Test Result for Inspection

Product Name : Sub-1GHz Low-IF FSK Receiver Module

Model No. : BM2502-63-1, BM2502-64-1, BM2502-69-1

Applicant : HOLTEK SEMICONDUCTOR INCORPORATION

Address : NO.3, CREATION RD. II, HSINCHU SCIENCE PARK, HSINCHU, TAIWAN, R.O.C.

Date of Receipt : 2021/10/29

Issued Date : 2021/11/09

Report No. : 21A0968R-E3012300003-1

Report Version : V1.0

Test Result for Inspection

Issued Date : 2021/11/09
Report No. : 21A0968R-E3012300003-1

Product Name	:	Sub-1GHz Low-IF FSK Receiver Module
Applicant	:	HOLTEK SEMICONDUCTOR INCORPORATION
Address	:	NO.3, CREATION RD. II, HSINCHU SCIENCE PARK, HSINCHU, TAIWAN, R.O.C.
Manufacturer	:	N/A
Model No.	:	BM2502-63-1, BM2502-64-1, BM2502-69-1
EUT Rated Voltage	:	DC 9V (by Battery)
EUT Test Voltage	:	DC 9V (by Battery)
Trade Name	:	HOLTEK
Applicable Standard	:	FCC CFR Title 47 Part 15 Subpart B: 2020, Class B
Description for Test	:	None

(Vincent Lin)
Approval

(Steven Lee)
Test Engineer

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Revision History

Report No.	Version	Description	Issued Date
21A0968R-E3012300003-1	V1.0	Initial issue of report.	2021-11-09

1. Mode of Operation

DEKRA has verified the construction and function in typical operation. All the test modes were carried out with the EUT in normal operation, which was shown in this test report and defined as:

Pre-Test Mode	
Mode 1: BM2502-63-1 Mode 2: BM2502-64-1 Mode 3: BM2502-69-1	
Final Test Mode	
Emission	Mode 1: BM2502-63-1 Mode 2: BM2502-64-1 Mode 3: BM2502-69-1

2. Technical Test

2.1. Summary of Test Result

☒ No deviations from the test standards

☐ Deviations from the test standards as below description:

Emission			
Performed Item	Normative References	Test Performed	Deviation
Radiated Emission	FCC CFR Title 47 Part 15 Subpart B: 2020, Class B CISPR 22: 2008 ANSI C63.4-2014, ANSI C63.4a-2017	Yes	No

2.2. List of Test Equipment

Radiated Emission / Site3

Instrument	Manufacturer	Type No.	Serial No	Cal. Date	Due. Date
Bilog Antenna	Schaffner	CBL6112B	2707	2021/02/26	2022/02/25
EMI Test Receiver	R&S	ESCS 30	838251/001	2021/07/16	2022/07/15
Coaxial Cable	SUHNER	RG 214	LC003A-RG LC003B-RG	2021/06/11	2022/06/10
Coaxial Switch	Anritsu	MP59B	6201415889	2021/06/11	2022/06/10
Preamplifier	Jet-Power	JPA-10M1G33	170101000330010	2021/06/11	2022/06/10
NSA	DEKRA	N/A	N/A	2021/06/11	2022/06/10

Note: Test Receiver Detector: Quasipeak Bandwidth: 120kHz

Radiated Emission (Above 1GHz) / CB7

Instrument	Manufacturer	Type No.	Serial No	Cal. Date	Due. Date
Double Ridged Guide Horn Antenna	ETS-Lindgren	3117	00202723	2021/10/12	2022/10/11
EMI Test Receiver	R&S	ESU26	100433	2020/11/20	2021/11/19
Coaxial Cable	SUHNER	SUCOFLEX 104	LC034-SF	2021/06/21	2022/06/20
Coaxial Cable	ROSNOL	R-Test EW0630	LC046-SF	2021/06/21	2022/06/20
Coaxial Cable	ROSNOL	MP533A	AC031-MP	2021/06/21	2022/06/20
Microwave Preamplifier	SGH	SGH118	20200301	2021/07/30	2022/07/29
VSWR	DEKRA	N/A	N/A	2021/06/22	2022/06/21

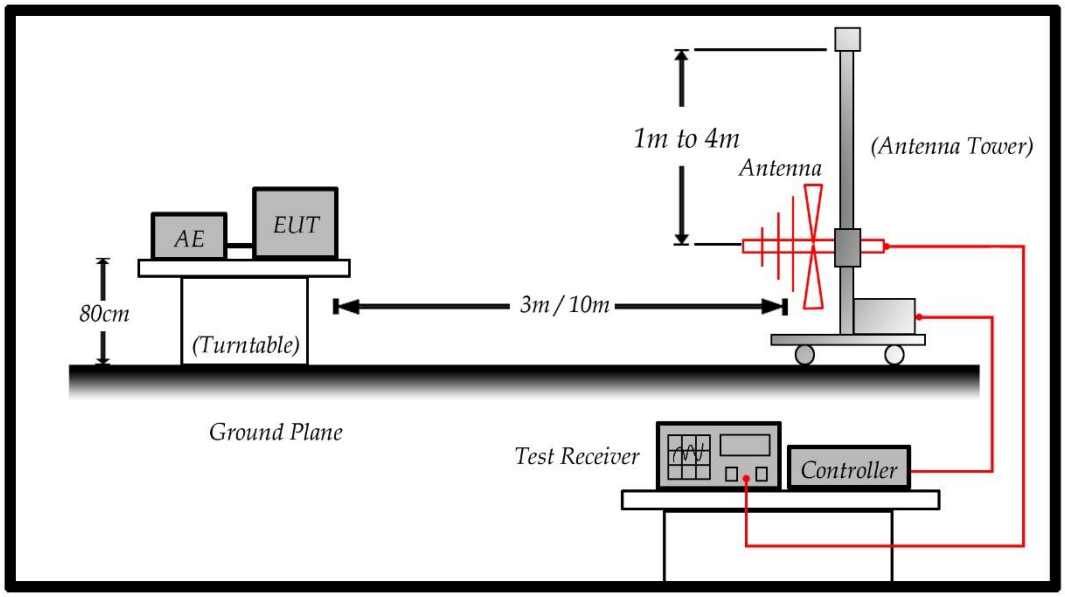
3. Radiated Emission

3.1. Test Specification

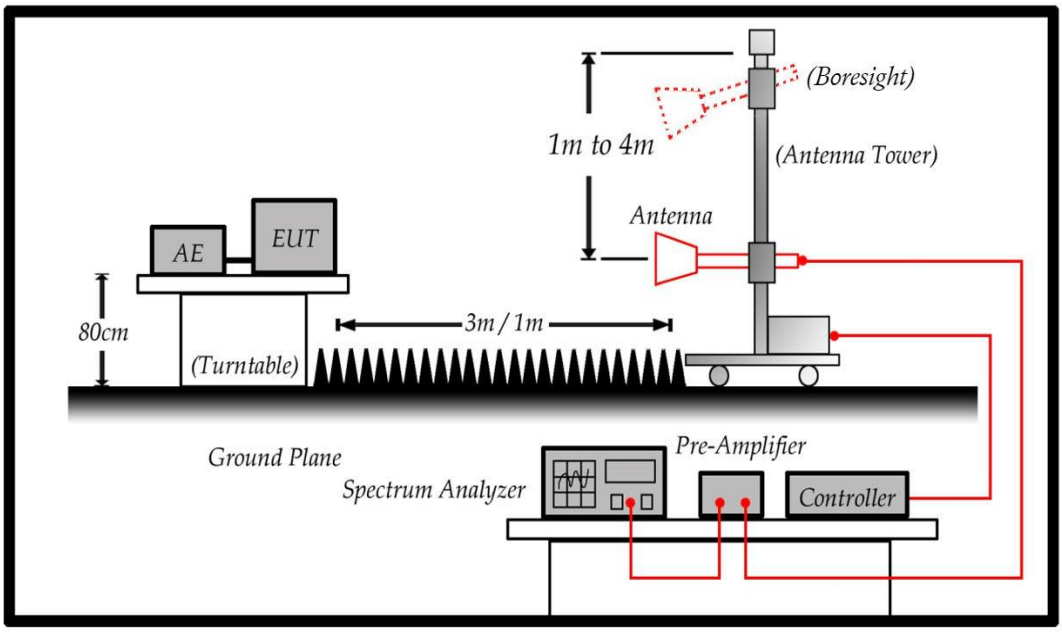
According to Standard : FCC Part 15 Subpart B, CISPR 22: 2008

3.2. Test Setup

Under 1GHz Test Setup:



Above 1GHz Test Setup:



3.3. Limit

Under 1GHz test shall not exceed the following value:

Limits		
Frequency (MHz)	Distance (m)	dBuV/m
30 – 230	10	30
230 – 1000	10	37

Remark:

1. The tighter limit shall apply at the edge between two frequency bands.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

Above 1GHz test shall not exceed the following value:

FCC Part 15 Subpart B Paragraph 15.109 Limits (dBuV/m)		
Frequency (MHz)	Distance (m)	dBuV/m
30-88	3	40
88-216	3	43.5
216-960	3	46.0
960-1000	3	54
1000-40000	3	54
18000-40000	1	63.5

Remark:

1. The tighter limit shall apply at the edge between two frequency bands.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
3. RF Voltage (dBuV/m) = 20 log RF Voltage (uV/m)

3.4. Test Procedure

The EUT and its simulators are placed on a turn table which is 0.8 meter above ground.

The turn table can rotate 360 degrees to determine the position of the maximum emission level and the antenna (boresight antenna tower) can move up and down between 1 meter and 4 meters to find out the maximum emission level.

Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated on radiated measurement.

For an unintentional radiator, including a digital device, the spectrum shall be investigated from the lowest radio frequency signal generated or used in the device, without going below the lowest frequency for which a radiated emission limit is specified, up to the frequency shown in the folowing table:

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30
1.705 – 108	1000
108 – 500	2000
500 – 1000	5000
Above 1000	5^{th} harmonic of the highest frequency or 40 GHz, whichever is lower

On any frequency or frequencies below or equal to 1000 MHz, the radiated limits shown are based on measuring equipment employing a quasi-peak detector function and above 1000 MHz, the radiated limits shown are based measuring equipment employing an average detector function.

When average radiated emission measurement are included emission measurement Above 1000 MHz, there also is a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.

