U.S. Patent No. 12,095,149 Claim Limitation Comparison Chart

I. Claims 13 and 7

REF	Limitation	REF	Limitation
13.PRE	A wireless device comprising:	7.PRE	A wireless device comprising:
13.a	a ground plane;	7.a	a ground plane;
13.b	a first antenna proximate to a first side of a ground plane rectangle enclosing the ground plane,	7.b	a first non-planar antenna proximate to a first side of a ground plane rectangle enclosing the ground plane,
13.c	the first antenna being configured to support at least three frequency bands of the electromagnetic spectrum,	7.c	the first non-planar antenna being configured to support at least three frequency bands of the electromagnetic spectrum,
13.d	a minimum-sized parallelepiped completely enclosing a volume of the first antenna, the minimum-sized parallelepiped having a face with a largest area;	7.d	a minimum-sized parallelepiped completely enclosing a volume of the first non-planar antenna, the minimum-sized parallelepiped having a face with a largest area;
13.e	a second antenna proximate to a second side of the ground plane rectangle configured to receive signals from at least two frequency bands of the at least three frequency bands,	7.e	a second antenna proximate to a second side of the ground plane rectangle, and wherein the second antenna is configured to receive signals from at least two frequency bands of the at least three frequency bands;

REF	Limitation	REF	Limitation
13.f	wherein the first antenna has a first contour defined as a perimeter of any portions of the first antenna arranged in the face, perimeters of any closed apertures of any portions of the first antenna arranged in the face, a perimeter of an orthogonal projection onto the face of any portions of the first antenna that are not arranged in the face, and perimeters of any closed apertures of the orthogonal projection;	7.f	wherein the first non-planar antenna has a first contour defined as a perimeter of any portions of the first non-planar antenna arranged in the face, perimeters of any closed apertures of any portions of the first non-planar antenna arranged in the face, a perimeter of an orthogonal projection onto the face of any portions of the first non-planar antenna that are not arranged in the face, and perimeters of any closed apertures of the orthogonal projection;
13.g	wherein the first 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	7.g	wherein the first 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
13.h	wherein the complexity factors F_{21} and F_{32} are given by: $F_{21} = -\frac{log(N_2) - log(N_1)}{log(1/2)}$ $F_{32} = -\frac{log(N_3) - log(N_2)}{log(1/2)}$	7.h	wherein the complexity factors F_{21} and F_{32} are given by: $F_{21} = -\frac{log(N_2) - log(N_1)}{log(1/2)}$ $F_{32} = -\frac{log(N_3) - log(N_2)}{log(1/2)}$

REF	Limitation	REF	Limitation
13.h.1	where N_1 is a number of cells of a grid G_1 that include at least a point of the first contour, N_2 is a number of cells of a grid G_2 that include at least a point of the first contour, and N_3 is a number of cells of a grid G_3 that include at least a point of the first contour,	7.h.1	where N_1 is a number of cells of a grid G_1 that include at least a point of the first contour, N_2 is a number of cells of a grid G_2 that include at least a point of the first contour, and N_3 is a number of cells of a grid G_3 that include at least a point of the first contour,
13.h.2	the grid G_2 divides the face into nine columns of equal width arranged along a long side of the face and an odd number of rows of equal height arranged along a short side of the [sic], wherein the number of rows results in the cells of grid G_2 being as square as possible,	7.h.2	the grid G_2 divides the face into nine columns of equal width arranged along a long side of the face and an odd number of rows of equal height arranged along a short side of the face, wherein the number of rows results in the cells of grid G_2 being as square as possible,
13.h.3	the grid G_1 being aligned with a corner of the grid G_2 to cover the face, the cells of grid G_1 having widths and heights that respectively are double the widths and heights of the cells of the grid G_2, and	7.h.3	the grid G_1 being aligned with a corner of the grid G_2 to cover the face, the cells of grid G_1 having widths and heights that respectively are double the widths and heights of the cells of the grid G_2, and
13.h.4	the grid G_3 being aligned with the grid G_2, the cells of the grid G_3 having widths and heights that respectively are half the widths and heights of the cells of the grid G_2, and	7.h.4	the grid G_3 being aligned with the grid G_2, the cells of the grid G_3 having widths and heights that respectively are half the widths and heights of the cells of the grid G_2, and

REF	Limitation	REF	Limitation
13.i	wherein the level of complexity of the first contour is configured to provide operation of the wireless device in the at least three frequency bands.	7.i	wherein the level of complexity of the first contour is configured to provide operation of the wireless device in the at least three frequency bands.

