Phillips Connect SolarNet

Infringement where the main antenna is considered the first antenna

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Claim 11
[11-preamble] A wireless device comprising:

[11-preamble] Wireless device

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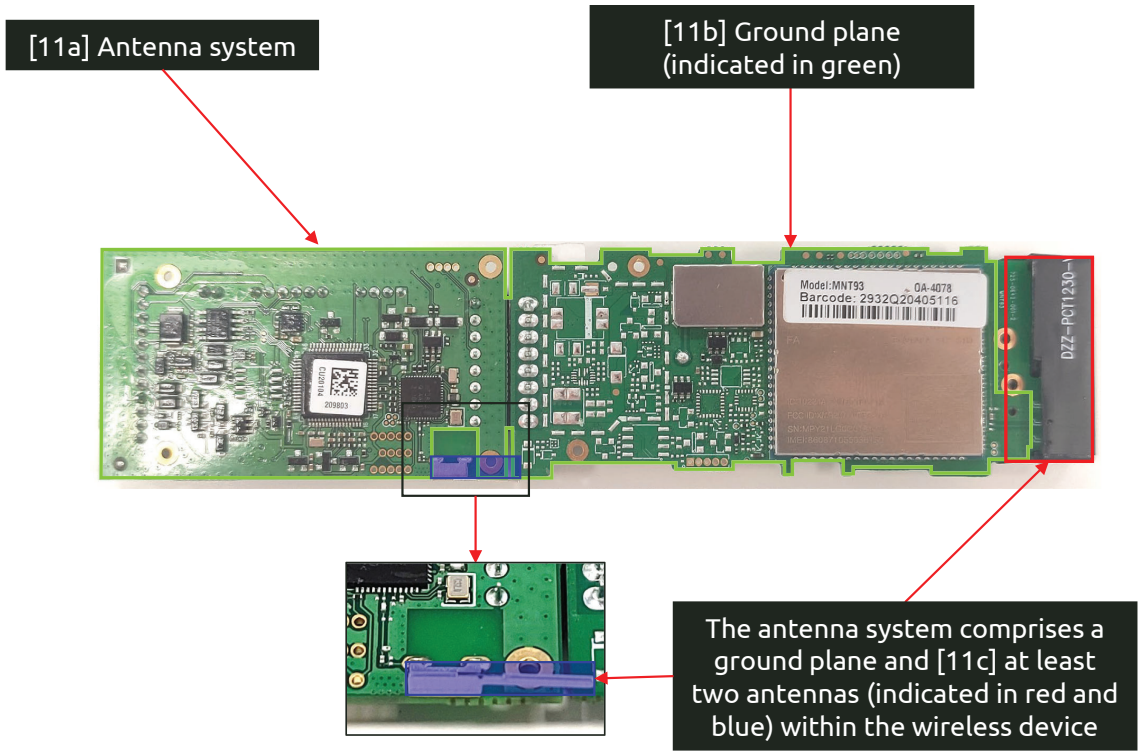
Claim 11
[11a] an antenna system comprising [11b] a ground plane and [11c] at least two antennas within the wireless device, the antenna system comprising:



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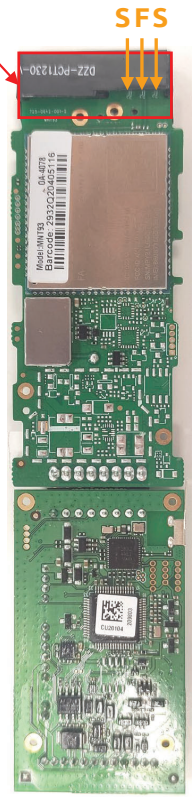
Claim 11

[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)



LTE Cat 1	EC21-A
Region/Operator	North America
Dimensions (mm)	29.0 × 32.0 × 2.4
Temperature Range	
Operation Temperature	-35 °C to +75 °C
Extended Temperature	-40 °C to +85 °C
Frequency Bands	
LTE-FDD	B2/4/12
LTE-TDD	-
WCDMA	B2/4/5
GSM/EDGE	-
GNSS (Optional)	GPS/GLONASS/BDS/Galileo/QZSS