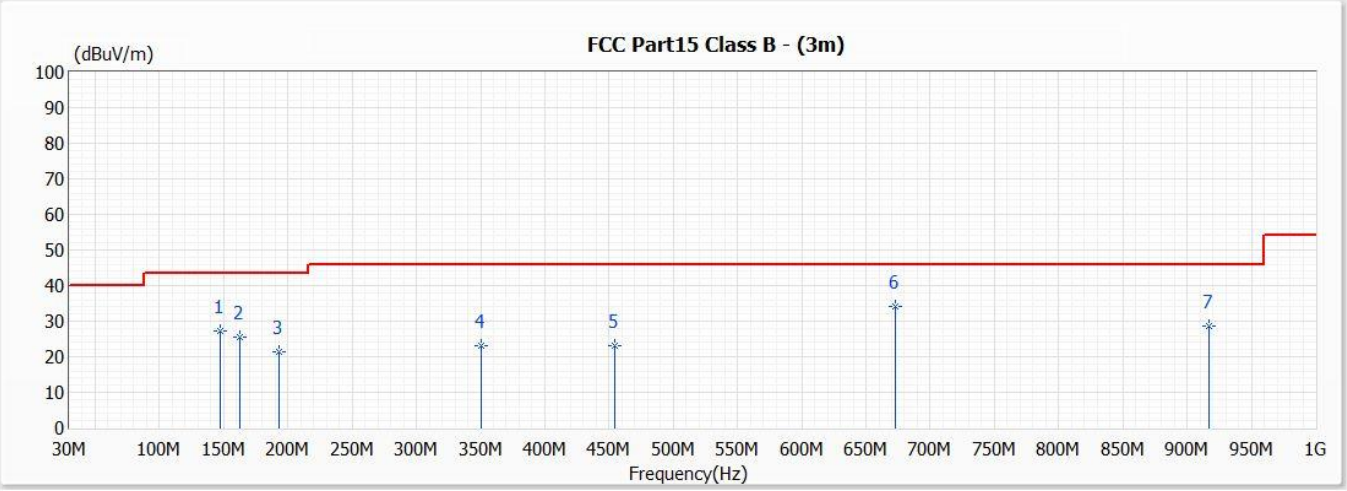
For class A, the measurement distance between the EUT and antenna is 10 meters for under 1GHz and above 1GHz.

For class B, the measurement distance between the EUT and antenna is 10 meters for under 1GHz and 3 meters for above 1GHz.

The bandwidth below 1GHz setting on the field strength meter (Test Receiver) is 120 kHz and above 1GHz is 1MHz.

3.5. Test Result

Model No	BM2502-63-1	Site	SITE3
Test Voltage	DC 9V	Test Date	2021/11/4
Test Mode	Mode 1	Engineer	Cloud Hsieh
Polarity	Horizontal	Temperature (℃)	24C
Test Condition	--	Humidity (%RH)	68%

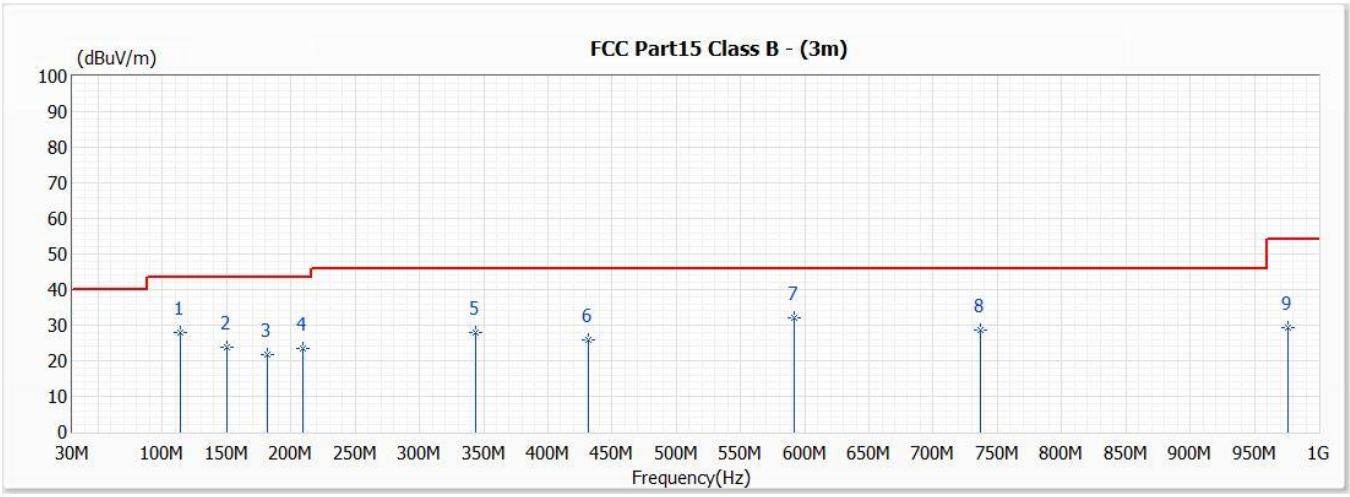


No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Reading Level (dBuV)	Correct Factor (dB/m)	Ant Pos (cm)	TT Pos (deg)	Detector Type
1	147.520	27.07	43.50	-16.43	39.90	-12.83	370	161	QP
2	162.600	25.64	43.50	-17.86	39.40	-13.76	370	152	QP
3	192.920	21.53	43.50	-21.97	35.90	-14.37	370	149	QP
4	350.000	23.21	46.00	-22.79	30.90	-7.69	300	114	QP
5	454.400	23.20	46.00	-22.80	27.70	-4.50	200	159	QP
* 6	672.800	34.27	46.00	-11.73	34.40	-0.13	100	112	QP
7	916.800	28.48	46.00	-17.52	24.50	3.98	100	152	QP

Remark:

1. "*" means this data is the worst emission level;"!" means this data is over limit.
2. Emission Level=Reading Level + Correct Factor(Correct Factor=Ant Factor+Cable Loss-Pre Amp).
3. Margin=Emission Level-Limit.

Model No	BM2502-63-1	Site	SITE3
Test Voltage	DC 9V	Test Date	2021/11/4
Test Mode	Mode 1	Engineer	Cloud Hsieh
Polarity	Vertical	Temperature (℃)	24C
Test Condition	--	Humidity (%RH)	68%

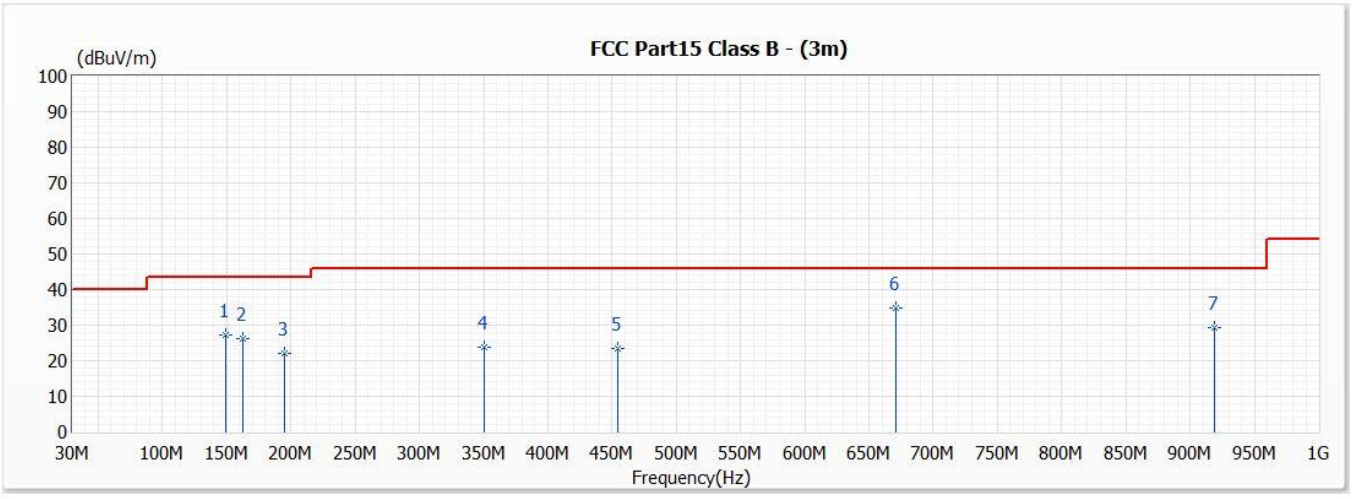


No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Reading Level (dBuV)	Correct Factor (dB/m)	Ant Pos (cm)	TT Pos (deg)	Detector Type
1	114.120	28.00	43.50	-15.50	40.50	-12.50	100	-126	QP
2	150.120	23.83	43.50	-19.67	36.90	-13.07	100	19	QP
3	181.960	21.69	43.50	-21.81	36.20	-14.51	100	-191	QP
4	209.400	23.41	43.50	-20.09	37.30	-13.89	100	97	QP
5	344.200	27.94	46.00	-18.06	35.90	-7.96	100	-97	QP
6	432.000	25.73	46.00	-20.27	30.60	-4.87	300	192	QP
* 7	591.800	32.20	46.00	-13.80	33.60	-1.40	300	-151	QP
8	737.200	28.51	46.00	-17.49	27.20	1.31	250	58	QP
9	976.000	29.46	54.00	-24.54	24.40	5.06	150	-97	QP

Remark:

1. "*" means this data is the worst emission level;"!" means this data is over limit.
2. Emission Level=Reading Level + Correct Factor(Correct Factor=Ant Factor+Cable Loss-Pre Amp).
3. Margin=Emission Level-Limit.

