Implementation of Mica antenna on Symbol scanners(MC3000-Option2, rev3.0)

Summary

The performance of the gigaAnt's Mica antenna on Symbol both scanners PCB was investigated.

The return loss of the antenna was measured and verified using vector network analyzer R3767CG. The return loss better than –8dB (i.e. VSWR <2.3:1) is achieved over the entire Bluetooth band for both scanners.

Measurements

During the measurement, the Mica antenna was mounted on PCB as shown in Figure 1.

Figure 1: Mounting of the Mica antenna on the symbol scanner

Matching

The addition of the matching network to the antenna is aiming to achieve optimum performance. The values of the matching components are shown in Figure 2.

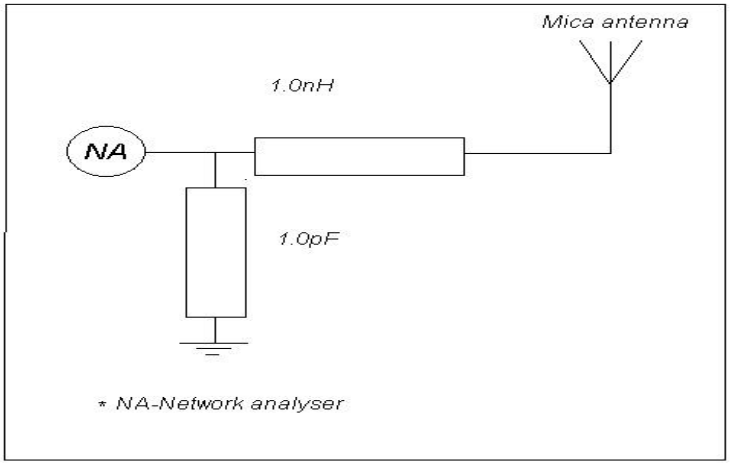

Figure 2: Matching components

Results

The return loss was better than –8dB (i.e. VSWR < 2.31:1) is achieved over the entire Bluetooth band for both scanners.

The efficiency measured was better than 22% at BT frequency band for both Symbol scanners.

The return loss, VSWR and efficiency of the antenna was tabulated in Table 1 & 2 below while the return loss curve and efficiency is presented in Figure 3 to 6.

Freq (GHz)	RL (db)	VSWR	Ave Gain/ Peak Gain	Efficiency(%)
2.402	-10.0	1.9:1	-6.32/-0.60	25
2.441	-10.8	1.7:1	-6.63/-0.47	26
2.480	-9.80	1.9:1	-6.86/-0.77	24

Table 1: Result of the Mica antenna on the Symbol scanner with handle

Freq (GHz)	RL (dB)	VSWR	Ave Gain/Peak Gain	Efficiency(%)
2.402	-8.0	2.3:1	-7.37/1.17	22
2.441	-11.1	1.7:1	-7.11/1.83	24
2.480	-10.7	1.8:1	-7.44/0.62	22

