IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

FRACTUS, S.A., **v.** **ADT LLC d/b/a ADT SECURITY SERVICES**	§ § § § § § §	**Civil Action No. 2:22-cv-00412-JRG (Lead Case)** Jury Trial Requested
FRACTUS, S.A., **v.** **VIVINT, INC.**	§ § § § § § §	**Civil Action No. 2:22-cv-00413-JRG (Member Case)** Jury Trial Requested

JOINT CLAIM CONSTUCTION CHART PURSUANT TO PATENT RULE 4-5(d)

Pursuant to P.R. 4-5(d) and this Court's applicable Docket Control Order (Dkt. 41), Plaintiff Fractus, S.A. ("Fractus") and Defendants ADT LLC and Vivint, Inc. ("Defendants") submit the attached Joint Claim Construction Charts.

Dated: January 4, 2024

Respectfully submitted,

By: */s/ Max L. Tribble*

Max L. Tribble
TX State Bar No. 20213950
mtribble@susmangodfrey.com
Joseph S. Grinstein
TX State Bar No. 24002188
jgrinstein@susmangodfrey.com
Justin A. Nelson
TX State Bar No. 24034766
jnelson@susmangodfrey.com
Adam Tisdall
TX State Bar No. 24106885
atisdall@susmangodfrey.com
SUSMAN GODFREY L.L.P.
1000 Louisiana, Suite 5100

Houston, TX 77002-5096
Telephone: (713) 651-9366
Facsimile: (713) 654-6666

Genevieve Vose Wallace
Washington State Bar No. 38422
SUSMAN GODFREY L.L.P.
401 Union Street, Suite 3000
Seattle, WA 98101
Phone: (206) 516-3880
Fax: (206) 516-3883

Craig Smyser
TX State Bar No. 24117083
csmyser@susmangodfrey.com
SUSMAN GODFREY L.L.P.
1301 Avenue of the Americas, 32nd Floor
New York, NY 10019
Telephone: (212) 336-8330
Facsimile: (212) 336-8340

S. Calvin Capshaw
TX Bar No. 03783900
ccapshaw@capshawlaw.com
Elizabeth L. DeRieux
TX Bar No. 05770585
ederieux@capshawlaw.com
CAPSHAW DERIEUX, L.L.P.
114 East Commerce Avenue
Gladewater, Texas 75647
Telephone: (903) 845-5770

T. John Ward, Jr.
TX Bar No. 00794818
jw@wsfirm.com
Claire Abernathy Henry
TX Bar No. 24053063
claire@wsfirm.com
Andrea L. Fair
TX Bar No. 24078488
andrea@wsfirm.com
WARD, SMITH & HILL, PLLC
P.O. Box 1231
Longview, Texas 75606-1231
Telephone: (903) 757-6400
Facsimile: (903) 757-2323

ATTORNEYS FOR FRACTUS, S.A.

By: */s/ Michael E. Zeliger*

Steven Tepera (24053510)
Pillsbury Winthrop Shaw Pittman LLP
steven.tepera@pillsburylaw.com
401 Congress Avenue, Suite 1700
Austin, TX 78701-3797
Phone: 512.580.9600
Fax: 512.580.9601

Michael E. Zeliger (Lead Attorney)
(pro hac vice)
Ranjini Acharya (pro hac vice)
Pillsbury Winthrop Shaw Pittman LLP
michael.zeliger@pillsburylaw.com
ranjini.acharya@pillsburylaw.com
2550 Hanover Street
Palo Alto, CA 94304-1115 USA
Telephone: 650.233.4500
Fax: 650.233.4545

David A. Simons (pro hac vice)
Pillsbury Winthrop Shaw Pittman LLP
david.simons@pillsburylaw.com
1650 Tysons Boulevard
14th Floor
McLean, VA 22102-4856 USA
Phone: 703.770.7900
Fax: 703.770.7901

Theresa A. Roozen (pro hac vice)
Pillsbury Winthrop Shaw Pittman LLP
theresa.roozen@pillsburylaw.com
1200 17th St NW,
Washington, DC 20036
Phone: 202.663.8000
Fax: 202.663.8007

ATTORNEYS FOR DEFENDANT ADT LLC

By:*/s/ Andy Tindel*

Andy Tindel (Texas Bar No. 20054500)
MT^2 Law Group
122 W. Line Street, Suite 304

Tyler, Texas 75702
(903) 596-0900
atindel@andytindel.com

David R. Wright (*Lead Attorney*)
(*Admitted Pro Hac Vice*)
Jared J. Braithwaite (*Admitted Pro Hac Vice*)
Michael Manookin (*Admitted Pro Hac Vice*)
Maren Laurence (*Admitted Pro Hac Vice*)
FOLEY & LARDNER LLP
95 South State Street, Suite 2500
Salt Lake City, Utah 84111
(801) 401-8900
drwright@foley.com
jbraithwaite@foley.com
mmanookin@foley.com

J. Michael Thomas (Texas Bar No. 24066812)
FOLEY & LARDNER LLP
2021 McKinney, Suite 1600
Dallas, Texas 75201
214-999-3000
jmthomas@foley.com

ATTORNEYS FOR DEFENDANT VIVNT, INC.

Claim Terms, Patent(s), & Claim Number(s)	Plaintiff's Construction	Defendants'[1] Construction	Court's Construction
"not similar/in shape/in size" • '092 Patent, claim 1: 1: A wireless device comprising: a radiating element, the radiating element comprising: a conducting body including a hole; an input terminal; a ground plane, the ground plane operating in cooperation with the radiating element; a dielectric support, wherein the radiating element is arranged on the dielectric support; a feeding means, the feeding means being coupled to the input terminal; wherein the radiating element defines an external perimeter; wherein the hole has an area of at least 20% of an area included inside the external perimeter; wherein the external perimeter of the radiating element is shaped as a first polygonal shape comprising at least four sides; wherein a perimeter of the hole is shaped as a second polygonal shape comprising a plurality of sides; wherein the first polygonal shape and the second polygonal shape are **not similar**, wherein the radiating element is shorter than a quarter of a longest operating wavelength of the wireless device; and wherein the wireless device is operative at multiple frequency bands. • '246 Patent, claims 13, 15, 30: 13: The antenna according to claim 1, wherein the radiating element comprises at least two holes and wherein the at least two holes are **not similar in shape.** 15: The antenna according to claim 1, wherein the radiating element comprises at least two holes and wherein the at least two holes are **not similar in size.** 30: A monopole antenna comprising: a radiating element defining an external perimeter; wherein the radiating element comprises at least one hole; wherein the at least one hole has an area of at least 20% of an area included inside the external perimeter; wherein the external perimeter of the radiating element is shaped as a polygonal element comprising at least four sides; wherein the perimeter of the at least one hole is shaped as a polygon comprising three or more sides; wherein the radiating element is shorter than a quarter of a longest operating wavelength of the antenna; wherein the monopole antenna	Not indefinite. No construction necessary.	Indefinite.	

