TEST REPORT

Reference No.	:	WTS17S0681598E
FCC ID.....	:	2AD33HE620700
Applicant	:	FLYBALL ELECTRONIC (SHENZHEN) CO. LTD
Address	:	5-6 Building, Zhiji Industrial Park, Shenzhen, China
Manufacturer	:	FLYBALL ELECTRONIC (SHENZHEN) CO. LTD
Address	:	5-6 Building, Zhiji Industrial Park, Shenzhen, China
Product Name	:	MULTIMEDIA SPEAKER SYSTEM
Model No.	:	HE-620700, HE-621200, H6311KBU, C9201KBU-F267G
Brand Name.	:	QFX
Standards	:	FCC CFR47 Part 15 Section 15.247:2016
Date of Receipt sample	:	Jun. 10, 2017
Date of Test	:	Jun. 11 – 21, 2017
Date of Issue	:	Jun. 23, 2017
Test Result	:	**Pass**

Remarks:

The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

Prepared By:

Waltek Services (Shenzhen) Co., Ltd.

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Robin Zhou / Test Engineer

Approved by:

Philo Zhong / Manager

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3 Revision History

Test report No.	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTS17S0681598E	Jun. 10, 2017	Jun. 11 – 21, 2017	Jun. 23, 2017	original	-	Valid

4 General Information

4.1 General Description of E.U.T.

Product Name	: MULTIMEDIA SPEAKER SYSTEM
Model No.	: HE-620700, HE-621200, H6311KBU, C9201KBU-F267G
Model Description	: The model HE-620700 is the tested sample. All models are same in all respects. Only except for the different model names due to market's requirement.
Operation Frequency	: 2402-2480MHz, 79(EDR) Channels in total
The Lowest Oscillator	: 32.768KHz
Antenna Gain	: 0dBi
Type of Modulation	: GFSK, Pi/4DQPSK, 8DPSK
Antenna installation	: PCB Printed Antenna

4.2 Details of E.U.T.

Technical Data : ~100-240V, 50-60Hz

4.3 Channel List

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
1	2402	2	2403	3	2404	4	2405
5	2406	6	2407	7	2408	8	2409
9	2410	10	2411	11	2412	12	2413
13	2414	14	2415	15	2416	16	2417
17	2418	18	2419	19	2420	20	2421
21	2422	22	2423	23	2424	24	2425
25	2426	26	2427	27	2428	28	2429
29	2430	30	2431	31	2432	32	2433
33	2434	34	2435	35	2436	36	2437
37	2438	38	2439	39	2440	40	2441
41	2442	42	2443	43	2444	44	2445
45	2446	46	2447	47	2448	48	2449
49	2450	50	2451	51	2452	52	2453
53	2454	54	2455	55	2456	56	2457
57	2458	58	2459	59	2460	60	2461
61	2462	62	2463	63	2464	64	2465
65	2466	66	2467	67	2468	68	2469
69	2470	70	2471	71	2472	72	2473
73	2474	74	2475	75	2476	76	2477
77	2478	78	2479	79	2480	-	-

4.4 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Table 1 Tests carried out under FCC part 15.247

Bluetooth mode	Test mode	Low channel	Middle channel	High channel
EDR	Transmitting	2402MHz	2441MHz	2480MHz

Table 2 Tests carried out under FCC part 15.207 and 15.209

Test Item	Test Mode
Radiated Emissions	Bluetooth Transmitting
Conducted Emissions	Bluetooth Transmitting

4.5 Test Facility

The test facility has a test site registered with the following organizations:

- **IC – Registration No.: 7760A-1**

  Waltek Services(Shenzhen) Co., Ltd. has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files. Registration 7760A-1, October 15, 2015

- **FCC Test Site– Registration No.: 328995**

  Waltek Services(Shenzhen) Co., Ltd. EMC Laboratory `has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 328995, December 3, 2014.