Table 2: Result of the Mica antenna on the Symbol scanner without handle

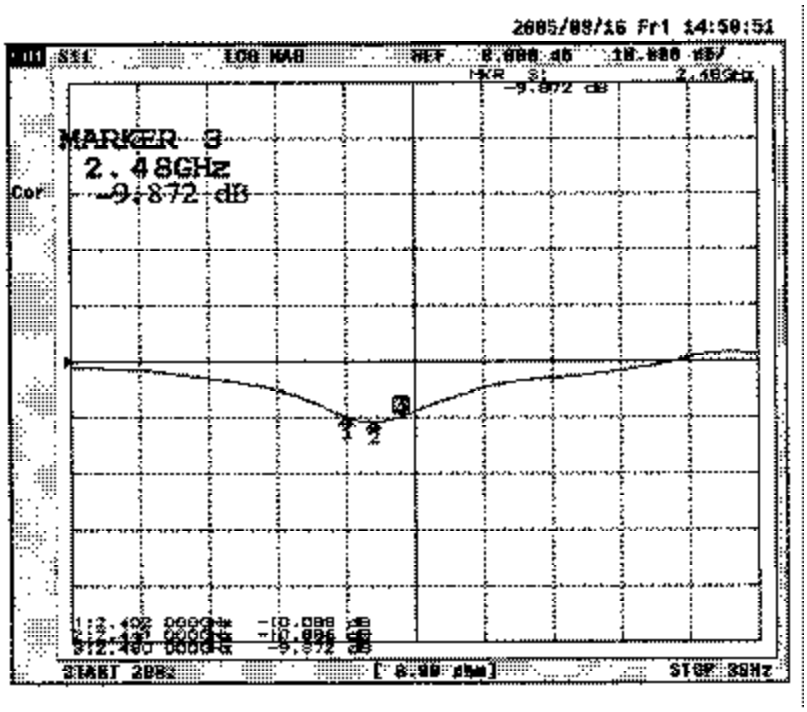

Figure 3: Mica antenna return loss curve on Symbol scanner with handle

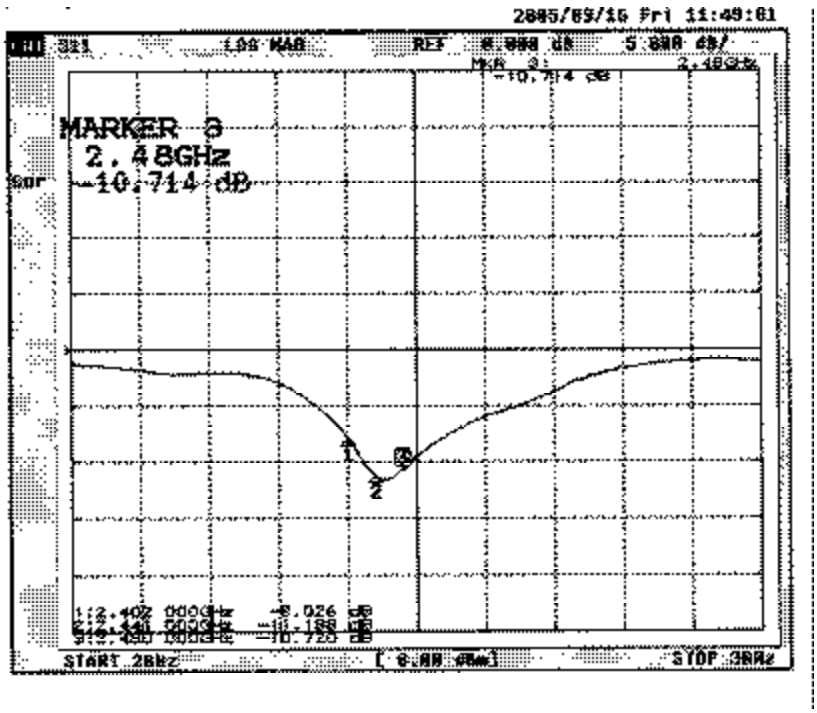

Figure 4: Mica antenna return loss curve on Symbol scanner without handle

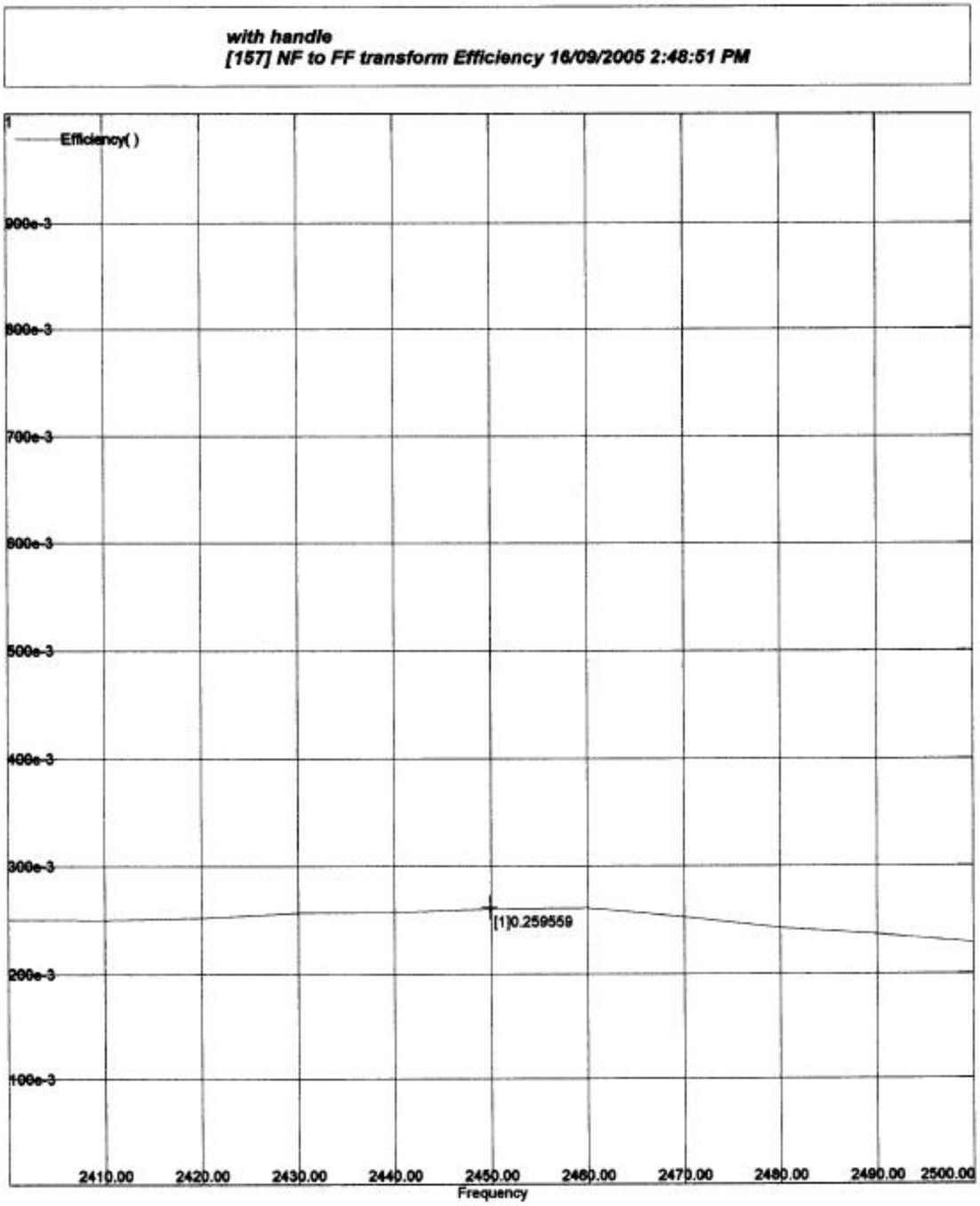

Figure 5: Efficiency curve on Symbol scanner with handle

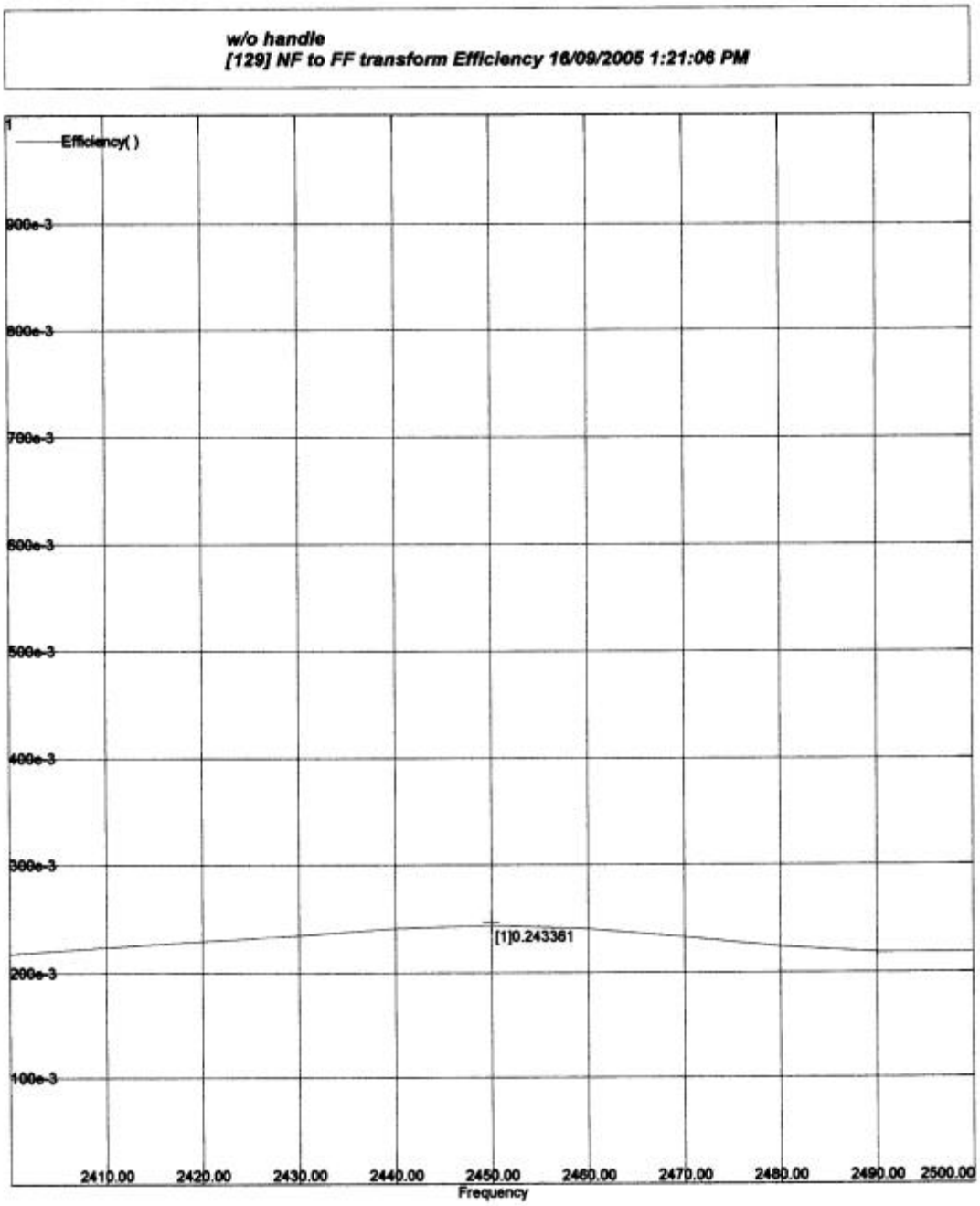

Figure 6: Efficiency curve on Symbol scanner without handle

Conclusions

The Mica antenna performed fairly well on both Symbol scanners.

The following need to be done for the Mica antenna to perform even better:

1. The transmission line from the RF output is relatively thin and I would appreciate that this line can be changed to a thicker 50ohm line, since a very thin line will create losses.
2. The shunt matching pad is too close to the Mica, difficult to hand solder, move the shunt pad further away.
3. The Mica placement must face the edges, refer to application note in page 6.
4. The speakers should not be located on top of the Mica.

