

# **SPECIFICATION**

#### MA104 GPS/GSM Combo Hercules Penta-Band Cellular Antenna

Part No. : **MA104.C.A301111.B301111** 

Product Name : MA104 GPS/GSM Combo Hercules Penta Band Antenna

Screw-mount (Permanent mount)

850/900/1800/1900/2100/1575.42 MHz

GPS/GSM/GPRS/CDMA/EVDO/UMTS/HSPA/WCDMA

Feature : • Low profile - Height 29 mm and diameter 49mm

• Heavy duty screw mount

• UV and vandal resistant ABS housing

• IP69K compliance

• Standard is 3M Cable RG174 SMA(M)-Customizable

ROHS Compliant





### I. INTRODUCTION

MA.104 GPS/Cellular Combo Hercules Antenna is a combination high performance GPS and penta-band cellular antenna solution for reliable asset tracking and remote monitoring. Industry's most advanced GPS active ceramic patch technology XtremeGain™, allowing for gains of up to 300% in accuracy compared to traditional antennas. Time to first fix is under 1 minute. Durable UV and robust ABS housing that is resistant to vandalism and direct attack. At only 29 mm height it complies with the latest EU height restrictions directives for roof-mounted objects, with a diameter of 49 mm. Designed to not catch on tree-branches. Can be mounted on metal structures.

#### II. SPECIFICATION

ELECTRICAL CELLULAR							
Standard		AMPS	GSM	PCS	DCS	3G	
Band (MHz)		850	900	1800	1900	2100	
Frequency (MHz)		824-896	880-960	1850-1990	1710-1880	1920 –2170	
Return Loss (dB)							
Cable length (meter)	0.3	-6.5	-6.0	-7	-8	-5	
	1.0	-9.5	-8	-17	-16	-15	
	2.0	-10	-9	-20	-21	-18	
	3.0	-13	-11	-21	-21	-19	
	5.0	-14	-14	-25	-25	-23	
Efficiency (%)							
Cable length (meter)	0.3	38	54	58	54	50	
	1.0	31	35	36	42	31	
	2.0	23	20	23	32	21	
	3.0	25	29	23	22	18	
	5.0	11	11.5	12	11	11	
Peak Gain (dBi)							
	0.3	2.0	3.3	4.0	3.6	3.0	
Cable length (meter)	1.0	1.2	1.3	2	1.8	1.2	
	2.0	0.5	-0.35	0	1.5	-0.1	
	3.0	0.1	1.6	0.6	0.1	-0.9	
	5.0	-2.5	-2.4	-2.3	-3.0	-2.0	
Polarization		Linear					
Impedance		50 Ohms					
Input Power		10 Watts max.					
VSWR		<3.5.0:1					



	ELECTRICAL	GPS						
Frequency		1575.42MHz ± 1.023MHz						
Impedance		50 ohm						
VSWR		2.0 Max						
GPS Patch Gain		2.0dB Passive Gain @ Zenith						
Axial ratio	-1.0dE	-1.0dBi Gain @ 10 degrees elevation 3.0 dB max						
Polarization		RHCP						
Out Band Rejection		fo = $1575.42$ MHz fo $\pm 30$ MHz 5dB Min. fo $\pm 50$ MHz 20dB Min. fo $\pm 100$ MHz 25dB Min.						
Input Voltage	Min:1.8V	Тур. 3.0V	Max: 5.5V					
Total Gain @ Zenith	25dBic	30dBic	32dBic					
Current Consumption	6mA	12mA	30mA					
Noise Figure	2.7dB	3.0dB	3.7dB					
MECHANICAL								
Dimensions	ŀ	Height 29mm x Diameter 49mm						
Casing		UV resistant PVC						
Base and thread		Nickel plated steel						
Thread diameter		18mm						
Weather proof gasket	CR4305 fc	CR4305 foam with 3M9448B double-side adhesive						
Cable pull		8 Kgf						
Recommended Mounting Torqu	ıe	95Nm						
Maximum Mounting Torque		135Nm						
ENVIRONMENTAL								
Waterproof		IP-69K						
Corrosion	5% NaCl for	5% NaCl for 96hrs - Nickel plated steel base and thread						
Temperature Range		-40°C to +85°C						
Thermal Shock		100 cycles -40°C to +80°C						
Humidity		Non-condensing 65°C 95% RH						
Shock (drop test)		1m drop on concrete 6 axes						

\*Note: The return loss, efficiency and gain in the above table, were conducted in 30x30 cm metal plate. For a specific case performance refers to the below plots.



