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

VERSION	DATE	PAGE	DESCRIPTION	CENTRE	APPROVED
A	06/22/2010	All	Antenna Specification	San Diego	Eleazar Zuniga
B	11/22/2010	GPS	GPS SAW Filter Added	Taiwan	Zita Lin
C	03/04/2011	19	Update Drawing	Taiwan	Zita Lin

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)						
Cable length (meter)	0.3	2.0	3.3	4.0	3.6	3.0
	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				

Specification

ELECTRICAL GPS			
Frequency	1575.42MHz ± 1.023MHz		
Impedance	50 ohm		
VSWR	2.0 Max		
GPS Patch Gain	2.0dB Passive Gain @ Zenith -1.0dBi Gain @ 10 degrees elevation		
Axial ratio	3.0 dB max		
Polarization	RHCP		
Out Band Rejection	fo = 1575.42MHz fo ± 30 MHz 5dB Min. fo ± 50 MHz 20dB Min. fo ± 100 MHz 25dB Min.		
Input Voltage	Min:1.8V	Typ. 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	Height 29mm x Diameter 49mm
Casing	UV resistant PVC
Base and thread	Nickel plated steel
Thread diameter	18mm
Weather proof gasket	CR4305 foam with 3M9448B double-side adhesive
Cable pull	8 Kgf
Recommended Mounting Torque	95Nm
Maximum Mounting Torque	135Nm

ENVIRONMENTAL	
Waterproof	IP-69K
Corrosion	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

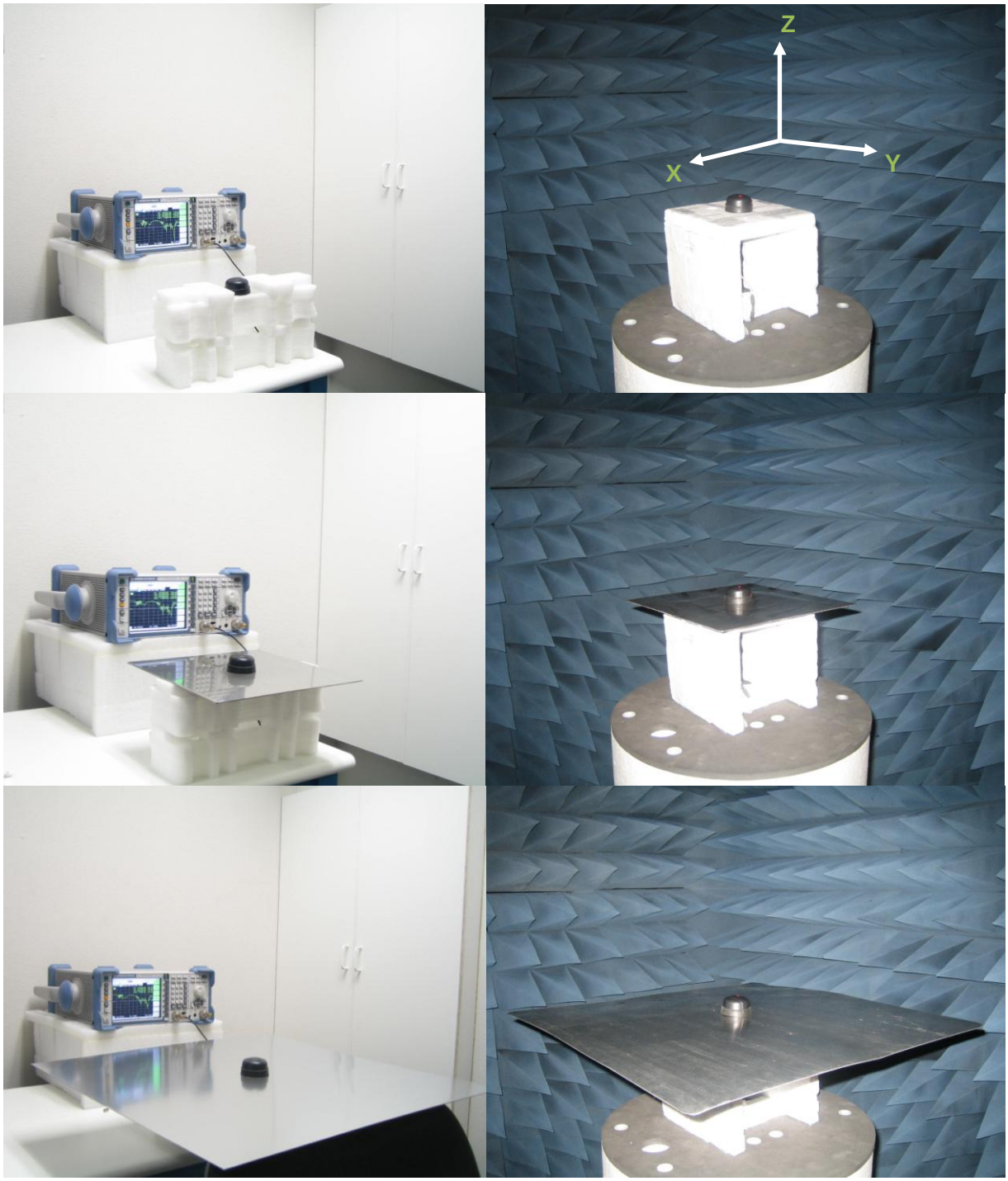


Figure 1. MA104 Antenna test set up in free space, 30x30 cm metal plate and 60x60 cm metal plate, R&SZVL6 VNA (left) and R&S4100 CTIA 3D Chamber (Right).

IV. IV. ANTENNA PARAMETERS

IV.1. Return Loss

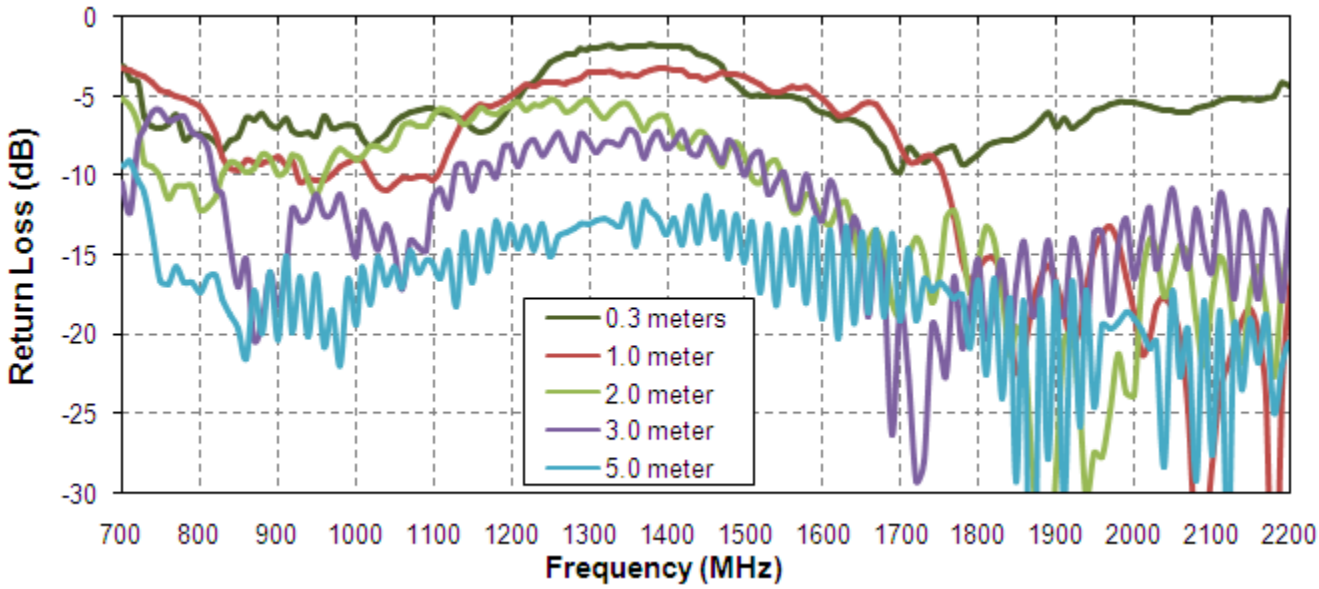


Figure 2. Return Loss of the MA104 antenna in free space.

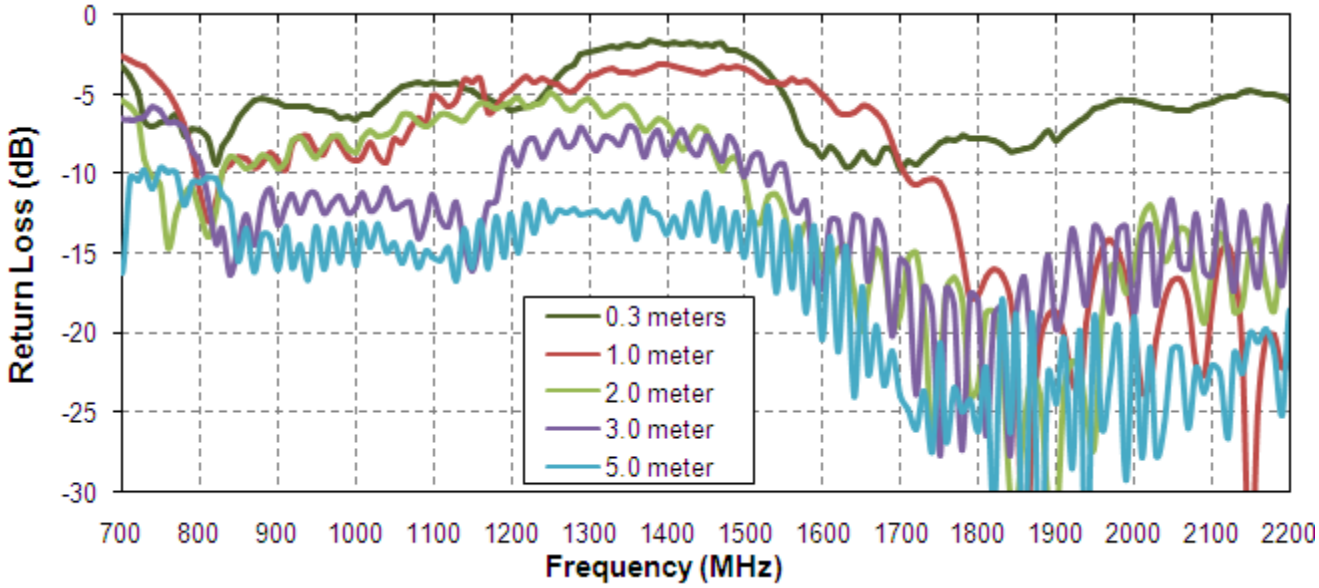


Figure 3. Return Loss of the MA104 antenna on 30 cm metal plate.

