

G7EXO-NA2 Antenna Compliance with Cellular Module Integration Requirements

1 Document Revision History

Revision	Date	Author	Summary
1	Aug 17, 2020	Scott Jacobsen	Initial Release
2			

2 Purpose of this Report

The purpose of this report is to show the radio frequency (RF) exposure compliance of the cellular module integration on G7EXO-NA2

3 Identifiers

3.1 Host Product

Product Name: G7 EXO

Model: G7EXO-NA2

3.2 Module Identifiers

Module Description	Model	FCC ID	IC ID	Grantee
Cellular	LARA-R202	XPY1EIQ24NN	8595A-1EIQ24NN	u-blox AG

3.3 Antennas

Frequency Band	Vendor	Model	Peak Gain(dBi)	Data Sheet Reference
Cellular	Blackline Safety	103452r2	See section 3.5	

3.4 Module Grant Requirements – XPY1EIQ24NN

Output Power is conducted. This device is certified for use in mobile and fixed applications; where the transmitter antenna(s) is at least 20cm from all persons. The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other transmitter antenna, except in accordance with FCC multi-transmitter product procedures. To meet the MPE RF Exposure, ERP and EIRP limits, the antenna gain including cable loss must not exceed:

9.8 dBi at 700 MHz;

10.0 dBi at 850 MHz;

6.5 dBi at 1700 MHz and

8.7 dBi at 1900 MHz.

End users and installers must be provided with transmitter operating conditions and installation instructions for satisfying compliance. This filing is only applicable for: 700 MHz LTE; 850 MHz Cell; 1700 MHz WCDMA and 1900 MHz PCS operations.

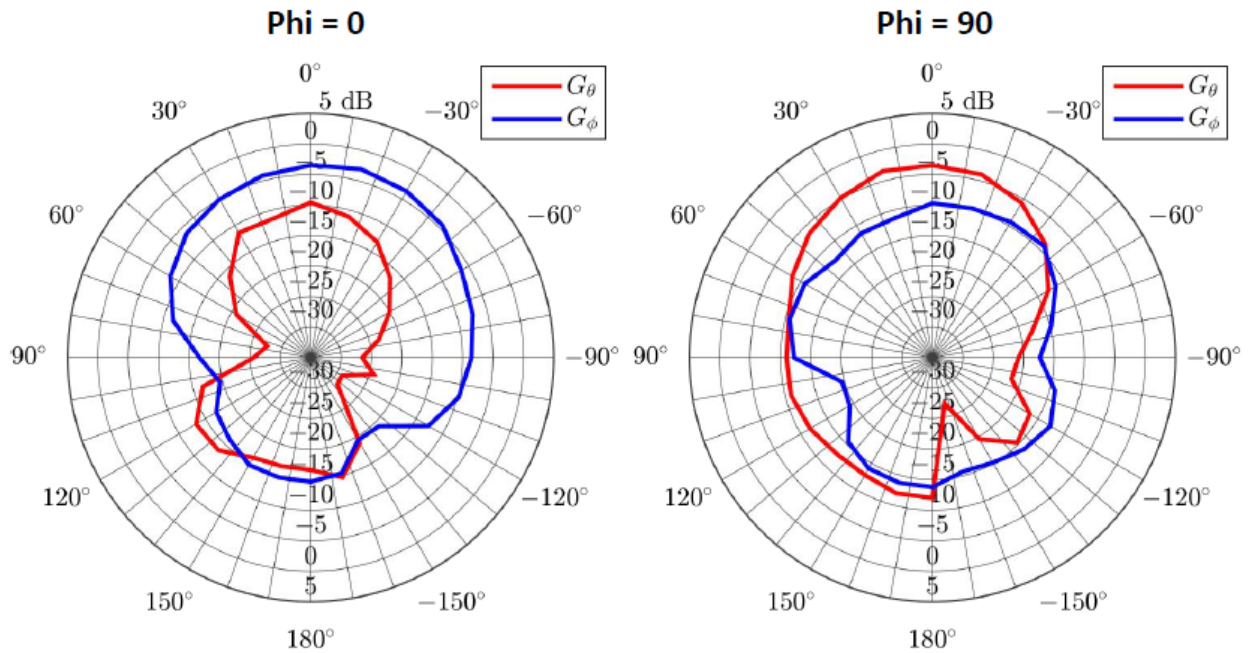
The Grantee is responsible for providing the documentation required for modular use. The responsibility for use of this module in all configurations remains with the Grantee.

3.5 Comparison of Antenna Gain with Module Requirements

Requirement Maximum Gain	Band	Measured Actual Gain	Frequency
9.8 dBi	700 MHz	-7.2 dBi	699.97 MHz
9.8 dBi	700 MHz	-6.7dBi	707.41 MHz
9.8 dBi	700 MHz	-6.4 dBi	715.03 MHz
10.0 dBi	850 MHz	-3.6 dBi	825.58 MHz
10.0 dBi	850 MHz	-3.1 dBi	836.5 MHz
10.0 dBi	850 MHz	-1.7 dBi	847.42 MHz
6.5 dBi	1700 MHz	1.6 dBi	1711.58 MHz
6.5 dBi	1700 MHz	1.0 dBi	1732.5 MHz
6.5 dBi	1700 MHz	-0.8 dBi	1753.42 MHz
8.7 dBi	1900 MHz	-0.3 dBi	1851.58 MHz
8.7 dBi	1900 MHz	-0.6 dBi	1880 MHz
8.7 dBi	1900 MHz	-1.8 dBi	1908.42 MHz

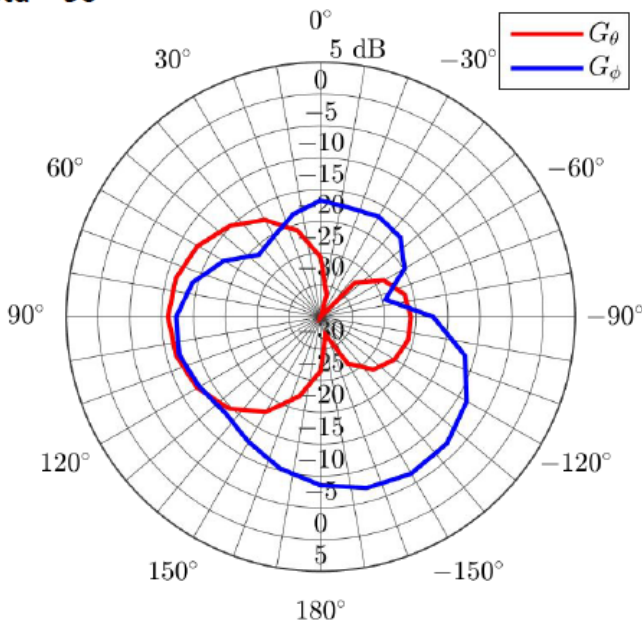
3.6 Sample Radiation Patterns

Cellular Linear Gain vs Theta Angle 0.75 GHz

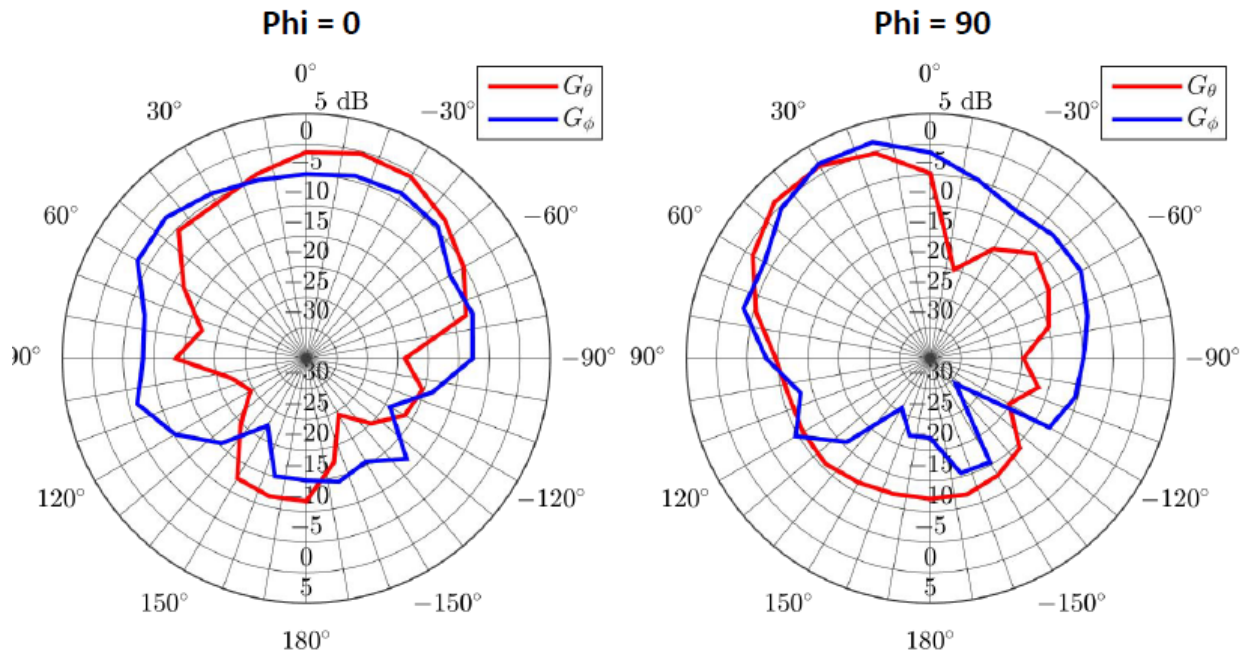


Cellular Linear Gain vs Phi Angle 0.75 GHz

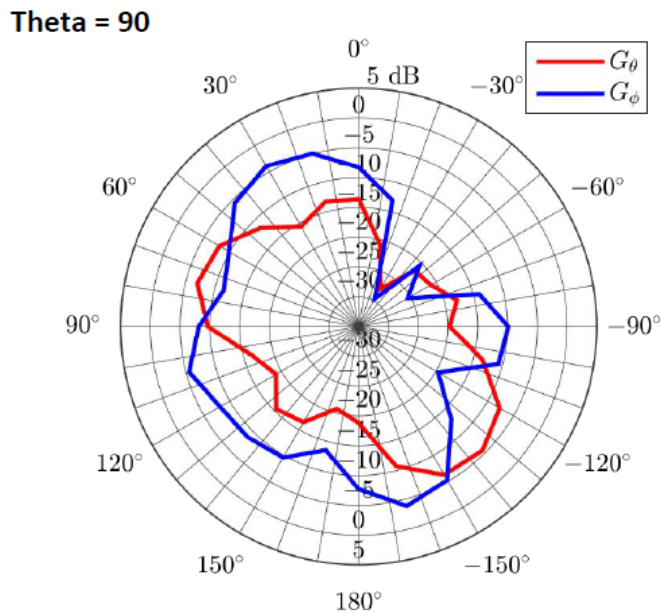
Theta = 90



Cellular Linear Gain vs Theta Angle 1.85 GHz



Cellular Linear Gain vs Phi Angle 1.85 GHz



3.7 Antenna Assembly

NOTES:

1. Assemble the board according to the requirements of IPC-A-610, class 2.
2. Assembly with lead free SAC 305 process. Use no clear soldering process.
3. The PCB photos are for information only which may not be identical to the actual PCB boards.

