User's Manual

Compact

CONFIDENTIAL

1. TABLE OF CONTENTS

2. TABLE OF TABLES / FIGURES

3. PROJECT DESCRIPTION

The Compact Transmitter main board is a coder board with 11 digital channel inputs designed to fit the Compact Transmitter housing. It can be used with all Intuitek Receiver products.

The top side of the PCB has eight panel switches that can be configured with 1-step or 2-step switches. All switches, including Start and Stop, have fixed DK assignments, with 2-step switches having a second DK assignment for the second level.

The Compact Transmitter main board includes an advanced Low Voltage Indicator (LVI) warning system with two levels of detection, variable duty cycle, and a 2 minute turn off time. It also includes switch detection on power up to ensure that no switch is active when the battery is inserted.

The RF section uses 2.4GHz selectable frequency and selectable baud rate. The channel selection is determined by the factory-programmed address.

The RF module operates using a three-pin interface (power, ground and TTL).

- RF link is Direct Sequence Spread Spectrum, using OQPSK modulation.
- There are no adjustable controls on the radio module to set output power, deviation, etc.
- The antenna connector is direct soldered to the PCBA.
- The antenna is **Model:** 66502905 – Antenna SMA-Conn CS2400TR **Manufacturer:** Hetronic **Length:** 25.00 mm

Note: This device complies with Industry Canada license-exempt RSS Standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Note: Do not co-locate this transmitter within 20cm of any other transmitter that is capable of operating simultaneously.

Note: The user is cautioned that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note: The antenna(s) used for this transmitter must not transmit simultaneously with any other antenna or transmitter, except in accordance with FCC and IC multi-transmitter product procedures.

Note: Under Industry Canada regulations, this radio transmitter may only operate using an antenna of the same type and equal or lesser gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its

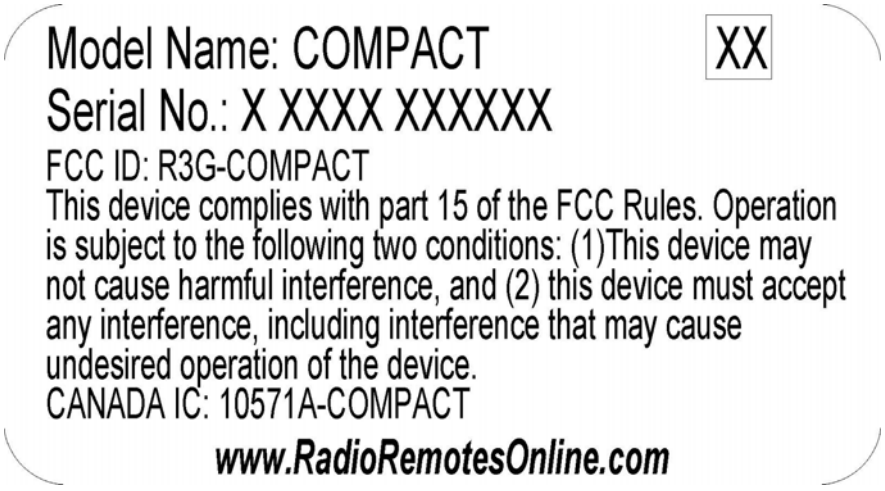
gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Remarque : Ce dispositif est conforme aux normes permis-exemptes du Canada RSS d'industrie. L'opération est soumis à deux conditions suivantes: (1) ce dispositif ne peut pas causer de brouillage, et (2) ce dispositif doit accepter toute interférence, y compris le brouillage qui peut causer intempestif de fonctionnement du dispositif.

Remarque : L'utilisateur est averti que les changements ou modifications non expressément approuvées par la partie responsable de la conformité pouvaient annuler l'autorisation l'utilisateur à faire fonctionner l'équipement.

Remarque : L'utilisation utilisée pour cet émetteur ne doit pas transmettre simultanément avec une autre antenne ou émetteur, sauf conformément aux procédures de produits multi-transmitter de FAC et IC.

FCC ID: R3G-COMPACT
IC ID: 10571A-COMPACT



4. TECHNICAL SPECIFICATION

Temperature Range	-30^{o} to $+70^{o}$ Celsius
Supply Voltage Range	2.0 to 5.0V_{DC}
Current Consumption	30mA max
Inputs	11 Digital Eight 2-step switches Start switch Stop switch
Output	2 LED Indicators RF Telegram
Board Dimension	104.4mm x 50.2mm