Model No	BM2502-64-1	Site	SITE3
Test Voltage	DC 9V	Test Date	2021/11/4
Test Mode	Mode 2	Engineer	Cloud Hsieh
Polarity	Horizontal	Temperature (℃)	24C
Test Condition	--	Humidity (%RH)	68%

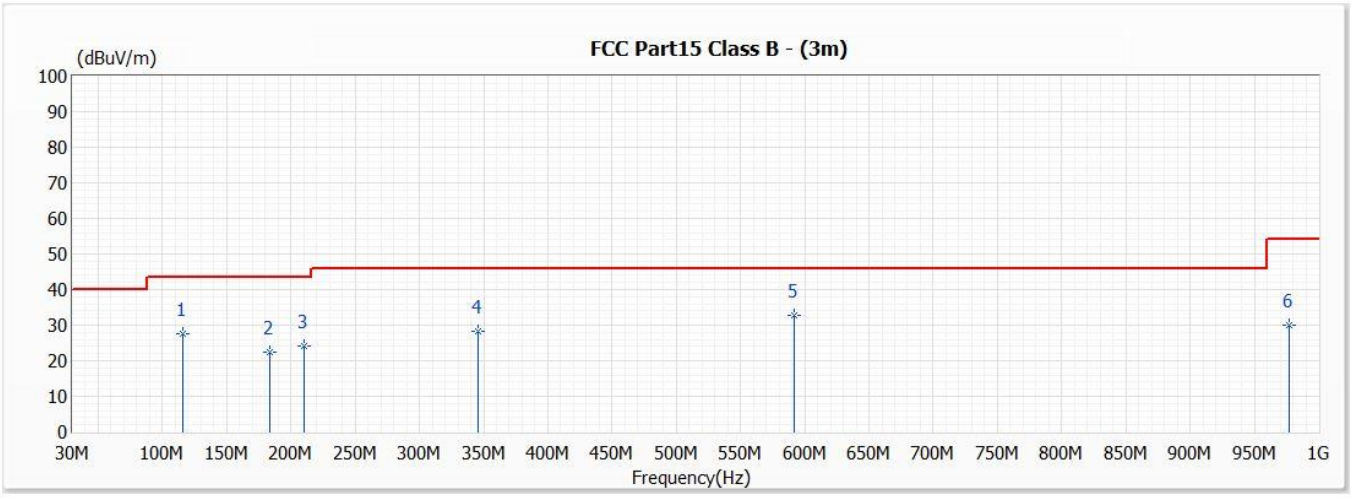


No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Reading Level (dBuV)	Correct Factor (dB/m)	Ant Pos (cm)	TT Pos (deg)	Detector Type
1	149.600	27.15	43.50	-16.35	40.20	-13.05	370	152	QP
2	162.400	26.16	43.50	-17.34	39.90	-13.74	370	142	QP
3	195.100	21.97	43.50	-21.53	36.30	-14.33	370	152	QP
4	350.600	23.94	46.00	-22.06	31.60	-7.66	300	129	QP
5	454.900	23.41	46.00	-22.59	27.90	-4.49	200	162	QP
* 6	670.500	34.83	46.00	-11.17	34.90	-0.07	100	129	QP
7	919.200	29.14	46.00	-16.86	25.10	4.04	100	149	QP

Remark:

1. "*" means this data is the worst emission level;"!" means this data is over limit.
2. Emission Level=Reading Level + Correct Factor(Correct Factor=Ant Factor+Cable Loss-Pre Amp).
3. Margin=Emission Level-Limit.

Model No	BM2502-64-1	Site	SITE3
Test Voltage	DC 9V	Test Date	2021/11/4
Test Mode	Mode 2	Engineer	Cloud Hsieh
Polarity	Vertical	Temperature (℃)	24C
Test Condition	--	Humidity (%RH)	68%

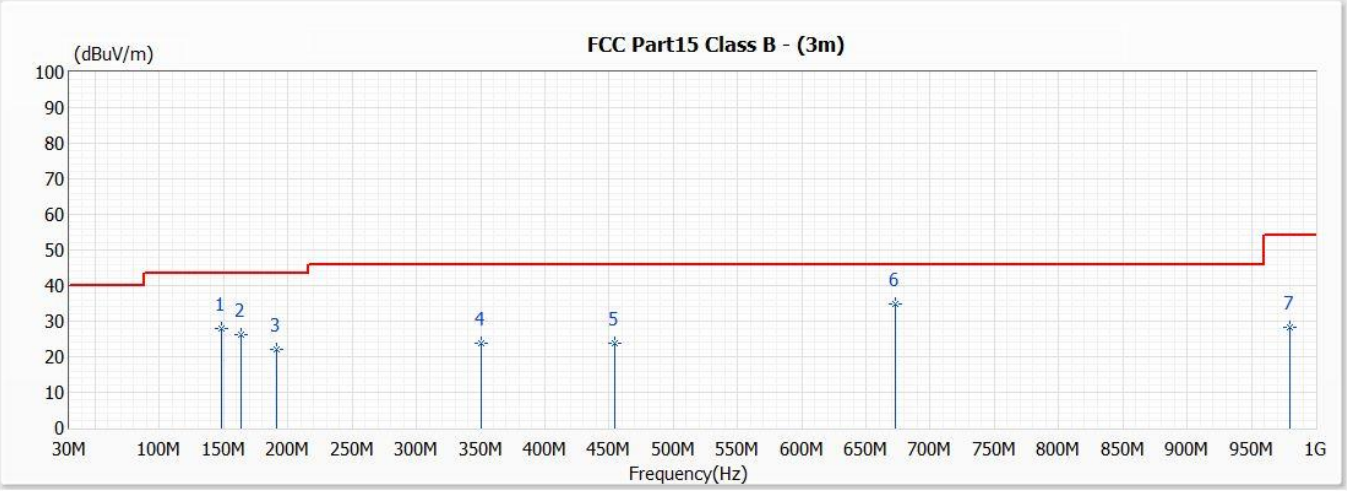


No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Reading Level (dBuV)	Correct Factor (dB/m)	Ant Pos (cm)	TT Pos (deg)	Detector Type
1	115.800	27.54	43.50	-15.96	40.10	-12.56	100	-119	QP
2	183.400	22.41	43.50	-21.09	36.90	-14.49	100	-185	QP
3	210.500	23.98	43.50	-19.52	37.90	-13.92	100	106	QP
4	345.800	28.41	46.00	-17.59	36.30	-7.89	100	-99	QP
* 5	592.100	32.61	46.00	-13.39	34.00	-1.39	300	-169	QP
6	977.200	30.09	54.00	-23.91	25.00	5.09	150	-90	QP

Remark:

1. "*" means this data is the worst emission level;"!" means this data is over limit.
2. Emission Level=Reading Level + Correct Factor(Correct Factor=Ant Factor+Cable Loss-Pre Amp).
3. Margin=Emission Level-Limit.

Model No	BM2502-69-1	Site	SITE3
Test Voltage	DC 9V	Test Date	2021/11/4
Test Mode	Mode 3	Engineer	Cloud Hsieh
Polarity	Horizontal	Temperature (℃)	24C
Test Condition	--	Humidity (%RH)	68%

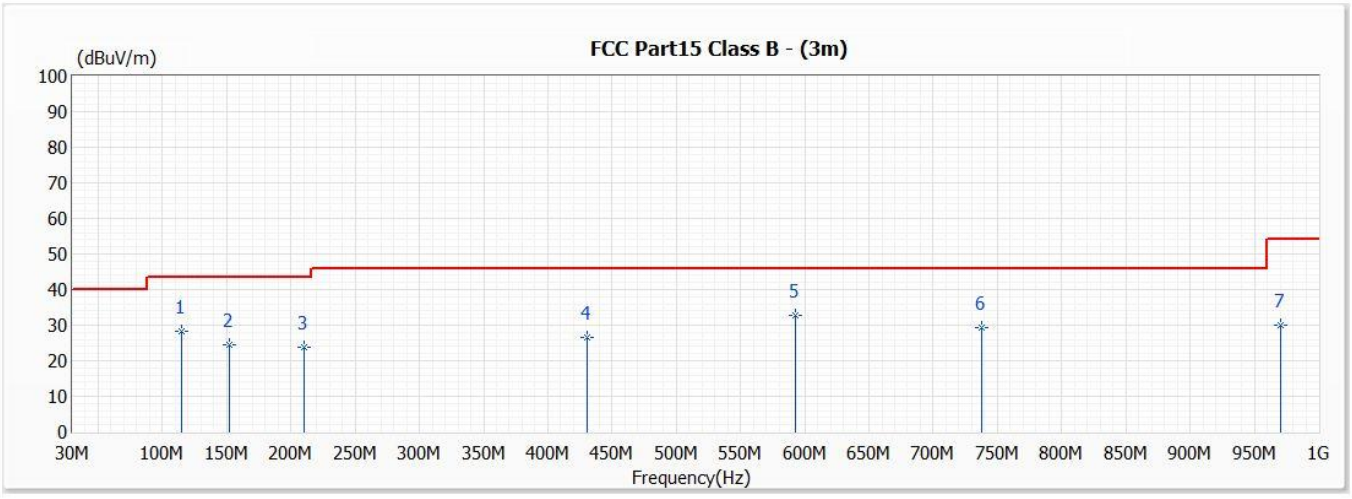


No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Reading Level (dBuV)	Correct Factor (dB/m)	Ant Pos (cm)	TT Pos (deg)	Detector Type
1	147.800	28.04	43.50	-15.46	40.90	-12.86	370	152	QP
2	163.900	26.12	43.50	-17.38	39.90	-13.78	370	163	QP
3	191.400	22.12	43.50	-21.38	36.60	-14.48	370	156	QP
4	350.800	23.95	46.00	-22.05	31.60	-7.65	300	129	QP
5	454.900	23.71	46.00	-22.29	28.20	-4.49	200	169	QP
* 6	672.800	34.77	46.00	-11.23	34.90	-0.13	100	129	QP
7	980.400	28.18	54.00	-25.82	23.00	5.18	100	169	QP

Remark:

1. "*" means this data is the worst emission level;"!" means this data is over limit.
2. Emission Level=Reading Level + Correct Factor(Correct Factor=Ant Factor+Cable Loss-Pre Amp).
3. Margin=Emission Level-Limit.

