



MA515.C.CG.001  
on ground-plane

## Hercules

MA515.C.CG.001

## Specification

<b>Part No.</b>	<b>MA515.C.CG.001</b>
<b>Product Name</b>	<b>Hercules</b> Heavy Duty Screw Mount Antenna MIMO Single Band 2.4GHz
<b>Feature</b>	2.4GHz suitable for ISM Bands/ZigBee/WLAN/Bluetooth IEEE.802.11n High Isolation between Antenna Elements UV and vandal resistant PE housing IP67 & IP69K compliance Height 29mm Diameter 49mm RoHS Compliant

## 1. Introduction

MIMO communication systems are needed in high speed wireless applications. A MIMO (Multiple-Input-Multiple-Output) system uses at least two antenna structures and is more advantageous than single-input single-output (SISO) by increasing channel capacity and reducing transmitting power. MIMO antennas should have compact structure, high radiation efficiency, low envelope correlation, and high isolation between the signal ports.

In small structures (antennas spaced closely), the application of MIMO technology has been restricted by high degree of coupling and spatial correlation between antenna elements due to the limited available space.

The isolation between antennas become critical as it can deteriorate the system

performance and decreases channel capacity. Taoglas have designed the Hercules MA515 antenna to meet these demanding requirements

The Hercules MA515 MIMO 2.4GHz 3dBi antenna is low profile, heavy-duty, fully IP67 and IP69K waterproof external M2M antenna for use, transportation and remote monitoring applications. This unique omni-directional 3dBi antenna provide high efficiency and high isolation (>20dB), between antennas elements in a heavy-duty low profile compact structure, delivering powerful MIMO antenna technology for Wi-Fi 802.11n.

The antenna screws down permanently onto a roof or metal panel and can be pole or wall-mounted. The two antenna elements are vertically polarized, matching well with the polarization of most wireless

routers antennas. An envelope correlation co-efficiency of only 0.2 ensures good performance with the MIMO module.

For industries such as remote monitoring, smart meter systems, construction equipment, public safety at only 29mm high, the Hercules MA515 MIMO antenna provides an unobtrusive, robust, rugged antenna that is durable even in extreme environments.

## 2. Specification

### Electrical

	Antenna 1	Antenna 2
<b>Operation Frequency (GHz)</b>	2.4~2.5	2.4~2.5
<b>Polarization</b>	Linear	Linear
<b>Impedance (ohms)</b>	50Ω	50Ω
<b>Min Isolation (dB)</b>	-25	-25
<b>Max VSWR</b>	2.0:1	2.0:1
<b>Max Return Loss (dB)</b>	-10	-10
<b>Peak Gain (dBi)</b>	3.0	3.0
<b>Efficiency (%)</b>	56	56
<b>Average Gain (dB)</b>	-2.5	-2.5
<b>Radiation Properties</b>	Omni - Directional	Omni - Directional
<b>Max Input Power</b>	2W Max	

### Mechanical

<b>Dimensions (mm)</b>	Height=29mm Diameter=49mm
<b>Cable</b>	1M RG316 - Fully Customizable
<b>Casing</b>	UV Resistant PC
<b>Base and Thread</b>	Nickel plated Zinc Alloy/Steel
<b>Weather proof gasket</b>	CR4305 foam with 3M9448WC double-side adhesive
<b>Connector</b>	RP-SMA Male Fully Customizable
<b>Tread Diameter (mm)</b>	18mm
<b>Sealant</b>	Rubber Stopper

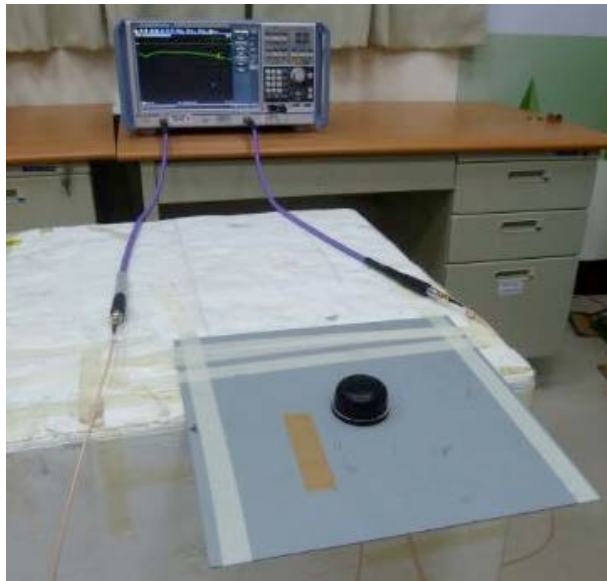
### Environmental

<b>Protection</b>	IP67 & IP69K
<b>Corrosion</b>	5% NaCl for 96hrs- Nickel plated steel base and thread
<b>Temperature Range</b>	-40°C to +85°C
<b>Thermal Shock</b>	100 cycles -40°C to +85°C
<b>Humidity</b>	Non-condensing 65°C 95% RH
<b>Shock (Drop Test)</b>	1M drop on concrete 6 axes

\* The Hercules MA515 MIMO antenna performance was measured with RG316 coaxial cable at 1 meter cable length on a 30x30 cm ground plane.