5 Equipment Used during Test

5.1 Equipments List

Conducted Emissions

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	EMI Test Receiver	R&S	ESCI	101155	Sep.12, 2016	Sep.11, 2017
2	LISN	SCHWARZBECK	NSLK 8128	8128-289	Sep.12, 2016	Sep.11, 2017
3	Limiter	York	MTS-IMP-136	261115-001-0024	Sep.12, 2016	Sep.11, 2017
4	Cable	Laplace	RF300	-	Sep.12, 2016	Sep.11, 2017

3m Semi-anechoic Chamber for Radiation Emissions

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	Spectrum Analyzer	R&S	FSP	100091	Apr. 07, 2017	Apr. 06, 2018
2	Amplifier	Agilent	8447D	2944A10178	Jan. 12, 2017	Jan. 11, 2018
3	Active Loop Antenna	Beijing Dazhi	ZN30900A	0703	Oct. 17, 2016	Oct. 16, 2017
4	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	Apr. 07, 2017	Apr. 06, 2018
5	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	Sep.12, 2016	Sep.11, 2017
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	Apr. 07, 2017	Apr. 06, 2018
7	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	Apr. 07, 2017	Apr. 06, 2018
8	Coaxial Cable (above 1GHz)	Top	1GHz-18GHz	EW02014-7	Apr. 07, 2017	Apr. 06, 2018
9	Test Receiver	R&S	ESCI	101296	Apr. 06, 2017	Apr. 05, 2018
10	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	Apr. 07, 2017	Apr. 06, 2018
11	Amplifier	ANRITSU	MH648A	M43381	Apr. 07, 2017	Apr. 06, 2018
12	Cable	HUBER+SUHNER	CBL2	525178	Apr. 07, 2017	Apr. 06, 2018

RF Conducted Testing

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMC Analyzer (9k~26.5GHz)	Agilent	E7405A	MY45114943	Sep.12, 2016	Sep.11, 2017
2.	Spectrum Analyzer (9k-6GHz)	R&S	FSL6	100959	Sep.12, 2016	Sep.11, 2017
3.	Signal Analyzer (9k~26.5GHz)	Agilent	N9010A	MY50520207	Sep.12, 2016	Sep.11, 2017

5.2 Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	± 1 x 10^{-6}
RF Power	± 1.0 dB
RF Power Density	± 2.2 dB
Radiated Spurious Emissions test	± 5.03 dB (30M~1000MHz)
	± 5.47 dB (1000M~25000MHz)
Conducted Spurious Emissions test	± 3.64 dB (AC mains 150KHz~30MHz)

5.3 Test Equipment Calibration

All the test equipments used are valid and calibrated by GUANG ZHOU GRG METROLOGY & TEST CO., LTD. address is No.163, Pingyun Rd. West of Huangpu Ave, Tianhe District, Guangzhou, Guangdong, China.

6 Test Summary

Test Items	Test Requirement	Result
Conduct Emission	15.207	C
Spurious Radiated Emissions	15.205(a) 15.209 15.247(d)	C
Band edge	15.247(d) 15.205(a)	C
20dB Bandwidth	15.247(a)(1)	C
Maximum Peak Output Power	15.247(b)(1)	C
Frequency Separation	15.247(a)(1)	C
Number of Hopping Frequency	15.247(a)(1)(iii)	C
Dwell time	15.247(a)(1)(iii)	C
Maximum Permissible Exposure (Exposure of Humans to RF Fields)	1.1307(b)(1)	C
Note: C=Compliance; NC=Not Compliance; NT=Not Tested; N/A=Not Applicable.		

7 Conducted Emission

Test Requirement:	FCC CFR 47 Part 15 Section 15.207
Test Method:	ANSI C63.10:2013;ANSI C63.4:2014
Test Result:	PASS
Frequency Range:	150kHz to 30MHz
Class/Severity:	Class B
Limit:	66-56 dBμV between 0.15MHz & 0.5MHz
	56 dBμV between 0.5MHz & 5MHz
	60 dBμV between 5MHz & 30MHz
Detector:	Peak for pre-scan (9kHz Resolution Bandwidth)

