

Geotab GO9+ (AT&T)

Infringement where the main antenna is considered the first antenna

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Geotab Exhibit 1051
Geotab v. Fractus

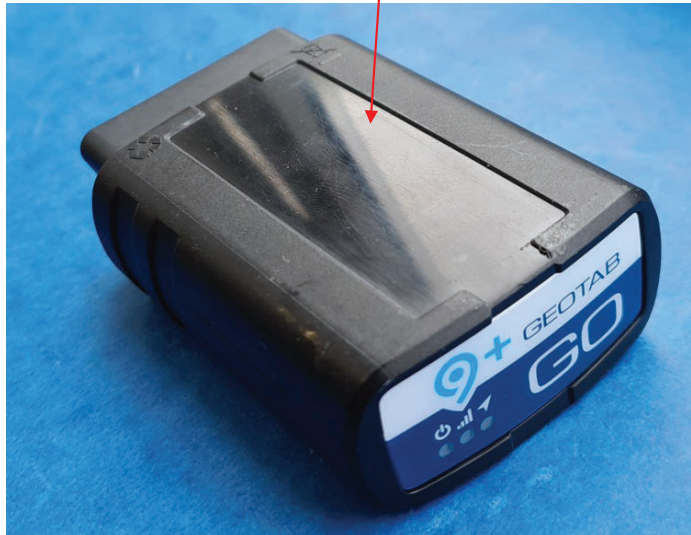
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Claim 11

[11-preamble] A wireless device comprising:

[11-preamble] Wireless device



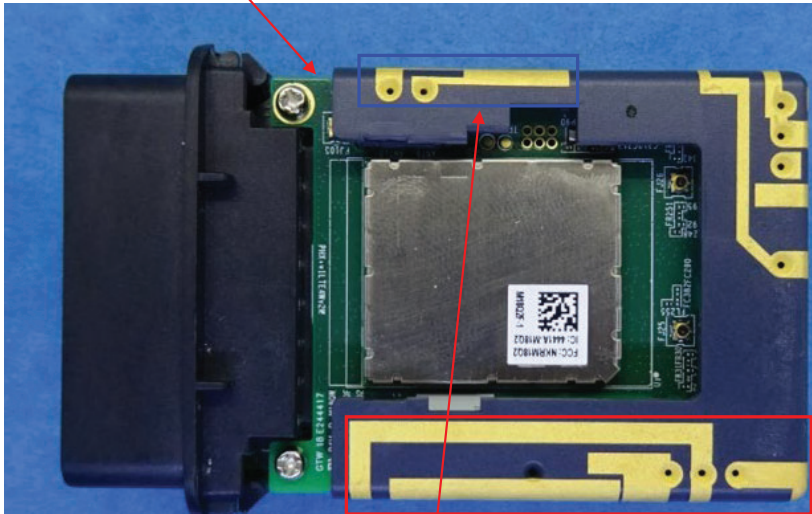
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Claim 11

[11a] an antenna system comprising [11b] a ground plane and [11c] at least two antennas within the wireless device, the antenna system comprising:

[11a] Antenna system



The antenna system comprises a ground plane and [11c] at least two antennas (indicated in red and blue) within the wireless device

[11b] Ground plane (indicated in green)



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Claim 11

[11d] a first antenna configured to provide operation in at least three frequency bands being used by 4G communication standards,

