TAOGLAS

Datasheet

Passive Dual Pin GNSS Patch Antenna

Part No:

GPDF254.A

Description:

GPS/GLONASS/Galileo/BeiDou Dual Pin Passive Antenna Covering 1561/1575/1602MHz

Features:

Dual-Pin Patch for Lowest Axial Ratio

Covering Bands:

- GPS L1
- GLONASS G1
- Galileo E1
- BeiDou B1

Manufactured and tested in a TS16949 first tier automotive approved facility

Dimensions: 25 x 25 x 4mm

RoHS & Reach Compliant

1. Introduction

The GPDF254.A is a high performance, single-band passive GNSS L1 antenna that has been carefully designed to provide fantastic positional accuracy on the full GNSS L1 spectrum. It has a dual feed, passive patch design which makes it ideal for next-generation GNSS devices that require excellent positional accuracy in a small form factor. The patch antenna, by means of a double resonance design, has a wide-band operation over GNSS systems including GPS (L1), GLONASS (G1), Galileo (E1) and BeiDou(B1). The 25 mm patch uses a dual-feed configuration to obtain an optimal axial ratio. The GPDF254.A is manufactured and tested in a TS16949 first tier automotive approved facility.

Typical applications include:

- High accuracy positioning and navigation systems
- UAVs, Robotics & Autonomous Vehicles
- Transportation & Telematics
- Precision Agriculture
- RTK Systems

The GPDF254.A is the latest embedded addition to Taoglas' product portfolio of high precision GNSS antennas. When used on the base and/or the rover as part of an RTK configuration, the GPDF254.A can achieve genuine cm-level accuracy with proven results.

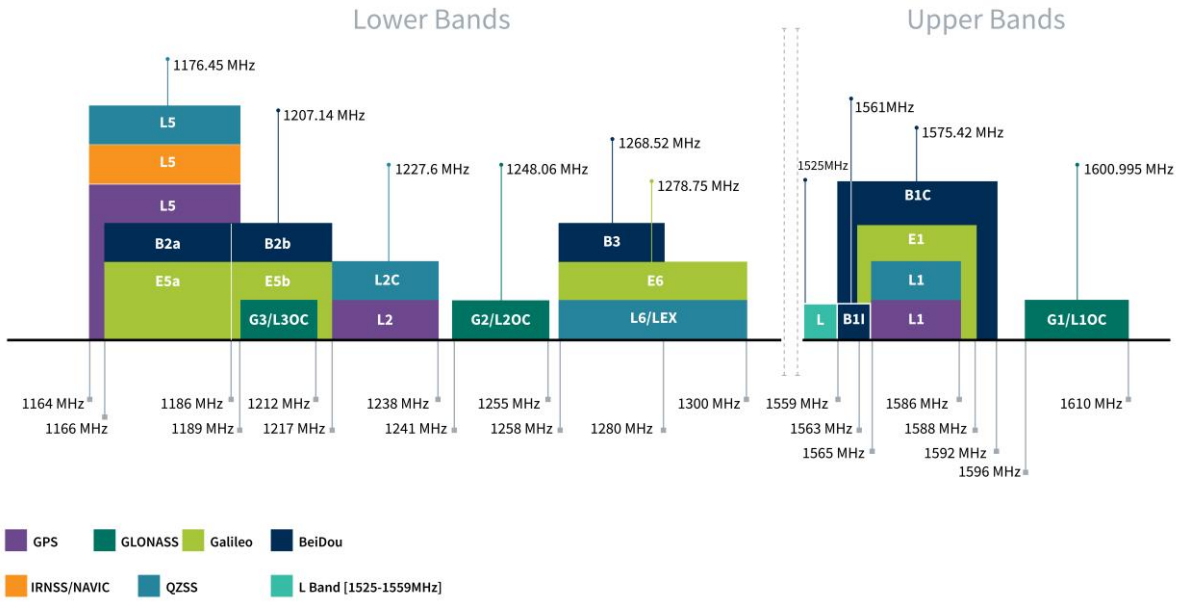
Full integration guidelines are contained in Section 8 of this datasheet including the Taoglas HC125.A hybrid coupler that will be required for use for dual pin feed patch integrations. Two active versions of this antenna, the ADFGP.25A.07.0100C – tuned for a 70*70mm Ground Plane and ADFGP.25E.07.0100C – tuned for free space is available and supplied with 100mm cable and I-PEX MHFI connector as standard.

Contact your local Taoglas Customer Services team for more information on any of the products listed above or for support regarding integration.

2. Specifications

GNSS Frequency Bands Covered					
GPS	L1	L2	L5		
	■	□	□		
GLONASS	G1	G2	G3		
	■	□	□		
Galileo	E1	E5a	E5b	E6	
	■	□	□	□	
BeiDou	B1	B2a	B2b	B3	
	■	□	□	□	
QZSS (Regional)	L1	L2C	L5	L6	
	■	□	□	□	
IRNSS (Regional)	L5				
	□				
SBAS	L1/E1/B1	L5/B2a/E5a	G1	G2	G3
	■	□	■	□	□

*SBAS systems: WASS(L1/L5), EGNOSS(E1/E5a), SDCM(G1/G2/G3), SNAS(B1,B2a), GAGAN(L1/L5), QZSS(L1/L5), KAZZ(L1/L5).



GNSS Bands and Constellations

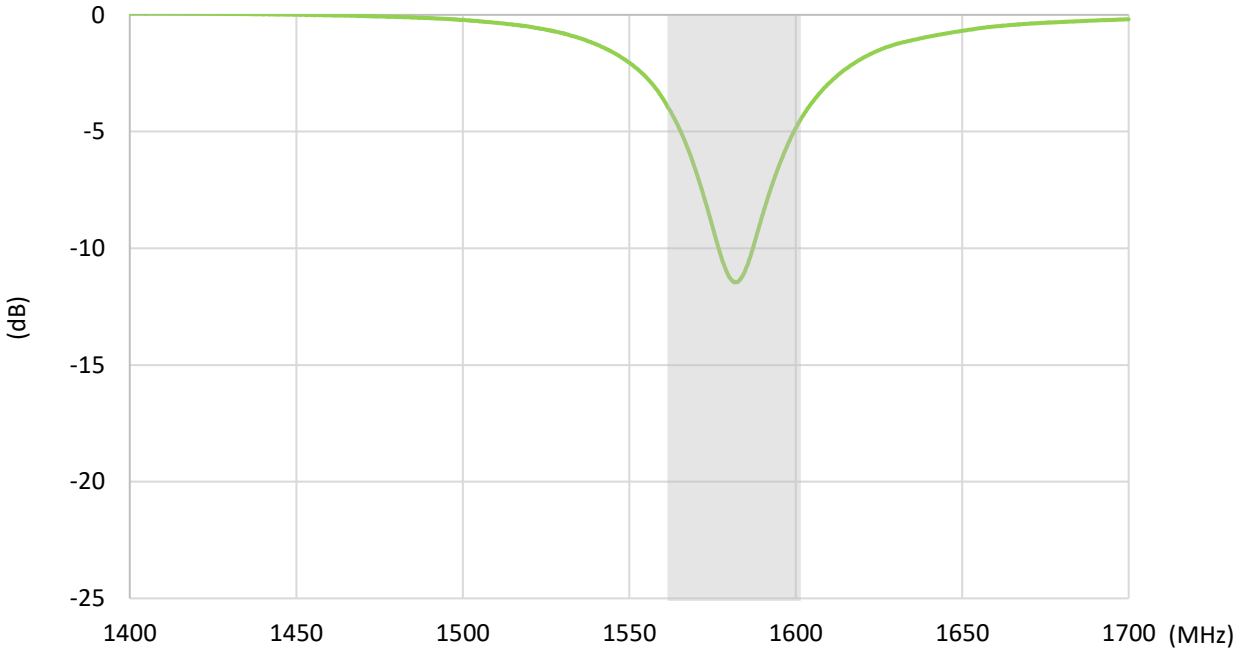
GNSS Electrical			
Frequency (MHz)	**1561**	**1575.42**	**1602**
Return Loss (dB)	< -10	< -10	< -10
Efficiency (%)	39.6	53.8	38
Peak Gain (dBi)	1.4	3.1	1.7
Average Gain (dB)	-4	-2.7	-4.2
Axial Ratio (dB)	0.9	0.7	0.54
Polarization	R.H.C.P.		
Impedance	**50**Ω		

Note. The patch antenna is tested with hybrid coupler HC125 and tuned on 70x70(mm) ground plane.

