



# FP40 ULTRA 4X4 MIMO ANTENNAS

## INTELLIGENT TRANSPORTATION

Datasheet & Kit Configurator Guide



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# FP40 ULTRA 4X4 MIMO VEHICULAR ANTENNAS

FP40 ultra antennas provide an all-in-one solution for LTE/5G, Wi-Fi, GNSS and Bluetooth in high bandwidth mobile connectivity applications.

The product family includes multi-port solutions up to 14-ports, along with a range of connector options to suit all major vehicular gateways and routers.

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## FEATURES AND BENEFITS

- Configurations available up to 14-ports incorporating next-generation technology
  - 4G, 5G, CBRS, Wi-Fi, Bluetooth, GNSS coverage from a single antenna
  - Designed for applications demanding the highest data rates and lowest latency
  - Future-proofed against future 4G and 5G frequency rollouts up to 7125 MHz
  - Compatible with all gateways & routers from major manufacturers
  - Customizable connector, cable length and port configurations
  - R118 compliant cables
  - Stylish and aesthetical design
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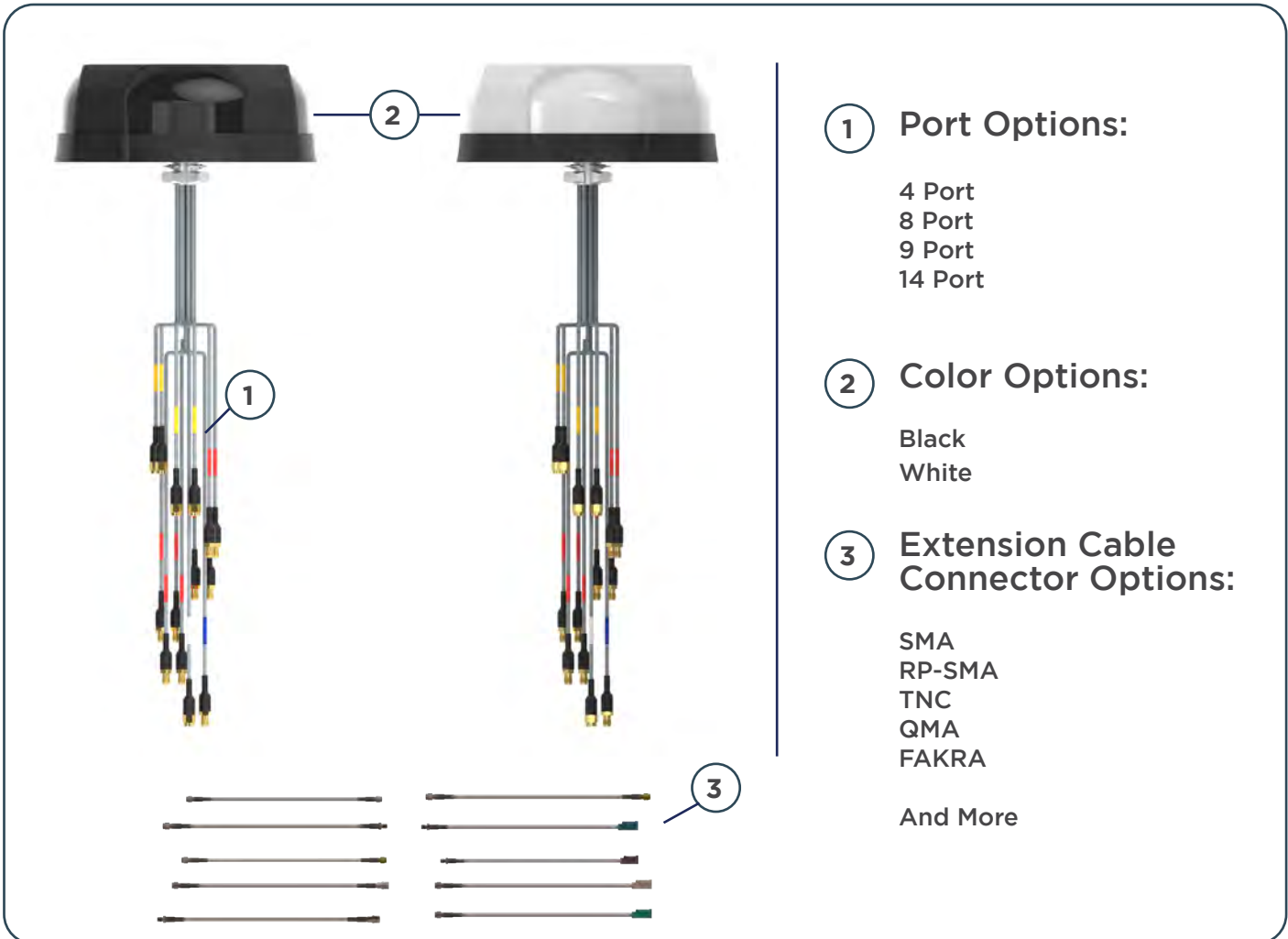
## KEY DIFFERENTIATORS

- Low profile design for improved vehicle clearance
  - L1 and L5 GNSS for improved positioning accuracy and response times
  - Out of band rejection filters maintain consistent performance
  - High data throughput is enabled by technologies such as carrier aggregation
  - Coverage of all 4G and 5G bands (617-7125 MHz), CBRS, Wi-Fi, Bluetooth and GNSS
  - Superior gain patterns, low gain ripple, high gain at horizon and efficiency over 70%
  - UV, flammability, humidity, impact, vibration, shock certified
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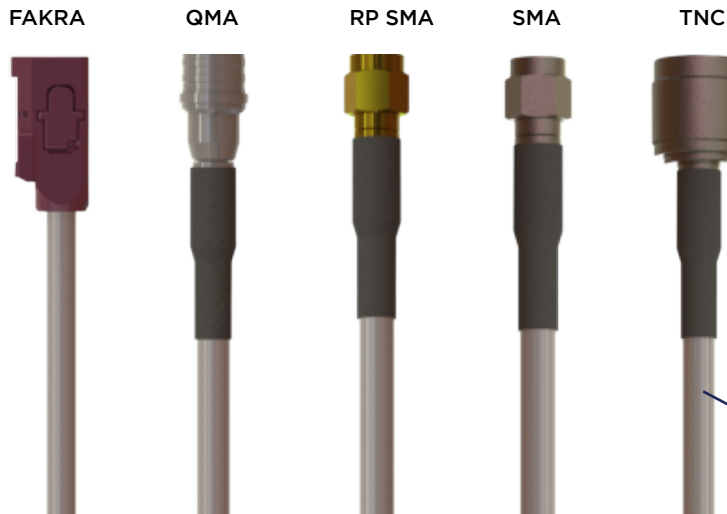
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# FP40 ULTRA 4X4 MIMO: ANTENNA OVERVIEW



## EXAMPLES OF CONNECTOR TERMINATIONS ON EXTENSION CABLES



### Extension Cables

All kits are supplied with a 5m extension cable set as standard (see pages 4-5 for standard extension cable connector options). Custom configurations are available on request.

Connectors will be individually marked with an appropriate label which is color coded to guide installers in connecting extension cables to the correct port on the router or gateway device.