Table 1, Basic technical specifications

5. CONNECTION DIAGRAM

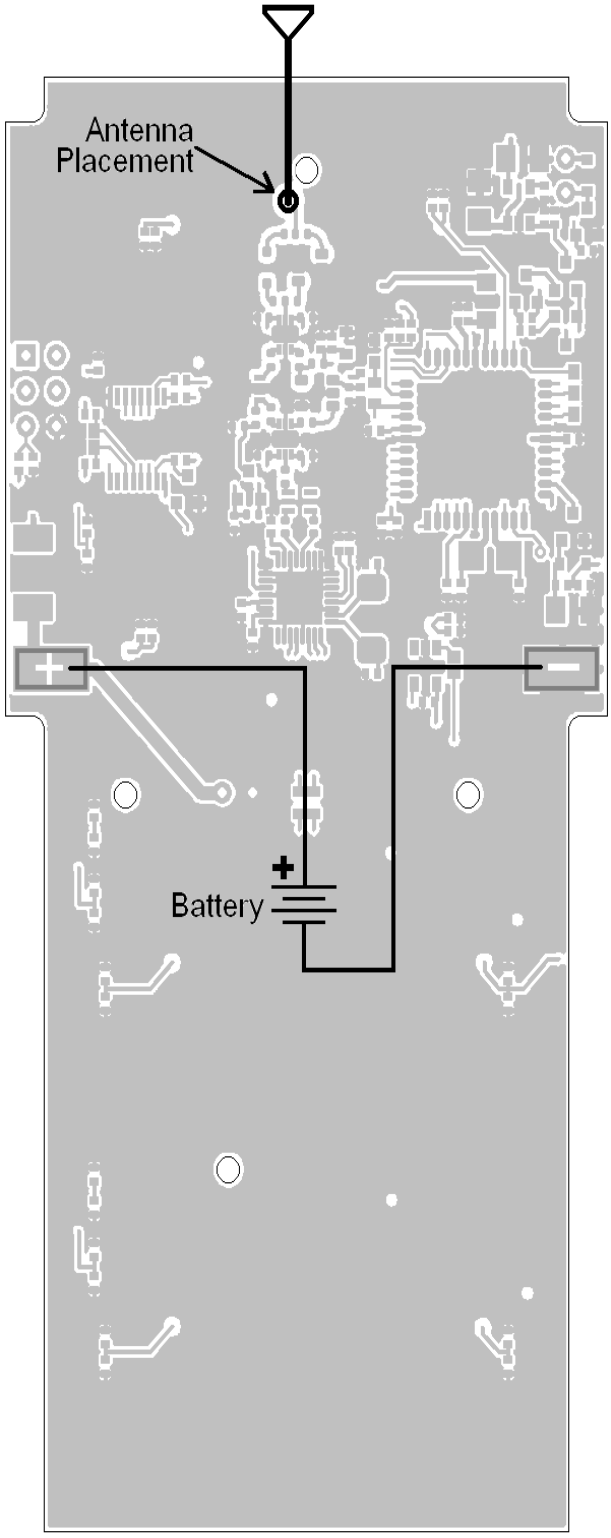


Figure 1, PCB Connections

6. FUNCTIONAL DESCRIPTION

6.1. General Description

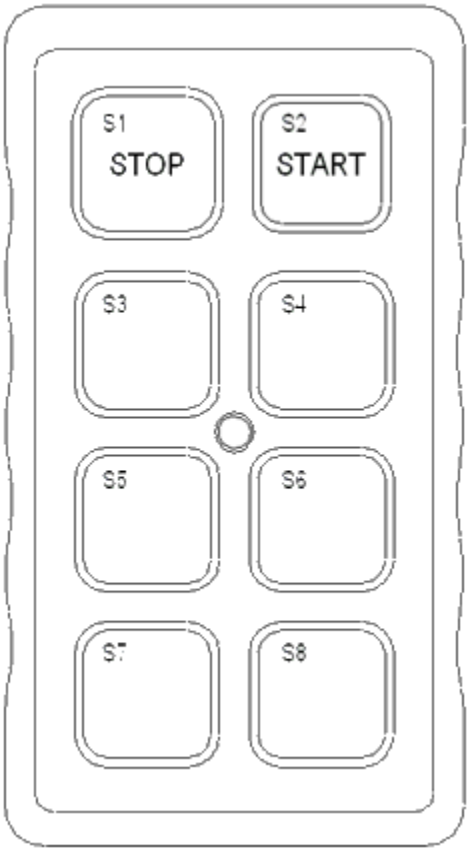


Figure 2, Transmitter switch layout

- This Transmitter updates with a fixed RF-transmission duty cycle of 2%.
- The Transmitter will turn off automatically after all buttons are released (2 minutes).
- STOP is an emergency stop button that has priority above all other buttons.
- START (DK1/DK2) is a start or horn function. This button can be used to reset errors in the Receiver (Overload/Main Contact error).
- DKs 3-8, 11-13, 15-17 are regular digital channels.

6.1.1. Switch Error Detect

This encoder is designed with switch detection that detects when a switch is broken. If a switch is active when a battery is inserted, the unit will go into an error state. The red LED will come on and stay on until the active switch is turned off.

6.1.2. Low Voltage Indicator

The encoder has a low battery detection function. The level is programmed at the factory (the actual voltage is not programmed, just Short, Medium, or Long delay before the battery reaches the critical level). Once the battery reaches the programmed level, the red LED will

come on solid while the green LED keeps blinking with every RF telegram. If the voltage level reaches the critical level, the Transmitter can only send neutral DKs or ESTOP telegrams.

6.1.3. Switch Operations

6.1.4. S1

Emergency Stop SW / Power OFF

6.1.5. S2

Power ON SW / DK1/ DK2 Start SW

6.1.6. S3-S8

2-step capable momentary switches

6.2. DK Mappings

The Compact main board has fixed DK assignments for each switch. Table 2 below indicates these settings.

Switch	Step 1	Step 2
S1	DK31	N/A
S2	DK1/DK2	N/A
S3	DK3	DK11
S4	DK4	DK15
S5	DK5	DK12
S6	DK6	DK16
S7	DK7	DK13
S8	DK8	DK17

Table 2, DK to switch mappings

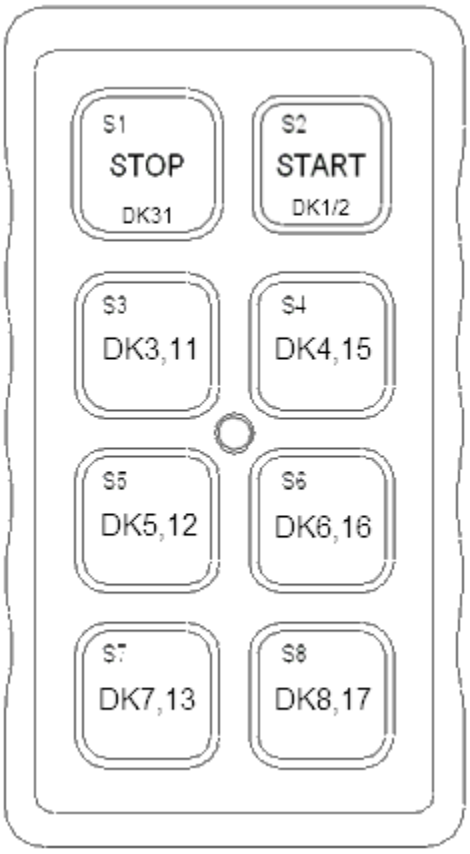


Figure 3, Switch layout with DK assignments

6.3. RF Control Signals

The coder is set to transmit 32 DK Intuitek telegram. Each switch is assigned a single DK, except for the six panel switches, which are assigned two DKs (one for each level), the Start SW (DKs 1 & 2 simultaneously), and the Stop SW. For information on DK mappings, see section 6.2 above.

6.3.1. Stop Command

The Stop button (SW1) is an emergency stop (E-Stop) button that has priority over all other buttons. When the Stop button is depressed, the software shall set all other DK's to "OFF".

RF telegrams contain a complimentary bitmapped structure, with two stop/start bits (DK31 and DK32) located in different areas of the telegram. The Compact automatically controls the state of the telegram's DK31 and DK32 bits based on the state of the Stop switch. Of the four possible states the DK31 and DK32 signals may take on, only one state will allow machine operation: and only then when the telegram passes an overall checksum.

In the Receiver, both the Main and Stop processors independently evaluate these telegrams. Each must process and recognize a valid signal in order for machine operation to be allowed. These signals are removed from the packet and transferred to two different I/O pins. Both the Stop and Main processors send the DK32 signal to their respective main contact element (the main contact consists of two series switching elements). The DK31 signal from both processors is sent to the "enable" circuitry for the

digital outputs. For relay-based designs, this signal would switch the coil power supply; for a solid-state design, this signal would switch a gate optocoupler drive or a bias enable. Even if the transmitter instructs the outputs to activate, they cannot unless the DK31 and DK32 signals are correct.

The E-Stop is considered an “Active” stop command and will cause the Transmitter and Receiver to cease all functions immediately. This STOP command will cause the equipment to stop in a “Safe” mode.

1. An “Active” STOP command is transmitted immediately and is caused by:

    - The STOP / E-Stop (SW15) button being depressed / activated,

2. A “Passive” STOP command allows for correction of the fault / error message before sending the STOP command. The “Passive” STOP may be transmitted due to any of the following conditions:

    - Transmitter issues,
    - Low supply voltage – the Transmitter battery is low. An alarm with a LED will notify the operator. If the operator does not stop operation and replace the battery, the battery voltage will eventually become too low for the Transmitter to operate leading to a loss of communications between the Transmitter and Receiver,
    - When a valid radio transmission has not been detected for a predetermined period (i.e. loss of communications). Valid signals include command signals and signals that confirm the communication is established and maintained. Normally, this alarm can be reset by user interaction.

6.4. Panel Switch Interlocking

Switch/DK interlocking is performed in the paired Receiver.

6.5. RF Channel Group Assignment

- Each transmitter will be using a Group of 2-channels from the 16 available 2.4GHz channels.
- There will be 120 groups pre-assigned with 2 different channels. A frequency/group table may be found in section 9.1.
- Group assignment will be based on the address of the Transmitter and an Offset value (0~119) saved in the internal EEPROM. The following formula describes the channel group calculation.

    *Group assignment = (((Address % 120)*8)%120 + Offset) % 120*
    Note: % = modulus operation

The channel Group may be incremented or decremented using the Option 1 and Option 2 side buttons. This allows the user a method of avoiding a close-proximity interferer.

6.5.1. Increment Channel Group

To increment the Channel Group, while pressing the E-Stop SW1, press SW1R (S4) for 3 seconds or more to activate Group increment. The new Group information will be transmitted to the Receiver for 2 seconds, or while the SW1R is still active, whichever is longer. The new RF Group will be used upon release of the SW1R and the new Group channel information has been transmitted for at least 2 seconds. The new Offset value will be saved in the EEPROM.

6.5.2. Decrement Channel Group

While pressing the E-Stop switch (SW1), press SW1L (S3) for 3 seconds or more to activate Group decrement. The new Group information will be transmitted to the Receiver for 2 seconds, or while the SW1L (S3) is still active, whichever is longer. The new RF Group will be used upon release of the SW1L (S3) and the new Group channel information has been transmitted for at least 2 seconds. The new Offset value will be saved in the EEPROM.

