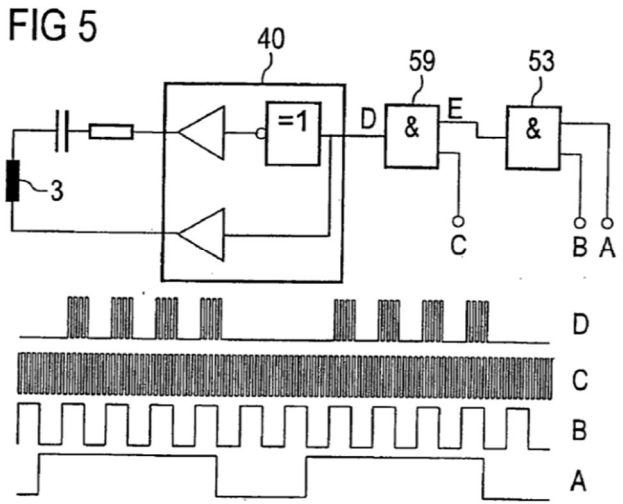
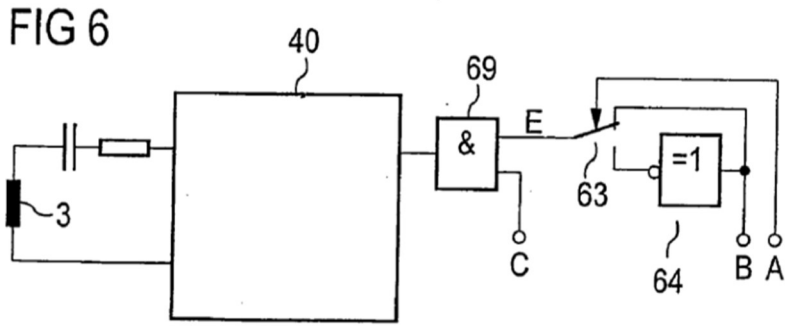
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	presence and/or sufficiency of an external voltage supply (on an optional connection Vcc not shown), or the sufficiency of an internal voltage supply (state of charge of the battery 2). It is thus for example possible to first operate a transponder unit 1 passively and switch it to an active operating mode if for example the distance from the reading device unintentionally increases. Finkenzeller at [0093] Both the interface module 71 and the chip 75 can draw their supply voltage from the device in which they are disposed preferably reversibly. The interface module 71 can act as an ordinary transponder in a second operating mode and supply the chip with an operating voltage Vcc_RF. Finkenzeller at [0127] It was ascertained that small antennas, e.g. in a SIM card with its own antenna (approx. 15×25 mm^2), obtain very low read ranges with a conventional load modulation. It is frequently even impossible to communicate with a contactless reading device when the SIM card with an antenna is disposed for example in a mobile telephone. If one of the inventive transmitters is used in a mobile terminal the range is not clearly increased. Moreover, it can be advantageously exploited that mobile terminals such as mobile telephones, PDAs, etc., have their own energy supply (battery) which can also be used for supplying an inventive circuit. Finkenzeller at [0129] Thus, an NFC unit could be adapted to behave according to the present solutions in its passive mode in the role ("being card") in which the NFC unit is to perform a load modulation. The NFC unit could for example always act as a component actively emitting its own field. Likewise, the NFC unit could also distinguish, and optionally switch, between a first submode corresponding to a conventional load modulation and an actively sending, second submode in which the load modulation is simulated. A thus improved NFC unit can also communicate with ordinary RFID reading devices over a higher range with the help of the changed passive operating mode. Since NFC units will already have certain units—such as an oscillator, an amplifier and a controller—for independent sending in their conventional active mode, comparatively few modifications of an NFC circuit are required to realize a circuit according to the present application in an NFC unit. Finkenzeller at [0131] The individual functional components of the transponder unit—antenna, interface unit, chip and optionally voltage supply unit—can be disposed in all sorts of combinations separately from each other or integrated jointly in one unit. An inventive transponder unit can be formed for example as a specially

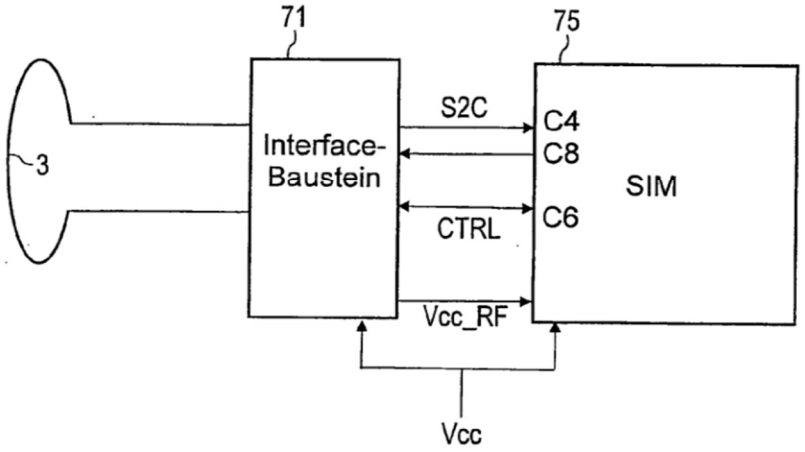
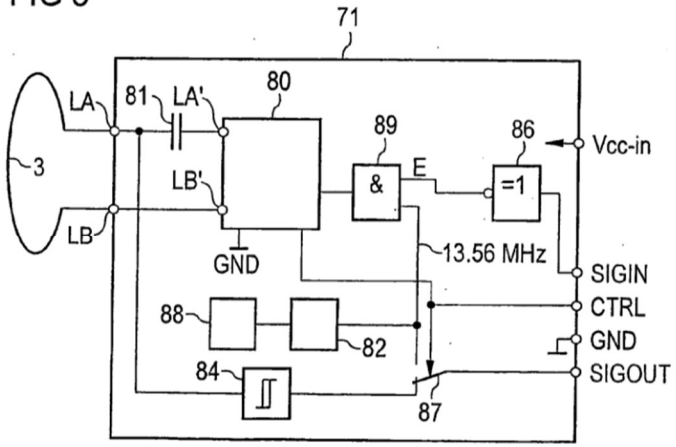
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	designed transponder, in a portable data carrier, in particular a chip card, which optionally has a battery. A portable data carrier, in particular SIM card, with a chip and an interface unit can be connected in a mobile terminal to an external voltage source and/or an external antenna. The interface unit can be disposed in a terminal, connected to its own or an external antenna, and communicate with a chip which is disposed reversibly or firmly in the terminal or temporarily on the terminal. To the extent this limitation is not disclosed by Finkenzeller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Finkenzeller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 1 above.
6. The mobile device of claim 1 wherein the mobile device comprises a mobile phone.	Finkenzeller expressly or inherently discloses "[t]he mobile device of claim 1 wherein the mobile device comprises a mobile phone." For example: Finkenzeller at [0006] For simple and fast contactless communication between two devices, the companies Philips and Sony have developed an inductive transmission technology which is known as so-called near field communication (NFC). This technology is integrated for example in mobile telephones or PDAs to permit communication between the devices or with a computer. The coupling of the two devices is effected via coils, the carrier frequency being 13.56 MHz as in RFID systems. As described more closely in the NFC standard ECMA 340, NFC systems have an active communication mode and a passive communication mode. In the active mode, two NFC units alternately generate their own RF field as a signal carrier, thus switching back and forth, coordinated with each other, between transmit mode and receive mode as in a classic mobile phone system. In the passive mode, however, the two NFC units must agree on which unit acts as a reading device and generates a field which the other unit can then influence by means of load modulation. Primarily due to the small antenna diameters used, NFC systems only permit small communication ranges of up to 20 cm. Finkenzeller at [0028] The transponder unit can also be part of a mobile terminal, for example a mobile telephone. The transponder unit can have its own antenna or use an antenna of the terminal. Finkenzeller at [0032] The transponder unit is preferably integrated in a card or data carrier insertable into the mobile terminal. For example, the transponder unit can be integrated in a SIM card. The advantage is that the mobile

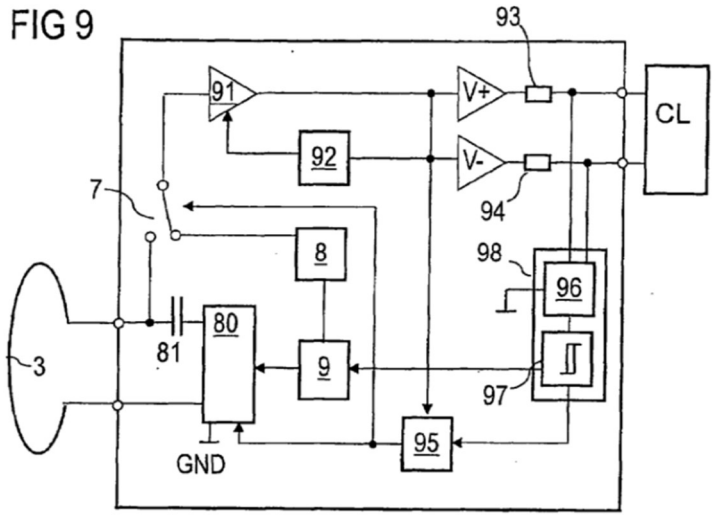
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	terminal, for example a mobile phone or PDA, into which the card with the inventive transponder unit is inserted requires no additional (integrated) antenna to be usable as an RFID unit. Finkenzeller at [0092] FIG. 7 shows schematically an inventive transponder unit, formed by an interface module 71 connected to an antenna 3, and a chip 75 with a suitable interface, for example an S^2C interface. Such a transponder unit can be formed for example in a mobile telephone with the help of the SIM card as chip 75, which is then preferably connected to the interface module 71 via one or more idle contact surfaces (C6 and/or C4, C8) of the SIM card. Finkenzeller at [0124] The interface module adapted to be coupled inductively and a further antenna connected thereto (see reference sign 3 in FIG. 10) can be disposed in a terminal. The range of an ordinary transponder can be increased with the help of such a terminal. The owner of a mobile telephone could for example set up a communication between his transponder and a reading device that is unfavorably disposed or inconvenient to reach for other reasons by holding the transponder against his mobile telephone provided according to the invention with an interface module adapted to be coupled inductively. Finkenzeller at [0127] It was ascertained that small antennas, e.g. in a SIM card with its own antenna (approx. 15×25 mm^2), obtain very low read ranges with a conventional load modulation. It is frequently even impossible to communicate with a contactless reading device when the SIM card with an antenna is disposed for example in a mobile telephone. If one of the inventive transmitters is used in a mobile terminal the range is not clearly increased. Moreover, it can be advantageously exploited that mobile terminals such as mobile telephones, PDAs, etc., have their own energy supply (battery) which can also be used for supplying an inventive circuit. *See also* Finkenzeller at [0001]. To the extent this limitation is not disclosed by Finkenzeller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Finkenzeller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 1 above.

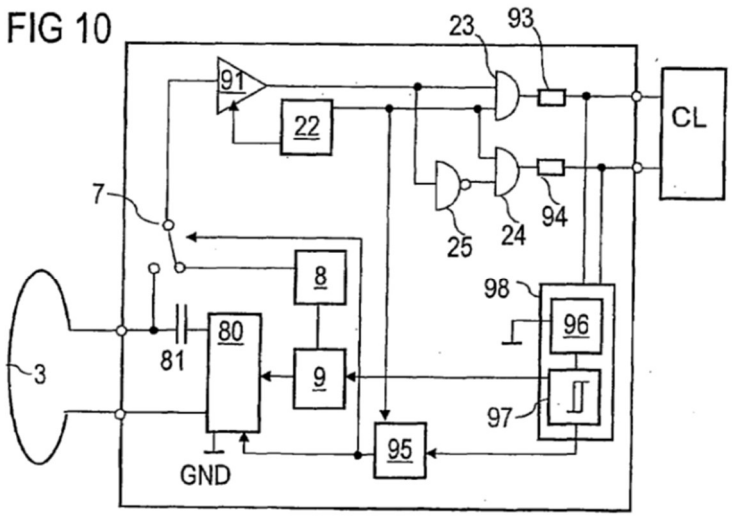
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
7[pre]. A mobile device comprising:	Finkenzeller expressly or inherently discloses "[a] mobile device." For example: *See* above at 1[pre]. To the extent this limitation is not disclosed by Finkenzeller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Finkenzeller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[7a] a smartcard controller;	Finkenzeller expressly or inherently discloses "a smartcard controller." For example: *See* above at [1a]. To the extent this limitation is not disclosed by Finkenzeller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Finkenzeller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[7b] an antenna; and	Finkenzeller expressly or inherently discloses "an antenna." For example: *See* above at [1b]. To the extent this limitation is not disclosed by Finkenzeller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Finkenzeller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[7c] performance enhancement circuits coupled between the smartcard controller and the antenna, wherein the performance enhancement circuits include an amplifier and an active transmit driver circuit, and	Finkenzeller expressly or inherently discloses "performance enhancement circuits coupled between the smartcard controller and the antenna, wherein the performance enhancement circuits include an amplifier and an active transmit driver circuit." For example: Finkenzeller at Figure 2

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	FIG 2  Finkenzeller at Figure 4 FIG 4 

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	Finkenzeller at Figure 5  Finkenzeller at Figure 6  Finkenzeller at Figure 7

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	FIG 7  Finkenzeller at Figure 8 FIG 8 

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	Finkenzeller at Figure 9  Finkenzeller at Figure 10

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	 Finkenzeller at [0002] Transponders are used for example in radio frequency identification (RFID) systems. Conventionally, both the energy supply to a transponder in an RFID system and the data interchange between the transponder and a reading device are effected using magnetic or electromagnetic fields. RFID transponders have an electronic circuit and, depending on the frequency domain, an antenna coil (e.g. 13.56 MHz) or an electromagnetic antenna (e.g. 868 MHz). Via the antenna the energy required for operating the transponder can be taken from the field of the reading device, as well as the data transfer carried out. Finkenzeller at [0004] The range within which communication is possible in the system by data transfer can be increased by using active transponders, that is, transponders with their own energy supply. The energy supply of the active transponder, for example in form of a battery, operates its electronic circuit. Conventional transponders without their own energy supply are referred to as passive transponders, in contrast. Finkenzeller at [0010]

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	According to the invention, a transponder unit sends a signal to a transponder reading device, which can communicate with the transponders by means of modulation of its own field by transponders, in such a way that the reading device can evaluate the signal as modulation by a conventional transponder. Instead of performing a load modulation or backscatter modulation of a field of the reading device, the transponder unit itself thus emits a field that simulates for the reading device a modulation of the reading device field by a transponder. An inventive transponder unit has means for sending the accordingly modulated signal. The total range of the system is consequently no longer limited by the communication range of the reading device, but is extended therebeyond up to a transmit range of the transponder unit. Finkenzeller at [0011] In an advantageous embodiment, an inventive RFID transponder unit has its own energy supply, at least one antenna for transmitting signals from and/or to a reading device, and an electronic circuit. The electronic circuit of the inventive transponder unit comprises a transmitter consisting of an oscillator and a modulator. Finkenzeller at [0015] Both modulators (ring modulator and ASK modulator) modulate the oscillator signal by means of the (modulated) data signal and deliver an output signal which is then transmitted to the reading device via the receive antenna or a separate transmitting antenna. Finkenzeller at [0017] A special advantage of using the described modulators is their compatibility to the prior art, since they deliver an output signal to be sent to the reading device whose (frequency and amplitude) spectrum is very similar to that of a load or backscatter modulation, as described above. Therefore, no technical changes must be performed on conventional reading devices. The inventive transponder can thus be operated with commercially available RFID reading devices, the communication range being many times that of passive or even active transponders. For example, a commercially available ISO 14443 reading device which can communicate with an inductively coupled, contactless chip card according to the prior art over a distance of approx. 10 cm could communicate with an inventive transponder unit over many times this distance. Finkenzeller at [0020] The electronic circuit of the transponder unit further comprises in the usual way a receiver which is so designed that it can detect signals from a reading device. From said signals the receiver extracts data by means of a demodulation circuit, so that a data stream transferred from the reading device is available at the output of the receiver as a baseband signal (e.g. as an NRZ code, Miller code, etc.). For example, the

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	data can be a simple instruction to activate the controller. However, the data may also contain a more complex instruction to the controller. The demodulated data are supplied to the controller in the electronic circuit. A data signal is thereupon generated in the controller, whereby the data signal can also be based on the extracted data. Finkenzeller at [0021] In a development, the inventive transponder unit has a load modulator according to the prior art, in addition to the above-described circuit having a receiver, a controller, an oscillator and a modulator. Finkenzeller at [0022] The voltage induced on the antenna of the transponder unit can be a problem for the operation of the inventive modulator circuits if the distance between trans-ponder unit and reading device is small and the induced voltage is therefore accordingly great. Therefore, the data to be sent to the reading device which are generated in the controller are supplied alternatively to the load modulator or to the inventive circuit configuration with a modulator. The switchover between the load modulator and the circuit configuration is preferably effected automatically, in dependence on the level of voltage induced on the antenna. The switchover is effected in such a way that the load modulator is used within the normal communication range, and the inventive modulator outside the normal communication range. Finkenzeller at [0026] To avoid a quartz oscillator, which has a large mounting form, an improved embodiment of the invention has the oscillator coupled in phase lock to the signal received from the reading device via a phase locked loop (PLL) circuit when the trans-ponder unit is in the receive mode. In the transmit mode of the transponder unit, that is, during data transfer from the transponder unit to the reading device, the control voltage of the PLL circuit is kept constant so that the frequency of the oscillator is maintained as stable as possible. The PLL can also be referred to as tracking synchronization. The oscillator is so regulated that it follows in phase a reference signal, in the present case the timing signal of the reading device. The regulation circuit continuously compares the phase relationship of the two signals and adjusts that of the oscillator in case of an error signal. A PLL circuit is used primarily for frequency stabilization or synchronization of the oscillator. Additionally, it is possible to also supply the signal generated by the oscillator to the controller and use it as a timing signal relevant for timing. Finkenzeller at [0027] The possibility of reading the inventive transponder unit over very large distances is not always desired, for example for privacy protection. It is therefore provided in one embodiment that the inventive circuit

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	configuration can be activated manually if communication over a long range is explicitly desired. Otherwise, communication can be effected via a load modulator provided in the transponder unit, which is usable only for short distances. If no load modulator is provided in the trans-ponder unit, it can be provided for example that the transponder unit is activated for sending data only if the signal emitted by the reading device contains a predetermined code. Finkenzeller at [0028] The transponder unit can also be part of a mobile terminal, for example a mobile telephone. The transponder unit can have its own antenna or use an antenna of the terminal. Finkenzeller at [0029] According to a first alternative, the circuit configuration for generating and modulating the subcarrier signal is a separate part of the mobile terminal. The trans-ponder unit then has a signal input for receiving the subcarrier signal modulated by means of the data to be sent from the circuit configuration. The signal input is connected via a suitable interface in particular to a chip, for example a smart card chip, which generates and modulates the subcarrier signal. Finkenzeller at [0030] According to a second alternative, the circuit configuration for generating and modulating the subcarrier signal is part of the inventive transponder unit itself. To then connect the transponder unit to a (smart card) chip of the terminal, which supplies data to be sent for example, an interface can be provided via which data are transferred in binary form. Finkenzeller at [0040] FIG. 7 a transponder unit in which a security module is connected to an interface module via an S^2C interface. Finkenzeller at [0048] The transponder unit 1 sends for data transfer to the reading device 100 a signal which the reading device 100 can evaluate as a signal of a transponder which carries out a load modulation of the field 110 of the reading device 100. Unlike the conventional transponders 200, 300 which modulate the field 110 of the reading device 100 into a modulated reading device field 102, 103, the transponder unit 1 thus generates and sends its own modulated field 20 as the signal for data transfer. The transponder unit 1 thus uses its own energy for the purpose of data transfer.

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	Finkenzeller at [0055] FIG. 2 shows purely schematically the transponder unit 1, for example in the form of an inductively coupled chip card, which comprises the usual components not shown explicitly here. For simplification, only one inventive RFID transponder unit in a chip card is shown. The transponder unit has a battery 2, an inductive antenna 3 and an electronic circuit 4, 5, 6, 7. The electronic circuit consists substantially of three functional blocks, a receiver 4, a controller 5 and a transmitter 6. A switch 7 is used for switching the antenna 3 between the receiver 4 and the transmitter 6. Finkenzeller at [0056] The receiver 4 is provided for demodulating a signal transmitted from the reading device 100 to extract data therefrom. The extracted data are passed on to the controller 5 which processes them and generates data to be sent to the reading device 100. Furthermore, the controller 5 transmits a control signal to the switch 7 which switches between receive mode and transmit mode of the transponder unit. However, a separate antenna can instead be provided for sending. The controller 5 used can be for example a part of the operating system of a portable data carrier, such as a chip card. Finkenzeller at [0057] The transmitter 6 consists of an oscillator 8, a modulator, an execution as a ring modulator 9 first being described, and a terminal repeater 10. Furthermore, the transmitter 6 of the transponder unit shown in FIG. 2 is extended by an electronic assembly 11 for generating and modulating a subcarrier signal to carry out the data transfer from the transponder unit to a reading device 100 with a subcarrier signal. Depending on the use of the transponder unit, the subcarrier signal can have different frequencies, for example 848 kHz according to ISO 14443, 424 kHz according to ISO 15693 and 212 kHz for LEGIC, but might also be completely omitted. Finkenzeller at [0058] In the transponder unit shown in FIG. 2 it is provided that the assembly 11 divides the oscillator frequency by a certain factor by means of a frequency divider 12, for example by binary division. The resulting subcarrier signal is modulated with the data to be sent which are supplied to the assembly 11 by the controller 5. Finkenzeller at [0060]

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	To supply the active components of the transponder unit at least partly with energy and to increase the energy range between the transponder unit 1 and the reading device 100, the inventive transponder unit has a battery 2. Finkenzeller at [0063] At the output of the ring modulator 9 an output signal is then available that contains the two modulation side bands and is identical (exactly enough) to a signal generated by load modulation or backscatter modulation. The output signal generated by the ring modulator 9 can then be optionally amplified by means of the amplifier 10, and be supplied to the antenna 3 for sending the data to be sent, via the switch 7 which is switched to the transmit mode of the transponder unit by a signal of the controller 5. Finkenzeller at [0064] The direct connection of the ring modulator output to the antenna is likewise possible. However, it is then necessary to adapt the antenna accordingly, and take account of a possible reaction of the signal coupled in from the reading device on the ring modulator, since the same antenna is normally used for sending and receiving, and since the reading device sends continually. Finkenzeller at [0065] The transponder unit 1 is operated in a first (active) operating mode as an actively sending transponder. In a second (passive) operating mode, however, the trans-ponder unit works like an ordinary passive transponder performing a load modulation on the field of the reading device. Finkenzeller at [0066] For example, the receiver 4 can additionally be formed as a conventional load modulator driven by the controller 5. The controller 5 then either switches the transmitter 6 on and the load modulator off, or the load modulator on and the transmitter 6 off. The switch 7 is switched accordingly. The criterion used for switching from a passive to an active operating state can be for example the received signal strength, the presence and/or sufficiency of an external voltage supply (on an optional connection Vcc not shown), or the sufficiency of an internal voltage supply (state of charge of the battery 2). It is thus for example possible to first operate a transponder unit 1 passively and switch it to an active operating mode if for example the distance from the reading device unintentionally increases. Finkenzeller at [0073] Just as in the structure according to FIG. 2, the binary data signal A is combined with a subcarrier signal B by an AND gate 43. The combined signal is available at a ring modulator 49. The digital ring modulator

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	49 used can be an XOR element. Departing from the structure of the transmitter in FIG. 2, a carrier signal C is not applied directly to the input of the ring modulator 49. Instead, the carrier signal C is first combined with a data signal A in an AND gate 46. This arrangement obtains better efficiency, as to be described more closely below. The output signal of the ring modulator 49 is amplified in an amplifier 40 before being emitted via the antenna 3 as the field of the transponder unit. The signal types A to C will hereinafter be described more closely by way of example with reference to FIG. 5. Finkenzeller at [0076] The signal D emitted by an antenna 3 to a reading device has a frequency spectrum that is like a frequency spectrum resulting by means of load modulation. The signal D can optionally be amplified by means of an amplifier 40. The amplifier 40 can be for example a push-pull amplifier with digital push-pull output amplifiers. Finkenzeller at [0085] For an external HF interface—for example with the S2C interface described more closely below—an ASK modulator should preferably be used, since the power consumption is the lowest here. If the HF interface is integrated into a smart card chip, or an HF interface providing the signal (TF ∩MS) is used, the optimized ring modulator will preferably be used in case of sufficient energy. If energy is to be saved, however, the ASK modulator can be used here too. Finkenzeller at [0091] There are smart card chips having a so-called S^2C interface, defined by the company Philips, for connecting the smart card chip to an HF interface of an NFC device. Such smart card chips have hardware means for generating and decoding signals required on an ISO/IEC 14443 interface (Miller code, Manchester code, subcarrier 848 kHz). However, such a chip does not have an HF interface unit of its own. Finkenzeller at [0092] FIG. 7 shows schematically an inventive transponder unit, formed by an interface module 71 connected to an antenna 3, and a chip 75 with a suitable interface, for example an S^2C interface. Such a transponder unit can be formed for example in a mobile telephone with the help of the SIM card as chip 75, which is then preferably connected to the interface module 71 via one or more idle contact surfaces (C6 and/or C4, C8) of the SIM card. Finkenzeller at [0093]

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	Both the interface module 71 and the chip 75 can draw their supply voltage from the device in which they are disposed preferably reversibly. The interface module 71 can act as an ordinary transponder in a second operating mode and supply the chip with an operating voltage Vcc_RF. Finkenzeller at [0094] FIG. 8 shows schematically more exactly the structure of an interface module for a chip with an S^2C interface. Finkenzeller at [0095] The interface module 71 is equipped with a signal input SIGIN and a signal output SIGOUT for passing signals from the antenna to the chip (not shown) and from the chip, which generates the modulated subcarrier signal, to the antenna. A signal at SIGOUT consists of a 13.56 MHz TTL signal which optionally contains a modulation signal of a remote reading device. Finkenzeller at [0098] When the interface module is in the transmit mode, i.e. there is a contactless data transfer to an external reading device or an NFC device, a modulated subcarrier signal is fed in at the signal input SIGIN by the smart card chip and optionally inverted in an inverter 86. The inverted signal E is combined with a 13.56 MHz carrier frequency signal in the AND gate 89 as the carrier frequency modulator, and supplied to the amplifier 80. Finkenzeller at [0099] The antenna 3 and the series capacitor 81 form a series-resonant circuit which is connected to the outputs LA′ and LB′ of the amplifier 80, so that the HF current flowing in case of resonance is limited in the antenna resonant circuit only by the ohmic resistances in the lines and in the amplifier 80. This obtains a greatest possible transmit power of the interface module. Finkenzeller at [0100] Further, the smart card chip can be supplied a constant 13.56 MHz timing signal from the oscillator 88 via the output SIGOUT in the transmit mode via the switch 87, if it requires such an (external) timing signal for operation to keep exact timing. As described above, this is necessary for communication according to the standard ISO 14443 type A. Finkenzeller at [0101]

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	In the receive mode, the smart card chip is supplied a digitized received signal tapped from the antenna 1, via the switch 87 and the output SIGOUT. The signal shaper 84 acts here as an amplifier to be able to receive even weak signals, and as a threshold switch to provide a digital output signal at the output of the signal shaper. For example, the threshold switch used can be a Schmitt trigger which outputs a clear high or low level depending on the over- or undershooting of a predetermined threshold value. Finkenzeller at [0102] Via the control input of the push-pull amplifier 80 the push-pull outputs of the output drivers (see amplifier units in FIG. 5) are switched to GND, so that the antenna 3 and the capacitor 41 result in a parallel-resonant circuit. To save energy, the amplifier 80 can be switched to a power save mode in the receive mode of the interface module. Finkenzeller at [0103] The oscillator 88 generates the 13.56 MHz carrier frequency signal required in the transmit mode. If the oscillator cannot be switched off in the receive mode since its building-up transient might last too long, the oscillator is operated in the receive mode of the interface module preferably at a multiple N of the carrier frequency signal (e.g. 27.120 MHz) so as not to disturb the possibly weak received signal by crosstalk. In the transmit mode the required 13.56 MHz signal can then be generated by dividing the oscillator signal by N by means of an optional divider 82. Finkenzeller at [0106] The inventive active transponder unit has a receive branch and a transmit branch. The receive branch consists of an antenna 3, an input amplifier 91, an automatic gain control 92 and an amplifier which is preferably designed as a push-pull amplifier (V+, V−). Further, a transponder chip CL is connected via its antenna connections to the push-pull amplifier. Finkenzeller at [0107] The transponder chip CL is a conventional RFID chip according to the prior art. It is normally connected at its connections with an antenna, e.g. in a chip card. Further, the transponder chip CL is so designed that data transfer from the transponder unit to a reading device is carried out by means of load modulation. This is almost always the case in usual RFID systems used at 13.56 MHz or also 125 kHz (e.g. ISO/IEC 14443, ISO/IEC 15693, ISO/IEC 18000-3). Finkenzeller at [0108]

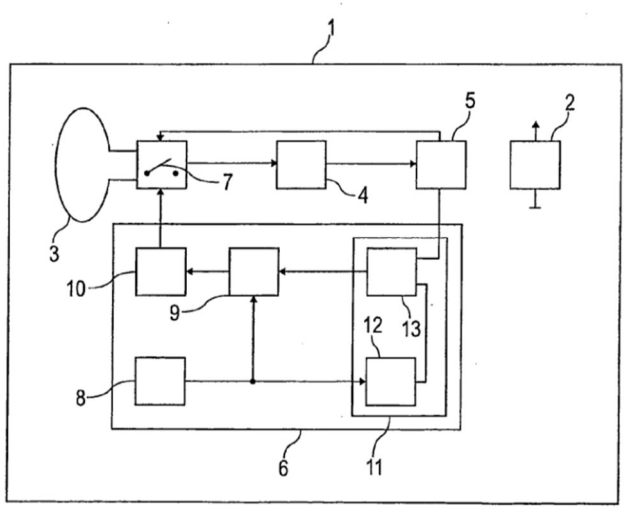
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	The transmit branch consists of a demodulation circuit 97, a modulator circuit 9, an oscillator 8 (e.g. 13.56 MHz), a controller 95, and a transmitter amplifier 80 connected to the antenna 3. The demodulation circuit 98 can consist for example of a rectifier 96 and a threshold switch 97. Finkenzeller at [0109] In the receive mode a voltage is induced in the antenna 3 by the magnetic field of a remote RFID reading device. Together with the capacitor 81 the antenna 3 forms a parallel-resonant circuit whose resonant frequency corresponds approximately to the transmitting frequency of the RFID reading device. The voltage thus available on the resonant circuit is supplied to the input amplifier 91 via the switch 7. Via a gain control 92 the gain factor of the input amplifier 91 is now so adjusted that the output amplitude of the voltage amplified by the input amplifier 91 remains largely constant. The time constant of the control is preferably so adjusted here that the output voltage of the amplifier 91 remains constant in case of varying distance from the reading device (i.e. different levels of induced voltage in the coil 3), but modulation signals (e.g. 10% ASK with 106 kbit/s) are not suppressed by excessively fast control. Finkenzeller at [0110] The output signal of the amplifier 91 is supplied to a further amplifier, preferably a push-pull amplifier (V+, V−). The output signal of the push-pull amplifier is supplied to the connections of the contactless RFID chip CL via (at least) one series resistor 93. The amplitude of the output signal of the push-pull amplifier V+/V− is so selected here that the RFID chip CL can be supplied with sufficient energy for operation by the output signal. Finkenzeller at [0114] The modulation signal reconstructed by the demodulation circuit 97 is also supplied to a controller 95. The latter switches the inventive circuit with the first edge of the modulation signal to a transmit mode without delay if possible, so that the data generated by the RFID chip CL can also be transferred to the remote reading device. For this purpose, the switch 7 is first switched from the antenna 3 to the oscillator 8 (13.56 MHz). This is necessary to be able to keep supplying the RFID chip CL with an alternating voltage of the right frequency. At the same time the amplifier 80 is activated by the controller 95. Finkenzeller at [0123] For an inductive coupling, the circuit has an additional antenna 29 which can be made to resonate with the working frequency (e.g. 13.56 MHz) by means of a capacitor 26. A transponder comprising a transponder chip CL and an antenna 28 is positioned in immediate proximity to the antenna 29, so as to obtain the best

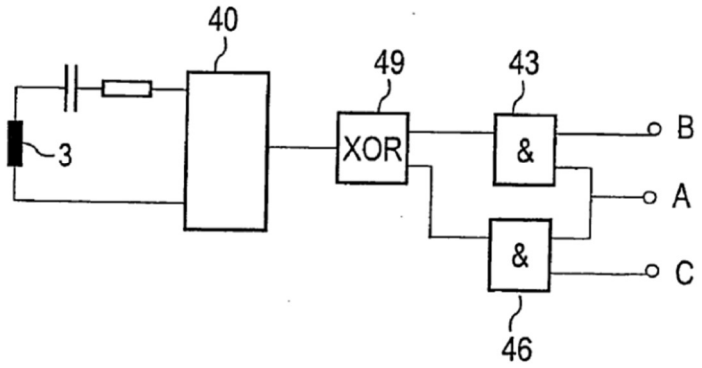
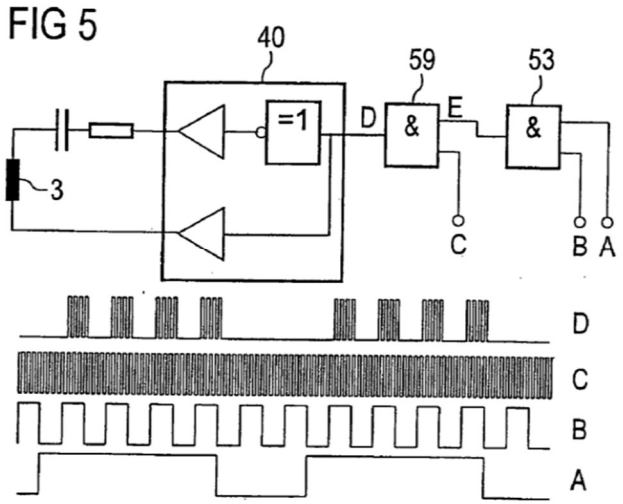
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	possible magnetic coupling between the antennas 28 and 29. A load modulation of the transponder chip CL can also be detected easily with this arrangement. Finkenzeller at [0124] The interface module adapted to be coupled inductively and a further antenna connected thereto (see reference sign 3 in FIG. 10) can be disposed in a terminal. The range of an ordinary transponder can be increased with the help of such a terminal. The owner of a mobile telephone could for example set up a communication between his transponder and a reading device that is unfavorably disposed or inconvenient to reach for other reasons by holding the transponder against his mobile telephone provided according to the invention with an interface module adapted to be coupled inductively. Finkenzeller at [0127] It was ascertained that small antennas, e.g. in a SIM card with its own antenna (approx. 15×25 mm^2), obtain very low read ranges with a conventional load modulation. It is frequently even impossible to communicate with a contactless reading device when the SIM card with an antenna is disposed for example in a mobile telephone. If one of the inventive transmitters is used in a mobile terminal the range is not clearly increased. Moreover, it can be advantageously exploited that mobile terminals such as mobile telephones, PDAs, etc., have their own energy supply (battery) which can also be used for supplying an inventive circuit. Finkenzeller at [0129] Thus, an NFC unit could be adapted to behave according to the present solutions in its passive mode in the role ("being card") in which the NFC unit is to perform a load modulation. The NFC unit could for example always act as a component actively emitting its own field. Likewise, the NFC unit could also distinguish, and optionally switch, between a first submode corresponding to a conventional load modulation and an actively sending, second submode in which the load modulation is simulated. A thus improved NFC unit can also communicate with ordinary RFID reading devices over a higher range with the help of the changed passive operating mode. Since NFC units will already have certain units—such as an oscillator, an amplifier and a controller—for independent sending in their conventional active mode, comparatively few modifications of an NFC circuit are required to realize a circuit according to the present application in an NFC unit. Finkenzeller at [0131] The individual functional components of the transponder unit—antenna, interface unit, chip and optionally voltage supply unit—can be disposed in all sorts of combinations separately from each other or

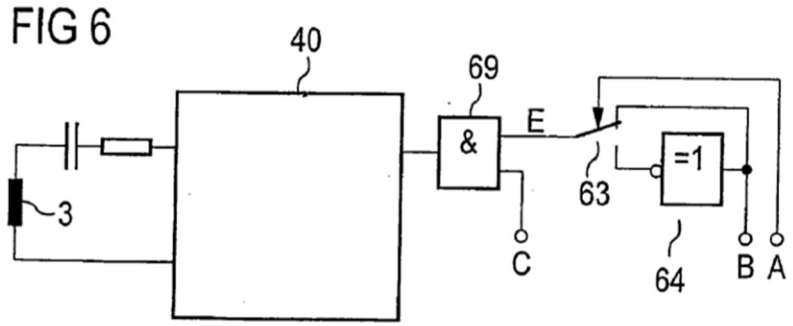
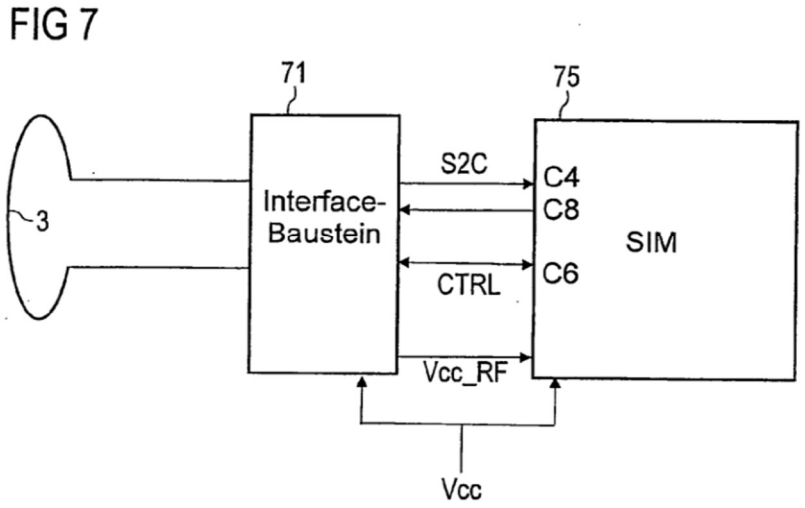
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	integrated jointly in one unit. An inventive transponder unit can be formed for example as a specially designed transponder, in a portable data carrier, in particular a chip card, which optionally has a battery. A portable data carrier, in particular SIM card, with a chip and an interface unit can be connected in a mobile terminal to an external voltage source and/or an external antenna. The interface unit can be disposed in a terminal, connected to its own or an external antenna, and communicate with a chip which is disposed reversibly or firmly in the terminal or temporarily on the terminal. Finkenzeller at claim 19 19. The transponder unit according to claim 16, including at least one antenna for transmitting the signal either or both from and to the reading device; a receiver for demodulating a signal transmitted from the reading device to extract data therefrom; and an electronic circuit which is set up to process the extracted data and to generate data to be sent to the reading device. *See also* above at [1c]. *See also* Finkenzeller at [0006], [0007], [0012], [0024], [0025], [0049], [0080], [0096], [0115], [0117], [0118], [0126], and claim 35. To the extent this limitation is not disclosed by Finkenzeller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Finkenzeller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[7d] wherein the amplifier is coupled to amplify a signal received from the antenna and to provide an amplified signal to the smartcard controller.	Finkenzeller expressly or inherently discloses "wherein the amplifier is coupled to amplify a signal received from the antenna and to provide an amplified signal to the smartcard controller." For example: *See* above at [1d]. To the extent this limitation is not disclosed by Finkenzeller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Finkenzeller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
8. The mobile device of claim 7 wherein the antenna is tuned to operate at 13.56 MHz.	Finkenzeller expressly or inherently discloses "[t]he mobile device of claim 7 wherein the antenna is tuned to operate at 13.56 MHz." *See* above at claim 2.

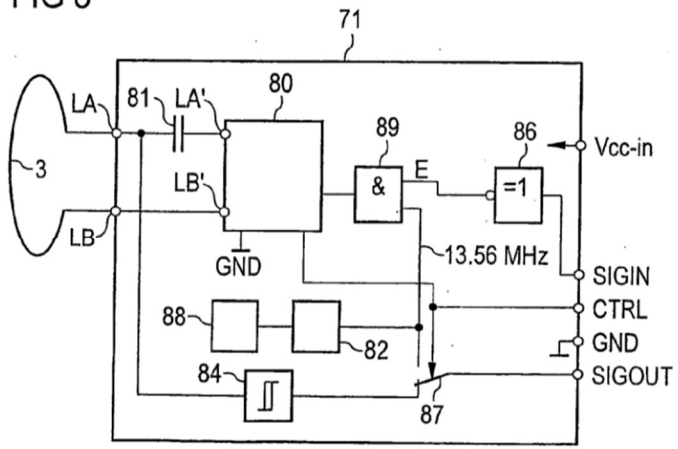
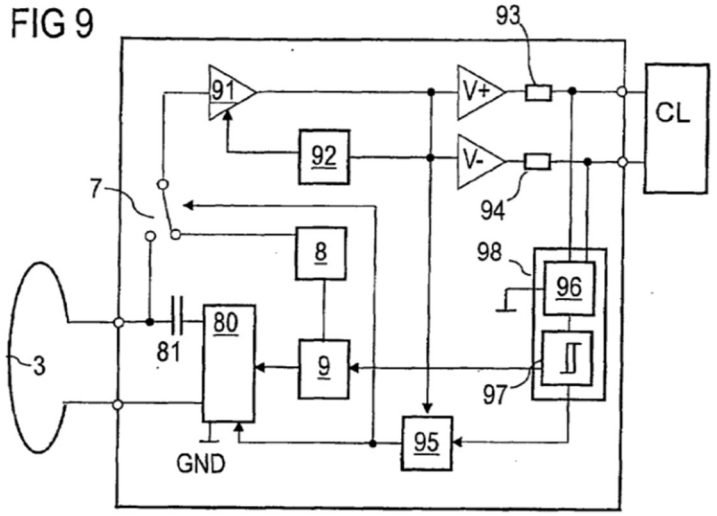
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	To the extent this limitation is not disclosed by Finkenzeller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Finkenzeller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 7 above.
9. The mobile device of claim 7 wherein the antenna comprises an inductive element too small to draw enough power sufficient to operate the smartcard controller from an interrogating radio frequency (RF) field.	Finkenzeller expressly or inherently discloses "[t]he mobile device of claim 7 wherein the antenna comprises an inductive element too small to draw enough power sufficient to operate the smartcard controller from an interrogating radio frequency (RF) field." *See* above at claim 3. To the extent this limitation is not disclosed by Finkenzeller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Finkenzeller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 7 above.
10. The mobile device of claim 7 wherein the smartcard controller is coupled to be powered by the mobile device.	Finkenzeller expressly or inherently discloses "[t]he mobile device of claim 7 wherein the smartcard controller is coupled to be powered by the mobile device." For example: *See* above at claim 4. To the extent this limitation is not disclosed by Finkenzeller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Finkenzeller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 7 above.
11. The mobile device of claim 7 wherein the performance enhancement circuits are coupled to be powered by the mobile device.	Finkenzeller expressly or inherently discloses "[t]he mobile device of claim 7 wherein the performance enhancement circuits are coupled to be powered by the mobile device." For example: *See* above at claim 5. To the extent this limitation is not disclosed by Finkenzeller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Finkenzeller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 7 above.

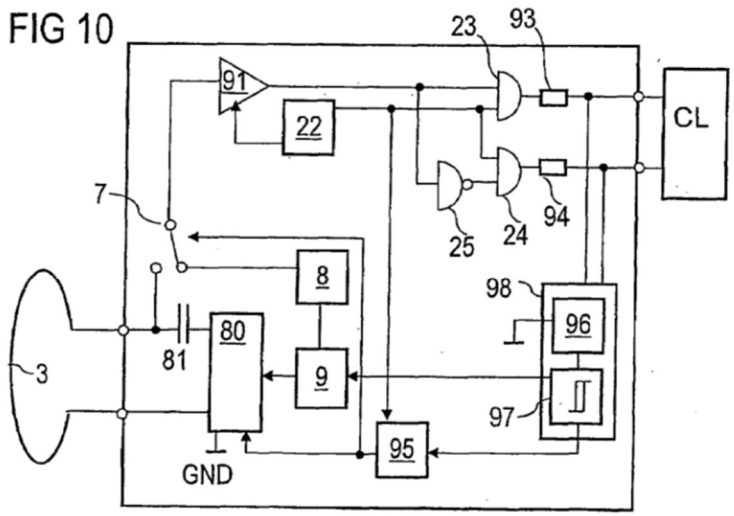
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12. The mobile device of claim 7 wherein the mobile device comprises a mobile phone.	Finkenzeller expressly or inherently discloses "[t]he mobile device of claim 7 wherein the mobile device comprises a mobile phone." For example: *See* above at claim 6. To the extent this limitation is not disclosed by Finkenzeller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Finkenzeller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 7 above.
13[pre]. A mobile device comprising:	Finkenzeller expressly or inherently discloses "[a] mobile device." For example: *See* above at 1[pre]. To the extent this limitation is not disclosed by Finkenzeller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Finkenzeller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[13a] a smartcard controller;	Finkenzeller expressly or inherently discloses "a smartcard controller." For example: *See* above at [1a]. To the extent this limitation is not disclosed by Finkenzeller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Finkenzeller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[13b] an antenna;	Finkenzeller expressly or inherently discloses "an antenna." For example: *See* above at [1b]. To the extent this limitation is not disclosed by Finkenzeller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Finkenzeller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[13c] an amplifier coupled to amplify signals received at the antenna and drive the smartcard controller; and	Finkenzeller expressly or inherently discloses "an amplifier coupled to amplify signals received at the antenna and drive the smartcard controller." For example: *See* above at [1d].

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	To the extent this limitation is not disclosed by Finkenzeller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Finkenzeller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[13d] a driver circuit to drive the antenna with data provided by the smartcard controller.	Finkenzeller expressly or inherently discloses "a driver circuit to drive the antenna with data provided by the smartcard controller." For example: Finkenzeller at Figure 2 FIG 2  Finkenzeller at Figure 4

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	FIG 4  Finkenzeller at Figure 5 FIG 5 

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	Finkenzeller at Figure 6  Finkenzeller at Figure 7  Finkenzeller at Figure 8

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	FIG 8  Finkenzeller at Figure 9 FIG 9 

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	Finkenzeller at Figure 10  Finkenzeller at [0002] Transponders are used for example in radio frequency identification (RFID) systems. Conventionally, both the energy supply to a transponder in an RFID system and the data interchange between the transponder and a reading device are effected using magnetic or electromagnetic fields. RFID transponders have an electronic circuit and, depending on the frequency domain, an antenna coil (e.g. 13.56 MHz) or an electromagnetic antenna (e.g. 868 MHz). Via the antenna the energy required for operating the transponder can be taken from the field of the reading device, as well as the data transfer carried out. Finkenzeller at [0010] According to the invention, a transponder unit sends a signal to a transponder reading device, which can communicate with the transponders by means of modulation of its own field by transponders, in such a way that the reading device can evaluate the signal as modulation by a conventional transponder. Instead of performing a load modulation or backscatter modulation of a field of the reading device, the transponder unit itself thus emits a field that simulates for the reading device a modulation of the reading

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	device field by a transponder. An inventive transponder unit has means for sending the accordingly modulated signal. The total range of the system is consequently no longer limited by the communication range of the reading device, but is extended therebeyond up to a transmit range of the transponder unit. Finkenzeller at [0011] In an advantageous embodiment, an inventive RFID transponder unit has its own energy supply, at least one antenna for transmitting signals from and/or to a reading device, and an electronic circuit. The electronic circuit of the inventive transponder unit comprises a transmitter consisting of an oscillator and a modulator. Finkenzeller at [0015] Both modulators (ring modulator and ASK modulator) modulate the oscillator signal by means of the (modulated) data signal and deliver an output signal which is then transmitted to the reading device via the receive antenna or a separate transmitting antenna. Finkenzeller at [0020] The electronic circuit of the transponder unit further comprises in the usual way a receiver which is so designed that it can detect signals from a reading device. From said signals the receiver extracts data by means of a demodulation circuit, so that a data stream transferred from the reading device is available at the output of the receiver as a baseband signal (e.g. as an NRZ code, Miller code, etc.). For example, the data can be a simple instruction to activate the controller. However, the data may also contain a more complex instruction to the controller. The demodulated data are supplied to the controller in the electronic circuit. A data signal is thereupon generated in the controller, whereby the data signal can also be based on the extracted data. Finkenzeller at [0021] In a development, the inventive transponder unit has a load modulator according to the prior art, in addition to the above-described circuit having a receiver, a controller, an oscillator and a modulator. Finkenzeller at [0022] The voltage induced on the antenna of the transponder unit can be a problem for the operation of the inventive modulator circuits if the distance between trans-ponder unit and reading device is small and the induced voltage is therefore accordingly great. Therefore, the data to be sent to the reading device which are generated in the controller are supplied alternatively to the load modulator or to the inventive circuit configuration with a modulator. The switchover between the load modulator and the circuit configuration

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	is preferably effected automatically, in dependence on the level of voltage induced on the antenna. The switchover is effected in such a way that the load modulator is used within the normal communication range, and the inventive modulator outside the normal communication range. Finkenzeller at [0026] To avoid a quartz oscillator, which has a large mounting form, an improved embodiment of the invention has the oscillator coupled in phase lock to the signal received from the reading device via a phase locked loop (PLL) circuit when the trans-ponder unit is in the receive mode. In the transmit mode of the transponder unit, that is, during data transfer from the transponder unit to the reading device, the control voltage of the PLL circuit is kept constant so that the frequency of the oscillator is maintained as stable as possible. The PLL can also be referred to as tracking synchronization. The oscillator is so regulated that it follows in phase a reference signal, in the present case the timing signal of the reading device. The regulation circuit continuously compares the phase relationship of the two signals and adjusts that of the oscillator in case of an error signal. A PLL circuit is used primarily for frequency stabilization or synchronization of the oscillator. Additionally, it is possible to also supply the signal generated by the oscillator to the controller and use it as a timing signal relevant for timing. Finkenzeller at [0027] The possibility of reading the inventive transponder unit over very large distances is not always desired, for example for privacy protection. It is therefore provided in one embodiment that the inventive circuit configuration can be activated manually if communication over a long range is explicitly desired. Otherwise, communication can be effected via a load modulator provided in the transponder unit, which is usable only for short distances. If no load modulator is provided in the trans-ponder unit, it can be provided for example that the transponder unit is activated for sending data only if the signal emitted by the reading device contains a predetermined code. Finkenzeller at [0028] The transponder unit can also be part of a mobile terminal, for example a mobile telephone. The transponder unit can have its own antenna or use an antenna of the terminal. Finkenzeller at [0029] According to a first alternative, the circuit configuration for generating and modulating the subcarrier signal is a separate part of the mobile terminal. The trans-ponder unit then has a signal input for receiving the subcarrier signal modulated by means of the data to be sent from the circuit configuration. The signal

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	input is connected via a suitable interface in particular to a chip, for example a smart card chip, which generates and modulates the subcarrier signal. Finkenzeller at [0030] According to a second alternative, the circuit configuration for generating and modulating the subcarrier signal is part of the inventive transponder unit itself. To then connect the transponder unit to a (smart card) chip of the terminal, which supplies data to be sent for example, an interface can be provided via which data are transferred in binary form. Finkenzeller at [0040] FIG. 7 a transponder unit in which a security module is connected to an interface module via an S^2C interface. Finkenzeller at [0048] The transponder unit 1 sends for data transfer to the reading device 100 a signal which the reading device 100 can evaluate as a signal of a transponder which carries out a load modulation of the field 110 of the reading device 100. Unlike the conventional transponders 200, 300 which modulate the field 110 of the reading device 100 into a modulated reading device field 102, 103, the transponder unit 1 thus generates and sends its own modulated field 20 as the signal for data transfer. The transponder unit 1 thus uses its own energy for the purpose of data transfer. Finkenzeller at [0055] FIG. 2 shows purely schematically the transponder unit 1, for example in the form of an inductively coupled chip card, which comprises the usual components not shown explicitly here. For simplification, only one inventive RFID transponder unit in a chip card is shown. The transponder unit has a battery 2, an inductive antenna 3 and an electronic circuit 4, 5, 6, 7. The electronic circuit consists substantially of three functional blocks, a receiver 4, a controller 5 and a transmitter 6. A switch 7 is used for switching the antenna 3 between the receiver 4 and the transmitter 6. Finkenzeller at [0056] The receiver 4 is provided for demodulating a signal transmitted from the reading device 100 to extract data therefrom. The extracted data are passed on to the controller 5 which processes them and generates data to be sent to the reading device 100. Furthermore, the controller 5 transmits a control signal to the switch 7 which switches between receive mode and transmit mode of the transponder unit. However, a

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	separate antenna can instead be provided for sending. The controller 5 used can be for example a part of the operating system of a portable data carrier, such as a chip card. Finkenzeller at [0058] In the transponder unit shown in FIG. 2 it is provided that the assembly 11 divides the oscillator frequency by a certain factor by means of a frequency divider 12, for example by binary division. The resulting subcarrier signal is modulated with the data to be sent which are supplied to the assembly 11 by the controller 5. Finkenzeller at [0063] At the output of the ring modulator 9 an output signal is then available that contains the two modulation side bands and is identical (exactly enough) to a signal generated by load modulation or backscatter modulation. The output signal generated by the ring modulator 9 can then be optionally amplified by means of the amplifier 10, and be supplied to the antenna 3 for sending the data to be sent, via the switch 7 which is switched to the transmit mode of the transponder unit by a signal of the controller 5. Finkenzeller at [0064] The direct connection of the ring modulator output to the antenna is likewise possible. However, it is then necessary to adapt the antenna accordingly, and take account of a possible reaction of the signal coupled in from the reading device on the ring modulator, since the same antenna is normally used for sending and receiving, and since the reading device sends continually. Finkenzeller at [0066] For example, the receiver 4 can additionally be formed as a conventional load modulator driven by the controller 5. The controller 5 then either switches the transmitter 6 on and the load modulator off, or the load modulator on and the transmitter 6 off. The switch 7 is switched accordingly. The criterion used for switching from a passive to an active operating state can be for example the received signal strength, the presence and/or sufficiency of an external voltage supply (on an optional connection Vcc not shown), or the sufficiency of an internal voltage supply (state of charge of the battery 2). It is thus for example possible to first operate a transponder unit 1 passively and switch it to an active operating mode if for example the distance from the reading device unintentionally increases. Finkenzeller at [0073] Just as in the structure according to FIG. 2, the binary data signal A is combined with a subcarrier signal B by an AND gate 43. The combined signal is available at a ring modulator 49. The digital ring modulator

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	49 used can be an XOR element. Departing from the structure of the transmitter in FIG. 2, a carrier signal C is not applied directly to the input of the ring modulator 49. Instead, the carrier signal C is first combined with a data signal A in an AND gate 46. This arrangement obtains better efficiency, as to be described more closely below. The output signal of the ring modulator 49 is amplified in an amplifier 40 before being emitted via the antenna 3 as the field of the transponder unit. The signal types A to C will hereinafter be described more closely by way of example with reference to FIG. 5. Finkenzeller at [0076] The signal D emitted by an antenna 3 to a reading device has a frequency spectrum that is like a frequency spectrum resulting by means of load modulation. The signal D can optionally be amplified by means of an amplifier 40. The amplifier 40 can be for example a push-pull amplifier with digital push-pull output amplifiers. Finkenzeller at [0085] For an external HF interface—for example with the S2C interface described more closely below—an ASK modulator should preferably be used, since the power consumption is the lowest here. If the HF interface is integrated into a smart card chip, or an HF interface providing the signal (TF ∩MS) is used, the optimized ring modulator will preferably be used in case of sufficient energy. If energy is to be saved, however, the ASK modulator can be used here too. Finkenzeller at [0091] There are smart card chips having a so-called S^2C interface, defined by the company Philips, for connecting the smart card chip to an HF interface of an NFC device. Such smart card chips have hardware means for generating and decoding signals required on an ISO/IEC 14443 interface (Miller code, Manchester code, subcarrier 848 kHz). However, such a chip does not have an HF interface unit of its own. Finkenzeller at [0092] FIG. 7 shows schematically an inventive transponder unit, formed by an interface module 71 connected to an antenna 3, and a chip 75 with a suitable interface, for example an S^2C interface. Such a transponder unit can be formed for example in a mobile telephone with the help of the SIM card as chip 75, which is then preferably connected to the interface module 71 via one or more idle contact surfaces (C6 and/or C4, C8) of the SIM card. Finkenzeller at [0093]

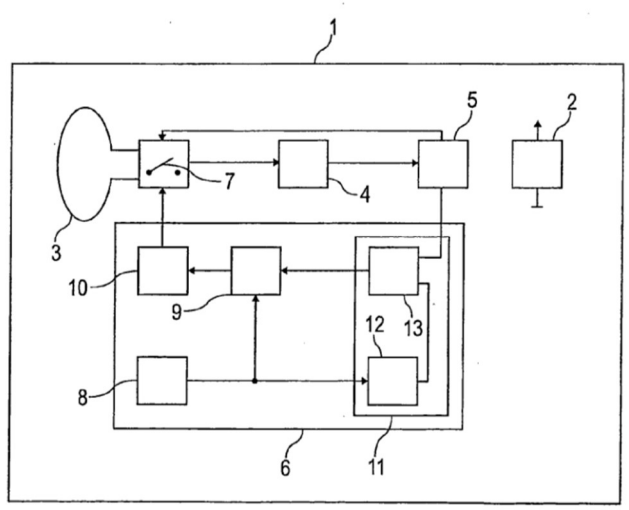
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	Both the interface module 71 and the chip 75 can draw their supply voltage from the device in which they are disposed preferably reversibly. The interface module 71 can act as an ordinary transponder in a second operating mode and supply the chip with an operating voltage Vcc_RF. Finkenzeller at [0094] FIG. 8 shows schematically more exactly the structure of an interface module for a chip with an S^2C interface. Finkenzeller at [0095] The interface module 71 is equipped with a signal input SIGIN and a signal output SIGOUT for passing signals from the antenna to the chip (not shown) and from the chip, which generates the modulated subcarrier signal, to the antenna. A signal at SIGOUT consists of a 13.56 MHz TTL signal which optionally contains a modulation signal of a remote reading device. Finkenzeller at [0096] The interface module 71 comprises an amplifier 80, an AND gate 89, an oscillator 88, a frequency divider 82, a signal shaper 84 and a switch 87. The amplifier 80 can be for example a push-pull amplifier with (digital) push-pull output amplifiers (not shown). The interface module also has two antenna connections LA and LB and a series capacitor 81. Furthermore, the interface module 71 has connections Vcc-in and GND for energy supply and a control input CTRL for switching between a transmit mode and a receive mode of the interface module by means of the switch 87. Finkenzeller at [0098] When the interface module is in the transmit mode, i.e. there is a contactless data transfer to an external reading device or an NFC device, a modulated subcarrier signal is fed in at the signal input SIGIN by the smart card chip and optionally inverted in an inverter 86. The inverted signal E is combined with a 13.56 MHz carrier frequency signal in the AND gate 89 as the carrier frequency modulator, and supplied to the amplifier 80. Finkenzeller at [0099] The antenna 3 and the series capacitor 81 form a series-resonant circuit which is connected to the outputs LA′ and LB′ of the amplifier 80, so that the HF current flowing in case of resonance is limited in the antenna resonant circuit only by the ohmic resistances in the lines and in the amplifier 80. This obtains a greatest possible transmit power of the interface module.

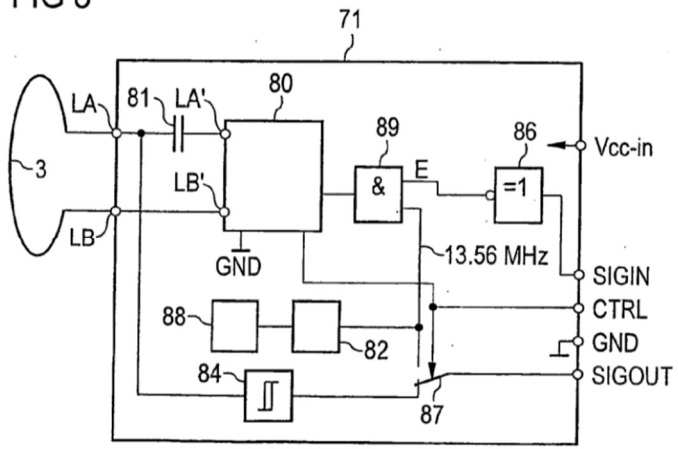
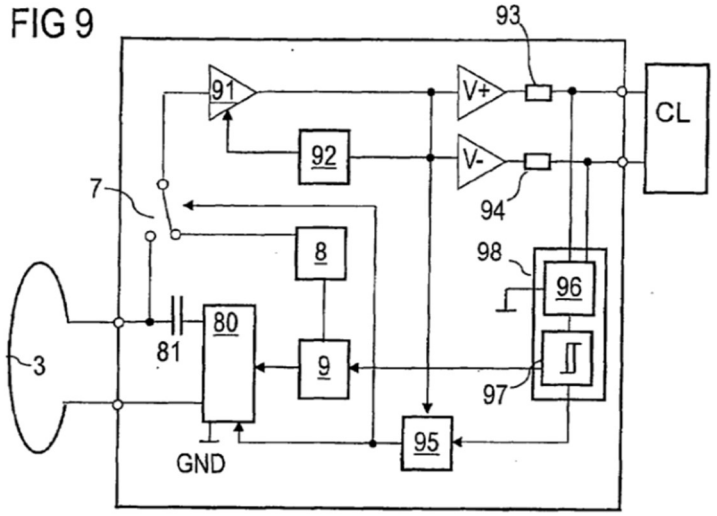
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	Finkenzeller at [0100] Further, the smart card chip can be supplied a constant 13.56 MHz timing signal from the oscillator 88 via the output SIGOUT in the transmit mode via the switch 87, if it requires such an (external) timing signal for operation to keep exact timing. As described above, this is necessary for communication according to the standard ISO 14443 type A. Finkenzeller at [0101] In the receive mode, the smart card chip is supplied a digitized received signal tapped from the antenna 1, via the switch 87 and the output SIGOUT. The signal shaper 84 acts here as an amplifier to be able to receive even weak signals, and as a threshold switch to provide a digital output signal at the output of the signal shaper. For example, the threshold switch used can be a Schmitt trigger which outputs a clear high or low level depending on the over- or undershooting of a predetermined threshold value. Finkenzeller at [0102] Via the control input of the push-pull amplifier 80 the push-pull outputs of the output drivers (see amplifier units in FIG. 5) are switched to GND, so that the antenna 3 and the capacitor 41 result in a parallel-resonant circuit. To save energy, the amplifier 80 can be switched to a power save mode in the receive mode of the interface module. Finkenzeller at [0103] The oscillator 88 generates the 13.56 MHz carrier frequency signal required in the transmit mode. If the oscillator cannot be switched off in the receive mode since its building-up transient might last too long, the oscillator is operated in the receive mode of the interface module preferably at a multiple N of the carrier frequency signal (e.g. 27.120 MHz) so as not to disturb the possibly weak received signal by crosstalk. In the transmit mode the required 13.56 MHz signal can then be generated by dividing the oscillator signal by N by means of an optional divider 82. Finkenzeller at [0106] The inventive active transponder unit has a receive branch and a transmit branch. The receive branch consists of an antenna 3, an input amplifier 91, an automatic gain control 92 and an amplifier which is preferably designed as a push-pull amplifier (V+, V−). Further, a transponder chip CL is connected via its antenna connections to the push-pull amplifier. Finkenzeller at [0107]

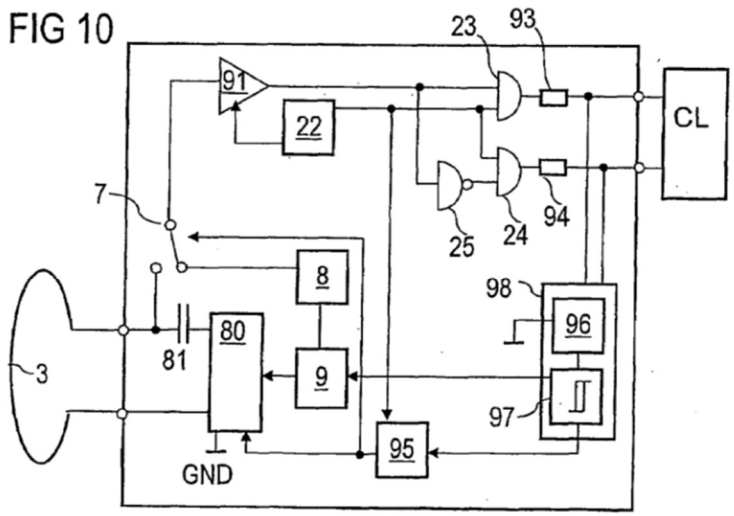
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	The transponder chip CL is a conventional RFID chip according to the prior art. It is normally connected at its connections with an antenna, e.g. in a chip card. Further, the transponder chip CL is so designed that data transfer from the transponder unit to a reading device is carried out by means of load modulation. This is almost always the case in usual RFID systems used at 13.56 MHz or also 125 kHz (e.g. ISO/IEC 14443, ISO/IEC 15693, ISO/IEC 18000-3). Finkenzeller at [0108] The transmit branch consists of a demodulation circuit 97, a modulator circuit 9, an oscillator 8 (e.g. 13.56 MHz), a controller 95, and a transmitter amplifier 80 connected to the antenna 3. The demodulation circuit 98 can consist for example of a rectifier 96 and a threshold switch 97. Finkenzeller at [0109] In the receive mode a voltage is induced in the antenna 3 by the magnetic field of a remote RFID reading device. Together with the capacitor 81 the antenna 3 forms a parallel-resonant circuit whose resonant frequency corresponds approximately to the transmitting frequency of the RFID reading device. The voltage thus available on the resonant circuit is supplied to the input amplifier 91 via the switch 7. Via a gain control 92 the gain factor of the input amplifier 91 is now so adjusted that the output amplitude of the voltage amplified by the input amplifier 91 remains largely constant. The time constant of the control is preferably so adjusted here that the output voltage of the amplifier 91 remains constant in case of varying distance from the reading device (i.e. different levels of induced voltage in the coil 3), but modulation signals (e.g. 10% ASK with 106 kbit/s) are not suppressed by excessively fast control. Finkenzeller at [0112] As soon as the RFID chip CL has received and processed a command, it tries to send a response back to the remote reading device. For this purpose the RFID chip normally uses a load modulation, i.e. an additional parallel resistor in the chip is switched on and off in time with the modulation signal. This leads to measurable fluctuations in the voltage drop across the resistors 93, 94. In other words, the HF alternating voltage at the connections is modulated in amplitude. By the demodulator circuit 98 this amplitude-modulated alternating voltage signal is demodulated and the original modulation signal thus reconstructed again. Finkenzeller at [0114] The modulation signal reconstructed by the demodulation circuit 97 is also supplied to a controller 95. The latter switches the inventive circuit with the first edge of the modulation signal to a transmit mode without delay if possible, so that the data generated by the RFID chip CL can also be transferred to the

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	remote reading device. For this purpose, the switch 7 is first switched from the antenna 3 to the oscillator 8 (13.56 MHz). This is necessary to be able to keep supplying the RFID chip CL with an alternating voltage of the right frequency. At the same time the amplifier 80 is activated by the controller 95. Finkenzeller at [0118] However, a load modulation of the transponder chip CL is recognizable exclusively on the connections, but a modulation signal of the reading device already in the receive branch (91, 92, V+, V−) of the inventive circuit. It is therefore provided to switch the inventive circuit to the transmit mode only when a modulation signal (amplitude modulation) can be detected exclusively on the connections of the RFID chip CL and not in the receive branch, since only in this case is a load modulation involved. This is indicated in FIG. 9 by the signal fed into the controller 95 from the receive branch (91, 92, V+, V−). Finkenzeller at [0119] A second way of distinguishing is to evaluate the modulation depth of the signal on the connections of the RFID chip. By load modulation a modulation depth less than 100% is obtained. In the breadboard setup approx. 25% was determined, other values arise from combining different resistors 93, 94 with different RFID chips CL. It is therefore provided to distinguish between the load modulation and the modulation of the reading device by determining modulation depth with reference to given switching thresholds. If the strength of the modulation signal is above a first, high threshold, a signal from the reading device is present. If the modulation signal is smaller than the first switching threshold and optionally greater than a second switching threshold, however, it is recognized that a load modulation is present. A switch-over to the transmit mode is effected if the modulation was caused by a load modulation. Finkenzeller at [0123] For an inductive coupling, the circuit has an additional antenna 29 which can be made to resonate with the working frequency (e.g. 13.56 MHz) by means of a capacitor 26. A transponder comprising a transponder chip CL and an antenna 28 is positioned in immediate proximity to the antenna 29, so as to obtain the best possible magnetic coupling between the antennas 28 and 29. A load modulation of the transponder chip CL can also be detected easily with this arrangement. Finkenzeller at [0124] The interface module adapted to be coupled inductively and a further antenna connected thereto (see reference sign 3 in FIG. 10) can be disposed in a terminal. The range of an ordinary transponder can be increased with the help of such a terminal. The owner of a mobile telephone could for example set up a communication between his transponder and a reading device that is unfavorably disposed or

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	inconvenient to reach for other reasons by holding the transponder against his mobile telephone provided according to the invention with an interface module adapted to be coupled inductively. Finkenzeller at [0127] It was ascertained that small antennas, e.g. in a SIM card with its own antenna (approx. 15×25 mm^2), obtain very low read ranges with a conventional load modulation. It is frequently even impossible to communicate with a contactless reading device when the SIM card with an antenna is disposed for example in a mobile telephone. If one of the inventive transmitters is used in a mobile terminal the range is not clearly increased. Moreover, it can be advantageously exploited that mobile terminals such as mobile telephones, PDAs, etc., have their own energy supply (battery) which can also be used for supplying an inventive circuit. Finkenzeller at [0129] Thus, an NFC unit could be adapted to behave according to the present solutions in its passive mode in the role ("being card") in which the NFC unit is to perform a load modulation. The NFC unit could for example always act as a component actively emitting its own field. Likewise, the NFC unit could also distinguish, and optionally switch, between a first submode corresponding to a conventional load modulation and an actively sending, second submode in which the load modulation is simulated. A thus improved NFC unit can also communicate with ordinary RFID reading devices over a higher range with the help of the changed passive operating mode. Since NFC units will already have certain units—such as an oscillator, an amplifier and a controller—for independent sending in their conventional active mode, comparatively few modifications of an NFC circuit are required to realize a circuit according to the present application in an NFC unit. Finkenzeller at [0131] The individual functional components of the transponder unit—antenna, interface unit, chip and optionally voltage supply unit—can be disposed in all sorts of combinations separately from each other or integrated jointly in one unit. An inventive transponder unit can be formed for example as a specially designed transponder, in a portable data carrier, in particular a chip card, which optionally has a battery. A portable data carrier, in particular SIM card, with a chip and an interface unit can be connected in a mobile terminal to an external voltage source and/or an external antenna. The interface unit can be disposed in a terminal, connected to its own or an external antenna, and communicate with a chip which is disposed reversibly or firmly in the terminal or temporarily on the terminal.

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	See also Finkenzeller at [0004], [0006], [0007], [0012], [0024], [0025], [0049], [0057], [0060], [0080], [0110], [0115], [0117], [0126], claim 19, and claim 35. To the extent this limitation is not disclosed by Finkenzeller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Finkenzeller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
14. The mobile device of claim 13 wherein the driver circuit comprises a load modulation circuit.	Finkenzeller expressly or inherently discloses "[t]he mobile device of claim 13 wherein the driver circuit comprises a load modulation circuit." For example: Finkenzeller at Figure 2 FIG 2  Finkenzeller at Figure 8

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	FIG 8  Finkenzeller at Figure 9 FIG 9 

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	Finkenzeller at Figure 10  Finkenzeller at [0006] For simple and fast contactless communication between two devices, the companies Philips and Sony have developed an inductive transmission technology which is known as so-called near field communication (NFC). This technology is integrated for example in mobile telephones or PDAs to permit communication between the devices or with a computer. The coupling of the two devices is effected via coils, the carrier frequency being 13.56 MHz as in RFID systems. As described more closely in the NFC standard ECMA 340, NFC systems have an active communication mode and a passive communication mode. In the active mode, two NFC units alternately generate their own RF field as a signal carrier, thus switching back and forth, coordinated with each other, between transmit mode and receive mode as in a classic mobile phone system. In the passive mode, however, the two NFC units must agree on which unit acts as a reading device and generates a field which the other unit can then influence by means of load modulation. Primarily due to the small antenna diameters used, NFC systems only permit small communication ranges of up to 20 cm. Finkenzeller at [0007]

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	Even with active transponders there is the problem that data transfer from the transponder to the reading device is limited by the signals becoming weaker with increasing distance between reading device and transponder. As a rule, ranges no longer than 1 to 2 m can therefore be obtained even with an active transponder for example in inductively coupled systems which transfer data to the reading device on the principle of load modulation. For RFID systems working on the principle of backscatter, however, communication ranges of 10 m are typically obtained. Finkenzeller at [0010] According to the invention, a transponder unit sends a signal to a transponder reading device, which can communicate with the transponders by means of modulation of its own field by transponders, in such a way that the reading device can evaluate the signal as modulation by a conventional transponder. Instead of performing a load modulation or backscatter modulation of a field of the reading device, the transponder unit itself thus emits a field that simulates for the reading device a modulation of the reading device field by a transponder. An inventive transponder unit has means for sending the accordingly modulated signal. The total range of the system is consequently no longer limited by the communication range of the reading device, but is extended therebeyond up to a transmit range of the transponder unit. Finkenzeller at [0011] In an advantageous embodiment, an inventive RFID transponder unit has its own energy supply, at least one antenna for transmitting signals from and/or to a reading device, and an electronic circuit. The electronic circuit of the inventive transponder unit comprises a transmitter consisting of an oscillator and a modulator. Finkenzeller at [0012] In a first alternative, the modulator comprises a ring modulator. The oscillator is coupled with the battery and provided to deliver an oscillator signal to the ring modulator. Furthermore, the ring modulator is supplied via a second input the data signal which either is generated in a controller of the transponder unit or which the transponder unit feeds in externally. Before being supplied to the ring modulator, the data signal can be modulated with a subcarrier. It is characteristic of the ring modulator that it performs a DSB modulation (double side-band modulation) and is usable independently of the form of the data signal (analog or digital). Finkenzeller at [0015]

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	Both modulators (ring modulator and ASK modulator) modulate the oscillator signal by means of the (modulated) data signal and deliver an output signal which is then transmitted to the reading device via the receive antenna or a separate transmitting antenna. Finkenzeller at [0021] In a development, the inventive transponder unit has a load modulator according to the prior art, in addition to the above-described circuit having a receiver, a controller, an oscillator and a modulator. Finkenzeller at [0022] The voltage induced on the antenna of the transponder unit can be a problem for the operation of the inventive modulator circuits if the distance between trans-ponder unit and reading device is small and the induced voltage is therefore accordingly great. Therefore, the data to be sent to the reading device which are generated in the controller are supplied alternatively to the load modulator or to the inventive circuit configuration with a modulator. The switchover between the load modulator and the circuit configuration is preferably effected automatically, in dependence on the level of voltage induced on the antenna. The switchover is effected in such a way that the load modulator is used within the normal communication range, and the inventive modulator outside the normal communication range. Finkenzeller at [0025] In particular for communication according to the standard ISO 14443 type A, exact timing is important. With conventional passive transponders, timing is ensured even in the transmit mode (load modulation) by the timing signal (13.56 MHz) continually received from the reading device. However, such a signal is no longer available in the transmit mode of an inventive circuit configuration. In one embodiment of the invention, an oscillator is therefore provided for example in the form of a quartz oscillator. Finkenzeller at [0027] The possibility of reading the inventive transponder unit over very large distances is not always desired, for example for privacy protection. It is therefore provided in one embodiment that the inventive circuit configuration can be activated manually if communication over a long range is explicitly desired. Otherwise, communication can be effected via a load modulator provided in the transponder unit, which is usable only for short distances. If no load modulator is provided in the trans-ponder unit, it can be provided for example that the transponder unit is activated for sending data only if the signal emitted by the reading device contains a predetermined code. Finkenzeller at [0047]

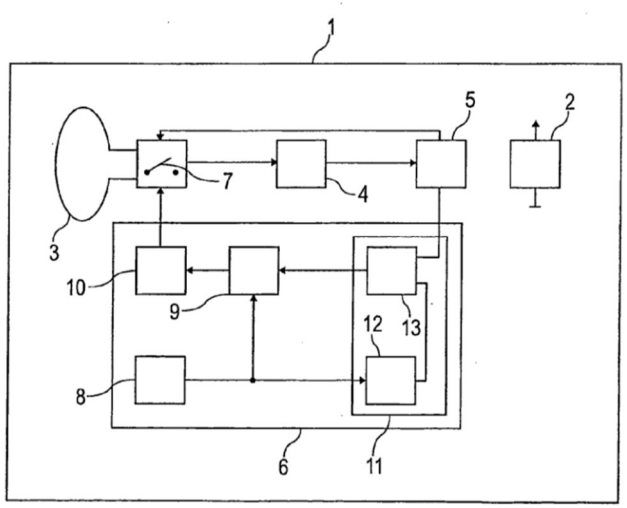
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	Depending on a type of system used, data can be transferred from the trans-ponders 200, 300 to the reading device 100 either by means of load modulation (inductive coupling) or by means of modulated backscatter cross section (electromagnetic backscatter coupling). Embodiments will preferably be described hereinafter for systems that transfer data to the reading device on the principle of load modulation. However, the individual aspects of the embodiments are largely also applicable analogously to systems that work on the principle of modulated backscatter cross sections of the transponder unit. Finkenzeller at [0048] The transponder unit 1 sends for data transfer to the reading device 100 a signal which the reading device 100 can evaluate as a signal of a transponder which carries out a load modulation of the field 110 of the reading device 100. Unlike the conventional transponders 200, 300 which modulate the field 110 of the reading device 100 into a modulated reading device field 102, 103, the transponder unit 1 thus generates and sends its own modulated field 20 as the signal for data transfer. The transponder unit 1 thus uses its own energy for the purpose of data transfer. Finkenzeller at [0056] The receiver 4 is provided for demodulating a signal transmitted from the reading device 100 to extract data therefrom. The extracted data are passed on to the controller 5 which processes them and generates data to be sent to the reading device 100. Furthermore, the controller 5 transmits a control signal to the switch 7 which switches between receive mode and transmit mode of the transponder unit. However, a separate antenna can instead be provided for sending. The controller 5 used can be for example a part of the operating system of a portable data carrier, such as a chip card. Finkenzeller at [0063] At the output of the ring modulator 9 an output signal is then available that contains the two modulation side bands and is identical (exactly enough) to a signal generated by load modulation or backscatter modulation. The output signal generated by the ring modulator 9 can then be optionally amplified by means of the amplifier 10, and be supplied to the antenna 3 for sending the data to be sent, via the switch 7 which is switched to the transmit mode of the transponder unit by a signal of the controller 5. Finkenzeller at [0065] The transponder unit 1 is operated in a first (active) operating mode as an actively sending transponder. In a second (passive) operating mode, however, the trans-ponder unit works like an ordinary passive transponder performing a load modulation on the field of the reading device.

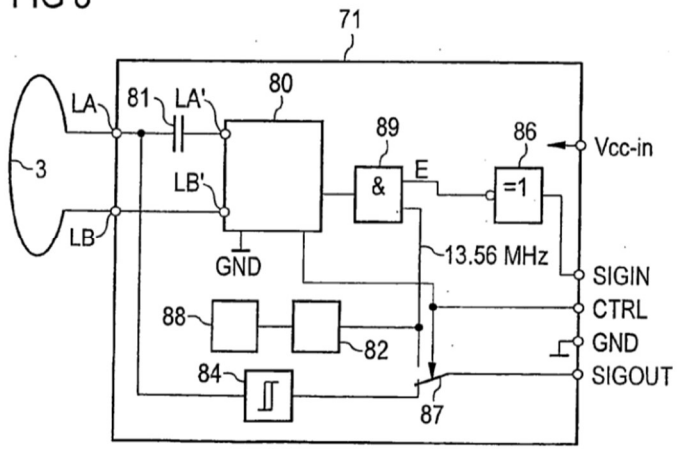
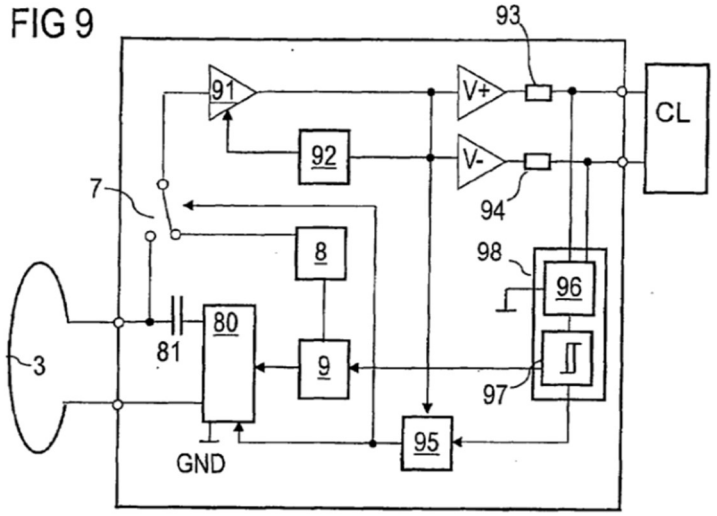
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	Finkenzeller at [0066] For example, the receiver 4 can additionally be formed as a conventional load modulator driven by the controller 5. The controller 5 then either switches the transmitter 6 on and the load modulator off, or the load modulator on and the transmitter 6 off. The switch 7 is switched accordingly. The criterion used for switching from a passive to an active operating state can be for example the received signal strength, the presence and/or sufficiency of an external voltage supply (on an optional connection Vcc not shown), or the sufficiency of an internal voltage supply (state of charge of the battery 2). It is thus for example possible to first operate a transponder unit 1 passively and switch it to an active operating mode if for example the distance from the reading device unintentionally increases. Finkenzeller at [0073] Just as in the structure according to FIG. 2, the binary data signal A is combined with a subcarrier signal B by an AND gate 43. The combined signal is available at a ring modulator 49. The digital ring modulator 49 used can be an XOR element. Departing from the structure of the transmitter in FIG. 2, a carrier signal C is not applied directly to the input of the ring modulator 49. Instead, the carrier signal C is first combined with a data signal A in an AND gate 46. This arrangement obtains better efficiency, as to be described more closely below. The output signal of the ring modulator 49 is amplified in an amplifier 40 before being emitted via the antenna 3 as the field of the transponder unit. The signal types A to C will hereinafter be described more closely by way of example with reference to FIG. 5. Finkenzeller at [0093] Both the interface module 71 and the chip 75 can draw their supply voltage from the device in which they are disposed preferably reversibly. The interface module 71 can act as an ordinary transponder in a second operating mode and supply the chip with an operating voltage Vcc_RF. Finkenzeller at [0096] The interface module 71 comprises an amplifier 80, an AND gate 89, an oscillator 88, a frequency divider 82, a signal shaper 84 and a switch 87. The amplifier 80 can be for example a push-pull amplifier with (digital) push-pull output amplifiers (not shown). The interface module also has two antenna connections LA and LB and a series capacitor 81. Furthermore, the interface module 71 has connections Vcc-in and GND for energy supply and a control input CTRL for switching between a transmit mode and a receive mode of the interface module by means of the switch 87. Finkenzeller at [0098]

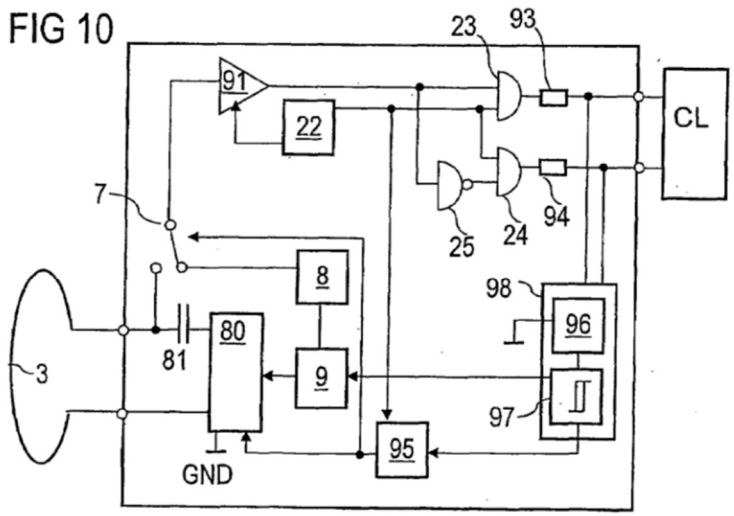
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	When the interface module is in the transmit mode, i.e. there is a contactless data transfer to an external reading device or an NFC device, a modulated subcarrier signal is fed in at the signal input SIGIN by the smart card chip and optionally inverted in an inverter 86. The inverted signal E is combined with a 13.56 MHz carrier frequency signal in the AND gate 89 as the carrier frequency modulator, and supplied to the amplifier 80. Finkenzeller at [0099] The antenna 3 and the series capacitor 81 form a series-resonant circuit which is connected to the outputs LA′ and LB′ of the amplifier 80, so that the HF current flowing in case of resonance is limited in the antenna resonant circuit only by the ohmic resistances in the lines and in the amplifier 80. This obtains a greatest possible transmit power of the interface module. Finkenzeller at [0100] Further, the smart card chip can be supplied a constant 13.56 MHz timing signal from the oscillator 88 via the output SIGOUT in the transmit mode via the switch 87, if it requires such an (external) timing signal for operation to keep exact timing. As described above, this is necessary for communication according to the standard ISO 14443 type A. Finkenzeller at [0103] The oscillator 88 generates the 13.56 MHz carrier frequency signal required in the transmit mode. If the oscillator cannot be switched off in the receive mode since its building-up transient might last too long, the oscillator is operated in the receive mode of the interface module preferably at a multiple N of the carrier frequency signal (e.g. 27.120 MHz) so as not to disturb the possibly weak received signal by crosstalk. In the transmit mode the required 13.56 MHz signal can then be generated by dividing the oscillator signal by N by means of an optional divider 82. Finkenzeller at [0107] The transponder chip CL is a conventional RFID chip according to the prior art. It is normally connected at its connections with an antenna, e.g. in a chip card. Further, the transponder chip CL is so designed that data transfer from the transponder unit to a reading device is carried out by means of load modulation. This is almost always the case in usual RFID systems used at 13.56 MHz or also 125 kHz (e.g. ISO/IEC 14443, ISO/IEC 15693, ISO/IEC 18000-3). Finkenzeller at [0112]

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	As soon as the RFID chip CL has received and processed a command, it tries to send a response back to the remote reading device. For this purpose the RFID chip normally uses a load modulation, i.e. an additional parallel resistor in the chip is switched on and off in time with the modulation signal. This leads to measurable fluctuations in the voltage drop across the resistors 93, 94. In other words, the HF alternating voltage at the connections is modulated in amplitude. By the demodulator circuit 98 this amplitude-modulated alternating voltage signal is demodulated and the original modulation signal thus reconstructed again. Finkenzeller at [0115] The reconstructed modulation signal and the signal of the oscillator 8 are supplied to the modulator circuit 9. The exact function of such a circuit has already been described in detail. The output signal of the modulator circuit 9 is supplied to the amplifier 80 and sent via the antenna 3 to the remote reading device. Finkenzeller at [0117] An important role is played by the signal received by the controller 95 from the receive branch (91, 92 V+, V−). When a reading device sends data to the trans-ponder unit by means of an amplitude modulation of the emitted field (e.g. 150/IEC 14443-A: 100% ASK, ISO/IEC 14443-B: 10% ASK), this modulation is also passed on to the transponder chip CL. The demodulation circuit 98 can possibly not distinguish here between a modulation signal from a reading device and a load modulation of the RFID chip CL, since both are expressed as amplitude modulation of the HF signal on the connections of the RFID chip CL. Finkenzeller at [0118] However, a load modulation of the transponder chip CL is recognizable exclusively on the connections, but a modulation signal of the reading device already in the receive branch (91, 92, V+, V−) of the inventive circuit. It is therefore provided to switch the inventive circuit to the transmit mode only when a modulation signal (amplitude modulation) can be detected exclusively on the connections of the RFID chip CL and not in the receive branch, since only in this case is a load modulation involved. This is indicated in FIG. 9 by the signal fed into the controller 95 from the receive branch (91, 92, V+, V−). Finkenzeller at [0119] A second way of distinguishing is to evaluate the modulation depth of the signal on the connections of the RFID chip. By load modulation a modulation depth less than 100% is obtained. In the breadboard setup approx. 25% was determined, other values arise from combining different resistors 93, 94 with different RFID chips CL. It is therefore provided to distinguish between the load modulation and the modulation of the reading device by determining modulation depth with reference to given switching thresholds. If the

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	strength of the modulation signal is above a first, high threshold, a signal from the reading device is present. If the modulation signal is smaller than the first switching threshold and optionally greater than a second switching threshold, however, it is recognized that a load modulation is present. A switch-over to the transmit mode is effected if the modulation was caused by a load modulation. Finkenzeller at [0127] It was ascertained that small antennas, e.g. in a SIM card with its own antenna (approx. 15×25 mm^2), obtain very low read ranges with a conventional load modulation. It is frequently even impossible to communicate with a contactless reading device when the SIM card with an antenna is disposed for example in a mobile telephone. If one of the inventive transmitters is used in a mobile terminal the range is not clearly increased. Moreover, it can be advantageously exploited that mobile terminals such as mobile telephones, PDAs, etc., have their own energy supply (battery) which can also be used for supplying an inventive circuit. Finkenzeller at [0129] Thus, an NFC unit could be adapted to behave according to the present solutions in its passive mode in the role ("being card") in which the NFC unit is to perform a load modulation. The NFC unit could for example always act as a component actively emitting its own field. Likewise, the NFC unit could also distinguish, and optionally switch, between a first submode corresponding to a conventional load modulation and an actively sending, second submode in which the load modulation is simulated. A thus improved NFC unit can also communicate with ordinary RFID reading devices over a higher range with the help of the changed passive operating mode. Since NFC units will already have certain units—such as an oscillator, an amplifier and a controller—for independent sending in their conventional active mode, comparatively few modifications of an NFC circuit are required to realize a circuit according to the present application in an NFC unit. *See also* Finkenzeller at [0004], [0055], [0057], [0060], [0076], and [0131]. To the extent this limitation is not disclosed by Finkenzeller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Finkenzeller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* [1c] and claim 13 above.
15. The mobile device of claim 13 wherein the driver circuit	Finkenzeller expressly or inherently discloses "[t]he mobile device of claim 13 wherein the driver circuit comprises an active transmit driver circuit." For example:

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comprises an active transmit driver circuit.	Finkenzeller at Figure 2 FIG 2  Finkenzeller at Figure 8

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	FIG 8  Finkenzeller at Figure 9 FIG 9 

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	Finkenzeller at Figure 10  Finkenzeller at [0004] The range within which communication is possible in the system by data transfer can be increased by using active transponders, that is, transponders with their own energy supply. The energy supply of the active transponder, for example in form of a battery, operates its electronic circuit. Conventional transponders without their own energy supply are referred to as passive transponders, in contrast. Finkenzeller at [0010] According to the invention, a transponder unit sends a signal to a transponder reading device, which can communicate with the transponders by means of modulation of its own field by transponders, in such a way that the reading device can evaluate the signal as modulation by a conventional transponder. Instead of performing a load modulation or backscatter modulation of a field of the reading device, the transponder unit itself thus emits a field that simulates for the reading device a modulation of the reading device field by a transponder. An inventive transponder unit has means for sending the accordingly modulated signal. The total range of the system is consequently no longer limited by the communication range of the reading device, but is extended therebeyond up to a transmit range of the transponder unit.

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	Finkenzeller at [0011] In an advantageous embodiment, an inventive RFID transponder unit has its own energy supply, at least one antenna for transmitting signals from and/or to a reading device, and an electronic circuit. The electronic circuit of the inventive transponder unit comprises a transmitter consisting of an oscillator and a modulator. Finkenzeller at [0015] Both modulators (ring modulator and ASK modulator) modulate the oscillator signal by means of the (modulated) data signal and deliver an output signal which is then transmitted to the reading device via the receive antenna or a separate transmitting antenna. Finkenzeller at [0017] A special advantage of using the described modulators is their compatibility to the prior art, since they deliver an output signal to be sent to the reading device whose (frequency and amplitude) spectrum is very similar to that of a load or backscatter modulation, as described above. Therefore, no technical changes must be performed on conventional reading devices. The inventive transponder can thus be operated with commercially available RFID reading devices, the communication range being many times that of passive or even active transponders. For example, a commercially available ISO 14443 reading device which can communicate with an inductively coupled, contactless chip card according to the prior art over a distance of approx. 10 cm could communicate with an inventive transponder unit over many times this distance. Finkenzeller at [0021] In a development, the inventive transponder unit has a load modulator according to the prior art, in addition to the above-described circuit having a receiver, a controller, an oscillator and a modulator. Finkenzeller at [0022] The voltage induced on the antenna of the transponder unit can be a problem for the operation of the inventive modulator circuits if the distance between trans-ponder unit and reading device is small and the induced voltage is therefore accordingly great. Therefore, the data to be sent to the reading device which are generated in the controller are supplied alternatively to the load modulator or to the inventive circuit configuration with a modulator. The switchover between the load modulator and the circuit configuration is preferably effected automatically, in dependence on the level of voltage induced on the antenna. The switchover is effected in such a way that the load modulator is used within the normal communication range, and the inventive modulator outside the normal communication range.

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	Finkenzeller at [0027] The possibility of reading the inventive transponder unit over very large distances is not always desired, for example for privacy protection. It is therefore provided in one embodiment that the inventive circuit configuration can be activated manually if communication over a long range is explicitly desired. Otherwise, communication can be effected via a load modulator provided in the transponder unit, which is usable only for short distances. If no load modulator is provided in the trans-ponder unit, it can be provided for example that the transponder unit is activated for sending data only if the signal emitted by the reading device contains a predetermined code. Finkenzeller at [0048] The transponder unit 1 sends for data transfer to the reading device 100 a signal which the reading device 100 can evaluate as a signal of a transponder which carries out a load modulation of the field 110 of the reading device 100. Unlike the conventional transponders 200, 300 which modulate the field 110 of the reading device 100 into a modulated reading device field 102, 103, the transponder unit 1 thus generates and sends its own modulated field 20 as the signal for data transfer. The transponder unit 1 thus uses its own energy for the purpose of data transfer. Finkenzeller at [0055] FIG. 2 shows purely schematically the transponder unit 1, for example in the form of an inductively coupled chip card, which comprises the usual components not shown explicitly here. For simplification, only one inventive RFID transponder unit in a chip card is shown. The transponder unit has a battery 2, an inductive antenna 3 and an electronic circuit 4, 5, 6, 7. The electronic circuit consists substantially of three functional blocks, a receiver 4, a controller 5 and a transmitter 6. A switch 7 is used for switching the antenna 3 between the receiver 4 and the transmitter 6. Finkenzeller at [0056] The receiver 4 is provided for demodulating a signal transmitted from the reading device 100 to extract data therefrom. The extracted data are passed on to the controller 5 which processes them and generates data to be sent to the reading device 100. Furthermore, the controller 5 transmits a control signal to the switch 7 which switches between receive mode and transmit mode of the transponder unit. However, a separate antenna can instead be provided for sending. The controller 5 used can be for example a part of the operating system of a portable data carrier, such as a chip card. Finkenzeller at [0057]

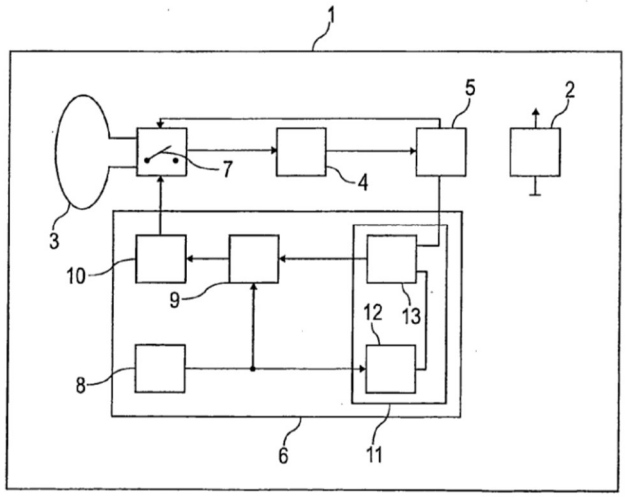
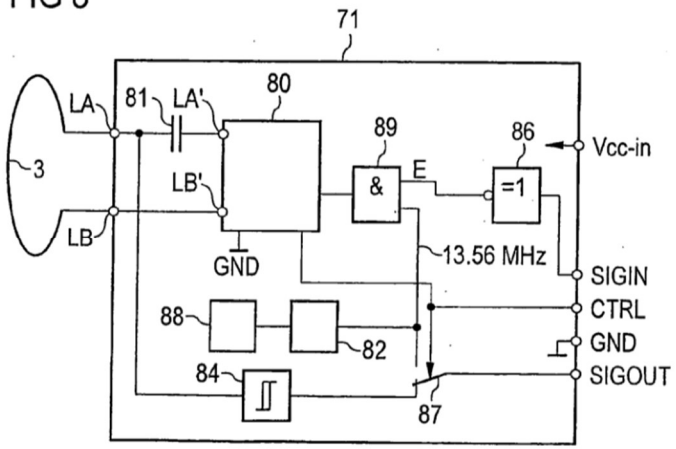
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	The transmitter 6 consists of an oscillator 8, a modulator, an execution as a ring modulator 9 first being described, and a terminal repeater 10. Furthermore, the transmitter 6 of the transponder unit shown in FIG. 2 is extended by an electronic assembly 11 for generating and modulating a subcarrier signal to carry out the data transfer from the transponder unit to a reading device 100 with a subcarrier signal. Depending on the use of the transponder unit, the subcarrier signal can have different frequencies, for example 848 kHz according to ISO 14443, 424 kHz according to ISO 15693 and 212 kHz for LEGIC, but might also be completely omitted. Finkenzeller at [0060] To supply the active components of the transponder unit at least partly with energy and to increase the energy range between the transponder unit 1 and the reading device 100, the inventive transponder unit has a battery 2. Finkenzeller at [0063] At the output of the ring modulator 9 an output signal is then available that contains the two modulation side bands and is identical (exactly enough) to a signal generated by load modulation or backscatter modulation. The output signal generated by the ring modulator 9 can then be optionally amplified by means of the amplifier 10, and be supplied to the antenna 3 for sending the data to be sent, via the switch 7 which is switched to the transmit mode of the transponder unit by a signal of the controller 5. Finkenzeller at [0065] The transponder unit 1 is operated in a first (active) operating mode as an actively sending transponder. In a second (passive) operating mode, however, the trans-ponder unit works like an ordinary passive transponder performing a load modulation on the field of the reading device. Finkenzeller at [0066] For example, the receiver 4 can additionally be formed as a conventional load modulator driven by the controller 5. The controller 5 then either switches the transmitter 6 on and the load modulator off, or the load modulator on and the transmitter 6 off. The switch 7 is switched accordingly. The criterion used for switching from a passive to an active operating state can be for example the received signal strength, the presence and/or sufficiency of an external voltage supply (on an optional connection Vcc not shown), or the sufficiency of an internal voltage supply (state of charge of the battery 2). It is thus for example possible to first operate a transponder unit 1 passively and switch it to an active operating mode if for example the distance from the reading device unintentionally increases.

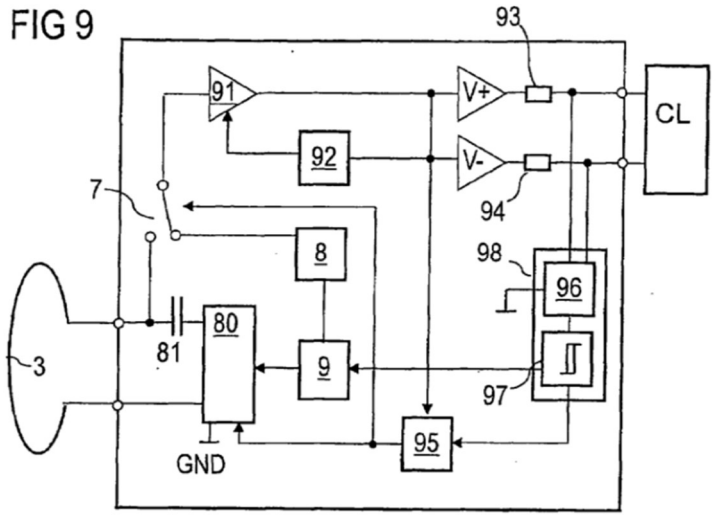
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	Finkenzeller at [0073] Just as in the structure according to FIG. 2, the binary data signal A is combined with a subcarrier signal B by an AND gate 43. The combined signal is available at a ring modulator 49. The digital ring modulator 49 used can be an XOR element. Departing from the structure of the transmitter in FIG. 2, a carrier signal C is not applied directly to the input of the ring modulator 49. Instead, the carrier signal C is first combined with a data signal A in an AND gate 46. This arrangement obtains better efficiency, as to be described more closely below. The output signal of the ring modulator 49 is amplified in an amplifier 40 before being emitted via the antenna 3 as the field of the transponder unit. The signal types A to C will hereinafter be described more closely by way of example with reference to FIG. 5. Finkenzeller at [0076] The signal D emitted by an antenna 3 to a reading device has a frequency spectrum that is like a frequency spectrum resulting by means of load modulation. The signal D can optionally be amplified by means of an amplifier 40. The amplifier 40 can be for example a push-pull amplifier with digital push-pull output amplifiers. Finkenzeller at [0093] Both the interface module 71 and the chip 75 can draw their supply voltage from the device in which they are disposed preferably reversibly. The interface module 71 can act as an ordinary transponder in a second operating mode and supply the chip with an operating voltage Vcc_RF. Finkenzeller at [0096] The interface module 71 comprises an amplifier 80, an AND gate 89, an oscillator 88, a frequency divider 82, a signal shaper 84 and a switch 87. The amplifier 80 can be for example a push-pull amplifier with (digital) push-pull output amplifiers (not shown). The interface module also has two antenna connections LA and LB and a series capacitor 81. Furthermore, the interface module 71 has connections Vcc-in and GND for energy supply and a control input CTRL for switching between a transmit mode and a receive mode of the interface module by means of the switch 87. Finkenzeller at [0098] When the interface module is in the transmit mode, i.e. there is a contactless data transfer to an external reading device or an NFC device, a modulated subcarrier signal is fed in at the signal input SIGIN by the smart card chip and optionally inverted in an inverter 86. The inverted signal E is combined with a 13.56

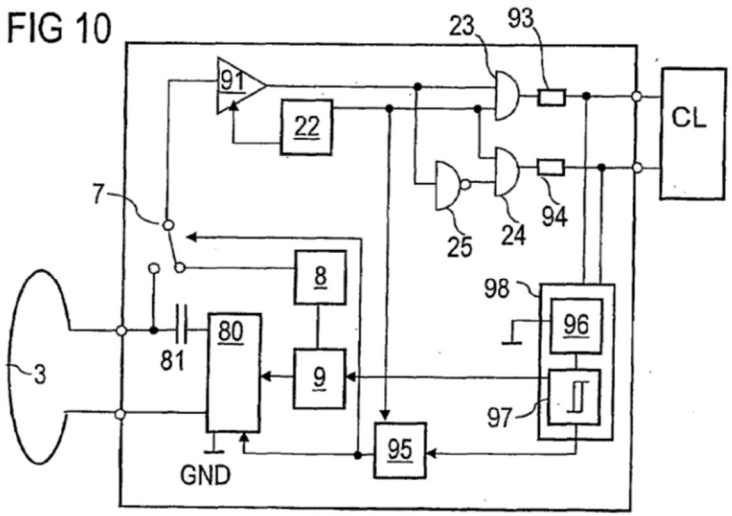
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	MHz carrier frequency signal in the AND gate 89 as the carrier frequency modulator, and supplied to the amplifier 80. Finkenzeller at [0099] The antenna 3 and the series capacitor 81 form a series-resonant circuit which is connected to the outputs LA′ and LB′ of the amplifier 80, so that the HF current flowing in case of resonance is limited in the antenna resonant circuit only by the ohmic resistances in the lines and in the amplifier 80. This obtains a greatest possible transmit power of the interface module. Finkenzeller at [0100] Further, the smart card chip can be supplied a constant 13.56 MHz timing signal from the oscillator 88 via the output SIGOUT in the transmit mode via the switch 87, if it requires such an (external) timing signal for operation to keep exact timing. As described above, this is necessary for communication according to the standard ISO 14443 type A. Finkenzeller at [0103] The oscillator 88 generates the 13.56 MHz carrier frequency signal required in the transmit mode. If the oscillator cannot be switched off in the receive mode since its building-up transient might last too long, the oscillator is operated in the receive mode of the interface module preferably at a multiple N of the carrier frequency signal (e.g. 27.120 MHz) so as not to disturb the possibly weak received signal by crosstalk. In the transmit mode the required 13.56 MHz signal can then be generated by dividing the oscillator signal by N by means of an optional divider 82. Finkenzeller at [0112] As soon as the RFID chip CL has received and processed a command, it tries to send a response back to the remote reading device. For this purpose the RFID chip normally uses a load modulation, i.e. an additional parallel resistor in the chip is switched on and off in time with the modulation signal. This leads to measurable fluctuations in the voltage drop across the resistors 93, 94. In other words, the HF alternating voltage at the connections is modulated in amplitude. By the demodulator circuit 98 this amplitude-modulated alternating voltage signal is demodulated and the original modulation signal thus reconstructed again. Finkenzeller at [0118] However, a load modulation of the transponder chip CL is recognizable exclusively on the connections, but a modulation signal of the reading device already in the receive branch (91, 92, V+, V−) of the

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	inventive circuit. It is therefore provided to switch the inventive circuit to the transmit mode only when a modulation signal (amplitude modulation) can be detected exclusively on the connections of the RFID chip CL and not in the receive branch, since only in this case is a load modulation involved. This is indicated in FIG. 9 by the signal fed into the controller 95 from the receive branch (91, 92, V+, V−). Finkenzeller at [0119] A second way of distinguishing is to evaluate the modulation depth of the signal on the connections of the RFID chip. By load modulation a modulation depth less than 100% is obtained. In the breadboard setup approx. 25% was determined, other values arise from combining different resistors 93, 94 with different RFID chips CL. It is therefore provided to distinguish between the load modulation and the modulation of the reading device by determining modulation depth with reference to given switching thresholds. If the strength of the modulation signal is above a first, high threshold, a signal from the reading device is present. If the modulation signal is smaller than the first switching threshold and optionally greater than a second switching threshold, however, it is recognized that a load modulation is present. A switch-over to the transmit mode is effected if the modulation was caused by a load modulation. Finkenzeller at [0127] It was ascertained that small antennas, e.g. in a SIM card with its own antenna (approx. 15×25 mm^2), obtain very low read ranges with a conventional load modulation. It is frequently even impossible to communicate with a contactless reading device when the SIM card with an antenna is disposed for example in a mobile telephone. If one of the inventive transmitters is used in a mobile terminal the range is not clearly increased. Moreover, it can be advantageously exploited that mobile terminals such as mobile telephones, PDAs, etc., have their own energy supply (battery) which can also be used for supplying an inventive circuit. Finkenzeller at [0129] Thus, an NFC unit could be adapted to behave according to the present solutions in its passive mode in the role ("being card") in which the NFC unit is to perform a load modulation. The NFC unit could for example always act as a component actively emitting its own field. Likewise, the NFC unit could also distinguish, and optionally switch, between a first submode corresponding to a conventional load modulation and an actively sending, second submode in which the load modulation is simulated. A thus improved NFC unit can also communicate with ordinary RFID reading devices over a higher range with the help of the changed passive operating mode. Since NFC units will already have certain units—such as an oscillator, an amplifier and a controller—for independent sending in their conventional active mode,

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	comparatively few modifications of an NFC circuit are required to realize a circuit according to the present application in an NFC unit. Finkenzeller at [0131] The individual functional components of the transponder unit—antenna, interface unit, chip and optionally voltage supply unit—can be disposed in all sorts of combinations separately from each other or integrated jointly in one unit. An inventive transponder unit can be formed for example as a specially designed transponder, in a portable data carrier, in particular a chip card, which optionally has a battery. A portable data carrier, in particular SIM card, with a chip and an interface unit can be connected in a mobile terminal to an external voltage source and/or an external antenna. The interface unit can be disposed in a terminal, connected to its own or an external antenna, and communicate with a chip which is disposed reversibly or firmly in the terminal or temporarily on the terminal. Finkenzeller at claim 19 19. The transponder unit according to claim 16, including at least one antenna for transmitting the signal either or both from and to the reading device; a receiver for demodulating a signal transmitted from the reading device to extract data therefrom; and an electronic circuit which is set up to process the extracted data and to generate data to be sent to the reading device. *See also* Finkenzeller at [0107] and [0115]. To the extent this limitation is not disclosed by Finkenzeller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Finkenzeller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* [7c] and claim 13 above.
16. The mobile device of claim 15 wherein the active transmit driver circuit is coupled to be powered by the mobile device.	Finkenzeller expressly or inherently discloses "[t]he mobile device of claim 15 wherein the active transmit driver circuit is coupled to be powered by the mobile device." For example: Finkenzeller at Figure 2

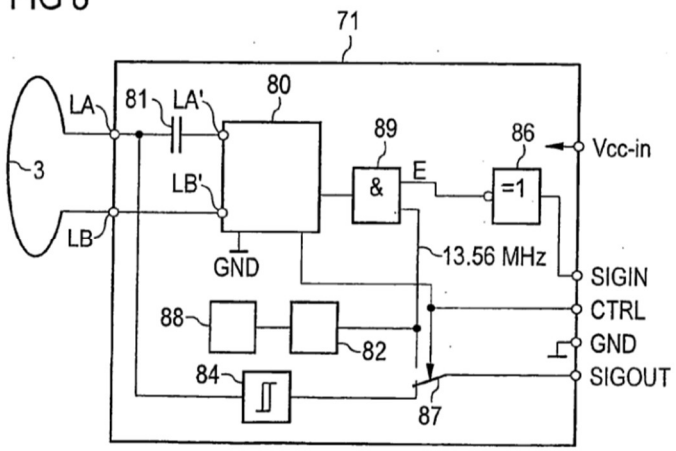
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	FIG 2  Finkenzeller at Figure 8 FIG 8 

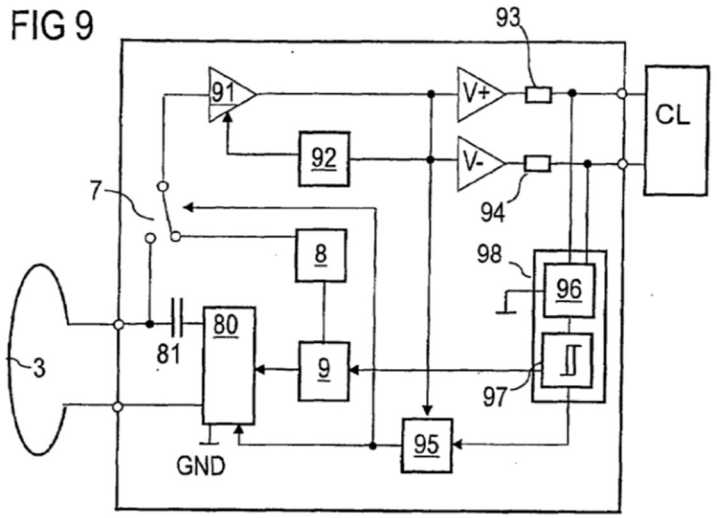
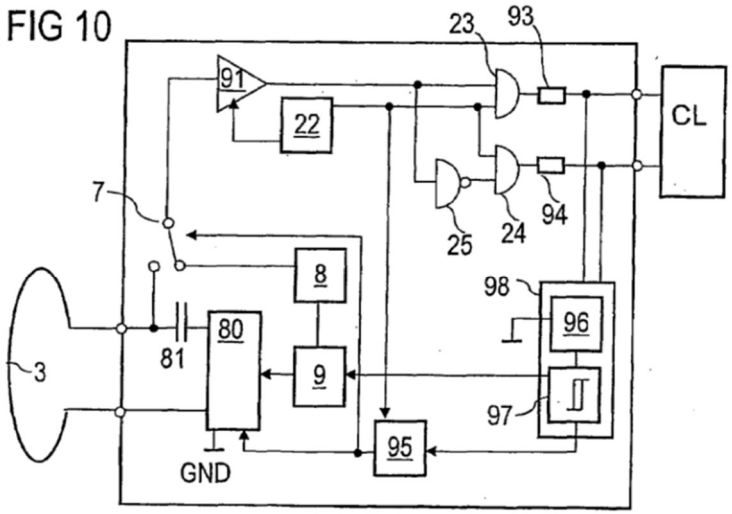
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	Finkenzeller at Figure 9  Finkenzeller at Figure 10

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	 Finkenzeller at [0004] The range within which communication is possible in the system by data transfer can be increased by using active transponders, that is, transponders with their own energy supply. The energy supply of the active transponder, for example in form of a battery, operates its electronic circuit. Conventional transponders without their own energy supply are referred to as passive transponders, in contrast. Finkenzeller at [0011] In an advantageous embodiment, an inventive RFID transponder unit has its own energy supply, at least one antenna for transmitting signals from and/or to a reading device, and an electronic circuit. The electronic circuit of the inventive transponder unit comprises a transmitter consisting of an oscillator and a modulator. Finkenzeller at [0048] The transponder unit 1 sends for data transfer to the reading device 100 a signal which the reading device 100 can evaluate as a signal of a transponder which carries out a load modulation of the field 110 of the reading device 100. Unlike the conventional transponders 200, 300 which modulate the field 110 of the reading device 100 into a modulated reading device field 102, 103, the transponder unit 1 thus generates

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	and sends its own modulated field 20 as the signal for data transfer. The transponder unit 1 thus uses its own energy for the purpose of data transfer. Finkenzeller at [0055] FIG. 2 shows purely schematically the transponder unit 1, for example in the form of an inductively coupled chip card, which comprises the usual components not shown explicitly here. For simplification, only one inventive RFID transponder unit in a chip card is shown. The transponder unit has a battery 2, an inductive antenna 3 and an electronic circuit 4, 5, 6, 7. The electronic circuit consists substantially of three functional blocks, a receiver 4, a controller 5 and a transmitter 6. A switch 7 is used for switching the antenna 3 between the receiver 4 and the transmitter 6. Finkenzeller at [0060] To supply the active components of the transponder unit at least partly with energy and to increase the energy range between the transponder unit 1 and the reading device 100, the inventive transponder unit has a battery 2. Finkenzeller at [0063] At the output of the ring modulator 9 an output signal is then available that contains the two modulation side bands and is identical (exactly enough) to a signal generated by load modulation or backscatter modulation. The output signal generated by the ring modulator 9 can then be optionally amplified by means of the amplifier 10, and be supplied to the antenna 3 for sending the data to be sent, via the switch 7 which is switched to the transmit mode of the transponder unit by a signal of the controller 5. Finkenzeller at [0065] The transponder unit 1 is operated in a first (active) operating mode as an actively sending transponder. In a second (passive) operating mode, however, the trans-ponder unit works like an ordinary passive transponder performing a load modulation on the field of the reading device. Finkenzeller at [0066] For example, the receiver 4 can additionally be formed as a conventional load modulator driven by the controller 5. The controller 5 then either switches the transmitter 6 on and the load modulator off, or the load modulator on and the transmitter 6 off. The switch 7 is switched accordingly. The criterion used for switching from a passive to an active operating state can be for example the received signal strength, the presence and/or sufficiency of an external voltage supply (on an optional connection Vcc not shown), or the sufficiency of an internal voltage supply (state of charge of the battery 2). It is thus for example

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	possible to first operate a transponder unit 1 passively and switch it to an active operating mode if for example the distance from the reading device unintentionally increases. Finkenzeller at [0093] Both the interface module 71 and the chip 75 can draw their supply voltage from the device in which they are disposed preferably reversibly. The interface module 71 can act as an ordinary transponder in a second operating mode and supply the chip with an operating voltage Vcc_RF. Finkenzeller at [0127] It was ascertained that small antennas, e.g. in a SIM card with its own antenna (approx. 15×25 mm^2), obtain very low read ranges with a conventional load modulation. It is frequently even impossible to communicate with a contactless reading device when the SIM card with an antenna is disposed for example in a mobile telephone. If one of the inventive transmitters is used in a mobile terminal the range is not clearly increased. Moreover, it can be advantageously exploited that mobile terminals such as mobile telephones, PDAs, etc., have their own energy supply (battery) which can also be used for supplying an inventive circuit. Finkenzeller at [0129] Thus, an NFC unit could be adapted to behave according to the present solutions in its passive mode in the role ("being card") in which the NFC unit is to perform a load modulation. The NFC unit could for example always act as a component actively emitting its own field. Likewise, the NFC unit could also distinguish, and optionally switch, between a first submode corresponding to a conventional load modulation and an actively sending, second submode in which the load modulation is simulated. A thus improved NFC unit can also communicate with ordinary RFID reading devices over a higher range with the help of the changed passive operating mode. Since NFC units will already have certain units—such as an oscillator, an amplifier and a controller—for independent sending in their conventional active mode, comparatively few modifications of an NFC circuit are required to realize a circuit according to the present application in an NFC unit. Finkenzeller at [0131] The individual functional components of the transponder unit—antenna, interface unit, chip and optionally voltage supply unit—can be disposed in all sorts of combinations separately from each other or integrated jointly in one unit. An inventive transponder unit can be formed for example as a specially designed transponder, in a portable data carrier, in particular a chip card, which optionally has a battery. A portable data carrier, in particular SIM card, with a chip and an interface unit can be connected in a

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	mobile terminal to an external voltage source and/or an external antenna. The interface unit can be disposed in a terminal, connected to its own or an external antenna, and communicate with a chip which is disposed reversibly or firmly in the terminal or temporarily on the terminal. To the extent this limitation is not disclosed by Finkenzeller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Finkenzeller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 11 and claim 15 above.
17. The mobile device of claim 13 wherein the amplifier is coupled to be powered by the mobile device.	Finkenzeller expressly or inherently discloses "[t]he mobile device of claim 13 wherein the amplifier is coupled to be powered by the mobile device." For example: Finkenzeller at Figure 8 FIG 8  Finkenzeller at Figure 9

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	FIG 9  Finkenzeller at Figure 10 FIG 10 

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	Finkenzeller at [0048] The transponder unit 1 sends for data transfer to the reading device 100 a signal which the reading device 100 can evaluate as a signal of a transponder which carries out a load modulation of the field 110 of the reading device 100. Unlike the conventional transponders 200, 300 which modulate the field 110 of the reading device 100 into a modulated reading device field 102, 103, the transponder unit 1 thus generates and sends its own modulated field 20 as the signal for data transfer. The transponder unit 1 thus uses its own energy for the purpose of data transfer. Finkenzeller at [0060] To supply the active components of the transponder unit at least partly with energy and to increase the energy range between the transponder unit 1 and the reading device 100, the inventive transponder unit has a battery 2. Finkenzeller at [0063] At the output of the ring modulator 9 an output signal is then available that contains the two modulation side bands and is identical (exactly enough) to a signal generated by load modulation or backscatter modulation. The output signal generated by the ring modulator 9 can then be optionally amplified by means of the amplifier 10, and be supplied to the antenna 3 for sending the data to be sent, via the switch 7 which is switched to the transmit mode of the transponder unit by a signal of the controller 5. Finkenzeller at [0065] The transponder unit 1 is operated in a first (active) operating mode as an actively sending transponder. In a second (passive) operating mode, however, the trans-ponder unit works like an ordinary passive transponder performing a load modulation on the field of the reading device. Finkenzeller at [0066] For example, the receiver 4 can additionally be formed as a conventional load modulator driven by the controller 5. The controller 5 then either switches the transmitter 6 on and the load modulator off, or the load modulator on and the transmitter 6 off. The switch 7 is switched accordingly. The criterion used for switching from a passive to an active operating state can be for example the received signal strength, the presence and/or sufficiency of an external voltage supply (on an optional connection Vcc not shown), or the sufficiency of an internal voltage supply (state of charge of the battery 2). It is thus for example possible to first operate a transponder unit 1 passively and switch it to an active operating mode if for example the distance from the reading device unintentionally increases.

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
	Finkenzeller at [0093] Both the interface module 71 and the chip 75 can draw their supply voltage from the device in which they are disposed preferably reversibly. The interface module 71 can act as an ordinary transponder in a second operating mode and supply the chip with an operating voltage Vcc_RF. Finkenzeller at [0127] It was ascertained that small antennas, e.g. in a SIM card with its own antenna (approx. 15×25 mm^2), obtain very low read ranges with a conventional load modulation. It is frequently even impossible to communicate with a contactless reading device when the SIM card with an antenna is disposed for example in a mobile telephone. If one of the inventive transmitters is used in a mobile terminal the range is not clearly increased. Moreover, it can be advantageously exploited that mobile terminals such as mobile telephones, PDAs, etc., have their own energy supply (battery) which can also be used for supplying an inventive circuit. Finkenzeller at [0129] Thus, an NFC unit could be adapted to behave according to the present solutions in its passive mode in the role ("being card") in which the NFC unit is to perform a load modulation. The NFC unit could for example always act as a component actively emitting its own field. Likewise, the NFC unit could also distinguish, and optionally switch, between a first submode corresponding to a conventional load modulation and an actively sending, second submode in which the load modulation is simulated. A thus improved NFC unit can also communicate with ordinary RFID reading devices over a higher range with the help of the changed passive operating mode. Since NFC units will already have certain units—such as an oscillator, an amplifier and a controller—for independent sending in their conventional active mode, comparatively few modifications of an NFC circuit are required to realize a circuit according to the present application in an NFC unit. *See also* Finkenzeller at [0004] and [0011]. To the extent this limitation is not disclosed by Finkenzeller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Finkenzeller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 13 above.

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2009/0040022 ("Finkenzeller")
18. The mobile device of claim 13 wherein the antenna is tuned to operate at 13.56 MHz.	Finkenzeller expressly or inherently discloses "[t]he mobile device of claim 13 wherein the antenna is tuned to operate at 13.56 MHz." For example: *See* above at claim 2. To the extent this limitation is not disclosed by Finkenzeller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Finkenzeller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 13 above.
19. The mobile device of claim 13 wherein the antenna comprises an inductive element too small to draw enough power sufficient to operate the smartcard controller from an interrogating radio frequency (RF) field.	Finkenzeller expressly or inherently discloses "[t]he mobile device of claim 13 wherein the antenna comprises an inductive element too small to draw enough power sufficient to operate the smartcard controller from an interrogating radio frequency (RF) field." For example: *See* above at claim 3. To the extent this limitation is not disclosed by Finkenzeller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Finkenzeller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 13 above.
20. The mobile device of claim 13 wherein the mobile device comprises a mobile phone.	Finkenzeller expressly or inherently discloses "[t]he mobile device of claim 13 wherein the mobile device comprises a mobile phone." For example: *See* above at claim 6. To the extent this limitation is not disclosed by Finkenzeller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Finkenzeller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 13 above.