Product Specification

Mica 2.4 GHz SMD Antenna

Product Specification

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1. FEATURES

- Designed for 2.4 GHz applications [Bluetooth™, WiFi™ (802.11b/g), Zigbee™, WiMedia™ etc.]
- Intended for SMD mounting
- Supplied in tape on reel

2. DESCRIPTION

The Mica antenna is intended for use with all 2.4 GHz applications. The antenna requires a groundplane, i.e your device acts as an active part of the antenna and thus demand careful consideration concerning its placement

3. APPLICATION

- Mobile phones
- PDAs
- Headsets
- Laptops
- Medical equipment
- Automotive

4.MODEL NAME

30 30 A5645 - 01

- **Drawing No.**
- **Technology**
  -PCB
- **Antenna Family**
  -SMD

5. GENERAL DATA

Product Name	Mica 2.4 GHz
Article No.	3030A5645-01
Frequency	2.4-2.5 GHz
Polarization	Linear
Operating temperature	-40 to + 85 degC
Impedance	50 Ohm
Weight	0.4 gram
Antenna type	SMD

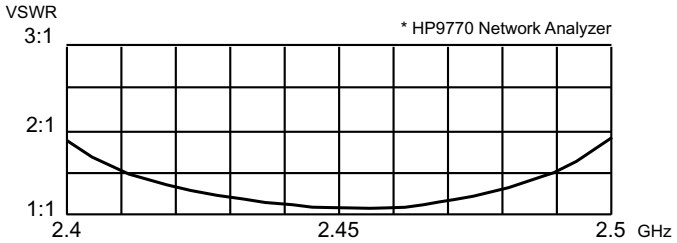
6. ELECTRICAL CHARACTERISTICS

	Characteristics			Conditions*
	Min	Typ	Max	
Peak Gain	2.1 dBi	2.4 dBi	2.7 dBi	Frequency 2.4-2.5 GHz, Measured in 3D chamber (near field)
Efficiency	70%	75%	79%	
VSWR	1.0:1	1.5:1	1.9:1	Frequency 2.4-2.5 GHz, Measured in Network Analyzer

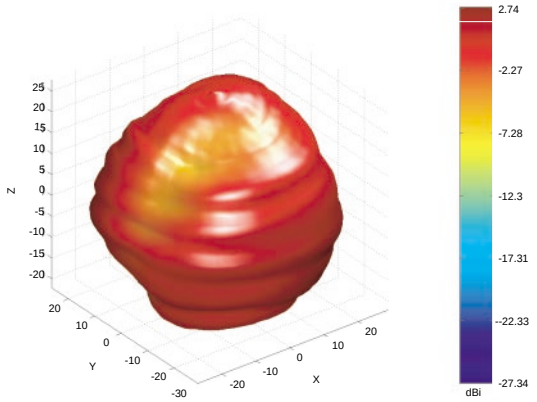
*Note all data provided in this table are based on the gigaAnt reference board