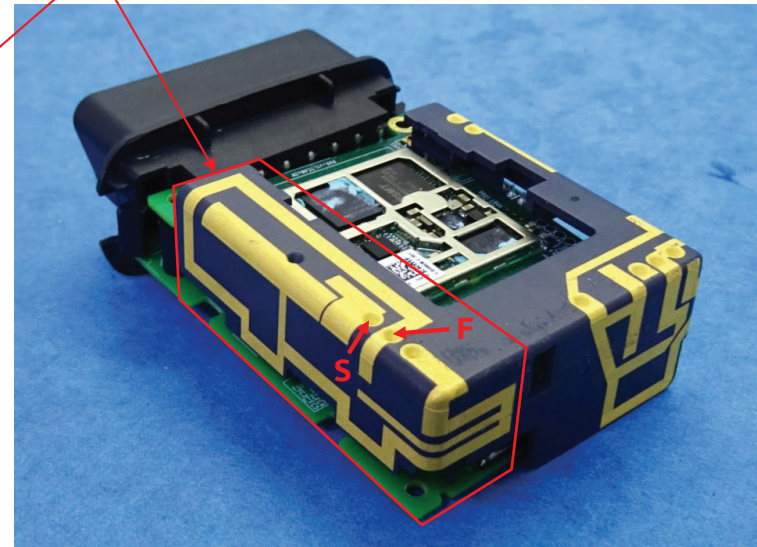
[11d] The antenna system comprises a first antenna (indicated in red) configured to provide operation in at least LTE 700(B12)/1700-2100(B4)/1900(B2)

Regulatory Band:

❖ Cellular:

- LTE Band 2 : 1850 ~ 1910 MHz
- LTE Band 4 : 1710 ~ 1755 MHz
- LTE Band 5 : 824.0 ~ 849 MHz
- LTE Band 12 : 699 ~ 716 MHz

Source: FCC RF Exposure evaluation report



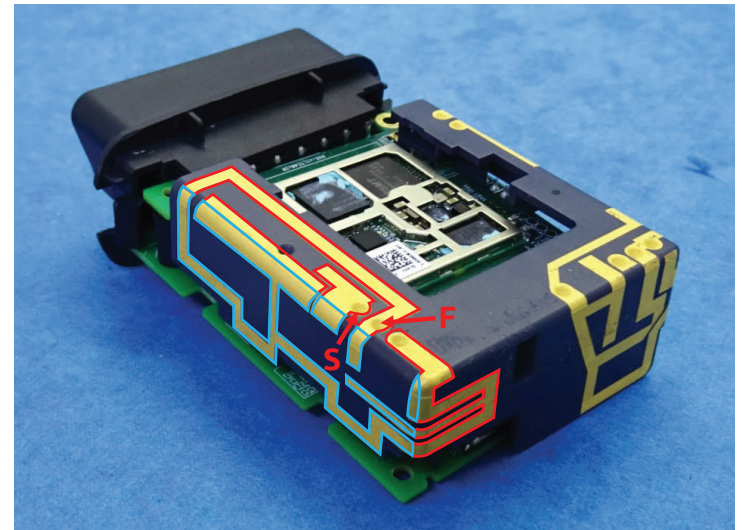
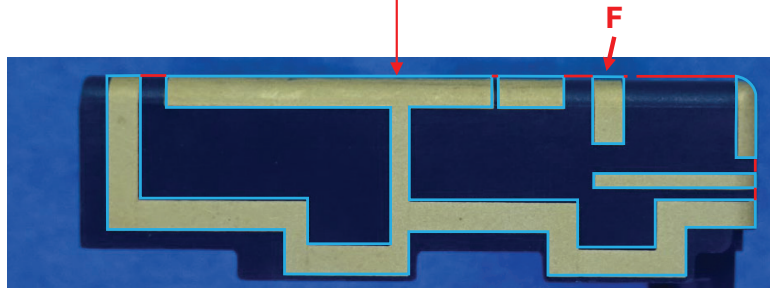
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Claim 11

[11e] the first antenna defining an antenna contour comprising an entire perimeter of the first antenna,

[11e] The first antenna defines an antenna contour (indicated in blue and red) comprising an entire perimeter of the first antenna



