

WLAN+Bluetooth Module User Manual
Part Number: LBEE5PK2AE

LBEE5PK2AE has been FCC certified as Single Modular Approval with the following IDs.

FCC ID: ZLPEDGE3A1

The module is limited to OEM installation ONLY. The OEM integrator is responsible for ensuring that the end-user has no manual instruction to remove or install module.

Therefore, the final host product must be submitted to EtherWAN Systems for confirmation that the installation for the module into the host is in compliance with regulations of FCC. Specially, if an antenna other than the model documented in the Filing is used, a Class 2 Permissive Change must be filed with the FCC.

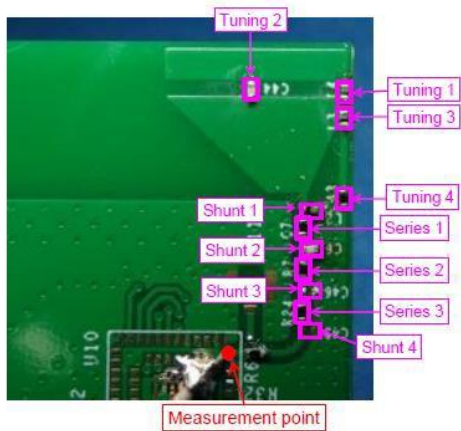
Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

This module has been approved by FCC to operate with the antenna types with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device. The following antennas have been certified in combination with the module. Refer to next pages for the antenna application guidance.

- (a) Monopole PCB antenna with peak gains of 3.0dBi (2.4GHz) and 3.3dBi (5GHz);
- (b) External dipole antenna with peak gains of 3.4dBi (2.4GHz) and 4.75dBi (5GHz);

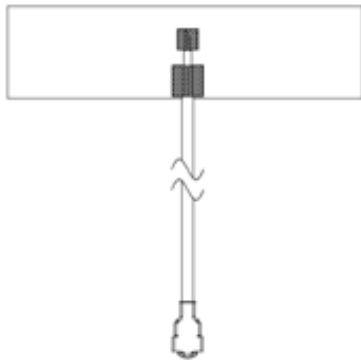
The operational temperature is -40°C~85°C.

Antenna Application Guidance – Monopole PCB antenna



Tuning 1	Tuning 2	Tuning 3	Tuning 4	Matching circuit						
				Shunt 1	Series 1	Shunt 2	Series 2	Shunt 3	Series 3	Shunt 4
1.2nH	0.1pF	2.0nH	0ohm	3.6nH	0ohm	0.2pF	0ohm	None	0ohm	None
Size:1005 GRM15 / LQG15HS / Register							Size:1005 GJM15			

Antenna Application Guidance – External dipole antenna



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

FCC Statements

Please take attention that changes or modification not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) This device must accept any interference received, including interference that may cause undesired operation.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

Please notice that if the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: "Contains FCC ID: ZLPEDGE3A1" any similar wording that expresses the same meaning may be used.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the radiator & your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

FCC Statements (cont.)

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help

The device must be professionally installed. The intended use is generally not for the general public. It is generally for industry/commercial use. The connector is within the transmitter enclosure and can only be accessed by disassembly of the transmitter that is not normally required. The user has no access to the connector. Installation must be controlled. Installation requires special training. This module has been assessed against the following FCC rule parts: CFR 47 FCC Part 15 C (15.247, DTS and DSS) and CFR 47 FCC Part 15 E (15.407, NII). It is applicable to the modular transmitter.

This radio transmitter FCC ID: ZLPEDGE3A1 has been approved by Federal Communications Commission to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device. The concrete contents to check are the following three points.

- 1) Must use antenna such as dipole antenna (with gain not exceeding 3.4dBi at 2.4GHz & 4.75dBi at 5GHz);
- 2) Should be installed so that the end user cannot modify the antenna;
- 3) Feed line should be designed in 50ohm

Fine tuning of return loss etc. can be performed using a matching network.

BT/BLE/2.4G WIFI:

Ant.	Frequency (MHz)	Antenna Type	Antenna Gain (dBi)
1	2402-2480	PCB Antenna	3.0
		External Dipole Antenna	3.4

5G WIFI:

Antenna	Frequency Band	Antenna Type	Maximum Antenna Gain
			(dBi)
1	UNII-1	PCB Antenna	3.3
		External Dipole Antenna	4.75
1	UNII-2A	PCB Antenna	3.3
		External Dipole Antenna	4.75
1	UNII-2C	PCB Antenna	3.3
		External Dipole Antenna	4.75
1	UNII-3	PCB Antenna	3.3
		External Dipole Antenna	4.75

The PCB Antenna is permanently attached, can't be replaced.