DEFENDANTS' INVALIDITY CONTENTIONS FOR U.S. PAT. 9,122,965

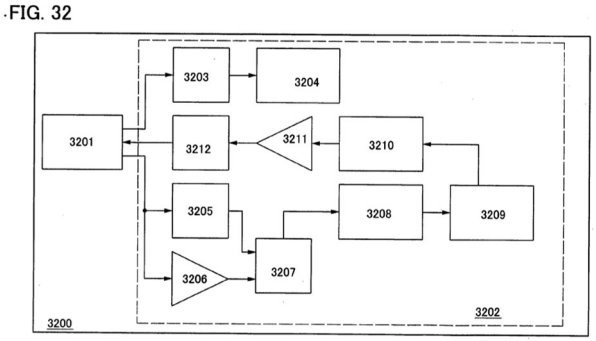
EXHIBIT A02: U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")

As demonstrated in the claim charts below, the claims of U.S. Patent No. 9,122,965 ("the '965 patent") are invalid (a) under one or more sections of 35 U.S.C. § 102 as anticipated by Yamazaki–279 and (b) under 35 U.S.C. § 103(a) as obvious over Yamazaki–279 standing alone and as set forth herein, and/or combined with the knowledge of a person of ordinary skill in the art, Applicant's Admitted Prior Art, and/or the additional prior art references discussed in Exhibit A and Exhibits A01–A05, the contents of which are hereby incorporated by reference into this chart. One of ordinary skill in the art, as of the priority date of the '965 patent, would have known to combine the prior art elements disclosed by the foregoing references using known methods, and to use these elements according to their established functions in order to achieve a known and predictable result.

Defendants have conducted the invalidity analysis herein based at least in part and in some instance entirely upon Plaintiff's apparent application of the claims of the '965 patent. By charting the prior art against the claims and limitations herein, Defendants are not admitting or agreeing to Plaintiff's application of the claims at issue in this case, and these charts should not be interpreted as an admission or concession by Defendants that any particular construction or application of any claim limitation by Plaintiff is correct or proper. Additionally, these charts provide representative examples of portions of the charted references that disclose the indicated limitations of the claims; additional portions of these references other than the representative examples provided herein may also disclose the indicated limitation(s) and Defendants contend that the asserted claims are invalid in light of the charted reference(s) as a whole in its or their entirety. Where a particular figure is cited, the citation should be understood to encompass the caption and description of the figure as well as any text relating to or describing the figure. Conversely, where particular text referring to a figure is cited, the citation should be understood to include the figure as well.

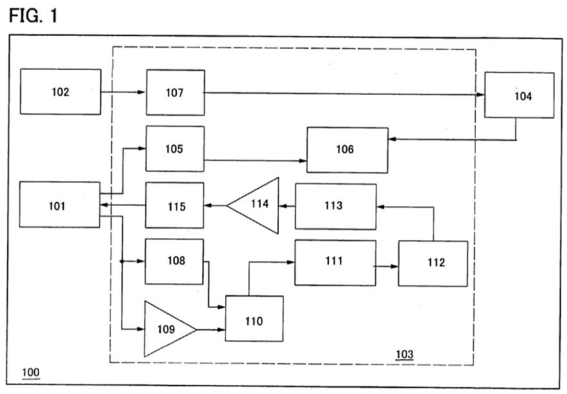
Claim Element	**Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")**
1[pre]. A mobile device comprising:	By providing this disclosure, Defendants do not take a position on whether the preamble is a claim limitation. Yamazaki–279 discloses or renders obvious "[a] mobile device." For example: Yamazaki–279 at [0001] The present invention relates to a semiconductor device. In particular, the present invention relates to a semiconductor device which transmits and receives data through radio waves and receives power. Furthermore, the present invention relates to a communication system using a semiconductor device through radio waves, an antenna and a reader/writer which transmit and receive data to and from the semiconductor device, and an antenna and a charger which supply power to the semiconductor device. Yamazaki–279 at [0002] Note that a semiconductor device in this specification refers to all devices which can function by using a semiconductor property. Yamazaki–279 at [0114]

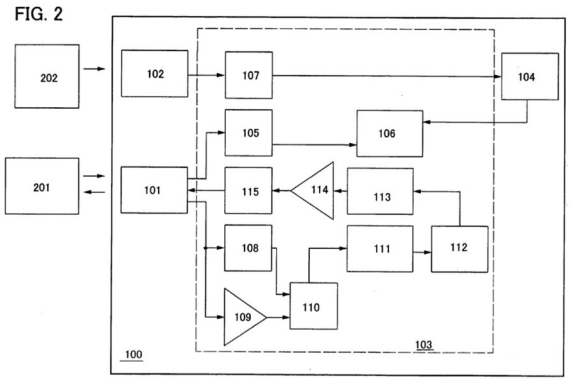
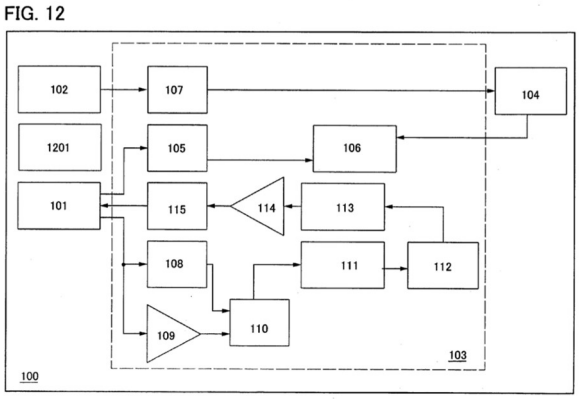
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	As described above, a semiconductor device including an RFID of the present invention includes a battery. Therefore, similarly to a conventional semiconductor device, the semiconductor device of the present invention can prevent power shortage for transmitting and receiving individual information associated with deterioration over time of a cell. In addition, the semiconductor device of the present invention has an antenna which receives a signal for supplying power to the battery. Therefore, when power of radio waves from outside is used, the battery can be charged without direct connection between the semiconductor device and the charger. Accordingly, the semiconductor device of the present invention can be continuously used without generating confirmation of remaining capacity of a cell and replacement of a cell, like an active type RFID. In addition, power for driving the RFID is always held in the battery, so that enough power for operating the RFID can be obtained, and a communication distance between a reader/writer and the RFID can be extended. Yamazaki–279 at [0215] This embodiment mode will describe applications of a semiconductor device of the present invention which communicates data by wireless communication (hereinafter referred to an RFID). The semiconductor device of the present invention can be used as a so-called ID label, ID tag, or ID card, which is incorporated in, for example, bills, coins, securities, bearer bonds, certificates (driving licenses, resident cards, and the like), containers for wrapping objects (wrapping paper, bottles, and the like), recording media (DVD software, video tapes, and the like), vehicles (bicycles and the like), personal belongings (bags, glasses, and the like), foods, plants, animals, human bodies, clothes, commodities, products such as electronic devices, or shipping tags of baggage, and the like. The electronic devices include a liquid crystal display device, an EL display device, a television set (also simply called a television, a TV receiver, or a television receiver), a mobile phone, and the like. Yamazaki–279 at [0219] FIG. 30C shows an example of a state of a completed product of an ID card 3021 including an RFID 3022 of the present invention. The ID card 3021 includes all kinds of cards such as a cash card, a credit card, a prepaid card, an electronic ticket, electronic money, a telephone card, and a membership card. To the extent this limitation is not disclosed by Yamazaki–279, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Yamazaki–279, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[1a] a smartcard controller;	Yamazaki–279 discloses or renders obvious "a smartcard controller." For example:

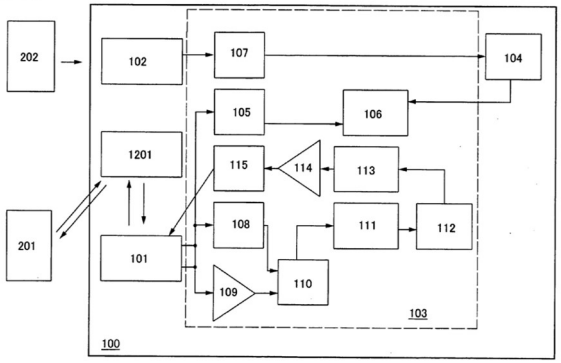
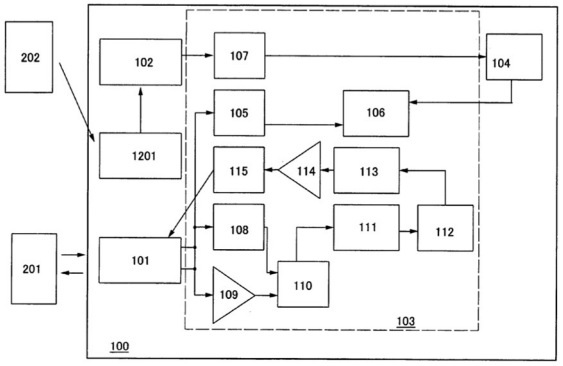
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	Yamazaki–279 at Figure 32  Yamazaki–279 at [0005] FIG. 31 is a block diagram showing a specific structure of an active type RFID. In an active type RFID 3100 of FIG. 31, a communication signal received by an antenna circuit 3101 is inputted to a demodulation circuit 3105 and an amplifier 3106 in a signal processing circuit 3102. The communication signal is usually transmitted after a carrier such as a 13.56 MHz carrier or a 915 MHz carrier is processed using ASK modulation, PSK modulation, or the like. Here, in FIG. 31, an example of a 13.56 MHz carrier is shown as the communication signal. In FIG. 31, a clock signal which is a reference for processing a signal is required, and a 13.56 MHz carrier is used as a clock here. The amplifier 3106 amplifies the 13.56 MHz carrier and supplies it to a logic circuit 3107 as the clock. In addition, the ASK modulated communication signal or the PSK modulated communication signal is demodulated by the demodulation circuit 3105. The signal which has been demodulated is also transmitted to the logic circuit 3107 to be analyzed. The signal analyzed by the logic circuit 3107 is transmitted to a memory control circuit 3108, and based on it, the memory control circuit 3108 controls a memory circuit 3109, and data stored in the memory circuit 3109 is taken out and transmitted to a logic circuit 3110. The signal stored in the memory circuit 3109 is subjected to encode processing by the logic circuit 3110 and then amplified by an amplifier 3111, so that the carrier is modulated by a modulation circuit 3112 with the signal. Here, a power supply in FIG. 31 is supplied by a cell 3103 provided outside the signal processing circuit through a power supply circuit 3104. The power supply circuit 3104 supplies power to the amplifier 3106, the demodulation circuit 3105, the logic circuit 3107, the memory control circuit 3108, the memory circuit 3109, the logic circuit 3110, the amplifier 3111, the modulation circuit 3112, and the like. In this manner, the active type RFID operates.

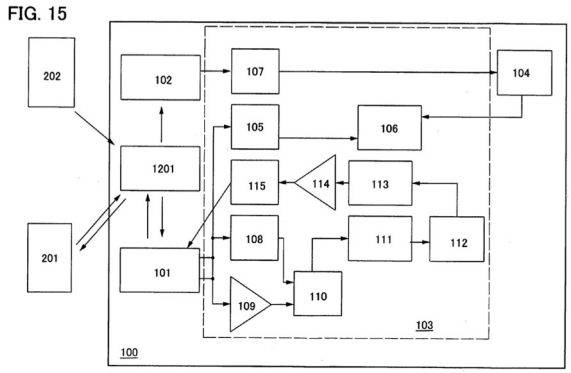
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	Yamazaki–279 at [0006] FIG. 32 is a block diagram showing a specific structure of a passive type RFID. In a passive type RFID 3200 of FIG. 32, a communication signal received by an antenna circuit 3201 is inputted to a demodulation circuit 3205 and an amplifier 3206 in a signal processing circuit 3202. A communication signal is usually transmitted after a carrier such as a 13.56 MHz carrier or a 915 MHz carrier is processed using ASK modulation, PSK modulation, or the like. Here, in FIG. 32, an example of a 13.56 MHz carrier is shown as a communication signal. In FIG. 32, a clock signal which is a reference for processing a signal is required, and a 13.56 MHz carrier is used as the clock here. The amplifier 3206 amplifies the 13.56 MHz carrier and supplies it to a logic circuit 3207 as the clock. In addition, the ASK modulated communication signal or the PSK modulated communication signal is demodulated by the demodulation circuit 3205. The signal which has been demodulated is also transmitted to the logic circuit 3207 to be analyzed. The signal analyzed by the logic circuit 3207 is transmitted to a memory control circuit 3208, and based on it, the memory control circuit 3208 controls a memory circuit 3209, and data stored in the memory circuit 3209 is taken out and transmitted to a logic circuit 3210. The signal stored in the memory circuit 3209 is subjected to encode processing by the logic circuit 3210 and then amplified by an amplifier 3211, so that the carrier is modulated by a modulation circuit 3212 with the signal. On the other hand, the communication signal inputted to a rectifier circuit 3203 is rectified and is inputted to a power supply circuit 3204. The power supply circuit 3204 supplies power to the amplifier 3206, the demodulation circuit 3205, the logic circuit 3207, the memory control circuit 3208, the memory circuit 3209, the logic circuit 3210, the amplifier 3211, the modulation circuit 3212, and the like. In this manner, the passive type RFID operates. Yamazaki–279 at [0059] An RFID 100 of FIG. 1 includes a first antenna circuit 101, a second antenna circuit 102, a signal processing circuit 103, and a battery 104. The signal processing circuit 103 includes a first rectifier circuit 105, a power supply circuit 106, a second rectifier circuit 107, a demodulation circuit 108, an amplifier 109, a logic circuit 110, a memory control circuit 111, a memory circuit 112, a logic circuit 113, an amplifier 114, and a modulation circuit 115. Yamazaki–279 at [0076] Next, an operation when data is transmitted from the reader/writer 201 to the RFID 100 shown in FIGS. 1 and 2 is described below. A signal received by the first antenna circuit 101 is half-wave rectified by the first rectifier circuit 105 and then smoothed. A voltage which is half-wave rectified and smoothed by the first rectifier circuit 105 is inputted to the power supply circuit 106. The power supply circuit supplies a

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	voltage which has been stabilized to the first rectifier circuit 105, the power supply circuit 106, the second rectifier circuit 107, the demodulation circuit 108, the amplifier 109, the logic circuit 110, the memory control circuit 111, the memory circuit 112, the logic circuit 113, the amplifier 114, and the modulation circuit 115. Yamazaki–279 at [0077] In addition, the signal received by the first antenna circuit 101 is inputted to the logic circuit 110 as a clock signal through the amplifier 109. Further, the signal inputted from the first antenna circuit 101 is demodulated by the demodulation circuit 108 and inputted to the logic circuit 110 as data. Yamazaki–279 at [0091] The RFID 100 of FIG. 12 includes the first antenna circuit 101, the second antenna circuit 102, a booster antenna 1201, the signal processing circuit 103, and the battery 104. The signal processing circuit 103 includes the first rectifier circuit 105, the power supply circuit 106, the second rectifier circuit 107, the demodulation circuit 108, the amplifier 109, the logic circuit 110, the memory control circuit 111, the memory circuit 112, the logic circuit 113, the amplifier 114, and the modulation circuit 115. Yamazaki–279 at [0215] This embodiment mode will describe applications of a semiconductor device of the present invention which communicates data by wireless communication (hereinafter referred to an RFID). The semiconductor device of the present invention can be used as a so-called ID label, ID tag, or ID card, which is incorporated in, for example, bills, coins, securities, bearer bonds, certificates (driving licenses, resident cards, and the like), containers for wrapping objects (wrapping paper, bottles, and the like), recording media (DVD software, video tapes, and the like), vehicles (bicycles and the like), personal belongings (bags, glasses, and the like), foods, plants, animals, human bodies, clothes, commodities, products such as electronic devices, or shipping tags of baggage, and the like. The electronic devices include a liquid crystal display device, an EL display device, a television set (also simply called a television, a TV receiver, or a television receiver), a mobile phone, and the like. Yamazaki–279 at [0219] FIG. 30C shows an example of a state of a completed product of an ID card 3021 including an RFID 3022 of the present invention. The ID card 3021 includes all kinds of cards such as a cash card, a credit card, a prepaid card, an electronic ticket, electronic money, a telephone card, and a membership card. *See also* Yamazaki–279 at [0078] and [0080].

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	To the extent this limitation is not disclosed by Yamazaki–279, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Yamazaki–279, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[1b] an antenna; and	Yamazaki–279 discloses or renders obvious "an antenna." For example: Yamazaki–279 at Abstract The present invention provides a battery as a power supply for supplying power in the RFID, and another antenna for charging the battery, in addition to an antenna which transmits and receives individual information to and from outside as a means for supplying power to the battery. Yamazaki–279 at Figure 1  Yamazaki–279 at Figure 2

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	 Yamazaki–279 at Figure 12  Yamazaki–279 at Figure 13

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	FIG. 13  Yamazaki–279 at Figure 14 FIG. 14  Yamazaki–279 at Figure 15

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	 Yamazaki–279 at [0001] The present invention relates to a semiconductor device. In particular, the present invention relates to a semiconductor device which transmits and receives data through radio waves and receives power. Furthermore, the present invention relates to a communication system using a semiconductor device through radio waves, an antenna and a reader/writer which transmit and receive data to and from the semiconductor device, and an antenna and a charger which supply power to the semiconductor device. Yamazaki–279 at [0005] FIG. 31 is a block diagram showing a specific structure of an active type RFID. In an active type RFID 3100 of FIG. 31, a communication signal received by an antenna circuit 3101 is inputted to a demodulation circuit 3105 and an amplifier 3106 in a signal processing circuit 3102. The communication signal is usually transmitted after a carrier such as a 13.56 MHz carrier or a 915 MHz carrier is processed using ASK modulation, PSK modulation, or the like. Here, in FIG. 31, an example of a 13.56 MHz carrier is shown as the communication signal. In FIG. 31, a clock signal which is a reference for processing a signal is required, and a 13.56 MHz carrier is used as a clock here. The amplifier 3106 amplifies the 13.56 MHz carrier and supplies it to a logic circuit 3107 as the clock. In addition, the ASK modulated communication signal or the PSK modulated communication signal is demodulated by the demodulation circuit 3105. The signal which has been demodulated is also transmitted to the logic circuit 3107 to be analyzed. The signal analyzed by the logic circuit 3107 is transmitted to a memory control circuit 3108, and based on it, the memory control circuit 3108 controls a memory circuit 3109, and data stored in the memory circuit 3109 is taken out and transmitted to a logic circuit 3110. The signal stored in the memory circuit 3109 is subjected to encode processing by the logic circuit 3110 and then amplified by an amplifier

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	3111, so that the carrier is modulated by a modulation circuit 3112 with the signal. Here, a power supply in FIG. 31 is supplied by a cell 3103 provided outside the signal processing circuit through a power supply circuit 3104. The power supply circuit 3104 supplies power to the amplifier 3106, the demodulation circuit 3105, the logic circuit 3107, the memory control circuit 3108, the memory circuit 3109, the logic circuit 3110, the amplifier 3111, the modulation circuit 3112, and the like. In this manner, the active type RFID operates. Yamazaki–279 at [0006] FIG. 32 is a block diagram showing a specific structure of a passive type RFID. In a passive type RFID 3200 of FIG. 32, a communication signal received by an antenna circuit 3201 is inputted to a demodulation circuit 3205 and an amplifier 3206 in a signal processing circuit 3202. A communication signal is usually transmitted after a carrier such as a 13.56 MHz carrier or a 915 MHz carrier is processed using ASK modulation, PSK modulation, or the like. Here, in FIG. 32, an example of a 13.56 MHz carrier is shown as a communication signal. In FIG. 32, a clock signal which is a reference for processing a signal is required, and a 13.56 MHz carrier is used as the clock here. The amplifier 3206 amplifies the 13.56 MHz carrier and supplies it to a logic circuit 3207 as the clock. In addition, the ASK modulated communication signal or the PSK modulated communication signal is demodulated by the demodulation circuit 3205. The signal which has been demodulated is also transmitted to the logic circuit 3207 to be analyzed. The signal analyzed by the logic circuit 3207 is transmitted to a memory control circuit 3208, and based on it, the memory control circuit 3208 controls a memory circuit 3209, and data stored in the memory circuit 3209 is taken out and transmitted to a logic circuit 3210. The signal stored in the memory circuit 3209 is subjected to encode processing by the logic circuit 3210 and then amplified by an amplifier 3211, so that the carrier is modulated by a modulation circuit 3212 with the signal. On the other hand, the communication signal inputted to a rectifier circuit 3203 is rectified and is inputted to a power supply circuit 3204. The power supply circuit 3204 supplies power to the amplifier 3206, the demodulation circuit 3205, the logic circuit 3207, the memory control circuit 3208, the memory circuit 3209, the logic circuit 3210, the amplifier 3211, the modulation circuit 3212, and the like. In this manner, the passive type RFID operates. Yamazaki–279 at [0008] In addition, as shown in FIG. 32, in the case of a semiconductor device having a passive type RFID which generates a power supply for driving by using power of radio waves (carrier waves) from outside, there has been a problem in that it is difficult to transmit and receive signals from a long distance and to secure power for transmitting radio waves required for transmission and reception, so that it is difficult to realize

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	transmission and reception in excellent condition. Accordingly, there has been a problem in that a distance from an antenna of a reader/writer which is a power supply means to which enough power of radio waves (carrier waves) from outside is supplied is limited to be short, in order to use a semiconductor device having a passive type RFID which generates a power supply for driving by using power of radio waves (carrier waves) from outside. Yamazaki–279 at [0010] In order to solve the above-mentioned problems, the present invention provides a battery (also referred to as a secondary cell) as a power supply for supplying power in an RFID. The present invention provides another antenna for charging the battery as a means for supplying power to the battery, in addition to an antenna which transmits and receives individual information to and from outside. Hereinafter, a specific structure of the present invention is shown. Yamazaki–279 at [0011] One feature of the present invention is a semiconductor device including: a first antenna circuit; a second antenna circuit; a signal processing circuit; and a battery, in which the first antenna circuit receives a signal through the booster antenna and transmits a signal for transmitting data stored in the signal processing circuit; and the second antenna circuit receives a signal for charging the battery. Yamazaki–279 at [0012] Another feature of the present invention is a semiconductor device including: a first antenna circuit; a second antenna circuit; a signal processing circuit; and a battery, in which the first antenna circuit receives a signal and transmits a signal for transmitting data stored in the signal processing circuit to and from a reader/writer; and the second antenna circuit receives a signal for charging the battery from a charger including an antenna circuit. Yamazaki–279 at [0020] The first antenna circuit and the second antenna circuit of the present invention may transmit and receive a radio signal by an electromagnetic induction method. Yamazaki–279 at [0059] An RFID 100 of FIG. 1 includes a first antenna circuit 101, a second antenna circuit 102, a signal processing circuit 103, and a battery 104. The signal processing circuit 103 includes a first rectifier circuit 105, a power supply circuit 106, a second rectifier circuit 107, a demodulation circuit 108, an amplifier

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	109, a logic circuit 110, a memory control circuit 111, a memory circuit 112, a logic circuit 113, an amplifier 114, and a modulation circuit 115. Yamazaki–279 at [0060] In addition, FIG. 2 shows a block diagram in which the first antenna circuit 101 transmits and receives a signal to and from a reader/writer 201, and the second antenna circuit 102 receives a signal from a charger 202. In FIG. 2, the signal received by the first antenna circuit 101 is inputted to the power supply circuit 106 through the first rectifier circuit 105. In FIG. 2, the signal received by the second antenna circuit 102 is inputted to the battery 104 through the second rectifier circuit 107, and power is supplied to the power supply circuit 106 from the battery 104, as appropriate. Yamazaki–279 at [0061] Note that each of shapes of antennas of the first antenna circuit 101 and the second antenna circuit 102 is not particularly limited. For example, as shown in FIG. 3A, a structure in which an antenna 303 covers the periphery of a signal processing circuit 302 over a substrate 301 may be used. In addition, as shown in FIG. 3B, a structure in which the signal processing circuit 302 is arranged so as to be superimposed over the antenna 303 which is circularly formed over the substrate 301 may be used. Further, as shown in FIG. 3C, the shape of the antenna 303 for receiving a high frequency electromagnetic wave in accordance with the signal processing circuit 302 over the substrate 301 may be used. In addition, as shown in FIG. 3D, the 180 degree omnidirectional antenna 303 (capable of receiving signals similarly from any direction) in accordance with the signal processing circuit 302 over the substrate 301 may be used. In addition, as shown in FIG. 3E, the shape of the antenna 303 which is extended to be a stick shape in accordance with the signal processing circuit 302 over the substrate 301 may be used. Furthermore, connection between the signal processing circuit 103 and the antennas in the first antenna circuit 101 and the second antenna circuit 102 is not particularly limited. For example, the antenna 303 and the signal processing circuit 302 are connected by wire bonding or bump bonding. Alternatively, the signal processing circuit 302 being a chip having an electrode over an entire surface thereof may be attached to the antenna 303. In this method, by using an ACF (Anisotropic Conductive Film), the signal processing circuit 302 and the antenna 303 can be attached to each other. In this embodiment mode, the shape shown in FIG. 3B is adopted as each of the shapes of the first antenna circuit 101 and the second antenna circuit 102. That is, as shown in FIG. 4A, each of the first antenna circuit 101 and the second antenna circuit 102 is described to have a structure including an antenna 401 and a resonant capacitor 402, and an antenna circuit 403 refers to a combination of the antenna 401 and the resonant capacitor 402. Yamazaki–279 at [0062]

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	In addition, the first rectifier circuit 105 and the second rectifier circuit 107 may be circuits in which AC signals induced by electromagnetic waves which are received by the first antenna circuit 101 and the second antenna circuit 102 are converted to DC signals. For example, as shown in FIG. 4B, a rectifier circuit 407 may include a diode 404, a diode 405, and a smoothing capacitor 406. Yamazaki–279 at [0068] In addition, in this embodiment mode, signals received by the first antenna circuit 101 and the second antenna circuit 102 preferably perform communication of signals by an electromagnetic induction method. Accordingly, the RFID 100 in FIGS. 1 and 2 preferably has a structure including the first coiled antenna circuit 101 and the second coiled antenna circuit 102. For example, FIG. 7 shows a positional relationship of the first antenna circuit and the second antenna circuit, and shapes of antennas in a semiconductor device including an RFID. FIG. 7 shows a structure in which a first coiled antenna circuit 701 and a second coiled antenna circuit 702 are provided over a front surface and a rear surface of an RFID 700 respectively, and in which a signal from an antenna of a charger is received. Yamazaki–279 at [0069] In FIG. 7, when a coiled antenna 705 in an antenna circuit 704 of a charger connected to a transmission control portion 703 is brought close to the second antenna circuit 702 of the RFID, an AC magnetic field is generated from the coiled antenna 705 of the antenna circuit 704 in the charger. The AC magnetic field passes through the second coiled antenna circuit 702 in the RFID 700, so that an electromotive force is generated between terminals (between one end of the antenna and the other end thereof) of the second coiled antenna circuit 702 in the RFID 700 due to electromagnetic induction. A battery in the RFID 700 can be charged by the electromotive force. Note that as shown in FIG. 8, a second antenna circuit 801 for charging which is provided over a front surface or a rear surface of a substrate in an RFID 800 can be charged from a charger even when the RFIDs 800 are superimposed. In addition as shown in FIG. 9, an RFID 900 may have a structure in which a first antenna circuit 901 and a second antenna circuit 902 may be arranged side by side over the same substrate, and a signal from the antenna circuit 704 of the charger is received. Yamazaki–279 at [0070] Note that a frequency of a signal transmitted and received between the first antenna circuit 101 and the reader/writer 201 is 125 kHz, 13.56 MHz, 915 MHz, 2.45 GHz, or the like, and each of which is standardized by ISO or the like. Naturally, a frequency of a signal transmitted and received between the first antenna circuit 101 and the reader/writer 201 is not limited to this, and for example, any of the following can be used: a submillimeter wave of 300 GHz to 3 THz; a millimeter wave of 30 GHz to 300

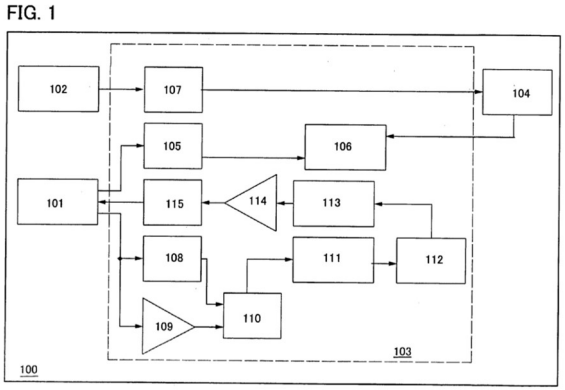
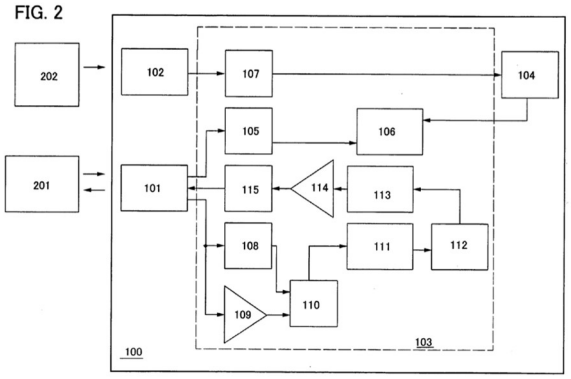
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	GHz; a microwave of 3 GHz to 30 GHz; an ultrashort wave of 300 MHz to 3 GHz; a very short wave of 30 MHz to 300 MHz; a short wave of 3 MHz to 30 MHz; a medium wave of 300 KHz to 3 MHz; a long wave of 30 KHz to 300 KHz; and a very long wave of 3 KHz to 30 KHz. In addition, a signal transmitted and received between the first antenna circuit 101 and the reader/writer 201 is a signal in which a carrier wave is modulated. A modulation method of a carrier wave may be either analog modulation or digital modulation, or may be any of amplitude modulation, phase modulation, frequency modulation, and spread spectrum. Preferably, amplitude modulation or frequency modulation may be used. Yamazaki–279 at [0076] Next, an operation when data is transmitted from the reader/writer 201 to the RFID 100 shown in FIGS. 1 and 2 is described below. A signal received by the first antenna circuit 101 is half-wave rectified by the first rectifier circuit 105 and then smoothed. A voltage which is half-wave rectified and smoothed by the first rectifier circuit 105 is inputted to the power supply circuit 106. The power supply circuit supplies a voltage which has been stabilized to the first rectifier circuit 105, the power supply circuit 106, the second rectifier circuit 107, the demodulation circuit 108, the amplifier 109, the logic circuit 110, the memory control circuit 111, the memory circuit 112, the logic circuit 113, the amplifier 114, and the modulation circuit 115. Yamazaki–279 at [0077] In addition, the signal received by the first antenna circuit 101 is inputted to the logic circuit 110 as a clock signal through the amplifier 109. Further, the signal inputted from the first antenna circuit 101 is demodulated by the demodulation circuit 108 and inputted to the logic circuit 110 as data. Yamazaki–279 at [0081] When the modulation circuit 115 operates, impedance of the first antenna circuit 101 is changed. Accordingly, a signal of the reader/writer 201 which is reflected on the first antenna circuit 101 changes. When the reader/writer reads this change, the data stored in the memory circuit 112 in the RFID 100 can be recognized. Such a modulation method is referred to as a load modulation method. Yamazaki–279 at [0082] Next, an operation when power is charged in the RFID 100 shown in FIGS. 1 and 2 by the charger 202 is described below. The signal received by the second antenna circuit is half-wave rectified and smoothed by the second rectifier circuit 107. A voltage which is half-wave rectified and smoothed by the second rectifier circuit 107 is once held in the battery 104. The power held in the battery 104 is used as power to be supplied to the power supply circuit 106. Note that when the signal supplied by the first antenna circuit

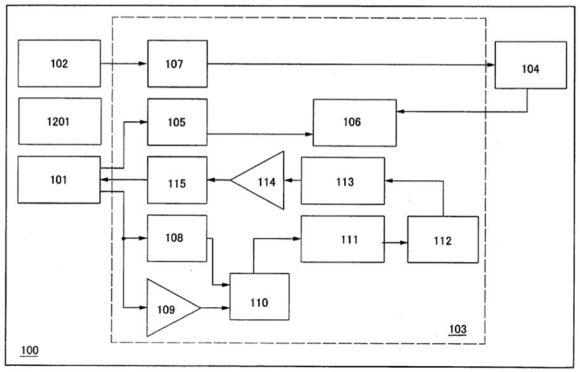
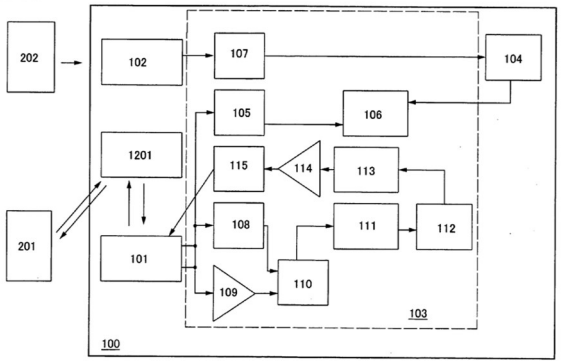
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	can be received but there is a shortage of power for transmitting the signal to the reader/writer, a structure provided with a circuit which determines whether power is supplied by the battery may be used. Yamazaki–279 at [0086] As described above, a semiconductor device including an RFID of the present invention includes a battery. Therefore, similarly to a conventional semiconductor device, the semiconductor device of the present invention can prevent power shortage for transmitting and receiving individual information associated with deterioration over time of a cell. In addition, the semiconductor device of the present invention has an antenna which receives a signal for supplying power to the battery. Therefore, when power of radio waves from outside is used, the battery can be charged without direct connection between the semiconductor device and the charger. Accordingly, the semiconductor device of the present invention can be continuously used without generating confirmation of remaining capacity of a cell and replacement of a cell, like an active type RFID. In addition, power is held in the battery, so that enough power for operating the RFID can be obtained and a communication distance between a reader/writer and the RFID can be extended. Yamazaki–279 at [0089] Note that a booster antenna described in this embodiment mode means an antenna (hereinafter referred to as a booster antenna) which is larger than an antenna (hereinafter referred to as a first chip antenna or a first antenna circuit) which receives a signal from a reader/writer and outputs it to a signal processing circuit of an RFID included in a semiconductor device, or an antenna (hereinafter referred to as a second chip antenna or a second antenna circuit) which receives a signal from a charger included in the semiconductor device. The booster antenna and the first chip antenna or the second chip antenna resonate at a frequency band and are magnetic-field coupled, so that a signal oscillated by the reader/writer or the charger can be efficiently transmitted to a targeted RFID. Since the booster antenna is connected to a coil antenna through a magnetic field, the booster antenna is not required to be directly connected to the chip antenna and the signal processing circuit, which is preferable. Yamazaki–279 at [0091] The RFID 100 of FIG. 12 includes the first antenna circuit 101, the second antenna circuit 102, a booster antenna 1201, the signal processing circuit 103, and the battery 104. The signal processing circuit 103 includes the first rectifier circuit 105, the power supply circuit 106, the second rectifier circuit 107, the demodulation circuit 108, the amplifier 109, the logic circuit 110, the memory control circuit 111, the memory circuit 112, the logic circuit 113, the amplifier 114, and the modulation circuit 115.

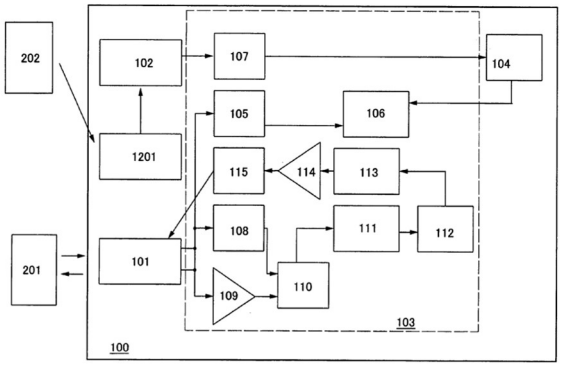
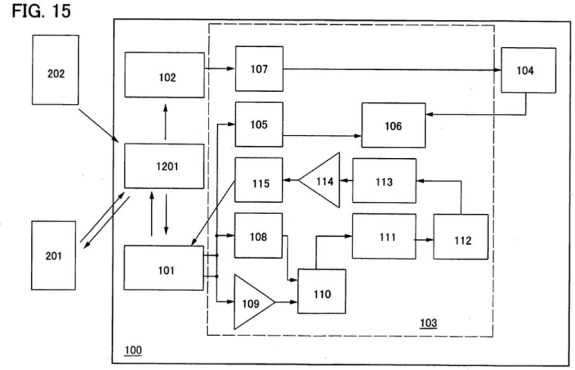
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	Yamazaki–279 at [0092] FIG. 13 shows a block diagram in which the booster antenna 1201 transmits and receives a signal to and from the reader/writer 201, and is magnetic-field coupled to the first antenna circuit 101, so that a signal from the reader/writer is transmitted and received, and the second antenna circuit 102 receives a signal from the charger 202. In FIG. 13, the booster antenna 1201 receives the signal from the reader/writer 201 and is magnetic-field coupled to the first antenna circuit in accordance with electromagnetic induction, so that the signal received by the first antenna circuit 101 is inputted to the power supply circuit 106 through the first rectifier circuit 105 and inputted to the demodulation circuit 108 and the amplifier 109. In addition in FIG. 13, the signal received by the second antenna circuit 102 is inputted to the battery 104 through the second rectifier circuit 107, and power is supplied to the power supply circuit 106 from the battery 104, as appropriate. With the structure shown in FIG. 13, a communication distance of transmission and reception of a signal between the reader/writer 201 and the RFID 100 can be extended more than Embodiment Mode 1, which is preferable because data can be transmitted and received more surely. Yamazaki–279 at [0094] For example, FIG. 14 shows a block diagram in which the booster antenna 1201 receives a signal from the charger 202 and is magnetic-field coupled to the second antenna circuit 102, so that a signal from the charger is received and the first antenna circuit 101 transmits and receives a signal to and from the reader/writer 201. In FIG. 14, the booster antenna 1201 receives the signal from the charger 202 and is magnetic-field coupled to the second antenna circuit in accordance with electromagnetic induction, so that the signal received by the second antenna circuit 102 is inputted to the battery 104 through the second rectifier circuit 107. Then, power is supplied to the power supply circuit 106 from the battery 104, as appropriate. In addition in FIG. 14, the signal received by the first antenna circuit 101 is inputted to the power supply circuit 106 through the first rectifier circuit 105, and inputted to the demodulation circuit 108 and the amplifier 109. With the structure shown in FIG. 14, a communication distance of transmission and reception of a signal between the charger 202 and the RFID 100 can be extended, which is preferable because charge can be performed to the battery more surely. Yamazaki–279 at [0096] For example, FIG. 15 shows a block diagram in which the booster antenna 1201 transmits and receives a signal to and from the reader/writer 201 and the charger 202 and is magnetic-field coupled to the first antenna circuit 101 and the second antenna circuit 102, so that a signal from the reader/writer and a signal from the charger are transmitted and received. In FIG. 15, the booster antenna 1201 receives the signal

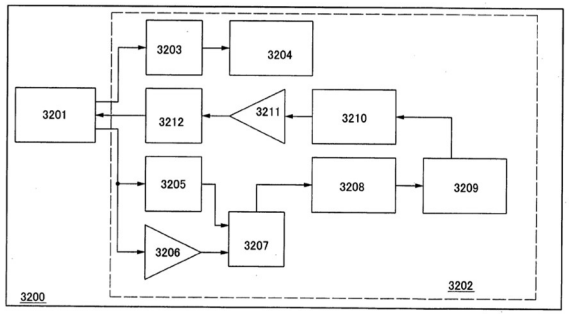
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	from the reader/writer 201 and is magnetic-field coupled to the first antenna circuit in accordance with electromagnetic induction, so that the signal received by the first antenna circuit 101 is inputted to the power supply circuit 106 through the first rectifier circuit 105. In addition, in FIG. 15, the booster antenna 1201 receives the signal from the charger 202 and is magnetic-field coupled to the second antenna circuit in accordance with electromagnetic induction, so that the signal received by the second antenna circuit 102 is inputted to the battery 104 through the second rectifier circuit 107. Then, power is supplied to the power supply circuit 106 from the battery 104, as appropriate. Frequencies that the first antenna circuit and the second antenna circuit are tuned are close to each other, so that efficiency of electromagnetic induction in the booster antenna is more increased, which is preferable. Therefore, when a frequency of a signal transmitted and received between the second antenna circuit 102 and the charger 202 is set m (m is a positive number) and a frequency of a signal transmitted and received between the first antenna circuit 101 and the reader/writer 201 is set M (M is a positive number), a frequency which satisfies a relation of $0.5\ m<M<1.5\ m$ and $m \neq M$ is preferably used. In addition to the above advantageous effect, when a frequency of a signal inputted to the second antenna circuit 102 is set within the above range, design can be performed without significantly changing the shapes of the first antenna circuit 101 and the second antenna circuit 102, which is preferable. With the structure shown in FIG. 15, a communication distance of transmission and reception of a signal between the reader/writer 201 and the RFID 100 and of transmission and reception of a signal between the charger 202 and the RFID 100 can be extended, which is preferable because data can be transmitted and received more surely and charge can be performed to the battery 104 more surely. Yamazaki–279 at [0103] In FIG. 16, when a coiled antenna 1606 in an antenna circuit 1605 of a charger connected to a transmission control portion 1604 is brought close to the booster antenna 1603 of the RFID, an AC magnetic field is generated from the coiled antenna 1606 of the antenna circuit 1605 in the charger. The AC magnetic field passes through the coiled booster antenna 1603 in the RFID 1600, so that an electromotive force is generated between terminals (between one end of the antenna and the other end thereof) of the coiled booster antenna 1603 in the RFID 1600 due to electromagnetic induction. The electromotive force due to electromagnetic induction is generated in the coiled booster antenna 1603, and an AC magnetic field is generated from the booster coil itself. Then, the AC magnetic field generated from the booster antenna 1603 passes through the second coiled antenna circuit 1602 in the RFID 1600, so that an electromotive force is generated between terminals (between one end of the antenna and the other end thereof) of the second coiled antenna circuit 1602 in the RFID 1600 due to electromagnetic induction. A battery in the RFID 1600 can be charged by the electromotive force.

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	Yamazaki–279 at [0104] In addition, FIG. 17 shows a structure which is different from the structure shown in FIG. 16. FIG. 17 shows a structure in which the coiled booster antenna 1603 and either the first antenna circuit 1601 or the second antenna circuit 1602 are provided on one surface of the RFID 1600, and the other of the first antenna circuit 1601 and the second antenna circuit 1602 is provided on the other surface of the RFID 1600, and in which a signal from the antenna of the charger is received. In FIG. 17, when the coiled antenna 1606 in the antenna circuit 1605 of the charger connected to the transmission control portion 1604 is brought close to the booster antenna 1603 of the RFID, an AC magnetic field is generated from the coiled antenna 1606 of the antenna circuit 1605 in the charger. The AC magnetic field passes through the coiled booster antenna 1603 in the RFID 1600, so that an electromotive force is generated between the terminals (between the one end of the antenna and the other end thereof) of the coiled booster antenna 1603 in the RFID 1600 due to electromagnetic induction. The electromotive force due to electromagnetic induction is generated in the coiled booster antenna 1603, and an AC magnetic field is generated from the booster coil itself. Then, the AC magnetic field generated from the booster antenna 1603 passes through the second coiled antenna circuit 1602 in the RFID 1600, and an electromotive force is generated between the terminals (between the one end of the antenna and the other end thereof) of the second coiled antenna circuit 1602 in the RFID 1600 due to electromagnetic induction. The battery in the RFID 1600 can be charged by the electromotive force. The arrangement of the first antenna circuit, the second antenna circuit, and the booster antenna in this embodiment mode may be designed so that the antennas are located to make an AC magnetic field pass through the antenna coil. In addition, as shown in FIG. 17, by arranging the first antenna circuit or the second antenna circuit inside the booster antenna which holds a large area, efficient arrangement can be performed; therefore, a battery area or the like can be increased and the number of windings of an antenna can be increased, which is preferable. *See also* Yamazaki–279 at [0013], [0014], [0015], [0016], [0017], [0018], [0023], [0072], [0108], [0114], and [0201]. To the extent this limitation is not disclosed by Yamazaki–279, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Yamazaki–279, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[1c] performance enhancement circuits coupled between the smartcard controller and the antenna, wherein the performance	Yamazaki–279 discloses or renders obvious "performance enhancement circuits coupled between the smartcard controller and the antenna, wherein the performance enhancement circuits include an amplifier and a load modulation circuit." For example:

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
enhancement circuits include an amplifier and a load modulation circuit, and	Yamazaki–279 at Abstract The present invention provides a battery as a power supply for supplying power in the RFID, and another antenna for charging the battery, in addition to an antenna which transmits and receives individual information to and from outside as a means for supplying power to the battery. Yamazaki–279 at Figure 1  Yamazaki–279 at Figure 2  Yamazaki–279 at Figure 12

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	FIG. 12  Yamazaki–279 at Figure 13 FIG. 13  Yamazaki–279 at Figure 14

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	FIG. 14  Yamazaki–279 at Figure 15 FIG. 15  Yamazaki–279 at Figure 32

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	FIG. 32  Yamazaki–279 at [0001] The present invention relates to a semiconductor device. In particular, the present invention relates to a semiconductor device which transmits and receives data through radio waves and receives power. Furthermore, the present invention relates to a communication system using a semiconductor device through radio waves, an antenna and a reader/writer which transmit and receive data to and from the semiconductor device, and an antenna and a charger which supply power to the semiconductor device. Yamazaki–279 at [0005] FIG. 31 is a block diagram showing a specific structure of an active type RFID. In an active type RFID 3100 of FIG. 31, a communication signal received by an antenna circuit 3101 is inputted to a demodulation circuit 3105 and an amplifier 3106 in a signal processing circuit 3102. The communication signal is usually transmitted after a carrier such as a 13.56 MHz carrier or a 915 MHz carrier is processed using ASK modulation, PSK modulation, or the like. Here, in FIG. 31, an example of a 13.56 MHz carrier is shown as the communication signal. In FIG. 31, a clock signal which is a reference for processing a signal is required, and a 13.56 MHz carrier is used as a clock here. The amplifier 3106 amplifies the 13.56 MHz carrier and supplies it to a logic circuit 3107 as the clock. In addition, the ASK modulated communication signal or the PSK modulated communication signal is demodulated by the demodulation circuit 3105. The signal which has been demodulated is also transmitted to the logic circuit 3107 to be analyzed. The signal analyzed by the logic circuit 3107 is transmitted to a memory control circuit 3108, and based on it, the memory control circuit 3108 controls a memory circuit 3109, and data stored in the memory circuit 3109 is taken out and transmitted to a logic circuit 3110. The signal stored in the memory circuit 3109 is subjected to encode processing by the logic circuit 3110 and then amplified by an amplifier 3111, so that the carrier is modulated by a modulation circuit 3112 with the signal. Here, a power supply

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	in FIG. 31 is supplied by a cell 3103 provided outside the signal processing circuit through a power supply circuit 3104. The power supply circuit 3104 supplies power to the amplifier 3106, the demodulation circuit 3105, the logic circuit 3107, the memory control circuit 3108, the memory circuit 3109, the logic circuit 3110, the amplifier 3111, the modulation circuit 3112, and the like. In this manner, the active type RFID operates. Yamazaki–279 at [0006] FIG. 32 is a block diagram showing a specific structure of a passive type RFID. In a passive type RFID 3200 of FIG. 32, a communication signal received by an antenna circuit 3201 is inputted to a demodulation circuit 3205 and an amplifier 3206 in a signal processing circuit 3202. A communication signal is usually transmitted after a carrier such as a 13.56 MHz carrier or a 915 MHz carrier is processed using ASK modulation, PSK modulation, or the like. Here, in FIG. 32, an example of a 13.56 MHz carrier is shown as a communication signal. In FIG. 32, a clock signal which is a reference for processing a signal is required, and a 13.56 MHz carrier is used as the clock here. The amplifier 3206 amplifies the 13.56 MHz carrier and supplies it to a logic circuit 3207 as the clock. In addition, the ASK modulated communication signal or the PSK modulated communication signal is demodulated by the demodulation circuit 3205. The signal which has been demodulated is also transmitted to the logic circuit 3207 to be analyzed. The signal analyzed by the logic circuit 3207 is transmitted to a memory control circuit 3208, and based on it, the memory control circuit 3208 controls a memory circuit 3209, and data stored in the memory circuit 3209 is taken out and transmitted to a logic circuit 3210. The signal stored in the memory circuit 3209 is subjected to encode processing by the logic circuit 3210 and then amplified by an amplifier 3211, so that the carrier is modulated by a modulation circuit 3212 with the signal. On the other hand, the communication signal inputted to a rectifier circuit 3203 is rectified and is inputted to a power supply circuit 3204. The power supply circuit 3204 supplies power to the amplifier 3206, the demodulation circuit 3205, the logic circuit 3207, the memory control circuit 3208, the memory circuit 3209, the logic circuit 3210, the amplifier 3211, the modulation circuit 3212, and the like. In this manner, the passive type RFID operates. Yamazaki–279 at [0008] In addition, as shown in FIG. 32, in the case of a semiconductor device having a passive type RFID which generates a power supply for driving by using power of radio waves (carrier waves) from outside, there has been a problem in that it is difficult to transmit and receive signals from a long distance and to secure power for transmitting radio waves required for transmission and reception, so that it is difficult to realize transmission and reception in excellent condition. Accordingly, there has been a problem in that a distance

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	from an antenna of a reader/writer which is a power supply means to which enough power of radio waves (carrier waves) from outside is supplied is limited to be short, in order to use a semiconductor device having a passive type RFID which generates a power supply for driving by using power of radio waves (carrier waves) from outside. Yamazaki–279 at [0010] In order to solve the above-mentioned problems, the present invention provides a battery (also referred to as a secondary cell) as a power supply for supplying power in an RFID. The present invention provides another antenna for charging the battery as a means for supplying power to the battery, in addition to an antenna which transmits and receives individual information to and from outside. Hereinafter, a specific structure of the present invention is shown. Yamazaki–279 at [0011] One feature of the present invention is a semiconductor device including: a first antenna circuit; a second antenna circuit; a signal processing circuit; and a battery, in which the first antenna circuit receives a signal through the booster antenna and transmits a signal for transmitting data stored in the signal processing circuit; and the second antenna circuit receives a signal for charging the battery. Yamazaki–279 at [0012] Another feature of the present invention is a semiconductor device including: a first antenna circuit; a second antenna circuit; a signal processing circuit; and a battery, in which the first antenna circuit receives a signal and transmits a signal for transmitting data stored in the signal processing circuit to and from a reader/writer; and the second antenna circuit receives a signal for charging the battery from a charger including an antenna circuit. Yamazaki–279 at [0020] The first antenna circuit and the second antenna circuit of the present invention may transmit and receive a radio signal by an electromagnetic induction method. Yamazaki–279 at [0059] An RFID 100 of FIG. 1 includes a first antenna circuit 101, a second antenna circuit 102, a signal processing circuit 103, and a battery 104. The signal processing circuit 103 includes a first rectifier circuit 105, a power supply circuit 106, a second rectifier circuit 107, a demodulation circuit 108, an amplifier 109, a logic circuit 110, a memory control circuit 111, a memory circuit 112, a logic circuit 113, an amplifier 114, and a modulation circuit 115.

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	Yamazaki–279 at [0060] In addition, FIG. 2 shows a block diagram in which the first antenna circuit 101 transmits and receives a signal to and from a reader/writer 201, and the second antenna circuit 102 receives a signal from a charger 202. In FIG. 2, the signal received by the first antenna circuit 101 is inputted to the power supply circuit 106 through the first rectifier circuit 105. In FIG. 2, the signal received by the second antenna circuit 102 is inputted to the battery 104 through the second rectifier circuit 107, and power is supplied to the power supply circuit 106 from the battery 104, as appropriate. Yamazaki–279 at [0061] Note that each of shapes of antennas of the first antenna circuit 101 and the second antenna circuit 102 is not particularly limited. For example, as shown in FIG. 3A, a structure in which an antenna 303 covers the periphery of a signal processing circuit 302 over a substrate 301 may be used. In addition, as shown in FIG. 3B, a structure in which the signal processing circuit 302 is arranged so as to be superimposed over the antenna 303 which is circularly formed over the substrate 301 may be used. Further, as shown in FIG. 3C, the shape of the antenna 303 for receiving a high frequency electromagnetic wave in accordance with the signal processing circuit 302 over the substrate 301 may be used. In addition, as shown in FIG. 3D, the 180 degree omnidirectional antenna 303 (capable of receiving signals similarly from any direction) in accordance with the signal processing circuit 302 over the substrate 301 may be used. In addition, as shown in FIG. 3E, the shape of the antenna 303 which is extended to be a stick shape in accordance with the signal processing circuit 302 over the substrate 301 may be used. Furthermore, connection between the signal processing circuit 103 and the antennas in the first antenna circuit 101 and the second antenna circuit 102 is not particularly limited. For example, the antenna 303 and the signal processing circuit 302 are connected by wire bonding or bump bonding. Alternatively, the signal processing circuit 302 being a chip having an electrode over an entire surface thereof may be attached to the antenna 303. In this method, by using an ACF (Anisotropic Conductive Film), the signal processing circuit 302 and the antenna 303 can be attached to each other. In this embodiment mode, the shape shown in FIG. 3B is adopted as each of the shapes of the first antenna circuit 101 and the second antenna circuit 102. That is, as shown in FIG. 4A, each of the first antenna circuit 101 and the second antenna circuit 102 is described to have a structure including an antenna 401 and a resonant capacitor 402, and an antenna circuit 403 refers to a combination of the antenna 401 and the resonant capacitor 402. Yamazaki–279 at [0062] In addition, the first rectifier circuit 105 and the second rectifier circuit 107 may be circuits in which AC signals induced by electromagnetic waves which are received by the first antenna circuit 101 and the

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	second antenna circuit 102 are converted to DC signals. For example, as shown in FIG. 4B, a rectifier circuit 407 may include a diode 404, a diode 405, and a smoothing capacitor 406. Yamazaki–279 at [0068] In addition, in this embodiment mode, signals received by the first antenna circuit 101 and the second antenna circuit 102 preferably perform communication of signals by an electromagnetic induction method. Accordingly, the RFID 100 in FIGS. 1 and 2 preferably has a structure including the first coiled antenna circuit 101 and the second coiled antenna circuit 102. For example, FIG. 7 shows a positional relationship of the first antenna circuit and the second antenna circuit, and shapes of antennas in a semiconductor device including an RFID. FIG. 7 shows a structure in which a first coiled antenna circuit 701 and a second coiled antenna circuit 702 are provided over a front surface and a rear surface of an RFID 700 respectively, and in which a signal from an antenna of a charger is received. Yamazaki–279 at [0069] In FIG. 7, when a coiled antenna 705 in an antenna circuit 704 of a charger connected to a transmission control portion 703 is brought close to the second antenna circuit 702 of the RFID, an AC magnetic field is generated from the coiled antenna 705 of the antenna circuit 704 in the charger. The AC magnetic field passes through the second coiled antenna circuit 702 in the RFID 700, so that an electromotive force is generated between terminals (between one end of the antenna and the other end thereof) of the second coiled antenna circuit 702 in the RFID 700 due to electromagnetic induction. A battery in the RFID 700 can be charged by the electromotive force. Note that as shown in FIG. 8, a second antenna circuit 801 for charging which is provided over a front surface or a rear surface of a substrate in an RFID 800 can be charged from a charger even when the RFIDs 800 are superimposed. In addition as shown in FIG. 9, an RFID 900 may have a structure in which a first antenna circuit 901 and a second antenna circuit 902 may be arranged side by side over the same substrate, and a signal from the antenna circuit 704 of the charger is received. Yamazaki–279 at [0070] Note that a frequency of a signal transmitted and received between the first antenna circuit 101 and the reader/writer 201 is 125 kHz, 13.56 MHz, 915 MHz, 2.45 GHz, or the like, and each of which is standardized by ISO or the like. Naturally, a frequency of a signal transmitted and received between the first antenna circuit 101 and the reader/writer 201 is not limited to this, and for example, any of the following can be used: a submillimeter wave of 300 GHz to 3 THz; a millimeter wave of 30 GHz to 300 GHz; a microwave of 3 GHz to 30 GHz; an ultrashort wave of 300 MHz to 3 GHz; a very short wave of 30 MHz to 300 MHz; a short wave of 3 MHz to 30 MHz; a medium wave of 300 KHz to 3 MHz; a long

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	wave of 30 KHz to 300 KHz; and a very long wave of 3 KHz to 30 KHz. In addition, a signal transmitted and received between the first antenna circuit 101 and the reader/writer 201 is a signal in which a carrier wave is modulated. A modulation method of a carrier wave may be either analog modulation or digital modulation, or may be any of amplitude modulation, phase modulation, frequency modulation, and spread spectrum. Preferably, amplitude modulation or frequency modulation may be used. Yamazaki–279 at [0076] Next, an operation when data is transmitted from the reader/writer 201 to the RFID 100 shown in FIGS. 1 and 2 is described below. A signal received by the first antenna circuit 101 is half-wave rectified by the first rectifier circuit 105 and then smoothed. A voltage which is half-wave rectified and smoothed by the first rectifier circuit 105 is inputted to the power supply circuit 106. The power supply circuit supplies a voltage which has been stabilized to the first rectifier circuit 105, the power supply circuit 106, the second rectifier circuit 107, the demodulation circuit 108, the amplifier 109, the logic circuit 110, the memory control circuit 111, the memory circuit 112, the logic circuit 113, the amplifier 114, and the modulation circuit 115. Yamazaki–279 at [0077] In addition, the signal received by the first antenna circuit 101 is inputted to the logic circuit 110 as a clock signal through the amplifier 109. Further, the signal inputted from the first antenna circuit 101 is demodulated by the demodulation circuit 108 and inputted to the logic circuit 110 as data. Yamazaki–279 at [0080] Further, an AC signal received by the first antenna circuit 101 is inputted to the logic circuit 110 through the amplifier 109, and a logic operation is performed. Then, the memory control circuit 111 is controlled using the signal from the logic circuit 110, and the data stored in the memory circuit 112 is called out. The data called out from the memory circuit 112 is processed by the logic circuit 113, amplified by the amplifier 114, and then, the modulation circuit 115 is operated. Although the data processing is carried out in accordance with a standard such as ISO14443, ISO15693, or ISO18000, processing system other than these standards can be adopted as long as compatibility with the reader/writer is ensured. Yamazaki–279 at [0081] When the modulation circuit 115 operates, impedance of the first antenna circuit 101 is changed. Accordingly, a signal of the reader/writer 201 which is reflected on the first antenna circuit 101 changes. When the reader/writer reads this change, the data stored in the memory circuit 112 in the RFID 100 can be recognized. Such a modulation method is referred to as a load modulation method.

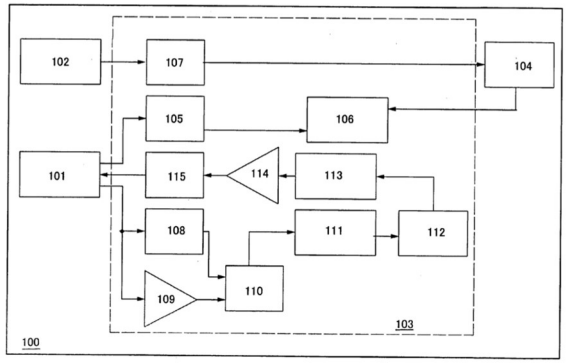
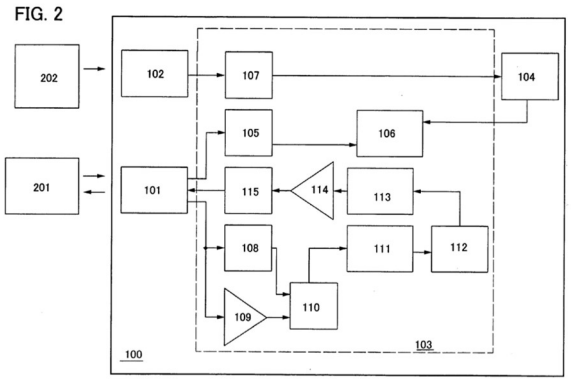
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	Yamazaki–279 at [0082] Next, an operation when power is charged in the RFID 100 shown in FIGS. 1 and 2 by the charger 202 is described below. The signal received by the second antenna circuit is half-wave rectified and smoothed by the second rectifier circuit 107. A voltage which is half-wave rectified and smoothed by the second rectifier circuit 107 is once held in the battery 104. The power held in the battery 104 is used as power to be supplied to the power supply circuit 106. Note that when the signal supplied by the first antenna circuit can be received but there is a shortage of power for transmitting the signal to the reader/writer, a structure provided with a circuit which determines whether power is supplied by the battery may be used. Yamazaki–279 at [0086] As described above, a semiconductor device including an RFID of the present invention includes a battery. Therefore, similarly to a conventional semiconductor device, the semiconductor device of the present invention can prevent power shortage for transmitting and receiving individual information associated with deterioration over time of a cell. In addition, the semiconductor device of the present invention has an antenna which receives a signal for supplying power to the battery. Therefore, when power of radio waves from outside is used, the battery can be charged without direct connection between the semiconductor device and the charger. Accordingly, the semiconductor device of the present invention can be continuously used without generating confirmation of remaining capacity of a cell and replacement of a cell, like an active type RFID. In addition, power is held in the battery, so that enough power for operating the RFID can be obtained and a communication distance between a reader/writer and the RFID can be extended. Yamazaki–279 at [0089] Note that a booster antenna described in this embodiment mode means an antenna (hereinafter referred to as a booster antenna) which is larger than an antenna (hereinafter referred to as a first chip antenna or a first antenna circuit) which receives a signal from a reader/writer and outputs it to a signal processing circuit of an RFID included in a semiconductor device, or an antenna (hereinafter referred to as a second chip antenna or a second antenna circuit) which receives a signal from a charger included in the semiconductor device. The booster antenna and the first chip antenna or the second chip antenna resonate at a frequency band and are magnetic-field coupled, so that a signal oscillated by the reader/writer or the charger can be efficiently transmitted to a targeted RFID. Since the booster antenna is connected to a coil antenna through a magnetic field, the booster antenna is not required to be directly connected to the chip antenna and the signal processing circuit, which is preferable.

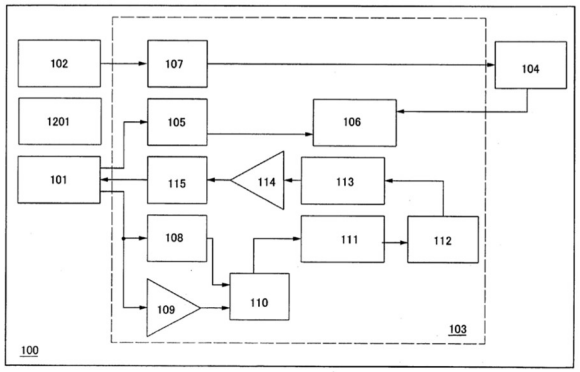
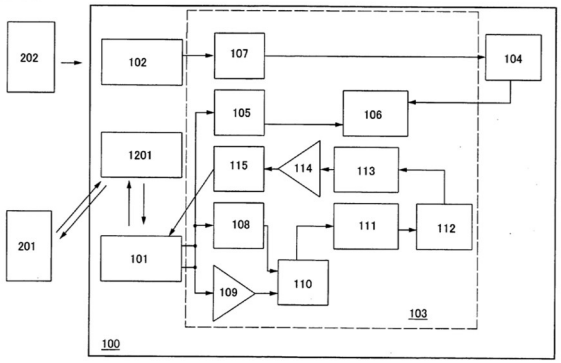
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	Yamazaki–279 at [0091] The RFID 100 of FIG. 12 includes the first antenna circuit 101, the second antenna circuit 102, a booster antenna 1201, the signal processing circuit 103, and the battery 104. The signal processing circuit 103 includes the first rectifier circuit 105, the power supply circuit 106, the second rectifier circuit 107, the demodulation circuit 108, the amplifier 109, the logic circuit 110, the memory control circuit 111, the memory circuit 112, the logic circuit 113, the amplifier 114, and the modulation circuit 115. Yamazaki–279 at [0092] FIG. 13 shows a block diagram in which the booster antenna 1201 transmits and receives a signal to and from the reader/writer 201, and is magnetic-field coupled to the first antenna circuit 101, so that a signal from the reader/writer is transmitted and received, and the second antenna circuit 102 receives a signal from the charger 202. In FIG. 13, the booster antenna 1201 receives the signal from the reader/writer 201 and is magnetic-field coupled to the first antenna circuit in accordance with electromagnetic induction, so that the signal received by the first antenna circuit 101 is inputted to the power supply circuit 106 through the first rectifier circuit 105 and inputted to the demodulation circuit 108 and the amplifier 109. In addition in FIG. 13, the signal received by the second antenna circuit 102 is inputted to the battery 104 through the second rectifier circuit 107, and power is supplied to the power supply circuit 106 from the battery 104, as appropriate. With the structure shown in FIG. 13, a communication distance of transmission and reception of a signal between the reader/writer 201 and the RFID 100 can be extended more than Embodiment Mode 1, which is preferable because data can be transmitted and received more surely. Yamazaki–279 at [0094] For example, FIG. 14 shows a block diagram in which the booster antenna 1201 receives a signal from the charger 202 and is magnetic-field coupled to the second antenna circuit 102, so that a signal from the charger is received and the first antenna circuit 101 transmits and receives a signal to and from the reader/writer 201. In FIG. 14, the booster antenna 1201 receives the signal from the charger 202 and is magnetic-field coupled to the second antenna circuit in accordance with electromagnetic induction, so that the signal received by the second antenna circuit 102 is inputted to the battery 104 through the second rectifier circuit 107. Then, power is supplied to the power supply circuit 106 from the battery 104, as appropriate. In addition in FIG. 14, the signal received by the first antenna circuit 101 is inputted to the power supply circuit 106 through the first rectifier circuit 105, and inputted to the demodulation circuit 108 and the amplifier 109. With the structure shown in FIG. 14, a communication distance of transmission

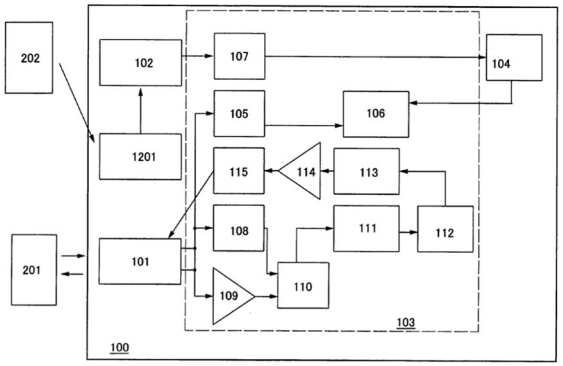
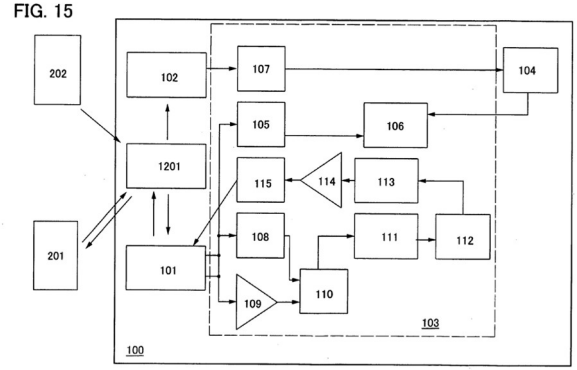
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	and reception of a signal between the charger 202 and the RFID 100 can be extended, which is preferable because charge can be performed to the battery more surely. Yamazaki–279 at [0096] For example, FIG. 15 shows a block diagram in which the booster antenna 1201 transmits and receives a signal to and from the reader/writer 201 and the charger 202 and is magnetic-field coupled to the first antenna circuit 101 and the second antenna circuit 102, so that a signal from the reader/writer and a signal from the charger are transmitted and received. In FIG. 15, the booster antenna 1201 receives the signal from the reader/writer 201 and is magnetic-field coupled to the first antenna circuit in accordance with electromagnetic induction, so that the signal received by the first antenna circuit 101 is inputted to the power supply circuit 106 through the first rectifier circuit 105. In addition, in FIG. 15, the booster antenna 1201 receives the signal from the charger 202 and is magnetic-field coupled to the second antenna circuit in accordance with electromagnetic induction, so that the signal received by the second antenna circuit 102 is inputted to the battery 104 through the second rectifier circuit 107. Then, power is supplied to the power supply circuit 106 from the battery 104, as appropriate. Frequencies that the first antenna circuit and the second antenna circuit are tuned are close to each other, so that efficiency of electromagnetic induction in the booster antenna is more increased, which is preferable. Therefore, when a frequency of a signal transmitted and received between the second antenna circuit 102 and the charger 202 is set m (m is a positive number) and a frequency of a signal transmitted and received between the first antenna circuit 101 and the reader/writer 201 is set M (M is a positive number), a frequency which satisfies a relation of $0.5\ m<M<1.5\ m$ and $m \neq M$ is preferably used. In addition to the above advantageous effect, when a frequency of a signal inputted to the second antenna circuit 102 is set within the above range, design can be performed without significantly changing the shapes of the first antenna circuit 101 and the second antenna circuit 102, which is preferable. With the structure shown in FIG. 15, a communication distance of transmission and reception of a signal between the reader/writer 201 and the RFID 100 and of transmission and reception of a signal between the charger 202 and the RFID 100 can be extended, which is preferable because data can be transmitted and received more surely and charge can be performed to the battery 104 more surely. Yamazaki–279 at [0103] In FIG. 16, when a coiled antenna 1606 in an antenna circuit 1605 of a charger connected to a transmission control portion 1604 is brought close to the booster antenna 1603 of the RFID, an AC magnetic field is generated from the coiled antenna 1606 of the antenna circuit 1605 in the charger. The AC magnetic field passes through the coiled booster antenna 1603 in the RFID 1600, so that an

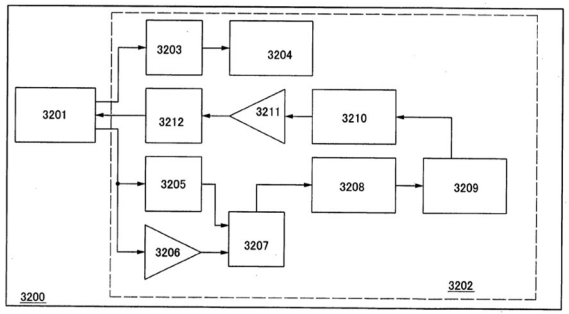
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	electromotive force is generated between terminals (between one end of the antenna and the other end thereof) of the coiled booster antenna 1603 in the RFID 1600 due to electromagnetic induction. The electromotive force due to electromagnetic induction is generated in the coiled booster antenna 1603, and an AC magnetic field is generated from the booster coil itself. Then, the AC magnetic field generated from the booster antenna 1603 passes through the second coiled antenna circuit 1602 in the RFID 1600, so that an electromotive force is generated between terminals (between one end of the antenna and the other end thereof) of the second coiled antenna circuit 1602 in the RFID 1600 due to electromagnetic induction. A battery in the RFID 1600 can be charged by the electromotive force. Yamazaki–279 at [0104] In addition, FIG. 17 shows a structure which is different from the structure shown in FIG. 16. FIG. 17 shows a structure in which the coiled booster antenna 1603 and either the first antenna circuit 1601 or the second antenna circuit 1602 are provided on one surface of the RFID 1600, and the other of the first antenna circuit 1601 and the second antenna circuit 1602 is provided on the other surface of the RFID 1600, and in which a signal from the antenna of the charger is received. In FIG. 17, when the coiled antenna 1606 in the antenna circuit 1605 of the charger connected to the transmission control portion 1604 is brought close to the booster antenna 1603 of the RFID, an AC magnetic field is generated from the coiled antenna 1606 of the antenna circuit 1605 in the charger. The AC magnetic field passes through the coiled booster antenna 1603 in the RFID 1600, so that an electromotive force is generated between the terminals (between the one end of the antenna and the other end thereof) of the coiled booster antenna 1603 in the RFID 1600 due to electromagnetic induction. The electromotive force due to electromagnetic induction is generated in the coiled booster antenna 1603, and an AC magnetic field is generated from the booster coil itself. Then, the AC magnetic field generated from the booster antenna 1603 passes through the second coiled antenna circuit 1602 in the RFID 1600, and an electromotive force is generated between the terminals (between the one end of the antenna and the other end thereof) of the second coiled antenna circuit 1602 in the RFID 1600 due to electromagnetic induction. The battery in the RFID 1600 can be charged by the electromotive force. The arrangement of the first antenna circuit, the second antenna circuit, and the booster antenna in this embodiment mode may be designed so that the antennas are located to make an AC magnetic field pass through the antenna coil. In addition, as shown in FIG. 17, by arranging the first antenna circuit or the second antenna circuit inside the booster antenna which holds a large area, efficient arrangement can be performed; therefore, a battery area or the like can be increased and the number of windings of an antenna can be increased, which is preferable. Yamazaki–279 at [0108]

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	Note that power can be supplied to the power supply circuit 106 in FIGS. 12 to 15 by two ways: one is a power supply which is made such that a signal of a carrier wave is rectified in the first rectifier circuit 105 similarly to the passive type RFID described in the conventional example, and a power supply which drives each circuit of the signal processing circuit 103 is generated through the power supply circuit 106; the other is a power supply which is made such that the battery 104 is charged by a battery charging signal inputted from the second antenna circuit 102 through the second rectifier circuit 107, and power which is charged in the battery 104 is supplied. The power which is charged in the battery 104 can be supplied to the power supply circuit 106 in the case where enough power cannot be obtained from the first antenna circuit 101 of the RFID 100 when a communication distance extends. *See also* Yamazaki–279 at [0013], [0014], [0015], [0016], [0017], [0018], [0023], [0072], [0078], [0114], and [0201]. To the extent this limitation is not disclosed by Yamazaki–279, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Yamazaki–279, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[1d] wherein the amplifier is coupled to amplify a signal received from the antenna and to provide an amplified signal to the smartcard controller.	Yamazaki–279 discloses or renders obvious "wherein the amplifier is coupled to amplify a signal received from the antenna and to provide an amplified signal to the smartcard controller." For example: Yamazaki–279 at Abstract The present invention provides a battery as a power supply for supplying power in the RFID, and another antenna for charging the battery, in addition to an antenna which transmits and receives individual information to and from outside as a means for supplying power to the battery. Yamazaki–279 at Figure 1

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	FIG. 1  Yamazaki–279 at Figure 2 FIG. 2  Yamazaki–279 at Figure 12

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	FIG. 12  Yamazaki–279 at Figure 13 FIG. 13  Yamazaki–279 at Figure 14

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	FIG. 14  Yamazaki–279 at Figure 15 FIG. 15  Yamazaki–279 at Figure 32

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	FIG. 32  Yamazaki–279 at [0001] The present invention relates to a semiconductor device. In particular, the present invention relates to a semiconductor device which transmits and receives data through radio waves and receives power. Furthermore, the present invention relates to a communication system using a semiconductor device through radio waves, an antenna and a reader/writer which transmit and receive data to and from the semiconductor device, and an antenna and a charger which supply power to the semiconductor device. Yamazaki–279 at [0005] FIG. 31 is a block diagram showing a specific structure of an active type RFID. In an active type RFID 3100 of FIG. 31, a communication signal received by an antenna circuit 3101 is inputted to a demodulation circuit 3105 and an amplifier 3106 in a signal processing circuit 3102. The communication signal is usually transmitted after a carrier such as a 13.56 MHz carrier or a 915 MHz carrier is processed using ASK modulation, PSK modulation, or the like. Here, in FIG. 31, an example of a 13.56 MHz carrier is shown as the communication signal. In FIG. 31, a clock signal which is a reference for processing a signal is required, and a 13.56 MHz carrier is used as a clock here. The amplifier 3106 amplifies the 13.56 MHz carrier and supplies it to a logic circuit 3107 as the clock. In addition, the ASK modulated communication signal or the PSK modulated communication signal is demodulated by the demodulation circuit 3105. The signal which has been demodulated is also transmitted to the logic circuit 3107 to be analyzed. The signal analyzed by the logic circuit 3107 is transmitted to a memory control circuit 3108, and based on it, the memory control circuit 3108 controls a memory circuit 3109, and data stored in the memory circuit 3109 is taken out and transmitted to a logic circuit 3110. The signal stored in the memory circuit 3109 is subjected to encode processing by the logic circuit 3110 and then amplified by an amplifier 3111, so that the carrier is modulated by a modulation circuit 3112 with the signal. Here, a power supply

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	in FIG. 31 is supplied by a cell 3103 provided outside the signal processing circuit through a power supply circuit 3104. The power supply circuit 3104 supplies power to the amplifier 3106, the demodulation circuit 3105, the logic circuit 3107, the memory control circuit 3108, the memory circuit 3109, the logic circuit 3110, the amplifier 3111, the modulation circuit 3112, and the like. In this manner, the active type RFID operates. Yamazaki–279 at [0006] FIG. 32 is a block diagram showing a specific structure of a passive type RFID. In a passive type RFID 3200 of FIG. 32, a communication signal received by an antenna circuit 3201 is inputted to a demodulation circuit 3205 and an amplifier 3206 in a signal processing circuit 3202. A communication signal is usually transmitted after a carrier such as a 13.56 MHz carrier or a 915 MHz carrier is processed using ASK modulation, PSK modulation, or the like. Here, in FIG. 32, an example of a 13.56 MHz carrier is shown as a communication signal. In FIG. 32, a clock signal which is a reference for processing a signal is required, and a 13.56 MHz carrier is used as the clock here. The amplifier 3206 amplifies the 13.56 MHz carrier and supplies it to a logic circuit 3207 as the clock. In addition, the ASK modulated communication signal or the PSK modulated communication signal is demodulated by the demodulation circuit 3205. The signal which has been demodulated is also transmitted to the logic circuit 3207 to be analyzed. The signal analyzed by the logic circuit 3207 is transmitted to a memory control circuit 3208, and based on it, the memory control circuit 3208 controls a memory circuit 3209, and data stored in the memory circuit 3209 is taken out and transmitted to a logic circuit 3210. The signal stored in the memory circuit 3209 is subjected to encode processing by the logic circuit 3210 and then amplified by an amplifier 3211, so that the carrier is modulated by a modulation circuit 3212 with the signal. On the other hand, the communication signal inputted to a rectifier circuit 3203 is rectified and is inputted to a power supply circuit 3204. The power supply circuit 3204 supplies power to the amplifier 3206, the demodulation circuit 3205, the logic circuit 3207, the memory control circuit 3208, the memory circuit 3209, the logic circuit 3210, the amplifier 3211, the modulation circuit 3212, and the like. In this manner, the passive type RFID operates. Yamazaki–279 at [0008] In addition, as shown in FIG. 32, in the case of a semiconductor device having a passive type RFID which generates a power supply for driving by using power of radio waves (carrier waves) from outside, there has been a problem in that it is difficult to transmit and receive signals from a long distance and to secure power for transmitting radio waves required for transmission and reception, so that it is difficult to realize transmission and reception in excellent condition. Accordingly, there has been a problem in that a distance

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	from an antenna of a reader/writer which is a power supply means to which enough power of radio waves (carrier waves) from outside is supplied is limited to be short, in order to use a semiconductor device having a passive type RFID which generates a power supply for driving by using power of radio waves (carrier waves) from outside. Yamazaki–279 at [0010] In order to solve the above-mentioned problems, the present invention provides a battery (also referred to as a secondary cell) as a power supply for supplying power in an RFID. The present invention provides another antenna for charging the battery as a means for supplying power to the battery, in addition to an antenna which transmits and receives individual information to and from outside. Hereinafter, a specific structure of the present invention is shown. Yamazaki–279 at [0011] One feature of the present invention is a semiconductor device including: a first antenna circuit; a second antenna circuit; a signal processing circuit; and a battery, in which the first antenna circuit receives a signal through the booster antenna and transmits a signal for transmitting data stored in the signal processing circuit; and the second antenna circuit receives a signal for charging the battery. Yamazaki–279 at [0012] Another feature of the present invention is a semiconductor device including: a first antenna circuit; a second antenna circuit; a signal processing circuit; and a battery, in which the first antenna circuit receives a signal and transmits a signal for transmitting data stored in the signal processing circuit to and from a reader/writer; and the second antenna circuit receives a signal for charging the battery from a charger including an antenna circuit. Yamazaki–279 at [0020] The first antenna circuit and the second antenna circuit of the present invention may transmit and receive a radio signal by an electromagnetic induction method. Yamazaki–279 at [0059] An RFID 100 of FIG. 1 includes a first antenna circuit 101, a second antenna circuit 102, a signal processing circuit 103, and a battery 104. The signal processing circuit 103 includes a first rectifier circuit 105, a power supply circuit 106, a second rectifier circuit 107, a demodulation circuit 108, an amplifier 109, a logic circuit 110, a memory control circuit 111, a memory circuit 112, a logic circuit 113, an amplifier 114, and a modulation circuit 115.

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	Yamazaki–279 at [0060] In addition, FIG. 2 shows a block diagram in which the first antenna circuit 101 transmits and receives a signal to and from a reader/writer 201, and the second antenna circuit 102 receives a signal from a charger 202. In FIG. 2, the signal received by the first antenna circuit 101 is inputted to the power supply circuit 106 through the first rectifier circuit 105. In FIG. 2, the signal received by the second antenna circuit 102 is inputted to the battery 104 through the second rectifier circuit 107, and power is supplied to the power supply circuit 106 from the battery 104, as appropriate. Yamazaki–279 at [0061] Note that each of shapes of antennas of the first antenna circuit 101 and the second antenna circuit 102 is not particularly limited. For example, as shown in FIG. 3A, a structure in which an antenna 303 covers the periphery of a signal processing circuit 302 over a substrate 301 may be used. In addition, as shown in FIG. 3B, a structure in which the signal processing circuit 302 is arranged so as to be superimposed over the antenna 303 which is circularly formed over the substrate 301 may be used. Further, as shown in FIG. 3C, the shape of the antenna 303 for receiving a high frequency electromagnetic wave in accordance with the signal processing circuit 302 over the substrate 301 may be used. In addition, as shown in FIG. 3D, the 180 degree omnidirectional antenna 303 (capable of receiving signals similarly from any direction) in accordance with the signal processing circuit 302 over the substrate 301 may be used. In addition, as shown in FIG. 3E, the shape of the antenna 303 which is extended to be a stick shape in accordance with the signal processing circuit 302 over the substrate 301 may be used. Furthermore, connection between the signal processing circuit 103 and the antennas in the first antenna circuit 101 and the second antenna circuit 102 is not particularly limited. For example, the antenna 303 and the signal processing circuit 302 are connected by wire bonding or bump bonding. Alternatively, the signal processing circuit 302 being a chip having an electrode over an entire surface thereof may be attached to the antenna 303. In this method, by using an ACF (Anisotropic Conductive Film), the signal processing circuit 302 and the antenna 303 can be attached to each other. In this embodiment mode, the shape shown in FIG. 3B is adopted as each of the shapes of the first antenna circuit 101 and the second antenna circuit 102. That is, as shown in FIG. 4A, each of the first antenna circuit 101 and the second antenna circuit 102 is described to have a structure including an antenna 401 and a resonant capacitor 402, and an antenna circuit 403 refers to a combination of the antenna 401 and the resonant capacitor 402. Yamazaki–279 at [0062] In addition, the first rectifier circuit 105 and the second rectifier circuit 107 may be circuits in which AC signals induced by electromagnetic waves which are received by the first antenna circuit 101 and the

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	second antenna circuit 102 are converted to DC signals. For example, as shown in FIG. 4B, a rectifier circuit 407 may include a diode 404, a diode 405, and a smoothing capacitor 406. Yamazaki–279 at [0068] In addition, in this embodiment mode, signals received by the first antenna circuit 101 and the second antenna circuit 102 preferably perform communication of signals by an electromagnetic induction method. Accordingly, the RFID 100 in FIGS. 1 and 2 preferably has a structure including the first coiled antenna circuit 101 and the second coiled antenna circuit 102. For example, FIG. 7 shows a positional relationship of the first antenna circuit and the second antenna circuit, and shapes of antennas in a semiconductor device including an RFID. FIG. 7 shows a structure in which a first coiled antenna circuit 701 and a second coiled antenna circuit 702 are provided over a front surface and a rear surface of an RFID 700 respectively, and in which a signal from an antenna of a charger is received. Yamazaki–279 at [0069] In FIG. 7, when a coiled antenna 705 in an antenna circuit 704 of a charger connected to a transmission control portion 703 is brought close to the second antenna circuit 702 of the RFID, an AC magnetic field is generated from the coiled antenna 705 of the antenna circuit 704 in the charger. The AC magnetic field passes through the second coiled antenna circuit 702 in the RFID 700, so that an electromotive force is generated between terminals (between one end of the antenna and the other end thereof) of the second coiled antenna circuit 702 in the RFID 700 due to electromagnetic induction. A battery in the RFID 700 can be charged by the electromotive force. Note that as shown in FIG. 8, a second antenna circuit 801 for charging which is provided over a front surface or a rear surface of a substrate in an RFID 800 can be charged from a charger even when the RFIDs 800 are superimposed. In addition as shown in FIG. 9, an RFID 900 may have a structure in which a first antenna circuit 901 and a second antenna circuit 902 may be arranged side by side over the same substrate, and a signal from the antenna circuit 704 of the charger is received. Yamazaki–279 at [0070] Note that a frequency of a signal transmitted and received between the first antenna circuit 101 and the reader/writer 201 is 125 kHz, 13.56 MHz, 915 MHz, 2.45 GHz, or the like, and each of which is standardized by ISO or the like. Naturally, a frequency of a signal transmitted and received between the first antenna circuit 101 and the reader/writer 201 is not limited to this, and for example, any of the following can be used: a submillimeter wave of 300 GHz to 3 THz; a millimeter wave of 30 GHz to 300 GHz; a microwave of 3 GHz to 30 GHz; an ultrashort wave of 300 MHz to 3 GHz; a very short wave of 30 MHz to 300 MHz; a short wave of 3 MHz to 30 MHz; a medium wave of 300 KHz to 3 MHz; a long

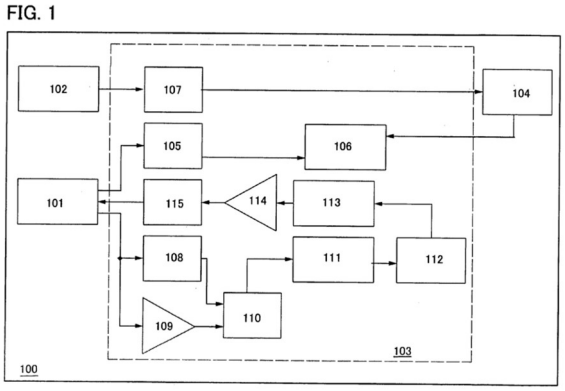
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	wave of 30 KHz to 300 KHz; and a very long wave of 3 KHz to 30 KHz. In addition, a signal transmitted and received between the first antenna circuit 101 and the reader/writer 201 is a signal in which a carrier wave is modulated. A modulation method of a carrier wave may be either analog modulation or digital modulation, or may be any of amplitude modulation, phase modulation, frequency modulation, and spread spectrum. Preferably, amplitude modulation or frequency modulation may be used. Yamazaki–279 at [0076] Next, an operation when data is transmitted from the reader/writer 201 to the RFID 100 shown in FIGS. 1 and 2 is described below. A signal received by the first antenna circuit 101 is half-wave rectified by the first rectifier circuit 105 and then smoothed. A voltage which is half-wave rectified and smoothed by the first rectifier circuit 105 is inputted to the power supply circuit 106. The power supply circuit supplies a voltage which has been stabilized to the first rectifier circuit 105, the power supply circuit 106, the second rectifier circuit 107, the demodulation circuit 108, the amplifier 109, the logic circuit 110, the memory control circuit 111, the memory circuit 112, the logic circuit 113, the amplifier 114, and the modulation circuit 115. Yamazaki–279 at [0077] In addition, the signal received by the first antenna circuit 101 is inputted to the logic circuit 110 as a clock signal through the amplifier 109. Further, the signal inputted from the first antenna circuit 101 is demodulated by the demodulation circuit 108 and inputted to the logic circuit 110 as data. Yamazaki–279 at [0080] Further, an AC signal received by the first antenna circuit 101 is inputted to the logic circuit 110 through the amplifier 109, and a logic operation is performed. Then, the memory control circuit 111 is controlled using the signal from the logic circuit 110, and the data stored in the memory circuit 112 is called out. The data called out from the memory circuit 112 is processed by the logic circuit 113, amplified by the amplifier 114, and then, the modulation circuit 115 is operated. Although the data processing is carried out in accordance with a standard such as ISO14443, ISO15693, or ISO18000, processing system other than these standards can be adopted as long as compatibility with the reader/writer is ensured. Yamazaki–279 at [0081] When the modulation circuit 115 operates, impedance of the first antenna circuit 101 is changed. Accordingly, a signal of the reader/writer 201 which is reflected on the first antenna circuit 101 changes. When the reader/writer reads this change, the data stored in the memory circuit 112 in the RFID 100 can be recognized. Such a modulation method is referred to as a load modulation method.

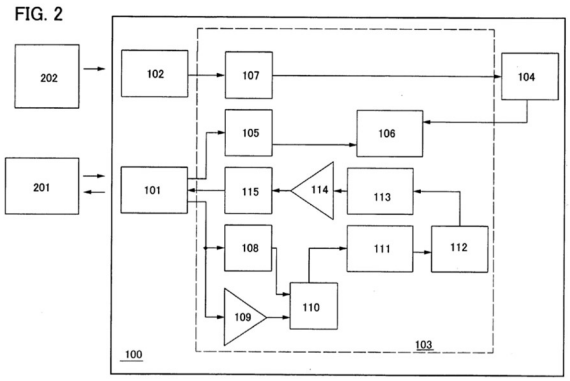
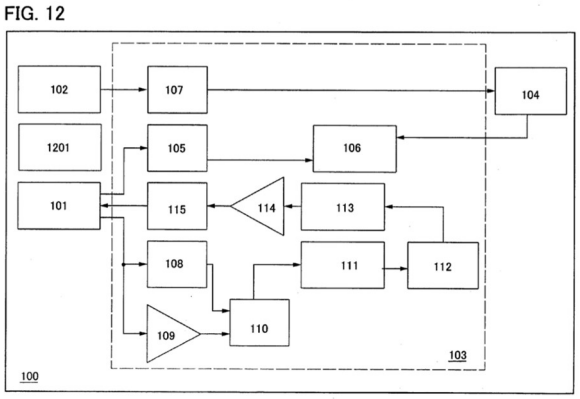
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	Yamazaki–279 at [0082] Next, an operation when power is charged in the RFID 100 shown in FIGS. 1 and 2 by the charger 202 is described below. The signal received by the second antenna circuit is half-wave rectified and smoothed by the second rectifier circuit 107. A voltage which is half-wave rectified and smoothed by the second rectifier circuit 107 is once held in the battery 104. The power held in the battery 104 is used as power to be supplied to the power supply circuit 106. Note that when the signal supplied by the first antenna circuit can be received but there is a shortage of power for transmitting the signal to the reader/writer, a structure provided with a circuit which determines whether power is supplied by the battery may be used. Yamazaki–279 at [0086] As described above, a semiconductor device including an RFID of the present invention includes a battery. Therefore, similarly to a conventional semiconductor device, the semiconductor device of the present invention can prevent power shortage for transmitting and receiving individual information associated with deterioration over time of a cell. In addition, the semiconductor device of the present invention has an antenna which receives a signal for supplying power to the battery. Therefore, when power of radio waves from outside is used, the battery can be charged without direct connection between the semiconductor device and the charger. Accordingly, the semiconductor device of the present invention can be continuously used without generating confirmation of remaining capacity of a cell and replacement of a cell, like an active type RFID. In addition, power is held in the battery, so that enough power for operating the RFID can be obtained and a communication distance between a reader/writer and the RFID can be extended. Yamazaki–279 at [0089] Note that a booster antenna described in this embodiment mode means an antenna (hereinafter referred to as a booster antenna) which is larger than an antenna (hereinafter referred to as a first chip antenna or a first antenna circuit) which receives a signal from a reader/writer and outputs it to a signal processing circuit of an RFID included in a semiconductor device, or an antenna (hereinafter referred to as a second chip antenna or a second antenna circuit) which receives a signal from a charger included in the semiconductor device. The booster antenna and the first chip antenna or the second chip antenna resonate at a frequency band and are magnetic-field coupled, so that a signal oscillated by the reader/writer or the charger can be efficiently transmitted to a targeted RFID. Since the booster antenna is connected to a coil antenna through a magnetic field, the booster antenna is not required to be directly connected to the chip antenna and the signal processing circuit, which is preferable.

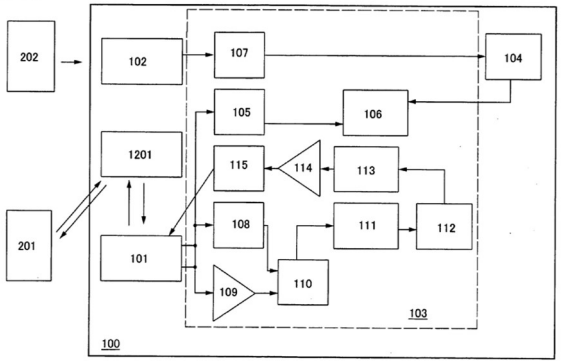
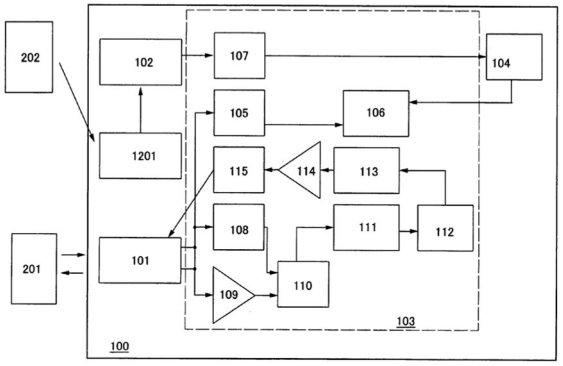
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	Yamazaki–279 at [0091] The RFID 100 of FIG. 12 includes the first antenna circuit 101, the second antenna circuit 102, a booster antenna 1201, the signal processing circuit 103, and the battery 104. The signal processing circuit 103 includes the first rectifier circuit 105, the power supply circuit 106, the second rectifier circuit 107, the demodulation circuit 108, the amplifier 109, the logic circuit 110, the memory control circuit 111, the memory circuit 112, the logic circuit 113, the amplifier 114, and the modulation circuit 115. Yamazaki–279 at [0092] FIG. 13 shows a block diagram in which the booster antenna 1201 transmits and receives a signal to and from the reader/writer 201, and is magnetic-field coupled to the first antenna circuit 101, so that a signal from the reader/writer is transmitted and received, and the second antenna circuit 102 receives a signal from the charger 202. In FIG. 13, the booster antenna 1201 receives the signal from the reader/writer 201 and is magnetic-field coupled to the first antenna circuit in accordance with electromagnetic induction, so that the signal received by the first antenna circuit 101 is inputted to the power supply circuit 106 through the first rectifier circuit 105 and inputted to the demodulation circuit 108 and the amplifier 109. In addition in FIG. 13, the signal received by the second antenna circuit 102 is inputted to the battery 104 through the second rectifier circuit 107, and power is supplied to the power supply circuit 106 from the battery 104, as appropriate. With the structure shown in FIG. 13, a communication distance of transmission and reception of a signal between the reader/writer 201 and the RFID 100 can be extended more than Embodiment Mode 1, which is preferable because data can be transmitted and received more surely. Yamazaki–279 at [0094] For example, FIG. 14 shows a block diagram in which the booster antenna 1201 receives a signal from the charger 202 and is magnetic-field coupled to the second antenna circuit 102, so that a signal from the charger is received and the first antenna circuit 101 transmits and receives a signal to and from the reader/writer 201. In FIG. 14, the booster antenna 1201 receives the signal from the charger 202 and is magnetic-field coupled to the second antenna circuit in accordance with electromagnetic induction, so that the signal received by the second antenna circuit 102 is inputted to the battery 104 through the second rectifier circuit 107. Then, power is supplied to the power supply circuit 106 from the battery 104, as appropriate. In addition in FIG. 14, the signal received by the first antenna circuit 101 is inputted to the power supply circuit 106 through the first rectifier circuit 105, and inputted to the demodulation circuit 108 and the amplifier 109. With the structure shown in FIG. 14, a communication distance of transmission

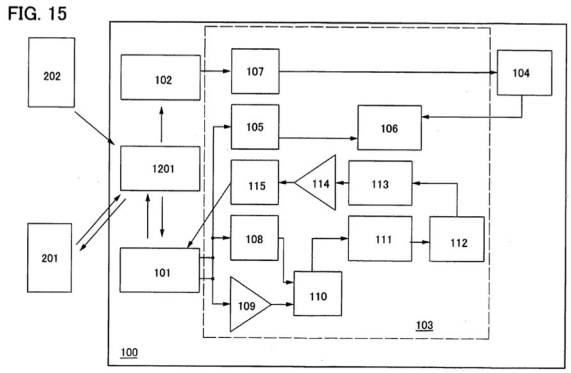
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	and reception of a signal between the charger 202 and the RFID 100 can be extended, which is preferable because charge can be performed to the battery more surely. Yamazaki–279 at [0096] For example, FIG. 15 shows a block diagram in which the booster antenna 1201 transmits and receives a signal to and from the reader/writer 201 and the charger 202 and is magnetic-field coupled to the first antenna circuit 101 and the second antenna circuit 102, so that a signal from the reader/writer and a signal from the charger are transmitted and received. In FIG. 15, the booster antenna 1201 receives the signal from the reader/writer 201 and is magnetic-field coupled to the first antenna circuit in accordance with electromagnetic induction, so that the signal received by the first antenna circuit 101 is inputted to the power supply circuit 106 through the first rectifier circuit 105. In addition, in FIG. 15, the booster antenna 1201 receives the signal from the charger 202 and is magnetic-field coupled to the second antenna circuit in accordance with electromagnetic induction, so that the signal received by the second antenna circuit 102 is inputted to the battery 104 through the second rectifier circuit 107. Then, power is supplied to the power supply circuit 106 from the battery 104, as appropriate. Frequencies that the first antenna circuit and the second antenna circuit are tuned are close to each other, so that efficiency of electromagnetic induction in the booster antenna is more increased, which is preferable. Therefore, when a frequency of a signal transmitted and received between the second antenna circuit 102 and the charger 202 is set m (m is a positive number) and a frequency of a signal transmitted and received between the first antenna circuit 101 and the reader/writer 201 is set M (M is a positive number), a frequency which satisfies a relation of $0.5\ m<M<1.5\ m$ and $m \neq M$ is preferably used. In addition to the above advantageous effect, when a frequency of a signal inputted to the second antenna circuit 102 is set within the above range, design can be performed without significantly changing the shapes of the first antenna circuit 101 and the second antenna circuit 102, which is preferable. With the structure shown in FIG. 15, a communication distance of transmission and reception of a signal between the reader/writer 201 and the RFID 100 and of transmission and reception of a signal between the charger 202 and the RFID 100 can be extended, which is preferable because data can be transmitted and received more surely and charge can be performed to the battery 104 more surely. Yamazaki–279 at [0103] In FIG. 16, when a coiled antenna 1606 in an antenna circuit 1605 of a charger connected to a transmission control portion 1604 is brought close to the booster antenna 1603 of the RFID, an AC magnetic field is generated from the coiled antenna 1606 of the antenna circuit 1605 in the charger. The AC magnetic field passes through the coiled booster antenna 1603 in the RFID 1600, so that an

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	electromotive force is generated between terminals (between one end of the antenna and the other end thereof) of the coiled booster antenna 1603 in the RFID 1600 due to electromagnetic induction. The electromotive force due to electromagnetic induction is generated in the coiled booster antenna 1603, and an AC magnetic field is generated from the booster coil itself. Then, the AC magnetic field generated from the booster antenna 1603 passes through the second coiled antenna circuit 1602 in the RFID 1600, so that an electromotive force is generated between terminals (between one end of the antenna and the other end thereof) of the second coiled antenna circuit 1602 in the RFID 1600 due to electromagnetic induction. A battery in the RFID 1600 can be charged by the electromotive force. Yamazaki–279 at [0104] In addition, FIG. 17 shows a structure which is different from the structure shown in FIG. 16. FIG. 17 shows a structure in which the coiled booster antenna 1603 and either the first antenna circuit 1601 or the second antenna circuit 1602 are provided on one surface of the RFID 1600, and the other of the first antenna circuit 1601 and the second antenna circuit 1602 is provided on the other surface of the RFID 1600, and in which a signal from the antenna of the charger is received. In FIG. 17, when the coiled antenna 1606 in the antenna circuit 1605 of the charger connected to the transmission control portion 1604 is brought close to the booster antenna 1603 of the RFID, an AC magnetic field is generated from the coiled antenna 1606 of the antenna circuit 1605 in the charger. The AC magnetic field passes through the coiled booster antenna 1603 in the RFID 1600, so that an electromotive force is generated between the terminals (between the one end of the antenna and the other end thereof) of the coiled booster antenna 1603 in the RFID 1600 due to electromagnetic induction. The electromotive force due to electromagnetic induction is generated in the coiled booster antenna 1603, and an AC magnetic field is generated from the booster coil itself. Then, the AC magnetic field generated from the booster antenna 1603 passes through the second coiled antenna circuit 1602 in the RFID 1600, and an electromotive force is generated between the terminals (between the one end of the antenna and the other end thereof) of the second coiled antenna circuit 1602 in the RFID 1600 due to electromagnetic induction. The battery in the RFID 1600 can be charged by the electromotive force. The arrangement of the first antenna circuit, the second antenna circuit, and the booster antenna in this embodiment mode may be designed so that the antennas are located to make an AC magnetic field pass through the antenna coil. In addition, as shown in FIG. 17, by arranging the first antenna circuit or the second antenna circuit inside the booster antenna which holds a large area, efficient arrangement can be performed; therefore, a battery area or the like can be increased and the number of windings of an antenna can be increased, which is preferable.

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	See also Yamazaki–279 at [0013], [0014], [0015], [0016], [0017], [0018], [0023], [0072], [0078], [0108], [0114], and [0201]. To the extent this limitation is not disclosed by Yamazaki–279, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Yamazaki–279, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
2. The mobile device of claim 1 wherein the antenna is tuned to operate at 13.56 MHz.	Yamazaki–279 expressly or inherently discloses "[t]he mobile device of claim 1 wherein the antenna is tuned to operate at 13.56 MHz." For example: Yamazaki–279 at Abstract The present invention provides a battery as a power supply for supplying power in the RFID, and another antenna for charging the battery, in addition to an antenna which transmits and receives individual information to and from outside as a means for supplying power to the battery. Yamazaki–279 at Figure 1  Yamazaki–279 at Figure 2

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	 Yamazaki–279 at Figure 12  Yamazaki–279 at Figure 13

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	FIG. 13  Yamazaki–279 at Figure 14 FIG. 14  Yamazaki–279 at Figure 15

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	 Yamazaki–279 at [0001] The present invention relates to a semiconductor device. In particular, the present invention relates to a semiconductor device which transmits and receives data through radio waves and receives power. Furthermore, the present invention relates to a communication system using a semiconductor device through radio waves, an antenna and a reader/writer which transmit and receive data to and from the semiconductor device, and an antenna and a charger which supply power to the semiconductor device. Yamazaki–279 at [0005] FIG. 31 is a block diagram showing a specific structure of an active type RFID. In an active type RFID 3100 of FIG. 31, a communication signal received by an antenna circuit 3101 is inputted to a demodulation circuit 3105 and an amplifier 3106 in a signal processing circuit 3102. The communication signal is usually transmitted after a carrier such as a 13.56 MHz carrier or a 915 MHz carrier is processed using ASK modulation, PSK modulation, or the like. Here, in FIG. 31, an example of a 13.56 MHz carrier is shown as the communication signal. In FIG. 31, a clock signal which is a reference for processing a signal is required, and a 13.56 MHz carrier is used as a clock here. The amplifier 3106 amplifies the 13.56 MHz carrier and supplies it to a logic circuit 3107 as the clock. In addition, the ASK modulated communication signal or the PSK modulated communication signal is demodulated by the demodulation circuit 3105. The signal which has been demodulated is also transmitted to the logic circuit 3107 to be analyzed. The signal analyzed by the logic circuit 3107 is transmitted to a memory control circuit 3108, and based on it, the memory control circuit 3108 controls a memory circuit 3109, and data stored in the memory circuit 3109 is taken out and transmitted to a logic circuit 3110. The signal stored in the memory circuit 3109 is subjected to encode processing by the logic circuit 3110 and then amplified by an amplifier

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	3111, so that the carrier is modulated by a modulation circuit 3112 with the signal. Here, a power supply in FIG. 31 is supplied by a cell 3103 provided outside the signal processing circuit through a power supply circuit 3104. The power supply circuit 3104 supplies power to the amplifier 3106, the demodulation circuit 3105, the logic circuit 3107, the memory control circuit 3108, the memory circuit 3109, the logic circuit 3110, the amplifier 3111, the modulation circuit 3112, and the like. In this manner, the active type RFID operates. Yamazaki–279 at [0006] FIG. 32 is a block diagram showing a specific structure of a passive type RFID. In a passive type RFID 3200 of FIG. 32, a communication signal received by an antenna circuit 3201 is inputted to a demodulation circuit 3205 and an amplifier 3206 in a signal processing circuit 3202. A communication signal is usually transmitted after a carrier such as a 13.56 MHz carrier or a 915 MHz carrier is processed using ASK modulation, PSK modulation, or the like. Here, in FIG. 32, an example of a 13.56 MHz carrier is shown as a communication signal. In FIG. 32, a clock signal which is a reference for processing a signal is required, and a 13.56 MHz carrier is used as the clock here. The amplifier 3206 amplifies the 13.56 MHz carrier and supplies it to a logic circuit 3207 as the clock. In addition, the ASK modulated communication signal or the PSK modulated communication signal is demodulated by the demodulation circuit 3205. The signal which has been demodulated is also transmitted to the logic circuit 3207 to be analyzed. The signal analyzed by the logic circuit 3207 is transmitted to a memory control circuit 3208, and based on it, the memory control circuit 3208 controls a memory circuit 3209, and data stored in the memory circuit 3209 is taken out and transmitted to a logic circuit 3210. The signal stored in the memory circuit 3209 is subjected to encode processing by the logic circuit 3210 and then amplified by an amplifier 3211, so that the carrier is modulated by a modulation circuit 3212 with the signal. On the other hand, the communication signal inputted to a rectifier circuit 3203 is rectified and is inputted to a power supply circuit 3204. The power supply circuit 3204 supplies power to the amplifier 3206, the demodulation circuit 3205, the logic circuit 3207, the memory control circuit 3208, the memory circuit 3209, the logic circuit 3210, the amplifier 3211, the modulation circuit 3212, and the like. In this manner, the passive type RFID operates. Yamazaki–279 at [0008] In addition, as shown in FIG. 32, in the case of a semiconductor device having a passive type RFID which generates a power supply for driving by using power of radio waves (carrier waves) from outside, there has been a problem in that it is difficult to transmit and receive signals from a long distance and to secure power for transmitting radio waves required for transmission and reception, so that it is difficult to realize

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	transmission and reception in excellent condition. Accordingly, there has been a problem in that a distance from an antenna of a reader/writer which is a power supply means to which enough power of radio waves (carrier waves) from outside is supplied is limited to be short, in order to use a semiconductor device having a passive type RFID which generates a power supply for driving by using power of radio waves (carrier waves) from outside. Yamazaki–279 at [0010] In order to solve the above-mentioned problems, the present invention provides a battery (also referred to as a secondary cell) as a power supply for supplying power in an RFID. The present invention provides another antenna for charging the battery as a means for supplying power to the battery, in addition to an antenna which transmits and receives individual information to and from outside. Hereinafter, a specific structure of the present invention is shown. Yamazaki–279 at [0011] One feature of the present invention is a semiconductor device including: a first antenna circuit; a second antenna circuit; a signal processing circuit; and a battery, in which the first antenna circuit receives a signal through the booster antenna and transmits a signal for transmitting data stored in the signal processing circuit; and the second antenna circuit receives a signal for charging the battery. Yamazaki–279 at [0012] Another feature of the present invention is a semiconductor device including: a first antenna circuit; a second antenna circuit; a signal processing circuit; and a battery, in which the first antenna circuit receives a signal and transmits a signal for transmitting data stored in the signal processing circuit to and from a reader/writer; and the second antenna circuit receives a signal for charging the battery from a charger including an antenna circuit. Yamazaki–279 at [0020] The first antenna circuit and the second antenna circuit of the present invention may transmit and receive a radio signal by an electromagnetic induction method. Yamazaki–279 at [0059] An RFID 100 of FIG. 1 includes a first antenna circuit 101, a second antenna circuit 102, a signal processing circuit 103, and a battery 104. The signal processing circuit 103 includes a first rectifier circuit 105, a power supply circuit 106, a second rectifier circuit 107, a demodulation circuit 108, an amplifier

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	109, a logic circuit 110, a memory control circuit 111, a memory circuit 112, a logic circuit 113, an amplifier 114, and a modulation circuit 115. Yamazaki–279 at [0060] In addition, FIG. 2 shows a block diagram in which the first antenna circuit 101 transmits and receives a signal to and from a reader/writer 201, and the second antenna circuit 102 receives a signal from a charger 202. In FIG. 2, the signal received by the first antenna circuit 101 is inputted to the power supply circuit 106 through the first rectifier circuit 105. In FIG. 2, the signal received by the second antenna circuit 102 is inputted to the battery 104 through the second rectifier circuit 107, and power is supplied to the power supply circuit 106 from the battery 104, as appropriate. Yamazaki–279 at [0061] Note that each of shapes of antennas of the first antenna circuit 101 and the second antenna circuit 102 is not particularly limited. For example, as shown in FIG. 3A, a structure in which an antenna 303 covers the periphery of a signal processing circuit 302 over a substrate 301 may be used. In addition, as shown in FIG. 3B, a structure in which the signal processing circuit 302 is arranged so as to be superimposed over the antenna 303 which is circularly formed over the substrate 301 may be used. Further, as shown in FIG. 3C, the shape of the antenna 303 for receiving a high frequency electromagnetic wave in accordance with the signal processing circuit 302 over the substrate 301 may be used. In addition, as shown in FIG. 3D, the 180 degree omnidirectional antenna 303 (capable of receiving signals similarly from any direction) in accordance with the signal processing circuit 302 over the substrate 301 may be used. In addition, as shown in FIG. 3E, the shape of the antenna 303 which is extended to be a stick shape in accordance with the signal processing circuit 302 over the substrate 301 may be used. Furthermore, connection between the signal processing circuit 103 and the antennas in the first antenna circuit 101 and the second antenna circuit 102 is not particularly limited. For example, the antenna 303 and the signal processing circuit 302 are connected by wire bonding or bump bonding. Alternatively, the signal processing circuit 302 being a chip having an electrode over an entire surface thereof may be attached to the antenna 303. In this method, by using an ACF (Anisotropic Conductive Film), the signal processing circuit 302 and the antenna 303 can be attached to each other. In this embodiment mode, the shape shown in FIG. 3B is adopted as each of the shapes of the first antenna circuit 101 and the second antenna circuit 102. That is, as shown in FIG. 4A, each of the first antenna circuit 101 and the second antenna circuit 102 is described to have a structure including an antenna 401 and a resonant capacitor 402, and an antenna circuit 403 refers to a combination of the antenna 401 and the resonant capacitor 402. Yamazaki–279 at [0062]

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	In addition, the first rectifier circuit 105 and the second rectifier circuit 107 may be circuits in which AC signals induced by electromagnetic waves which are received by the first antenna circuit 101 and the second antenna circuit 102 are converted to DC signals. For example, as shown in FIG. 4B, a rectifier circuit 407 may include a diode 404, a diode 405, and a smoothing capacitor 406. Yamazaki–279 at [0068] In addition, in this embodiment mode, signals received by the first antenna circuit 101 and the second antenna circuit 102 preferably perform communication of signals by an electromagnetic induction method. Accordingly, the RFID 100 in FIGS. 1 and 2 preferably has a structure including the first coiled antenna circuit 101 and the second coiled antenna circuit 102. For example, FIG. 7 shows a positional relationship of the first antenna circuit and the second antenna circuit, and shapes of antennas in a semiconductor device including an RFID. FIG. 7 shows a structure in which a first coiled antenna circuit 701 and a second coiled antenna circuit 702 are provided over a front surface and a rear surface of an RFID 700 respectively, and in which a signal from an antenna of a charger is received. Yamazaki–279 at [0069] In FIG. 7, when a coiled antenna 705 in an antenna circuit 704 of a charger connected to a transmission control portion 703 is brought close to the second antenna circuit 702 of the RFID, an AC magnetic field is generated from the coiled antenna 705 of the antenna circuit 704 in the charger. The AC magnetic field passes through the second coiled antenna circuit 702 in the RFID 700, so that an electromotive force is generated between terminals (between one end of the antenna and the other end thereof) of the second coiled antenna circuit 702 in the RFID 700 due to electromagnetic induction. A battery in the RFID 700 can be charged by the electromotive force. Note that as shown in FIG. 8, a second antenna circuit 801 for charging which is provided over a front surface or a rear surface of a substrate in an RFID 800 can be charged from a charger even when the RFIDs 800 are superimposed. In addition as shown in FIG. 9, an RFID 900 may have a structure in which a first antenna circuit 901 and a second antenna circuit 902 may be arranged side by side over the same substrate, and a signal from the antenna circuit 704 of the charger is received. Yamazaki–279 at [0070] Note that a frequency of a signal transmitted and received between the first antenna circuit 101 and the reader/writer 201 is 125 kHz, 13.56 MHz, 915 MHz, 2.45 GHz, or the like, and each of which is standardized by ISO or the like. Naturally, a frequency of a signal transmitted and received between the first antenna circuit 101 and the reader/writer 201 is not limited to this, and for example, any of the following can be used: a submillimeter wave of 300 GHz to 3 THz; a millimeter wave of 30 GHz to 300

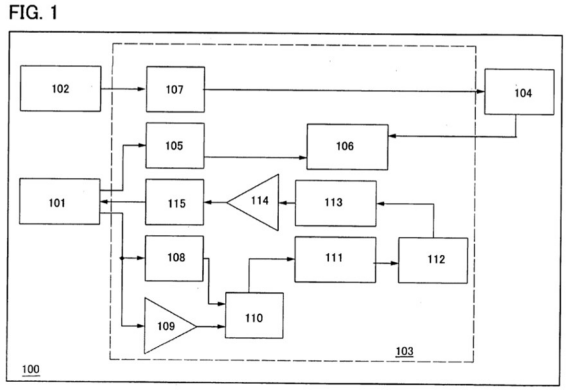
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	GHz; a microwave of 3 GHz to 30 GHz; an ultrashort wave of 300 MHz to 3 GHz; a very short wave of 30 MHz to 300 MHz; a short wave of 3 MHz to 30 MHz; a medium wave of 300 KHz to 3 MHz; a long wave of 30 KHz to 300 KHz; and a very long wave of 3 KHz to 30 KHz. In addition, a signal transmitted and received between the first antenna circuit 101 and the reader/writer 201 is a signal in which a carrier wave is modulated. A modulation method of a carrier wave may be either analog modulation or digital modulation, or may be any of amplitude modulation, phase modulation, frequency modulation, and spread spectrum. Preferably, amplitude modulation or frequency modulation may be used. Yamazaki–279 at [0076] Next, an operation when data is transmitted from the reader/writer 201 to the RFID 100 shown in FIGS. 1 and 2 is described below. A signal received by the first antenna circuit 101 is half-wave rectified by the first rectifier circuit 105 and then smoothed. A voltage which is half-wave rectified and smoothed by the first rectifier circuit 105 is inputted to the power supply circuit 106. The power supply circuit supplies a voltage which has been stabilized to the first rectifier circuit 105, the power supply circuit 106, the second rectifier circuit 107, the demodulation circuit 108, the amplifier 109, the logic circuit 110, the memory control circuit 111, the memory circuit 112, the logic circuit 113, the amplifier 114, and the modulation circuit 115. Yamazaki–279 at [0077] In addition, the signal received by the first antenna circuit 101 is inputted to the logic circuit 110 as a clock signal through the amplifier 109. Further, the signal inputted from the first antenna circuit 101 is demodulated by the demodulation circuit 108 and inputted to the logic circuit 110 as data. Yamazaki–279 at [0081] When the modulation circuit 115 operates, impedance of the first antenna circuit 101 is changed. Accordingly, a signal of the reader/writer 201 which is reflected on the first antenna circuit 101 changes. When the reader/writer reads this change, the data stored in the memory circuit 112 in the RFID 100 can be recognized. Such a modulation method is referred to as a load modulation method. Yamazaki–279 at [0082] Next, an operation when power is charged in the RFID 100 shown in FIGS. 1 and 2 by the charger 202 is described below. The signal received by the second antenna circuit is half-wave rectified and smoothed by the second rectifier circuit 107. A voltage which is half-wave rectified and smoothed by the second rectifier circuit 107 is once held in the battery 104. The power held in the battery 104 is used as power to be supplied to the power supply circuit 106. Note that when the signal supplied by the first antenna circuit

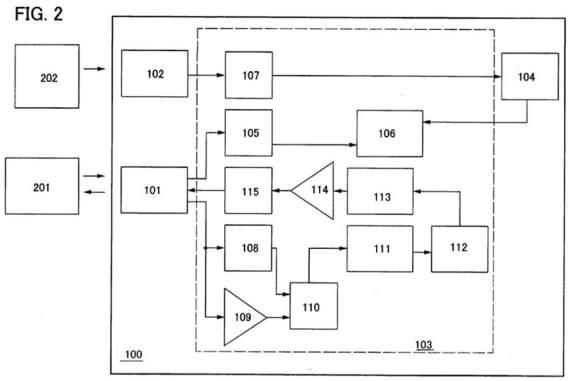
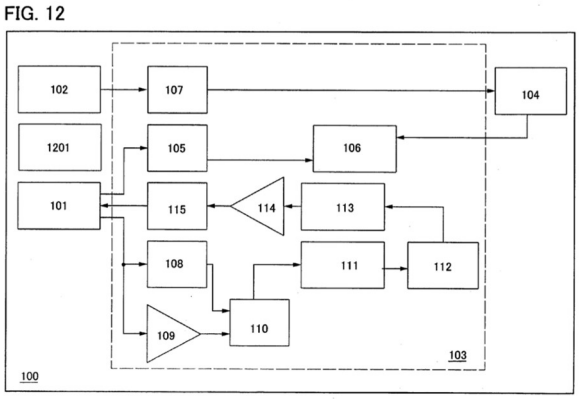
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	can be received but there is a shortage of power for transmitting the signal to the reader/writer, a structure provided with a circuit which determines whether power is supplied by the battery may be used. Yamazaki–279 at [0086] As described above, a semiconductor device including an RFID of the present invention includes a battery. Therefore, similarly to a conventional semiconductor device, the semiconductor device of the present invention can prevent power shortage for transmitting and receiving individual information associated with deterioration over time of a cell. In addition, the semiconductor device of the present invention has an antenna which receives a signal for supplying power to the battery. Therefore, when power of radio waves from outside is used, the battery can be charged without direct connection between the semiconductor device and the charger. Accordingly, the semiconductor device of the present invention can be continuously used without generating confirmation of remaining capacity of a cell and replacement of a cell, like an active type RFID. In addition, power is held in the battery, so that enough power for operating the RFID can be obtained and a communication distance between a reader/writer and the RFID can be extended. Yamazaki–279 at [0089] Note that a booster antenna described in this embodiment mode means an antenna (hereinafter referred to as a booster antenna) which is larger than an antenna (hereinafter referred to as a first chip antenna or a first antenna circuit) which receives a signal from a reader/writer and outputs it to a signal processing circuit of an RFID included in a semiconductor device, or an antenna (hereinafter referred to as a second chip antenna or a second antenna circuit) which receives a signal from a charger included in the semiconductor device. The booster antenna and the first chip antenna or the second chip antenna resonate at a frequency band and are magnetic-field coupled, so that a signal oscillated by the reader/writer or the charger can be efficiently transmitted to a targeted RFID. Since the booster antenna is connected to a coil antenna through a magnetic field, the booster antenna is not required to be directly connected to the chip antenna and the signal processing circuit, which is preferable. Yamazaki–279 at [0091] The RFID 100 of FIG. 12 includes the first antenna circuit 101, the second antenna circuit 102, a booster antenna 1201, the signal processing circuit 103, and the battery 104. The signal processing circuit 103 includes the first rectifier circuit 105, the power supply circuit 106, the second rectifier circuit 107, the demodulation circuit 108, the amplifier 109, the logic circuit 110, the memory control circuit 111, the memory circuit 112, the logic circuit 113, the amplifier 114, and the modulation circuit 115.

