

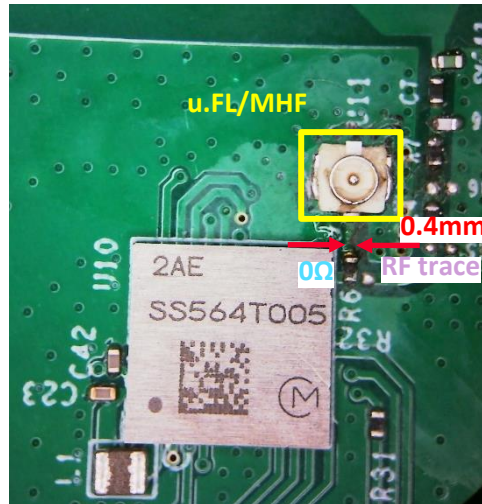
# Type2BC

## RF trace and trace antenna design guidelines for FCC

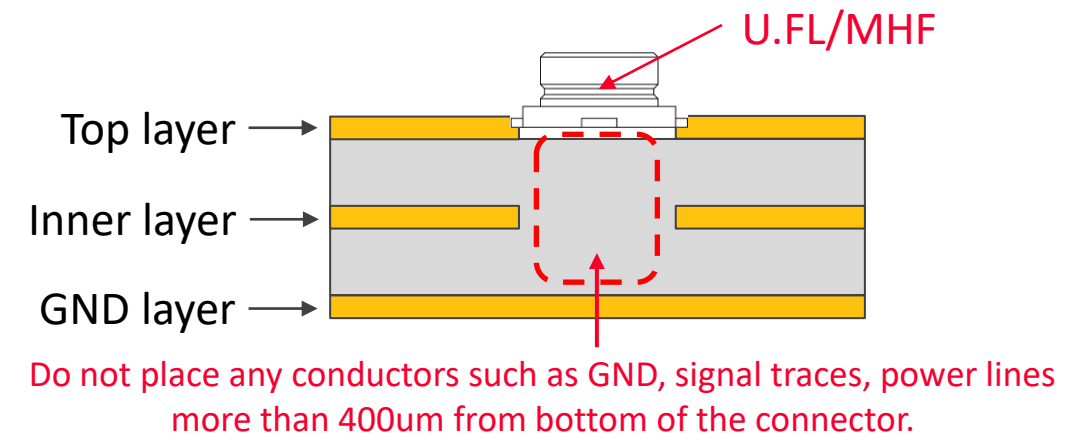
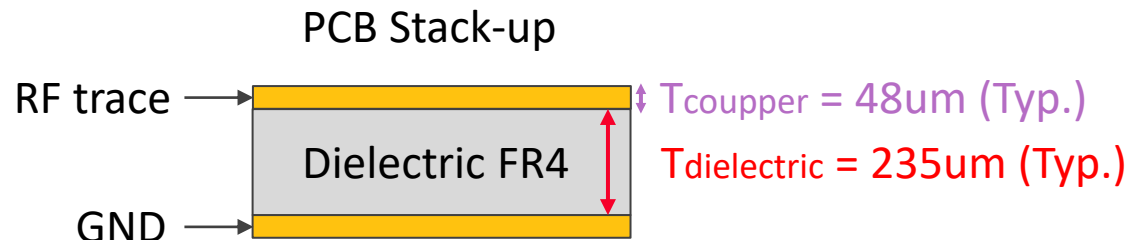
Rev.1.0



## Layout guide of RF trace for the u.FL antenna connector



- Must copy the RF traces of the DXF file on the board completely. Allowance to inaccuracy of trace width is Typ. +/-0.025mm (1mil). Typical width should be read from the DXF file.
- Stack height between the standard GND layer and the RF trace layer must be 235um (Typ.)  
Allowance to inaccuracy of stack height is +/-0.025mm (1mil).
- Passive components must be placed on the same location as the DXF file shows and also same values must be used as the left figure.
- Keep out more than 400um under the U.FL/MHF connectors.  
Ask to connector vendor in detail.

