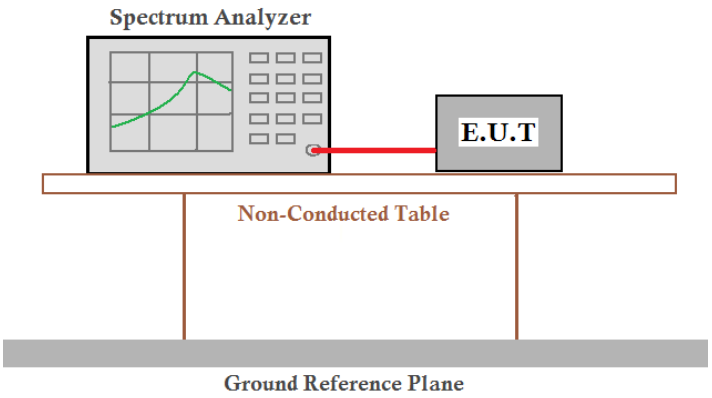
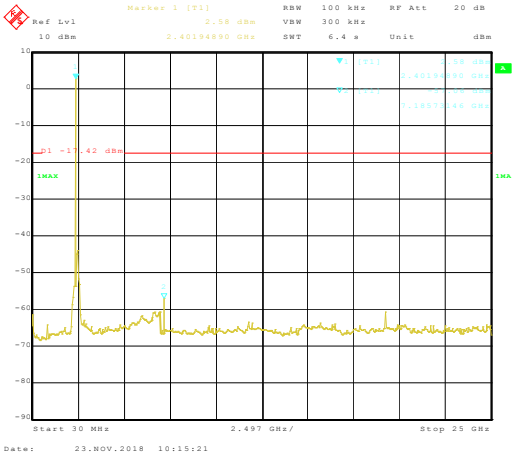
7.7 Spurious Emission

7.7.1 Conducted Emission Method

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013 and KDB558074 D01 DTS Meas Guidance V05
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

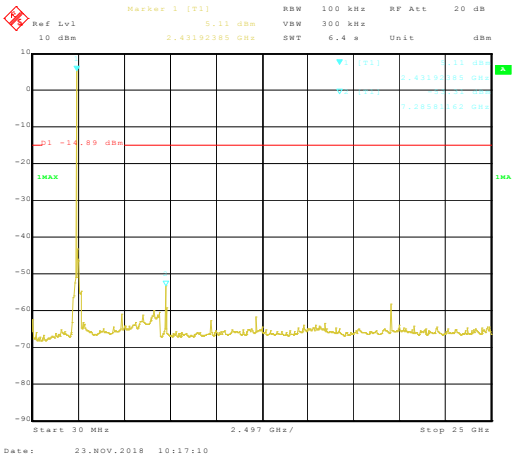
Test plot as follows:

Lowest channel



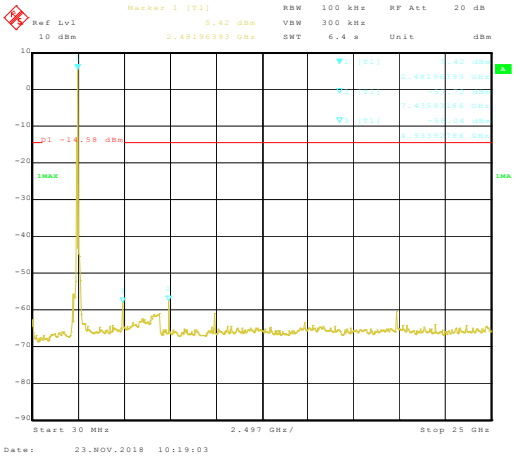
30MHz~25GHz

Middle channel



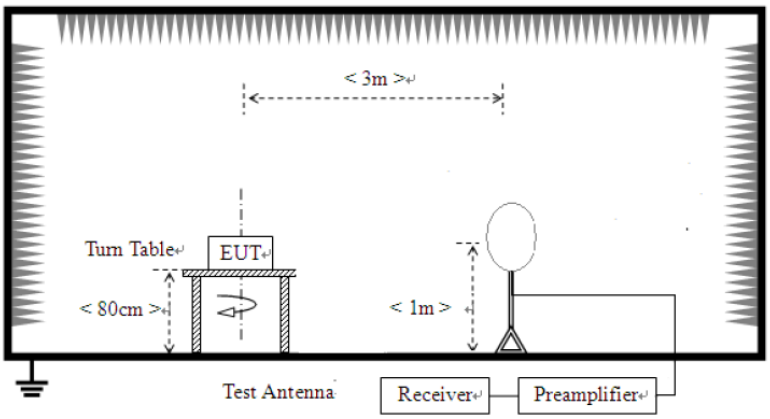
30MHz~25GHz

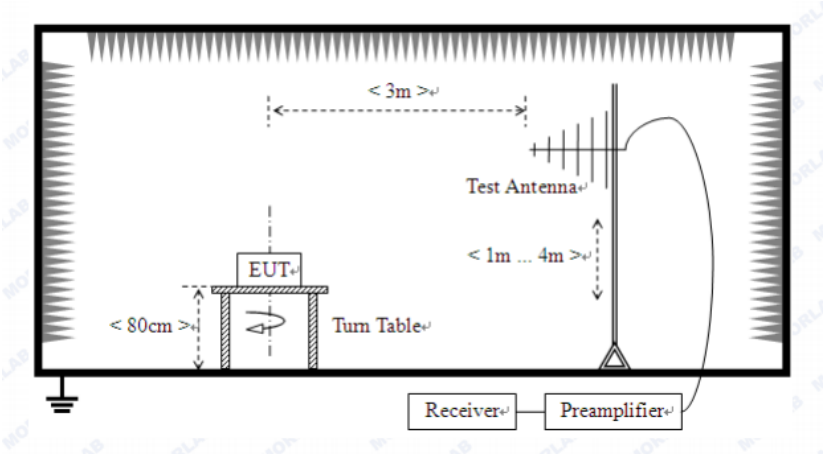
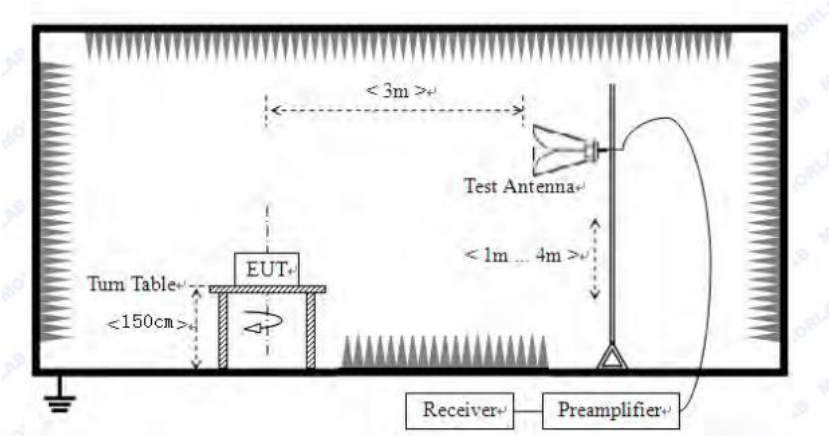
Highest channel



