

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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SAMSUNG ELECTRONICS AMERICA, INC., and  
SAMSUNG ELECTRONICS CO. LTD.,  
Petitioner,

v.

FASTVDO LLC,  
Patent Owner.

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Case IPR2016-01179  
Patent 5,850,482

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Before KARL D. EASTHOM, JEFFREY S. SMITH, and  
PATRICK M. BOUCHER, *Administrative Patent Judges*.

SMITH, *Administrative Patent Judge*.

FINAL WRITTEN DECISION  
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

## I. INTRODUCTION

Petitioner filed a Petition for *inter partes* review of claims 1–3, 5, 6, 12–14, 16, 17, and 28 of U.S. Patent No. 5,850,482 (Ex. 1001, “the ’482 patent”). Paper 3 (“Pet.”). Patent Owner filed a Preliminary Response. Paper 13 (“Prelim. Resp.”). We instituted trial for claims 1–3, 5, 6, 12–14, 16, 17, and 28. Paper 15. Patent Owner filed a response. Paper 22 (“PO Resp.”). Petitioner filed a reply to the Patent Owner’s Response. Paper 24 (“Reply”). The record includes a transcript of the Oral Hearing. Paper 32.

We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision issues pursuant to 35 U.S.C. § 318(a). Petitioner has shown by a preponderance of the evidence that claims 1–3, 5, 6, 12–14, 16, 17, and 28 of the ’482 patent are unpatentable.

### A. *Related Matters*

The ’482 patent is the subject of the following related litigations:

*FastVDO LLC v. AT&T Mobility LLC et al.*, Case No. 3:16-cv-00385 (S.D. Cal.), filed Feb. 11, 2016. Pet. 2; Paper 7 (Patent Owner’s Mandatory Notice).

*FastVDO LLC v. LG Electronics, Inc. et al.*, Case No. 3:16-cv-00386 (S.D. Cal.), filed Feb. 11, 2016. Pet. 2; Paper 7 (Patent Owner’s Mandatory Notice).

*FastVDO LLC v. NEC Corp. et al.*, Case No. 3:16-cv-00389 (S.D. Cal.), filed Feb. 11, 2016 (terminated). Pet. 2; Paper 7 (Patent Owner’s Mandatory Notice).

*FastVDO LLC v. Nokia Corp. et al.*, Case No. 3:16-cv-00390 (S.D. Cal.), filed Feb. 11, 2016. Paper 7 (Patent Owner’s Mandatory Notice).

*FastVDO LLC v. ZTE Corp. et al.*, Case No. 3:16-cv-00394 (S.D. Cal.), filed Feb. 11, 2016. Pet. 2; Paper 7 (Patent Owner's Mandatory Notice).

*FastVDO LLC v. Dell Inc. et al.*, Case No. 3:16-cv-00395 (S.D. Cal.), filed Feb. 11, 2016. Paper 7 (Patent Owner's Mandatory Notice).

*FastVDO LLC v. Huawei Technologies Co., et al.*, Case No. 3:16-cv-00396 (S.D. Cal.), filed Feb. 11, 2016. Pet. 2; Paper 7 (Patent Owner's Mandatory Notice).

The '482 patent is also the subject of IPR2016-01203. Paper 7 (Patent Owner's Mandatory Notice).

#### *B. The '482 Patent*

The '482 patent relates generally to error resilient methods and apparatus for entropy coding, and the application of error resilient coding to image compression. Ex. 1001, 1:5–11. Entropy coding reduces the number of bits required to represent a data set by using variable length coding in a manner that exploits the statistical probabilities of various symbols in the data set. *Id.* at 4:36–39. For example, entropy coding assigns shorter code words to those symbols that occur frequently, and assigns longer code words to those symbols that occur less frequently. *Id.* at 4:40–43. Error resilient entropy coding can utilize unequal error protection techniques, isolate effects of a bit error to a single code word, and constrain the resulting error to an interval. *Id.* at 6:33–47.

The error resilient method and apparatus includes a code word generator that encodes data pursuant to split field coding, in which each code word includes a prefix field and an associated suffix field. *Id.* at Abstract. The prefix field includes information representing a characteristic of the

suffix field, such as the length. *Id.* The suffix field includes information representing at least some of the original data. *Id.* If the prefix field is decoded without any errors, the method and apparatus can correctly determine the length of the suffix field and the range of values represented by the suffix field such that the suffix field is resilient to errors. *Id.* To increase the probability that the prefix field is correctly decoded, the prefix field is error protected to a greater degree than the suffix field, such that the data can be more efficiently compressed. *Id.* Figure 1 of the '482 patent is reproduced below.

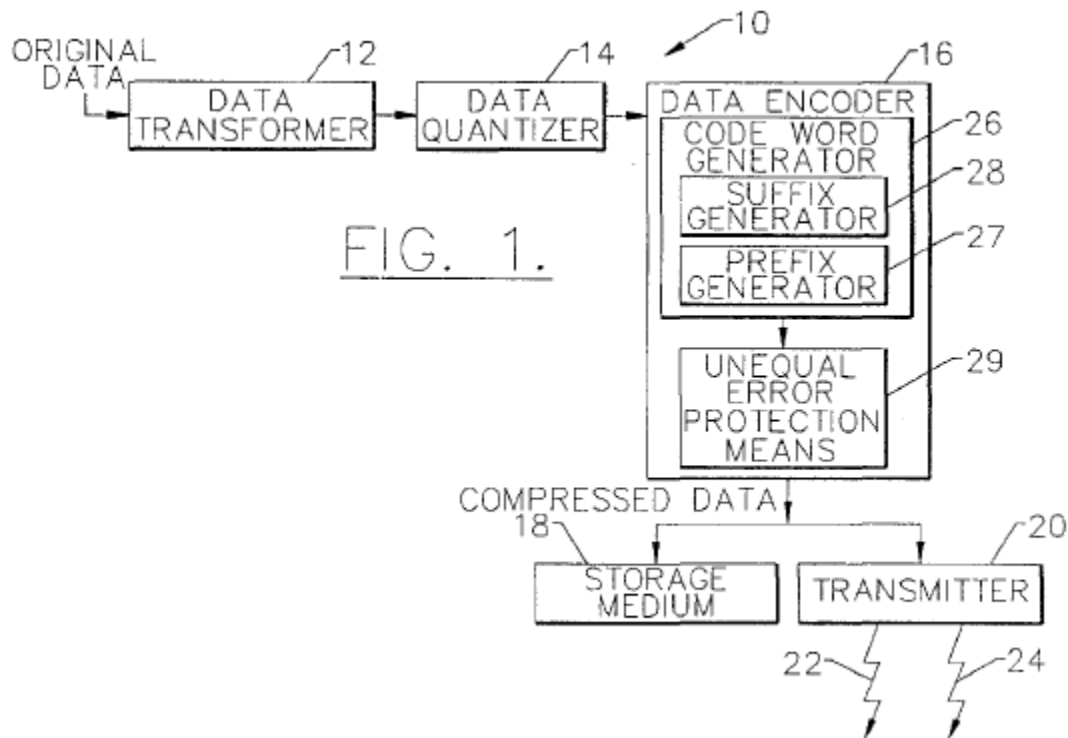


Figure 1 above shows a block diagram of error resilient data compression apparatus 10, including error resilient data encoder 16. *Id.* at 8:48–51. Original data is initially transformed by data transformer 12. *Id.* at 9:30–32. The original data can be transformed based upon one of a number of predetermined functions, such as a cosine function, a complex

exponential function, or a wavelet transform. *Id.* at 9:41–52. The transformed data is then quantized by data quantizer 14 such that the quantized data has fewer unique data values or coefficients than the transformed data. *Id.* at 11:36–38. In one embodiment, transformed coefficients whose magnitudes fall below a certain level, called a clipping threshold, are designated as insignificant and set to zero. *Id.* at 11:55–61.

Entropy encoder 16 shown in Figure 1 above includes code word generator 26 to generate code words that represent the quantized significant coefficients. *Id.* at 13:36–39. Each code word includes a first portion, or prefix field, and an associated second portion, or suffix field. *Id.* at 13:41–43. Code word generator 26 includes prefix generator 27 for generating the prefix field of each code word and suffix generator 28 for generating the associated suffix field of each code word. *Id.* at 13:44–48. Because each code word is composed of two fields, this method of coding is termed split field coding. *Id.* at 13:48–50.

According to split field coding, the prefix field includes information representative of the associated suffix field, such as the number of characters which form the suffix field, or the range of coefficient values represented by the suffix field. *Id.* at 13:51–63. If the prefix field is decoded correctly, the length of the suffix field and the range of values represented by the suffix field can be determined. *Id.* at 15:61–66. Bit errors within the suffix field will not result in loss of code word synchronization, but instead will be isolated to that single code word. *Id.* at 16:1–4. Also, the resulting error will be within the range of coefficient values included in the prefix field. *Id.* at 16:4–9.

The prefix fields are encoded at an appropriately high level of error protection in order to provide a high probability that the prefix fields will be decoded correctly. *Id.* at 16:15–18. The suffix field can be encoded with a lower level of error protection, which reduces storage requirements and transmission bandwidth while still providing error resiliency. *Id.* at 16:18–27. To provide error protection, entropy encoder 16 includes unequal error protection means 29 for providing appropriate levels of error protection to the encoded data. *Id.* at 17:1–4.