### 3. Antenna Characteristics

#### 3.1 Test Set-Up



**Figure 1.** Impedance measurements.



**Figure 2.** Peak gain, efficiency and radiation pattern measurements.

### 3. Antenna Characteristics

#### 3.2 Return Loss

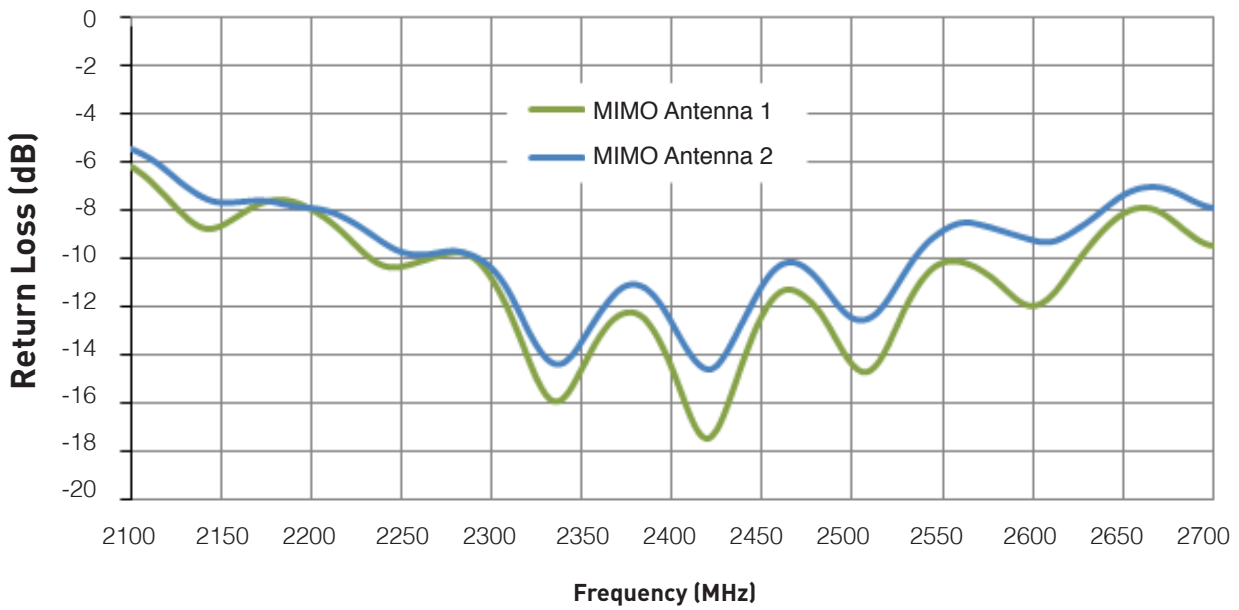


Figure 3. Return loss of the Hercules MA515 MIMO antenna from 2100 MHz to 2700 MHz.

#### 3.3 VSWR

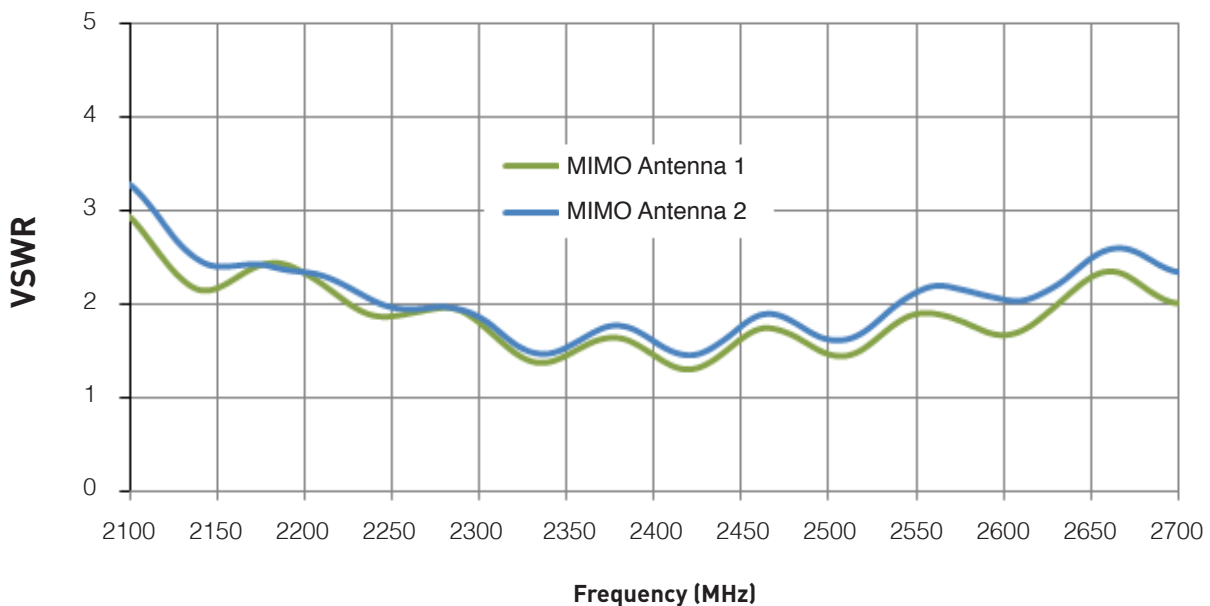


Figure 4. VSWR of the Hercules MA515 MIMO antenna from 2100 MHz to 2700 MHz.

