MA.105
on ground-plane

MA.105.C

Specification

Part No.	**MA105.C.LB.001**
Product Name	MA105 GPS/GLONASS and Cellular 2in1 Combination Hercules Screw Mount (Permanent Mount)
Feature	Low profile - Height 29mm and Diameter 49mm Heavy duty Screw Mount UV and vandal resistant ABS housing Cellular -Penta Band Antenna 850/900/1800/1900/2100 GSM/GPRS/CDMA/EVDO/UMTS/HSPA/WCDMA Cellular - 3 Metres Low Loss CFD200 SMA(M) GPS – 1575.42MHz - Two Stage 27dB+ LNA GLONASS - 1602MHz - Two Stage 27dB+ LNA GPS/Glonass - 3 Metres RG174 SMA(M) IP65 compliance Cables and connectors are fully customizable ROHS Compliant

1. Introduction

The MA.105.C GPS/GLONASS Cellular Combination Hercules Antenna is the newest upgraded model of Taoglas popular Hercules series. It is a combination 2in1 high performance GPS/GLONASS and penta-band cellular antenna solution for the most reliable asset tracking and remote monitoring.
The GPS/GLONASS antenna inside has been optimized to work on both GPS and GLONASS bands allowing the antenna to see the maximum amount of satellites in the sky and improving tracking accuracy enormously especially in built up areas, the urban canyons where traditional GPS only solutions struggle to maintain a lock driving around corners.

The penta-band cellular antenna delivers high efficiency at all common 2G/3G bands worldwide, ideal for use on GSM, GPRS, CDMA systems.

Durable UV and robust ABS housing 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. It is designed to be covert, and not catch on tree-branches.

The Hercules can be mounted on metal or non-metal structures as it has a metal ground-plane base integrated inside.
A waterproof closed cell foam seal under the base adheres to the surface it is mounted on and can stretch to fit curved surfaces typical on vehicles, preventing water entering through any mounting hole.

2. Specification

Electrical Cellular

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

Polarization	Linear
Impedance	50 Ohms
Input Power	10 Watts max.
VSWR	< 3.5.0:1

2. Specifications

Electrical GPS-GLONASS

Frequency	1574~1606MHz
Impedance	50 ohm
VSWR	2.0 Max
GPS Patch Gain @ Zenith	-1.4dB Passive Gain @ Zenith
GLONASS Patch Gain @ Zenith	-1.3dBi Gain @ Zenith
Out Band Rejection	fo = 1575.42MHz fo ± 30 MHz 5dB Min. fo ± 50 MHz 20dB Min. fo ± 100 MHz 25dB Min.
Input Voltage	Typ. 2.5~5.5V
Total Gain @ Zenith	27dB typical at 3.0V
Current Consumption	10mA typical at 3.0V
Noise Figure	1.3dB typical

Mechanical

Dimensions	Height 28.5mm x Diameter 49.2mm
Housing	UV Resistant ABS
Base and Thread	Nickel plated steel
Thread	M18
Thread Diameter	18mm
Weather Proof Gasket	CR4305 foam with 3M9448WC double-side adhesive
Cable Pull	8 Kgf
Recommended Mounting Torque	95Nm
Maximum Mounting Torque	135Nm

Environmental

Waterproof	IP67
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 measurements in the above table, were taken for the antenna mounted on a 30x30 cm metal plate. For a specific case performance refers to the below plots.

3. Test Set Up

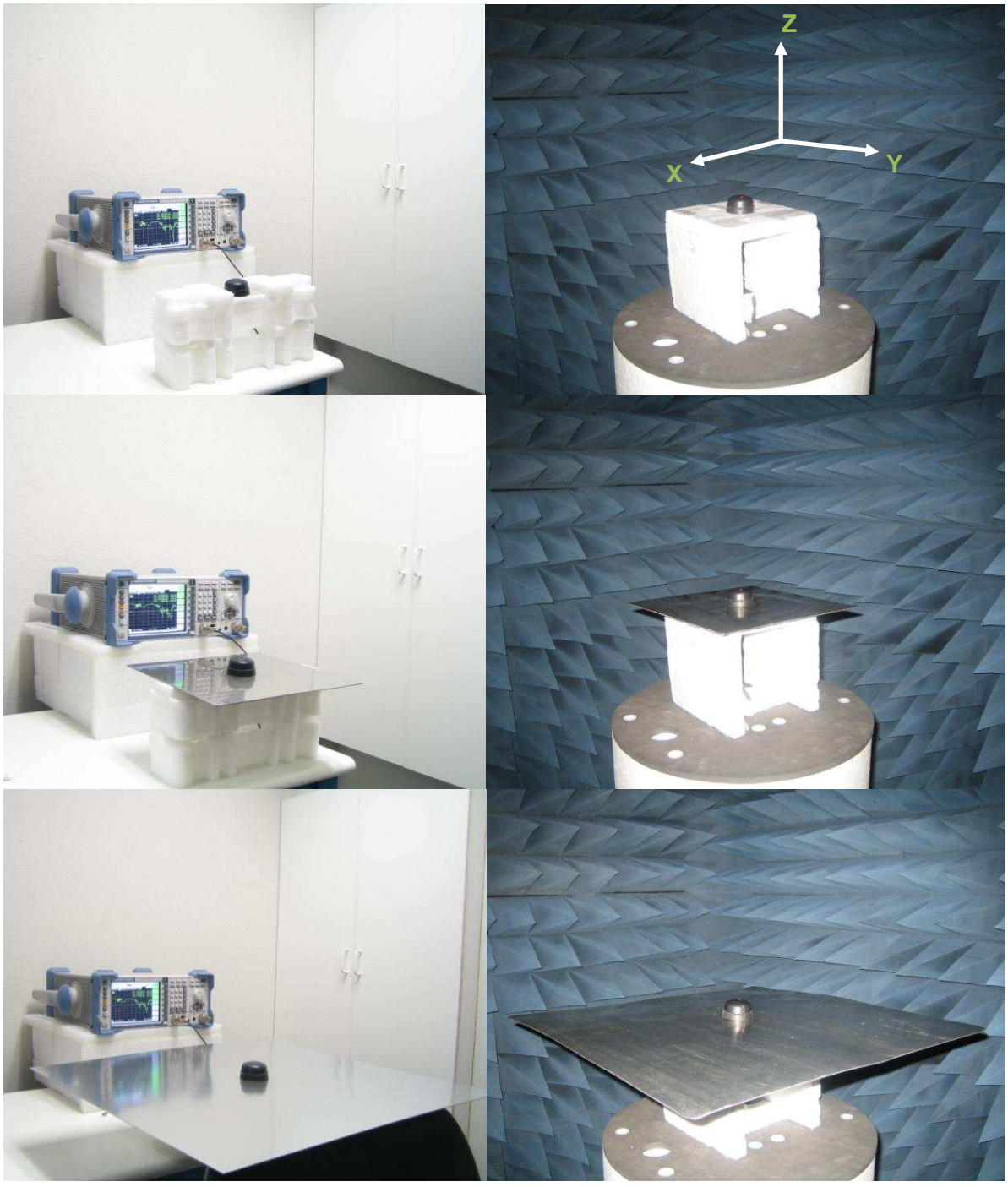


Figure 1. MA105 Antenna test set up in free space, 30x30 cm metal plate and 60x60 cm metal plate, R&SZVL6 VNA (Left) and R&S4100 CTIA 3D Chamber (Right).

