

1. Features

- Designed for 2.4GHz applications: BT / BLE, Wi-Fi® (802.11/b/g/n), ZigBee®, etc.
- Easy to integrate
- Low profile design
- High efficiency
- Intended for SMD mounting
- Supplied in tape and reel

2. Description

F1-FR4-ANT is intended for use with all 2.4 GHz applications. The antenna uses a ground plane in order to radiate efficiently, but this ground plane must not extend underneath the antenna itself.

3. Applications

- Wearables
- Notebooks
- PC-cards
- Sensors



4. Part Number

F1-FR4-ANT : F1304R



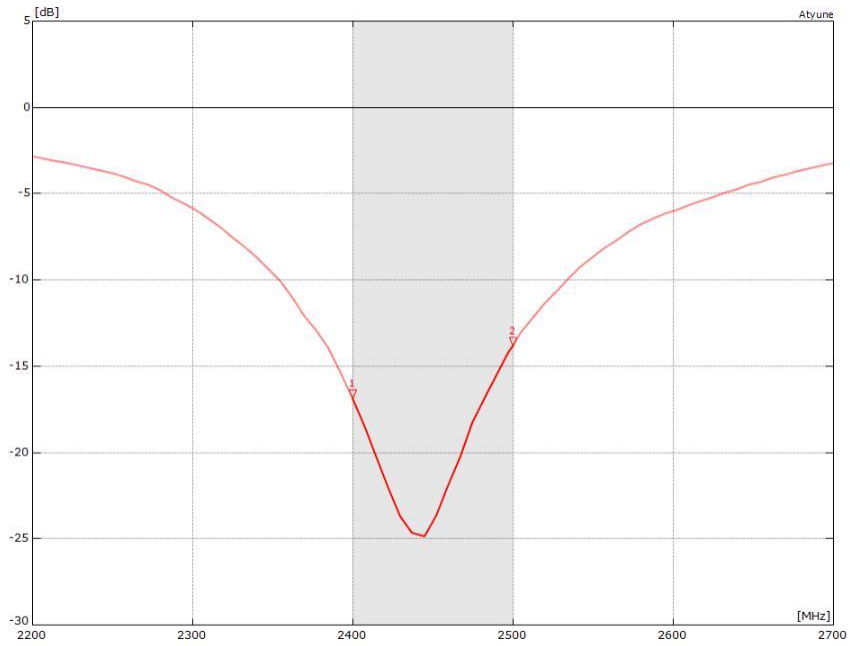
5. General Data

Product name	F1-FR4 ANT
Part Number	F1304R
Frequency	2.4 – 2.5GHz
Polarization	Linear
Operating temperature	-40°C to 140°C
Environmental condition test	ISO 16750-4.5.1.1.1/5.1.2.1/5.3.2
Impedance with matching	50Ω
Weight	0.1g
Antenna type	SMD
Dimensions	12.8 X 3.9 X 1.1 (mm)