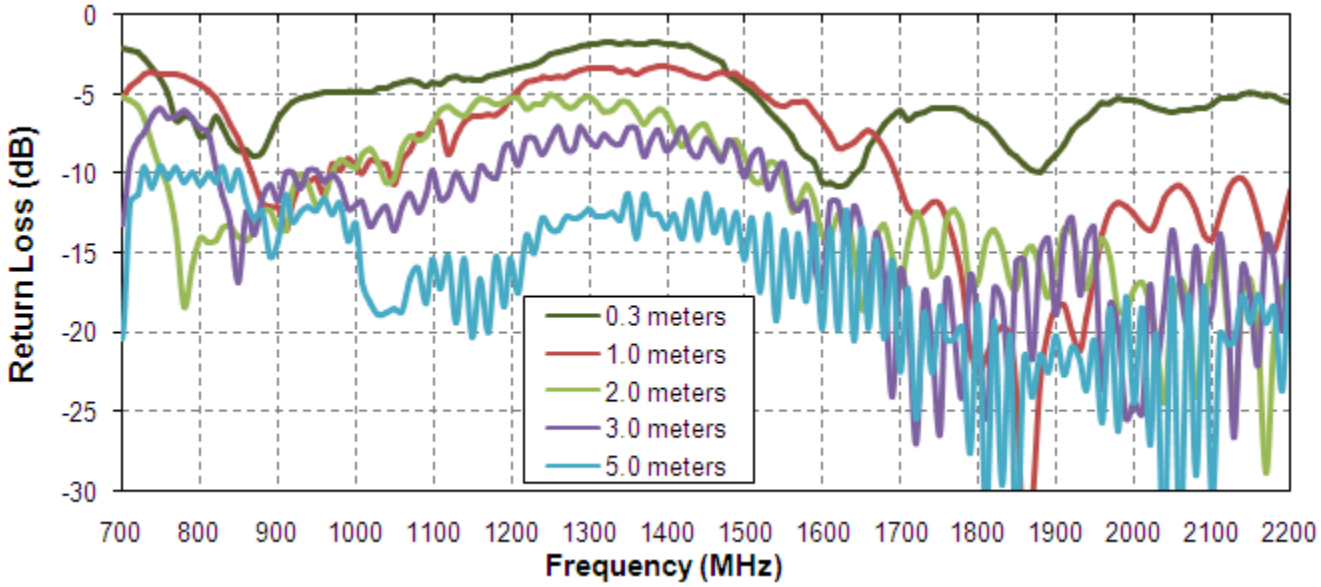


Figure 4. Return Loss of the MA104 antenna on 60 cm metal plate.

IV.2 Efficiency

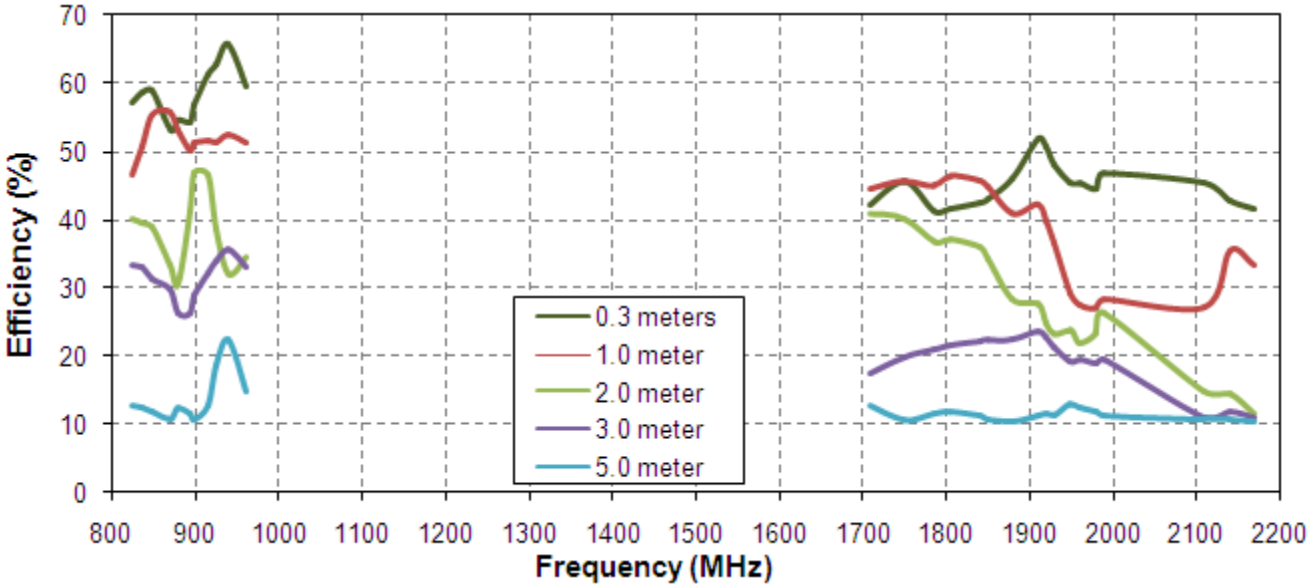


Figure 5. Efficiency of the MA104 antenna in free space.

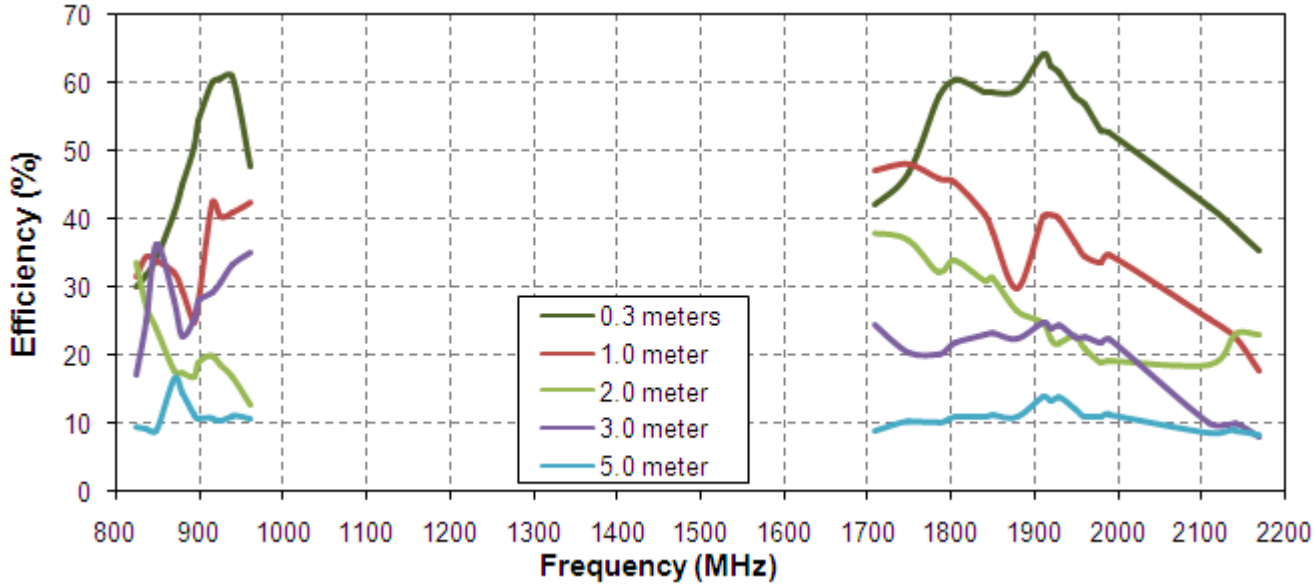


Figure 6. Efficiency of the MA104 antenna on 30 cm metal plate.

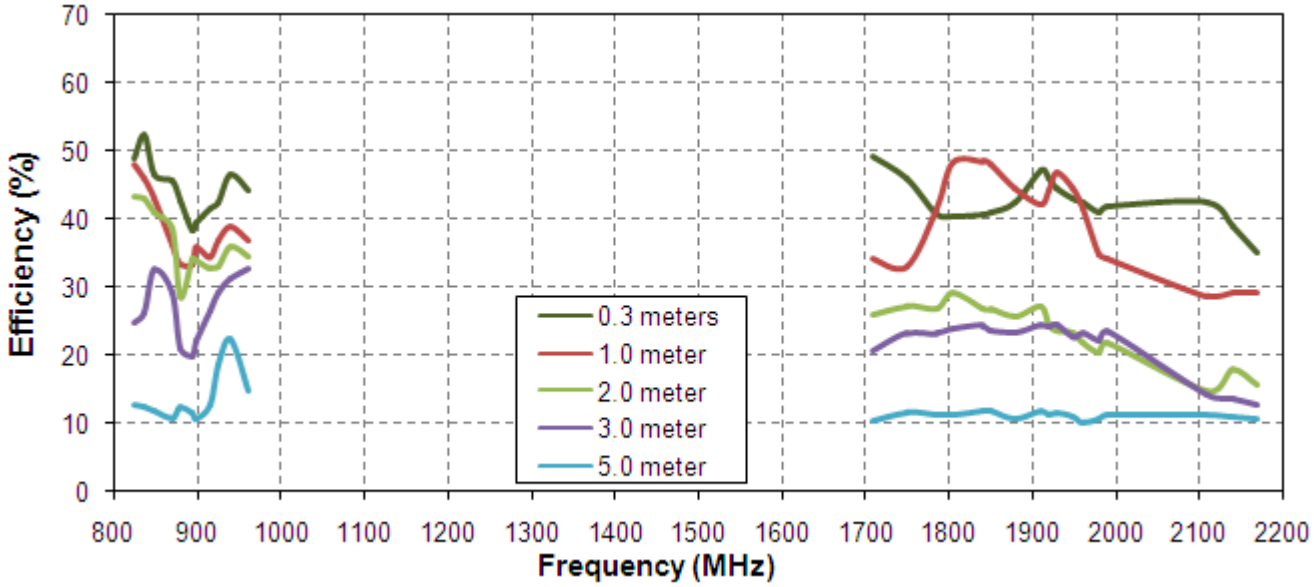


Figure 7. Efficiency of the MA104 antenna on 60 cm metal plate.