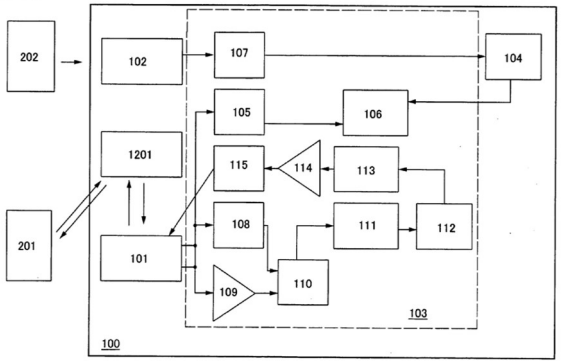
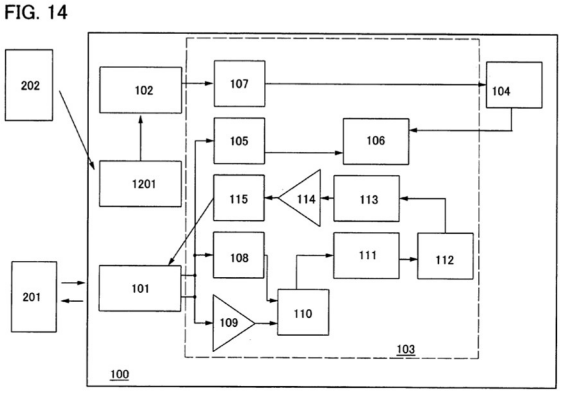
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	Yamazaki–279 at [0092] FIG. 13 shows a block diagram in which the booster antenna 1201 transmits and receives a signal to and from the reader/writer 201, and is magnetic-field coupled to the first antenna circuit 101, so that a signal from the reader/writer is transmitted and received, and the second antenna circuit 102 receives a signal from the charger 202. In FIG. 13, the booster antenna 1201 receives the signal from the reader/writer 201 and is magnetic-field coupled to the first antenna circuit in accordance with electromagnetic induction, so that the signal received by the first antenna circuit 101 is inputted to the power supply circuit 106 through the first rectifier circuit 105 and inputted to the demodulation circuit 108 and the amplifier 109. In addition in FIG. 13, the signal received by the second antenna circuit 102 is inputted to the battery 104 through the second rectifier circuit 107, and power is supplied to the power supply circuit 106 from the battery 104, as appropriate. With the structure shown in FIG. 13, a communication distance of transmission and reception of a signal between the reader/writer 201 and the RFID 100 can be extended more than Embodiment Mode 1, which is preferable because data can be transmitted and received more surely. Yamazaki–279 at [0094] For example, FIG. 14 shows a block diagram in which the booster antenna 1201 receives a signal from the charger 202 and is magnetic-field coupled to the second antenna circuit 102, so that a signal from the charger is received and the first antenna circuit 101 transmits and receives a signal to and from the reader/writer 201. In FIG. 14, the booster antenna 1201 receives the signal from the charger 202 and is magnetic-field coupled to the second antenna circuit in accordance with electromagnetic induction, so that the signal received by the second antenna circuit 102 is inputted to the battery 104 through the second rectifier circuit 107. Then, power is supplied to the power supply circuit 106 from the battery 104, as appropriate. In addition in FIG. 14, the signal received by the first antenna circuit 101 is inputted to the power supply circuit 106 through the first rectifier circuit 105, and inputted to the demodulation circuit 108 and the amplifier 109. With the structure shown in FIG. 14, a communication distance of transmission and reception of a signal between the charger 202 and the RFID 100 can be extended, which is preferable because charge can be performed to the battery more surely. Yamazaki–279 at [0096] For example, FIG. 15 shows a block diagram in which the booster antenna 1201 transmits and receives a signal to and from the reader/writer 201 and the charger 202 and is magnetic-field coupled to the first antenna circuit 101 and the second antenna circuit 102, so that a signal from the reader/writer and a signal from the charger are transmitted and received. In FIG. 15, the booster antenna 1201 receives the signal

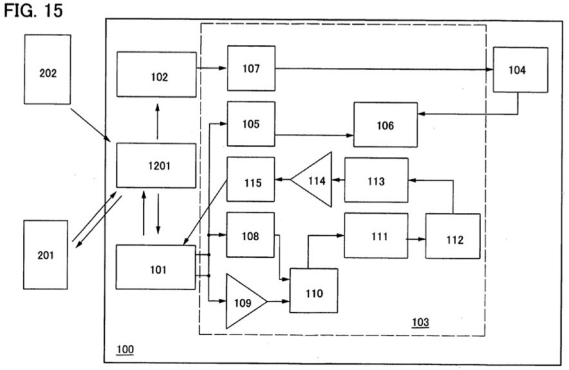
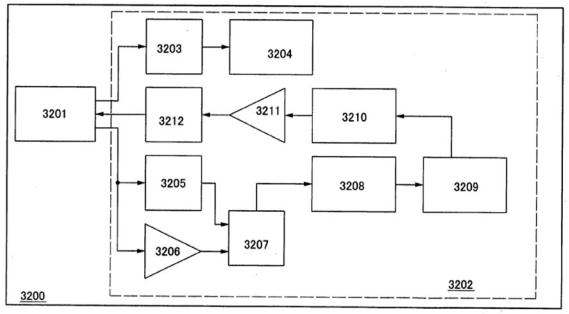
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	from the reader/writer 201 and is magnetic-field coupled to the first antenna circuit in accordance with electromagnetic induction, so that the signal received by the first antenna circuit 101 is inputted to the power supply circuit 106 through the first rectifier circuit 105. In addition, in FIG. 15, the booster antenna 1201 receives the signal from the charger 202 and is magnetic-field coupled to the second antenna circuit in accordance with electromagnetic induction, so that the signal received by the second antenna circuit 102 is inputted to the battery 104 through the second rectifier circuit 107. Then, power is supplied to the power supply circuit 106 from the battery 104, as appropriate. Frequencies that the first antenna circuit and the second antenna circuit are tuned are close to each other, so that efficiency of electromagnetic induction in the booster antenna is more increased, which is preferable. Therefore, when a frequency of a signal transmitted and received between the second antenna circuit 102 and the charger 202 is set m (m is a positive number) and a frequency of a signal transmitted and received between the first antenna circuit 101 and the reader/writer 201 is set M (M is a positive number), a frequency which satisfies a relation of $0.5\ m<M<1.5\ m$ and $m \neq M$ is preferably used. In addition to the above advantageous effect, when a frequency of a signal inputted to the second antenna circuit 102 is set within the above range, design can be performed without significantly changing the shapes of the first antenna circuit 101 and the second antenna circuit 102, which is preferable. With the structure shown in FIG. 15, a communication distance of transmission and reception of a signal between the reader/writer 201 and the RFID 100 and of transmission and reception of a signal between the charger 202 and the RFID 100 can be extended, which is preferable because data can be transmitted and received more surely and charge can be performed to the battery 104 more surely. Yamazaki–279 at [0103] In FIG. 16, when a coiled antenna 1606 in an antenna circuit 1605 of a charger connected to a transmission control portion 1604 is brought close to the booster antenna 1603 of the RFID, an AC magnetic field is generated from the coiled antenna 1606 of the antenna circuit 1605 in the charger. The AC magnetic field passes through the coiled booster antenna 1603 in the RFID 1600, so that an electromotive force is generated between terminals (between one end of the antenna and the other end thereof) of the coiled booster antenna 1603 in the RFID 1600 due to electromagnetic induction. The electromotive force due to electromagnetic induction is generated in the coiled booster antenna 1603, and an AC magnetic field is generated from the booster coil itself. Then, the AC magnetic field generated from the booster antenna 1603 passes through the second coiled antenna circuit 1602 in the RFID 1600, so that an electromotive force is generated between terminals (between one end of the antenna and the other end thereof) of the second coiled antenna circuit 1602 in the RFID 1600 due to electromagnetic induction. A battery in the RFID 1600 can be charged by the electromotive force.

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	Yamazaki–279 at [0104] In addition, FIG. 17 shows a structure which is different from the structure shown in FIG. 16. FIG. 17 shows a structure in which the coiled booster antenna 1603 and either the first antenna circuit 1601 or the second antenna circuit 1602 are provided on one surface of the RFID 1600, and the other of the first antenna circuit 1601 and the second antenna circuit 1602 is provided on the other surface of the RFID 1600, and in which a signal from the antenna of the charger is received. In FIG. 17, when the coiled antenna 1606 in the antenna circuit 1605 of the charger connected to the transmission control portion 1604 is brought close to the booster antenna 1603 of the RFID, an AC magnetic field is generated from the coiled antenna 1606 of the antenna circuit 1605 in the charger. The AC magnetic field passes through the coiled booster antenna 1603 in the RFID 1600, so that an electromotive force is generated between the terminals (between the one end of the antenna and the other end thereof) of the coiled booster antenna 1603 in the RFID 1600 due to electromagnetic induction. The electromotive force due to electromagnetic induction is generated in the coiled booster antenna 1603, and an AC magnetic field is generated from the booster coil itself. Then, the AC magnetic field generated from the booster antenna 1603 passes through the second coiled antenna circuit 1602 in the RFID 1600, and an electromotive force is generated between the terminals (between the one end of the antenna and the other end thereof) of the second coiled antenna circuit 1602 in the RFID 1600 due to electromagnetic induction. The battery in the RFID 1600 can be charged by the electromotive force. The arrangement of the first antenna circuit, the second antenna circuit, and the booster antenna in this embodiment mode may be designed so that the antennas are located to make an AC magnetic field pass through the antenna coil. In addition, as shown in FIG. 17, by arranging the first antenna circuit or the second antenna circuit inside the booster antenna which holds a large area, efficient arrangement can be performed; therefore, a battery area or the like can be increased and the number of windings of an antenna can be increased, which is preferable. *See also* Yamazaki–279 at [0013], [0014], [0015], [0016], [0017], [0018], [0023], [0072], [0108], [0114], and [0201]. To the extent this limitation is not disclosed by Yamazaki–279, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Yamazaki–279, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 1 above.

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3. The mobile device of claim 1 wherein the antenna comprises an inductive element too small to draw enough power sufficient to operate the smartcard controller from an interrogating radio frequency (RF) field.	Yamazaki–279 expressly or inherently discloses "[t]he mobile device of claim 1 wherein the antenna comprises an inductive element too small to draw enough power sufficient to operate the smartcard controller from an interrogating radio frequency (RF) field." For example: Yamazaki–279 at Abstract The present invention provides a battery as a power supply for supplying power in the RFID, and another antenna for charging the battery, in addition to an antenna which transmits and receives individual information to and from outside as a means for supplying power to the battery. Yamazaki–279 at Figure 1  Yamazaki–279 at Figure 2

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	 Yamazaki–279 at Figure 12  Yamazaki–279 at Figure 13

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	FIG. 13  Yamazaki–279 at Figure 14 FIG. 14  Yamazaki–279 at Figure 15

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	FIG. 15  Yamazaki–279 at Figure 32 FIG. 32  Yamazaki–279 at [0001] The present invention relates to a semiconductor device. In particular, the present invention relates to a semiconductor device which transmits and receives data through radio waves and receives power. Furthermore, the present invention relates to a communication system using a semiconductor device through radio waves, an antenna and a reader/writer which transmit and receive data to and from the semiconductor device, and an antenna and a charger which supply power to the semiconductor device. Yamazaki–279 at [0005] FIG. 31 is a block diagram showing a specific structure of an active type RFID. In an active type RFID 3100 of FIG. 31, a communication signal received by an antenna circuit 3101 is inputted to a demodulation circuit 3105 and an amplifier 3106 in a signal processing circuit 3102. The communication

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	signal is usually transmitted after a carrier such as a 13.56 MHz carrier or a 915 MHz carrier is processed using ASK modulation, PSK modulation, or the like. Here, in FIG. 31, an example of a 13.56 MHz carrier is shown as the communication signal. In FIG. 31, a clock signal which is a reference for processing a signal is required, and a 13.56 MHz carrier is used as a clock here. The amplifier 3106 amplifies the 13.56 MHz carrier and supplies it to a logic circuit 3107 as the clock. In addition, the ASK modulated communication signal or the PSK modulated communication signal is demodulated by the demodulation circuit 3105. The signal which has been demodulated is also transmitted to the logic circuit 3107 to be analyzed. The signal analyzed by the logic circuit 3107 is transmitted to a memory control circuit 3108, and based on it, the memory control circuit 3108 controls a memory circuit 3109, and data stored in the memory circuit 3109 is taken out and transmitted to a logic circuit 3110. The signal stored in the memory circuit 3109 is subjected to encode processing by the logic circuit 3110 and then amplified by an amplifier 3111, so that the carrier is modulated by a modulation circuit 3112 with the signal. Here, a power supply in FIG. 31 is supplied by a cell 3103 provided outside the signal processing circuit through a power supply circuit 3104. The power supply circuit 3104 supplies power to the amplifier 3106, the demodulation circuit 3105, the logic circuit 3107, the memory control circuit 3108, the memory circuit 3109, the logic circuit 3110, the amplifier 3111, the modulation circuit 3112, and the like. In this manner, the active type RFID operates. Yamazaki–279 at [0006] FIG. 32 is a block diagram showing a specific structure of a passive type RFID. In a passive type RFID 3200 of FIG. 32, a communication signal received by an antenna circuit 3201 is inputted to a demodulation circuit 3205 and an amplifier 3206 in a signal processing circuit 3202. A communication signal is usually transmitted after a carrier such as a 13.56 MHz carrier or a 915 MHz carrier is processed using ASK modulation, PSK modulation, or the like. Here, in FIG. 32, an example of a 13.56 MHz carrier is shown as a communication signal. In FIG. 32, a clock signal which is a reference for processing a signal is required, and a 13.56 MHz carrier is used as the clock here. The amplifier 3206 amplifies the 13.56 MHz carrier and supplies it to a logic circuit 3207 as the clock. In addition, the ASK modulated communication signal or the PSK modulated communication signal is demodulated by the demodulation circuit 3205. The signal which has been demodulated is also transmitted to the logic circuit 3207 to be analyzed. The signal analyzed by the logic circuit 3207 is transmitted to a memory control circuit 3208, and based on it, the memory control circuit 3208 controls a memory circuit 3209, and data stored in the memory circuit 3209 is taken out and transmitted to a logic circuit 3210. The signal stored in the memory circuit 3209 is subjected to encode processing by the logic circuit 3210 and then amplified by an amplifier 3211, so that the carrier is modulated by a modulation circuit 3212 with the signal. On the other hand, the

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	communication signal inputted to a rectifier circuit 3203 is rectified and is inputted to a power supply circuit 3204. The power supply circuit 3204 supplies power to the amplifier 3206, the demodulation circuit 3205, the logic circuit 3207, the memory control circuit 3208, the memory circuit 3209, the logic circuit 3210, the amplifier 3211, the modulation circuit 3212, and the like. In this manner, the passive type RFID operates. Yamazaki–279 at [0008] In addition, as shown in FIG. 32, in the case of a semiconductor device having a passive type RFID which generates a power supply for driving by using power of radio waves (carrier waves) from outside, there has been a problem in that it is difficult to transmit and receive signals from a long distance and to secure power for transmitting radio waves required for transmission and reception, so that it is difficult to realize transmission and reception in excellent condition. Accordingly, there has been a problem in that a distance from an antenna of a reader/writer which is a power supply means to which enough power of radio waves (carrier waves) from outside is supplied is limited to be short, in order to use a semiconductor device having a passive type RFID which generates a power supply for driving by using power of radio waves (carrier waves) from outside. Yamazaki–279 at [0010] In order to solve the above-mentioned problems, the present invention provides a battery (also referred to as a secondary cell) as a power supply for supplying power in an RFID. The present invention provides another antenna for charging the battery as a means for supplying power to the battery, in addition to an antenna which transmits and receives individual information to and from outside. Hereinafter, a specific structure of the present invention is shown. Yamazaki–279 at [0011] One feature of the present invention is a semiconductor device including: a first antenna circuit; a second antenna circuit; a signal processing circuit; and a battery, in which the first antenna circuit receives a signal through the booster antenna and transmits a signal for transmitting data stored in the signal processing circuit; and the second antenna circuit receives a signal for charging the battery. Yamazaki–279 at [0012] Another feature of the present invention is a semiconductor device including: a first antenna circuit; a second antenna circuit; a signal processing circuit; and a battery, in which the first antenna circuit receives a signal and transmits a signal for transmitting data stored in the signal processing circuit to and from a

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	reader/writer; and the second antenna circuit receives a signal for charging the battery from a charger including an antenna circuit. Yamazaki–279 at [0020] The first antenna circuit and the second antenna circuit of the present invention may transmit and receive a radio signal by an electromagnetic induction method. Yamazaki–279 at [0059] An RFID 100 of FIG. 1 includes a first antenna circuit 101, a second antenna circuit 102, a signal processing circuit 103, and a battery 104. The signal processing circuit 103 includes a first rectifier circuit 105, a power supply circuit 106, a second rectifier circuit 107, a demodulation circuit 108, an amplifier 109, a logic circuit 110, a memory control circuit 111, a memory circuit 112, a logic circuit 113, an amplifier 114, and a modulation circuit 115. Yamazaki–279 at [0060] In addition, FIG. 2 shows a block diagram in which the first antenna circuit 101 transmits and receives a signal to and from a reader/writer 201, and the second antenna circuit 102 receives a signal from a charger 202. In FIG. 2, the signal received by the first antenna circuit 101 is inputted to the power supply circuit 106 through the first rectifier circuit 105. In FIG. 2, the signal received by the second antenna circuit 102 is inputted to the battery 104 through the second rectifier circuit 107, and power is supplied to the power supply circuit 106 from the battery 104, as appropriate. Yamazaki–279 at [0061] Note that each of shapes of antennas of the first antenna circuit 101 and the second antenna circuit 102 is not particularly limited. For example, as shown in FIG. 3A, a structure in which an antenna 303 covers the periphery of a signal processing circuit 302 over a substrate 301 may be used. In addition, as shown in FIG. 3B, a structure in which the signal processing circuit 302 is arranged so as to be superimposed over the antenna 303 which is circularly formed over the substrate 301 may be used. Further, as shown in FIG. 3C, the shape of the antenna 303 for receiving a high frequency electromagnetic wave in accordance with the signal processing circuit 302 over the substrate 301 may be used. In addition, as shown in FIG. 3D, the 180 degree omnidirectional antenna 303 (capable of receiving signals similarly from any direction) in accordance with the signal processing circuit 302 over the substrate 301 may be used. In addition, as shown in FIG. 3E, the shape of the antenna 303 which is extended to be a stick shape in accordance with the signal processing circuit 302 over the substrate 301 may be used. Furthermore, connection between the signal processing circuit 103 and the antennas in the first antenna circuit 101 and the second antenna

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	circuit 102 is not particularly limited. For example, the antenna 303 and the signal processing circuit 302 are connected by wire bonding or bump bonding. Alternatively, the signal processing circuit 302 being a chip having an electrode over an entire surface thereof may be attached to the antenna 303. In this method, by using an ACF (Anisotropic Conductive Film), the signal processing circuit 302 and the antenna 303 can be attached to each other. In this embodiment mode, the shape shown in FIG. 3B is adopted as each of the shapes of the first antenna circuit 101 and the second antenna circuit 102. That is, as shown in FIG. 4A, each of the first antenna circuit 101 and the second antenna circuit 102 is described to have a structure including an antenna 401 and a resonant capacitor 402, and an antenna circuit 403 refers to a combination of the antenna 401 and the resonant capacitor 402. Yamazaki–279 at [0062] In addition, the first rectifier circuit 105 and the second rectifier circuit 107 may be circuits in which AC signals induced by electromagnetic waves which are received by the first antenna circuit 101 and the second antenna circuit 102 are converted to DC signals. For example, as shown in FIG. 4B, a rectifier circuit 407 may include a diode 404, a diode 405, and a smoothing capacitor 406. Yamazaki–279 at [0068] In addition, in this embodiment mode, signals received by the first antenna circuit 101 and the second antenna circuit 102 preferably perform communication of signals by an electromagnetic induction method. Accordingly, the RFID 100 in FIGS. 1 and 2 preferably has a structure including the first coiled antenna circuit 101 and the second coiled antenna circuit 102. For example, FIG. 7 shows a positional relationship of the first antenna circuit and the second antenna circuit, and shapes of antennas in a semiconductor device including an RFID. FIG. 7 shows a structure in which a first coiled antenna circuit 701 and a second coiled antenna circuit 702 are provided over a front surface and a rear surface of an RFID 700 respectively, and in which a signal from an antenna of a charger is received. Yamazaki–279 at [0069] In FIG. 7, when a coiled antenna 705 in an antenna circuit 704 of a charger connected to a transmission control portion 703 is brought close to the second antenna circuit 702 of the RFID, an AC magnetic field is generated from the coiled antenna 705 of the antenna circuit 704 in the charger. The AC magnetic field passes through the second coiled antenna circuit 702 in the RFID 700, so that an electromotive force is generated between terminals (between one end of the antenna and the other end thereof) of the second coiled antenna circuit 702 in the RFID 700 due to electromagnetic induction. A battery in the RFID 700 can be charged by the electromotive force. Note that as shown in FIG. 8, a second antenna circuit 801 for charging which is provided over a front surface or a rear surface of a substrate in an RFID 800 can be

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	charged from a charger even when the RFIDs 800 are superimposed. In addition as shown in FIG. 9, an RFID 900 may have a structure in which a first antenna circuit 901 and a second antenna circuit 902 may be arranged side by side over the same substrate, and a signal from the antenna circuit 704 of the charger is received. Yamazaki–279 at [0070] Note that a frequency of a signal transmitted and received between the first antenna circuit 101 and the reader/writer 201 is 125 kHz, 13.56 MHz, 915 MHz, 2.45 GHz, or the like, and each of which is standardized by ISO or the like. Naturally, a frequency of a signal transmitted and received between the first antenna circuit 101 and the reader/writer 201 is not limited to this, and for example, any of the following can be used: a submillimeter wave of 300 GHz to 3 THz; a millimeter wave of 30 GHz to 300 GHz; a microwave of 3 GHz to 30 GHz; an ultrashort wave of 300 MHz to 3 GHz; a very short wave of 30 MHz to 300 MHz; a short wave of 3 MHz to 30 MHz; a medium wave of 300 KHz to 3 MHz; a long wave of 30 KHz to 300 KHz; and a very long wave of 3 KHz to 30 KHz. In addition, a signal transmitted and received between the first antenna circuit 101 and the reader/writer 201 is a signal in which a carrier wave is modulated. A modulation method of a carrier wave may be either analog modulation or digital modulation, or may be any of amplitude modulation, phase modulation, frequency modulation, and spread spectrum. Preferably, amplitude modulation or frequency modulation may be used. Yamazaki–279 at [0072] Note that power can be supplied to the power supply circuit 106 in FIGS. 1 and 2 by two ways: one is a power supply which is made such that a signal of a carrier wave is rectified in the first rectifier circuit 105 similarly to the passive type RFID described in the conventional example, and a power supply which drives each circuit of the signal processing circuit 103 is generated through the power supply circuit 106; the other is a power supply which is made such that the battery 104 is charged by a battery charging signal inputted from the second antenna circuit 102 through the second rectifier circuit 107, and power which is charged in the battery 104 is supplied. The power which is charged in the battery 104 can be supplied to the power supply circuit 106 in the case where enough power cannot be obtained from the first antenna circuit 101 of the RFID 100 when a communication distance extends. Yamazaki–279 at [0076] Next, an operation when data is transmitted from the reader/writer 201 to the RFID 100 shown in FIGS. 1 and 2 is described below. A signal received by the first antenna circuit 101 is half-wave rectified by the first rectifier circuit 105 and then smoothed. A voltage which is half-wave rectified and smoothed by the first rectifier circuit 105 is inputted to the power supply circuit 106. The power supply circuit supplies a

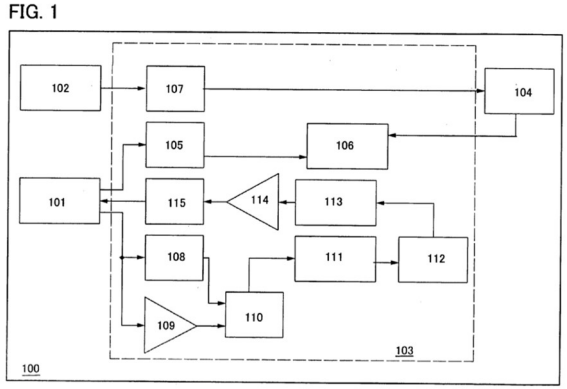
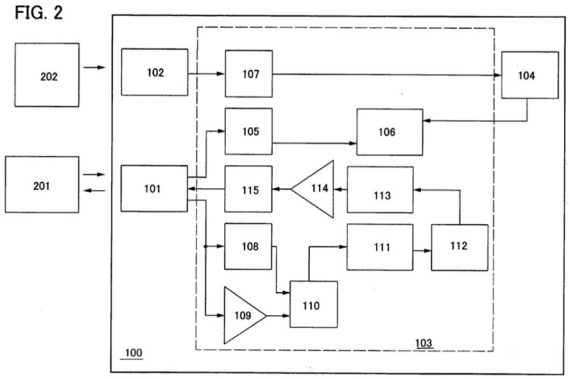
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	voltage which has been stabilized to the first rectifier circuit 105, the power supply circuit 106, the second rectifier circuit 107, the demodulation circuit 108, the amplifier 109, the logic circuit 110, the memory control circuit 111, the memory circuit 112, the logic circuit 113, the amplifier 114, and the modulation circuit 115. Yamazaki–279 at [0077] In addition, the signal received by the first antenna circuit 101 is inputted to the logic circuit 110 as a clock signal through the amplifier 109. Further, the signal inputted from the first antenna circuit 101 is demodulated by the demodulation circuit 108 and inputted to the logic circuit 110 as data. Yamazaki–279 at [0081] When the modulation circuit 115 operates, impedance of the first antenna circuit 101 is changed. Accordingly, a signal of the reader/writer 201 which is reflected on the first antenna circuit 101 changes. When the reader/writer reads this change, the data stored in the memory circuit 112 in the RFID 100 can be recognized. Such a modulation method is referred to as a load modulation method. Yamazaki–279 at [0082] Next, an operation when power is charged in the RFID 100 shown in FIGS. 1 and 2 by the charger 202 is described below. The signal received by the second antenna circuit is half-wave rectified and smoothed by the second rectifier circuit 107. A voltage which is half-wave rectified and smoothed by the second rectifier circuit 107 is once held in the battery 104. The power held in the battery 104 is used as power to be supplied to the power supply circuit 106. Note that when the signal supplied by the first antenna circuit can be received but there is a shortage of power for transmitting the signal to the reader/writer, a structure provided with a circuit which determines whether power is supplied by the battery may be used. Yamazaki–279 at [0086] As described above, a semiconductor device including an RFID of the present invention includes a battery. Therefore, similarly to a conventional semiconductor device, the semiconductor device of the present invention can prevent power shortage for transmitting and receiving individual information associated with deterioration over time of a cell. In addition, the semiconductor device of the present invention has an antenna which receives a signal for supplying power to the battery. Therefore, when power of radio waves from outside is used, the battery can be charged without direct connection between the semiconductor device and the charger. Accordingly, the semiconductor device of the present invention can be continuously used without generating confirmation of remaining capacity of a cell and replacement of a cell, like an active type RFID. In addition, power is held in the battery, so that enough power for

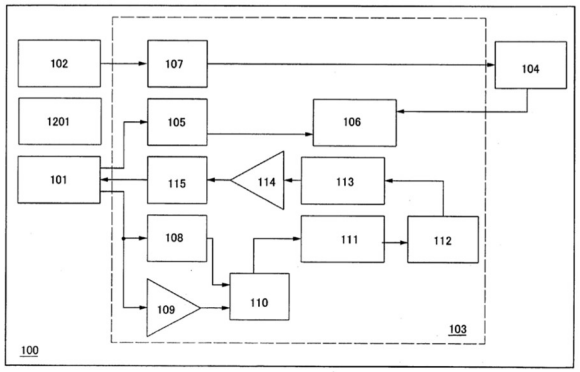
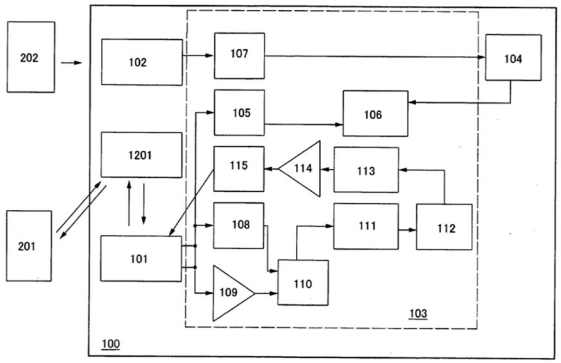
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	operating the RFID can be obtained and a communication distance between a reader/writer and the RFID can be extended. Yamazaki–279 at [0089] Note that a booster antenna described in this embodiment mode means an antenna (hereinafter referred to as a booster antenna) which is larger than an antenna (hereinafter referred to as a first chip antenna or a first antenna circuit) which receives a signal from a reader/writer and outputs it to a signal processing circuit of an RFID included in a semiconductor device, or an antenna (hereinafter referred to as a second chip antenna or a second antenna circuit) which receives a signal from a charger included in the semiconductor device. The booster antenna and the first chip antenna or the second chip antenna resonate at a frequency band and are magnetic-field coupled, so that a signal oscillated by the reader/writer or the charger can be efficiently transmitted to a targeted RFID. Since the booster antenna is connected to a coil antenna through a magnetic field, the booster antenna is not required to be directly connected to the chip antenna and the signal processing circuit, which is preferable. Yamazaki–279 at [0091] The RFID 100 of FIG. 12 includes the first antenna circuit 101, the second antenna circuit 102, a booster antenna 1201, the signal processing circuit 103, and the battery 104. The signal processing circuit 103 includes the first rectifier circuit 105, the power supply circuit 106, the second rectifier circuit 107, the demodulation circuit 108, the amplifier 109, the logic circuit 110, the memory control circuit 111, the memory circuit 112, the logic circuit 113, the amplifier 114, and the modulation circuit 115. Yamazaki–279 at [0092] FIG. 13 shows a block diagram in which the booster antenna 1201 transmits and receives a signal to and from the reader/writer 201, and is magnetic-field coupled to the first antenna circuit 101, so that a signal from the reader/writer is transmitted and received, and the second antenna circuit 102 receives a signal from the charger 202. In FIG. 13, the booster antenna 1201 receives the signal from the reader/writer 201 and is magnetic-field coupled to the first antenna circuit in accordance with electromagnetic induction, so that the signal received by the first antenna circuit 101 is inputted to the power supply circuit 106 through the first rectifier circuit 105 and inputted to the demodulation circuit 108 and the amplifier 109. In addition in FIG. 13, the signal received by the second antenna circuit 102 is inputted to the battery 104 through the second rectifier circuit 107, and power is supplied to the power supply circuit 106 from the battery 104, as appropriate. With the structure shown in FIG. 13, a communication distance of transmission and reception of a signal between the reader/writer 201 and the RFID 100 can be extended

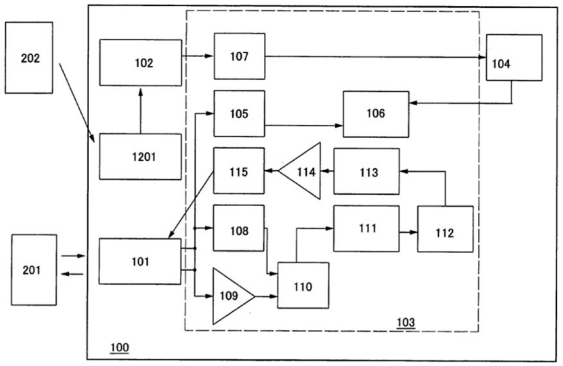
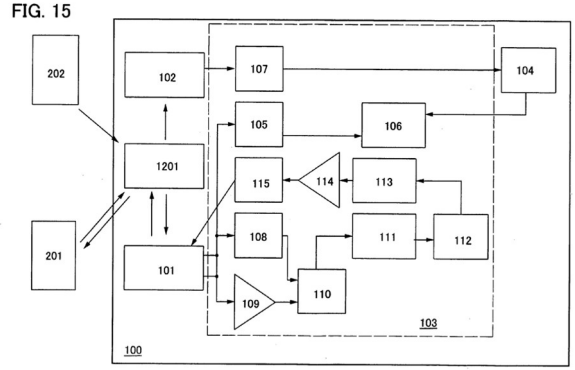
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	more than Embodiment Mode 1, which is preferable because data can be transmitted and received more surely. Yamazaki–279 at [0094] For example, FIG. 14 shows a block diagram in which the booster antenna 1201 receives a signal from the charger 202 and is magnetic-field coupled to the second antenna circuit 102, so that a signal from the charger is received and the first antenna circuit 101 transmits and receives a signal to and from the reader/writer 201. In FIG. 14, the booster antenna 1201 receives the signal from the charger 202 and is magnetic-field coupled to the second antenna circuit in accordance with electromagnetic induction, so that the signal received by the second antenna circuit 102 is inputted to the battery 104 through the second rectifier circuit 107. Then, power is supplied to the power supply circuit 106 from the battery 104, as appropriate. In addition in FIG. 14, the signal received by the first antenna circuit 101 is inputted to the power supply circuit 106 through the first rectifier circuit 105, and inputted to the demodulation circuit 108 and the amplifier 109. With the structure shown in FIG. 14, a communication distance of transmission and reception of a signal between the charger 202 and the RFID 100 can be extended, which is preferable because charge can be performed to the battery more surely. Yamazaki–279 at [0096] For example, FIG. 15 shows a block diagram in which the booster antenna 1201 transmits and receives a signal to and from the reader/writer 201 and the charger 202 and is magnetic-field coupled to the first antenna circuit 101 and the second antenna circuit 102, so that a signal from the reader/writer and a signal from the charger are transmitted and received. In FIG. 15, the booster antenna 1201 receives the signal from the reader/writer 201 and is magnetic-field coupled to the first antenna circuit in accordance with electromagnetic induction, so that the signal received by the first antenna circuit 101 is inputted to the power supply circuit 106 through the first rectifier circuit 105. In addition, in FIG. 15, the booster antenna 1201 receives the signal from the charger 202 and is magnetic-field coupled to the second antenna circuit in accordance with electromagnetic induction, so that the signal received by the second antenna circuit 102 is inputted to the battery 104 through the second rectifier circuit 107. Then, power is supplied to the power supply circuit 106 from the battery 104, as appropriate. Frequencies that the first antenna circuit and the second antenna circuit are tuned are close to each other, so that efficiency of electromagnetic induction in the booster antenna is more increased, which is preferable. Therefore, when a frequency of a signal transmitted and received between the second antenna circuit 102 and the charger 202 is set m (m is a positive number) and a frequency of a signal transmitted and received between the first antenna circuit 101 and the reader/writer 201 is set M (M is a positive number), a frequency which satisfies a relation of

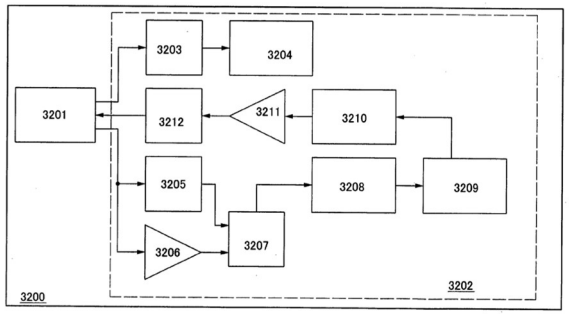
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	0.5 m<M<1.5 m and m≠M is preferably used. In addition to the above advantageous effect, when a frequency of a signal inputted to the second antenna circuit 102 is set within the above range, design can be performed without significantly changing the shapes of the first antenna circuit 101 and the second antenna circuit 102, which is preferable. With the structure shown in FIG. 15, a communication distance of transmission and reception of a signal between the reader/writer 201 and the RFID 100 and of transmission and reception of a signal between the charger 202 and the RFID 100 can be extended, which is preferable because data can be transmitted and received more surely and charge can be performed to the battery 104 more surely. Yamazaki–279 at [0103] In FIG. 16, when a coiled antenna 1606 in an antenna circuit 1605 of a charger connected to a transmission control portion 1604 is brought close to the booster antenna 1603 of the RFID, an AC magnetic field is generated from the coiled antenna 1606 of the antenna circuit 1605 in the charger. The AC magnetic field passes through the coiled booster antenna 1603 in the RFID 1600, so that an electromotive force is generated between terminals (between one end of the antenna and the other end thereof) of the coiled booster antenna 1603 in the RFID 1600 due to electromagnetic induction. The electromotive force due to electromagnetic induction is generated in the coiled booster antenna 1603, and an AC magnetic field is generated from the booster coil itself. Then, the AC magnetic field generated from the booster antenna 1603 passes through the second coiled antenna circuit 1602 in the RFID 1600, so that an electromotive force is generated between terminals (between one end of the antenna and the other end thereof) of the second coiled antenna circuit 1602 in the RFID 1600 due to electromagnetic induction. A battery in the RFID 1600 can be charged by the electromotive force. Yamazaki–279 at [0104] In addition, FIG. 17 shows a structure which is different from the structure shown in FIG. 16. FIG. 17 shows a structure in which the coiled booster antenna 1603 and either the first antenna circuit 1601 or the second antenna circuit 1602 are provided on one surface of the RFID 1600, and the other of the first antenna circuit 1601 and the second antenna circuit 1602 is provided on the other surface of the RFID 1600, and in which a signal from the antenna of the charger is received. In FIG. 17, when the coiled antenna 1606 in the antenna circuit 1605 of the charger connected to the transmission control portion 1604 is brought close to the booster antenna 1603 of the RFID, an AC magnetic field is generated from the coiled antenna 1606 of the antenna circuit 1605 in the charger. The AC magnetic field passes through the coiled booster antenna 1603 in the RFID 1600, so that an electromotive force is generated between the terminals (between the one end of the antenna and the other end thereof) of the coiled booster antenna

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	1603 in the RFID 1600 due to electromagnetic induction. The electromotive force due to electromagnetic induction is generated in the coiled booster antenna 1603, and an AC magnetic field is generated from the booster coil itself. Then, the AC magnetic field generated from the booster antenna 1603 passes through the second coiled antenna circuit 1602 in the RFID 1600, and an electromotive force is generated between the terminals (between the one end of the antenna and the other end thereof) of the second coiled antenna circuit 1602 in the RFID 1600 due to electromagnetic induction. The battery in the RFID 1600 can be charged by the electromotive force. The arrangement of the first antenna circuit, the second antenna circuit, and the booster antenna in this embodiment mode may be designed so that the antennas are located to make an AC magnetic field pass through the antenna coil. In addition, as shown in FIG. 17, by arranging the first antenna circuit or the second antenna circuit inside the booster antenna which holds a large area, efficient arrangement can be performed; therefore, a battery area or the like can be increased and the number of windings of an antenna can be increased, which is preferable. Yamazaki–279 at [0108] Note that power can be supplied to the power supply circuit 106 in FIGS. 12 to 15 by two ways: one is a power supply which is made such that a signal of a carrier wave is rectified in the first rectifier circuit 105 similarly to the passive type RFID described in the conventional example, and a power supply which drives each circuit of the signal processing circuit 103 is generated through the power supply circuit 106; the other is a power supply which is made such that the battery 104 is charged by a battery charging signal inputted from the second antenna circuit 102 through the second rectifier circuit 107, and power which is charged in the battery 104 is supplied. The power which is charged in the battery 104 can be supplied to the power supply circuit 106 in the case where enough power cannot be obtained from the first antenna circuit 101 of the RFID 100 when a communication distance extends. *See also* Yamazaki–279 at [0013], [0014], [0015], [0016], [0017], [0018], [0023], [0078], [0080], [0114], and [0201]. To the extent this limitation is not disclosed by Yamazaki–279, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Yamazaki–279, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 1 above.
4. The mobile device of claim 1 wherein the smartcard controller is	Yamazaki–279 expressly or inherently discloses "[t]he mobile device of claim 1 wherein the smartcard controller is coupled to be powered by the mobile device." For example:

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
coupled to be powered by the mobile device.	Yamazaki–279 at Figure 1  Yamazaki–279 at Figure 2  Yamazaki–279 at Figure 12

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	FIG. 12  Yamazaki–279 at Figure 13 FIG. 13  Yamazaki–279 at Figure 14

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	FIG. 14  Yamazaki–279 at Figure 15 FIG. 15  Yamazaki–279 at Figure 32

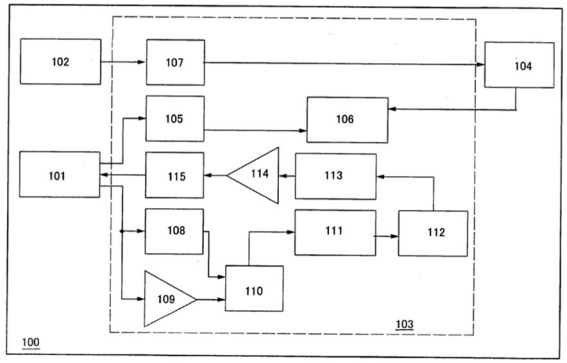
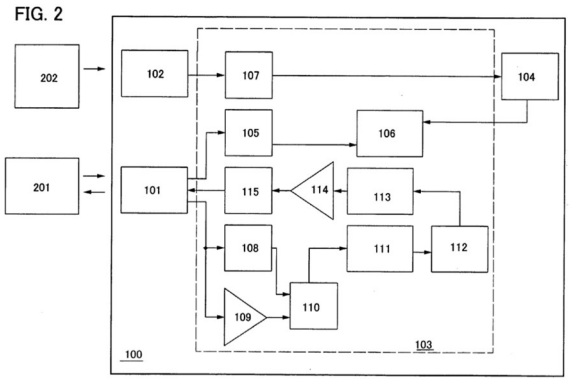
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	FIG. 32  Yamazaki–279 at [0004] Depending on whether a power supply is incorporated in an RFID or whether a power supply is supplied from outside, the RFID can be divided into two types: an active type RFID capable of transmitting radio waves including information on the RFID, and a passive type RFID which is driven using radio waves from outside or power of radio waves (carrier waves) (the active type RFID is referred to Reference 1: Japanese Published Patent Application No. 2005-316724; and the passive type RFID is referred to Reference 2: Japanese Translation of PCT International Application No. 2006-503376). Of these, the active type RFID has a structure in which a power supply for driving the RFID is incorporated and a cell is provided as the power supply. In addition, the passive type RFID has a structure in which a power supply for driving the RFID is generated using power of radio waves (carrier waves) from outside, so that a structure without a cell is realized. Yamazaki–279 at [0005] FIG. 31 is a block diagram showing a specific structure of an active type RFID. In an active type RFID 3100 of FIG. 31, a communication signal received by an antenna circuit 3101 is inputted to a demodulation circuit 3105 and an amplifier 3106 in a signal processing circuit 3102. The communication signal is usually transmitted after a carrier such as a 13.56 MHz carrier or a 915 MHz carrier is processed using ASK modulation, PSK modulation, or the like. Here, in FIG. 31, an example of a 13.56 MHz carrier is shown as the communication signal. In FIG. 31, a clock signal which is a reference for processing a signal is required, and a 13.56 MHz carrier is used as a clock here. The amplifier 3106 amplifies the 13.56 MHz carrier and supplies it to a logic circuit 3107 as the clock. In addition, the ASK modulated communication signal or the PSK modulated communication signal is demodulated by the demodulation circuit 3105. The signal which has been demodulated is also transmitted to the logic circuit 3107 to be

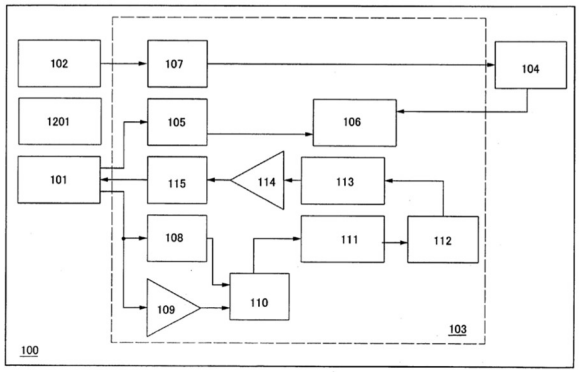
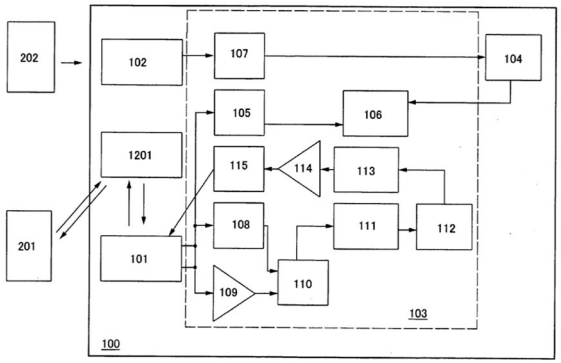
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	analyzed. The signal analyzed by the logic circuit 3107 is transmitted to a memory control circuit 3108, and based on it, the memory control circuit 3108 controls a memory circuit 3109, and data stored in the memory circuit 3109 is taken out and transmitted to a logic circuit 3110. The signal stored in the memory circuit 3109 is subjected to encode processing by the logic circuit 3110 and then amplified by an amplifier 3111, so that the carrier is modulated by a modulation circuit 3112 with the signal. Here, a power supply in FIG. 31 is supplied by a cell 3103 provided outside the signal processing circuit through a power supply circuit 3104. The power supply circuit 3104 supplies power to the amplifier 3106, the demodulation circuit 3105, the logic circuit 3107, the memory control circuit 3108, the memory circuit 3109, the logic circuit 3110, the amplifier 3111, the modulation circuit 3112, and the like. In this manner, the active type RFID operates. Yamazaki–279 at [0006] FIG. 32 is a block diagram showing a specific structure of a passive type RFID. In a passive type RFID 3200 of FIG. 32, a communication signal received by an antenna circuit 3201 is inputted to a demodulation circuit 3205 and an amplifier 3206 in a signal processing circuit 3202. A communication signal is usually transmitted after a carrier such as a 13.56 MHz carrier or a 915 MHz carrier is processed using ASK modulation, PSK modulation, or the like. Here, in FIG. 32, an example of a 13.56 MHz carrier is shown as a communication signal. In FIG. 32, a clock signal which is a reference for processing a signal is required, and a 13.56 MHz carrier is used as the clock here. The amplifier 3206 amplifies the 13.56 MHz carrier and supplies it to a logic circuit 3207 as the clock. In addition, the ASK modulated communication signal or the PSK modulated communication signal is demodulated by the demodulation circuit 3205. The signal which has been demodulated is also transmitted to the logic circuit 3207 to be analyzed. The signal analyzed by the logic circuit 3207 is transmitted to a memory control circuit 3208, and based on it, the memory control circuit 3208 controls a memory circuit 3209, and data stored in the memory circuit 3209 is taken out and transmitted to a logic circuit 3210. The signal stored in the memory circuit 3209 is subjected to encode processing by the logic circuit 3210 and then amplified by an amplifier 3211, so that the carrier is modulated by a modulation circuit 3212 with the signal. On the other hand, the communication signal inputted to a rectifier circuit 3203 is rectified and is inputted to a power supply circuit 3204. The power supply circuit 3204 supplies power to the amplifier 3206, the demodulation circuit 3205, the logic circuit 3207, the memory control circuit 3208, the memory circuit 3209, the logic circuit 3210, the amplifier 3211, the modulation circuit 3212, and the like. In this manner, the passive type RFID operates. Yamazaki–279 at [0010]

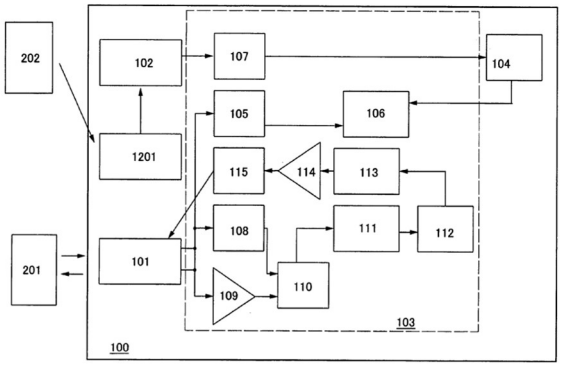
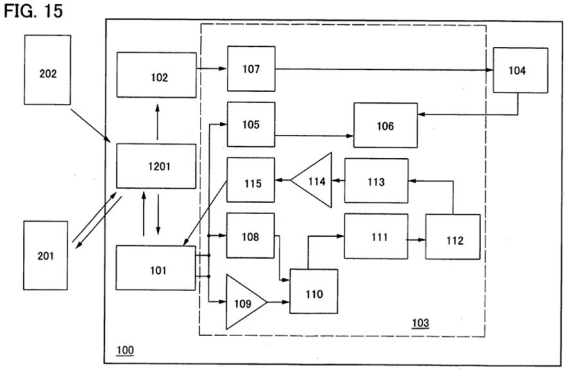
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	In order to solve the above-mentioned problems, the present invention provides a battery (also referred to as a secondary cell) as a power supply for supplying power in an RFID. The present invention provides another antenna for charging the battery as a means for supplying power to the battery, in addition to an antenna which transmits and receives individual information to and from outside. Hereinafter, a specific structure of the present invention is shown. Yamazaki–279 at [0019] The battery of the present invention may supply power to a power supply circuit included in the signal processing circuit. Yamazaki–279 at [0023] The semiconductor device of the present invention includes a battery. Therefore, similarly to a conventional semiconductor device, the semiconductor device of the present invention can prevent power shortage for transmitting and receiving individual information associated with deterioration over time of a cell. In addition, the semiconductor device of the present invention has an antenna which receives a signal for supplying power to the battery. Therefore, when power of radio waves from outside is used, the battery can be charged without direct connection between the semiconductor device and a charger. Accordingly, the semiconductor device of the present invention can be continuously used without generating confirmation of remaining capacity of a cell and replacement of a cell, like an active type RFID. In addition, power for driving the RFID is always held in the battery, so that enough power for operating the RFID can be obtained and a communication distance between a reader/writer and the RFID can be extended. Yamazaki–279 at [0059] An RFID 100 of FIG. 1 includes a first antenna circuit 101, a second antenna circuit 102, a signal processing circuit 103, and a battery 104. The signal processing circuit 103 includes a first rectifier circuit 105, a power supply circuit 106, a second rectifier circuit 107, a demodulation circuit 108, an amplifier 109, a logic circuit 110, a memory control circuit 111, a memory circuit 112, a logic circuit 113, an amplifier 114, and a modulation circuit 115. Yamazaki–279 at [0060] In addition, FIG. 2 shows a block diagram in which the first antenna circuit 101 transmits and receives a signal to and from a reader/writer 201, and the second antenna circuit 102 receives a signal from a charger 202. In FIG. 2, the signal received by the first antenna circuit 101 is inputted to the power supply circuit 106 through the first rectifier circuit 105. In FIG. 2, the signal received by the second antenna circuit 102

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	is inputted to the battery 104 through the second rectifier circuit 107, and power is supplied to the power supply circuit 106 from the battery 104, as appropriate. Yamazaki–279 at [0072] Note that power can be supplied to the power supply circuit 106 in FIGS. 1 and 2 by two ways: one is a power supply which is made such that a signal of a carrier wave is rectified in the first rectifier circuit 105 similarly to the passive type RFID described in the conventional example, and a power supply which drives each circuit of the signal processing circuit 103 is generated through the power supply circuit 106; the other is a power supply which is made such that the battery 104 is charged by a battery charging signal inputted from the second antenna circuit 102 through the second rectifier circuit 107, and power which is charged in the battery 104 is supplied. The power which is charged in the battery 104 can be supplied to the power supply circuit 106 in the case where enough power cannot be obtained from the first antenna circuit 101 of the RFID 100 when a communication distance extends. Yamazaki–279 at [0075] Note that in this specification, a battery means a cell which can recover a continuous using time by charging. Note that a sheet-like cell is preferably used as the battery. For example, the battery can be made smaller by using a lithium cell, preferably a lithium polymer cell using a gel-like electrolyte, a lithium ion cell, or the like. Naturally, any cell can be used as the battery as long as it is a chargeable cell, and a cell capable of charging and discharging such as a nickel metal hydride cell or a nickel cadmium cell may be used, or a capacitor having high capacity or the like may be used. Yamazaki–279 at [0076] Next, an operation when data is transmitted from the reader/writer 201 to the RFID 100 shown in FIGS. 1 and 2 is described below. A signal received by the first antenna circuit 101 is half-wave rectified by the first rectifier circuit 105 and then smoothed. A voltage which is half-wave rectified and smoothed by the first rectifier circuit 105 is inputted to the power supply circuit 106. The power supply circuit supplies a voltage which has been stabilized to the first rectifier circuit 105, the power supply circuit 106, the second rectifier circuit 107, the demodulation circuit 108, the amplifier 109, the logic circuit 110, the memory control circuit 111, the memory circuit 112, the logic circuit 113, the amplifier 114, and the modulation circuit 115. Yamazaki–279 at [0077]

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	In addition, the signal received by the first antenna circuit 101 is inputted to the logic circuit 110 as a clock signal through the amplifier 109. Further, the signal inputted from the first antenna circuit 101 is demodulated by the demodulation circuit 108 and inputted to the logic circuit 110 as data. Yamazaki–279 at [0082] Next, an operation when power is charged in the RFID 100 shown in FIGS. 1 and 2 by the charger 202 is described below. The signal received by the second antenna circuit is half-wave rectified and smoothed by the second rectifier circuit 107. A voltage which is half-wave rectified and smoothed by the second rectifier circuit 107 is once held in the battery 104. The power held in the battery 104 is used as power to be supplied to the power supply circuit 106. Note that when the signal supplied by the first antenna circuit can be received but there is a shortage of power for transmitting the signal to the reader/writer, a structure provided with a circuit which determines whether power is supplied by the battery may be used. Yamazaki–279 at [0091] The RFID 100 of FIG. 12 includes the first antenna circuit 101, the second antenna circuit 102, a booster antenna 1201, the signal processing circuit 103, and the battery 104. The signal processing circuit 103 includes the first rectifier circuit 105, the power supply circuit 106, the second rectifier circuit 107, the demodulation circuit 108, the amplifier 109, the logic circuit 110, the memory control circuit 111, the memory circuit 112, the logic circuit 113, the amplifier 114, and the modulation circuit 115. *See also* Yamazaki–279 at Abstract, [0078], and [0080]. To the extent this limitation is not disclosed by Yamazaki–279, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Yamazaki–279, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 1 above.
5. The mobile device of claim 1 wherein the performance enhancement circuits are coupled to be powered by the mobile device.	Yamazaki–279 expressly or inherently discloses "[t]he mobile device of claim 1 wherein the performance enhancement circuits are coupled to be powered by the mobile device." For example: Yamazaki–279 at Figure 1

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	FIG. 1  Yamazaki–279 at Figure 2 FIG. 2  Yamazaki–279 at Figure 12

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	FIG. 12  Yamazaki–279 at Figure 13 FIG. 13  Yamazaki–279 at Figure 14

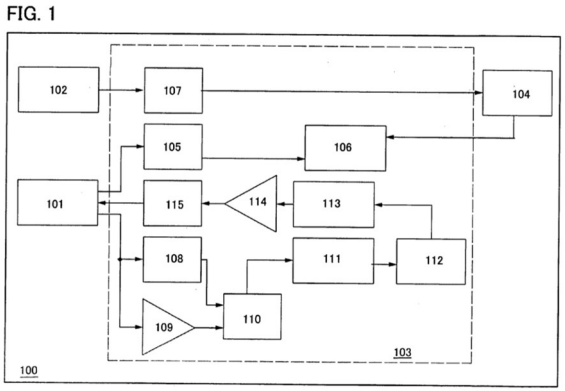
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	FIG. 14  Yamazaki–279 at Figure 15 FIG. 15  Yamazaki–279 at [0004] Depending on whether a power supply is incorporated in an RFID or whether a power supply is supplied from outside, the RFID can be divided into two types: an active type RFID capable of transmitting radio waves including information on the RFID, and a passive type RFID which is driven using radio waves from outside or power of radio waves (carrier waves) (the active type RFID is referred to Reference 1: Japanese Published Patent Application No. 2005-316724; and the passive type RFID is referred to Reference 2: Japanese Translation of PCT International Application No. 2006-503376). Of these, the active type RFID has a structure in which a power supply for driving the RFID is incorporated and a cell is provided as the power supply. In addition, the passive type RFID has a structure in which a power

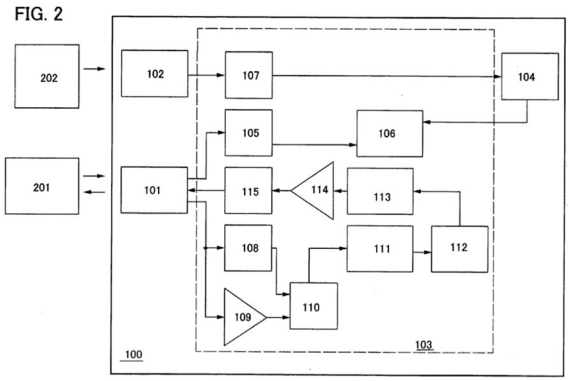
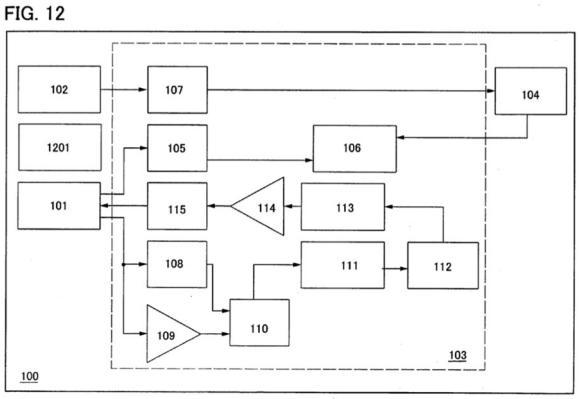
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	supply for driving the RFID is generated using power of radio waves (carrier waves) from outside, so that a structure without a cell is realized. Yamazaki–279 at [0005] FIG. 31 is a block diagram showing a specific structure of an active type RFID. In an active type RFID 3100 of FIG. 31, a communication signal received by an antenna circuit 3101 is inputted to a demodulation circuit 3105 and an amplifier 3106 in a signal processing circuit 3102. The communication signal is usually transmitted after a carrier such as a 13.56 MHz carrier or a 915 MHz carrier is processed using ASK modulation, PSK modulation, or the like. Here, in FIG. 31, an example of a 13.56 MHz carrier is shown as the communication signal. In FIG. 31, a clock signal which is a reference for processing a signal is required, and a 13.56 MHz carrier is used as a clock here. The amplifier 3106 amplifies the 13.56 MHz carrier and supplies it to a logic circuit 3107 as the clock. In addition, the ASK modulated communication signal or the PSK modulated communication signal is demodulated by the demodulation circuit 3105. The signal which has been demodulated is also transmitted to the logic circuit 3107 to be analyzed. The signal analyzed by the logic circuit 3107 is transmitted to a memory control circuit 3108, and based on it, the memory control circuit 3108 controls a memory circuit 3109, and data stored in the memory circuit 3109 is taken out and transmitted to a logic circuit 3110. The signal stored in the memory circuit 3109 is subjected to encode processing by the logic circuit 3110 and then amplified by an amplifier 3111, so that the carrier is modulated by a modulation circuit 3112 with the signal. Here, a power supply in FIG. 31 is supplied by a cell 3103 provided outside the signal processing circuit through a power supply circuit 3104. The power supply circuit 3104 supplies power to the amplifier 3106, the demodulation circuit 3105, the logic circuit 3107, the memory control circuit 3108, the memory circuit 3109, the logic circuit 3110, the amplifier 3111, the modulation circuit 3112, and the like. In this manner, the active type RFID operates. Yamazaki–279 at [0010] In order to solve the above-mentioned problems, the present invention provides a battery (also referred to as a secondary cell) as a power supply for supplying power in an RFID. The present invention provides another antenna for charging the battery as a means for supplying power to the battery, in addition to an antenna which transmits and receives individual information to and from outside. Hereinafter, a specific structure of the present invention is shown. Yamazaki–279 at [0019] The battery of the present invention may supply power to a power supply circuit included in the signal processing circuit.

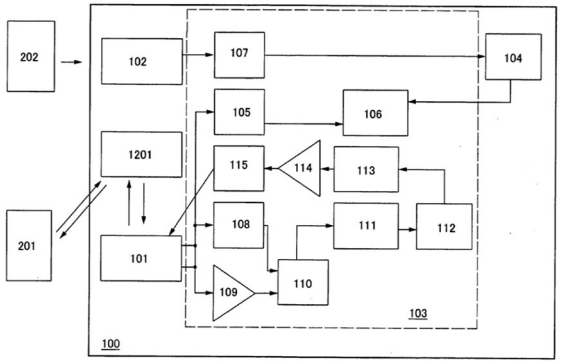
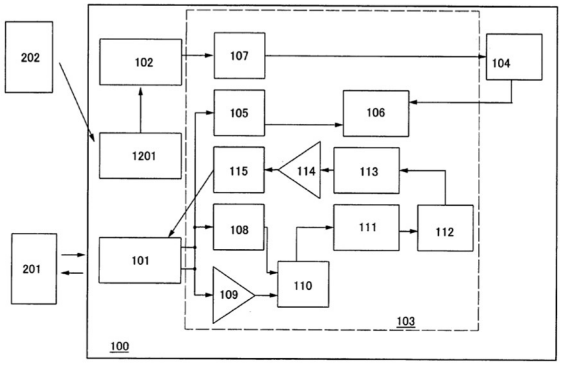
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	Yamazaki–279 at [0023] The semiconductor device of the present invention includes a battery. Therefore, similarly to a conventional semiconductor device, the semiconductor device of the present invention can prevent power shortage for transmitting and receiving individual information associated with deterioration over time of a cell. In addition, the semiconductor device of the present invention has an antenna which receives a signal for supplying power to the battery. Therefore, when power of radio waves from outside is used, the battery can be charged without direct connection between the semiconductor device and a charger. Accordingly, the semiconductor device of the present invention can be continuously used without generating confirmation of remaining capacity of a cell and replacement of a cell, like an active type RFID. In addition, power for driving the RFID is always held in the battery, so that enough power for operating the RFID can be obtained and a communication distance between a reader/writer and the RFID can be extended. Yamazaki–279 at [0060] In addition, FIG. 2 shows a block diagram in which the first antenna circuit 101 transmits and receives a signal to and from a reader/writer 201, and the second antenna circuit 102 receives a signal from a charger 202. In FIG. 2, the signal received by the first antenna circuit 101 is inputted to the power supply circuit 106 through the first rectifier circuit 105. In FIG. 2, the signal received by the second antenna circuit 102 is inputted to the battery 104 through the second rectifier circuit 107, and power is supplied to the power supply circuit 106 from the battery 104, as appropriate. Yamazaki–279 at [0072] Note that power can be supplied to the power supply circuit 106 in FIGS. 1 and 2 by two ways: one is a power supply which is made such that a signal of a carrier wave is rectified in the first rectifier circuit 105 similarly to the passive type RFID described in the conventional example, and a power supply which drives each circuit of the signal processing circuit 103 is generated through the power supply circuit 106; the other is a power supply which is made such that the battery 104 is charged by a battery charging signal inputted from the second antenna circuit 102 through the second rectifier circuit 107, and power which is charged in the battery 104 is supplied. The power which is charged in the battery 104 can be supplied to the power supply circuit 106 in the case where enough power cannot be obtained from the first antenna circuit 101 of the RFID 100 when a communication distance extends. Yamazaki–279 at [0075]

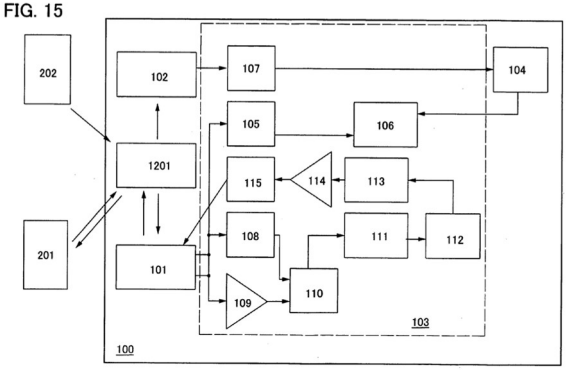
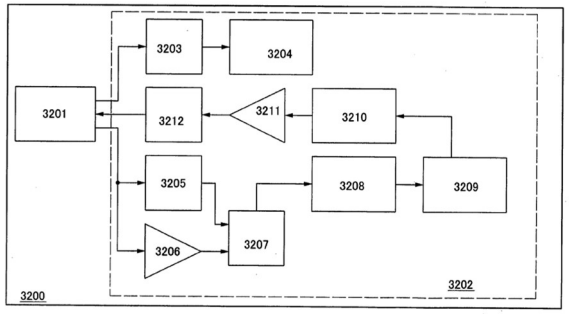
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	Note that in this specification, a battery means a cell which can recover a continuous using time by charging. Note that a sheet-like cell is preferably used as the battery. For example, the battery can be made smaller by using a lithium cell, preferably a lithium polymer cell using a gel-like electrolyte, a lithium ion cell, or the like. Naturally, any cell can be used as the battery as long as it is a chargeable cell, and a cell capable of charging and discharging such as a nickel metal hydride cell or a nickel cadmium cell may be used, or a capacitor having high capacity or the like may be used. Yamazaki–279 at [0082] Next, an operation when power is charged in the RFID 100 shown in FIGS. 1 and 2 by the charger 202 is described below. The signal received by the second antenna circuit is half-wave rectified and smoothed by the second rectifier circuit 107. A voltage which is half-wave rectified and smoothed by the second rectifier circuit 107 is once held in the battery 104. The power held in the battery 104 is used as power to be supplied to the power supply circuit 106. Note that when the signal supplied by the first antenna circuit can be received but there is a shortage of power for transmitting the signal to the reader/writer, a structure provided with a circuit which determines whether power is supplied by the battery may be used. Yamazaki–279 at [0091] The RFID 100 of FIG. 12 includes the first antenna circuit 101, the second antenna circuit 102, a booster antenna 1201, the signal processing circuit 103, and the battery 104. The signal processing circuit 103 includes the first rectifier circuit 105, the power supply circuit 106, the second rectifier circuit 107, the demodulation circuit 108, the amplifier 109, the logic circuit 110, the memory control circuit 111, the memory circuit 112, the logic circuit 113, the amplifier 114, and the modulation circuit 115. *See also* Yamazaki–279 at Abstract. To the extent this limitation is not disclosed by Yamazaki–279, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Yamazaki–279, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 1 above.
6. The mobile device of claim 1 wherein the mobile device comprises a mobile phone.	Yamazaki–279 expressly or inherently discloses "[t]he mobile device of claim 1 wherein the mobile device comprises a mobile phone." For example: Yamazaki–279 at [0215]

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	> This embodiment mode will describe applications of a semiconductor device of the present invention which communicates data by wireless communication (hereinafter referred to an RFID). The semiconductor device of the present invention can be used as a so-called ID label, ID tag, or ID card, which is incorporated in, for example, bills, coins, securities, bearer bonds, certificates (driving licenses, resident cards, and the like), containers for wrapping objects (wrapping paper, bottles, and the like), recording media (DVD software, video tapes, and the like), vehicles (bicycles and the like), personal belongings (bags, glasses, and the like), foods, plants, animals, human bodies, clothes, commodities, products such as electronic devices, or shipping tags of baggage, and the like. The electronic devices include a liquid crystal display device, an EL display device, a television set (also simply called a television, a TV receiver, or a television receiver), a mobile phone, and the like. To the extent this limitation is not disclosed by Yamazaki–279, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Yamazaki–279, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 1 above.
7[pre]. A mobile device comprising:	Yamazaki–279 expressly or inherently discloses "[a] mobile device." For example: *See* above at 1[pre]. To the extent this limitation is not disclosed by Yamazaki–279, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Yamazaki–279, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[7a] a smartcard controller;	Yamazaki–279 expressly or inherently discloses "a smartcard controller." For example: *See* above at [1a]. To the extent this limitation is not disclosed by Yamazaki–279, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Yamazaki–279, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[7b] an antenna; and	Yamazaki–279 expressly or inherently discloses "an antenna." For example: *See* above at [1b].

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	To the extent this limitation is not disclosed by Yamazaki–279, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Yamazaki–279, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[7c] performance enhancement circuits coupled between the smartcard controller and the antenna, wherein the performance enhancement circuits include an amplifier and an active transmit driver circuit, and	Yamazaki–279 expressly or inherently discloses "performance enhancement circuits coupled between the smartcard controller and the antenna, wherein the performance enhancement circuits include an amplifier and an active transmit driver circuit." For example: Yamazaki–279 at Abstract The present invention provides a battery as a power supply for supplying power in the RFID, and another antenna for charging the battery, in addition to an antenna which transmits and receives individual information to and from outside as a means for supplying power to the battery. Yamazaki–279 at Figure 1  Yamazaki–279 at Figure 2

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	 Yamazaki–279 at Figure 12  Yamazaki–279 at Figure 13

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	FIG. 13  Yamazaki–279 at Figure 14 FIG. 14  Yamazaki–279 at Figure 15

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	FIG. 15  Yamazaki–279 at Figure 32 FIG. 32  Yamazaki–279 at [0001] The present invention relates to a semiconductor device. In particular, the present invention relates to a semiconductor device which transmits and receives data through radio waves and receives power. Furthermore, the present invention relates to a communication system using a semiconductor device through radio waves, an antenna and a reader/writer which transmit and receive data to and from the semiconductor device, and an antenna and a charger which supply power to the semiconductor device. Yamazaki–279 at [0005] FIG. 31 is a block diagram showing a specific structure of an active type RFID. In an active type RFID 3100 of FIG. 31, a communication signal received by an antenna circuit 3101 is inputted to a demodulation circuit 3105 and an amplifier 3106 in a signal processing circuit 3102. The communication

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	signal is usually transmitted after a carrier such as a 13.56 MHz carrier or a 915 MHz carrier is processed using ASK modulation, PSK modulation, or the like. Here, in FIG. 31, an example of a 13.56 MHz carrier is shown as the communication signal. In FIG. 31, a clock signal which is a reference for processing a signal is required, and a 13.56 MHz carrier is used as a clock here. The amplifier 3106 amplifies the 13.56 MHz carrier and supplies it to a logic circuit 3107 as the clock. In addition, the ASK modulated communication signal or the PSK modulated communication signal is demodulated by the demodulation circuit 3105. The signal which has been demodulated is also transmitted to the logic circuit 3107 to be analyzed. The signal analyzed by the logic circuit 3107 is transmitted to a memory control circuit 3108, and based on it, the memory control circuit 3108 controls a memory circuit 3109, and data stored in the memory circuit 3109 is taken out and transmitted to a logic circuit 3110. The signal stored in the memory circuit 3109 is subjected to encode processing by the logic circuit 3110 and then amplified by an amplifier 3111, so that the carrier is modulated by a modulation circuit 3112 with the signal. Here, a power supply in FIG. 31 is supplied by a cell 3103 provided outside the signal processing circuit through a power supply circuit 3104. The power supply circuit 3104 supplies power to the amplifier 3106, the demodulation circuit 3105, the logic circuit 3107, the memory control circuit 3108, the memory circuit 3109, the logic circuit 3110, the amplifier 3111, the modulation circuit 3112, and the like. In this manner, the active type RFID operates. Yamazaki–279 at [0006] FIG. 32 is a block diagram showing a specific structure of a passive type RFID. In a passive type RFID 3200 of FIG. 32, a communication signal received by an antenna circuit 3201 is inputted to a demodulation circuit 3205 and an amplifier 3206 in a signal processing circuit 3202. A communication signal is usually transmitted after a carrier such as a 13.56 MHz carrier or a 915 MHz carrier is processed using ASK modulation, PSK modulation, or the like. Here, in FIG. 32, an example of a 13.56 MHz carrier is shown as a communication signal. In FIG. 32, a clock signal which is a reference for processing a signal is required, and a 13.56 MHz carrier is used as the clock here. The amplifier 3206 amplifies the 13.56 MHz carrier and supplies it to a logic circuit 3207 as the clock. In addition, the ASK modulated communication signal or the PSK modulated communication signal is demodulated by the demodulation circuit 3205. The signal which has been demodulated is also transmitted to the logic circuit 3207 to be analyzed. The signal analyzed by the logic circuit 3207 is transmitted to a memory control circuit 3208, and based on it, the memory control circuit 3208 controls a memory circuit 3209, and data stored in the memory circuit 3209 is taken out and transmitted to a logic circuit 3210. The signal stored in the memory circuit 3209 is subjected to encode processing by the logic circuit 3210 and then amplified by an amplifier 3211, so that the carrier is modulated by a modulation circuit 3212 with the signal. On the other hand, the

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	communication signal inputted to a rectifier circuit 3203 is rectified and is inputted to a power supply circuit 3204. The power supply circuit 3204 supplies power to the amplifier 3206, the demodulation circuit 3205, the logic circuit 3207, the memory control circuit 3208, the memory circuit 3209, the logic circuit 3210, the amplifier 3211, the modulation circuit 3212, and the like. In this manner, the passive type RFID operates. Yamazaki–279 at [0008] In addition, as shown in FIG. 32, in the case of a semiconductor device having a passive type RFID which generates a power supply for driving by using power of radio waves (carrier waves) from outside, there has been a problem in that it is difficult to transmit and receive signals from a long distance and to secure power for transmitting radio waves required for transmission and reception, so that it is difficult to realize transmission and reception in excellent condition. Accordingly, there has been a problem in that a distance from an antenna of a reader/writer which is a power supply means to which enough power of radio waves (carrier waves) from outside is supplied is limited to be short, in order to use a semiconductor device having a passive type RFID which generates a power supply for driving by using power of radio waves (carrier waves) from outside. Yamazaki–279 at [0010] In order to solve the above-mentioned problems, the present invention provides a battery (also referred to as a secondary cell) as a power supply for supplying power in an RFID. The present invention provides another antenna for charging the battery as a means for supplying power to the battery, in addition to an antenna which transmits and receives individual information to and from outside. Hereinafter, a specific structure of the present invention is shown. Yamazaki–279 at [0011] One feature of the present invention is a semiconductor device including: a first antenna circuit; a second antenna circuit; a signal processing circuit; and a battery, in which the first antenna circuit receives a signal through the booster antenna and transmits a signal for transmitting data stored in the signal processing circuit; and the second antenna circuit receives a signal for charging the battery. Yamazaki–279 at [0012] Another feature of the present invention is a semiconductor device including: a first antenna circuit; a second antenna circuit; a signal processing circuit; and a battery, in which the first antenna circuit receives a signal and transmits a signal for transmitting data stored in the signal processing circuit to and from a

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	reader/writer; and the second antenna circuit receives a signal for charging the battery from a charger including an antenna circuit. Yamazaki–279 at [0013] Another feature of the present invention is a semiconductor device including: a first antenna circuit; a second antenna circuit; a booster antenna; a signal processing circuit; and a battery, in which the first antenna circuit receives a signal through the booster antenna and transmits a signal for transmitting data stored in the signal processing circuit; and the second antenna circuit receives a signal for charging the battery through the booster antenna. Yamazaki–279 at [0014] Another feature of the present invention is a semiconductor device including: a first antenna circuit; a second antenna circuit; a booster antenna; a signal processing circuit; and a battery, in which the first antenna circuit receives a signal and transmits a signal for transmitting data stored in the signal processing circuit; and the second antenna circuit receives a signal for charging the battery through the booster antenna. Yamazaki–279 at [0015] Another feature of the present invention is a semiconductor device including: a first antenna circuit; a second antenna circuit; a booster antenna; a signal processing circuit; and a battery, in which the first antenna circuit receives a signal and transmits a signal for transmitting data stored in the signal processing circuit through the booster antenna; and the second antenna circuit receives a signal for charging the battery from a charger including an antenna circuit through the booster antenna. Yamazaki–279 at [0016] Another feature of the present invention is a semiconductor device including: a first antenna circuit; a second antenna circuit; a booster antenna; a signal processing circuit; and a battery, in which the first antenna circuit receives a signal and transmits a signal for transmitting data stored in the signal processing circuit to and from a reader/writer through the booster antenna; and the second antenna circuit receives a signal for charging the battery. Yamazaki–279 at [0017] Another feature of the present invention is a semiconductor device including: a first antenna circuit; a second antenna circuit; a booster antenna; a signal processing circuit; and a battery, in which the first antenna circuit receives a signal and transmits a signal for transmitting data stored in the signal processing

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	circuit to and from a reader/writer; and the second antenna circuit receives a signal for charging the battery from a charger including an antenna circuit through the booster antenna. Yamazaki–279 at [0018] Another feature of the present invention is a semiconductor device including: a first antenna circuit; a second antenna circuit; a booster antenna; a signal processing circuit; and a battery, in which the first antenna circuit receives a signal and transmits a signal for transmitting data stored in the signal processing circuit to and from a reader/writer through the booster antenna; and the second antenna circuit receives a signal for charging the battery from a charger including an antenna circuit through the booster antenna. Yamazaki–279 at [0020] The first antenna circuit and the second antenna circuit of the present invention may transmit and receive a radio signal by an electromagnetic induction method. Yamazaki–279 at [0059] An RFID 100 of FIG. 1 includes a first antenna circuit 101, a second antenna circuit 102, a signal processing circuit 103, and a battery 104. The signal processing circuit 103 includes a first rectifier circuit 105, a power supply circuit 106, a second rectifier circuit 107, a demodulation circuit 108, an amplifier 109, a logic circuit 110, a memory control circuit 111, a memory circuit 112, a logic circuit 113, an amplifier 114, and a modulation circuit 115. Yamazaki–279 at [0060] In addition, FIG. 2 shows a block diagram in which the first antenna circuit 101 transmits and receives a signal to and from a reader/writer 201, and the second antenna circuit 102 receives a signal from a charger 202. In FIG. 2, the signal received by the first antenna circuit 101 is inputted to the power supply circuit 106 through the first rectifier circuit 105. In FIG. 2, the signal received by the second antenna circuit 102 is inputted to the battery 104 through the second rectifier circuit 107, and power is supplied to the power supply circuit 106 from the battery 104, as appropriate. Yamazaki–279 at [0061] Note that each of shapes of antennas of the first antenna circuit 101 and the second antenna circuit 102 is not particularly limited. For example, as shown in FIG. 3A, a structure in which an antenna 303 covers the periphery of a signal processing circuit 302 over a substrate 301 may be used. In addition, as shown in FIG. 3B, a structure in which the signal processing circuit 302 is arranged so as to be superimposed over the antenna 303 which is circularly formed over the substrate 301 may be used. Further, as shown in FIG.

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	3C, the shape of the antenna 303 for receiving a high frequency electromagnetic wave in accordance with the signal processing circuit 302 over the substrate 301 may be used. In addition, as shown in FIG. 3D, the 180 degree omnidirectional antenna 303 (capable of receiving signals similarly from any direction) in accordance with the signal processing circuit 302 over the substrate 301 may be used. In addition, as shown in FIG. 3E, the shape of the antenna 303 which is extended to be a stick shape in accordance with the signal processing circuit 302 over the substrate 301 may be used. Furthermore, connection between the signal processing circuit 103 and the antennas in the first antenna circuit 101 and the second antenna circuit 102 is not particularly limited. For example, the antenna 303 and the signal processing circuit 302 are connected by wire bonding or bump bonding. Alternatively, the signal processing circuit 302 being a chip having an electrode over an entire surface thereof may be attached to the antenna 303. In this method, by using an ACF (Anisotropic Conductive Film), the signal processing circuit 302 and the antenna 303 can be attached to each other. In this embodiment mode, the shape shown in FIG. 3B is adopted as each of the shapes of the first antenna circuit 101 and the second antenna circuit 102. That is, as shown in FIG. 4A, each of the first antenna circuit 101 and the second antenna circuit 102 is described to have a structure including an antenna 401 and a resonant capacitor 402, and an antenna circuit 403 refers to a combination of the antenna 401 and the resonant capacitor 402. Yamazaki–279 at [0062] In addition, the first rectifier circuit 105 and the second rectifier circuit 107 may be circuits in which AC signals induced by electromagnetic waves which are received by the first antenna circuit 101 and the second antenna circuit 102 are converted to DC signals. For example, as shown in FIG. 4B, a rectifier circuit 407 may include a diode 404, a diode 405, and a smoothing capacitor 406. Yamazaki–279 at [0068] In addition, in this embodiment mode, signals received by the first antenna circuit 101 and the second antenna circuit 102 preferably perform communication of signals by an electromagnetic induction method. Accordingly, the RFID 100 in FIGS. 1 and 2 preferably has a structure including the first coiled antenna circuit 101 and the second coiled antenna circuit 102. For example, FIG. 7 shows a positional relationship of the first antenna circuit and the second antenna circuit, and shapes of antennas in a semiconductor device including an RFID. FIG. 7 shows a structure in which a first coiled antenna circuit 701 and a second coiled antenna circuit 702 are provided over a front surface and a rear surface of an RFID 700 respectively, and in which a signal from an antenna of a charger is received. Yamazaki–279 at [0069]

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	In FIG. 7, when a coiled antenna 705 in an antenna circuit 704 of a charger connected to a transmission control portion 703 is brought close to the second antenna circuit 702 of the RFID, an AC magnetic field is generated from the coiled antenna 705 of the antenna circuit 704 in the charger. The AC magnetic field passes through the second coiled antenna circuit 702 in the RFID 700, so that an electromotive force is generated between terminals (between one end of the antenna and the other end thereof) of the second coiled antenna circuit 702 in the RFID 700 due to electromagnetic induction. A battery in the RFID 700 can be charged by the electromotive force. Note that as shown in FIG. 8, a second antenna circuit 801 for charging which is provided over a front surface or a rear surface of a substrate in an RFID 800 can be charged from a charger even when the RFIDs 800 are superimposed. In addition as shown in FIG. 9, an RFID 900 may have a structure in which a first antenna circuit 901 and a second antenna circuit 902 may be arranged side by side over the same substrate, and a signal from the antenna circuit 704 of the charger is received. Yamazaki–279 at [0070] Note that a frequency of a signal transmitted and received between the first antenna circuit 101 and the reader/writer 201 is 125 kHz, 13.56 MHz, 915 MHz, 2.45 GHz, or the like, and each of which is standardized by ISO or the like. Naturally, a frequency of a signal transmitted and received between the first antenna circuit 101 and the reader/writer 201 is not limited to this, and for example, any of the following can be used: a submillimeter wave of 300 GHz to 3 THz; a millimeter wave of 30 GHz to 300 GHz; a microwave of 3 GHz to 30 GHz; an ultrashort wave of 300 MHz to 3 GHz; a very short wave of 30 MHz to 300 MHz; a short wave of 3 MHz to 30 MHz; a medium wave of 300 KHz to 3 MHz; a long wave of 30 KHz to 300 KHz; and a very long wave of 3 KHz to 30 KHz. In addition, a signal transmitted and received between the first antenna circuit 101 and the reader/writer 201 is a signal in which a carrier wave is modulated. A modulation method of a carrier wave may be either analog modulation or digital modulation, or may be any of amplitude modulation, phase modulation, frequency modulation, and spread spectrum. Preferably, amplitude modulation or frequency modulation may be used. Yamazaki–279 at [0072] Note that power can be supplied to the power supply circuit 106 in FIGS. 1 and 2 by two ways: one is a power supply which is made such that a signal of a carrier wave is rectified in the first rectifier circuit 105 similarly to the passive type RFID described in the conventional example, and a power supply which drives each circuit of the signal processing circuit 103 is generated through the power supply circuit 106; the other is a power supply which is made such that the battery 104 is charged by a battery charging signal inputted from the second antenna circuit 102 through the second rectifier circuit 107, and power which is

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	charged in the battery 104 is supplied. The power which is charged in the battery 104 can be supplied to the power supply circuit 106 in the case where enough power cannot be obtained from the first antenna circuit 101 of the RFID 100 when a communication distance extends. Yamazaki–279 at [0073] An example of the power supply circuit in FIGS. 1 and 2 is described with reference to FIG. 10. The power supply circuit includes a reference voltage circuit and a buffer amplifier. The reference voltage circuit includes a resistor 1001, diode-connected transistors 1002 and 1003, and generates a reference voltage which is equivalent to twice VGS of a transistor. The buffer amplifier includes a differential circuit including transistors 1005 and 1006; a current mirror circuit including transistors 1007 and 1008; and a common-source amplifier including a current supply resistor 1004, a transistor 1009, and a resistor 1010. Yamazaki–279 at [0076] Next, an operation when data is transmitted from the reader/writer 201 to the RFID 100 shown in FIGS. 1 and 2 is described below. A signal received by the first antenna circuit 101 is half-wave rectified by the first rectifier circuit 105 and then smoothed. A voltage which is half-wave rectified and smoothed by the first rectifier circuit 105 is inputted to the power supply circuit 106. The power supply circuit supplies a voltage which has been stabilized to the first rectifier circuit 105, the power supply circuit 106, the second rectifier circuit 107, the demodulation circuit 108, the amplifier 109, the logic circuit 110, the memory control circuit 111, the memory circuit 112, the logic circuit 113, the amplifier 114, and the modulation circuit 115. Yamazaki–279 at [0077] In addition, the signal received by the first antenna circuit 101 is inputted to the logic circuit 110 as a clock signal through the amplifier 109. Further, the signal inputted from the first antenna circuit 101 is demodulated by the demodulation circuit 108 and inputted to the logic circuit 110 as data. Yamazaki–279 at [0080] Further, an AC signal received by the first antenna circuit 101 is inputted to the logic circuit 110 through the amplifier 109, and a logic operation is performed. Then, the memory control circuit 111 is controlled using the signal from the logic circuit 110, and the data stored in the memory circuit 112 is called out. The data called out from the memory circuit 112 is processed by the logic circuit 113, amplified by the amplifier 114, and then, the modulation circuit 115 is operated. Although the data processing is carried

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	out in accordance with a standard such as ISO14443, ISO15693, or ISO18000, processing system other than these standards can be adopted as long as compatibility with the reader/writer is ensured. Yamazaki–279 at [0081] When the modulation circuit 115 operates, impedance of the first antenna circuit 101 is changed. Accordingly, a signal of the reader/writer 201 which is reflected on the first antenna circuit 101 changes. When the reader/writer reads this change, the data stored in the memory circuit 112 in the RFID 100 can be recognized. Such a modulation method is referred to as a load modulation method. Yamazaki–279 at [0082] Next, an operation when power is charged in the RFID 100 shown in FIGS. 1 and 2 by the charger 202 is described below. The signal received by the second antenna circuit is half-wave rectified and smoothed by the second rectifier circuit 107. A voltage which is half-wave rectified and smoothed by the second rectifier circuit 107 is once held in the battery 104. The power held in the battery 104 is used as power to be supplied to the power supply circuit 106. Note that when the signal supplied by the first antenna circuit can be received but there is a shortage of power for transmitting the signal to the reader/writer, a structure provided with a circuit which determines whether power is supplied by the battery may be used. Yamazaki–279 at [0086] As described above, a semiconductor device including an RFID of the present invention includes a battery. Therefore, similarly to a conventional semiconductor device, the semiconductor device of the present invention can prevent power shortage for transmitting and receiving individual information associated with deterioration over time of a cell. In addition, the semiconductor device of the present invention has an antenna which receives a signal for supplying power to the battery. Therefore, when power of radio waves from outside is used, the battery can be charged without direct connection between the semiconductor device and the charger. Accordingly, the semiconductor device of the present invention can be continuously used without generating confirmation of remaining capacity of a cell and replacement of a cell, like an active type RFID. In addition, power is held in the battery, so that enough power for operating the RFID can be obtained and a communication distance between a reader/writer and the RFID can be extended. Yamazaki–279 at [0089] Note that a booster antenna described in this embodiment mode means an antenna (hereinafter referred to as a booster antenna) which is larger than an antenna (hereinafter referred to as a first chip antenna or a first antenna circuit) which receives a signal from a reader/writer and outputs it to a signal processing

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	circuit of an RFID included in a semiconductor device, or an antenna (hereinafter referred to as a second chip antenna or a second antenna circuit) which receives a signal from a charger included in the semiconductor device. The booster antenna and the first chip antenna or the second chip antenna resonate at a frequency band and are magnetic-field coupled, so that a signal oscillated by the reader/writer or the charger can be efficiently transmitted to a targeted RFID. Since the booster antenna is connected to a coil antenna through a magnetic field, the booster antenna is not required to be directly connected to the chip antenna and the signal processing circuit, which is preferable. Yamazaki–279 at [0091] The RFID 100 of FIG. 12 includes the first antenna circuit 101, the second antenna circuit 102, a booster antenna 1201, the signal processing circuit 103, and the battery 104. The signal processing circuit 103 includes the first rectifier circuit 105, the power supply circuit 106, the second rectifier circuit 107, the demodulation circuit 108, the amplifier 109, the logic circuit 110, the memory control circuit 111, the memory circuit 112, the logic circuit 113, the amplifier 114, and the modulation circuit 115. Yamazaki–279 at [0092] FIG. 13 shows a block diagram in which the booster antenna 1201 transmits and receives a signal to and from the reader/writer 201, and is magnetic-field coupled to the first antenna circuit 101, so that a signal from the reader/writer is transmitted and received, and the second antenna circuit 102 receives a signal from the charger 202. In FIG. 13, the booster antenna 1201 receives the signal from the reader/writer 201 and is magnetic-field coupled to the first antenna circuit in accordance with electromagnetic induction, so that the signal received by the first antenna circuit 101 is inputted to the power supply circuit 106 through the first rectifier circuit 105 and inputted to the demodulation circuit 108 and the amplifier 109. In addition in FIG. 13, the signal received by the second antenna circuit 102 is inputted to the battery 104 through the second rectifier circuit 107, and power is supplied to the power supply circuit 106 from the battery 104, as appropriate. With the structure shown in FIG. 13, a communication distance of transmission and reception of a signal between the reader/writer 201 and the RFID 100 can be extended more than Embodiment Mode 1, which is preferable because data can be transmitted and received more surely. Yamazaki–279 at [0094] For example, FIG. 14 shows a block diagram in which the booster antenna 1201 receives a signal from the charger 202 and is magnetic-field coupled to the second antenna circuit 102, so that a signal from the charger is received and the first antenna circuit 101 transmits and receives a signal to and from the reader/writer 201. In FIG. 14, the booster antenna 1201 receives the signal from the charger 202 and is

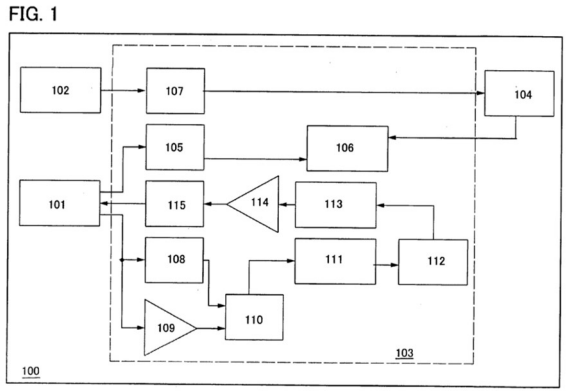
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	magnetic-field coupled to the second antenna circuit in accordance with electromagnetic induction, so that the signal received by the second antenna circuit 102 is inputted to the battery 104 through the second rectifier circuit 107. Then, power is supplied to the power supply circuit 106 from the battery 104, as appropriate. In addition in FIG. 14, the signal received by the first antenna circuit 101 is inputted to the power supply circuit 106 through the first rectifier circuit 105, and inputted to the demodulation circuit 108 and the amplifier 109. With the structure shown in FIG. 14, a communication distance of transmission and reception of a signal between the charger 202 and the RFID 100 can be extended, which is preferable because charge can be performed to the battery more surely. Yamazaki–279 at [0096] For example, FIG. 15 shows a block diagram in which the booster antenna 1201 transmits and receives a signal to and from the reader/writer 201 and the charger 202 and is magnetic-field coupled to the first antenna circuit 101 and the second antenna circuit 102, so that a signal from the reader/writer and a signal from the charger are transmitted and received. In FIG. 15, the booster antenna 1201 receives the signal from the reader/writer 201 and is magnetic-field coupled to the first antenna circuit in accordance with electromagnetic induction, so that the signal received by the first antenna circuit 101 is inputted to the power supply circuit 106 through the first rectifier circuit 105. In addition, in FIG. 15, the booster antenna 1201 receives the signal from the charger 202 and is magnetic-field coupled to the second antenna circuit in accordance with electromagnetic induction, so that the signal received by the second antenna circuit 102 is inputted to the battery 104 through the second rectifier circuit 107. Then, power is supplied to the power supply circuit 106 from the battery 104, as appropriate. Frequencies that the first antenna circuit and the second antenna circuit are tuned are close to each other, so that efficiency of electromagnetic induction in the booster antenna is more increased, which is preferable. Therefore, when a frequency of a signal transmitted and received between the second antenna circuit 102 and the charger 202 is set m (m is a positive number) and a frequency of a signal transmitted and received between the first antenna circuit 101 and the reader/writer 201 is set M (M is a positive number), a frequency which satisfies a relation of $0.5\ m<M<1.5\ m$ and $m \neq M$ is preferably used. In addition to the above advantageous effect, when a frequency of a signal inputted to the second antenna circuit 102 is set within the above range, design can be performed without significantly changing the shapes of the first antenna circuit 101 and the second antenna circuit 102, which is preferable. With the structure shown in FIG. 15, a communication distance of transmission and reception of a signal between the reader/writer 201 and the RFID 100 and of transmission and reception of a signal between the charger 202 and the RFID 100 can be extended, which is preferable because data can be transmitted and received more surely and charge can be performed to the battery 104 more surely.

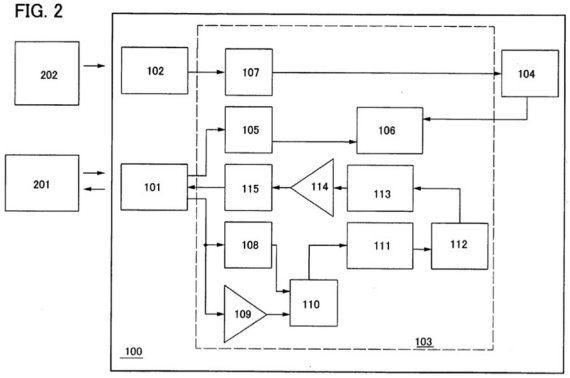
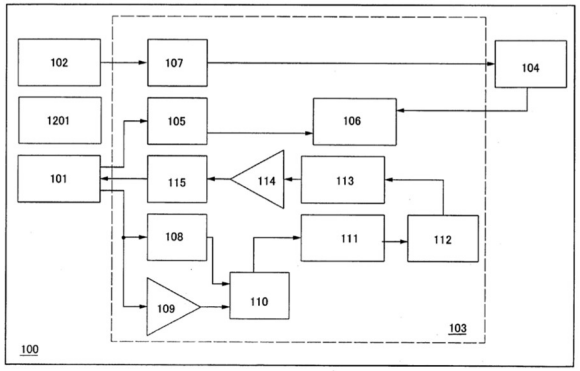
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	Yamazaki–279 at [0103] In FIG. 16, when a coiled antenna 1606 in an antenna circuit 1605 of a charger connected to a transmission control portion 1604 is brought close to the booster antenna 1603 of the RFID, an AC magnetic field is generated from the coiled antenna 1606 of the antenna circuit 1605 in the charger. The AC magnetic field passes through the coiled booster antenna 1603 in the RFID 1600, so that an electromotive force is generated between terminals (between one end of the antenna and the other end thereof) of the coiled booster antenna 1603 in the RFID 1600 due to electromagnetic induction. The electromotive force due to electromagnetic induction is generated in the coiled booster antenna 1603, and an AC magnetic field is generated from the booster coil itself. Then, the AC magnetic field generated from the booster antenna 1603 passes through the second coiled antenna circuit 1602 in the RFID 1600, so that an electromotive force is generated between terminals (between one end of the antenna and the other end thereof) of the second coiled antenna circuit 1602 in the RFID 1600 due to electromagnetic induction. A battery in the RFID 1600 can be charged by the electromotive force. Yamazaki–279 at [0104] In addition, FIG. 17 shows a structure which is different from the structure shown in FIG. 16. FIG. 17 shows a structure in which the coiled booster antenna 1603 and either the first antenna circuit 1601 or the second antenna circuit 1602 are provided on one surface of the RFID 1600, and the other of the first antenna circuit 1601 and the second antenna circuit 1602 is provided on the other surface of the RFID 1600, and in which a signal from the antenna of the charger is received. In FIG. 17, when the coiled antenna 1606 in the antenna circuit 1605 of the charger connected to the transmission control portion 1604 is brought close to the booster antenna 1603 of the RFID, an AC magnetic field is generated from the coiled antenna 1606 of the antenna circuit 1605 in the charger. The AC magnetic field passes through the coiled booster antenna 1603 in the RFID 1600, so that an electromotive force is generated between the terminals (between the one end of the antenna and the other end thereof) of the coiled booster antenna 1603 in the RFID 1600 due to electromagnetic induction. The electromotive force due to electromagnetic induction is generated in the coiled booster antenna 1603, and an AC magnetic field is generated from the booster coil itself. Then, the AC magnetic field generated from the booster antenna 1603 passes through the second coiled antenna circuit 1602 in the RFID 1600, and an electromotive force is generated between the terminals (between the one end of the antenna and the other end thereof) of the second coiled antenna circuit 1602 in the RFID 1600 due to electromagnetic induction. The battery in the RFID 1600 can be charged by the electromotive force. The arrangement of the first antenna circuit, the second antenna circuit, and the booster antenna in this embodiment mode may be designed so that the antennas are

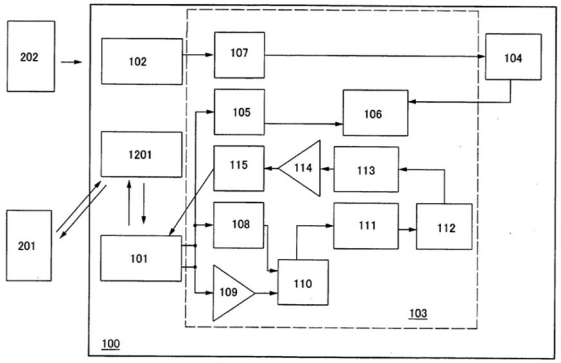
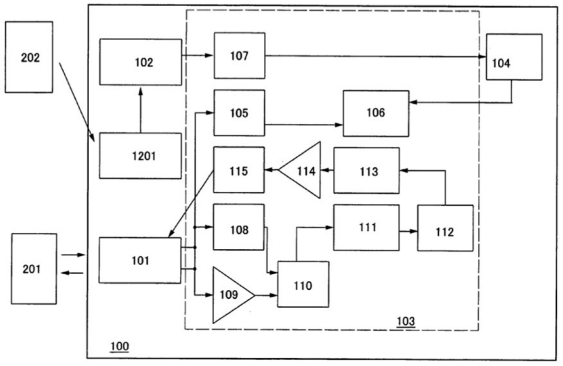
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	located to make an AC magnetic field pass through the antenna coil. In addition, as shown in FIG. 17, by arranging the first antenna circuit or the second antenna circuit inside the booster antenna which holds a large area, efficient arrangement can be performed; therefore, a battery area or the like can be increased and the number of windings of an antenna can be increased, which is preferable. Yamazaki–279 at [0108] Note that power can be supplied to the power supply circuit 106 in FIGS. 12 to 15 by two ways: one is a power supply which is made such that a signal of a carrier wave is rectified in the first rectifier circuit 105 similarly to the passive type RFID described in the conventional example, and a power supply which drives each circuit of the signal processing circuit 103 is generated through the power supply circuit 106; the other is a power supply which is made such that the battery 104 is charged by a battery charging signal inputted from the second antenna circuit 102 through the second rectifier circuit 107, and power which is charged in the battery 104 is supplied. The power which is charged in the battery 104 can be supplied to the power supply circuit 106 in the case where enough power cannot be obtained from the first antenna circuit 101 of the RFID 100 when a communication distance extends. *See also* above at [1c]. *See also* Yamazaki–279 at [0023], [0078], [0114], and [0201]. To the extent this limitation is not disclosed by Yamazaki–279, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Yamazaki–279, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[7d] wherein the amplifier is coupled to amplify a signal received from the antenna and to provide an amplified signal to the smartcard controller.	Yamazaki–279 expressly or inherently discloses "wherein the amplifier is coupled to amplify a signal received from the antenna and to provide an amplified signal to the smartcard controller." For example: *See* above at [1d]. To the extent this limitation is not disclosed by Yamazaki–279, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Yamazaki–279, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
8. The mobile device of claim 7 wherein the antenna is tuned to operate at 13.56 MHz.	Yamazaki–279 expressly or inherently discloses "[t]he mobile device of claim 7 wherein the antenna is tuned to operate at 13.56 MHz." *See* above at claim 2.

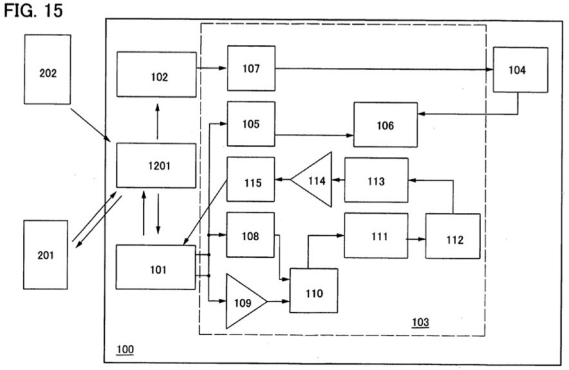
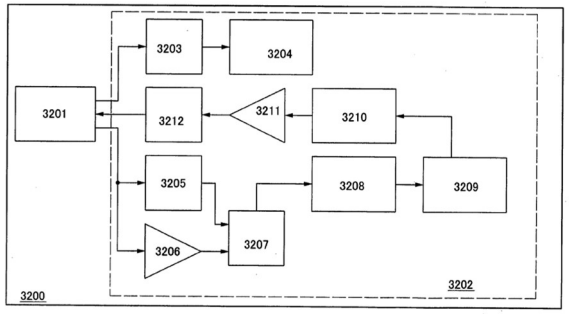
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	To the extent this limitation is not disclosed by Yamazaki–279, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Yamazaki–279, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 7 above.
9. The mobile device of claim 7 wherein the antenna comprises an inductive element too small to draw enough power sufficient to operate the smartcard controller from an interrogating radio frequency (RF) field.	Yamazaki–279 expressly or inherently discloses "[t]he mobile device of claim 7 wherein the antenna comprises an inductive element too small to draw enough power sufficient to operate the smartcard controller from an interrogating radio frequency (RF) field." For example: *See* above at claim 3. To the extent this limitation is not disclosed by Yamazaki–279, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Yamazaki–279, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 7 above.
10. The mobile device of claim 7 wherein the smartcard controller is coupled to be powered by the mobile device.	Yamazaki–279 expressly or inherently discloses "[t]he mobile device of claim 7 wherein the smartcard controller is coupled to be powered by the mobile device." For example: *See* above at claim 4. To the extent this limitation is not disclosed by Yamazaki–279, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Yamazaki–279, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 7 above.
11. The mobile device of claim 7 wherein the performance enhancement circuits are coupled to be powered by the mobile device.	Yamazaki–279 expressly or inherently discloses "[t]he mobile device of claim 7 wherein the performance enhancement circuits are coupled to be powered by the mobile device." For example: *See* above at claim 5. To the extent this limitation is not disclosed by Yamazaki–279, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Yamazaki–279, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 7 above.

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12. The mobile device of claim 7 wherein the mobile device comprises a mobile phone.	Yamazaki–279 expressly or inherently discloses "[t]he mobile device of claim 7 wherein the mobile device comprises a mobile phone." For example: *See* above at claim 6. To the extent this limitation is not disclosed by Yamazaki–279, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Yamazaki–279, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 7 above.
13[pre]. A mobile device comprising:	Yamazaki–279 expressly or inherently discloses "[a] mobile device." For example: *See* above at 1[pre]. To the extent this limitation is not disclosed by Yamazaki–279, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Yamazaki–279, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[13a] a smartcard controller;	Yamazaki–279 expressly or inherently discloses "a smartcard controller." For example: *See* above at [1a]. To the extent this limitation is not disclosed by Yamazaki–279, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Yamazaki–279, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[13b] an antenna;	Yamazaki–279 expressly or inherently discloses "an antenna." For example: *See* above at [1b]. To the extent this limitation is not disclosed by Yamazaki–279, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Yamazaki–279, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[13c] an amplifier coupled to amplify signals received at the antenna and drive the smartcard controller; and	Yamazaki–279 expressly or inherently discloses "an amplifier coupled to amplify signals received at the antenna and drive the smartcard controller." For example: *See* above at [1d].

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	To the extent this limitation is not disclosed by Yamazaki–279, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Yamazaki–279, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[13d] a driver circuit to drive the antenna with data provided by the smartcard controller.	Yamazaki–279 expressly or inherently discloses "a driver circuit to drive the antenna with data provided by the smartcard controller." For example: Yamazaki–279 at Abstract The present invention provides a battery as a power supply for supplying power in the RFID, and another antenna for charging the battery, in addition to an antenna which transmits and receives individual information to and from outside as a means for supplying power to the battery. Yamazaki–279 at Figure 1  Yamazaki–279 at Figure 2

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	FIG. 2  Yamazaki–279 at Figure 12 FIG. 12  Yamazaki–279 at Figure 13

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	FIG. 13  Yamazaki–279 at Figure 14 FIG. 14  Yamazaki–279 at Figure 15

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	FIG. 15  Yamazaki–279 at Figure 32 FIG. 32  Yamazaki–279 at [0001] The present invention relates to a semiconductor device. In particular, the present invention relates to a semiconductor device which transmits and receives data through radio waves and receives power. Furthermore, the present invention relates to a communication system using a semiconductor device through radio waves, an antenna and a reader/writer which transmit and receive data to and from the semiconductor device, and an antenna and a charger which supply power to the semiconductor device. Yamazaki–279 at [0004] Depending on whether a power supply is incorporated in an RFID or whether a power supply is supplied from outside, the RFID can be divided into two types: an active type RFID capable of transmitting radio waves including information on the RFID, and a passive type RFID which is driven using radio waves

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	from outside or power of radio waves (carrier waves) (the active type RFID is referred to Reference 1: Japanese Published Patent Application No. 2005-316724; and the passive type RFID is referred to Reference 2: Japanese Translation of PCT International Application No. 2006-503376). Of these, the active type RFID has a structure in which a power supply for driving the RFID is incorporated and a cell is provided as the power supply. In addition, the passive type RFID has a structure in which a power supply for driving the RFID is generated using power of radio waves (carrier waves) from outside, so that a structure without a cell is realized. Yamazaki–279 at [0005] FIG. 31 is a block diagram showing a specific structure of an active type RFID. In an active type RFID 3100 of FIG. 31, a communication signal received by an antenna circuit 3101 is inputted to a demodulation circuit 3105 and an amplifier 3106 in a signal processing circuit 3102. The communication signal is usually transmitted after a carrier such as a 13.56 MHz carrier or a 915 MHz carrier is processed using ASK modulation, PSK modulation, or the like. Here, in FIG. 31, an example of a 13.56 MHz carrier is shown as the communication signal. In FIG. 31, a clock signal which is a reference for processing a signal is required, and a 13.56 MHz carrier is used as a clock here. The amplifier 3106 amplifies the 13.56 MHz carrier and supplies it to a logic circuit 3107 as the clock. In addition, the ASK modulated communication signal or the PSK modulated communication signal is demodulated by the demodulation circuit 3105. The signal which has been demodulated is also transmitted to the logic circuit 3107 to be analyzed. The signal analyzed by the logic circuit 3107 is transmitted to a memory control circuit 3108, and based on it, the memory control circuit 3108 controls a memory circuit 3109, and data stored in the memory circuit 3109 is taken out and transmitted to a logic circuit 3110. The signal stored in the memory circuit 3109 is subjected to encode processing by the logic circuit 3110 and then amplified by an amplifier 3111, so that the carrier is modulated by a modulation circuit 3112 with the signal. Here, a power supply in FIG. 31 is supplied by a cell 3103 provided outside the signal processing circuit through a power supply circuit 3104. The power supply circuit 3104 supplies power to the amplifier 3106, the demodulation circuit 3105, the logic circuit 3107, the memory control circuit 3108, the memory circuit 3109, the logic circuit 3110, the amplifier 3111, the modulation circuit 3112, and the like. In this manner, the active type RFID operates. Yamazaki–279 at [0006] FIG. 32 is a block diagram showing a specific structure of a passive type RFID. In a passive type RFID 3200 of FIG. 32, a communication signal received by an antenna circuit 3201 is inputted to a demodulation circuit 3205 and an amplifier 3206 in a signal processing circuit 3202. A communication

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	signal is usually transmitted after a carrier such as a 13.56 MHz carrier or a 915 MHz carrier is processed using ASK modulation, PSK modulation, or the like. Here, in FIG. 32, an example of a 13.56 MHz carrier is shown as a communication signal. In FIG. 32, a clock signal which is a reference for processing a signal is required, and a 13.56 MHz carrier is used as the clock here. The amplifier 3206 amplifies the 13.56 MHz carrier and supplies it to a logic circuit 3207 as the clock. In addition, the ASK modulated communication signal or the PSK modulated communication signal is demodulated by the demodulation circuit 3205. The signal which has been demodulated is also transmitted to the logic circuit 3207 to be analyzed. The signal analyzed by the logic circuit 3207 is transmitted to a memory control circuit 3208, and based on it, the memory control circuit 3208 controls a memory circuit 3209, and data stored in the memory circuit 3209 is taken out and transmitted to a logic circuit 3210. The signal stored in the memory circuit 3209 is subjected to encode processing by the logic circuit 3210 and then amplified by an amplifier 3211, so that the carrier is modulated by a modulation circuit 3212 with the signal. On the other hand, the communication signal inputted to a rectifier circuit 3203 is rectified and is inputted to a power supply circuit 3204. The power supply circuit 3204 supplies power to the amplifier 3206, the demodulation circuit 3205, the logic circuit 3207, the memory control circuit 3208, the memory circuit 3209, the logic circuit 3210, the amplifier 3211, the modulation circuit 3212, and the like. In this manner, the passive type RFID operates. Yamazaki–279 at [0008] In addition, as shown in FIG. 32, in the case of a semiconductor device having a passive type RFID which generates a power supply for driving by using power of radio waves (carrier waves) from outside, there has been a problem in that it is difficult to transmit and receive signals from a long distance and to secure power for transmitting radio waves required for transmission and reception, so that it is difficult to realize transmission and reception in excellent condition. Accordingly, there has been a problem in that a distance from an antenna of a reader/writer which is a power supply means to which enough power of radio waves (carrier waves) from outside is supplied is limited to be short, in order to use a semiconductor device having a passive type RFID which generates a power supply for driving by using power of radio waves (carrier waves) from outside. Yamazaki–279 at [0010] In order to solve the above-mentioned problems, the present invention provides a battery (also referred to as a secondary cell) as a power supply for supplying power in an RFID. The present invention provides another antenna for charging the battery as a means for supplying power to the battery, in addition to an

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	antenna which transmits and receives individual information to and from outside. Hereinafter, a specific structure of the present invention is shown. Yamazaki–279 at [0011] One feature of the present invention is a semiconductor device including: a first antenna circuit; a second antenna circuit; a signal processing circuit; and a battery, in which the first antenna circuit receives a signal through the booster antenna and transmits a signal for transmitting data stored in the signal processing circuit; and the second antenna circuit receives a signal for charging the battery. Yamazaki–279 at [0012] Another feature of the present invention is a semiconductor device including: a first antenna circuit; a second antenna circuit; a signal processing circuit; and a battery, in which the first antenna circuit receives a signal and transmits a signal for transmitting data stored in the signal processing circuit to and from a reader/writer; and the second antenna circuit receives a signal for charging the battery from a charger including an antenna circuit. Yamazaki–279 at [0013] Another feature of the present invention is a semiconductor device including: a first antenna circuit; a second antenna circuit; a booster antenna; a signal processing circuit; and a battery, in which the first antenna circuit receives a signal through the booster antenna and transmits a signal for transmitting data stored in the signal processing circuit; and the second antenna circuit receives a signal for charging the battery through the booster antenna. Yamazaki–279 at [0014] Another feature of the present invention is a semiconductor device including: a first antenna circuit; a second antenna circuit; a booster antenna; a signal processing circuit; and a battery, in which the first antenna circuit receives a signal and transmits a signal for transmitting data stored in the signal processing circuit; and the second antenna circuit receives a signal for charging the battery through the booster antenna. Yamazaki–279 at [0015] Another feature of the present invention is a semiconductor device including: a first antenna circuit; a second antenna circuit; a booster antenna; a signal processing circuit; and a battery, in which the first antenna circuit receives a signal and transmits a signal for transmitting data stored in the signal processing

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	circuit through the booster antenna; and the second antenna circuit receives a signal for charging the battery from a charger including an antenna circuit through the booster antenna. Yamazaki–279 at [0016] Another feature of the present invention is a semiconductor device including: a first antenna circuit; a second antenna circuit; a booster antenna; a signal processing circuit; and a battery, in which the first antenna circuit receives a signal and transmits a signal for transmitting data stored in the signal processing circuit to and from a reader/writer through the booster antenna; and the second antenna circuit receives a signal for charging the battery. Yamazaki–279 at [0017] Another feature of the present invention is a semiconductor device including: a first antenna circuit; a second antenna circuit; a booster antenna; a signal processing circuit; and a battery, in which the first antenna circuit receives a signal and transmits a signal for transmitting data stored in the signal processing circuit to and from a reader/writer; and the second antenna circuit receives a signal for charging the battery from a charger including an antenna circuit through the booster antenna. Yamazaki–279 at [0018] Another feature of the present invention is a semiconductor device including: a first antenna circuit; a second antenna circuit; a booster antenna; a signal processing circuit; and a battery, in which the first antenna circuit receives a signal and transmits a signal for transmitting data stored in the signal processing circuit to and from a reader/writer through the booster antenna; and the second antenna circuit receives a signal for charging the battery from a charger including an antenna circuit through the booster antenna. Yamazaki–279 at [0019] The battery of the present invention may supply power to a power supply circuit included in the signal processing circuit. Yamazaki–279 at [0020] The first antenna circuit and the second antenna circuit of the present invention may transmit and receive a radio signal by an electromagnetic induction method. Yamazaki–279 at [0023] The semiconductor device of the present invention includes a battery. Therefore, similarly to a conventional semiconductor device, the semiconductor device of the present invention can prevent power

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	shortage for transmitting and receiving individual information associated with deterioration over time of a cell. In addition, the semiconductor device of the present invention has an antenna which receives a signal for supplying power to the battery. Therefore, when power of radio waves from outside is used, the battery can be charged without direct connection between the semiconductor device and a charger. Accordingly, the semiconductor device of the present invention can be continuously used without generating confirmation of remaining capacity of a cell and replacement of a cell, like an active type RFID. In addition, power for driving the RFID is always held in the battery, so that enough power for operating the RFID can be obtained and a communication distance between a reader/writer and the RFID can be extended. Yamazaki–279 at [0059] An RFID 100 of FIG. 1 includes a first antenna circuit 101, a second antenna circuit 102, a signal processing circuit 103, and a battery 104. The signal processing circuit 103 includes a first rectifier circuit 105, a power supply circuit 106, a second rectifier circuit 107, a demodulation circuit 108, an amplifier 109, a logic circuit 110, a memory control circuit 111, a memory circuit 112, a logic circuit 113, an amplifier 114, and a modulation circuit 115. Yamazaki–279 at [0060] In addition, FIG. 2 shows a block diagram in which the first antenna circuit 101 transmits and receives a signal to and from a reader/writer 201, and the second antenna circuit 102 receives a signal from a charger 202. In FIG. 2, the signal received by the first antenna circuit 101 is inputted to the power supply circuit 106 through the first rectifier circuit 105. In FIG. 2, the signal received by the second antenna circuit 102 is inputted to the battery 104 through the second rectifier circuit 107, and power is supplied to the power supply circuit 106 from the battery 104, as appropriate. Yamazaki–279 at [0061] Note that each of shapes of antennas of the first antenna circuit 101 and the second antenna circuit 102 is not particularly limited. For example, as shown in FIG. 3A, a structure in which an antenna 303 covers the periphery of a signal processing circuit 302 over a substrate 301 may be used. In addition, as shown in FIG. 3B, a structure in which the signal processing circuit 302 is arranged so as to be superimposed over the antenna 303 which is circularly formed over the substrate 301 may be used. Further, as shown in FIG. 3C, the shape of the antenna 303 for receiving a high frequency electromagnetic wave in accordance with the signal processing circuit 302 over the substrate 301 may be used. In addition, as shown in FIG. 3D, the 180 degree omnidirectional antenna 303 (capable of receiving signals similarly from any direction) in accordance with the signal processing circuit 302 over the substrate 301 may be used. In addition, as

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	shown in FIG. 3E, the shape of the antenna 303 which is extended to be a stick shape in accordance with the signal processing circuit 302 over the substrate 301 may be used. Furthermore, connection between the signal processing circuit 103 and the antennas in the first antenna circuit 101 and the second antenna circuit 102 is not particularly limited. For example, the antenna 303 and the signal processing circuit 302 are connected by wire bonding or bump bonding. Alternatively, the signal processing circuit 302 being a chip having an electrode over an entire surface thereof may be attached to the antenna 303. In this method, by using an ACF (Anisotropic Conductive Film), the signal processing circuit 302 and the antenna 303 can be attached to each other. In this embodiment mode, the shape shown in FIG. 3B is adopted as each of the shapes of the first antenna circuit 101 and the second antenna circuit 102. That is, as shown in FIG. 4A, each of the first antenna circuit 101 and the second antenna circuit 102 is described to have a structure including an antenna 401 and a resonant capacitor 402, and an antenna circuit 403 refers to a combination of the antenna 401 and the resonant capacitor 402. Yamazaki–279 at [0062] In addition, the first rectifier circuit 105 and the second rectifier circuit 107 may be circuits in which AC signals induced by electromagnetic waves which are received by the first antenna circuit 101 and the second antenna circuit 102 are converted to DC signals. For example, as shown in FIG. 4B, a rectifier circuit 407 may include a diode 404, a diode 405, and a smoothing capacitor 406. Yamazaki–279 at [0068] In addition, in this embodiment mode, signals received by the first antenna circuit 101 and the second antenna circuit 102 preferably perform communication of signals by an electromagnetic induction method. Accordingly, the RFID 100 in FIGS. 1 and 2 preferably has a structure including the first coiled antenna circuit 101 and the second coiled antenna circuit 102. For example, FIG. 7 shows a positional relationship of the first antenna circuit and the second antenna circuit, and shapes of antennas in a semiconductor device including an RFID. FIG. 7 shows a structure in which a first coiled antenna circuit 701 and a second coiled antenna circuit 702 are provided over a front surface and a rear surface of an RFID 700 respectively, and in which a signal from an antenna of a charger is received. Yamazaki–279 at [0069] In FIG. 7, when a coiled antenna 705 in an antenna circuit 704 of a charger connected to a transmission control portion 703 is brought close to the second antenna circuit 702 of the RFID, an AC magnetic field is generated from the coiled antenna 705 of the antenna circuit 704 in the charger. The AC magnetic field passes through the second coiled antenna circuit 702 in the RFID 700, so that an electromotive force is generated between terminals (between one end of the antenna and the other end thereof) of the second

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	coiled antenna circuit 702 in the RFID 700 due to electromagnetic induction. A battery in the RFID 700 can be charged by the electromotive force. Note that as shown in FIG. 8, a second antenna circuit 801 for charging which is provided over a front surface or a rear surface of a substrate in an RFID 800 can be charged from a charger even when the RFIDs 800 are superimposed. In addition as shown in FIG. 9, an RFID 900 may have a structure in which a first antenna circuit 901 and a second antenna circuit 902 may be arranged side by side over the same substrate, and a signal from the antenna circuit 704 of the charger is received. Yamazaki–279 at [0070] Note that a frequency of a signal transmitted and received between the first antenna circuit 101 and the reader/writer 201 is 125 kHz, 13.56 MHz, 915 MHz, 2.45 GHz, or the like, and each of which is standardized by ISO or the like. Naturally, a frequency of a signal transmitted and received between the first antenna circuit 101 and the reader/writer 201 is not limited to this, and for example, any of the following can be used: a submillimeter wave of 300 GHz to 3 THz; a millimeter wave of 30 GHz to 300 GHz; a microwave of 3 GHz to 30 GHz; an ultrashort wave of 300 MHz to 3 GHz; a very short wave of 30 MHz to 300 MHz; a short wave of 3 MHz to 30 MHz; a medium wave of 300 KHz to 3 MHz; a long wave of 30 KHz to 300 KHz; and a very long wave of 3 KHz to 30 KHz. In addition, a signal transmitted and received between the first antenna circuit 101 and the reader/writer 201 is a signal in which a carrier wave is modulated. A modulation method of a carrier wave may be either analog modulation or digital modulation, or may be any of amplitude modulation, phase modulation, frequency modulation, and spread spectrum. Preferably, amplitude modulation or frequency modulation may be used. Yamazaki–279 at [0072] Note that power can be supplied to the power supply circuit 106 in FIGS. 1 and 2 by two ways: one is a power supply which is made such that a signal of a carrier wave is rectified in the first rectifier circuit 105 similarly to the passive type RFID described in the conventional example, and a power supply which drives each circuit of the signal processing circuit 103 is generated through the power supply circuit 106; the other is a power supply which is made such that the battery 104 is charged by a battery charging signal inputted from the second antenna circuit 102 through the second rectifier circuit 107, and power which is charged in the battery 104 is supplied. The power which is charged in the battery 104 can be supplied to the power supply circuit 106 in the case where enough power cannot be obtained from the first antenna circuit 101 of the RFID 100 when a communication distance extends. Yamazaki–279 at [0073]

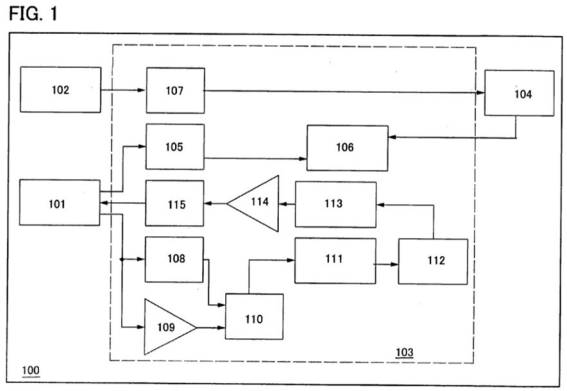
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	An example of the power supply circuit in FIGS. 1 and 2 is described with reference to FIG. 10. The power supply circuit includes a reference voltage circuit and a buffer amplifier. The reference voltage circuit includes a resistor 1001, diode-connected transistors 1002 and 1003, and generates a reference voltage which is equivalent to twice VGS of a transistor. The buffer amplifier includes a differential circuit including transistors 1005 and 1006; a current mirror circuit including transistors 1007 and 1008; and a common-source amplifier including a current supply resistor 1004, a transistor 1009, and a resistor 1010. Yamazaki–279 at [0076] Next, an operation when data is transmitted from the reader/writer 201 to the RFID 100 shown in FIGS. 1 and 2 is described below. A signal received by the first antenna circuit 101 is half-wave rectified by the first rectifier circuit 105 and then smoothed. A voltage which is half-wave rectified and smoothed by the first rectifier circuit 105 is inputted to the power supply circuit 106. The power supply circuit supplies a voltage which has been stabilized to the first rectifier circuit 105, the power supply circuit 106, the second rectifier circuit 107, the demodulation circuit 108, the amplifier 109, the logic circuit 110, the memory control circuit 111, the memory circuit 112, the logic circuit 113, the amplifier 114, and the modulation circuit 115. Yamazaki–279 at [0077] In addition, the signal received by the first antenna circuit 101 is inputted to the logic circuit 110 as a clock signal through the amplifier 109. Further, the signal inputted from the first antenna circuit 101 is demodulated by the demodulation circuit 108 and inputted to the logic circuit 110 as data. Yamazaki–279 at [0080] Further, an AC signal received by the first antenna circuit 101 is inputted to the logic circuit 110 through the amplifier 109, and a logic operation is performed. Then, the memory control circuit 111 is controlled using the signal from the logic circuit 110, and the data stored in the memory circuit 112 is called out. The data called out from the memory circuit 112 is processed by the logic circuit 113, amplified by the amplifier 114, and then, the modulation circuit 115 is operated. Although the data processing is carried out in accordance with a standard such as ISO14443, ISO15693, or ISO18000, processing system other than these standards can be adopted as long as compatibility with the reader/writer is ensured. Yamazaki–279 at [0081] When the modulation circuit 115 operates, impedance of the first antenna circuit 101 is changed. Accordingly, a signal of the reader/writer 201 which is reflected on the first antenna circuit 101 changes.