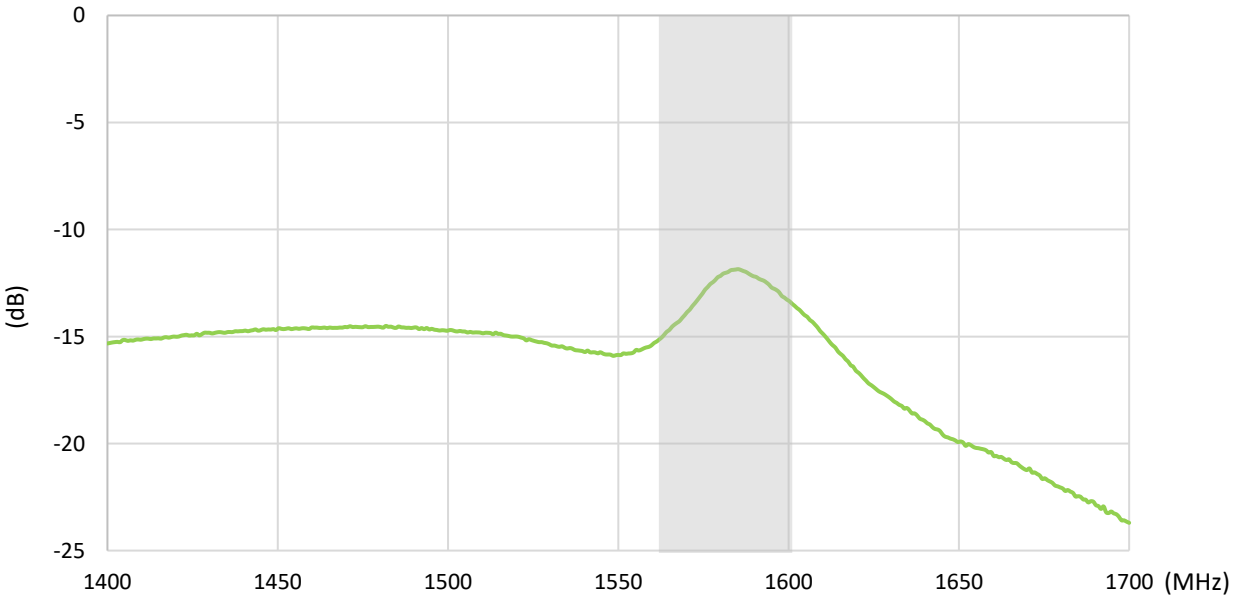
Mechanical	
Ceramic Dimension	25 x 25 x 4.0 mm
Pin Length	2.4mm
Weight	9.7 g
Environmental	
Operation Temperature	-40°C to 85°C
Storage Temperature	-40°C to 85°C
Humidity	Non-condensing 65°C 95% RH

3. Passive Antenna Characteristics

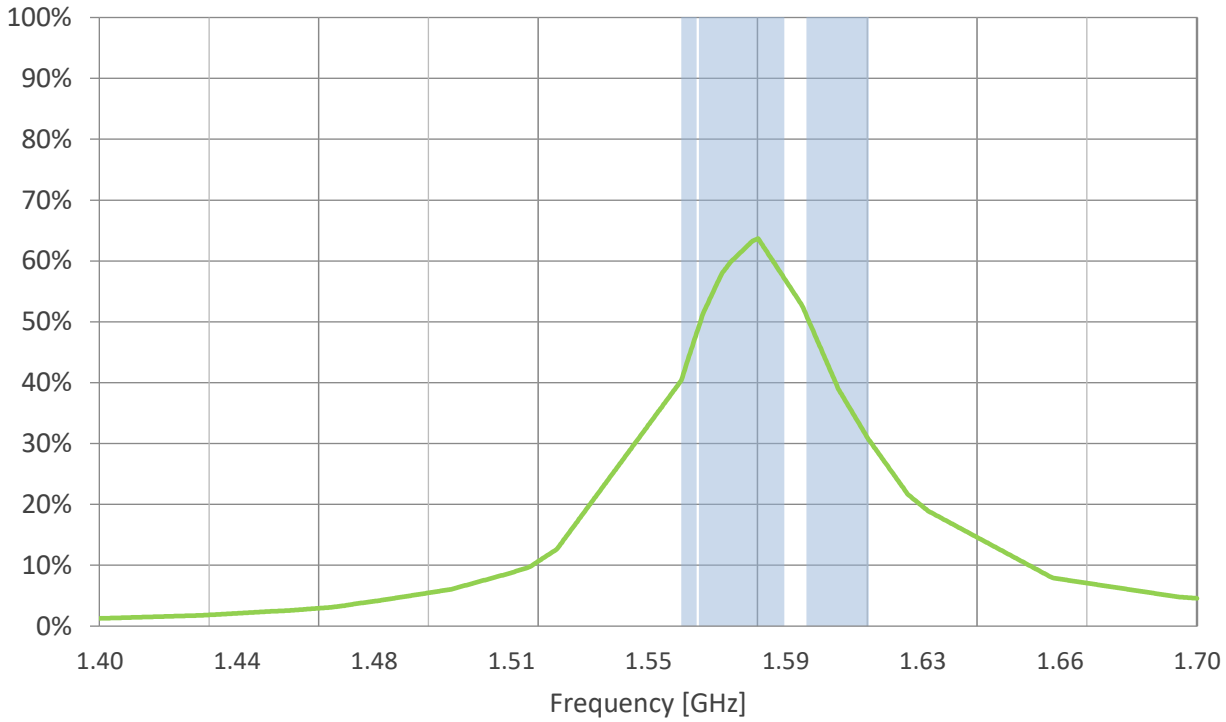
3.1 Return Loss for single pin without coupler



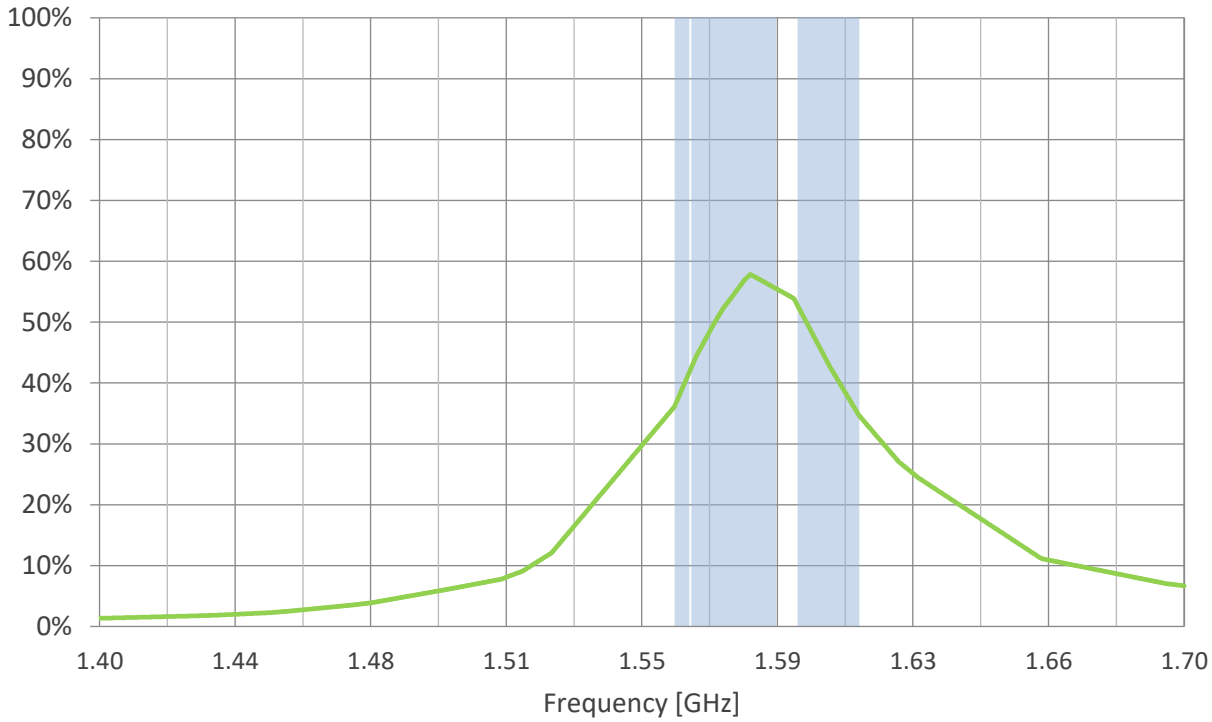
3.2 Return Loss For dual pin with coupler