IV.2. IV.3 Peak Gain

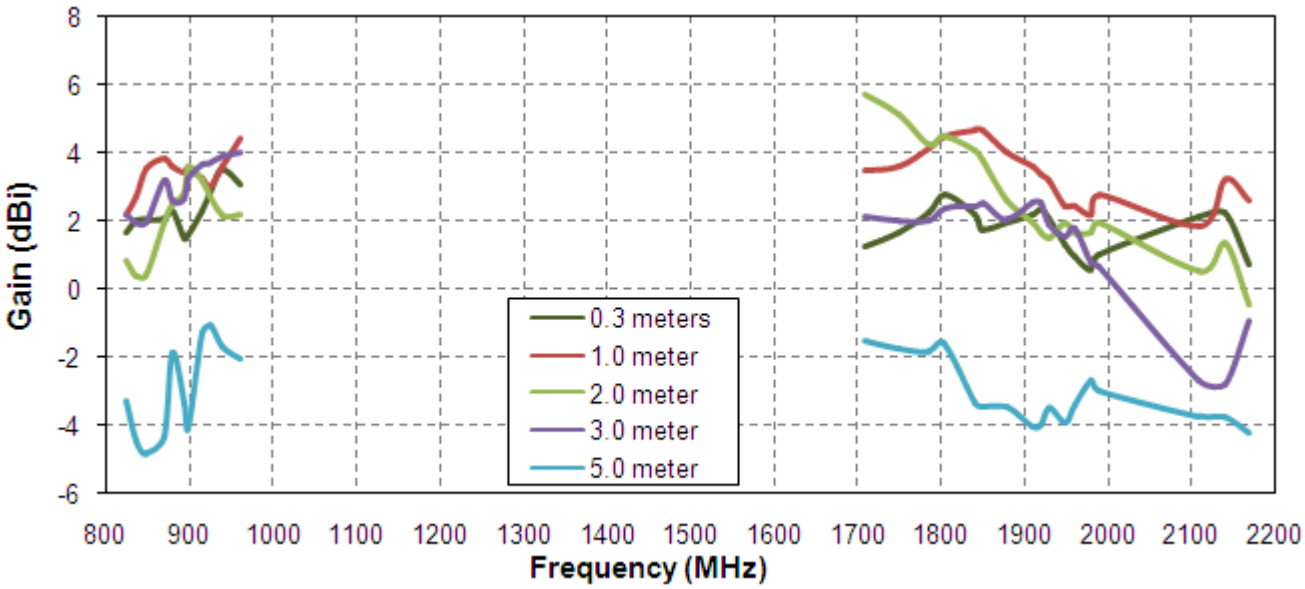


Figure 8. Gain of the MA104 antenna in free space.

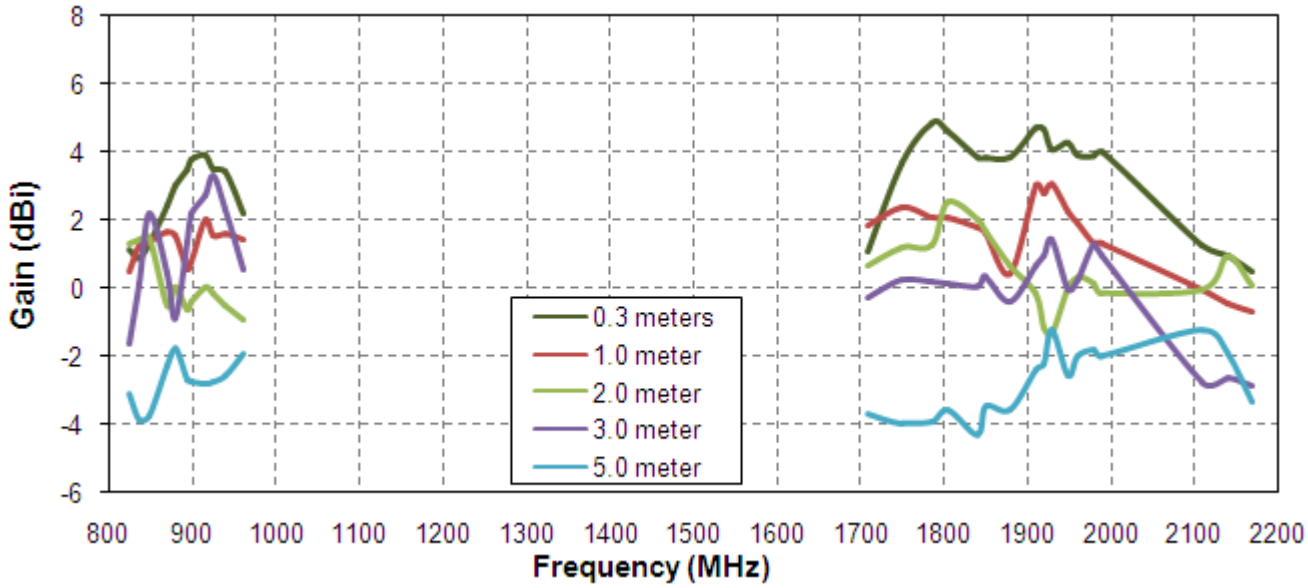


Figure 9. Gain of the MA104 antenna on 30 cm metal plate.

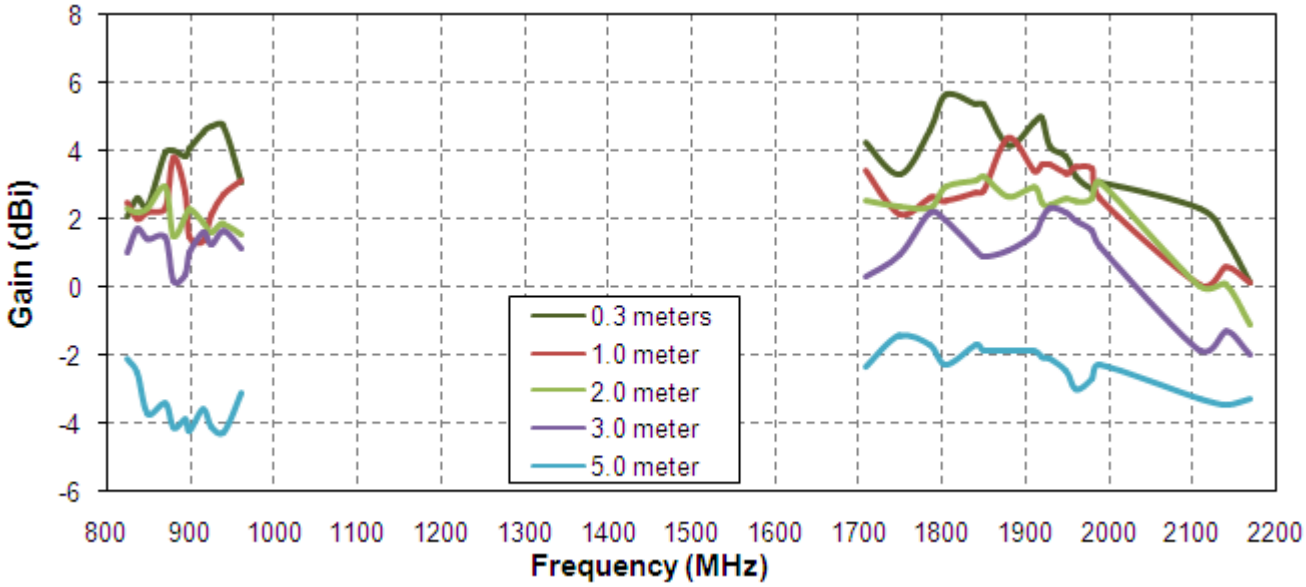


Figure 10. Gain of the MA104 antenna on 60 cm metal plate.