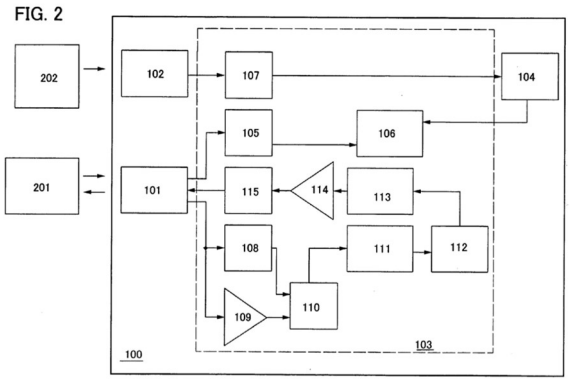
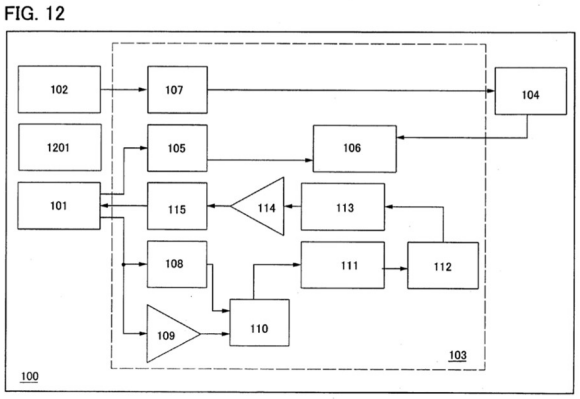
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	When the reader/writer reads this change, the data stored in the memory circuit 112 in the RFID 100 can be recognized. Such a modulation method is referred to as a load modulation method. Yamazaki–279 at [0082] Next, an operation when power is charged in the RFID 100 shown in FIGS. 1 and 2 by the charger 202 is described below. The signal received by the second antenna circuit is half-wave rectified and smoothed by the second rectifier circuit 107. A voltage which is half-wave rectified and smoothed by the second rectifier circuit 107 is once held in the battery 104. The power held in the battery 104 is used as power to be supplied to the power supply circuit 106. Note that when the signal supplied by the first antenna circuit can be received but there is a shortage of power for transmitting the signal to the reader/writer, a structure provided with a circuit which determines whether power is supplied by the battery may be used. Yamazaki–279 at [0086] As described above, a semiconductor device including an RFID of the present invention includes a battery. Therefore, similarly to a conventional semiconductor device, the semiconductor device of the present invention can prevent power shortage for transmitting and receiving individual information associated with deterioration over time of a cell. In addition, the semiconductor device of the present invention has an antenna which receives a signal for supplying power to the battery. Therefore, when power of radio waves from outside is used, the battery can be charged without direct connection between the semiconductor device and the charger. Accordingly, the semiconductor device of the present invention can be continuously used without generating confirmation of remaining capacity of a cell and replacement of a cell, like an active type RFID. In addition, power is held in the battery, so that enough power for operating the RFID can be obtained and a communication distance between a reader/writer and the RFID can be extended. Yamazaki–279 at [0089] Note that a booster antenna described in this embodiment mode means an antenna (hereinafter referred to as a booster antenna) which is larger than an antenna (hereinafter referred to as a first chip antenna or a first antenna circuit) which receives a signal from a reader/writer and outputs it to a signal processing circuit of an RFID included in a semiconductor device, or an antenna (hereinafter referred to as a second chip antenna or a second antenna circuit) which receives a signal from a charger included in the semiconductor device. The booster antenna and the first chip antenna or the second chip antenna resonate at a frequency band and are magnetic-field coupled, so that a signal oscillated by the reader/writer or the charger can be efficiently transmitted to a targeted RFID. Since the booster antenna is connected to a coil

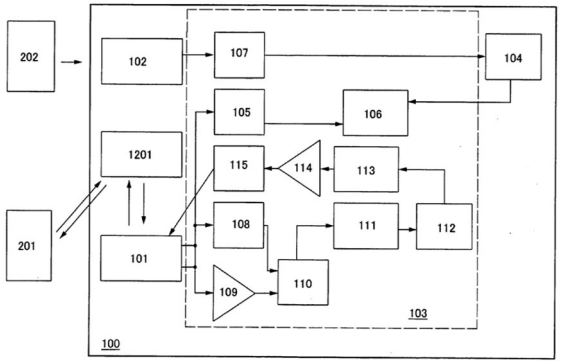
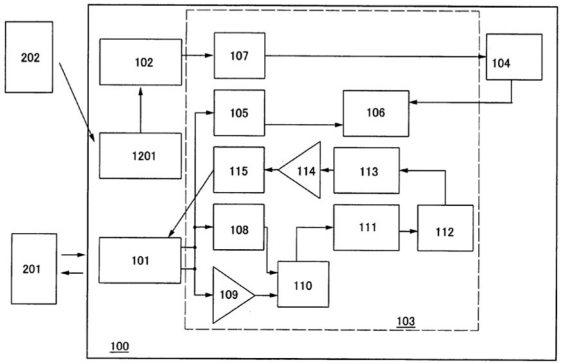
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	antenna through a magnetic field, the booster antenna is not required to be directly connected to the chip antenna and the signal processing circuit, which is preferable. Yamazaki–279 at [0091] The RFID 100 of FIG. 12 includes the first antenna circuit 101, the second antenna circuit 102, a booster antenna 1201, the signal processing circuit 103, and the battery 104. The signal processing circuit 103 includes the first rectifier circuit 105, the power supply circuit 106, the second rectifier circuit 107, the demodulation circuit 108, the amplifier 109, the logic circuit 110, the memory control circuit 111, the memory circuit 112, the logic circuit 113, the amplifier 114, and the modulation circuit 115. Yamazaki–279 at [0092] FIG. 13 shows a block diagram in which the booster antenna 1201 transmits and receives a signal to and from the reader/writer 201, and is magnetic-field coupled to the first antenna circuit 101, so that a signal from the reader/writer is transmitted and received, and the second antenna circuit 102 receives a signal from the charger 202. In FIG. 13, the booster antenna 1201 receives the signal from the reader/writer 201 and is magnetic-field coupled to the first antenna circuit in accordance with electromagnetic induction, so that the signal received by the first antenna circuit 101 is inputted to the power supply circuit 106 through the first rectifier circuit 105 and inputted to the demodulation circuit 108 and the amplifier 109. In addition in FIG. 13, the signal received by the second antenna circuit 102 is inputted to the battery 104 through the second rectifier circuit 107, and power is supplied to the power supply circuit 106 from the battery 104, as appropriate. With the structure shown in FIG. 13, a communication distance of transmission and reception of a signal between the reader/writer 201 and the RFID 100 can be extended more than Embodiment Mode 1, which is preferable because data can be transmitted and received more surely. Yamazaki–279 at [0094] For example, FIG. 14 shows a block diagram in which the booster antenna 1201 receives a signal from the charger 202 and is magnetic-field coupled to the second antenna circuit 102, so that a signal from the charger is received and the first antenna circuit 101 transmits and receives a signal to and from the reader/writer 201. In FIG. 14, the booster antenna 1201 receives the signal from the charger 202 and is magnetic-field coupled to the second antenna circuit in accordance with electromagnetic induction, so that the signal received by the second antenna circuit 102 is inputted to the battery 104 through the second rectifier circuit 107. Then, power is supplied to the power supply circuit 106 from the battery 104, as appropriate. In addition in FIG. 14, the signal received by the first antenna circuit 101 is inputted to the power supply circuit 106 through the first rectifier circuit 105, and inputted to the demodulation circuit

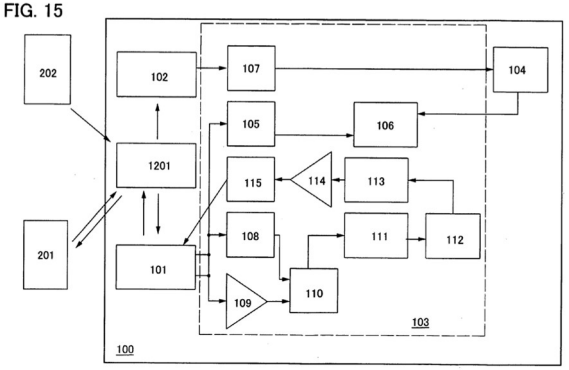
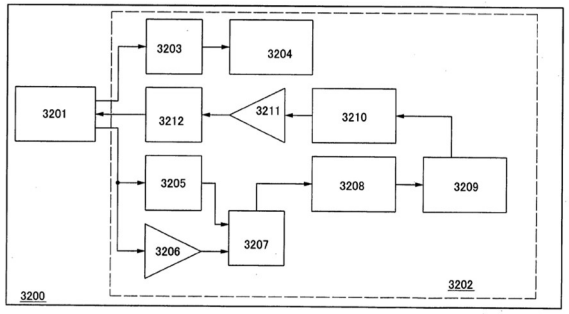
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	108 and the amplifier 109. With the structure shown in FIG. 14, a communication distance of transmission and reception of a signal between the charger 202 and the RFID 100 can be extended, which is preferable because charge can be performed to the battery more surely. Yamazaki–279 at [0096] For example, FIG. 15 shows a block diagram in which the booster antenna 1201 transmits and receives a signal to and from the reader/writer 201 and the charger 202 and is magnetic-field coupled to the first antenna circuit 101 and the second antenna circuit 102, so that a signal from the reader/writer and a signal from the charger are transmitted and received. In FIG. 15, the booster antenna 1201 receives the signal from the reader/writer 201 and is magnetic-field coupled to the first antenna circuit in accordance with electromagnetic induction, so that the signal received by the first antenna circuit 101 is inputted to the power supply circuit 106 through the first rectifier circuit 105. In addition, in FIG. 15, the booster antenna 1201 receives the signal from the charger 202 and is magnetic-field coupled to the second antenna circuit in accordance with electromagnetic induction, so that the signal received by the second antenna circuit 102 is inputted to the battery 104 through the second rectifier circuit 107. Then, power is supplied to the power supply circuit 106 from the battery 104, as appropriate. Frequencies that the first antenna circuit and the second antenna circuit are tuned are close to each other, so that efficiency of electromagnetic induction in the booster antenna is more increased, which is preferable. Therefore, when a frequency of a signal transmitted and received between the second antenna circuit 102 and the charger 202 is set m (m is a positive number) and a frequency of a signal transmitted and received between the first antenna circuit 101 and the reader/writer 201 is set M (M is a positive number), a frequency which satisfies a relation of $0.5\ m<M<1.5\ m$ and $m \neq M$ is preferably used. In addition to the above advantageous effect, when a frequency of a signal inputted to the second antenna circuit 102 is set within the above range, design can be performed without significantly changing the shapes of the first antenna circuit 101 and the second antenna circuit 102, which is preferable. With the structure shown in FIG. 15, a communication distance of transmission and reception of a signal between the reader/writer 201 and the RFID 100 and of transmission and reception of a signal between the charger 202 and the RFID 100 can be extended, which is preferable because data can be transmitted and received more surely and charge can be performed to the battery 104 more surely. Yamazaki–279 at [0103] In FIG. 16, when a coiled antenna 1606 in an antenna circuit 1605 of a charger connected to a transmission control portion 1604 is brought close to the booster antenna 1603 of the RFID, an AC magnetic field is generated from the coiled antenna 1606 of the antenna circuit 1605 in the charger. The

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	AC magnetic field passes through the coiled booster antenna 1603 in the RFID 1600, so that an electromotive force is generated between terminals (between one end of the antenna and the other end thereof) of the coiled booster antenna 1603 in the RFID 1600 due to electromagnetic induction. The electromotive force due to electromagnetic induction is generated in the coiled booster antenna 1603, and an AC magnetic field is generated from the booster coil itself. Then, the AC magnetic field generated from the booster antenna 1603 passes through the second coiled antenna circuit 1602 in the RFID 1600, so that an electromotive force is generated between terminals (between one end of the antenna and the other end thereof) of the second coiled antenna circuit 1602 in the RFID 1600 due to electromagnetic induction. A battery in the RFID 1600 can be charged by the electromotive force. Yamazaki–279 at [0104] In addition, FIG. 17 shows a structure which is different from the structure shown in FIG. 16. FIG. 17 shows a structure in which the coiled booster antenna 1603 and either the first antenna circuit 1601 or the second antenna circuit 1602 are provided on one surface of the RFID 1600, and the other of the first antenna circuit 1601 and the second antenna circuit 1602 is provided on the other surface of the RFID 1600, and in which a signal from the antenna of the charger is received. In FIG. 17, when the coiled antenna 1606 in the antenna circuit 1605 of the charger connected to the transmission control portion 1604 is brought close to the booster antenna 1603 of the RFID, an AC magnetic field is generated from the coiled antenna 1606 of the antenna circuit 1605 in the charger. The AC magnetic field passes through the coiled booster antenna 1603 in the RFID 1600, so that an electromotive force is generated between the terminals (between the one end of the antenna and the other end thereof) of the coiled booster antenna 1603 in the RFID 1600 due to electromagnetic induction. The electromotive force due to electromagnetic induction is generated in the coiled booster antenna 1603, and an AC magnetic field is generated from the booster coil itself. Then, the AC magnetic field generated from the booster antenna 1603 passes through the second coiled antenna circuit 1602 in the RFID 1600, and an electromotive force is generated between the terminals (between the one end of the antenna and the other end thereof) of the second coiled antenna circuit 1602 in the RFID 1600 due to electromagnetic induction. The battery in the RFID 1600 can be charged by the electromotive force. The arrangement of the first antenna circuit, the second antenna circuit, and the booster antenna in this embodiment mode may be designed so that the antennas are located to make an AC magnetic field pass through the antenna coil. In addition, as shown in FIG. 17, by arranging the first antenna circuit or the second antenna circuit inside the booster antenna which holds a large area, efficient arrangement can be performed; therefore, a battery area or the like can be increased and the number of windings of an antenna can be increased, which is preferable.

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	Yamazaki–279 at [0108] Note that power can be supplied to the power supply circuit 106 in FIGS. 12 to 15 by two ways: one is a power supply which is made such that a signal of a carrier wave is rectified in the first rectifier circuit 105 similarly to the passive type RFID described in the conventional example, and a power supply which drives each circuit of the signal processing circuit 103 is generated through the power supply circuit 106; the other is a power supply which is made such that the battery 104 is charged by a battery charging signal inputted from the second antenna circuit 102 through the second rectifier circuit 107, and power which is charged in the battery 104 is supplied. The power which is charged in the battery 104 can be supplied to the power supply circuit 106 in the case where enough power cannot be obtained from the first antenna circuit 101 of the RFID 100 when a communication distance extends. *See also* Yamazaki–279 at [0078], [0114], and [0201]. To the extent this limitation is not disclosed by Yamazaki–279, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Yamazaki–279, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
14. The mobile device of claim 13 wherein the driver circuit comprises a load modulation circuit.	Yamazaki–279 expressly or inherently discloses "[t]he mobile device of claim 13 wherein the driver circuit comprises a load modulation circuit." For example: Yamazaki–279 at Figure 1  Yamazaki–279 at Figure 2

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	 Yamazaki–279 at Figure 12  Yamazaki–279 at Figure 13

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	FIG. 13  Yamazaki–279 at Figure 14 FIG. 14  Yamazaki–279 at Figure 15

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	FIG. 15  Yamazaki–279 at Figure 32 FIG. 32  Yamazaki–279 at [0005] FIG. 31 is a block diagram showing a specific structure of an active type RFID. In an active type RFID 3100 of FIG. 31, a communication signal received by an antenna circuit 3101 is inputted to a demodulation circuit 3105 and an amplifier 3106 in a signal processing circuit 3102. The communication signal is usually transmitted after a carrier such as a 13.56 MHz carrier or a 915 MHz carrier is processed using ASK modulation, PSK modulation, or the like. Here, in FIG. 31, an example of a 13.56 MHz carrier is shown as the communication signal. In FIG. 31, a clock signal which is a reference for processing a signal is required, and a 13.56 MHz carrier is used as a clock here. The amplifier 3106 amplifies the 13.56 MHz carrier and supplies it to a logic circuit 3107 as the clock. In addition, the ASK modulated communication signal or the PSK modulated communication signal is demodulated by the demodulation

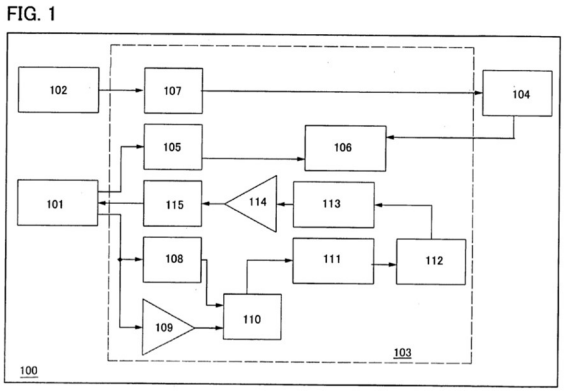
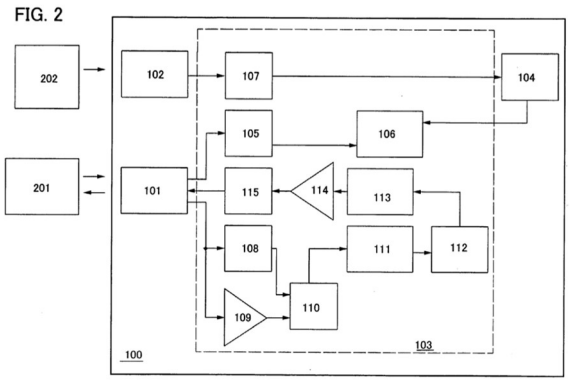
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	circuit 3105. The signal which has been demodulated is also transmitted to the logic circuit 3107 to be analyzed. The signal analyzed by the logic circuit 3107 is transmitted to a memory control circuit 3108, and based on it, the memory control circuit 3108 controls a memory circuit 3109, and data stored in the memory circuit 3109 is taken out and transmitted to a logic circuit 3110. The signal stored in the memory circuit 3109 is subjected to encode processing by the logic circuit 3110 and then amplified by an amplifier 3111, so that the carrier is modulated by a modulation circuit 3112 with the signal. Here, a power supply in FIG. 31 is supplied by a cell 3103 provided outside the signal processing circuit through a power supply circuit 3104. The power supply circuit 3104 supplies power to the amplifier 3106, the demodulation circuit 3105, the logic circuit 3107, the memory control circuit 3108, the memory circuit 3109, the logic circuit 3110, the amplifier 3111, the modulation circuit 3112, and the like. In this manner, the active type RFID operates. Yamazaki–279 at [0006] FIG. 32 is a block diagram showing a specific structure of a passive type RFID. In a passive type RFID 3200 of FIG. 32, a communication signal received by an antenna circuit 3201 is inputted to a demodulation circuit 3205 and an amplifier 3206 in a signal processing circuit 3202. A communication signal is usually transmitted after a carrier such as a 13.56 MHz carrier or a 915 MHz carrier is processed using ASK modulation, PSK modulation, or the like. Here, in FIG. 32, an example of a 13.56 MHz carrier is shown as a communication signal. In FIG. 32, a clock signal which is a reference for processing a signal is required, and a 13.56 MHz carrier is used as the clock here. The amplifier 3206 amplifies the 13.56 MHz carrier and supplies it to a logic circuit 3207 as the clock. In addition, the ASK modulated communication signal or the PSK modulated communication signal is demodulated by the demodulation circuit 3205. The signal which has been demodulated is also transmitted to the logic circuit 3207 to be analyzed. The signal analyzed by the logic circuit 3207 is transmitted to a memory control circuit 3208, and based on it, the memory control circuit 3208 controls a memory circuit 3209, and data stored in the memory circuit 3209 is taken out and transmitted to a logic circuit 3210. The signal stored in the memory circuit 3209 is subjected to encode processing by the logic circuit 3210 and then amplified by an amplifier 3211, so that the carrier is modulated by a modulation circuit 3212 with the signal. On the other hand, the communication signal inputted to a rectifier circuit 3203 is rectified and is inputted to a power supply circuit 3204. The power supply circuit 3204 supplies power to the amplifier 3206, the demodulation circuit 3205, the logic circuit 3207, the memory control circuit 3208, the memory circuit 3209, the logic circuit 3210, the amplifier 3211, the modulation circuit 3212, and the like. In this manner, the passive type RFID operates.

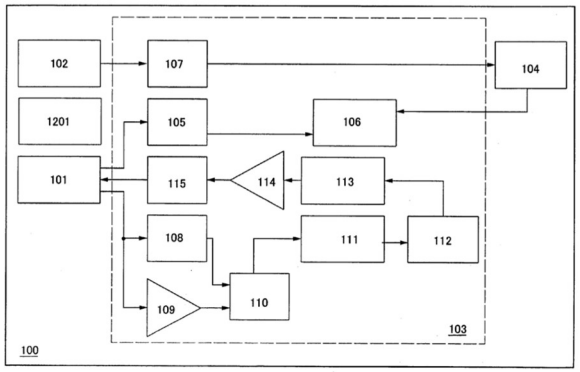
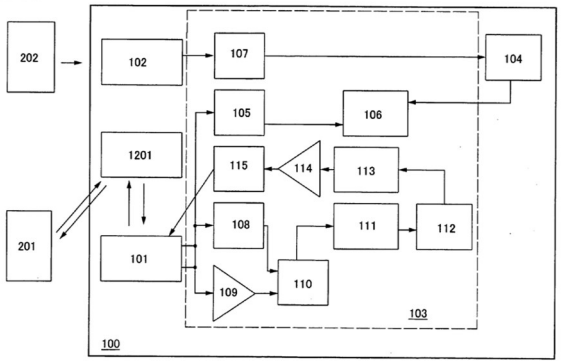
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	Yamazaki–279 at [0008] In addition, as shown in FIG. 32, in the case of a semiconductor device having a passive type RFID which generates a power supply for driving by using power of radio waves (carrier waves) from outside, there has been a problem in that it is difficult to transmit and receive signals from a long distance and to secure power for transmitting radio waves required for transmission and reception, so that it is difficult to realize transmission and reception in excellent condition. Accordingly, there has been a problem in that a distance from an antenna of a reader/writer which is a power supply means to which enough power of radio waves (carrier waves) from outside is supplied is limited to be short, in order to use a semiconductor device having a passive type RFID which generates a power supply for driving by using power of radio waves (carrier waves) from outside. Yamazaki–279 at [0011] One feature of the present invention is a semiconductor device including: a first antenna circuit; a second antenna circuit; a signal processing circuit; and a battery, in which the first antenna circuit receives a signal through the booster antenna and transmits a signal for transmitting data stored in the signal processing circuit; and the second antenna circuit receives a signal for charging the battery. Yamazaki–279 at [0019] The battery of the present invention may supply power to a power supply circuit included in the signal processing circuit. Yamazaki–279 at [0020] The first antenna circuit and the second antenna circuit of the present invention may transmit and receive a radio signal by an electromagnetic induction method. Yamazaki–279 at [0023] The semiconductor device of the present invention includes a battery. Therefore, similarly to a conventional semiconductor device, the semiconductor device of the present invention can prevent power shortage for transmitting and receiving individual information associated with deterioration over time of a cell. In addition, the semiconductor device of the present invention has an antenna which receives a signal for supplying power to the battery. Therefore, when power of radio waves from outside is used, the battery can be charged without direct connection between the semiconductor device and a charger. Accordingly, the semiconductor device of the present invention can be continuously used without generating confirmation of remaining capacity of a cell and replacement of a cell, like an active type

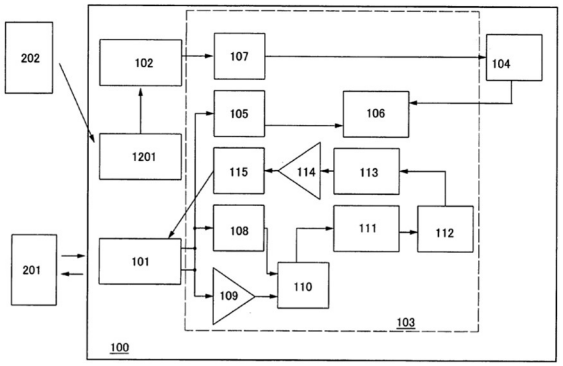
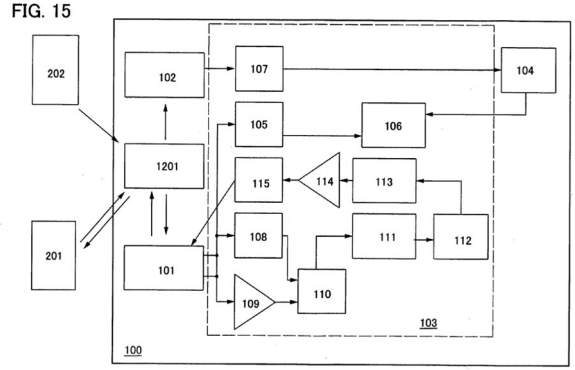
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	RFID. In addition, power for driving the RFID is always held in the battery, so that enough power for operating the RFID can be obtained and a communication distance between a reader/writer and the RFID can be extended. Yamazaki–279 at [0059] An RFID 100 of FIG. 1 includes a first antenna circuit 101, a second antenna circuit 102, a signal processing circuit 103, and a battery 104. The signal processing circuit 103 includes a first rectifier circuit 105, a power supply circuit 106, a second rectifier circuit 107, a demodulation circuit 108, an amplifier 109, a logic circuit 110, a memory control circuit 111, a memory circuit 112, a logic circuit 113, an amplifier 114, and a modulation circuit 115. Yamazaki–279 at [0060] In addition, FIG. 2 shows a block diagram in which the first antenna circuit 101 transmits and receives a signal to and from a reader/writer 201, and the second antenna circuit 102 receives a signal from a charger 202. In FIG. 2, the signal received by the first antenna circuit 101 is inputted to the power supply circuit 106 through the first rectifier circuit 105. In FIG. 2, the signal received by the second antenna circuit 102 is inputted to the battery 104 through the second rectifier circuit 107, and power is supplied to the power supply circuit 106 from the battery 104, as appropriate. Yamazaki–279 at [0070] Note that a frequency of a signal transmitted and received between the first antenna circuit 101 and the reader/writer 201 is 125 kHz, 13.56 MHz, 915 MHz, 2.45 GHz, or the like, and each of which is standardized by ISO or the like. Naturally, a frequency of a signal transmitted and received between the first antenna circuit 101 and the reader/writer 201 is not limited to this, and for example, any of the following can be used: a submillimeter wave of 300 GHz to 3 THz; a millimeter wave of 30 GHz to 300 GHz; a microwave of 3 GHz to 30 GHz; an ultrashort wave of 300 MHz to 3 GHz; a very short wave of 30 MHz to 300 MHz; a short wave of 3 MHz to 30 MHz; a medium wave of 300 KHz to 3 MHz; a long wave of 30 KHz to 300 KHz; and a very long wave of 3 KHz to 30 KHz. In addition, a signal transmitted and received between the first antenna circuit 101 and the reader/writer 201 is a signal in which a carrier wave is modulated. A modulation method of a carrier wave may be either analog modulation or digital modulation, or may be any of amplitude modulation, phase modulation, frequency modulation, and spread spectrum. Preferably, amplitude modulation or frequency modulation may be used. Yamazaki–279 at [0072]

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	Note that power can be supplied to the power supply circuit 106 in FIGS. 1 and 2 by two ways: one is a power supply which is made such that a signal of a carrier wave is rectified in the first rectifier circuit 105 similarly to the passive type RFID described in the conventional example, and a power supply which drives each circuit of the signal processing circuit 103 is generated through the power supply circuit 106; the other is a power supply which is made such that the battery 104 is charged by a battery charging signal inputted from the second antenna circuit 102 through the second rectifier circuit 107, and power which is charged in the battery 104 is supplied. The power which is charged in the battery 104 can be supplied to the power supply circuit 106 in the case where enough power cannot be obtained from the first antenna circuit 101 of the RFID 100 when a communication distance extends. Yamazaki–279 at [0073] An example of the power supply circuit in FIGS. 1 and 2 is described with reference to FIG. 10. The power supply circuit includes a reference voltage circuit and a buffer amplifier. The reference voltage circuit includes a resistor 1001, diode-connected transistors 1002 and 1003, and generates a reference voltage which is equivalent to twice VGS of a transistor. The buffer amplifier includes a differential circuit including transistors 1005 and 1006; a current mirror circuit including transistors 1007 and 1008; and a common-source amplifier including a current supply resistor 1004, a transistor 1009, and a resistor 1010. Yamazaki–279 at [0076] Next, an operation when data is transmitted from the reader/writer 201 to the RFID 100 shown in FIGS. 1 and 2 is described below. A signal received by the first antenna circuit 101 is half-wave rectified by the first rectifier circuit 105 and then smoothed. A voltage which is half-wave rectified and smoothed by the first rectifier circuit 105 is inputted to the power supply circuit 106. The power supply circuit supplies a voltage which has been stabilized to the first rectifier circuit 105, the power supply circuit 106, the second rectifier circuit 107, the demodulation circuit 108, the amplifier 109, the logic circuit 110, the memory control circuit 111, the memory circuit 112, the logic circuit 113, the amplifier 114, and the modulation circuit 115. Yamazaki–279 at [0080] Further, an AC signal received by the first antenna circuit 101 is inputted to the logic circuit 110 through the amplifier 109, and a logic operation is performed. Then, the memory control circuit 111 is controlled using the signal from the logic circuit 110, and the data stored in the memory circuit 112 is called out. The data called out from the memory circuit 112 is processed by the logic circuit 113, amplified by the amplifier 114, and then, the modulation circuit 115 is operated. Although the data processing is carried

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	out in accordance with a standard such as ISO14443, ISO15693, or ISO18000, processing system other than these standards can be adopted as long as compatibility with the reader/writer is ensured. Yamazaki–279 at [0081] When the modulation circuit 115 operates, impedance of the first antenna circuit 101 is changed. Accordingly, a signal of the reader/writer 201 which is reflected on the first antenna circuit 101 changes. When the reader/writer reads this change, the data stored in the memory circuit 112 in the RFID 100 can be recognized. Such a modulation method is referred to as a load modulation method. Yamazaki–279 at [0091] The RFID 100 of FIG. 12 includes the first antenna circuit 101, the second antenna circuit 102, a booster antenna 1201, the signal processing circuit 103, and the battery 104. The signal processing circuit 103 includes the first rectifier circuit 105, the power supply circuit 106, the second rectifier circuit 107, the demodulation circuit 108, the amplifier 109, the logic circuit 110, the memory control circuit 111, the memory circuit 112, the logic circuit 113, the amplifier 114, and the modulation circuit 115. Yamazaki–279 at [0108] Note that power can be supplied to the power supply circuit 106 in FIGS. 12 to 15 by two ways: one is a power supply which is made such that a signal of a carrier wave is rectified in the first rectifier circuit 105 similarly to the passive type RFID described in the conventional example, and a power supply which drives each circuit of the signal processing circuit 103 is generated through the power supply circuit 106; the other is a power supply which is made such that the battery 104 is charged by a battery charging signal inputted from the second antenna circuit 102 through the second rectifier circuit 107, and power which is charged in the battery 104 is supplied. The power which is charged in the battery 104 can be supplied to the power supply circuit 106 in the case where enough power cannot be obtained from the first antenna circuit 101 of the RFID 100 when a communication distance extends. *See also* Yamazaki–279 at [0004], [0010], [0012], [0013], [0014], [0015], [0016], [0017], [0018], and [0082]. To the extent this limitation is not disclosed by Yamazaki–279, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Yamazaki–279, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* [1c] and claim 13 above.

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
15. The mobile device of claim 13 wherein the driver circuit comprises an active transmit driver circuit.	Yamazaki–279 expressly or inherently discloses "[t]he mobile device of claim 13 wherein the driver circuit comprises an active transmit driver circuit." For example: Yamazaki–279 at Figure 1  Yamazaki–279 at Figure 2  Yamazaki–279 at Figure 12

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	FIG. 12  Yamazaki–279 at Figure 13 FIG. 13  Yamazaki–279 at Figure 14

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	FIG. 14  Yamazaki–279 at Figure 15 FIG. 15  Yamazaki–279 at [0005] FIG. 31 is a block diagram showing a specific structure of an active type RFID. In an active type RFID 3100 of FIG. 31, a communication signal received by an antenna circuit 3101 is inputted to a demodulation circuit 3105 and an amplifier 3106 in a signal processing circuit 3102. The communication signal is usually transmitted after a carrier such as a 13.56 MHz carrier or a 915 MHz carrier is processed using ASK modulation, PSK modulation, or the like. Here, in FIG. 31, an example of a 13.56 MHz carrier is shown as the communication signal. In FIG. 31, a clock signal which is a reference for processing a signal is required, and a 13.56 MHz carrier is used as a clock here. The amplifier 3106 amplifies the 13.56 MHz carrier and supplies it to a logic circuit 3107 as the clock. In addition, the ASK modulated

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	communication signal or the PSK modulated communication signal is demodulated by the demodulation circuit 3105. The signal which has been demodulated is also transmitted to the logic circuit 3107 to be analyzed. The signal analyzed by the logic circuit 3107 is transmitted to a memory control circuit 3108, and based on it, the memory control circuit 3108 controls a memory circuit 3109, and data stored in the memory circuit 3109 is taken out and transmitted to a logic circuit 3110. The signal stored in the memory circuit 3109 is subjected to encode processing by the logic circuit 3110 and then amplified by an amplifier 3111, so that the carrier is modulated by a modulation circuit 3112 with the signal. Here, a power supply in FIG. 31 is supplied by a cell 3103 provided outside the signal processing circuit through a power supply circuit 3104. The power supply circuit 3104 supplies power to the amplifier 3106, the demodulation circuit 3105, the logic circuit 3107, the memory control circuit 3108, the memory circuit 3109, the logic circuit 3110, the amplifier 3111, the modulation circuit 3112, and the like. In this manner, the active type RFID operates. Yamazaki–279 at [0008] In addition, as shown in FIG. 32, in the case of a semiconductor device having a passive type RFID which generates a power supply for driving by using power of radio waves (carrier waves) from outside, there has been a problem in that it is difficult to transmit and receive signals from a long distance and to secure power for transmitting radio waves required for transmission and reception, so that it is difficult to realize transmission and reception in excellent condition. Accordingly, there has been a problem in that a distance from an antenna of a reader/writer which is a power supply means to which enough power of radio waves (carrier waves) from outside is supplied is limited to be short, in order to use a semiconductor device having a passive type RFID which generates a power supply for driving by using power of radio waves (carrier waves) from outside. Yamazaki–279 at [0010] In order to solve the above-mentioned problems, the present invention provides a battery (also referred to as a secondary cell) as a power supply for supplying power in an RFID. The present invention provides another antenna for charging the battery as a means for supplying power to the battery, in addition to an antenna which transmits and receives individual information to and from outside. Hereinafter, a specific structure of the present invention is shown. Yamazaki–279 at [0011] One feature of the present invention is a semiconductor device including: a first antenna circuit; a second antenna circuit; a signal processing circuit; and a battery, in which the first antenna circuit receives a

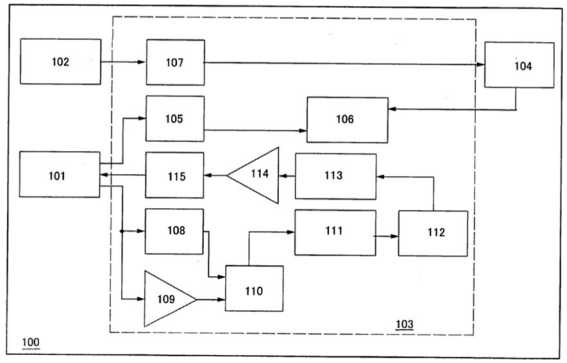
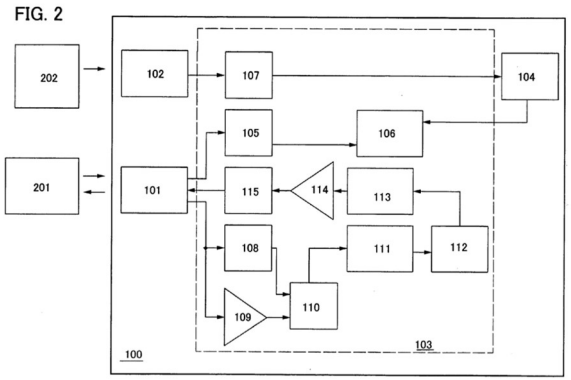
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	signal through the booster antenna and transmits a signal for transmitting data stored in the signal processing circuit; and the second antenna circuit receives a signal for charging the battery. Yamazaki–279 at [0012] Another feature of the present invention is a semiconductor device including: a first antenna circuit; a second antenna circuit; a signal processing circuit; and a battery, in which the first antenna circuit receives a signal and transmits a signal for transmitting data stored in the signal processing circuit to and from a reader/writer; and the second antenna circuit receives a signal for charging the battery from a charger including an antenna circuit. Yamazaki–279 at [0013] Another feature of the present invention is a semiconductor device including: a first antenna circuit; a second antenna circuit; a booster antenna; a signal processing circuit; and a battery, in which the first antenna circuit receives a signal through the booster antenna and transmits a signal for transmitting data stored in the signal processing circuit; and the second antenna circuit receives a signal for charging the battery through the booster antenna. Yamazaki–279 at [0014] Another feature of the present invention is a semiconductor device including: a first antenna circuit; a second antenna circuit; a booster antenna; a signal processing circuit; and a battery, in which the first antenna circuit receives a signal and transmits a signal for transmitting data stored in the signal processing circuit; and the second antenna circuit receives a signal for charging the battery through the booster antenna. Yamazaki–279 at [0015] Another feature of the present invention is a semiconductor device including: a first antenna circuit; a second antenna circuit; a booster antenna; a signal processing circuit; and a battery, in which the first antenna circuit receives a signal and transmits a signal for transmitting data stored in the signal processing circuit through the booster antenna; and the second antenna circuit receives a signal for charging the battery from a charger including an antenna circuit through the booster antenna. Yamazaki–279 at [0016] Another feature of the present invention is a semiconductor device including: a first antenna circuit; a second antenna circuit; a booster antenna; a signal processing circuit; and a battery, in which the first antenna circuit receives a signal and transmits a signal for transmitting data stored in the signal processing

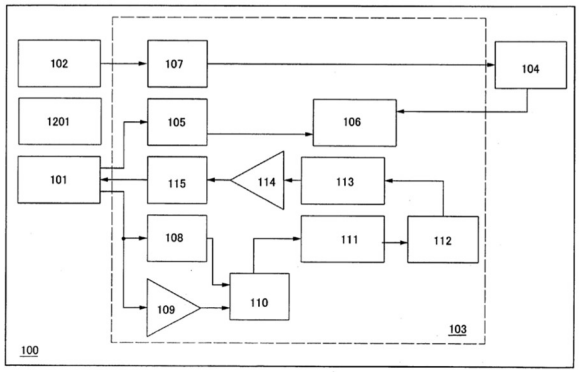
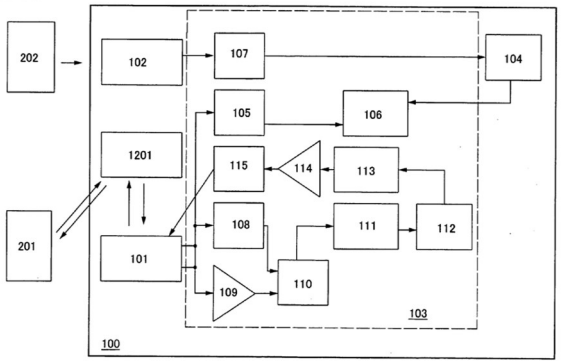
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	circuit to and from a reader/writer through the booster antenna; and the second antenna circuit receives a signal for charging the battery. Yamazaki–279 at [0017] Another feature of the present invention is a semiconductor device including: a first antenna circuit; a second antenna circuit; a booster antenna; a signal processing circuit; and a battery, in which the first antenna circuit receives a signal and transmits a signal for transmitting data stored in the signal processing circuit to and from a reader/writer; and the second antenna circuit receives a signal for charging the battery from a charger including an antenna circuit through the booster antenna. Yamazaki–279 at [0018] Another feature of the present invention is a semiconductor device including: a first antenna circuit; a second antenna circuit; a booster antenna; a signal processing circuit; and a battery, in which the first antenna circuit receives a signal and transmits a signal for transmitting data stored in the signal processing circuit to and from a reader/writer through the booster antenna; and the second antenna circuit receives a signal for charging the battery from a charger including an antenna circuit through the booster antenna. Yamazaki–279 at [0019] The battery of the present invention may supply power to a power supply circuit included in the signal processing circuit. Yamazaki–279 at [0023] The semiconductor device of the present invention includes a battery. Therefore, similarly to a conventional semiconductor device, the semiconductor device of the present invention can prevent power shortage for transmitting and receiving individual information associated with deterioration over time of a cell. In addition, the semiconductor device of the present invention has an antenna which receives a signal for supplying power to the battery. Therefore, when power of radio waves from outside is used, the battery can be charged without direct connection between the semiconductor device and a charger. Accordingly, the semiconductor device of the present invention can be continuously used without generating confirmation of remaining capacity of a cell and replacement of a cell, like an active type RFID. In addition, power for driving the RFID is always held in the battery, so that enough power for operating the RFID can be obtained and a communication distance between a reader/writer and the RFID can be extended. Yamazaki–279 at [0059]

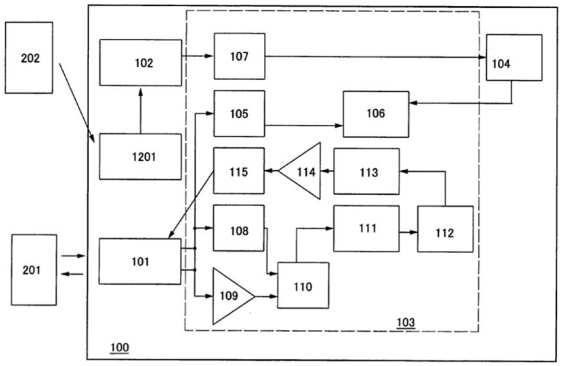
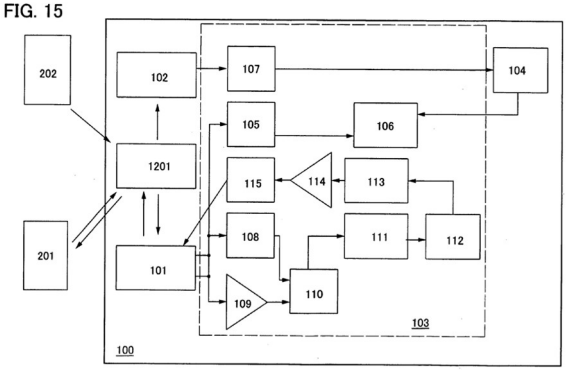
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	An RFID 100 of FIG. 1 includes a first antenna circuit 101, a second antenna circuit 102, a signal processing circuit 103, and a battery 104. The signal processing circuit 103 includes a first rectifier circuit 105, a power supply circuit 106, a second rectifier circuit 107, a demodulation circuit 108, an amplifier 109, a logic circuit 110, a memory control circuit 111, a memory circuit 112, a logic circuit 113, an amplifier 114, and a modulation circuit 115. Yamazaki–279 at [0060] In addition, FIG. 2 shows a block diagram in which the first antenna circuit 101 transmits and receives a signal to and from a reader/writer 201, and the second antenna circuit 102 receives a signal from a charger 202. In FIG. 2, the signal received by the first antenna circuit 101 is inputted to the power supply circuit 106 through the first rectifier circuit 105. In FIG. 2, the signal received by the second antenna circuit 102 is inputted to the battery 104 through the second rectifier circuit 107, and power is supplied to the power supply circuit 106 from the battery 104, as appropriate. Yamazaki–279 at [0070] Note that a frequency of a signal transmitted and received between the first antenna circuit 101 and the reader/writer 201 is 125 kHz, 13.56 MHz, 915 MHz, 2.45 GHz, or the like, and each of which is standardized by ISO or the like. Naturally, a frequency of a signal transmitted and received between the first antenna circuit 101 and the reader/writer 201 is not limited to this, and for example, any of the following can be used: a submillimeter wave of 300 GHz to 3 THz; a millimeter wave of 30 GHz to 300 GHz; a microwave of 3 GHz to 30 GHz; an ultrashort wave of 300 MHz to 3 GHz; a very short wave of 30 MHz to 300 MHz; a short wave of 3 MHz to 30 MHz; a medium wave of 300 KHz to 3 MHz; a long wave of 30 KHz to 300 KHz; and a very long wave of 3 KHz to 30 KHz. In addition, a signal transmitted and received between the first antenna circuit 101 and the reader/writer 201 is a signal in which a carrier wave is modulated. A modulation method of a carrier wave may be either analog modulation or digital modulation, or may be any of amplitude modulation, phase modulation, frequency modulation, and spread spectrum. Preferably, amplitude modulation or frequency modulation may be used. Yamazaki–279 at [0072] Note that power can be supplied to the power supply circuit 106 in FIGS. 1 and 2 by two ways: one is a power supply which is made such that a signal of a carrier wave is rectified in the first rectifier circuit 105 similarly to the passive type RFID described in the conventional example, and a power supply which drives each circuit of the signal processing circuit 103 is generated through the power supply circuit 106; the other is a power supply which is made such that the battery 104 is charged by a battery charging signal inputted from the second antenna circuit 102 through the second rectifier circuit 107, and power which is

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	charged in the battery 104 is supplied. The power which is charged in the battery 104 can be supplied to the power supply circuit 106 in the case where enough power cannot be obtained from the first antenna circuit 101 of the RFID 100 when a communication distance extends. Yamazaki–279 at [0073] An example of the power supply circuit in FIGS. 1 and 2 is described with reference to FIG. 10. The power supply circuit includes a reference voltage circuit and a buffer amplifier. The reference voltage circuit includes a resistor 1001, diode-connected transistors 1002 and 1003, and generates a reference voltage which is equivalent to twice VGS of a transistor. The buffer amplifier includes a differential circuit including transistors 1005 and 1006; a current mirror circuit including transistors 1007 and 1008; and a common-source amplifier including a current supply resistor 1004, a transistor 1009, and a resistor 1010. Yamazaki–279 at [0076] Next, an operation when data is transmitted from the reader/writer 201 to the RFID 100 shown in FIGS. 1 and 2 is described below. A signal received by the first antenna circuit 101 is half-wave rectified by the first rectifier circuit 105 and then smoothed. A voltage which is half-wave rectified and smoothed by the first rectifier circuit 105 is inputted to the power supply circuit 106. The power supply circuit supplies a voltage which has been stabilized to the first rectifier circuit 105, the power supply circuit 106, the second rectifier circuit 107, the demodulation circuit 108, the amplifier 109, the logic circuit 110, the memory control circuit 111, the memory circuit 112, the logic circuit 113, the amplifier 114, and the modulation circuit 115. Yamazaki–279 at [0082] Next, an operation when power is charged in the RFID 100 shown in FIGS. 1 and 2 by the charger 202 is described below. The signal received by the second antenna circuit is half-wave rectified and smoothed by the second rectifier circuit 107. A voltage which is half-wave rectified and smoothed by the second rectifier circuit 107 is once held in the battery 104. The power held in the battery 104 is used as power to be supplied to the power supply circuit 106. Note that when the signal supplied by the first antenna circuit can be received but there is a shortage of power for transmitting the signal to the reader/writer, a structure provided with a circuit which determines whether power is supplied by the battery may be used. Yamazaki–279 at [0091] The RFID 100 of FIG. 12 includes the first antenna circuit 101, the second antenna circuit 102, a booster antenna 1201, the signal processing circuit 103, and the battery 104. The signal processing circuit 103

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	includes the first rectifier circuit 105, the power supply circuit 106, the second rectifier circuit 107, the demodulation circuit 108, the amplifier 109, the logic circuit 110, the memory control circuit 111, the memory circuit 112, the logic circuit 113, the amplifier 114, and the modulation circuit 115. Yamazaki–279 at [0108] Note that power can be supplied to the power supply circuit 106 in FIGS. 12 to 15 by two ways: one is a power supply which is made such that a signal of a carrier wave is rectified in the first rectifier circuit 105 similarly to the passive type RFID described in the conventional example, and a power supply which drives each circuit of the signal processing circuit 103 is generated through the power supply circuit 106; the other is a power supply which is made such that the battery 104 is charged by a battery charging signal inputted from the second antenna circuit 102 through the second rectifier circuit 107, and power which is charged in the battery 104 is supplied. The power which is charged in the battery 104 can be supplied to the power supply circuit 106 in the case where enough power cannot be obtained from the first antenna circuit 101 of the RFID 100 when a communication distance extends. *See also* Yamazaki–279 at [0004], [0006], and [0080]. To the extent this limitation is not disclosed by Yamazaki–279, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Yamazaki–279, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* [7c] and claim 13 above.
16. The mobile device of claim 15 wherein the active transmit driver circuit is coupled to be powered by the mobile device.	Yamazaki–279 expressly or inherently discloses "[t]he mobile device of claim 15 wherein the active transmit driver circuit is coupled to be powered by the mobile device." For example: Yamazaki–279 at Figure 1

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	FIG. 1  Yamazaki–279 at Figure 2 FIG. 2  Yamazaki–279 at Figure 12

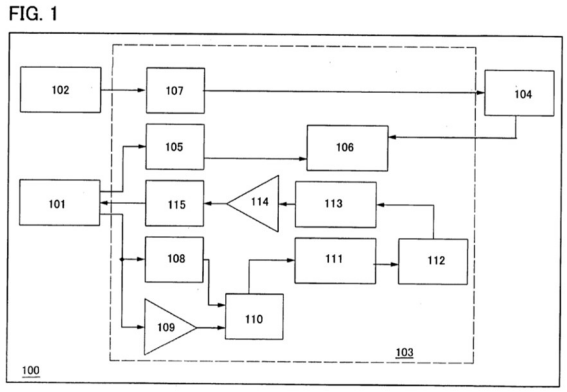
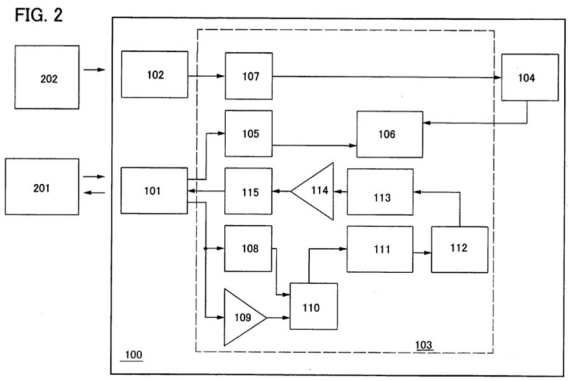
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	FIG. 12  Yamazaki–279 at Figure 13 FIG. 13  Yamazaki–279 at Figure 14

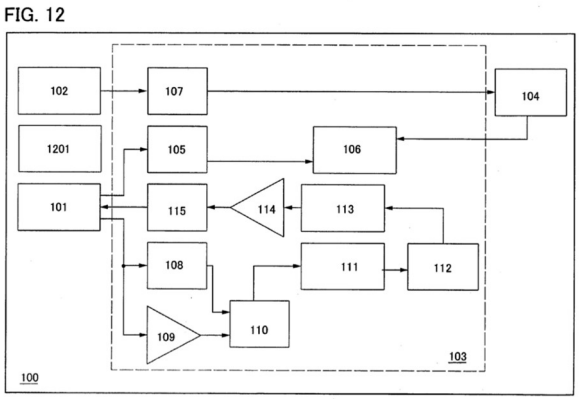
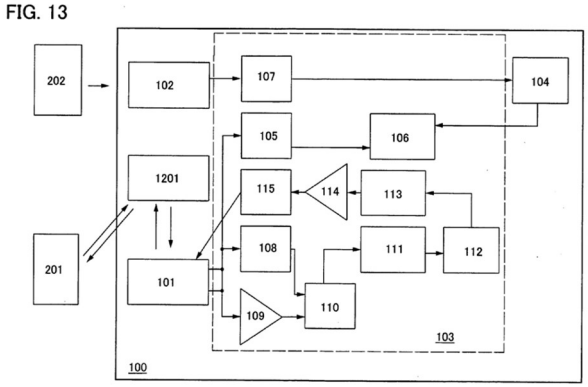
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	FIG. 14  Yamazaki–279 at Figure 15 FIG. 15  Yamazaki–279 at [0004] Depending on whether a power supply is incorporated in an RFID or whether a power supply is supplied from outside, the RFID can be divided into two types: an active type RFID capable of transmitting radio waves including information on the RFID, and a passive type RFID which is driven using radio waves from outside or power of radio waves (carrier waves) (the active type RFID is referred to Reference 1: Japanese Published Patent Application No. 2005-316724; and the passive type RFID is referred to Reference 2: Japanese Translation of PCT International Application No. 2006-503376). Of these, the active type RFID has a structure in which a power supply for driving the RFID is incorporated and a cell is provided as the power supply. In addition, the passive type RFID has a structure in which a power

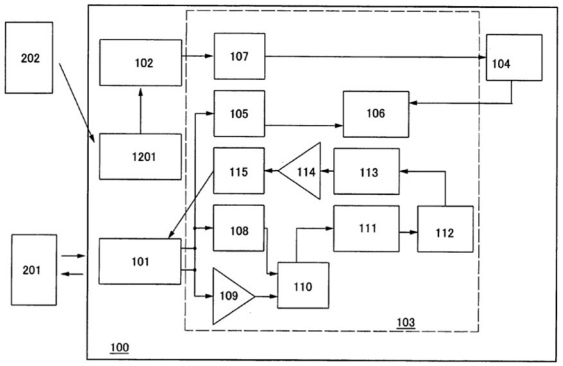
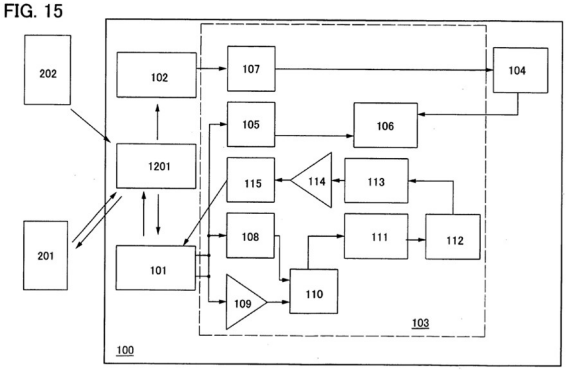
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	supply for driving the RFID is generated using power of radio waves (carrier waves) from outside, so that a structure without a cell is realized. Yamazaki–279 at [0005] FIG. 31 is a block diagram showing a specific structure of an active type RFID. In an active type RFID 3100 of FIG. 31, a communication signal received by an antenna circuit 3101 is inputted to a demodulation circuit 3105 and an amplifier 3106 in a signal processing circuit 3102. The communication signal is usually transmitted after a carrier such as a 13.56 MHz carrier or a 915 MHz carrier is processed using ASK modulation, PSK modulation, or the like. Here, in FIG. 31, an example of a 13.56 MHz carrier is shown as the communication signal. In FIG. 31, a clock signal which is a reference for processing a signal is required, and a 13.56 MHz carrier is used as a clock here. The amplifier 3106 amplifies the 13.56 MHz carrier and supplies it to a logic circuit 3107 as the clock. In addition, the ASK modulated communication signal or the PSK modulated communication signal is demodulated by the demodulation circuit 3105. The signal which has been demodulated is also transmitted to the logic circuit 3107 to be analyzed. The signal analyzed by the logic circuit 3107 is transmitted to a memory control circuit 3108, and based on it, the memory control circuit 3108 controls a memory circuit 3109, and data stored in the memory circuit 3109 is taken out and transmitted to a logic circuit 3110. The signal stored in the memory circuit 3109 is subjected to encode processing by the logic circuit 3110 and then amplified by an amplifier 3111, so that the carrier is modulated by a modulation circuit 3112 with the signal. Here, a power supply in FIG. 31 is supplied by a cell 3103 provided outside the signal processing circuit through a power supply circuit 3104. The power supply circuit 3104 supplies power to the amplifier 3106, the demodulation circuit 3105, the logic circuit 3107, the memory control circuit 3108, the memory circuit 3109, the logic circuit 3110, the amplifier 3111, the modulation circuit 3112, and the like. In this manner, the active type RFID operates. Yamazaki–279 at [0010] In order to solve the above-mentioned problems, the present invention provides a battery (also referred to as a secondary cell) as a power supply for supplying power in an RFID. The present invention provides another antenna for charging the battery as a means for supplying power to the battery, in addition to an antenna which transmits and receives individual information to and from outside. Hereinafter, a specific structure of the present invention is shown. Yamazaki–279 at [0019] The battery of the present invention may supply power to a power supply circuit included in the signal processing circuit.

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	Yamazaki–279 at [0023] The semiconductor device of the present invention includes a battery. Therefore, similarly to a conventional semiconductor device, the semiconductor device of the present invention can prevent power shortage for transmitting and receiving individual information associated with deterioration over time of a cell. In addition, the semiconductor device of the present invention has an antenna which receives a signal for supplying power to the battery. Therefore, when power of radio waves from outside is used, the battery can be charged without direct connection between the semiconductor device and a charger. Accordingly, the semiconductor device of the present invention can be continuously used without generating confirmation of remaining capacity of a cell and replacement of a cell, like an active type RFID. In addition, power for driving the RFID is always held in the battery, so that enough power for operating the RFID can be obtained and a communication distance between a reader/writer and the RFID can be extended. Yamazaki–279 at [0060] In addition, FIG. 2 shows a block diagram in which the first antenna circuit 101 transmits and receives a signal to and from a reader/writer 201, and the second antenna circuit 102 receives a signal from a charger 202. In FIG. 2, the signal received by the first antenna circuit 101 is inputted to the power supply circuit 106 through the first rectifier circuit 105. In FIG. 2, the signal received by the second antenna circuit 102 is inputted to the battery 104 through the second rectifier circuit 107, and power is supplied to the power supply circuit 106 from the battery 104, as appropriate. Yamazaki–279 at [0072] Note that power can be supplied to the power supply circuit 106 in FIGS. 1 and 2 by two ways: one is a power supply which is made such that a signal of a carrier wave is rectified in the first rectifier circuit 105 similarly to the passive type RFID described in the conventional example, and a power supply which drives each circuit of the signal processing circuit 103 is generated through the power supply circuit 106; the other is a power supply which is made such that the battery 104 is charged by a battery charging signal inputted from the second antenna circuit 102 through the second rectifier circuit 107, and power which is charged in the battery 104 is supplied. The power which is charged in the battery 104 can be supplied to the power supply circuit 106 in the case where enough power cannot be obtained from the first antenna circuit 101 of the RFID 100 when a communication distance extends. Yamazaki–279 at [0075]

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	Note that in this specification, a battery means a cell which can recover a continuous using time by charging. Note that a sheet-like cell is preferably used as the battery. For example, the battery can be made smaller by using a lithium cell, preferably a lithium polymer cell using a gel-like electrolyte, a lithium ion cell, or the like. Naturally, any cell can be used as the battery as long as it is a chargeable cell, and a cell capable of charging and discharging such as a nickel metal hydride cell or a nickel cadmium cell may be used, or a capacitor having high capacity or the like may be used. Yamazaki–279 at [0082] Next, an operation when power is charged in the RFID 100 shown in FIGS. 1 and 2 by the charger 202 is described below. The signal received by the second antenna circuit is half-wave rectified and smoothed by the second rectifier circuit 107. A voltage which is half-wave rectified and smoothed by the second rectifier circuit 107 is once held in the battery 104. The power held in the battery 104 is used as power to be supplied to the power supply circuit 106. Note that when the signal supplied by the first antenna circuit can be received but there is a shortage of power for transmitting the signal to the reader/writer, a structure provided with a circuit which determines whether power is supplied by the battery may be used. Yamazaki–279 at [0091] The RFID 100 of FIG. 12 includes the first antenna circuit 101, the second antenna circuit 102, a booster antenna 1201, the signal processing circuit 103, and the battery 104. The signal processing circuit 103 includes the first rectifier circuit 105, the power supply circuit 106, the second rectifier circuit 107, the demodulation circuit 108, the amplifier 109, the logic circuit 110, the memory control circuit 111, the memory circuit 112, the logic circuit 113, the amplifier 114, and the modulation circuit 115. Yamazaki–279 at [0108] Note that power can be supplied to the power supply circuit 106 in FIGS. 12 to 15 by two ways: one is a power supply which is made such that a signal of a carrier wave is rectified in the first rectifier circuit 105 similarly to the passive type RFID described in the conventional example, and a power supply which drives each circuit of the signal processing circuit 103 is generated through the power supply circuit 106; the other is a power supply which is made such that the battery 104 is charged by a battery charging signal inputted from the second antenna circuit 102 through the second rectifier circuit 107, and power which is charged in the battery 104 is supplied. The power which is charged in the battery 104 can be supplied to the power supply circuit 106 in the case where enough power cannot be obtained from the first antenna circuit 101 of the RFID 100 when a communication distance extends. *See also* Yamazaki–279 at Abstract.

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	To the extent this limitation is not disclosed by Yamazaki–279, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Yamazaki–279, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 11 and claim 15 above.
17. The mobile device of claim 13 wherein the amplifier is coupled to be powered by the mobile device.	Yamazaki–279 expressly or inherently discloses "[t]he mobile device of claim 13 wherein the amplifier is coupled to be powered by the mobile device." For example: Yamazaki–279 at Figure 1  Yamazaki–279 at Figure 2 

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	Yamazaki–279 at Figure 12  Yamazaki–279 at Figure 13  Yamazaki–279 at Figure 14

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	FIG. 14  Yamazaki–279 at Figure 15 FIG. 15  Yamazaki–279 at [0004] Depending on whether a power supply is incorporated in an RFID or whether a power supply is supplied from outside, the RFID can be divided into two types: an active type RFID capable of transmitting radio waves including information on the RFID, and a passive type RFID which is driven using radio waves from outside or power of radio waves (carrier waves) (the active type RFID is referred to Reference 1: Japanese Published Patent Application No. 2005-316724; and the passive type RFID is referred to Reference 2: Japanese Translation of PCT International Application No. 2006-503376). Of these, the active type RFID has a structure in which a power supply for driving the RFID is incorporated and a cell is provided as the power supply. In addition, the passive type RFID has a structure in which a power

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	supply for driving the RFID is generated using power of radio waves (carrier waves) from outside, so that a structure without a cell is realized. Yamazaki–279 at [0005] FIG. 31 is a block diagram showing a specific structure of an active type RFID. In an active type RFID 3100 of FIG. 31, a communication signal received by an antenna circuit 3101 is inputted to a demodulation circuit 3105 and an amplifier 3106 in a signal processing circuit 3102. The communication signal is usually transmitted after a carrier such as a 13.56 MHz carrier or a 915 MHz carrier is processed using ASK modulation, PSK modulation, or the like. Here, in FIG. 31, an example of a 13.56 MHz carrier is shown as the communication signal. In FIG. 31, a clock signal which is a reference for processing a signal is required, and a 13.56 MHz carrier is used as a clock here. The amplifier 3106 amplifies the 13.56 MHz carrier and supplies it to a logic circuit 3107 as the clock. In addition, the ASK modulated communication signal or the PSK modulated communication signal is demodulated by the demodulation circuit 3105. The signal which has been demodulated is also transmitted to the logic circuit 3107 to be analyzed. The signal analyzed by the logic circuit 3107 is transmitted to a memory control circuit 3108, and based on it, the memory control circuit 3108 controls a memory circuit 3109, and data stored in the memory circuit 3109 is taken out and transmitted to a logic circuit 3110. The signal stored in the memory circuit 3109 is subjected to encode processing by the logic circuit 3110 and then amplified by an amplifier 3111, so that the carrier is modulated by a modulation circuit 3112 with the signal. Here, a power supply in FIG. 31 is supplied by a cell 3103 provided outside the signal processing circuit through a power supply circuit 3104. The power supply circuit 3104 supplies power to the amplifier 3106, the demodulation circuit 3105, the logic circuit 3107, the memory control circuit 3108, the memory circuit 3109, the logic circuit 3110, the amplifier 3111, the modulation circuit 3112, and the like. In this manner, the active type RFID operates. Yamazaki–279 at [0010] In order to solve the above-mentioned problems, the present invention provides a battery (also referred to as a secondary cell) as a power supply for supplying power in an RFID. The present invention provides another antenna for charging the battery as a means for supplying power to the battery, in addition to an antenna which transmits and receives individual information to and from outside. Hereinafter, a specific structure of the present invention is shown. Yamazaki–279 at [0019] The battery of the present invention may supply power to a power supply circuit included in the signal processing circuit.

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	Yamazaki–279 at [0023] The semiconductor device of the present invention includes a battery. Therefore, similarly to a conventional semiconductor device, the semiconductor device of the present invention can prevent power shortage for transmitting and receiving individual information associated with deterioration over time of a cell. In addition, the semiconductor device of the present invention has an antenna which receives a signal for supplying power to the battery. Therefore, when power of radio waves from outside is used, the battery can be charged without direct connection between the semiconductor device and a charger. Accordingly, the semiconductor device of the present invention can be continuously used without generating confirmation of remaining capacity of a cell and replacement of a cell, like an active type RFID. In addition, power for driving the RFID is always held in the battery, so that enough power for operating the RFID can be obtained and a communication distance between a reader/writer and the RFID can be extended. Yamazaki–279 at [0060] In addition, FIG. 2 shows a block diagram in which the first antenna circuit 101 transmits and receives a signal to and from a reader/writer 201, and the second antenna circuit 102 receives a signal from a charger 202. In FIG. 2, the signal received by the first antenna circuit 101 is inputted to the power supply circuit 106 through the first rectifier circuit 105. In FIG. 2, the signal received by the second antenna circuit 102 is inputted to the battery 104 through the second rectifier circuit 107, and power is supplied to the power supply circuit 106 from the battery 104, as appropriate. Yamazaki–279 at [0072] Note that power can be supplied to the power supply circuit 106 in FIGS. 1 and 2 by two ways: one is a power supply which is made such that a signal of a carrier wave is rectified in the first rectifier circuit 105 similarly to the passive type RFID described in the conventional example, and a power supply which drives each circuit of the signal processing circuit 103 is generated through the power supply circuit 106; the other is a power supply which is made such that the battery 104 is charged by a battery charging signal inputted from the second antenna circuit 102 through the second rectifier circuit 107, and power which is charged in the battery 104 is supplied. The power which is charged in the battery 104 can be supplied to the power supply circuit 106 in the case where enough power cannot be obtained from the first antenna circuit 101 of the RFID 100 when a communication distance extends. Yamazaki–279 at [0075]

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	Note that in this specification, a battery means a cell which can recover a continuous using time by charging. Note that a sheet-like cell is preferably used as the battery. For example, the battery can be made smaller by using a lithium cell, preferably a lithium polymer cell using a gel-like electrolyte, a lithium ion cell, or the like. Naturally, any cell can be used as the battery as long as it is a chargeable cell, and a cell capable of charging and discharging such as a nickel metal hydride cell or a nickel cadmium cell may be used, or a capacitor having high capacity or the like may be used. Yamazaki–279 at [0082] Next, an operation when power is charged in the RFID 100 shown in FIGS. 1 and 2 by the charger 202 is described below. The signal received by the second antenna circuit is half-wave rectified and smoothed by the second rectifier circuit 107. A voltage which is half-wave rectified and smoothed by the second rectifier circuit 107 is once held in the battery 104. The power held in the battery 104 is used as power to be supplied to the power supply circuit 106. Note that when the signal supplied by the first antenna circuit can be received but there is a shortage of power for transmitting the signal to the reader/writer, a structure provided with a circuit which determines whether power is supplied by the battery may be used. Yamazaki–279 at [0091] The RFID 100 of FIG. 12 includes the first antenna circuit 101, the second antenna circuit 102, a booster antenna 1201, the signal processing circuit 103, and the battery 104. The signal processing circuit 103 includes the first rectifier circuit 105, the power supply circuit 106, the second rectifier circuit 107, the demodulation circuit 108, the amplifier 109, the logic circuit 110, the memory control circuit 111, the memory circuit 112, the logic circuit 113, the amplifier 114, and the modulation circuit 115. *See also* Yamazaki–279 at Abstract. To the extent this limitation is not disclosed by Yamazaki–279, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Yamazaki–279, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 13 above.
18. The mobile device of claim 13 wherein the antenna is tuned to operate at 13.56 MHz.	Yamazaki–279 expressly or inherently discloses "[t]he mobile device of claim 13 wherein the antenna is tuned to operate at 13.56 MHz." For example: *See* above at claim 2.

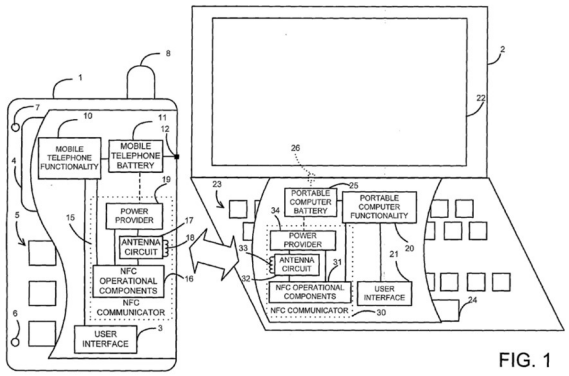
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2007/0229279 ("Yamazaki–279")
	To the extent this limitation is not disclosed by Yamazaki–279, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Yamazaki–279, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 13 above.
19. The mobile device of claim 13 wherein the antenna comprises an inductive element too small to draw enough power sufficient to operate the smartcard controller from an interrogating radio frequency (RF) field.	Yamazaki–279 expressly or inherently discloses "[t]he mobile device of claim 13 wherein the antenna comprises an inductive element too small to draw enough power sufficient to operate the smartcard controller from an interrogating radio frequency (RF) field." For example: *See* above at claim 3. To the extent this limitation is not disclosed by Yamazaki–279, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Yamazaki–279, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 13 above.
20. The mobile device of claim 13 wherein the mobile device comprises a mobile phone.	Yamazaki–279 expressly or inherently discloses "[t]he mobile device of claim 13 wherein the mobile device comprises a mobile phone." For example: *See* above at claim 6. To the extent this limitation is not disclosed by Yamazaki–279, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Yamazaki–279, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 13 above.

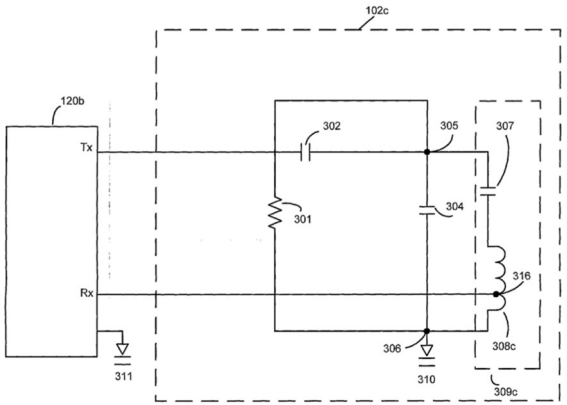
DEFENDANTS' INVALIDITY CONTENTIONS FOR U.S. PAT. 9,122,965

EXHIBIT A03: U.S. Patent Pub. No. 2010/0112941 ("Bangs")

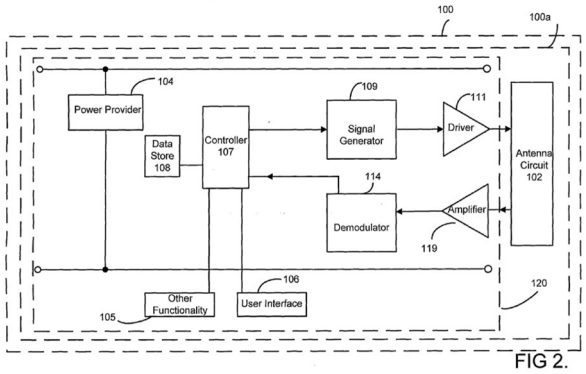
As demonstrated in the claim charts below, the claims of U.S. Patent No. 9,122,965 ("the '965 patent") are invalid (a) under one or more sections of 35 U.S.C. § 102 as anticipated by Bangs and (b) under 35 U.S.C. § 103(a) as obvious over Bangs standing alone and as set forth herein, and/or combined with the knowledge of a person of ordinary skill in the art, Applicant's Admitted Prior Art, and/or the additional prior art references discussed in Exhibit A and Exhibits A01–A05, the contents of which are hereby incorporated by reference into this chart. One of ordinary skill in the art, as of the priority date of the '965 patent, would have known to combine the prior art elements disclosed by the foregoing references using known methods, and to use these elements according to their established functions in order to achieve a known and predictable result.

Defendants have conducted the invalidity analysis herein based at least in part and in some instance entirely upon Plaintiff's apparent application of the claims of the '965 patent. By charting the prior art against the claims and limitations herein, Defendants are not admitting or agreeing to Plaintiff's application of the claims at issue in this case, and these charts should not be interpreted as an admission or concession by Defendants that any particular construction or application of any claim limitation by Plaintiff is correct or proper. Additionally, these charts provide representative examples of portions of the charted references that disclose the indicated limitations of the claims; additional portions of these references other than the representative examples provided herein may also disclose the indicated limitation(s) and Defendants contend that the asserted claims are invalid in light of the charted reference(s) as a whole in its or their entirety. Where a particular figure is cited, the citation should be understood to encompass the caption and description of the figure as well as any text relating to or describing the figure. Conversely, where particular text referring to a figure is cited, the citation should be understood to include the figure as well.

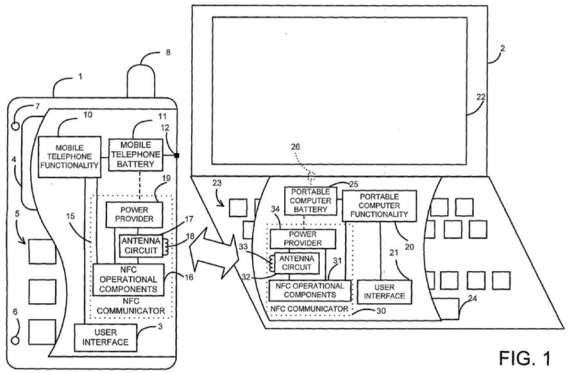
Claim Element	**Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")**
1[pre]. A mobile device comprising:	By providing this disclosure, Defendants do not take a position on whether the preamble is a claim limitation. Bangs discloses or renders obvious "[a] mobile device." For example: Bangs at Figure 1  FIG. 1

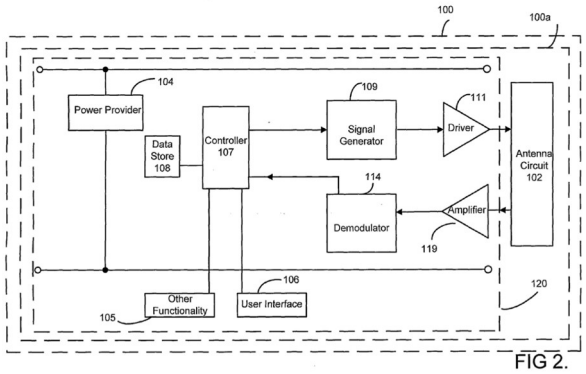
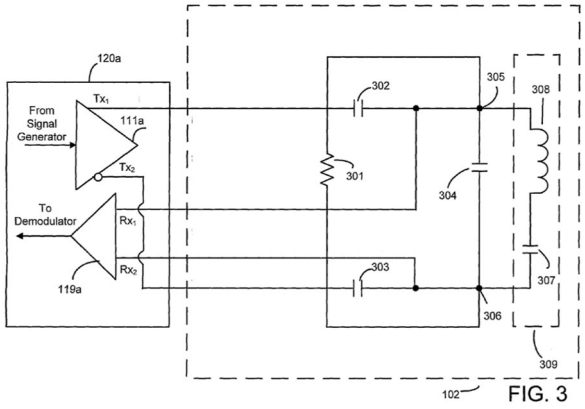
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	Bangs at Figure 6  FIG. 6 Bangs at [0006] Near field RF communicators may be provided as standalone or discrete devices or may be incorporated within or coupled to larger electrical devices or host devices (referred to below as near field RF communications enabled devices) to enable those devices to communicate by the near field with other near field RF communicators or devices incorporating or coupled to such near field RF communicators. When incorporated within a larger device or host, a near field RF communicator may be a discrete entity or may be provided by functionality within the larger device or host. Examples of such larger devices or host devices are, for example, mobile telephones, portable computing devices (such as personal digital assistants, notebooks, lap-tops), other computing devices such as personal or desk top computers, computer peripherals such as printers, or other electrical devices such as portable audio and/or video players such as MP3 players, IPODs®, CD players, DVD players. Other examples of such larger devices or host devices are other electrical or electronic products, for example consumer products such as domestic appliances or personal care products, and other electrical or electronic devices, apparatus or systems. Some areas of application are payment systems, ticketing systems, for example in tickets (for example parking tickets, bus tickets, train tickets or entrance permits or tickets) or in ticket checking systems, toys, games, posters, packaging, advertising material, product inventory checking systems and so on. Bangs at [0042]

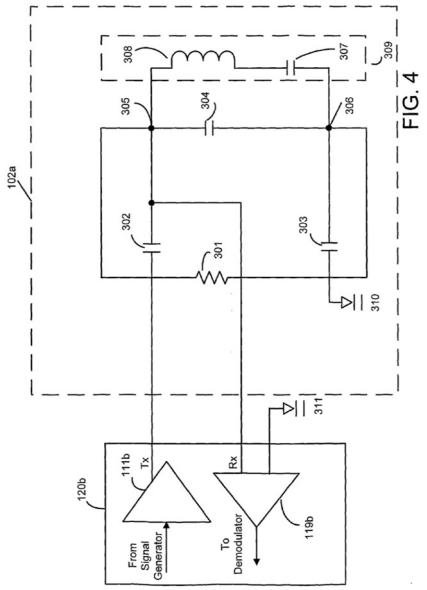
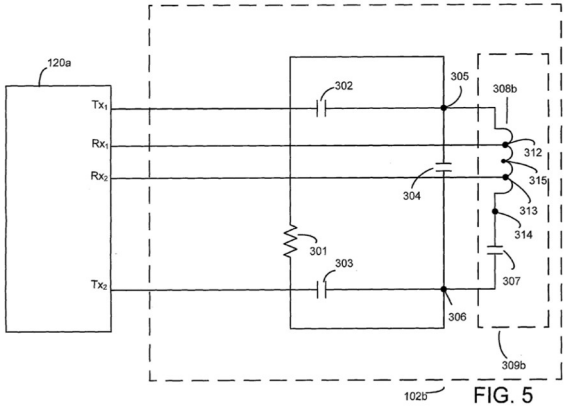
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	It will be appreciated that FIG. 1 shows only examples of types of host devices. A host device may be another type of electrical device such as a personal digital assistant (PDA), other portable electrical device such as a portable audio and/or video player such as an MP3 player, an IPOD®, CD player, DVD player or other electrical device. Bangs at [0046] In this example, the NFC communications enabled device 100 comprises an NFC communicator 100a having NFC operational components including an antenna circuit 102 and NFC functionality 120 comprising power provider 104, controller 107, data store 108, receiver circuitry and transmitter circuitry. Bangs at [0054] In FIG. 2 control of the operation of the NFC communicator is through controller 107. As another possibility, where the NFC communicator is part of or associated with a host device, control of the operation of the NFC communicator may at least partly be directed by the host device, for example through the other functionality 105. In such circumstances all or part of the control may be provided by the other functionality 105 which may be part of the NFC functionality or a host. For example the NFC communicator controller 107 may control modulation and modulation protocols whereas the data to be transmitted may be provided by the other functionality 105. Bangs at [0064] Generally, the NFC functionality 120a will be formed as one or more integrated circuits (generally monocrystalline silicon integrated circuits) mounted on a Printed Circuit Board(s) (PCB(s)) or the like and the antenna circuit will be formed by external discrete components formed on or carried by (e.g. surface mounted on) a PCB, for example the antenna coil element may be defined by conductive tracks on a PCB while any capacitors and resistors of the antenna circuit may be provided by discrete components mounted to the PCB. Bangs at [0076] FIG. 4 shows a functional circuit diagram of an NFC communicator having an antenna circuit 102a that differs from that shown in FIG. 3 in that the antenna circuit has a single transmission input coupling Tx coupled to a single output driver 111b and a single receiver output coupling Rx coupled to a single input amplifier 119b so that the transmission signal is defined between transmission connection Tx and a signal ground coupling 311 and the receiver signal is defined between Rx and a coupling to ground 310 via capacitor 303. Both grounds (earths) may be provided by a local ground of the NFC communicator or a host.

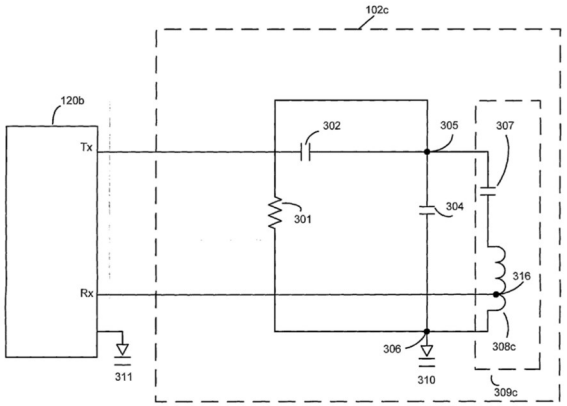
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	See also Bangs at [0033], [0035], [0036], [0038], [0039], [0040], [0041], [0043], claim 29, claim 30, claim 31, claim 32, claim 33, claim 34, claim 35, claim 36, claim 37, claim 38, claim 39, claim 40, claim 41, claim 42, claim 43, claim 44, and claim 45. To the extent this limitation is not disclosed by Bangs, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Bangs, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[1a] a smartcard controller;	Bangs discloses or renders obvious "a smartcard controller." For example: Bangs at Figure 2  FIG 2. Bangs at [0043] Also, rather than being incorporated within the host device, the NFC communicator 15 or 30 may be associated with the host device, for example by a wired or wireless coupling. In such a case, a housing of the NFC communicator may be physically separate from or may be attached to the housing of the host device; in the later case, the attachment may be permanent once-made or the NFC communicator may be removable. For example, the NFC communicator may be housed within: a housing attachable to another device; a housing portion, such as a fascia of the NFC communications enabled device or another device; an access card; or may have a housing shaped or configured to look like a smart card. For example an NFC communicator may be coupled to a larger device by way of a communications link such as, for example, a USB link, or may be provided as a card (for example a PCMCIA card or a card that looks like a smart card) which can be received in an appropriate slot of the larger or host device.

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	Bangs at [0046] In this example, the NFC communications enabled device 100 comprises an NFC communicator 100a having NFC operational components including an antenna circuit 102 and NFC functionality 120 comprising power provider 104, controller 107, data store 108, receiver circuitry and transmitter circuitry. Bangs at [0049] In this example, the receiver circuitry comprises an amplifier 119 coupled to the antenna circuit 102 and a demodulator 114 coupled to the amplifier 119 and the controller 107 for amplifying and demodulating a modulated RF signal inductively coupled to the antenna circuit 102 from another near field RF communicator in near field range and for supplying the thus-extracted data to the controller 107 for processing. Bangs at [0051] The controller 107 of the NFC functionality 120 is provided to control overall operation of the NFC communicator. The controller 107 is coupled to the data store 108 which is provided to store data (information and/or control data) to be transmitted from and/or data received by the NFC communications enabled device. The controller 107 may be a microprocessor, for example a RISC processor or other microprocessor or a state machine. Program instructions for programming the controller and/or control data for communication to another near field RF communicator may be stored in an internal memory of the controller and/or the data store. Bangs at [0054] In FIG. 2 control of the operation of the NFC communicator is through controller 107. As another possibility, where the NFC communicator is part of or associated with a host device, control of the operation of the NFC communicator may at least partly be directed by the host device, for example through the other functionality 105. In such circumstances all or part of the control may be provided by the other functionality 105 which may be part of the NFC functionality or a host. For example the NFC communicator controller 107 may control modulation and modulation protocols whereas the data to be transmitted may be provided by the other functionality 105. *See also* Bangs at Figure 5, Figure 6, [0018], [0050], [0052], [0053], [0065], [0067], [0068], [0070], [0073], and [0086].

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	To the extent this limitation is not disclosed by Bangs, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Bangs, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[1b] an antenna; and	Bangs discloses or renders obvious "an antenna." For example: Bangs at Abstract An NFC communicator has an antenna circuit to enable inductive coupling, via an RF H field, of the NFC communicator and another near field RF communicator in near field range. The antenna circuit has an antenna element coupled in parallel with a first capacitor to form a parallel LC circuit. The antenna element has an antenna coil in series with a second capacitor to reduce the voltage to which circuitry of the NFC communicator is subjected by a received RF H field. Alternatively or additionally, receive circuitry of the NFC communicator may be coupled to only a proportion of the antenna coil to reduce the voltage to which circuitry of the NFC communicator is subjected by a received RF H field. Bangs at Figure 1  FIG. 1 Bangs at Figure 2

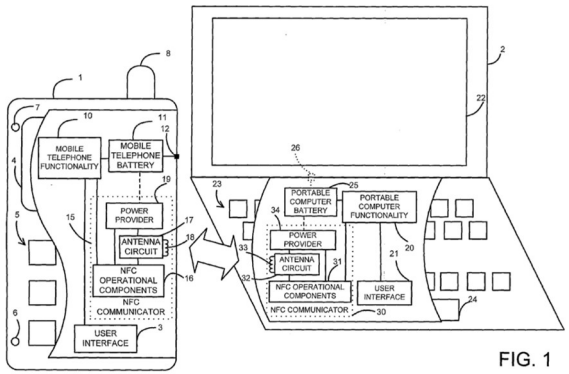
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	 FIG 2. Bangs at Figure 3  FIG. 3 Bangs at Figure 4

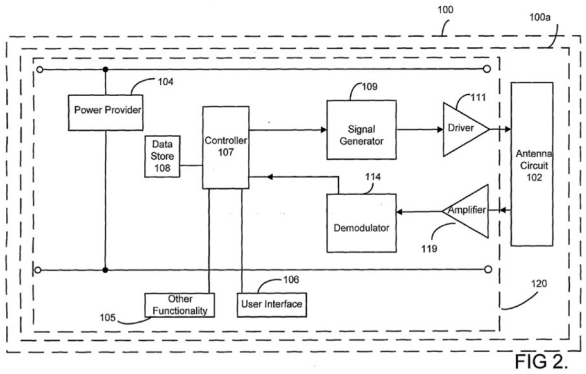
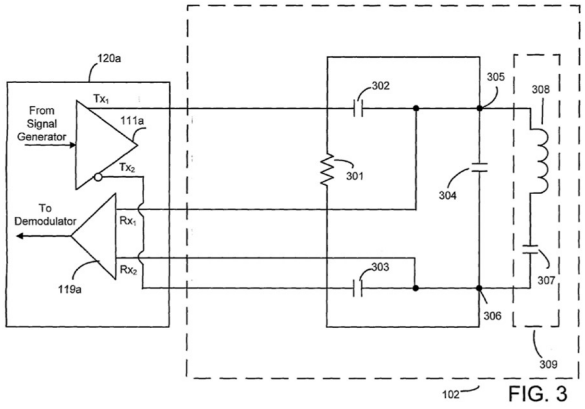
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	 FIG. 4 Bangs at Figure 5  FIG. 5 Bangs at Figure 6

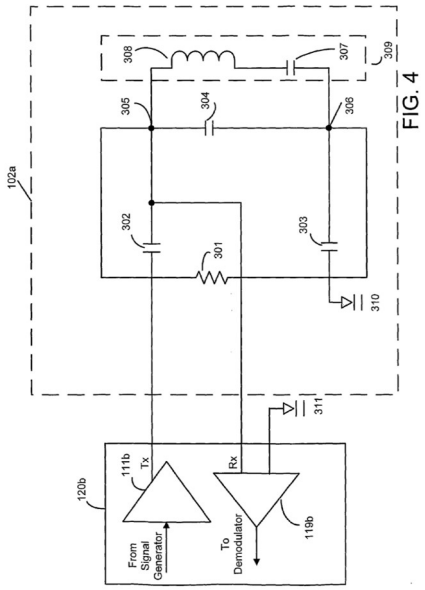
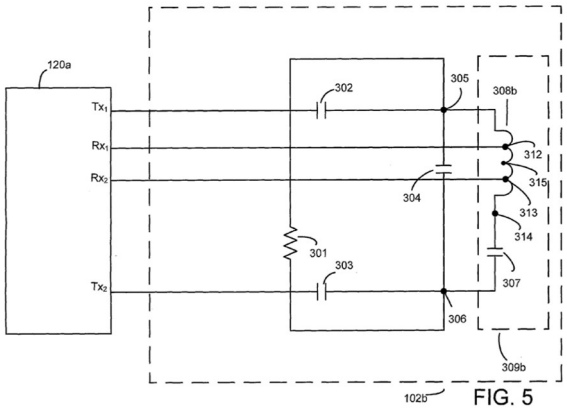
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	 FIG. 6 Bangs at [0002] Near field RF (radio frequency) communication requires an antenna of one near field RF communicator to be present within the alternating magnetic field (H field) generated by the antenna of another near field RF communicator by transmission of an RF signal (for example a 13.56 Mega Hertz signal) to enable the magnetic field (H field) of the RF signal to be inductively coupled between the communicators. The RF signal may be modulated to enable communication of control and/or other data. Ranges of up to several centimetres (generally to a maximum of 1 metre) are common for near field RF communicators. Bangs at [0016] An aspect of the present invention provides an NFC communicator that alleviates at least some of the aforementioned problems. An aspect of the invention provides an antenna circuit for an NFC communicator which enables operation of the NFC communicator in both active and passive communication modes. Bangs at [0021] According to an aspect of the present invention, there is provided a near field RF communicator, comprising: an antenna circuit to enable inductive coupling of the near field RF communicator and another near field RF communicator in near field range; a signal supplier coupled to the antenna circuit to supply a drive signal to cause the antenna circuit to generate an RF signal; and a receiver coupled to the antenna circuit to receive a signal inductively coupled to the antenna circuit from another near field RF communicator in near field range, wherein the antenna circuit comprises an antenna element coupled in

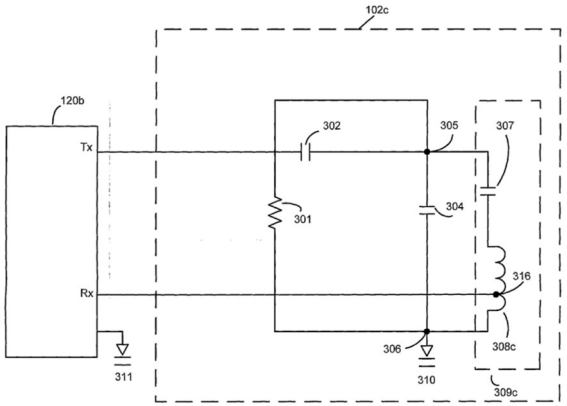
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	parallel with a first capacitor, wherein the antenna element comprises an antenna coil in series with a second capacitor to affect a voltage resulting from inductive coupling to the antenna circuit. Bangs at [0023] According to an aspect of the present invention, there is provided a near field RF communicator, comprising: an antenna circuit to enable inductive coupling of the near field RF communicator and another near field RF communicator in near field range; a signal supplier coupled to the antenna circuit to supply a drive signal to cause the antenna circuit to generate an RF signal; and a receiver coupled to the antenna circuit to receive a signal inductively coupled to the antenna circuit from another near field RF communicator in near field range, wherein the antenna circuit comprises an antenna element coupled in parallel with a capacitor, wherein the antenna element comprises an antenna coil having a tap and the receiver is coupled to the tap. Bangs at [0029] FIG. 3 shows a functional circuit diagram of an NFC communicator to illustrate one example of an antenna circuit embodying the present invention; Bangs at [0030] FIG. 4 shows a functional circuit diagram of an NFC communicator to illustrate another example of an antenna circuit embodying the present invention; Bangs at [0031] FIG. 5 shows a functional circuit diagram of an NFC communicator to illustrate another example of an antenna circuit embodying the present invention; and Bangs at [0032] FIG. 6 shows a functional circuit diagram of an NFC communicator to illustrate another example of an antenna circuit embodying the present invention. Bangs at [0056] FIG. 3 shows a functional circuit diagram of an NFC communicator embodying the invention to illustrate one example of an antenna circuit 102. In the interests of simplicity in FIG. 3, only some of the NFC functionality 120a is shown in FIG. 3. Bangs at [0057]

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	As shown in FIG. 3, antenna circuit 102 comprises an antenna element 309 coupled in parallel with a first capacitor 304 to form a tank circuit (a parallel LC resonant circuit). Bangs at [0058] The antenna element 309 comprises an antenna coil element 308 in series with a second capacitor 307 which second capacitor 307 is anti-phase to the antenna coil element 308 and affects a voltage resulting from inductive coupling of an RF H field to the antenna circuit. As shown the antenna coil element 308 comprises a single antenna coil which may comprise one, two or more coils or loops. Bangs at [0076] FIG. 4 shows a functional circuit diagram of an NFC communicator having an antenna circuit 102a that differs from that shown in FIG. 3 in that the antenna circuit has a single transmission input coupling Tx coupled to a single output driver 111b and a single receiver output coupling Rx coupled to a single input amplifier 119b so that the transmission signal is defined between transmission connection Tx and a signal ground coupling 311 and the receiver signal is defined between Rx and a coupling to ground 310 via capacitor 303. Both grounds (earths) may be provided by a local ground of the NFC communicator or a host. Bangs at [0078] FIG. 5 shows a functional circuit diagram of an NFC communicator to illustrate another example of an antenna circuit 102 embodying the present invention. Bangs at [0081] FIG. 6 shows a functional circuit diagram of an NFC communicator having an antenna circuit 102c that differs from that shown in FIG. 5 in that, like the antenna circuit shown in FIG. 4, the antenna circuit 102c has a single transmission input coupling Tx coupled to a single output driver (not shown in FIG. 6) and a single receiver output coupling Rx coupled to a single input amplifier (not shown in FIG. 6) so that the transmission signal is defined between transmission connection Tx and a ground coupling 311 and the receiver signal is defined between Rx and a coupling to ground 310. *See also* Bangs at [0001], [0010], [0017], [0018], [0019], [0020], [0022], [0024], [0025], [0039], [0046], [0049], [0050], [0053], [0059], [0061], [0062], [0063], [0064], [0065], [0067], [0068], [0069], [0070], [0071], [0072], [0073], [0074], [0075], [0077], [0079], [0080], [0082], [0083], [0084], [0085], [0086], [0087], [0088], [0089], [0090], [0091], [0092], [0093], [0094], [0096], [0097], claim 29, claim 30, claim 31, claim 32, claim

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	33, claim 34, claim 35, claim 36, claim 37, claim 38, claim 39, claim 40, claim 41, claim 42, claim 43, claim 44, claim 46, claim 47, and claim 48. To the extent this limitation is not disclosed by Bangs, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Bangs, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[1c] performance enhancement circuits coupled between the smartcard controller and the antenna, wherein the performance enhancement circuits include an amplifier and a load modulation circuit, and	Bangs discloses or renders obvious "performance enhancement circuits coupled between the smartcard controller and the antenna, wherein the performance enhancement circuits include an amplifier and a load modulation circuit." For example: Bangs at Abstract An NFC communicator has an antenna circuit to enable inductive coupling, via an RF H field, of the NFC communicator and another near field RF communicator in near field range. The antenna circuit has an antenna element coupled in parallel with a first capacitor to form a parallel LC circuit. The antenna element has an antenna coil in series with a second capacitor to reduce the voltage to which circuitry of the NFC communicator is subjected by a received RF H field. Alternatively or additionally, receive circuitry of the NFC communicator may be coupled to only a proportion of the antenna coil to reduce the voltage to which circuitry of the NFC communicator is subjected by a received RF H field. Bangs at Figure 1  FIG. 1 Bangs at Figure 2

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	 FIG 2. Bangs at Figure 3  FIG. 3 Bangs at Figure 4

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	 FIG. 4 Bangs at Figure 5  FIG. 5 Bangs at Figure 6

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	 FIG. 6 Bangs at [0002] Near field RF (radio frequency) communication requires an antenna of one near field RF communicator to be present within the alternating magnetic field (H field) generated by the antenna of another near field RF communicator by transmission of an RF signal (for example a 13.56 Mega Hertz signal) to enable the magnetic field (H field) of the RF signal to be inductively coupled between the communicators. The RF signal may be modulated to enable communication of control and/or other data. Ranges of up to several centimetres (generally to a maximum of 1 metre) are common for near field RF communicators. Bangs at [0007] RFID readers are generally designed specifically to enable initiation or generation of an RF H field and to detect modulation or affects on that initiated RF H field. The modulation or affects are then demodulated by the circuitry of the RFID reader and the demodulated data interpreted in accordance with the communication protocol under which the RFID reader is operating. This requires that the antenna circuit for such an RFID reader is designed specifically for this purpose. Likewise RFID tags are generally designed specifically to receive an RF H field and to modulate that H field, for example by load modulation or amplitude modulation, and the antenna circuits for such RFID tags are designed specifically for that purpose. The antennas of RFID tags and RFID readers of a specific system will also be designed to be impedance-matched, thus optimizing the inductive coupling range and therefore distance at which the RFID tags and RFID readers can operate and minimizing any null zones or regions within which communication is not possible.

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	Bangs at [0016] An aspect of the present invention provides an NFC communicator that alleviates at least some of the aforementioned problems. An aspect of the invention provides an antenna circuit for an NFC communicator which enables operation of the NFC communicator in both active and passive communication modes. Bangs at [0021] According to an aspect of the present invention, there is provided a near field RF communicator, comprising: an antenna circuit to enable inductive coupling of the near field RF communicator and another near field RF communicator in near field range; a signal supplier coupled to the antenna circuit to supply a drive signal to cause the antenna circuit to generate an RF signal; and a receiver coupled to the antenna circuit to receive a signal inductively coupled to the antenna circuit from another near field RF communicator in near field range, wherein the antenna circuit comprises an antenna element coupled in parallel with a first capacitor, wherein the antenna element comprises an antenna coil in series with a second capacitor to affect a voltage resulting from inductive coupling to the antenna circuit. Bangs at [0023] According to an aspect of the present invention, there is provided a near field RF communicator, comprising: an antenna circuit to enable inductive coupling of the near field RF communicator and another near field RF communicator in near field range; a signal supplier coupled to the antenna circuit to supply a drive signal to cause the antenna circuit to generate an RF signal; and a receiver coupled to the antenna circuit to receive a signal inductively coupled to the antenna circuit from another near field RF communicator in near field range, wherein the antenna circuit comprises an antenna element coupled in parallel with a capacitor, wherein the antenna element comprises an antenna coil having a tap and the receiver is coupled to the tap. Bangs at [0029] FIG. 3 shows a functional circuit diagram of an NFC communicator to illustrate one example of an antenna circuit embodying the present invention; Bangs at [0030] FIG. 4 shows a functional circuit diagram of an NFC communicator to illustrate another example of an antenna circuit embodying the present invention;

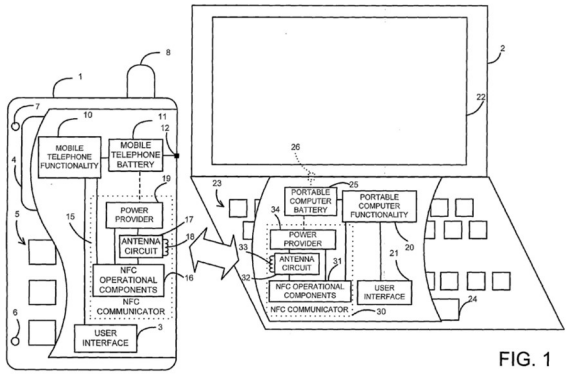
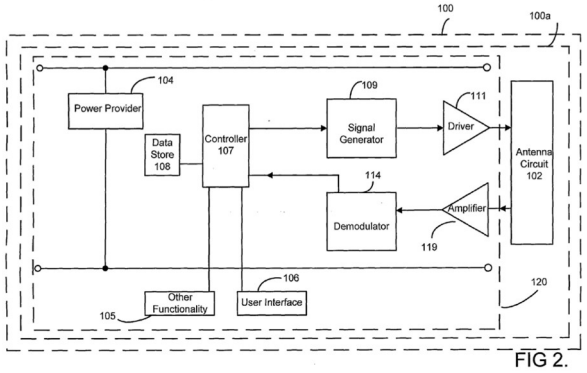
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	Bangs at [0031] FIG. 5 shows a functional circuit diagram of an NFC communicator to illustrate another example of an antenna circuit embodying the present invention; and Bangs at [0032] FIG. 6 shows a functional circuit diagram of an NFC communicator to illustrate another example of an antenna circuit embodying the present invention. Bangs at [0046] In this example, the NFC communications enabled device 100 comprises an NFC communicator 100a having NFC operational components including an antenna circuit 102 and NFC functionality 120 comprising power provider 104, controller 107, data store 108, receiver circuitry and transmitter circuitry. Bangs at [0049] In this example, the receiver circuitry comprises an amplifier 119 coupled to the antenna circuit 102 and a demodulator 114 coupled to the amplifier 119 and the controller 107 for amplifying and demodulating a modulated RF signal inductively coupled to the antenna circuit 102 from another near field RF communicator in near field range and for supplying the thus-extracted data to the controller 107 for processing. Bangs at [0050] In this example, the transmitter circuitry comprises components for driving the antenna circuit 102 to transmit an RF signal and for modulating an RF signal to enable communication of data between near field RF communicators in near field range. As shown in FIG. 2, the transmitter circuitry comprises a signal generator 109 coupled via a driver 111 to the antenna circuit 102. In this example, the signal generator 110 is configured to cause modulation by gating or switching on and off the RF signal in accordance with the data to be communicated. The NFC communicator may use any appropriate modulation scheme that is in accordance with the standards and/or protocols under which the NFC communicator operates. Alternatively a separate or further signal controller may be incorporated within the NFC operational components of functionality 120 to control modulation of the signal generated by the signal generator 109 in accordance with data or instructions received from the controller 107. Bangs at [0051]

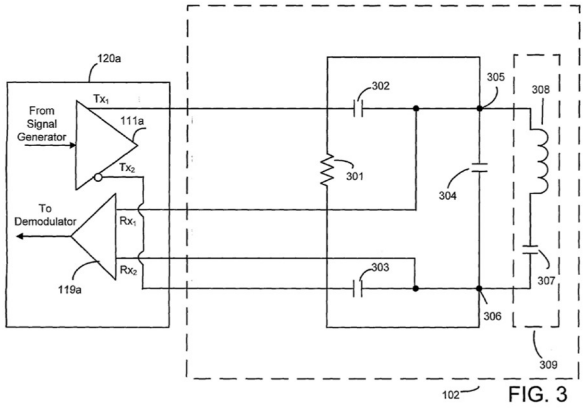
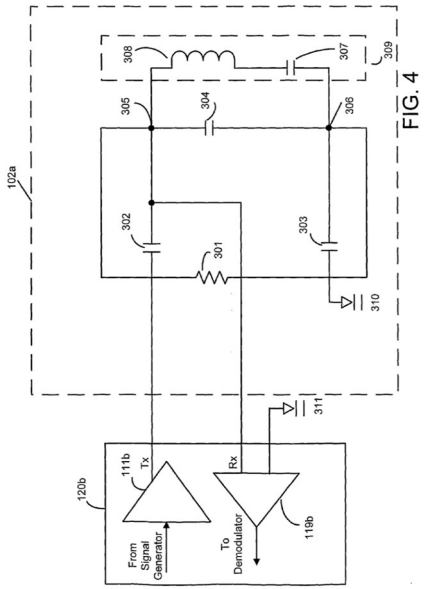
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	The controller 107 of the NFC functionality 120 is provided to control overall operation of the NFC communicator. The controller 107 is coupled to the data store 108 which is provided to store data (information and/or control data) to be transmitted from and/or data received by the NFC communications enabled device. The controller 107 may be a microprocessor, for example a RISC processor or other microprocessor or a state machine. Program instructions for programming the controller and/or control data for communication to another near field RF communicator may be stored in an internal memory of the controller and/or the data store. Bangs at [0053] When in initiator or target mode, the NFC communicator may communicate in accordance with an active or passive protocol. When using an active protocol, the initiating NFC communicator will transmit an RF field and following completion of its data communication will turn off its RF field. The responding near field RF communicator (target) will then transmit its own RF field and data and then turn off its RF field and so on. When using a passive protocol the NFC communicator (initiator) will transmit and maintain its RF field throughout the entire communication sequence and the target will modulate that RF field with the data to be communicated. The protocol used will depend on instructions received from the controller 107 and the response received from a responding near field RF communicator. Bangs at [0054] In FIG. 2 control of the operation of the NFC communicator is through controller 107. As another possibility, where the NFC communicator is part of or associated with a host device, control of the operation of the NFC communicator may at least partly be directed by the host device, for example through the other functionality 105. In such circumstances all or part of the control may be provided by the other functionality 105 which may be part of the NFC functionality or a host. For example the NFC communicator controller 107 may control modulation and modulation protocols whereas the data to be transmitted may be provided by the other functionality 105. Bangs at [0055] An NFC communicator thus has the capability to transmit an RF H field, to receive an RF H field, to modulate a transmitted RF H field and also to modulate a received RF H field. Bangs at [0056] FIG. 3 shows a functional circuit diagram of an NFC communicator embodying the invention to illustrate one example of an antenna circuit 102. In the interests of simplicity in FIG. 3, only some of the NFC functionality 120a is shown in FIG. 3.

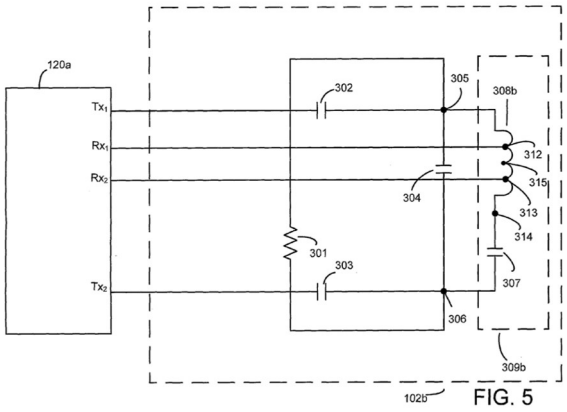
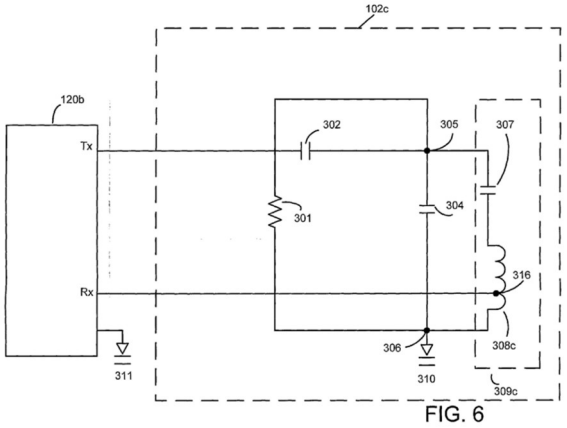
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	Bangs at [0057] As shown in FIG. 3, antenna circuit 102 comprises an antenna element 309 coupled in parallel with a first capacitor 304 to form a tank circuit (a parallel LC resonant circuit). Bangs at [0058] The antenna element 309 comprises an antenna coil element 308 in series with a second capacitor 307 which second capacitor 307 is anti-phase to the antenna coil element 308 and affects a voltage resulting from inductive coupling of an RF H field to the antenna circuit. As shown the antenna coil element 308 comprises a single antenna coil which may comprise one, two or more coils or loops. Bangs at [0059] The junction 305 between capacitor 304 and antenna element 309 is coupled to one input Rx1 of a differential amplifier 119a forming the amplifier 119 shown in FIG. 2 while the junction 306 between capacitor 304 and antenna element 309 is coupled to the other input Rx2 of the differential amplifier 119a. To enable the antenna circuit to be driven, respective outputs Tx1 and Tx2 of driver 111a are coupled to the junctions 305 and 306 via respective further capacitors 302 and 303. Thus, in this example, the antenna circuit 102 has double-ended or differential coupling (Rx1 and Rx2) to the receive circuitry and double-ended or differential coupling (Tx1 and Tx2) to the transmit circuitry of the NEC functionality 120a. Bangs at [0067] In operation of the NFC communicator shown by FIG. 3, when the NFC communicator is acting as a target and is in passive target communication mode, then the NFC communicator will communicate any response to an initiator near field RF communicator in near field range by modulating the RF H field received from that near field RF communicator under the control of the controller 107. The NFC communicator may in these circumstances use load modulation, that is an impedance (not shown) of the NFC functionality may be switched in and out under the control of the controller 107 in accordance with the data to be communicated so as to change the effective impedance of the antenna 'tank' (that is the parallel LC resonant circuit defined by the antenna coil element (antenna coil 308 in series with capacitor 307) and capacitor 304) in accordance with the data to be communicated, thereby modulating the load on the antenna circuit of the initiating near field RF communicator and thus modulating, in this example, the amplitude and phase of the signal provided by the antenna circuit of the initiator to its receiver circuitry. Bangs at [0069]

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	The presence of capacitor 307 thus reduces the potential difference (voltage) developed between junctions 306 and 305 for a given received H field, thereby reducing the voltage between receiver couplings Rx1 and Rx2 and between transmission couplings Tx1 and Tx2, so reducing the maximum potential voltage to which the receiver and transmitter circuitry may be subjected. Although antenna circuit designers generally aim to maximise the voltage induced by any given H field, the use of capacitor 307 enables control of the voltage that the capacitors 302, 303 and 304 and the NFC functionality 120a (for example the driver 111a and amplifier 119a) need to be able to withstand, thereby enabling the use of capacitors 302, 303 and 304 with lower voltage ratings and enabling coupling of the antenna circuit 102 directly to the NFC functionality 120a. Bangs at [0074] Any appropriate form of modulation may be used to enable data communication, for example modulation of the RF H field may be achieved through gating or switching of the generated signal in accordance with the relevant communication protocols. The form of modulation will depend on the type of drive functionality incorporated within the NFC communicator. For example, a current drive will control the current supplied to the antenna circuit 102 and may achieve modulation by changing the current. A voltage drive on the other hand will control the voltage supplied to the antenna circuit 102 and may achieve modulation by controlling pulses supplied the antenna circuit 102. Any suitable type of modulation technique may be used (e.g. amplitude and/or phase modulation) and any suitable modulation encoding scheme may be used Bangs at [0076] FIG. 4 shows a functional circuit diagram of an NFC communicator having an antenna circuit 102a that differs from that shown in FIG. 3 in that the antenna circuit has a single transmission input coupling Tx coupled to a single output driver 111b and a single receiver output coupling Rx coupled to a single input amplifier 119b so that the transmission signal is defined between transmission connection Tx and a signal ground coupling 311 and the receiver signal is defined between Rx and a coupling to ground 310 via capacitor 303. Both grounds (earths) may be provided by a local ground of the NFC communicator or a host. Bangs at [0078] FIG. 5 shows a functional circuit diagram of an NFC communicator to illustrate another example of an antenna circuit 102 embodying the present invention. Bangs at [0081]

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	FIG. 6 shows a functional circuit diagram of an NFC communicator having an antenna circuit 102c that differs from that shown in FIG. 5 in that, like the antenna circuit shown in FIG. 4, the antenna circuit 102c has a single transmission input coupling Tx coupled to a single output driver (not shown in FIG. 6) and a single receiver output coupling Rx coupled to a single input amplifier (not shown in FIG. 6) so that the transmission signal is defined between transmission connection Tx and a ground coupling 311 and the receiver signal is defined between Rx and a coupling to ground 310. *See also* Bangs at [0001], [0010], [0017], [0018], [0019], [0020], [0022], [0024], [0025], [0039], [0052], [0061], [0062], [0063], [0064], [0065], [0066], [0068], [0070], [0071], [0072], [0073], [0075], [0077], [0079], [0080], [0082], [0083], [0084], [0085], [0086], [0087], [0088], [0089], [0090], [0091], [0092], [0093], [0094], [0096], [0097], claim 29, claim 30, claim 31, claim 32, claim 33, claim 34, claim 35, claim 36, claim 37, claim 38, claim 39, claim 40, claim 41, claim 42, claim 43, claim 44, claim 46, claim 47, and claim 48. To the extent this limitation is not disclosed by Bangs, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Bangs, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[1d] wherein the amplifier is coupled to amplify a signal received from the antenna and to provide an amplified signal to the smartcard controller.	Bangs discloses or renders obvious "wherein the amplifier is coupled to amplify a signal received from the antenna and to provide an amplified signal to the smartcard controller." For example: Bangs at Abstract An NFC communicator has an antenna circuit to enable inductive coupling, via an RF H field, of the NFC communicator and another near field RF communicator in near field range. The antenna circuit has an antenna element coupled in parallel with a first capacitor to form a parallel LC circuit. The antenna element has an antenna coil in series with a second capacitor to reduce the voltage to which circuitry of the NFC communicator is subjected by a received RF H field. Alternatively or additionally, receive circuitry of the NFC communicator may be coupled to only a proportion of the antenna coil to reduce the voltage to which circuitry of the NFC communicator is subjected by a received RF H field. Bangs at Figure 1

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	 FIG. 1 Bangs at Figure 2  FIG 2. Bangs at Figure 3

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	 FIG. 3 Bangs at Figure 4  FIG. 4 Bangs at Figure 5

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	 FIG. 5 Bangs at Figure 6  FIG. 6 Bangs at [0002] Near field RF (radio frequency) communication requires an antenna of one near field RF communicator to be present within the alternating magnetic field (H field) generated by the antenna of another near field RF communicator by transmission of an RF signal (for example a 13.56 Mega Hertz signal) to enable the magnetic field (H field) of the RF signal to be inductively coupled between the communicators. The RF signal may be modulated to enable communication of control and/or other data. Ranges of up to several centimetres (generally to a maximum of 1 metre) are common for near field RF communicators.

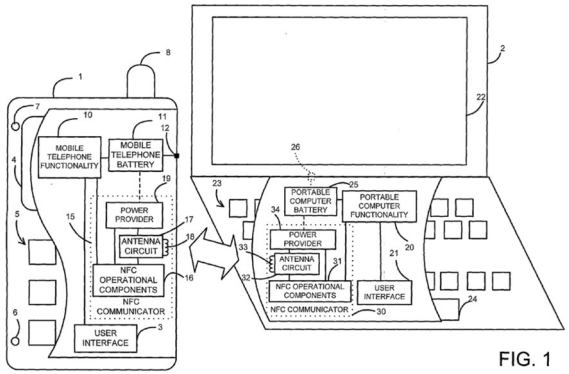
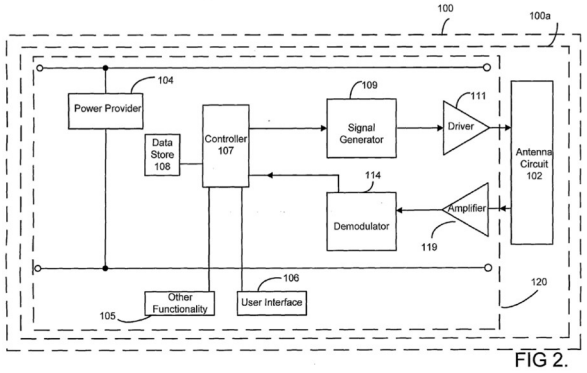
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	Bangs at [0016] An aspect of the present invention provides an NFC communicator that alleviates at least some of the aforementioned problems. An aspect of the invention provides an antenna circuit for an NFC communicator which enables operation of the NFC communicator in both active and passive communication modes. Bangs at [0021] According to an aspect of the present invention, there is provided a near field RF communicator, comprising: an antenna circuit to enable inductive coupling of the near field RF communicator and another near field RF communicator in near field range; a signal supplier coupled to the antenna circuit to supply a drive signal to cause the antenna circuit to generate an RF signal; and a receiver coupled to the antenna circuit to receive a signal inductively coupled to the antenna circuit from another near field RF communicator in near field range, wherein the antenna circuit comprises an antenna element coupled in parallel with a first capacitor, wherein the antenna element comprises an antenna coil in series with a second capacitor to affect a voltage resulting from inductive coupling to the antenna circuit. Bangs at [0023] According to an aspect of the present invention, there is provided a near field RF communicator, comprising: an antenna circuit to enable inductive coupling of the near field RF communicator and another near field RF communicator in near field range; a signal supplier coupled to the antenna circuit to supply a drive signal to cause the antenna circuit to generate an RF signal; and a receiver coupled to the antenna circuit to receive a signal inductively coupled to the antenna circuit from another near field RF communicator in near field range, wherein the antenna circuit comprises an antenna element coupled in parallel with a capacitor, wherein the antenna element comprises an antenna coil having a tap and the receiver is coupled to the tap. Bangs at [0029] FIG. 3 shows a functional circuit diagram of an NFC communicator to illustrate one example of an antenna circuit embodying the present invention; Bangs at [0030] FIG. 4 shows a functional circuit diagram of an NFC communicator to illustrate another example of an antenna circuit embodying the present invention;

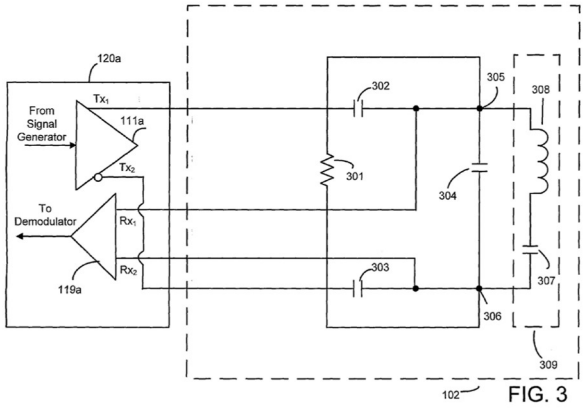
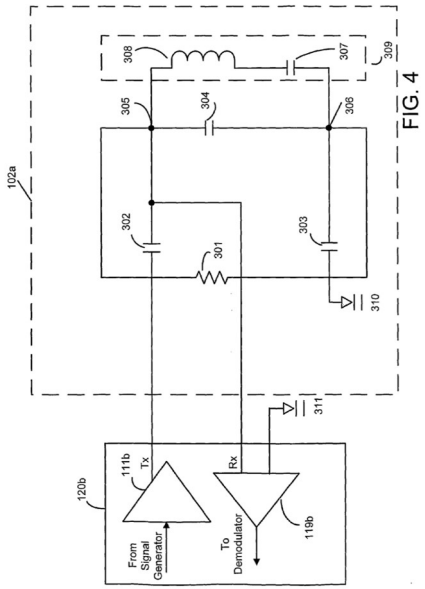
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	Bangs at [0031] FIG. 5 shows a functional circuit diagram of an NFC communicator to illustrate another example of an antenna circuit embodying the present invention; and Bangs at [0032] FIG. 6 shows a functional circuit diagram of an NFC communicator to illustrate another example of an antenna circuit embodying the present invention. Bangs at [0046] In this example, the NFC communications enabled device 100 comprises an NFC communicator 100a having NFC operational components including an antenna circuit 102 and NFC functionality 120 comprising power provider 104, controller 107, data store 108, receiver circuitry and transmitter circuitry. Bangs at [0049] In this example, the receiver circuitry comprises an amplifier 119 coupled to the antenna circuit 102 and a demodulator 114 coupled to the amplifier 119 and the controller 107 for amplifying and demodulating a modulated RF signal inductively coupled to the antenna circuit 102 from another near field RF communicator in near field range and for supplying the thus-extracted data to the controller 107 for processing. Bangs at [0051] The controller 107 of the NFC functionality 120 is provided to control overall operation of the NFC communicator. The controller 107 is coupled to the data store 108 which is provided to store data (information and/or control data) to be transmitted from and/or data received by the NFC communications enabled device. The controller 107 may be a microprocessor, for example a RISC processor or other microprocessor or a state machine. Program instructions for programming the controller and/or control data for communication to another near field RF communicator may be stored in an internal memory of the controller and/or the data store. Bangs at [0054] In FIG. 2 control of the operation of the NFC communicator is through controller 107. As another possibility, where the NFC communicator is part of or associated with a host device, control of the operation of the NFC communicator may at least partly be directed by the host device, for example through the other functionality 105. In such circumstances all or part of the control may be provided by

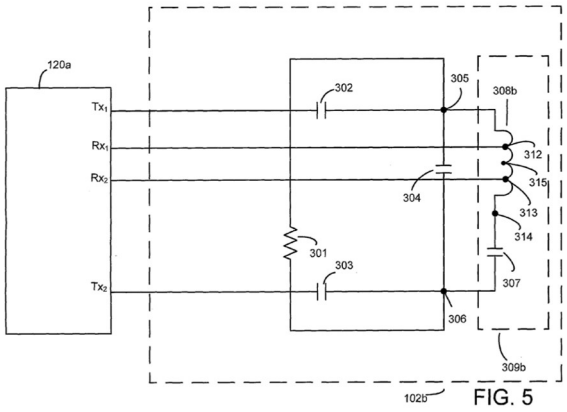
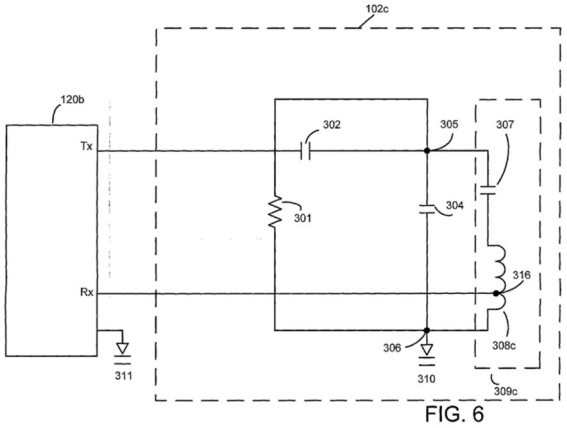
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	the other functionality 105 which may be part of the NFC functionality or a host. For example the NFC communicator controller 107 may control modulation and modulation protocols whereas the data to be transmitted may be provided by the other functionality 105. Bangs at [0056] FIG. 3 shows a functional circuit diagram of an NFC communicator embodying the invention to illustrate one example of an antenna circuit 102. In the interests of simplicity in FIG. 3, only some of the NFC functionality 120a is shown in FIG. 3. Bangs at [0057] As shown in FIG. 3, antenna circuit 102 comprises an antenna element 309 coupled in parallel with a first capacitor 304 to form a tank circuit (a parallel LC resonant circuit). Bangs at [0058] The antenna element 309 comprises an antenna coil element 308 in series with a second capacitor 307 which second capacitor 307 is anti-phase to the antenna coil element 308 and affects a voltage resulting from inductive coupling of an RF H field to the antenna circuit. As shown the antenna coil element 308 comprises a single antenna coil which may comprise one, two or more coils or loops. Bangs at [0059] The junction 305 between capacitor 304 and antenna element 309 is coupled to one input Rx1 of a differential amplifier 119a forming the amplifier 119 shown in FIG. 2 while the junction 306 between capacitor 304 and antenna element 309 is coupled to the other input Rx2 of the differential amplifier 119a. To enable the antenna circuit to be driven, respective outputs Tx1 and Tx2 of driver 111a are coupled to the junctions 305 and 306 via respective further capacitors 302 and 303. Thus, in this example, the antenna circuit 102 has double-ended or differential coupling (Rx1 and Rx2) to the receive circuitry and double-ended or differential coupling (Tx1 and Tx2) to the transmit circuitry of the NEC functionality 120a. Bangs at [0069] The presence of capacitor 307 thus reduces the potential difference (voltage) developed between junctions 306 and 305 for a given received H field, thereby reducing the voltage between receiver couplings Rx1 and Rx2 and between transmission couplings Tx1 and Tx2, so reducing the maximum potential voltage to which the receiver and transmitter circuitry may be subjected. Although antenna circuit designers generally aim to maximise the voltage induced by any given H field, the use of capacitor 307 enables

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	control of the voltage that the capacitors 302, 303 and 304 and the NFC functionality 120a (for example the driver 111a and amplifier 119a) need to be able to withstand, thereby enabling the use of capacitors 302, 303 and 304 with lower voltage ratings and enabling coupling of the antenna circuit 102 directly to the NFC functionality 120a. Bangs at [0076] FIG. 4 shows a functional circuit diagram of an NFC communicator having an antenna circuit 102a that differs from that shown in FIG. 3 in that the antenna circuit has a single transmission input coupling Tx coupled to a single output driver 111b and a single receiver output coupling Rx coupled to a single input amplifier 119b so that the transmission signal is defined between transmission connection Tx and a signal ground coupling 311 and the receiver signal is defined between Rx and a coupling to ground 310 via capacitor 303. Both grounds (earths) may be provided by a local ground of the NFC communicator or a host. Bangs at [0078] FIG. 5 shows a functional circuit diagram of an NFC communicator to illustrate another example of an antenna circuit 102 embodying the present invention. Bangs at [0079] The embodiment shown in FIG. 5 differs from that shown in FIG. 3 in that the receiver input couplings Rx1 and Rx2 are coupled across only a part of the antenna coil 308b, that is receiver input couplings Rx1 and Rx2 are coupled to taps 312 and 313 so that the antenna coil 308b forms an autotransformer and the voltage across the receiver input couplings Rx1 and Rx2 is stepped down from that across the entire antenna coil 308b (i.e. from that between junctions 305 and 306) so that the voltage to which the receiver circuitry is subjected when an RF H field is coupled to or received by the antenna coil is less than the voltage to which the transmitter circuitry is subjected thereby reducing even further the maximum voltage that amplifier 119 needs to be able to withstand. This is advantageous because it enables the NFC communicator to protect the receiver circuitry against received RF H fields without reducing the strength of the NFC communicator's own RF H field. The transmitter circuitry should be isolated or otherwise protected during reception in this example. Bangs at [0081] FIG. 6 shows a functional circuit diagram of an NFC communicator having an antenna circuit 102c that differs from that shown in FIG. 5 in that, like the antenna circuit shown in FIG. 4, the antenna circuit 102c has a single transmission input coupling Tx coupled to a single output driver (not shown in FIG. 6) and a

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	single receiver output coupling Rx coupled to a single input amplifier (not shown in FIG. 6) so that the transmission signal is defined between transmission connection Tx and a ground coupling 311 and the receiver signal is defined between Rx and a coupling to ground 310. *See also* Bangs at [0001], [0010], [0017], [0018], [0019], [0020], [0022], [0024], [0025], [0039], [0050], [0052], [0053], [0061], [0062], [0063], [0064], [0065], [0067], [0068], [0070], [0071], [0072], [0073], [0074], [0075], [0077], [0080], [0082], [0083], [0084], [0085], [0086], [0087], [0088], [0089], [0090], [0091], [0092], [0093], [0094], [0096], [0097], claim 29, claim 30, claim 31, claim 32, claim 33, claim 34, claim 35, claim 36, claim 37, claim 38, claim 39, claim 40, claim 41, claim 42, claim 43, claim 44, claim 46, claim 47, and claim 48. To the extent this limitation is not disclosed by Bangs, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Bangs, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
2. The mobile device of claim 1 wherein the antenna is tuned to operate at 13.56 MHz.	Bangs expressly or inherently discloses "[t]he mobile device of claim 1 wherein the antenna is tuned to operate at 13.56 MHz." For example: Bangs at Abstract An NFC communicator has an antenna circuit to enable inductive coupling, via an RF H field, of the NFC communicator and another near field RF communicator in near field range. The antenna circuit has an antenna element coupled in parallel with a first capacitor to form a parallel LC circuit. The antenna element has an antenna coil in series with a second capacitor to reduce the voltage to which circuitry of the NFC communicator is subjected by a received RF H field. Alternatively or additionally, receive circuitry of the NFC communicator may be coupled to only a proportion of the antenna coil to reduce the voltage to which circuitry of the NFC communicator is subjected by a received RF H field. Bangs at Figure 1

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	 FIG. 1 Bangs at Figure 2  FIG 2. Bangs at Figure 3

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	 FIG. 3 Bangs at Figure 4  FIG. 4 Bangs at Figure 5

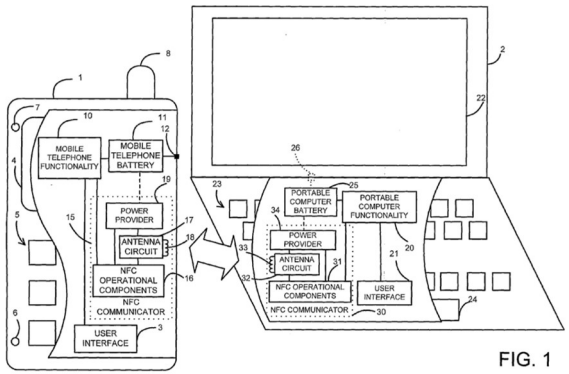
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	 FIG. 5 Bangs at Figure 6  FIG. 6 Bangs at [0002] Near field RF (radio frequency) communication requires an antenna of one near field RF communicator to be present within the alternating magnetic field (H field) generated by the antenna of another near field RF communicator by transmission of an RF signal (for example a 13.56 Mega Hertz signal) to enable the magnetic field (H field) of the RF signal to be inductively coupled between the communicators. The RF signal may be modulated to enable communication of control and/or other data. Ranges of up to several centimetres (generally to a maximum of 1 metre) are common for near field RF communicators.