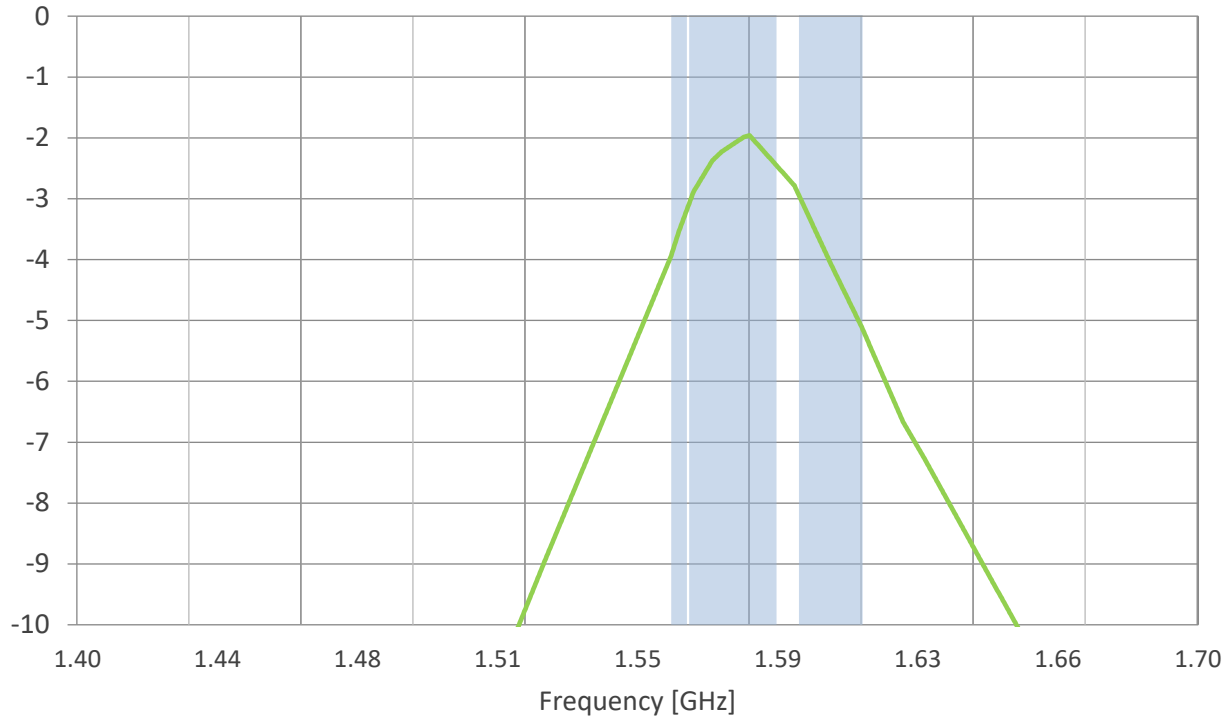
3.3 Efficiency for single pin without coupler



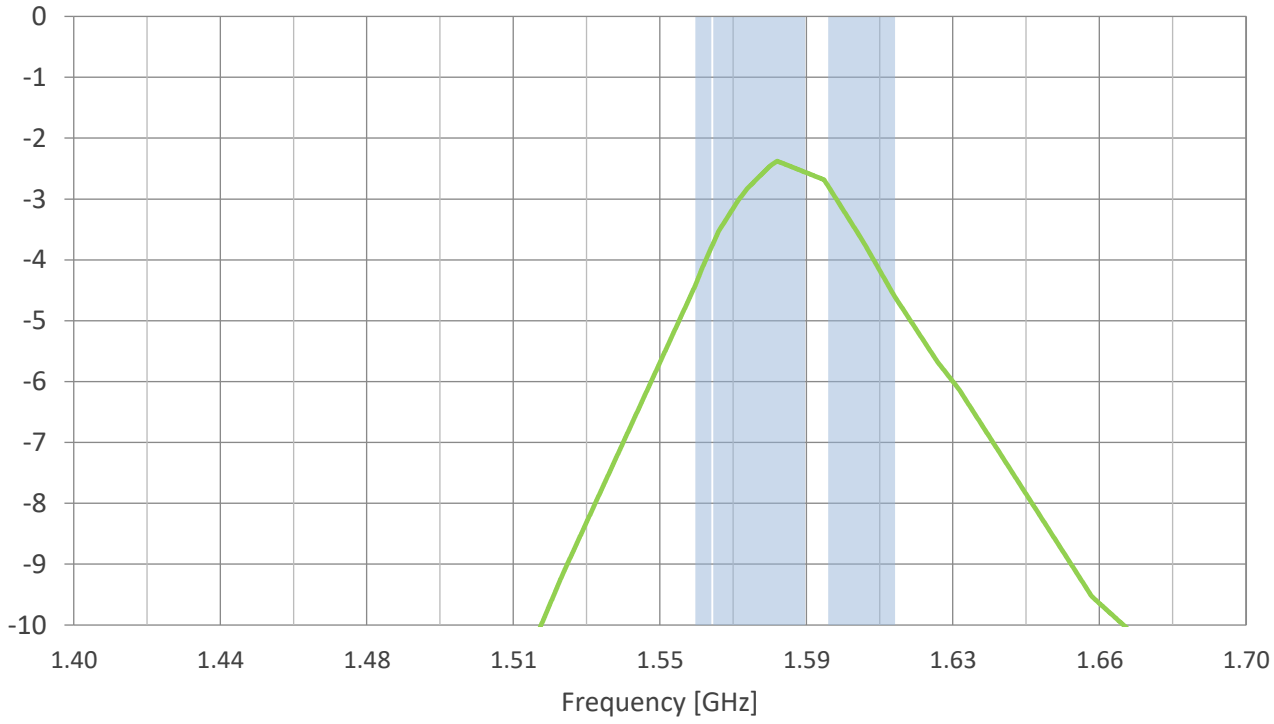
3.4 Efficiency for dual pin with coupler



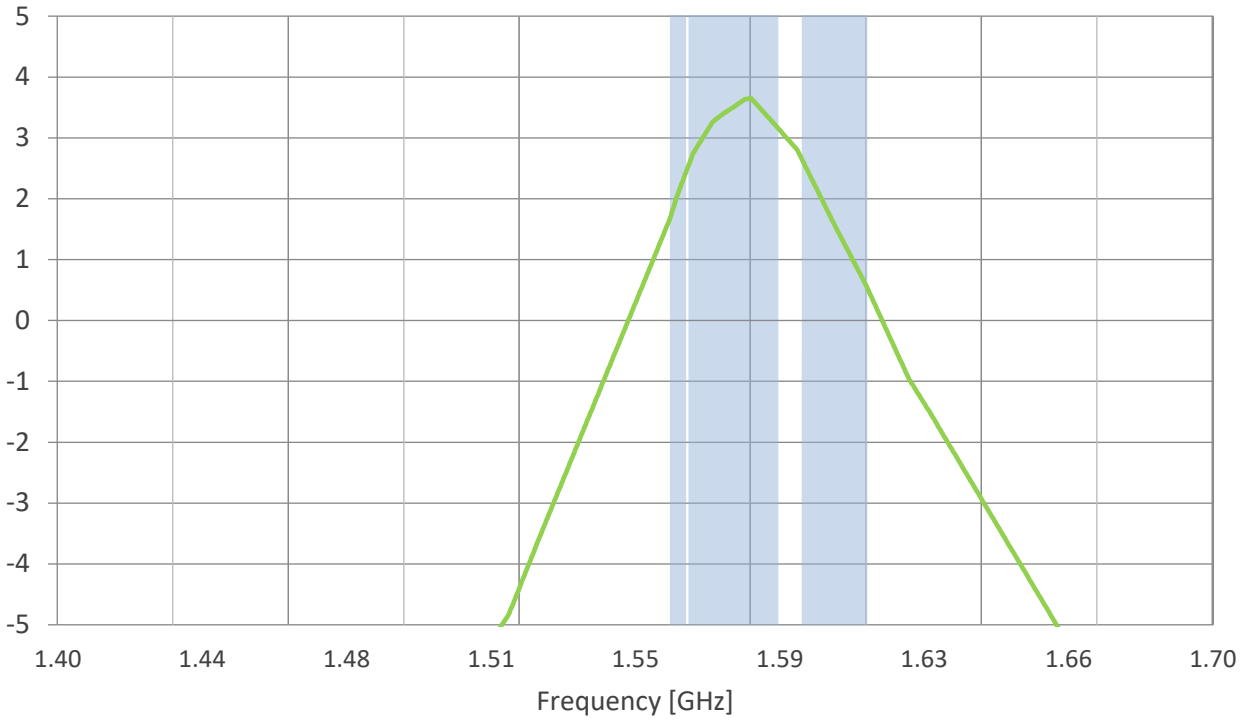
3.5 Average Gain for single pin without coupler



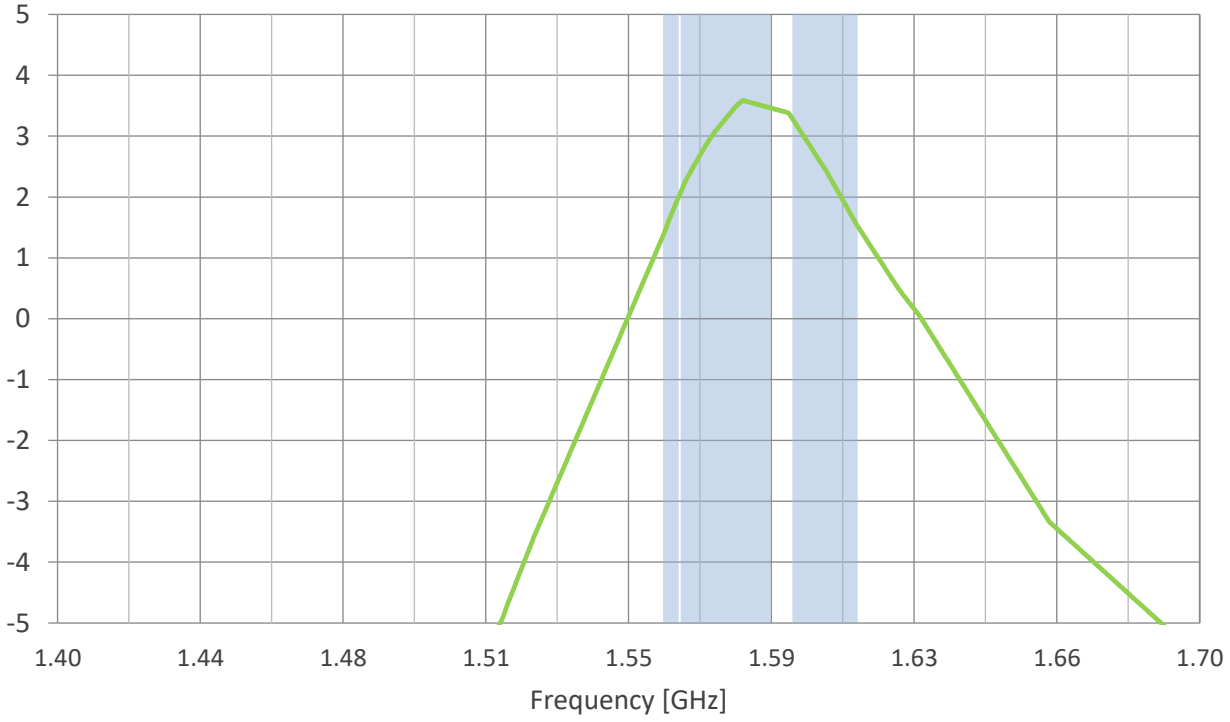
3.6 Average Gain for dual pin with coupler