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Claim 11

[11f] the antenna contour comprising at least twenty segments,

[11f] The antenna contour comprises at least 20 segments



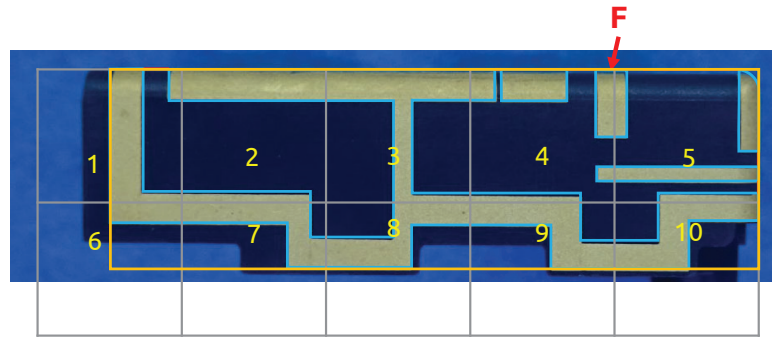
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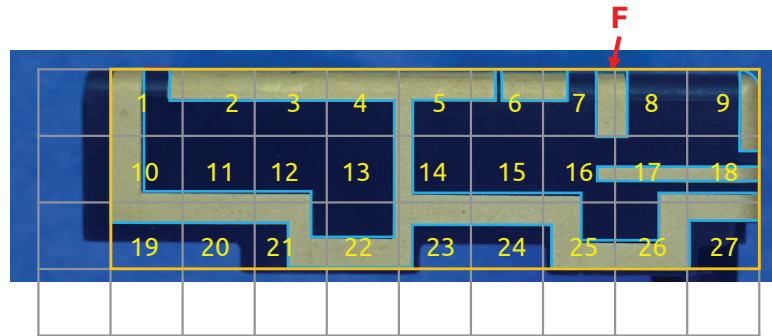
Claim 11

[11g] wherein the antenna contour has a level of complexity defined by complexity factor F_{21} having a value of at least 1.20 and

[11g] The antenna contour has a level of complexity defined by complexity factor F_{21} having a value of at least 1.20



$N_1 = 10$ cells



$N_2 = 27$ cells

$$F_{21} = -\frac{\log(N_2) - \log(N_1)}{\log(1/2)} = -\frac{\log(27) - \log(10)}{\log(1/2)} = 1.43 \geq 1.20$$

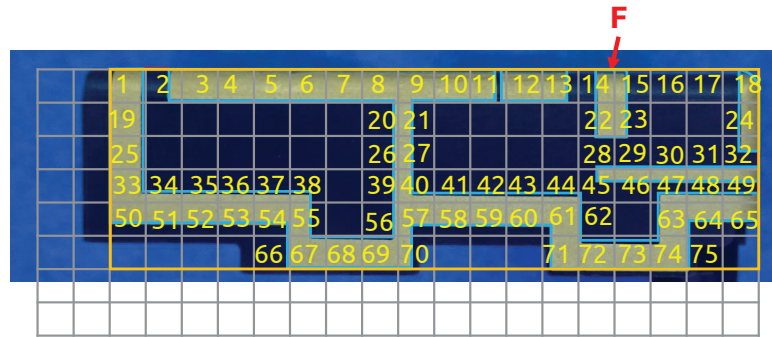
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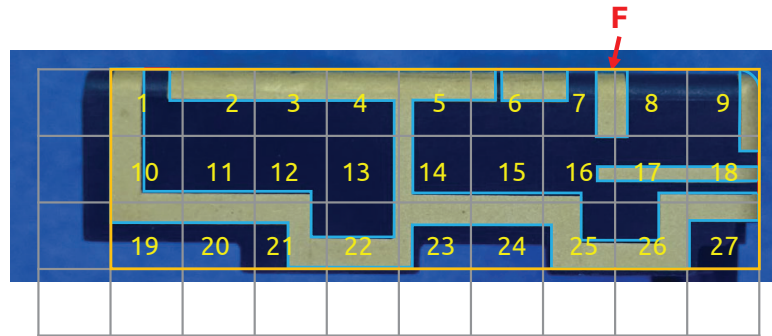
Claim 11

[11h] complexity factor F_{32} having a value of at least 1.35, and

[11h] The antenna contour has a level of complexity defined by complexity factor F_{32} having a value of at least 1.35



$N_3 = 75$ cells



$N_2 = 27$ cells

$$F_{32} = -\frac{\log(N_3) - \log(N_2)}{\log(1/2)} = -\frac{\log(75) - \log(27)}{\log(1/2)} = 1.47 \geq 1.35$$