[1] ADT does not take a position on construction of claim terms, phrases, or clauses found in the patents that are not asserted against it. Similarly, Vivint does not take a position on construction of claim terms, phrases, or clauses that are found in the patents that are not asserted against it.

features a multiband behavior, and wherein the radiating element comprises at least two holes and wherein the at least two holes are **not similar in shape.**			
"hole(s) intersects the [external] perimeter" • '092 Patent, claims 11, 32: 11: The wireless device according to claim 1, wherein the **hole intersects the external perimeter** of the radiating element. 32: The wireless device according to claim 26, wherein at least one hole of the plurality of **holes intersects the external perimeter** of the radiating element. • '246 Patent, claims 18, 28: 18: The antenna according to claim 1, wherein the at least one **hole intersects the perimeter** of the radiating element at a distance to its feeding point shorter than a quarter, or longer than three quarters, of the external perimeter of the radiating element. 28: The antenna according to claim 27, wherein the at least one **hole intersects the perimeter** of the radiating element at a distance to its feeding point shorter than a quarter, or longer than three quarters, of the external perimeter of the radiating element.	Not indefinite. No construction necessary.	Indefinite.	
"4G communication standard / communication standard(s)" • '103 Patent, claims 12, 16: 12: A handheld multifunction wireless device having at least one of multimedia functionality and smartphone functionality, the handheld multifunction wireless device comprising: a touch screen; a processing module: a memory module: a communication module: a power management module: an antenna system within the handheld multifunction wire less device and comprising: a ground plane layer, a first antenna element configured to simultaneously support radiation modes for first, second, and third frequency bands, the first frequency band being contained within a first frequency region of an electro magnetic spectrum, the second frequency band being contained within a second frequency region of the electromagnetic spectrum that is higher in frequency than the first frequency region, the third frequency band of	Not indefinite. No construction necessary.	Indefinite.	

operation being used by **a 4G communication standard**, wherein a perimeter of the first antenna element defines a first antenna contour comprising at least thirty-five segments, the first antenna element defining an antenna box, an orthogonal projection of the antenna box along a normal to a face with a largest area of the antenna box defining an antenna rectangle, wherein a length of the first antenna contour is greater than four times a diagonal of the antenna rectangle; and a second antenna element configured to operate in at least one frequency band used by **a 4G communication standard**, wherein a perimeter of the second antenna element defines a second antenna contour comprising at least twenty segments. 16: A handheld multifunction wireless device having at least one of multimedia functionality and smartphone functionality, the handheld multifunction wireless device comprising: a touch screen; a microprocessor, at least one memory module; and a communication module configured to operate in a first frequency band used by at least one communication standard and contained within a first frequency region of an electromagnetic spectrum, in a second frequency band used by at least one communication standard and contained within a second frequency region of the electromagnetic spectrum that is higher in frequency than the first frequency region, and in a third frequency band used by **a 4G communication standard**; the communication module comprising an antenna system within the handheld multifunction wireless device having at least a first and a second antenna elements and a ground plane layer, the first antenna element being con figured to transmit and receive signals from **a 4G communication standard**, and the second antenna element being configured to receive signals from **a 4G communication standard**, wherein: the ground plane layer defines a ground plane rectangle; the first antenna element is proximate to a first short side of the ground plane rectangle; the second antenna element is proximate to a second short side of the ground plane rectangle; and a perimeter of the second antenna element defines an antenna contour having a level of complexity defined by complexity factor F_{21} having a value of at least 1.20 and complexity factor F_{32} having a value less than 1.75. • ’200 Patent, claims 1, 6, 11: 1: A wireless device comprising: an antenna system comprising a ground plane and at least two antennas within the wireless device the antenna system comprising: a first antenna proximate to a first short side of a ground plane rectangle enclosing the ground plane, the first			

antenna being configured to support at least three frequency bands contained within first and second frequency ranges of the electromagnetic spectrum, the second frequency range being higher in frequency than the first frequency range, the first antenna being configured to transmit and receive signals from **a 4G communication standard**, the first antenna defining a first antenna contour comprising an entire perimeter of the first antenna, wherein the first antenna contour has a level of complexity defined by complexity factor F_{21} having a value of at least 1.20 and complexity factor F_{32} having a value of at least 1.35; and a second antenna proximate to a first long side of the ground plane rectangle, and wherein the second antenna is configured to receive signals from a 4G communication standard. 6: A wireless device comprising: an antenna system comprising a ground plane and at least two antennas within the wireless device, the antenna system comprising: a first antenna configured to provide operation in at least four frequency bands being used by **4G communication standards**, wherein at least two of the at least four frequency bands are contained within a first frequency range and at least two of the four frequency bands are contained within a second frequency range, the first frequency range being lower in frequency than the second frequency range, the first antenna defining a first antenna contour comprising an entire perimeter of the first antenna, and wherein the first antenna contour has a level of complexity defined by complexity factor F_{21} having a value of at least 1.20 and complexity factor F_{32} having a value of at least 1.35; and a second antenna configured to operate in at least one frequency band being used by **a 4G communication standard**, the second antenna defining an antenna box that is a minimum-sized parallelepiped that completely encloses a volume of the second antenna and wherein each face of the minimum-sized parallelepiped is tangent to at least one point of the volume of the second antenna, an orthogonal projection of the antenna box along a normal to a face with a largest area of the second antenna defining an antenna rectangle, an aspect ratio of the antenna rectangle being defined as a ratio between a width and a height of the antenna rectangle, and wherein the aspect ratio has a value of at least 2, and wherein at least one of the first and second antennas is close to a first short side of a ground plane rectangle enclosing the ground plane. 11: A wireless device comprising: an antenna system comprising a ground plane and at least two antennas within the wireless device, the antenna system comprising: a first antenna configured to provide			

operation in at least three frequency bands being used by **4G communication standards**, the first antenna defining an antenna contour comprising an entire perimeter of the first antenna, the antenna contour comprising at least twenty segments, wherein the antenna contour has a level of complexity defined by complexity factor $F_{21}1$ having a value of at least 1.20 and complexity factor F_{32} having a value of at least 1.35, and wherein the first antenna defines an antenna box that is a minimum-sized parallelepiped that completely encloses a volume of the first antenna and wherein each face of the minimum-sized parallelepiped is tangent to at least one point of the volume of the first antenna, an orthogonal projection of the antenna box along a normal to a face with a largest area of the first antenna defining an antenna rectangle, an aspect ratio of the antenna rectangle being defined as a ratio between a width and a height of the antenna rectangle, wherein the aspect ratio has a value of at least 2; and a second antenna configured to provide operation in a first wireless service, the second antenna being proximate to a side of a ground plane rectangle enclosing the ground plane.			
"receive signals from a 4G communication standard" • '200 Patent, claim 1: 1: A wireless device comprising: an antenna system comprising a ground plane and at least two antennas within the wireless device the antenna system comprising: a first antenna proximate to a first short side of a ground plane rectangle enclosing the ground plane, the first antenna being configured to support at least three frequency bands contained within first and second frequency ranges of the electromagnetic spectrum, the second frequency range being higher in frequency than the first frequency range, the first antenna being configured to transmit and **receive signals from a 4G communication standard**, the first antenna defining a first antenna contour comprising an entire perimeter of the first antenna, wherein the first antenna contour has a level of complexity defined by complexity factor F_{21}having a value of at least 1.20 and complexity factor F_{32} having a value of at least 1.35; and a second antenna proximate to a first long side of the ground plane rectangle, and wherein the second antenna is configured to **receive signals from a 4G communication standard**.	Not indefinite. No construction necessary.	Indefinite.	

"complexity factor" • '103 Patent, claim 16: 16: A handheld multifunction wireless device having at least one of multimedia functionality and smartphone functionality, the handheld multifunction wireless device comprising: a touch screen; a microprocessor, at least one memory module; and a communication module configured to operate in a first frequency band used by at least one communication standard and contained within a first frequency region of an electromagnetic spectrum, in a second frequency band used by at least one communication standard and contained within a second frequency region of the electromagnetic spectrum that is higher in frequency than the first frequency region, and in a third frequency band used by a 4G communication standard; the communication module comprising an antenna system within the handheld multifunction wireless device having at least a first and a second antenna elements and a ground plane layer, the first antenna element being con figured to transmit and receive signals from a 4G communication standard, and the second antenna element being configured to receive signals from a 4G communication standard, wherein: the ground plane layer defines a ground plane rectangle; the first antenna element is proximate to a first short side of the ground plane rectangle; the second antenna element is proximate to a second short side of the ground plane rectangle; and a perimeter of the second antenna element defines an antenna contour having a level of complexity defined by **complexity factor** F_{21} having a value of at least 1.20 and **complexity factor** F_{32} having a value less than 1.75. • '200 Patent, claims 1, 6, 11: 1: A wireless device comprising: an antenna system comprising a ground plane and at least two antennas within the wireless device the antenna system comprising: a first antenna proximate to a first short side of a ground plane rectangle enclosing the ground plane, the first antenna being configured to support at least three frequency bands contained within first and second frequency ranges of the electromagnetic spectrum, the second frequency range being higher in frequency than the first frequency range, the first antenna being configured to transmit and receive signals from a 4G communication standard, the first antenna defining a first antenna contour comprising an entire perimeter of the first antenna, wherein the first antenna contour has a level of complexity defined by **complexity factor** F_{21} having a value of at least	Not indefinite. No construction necessary. Alternatively: "a numerical value calculated using a formula that parametrizes the level of complexity of an antenna that captures and characterizes certain aspects of the geometrical details of the antenna contour."	Indefinite.	