30MHz~25GHz

7.7.2 Radiated Emission Method

<table>
<tr><td>Test Requirement:</td><td>FCC Part15 C Section 15.209</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10:2013</td></tr>
<tr><td>Test Frequency Range:</td><td>9kHz to 25GHz</td></tr>
<tr><td>Test site:</td><td>Measurement Distance: 3m</td></tr>
<tr><td>Receiver setup:</td><td>
<table>
<tr><th>Frequency</th><th>Detector</th><th>RBW</th><th>VBW</th><th>Value</th></tr>
<tr><td>30MHz-1GHz</td><td>Quasi-peak</td><td>120KHz</td><td>300KHz</td><td>Quasi-peak</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>Peak</td><td>1MHz</td><td>3MHz</td><td>Peak</td></tr>
<tr><td>Peak</td><td>1MHz</td><td>10Hz</td><td>Average</td></tr>
</table>
</td></tr>
<tr><td>Limit:</td><td>
<table>
<tr><th>Frequency</th><th>Limit (uV/m)</th><th>Value</th><th>Measurement Distance</th></tr>
<tr><td>30MHz-88MHz</td><td>100</td><td>QP</td><td rowspan="6">3m</td></tr>
<tr><td>88MHz-216MHz</td><td>150</td><td>QP</td></tr>
<tr><td>216MHz-960MHz</td><td>200</td><td>QP</td></tr>
<tr><td>960MHz-1GHz</td><td>500</td><td>QP</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>500</td><td>Average</td></tr>
<tr><td>5000</td><td>Peak</td></tr>
</table>
</td></tr>
<tr><td>Test setup:</td><td>For radiated emissions from 9kHz to 30MHz
 
</td></tr>
</table>

	For radiated emissions from 30MHz to1GHz  For radiated emissions above 1GHz 
Test Procedure:	1. The EUT was placed on the top of a rotating table (0.8m for below 1G and 1.5m for above 1G) above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation. 2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. 3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. 4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading. 5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. If the emission level of the EUT in peak mode was 10dB lower than the

	limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test voltage:	AC 120V, 60Hz
Test results:	Pass

Measurement data:

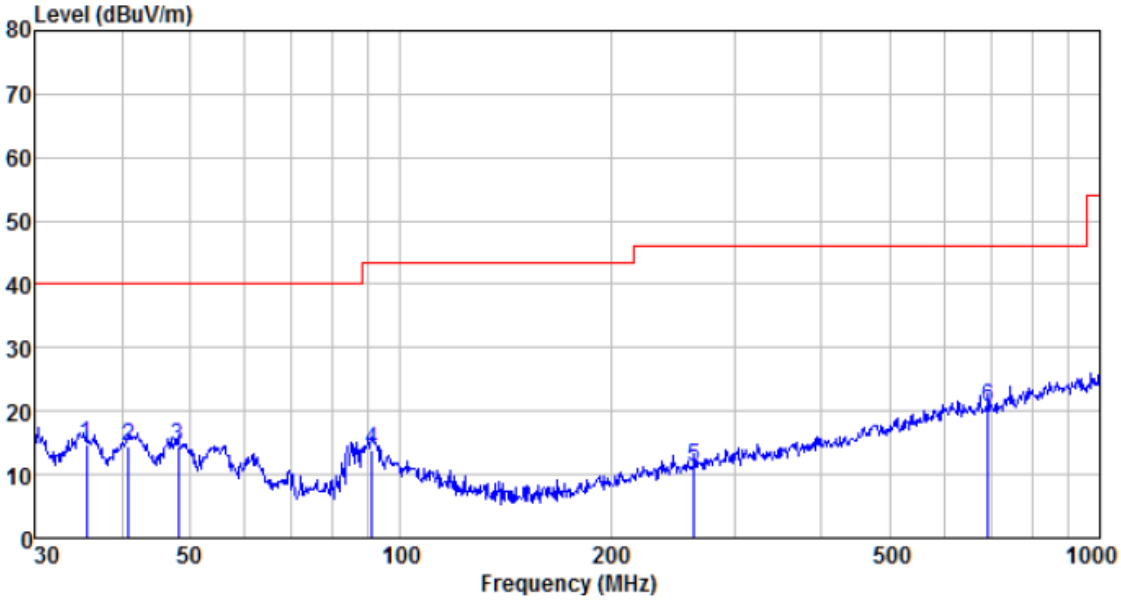
Remark:
Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis which it is worse case.