IV.4 Radiation pattern

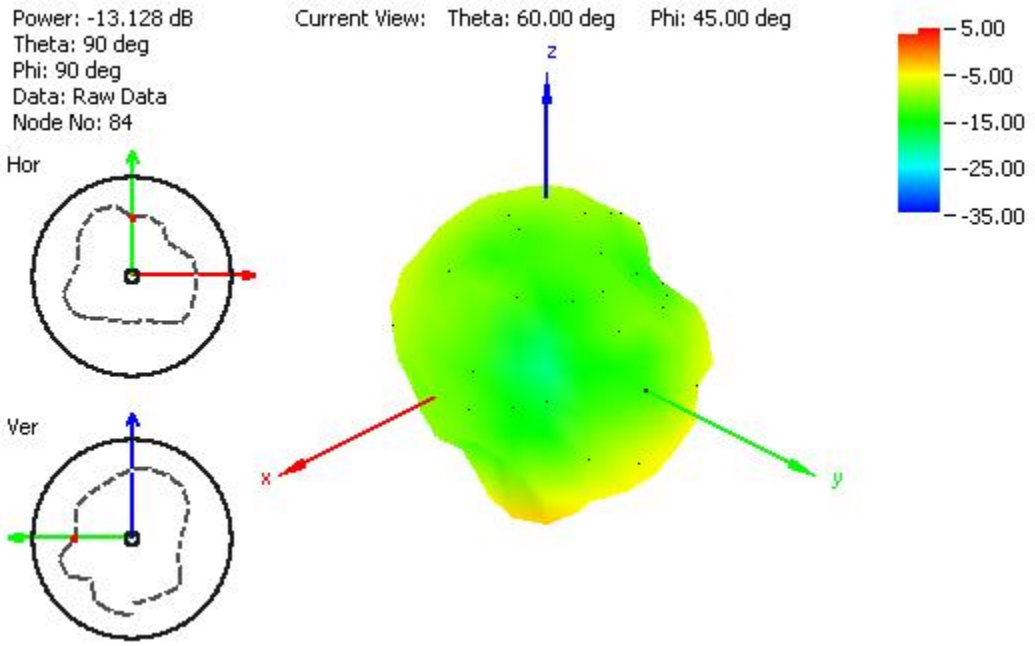


Figure 11. Radiation pattern at 849 MHz, Figure 1 as reference (dB), with 2 m RG174 cable and free space.

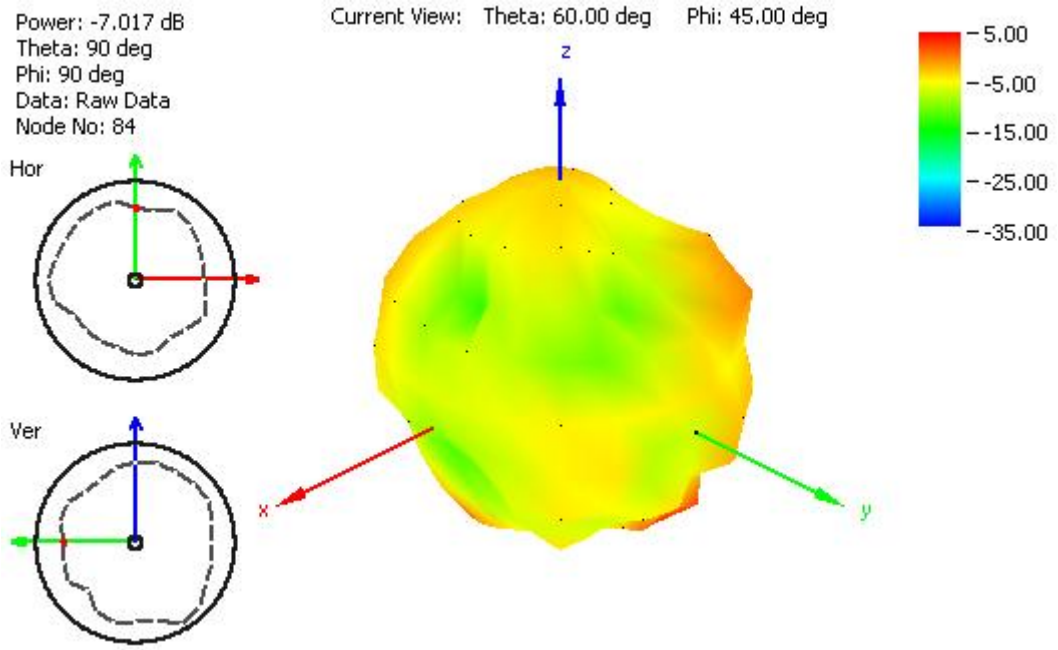


Figure 12. Radiation pattern at 915 MHz, Figure 1 as reference (dB), with 2 m RG174 cable and free space.

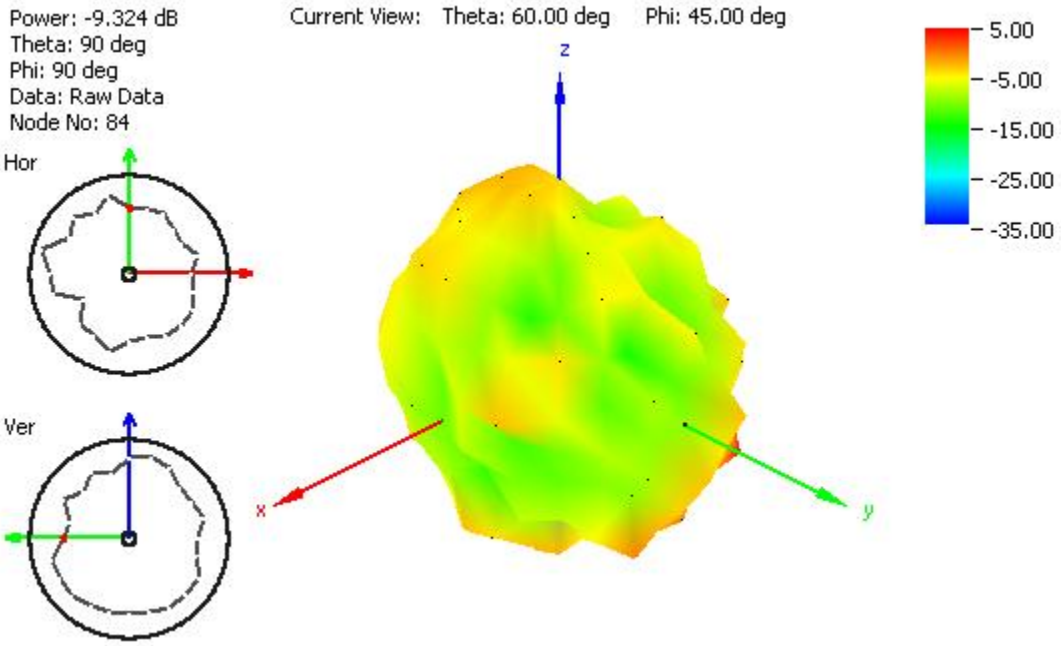


Figure 13. Radiation pattern at 1805 MHz, Figure 1 as reference (dB), with 2 m RG174 cable and free space.

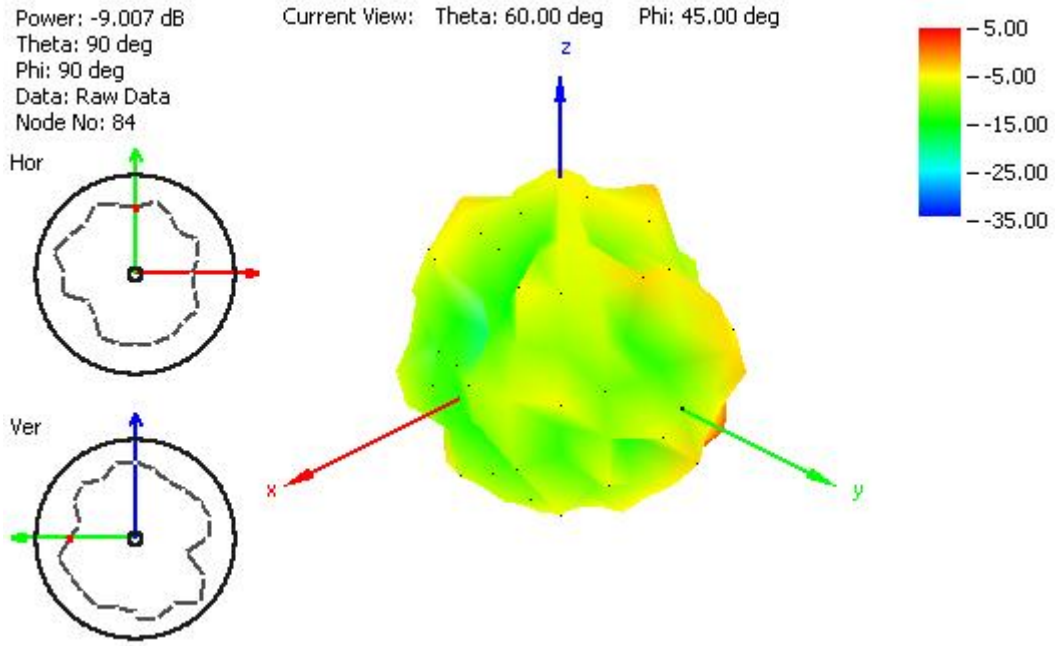


Figure 14. Radiation pattern at 1910 MHz, Figure 1 as reference (dB), with 2 m RG174 cable and free space.

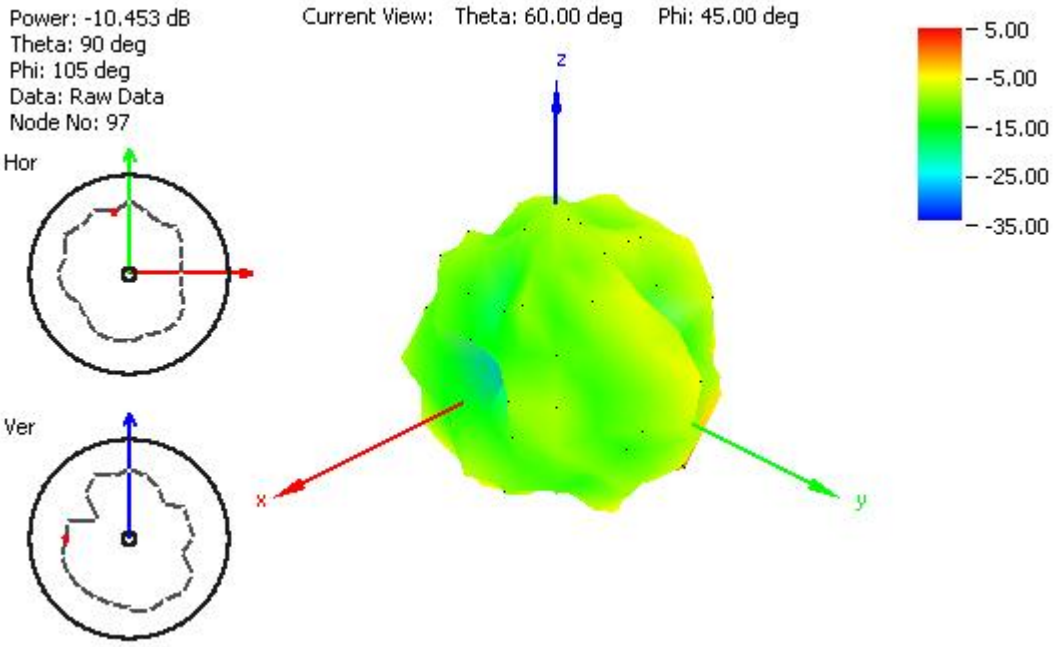


Figure 15. Radiation pattern at 2110 MHz, Figure 1 as reference (dB), with 2 m RG174 cable and free space.

