



FCC TEST REPORT

FCC ID: L73-M17

On Behalf of

Sanwa Electronic Instrument Co., Ltd

2.4GHz Radio Control System

Model No.: M17

Prepared for : Sanwa Electronic Instrument Co., Ltd
Address : 1-2-50, Yoshida Honmachi, Higashi-Osaka, Osaka 578-0982, Japan

Prepared By : Shenzhen Alpha Product Testing Co., Ltd.
Address : Building i, No.2, Lixin Road, Fuyong Street, Bao'an District, 518103, Shenzhen, Guangdong, China

Report Number : T1881234 05
Date of Receipt : August 03, 2018
Date of Test : August 03, 2018-September 20, 2018
Date of Report : September 20, 2018
Version Number : REV0

TABLE OF CONTENTS

<u>Description</u>	<u>Page</u>
1. Summary of Standards And Results	6
1.1. Description of Standards and Results	6
2. General Information.....	7
2.1. Description of Device (EUT).....	7
2.2. Accessories of Device (EUT)	8
2.3. Tested Supporting System Details	8
2.4. Block Diagram of connection between EUT and simulators	8
2.5. Test Mode Description.....	8
2.6. Test Conditions	8
2.7. Test Facility	9
2.8. Measurement Uncertainty.....	9
2.9. Test Equipment List.....	10
3. Maximum Peak Output power	11
3.1. Limit	11
3.2. Test Procedure	11
3.3. Test Setup.....	11
3.4. Test Result	11
4. Bandwidth.....	13
4.1. Limit	13
4.2. Test Procedure	13
4.3. Test Result	13
5. Carrier Frequency Separation.....	18
5.1. Limit	18
5.2. Test Procedure	18
5.3. Test Result	18
6. Number Of Hopping Channel.....	21
6.1. Limit	21
6.2. Test Procedure	21
6.3. Test Result	21
7. Dwell Time.....	23
7.1. Test limit	23
7.2. Test Procedure	23
7.3. Test Result	23
8. Radiated emissions.....	29
8.1. Limit	29
8.2. Block Diagram of Test setup	30
8.3. Test Procedure	31
8.4. Test Result	31
9. Band Edge Compliance	35

9.1. Block Diagram of Test Setup.....	35
9.2. Limit	35
9.3. Test Procedure	35
9.4. Test Result	35
10. Power Line Conducted Emissions	51
10.1. Block Diagram of Test Setup.....	51
10.2. Limit	51
10.3. Test Procedure	51
10.4. Test Result	51
11. Antenna Requirements.....	54
11.1. Limit	54
11.2. Result	54
12. Test setup photo	55
12.1. Photos of Radiated emission.....	55
12.2. Photos of Conducted Emission test	56
13. Photos of The EUT.....	57

TEST REPORT DECLARATION

Applicant : Sanwa Electronic Instrument Co., Ltd
Address : 1-2-50, Yoshida Honmachi, Higashi-Osaka, Osaka 578-0982, Japan
Manufacturer : Dongguan Fountain Electronics
Address : Qiaolian Industrial District, Erhuan St., Dongkeng Town, Dongguan City, Guangdong, P.R.China
EUT Description : 2.4GHz Radio Control System
 (A) Model No. : M17
 (B) Trademark : SANWA

Measurement Standard Used:

**FCC Rules and Regulations Part 15 Subpart C Section 15.247: 2017,
ANSI C63.10:2013**

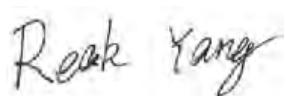
The device described above is tested by Shenzhen Alpha Product Testing Co., Ltd. to determine the maximum emission levels emanating from the device. The maximum emission levels are compared to the FCC Part 15 Subpart C limits both conducted and radiated emissions. The test results are contained in this test report and Shenzhen Alpha Product Testing Co., Ltd. is assumed of full responsibility for the accuracy and completeness of these tests.

After the test, our opinion is that EUT compliance with the requirement of the above standards.

This report applies to above tested sample only. This report shall not be reproduced in parts without written approval of Shenzhen Alpha Product Testing Co., Ltd.

Tested by (name + signature).....:

Reak Yang
Project Engineer



Approved by (name + signature).....:

Simple Guan
Project Manager



Date of issue.....:

September 20, 2018

Revision History

Revision	Issue Date	Revisions	Revised By
00	September 20, 2018	Initial released Issue	Simple Guan

1. SUMMARY OF STANDARDS AND RESULTS

1.1. Description of Standards and Results

The EUT have been tested according to the applicable standards as referenced below:

Test Item	Standards Paragraph	Result
Maximum Peak Output Power	FCC Part 15: 15.247(b)(1) ANSI C63.10 :2013	P
Bandwidth	FCC Part 15: 15.215 ANSI C63.10 :2013	P
Carrier Frequency Separation	FCC Part 15: 15.247(a)(1) ANSI C63.10 :2013	P
Number Of Hopping Channel	FCC Part 15: 15.247(a)(1)(iii) ANSI C63.10 :2013	P
Dwell Time	FCC Part 15: 15.247(a)(1)(iii) ANSI C63.10 :2013	P
Radiated Emission	FCC Part 15: 15.209 FCC Part 15: 15.247(d) ANSI C63.10 :2013	P
Band Edge Compliance	FCC Part 15: 15.247(d) ANSI C63.10 :2013	P
Power Line Conducted Emissions	FCC Part 15: 15.207 ANSI C63.10 :2013	P
Antenna requirement	FCC Part 15: 15.203	P
Note:		<ol style="list-style-type: none"> 1. P is an abbreviation for Pass. 2. F is an abbreviation for Fail. 3. N/A is an abbreviation for Not Applicable.

2. GENERAL INFORMATION

2.1. Description of Device (EUT)

Description : 2.4GHz Radio Control System

Model Number : M17

Diff : N/A

Trademark : SANWA

Test Voltage : Input rating: DC5V, 800mA
DC 3.7V by Built-in battery

Operation frequency : FH4T: 2410-2465MHz
FH5: ①2404-2470 MHz, ②2405-2471 MHz, ③2412-2478 MHz,
④2413-2479MHz

Channel No. : FH4T: 56Channels
FH5: 34Channels

Channel Separation : FH4T: 1MHz
FH5: 2MHz

Modulation type : GFSK

Antenna Type : PIFA Antenna, Maximum Gain is 3.14dBi

Antenna connector : ipex connector

Software version : SP-130_VER1104/SP-133_VER0100

Hardware version : 700A17141A

Note: This product has two basic operations: FH4T and FH5 are just different Channel Separation and Channel No.

2.2. Accessories of Device (EUT)

Accessories1 : /

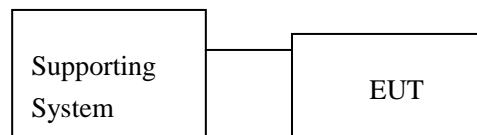
Manufacturer : /

Model : /

2.3. Tested Supporting System Details

No.	Description	Manufacturer	Model	Serial Number	Certification or DOC
1	Notebook	ACER	ZQT	N/A	DOC

2.4. Block Diagram of connection between EUT and simulators



2.5. Test Mode Description

Mode	Channel
GFSK	Low
	Middle
	High

2.6. Test Conditions

Items	Required	Actual
Temperature range:	15-35°C	27°C
Humidity range:	25-75%	56%
Pressure range:	86-106kPa	980kPa

2.7. Test Facility

Shenzhen Alpha Product Testing Co., Ltd
 Building i, No.2, Lixin Road, Fuyong Street, Bao'an District, 518103,
 Shenzhen, Guangdong, China

June 21, 2018 File on Federal Communication Commission
 Registration Number: 293961

July 25, 2017 Certificated by IC
 Registration Number: 12135A

2.8. Measurement Uncertainty

(95% confidence levels, k=2)

Item	Uncertainty
Uncertainty for Power point Conducted Emissions Test	2.74dB
Uncertainty for Radiation Emission test in 3m chamber (below 30MHz)	2.13 dB(Polarize: V)
	2.57dB(Polarize: H)
Uncertainty for Radiation Emission test in 3m chamber (30MHz to 1GHz)	3.77dB(Polarize: V)
	3.80dB(Polarize: H)
Uncertainty for Radiation Emission test in 3m chamber (1GHz to 25GHz)	4.16dB(Polarize: H)
	4.13dB(Polarize: V)
Uncertainty for radio frequency	5.4×10^{-8}
Uncertainty for conducted RF Power	0.37dB
Uncertainty for temperature	0.2 °C
Uncertainty for humidity	1%
Uncertainty for DC and low frequency voltages	0.06%

2.9. Test Equipment List

Equipment	Manufacture	Model No.	Serial No.	Last cal.	Cal Interval
3m Semi-Anechoic	ETS-LINDGRE N	N/A	SEL0017	2017.09.22	1 Year
Spectrum analyzer	Agilent	E4407B	MY46185649	2017.09.22	1 Year
Receiver	R&S	ESCI	1166.5950K03-1011	2017.09.22	1 Year
Receiver	R&S	ESCI	101202	2017.09.22	1 Year
Bilog Antenna	Schwarzbeck	VULB 9168	VULB9168-438	2016.09.30	2 Year
Horn Antenna	EMCO	3115	640201028-06	2016.09.30	2 Year
Active Loop Antenna	Beijing Daze	ZN30900A	SEL0097	2016.09.30	2 Year
Cable	Resenberger	N/A	No.1	2017.09.22	1 Year
Cable	SCHWARZBEC K	N/A	No.2	2017.09.22	1 Year
Cable	SCHWARZBEC K	N/A	No.3	2017.09.22	1 Year
Pre-amplifier	Schwarzbeck	BBV9743	9743-019	2017.09.22	1 Year
Pre-amplifier	R&S	AFS33-1800265 0-30-8P-44	SEL0080	2017.09.22	1 Year
Temperature controller	Terchy	MHQ	120	2017.09.22	1 Year
20db Attenuator	ICPROBING	IATS1	82347	2017.09.22	1 Year
18-40 Horn Antenna	18-40G antenna	Sas-574	571	2018-3-15	3 Year
Power Meter	Anritsu	ML2487A	6K00001491	2017.09.22	1 Year
L.I.S.N.#1	Schwarzbeck	NSLK8126	8126466	2017.09.22	1 Year
L.I.S.N.#2	ROHDE&SCHW ARZ	ENV216	101043	2017.09.22	1 Year

3. MAXIMUM PEAK OUTPUT POWER

3.1. Limit

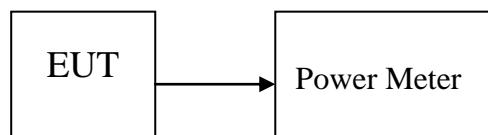
Please refer section 15.247.

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts, the e.i.r.p shall not exceed 4W

3.2. Test Procedure

The transmitter output is connected to the RF Power Meter. The RF Power Meter is set to the peak power detection.

3.3. Test Setup



3.4. Test Result

2404-2470 MHz:

Mode	Freq (MHz)	PK Output Power (dBm)	PK Output Power (mW)	Limit (dBm)	Result
GFSK	2404	9.56	9.036	30	Pass
	2436	9.27	8.453	30	Pass
	2470	9.41	8.730	30	Pass
Conclusion: PASS					

2405-2471 MHz:

Mode	Freq (MHz)	PK Output Power (dBm)	PK Output Power (mW)	Limit (dBm)	Result
GFSK	2405	9.58	9.078	30	Pass
	2437	9.31	8.531	30	Pass
	2471	9.50	8.913	30	Pass
Conclusion: PASS					

2412-2478 MHz:

Mode	Freq (MHz)	PK Output Power (dBm)	PK Output Power (mW)	Limit (dBm)	Result
GFSK	2412	9.64	9.204	30	Pass
	2444	9.34	8.590	30	Pass
	2478	9.56	9.036	30	Pass
Conclusion: PASS					

2413-2479 MHz:

Mode	Freq (MHz)	PK Output Power (dBm)	PK Output Power (mW)	Limit (dBm)	Result
GFSK	2413	9.51	8.933	30	Pass
	2445	9.42	8.750	30	Pass
	2479	9.42	8.750	30	Pass
Conclusion: PASS					

2410-2465 MHz:

Mode	Freq (MHz)	PK Output Power (dBm)	PK Output Power (mW)	Limit (dBm)	Result
GFSK	2410	9.32	8.551	30	Pass
	2438	9.19	8.299	30	Pass
	2465	9.08	8.091	30	Pass
Conclusion: PASS					

4. BANDWIDTH

4.1. Limit

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

4.2. Test Procedure

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 30kHz RBW and 100kHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

4.3. Test Result

2404-2470 MHz:

Mode	Freq (MHz)	20dB Bandwidth (KHz)	Conclusion
GFSK	2404	1800	PASS
	2436	1795	PASS
	2470	1797	PASS

2405-2471 MHz:

Mode	Freq (MHz)	20dB Bandwidth (KHz)	Conclusion
GFSK	2405	1793	PASS
	2437	1855	PASS
	2471	1691	PASS

2412-2478 MHz:

Mode	Freq (MHz)	20dB Bandwidth (KHz)	Conclusion
GFSK	2412	1442	PASS
	2444	1811	PASS
	2478	1811	PASS

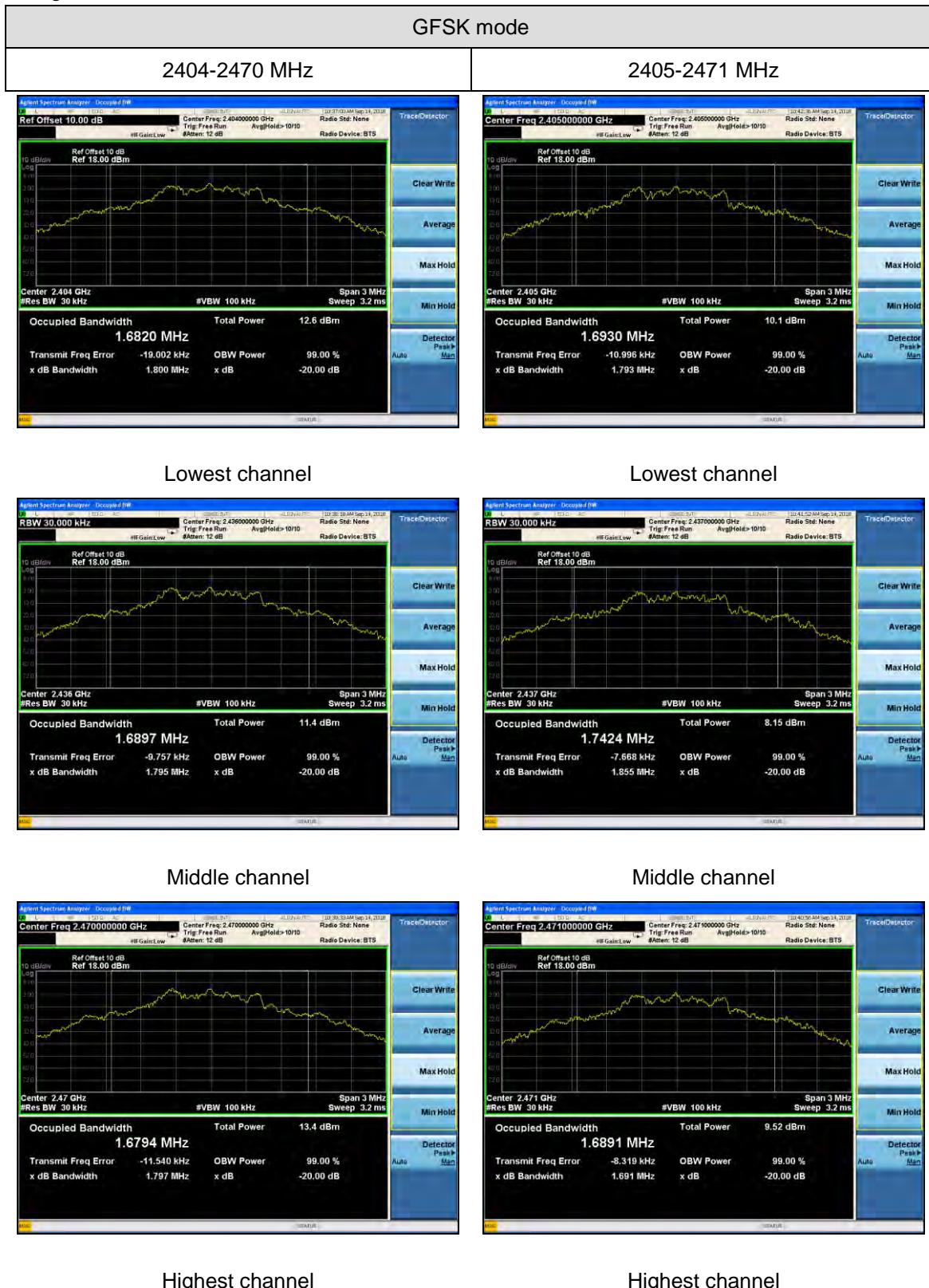
2413-2479MHz:

Mode	Freq (MHz)	20dB Bandwidth (KHz)	Conclusion
GFSK	2413	1793	PASS
	2445	1686	PASS
	2479	1801	PASS

2410-2465MHz:

Mode	Freq (MHz)	20dB Bandwidth (KHz)	Conclusion
GFSK	2410	1217	PASS
	2438	1163	PASS
	2465	1219	PASS

Orginal Test data For 20dB bandwidth



GFSK mode

2412-2478 MHz



2413-2479 MHz



Lowest channel



Lowest channel



Middle channel



Middle channel



Highest channel

Highest channel

GFSK mode

2410-2465MHz



Lowest channel



Middle channel



Highest channel

5. CARRIER FREQUENCY SEPARATION

5.1. Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW

5.2. Test Procedure

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The carrier frequency was measured by spectrum analyzer with 100kHz RBW and 300kHz VBW.

5.3. Test Result

Mode	Channel separation(MHz)	20dB Bandwidth (KHz)	Limit (KHz)	Conclusion
GFSK (2404-2470MHz)	2.000	1800	1237	PASS
GFSK (2405-2471MHz)	2.012	1855	1207	PASS
GFSK (2412-2478MHz)	2.000	1811	1201	PASS
GFSK (2413-2479MHz)	2.000	1801	813	PASS
GFSK (2410-2465MHz)	1.014	1219	1237	PASS

Orginal test data for channel separation

2404-2470 MHz

Channel separation(MHz): 2.000



2405-2471 MHz

Channel separation(MHz): 2.012



2412-2478 MHz

Channel separation(MHz): 2.000



2413-2479MHz

Channel separation(MHz): 2.000



2410-2465 MHz

Channel separation(MHz): 1.014



6. NUMBER OF HOPPING CHANNEL

6.1. Limit

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels

6.2. Test Procedure

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The number of hopping channel was measured by spectrum analyzer with 100kHz RBW and 300KHz VBW.

6.3. Test Result

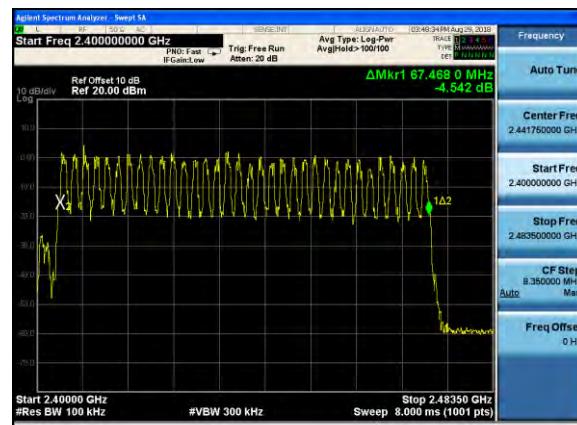
Mode	Number of hopping channel	Limit	Conclusion
GFSK (FH5)	34	>15	PASS
GFSK (FH4T)	56	>15	PASS

Original test data for hopping channel number

FH5: 2404-2470 MHz



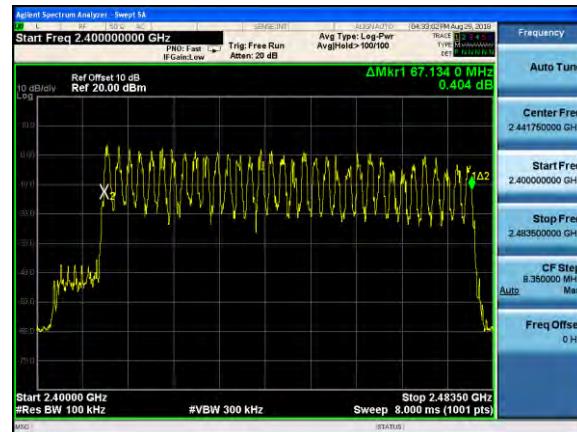
FH5: 2405-2471 MHz



FH5: 2412-2478 MHz



FH5: 2413-2479MHz



FH4T : 2410-2465 MHz



7. DWELL TIME

7.1. Test limit

Please refer section 15.247

According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz. The average time of occupancy on any frequency shall not greater than 0.4 s within period of 0.4 seconds multiplied by the number of hopping channel employed.