■ **9kHz~30MHz**

The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

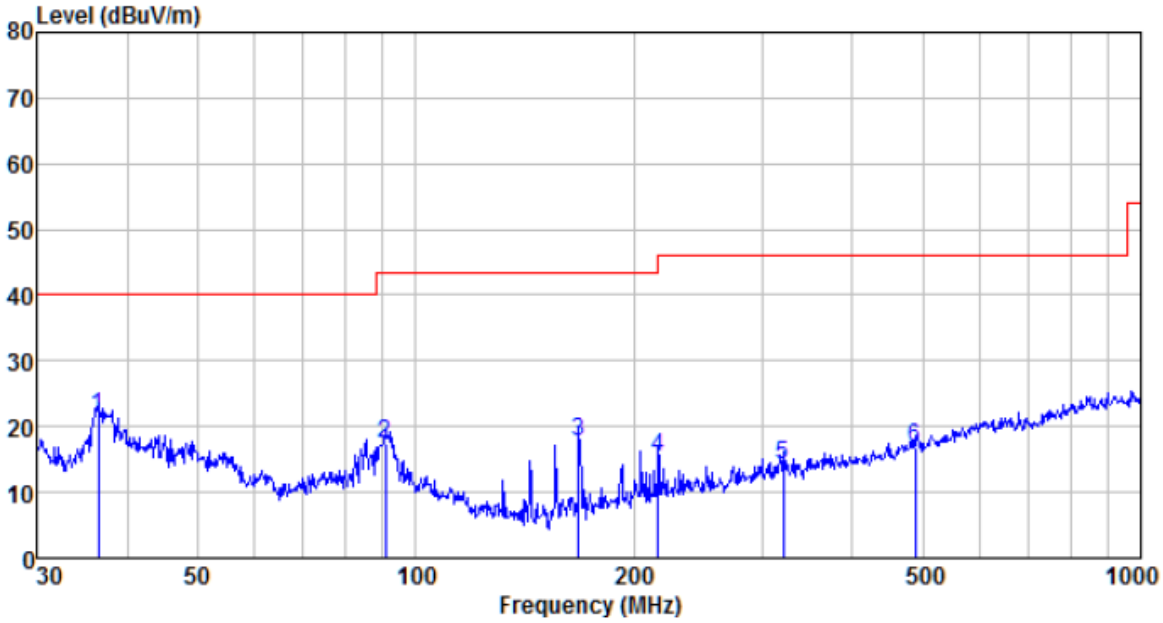
■ **Below 1GHz**

Mode:	**Transmitting mode**	**Test by:**	**Jason**
Temp./Hum.(%H):	**26℃/56%RH**	**Polarziation:**	**Horizontal**



Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV	dBuV/m	dB	
35.624	38.04	11.42	0.62	35.40	14.68	40.00	-25.32	QP
40.845	37.40	12.21	0.67	35.71	14.57	40.00	-25.43	QP
48.163	37.39	12.28	0.75	36.09	14.33	40.00	-25.67	QP
91.175	38.71	10.84	1.12	36.65	14.02	43.50	-29.48	QP
262.896	33.98	12.55	2.19	37.39	11.33	46.00	-34.67	QP
691.987	34.68	19.59	4.06	37.62	20.71	46.00	-25.29	QP

Mode:	**Transmitting mode**	**Test by:**	**Jason**
Temp./Hum.(%H):	**26℃/56%RH**	**Polarziation:**	**Vertical**



Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV	dBuV/m	dB	
36.509	44.82	11.61	0.62	35.45	21.60	40.00	-18.40	QP
90.855	42.04	10.84	1.12	36.65	17.35	43.50	-26.15	QP
167.824	44.82	8.46	1.67	37.18	17.77	43.50	-25.73	QP
216.024	39.65	11.02	1.93	37.35	15.25	46.00	-30.75	QP
321.061	35.26	14.01	2.47	37.44	14.30	46.00	-31.70	QP
489.027	33.86	17.10	3.26	37.51	16.71	46.00	-29.29	QP

■ **Above 1GHz**

Test channel:	Lowest

Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4804.00	35.76	31.78	8.60	32.09	44.05	74.00	-29.95	Vertical
7206.00	30.80	36.15	11.65	32.00	46.60	74.00	-27.40	Vertical
9608.00	30.56	37.95	14.14	31.62	51.03	74.00	-22.97	Vertical
12010.00	*					74.00		Vertical
14412.00	*					74.00		Vertical
4804.00	39.73	31.78	8.60	32.09	48.02	74.00	-25.98	Horizontal
7206.00	32.42	36.15	11.65	32.00	48.22	74.00	-25.78	Horizontal
9608.00	29.83	37.95	14.14	31.62	50.30	74.00	-23.70	Horizontal
12010.00	*					74.00		Horizontal
14412.00	*					74.00		Horizontal

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4804.00	24.87	31.78	8.60	32.09	33.16	54.00	-20.84	Vertical
7206.00	19.67	36.15	11.65	32.00	35.47	54.00	-18.53	Vertical
9608.00	18.84	37.95	14.14	31.62	39.31	54.00	-14.69	Vertical
12010.00	*					54.00		Vertical
14412.00	*					54.00		Vertical
4804.00	28.92	31.78	8.60	32.09	37.21	54.00	-16.79	Horizontal
7206.00	21.74	36.15	11.65	32.00	37.54	54.00	-16.46	Horizontal
9608.00	18.44	37.95	14.14	31.62	38.91	54.00	-15.09	Horizontal
12010.00	*					54.00		Horizontal
14412.00	*					54.00		Horizontal

Remarks:

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*
2. *"*", means this data is the too weak instrument of signal is unable to test.*
3. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

Test channel:	Middle

Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4880.00	35.53	31.85	8.67	32.12	43.93	74.00	-30.07	Vertical
7320.00	30.65	36.37	11.72	31.89	46.85	74.00	-27.15	Vertical
9760.00	30.42	38.35	14.25	31.62	51.40	74.00	-22.60	Vertical
12200.00	*					74.00		Vertical
14640.00	*					74.00		Vertical
4880.00	39.45	31.85	8.67	32.12	47.85	74.00	-26.15	Horizontal
7320.00	32.25	36.37	11.72	31.89	48.45	74.00	-25.55	Horizontal
9760.00	29.67	38.35	14.25	31.62	50.65	74.00	-23.35	Horizontal
12200.00	*					74.00		Horizontal
14640.00	*					74.00		Horizontal

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4880.00	24.68	31.85	8.67	32.12	33.08	54.00	-20.92	Vertical
7320.00	19.54	36.37	11.72	31.89	35.74	54.00	-18.26	Vertical
9760.00	18.73	38.35	14.25	31.62	39.71	54.00	-14.29	Vertical
12200.00	*					54.00		Vertical
14640.00	*					54.00		Vertical
4880.00	28.71	31.85	8.67	32.12	37.11	54.00	-16.89	Horizontal
7320.00	21.60	36.37	11.72	31.89	37.80	54.00	-16.20	Horizontal
9760.00	18.31	38.35	14.25	31.62	39.29	54.00	-14.71	Horizontal
12200.00	*					54.00		Horizontal
14640.00	*					54.00		Horizontal

Remarks:

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*
2. *"*", means this data is the too weak instrument of signal is unable to test.*
3. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