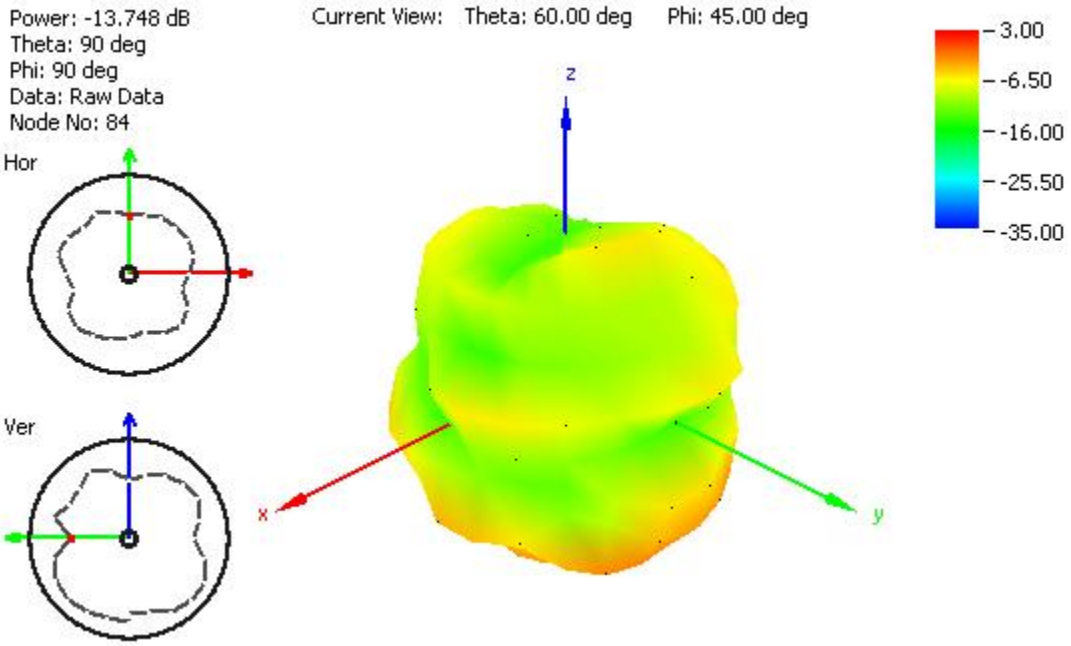
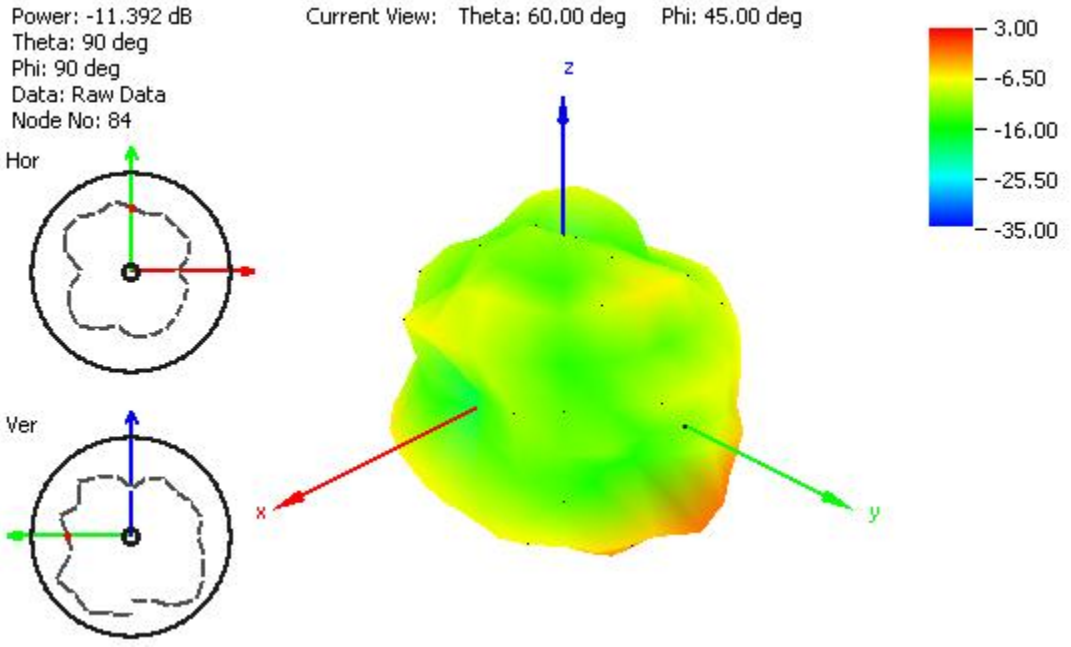


Figure 16. Radiation pattern at 849 MHz, Figure 1 as reference (dB), with 2 m RG174 cable and 30x30 cm metal plate.



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

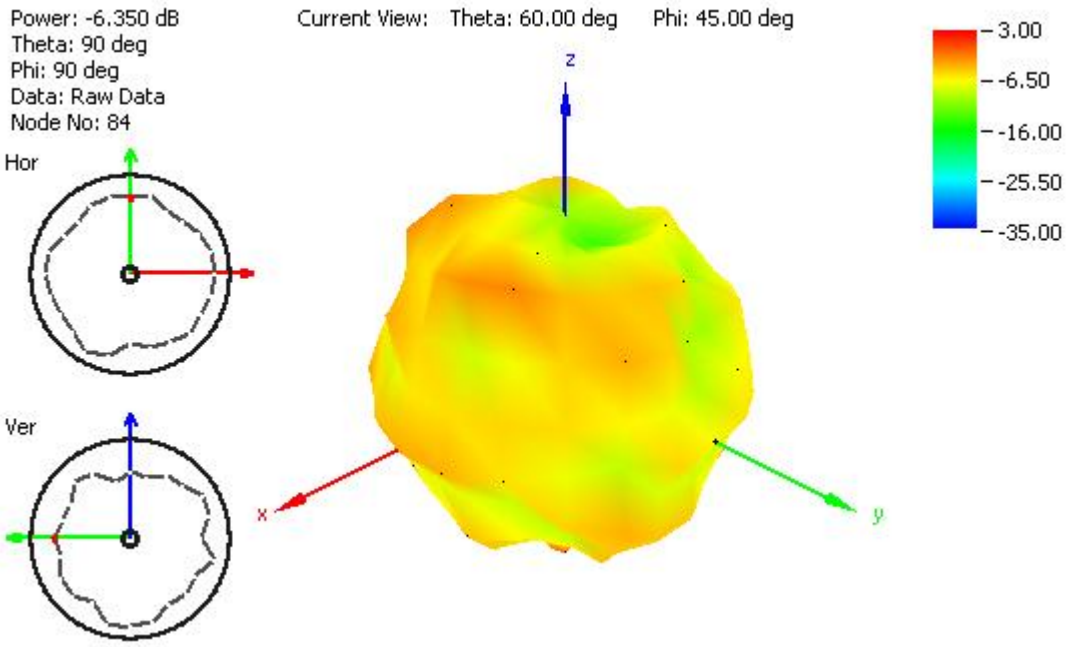


Figure 18. Radiation pattern at 1805 MHz, Figure 1 as reference (dB), with 2 m RG174 cable and 30x30 cm metal plate.

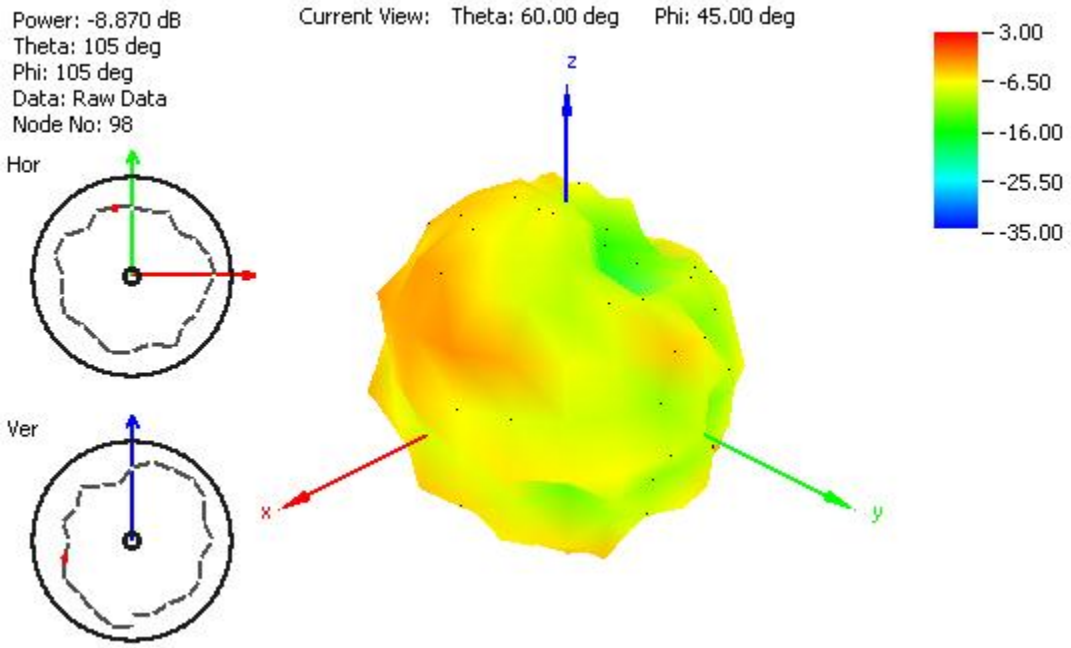


Figure 19. Radiation pattern at 1910 MHz, Figure 1 as reference (dB), with 2 m RG174 cable and 30x30 cm metal plate.