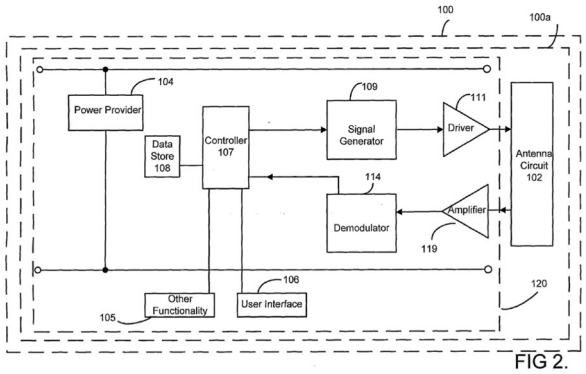
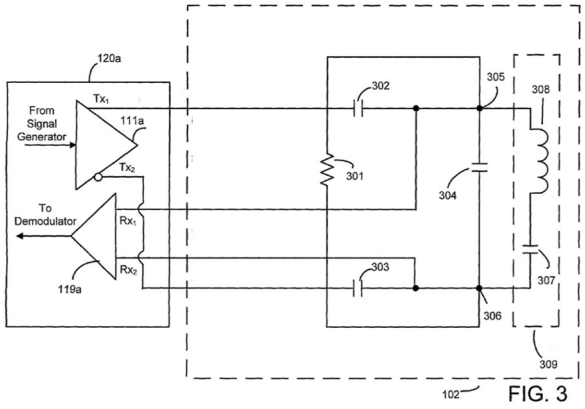
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	Bangs at [0016] An aspect of the present invention provides an NFC communicator that alleviates at least some of the aforementioned problems. An aspect of the invention provides an antenna circuit for an NFC communicator which enables operation of the NFC communicator in both active and passive communication modes. Bangs at [0021] According to an aspect of the present invention, there is provided a near field RF communicator, comprising: an antenna circuit to enable inductive coupling of the near field RF communicator and another near field RF communicator in near field range; a signal supplier coupled to the antenna circuit to supply a drive signal to cause the antenna circuit to generate an RF signal; and a receiver coupled to the antenna circuit to receive a signal inductively coupled to the antenna circuit from another near field RF communicator in near field range, wherein the antenna circuit comprises an antenna element coupled in parallel with a first capacitor, wherein the antenna element comprises an antenna coil in series with a second capacitor to affect a voltage resulting from inductive coupling to the antenna circuit. Bangs at [0023] According to an aspect of the present invention, there is provided a near field RF communicator, comprising: an antenna circuit to enable inductive coupling of the near field RF communicator and another near field RF communicator in near field range; a signal supplier coupled to the antenna circuit to supply a drive signal to cause the antenna circuit to generate an RF signal; and a receiver coupled to the antenna circuit to receive a signal inductively coupled to the antenna circuit from another near field RF communicator in near field range, wherein the antenna circuit comprises an antenna element coupled in parallel with a capacitor, wherein the antenna element comprises an antenna coil having a tap and the receiver is coupled to the tap. Bangs at [0029] FIG. 3 shows a functional circuit diagram of an NFC communicator to illustrate one example of an antenna circuit embodying the present invention; Bangs at [0030] FIG. 4 shows a functional circuit diagram of an NFC communicator to illustrate another example of an antenna circuit embodying the present invention;

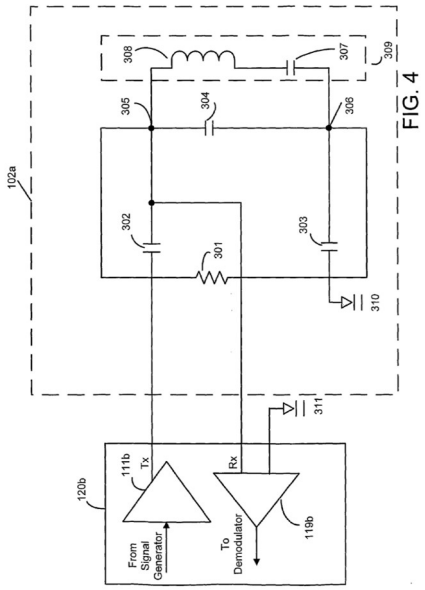
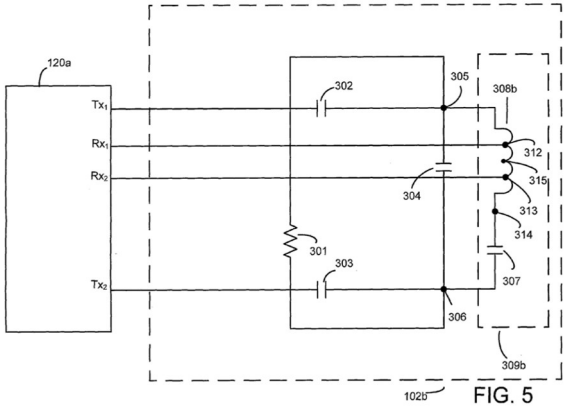
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	Bangs at [0031] FIG. 5 shows a functional circuit diagram of an NFC communicator to illustrate another example of an antenna circuit embodying the present invention; and Bangs at [0032] FIG. 6 shows a functional circuit diagram of an NFC communicator to illustrate another example of an antenna circuit embodying the present invention. Bangs at [0039] Each NFC communicator 15 and 30 comprises NFC operational components 16 and 31 for, as will be described below, enabling control of the NFC functionality and generation, modulation and demodulation of an RF signal. Each NFC communicator 15 and 30 also comprises an antenna circuit 17 and 32 comprising an inductor or coil in the form of an antenna 18 and 33. The antenna circuits 17 and 32 enable an alternating magnetic field (RF H field) generated by the antenna of one near field RF communicator 15 (or 30) by transmission of an RF signal (for example a 13.56 Mega Hertz signal) to be inductively coupled to the antenna of the other near field RF communicator 30 (or 15) when that antenna is within the near field of the RF signal generated by the one near field RF communicator 15 (or 30). Bangs at [0052] The NFC communicator 100a may operate in an initiator mode (that is as an initiating near field RF communicator) or a target mode (that is as a responding near field RF communicator), dependent on the mode to which the NFC communicator is set. The mode may be determined by the controller 107 or may be determined in dependence on the nature of a received near field RF signal. When in initiator mode, an NFC communicator initiates communications with any compatible responding near field RF communicator capable of responding to the initiating NFC communicator (for example an NFC communicator in target mode or an RFID tag or transponder) that is in its near field range, while when in target mode an NFC communicator waits for a communication from a compatible initiating near field RF communicator (for example an NFC communicator in initiator mode or an RFID initiator or transceiver). As thus used, compatible means operable at the same frequency and in accordance with the same protocols, for example in accordance with the protocols set out in various standards such as ISO/IEC 18092, ISO/IEC 21481, ISO/IEC 14443 and ISO/IEC 15693. NFC communicators commonly operate at or around 13.56 MHz. Bangs at [0056]

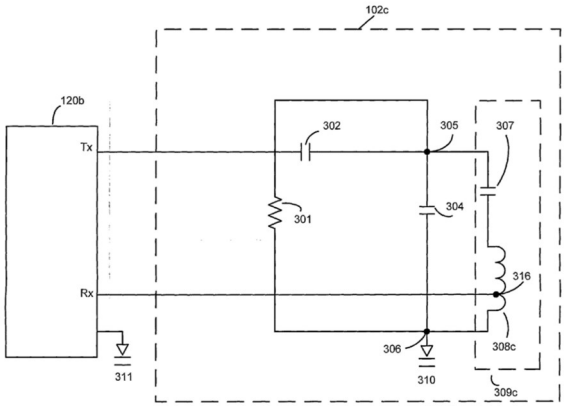
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	FIG. 3 shows a functional circuit diagram of an NFC communicator embodying the invention to illustrate one example of an antenna circuit 102. In the interests of simplicity in FIG. 3, only some of the NFC functionality 120a is shown in FIG. 3. Bangs at [0057] As shown in FIG. 3, antenna circuit 102 comprises an antenna element 309 coupled in parallel with a first capacitor 304 to form a tank circuit (a parallel LC resonant circuit). Bangs at [0058] The antenna element 309 comprises an antenna coil element 308 in series with a second capacitor 307 which second capacitor 307 is anti-phase to the antenna coil element 308 and affects a voltage resulting from inductive coupling of an RF H field to the antenna circuit. As shown the antenna coil element 308 comprises a single antenna coil which may comprise one, two or more coils or loops. Bangs at [0063] As one possibility, the size of capacitor 307 to be employed to back off antenna coil 308 to effect a reduction in the apparent inductance of antenna coil 308 (that is the total inductance of antenna element 309) may be calculated using the following formula: $$C_{307} = \frac{1}{(2\pi \times F_c)^2 L_{neg}}$$ where F_c is the carrier frequency (for example 13.56 MHz) and L_{neg} is the amount (in Henrys) that inductance 308 is to be reduced by. Bangs at [0070] When the NFC communicator is in the active communication mode, the controller 107 (FIG. 2) will cause the signal generator 109 (FIG. 2) and driver 111a to drive the antenna circuit 102 to initiate or generate an RF-H field. The antenna circuit 102 is tuned to the required RF transmission frequency which, for an NFC communicator operating in accordance with ISO 18092, is 13.56 MHz (Megahertz). The capacitors 302 and 303 add capacitance to bring the tuning closer to the required frequency. Bangs at [0076] FIG. 4 shows a functional circuit diagram of an NFC communicator having an antenna circuit 102a that differs from that shown in FIG. 3 in that the antenna circuit has a single transmission input coupling Tx coupled to a single output driver 111b and a single receiver output coupling Rx coupled to a single input

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	amplifier 119b so that the transmission signal is defined between transmission connection Tx and a signal ground coupling 311 and the receiver signal is defined between Rx and a coupling to ground 310 via capacitor 303. Both grounds (earths) may be provided by a local ground of the NFC communicator or a host. Bangs at [0078] FIG. 5 shows a functional circuit diagram of an NFC communicator to illustrate another example of an antenna circuit 102 embodying the present invention. Bangs at [0081] FIG. 6 shows a functional circuit diagram of an NFC communicator having an antenna circuit 102c that differs from that shown in FIG. 5 in that, like the antenna circuit shown in FIG. 4, the antenna circuit 102c has a single transmission input coupling Tx coupled to a single output driver (not shown in FIG. 6) and a single receiver output coupling Rx coupled to a single input amplifier (not shown in FIG. 6) so that the transmission signal is defined between transmission connection Tx and a ground coupling 311 and the receiver signal is defined between Rx and a coupling to ground 310. Bangs at [0099] As used herein RF means any suitable frequency under which near field RF communicators may operate, for example 13.56 MHz for NFC communicators. Bangs at claim 44 The NFC communicator according to claim 29 arranged to communicate using any of: ISO/IEC 18092, ISO/IEC 21481, ISO/IEC 14443 and ISO/IEC 15693. *See also* Bangs at [0001], [0005], [0010], [0017], [0018], [0019], [0020], [0022], [0024], [0025], [0046], [0049], [0050], [0053], [0059], [0061], [0062], [0064], [0065], [0066], [0067], [0068], [0069], [0071], [0072], [0073], [0074], [0075], [0077], [0079], [0080], [0082], [0083], [0084], [0085], [0086], [0087], [0088], [0089], [0090], [0091], [0092], [0093], [0094], [0096], [0097], [0098], claim 29, claim 30, claim 31, claim 32, claim 33, claim 34, claim 35, claim 36, claim 37, claim 38, claim 39, claim 40, claim 41, claim 42, claim 43, claim 45, claim 46, claim 47, and claim 48. To the extent this limitation is not disclosed by Bangs, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Bangs, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.

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	See also claim 1 above.
3. The mobile device of claim 1 wherein the antenna comprises an inductive element too small to draw enough power sufficient to operate the smartcard controller from an interrogating radio frequency (RF) field.	Bangs expressly or inherently discloses "[t]he mobile device of claim 1 wherein the antenna comprises an inductive element too small to draw enough power sufficient to operate the smartcard controller from an interrogating radio frequency (RF) field." For example: Bangs at Abstract An NFC communicator has an antenna circuit to enable inductive coupling, via an RF H field, of the NFC communicator and another near field RF communicator in near field range. The antenna circuit has an antenna element coupled in parallel with a first capacitor to form a parallel LC circuit. The antenna element has an antenna coil in series with a second capacitor to reduce the voltage to which circuitry of the NFC communicator is subjected by a received RF H field. Alternatively or additionally, receive circuitry of the NFC communicator may be coupled to only a proportion of the antenna coil to reduce the voltage to which circuitry of the NFC communicator is subjected by a received RF H field. Bangs at Figure 1  FIG. 1 Bangs at Figure 2

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	 FIG 2. Bangs at Figure 3  FIG. 3 Bangs at Figure 4

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	 FIG. 6 Bangs at [0002] Near field RF (radio frequency) communication requires an antenna of one near field RF communicator to be present within the alternating magnetic field (H field) generated by the antenna of another near field RF communicator by transmission of an RF signal (for example a 13.56 Mega Hertz signal) to enable the magnetic field (H field) of the RF signal to be inductively coupled between the communicators. The RF signal may be modulated to enable communication of control and/or other data. Ranges of up to several centimetres (generally to a maximum of 1 metre) are common for near field RF communicators. Bangs at [0008] With NFC communicators the position is different. Such NFC communicators need to be capable of both initiating an RF H field and of receiving an RF H field. Moreover a single design of NFC communicator may be used for many different applications and in some of those applications the NFC communicator may function like an RFID tag, in other applications the NFC communicator may function like an RFID reader and in other applications the NFC communicator may sometimes function like an RFID tag and sometimes function like an RFID reader. Also, NFC communicators tend to have small antennas as compared to traditional RFID readers. Bangs at [0010] In addition, where the NFC communicator is within a host device, then size limitations of the host and/or the local environment provided by the host may impact on the antenna circuit design and/or constrain the

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	size of the antenna circuit or the antenna coil itself. Such impacts and constraints may seriously detrimentally affect the range over which inductive coupling may be achieved. Bangs at [0011] The use of existing antenna circuit designs for an NFC communicator thus requires compromise in the operating range or functionality of the NFC communicator. For example an existing antenna circuit might enable inductive coupling up to a range of 10 cm under certain environments, standards or protocols but only up to a range of 1 cm of under other environments, standards or protocols. Also an NFC communicator may be able to operate at a greater range when initiating an RF H field but may have a much reduced range when modulating a received RF H field. Bangs at [0012] Existing antenna circuit designs can result in large voltage fluctuations across the rest of the NFC communicator during inductive coupling and it can be difficult to protect the circuitry from those voltage fluctuations. In addition existing antenna designs tend to require the use high voltage capacitors, that is capacitors having a voltage rating which exceeds the operating voltage of the relevant circuit. For example if NFC communicator circuitry operates at 3.3 volts, a high voltage capacitor would be a capacitor having a voltage rating above 3.3 volts. Such high voltage capacitors are costly and generally have to be provided as discrete fixed capacitance components which is of itself costly and minimizes flexibility in design. Bangs at [0016] An aspect of the present invention provides an NFC communicator that alleviates at least some of the aforementioned problems. An aspect of the invention provides an antenna circuit for an NFC communicator which enables operation of the NFC communicator in both active and passive communication modes. Bangs at [0020] An aspect of the invention provides an antenna circuit operable to both inductively couple with a received RF H field and to transmit an RF H field, the antenna circuit comprising at least one antenna coil and at least one capacitance in anti-phase with the antenna coil. Bangs at [0021] According to an aspect of the present invention, there is provided a near field RF communicator, comprising: an antenna circuit to enable inductive coupling of the near field RF communicator and

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	another near field RF communicator in near field range; a signal supplier coupled to the antenna circuit to supply a drive signal to cause the antenna circuit to generate an RF signal; and a receiver coupled to the antenna circuit to receive a signal inductively coupled to the antenna circuit from another near field RF communicator in near field range, wherein the antenna circuit comprises an antenna element coupled in parallel with a first capacitor, wherein the antenna element comprises an antenna coil in series with a second capacitor to affect a voltage resulting from inductive coupling to the antenna circuit. Bangs at [0023] According to an aspect of the present invention, there is provided a near field RF communicator, comprising: an antenna circuit to enable inductive coupling of the near field RF communicator and another near field RF communicator in near field range; a signal supplier coupled to the antenna circuit to supply a drive signal to cause the antenna circuit to generate an RF signal; and a receiver coupled to the antenna circuit to receive a signal inductively coupled to the antenna circuit from another near field RF communicator in near field range, wherein the antenna circuit comprises an antenna element coupled in parallel with a capacitor, wherein the antenna element comprises an antenna coil having a tap and the receiver is coupled to the tap. Bangs at [0029] FIG. 3 shows a functional circuit diagram of an NFC communicator to illustrate one example of an antenna circuit embodying the present invention; Bangs at [0030] FIG. 4 shows a functional circuit diagram of an NFC communicator to illustrate another example of an antenna circuit embodying the present invention; Bangs at [0031] FIG. 5 shows a functional circuit diagram of an NFC communicator to illustrate another example of an antenna circuit embodying the present invention; and Bangs at [0032] FIG. 6 shows a functional circuit diagram of an NFC communicator to illustrate another example of an antenna circuit embodying the present invention. Bangs at [0039]

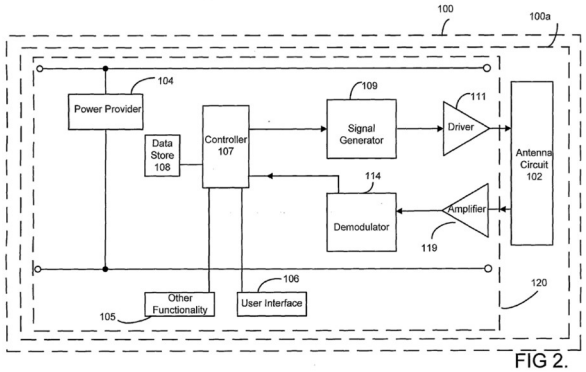
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	Each NFC communicator 15 and 30 comprises NFC operational components 16 and 31 for, as will be described below, enabling control of the NFC functionality and generation, modulation and demodulation of an RF signal. Each NFC communicator 15 and 30 also comprises an antenna circuit 17 and 32 comprising an inductor or coil in the form of an antenna 18 and 33. The antenna circuits 17 and 32 enable an alternating magnetic field (RF H field) generated by the antenna of one near field RF communicator 15 (or 30) by transmission of an RF signal (for example a 13.56 Mega Hertz signal) to be inductively coupled to the antenna of the other near field RF communicator 30 (or 15) when that antenna is within the near field of the RF signal generated by the one near field RF communicator 15 (or 30). Bangs at [0046] In this example, the NFC communications enabled device 100 comprises an NFC communicator 100a having NFC operational components including an antenna circuit 102 and NFC functionality 120 comprising power provider 104, controller 107, data store 108, receiver circuitry and transmitter circuitry. Bangs at [0049] In this example, the receiver circuitry comprises an amplifier 119 coupled to the antenna circuit 102 and a demodulator 114 coupled to the amplifier 119 and the controller 107 for amplifying and demodulating a modulated RF signal inductively coupled to the antenna circuit 102 from another near field RF communicator in near field range and for supplying the thus-extracted data to the controller 107 for processing. Bangs at [0051] The controller 107 of the NFC functionality 120 is provided to control overall operation of the NFC communicator. The controller 107 is coupled to the data store 108 which is provided to store data (information and/or control data) to be transmitted from and/or data received by the NFC communications enabled device. The controller 107 may be a microprocessor, for example a RISC processor or other microprocessor or a state machine. Program instructions for programming the controller and/or control data for communication to another near field RF communicator may be stored in an internal memory of the controller and/or the data store. Bangs at [0054] In FIG. 2 control of the operation of the NFC communicator is through controller 107. As another possibility, where the NFC communicator is part of or associated with a host device, control of the operation of the NFC communicator may at least partly be directed by the host device, for example through the other functionality 105. In such circumstances all or part of the control may be provided by

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	the other functionality 105 which may be part of the NFC functionality or a host. For example the NFC communicator controller 107 may control modulation and modulation protocols whereas the data to be transmitted may be provided by the other functionality 105. Bangs at [0056] FIG. 3 shows a functional circuit diagram of an NFC communicator embodying the invention to illustrate one example of an antenna circuit 102. In the interests of simplicity in FIG. 3, only some of the NFC functionality 120a is shown in FIG. 3. Bangs at [0057] As shown in FIG. 3, antenna circuit 102 comprises an antenna element 309 coupled in parallel with a first capacitor 304 to form a tank circuit (a parallel LC resonant circuit). Bangs at [0058] The antenna element 309 comprises an antenna coil element 308 in series with a second capacitor 307 which second capacitor 307 is anti-phase to the antenna coil element 308 and affects a voltage resulting from inductive coupling of an RF H field to the antenna circuit. As shown the antenna coil element 308 comprises a single antenna coil which may comprise one, two or more coils or loops. Bangs at [0061] The value of the capacitor 307 is chosen to "back-off" or reduce an induced voltage below that which might potentially have been induced by a received RF H field in the absence of the capacitor 307 while the resistor 301 acts as a shunt, limiting the voltage that can potentially be generated across the antenna circuit 102, and so protecting the NFC functionality from the potentially higher voltages that may otherwise occur across the antenna coil element 309. This enables the receiver circuitry to be connected directly to the antenna coil element 309. This enables protection of the receiver circuitry against received RF H fields whose strength is not only not known in advance but may because, for example, of the different nature of the near field RF communicator with which the NFC communicator is communicating, significantly exceed that of the NFC communicator's own transmitted RF H field, for example the other near field RF communicator may be designed to operate over a much larger range than the NFC communicator and/or any geometrical mismatch between the two antennas may expose one to a greater RF H field than antenna size/shape would otherwise dictate. The provision of capacitor 307 thus provides protection without reducing the antenna circuit's own RF H field strength. Bangs at [0063]

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	As one possibility, the size of capacitor 307 to be employed to back off antenna coil 308 to effect a reduction in the apparent inductance of antenna coil 308 (that is the total inductance of antenna element 309) may be calculated using the following formula: $$C_{307} = \frac{1}{(2\pi \times F_c)^2 L_{neg}}$$ where F_c is the carrier frequency (for example 13.56 MHz) and L_{neg} s the amount (in Henrys) that inductance 308 is to be reduced by. Bangs at [0072] For any given RF voltage supplied by driver 111, the RF current that flows through antenna circuit 102 is inversely proportional to the total impedance of antenna circuit 102. Capacitors 302 and 303 act to transform the impedance of the tank circuit to reduce the total impedance of antenna circuit 102 and thus multiply the RF current produced for any given RF voltage. For example, if the impedance of the tank circuit is Xtank=A+Bj, and the impedance of each capacitor 302, 303 is Xc=−Cj, then the total impedance of antenna circuit 102 will be Xtotal=A+(B−2C)j. Accordingly, capacitors 302 and 303 reduce the total impedance of antenna circuit 102 thereby multiplying the current going to the tank circuit to top up the resonant current flowing through the antenna coil 308 and consequently the strength of the induced RF H field. Bangs at [0073] Although not shown in FIG. 3, the resistor 301 may be coupled in series with a switch controlled by the controller 107 to enable the resistor to be switched out of the circuit whilst the NFC communicator is transmitting an RF H field, so as not to limit the RF current available to the antenna coil during transmission. The antenna-coil 308 and capacitances 304 and 307 act in a similar way as for passive communication (or receiving mode) and can also act as a current reservoir. Capacitance 304 forms a parallel resonant tank circuit with capacitor 307 and antenna coil 308 and thus may enable the amount of current seen at antenna coil 308 to be increased when device is generating an RF H field. The capacitors 302 and 303 change the high impedance of the tank circuit (which looks inductive) to allow efficient "top up" of the resonant current to compensate for losses due to resistance and/or other coils in the proximity. Bangs at [0076] FIG. 4 shows a functional circuit diagram of an NFC communicator having an antenna circuit 102a that differs from that shown in FIG. 3 in that the antenna circuit has a single transmission input coupling Tx

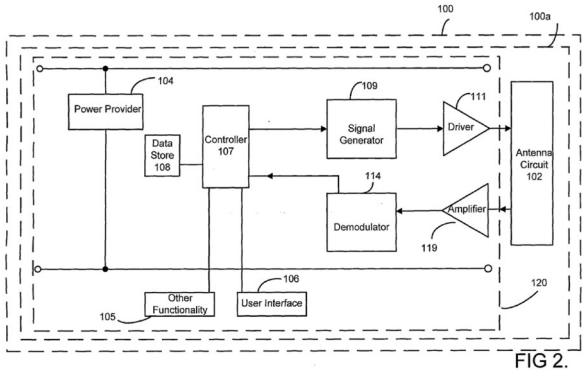
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	coupled to a single output driver 111b and a single receiver output coupling Rx coupled to a single input amplifier 119b so that the transmission signal is defined between transmission connection Tx and a signal ground coupling 311 and the receiver signal is defined between Rx and a coupling to ground 310 via capacitor 303. Both grounds (earths) may be provided by a local ground of the NFC communicator or a host. Bangs at [0077] The above described embodiments enable protection of the receiver circuitry against received RF H fields whose strength is not only not known in advance but may because, for example, of the different nature of the near field RF communicator with which the NFC communicator is communicating, significantly exceed that of the NFC communicator's own transmitted RF H field, for example the other near field RF communicator may be designed to operate over a much larger range than the NFC communicator and/or any geometrical mismatch between the two antennas may expose one to a greater RF H field than antenna size/shape would otherwise dictate. Bangs at [0078] FIG. 5 shows a functional circuit diagram of an NFC communicator to illustrate another example of an antenna circuit 102 embodying the present invention. Bangs at [0081] FIG. 6 shows a functional circuit diagram of an NFC communicator having an antenna circuit 102c that differs from that shown in FIG. 5 in that, like the antenna circuit shown in FIG. 4, the antenna circuit 102c has a single transmission input coupling Tx coupled to a single output driver (not shown in FIG. 6) and a single receiver output coupling Rx coupled to a single input amplifier (not shown in FIG. 6) so that the transmission signal is defined between transmission connection Tx and a ground coupling 311 and the receiver signal is defined between Rx and a coupling to ground 310. Bangs at [0087] Providing an NFC communicator with an antenna circuit as described above avoids the performance of the NFC communicator being restricted by the physical size and shape of the coil antenna. Readers/initiators, for example, are generally larger than and have fewer coils than tags/targets. Capacitor 307 advantageously reduces the affects of the physical size and shape of the antenna coil on the performance of the antenna circuit. Thus, capacitor 307 may be described as a "negative inductance" which reduces the apparent inductive value of the antenna coil. This allows the apparent inductive value

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	of the antenna coil to be divorced from its physical form thereby enabling greater ranges of antenna coil sizes and configurations to be employed. Bangs at [0088] Small NFC communicators, for example tag sized devices, can be poor initiators due to physical size constraints on their antenna coils. This may be ameliorated by increasing the number of antenna coil turns to increase the generated field strength. However, an increased number of antenna coil turns results in both the antenna coil having an increased inductance, and an increase in the voltage induced across the coil for a given amount of current. If this increase in voltage is too great it may exceed the operating voltage of other components of the NFC communicator thereby causing failure or reduced performance. Advantageously, by reducing the apparent inductive value of the antenna coil, capacitor 307 removes a proportion of the antenna coil voltage seen by other components of the NFC communicator thereby enabling their continued operation. Bangs at [0089] For a given supply voltage, reducing the apparent inductive value of the antenna coil advantageously facilitates the supply of current to the antenna coil. Furthermore, it allows lower voltage rated components to be used, and allows a shunt circuit (used in target mode and represented by resistor 301 above) to be connected across the combined inductance of the antenna coil plus the "negative inductance" of the capacitor 307. Bangs at [0094] Where this application refers to capacitors, this should be taken to encompass any suitable component having capacitance. Likewise where the text refers to an antenna, or an antenna coil, this should be taken to mean any inductive component suitable for use in coupling to an RF H field. Also, where this application refers to a resistor, this should be taken to encompass any suitable component having resistance. *See also* Bangs at [0001], [0007], [0009], [0017], [0018], [0019], [0022], [0024], [0025], [0050], [0052], [0053], [0059], [0062], [0064], [0065], [0067], [0068], [0069], [0070], [0071], [0074], [0075], [0079], [0080], [0082], [0083], [0084], [0085], [0086], [0090], [0091], [0092], [0093], [0095], [0096], [0097], claim 29, claim 30, claim 31, claim 32, claim 33, claim 34, claim 35, claim 36, claim 37, claim 38, claim 39, claim 40, claim 41, claim 42, claim 43, claim 44, claim 46, claim 47, and claim 48.

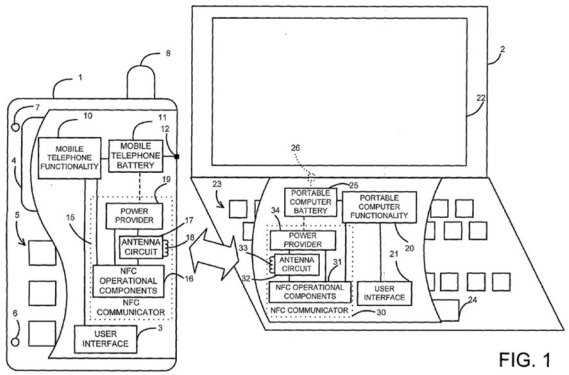
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	To the extent this limitation is not disclosed by Bangs, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Bangs, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 1 above.
4. The mobile device of claim 1 wherein the smartcard controller is coupled to be powered by the mobile device.	Bangs expressly or inherently discloses "[t]he mobile device of claim 1 wherein the smartcard controller is coupled to be powered by the mobile device." For example: Bangs at Figure 2  FIG 2. Bangs at [0004] As will be understood from the above, an NFC communicator may operate in an "initiator" mode in which the NFC communicator seeks to initiate near field RF communication or in a "target" mode in which the NFC communicator is receptive to initiation of near field RF communication. NFC communicators may also operate in either a "passive communications mode" or an "active communications mode". When communication is by the "passive communications mode", an initiator NFC communicator will generate an RF field and a target NFC communicator will respond by modulation of the received H field, usually by load modulation. When communication is by the "active communications mode" the initiator NFC communicator and the target NFC communicator each use their own RF H field to enable communication. The terms "passive" and "active" in the context of NFC communicators do not have the same meaning as "passive" and "active" when used in the context of traditional RFID tags and readers where the terms are instead used to define whether the RFID tags and readers have their own power supply or whether a power supply is derived from the received RF HF field.

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	Bangs at [0015] An NFC communicator may be battery powered and the desire to minimise power consumption, for example to prolong battery life, can limit the amount of current available to drive the antenna circuit. Also, as indicated above, size or environmental constraints may affect the antenna circuit design, limiting the size and/or topology of the antenna circuit, particularly the antenna coil. All of these factors will have an effect on the RF H field and therefore the voltage developed across an NFC communicator's antenna circuit during communication to the extent that the components of the NFC communicator need to be designed to operate at or need to be protected from voltages much higher than their intended operating voltages. Bangs at [0036] The mobile telephone 1 has the usual features of a mobile telephone including mobile telephone functionality 10 (in the form of, usually, a programmed controller, generally a processor or microprocessor with associated memory or data storage, for controlling operation of the mobile telephone in combination with a SIM card), an antenna 8 for enabling connection to a mobile telecommunications network, and a user interface 3 with a display 4, a keypad 5, a microphone 6 for receiving user voice input and a loudspeaker 7 for outputting received audio to the user. The mobile telephone also has a chargeable battery 11 coupled to a charging socket 12 via which a mains adapter (not shown) may be connected to enable charging of the battery 11. The mobile telephone 1 may have an alternative or additional power supply (not shown), for example a reserve battery or emergency battery. Although FIG. 1 shows a standalone mobile telephone (cellphone), the mobile telephone functionality may be incorporated in or associated with a host device such as a computer, for example a notebook, laptop or PDA. Bangs at [0041] Each NFC communicator 15 and 30 also comprises a power provider 19 and 34. The power providers 19 and 34 may be power supplies within the host device or specific to the NFC communicators 15 and 30, for example a button cell battery, or other small battery. As another possibility or additionally as shown by dashed lines in FIG. 1, one or both of the power providers 19 and 34 may simply comprise a coupling to derive power from the corresponding device battery 11 or 25. Bangs at [0046] In this example, the NFC communications enabled device 100 comprises an NFC communicator 100a having NFC operational components including an antenna circuit 102 and NFC functionality 120 comprising power provider 104, controller 107, data store 108, receiver circuitry and transmitter circuitry.

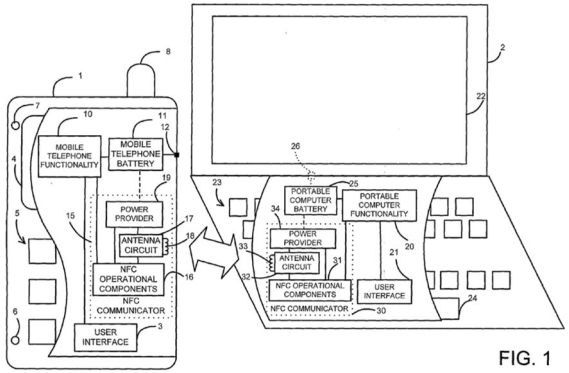
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	Bangs at [0047] The power provider 104 may be any one or more of the types of power providers discussed above. In the interests of simplicity, power supply couplings from the power provider 104 to other components are not shown in FIG. 2. Bangs at [0049] In this example, the receiver circuitry comprises an amplifier 119 coupled to the antenna circuit 102 and a demodulator 114 coupled to the amplifier 119 and the controller 107 for amplifying and demodulating a modulated RF signal inductively coupled to the antenna circuit 102 from another near field RF communicator in near field range and for supplying the thus-extracted data to the controller 107 for processing. Bangs at [0051] The controller 107 of the NFC functionality 120 is provided to control overall operation of the NFC communicator. The controller 107 is coupled to the data store 108 which is provided to store data (information and/or control data) to be transmitted from and/or data received by the NFC communications enabled device. The controller 107 may be a microprocessor, for example a RISC processor or other microprocessor or a state machine. Program instructions for programming the controller and/or control data for communication to another near field RF communicator may be stored in an internal memory of the controller and/or the data store. Bangs at [0054] In FIG. 2 control of the operation of the NFC communicator is through controller 107. As another possibility, where the NFC communicator is part of or associated with a host device, control of the operation of the NFC communicator may at least partly be directed by the host device, for example through the other functionality 105. In such circumstances all or part of the control may be provided by the other functionality 105 which may be part of the NFC functionality or a host. For example the NFC communicator controller 107 may control modulation and modulation protocols whereas the data to be transmitted may be provided by the other functionality 105. *See also* Bangs at Figure 1, Figure 5, Figure 6, [0018], [0038], [0050], [0052], [0053], [0065], [0067], [0068], [0070], [0073], and [0086].

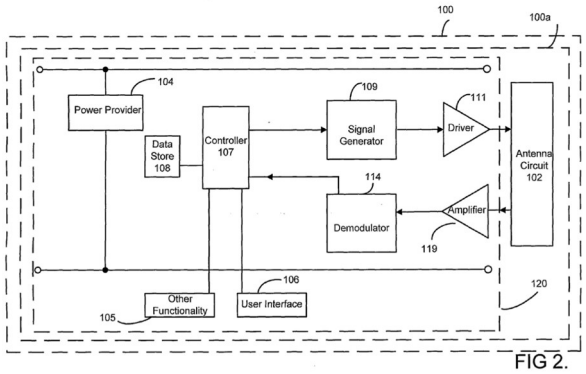
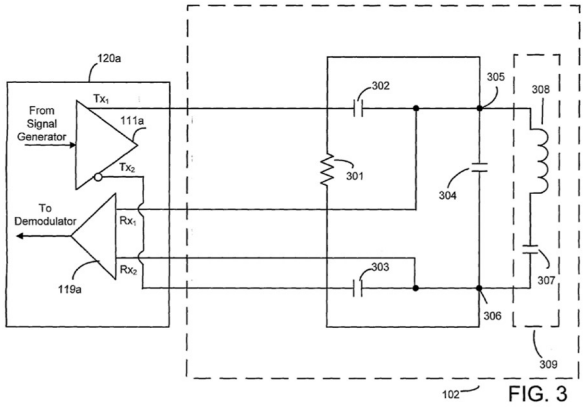
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	To the extent this limitation is not disclosed by Bangs, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Bangs, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 1 above.
5. The mobile device of claim 1 wherein the performance enhancement circuits are coupled to be powered by the mobile device.	Bangs expressly or inherently discloses "[t]he mobile device of claim 1 wherein the performance enhancement circuits are coupled to be powered by the mobile device." For example: Bangs at Figure 2  FIG 2. Bangs at [0004] As will be understood from the above, an NFC communicator may operate in an "initiator" mode in which the NFC communicator seeks to initiate near field RF communication or in a "target" mode in which the NFC communicator is receptive to initiation of near field RF communication. NFC communicators may also operate in either a "passive communications mode" or an "active communications mode". When communication is by the "passive communications mode", an initiator NFC communicator will generate an RF field and a target NFC communicator will respond by modulation of the received H field, usually by load modulation. When communication is by the "active communications mode" the initiator NFC communicator and the target NFC communicator each use their own RF H field to enable communication. The terms "passive" and "active" in the context of NFC communicators do not have the same meaning as "passive" and "active" when used in the context of traditional RFID tags and readers where the terms are instead used to define whether the RFID tags and readers have their own power supply or whether a power supply is derived from the received RF HF field.

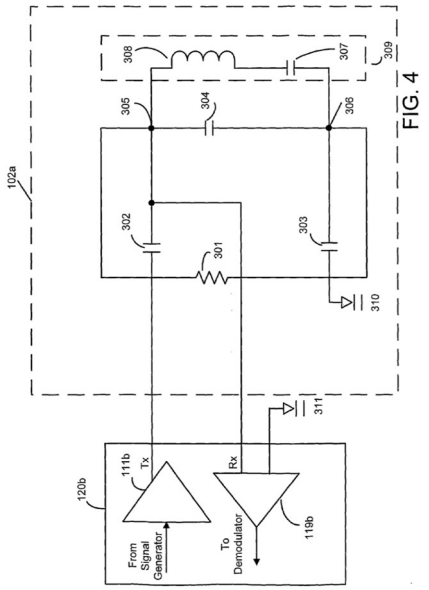
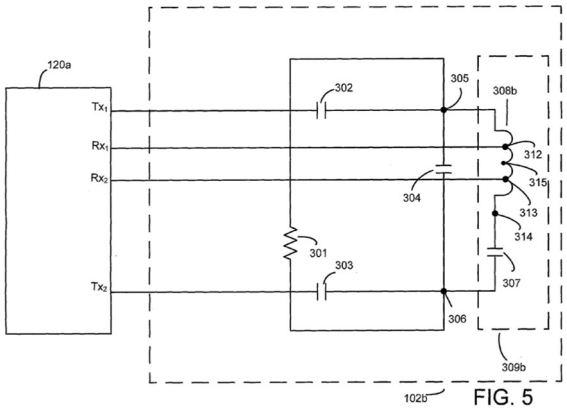
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	Bangs at [0015] An NFC communicator may be battery powered and the desire to minimise power consumption, for example to prolong battery life, can limit the amount of current available to drive the antenna circuit. Also, as indicated above, size or environmental constraints may affect the antenna circuit design, limiting the size and/or topology of the antenna circuit, particularly the antenna coil. All of these factors will have an effect on the RF H field and therefore the voltage developed across an NFC communicator's antenna circuit during communication to the extent that the components of the NFC communicator need to be designed to operate at or need to be protected from voltages much higher than their intended operating voltages. Bangs at [0036] The mobile telephone 1 has the usual features of a mobile telephone including mobile telephone functionality 10 (in the form of, usually, a programmed controller, generally a processor or microprocessor with associated memory or data storage, for controlling operation of the mobile telephone in combination with a SIM card), an antenna 8 for enabling connection to a mobile telecommunications network, and a user interface 3 with a display 4, a keypad 5, a microphone 6 for receiving user voice input and a loudspeaker 7 for outputting received audio to the user. The mobile telephone also has a chargeable battery 11 coupled to a charging socket 12 via which a mains adapter (not shown) may be connected to enable charging of the battery 11. The mobile telephone 1 may have an alternative or additional power supply (not shown), for example a reserve battery or emergency battery. Although FIG. 1 shows a standalone mobile telephone (cellphone), the mobile telephone functionality may be incorporated in or associated with a host device such as a computer, for example a notebook, laptop or PDA. Bangs at [0041] Each NFC communicator 15 and 30 also comprises a power provider 19 and 34. The power providers 19 and 34 may be power supplies within the host device or specific to the NFC communicators 15 and 30, for example a button cell battery, or other small battery. As another possibility or additionally as shown by dashed lines in FIG. 1, one or both of the power providers 19 and 34 may simply comprise a coupling to derive power from the corresponding device battery 11 or 25. Bangs at [0046] In this example, the NFC communications enabled device 100 comprises an NFC communicator 100a having NFC operational components including an antenna circuit 102 and NFC functionality 120 comprising power provider 104, controller 107, data store 108, receiver circuitry and transmitter circuitry.

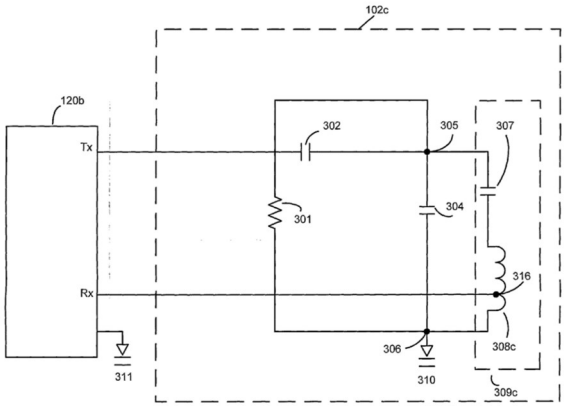
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	Bangs at [0047] The power provider 104 may be any one or more of the types of power providers discussed above. In the interests of simplicity, power supply couplings from the power provider 104 to other components are not shown in FIG. 2. *See also* Bangs at Figure 1, [0033], and [0038]. To the extent this limitation is not disclosed by Bangs, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Bangs, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 1 above.
6. The mobile device of claim 1 wherein the mobile device comprises a mobile phone.	Bangs expressly or inherently discloses "[t]he mobile device of claim 1 wherein the mobile device comprises a mobile phone." For example: Bangs at Figure 1  FIG. 1 Bangs at [0035] As shown in FIG. 1, one NFC communications enabled device comprises a mobile telephone (cellphone) 1 and the other NFC communications enabled device comprises a portable computer 2 such as a notebook or laptop computer. Bangs at [0036]

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	The mobile telephone 1 has the usual features of a mobile telephone including mobile telephone functionality 10 (in the form of, usually, a programmed controller, generally a processor or microprocessor with associated memory or data storage, for controlling operation of the mobile telephone in combination with a SIM card), an antenna 8 for enabling connection to a mobile telecommunications network, and a user interface 3 with a display 4, a keypad 5, a microphone 6 for receiving user voice input and a loudspeaker 7 for outputting received audio to the user. The mobile telephone also has a chargeable battery 11 coupled to a charging socket 12 via which a mains adapter (not shown) may be connected to enable charging of the battery 11. The mobile telephone 1 may have an alternative or additional power supply (not shown), for example a reserve battery or emergency battery. Although FIG. 1 shows a standalone mobile telephone (cellphone), the mobile telephone functionality may be incorporated in or associated with a host device such as a computer, for example a notebook, laptop or PDA. *See also* Bangs at [0006] and [0040]. To the extent this limitation is not disclosed by Bangs, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Bangs, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 1 above.
7[pre]. A mobile device comprising:	Bangs expressly or inherently discloses "[a] mobile device." For example: *See* above at 1[pre]. To the extent this limitation is not disclosed by Bangs, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Bangs, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[7a] a smartcard controller;	Bangs expressly or inherently discloses "a smartcard controller." For example: *See* above at [1a]. To the extent this limitation is not disclosed by Bangs, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Bangs, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[7b] an antenna; and	Bangs expressly or inherently discloses "an antenna." For example: *See* above at [1b].

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	To the extent this limitation is not disclosed by Bangs, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Bangs, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[7c] performance enhancement circuits coupled between the smartcard controller and the antenna, wherein the performance enhancement circuits include an amplifier and an active transmit driver circuit, and	Bangs expressly or inherently discloses "performance enhancement circuits coupled between the smartcard controller and the antenna, wherein the performance enhancement circuits include an amplifier and an active transmit driver circuit." For example: Bangs at Abstract An NFC communicator has an antenna circuit to enable inductive coupling, via an RF H field, of the NFC communicator and another near field RF communicator in near field range. The antenna circuit has an antenna element coupled in parallel with a first capacitor to form a parallel LC circuit. The antenna element has an antenna coil in series with a second capacitor to reduce the voltage to which circuitry of the NFC communicator is subjected by a received RF H field. Alternatively or additionally, receive circuitry of the NFC communicator may be coupled to only a proportion of the antenna coil to reduce the voltage to which circuitry of the NFC communicator is subjected by a received RF H field. Bangs at Figure 1  FIG. 1 Bangs at Figure 2

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	 FIG 2. Bangs at Figure 3  FIG. 3 Bangs at Figure 4

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	 FIG. 4 Bangs at Figure 5  FIG. 5 Bangs at Figure 6

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	 FIG. 6 Bangs at [0002] Near field RF (radio frequency) communication requires an antenna of one near field RF communicator to be present within the alternating magnetic field (H field) generated by the antenna of another near field RF communicator by transmission of an RF signal (for example a 13.56 Mega Hertz signal) to enable the magnetic field (H field) of the RF signal to be inductively coupled between the communicators. The RF signal may be modulated to enable communication of control and/or other data. Ranges of up to several centimetres (generally to a maximum of 1 metre) are common for near field RF communicators. Bangs at [0016] An aspect of the present invention provides an NFC communicator that alleviates at least some of the aforementioned problems. An aspect of the invention provides an antenna circuit for an NFC communicator which enables operation of the NFC communicator in both active and passive communication modes. Bangs at [0021] According to an aspect of the present invention, there is provided a near field RF communicator, comprising: an antenna circuit to enable inductive coupling of the near field RF communicator and another near field RF communicator in near field range; a signal supplier coupled to the antenna circuit to supply a drive signal to cause the antenna circuit to generate an RF signal; and a receiver coupled to the antenna circuit to receive a signal inductively coupled to the antenna circuit from another near field RF communicator in near field range, wherein the antenna circuit comprises an antenna element coupled in

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	parallel with a first capacitor, wherein the antenna element comprises an antenna coil in series with a second capacitor to affect a voltage resulting from inductive coupling to the antenna circuit. Bangs at [0023] According to an aspect of the present invention, there is provided a near field RF communicator, comprising: an antenna circuit to enable inductive coupling of the near field RF communicator and another near field RF communicator in near field range; a signal supplier coupled to the antenna circuit to supply a drive signal to cause the antenna circuit to generate an RF signal; and a receiver coupled to the antenna circuit to receive a signal inductively coupled to the antenna circuit from another near field RF communicator in near field range, wherein the antenna circuit comprises an antenna element coupled in parallel with a capacitor, wherein the antenna element comprises an antenna coil having a tap and the receiver is coupled to the tap. Bangs at [0029] FIG. 3 shows a functional circuit diagram of an NFC communicator to illustrate one example of an antenna circuit embodying the present invention; Bangs at [0030] FIG. 4 shows a functional circuit diagram of an NFC communicator to illustrate another example of an antenna circuit embodying the present invention; Bangs at [0031] FIG. 5 shows a functional circuit diagram of an NFC communicator to illustrate another example of an antenna circuit embodying the present invention; and Bangs at [0032] FIG. 6 shows a functional circuit diagram of an NFC communicator to illustrate another example of an antenna circuit embodying the present invention. Bangs at [0046] In this example, the NFC communications enabled device 100 comprises an NFC communicator 100a having NFC operational components including an antenna circuit 102 and NFC functionality 120 comprising power provider 104, controller 107, data store 108, receiver circuitry and transmitter circuitry. Bangs at [0049]

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	In this example, the receiver circuitry comprises an amplifier 119 coupled to the antenna circuit 102 and a demodulator 114 coupled to the amplifier 119 and the controller 107 for amplifying and demodulating a modulated RF signal inductively coupled to the antenna circuit 102 from another near field RF communicator in near field range and for supplying the thus-extracted data to the controller 107 for processing. Bangs at [0051] The controller 107 of the NFC functionality 120 is provided to control overall operation of the NFC communicator. The controller 107 is coupled to the data store 108 which is provided to store data (information and/or control data) to be transmitted from and/or data received by the NFC communications enabled device. The controller 107 may be a microprocessor, for example a RISC processor or other microprocessor or a state machine. Program instructions for programming the controller and/or control data for communication to another near field RF communicator may be stored in an internal memory of the controller and/or the data store. Bangs at [0054] In FIG. 2 control of the operation of the NFC communicator is through controller 107. As another possibility, where the NFC communicator is part of or associated with a host device, control of the operation of the NFC communicator may at least partly be directed by the host device, for example through the other functionality 105. In such circumstances all or part of the control may be provided by the other functionality 105 which may be part of the NFC functionality or a host. For example the NFC communicator controller 107 may control modulation and modulation protocols whereas the data to be transmitted may be provided by the other functionality 105. Bangs at [0056] FIG. 3 shows a functional circuit diagram of an NFC communicator embodying the invention to illustrate one example of an antenna circuit 102. In the interests of simplicity in FIG. 3, only some of the NFC functionality 120a is shown in FIG. 3. Bangs at [0057] As shown in FIG. 3, antenna circuit 102 comprises an antenna element 309 coupled in parallel with a first capacitor 304 to form a tank circuit (a parallel LC resonant circuit). Bangs at [0058]

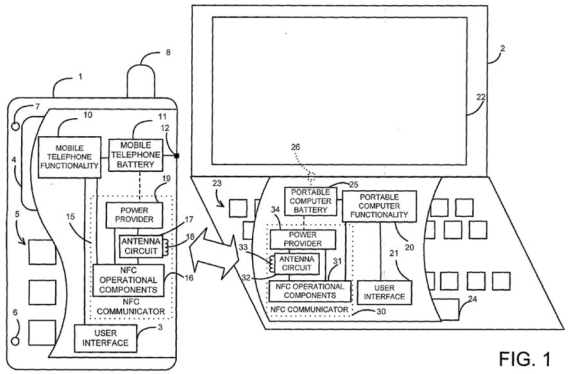
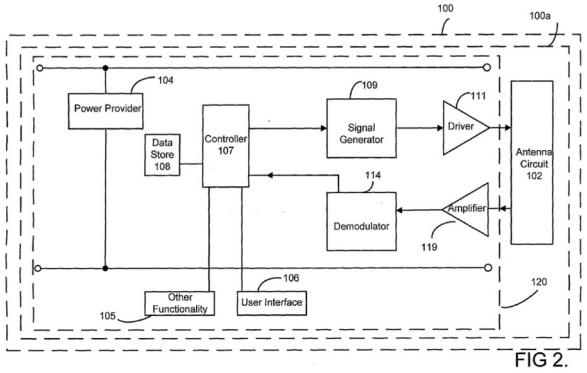
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	The antenna element 309 comprises an antenna coil element 308 in series with a second capacitor 307 which second capacitor 307 is anti-phase to the antenna coil element 308 and affects a voltage resulting from inductive coupling of an RF H field to the antenna circuit. As shown the antenna coil element 308 comprises a single antenna coil which may comprise one, two or more coils or loops. Bangs at [0059] The junction 305 between capacitor 304 and antenna element 309 is coupled to one input Rx1 of a differential amplifier 119a forming the amplifier 119 shown in FIG. 2 while the junction 306 between capacitor 304 and antenna element 309 is coupled to the other input Rx2 of the differential amplifier 119a. To enable the antenna circuit to be driven, respective outputs Tx1 and Tx2 of driver 111a are coupled to the junctions 305 and 306 via respective further capacitors 302 and 303. Thus, in this example, the antenna circuit 102 has double-ended or differential coupling (Rx1 and Rx2) to the receive circuitry and double-ended or differential coupling (Tx1 and Tx2) to the transmit circuitry of the NEC functionality 120a. Bangs at [0069] The presence of capacitor 307 thus reduces the potential difference (voltage) developed between junctions 306 and 305 for a given received H field, thereby reducing the voltage between receiver couplings Rx1 and Rx2 and between transmission couplings Tx1 and Tx2, so reducing the maximum potential voltage to which the receiver and transmitter circuitry may be subjected. Although antenna circuit designers generally aim to maximise the voltage induced by any given H field, the use of capacitor 307 enables control of the voltage that the capacitors 302, 303 and 304 and the NFC functionality 120a (for example the driver 111a and amplifier 119a) need to be able to withstand, thereby enabling the use of capacitors 302, 303 and 304 with lower voltage ratings and enabling coupling of the antenna circuit 102 directly to the NFC functionality 120a. Bangs at [0071] The drive signal from the driver 111a is coupled to the antenna coil 308 via capacitors 302 and 303. The driver 111a thus develops an RF voltage across transmission connections Tx1 and Tx2 which causes an RF current to flow between transmission connections Tx1 and Tx2 through antenna circuit 102. As this RF current flows between points 306 and 305, it divides between resistor 301, capacitor 304 and antenna element 309 in accordance with their relative impedances. The portion of the RF current that flows through antenna element 309 passes through antenna coil 308 producing an RF H field. Bangs at [0076]

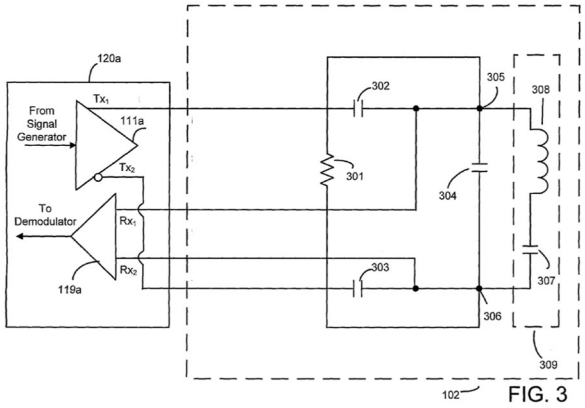
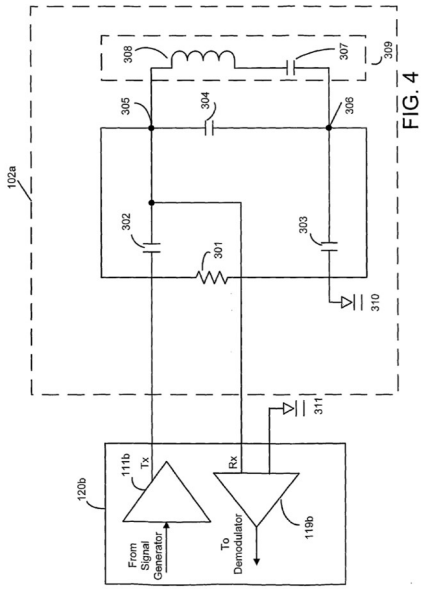
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	FIG. 4 shows a functional circuit diagram of an NFC communicator having an antenna circuit 102a that differs from that shown in FIG. 3 in that the antenna circuit has a single transmission input coupling Tx coupled to a single output driver 111b and a single receiver output coupling Rx coupled to a single input amplifier 119b so that the transmission signal is defined between transmission connection Tx and a signal ground coupling 311 and the receiver signal is defined between Rx and a coupling to ground 310 via capacitor 303. Both grounds (earths) may be provided by a local ground of the NFC communicator or a host. Bangs at [0078] FIG. 5 shows a functional circuit diagram of an NFC communicator to illustrate another example of an antenna circuit 102 embodying the present invention. Bangs at [0081] FIG. 6 shows a functional circuit diagram of an NFC communicator having an antenna circuit 102c that differs from that shown in FIG. 5 in that, like the antenna circuit shown in FIG. 4, the antenna circuit 102c has a single transmission input coupling Tx coupled to a single output driver (not shown in FIG. 6) and a single receiver output coupling Rx coupled to a single input amplifier (not shown in FIG. 6) so that the transmission signal is defined between transmission connection Tx and a ground coupling 311 and the receiver signal is defined between Rx and a coupling to ground 310. *See also* above at [1c]. *See also* Bangs at [0001], [0010], [0017], [0018], [0019], [0020], [0022], [0024], [0025], [0039], [0050], [0052], [0053], [0061], [0062], [0063], [0064], [0065], [0067], [0068], [0070], [0072], [0073], [0074], [0075], [0077], [0079], [0080], [0082], [0083], [0084], [0085], [0086], [0087], [0088], [0089], [0090], [0091], [0092], [0093], [0094], [0096], [0097], claim 29, claim 30, claim 31, claim 32, claim 33, claim 34, claim 35, claim 36, claim 37, claim 38, claim 39, claim 40, claim 41, claim 42, claim 43, claim 44, claim 46, claim 47, and claim 48. To the extent this limitation is not disclosed by Bangs, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Bangs, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[7d] wherein the amplifier is coupled to amplify a signal received from the antenna and to	Bangs expressly or inherently discloses "wherein the amplifier is coupled to amplify a signal received from the antenna and to provide an amplified signal to the smartcard controller." For example:

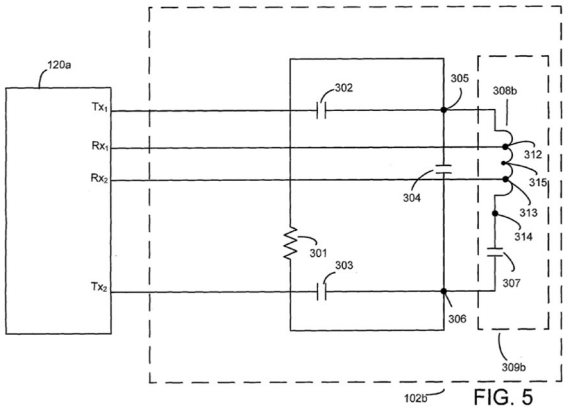
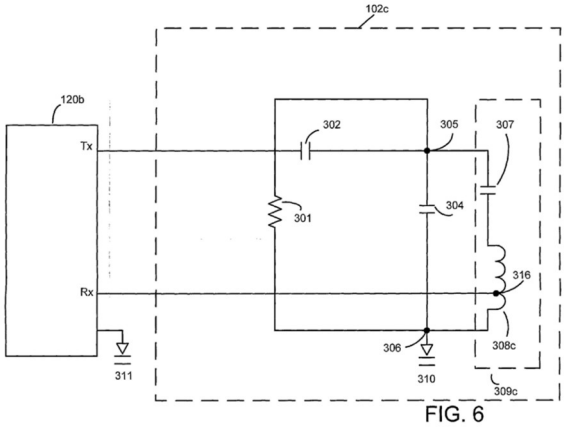
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
provide an amplified signal to the smartcard controller.	*See* above at [1d]. To the extent this limitation is not disclosed by Bangs, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Bangs, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
8. The mobile device of claim 7 wherein the antenna is tuned to operate at 13.56 MHz.	Bangs expressly or inherently discloses "[t]he mobile device of claim 7 wherein the antenna is tuned to operate at 13.56 MHz." *See* above at claim 2. To the extent this limitation is not disclosed by Bangs, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Bangs, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 7 above.
9. The mobile device of claim 7 wherein the antenna comprises an inductive element too small to draw enough power sufficient to operate the smartcard controller from an interrogating radio frequency (RF) field.	Bangs expressly or inherently discloses "[t]he mobile device of claim 7 wherein the antenna comprises an inductive element too small to draw enough power sufficient to operate the smartcard controller from an interrogating radio frequency (RF) field." *See* claim 3 above. To the extent this limitation is not disclosed by Bangs, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Bangs, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 7 above.
10. The mobile device of claim 7 wherein the smartcard controller is coupled to be powered by the mobile device.	Bangs expressly or inherently discloses "[t]he mobile device of claim 7 wherein the smartcard controller is coupled to be powered by the mobile device." For example: *See* above at claim 4. To the extent this limitation is not disclosed by Bangs, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Bangs, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 7 above.

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11. The mobile device of claim 7 wherein the performance enhancement circuits are coupled to be powered by the mobile device.	Bangs expressly or inherently discloses "[t]he mobile device of claim 7 wherein the performance enhancement circuits are coupled to be powered by the mobile device." For example: *See* above at claim 5. To the extent this limitation is not disclosed by Bangs, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Bangs, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 7 above.
12. The mobile device of claim 7 wherein the mobile device comprises a mobile phone.	Bangs expressly or inherently discloses "[t]he mobile device of claim 7 wherein the mobile device comprises a mobile phone." For example: *See* above at claim 6. To the extent this limitation is not disclosed by Bangs, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Bangs, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 7 above.
13[pre]. A mobile device comprising:	Bangs expressly or inherently discloses "[a] mobile device." For example: *See* above at 1[pre]. To the extent this limitation is not disclosed by Bangs, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Bangs, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[13a] a smartcard controller;	Bangs expressly or inherently discloses "a smartcard controller." For example: *See* above at [1a]. To the extent this limitation is not disclosed by Bangs, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Bangs, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[13b] an antenna;	Bangs expressly or inherently discloses "an antenna." For example: *See* above at [1b].

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	To the extent this limitation is not disclosed by Bangs, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Bangs, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[13c] an amplifier coupled to amplify signals received at the antenna and drive the smartcard controller; and	Bangs expressly or inherently discloses "an amplifier coupled to amplify signals received at the antenna and drive the smartcard controller." For example: *See* above at [1d]. To the extent this limitation is not disclosed by Bangs, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Bangs, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[13d] a driver circuit to drive the antenna with data provided by the smartcard controller.	Bangs expressly or inherently discloses "a driver circuit to drive the antenna with data provided by the smartcard controller." For example: Bangs at Abstract > An NFC communicator has an antenna circuit to enable inductive coupling, via an RF H field, of the NFC communicator and another near field RF communicator in near field range. The antenna circuit has an antenna element coupled in parallel with a first capacitor to form a parallel LC circuit. The antenna element has an antenna coil in series with a second capacitor to reduce the voltage to which circuitry of the NFC communicator is subjected by a received RF H field. Alternatively or additionally, receive circuitry of the NFC communicator may be coupled to only a proportion of the antenna coil to reduce the voltage to which circuitry of the NFC communicator is subjected by a received RF H field. Bangs at Figure 1

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	 FIG. 1 Bangs at Figure 2  FIG 2. Bangs at Figure 3

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	 FIG. 3 Bangs at Figure 4  FIG. 4 Bangs at Figure 5

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	 FIG. 5 Bangs at Figure 6  FIG. 6 Bangs at [0002] Near field RF (radio frequency) communication requires an antenna of one near field RF communicator to be present within the alternating magnetic field (H field) generated by the antenna of another near field RF communicator by transmission of an RF signal (for example a 13.56 Mega Hertz signal) to enable the magnetic field (H field) of the RF signal to be inductively coupled between the communicators. The RF signal may be modulated to enable communication of control and/or other data. Ranges of up to several centimetres (generally to a maximum of 1 metre) are common for near field RF communicators.

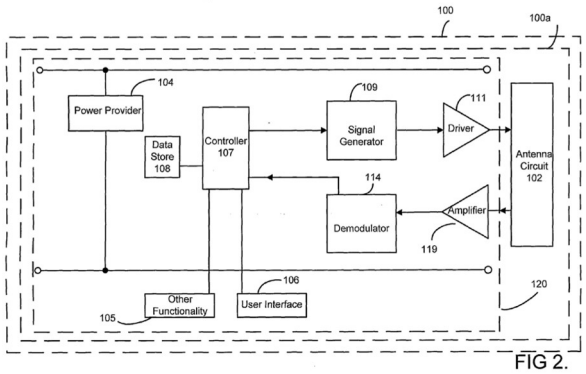
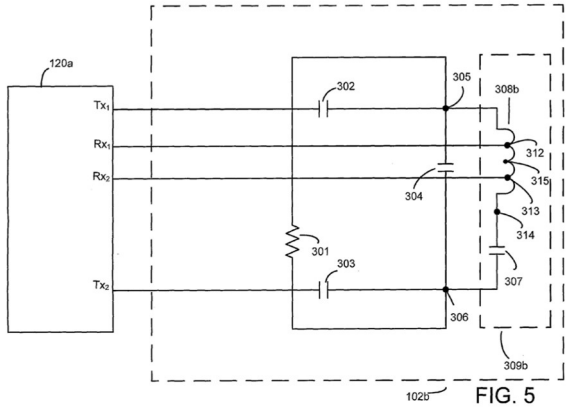
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	Bangs at [0016] An aspect of the present invention provides an NFC communicator that alleviates at least some of the aforementioned problems. An aspect of the invention provides an antenna circuit for an NFC communicator which enables operation of the NFC communicator in both active and passive communication modes. Bangs at [0021] According to an aspect of the present invention, there is provided a near field RF communicator, comprising: an antenna circuit to enable inductive coupling of the near field RF communicator and another near field RF communicator in near field range; a signal supplier coupled to the antenna circuit to supply a drive signal to cause the antenna circuit to generate an RF signal; and a receiver coupled to the antenna circuit to receive a signal inductively coupled to the antenna circuit from another near field RF communicator in near field range, wherein the antenna circuit comprises an antenna element coupled in parallel with a first capacitor, wherein the antenna element comprises an antenna coil in series with a second capacitor to affect a voltage resulting from inductive coupling to the antenna circuit. Bangs at [0023] According to an aspect of the present invention, there is provided a near field RF communicator, comprising: an antenna circuit to enable inductive coupling of the near field RF communicator and another near field RF communicator in near field range; a signal supplier coupled to the antenna circuit to supply a drive signal to cause the antenna circuit to generate an RF signal; and a receiver coupled to the antenna circuit to receive a signal inductively coupled to the antenna circuit from another near field RF communicator in near field range, wherein the antenna circuit comprises an antenna element coupled in parallel with a capacitor, wherein the antenna element comprises an antenna coil having a tap and the receiver is coupled to the tap. Bangs at [0029] FIG. 3 shows a functional circuit diagram of an NFC communicator to illustrate one example of an antenna circuit embodying the present invention; Bangs at [0030] FIG. 4 shows a functional circuit diagram of an NFC communicator to illustrate another example of an antenna circuit embodying the present invention;

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	Bangs at [0031] FIG. 5 shows a functional circuit diagram of an NFC communicator to illustrate another example of an antenna circuit embodying the present invention; and Bangs at [0032] FIG. 6 shows a functional circuit diagram of an NFC communicator to illustrate another example of an antenna circuit embodying the present invention. Bangs at [0046] In this example, the NFC communications enabled device 100 comprises an NFC communicator 100a having NFC operational components including an antenna circuit 102 and NFC functionality 120 comprising power provider 104, controller 107, data store 108, receiver circuitry and transmitter circuitry. Bangs at [0049] In this example, the receiver circuitry comprises an amplifier 119 coupled to the antenna circuit 102 and a demodulator 114 coupled to the amplifier 119 and the controller 107 for amplifying and demodulating a modulated RF signal inductively coupled to the antenna circuit 102 from another near field RF communicator in near field range and for supplying the thus-extracted data to the controller 107 for processing. Bangs at [0050] In this example, the transmitter circuitry comprises components for driving the antenna circuit 102 to transmit an RF signal and for modulating an RF signal to enable communication of data between near field RF communicators in near field range. As shown in FIG. 2, the transmitter circuitry comprises a signal generator 109 coupled via a driver 111 to the antenna circuit 102. In this example, the signal generator 110 is configured to cause modulation by gating or switching on and off the RF signal in accordance with the data to be communicated. The NFC communicator may use any appropriate modulation scheme that is in accordance with the standards and/or protocols under which the NFC communicator operates. Alternatively a separate or further signal controller may be incorporated within the NFC operational components of functionality 120 to control modulation of the signal generated by the signal generator 109 in accordance with data or instructions received from the controller 107. Bangs at [0051]

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	The controller 107 of the NFC functionality 120 is provided to control overall operation of the NFC communicator. The controller 107 is coupled to the data store 108 which is provided to store data (information and/or control data) to be transmitted from and/or data received by the NFC communications enabled device. The controller 107 may be a microprocessor, for example a RISC processor or other microprocessor or a state machine. Program instructions for programming the controller and/or control data for communication to another near field RF communicator may be stored in an internal memory of the controller and/or the data store. Bangs at [0054] In FIG. 2 control of the operation of the NFC communicator is through controller 107. As another possibility, where the NFC communicator is part of or associated with a host device, control of the operation of the NFC communicator may at least partly be directed by the host device, for example through the other functionality 105. In such circumstances all or part of the control may be provided by the other functionality 105 which may be part of the NFC functionality or a host. For example the NFC communicator controller 107 may control modulation and modulation protocols whereas the data to be transmitted may be provided by the other functionality 105. Bangs at [0056] FIG. 3 shows a functional circuit diagram of an NFC communicator embodying the invention to illustrate one example of an antenna circuit 102. In the interests of simplicity in FIG. 3, only some of the NFC functionality 120a is shown in FIG. 3. Bangs at [0057] As shown in FIG. 3, antenna circuit 102 comprises an antenna element 309 coupled in parallel with a first capacitor 304 to form a tank circuit (a parallel LC resonant circuit). Bangs at [0058] The antenna element 309 comprises an antenna coil element 308 in series with a second capacitor 307 which second capacitor 307 is anti-phase to the antenna coil element 308 and affects a voltage resulting from inductive coupling of an RF H field to the antenna circuit. As shown the antenna coil element 308 comprises a single antenna coil which may comprise one, two or more coils or loops. Bangs at [0069] The presence of capacitor 307 thus reduces the potential difference (voltage) developed between junctions 306 and 305 for a given received H field, thereby reducing the voltage between receiver couplings Rx1

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	and Rx2 and between transmission couplings Tx1 and Tx2, so reducing the maximum potential voltage to which the receiver and transmitter circuitry may be subjected. Although antenna circuit designers generally aim to maximise the voltage induced by any given H field, the use of capacitor 307 enables control of the voltage that the capacitors 302, 303 and 304 and the NFC functionality 120a (for example the driver 111a and amplifier 119a) need to be able to withstand, thereby enabling the use of capacitors 302, 303 and 304 with lower voltage ratings and enabling coupling of the antenna circuit 102 directly to the NFC functionality 120a. Bangs at [0070] When the NFC communicator is in the active communication mode, the controller 107 (FIG. 2) will cause the signal generator 109 (FIG. 2) and driver 111a to drive the antenna circuit 102 to initiate or generate an RF-H field. The antenna circuit 102 is tuned to the required RF transmission frequency which, for an NFC communicator operating in accordance with ISO 18092, is 13.56 MHz (Megahertz). The capacitors 302 and 303 add capacitance to bring the tuning closer to the required frequency. Bangs at [0071] The drive signal from the driver 111a is coupled to the antenna coil 308 via capacitors 302 and 303. The driver 111a thus develops an RF voltage across transmission connections Tx1 and Tx2 which causes an RF current to flow between transmission connections Tx1 and Tx2 through antenna circuit 102. As this RF current flows between points 306 and 305, it divides between resistor 301, capacitor 304 and antenna element 309 in accordance with their relative impedances. The portion of the RF current that flows through antenna element 309 passes through antenna coil 308 producing an RF H field. Bangs at [0074] Any appropriate form of modulation may be used to enable data communication, for example modulation of the RF H field may be achieved through gating or switching of the generated signal in accordance with the relevant communication protocols. The form of modulation will depend on the type of drive functionality incorporated within the NFC communicator. For example, a current drive will control the current supplied to the antenna circuit 102 and may achieve modulation by changing the current. A voltage drive on the other hand will control the voltage supplied to the antenna circuit 102 and may achieve modulation by controlling pulses supplied the antenna circuit 102. Any suitable type of modulation technique may be used (e.g. amplitude and/or phase modulation) and any suitable modulation encoding scheme may be used Bangs at [0075]

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	The antenna circuit 102 of FIG. 3 has a double-ended, balanced or differential transmission input, that is the drive signal supplied to the antenna circuit 102 is the difference between the signals at transmission couplings Tx1 and Tx2. Likewise, the receiver output of the antenna circuit is double-ended or differential, that is the received signal is the difference between the signals at receiver couplings Rx1 and Rx2. Bangs at [0076] FIG. 4 shows a functional circuit diagram of an NFC communicator having an antenna circuit 102a that differs from that shown in FIG. 3 in that the antenna circuit has a single transmission input coupling Tx coupled to a single output driver 111b and a single receiver output coupling Rx coupled to a single input amplifier 119b so that the transmission signal is defined between transmission connection Tx and a signal ground coupling 311 and the receiver signal is defined between Rx and a coupling to ground 310 via capacitor 303. Both grounds (earths) may be provided by a local ground of the NFC communicator or a host. Bangs at [0078] FIG. 5 shows a functional circuit diagram of an NFC communicator to illustrate another example of an antenna circuit 102 embodying the present invention. Bangs at [0081] FIG. 6 shows a functional circuit diagram of an NFC communicator having an antenna circuit 102c that differs from that shown in FIG. 5 in that, like the antenna circuit shown in FIG. 4, the antenna circuit 102c has a single transmission input coupling Tx coupled to a single output driver (not shown in FIG. 6) and a single receiver output coupling Rx coupled to a single input amplifier (not shown in FIG. 6) so that the transmission signal is defined between transmission connection Tx and a ground coupling 311 and the receiver signal is defined between Rx and a coupling to ground 310. *See also* Bangs at [0001], [0010], [0017], [0018], [0019], [0020], [0022], [0024], [0025], [0039], [0052], [0053], [0059], [0061], [0062], [0063], [0064], [0065], [0067], [0068], [0072], [0073], [0077], [0079], [0080], [0082], [0083], [0084], [0085], [0086], [0087], [0088], [0089], [0090], [0091], [0092], [0093], [0094], [0096], [0097], claim 29, claim 30, claim 31, claim 32, claim 33, claim 34, claim 35, claim 36, claim 37, claim 38, claim 39, claim 40, claim 41, claim 42, claim 43, claim 44, claim 46, claim 47, and claim 48. To the extent this limitation is not disclosed by Bangs, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Bangs, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.

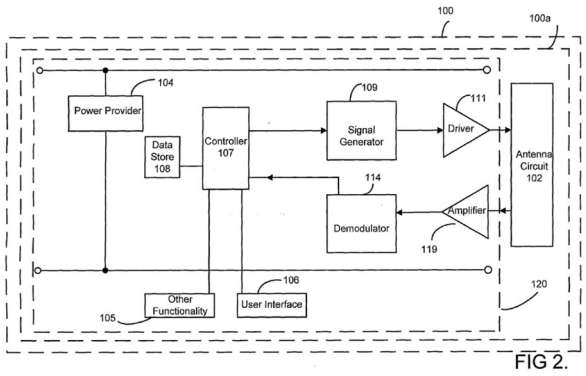
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
14. The mobile device of claim 13 wherein the driver circuit comprises a load modulation circuit.	Bangs expressly or inherently discloses "[t]he mobile device of claim 13 wherein the driver circuit comprises a load modulation circuit." For example: Bangs at Figure 2  FIG 2. Bangs at Figure 5  FIG. 5 Bangs at [0002] Near field RF (radio frequency) communication requires an antenna of one near field RF communicator to be present within the alternating magnetic field (H field) generated by the antenna of another near field RF communicator by transmission of an RF signal (for example a 13.56 Mega Hertz signal) to enable the

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	magnetic field (H field) of the RF signal to be inductively coupled between the communicators. The RF signal may be modulated to enable communication of control and/or other data. Ranges of up to several centimetres (generally to a maximum of 1 metre) are common for near field RF communicators. Bangs at [0007] RFID readers are generally designed specifically to enable initiation or generation of an RF H field and to detect modulation or affects on that initiated RF H field. The modulation or affects are then demodulated by the circuitry of the RFID reader and the demodulated data interpreted in accordance with the communication protocol under which the RFID reader is operating. This requires that the antenna circuit for such an RFID reader is designed specifically for this purpose. Likewise RFID tags are generally designed specifically to receive an RF H field and to modulate that H field, for example by load modulation or amplitude modulation, and the antenna circuits for such RFID tags are designed specifically for that purpose. The antennas of RFID tags and RFID readers of a specific system will also be designed to be impedance-matched, thus optimizing the inductive coupling range and therefore distance at which the RFID tags and RFID readers can operate and minimizing any null zones or regions within which communication is not possible. Bangs at [0021] According to an aspect of the present invention, there is provided a near field RF communicator, comprising: an antenna circuit to enable inductive coupling of the near field RF communicator and another near field RF communicator in near field range; a signal supplier coupled to the antenna circuit to supply a drive signal to cause the antenna circuit to generate an RF signal; and a receiver coupled to the antenna circuit to receive a signal inductively coupled to the antenna circuit from another near field RF communicator in near field range, wherein the antenna circuit comprises an antenna element coupled in parallel with a first capacitor, wherein the antenna element comprises an antenna coil in series with a second capacitor to affect a voltage resulting from inductive coupling to the antenna circuit. Bangs at [0023] According to an aspect of the present invention, there is provided a near field RF communicator, comprising: an antenna circuit to enable inductive coupling of the near field RF communicator and another near field RF communicator in near field range; a signal supplier coupled to the antenna circuit to supply a drive signal to cause the antenna circuit to generate an RF signal; and a receiver coupled to the antenna circuit to receive a signal inductively coupled to the antenna circuit from another near field RF communicator in near field range, wherein the antenna circuit comprises an antenna element coupled in

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	parallel with a capacitor, wherein the antenna element comprises an antenna coil having a tap and the receiver is coupled to the tap. Bangs at [0049] In this example, the receiver circuitry comprises an amplifier 119 coupled to the antenna circuit 102 and a demodulator 114 coupled to the amplifier 119 and the controller 107 for amplifying and demodulating a modulated RF signal inductively coupled to the antenna circuit 102 from another near field RF communicator in near field range and for supplying the thus-extracted data to the controller 107 for processing. Bangs at [0050] In this example, the transmitter circuitry comprises components for driving the antenna circuit 102 to transmit an RF signal and for modulating an RF signal to enable communication of data between near field RF communicators in near field range. As shown in FIG. 2, the transmitter circuitry comprises a signal generator 109 coupled via a driver 111 to the antenna circuit 102. In this example, the signal generator 110 is configured to cause modulation by gating or switching on and off the RF signal in accordance with the data to be communicated. The NFC communicator may use any appropriate modulation scheme that is in accordance with the standards and/or protocols under which the NFC communicator operates. Alternatively a separate or further signal controller may be incorporated within the NFC operational components of functionality 120 to control modulation of the signal generated by the signal generator 109 in accordance with data or instructions received from the controller 107. Bangs at [0053] When in initiator or target mode, the NFC communicator may communicate in accordance with an active or passive protocol. When using an active protocol, the initiating NFC communicator will transmit an RF field and following completion of its data communication will turn off its RF field. The responding near field RF communicator (target) will then transmit its own RF field and data and then turn off its RF field and so on. When using a passive protocol the NFC communicator (initiator) will transmit and maintain its RF field throughout the entire communication sequence and the target will modulate that RF field with the data to be communicated. The protocol used will depend on instructions received from the controller 107 and the response received from a responding near field RF communicator. Bangs at [0054] In FIG. 2 control of the operation of the NFC communicator is through controller 107. As another possibility, where the NFC communicator is part of or associated with a host device, control of the

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	operation of the NFC communicator may at least partly be directed by the host device, for example through the other functionality 105. In such circumstances all or part of the control may be provided by the other functionality 105 which may be part of the NFC functionality or a host. For example the NFC communicator controller 107 may control modulation and modulation protocols whereas the data to be transmitted may be provided by the other functionality 105. Bangs at [0055] An NFC communicator thus has the capability to transmit an RF H field, to receive an RF H field, to modulate a transmitted RF H field and also to modulate a received RF H field. Bangs at [0067] In operation of the NFC communicator shown by FIG. 3, when the NFC communicator is acting as a target and is in passive target communication mode, then the NFC communicator will communicate any response to an initiator near field RF communicator in near field range by modulating the RF H field received from that near field RF communicator under the control of the controller 107. The NFC communicator may in these circumstances use load modulation, that is an impedance (not shown) of the NFC functionality may be switched in and out under the control of the controller 107 in accordance with the data to be communicated so as to change the effective impedance of the antenna 'tank' (that is the parallel LC resonant circuit defined by the antenna coil element (antenna coil 308 in series with capacitor 307) and capacitor 304) in accordance with the data to be communicated, thereby modulating the load on the antenna circuit of the initiating near field RF communicator and thus modulating, in this example, the amplitude and phase of the signal provided by the antenna circuit of the initiator to its receiver circuitry. Bangs at [0069] The presence of capacitor 307 thus reduces the potential difference (voltage) developed between junctions 306 and 305 for a given received H field, thereby reducing the voltage between receiver couplings Rx1 and Rx2 and between transmission couplings Tx1 and Tx2, so reducing the maximum potential voltage to which the receiver and transmitter circuitry may be subjected. Although antenna circuit designers generally aim to maximise the voltage induced by any given H field, the use of capacitor 307 enables control of the voltage that the capacitors 302, 303 and 304 and the NFC functionality 120a (for example the driver 111a and amplifier 119a) need to be able to withstand, thereby enabling the use of capacitors 302, 303 and 304 with lower voltage ratings and enabling coupling of the antenna circuit 102 directly to the NFC functionality 120a. Bangs at [0070]

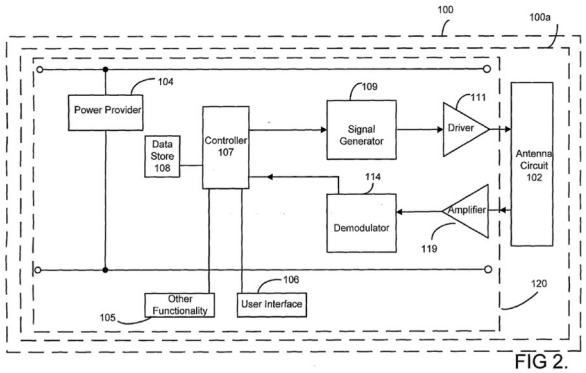
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	When the NFC communicator is in the active communication mode, the controller 107 (FIG. 2) will cause the signal generator 109 (FIG. 2) and driver 111a to drive the antenna circuit 102 to initiate or generate an RF-H field. The antenna circuit 102 is tuned to the required RF transmission frequency which, for an NFC communicator operating in accordance with ISO 18092, is 13.56 MHz (Megahertz). The capacitors 302 and 303 add capacitance to bring the tuning closer to the required frequency. Bangs at [0071] The drive signal from the driver 111a is coupled to the antenna coil 308 via capacitors 302 and 303. The driver 111a thus develops an RF voltage across transmission connections Tx1 and Tx2 which causes an RF current to flow between transmission connections Tx1 and Tx2 through antenna circuit 102. As this RF current flows between points 306 and 305, it divides between resistor 301, capacitor 304 and antenna element 309 in accordance with their relative impedances. The portion of the RF current that flows through antenna element 309 passes through antenna coil 308 producing an RF H field. Bangs at [0074] Any appropriate form of modulation may be used to enable data communication, for example modulation of the RF H field may be achieved through gating or switching of the generated signal in accordance with the relevant communication protocols. The form of modulation will depend on the type of drive functionality incorporated within the NFC communicator. For example, a current drive will control the current supplied to the antenna circuit 102 and may achieve modulation by changing the current. A voltage drive on the other hand will control the voltage supplied to the antenna circuit 102 and may achieve modulation by controlling pulses supplied the antenna circuit 102. Any suitable type of modulation technique may be used (e.g. amplitude and/or phase modulation) and any suitable modulation encoding scheme may be used Bangs at [0075] The antenna circuit 102 of FIG. 3 has a double-ended, balanced or differential transmission input, that is the drive signal supplied to the antenna circuit 102 is the difference between the signals at transmission couplings Tx1 and Tx2. Likewise, the receiver output of the antenna circuit is double-ended or differential, that is the received signal is the difference between the signals at receiver couplings Rx1 and Rx2. Bangs at [0076] FIG. 4 shows a functional circuit diagram of an NFC communicator having an antenna circuit 102a that differs from that shown in FIG. 3 in that the antenna circuit has a single transmission input coupling Tx

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	coupled to a single output driver 111b and a single receiver output coupling Rx coupled to a single input amplifier 119b so that the transmission signal is defined between transmission connection Tx and a signal ground coupling 311 and the receiver signal is defined between Rx and a coupling to ground 310 via capacitor 303. Both grounds (earths) may be provided by a local ground of the NFC communicator or a host. *See also* Bangs at [0039], [0046], [0066], [0072], [0073], [0092], claim 29, and claim 32. To the extent this limitation is not disclosed by Bangs, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Bangs, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* [1c] and claim 13 above.
15. The mobile device of claim 13 wherein the driver circuit comprises an active transmit driver circuit.	Bangs expressly or inherently discloses "[t]he mobile device of claim 13 wherein the driver circuit comprises an active transmit driver circuit." For example: Bangs at Figure 2  FIG 2. Bangs at [0021] According to an aspect of the present invention, there is provided a near field RF communicator, comprising: an antenna circuit to enable inductive coupling of the near field RF communicator and another near field RF communicator in near field range; a signal supplier coupled to the antenna circuit to supply a drive signal to cause the antenna circuit to generate an RF signal; and a receiver coupled to the antenna circuit to receive a signal inductively coupled to the antenna circuit from another near field RF

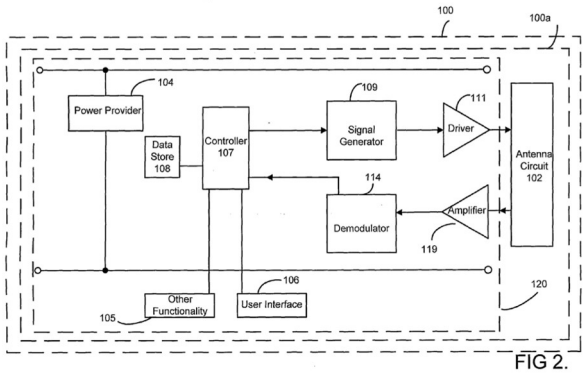
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	communicator in near field range, wherein the antenna circuit comprises an antenna element coupled in parallel with a first capacitor, wherein the antenna element comprises an antenna coil in series with a second capacitor to affect a voltage resulting from inductive coupling to the antenna circuit. Bangs at [0023] According to an aspect of the present invention, there is provided a near field RF communicator, comprising: an antenna circuit to enable inductive coupling of the near field RF communicator and another near field RF communicator in near field range; a signal supplier coupled to the antenna circuit to supply a drive signal to cause the antenna circuit to generate an RF signal; and a receiver coupled to the antenna circuit to receive a signal inductively coupled to the antenna circuit from another near field RF communicator in near field range, wherein the antenna circuit comprises an antenna element coupled in parallel with a capacitor, wherein the antenna element comprises an antenna coil having a tap and the receiver is coupled to the tap. Bangs at [0050] In this example, the transmitter circuitry comprises components for driving the antenna circuit 102 to transmit an RF signal and for modulating an RF signal to enable communication of data between near field RF communicators in near field range. As shown in FIG. 2, the transmitter circuitry comprises a signal generator 109 coupled via a driver 111 to the antenna circuit 102. In this example, the signal generator 110 is configured to cause modulation by gating or switching on and off the RF signal in accordance with the data to be communicated. The NFC communicator may use any appropriate modulation scheme that is in accordance with the standards and/or protocols under which the NFC communicator operates. Alternatively a separate or further signal controller may be incorporated within the NFC operational components of functionality 120 to control modulation of the signal generated by the signal generator 109 in accordance with data or instructions received from the controller 107. Bangs at [0053] When in initiator or target mode, the NFC communicator may communicate in accordance with an active or passive protocol. When using an active protocol, the initiating NFC communicator will transmit an RF field and following completion of its data communication will turn off its RF field. The responding near field RF communicator (target) will then transmit its own RF field and data and then turn off its RF field and so on. When using a passive protocol the NFC communicator (initiator) will transmit and maintain its RF field throughout the entire communication sequence and the target will modulate that RF field with the data to be communicated. The protocol used will depend on instructions received from the controller 107 and the response received from a responding near field RF communicator.

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	Bangs at [0069] The presence of capacitor 307 thus reduces the potential difference (voltage) developed between junctions 306 and 305 for a given received H field, thereby reducing the voltage between receiver couplings Rx1 and Rx2 and between transmission couplings Tx1 and Tx2, so reducing the maximum potential voltage to which the receiver and transmitter circuitry may be subjected. Although antenna circuit designers generally aim to maximise the voltage induced by any given H field, the use of capacitor 307 enables control of the voltage that the capacitors 302, 303 and 304 and the NFC functionality 120a (for example the driver 111a and amplifier 119a) need to be able to withstand, thereby enabling the use of capacitors 302, 303 and 304 with lower voltage ratings and enabling coupling of the antenna circuit 102 directly to the NFC functionality 120a. Bangs at [0070] When the NFC communicator is in the active communication mode, the controller 107 (FIG. 2) will cause the signal generator 109 (FIG. 2) and driver 111a to drive the antenna circuit 102 to initiate or generate an RF-H field. The antenna circuit 102 is tuned to the required RF transmission frequency which, for an NFC communicator operating in accordance with ISO 18092, is 13.56 MHz (Megahertz). The capacitors 302 and 303 add capacitance to bring the tuning closer to the required frequency. Bangs at [0071] The drive signal from the driver 111a is coupled to the antenna coil 308 via capacitors 302 and 303. The driver 111a thus develops an RF voltage across transmission connections Tx1 and Tx2 which causes an RF current to flow between transmission connections Tx1 and Tx2 through antenna circuit 102. As this RF current flows between points 306 and 305, it divides between resistor 301, capacitor 304 and antenna element 309 in accordance with their relative impedances. The portion of the RF current that flows through antenna element 309 passes through antenna coil 308 producing an RF H field. Bangs at [0074] Any appropriate form of modulation may be used to enable data communication, for example modulation of the RF H field may be achieved through gating or switching of the generated signal in accordance with the relevant communication protocols. The form of modulation will depend on the type of drive functionality incorporated within the NFC communicator. For example, a current drive will control the current supplied to the antenna circuit 102 and may achieve modulation by changing the current. A voltage drive on the other hand will control the voltage supplied to the antenna circuit 102 and may achieve modulation by controlling pulses supplied the antenna circuit 102. Any suitable type of

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	modulation technique may be used (e.g. amplitude and/or phase modulation) and any suitable modulation encoding scheme may be used Bangs at [0075] The antenna circuit 102 of FIG. 3 has a double-ended, balanced or differential transmission input, that is the drive signal supplied to the antenna circuit 102 is the difference between the signals at transmission couplings Tx1 and Tx2. Likewise, the receiver output of the antenna circuit is double-ended or differential, that is the received signal is the difference between the signals at receiver couplings Rx1 and Rx2. Bangs at [0076] FIG. 4 shows a functional circuit diagram of an NFC communicator having an antenna circuit 102a that differs from that shown in FIG. 3 in that the antenna circuit has a single transmission input coupling Tx coupled to a single output driver 111b and a single receiver output coupling Rx coupled to a single input amplifier 119b so that the transmission signal is defined between transmission connection Tx and a signal ground coupling 311 and the receiver signal is defined between Rx and a coupling to ground 310 via capacitor 303. Both grounds (earths) may be provided by a local ground of the NFC communicator or a host. *See also* Bangs at Figure 5, [0039], [0046], [0072], [0073], [0092], claim 29, and claim 32. To the extent this limitation is not disclosed by Bangs, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Bangs, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* [7c] and claim 13 above.
16. The mobile device of claim 15 wherein the active transmit driver circuit is coupled to be powered by the mobile device.	Bangs expressly or inherently discloses "[t]he mobile device of claim 15 wherein the active transmit driver circuit is coupled to be powered by the mobile device." For example: Bangs at Figure 2

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	 FIG 2. Bangs at [0004] As will be understood from the above, an NFC communicator may operate in an "initiator" mode in which the NFC communicator seeks to initiate near field RF communication or in a "target" mode in which the NFC communicator is receptive to initiation of near field RF communication. NFC communicators may also operate in either a "passive communications mode" or an "active communications mode". When communication is by the "passive communications mode", an initiator NFC communicator will generate an RF field and a target NFC communicator will respond by modulation of the received H field, usually by load modulation. When communication is by the "active communications mode" the initiator NFC communicator and the target NFC communicator each use their own RF H field to enable communication. The terms "passive" and "active" in the context of NFC communicators do not have the same meaning as "passive" and "active" when used in the context of traditional RFID tags and readers where the terms are instead used to define whether the RFID tags and readers have their own power supply or whether a power supply is derived from the received RF HF field. Bangs at [0015] An NFC communicator may be battery powered and the desire to minimise power consumption, for example to prolong battery life, can limit the amount of current available to drive the antenna circuit. Also, as indicated above, size or environmental constraints may affect the antenna circuit design, limiting the size and/or topology of the antenna circuit, particularly the antenna coil. All of these factors will have an effect on the RF H field and therefore the voltage developed across an NFC communicator's antenna circuit during communication to the extent that the components of the NFC communicator need to be

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	designed to operate at or need to be protected from voltages much higher than their intended operating voltages. Bangs at [0036] The mobile telephone 1 has the usual features of a mobile telephone including mobile telephone functionality 10 (in the form of, usually, a programmed controller, generally a processor or microprocessor with associated memory or data storage, for controlling operation of the mobile telephone in combination with a SIM card), an antenna 8 for enabling connection to a mobile telecommunications network, and a user interface 3 with a display 4, a keypad 5, a microphone 6 for receiving user voice input and a loudspeaker 7 for outputting received audio to the user. The mobile telephone also has a chargeable battery 11 coupled to a charging socket 12 via which a mains adapter (not shown) may be connected to enable charging of the battery 11. The mobile telephone 1 may have an alternative or additional power supply (not shown), for example a reserve battery or emergency battery. Although FIG. 1 shows a standalone mobile telephone (cellphone), the mobile telephone functionality may be incorporated in or associated with a host device such as a computer, for example a notebook, laptop or PDA. Bangs at [0041] Each NFC communicator 15 and 30 also comprises a power provider 19 and 34. The power providers 19 and 34 may be power supplies within the host device or specific to the NFC communicators 15 and 30, for example a button cell battery, or other small battery. As another possibility or additionally as shown by dashed lines in FIG. 1, one or both of the power providers 19 and 34 may simply comprise a coupling to derive power from the corresponding device battery 11 or 25. Bangs at [0046] In this example, the NFC communications enabled device 100 comprises an NFC communicator 100a having NFC operational components including an antenna circuit 102 and NFC functionality 120 comprising power provider 104, controller 107, data store 108, receiver circuitry and transmitter circuitry. *See also* Bangs at Figure 1 and [0047]. To the extent this limitation is not disclosed by Bangs, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Bangs, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 11 and claim 15 above.

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
17. The mobile device of claim 13 wherein the amplifier is coupled to be powered by the mobile device.	Bangs expressly or inherently discloses "[t]he mobile device of claim 13 wherein the amplifier is coupled to be powered by the mobile device." For example: Bangs at Figure 2  FIG 2. Bangs at [0004] As will be understood from the above, an NFC communicator may operate in an "initiator" mode in which the NFC communicator seeks to initiate near field RF communication or in a "target" mode in which the NFC communicator is receptive to initiation of near field RF communication. NFC communicators may also operate in either a "passive communications mode" or an "active communications mode". When communication is by the "passive communications mode", an initiator NFC communicator will generate an RF field and a target NFC communicator will respond by modulation of the received H field, usually by load modulation. When communication is by the "active communications mode" the initiator NFC communicator and the target NFC communicator each use their own RF H field to enable communication. The terms "passive" and "active" in the context of NFC communicators do not have the same meaning as "passive" and "active" when used in the context of traditional RFID tags and readers where the terms are instead used to define whether the RFID tags and readers have their own power supply or whether a power supply is derived from the received RF HF field. Bangs at [0015] An NFC communicator may be battery powered and the desire to minimise power consumption, for example to prolong battery life, can limit the amount of current available to drive the antenna circuit. Also, as indicated above, size or environmental constraints may affect the antenna circuit design, limiting

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	the size and/or topology of the antenna circuit, particularly the antenna coil. All of these factors will have an effect on the RF H field and therefore the voltage developed across an NFC communicator's antenna circuit during communication to the extent that the components of the NFC communicator need to be designed to operate at or need to be protected from voltages much higher than their intended operating voltages. Bangs at [0036] The mobile telephone 1 has the usual features of a mobile telephone including mobile telephone functionality 10 (in the form of, usually, a programmed controller, generally a processor or microprocessor with associated memory or data storage, for controlling operation of the mobile telephone in combination with a SIM card), an antenna 8 for enabling connection to a mobile telecommunications network, and a user interface 3 with a display 4, a keypad 5, a microphone 6 for receiving user voice input and a loudspeaker 7 for outputting received audio to the user. The mobile telephone also has a chargeable battery 11 coupled to a charging socket 12 via which a mains adapter (not shown) may be connected to enable charging of the battery 11. The mobile telephone 1 may have an alternative or additional power supply (not shown), for example a reserve battery or emergency battery. Although FIG. 1 shows a standalone mobile telephone (cellphone), the mobile telephone functionality may be incorporated in or associated with a host device such as a computer, for example a notebook, laptop or PDA. Bangs at [0041] Each NFC communicator 15 and 30 also comprises a power provider 19 and 34. The power providers 19 and 34 may be power supplies within the host device or specific to the NFC communicators 15 and 30, for example a button cell battery, or other small battery. As another possibility or additionally as shown by dashed lines in FIG. 1, one or both of the power providers 19 and 34 may simply comprise a coupling to derive power from the corresponding device battery 11 or 25. Bangs at [0046] In this example, the NFC communications enabled device 100 comprises an NFC communicator 100a having NFC operational components including an antenna circuit 102 and NFC functionality 120 comprising power provider 104, controller 107, data store 108, receiver circuitry and transmitter circuitry. Bangs at [0047] The power provider 104 may be any one or more of the types of power providers discussed above. In the interests of simplicity, power supply couplings from the power provider 104 to other components are not shown in FIG. 2.

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 ("Bangs")
	See also Bangs at Figure 1 and [0038]. To the extent this limitation is not disclosed by Bangs, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Bangs, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 13 above.
18. The mobile device of claim 13 wherein the antenna is tuned to operate at 13.56 MHz.	Bangs expressly or inherently discloses "[t]he mobile device of claim 13 wherein the antenna is tuned to operate at 13.56 MHz." For example: *See* above at claim 2. To the extent this limitation is not disclosed by Bangs, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Bangs, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 13 above.
19. The mobile device of claim 13 wherein the antenna comprises an inductive element too small to draw enough power sufficient to operate the smartcard controller from an interrogating radio frequency (RF) field.	Bangs expressly or inherently discloses "[t]he mobile device of claim 13 wherein the antenna comprises an inductive element too small to draw enough power sufficient to operate the smartcard controller from an interrogating radio frequency (RF) field." For example: *See* above at claim 3. To the extent this limitation is not disclosed by Bangs, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Bangs, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 13 above.
20. The mobile device of claim 13 wherein the mobile device comprises a mobile phone.	Bangs expressly or inherently discloses "[t]he mobile device of claim 13 wherein the mobile device comprises a mobile phone." For example: *See* above at claim 6. To the extent this limitation is not disclosed by Bangs, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Bangs, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 13 above.

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0112941 (“Bangs”)

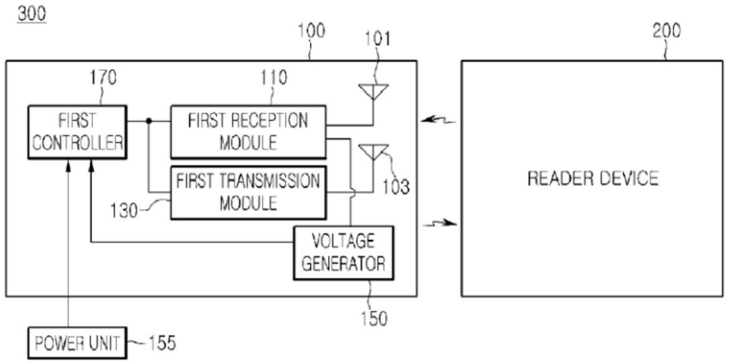
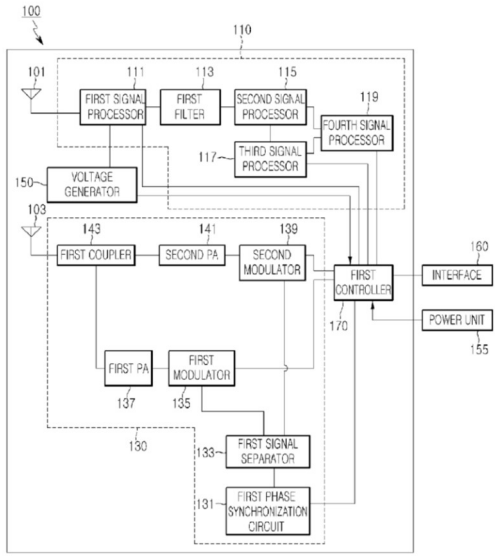
DEFENDANTS' INVALIDITY CONTENTIONS FOR U.S. PAT. 9,122,965

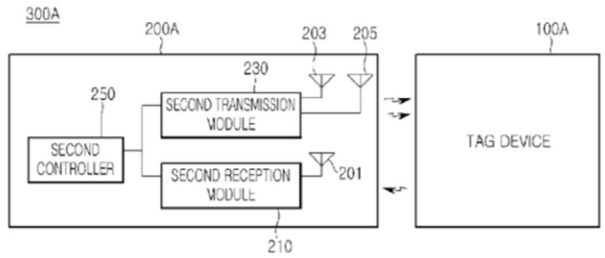
EXHIBIT A04: U.S. Patent Pub. No. 2010/0072277 ("Kim–277")

As demonstrated in the claim charts below, the claims of U.S. Patent No. 9,122,965 ("the '965 patent") are invalid (a) under one or more sections of 35 U.S.C. § 102 as anticipated by Kim–277 and (b) under 35 U.S.C. § 103(a) as obvious over Kim–277 standing alone and as set forth herein, and/or combined with the knowledge of a person of ordinary skill in the art, Applicant's Admitted Prior Art, and/or the additional prior art references discussed in Exhibit A and Exhibits A01–A05, the contents of which are hereby incorporated by reference into this chart. One of ordinary skill in the art, as of the priority date of the '965 patent, would have known to combine the prior art elements disclosed by the foregoing references using known methods, and to use these elements according to their established functions in order to achieve a known and predictable result.

Defendants have conducted the invalidity analysis herein based at least in part and in some instance entirely upon Plaintiff's apparent application of the claims of the '965 patent. By charting the prior art against the claims and limitations herein, Defendants are not admitting or agreeing to Plaintiff's application of the claims at issue in this case, and these charts should not be interpreted as an admission or concession by Defendants that any particular construction or application of any claim limitation by Plaintiff is correct or proper. Additionally, these charts provide representative examples of portions of the charted references that disclose the indicated limitations of the claims; additional portions of these references other than the representative examples provided herein may also disclose the indicated limitation(s) and Defendants contend that the asserted claims are invalid in light of the charted reference(s) as a whole in its or their entirety. Where a particular figure is cited, the citation should be understood to encompass the caption and description of the figure as well as any text relating to or describing the figure. Conversely, where particular text referring to a figure is cited, the citation should be understood to include the figure as well.

Claim Element	**Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")**
1[pre]. A mobile device comprising:	By providing this disclosure, Defendants do not take a position on whether the preamble is a claim limitation. Kim–277 discloses or renders obvious "[a] mobile device." For example: Kim–277 at Abstract Embodiments relate to a tag device, a reader device, and a radio frequency identification (RFID) system. The Q embodiment provides a tag device comprising: a reception module converting a received high frequency signal into a scale level, and Q converting the converted scale level into a digital signal to output the same; a transmission module modulating a transmission signal M to output the same; and a controller controlling the reception module and the transmission module. The tag device communicates o with the reader device through wireless short distance communication. Kim–277 at Figure 1

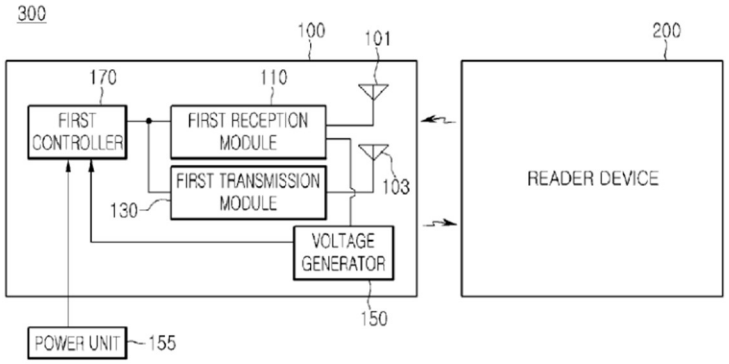
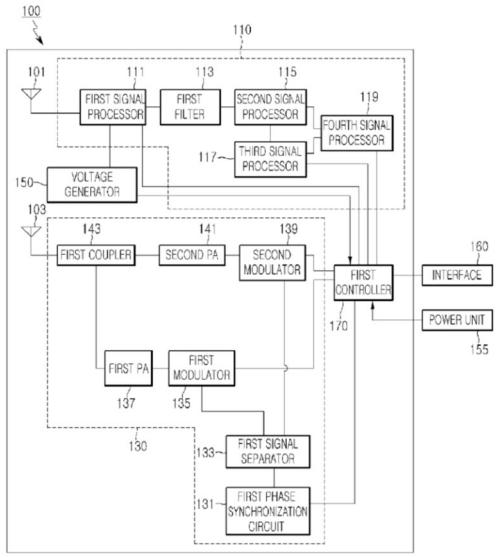
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	[Fig. 1]  Kim–277 at Figure 2 [Fig. 2]  Kim–277 at Figure 7

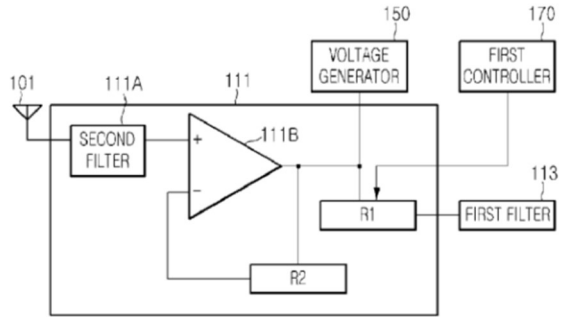
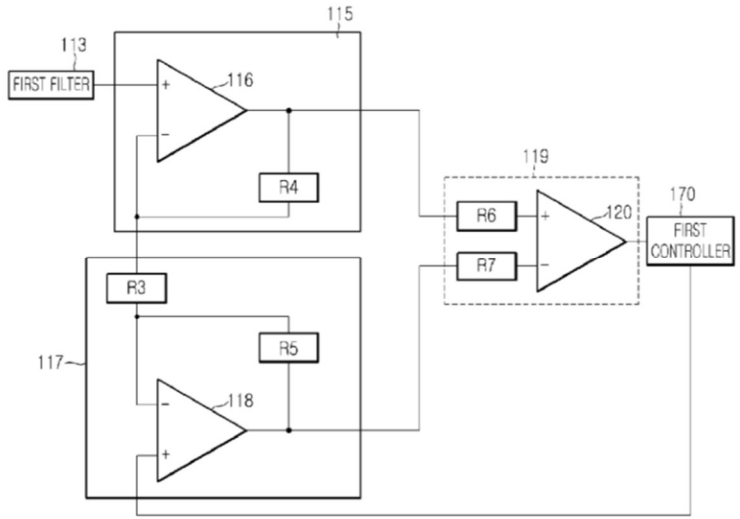
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	[Fig. 7]  Kim–277 at [0003] Generally, the RFID technology comprises a tag device and a reader device. The tag device is attached on an object such as goods to record detail information of the object. The reader device performs RF communication with the tag device to obtain the information of the object from the tag device. This RFID technology provides an infrastructure on which distribution/circulation management such as distribution, assembly, price change, and selling can be efficiently processed. Kim–277 at [0005] Embodiments provide a tag device that can efficiently use power by providing various modulation methods and operating in a passive mode modulation method or an active mode modulation method depending on the kind of power. Kim–277 at [0010] An embodiment provides a tag device comprising: a reception module converting a received high frequency signal into a scale level, and converting the converted scale level into a digital signal to output the same; a transmission module modulating a transmission signal to output the same; and a controller controlling the reception module and the transmission module. Kim–277 at [0012] An embodiment provides a radio frequency identification system comprising: a tag device comprising: a first reception module converting a received high frequency signal into a scale level, and outputting the converted scale level reception signal as a digital signal; a first transmission module modulating an information request signal to output the same; and a first controller controlling the first reception module and the first transmission module; and a reader device comprising: a second reception module converting a high frequency signal received from the tag device into a scale level, and outputting the converted scale level reception signal as a digital signal; a second transmission module modulating an information request

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	signal, and transmitting the signal to the tag device; and a second controller controlling the second reception module and the second transmission module. Kim–277 at [0020] FIG. 2 is a construction view of the tag device of FIG. 1. Kim–277 at [0031] Referring to FIG. 1, the RFID system 300 comprises a tag (or transponder) device 100 and a reader (or interrogator) device 200. Kim–277 at [0033] The tag device 100 has various shapes and sizes, and is classified into an active tag and a passive tag depending on whether power is supplied, classified into a low frequency system and a high frequency system depending on a frequency in use. The tag device 100 is attached to persons, automobiles, goods, livestock, and buildings, and contains detailed information of a corresponding object. Also, the tag device 100 can be mounted on a smart card to perform user authentication and electronic payment. The tag device 100 can be attached or function in cooperation with another device to provide various services. Kim–277 at [0034] The RF frequency tag of the RFID system 300 can be classified into a low frequency (LF) tag of 124-134 kHz used for access control and animal management, a high frequency (HF) tag of 13.56 MHz used for an integrated circuit (IC) card and an identification card, an ultra HF (UHF) tag of 400-915 MHz used for identification of containers in distribution and circulation, and a microwave tag of 2.45 GHz. Also, a 5.8 GHz tag can be used for telematics. These communication bands are provided for an exemplary purpose, and can change within the technical spirit and the scope of the embodiments. Kim–277 at [0035] Here, the tag device 100 can operate in an active mode driven by power supplied from a power unit 155, and a passive mode not requiring power. That is, the tag device 100 can operate in a semi-active mode. Here, when the tag device 100 is mounted on a terminal such as a mobile terminal, the tag device 100 can use the battery power of the mobile terminal as the power unit 155. Kim–277 at [0043] Referring to FIG. 2, the tag device 100 comprises the first reception module 110, the first transmission module 130, and the voltage generator 150. The first reception module 110 comprises a first signal

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	processor 111, a first filter 113, a second signal processor 115, a third signal processor 117, and a fourth signal processor 119. Kim–277 at [0056] Also, an interface 160 is connected to a mobile terminal, for example, to receive manipulation signals of the active mode and the passive mode and deliver the signals to the first controller 170. The first controller 170 can select the active mode or the passive mode depending on the manipulation signal. That is, during the passive mode, the first controller 170 can output a digital transmission signal to the first modulator 135, and during the active mode, the first controller 170 can output a digital transmission signal to the second modulator 139. Embodiments may not use the power unit 155 and the interface 160. Since the construction of the tag device may change depending on an installation environment or application service, the embodiments are not limited to using the power unit 155 and the interface 160. Kim–277 at [0084] Referring to FIG. 6, the tag device 100 comprises an IC chip 100B and a single antenna 105. The IC chip can comprise the first reception module 110, the first transmission module 130, the first controller 170, and the voltage generator 150 of FIG. 1. The antenna 105 is a transmission/reception antenna, and is formed in a closed loop type, for example, and has a structure in which the IC chip 100B has been mounted between two sides facing each other. The IC chip 100B can transmit or receive a signal through the antenna 105, there is no limitation in the structure of the antenna. Kim–277 at [0087] Referring to FIG. 7, the RFID system 300A comprises a tag device 100A and a reader device 200A. The reader device 200A communicates with the tag device 100A through wireless short distance communication in order to collect information of the tag device 100A. For example, the reader device 200A can collect data of the tag device 100A by transmitting an information request signal to the tag device 100A, and receiving object detailed information from the tag device 100A. The reader device 200A transmits/receives the collected information to/from a middle ware or other nodes. Kim–277 at [0133] Meanwhile, in the embodiments, the tag device 100 of FIG. 1 described in the first embodiment can be applied as the tag device 100A of FIG. 7 described in the second embodiment, and the reader device 200A of FIG. 7 described in the second embodiment can be applied as the reader device 200 of FIG. 1 described in the first embodiment. The elements and the descriptions of the first embodiment, and the elements and

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	the descriptions of the second embodiment are not limited to the relevant embodiment but can be applied to the other embodiment. Kim–277 at [0137] Since embodiments provide various modulation methods to the tag device and/or the reader device, the system can stably maintain communication according to an electromagnetic wave environment. *See also* Kim–277 at [0004], [0009], [0015], [0016], [0017], [0024], [0032], [0036], [0037], [0038], [0052], [0057], [0066], [0067], [0083], [0089], [0093], [0094], [0103], [0117], [0118], [0132], [0136], [0138], and [0139]. To the extent this limitation is not disclosed by Kim–277, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kim–277, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[1a] a smartcard controller;	Kim–277 discloses or renders obvious "a smartcard controller." For example: Kim–277 at Abstract Embodiments relate to a tag device, a reader device, and a radio frequency identification (RFID) system. The Q embodiment provides a tag device comprising: a reception module converting a received high frequency signal into a scale level, and Q converting the converted scale level into a digital signal to output the same; a transmission module modulating a transmission signal M to output the same; and a controller controlling the reception module and the transmission module. The tag device communicates o with the reader device through wireless short distance communication. Kim–277 at Figure 1

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	[Fig. 1]  Kim–277 at Figure 2 [Fig. 2]  Kim–277 at Figure 3

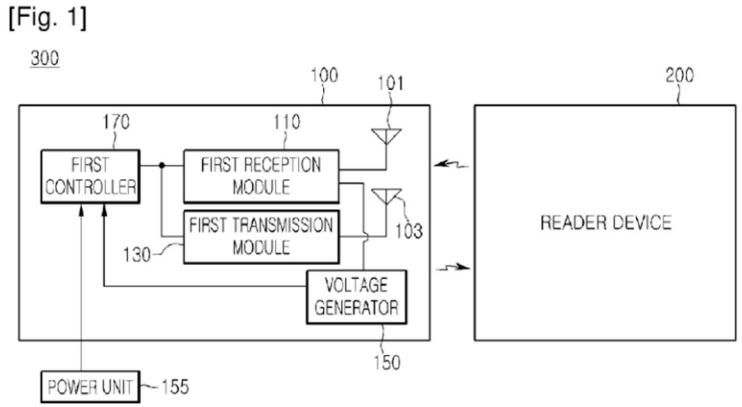
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	[Fig. 3]  Kim–277 at Figure 5 [Fig. 5]  Kim–277 at [0010] An embodiment provides a tag device comprising: a reception module converting a received high frequency signal into a scale level, and converting the converted scale level into a digital signal to output the same; a transmission module modulating a transmission signal to output the same; and a controller controlling the reception module and the transmission module.

