INVENTEK SYSTEMS

ISM43439-WBP-151

Layout Guidelines

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1 Abstract

This document provides the design guidelines of a 4-layer PCB board, for easy to lay-out LGA packaged devices. The board's performance will be optimal if the designer follows these suggestions during the board's design.

Inventek has obtained FCC, IC, and CE modular transmitter certifications for the ISM43439-WBP-151 SiP (System in Package). These certifications can be used to the advantage of any manufacturer developing a product using these devices. In order to take full advantage of the certifications, developers must follow the antenna design/layout guidelines exactly as shown in the datasheet. For FCC compliance, products will still need to go through verification testing or have a declaration of conformance according to 47 CFR Chapter 1, part 15, subpart B.

The testing required for both verification and declaration of conformance is specified in sections 15.107 and 15.109. The official documents can be obtained from the U.S Government Printing Office online. U.S. Government Printing Office CFR 47. There are some changes allowed to the reference design which do not require any testing beyond the verification or declaration of conformance.

If it is desired to add a connector or u.fl connector in the RF path or change the antenna to one of the same type (chip) with equal or less gain, they can do so without refiling. Other changes such as a different antenna or adding an antenna diversity switch will require filing for a class 2 permissive change. This costs about half as much as the full certification. Any class 2 permissive changes but be performed under Inventek's grant, and therefore must be done in cooperation with Inventek. In addition to this document, Inventek recommends verifying the schematic board design with Inventek Engineering once the schematic is complete for further review and validation.

2 PCB Design Rules

Parameter	Value	Comments
Number of layers	4	
Thickness	31 mil ± 10%	For greater thickness increase the distance between L2 and L3
Size of PCB	14.73mm x 34.22mm	
Solder mask	Green	Can be replaced with any color
Dielectric	FR4	Dielectric Constant (Er = 4.5)
Silk	White	Can be replaced with any color
Surface finish	ENIG	
Copper thickness	1 oz	
Lead free / ROHS	Yes	
Impedance control	Yes	50 Ω controlled impedance trace of 11 mils width on L1 w.r.t L2 (GND), 8 mils GND strip separation. Inventek Gerbers available to copy

Table 1: PCB Specification

Layer	Information	Thickness (mil)
Top (L1)	Electrical Layer	1.4
A	==========	6
L2	Electrical Layer	1.4
B	==========	14
L3	Electrical Layer	1.4
C	==========	6
Bottom (L4)	Electrical Layer	1.4

Table 2: PCB Stack up.

3 Layout

The complete layout package is available upon request. Inventek recommends that the customers copy the exact layout of the engine area to ensure optimum performance as measured on the Inventek reference boards.

3.1 WIFI and BLUETOOTH ANTENNA:

The same RF path is used for both Bluetooth and Wi-Fi, thus only one antenna is required. Inventek offers two different antenna options.:

1. Dual Band (2.4 GHz and 5 GHz) Chip Antenna.
2. External Antenna path with U.Fl connector (W2.4-5P-U).

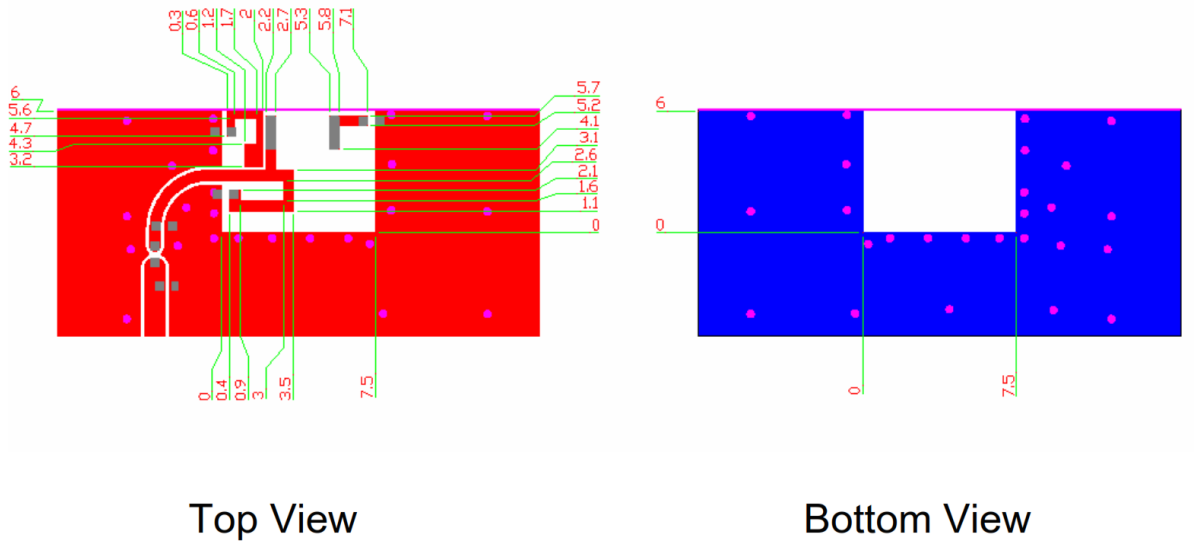

Figure 3. Top and Bottom View of the Solder Land Pattern (Gray Areas) for the Chip Antenna Layout