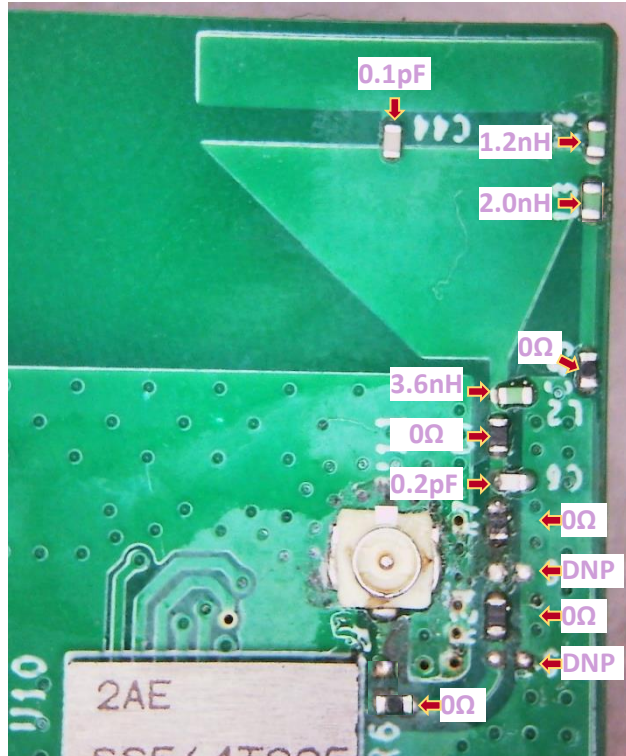


## Layout guide of RF trace for the trace antenna

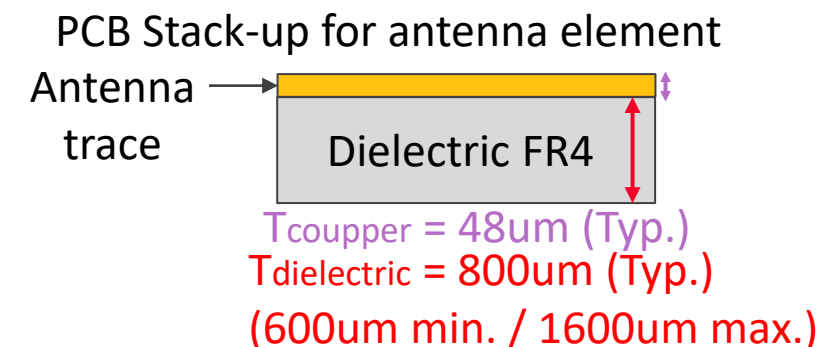
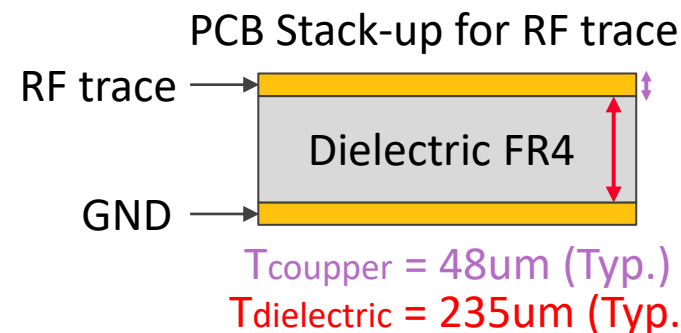
<Measurement condition>

Condition	Memo	Tuning 1	Tuning 2	Tuning 3	Tuning 4	Matching circuit							
						Shunt 1	Series 1	Shunt 2	Series 2	Shunt 3	Series 3	Shunt 4	
Condition 1	Optimized matching	1.2nH	0.1pF	2.0nH	0ohm	3.6nH	0ohm	0.2pF	0ohm	None	0ohm	None	

Size:1005 GRM15 / LQG15HS / Register      Size:1005 GJM15



- Must copy the antenna design of the DXF file on the board completely
- Must copy the RF traces of the DXF file on the board completely.  
Allowance to inaccuracy of trace width is Typ. +/-0.025mm (1mil).  
Typical width should be read from the DXF file.
- Recommended total thickness of PCB (Dielectric) is 0.8mm.  
(Must be  $0.6\text{mm} \leq \text{PCB Thickness} \leq 1.6\text{mm}$ )
- Stack height between the standard GND layer and the RF trace layer must be 235um (Typ.)  
Allowance to inaccuracy of stack height is +/-0.025mm (1mil).
- Passive components must be placed on the same location as the DXF file shows and also same values must be used as the left figure.