7. ASSEMBLY DESCRIPTION

7.1. Antenna Wire

The antenna wire should be silver tinned (D=0.5~1.0mm) and about 25mm long when measured from the tip of the wire to the board.

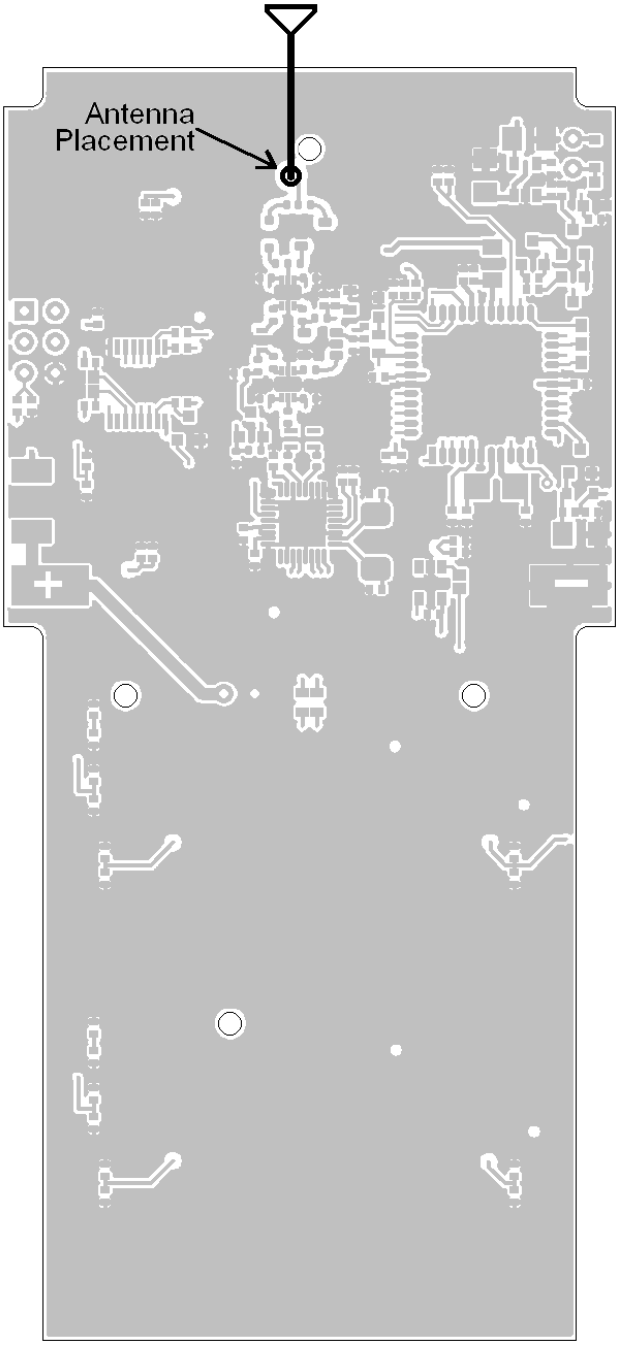


Figure 4, Antenna configuration

7.2. Screw Holes

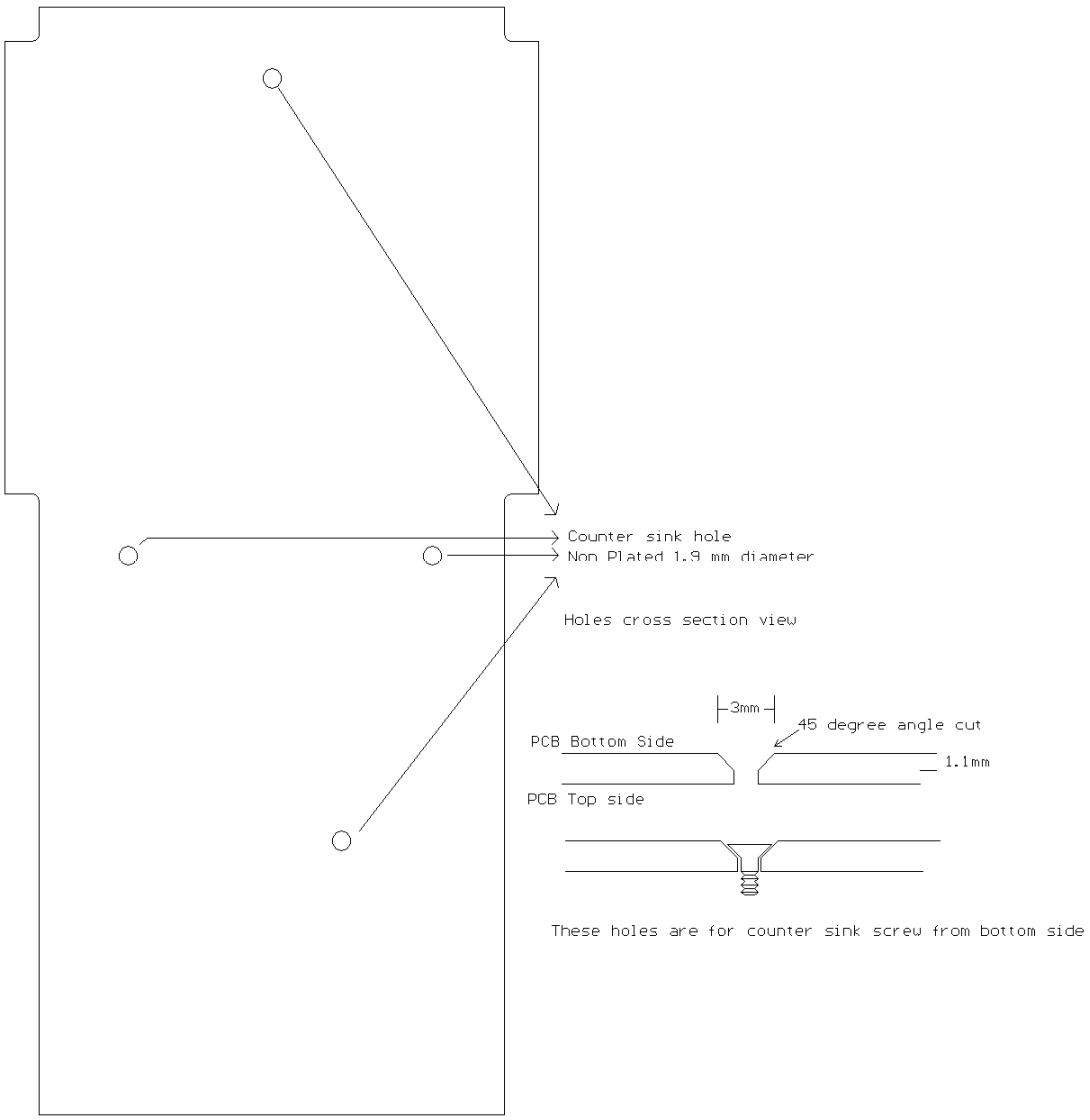


Figure 5, Antenna configuration

7.3. Lacquer Instructions

Apply lacquer on the component side of the board shown except the areas marked in red.