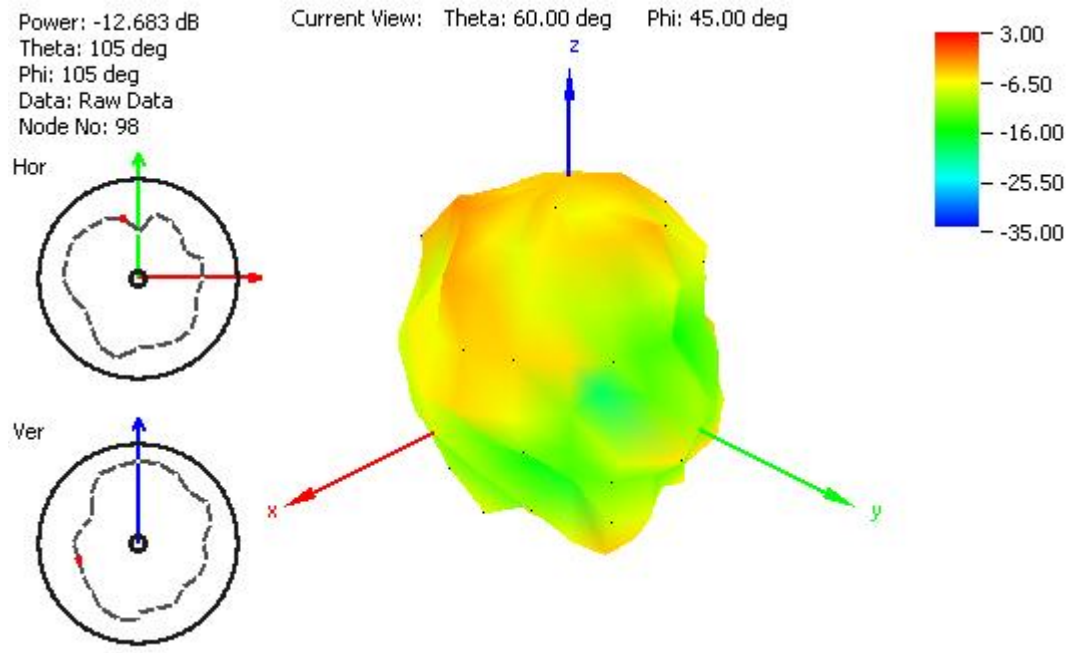


Figure 20. Radiation pattern at 2110 MHz, Figure 1 as reference (dB), with 2 m RG174 cable and 30x30 cm metal plate.

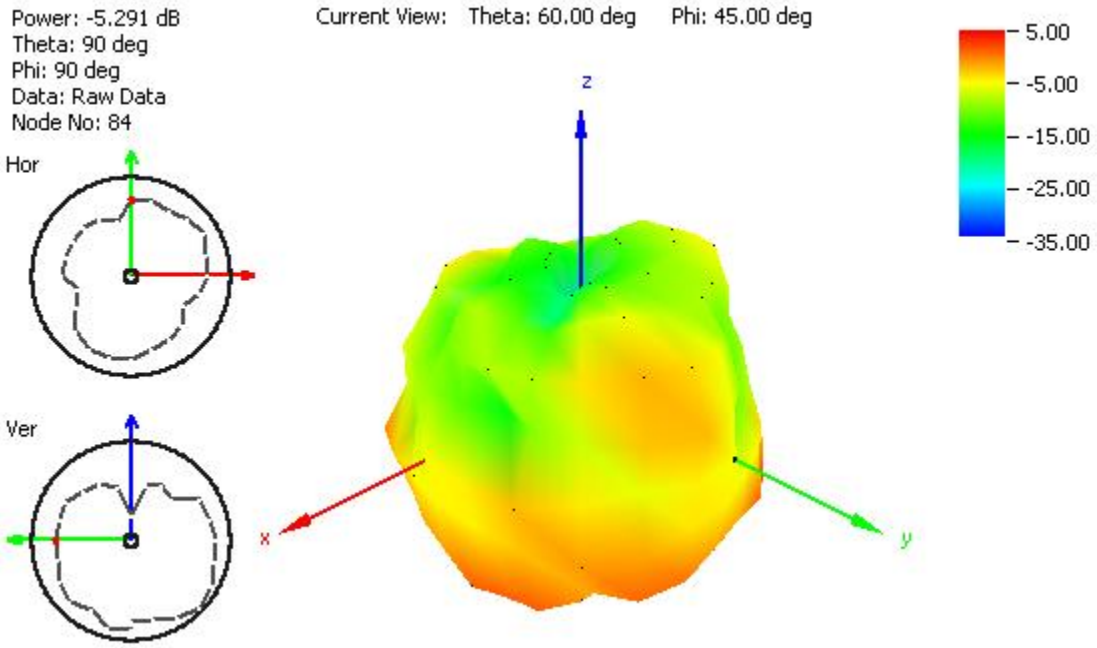


Figure 21. Radiation pattern at 849 MHz, Figure 1 as reference (dB), with 2 m RG174 cable and 60x60 cm metal plate.

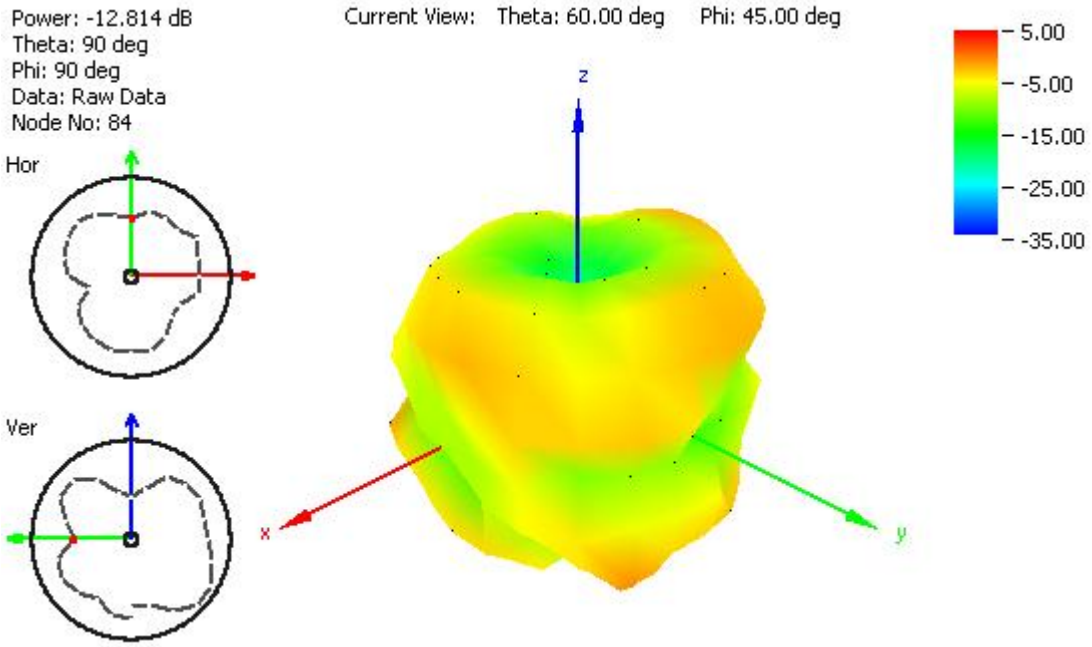


Figure 22. Radiation pattern at 915 MHz, Figure 1 as reference (dB), with 2 m RG174 cable and 60x60 cm metal plate.

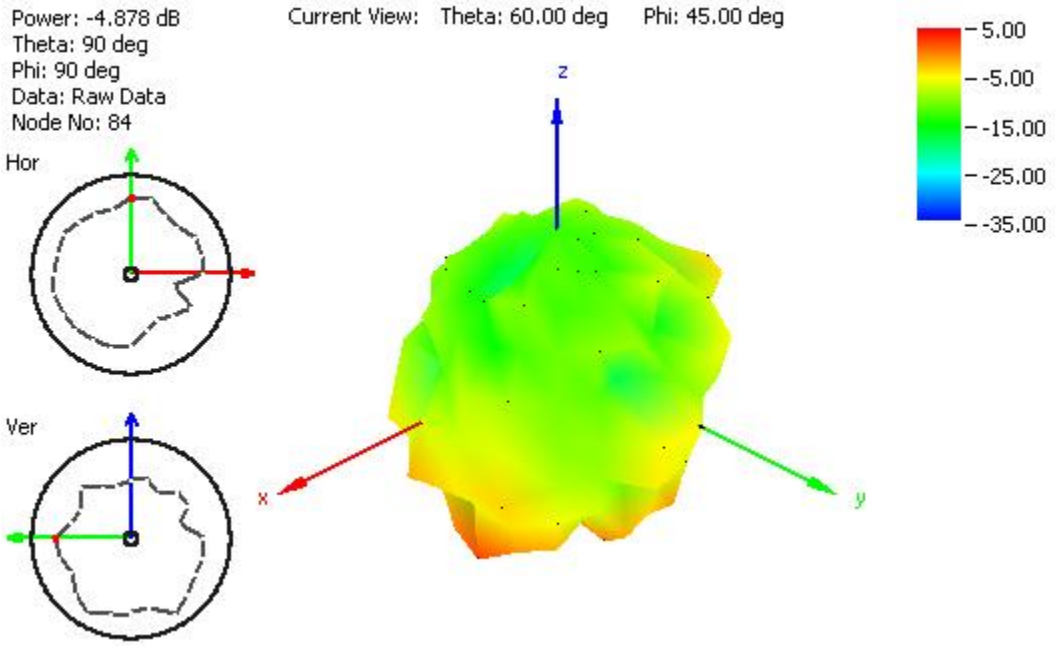


Figure 23. Radiation pattern at 1805 MHz, Figure 1 as reference (dB), with 2 m RG174 cable and 60x60 cm metal plate.