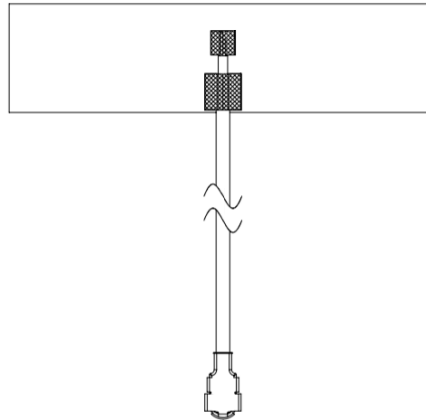


## Planning certified external antenna

- Type2BC module is going to be certified with below antennas.

Maker	P/N	Form factor	Type	2.4Ghz Gain (dBi)	5Ghz Gain (dBi)
Molex	146187	u.FL/flexible	dipole	3.4	4.75

- The user can use any other antennas that is attached to the U.FL/MHF connectors with following conditions.
  - Form factor : PCB/Film type antenna (Similar “T-Shape” appearance is acceptable)

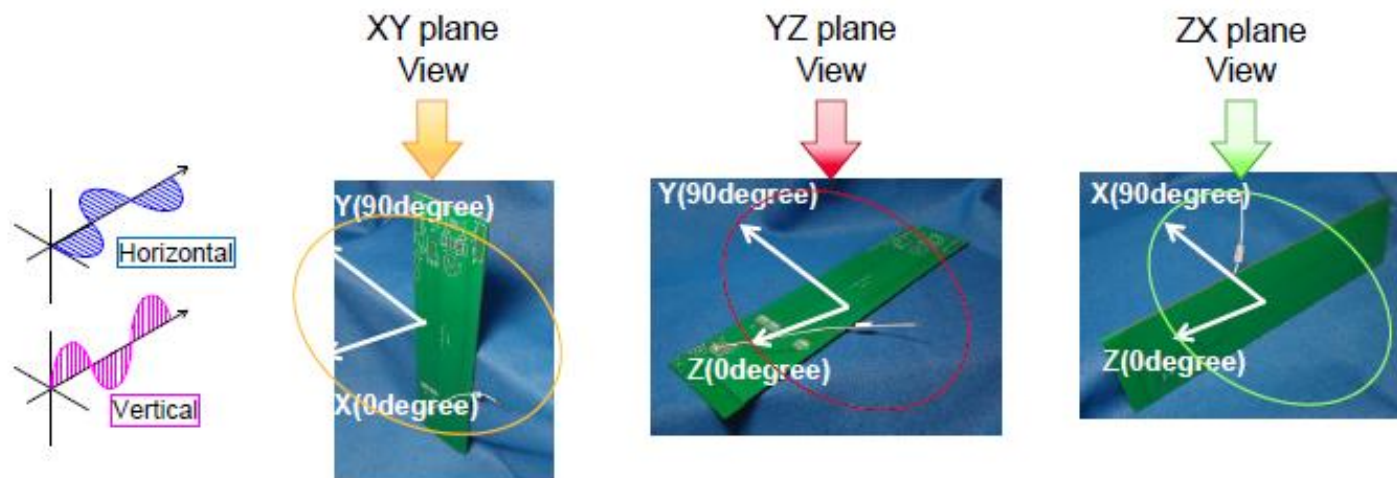
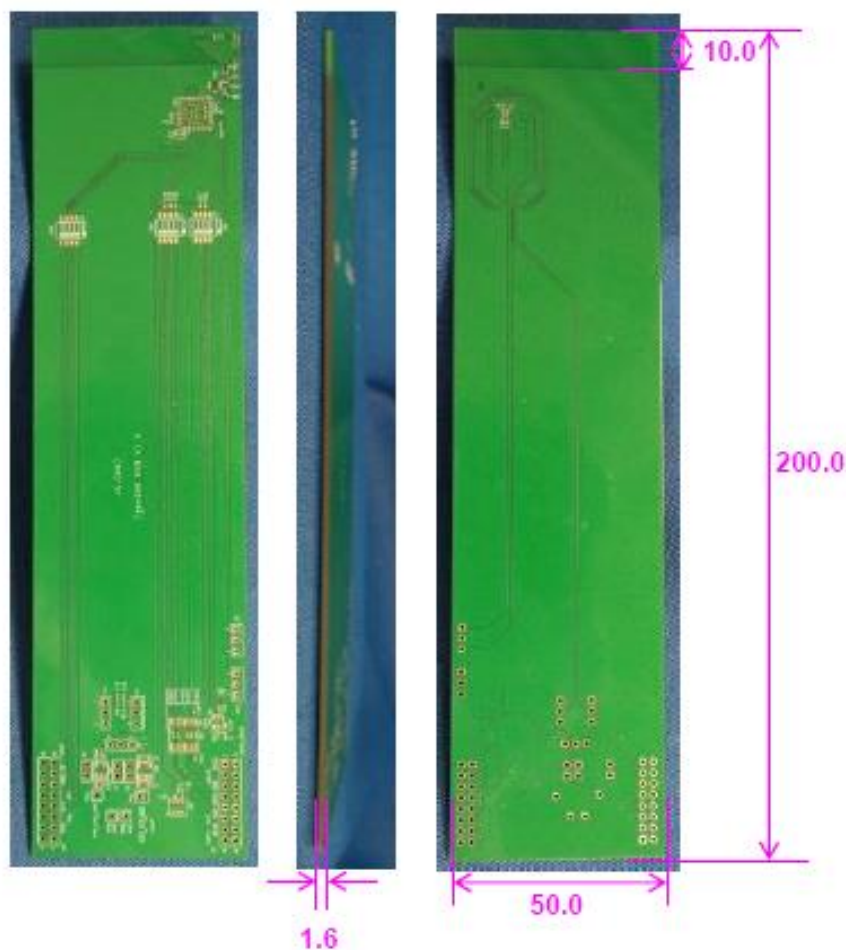