### *C. Illustrative Claim*

Claims 1, 12, and 28 of the challenged claims of the '482 patent are independent. Claim 1 is illustrative of the claimed subject matter:

1. An error resilient method of encoding data comprising the steps of:

generating a plurality of code words representative of respective portions of the data, wherein each code word comprises a first portion and an associated second portion, and wherein said code word generating step comprises the steps of:

generating the first portion of each code word, wherein said first portion generating step comprises the step of including information within the first portion that is representative of a predetermined characteristic of the associated second portion; and

generating the second portion of each code word, wherein said second portion generating step comprises the step of including information within the second portion that is representative of the respective portion of the data; and

providing error protection to at least one of the first portions of the plurality of code words while maintaining any error protection provided to the respective second portion associated with the at least one first portion at a lower level than the error protection provided to the respective first portion.

Ex. 1001, 18:8–29.

#### *D. References*

Petitioner relies on the following references. Pet. 4.

|      |              |               |          |
|------|--------------|---------------|----------|
| Wei  | US 5,243,629 | Sept. 7, 1993 | Ex. 1004 |
| Kato | US 5,392,037 | Feb. 21, 1995 | Ex. 1002 |

#### *E. Instituted Grounds of Unpatentability*

We instituted review of claims 1–3, 5, 6, 12–14, 16, 17, and 28 of the '482 patent on the following specific grounds:

| Reference(s) | Basis | Challenged Claims         |
|--------------|-------|---------------------------|
| Kato         | § 103 | 1–3, 5, 12–14, 16, and 28 |
| Kato and Wei | § 103 | 6 and 17                  |

## II. ANALYSIS

### *A. Claim Construction*

The term of the '482 patent expired April 17, 2016. *See* Pet. 17. For claims of an expired patent, the Board's claim interpretation is similar to that of a district court. *See In re Rambus Inc.*, 694 F.3d 42, 46 (Fed. Cir. 2012). "[T]he words of a claim 'are generally given their ordinary and customary meaning' . . . that the term would have to a person of ordinary skill in the art in question at the time of the invention." *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed. Cir. 2005) (en banc) (citations omitted). "[T]he person of ordinary skill in the art is deemed to read the claim term not only in the context of the particular claim in which [it] appears, but in the context of the entire patent, including the specification." *Phillips*, 415 F.3d at 1313. For example, a "claim construction that excludes [a] preferred embodiment [described in the specification] 'is rarely, if ever, correct and would require

highly persuasive evidentiary support.” *Adams Respiratory Therapeutics, Inc. v. Perrigo Co.*, 616 F.3d 1283, 1290 (Fed. Cir. 2010) (citation omitted). But “a claim construction must not import limitations from the specification into the claims.” *Douglas Dynamics, LLC v. Buyers Products Co.*, 717 F.3d 1336, 1342 (Fed. Cir. 2013) (citation omitted). Therefore, “it is improper to read limitations from a preferred embodiment described in the specification—even if it is the only embodiment—into the claims absent a clear indication in the intrinsic record that the patentee intended the claims to be so limited.” *Dealertrack, Inc. v. Huber*, 674 F.3d 1315, 1327 (Fed. Cir. 2012) (citation omitted).

1. “code word”

Each of independent claims 1, 12, and 28 recites “a plurality of code words.” Petitioner contends one of ordinary skill in the art would have understood “code word” as used in the ’482 patent to mean “‘code from a code book representing a symbol.’” Pet. 19. Patent Owner does not propose construction of the phrase “code word” in its Response.

The language of claims 1–3, 5, 6, 12–14, 16, 17, and 28 at issue does not contain the word “codebook.” In support of the argument that the claimed “code word” is limited to code “from a code book,” Petitioner relies on the following language from the Specification of the ’482 patent: “The assignment of code words for entropy coding is typically governed by means of a codebook which must be known to both the encoder and decoder.” Pet. 19 (emphasis omitted) (citing Ex. 1001, 4:51–54). But it is improper to read limitations from the Specification into the claims absent a clear indication in the intrinsic record that the patentee intended the claims to be so limited. *See Dealertrack*, 674 F.3d at 1327; *Douglas Dynamics*, 717 F.3d at 1342.

Here, the Specification merely states that the code word is “typically” governed by a codebook. The Specification does not state that the code word must be generated from a codebook. We decline to include the “codebook” limitation in our construction of the term “code word.”

The ’482 patent explains that entropy *coding assigns* shorter code words to symbols which occur frequently, and longer code words to symbols which occur less frequently. Ex. 1001, 4:36–43; 14:27–31 (italics added). An example of entropy coding is Huffman coding. *Id.* at 4:25–26, 43–46. The ’482 patent also explains that Huffman *coding represents data symbols using* code words that each have a length of *a number of bits*. *Id.* at 4:43–46 (italics added).

We construe “code word” as used in the ’482 patent to encompass “a number of bits assigned to a symbol and used to represent the symbol.”

2. “*first portion of each code word*”

Each of independent claims 1 and 28 recites a “first portion of each code word.” Ex. 1001, Claim 12 recites “a plurality of code words . . . which have respective first and second portions.”

Petitioner contends one of ordinary skill in the art would have understood “first portion of each code word” as used in the ’482 patent to mean, “prefix field of a code word generated in a manner such that a bit error in the field could result in a potential loss of code word synchronization.” Pet. 20 (citation omitted). Patent Owner does not propose construction of the phrase “first portion of each code word” in its Preliminary Response.

The language of independent claims 1, 12, and 28 does not include the requirement that the first portion is generated in a manner such that a bit

error could result in loss of code word synchronization. The '482 patent discloses that each code word includes at least a first portion, termed a prefix field, and an associated second portion, termed a suffix field. Ex. 1001, 13:41–50. The '482 patent also provides that “[e]ach code word has . . . a first or prefix field which is susceptible to bit errors . . . . [T]he code words *can* be generated such that a bit error in the prefix field of a code word could result in a potential loss of code word synchronization . . . .” *Id.* at 6:52–59 (emphasis added). The '482 patent states that the first portion is susceptible to errors, but does not state that the first portion must be generated such that an error in the prefix field could result in loss of synchronization. Rather, the '482 patent uses permissive language, stating that the first portion can be generated such that a bit error could result in loss of synchronization. Therefore, we decline to import the merely permissive language into the claim.

We construe a “first portion of each code word” as used in the '482 patent to encompass “a first or prefix field which is susceptible to bit errors.”

3. *“second portion of each code word”*

Each of independent claims 1 and 28 recites a “second portion of each code word.” Claim 12 recites “a plurality of code words . . . which have respective first and second portions.” Petitioner contends one of ordinary skill in the art would have understood “second portion of each code word” as used in the '482 patent to mean a “‘suffix field of a code word generated in a manner such that a bit error in the field results in a miscoded value that falls in a predetermined range about the correct value.’” Pet. 21. Patent Owner does not propose construction of the phrase “second portion of each code word” in its Response.

The '482 patent discloses that each code word includes at least a first portion, termed a prefix field, and an associated second portion, termed a suffix field. Ex. 1001, 13:41–50. The '482 patent also provides that “[e]ach code word has . . . an associated second or suffix field which is resilient to bit errors. [T]he code words *can be* generated such that . . . a bit error in the suffix field of a code word will . . . fall within a predetermined interval about the correct value.” *Id.* at 6:52–65 (emphasis added). The '482 patent does not state that the second portion must be generated in this manner. We do not import this limitation into the claims.

We construe a “second portion of each code word” as used in the '482 patent to encompass at least “a second or suffix field associated with the first field which is resilient to bit errors.”

#### 4. “*storage medium*”

Patent Owner contends “storage medium” recited in claims 5, 16, and 28 should be construed as a physical storage device or memory, and should not be construed so broadly as to cover a transmission channel, data link, or transmission media generally. PO Resp. 13. According to Patent Owner, the claims of the '482 patent distinguish between “storing” data “in a first block of a storage medium” and “transmitting” data “via a first data link.” PO Resp. 15 (citing Ex. 1001, 18:57–59, 19:1–2). Patent Owner also relies on the '482 patent’s distinction between the storage medium represented as module 18, and transmitter module 20 that accesses data links 22 and 24. *Id.* (citing Ex. 1001, Fig. 1, 17:15–19, 26–27; Ex. 2004 ¶¶ 34–35).

Petitioner observes that Patent Owner did not include this construction in the Preliminary Response. Reply 17. But without more, this is an insufficient basis to reject Patent Owner’s proposal. Whether to file a

Preliminary Response is optional, and Patent Owner is under no obligation to set forth all of its positions in a Preliminary Response. *See* 37 C.F.R. 42.107(a) (“The patent owner *may* file a preliminary response to the petition.” (Emphasis added)). Petitioner does not propose an alternative construction of “storage medium.”