There is only one antenna port, which is shared by all the radios by time divided.

The module doesn't have a permanent antenna. The following antennas are certified to be FCC regulatory conformity.

- (a) Monopole PCB antenna with peak gains of 3.0dBi (2.4GHz) and 3.3dBi (5GHz);
- (b) External dipole antenna with peak gains of 3.4dBi (2.4GHz) and 4.75dBi (5GHz);

Notice to OEM integrator

Must use the device only in host devices that meet the FCC RF exposure category of mobile, which means the device is installed and used at distances of at least 20cm from persons. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

The end user manual shall include FCC Part 15 compliance statements related to the transmitter as show in this manual(FCC statement). Host manufacturer is responsible for compliance of the host system with module installed with all other applicable requirements for the system such as Part 15 B. Host manufacturer is strongly recommended to confirm compliance with FCC requirements for the transmitter when the module is installed in the host.

Must have on the host device a label showing Contains FCC ID: ZLPEDGE3A

The use condition limitations extend to professional users, then instructions must state that this information also extends to the host manufacturer's instruction manual.

This module is stand-alone modular. If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, host manufacturer have to consult with module manufacturer for the installation method in end system. Any company of the host device which install this modular should perform the test of radiated & conducted emission and spurious emission etc. according to FCC Part 15C: 15.247 and 15.209 & 15.207, 15B class B requirement, only if the test result comply with FCC part 15C: 15.247 and 15.209 & 15.207, 15B class B requirement. Then the host can be sold legally.

This modular transmitter is only FCC authorized for the specific rule parts (47CFR Part 15.247 and 15.407) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. Host manufacturer is strongly recommended to confirm compliance with FCC requirements for the transmitter when the module is installed in the host. Must have on the host device a label showing Contains FCC ID: ZLPEDGE3A1.

This module is stand-alone modular. If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, host manufacturer have to consult with module manufacturer for the installation method in end system. Any company of the host device which install this module should perform the test of radiated & conducted emission and spurious emission etc. according to FCC Part 15C: 15.247 and 15.209 & 15.207, 15.407, 15B class B requirement, only if the test result comply with FCC part 15C: 15.247 and 15.209 & 15.207, 15.407, 15B class B requirement. Then the host can be sold legally.