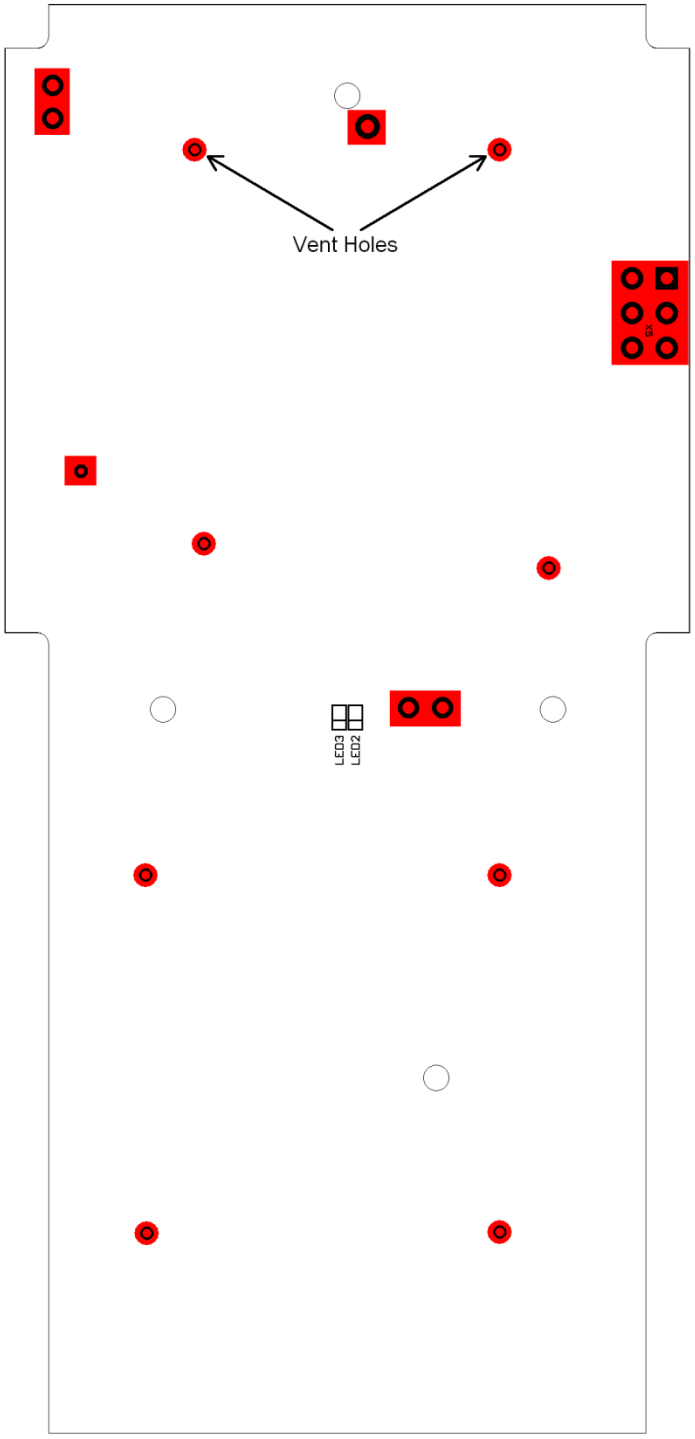


Figure 6, Lacquer mask – Top

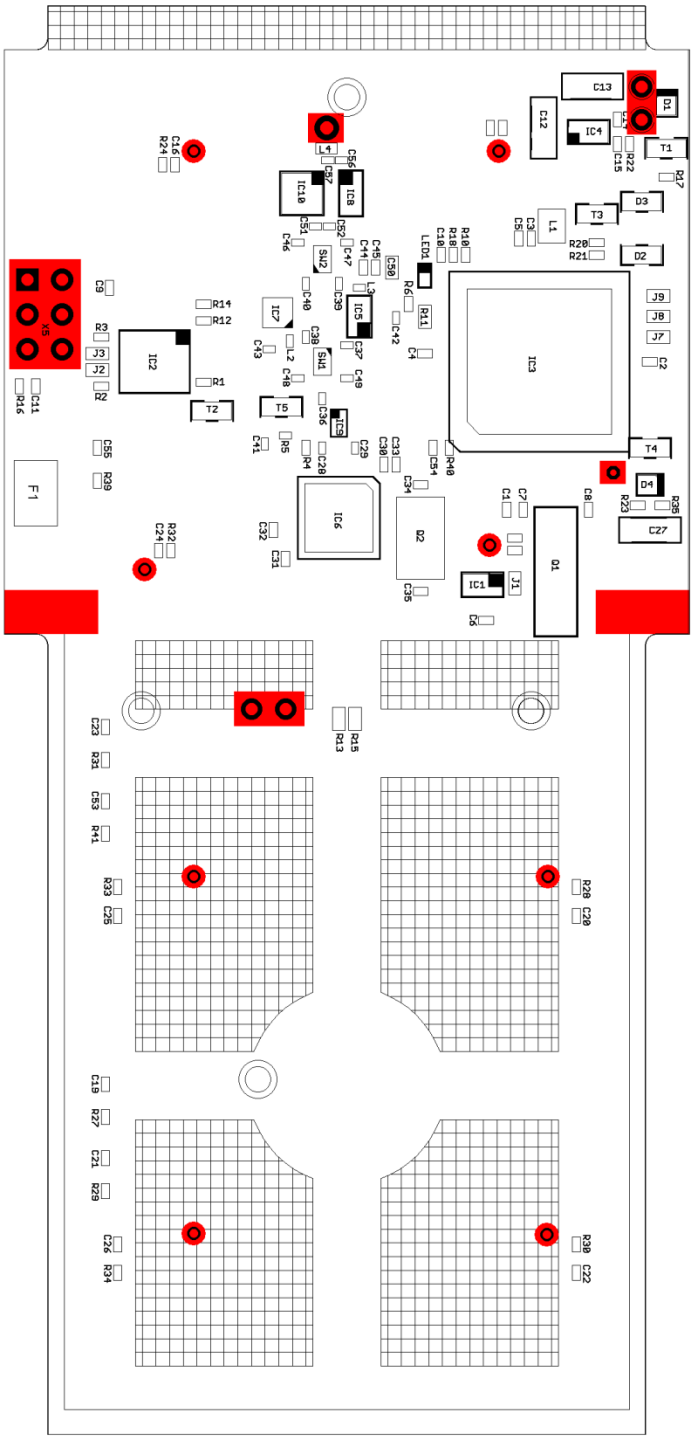


Figure 7, Lacquer Mask – Bottom

7.4. Gluing Instructions

Apply glue on the areas marked below to fix wires and tall components

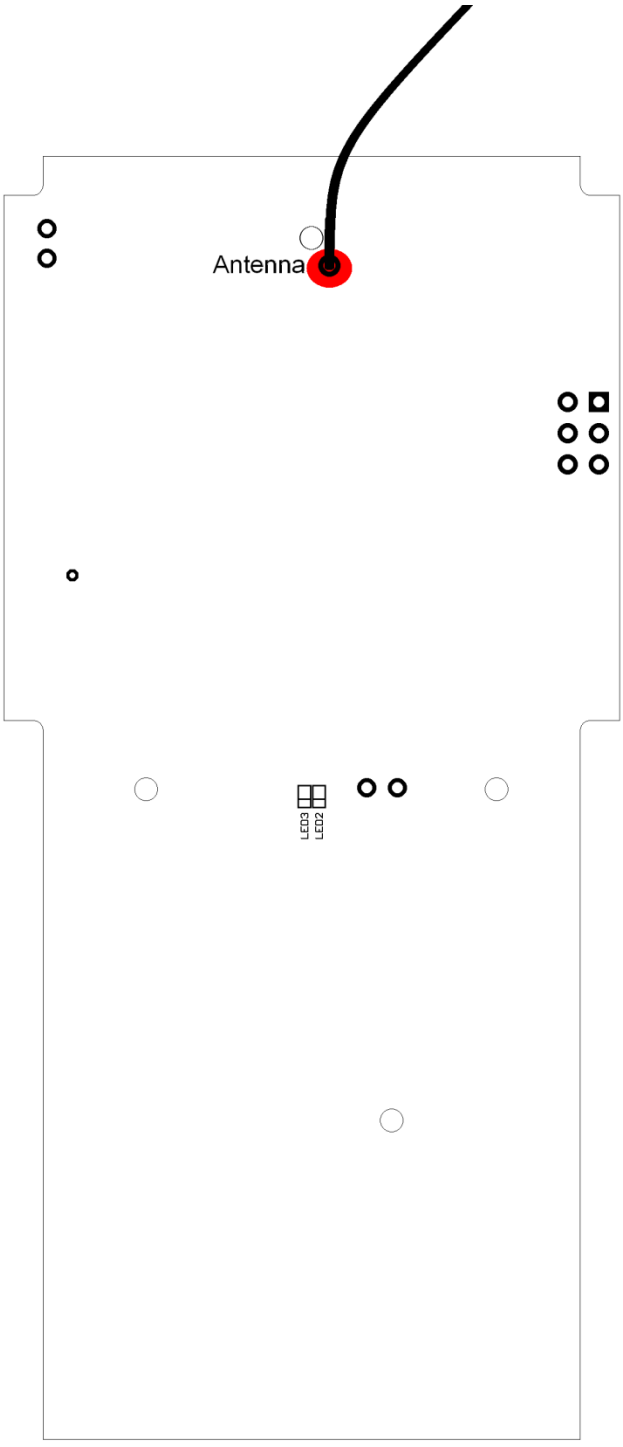


Figure 8, Glue locations

7.5. Production Label

Place Date and Supplier code label within the area marked below.