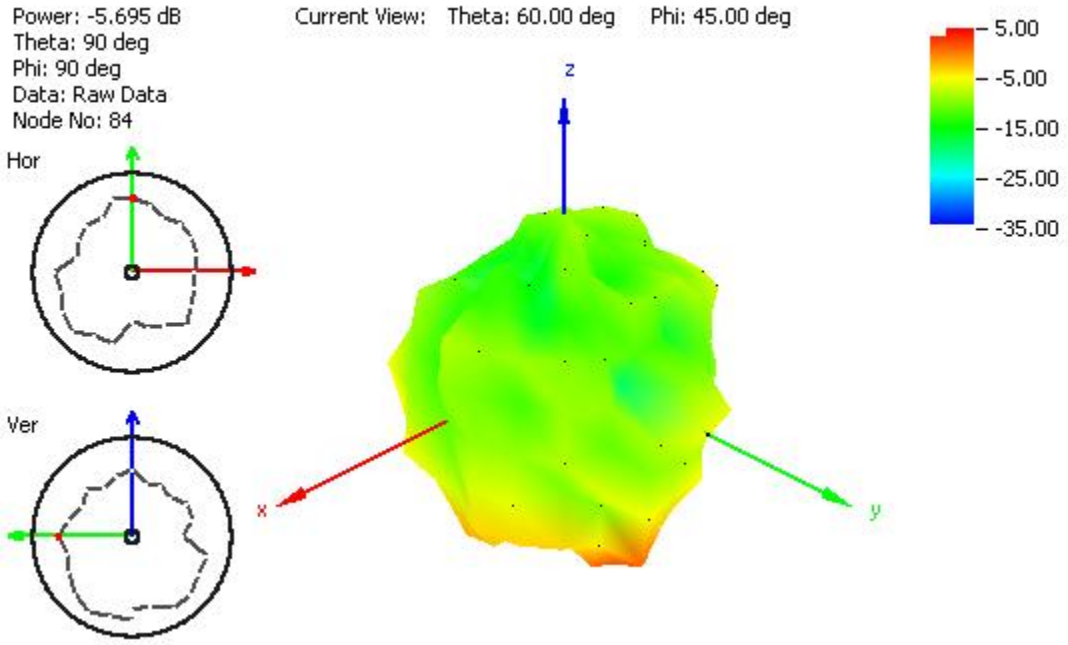


Figure 24. Radiation pattern at 1910 MHz, Figure 1 as reference (dB), with 2 m RG174 cable and 60x60 cm metal plate.

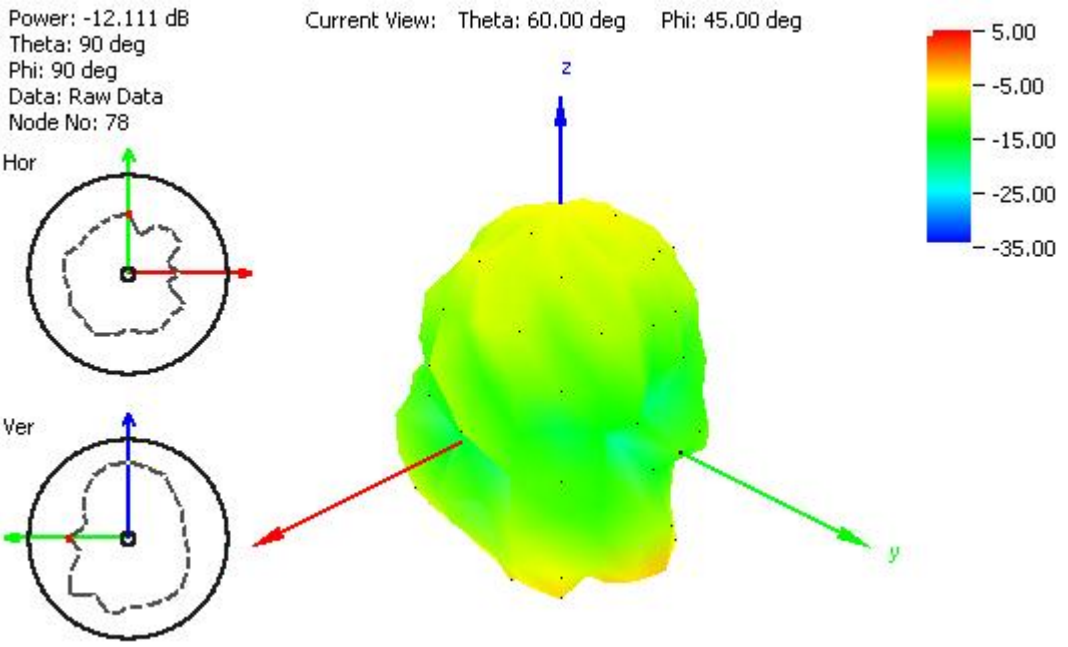
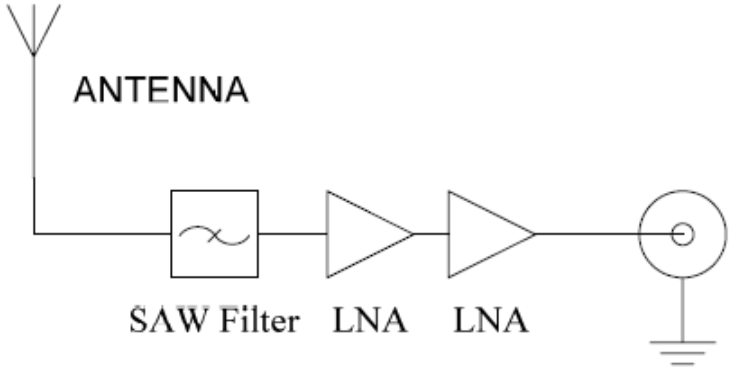
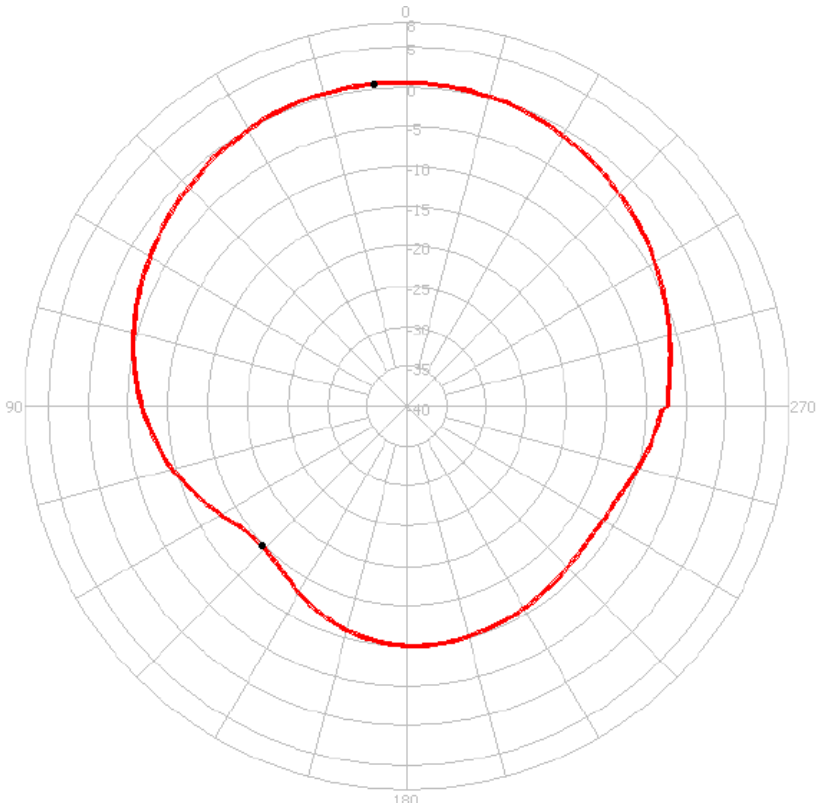


Figure 25. Radiation pattern at 2110 MHz, Figure 1 as reference (dB), with 2 m RG174 cable and 60x60 cm metal plate.