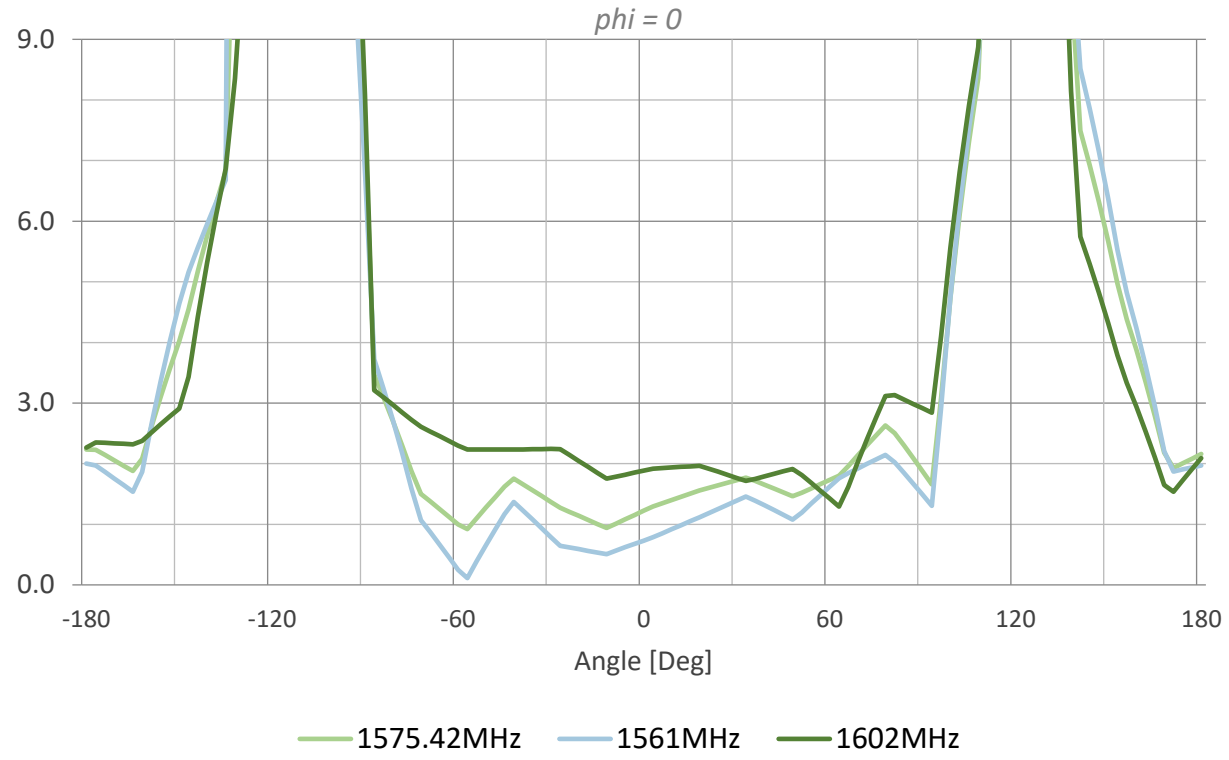
3.7 Peak Gain for single pin without coupler