7.2. Test Procedure

7.2.1. Place the EUT on the table and set it in transmitting mode.

7.2.2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

7.2.3. Set center frequency of spectrum analyzer = operating frequency.

7.2.4. Set the spectrum analyzer as RBW=1MHz, VBW=1MHz, Span = 0Hz, Sweep = auto.

7.2.5. Repeat above procedures until all frequency measured were complete.

7.3. Test Result

PASS.

Detailed information please see the following page.

2404-2470 MHz:

Mode	Frequency (MHz)	Pulse Duration (ms)	Dwell Time (ms)	Limit (ms)	Conclusion
GFSK	2404	0.128	81.920	400	PASS
	2436	0.129	82.560		PASS
	2470	0.129	82.560		PASS

Note: 1 A period time = 0.4 (s) * 34 = 13.6(s)
 2 Time slot = Pulse Duration * (1600/(2*34)) * A period time/1000

2405-2471 MHz:

Mode	Frequency (MHz)	Pulse Duration (ms)	Dwell Time (ms)	Limit (ms)	Conclusion
GFSK	2405	0.138	88.320	400	PASS
	2437	0.138	88.320		PASS
	2471	0.138	88.320		PASS

Note: 1 A period time = 0.4 (s) * 34 = 13.6(s)
 2 Time slot = Pulse Duration * (1600/(2*34)) * A period time/1000

2412-2478 MHz:

Mode	Frequency (MHz)	Pulse Duration (ms)	Dwell Time (ms)	Limit (ms)	Conclusion
GFSK	2412	0.138	88.320	400	PASS
	2444	0.138	88.320		PASS
	2478	0.138	88.320		PASS

Note: 1 A period time = 0.4 (s) * 34 = 13.6(s)
 2 Time slot = Pulse Duration * (1600/(2*34)) * A period time/1000

2413-2479MHz:

Mode	Frequency (MHz)	Pulse Duration (ms)	Dwell Time (ms)	Limit (ms)	Conclusion
GFSK	2413	0.138	88.320	400	PASS
	2445	0.138	88.320		PASS
	2479	0.138	88.320		PASS

Note: 1 A period time = 0.4 (s) * 34 = 13.6(s)
 2 Time slot = Pulse Duration * (1600/(2*34)) * A period time/1000

2410-2465MHz:

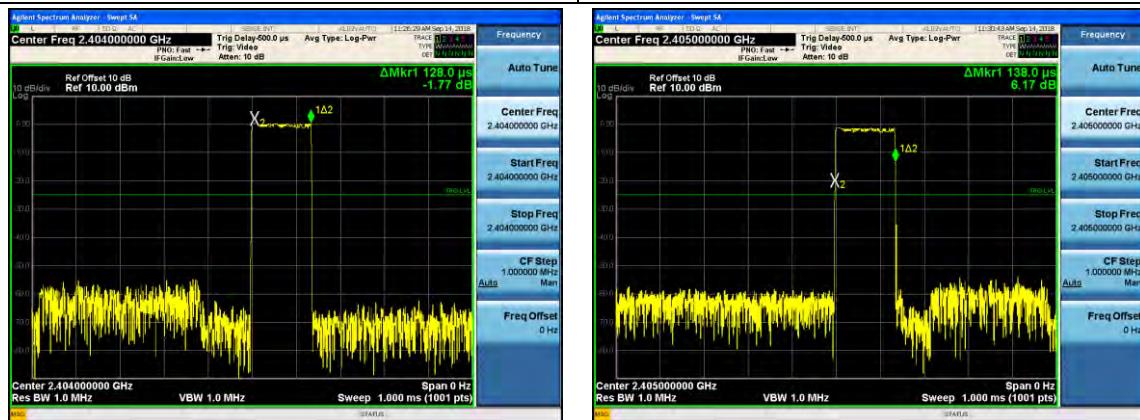
Mode	Frequency (MHz)	Pulse Duration (ms)	Dwell Time (ms)	Limit (ms)	Conclusion
GFSK	2410	0.388	248.320	400	PASS
	2438	0.388	248.320		PASS
	2465	0.388	248.320		PASS

Note: 1 A period time = 0.4 (s) * 56 = 22.4(s)
2 Time slot = Pulse Duration * (1600/(2*56)) * A period time/1000

GFSK mode

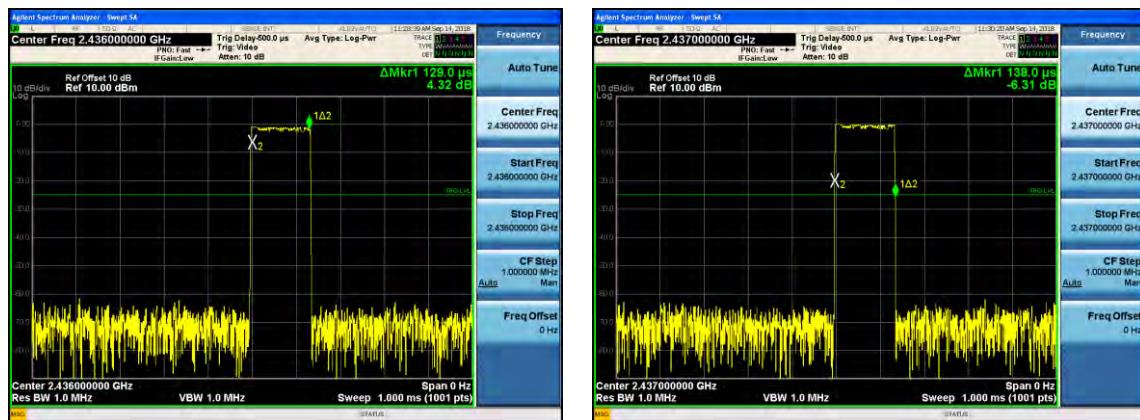
2404-2470 MHz

2405-2471 MHz



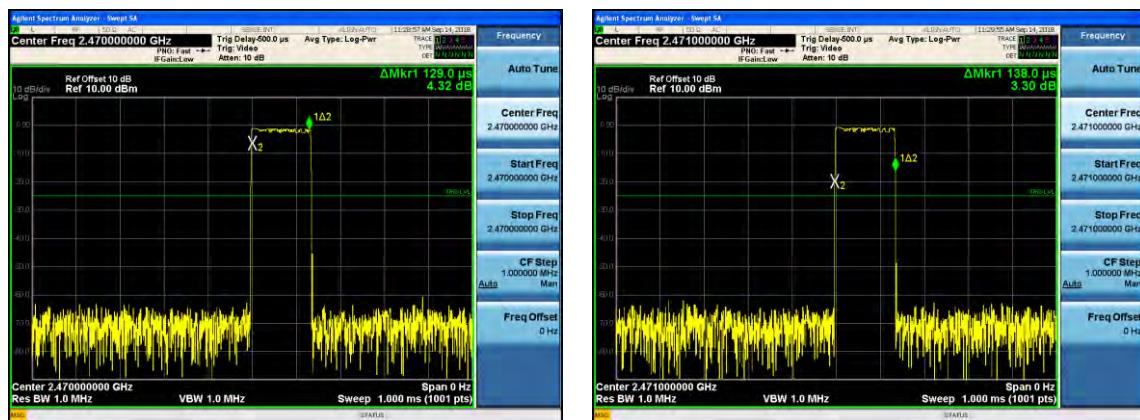
Lowest channel

Lowest channel



Middle channel

Middle channel



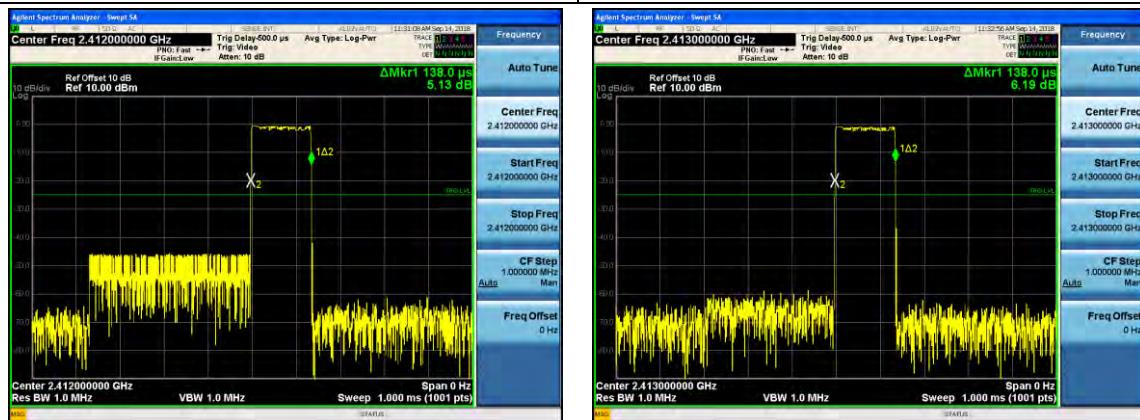
Highest channel

Highest channel

GFSK mode

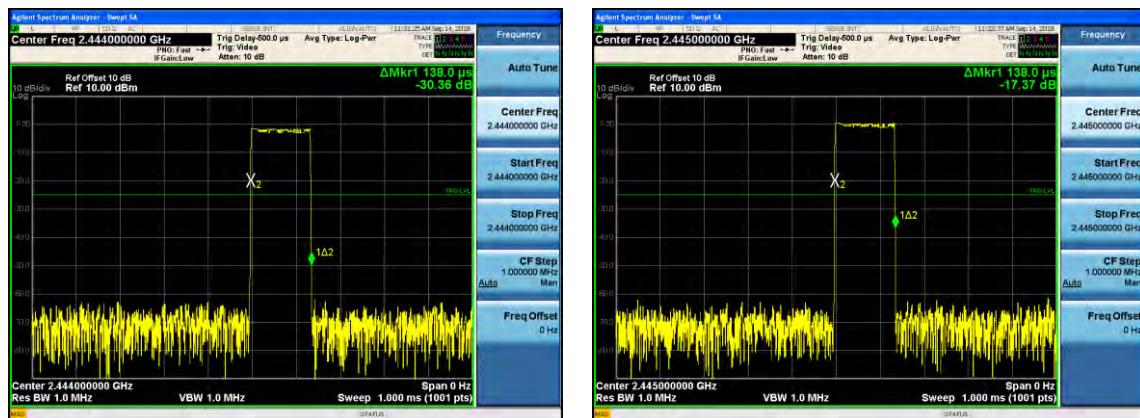
2412-2478 MHz

2413-2479 MHz



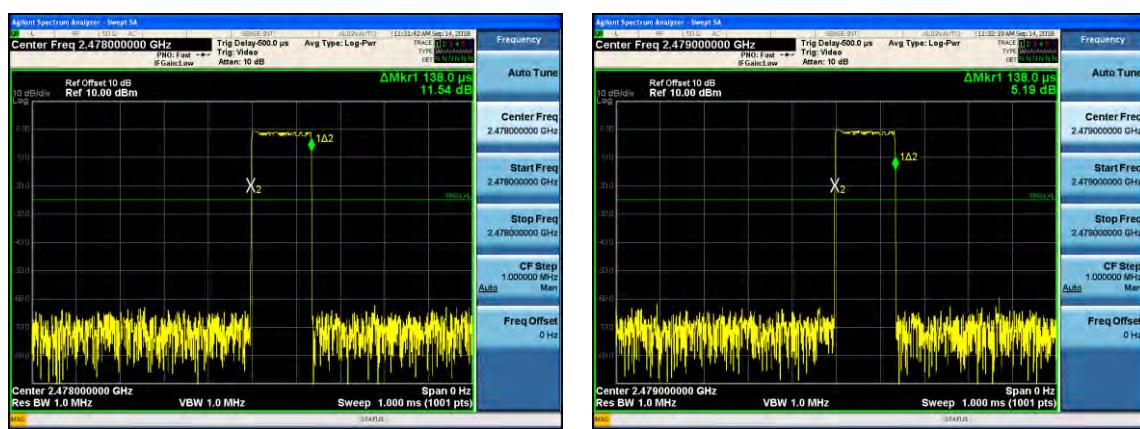
Lowest channel

Lowest channel



Middle channel

Middle channel

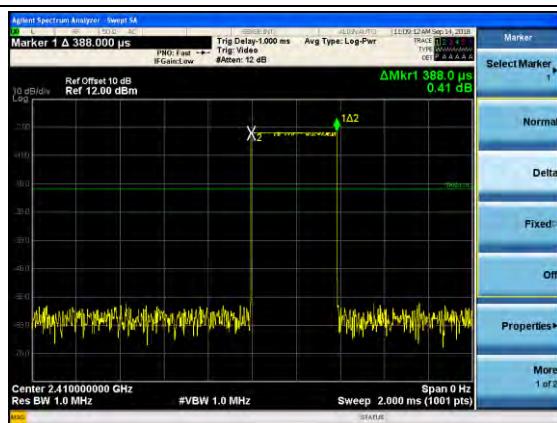


Highest channel

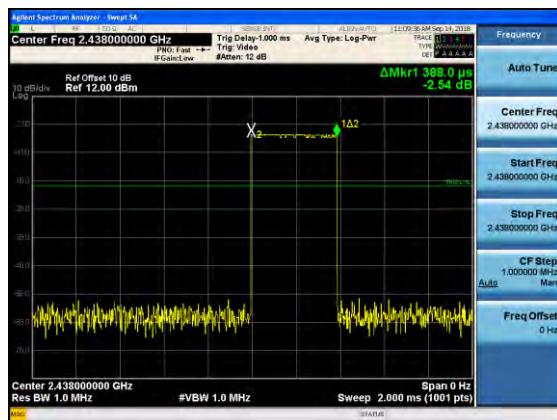
Highest channel

GFSK mode

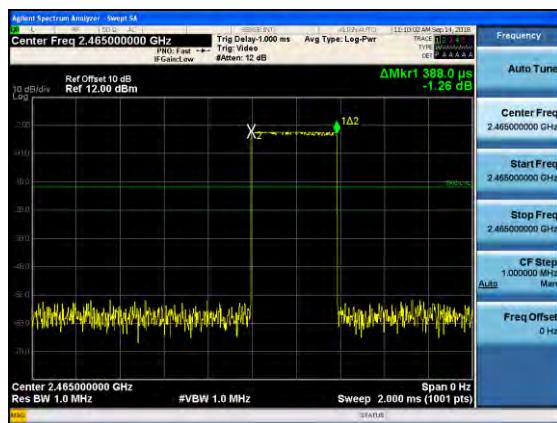
2410-2465MHz



Lowest channel



Middle channel



Highest channel

8. RADIATED EMISSIONS

8.1. Limit

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

15.205 Restricted frequency band

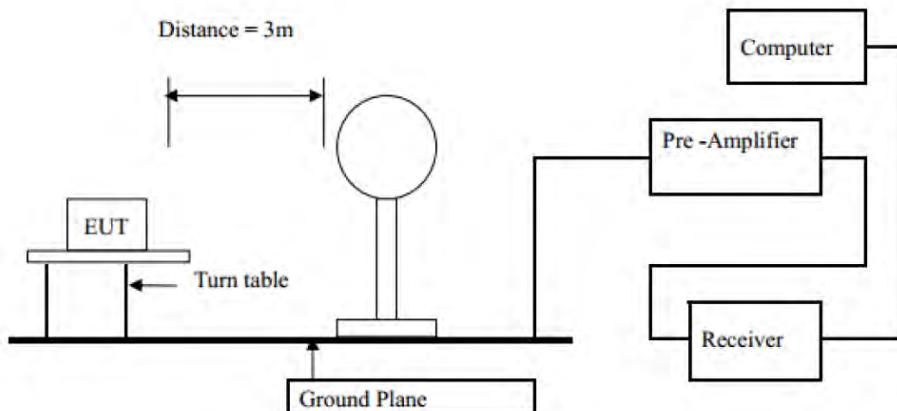
MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)

15.209 Limit

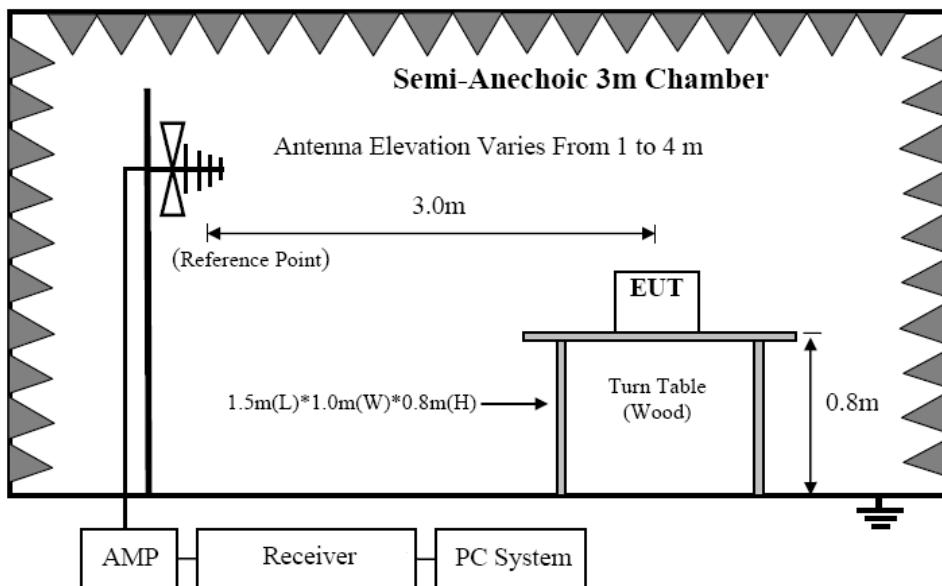
FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMIT	
		μ V/m	dB(μ V)/m
0.009-0.490	300	2400/F(KHz)	/
0.490-1.705	30	24000/F(KHz)	/
1.705-30	30	30	29.5
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above	1000	74.0 dB(μ V)/m (Peak) 54.0 dB(μ V)/m (Average)	

8.2. Block Diagram of Test setup

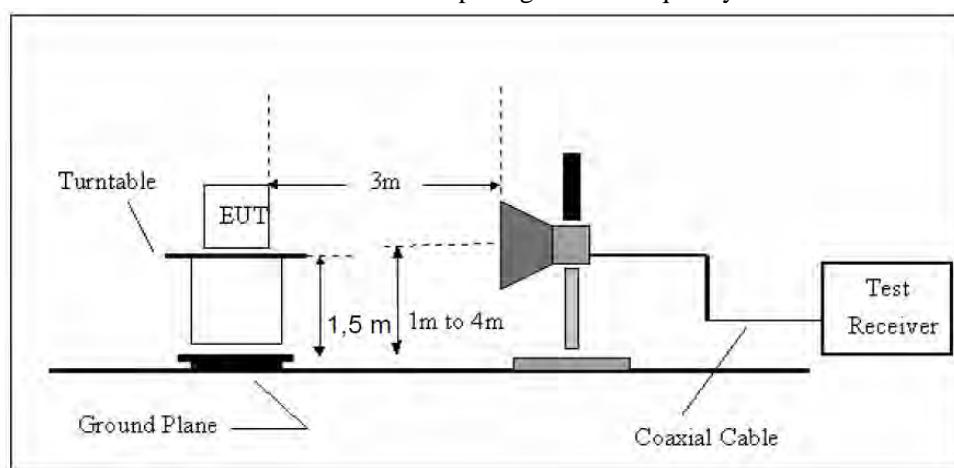
8.2.1 In 3m Anechoic Chamber Test Setup Diagram for below 30MHz



8.2.1 In 3m Anechoic Chamber Test Setup Diagram for below 1GHz



8.2.2 In 3m Anechoic Chamber Test Setup Diagram for frequency above 1GHz



Note: For harmonic emissions test a appropriate high pass filter was inserted in the input port of AMP.