EXO LTE Antennas Sub Assembly (P/N: 103452r2)

(Material and Assembly Steps)

Material: All material must be ROHS compliancy

Material 1: Flex PCB Board (P/N: 103451r2)

Two Pads for RF Cable (Material 2) Soldering.

Material 2: RF 50 ohm Coaxial Cable (Customized cable with 50 ohm MMCX-Male connector, Units: mm)

Material 3: Ferrite Cores

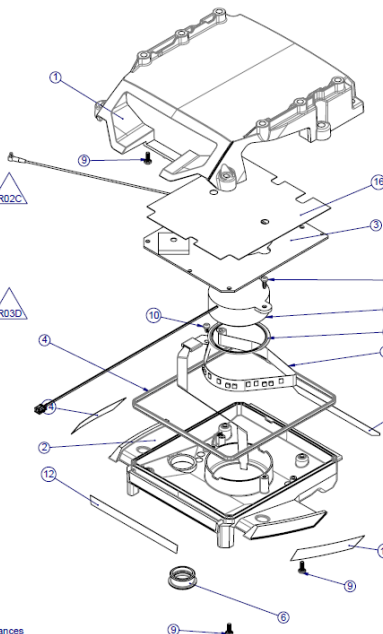
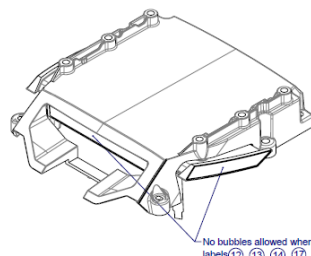
Manufacturer: Fair-Rite Products Corp.	
FERRITE CORE	Manufacturer Part Number
1	2661022401
2	2661021801

Assembly Steps: ROHS compliancy build

Step1: To Have the cable through the ferrite cores as shown in the figure below. The order of the ferrite cores must be the same as shown in the figure below:

Step2: To solder RF Cable (Material 2) to Flex PCB Board (Material 1, P/N: 103451r2) as shown in the figure below:

ITEM NO.	Part No.	Description	Supplier	Sup Pk Number	DelusQty
1	01956-36559	Speaker in-vents			8
2	01956-36560	Alarm Light Cover			1
3	01956-15073	PCBA Antenna			1
4	01956-43607	Alarm cover antenna gasket			1
5	01956-43608	Alarm cover plate gasket			1
6	01956-43606	Alarm cover chimney gasket			1
7	01956-15080	Plazzo Stop-Army			1
8	01956-43615	Light stripe pad			1
9	01956-43616	M4 x 8mm Slotted Phillips Head Screw	McMaster	936274410	4
10	01956-43612	STS M4 x 8mm PAN TIX STL 2P	McMaster	96817A000	2
11	01956-44421	STS M4 x 8mm PAN TIX STL 5P	McMaster-Carr	96817A908	1
12	01956-43754	Label alarm light front			1
13	01956-43756	Label alarm light right			1
14	01956-43757	Label alarm light left			1
15	01956-43765	Label alarm light back			1
16	01956-15058	LTE Peak Antenna			1



Revisions				
REV	REV	Description	DATE	BY
R01	A	Release for production	09-20-19	VA
R01	B	Piezo is now shown Exploded view corrected	10-03-19	EC
R02	C	Hard remove & screw changes	12-19-19	AF
R03	D	LTE Antenna addition	02-11-20	AF

General tolerance base on IT-
6.3 dimensions in table 10.1 (in mm)

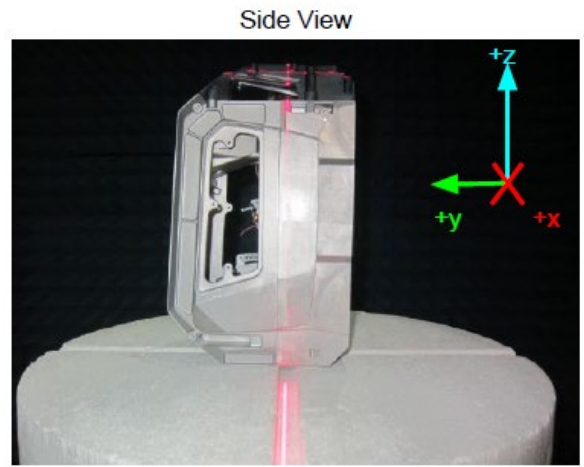
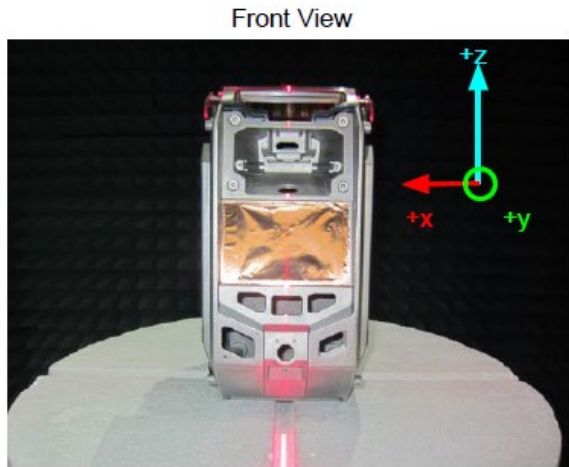
Dim. From	0	3	6	10	18	30	50	80	120	180	250
To Dim.	3	6	10	18	30	50	80	120	180	250	315

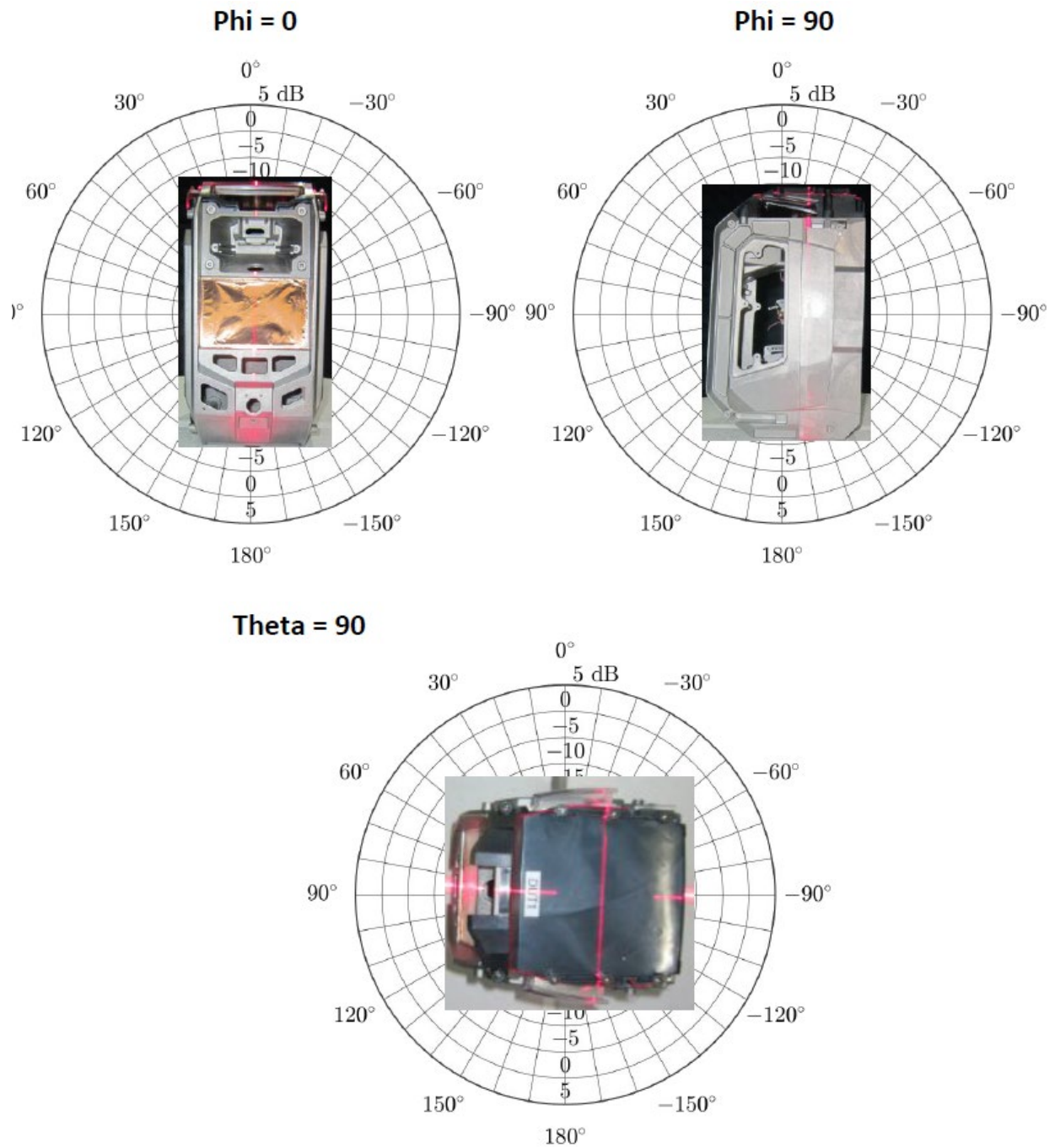
Tolerance $\pm$

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	www.advantadesign.com							
PROJECT TITLE: EXO								
SKETCH TITLE: Antenna & Speaker Sub-Assy								
MATERIAL: NIA								
SURFACE FINISH: -								
COLOR: -								
VOLUME: 209.3369 cm³		WEIGHT: 311.2941 g						
DATE: August 29, 2016		MOODED: February 11, 2020						
01696-A16222		<table> <tr> <th>REVISION</th> <th>A3</th> </tr> <tr> <td>PART / DEX</td> <td>SCALE: 1:1</td> </tr> <tr> <td>R04 / D</td> <td>UNITS: mm</td> </tr> </table>	REVISION	A3	PART / DEX	SCALE: 1:1	R04 / D	UNITS: mm
REVISION	A3							
PART / DEX	SCALE: 1:1							
R04 / D	UNITS: mm							
DRAWING AND PART NO:								

3.8 Test Setup Pictures





4 Statement of Compliance

The gain values found for Blackline cellular antenna 103452r2 are below the maximum allowed levels according to module integration requirements.

SPECIFICATION

Iridium Certified

Part No. : **IP.1621.25.4.A.02**

Product Name : **4mm thick Iridium Patch Antenna, 1621MHz**

Features : 25.1mm*25.1mm*4mm
ROHS Compliant

:



1. Introduction

This miniaturized ceramic Iridium patch antenna is based on smart ***XtremeGain™*** technology. It is mounted via pin and double-sided adhesive and has been selected as optimal solution for the customer device environment. Iridium certifies the IP.1621.25.4.A.02 for commercial use in connection with the Iridium Communications systems.