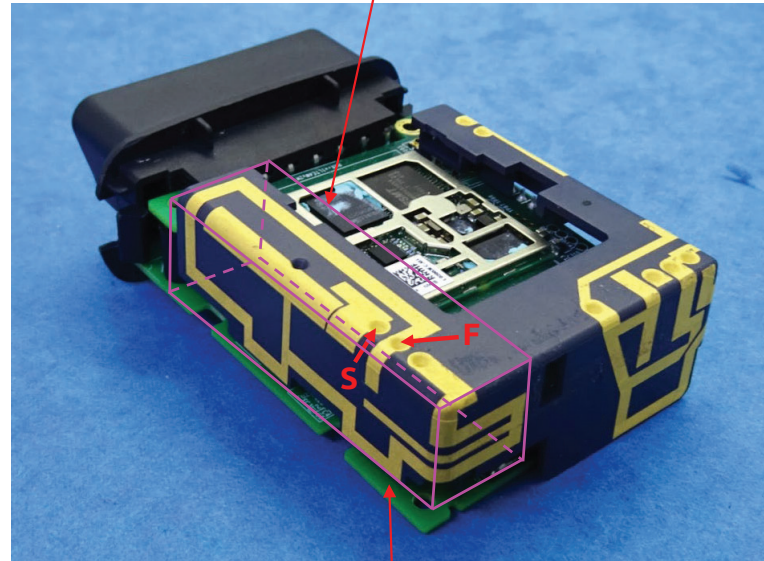
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Claim 11

[11i] wherein the first antenna defines an antenna box that is a minimum-sized parallelepiped that completely encloses a volume of the first antenna and
[11j] wherein each face of the minimum-sized parallelepiped is tangent to at least one point of the volume of the first antenna,

[11i] The first antenna defines an antenna box (outlined in pink) that is a minimum-sized parallelepiped that completely encloses a volume of the first antenna



[11j] Each face of the minimum-sized parallelepiped is tangent to at least one point of the volume of the first antenna

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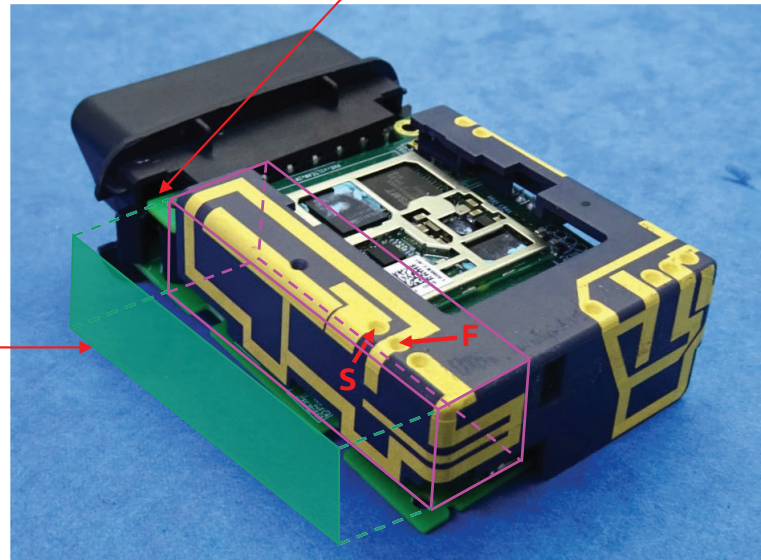
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Claim 11

[11k] an orthogonal projection of the antenna box along a normal to a face with a largest area of the first antenna defining [11l] an antenna rectangle,

[11k] Orthogonal projection of the antenna box along a normal to a face* with a largest area of the first antenna

[11l] Antenna rectangle (filled in green)