1.20 and **complexity factor** F_{32} having a value of at least 1.35; and a second antenna proximate to a first long side of the ground plane rectangle, and wherein the second antenna is configured to receive signals from a 4G communication standard. 6: A wireless device comprising: an antenna system comprising a ground plane and at least two antennas within the wireless device, the antenna system comprising: a first antenna configured to provide operation in at least four frequency bands being used by 4G communication standards, wherein at least two of the at least four frequency bands are contained within a first frequency range and at least two of the four frequency bands are contained within a second frequency range, the first frequency range being lower in frequency than the second frequency range, the first antenna defining a first antenna contour comprising an entire perimeter of the first antenna, and wherein the first antenna contour has a level of complexity defined by **complexity factor** F_{21} having a value of at least 1.20 and **complexity factor** F_{32} having a value of at least 1.35; and a second antenna configured to operate in at least one frequency band being used by a 4G communication standard, the second antenna defining an antenna box that is a minimum-sized parallelepiped that completely encloses a volume of the second antenna and wherein each face of the minimum-sized parallelepiped is tangent to at least one point of the volume of the second antenna, an orthogonal projection of the antenna box along a normal to a face with a largest area of the second antenna defining an antenna rectangle, an aspect ratio of the antenna rectangle being defined as a ratio between a width and a height of the antenna rectangle, and wherein the aspect ratio has a value of at least 2, and wherein at least one of the first and second antennas is close to a first short side of a ground plane rectangle enclosing the ground plane. 11: A wireless device comprising: an antenna system comprising a ground plane and at least two antennas within the wireless device, the antenna system comprising: a first antenna configured to provide operation in at least three frequency bands being used by 4G communication standards, the first antenna defining an antenna contour comprising an entire perimeter of the first antenna, the antenna contour comprising at least twenty segments, wherein the antenna contour has a level of complexity defined by **complexity factor** F_{21} having a value of at least 1.20 and **complexity factor** F_{32} having a value of at least 1.35, and wherein the first antenna defines an antenna box that is a minimum-sized parallelepiped that completely encloses a volume of the first antenna and			

wherein each face of the minimum-sized parallelepiped is tangent to at least one point of the volume of the first antenna, an orthogonal projection of the antenna box along a normal to a face with a largest area of the first antenna defining an antenna rectangle, an aspect ratio of the antenna rectangle being defined as a ratio between a width and a height of the antenna rectangle, wherein the aspect ratio has a value of at least 2; and a second antenna configured to provide operation in a first wireless service, the second antenna being proximate to a side of a ground plane rectangle enclosing the ground plane.			
"close proximity region"/ "coupled through a close proximity region" • '604 Patent, claims 1, 3, 13: 1: A wireless portable device comprising: a printed circuit board comprising a ground plane structure; an antenna system operating in multiple frequency bands, the antenna system comprising: a first radiating arm comprising a first-radiating-arm first tip, a first-radiating-arm second tip, and a feeding terminal connected to the first-radiating-arm first tip, wherein the first radiating arm is not connected to the ground plane structure through a grounding terminal; and a second radiating arm comprising a second-radiating arm first tip, a second-radiating-arm second tip, and a grounding terminal connected to the second-radiating-arm first tip, wherein the second radiating arm does not include a contact point with first radiating arm, wherein: the first radiating arm and the second radiating arm are **coupled through a close proximity region** from a first specific portion of the first radiating arm and from a second specific portion of the second radiating arm; a length of a line segment between a point of the first specific portion and a point of the second specific portion is shorter than a distance between the feeding terminal and the grounding terminal; an orthogonal projection of the line segment onto a plane of the ground plane structure does not intersect the ground plane structure; and the first radiating arm, the second radiating arm and the **close proximity region** are configured to simultaneously provide the bandwidth required for the antenna system to operate in the multiple frequency bands. 3: The wireless portable device of claim 1, wherein the **close proximity region** is located at a distance from the feeding terminal that is longer than 1/40 of the longest free-space operating wavelength of the antenna system.	Not indefinite. No construction necessary. Alternatively: "a region between two radiating arms in which at least one portion on each arm is placed to allow electro-magnetic fields in one arm being transferred to the other (excluding the feeding port) and the distance between the two arms is not constant throughout the entirety of the arms."	Indefinite	

13: A wireless portable device comprising: a printed circuit board comprising a ground plane structure; an antenna system operating in multiple frequency bands and included within the wireless portable device, the antenna system comprising: a first radiating arm comprising a first-radiating-arm first tip, a first-radiating-arm second tip, a feeding terminal connected to the first-radiating-arm first tip, and a first-radiating-arm first point; and a second radiating arm comprising a second-radiating arm first tip, a second-radiating-arm second tip, and a grounding terminal connected to the second-radiating-arm first tip, wherein: the second radiating arm does not include a contact point with the first radiating arm; the first radiating arm and the second radiating arm are **coupled through a close proximity region** formed by a portion including the first-radiating-arm first point and the second-radiating-arm second tip; a length of a line segment between the first-radiating arm first point and the second-radiating-arm second tip is shorter than a distance between a point of the feeding terminal and a point of the grounding terminal; an orthogonal projection of the line segment onto a plane of the ground plane structure does not intersect the ground plane structure; and the first radiating arm, the second radiating arm and the **close proximity region** are configured to simultaneously provide a bandwidth required for the antenna system to operate in the multiple frequency bands. • ’138 Patent, claims 9, 15: 9: An apparatus comprising: an antenna having a multi-band behavior, the antenna being arranged within the apparatus and the antenna comprising: a ground plane; a first radiating structure fed through a feeding terminal, the first radiating structure including a plurality of first conductive traces connected end-to-end in a folded arrangement, the first radiating structure having a length extending along a non-straight path formed by the first conductive traces from a first end at the feeding terminal to a second, open end and having a width perpendicular to the non-straight path formed by the first conductive traces; and a second radiating structure connected to the ground plane through a grounding terminal, the second radiating structure including a plurality of second conductive traces connected end-to-end in a folded arrangement and having a length extending along a non-straight path formed by the second conductive traces from a first end at the grounding terminal to a second, open end, the second radiating structure being arranged separated from the first radiating structure, and a spacing between the first and the second radiating structures being non-constant, wherein: the length of the second radiating structure is shorter than the			