- Antenna type : Dipole antenna
- Antenna gain :
  - 2.4GHz 0dBi  $\leq$  2.4GHz Gain  $\leq$  3.4dBi (Planning)
  - 5GHz 0dBi  $\leq$  5GHz Gain  $\leq$  4.75dBi (Planning)

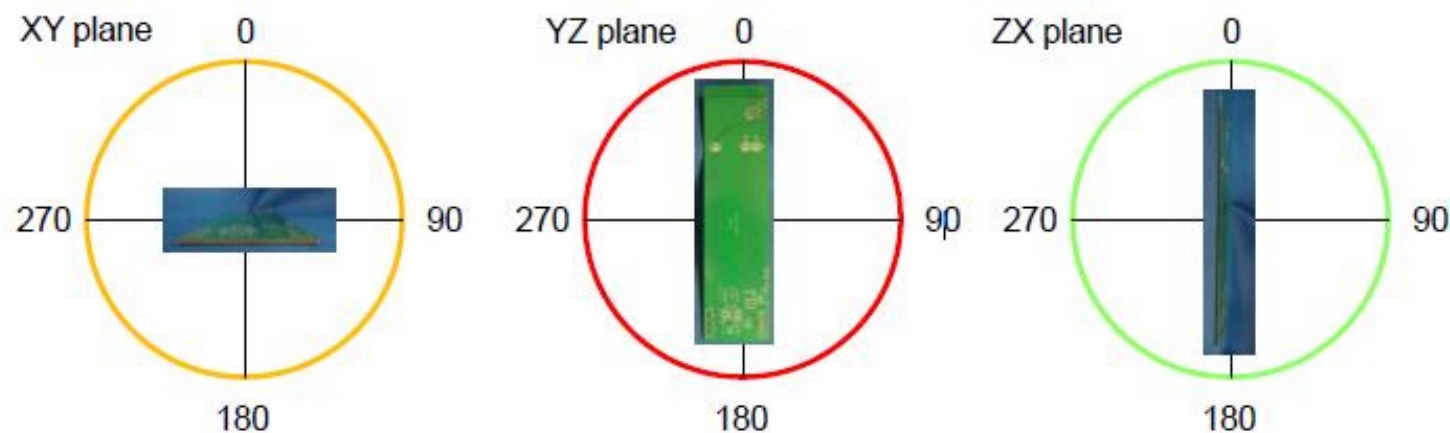


## Certified trace antenna - measurement conditions

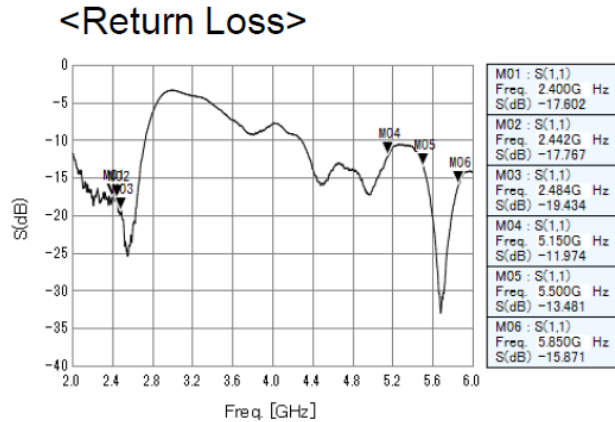
### Board appearance



### 2D Directional indication



## Certified trace antenna - performance



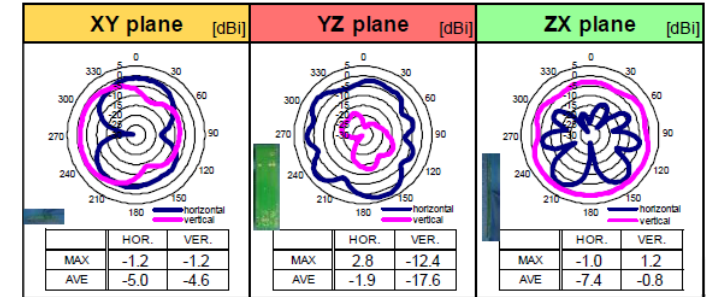
### <Efficiency>

\*Red color shows peak gain  
[dBi] [dB]

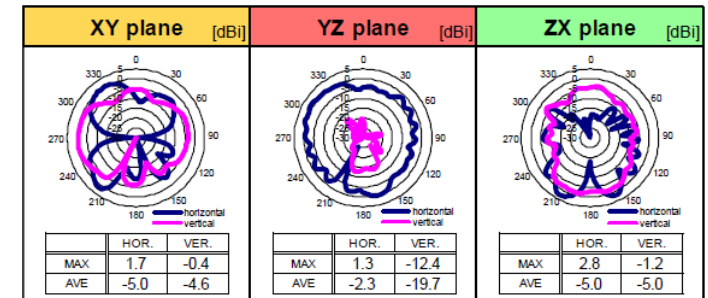
LINEAR POLAMIZATION		XY-plane		YZ-plane		ZX-plane		Total Efficiency
		hor.	ver.	hor.	ver.	hor.	ver.	
2400 MHz	MAX.	-1.1	-1.0	3.0	-13.4	-1.1	0.9	-0.9
	AVE.	-4.8	-4.5	-2.0	-18.7	-7.5	-1.0	
2442 MHz	MAX.	-1.2	-1.2	2.8	-12.4	-1.0	1.2	-0.9
	AVE.	-5.0	-4.6	-1.9	-17.6	-7.4	-0.8	
2484 MHz	MAX.	-1.5	-0.5	3.0	-11.8	-0.5	1.7	-0.8