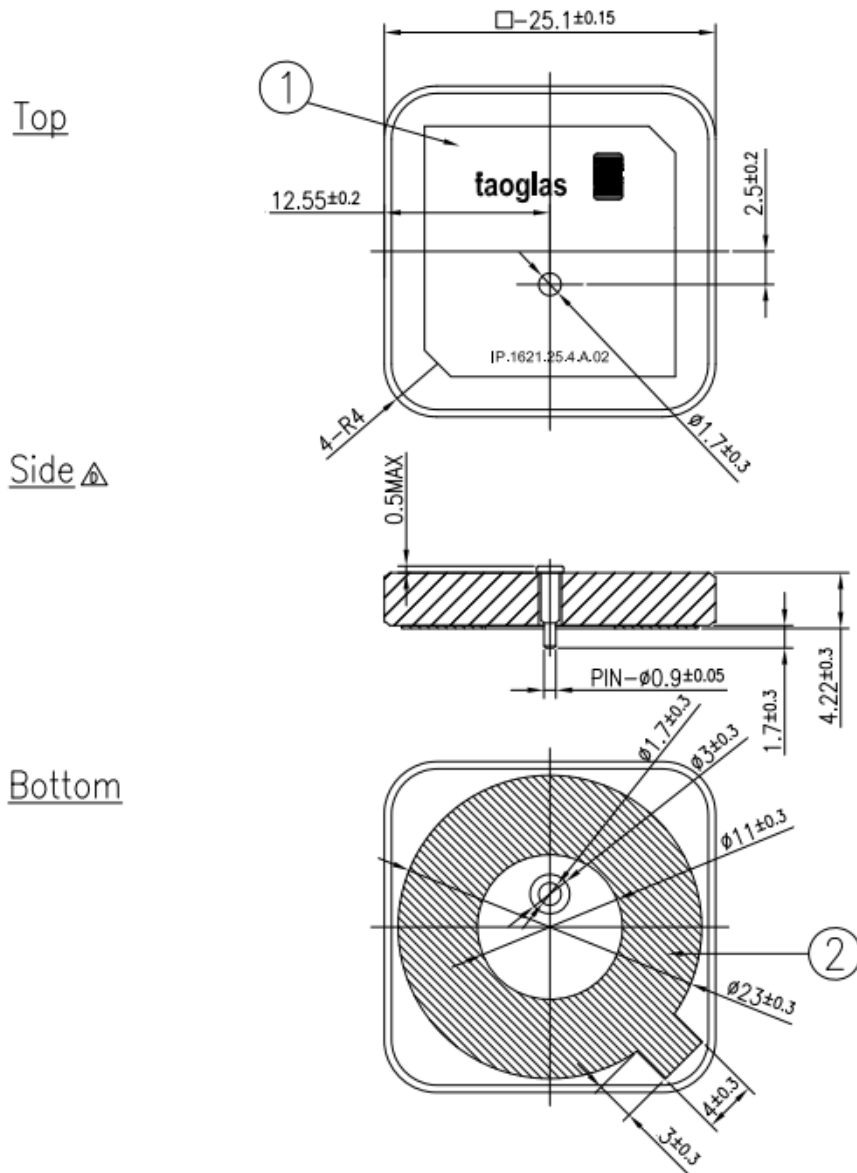
2. Key Antenna Performance Indicators

Original Patch Specification tested on 50*50mm ground plane

No	Parameter	Specification	Notes
1	Range of Receiving Frequency	1616~1626.5Mhz	
2	Center Frequency	1621MHz ±3MHz	with 50*50mm GND Plane
3	Bandwidth	16MHz	Return Loss ≤-10dB
4	VSWR	1.5 max	Center Frequency
5	Gain at Zenith	+2.0dBi typ.	Center Frequency
6	Gain at 10° Elevation	--	Center Frequency
7	Axial Ratio	3 dB Max	Center Frequency
8	Polarization	RHCP	
9	Impedance	50Ω	
10	Frequency Temp Coefficient (Tf)	0±20ppm/°C	-40°C to +85°C
11	Operating Temperature	-40°C to +85°C	
12	Antenna Weight	10g	

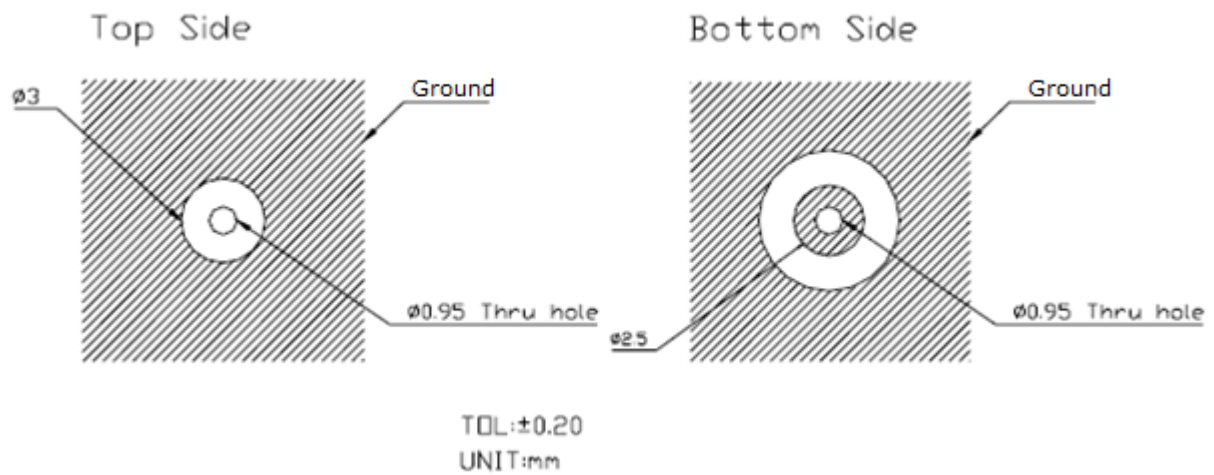
3. Mechanical Drawing

3.1 Shape and Dimension

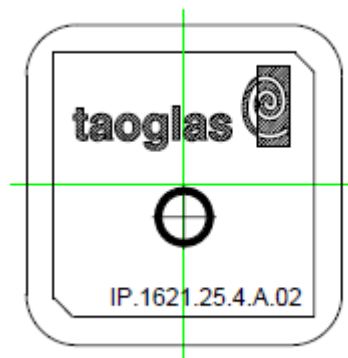


	Name	P/N	Material	Finish	QTY
1	IP.25A Iridium Patch(25.1x25.1x4mm)	001514C000007A	Ceramic	Clear	1
2	Double sided Adhesive	001013C180007A	NITTO 5015	White Liner	1