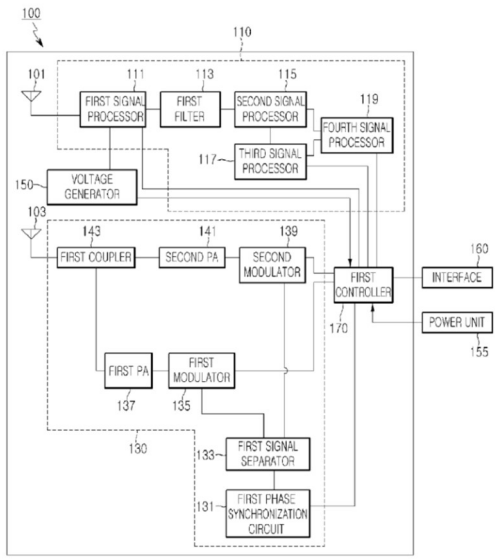
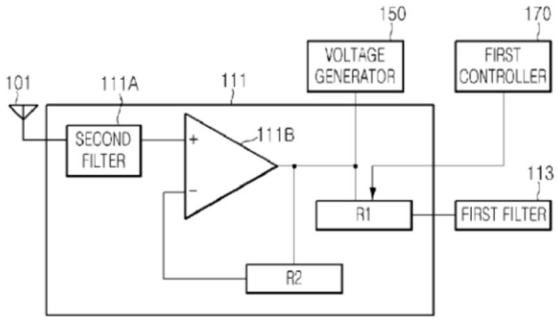
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	Kim–277 at [0033] The tag device 100 has various shapes and sizes, and is classified into an active tag and a passive tag depending on whether power is supplied, classified into a low frequency system and a high frequency system depending on a frequency in use. The tag device 100 is attached to persons, automobiles, goods, livestock, and buildings, and contains detailed information of a corresponding object. Also, the tag device 100 can be mounted on a smart card to perform user authentication and electronic payment. The tag device 100 can be attached or function in cooperation with another device to provide various services. Kim–277 at [0034] The RF frequency tag of the RFID system 300 can be classified into a low frequency (LF) tag of 124-134 kHz used for access control and animal management, a high frequency (HF) tag of 13.56 MHz used for an integrated circuit (IC) card and an identification card, an ultra HF (UHF) tag of 400-915 MHz used for identification of containers in distribution and circulation, and a microwave tag of 2.45 GHz. Also, a 5.8 GHz tag can be used for telematics. These communication bands are provided for an exemplary purpose, and can change within the technical spirit and the scope of the embodiments. Kim–277 at [0036] The tag device 100 comprises a first reception module 110, a first transmission module 130, a voltage generator 150, and a first controller 170. The first reception module 110 can decode high frequency signals received through a reception antenna 101, and the decoded signals are delivered to the first controller 170. Here, the first reception module 110 converts high frequency signals into digital signals using a log amplifier and a comparator. Since the first reception module 110 does not use general a superheterodyne method, a sequential low frequency method, an intermediate frequency synthesis method, the number of parts can be reduced and a circuit size can be minimized. Kim–277 at [0037] The controller 170 controls a drive in the active mode or a passive mode depending on whether power is supplied. For example, the tag device 100 is driven by the power unit 155 during the active mode, and driven by a voltage generated by the voltage generator 150 during the passive mode. Also, the active mode and the passive mode can be changed depending on whether power is supplied from the power unit 155, or can be switched from the passive mode to the active mode when power is supplied to the power unit 155. One of the active mode and the passive mode can be changed to the other according to a manipulation signal of an operator.

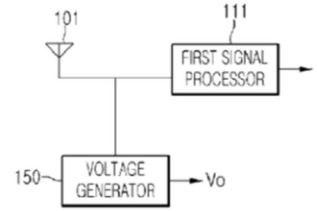
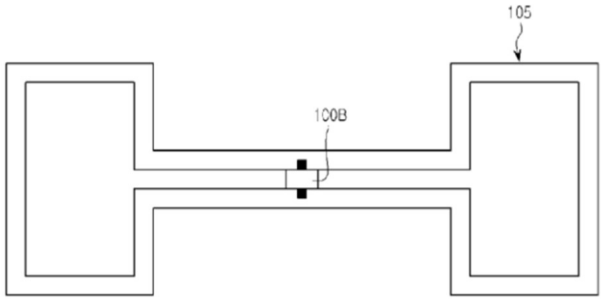
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	Kim–277 at [0038] The voltage generator 150 receives a scale signal corresponding to a high frequency signal processed by the first reception module 110 to generate a voltage necessary for the tag device. The voltage generator 150 supplies a generated voltage to each part through a logic board or the first controller 170 of the tag device 100, so that the tag device 100 can operate in the passive mode. Kim–277 at [0046] At this point, the first controller 170 outputs a control signal to the first signal processor 111, and the control signal controls the gain of the first signal processor 111. Kim–277 at [0049] The output of the third signal processor 117 changes depending on a reference voltage of the first controller 170, and the changed output is output to the fourth signal processor 119. Here, the second signal processor 115 controls a signal output from the first signal processor 111 using a signal fed back from the third signal processor 117. At this point, the amplification gain of the second signal processor 115 is compensated for according to various reference voltages of the first controller 170. Kim–277 at [0050] The fourth signal processor 119 compares an amplified signal of the second signal processor 115 with an output signal of the third signal processor 117 to output a digital signal as a result of the comparison. That is, the fourth signal processor 119 serves as an analog-to-digital converter. A digital signal of the fourth signal processor 119 changes depending on the output level of the third signal processor 117, and is input to the first controller 170. Kim–277 at [0051] The first controller 170 controls the gain of the first signal processor 111 depending on a received signal state, and controls the reference voltage of the third signal processor 117. Accordingly, the first controller 170 can control the sensitivity of a digital signal output to the fourth signal processor 119. Also, the first controller 170 delivers synchronization information to the fourth signal processor 119 to control a comparison operation. Kim–277 at [0052] The first controller 170 can store tag information. For example, the first controller 170 can comprise a memory (not shown), or the tag information can be separately stored. The first controller 170 has a

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	communication protocol to control radio communication with the reader device 200, and provides tag information when an information request signal is received from the reader device 200. Also, the first controller 170 analyzes codes of signals decoded by the first to fourth signal processors 113, 115, 117, and 119, and generates transmission data. Kim–277 at [0055] Here, the first controller 170 delivers a digital transmission signal to the first modulator 135 and/or the second modulator 139 of the first transmission module 130. At this point, when the first transmission module is in the passive mode, the first modulator 135 operates. When the first transmission module is in the active mode, the second modulator 139 operates. Kim–277 at [0056] Also, an interface 160 is connected to a mobile terminal, for example, to receive manipulation signals of the active mode and the passive mode and deliver the signals to the first controller 170. The first controller 170 can select the active mode or the passive mode depending on the manipulation signal. That is, during the passive mode, the first controller 170 can output a digital transmission signal to the first modulator 135, and during the active mode, the first controller 170 can output a digital transmission signal to the second modulator 139. Embodiments may not use the power unit 155 and the interface 160. Since the construction of the tag device may change depending on an installation environment or application service, the embodiments are not limited to using the power unit 155 and the interface 160. Kim–277 at [0057] Here, the voltage generator 150 receives an analog signal from the first signal processor 111 to multiply the signal in order to generate a voltage. The generated voltage is supplied to each part through the first controller 170 of the tag device 100. That is, a voltage for the passive mode is supplied. The voltage generator 150 can be realized using a voltage oscillation circuit or a voltage multiplier circuit, for example. The voltage generator 150 can comprise a plurality of detection diodes and capacitors connected in a multiple steps. Kim–277 at [0058] The power unit 155 can be realized in a battery and a voltage control circuit and supplies power to each part through the first controller 170. Here, through the powers of the voltage generator 150 and the power unit 155 have been described to be supplied through the first controller 170, this is only one example, the powers can be supplied through a logic board of the device.

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	Kim–277 at [0079] The first filter 113 is connected to the positive terminal (+) of the first operation amplifier 116, and the fourth resistor R4 and the third resistor R3 of the negative feedback circuit are connected to the negative terminal (−) of the first operation amplifier 116 in parallel. A reference voltage of the first controller 170 is input to the positive terminal (+) of the second operation amplifier 118, and a fifth resistor R5 of the negative feedback circuit is connected to the negative terminal (−) of the second operation amplifier 118. The third resistor R3 is connected between the negative terminal (−) of the first operation amplifier 116 and the negative terminal (−) of the second operation amplifier 118. The output terminal of the first operation amplifier 116 is connected to the positive terminal (+) of the first comparator 120 through the sixth resistor R6, and connected to the fourth resistor R4 in parallel. The output terminal of the second operation amplifier 118 is connected to the negative terminal (−) of the first comparator 120 through the seventh resistor R7. The positive terminal (+) and negative terminal (−) of the first comparator 120 can be mutually changed and is not limited thereto. Kim–277 at [0080] The first operation amplifier 116 amplifies the gain of a signal that has passed through the first filter 113 to output the same. At this point, the gain is controlled by the fourth resistor R4 of a first feedback circuit of the first operation amplifier 116. The second operation amplifier 118 amplifies the reference voltage of the first controller 170 input to the positive terminal (+) of the second operation amplifier 118 to output the same. An output signal of the second operation amplifier 118 controls the level of a signal input to the negative terminal (−) of the first operation amplifier 116 through the fifth resistor R5 of a second feedback circuit, the third resistor R3, which is a feedback circuit, and the fourth resistor R4 of the first feedback circuit. Accordingly, the output signal of the second operation amplifier 118 changes according to the reference voltage of the first controller 170. The amplification gain of the first operation amplifier 116 is controlled by a change in the output signal of the second operation amplifier 118. That is, the amplification gains of the second operation amplifier 118 and the first operation amplifier 116 are controlled using the reference voltage of the first controller 170, so that the sensitivity of a reception signal output to the first operation amplifier 116 can be controlled. Kim–277 at [0084] Referring to FIG. 6, the tag device 100 comprises an IC chip 100B and a single antenna 105. The IC chip can comprise the first reception module 110, the first transmission module 130, the first controller 170, and the voltage generator 150 of FIG. 1. The antenna 105 is a transmission/reception antenna, and is formed in a closed loop type, for example, and has a structure in which the IC chip 100B has been

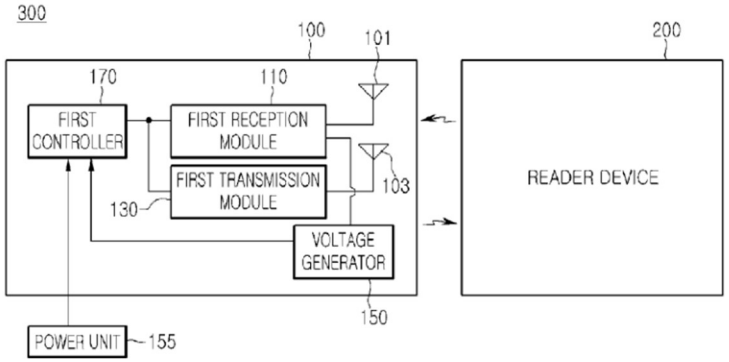
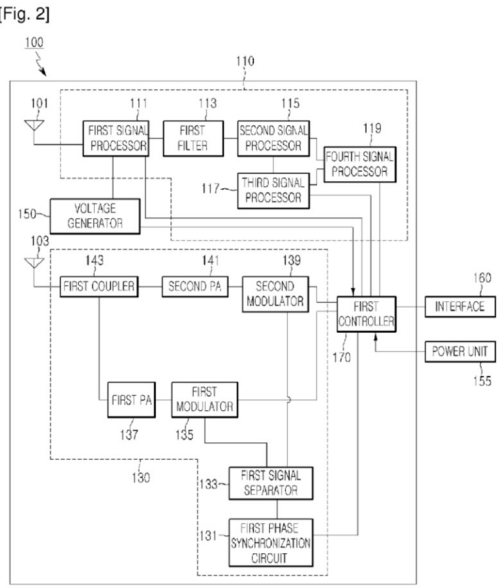
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	mounted between two sides facing each other. The IC chip 100B can transmit or receive a signal through the antenna 105, there is no limitation in the structure of the antenna. *See also* Kim–277 at [0012], [0054], and [0082]. To the extent this limitation is not disclosed by Kim–277, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kim–277, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[1b] an antenna; and	Kim–277 discloses or renders obvious "an antenna." For example: Kim–277 at Figure 1  Kim–277 at Figure 2

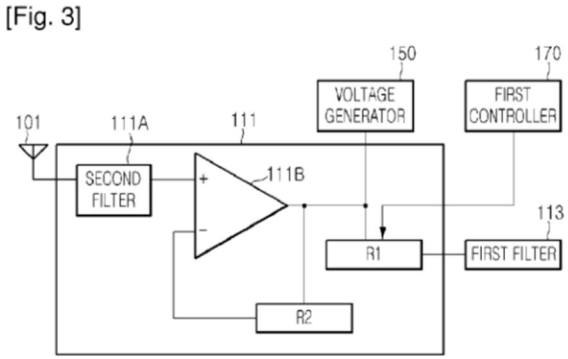
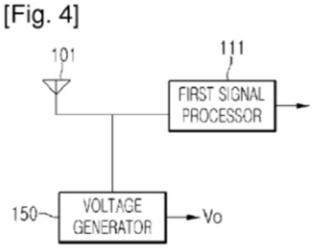
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	[Fig. 2]  Kim–277 at Figure 3 [Fig. 3]  Kim–277 at Figure 4

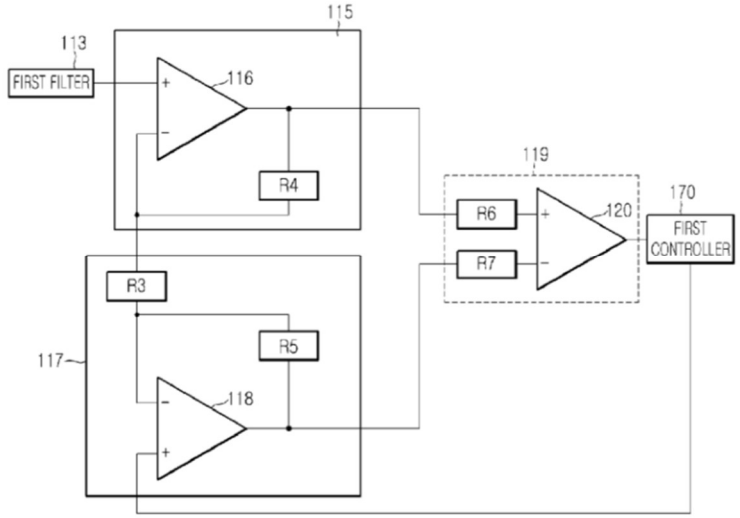
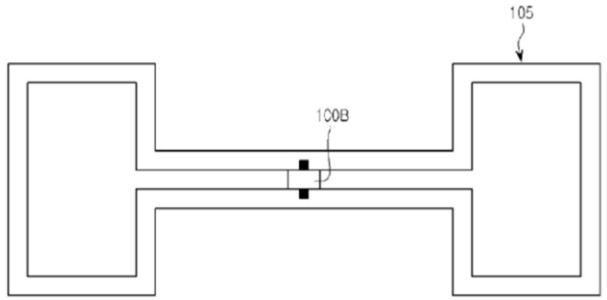
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	[Fig. 4]  Kim–277 at Figure 6 [Fig. 6]  Kim–277 at [0024] FIG. 6 is a view illustrating an example of an antenna of a tag device according to the first embodiment. Kim–277 at [0036] The tag device 100 comprises a first reception module 110, a first transmission module 130, a voltage generator 150, and a first controller 170. The first reception module 110 can decode high frequency signals received through a reception antenna 101, and the decoded signals are delivered to the first controller 170. Here, the first reception module 110 converts high frequency signals into digital signals using a log amplifier and a comparator. Since the first reception module 110 does not use general a superheterodyne method, a sequential low frequency method, an intermediate frequency synthesis method, the number of parts can be reduced and a circuit size can be minimized. Kim–277 at [0040] During the passive mode, the first transmission module 130 transmits a transmission signal through a transmission antenna 103 in a backscatter method.

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	Kim–277 at [0045] The first signal processor 111 filters RF signals in a predetermined frequency band from RF signals received through an reception antenna 101, amplifies a gain of the RF signals, and processes the RF signals into DC level analog signals. For example, the first signal processor 111 can output the high frequency signals into baseband signals using a log amplifier, or the high frequency signals into baseband signals using an RF pin diode. Here, the log amplifier can be applied to a system requiring long distance communication and high sensitivity. The RF pin diode can be used for low price and short distance communication. An embodiment is described to use the log amplifier. Kim–277 at [0063] A signal modulated by the second modulator 139 is amplified by the second power amplifier 141, and the amplified signal is coupled to the first coupler 143 and transmitted through the transmission antenna 103. Here, elements on the transmission path using the first modulator 135 and the transmission path using the second modulator 139 can change depending on a transmission frequency. For example, the power amplifier on one of the paths can be removed. Kim–277 at [0065] The transmission antenna 103 is connected to the first power amplifier 137 or the second power amplifier 141 through the first coupler 143. Kim–277 at [0066] The tag device 100 can comprise a reception antenna 101 and the transmission antenna 103, or transmit/receive signals using one antenna and a duplexer. There is no limitation in the structure and the number of the antennas. Kim–277 at [0069] Referring to FIG. 3, the first signal processor 111 comprises a second filter 111A, a first log amplifier 111B, resistors R1 and R2. The second filter 111A is connected to the reception antenna 101. The positive terminal (+) of the first log amplifier 111B is connected to the second filter 111A, and the negative terminal (−) of the log amplifier 111B is connected to the second resistor R2 of a negative feedback circuit. The output terminal of the first log amplifier 111B is connected to the first filter 113 through the first resistor R1. Kim–277 at [0076]

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	Referring to FIG. 4, the voltage generator 150 can generate a voltage Vo using the electromagnetic energy of a high frequency signal received from the reception antenna 101. That is, the voltage generator 150 is a voltage oscillation circuit or a voltage multiplier circuit, and can be realized using a plurality of detection diodes and capacitors connected in multiple steps. The voltage generator 150 sequentially repeatedly rectifies an RF signal received through the reception antenna 101 into a DC voltage to increase the rectified DC voltage. The voltage generated by the voltage generator 150 is supplied to each part through a logic board. Kim–277 at [0083] FIG. 6 is a view illustrating a modified example of an antenna of a tag device 100 according to the first embodiment. Kim–277 at [0084] Referring to FIG. 6, the tag device 100 comprises an IC chip 100B and a single antenna 105. The IC chip can comprise the first reception module 110, the first transmission module 130, the first controller 170, and the voltage generator 150 of FIG. 1. The antenna 105 is a transmission/reception antenna, and is formed in a closed loop type, for example, and has a structure in which the IC chip 100B has been mounted between two sides facing each other. The IC chip 100B can transmit or receive a signal through the antenna 105, there is no limitation in the structure of the antenna. *See also* Kim–277 at [0060], [0067], and [0088]. To the extent this limitation is not disclosed by Kim–277, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kim–277, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[1c] performance enhancement circuits coupled between the smartcard controller and the antenna, wherein the performance enhancement circuits include an amplifier and a load modulation circuit, and	Kim–277 discloses or renders obvious "performance enhancement circuits coupled between the smartcard controller and the antenna, wherein the performance enhancement circuits include an amplifier and a load modulation circuit." For example: Kim–277 at Abstract Embodiments relate to a tag device, a reader device, and a radio frequency identification (RFID) system. The Q embodiment provides a tag device comprising: a reception module converting a received high frequency signal into a scale level, and Q converting the converted scale level into a digital signal to output the same; a transmission module modulating a transmission signal M to output the same; and a

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	controller controlling the reception module and the transmission module. The tag device communicates o with the reader device through wireless short distance communication. Kim–277 at Figure 1 [Fig. 1]  Kim–277 at Figure 2 [Fig. 2] 

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	Kim–277 at Figure 3  Kim–277 at Figure 4  Kim–277 at Figure 5

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	[Fig. 5]  Kim–277 at Figure 6 [Fig. 6]  Kim–277 at [0005] Embodiments provide a tag device that can efficiently use power by providing various modulation methods and operating in a passive mode modulation method or an active mode modulation method depending on the kind of power. Kim–277 at [0010]

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	An embodiment provides a tag device comprising: a reception module converting a received high frequency signal into a scale level, and converting the converted scale level into a digital signal to output the same; a transmission module modulating a transmission signal to output the same; and a controller controlling the reception module and the transmission module. Kim–277 at [0012] An embodiment provides a radio frequency identification system comprising: a tag device comprising: a first reception module converting a received high frequency signal into a scale level, and outputting the converted scale level reception signal as a digital signal; a first transmission module modulating an information request signal to output the same; and a first controller controlling the first reception module and the first transmission module; and a reader device comprising: a second reception module converting a high frequency signal received from the tag device into a scale level, and outputting the converted scale level reception signal as a digital signal; a second transmission module modulating an information request signal, and transmitting the signal to the tag device; and a second controller controlling the second reception module and the second transmission module. Kim–277 at [0016] Embodiments can provide various modulation methods to a tag device and/or a reader device to maintain stabile communication according to an electromagnetic wave environment. Kim–277 at [0024] FIG. 6 is a view illustrating an example of an antenna of a tag device according to the first embodiment. Kim–277 at [0033] The tag device 100 has various shapes and sizes, and is classified into an active tag and a passive tag depending on whether power is supplied, classified into a low frequency system and a high frequency system depending on a frequency in use. The tag device 100 is attached to persons, automobiles, goods, livestock, and buildings, and contains detailed information of a corresponding object. Also, the tag device 100 can be mounted on a smart card to perform user authentication and electronic payment. The tag device 100 can be attached or function in cooperation with another device to provide various services. Kim–277 at [0036] The tag device 100 comprises a first reception module 110, a first transmission module 130, a voltage generator 150, and a first controller 170. The first reception module 110 can decode high frequency signals received through a reception antenna 101, and the decoded signals are delivered to the first

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	controller 170. Here, the first reception module 110 converts high frequency signals into digital signals using a log amplifier and a comparator. Since the first reception module 110 does not use general a superheterodyne method, a sequential low frequency method, an intermediate frequency synthesis method, the number of parts can be reduced and a circuit size can be minimized. Kim–277 at [0037] The controller 170 controls a drive in the active mode or a passive mode depending on whether power is supplied. For example, the tag device 100 is driven by the power unit 155 during the active mode, and driven by a voltage generated by the voltage generator 150 during the passive mode. Also, the active mode and the passive mode can be changed depending on whether power is supplied from the power unit 155, or can be switched from the passive mode to the active mode when power is supplied to the power unit 155. One of the active mode and the passive mode can be changed to the other according to a manipulation signal of an operator. Kim–277 at [0038] The voltage generator 150 receives a scale signal corresponding to a high frequency signal processed by the first reception module 110 to generate a voltage necessary for the tag device. The voltage generator 150 supplies a generated voltage to each part through a logic board or the first controller 170 of the tag device 100, so that the tag device 100 can operate in the passive mode. Kim–277 at [0040] During the passive mode, the first transmission module 130 transmits a transmission signal through a transmission antenna 103 in a backscatter method. Kim–277 at [0041] Here, during the passive mode and the active mode, the first transmission module 130 can use different modulation methods. For example, the first transmission module 130 can use amplitude shift keying (ASK) during the passive mode, and can selectively use frequency shift keying (FSK), quadrature phase shift keying (QPSK), and phase shift keying (PSK) during the active mode. Kim–277 at [0045] The first signal processor 111 filters RF signals in a predetermined frequency band from RF signals received through an reception antenna 101, amplifies a gain of the RF signals, and processes the RF signals into DC level analog signals. For example, the first signal processor 111 can output the high frequency signals into baseband signals using a log amplifier, or the high frequency signals into baseband

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	signals using an RF pin diode. Here, the log amplifier can be applied to a system requiring long distance communication and high sensitivity. The RF pin diode can be used for low price and short distance communication. An embodiment is described to use the log amplifier. Kim–277 at [0046] At this point, the first controller 170 outputs a control signal to the first signal processor 111, and the control signal controls the gain of the first signal processor 111. Kim–277 at [0048] The second signal processor 115 controls the gain of the first filter 113 and amplifies a signal, and the amplified signal is input to the fourth signal processor 119. Kim–277 at [0049] The output of the third signal processor 117 changes depending on a reference voltage of the first controller 170, and the changed output is output to the fourth signal processor 119. Here, the second signal processor 115 controls a signal output from the first signal processor 111 using a signal fed back from the third signal processor 117. At this point, the amplification gain of the second signal processor 115 is compensated for according to various reference voltages of the first controller 170. Kim–277 at [0050] The fourth signal processor 119 compares an amplified signal of the second signal processor 115 with an output signal of the third signal processor 117 to output a digital signal as a result of the comparison. That is, the fourth signal processor 119 serves as an analog-to-digital converter. A digital signal of the fourth signal processor 119 changes depending on the output level of the third signal processor 117, and is input to the first controller 170. Kim–277 at [0051] The first controller 170 controls the gain of the first signal processor 111 depending on a received signal state, and controls the reference voltage of the third signal processor 117. Accordingly, the first controller 170 can control the sensitivity of a digital signal output to the fourth signal processor 119. Also, the first controller 170 delivers synchronization information to the fourth signal processor 119 to control a comparison operation. Kim–277 at [0052]

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	The first controller 170 can store tag information. For example, the first controller 170 can comprise a memory (not shown), or the tag information can be separately stored. The first controller 170 has a communication protocol to control radio communication with the reader device 200, and provides tag information when an information request signal is received from the reader device 200. Also, the first controller 170 analyzes codes of signals decoded by the first to fourth signal processors 113, 115, 117, and 119, and generates transmission data. Kim–277 at [0053] The first transmission module 130 comprises a first phase synchronization circuit 131, a first signal separator 133, a first modulator 135, a first power amplifier 137, a second modulator 139, a second power amplifier 141, and a first coupler 143. Kim–277 at [0054] The first phase synchronization circuit 131 generates a reference signal under control of the first controller 170. The first signal separator 133 outputs the reference signal to the first modulator 135 and the second modulator 139. Here, the first signal separator 133 can be realized using a switch device such as a single pole double throw (SPDT) or a coupler, but is not limited thereto. Kim–277 at [0055] Here, the first controller 170 delivers a digital transmission signal to the first modulator 135 and/or the second modulator 139 of the first transmission module 130. At this point, when the first transmission module is in the passive mode, the first modulator 135 operates. When the first transmission module is in the active mode, the second modulator 139 operates. Kim–277 at [0056] Also, an interface 160 is connected to a mobile terminal, for example, to receive manipulation signals of the active mode and the passive mode and deliver the signals to the first controller 170. The first controller 170 can select the active mode or the passive mode depending on the manipulation signal. That is, during the passive mode, the first controller 170 can output a digital transmission signal to the first modulator 135, and during the active mode, the first controller 170 can output a digital transmission signal to the second modulator 139. Embodiments may not use the power unit 155 and the interface 160. Since the construction of the tag device may change depending on an installation environment or application service, the embodiments are not limited to using the power unit 155 and the interface 160. Kim–277 at [0057]

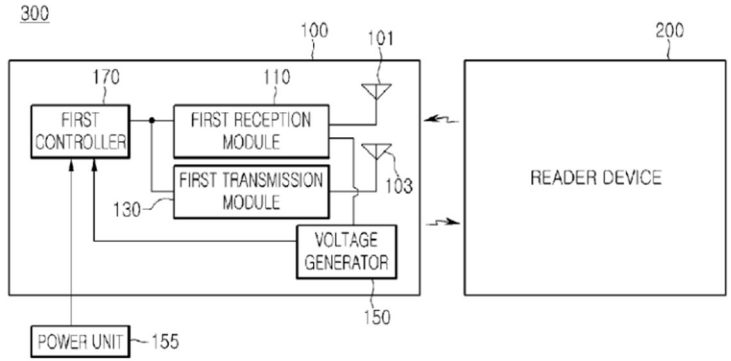
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	Here, the voltage generator 150 receives an analog signal from the first signal processor 111 to multiply the signal in order to generate a voltage. The generated voltage is supplied to each part through the first controller 170 of the tag device 100. That is, a voltage for the passive mode is supplied. The voltage generator 150 can be realized using a voltage oscillation circuit or a voltage multiplier circuit, for example. The voltage generator 150 can comprise a plurality of detection diodes and capacitors connected in a multiple steps. Kim–277 at [0058] The power unit 155 can be realized in a battery and a voltage control circuit and supplies power to each part through the first controller 170. Here, through the powers of the voltage generator 150 and the power unit 155 have been described to be supplied through the first controller 170, this is only one example, the powers can be supplied through a logic board of the device. Kim–277 at [0059] The first modulator 135 modulates a digital transmission signal into a first analog signal using ASK. The first modulator 135 can comprise a rectifying filter, a low pass filter, and a level detector, and is not limited to thereto. Kim–277 at [0060] The first power amplifier 137 amplifies a signal modulated by the first modulator 135 to a transmission level, and the amplified signal passes through the first coupler 143 and is transmitted through the transmission antenna 103. Kim–277 at [0062] Here, though the first modulator 135 exemplarily uses ASK modulation, and the second modulator 139 exemplarily uses QPSK modulation, the first modulator 135 and the second modulator 139 can use one of ASK, FSK, and QPSK modulations. The first and second modulators 135 and 139 can use the same modulation or a different modulation. Kim–277 at [0063] A signal modulated by the second modulator 139 is amplified by the second power amplifier 141, and the amplified signal is coupled to the first coupler 143 and transmitted through the transmission antenna 103. Here, elements on the transmission path using the first modulator 135 and the transmission path using the second modulator 139 can change depending on a transmission frequency. For example, the power amplifier on one of the paths can be removed.

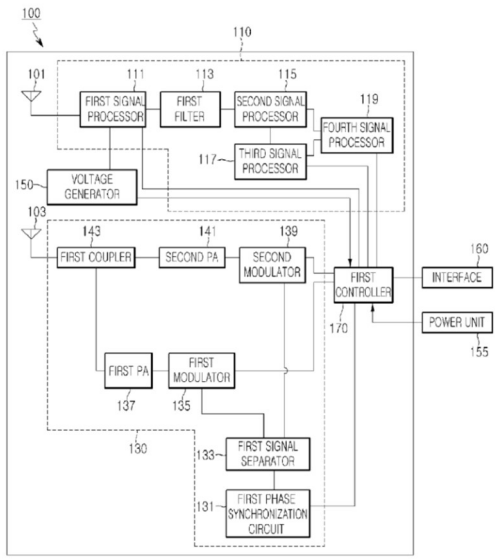
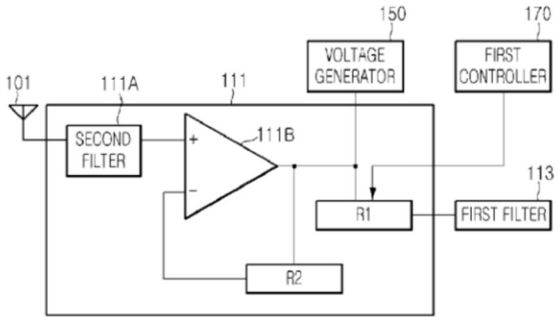
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	Kim–277 at [0064] The above-described first transmission module 130 can operate in the active mode and the passive mode by the power of the voltage generator 150 and the power unit 155. Also, the first transmission module 130 can be set to switch to the active mode when power is supplied through the power unit 155 with the passive mode set as a default. The setting of the passive mode and the active mode can change and is not limited thereto. Kim–277 at [0065] The transmission antenna 103 is connected to the first power amplifier 137 or the second power amplifier 141 through the first coupler 143. Kim–277 at [0066] The tag device 100 can comprise a reception antenna 101 and the transmission antenna 103, or transmit/receive signals using one antenna and a duplexer. There is no limitation in the structure and the number of the antennas. Kim–277 at [0067] Since the tag device 100 according to the first embodiment transmits signals modulated in various modulation methods, it can stably maintain communication according to an electromagnetic wave environment. Also, the tag device 100 can improve the signal recognition rate of the reader device, and improve reception sensitivity and signal recognition distance. Kim–277 at [0069] Referring to FIG. 3, the first signal processor 111 comprises a second filter 111A, a first log amplifier 111B, resistors R1 and R2. The second filter 111A is connected to the reception antenna 101. The positive terminal (+) of the first log amplifier 111B is connected to the second filter 111A, and the negative terminal (−) of the log amplifier 111B is connected to the second resistor R2 of a negative feedback circuit. The output terminal of the first log amplifier 111B is connected to the first filter 113 through the first resistor R1. Kim–277 at [0071] Also, the first log amplifier 111B can comprise at least one of a gain amplification circuit, a power amplification circuit, and a signal conversion circuit. The gain amplification circuit amplifies a signal according to a voltage gain to output an unstable high frequency signal in a state easy to recover. A

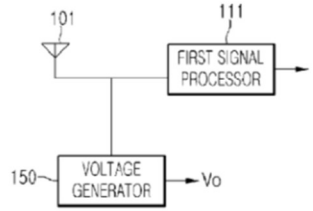
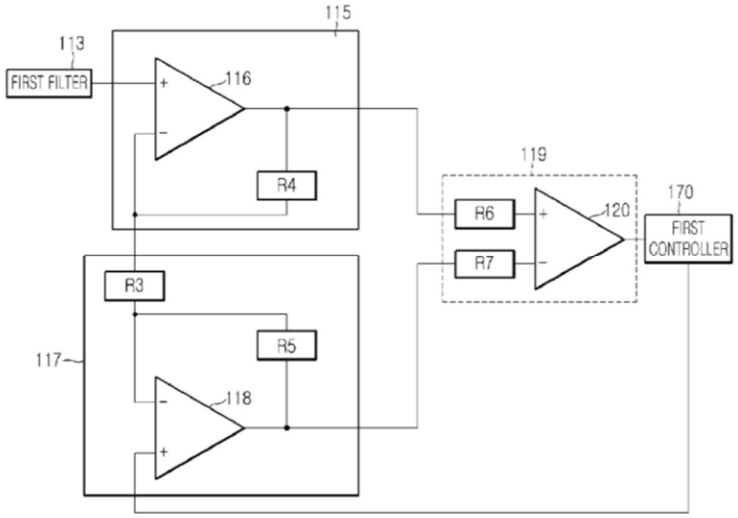
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	reception signal whose gain has been amplified by the gain amplification circuit has a reduced bit error rate and has a high recognition rate even under a fading environment. Such a reception signal can be recovered to a stable signal even in a section where a reception level is about −90 dBm. The power amplification circuit secondarily amplifies and outputs the power of a signal whose gain has been amplified by the gain amplification circuit. The signal conversion circuit converts an RF signal amplified by the power amplification circuit, for example, a signal in a band of 900 MHz into a DC level analog signal proportional to a decibel value. Kim–277 at [0072] The amplification gain of the first log amplifier 111B can be controlled by the first resistor R1 and the second resistor R2. The second resistor R2 has fixed resistance, and the first resistor R1 is a variable resistor whose resistance is varied by the first controller 170. The second resistor R2 can be connected between the output terminal of the first log amplifier 111B and a connection point of the negative feedback circuit, or between the first resistor R1 and the first filter 113. Here, the first resistor R1 and the second resistor R2 connected to the first log amplifier 111B can serve as a gain control circuit of the first log amplifier 111B. Kim–277 at [0073] The amplification gain of the first log amplifier 111B can be controlled by math FIG. 1 below. For example, the amplification gain of the first log amplifier 111B is controlled within the range of about 0 dB-20 dB according to a numerical value of the first resistor R1. Kim–277 at [0076] Referring to FIG. 4, the voltage generator 150 can generate a voltage Vo using the electromagnetic energy of a high frequency signal received from the reception antenna 101. That is, the voltage generator 150 is a voltage oscillation circuit or a voltage multiplier circuit, and can be realized using a plurality of detection diodes and capacitors connected in multiple steps. The voltage generator 150 sequentially repeatedly rectifies an RF signal received through the reception antenna 101 into a DC voltage to increase the rectified DC voltage. The voltage generated by the voltage generator 150 is supplied to each part through a logic board. Kim–277 at [0078] Referring to FIG. 5, the second signal processor 115 comprises a first operation amplifier 116 and a fourth resistor R4. The third signal processor 117 comprises a second operation amplifier 118, a fifth resistor R5,

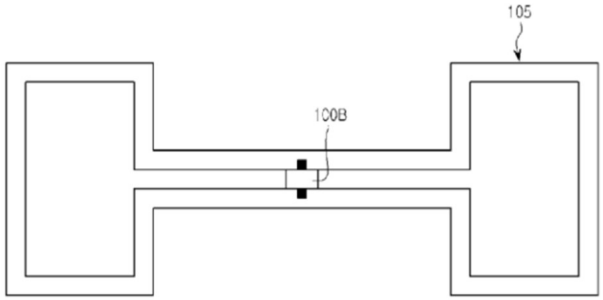
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	and a third resistor R3. The fourth signal processor 119 comprises a first comparator 120, a sixth resistor R6, and a seventh resistor R7. Kim–277 at [0079] The first filter 113 is connected to the positive terminal (+) of the first operation amplifier 116, and the fourth resistor R4 and the third resistor R3 of the negative feedback circuit are connected to the negative terminal (−) of the first operation amplifier 116 in parallel. A reference voltage of the first controller 170 is input to the positive terminal (+) of the second operation amplifier 118, and a fifth resistor R5 of the negative feedback circuit is connected to the negative terminal (−) of the second operation amplifier 118. The third resistor R3 is connected between the negative terminal (−) of the first operation amplifier 116 and the negative terminal (−) of the second operation amplifier 118. The output terminal of the first operation amplifier 116 is connected to the positive terminal (+) of the first comparator 120 through the sixth resistor R6, and connected to the fourth resistor R4 in parallel. The output terminal of the second operation amplifier 118 is connected to the negative terminal (−) of the first comparator 120 through the seventh resistor R7. The positive terminal (+) and negative terminal (−) of the first comparator 120 can be mutually changed and is not limited thereto. Kim–277 at [0080] The first operation amplifier 116 amplifies the gain of a signal that has passed through the first filter 113 to output the same. At this point, the gain is controlled by the fourth resistor R4 of a first feedback circuit of the first operation amplifier 116. The second operation amplifier 118 amplifies the reference voltage of the first controller 170 input to the positive terminal (+) of the second operation amplifier 118 to output the same. An output signal of the second operation amplifier 118 controls the level of a signal input to the negative terminal (−) of the first operation amplifier 116 through the fifth resistor R5 of a second feedback circuit, the third resistor R3, which is a feedback circuit, and the fourth resistor R4 of the first feedback circuit. Accordingly, the output signal of the second operation amplifier 118 changes according to the reference voltage of the first controller 170. The amplification gain of the first operation amplifier 116 is controlled by a change in the output signal of the second operation amplifier 118. That is, the amplification gains of the second operation amplifier 118 and the first operation amplifier 116 are controlled using the reference voltage of the first controller 170, so that the sensitivity of a reception signal output to the first operation amplifier 116 can be controlled. Kim–277 at [0081] Also, since the negative terminals (−) of the first operation amplifier 116 and the second operation amplifier 118 are connected to each other, the output signals of them can have an inverted phase. For

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	example, a signal processed by the first and second operation amplifiers 116 and 118 is a DC level analog signal. When the output signal of the first operation amplifier 116 is a high level, the output signal of the second operation amplifier 118 becomes a low level. Kim–277 at [0082] The first comparator 120 of the fourth signal processor 119 compares the output signal of the first operation amplifier 116 with the output signal of the second operation amplifier 118, and outputs a digital signal to the first controller 170 according to the comparison result. Here, the first controller 170 can recover a digital signal more completely by delivering synchronization information to the fourth signal processor 119. Here, the digital signal of the fourth signal processor 119 is input to the first controller 170 as a transistor-transistor logic (TTL)/complementary metal oxide semiconductor (CMOS) signal. Kim–277 at [0083] FIG. 6 is a view illustrating a modified example of an antenna of a tag device 100 according to the first embodiment. Kim–277 at [0084] Referring to FIG. 6, the tag device 100 comprises an IC chip 100B and a single antenna 105. The IC chip can comprise the first reception module 110, the first transmission module 130, the first controller 170, and the voltage generator 150 of FIG. 1. The antenna 105 is a transmission/reception antenna, and is formed in a closed loop type, for example, and has a structure in which the IC chip 100B has been mounted between two sides facing each other. The IC chip 100B can transmit or receive a signal through the antenna 105, there is no limitation in the structure of the antenna. Kim–277 at [0137] Since embodiments provide various modulation methods to the tag device and/or the reader device, the system can stably maintain communication according to an electromagnetic wave environment. Kim–277 at [0139] Embodiments can modulate transmission signals in various modulation methods, and transmit the signals in a circularly polarized component to provide the reader device that can stably communicate with the tag device. *See also* Kim–277 at [0088].

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	To the extent this limitation is not disclosed by Kim–277, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kim–277, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[1d] wherein the amplifier is coupled to amplify a signal received from the antenna and to provide an amplified signal to the smartcard controller.	Kim–277 discloses or renders obvious "wherein the amplifier is coupled to amplify a signal received from the antenna and to provide an amplified signal to the smartcard controller." For example: Kim–277 at Abstract Embodiments relate to a tag device, a reader device, and a radio frequency identification (RFID) system. The Q embodiment provides a tag device comprising: a reception module converting a received high frequency signal into a scale level, and Q converting the converted scale level into a digital signal to output the same; a transmission module modulating a transmission signal M to output the same; and a controller controlling the reception module and the transmission module. The tag device communicates o with the reader device through wireless short distance communication. Kim–277 at Figure 1 [Fig. 1]  Kim–277 at Figure 2

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	[Fig. 2]  Kim–277 at Figure 3 [Fig. 3]  Kim–277 at Figure 4

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	[Fig. 4]  Kim–277 at Figure 5 [Fig. 5]  Kim–277 at Figure 6

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	[Fig. 6]  Kim–277 at [0010] An embodiment provides a tag device comprising: a reception module converting a received high frequency signal into a scale level, and converting the converted scale level into a digital signal to output the same; a transmission module modulating a transmission signal to output the same; and a controller controlling the reception module and the transmission module. Kim–277 at [0024] FIG. 6 is a view illustrating an example of an antenna of a tag device according to the first embodiment. Kim–277 at [0033] The tag device 100 has various shapes and sizes, and is classified into an active tag and a passive tag depending on whether power is supplied, classified into a low frequency system and a high frequency system depending on a frequency in use. The tag device 100 is attached to persons, automobiles, goods, livestock, and buildings, and contains detailed information of a corresponding object. Also, the tag device 100 can be mounted on a smart card to perform user authentication and electronic payment. The tag device 100 can be attached or function in cooperation with another device to provide various services. Kim–277 at [0036] The tag device 100 comprises a first reception module 110, a first transmission module 130, a voltage generator 150, and a first controller 170. The first reception module 110 can decode high frequency signals received through a reception antenna 101, and the decoded signals are delivered to the first controller 170. Here, the first reception module 110 converts high frequency signals into digital signals using a log amplifier and a comparator. Since the first reception module 110 does not use general a

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	superheterodyne method, a sequential low frequency method, an intermediate frequency synthesis method, the number of parts can be reduced and a circuit size can be minimized. Kim–277 at [0037] The controller 170 controls a drive in the active mode or a passive mode depending on whether power is supplied. For example, the tag device 100 is driven by the power unit 155 during the active mode, and driven by a voltage generated by the voltage generator 150 during the passive mode. Also, the active mode and the passive mode can be changed depending on whether power is supplied from the power unit 155, or can be switched from the passive mode to the active mode when power is supplied to the power unit 155. One of the active mode and the passive mode can be changed to the other according to a manipulation signal of an operator. Kim–277 at [0038] The voltage generator 150 receives a scale signal corresponding to a high frequency signal processed by the first reception module 110 to generate a voltage necessary for the tag device. The voltage generator 150 supplies a generated voltage to each part through a logic board or the first controller 170 of the tag device 100, so that the tag device 100 can operate in the passive mode. Kim–277 at [0040] During the passive mode, the first transmission module 130 transmits a transmission signal through a transmission antenna 103 in a backscatter method. Kim–277 at [0045] The first signal processor 111 filters RF signals in a predetermined frequency band from RF signals received through an reception antenna 101, amplifies a gain of the RF signals, and processes the RF signals into DC level analog signals. For example, the first signal processor 111 can output the high frequency signals into baseband signals using a log amplifier, or the high frequency signals into baseband signals using an RF pin diode. Here, the log amplifier can be applied to a system requiring long distance communication and high sensitivity. The RF pin diode can be used for low price and short distance communication. An embodiment is described to use the log amplifier. Kim–277 at [0046] At this point, the first controller 170 outputs a control signal to the first signal processor 111, and the control signal controls the gain of the first signal processor 111.

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	Kim–277 at [0048] The second signal processor 115 controls the gain of the first filter 113 and amplifies a signal, and the amplified signal is input to the fourth signal processor 119. Kim–277 at [0049] The output of the third signal processor 117 changes depending on a reference voltage of the first controller 170, and the changed output is output to the fourth signal processor 119. Here, the second signal processor 115 controls a signal output from the first signal processor 111 using a signal fed back from the third signal processor 117. At this point, the amplification gain of the second signal processor 115 is compensated for according to various reference voltages of the first controller 170. Kim–277 at [0050] The fourth signal processor 119 compares an amplified signal of the second signal processor 115 with an output signal of the third signal processor 117 to output a digital signal as a result of the comparison. That is, the fourth signal processor 119 serves as an analog-to-digital converter. A digital signal of the fourth signal processor 119 changes depending on the output level of the third signal processor 117, and is input to the first controller 170. Kim–277 at [0051] The first controller 170 controls the gain of the first signal processor 111 depending on a received signal state, and controls the reference voltage of the third signal processor 117. Accordingly, the first controller 170 can control the sensitivity of a digital signal output to the fourth signal processor 119. Also, the first controller 170 delivers synchronization information to the fourth signal processor 119 to control a comparison operation. Kim–277 at [0052] The first controller 170 can store tag information. For example, the first controller 170 can comprise a memory (not shown), or the tag information can be separately stored. The first controller 170 has a communication protocol to control radio communication with the reader device 200, and provides tag information when an information request signal is received from the reader device 200. Also, the first controller 170 analyzes codes of signals decoded by the first to fourth signal processors 113, 115, 117, and 119, and generates transmission data. Kim–277 at [0053]

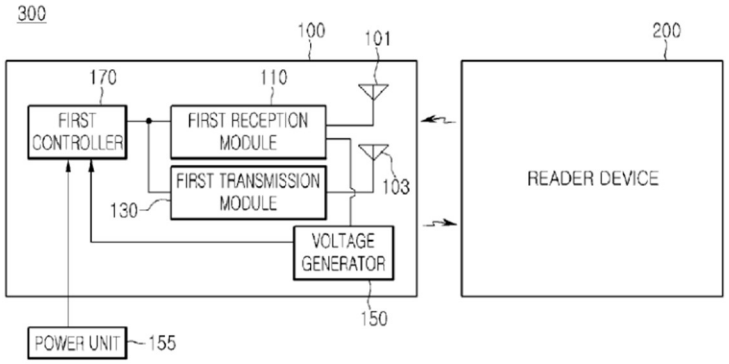
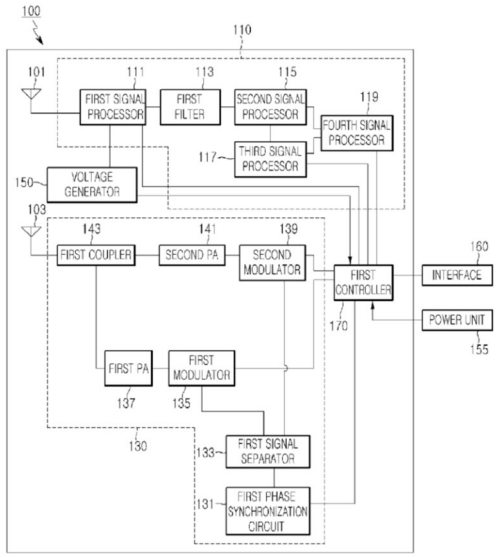
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	The first transmission module 130 comprises a first phase synchronization circuit 131, a first signal separator 133, a first modulator 135, a first power amplifier 137, a second modulator 139, a second power amplifier 141, and a first coupler 143. Kim–277 at [0055] Here, the first controller 170 delivers a digital transmission signal to the first modulator 135 and/or the second modulator 139 of the first transmission module 130. At this point, when the first transmission module is in the passive mode, the first modulator 135 operates. When the first transmission module is in the active mode, the second modulator 139 operates. Kim–277 at [0056] Also, an interface 160 is connected to a mobile terminal, for example, to receive manipulation signals of the active mode and the passive mode and deliver the signals to the first controller 170. The first controller 170 can select the active mode or the passive mode depending on the manipulation signal. That is, during the passive mode, the first controller 170 can output a digital transmission signal to the first modulator 135, and during the active mode, the first controller 170 can output a digital transmission signal to the second modulator 139. Embodiments may not use the power unit 155 and the interface 160. Since the construction of the tag device may change depending on an installation environment or application service, the embodiments are not limited to using the power unit 155 and the interface 160. Kim–277 at [0057] Here, the voltage generator 150 receives an analog signal from the first signal processor 111 to multiply the signal in order to generate a voltage. The generated voltage is supplied to each part through the first controller 170 of the tag device 100. That is, a voltage for the passive mode is supplied. The voltage generator 150 can be realized using a voltage oscillation circuit or a voltage multiplier circuit, for example. The voltage generator 150 can comprise a plurality of detection diodes and capacitors connected in a multiple steps. Kim–277 at [0058] The power unit 155 can be realized in a battery and a voltage control circuit and supplies power to each part through the first controller 170. Here, through the powers of the voltage generator 150 and the power unit 155 have been described to be supplied through the first controller 170, this is only one example, the powers can be supplied through a logic board of the device. Kim–277 at [0060]

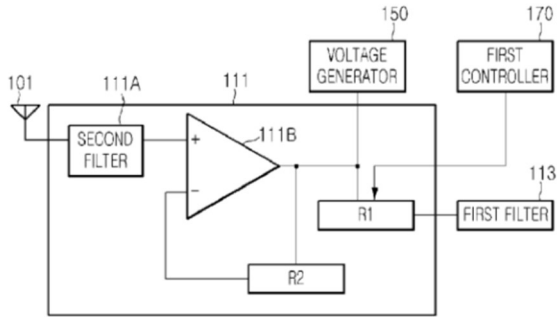
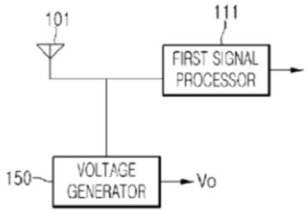
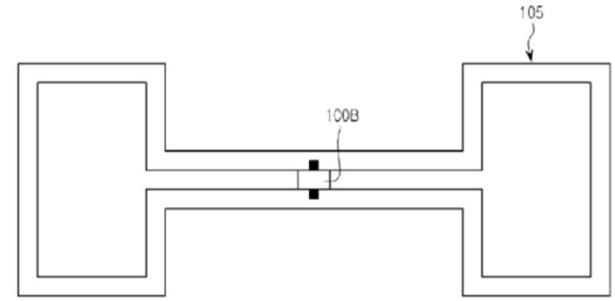
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	The first power amplifier 137 amplifies a signal modulated by the first modulator 135 to a transmission level, and the amplified signal passes through the first coupler 143 and is transmitted through the transmission antenna 103. Kim–277 at [0063] A signal modulated by the second modulator 139 is amplified by the second power amplifier 141, and the amplified signal is coupled to the first coupler 143 and transmitted through the transmission antenna 103. Here, elements on the transmission path using the first modulator 135 and the transmission path using the second modulator 139 can change depending on a transmission frequency. For example, the power amplifier on one of the paths can be removed. Kim–277 at [0065] The transmission antenna 103 is connected to the first power amplifier 137 or the second power amplifier 141 through the first coupler 143. Kim–277 at [0066] The tag device 100 can comprise a reception antenna 101 and the transmission antenna 103, or transmit/receive signals using one antenna and a duplexer. There is no limitation in the structure and the number of the antennas. Kim–277 at [0069] Referring to FIG. 3, the first signal processor 111 comprises a second filter 111A, a first log amplifier 111B, resistors R1 and R2. The second filter 111A is connected to the reception antenna 101. The positive terminal (+) of the first log amplifier 111B is connected to the second filter 111A, and the negative terminal (−) of the log amplifier 111B is connected to the second resistor R2 of a negative feedback circuit. The output terminal of the first log amplifier 111B is connected to the first filter 113 through the first resistor R1. Kim–277 at [0071] Also, the first log amplifier 111B can comprise at least one of a gain amplification circuit, a power amplification circuit, and a signal conversion circuit. The gain amplification circuit amplifies a signal according to a voltage gain to output an unstable high frequency signal in a state easy to recover. A reception signal whose gain has been amplified by the gain amplification circuit has a reduced bit error rate and has a high recognition rate even under a fading environment. Such a reception signal can be recovered to a stable signal even in a section where a reception level is about −90 dBm. The power

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	amplification circuit secondarily amplifies and outputs the power of a signal whose gain has been amplified by the gain amplification circuit. The signal conversion circuit converts an RF signal amplified by the power amplification circuit, for example, a signal in a band of 900 MHz into a DC level analog signal proportional to a decibel value. Kim–277 at [0072] The amplification gain of the first log amplifier 111B can be controlled by the first resistor R1 and the second resistor R2. The second resistor R2 has fixed resistance, and the first resistor R1 is a variable resistor whose resistance is varied by the first controller 170. The second resistor R2 can be connected between the output terminal of the first log amplifier 111B and a connection point of the negative feedback circuit, or between the first resistor R1 and the first filter 113. Here, the first resistor R1 and the second resistor R2 connected to the first log amplifier 111B can serve as a gain control circuit of the first log amplifier 111B. Kim–277 at [0073] The amplification gain of the first log amplifier 111B can be controlled by math FIG. 1 below. For example, the amplification gain of the first log amplifier 111B is controlled within the range of about 0 dB-20 dB according to a numerical value of the first resistor R1. Kim–277 at [0076] Referring to FIG. 4, the voltage generator 150 can generate a voltage Vo using the electromagnetic energy of a high frequency signal received from the reception antenna 101. That is, the voltage generator 150 is a voltage oscillation circuit or a voltage multiplier circuit, and can be realized using a plurality of detection diodes and capacitors connected in multiple steps. The voltage generator 150 sequentially repeatedly rectifies an RF signal received through the reception antenna 101 into a DC voltage to increase the rectified DC voltage. The voltage generated by the voltage generator 150 is supplied to each part through a logic board. Kim–277 at [0078] Referring to FIG. 5, the second signal processor 115 comprises a first operation amplifier 116 and a fourth resistor R4. The third signal processor 117 comprises a second operation amplifier 118, a fifth resistor R5, and a third resistor R3. The fourth signal processor 119 comprises a first comparator 120, a sixth resistor R6, and a seventh resistor R7. Kim–277 at [0079]

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	The first filter 113 is connected to the positive terminal (+) of the first operation amplifier 116, and the fourth resistor R4 and the third resistor R3 of the negative feedback circuit are connected to the negative terminal (−) of the first operation amplifier 116 in parallel. A reference voltage of the first controller 170 is input to the positive terminal (+) of the second operation amplifier 118, and a fifth resistor R5 of the negative feedback circuit is connected to the negative terminal (−) of the second operation amplifier 118. The third resistor R3 is connected between the negative terminal (−) of the first operation amplifier 116 and the negative terminal (−) of the second operation amplifier 118. The output terminal of the first operation amplifier 116 is connected to the positive terminal (+) of the first comparator 120 through the sixth resistor R6, and connected to the fourth resistor R4 in parallel. The output terminal of the second operation amplifier 118 is connected to the negative terminal (−) of the first comparator 120 through the seventh resistor R7. The positive terminal (+) and negative terminal (−) of the first comparator 120 can be mutually changed and is not limited thereto. Kim–277 at [0080] The first operation amplifier 116 amplifies the gain of a signal that has passed through the first filter 113 to output the same. At this point, the gain is controlled by the fourth resistor R4 of a first feedback circuit of the first operation amplifier 116. The second operation amplifier 118 amplifies the reference voltage of the first controller 170 input to the positive terminal (+) of the second operation amplifier 118 to output the same. An output signal of the second operation amplifier 118 controls the level of a signal input to the negative terminal (−) of the first operation amplifier 116 through the fifth resistor R5 of a second feedback circuit, the third resistor R3, which is a feedback circuit, and the fourth resistor R4 of the first feedback circuit. Accordingly, the output signal of the second operation amplifier 118 changes according to the reference voltage of the first controller 170. The amplification gain of the first operation amplifier 116 is controlled by a change in the output signal of the second operation amplifier 118. That is, the amplification gains of the second operation amplifier 118 and the first operation amplifier 116 are controlled using the reference voltage of the first controller 170, so that the sensitivity of a reception signal output to the first operation amplifier 116 can be controlled. Kim–277 at [0081] Also, since the negative terminals (−) of the first operation amplifier 116 and the second operation amplifier 118 are connected to each other, the output signals of them can have an inverted phase. For example, a signal processed by the first and second operation amplifiers 116 and 118 is a DC level analog signal. When the output signal of the first operation amplifier 116 is a high level, the output signal of the second operation amplifier 118 becomes a low level.

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	Kim–277 at [0082] The first comparator 120 of the fourth signal processor 119 compares the output signal of the first operation amplifier 116 with the output signal of the second operation amplifier 118, and outputs a digital signal to the first controller 170 according to the comparison result. Here, the first controller 170 can recover a digital signal more completely by delivering synchronization information to the fourth signal processor 119. Here, the digital signal of the fourth signal processor 119 is input to the first controller 170 as a transistor-transistor logic (TTL)/complementary metal oxide semiconductor (CMOS) signal. Kim–277 at [0083] FIG. 6 is a view illustrating a modified example of an antenna of a tag device 100 according to the first embodiment. Kim–277 at [0084] Referring to FIG. 6, the tag device 100 comprises an IC chip 100B and a single antenna 105. The IC chip can comprise the first reception module 110, the first transmission module 130, the first controller 170, and the voltage generator 150 of FIG. 1. The antenna 105 is a transmission/reception antenna, and is formed in a closed loop type, for example, and has a structure in which the IC chip 100B has been mounted between two sides facing each other. The IC chip 100B can transmit or receive a signal through the antenna 105, there is no limitation in the structure of the antenna. *See also* Kim–277 at [0012], [0054], [0067], and [0088]. To the extent this limitation is not disclosed by Kim–277, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kim–277, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
2. The mobile device of claim 1 wherein the antenna is tuned to operate at 13.56 MHz.	Kim–277 expressly or inherently discloses "[t]he mobile device of claim 1 wherein the antenna is tuned to operate at 13.56 MHz." For example: Kim–277 at Figure 1

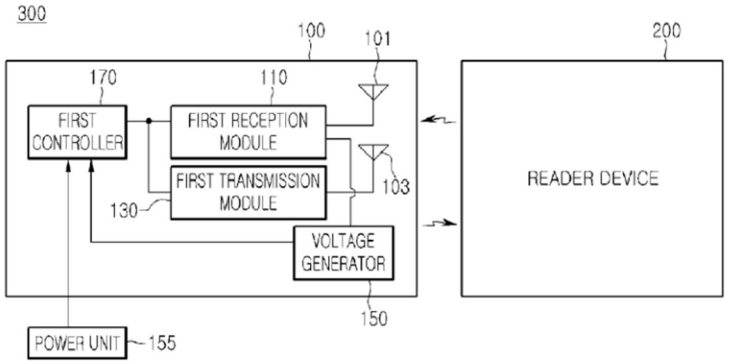
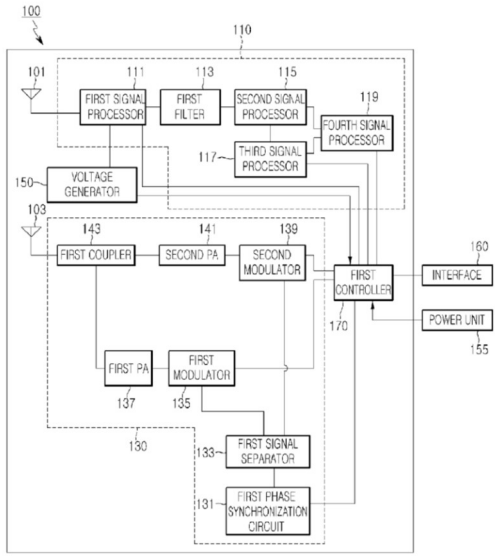
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	[Fig. 1]  Kim–277 at Figure 2 [Fig. 2]  Kim–277 at Figure 3

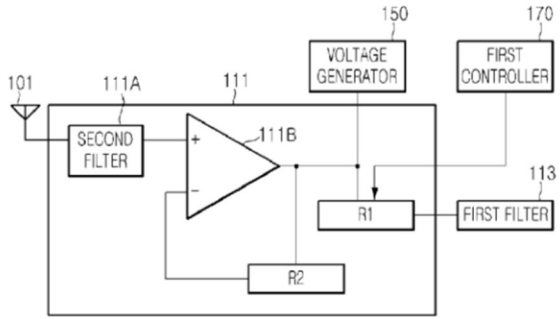
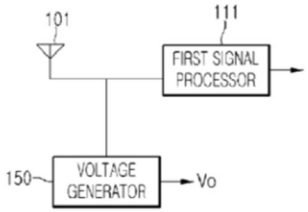
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	[Fig. 3]  Kim–277 at Figure 4 [Fig. 4]  Kim–277 at Figure 6 [Fig. 6]  Kim–277 at [0024] FIG. 6 is a view illustrating an example of an antenna of a tag device according to the first embodiment.

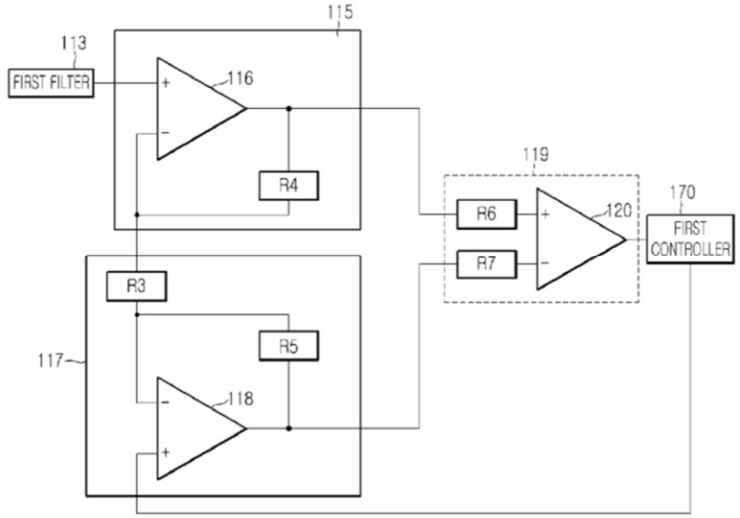
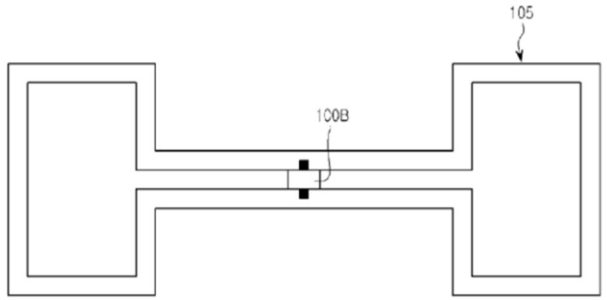
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	Kim–277 at [0034] The RF frequency tag of the RFID system 300 can be classified into a low frequency (LF) tag of 124-134 kHz used for access control and animal management, a high frequency (HF) tag of 13.56 MHz used for an integrated circuit (IC) card and an identification card, an ultra HF (UHF) tag of 400-915 MHz used for identification of containers in distribution and circulation, and a microwave tag of 2.45 GHz. Also, a 5.8 GHz tag can be used for telematics. These communication bands are provided for an exemplary purpose, and can change within the technical spirit and the scope of the embodiments. Kim–277 at [0036] The tag device 100 comprises a first reception module 110, a first transmission module 130, a voltage generator 150, and a first controller 170. The first reception module 110 can decode high frequency signals received through a reception antenna 101, and the decoded signals are delivered to the first controller 170. Here, the first reception module 110 converts high frequency signals into digital signals using a log amplifier and a comparator. Since the first reception module 110 does not use general a superheterodyne method, a sequential low frequency method, an intermediate frequency synthesis method, the number of parts can be reduced and a circuit size can be minimized. Kim–277 at [0040] During the passive mode, the first transmission module 130 transmits a transmission signal through a transmission antenna 103 in a backscatter method. Kim–277 at [0045] The first signal processor 111 filters RF signals in a predetermined frequency band from RF signals received through an reception antenna 101, amplifies a gain of the RF signals, and processes the RF signals into DC level analog signals. For example, the first signal processor 111 can output the high frequency signals into baseband signals using a log amplifier, or the high frequency signals into baseband signals using an RF pin diode. Here, the log amplifier can be applied to a system requiring long distance communication and high sensitivity. The RF pin diode can be used for low price and short distance communication. An embodiment is described to use the log amplifier. Kim–277 at [0063] A signal modulated by the second modulator 139 is amplified by the second power amplifier 141, and the amplified signal is coupled to the first coupler 143 and transmitted through the transmission antenna 103. Here, elements on the transmission path using the first modulator 135 and the transmission path using the

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	second modulator 139 can change depending on a transmission frequency. For example, the power amplifier on one of the paths can be removed. Kim–277 at [0065] The transmission antenna 103 is connected to the first power amplifier 137 or the second power amplifier 141 through the first coupler 143. Kim–277 at [0066] The tag device 100 can comprise a reception antenna 101 and the transmission antenna 103, or transmit/receive signals using one antenna and a duplexer. There is no limitation in the structure and the number of the antennas. Kim–277 at [0069] Referring to FIG. 3, the first signal processor 111 comprises a second filter 111A, a first log amplifier 111B, resistors R1 and R2. The second filter 111A is connected to the reception antenna 101. The positive terminal (+) of the first log amplifier 111B is connected to the second filter 111A, and the negative terminal (−) of the log amplifier 111B is connected to the second resistor R2 of a negative feedback circuit. The output terminal of the first log amplifier 111B is connected to the first filter 113 through the first resistor R1. Kim–277 at [0076] Referring to FIG. 4, the voltage generator 150 can generate a voltage Vo using the electromagnetic energy of a high frequency signal received from the reception antenna 101. That is, the voltage generator 150 is a voltage oscillation circuit or a voltage multiplier circuit, and can be realized using a plurality of detection diodes and capacitors connected in multiple steps. The voltage generator 150 sequentially repeatedly rectifies an RF signal received through the reception antenna 101 into a DC voltage to increase the rectified DC voltage. The voltage generated by the voltage generator 150 is supplied to each part through a logic board. Kim–277 at [0083] FIG. 6 is a view illustrating a modified example of an antenna of a tag device 100 according to the first embodiment. Kim–277 at [0084]

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	Referring to FIG. 6, the tag device 100 comprises an IC chip 100B and a single antenna 105. The IC chip can comprise the first reception module 110, the first transmission module 130, the first controller 170, and the voltage generator 150 of FIG. 1. The antenna 105 is a transmission/reception antenna, and is formed in a closed loop type, for example, and has a structure in which the IC chip 100B has been mounted between two sides facing each other. The IC chip 100B can transmit or receive a signal through the antenna 105, there is no limitation in the structure of the antenna. Kim–277 at [0088] The RFID system 300A performs communication through at least one RF frequency of an LF of 124-134 kHz, 13.56 MHz, 400-915 MHz, 2.45 GHz, and 5.8 GHz. *See also* Kim–277 at [0060] and [0067]. To the extent this limitation is not disclosed by Kim–277, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kim–277, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 1 above.
3. The mobile device of claim 1 wherein the antenna comprises an inductive element too small to draw enough power sufficient to operate the smartcard controller from an interrogating radio frequency (RF) field.	Kim–277 expressly or inherently discloses "[t]he mobile device of claim 1 wherein the antenna comprises an inductive element too small to draw enough power sufficient to operate the smartcard controller from an interrogating radio frequency (RF) field." For example: Kim–277 at Abstract Embodiments relate to a tag device, a reader device, and a radio frequency identification (RFID) system. The Q embodiment provides a tag device comprising: a reception module converting a received high frequency signal into a scale level, and Q converting the converted scale level into a digital signal to output the same; a transmission module modulating a transmission signal M to output the same; and a controller controlling the reception module and the transmission module. The tag device communicates o with the reader device through wireless short distance communication. Kim–277 at Figure 1

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	[Fig. 1]  Kim–277 at Figure 2 [Fig. 2]  Kim–277 at Figure 3

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	[Fig. 3]  Kim–277 at Figure 4 [Fig. 4]  Kim–277 at Figure 5

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	[Fig. 5]  Kim–277 at Figure 6 [Fig. 6]  Kim–277 at [0010] An embodiment provides a tag device comprising: a reception module converting a received high frequency signal into a scale level, and converting the converted scale level into a digital signal to output the same; a transmission module modulating a transmission signal to output the same; and a controller controlling the reception module and the transmission module.

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	Kim–277 at [0024] FIG. 6 is a view illustrating an example of an antenna of a tag device according to the first embodiment. Kim–277 at [0033] The tag device 100 has various shapes and sizes, and is classified into an active tag and a passive tag depending on whether power is supplied, classified into a low frequency system and a high frequency system depending on a frequency in use. The tag device 100 is attached to persons, automobiles, goods, livestock, and buildings, and contains detailed information of a corresponding object. Also, the tag device 100 can be mounted on a smart card to perform user authentication and electronic payment. The tag device 100 can be attached or function in cooperation with another device to provide various services. Kim–277 at [0036] The tag device 100 comprises a first reception module 110, a first transmission module 130, a voltage generator 150, and a first controller 170. The first reception module 110 can decode high frequency signals received through a reception antenna 101, and the decoded signals are delivered to the first controller 170. Here, the first reception module 110 converts high frequency signals into digital signals using a log amplifier and a comparator. Since the first reception module 110 does not use general a superheterodyne method, a sequential low frequency method, an intermediate frequency synthesis method, the number of parts can be reduced and a circuit size can be minimized. Kim–277 at [0037] The controller 170 controls a drive in the active mode or a passive mode depending on whether power is supplied. For example, the tag device 100 is driven by the power unit 155 during the active mode, and driven by a voltage generated by the voltage generator 150 during the passive mode. Also, the active mode and the passive mode can be changed depending on whether power is supplied from the power unit 155, or can be switched from the passive mode to the active mode when power is supplied to the power unit 155. One of the active mode and the passive mode can be changed to the other according to a manipulation signal of an operator. Kim–277 at [0038] The voltage generator 150 receives a scale signal corresponding to a high frequency signal processed by the first reception module 110 to generate a voltage necessary for the tag device. The voltage generator 150 supplies a generated voltage to each part through a logic board or the first controller 170 of the tag device 100, so that the tag device 100 can operate in the passive mode.

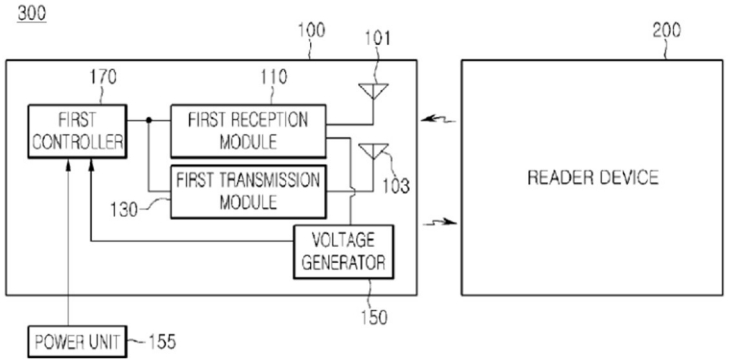
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	Kim–277 at [0040] During the passive mode, the first transmission module 130 transmits a transmission signal through a transmission antenna 103 in a backscatter method. Kim–277 at [0045] The first signal processor 111 filters RF signals in a predetermined frequency band from RF signals received through an reception antenna 101, amplifies a gain of the RF signals, and processes the RF signals into DC level analog signals. For example, the first signal processor 111 can output the high frequency signals into baseband signals using a log amplifier, or the high frequency signals into baseband signals using an RF pin diode. Here, the log amplifier can be applied to a system requiring long distance communication and high sensitivity. The RF pin diode can be used for low price and short distance communication. An embodiment is described to use the log amplifier. Kim–277 at [0046] At this point, the first controller 170 outputs a control signal to the first signal processor 111, and the control signal controls the gain of the first signal processor 111. Kim–277 at [0049] The output of the third signal processor 117 changes depending on a reference voltage of the first controller 170, and the changed output is output to the fourth signal processor 119. Here, the second signal processor 115 controls a signal output from the first signal processor 111 using a signal fed back from the third signal processor 117. At this point, the amplification gain of the second signal processor 115 is compensated for according to various reference voltages of the first controller 170. Kim–277 at [0050] The fourth signal processor 119 compares an amplified signal of the second signal processor 115 with an output signal of the third signal processor 117 to output a digital signal as a result of the comparison. That is, the fourth signal processor 119 serves as an analog-to-digital converter. A digital signal of the fourth signal processor 119 changes depending on the output level of the third signal processor 117, and is input to the first controller 170. Kim–277 at [0051] The first controller 170 controls the gain of the first signal processor 111 depending on a received signal state, and controls the reference voltage of the third signal processor 117. Accordingly, the first controller

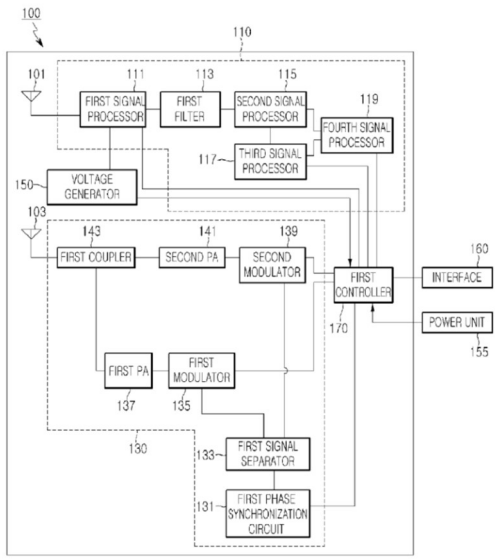
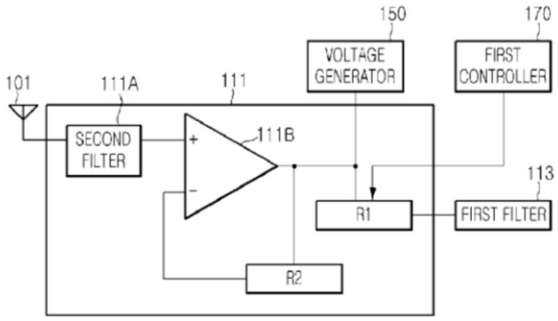
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	170 can control the sensitivity of a digital signal output to the fourth signal processor 119. Also, the first controller 170 delivers synchronization information to the fourth signal processor 119 to control a comparison operation. Kim–277 at [0052] The first controller 170 can store tag information. For example, the first controller 170 can comprise a memory (not shown), or the tag information can be separately stored. The first controller 170 has a communication protocol to control radio communication with the reader device 200, and provides tag information when an information request signal is received from the reader device 200. Also, the first controller 170 analyzes codes of signals decoded by the first to fourth signal processors 113, 115, 117, and 119, and generates transmission data. Kim–277 at [0055] Here, the first controller 170 delivers a digital transmission signal to the first modulator 135 and/or the second modulator 139 of the first transmission module 130. At this point, when the first transmission module is in the passive mode, the first modulator 135 operates. When the first transmission module is in the active mode, the second modulator 139 operates. Kim–277 at [0056] Also, an interface 160 is connected to a mobile terminal, for example, to receive manipulation signals of the active mode and the passive mode and deliver the signals to the first controller 170. The first controller 170 can select the active mode or the passive mode depending on the manipulation signal. That is, during the passive mode, the first controller 170 can output a digital transmission signal to the first modulator 135, and during the active mode, the first controller 170 can output a digital transmission signal to the second modulator 139. Embodiments may not use the power unit 155 and the interface 160. Since the construction of the tag device may change depending on an installation environment or application service, the embodiments are not limited to using the power unit 155 and the interface 160. Kim–277 at [0057] Here, the voltage generator 150 receives an analog signal from the first signal processor 111 to multiply the signal in order to generate a voltage. The generated voltage is supplied to each part through the first controller 170 of the tag device 100. That is, a voltage for the passive mode is supplied. The voltage generator 150 can be realized using a voltage oscillation circuit or a voltage multiplier circuit, for example. The voltage generator 150 can comprise a plurality of detection diodes and capacitors connected in a multiple steps.

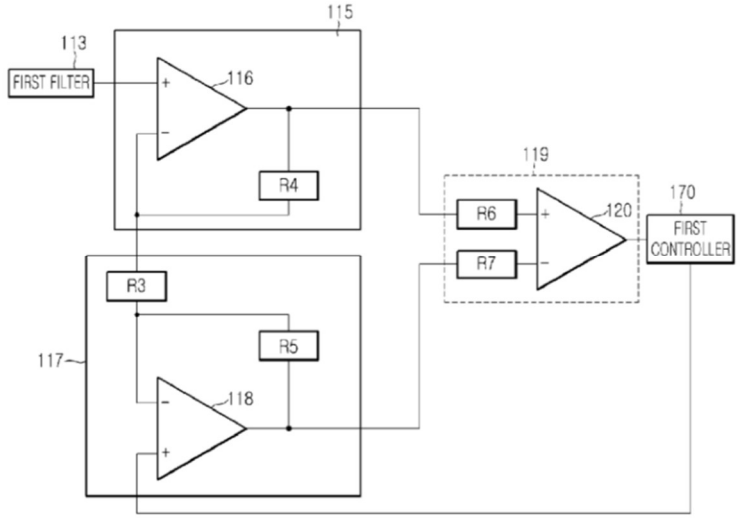
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	Kim–277 at [0058] The power unit 155 can be realized in a battery and a voltage control circuit and supplies power to each part through the first controller 170. Here, through the powers of the voltage generator 150 and the power unit 155 have been described to be supplied through the first controller 170, this is only one example, the powers can be supplied through a logic board of the device. Kim–277 at [0063] A signal modulated by the second modulator 139 is amplified by the second power amplifier 141, and the amplified signal is coupled to the first coupler 143 and transmitted through the transmission antenna 103. Here, elements on the transmission path using the first modulator 135 and the transmission path using the second modulator 139 can change depending on a transmission frequency. For example, the power amplifier on one of the paths can be removed. Kim–277 at [0065] The transmission antenna 103 is connected to the first power amplifier 137 or the second power amplifier 141 through the first coupler 143. Kim–277 at [0066] The tag device 100 can comprise a reception antenna 101 and the transmission antenna 103, or transmit/receive signals using one antenna and a duplexer. There is no limitation in the structure and the number of the antennas. Kim–277 at [0069] Referring to FIG. 3, the first signal processor 111 comprises a second filter 111A, a first log amplifier 111B, resistors R1 and R2. The second filter 111A is connected to the reception antenna 101. The positive terminal (+) of the first log amplifier 111B is connected to the second filter 111A, and the negative terminal (−) of the log amplifier 111B is connected to the second resistor R2 of a negative feedback circuit. The output terminal of the first log amplifier 111B is connected to the first filter 113 through the first resistor R1. Kim–277 at [0076] Referring to FIG. 4, the voltage generator 150 can generate a voltage Vo using the electromagnetic energy of a high frequency signal received from the reception antenna 101. That is, the voltage generator 150 is a voltage oscillation circuit or a voltage multiplier circuit, and can be realized using a plurality of detection

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	diodes and capacitors connected in multiple steps. The voltage generator 150 sequentially repeatedly rectifies an RF signal received through the reception antenna 101 into a DC voltage to increase the rectified DC voltage. The voltage generated by the voltage generator 150 is supplied to each part through a logic board. Kim–277 at [0079] The first filter 113 is connected to the positive terminal (+) of the first operation amplifier 116, and the fourth resistor R4 and the third resistor R3 of the negative feedback circuit are connected to the negative terminal (−) of the first operation amplifier 116 in parallel. A reference voltage of the first controller 170 is input to the positive terminal (+) of the second operation amplifier 118, and a fifth resistor R5 of the negative feedback circuit is connected to the negative terminal (−) of the second operation amplifier 118. The third resistor R3 is connected between the negative terminal (−) of the first operation amplifier 116 and the negative terminal (−) of the second operation amplifier 118. The output terminal of the first operation amplifier 116 is connected to the positive terminal (+) of the first comparator 120 through the sixth resistor R6, and connected to the fourth resistor R4 in parallel. The output terminal of the second operation amplifier 118 is connected to the negative terminal (−) of the first comparator 120 through the seventh resistor R7. The positive terminal (+) and negative terminal (−) of the first comparator 120 can be mutually changed and is not limited thereto. Kim–277 at [0080] The first operation amplifier 116 amplifies the gain of a signal that has passed through the first filter 113 to output the same. At this point, the gain is controlled by the fourth resistor R4 of a first feedback circuit of the first operation amplifier 116. The second operation amplifier 118 amplifies the reference voltage of the first controller 170 input to the positive terminal (+) of the second operation amplifier 118 to output the same. An output signal of the second operation amplifier 118 controls the level of a signal input to the negative terminal (−) of the first operation amplifier 116 through the fifth resistor R5 of a second feedback circuit, the third resistor R3, which is a feedback circuit, and the fourth resistor R4 of the first feedback circuit. Accordingly, the output signal of the second operation amplifier 118 changes according to the reference voltage of the first controller 170. The amplification gain of the first operation amplifier 116 is controlled by a change in the output signal of the second operation amplifier 118. That is, the amplification gains of the second operation amplifier 118 and the first operation amplifier 116 are controlled using the reference voltage of the first controller 170, so that the sensitivity of a reception signal output to the first operation amplifier 116 can be controlled. Kim–277 at [0083]

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	FIG. 6 is a view illustrating a modified example of an antenna of a tag device 100 according to the first embodiment. Kim–277 at [0084] Referring to FIG. 6, the tag device 100 comprises an IC chip 100B and a single antenna 105. The IC chip can comprise the first reception module 110, the first transmission module 130, the first controller 170, and the voltage generator 150 of FIG. 1. The antenna 105 is a transmission/reception antenna, and is formed in a closed loop type, for example, and has a structure in which the IC chip 100B has been mounted between two sides facing each other. The IC chip 100B can transmit or receive a signal through the antenna 105, there is no limitation in the structure of the antenna. Kim–277 at [0118] The reader device 200A according to the second embodiment can remove a phase change by movement of a tag device and remove recognition reduction by an energy delivery position. Also, the second embodiment improves a signal recognition distance, improves an energy supply to the tag device, and improves the reception sensitivity of the tag device by removing a reason why the intensity of a signal reduces as a distance between the reader device 200A and the tag device increases. The reader device can stably communicate with the tag device on the whole. Kim–277 at [0137] Since embodiments provide various modulation methods to the tag device and/or the reader device, the system can stably maintain communication according to an electromagnetic wave environment. *See also* Kim–277 at [0012], [0017], [0054], [0060], [0067], [0082], [0088], and [0138]. To the extent this limitation is not disclosed by Kim–277, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kim–277, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 1 above.
4. The mobile device of claim 1 wherein the smartcard controller is coupled to be powered by the mobile device.	Kim–277 expressly or inherently discloses "[t]he mobile device of claim 1 wherein the smartcard controller is coupled to be powered by the mobile device." For example: Kim–277 at Abstract Embodiments relate to a tag device, a reader device, and a radio frequency identification (RFID) system. The Q embodiment provides a tag device comprising: a reception module converting a received high

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	frequency signal into a scale level, and Q converting the converted scale level into a digital signal to output the same; a transmission module modulating a transmission signal M to output the same; and a controller controlling the reception module and the transmission module. The tag device communicates o with the reader device through wireless short distance communication. Kim–277 at Figure 1 [Fig. 1]  Kim–277 at Figure 2

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	[Fig. 2]  Kim–277 at Figure 3 [Fig. 3]  Kim–277 at Figure 5

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	[Fig. 5]  Kim–277 at [0005] Embodiments provide a tag device that can efficiently use power by providing various modulation methods and operating in a passive mode modulation method or an active mode modulation method depending on the kind of power. Kim–277 at [0010] An embodiment provides a tag device comprising: a reception module converting a received high frequency signal into a scale level, and converting the converted scale level into a digital signal to output the same; a transmission module modulating a transmission signal to output the same; and a controller controlling the reception module and the transmission module. Kim–277 at [0015] Embodiments can efficiently use power of a tag device. Kim–277 at [0033] The tag device 100 has various shapes and sizes, and is classified into an active tag and a passive tag depending on whether power is supplied, classified into a low frequency system and a high frequency

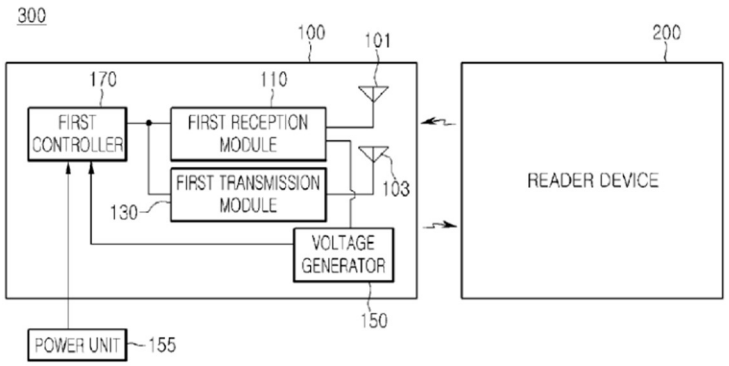
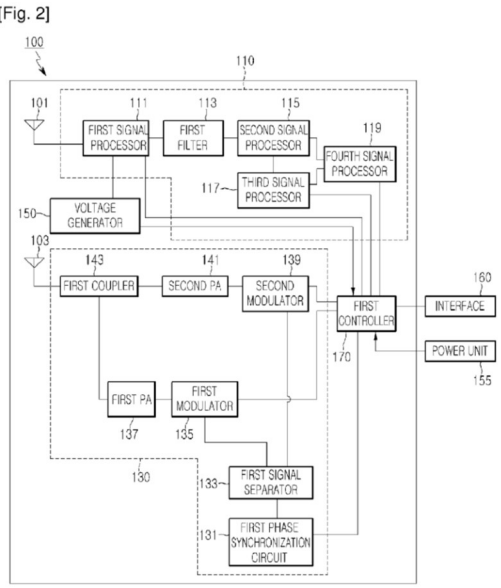
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	system depending on a frequency in use. The tag device 100 is attached to persons, automobiles, goods, livestock, and buildings, and contains detailed information of a corresponding object. Also, the tag device 100 can be mounted on a smart card to perform user authentication and electronic payment. The tag device 100 can be attached or function in cooperation with another device to provide various services. Kim–277 at [0035] Here, the tag device 100 can operate in an active mode driven by power supplied from a power unit 155, and a passive mode not requiring power. That is, the tag device 100 can operate in a semi-active mode. Here, when the tag device 100 is mounted on a terminal such as a mobile terminal, the tag device 100 can use the battery power of the mobile terminal as the power unit 155. Kim–277 at [0036] The tag device 100 comprises a first reception module 110, a first transmission module 130, a voltage generator 150, and a first controller 170. The first reception module 110 can decode high frequency signals received through a reception antenna 101, and the decoded signals are delivered to the first controller 170. Here, the first reception module 110 converts high frequency signals into digital signals using a log amplifier and a comparator. Since the first reception module 110 does not use general a superheterodyne method, a sequential low frequency method, an intermediate frequency synthesis method, the number of parts can be reduced and a circuit size can be minimized. Kim–277 at [0037] The controller 170 controls a drive in the active mode or a passive mode depending on whether power is supplied. For example, the tag device 100 is driven by the power unit 155 during the active mode, and driven by a voltage generated by the voltage generator 150 during the passive mode. Also, the active mode and the passive mode can be changed depending on whether power is supplied from the power unit 155, or can be switched from the passive mode to the active mode when power is supplied to the power unit 155. One of the active mode and the passive mode can be changed to the other according to a manipulation signal of an operator. Kim–277 at [0038] The voltage generator 150 receives a scale signal corresponding to a high frequency signal processed by the first reception module 110 to generate a voltage necessary for the tag device. The voltage generator 150 supplies a generated voltage to each part through a logic board or the first controller 170 of the tag device 100, so that the tag device 100 can operate in the passive mode.

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	Kim–277 at [0041] Here, during the passive mode and the active mode, the first transmission module 130 can use different modulation methods. For example, the first transmission module 130 can use amplitude shift keying (ASK) during the passive mode, and can selectively use frequency shift keying (FSK), quadrature phase shift keying (QPSK), and phase shift keying (PSK) during the active mode. Kim–277 at [0046] At this point, the first controller 170 outputs a control signal to the first signal processor 111, and the control signal controls the gain of the first signal processor 111. Kim–277 at [0049] The output of the third signal processor 117 changes depending on a reference voltage of the first controller 170, and the changed output is output to the fourth signal processor 119. Here, the second signal processor 115 controls a signal output from the first signal processor 111 using a signal fed back from the third signal processor 117. At this point, the amplification gain of the second signal processor 115 is compensated for according to various reference voltages of the first controller 170. Kim–277 at [0050] The fourth signal processor 119 compares an amplified signal of the second signal processor 115 with an output signal of the third signal processor 117 to output a digital signal as a result of the comparison. That is, the fourth signal processor 119 serves as an analog-to-digital converter. A digital signal of the fourth signal processor 119 changes depending on the output level of the third signal processor 117, and is input to the first controller 170. Kim–277 at [0051] The first controller 170 controls the gain of the first signal processor 111 depending on a received signal state, and controls the reference voltage of the third signal processor 117. Accordingly, the first controller 170 can control the sensitivity of a digital signal output to the fourth signal processor 119. Also, the first controller 170 delivers synchronization information to the fourth signal processor 119 to control a comparison operation. Kim–277 at [0052] The first controller 170 can store tag information. For example, the first controller 170 can comprise a memory (not shown), or the tag information can be separately stored. The first controller 170 has a

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	communication protocol to control radio communication with the reader device 200, and provides tag information when an information request signal is received from the reader device 200. Also, the first controller 170 analyzes codes of signals decoded by the first to fourth signal processors 113, 115, 117, and 119, and generates transmission data. Kim–277 at [0055] Here, the first controller 170 delivers a digital transmission signal to the first modulator 135 and/or the second modulator 139 of the first transmission module 130. At this point, when the first transmission module is in the passive mode, the first modulator 135 operates. When the first transmission module is in the active mode, the second modulator 139 operates. Kim–277 at [0056] Also, an interface 160 is connected to a mobile terminal, for example, to receive manipulation signals of the active mode and the passive mode and deliver the signals to the first controller 170. The first controller 170 can select the active mode or the passive mode depending on the manipulation signal. That is, during the passive mode, the first controller 170 can output a digital transmission signal to the first modulator 135, and during the active mode, the first controller 170 can output a digital transmission signal to the second modulator 139. Embodiments may not use the power unit 155 and the interface 160. Since the construction of the tag device may change depending on an installation environment or application service, the embodiments are not limited to using the power unit 155 and the interface 160. Kim–277 at [0057] Here, the voltage generator 150 receives an analog signal from the first signal processor 111 to multiply the signal in order to generate a voltage. The generated voltage is supplied to each part through the first controller 170 of the tag device 100. That is, a voltage for the passive mode is supplied. The voltage generator 150 can be realized using a voltage oscillation circuit or a voltage multiplier circuit, for example. The voltage generator 150 can comprise a plurality of detection diodes and capacitors connected in a multiple steps. Kim–277 at [0058] The power unit 155 can be realized in a battery and a voltage control circuit and supplies power to each part through the first controller 170. Here, through the powers of the voltage generator 150 and the power unit 155 have been described to be supplied through the first controller 170, this is only one example, the powers can be supplied through a logic board of the device.

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	Kim–277 at [0064] The above-described first transmission module 130 can operate in the active mode and the passive mode by the power of the voltage generator 150 and the power unit 155. Also, the first transmission module 130 can be set to switch to the active mode when power is supplied through the power unit 155 with the passive mode set as a default. The setting of the passive mode and the active mode can change and is not limited thereto. Kim–277 at [0079] The first filter 113 is connected to the positive terminal (+) of the first operation amplifier 116, and the fourth resistor R4 and the third resistor R3 of the negative feedback circuit are connected to the negative terminal (−) of the first operation amplifier 116 in parallel. A reference voltage of the first controller 170 is input to the positive terminal (+) of the second operation amplifier 118, and a fifth resistor R5 of the negative feedback circuit is connected to the negative terminal (−) of the second operation amplifier 118. The third resistor R3 is connected between the negative terminal (−) of the first operation amplifier 116 and the negative terminal (−) of the second operation amplifier 118. The output terminal of the first operation amplifier 116 is connected to the positive terminal (+) of the first comparator 120 through the sixth resistor R6, and connected to the fourth resistor R4 in parallel. The output terminal of the second operation amplifier 118 is connected to the negative terminal (−) of the first comparator 120 through the seventh resistor R7. The positive terminal (+) and negative terminal (−) of the first comparator 120 can be mutually changed and is not limited thereto. Kim–277 at [0080] The first operation amplifier 116 amplifies the gain of a signal that has passed through the first filter 113 to output the same. At this point, the gain is controlled by the fourth resistor R4 of a first feedback circuit of the first operation amplifier 116. The second operation amplifier 118 amplifies the reference voltage of the first controller 170 input to the positive terminal (+) of the second operation amplifier 118 to output the same. An output signal of the second operation amplifier 118 controls the level of a signal input to the negative terminal (−) of the first operation amplifier 116 through the fifth resistor R5 of a second feedback circuit, the third resistor R3, which is a feedback circuit, and the fourth resistor R4 of the first feedback circuit. Accordingly, the output signal of the second operation amplifier 118 changes according to the reference voltage of the first controller 170. The amplification gain of the first operation amplifier 116 is controlled by a change in the output signal of the second operation amplifier 118. That is, the amplification gains of the second operation amplifier 118 and the first operation amplifier 116 are

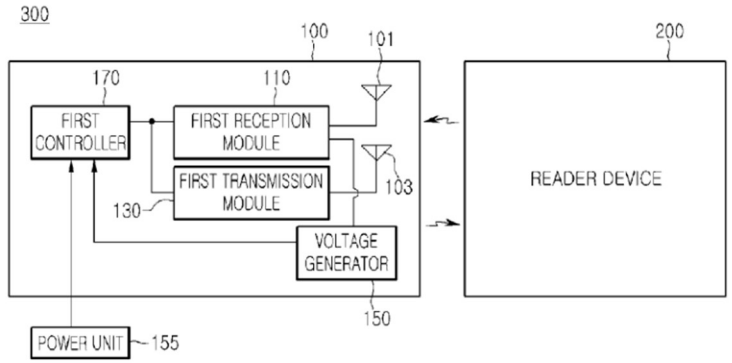
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	controlled using the reference voltage of the first controller 170, so that the sensitivity of a reception signal output to the first operation amplifier 116 can be controlled. Kim–277 at [0084] Referring to FIG. 6, the tag device 100 comprises an IC chip 100B and a single antenna 105. The IC chip can comprise the first reception module 110, the first transmission module 130, the first controller 170, and the voltage generator 150 of FIG. 1. The antenna 105 is a transmission/reception antenna, and is formed in a closed loop type, for example, and has a structure in which the IC chip 100B has been mounted between two sides facing each other. The IC chip 100B can transmit or receive a signal through the antenna 105, there is no limitation in the structure of the antenna. Kim–277 at [0089] The tag device 100A can operate in at least one of a passive mode, an active mode, and a semi-active mode. The tag device 100A can operate in the semi-active mode, that is, in the passive mode and the active mode depending on whether power is supplied as in the tag device of the first embodiment. Kim–277 at [0136] Embodiments can efficiently use the power of the tag device. *See also* Kim–277 at [0012], [0054], and [0082]. To the extent this limitation is not disclosed by Kim–277, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kim–277, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 1 above.
5. The mobile device of claim 1 wherein the performance enhancement circuits are coupled to be powered by the mobile device.	Kim–277 expressly or inherently discloses "[t]he mobile device of claim 1 wherein the performance enhancement circuits are coupled to be powered by the mobile device." For example: Kim–277 at Figure 1

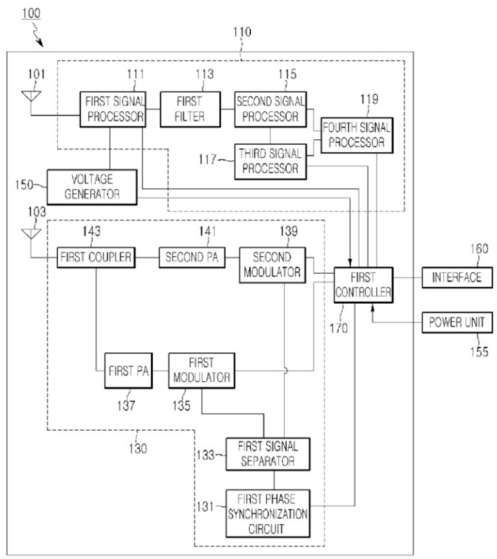
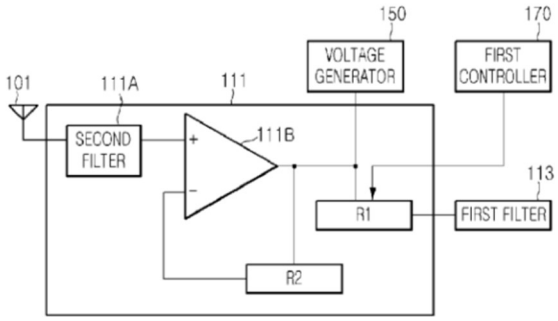
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	[Fig. 1]  Kim–277 at Figure 2 [Fig. 2]  Kim–277 at [0005] Embodiments provide a tag device that can efficiently use power by providing various modulation methods and operating in a passive mode modulation method or an active mode modulation method depending on the kind of power.

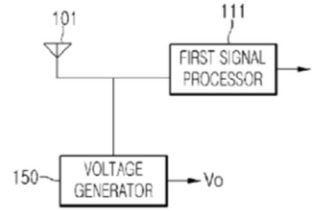
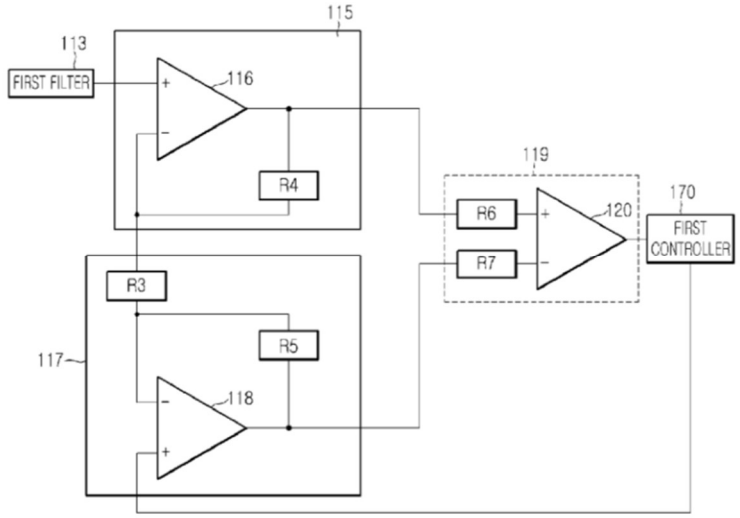
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	Kim–277 at [0015] Embodiments can efficiently use power of a tag device. Kim–277 at [0033] The tag device 100 has various shapes and sizes, and is classified into an active tag and a passive tag depending on whether power is supplied, classified into a low frequency system and a high frequency system depending on a frequency in use. The tag device 100 is attached to persons, automobiles, goods, livestock, and buildings, and contains detailed information of a corresponding object. Also, the tag device 100 can be mounted on a smart card to perform user authentication and electronic payment. The tag device 100 can be attached or function in cooperation with another device to provide various services. Kim–277 at [0035] Here, the tag device 100 can operate in an active mode driven by power supplied from a power unit 155, and a passive mode not requiring power. That is, the tag device 100 can operate in a semi-active mode. Here, when the tag device 100 is mounted on a terminal such as a mobile terminal, the tag device 100 can use the battery power of the mobile terminal as the power unit 155. Kim–277 at [0037] The controller 170 controls a drive in the active mode or a passive mode depending on whether power is supplied. For example, the tag device 100 is driven by the power unit 155 during the active mode, and driven by a voltage generated by the voltage generator 150 during the passive mode. Also, the active mode and the passive mode can be changed depending on whether power is supplied from the power unit 155, or can be switched from the passive mode to the active mode when power is supplied to the power unit 155. One of the active mode and the passive mode can be changed to the other according to a manipulation signal of an operator. Kim–277 at [0041] Here, during the passive mode and the active mode, the first transmission module 130 can use different modulation methods. For example, the first transmission module 130 can use amplitude shift keying (ASK) during the passive mode, and can selectively use frequency shift keying (FSK), quadrature phase shift keying (QPSK), and phase shift keying (PSK) during the active mode. Kim–277 at [0055]

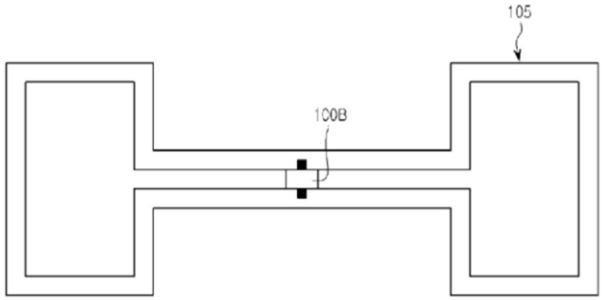
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	Here, the first controller 170 delivers a digital transmission signal to the first modulator 135 and/or the second modulator 139 of the first transmission module 130. At this point, when the first transmission module is in the passive mode, the first modulator 135 operates. When the first transmission module is in the active mode, the second modulator 139 operates. Kim–277 at [0056] Also, an interface 160 is connected to a mobile terminal, for example, to receive manipulation signals of the active mode and the passive mode and deliver the signals to the first controller 170. The first controller 170 can select the active mode or the passive mode depending on the manipulation signal. That is, during the passive mode, the first controller 170 can output a digital transmission signal to the first modulator 135, and during the active mode, the first controller 170 can output a digital transmission signal to the second modulator 139. Embodiments may not use the power unit 155 and the interface 160. Since the construction of the tag device may change depending on an installation environment or application service, the embodiments are not limited to using the power unit 155 and the interface 160. Kim–277 at [0064] The above-described first transmission module 130 can operate in the active mode and the passive mode by the power of the voltage generator 150 and the power unit 155. Also, the first transmission module 130 can be set to switch to the active mode when power is supplied through the power unit 155 with the passive mode set as a default. The setting of the passive mode and the active mode can change and is not limited thereto. Kim–277 at [0089] The tag device 100A can operate in at least one of a passive mode, an active mode, and a semi-active mode. The tag device 100A can operate in the semi-active mode, that is, in the passive mode and the active mode depending on whether power is supplied as in the tag device of the first embodiment. Kim–277 at [0136] Embodiments can efficiently use the power of the tag device. To the extent this limitation is not disclosed by Kim–277, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kim–277, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 1 above.

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6. The mobile device of claim 1 wherein the mobile device comprises a mobile phone.	Kim–277 expressly or inherently discloses "[t]he mobile device of claim 1 wherein the mobile device comprises a mobile phone." For example: Kim–277 at [0134] > Although embodiments have been described with reference to a number of illustrative embodiments thereof, it should be understood that numerous other modifications and embodiments can be devised by those skilled in the art that will fall within the spirit and scope of the principles of this disclosure. More particularly, various variations and modifications are possible in the component parts and/or arrangements of the subject combination arrangement within the scope of the disclosure, the drawings and the appended claims. In addition to variations and modifications in the component parts and/or arrangements, alternative uses will also be apparent to those skilled in the art. *See also* Kim–277 at [0033]. To the extent this limitation is not disclosed by Kim–277, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kim–277, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 1 above.
7[pre]. A mobile device comprising:	Kim–277 expressly or inherently discloses "[a] mobile device." For example: *See* above at 1[pre]. To the extent this limitation is not disclosed by Kim–277, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kim–277, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[7a] a smartcard controller;	Kim–277 expressly or inherently discloses "a smartcard controller." For example: *See* above at [1a]. To the extent this limitation is not disclosed by Kim–277, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kim–277, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[7b] an antenna; and	Kim–277 expressly or inherently discloses "an antenna." For example: *See* above at [1b].

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	To the extent this limitation is not disclosed by Kim–277, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kim–277, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[7c] performance enhancement circuits coupled between the smartcard controller and the antenna, wherein the performance enhancement circuits include an amplifier and an active transmit driver circuit, and	Kim–277 expressly or inherently discloses "performance enhancement circuits coupled between the smartcard controller and the antenna, wherein the performance enhancement circuits include an amplifier and an active transmit driver circuit." For example: Kim–277 at Abstract Embodiments relate to a tag device, a reader device, and a radio frequency identification (RFID) system. The Q embodiment provides a tag device comprising: a reception module converting a received high frequency signal into a scale level, and Q converting the converted scale level into a digital signal to output the same; a transmission module modulating a transmission signal M to output the same; and a controller controlling the reception module and the transmission module. The tag device communicates o with the reader device through wireless short distance communication. Kim–277 at Figure 1 [Fig. 1]  Kim–277 at Figure 2

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	[Fig. 2]  Kim–277 at Figure 3 [Fig. 3]  Kim–277 at Figure 4

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	[Fig. 4]  Kim–277 at Figure 5 [Fig. 5]  Kim–277 at Figure 6

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	[Fig. 6]  Kim–277 at [0005] Embodiments provide a tag device that can efficiently use power by providing various modulation methods and operating in a passive mode modulation method or an active mode modulation method depending on the kind of power. Kim–277 at [0010] An embodiment provides a tag device comprising: a reception module converting a received high frequency signal into a scale level, and converting the converted scale level into a digital signal to output the same; a transmission module modulating a transmission signal to output the same; and a controller controlling the reception module and the transmission module. Kim–277 at [0012] An embodiment provides a radio frequency identification system comprising: a tag device comprising: a first reception module converting a received high frequency signal into a scale level, and outputting the converted scale level reception signal as a digital signal; a first transmission module modulating an information request signal to output the same; and a first controller controlling the first reception module and the first transmission module; and a reader device comprising: a second reception module converting a high frequency signal received from the tag device into a scale level, and outputting the converted scale level reception signal as a digital signal; a second transmission module modulating an information request signal, and transmitting the signal to the tag device; and a second controller controlling the second reception module and the second transmission module. Kim–277 at [0024] FIG. 6 is a view illustrating an example of an antenna of a tag device according to the first embodiment.

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	Kim–277 at [0033] The tag device 100 has various shapes and sizes, and is classified into an active tag and a passive tag depending on whether power is supplied, classified into a low frequency system and a high frequency system depending on a frequency in use. The tag device 100 is attached to persons, automobiles, goods, livestock, and buildings, and contains detailed information of a corresponding object. Also, the tag device 100 can be mounted on a smart card to perform user authentication and electronic payment. The tag device 100 can be attached or function in cooperation with another device to provide various services. Kim–277 at [0035] Here, the tag device 100 can operate in an active mode driven by power supplied from a power unit 155, and a passive mode not requiring power. That is, the tag device 100 can operate in a semi-active mode. Here, when the tag device 100 is mounted on a terminal such as a mobile terminal, the tag device 100 can use the battery power of the mobile terminal as the power unit 155. Kim–277 at [0036] The tag device 100 comprises a first reception module 110, a first transmission module 130, a voltage generator 150, and a first controller 170. The first reception module 110 can decode high frequency signals received through a reception antenna 101, and the decoded signals are delivered to the first controller 170. Here, the first reception module 110 converts high frequency signals into digital signals using a log amplifier and a comparator. Since the first reception module 110 does not use general a superheterodyne method, a sequential low frequency method, an intermediate frequency synthesis method, the number of parts can be reduced and a circuit size can be minimized. Kim–277 at [0037] The controller 170 controls a drive in the active mode or a passive mode depending on whether power is supplied. For example, the tag device 100 is driven by the power unit 155 during the active mode, and driven by a voltage generated by the voltage generator 150 during the passive mode. Also, the active mode and the passive mode can be changed depending on whether power is supplied from the power unit 155, or can be switched from the passive mode to the active mode when power is supplied to the power unit 155. One of the active mode and the passive mode can be changed to the other according to a manipulation signal of an operator. Kim–277 at [0038]

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	The voltage generator 150 receives a scale signal corresponding to a high frequency signal processed by the first reception module 110 to generate a voltage necessary for the tag device. The voltage generator 150 supplies a generated voltage to each part through a logic board or the first controller 170 of the tag device 100, so that the tag device 100 can operate in the passive mode. Kim–277 at [0040] During the passive mode, the first transmission module 130 transmits a transmission signal through a transmission antenna 103 in a backscatter method. Kim–277 at [0041] Here, during the passive mode and the active mode, the first transmission module 130 can use different modulation methods. For example, the first transmission module 130 can use amplitude shift keying (ASK) during the passive mode, and can selectively use frequency shift keying (FSK), quadrature phase shift keying (QPSK), and phase shift keying (PSK) during the active mode. Kim–277 at [0045] The first signal processor 111 filters RF signals in a predetermined frequency band from RF signals received through an reception antenna 101, amplifies a gain of the RF signals, and processes the RF signals into DC level analog signals. For example, the first signal processor 111 can output the high frequency signals into baseband signals using a log amplifier, or the high frequency signals into baseband signals using an RF pin diode. Here, the log amplifier can be applied to a system requiring long distance communication and high sensitivity. The RF pin diode can be used for low price and short distance communication. An embodiment is described to use the log amplifier. Kim–277 at [0046] At this point, the first controller 170 outputs a control signal to the first signal processor 111, and the control signal controls the gain of the first signal processor 111. Kim–277 at [0048] The second signal processor 115 controls the gain of the first filter 113 and amplifies a signal, and the amplified signal is input to the fourth signal processor 119. Kim–277 at [0049] The output of the third signal processor 117 changes depending on a reference voltage of the first controller 170, and the changed output is output to the fourth signal processor 119. Here, the second

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	signal processor 115 controls a signal output from the first signal processor 111 using a signal fed back from the third signal processor 117. At this point, the amplification gain of the second signal processor 115 is compensated for according to various reference voltages of the first controller 170. Kim–277 at [0050] The fourth signal processor 119 compares an amplified signal of the second signal processor 115 with an output signal of the third signal processor 117 to output a digital signal as a result of the comparison. That is, the fourth signal processor 119 serves as an analog-to-digital converter. A digital signal of the fourth signal processor 119 changes depending on the output level of the third signal processor 117, and is input to the first controller 170. Kim–277 at [0051] The first controller 170 controls the gain of the first signal processor 111 depending on a received signal state, and controls the reference voltage of the third signal processor 117. Accordingly, the first controller 170 can control the sensitivity of a digital signal output to the fourth signal processor 119. Also, the first controller 170 delivers synchronization information to the fourth signal processor 119 to control a comparison operation. Kim–277 at [0052] The first controller 170 can store tag information. For example, the first controller 170 can comprise a memory (not shown), or the tag information can be separately stored. The first controller 170 has a communication protocol to control radio communication with the reader device 200, and provides tag information when an information request signal is received from the reader device 200. Also, the first controller 170 analyzes codes of signals decoded by the first to fourth signal processors 113, 115, 117, and 119, and generates transmission data. Kim–277 at [0053] The first transmission module 130 comprises a first phase synchronization circuit 131, a first signal separator 133, a first modulator 135, a first power amplifier 137, a second modulator 139, a second power amplifier 141, and a first coupler 143. Kim–277 at [0055] Here, the first controller 170 delivers a digital transmission signal to the first modulator 135 and/or the second modulator 139 of the first transmission module 130. At this point, when the first transmission

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	module is in the passive mode, the first modulator 135 operates. When the first transmission module is in the active mode, the second modulator 139 operates. Kim–277 at [0056] Also, an interface 160 is connected to a mobile terminal, for example, to receive manipulation signals of the active mode and the passive mode and deliver the signals to the first controller 170. The first controller 170 can select the active mode or the passive mode depending on the manipulation signal. That is, during the passive mode, the first controller 170 can output a digital transmission signal to the first modulator 135, and during the active mode, the first controller 170 can output a digital transmission signal to the second modulator 139. Embodiments may not use the power unit 155 and the interface 160. Since the construction of the tag device may change depending on an installation environment or application service, the embodiments are not limited to using the power unit 155 and the interface 160. Kim–277 at [0057] Here, the voltage generator 150 receives an analog signal from the first signal processor 111 to multiply the signal in order to generate a voltage. The generated voltage is supplied to each part through the first controller 170 of the tag device 100. That is, a voltage for the passive mode is supplied. The voltage generator 150 can be realized using a voltage oscillation circuit or a voltage multiplier circuit, for example. The voltage generator 150 can comprise a plurality of detection diodes and capacitors connected in a multiple steps. Kim–277 at [0058] The power unit 155 can be realized in a battery and a voltage control circuit and supplies power to each part through the first controller 170. Here, through the powers of the voltage generator 150 and the power unit 155 have been described to be supplied through the first controller 170, this is only one example, the powers can be supplied through a logic board of the device. Kim–277 at [0060] The first power amplifier 137 amplifies a signal modulated by the first modulator 135 to a transmission level, and the amplified signal passes through the first coupler 143 and is transmitted through the transmission antenna 103. Kim–277 at [0061] The second modulator 139 modulates a digital transmission signal into a second analog signal. The second modulator 139 can modulate a signal using FSK or QPSK for example. The second modulator 139

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	can comprise a plurality of mixers, adders, and orthogonal signal conversion circuits. The second modulator 139 can change the phase of a transmission signal by 90° to convert a signal in the form in which four signals I^+, I^-, Q^+ and Q^- are added. Kim–277 at [0062] Here, though the first modulator 135 exemplarily uses ASK modulation, and the second modulator 139 exemplarily uses QPSK modulation, the first modulator 135 and the second modulator 139 can use one of ASK, FSK, and QPSK modulations. The first and second modulators 135 and 139 can use the same modulation or a different modulation. Kim–277 at [0063] A signal modulated by the second modulator 139 is amplified by the second power amplifier 141, and the amplified signal is coupled to the first coupler 143 and transmitted through the transmission antenna 103. Here, elements on the transmission path using the first modulator 135 and the transmission path using the second modulator 139 can change depending on a transmission frequency. For example, the power amplifier on one of the paths can be removed. Kim–277 at [0064] The above-described first transmission module 130 can operate in the active mode and the passive mode by the power of the voltage generator 150 and the power unit 155. Also, the first transmission module 130 can be set to switch to the active mode when power is supplied through the power unit 155 with the passive mode set as a default. The setting of the passive mode and the active mode can change and is not limited thereto. Kim–277 at [0065] The transmission antenna 103 is connected to the first power amplifier 137 or the second power amplifier 141 through the first coupler 143. Kim–277 at [0066] The tag device 100 can comprise a reception antenna 101 and the transmission antenna 103, or transmit/receive signals using one antenna and a duplexer. There is no limitation in the structure and the number of the antennas. Kim–277 at [0069]

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	Referring to FIG. 3, the first signal processor 111 comprises a second filter 111A, a first log amplifier 111B, resistors R1 and R2. The second filter 111A is connected to the reception antenna 101. The positive terminal (+) of the first log amplifier 111B is connected to the second filter 111A, and the negative terminal (−) of the log amplifier 111B is connected to the second resistor R2 of a negative feedback circuit. The output terminal of the first log amplifier 111B is connected to the first filter 113 through the first resistor R1. Kim–277 at [0071] Also, the first log amplifier 111B can comprise at least one of a gain amplification circuit, a power amplification circuit, and a signal conversion circuit. The gain amplification circuit amplifies a signal according to a voltage gain to output an unstable high frequency signal in a state easy to recover. A reception signal whose gain has been amplified by the gain amplification circuit has a reduced bit error rate and has a high recognition rate even under a fading environment. Such a reception signal can be recovered to a stable signal even in a section where a reception level is about −90 dBm. The power amplification circuit secondarily amplifies and outputs the power of a signal whose gain has been amplified by the gain amplification circuit. The signal conversion circuit converts an RF signal amplified by the power amplification circuit, for example, a signal in a band of 900 MHz into a DC level analog signal proportional to a decibel value. Kim–277 at [0072] The amplification gain of the first log amplifier 111B can be controlled by the first resistor R1 and the second resistor R2. The second resistor R2 has fixed resistance, and the first resistor R1 is a variable resistor whose resistance is varied by the first controller 170. The second resistor R2 can be connected between the output terminal of the first log amplifier 111B and a connection point of the negative feedback circuit, or between the first resistor R1 and the first filter 113. Here, the first resistor R1 and the second resistor R2 connected to the first log amplifier 111B can serve as a gain control circuit of the first log amplifier 111B. Kim–277 at [0073] The amplification gain of the first log amplifier 111B can be controlled by math FIG. 1 below. For example, the amplification gain of the first log amplifier 111B is controlled within the range of about 0 dB-20 dB according to a numerical value of the first resistor R1. Kim–277 at [0076]

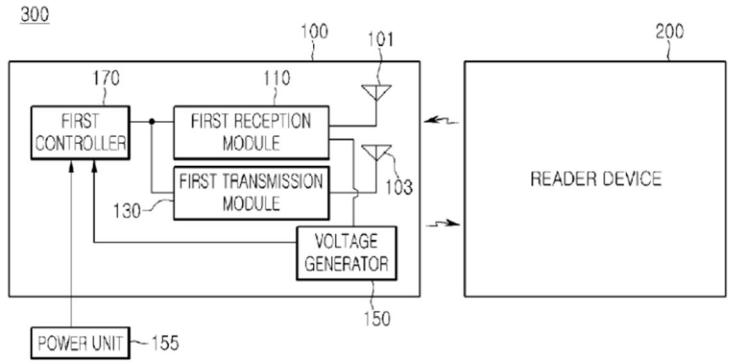
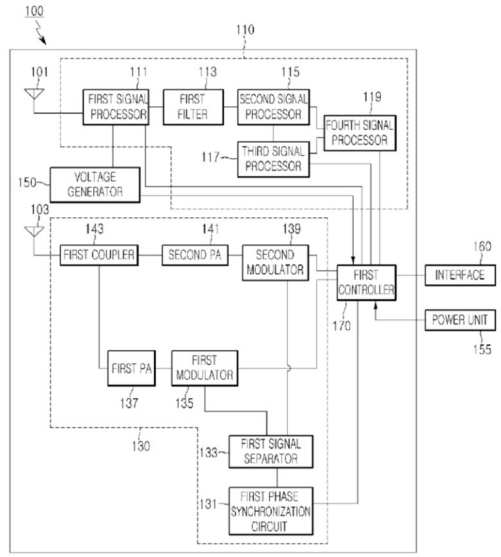
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	Referring to FIG. 4, the voltage generator 150 can generate a voltage Vo using the electromagnetic energy of a high frequency signal received from the reception antenna 101. That is, the voltage generator 150 is a voltage oscillation circuit or a voltage multiplier circuit, and can be realized using a plurality of detection diodes and capacitors connected in multiple steps. The voltage generator 150 sequentially repeatedly rectifies an RF signal received through the reception antenna 101 into a DC voltage to increase the rectified DC voltage. The voltage generated by the voltage generator 150 is supplied to each part through a logic board. Kim–277 at [0078] Referring to FIG. 5, the second signal processor 115 comprises a first operation amplifier 116 and a fourth resistor R4. The third signal processor 117 comprises a second operation amplifier 118, a fifth resistor R5, and a third resistor R3. The fourth signal processor 119 comprises a first comparator 120, a sixth resistor R6, and a seventh resistor R7. Kim–277 at [0079] The first filter 113 is connected to the positive terminal (+) of the first operation amplifier 116, and the fourth resistor R4 and the third resistor R3 of the negative feedback circuit are connected to the negative terminal (−) of the first operation amplifier 116 in parallel. A reference voltage of the first controller 170 is input to the positive terminal (+) of the second operation amplifier 118, and a fifth resistor R5 of the negative feedback circuit is connected to the negative terminal (−) of the second operation amplifier 118. The third resistor R3 is connected between the negative terminal (−) of the first operation amplifier 116 and the negative terminal (−) of the second operation amplifier 118. The output terminal of the first operation amplifier 116 is connected to the positive terminal (+) of the first comparator 120 through the sixth resistor R6, and connected to the fourth resistor R4 in parallel. The output terminal of the second operation amplifier 118 is connected to the negative terminal (−) of the first comparator 120 through the seventh resistor R7. The positive terminal (+) and negative terminal (−) of the first comparator 120 can be mutually changed and is not limited thereto. Kim–277 at [0080] The first operation amplifier 116 amplifies the gain of a signal that has passed through the first filter 113 to output the same. At this point, the gain is controlled by the fourth resistor R4 of a first feedback circuit of the first operation amplifier 116. The second operation amplifier 118 amplifies the reference voltage of the first controller 170 input to the positive terminal (+) of the second operation amplifier 118 to output the same. An output signal of the second operation amplifier 118 controls the level of a signal input to the negative terminal (−) of the first operation amplifier 116 through the fifth resistor R5 of a second feedback

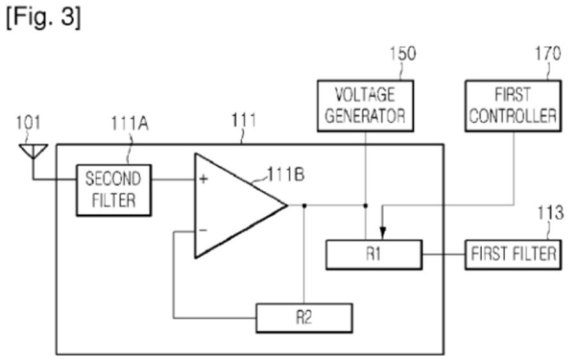
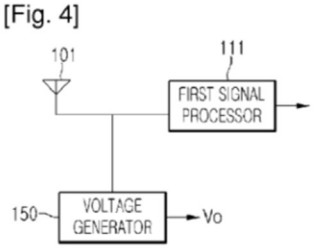
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	circuit, the third resistor R3, which is a feedback circuit, and the fourth resistor R4 of the first feedback circuit. Accordingly, the output signal of the second operation amplifier 118 changes according to the reference voltage of the first controller 170. The amplification gain of the first operation amplifier 116 is controlled by a change in the output signal of the second operation amplifier 118. That is, the amplification gains of the second operation amplifier 118 and the first operation amplifier 116 are controlled using the reference voltage of the first controller 170, so that the sensitivity of a reception signal output to the first operation amplifier 116 can be controlled. Kim–277 at [0081] Also, since the negative terminals (−) of the first operation amplifier 116 and the second operation amplifier 118 are connected to each other, the output signals of them can have an inverted phase. For example, a signal processed by the first and second operation amplifiers 116 and 118 is a DC level analog signal. When the output signal of the first operation amplifier 116 is a high level, the output signal of the second operation amplifier 118 becomes a low level. Kim–277 at [0082] The first comparator 120 of the fourth signal processor 119 compares the output signal of the first operation amplifier 116 with the output signal of the second operation amplifier 118, and outputs a digital signal to the first controller 170 according to the comparison result. Here, the first controller 170 can recover a digital signal more completely by delivering synchronization information to the fourth signal processor 119. Here, the digital signal of the fourth signal processor 119 is input to the first controller 170 as a transistor-transistor logic (TTL)/complementary metal oxide semiconductor (CMOS) signal. Kim–277 at [0083] FIG. 6 is a view illustrating a modified example of an antenna of a tag device 100 according to the first embodiment. Kim–277 at [0084] Referring to FIG. 6, the tag device 100 comprises an IC chip 100B and a single antenna 105. The IC chip can comprise the first reception module 110, the first transmission module 130, the first controller 170, and the voltage generator 150 of FIG. 1. The antenna 105 is a transmission/reception antenna, and is formed in a closed loop type, for example, and has a structure in which the IC chip 100B has been mounted between two sides facing each other. The IC chip 100B can transmit or receive a signal through the antenna 105, there is no limitation in the structure of the antenna.