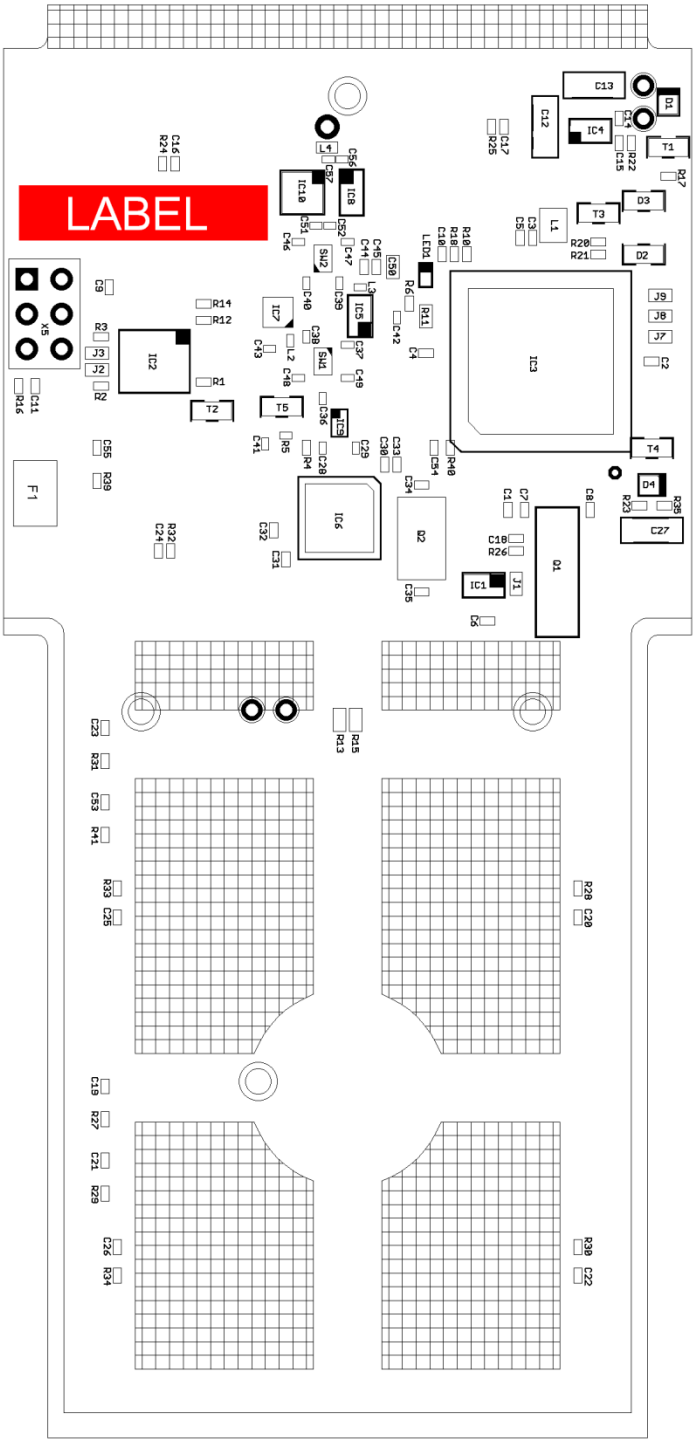


Figure 9, Production label placement

8. PCB

8.1. PCB Layout / Gerbers

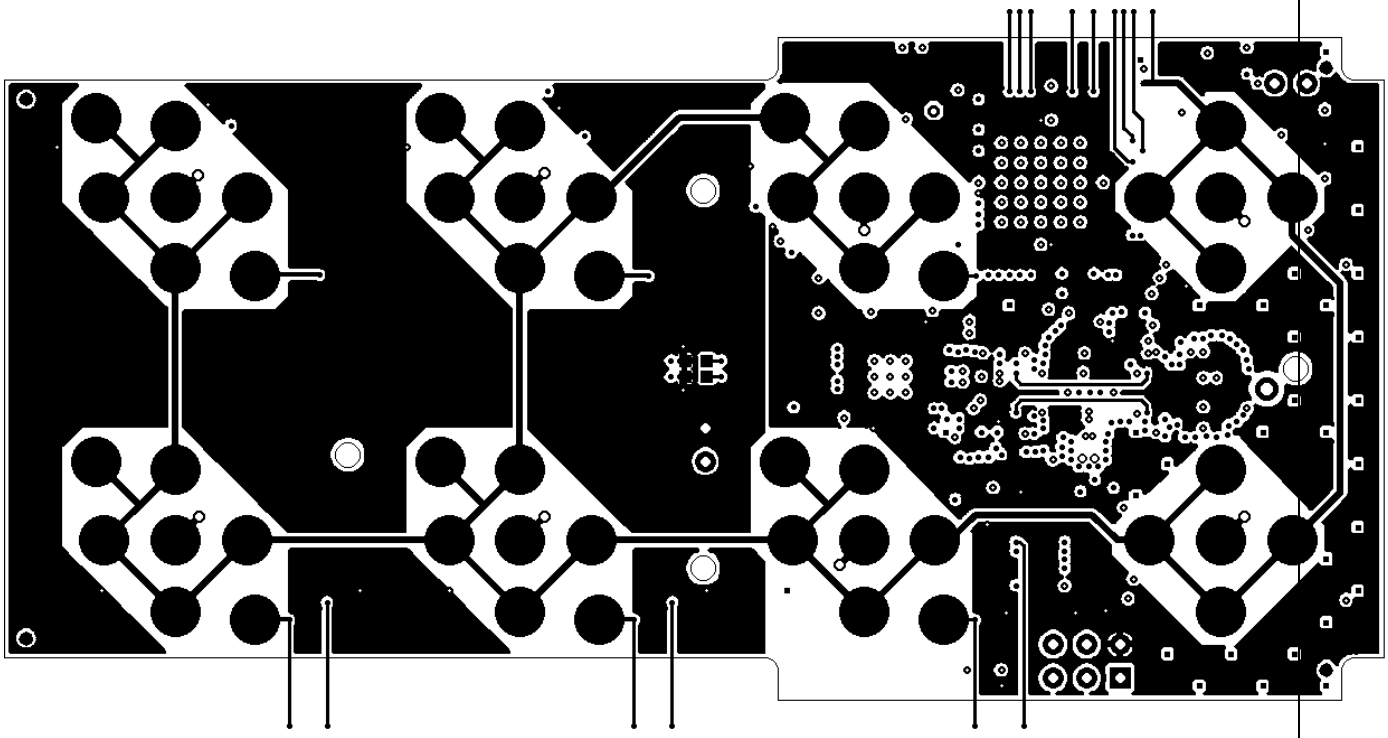


Figure 10, PCB layout - top

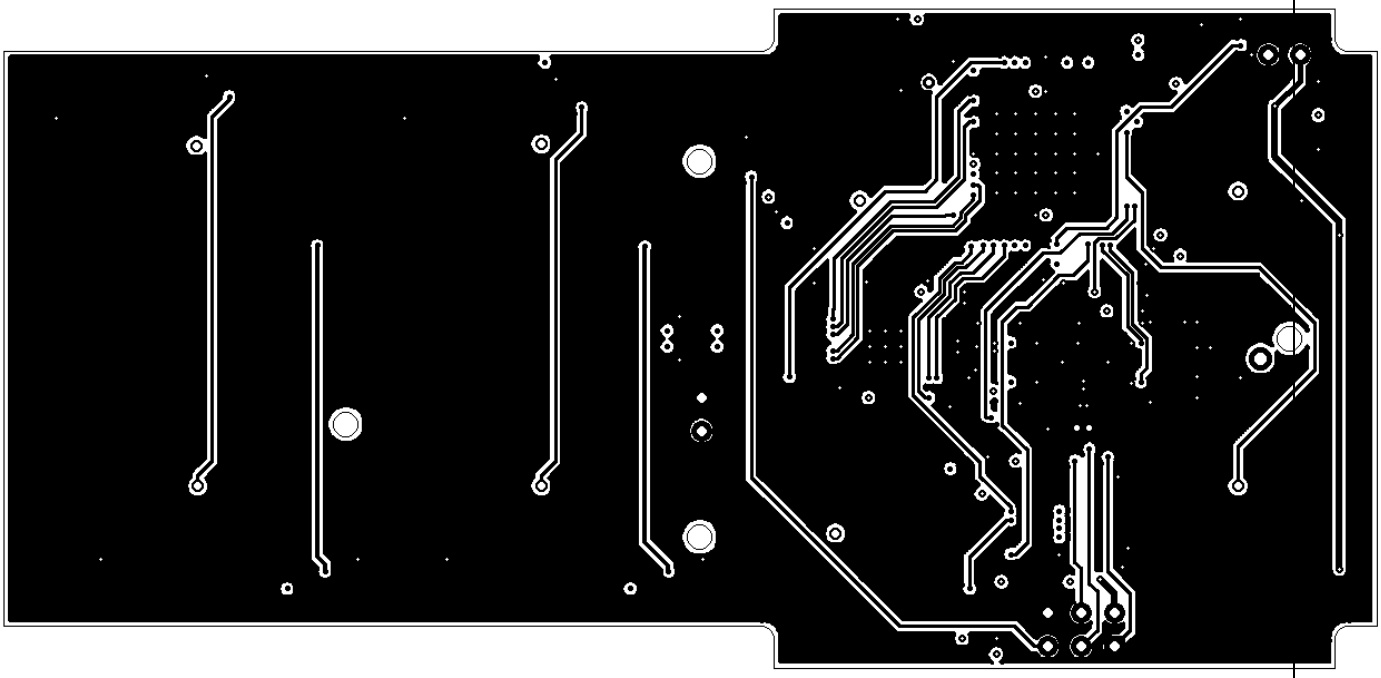


Figure 11, PCB layout - layer 2

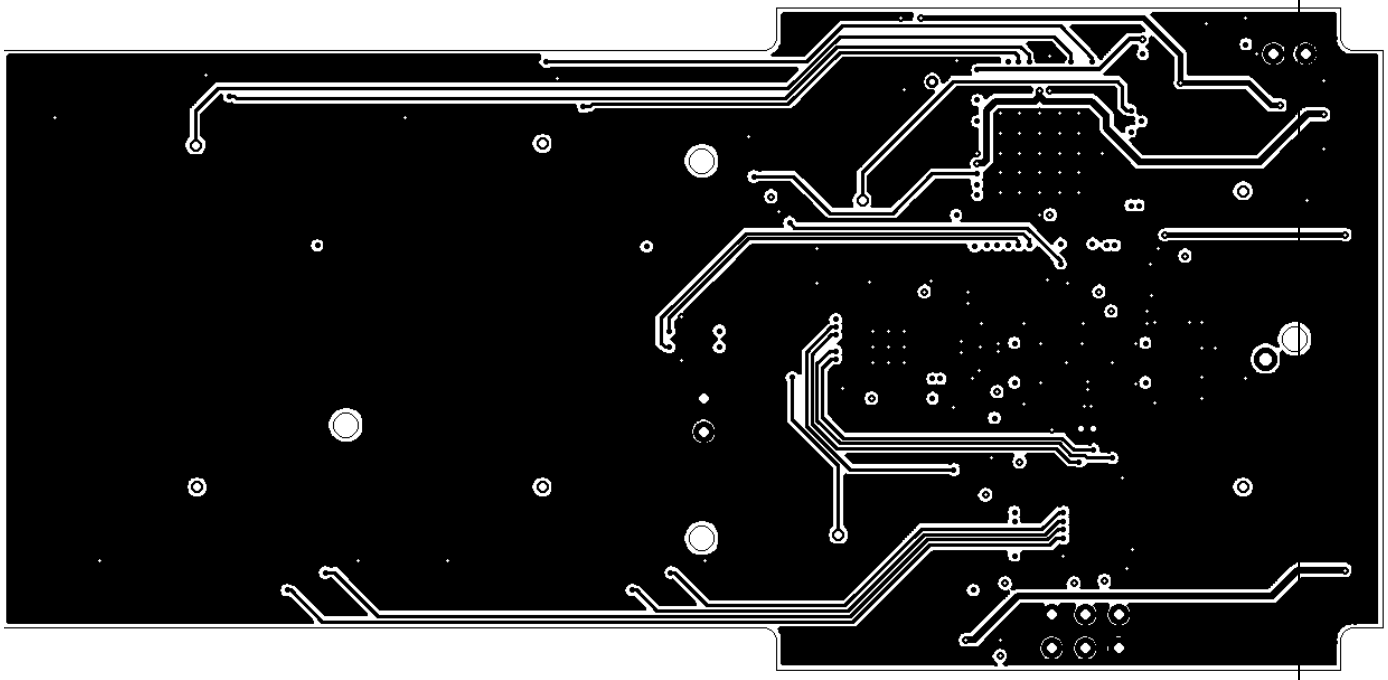


Figure 12, PCB layout - layer 3

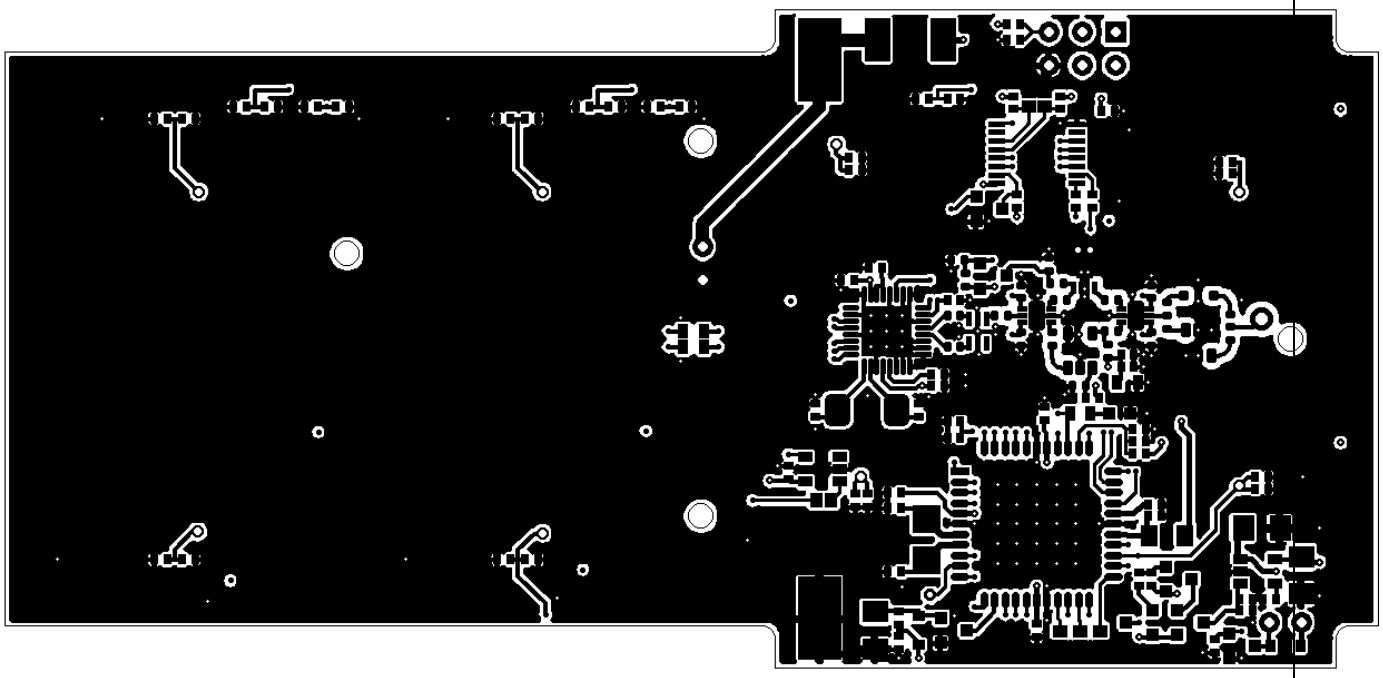


Figure 13, PCB layout - bottom

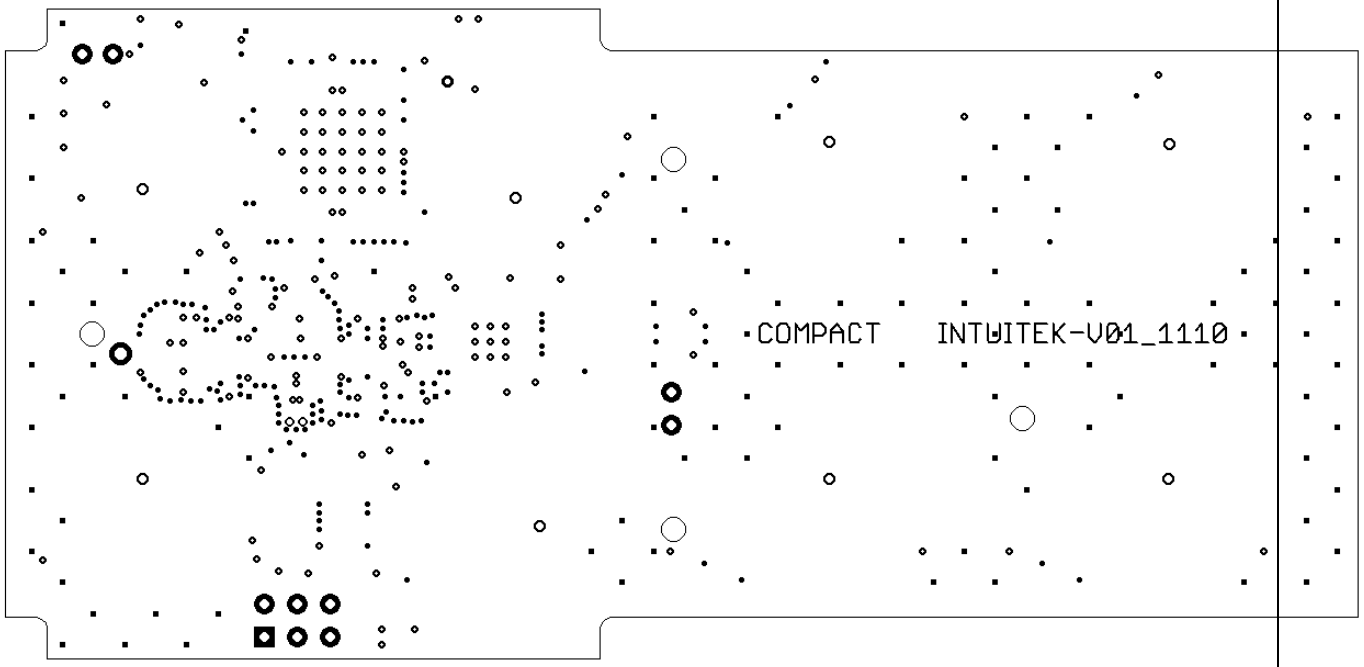


Figure 14, PCB layout - bottom silk

8.2. Component Placement

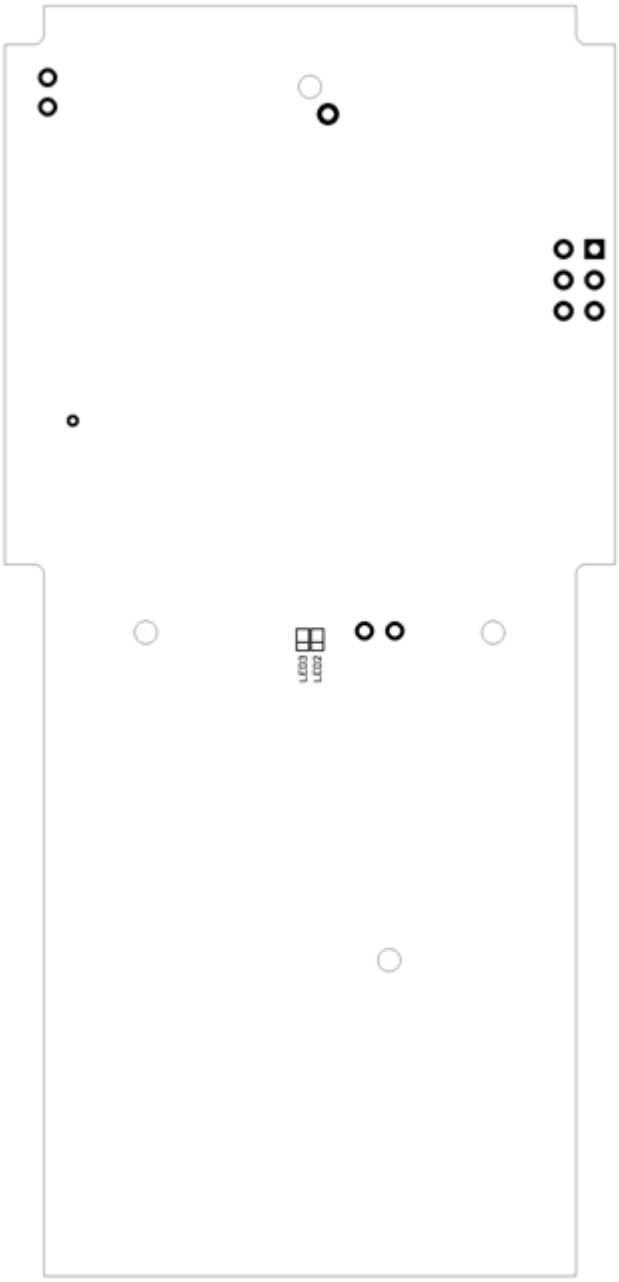


Figure 15, Component placement – top

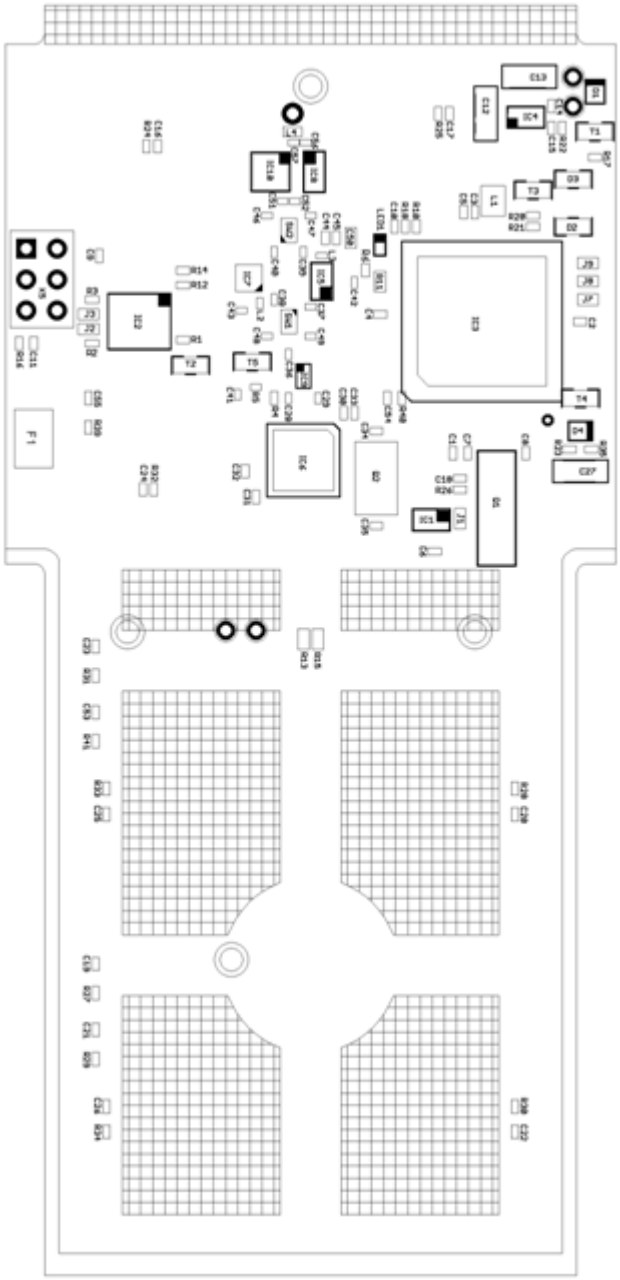


Figure 16, Component placement – bottom

8.3. PCB Specifications

PCB Material	FR4
Finished PCB Thickness	1.6 mm (62 mil)
Copper Weight	1 oz