Source: Cellular module datasheet

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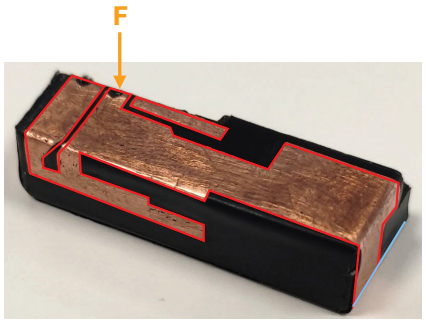
Claim 11
[11e] the first antenna defining an antenna contour comprising an entire perimeter of the first antenna,

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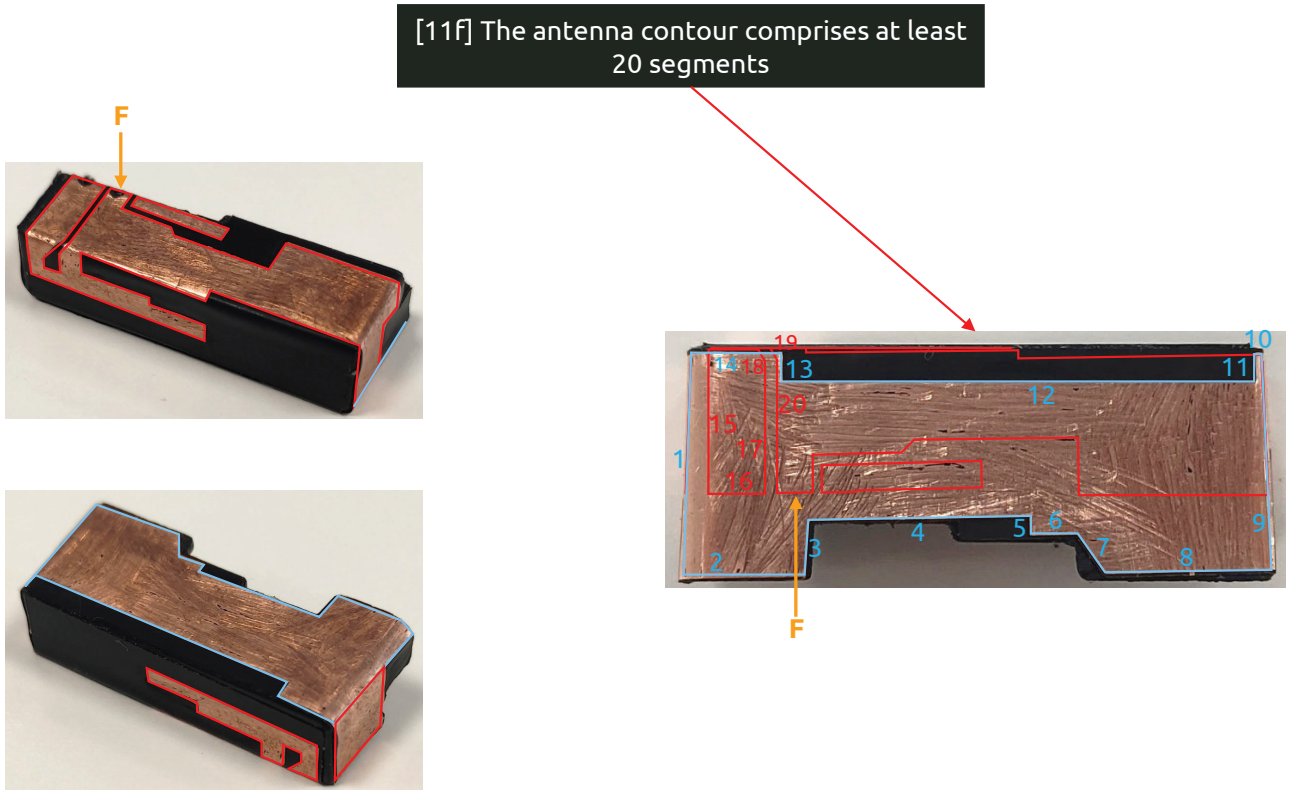
Claim 11
[11f] the antenna contour comprising at least twenty segments,