Differences among claims can “be a useful guide in understanding the meaning of particular claim terms.” *Phillips*, 550 F.3d at 1314–15. Here, claim 5 of the ’482 patent, which depends from claim 1, recites “storing” data in “a storage medium,” while claim 6, which also depends from claim 1, recites “transmitting” data “via a data link.” Given that the claims of the ’482 patent distinguish between storing data in a storage medium and transmitting data over a transmission medium, we construe the scope of the claim term “storage medium” excludes a transmission channel or a transmission medium.

Also, we read the claimed “storage medium” in view of the Specification of the ’482 patent, because the Specification “‘is always highly relevant to the claim construction analysis. Usually, it is dispositive, it is the single best guide to the meaning of the disputed term.’” *Phillips*, 550 F.3d at 1315. The ’482 patent discloses that a communications or storage medium is referred to as a channel. Ex. 1001, 4:66–5:3. We conclude the scope of the claim term “storage medium,” read in view of the Specification of the ’482 patent, encompasses at least a channel other than a transmission channel.

We further determine that none of the other terms require express construction.

*B. Asserted Obviousness Over Kato: Claims 1–3, 5, and 28*

Petitioner, relying on the declaration of Robert L. Stevenson, Ph. D., challenges claims 1–3, 5, and 28 as obvious over Kato. Pet. 38–52, 56–59 (citing Ex. 1005 ¶¶ 79–115, 131–135). The first embodiment of Kato entropy encodes input data into a first portion and a second portion. Ex. 1002, 10:44–11:4. The fourth embodiment of Kato entropy encodes input data into a first portion and a second portion, then provides unequal error protection to the first and second portions. *Id.* at 24:2–59, 31:52–67.

*1. Kato (Ex. 1002) first and fourth embodiments*

*a. first embodiment*

Kato provides a method of efficient encoding that can reduce the total number of bits of recorded or transmitted data. Ex. 1002, 1:7–9. Figure 1(a) of Kato is reproduced below.

*FIG. 1(a)*

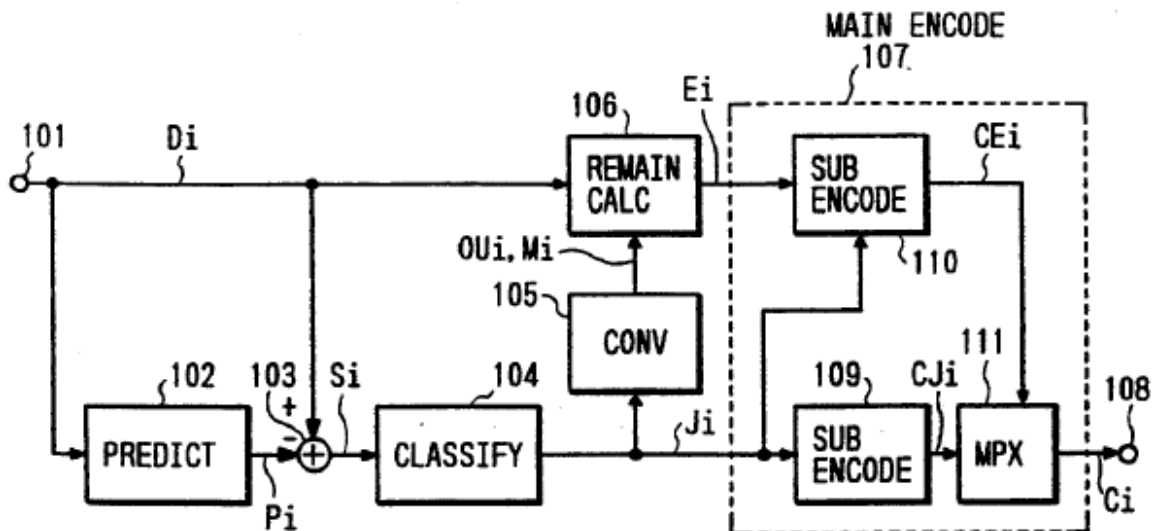


Figure 1(a) of Kato above shows an efficient encoding apparatus that uses an efficient coding method according to what it designates as a “first embodiment.” The efficient encoding apparatus includes prediction circuit

102, subtraction circuit 103, classification circuit 104, data conversion circuit 105, remainder calculation circuit 106, main encoding circuit 107, sub encoding circuit 109, sub encoding circuit 110, and multiplexing circuit 111. Ex. 1002, 9:46–51.

Input terminal 101 is subject to input data  $D_i$  to be encoded. *Id.* at 9:41–42. Prediction circuit 102 generates an estimate  $P_i$  of the input data. *Id.* at 9:52–53. The estimate  $P_i$  is subtracted from the input data  $D_i$  by subtraction circuit 103 to generate estimation error  $S_i$ . *Id.* at 9:53–55. Classification circuit 104 receives the estimation error  $S_i$  and outputs a category index  $J_i$ . *Id.* at 9:56–57. Data conversion circuit 105 generates divisor data  $O_{U_i}$  in response to the category index  $J_i$ . *Id.* at 9:57–59. Remainder calculation circuit 106 divides data  $D_i$  by divisor data  $O_{U_i}$  to generate remainder data  $E_i$ . *Id.* at 9:59–62. Main encoding circuit 107 encodes the category number  $J_i$  and remainder data  $E_i$  into coded data  $C_i$ , which is transmitted through output terminal 108. *Id.* at 9:62–65. Main encoding circuit 107 includes sub encoding circuit 109 which encodes category index  $J_i$  into a Huffman code  $C_{J_i}$ . *Id.* at 9:65–10:1. Sub encoding circuit 110 in main encoding circuit 107 determines a bit number  $M_i$  of remainder data  $E_i$ , and outputs coded data  $C_{E_i}$ . *Id.* at 10:1–2. Multiplexing circuit 111 adds coded data  $C_{E_i}$  to the end of the coded data  $C_{J_i}$  to produce multiplexed coded data  $C_i$ . *Id.* at 10:2–4.

Table 1 of Kato is reproduced below.

TABLE 1

| CATEGORY<br>INDEX | ESTIMATION<br>ERROR<br>RANGE (SN ~ SX) |      | DIVISOR<br>DATA | REMAIND-<br>ER DATA<br>WORD<br>LENGTH |
|-------------------|----------------------------------------|------|-----------------|---------------------------------------|
|                   | SNi                                    | SXi  |                 |                                       |
| Ji                |                                        |      | OUI             | Mi                                    |
| -8                | -255                                   | -128 | 128             | 7                                     |
| -7                | -127                                   | -64  | 64              | 6                                     |
| -6                | -63                                    | -32  | 32              | 5                                     |
| -5                | -31                                    | -16  | 1               | 4                                     |
| -4                | -15                                    | -8   | 8               | 3                                     |
| -3                | -7                                     | -4   | 4               | 2                                     |
| -2                | -3                                     | -2   | 2               | 1                                     |
| -1                | -1                                     | -1   | 1               | 0                                     |
| 0                 | 0                                      | 0    | 1               | 0                                     |
| 1                 | 1                                      | 1    | 1               | 0                                     |
| 2                 | 2                                      | 3    | 2               | 1                                     |
| 3                 | 4                                      | 7    | 4               | 2                                     |
| 4                 | 8                                      | 15   | 8               | 3                                     |
| 5                 | 16                                     | 31   | 16              | 4                                     |
| 6                 | 32                                     | 63   | 32              | 5                                     |
| 7                 | 64                                     | 127  | 64              | 6                                     |
| 8                 | 128                                    | 255  | 128             | 7                                     |

Table 1 above shows category indexes Ji, corresponding estimation error ranges (SNi – SXi), divisor data OUi, and word lengths Mi of remainder data Ei. *Id.* at 7:56–59. The estimation error Si is classified in accordance with the value thereof by referring to Table 1. *Id.* at 7:1–5. A decision is made regarding which range, or category, the estimation error is in, and the category index Ji denoting this range is determined. *Id.* at 7:5–7. The bit number Mi of remainder data Ei is determined in accordance with category index Ji by referring to Table 1. *Id.* at 10:64–67.

*b. fourth embodiment*

Kato also provides, in what it styles as its “fourth embodiment,” a method of efficient encoding that encodes input data into variable-length code words, each having a first portion and a second portion, wherein the first portion includes a bit pattern that can determine a code length of the related word, and wherein the second portion is equal to a part of the related word except the first portion. Ex. 1002, 4:31–42. The first portions are collected into a group and arranged into a data store region. *Id.* at 4:42–44.

The second portions are also collected into a group and arranged into the data store region. *Id.* at 44–46. Figure 6(a) is reproduced below.