7.1 E.U.T. Operation

Operating Environment **:**

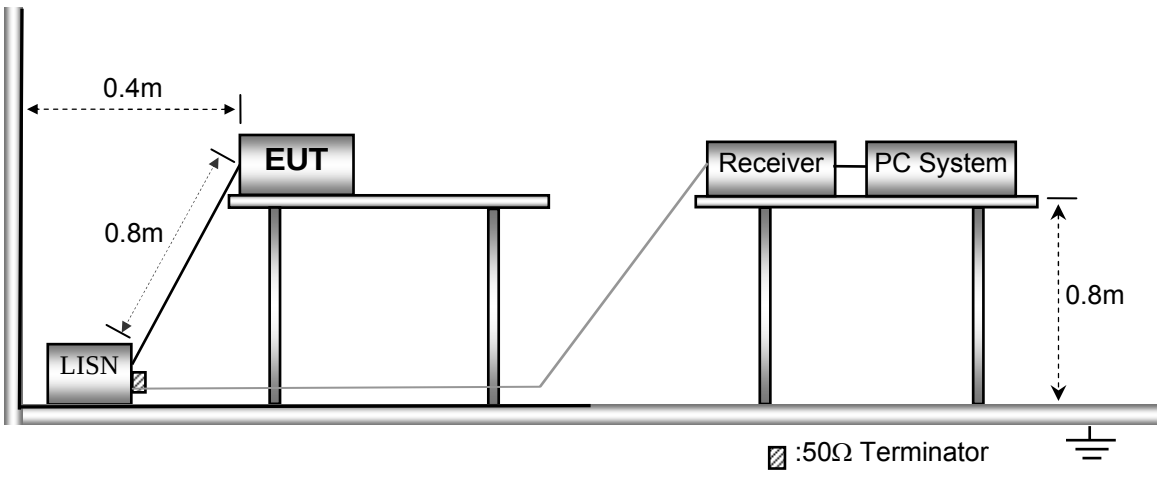
Temperature:	22.8 °C
Humidity:	52.6 % RH
Atmospheric Pressure:	101.2kPa

EUT Operation **:**

The test was performed in Bluetooth Transmitting mode, the test data were shown in the report.

7.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.10:2013.