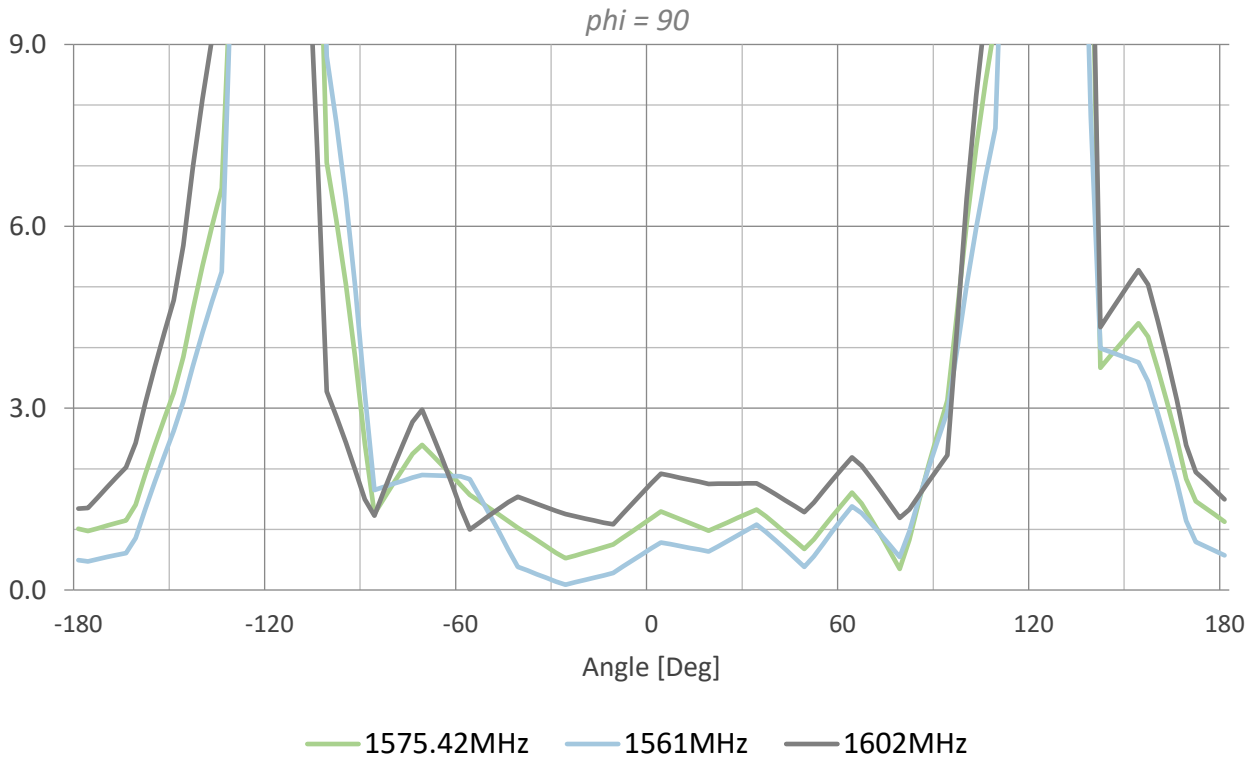
3.8 Peak Gain for dual pin with coupler



3.9 Axial Ratio at Phi=0

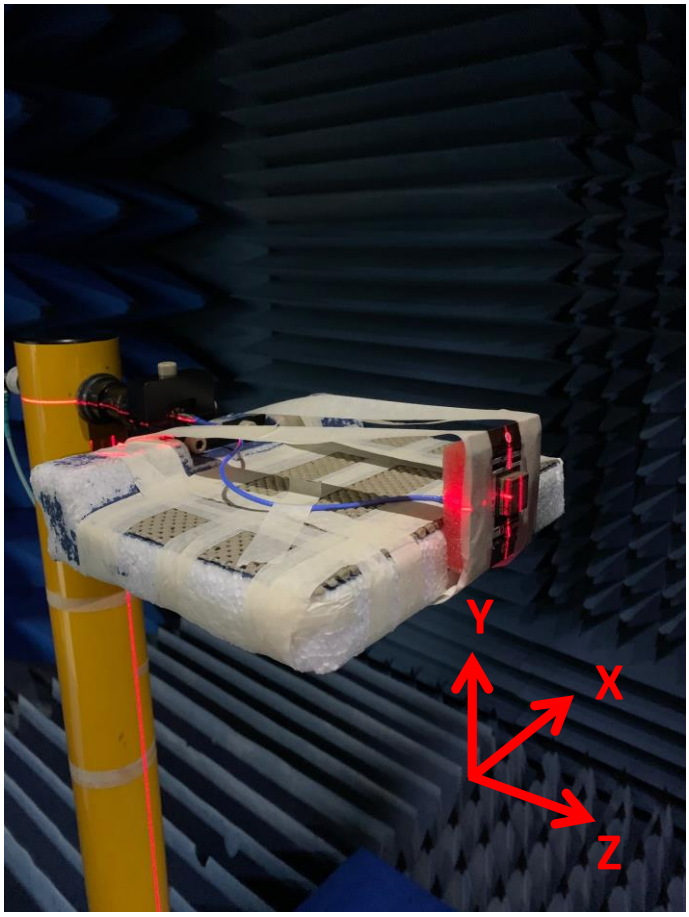


3.10 Axial Ratio at Phi=90



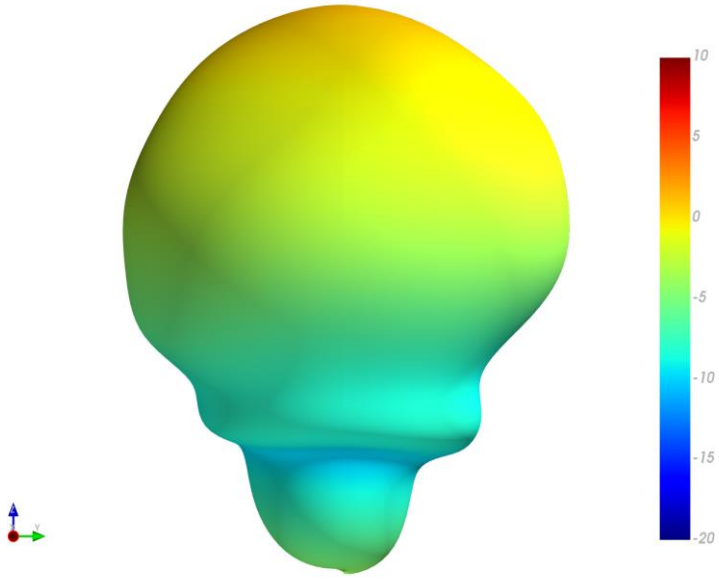
4. Radiation Patterns

4.1 Test Setup

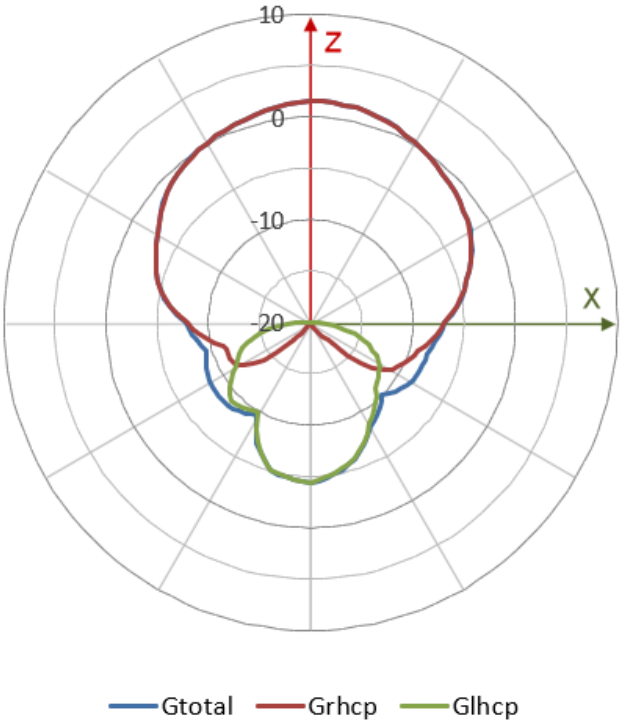


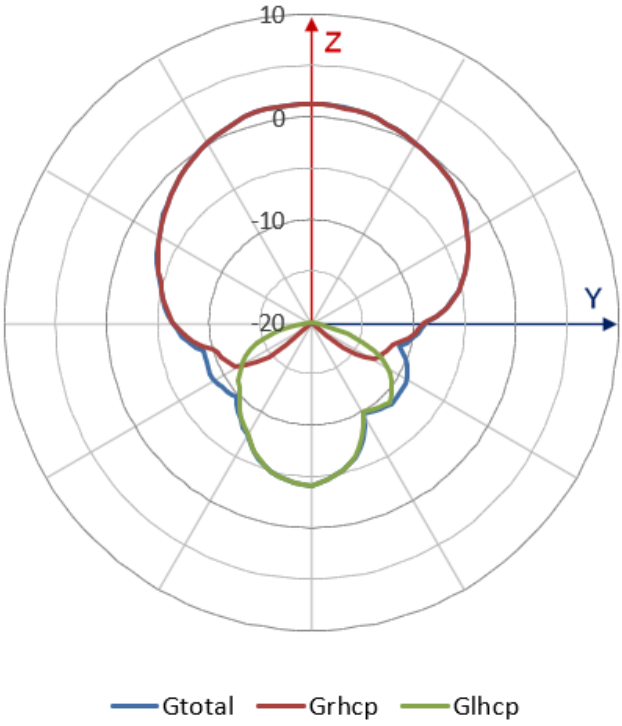
Note. The patch antenna test with hybrid coupler HC125.A and tuned on 70x70(mm) ground plane.