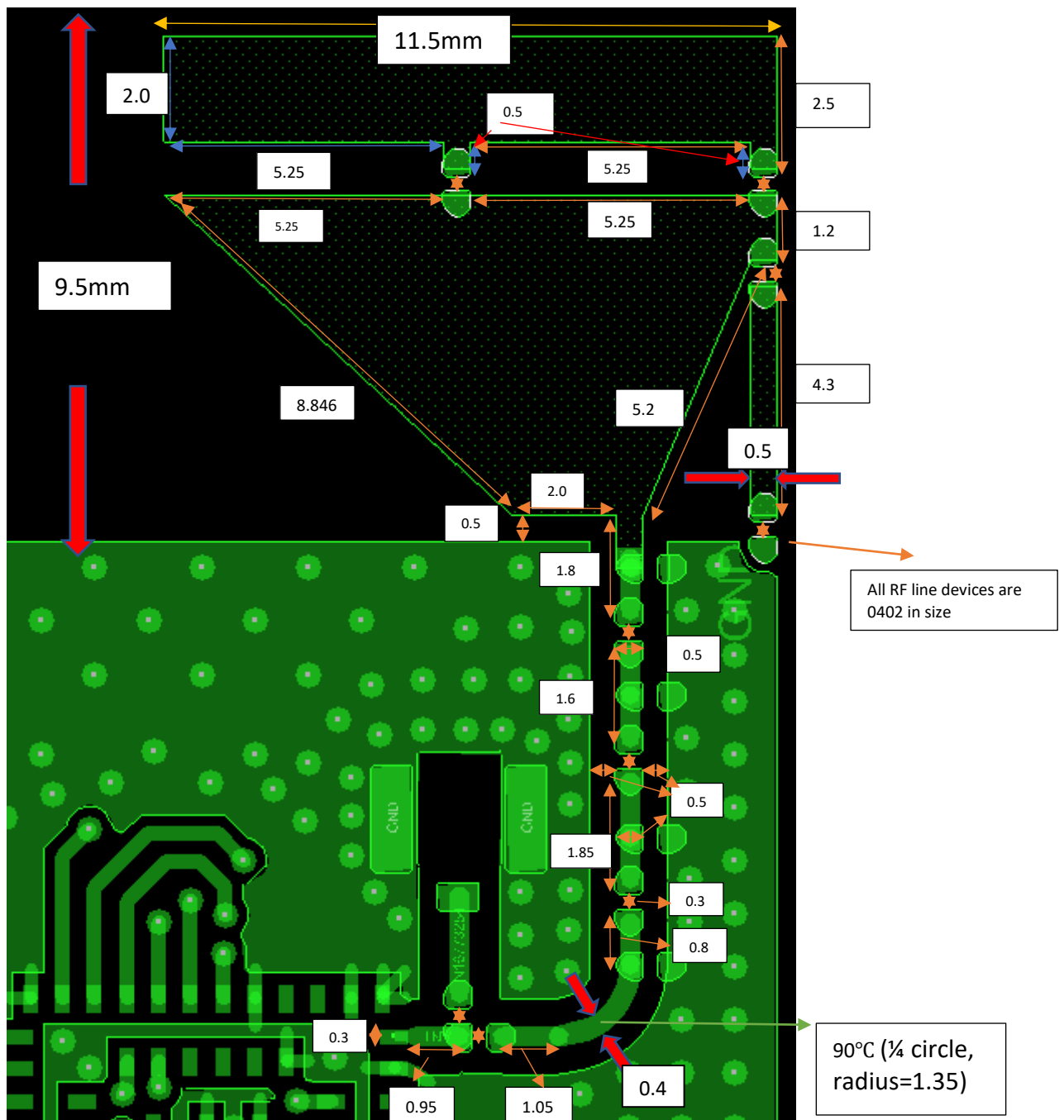
This modular transmitter is only FCC authorized for the specific rule parts (47CFR Part 15.247 and 15.407) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. Host manufacturer is strongly recommended to confirm compliance with FCC requirements for the transmitter when the module is installed in the host.

User manual Supplementary information

- a) Trace layout and dimensions including specific designs for each type:
 - 1. Layout of trace design, parts, antenna, connectors, and isolation requirements:

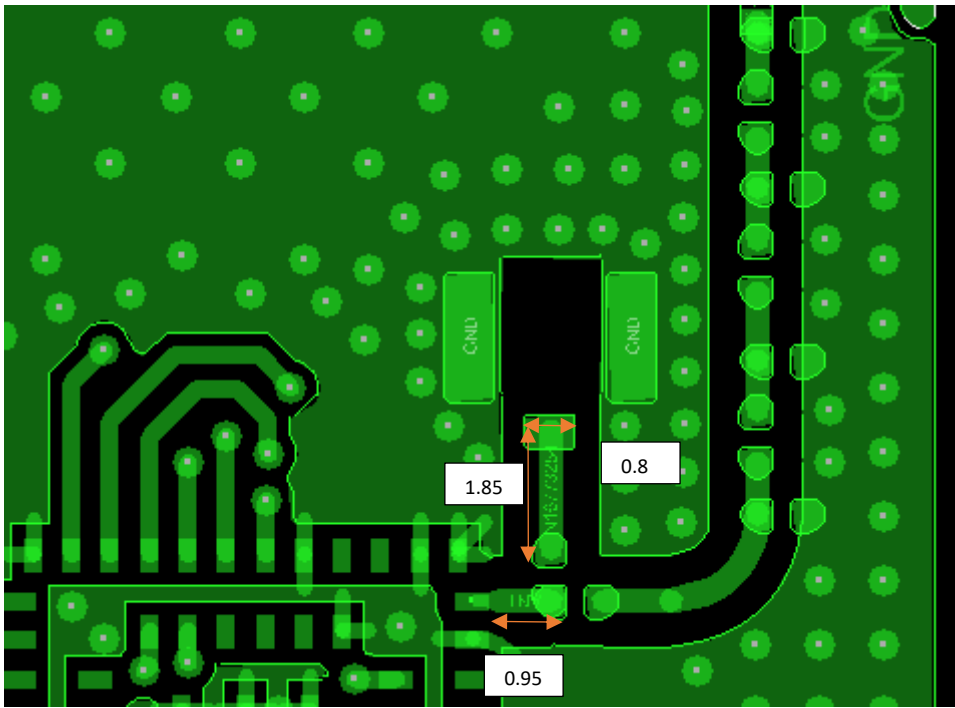
Please refer to 2AE Certification board Gerber file