Test channel:	Highest

Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4960.00	35.22	31.93	8.73	32.16	43.72	74.00	-30.28	Vertical
7440.00	30.45	36.59	11.79	31.78	47.05	74.00	-26.95	Vertical
9920.00	30.24	38.81	14.38	31.88	51.55	74.00	-22.45	Vertical
12400.00	*					74.00		Vertical
14880.00	*					74.00		Vertical
4960.00	39.08	31.93	8.73	32.16	47.58	74.00	-26.42	Horizontal
7440.00	32.02	36.59	11.79	31.78	48.62	74.00	-25.38	Horizontal
9920.00	29.46	38.81	14.38	31.88	50.77	74.00	-23.23	Horizontal
12400.00	*					74.00		Horizontal
14880.00	*					74.00		Horizontal

Average value:

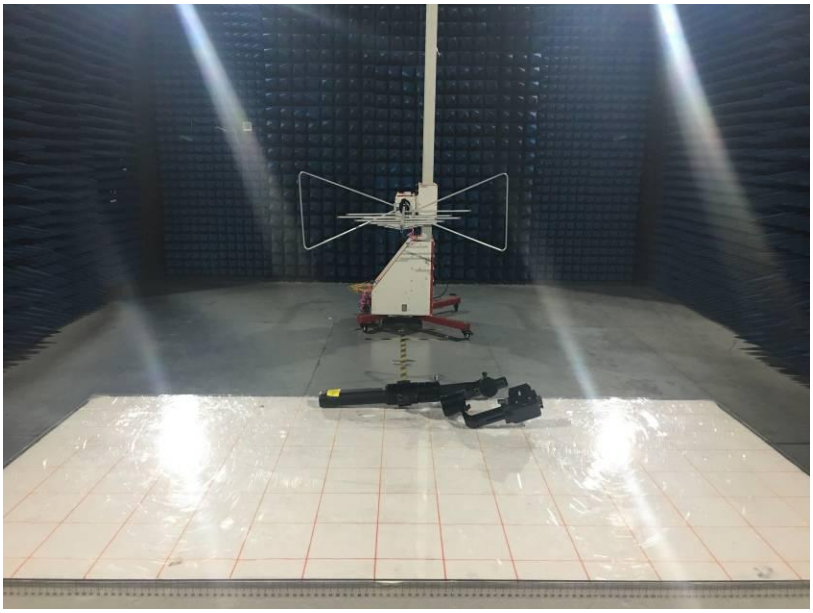
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4960.00	24.45	31.93	8.73	32.16	32.95	54.00	-21.05	Vertical
7440.00	19.38	36.59	11.79	31.78	35.98	54.00	-18.02	Vertical
9920.00	18.59	38.81	14.38	31.88	39.90	54.00	-14.10	Vertical
12400.00	*					54.00		Vertical
14880.00	*					54.00		Vertical
4960.00	28.45	31.93	8.73	32.16	36.95	54.00	-17.05	Horizontal
7440.00	21.42	36.59	11.79	31.78	38.02	54.00	-15.98	Horizontal
9920.00	18.15	38.81	14.38	31.88	39.46	54.00	-14.54	Horizontal
12400.00	*					54.00		Horizontal
14880.00	*					54.00		Horizontal

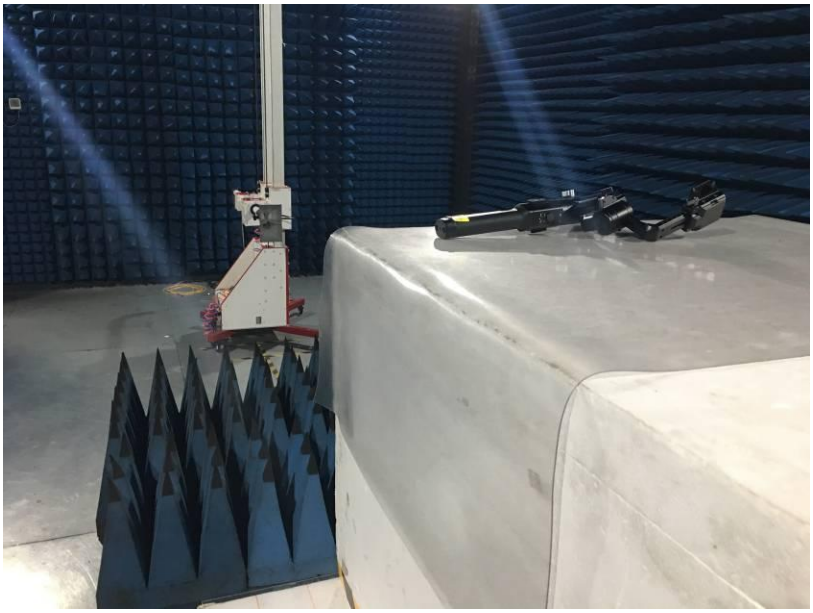
Remarks:

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*
2. *"*", means this data is the too weak instrument of signal is unable to test.*
3. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