4.2 1561MHz 3D and 2D Radiation Patterns

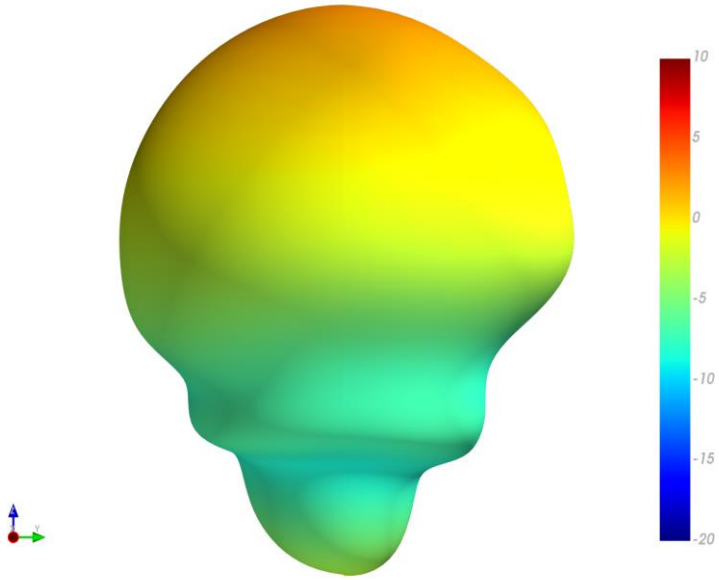


XZ Plane	YZ Plane
phi = 0	*phi = 90*

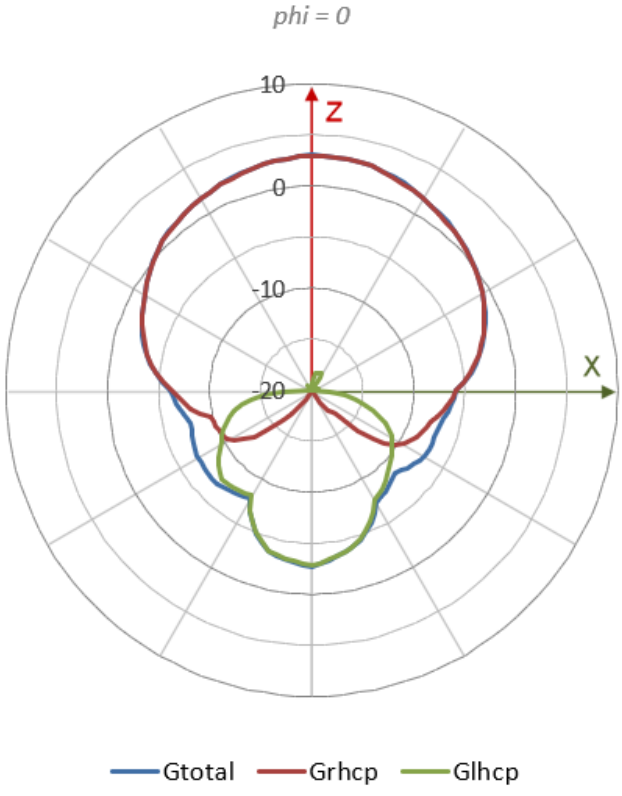


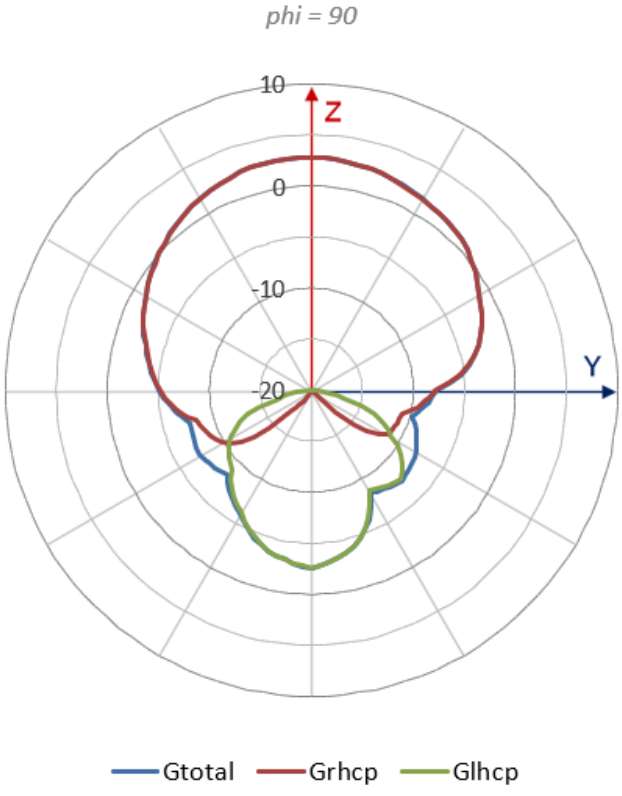


4.3 1575.42MHz 3D and 2D Radiation Patterns

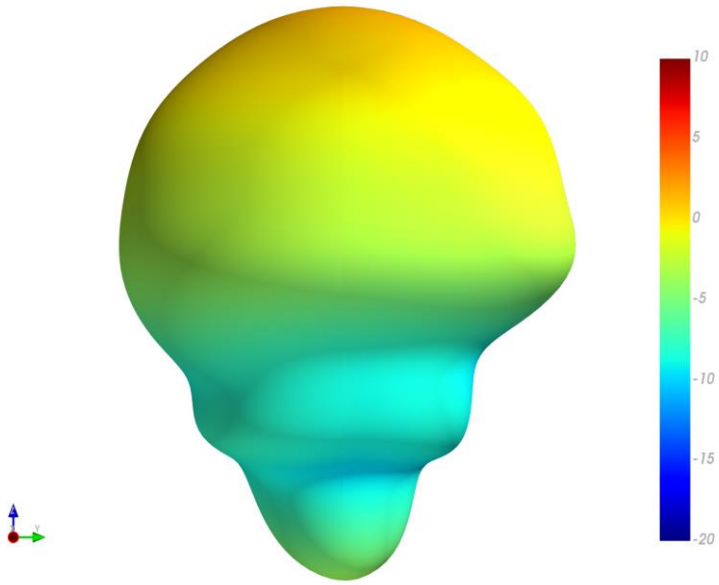


XZ Plane	YZ Plane

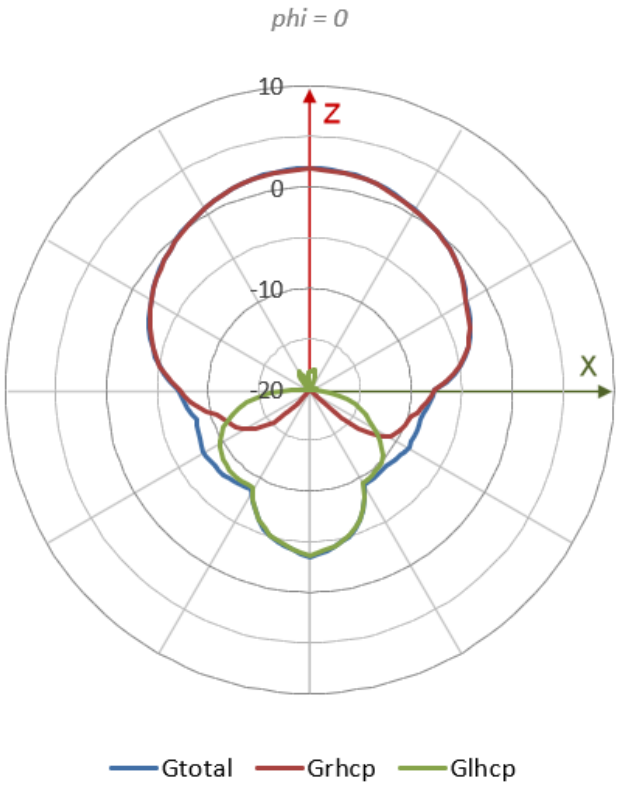


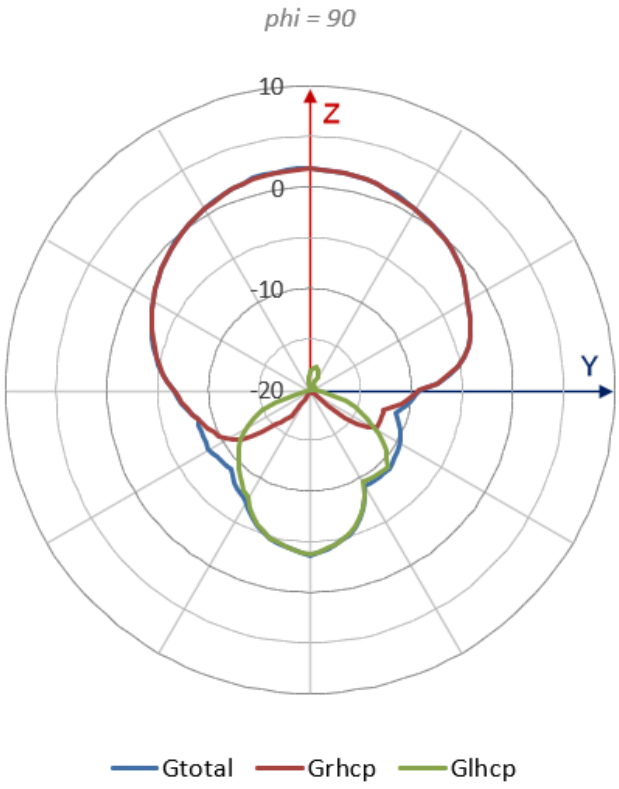


4.4 1602MHz 3D and 2D Radiation Patterns



XZ Plane	YZ Plane





5. Field Test Results

In this section Taoglas will present the field test result for GPDF254.A antenna. The test was performed when the antenna was mounted on a static rooftop test set up in an open sky environment for at least 6 hours.

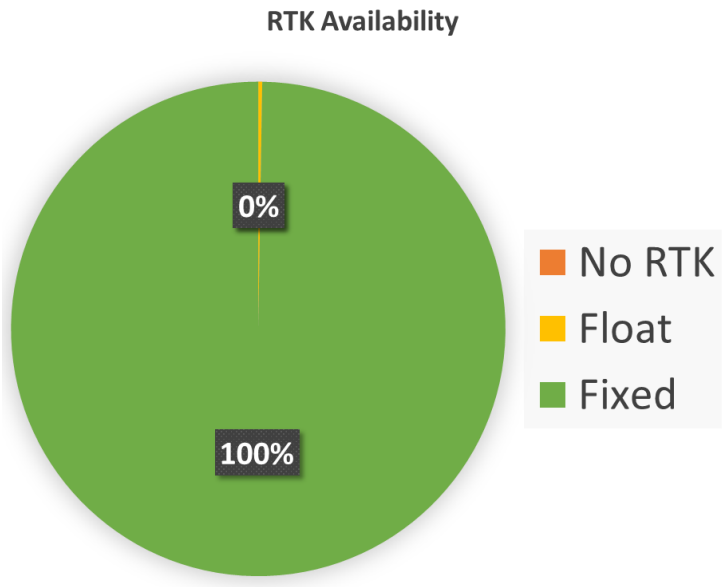
Taoglas will show the field test results using the following receivers:

5.1 Ublox ZED-F9P

Receiver features:

- Multi-band GNSS: 184-channel GPS L1C/A L2C, GLONASS: L1OF L2OF, Galileo: E1B/C E5b, BeiDou: B1I B2I, QZSS: L1C/A L2C
- Multi-band RTK with fast convergence times and reliable performance
- Nav. update rate RTK up to 20 Hz
- Position accuracy = RTK 0.01 m + 1 ppm CEP

Positioning Accuracy Table (2D Accuracy)					
Test Condition	Correction Service	CEP (50%)	DRMS (68%)	2DRMS (95-98.2%)	TTFF (sec)
On 70*70mm EVB	RTK DISABLED	63.58 cm	79.96 cm	159.92 cm	18
	RTK ENABLED	0.66 cm	0.79 cm	1.59 cm	18

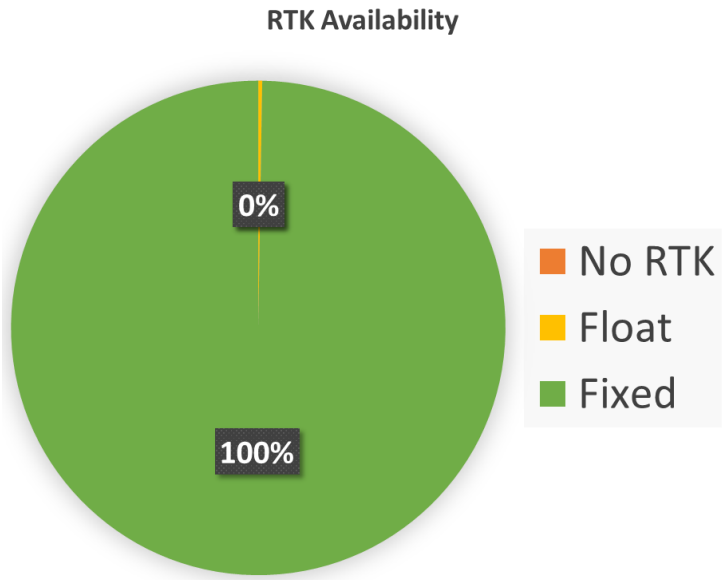


5.2 Ublox NEO-M8P

Receiver features:

