

## Vehicular – Twin Castle (TWC) Series

### 5G-FR1+WiFi 6E+GNSS L1 Direct Mount 9-in-1 Antenna

TWC94411DM and TWC94412DM - 617 to 7125 MHz



## Features & Applications:

- Vehicle roof mount, directly on metal plane
- 4 port 5G/4G
- 4 port WiFi 6E, DSRC, V2X
- 1 port Active GNSS L1 with low noise 30dB amplifier
- Cable length and connector type per request
- Available in Black (P/N TWC94411DM) or White (P/N TWC94412DM)
- Heavy and light vehicles Tracking
- ECE-R10 / R118 compliant
- Robust mechanical design rated with IP67 and IK10 impact protection

### ELECTRICAL SPECIFICATIONS @ 25°C

#### General Specifications– 5G FR1 + WiFi 6E

| Antenna type          | Nominal Impedance | Polarization      | Radiation pattern | Power withstanding | DC Ground |
|-----------------------|-------------------|-------------------|-------------------|--------------------|-----------|
| Monopole <sup>1</sup> | 50Ω               | Vertical / Linear | Omni              | 45W                | No        |

### ELECTRICAL SPECIFICATIONS @ 25°C

#### 5G-FR1 Antennas: 617 – 7125MHz

| Ports                              | Frequency (MHz)          | 617-960 | 1710-2700 | 3300-4200 | 4400-5000 | 5150-5925 | 6000-7125 |
|------------------------------------|--------------------------|---------|-----------|-----------|-----------|-----------|-----------|
| Port 1 & 4 (Main)                  | VSWR                     | 3:1     | 2:1       | 2.5:1     | 2.5:1     | 2.5:1     | 2.5:1     |
|                                    | Avg. Peak Gain (dBi)     | 2.5     | 5.0       | 5.9       | 7.2       | 6.4       | 4.5       |
|                                    | Avg. Efficiency (%)      | 60      | 64        | 58        | 56        | 58        | 51        |
|                                    | Avg. HPBW (°)            | 82      | 40        | 27        | 21        | 23        | 40        |
| Port 2 & 3 (Secondary)             | VSWR                     | 3:1     | 2:1       | 2.5:1     | 2.5:1     | 2.5:1     | 2.5:1     |
|                                    | Avg. Peak Gain (dBi)     | 2.4     | 5.5       | 7.4       | 7.2       | 6.8       | 5.5       |
|                                    | Avg. Efficiency (%)      | 47      | 61        | 60        | 57        | 58        | 51        |
|                                    | Avg. HPBW (°)            | 77      | 31        | 27        | 24        | 26        | 21        |
| Port – Port Isolation <sup>2</sup> | Port 1-2 / Port 3-4 (dB) | 8       | 20        | 19        | 18        | 20        | 29        |
|                                    | Port 1-3 / Port 2-4 (dB) | 13      | 25        | 24        | 30        | 28        | 36        |
|                                    | Port 1-4 (dB)            | 21      | 24        | 26        | 29        | 36        | 39        |

## Vehicular – Twin Castle (TWC) Series

### 5G-FR1+WiFi 6E+GNSS L1 Direct Mount 9-in-1 Antenna

TWC94411DM and TWC94412DM - 617 to 7125 MHz

| WiFi 6E Antennas: 2400-2500/ 4900-7125MHz |                          |           |           |
|-------------------------------------------|--------------------------|-----------|-----------|
| Ports                                     | Frequency (MHz)          | 2400-2500 | 4900-7125 |
| Port 1 & 4<br>(WiFi)                      | VSWR                     | 2:1       | 2:5       |
|                                           | Avg. Peak Gain (dBi)     | 6.3       | 5.8       |
|                                           | Avg. Efficiency (%)      | 69        | 60        |
|                                           | Avg. HPBW (°)            | 34        | 23        |
| Port 2 & 3<br>(WiFi)                      | VSWR                     | 2:1       | 2:5       |
|                                           | Peak Gain (dBi)          | 6.0       | 6.5       |
|                                           | Avg. Efficiency (%)      | 60        | 60        |
|                                           | Avg. HPBW (°)            | 35        | 30        |
| Port – Port Isolation <sup>3</sup>        | Port 1-2 / Port 3-4 (dB) | 17        | 17        |
|                                           | Port 1-3 / Port 2-4 (dB) | 23        | 28        |
|                                           | Port 1-4 (dB)            | 26        | 37        |

| GNSS Antenna: 1561.098 +/- 2.046MHz, 1575.42 +/- 1.023MHz, 1602.5625 +/- 4MHz |                    |                   |                                      |                          |
|-------------------------------------------------------------------------------|--------------------|-------------------|--------------------------------------|--------------------------|
| Frequency (MHz)                                                               | 1561.098 +/- 2.046 | 1575.42 +/- 1.023 | 1602.5625 +/- 4                      |                          |
| VSWR                                                                          | 2:1                | 2:1               | 2:1                                  |                          |
| Gain – Radiating Element (dBic)                                               | -5 +/- 1           | -0.8 +/- 1        | 4.4 +/- 1                            |                          |
| Polarization                                                                  | LNA Gain (dB)      | Noise Figure (dB) | Operating Voltage (V <sub>dc</sub> ) | Current Consumption (mA) |
| RHCP                                                                          | 30 +/- 2           | < 2.4             | 3.3 – 5.0                            | < 11                     |
| Frequency (MHz)                                                               | 960                | 1710              | 2170                                 | 2400                     |
| Out of Band Rejection (dB)                                                    | > 65               | > 60              | > 65                                 | > 65                     |

| MECHANICAL SPECIFICATIONS                             |                     |                    |                   |                |                        |
|-------------------------------------------------------|---------------------|--------------------|-------------------|----------------|------------------------|
| TWC94411DM (TWC94412DM)                               |                     |                    |                   |                |                        |
| Dimension<br>(Length x Width x Height)                | Housing Material    | Color <sup>3</sup> | Weight            | Fixing System  | Mounting Hole Diameter |
| 275.3 x 123.4 x 92.3 mm<br>(10.84 x 4.86 x 3.63 inch) | PC,<br>UV Protected | Black or White     | 894g<br>(1.85lbs) | Direct Mount   | 1.063" (27mm)          |
| Wireless Technology                                   | No. of Port         | Cable Length       | Cable Type        | Connector Type |                        |
| 5G FR1                                                | 4                   | 1ft (0.3m)         | RG-316            | SMA (Male)     |                        |
| WiFi 6E                                               | 4                   | 1ft (0.3m)         | RG-316            | SMA (Male)     |                        |
| GNSS L1                                               | 1                   | 1ft (0.3m)         | RG-174            | SMA (Male)     |                        |

| ENVIRONMENTAL SPECIFICATIONS |                     |                    |                       |                   |                |
|------------------------------|---------------------|--------------------|-----------------------|-------------------|----------------|
| TWC94411DM (TWC94412DM)      |                     |                    |                       |                   |                |
| Operating Temperature        | Storage Temperature | Ingress Protection | Standard / Regulation | Impact Protection | RoHS Compliant |
| -40/+85° C                   | -40/+85° C          | IP67               | UN/ECE R118           | IK10              | Yes            |

Notes:

- (8) Multi-Band Monopoles with built in ground plane, Independent from external ground plane
- Minimum Isolation (dB)
- Black antenna P/N TWC94411DM, White antenna P/N TWC94412DM
- ECE R10.06 supplement 02 certified, Approval No: E24\*10R06/02\*5124\*00
- ECE R118 compliant cables