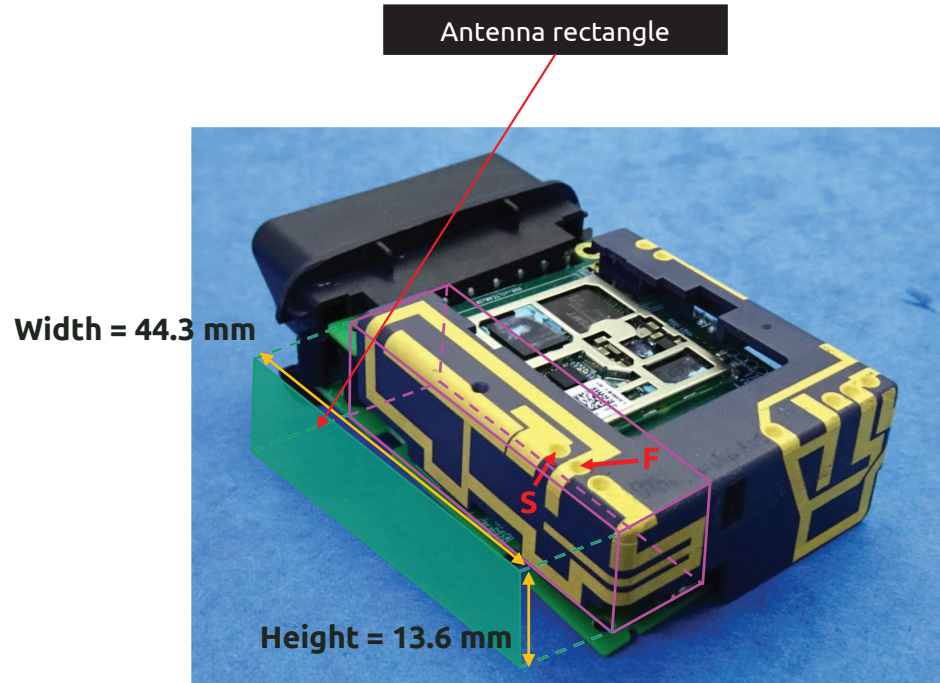
*Normal to a face means perpendicular to the face

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Claim 11

[11m] 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



[11m] Aspect ratio of the antenna rectangle = $44.3/13.6 = 3.2 \geq 2$

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Claim 11

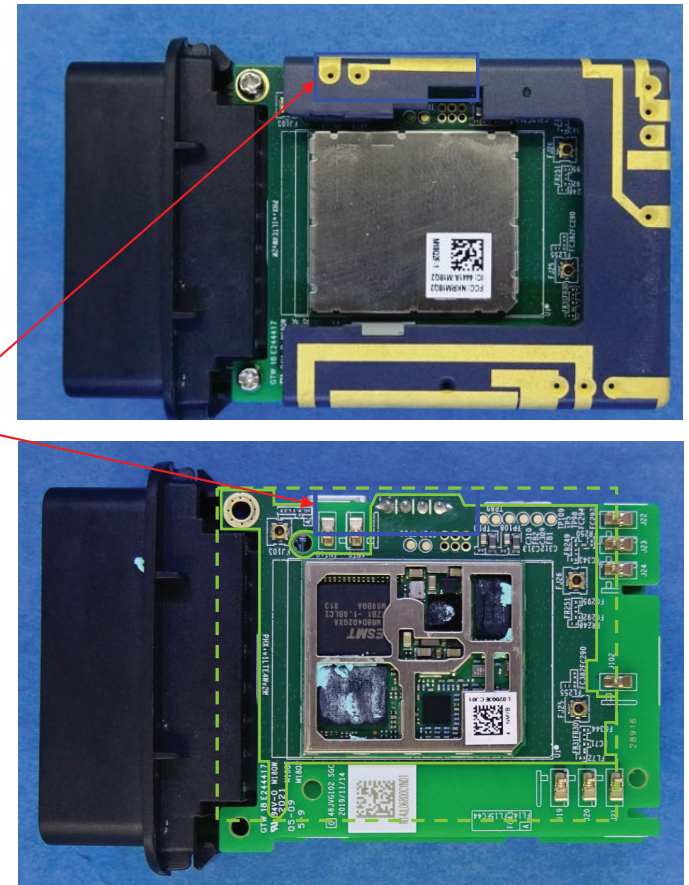
[11n] a second antenna configured to provide operation in a first wireless service, [11o] the second antenna being proximate to a side of a ground plane rectangle enclosing the ground plane.