4G/5G

GNSS



BT


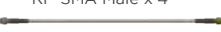





WLAN

# FP40 ULTRA 4X4 MIMO: KIT CONFIGURATIONS

The table below shows common examples of the **FP40 ultra** kit configurations and the part numbers used to order these kits. Other options are available on request.

All kits are supplied with 5 meter (16 ft.) extension cables attached as standard. If you require different extension cable lengths or connector configurations please contact us to discuss your options.

| FP40 ultra Kit  | Port Configuration | Frequency (MHz)                             | Extension Cable Connector |
|---|--------------------|---|---------------------------|
| <b>4 Port - Kit Part No. - L000434-07</b>   |                    |   |                           |
|  + SMA Male x 4<br>   | 4G/5G Port x 4     | 617-960; 1427-1511;<br>1690-2700; 3300-7125 | SMA Male x 4              |
| <b>8 Port Option 1 - Kit Part No. - L000434-04</b>  |                    |   |                           |
|  + SMA Male x 4<br><br>RP-SMA Male x 2<br><br>SMA Male x 1<br><br>SMA Male x 1<br>     | 4G/5G Port x 4     | 617-960; 1427-1511;<br>1690-2700; 3300-7125 | SMA Male x 4              |
|   | WLAN Port x 2      | 2400-2500; 4900-7125                        | RP-SMA Male x 2           |
|   | GNSS Port x 1      | 1427-1511 (L1 & L5)                         | SMA Male x 1              |
|   | Bluetooth          | 2400-2500                                   | SMA Male x 1              |
| <b>8 Port Option 2 - Kit Part No. - L000434-05</b>  |                    |   |                           |
|  + FAKRA D x 4<br><br>FAKRA I x 2<br><br>FAKRA C x 1<br><br>FAKRA Z x 1<br>        | 4G/5G Port x 4     | 617-960; 1427-1511;<br>1690-2700; 3300-7125 | FAKRA D x 4               |
|   | WLAN Port x 2      | 2400-2500; 4900-7125                        | FAKRA I x 2               |
|   | GNSS Port x 1      | 1427-1511 (L1 & L5)                         | FAKRA C x 1               |
|   | Bluetooth          | 2400-2500                                   | FAKRA Z x 1               |
| <b>8 Port Option 3 - Kit Part No. - L000434-06</b>  |                    |   |                           |
|  + SMA Male x 4<br><br>RP-SMA Male x 2<br><br>SMA Male x 1<br><br>SMA Male x 1<br> | 4G/5G Port x 4     | 617-960; 1427-1511;<br>1690-2700; 3300-7125 | SMA Male x 4              |
|   | WLAN Port x 2      | 2400-2500; 4900-7125                        | RP-SMA Male x 2           |
|   | GNSS Port x 1      | 1427-1511 (L1 & L5)                         | SMA Male x 1              |
|   | Bluetooth          | 2400-2500                                   | SMA Male x 1              |

| FP40 ultra Kit  | Port Configuration | Frequency (MHz)                             | Extension Cable Connector |
|---|--------------------|---|---------------------------|
| <b>9 Port Option 1 - Kit Part No. - L000434-01</b>  |                    |   |                           |
| <br>+ <ul style="list-style-type: none"> <li> SMA Male x 4</li> <li> RP-SMA Male x 4</li> <li> SMA Male x 1</li> </ul>  | 4G/5G Port x 4     | 617-960; 1427-1511;<br>1690-2700; 3300-7125 | SMA Male x 4              |
|   | WLAN Port x 4      | 2400-2500; 4900-7125                        | RP-SMA Male x 4           |
|   | GNSS Port x 1      | 1427-1511 (L1 & L5)                         | SMA Male x 1              |
| <b>9 Port Option 2 - Kit Part No. - L000434-02</b>  |                    |   |                           |
| <br>+ <ul style="list-style-type: none"> <li> FAKRA D x 4</li> <li> FAKRA I x 4</li> <li> FAKRA C x 1</li> </ul>  | 4G/5G Port x 4     | 617-960; 1427-1511;<br>1690-2700; 3300-7125 | Fakra D x 4               |
|   | WLAN Port x 4      | 2400-2500; 4900-7125                        | Fakra I x 4               |
|   | GNSS Port x 1      | 1427-1511 (L1 & L5)                         | Fakra C x 1               |
| <b>9 Port Option 3 - Kit Part No. - L000434-03</b>  |                    |   |                           |
| <br>+ <ul style="list-style-type: none"> <li> SMA Male x 4</li> <li> RP-SMA Male x 4</li> <li> SMA Male x 1</li> </ul>  | 4G/5G Port x 4     | 617-960; 1427-1511;<br>1690-2700; 3300-7125 | SMA Male x 4              |
|   | WLAN Port x 4      | 2400-2500; 4900-7125                        | RP-SMA Male x 4           |
|   | GNSS Port x 1      | 1427-1511 (L1 & L5)                         | SMA Male x 1              |
| <b>14 Port - Kit Part No. - L000434-08</b>  |                    |   |                           |
| <br>+ <ul style="list-style-type: none"> <li> SMA Male x 4</li> <li> RP-SMA x 8</li> <li> SMA Male x 1</li> <li> SMA Male x 1</li> </ul> | 4G/5G Port x 4     | 617-960; 1427-1511;<br>1690-2700; 3300-7125 | SMA Male x 4              |
|   | WLAN Port x 8      | 2400-2500; 4900-7125                        | RP-SMA Male x 8           |
|   | GNSS Port x 1      | 1427-1511 (L1 & L5)                         | SMA Male x 1              |
|   | Bluetooth          | 2400-2500                                   | SMA Male x 1              |

For ease of installation, high-port count antenna kits may not have all extension cables pre-attached.

# FP40 ULTRA 4X4 MIMO: SPECIFICATIONS

The following specifications are representative of all models/port options in the **FP40 ultra** antenna family. Unless stated the data includes testing of the antenna only and does not include testing with a 5 meter (16 feet) extension cable. For more detailed information please contact us.



| ELECTRICAL SPECIFICATION - 4G/5G/CBRS (CELLULAR), WI-FI & BLUETOOTH |                       |           |           |           |           |           |           |           |           |           |
|---|-----------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|   | 4G/5G/CBRS (Cellular) |           |           |           |           |           | Wi-Fi     |           |           | Bluetooth |
| Operating Frequency (MHz)   | 617-960               | 1427-1511 | 1690-2700 | 3300-4200 | 4400-6000 | 6000-7125 | 2400-2500 | 4900-6000 | 6000-7125 | 2400-2500 |
| Peak Gain - Max (dBi)*  | 4.0                   | 8.0       |           |           | 9.0       | 7.0       | 7.5       | 8.5       | 9.5       | 6.0       |
| Total Efficiency Average (%)*                                       | 42                    | 41        | 61        | 61        | 54        | 49        | 50        | 51        | 53        | 54        |
| Isolation - Cellular-to-Cellular/BT Elements (dB)**                 | 13                    | 21        | 20        | 26        | 34        | 38        | N/A       |           |           | 22        |
| Isolation - Wi-Fi-to-Wi-Fi Elements (dB)**                          | N/A                   |           |           |           |           |           | 22        | 22        | 27        | N/A       |
| Max Power @ Ambient 20°C (Watts)                                    | 10                    |           |           |           |           |           | 1         |           |           |           |
| Nominal Impedance (Ohms)  | 50                    |           |           |           |           |           |           |           |           |           |
| Polarization  | Linear                |           |           |           |           |           |           |           |           |           |
| Azimuth Beamwidth   | 360°, Omnidirectional |           |           |           |           |           |           |           |           |           |