V. System Block Diagram



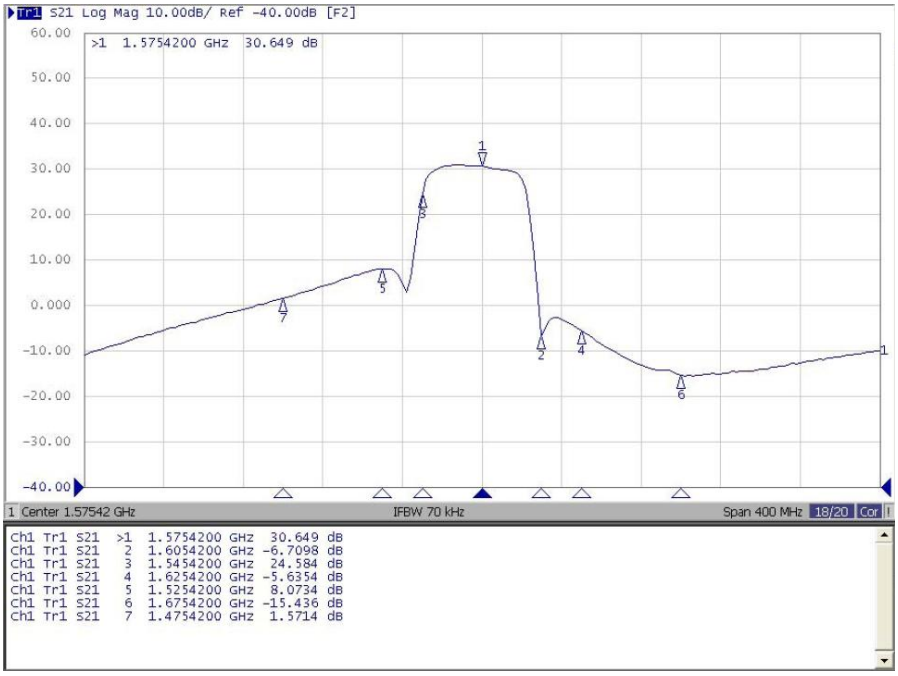
VI. GPS Patch Radiation Pattern



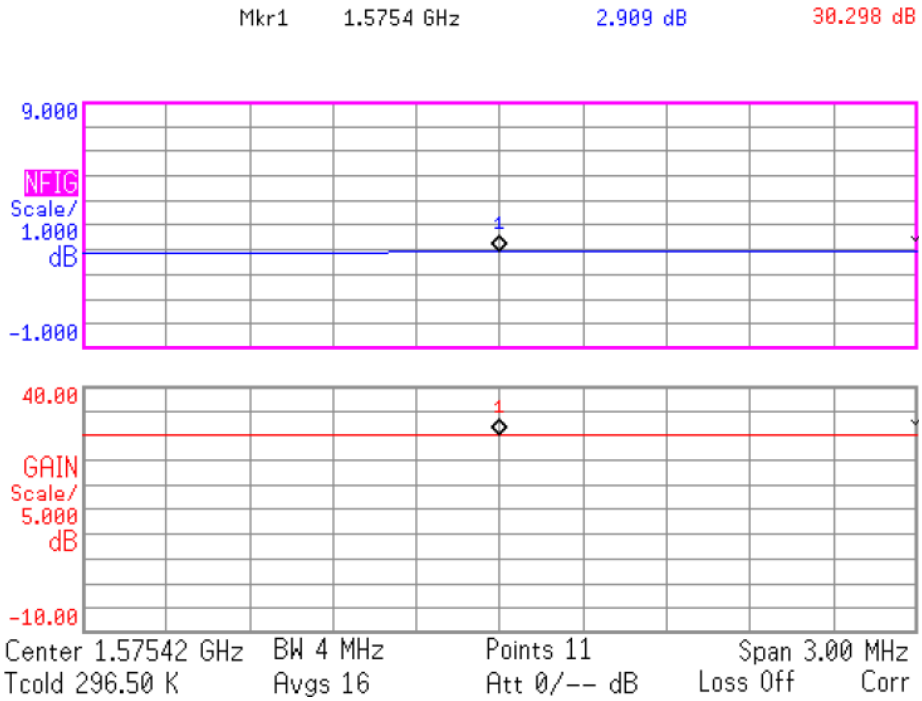
0 degree is the top of Hercules.

VII. LNA Properties

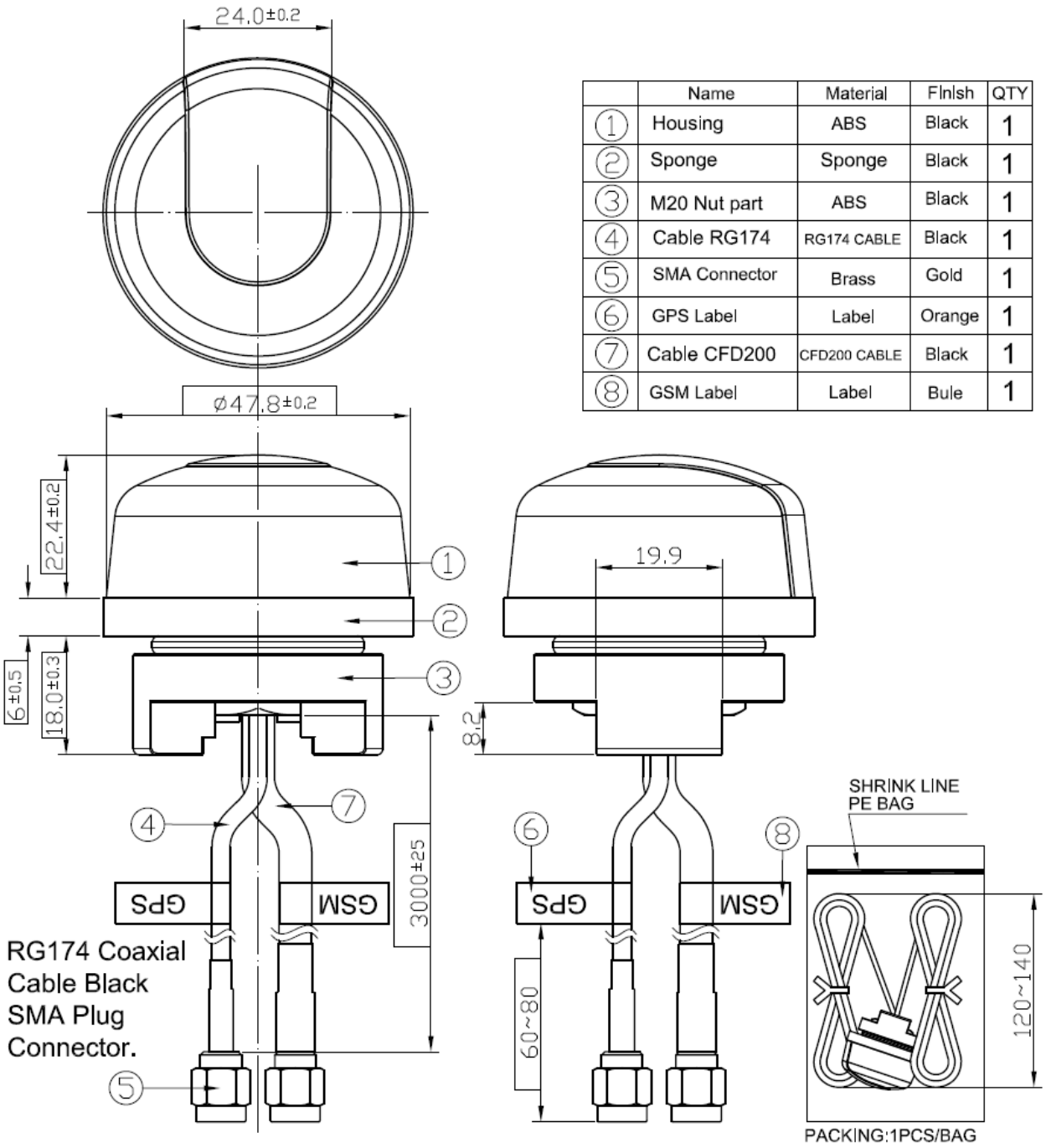
VII.1. LNA Gain and Out-band Rejection @ 3.0V



VII.2. Noise Figure



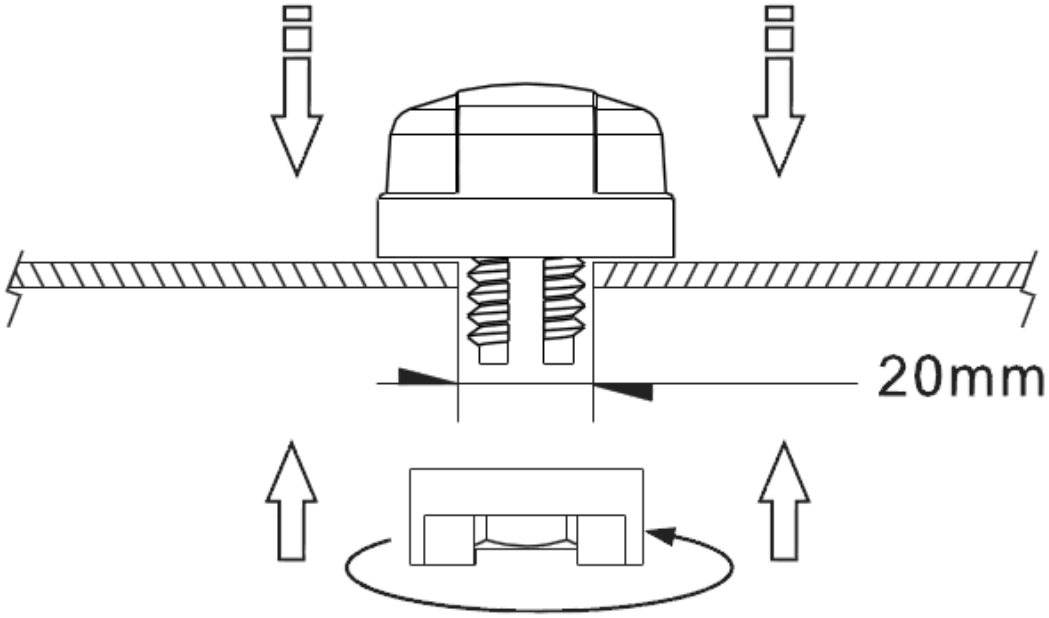
VIII. Drawings



	Name	Material	Finish	QTY
1	Housing	ABS	Black	1
2	Sponge	Sponge	Black	1
3	M20 Nut part	ABS	Black	1
4	Cable RG174	RG174 CABLE	Black	1
5	SMA Connector	Brass	Gold	1
6	GPS Label	Label	Orange	1
7	Cable CFD200	CFD200 CABLE	Black	1
8	GSM Label	Label	Bule	1

Unit : mm

Installation



Recommended torque for mounting is 95Nm or 70ftlbs

Maximum torque for mounting is 135.6Nm or 100ft lbs