*FIG. 6(a)*

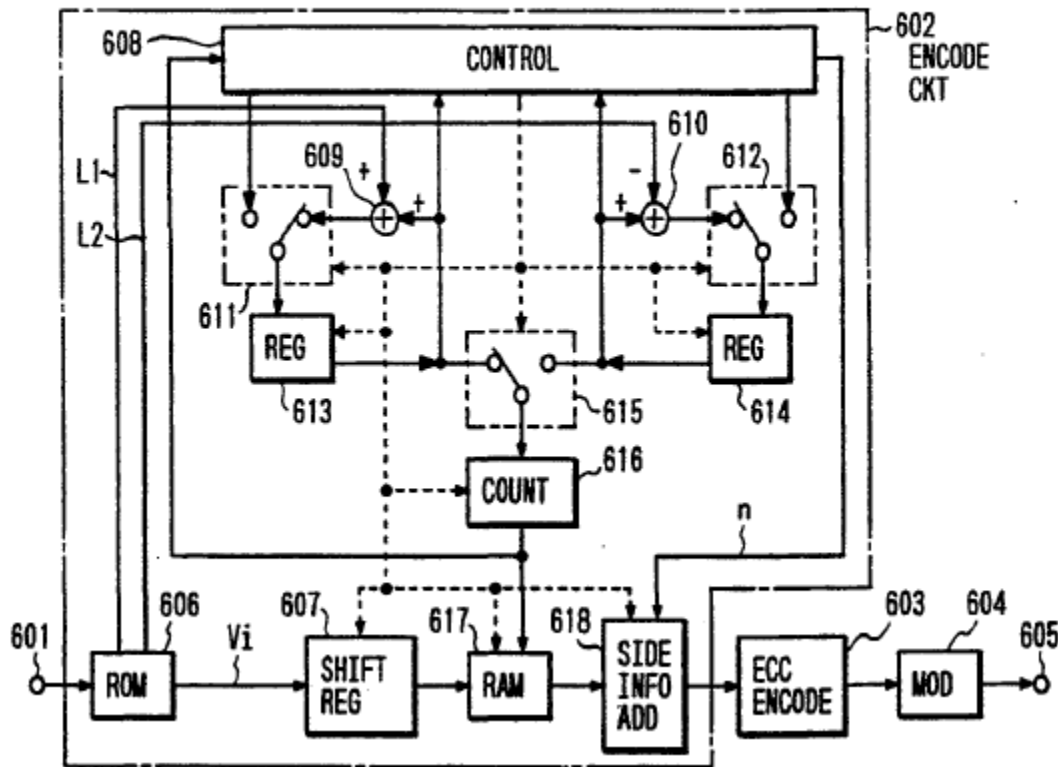


Figure 6(a) above shows a transmitter using an efficient coding method according to the so-called fourth embodiment. *Ex.* 1002, 23:47–49. The transmitter includes encoding circuit 602, ECC (error correction code) encoder 603, and modulation circuit 604. *Id.* at 23:52–54. Encoding circuit 602 encodes input data  $D_i$  into a variable-length code, and places the variable-length code in a data store region within a transmission format. *Id.* at 23:54–57. ECC encoder 603 adds an error correction code to the data output from encoding circuit 602. *Id.* at 23:57–59. Modulation circuit 604 modulates the data from ECC encoder 603 and feeds the signal to output terminal 605. *Id.* at 23:59–62.

Encoding circuit 602 includes read only memory (ROM) 606, shift register 607, control circuit 608, addition circuit 609, subtraction circuit 610, selection circuit 611, selection circuit 612, register 613, register 614, selection circuit 615, counter 616, random access memory (RAM) 617, and side information adding circuit 618. *Id.* at 23:64–24:21. ROM 606 receives input data  $D_i$  via input terminal 601 and encodes it into data  $V_i$ , and generates word length data  $L_1$  and  $L_2$ . *Id.* at 24:2–5. Shift register 607 converts data  $V_i$  from bit-parallel format to bit-series format, which is stored in RAM 617. *Id.* at 24:7–10.

A first portion  $P_i$  of code word  $C_i$  has length  $L_1$ . *Id.* at 25:20–21. When writing  $P_i$  to RAM 617, control circuit 608 controls register 613, selection circuit 615, and counter 616 to write the  $L_1$  bits into RAM 617. *Id.* at 25:45–58. A second portion  $R_i$  of code word  $C_i$  has length  $L_2$ . *Id.* at 25:21–23. When the second portion  $R_i$  is written into RAM 617, control circuit 608 controls register 614, selection circuit 615, and counter 616 to write the  $L_2$  bites into RAM 617. *Id.* at 25:59–26:4.

Encoding circuit 602 encodes input data  $D_i$  into a variable length code word  $C_i$  and locates the code word  $C_i$  in a data store region within a data transmission format. *Id.* at 24:40–45. Figure 7 of Kato is reproduced below.

**FIG. 7**

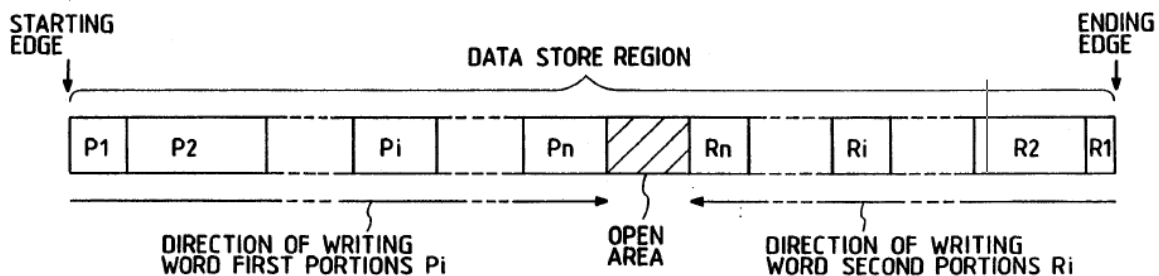


Figure 7 above shows an example of conditions of the arrangement of variable-length code words in the data store region within the data transmission format. *Id.* at 24:46–48. Each variable length code word  $C_i$  is divided into a first portion  $P_i$  and a second portion  $R_i$ . *Id.* at 24:48–50. The first portion  $P_i$  includes a bit pattern from which the code length  $L$  ( $L=L_1+L_2$ ) of the word  $C_i$  can be detected. *Id.* at 24:50–53. The first portion  $P_i$  has  $L_1$  former bits of word  $C_i$ , and the second portion  $R_i$  is equal to the remaining portion having  $L_2$  remaining bits of word  $C_i$ . *Id.* at 24:53–58. First portions  $P_i$  and second portions  $R_i$  of respective code words  $C_i$  are arranged in the data store region. *Id.* at 24:58–63.

First portions  $P_i$  are sequentially arranged from the starting edge of the data store region toward the ending edge, and second portions  $R_i$  are sequentially arranged from the ending edge toward the starting edge. *Id.* at 24:63–25:8. First portions  $P_i$  are separated from second portions  $R_i$ . *Id.* at 31:51–55. This separating arrangement is adopted because an error can propagate through the first portions  $P_i$ , but cannot propagate through the second portions  $R_i$ . *Id.* at 31:55–59. ECC encoder 603 of Figure 6(a) adds error correction codes of higher ability to first portions  $P_i$  to increase the average number of code words which can be decoded correctly in the presence of a transmission error. *Id.* at 31:60–67.

## 2. Analysis of Claims 1–3 and 5

Petitioner contends, “[a]n error resilient method of encoding data” as recited in the preamble of claim 1, is disclosed by the “fourth embodiment” of Kato, which describes that ECC encoder 603 increases the average number of code words which can be decoded correctly in the presence of a transmission error. Pet. 41 (citing Ex. 1002, 31:62–65).

Petitioner contends “generating a plurality of code words representative of respective portions of the data” is disclosed by the “first embodiment” of Kato, which describes generating code words  $C_i$  having two portions,  $C_{Ji}$  and  $CE_i$ . Pet. 41–42 (citing Ex. 1002, 10:45–49 and 10:65–11:2).

Petitioner contends “wherein each code word comprises a first portion and an associated second portion” is disclosed by the first embodiment of Kato, which discloses that code word  $C_i$  comprises a first portion  $C_{Ji}$  and an associated second portion  $CE_i$ . Pet 42–43 (citing Ex. 1002, 10:1–4).

Petitioner also contends this limitation is disclosed by the fourth embodiment of Kato, which describes a code word  $C_i$  comprising a first portion  $P_i$  and an associated second portion  $R_i$ . Pet. 43 (citing Ex. 1002, 23:46–57 and 24:40–45). According to Dr. Stevenson, “an error” to first portions  $C_{Ji}$  from Kato’s first embodiment, or first portions  $P_i$  from Kato’s fourth embodiment, “can propagate through,” but “an error” to associated second portions  $CE_i$  or  $R_i$  “can not propagate through.” Ex. 1005 ¶ 87 (citing Ex. 1002 31:55–59).

Petitioner contends “generating the first portion of each code word, wherein said first portion generating step comprises the step of including information within the first portion that is representative of a predetermined characteristic of the associated second portion” is disclosed by the first embodiment of Kato, which describes generating a first portion of a code word  $C_{Ji}$  from a category index  $J_i$ , and an associated second portion  $CE_i$  generated from remainder data  $E_i$ . Pet 43 (citing Ex. 1002, Table 1, 6:55–7:59). Petitioner contends the length  $M_i$  of remainder data  $E_i$  is determined by  $J_i$ , as shown in Table 1 of Kato, which represents a predetermined

characteristic of  $CE_i$ , namely, the length of remainder data  $E_i$  represented by  $CE_i$ . Pet. 43–44. Petitioner also contends this limitation is disclosed by the fourth embodiment of Kato, which describes a code word  $C_i$  generated to have first portion  $P_i$  that provides information about a second portion  $R_i$ . Pet. 44. According to Petitioner, Kato describes that  $P_i$  includes a bit pattern from which the length  $L$  ( $L=L_1+L_2$ ) of the code word  $C_i$  can be determined, which in turn determines the length of  $R_i$ , where the first portion  $P_i$  has  $L_1$  bits and the second portion  $R_i$  has  $L_2$  bits. Pet. 44–45 (citing Ex. 1002, 24:50–58).