# **III. TEST SET UP**



Figure 1. MA104 Antenna test set up in free space, 30x30 cm metal plate and 60x60 cm metal plate, R&SZVL6 VNA (left) and R&S4100 CTIA 3D Chamber (Right).



#### IV.IV. ANTENNA PARAMETERS

#### IV.1. Return Loss

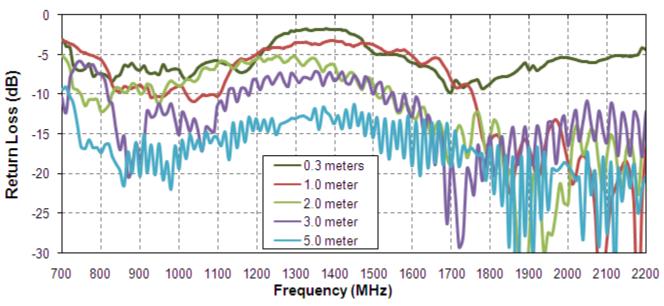


Figure 2. Return Loss of the MA104 antenna in free space.

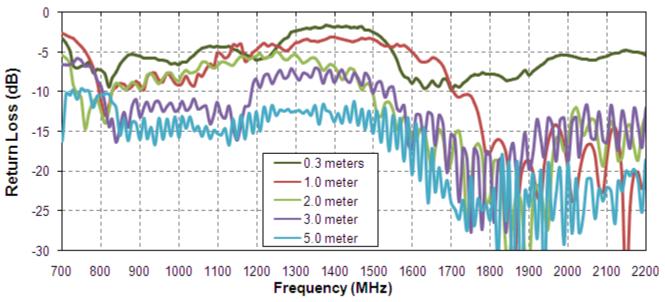


Figure 3. Return Loss of the MA104 antenna on 30 cm metal plate.



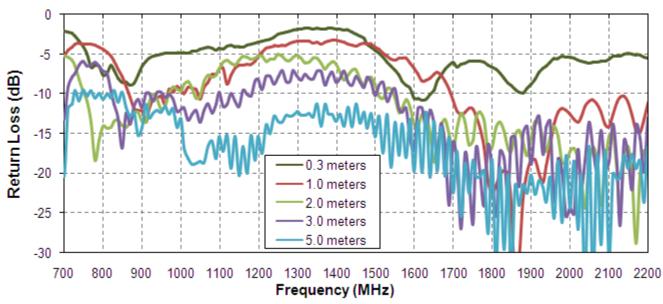


Figure 4. Return Loss of the MA104 antenna on 60 cm metal plate.

## **IV.2 Efficiency**

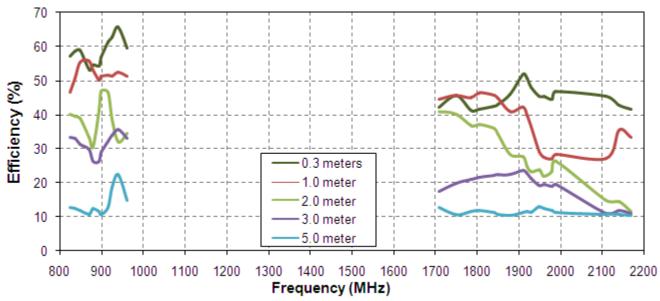


Figure 5. Efficiency of the MA104 antenna in free space.