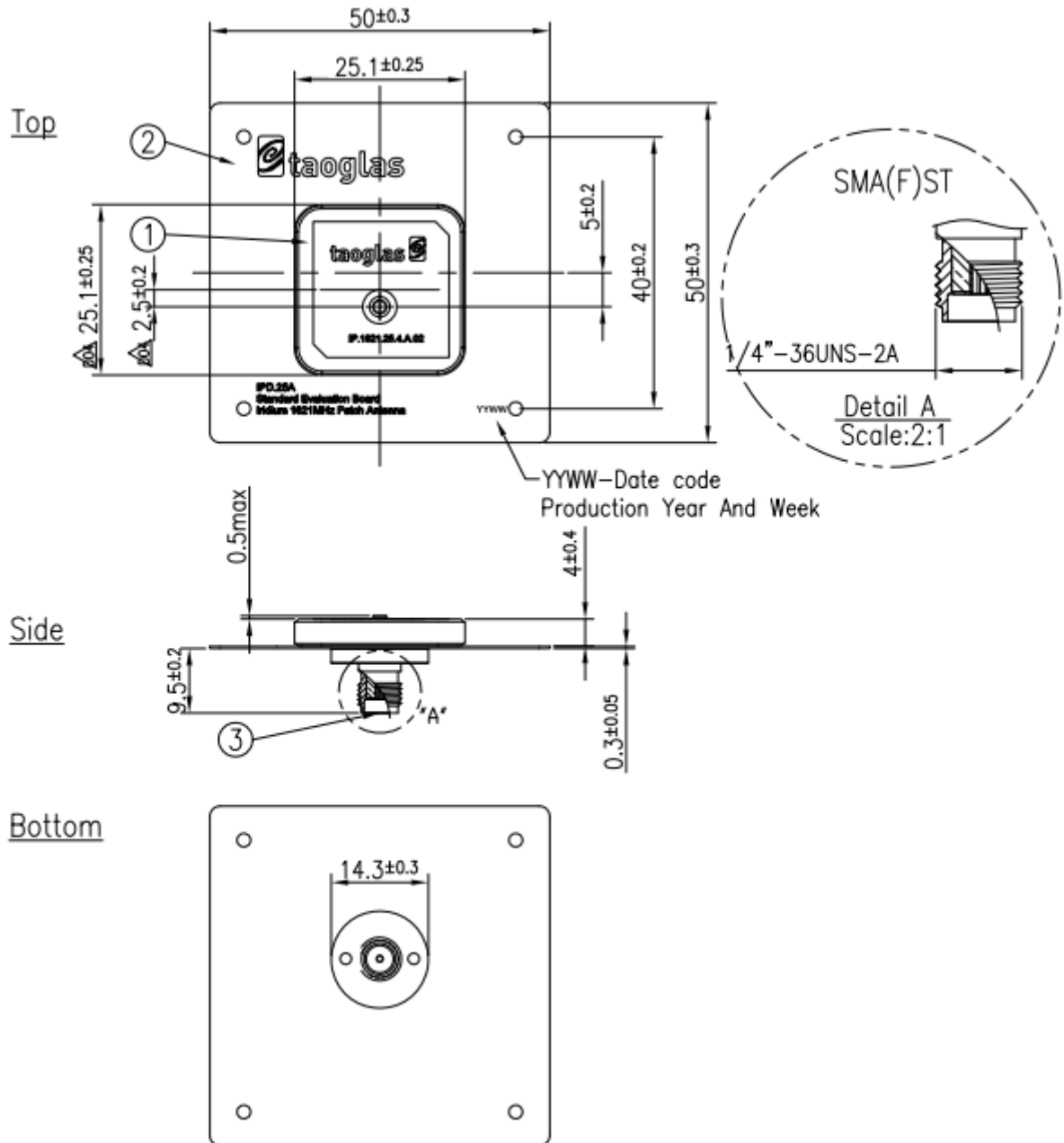
3.2 Layout



3.3 Mark

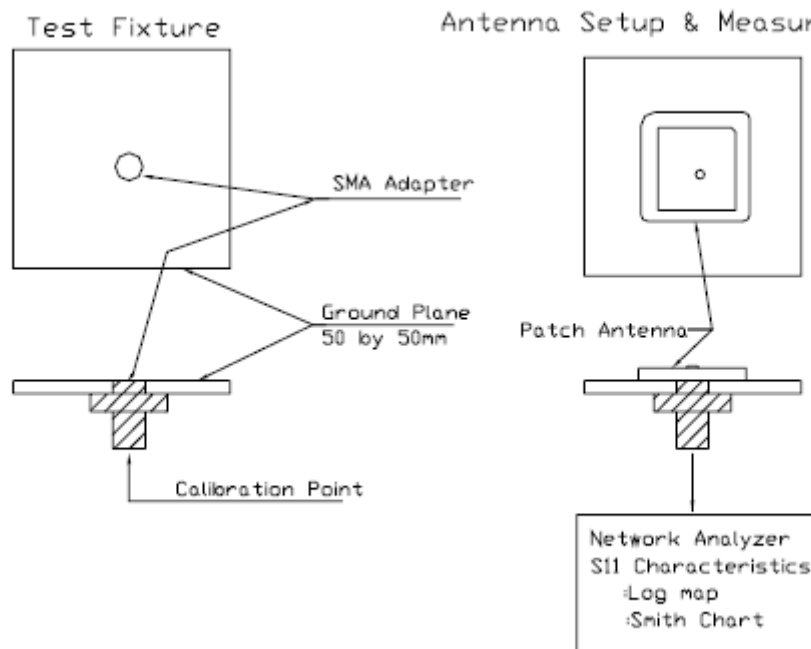


3.4 Evaluation Board (IPD.25A)

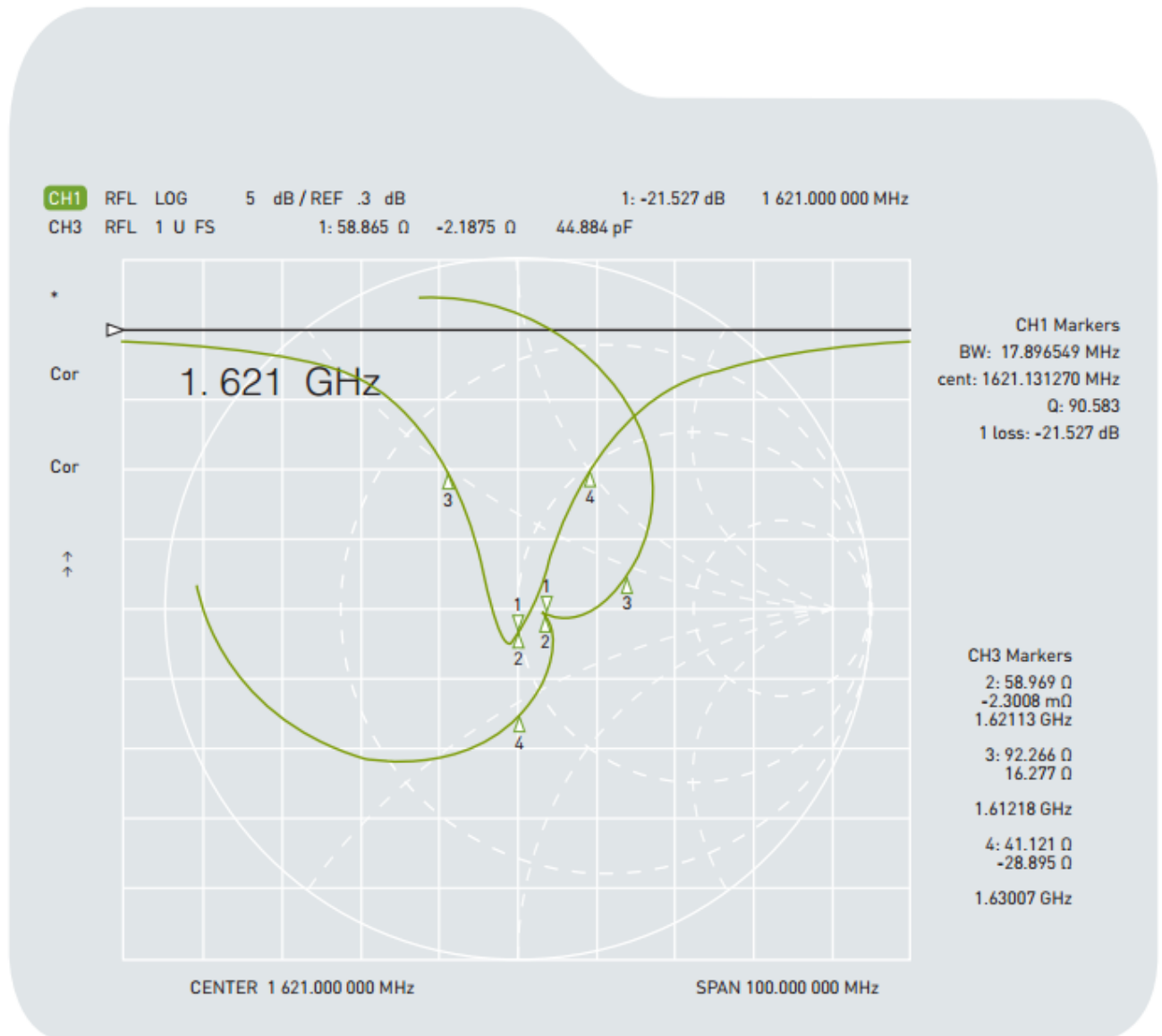


	Name	P/N	Material	Finish	QTY
1	IP.25A Iridium Patch(25.1x25.1x4mm)	001514C000007A	Ceramic	Clear	1
2	Ground-Plane(50x50x0.3mm)	000514C000007A	Brass	Silver	1
3	SMA(F) ST	200413L000007A	Brass	Au Plated	1