Finished Plating - Switch Pads	Electro-Deposited, Hard Gold Plated MIL-G-45204C Type II Grade C 0.38 - 0.76 microns
Finished Plating – all except Switch Pads	Flash Gold
PCB Layers	4 Layer
PCB Dimension	104.4 x 50.2mm
Min Trace Width/Space	0.2/0.2 mm
Smallest SMD Pitch	0.5mm
Number of Pads	27
Number of SMDs	444
Top SMD Pads Count	56
Bottom SMD Pads Count	388
Solder Mask	Green LPI, Top and Bottom
Silk Screen	Bottom-white
Number of Holes	4
Number of Vias	16

Table 3, PCB specifications

8.4. PCB Layer Stack Up

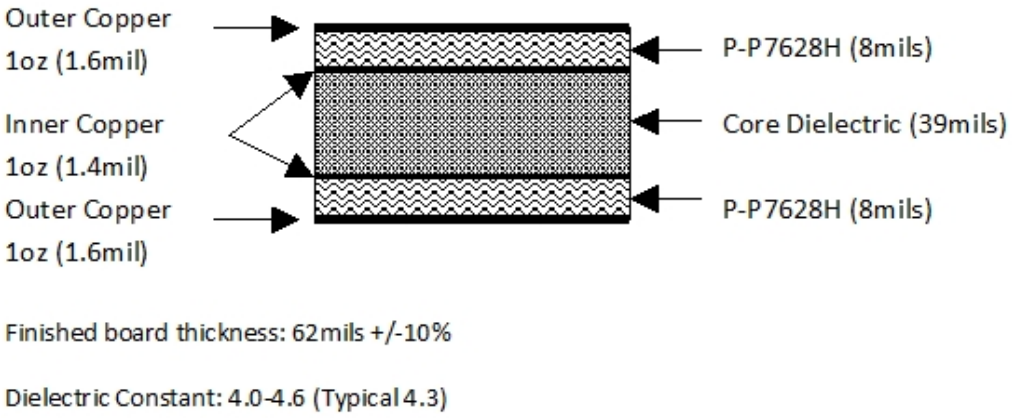


Figure 17, PCB Stack-up

9. ATTACHMENTS

9.1. RF Channel Frequency Grouping Table

A\B	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
1	60	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2	77	66	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3	88	76	70	X	X	X	X	X	X	X	X	X	X	X	X	X