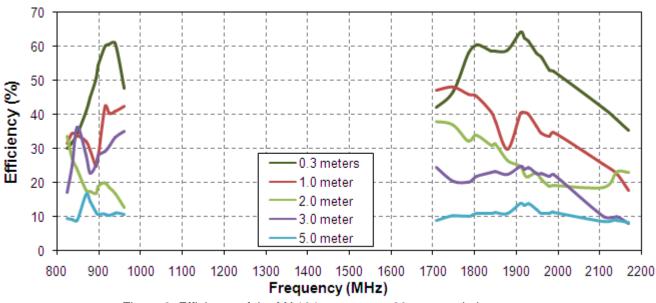


Figure 6. Efficiency of the MA104 antenna on 30 cm metal plate.

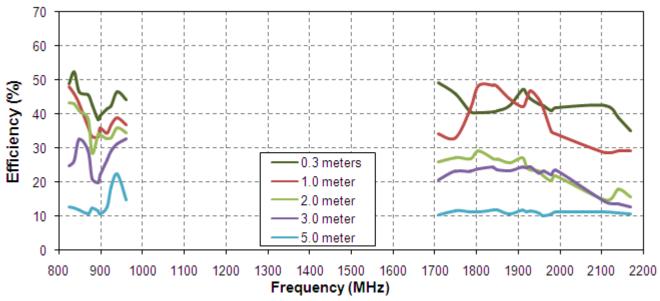


Figure 7. Efficiency of the MA104 antenna on 60 cm metal plate.

#### IV.2. IV.3 Peak Gain



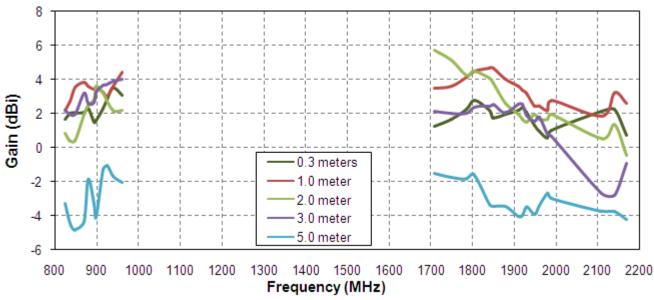


Figure 8. Gain of the MA104 antenna in free space.

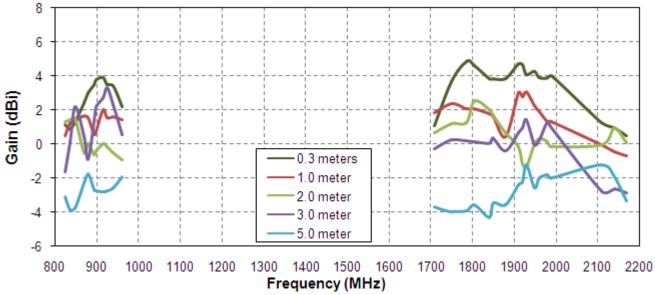


Figure 9. Gain of the MA104 antenna on 30 cm metal plate.



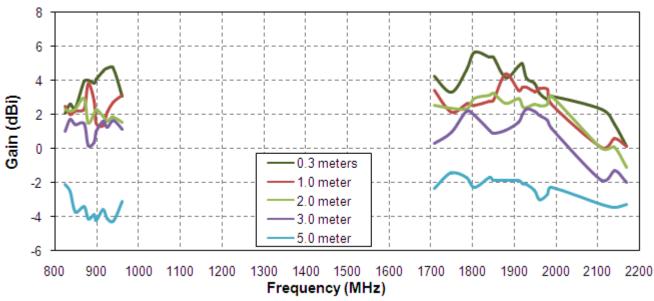


Figure 10. Gain of the MA104 antenna on 60 cm metal plate.

## **IV.4 Radiation pattern**

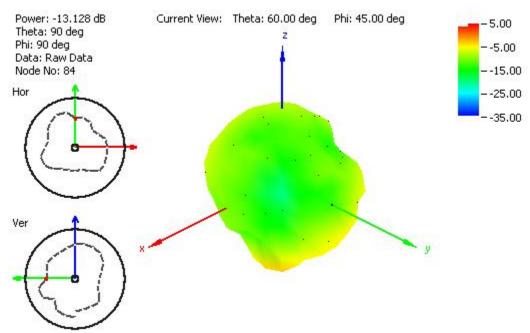


Figure 11. Radiation pattern at 849 MHz, Figure 1 as reference (dB), with 2 m RG174 cable and free space.