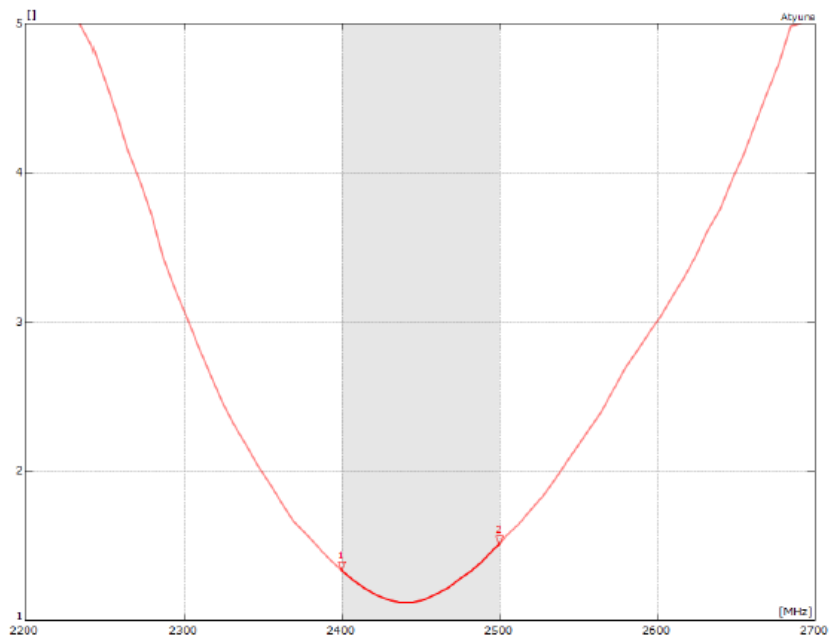
6. RF Characteristics

	2.4-2.5GHz	Conditions
Peak gain	2.1 dBi	All data measured on F1-media's evaluation PCB, part no. F1304R-EVB-1
Average gain (Linear)	-1.2 dBi	
Average efficiency	75%	
Maximum return loss	-11 dB	
Maximum VSWR	1.8:1	