\*Measured with 0.3m (1 ft) coax cable

\*\*Measured with 0.3m (1 ft) pigtail + 5m (16ft) 0.195" diameter extension cable

| ELECTRICAL SPECIFICATION - GNSS***    |                        |         |      |         |
|---------------------------------------|------------------------|---------|------|---------|
| Number of Ports                       | 1                      |         |      |         |
| Frequency (MHz)                       | L1 Band                |         |      | L5 Band |
|                                       | 1561                   | 1575.42 | 1602 | 1176.45 |
| Patch/Passive Antenna Peak Gain (dBi) | -0.6                   | 0.9     | -0.5 | -0.4    |
| LNA Gain (dBi)                        | 28 ± 3                 |         |      |         |
| Noise Figure (dB)                     | < 3                    |         |      |         |
| Input Max Power (dBm)                 | +10                    |         |      |         |
| Nominal Impedance (Ohms)              | 50                     |         |      |         |
| Out of Band Rejection (dBc)           | 350-520 MHz            |         |      | > 65    |
|                                       | 698-960 MHz            |         |      | > 70    |
|                                       | 1428-1511 MHz          |         |      | > 40    |
|                                       | 1710-2700 MHz          |         |      | > 65    |
|                                       | 4900-5800 MHz          |         |      | > 75    |
| DC Voltage (V)                        | 2-5                    |         |      |         |
| Current (mA)                          | 12.5 Typ. (at DC 3.0V) |         |      |         |

\*\*\*Measured on 0.6 x 0.6m (2 x 2ft) ground plane

## EXTENSION CABLE ATTENUATION FIGURES - 5MM (0.195 INCH) CABLES

|                          |       |       |       |       |       |       |       |       |       |       |       |
|--------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Frequency Range (MHz)    | 698   | 960   | 1511  | 2500  | 2700  | 3300  | 4200  | 4400  | 4900  | 6000  | 7125  |
| Cable Attenuation (dB/m) | < 0.3 | < 0.4 | < 0.5 | < 0.7 | < 0.7 | < 0.8 | < 0.9 | < 1.0 | < 1.1 | < 1.2 | < 1.3 |

## MECHANICAL SPECIFICATION

|  |   |
|--|---|
| Dimensions HxDia mm (in.)                                | 66 x 187 (2.7 x 7.4)                          |
| Max Weight - g (oz.)<br>- Not Including Extension Cables | 479 (16.9) - 612 (21.59) - Dependent on Model |
| Number of Ports  | 4 to 14 Port Options Available                |
| Mounting Type  | Fixed Stud M20                                |
| Radome   | Polycarbonate, UL94-V0                        |
| Baseplate Material                                       | Aluminium                                     |

## ENVIRONMENTAL SPECIFICATION

|                                 |   |
|---------------------------------|---|
| Operating Temperature - °C (°F) | -40 to +85 (-40 to +185)  |
| Storage Temperature - °C (°F)   | -40 to +85 (-40 to +185)  |
| Ingress Protection              | IP67  |
| UV Rating                       | ASTM D4674  |
| Flammability Rating             | Radome: UL94 V0<br>Cable: UN ECE R118                           |
| Mechanical Shock Rating         | IEC 60068-2-27, Secured Cross Country Vehicles                  |
| Vibration Test Rating           | MIL-STD-810G, Method 514.6, Category 4, Highway Truck Vibration |
| Humidity Rating                 | MIL-STD-810G, 507.5, Procedure II, Aggravated Humidity @ 95%    |
| Material Substance Compliance   | RoHS Compliant<br>CE & UKCA Compliant - Antenna                 |

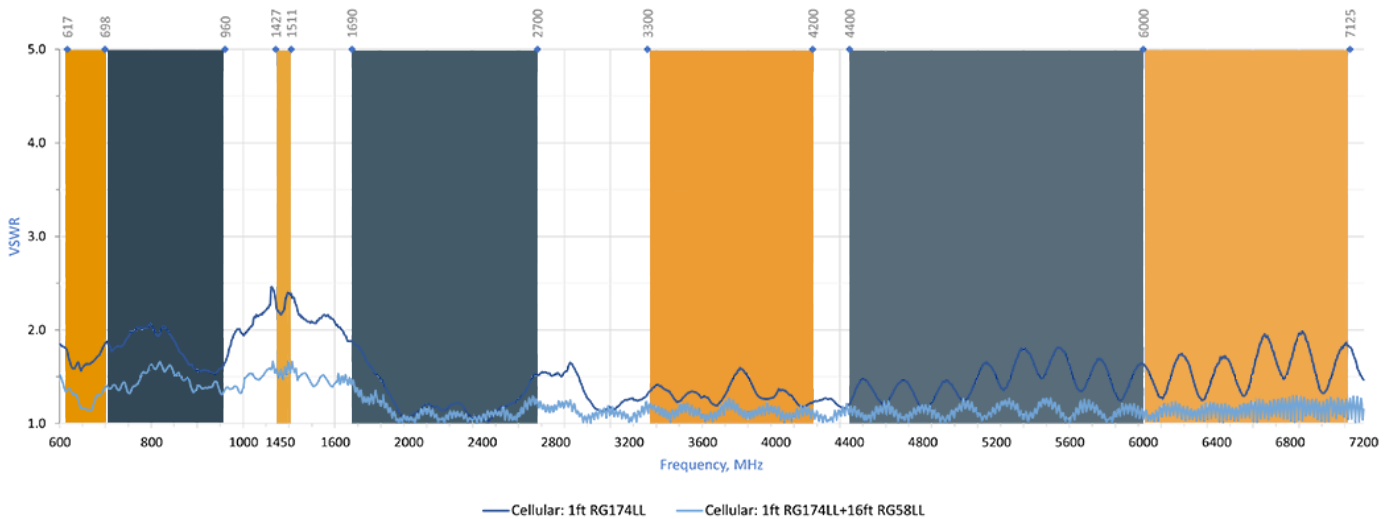
# GLOBAL 4G, 5G, CBRS CELLULAR COVERAGE

The **FP40 ultra** antenna family provides truly global cellular coverage. The table below shows the frequencies and bands covered and the corresponding performance across those bands is shown in the charts below.

| FREQUENCY      | RF BANDS COVERED   |
|----------------|--|
| 617-698 MHz    | 71   |
| 698-960 MHz    | 5, 6, 8, 12, 13, 14, 17, 18, 19, 20, 26, 27, 28, 29, 44, 67, 68, 85<br>N5, N8, N12, N14, N18, N20, N28, N29, N81, N82, N83, N89, N91, N92, N93, N94                  |
| 1427-1511 MHz  | 11, 21, 32, 45, 74<br>N50, N51, N74, N75, N76  |
| 1690-2700 MHz  | 1, 2, 3, 4, 7, 9, 10, 15, 16, 23, 25, 30, 33, 34, 35, 36, 37, 38, 39, 40, 41, 65, 66, 69, 70<br>N30, N34, N38, N39, N40, N41, N65, N66, N70, N80, N84, N86, N90, N95 |
| 3300-4200 MHz  | 22, 42, 43, 48<br>N48, N77, N78  |
| 4400-6000 MHz  | N79  |
| 6000-7125 MHz* | 46, 47<br>N96, N102, N104  |