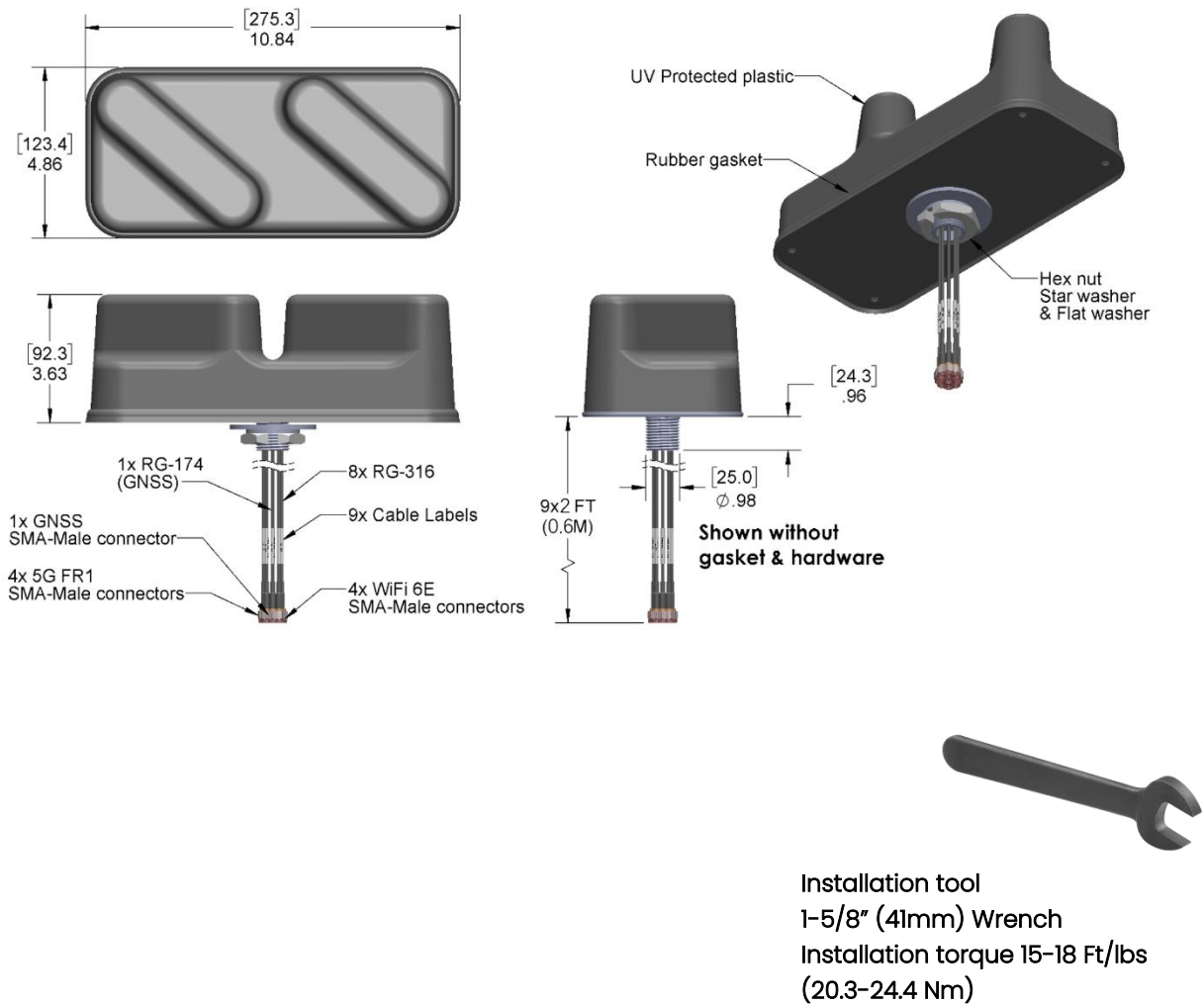
## Vehicular – Twin Castle (TWC) Series

### 5G-FR1+WiFi 6E+GNSS L1 Direct Mount 9-in-1 Antenna

TWC94411DM and TWC94412DM - 617 to 7125 MHz

#### MECHANICAL DRAWING

##### TWC94411DM (TWC94412DM)



Dimensions: inches (mm) Unless otherwise specified, all tolerances are  $\pm 0.010$  (0.25mm)

## Vehicular – Twin Castle (TWC) Series

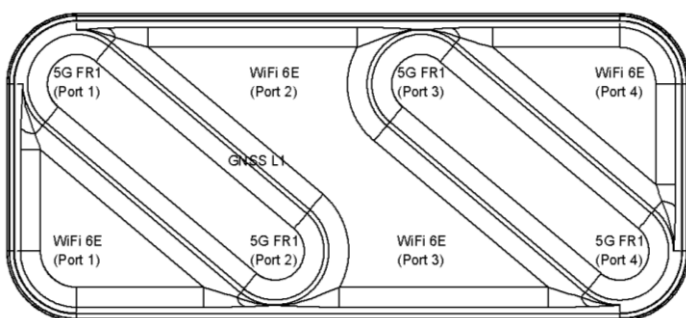
### 5G-FR1+WiFi 6E+GNSS L1 Direct Mount 9-in-1 Antenna

TWC94411DM and TWC94412DM - 617 to 7125 MHz

#### TESTING SETUP

##### General / Chamber test setup

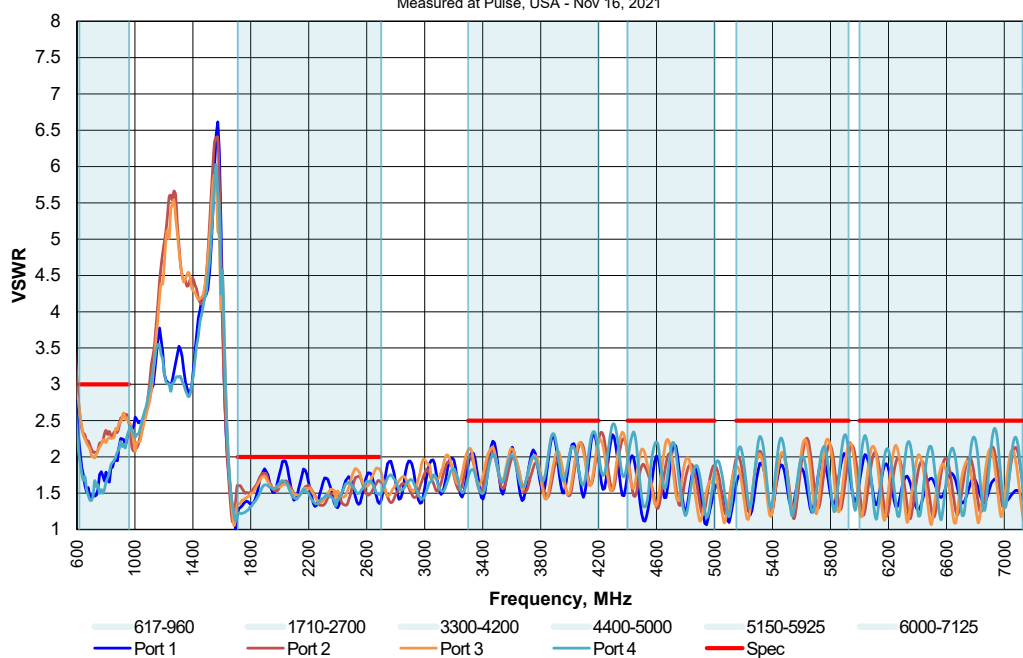
- All measurements done on Ø 600mm (24") round ground plane.
- S-parameters with 0.3m (1ft) RG316 cable
- Gain and Efficiency with 0.3m (1ft) RG316 cable
- Measured at Pulse, USA (in ETS chamber)



#### Charts – VSWR

##### 5G-FR1

**VSWR vs Frequency**  
**TWC94411DM (5G FR1, Ports 1, 2, 3 & 4) Measured on Ø0.6M (24") GP**  
Measured at Pulse, USA - Nov 16, 2021