8.3. Test Procedure

- (1) The EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber for below 1GHz and 150 cm above the ground plane inside a semi-anechoic chamber for above 1GHz.
- (2) Setup EUT and simulator as shown in section 1.4 and 6.1
- (3) Test antenna was located 3m from the EUT on an adjustable mast. Below pre-scan procedure was first performed in order to find prominent radiated emissions.
 - (a) Change work frequency or channel of device if practicable.
 - (b) Change modulation type of device if practicable.
 - (c) Rotated EUT though three orthogonal axes to determine the attitude of EUT arrangement produces highest emissions
- (4) Spectrum frequency from 9KHz to 25GHz (tenth harmonic of fundamental frequency) was investigated
- (5) For final emissions measurements at each frequency of interest, the EUT were rotated and the antenna height was varied between 1m and 4m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. In order to find the maximum emission, the relative positions of equipments and all of the interface cables were changed according to ANSI C63.10 :2013 on Radiated Emission test.
- (6) For emissions above 1GHz, both Peak and Average level were measured with Spectrum Analyzer, and the RBW is set at 1MHz, VBW is set at 3MHz for Peak measure; RBW is set at 1MHz, VBW is set at 10Hz for Average measure.

8.4. Test Result

We have scanned the 10th harmonic from 9KHz to the EUT's highest frequency..
Detailed information please see the following page.

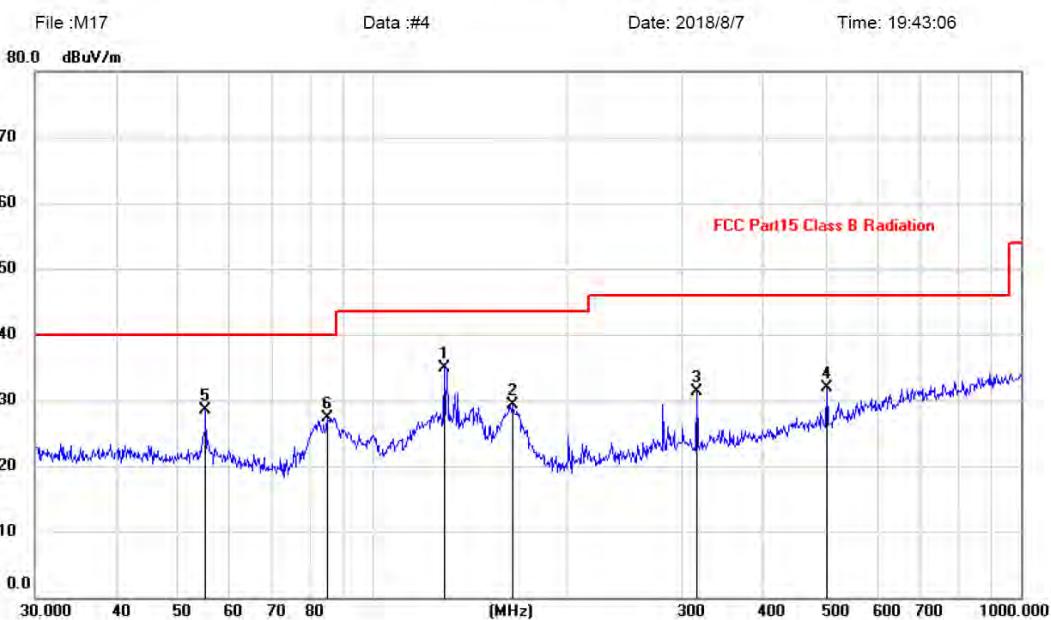
From 9KHz to 30MHz: Conclusion: PASS

Note: The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

From 30MHz to 1000MHz; Conclusion: PASS

Vertical:

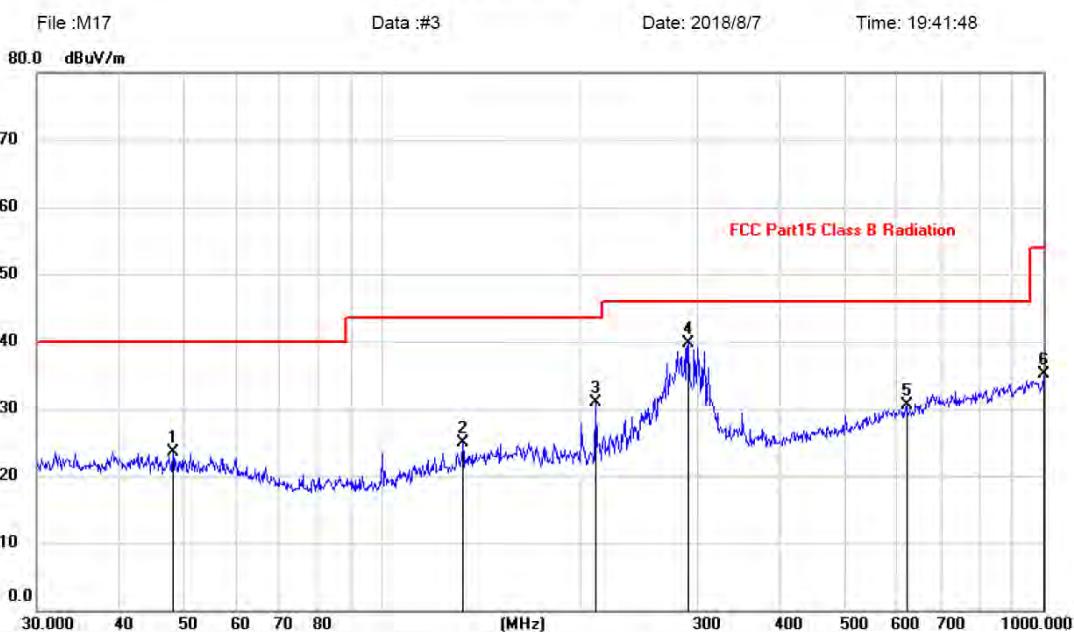
Radiated Emission Measurement



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Margin	Antenna Height	Table	Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1	*	129.0146	21.70	13.17	34.87	43.50	-8.63	peak			
2		163.7550	15.00	14.28	29.28	43.50	-14.22	peak			
3		316.5890	17.42	13.79	31.21	46.00	-14.79	peak			
4		501.1790	14.69	17.22	31.91	46.00	-14.09	peak			
5		55.0274	15.25	13.25	28.50	40.00	-11.50	peak			
6		84.7019	17.58	9.65	27.23	40.00	-12.77	peak			

Note:1. *:Maximum data; x:Over limit; !:over margin.

2.Measurement=Reading Level+Correct Factor; Correct Factor=Antenna Factor+Cable Loss.

Horizontal:**Radiated Emission Measurement**

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Margin	Antenna Height	Table Degree		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		48.3318	9.76	13.67	23.43	40.00	-16.57	peak			
2		132.2206	11.46	13.36	24.82	43.50	-18.68	peak			
3		210.0482	20.26	10.69	30.95	43.50	-12.55	peak			
4	*	290.0172	26.55	13.12	39.67	46.00	-6.33	peak			
5		620.7096	10.82	19.68	30.50	46.00	-15.50	peak			
6		1000.000	11.44	23.71	35.15	54.00	-18.85	peak			

Note: 1. *:Maximum data; x:Over limit; !:over margin.

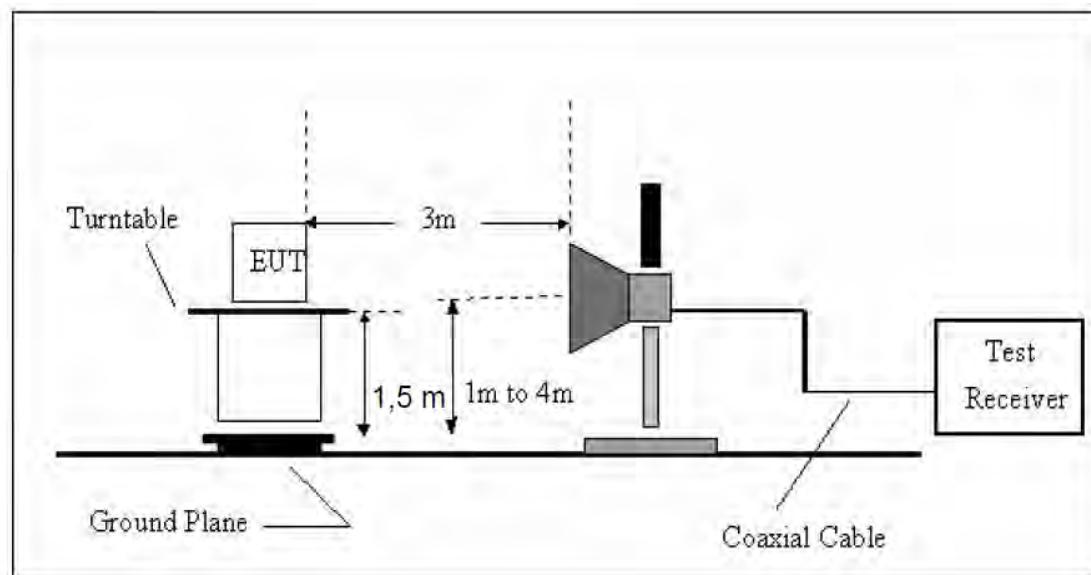
2. Measurement=Reading Level+Correct Factor; Correct Factor=Antenna Factor+Cable Loss.

Remark: All modes have been tested, and only worst data of Channel 2479MHz (FH5: 2413-2479MHz; DC 3.7V) was listed in this report.

From 1G-25GHz

9. BAND EDGE COMPLIANCE

9.1. Block Diagram of Test Setup



9.2. Limit

All the lower and upper band-edges emissions appearing within restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions outside operation shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

9.3. Test Procedure

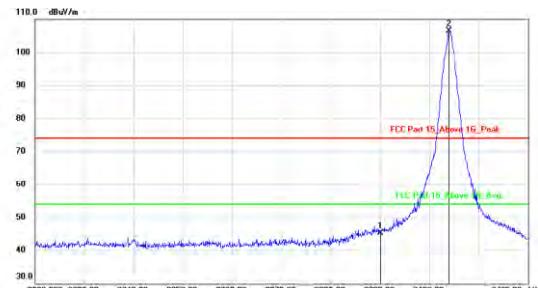
All restriction band and non- restriction band have been tested , only worse case is reported.

9.4. Test Result

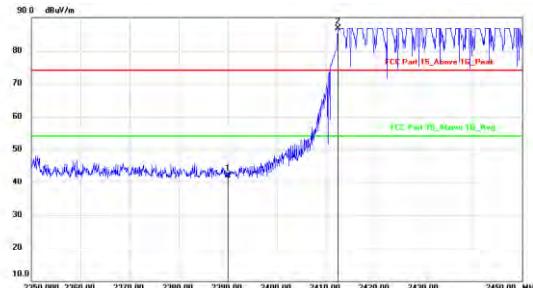
PASS. (See below detailed test data)

Test Mode: GFSK-Low (2404MHz)

Polarization: Vertical



No.	Mk.	Freq	Reading Level	Correct Factor	Measure-ment	Limit	Margin	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree
1		2390.000	48.78	-3.40	45.38	74.00	-28.62	peak		
2	*	2403.900	110.01	-3.41	106.60	74.00	-32.60	peak		

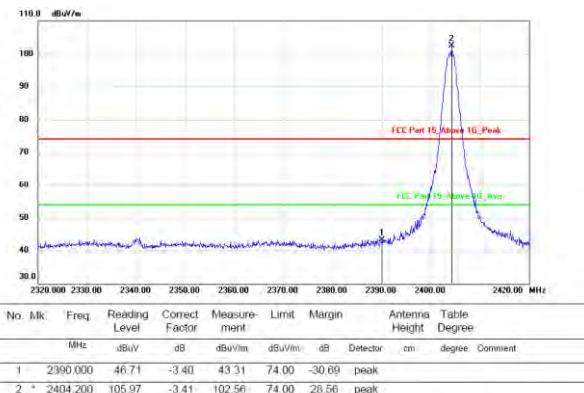


No.	Mk.	Freq	Reading Level	Correct Factor	Measure-ment	Limit	Margin	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree
1		2390.000	45.53	-3.40	42.13	74.00	-31.87	peak		
2	*	2412.400	90.01	-3.40	86.61	74.00	-12.61	peak		

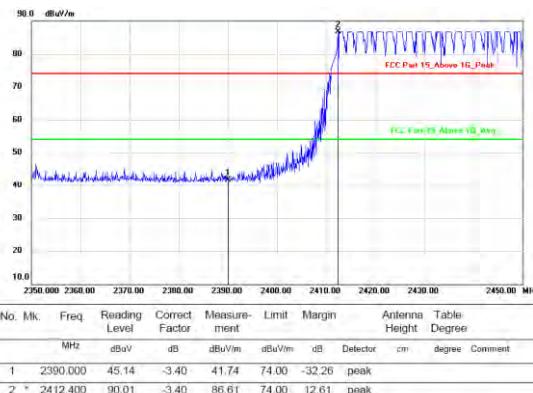
hopping-off

hopping-on

Polarization: Horizontal



No.	Mk.	Freq	Reading Level	Correct Factor	Measure-ment	Limit	Margin	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree
1		2390.000	46.71	-3.40	43.31	74.00	-30.69	peak		
2	*	2404.200	105.97	-3.41	102.56	74.00	-28.56	peak		



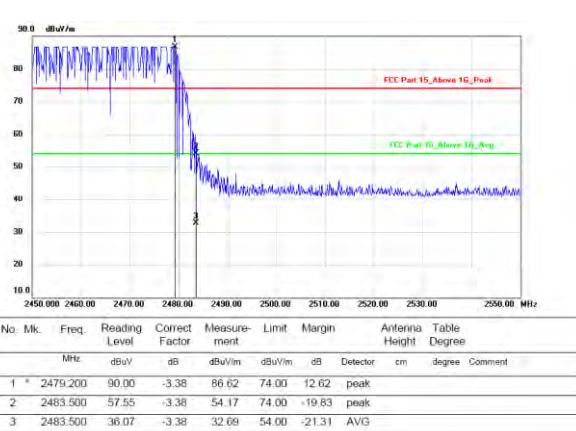
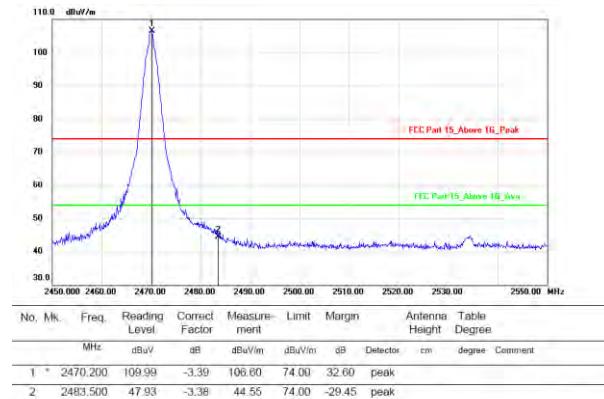
No.	Mk.	Freq	Reading Level	Correct Factor	Measure-ment	Limit	Margin	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree
1		2390.000	45.14	-3.40	41.74	74.00	-32.26	peak		
2	*	2412.400	90.01	-3.40	86.61	74.00	-12.61	peak		

hopping-off

hopping-on

Test Mode: GFSK-High (2470MHz)

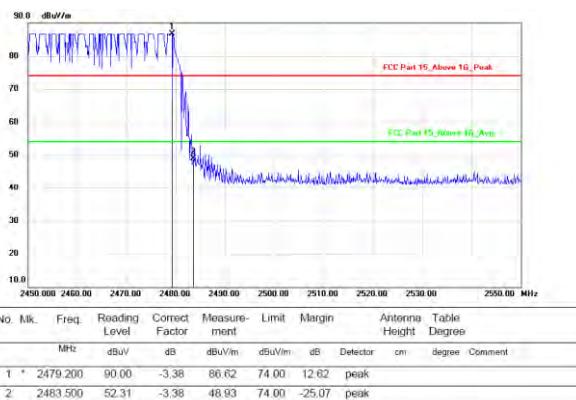
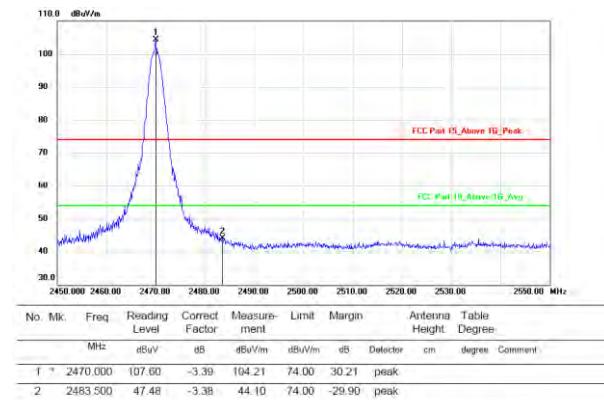
Polarization: Vertical



hopping-off

hopping-on

Polarization: Horizontal

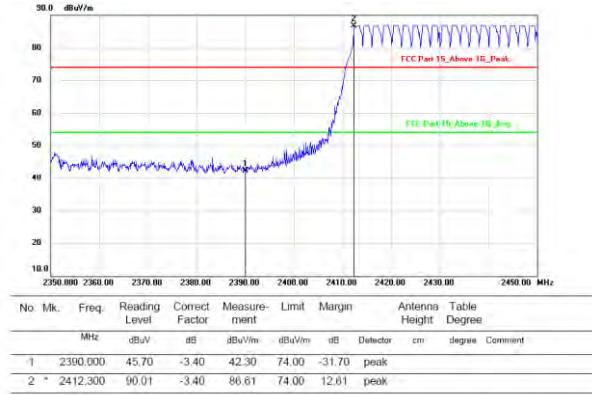
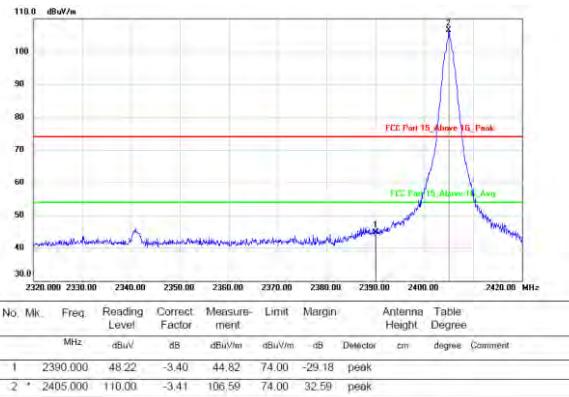


hopping-off

hopping-on

Test Mode: GFSK-Low (2405MHz)