	AVE.	-5.2	-4.1	-1.7	-16.8	-7.3	-0.6	

LINEAR POLAMIZATION		XY-plane		YZ-plane		ZX-plane		Total Efficiency
		hor.	ver.	hor.	ver.	hor.	ver.	
5150 MHz	MAX.	1.8	-0.8	1.9	-12.2	2.7	-0.7	-1.4
	AVE.	-4.4	-4.7	-2.1	-19.6	-4.6	-4.4	
5500 MHz	MAX.	1.7	-0.4	1.3	-12.4	2.8	-1.2	-1.6
	AVE.	-5.0	-4.6	-2.3	-19.7	-5.0	-5.0	
5850 MHz	MAX.	2.1	-1.4	0.9	-12.7	3.3	-3.0	-1.6
	AVE.	-4.7	-5.6	-2.5	-19.8	-4.4	-6.0	

### <Directivity>



@2442MHz



@5500MHz

### <Measurement result>

#### Total efficiency

Condition	Frequency [MHz]						Average 2GHz band [dB]		Average 5GHz band [%]	
	2400	2442	2484	5150	5500	5850	2GHz band	5GHz band	2GHz band	5GHz band
Condition 1	-0.9	-0.9	-0.8	-1.4	-1.6	-1.6	-0.9	-1.5	82.1	70.3

#### Peak gain

Condition	Frequency [MHz]						Max. [dBi]	
	2400	2442	2484	5150	5500	5850	2GHz band	5GHz band
Condition 1	3.0	2.8	3.0	2.7	2.8	3.3	3.0	3.3