## 4G, 5G, CBRS CELLULAR PERFORMANCE

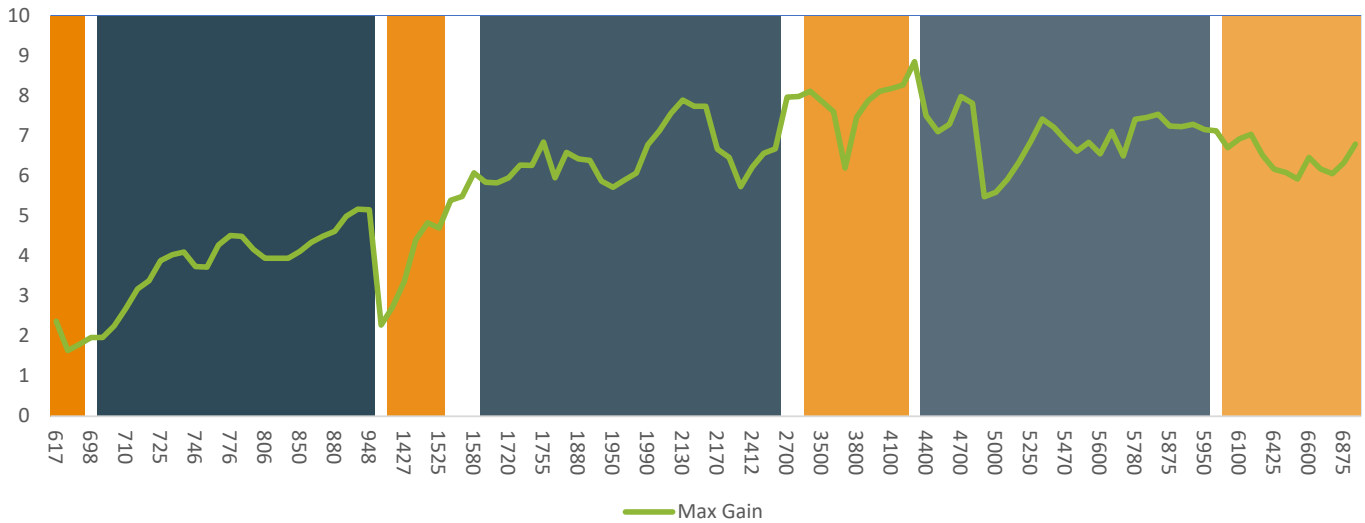
### TYPICAL VSWR



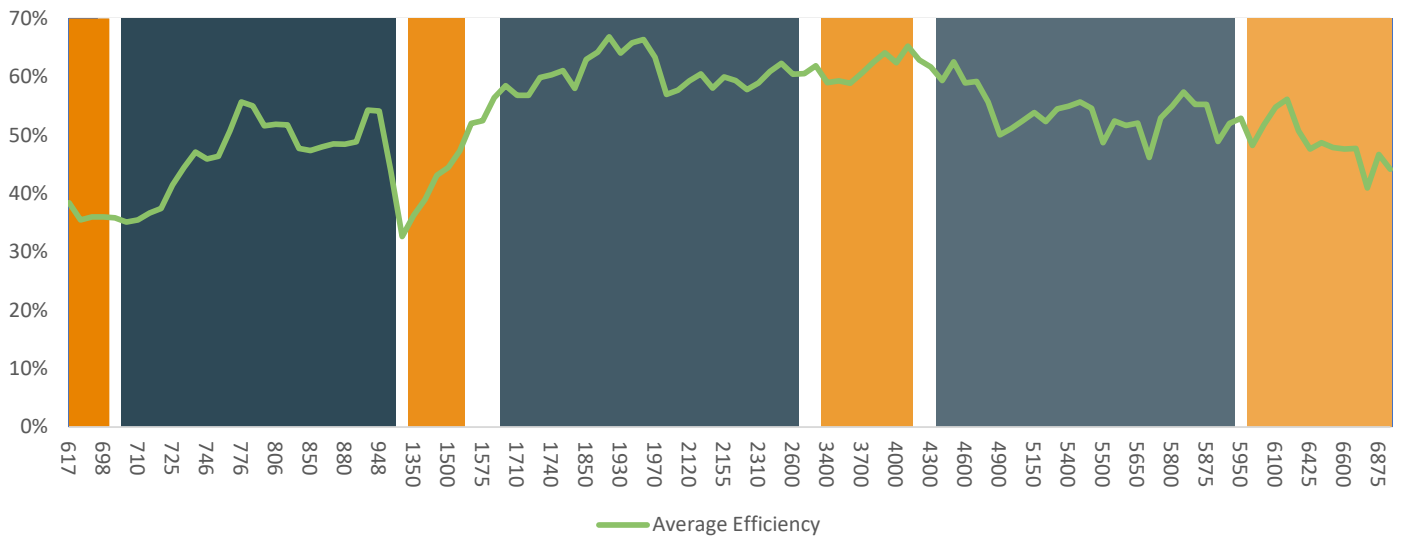


# 4G, 5G, CBRS CELLULAR PERFORMANCE

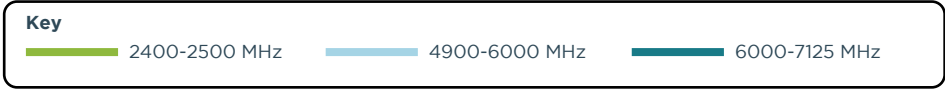
## GAIN MAX (DBI)