7. ELECTRICAL PERFORMANCE

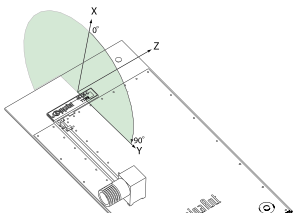
7.1 Voltage Standing Wave Ratio



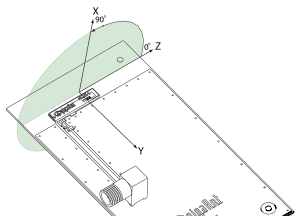
7.2 3D-Radiation



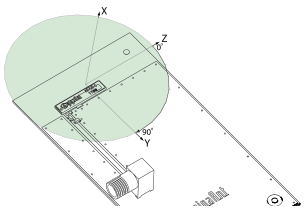
7.3 Radiation patterns



XY- Plane

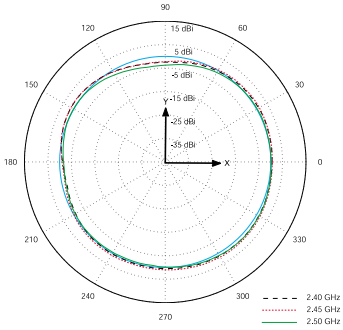


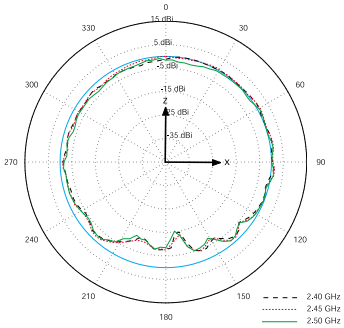
XZ- Plane

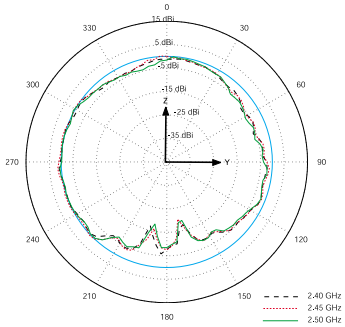


YZ- Plane

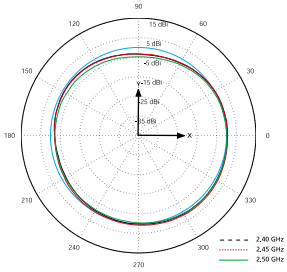
Total polarization

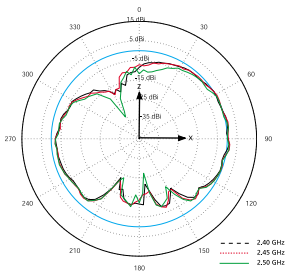


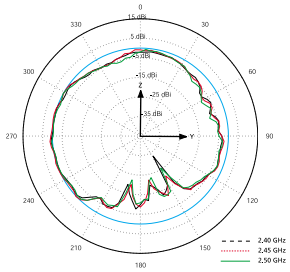




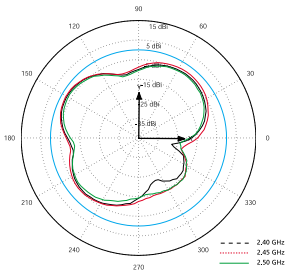
Vertical polarization

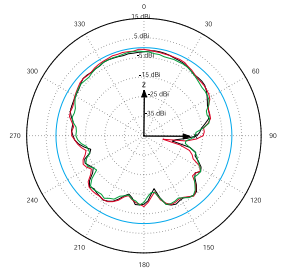


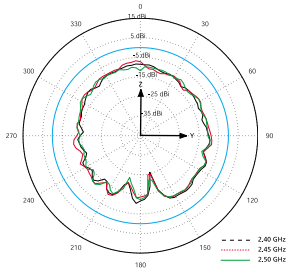




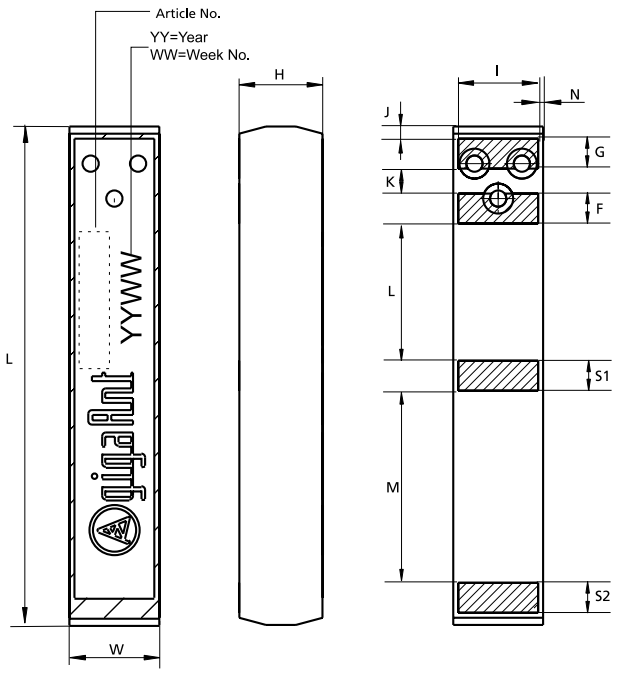
Horizontal polarization





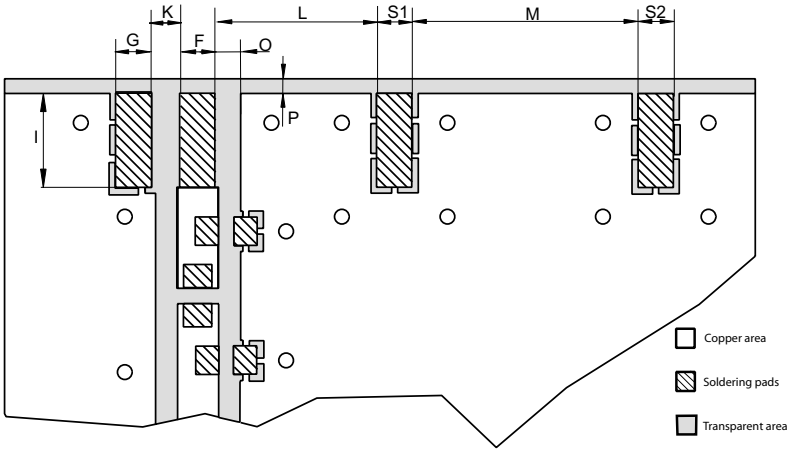


8. ANTENNA DIMENSIONS



L	W	H	G	F	S1, S2	I	J	K	L	M	N
Length	Width	Height	Ground	Feed	Solder	Feed	Feed				
20.5 ±0.2	3.6 ±0.1	3.3±0.2	1.2±0.1	1.2±0.1	1.2±0.1	3.2±0.1	0.55±0.25	1.0±0.1	5.5±0.1	7.7±0.1	0.2±0.1
Dimensions in millimeter											