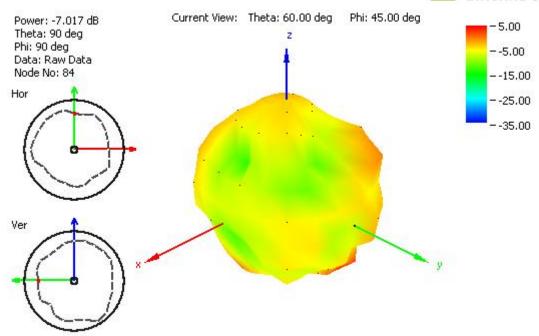


Figure 12. Radiation pattern at 915 MHz, Figure 1 as reference (dB), with 2 m RG174 cable and free space.

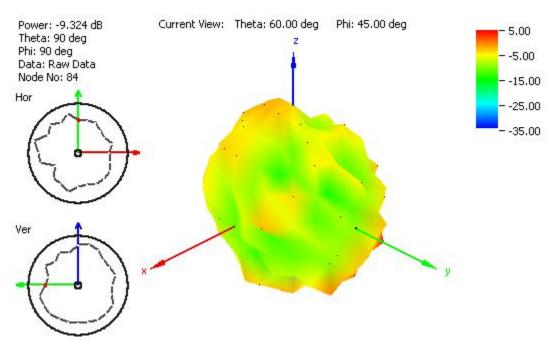


Figure 13. Radiation pattern at 1805 MHz, Figure 1 as reference (dB), with 2 m RG174 cable and free space.



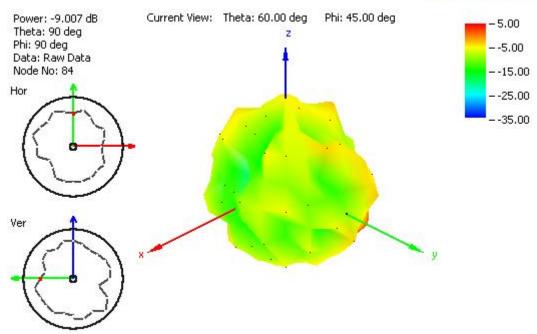


Figure 14. Radiation pattern at 1910 MHz, Figure 1 as reference (dB), with 2 m RG174 cable and free space.

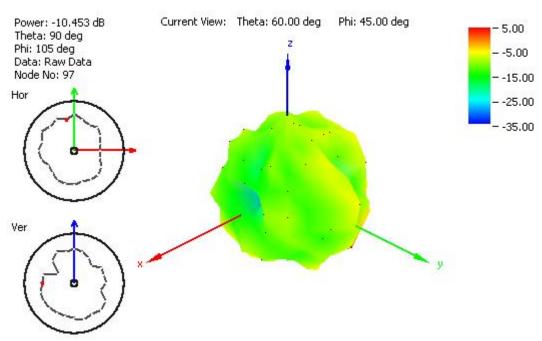


Figure 15. Radiation pattern at 2110 MHz, Figure 1 as reference (dB), with 2 m RG174 cable and free space.



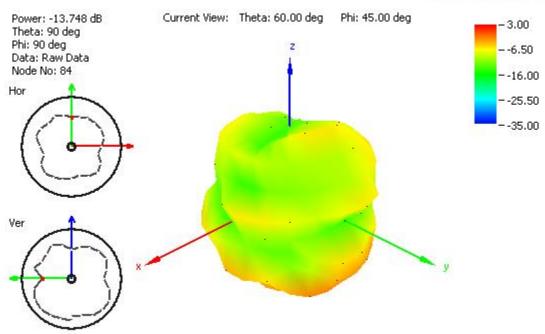
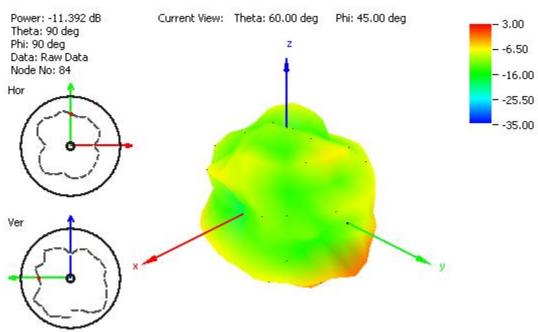


Figure 16. Radiation pattern at 849 MHz, Figure 1 as reference (dB), with 2 m RG174 cable and 30x30 cm metal plate.