II. Claims 14, 16-17, 19

Ref	Limitation	Ref	Corresponding limitation
14	The wireless device of claim 13, wherein the first antenna includes at least two antenna elements that are electromagnetically coupled.	8	The wireless device of claim 7, wherein the first non-planar antenna includes at least two antenna elements that are electromagnetically coupled.
16	The wireless device of claim 13, wherein a projection of the antenna rectangle on the ground plane rectangle partially overlaps the ground plane rectangle.	11	The wireless device of claim 7, wherein a projection of the antenna rectangle on the ground plane rectangle partially overlaps the ground plane rectangle.
17	The wireless device of claim 13, wherein the complexity factor F_{32} for the first contour is smaller than 1.75.	9	The wireless device of claim 7, wherein the complexity factor F_{32} for the first contour is smaller than 1.75.
19	The wireless device of claim 13, wherein the first side of the ground plane rectangle is a short side of the ground plane rectangle.	12	The wireless device of claim 7, wherein the first side of the ground plane rectangle is a short side of the ground plane rectangle.

III. Claims 10, 18

Ref	Limitation	Ref	Corresponding limitation
10	The wireless device of claim 7, wherein a third antenna is configured to operate in at least two frequency bands being different from the at least three frequency bands and the third antenna is arranged within the wireless device.	18	The wireless device of claim 13, wherein a third antenna is configured to operate in at least two frequency bands being different from the at least three frequency bands and the third antenna is arranged within the wireless device.

IV. Claims 13 and 1

REF	Limitation	REF	Limitation
13.PRE	A wireless device comprising:	1.PRE	A wireless device comprising:
13.a	a ground plane;	1.a	a ground plane;
13.b	a first antenna proximate to a first side of a ground plane rectangle enclosing the ground plane,	1.b	a first planar antenna proximate to a first side of a ground plane rectangle enclosing the ground plane,
13.c	the first antenna being configured to support at least three frequency bands of the electromagnetic spectrum,	1.c	the first planar antenna being configured to support at least three frequency bands of the electromagnetic spectrum,
13.d	a minimum-sized parallelepiped completely enclosing a volume of the first antenna, the minimum-sized parallelepiped having a face with a largest area;		
13.e	a second antenna proximate to a second side of the ground plane rectangle configured to receive signals from at least two frequency bands of the at least three frequency bands,	1.f	a second antenna proximate to a second side of the ground plane rectangle, wherein the second antenna is configured to receive signals from at least two frequency bands of the at least three frequency bands;

REF	Limitation	REF	Limitation
13.f	wherein the first antenna has a first contour defined as a perimeter of any portions of the first antenna arranged in the face, perimeters of any closed apertures of any portions of the first antenna arranged in the face, a perimeter of an orthogonal projection onto the face of any portions of the first antenna that are not arranged in the face, and perimeters of any closed apertures of the orthogonal projection;		
13.g	wherein the first 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	1.e	wherein the first 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
13.h	wherein the complexity factors F_{21} and F_{32} are given by: $F_{21} = -\frac{log(N_2) - log(N_1)}{log(1/2)}$ $F_{32} = -\frac{log(N_3) - log(N_2)}{log(1/2)}$	1.h	wherein the complexity factors F_{21} and F_{32} are given by: $F_{21} = -\frac{log(N_2) - log(N_1)}{log(1/2)}$ $F_{32} = -\frac{log(N_3) - log(N_2)}{log(1/2)}$