- Multi-band GNSS: 72 channels ublox M8 engine
- GPS: L1 C/A GLONASS: L1OF BeiDou: B1, Not support RTK
- Nav. update rate up to 8 Hz (RTK)
- Carrier phase data up to 10Hz
- Position accuracy =
- Standalone: 2.5m CEP
- RTK 0.025 m + 1 ppm CEP

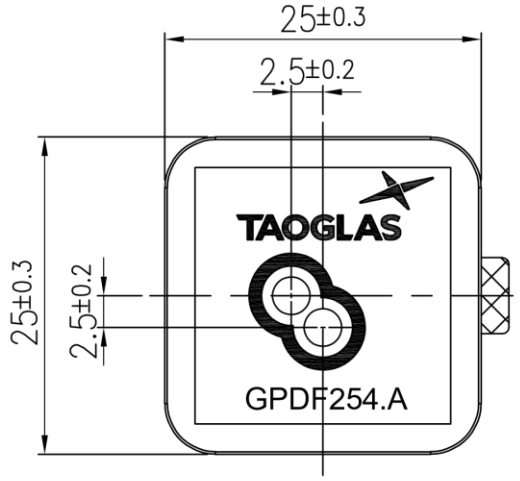
• Positioning Accuracy Table (2D Accuracy)					
Test Condition	**Correction Service**	**CEP (50%)**	**DRMS (68%)**	**2DRMS (95-98.2%)**	**TTFF (sec)**
On 70*70mm EVB	RTK DISABLED	66.26 cm	81.71 cm	163.43 cm	30
	RTK ENABLED	2.39 cm	3 cm	6.01 cm	30

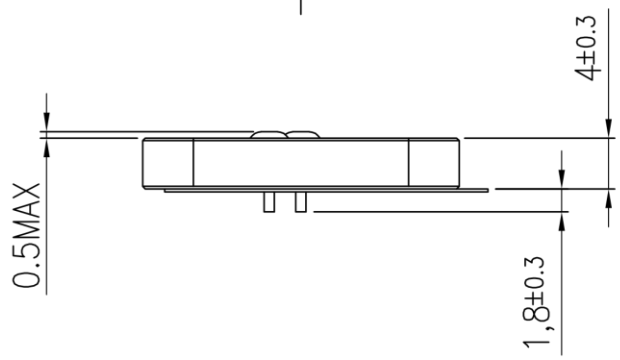


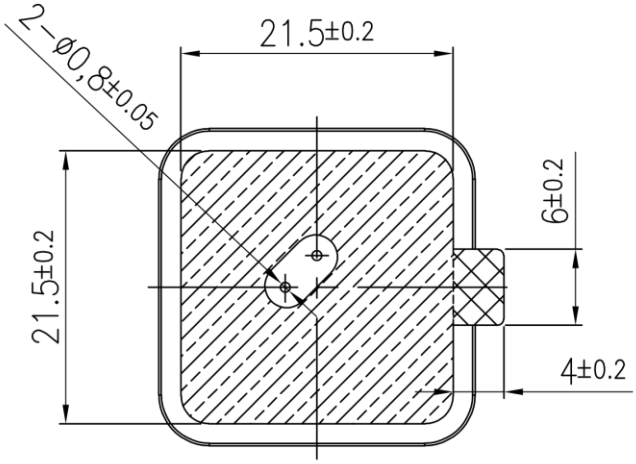
6. Mechanical Drawing (Units: mm)

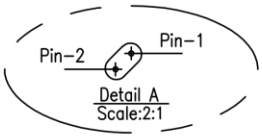
ISO NO.: EDW-20-8-0713
STATE: Release
NOTES: 1. Double sided adhesive area
2. Release paper

REV.	DESCRIPTION	ENG.	APPROVED	DATE
D01	Initial Design	Mickey	Buluto	2020/08/11
D02	Add pin definition	Mickey	Buluto	2020/09/23









D02

Configuration	Pin-1	Pin-2
Phase angle	∠θ	∠θ-90

	Name	P/N	Material	Finish	QTY
1	GPDF254.A Patch 25x25x4mm	013A016000131D	Ceramic	Clear	1
2	Double sided Adhesive	013A016000131D	NITTO 5015	White Linter	1

APPROVED BY:	Buluto
CHECK BY:	Amos
DRAWN BY:	Mickey
DATE:	2020/08/11
UNLESS OTHERWISE SPECFIED TOLERANCES ON:	XX:±0.5 X.±0.3 .X±0.2 .XX±0.1 .XXX±0.05
THIRD ANGLE PROJECTION	

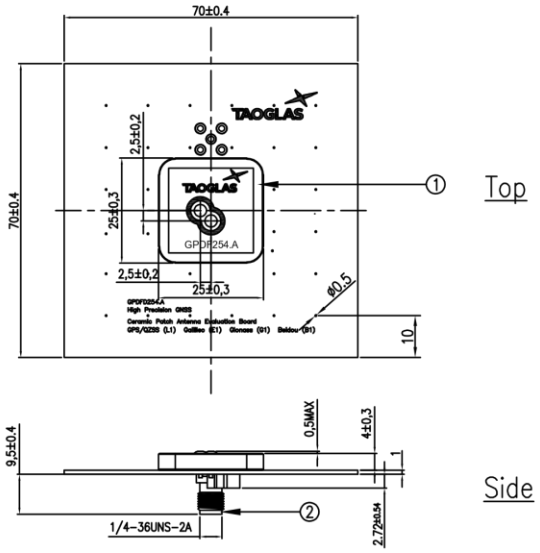
TAOGLAS. TW Design Centre

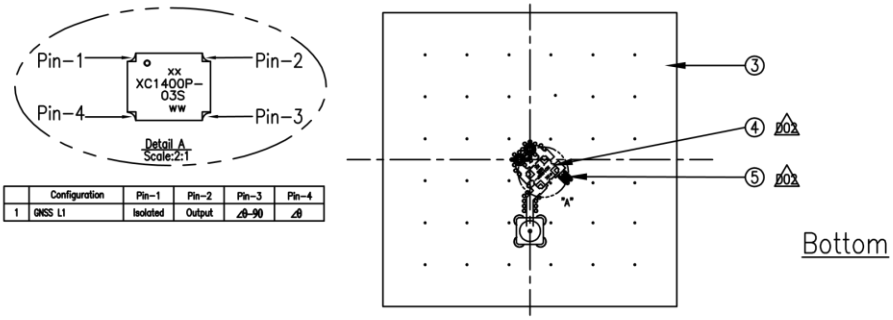
TITLE : GPDF254.A Dual-pin Patch Antenna 25*25*4 GNSS L1
PART NO. : GPDF254.A
UNIT: mm | SCALE: 2:1 | PAGES: 1/1 | REV. D02

7. Evaluation Board Mechanical Drawing (Units: mm)

ISO NO.: EDW-20-8-0503
STATE: Release
NOTES: 1. Soldermask area.

REV.	DESCRIPTION	ENG.	APPROVED	DATE
D01	Initial Design	Mickey	Buluto	2020/05/26
D02	Add electronic part number	Mickey	Buluto	2020/08/07





	Configuration	Pin-1	Pin-2	Pin-3	Pin-4
1	GNSS L1	Isolated	Output	-90	

		Name	P/N	Material	Finish	QTY
	1	GPDF254.A Patch 25x25x4mm	013A016000131D	Ceramic	Clear	1
	2	SMA(F) ST	200413B000002A	Brass	Au Plated	1
	3	PCB	021102130402OO	FR-4	Black	1
D02	4	Hybrid Coupler	02121140061010	-	-	1
D01	5	Thick Film Res.	021R11101D16J0	-	-	2

APPROVED BY:	Buluto
CHECK BY:	Amos
DRAWN BY:	Mickey
DATE:	2020/05/26
UNLESS OTHERWISE SPECIFIED TOLERANCES ON:	XX:±0.5 X:±0.3 .X:±0.2 .XX:±0.1 .XXX:±0.05
THIRD ANGLE PROJECTION	

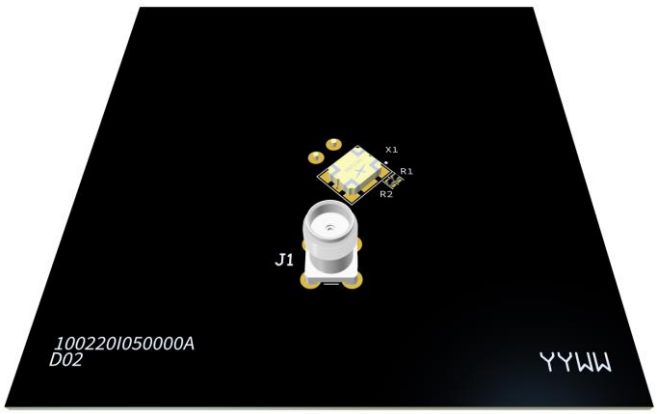
TAOGLAS. TW Design Centre

TITLE :	GPDF254.A Patch Antenna on EV Board for GNSS L1 Band
PART NO. :	GPDFD254.A
UNIT: mm	SCALE: 1:1.5 PAGES: 1/1 REV. D02

8. Antenna Integration Guide

8.1 Integration Guide

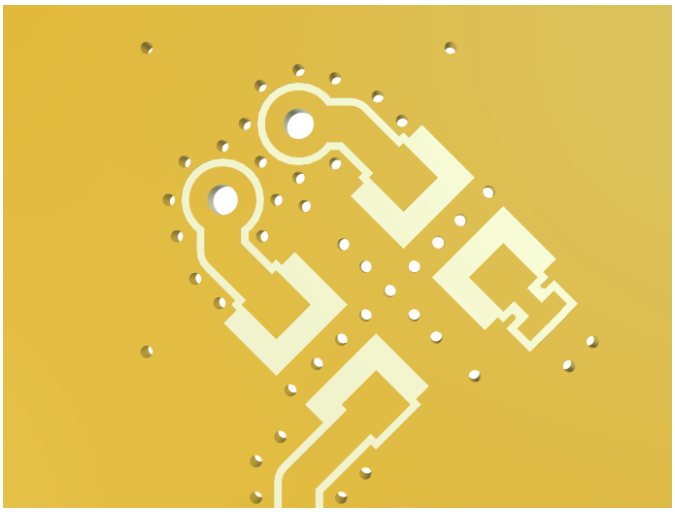
Whatever the size of the PCB, the ideal location for the antenna is as illustrated in the below diagram; on the PCB's shortest side, in the left corner. This allows placement of the optimized matching components alongside the antenna.