3.5 Test Fixture Antenna Setup and Measurements

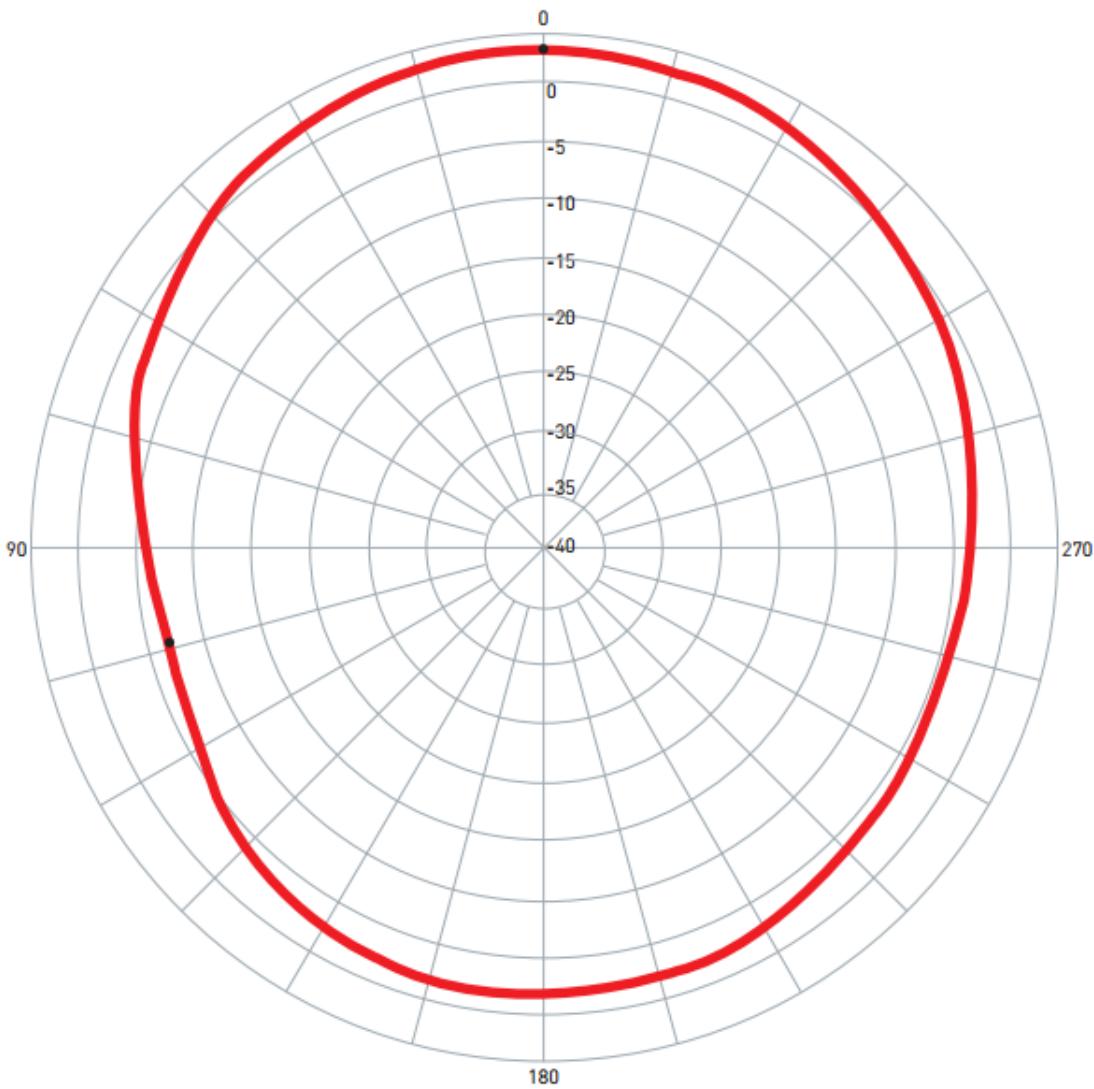


4. Performance testing and results



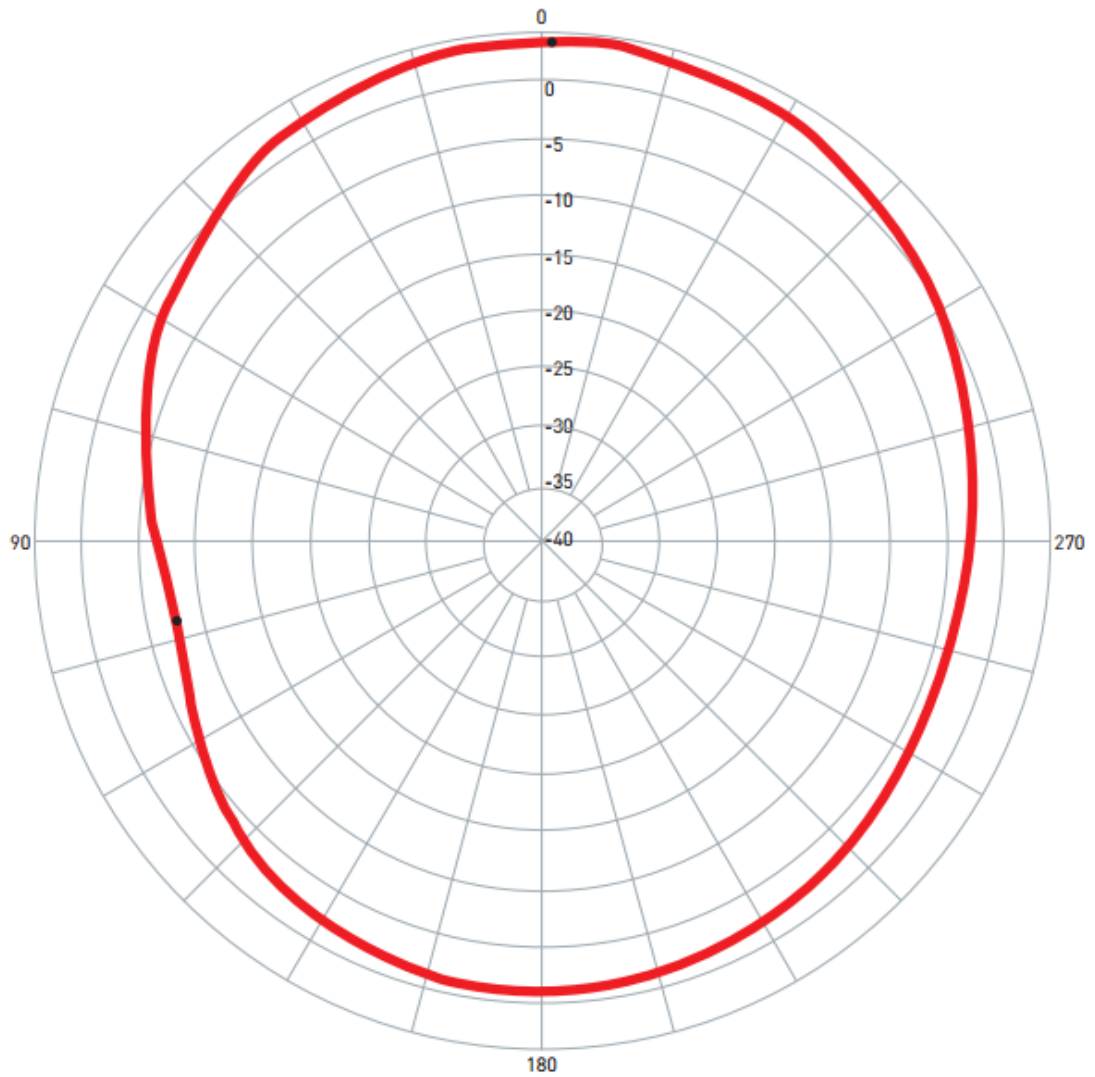
4.1 Antenna Gain Chart

4.1.1 XZ Plane



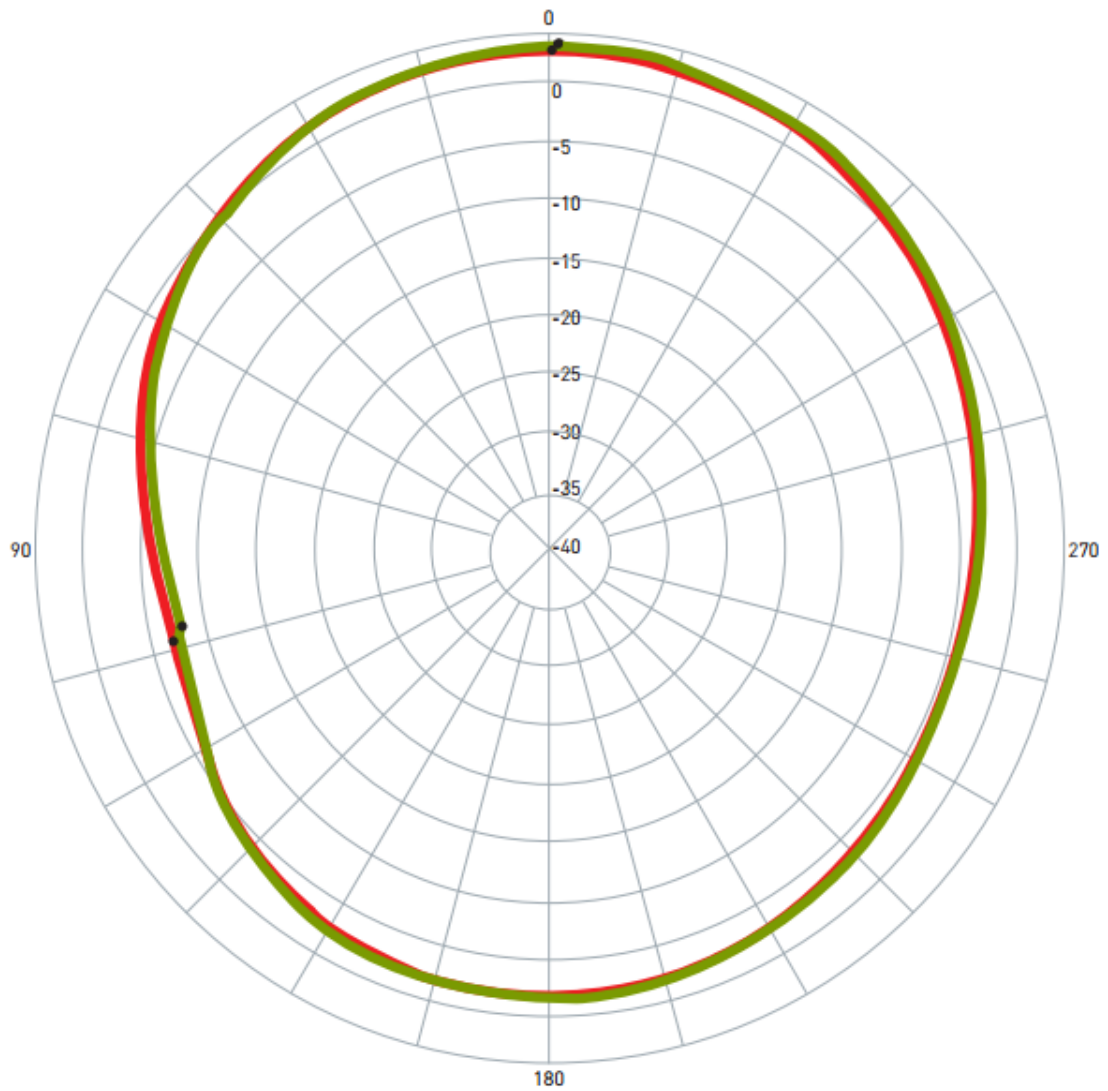
Pattern	Model No.	Test Mode	Freq (MHz)	Max Gain[dBi]	Min Gain[dBi]	Avg. Gain[dBi]	Source Polar.
1 	IP.1621.25.4.A.02	XZ	1621.00	2.72 / 0.00	-6.84 / 104.00	-1.05	V+H

4.1.2 YZ Plane



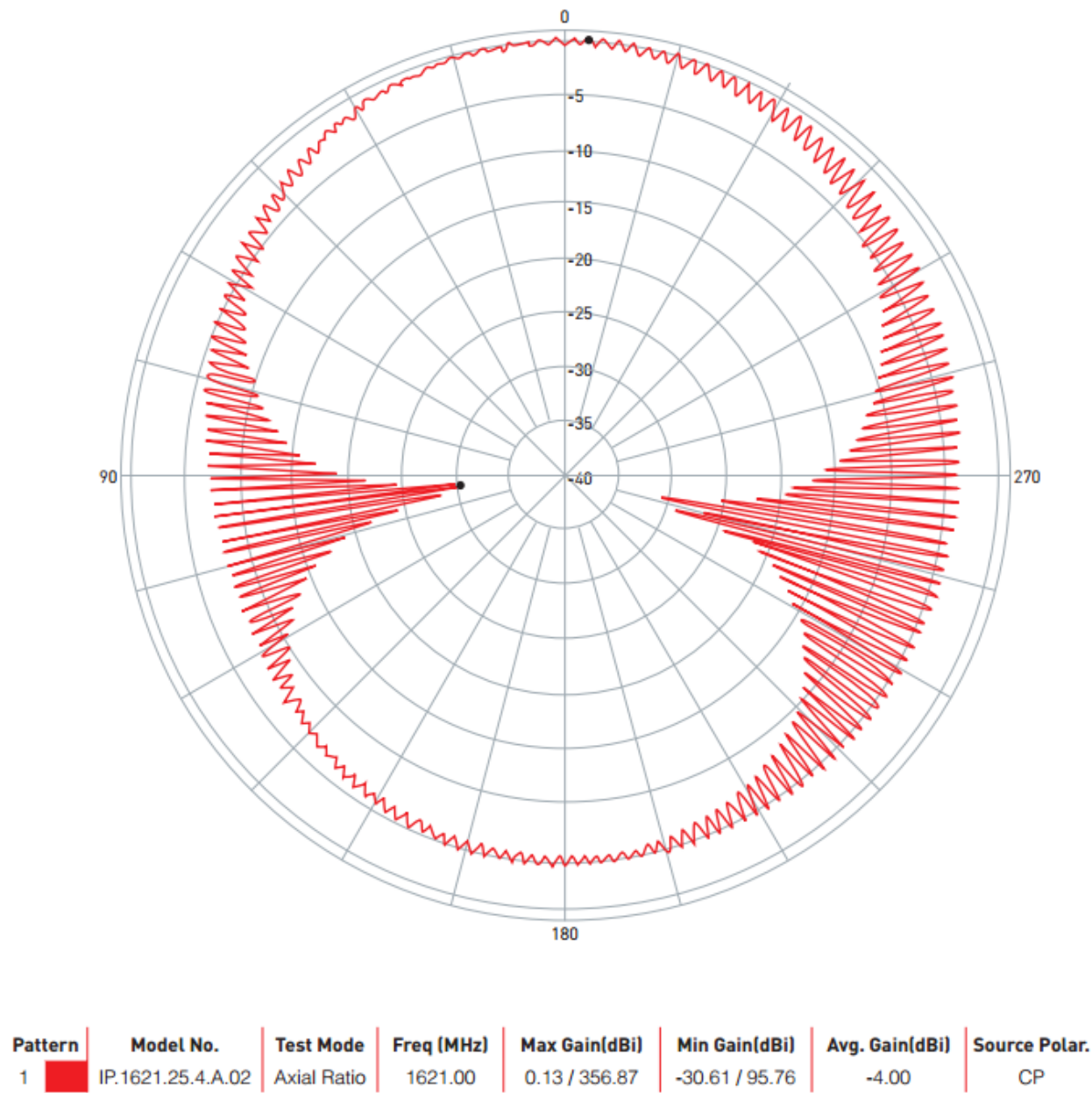
Pattern	Model No.	Test Mode	Freq [MHz]	Max Gain[dBi]	Min Gain[dBi]	Avg. Gain[dBi]	Source Polar.
1 	IP.1621.25.4.A.02	YZ	1621.00	3.00 / 358.99	-7.57 / 101.85	-0.86	V+H

4.1.3 XZ +YZ Plane



Pattern	Model No.	Test Mode	Freq (MHz)	Max Gain(dBi)	Min Gain(dBi)	Avg. Gain(dBi)	Source Polar.
1	IP.1621.25.4.A.02	XZ	1621.00	2.72 / 1.00	-6.84 / 104	-1.05	V+H
2	IP.1621.25.4.A.02	YZ	1621.00	3.00 / 358.99	-7.57 / 101.85	-0.86	V+H