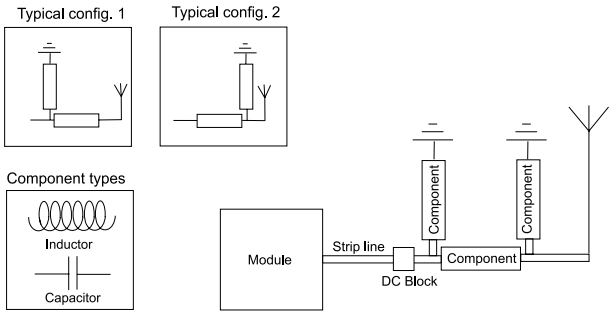
9. ANTENNA FOOT PRINT



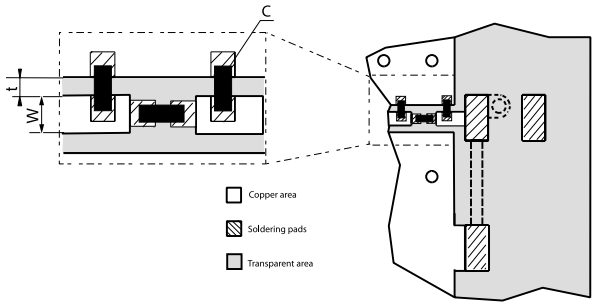
G	F	S1	S2	I	K	L	M	O	P
Ground	Feed	Solder	Solder						
1.2±0.1	1.2±0.1	1.2±0.1	1.2±0.1	3.2±0.1	1.0±0.1	5.5±0.1	7.7±0.1	0.5±0.1	0.5±0.1
Dimensions in millimeters									

10. ELECTRICAL INTERFACE

10.1 Transmission line and matching



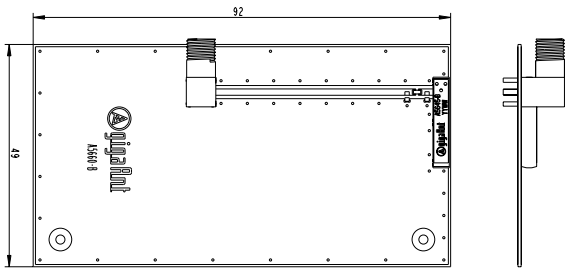
The matching network has to be individually designed using one, two or three components.



t, w = Unique dimensioning according to your PCB *
C = Inductor and capacitor values according to your specific device*

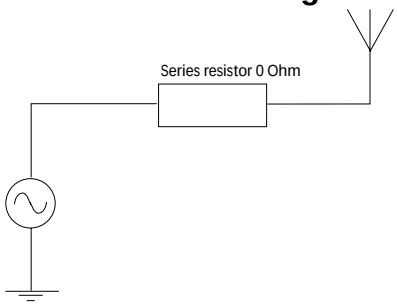
* gigaAnt provides this service upon request

10.2 Test board dimensions



The testboard is designed for evaluation purposes for Mica 2.4 GHz SMD antenna. The board has the same size as a typical PCMCIA card and is fitted with an SMA connector.

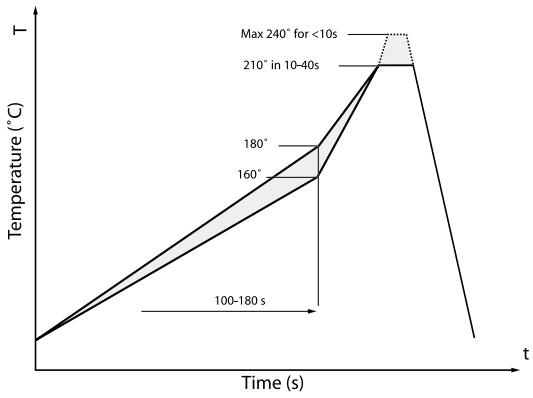
10.3 Test board matching



The testboard is matched with above specified component. Note! The component value(s) will vary depending on size of PCB, surrounding components etc.

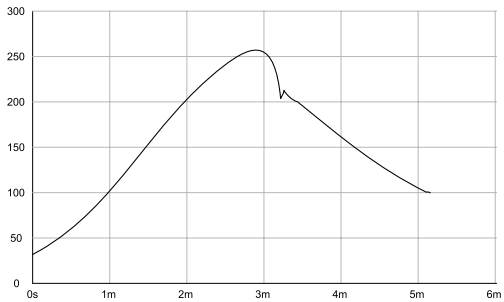
11. SOLDERING

11.1 Recommended soldering conditions



11.2 Leadfree soldering

The antenna has been tested and approved for leadfree soldering. The reflow curve and solder paste used is listed below.