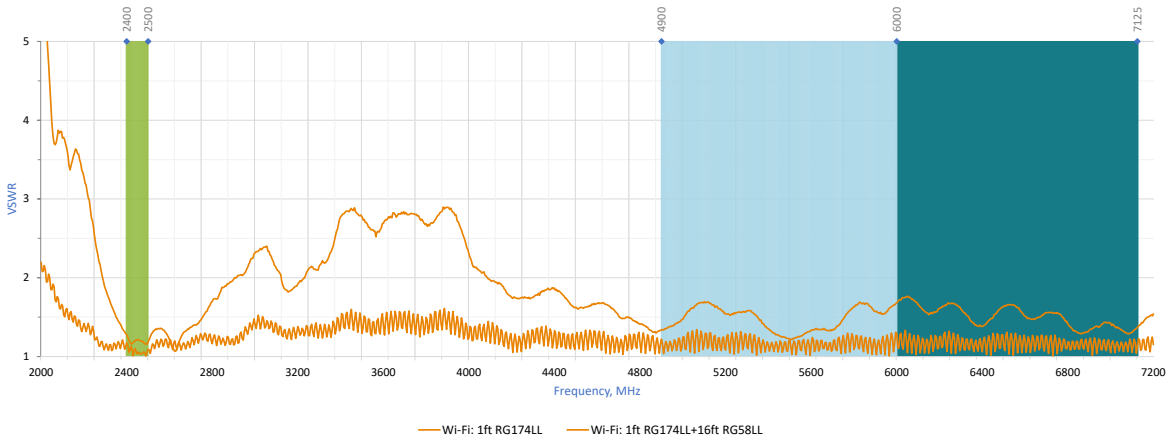
## AVERAGE EFFICIENCY



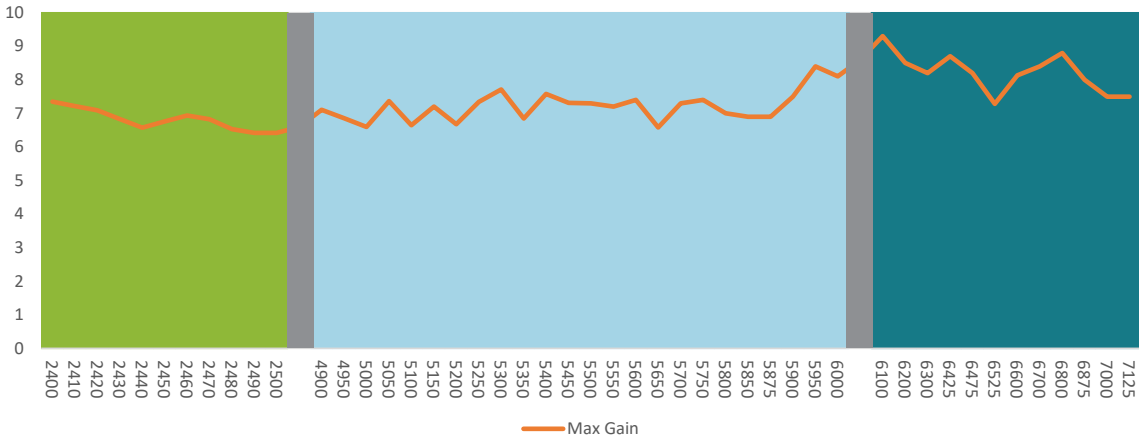
# WI-FI AND BLUETOOTH PERFORMANCE



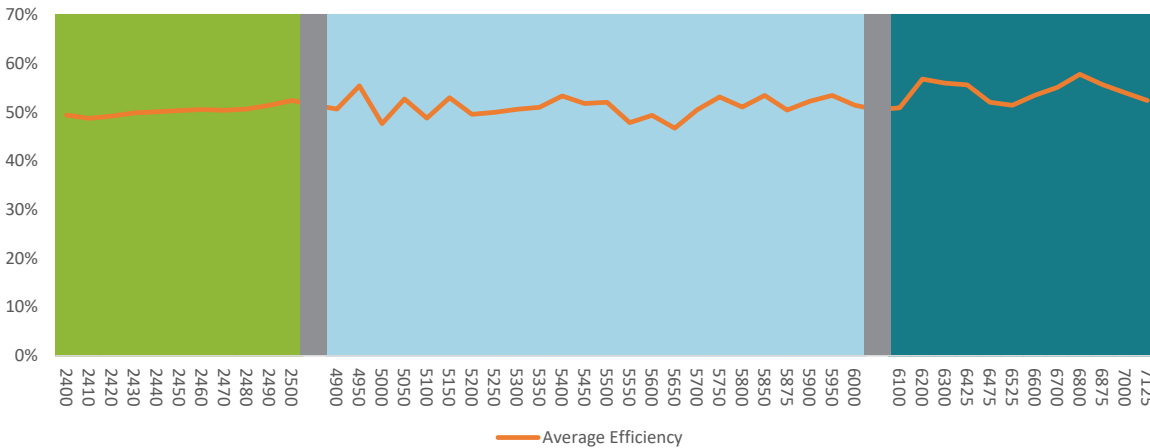
## TYPICAL VSWR - WI-FI



## GAIN MAX (DBI) - WI-FI



## AVERAGE EFFICIENCY - WI-FI

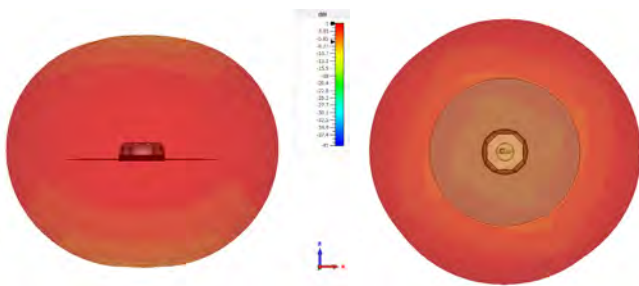


# FP40 ULTRA 4X4 MIMO: RADIATION PATTERNS

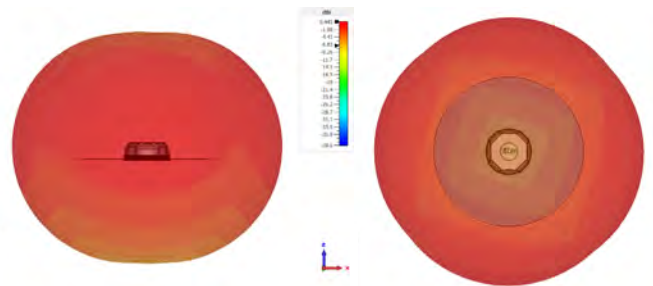
The patterns below are representative of the typical performance of all **FP40 ultra** 4x4 MIMO antenna models. Patterns are recorded without the extension cable added and are four element (cellular) or up to eight element (Wi-Fi) simulated composite data. Please contact us for full test data. These antennas will perform on and off a ground plane. Performance may vary slightly when no ground plane is used in conjunction with these antennas. If you require test data for both scenarios please get in touch.