REF	Limitation	REF	Limitation
13.h.1	where N_1 is a number of cells of a grid G_1 that include at least a point of the first contour, N_2 is a number of cells of a grid G_2 that include at least a point of the first contour, and N_3 is a number of cells of a grid G_3 that include at least a point of the first contour,	1.h.1	where N_1 is a number of cells of a grid G_1 that include at least a point of the first contour, N_2 is a number of cells of a grid G_2 that include at least a point of the first contour, and N_3 is a number of cells of a grid G_3 that include at least a point of the first contour,
13.h.2	the grid G_2 divides the face into nine columns of equal width arranged along a long side of the face and an odd number of rows of equal height arranged along a short side of the [sic], wherein the number of rows results in the cells of grid G_2 being as square as possible,	1.h.2	the grid G_2 divides a minimum-sized rectangle enclosing the first planar antenna into nine columns of equal width arranged along a long side of the minimum-sized rectangle and into an odd number of rows of equal height arranged along a short side of the minimum-sized rectangle, wherein the number of rows results in the cells of grid G_2 being as square as possible,
13.h.3	the grid G_1 being aligned with a corner of the grid G_2 to cover the face, the cells of grid G_1 having widths and heights that respectively are double the widths and heights of the cells of the grid G_2, and	1.h.3	the grid G_1 being aligned with a corner of the grid G_2 to cover the minimum-sized rectangle, the cells of the grid G_1 having widths and heights that respectively are double the widths and heights of the cells of the grid G_2, and

REF	Limitation	REF	Limitation
13.h.4	the grid G_3 being aligned with the grid G_2, the cells of the grid G_3 having widths and heights that respectively are half the widths and heights of the cells of the grid G_2, and	1.h.4	the grid G_3 being aligned with the grid G_2, the cells of the grid G_3 having widths and heights that respectively are half the widths and heights of the cells of the grid G_2, and
13.i	wherein the level of complexity of the first contour is configured to provide operation of the wireless device in the at least three frequency bands.	1.i	wherein the level of complexity of the first contour is configured to provide operation of the wireless device in the at least three frequency bands.

V. Claims 14, 17, 19

Ref	Limitation	Ref	Corresponding limitation
14	The wireless device of claim 13, wherein the first antenna includes at least two antenna elements that are electromagnetically coupled.	2	The wireless device of claim 1, wherein the first planar antenna includes at least two antenna elements that are electromagnetically coupled.
17	The wireless device of claim 13, wherein the complexity factor F_{32} for the first contour is smaller than 1.75.	5	The wireless device of claim 1, wherein the complexity factor F32 for the first contour is smaller than 1.75.
19	The wireless device of claim 13, wherein the first side of the ground plane rectangle is a short side of the ground plane rectangle.	3	The wireless device of claim 1, wherein the first side of the ground plane rectangle is a short side of the ground plane rectangle.

VI. Claims 14, 16-19

Ref	Limitation	Ref	Corresponding limitation
14	The wireless device of claim 13, wherein the first antenna includes at least two antenna elements that are electromagnetically coupled.	8	The wireless device of claim 7, wherein the first non-planar antenna includes at least two antenna elements that are electromagnetically coupled.
16	The wireless device of claim 13, wherein a projection of the antenna rectangle on the ground plane rectangle partially overlaps the ground plane rectangle.	11	The wireless device of claim 7, wherein a projection of the antenna rectangle on the ground plane rectangle partially overlaps the ground plane rectangle.
17	The wireless device of claim 13, wherein the complexity factor F_{32} for the first contour is smaller than 1.75.	9	The wireless device of claim 1, wherein the complexity factor F32 for the first contour is smaller than 1.75.
18	The wireless device of claim 13, wherein a third antenna is configured to operate in at least two frequency bands being different from the at least three frequency bands and the third antenna is arranged within the wireless device.	10	The wireless device of claim 7, wherein a third antenna is configured to operate in at least two frequency bands being different from the at least three frequency bands and the third antenna is arranged within the wireless device.
19	The wireless device of claim 13, wherein the first side of the ground plane rectangle is a short side of the ground plane rectangle.	12	The wireless device of claim 1, wherein the first side of the ground plane rectangle is a short side of the ground plane rectangle.