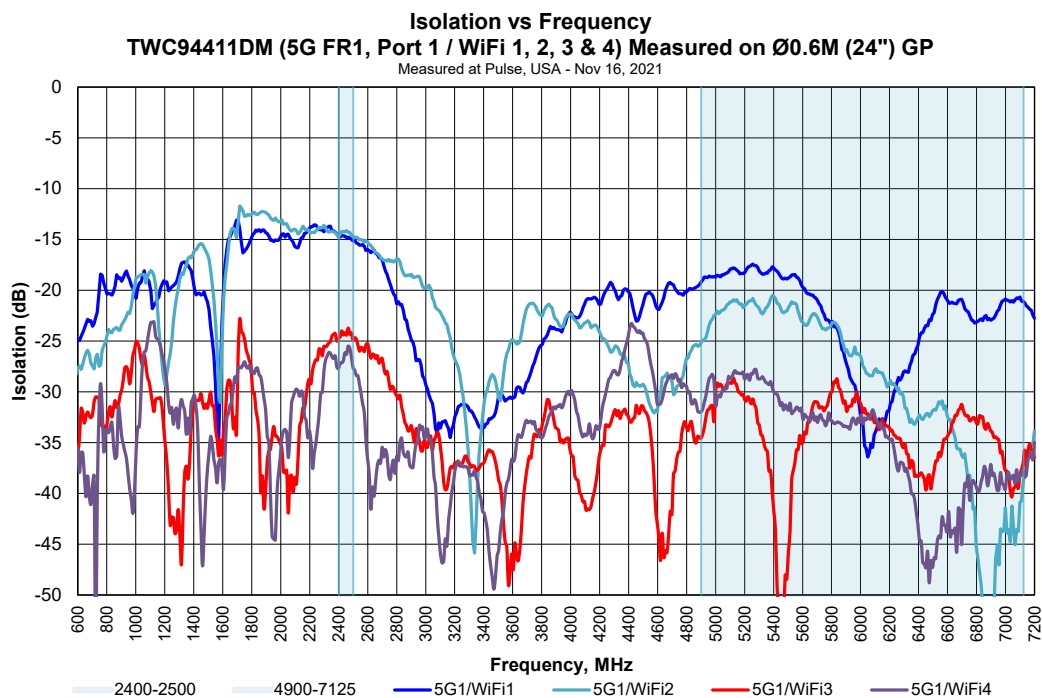
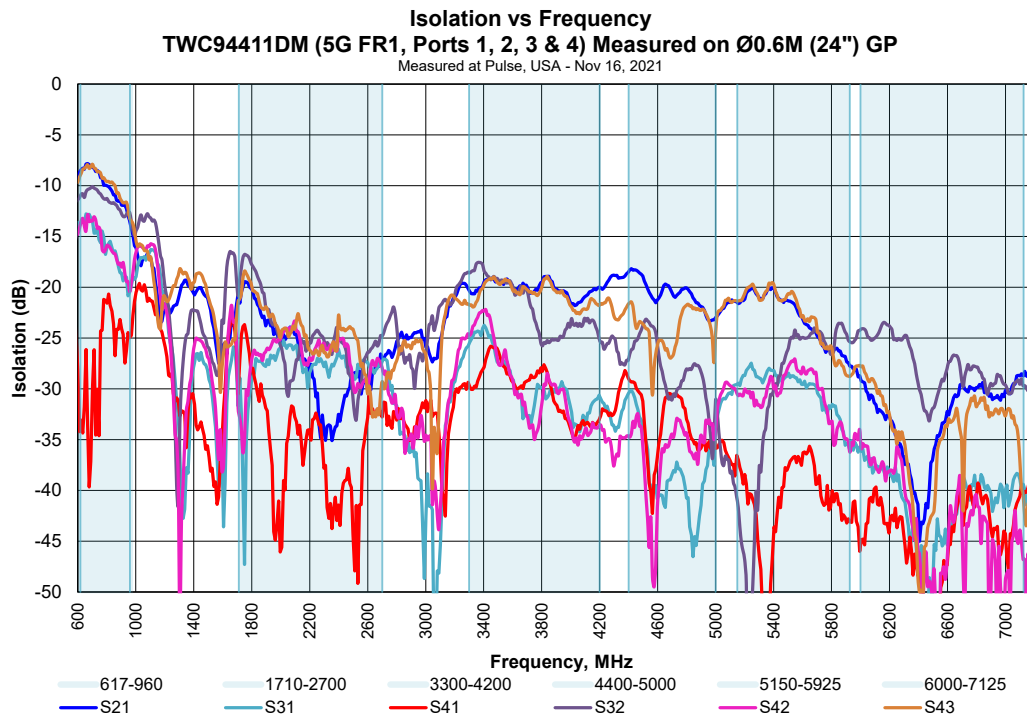
## Vehicular – Twin Castle (TWC) Series