8 Test Setup Photo

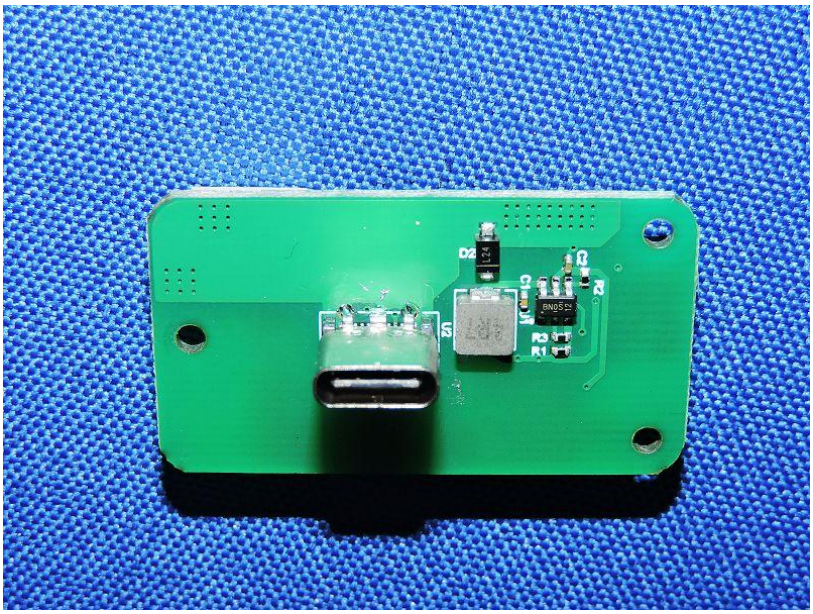
Radiated Emission

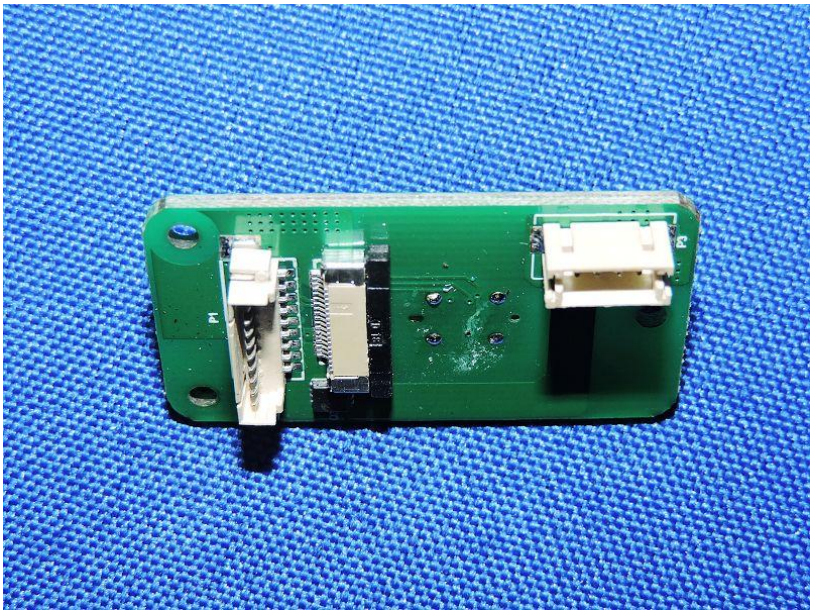


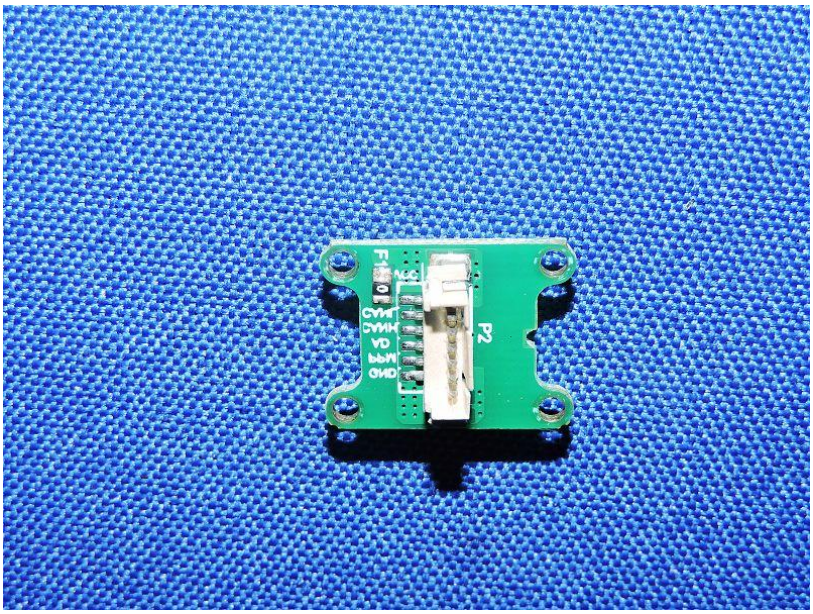


Conducted Emission

9 EUT Constructional Details



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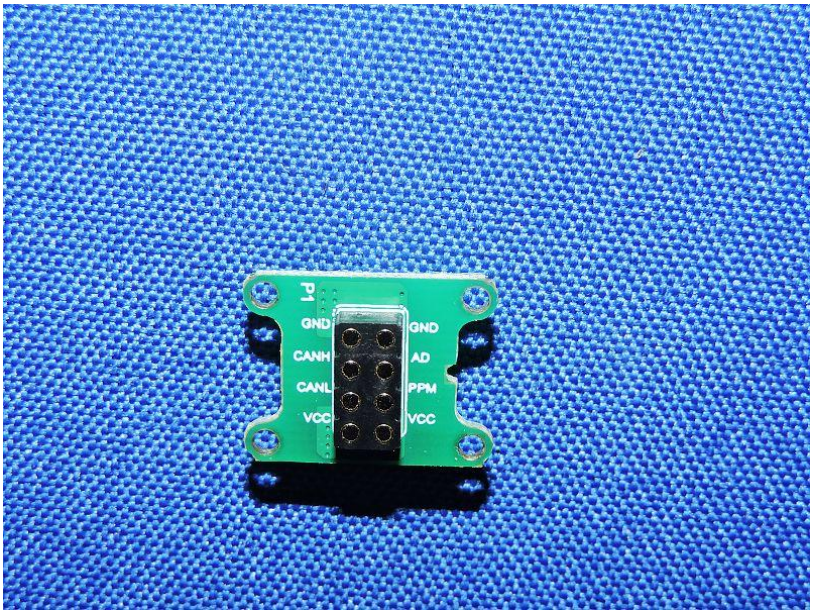