17. Radiation pattern at 915 MHz, Figure 1 as reference (dB), with 2 m RG174 cable and 30x30 cm metal plate.



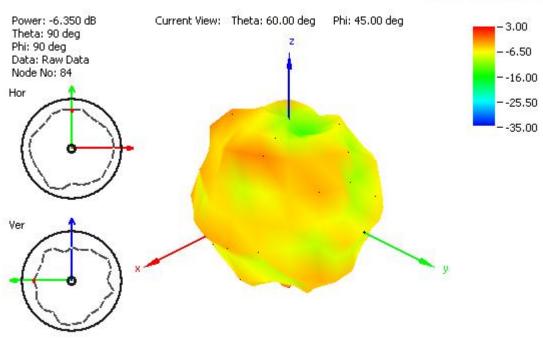


Figure 18. Radiation pattern at 1805 MHz, Figure 1 as reference (dB), with 2 m RG174 cable and 30x30 cm metal plate.

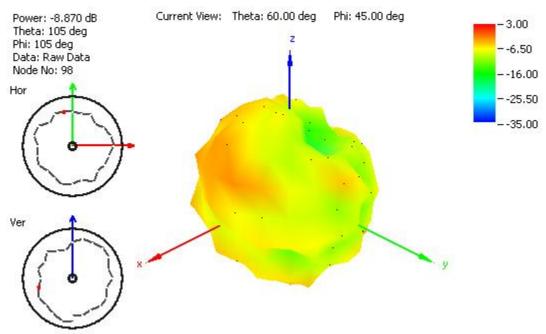


Figure 19. Radiation pattern at 1910 MHz, Figure 1 as reference (dB), with 2 m RG174 cable and 30x30 cm metal plate.



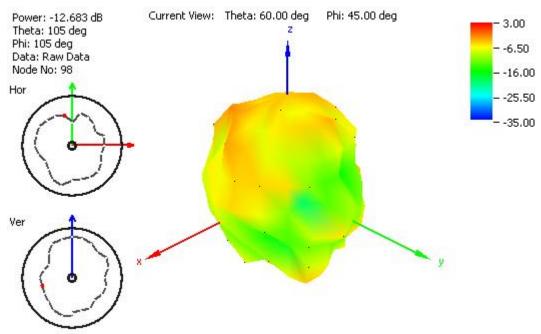


Figure 20. Radiation pattern at 2110 MHz, Figure 1 as reference (dB), with 2 m RG174 cable and 30x30 cm metal plate.

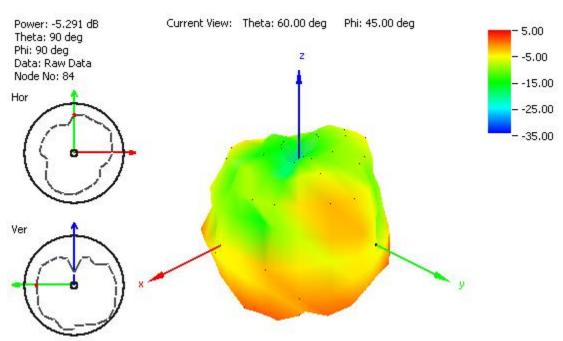


Figure 21. Radiation pattern at 849 MHz, Figure 1 as reference (dB), with 2 m RG174 cable and 60x60 cm metal plate.