### 5G-FR1+WiFi 6E+GNSS L1 Direct Mount 9-in-1 Antenna

TWC94411DM and TWC94412DM - 617 to 7125 MHz

#### Charts-Isolation

##### 5G-FR1



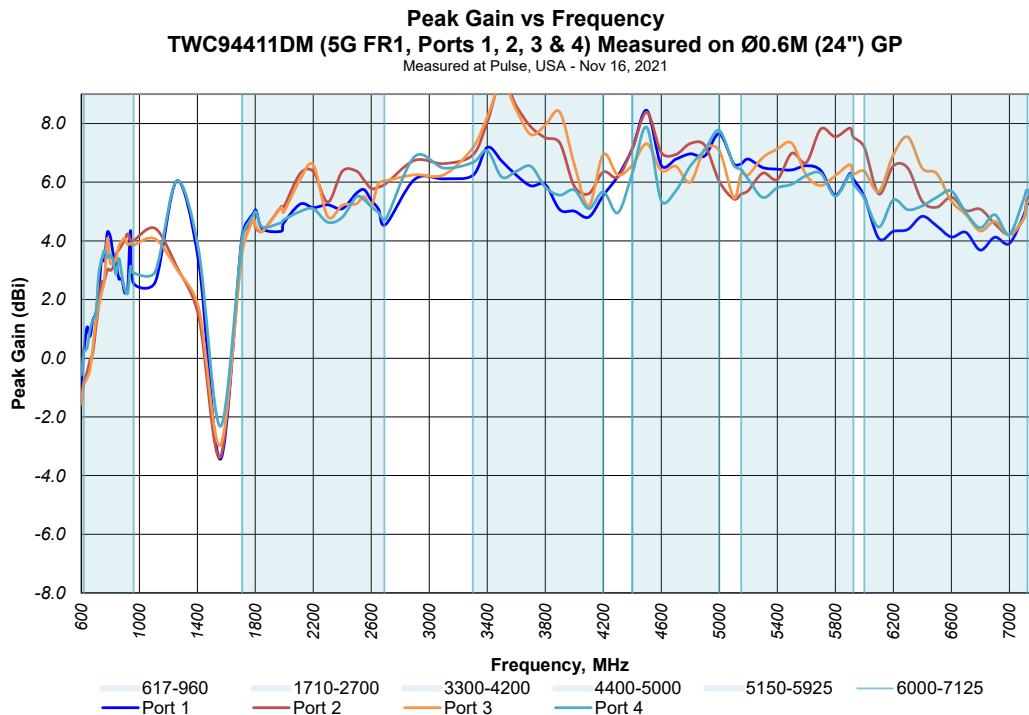
## Vehicular – Twin Castle (TWC) Series

### 5G-FR1+WiFi 6E+GNSS L1 Direct Mount 9-in-1 Antenna

TWC94411DM and TWC94412DM - 617 to 7125 MHz

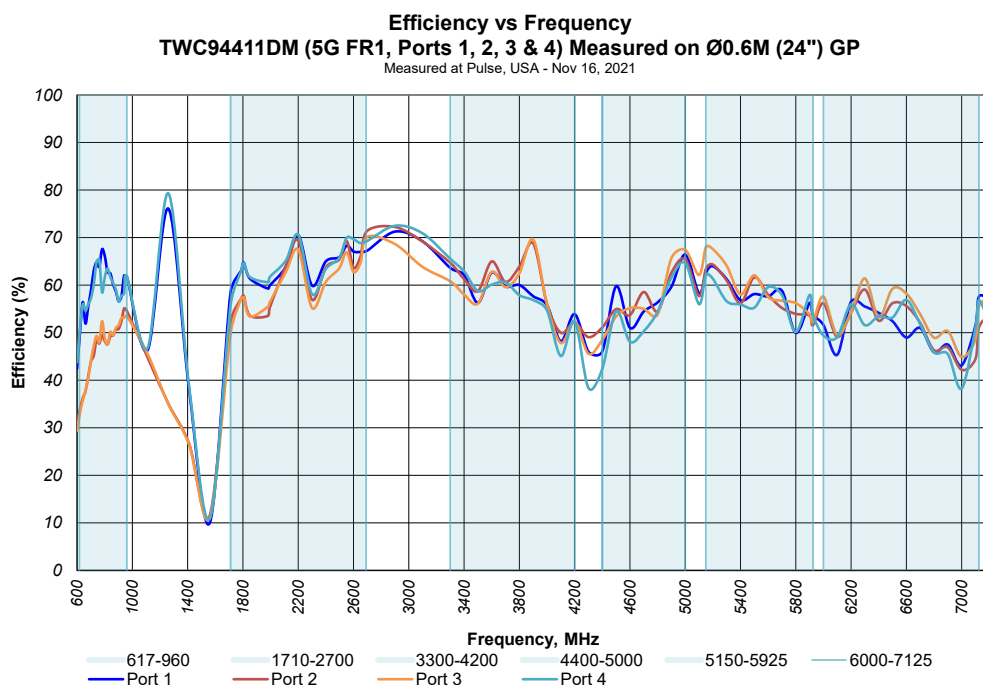
#### Charts-Peak Gain

5G-FR1



#### Charts-Peak Efficiency

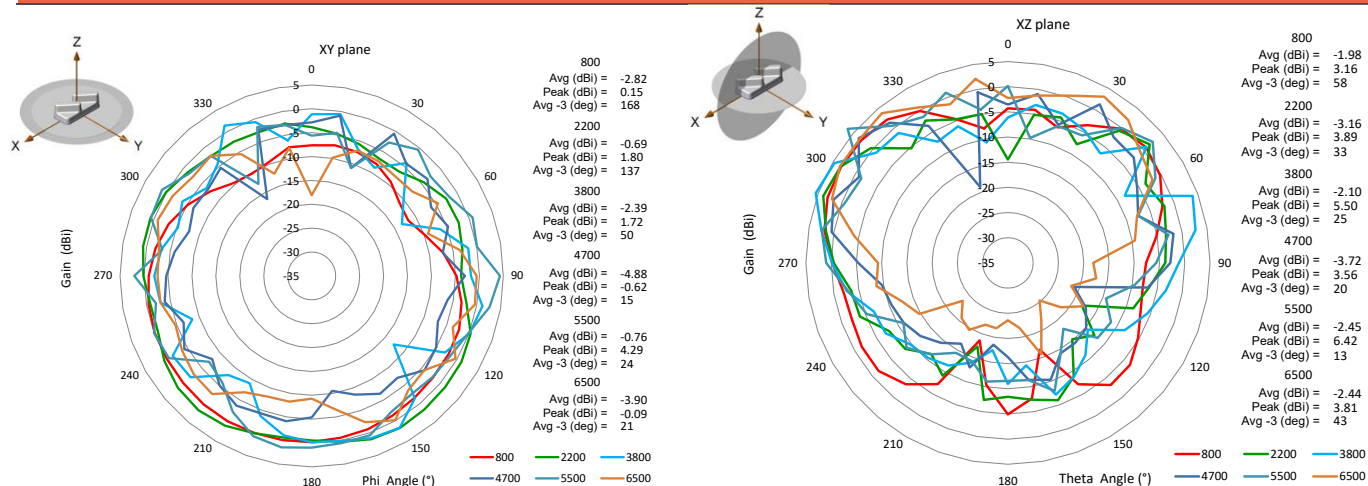
5G-FR1



**Vehicular – Twin Castle (TWC) Series**  
**5G-FR1+WiFi 6E+GNSS L1 Direct Mount 9-in-1 Antenna**  
**TWC94411DM and TWC94412DM - 617 to 7125 MHz**

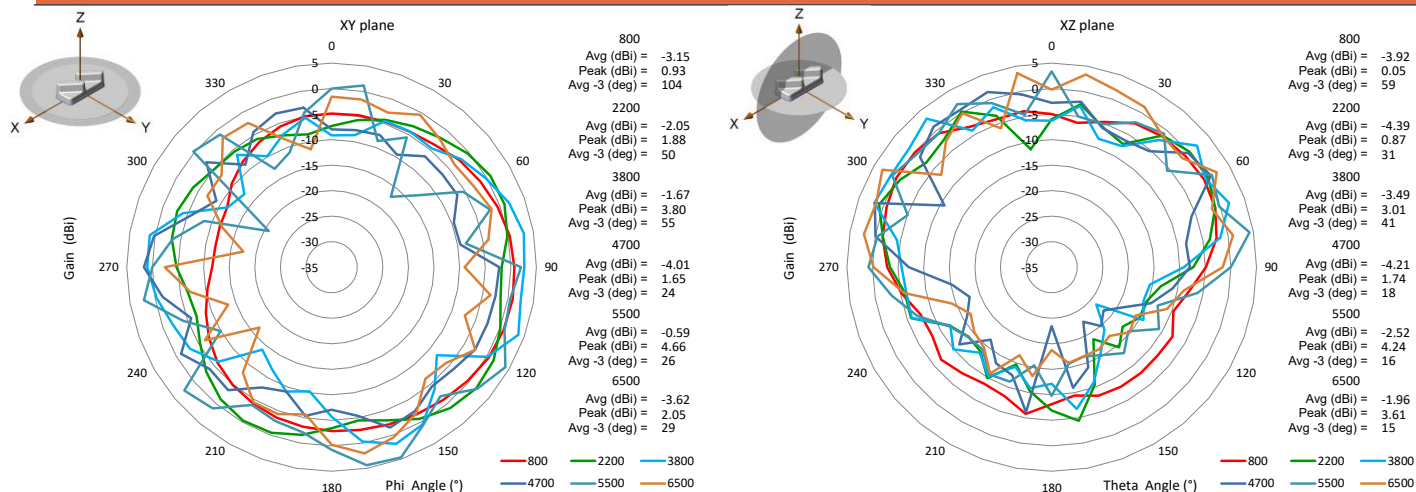
**Radiation Pattern – 5G FR1 – Port 1 – XY & XZ Gain Plot**

**5G-FR1 Port 1**



**Radiation Pattern – 5G FR1 – Port 2 – XY & XZ Gain Plots**

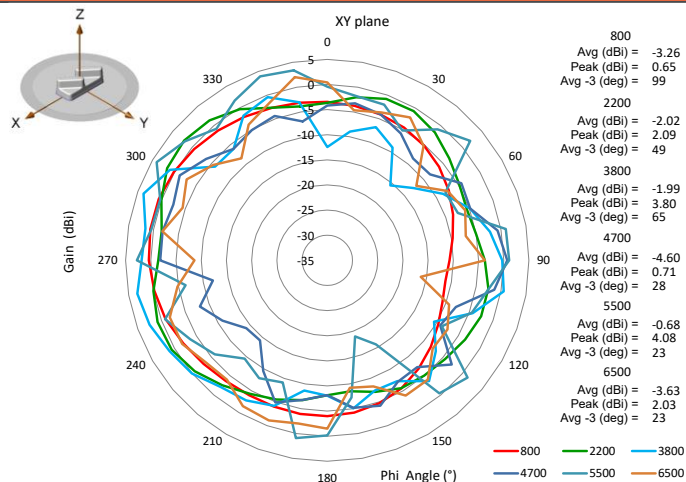
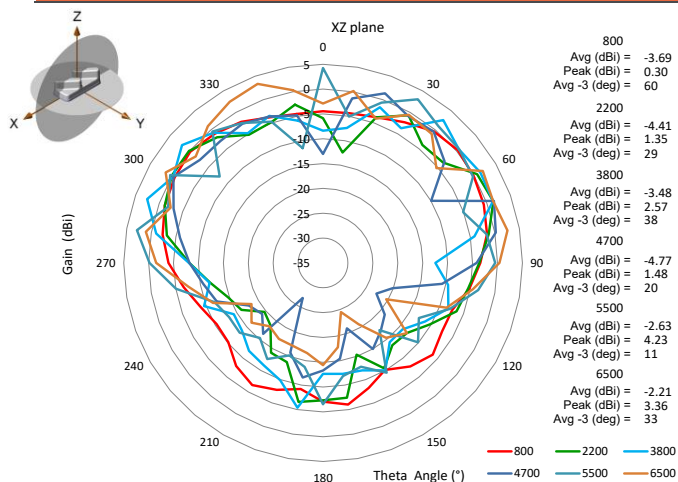
**5G-FR1 Port 2**