length of the first radiating structure; the first and second radiating structures are folded to form a **close proximity region** between the first and the second radiating structures; the first and second radiating structures and the spacing between the first and second radiating structures are configured to enable the antenna to operate at a first frequency band and a second separate frequency band higher in frequency than the first frequency band; the spacing between the first and second radiating structures is configured to couple an electric current of the first radiating structure to the second radiating structure at an operating frequency of the second frequency band; and the length of the second radiating structure is configured to provide the bandwidth required for the antenna to operate in the second frequency band. 15: An apparatus comprising: an antenna having a multi-band behavior, the antenna being arranged within the apparatus and configured to operate in separate first and second frequency bands, the antenna comprising: a ground plane; a first radiating structure fed through a feeding terminal; and a second radiating structure connected to the ground plane through a grounding terminal, wherein: the second radiating structure has a first end at the grounding terminal and a second, open end, and a distance between the first end of the second radiating structure and the feeding terminal of the first radiating structure is less than a distance between the second, open end of the second radiating structure and the feeding terminal of the first radiating structure; the first and second radiating structures are folded to form a **close proximity region** between the first and second radiating structures, a spacing between the first and the second radiating structures being non-constant; the spacing between the first and second radiating structures is configured to provide coupling between the first and second radiating structures at an operating frequency of the second frequency band; a length of the second radiating structure from the first end at the grounding terminal to the second, open end is configured to provide the bandwidth required for the antenna to operate in the second frequency band; and the second frequency band has higher operating frequencies than the operating frequencies of the first frequency band. • ’770 Patent, claims 8, 13, 14: 8: An apparatus comprising: an antenna having a multi-band behavior, the antenna being arranged within the apparatus and the antenna comprising: a ground plane; a first radiating structure fed through a feeding terminal, the first radiating structure including a plurality of first conductive traces connected			

end-to-end in a folded arrangement, the first radiating structure having a length extending along a non-straight path formed by the first conductive traces from a first end at the feeding terminal to a second, open end; and a second radiating structure connected to the ground plane through a grounding terminal, the second radiating structure including a plurality of second conductive traces connected end-to-end in a folded arrangement and having a length extending along a non-straight path formed by the second conductive traces from a first end at the grounding terminal to a second, open end, the second radiating structure being arranged separated from the first radiating structure, and a spacing between the first and the second radiating structures being non-constant, wherein: the length of the second radiating structure is shorter than the length of the first radiating structure; the first and second radiating structures are folded to form a **close proximity region** between the first and the second radiating structures; a portion bounding the first radiating structure is formed by at least ten connected segments, each of the connected segments forming an angle with its neighboring connected segment, the angle being less than 180; the first and second radiating structures and the spacing between the first and second radiating structures are configured to enable the antenna to operate at a first frequency band, a second separate frequency band higher in frequency than the first frequency band, and a third frequency band higher than the second frequency band; the spacing between the first and second radiating structures is configured to couple an electric current of the first radiating structure to the second radiating structure at an operating frequency of at least the second frequency band. 13: The apparatus of claim 9, wherein the **close proximity region** is shorter than a tenth of a longest free space wavelength of operation in the first, second, and third frequency bands. 14: An apparatus comprising: an antenna having a multi-band behavior, the antenna being arranged within the apparatus and configured to operate in separate first, second and third frequency bands, the antenna comprising: a ground plane; a first radiating structure fed through a feeding terminal; and a second radiating structure connected to the ground plane through a grounding terminal, wherein: the second radiating structure has a first end at the grounding terminal and a second, open end, and a distance between the first end of the second radiating structure and the feeding terminal of the first radiating structure is less than a distance between the second, open end of the second radiating structure and the feeding terminal of the first radiating structure; the first			

and second radiating structures are folded to form a **close proximity region** between the first and second radiating structures, a spacing between the first and the second radiating structures being non-constant; the spacing between the first and second radiating structures is configured to provide coupling between the first and second radiating structures at an operating frequency of the at least the second frequency band; and the second frequency band has higher operating frequencies than the operating frequencies of the first frequency band.			
"perimeter" • '092 Patent claims 1, 11, 12, 26: 1: A wireless device comprising: a radiating element, the radiating element comprising: a conducting body including a hole; an input terminal; a ground plane, the ground plane operating in cooperation with the radiating element; a dielectric support, wherein the radiating element is arranged on the dielectric support; a feeding means, the feeding means being coupled to the input terminal; wherein the radiating element defines an external **perimeter**; wherein the hole has an area of at least 20% of an area included inside the external **perimeter**; wherein the external **perimeter** of the radiating element is shaped as a first polygonal shape comprising at least four sides; wherein a **perimeter** of the hole is shaped as a second polygonal shape comprising a plurality of sides; wherein the first polygonal shape and the second polygonal shape are not similar, wherein the radiating element is shorter than a quarter of a longest operating wavelength of the wireless device; and wherein the wireless device is operative at multiple frequency bands. 11: The wireless device according to claim 1, wherein the hole intersects the external **perimeter** of the radiating element. 12: The wireless device according to claim 11, wherein said intersection is at a distance from the input terminal shorter than a quarter of a length of the external **perimeter** of the radiating element. 26: A wireless device comprising: a radiating element, the radiating element comprising: a conducting body including a plurality of holes; an input terminal; a ground plane, the ground plane operating in cooperation with the radiating element; a dielectric support, wherein the radiating element is arranged on the dielectric support; a feeding means, the feeding means being coupled to the input terminal; wherein the radiating element defines an	No construction necessary.	"The continuous line forming the boundary of a closed geometric figure."	

external **perimeter**; wherein the plurality of holes have a combined area of at least 20% of an area included inside the external **perimeter**; wherein the external **perimeter** of the radiating element is shaped as a polygonal shape comprising at least four sides; wherein a **perimeter** of a first hole of the plurality of holes comprises at least three sides; wherein a **perimeter** of a second hole of the plurality of holes comprises at least three sides; wherein the **perimeter** of the first hole and the **perimeter** of the second hole have different number of sides; wherein the radiating element is shorter than a quarter of a longest operating wavelength of the wireless device; and wherein the wireless device is operative at multiple frequency bands. • ’103 Patent claim 12: 12: A handheld multifunction wireless device having at least one of multimedia functionality and smartphone functionality, the handheld multifunction wireless device comprising: a touch screen; a processing module: a memory module: a communication module: a power management module: an antenna system within the handheld multifunction wire less device and comprising: a ground plane layer, a first antenna element configured to simultaneously Support radiation modes for first, second, and third frequency bands, the first frequency band being contained within a first frequency region of an electro magnetic spectrum, the second frequency band being contained within a second frequency region of the electromagnetic spectrum that is higher in frequency than the first frequency region, the third frequency band of operation being used by a 4G communication standard, wherein a **perimeter** of the first antenna element defines a first antenna contour comprising at least thirty-five segments, the first antenna element defining an antenna box, an orthogonal projection of the antenna box along a normal to a face with a largest area of the antenna box defining an antenna rectangle, wherein a length of the first antenna contour is greater than four times a diagonal of the antenna rectangle; and a second antenna element configured to operate in at least one frequency band used by a 4G communication standard, wherein a **perimeter** of the second antenna element defines a second antenna contour comprising at least twenty segments. • ’200 Patent claims 1, 3, 6, 9, 11: 1: A wireless device comprising: an antenna system comprising a ground plane and at least two antennas within the wireless device the antenna system comprising:			

a first antenna proximate to a first short side of a ground plane rectangle enclosing the ground plane, the first antenna being configured to support at least three frequency bands contained within first and second frequency ranges of the electromagnetic spectrum, the second frequency range being higher in frequency than the first frequency range, the first antenna being configured to transmit and receive signals from a 4G communication standard, the first antenna defining a first antenna contour comprising an entire **perimeter** of the first antenna, wherein the first antenna contour has a level of complexity defined by complexity factor F_{21} having a value of at least 1.20 and complexity factor F_{32} having a value of at least 1.35; and a second antenna proximate to a first long side of the ground plane rectangle, and wherein the second antenna is configured to receive signals from a 4G communication standard. 3: The wireless device of claim 2, wherein the second antenna defines a second antenna contour comprising an entire **perimeter** of the second antenna, wherein a length of the second antenna contour is greater than four times a diagonal of the antenna rectangle. 6: A wireless device comprising: an antenna system comprising a ground plane and at least two antennas within the wireless device, the antenna system comprising: a first antenna configured to provide operation in at least four frequency bands being used by 4G communication standards, wherein at least two of the at least four frequency bands are contained within a first frequency range and at least two of the four frequency bands are contained within a second frequency range, the first frequency range being lower in frequency than the second frequency range, the first antenna defining a first antenna contour comprising an entire **perimeter** of the first antenna, and wherein the first antenna contour has a level of complexity defined by complexity factor F_{21} having a value of at least 1.20 and complexity factor F_{32} having a value of at least 1.35; and a second antenna configured to operate in at least one frequency band being used by a 4G communication standard, the second antenna defining an antenna box that is a minimum-sized parallelepiped that completely encloses a volume of the second antenna and wherein each face of the minimum-sized parallelepiped is tangent to at least one point of the volume of the second antenna, an orthogonal projection of the antenna box along a normal to a face with a largest area of the second antenna defining an antenna rectangle, an aspect ratio of the antenna rectangle being defined as a			