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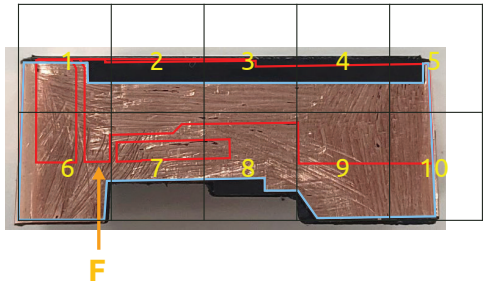
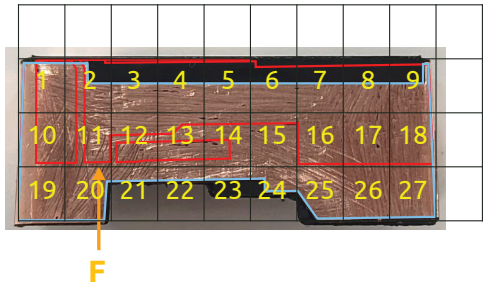
Claim 11

[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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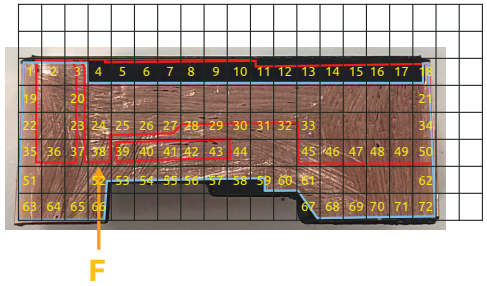
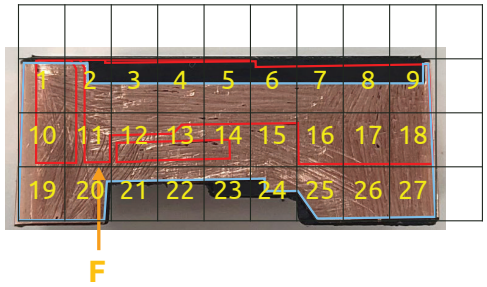
Claim 11

[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



$N_3 = 72\ cells$



$N_2 = 27\ cells$

$$F_{32} = -\frac{\log(N_3) - \log(N_2)}{\log(1/2)} = -\frac{\log(72) - \log(27)}{\log(1/2)} = 1.42 \geq 1.35$$

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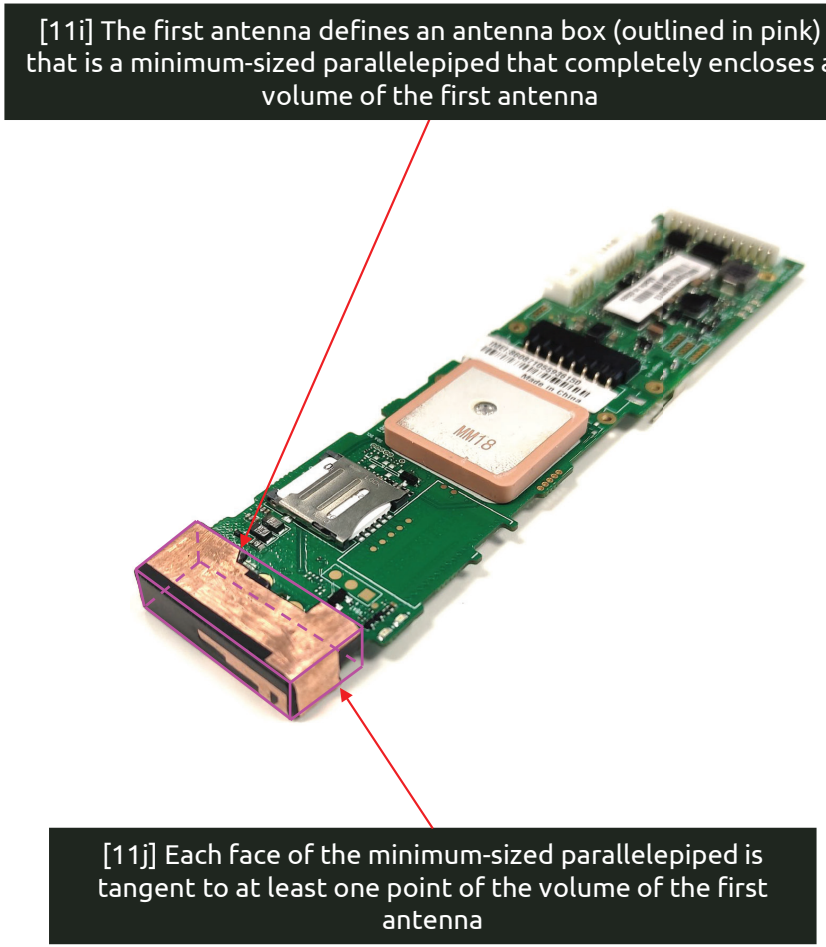
Claim 11
[11i] wherein the first antenna defines an antenna box that is a minimum-sized parallelepiped that completely encloses a volume of the first antenna and [11j] wherein each face of the minimum-sized parallelepiped is tangent to at least one point of the volume of the first antenna,