- PCB Antenna trace antenna Dimension:

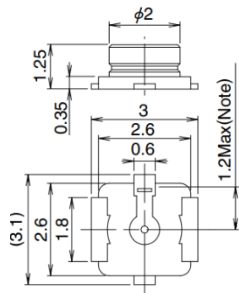


Note: all ★ distance is 0.3mm.

Dipole antenna dimension:



u.FL connector information:
Manufacturer: HIROSE ELECTRIC;
Size:

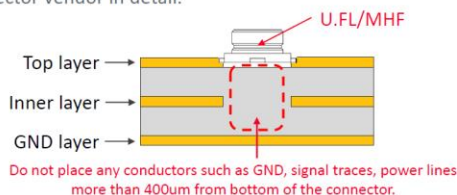


U.FL-R-SMT-1

Part number: U.FL-R-SMT-1

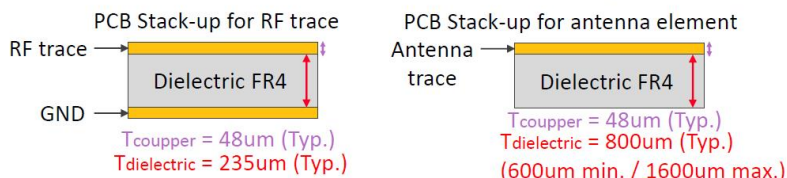
商品名称	U.FL-R-SMT-1(10)
类别	同轴连接器 (RF)
连接器类型	插座, 公形引脚
阻抗	50Ω
安装类型	表面贴装
频率 - 最大值	6000MHz
端口数	1

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



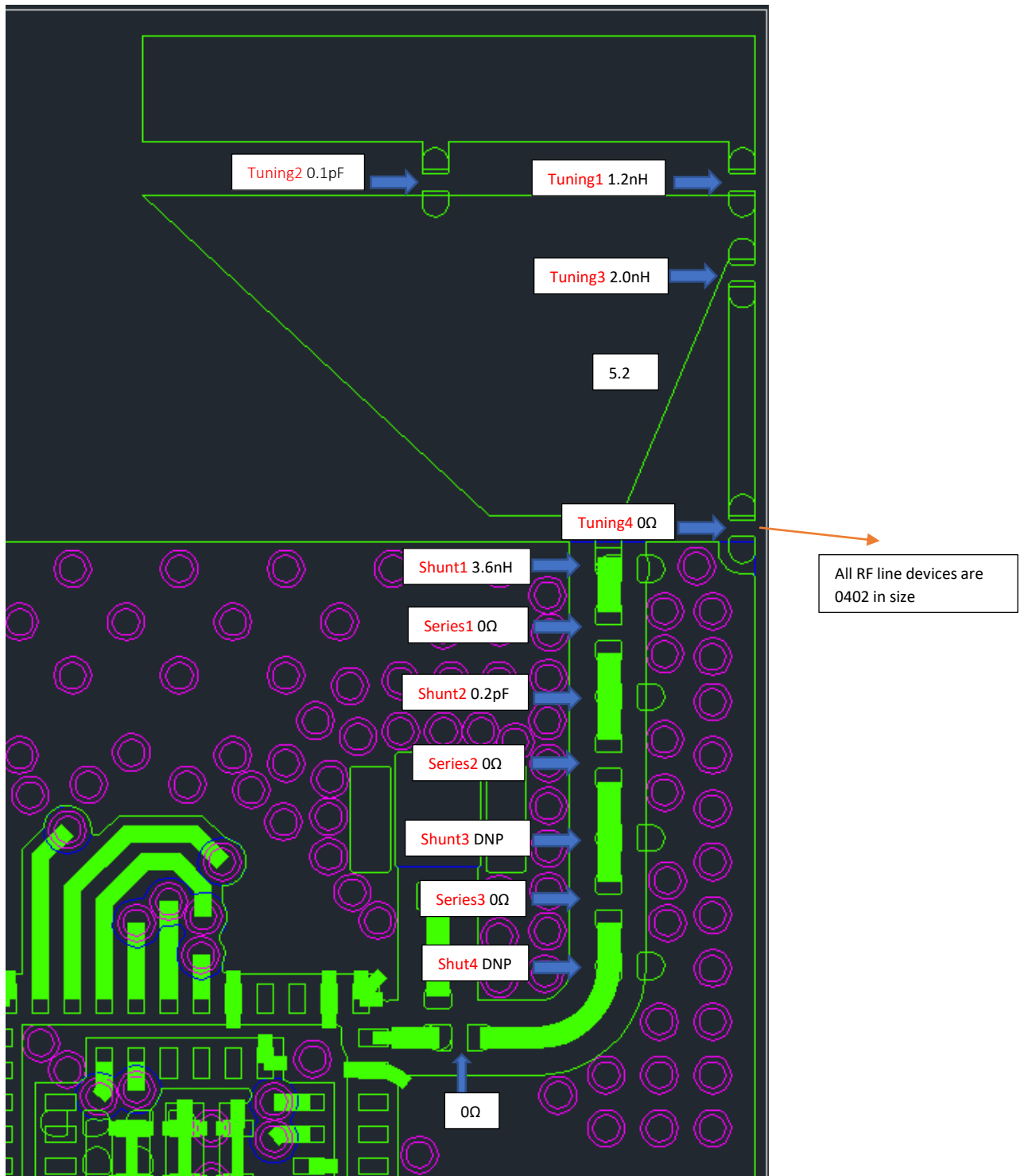
Layout guide of RF trace for the trace antenna