Model No	BM2502-69-1	Site	SITE3
Test Voltage	DC 9V	Test Date	2021/11/4
Test Mode	Mode 3	Engineer	Cloud Hsieh
Polarity	Vertical	Temperature (℃)	24C
Test Condition	--	Humidity (%RH)	68%

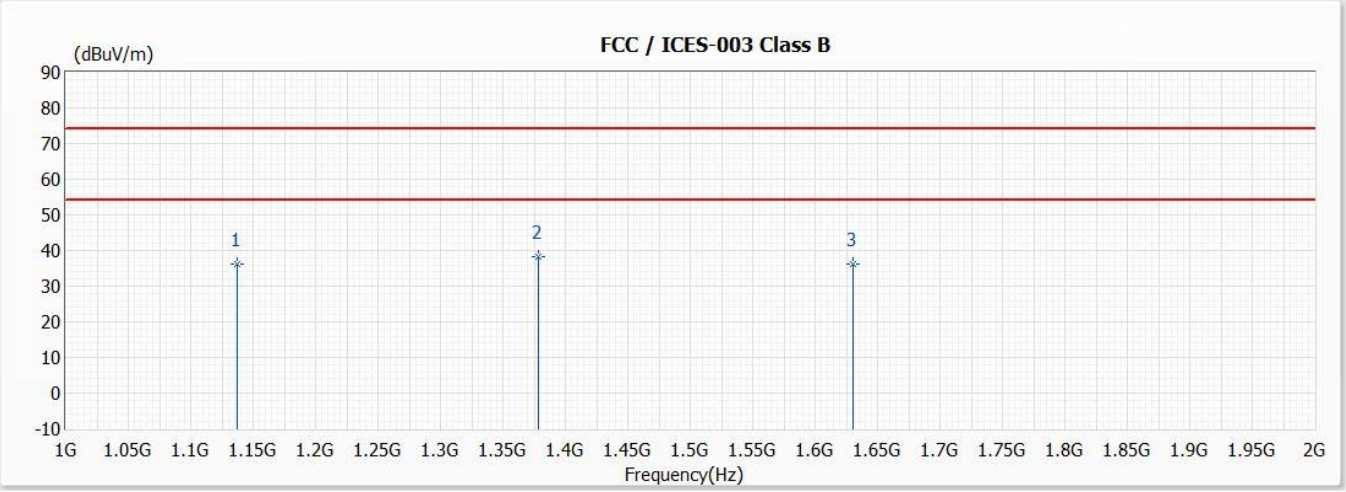


No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Reading Level (dBuV)	Correct Factor (dB/m)	Ant Pos (cm)	TT Pos (deg)	Detector Type
1	114.900	28.41	43.50	-15.09	40.90	-12.49	100	-125	QP
2	151.800	24.34	43.50	-19.16	37.40	-13.06	100	26	QP
3	210.400	23.69	43.50	-19.81	37.60	-13.91	100	85	QP
4	430.400	26.72	46.00	-19.28	31.60	-4.88	300	185	QP
* 5	592.600	32.82	46.00	-13.18	34.20	-1.38	300	-110	QP
6	737.900	29.24	46.00	-16.76	27.90	1.34	250	63	QP
7	970.500	29.89	54.00	-24.11	24.90	4.99	150	-90	QP

Remark:

1. "*" means this data is the worst emission level;"!" means this data is over limit.
2. Emission Level=Reading Level + Correct Factor(Correct Factor=Ant Factor+Cable Loss-Pre Amp).
3. Margin=Emission Level-Limit.

Model No	BM2502-63-1	Site	CB7
Test Voltage	DC 9V	Test Date	2021/11/5
Test Mode	Mode 1	Engineer	Nilk Chen
Polarity	Horizontal	Temperature (℃)	26.1
Test Condition	--	Humidity (%RH)	62

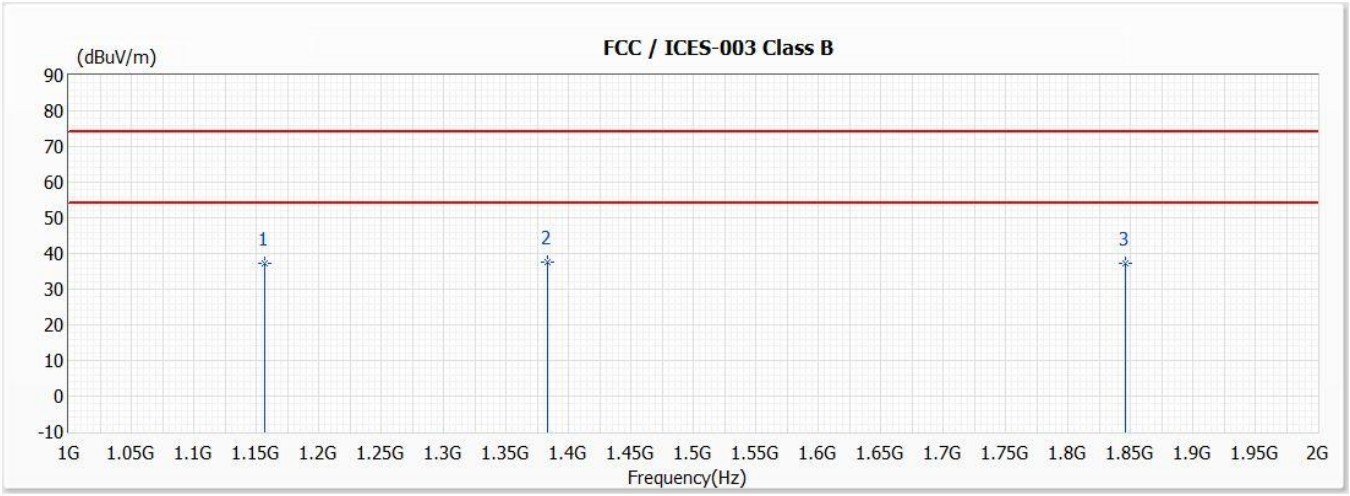


No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Reading Level (dBuV)	Correct Factor (dB/m)	Ant Pos (cm)	TT Pos (deg)	Detector Type
1	1137.000	36.23	74.00	-37.77	49.06	-12.83	130	42	PK
* 2	1378.000	38.17	74.00	-35.83	49.75	-11.58	100	-109	PK
3	1630.000	36.14	74.00	-37.86	48.03	-11.89	150	84	PK

Remark:

1. "*" means this data is the worst emission level;"!" means this data is over limit.
2. Emission Level=Reading Level + Correct Factor (Correct Factor=Ant Factor+Cable Loss-Pre Amp).
3. Margin= Emission Level-Limit.
4. The above 1 GHz test. When PEAK measures level less than AV limit by 20 dBuV, its average is not measured separately.

Model No	BM2502-63-1	Site	CB7
Test Voltage	DC 9V	Test Date	2021/11/5
Test Mode	Mode 1	Engineer	Nilk Chen
Polarity	Vertical	Temperature (℃)	26.1
Test Condition	--	Humidity (%RH)	62

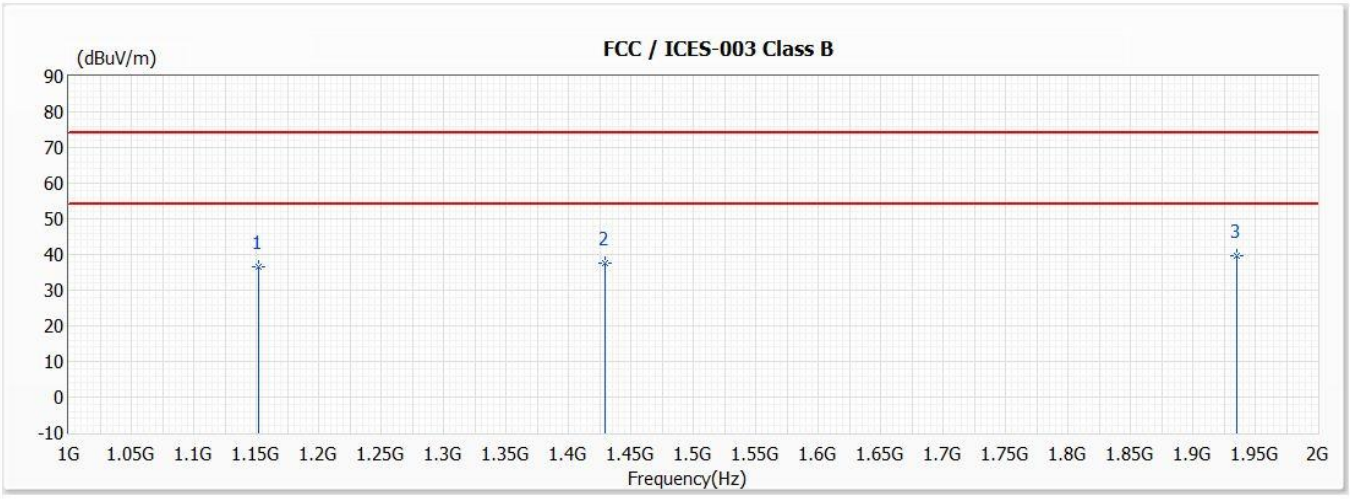


No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Reading Level (dBuV)	Correct Factor (dB/m)	Ant Pos (cm)	TT Pos (deg)	Detector Type
1	1157.000	37.08	74.00	-36.92	49.70	-12.62	160	147	PK
* 2	1383.000	37.46	74.00	-36.54	48.95	-11.49	150	-9	PK
3	1846.000	37.12	74.00	-36.88	46.17	-9.05	110	28	PK

Remark:

1. "*" means this data is the worst emission level;"!" means this data is over limit.
2. Emission Level=Reading Level + Correct Factor (Correct Factor=Ant Factor+Cable Loss-Pre Amp).
3. Margin= Emission Level-Limit.
4. The above 1 GHz test. When PEAK measures level less than AV limit by 20 dBuV, its average is not measured separately.

Model No	BM2502-64-1	Site	CB7
Test Voltage	DC 9V	Test Date	2021/11/5
Test Mode	Mode 2	Engineer	Nilk Chen
Polarity	Horizontal	Temperature (℃)	26.1
Test Condition	--	Humidity (%RH)	62

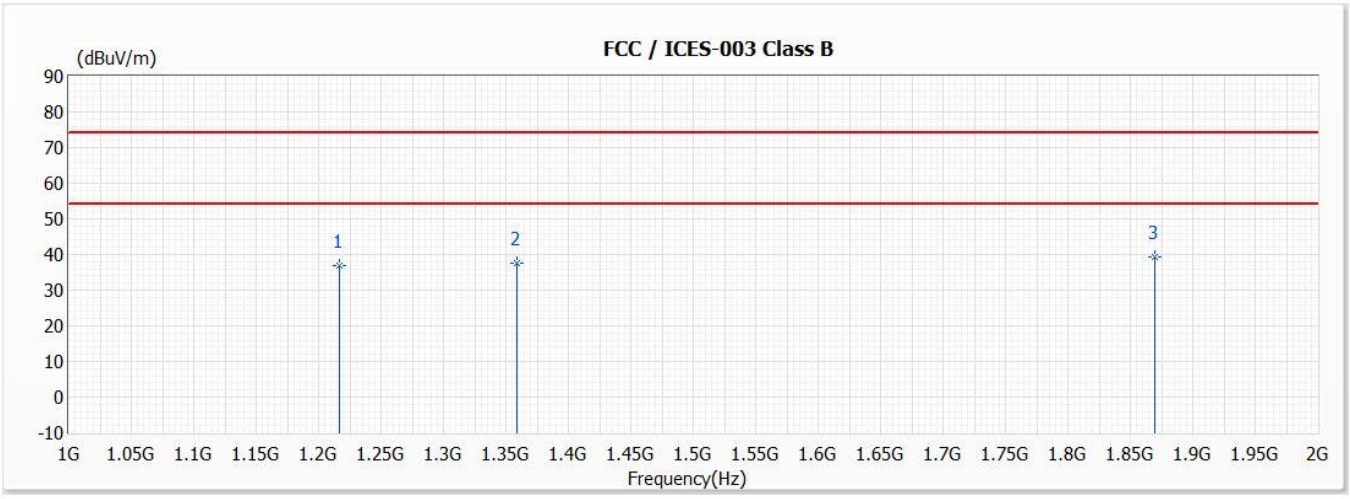


No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Reading Level (dBuV)	Correct Factor (dB/m)	Ant Pos (cm)	TT Pos (deg)	Detector Type
1	1152.000	36.70	74.00	-37.30	49.32	-12.62	110	-69	PK
2	1429.000	37.60	74.00	-36.40	49.08	-11.48	160	194	PK
* 3	1935.000	39.68	74.00	-34.32	47.91	-8.23	100	88	PK

Remark:

1. "*" means this data is the worst emission level;"!" means this data is over limit.
2. Emission Level=Reading Level + Correct Factor (Correct Factor=Ant Factor+Cable Loss-Pre Amp).
3. Margin= Emission Level-Limit.
4. The above 1 GHz test. When PEAK measures level less than AV limit by 20 dBuV, its average is not measured separately.