4. Cellular Antenna Parameters

4.1 Return Loss

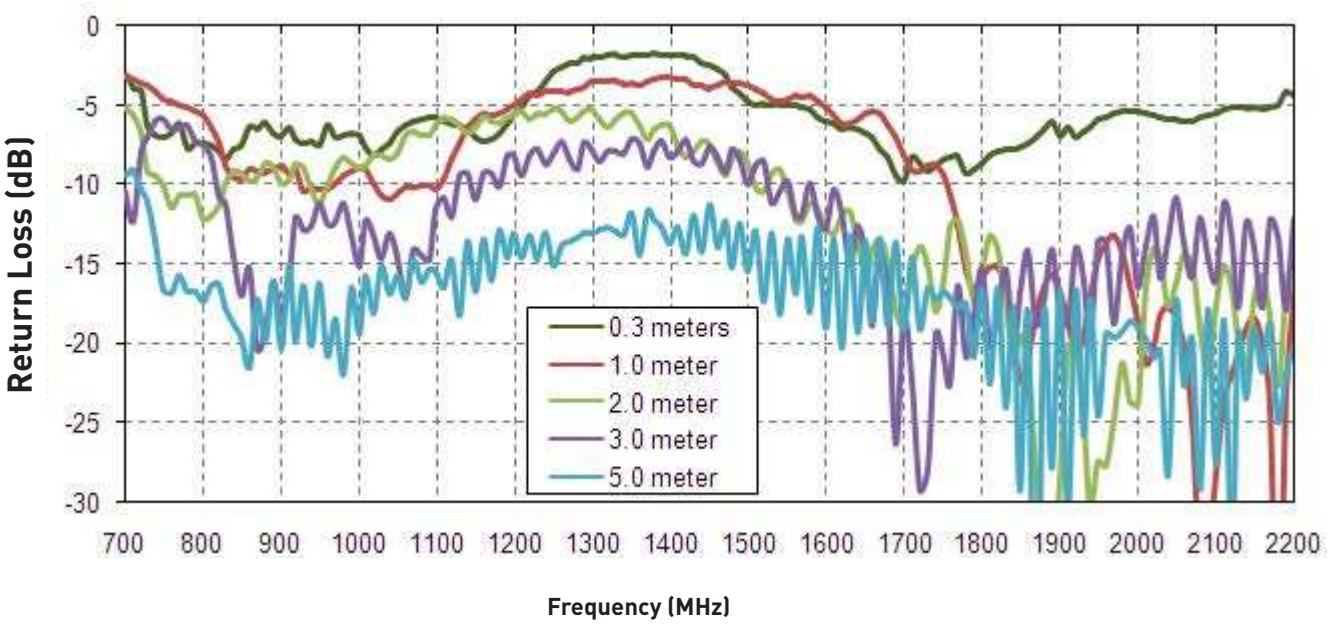


Figure 2. Return Loss of the MA105 antenna in free space

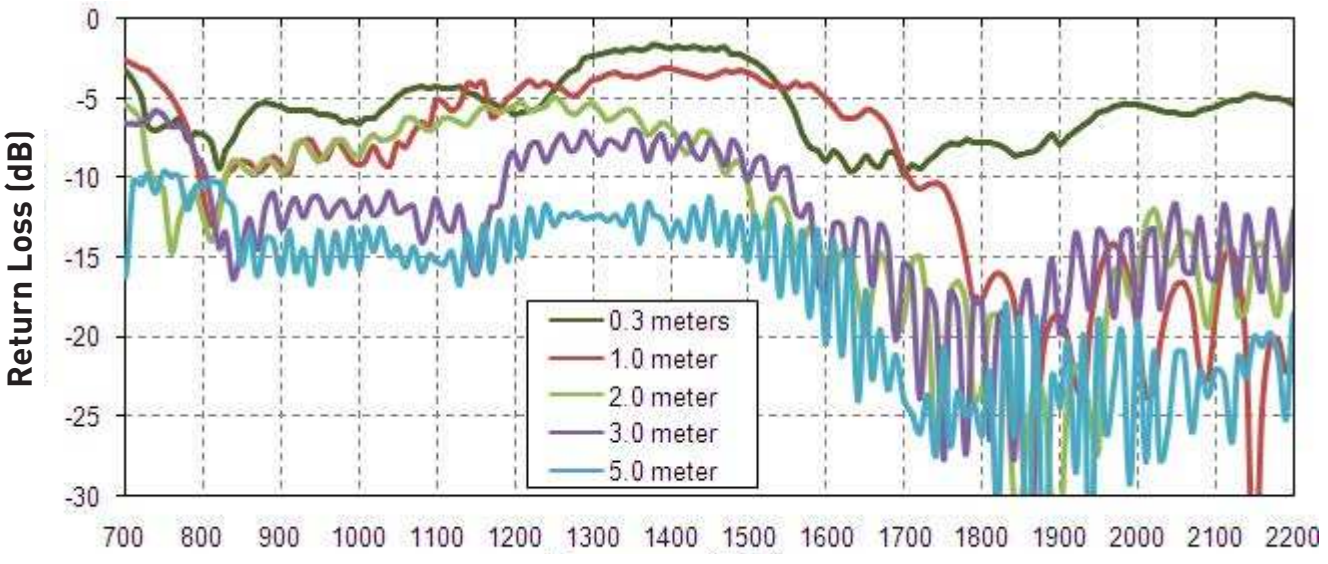


Figure 3. Return Loss of the MA105 antenna on 30*30cm metal plate

4.1 Return Loss

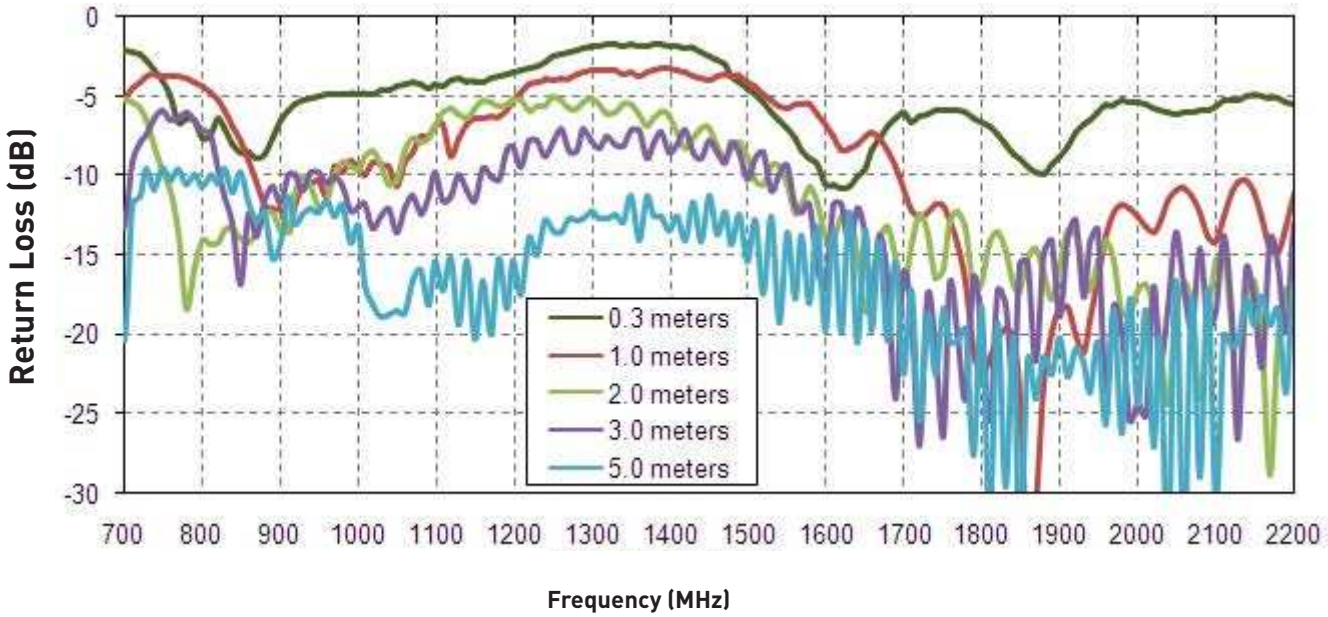


Figure 4. Return Loss of the MA105 antenna on 60*60cm metal plate

4.2 Efficiency

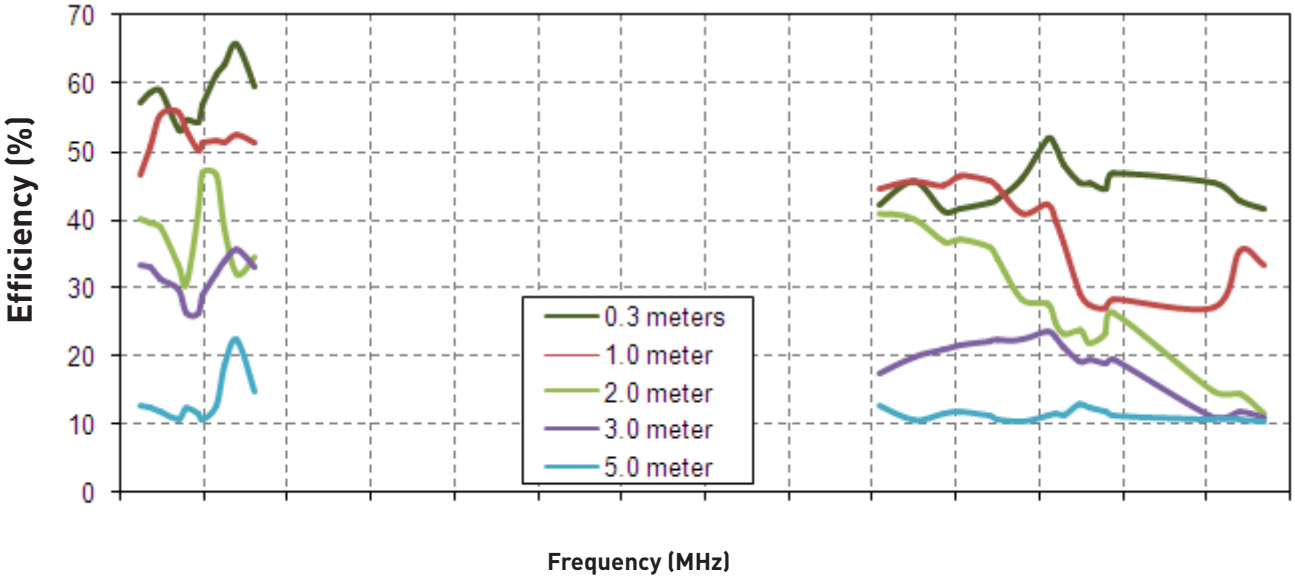


Figure 5. Efficiency of the MA105 antenna in free space

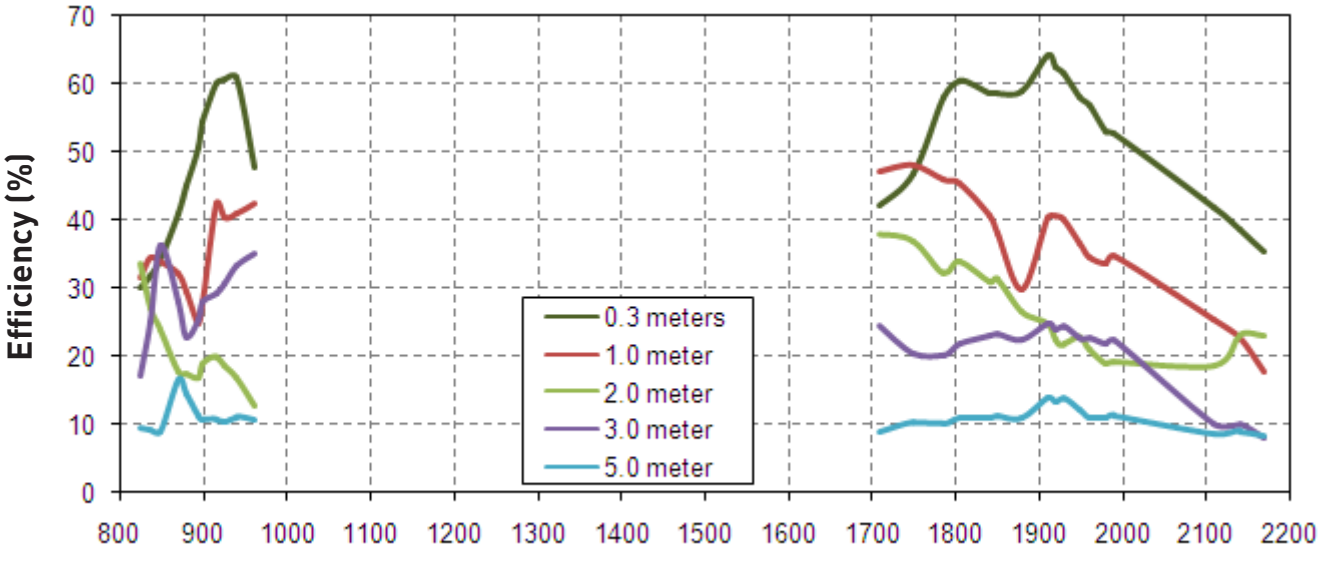


Figure 6. Efficiency of the MA105 antenna on 30*30cm metal plate

4.2 Efficiency

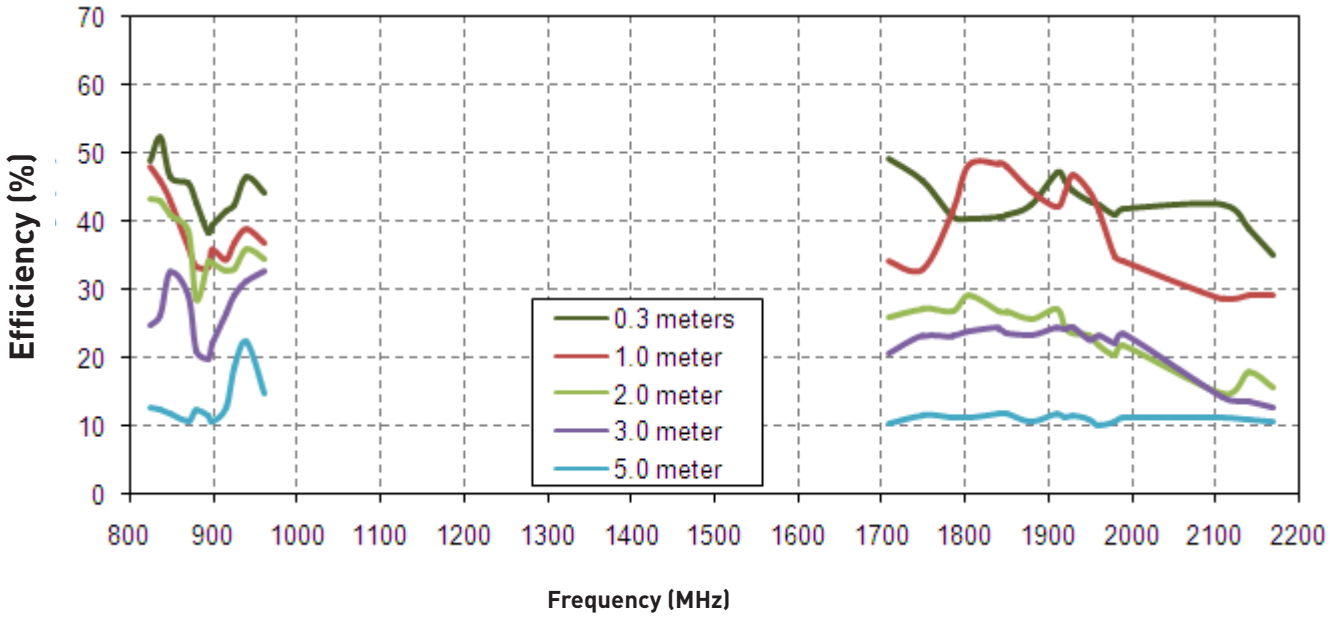


Figure 7. Efficiency of the MA105 antenna on 60*60cm metal plate.