- 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.



PCB requirement: The dielectric constant of PCB is 4.6, and the impedance boundary is limited to 0.5mm. The thickness of RF trace copper is 48um, and the total thickness of base plate is 1.6mm.

Matching

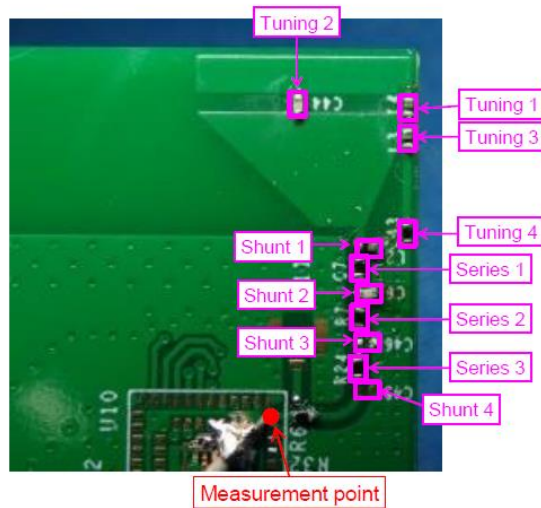


RF matching

<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



3. Different antenna length and shapes effect radiated emission and each design should be considered a different type:

2.4G WIFI:

Ant.	Frequency (MHz)	Antenna Type	Antenna Gain (dBi)
1	2402-2480	PCB Antenna	3.0
		External Dipole Antenna	3.4

5G WIFI:

Antenna	Frequency Band	Antenna Type	Maximum Antenna Gain
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1	UNII-1	PCB Antenna	3.3
		External Dipole Antenna	4.75
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		External Dipole Antenna	4.75
1	UNII-2C	PCB Antenna	3.3
		External Dipole Antenna	4.75
1	UNII-3	PCB Antenna	3.3
		External Dipole Antenna	4.75

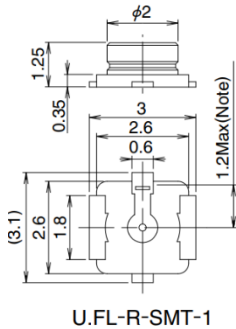
b) Appropriate parts and specifications:
 Information about devices on RF lines:

Parts list	Part number	Size
Tuning 1/ 1.2nH	LQG15HS series	0402
Tuning 2/ 0.1pF	GJM15 series	0402
Tuning 3/ 2.0nH	LQG15HS series	0402
Tuning 4/ 0ohm	-	0402
Shunt 1/ 3.6nH	LQG15HS series	0402
Series 1/ 0ohm	-	0402
Shunt 2/ 0.2pF	GJM15 series	0402
Series 2/ 0ohm	-	0402
Shunt 3/ DNP	-	-
Series 3/ 0ohm	-	0402
Shunt 4/ DNP	-	-

<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			

If customers completely refer to our antenna design for their own design, the antenna performance should also be the same as ours.