ratio between a width and a height of the antenna rectangle, and wherein the aspect ratio has a value of at least 2, and wherein at least one of the first and second antennas is close to a first short side of a ground plane rectangle enclosing the ground plane. 9: The wireless device of claim 6, herein the second antenna defines a second antenna contour comprising an entire **perimeter** of the second antenna, wherein a length of the second antenna contour is greater than four times a diagonal of the antenna rectangle. 11: A wireless device comprising: an antenna system comprising a ground plane and at least two antennas within the wireless device, the antenna system comprising: a first antenna configured to provide operation in at least three frequency bands being used by 4G communication standards, the first antenna defining an antenna contour comprising an entire **perimeter** of the first antenna, the antenna contour comprising at least twenty segments, wherein the antenna contour has a level of complexity defined by complexity factor $F_{21}1$ having a value of at least 1.20 and complexity factor F_{32} having a value of at least 1.35, and wherein the first antenna defines an antenna box that is a minimum-sized parallelepiped that completely encloses a volume of the first antenna and wherein each face of the minimum-sized parallelepiped is tangent to at least one point of the volume of the first antenna, an orthogonal projection of the antenna box along a normal to a face with a largest area of the first antenna defining an antenna rectangle, an aspect ratio of the antenna rectangle being defined as a ratio between a width and a height of the antenna rectangle, wherein the aspect ratio has a value of at least 2; and a second antenna configured to provide operation in a first wireless service, the second antenna being proximate to a side of a ground plane rectangle enclosing the ground plane.			
"wireless device" • '092 Patent all asserted claims (1, 2, 3, 11, 12, 13, 14, 24, 26, 32, 33, 34, 41): 1: A **wireless device** comprising: a radiating element, the radiating element comprising: a conducting body including a hole; an input terminal; a ground plane, the ground plane operating in cooperation with the radiating element; a dielectric support, wherein the radiating element is arranged on the dielectric support; a feeding means, the feeding means being coupled to the input	No construction necessary.	"A device with the ability to transmit and receive voice, data, or video signals through the radio spectrum that does not require a physical wire to operate."	

terminal; wherein the radiating element defines an external perimeter; wherein the hole has an area of at least 20% of an area included inside the external perimeter; wherein the external perimeter of the radiating element is shaped as a first polygonal shape comprising at least four sides; wherein a perimeter of the hole is shaped as a second polygonal shape comprising a plurality of sides; wherein the first polygonal shape and the second polygonal shape are not similar; wherein the radiating element is shorter than a quarter of a longest operating wavelength of the **wireless device**; and wherein the **wireless device** is operative at multiple frequency bands. 2: The **wireless device** according to claim 1, wherein the first polygonal shape comprises a different number of sides than the second polygonal shape. 3: The **wireless device** according to claim 2, wherein the first polygonal shape comprises more sides than the second polygonal shape. 11: The **wireless device** according to claim 1, wherein the hole intersects the external perimeter of the radiating element. 12: The **wireless device** according to claim 11, wherein said intersection is at a distance from the input terminal shorter than a quarter of a length of the external perimeter of the radiating element. 13: The **wireless device** according to claim 1, wherein the input terminal is located at a point on the perimeter of the hole. 14: The **wireless device** according to claim 1, wherein the radiating element is an arm of a monopole antenna. 24: The **wireless device** of claim 1, wherein the **wireless device** is operative at least at four frequency bands. 26: A **wireless device** comprising: a radiating element, the radiating element comprising: a conducting body including a plurality of holes; an input terminal; a ground plane, the ground plane operating in cooperation with the radiating element; a dielectric support, wherein the radiating element is arranged on the dielectric support; a feeding means, the feeding means being coupled to the input terminal; wherein the radiating element defines an external perimeter; wherein the plurality of holes have a combined area of at least 20% of an area included inside the external perimeter; wherein the external perimeter of			

the radiating element is shaped as a polygonal shape comprising at least four sides; wherein a perimeter of a first hole of the plurality of holes comprises at least three sides; wherein a perimeter of a second hole of the plurality of holes comprises at least three sides; wherein the perimeter of the first hole and the perimeter of the second hole have different number of sides; wherein the radiating element is shorter than a quarter of a longest operating wavelength of the **wireless device**; and wherein the **wireless device** is operative at multiple frequency bands. 32: The **wireless device** according to claim 26, wherein at least one hole of the plurality of holes intersects the external perimeter of the radiating element. 33: The **wireless device** according to claim 32, wherein said intersection is at a distance from the input terminal shorter than a quarter of a length of the external perimeter of the radiating element. 34: The **wireless device** according to claim 26, wherein the radiating element is an arm of a monopole antenna. 41: The **wireless device** of claim 26, wherein the **wireless device** is operative at least at four frequency bands. • ’103 Patent all asserted claims (12, 15, 16, 17, 19, 20): 12: A handheld multifunction **wireless device** having at least one of multimedia functionality and smartphone functionality, the handheld multifunction **wireless device** comprising: a touch screen; a processing module; a memory module; a communication module; a power management module; an antenna system within the handheld multifunction **wireless device** and comprising: a ground plane layer; a first antenna element configured to simultaneously support radiation modes for first, second, and third frequency bands, the first frequency band being contained within a first frequency region of an electromagnetic spectrum, the second frequency band being contained within a second frequency region of the electromagnetic spectrum that is higher in frequency than the first frequency region, the third frequency band of operation being used by a 4G communication standard, wherein a perimeter of the first antenna element defines a first antenna contour comprising at least thirty-five segments, the first antenna element defining an antenna box, an orthogonal projection of the antenna box along a normal to a face with a largest area of the antenna box defining an antenna rectangle, wherein a length of the first antenna contour is greater than four times a diagonal of the			

antenna rectangle; and a second antenna element configured to operate in at least one frequency band used by a 4 G communication standard, wherein a perimeter of the second antenna element defines a second antenna contour comprising at least twenty segments. 15: The handheld multifunction **wireless device** according to claim 12, wherein the ground plane layer defines a ground plane rectangle, the projection of the antenna rectangle on the ground plane rectangle partially overlapping the ground plane rectangle. 16: A handheld multifunction **wireless device** having at least one of multimedia functionality and smartphone functionality, the handheld multifunction **wireless device** comprising: a touch screen; a microprocessor; at least one memory module; and a communication module configured to operate in a first frequency band used by at least one communication standard and contained within a first frequency region of an electromagnetic spectrum, in a second frequency band used by at least one communication standard and contained within a second frequency region of the electromagnetic spectrum that is higher in frequency than the first frequency region, and in a third frequency band used by a 4G communication standard; the communication module comprising an antenna system within the handheld multifunction **wireless device** having at least a first and a second antenna elements and a ground plane layer, the first antenna element being configured to transmit and receive signals from a 4G communication standard, and the second antenna element being configured to receive signals from a 4G communication standard, wherein: the ground plane layer defines a ground plane rectangle; the first antenna element is proximate to a first short side of the ground plane rectangle; the second antenna element is proximate to a second short side of the ground plane rectangle; and a perimeter of the second antenna element defines an antenna contour having a level of complexity defined by complexity factor F_{21} having a value of at least 1.20 and complexity factor F_{32} having a value less than 1.75. 17: The handheld multifunction **wireless device** according to claim 16, wherein an antenna box is defined by the first antenna element, an antenna rectangle is defined by an orthogonal projection of the antenna box along a normal to a face with a largest area of the antenna box, and wherein a longer side of said antenna rectangle is substantially parallel to the first short side of the ground plane rectangle.			