4.3 Peak Gain

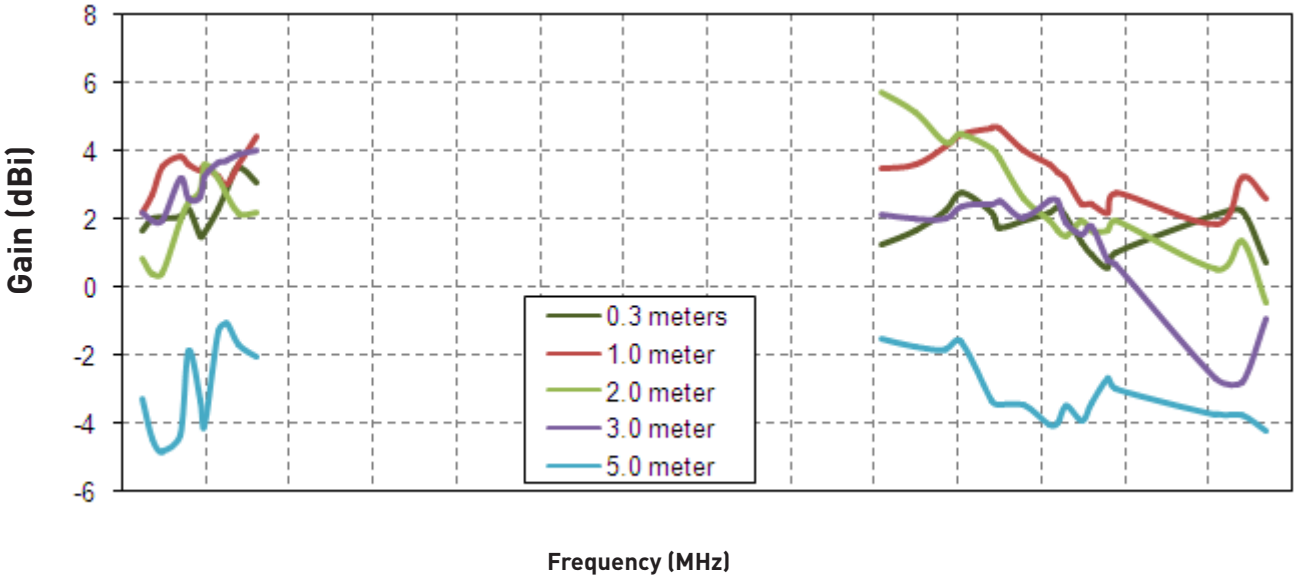


Figure 8. Gain of the MA105 antenna in free space

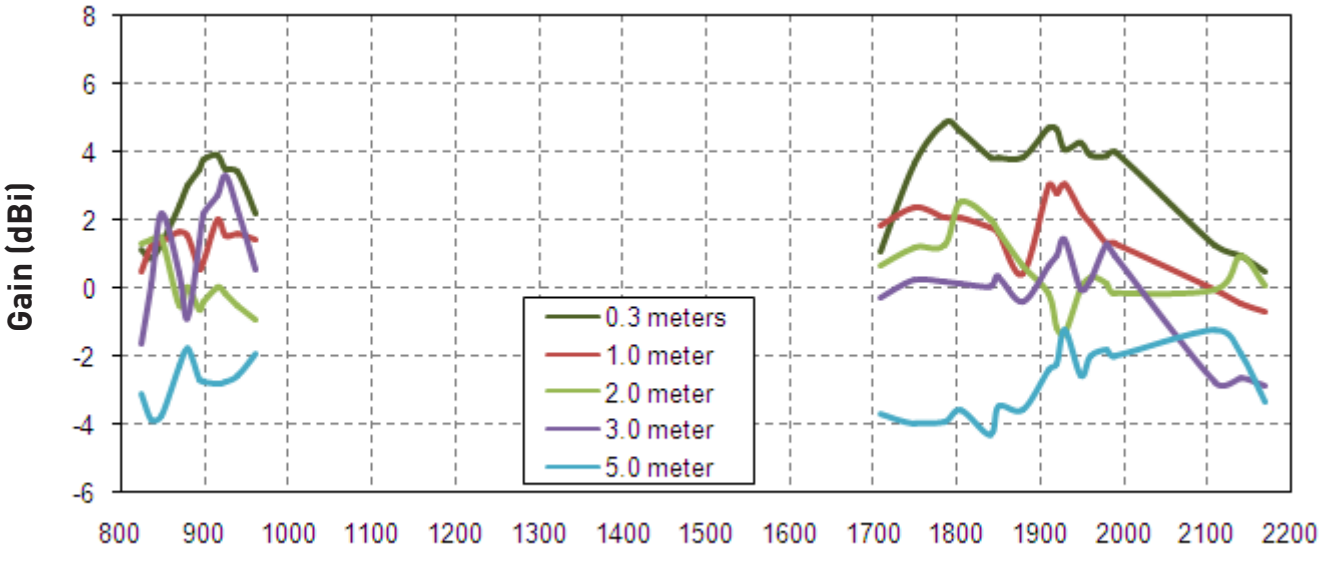


Figure 9. Gain of the MA105 antenna on 30*30cm metal plate

4.3 Peak Gain

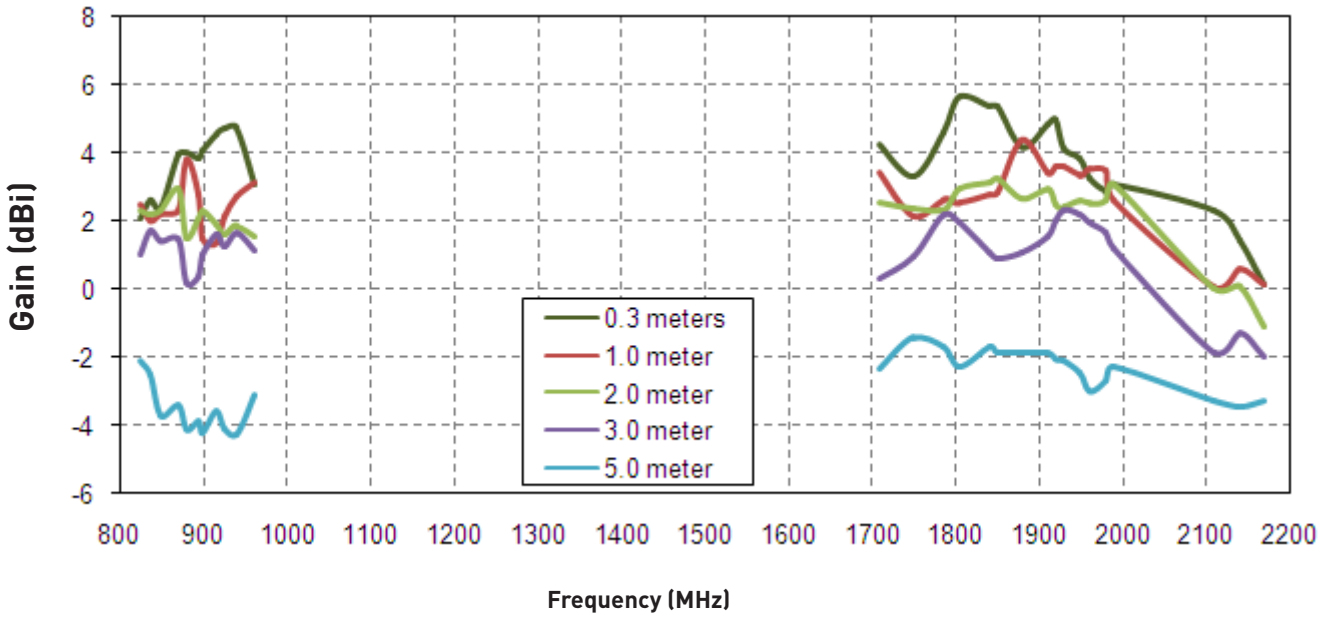


Figure 10. Gain of the MA105 antenna on 60*60cm metal plate

4.4 Radiation pattern

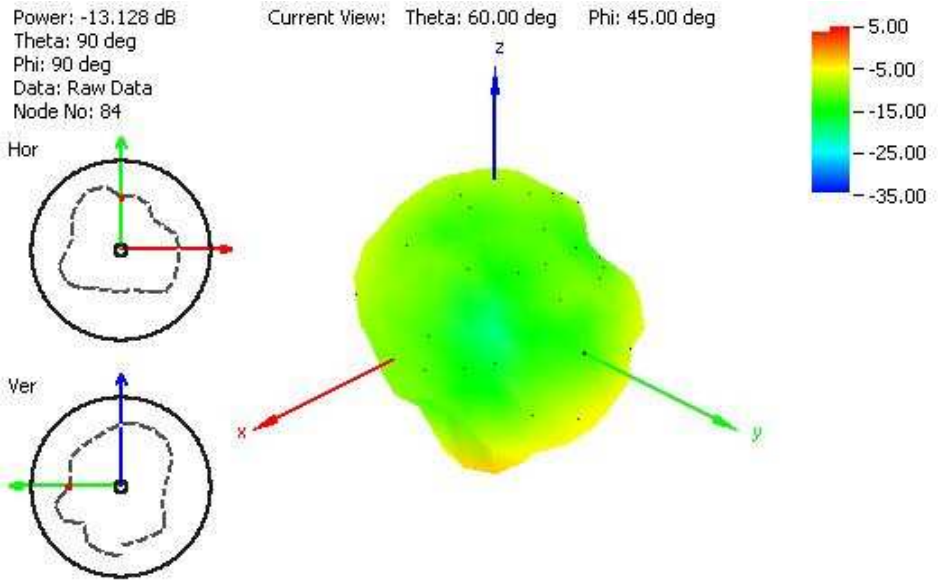


Figure 11. Radiation pattern at 849 MHz, Figure 1 as reference (dB), with 2 meter RG174 cable and free space

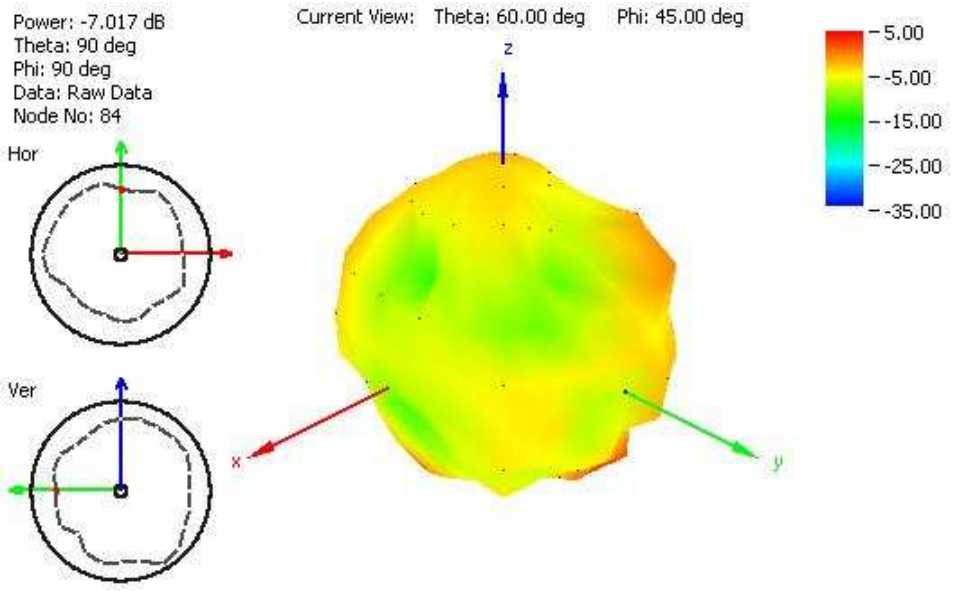


Figure 12. Radiation pattern at 915 MHz, Figure 1 as reference (dB), with 2 meter RG174 cable and free space

4.4 Radiation pattern

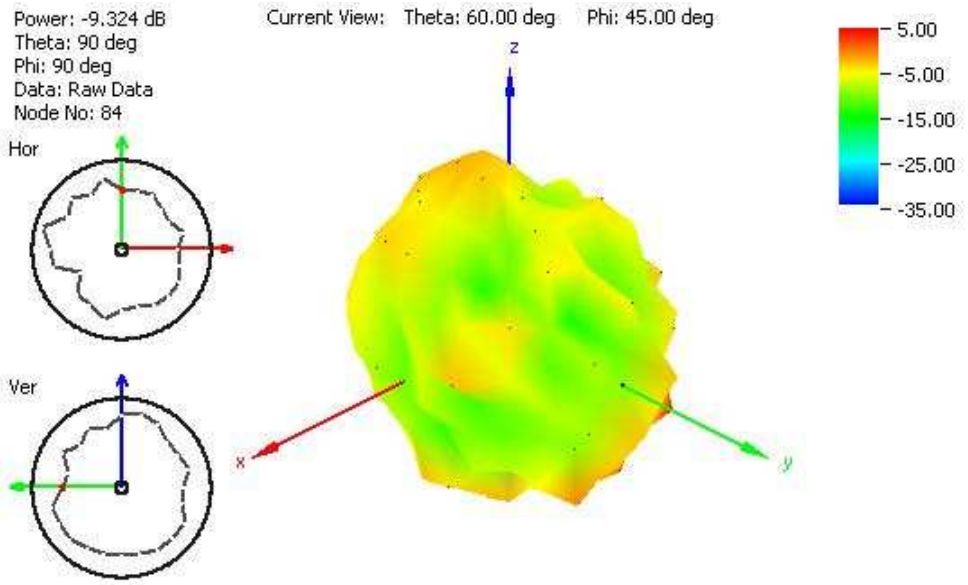


Figure 13. Radiation pattern at 1805 MHz, Figure 1 as reference (dB), with 2 meter RG174 cable and free space