Model No	BM2502-64-1	Site	CB7
Test Voltage	DC 9V	Test Date	2021/11/5
Test Mode	Mode 2	Engineer	Nilk Chen
Polarity	Vertical	Temperature (℃)	26.1
Test Condition	--	Humidity (%RH)	62

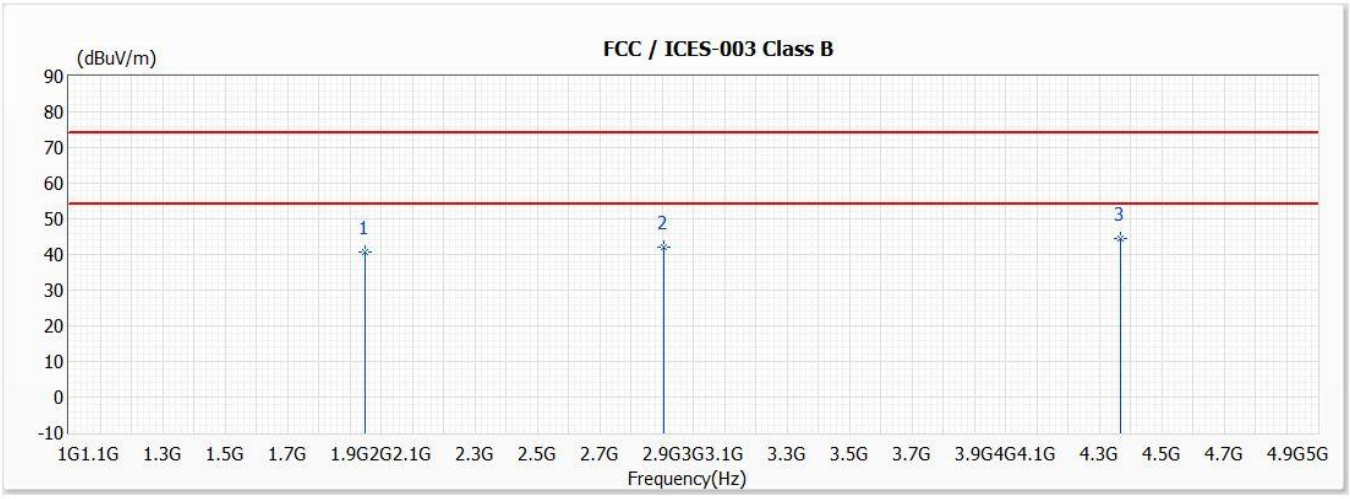


No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Reading Level (dBuV)	Correct Factor (dB/m)	Ant Pos (cm)	TT Pos (deg)	Detector Type
1	1217.000	36.99	74.00	-37.01	49.62	-12.63	140	191	PK
2	1359.000	37.54	74.00	-36.46	49.41	-11.87	130	-158	PK
* 3	1870.000	39.23	74.00	-34.77	48.03	-8.80	100	-44	PK

Remark:

1. "*" means this data is the worst emission level;"!" means this data is over limit.
2. Emission Level=Reading Level + Correct Factor (Correct Factor=Ant Factor+Cable Loss-Pre Amp).
3. Margin= Emission Level-Limit.
4. The above 1 GHz test. When PEAK measures level less than AV limit by 20 dBuV, its average is not measured separately.

Model No	BM2502-69-1	Site	CB7
Test Voltage	DC 9V	Test Date	2021/11/5
Test Mode	Mode 3	Engineer	Nilk Chen
Polarity	Horizontal	Temperature (℃)	26.1
Test Condition	--	Humidity (%RH)	62

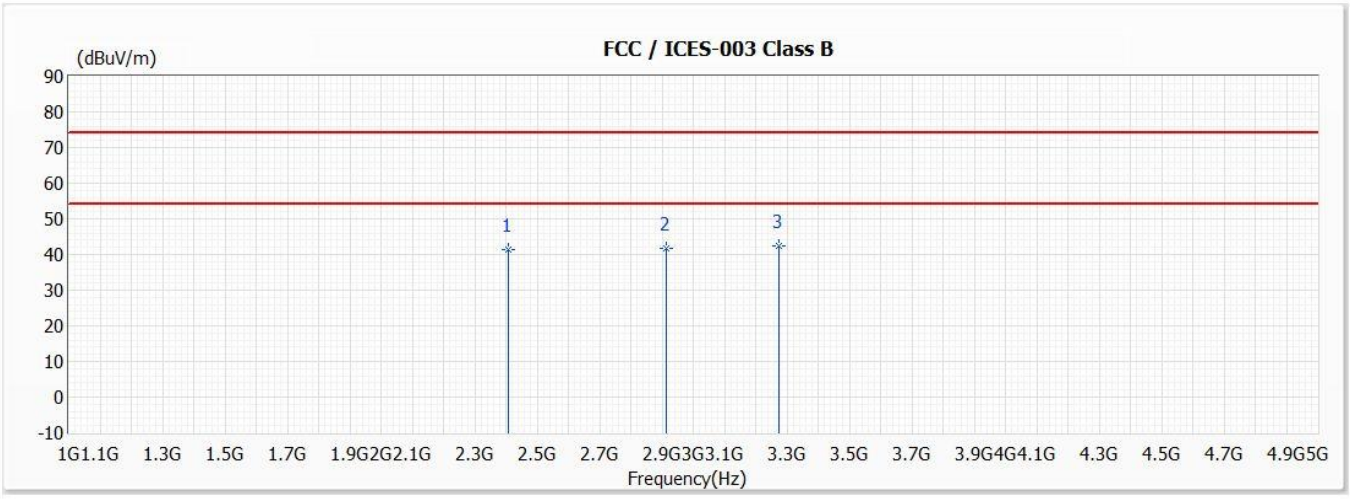


No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Reading Level (dBuV)	Correct Factor (dB/m)	Ant Pos (cm)	TT Pos (deg)	Detector Type
1	1948.000	40.53	74.00	-33.47	48.65	-8.12	160	128	PK
2	2904.000	42.13	74.00	-31.87	47.49	-5.36	110	-38	PK
* 3	4368.000	44.42	74.00	-29.58	46.22	-1.80	100	54	PK

Remark:

1. "*" means this data is the worst emission level;"!" means this data is over limit.
2. Emission Level=Reading Level + Correct Factor (Correct Factor=Ant Factor+Cable Loss-Pre Amp).
3. Margin= Emission Level-Limit.
4. The above 1 GHz test. When PEAK measures level less than AV limit by 20 dBuV, its average is not measured separately.

Model No	BM2502-69-1	Site	CB7
Test Voltage	DC 9V	Test Date	2021/11/5
Test Mode	Mode 3	Engineer	Nilk Chen
Polarity	Vertical	Temperature (℃)	26.1
Test Condition	--	Humidity (%RH)	62



No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Reading Level (dBuV)	Correct Factor (dB/m)	Ant Pos (cm)	TT Pos (deg)	Detector Type
1	2408.000	41.34	74.00	-32.66	48.18	-6.84	140	173	PK
2	2912.000	41.71	74.00	-32.29	47.05	-5.34	100	98	PK
* 3	3276.000	42.48	74.00	-31.52	46.83	-4.35	120	-151	PK

Remark:

1. "*" means this data is the worst emission level;"!" means this data is over limit.
2. Emission Level=Reading Level + Correct Factor (Correct Factor=Ant Factor+Cable Loss-Pre Amp).
3. Margin= Emission Level-Limit.
4. The above 1 GHz test. When PEAK measures level less than AV limit by 20 dBuV, its average is not measured separately.

3.6. Test Photograph

Test Mode : Mode 1: BM2502-63-1

Description : Front View of Radiated Test

Test Mode : Mode 1: BM2502-63-1

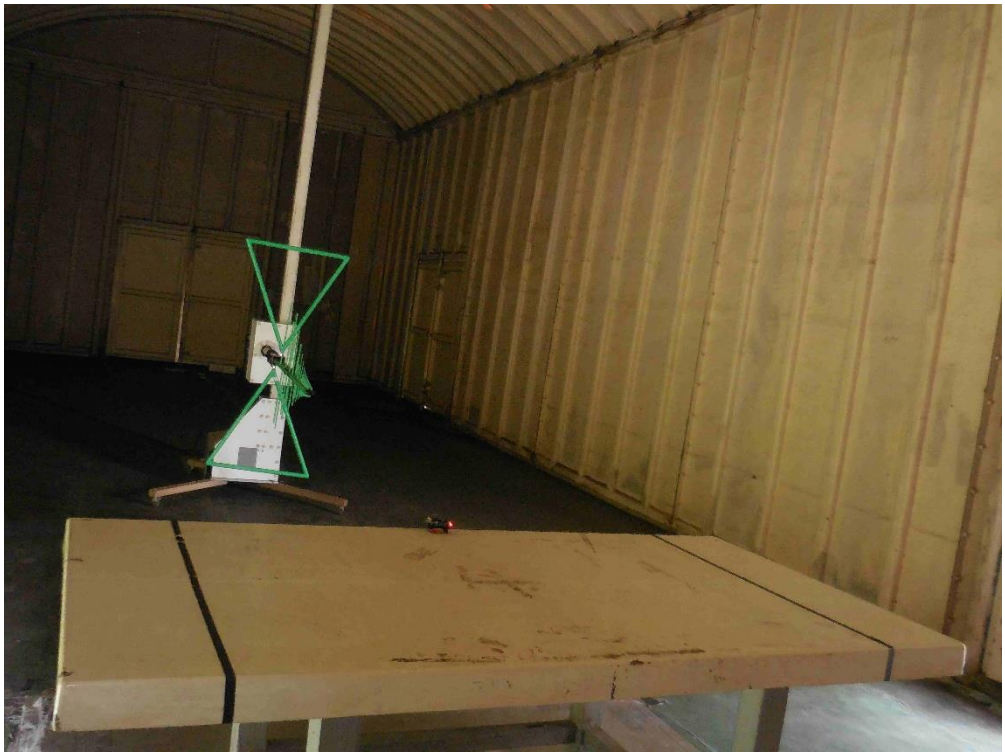
Description : Back View of Radiated Test