19: The handheld multifunction **wireless device** according to claim 16, wherein the complexity factor F_{21} has a value less than 1.45. 20: The handheld multifunction **wireless device** according to claim 16, wherein the handheld multifunction **wireless device** is configured to use the first antenna element and the second antenna element as a diversity system. • ’200 Patent all asserted claims (1, 2, 3, 4, 6, 7, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20): 1: A **wireless device** comprising: an antenna system comprising a ground plane and at least two antennas within the **wireless device**, the antenna system comprising: a first antenna proximate to a first short side of a ground plane rectangle enclosing the ground plane, the first antenna being configured to support at least three frequency bands contained within first and second frequency ranges of the electromagnetic spectrum, the second frequency range being higher in frequency than the first frequency range, the first antenna being configured to transmit and receive signals from a 4G communication standard, the first antenna defining a first antenna contour comprising an entire perimeter of the first antenna, wherein the first antenna contour has a level of complexity defined by complexity factor F_{21} having a value of at least 1.20 and complexity factor F_{32} having a value of at least 1.35; and a second antenna proximate to a first long side of the ground plane rectangle, and wherein the second antenna is configured to receive signals from a 4G communication standard. 2: The **wireless device** of claim 1, wherein the second antenna defines an antenna box that is a minimum-sized parallelepiped that completely encloses a volume of the second antenna and wherein each face of the minimum-sized parallelepiped is tangent to at least one point of the volume of the second antenna, an orthogonal projection of the antenna box along a normal to a face with a largest area of the second antenna defining an antenna rectangle, an aspect ratio of the antenna rectangle being defined as a ratio between a width and a height of the antenna rectangle, and wherein the aspect ratio has a value of at least 2. 3: The **wireless device** of claim 2, wherein the second antenna defines a second antenna contour comprising an entire perimeter of the second antenna, wherein a length of the second antenna contour is greater than four times a diagonal of the antenna rectangle.			

4: The **wireless device** of claim 1, wherein the first antenna is configured to support at least four frequency bands. 6: A **wireless device** comprising: an antenna system comprising a ground plane and at least two antennas within the **wireless device**, the antenna system comprising: a first antenna configured to provide operation in at least four frequency bands being used by 4G communication standards, wherein at least two of the at least four frequency bands are contained within a first frequency range and at least two of the four frequency bands are contained within a second frequency range, the first frequency range being lower in frequency than the second frequency range, the first antenna defining a first antenna contour comprising an entire perimeter of the first antenna, and wherein the first antenna contour has a level of complexity defined by complexity factor F_{21} having a value of at least 1.20 and complexity factor F_{32} having a value of at least 1.35; and a second antenna configured to operate in at least one frequency band being used by a 4G communication standard, the second antenna defining an antenna box that is a minimum-sized parallelepiped that completely encloses a volume of the second antenna and wherein each face of the minimum-sized parallelepiped is tangent to at least one point of the volume of the second antenna, an orthogonal projection of the antenna box along a normal to a face with a largest area of the second antenna defining an antenna rectangle, an aspect ratio of the antenna rectangle being defined as a ratio between a width and a height of the antenna rectangle, and wherein the aspect ratio has a value of at least 2, and wherein at least one of the first and second antennas is close to a first short side of a ground plane rectangle enclosing the ground plane. 7: The **wireless device** of claim 6, wherein the first antenna contour comprises at least 20 segments. 9: The **wireless device** of claim 6, wherein the second antenna defines a second antenna contour comprising an entire perimeter of the second antenna, wherein a length of the second antenna contour is greater than four times a diagonal of the antenna rectangle. 10: The **wireless device** of claim 6, wherein the antenna system comprises a third antenna configured to provide operation in a wireless communication standard. 11: A **wireless device** comprising: an antenna system comprising a ground plane and at least two antennas			

within the **wireless device**, the antenna system comprising: a first antenna configured to provide operation in at least three frequency bands being used by 4G communication standards, the first antenna defining an antenna contour comprising an entire perimeter of the first antenna, the antenna contour comprising at least twenty segments, wherein the antenna contour has a level of complexity defined by complexity factor F_{21} having a value of at least 1.20 and complexity factor F_{32} having a value of at least 1.35, and wherein the first antenna defines an antenna box that is a minimum-sized parallelepiped that completely encloses a volume of the first antenna and wherein each face of the minimum-sized parallelepiped is tangent to at least one point of the volume of the first antenna, an orthogonal projection of the antenna box along a normal to a face with a largest area of the first antenna defining an antenna rectangle, an aspect ratio of the antenna rectangle being defined as a ratio between a width and a height of the antenna rectangle, wherein the aspect ratio has a value of at least 2; and a second antenna configured to provide operation in a first wireless service, the second antenna being proximate to a side of a ground plane rectangle enclosing the ground plane. 12: The **wireless device** of claim 11, wherein the first antenna is configured to support at least four frequency bands. 13: The **wireless device** of claim 11, wherein the first wireless service is a WiFi communication standard. 15: The **wireless device** of claim 11, wherein the antenna system comprises a third antenna. 16: The **wireless device** of claim 15, wherein the third antenna is configured to provide operation in the first wireless service. 17: The **wireless device** of claim 15, wherein the third antenna is configured to provide operation in a second wireless service. 18: The **wireless device** of claim 17, wherein the second wireless service provides operation in the 902-928 MHz frequency range. 19: The **wireless device** of claim 15, wherein the antenna system comprises a fourth antenna. 20: The **wireless device** of claim 19, wherein the fourth antenna is configured to provide operation in a third wireless service.			

"mobile communication device" • '887 Patent, all asserted claims (1, 2, 4, 5, 7, 14, 16, 18): 1: A **mobile communication device** comprising: communications circuitry; a circuit board comprising a ground plane and a feeding point, the feeding point being coupled to the communications circuitry; a mounting structure positioned within the **mobile communication device**, a section of the mounting structure extending over the circuit board; and a multi-band antenna secured to the mounting structure and laterally offset from an edge of the ground plane, the multi-band antenna comprising: a common conductor coupled to the feeding point; first and second radiating arms coupled to and extending from the common conductor; and a space-filling curve constituting at least a part of the first radiating arm, wherein the space-filling curve comprises at least ten segments that are shorter than a tenth of a free-space operating wavelength of the multi-band antenna, each of the segments being connected to its neighboring segments at an angle such that no pair of adjacent segments defines a longer straight segment, wherein any periodicity of the space-filling curve along a fixed straight direction of space involves a periodic structure having a period defined by a non-periodic curve comprising at least ten connected segments in which no pair of adjacent ones of the connected segments defines a longer straight segment. 2: The **mobile communication device** of claim 1, wherein the antenna feeding point is located at a position on the circuit board corresponding to a corner of the ground plane. 4: The **mobile communication device** of claim 3, wherein the second radiating arm of the multi-band antenna includes a linear section adjacent to the first radiating arm. 5: The **mobile communication device** of claim 4, wherein the first radiating arm comprises a first section extending away from the common conductor in a first direction and a second section extending in a second direction that is different from the first direction. 7: The **mobile communication device** of claim 3, wherein the multi-band antenna is configured to operate in at least three frequency bands.	No construction necessary.	"A device with the ability to transmit and receive voice, data, or video signals through the radio spectrum that does not require a physical wire to operate."	