**Vehicular – Twin Castle (TWC) Series**  
**5G-FR1+WiFi 6E+GNSS L1 Direct Mount 9-in-1 Antenna**  
**TWC94411DM and TWC94412DM - 617 to 7125 MHz**

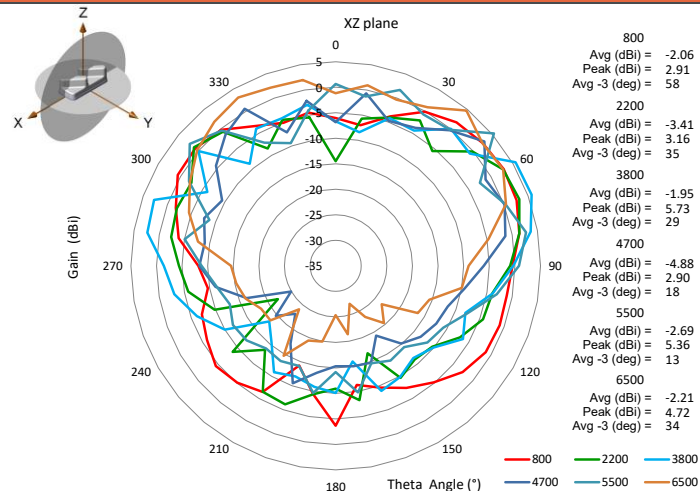
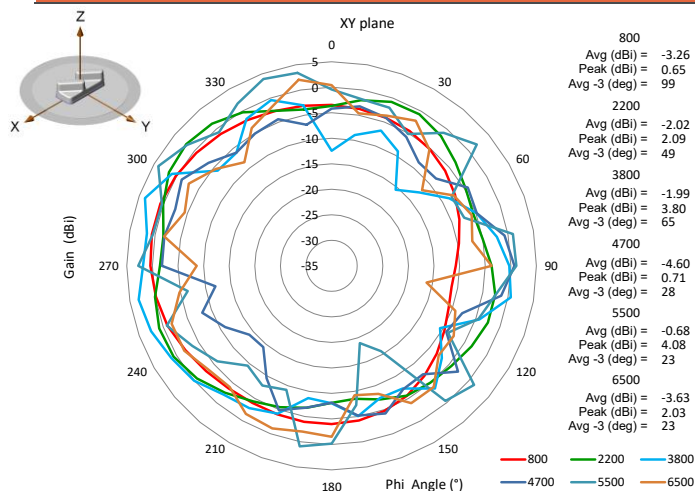
**Radiation Pattern – 5G FR1 – Port 3 - XY & XZ Gain Plots**