8.2 PCB Layout

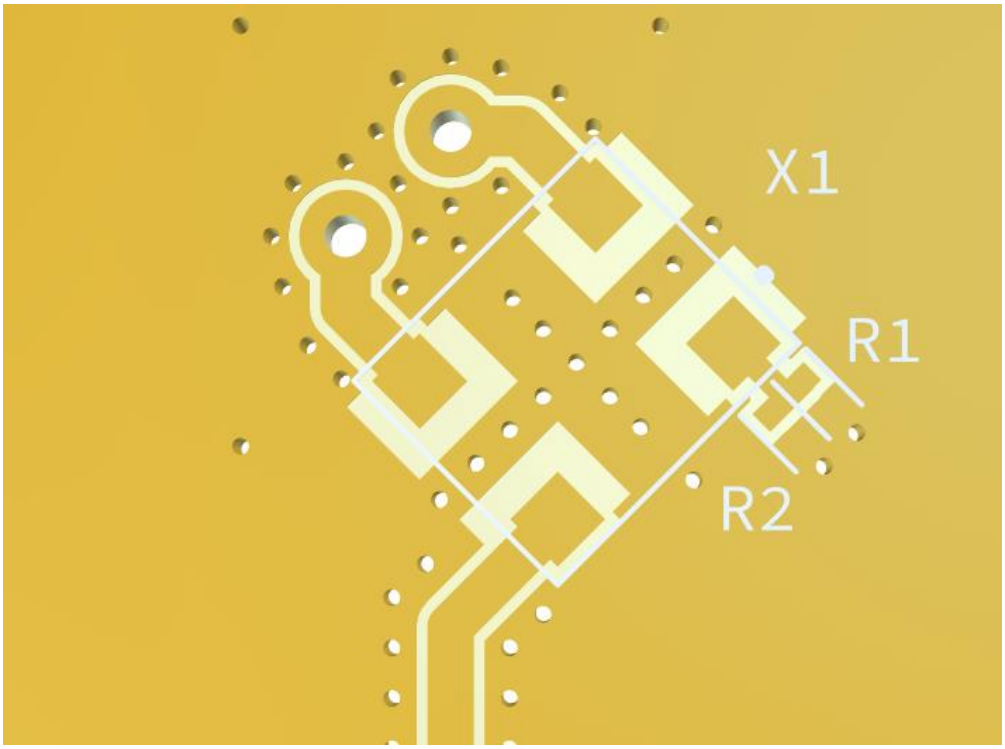
The footprint and clearance on the PCB must comply with the antenna specification. The PCB layout shown in the diagram below demonstrates the antenna footprint.

Topside



Bottom Side

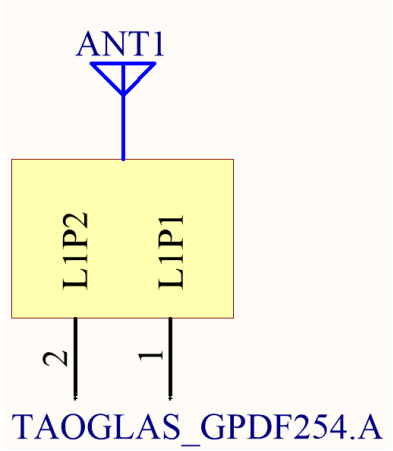
8.3 PCB Layout



8.4 Schematic Symbol and Pin Definitions

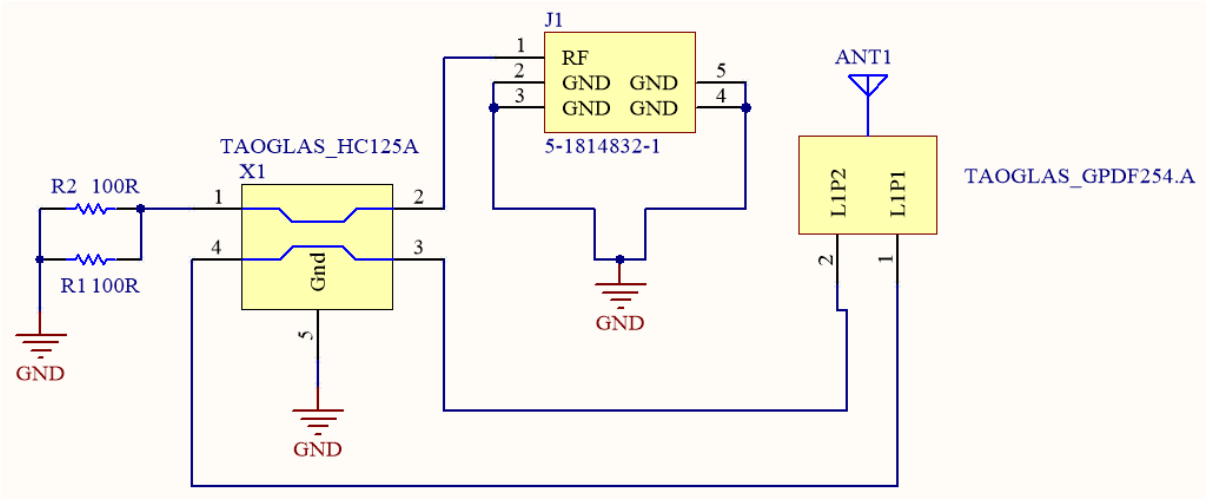
The circuit symbol for the antenna is shown below. The antenna has 2 pins that are orthogonal feeds.

Pin	Description
1	L1P1 (0°)
2	L1P2 (-90°)



9. Evaluation Board Matching Circuit

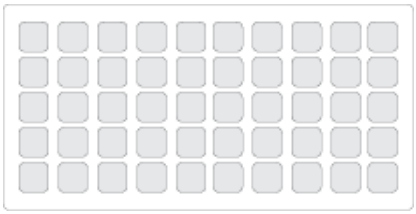
The antenna patch element uses two orthogonal feeds that are combined in a hybrid coupler to ensure optimal axial ratio. A hybrid coupler is required for this antenna and should be included in the design. The hybrid coupler should be placed close to the antenna pins and terminated correctly using 2x 100 ohm resistors in parallel.



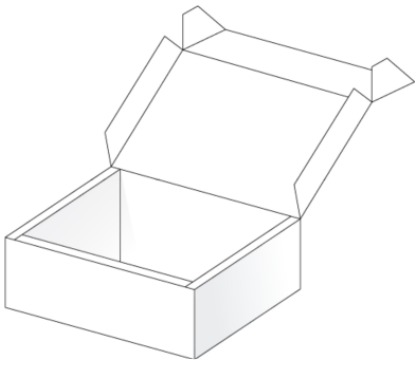
Matching Components			
Designator	Type	Value	Description
R1, R2	Resistor (0402)	100Ω (1%)	Yageo RT0402BRE07100RL
X1	Hybrid Coupler	HC125A	Taoglas

10. Packaging

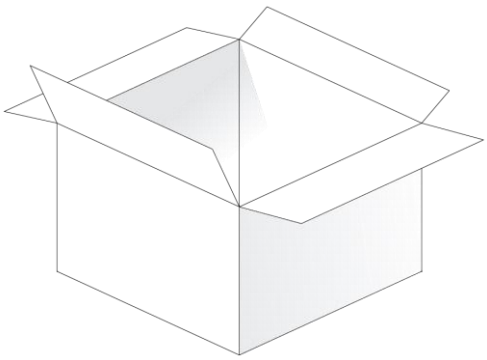
50pcs GPDF254.A per Tray
Weight: 520g



200pcs GPDF254.A per Inner Carton
Dimensions: 261*152*118 mm
Weight: 2.5Kg



800pcs GPDF254.A per Carton
Dimensions: 330*280*270 mm
Weight: 10.2Kg



Changelog for the datasheet

SPE-20-8-101-A – GPDF254.A

Revision: B (Current Version)	
Date:	2023-02-21
Changes:	Updated GNSS Bands & Constellations Graphics
Changes Made by:	Cesar Sousa

Previous Revisions

Revision: A	
Date:	2020-10-14
Changes:	Initial Release
Changes Made by:	David Connolly

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