7.1 Return Loss

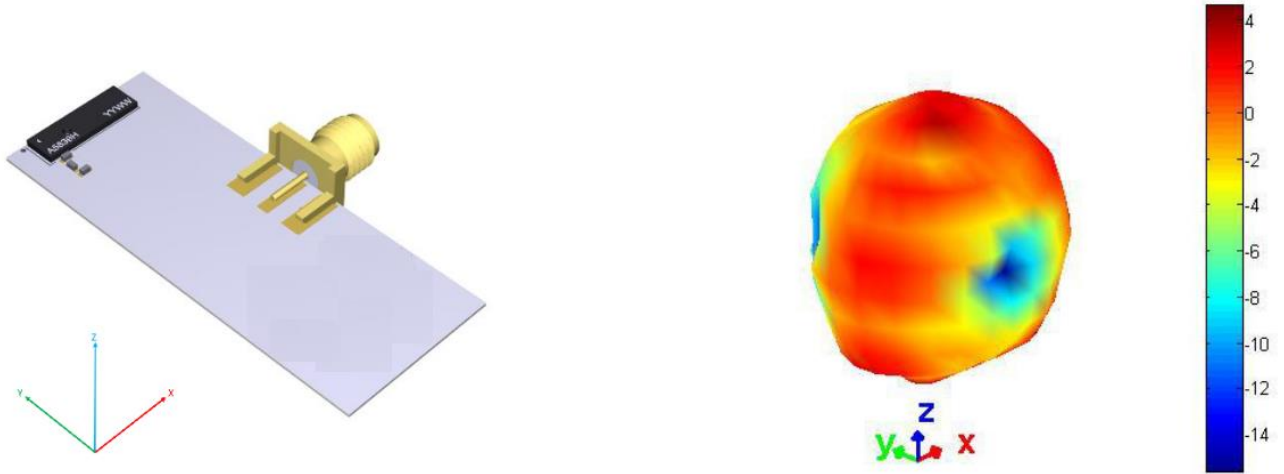


7.2 VSWR



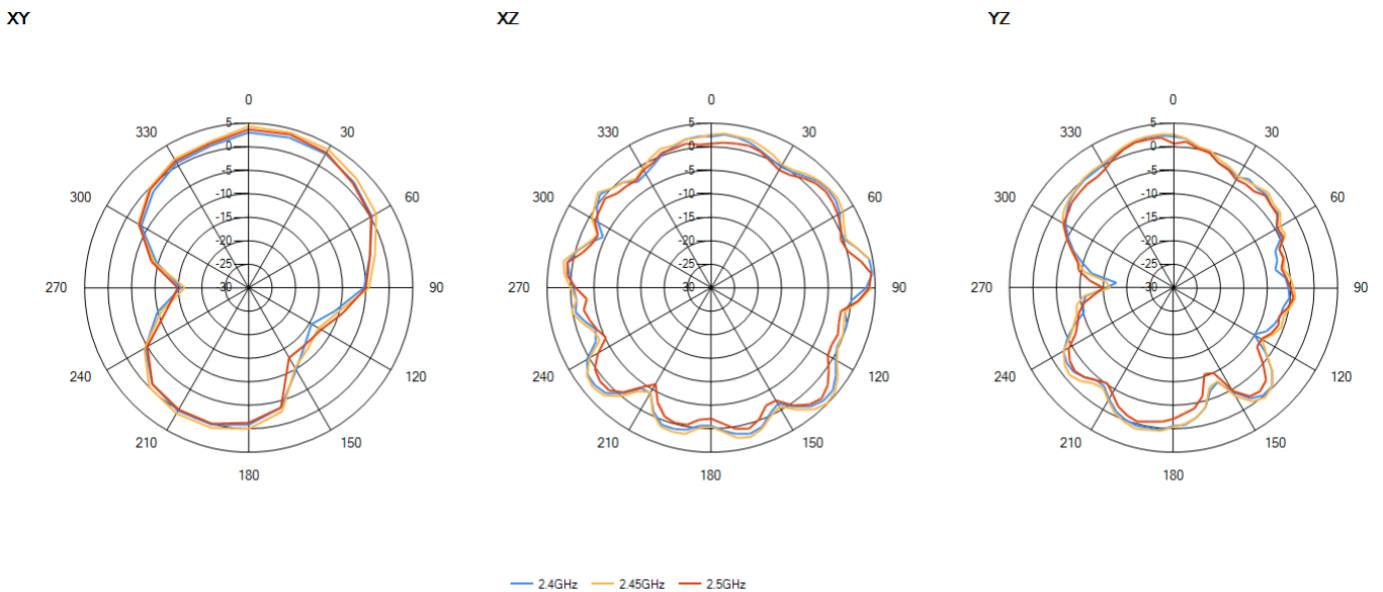
7.3 Antenna pattern

7.3.1 2400 MHz – 2500 MHz



3D pattern at 2450 MHz

Drag to rotate pattern and PCB by using Adobe Reader (Click to Activate)

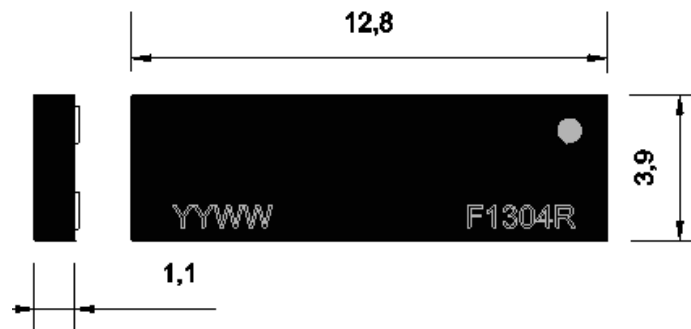


8. Antenna Dimensions

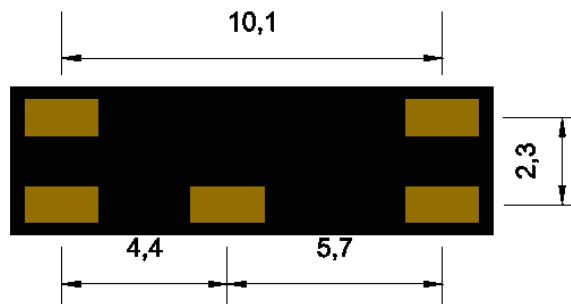
F1-FR4-ANT: F1304R



Top side



Bottom Side



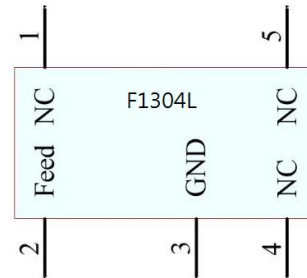
5 solder pads (2.0 x 1.0 mm)

All Dimensions in (mm)