**5G-FR1 Port 3**



**Radiation Pattern – 5G FR1 – Port 4 - XY & XZ Gain Plots**

**5G-FR1 Port 4**



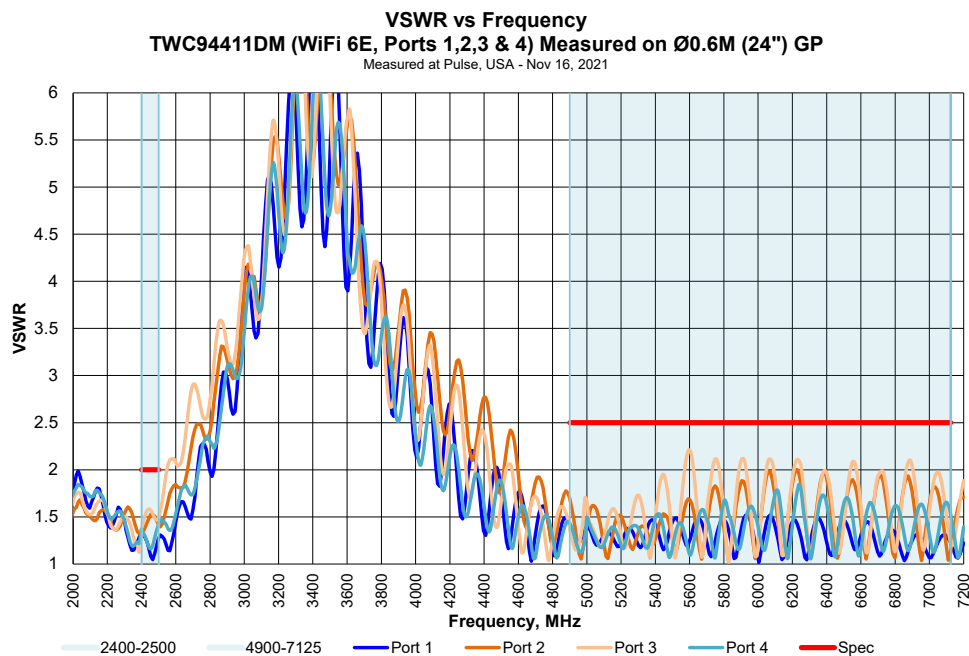
## Vehicular – Twin Castle (TWC) Series

### 5G-FR1+WiFi 6E+GNSS L1 Direct Mount 9-in-1 Antenna

TWC94411DM and TWC94412DM - 617 to 7125 MHz

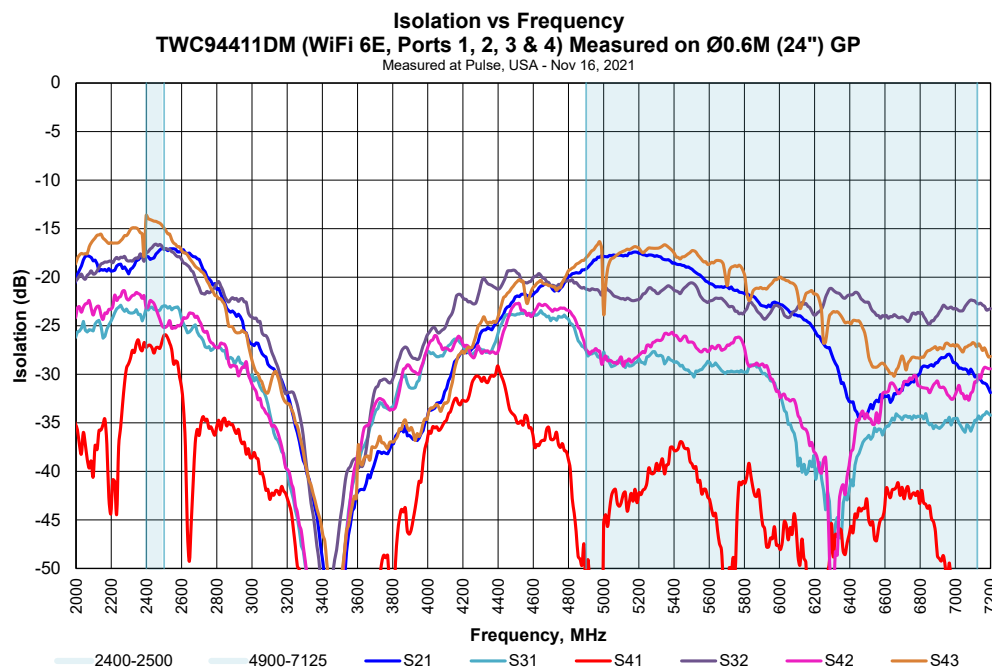
#### Charts-VSWR

##### WiFi 6E



#### Charts--Isolation

##### WiFi 6E



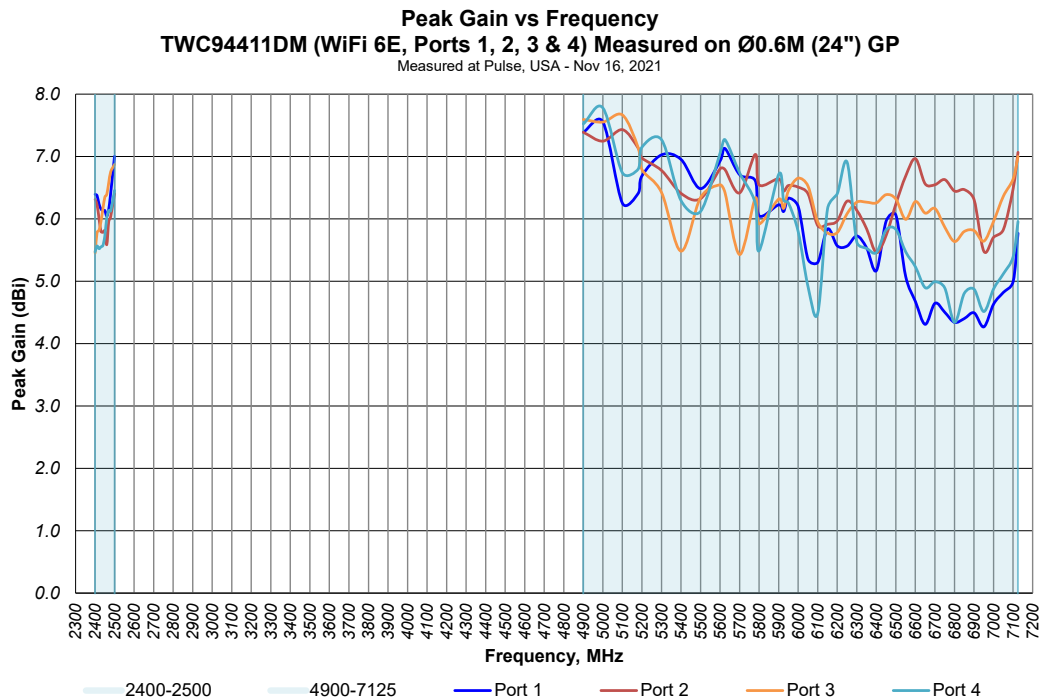
## Vehicular – Twin Castle (TWC) Series

### 5G-FR1+WiFi 6E+GNSS L1 Direct Mount 9-in-1 Antenna

TWC94411DM and TWC94412DM - 617 to 7125 MHz

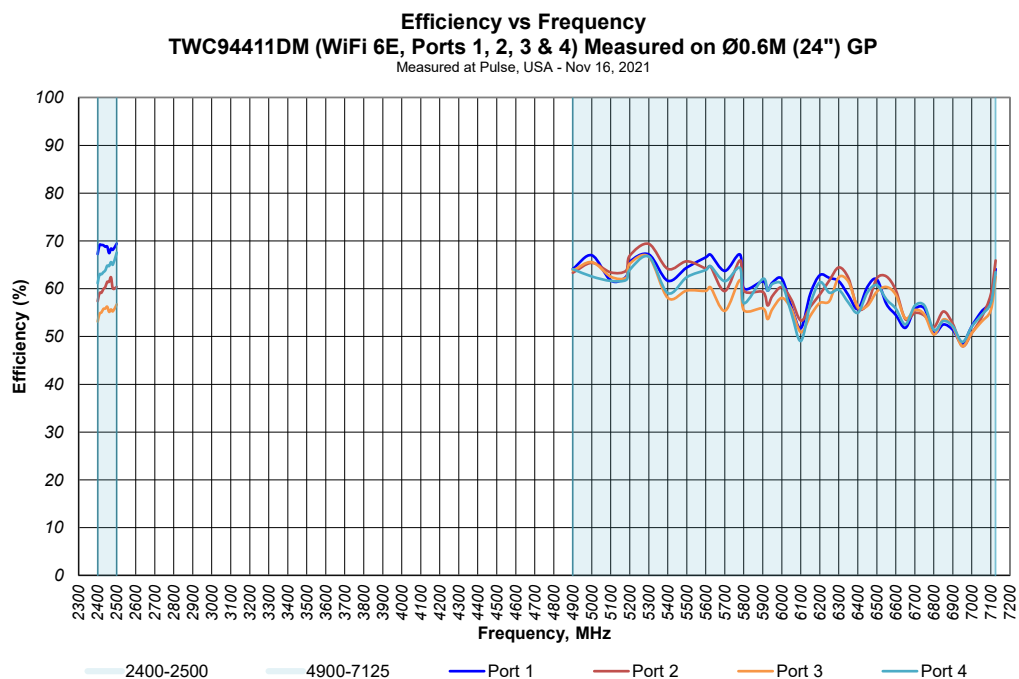
#### Charts-Peak Gain

##### WiFi 6E



#### Charts-Peak Efficiency

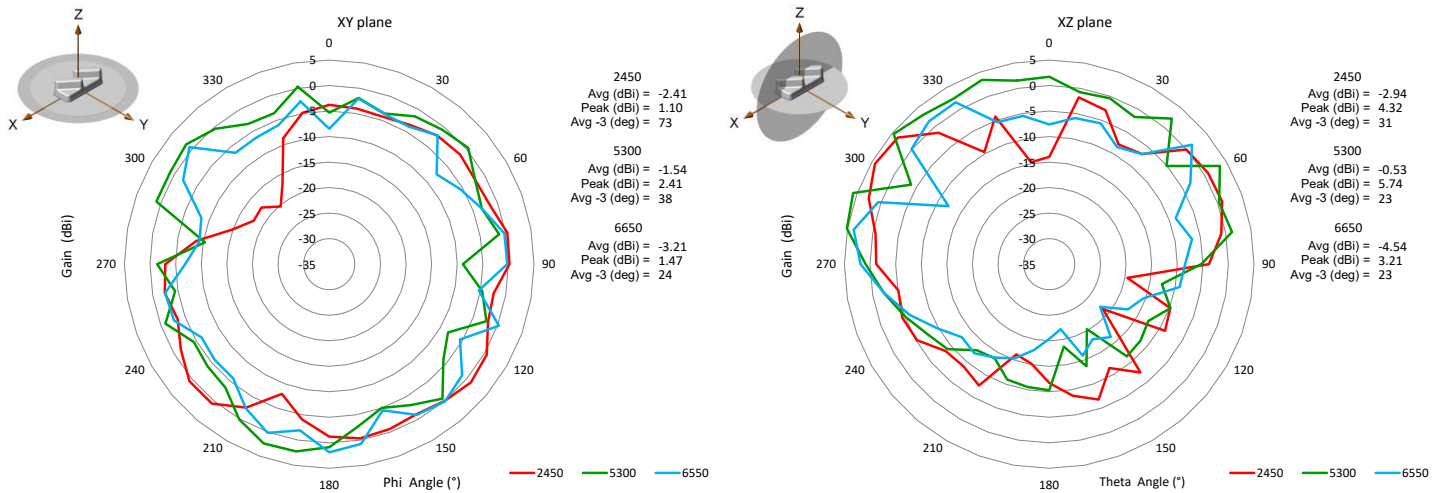
##### WiFi 6E



**Vehicular – Twin Castle (TWC) Series**  
**5G-FR1+WiFi 6E+GNSS L1 Direct Mount 9-in-1 Antenna**  
**TWC94411DM and TWC94412DM - 617 to 7125 MHz**

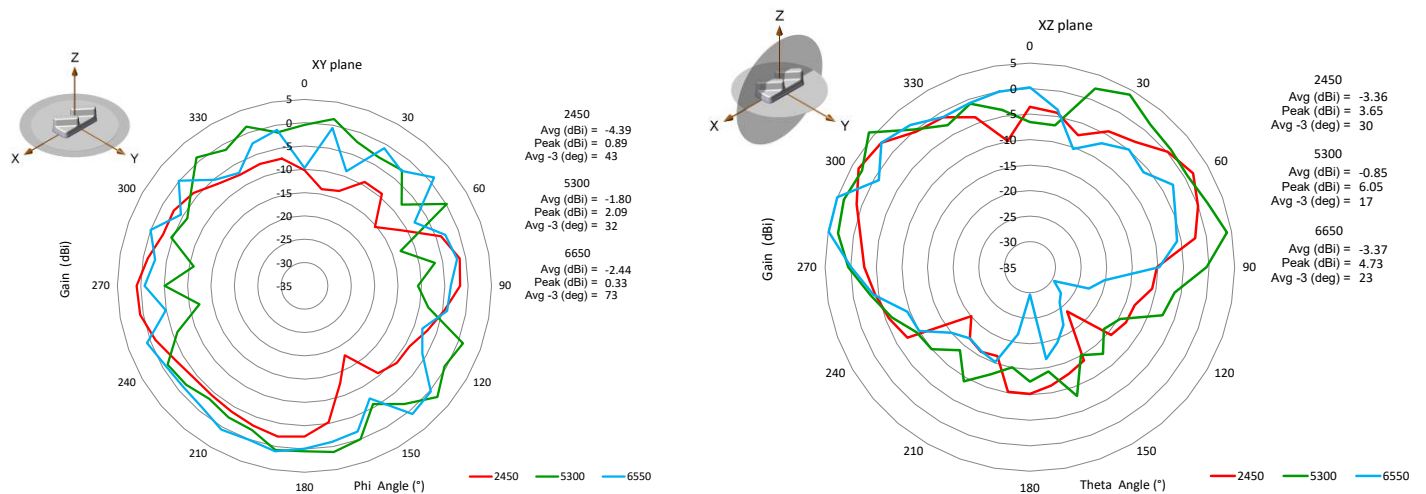
**Radiation Pattern – WiFi 6E – Port 1 - XY & XZ Gain Plots**