### 3. Antenna Characteristics

#### 3.4 Isolation

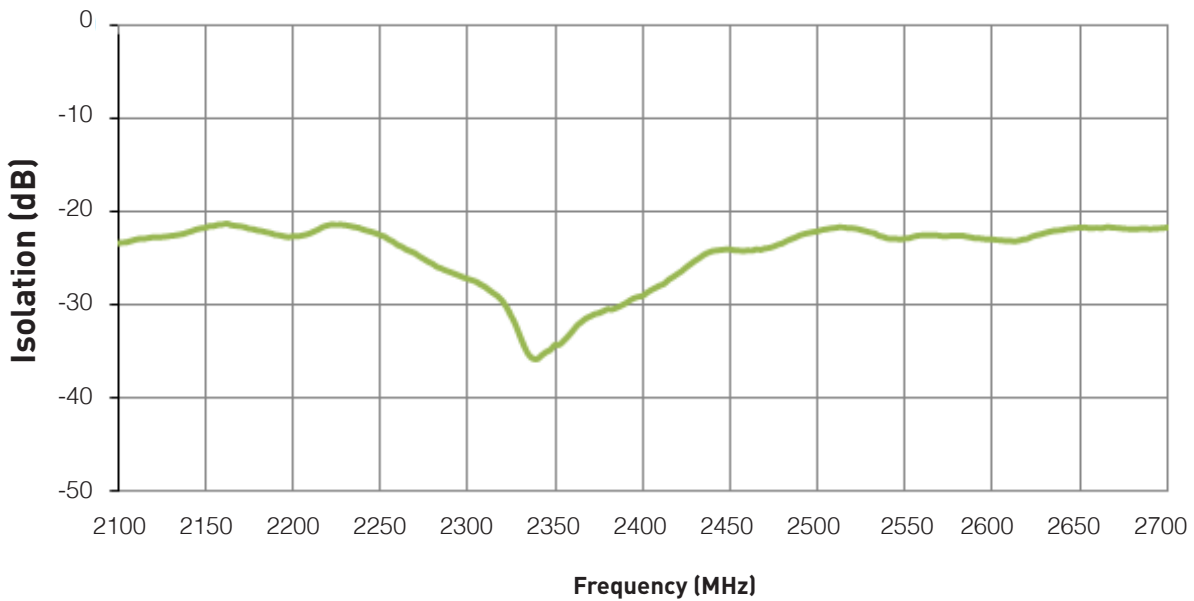


Figure 5. Isolation of the Hercules MA515 MIMO antenna from 2100 MHz to 2700 MHz

#### 3.5 Envelope Correlation Coefficient (ECC)

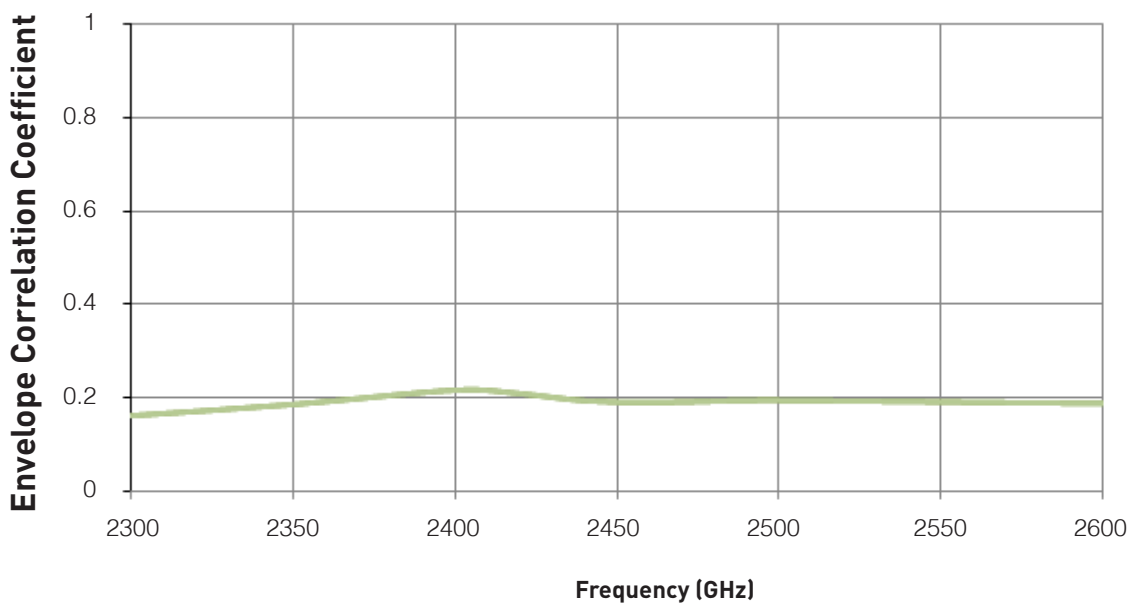


Figure 6. ECC of the Hercules MA515 MIMO antenna from 2300 MHz to 2600 MHz.