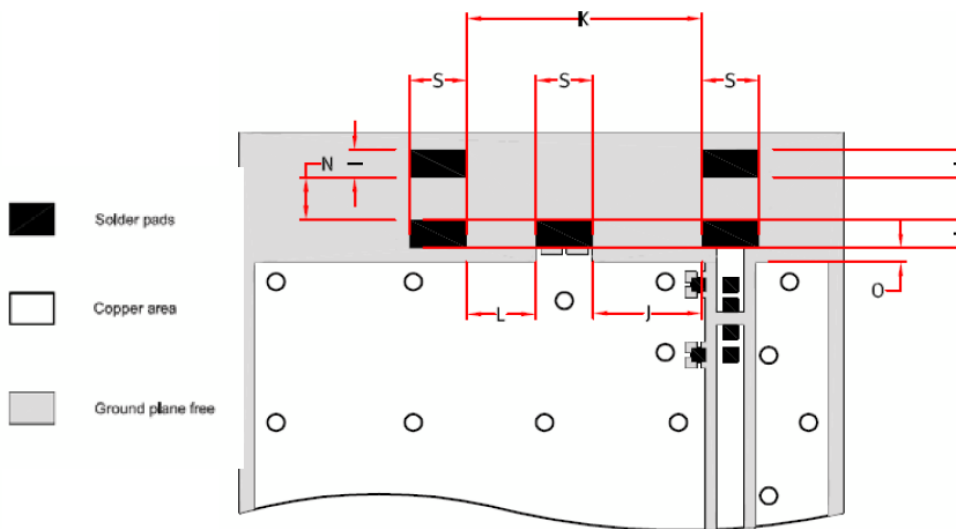
9. Schematic symbol and Pin definition

The circuit symbol for the antenna is shown below. The antenna has 5 pins with only two as functional. All other pins are for mechanical strength.

Pin	Description
2	Feed
3	GND
1,4,5	Not used (Mechanical only)



10. Antenna footprint



I	S	K	J	N	L	O
1.0±0.1	20.±0.1	8.1±0.1	3.7±0.1	1.3±0.1	2.4±0.1	0.5±0.1

11. Electrical Interface

11.1 Transmission Line

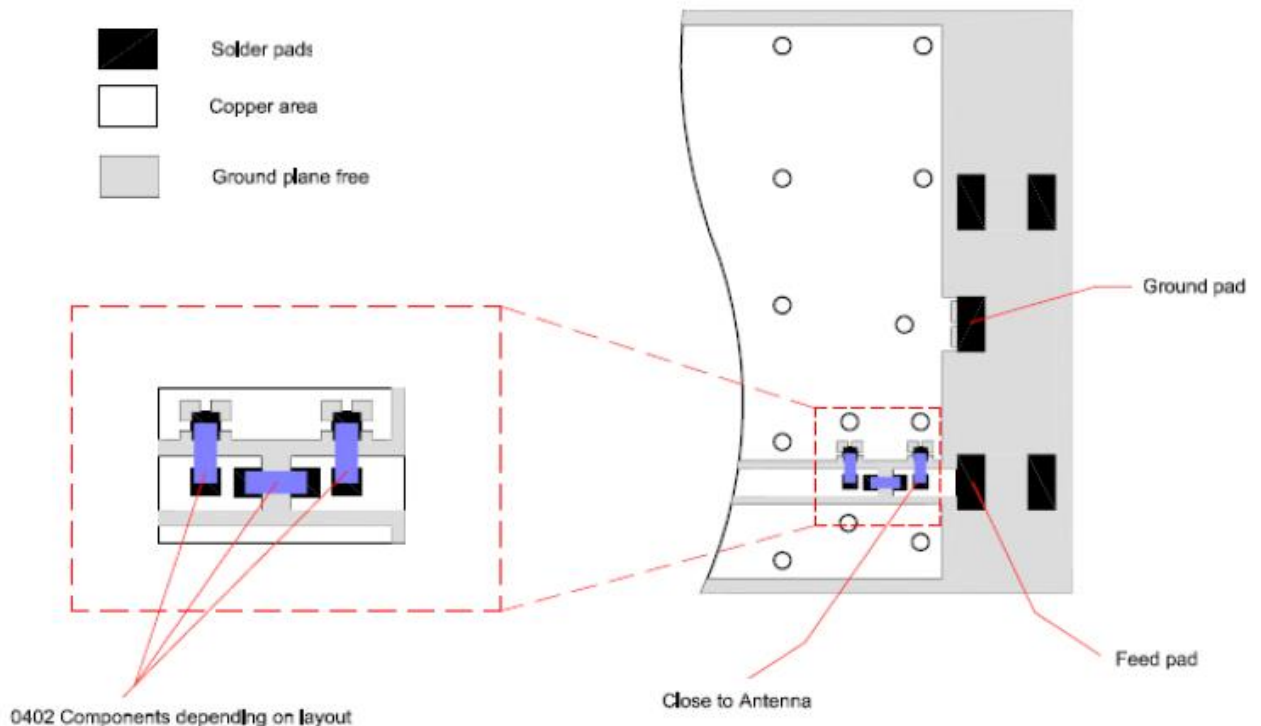
All transmission lines should be designed to have a characteristic impedance of 50Ω.