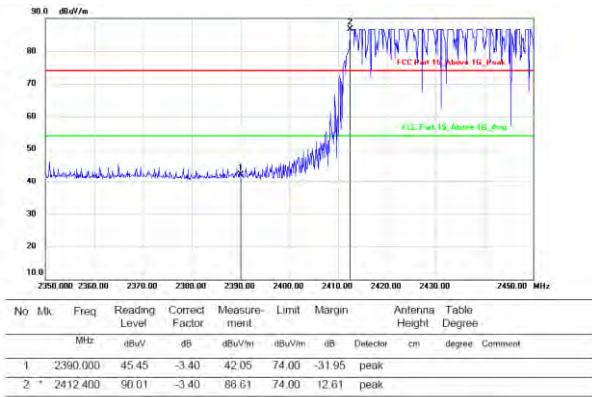
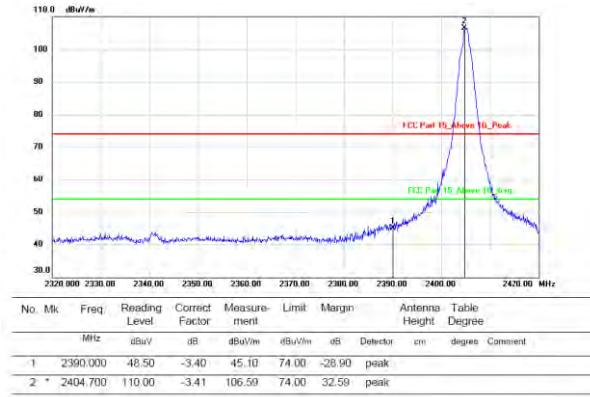
Polarization: Vertical



hopping-off

hopping-on

Polarization: Horizontal

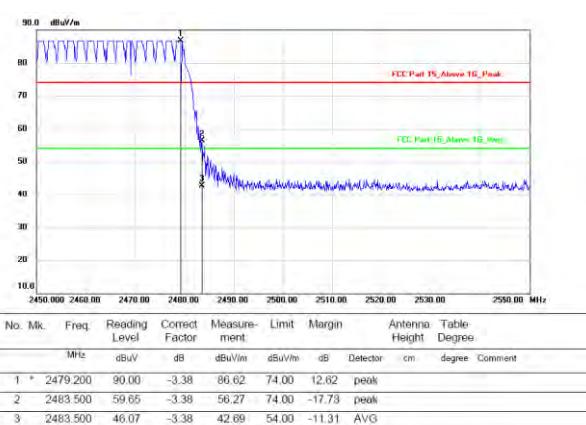
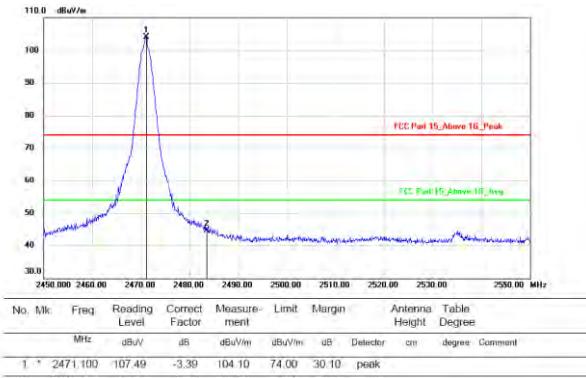


hopping-off

hopping-on

Test Mode: GFSK-High (2471MHz)

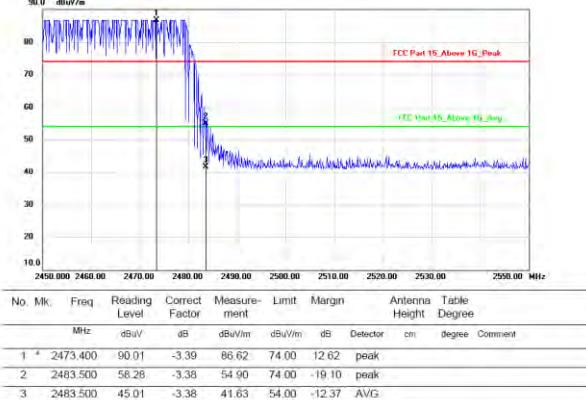
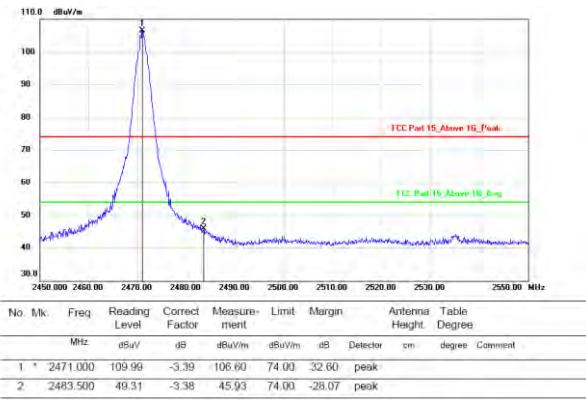
Polarization: Vertical



hopping-off

hopping-on

Polarization: Horizontal

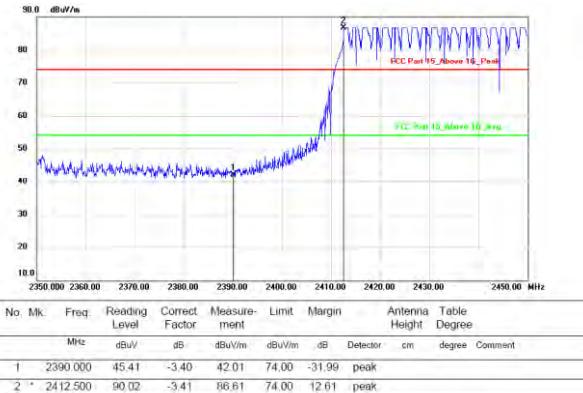
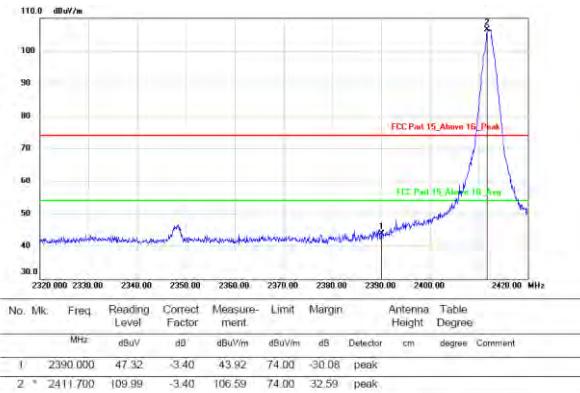


hopping-off

hopping-on

Test Mode: GFSK-Low (2412MHz)

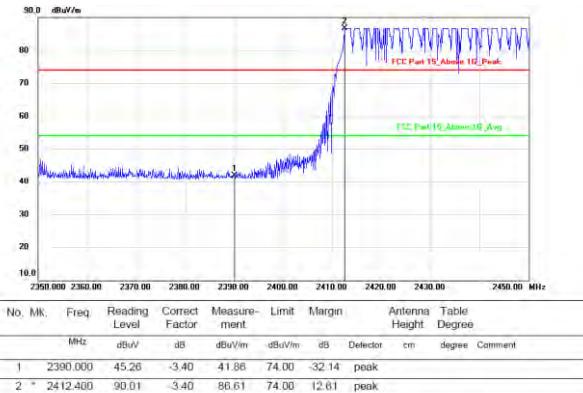
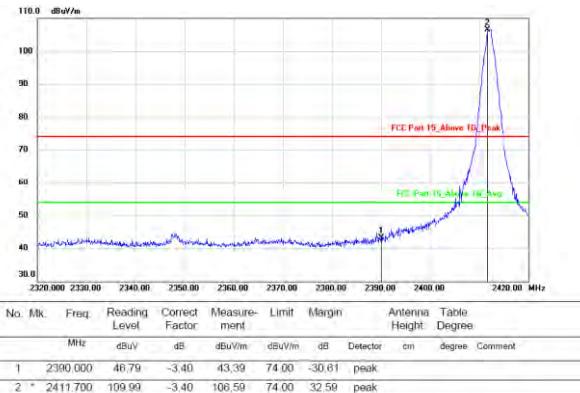
Polarization: Vertical



hopping-off

hopping-on

Polarization: Horizontal

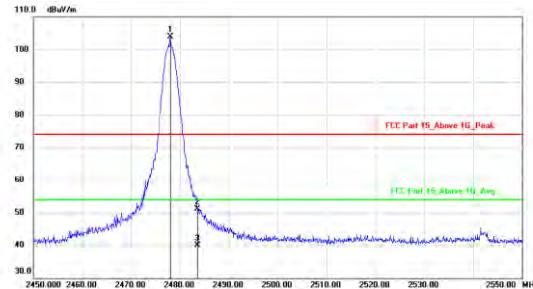


hopping-off

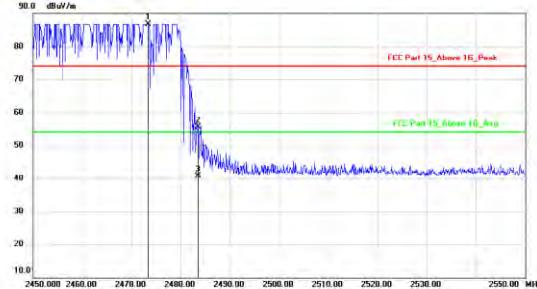
hopping-on

Test Mode: GFSK-High (2478MHz)

Polarization: Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree
1	*	2478.100	107.33	-3.39	103.94	74.00	29.94	peak		
2		2483.500	54.42	-3.38	51.04	74.00	-22.96	peak		
3		2483.500	43.25	-3.38	39.87	54.00	-14.13	AVG		

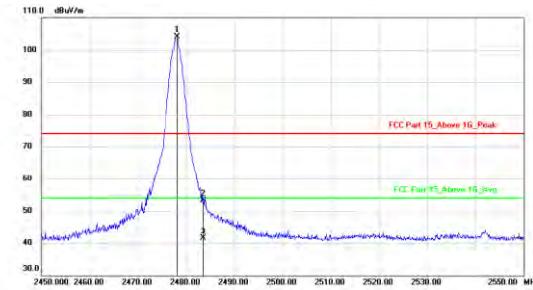


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree
1	*	2473.400	90.01	-3.39	86.62	74.00	12.62	peak		
2		2483.500	58.88	-3.38	55.50	74.00	-16.50	peak		
3		2483.500	44.03	-3.38	40.65	54.00	-13.35	AVG		

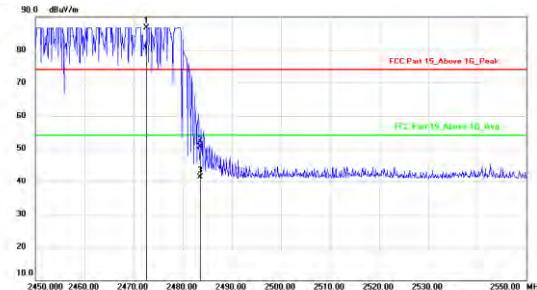
hopping-off

hopping-on

Polarization: Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree
1	*	2478.200	107.48	-3.39	104.09	74.00	30.09	peak		
2		2483.500	56.67	-3.38	53.29	74.00	-20.71	peak		
3		2483.500	44.96	-3.38	41.58	54.00	-12.42	AVG		



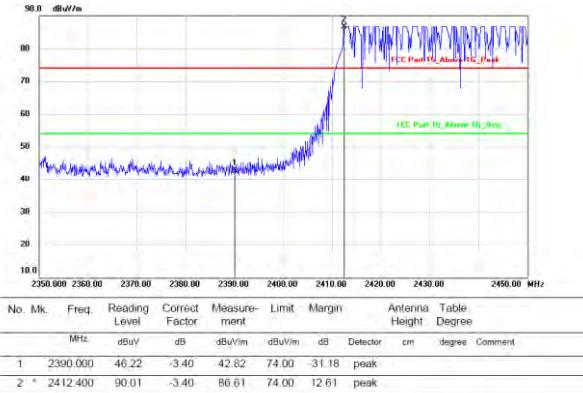
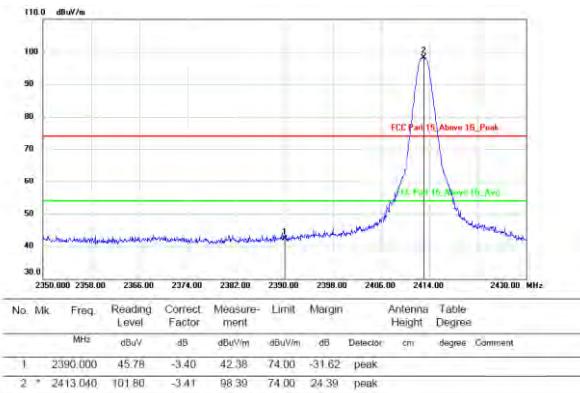
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree
1	*	2472.600	90.01	-3.39	86.62	74.00	12.62	peak		
2		2483.500	53.86	-3.38	50.48	74.00	-23.52	peak		
3		2483.500	44.70	-3.38	41.32	54.00	-12.68	AVG		

hopping-off

hopping-on

Test Mode: GFSK-Low (2413MHz)

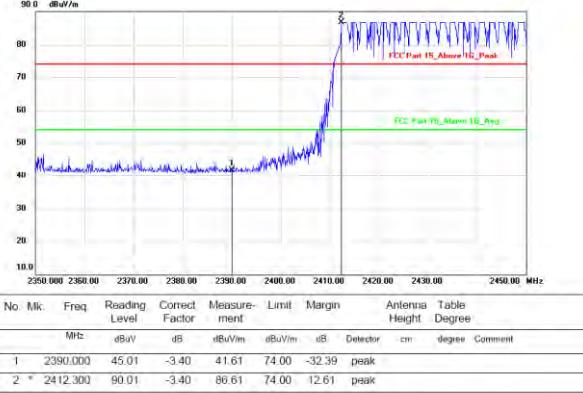
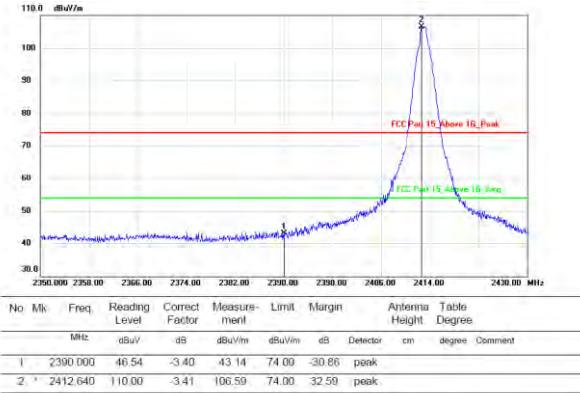
Polarization: Vertical



hopping-off

hopping-on

Polarization: Horizontal

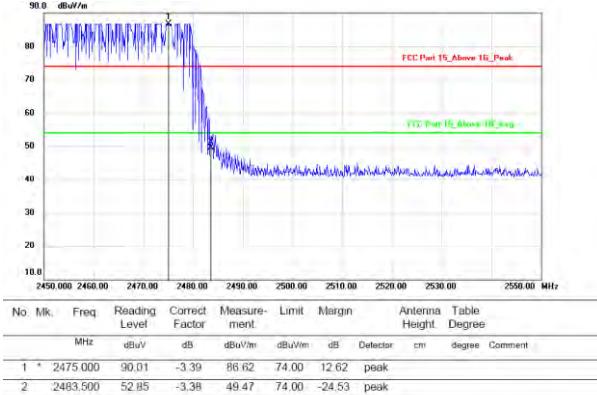
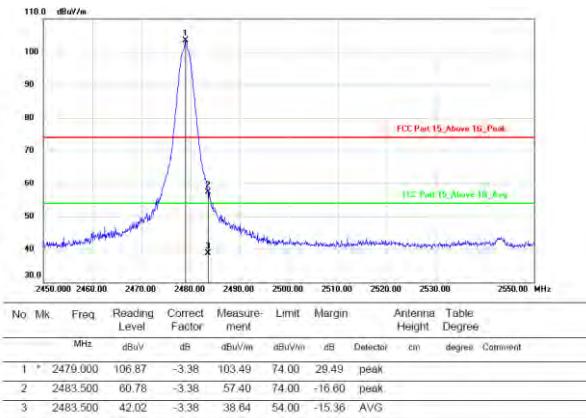


hopping-off

hopping-on

Test Mode: GFSK-High (2479MHz)

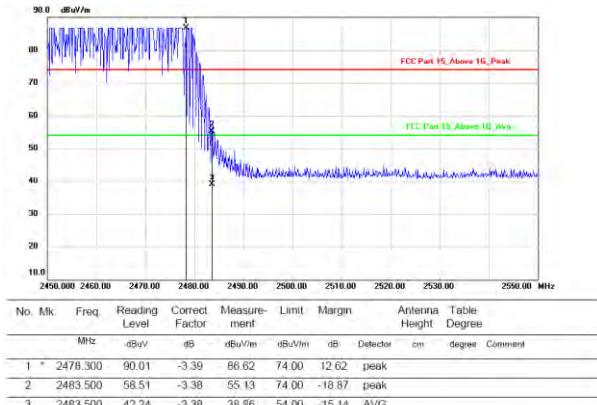
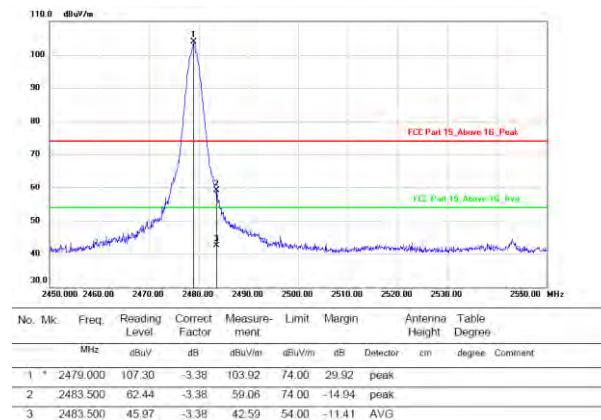
Polarization: Vertical



hopping-off

hopping-on

Polarization: Horizontal

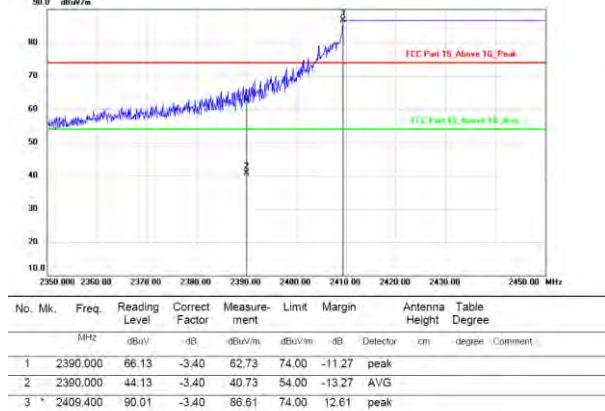
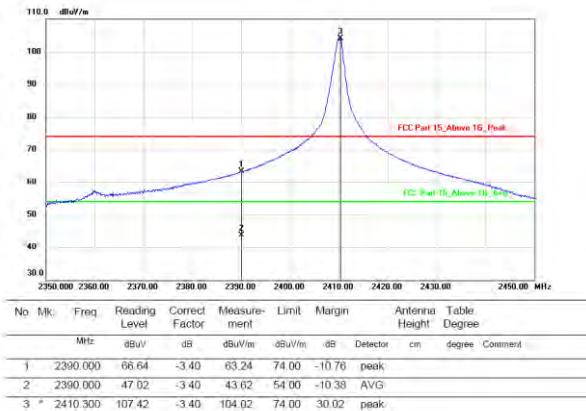


hopping-off

hopping-on

Test Mode: GFSK-Low (2410MHz)