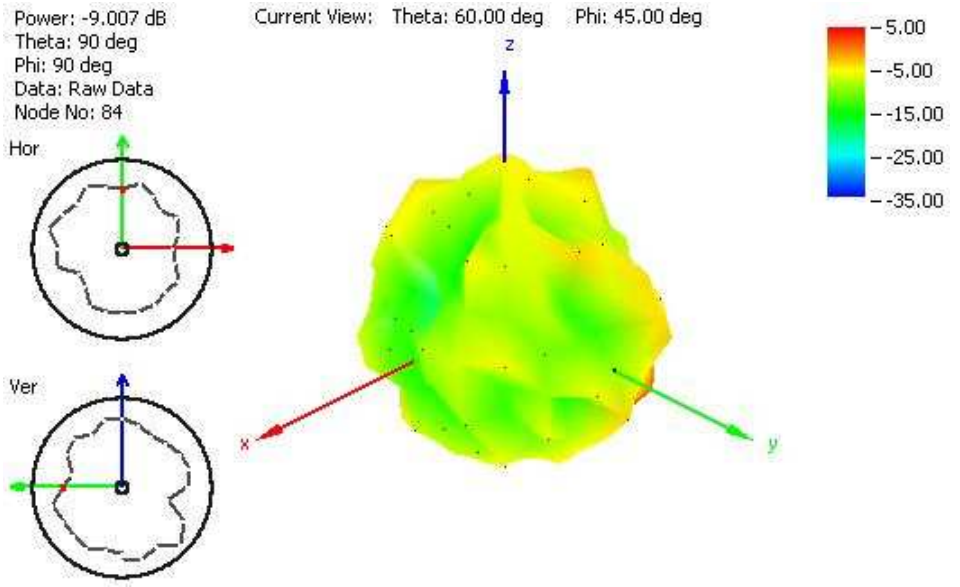


Figure 14. Radiation pattern at 1910 MHz, Figure 1 as reference (dB), with 2 meter RG174 cable and free space

4.4 Radiation pattern

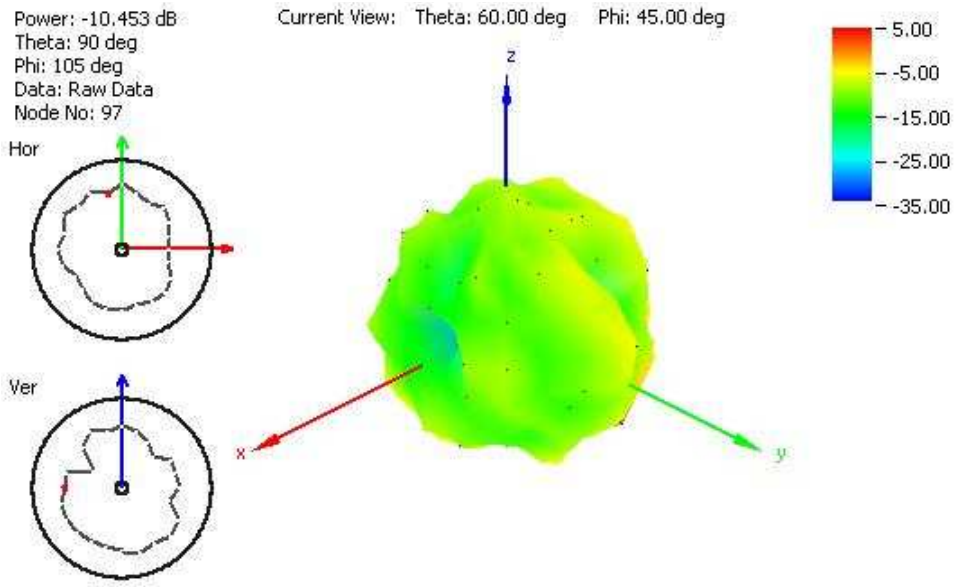


Figure 15. Radiation pattern at 2110 MHz, Figure 1 as reference (dB), with 2 meter RG174 cable and free space.

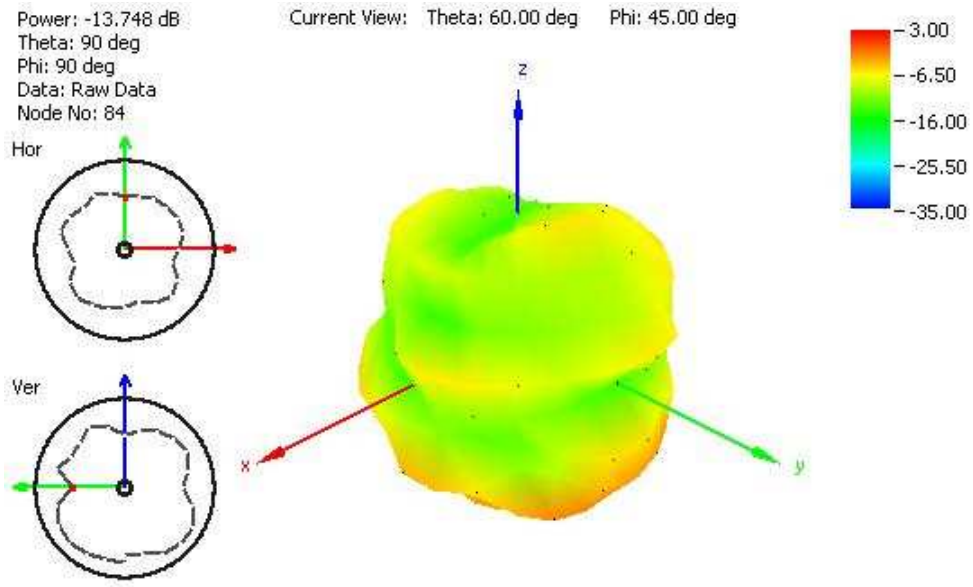


Figure 16. Radiation pattern at 849 MHz, Figure 1 as reference (dB), with 2 meter RG174 cable and 30x30 cm metal plate

4.4 Radiation pattern

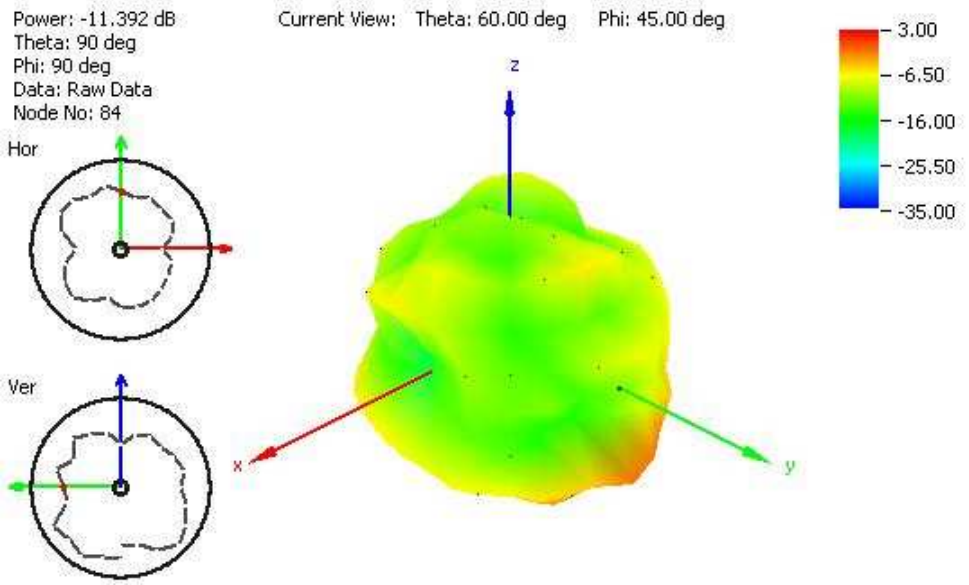


Figure 17. Radiation pattern at 915 MHz, Figure 1 as reference (dB), with 2 meter RG174 cable and 30x30 cm metal plate

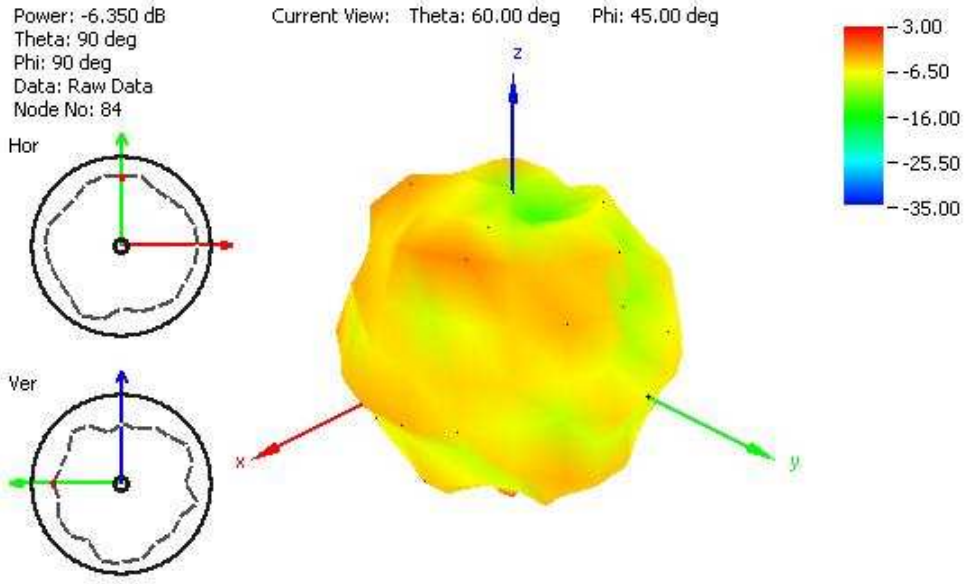


Figure 18. Radiation pattern at 1805 MHz, Figure 1 as reference (dB), with 2 m RG174 cable and 30x30 cm metal plate

4.4 Radiation pattern

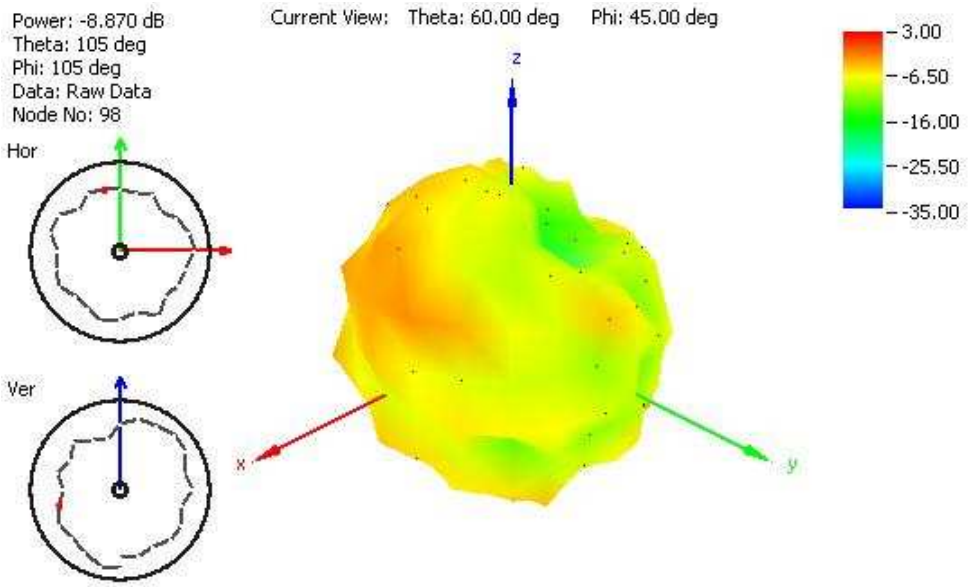


Figure 19. Radiation pattern at 1910 MHz, Figure 1 as reference (dB), with 2 meter RG174 cable and 30x30 cm metal plate