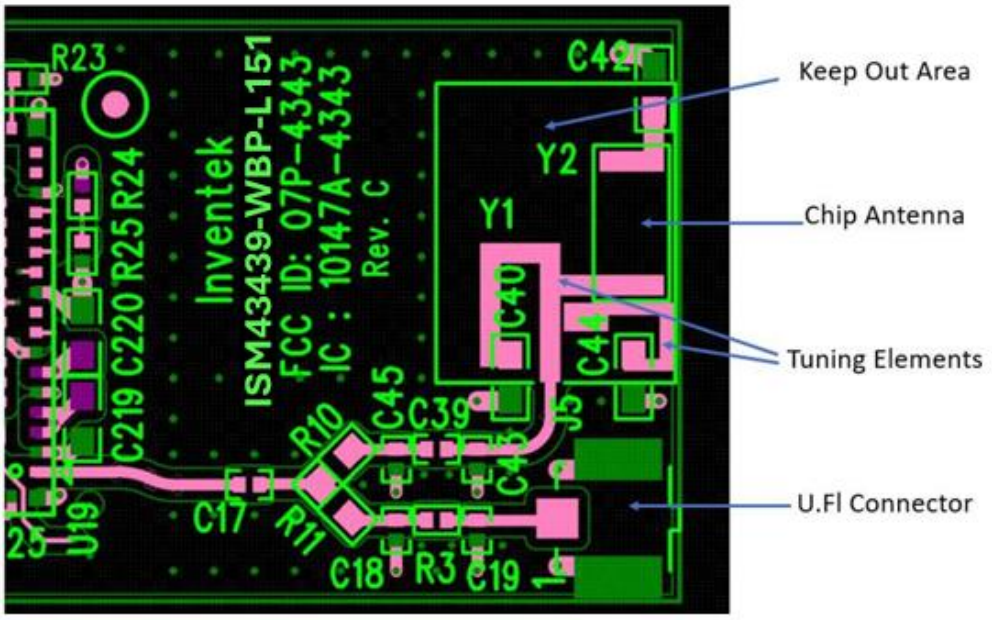

Figure 4. RF Path Description.

	Description	MFG	Part Number
C17	Fixed 0R 0201 5% 1/20W	Yageo	RC0201JR-070RL
C40	CAP CER 3.6PF 50V NP0 0402	Murata	GRM1555C1H3R6BA01D
C45	CAP CER 0.3PF 25V NP0 0201	Johanson	250R05L0R3AV4T
C42	CAP CER 1.2PF 50V NP0 0402	Murata	GRM1555C1H1R2WA01D
C43	DNI		
C44	CAP CER 2.7PF 50V NP0 0402	Murata	GRM1555C1H2R7BA01D
C39	Fixed 0R 0201 5% 1/20W	Yageo	RC0201JR-070RL
R10	Fixed 0R 0402 1/16W	Yageo	RC0402JR-070RL
Y2	ANTENNA BLUETOOTH/WI-FI CHIP ANTENNA 2400-2500MHZ and 5GHZ	Inventek	W245-SC (Certified Antenna)

Table 3.1 Components for Chip Antenna Design

	Description	MFG	Part Number
C17	Fixed 0R 0201 5% 1/20W	Yageo	RC0201JR-070RL
R11	Fixed 0R 0201 5% 1/20W	Yageo	RC0201JR-070RL
C18	Open		
R3	Fixed 0R 0201 5% 1/20W	Yageo	RC0201JR-070RL
C19	Open		
U.FL	U.FL Connector		Note: W24P-U Certified Antenna Recommended

Table 3.2 Components for U.FL External Antenna Design

3.2 Antenna Placement and Routing

The antenna is the element used to convert the guided waves on the PCB traces to the free-space electromagnetic radiation. The placement and layout of the antenna is key to increased range and data rates.

The guidelines in Table 4 of Section 3.3 need to be observed for the antenna.

3.3 Antenna Guidelines

Sr	Guidelines
1	Place the antenna on an edge or corner of the PCB as shown in our layout
2	Make sure that no signals are routed across the antenna elements on all the layers of the PCB.
3	Use W245-SC chip antenna and require ground clearance on all the layers of the PCB. Ensure that the ground is cleared on inner layers as well.

4	Ensure that there is provision to place matching components for the antenna. These need to be tuned for best return loss once the complete board is assembled. Any plastics or casing should also be mounted while tuning the antenna as this can impact the impedance.
5	Ensure that the antenna impedance is 50 Ω as the device is rated to work only

Table 4. Characteristic of Recommended Antenna

Parameter	Spec
Frequency Bandwidth	2.4GHz
Typical Peak Gain	+1.4 dBi (2.4 GHz)

Table 5. Antenna Characteristics

3.4 Impedance instructions

The trace that connects pin 1 (ANT) to the antenna must have a 50 Ohm impedance. The 50 ohm controlled impedance is achieved using a 11 mil trace with 8 mil ground strip separation.

Layer	Trace (mil)	Requirement	Measured
Top (L1)	11 (+/-10%)	50 Ω (+/-10%)	-

Table 3: Impedance Information

4 REVISION CONTROL

Document : ISM43439-WBP-151 Layout	Dual Band Wi-Fi + BT/BLE SiP
External Release	DOC-AN-040424

Date	Author	Revision	Comment
4-4-2024	AS	1.0	Preliminary

5 CONTACT INFORMATION

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