14: A **mobile communication device** comprising: a circuit board including an antenna feeding point and a ground plane; communications circuitry coupled to the antenna feeding point of the circuit board; and a multi-band antenna mounted within the **mobile communication device** and comprising: a common conductor coupled to the feeding point; a first radiating arm coupled to the common conductor and having a section comprising a space-filling curve extending from the common conductor in a first direction and a contiguous extended substantially straight section extending from the section comprising the space-filling curve in a substantially opposite direction as the first direction; and a second radiating arm coupled to the common conductor, wherein an orthogonal projection of a footprint of the multi-band antenna on a plane of the circuit board intersects a metallization of the ground plane by less than fifty percent. 16: The **mobile communication device** of claim 15, wherein the antenna feeding point is located at a position on the circuit board corresponding to a corner of the ground plane. 18: The **mobile communication device** of claim 15, wherein the antenna is offset laterally from the ground plane. • ’365 Patent, all asserted claims (1, 2, 4, 5, 6, 7, 8, 9, 12, 13, 14, 15, 20, 22, 23, 31, 32, 33, 35, 36, 37, 41, 43, 44): 1: A **mobile communication device**, comprising: a device housing; a printed circuit board, the printed circuit board comprising: a ground plane layer; a feeding point; a communication circuitry, the communication circuitry being mounted on the printed circuit board; wherein the communication circuitry is coupled to the feeding point and to the ground plane layer; a multi-band antenna capable of operating at multiple frequency bands, the multi-band antenna including an antenna element; wherein the antenna element operates in cooperation with the ground plane layer; the antenna element comprising: a common conductor; a first radiating arm connected to the common conductor; a second radiating arm connected to the common conductor; wherein the common conductor includes a feeding port, the feeding port being coupled to the feeding point; wherein at least a portion of the first radiating arm and at least a portion of the second radiating arm are arranged on different planes; wherein the first radiating arm is at least partially shaped according to a grid-dimension curve; and wherein the printed circuit			

board, the communication circuitry, and the multi-band antenna are arranged inside the device housing. 2: The **mobile communication device** according to claim 1, wherein the first radiating arm comprises a first plurality of segments; wherein each segment of the first plurality of segments is smaller than 1/10 of a lowest operating free-space wavelength of the multi-band antenna; wherein the segments are spatially arranged such that each pair of adjacent segments forms a corner; and wherein no two adjacent and connected segments form another longer straight segment; and wherein none of said segments intersect with another segment other than to form a closed loop. 4: The **mobile communication device** according to claim 2, wherein the first plurality of segments comprises at least ten segments. 5: The **mobile communication device** according to claim 2, wherein the second radiating arm comprises a second plurality of segments; wherein each segment of the second plurality of segments is smaller than 1/10 of a lowest operating free-space wavelength of the multi-band antenna; wherein the segments are spatially arranged such that each pair of adjacent segments forms a corner; and wherein no two adjacent and connected segments form another longer straight segment; and wherein none of said segments intersect with another segment other than to form a closed loop. 6: The **mobile communication device** according to claim 5, wherein the first plurality of segments comprises more segments than the second plurality of segments. 7: The **mobile communication device** according to claim 1, wherein the grid-dimension curve has a grid dimension larger than 1.3. 8: The **mobile communication device** according to claim 1, wherein the grid-dimension curve has a grid dimension larger than 1.5. 9: The **mobile communication device** according to claim 1, wherein the second radiating arm is at least partially shaped according to a second grid-dimension curve. 12: The **mobile communication device** according to claim 1, wherein an orthogonal projection of a footprint of the antenna element on a plane of the printed circuit board overlaps the ground plane layer in less than 50% of an area of said footprint.			

13: The **mobile communication device** according to claim 1, comprising: a dielectric mounting structure having a plurality of surfaces; wherein at least a portion of the first radiating arm is arranged on a first surface of said plurality of surfaces; and wherein at least a portion of the second radiating arm is arranged on a second surface of said plurality of surfaces, the second surface being different from the first surface. 14: The **mobile communication device** according to claim 13, wherein the first surface and the second surface are opposite surfaces of the dielectric mounting structure. 15: A **mobile communication device**, comprising: a device housing; a printed circuit board, the printed circuit board comprising: a ground plane layer; a feeding point; a communication circuitry, the communication circuitry being mounted on the printed circuit board; wherein the communication circuitry is coupled to the feeding point and to the ground plane layer; a multi-band antenna capable of operating at multiple frequency bands, the multi-band antenna including an antenna element; wherein the antenna element is coupled to the feeding point and operates in cooperation with the ground plane layer; the antenna element comprising: a first conductor, the first conductor comprising a first radiating arm having a grid-dimension section shaped according to a grid-dimension curve; a second conductor arranged at a predetermined distance from the first conductor and electromagnetically coupled to the first conductor, the second conductor comprising a planar section; and wherein the printed circuit board, the communication circuitry, and the multi-band antenna are arranged inside the device housing. 20: The **mobile communication device** according to claim 15, wherein the grid-dimension curve comprises at least ten connected segments; wherein said segments are each smaller than 1/10 of a lowest operating free-space wavelength of the multi-band antenna; wherein the segments are spatially arranged such that no two adjacent and connected segments form another longer straight segment; wherein none of said segments intersect with another segment other than to form a closed loop; wherein each pair of adjacent segments forms a corner; and wherein any portion of the grid-dimension curve that is periodic along a fixed straight direction of space is defined by a non-periodic curve that includes at least ten connected segments in which no two adjacent and connected segments define a straight longer segment.			

22: The **mobile communication device** according to claim 21, wherein the grid-dimension section is arranged on the first surface; and wherein the planar section is arranged on the second surface. 23: The **mobile communication device** according to claim 21, wherein the first surface and the second surface are two opposite surfaces of the dielectric mounting structure. 31: A **mobile communication device**, comprising: a device housing; a printed circuit board, the printed circuit board comprising: a ground plane layer; a feeding point; a communication circuitry, the communication circuitry being mounted on the printed circuit board; wherein the communication circuitry is coupled to the feeding point and to the ground plane layer; a multi-band antenna capable of operating at multiple frequency bands, the multi-band antenna including: a dielectric mounting structure having a plurality of surfaces; an antenna element, the antenna element being coupled to the feeding point and operating in cooperation with the ground plane layer; wherein the antenna element comprises a first radiating arm arranged on two or more surfaces of the plurality of surfaces of the dielectric mounting structure; the first radiating arm comprising: a first section shaped according to a grid-dimension curve; a second section connected to the grid-dimension section, the second section having a width different from a width of the first section; and wherein the printed circuit board, the communication circuitry, and the multi-band antenna are arranged inside the device housing. 32: The **mobile communication device** according to claim 31, wherein the first section is arranged on a first surface of said plurality of surfaces; and wherein the second section is arranged on a second surface of said plurality of surfaces, the second surface being different from the first surface. 33: The **mobile communication device** according to claim 32, wherein the first surface and the second surface are opposite surfaces of the dielectric mounting structure. 35: The **mobile communication device** according to claim 31, wherein the first section extends along a first direction and the second section extends along a second direction, the second direction being different from the first direction.			