**WiFi 6E Port1**



**Radiation Pattern – WiFi 6E – Port 2 - XY & XZ Gain Plots**

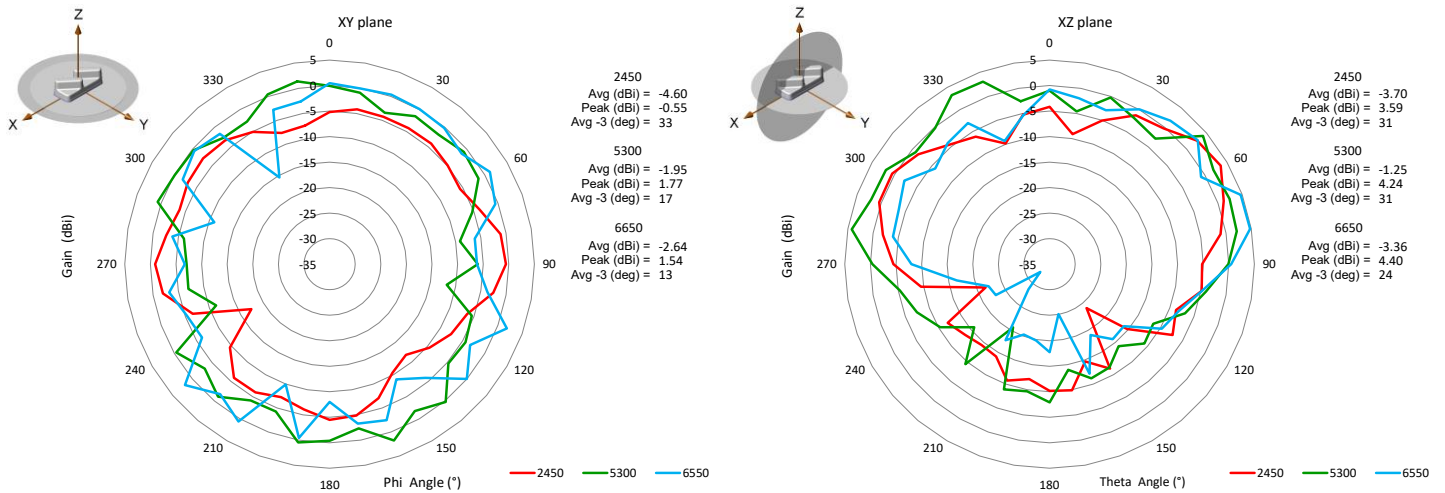
**WiFi 6E Port2**



**Vehicular – Twin Castle (TWC) Series**  
**5G-FR1+WiFi 6E+GNSS L1 Direct Mount 9-in-1 Antenna**  
**TWC94411DM and TWC94412DM - 617 to 7125 MHz**

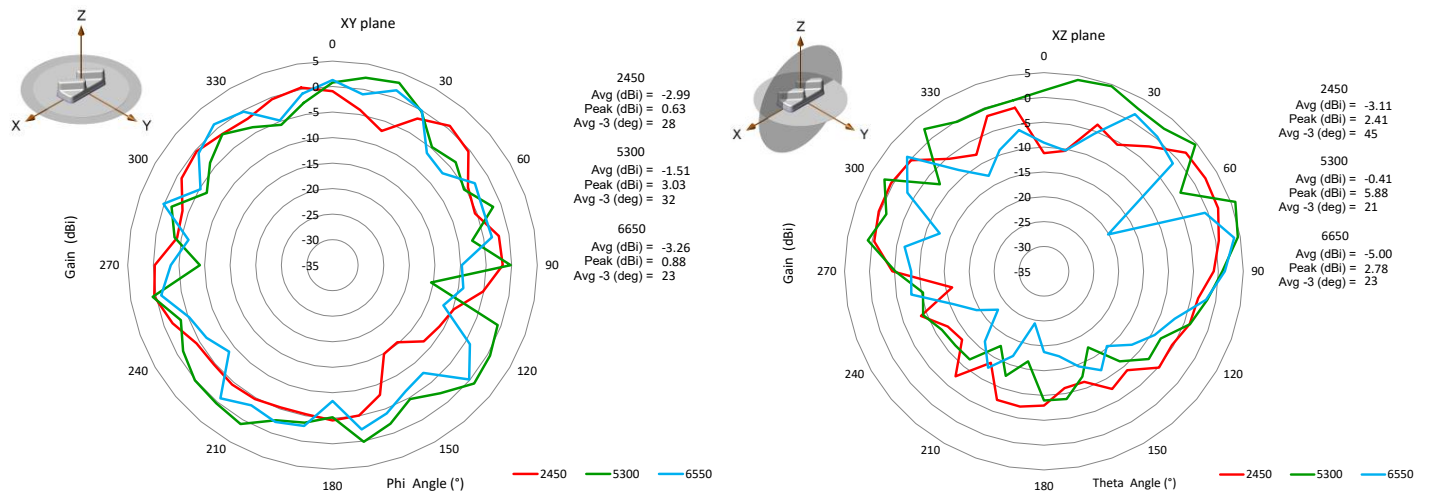
**Radiation Pattern – WiFi 6E – Port 3 - XY & XZ Gain Plots**

**WiFi 6E Port3**



**Radiation Pattern – WiFi 6E – Port 4 - XY & XZ Gain Plots**

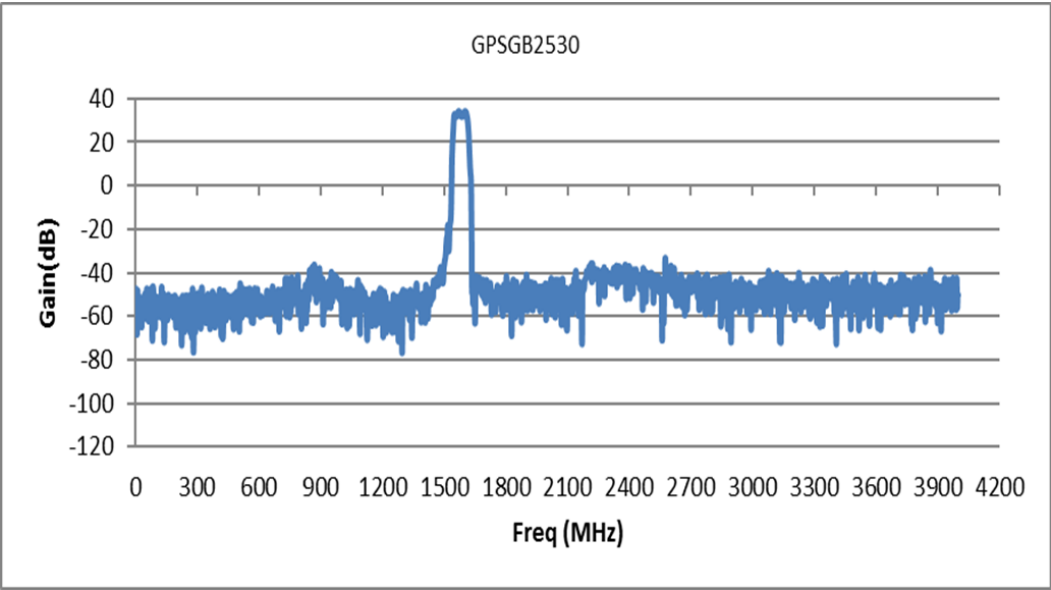
**WiFi 6E Port4**



Vehicular – Twin Castle (TWC) Series  
5G-FR1+WiFi 6E+GNSS L1 Direct Mount 9-in-1 Antenna  
TWC94411DM and TWC94412DM - 617 to 7125 MHz