[11n] The antenna system comprises a second antenna (indicated in blue) configured to provide operation in at least a first wireless service: WiFi 2.4 GHz, and [11o] is proximate to a side of a ground plane rectangle (indicated with a dashed green line) enclosing the ground plane

Regulatory Band:

- ❖ WLAN (Wi-Fi):
 - 802.11b.g.n : Center to center: 2412 MHz (ch 1) – 2462 MHz (ch 11), 11 channels.

Source: FCC RF Exposure evaluation report



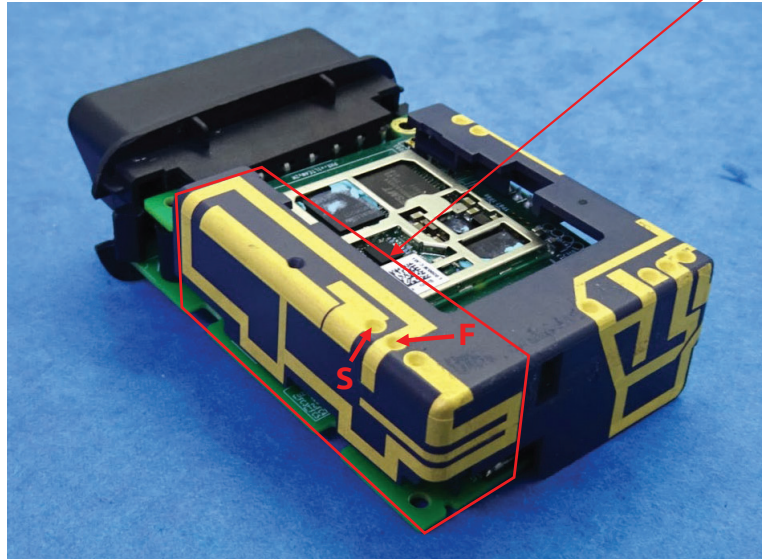
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Claim 12

[12a] The wireless device of claim 11, wherein the first antenna is configured to support at least four frequency bands.

[12a] The first antenna (indicated in red) is configured to support at least LTE 700(B12)/850(B5)/1700-2100(B4)/1900(B2)



Regulatory Band:

❖ Cellular:

- LTE Band 2 : 1850 ~ 1910 MHz
- LTE Band 4 : 1710 ~ 1755 MHz
- LTE Band 5 : 824.0 ~ 849 MHz
- LTE Band 12 : 699 ~ 716 MHz

Source: FCC RF Exposure evaluation report

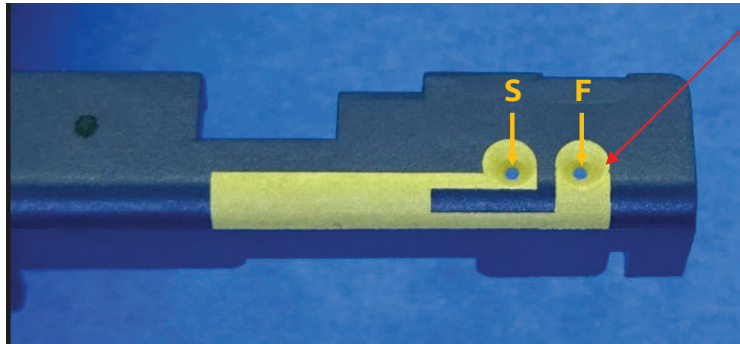
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Claim 13

[13a] The wireless device of claim 11, wherein the first wireless service is a WiFi communication standard.

[13a] The first wireless service is a WiFi communication standard



Regulatory Band:

- ❖ **WLAN (Wi-Fi):**
 - [802.11b.g.n](#) : Center to center: 2412 MHz (ch 1) – 2462 MHz (ch 11), 11 channels.