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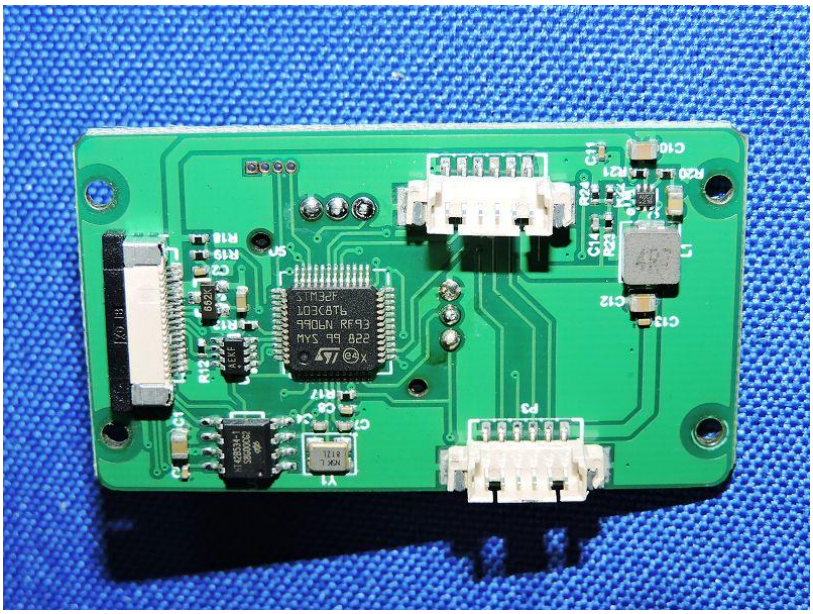
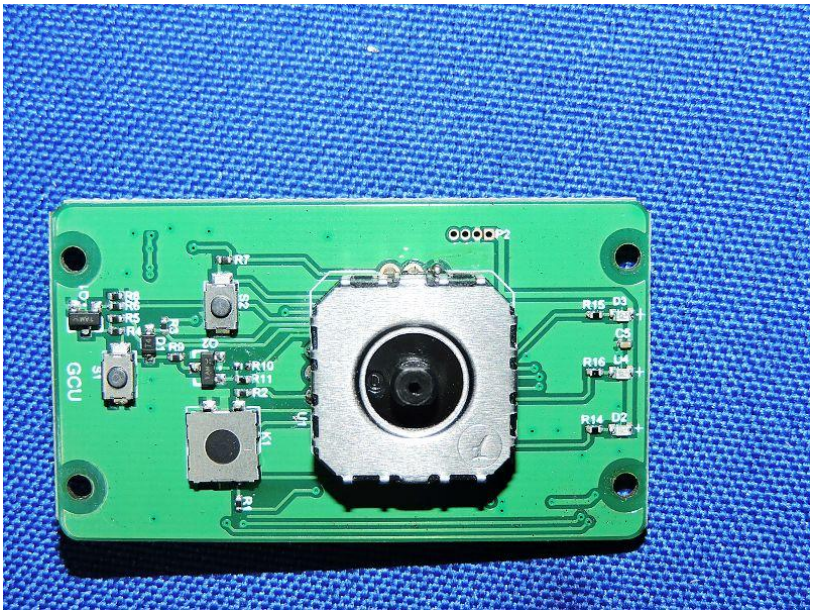
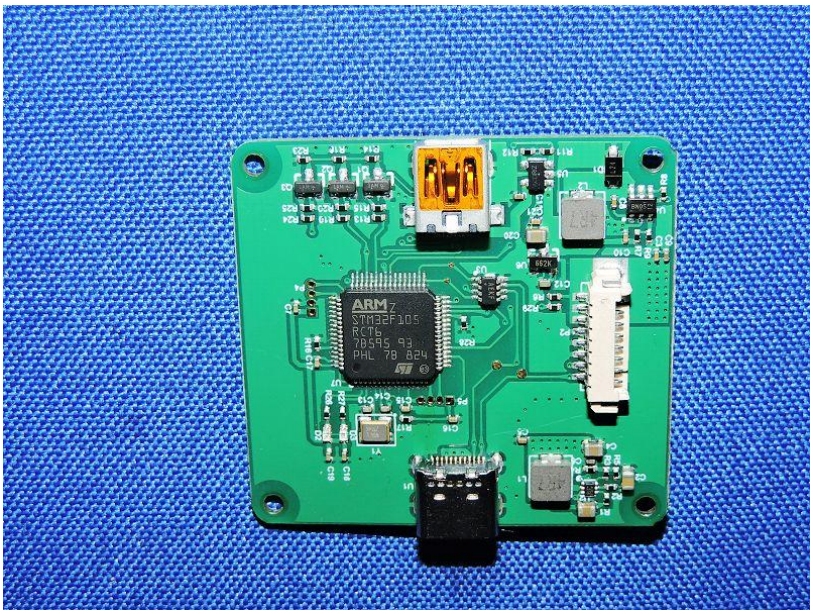
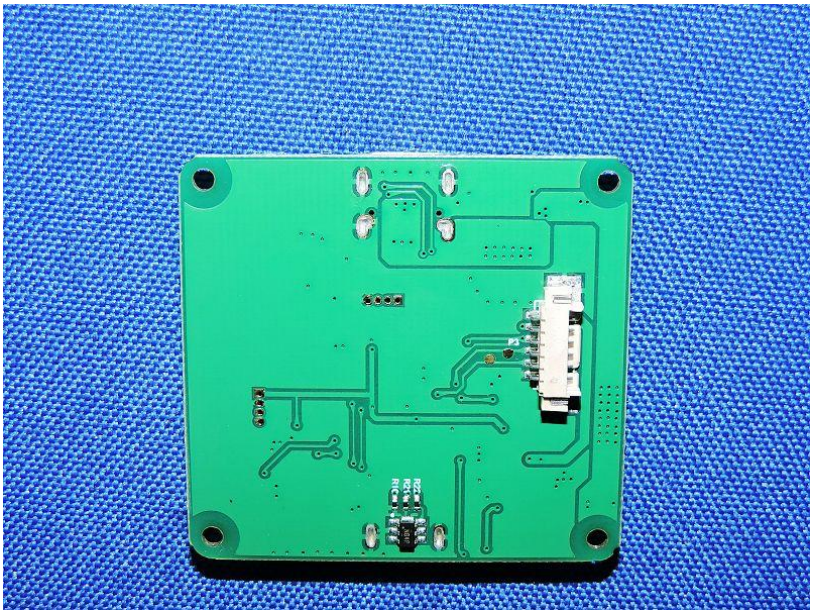
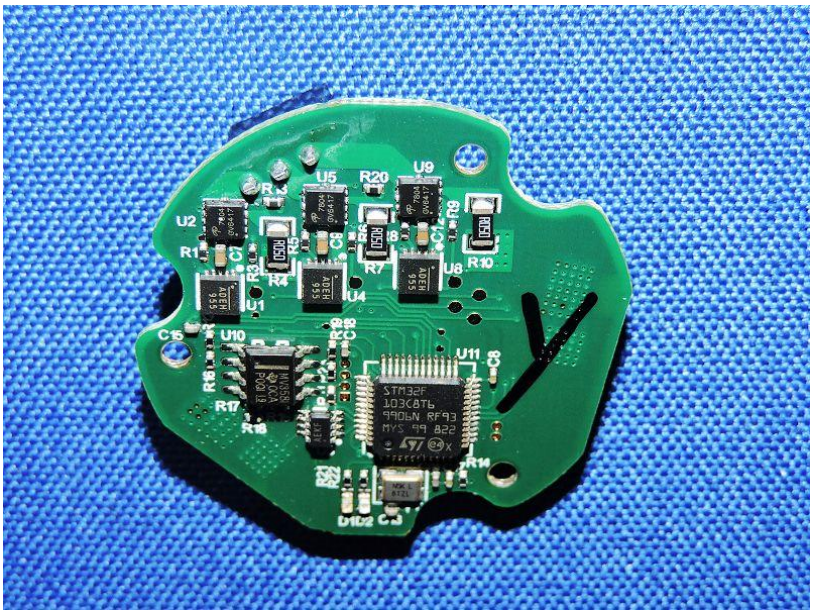
GND
CANH
CANL
VCC
GND
AD
PPM
VCC