Solder paste: KOKI S3X58-M405

12. RELIABILITY

12.1 Temperature and Humidity

Item	Standard	Low	High	Duration
Operating temperature	EN/IEC 60068-2-2, Test Bd: Dry heat	-30 degC	+90 degC	-
Temperature cycling	EN/IEC 60068-2-14, Test Na: Change of temperature	-40 degC	+90 degC	500 cycles / 10 min
Storage life Humidity	EN/IEC 60068-2-1, Test Ca: Damp heat	+60 degC / 90% RH		500 h
Storage life Low temperature	EN/IEC 60068-2-1, Test Ad: Cold	-55 degC	-	500 h
Storage life High temperature	EN/IEC 60068-2-2, Test Bb: Dry heat	-	+125 degC	500 h

12.2 Mechanical

Item	Standard	Low	High	Duration
Bending	IEC 60068-2-21, Test Ue1: Bending	Bending 1 mm at a rate of 1 mm/s with support at end of PCB 1mm depth on reference board		
Shear	IEC 60068-2-21, Test Ue3: Shear	Force of 5 N applied to the side of the antenna.		
Drop test		Dummy weight: 150g Height: 170cm		One drop at each side, total drops: 6
Vibration	EN/IEC 60068-2-6, Test Fc (sinusoidal)	Acceleration spectral density:10-1000Hz Acceleration: 20m/s2 Number of axes: 3 mutually perpendicular		5 cycles per axis

12.3 Miscellaneous

Item	Standard	Low	High	Duration
Solderability	EN/IEC 60068-2-58, Test Td	Visual inspection of soldering pads. Estimation of how many % of the pads that are well tin plated.		

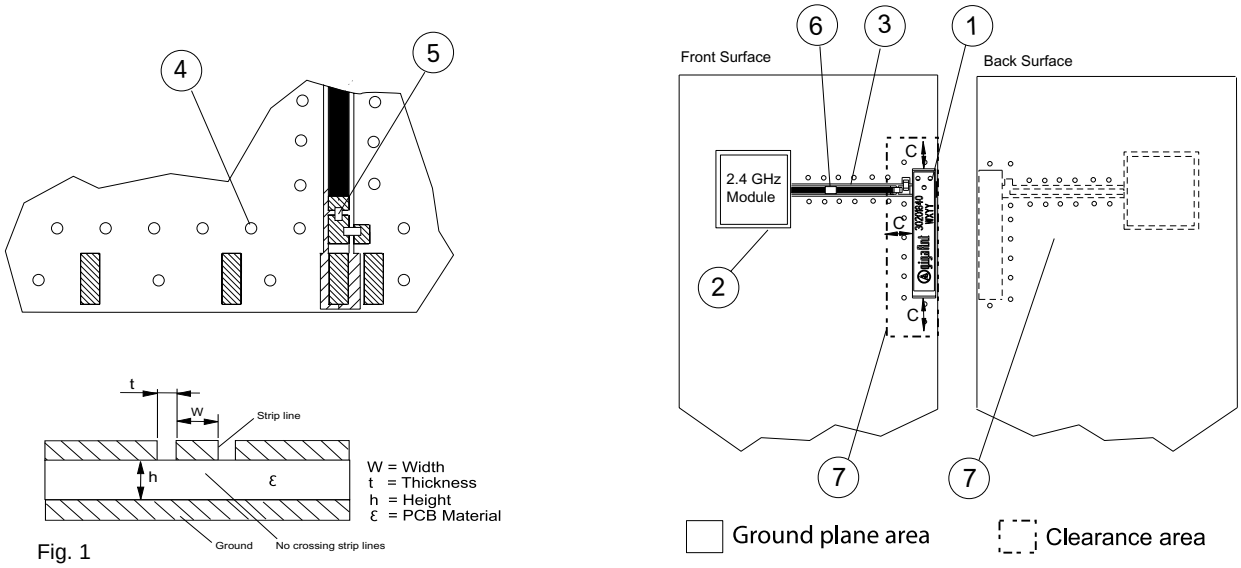
12.4 Judgement standard

The judgement of the above tests should be made as follows:
1. Visual inspection - Normal apperance with no obvious cracking, peeling-off.
2. Electrical inspection - The DUT satisfies the VSWR specification throughout the 2.4-2.5 GHz band

13. HAZARDOUS MATERIAL REGURATION CONFORMANCE

Cadmium and cadmium compound.	Lead and lead compound
Organic brominated compound (PBB, PBDE)	Mercury and mercury compound
Polychlorinated biphenyl (PCB)	Sexivalent chrome compound
Polychlorinated naphthalene (PCN)	Chlorinated paraffin (CP)
Organic tin compound	Mirex
Asbestos	Formaldehyde
Azo compound	Tetra-bromo-bisphenol-A-bis (TBBP-A-bis)

14. APPLICATION EXAMPLE



General

The antenna is of a quarter wave type and is dependent on the groundplane area to complete the antenna function. The antenna performance is also dependent on the size of the groundplane.

1. **Placement of the antenna**
   The antenna shall be placed on a groundplane area, preferably at the edge of the PCB oriented as above.
2. **Placement of 2.4 GHz module**
   To avoid losses in the strip line, the module shall be placed as close to the antenna as possible.
3. **Strip line**
   The strip line must be dimensioned according to your specific PCB. (see fig 1). No crossing strip lines are allowed between the strip line and its ground plane.
4. **Via connections**
   To avoid spurious effects, via connections must be made to analogue ground.
5. **Component matching**
   Component values are depending on antenna placement, PCB dimensions and location of other components.
6. **DC Block**
   Might be needed depending on RF Module configuration.
7. **Clearance**
   Front surface: Minimum clearance to other components, C = 2-5 mm
   Back surface: Components allowed.
8. **Casing material**
   No metal casing or plastics using metal flakes shall be used, avoid also metallic based paint or laquer.