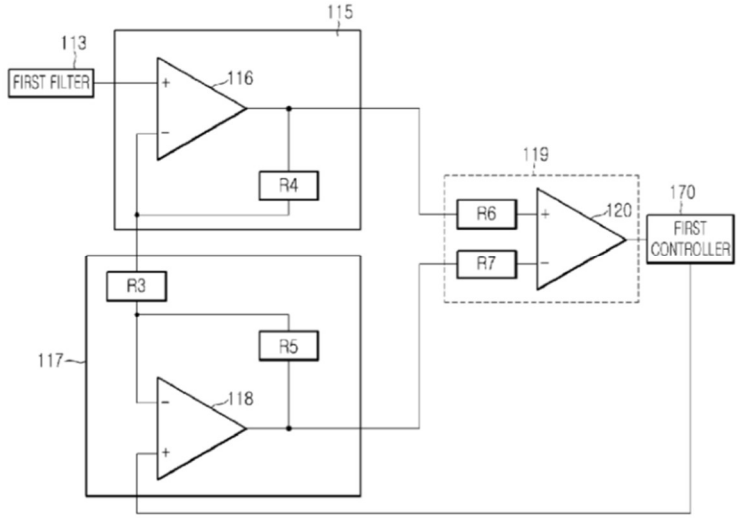
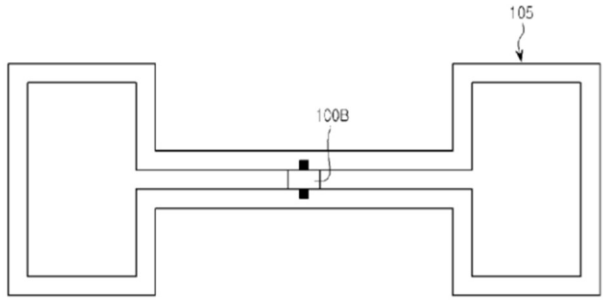
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	Kim–277 at [0089] The tag device 100A can operate in at least one of a passive mode, an active mode, and a semi-active mode. The tag device 100A can operate in the semi-active mode, that is, in the passive mode and the active mode depending on whether power is supplied as in the tag device of the first embodiment. *See also* above at [1c]. *See also* Kim–277 at [0054], [0067], and [0088]. To the extent this limitation is not disclosed by Kim–277, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kim–277, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[7d] wherein the amplifier is coupled to amplify a signal received from the antenna and to provide an amplified signal to the smartcard controller.	Kim–277 expressly or inherently discloses "wherein the amplifier is coupled to amplify a signal received from the antenna and to provide an amplified signal to the smartcard controller." For example: *See* above at [1d]. To the extent this limitation is not disclosed by Kim–277, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kim–277, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
8. The mobile device of claim 7 wherein the antenna is tuned to operate at 13.56 MHz.	Kim–277 expressly or inherently discloses "[t]he mobile device of claim 7 wherein the antenna is tuned to operate at 13.56 MHz." *See* above at claim 2. To the extent this limitation is not disclosed by Kim–277, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kim–277, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 7 above.
9. The mobile device of claim 7 wherein the antenna comprises an inductive element too small to draw enough power sufficient to operate the smartcard controller	Kim–277 expressly or inherently discloses "[t]he mobile device of claim 7 wherein the antenna comprises an inductive element too small to draw enough power sufficient to operate the smartcard controller from an interrogating radio frequency (RF) field." *See* above at claim 3.

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from an interrogating radio frequency (RF) field.	To the extent this limitation is not disclosed by Kim–277, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kim–277, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 7 above.
10. The mobile device of claim 7 wherein the smartcard controller is coupled to be powered by the mobile device.	Kim–277 expressly or inherently discloses "[t]he mobile device of claim 7 wherein the smartcard controller is coupled to be powered by the mobile device." For example: *See* above at claim 4. To the extent this limitation is not disclosed by Kim–277, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kim–277, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 7 above.
11. The mobile device of claim 7 wherein the performance enhancement circuits are coupled to be powered by the mobile device.	Kim–277 expressly or inherently discloses "[t]he mobile device of claim 7 wherein the performance enhancement circuits are coupled to be powered by the mobile device." For example: *See* above at claim 5. To the extent this limitation is not disclosed by Kim–277, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kim–277, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 7 above.
12. The mobile device of claim 7 wherein the mobile device comprises a mobile phone.	Kim–277 expressly or inherently discloses "[t]he mobile device of claim 7 wherein the mobile device comprises a mobile phone." For example: *See* above at claim 6. To the extent this limitation is not disclosed by Kim–277, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kim–277, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 7 above.

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13[pre]. A mobile device comprising:	Kim–277 expressly or inherently discloses "[a] mobile device." For example: *See* above at 1[pre]. To the extent this limitation is not disclosed by Kim–277, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kim–277, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[13a] a smartcard controller;	Kim–277 expressly or inherently discloses "a smartcard controller." For example: *See* above at [1a]. To the extent this limitation is not disclosed by Kim–277, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kim–277, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[13b] an antenna;	Kim–277 expressly or inherently discloses "an antenna." For example: *See* above at [1b]. To the extent this limitation is not disclosed by Kim–277, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kim–277, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[13c] an amplifier coupled to amplify signals received at the antenna and drive the smartcard controller; and	Kim–277 expressly or inherently discloses "an amplifier coupled to amplify signals received at the antenna and drive the smartcard controller." For example: *See* above at [1d]. To the extent this limitation is not disclosed by Kim–277, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kim–277, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[13d] a driver circuit to drive the antenna with data provided by the smartcard controller.	Kim–277 expressly or inherently discloses "a driver circuit to drive the antenna with data provided by the smartcard controller." For example: Kim–277 at Abstract Embodiments relate to a tag device, a reader device, and a radio frequency identification (RFID) system. The Q embodiment provides a tag device comprising: a reception module converting a received high frequency signal into a scale level, and Q converting the converted scale level into a digital signal to

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	output the same; a transmission module modulating a transmission signal M to output the same; and a controller controlling the reception module and the transmission module. The tag device communicates o with the reader device through wireless short distance communication. Kim–277 at Figure 1 [Fig. 1]  Kim–277 at Figure 2 [Fig. 2] 

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	Kim–277 at Figure 3  Kim–277 at Figure 4  Kim–277 at Figure 5

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	[Fig. 5]  Kim–277 at Figure 6 [Fig. 6]  Kim–277 at [0005] Embodiments provide a tag device that can efficiently use power by providing various modulation methods and operating in a passive mode modulation method or an active mode modulation method depending on the kind of power. Kim–277 at [0010]

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	An embodiment provides a tag device comprising: a reception module converting a received high frequency signal into a scale level, and converting the converted scale level into a digital signal to output the same; a transmission module modulating a transmission signal to output the same; and a controller controlling the reception module and the transmission module. Kim–277 at [0012] An embodiment provides a radio frequency identification system comprising: a tag device comprising: a first reception module converting a received high frequency signal into a scale level, and outputting the converted scale level reception signal as a digital signal; a first transmission module modulating an information request signal to output the same; and a first controller controlling the first reception module and the first transmission module; and a reader device comprising: a second reception module converting a high frequency signal received from the tag device into a scale level, and outputting the converted scale level reception signal as a digital signal; a second transmission module modulating an information request signal, and transmitting the signal to the tag device; and a second controller controlling the second reception module and the second transmission module. Kim–277 at [0024] FIG. 6 is a view illustrating an example of an antenna of a tag device according to the first embodiment. Kim–277 at [0033] The tag device 100 has various shapes and sizes, and is classified into an active tag and a passive tag depending on whether power is supplied, classified into a low frequency system and a high frequency system depending on a frequency in use. The tag device 100 is attached to persons, automobiles, goods, livestock, and buildings, and contains detailed information of a corresponding object. Also, the tag device 100 can be mounted on a smart card to perform user authentication and electronic payment. The tag device 100 can be attached or function in cooperation with another device to provide various services. Kim–277 at [0035] Here, the tag device 100 can operate in an active mode driven by power supplied from a power unit 155, and a passive mode not requiring power. That is, the tag device 100 can operate in a semi-active mode. Here, when the tag device 100 is mounted on a terminal such as a mobile terminal, the tag device 100 can use the battery power of the mobile terminal as the power unit 155. Kim–277 at [0036]

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	The tag device 100 comprises a first reception module 110, a first transmission module 130, a voltage generator 150, and a first controller 170. The first reception module 110 can decode high frequency signals received through a reception antenna 101, and the decoded signals are delivered to the first controller 170. Here, the first reception module 110 converts high frequency signals into digital signals using a log amplifier and a comparator. Since the first reception module 110 does not use general a superheterodyne method, a sequential low frequency method, an intermediate frequency synthesis method, the number of parts can be reduced and a circuit size can be minimized. Kim–277 at [0037] The controller 170 controls a drive in the active mode or a passive mode depending on whether power is supplied. For example, the tag device 100 is driven by the power unit 155 during the active mode, and driven by a voltage generated by the voltage generator 150 during the passive mode. Also, the active mode and the passive mode can be changed depending on whether power is supplied from the power unit 155, or can be switched from the passive mode to the active mode when power is supplied to the power unit 155. One of the active mode and the passive mode can be changed to the other according to a manipulation signal of an operator. Kim–277 at [0038] The voltage generator 150 receives a scale signal corresponding to a high frequency signal processed by the first reception module 110 to generate a voltage necessary for the tag device. The voltage generator 150 supplies a generated voltage to each part through a logic board or the first controller 170 of the tag device 100, so that the tag device 100 can operate in the passive mode. Kim–277 at [0040] During the passive mode, the first transmission module 130 transmits a transmission signal through a transmission antenna 103 in a backscatter method. Kim–277 at [0041] Here, during the passive mode and the active mode, the first transmission module 130 can use different modulation methods. For example, the first transmission module 130 can use amplitude shift keying (ASK) during the passive mode, and can selectively use frequency shift keying (FSK), quadrature phase shift keying (QPSK), and phase shift keying (PSK) during the active mode. Kim–277 at [0043]

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	Referring to FIG. 2, the tag device 100 comprises the first reception module 110, the first transmission module 130, and the voltage generator 150. The first reception module 110 comprises a first signal processor 111, a first filter 113, a second signal processor 115, a third signal processor 117, and a fourth signal processor 119. Kim–277 at [0045] The first signal processor 111 filters RF signals in a predetermined frequency band from RF signals received through an reception antenna 101, amplifies a gain of the RF signals, and processes the RF signals into DC level analog signals. For example, the first signal processor 111 can output the high frequency signals into baseband signals using a log amplifier, or the high frequency signals into baseband signals using an RF pin diode. Here, the log amplifier can be applied to a system requiring long distance communication and high sensitivity. The RF pin diode can be used for low price and short distance communication. An embodiment is described to use the log amplifier. Kim–277 at [0046] At this point, the first controller 170 outputs a control signal to the first signal processor 111, and the control signal controls the gain of the first signal processor 111. Kim–277 at [0049] The output of the third signal processor 117 changes depending on a reference voltage of the first controller 170, and the changed output is output to the fourth signal processor 119. Here, the second signal processor 115 controls a signal output from the first signal processor 111 using a signal fed back from the third signal processor 117. At this point, the amplification gain of the second signal processor 115 is compensated for according to various reference voltages of the first controller 170. Kim–277 at [0050] The fourth signal processor 119 compares an amplified signal of the second signal processor 115 with an output signal of the third signal processor 117 to output a digital signal as a result of the comparison. That is, the fourth signal processor 119 serves as an analog-to-digital converter. A digital signal of the fourth signal processor 119 changes depending on the output level of the third signal processor 117, and is input to the first controller 170. Kim–277 at [0051] The first controller 170 controls the gain of the first signal processor 111 depending on a received signal state, and controls the reference voltage of the third signal processor 117. Accordingly, the first controller

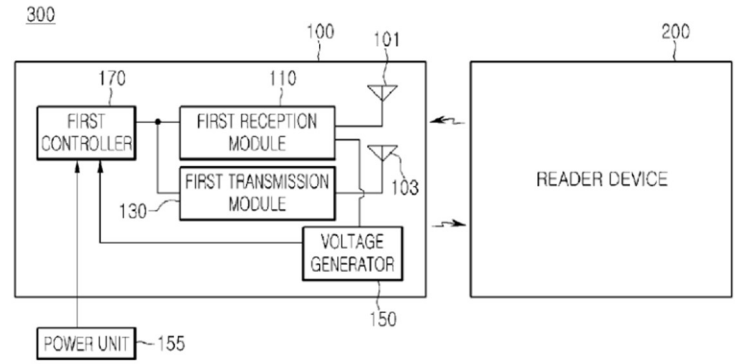
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	170 can control the sensitivity of a digital signal output to the fourth signal processor 119. Also, the first controller 170 delivers synchronization information to the fourth signal processor 119 to control a comparison operation. Kim–277 at [0052] The first controller 170 can store tag information. For example, the first controller 170 can comprise a memory (not shown), or the tag information can be separately stored. The first controller 170 has a communication protocol to control radio communication with the reader device 200, and provides tag information when an information request signal is received from the reader device 200. Also, the first controller 170 analyzes codes of signals decoded by the first to fourth signal processors 113, 115, 117, and 119, and generates transmission data. Kim–277 at [0053] The first transmission module 130 comprises a first phase synchronization circuit 131, a first signal separator 133, a first modulator 135, a first power amplifier 137, a second modulator 139, a second power amplifier 141, and a first coupler 143. Kim–277 at [0054] The first phase synchronization circuit 131 generates a reference signal under control of the first controller 170. The first signal separator 133 outputs the reference signal to the first modulator 135 and the second modulator 139. Here, the first signal separator 133 can be realized using a switch device such as a single pole double throw (SPDT) or a coupler, but is not limited thereto. Kim–277 at [0055] Here, the first controller 170 delivers a digital transmission signal to the first modulator 135 and/or the second modulator 139 of the first transmission module 130. At this point, when the first transmission module is in the passive mode, the first modulator 135 operates. When the first transmission module is in the active mode, the second modulator 139 operates. Kim–277 at [0056] Also, an interface 160 is connected to a mobile terminal, for example, to receive manipulation signals of the active mode and the passive mode and deliver the signals to the first controller 170. The first controller 170 can select the active mode or the passive mode depending on the manipulation signal. That is, during the passive mode, the first controller 170 can output a digital transmission signal to the first modulator 135, and during the active mode, the first controller 170 can output a digital transmission signal

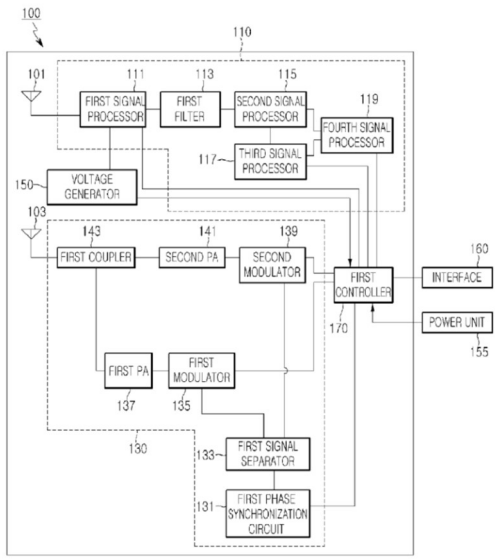
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	to the second modulator 139. Embodiments may not use the power unit 155 and the interface 160. Since the construction of the tag device may change depending on an installation environment or application service, the embodiments are not limited to using the power unit 155 and the interface 160. Kim–277 at [0057] Here, the voltage generator 150 receives an analog signal from the first signal processor 111 to multiply the signal in order to generate a voltage. The generated voltage is supplied to each part through the first controller 170 of the tag device 100. That is, a voltage for the passive mode is supplied. The voltage generator 150 can be realized using a voltage oscillation circuit or a voltage multiplier circuit, for example. The voltage generator 150 can comprise a plurality of detection diodes and capacitors connected in a multiple steps. Kim–277 at [0058] The power unit 155 can be realized in a battery and a voltage control circuit and supplies power to each part through the first controller 170. Here, through the powers of the voltage generator 150 and the power unit 155 have been described to be supplied through the first controller 170, this is only one example, the powers can be supplied through a logic board of the device. Kim–277 at [0059] The first modulator 135 modulates a digital transmission signal into a first analog signal using ASK. The first modulator 135 can comprise a rectifying filter, a low pass filter, and a level detector, and is not limited to thereto. Kim–277 at [0060] The first power amplifier 137 amplifies a signal modulated by the first modulator 135 to a transmission level, and the amplified signal passes through the first coupler 143 and is transmitted through the transmission antenna 103. Kim–277 at [0061] The second modulator 139 modulates a digital transmission signal into a second analog signal. The second modulator 139 can modulate a signal using FSK or QPSK for example. The second modulator 139 can comprise a plurality of mixers, adders, and orthogonal signal conversion circuits. The second modulator 139 can change the phase of a transmission signal by 90° to convert a signal in the form in which four signals I^+, I^-, Q^+ and Q^- are added.

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	Kim–277 at [0062] Here, though the first modulator 135 exemplarily uses ASK modulation, and the second modulator 139 exemplarily uses QPSK modulation, the first modulator 135 and the second modulator 139 can use one of ASK, FSK, and QPSK modulations. The first and second modulators 135 and 139 can use the same modulation or a different modulation. Kim–277 at [0063] A signal modulated by the second modulator 139 is amplified by the second power amplifier 141, and the amplified signal is coupled to the first coupler 143 and transmitted through the transmission antenna 103. Here, elements on the transmission path using the first modulator 135 and the transmission path using the second modulator 139 can change depending on a transmission frequency. For example, the power amplifier on one of the paths can be removed. Kim–277 at [0064] The above-described first transmission module 130 can operate in the active mode and the passive mode by the power of the voltage generator 150 and the power unit 155. Also, the first transmission module 130 can be set to switch to the active mode when power is supplied through the power unit 155 with the passive mode set as a default. The setting of the passive mode and the active mode can change and is not limited thereto. Kim–277 at [0065] The transmission antenna 103 is connected to the first power amplifier 137 or the second power amplifier 141 through the first coupler 143. Kim–277 at [0066] The tag device 100 can comprise a reception antenna 101 and the transmission antenna 103, or transmit/receive signals using one antenna and a duplexer. There is no limitation in the structure and the number of the antennas. Kim–277 at [0067] Since the tag device 100 according to the first embodiment transmits signals modulated in various modulation methods, it can stably maintain communication according to an electromagnetic wave environment. Also, the tag device 100 can improve the signal recognition rate of the reader device, and improve reception sensitivity and signal recognition distance.

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	Kim–277 at [0069] Referring to FIG. 3, the first signal processor 111 comprises a second filter 111A, a first log amplifier 111B, resistors R1 and R2. The second filter 111A is connected to the reception antenna 101. The positive terminal (+) of the first log amplifier 111B is connected to the second filter 111A, and the negative terminal (−) of the log amplifier 111B is connected to the second resistor R2 of a negative feedback circuit. The output terminal of the first log amplifier 111B is connected to the first filter 113 through the first resistor R1. Kim–277 at [0076] Referring to FIG. 4, the voltage generator 150 can generate a voltage Vo using the electromagnetic energy of a high frequency signal received from the reception antenna 101. That is, the voltage generator 150 is a voltage oscillation circuit or a voltage multiplier circuit, and can be realized using a plurality of detection diodes and capacitors connected in multiple steps. The voltage generator 150 sequentially repeatedly rectifies an RF signal received through the reception antenna 101 into a DC voltage to increase the rectified DC voltage. The voltage generated by the voltage generator 150 is supplied to each part through a logic board. Kim–277 at [0079] The first filter 113 is connected to the positive terminal (+) of the first operation amplifier 116, and the fourth resistor R4 and the third resistor R3 of the negative feedback circuit are connected to the negative terminal (−) of the first operation amplifier 116 in parallel. A reference voltage of the first controller 170 is input to the positive terminal (+) of the second operation amplifier 118, and a fifth resistor R5 of the negative feedback circuit is connected to the negative terminal (−) of the second operation amplifier 118. The third resistor R3 is connected between the negative terminal (−) of the first operation amplifier 116 and the negative terminal (−) of the second operation amplifier 118. The output terminal of the first operation amplifier 116 is connected to the positive terminal (+) of the first comparator 120 through the sixth resistor R6, and connected to the fourth resistor R4 in parallel. The output terminal of the second operation amplifier 118 is connected to the negative terminal (−) of the first comparator 120 through the seventh resistor R7. The positive terminal (+) and negative terminal (−) of the first comparator 120 can be mutually changed and is not limited thereto. Kim–277 at [0080] The first operation amplifier 116 amplifies the gain of a signal that has passed through the first filter 113 to output the same. At this point, the gain is controlled by the fourth resistor R4 of a first feedback circuit

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	of the first operation amplifier 116. The second operation amplifier 118 amplifies the reference voltage of the first controller 170 input to the positive terminal (+) of the second operation amplifier 118 to output the same. An output signal of the second operation amplifier 118 controls the level of a signal input to the negative terminal (−) of the first operation amplifier 116 through the fifth resistor R5 of a second feedback circuit, the third resistor R3, which is a feedback circuit, and the fourth resistor R4 of the first feedback circuit. Accordingly, the output signal of the second operation amplifier 118 changes according to the reference voltage of the first controller 170. The amplification gain of the first operation amplifier 116 is controlled by a change in the output signal of the second operation amplifier 118. That is, the amplification gains of the second operation amplifier 118 and the first operation amplifier 116 are controlled using the reference voltage of the first controller 170, so that the sensitivity of a reception signal output to the first operation amplifier 116 can be controlled. Kim–277 at [0083] FIG. 6 is a view illustrating a modified example of an antenna of a tag device 100 according to the first embodiment. Kim–277 at [0084] Referring to FIG. 6, the tag device 100 comprises an IC chip 100B and a single antenna 105. The IC chip can comprise the first reception module 110, the first transmission module 130, the first controller 170, and the voltage generator 150 of FIG. 1. The antenna 105 is a transmission/reception antenna, and is formed in a closed loop type, for example, and has a structure in which the IC chip 100B has been mounted between two sides facing each other. The IC chip 100B can transmit or receive a signal through the antenna 105, there is no limitation in the structure of the antenna. Kim–277 at [0089] The tag device 100A can operate in at least one of a passive mode, an active mode, and a semi-active mode. The tag device 100A can operate in the semi-active mode, that is, in the passive mode and the active mode depending on whether power is supplied as in the tag device of the first embodiment. Kim–277 at [0137] Since embodiments provide various modulation methods to the tag device and/or the reader device, the system can stably maintain communication according to an electromagnetic wave environment. Kim–277 at [0139]

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	Embodiments can modulate transmission signals in various modulation methods, and transmit the signals in a circularly polarized component to provide the reader device that can stably communicate with the tag device. *See also* Kim–277 at [0082] and [0088]. To the extent this limitation is not disclosed by Kim–277, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kim–277, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
14. The mobile device of claim 13 wherein the driver circuit comprises a load modulation circuit.	Kim–277 expressly or inherently discloses "[t]he mobile device of claim 13 wherein the driver circuit comprises a load modulation circuit." For example: Kim–277 at Abstract Embodiments relate to a tag device, a reader device, and a radio frequency identification (RFID) system. The Q embodiment provides a tag device comprising: a reception module converting a received high frequency signal into a scale level, and Q converting the converted scale level into a digital signal to output the same; a transmission module modulating a transmission signal M to output the same; and a controller controlling the reception module and the transmission module. The tag device communicates o with the reader device through wireless short distance communication. Kim–277 at Figure 1 [Fig. 1]  Kim–277 at Figure 2

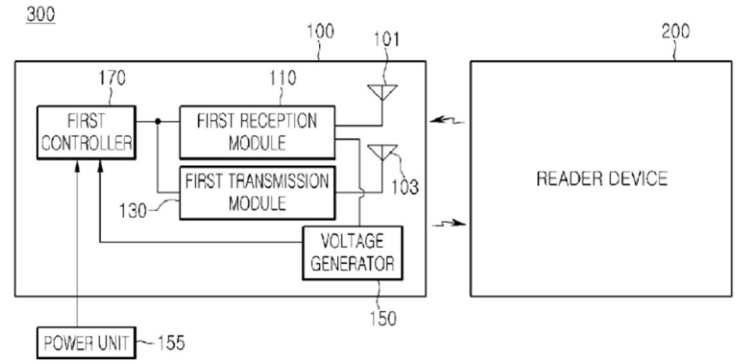
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	[Fig. 2]  Kim–277 at [0005] Embodiments provide a tag device that can efficiently use power by providing various modulation methods and operating in a passive mode modulation method or an active mode modulation method depending on the kind of power. Kim–277 at [0010] An embodiment provides a tag device comprising: a reception module converting a received high frequency signal into a scale level, and converting the converted scale level into a digital signal to output the same; a transmission module modulating a transmission signal to output the same; and a controller controlling the reception module and the transmission module. Kim–277 at [0012] An embodiment provides a radio frequency identification system comprising: a tag device comprising: a first reception module converting a received high frequency signal into a scale level, and outputting the converted scale level reception signal as a digital signal; a first transmission module modulating an information request signal to output the same; and a first controller controlling the first reception module and the first transmission module; and a reader device comprising: a second reception module converting

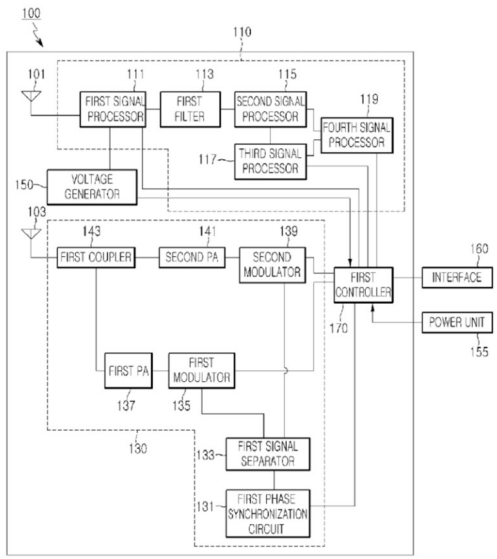
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	a high frequency signal received from the tag device into a scale level, and outputting the converted scale level reception signal as a digital signal; a second transmission module modulating an information request signal, and transmitting the signal to the tag device; and a second controller controlling the second reception module and the second transmission module. Kim–277 at [0016] Embodiments can provide various modulation methods to a tag device and/or a reader device to maintain stabile communication according to an electromagnetic wave environment. Kim–277 at [0037] The controller 170 controls a drive in the active mode or a passive mode depending on whether power is supplied. For example, the tag device 100 is driven by the power unit 155 during the active mode, and driven by a voltage generated by the voltage generator 150 during the passive mode. Also, the active mode and the passive mode can be changed depending on whether power is supplied from the power unit 155, or can be switched from the passive mode to the active mode when power is supplied to the power unit 155. One of the active mode and the passive mode can be changed to the other according to a manipulation signal of an operator. Kim–277 at [0040] During the passive mode, the first transmission module 130 transmits a transmission signal through a transmission antenna 103 in a backscatter method. Kim–277 at [0041] Here, during the passive mode and the active mode, the first transmission module 130 can use different modulation methods. For example, the first transmission module 130 can use amplitude shift keying (ASK) during the passive mode, and can selectively use frequency shift keying (FSK), quadrature phase shift keying (QPSK), and phase shift keying (PSK) during the active mode. Kim–277 at [0043] Referring to FIG. 2, the tag device 100 comprises the first reception module 110, the first transmission module 130, and the voltage generator 150. The first reception module 110 comprises a first signal processor 111, a first filter 113, a second signal processor 115, a third signal processor 117, and a fourth signal processor 119. Kim–277 at [0046]

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	At this point, the first controller 170 outputs a control signal to the first signal processor 111, and the control signal controls the gain of the first signal processor 111. Kim–277 at [0052] The first controller 170 can store tag information. For example, the first controller 170 can comprise a memory (not shown), or the tag information can be separately stored. The first controller 170 has a communication protocol to control radio communication with the reader device 200, and provides tag information when an information request signal is received from the reader device 200. Also, the first controller 170 analyzes codes of signals decoded by the first to fourth signal processors 113, 115, 117, and 119, and generates transmission data. Kim–277 at [0053] The first transmission module 130 comprises a first phase synchronization circuit 131, a first signal separator 133, a first modulator 135, a first power amplifier 137, a second modulator 139, a second power amplifier 141, and a first coupler 143. Kim–277 at [0054] The first phase synchronization circuit 131 generates a reference signal under control of the first controller 170. The first signal separator 133 outputs the reference signal to the first modulator 135 and the second modulator 139. Here, the first signal separator 133 can be realized using a switch device such as a single pole double throw (SPDT) or a coupler, but is not limited thereto. Kim–277 at [0055] Here, the first controller 170 delivers a digital transmission signal to the first modulator 135 and/or the second modulator 139 of the first transmission module 130. At this point, when the first transmission module is in the passive mode, the first modulator 135 operates. When the first transmission module is in the active mode, the second modulator 139 operates. Kim–277 at [0056] Also, an interface 160 is connected to a mobile terminal, for example, to receive manipulation signals of the active mode and the passive mode and deliver the signals to the first controller 170. The first controller 170 can select the active mode or the passive mode depending on the manipulation signal. That is, during the passive mode, the first controller 170 can output a digital transmission signal to the first modulator 135, and during the active mode, the first controller 170 can output a digital transmission signal to the second modulator 139. Embodiments may not use the power unit 155 and the interface 160. Since

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	the construction of the tag device may change depending on an installation environment or application service, the embodiments are not limited to using the power unit 155 and the interface 160. Kim–277 at [0059] The first modulator 135 modulates a digital transmission signal into a first analog signal using ASK. The first modulator 135 can comprise a rectifying filter, a low pass filter, and a level detector, and is not limited to thereto. Kim–277 at [0060] The first power amplifier 137 amplifies a signal modulated by the first modulator 135 to a transmission level, and the amplified signal passes through the first coupler 143 and is transmitted through the transmission antenna 103. Kim–277 at [0061] The second modulator 139 modulates a digital transmission signal into a second analog signal. The second modulator 139 can modulate a signal using FSK or QPSK for example. The second modulator 139 can comprise a plurality of mixers, adders, and orthogonal signal conversion circuits. The second modulator 139 can change the phase of a transmission signal by 90° to convert a signal in the form in which four signals I^+, I^-, Q^+ and Q^- are added. Kim–277 at [0062] Here, though the first modulator 135 exemplarily uses ASK modulation, and the second modulator 139 exemplarily uses QPSK modulation, the first modulator 135 and the second modulator 139 can use one of ASK, FSK, and QPSK modulations. The first and second modulators 135 and 139 can use the same modulation or a different modulation. Kim–277 at [0063] A signal modulated by the second modulator 139 is amplified by the second power amplifier 141, and the amplified signal is coupled to the first coupler 143 and transmitted through the transmission antenna 103. Here, elements on the transmission path using the first modulator 135 and the transmission path using the second modulator 139 can change depending on a transmission frequency. For example, the power amplifier on one of the paths can be removed. Kim–277 at [0064]

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	The above-described first transmission module 130 can operate in the active mode and the passive mode by the power of the voltage generator 150 and the power unit 155. Also, the first transmission module 130 can be set to switch to the active mode when power is supplied through the power unit 155 with the passive mode set as a default. The setting of the passive mode and the active mode can change and is not limited thereto. Kim–277 at [0067] Since the tag device 100 according to the first embodiment transmits signals modulated in various modulation methods, it can stably maintain communication according to an electromagnetic wave environment. Also, the tag device 100 can improve the signal recognition rate of the reader device, and improve reception sensitivity and signal recognition distance. Kim–277 at [0084] Referring to FIG. 6, the tag device 100 comprises an IC chip 100B and a single antenna 105. The IC chip can comprise the first reception module 110, the first transmission module 130, the first controller 170, and the voltage generator 150 of FIG. 1. The antenna 105 is a transmission/reception antenna, and is formed in a closed loop type, for example, and has a structure in which the IC chip 100B has been mounted between two sides facing each other. The IC chip 100B can transmit or receive a signal through the antenna 105, there is no limitation in the structure of the antenna. Kim–277 at [0089] The tag device 100A can operate in at least one of a passive mode, an active mode, and a semi-active mode. The tag device 100A can operate in the semi-active mode, that is, in the passive mode and the active mode depending on whether power is supplied as in the tag device of the first embodiment. Kim–277 at [0137] Since embodiments provide various modulation methods to the tag device and/or the reader device, the system can stably maintain communication according to an electromagnetic wave environment. Kim–277 at [0139] Embodiments can modulate transmission signals in various modulation methods, and transmit the signals in a circularly polarized component to provide the reader device that can stably communicate with the tag device. *See also* Kim–277 at [0035].

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	To the extent this limitation is not disclosed by Kim–277, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kim–277, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* [1c] and claim 13 above.
15. The mobile device of claim 13 wherein the driver circuit comprises an active transmit driver circuit.	Kim–277 expressly or inherently discloses "[t]he mobile device of claim 13 wherein the driver circuit comprises an active transmit driver circuit." For example: Kim–277 at Abstract Embodiments relate to a tag device, a reader device, and a radio frequency identification (RFID) system. The Q embodiment provides a tag device comprising: a reception module converting a received high frequency signal into a scale level, and Q converting the converted scale level into a digital signal to output the same; a transmission module modulating a transmission signal M to output the same; and a controller controlling the reception module and the transmission module. The tag device communicates o with the reader device through wireless short distance communication. Kim–277 at Figure 1 [Fig. 1]  Kim–277 at Figure 2

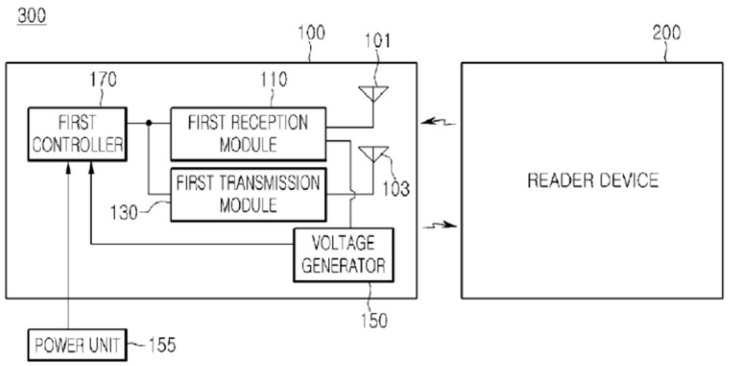
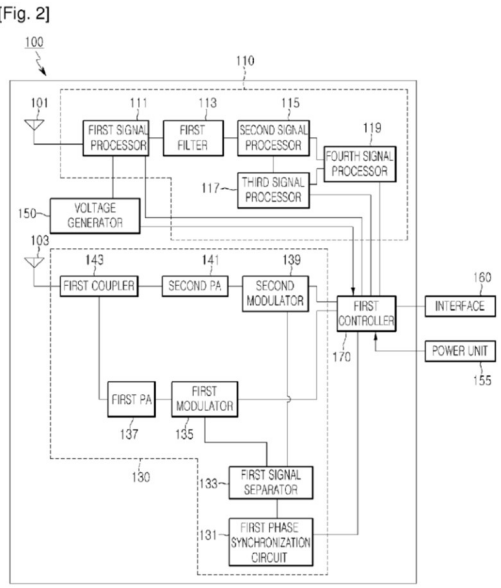
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	[Fig. 2]  Kim–277 at [0005] Embodiments provide a tag device that can efficiently use power by providing various modulation methods and operating in a passive mode modulation method or an active mode modulation method depending on the kind of power. Kim–277 at [0010] An embodiment provides a tag device comprising: a reception module converting a received high frequency signal into a scale level, and converting the converted scale level into a digital signal to output the same; a transmission module modulating a transmission signal to output the same; and a controller controlling the reception module and the transmission module. Kim–277 at [0012] An embodiment provides a radio frequency identification system comprising: a tag device comprising: a first reception module converting a received high frequency signal into a scale level, and outputting the converted scale level reception signal as a digital signal; a first transmission module modulating an information request signal to output the same; and a first controller controlling the first reception module and the first transmission module; and a reader device comprising: a second reception module converting

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	a high frequency signal received from the tag device into a scale level, and outputting the converted scale level reception signal as a digital signal; a second transmission module modulating an information request signal, and transmitting the signal to the tag device; and a second controller controlling the second reception module and the second transmission module. Kim–277 at [0035] Here, the tag device 100 can operate in an active mode driven by power supplied from a power unit 155, and a passive mode not requiring power. That is, the tag device 100 can operate in a semi-active mode. Here, when the tag device 100 is mounted on a terminal such as a mobile terminal, the tag device 100 can use the battery power of the mobile terminal as the power unit 155. Kim–277 at [0037] The controller 170 controls a drive in the active mode or a passive mode depending on whether power is supplied. For example, the tag device 100 is driven by the power unit 155 during the active mode, and driven by a voltage generated by the voltage generator 150 during the passive mode. Also, the active mode and the passive mode can be changed depending on whether power is supplied from the power unit 155, or can be switched from the passive mode to the active mode when power is supplied to the power unit 155. One of the active mode and the passive mode can be changed to the other according to a manipulation signal of an operator. Kim–277 at [0040] During the passive mode, the first transmission module 130 transmits a transmission signal through a transmission antenna 103 in a backscatter method. Kim–277 at [0041] Here, during the passive mode and the active mode, the first transmission module 130 can use different modulation methods. For example, the first transmission module 130 can use amplitude shift keying (ASK) during the passive mode, and can selectively use frequency shift keying (FSK), quadrature phase shift keying (QPSK), and phase shift keying (PSK) during the active mode. Kim–277 at [0043] Referring to FIG. 2, the tag device 100 comprises the first reception module 110, the first transmission module 130, and the voltage generator 150. The first reception module 110 comprises a first signal processor 111, a first filter 113, a second signal processor 115, a third signal processor 117, and a fourth signal processor 119.

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	Kim–277 at [0046] At this point, the first controller 170 outputs a control signal to the first signal processor 111, and the control signal controls the gain of the first signal processor 111. Kim–277 at [0052] The first controller 170 can store tag information. For example, the first controller 170 can comprise a memory (not shown), or the tag information can be separately stored. The first controller 170 has a communication protocol to control radio communication with the reader device 200, and provides tag information when an information request signal is received from the reader device 200. Also, the first controller 170 analyzes codes of signals decoded by the first to fourth signal processors 113, 115, 117, and 119, and generates transmission data. Kim–277 at [0053] The first transmission module 130 comprises a first phase synchronization circuit 131, a first signal separator 133, a first modulator 135, a first power amplifier 137, a second modulator 139, a second power amplifier 141, and a first coupler 143. Kim–277 at [0055] Here, the first controller 170 delivers a digital transmission signal to the first modulator 135 and/or the second modulator 139 of the first transmission module 130. At this point, when the first transmission module is in the passive mode, the first modulator 135 operates. When the first transmission module is in the active mode, the second modulator 139 operates. Kim–277 at [0056] Also, an interface 160 is connected to a mobile terminal, for example, to receive manipulation signals of the active mode and the passive mode and deliver the signals to the first controller 170. The first controller 170 can select the active mode or the passive mode depending on the manipulation signal. That is, during the passive mode, the first controller 170 can output a digital transmission signal to the first modulator 135, and during the active mode, the first controller 170 can output a digital transmission signal to the second modulator 139. Embodiments may not use the power unit 155 and the interface 160. Since the construction of the tag device may change depending on an installation environment or application service, the embodiments are not limited to using the power unit 155 and the interface 160. Kim–277 at [0060]

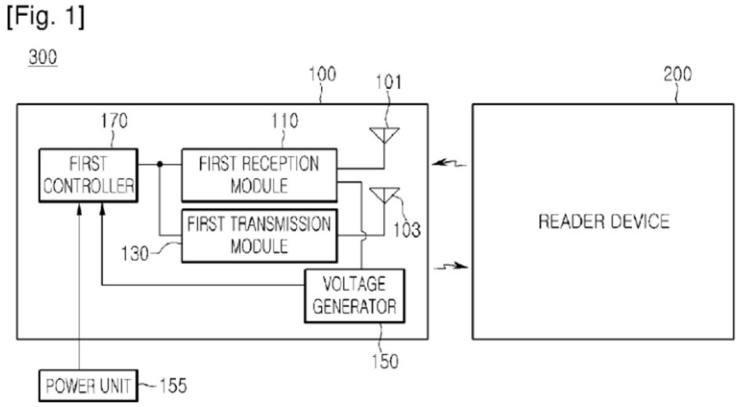
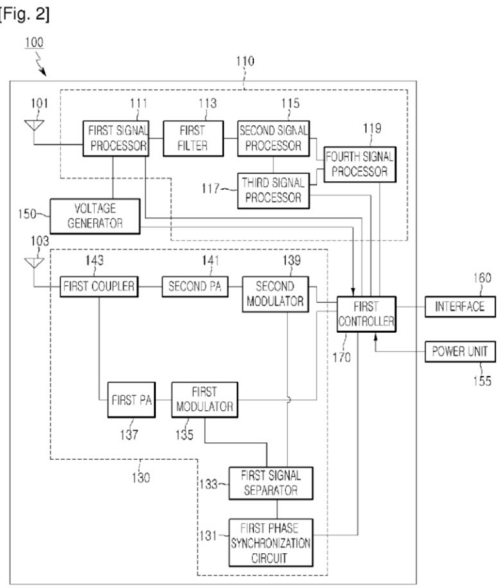
Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	The first power amplifier 137 amplifies a signal modulated by the first modulator 135 to a transmission level, and the amplified signal passes through the first coupler 143 and is transmitted through the transmission antenna 103. Kim–277 at [0061] The second modulator 139 modulates a digital transmission signal into a second analog signal. The second modulator 139 can modulate a signal using FSK or QPSK for example. The second modulator 139 can comprise a plurality of mixers, adders, and orthogonal signal conversion circuits. The second modulator 139 can change the phase of a transmission signal by 90° to convert a signal in the form in which four signals I^+, I^-, Q^+ and Q^- are added. Kim–277 at [0062] Here, though the first modulator 135 exemplarily uses ASK modulation, and the second modulator 139 exemplarily uses QPSK modulation, the first modulator 135 and the second modulator 139 can use one of ASK, FSK, and QPSK modulations. The first and second modulators 135 and 139 can use the same modulation or a different modulation. Kim–277 at [0063] A signal modulated by the second modulator 139 is amplified by the second power amplifier 141, and the amplified signal is coupled to the first coupler 143 and transmitted through the transmission antenna 103. Here, elements on the transmission path using the first modulator 135 and the transmission path using the second modulator 139 can change depending on a transmission frequency. For example, the power amplifier on one of the paths can be removed. Kim–277 at [0064] The above-described first transmission module 130 can operate in the active mode and the passive mode by the power of the voltage generator 150 and the power unit 155. Also, the first transmission module 130 can be set to switch to the active mode when power is supplied through the power unit 155 with the passive mode set as a default. The setting of the passive mode and the active mode can change and is not limited thereto. Kim–277 at [0067] Since the tag device 100 according to the first embodiment transmits signals modulated in various modulation methods, it can stably maintain communication according to an electromagnetic wave

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	environment. Also, the tag device 100 can improve the signal recognition rate of the reader device, and improve reception sensitivity and signal recognition distance. Kim–277 at [0084] Referring to FIG. 6, the tag device 100 comprises an IC chip 100B and a single antenna 105. The IC chip can comprise the first reception module 110, the first transmission module 130, the first controller 170, and the voltage generator 150 of FIG. 1. The antenna 105 is a transmission/reception antenna, and is formed in a closed loop type, for example, and has a structure in which the IC chip 100B has been mounted between two sides facing each other. The IC chip 100B can transmit or receive a signal through the antenna 105, there is no limitation in the structure of the antenna. Kim–277 at [0089] The tag device 100A can operate in at least one of a passive mode, an active mode, and a semi-active mode. The tag device 100A can operate in the semi-active mode, that is, in the passive mode and the active mode depending on whether power is supplied as in the tag device of the first embodiment. *See also* Kim–277 at [0054], [0059], [0137], and [0139]. To the extent this limitation is not disclosed by Kim–277, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kim–277, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* [7c] and claim 13 above.
16. The mobile device of claim 15 wherein the active transmit driver circuit is coupled to be powered by the mobile device.	Kim–277 expressly or inherently discloses "[t]he mobile device of claim 15 wherein the active transmit driver circuit is coupled to be powered by the mobile device." For example: Kim–277 at Figure 1

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	[Fig. 1]  Kim–277 at Figure 2 [Fig. 2]  Kim–277 at [0005] Embodiments provide a tag device that can efficiently use power by providing various modulation methods and operating in a passive mode modulation method or an active mode modulation method depending on the kind of power.

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	Kim–277 at [0015] Embodiments can efficiently use power of a tag device. Kim–277 at [0033] The tag device 100 has various shapes and sizes, and is classified into an active tag and a passive tag depending on whether power is supplied, classified into a low frequency system and a high frequency system depending on a frequency in use. The tag device 100 is attached to persons, automobiles, goods, livestock, and buildings, and contains detailed information of a corresponding object. Also, the tag device 100 can be mounted on a smart card to perform user authentication and electronic payment. The tag device 100 can be attached or function in cooperation with another device to provide various services. Kim–277 at [0035] Here, the tag device 100 can operate in an active mode driven by power supplied from a power unit 155, and a passive mode not requiring power. That is, the tag device 100 can operate in a semi-active mode. Here, when the tag device 100 is mounted on a terminal such as a mobile terminal, the tag device 100 can use the battery power of the mobile terminal as the power unit 155. Kim–277 at [0037] The controller 170 controls a drive in the active mode or a passive mode depending on whether power is supplied. For example, the tag device 100 is driven by the power unit 155 during the active mode, and driven by a voltage generated by the voltage generator 150 during the passive mode. Also, the active mode and the passive mode can be changed depending on whether power is supplied from the power unit 155, or can be switched from the passive mode to the active mode when power is supplied to the power unit 155. One of the active mode and the passive mode can be changed to the other according to a manipulation signal of an operator. Kim–277 at [0041] Here, during the passive mode and the active mode, the first transmission module 130 can use different modulation methods. For example, the first transmission module 130 can use amplitude shift keying (ASK) during the passive mode, and can selectively use frequency shift keying (FSK), quadrature phase shift keying (QPSK), and phase shift keying (PSK) during the active mode. Kim–277 at [0055]

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	Here, the first controller 170 delivers a digital transmission signal to the first modulator 135 and/or the second modulator 139 of the first transmission module 130. At this point, when the first transmission module is in the passive mode, the first modulator 135 operates. When the first transmission module is in the active mode, the second modulator 139 operates. Kim–277 at [0056] Also, an interface 160 is connected to a mobile terminal, for example, to receive manipulation signals of the active mode and the passive mode and deliver the signals to the first controller 170. The first controller 170 can select the active mode or the passive mode depending on the manipulation signal. That is, during the passive mode, the first controller 170 can output a digital transmission signal to the first modulator 135, and during the active mode, the first controller 170 can output a digital transmission signal to the second modulator 139. Embodiments may not use the power unit 155 and the interface 160. Since the construction of the tag device may change depending on an installation environment or application service, the embodiments are not limited to using the power unit 155 and the interface 160. Kim–277 at [0064] The above-described first transmission module 130 can operate in the active mode and the passive mode by the power of the voltage generator 150 and the power unit 155. Also, the first transmission module 130 can be set to switch to the active mode when power is supplied through the power unit 155 with the passive mode set as a default. The setting of the passive mode and the active mode can change and is not limited thereto. Kim–277 at [0089] The tag device 100A can operate in at least one of a passive mode, an active mode, and a semi-active mode. The tag device 100A can operate in the semi-active mode, that is, in the passive mode and the active mode depending on whether power is supplied as in the tag device of the first embodiment. Kim–277 at [0136] Embodiments can efficiently use the power of the tag device. To the extent this limitation is not disclosed by Kim–277, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kim–277, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 11 and 15 above.

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
17. The mobile device of claim 13 wherein the amplifier is coupled to be powered by the mobile device.	Kim–277 expressly or inherently discloses "[t]he mobile device of claim 13 wherein the amplifier is coupled to be powered by the mobile device." For example: Kim–277 at Figure 1  Kim–277 at Figure 2 

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	Kim–277 at [0005] Embodiments provide a tag device that can efficiently use power by providing various modulation methods and operating in a passive mode modulation method or an active mode modulation method depending on the kind of power. Kim–277 at [0015] Embodiments can efficiently use power of a tag device. Kim–277 at [0033] The tag device 100 has various shapes and sizes, and is classified into an active tag and a passive tag depending on whether power is supplied, classified into a low frequency system and a high frequency system depending on a frequency in use. The tag device 100 is attached to persons, automobiles, goods, livestock, and buildings, and contains detailed information of a corresponding object. Also, the tag device 100 can be mounted on a smart card to perform user authentication and electronic payment. The tag device 100 can be attached or function in cooperation with another device to provide various services. Kim–277 at [0035] Here, the tag device 100 can operate in an active mode driven by power supplied from a power unit 155, and a passive mode not requiring power. That is, the tag device 100 can operate in a semi-active mode. Here, when the tag device 100 is mounted on a terminal such as a mobile terminal, the tag device 100 can use the battery power of the mobile terminal as the power unit 155. Kim–277 at [0037] The controller 170 controls a drive in the active mode or a passive mode depending on whether power is supplied. For example, the tag device 100 is driven by the power unit 155 during the active mode, and driven by a voltage generated by the voltage generator 150 during the passive mode. Also, the active mode and the passive mode can be changed depending on whether power is supplied from the power unit 155, or can be switched from the passive mode to the active mode when power is supplied to the power unit 155. One of the active mode and the passive mode can be changed to the other according to a manipulation signal of an operator. Kim–277 at [0041] Here, during the passive mode and the active mode, the first transmission module 130 can use different modulation methods. For example, the first transmission module 130 can use amplitude shift keying

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	(ASK) during the passive mode, and can selectively use frequency shift keying (FSK), quadrature phase shift keying (QPSK), and phase shift keying (PSK) during the active mode. Kim–277 at [0055] Here, the first controller 170 delivers a digital transmission signal to the first modulator 135 and/or the second modulator 139 of the first transmission module 130. At this point, when the first transmission module is in the passive mode, the first modulator 135 operates. When the first transmission module is in the active mode, the second modulator 139 operates. Kim–277 at [0056] Also, an interface 160 is connected to a mobile terminal, for example, to receive manipulation signals of the active mode and the passive mode and deliver the signals to the first controller 170. The first controller 170 can select the active mode or the passive mode depending on the manipulation signal. That is, during the passive mode, the first controller 170 can output a digital transmission signal to the first modulator 135, and during the active mode, the first controller 170 can output a digital transmission signal to the second modulator 139. Embodiments may not use the power unit 155 and the interface 160. Since the construction of the tag device may change depending on an installation environment or application service, the embodiments are not limited to using the power unit 155 and the interface 160. Kim–277 at [0064] The above-described first transmission module 130 can operate in the active mode and the passive mode by the power of the voltage generator 150 and the power unit 155. Also, the first transmission module 130 can be set to switch to the active mode when power is supplied through the power unit 155 with the passive mode set as a default. The setting of the passive mode and the active mode can change and is not limited thereto. Kim–277 at [0089] The tag device 100A can operate in at least one of a passive mode, an active mode, and a semi-active mode. The tag device 100A can operate in the semi-active mode, that is, in the passive mode and the active mode depending on whether power is supplied as in the tag device of the first embodiment. Kim–277 at [0136] Embodiments can efficiently use the power of the tag device.

Claim Element	Exemplary Citations to U.S. Patent Pub. No. 2010/0072277 ("Kim–277")
	To the extent this limitation is not disclosed by Kim–277, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kim–277, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 13 above.
18. The mobile device of claim 13 wherein the antenna is tuned to operate at 13.56 MHz.	Kim–277 expressly or inherently discloses "[t]he mobile device of claim 13 wherein the antenna is tuned to operate at 13.56 MHz." For example: *See* above at claim 2. To the extent this limitation is not disclosed by Kim–277, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kim–277, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 13 above.
19. The mobile device of claim 13 wherein the antenna comprises an inductive element too small to draw enough power sufficient to operate the smartcard controller from an interrogating radio frequency (RF) field.	Kim–277 expressly or inherently discloses "[t]he mobile device of claim 13 wherein the antenna comprises an inductive element too small to draw enough power sufficient to operate the smartcard controller from an interrogating radio frequency (RF) field." For example: *See* above at claim 3. To the extent this limitation is not disclosed by Kim–277, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kim–277, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 13 above.
20. The mobile device of claim 13 wherein the mobile device comprises a mobile phone.	Kim–277 expressly or inherently discloses "[t]he mobile device of claim 13 wherein the mobile device comprises a mobile phone." For example: *See* above at claim 6. To the extent this limitation is not disclosed by Kim–277, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kim–277, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 13 above.

DEFENDANTS' INVALIDITY CONTENTIONS FOR U.S. PAT. 9,122,965

EXHIBIT A05: Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")

As demonstrated in the claim charts below, the claims of U.S. Patent No. 9,122,965 ("the '965 patent") are invalid (a) under one or more sections of 35 U.S.C. § 102 as anticipated by Philips Specification and (b) under 35 U.S.C. § 103(a) as obvious over Philips Specification standing alone and as set forth herein, and/or combined with the knowledge of a person of ordinary skill in the art, Applicant's Admitted Prior Art, and/or the additional prior art references discussed in Exhibit A and Exhibits A01–A05, the contents of which are hereby incorporated by reference into this chart. One of ordinary skill in the art, as of the priority date of the '965 patent, would have known to combine the prior art elements disclosed by the foregoing references using known methods, and to use these elements according to their established functions in order to achieve a known and predictable result.

Defendants have conducted the invalidity analysis herein based at least in part and in some instance entirely upon Plaintiff's apparent application of the claims of the '965 patent. By charting the prior art against the claims and limitations herein, Defendants are not admitting or agreeing to Plaintiff's application of the claims at issue in this case, and these charts should not be interpreted as an admission or concession by Defendants that any particular construction or application of any claim limitation by Plaintiff is correct or proper. Additionally, these charts provide representative examples of portions of the charted references that disclose the indicated limitations of the claims; additional portions of these references other than the representative examples provided herein may also disclose the indicated limitation(s) and Defendants contend that the asserted claims are invalid in light of the charted reference(s) as a whole in its or their entirety. Where a particular figure is cited, the citation should be understood to encompass the caption and description of the figure as well as any text relating to or describing the figure. Conversely, where particular text referring to a figure is cited, the citation should be understood to include the figure as well.

Claim Element	**Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")**
1[pre]. A mobile device comprising:	By providing this disclosure, Defendants do not take a position on whether the preamble is a claim limitation. Philips Specification discloses or renders obvious "[a] mobile device." For example: Philips Specification at 5 Typical devices to integrate the PN531 are • Mobile phones • PDAs • PCs • Intelligent remote controls • PC peripherals e.g. printers and mice • Consumer electronic devices like digital cameras

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	To the extent this limitation is not disclosed by Philips Specification, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Philips Specification, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[1a] a smartcard controller;	Philips Specification discloses or renders obvious "a smartcard controller." For example: Philips Specification at 3 The PN531 is a highly integrated transmission module for contactless communication at 13.56 MHz including µ-controller functionality based on an 80C51 core with 32 kbyte of ROM and 1 kbyte of RAM. This µc-based transmission module combines an outstanding modulation and demodulation concept completely integrated for different kinds of contactless communication methods and protocols at 13.56 MHz with an easy to use firmware for the different supported modes and the required host interfaces. Philips Specification at 3 The PN531 supports 3 different operating modes • Reader/writer mode for FeliCa™ and ISO14443A cards • Supports Card interface mode for FeliCa™ and ISO14443A/MIFARE® in combination with secure µC • NFC IP-1 mode Philips Specification at 3 In reader/ writer mode the PN531's internal transmitter part is able to drive a reader/writer antenna designed to communicate with ISO14443A /MIFARE® or FeliCa™ cards and transponders without additional active circuitry. The receiver part provides a robust and efficient implementation of a demodulation and decoding circuitry for signals from ISO14443A compatible cards and transponders. The digital part handles the complete ISO14443A framing and error detection (Parity & CRC). Philips Specification at 3 In card mode the PN531 is able to answer a reader/writer command either in FeliCa™ or ISO14443A/MIFARE® card mode. The PN531 generates the proper digital load modulated signals and with an external circuit, can respond to commands sent by the reader/writer. Philips Specification at 4 • 80C51 microcontroller core with 32 kbyte ROM and 1 kbyte RAM

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	• Highly integrated analog circuitry for transmission and reception • Output drivers to connect an antenna with minimum number of external components • Integrated RF Level detector • Integrated mode detector • Hardware and embedded Firmware support for • ISO 14443A reader/writer mode • MIFARE®Classic encryption and MIFARE® higher baudrate communication up to 424 kbit/s • Contactless communication according to the FeliCa™ scheme at 212 kbit/s and 424 kbit/s • NFC standard ECMA 340 and ISO 18092: NFC IP-1 interface and protocol • Host protocol on following interfaces • USB 2.0 full speed compliant device • SPI • I2C • High speed serial UART • Optional interrupt line to the host • Hard reset with low power function • Flexible Power down mode or power reduction mode per software • Internal oscillator to connect a 27.12 MHz quartz • Internal oscillator to connect a 4 MHz quartz for the USB interface • 2.5 - 3.6 V power supply • USB bus powered (In USB mode) • Specific IO ports and interrupt sources for external devices control Philips Specification at 5 The integrated microcontroller and embedded firmware of the PN 531 means a fast and easy integration in a contactless system. The high-level abstraction commands and the complete handling of RF communication protocols free the host CPU of all real time related constraints. Philips Specification at Figure 1

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")

2 BLOCK DIAGRAM

2.1 Simplified PN531 Block Diagram

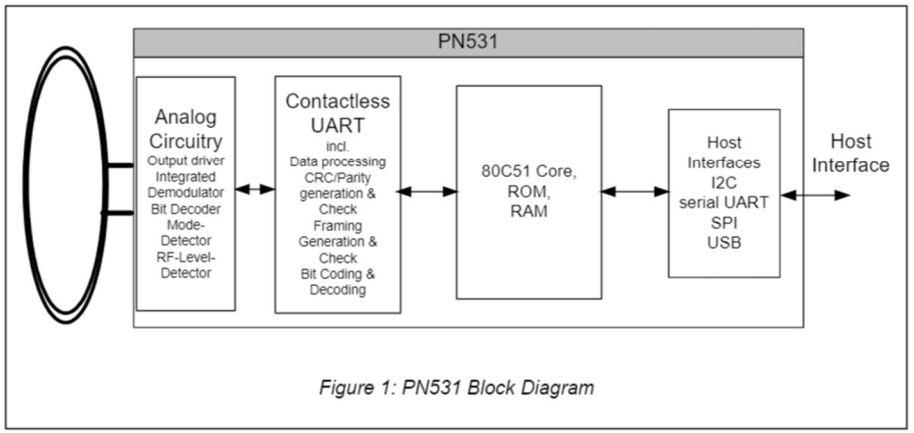


Figure 1: PN531 Block Diagram

Philips Specification at 6

> The microcontroller with its embedded firmware allows autonomous management of communication both on the RF interface and with the host.

Philips Specification at Figure 3

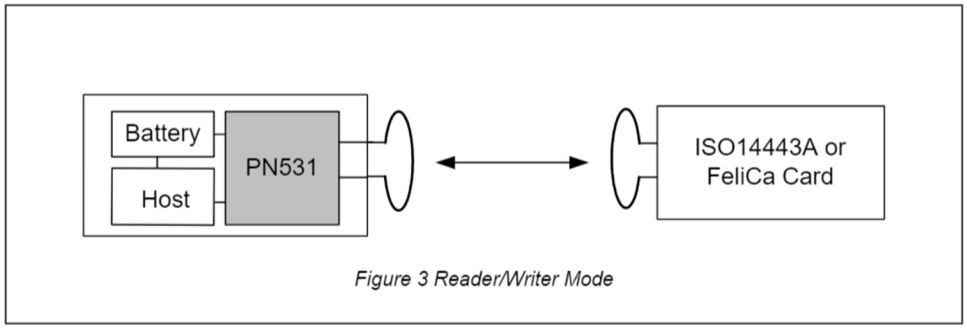
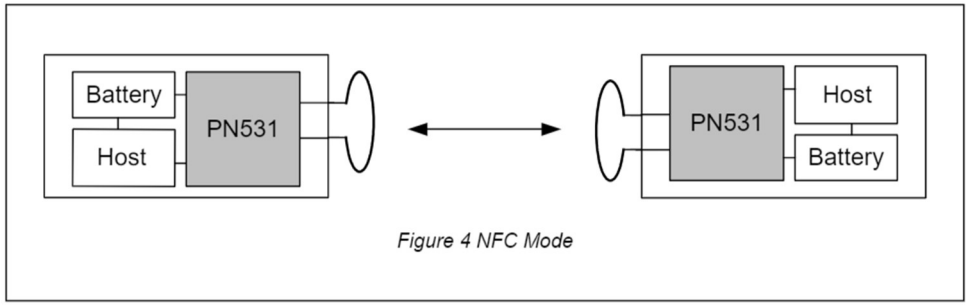
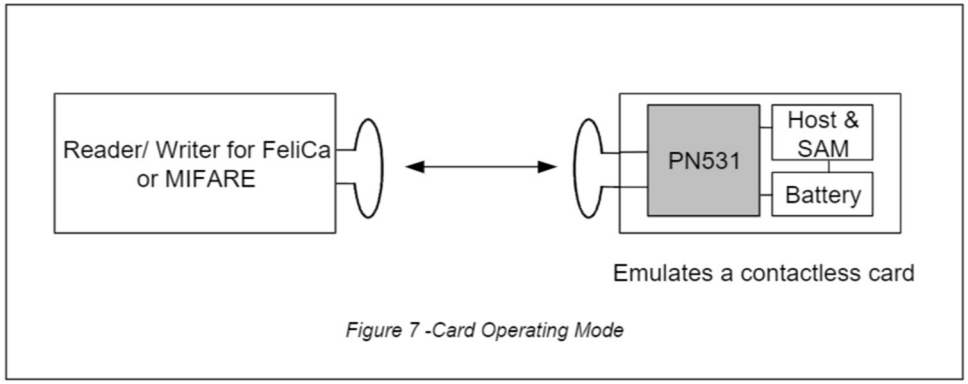
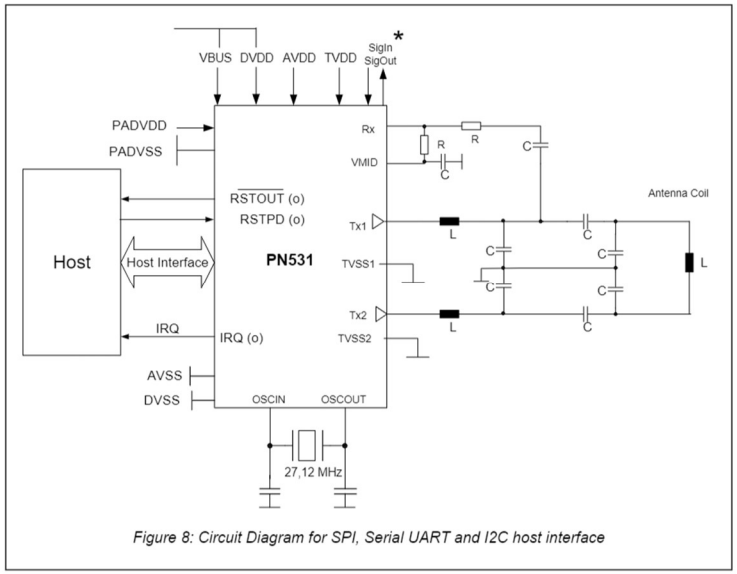
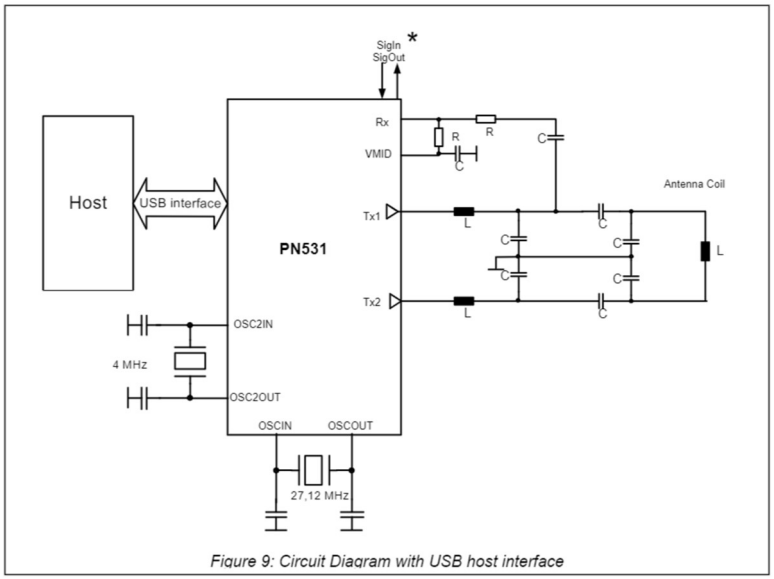


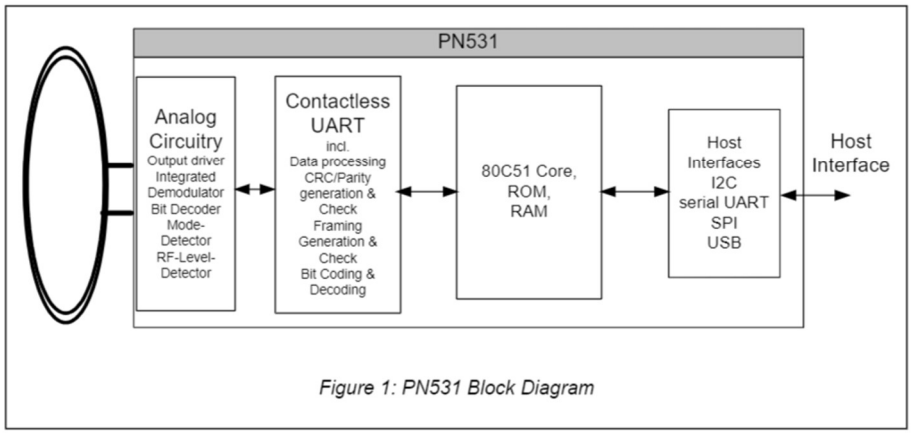
Figure 3 Reader/Writer Mode

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	Philips Specification at Figure 4  *Figure 4 NFC Mode* Philips Specification at Figure 7  *Figure 7 -Card Operating Mode* Philips Specification at 13 The PN531 can be addressed like a FeliCa™ or ISO14443A/ MIFARE® card. This means that the PN531 in combination with a secure µC may acts as an ISO14443A /MIFARE® or FeliCa™ card. Philips Specification at Figure 8

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	 *Figure 8: Circuit Diagram for SPI, Serial UART and I2C host interface* Philips Specification at 14 The figure below shows a typical application, where the antenna is directly connected to the PN531. The used host interface is SPI, Serial UART or I2C. Philips Specification at Figure 9

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	 *Figure 9: Circuit Diagram with USB host interface* To the extent this limitation is not disclosed by Philips Specification, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Philips Specification, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[1b] an antenna; and	Philips Specification discloses or renders obvious "an antenna." For example: Philips Specification at 3 In reader/ writer mode the PN531's internal transmitter part is able to drive a reader/writer antenna designed to communicate with ISO14443A /MIFARE® or FeliCa™ cards and transponders without additional active circuitry. The receiver part provides a robust and efficient implementation of a demodulation and decoding circuitry for signals from ISO14443A compatible cards and transponders. The digital part handles the complete ISO14443A framing and error detection (Parity & CRC). Philips Specification at 4 • 80C51 microcontroller core with 32 kbyte ROM and 1 kbyte RAM • Highly integrated analog circuitry for transmission and reception • Output drivers to connect an antenna with minimum number of external components

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	• Integrated RF Level detector • Integrated mode detector • Hardware and embedded Firmware support for • ISO 14443A reader/writer mode • MIFARE®Classic encryption and MIFARE® higher baudrate communication up to 424 kbit/s • Contactless communication according to the FeliCa™ scheme at 212 kbit/s and 424 kbit/s • NFC standard ECMA 340 and ISO 18092: NFC IP-1 interface and protocol • Host protocol on following interfaces • USB 2.0 full speed compliant device • SPI • I2C • High speed serial UART • Optional interrupt line to the host • Hard reset with low power function • Flexible Power down mode or power reduction mode per software • Internal oscillator to connect a 27.12 MHz quartz • Internal oscillator to connect a 4 MHz quartz for the USB interface • 2.5 - 3.6 V power supply • USB bus powered (In USB mode) • Specific IO ports and interrupt sources for external devices control Philips Specification at Figure 1

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	2 BLOCK DIAGRAM **2.1 Simplified PN531 Block Diagram**  *Figure 1: PN531 Block Diagram* Philips Specification at Figure 3.2

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")

3.2 Pin Description

Pin	Symbol	Type	Pad Ref Voltage	Description
1	DVSS	PWR		Digital Ground
2	LOADMOD	O	DVDD	Load Modulation output provides digital signal for FeliCa and MIFARE® card operating mode
3	TVSS1	PWR		Transmitter Ground: supplies the output stage of TX1 and TX2
4	TX1	O	TVDD	Transmitter 1: delivers the modulated 13.56 MHz energy carrier
5	TVDD	PWR		Transmitter power supply: supplies the output stage of TX1 and TX2
6	TX2	O	TVDD	Transmitter 2: delivers the modulated 13.56 MHz energy carrier
7	TVSS2	PWR		Transmitter Ground: supplies the output stage of TX1 and TX2
8	AVDD	PWR		Analog Power Supply
9	VMID	PWR	AVDD	Internal Reference Voltage: This pin delivers the internal reference voltage.
10	RX	I	AVDD	Receiver Input: Input pin for the reception signal, which is the load modulated 13.56 MHz energy carrier from the antenna circuit.
11	AVSS	PWR		Analog Ground
12	AUX1	O	DVDD	Auxiliary Output: This pin delivers analog and digital test signals.
13	AUX2	O	DVDD	Auxiliary Output: This pin delivers analog and digital test signals.
14	OSCIN	I	AVDD	Crystal Oscillator Input: input to the inverting amplifier of the oscillator. This pin is also the input for an externally generated clock (fosc = 27.12 MHz).
15	OSCOUT	O	AVDD	Crystal Oscillator output: Output of the inverting amplifier of the oscillator.
16	I0	I	DVDD	Interface mode lines: selects the used host interface. In test mode I0 is used as test signals.
17	I1	I	DVDD	Interface mode lines: selects the used host interface. In test mode I0 is used as test signals.
18	TESTEN	I	DVDD	Test enable pin: When set to 1 enable the test mode. When set to 0 reset the TCB and disable the access to the test mode.
19	OSC2OUT	O	DVDD	Crystal Oscillator output: Output of the inverting amplifier of the oscillator for the USB clock.
20	OSC2IN	I	DVDD	Crystal Oscillator Input: input to the inverting amplifier of the oscillator for the USB clock generation. This pin is also the input for an externally generated clock (f_{osc} =4 MHz). In test mode this signal is used as test clock input
21	P35	IO	DVDD	General purpose IO signal
22	P34	IO	SVDD	General purpose IO signal or clk signal for the SAM
23	SIGOUT	O	SVDD	Contactless communication interface output: delivers a serial data stream according to NFCIP-1 and output signal for the SAM. In test mode this signal is used as test signal output.
24	SIGIN	I	SVDD	Contactless communication interface input: accepts a digital, serial data stream according to NFCIP-1 and input signal from the SAM. In test mode

Philips Specification at Figure 3

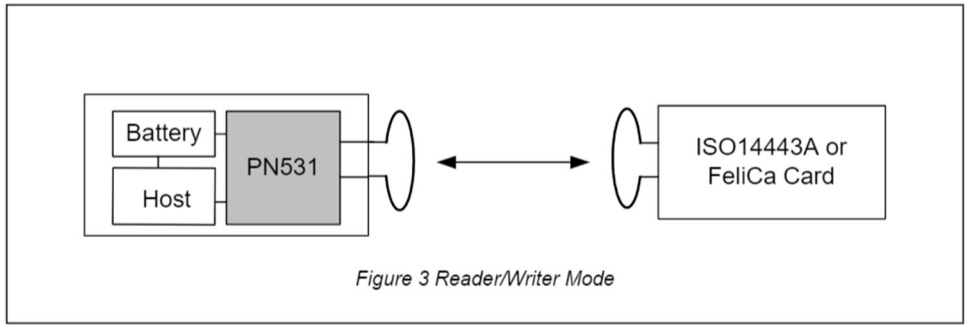
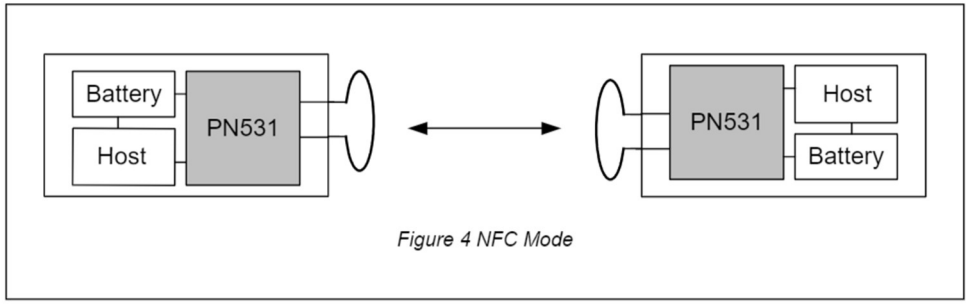
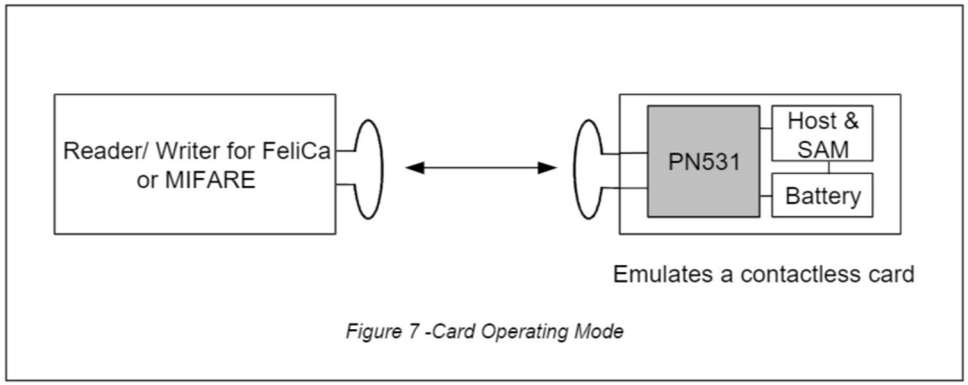
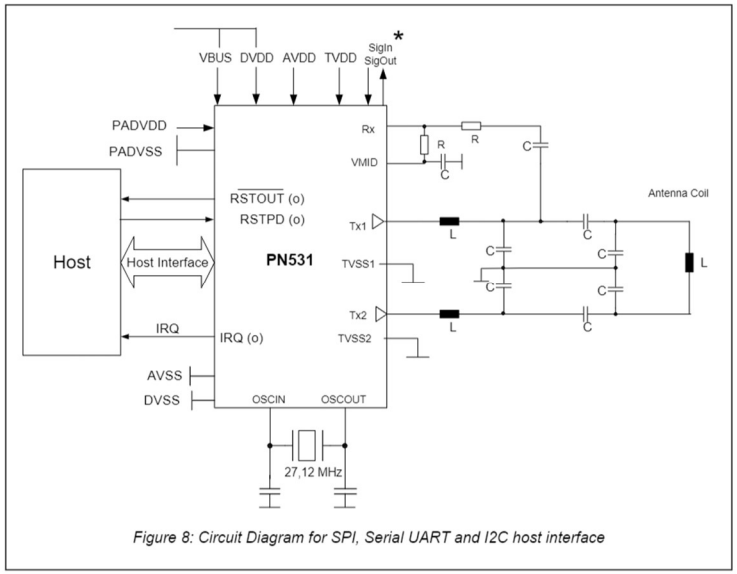
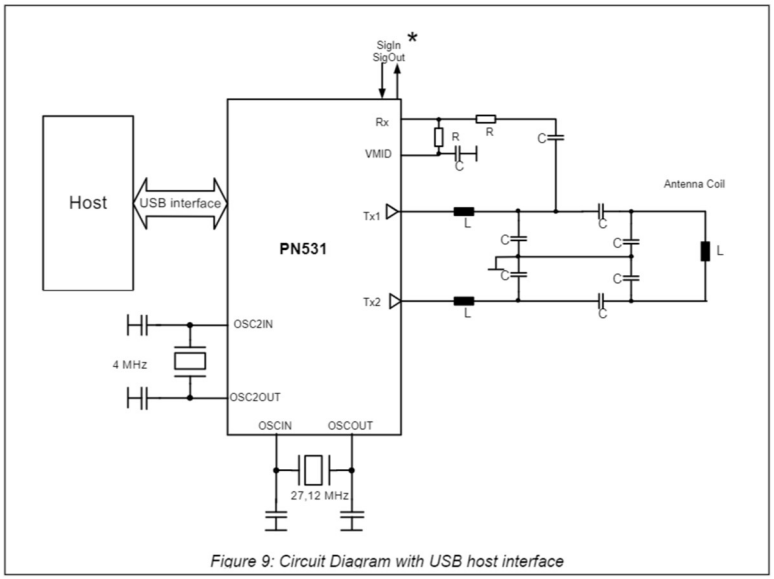


Figure 3 Reader/Writer Mode

Philips Specification at Figure 4

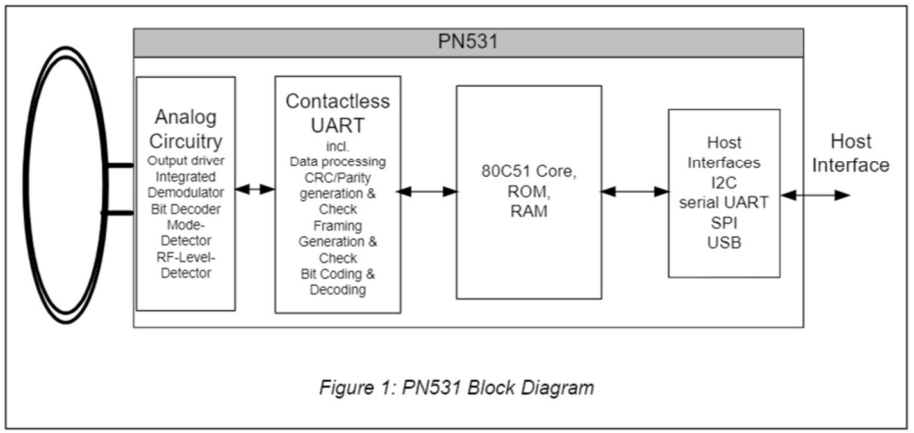
Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	 *Figure 4 NFC Mode* Philips Specification at Figure 7  *Figure 7 -Card Operating Mode* Philips Specification at Figure 8

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
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Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	 *Figure 9: Circuit Diagram with USB host interface* Philips Specification at 15 The figure below shows a typical application where the antenna is directly connected to the PN531. The host interface is USB. To the extent this limitation is not disclosed by Philips Specification, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Philips Specification, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[1c] performance enhancement circuits coupled between the smartcard controller and the antenna, wherein the performance enhancement circuits include an amplifier and a load modulation circuit, and	Philips Specification discloses or renders obvious "performance enhancement circuits coupled between the smartcard controller and the antenna, wherein the performance enhancement circuits include an amplifier and a load modulation circuit." For example: Philips Specification at 3 The PN531 is a highly integrated transmission module for contactless communication at 13.56 MHz including µ-controller functionality based on an 80C51 core with 32 kbyte of ROM and 1 kbyte of RAM. This µc-based transmission module combines an outstanding modulation and demodulation concept

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	completely integrated for different kinds of contactless communication methods and protocols at 13.56 MHz with an easy to use firmware for the different supported modes and the required host interfaces. Philips Specification at 3 The PN531 supports 3 different operating modes • Reader/writer mode for FeliCa™ and ISO14443A cards • Supports Card interface mode for FeliCa™ and ISO14443A/MIFARE® in combination with secure µC • NFC IP-1 mode Philips Specification at 3 In reader/ writer mode the PN531's internal transmitter part is able to drive a reader/writer antenna designed to communicate with ISO14443A /MIFARE® or FeliCa™ cards and transponders without additional active circuitry. The receiver part provides a robust and efficient implementation of a demodulation and decoding circuitry for signals from ISO14443A compatible cards and transponders. The digital part handles the complete ISO14443A framing and error detection (Parity & CRC). Philips Specification at 3 In card mode the PN531 is able to answer a reader/writer command either in FeliCa™ or ISO14443A/MIFARE® card mode. The PN531 generates the proper digital load modulated signals and with an external circuit, can respond to commands sent by the reader/writer. Philips Specification at 4 • 80C51 microcontroller core with 32 kbyte ROM and 1 kbyte RAM • Highly integrated analog circuitry for transmission and reception • Output drivers to connect an antenna with minimum number of external components • Integrated RF Level detector • Integrated mode detector • Hardware and embedded Firmware support for • ISO 14443A reader/writer mode • MIFARE®Classic encryption and MIFARE® higher baudrate communication up to 424 kbit/s • Contactless communication according to the FeliCa™ scheme at 212 kbit/s and 424 kbit/s • NFC standard ECMA 340 and ISO 18092: NFC IP-1 interface and protocol

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	• Host protocol on following interfaces • USB 2.0 full speed compliant device • SPI • I2C • High speed serial UART • Optional interrupt line to the host • Hard reset with low power function • Flexible Power down mode or power reduction mode per software • Internal oscillator to connect a 27.12 MHz quartz • Internal oscillator to connect a 4 MHz quartz for the USB interface • 2.5 - 3.6 V power supply • USB bus powered (In USB mode) • Specific IO ports and interrupt sources for external devices control Philips Specification at 5 The integrated microcontroller and embedded firmware of the PN 531 means a fast and easy integration in a contactless system. The high-level abstraction commands and the complete handling of RF communication protocols free the host CPU of all real time related constraints. Philips Specification at Figure 1

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	2 BLOCK DIAGRAM **2.1 Simplified PN531 Block Diagram**  *Figure 1: PN531 Block Diagram* Philips Specification at 6 The Analog circuitry handles the modulation and demodulation of the analog signals according to the card mode, reader /writer mode and NFC mode communication scheme. Philips Specification at 6 The microcontroller with its embedded firmware allows autonomous management of communication both on the RF interface and with the host. Philips Specification at Figure 3.2

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")

3.2 Pin Description

Pin	Symbol	Type	Pad Ref Voltage	Description
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4	TX1	O	TVDD	Transmitter 1: delivers the modulated 13.56 MHz energy carrier
5	TVDD	PWR		Transmitter power supply: supplies the output stage of TX1 and TX2
6	TX2	O	TVDD	Transmitter 2: delivers the modulated 13.56 MHz energy carrier
7	TVSS2	PWR		Transmitter Ground: supplies the output stage of TX1 and TX2
8	AVDD	PWR		Analog Power Supply
9	VMID	PWR	AVDD	Internal Reference Voltage: This pin delivers the internal reference voltage.
10	RX	I	AVDD	Receiver Input: Input pin for the reception signal, which is the load modulated 13.56 MHz energy carrier from the antenna circuit.
11	AVSS	PWR		Analog Ground
12	AUX1	O	DVDD	Auxiliary Output: This pin delivers analog and digital test signals.
13	AUX2	O	DVDD	Auxiliary Output: This pin delivers analog and digital test signals.
14	OSCIN	I	AVDD	Crystal Oscillator Input: input to the inverting amplifier of the oscillator. This pin is also the input for an externally generated clock (fosc = 27.12 MHz).
15	OSCOUT	O	AVDD	Crystal Oscillator output: Output of the inverting amplifier of the oscillator.
16	I0	I	DVDD	Interface mode lines: selects the used host interface. In test mode I0 is used as test signals.
17	I1	I	DVDD	Interface mode lines: selects the used host interface. In test mode I0 is used as test signals.
18	TESTEN	I	DVDD	Test enable pin: When set to 1 enable the test mode. When set to 0 reset the TCB and disable the access to the test mode.
19	OSC2OUT	O	DVDD	Crystal Oscillator output: Output of the inverting amplifier of the oscillator for the USB clock.
20	OSC2IN	I	DVDD	Crystal Oscillator Input: input to the inverting amplifier of the oscillator for the USB clock generation. This pin is also the input for an externally generated clock (f_{osc} =4 MHz). In test mode this signal is used as test clock input
21	P35	IO	DVDD	General purpose IO signal
22	P34	IO	SVDD	General purpose IO signal or clk signal for the SAM
23	SIGOUT	O	SVDD	Contactless communication interface output: delivers a serial data stream according to NFCIP-1 and output signal for the SAM. In test mode this signal is used as test signal output.
24	SIGIN	I	SVDD	Contactless communication interface input: accepts a digital, serial data stream according to NFCIP-1 and input signal from the SAM. In test mode

Philips Specification at Figure 3

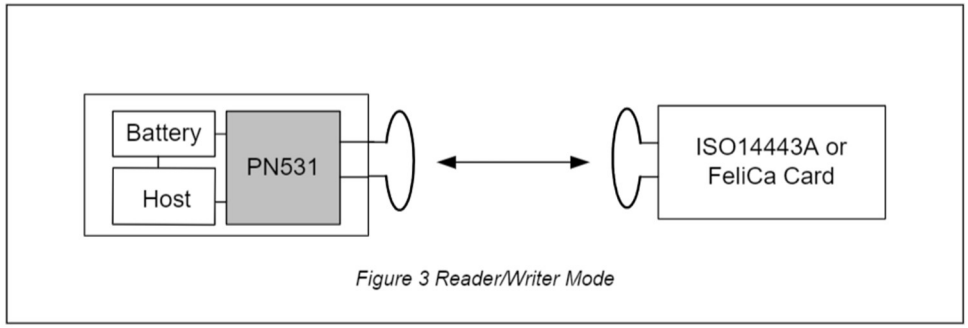
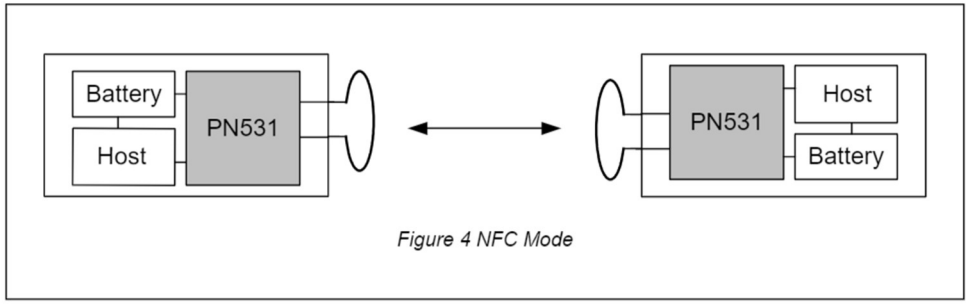
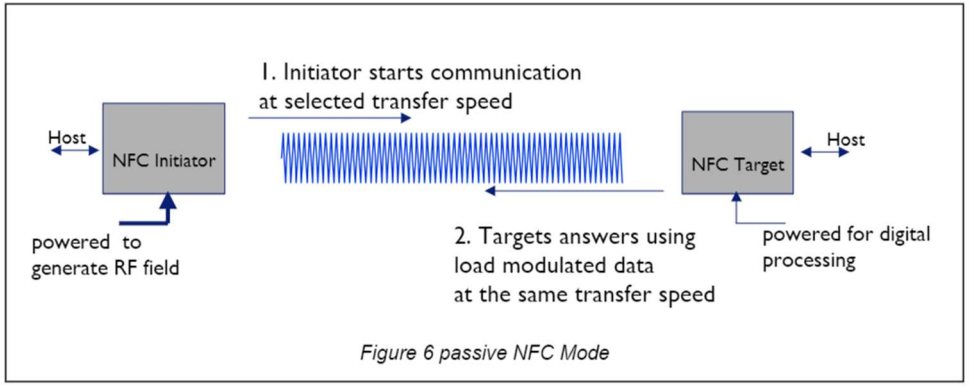
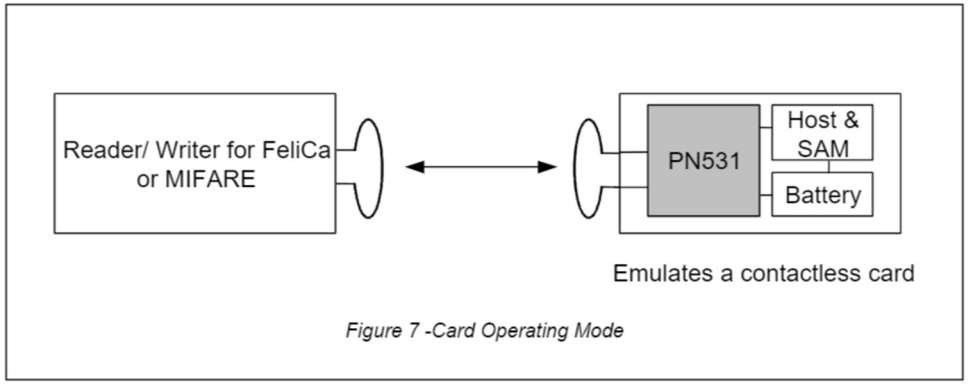
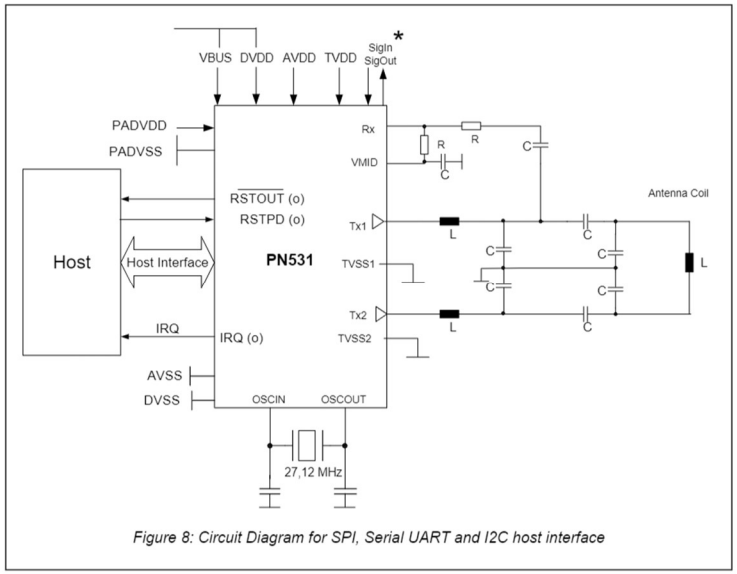


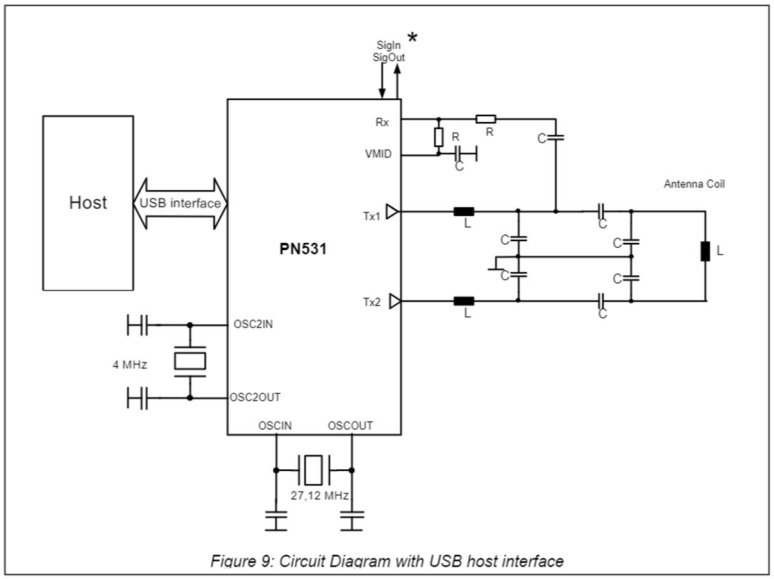
Figure 3 Reader/Writer Mode

Philips Specification at Figure 4

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	 *Figure 4 NFC Mode* Philips Specification at 11 NFC communication differentiates between an active and a passive communication. • Active NFC Mode means both the initiator and the target are using their own RF field for the communication. • Passive NFC Mode means that the target answers to an initiator command in a load modulation scheme. The initiator is active i.e. generating the RF field. Philips Specification at 11 • Initiator: generates RF field @ 13.56 MHz and starts the NFC communication • Target: responds to initiator commands either using load modulation scheme (RF field continuously generated by Initiator) or using modulation of self generated RF field (no RF field generated by initiator) Philips Specification at Figure 6

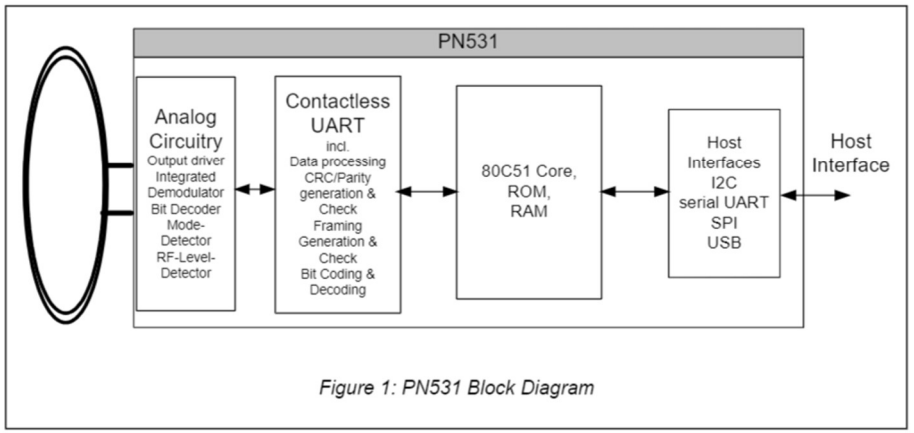
Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	 *Figure 6 passive NFC Mode* Philips Specification at Figure 7  *Figure 7 -Card Operating Mode* Philips Specification at 13 The PN531 can be addressed like a FeliCa™ or ISO14443A/ MIFARE® card. This means that the PN531 in combination with a secure µC may acts as an ISO14443A /MIFARE® or FeliCa™ card. Philips Specification at Figure 8

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	 *Figure 8: Circuit Diagram for SPI, Serial UART and I2C host interface* Philips Specification at 14 The figure below shows a typical application, where the antenna is directly connected to the PN531. The used host interface is SPI, Serial UART or I2C. Philips Specification at Figure 9

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
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[1d] wherein the amplifier is coupled to amplify a signal received from the antenna and to provide an amplified signal to the smartcard controller.	Philips Specification discloses or renders obvious "wherein the amplifier is coupled to amplify a signal received from the antenna and to provide an amplified signal to the smartcard controller." For example: Philips Specification at 3 The PN531 is a highly integrated transmission module for contactless communication at 13.56 MHz including µ-controller functionality based on an 80C51 core with 32 kbyte of ROM and 1 kbyte of RAM. This µc-based transmission module combines an outstanding modulation and demodulation concept completely integrated for different kinds of contactless communication methods and protocols at 13.56 MHz with an easy to use firmware for the different supported modes and the required host interfaces.

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	Philips Specification at 3 The PN531 supports 3 different operating modes • Reader/writer mode for FeliCa™ and ISO14443A cards • Supports Card interface mode for FeliCa™ and ISO14443A/MIFARE® in combination with secure µC • NFC IP-1 mode Philips Specification at 3 In reader/ writer mode the PN531's internal transmitter part is able to drive a reader/writer antenna designed to communicate with ISO14443A /MIFARE® or FeliCa™ cards and transponders without additional active circuitry. The receiver part provides a robust and efficient implementation of a demodulation and decoding circuitry for signals from ISO14443A compatible cards and transponders. The digital part handles the complete ISO14443A framing and error detection (Parity & CRC). Philips Specification at 3 In card mode the PN531 is able to answer a reader/writer command either in FeliCa™ or ISO14443A/MIFARE® card mode. The PN531 generates the proper digital load modulated signals and with an external circuit, can respond to commands sent by the reader/writer. Philips Specification at 4 • 80C51 microcontroller core with 32 kbyte ROM and 1 kbyte RAM • Highly integrated analog circuitry for transmission and reception • Output drivers to connect an antenna with minimum number of external components • Integrated RF Level detector • Integrated mode detector • Hardware and embedded Firmware support for • ISO 14443A reader/writer mode • MIFARE®Classic encryption and MIFARE® higher baudrate communication up to 424 kbit/s • Contactless communication according to the FeliCa™ scheme at 212 kbit/s and 424 kbit/s • NFC standard ECMA 340 and ISO 18092: NFC IP-1 interface and protocol • Host protocol on following interfaces • USB 2.0 full speed compliant device

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	• SPI • I2C • High speed serial UART • Optional interrupt line to the host • Hard reset with low power function • Flexible Power down mode or power reduction mode per software • Internal oscillator to connect a 27.12 MHz quartz • Internal oscillator to connect a 4 MHz quartz for the USB interface • 2.5 - 3.6 V power supply • USB bus powered (In USB mode) • Specific IO ports and interrupt sources for external devices control Philips Specification at 5 The integrated microcontroller and embedded firmware of the PN 531 means a fast and easy integration in a contactless system. The high-level abstraction commands and the complete handling of RF communication protocols free the host CPU of all real time related constraints. Philips Specification at Figure 1

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5	TVDD	PWR		Transmitter power supply: supplies the output stage of TX1 and TX2
6	TX2	O	TVDD	Transmitter 2: delivers the modulated 13.56 MHz energy carrier
7	TVSS2	PWR		Transmitter Ground: supplies the output stage of TX1 and TX2
8	AVDD	PWR		Analog Power Supply
9	VMID	PWR	AVDD	Internal Reference Voltage: This pin delivers the internal reference voltage.
10	RX	I	AVDD	Receiver Input: Input pin for the reception signal, which is the load modulated 13.56 MHz energy carrier from the antenna circuit.
11	AVSS	PWR		Analog Ground
12	AUX1	O	DVDD	Auxiliary Output: This pin delivers analog and digital test signals.
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15	OSCOUT	O	AVDD	Crystal Oscillator output: Output of the inverting amplifier of the oscillator.
16	I0	I	DVDD	Interface mode lines: selects the used host interface. In test mode I0 is used as test signals.
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20	OSC2IN	I	DVDD	Crystal Oscillator Input: input to the inverting amplifier of the oscillator for the USB clock generation. This pin is also the input for an externally generated clock (f_{osc} =4 MHz). In test mode this signal is used as test clock input
21	P35	IO	DVDD	General purpose IO signal
22	P34	IO	SVDD	General purpose IO signal or clk signal for the SAM
23	SIGOUT	O	SVDD	Contactless communication interface output: delivers a serial data stream according to NFCIP-1 and output signal for the SAM. In test mode this signal is used as test signal output.
24	SIGIN	I	SVDD	Contactless communication interface input: accepts a digital, serial data stream according to NFCIP-1 and input signal from the SAM. In test mode

Philips Specification at Figure 3

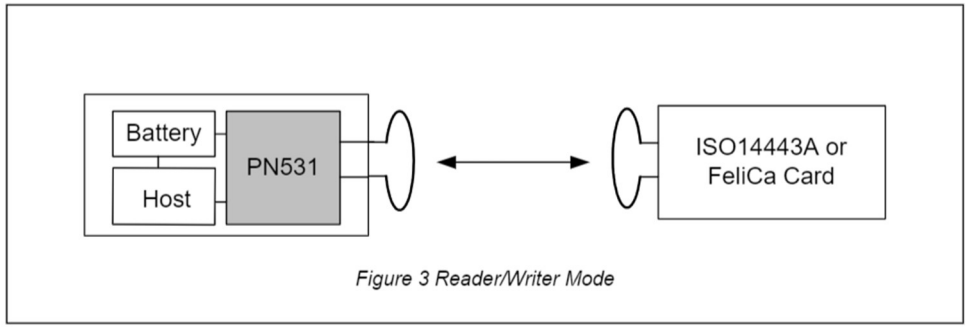
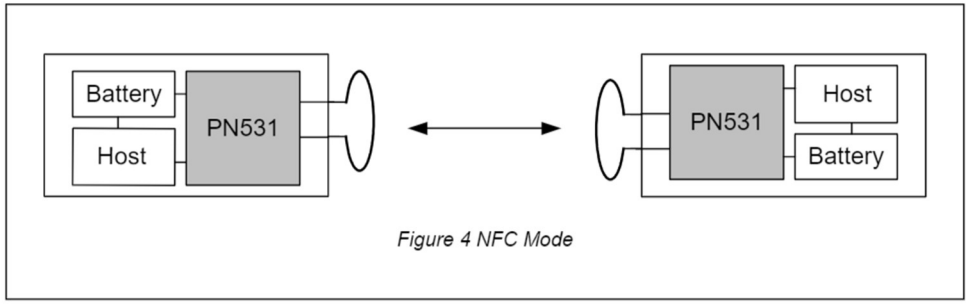
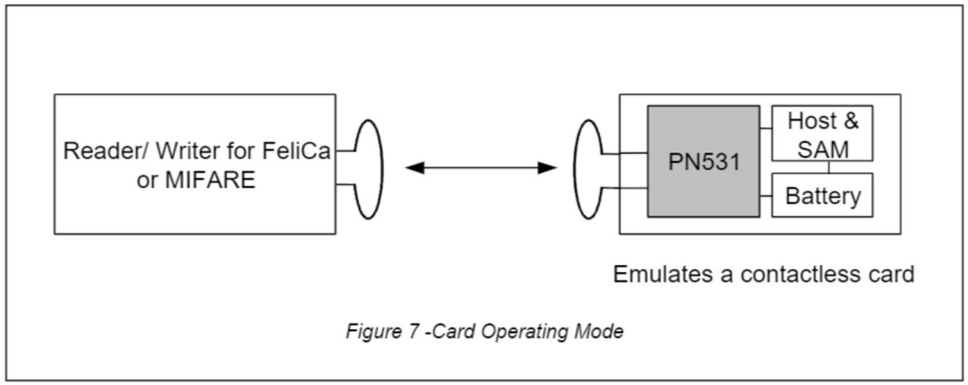
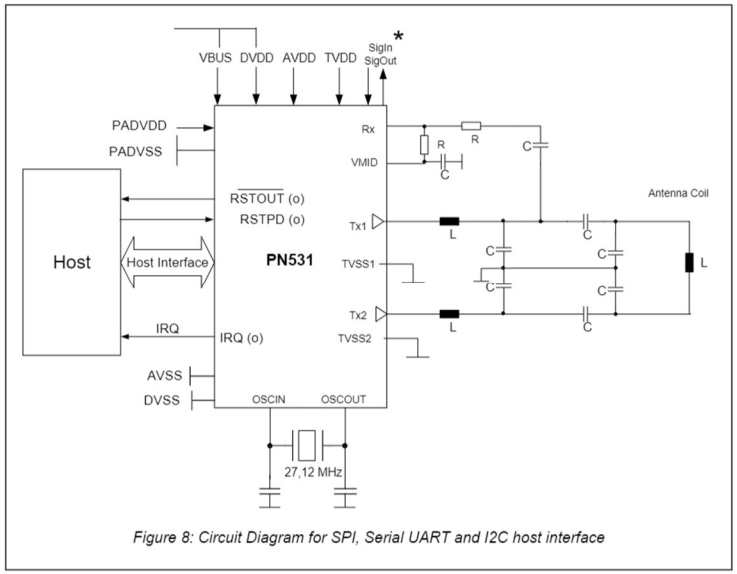
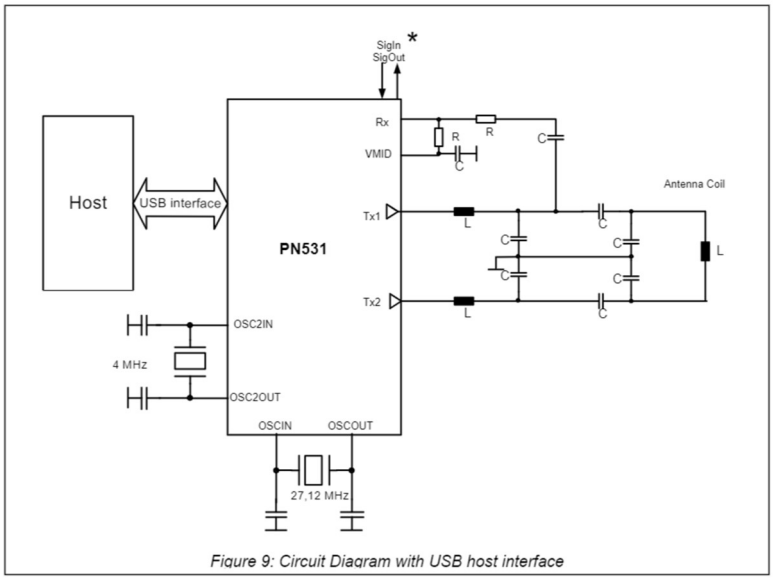


Figure 3 Reader/Writer Mode

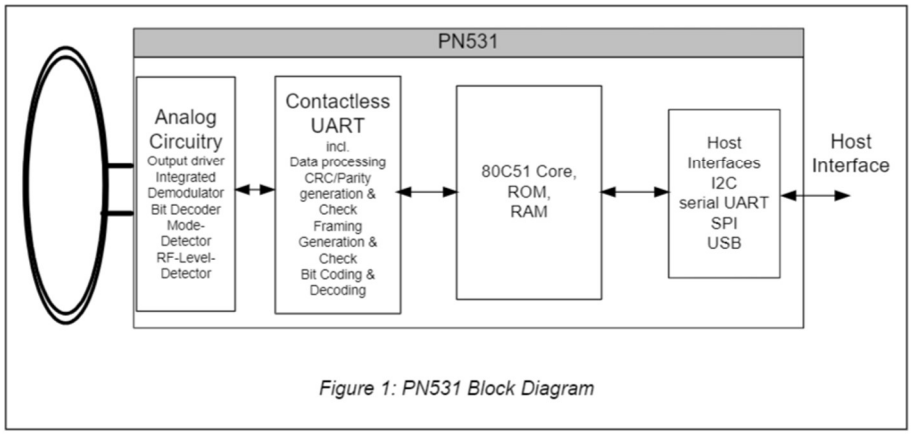
Philips Specification at Figure 4

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	 *Figure 4 NFC Mode* Philips Specification at Figure 7  *Figure 7 -Card Operating Mode* Philips Specification at 13 The PN531 can be addressed like a FeliCa™ or ISO14443A/ MIFARE® card. This means that the PN531 in combination with a secure µC may acts as an ISO14443A /MIFARE® or FeliCa™ card. Philips Specification at Figure 8

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	 *Figure 8: Circuit Diagram for SPI, Serial UART and I2C host interface* Philips Specification at 14 The figure below shows a typical application, where the antenna is directly connected to the PN531. The used host interface is SPI, Serial UART or I2C. Philips Specification at Figure 9

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	 *Figure 9: Circuit Diagram with USB host interface* Philips Specification at 15 The figure below shows a typical application where the antenna is directly connected to the PN531. The host interface is USB. To the extent this limitation is not disclosed by Philips Specification, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Philips Specification, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
2. The mobile device of claim 1 wherein the antenna is tuned to operate at 13.56 MHz.	Philips Specification expressly or inherently discloses "[t]he mobile device of claim 1 wherein the antenna is tuned to operate at 13.56 MHz." For example: Philips Specification at 3 The PN531 is a highly integrated transmission module for contactless communication at 13.56 MHz including µ-controller functionality based on an 80C51 core with 32 kbyte of ROM and 1 kbyte of RAM. This µc-based transmission module combines an outstanding modulation and demodulation concept completely integrated for different kinds of contactless communication methods and protocols at 13.56 MHz with an easy to use firmware for the different supported modes and the required host interfaces.