GCU


ARM7
STM32F105

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R20
U9
U2
R1
R4
R7
U8
R10
U4
U1
C15
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R17
R18
R14
STM32F
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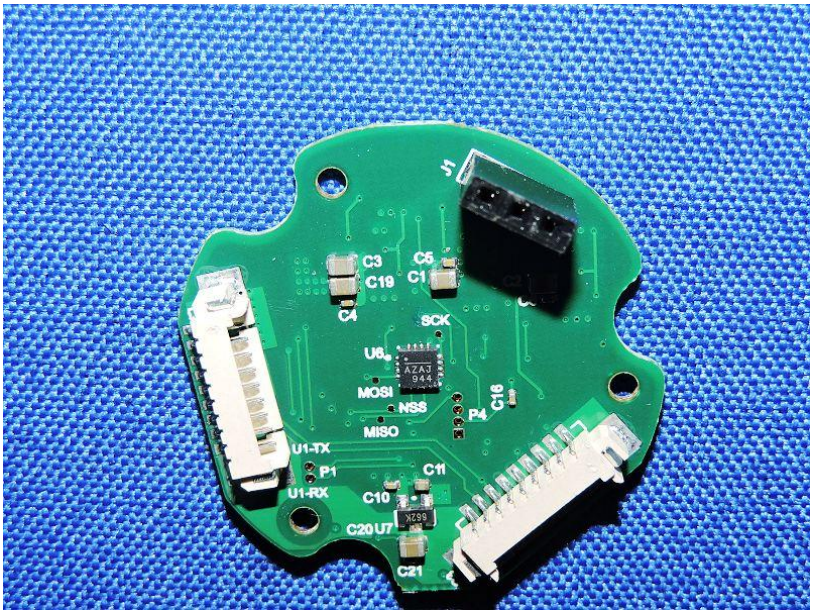
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C5
C1
C4
SCK
U6
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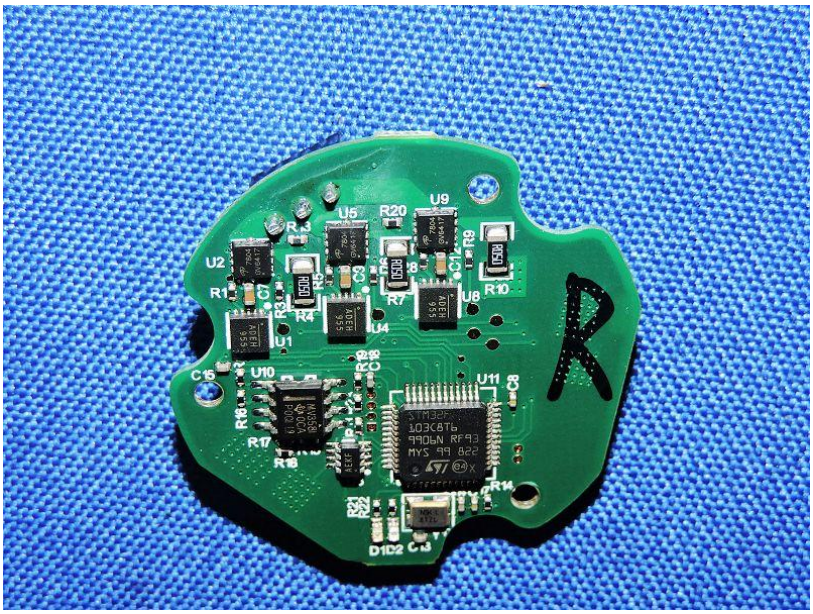
C10
C11
C20
U7
C21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U4
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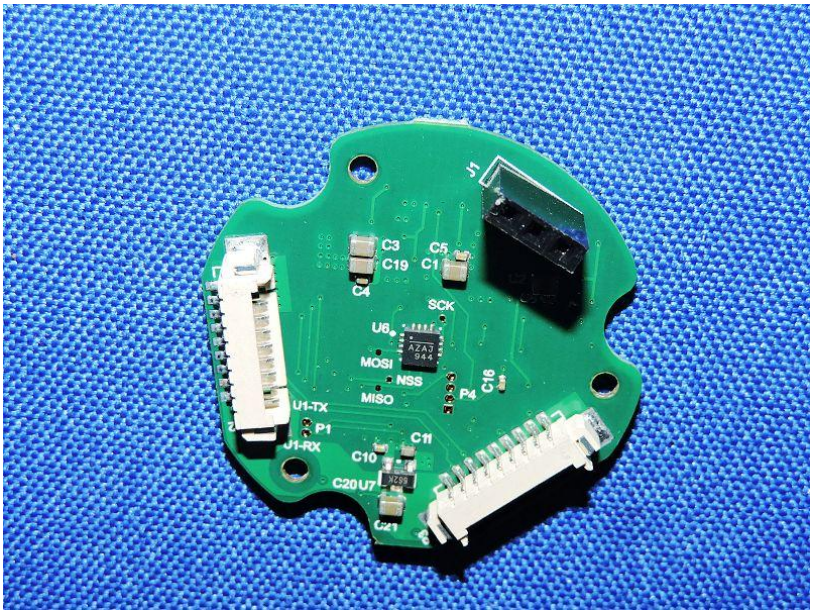
U11
R16
R17
R18
R14
D1
D2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C19