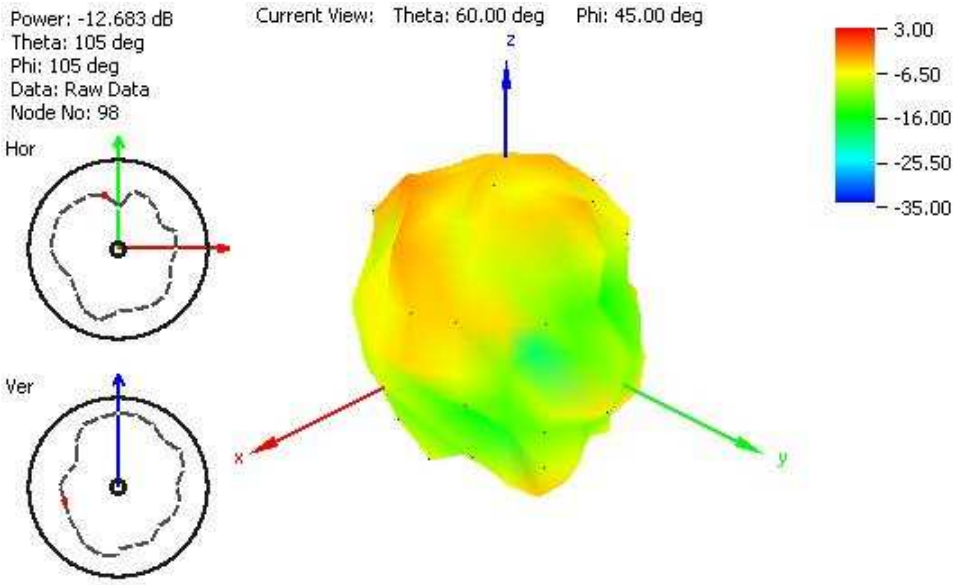


Figure 20. Radiation pattern at 2110 MHz, Figure 1 as reference (dB), with 2 meter RG174 cable and 30x30 cm metal plate

4.4 Radiation pattern

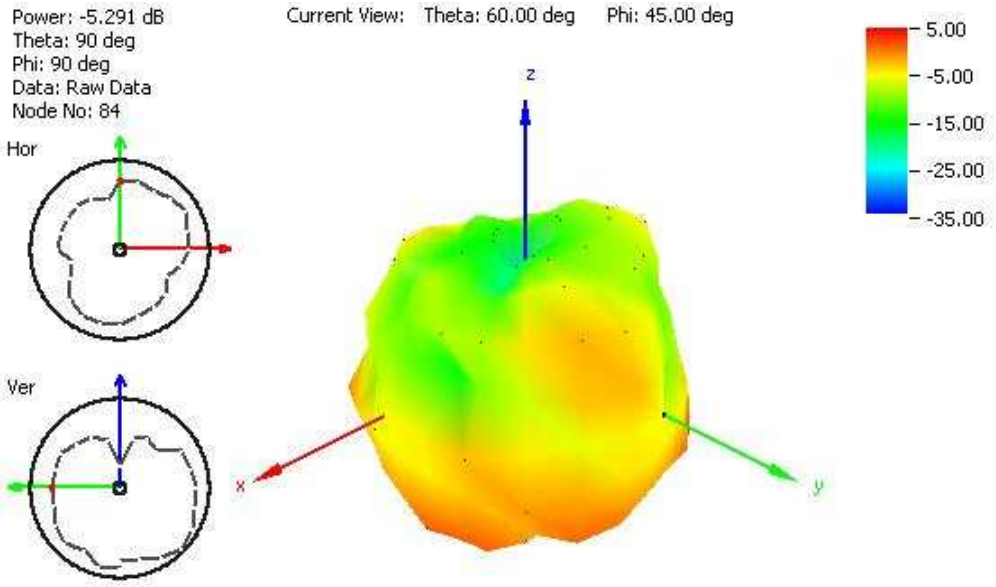


Figure 21. Radiation pattern at 849 MHz, Figure 1 as reference (dB), with 2 meter RG174 cable and 60x60 cm metal plate

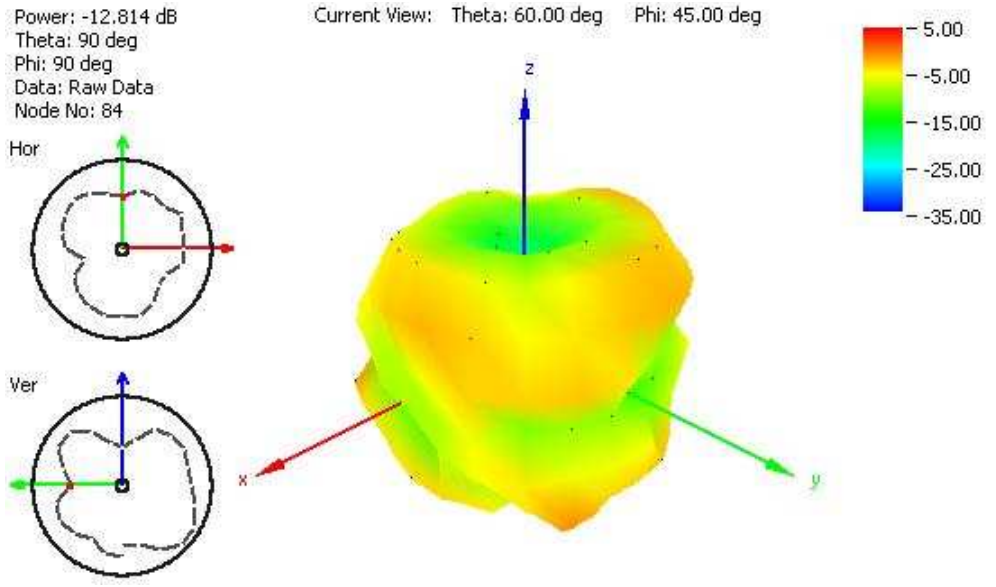


Figure 22. Radiation pattern at 915 MHz, Figure 1 as reference (dB), with 2 meter RG174 cable and 60x60 cm metal plate

4.4 Radiation pattern

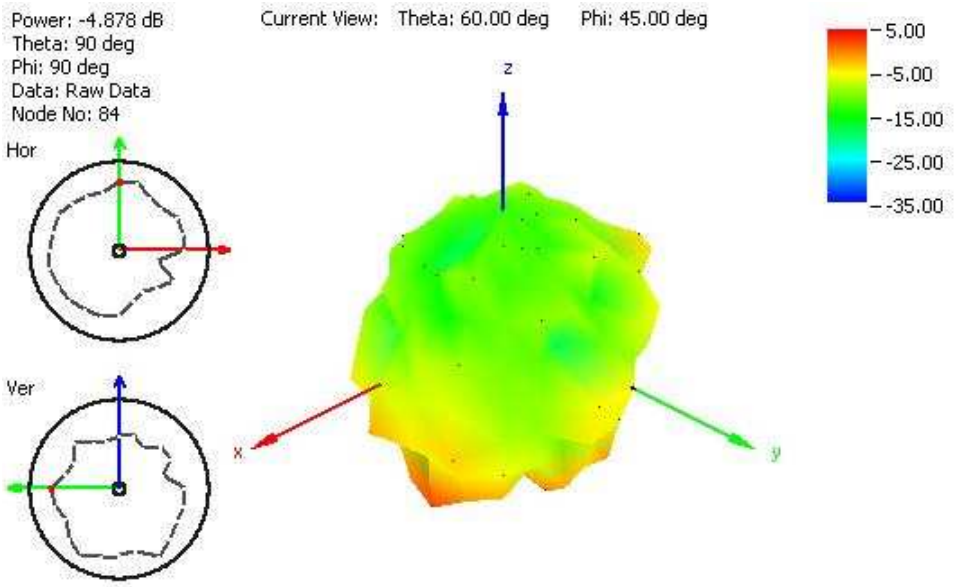


Figure 23. Radiation pattern at 1805 MHz, Figure 1 as reference (dB), with 2 meter RG174 cable and 60x60 cm metal plate

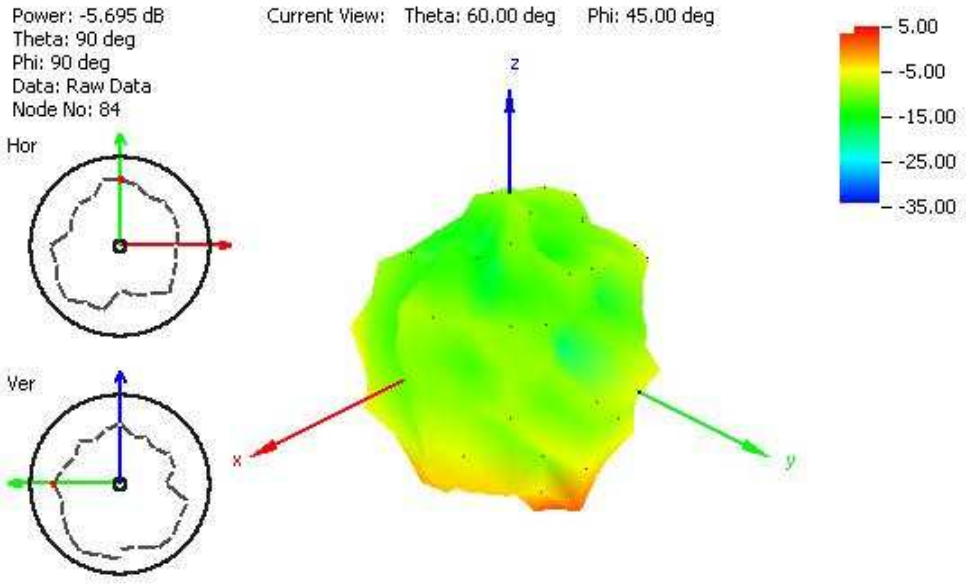


Figure 24. Radiation pattern at 1910 MHz, Figure 1 as reference (dB), with 2 meter RG174 cable and 60x60 cm metal plate