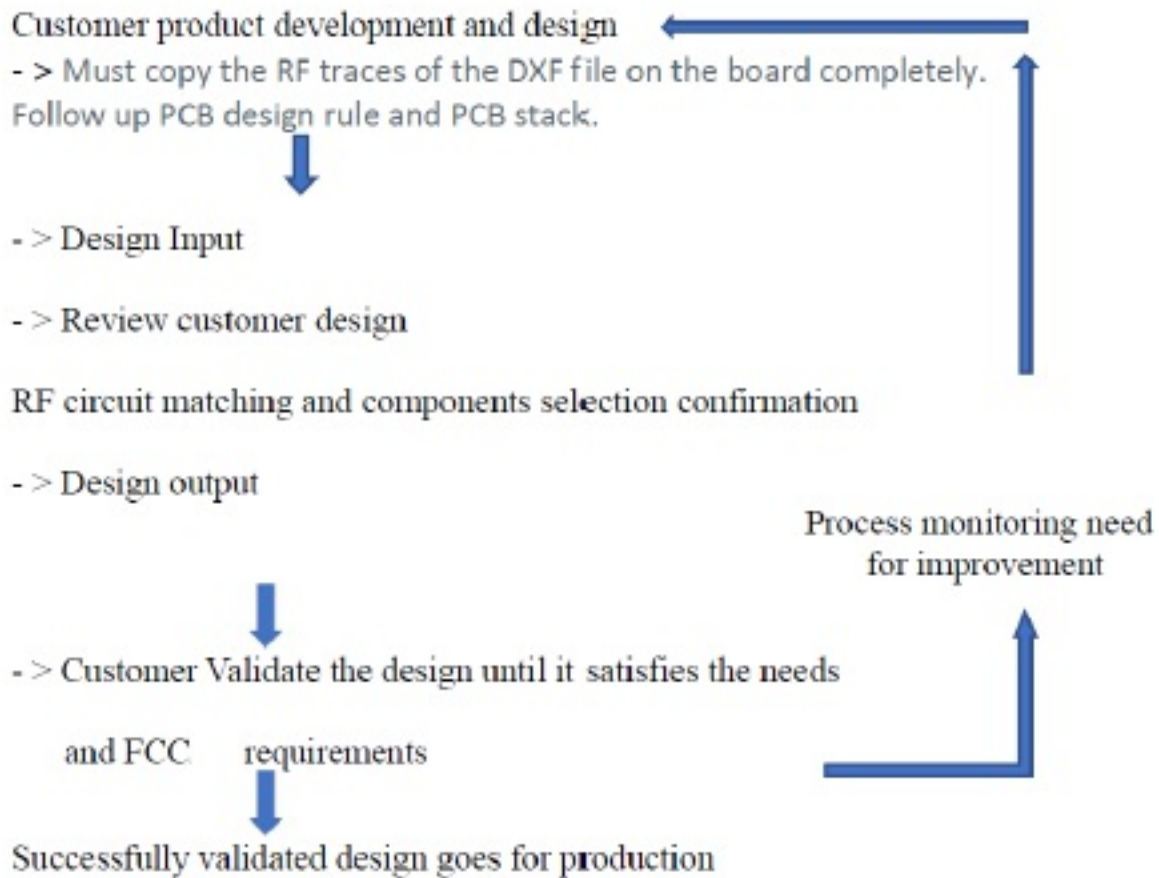
u.FL connector information:
 Manufacturer: HIROSE ELECTRIC;
 Size:



Part number: U.FL-R-SMT-1

商品名称	U.FL-R-SMT-1(10)
类别	同轴连接器 (RF)
连接器类型	插座, 公形引脚
阻抗	50Ω
安装类型	表面贴装
频率 - 最大值	6000MHz
端口数	1

C) Test procedures and design verifications:



d) Production test procedures for ensuring compliance