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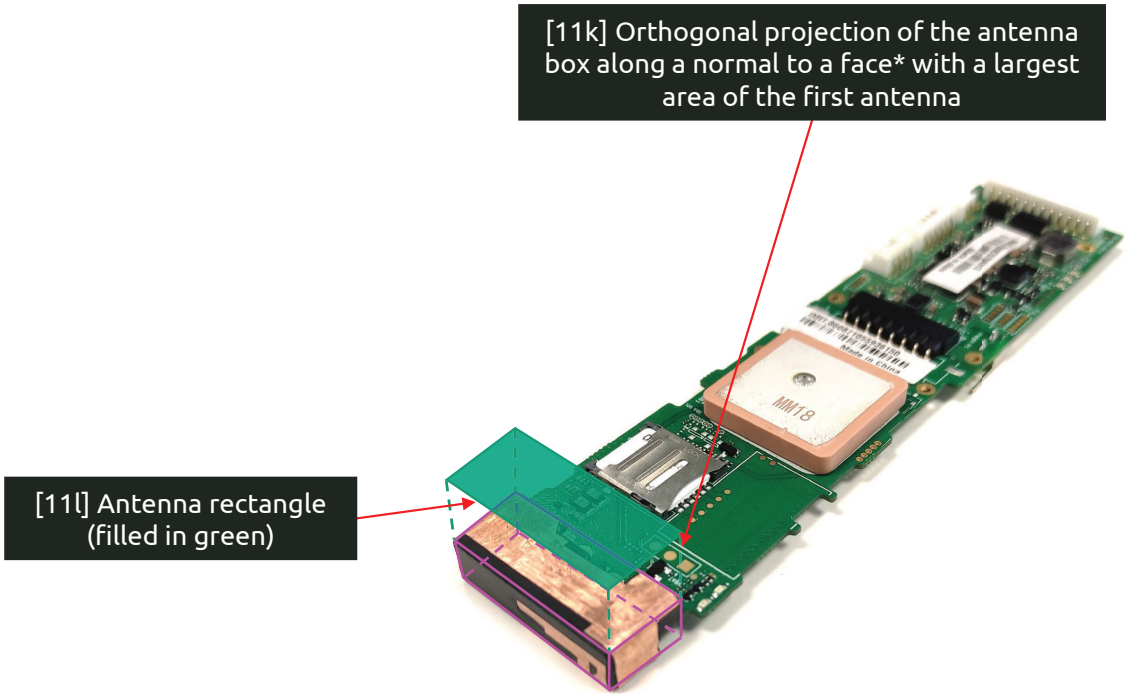
Claim 11

[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,



*Normal to a face means perpendicular to the face

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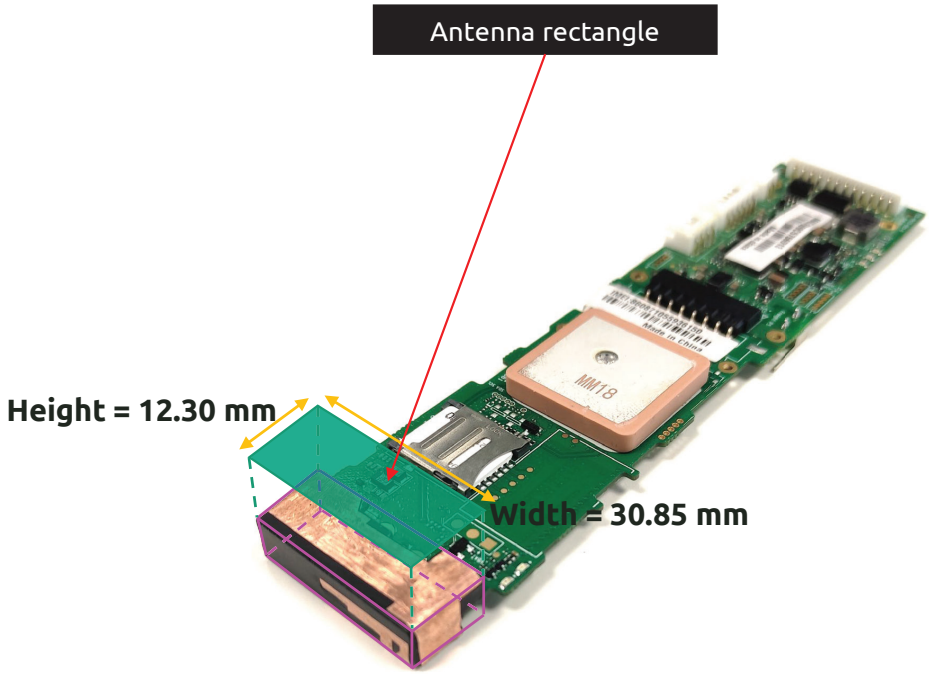
Claim 11