## 4G/5G/CBRS (CELLULAR)

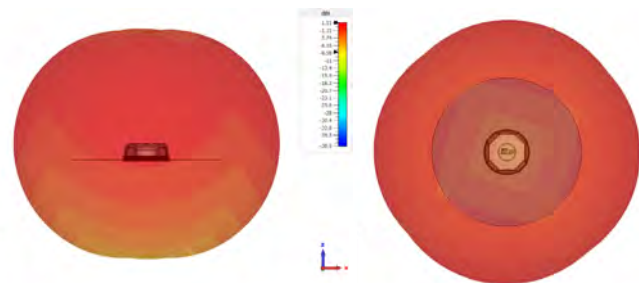
Radiation Patterns at 617 MHz



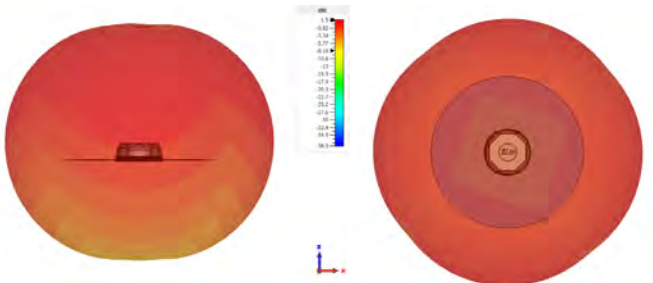
Radiation Patterns at 698 MHz



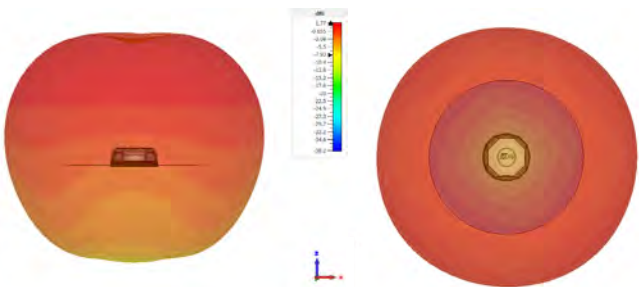
Radiation Patterns at 850 MHz



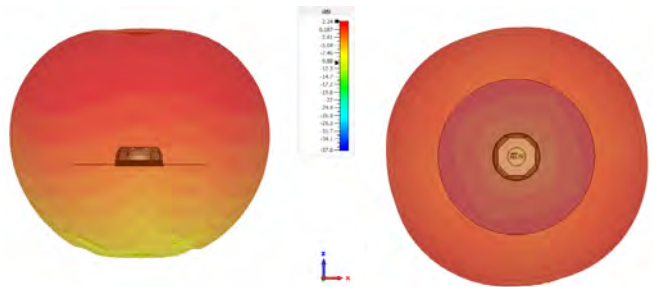
Radiation Patterns at 960 MHz



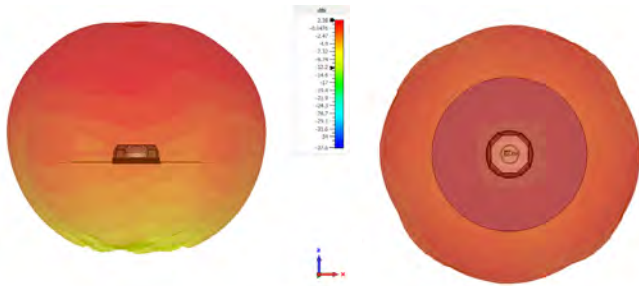
Radiation Patterns at 1500 MHz



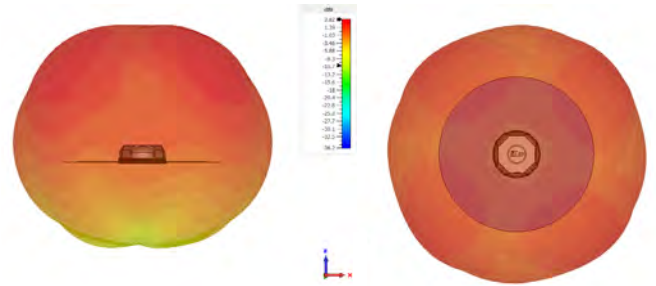
Radiation Patterns at 1690 MHz



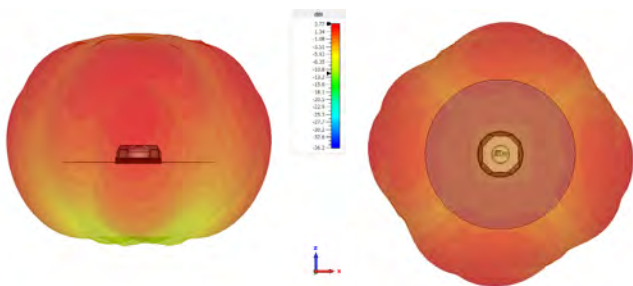
Radiation Patterns at 1850 MHz



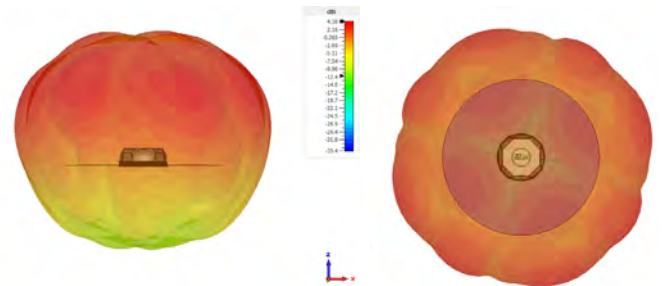
Radiation Patterns at 2170 MHz



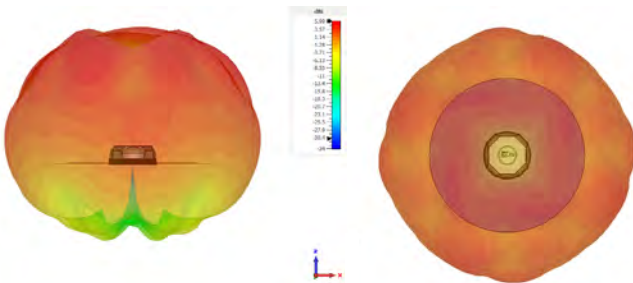
Radiation Patterns at 2500 MHz



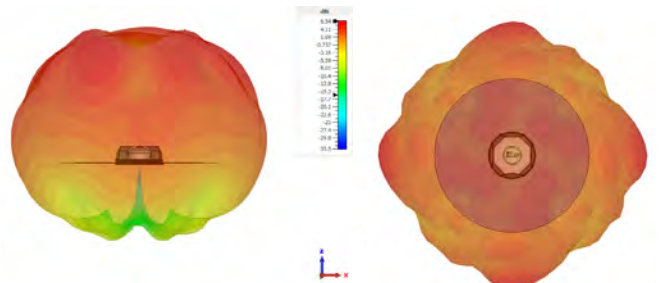
Radiation Patterns at 2700 MHz



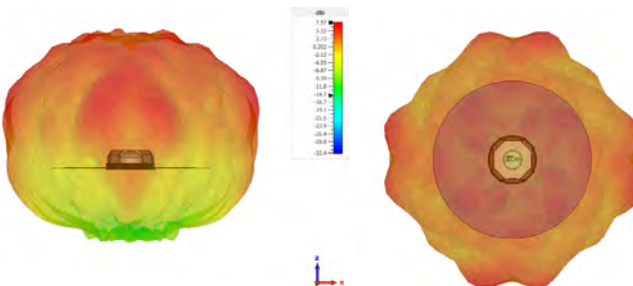
Radiation Patterns at 3500 MHz



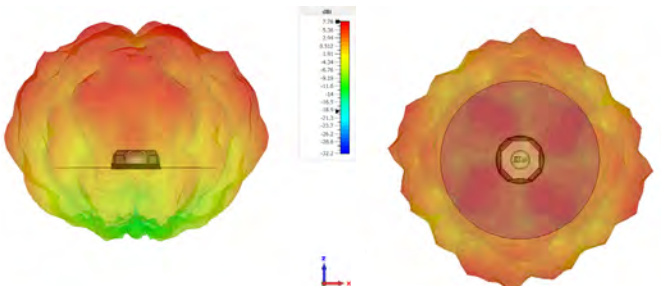
Radiation Patterns at 4900 MHz



Radiation Patterns at 6000 MHz

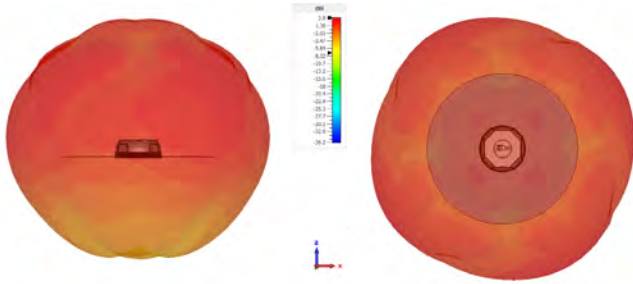


Radiation Patterns at 7125 MHz

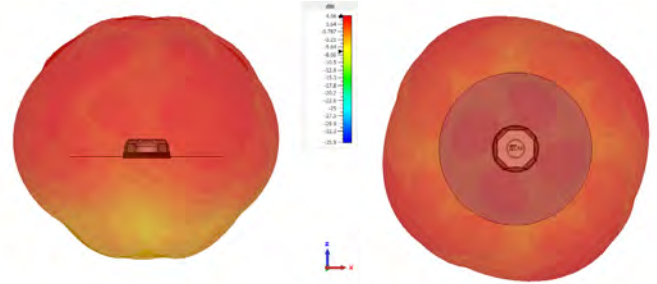


## WI-FI & BLUETOOTH

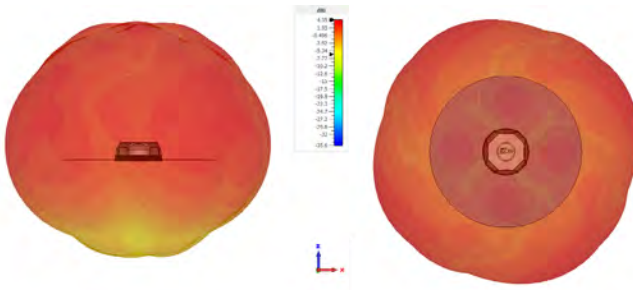
### Radiation Patterns at 2400 MHz



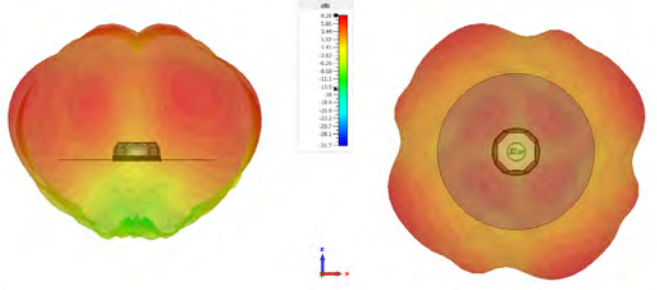
### Radiation Patterns at 2450 MHz



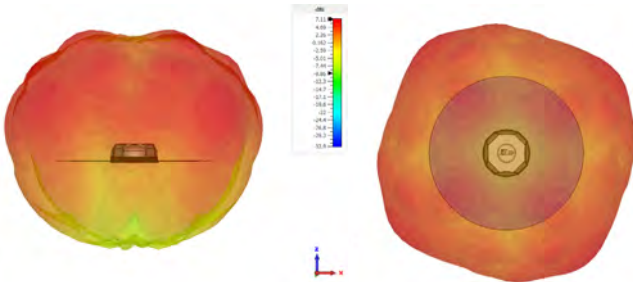
### Radiation Patterns at 2500 MHz



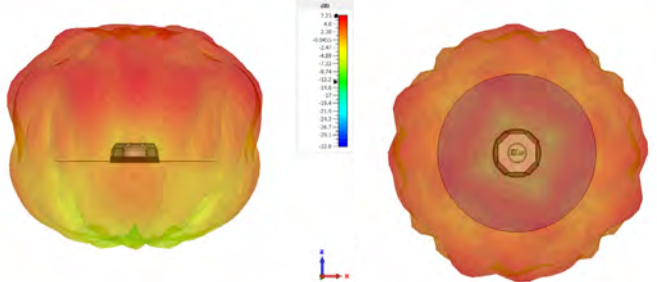
### Radiation Patterns at 4900 MHz



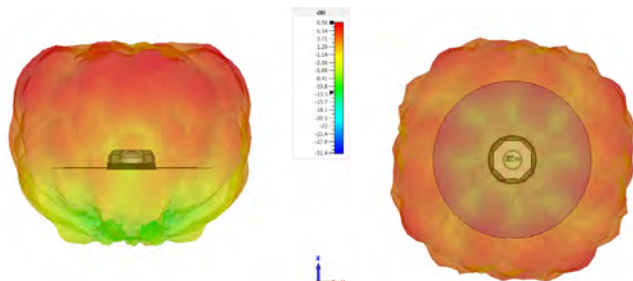
### Radiation Patterns at 5500 MHz



### Radiation Patterns at 6000 MHz

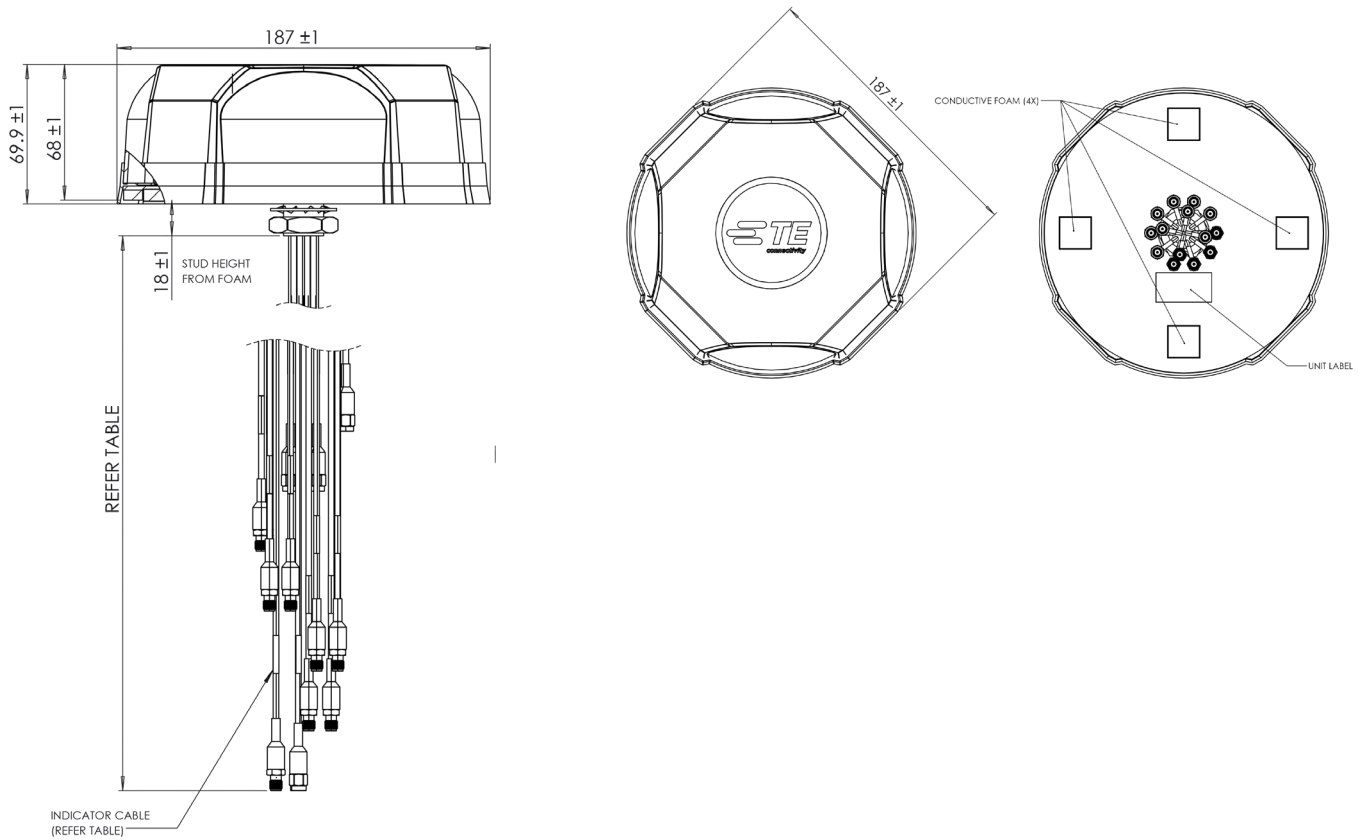


### Radiation Patterns at 7125 MHz



# FP40 ULTRA 4X4 MIMO: DRAWINGS

## MECHANICAL DRAWINGS



## PACKAGING

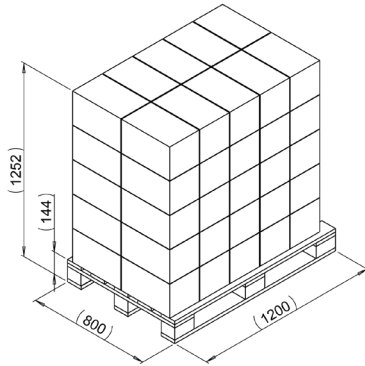