Petitioner contends “generating the second portion of each code word, wherein said second portion generating step comprises the step of including information within the second portion that is representative of the respective portion of the data” is disclosed by the first embodiment of Kato, which describes a code word  $C_i$  having a second portion  $CE_i$  generated from remainder data  $E_i$ . Pet. 45–46 (citing Ex. 1002, Table 1; 7:1–59 and 9:64–10:4).

Petitioner contends “providing error protection to at least one of the first portions of the plurality of code words while maintaining any error protection provided to the respective second portion associated with the at least one first portion at a lower level than the error protection provided to the respective first portion” is disclosed by the fourth embodiment of Kato, which describes providing greater error protection to first portions  $P_i$  than to second portions  $R_i$ . Pet. 47 (citing Ex. 1002, 31:51–67).

Petitioner contends a person of ordinary skill in the art would apply the unequal error protection provided to the first and second portions of a code word as taught by the fourth embodiment of Kato, to the first and

second portions C<sub>Ji</sub> and C<sub>Ei</sub> of the code word of the first embodiment of Kato, because an error can propagate through the first portions but not the second portions. Pet. 40 (citing Ex. 1002, 31:55–59; 32:14–20; Ex. 1005 ¶¶ 83–87). Petitioner contends that adding the error correction codes of higher ability to the first portions increases the average number of code words which can be decoded into correct data in the presence of transmission errors as taught by Kato. Pet. 40–41 (citing Ex. 1002, 31:63–65; Ex. 1005 ¶ 88); Pet. 48 (citing Ex. 1005 ¶¶ 107, 108).

Patent Owner contends first, that the Petition and Dr. Stevenson’s declaration lack any discussion of how the combined embodiments of Kato would operate; second, that the Petition does not establish a reason to incorporate the unequal error protection of the fourth embodiment into the first embodiment; and third, that Dr. Stevenson does not establish a reasonable expectation of success in combining Kato’s embodiments. PO Resp. 30–49.

According to Patent Owner’s first contention, Dr. Stevenson proposes to incorporate the unequal protection scheme from Kato’s fourth embodiment in the encoding apparatus of Kato’s first embodiment, but does not testify about where Error Correction Code (ECC) encoder 603 of the fourth embodiment would interact with components of the first embodiment. PO Resp. 32. Petitioner explains that applying unequal error protection to split field code word portions was within the level of ordinary skill, as recognized by the ’482 patent itself, which acknowledges that unequal error protection is known to those skilled in the art. Reply 12–14 (citing Ex. 1001, 16:10–22, 17:1–4). This explanation is persuasive, in light of Dr. Stevenson’s testimony that ECC encoder 603 of Kato’s fourth embodiment

can provide greater error protection to first code word portions C<sub>Ji</sub> of the first embodiment without the need for undue experimentation to yield the predictable result of an increase in the number of code words that can be decoded correctly. Ex. 1005 ¶¶ 83–88, 105–108.

Accordingly, we find that the Petition and supporting evidence establish, by a preponderance of the evidence, that applying unequal error protection to split field code word portions was within the level of ordinary skill. We find that the Petition and supporting evidence establish, by a preponderance of the evidence, that a person of ordinary skill would provide greater error protection to the first code word portions C<sub>Ji</sub> of Kato's first embodiment, namely, by using ECC 603 of Kato's fourth embodiment to add error protection to first code word portions C<sub>Ji</sub> without the need for undue experimentation to yield the predictable result of an increase in the number of code words that can be decoded correctly.

According to Patent Owner's second contention, the Petition and Dr. Stevenson propose to incorporate Kato's fourth embodiment into the first embodiment in order to provide a benefit that Kato's first embodiment already possesses, namely, preventing error propagation. PO Resp. 35–36. Petitioner contends that Kato's first embodiment does not provide higher error protection to first code word portions C<sub>Ji</sub>, which, if not decoded correctly, can result in catastrophic errors. Pet. 28–31, 39–40, 47; Reply 2–3. Dr. Stevenson testifies that a person of ordinary skill in the art would have provided the higher level of error protection taught by Kato's fourth embodiment to the first portions C<sub>Ji</sub> from Kato's first embodiment, where, like the first portions P<sub>i</sub> of Kato's fourth embodiment, an error can propagate through. Ex. 1005 ¶ 87 (citing Ex. 1002, 31:55–59). According to Dr.

Stevenson, the higher level of error protection to first code word portions taught by Kato's fourth embodiment, when applied to first code word portions C<sub>Ji</sub> of the first embodiment, reduces error propagation and increases the number of variable-length code words that can be decoded in the presence of a transmission error. Ex. 1005 ¶¶ 87–88.

We find that the Petition and supporting evidence establish, by a preponderance of the evidence, sufficient reason, with rational underpinning, to apply unequal error protection to first code word portions as taught by Kato's fourth embodiment to the first code word portions of Kato's first embodiment, namely, to reduce error propagation and increase the number of code words that can be decoded.

According to Patent Owner's third contention, Paragraphs 81 through 88 of Dr. Stevenson's declaration do not reveal any underlying facts or data to support his opinion that combining the embodiments of Kato could be achieved without undue experimentation. PO Resp. 44–46. Dr. Stevenson testifies that ECC encoder 603 of Kato's fourth embodiment provides an error correction code to data from the encoding circuit. Ex. 1005 ¶ 106 (citing Ex. 1002, 23:54–59). Dr. Stevenson testifies that a person of ordinary skill in the art would provide greater protection to first portions C<sub>Ji</sub> of Kato's first embodiment than to associated second portions C<sub>Ei</sub> of Kato's first embodiment, because an error to the first portions can undergo error propagation. Ex. 1005 ¶¶ 85 (citing Ex. 1002, 32:14–20), 87 (citing Ex. 1002, 31:55–59). According to Dr. Stevenson, the unequal error protection of the fourth embodiment could be added to the encoding apparatus of the first embodiment without the need for undue experimentation, yielding the predictable result of an increase in the number of variable length code words

which can be decoded into correct data in the presence of a transmission error. Ex. 1005 ¶ 88 (citing Ex. 1002, 31:63–65).

We find that the Petition and supporting evidence establish, by a preponderance of the evidence, that a person of ordinary skill in the art would have had a reasonable expectation of success in processing first code word portions CJi taught by Kato’s first embodiment, using ECC 603 taught by Kato’s fourth embodiment, without the need for undue experimentation, to yield the predictable result of greater error protection to CJi than to second code word portions CEi, resulting in reduced error propagation.

We credit Dr. Stevenson’s testimony and determine that Petitioner has articulated sufficient reasoning to support its conclusion that claim 1 is obvious. *See KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007) (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)). Based on the foregoing discussion and the record, Petitioner has shown by a preponderance of the evidence that Kato renders claim 1 obvious.

Claim 2 recites “said step of generating a plurality of code words comprises the step of entropy coding the data to thereby reduce the size of the resulting code words.” Ex. 1001, 18:30–33. Petitioner contends the first embodiment of Kato discloses this limitation in describing the benefits of entropy coding generally, and in teaching entropy coding of Ji to generate the first portions of the code words specifically. Pet. 48–49 (citing Ex. 1002, 2:45 and 10:44–46).

Based on the foregoing discussion and the record, Petitioner has shown by a preponderance of the evidence that the combination of the first and fourth embodiments of Kato renders claim 2 obvious.

Claim 3 recites “wherein said step of generating the second portion of each code word comprises the step of generating second portions having predetermined numbers of characters.” Ex. 1001, 18:34–41. Petitioner contends the first embodiment of Kato discloses this limitation in describing second portions CE<sub>i</sub> generated from remainder portions E<sub>i</sub> each having a predetermined number of characters as determined by the remainder word length M<sub>i</sub>. Pet. 49 (citing Ex. 1002, Table 1; 7:34–54).

Claim 3 also recites “wherein said step of generating the first portion of each code word comprises the step of generating first portions which include information representative of the predetermined number of characters which comprise the associated second portion.” Petitioner contends the first embodiment of Kato discloses this limitation in describing that first portion CJ<sub>i</sub> is encoded from J<sub>i</sub>, which determines a number of characters of remainder data E<sub>i</sub> that are encoded to form remainder portion CE<sub>i</sub>. Pet. 49–50 (citing Ex. 1002, Table 1; 6:55–7:59).

Based on the foregoing discussion and the record, Petitioner has shown by a preponderance of the evidence that the combination of the first and fourth embodiments of Kato renders claim 3 obvious.

Claim 5 recites

wherein said step of providing error protection comprises the steps of:

- storing the at least one first portion of the plurality of code words in a first data block of a storage medium, wherein the first data block is error protected; and

- storing the respective second portion associated with the at least one first portion in a second data block of the storage medium, wherein any error protection provided by the second data block is at a lower level than the error protection provided by the first data block.