4.2 Axial Ratio

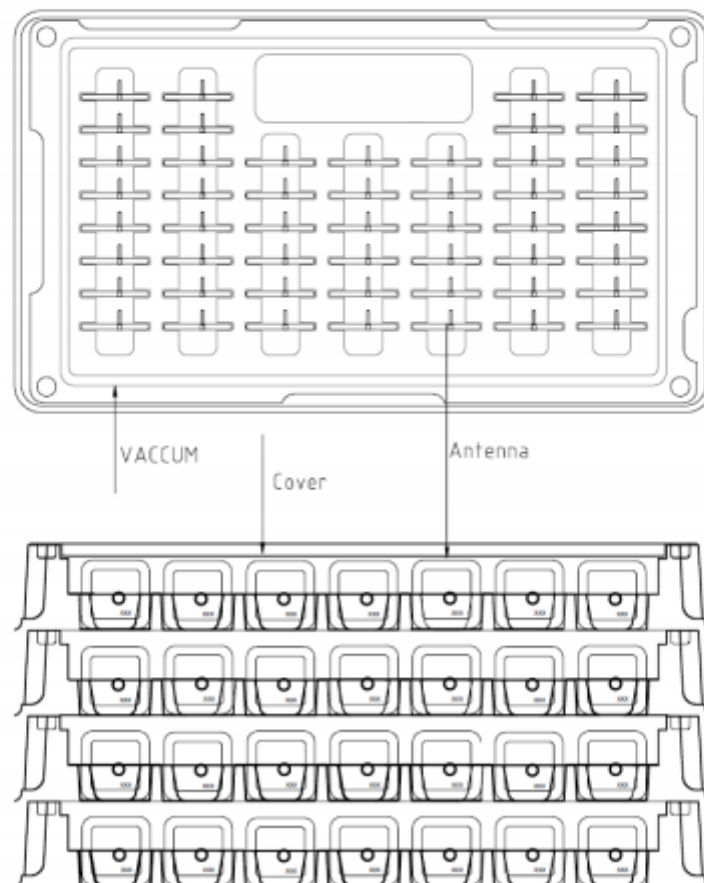


5. Packaging

Per Tray: 50 pieces

Per Carton (Inside Box) - 4 Trays = 200 pieces

Outer Carton (Outside Box) - 4 Cartons = 800 pieces





SPE-11-8-017/H/SS Page 13 of 13

Bluetooth / WLAN / WiFi Ceramic Chip Antenna

Ground cleared under antenna, clearance area 4.00 x 4.25/6.25 mm. Pulse Part Number W3008, W3008C



Features

- Omni directional radiation
- Low profile
- Compact size W x L x H (3.2 x 1.6 x 1.1 mm)
- Low weight (33 mg)
- Fully SMD compatible
- Lead free soldering compatible
- Tape and reel packing
- RoHS Compliant Product

Applications

- Bluetooth, WLAN, WiFi
- IEEE 802.11b/g
- ZigBee IEEE 802.15.4
- 2.4 GHz WLAN
- 2.4 GHz ISM Band Systems

Electrical specifications @ +25 °C

Note: Electrical characteristics depend on test board (GP) size and antenna positioning on GP and Ground Clearance area size.

Bluetooth, W3008

Typical performance (test board size 80x37 mm, PWB ground clearance area 4.00 x 4.25 mm)

Frequency Range [MHz]	Linear Max Gain [dBi]	Efficiency [%] / [dB]	Return loss min. [dB]	Impedance [Ω]	Operating Temperature [°C]
2400–2483.5	1.7 (Peak) 0.7 (Band edges)	70 / -1.6 (Peak) 55 / -2.6 (Band edges)	-8	50	-40 to +85

Bluetooth / WLAN / WiFi, W3008C

Typical performance (test board size 80x37 mm, PWB ground clearance area 4.00 x 6.25 mm)

Frequency Range [MHz]	Linear Max Gain [dBi]	Efficiency [%] / [dB]	Return loss min. [dB]	Impedance [Ω]	Operating Temperature [°C]
2400–2483.5	2.2 (Peak) 1.9 (Band edges)	75 / -1.3 (Peak) 70 / -1.6 (Band edges)	-11	50	-40 to +85

Pulse Finland Oy

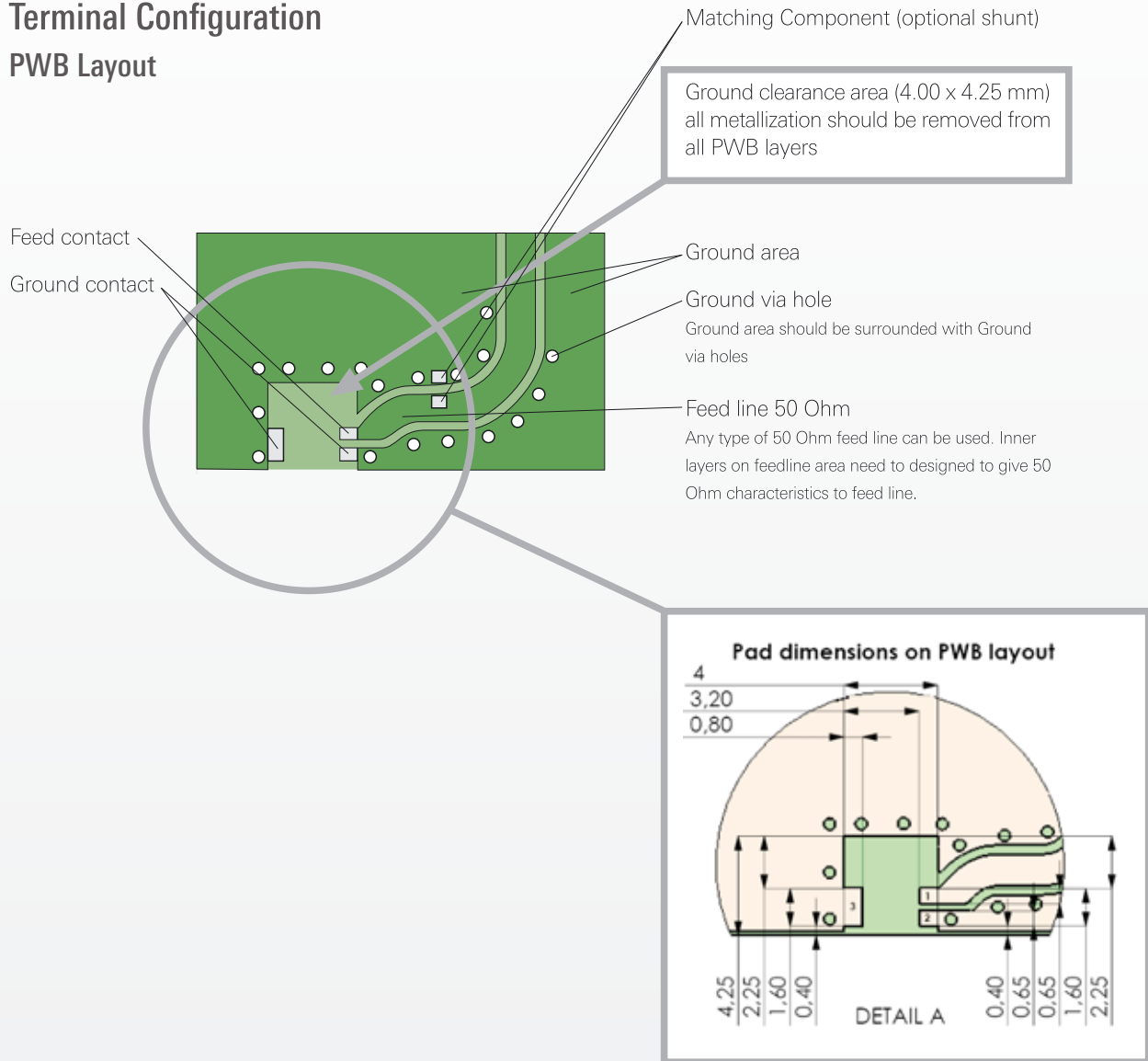
Takatie 6
90440 Kempele, Finland
Tel: +358 207 935 500
Fax: +358 207 935 501
www.pulseeng.com/antennas



Bluetooth / WLAN / WiFi Ceramic Chip Antenna

Terminal Configuration

PWB Layout



PWB features

No.	Terminal name	Terminal Dimensions
1	Feed	0.8 x 0.65 mm
2	GND	0.8 x 0.65 mm
3	GND	0.8 x 1.60 mm

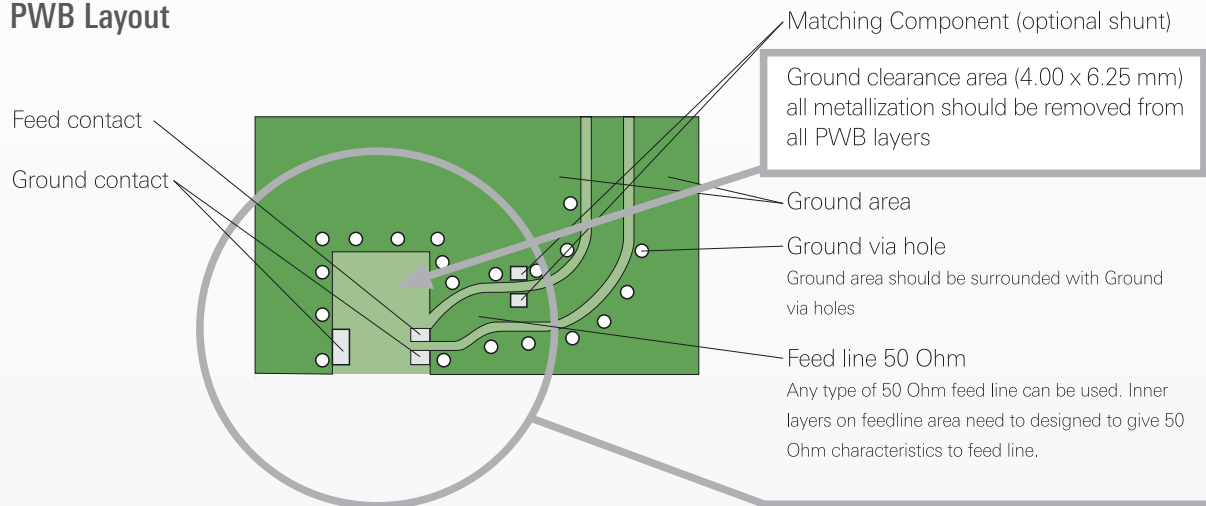
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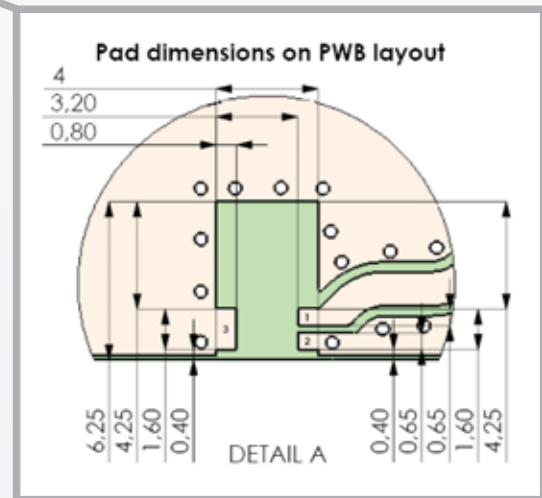
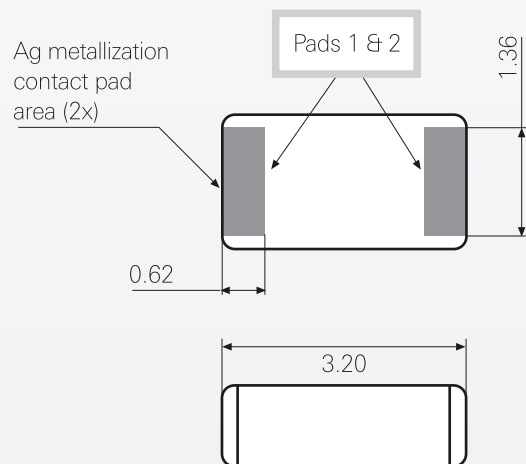
Bluetooth / WLAN / WiFi Ceramic Chip Antenna