Source: FCC RF Exposure evaluation report

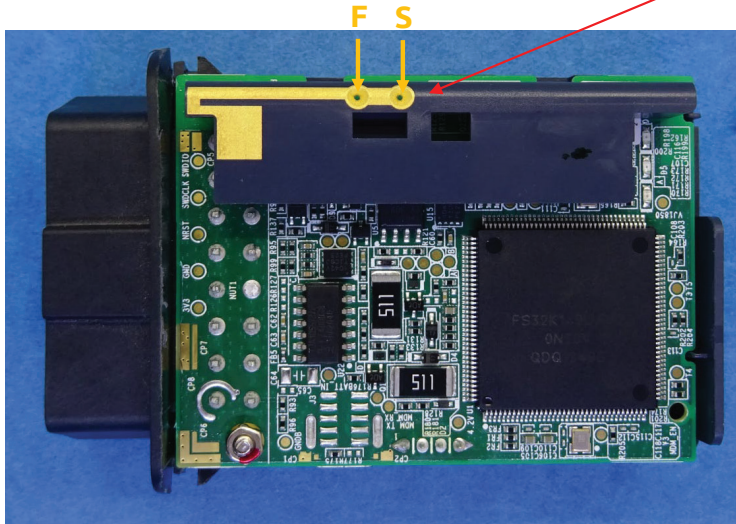
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Claim 15

[15a] The wireless device of claim 11, wherein the antenna system comprises a third antenna.

[15a] The antenna system comprises a third antenna, GPS antenna



GPS Receiver

72-channel engine (GPS/GLONASS/Beidou/Galileo/SBAS/WAAS/EGNOS/MSAS/GAGAN)

Source: User manual

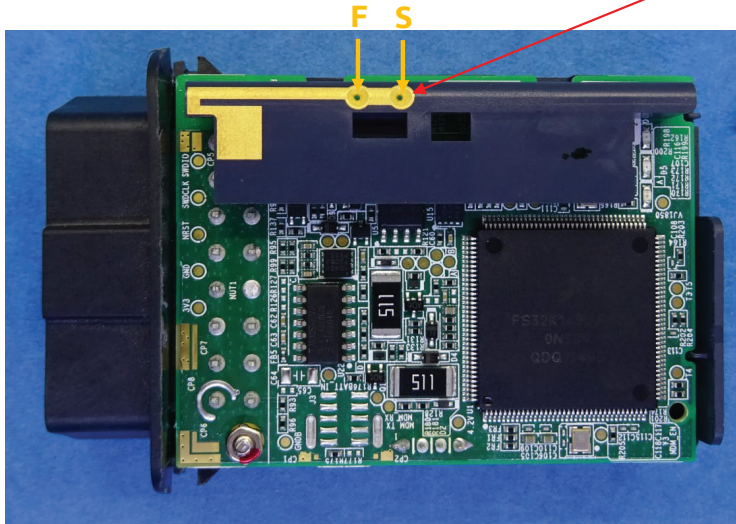
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Claim 17

[17a] The wireless device of claim 15, wherein the third antenna is configured to provide operation in a second wireless service.

[17a] The third antenna is configured to provide operation in a second wireless service, GPS



GPS Receiver

72-channel engine (GPS/GLONASS/Beidou/Galileo/SBAS/WAAS/EGNOS/MSAS/GAGAN)

Source: User manual

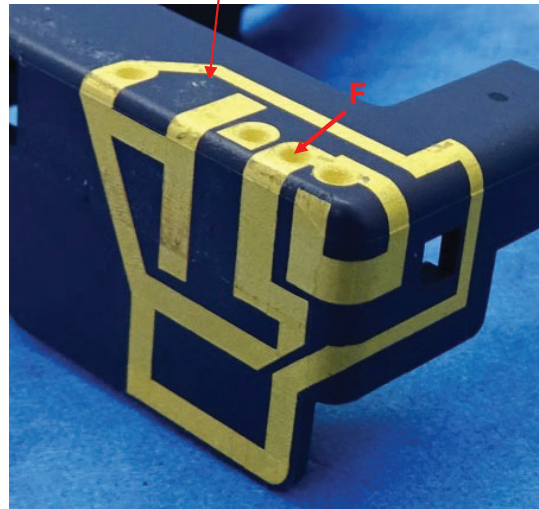
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Claim 19

[19a] The wireless device of claim 15, wherein the antenna system comprises a fourth antenna.

[19a] The antenna system comprises a fourth antenna, diversity antenna



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