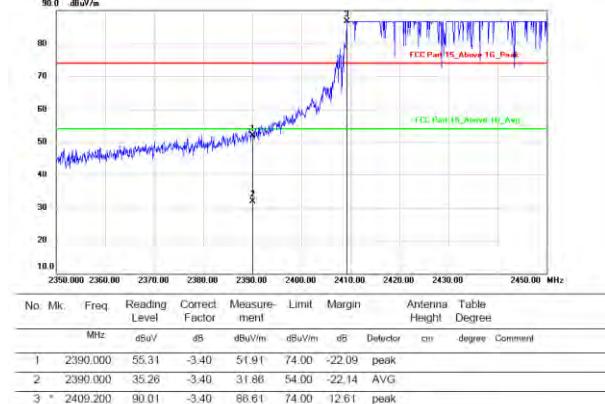
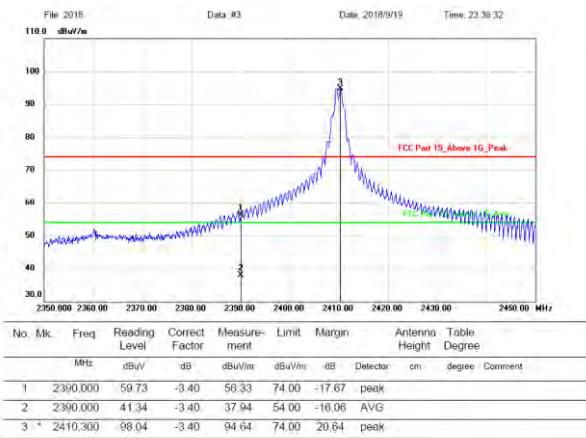
Polarization: Vertical



hopping-off

hopping-on

Polarization: Horizontal

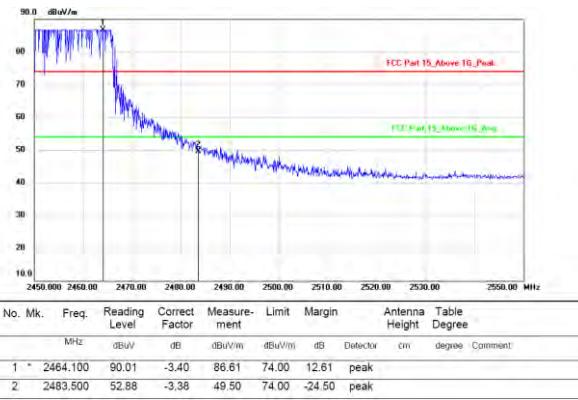
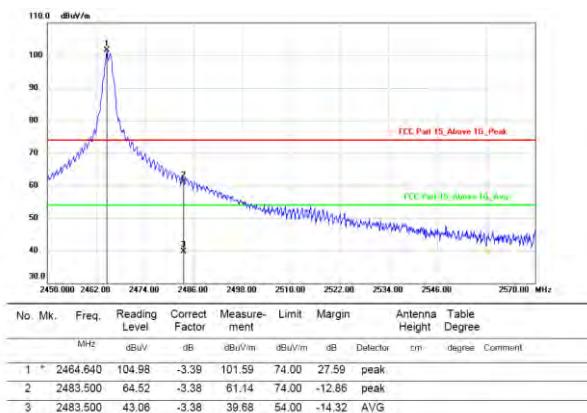


hopping-off

hopping-on

Test Mode: GFSK-High (2465MHz)

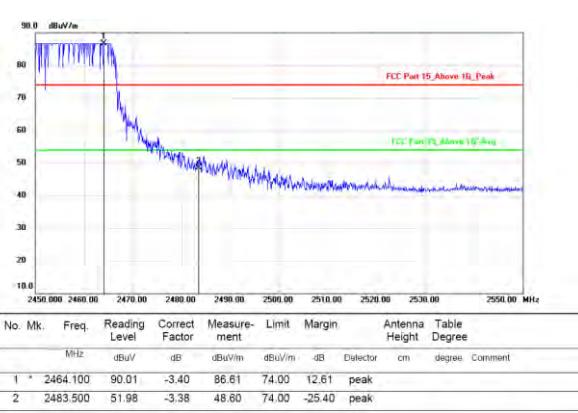
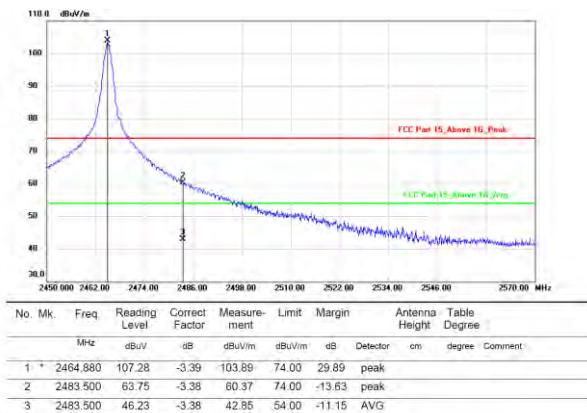
Polarization: Vertical



hopping-off

hopping-on

Polarization: Horizontal



hopping-off

hopping-on

Note: 1. *:Maximum data; x:Over limit; !:over margin.

2. Measurement=Reading Level+Correct Factor; Correct Factor=Antenna Factor+Cable Loss.

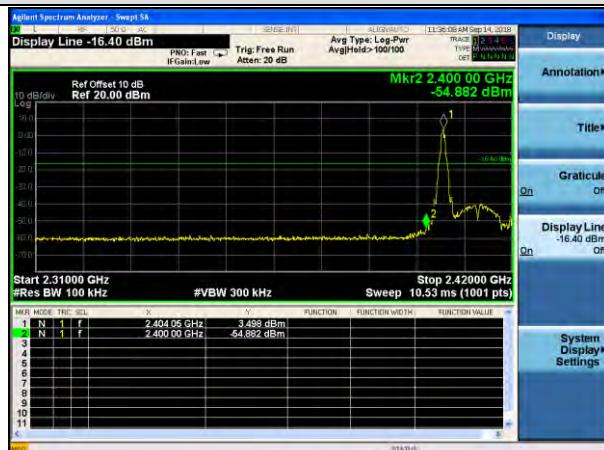
Conducted Method

GFSK Mode:

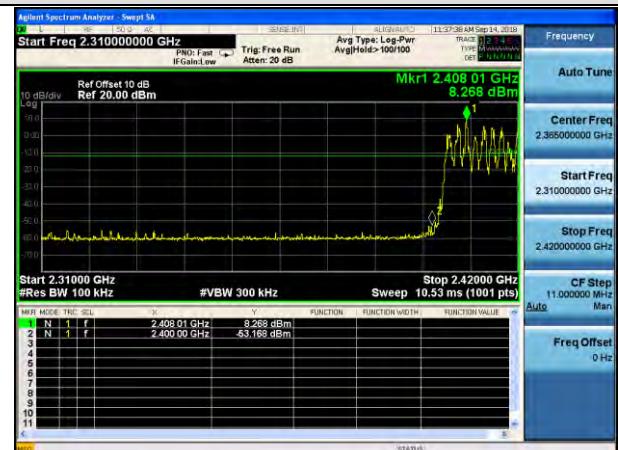
2404-2470 MHz:

Test channel:

Lowest channel



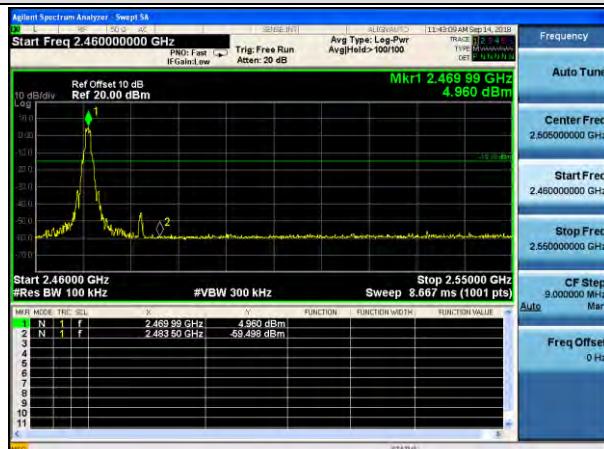
Hopping-off mode



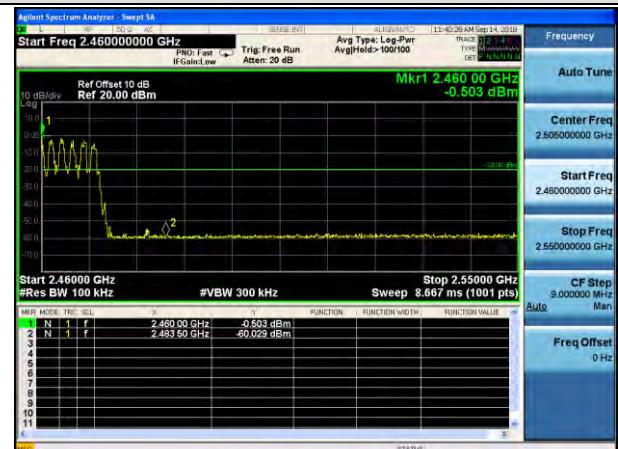
Hopping-on mode

Test channel:

Highest channel



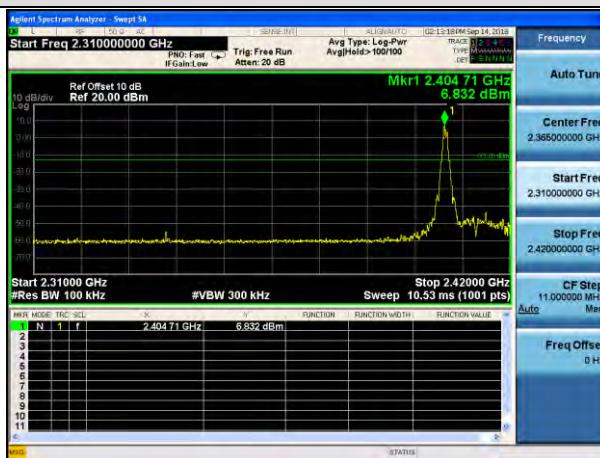
Hopping-off mode



Hopping-on mode

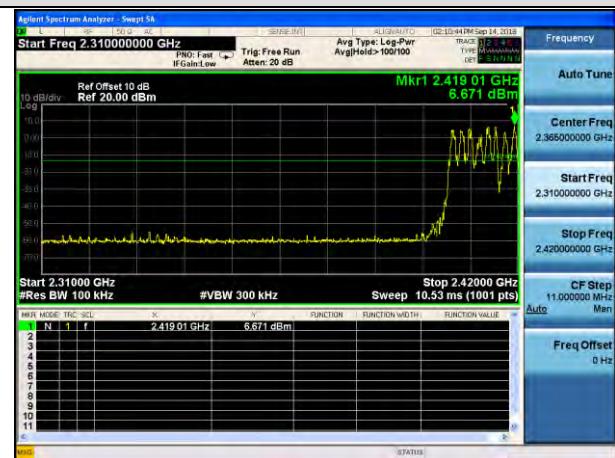
2405-2471 MHz:

Test channel:



Hopping-off mode

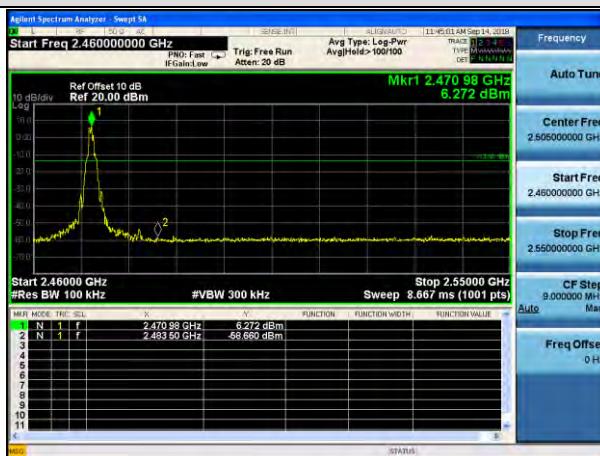
Lowest channel



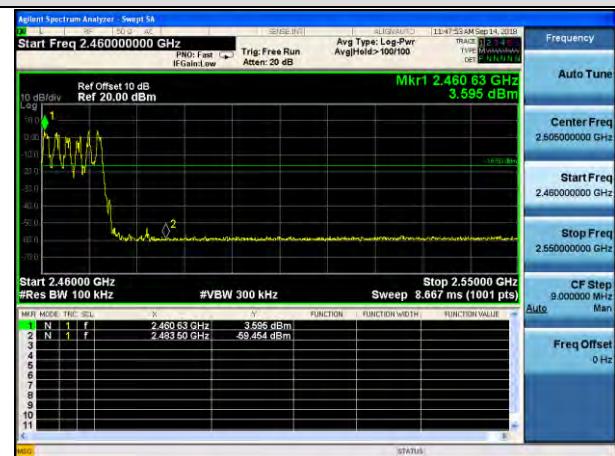
Hopping-on mode

Test channel:

Highest channel



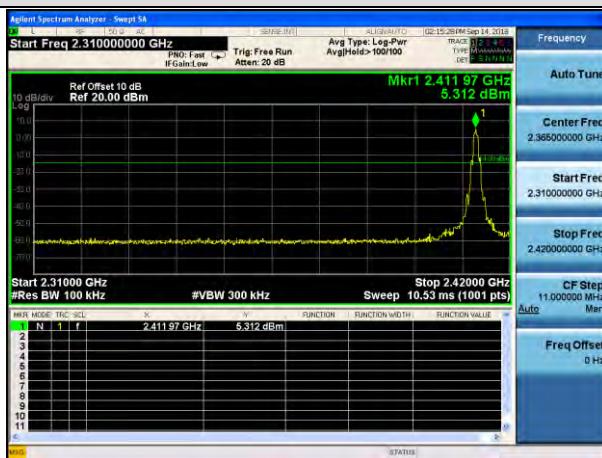
Hopping-off mode



Hopping-on mode

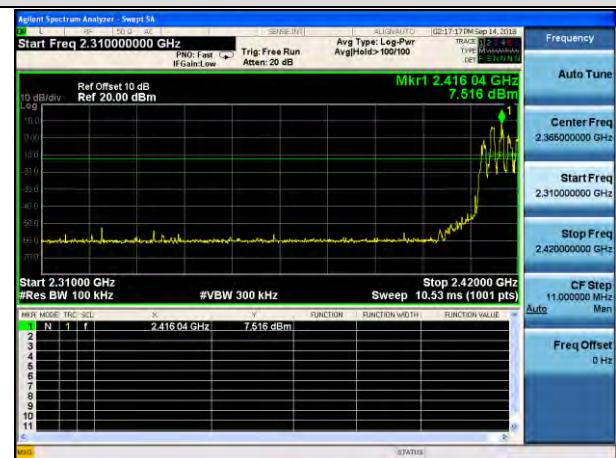
2412-2478 MHz:

Test channel:



Hopping-off mode

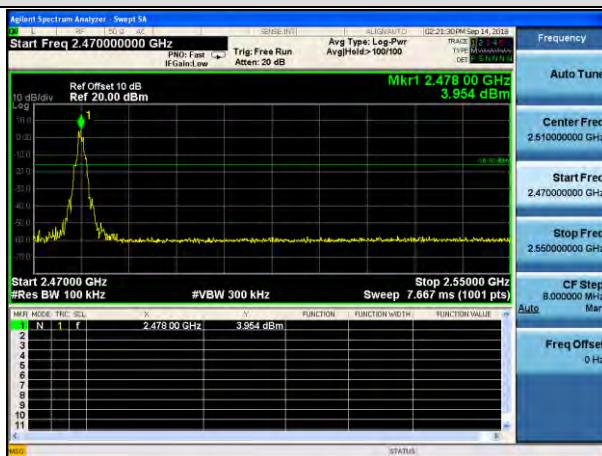
Lowest channel



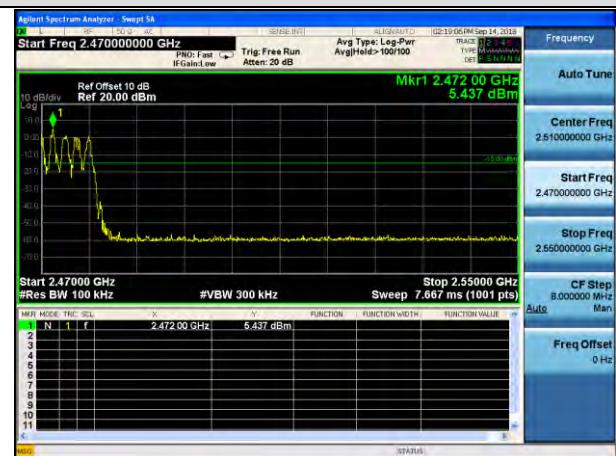
Hopping-on mode

Test channel:

Highest channel



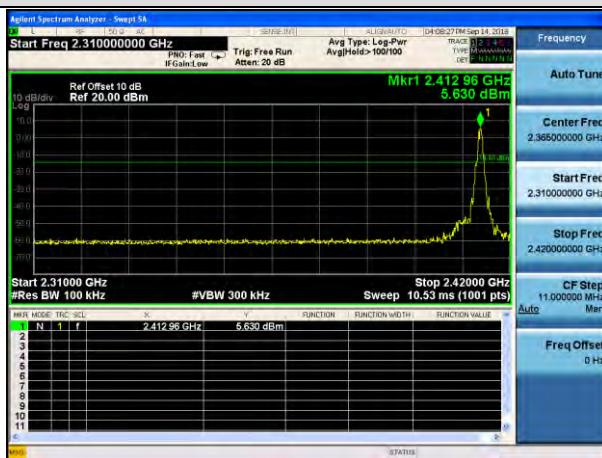
Hopping-off mode



Hopping-on mode

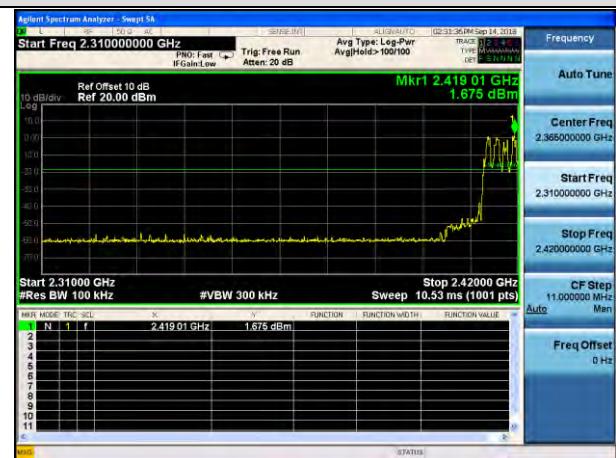
2413-2479 MHz:

Test channel:



Hopping-off mode

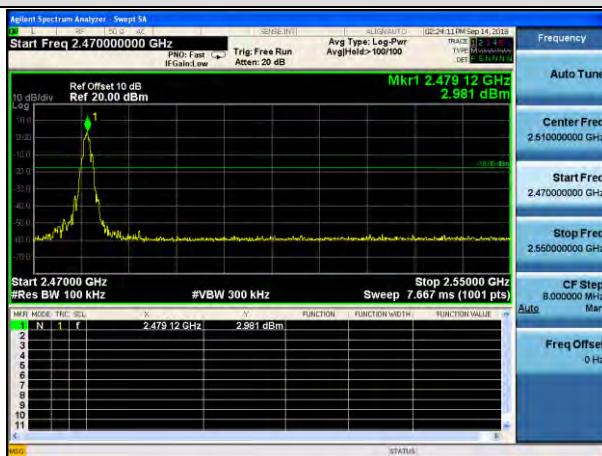
Lowest channel



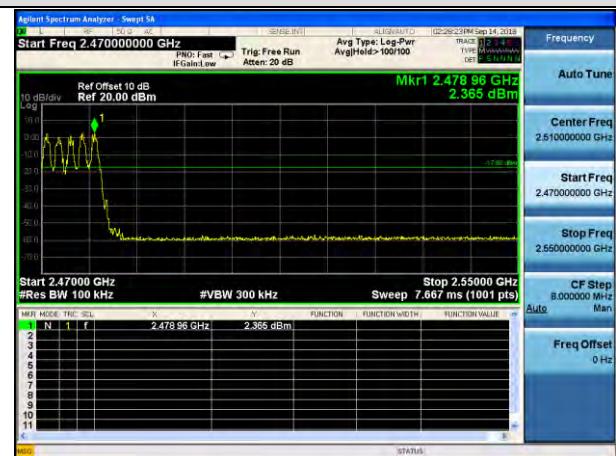
Hopping-on mode

Test channel:

Highest channel



Hopping-off mode



Hopping-on mode

2410-2465MHz:

Test channel:



Hopping-off mode

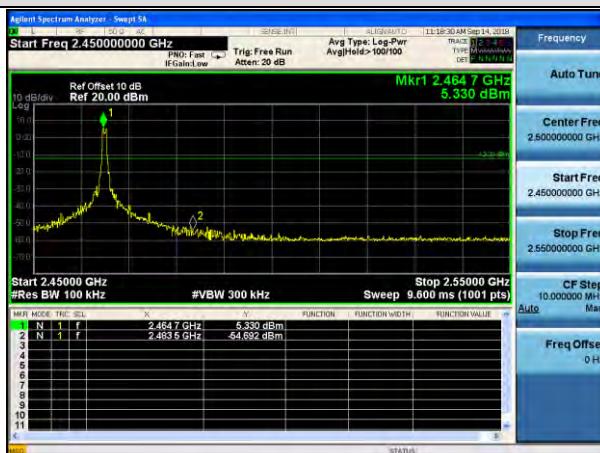
Lowest channel



Hopping-on mode

Test channel:

Highest channel



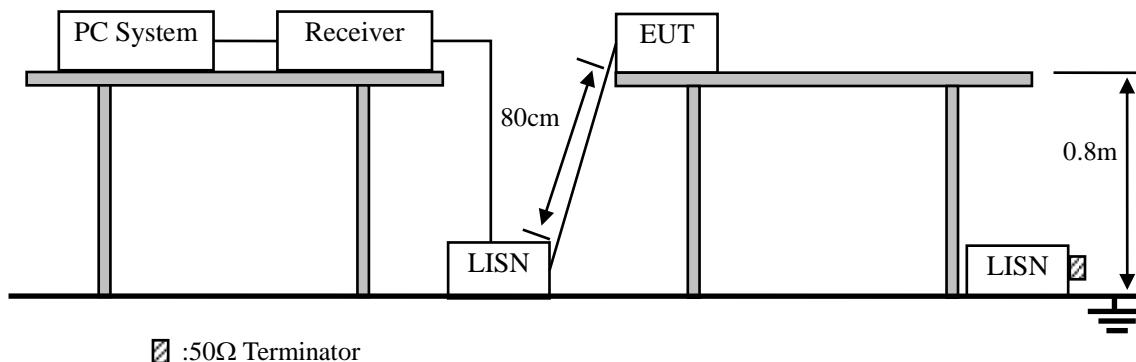
Hopping-off mode



Hopping-on mode

10. POWER LINE CONDUCTED EMISSIONS

10.1. Block Diagram of Test Setup



50Ω Terminator

10.2. Limit

Frequency	Maximum RF Line Voltage	
	Quasi-Peak Level dB(µV)	Average Level dB(µV)
150kHz ~ 500kHz	66 ~ 56*	56 ~ 46*
500kHz ~ 5MHz	56	46
5MHz ~ 30MHz	60	50

Notes: 1. * Decreasing linearly with logarithm of frequency.