FP40 ultra antennas will be shipped with the appropriate extension cable, in the kit configurations on pages 4-5 of this document. Extension cables will be pre-fitted to the antenna pigtail to reduce installation time. Shipping weights for each kit part number are shown below and quantities and dimensions on the following page.

| Kit Part Number | Description   | Estimated Master Carton Weight<br>Kg (lbs) | Air Shipment Estimated Pallet Weight<br>Kg (lbs) | Ocean Shipment Estimated Pallet Weight<br>Kg (lbs) |
|-----------------|---|--|--|--|
| L000434-01      | 9 Port: 4 x Cellular, 4 x Wi-Fi, 1 x GNSS                 | 2.75 (6.06)                                | 149.5 (329.59)                                   | 204.5 (450.85)                                     |
| L000434-02      | 9 Port: 4 x Cellular, 4 x Wi-Fi, 1 x GNSS                 | 2.75 (6.06)                                | 149.5 (329.59)                                   | 204.5 (450.85)                                     |
| L000434-03      | 9 Port: 4 x Cellular, 4 x Wi-Fi, 1 x GNSS                 | 2.75 (6.06)                                | 149.5 (329.59)                                   | 204.5 (450.85)                                     |
| L000434-04      | 8 Port: 4 x Cellular, 2 x Wi-Fi, 1 x Bluetooth, 1 x GNSS  | 2.55 (5.62)                                | 139.5 (307.55)                                   | 190.5 (419.98)                                     |
| L000434-05      | 8 Port: 4 x Cellular, 2 x Wi-Fi, 1 x Bluetooth, 1 x GNSS  | 2.55 (5.62)                                | 139.5 (307.55)                                   | 190.5 (419.98)                                     |