[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 = 30.85/12.30 = 2.51 ≥ 2

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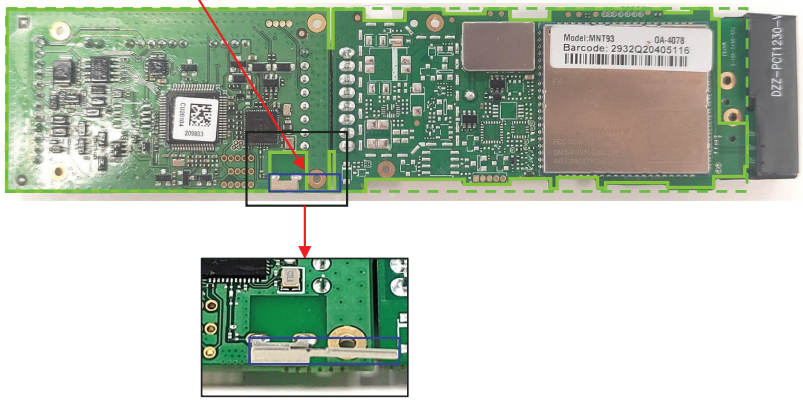
Claim 11
[11n] a second antenna configured to provide operation in a first wireless service, [11o] the second antenna being proximate to a side of a ground plane rectangle enclosing the ground plane.

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

BLUETOOTH
Low Energy (BLE)
Version 4.2

Source: device datasheet



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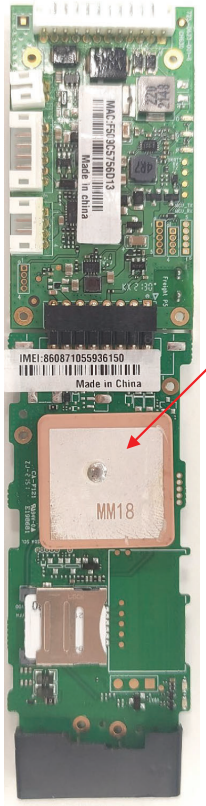
Claim 15

[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



Light Behavior	What it Means
Green, Red, & Orange OFF	GPS disconnected, cellular data session is off, device is either turned off (sleeping) or in low power mode (standby)
Green Blinking, Red Solid, Orange Blinking	Attempting to lock cellular, GPS locked, vibration detected
Green Solid, Red Solid, Orange Blinking	Perfect health; that's how it should be. Locked to cellular and GPS.

Source: SolarNet-Troubleshooting

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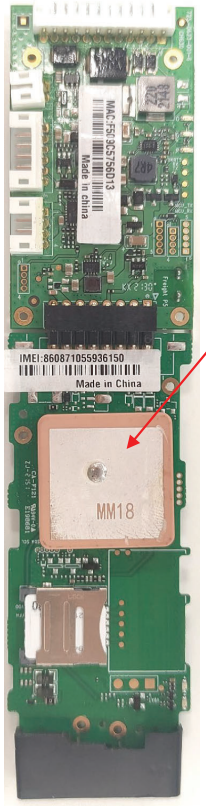
Claim 17

[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



Light Behavior	What it Means
Green, Red, & Orange OFF	GPS disconnected, cellular data session is off, device is either turned off (sleeping) or in low power mode (standby)
Green Blinking, Red Solid, Orange Blinking	Attempting to lock cellular, GPS locked, vibration detected
Green Solid, Red Solid, Orange Blinking	Perfect health; that's how it should be. Locked to cellular and GPS.

Source: SolarNet-Troubleshooting