Terminal Configuration

PWB Layout



Antenna



Antenna features

No.	Terminal name	Terminal Dimensions
1	Feed / GND	0.62 x 1.36 mm
2	Feed / GND	0.62 x 1.36 mm

Antenna is symmetrical.

Either of terminals 1 or 2 can be feed / GND

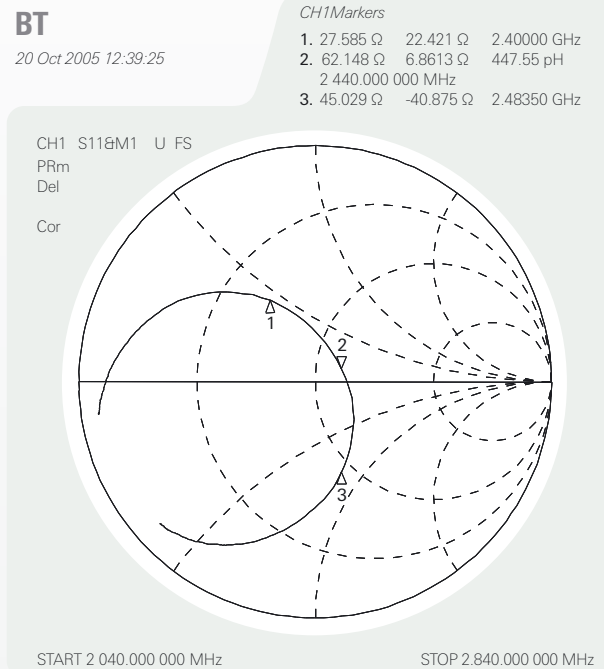
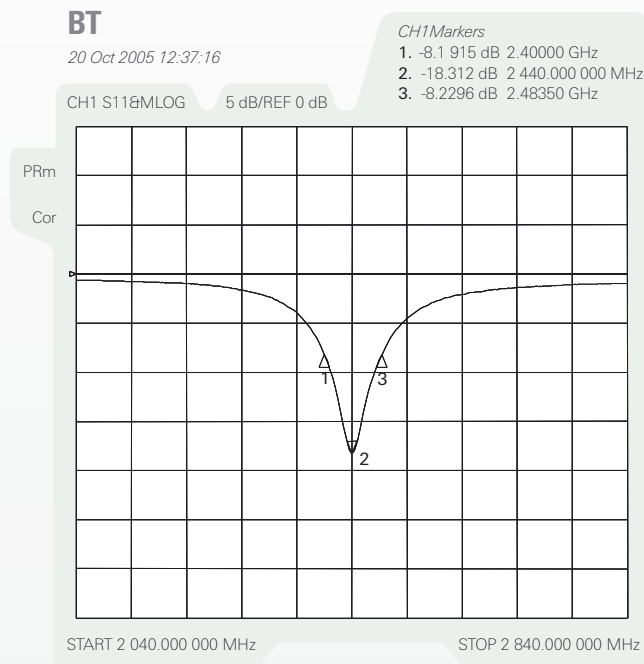
PWB features

No.	Terminal name	Terminal Dimensions
1	Feed	0.8 x 0.65 mm
2	GND	0.8 x 0.65 mm
3	GND	0.8 x 1.60 mm

Bluetooth / WLAN / WiFi Ceramic Chip Antenna

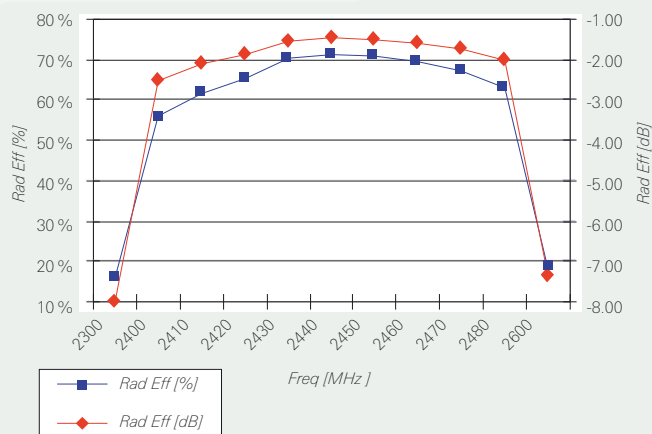
Typical Electrical Characteristics (T=25 °C), W3008

Typical Return Loss S11/ impedance, measured on the test board

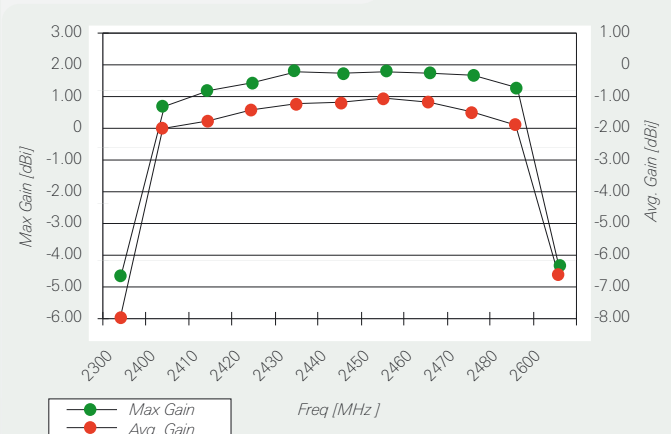


Free space efficiency and maximum gain / PWB ground clearance area 4.00 x 4.25 mm

BT GC 3.2 x 1.6 x 1.1 mm



BT GC 3.2 x 1.6 x 1.1 mm



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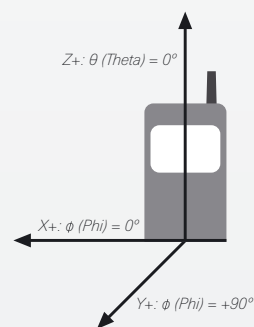
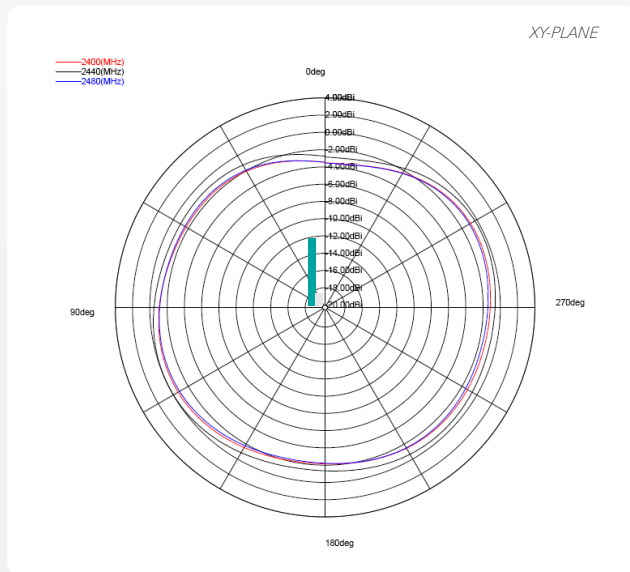
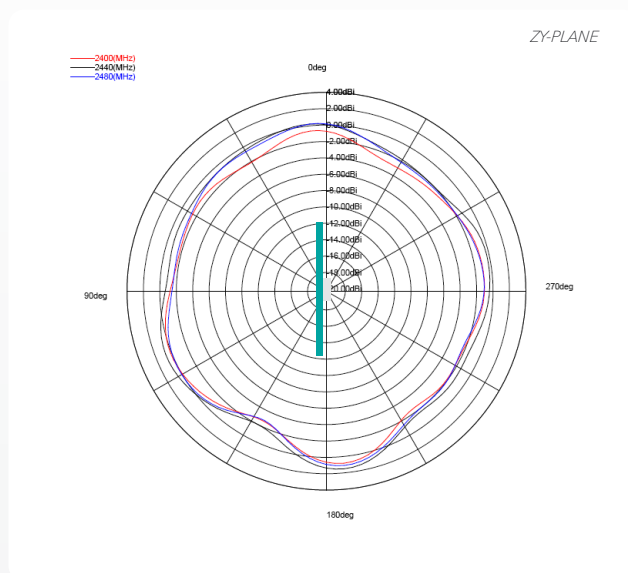
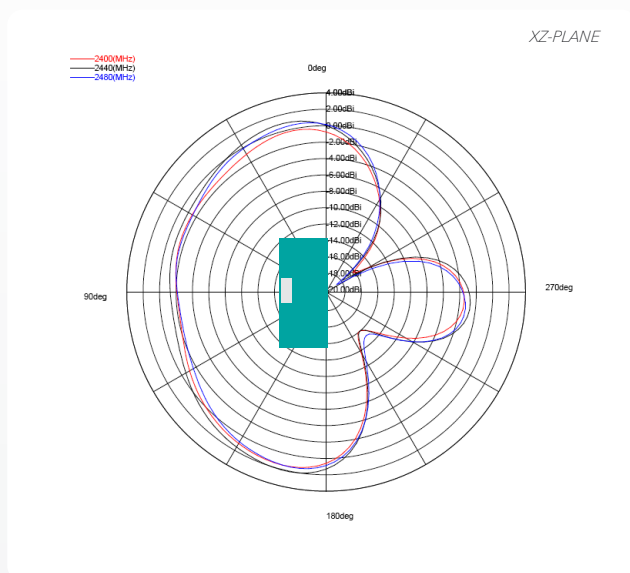
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Bluetooth / WLAN / WiFi Ceramic Chip Antenna