4	100	89	75	62	X	X	X	X	X	X	X	X	X	X	X	X
5	108	101	90	74	64	X	X	X	X	X	X	X	X	X	X	X
6	114	109	102	91	73	53	X	X	X	X	X	X	X	X	X	X
7	96	115	110	103	52	41	28	X	X	X	X	X	X	X	X	X
8	84	97	116	51	40	27	14	7	X	X	X	X	X	X	X	X
9	69	85	50	39	26	13	6	21	35	X	X	X	X	X	X	X
A	72	49	38	25	12	5	20	34	42	54	X	X	X	X	X	X
B	48	37	24	11	4	19	33	43	55	79	67	X	X	X	X	X
C	36	23	10	3	18	32	44	56	104	92	80	63	X	X	X	X
D	22	9	2	17	31	45	57	117	111	105	93	81	68	X	X	X
E	8	1	16	30	46	58	86	98	118	112	106	94	82	61	X	X
F	0	15	29	47	59	78	65	87	99	119	113	107	95	83	71	X

	F Ch	
F Grp	A	B
0	F	0
1	E	1
2	D	2
3	C	3
4	B	4
5	A	5
6	9	6
7	8	7
8	E	0
9	D	1
10	C	2
11	B	3
12	A	4
13	9	5
14	8	6
15	F	1
16	E	2
17	D	3
18	C	4
19	B	5
20	A	6
21	9	7
22	D	0
23	C	1