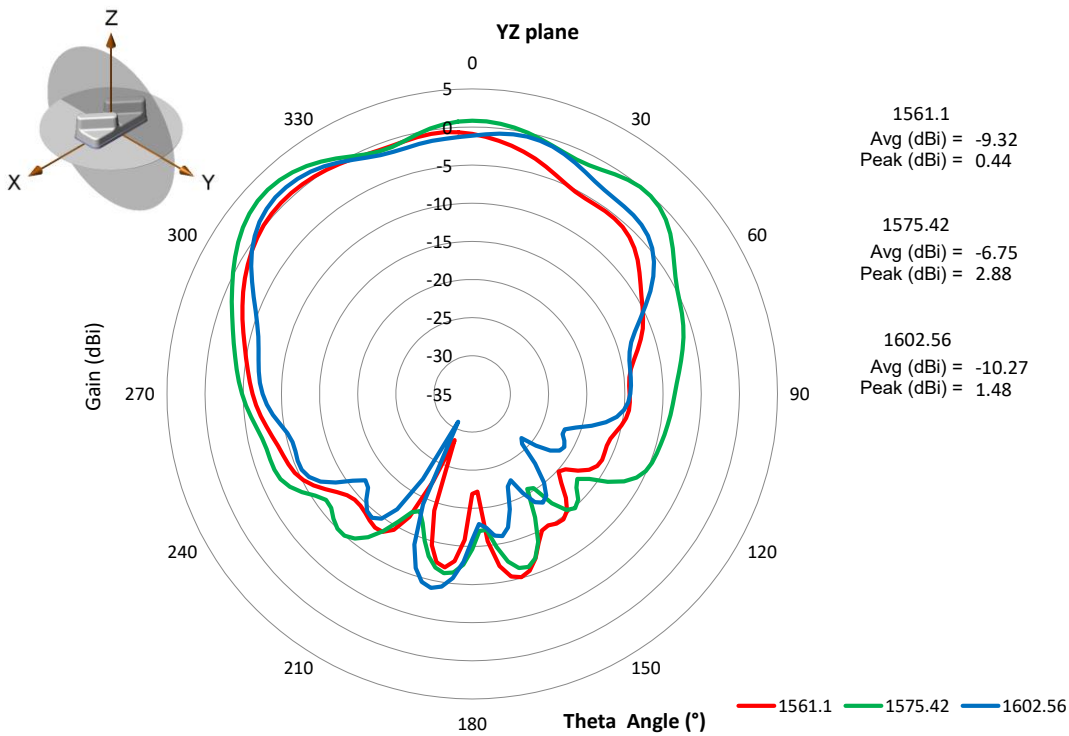
GNSS Antenna - LNA Gain Plots

LNA gain and Out-of-band Rejection



GNSS Antenna - Radiation Pattern (YZ Plane) Plots

YZ Plane: Passive measurement with 6" cable



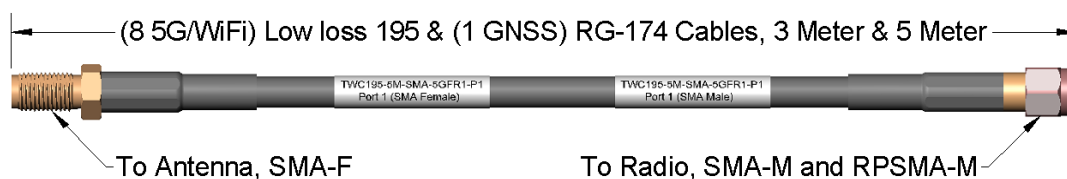
## Vehicular – Twin Castle (TWC) Series

### 5G-FR1+WiFi 6E+GNSS L1 Direct Mount 9-in-1 Antenna

TWC94411DM and TWC94412DM - 617 to 7125 MHz

#### Additional Product Info

#### Cable Assemblies for TWC94411DM (2DM) (Not included)



#### TWC (Twin Castle) Cable Assemblies

##### TWC Cable Assemblies

| Orderable P/N <sup>1</sup> | 5G FR1 Port 1 | 5G FR1 Port 2 | 5G FR1 Port 3 | 5G FR1 Port 4 | WiFi 6E Port 1 | WiFi 6E Port 2 | WiFi 6E Port 3 | WiFi 6E Port 4 | GNSS Port 1 |
|----------------------------|---------------|---------------|---------------|---------------|----------------|----------------|----------------|----------------|-------------|
| TWC9-3M                    | SMA-M         | SMA-M         | SMA-M         | SMA-M         | RPSMA-M        | RPSMA-M        | RPSMA-M        | RPSMA-M        | SMA-M       |
| TWC9-5M                    | SMA-M         | SMA-M         | SMA-M         | SMA-M         | RPSMA-M        | RPSMA-M        | RPSMA-M        | RPSMA-M        | SMA-M       |

#### Family Products – TWC (Twin Castle)

##### Multiport TWC Products - 5G FR1/ WiFi/ GNSS

| Orderable P/N   | No. of Total Ports | No. of 5G FR1 Ports | No. of WiFi 6E Ports | No. of GNSS Ports | Cable Length (Total) | Color |
|-----------------|--------------------|---------------------|----------------------|-------------------|----------------------|-------|
| TWC94411DM      | 9                  | 4                   | 4                    | 1                 | 0.3M                 | Black |
| TWC94412DM      | 9                  | 4                   | 4                    | 1                 | 0.3M                 | White |
| TWC94411DM3MKIT | 9                  | 4                   | 4                    | 1                 | 3.3M                 | Black |
| TWC94412DM3MKIT | 9                  | 4                   | 4                    | 1                 | 3.3M                 | White |
| TWC94411DM5MKIT | 9                  | 4                   | 4                    | 1                 | 5.3M                 | Black |
| TWC94412DM5MKIT | 9                  | 4                   | 4                    | 1                 | 5.3M                 | White |
| TWC74211DM06M   | 7                  | 4                   | 2                    | 1                 | 0.6M                 | Black |
| TWC44001DM      | 4                  | 4                   | 0                    | 0                 | 0.3M                 | Black |
| TWC44002DM      | 4                  | 4                   | 0                    | 0                 | 0.3M                 | White |

#### Notes:

1. TWC9-3M Included in TWC94411DM3MKIT (2DM3MKIT). TWC9-5M Included in TWC94411DM5MKIT (2DM5MKIT)
2. Please contact sales for availability, lead time, and/or any special requests. Samples available upon request.

## Vehicular – Twin Castle (TWC) Series

### 5G-FR1+WiFi 6E+GNSS L1 Direct Mount 9-in-1 Antenna

TWC94411DM and TWC94412DM - 617 to 7125 MHz

#### PACKAGING Specification

##### TWC94411DM (TWC94412DM)

#### Antennas packed in PE bag and carton box

1pcs antennas per plastic bag  
2pcs antennas per package box  
Package box: 17inch x12inch x 9inch



#### For more information

Americas - [antennas.us@pulseelectronics.com](mailto:antennas.us@pulseelectronics.com) | Europe – [antennas.eu@pulseelectronics.com](mailto:antennas.eu@pulseelectronics.com) | Asia – [antennas.as@pulseelectronics.com](mailto:antennas.as@pulseelectronics.com) | Questions? +1-800-ANTENNA  
Performance warranty of products offered on this data sheet is limited to the parameters specified. Data is subject to change without notice. Other brand and product names mentioned herein may be trademarks or registered trademarks of their respective owners. © Copyright , 2020. Pulse Electronics, Inc. All rights reserved.  
Company address: Pulse Electronics, a YAGEO Company, 15255 Innovation Drive, Suite #100, San Diego, CA 92128.

***‘YAGEO Corporation and its affiliates do not recommend the use of commercial, automotive, and/or COTS grade products for high reliability applications or manned space flight.’***

Issue: (26/04)