2. The lower limit shall apply at the transition frequencies.

10.3. Test Procedure

- (1) The EUT was placed on a non-metallic table, 80cm above the ground plane.
- (2) Setup the EUT and simulator as shown in 10.1
- (3) The EUT Power connected to the power mains through a power adapter and a line impedance stabilization network (L.I.S.N1). The other peripheral devices power cord connected to the power mains through a line impedance stabilization network (L.I.S.N2), this provided a 50-ohm coupling impedance for the EUT (Please refer to the block diagram of the test setup and photographs). Both sides of power line were checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipments and all of the interface cables were changed according to ANSI C63.10 :2013 on conducted Emission test.
- (4) The bandwidth of test receiver is set at 10KHz.
- (5) The frequency range from 150 KHz to 30MHz is checked.

10.4. Test Result

PASS. (See below detailed test data)

Note: If peak Result comply with AV limit, QP and AV Result is deemed to comply with AV limit

Line:

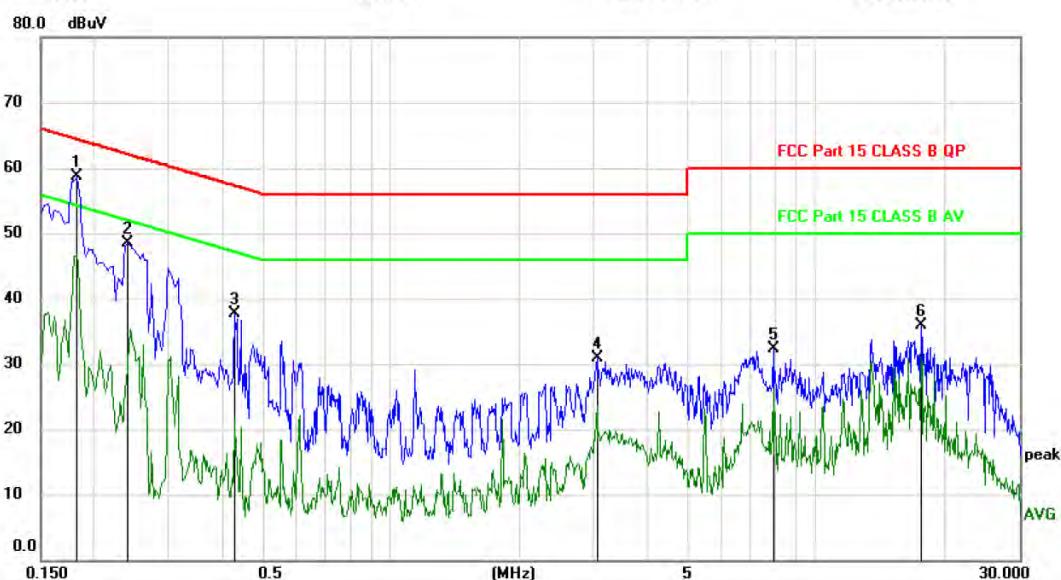
Conducted Emission Measurement

File :08

Data :#4

Date: 2018-8-7

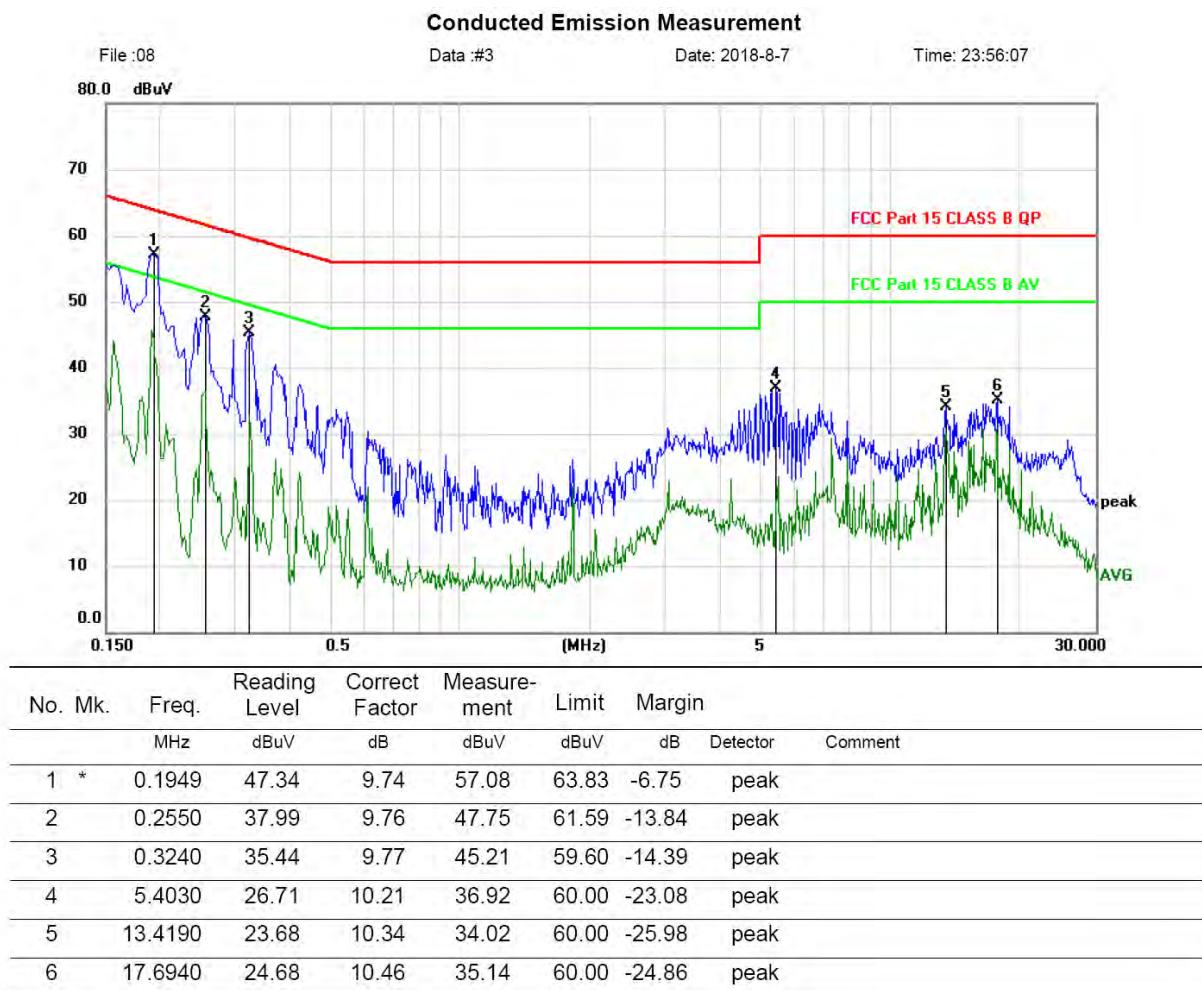
Time: 23:58:23



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin	Detector	Comment
		MHz	dBuV	dB	dBuV	dB			
1	*	0.1830	48.92	9.74	58.66	64.35	-5.69	peak	
2		0.2400	38.66	9.75	48.41	62.10	-13.69	peak	
3		0.4290	27.88	9.78	37.66	57.27	-19.61	peak	
4		3.0420	20.96	10.04	31.00	56.00	-25.00	peak	
5		7.9230	21.93	10.30	32.23	60.00	-27.77	peak	
6		17.6400	25.47	10.46	35.93	60.00	-24.07	peak	

*:Maximum data x:Over limit !:over margin

Note: Measurement=Reading Level+Correc Factor. Factor=(LISN or ISN or PLC or Current Probe)Factor+Cable

Neutral:

*:Maximum data x:Over limit !:over margin

Note: Measurement=Reading Level+Correc Factor. Factor=(LISN or ISN or PLC or Current Probe)Factor+Cable

Remark: All modes have been tested, and only worst data of Channel 2479MHz (FH5: 2413-2479MHz; AC 120V/ 60Hz) was listed in this report.

11. ANTENNA REQUIREMENTS

11.1. Limit

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

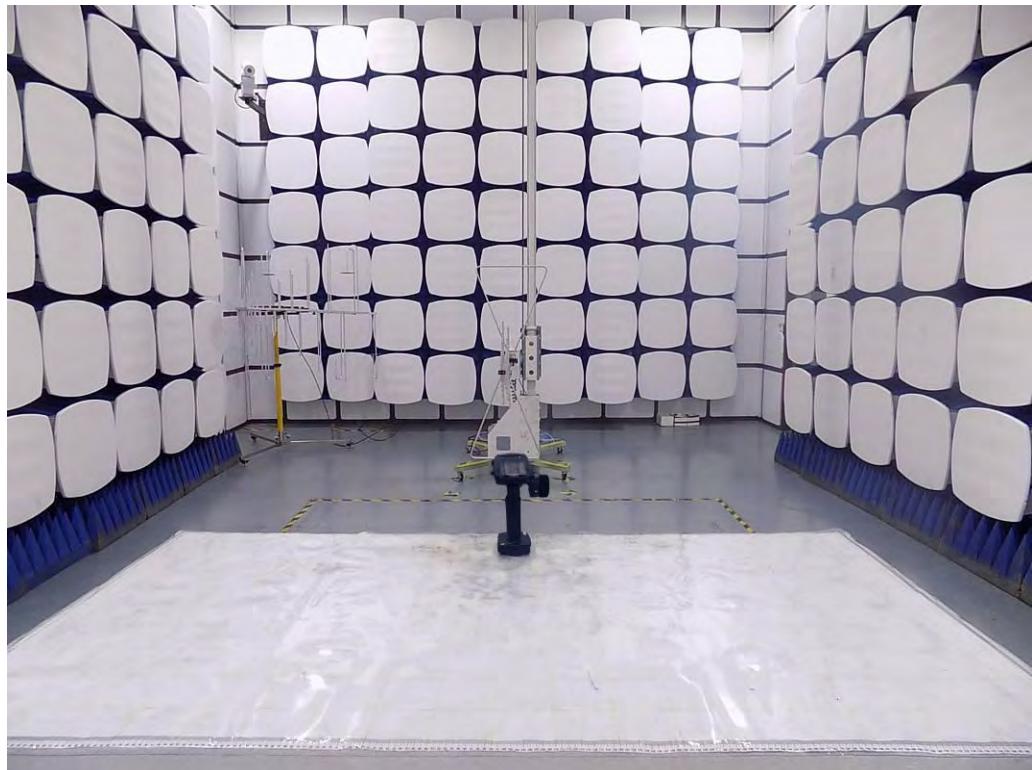
11.2. Result

The EUT antenna is PIFA Antenna. It complies with the standard requirement.

Antenna connector type: ipex connector.

12. TEST SETUP PHOTO

12.1. Photos of Radiated emission

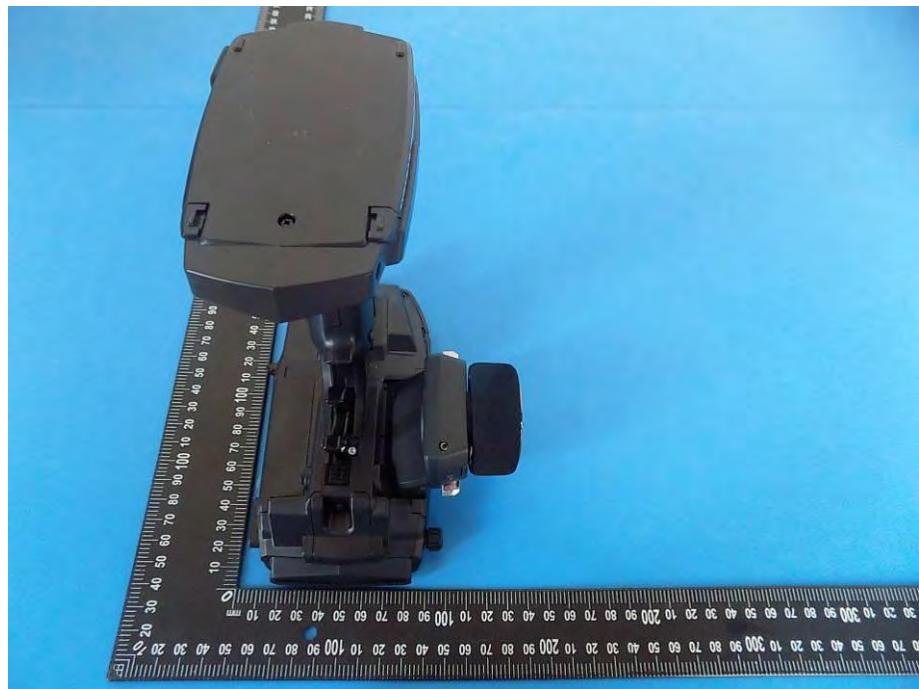


12.2.Photos of Conducted Emission test

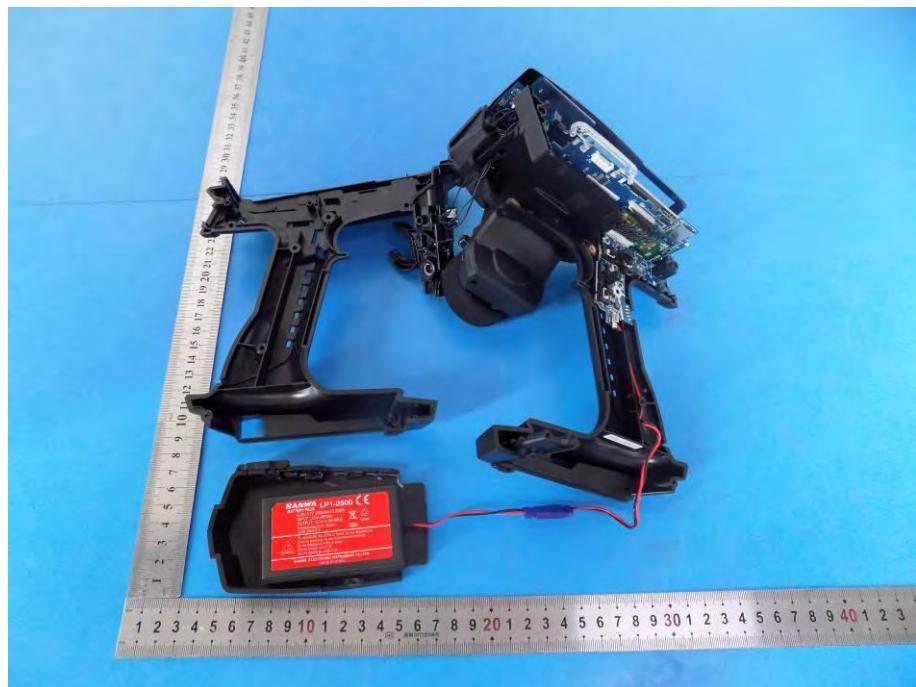


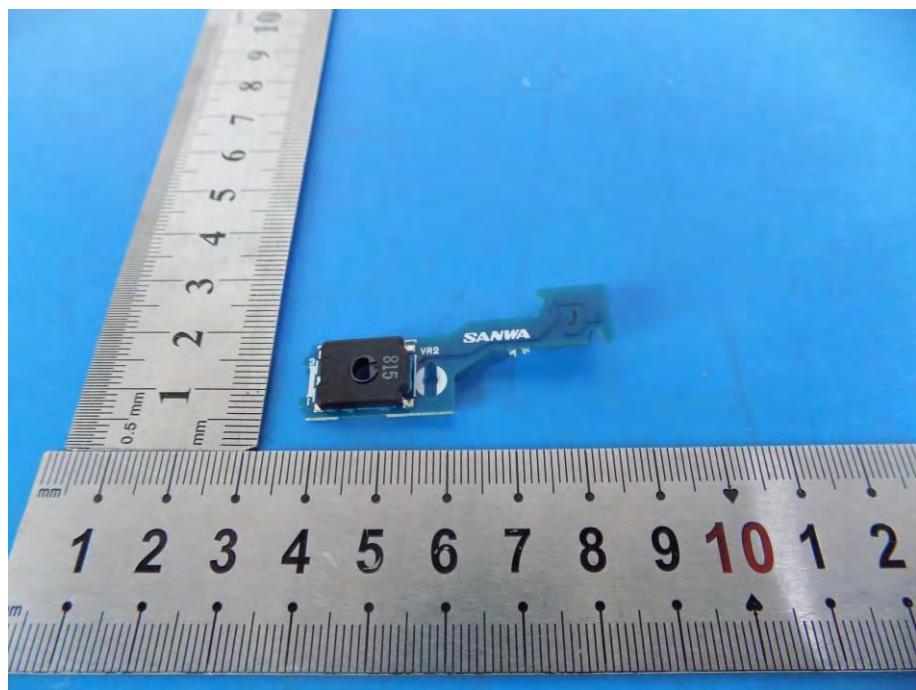
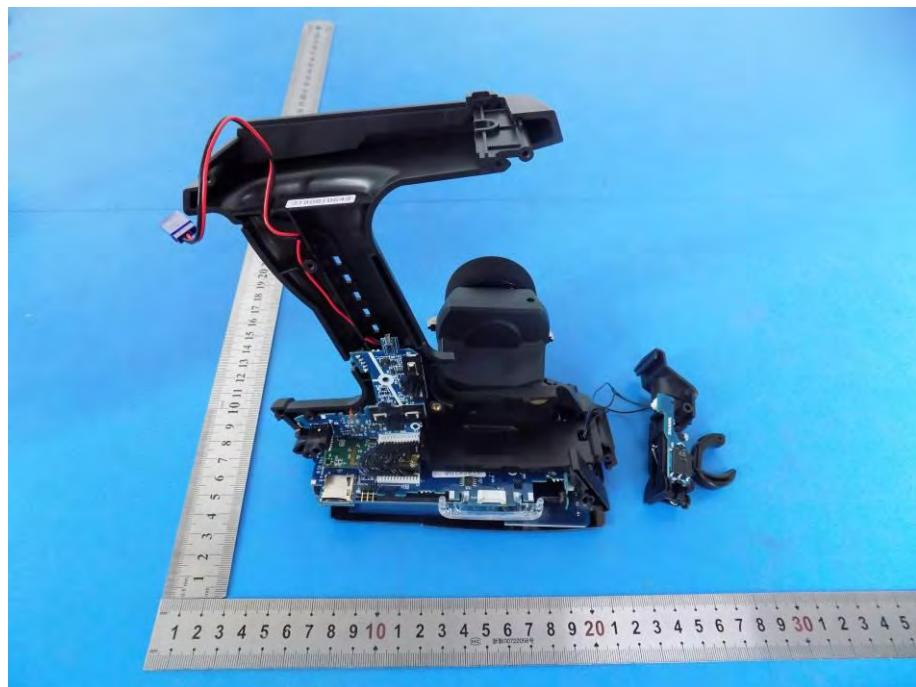
13. PHOTOS OF THE EUT