Test Mode : Mode 1: BM2502-63-1

Description : Front View of High Frequency Radiated Test

Test Mode : Mode 2: BM2502-64-1

Description : Front View of Radiated Test



Test Mode : Mode 2: BM2502-64-1

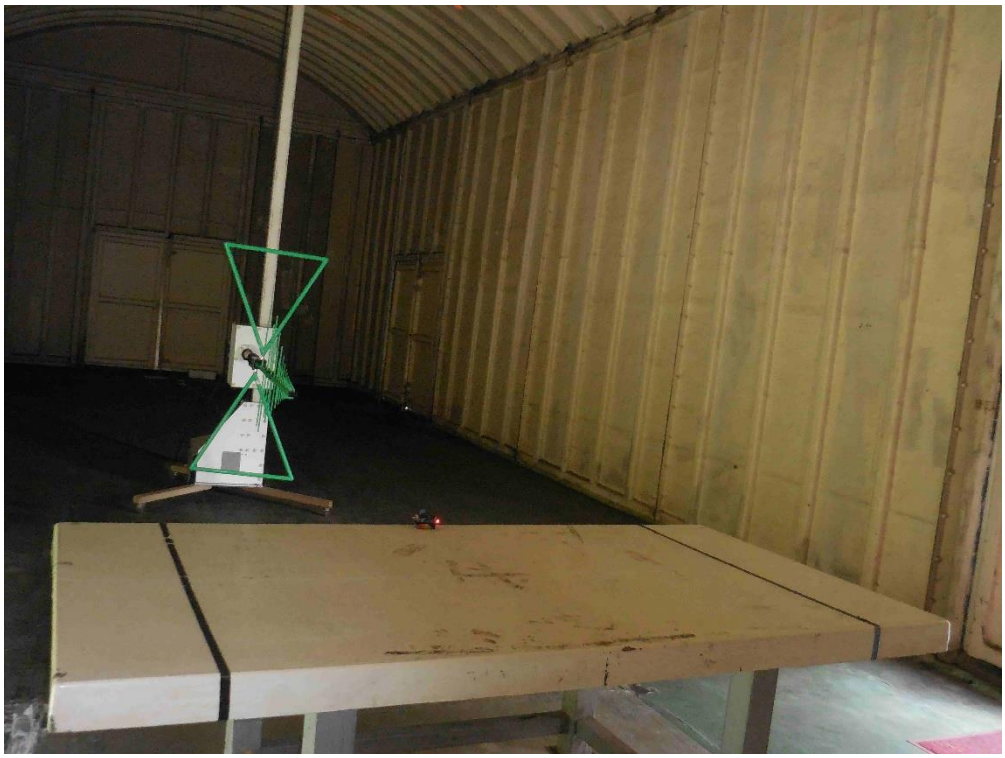
Description : Back View of Radiated Test

Test Mode : Mode 2: BM2502-64-1

Description : Front View of High Frequency Radiated Test

Test Mode : Mode 3: BM2502-69-1

Description : Front View of Radiated Test



Test Mode : Mode 3: BM2502-69-1

Description : Back View of Radiated Test

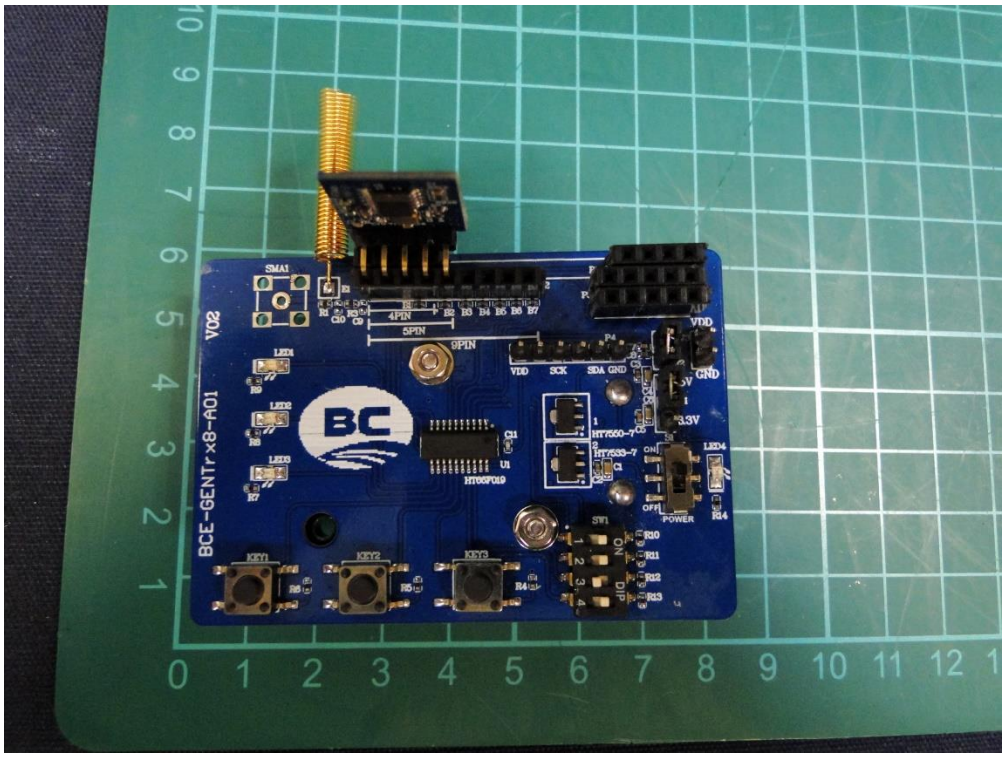
Test Mode : Mode 3: BM2502-69-1

Description : Front View of High Frequency Radiated Test

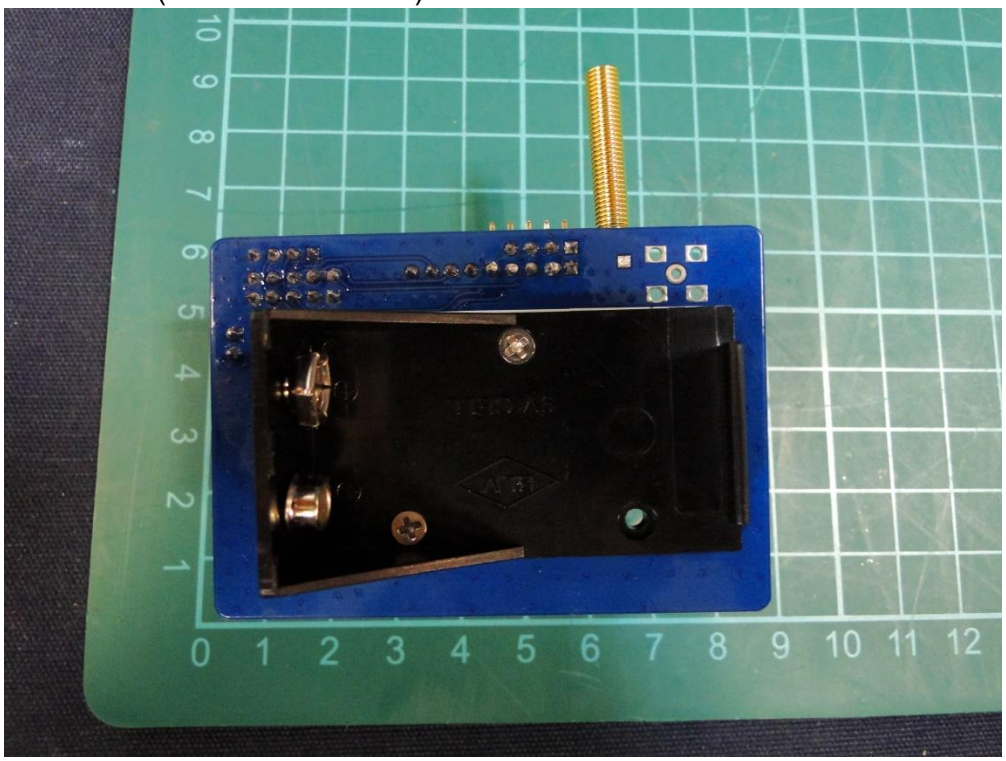
4. Attachment

➢ EUT Photograph

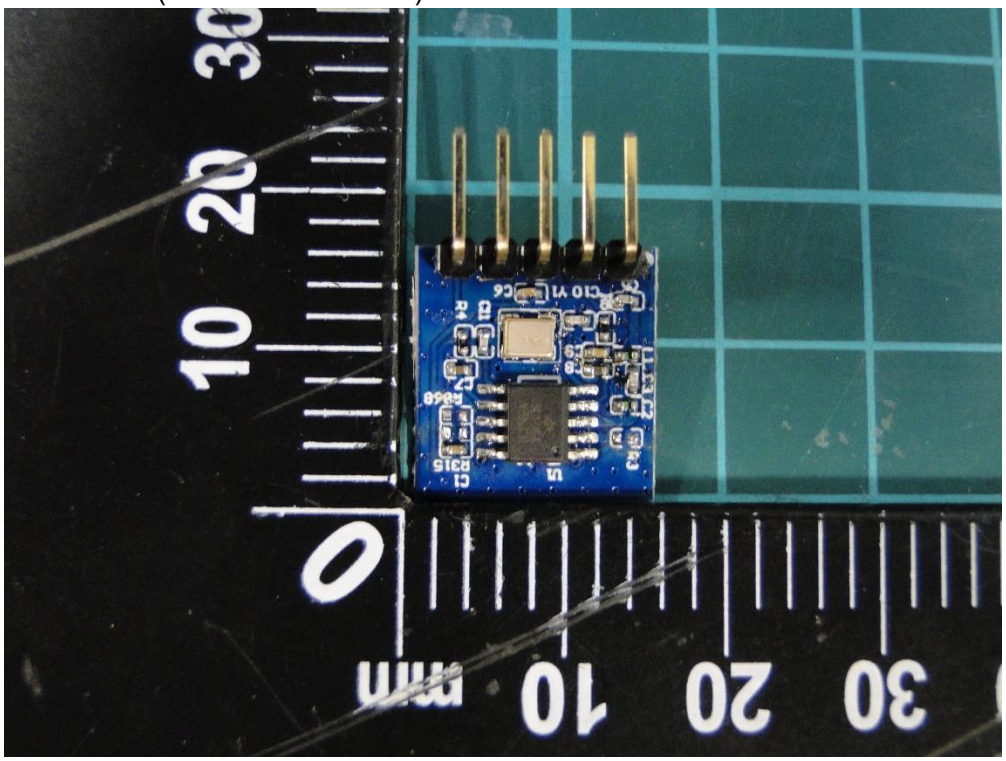
(1) EUT Photo (M/N: BM2502-63-1)