- The length of the transmission lines should be kept to a minimum
- Any other parts of the RF system like transceivers, power amplifiers, etc, should also be designed to have an impedance of 50 Ω

Once the material for the PCB has been chosen (PCB thickness and dielectric constant), a coplanar transmission line can easily be designed using any of the commercial software packages for transmission line design. For the chosen PCB thickness, copper thickness and substrate dielectric constant, the program will calculate the appropriate transmission line width and gaps on either side of the track, so the characteristic impedance of the co-planar transmission is 50 Ω.

11.2 Matching Circuit

The antenna requires a matching circuit that must be optimized for each customer's product. The matching circuit will require up to three components and the following pad layout should be designed into the device so the correct circuit can be installed:

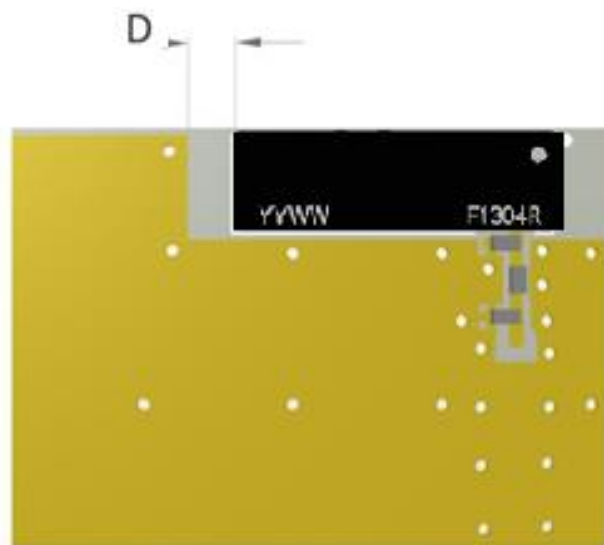


The antenna feed pad and the antenna ground pad are indicated in the drawing above. Additional pads are for mechanical attachment only and should not be grounded.