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	Philips Specification at 3 In reader/ writer mode the PN531's internal transmitter part is able to drive a reader/writer antenna designed to communicate with ISO14443A /MIFARE® or FeliCa™ cards and transponders without additional active circuitry. The receiver part provides a robust and efficient implementation of a demodulation and decoding circuitry for signals from ISO14443A compatible cards and transponders. The digital part handles the complete ISO14443A framing and error detection (Parity & CRC). Philips Specification at 4 • 80C51 microcontroller core with 32 kbyte ROM and 1 kbyte RAM • Highly integrated analog circuitry for transmission and reception • Output drivers to connect an antenna with minimum number of external components • Integrated RF Level detector • Integrated mode detector • Hardware and embedded Firmware support for • ISO 14443A reader/writer mode • MIFARE®Classic encryption and MIFARE® higher baudrate communication up to 424 kbit/s • Contactless communication according to the FeliCa™ scheme at 212 kbit/s and 424 kbit/s • NFC standard ECMA 340 and ISO 18092: NFC IP-1 interface and protocol • Host protocol on following interfaces • USB 2.0 full speed compliant device • SPI • I2C • High speed serial UART • Optional interrupt line to the host • Hard reset with low power function • Flexible Power down mode or power reduction mode per software • Internal oscillator to connect a 27.12 MHz quartz • Internal oscillator to connect a 4 MHz quartz for the USB interface • 2.5 - 3.6 V power supply • USB bus powered (In USB mode) • Specific IO ports and interrupt sources for external devices control

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	Philips Specification at 5 The PN531 is tailored to fulfil the requirements of various applications using contactless communication based on the ECMA340 (NFC IP-1) Interface and protocol standard, the ISO14443A reader and FeliCa reader protocol. NFC IP-1 is also standardised in ISO/IEC 18092. Philips Specification at Figure 1 **2 BLOCK DIAGRAM** **2.1 Simplified PN531 Block Diagram**  *Figure 1: PN531 Block Diagram* Philips Specification at 6 The RF level detector detects the presence of an external RF field at 13.56 MHz. Philips Specification at Figure 3.2

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")

3.2 Pin Description

Pin	Symbol	Type	Pad Ref Voltage	Description
1	DVSS	PWR		Digital Ground
2	LOADMOD	O	DVDD	Load Modulation output provides digital signal for FeliCa and MIFARE® card operating mode
3	TVSS1	PWR		Transmitter Ground: supplies the output stage of TX1 and TX2
4	TX1	O	TVDD	Transmitter 1: delivers the modulated 13.56 MHz energy carrier
5	TVDD	PWR		Transmitter power supply: supplies the output stage of TX1 and TX2
6	TX2	O	TVDD	Transmitter 2: delivers the modulated 13.56 MHz energy carrier
7	TVSS2	PWR		Transmitter Ground: supplies the output stage of TX1 and TX2
8	AVDD	PWR		Analog Power Supply
9	VMID	PWR	AVDD	Internal Reference Voltage: This pin delivers the internal reference voltage.
10	RX	I	AVDD	Receiver Input: Input pin for the reception signal, which is the load modulated 13.56 MHz energy carrier from the antenna circuit.
11	AVSS	PWR		Analog Ground
12	AUX1	O	DVDD	Auxiliary Output: This pin delivers analog and digital test signals.
13	AUX2	O	DVDD	Auxiliary Output: This pin delivers analog and digital test signals.
14	OSCIN	I	AVDD	Crystal Oscillator Input: input to the inverting amplifier of the oscillator. This pin is also the input for an externally generated clock (fosc = 27.12 MHz).
15	OSCOUT	O	AVDD	Crystal Oscillator output: Output of the inverting amplifier of the oscillator.
16	I0	I	DVDD	Interface mode lines: selects the used host interface. In test mode I0 is used as test signals.
17	I1	I	DVDD	Interface mode lines: selects the used host interface. In test mode I0 is used as test signals.
18	TESTEN	I	DVDD	Test enable pin: When set to 1 enable the test mode. When set to 0 reset the TCB and disable the access to the test mode.
19	OSC2OUT	O	DVDD	Crystal Oscillator output: Output of the inverting amplifier of the oscillator for the USB clock.
20	OSC2IN	I	DVDD	Crystal Oscillator Input: input to the inverting amplifier of the oscillator for the USB clock generation. This pin is also the input for an externally generated clock (f_{osc} =4 MHz). In test mode this signal is used as test clock input
21	P35	IO	DVDD	General purpose IO signal
22	P34	IO	SVDD	General purpose IO signal or clk signal for the SAM
23	SIGOUT	O	SVDD	Contactless communication interface output: delivers a serial data stream according to NFCIP-1 and output signal for the SAM. In test mode this signal is used as test signal output.
24	SIGIN	I	SVDD	Contactless communication interface input: accepts a digital, serial data stream according to NFCIP-1 and input signal from the SAM. In test mode

Philips Specification at Figure 3

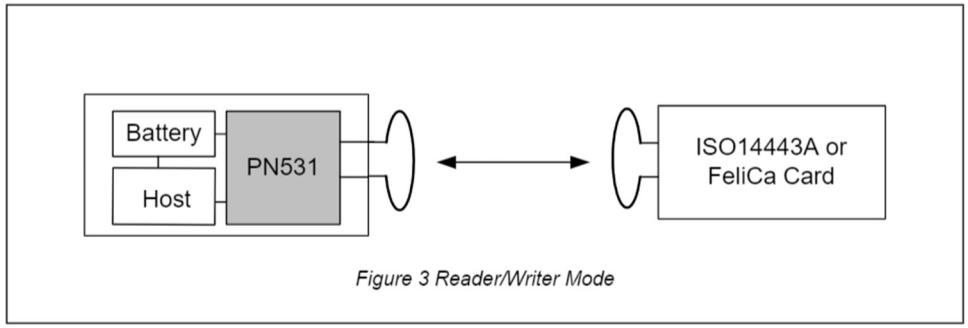
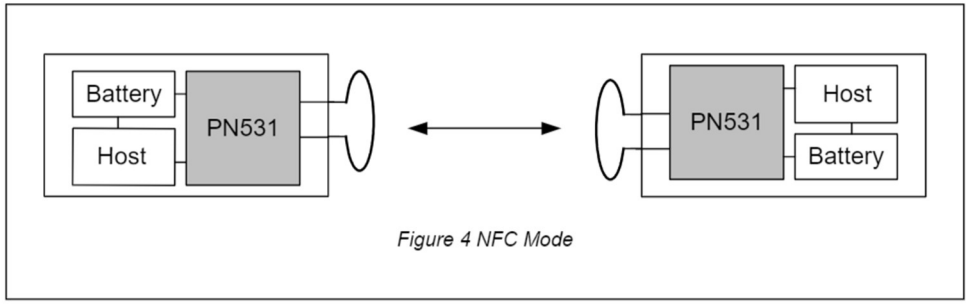
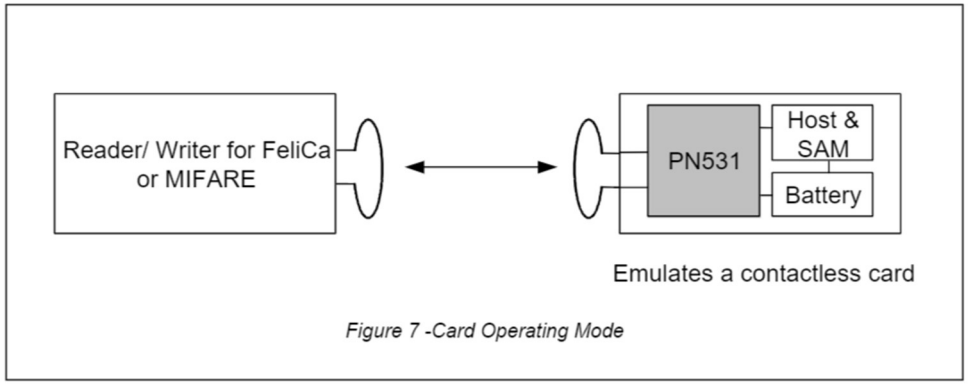
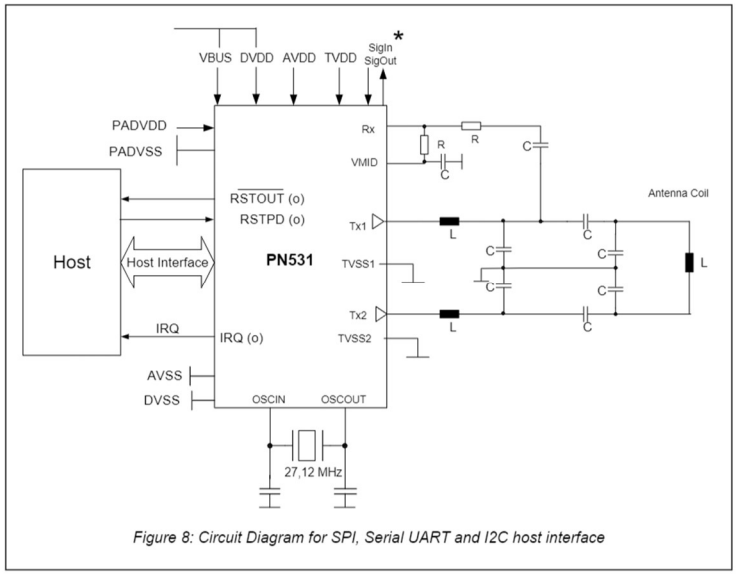
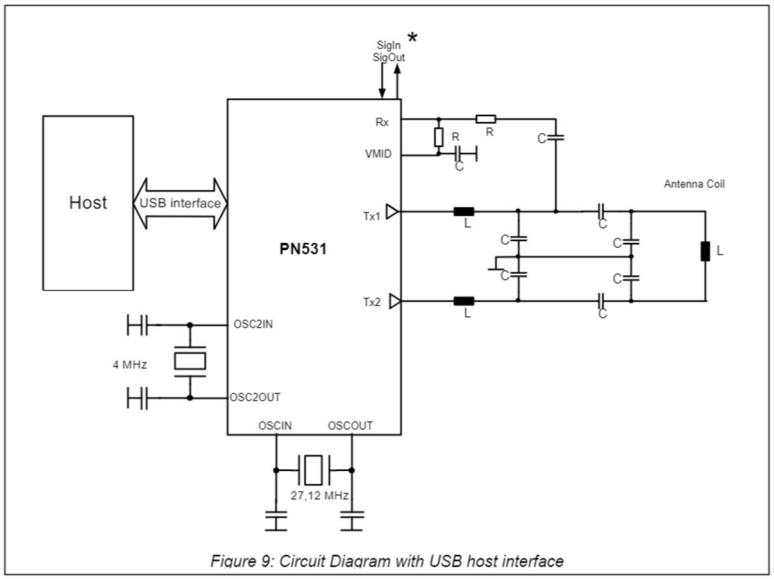


Figure 3 Reader/Writer Mode

Philips Specification at Figure 4

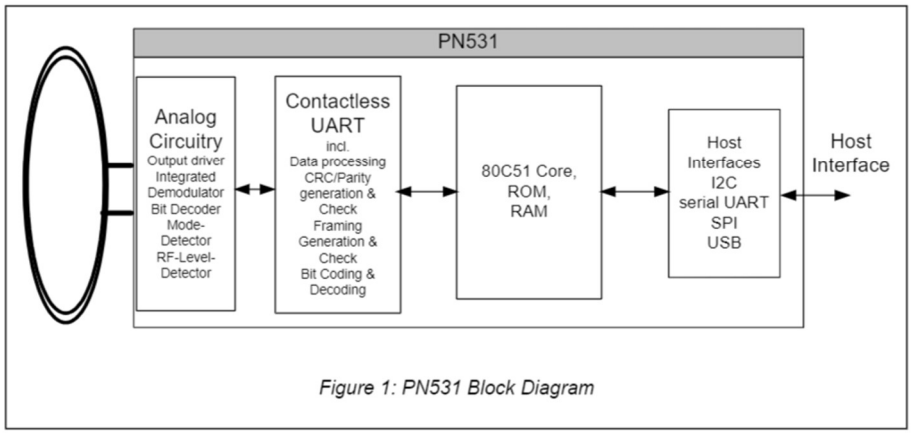
Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	 *Figure 4 NFC Mode* Philips Specification at 11 • Initiator: generates RF field @ 13.56 MHz and starts the NFC communication • Target: responds to initiator commands either using load modulation scheme (RF field continuously generated by Initiator) or using modulation of self generated RF field (no RF field generated by initiator) Philips Specification at Figure 7  *Figure 7 -Card Operating Mode* Philips Specification at Figure 8

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
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Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
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3. The mobile device of claim 1 wherein the antenna comprises an inductive element too small to draw enough power sufficient to operate the smartcard controller	Philips Specification expressly or inherently discloses "[t]he mobile device of claim 1 wherein the antenna comprises an inductive element too small to draw enough power sufficient to operate the smartcard controller from an interrogating radio frequency (RF) field." For example: Philips Specification at 3

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
from an interrogating radio frequency (RF) field.	The PN531 is a highly integrated transmission module for contactless communication at 13.56 MHz including µ-controller functionality based on an 80C51 core with 32 kbyte of ROM and 1 kbyte of RAM. This µc-based transmission module combines an outstanding modulation and demodulation concept completely integrated for different kinds of contactless communication methods and protocols at 13.56 MHz with an easy to use firmware for the different supported modes and the required host interfaces. Philips Specification at 3 The PN531 supports 3 different operating modes • Reader/writer mode for FeliCa™ and ISO14443A cards • Supports Card interface mode for FeliCa™ and ISO14443A/MIFARE® in combination with secure µC • NFC IP-1 mode Philips Specification at 3 In reader/ writer mode the PN531's internal transmitter part is able to drive a reader/writer antenna designed to communicate with ISO14443A /MIFARE® or FeliCa™ cards and transponders without additional active circuitry. The receiver part provides a robust and efficient implementation of a demodulation and decoding circuitry for signals from ISO14443A compatible cards and transponders. The digital part handles the complete ISO14443A framing and error detection (Parity & CRC). Philips Specification at 3 In card mode the PN531 is able to answer a reader/writer command either in FeliCa™ or ISO14443A/MIFARE® card mode. The PN531 generates the proper digital load modulated signals and with an external circuit, can respond to commands sent by the reader/writer. Philips Specification at 4 • 80C51 microcontroller core with 32 kbyte ROM and 1 kbyte RAM • Highly integrated analog circuitry for transmission and reception • Output drivers to connect an antenna with minimum number of external components • Integrated RF Level detector • Integrated mode detector • Hardware and embedded Firmware support for • ISO 14443A reader/writer mode

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	• MIFARE®Classic encryption and MIFARE® higher baudrate communication up to 424 kbit/s • Contactless communication according to the FeliCa™ scheme at 212 kbit/s and 424 kbit/s • NFC standard ECMA 340 and ISO 18092: NFC IP-1 interface and protocol • Host protocol on following interfaces • USB 2.0 full speed compliant device • SPI • I2C • High speed serial UART • Optional interrupt line to the host • Hard reset with low power function • Flexible Power down mode or power reduction mode per software • Internal oscillator to connect a 27.12 MHz quartz • Internal oscillator to connect a 4 MHz quartz for the USB interface • 2.5 - 3.6 V power supply • USB bus powered (In USB mode) • Specific IO ports and interrupt sources for external devices control Philips Specification at 5 The integrated microcontroller and embedded firmware of the PN 531 means a fast and easy integration in a contactless system. The high-level abstraction commands and the complete handling of RF communication protocols free the host CPU of all real time related constraints. Philips Specification at Figure 1

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	2 BLOCK DIAGRAM **2.1 Simplified PN531 Block Diagram**  *Figure 1: PN531 Block Diagram* Philips Specification at 6 The microcontroller with its embedded firmware allows autonomous management of communication both on the RF interface and with the host. Philips Specification at Figure 3.2

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")

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5	TVDD	PWR		Transmitter power supply: supplies the output stage of TX1 and TX2
6	TX2	O	TVDD	Transmitter 2: delivers the modulated 13.56 MHz energy carrier
7	TVSS2	PWR		Transmitter Ground: supplies the output stage of TX1 and TX2
8	AVDD	PWR		Analog Power Supply
9	VMID	PWR	AVDD	Internal Reference Voltage: This pin delivers the internal reference voltage.
10	RX	I	AVDD	Receiver Input: Input pin for the reception signal, which is the load modulated 13.56 MHz energy carrier from the antenna circuit.
11	AVSS	PWR		Analog Ground
12	AUX1	O	DVDD	Auxiliary Output: This pin delivers analog and digital test signals.
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14	OSCIN	I	AVDD	Crystal Oscillator Input: input to the inverting amplifier of the oscillator. This pin is also the input for an externally generated clock (fosc = 27.12 MHz).
15	OSCOUT	O	AVDD	Crystal Oscillator output: Output of the inverting amplifier of the oscillator.
16	I0	I	DVDD	Interface mode lines: selects the used host interface. In test mode I0 is used as test signals.
17	I1	I	DVDD	Interface mode lines: selects the used host interface. In test mode I0 is used as test signals.
18	TESTEN	I	DVDD	Test enable pin: When set to 1 enable the test mode. When set to 0 reset the TCB and disable the access to the test mode.
19	OSC2OUT	O	DVDD	Crystal Oscillator output: Output of the inverting amplifier of the oscillator for the USB clock.
20	OSC2IN	I	DVDD	Crystal Oscillator Input: input to the inverting amplifier of the oscillator for the USB clock generation. This pin is also the input for an externally generated clock (f_{osc} =4 MHz). In test mode this signal is used as test clock input
21	P35	IO	DVDD	General purpose IO signal
22	P34	IO	SVDD	General purpose IO signal or clk signal for the SAM
23	SIGOUT	O	SVDD	Contactless communication interface output: delivers a serial data stream according to NFCIP-1 and output signal for the SAM. In test mode this signal is used as test signal output.
24	SIGIN	I	SVDD	Contactless communication interface input: accepts a digital, serial data stream according to NFCIP-1 and input signal from the SAM. In test mode

Philips Specification at Figure 3

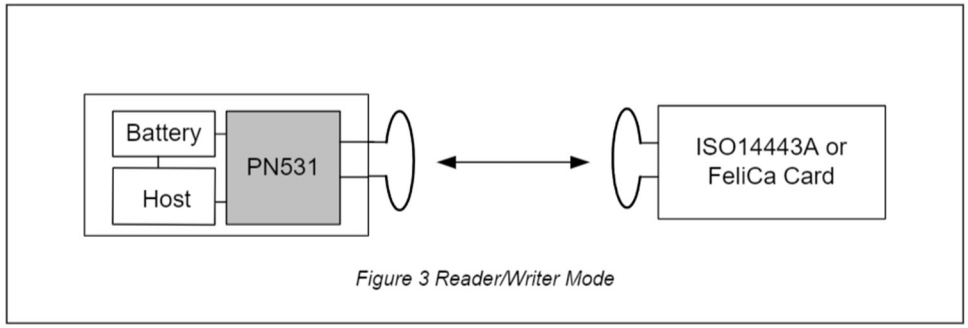
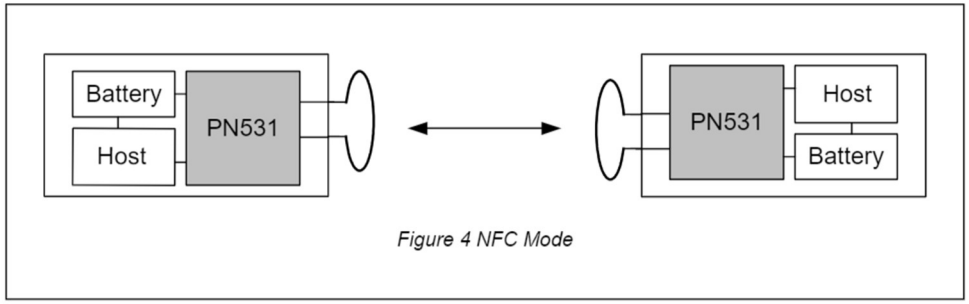
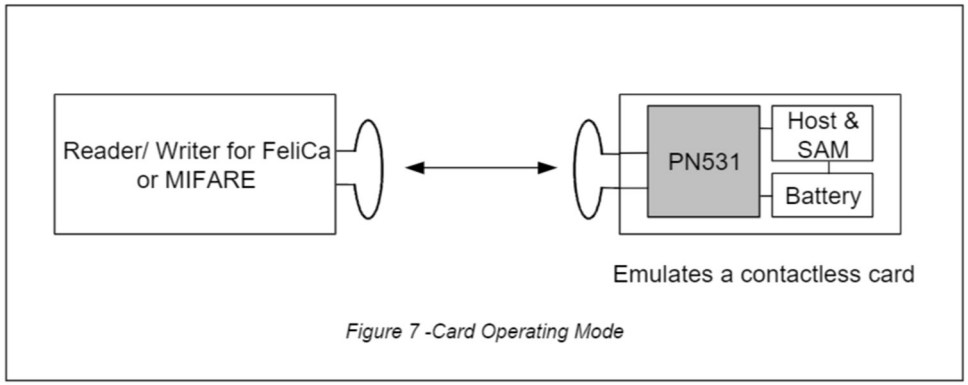
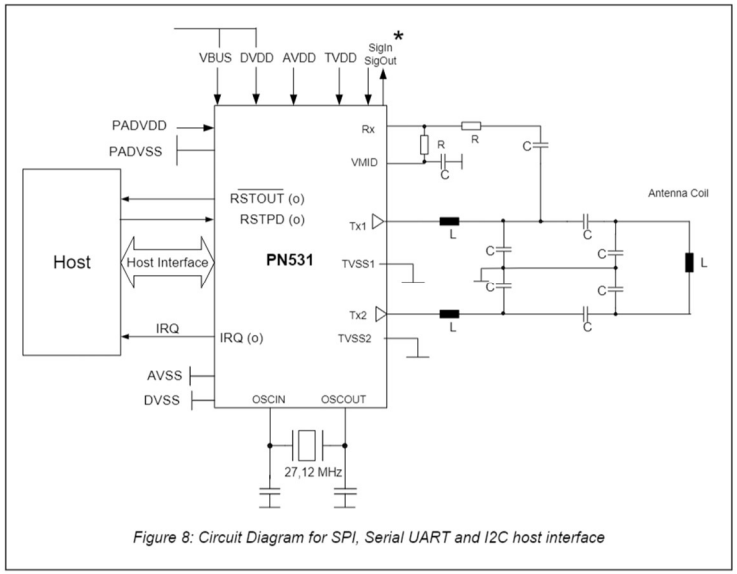
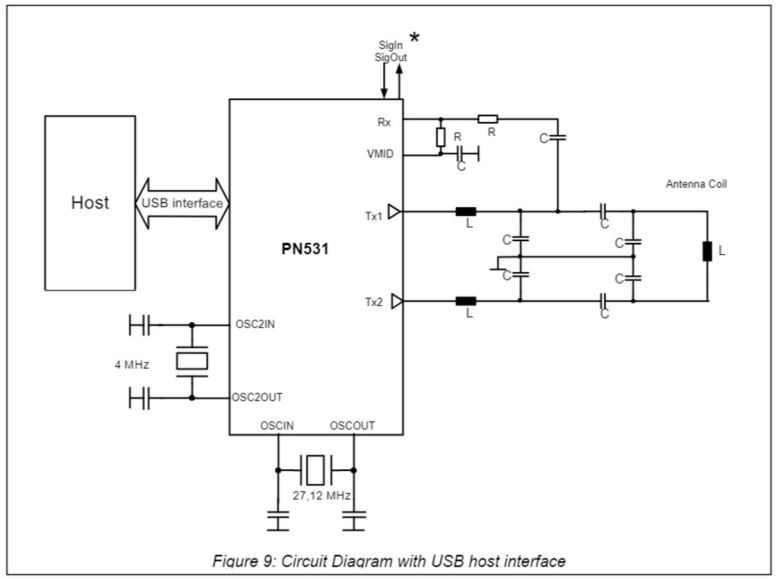


Figure 3 Reader/Writer Mode

Philips Specification at Figure 4

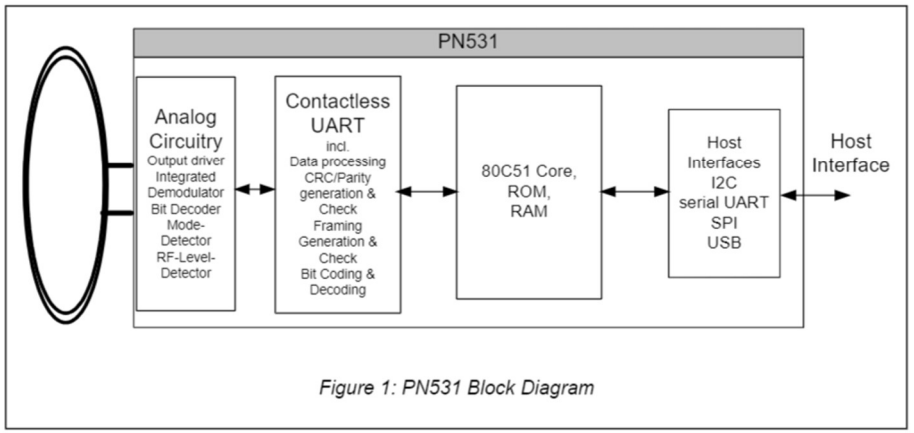
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4. The mobile device of claim 1 wherein the smartcard controller is coupled to be powered by the mobile device.	Philips Specification expressly or inherently discloses "[t]he mobile device of claim 1 wherein the smartcard controller is coupled to be powered by the mobile device." For example: Philips Specification at 3 The PN531 is a highly integrated transmission module for contactless communication at 13.56 MHz including µ-controller functionality based on an 80C51 core with 32 kbyte of ROM and 1 kbyte of RAM. This µc-based transmission module combines an outstanding modulation and demodulation concept

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Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	• Host protocol on following interfaces • USB 2.0 full speed compliant device • SPI • I2C • High speed serial UART • Optional interrupt line to the host • Hard reset with low power function • Flexible Power down mode or power reduction mode per software • Internal oscillator to connect a 27.12 MHz quartz • Internal oscillator to connect a 4 MHz quartz for the USB interface • 2.5 - 3.6 V power supply • USB bus powered (In USB mode) • Specific IO ports and interrupt sources for external devices control Philips Specification at 5 The integrated microcontroller and embedded firmware of the PN 531 means a fast and easy integration in a contactless system. The high-level abstraction commands and the complete handling of RF communication protocols free the host CPU of all real time related constraints. Philips Specification at Figure 1

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	2 BLOCK DIAGRAM **2.1 Simplified PN531 Block Diagram**  *Figure 1: PN531 Block Diagram* Philips Specification at 6 The microcontroller with its embedded firmware allows autonomous management of communication both on the RF interface and with the host. Philips Specification at 7 The device operates with six individual power supplies for best performance in terms of EMC behaviour and signal de-coupling. This gives outstanding RF performance and maximum flexibility to adapt to different operating voltages of digital and analog parts. Philips Specification at Figure 3.2

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")

3.2 Pin Description

Pin	Symbol	Type	Pad Ref Voltage	Description
1	DVSS	PWR		Digital Ground
2	LOADMOD	O	DVDD	Load Modulation output provides digital signal for FeliCa and MIFARE® card operating mode
3	TVSS1	PWR		Transmitter Ground: supplies the output stage of TX1 and TX2
4	TX1	O	TVDD	Transmitter 1: delivers the modulated 13.56 MHz energy carrier
5	TVDD	PWR		Transmitter power supply: supplies the output stage of TX1 and TX2
6	TX2	O	TVDD	Transmitter 2: delivers the modulated 13.56 MHz energy carrier
7	TVSS2	PWR		Transmitter Ground: supplies the output stage of TX1 and TX2
8	AVDD	PWR		Analog Power Supply
9	VMID	PWR	AVDD	Internal Reference Voltage: This pin delivers the internal reference voltage.
10	RX	I	AVDD	Receiver Input: Input pin for the reception signal, which is the load modulated 13.56 MHz energy carrier from the antenna circuit.
11	AVSS	PWR		Analog Ground
12	AUX1	O	DVDD	Auxiliary Output: This pin delivers analog and digital test signals.
13	AUX2	O	DVDD	Auxiliary Output: This pin delivers analog and digital test signals.
14	OSCIN	I	AVDD	Crystal Oscillator Input: input to the inverting amplifier of the oscillator. This pin is also the input for an externally generated clock (fosc = 27.12 MHz).
15	OSCOUT	O	AVDD	Crystal Oscillator output: Output of the inverting amplifier of the oscillator.
16	I0	I	DVDD	Interface mode lines: selects the used host interface. In test mode I0 is used as test signals.
17	I1	I	DVDD	Interface mode lines: selects the used host interface. In test mode I0 is used as test signals.
18	TESTEN	I	DVDD	Test enable pin: When set to 1 enable the test mode. When set to 0 reset the TCB and disable the access to the test mode.
19	OSC2OUT	O	DVDD	Crystal Oscillator output: Output of the inverting amplifier of the oscillator for the USB clock.
20	OSC2IN	I	DVDD	Crystal Oscillator Input: input to the inverting amplifier of the oscillator for the USB clock generation. This pin is also the input for an externally generated clock (f_{osc} =4 MHz). In test mode this signal is used as test clock input
21	P35	IO	DVDD	General purpose IO signal
22	P34	IO	SVDD	General purpose IO signal or clk signal for the SAM
23	SIGOUT	O	SVDD	Contactless communication interface output: delivers a serial data stream according to NFCIP-1 and output signal for the SAM. In test mode this signal is used as test signal output.
24	SIGIN	I	SVDD	Contactless communication interface input: accepts a digital, serial data stream according to NFCIP-1 and input signal from the SAM. In test mode

Philips Specification at Figure 3

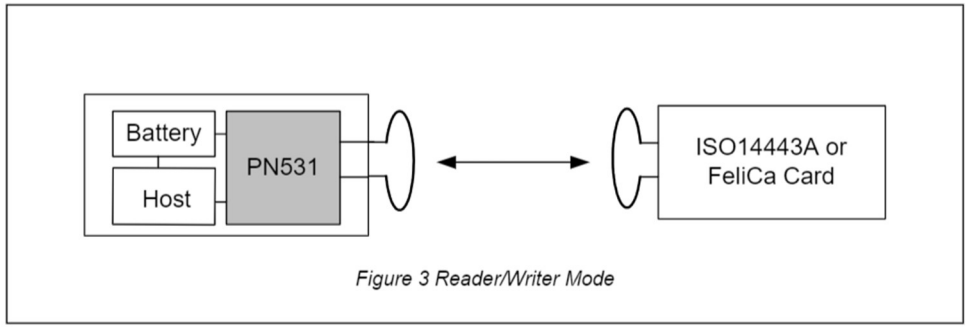
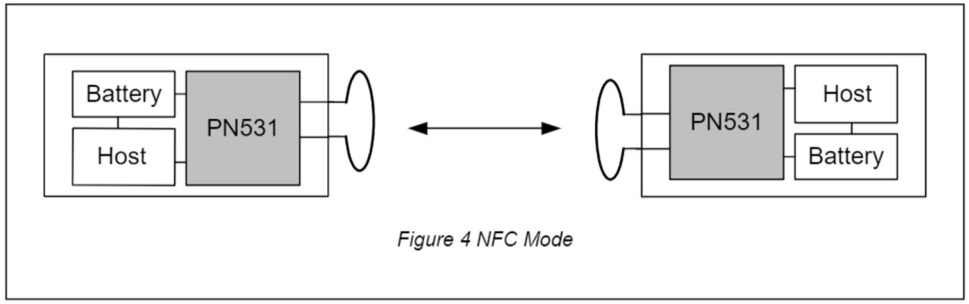
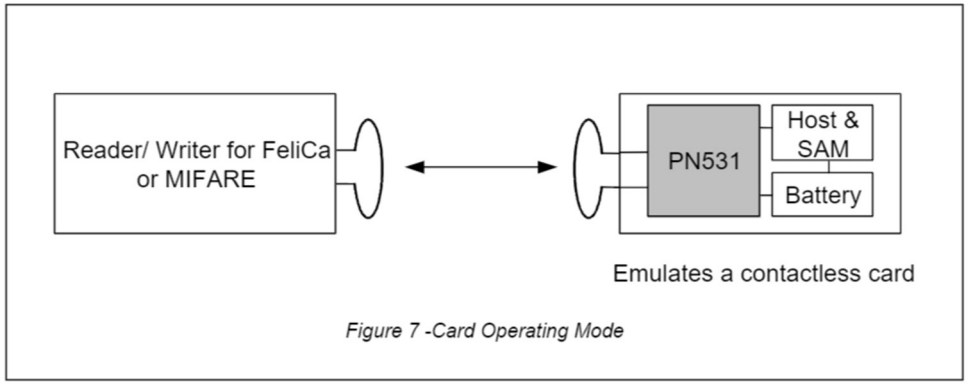
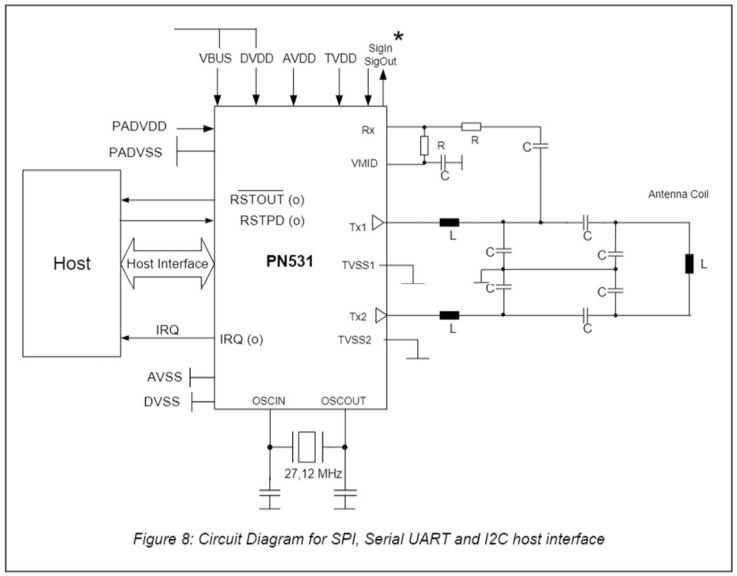


Figure 3 Reader/Writer Mode

Philips Specification at Figure 4

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	 *Figure 4 NFC Mode* Philips Specification at 11 • Initiator: generates RF field @ 13.56 MHz and starts the NFC communication • Target: responds to initiator commands either using load modulation scheme (RF field continuously generated by Initiator) or using modulation of self generated RF field (no RF field generated by initiator) Philips Specification at Figure 7  *Figure 7 -Card Operating Mode* Philips Specification at 13 The PN531 can be addressed like a FeliCa™ or ISO14443A/ MIFARE® card. This means that the PN531 in combination with a secure µC may acts as an ISO14443A /MIFARE® or FeliCa™ card.

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	Philips Specification at Figure 8  *Figure 8: Circuit Diagram for SPI, Serial UART and I2C host interface* Philips Specification at 14 The figure below shows a typical application, where the antenna is directly connected to the PN531. The used host interface is SPI, Serial UART or I2C. Philips Specification at Figure 9

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")

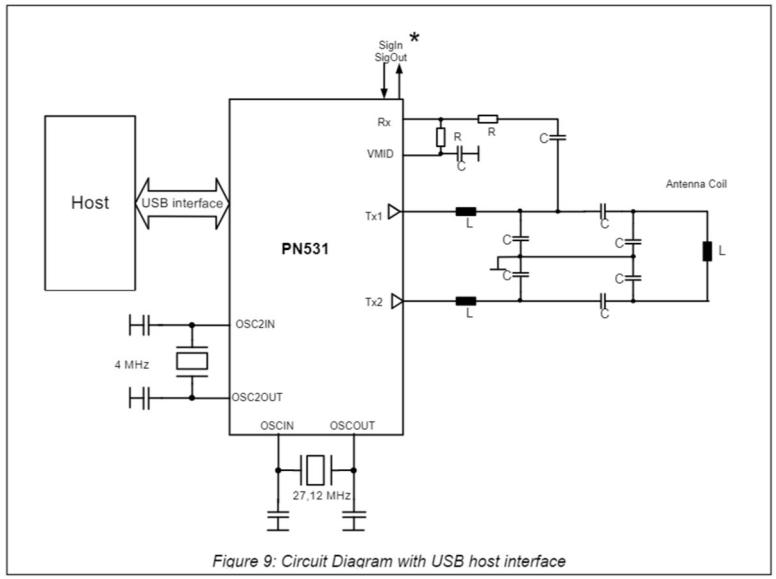


Figure 9: Circuit Diagram with USB host interface

Philips Specification at Table 6–1

6.1 Absolute Maximum Continuous Ratings

SYMBOL	PARAMETER	MIN	MAX	UNIT
AVDD DVDD PVDD SVDD TVDD	Supply Voltages	-0.5	4.0	V
VBUS	USB Supply Voltage	-0.5	5.5	V

Table 6-1: Absolute Maximum Continuous Ratings

To the extent this limitation is not disclosed by Philips Specification, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Philips Specification, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.

See also claim 1 above.

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
5. The mobile device of claim 1 wherein the performance enhancement circuits are coupled to be powered by the mobile device.	Philips Specification expressly or inherently discloses "[t]he mobile device of claim 1 wherein the performance enhancement circuits are coupled to be powered by the mobile device." For example: Philips Specification at 4 • 80C51 microcontroller core with 32 kbyte ROM and 1 kbyte RAM • Highly integrated analog circuitry for transmission and reception • Output drivers to connect an antenna with minimum number of external components • Integrated RF Level detector • Integrated mode detector • Hardware and embedded Firmware support for • ISO 14443A reader/writer mode • MIFARE®Classic encryption and MIFARE® higher baudrate communication up to 424 kbit/s • Contactless communication according to the FeliCa™ scheme at 212 kbit/s and 424 kbit/s • NFC standard ECMA 340 and ISO 18092: NFC IP-1 interface and protocol • Host protocol on following interfaces • USB 2.0 full speed compliant device • SPI • I2C • High speed serial UART • Optional interrupt line to the host • Hard reset with low power function • Flexible Power down mode or power reduction mode per software • Internal oscillator to connect a 27.12 MHz quartz • Internal oscillator to connect a 4 MHz quartz for the USB interface • 2.5 - 3.6 V power supply • USB bus powered (In USB mode) • Specific IO ports and interrupt sources for external devices control Philips Specification at 7 The device operates with six individual power supplies for best performance in terms of EMC behaviour and signal de-coupling. This gives outstanding RF performance and maximum flexibility to adapt to different operating voltages of digital and analog parts.

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	Philips Specification at Figure 3.2

3.2 Pin Description

Pin	Symbol	Type	Pad Ref Voltage	Description
1	DVSS	PWR		Digital Ground
2	LOADMOD	O	DVDD	Load Modulation output provides digital signal for FeliCa and MIFARE® card operating mode
3	TVSS1	PWR		Transmitter Ground: supplies the output stage of TX1 and TX2
4	TX1	O	TVDD	Transmitter 1: delivers the modulated 13.56 MHz energy carrier
5	TVDD	PWR		Transmitter power supply: supplies the output stage of TX1 and TX2
6	TX2	O	TVDD	Transmitter 2: delivers the modulated 13.56 MHz energy carrier
7	TVSS2	PWR		Transmitter Ground: supplies the output stage of TX1 and TX2
8	AVDD	PWR		Analog Power Supply
9	VMID	PWR	AVDD	Internal Reference Voltage: This pin delivers the internal reference voltage.
10	RX	I	AVDD	Receiver Input: Input pin for the reception signal, which is the load modulated 13.56 MHz energy carrier from the antenna circuit.
11	AVSS	PWR		Analog Ground
12	AUX1	O	DVDD	Auxiliary Output: This pin delivers analog and digital test signals.
13	AUX2	O	DVDD	Auxiliary Output: This pin delivers analog and digital test signals.
14	OSCIN	I	AVDD	Crystal Oscillator Input: input to the inverting amplifier of the oscillator. This pin is also the input for an externally generated clock (fosc = 27.12 MHz).
15	OSCOUT	O	AVDD	Crystal Oscillator output: Output of the inverting amplifier of the oscillator.
16	I0	I	DVDD	Interface mode lines: selects the used host interface. In test mode I0 is used as test signals.
17	I1	I	DVDD	Interface mode lines: selects the used host interface. In test mode I0 is used as test signals.
18	TESTEN	I	DVDD	Test enable pin: When set to 1 enable the test mode. When set to 0 reset the TCB and disable the access to the test mode.
19	OSC2OUT	O	DVDD	Crystal Oscillator output: Output of the inverting amplifier of the oscillator for the USB clock.
20	OSC2IN	I	DVDD	Crystal Oscillator Input: input to the inverting amplifier of the oscillator for the USB clock generation. This pin is also the input for an externally generated clock (f_{osc} =4 MHz). In test mode this signal is used as test clock input
21	P35	IO	DVDD	General purpose IO signal
22	P34	IO	SVDD	General purpose IO signal or clk signal for the SAM
23	SIGOUT	O	SVDD	Contactless communication interface output: delivers a serial data stream according to NFCIP-1 and output signal for the SAM. In test mode this signal is used as test signal output.
24	SIGIN	I	SVDD	Contactless communication interface input: accepts a digital, serial data stream according to NFCIP-1 and input signal from the SAM. In test mode

Philips Specification at Figure 3

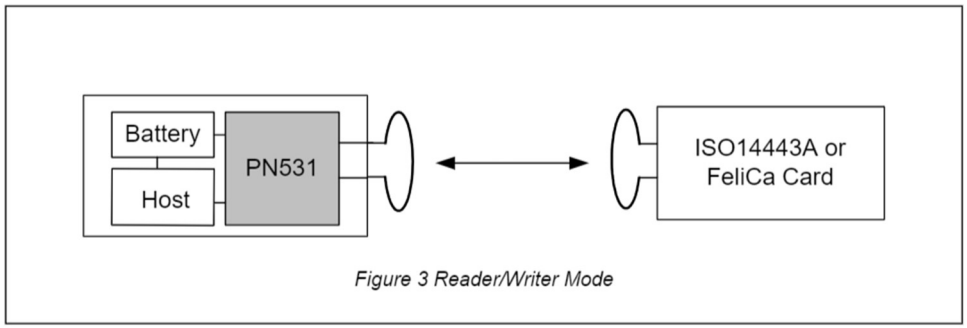
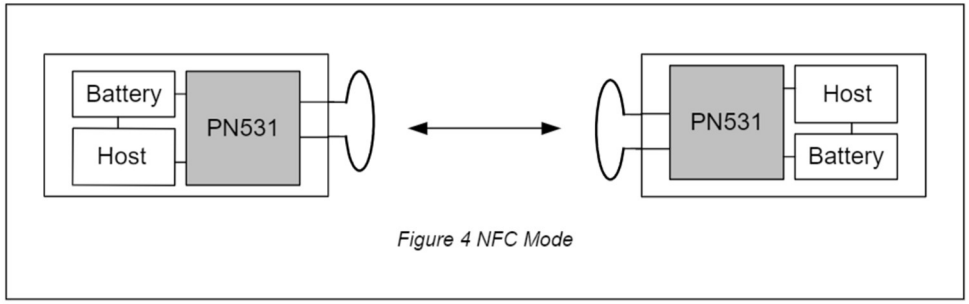
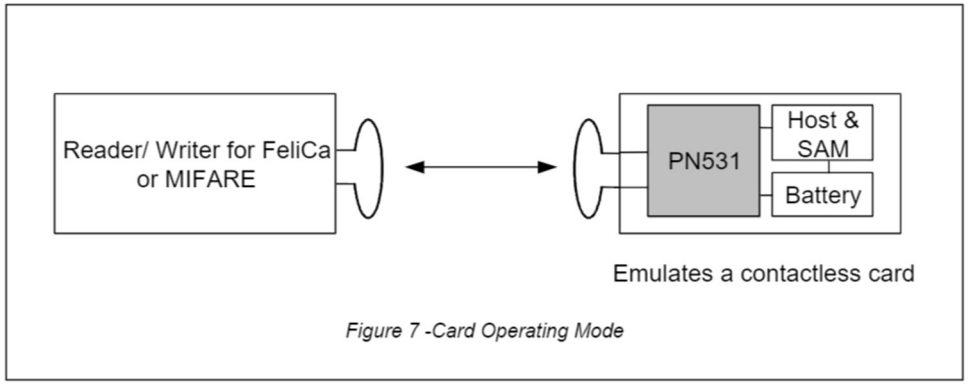


Figure 3 Reader/Writer Mode

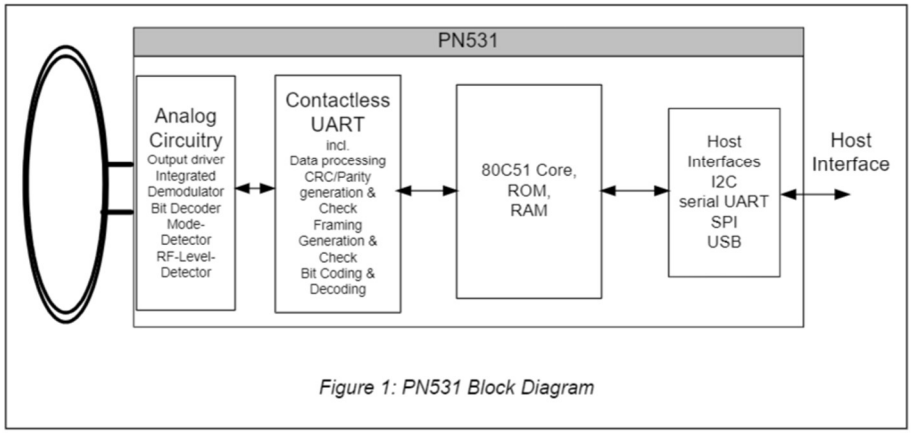
Philips Specification at Figure 4

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	 *Figure 4 NFC Mode* Philips Specification at 11 • Initiator: generates RF field @ 13.56 MHz and starts the NFC communication • Target: responds to initiator commands either using load modulation scheme (RF field continuously generated by Initiator) or using modulation of self generated RF field (no RF field generated by initiator) Philips Specification at Figure 7  *Figure 7 -Card Operating Mode* Philips Specification at Table 6–1

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	6.1 Absolute Maximum Continuous Ratings SYMBOL | PARAMETER | MIN | MAX | UNIT AVDD, DVDD, PVDD, SVDD, TVDD | Supply Voltages | -0.5 | 4.0 | V VBUS | USB Supply Voltage | -0.5 | 5.5 | V *Table 6-1: Absolute Maximum Continuous Ratings* To the extent this limitation is not disclosed by Philips Specification, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Philips Specification, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 1 above.
6. The mobile device of claim 1 wherein the mobile device comprises a mobile phone.	Philips Specification expressly or inherently discloses "[t]he mobile device of claim 1 wherein the mobile device comprises a mobile phone." For example: Philips Specification at 5 Typical devices to integrate the PN531 are • Mobile phones • PDAs • PCs • Intelligent remote controls • PC peripherals e.g. printers and mice • Consumer electronic devices like digital cameras To the extent this limitation is not disclosed by Philips Specification, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Philips Specification, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 1 above.
7[pre]. A mobile device comprising:	Philips Specification expressly or inherently discloses "[a] mobile device." *See* above at 1[pre].

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
[7a] a smartcard controller;	Philips Specification expressly or inherently discloses "a smartcard controller." *See* above at [1a].
[7b] an antenna; and	Philips Specification expressly or inherently discloses "an antenna." *See* above at [1b].
[7c] performance enhancement circuits coupled between the smartcard controller and the antenna, wherein the performance enhancement circuits include an amplifier and an active transmit driver circuit, and	Philips Specification expressly or inherently discloses "performance enhancement circuits coupled between the smartcard controller and the antenna, wherein the performance enhancement circuits include an amplifier and an active transmit driver circuit." For example: *See* [1c] above. Philips Specification at 3 The PN531 is a highly integrated transmission module for contactless communication at 13.56 MHz including µ-controller functionality based on an 80C51 core with 32 kbyte of ROM and 1 kbyte of RAM. This µc-based transmission module combines an outstanding modulation and demodulation concept completely integrated for different kinds of contactless communication methods and protocols at 13.56 MHz with an easy to use firmware for the different supported modes and the required host interfaces. Philips Specification at 3 The PN531 supports 3 different operating modes • Reader/writer mode for FeliCa™ and ISO14443A cards • Supports Card interface mode for FeliCa™ and ISO14443A/MIFARE® in combination with secure µC • NFC IP-1 mode Philips Specification at 3 In reader/ writer mode the PN531's internal transmitter part is able to drive a reader/writer antenna designed to communicate with ISO14443A /MIFARE® or FeliCa™ cards and transponders without additional active circuitry. The receiver part provides a robust and efficient implementation of a demodulation and decoding circuitry for signals from ISO14443A compatible cards and transponders. The digital part handles the complete ISO14443A framing and error detection (Parity & CRC).

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	Philips Specification at 3 In card mode the PN531 is able to answer a reader/writer command either in FeliCa™ or ISO14443A/MIFARE® card mode. The PN531 generates the proper digital load modulated signals and with an external circuit, can respond to commands sent by the reader/writer. Philips Specification at 4 • 80C51 microcontroller core with 32 kbyte ROM and 1 kbyte RAM • Highly integrated analog circuitry for transmission and reception • Output drivers to connect an antenna with minimum number of external components • Integrated RF Level detector • Integrated mode detector • Hardware and embedded Firmware support for • ISO 14443A reader/writer mode • MIFARE®Classic encryption and MIFARE® higher baudrate communication up to 424 kbit/s • Contactless communication according to the FeliCa™ scheme at 212 kbit/s and 424 kbit/s • NFC standard ECMA 340 and ISO 18092: NFC IP-1 interface and protocol • Host protocol on following interfaces • USB 2.0 full speed compliant device • SPI • I2C • High speed serial UART • Optional interrupt line to the host • Hard reset with low power function • Flexible Power down mode or power reduction mode per software • Internal oscillator to connect a 27.12 MHz quartz • Internal oscillator to connect a 4 MHz quartz for the USB interface • 2.5 - 3.6 V power supply • USB bus powered (In USB mode) • Specific IO ports and interrupt sources for external devices control Philips Specification at 5

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	The integrated microcontroller and embedded firmware of the PN 531 means a fast and easy integration in a contactless system. The high-level abstraction commands and the complete handling of RF communication protocols free the host CPU of all real time related constraints. Philips Specification at Figure 1 2 BLOCK DIAGRAM 2.1 Simplified PN531 Block Diagram  *Figure 1: PN531 Block Diagram* Philips Specification at 6 The microcontroller with its embedded firmware allows autonomous management of communication both on the RF interface and with the host. Philips Specification at Figure 3.2

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")

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4	TX1	O	TVDD	Transmitter 1: delivers the modulated 13.56 MHz energy carrier
5	TVDD	PWR		Transmitter power supply: supplies the output stage of TX1 and TX2
6	TX2	O	TVDD	Transmitter 2: delivers the modulated 13.56 MHz energy carrier
7	TVSS2	PWR		Transmitter Ground: supplies the output stage of TX1 and TX2
8	AVDD	PWR		Analog Power Supply
9	VMID	PWR	AVDD	Internal Reference Voltage: This pin delivers the internal reference voltage.
10	RX	I	AVDD	Receiver Input: Input pin for the reception signal, which is the load modulated 13.56 MHz energy carrier from the antenna circuit.
11	AVSS	PWR		Analog Ground
12	AUX1	O	DVDD	Auxiliary Output: This pin delivers analog and digital test signals.
13	AUX2	O	DVDD	Auxiliary Output: This pin delivers analog and digital test signals.
14	OSCIN	I	AVDD	Crystal Oscillator Input: input to the inverting amplifier of the oscillator. This pin is also the input for an externally generated clock (fosc = 27.12 MHz).
15	OSCOUT	O	AVDD	Crystal Oscillator output: Output of the inverting amplifier of the oscillator.
16	I0	I	DVDD	Interface mode lines: selects the used host interface. In test mode I0 is used as test signals.
17	I1	I	DVDD	Interface mode lines: selects the used host interface. In test mode I0 is used as test signals.
18	TESTEN	I	DVDD	Test enable pin: When set to 1 enable the test mode. When set to 0 reset the TCB and disable the access to the test mode.
19	OSC2OUT	O	DVDD	Crystal Oscillator output: Output of the inverting amplifier of the oscillator for the USB clock.
20	OSC2IN	I	DVDD	Crystal Oscillator Input: input to the inverting amplifier of the oscillator for the USB clock generation. This pin is also the input for an externally generated clock (f_{osc} =4 MHz). In test mode this signal is used as test clock input
21	P35	IO	DVDD	General purpose IO signal
22	P34	IO	SVDD	General purpose IO signal or clk signal for the SAM
23	SIGOUT	O	SVDD	Contactless communication interface output: delivers a serial data stream according to NFCIP-1 and output signal for the SAM. In test mode this signal is used as test signal output.
24	SIGIN	I	SVDD	Contactless communication interface input: accepts a digital, serial data stream according to NFCIP-1 and input signal from the SAM. In test mode

Philips Specification at Figure 3

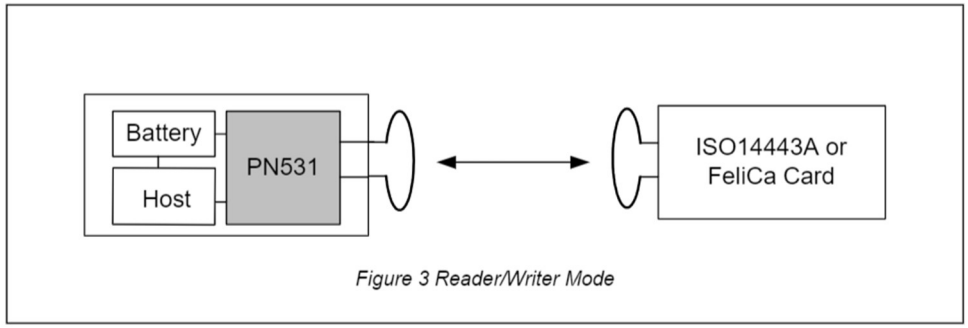
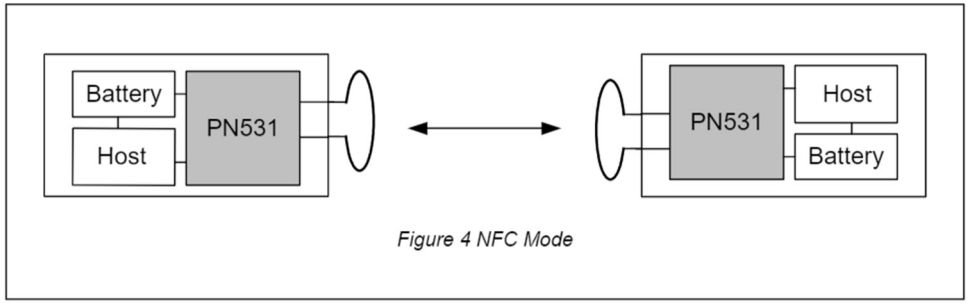


Figure 3 Reader/Writer Mode

Philips Specification at Figure 4

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	 *Figure 4 NFC Mode* Philips Specification at 11 NFC communication differentiates between an active and a passive communication. • Active NFC Mode means both the initiator and the target are using their own RF field for the communication. • Passive NFC Mode means that the target answers to an initiator command in a load modulation scheme. The initiator is active i.e. generating the RF field. Philips Specification at 11 • Initiator: generates RF field @ 13.56 MHz and starts the NFC communication • Target: responds to initiator commands either using load modulation scheme (RF field continuously generated by Initiator) or using modulation of self generated RF field (no RF field generated by initiator) Philips Specification at Figure 5

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")

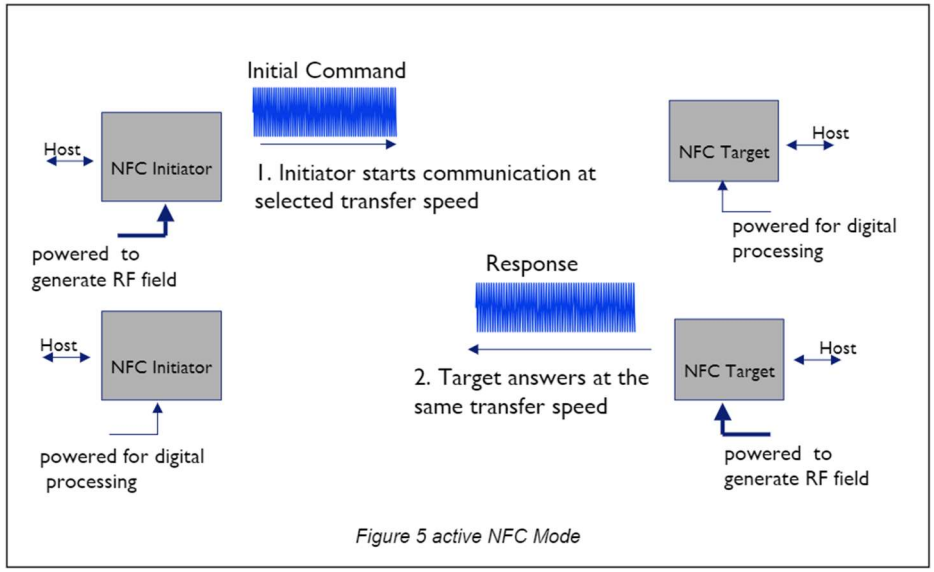


Figure 5 active NFC Mode

Philips Specification at Figure 7

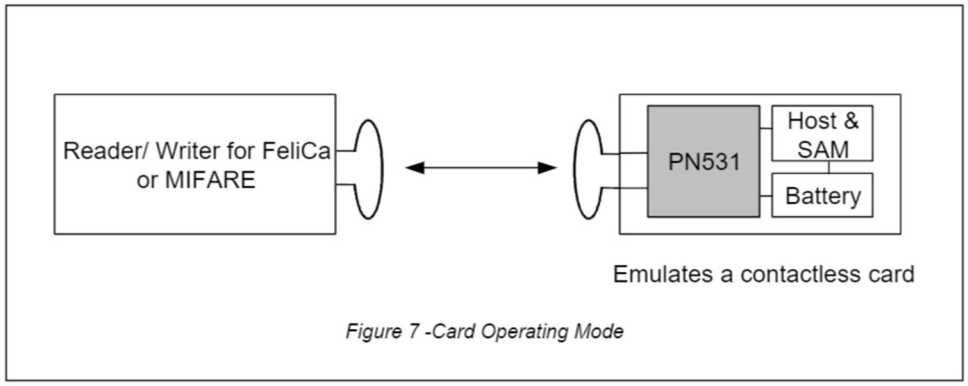
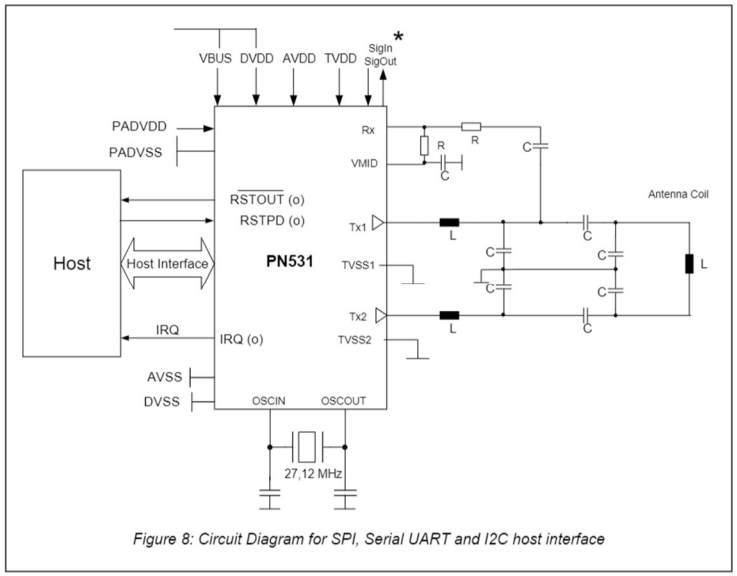
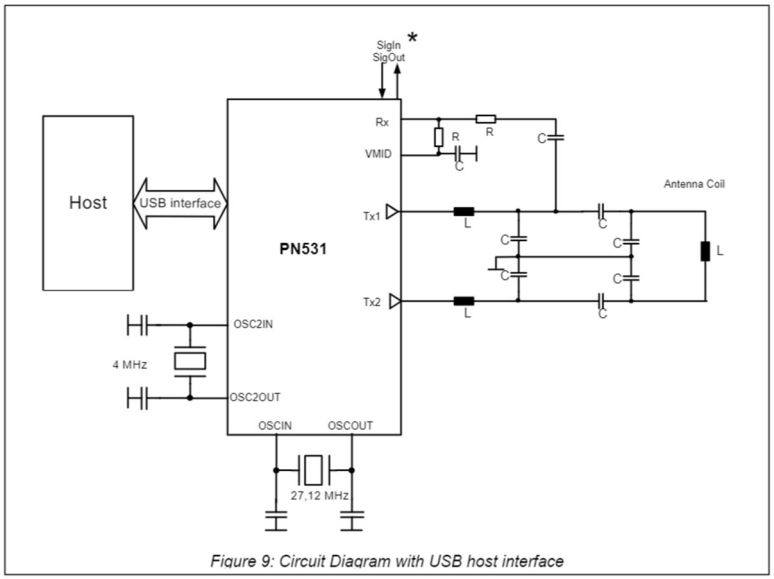


Figure 7 -Card Operating Mode

Philips Specification at 13

The PN531 can be addressed like a FeliCa™ or ISO14443A/ MIFARE® card. This means that the PN531 in combination with a secure µC may acts as an ISO14443A /MIFARE® or FeliCa™ card.

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	Philips Specification at Figure 8  *Figure 8: Circuit Diagram for SPI, Serial UART and I2C host interface* Philips Specification at 14 The figure below shows a typical application, where the antenna is directly connected to the PN531. The used host interface is SPI, Serial UART or I2C. Philips Specification at Figure 9

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	 *Figure 9: Circuit Diagram with USB host interface* Philips Specification at 15 The figure below shows a typical application where the antenna is directly connected to the PN531. The host interface is USB. To the extent this limitation is not disclosed by Philips Specification, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Philips Specification, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
[7d] wherein the amplifier is coupled to amplify a signal received from the antenna and to provide an amplified signal to the smartcard controller.	Philips Specification expressly or inherently discloses "wherein the amplifier is coupled to amplify a signal received from the antenna and to provide an amplified signal to the smartcard controller." *See* above at [1d].
8. The mobile device of claim 7 wherein the antenna is tuned to operate at 13.56 MHz.	Philips Specification expressly or inherently discloses "[t]he mobile device of claim 7 wherein the antenna is tuned to operate at 13.56 MHz."

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	Philips Specification at 3 The PN531 is a highly integrated transmission module for contactless communication at 13.56 MHz including µ-controller functionality based on an 80C51 core with 32 kbyte of ROM and 1 kbyte of RAM. This µc-based transmission module combines an outstanding modulation and demodulation concept completely integrated for different kinds of contactless communication methods and protocols at 13.56 MHz with an easy to use firmware for the different supported modes and the required host interfaces. Philips Specification at 4 • 80C51 microcontroller core with 32 kbyte ROM and 1 kbyte RAM • Highly integrated analog circuitry for transmission and reception • Output drivers to connect an antenna with minimum number of external components • Integrated RF Level detector • Integrated mode detector • Hardware and embedded Firmware support for • ISO 14443A reader/writer mode • MIFARE®Classic encryption and MIFARE® higher baudrate communication up to 424 kbit/s • Contactless communication according to the FeliCa™ scheme at 212 kbit/s and 424 kbit/s • NFC standard ECMA 340 and ISO 18092: NFC IP-1 interface and protocol • Host protocol on following interfaces • USB 2.0 full speed compliant device • SPI • I2C • High speed serial UART • Optional interrupt line to the host • Hard reset with low power function • Flexible Power down mode or power reduction mode per software • Internal oscillator to connect a 27.12 MHz quartz • Internal oscillator to connect a 4 MHz quartz for the USB interface • 2.5 - 3.6 V power supply • USB bus powered (In USB mode) • Specific IO ports and interrupt sources for external devices control

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	Philips Specification at 5 The PN531 is tailored to fulfil the requirements of various applications using contactless communication based on the ECMA340 (NFC IP-1) Interface and protocol standard, the ISO14443A reader and FeliCa reader protocol. NFC IP-1 is also standardised in ISO/IEC 18092. Philips Specification at 6 The RF level detector detects the presence of an external RF field at 13.56 MHz. Philips Specification at Figure 3.2

3.2 Pin Description

Pin	Symbol	Type	Pad Ref Voltage	Description
1	DVSS	PWR		Digital Ground
2	LOADMOD	O	DVDD	Load Modulation output provides digital signal for FeliCa and MIFARE® card operating mode
3	TVSS1	PWR		Transmitter Ground: supplies the output stage of TX1 and TX2
4	TX1	O	TVDD	Transmitter 1: delivers the modulated 13.56 MHz energy carrier
5	TVDD	PWR		Transmitter power supply: supplies the output stage of TX1 and TX2
6	TX2	O	TVDD	Transmitter 2: delivers the modulated 13.56 MHz energy carrier
7	TVSS2	PWR		Transmitter Ground: supplies the output stage of TX1 and TX2
8	AVDD	PWR		Analog Power Supply
9	VMID	PWR	AVDD	Internal Reference Voltage: This pin delivers the internal reference voltage.
10	RX	I	AVDD	Receiver Input: Input pin for the reception signal, which is the load modulated 13.56 MHz energy carrier from the antenna circuit.
11	AVSS	PWR		Analog Ground
12	AUX1	O	DVDD	Auxiliary Output: This pin delivers analog and digital test signals.
13	AUX2	O	DVDD	Auxiliary Output: This pin delivers analog and digital test signals.
14	OSCIN	I	AVDD	Crystal Oscillator Input: input to the inverting amplifier of the oscillator. This pin is also the input for an externally generated clock (fosc = 27,12 MHz).
15	OSCOUT	O	AVDD	Crystal Oscillator output: Output of the inverting amplifier of the oscillator.
16	I0	I	DVDD	Interface mode lines: selects the used host interface. In test mode I0 is used as test signals.
17	I1	I	DVDD	Interface mode lines: selects the used host interface. In test mode I0 is used as test signals.
18	TESTEN	I	DVDD	Test enable pin: When set to 1 enable the test mode. When set to 0 reset the TCB and disable the access to the test mode.
19	OSC2OUT	O	DVDD	Crystal Oscillator output: Output of the inverting amplifier of the oscillator for the USB clock.
20	OSC2IN	I	DVDD	Crystal Oscillator Input: input to the inverting amplifier of the oscillator for the USB clock generation. This pin is also the input for an externally generated clock (f_{osc} =4 MHz). In test mode this signal is used as test clock input
21	P35	IO	DVDD	General purpose IO signal
22	P34	IO	SVDD	General purpose IO signal or clk signal for the SAM
23	SIGOUT	O	SVDD	Contactless communication interface output: delivers a serial data stream according to NFCIP-1 and output signal for the SAM. In test mode this signal is used as test signal output.
24	SIGIN	I	SVDD	Contactless communication interface input: accepts a digital, serial data stream according to NFCIP-1 and input signal from the SAM. In test mode

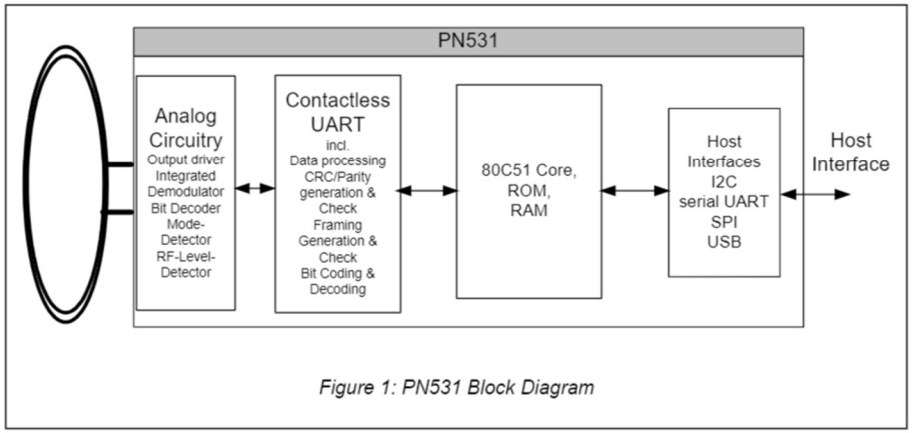
Philips Specification at 11

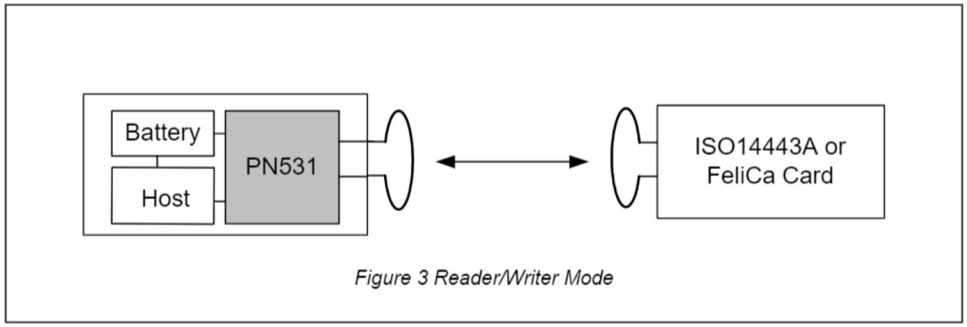
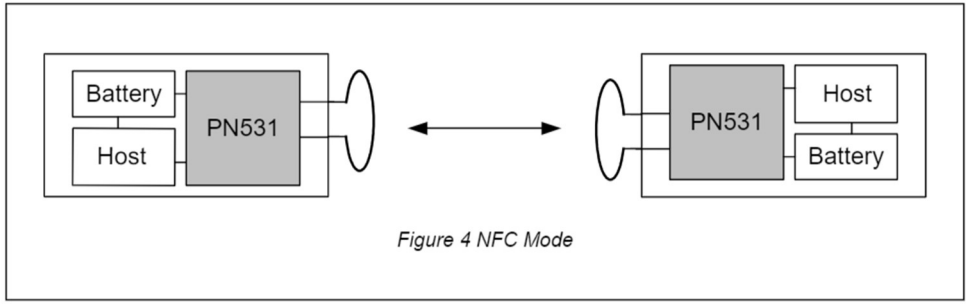
- Initiator: generates RF field @ 13.56 MHz and starts the NFC communication
- Target: responds to initiator commands either using load modulation scheme (RF field continuously generated by Initiator) or using modulation of self generated RF field (no RF field generated by initiator)

See also Philips Specification at 3, 6, Figure 4, 11, Figure 6, Figure 8, and Figure 9.

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	See claim 2 above. To the extent this limitation is not disclosed by Philips Specification, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Philips Specification, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 7 above.
9. The mobile device of claim 7 wherein the antenna comprises an inductive element too small to draw enough power sufficient to operate the smartcard controller from an interrogating radio frequency (RF) field.	Philips Specification expressly or inherently discloses "[t]he mobile device of claim 7 wherein the antenna comprises an inductive element too small to draw enough power sufficient to operate the smartcard controller from an interrogating radio frequency (RF) field." For example: Philips Specification at 3 The PN531 is a highly integrated transmission module for contactless communication at 13.56 MHz including µ-controller functionality based on an 80C51 core with 32 kbyte of ROM and 1 kbyte of RAM. This µc-based transmission module combines an outstanding modulation and demodulation concept completely integrated for different kinds of contactless communication methods and protocols at 13.56 MHz with an easy to use firmware for the different supported modes and the required host interfaces. Philips Specification at 3 The PN531 supports 3 different operating modes • Reader/writer mode for FeliCa™ and ISO14443A cards • Supports Card interface mode for FeliCa™ and ISO14443A/MIFARE® in combination with secure µC • NFC IP-1 mode Philips Specification at 3 In reader/ writer mode the PN531's internal transmitter part is able to drive a reader/writer antenna designed to communicate with ISO14443A /MIFARE® or FeliCa™ cards and transponders without additional active circuitry. The receiver part provides a robust and efficient implementation of a demodulation and decoding circuitry for signals from ISO14443A compatible cards and transponders. The digital part handles the complete ISO14443A framing and error detection (Parity & CRC). Philips Specification at 3

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	In card mode the PN531 is able to answer a reader/writer command either in FeliCa™ or ISO14443A/MIFARE® card mode. The PN531 generates the proper digital load modulated signals and with an external circuit, can respond to commands sent by the reader/writer. Philips Specification at 4 • 80C51 microcontroller core with 32 kbyte ROM and 1 kbyte RAM • Highly integrated analog circuitry for transmission and reception • Output drivers to connect an antenna with minimum number of external components • Integrated RF Level detector • Integrated mode detector • Hardware and embedded Firmware support for • ISO 14443A reader/writer mode • MIFARE®Classic encryption and MIFARE® higher baudrate communication up to 424 kbit/s • Contactless communication according to the FeliCa™ scheme at 212 kbit/s and 424 kbit/s • NFC standard ECMA 340 and ISO 18092: NFC IP-1 interface and protocol • Host protocol on following interfaces • USB 2.0 full speed compliant device • SPI • I2C • High speed serial UART • Optional interrupt line to the host • Hard reset with low power function • Flexible Power down mode or power reduction mode per software • Internal oscillator to connect a 27.12 MHz quartz • Internal oscillator to connect a 4 MHz quartz for the USB interface • 2.5 - 3.6 V power supply • USB bus powered (In USB mode) • Specific IO ports and interrupt sources for external devices control Philips Specification at 5

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	The integrated microcontroller and embedded firmware of the PN 531 means a fast and easy integration in a contactless system. The high-level abstraction commands and the complete handling of RF communication protocols free the host CPU of all real time related constraints. Philips Specification at Figure 1 2 BLOCK DIAGRAM 2.1 Simplified PN531 Block Diagram  *Figure 1: PN531 Block Diagram* Philips Specification at 6 The microcontroller with its embedded firmware allows autonomous management of communication both on the RF interface and with the host. Philips Specification at Figure 3

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	 *Figure 3 Reader/Writer Mode* Philips Specification at Figure 4  *Figure 4 NFC Mode* Philips Specification at Figure 7

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")

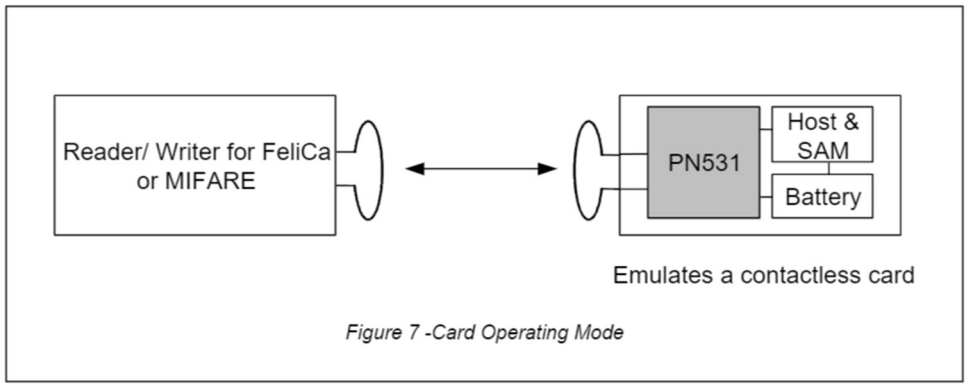


Figure 7 -Card Operating Mode

Philips Specification at 13

> The PN531 can be addressed like a FeliCa™ or ISO14443A/ MIFARE® card. This means that the PN531 in combination with a secure µC may acts as an ISO14443A /MIFARE® or FeliCa™ card.

Philips Specification at Figure 8

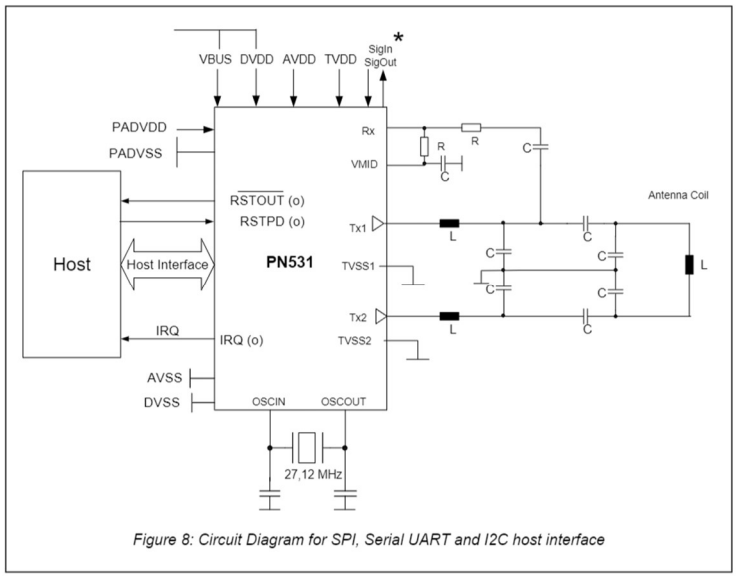
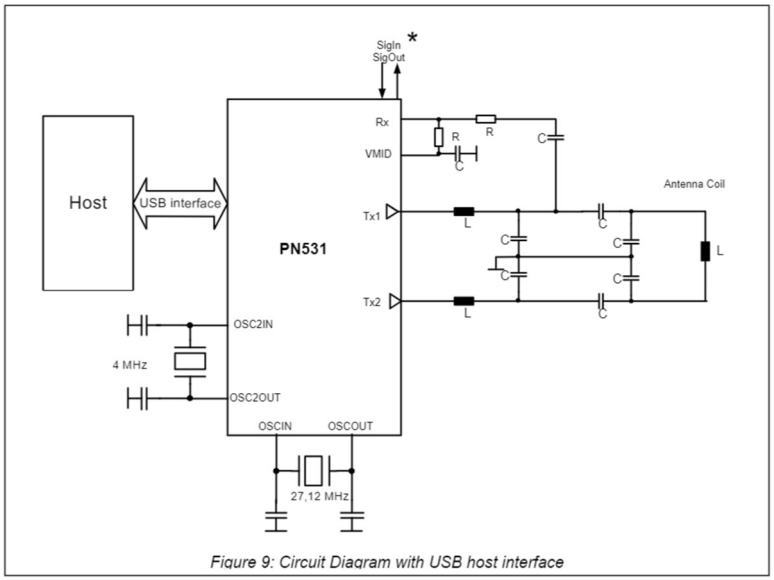


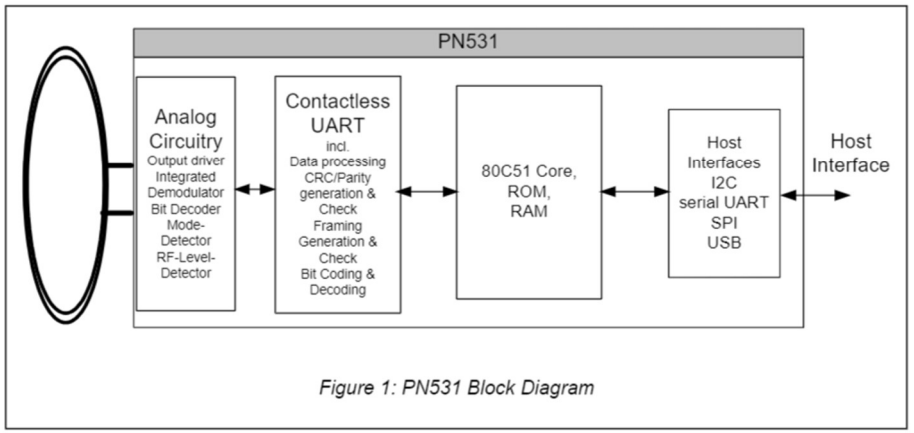
Figure 8: Circuit Diagram for SPI, Serial UART and I2C host interface

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	Philips Specification at 14 The figure below shows a typical application, where the antenna is directly connected to the PN531. The used host interface is SPI, Serial UART or I2C. Philips Specification at Figure 9  *Figure 9: Circuit Diagram with USB host interface* *See* claim 3 above. To the extent this limitation is not disclosed by Philips Specification, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Philips Specification, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 7 above.
10. The mobile device of claim 7 wherein the smartcard controller is coupled to be powered by the mobile device.	Philips Specification expressly or inherently discloses "[t]he mobile device of claim 7 wherein the smartcard controller is coupled to be powered by the mobile device." *See* above at claim 4.

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	See also claim 7 above.
11. The mobile device of claim 7 wherein the performance enhancement circuits are coupled to be powered by the mobile device.	Philips Specification expressly or inherently discloses "[t]he mobile device of claim 7 wherein the performance enhancement circuits are coupled to be powered by the mobile device." *See* above at claim 5. *See also* claim 7 above.
12. The mobile device of claim 7 wherein the mobile device comprises a mobile phone.	Philips Specification expressly or inherently discloses "[t]he mobile device of claim 7 wherein the mobile device comprises a mobile phone." *See* above at claim 6. *See also* claim 7 above.
13[pre]. A mobile device comprising:	Philips Specification expressly or inherently discloses "[a] mobile device." *See* above at 1[pre].
[13a] a smartcard controller;	Philips Specification expressly or inherently discloses "a smartcard controller." *See* above at [1a].
[13b] an antenna;	Philips Specification expressly or inherently discloses "an antenna." *See* above at [1b].
[13c] an amplifier coupled to amplify signals received at the antenna and drive the smartcard controller; and	Philips Specification expressly or inherently discloses "an amplifier coupled to amplify signals received at the antenna and drive the smartcard controller." For example: *See* above at [1d]. To the extent this limitation is not disclosed by Philips Specification, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Philips Specification, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
[13d] a driver circuit to drive the antenna with data provided by the smartcard controller.	Philips Specification expressly or inherently discloses "a driver circuit to drive the antenna with data provided by the smartcard controller." For example: Philips Specification at 3 The PN531 is a highly integrated transmission module for contactless communication at 13.56 MHz including µ-controller functionality based on an 80C51 core with 32 kbyte of ROM and 1 kbyte of RAM. This µc-based transmission module combines an outstanding modulation and demodulation concept completely integrated for different kinds of contactless communication methods and protocols at 13.56 MHz with an easy to use firmware for the different supported modes and the required host interfaces. Philips Specification at 3 The PN531 supports 3 different operating modes • Reader/writer mode for FeliCa™ and ISO14443A cards • Supports Card interface mode for FeliCa™ and ISO14443A/MIFARE® in combination with secure µC • NFC IP-1 mode Philips Specification at 3 In reader/ writer mode the PN531's internal transmitter part is able to drive a reader/writer antenna designed to communicate with ISO14443A /MIFARE® or FeliCa™ cards and transponders without additional active circuitry. The receiver part provides a robust and efficient implementation of a demodulation and decoding circuitry for signals from ISO14443A compatible cards and transponders. The digital part handles the complete ISO14443A framing and error detection (Parity & CRC). Philips Specification at 3 In card mode the PN531 is able to answer a reader/writer command either in FeliCa™ or ISO14443A/MIFARE® card mode. The PN531 generates the proper digital load modulated signals and with an external circuit, can respond to commands sent by the reader/writer. Philips Specification at 4 • 80C51 microcontroller core with 32 kbyte ROM and 1 kbyte RAM • Highly integrated analog circuitry for transmission and reception • Output drivers to connect an antenna with minimum number of external components • Integrated RF Level detector

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	• Integrated mode detector • Hardware and embedded Firmware support for • ISO 14443A reader/writer mode • MIFARE®Classic encryption and MIFARE® higher baudrate communication up to 424 kbit/s • Contactless communication according to the FeliCa™ scheme at 212 kbit/s and 424 kbit/s • NFC standard ECMA 340 and ISO 18092: NFC IP-1 interface and protocol • Host protocol on following interfaces • USB 2.0 full speed compliant device • SPI • I2C • High speed serial UART • Optional interrupt line to the host • Hard reset with low power function • Flexible Power down mode or power reduction mode per software • Internal oscillator to connect a 27.12 MHz quartz • Internal oscillator to connect a 4 MHz quartz for the USB interface • 2.5 - 3.6 V power supply • USB bus powered (In USB mode) • Specific IO ports and interrupt sources for external devices control Philips Specification at 5 The integrated microcontroller and embedded firmware of the PN 531 means a fast and easy integration in a contactless system. The high-level abstraction commands and the complete handling of RF communication protocols free the host CPU of all real time related constraints. Philips Specification at Figure 1

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	2 BLOCK DIAGRAM **2.1 Simplified PN531 Block Diagram**  *Figure 1: PN531 Block Diagram* Philips Specification at 6 The Analog circuitry handles the modulation and demodulation of the analog signals according to the card mode, reader /writer mode and NFC mode communication scheme. Philips Specification at 6 The microcontroller with its embedded firmware allows autonomous management of communication both on the RF interface and with the host. Philips Specification at Figure 3.2

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")

3.2 Pin Description

Pin	Symbol	Type	Pad Ref Voltage	Description
1	DVSS	PWR		Digital Ground
2	LOADMOD	O	DVDD	Load Modulation output provides digital signal for FeliCa and MIFARE® card operating mode
3	TVSS1	PWR		Transmitter Ground: supplies the output stage of TX1 and TX2
4	TX1	O	TVDD	Transmitter 1: delivers the modulated 13.56 MHz energy carrier
5	TVDD	PWR		Transmitter power supply: supplies the output stage of TX1 and TX2
6	TX2	O	TVDD	Transmitter 2: delivers the modulated 13.56 MHz energy carrier
7	TVSS2	PWR		Transmitter Ground: supplies the output stage of TX1 and TX2
8	AVDD	PWR		Analog Power Supply
9	VMID	PWR	AVDD	Internal Reference Voltage: This pin delivers the internal reference voltage.
10	RX	I	AVDD	Receiver Input: Input pin for the reception signal, which is the load modulated 13.56 MHz energy carrier from the antenna circuit.
11	AVSS	PWR		Analog Ground
12	AUX1	O	DVDD	Auxiliary Output: This pin delivers analog and digital test signals.
13	AUX2	O	DVDD	Auxiliary Output: This pin delivers analog and digital test signals.
14	OSCIN	I	AVDD	Crystal Oscillator Input: input to the inverting amplifier of the oscillator. This pin is also the input for an externally generated clock (fosc = 27.12 MHz).
15	OSCOUT	O	AVDD	Crystal Oscillator output: Output of the inverting amplifier of the oscillator.
16	I0	I	DVDD	Interface mode lines: selects the used host interface. In test mode I0 is used as test signals.
17	I1	I	DVDD	Interface mode lines: selects the used host interface. In test mode I0 is used as test signals.
18	TESTEN	I	DVDD	Test enable pin: When set to 1 enable the test mode. When set to 0 reset the TCB and disable the access to the test mode.
19	OSC2OUT	O	DVDD	Crystal Oscillator output: Output of the inverting amplifier of the oscillator for the USB clock.
20	OSC2IN	I	DVDD	Crystal Oscillator Input: input to the inverting amplifier of the oscillator for the USB clock generation. This pin is also the input for an externally generated clock (f_{osc} =4 MHz). In test mode this signal is used as test clock input
21	P35	IO	DVDD	General purpose IO signal
22	P34	IO	SVDD	General purpose IO signal or clk signal for the SAM
23	SIGOUT	O	SVDD	Contactless communication interface output: delivers a serial data stream according to NFCIP-1 and output signal for the SAM. In test mode this signal is used as test signal output.
24	SIGIN	I	SVDD	Contactless communication interface input: accepts a digital, serial data stream according to NFCIP-1 and input signal from the SAM. In test mode

Philips Specification at Figure 3

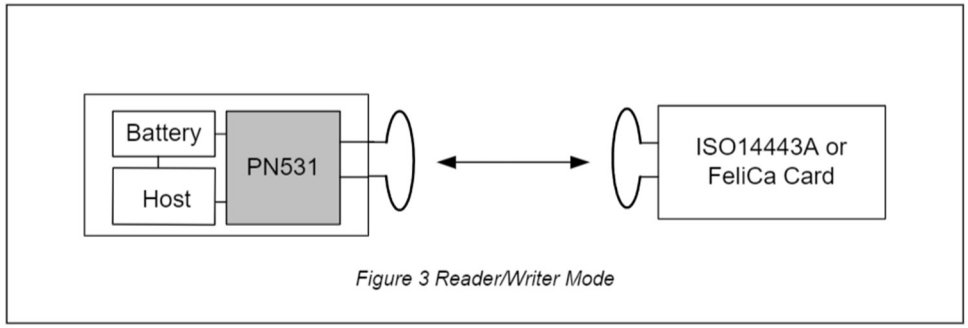
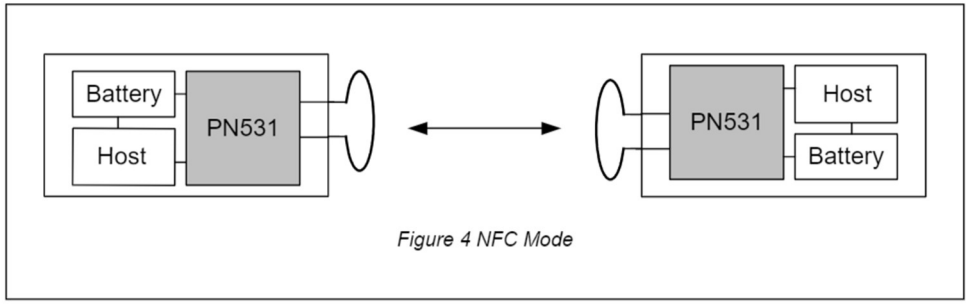
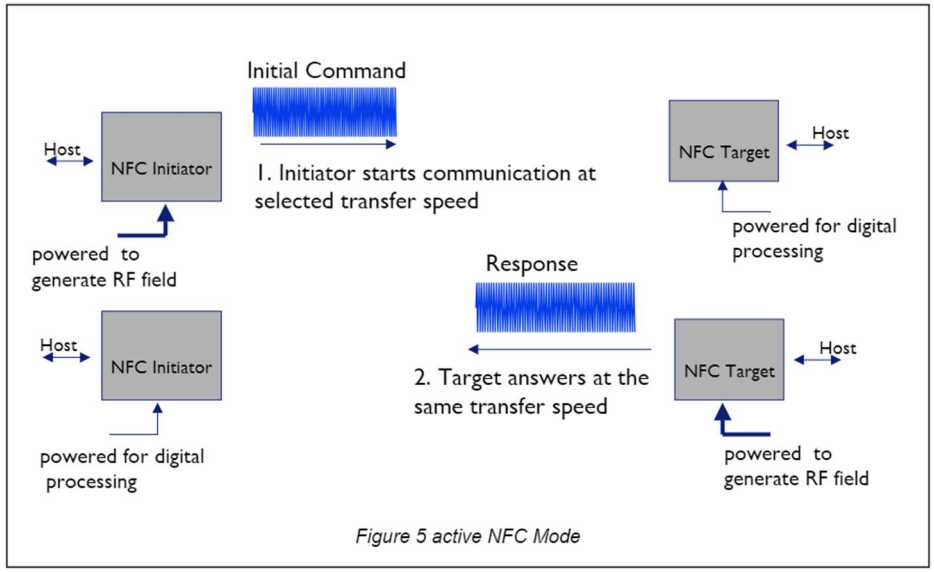
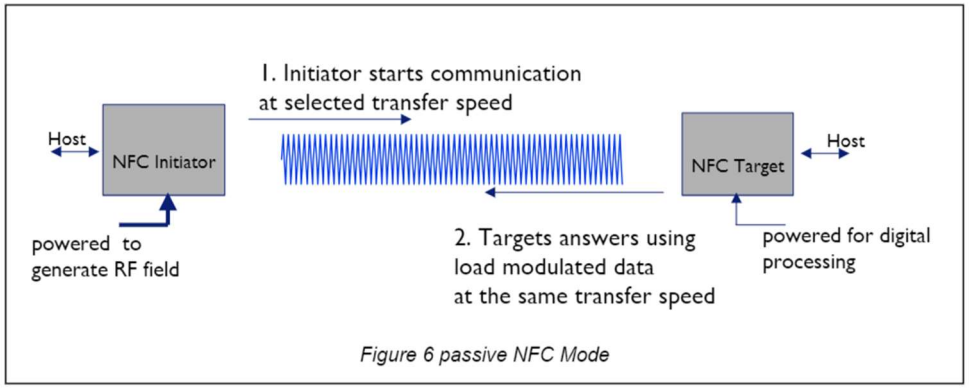


Figure 3 Reader/Writer Mode

Philips Specification at Figure 4

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	 *Figure 4 NFC Mode* Philips Specification at 11 NFC communication differentiates between an active and a passive communication. • Active NFC Mode means both the initiator and the target are using their own RF field for the communication. • Passive NFC Mode means that the target answers to an initiator command in a load modulation scheme. The initiator is active i.e. generating the RF field. Philips Specification at 11 • Initiator: generates RF field @ 13.56 MHz and starts the NFC communication • Target: responds to initiator commands either using load modulation scheme (RF field continuously generated by Initiator) or using modulation of self generated RF field (no RF field generated by initiator) Philips Specification at Figure 5

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	 *Figure 5 active NFC Mode* Philips Specification at Figure 6  *Figure 6 passive NFC Mode* Philips Specification at Figure 7

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")

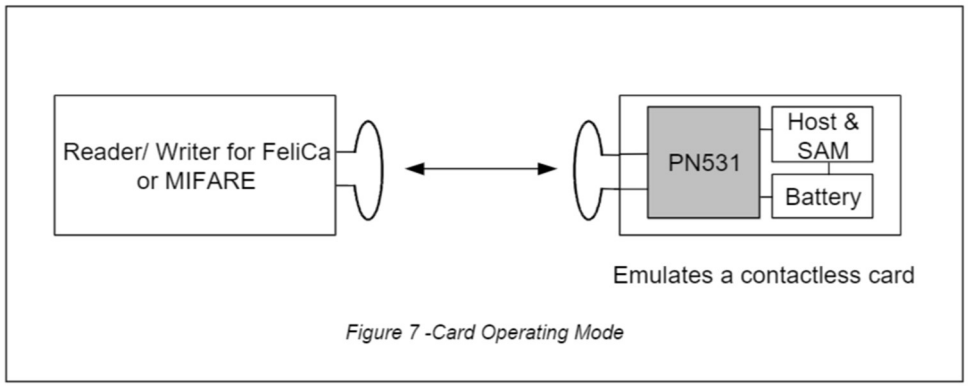


Figure 7 -Card Operating Mode

Philips Specification at 13

> The PN531 can be addressed like a FeliCa™ or ISO14443A/ MIFARE® card. This means that the PN531 in combination with a secure µC may acts as an ISO14443A /MIFARE® or FeliCa™ card.

Philips Specification at Figure 8

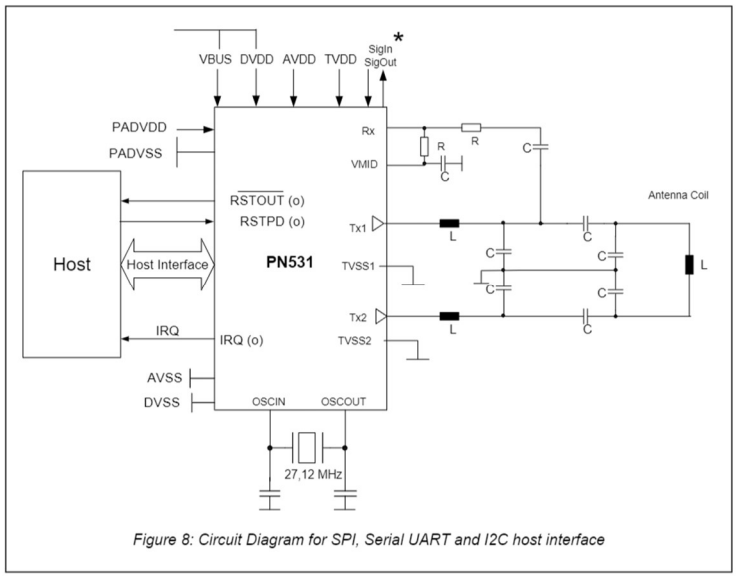
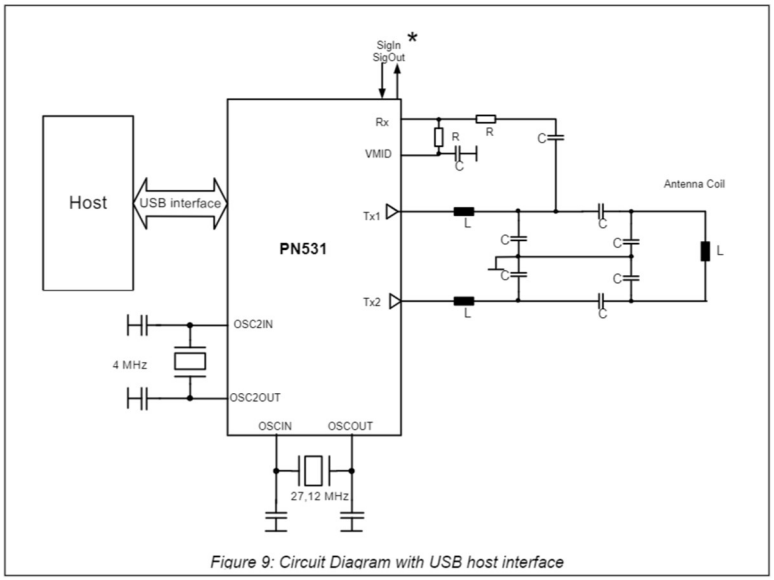
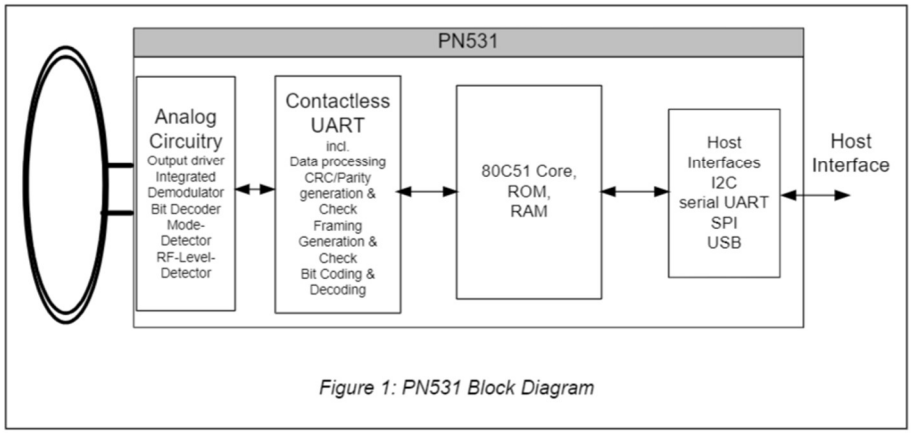


Figure 8: Circuit Diagram for SPI, Serial UART and I2C host interface

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	Philips Specification at 14 The figure below shows a typical application, where the antenna is directly connected to the PN531. The used host interface is SPI, Serial UART or I2C. Philips Specification at Figure 9  *Figure 9: Circuit Diagram with USB host interface* Philips Specification at 15 The figure below shows a typical application where the antenna is directly connected to the PN531. The host interface is USB. To the extent this limitation is not disclosed by Philips Specification, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Philips Specification, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
14. The mobile device of claim 13 wherein the driver circuit	Philips Specification expressly or inherently discloses "[t]he mobile device of claim 13 wherein the driver circuit comprises a load modulation circuit." For example:

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
comprises a load modulation circuit.	*See* [1c] above. Philips Specification at 3 In reader/ writer mode the PN531's internal transmitter part is able to drive a reader/writer antenna designed to communicate with ISO14443A /MIFARE® or FeliCa™ cards and transponders without additional active circuitry. The receiver part provides a robust and efficient implementation of a demodulation and decoding circuitry for signals from ISO14443A compatible cards and transponders. The digital part handles the complete ISO14443A framing and error detection (Parity & CRC). Philips Specification at 3 In card mode the PN531 is able to answer a reader/writer command either in FeliCa™ or ISO14443A/MIFARE® card mode. The PN531 generates the proper digital load modulated signals and with an external circuit, can respond to commands sent by the reader/writer. Philips Specification at 4 • 80C51 microcontroller core with 32 kbyte ROM and 1 kbyte RAM • Highly integrated analog circuitry for transmission and reception • Output drivers to connect an antenna with minimum number of external components • Integrated RF Level detector • Integrated mode detector • Hardware and embedded Firmware support for • ISO 14443A reader/writer mode • MIFARE®Classic encryption and MIFARE® higher baudrate communication up to 424 kbit/s • Contactless communication according to the FeliCa™ scheme at 212 kbit/s and 424 kbit/s • NFC standard ECMA 340 and ISO 18092: NFC IP-1 interface and protocol • Host protocol on following interfaces • USB 2.0 full speed compliant device • SPI • I2C • High speed serial UART • Optional interrupt line to the host • Hard reset with low power function • Flexible Power down mode or power reduction mode per software

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	• Internal oscillator to connect a 27.12 MHz quartz • Internal oscillator to connect a 4 MHz quartz for the USB interface • 2.5 - 3.6 V power supply • USB bus powered (In USB mode) • Specific IO ports and interrupt sources for external devices control Philips Specification at Figure 1 **2 BLOCK DIAGRAM** **2.1 Simplified PN531 Block Diagram**  *Figure 1: PN531 Block Diagram* Philips Specification at 6 The Analog circuitry handles the modulation and demodulation of the analog signals according to the card mode, reader /writer mode and NFC mode communication scheme. Philips Specification at Figure 3.2

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")

3.2 Pin Description

Pin	Symbol	Type	Pad Ref Voltage	Description
1	DVSS	PWR		Digital Ground
2	LOADMOD	O	DVDD	Load Modulation output provides digital signal for FeliCa and MIFARE® card operating mode
3	TVSS1	PWR		Transmitter Ground: supplies the output stage of TX1 and TX2
4	TX1	O	TVDD	Transmitter 1: delivers the modulated 13.56 MHz energy carrier
5	TVDD	PWR		Transmitter power supply: supplies the output stage of TX1 and TX2
6	TX2	O	TVDD	Transmitter 2: delivers the modulated 13.56 MHz energy carrier
7	TVSS2	PWR		Transmitter Ground: supplies the output stage of TX1 and TX2
8	AVDD	PWR		Analog Power Supply
9	VMID	PWR	AVDD	Internal Reference Voltage: This pin delivers the internal reference voltage.
10	RX	I	AVDD	Receiver Input: Input pin for the reception signal, which is the load modulated 13.56 MHz energy carrier from the antenna circuit.
11	AVSS	PWR		Analog Ground
12	AUX1	O	DVDD	Auxiliary Output: This pin delivers analog and digital test signals.
13	AUX2	O	DVDD	Auxiliary Output: This pin delivers analog and digital test signals.
14	OSCIN	I	AVDD	Crystal Oscillator Input: input to the inverting amplifier of the oscillator. This pin is also the input for an externally generated clock (fosc = 27.12 MHz).
15	OSCOUT	O	AVDD	Crystal Oscillator output: Output of the inverting amplifier of the oscillator.
16	I0	I	DVDD	Interface mode lines: selects the used host interface. In test mode I0 is used as test signals.
17	I1	I	DVDD	Interface mode lines: selects the used host interface. In test mode I0 is used as test signals.
18	TESTEN	I	DVDD	Test enable pin: When set to 1 enable the test mode. When set to 0 reset the TCB and disable the access to the test mode.
19	OSC2OUT	O	DVDD	Crystal Oscillator output: Output of the inverting amplifier of the oscillator for the USB clock.
20	OSC2IN	I	DVDD	Crystal Oscillator Input: input to the inverting amplifier of the oscillator for the USB clock generation. This pin is also the input for an externally generated clock (f_{osc} =4 MHz). In test mode this signal is used as test clock input
21	P35	IO	DVDD	General purpose IO signal
22	P34	IO	SVDD	General purpose IO signal or clk signal for the SAM
23	SIGOUT	O	SVDD	Contactless communication interface output: delivers a serial data stream according to NFCIP-1 and output signal for the SAM. In test mode this signal is used as test signal output.
24	SIGIN	I	SVDD	Contactless communication interface input: accepts a digital, serial data stream according to NFCIP-1 and input signal from the SAM. In test mode

Philips Specification at 11

NFC communication differentiates between an active and a passive communication.

• Active NFC Mode means both the initiator and the target are using their own RF field for the communication.

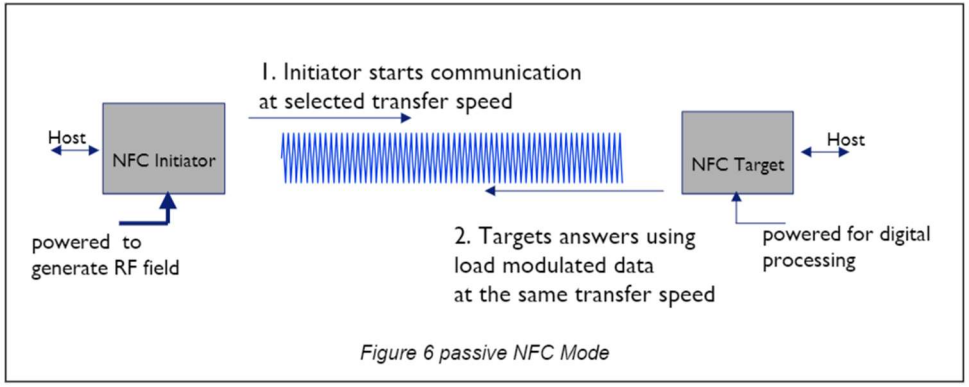
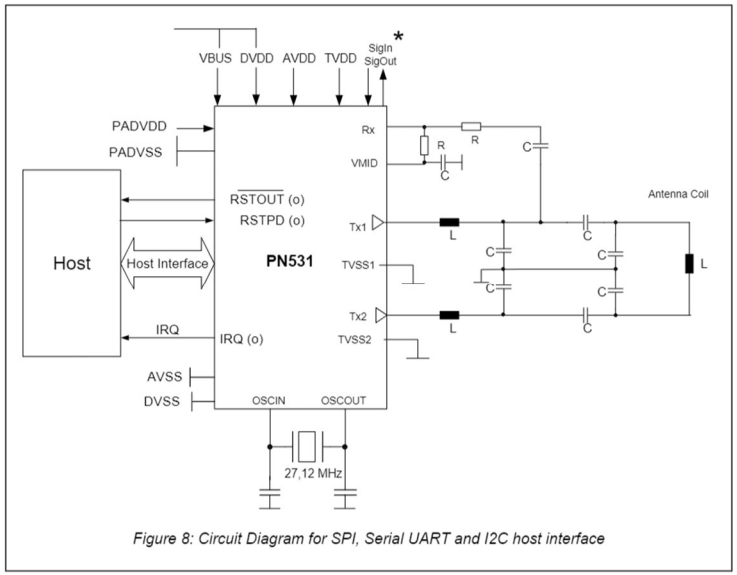
• Passive NFC Mode means that the target answers to an initiator command in a load modulation scheme. The initiator is active i.e. generating the RF field.

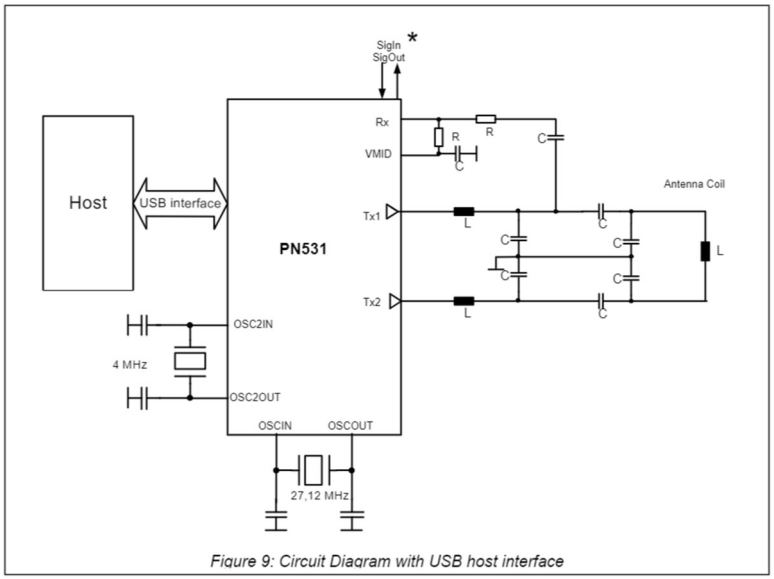
Philips Specification at 11

• Initiator: generates RF field @ 13.56 MHz and starts the NFC communication

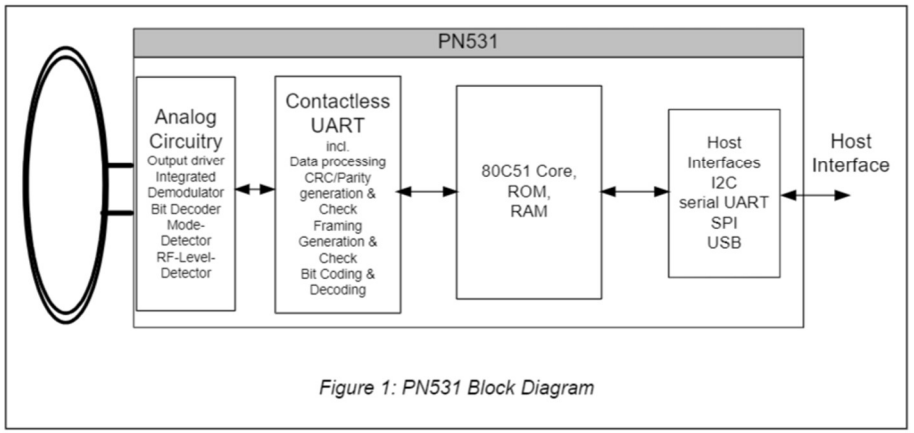
• Target: responds to initiator commands either using load modulation scheme (RF field continuously generated by Initiator) or using modulation of self generated RF field (no RF field generated by initiator)

Philips Specification at Figure 6

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	 *Figure 6 passive NFC Mode* Philips Specification at Figure 8  *Figure 8: Circuit Diagram for SPI, Serial UART and I2C host interface* Philips Specification at Figure 9

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	 *Figure 9: Circuit Diagram with USB host interface* *See also* Philips Specification at Figure 5. To the extent this limitation is not disclosed by Philips Specification, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Philips Specification, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 13 above.
15. The mobile device of claim 13 wherein the driver circuit comprises an active transmit driver circuit.	Philips Specification expressly or inherently discloses "[t]he mobile device of claim 13 wherein the driver circuit comprises an active transmit driver circuit." For example: *See* [7c] above. Philips Specification at 3 In reader/ writer mode the PN531's internal transmitter part is able to drive a reader/writer antenna designed to communicate with ISO14443A /MIFARE® or FeliCa™ cards and transponders without additional active circuitry. The receiver part provides a robust and efficient implementation of a

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	demodulation and decoding circuitry for signals from ISO14443A compatible cards and transponders. The digital part handles the complete ISO14443A framing and error detection (Parity & CRC). Philips Specification at 4 • 80C51 microcontroller core with 32 kbyte ROM and 1 kbyte RAM • Highly integrated analog circuitry for transmission and reception • Output drivers to connect an antenna with minimum number of external components • Integrated RF Level detector • Integrated mode detector • Hardware and embedded Firmware support for • ISO 14443A reader/writer mode • MIFARE®Classic encryption and MIFARE® higher baudrate communication up to 424 kbit/s • Contactless communication according to the FeliCa™ scheme at 212 kbit/s and 424 kbit/s • NFC standard ECMA 340 and ISO 18092: NFC IP-1 interface and protocol • Host protocol on following interfaces • USB 2.0 full speed compliant device • SPI • I2C • High speed serial UART • Optional interrupt line to the host • Hard reset with low power function • Flexible Power down mode or power reduction mode per software • Internal oscillator to connect a 27.12 MHz quartz • Internal oscillator to connect a 4 MHz quartz for the USB interface • 2.5 - 3.6 V power supply • USB bus powered (In USB mode) • Specific IO ports and interrupt sources for external devices control Philips Specification at Figure 1

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	2 BLOCK DIAGRAM **2.1 Simplified PN531 Block Diagram**  *Figure 1: PN531 Block Diagram* Philips Specification at Figure 3.2

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")

3.2 Pin Description

Pin	Symbol	Type	Pad Ref Voltage	Description
1	DVSS	PWR		Digital Ground
2	LOADMOD	O	DVDD	Load Modulation output provides digital signal for FeliCa and MIFARE® card operating mode
3	TVSS1	PWR		Transmitter Ground: supplies the output stage of TX1 and TX2
4	TX1	O	TVDD	Transmitter 1: delivers the modulated 13.56 MHz energy carrier
5	TVDD	PWR		Transmitter power supply: supplies the output stage of TX1 and TX2
6	TX2	O	TVDD	Transmitter 2: delivers the modulated 13.56 MHz energy carrier
7	TVSS2	PWR		Transmitter Ground: supplies the output stage of TX1 and TX2
8	AVDD	PWR		Analog Power Supply
9	VMID	PWR	AVDD	Internal Reference Voltage: This pin delivers the internal reference voltage.
10	RX	I	AVDD	Receiver Input: Input pin for the reception signal, which is the load modulated 13.56 MHz energy carrier from the antenna circuit.
11	AVSS	PWR		Analog Ground
12	AUX1	O	DVDD	Auxiliary Output: This pin delivers analog and digital test signals.
13	AUX2	O	DVDD	Auxiliary Output: This pin delivers analog and digital test signals.
14	OSCIN	I	AVDD	Crystal Oscillator Input: input to the inverting amplifier of the oscillator. This pin is also the input for an externally generated clock (fosc = 27.12 MHz).
15	OSCOUT	O	AVDD	Crystal Oscillator output: Output of the inverting amplifier of the oscillator.
16	I0	I	DVDD	Interface mode lines: selects the used host interface. In test mode I0 is used as test signals.
17	I1	I	DVDD	Interface mode lines: selects the used host interface. In test mode I0 is used as test signals.
18	TESTEN	I	DVDD	Test enable pin: When set to 1 enable the test mode. When set to 0 reset the TCB and disable the access to the test mode.
19	OSC2OUT	O	DVDD	Crystal Oscillator output: Output of the inverting amplifier of the oscillator for the USB clock.
20	OSC2IN	I	DVDD	Crystal Oscillator Input: input to the inverting amplifier of the oscillator for the USB clock generation. This pin is also the input for an externally generated clock (f_{osc} =4 MHz). In test mode this signal is used as test clock input
21	P35	IO	DVDD	General purpose IO signal
22	P34	IO	SVDD	General purpose IO signal or clk signal for the SAM
23	SIGOUT	O	SVDD	Contactless communication interface output: delivers a serial data stream according to NFCIP-1 and output signal for the SAM. In test mode this signal is used as test signal output.
24	SIGIN	I	SVDD	Contactless communication interface input: accepts a digital, serial data stream according to NFCIP-1 and input signal from the SAM. In test mode

Philips Specification at 11

NFC communication differentiates between an active and a passive communication.

• Active NFC Mode means both the initiator and the target are using their own RF field for the communication.

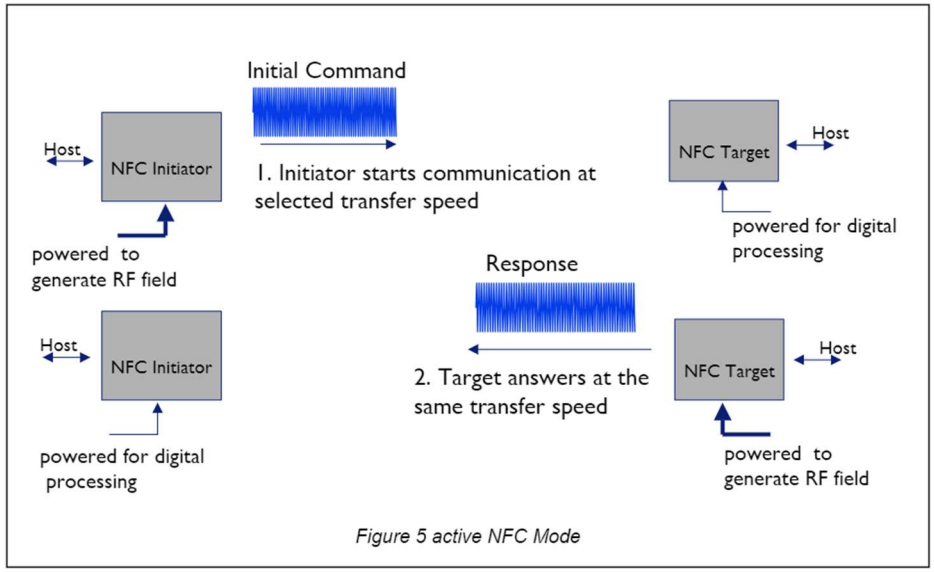
• Passive NFC Mode means that the target answers to an initiator command in a load modulation scheme. The initiator is active i.e. generating the RF field.

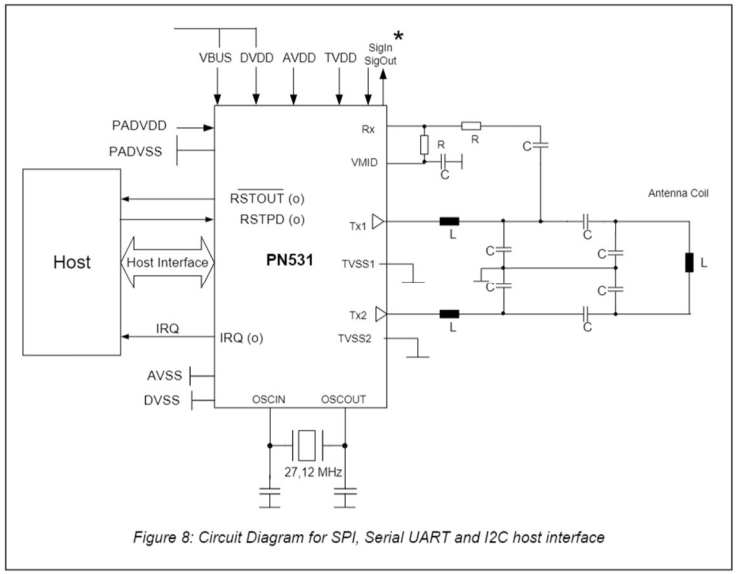
Philips Specification at 11

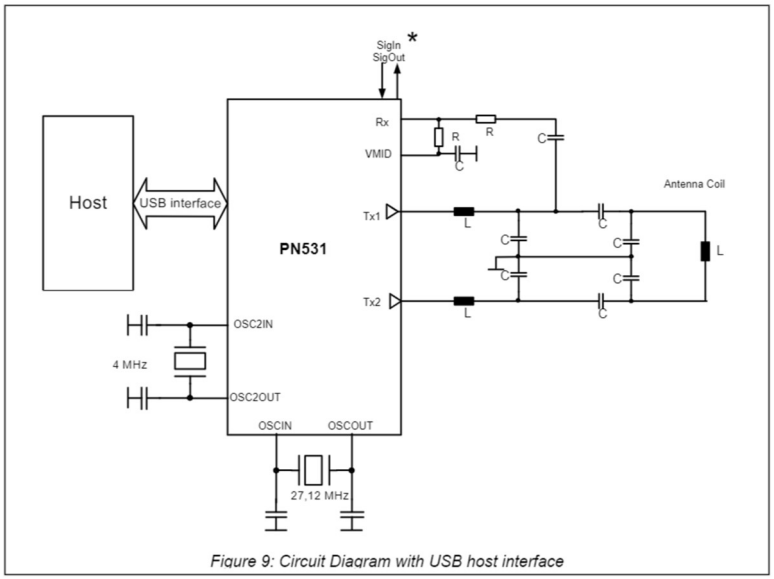
• Initiator: generates RF field @ 13.56 MHz and starts the NFC communication

• Target: responds to initiator commands either using load modulation scheme (RF field continuously generated by Initiator) or using modulation of self generated RF field (no RF field generated by initiator)

Philips Specification at Figure 5

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	 *Figure 5 active NFC Mode* Philips Specification at Figure 8

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	 *Figure 8: Circuit Diagram for SPI, Serial UART and I2C host interface* Philips Specification at Figure 9

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	 *Figure 9: Circuit Diagram with USB host interface* *See also* Philips Specification at 3, 6, and Figure 6. To the extent this limitation is not disclosed by Philips Specification, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Philips Specification, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 13 above.
16. The mobile device of claim 15 wherein the active transmit driver circuit is coupled to be powered by the mobile device.	Philips Specification expressly or inherently discloses "[t]he mobile device of claim 15 wherein the active transmit driver circuit is coupled to be powered by the mobile device." For example: *See* claim 11 above. Philips Specification at 4 • 80C51 microcontroller core with 32 kbyte ROM and 1 kbyte RAM • Highly integrated analog circuitry for transmission and reception • Output drivers to connect an antenna with minimum number of external components • Integrated RF Level detector

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	• Integrated mode detector • Hardware and embedded Firmware support for • ISO 14443A reader/writer mode • MIFARE®Classic encryption and MIFARE® higher baudrate communication up to 424 kbit/s • Contactless communication according to the FeliCa™ scheme at 212 kbit/s and 424 kbit/s • NFC standard ECMA 340 and ISO 18092: NFC IP-1 interface and protocol • Host protocol on following interfaces • USB 2.0 full speed compliant device • SPI • I2C • High speed serial UART • Optional interrupt line to the host • Hard reset with low power function • Flexible Power down mode or power reduction mode per software • Internal oscillator to connect a 27.12 MHz quartz • Internal oscillator to connect a 4 MHz quartz for the USB interface • 2.5 - 3.6 V power supply • USB bus powered (In USB mode) • Specific IO ports and interrupt sources for external devices control Philips Specification at 7 The device operates with six individual power supplies for best performance in terms of EMC behaviour and signal de-coupling. This gives outstanding RF performance and maximum flexibility to adapt to different operating voltages of digital and analog parts. Philips Specification at Figure 3.2

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")

3.2 Pin Description

Pin	Symbol	Type	Pad Ref Voltage	Description
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5	TVDD	PWR		Transmitter power supply: supplies the output stage of TX1 and TX2
6	TX2	O	TVDD	Transmitter 2: delivers the modulated 13.56 MHz energy carrier
7	TVSS2	PWR		Transmitter Ground: supplies the output stage of TX1 and TX2
8	AVDD	PWR		Analog Power Supply
9	VMID	PWR	AVDD	Internal Reference Voltage: This pin delivers the internal reference voltage.
10	RX	I	AVDD	Receiver Input: Input pin for the reception signal, which is the load modulated 13.56 MHz energy carrier from the antenna circuit.
11	AVSS	PWR		Analog Ground
12	AUX1	O	DVDD	Auxiliary Output: This pin delivers analog and digital test signals.
13	AUX2	O	DVDD	Auxiliary Output: This pin delivers analog and digital test signals.
14	OSCIN	I	AVDD	Crystal Oscillator Input: input to the inverting amplifier of the oscillator. This pin is also the input for an externally generated clock (fosc = 27.12 MHz).
15	OSCOUT	O	AVDD	Crystal Oscillator output: Output of the inverting amplifier of the oscillator.
16	I0	I	DVDD	Interface mode lines: selects the used host interface. In test mode I0 is used as test signals.
17	I1	I	DVDD	Interface mode lines: selects the used host interface. In test mode I0 is used as test signals.
18	TESTEN	I	DVDD	Test enable pin: When set to 1 enable the test mode. When set to 0 reset the TCB and disable the access to the test mode.
19	OSC2OUT	O	DVDD	Crystal Oscillator output: Output of the inverting amplifier of the oscillator for the USB clock.
20	OSC2IN	I	DVDD	Crystal Oscillator Input: input to the inverting amplifier of the oscillator for the USB clock generation. This pin is also the input for an externally generated clock (f_{osc} =4 MHz). In test mode this signal is used as test clock input
21	P35	IO	DVDD	General purpose IO signal
22	P34	IO	SVDD	General purpose IO signal or clk signal for the SAM
23	SIGOUT	O	SVDD	Contactless communication interface output: delivers a serial data stream according to NFCIP-1 and output signal for the SAM. In test mode this signal is used as test signal output.
24	SIGIN	I	SVDD	Contactless communication interface input: accepts a digital, serial data stream according to NFCIP-1 and input signal from the SAM. In test mode

Philips Specification at Figure 3

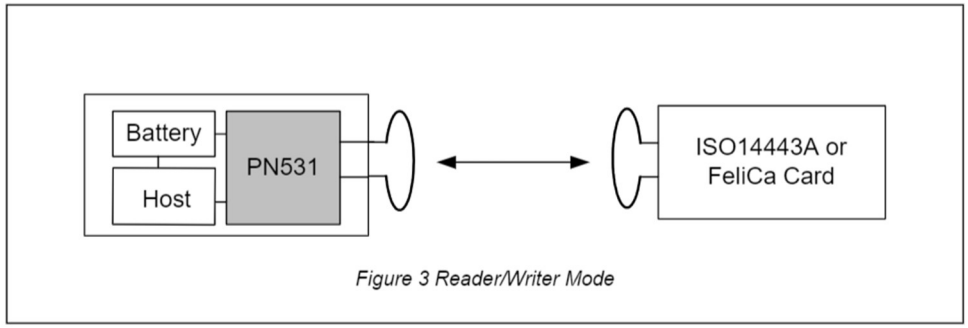
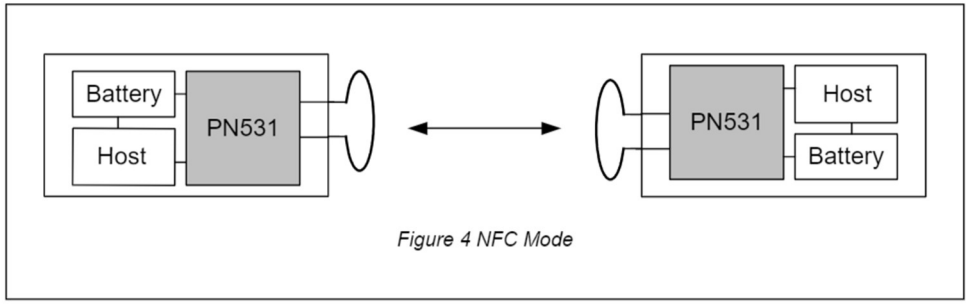
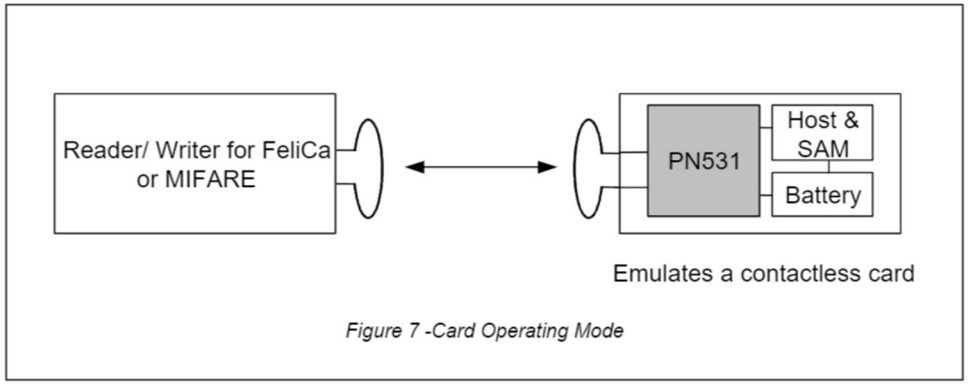


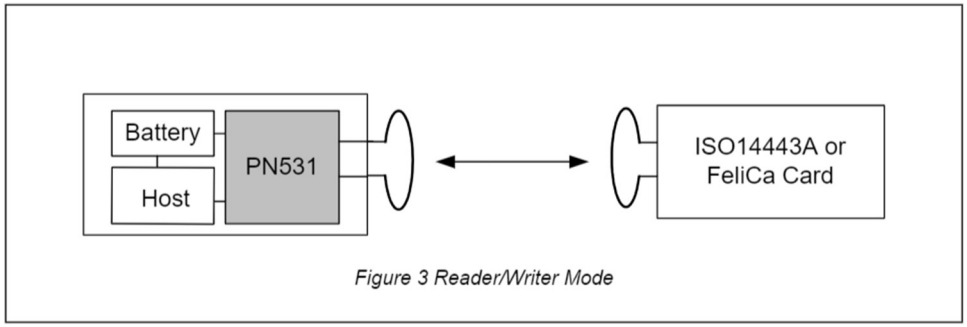
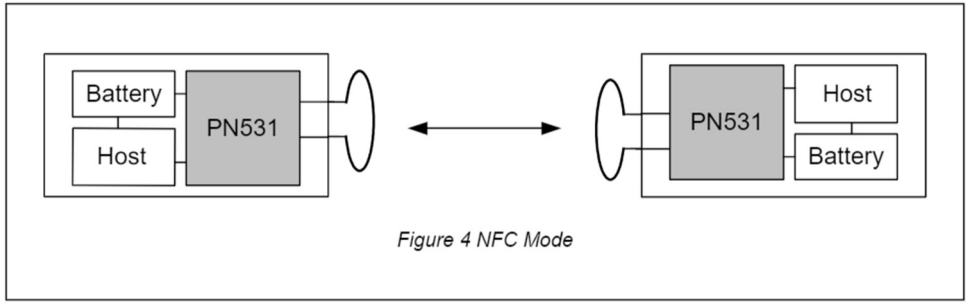
Figure 3 Reader/Writer Mode

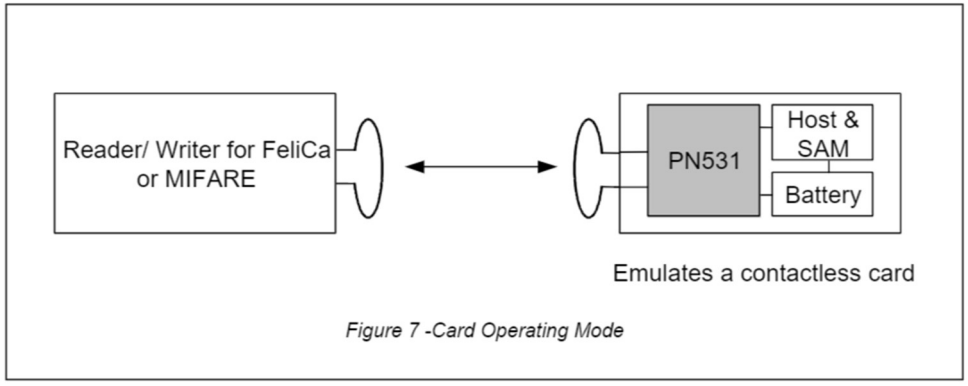
Philips Specification at Figure 4

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	 *Figure 4 NFC Mode* Philips Specification at 11 • Initiator: generates RF field @ 13.56 MHz and starts the NFC communication • Target: responds to initiator commands either using load modulation scheme (RF field continuously generated by Initiator) or using modulation of self generated RF field (no RF field generated by initiator) Philips Specification at Figure 7  *Figure 7 -Card Operating Mode* Philips Specification at Table 6–1

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	6.1 Absolute Maximum Continuous Ratings | SYMBOL	PARAMETER	MIN	MAX	UNIT
---	---	---	---	---
AVDD DVDD PVDD SVDD TVDD	Supply Voltages	-0.5	4.0	V
VBUS	USB Supply Voltage	-0.5	5.5	V	 *Table 6-1: Absolute Maximum Continuous Ratings* To the extent this limitation is not disclosed by Philips Specification, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Philips Specification, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 15 above.
17. The mobile device of claim 13 wherein the amplifier is coupled to be powered by the mobile device.	Philips Specification expressly or inherently discloses "[t]he mobile device of claim 13 wherein the amplifier is coupled to be powered by the mobile device." For example: Philips Specification at 4 • 80C51 microcontroller core with 32 kbyte ROM and 1 kbyte RAM • Highly integrated analog circuitry for transmission and reception • Output drivers to connect an antenna with minimum number of external components • Integrated RF Level detector • Integrated mode detector • Hardware and embedded Firmware support for • ISO 14443A reader/writer mode • MIFARE®Classic encryption and MIFARE® higher baudrate communication up to 424 kbit/s • Contactless communication according to the FeliCa™ scheme at 212 kbit/s and 424 kbit/s • NFC standard ECMA 340 and ISO 18092: NFC IP-1 interface and protocol • Host protocol on following interfaces • USB 2.0 full speed compliant device • SPI • I2C • High speed serial UART

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	• Optional interrupt line to the host • Hard reset with low power function • Flexible Power down mode or power reduction mode per software • Internal oscillator to connect a 27.12 MHz quartz • Internal oscillator to connect a 4 MHz quartz for the USB interface • 2.5 - 3.6 V power supply • USB bus powered (In USB mode) • Specific IO ports and interrupt sources for external devices control Philips Specification at 7 The device operates with six individual power supplies for best performance in terms of EMC behaviour and signal de-coupling. This gives outstanding RF performance and maximum flexibility to adapt to different operating voltages of digital and analog parts. Philips Specification at Figure 3.2 3.2 Pin Description Pin / Symbol / Type / Pad Ref Voltage / Description 1 / DVSS / PWR / / Digital Ground 2 / LOADMOD / O / DVDD / Load Modulation output provides digital signal for FeliCa and MIFARE® card operating mode 3 / TVSS1 / PWR / / Transmitter Ground: supplies the output stage of TX1 and TX2 4 / TX1 / O / TVDD / Transmitter 1: delivers the modulated 13.56 MHz energy carrier 5 / TVDD / PWR / / Transmitter power supply: supplies the output stage of TX1 and TX2 6 / TX2 / O / TVDD / Transmitter 2: delivers the modulated 13.56 MHz energy carrier 7 / TVSS2 / PWR / / Transmitter Ground: supplies the output stage of TX1 and TX2 8 / AVDD / PWR / / Analog Power Supply 9 / VMID / PWR / AVDD / Internal Reference Voltage: This pin delivers the internal reference voltage. 10 / RX / I / AVDD / Receiver Input: Input pin for the reception signal, which is the load modulated 13.56 MHz energy carrier from the antenna circuit. 11 / AVSS / PWR / / Analog Ground 12 / AUX1 / O / DVDD / Auxiliary Output: This pin delivers analog and digital test signals. 13 / AUX2 / O / DVDD / Auxiliary Output: This pin delivers analog and digital test signals. 14 / OSCIN / I / AVDD / Crystal Oscillator Input: input to the inverting amplifier of the oscillator. This pin is also the input for an externally generated clock (fosc = 27.12 MHz). 15 / OSCOUT / O / AVDD / Crystal Oscillator output: Output of the inverting amplifier of the oscillator. 16 / I0 / I / DVDD / Interface mode lines: selects the used host interface. In test mode I0 is used as test signals. 17 / I1 / I / DVDD / Interface mode lines: selects the used host interface. In test mode I0 is used as test signals. 18 / TESTEN / I / DVDD / Test enable pin: When set to 1 enable the test mode. When set to 0 reset the TCB and disable the access to the test mode. 19 / OSC2OUT / O / DVDD / Crystal Oscillator output: Output of the inverting amplifier of the oscillator for the USB clock. 20 / OSC2IN / I / DVDD / Crystal Oscillator Input: input to the inverting amplifier of the oscillator for the USB clock generation. This pin is also the input for an externally generated clock (f_{osc} =4 MHz). In test mode this signal is used as test clock input 21 / P35 / IO / DVDD / General purpose IO signal 22 / P34 / IO / SVDD / General purpose IO signal or clk signal for the SAM 23 / SIGOUT / O / SVDD / Contactless communication interface output: delivers a serial data stream according to NFCIP-1 and output signal for the SAM. In test mode this signal is used as test signal output. 24 / SIGIN / I / SVDD / Contactless communication interface input: accepts a digital, serial data stream according to NFCIP-1 and input signal from the SAM. In test mode Philips Specification at Figure 3

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	 *Figure 3 Reader/Writer Mode* Philips Specification at Figure 4  *Figure 4 NFC Mode* Philips Specification at Figure 7

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
	 *Figure 7 -Card Operating Mode* Philips Specification at Table 6–1 **6.1 Absolute Maximum Continuous Ratings** SYMBOL / PARAMETER / MIN / MAX / UNIT AVDD, DVDD, PVDD, SVDD, TVDD — Supply Voltages — -0.5 — 4.0 — V VBUS — USB Supply Voltage — -0.5 — 5.5 — V *Table 6-1: Absolute Maximum Continuous Ratings* To the extent this limitation is not disclosed by Philips Specification, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Philips Specification, those elements, as known to them or as disclosed by other prior art identified in the cover pleading. *See also* claim 13 above.
18. The mobile device of claim 13 wherein the antenna is tuned to operate at 13.56 MHz.	Philips Specification expressly or inherently discloses "[t]he mobile device of claim 13 wherein the antenna is tuned to operate at 13.56 MHz." *See* above at claim 2. *See also* claim 13 above.

Claim Element	Exemplary Citations to Philips Semiconductors, "Short Form Specification: Near Field Communication PN531–µC based Transmission module" (2004) ("Philips Specification")
19. The mobile device of claim 13 wherein the antenna comprises an inductive element too small to draw enough power sufficient to operate the smartcard controller from an interrogating radio frequency (RF) field.	Philips Specification expressly or inherently discloses "[t]he mobile device of claim 13 wherein the antenna comprises an inductive element too small to draw enough power sufficient to operate the smartcard controller from an interrogating radio frequency (RF) field." *See* above at claim 3. *See also* claim 13 above.
20. The mobile device of claim 13 wherein the mobile device comprises a mobile phone.	Philips Specification expressly or inherently discloses "[t]he mobile device of claim 13 wherein the mobile device comprises a mobile phone." *See* above at claim 6. *See also* claim 13 above.