### 3. Antenna Characteristics

#### 3.6 Efficiency

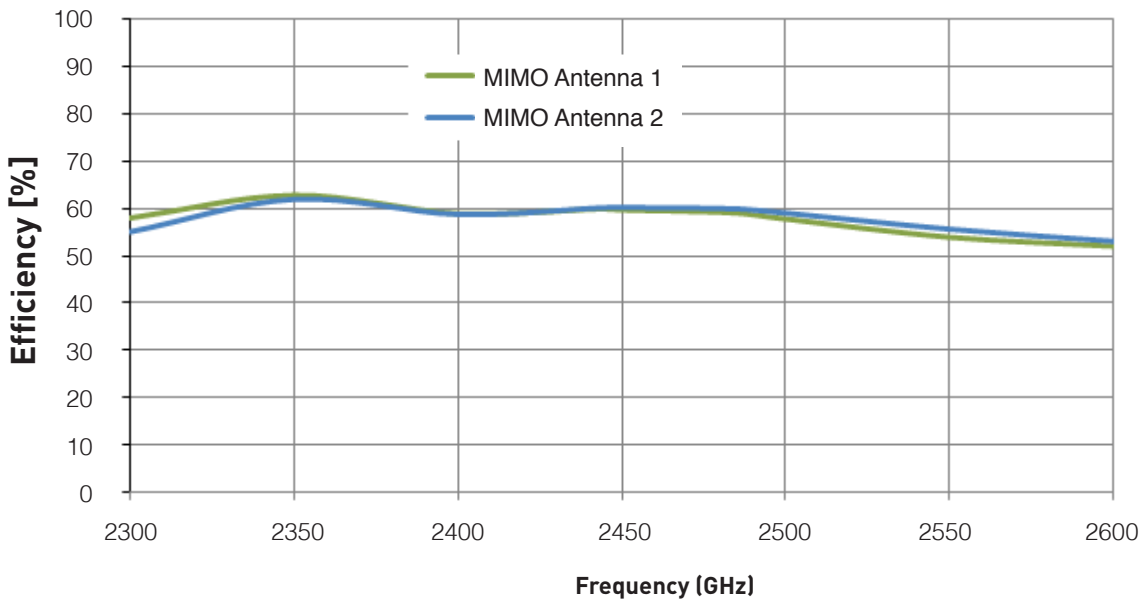


Figure 7. Efficiency of the Hercules MA515 MIMO antenna from 2300 MHz to 2600 MHz.

#### 3.7 Peak Gain

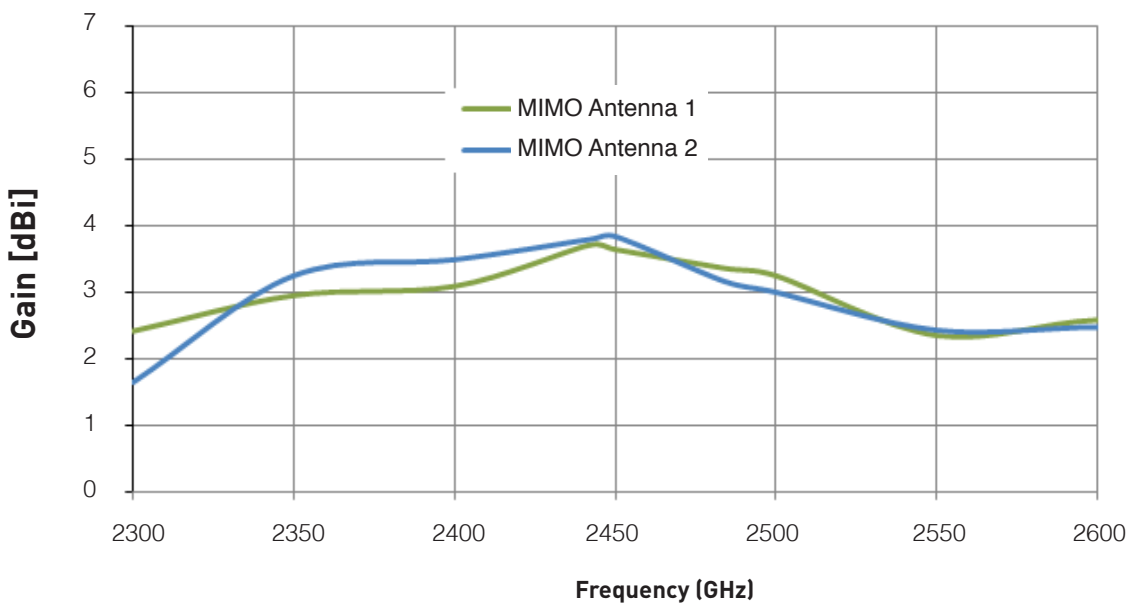


Figure 8. Peak Gain of the Hercules MA515 MIMO antenna from 2300 MHz to 2600 MHz.