24	B	2
25	A	3
26	9	4
27	8	5
28	7	6
29	F	2
30	E	3
31	D	4

	F Ch	
F Grp	A	B
32	C	5
33	B	6
34	A	7
35	9	8
36	C	0
37	B	1
38	A	2
39	9	3
40	8	4
41	7	5
42	A	8
43	B	7
44	C	6
45	D	5
46	E	4
47	F	3
48	B	0
49	A	1
50	9	2
51	8	3
52	7	4
53	6	5
54	A	9
55	B	8
56	C	7
57	D	6
58	E	5
59	F	4
60	1	0
61	2	1
62	3	2
63	4	3

	F Ch	
F Grp	A	B
64	5	4
65	F	6
66	9	0
67	B	A
68	C	B
69	D	C
70	E	D
71	F	E
72	A	0
73	6	4
74	5	3
75	4	2
76	3	1
77	2	0
78	F	5
79	B	9
80	C	A
81	D	B
82	E	C
83	F	D
84	8	0
85	9	1
86	E	6
87	F	7
88	3	0
89	4	1
90	5	2
91	6	3
92	C	9
93	D	A
94	E	B
95	F	C

	F Ch	
F Grp	A	B
96	7	0
97	8	1
98	E	7
99	F	8
100	4	0
101	5	1
102	6	2
103	7	3
104	C	8
105	D	9
106	E	A
107	F	B
108	5	0
109	6	1
110	7	2
111	D	8
112	E	9
113	F	A
114	6	0
115	7	1
116	8	2
117	D	7
118	E	8
119	F	9

Table 4, RF channel group assignment