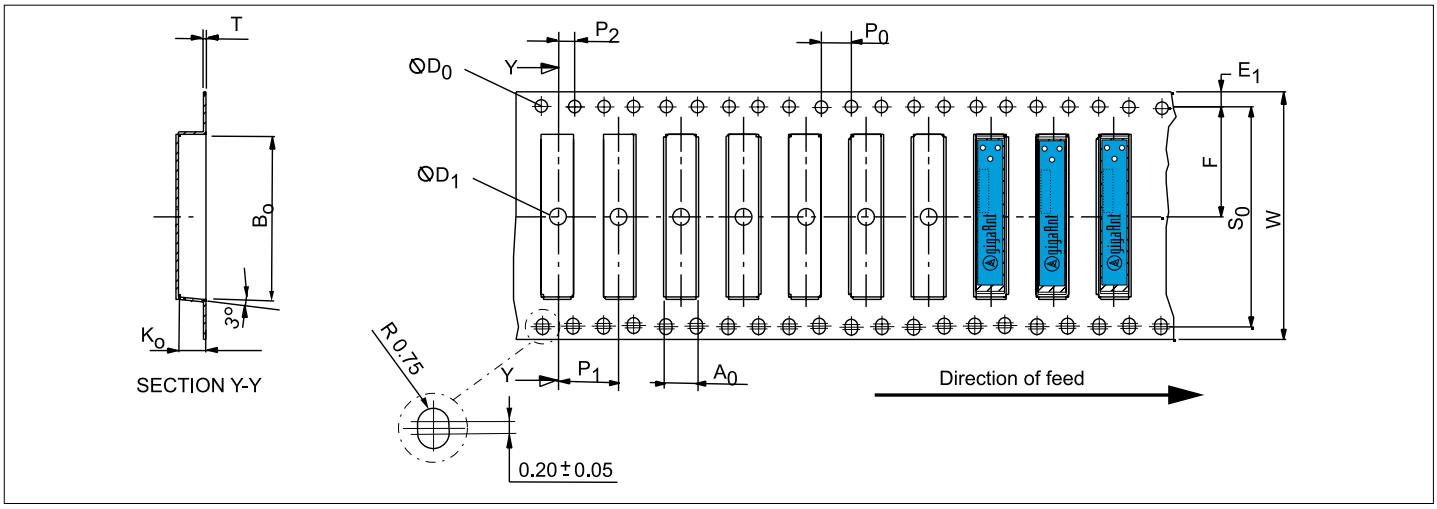
Note ! **Incorrect implementation of the antenna will affect the performance. Contact gigaAnt for implementation services.**

15. PACKAGING

15.1 Shelf storage recommendation

Temperature	-10 to +40 degree C
Humidity	Less than 75% RH
Shelf Life	18 Months
Storage place	Away from corrosive gas and direct sunlight

15.2 Tape characteristics

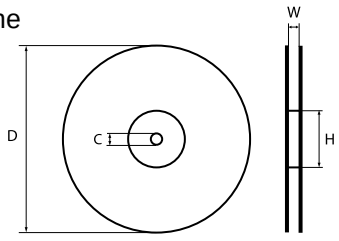


W	S_0	F	E_1	P_0	P_1	P_2	A_0	B_0	K_0	T	D_0	D_1
32±0.3	28.4±0.3	14.2±0.1	1.75±0.1	4.0±0.1	8.0±0.1	2.0±0.1	4.0±0.1	21±0.1	3.7±0.1	0.3±0.05	1.5±0.1	Min 2.0
Dimensions in millimeter												

Quantity	Leading space	Trailing space
2000 Pcs / reel	50 blank antenna holders	37 blank antenna holders

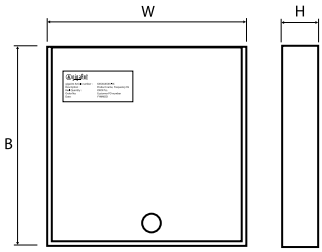
15.3 Reel dimension

Material: Conductive Polystyrene
Width [mm] W: 32
Reel dia [mm] D: 330(13”)
Hub dia [mm] H: 100(4”)
Shaft dia [mm] C: 13



15.4 Box dimension

Material: Cardboard
Width [mm] W: 345
Breadth [mm] B: 345
Thickness [mm] H: 45



15.5 Bag properties

Antistatic Aluminium Moisture Barrier Bag
Thickness [mil] T: 3.2

15.6 Reel label information

gigaAnt

gigaAnt Article number :	XXXXAXXXX-XX
Description :	Product name, Frequenzy Hz
Reel Quantity :	XXXX Pcs.
Order No:	Customer PO number
Date:	YYMMDD

16. CONTACT INFORMATION

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