### 3. Antenna Characteristics

#### 3.8 Average Gain

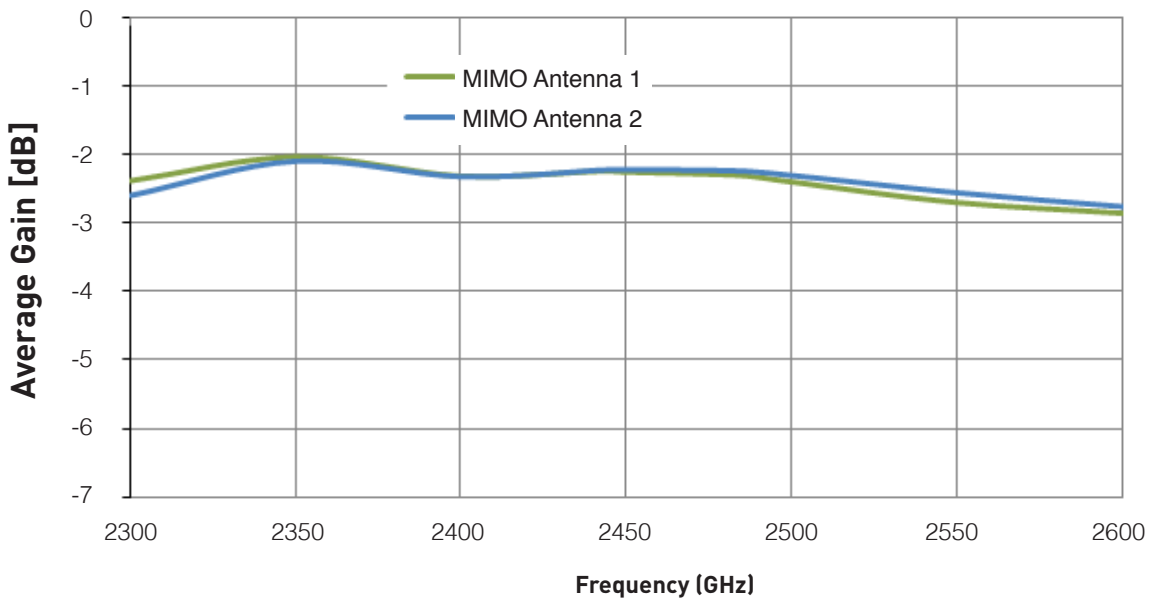


Figure 9. Average Gain of the Hercules MA515 MIMO antenna from 2300 MHz to 2600 MHz.

#### 3.9 3D Radiation Patterns

Azimuth = 3.0  
Elevation = -3.0  
Roll = -40.0

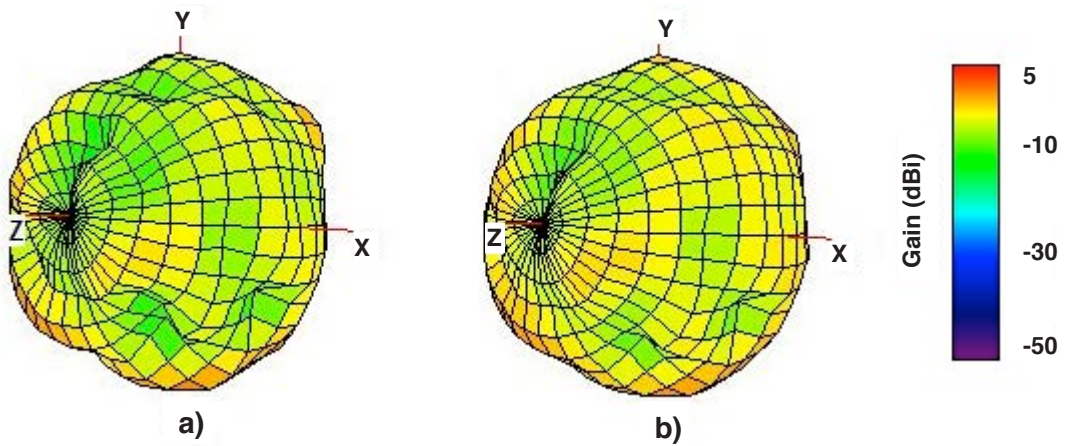
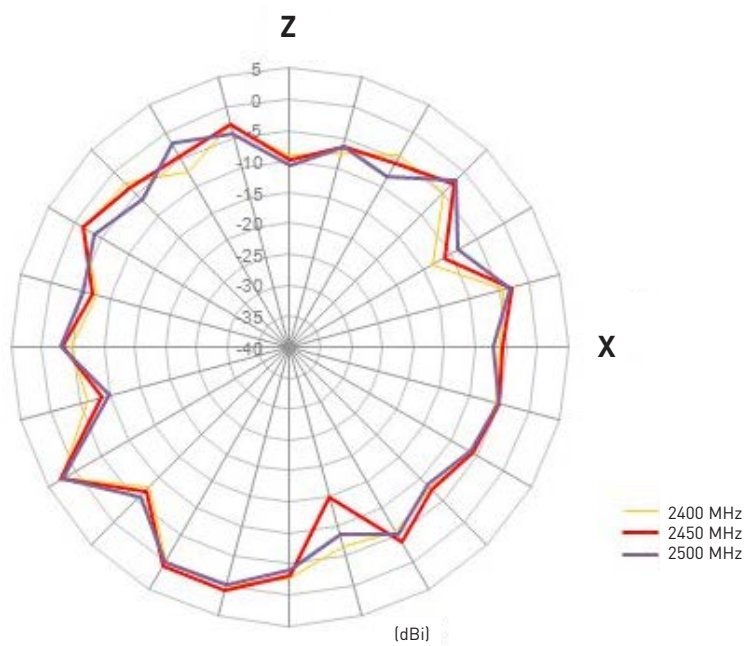
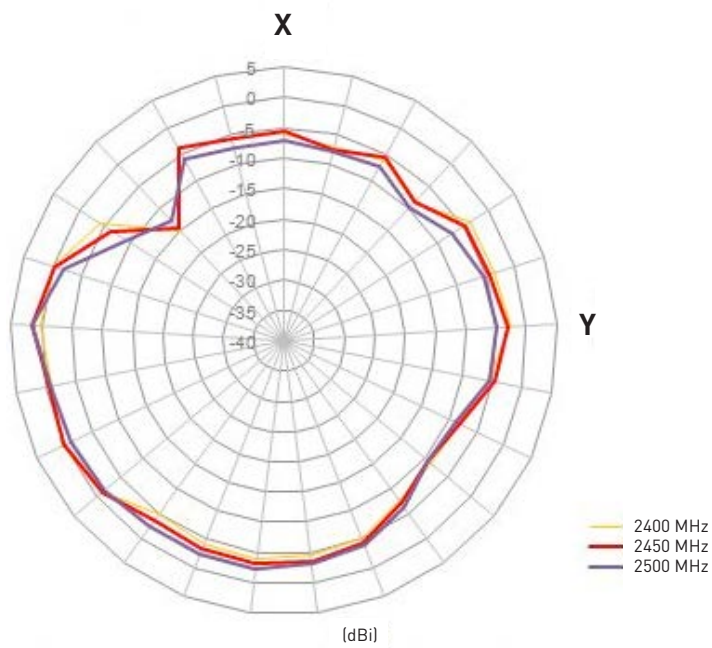