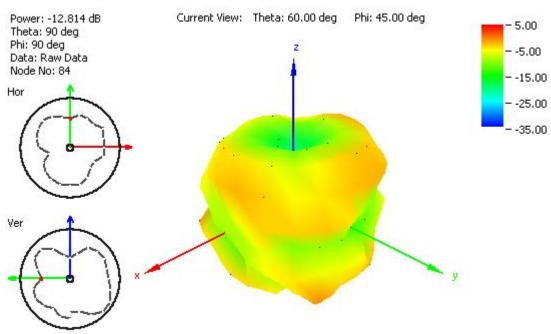


Figure 22. Radiation pattern at 915 MHz, Figure 1 as reference (dB), with 2 m RG174 cable and 60x60 cm metal plate.

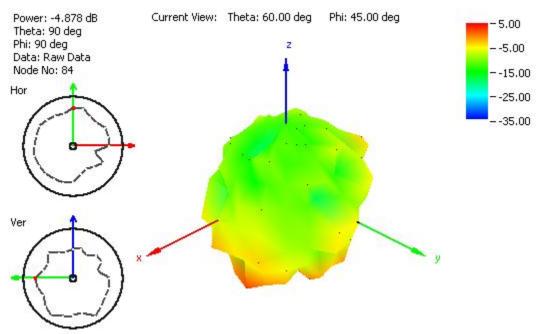


Figure 23. Radiation pattern at 1805 MHz, Figure 1 as reference (dB), with 2 m RG174 cable and 60x60 cm metal plate.



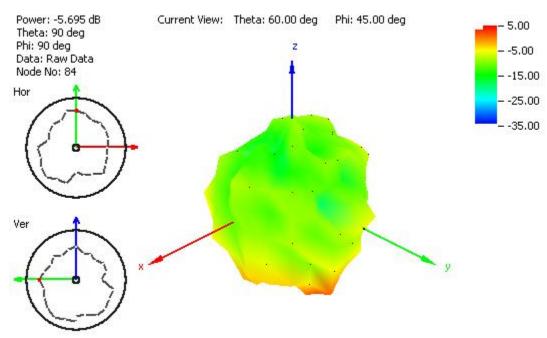


Figure 24. Radiation pattern at 1910 MHz, Figure 1 as reference (dB), with 2 m RG174 cable and 60x60 cm metal plate.

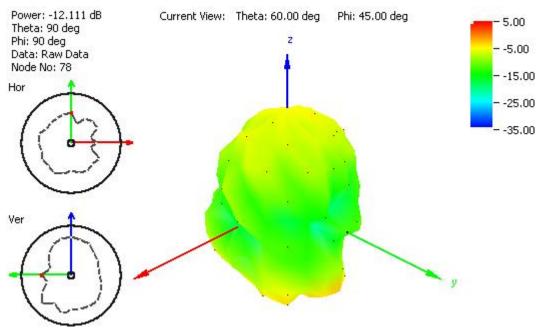
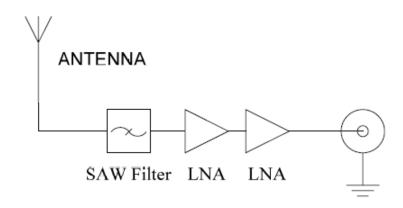


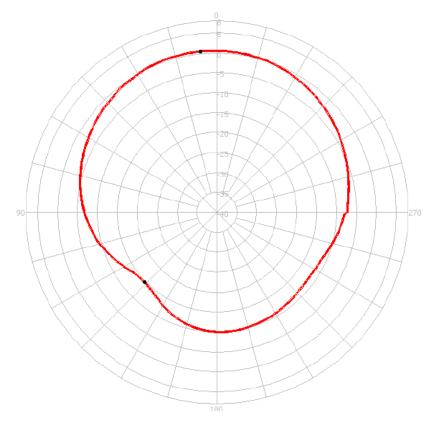
Figure 25. Radiation pattern at 2110 MHz, Figure 1 as reference (dB), with 2 m RG174 cable and 60x60 cm metal plate.