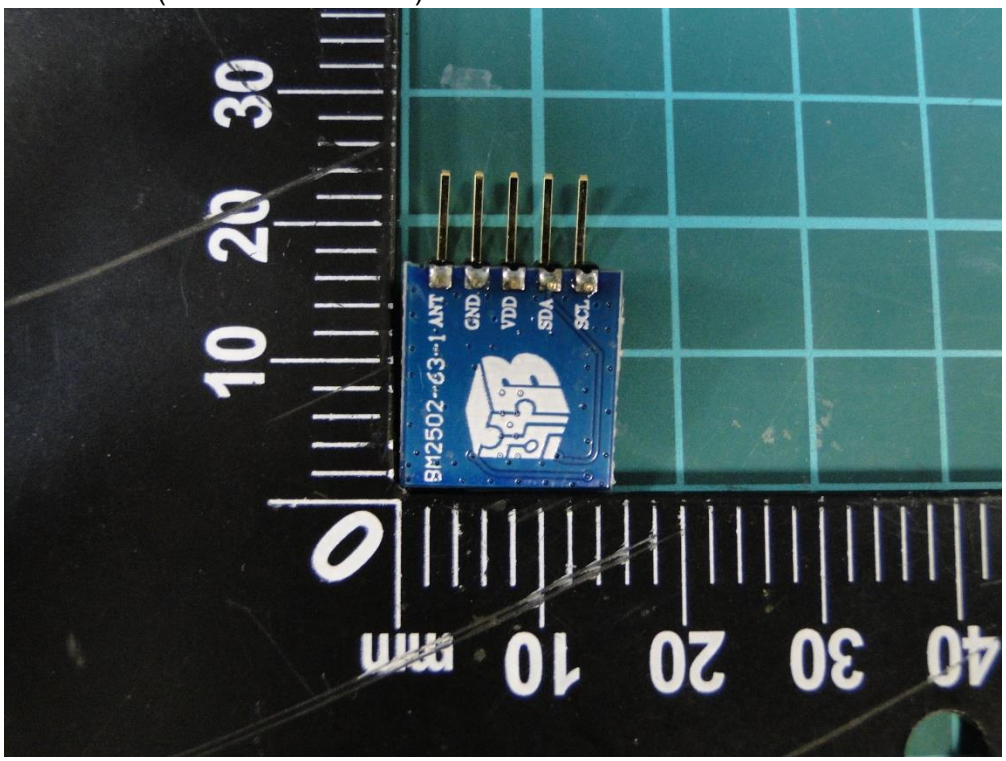
(2) EUT Photo (M/N: BM2502-63-1)



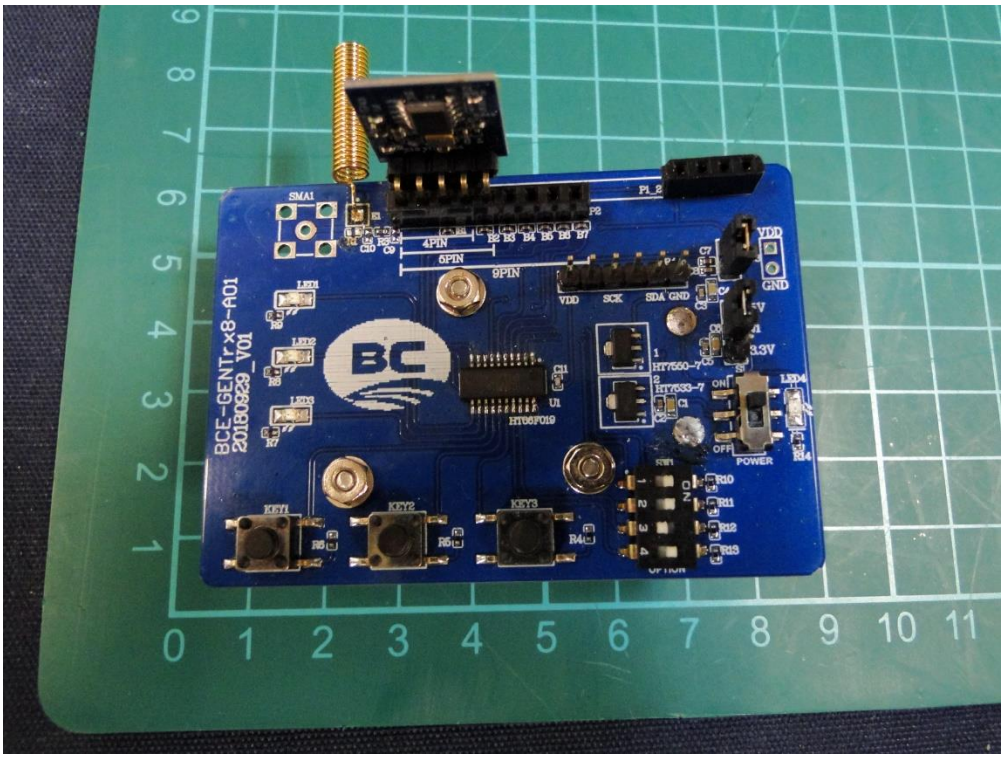
(3) EUT Photo (M/N: BM2502-63-1)



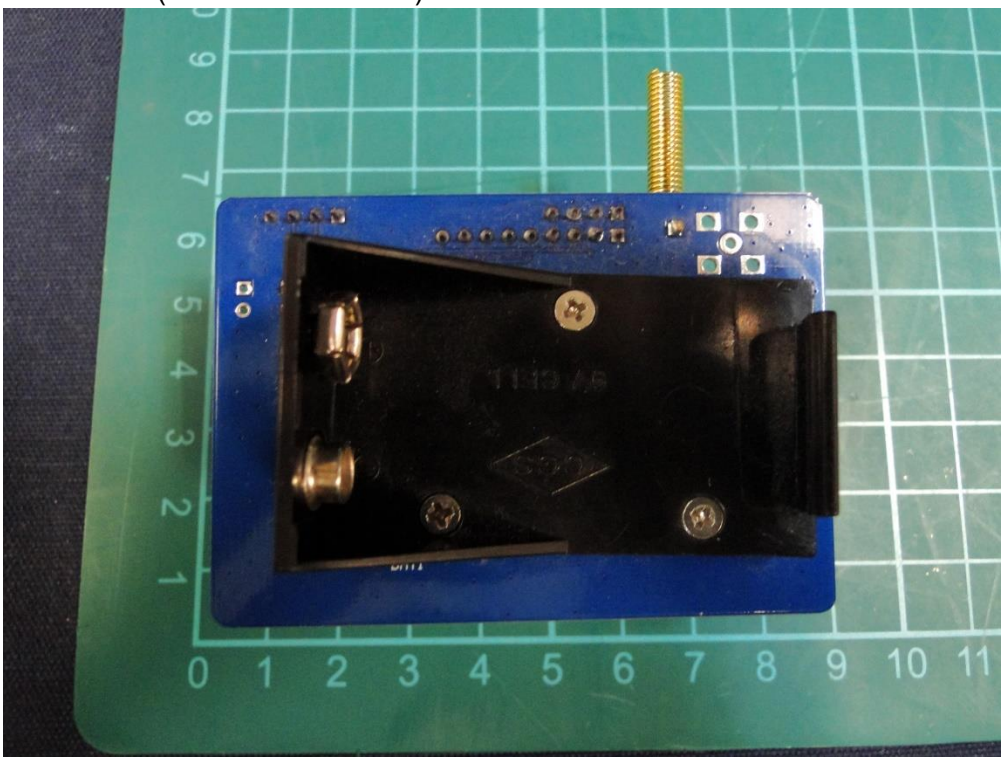
(4) EUT Photo (M/N: BM2502-63-1)



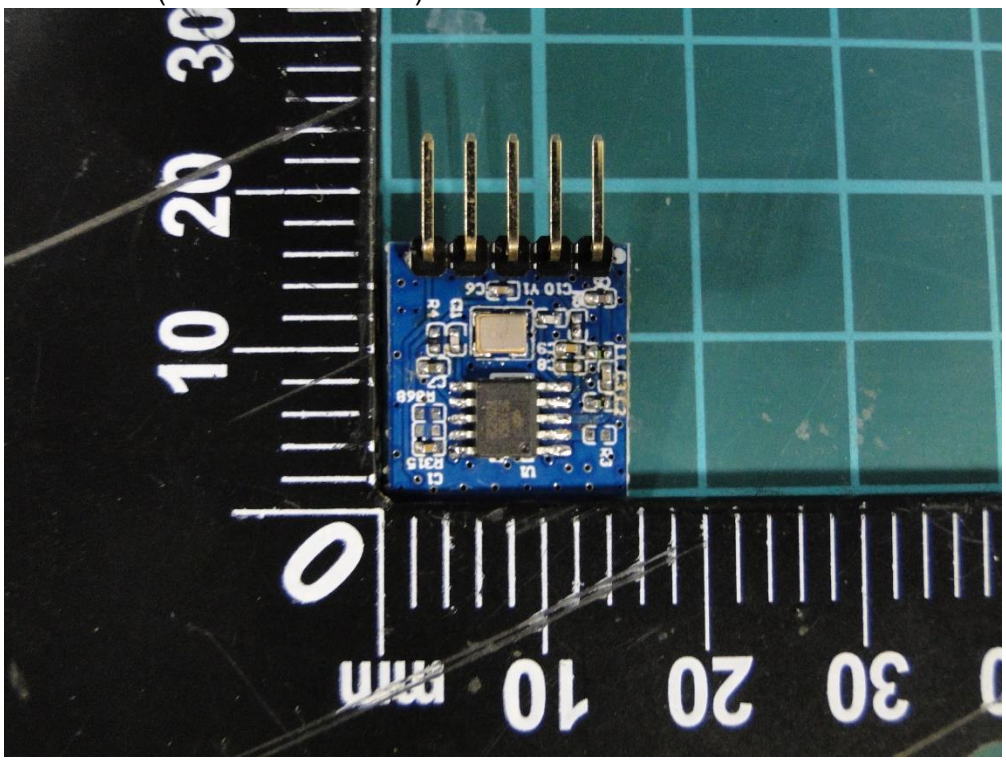
(5) EUT Photo (M/N: BM2502-64-1)