Figure 10. 3D Radiation Pattern at 2450 MHz of the MA515 Antenna, a) Antenna 1, b) Antenna 2



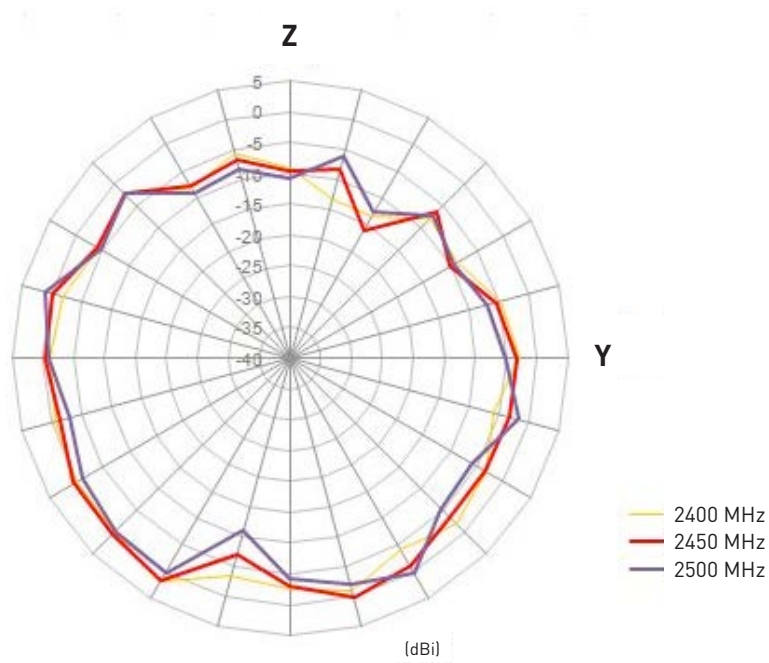
### 3.10 2D Radiation Patterns

#### 3.10.1 MIMO Antenna 1 2400 MHz Band

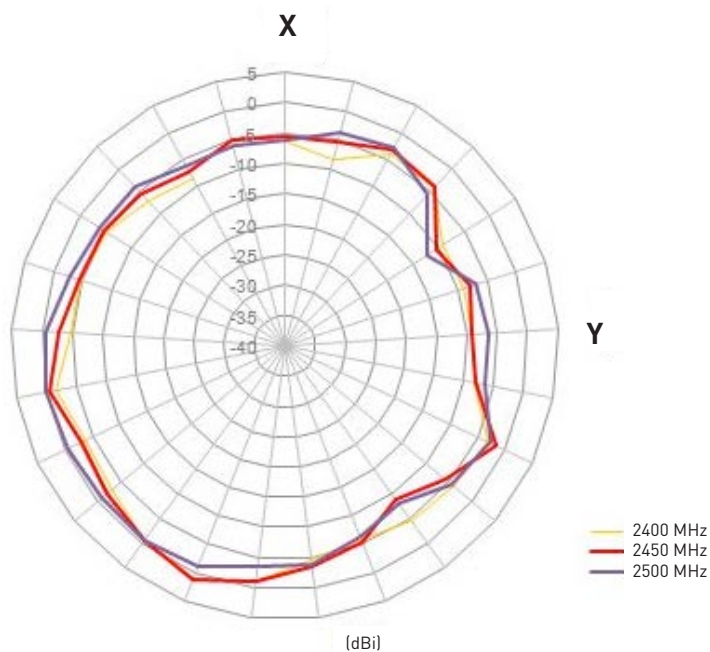