# V. System Block Diagram



## **VI. GPS Patch Radiation Pattern**

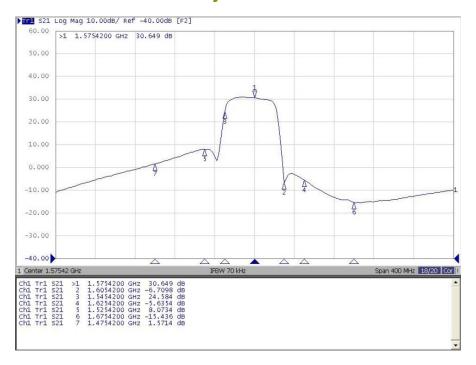


0 degree is the top of Hercules.

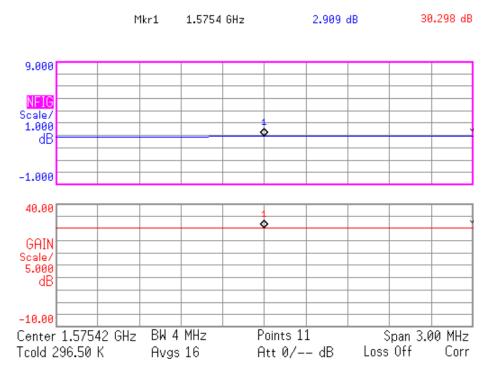


## **VII. LNA Properties**

### VII.1. LNA Gain and Out-band Rejection @ 3.0V

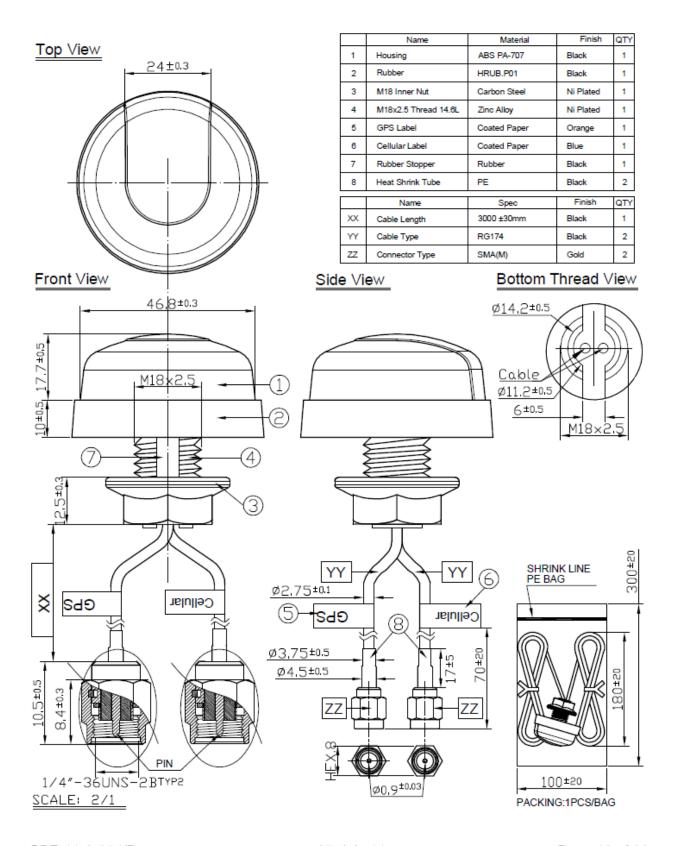


# **VII.2. Noise Figure**





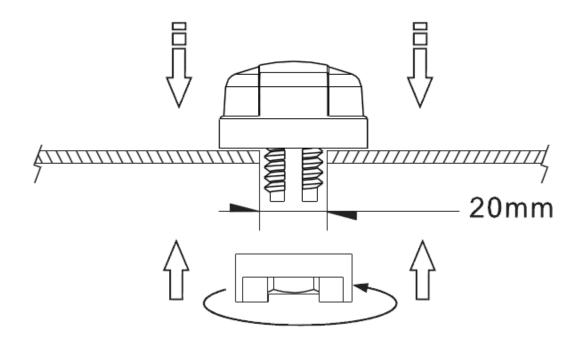
# **VIII. Drawings**





Unit: mm

# Installation



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