Ex. 1001, 18:54–64.

Petitioner contends the fourth embodiment of Kato discloses storing the first portion of the plurality of code words in a first data block and the associated second portion in a second data block in describing a data store region having two separate areas set off from one another by an open area, where the first area comprises a first portion  $P_i$  of code words, and the second area comprises the second portion  $R_i$  of code words. Pet. 50–51 (citing Ex. 1002, Fig. 7; 32:35–40).

Petitioner contends the fourth embodiment of Kato discloses providing higher error protection to the stored first portion than to the stored second portion in describing an ability of error correction with respect to the first portions in the data store region is higher than an ability of error correction with respect to the second portions in the data store region. Pet. 51 (citing Ex. 1002, 35:18–21).

Patent Owner contends the fourth embodiment of Kato adds an error correction code to the output of the encoding circuit immediately prior to transmission, but does not add the error correction code to the data in the storage areas of RAM 617. PO Resp. 20–26. According to Patent Owner, Kato does not identify any risk of errors in encoding circuit 602, such as between ROM 606 and Shift Register 607, or between Shift Register 607 and RAM 617, due to channel noise. *Id.* at 29 (citing Ex. 2004 ¶ 58). Therefore, according to Patent Owner, there is no reason to add redundancy codes to the data stored in RAM 617, because no channel noise occurs in the encoding circuit, and also because adding the redundancy codes increases the storage space of the stored data. *Id.* at 29–30 (citing Ex. 2004 ¶ 59).

Dr. Stevenson testifies that Kato teaches providing first portions Pi in one portion of a data store region with a higher level of error protection than the second portions Ri. Ex. 1005 ¶ 67 (citing Ex. 1002, 31:51–62, 65–67; 35:18–21). According to Dr. Stevenson, in view of Kato’s disclosure of providing unequal error protection to data Pi and Ri, it would have been obvious to provide unequal error protection to the separate regions in which they are stored. *Id.* ¶¶ 114–115.

In addition to Dr. Stevenson’s testimony that adding unequal error protection to stored data would have been obvious, Petitioner further contends that the need to protect first code word portions from errors in a storage medium was known in the art as acknowledged by the ’482 patent. Reply 19 (citing Ex. 1001 5:1–5). The ’482 patent discloses “the communications or storage medium is referred to as the ‘channel’. A digital data set, such as a compressed image, conveyed through such a channel is subject to corruption of some of the bits, thereby creating erroneous bit values.” Ex. 1001, 5:1–5. We agree with Petitioner that a person of ordinary skill in the art, aware that data conveyed through a storage medium is subject to errors, would have been motivated to protect the stored data using Kato’s unequal error protection. Reply 19 (citing Ex. 1005 ¶ 114).

Patent Owner contends that neither the Petition nor Dr. Stevenson’s declaration identifies any storage medium downstream, or after, ECC encoder 603 shown in Figure 6 of Kato. PO Resp. 25. Patent Owner, relying on testimony of Dr. Kenneth Zeger, contends the Petition does not explain how Kato discloses a storage medium storing an error-corrected first portion of a code word. *Id.* (citing Ex. 2004 ¶ 55).

Petitioner, citing testimony of Dr. Zeger, contends that Kato's first embodiment stores output code word portions in a memory buffer. Reply 20–21 (citing Ex. 1017, 139:22–140:1; Ex. 1002, Fig. 1(b)). According to Petitioner, adding the error correction codes of Kato's fourth embodiment to first code word portions  $CJ_i$  of Kato's first embodiment, then subsequently storing first and second code word portions  $CJ_i$  and  $CE_i$  in a buffer as taught by Kato's first embodiment, teaches storing the first and second code word portions in first and second data blocks of a storage medium within the meaning of claim 5. Reply 21–22.

Patent Owner contends that during the re-direct portion of Dr. Stevenson's deposition, Petitioner and Dr. Stevenson endorsed a new theory that Kato discloses additional examples of data store regions, other than those shown in Figure 7 of Kato. PO Resp. 55–59.

Petitioner contends that adding unequal error protection to data portions as taught by Kato, then storing the data portions after error protection has been applied, was an obvious variation. Reply 17. Petitioner contends a person of ordinary skill in the art would have known that storing data in a storage medium can result in errors, and that the ECC of Kato would protect against such errors. Reply 19 (citing Ex. 1001, 5:1–5; Ex. 1005 ¶ 114). Petitioner, relying on testimony of Dr. Zeger and the re-direct portion of the testimony of Dr. Stevenson, contends a person of ordinary skill in the art would understand that after the unequal error protection is applied to data portions, the data portions could be stored in a modem before or after transmission, such as in the buffer of Kato's first embodiment. Reply 20–22 (citing Ex. 1017, 139:22–140:1, 159:17–24, 160:8–25; Ex. 2006, 137:7–139:1; Ex. 1002, Fig. 1(b)).

The Federal Circuit

has made clear that the Board may consider a prior art reference to show the state of the art at the time of the invention, regardless of whether that reference was cited in the Board's institution decision. In *Ariosa Diagnostics v. Verinata Health, Inc.*, 805 F.3d 1359 (Fed. Cir. 2015), [the Federal Circuit] vacated the Board's decision because it appeared that the Board had declined to consider a reference simply because the reference "had not been identified at the petition stage as one of the pieces of prior art defining a combination for obviousness." *Id.* at 1365. The court in *Ariosa* held that such references "can legitimately serve to document the knowledge that skilled artisans would bring to bear in reading the prior art identified as producing obviousness."

*Genzyme Therapeutic Products Limited Partnership v. Biomarin Pharmaceutical Inc.*, 825 F.3d 1360, 1369 (Fed. Cir. 2016). We find that the additional evidence not originally cited in the Petition, namely, the background section of the '482 patent (Ex. 1001), Dr. Zeger's testimony (Ex. 1017), Dr. Stevenson's re-direct testimony (Ex. 2006), and the buffer shown in Figure 1(b) of Kato's first embodiment (Ex. 1002), serves to document the knowledge a person of ordinary skill in the art would bring to bear in reading Kato. Petitioner's evidence merely responds to Patent Owner's arguments properly, and Patent Owner was not denied notice of the evidence or an opportunity to respond to it. *See Genzyme*, 825 F.3d at 1369; *In re Baxter Travenol Labs*, 952 F.2d 388, 390 (Fed. Cir. 1991) (holding extrinsic evidence, including admissions, may be used to explain what a reference discloses in a reexamination proceeding).

Based on the foregoing discussion and the record, Petitioner has shown by a preponderance of the evidence that the combination of the first and fourth embodiments of Kato renders claim 5 obvious.

### *3. Analysis of Claim 28*

Petitioner contends Kato teaches the limitations recited in claim 28 for the reasons set forth in the analysis of claims 1 and 5. Pet. 56–59 (citing Ex. 1005 ¶¶ 130–135). Claim 28 recites

a storage medium for storing the error resilient encoded data, said storage medium being partitioned into a first error protected data block and a second data block, wherein any error protection provided by said second data block is at a lower level than the error protection provided by said first data block.

Ex. 1001, 22:25–30. Petitioner contends this limitation is similar to that recited in claim 5, and is obvious for the same reasons. Pet. 57. In particular, Petitioner contends this limitation is disclosed by Kato’s teaching of first portions  $P_i$  and second portions  $R_i$  arranged in separate data store regions, and by Kato’s teaching of partitioning data into blocks, and providing the blocks with different levels of error protection. Pet. 57–58 (citing Ex. 1002 32:35–39; Ex. 1005 ¶ 133).

Claim 28 further recites

a plurality of code words, representative of respective portions of the original data, which have respective first and second portions, wherein the first portion of each code word includes information representative of a predetermined characteristic of the associated second portion, and wherein the associated second portion of each code word includes information representative of a respective portion of the original data.

Ex. 1001, 22:31–39. Petitioner contends the plurality of code words recited in claim 28 is similar to the code words recited in claim 1, and is obvious for the same reasons. Pet. 58. Petitioner contends that although claim 1 does not expressly recite “original data” as recited in claim 28, Kato teaches the second portion represents original data, because the remainder data  $E_i$  in  $CE_i$

represents the estimation error  $S_i$  for original data  $D_i$ . Pet. 58 (citing Ex. 1005 ¶ 134).

Claim 28 further recites

wherein at least one of the first portions of the plurality of code words is stored in the first data block of said storage medium such that the at least one first portion is error protected, and wherein the respective second portion associated with the at least one first portion is stored in the second data block of said storage medium such that any error protection provided to the respective second portion associated with the at least one first portion is at a lower level than the error protection provided to the respective first portion.

Ex. 1001, 22:40–49. Petitioner contends the storage medium recited in claim 28 is similar to the unequal error protection recited in claim 1, and is obvious for the same reasons. Pet. 59 (citing Ex. 1005 ¶ 135).

Patent Owner contends Kato does not teach the limitations recited in claim 28 for the reasons set forth in Patent Owner's response to claims 5 and 16. PO Resp. 20–30. We disagree with Patent Owner's contentions for the reasons given in our analysis of claim 5.