### 3.10 2D Radiation Patterns

#### 3.10.1 MIMO Antenna 1 2400 MHz Band



**Figure 11.** 2D Radiation Pattern at 2400MHz band



### 3.10 2D Radiation Patterns

#### 3.10.1 MIMO Antenna 1 2400 MHz Band

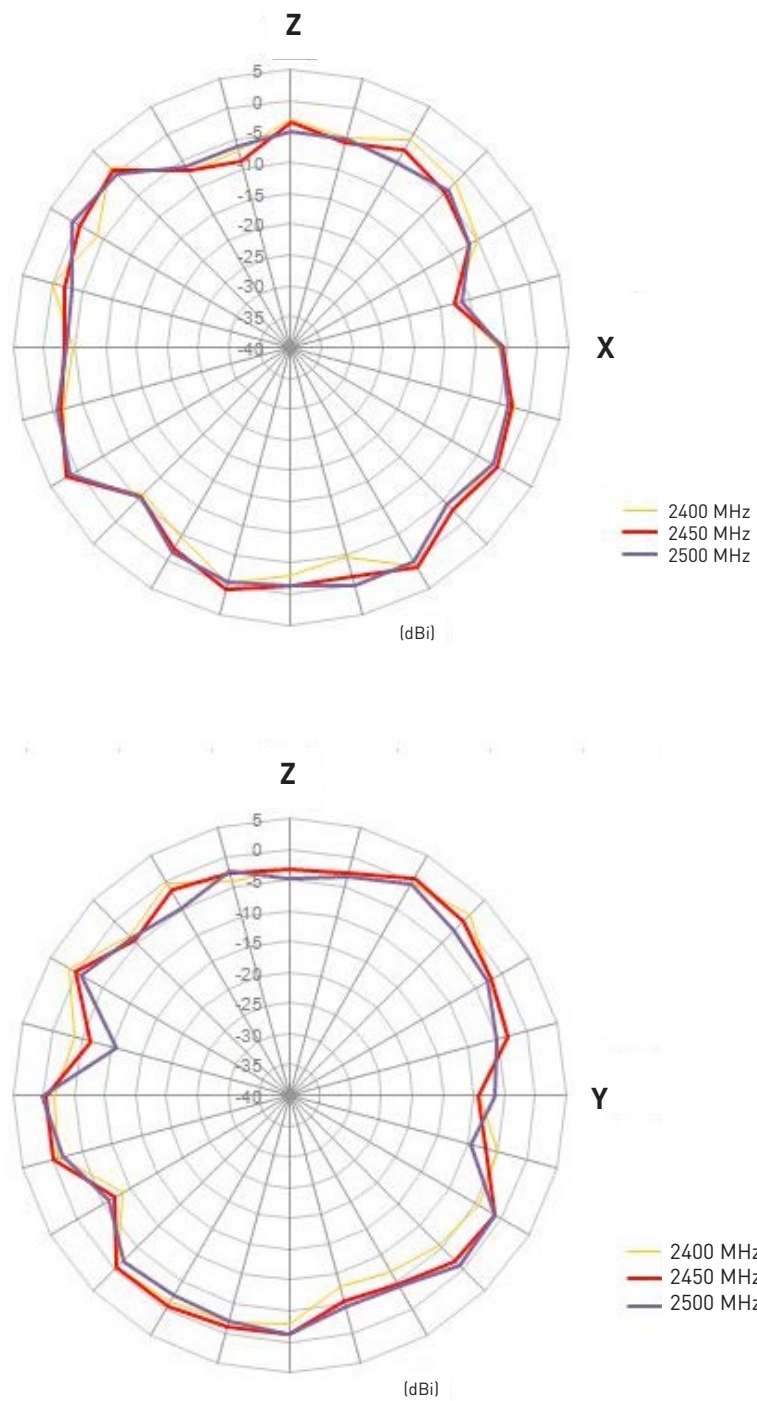
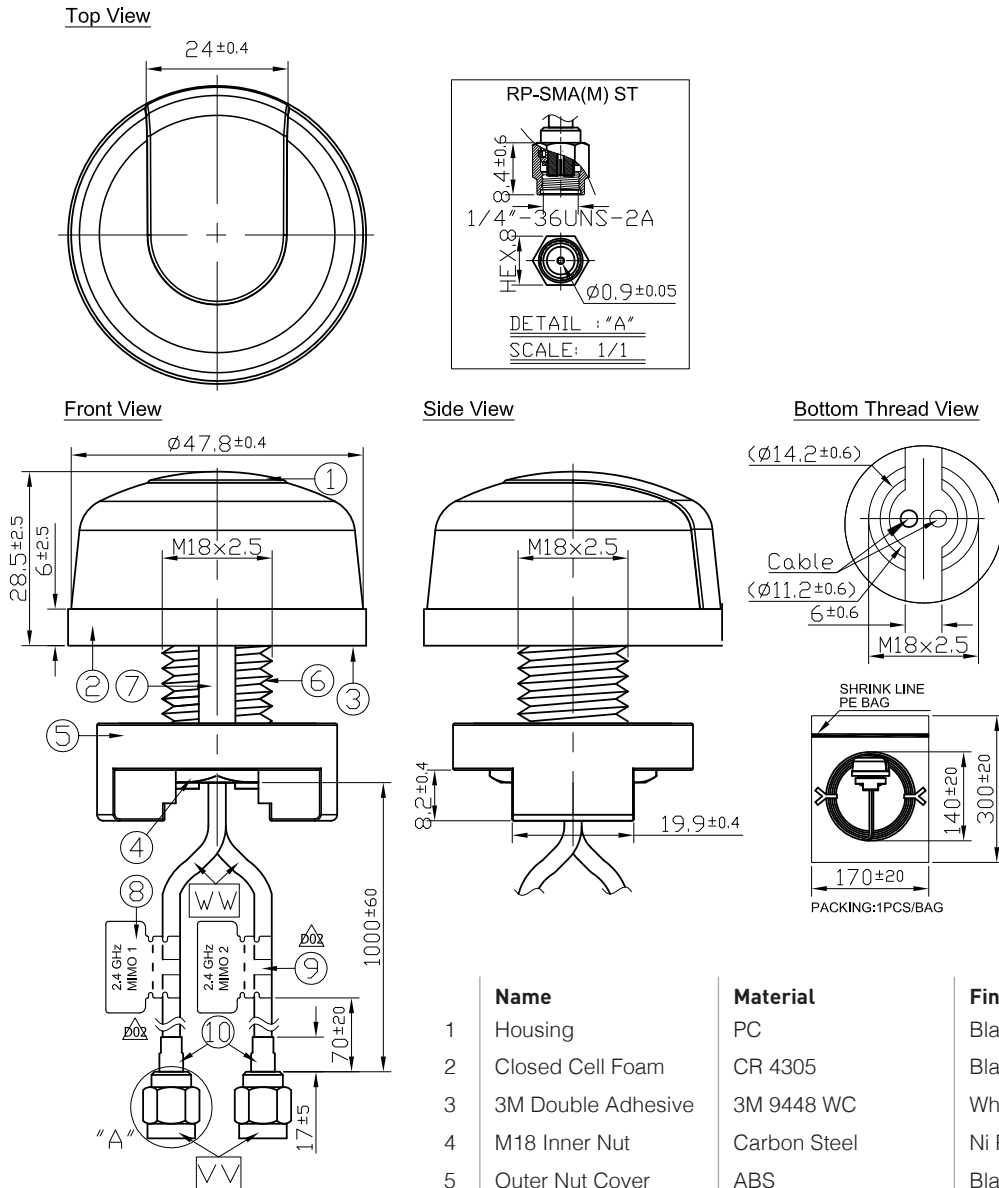