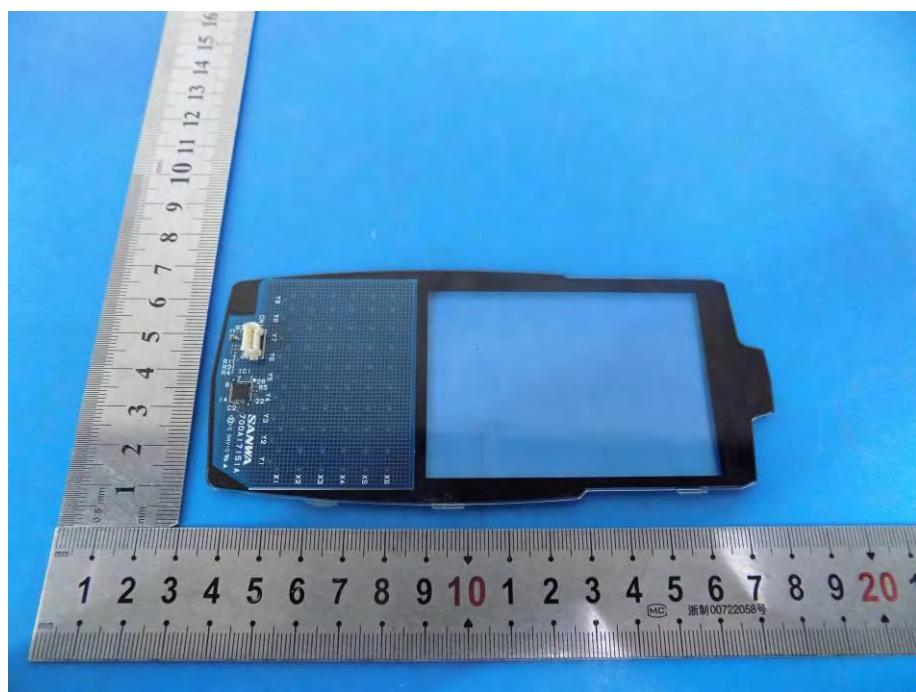
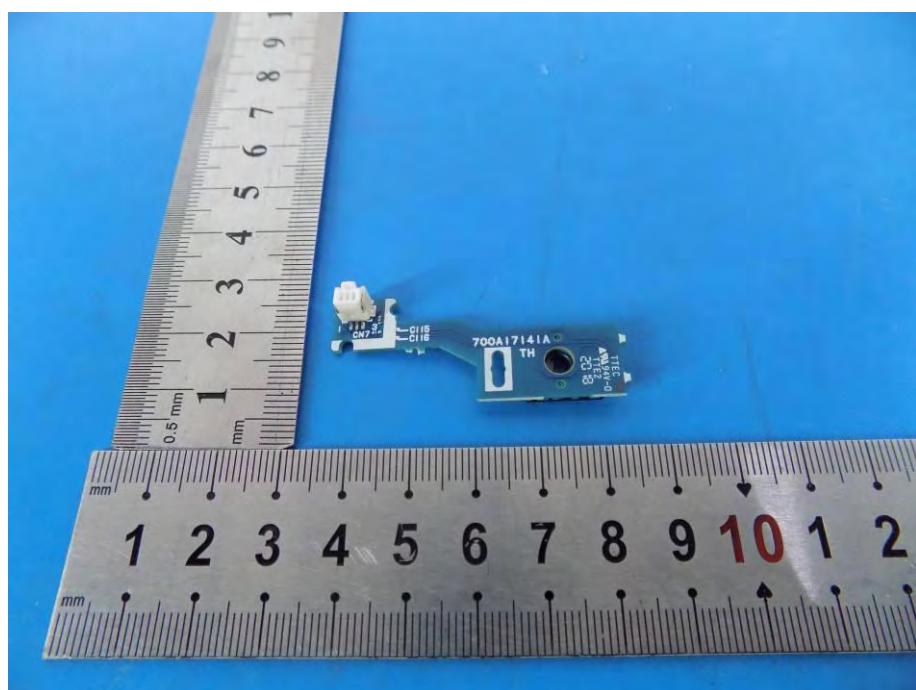


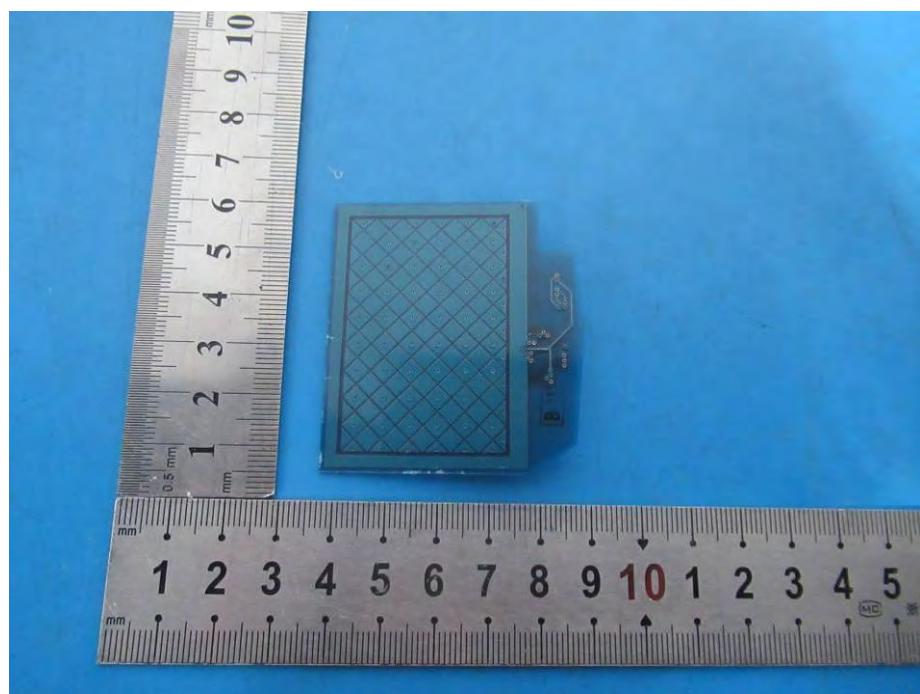
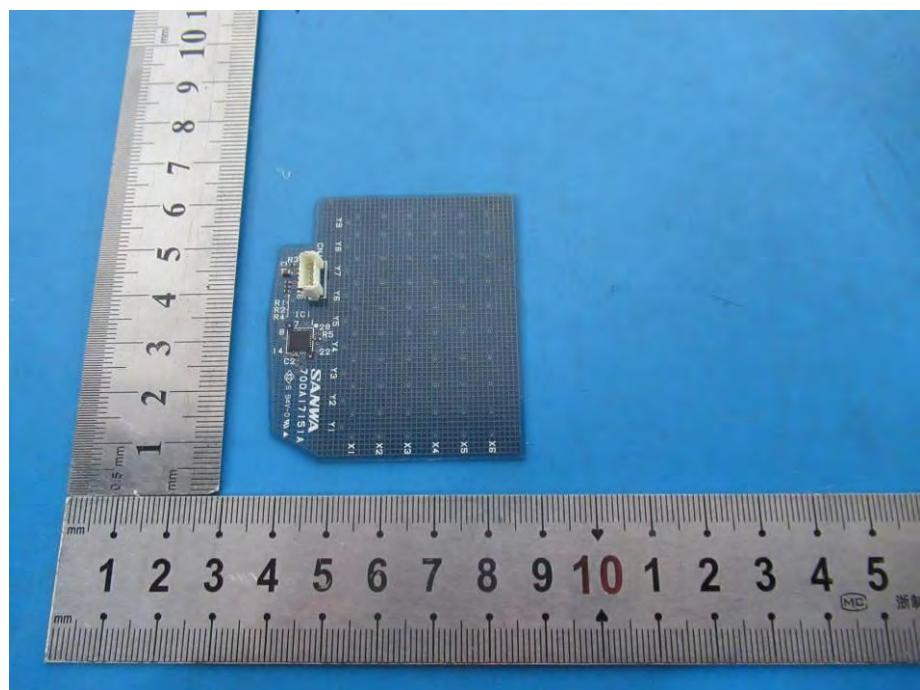


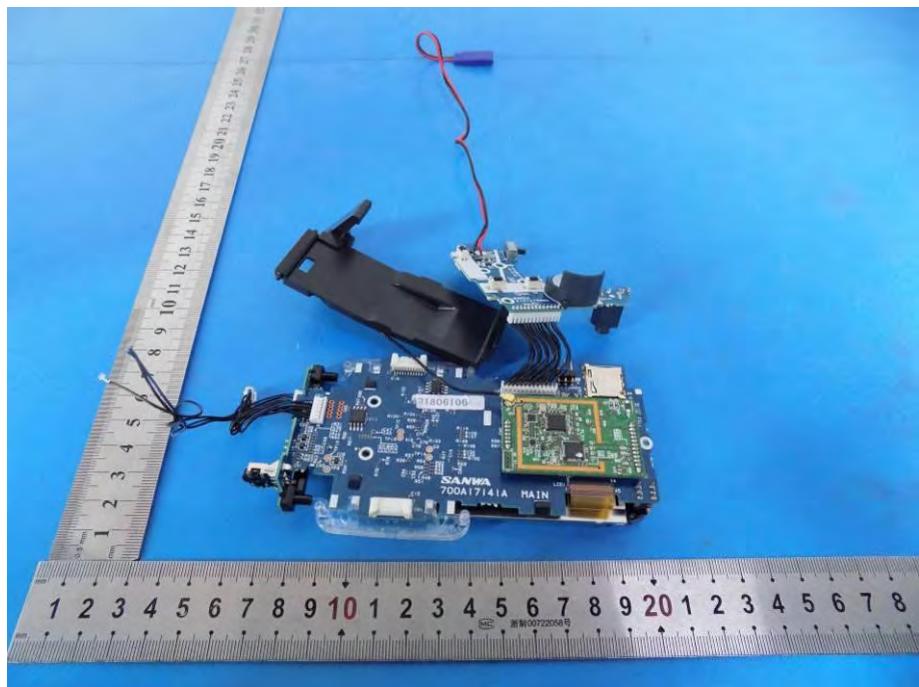


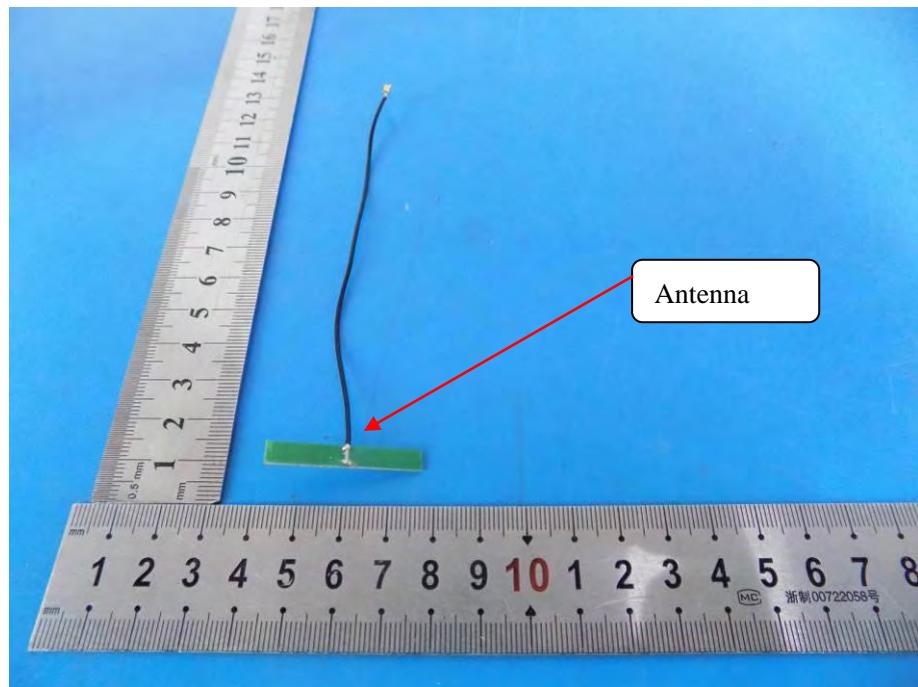


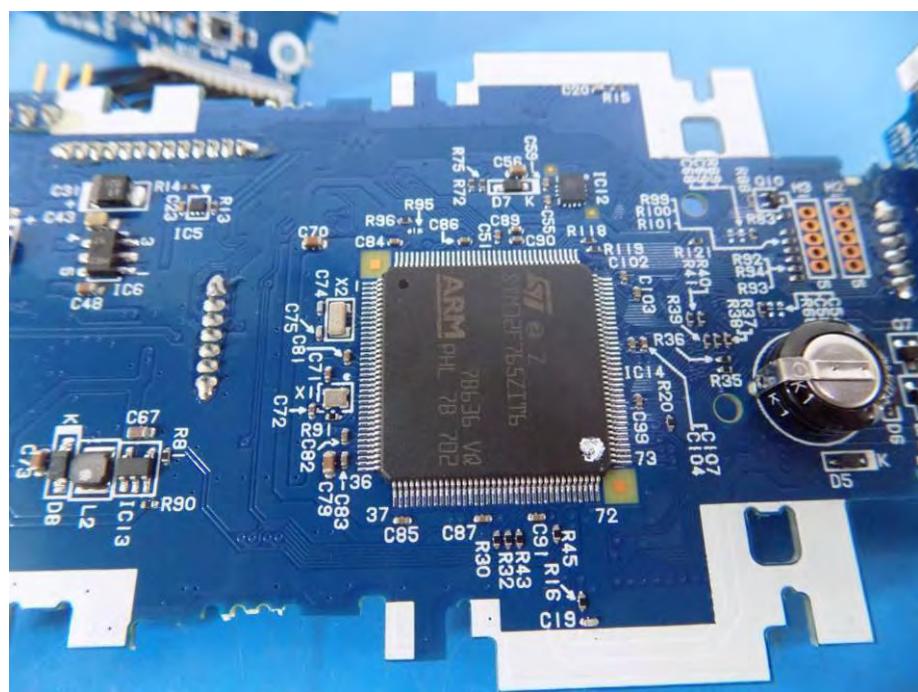
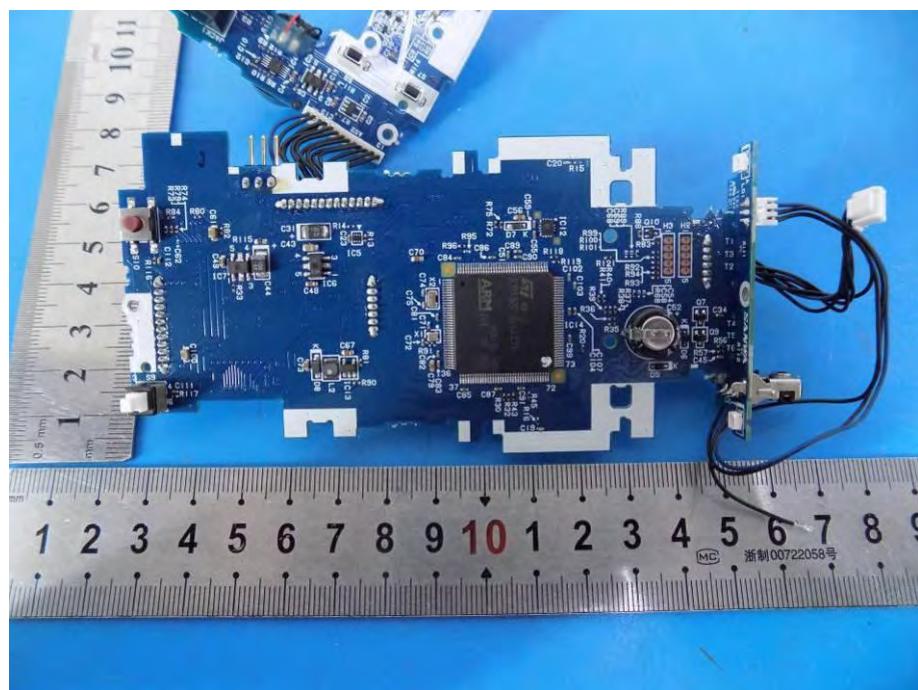


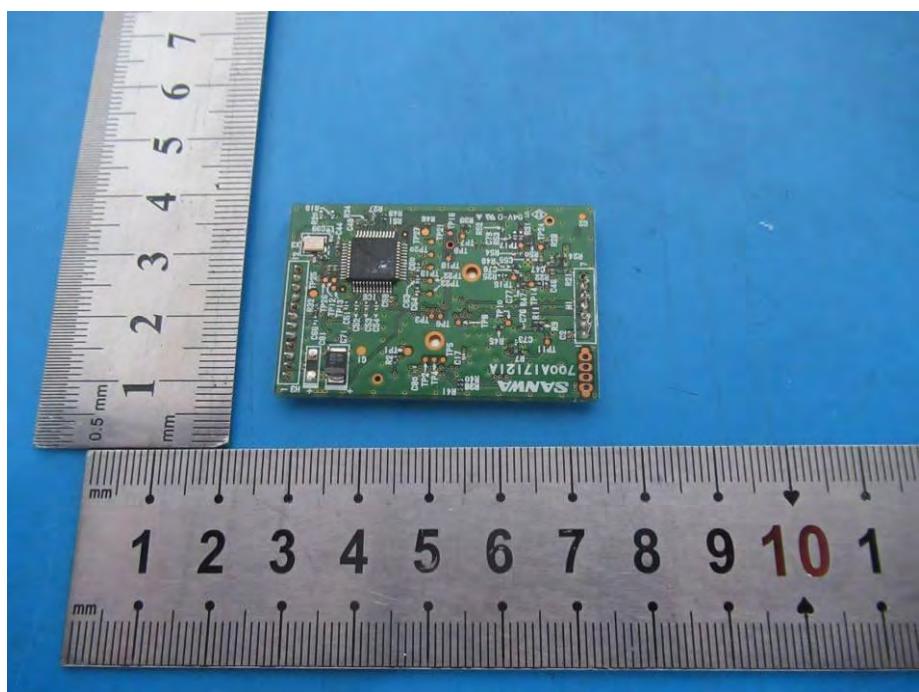
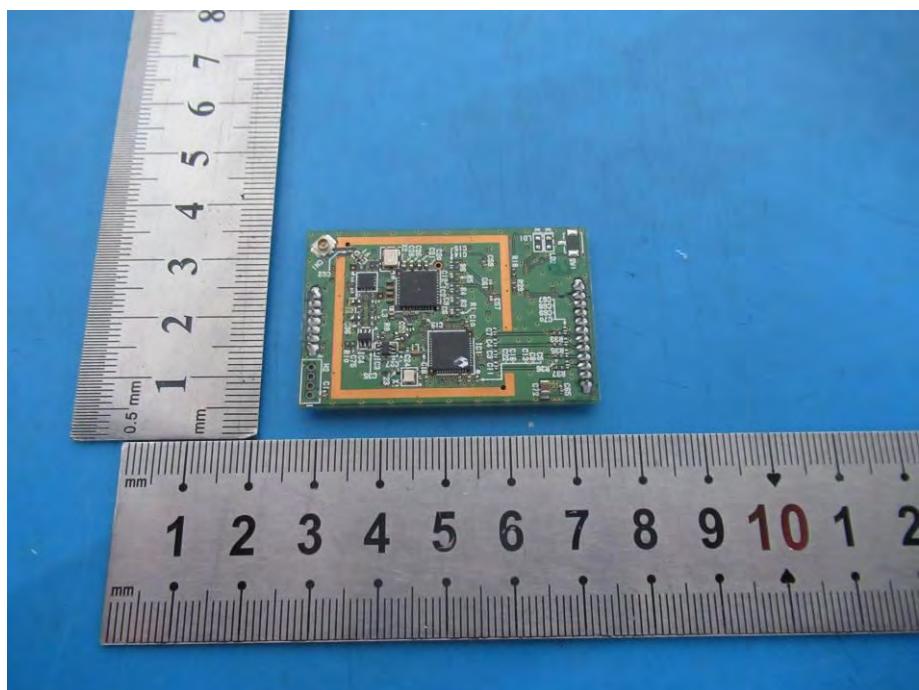