12. Antenna Integration Guide

12.1 Antenna Placement

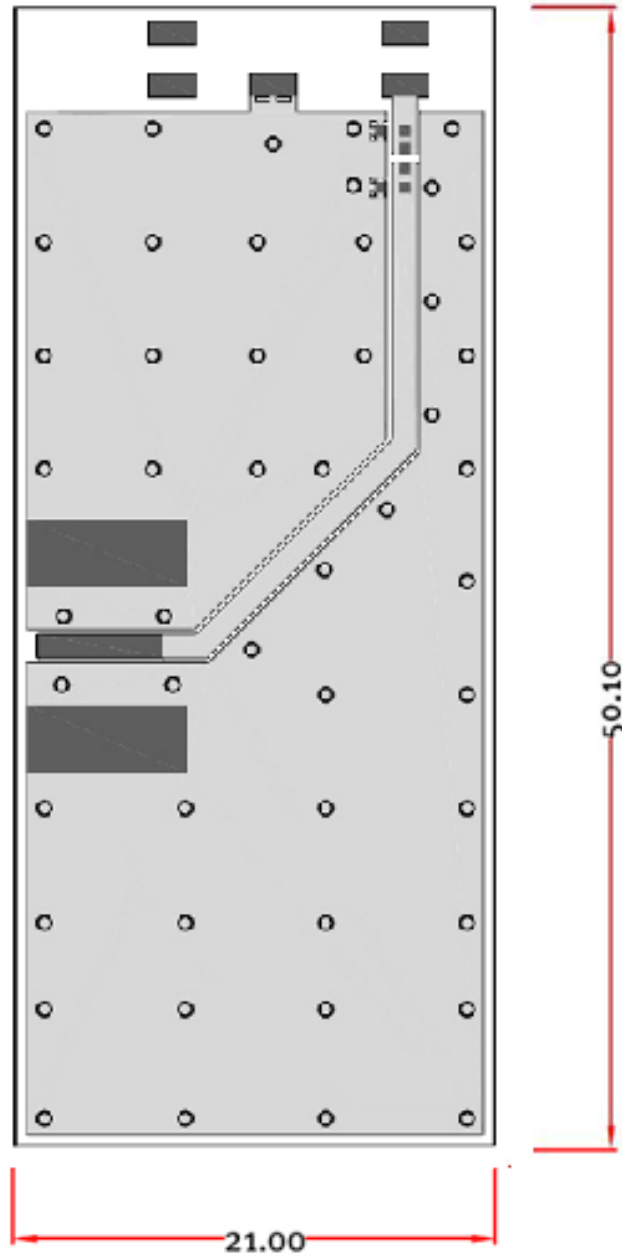
F1media M2M strongly recommends placing the antenna at the edge of the board. Maximum antenna performance is achieved by placing the antenna towards one of the corners of the PCB and with the feed point of the antenna as close to same corner of the PCB as possible.



Additional ground and components near the antenna should be at a distance of at least 2mm. Where possible the antenna should be clear of ground from both sides, although the antenna can work well with a minimum clearance of $D \geq 2$ mm as shown in the drawing above.

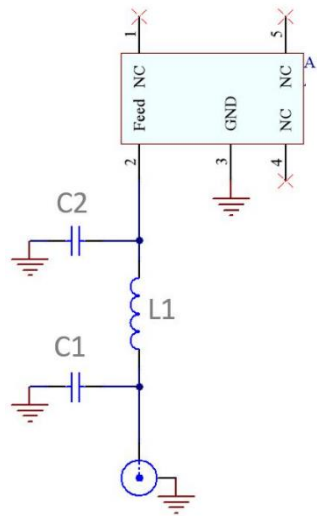
13. Reference Board

The reference board has been designed for evaluation of F1304R and they include a SMA female connector.



Dimensions in mm

14. Reference Board Matching Circuit



Designator	Type	Value	Description
L1	Inductor	15nH	Murata LQG15HN series
C1	Capacitor	2.2pF	Murata GJM15 series
C2	Capacitor	Not fitted	Not fitted

15. Soldering

This antenna is suitable for lead free soldering.

The reflow profile should be adjusted to suit the device, oven, and solder paste, while observing the following conditions:

- The maximum temperature should not exceed 240 °C
- However, for lead free soldering, a maximum temperature of 255 °C for no more than 20 seconds is permitted.
- The antenna should not be exposed to temperatures exceeding 120 °C more than 3 times during the soldering process.

16. Packaging

16.1 Optimal Storage Conditions

Temperature	-10°C to 40°C
Humidity	Less than 75% RH
Shelf life	24 Months
Storage place	Away from corrosive gas and direct sunlight
Packaging	Reels should be stored in unopened sealed manufacturer's plastic packaging.

Note: Storage of open reels of antennas is not recommended due to possible oxidization of pads on antennas. If short term storage is necessary, then it is highly recommended that the bag containing the antenna reel is re-sealed and stored in like storage conditions as in above table.

17. Revision History

Revision	Date	Change Descriptions	Issued by
Rev 1.0	2020-01-08	Initial release	T.G KIM