4.4 Radiation pattern

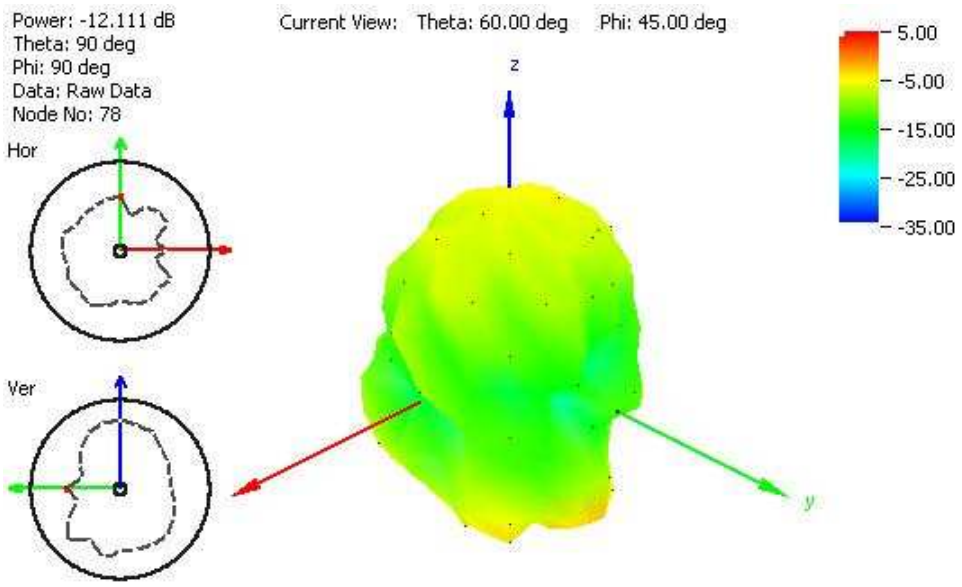
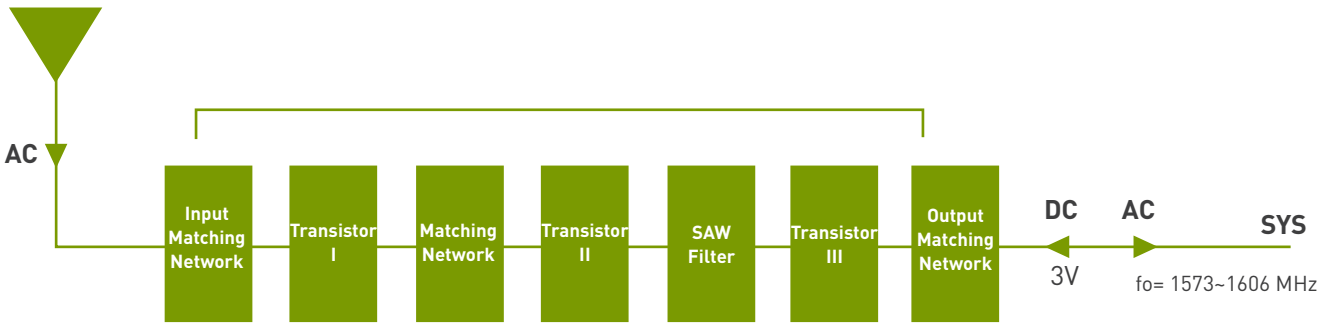


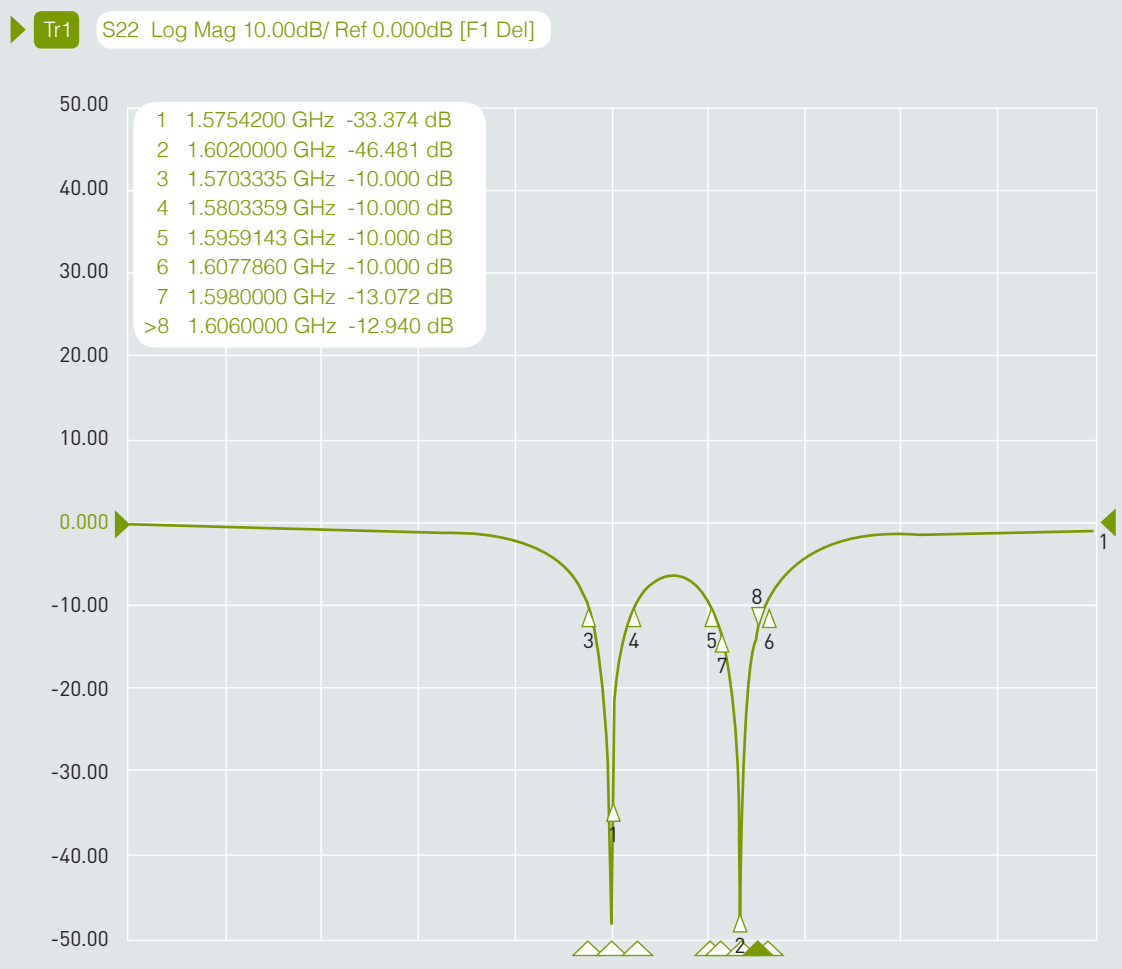
Figure 25. Radiation pattern at 2110 MHz, Figure 1 as reference (dB), with 2 meter RG174 cable and 60x60 cm metal plate

5. System Block Diagram



6. GPS-GLONASS Passive Antenna Results

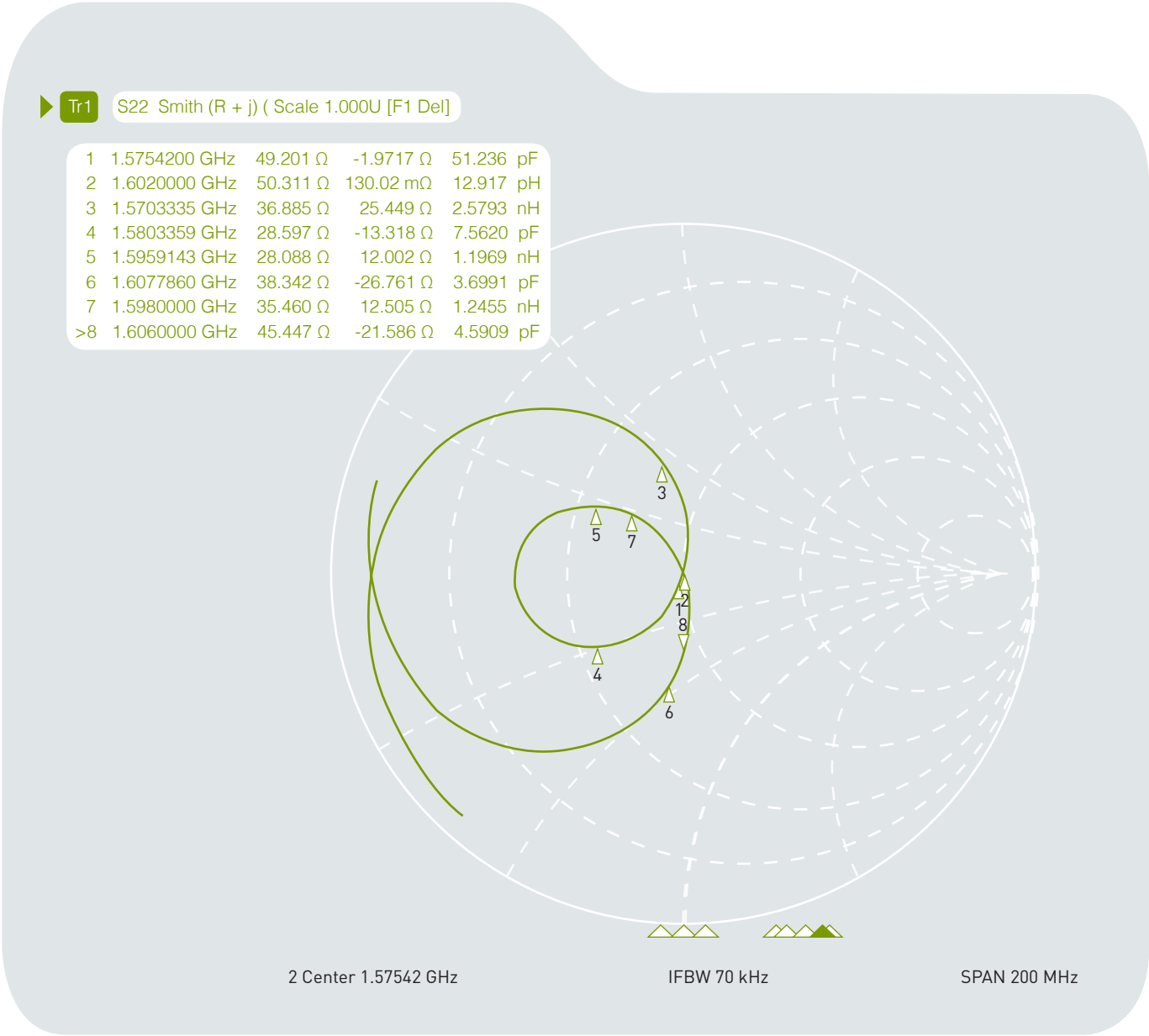
6.1 Return Loss



6.2 VSWR


Tr1
S22 SWR 1.000dB/ Ref 1.000 [F1 Del]
1 1.5754200 GHz 1.0438
2 1.6020000 GHz 1.0097
3 1.5703335 GHz 1.9251
4 1.5803359 GHz 1.9251
5 1.5959143 GHz 1.9250
6 1.6077860 GHz 1.9250
7 1.5980000 GHz 1.5709
>8 1.6060000 GHz 1.5822
11.00
10.00
9.000
8.000
7.000
6.000
5.000
4.000
3.000
2.000
1.000
2 Center 1.57542 GHz
IFBW 70 kHz
Span 200 MHz