Figure 12. 2D Radiation Pattern at 2400MHz band

## 4. Antenna Drawing

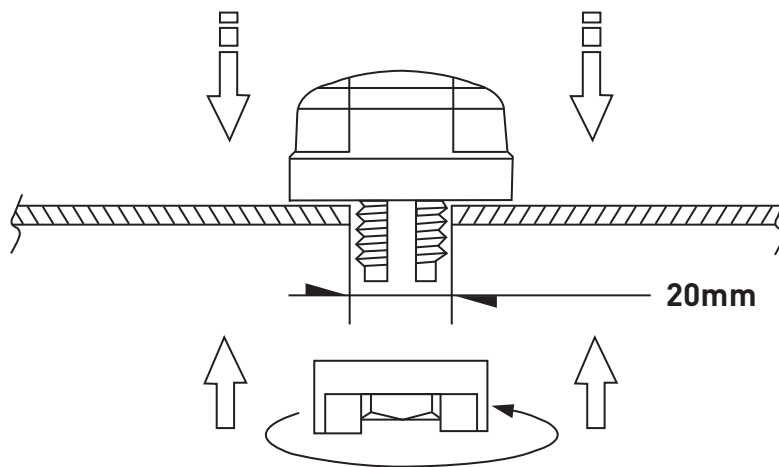


NOTES:  
1.Part Number: MA.515.C.C108151.G108151

**Figure 13.**  
Antenna Drawing

	Name	Spec	Finish	QTY
WW	Cable Type	RG316 Coaxial Cable	Brown	2
VV	Connector Type	RP-SMA(M) ST	Gold	2

## 5. Installation

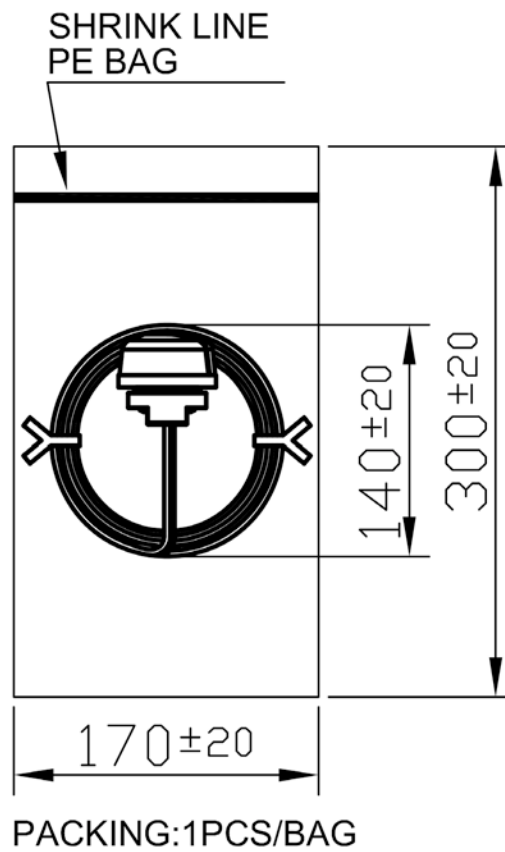


Recommended torque for mounting is 95Nm or 70ftlbs  
 Maximum torque for mounting is 135.6Nm or 100ft lbs



**Figure 14.** Installation

## 6. Packaging



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