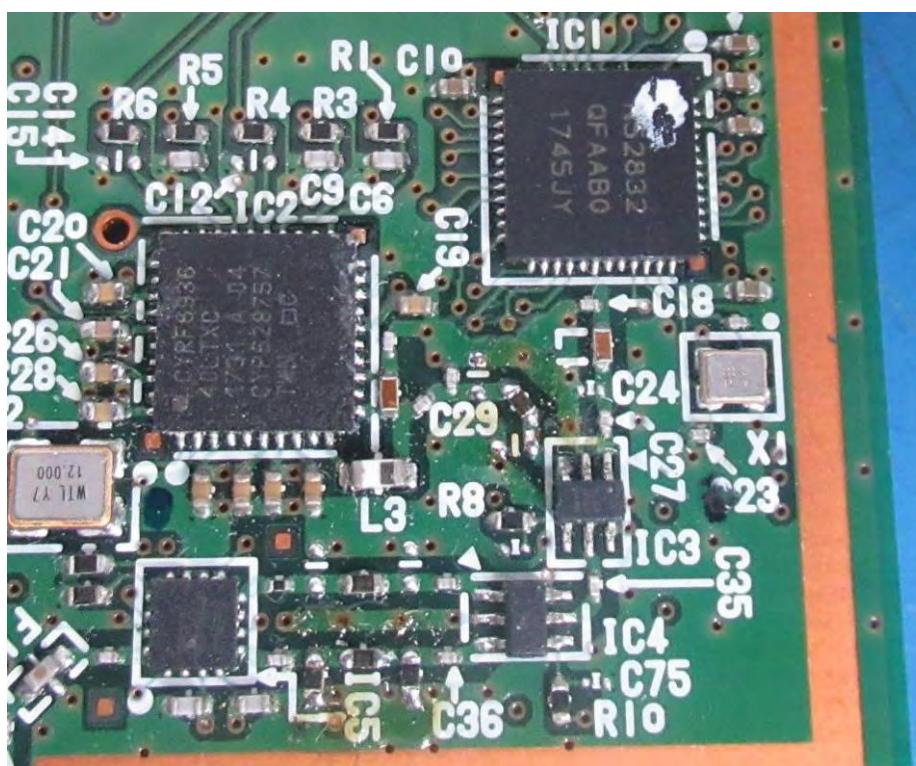
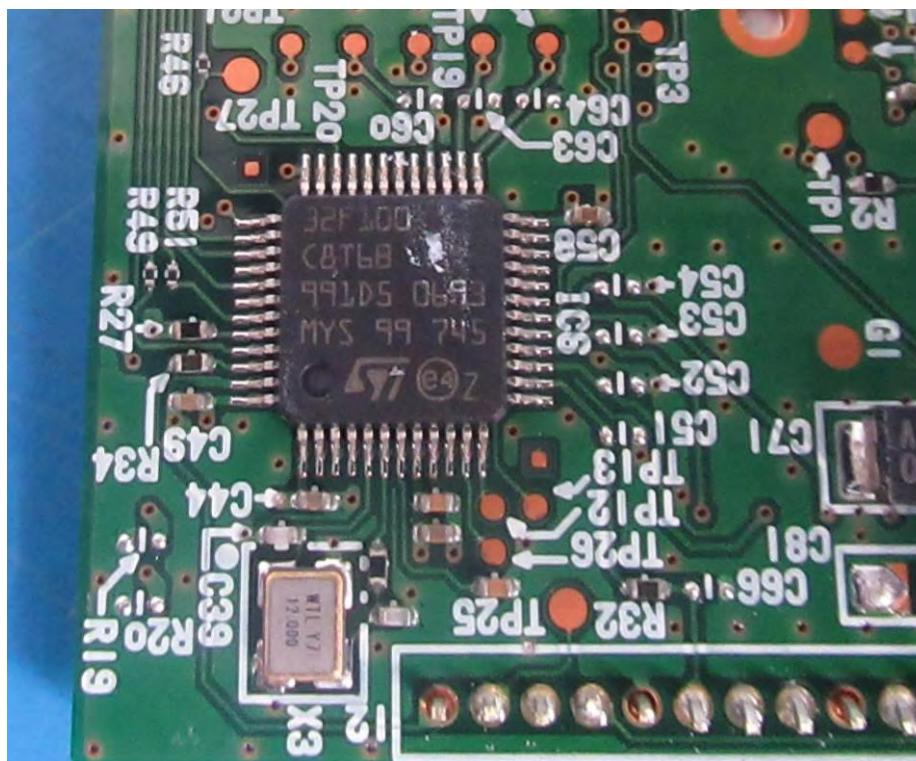


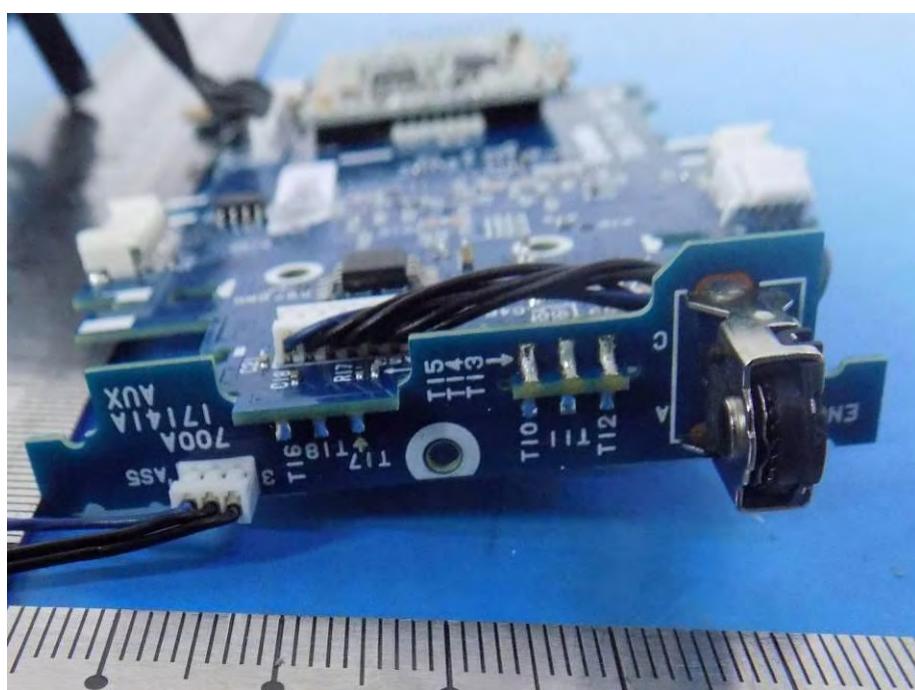
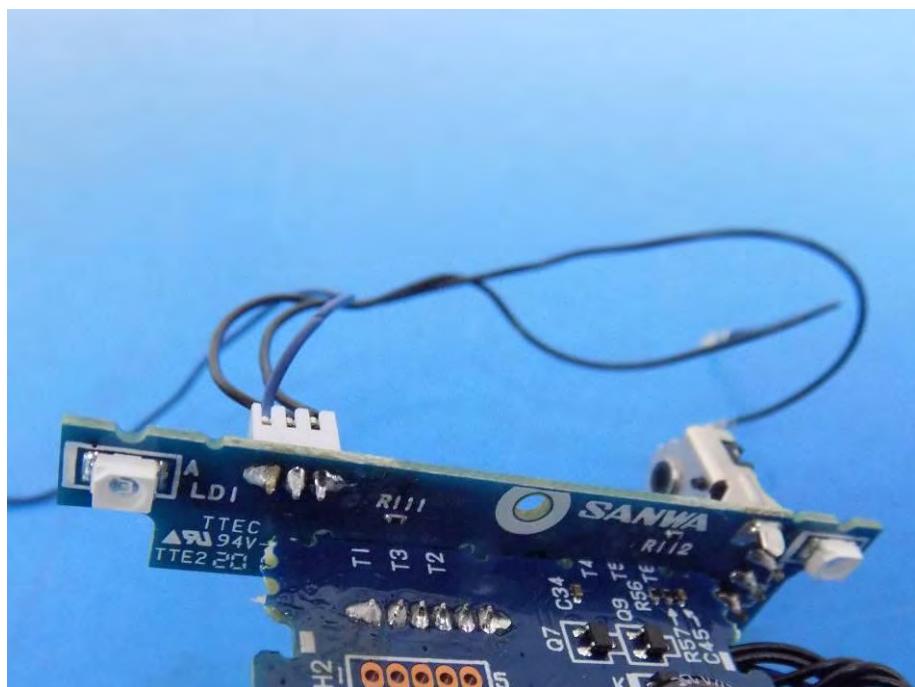


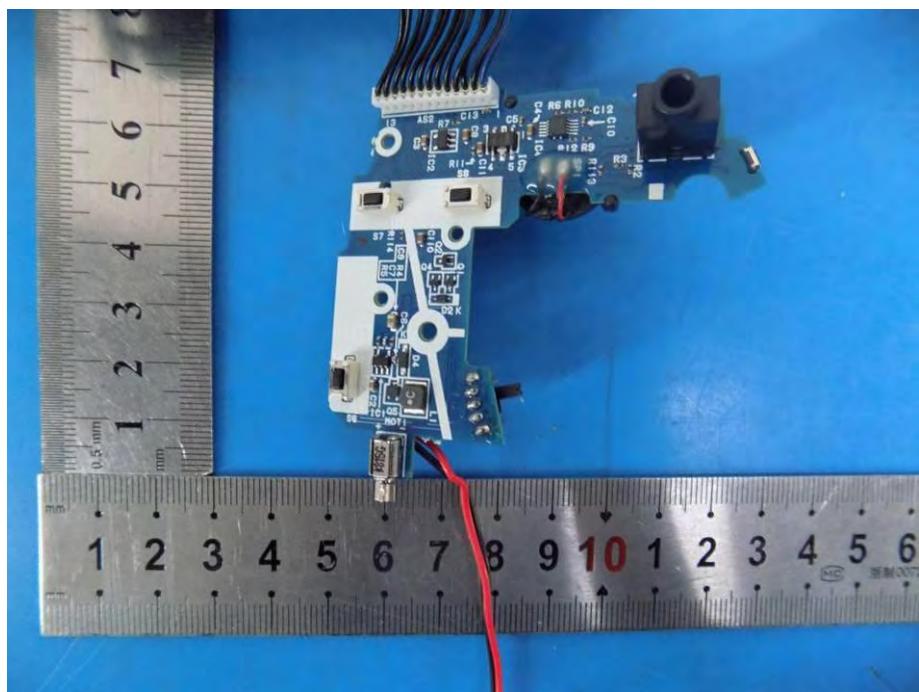
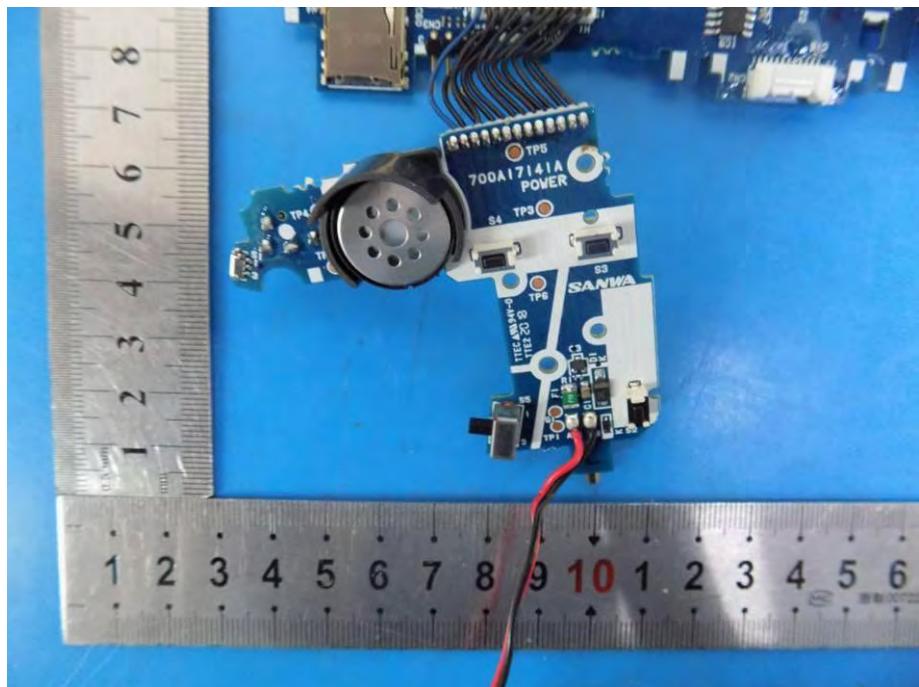


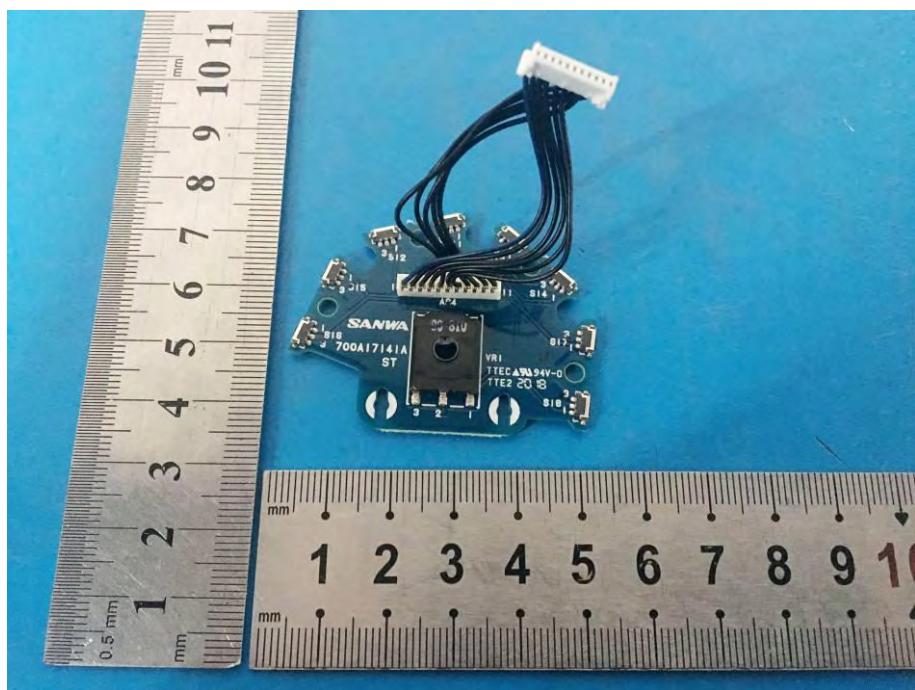
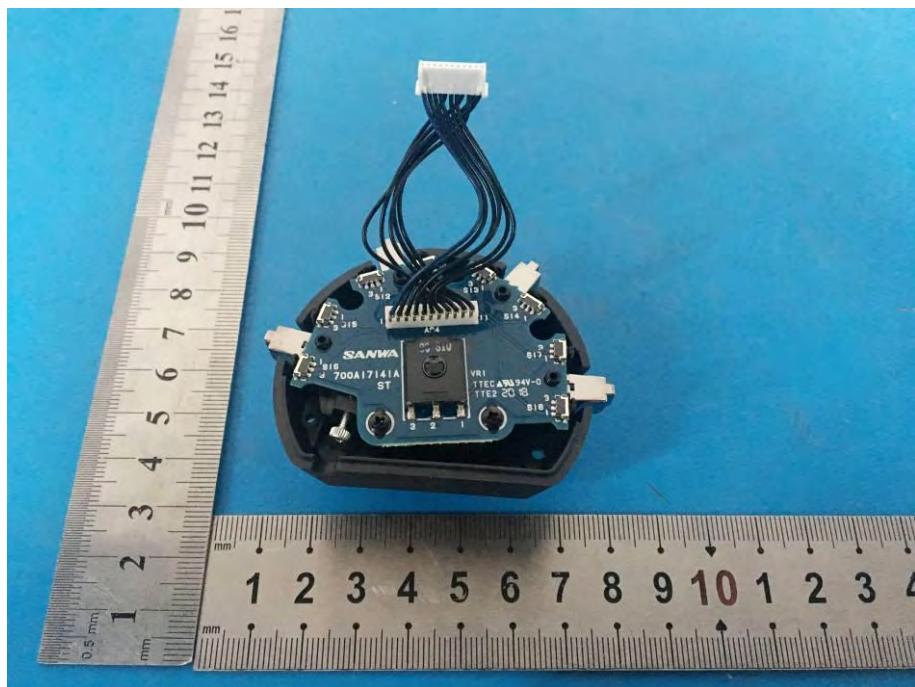


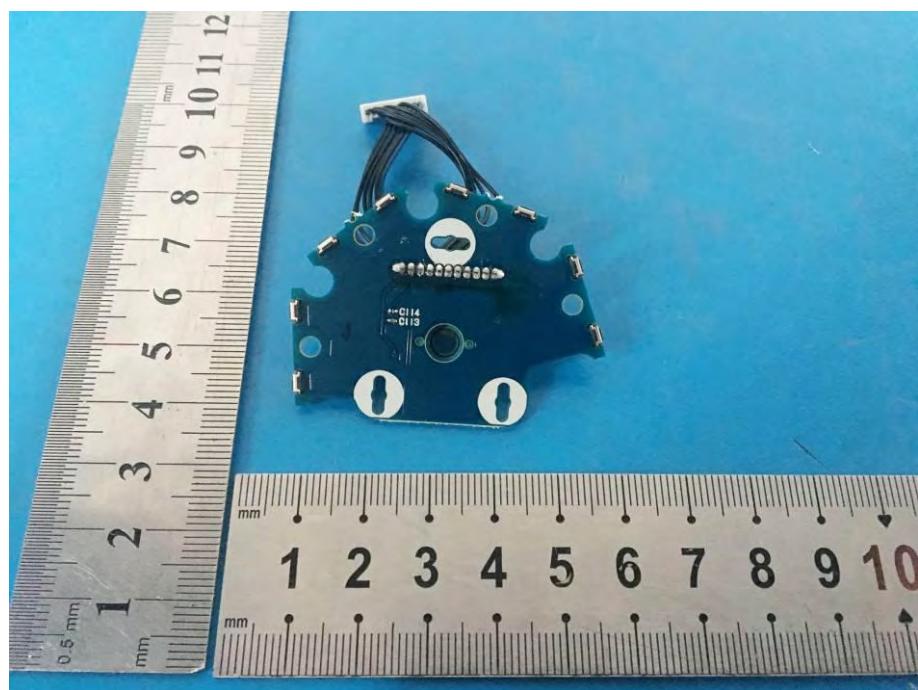












----END OF REPORT----