Patent Owner also contends Dr. Stevenson has not provided the Board with an articulated reason to conclude that second portion  $CE_i$  of Kato's first embodiment "includes information representative of a respective portion of the original data"  $D_i$  within the meaning of claim 28. PO Resp. 49–50. According to Patent Owner, Dr. Stevenson's testimony in paragraph 134 of Dr. Stevenson's original declaration, which states "'the remainder data  $E_i$  in  $CE_i$  represents the estimation error  $S_i$ '" for data  $D_i$  is incorrect. PO Resp. 50. Also according to Patent Owner, paragraph 92 of Dr. Stevenson's testimony, which states that together "***CJ<sub>i</sub> and CE<sub>i</sub> represent an estimation error S<sub>i</sub>*** for data  $D_i$ " does not sufficiently explain how this statement

discloses “information representative of a respective portion of the original data” as claimed. PO Resp. 50.

Dr. Stevenson testifies that Kato’s original data  $D_i$  is represented by subtracting an estimate  $P_i$  from the original data  $D_i$  to generate estimation error  $S_i$ , which is then encoded into first and second portions  $C_{Ji}$  and  $CE_i$ . Reply 22–23 (citing Ex. 1005 ¶¶ 55–62). According to Petitioner, Kato discloses encoding each  $CE_i$  from a value  $E_i$  that represents a specific remainder portion of a particular estimation error that falls within a range of estimation errors designated by the category index  $J_i$  encoded into  $C_{Ji}$ , which together represent the original data. Reply 23–24 (citing Ex. 1005 ¶¶ 92, 101, 104, 108; Ex. 1002, 9:64–10:4). Dr. Stevenson testifies that “the second portion of the code word,  $CE_i$ , is generated from remainder data  $E_i$ , and therefore includes information representative of the respective portions of the data that the code word represents . . . [and] the category index  $J_i$  encoded into a given  $C_{Ji}$  sets forth the number of bits of  $E_i$  that are coded into  $CE_i$ .” Ex. 1005 ¶ 101 (citations omitted). Dr. Stevenson testifies that together,  $C_{Ji}$  and  $CE_i$  represent an estimation error  $S_i$  for data  $D_i$ . Ex. 1005 ¶ 108.

Based on the foregoing discussion and the record, Petitioner has shown by a preponderance of the evidence that Petitioner sufficiently establishes a reasonable likelihood that Kato teaches the limitations of claim 28.

*C. Asserted Obviousness Over Kato: Claims 12–14 and 16*

Petitioner challenges claims 12–14 and 16 as obvious over Kato. Pet. 38–41, 52–56 (citing Ex. 1005 ¶¶ 116–130).

*1. Kato's third embodiment*

The third embodiment of Kato transforms and quantizes input data, then entropy encodes the transformed, quantized input data into a first portion and a second portion. Ex. 1002, 19:46–20:34. An entropy coding circuit similar in structure to the encoding apparatus of the first embodiment can be used when performing the method according to the third embodiment. *Id.* at 20:9–12. The third embodiment of Kato collects bits of input data into a block, subjects the input data to a transform that generates a DC coefficient and AC coefficients, quantizes the coefficients, and codes the coefficients. *Id.* at 3:44–65. Figure 4(a) of Kato is reproduced below.

**FIG. 4(a)**

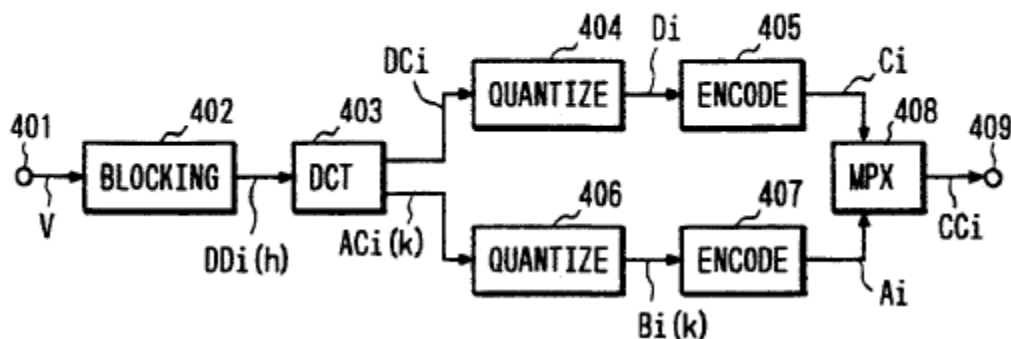


Figure 4(a) of Kato above shows an efficient encoding apparatus that uses an efficient encoding method according to a third embodiment. *Id.* at 19:39–41. The efficient encoding apparatus includes blocking circuit 402, DCT (discrete cosine transform) circuit 403, quantization circuit 404,

encoding circuit 405, quantization circuit 406, encoding circuit 407, and multiplexing circuit 408. *Id.* at 19:46–50.

Input image data  $V$  is fed via input terminal 401 to blocking circuit 402. *Id.* at 19:52–53. Blocking circuit 402 separates a frame represented by input data  $V$  into  $8 \times 8$  blocks of pixels, and outputs data  $DD_i(h)$  corresponding to each block, where  $h$  denotes an integer from 0 to 63. *Id.* at 19:53–60. DCT circuit 403 receives the block data  $DD_i(h)$  and transforms the block data into a set of DCT coefficients, including one DC coefficient  $DC_i$  and 63 AC coefficients  $AC_i(k)$ , where  $i$  denotes a block identification number and  $k$  denotes an integer from 1 to 63. *Id.* at 19:60–68. DCT circuit 403 outputs the DC coefficient  $DC_i$  to quantization circuit 404, and outputs the AC coefficients  $AC_i(k)$  to quantization circuit 406. *Id.* at 20:1–4. Quantization circuit 404 quantizes the DC coefficient  $DC_i$  into data  $Di$ . *Id.* at 20:4–9. Encoding circuit 405 encodes data  $Di$  into coded data  $Ci$ . *Id.* at 20:9–11. Encoding circuit 405 is similar in structure to the encoding apparatus of Figure 1(a). *Id.* at 20:11–12. Quantization circuit 406 quantizes the AC coefficients  $AC_i(k)$  into data  $Bi(k)$ . *Id.* at 20:25–28. Encoding circuit 407 receives data  $Bi(k)$  from quantization circuit 406 and encodes it using Huffman encoding into coded data  $Ai$ . *Id.* at 20:30–34. Multiplexing circuit 408 receives coded data  $Ci$ , coded data  $Ai$ , and combines them into multiplexed coded data  $CC_i$ , which is transmitted via output terminal 409. *Id.* at 20:34–41.

## 2. Analysis of Claims 12–14 and 16

Claim 12 recites “transforming the data based upon a predetermined transformation function.” Ex. 1001, 20:1–2. Petitioner contends the third embodiment of Kato discloses this limitation in describing a Discrete Cosine

Transform (DCT) function to transform data. Pet. 52–53 (citing Ex. 1002, 19:62–20:4). Claim 12 also recites “quantizing the transformed data such that the quantized data has fewer unique coefficients than the transformed data.” Ex. 1001, 20:3–5. Petitioner contends the third embodiment of Kato discloses this limitation in describing quantizing data to reduce the number of coefficients. Pet. 53 (citing Ex. 1002, 20:4–9, 25–30).

Claim 12 also recites “encoding the quantized data.” Ex. 1001, 20:6–22. Petitioner contends the third embodiment of Kato discloses this limitation in describing encoding quantized data. Pet. 53–54 (citing Ex. 1002, 20:11–25). Petitioner contends the remainder of the encoding step recited in claim 12 is similar to the steps recited in claim 1, which Petitioner contends are disclosed by the first and fourth embodiments of Kato. Pet. 41–48, 54–55.

Petitioner contends that the third embodiment of Kato teaches combining the third embodiment with the first embodiment by stating that “encoding circuit 405 is similar in structure to the encoding apparatus of FIG. 1(a)” of the first embodiment. Pet. 39 (quoting Ex. 1002, 20:11–12, 21–25).

Patent Owner contends neither the Petition nor Dr. Stevenson’s declaration discusses how the transforming and quantizing steps from the third embodiment would be incorporated into the first embodiment, or how those components would be configured together in the ultimate combination. PO Resp. 31.

To the contrary, Dr. Stevenson provides a persuasive explanation showing how and why to combine the related steps of the two embodiments.

For example, Dr. Stevenson testifies that Kato discloses transforming and quantizing image data, then subsequently encoding the data. Ex. 1005 ¶¶ 69–73 (citing Ex. 1002, 19:62–20:9, 20:11–30, 34:1–12). Dr. Stevenson provides testimony that the third embodiment uses the reference character Di, which is the same as that in Figure 1(a) of the first embodiment, to correlate the similarity between the encoding circuit 405 of the third embodiment and the encoding apparatus of the first embodiment. Ex. 1005 ¶ 82 (citing Ex. 1002, 20:11–25). Dr. Stevenson also testifies that combining the transforming and quantizing steps of the third embodiment, the unequal error protection of the fourth embodiment, and the encoding apparatus of the first embodiment, could occur without undue experimentation, yielding the predictable result of an increase in the average number of variable-length code words which can be decoded into correct data in the presence of a transmission error. Ex. 1005 ¶ 88 (citing Ex. 1002, 31:63–65).