6.3 Smith Chart

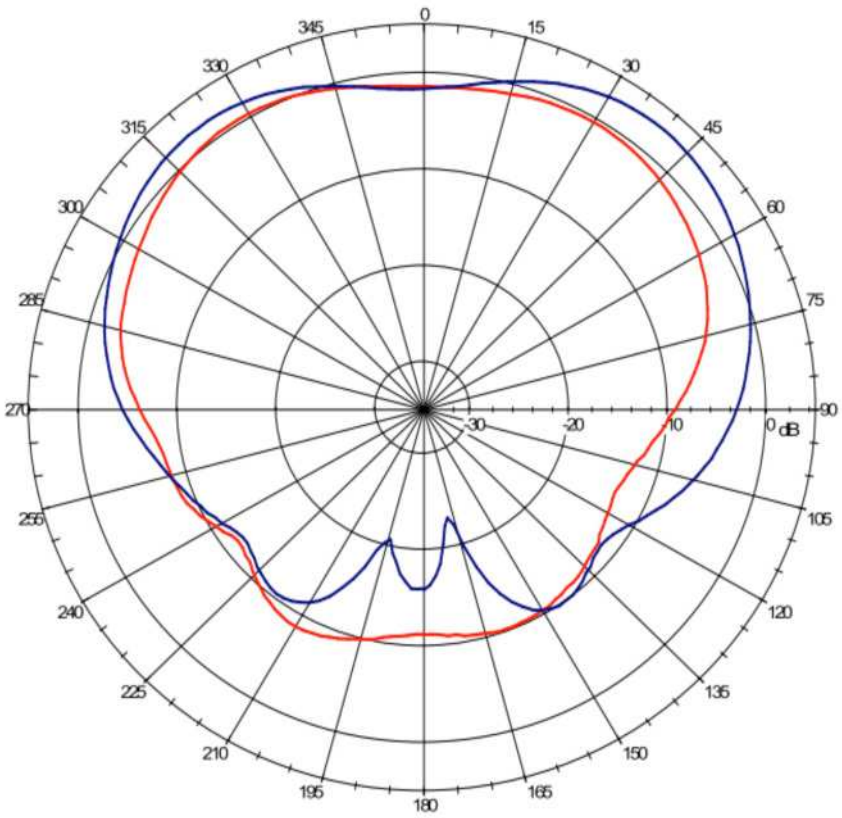


6.4 Radiation Patterns

6.4.1 1575.42MHz

Far-field amplitude of H.nsi

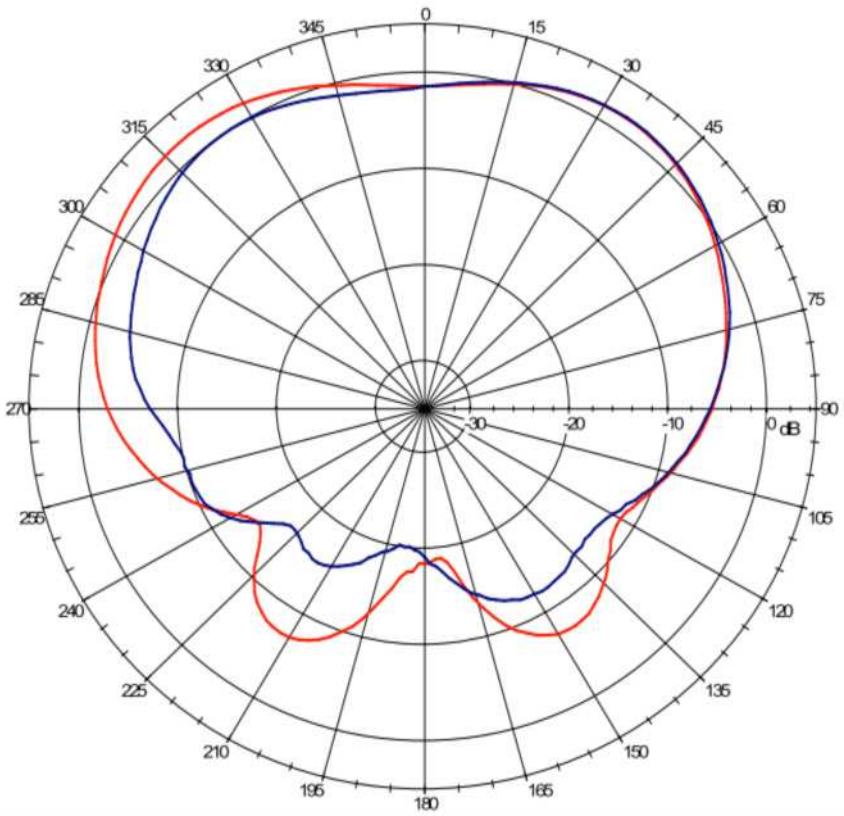
H E



6.4.2 1598MHz

Far-field amplitude of H.nsi

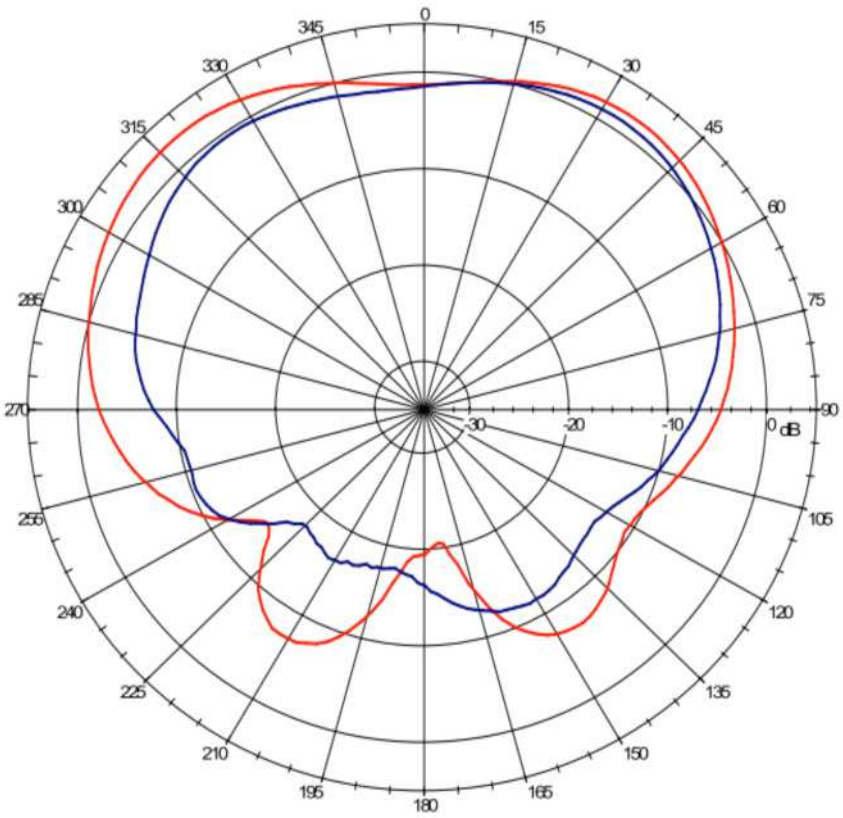
H E



6.4.3 1602MHz

Far-field amplitude of H.nsi

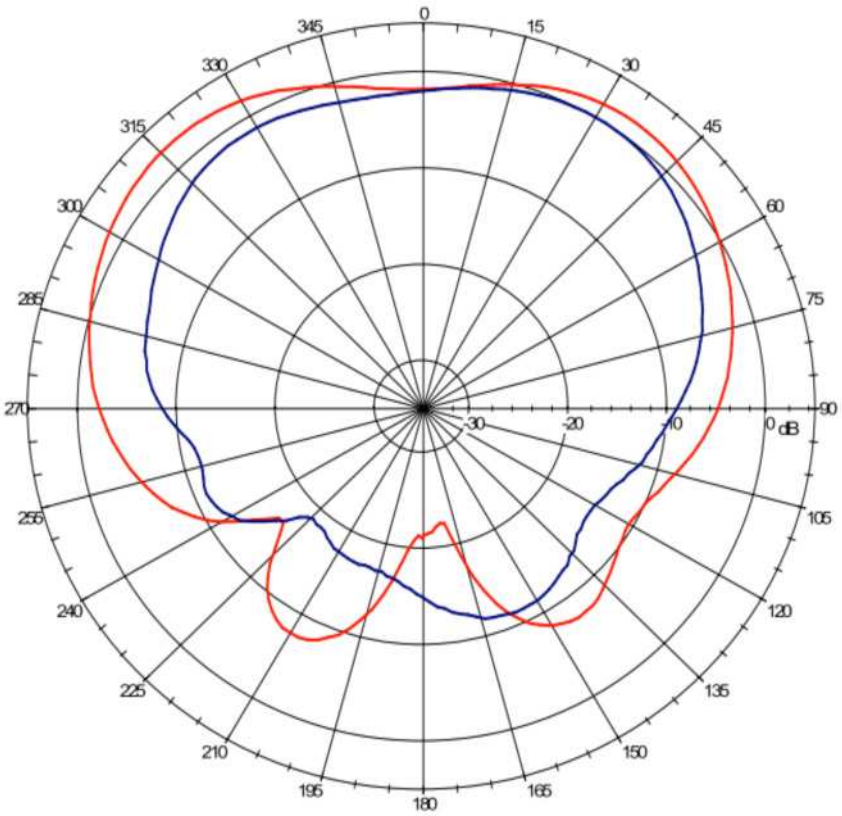
H E



6.4.4 1602MHz

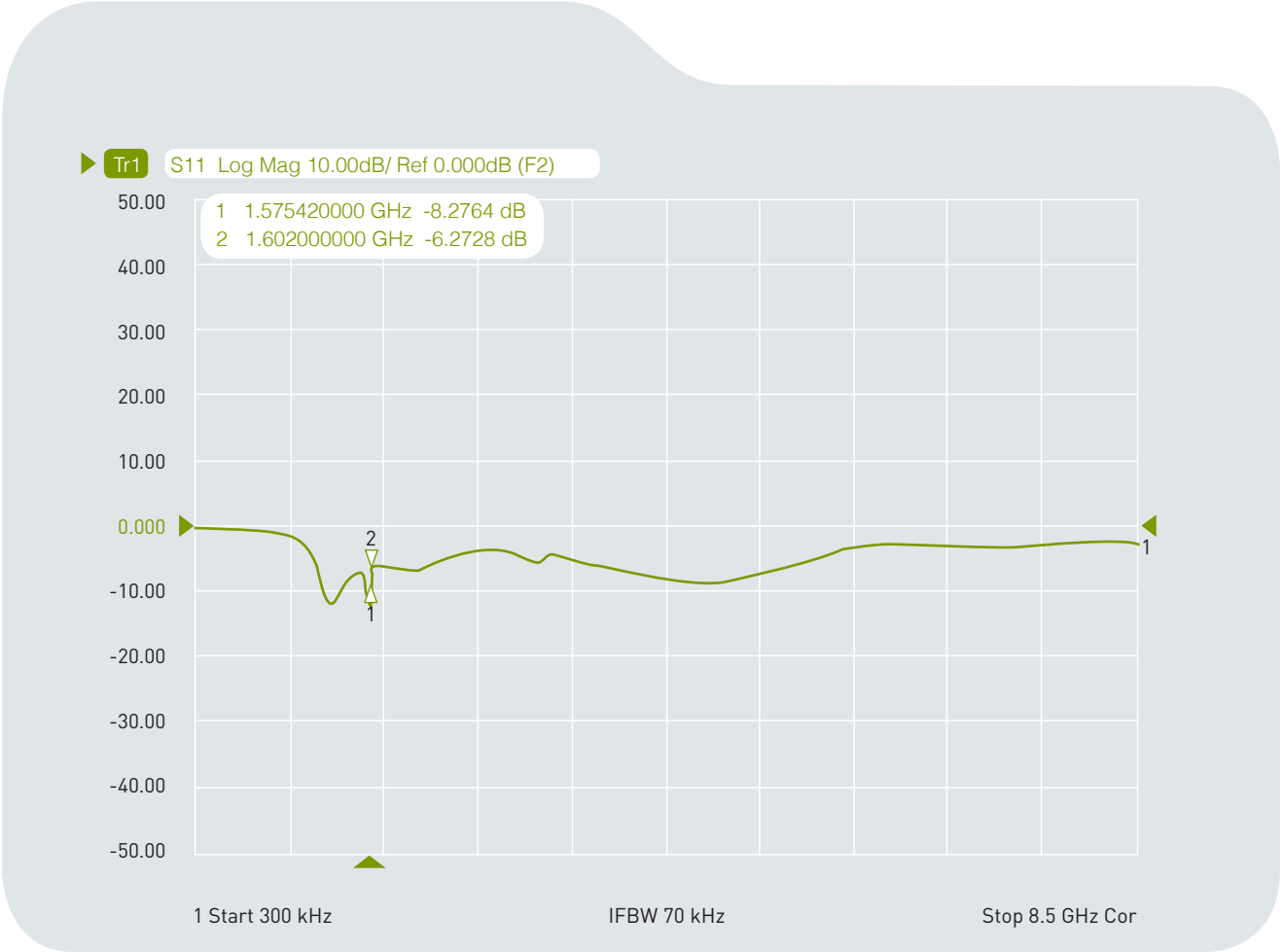
Far-field amplitude of H.nsi

H E

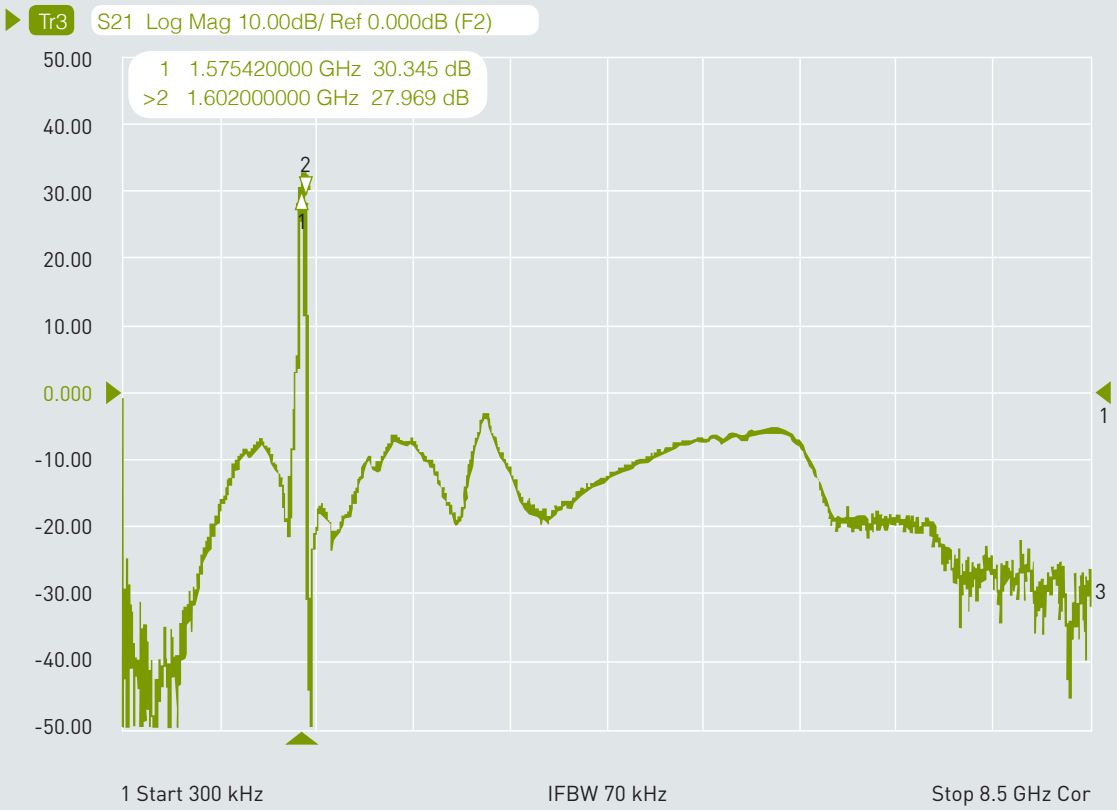


7. GPS - Low Noise Amplifier

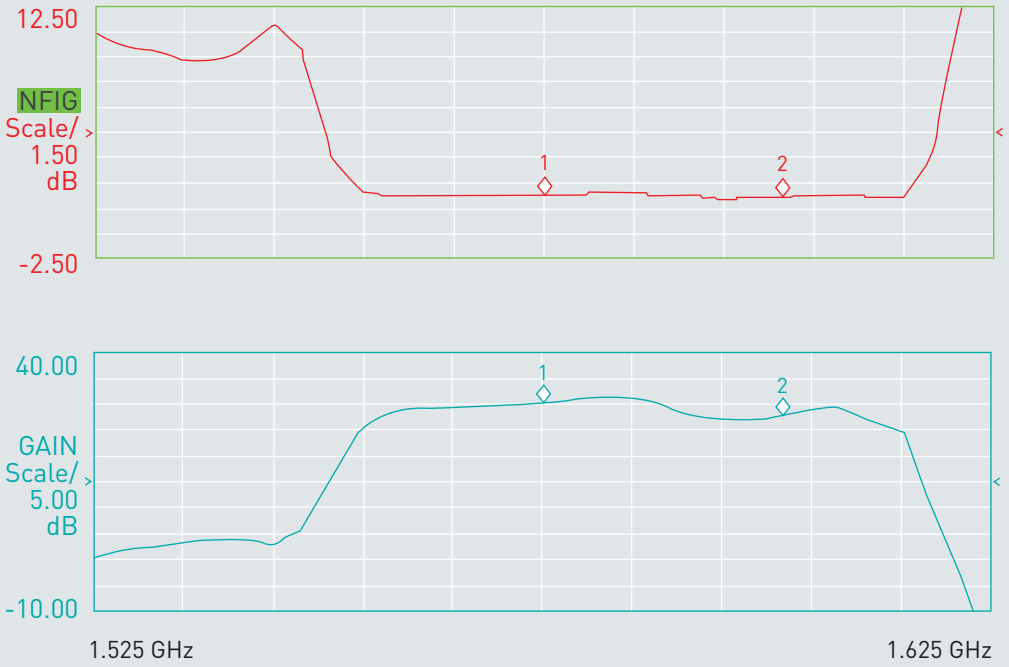
7.1 S11 Return Loss



7.2 S21 Gain


Tr3
S21 Log Mag 10.00dB/ Ref 0.000dB (F2)
1 1.575420000 GHz 30.345 dB
>2 1.602000000 GHz 27.969 dB
50.00
40.00
30.00
20.00
10.00
0.000
-10.00
-20.00
-30.00
-40.00
-50.00
1
3
1 Start 300 kHz
IFBW 70 kHz
Stop 8.5 GHz Cor

7.3 Noise Figure

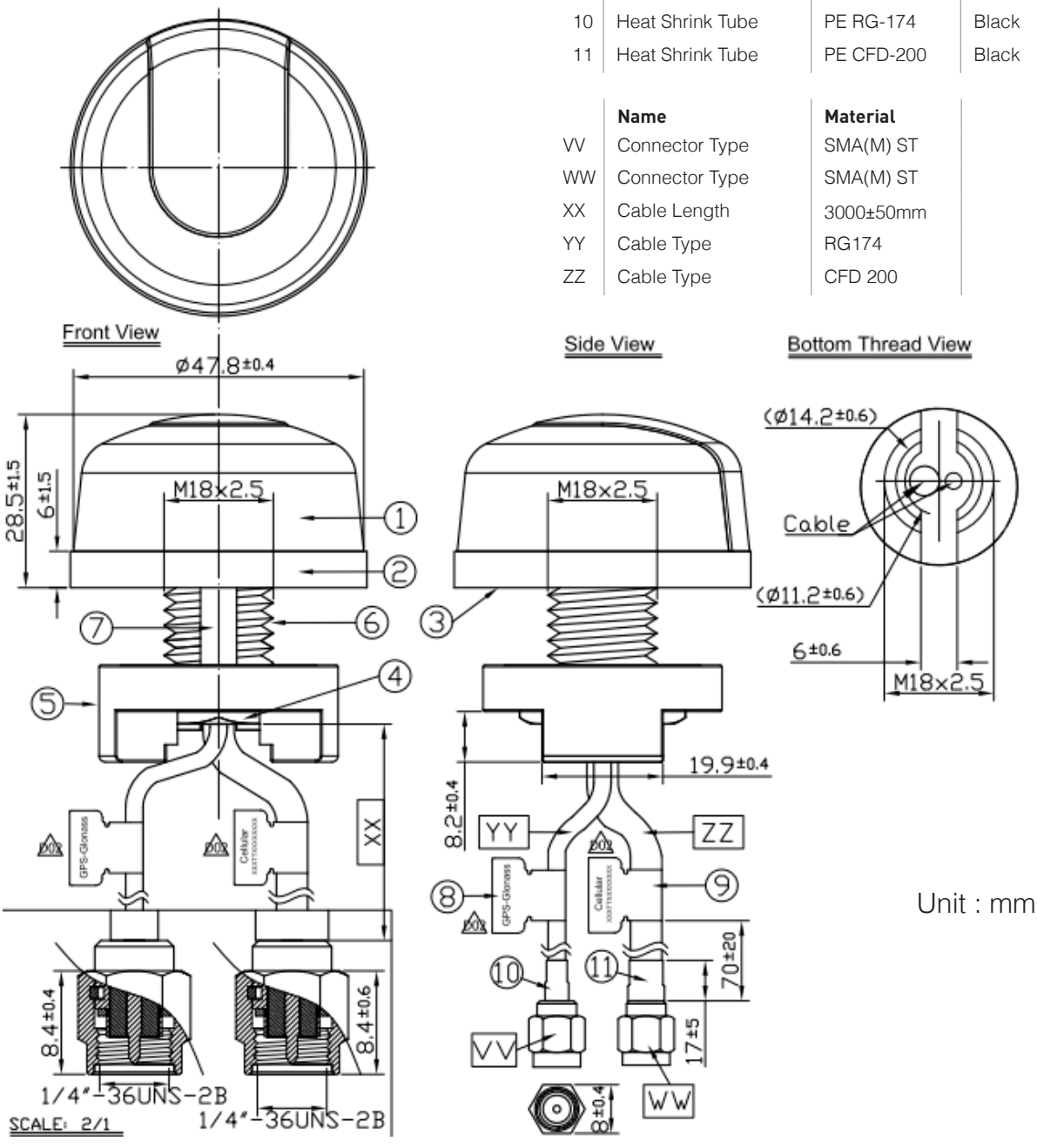


			NFIG	GAIN