| L000434-06      | 8 Port: 4 x Cellular, 2 x Wi-Fi, 1 x Bluetooth, 1 x GNSS  | 2.55 (5.62)                                | 139.5 (307.55)                                   | 190.5 (419.98)                                     |
| L000434-07      | 4 Port: 4 x Cellular                                      | 3.40 (7.50)                                | 114 (251.32)                                     | 165 (363.76)                                       |
| L000434-08      | 14 Port: 4 x Cellular, 8 x Wi-Fi, 1 x Bluetooth, 1 x GNSS | 3.76 (8.29)                                | 200 (440.93)                                     | 275.2 (606.71)                                     |

# PACKAGING DIMENSIONS & QUANTITY

## 8-14 PORT KIT PACKAGING

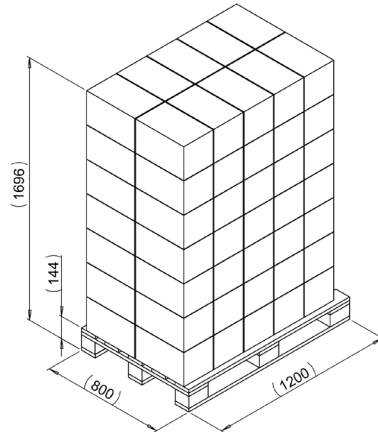
### Air Pallet



#### AIR SHIPMENT

- 1 ANTENNA PER MASTER CARTON
- 10 CARTONS PER LAYER
- 5 LAYERS PER PALLET
- TOTAL ANTENNAS PER PALLET = 50 PCS

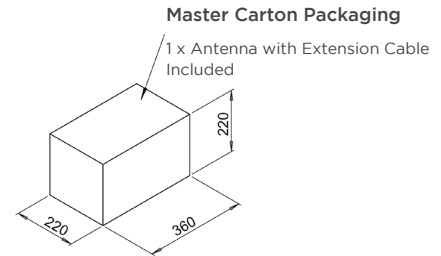
### Ocean Pallet



#### OCEAN SHIPMENT

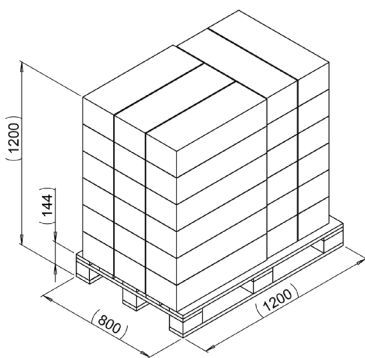
- 1 ANTENNA PER MASTER CARTON
- 10 CARTONS PER LAYER
- 7 LAYERS PER PALLET
- TOTAL ANTENNAS PER PALLET = 70 PCS

### Master Carton



## 4 PORT KIT PACKAGING

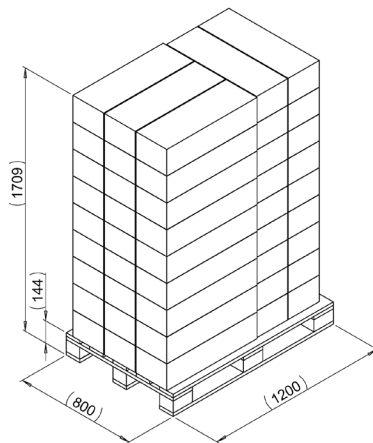
### Air Pallet



#### AIR SHIPMENT

- 3 ANTENNAS PER MASTER CARTON
- 5 CARTONS PER LAYER
- 6 LAYERS PER PALLET
- TOTAL ANTENNAS PER PALLET = 90 PCS

### Ocean Pallet



#### OCEAN SHIPMENT

- 3 ANTENNAS PER MASTER CARTON
- 5 CARTONS PER LAYER
- 9 LAYERS PER PALLET
- TOTAL ANTENNAS PER PALLET = 135 PCS

### Master Carton