Typical Free Space Radiation Patterns, W3008



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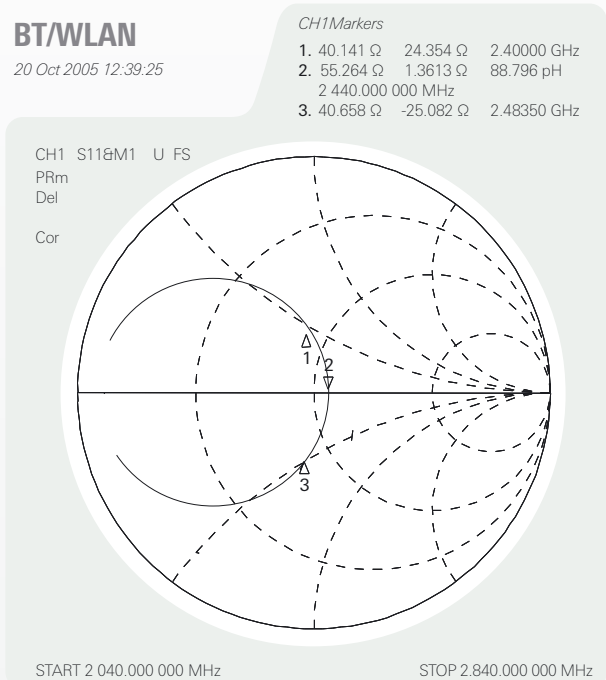
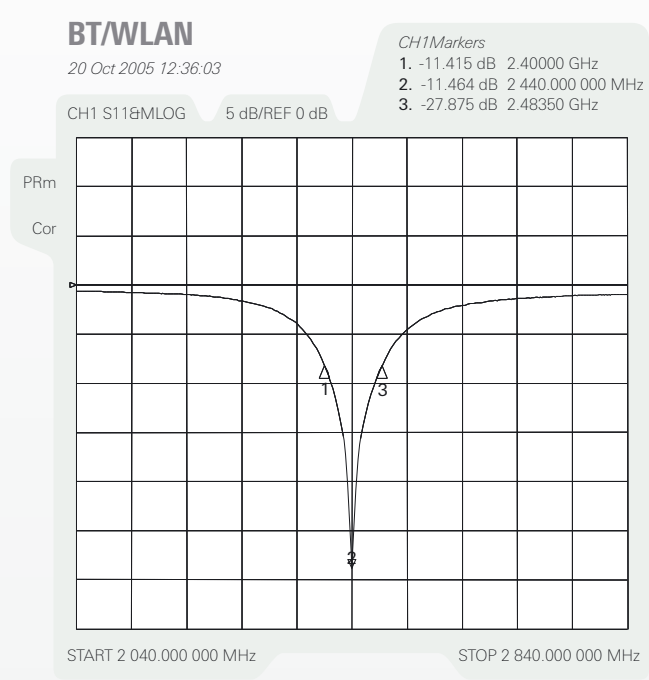


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Bluetooth / WLAN / WiFi Ceramic Chip Antenna

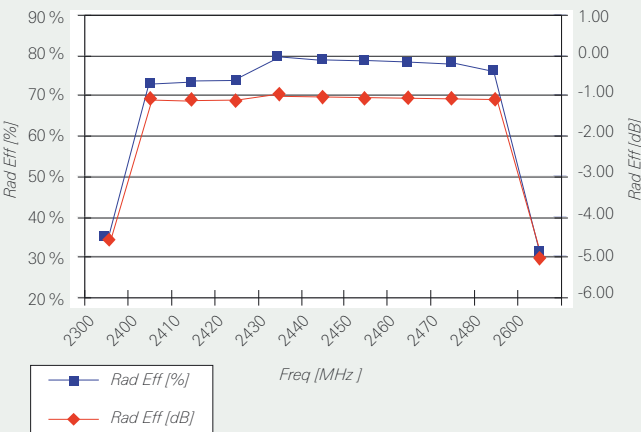
Typical Electrical Characteristics (T=25 °C), W3008C

Typical Return Loss S11/ impedance, measured on the test board

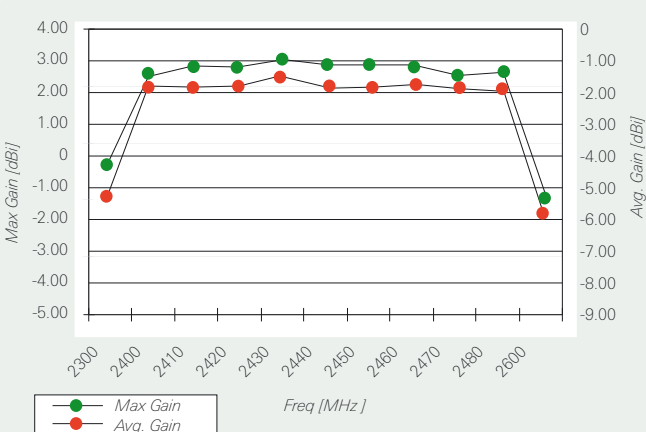


Free space efficiency and maximum gain / PWB ground clearance area 4.00 x 6.25 mm

BT GC 3.2 x 1.6 x 1.1 mm

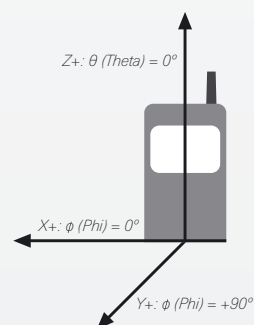
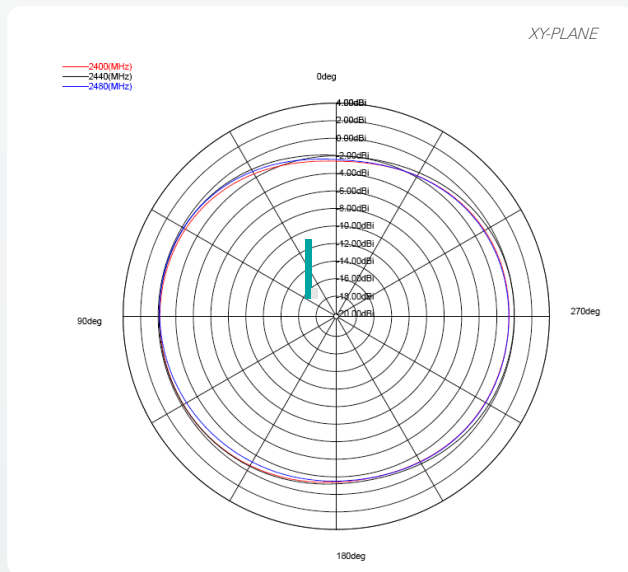
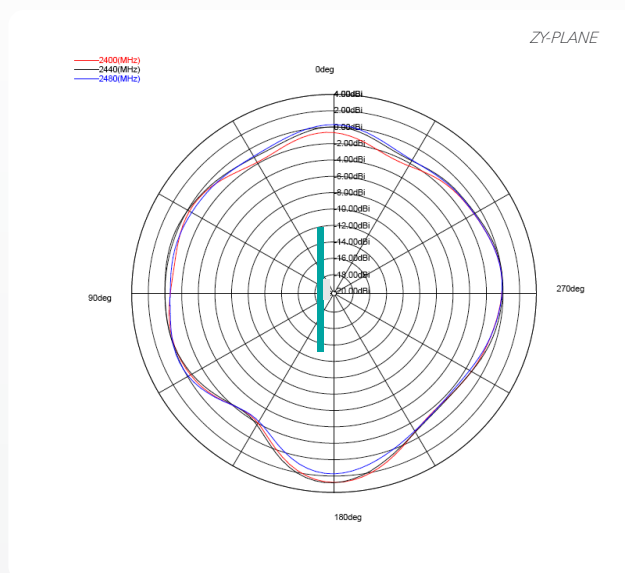
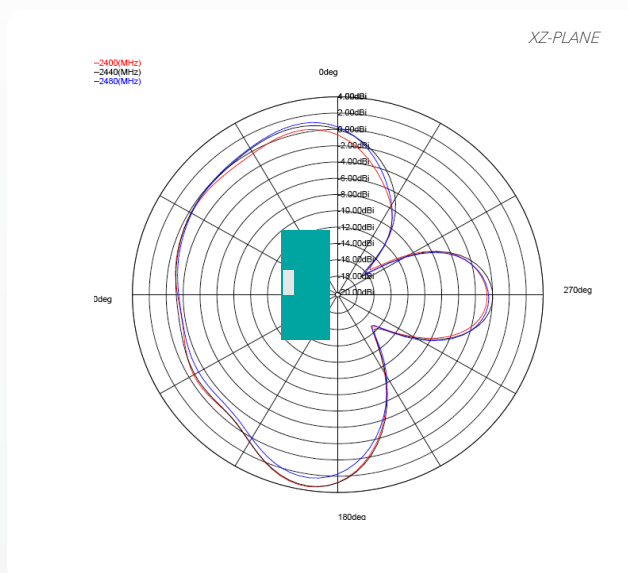


BT GC 3.2 x 1.6 x 1.1 mm



Bluetooth / WLAN / WiFi Ceramic Chip Antenna

Typical Free Space Radiation Patterns , W3008C



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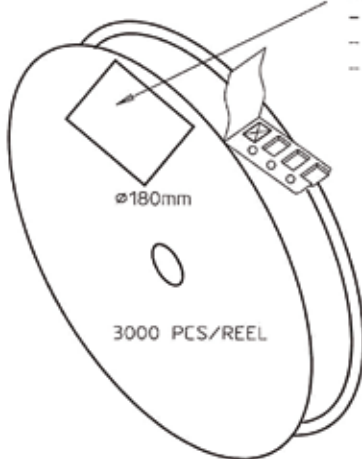
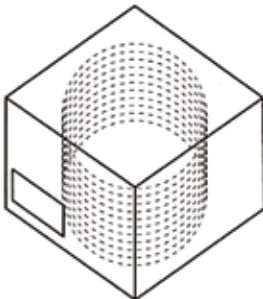
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Bluetooth / WLAN / WiFi Ceramic Chip Antenna

Packing Form

REEL LABEL INFORMATION:

- TRACEABILITY
- QUANTITY
- PRODUCT CODE

CARRIER TAPE H85-00125
width=8,00 depth=1,22
COVER TAPE H85-00126
width=5,60

LENGTH OF TAPE:

- Leader section: 50 empty cavities before component section
- Trailer section: 25 empty cavities after component section.

Empty part cavities at leader and trailer section of the tape must be sealed with top cover tape.

BOX H85-00128 (182x182x132)	1 pcs
- LABEL	1 pcs/BOX
REEL H85-00127 (D180, W12)	10 pcs
- REEL LABEL	1 pcs/REEL

MATERIAL					
HANDLINGS					
		RATIO	DRWN	010305 PeHa	H
			DGNER		G
			CHKD		F
			APPRD		E
			APPRD BY		D
PRODUCT H90-OY116-F01P01				C	
				B	
				A	
		DENOMINATION PACKING FORM		VERSION	MOD/DATE/NAME

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