Based on the foregoing discussion and the record, Petitioner has shown by a preponderance of the evidence that Kato teaches the limitations of claim 12.

Petitioner persuasively shows the limitations recited in dependent claims 13, 14, and 16 are similar to those of dependent claims 2, 3, and 5, which are disclosed by Kato. Pet. 55–56 (citing Ex. 1005 ¶¶ 128–130). Based on the foregoing discussion and the record, Petitioner has shown by a preponderance of the evidence that Kato teaches the limitations of claims 13, 14, and 16, for the reasons given in our analysis of claims 2, 3, and 5 above.

*D. Asserted Obviousness Over Kato and Wei: Claims 6 and 17*

Petitioner challenges claims 6 and 17 as obvious over Kato and Wei.  
Pet. 59–65.

*1. Wei*

Wei discloses transmitting a high definition television (HDTV) signal with a multi-subcarrier transmission scheme in which each subcarrier is used to carry a different class of HDTV information. Ex. 1004, Abstract. A signal is divided into a plurality of classes that are encoded for different error protection levels. Ex. 1004, 2:36–38. At least one class of information is more important and is provided with more error protection than the other classes. *Id.* at 2:43–46. A subchannel that carries the more important information is assigned to a frequency spectrum that is not subject to substantial interferences. *Id.* at 2:51–58. Figure 1 of Wei is reproduced below.

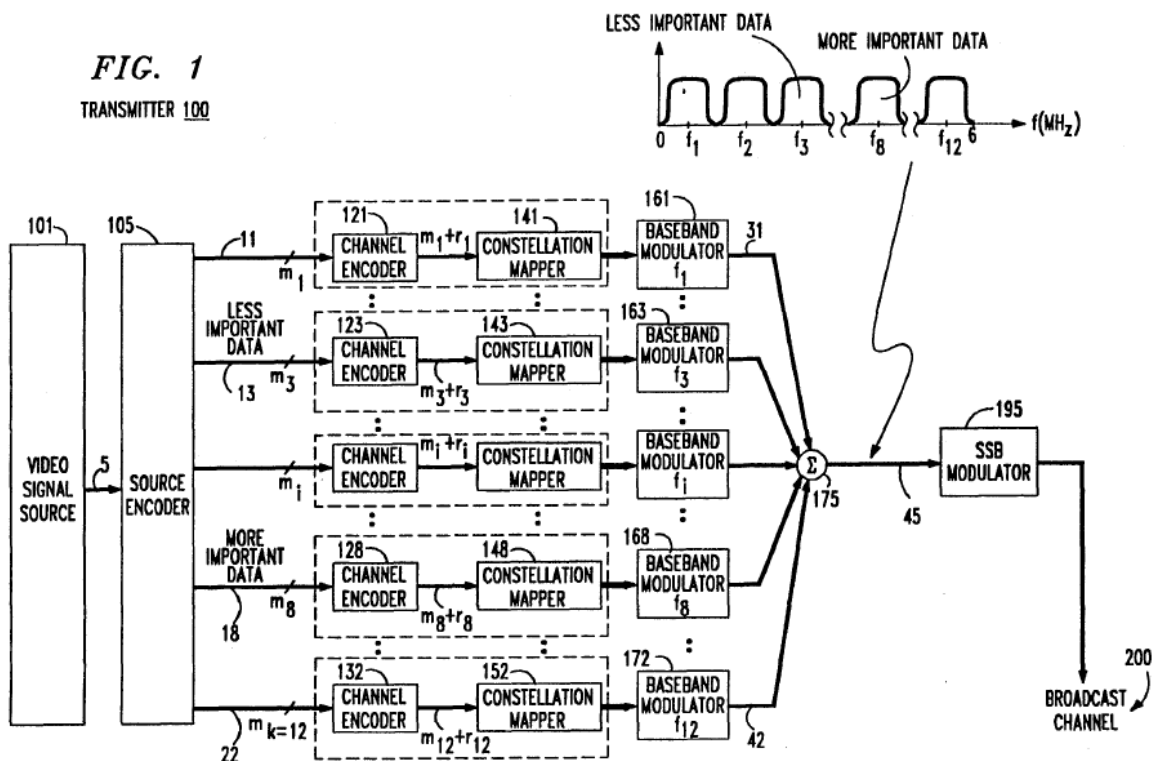


Figure 1 of Wei above shows a block diagram of a transmitter that uses a multi-subcarrier transmission scheme. Ex. 1004, 2:67–68. Video signal source 101 sends a video signal to source encoder 105, which generates a digital signal comprising a plurality of classes of information in which at least one class is more important than the other classes. *Id.* at 3:18–42. More important data on lead 18 is input to channel encoder 128, which operates according to known encoding techniques to output encoded data to constellation mapper 148. *Id.* at 3:43–66. The modulation schemes implemented by each channel encoder 121, 123, 128, 132, and respective constellation mapper 141, 143, 148, 152, are chosen to provide unequal error protection to the plurality of classes, such that more important information is provided with more error protection. *Id.* at 3:67–4:21. Channel encoder 128 and constellation mapper 148 implement a modulation scheme that provides more error protection to the more important data. *Id.* at 4:26–29.

## *2. Analysis of claims 6 and 17*

Claim 6 of the '482 patent depends from claim 1 and recites

transmitting the at least one first portion of the plurality of code words via a first data link, wherein the first data link is error protected; and

transmitting the respective second portion associated with the at least one first portion via a second data link, wherein any error protection provided by the second data link is at a lower level than the error protection provided by the first data link.

Ex. 1001, 19:1–8. Claim 17, which depends from claim 12, recites a similar limitation. *Id.* at 20:62–21:2.

Petitioner contends Wei discloses the limitations of claims 6 and 17 in describing a system which sends data of varying importance along different subchannels, reserving a subchannel providing a higher level of error

protection for the more important data. Pet. 61–64 (citing Ex. 1004, Fig. 1; 4:62–5:24). Petitioner contends one of ordinary skill in the art looking to provide greater error protection to code word portions having greater significance, such as code word portions that can propagate errors, would send those portions along Wei’s subchannel with higher error protection to guard against error propagation. Pet. 61, 64.

Patent Owner contends that there is no evidence to conclude that Kato’s data transmission would be more reliable, or would have greater error resilience, through the use of Wei’s channel encoding and modulation scheme. PO Resp. 53 (citing Ex. 2004 ¶ 64). According to Patent Owner, there is no supported reasoning establishing that a person of ordinary skill in the art would have been motivated to swap out Kato’s ECC encoder 603 and modulator 604 with a set of channel encoders and baseband modulators to map Kato’s data to different subchannels for avoiding interference when transmitting HDTV signals. PO Resp. 54–55 (citing Ex. 2004 ¶ 67).

Petitioner contends Dr. Stevenson discussed the motivation to combine the teachings of Kato and Wei in the declaration. Reply 24 (citing Ex. 1005 ¶¶ 136–143). Dr. Stevenson testifies that Wei suggests combining error correction codes, such as those taught by Kato, with the invention of Wei. Ex. 1005 ¶ 140. According to Dr. Stevenson, adding the channel encoding and modulation scheme of Wei to provide additional error protection beyond that provided by the error correction codes of Kato would have yielded the predictable result of increasing the average number of variable-length code words which can be decoded into correct data in the presence of a transmission error as taught by Kato. *Id.* ¶ 141 (citing Ex. 1002, 31:63–65). Dr. Stevenson testifies that

applying Wei's coded subchannel modulators to the ECC encoder and modulator in Kato would have been a simple substitution of one well-known element for another since both were well-known and, in this case, serve very similar functions, namely providing a higher level of error protection to more important (in Kato's case error propagatable) data than to the less important (error resilient) data. And the results would have been predictable. Wei itself suggests and even claims the combination of error correction codes with its claimed invention, such as those used in Kato (Ex. 1004, Wei, 3:57-60: "It should be noted that error correcting codes, such as a Reed-Solomon code, can also be used in place of, or in conjunction with, a coded modulation scheme.")

*Id.* ¶ 142.

As the testimony shows, Dr. Stevenson persuasively explains that using Wei's subchannel modulator would have been obvious in Kato's system in order to protect more important data in Kato's system. Based on the foregoing discussion and the record, Petitioner has shown by a preponderance of the evidence that the combination of Kato and Wei teaches the limitations of claims 6 and 17.

### III. CONCLUSION

On this record, Petitioner has shown by a preponderance of the evidence that claims 1–3, 5, 6, 12–14, 16, 17, and 28 of the '482 patent are unpatentable.

### IV. ORDER

Accordingly, it is ORDERED that

1. Claims 1–3, 5, 12–14, 16, and 28 of the '482 patent are unpatentable under 35 U.S.C. § 103 over Kato;

2. Claims 6 and 17 of the '482 patent are unpatentable under 35 U.S.C. § 103 over Kato and Wei; and

FURTHER ORDERED that because this Final Written Decision is final, a party to the proceeding seeking judicial review of the Decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

IPR2016-01179  
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