36: The **mobile communication device** according to claim 35, wherein the second direction is substantially opposite to the first direction. 37: The **mobile communication device** according to claim 31, wherein the antenna element further comprises: a common conductor; a second radiating arm; wherein each of the first radiating arm and the second radiating arm is connected to the common conductor; and wherein the second radiating arm is arranged on at least one surface of the plurality of surfaces of the dielectric mounting structure. 41: The **mobile communication device** according to claim 31, wherein an orthogonal projection of a footprint of the antenna element on a plane of the printed circuit board overlaps the ground plane layer in less than 50% of an area of said footprint. 43: The **mobile communication device** according to claim 37, wherein the second radiating arm is shaped according to a second grid-dimension curve. 44: The **mobile communication device** according to claim 37, wherein the first section of the first radiating arm is connected to the common conductor and extends away from the common conductor along a first direction; wherein the second section of the first radiating arm is connected to the first section and extends along a second direction; and wherein the second radiating arm extends away from the common conductor along a direction substantially opposite to the second direction.			
"wireless portable device" • '604 Patent, all asserted claims (1, 3, 4, 9, 13): 1: A **wireless portable device** comprising: a printed circuit board comprising a ground plane structure; an antenna system operating in multiple frequency bands, the antenna system comprising: a first radiating arm comprising a first-radiating-arm first tip, a first-radiating-arm second tip, and a feeding terminal connected to the first-radiating-arm first tip, wherein the first radiating arm is not connected to the ground plane structure through a grounding terminal; and a second radiating arm comprising a second-radiating arm first tip, a second-radiating-arm second tip, and a grounding terminal connected to the second-radiating-arm first tip, wherein the second radiating arm does not include a contact point	No construction necessary.	"A device with the ability to transmit and receive voice, data, or video signals through the radio spectrum that does not require a physical wire to operate." Alternatively: The plain and ordinary meaning,	

with first radiating arm, wherein: the first radiating arm and the second radiating arm are coupled through a close proximity region from a first specific portion of the first radiating arm and from a second specific portion of the second radiating arm; a length of a line segment between a point of the first specific portion and a point of the second specific portion is shorter than a distance between the feeding terminal and the grounding terminal; an orthogonal projection of the line segment onto a plane of the ground plane structure does not intersect the ground plane structure; and the first radiating arm, the second radiating arm and the close proximity region are configured to simultaneously provide the bandwidth required for the antenna system to operate in the multiple frequency bands. 3: The **wireless portable device** of claim 1, wherein the close proximity region is located at a distance from the feeding terminal that is longer than 40 of the longest free-space operating wavelength of the antenna system. 4: The **wireless portable device** of claim 1, wherein the first specific portion of the first radiating arm includes the first radiating-arm second tip. 9: The **wireless portable device** of claim 1, wherein the first radiating arm comprises a portion formed by ten or more connected segments, each of the connected segments forming an angle with its neighboring connected segment, the angle being Smaller than 180 degrees, and the segments being shorter than /8 of the longest free-space operating wavelength of the antenna system. 13: A **wireless portable device** comprising: a printed circuit board comprising a ground plane structure; an antenna system operating in multiple frequency bands and included within the **wireless portable device**, the antenna system comprising: a first radiating arm comprising a first-radiating-arm first tip, a first-radiating-arm second tip, a feeding terminal connected to the first-radiating-arm first tip, and a first-radiating-arm first point; and a second radiating arm comprising a second-radiating arm first tip, a second-radiating-arm second tip, and a grounding terminal connected to the second-radiating-arm first tip, wherein: the second radiating arm does not include a contact point with the first radiating arm; the first radiating arm and the second radiating arm are coupled through a close proximity region formed by a portion including the first-radiating-arm first point and the second-radiating-arm second tip; a length of a line segment between the first-radiating arm first point and the second-radiating-arm second tip is shorter than a distance between a point of the		which is "a device that does not require a physical wire to operate while being easily carried or moved from one location to another."	

feeding terminal and a point of the grounding terminal; an orthogonal projection of the line segment onto a plane of the ground plane structure does not intersect the ground plane structure; and the first radiating arm, the second radiating arm and the close proximity region are configured to simultaneously provide a bandwidth required for the antenna system to operate in the multiple frequency bands.			
"common conductor" • '887 Patent, claims 1, 14: 1: A mobile communication device comprising: communications circuitry; a circuit board comprising a ground plane and a feeding point, the feeding point being coupled to the communications circuitry; a mounting structure positioned within the mobile communication device, a section of the mounting structure extending over the circuit board; and a multi-band antenna secured to the mounting structure and laterally offset from an edge of the ground plane, the multi-band antenna comprising: a **common conductor** coupled to the feeding point; first and second radiating arms coupled to and extending from the **common conductor**; and a space-filling curve constituting at least a part of the first radiating arm, wherein the space-filling curve comprises at least ten segments that are shorter than a tenth of a free-space operating wavelength of the multi-band antenna, each of the segments being connected to its neighboring segments at an angle such that no pair of adjacent segments defines a longer straight segment, wherein any periodicity of the space-filling curve along a fixed straight direction of space involves a periodic structure having a period defined by a non-periodic curve comprising at least ten connected segments in which no pair of adjacent ones of the connected segments defines a longer straight segment. 14: A mobile communication device comprising: a circuit board including an antenna feeding point and a ground plane; communications circuitry coupled to the antenna feeding point of the circuit board; and a multi-band antenna mounted within the mobile communication device and comprising: a **common conductor** coupled to the feeding point; a first radiating arm coupled to the **common conductor** and having a section comprising a space-filling curve extending from the **common conductor** in a first direction and a contiguous extended	No construction necessary. Alternatively: "The part of a conducting radiating structure coupled to the feeding point that carries current to multiple portions (or arms or branches) of the radiator."[2]	"A contiguous conductive element having at least a first and second radiating arm each originating from discrete points along the perimeter of the contiguous conductive element."	

[2] ADT notes that Fractus offered this construction of "common conductor" for the first time in its Opening Claim Construction Brief on November 16, 2023. Fractus did not previously include it in its required claim construction disclosures.

substantially straight section extending from the section comprising the space-filling curve in a substantially opposite direction as the first direction; and a second radiating arm coupled to the **common conductor**, wherein an orthogonal projection of a footprint of the multi-band antenna on a plane of the circuit board intersects a metallization of the ground plane by less than fifty percent. • ’365 Patent, claims 1, 37: 1: A mobile communication device, comprising: a device housing; a printed circuit board, the printed circuit board comprising: a ground plane layer; a feeding point; a communication circuitry, the communication circuitry being mounted on the printed circuit board; wherein the communication circuitry is coupled to the feeding point and to the ground plane layer; a multi-band antenna capable of operating at multiple frequency bands, the multi-band antenna including an antenna element; wherein the antenna element operates in cooperation with the ground plane layer; the antenna element comprising: a **common conductor**; a first radiating arm connected to the **common conductor**; a second radiating arm connected to the **common conductor**; wherein the **common conductor** includes a feeding port, the feeding port being coupled to the feeding point; wherein at least a portion of the first radiating arm and at least a portion of the second radiating arm are arranged on different planes; wherein the first radiating arm is at least partially shaped according to a grid-dimension curve; and wherein the printed circuit board, the communication circuitry, and the multi-band antenna are arranged inside the device housing. 37: The mobile communication device according to claim 31, wherein the antenna element further comprises: a **common conductor**; a second radiating arm; wherein each of the first radiating arm and the second radiating arm is connected to the **common conductor**; and wherein the second radiating arm is arranged on at least one surface of the plurality of surfaces of the dielectric mounting structure.			
“grid-dimension curve”[3] • ’365 Patent, claims 1, 2, 4, 5, 6, 7, 8, 9, 12, 13, 14, 15, 20, 22, 23, 31, 32, 33, 35, 36, 37, 41, 43, 44	**[AGREED]**	**[AGREED]**	“A curve which is not self-similar, which possesses a geometry having a grid dimension that is greater than one (1), and, if the curve has

[3] Claim language for agreed-upon terms has been omitted.

			any periodicity, the period is defined by a non-periodic curve that includes at least ten connected segments in which no two adjacent and connected segments define a longer straight segment."
"space-filling curve"[4] • '887 Patent, claims 1, 2, 4, 5, 7, 14, 16, 18	**[AGREED]**	**[AGREED]**	"A curve characterized by at least ten segments that are shorter than a tenth of a free-space operating wavelength of the multi-band antenna, each of the segments being connected to its neighboring segments at an angle such that no pair of adjacent segments defines a longer straight segment, wherein any periodicity of the space-filling curve along a fixed straight direction of space involves a periodic structure having a period defined by a non-periodic curve comprising at least ten connected segments in which no pair of adjacent ones of the connected segments defines a longer straight segment."

[4] Claim language for agreed-upon terms has been omitted.