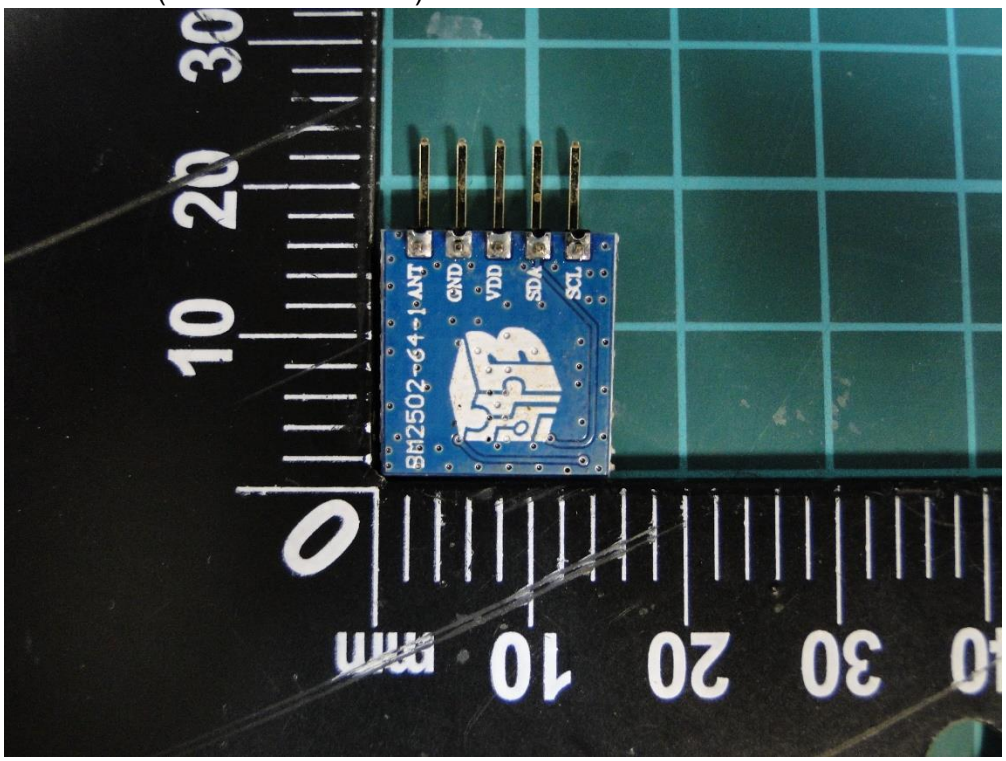
(6) EUT Photo (M/N: BM2502-64-1)



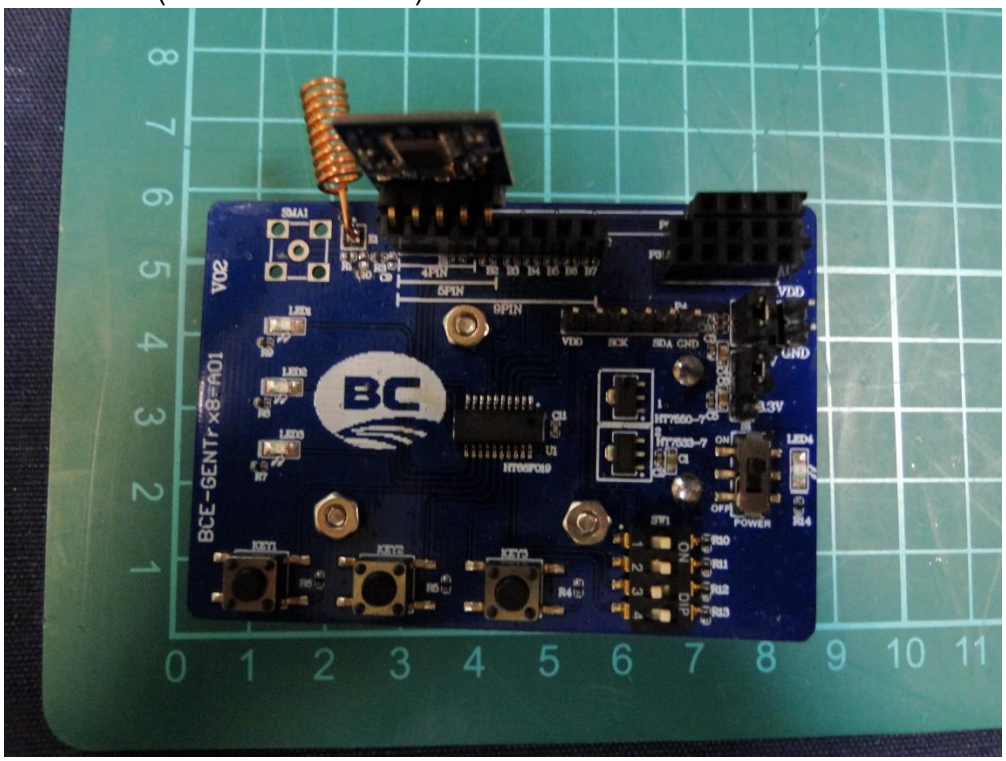
(7) EUT Photo (M/N: BM2502-64-1)



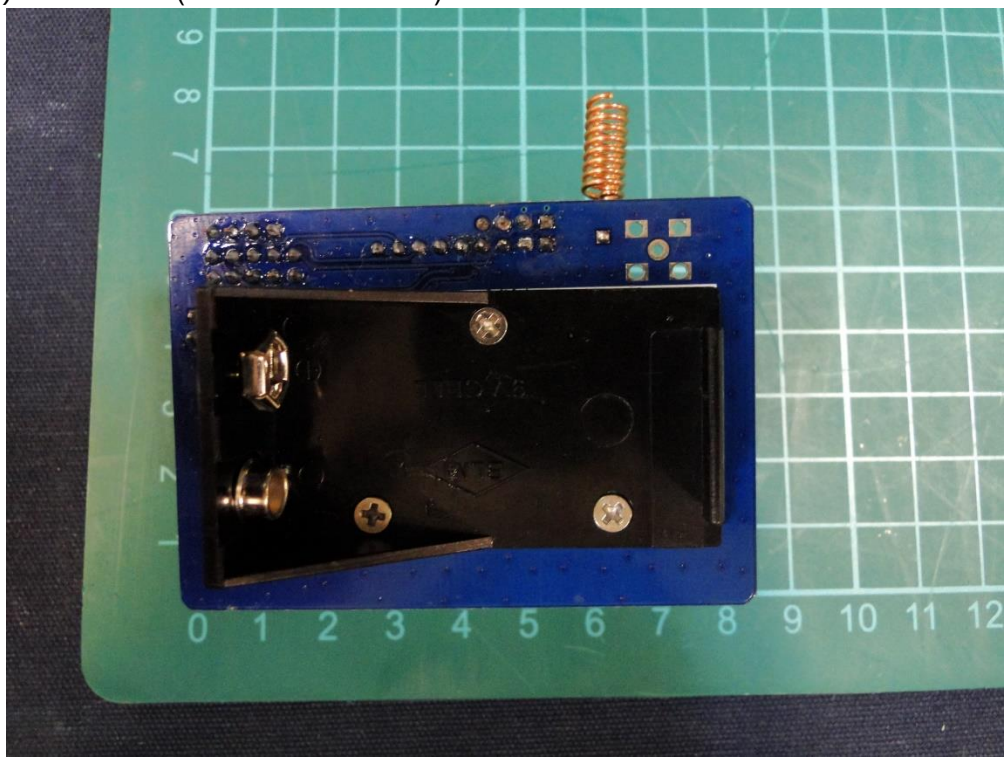
(8) EUT Photo (M/N: BM2502-64-1)



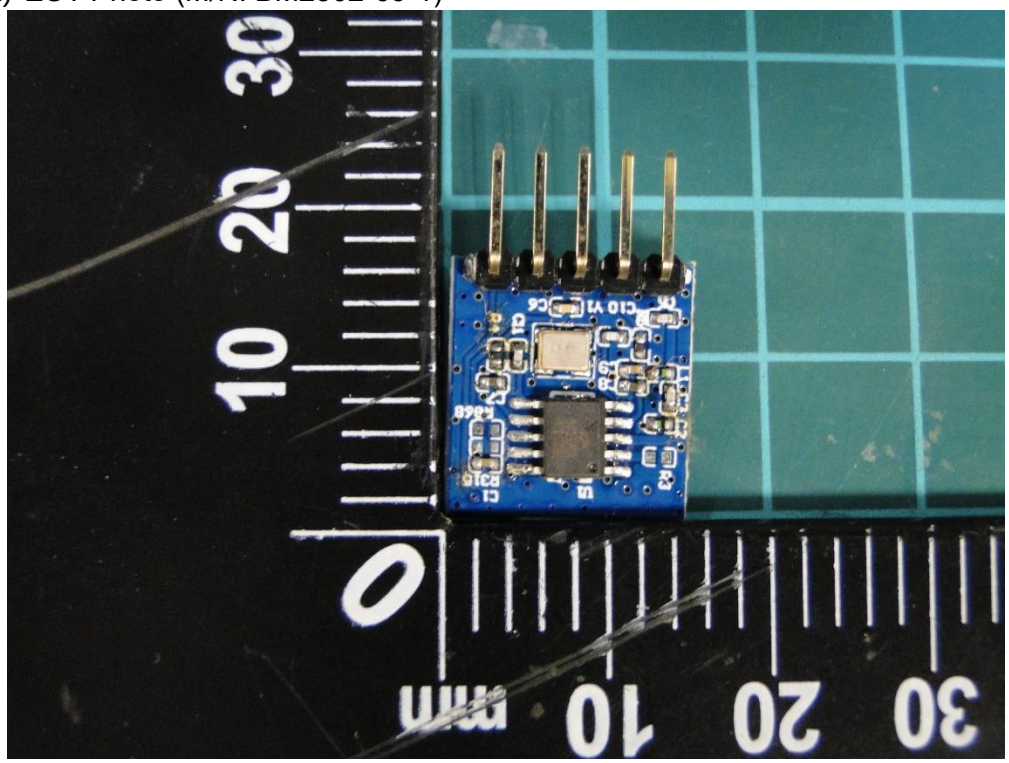
(9) EUT Photo (M/N: BM2502-69-1)



(10) EUT Photo (M/N: BM2502-69-1)



(11) EUT Photo (M/N: BM2502-69-1)



(12) EUT Photo (M/N: BM2502-69-1)