Markers	MKr1	1.5754 GHz	1.3977 dB	30.2930 dB
	MKr2	1.6021 GHz	1.2314 dB	27.5857 dB

8. Drawing

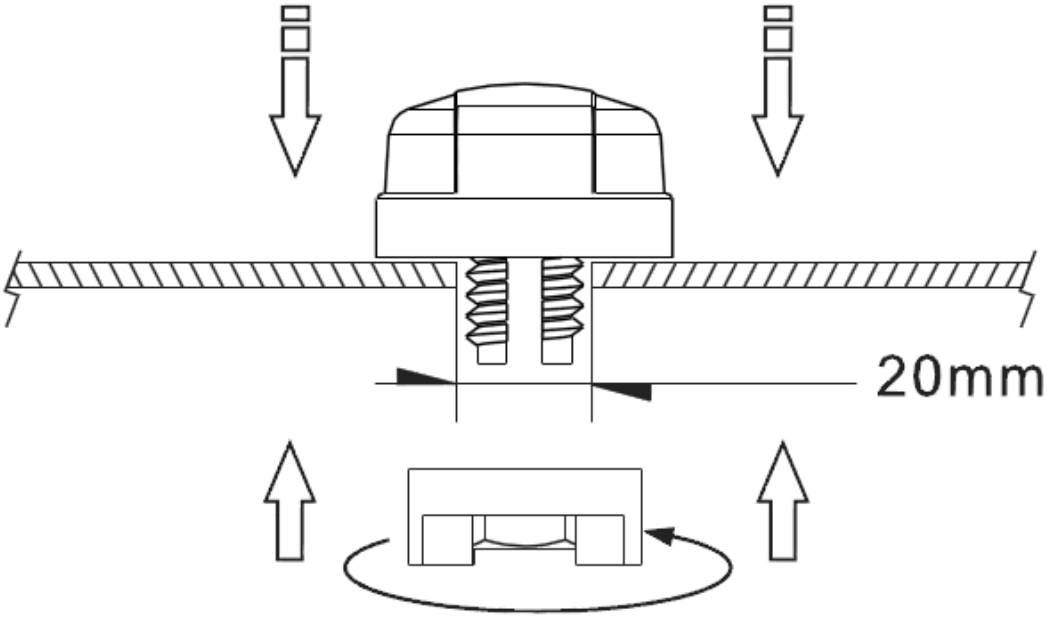
	Name	Material	Finish	QTY
1	Housing	ABS	Black	1
2	Closed Cell Foam	CR 4305	Black	1
3	3M Double Adhesive	3M 9448 HK	White Liner	1
4	M18 Inner Nut	Carbon Steel	Ni Plated	1
5	Outer Nut Cover	ABS	Black	1
6	M18x2.5 Thread	Zinc Alloy	Ni Plated	1
7	Rubber Stopper	Rubber	Black	1
8	GPS-Glonass Label	Coated Paper	Orange	1
9	Cellular Label	Coated Paper	Blue	1
10	Heat Shrink Tube	PE RG-174	Black	1
11	Heat Shrink Tube	PE CFD-200	Black	1

	Name	Material
VV	Connector Type	SMA(M) ST
WW	Connector Type	SMA(M) ST
XX	Cable Length	3000±50mm
YY	Cable Type	RG174
ZZ	Cable Type	CFD 200



Unit : mm

9. Installation



Recommended torque for mounting is 95Nm or 70ftlbs

Maximum torque for mounting is 135.6Nm or 100ft lbs

10. Packaging

1pcs antenna per big PE bag

40 big PE bags per box

Unit : mm