C5
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C4
SCK
U6
MOSI
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MISO
P4
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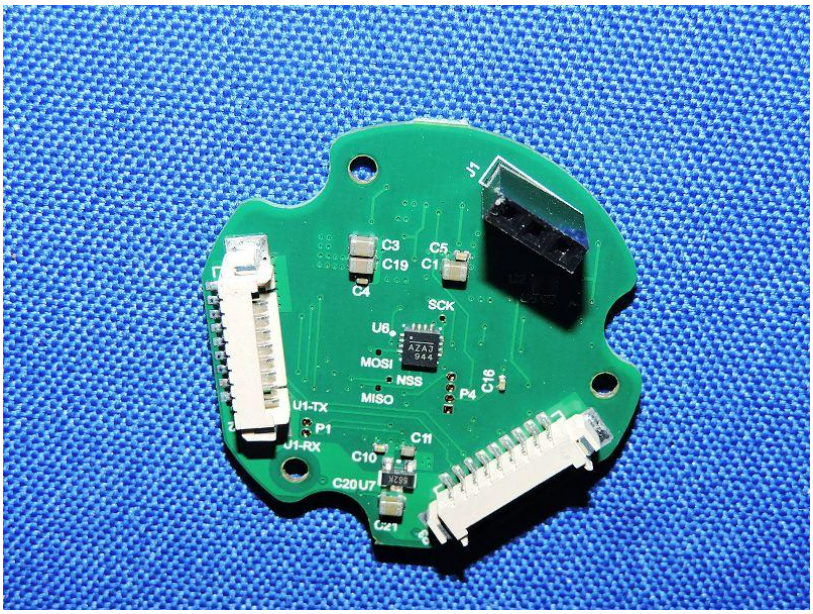
U1-RX
C11
C10
C20
U7
C21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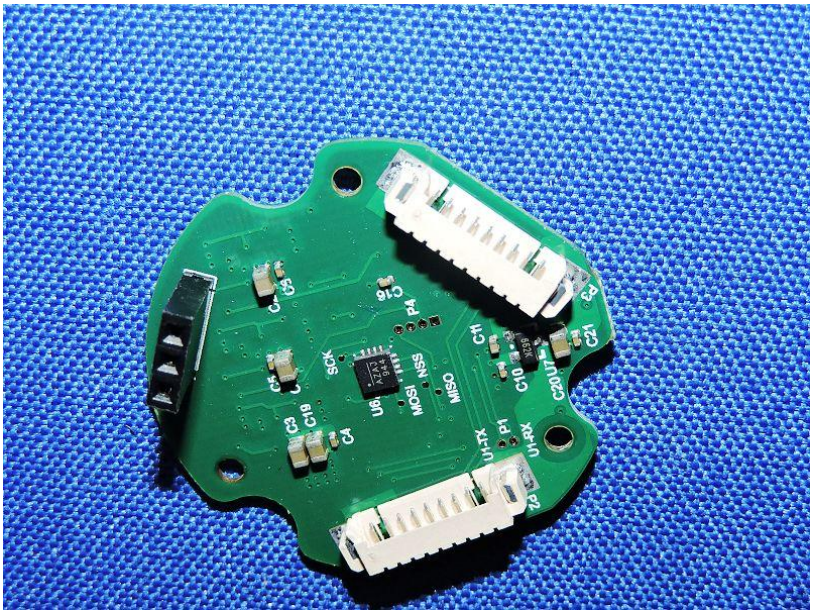
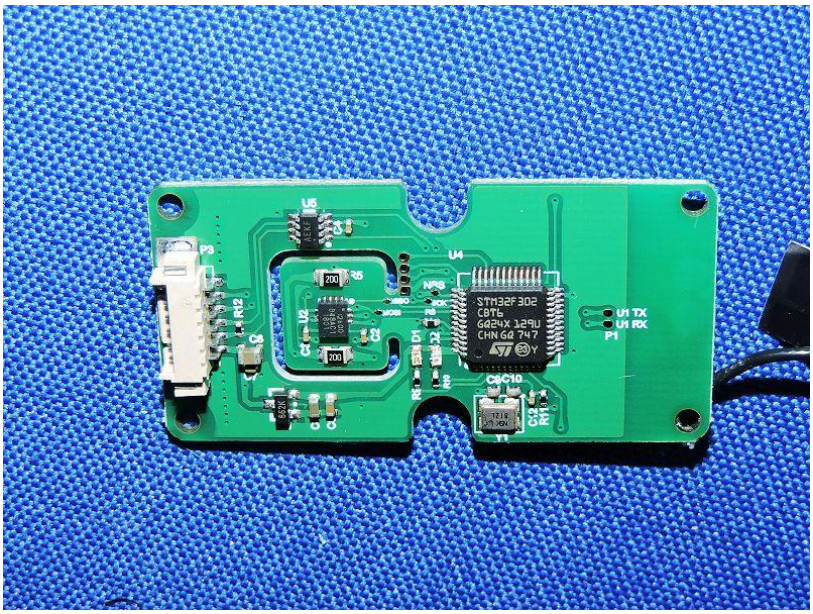
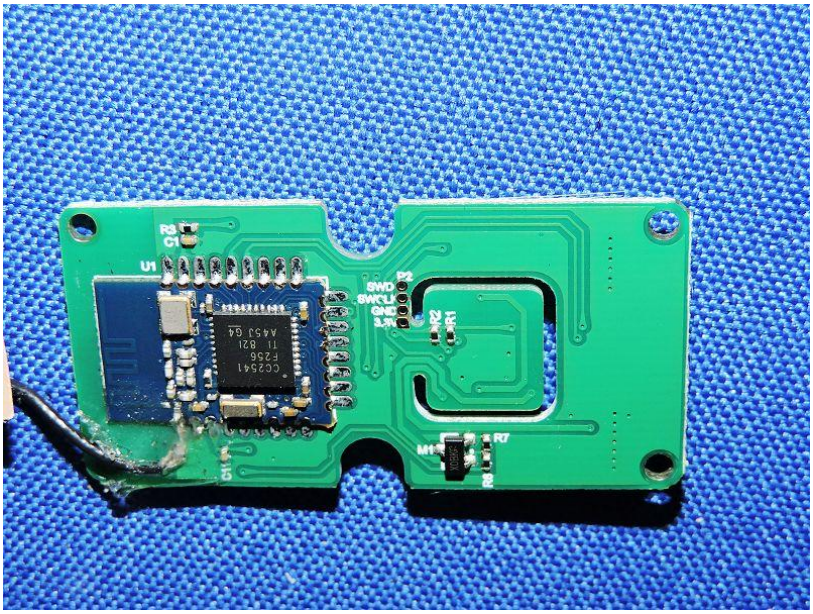
C3
C19
C5
C1
C4
SCK
U6
MOSI
NSS
MISO
P4
C16
U1-TX
P1
U1-RX
C11
C10
C20
U7
C21


C16
P4
C11
C21
SCK
MOSI
MISO
C10
C20
C19
C4
P1
U1-TX
U1-RX
P2


U6
P3
U4
R5
R12
U2
C8
STM32F302
CBT6
U1 TX
U1 RX
P1
C9
C10



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