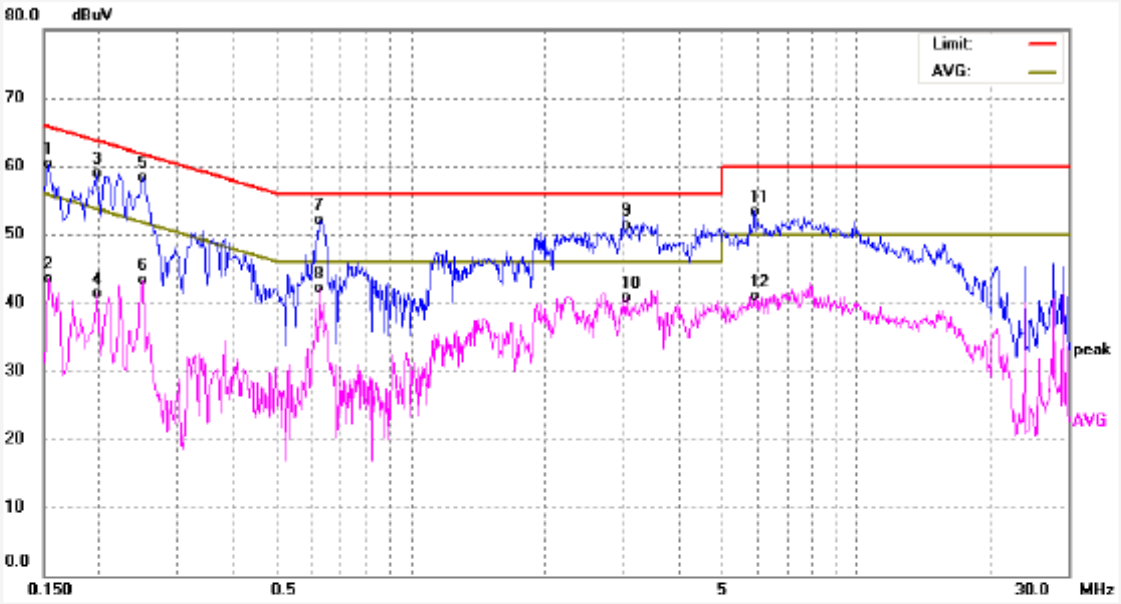
7.3 Measurement Description

The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

7.4 Conducted Emission Test Result

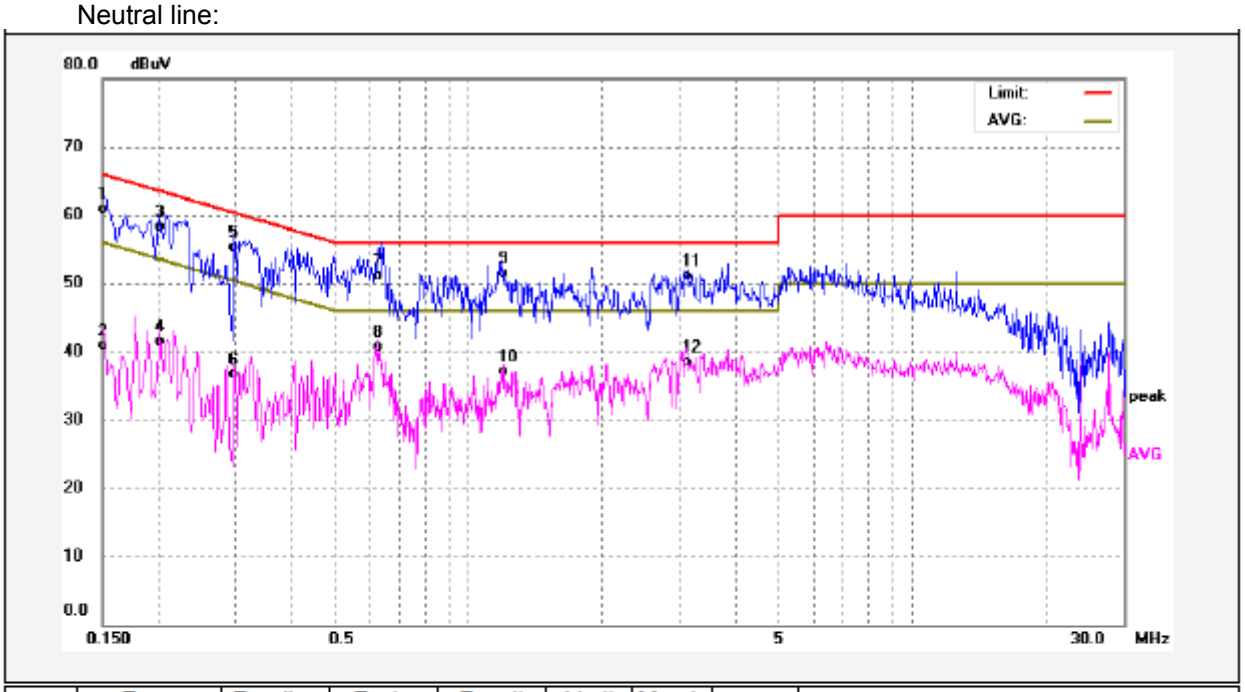
An initial pre-scan was performed on the live and neutral lines.

Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1539	50.25	10.02	60.27	65.78	-5.51	QP	
2	0.1539	33.47	10.02	43.49	55.78	-12.29	AVG	
3	0.1980	49.09	9.91	59.00	63.69	-4.69	QP	
4	0.1980	31.41	9.91	41.32	53.69	-12.37	AVG	
5	0.2500	48.28	10.01	58.29	61.75	-3.46	QP	
6	0.2500	33.32	10.01	43.33	51.75	-8.42	AVG	
7	0.6300	42.11	10.08	52.19	56.00	-3.81	QP	
8	0.6300	32.01	10.08	42.09	46.00	-3.91	AVG	
9	3.0540	41.14	10.24	51.38	56.00	-4.62	QP	
10	3.0540	30.52	10.24	40.76	46.00	-5.24	AVG	
11	5.9459	43.07	10.26	53.33	60.00	-6.67	QP	
12	5.9459	30.74	10.26	41.00	50.00	-9.00	AVG	

Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1499	50.93	10.06	60.99	66.00	-5.01	QP	
2	0.1499	30.93	10.06	40.99	56.00	-15.01	AVG	
3	0.2017	48.31	9.92	58.23	63.54	-5.31	QP	
4	0.2017	31.57	9.92	41.49	53.54	-12.05	AVG	
5	0.2971	45.37	9.98	55.35	60.32	-4.97	QP	
6	0.2971	26.64	9.98	36.62	50.32	-13.70	AVG	
7	0.6238	41.06	10.07	51.13	56.00	-4.87	QP	
8	0.6238	30.67	10.07	40.74	46.00	-5.26	AVG	
9	1.1970	41.18	10.41	51.59	56.00	-4.41	QP	
10	1.1970	26.69	10.41	37.10	46.00	-8.90	AVG	
11	3.0901	40.82	10.24	51.06	56.00	-4.94	QP	
12	3.0901	28.21	10.24	38.45	46.00	-7.55	AVG	

8 Radiated Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method: ANSI C63.10:2013;ANSI C63.4:2014

Test Result: PASS

Measurement Distance: 3m

Limit:

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Dist	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	2400/F(kHz)	300	10000 * 2400/F(kHz)	$20\log^{(2400/F(kHz))} + 80$
0.490 ~ 1.705	24000/F(kHz)	30	100 * 24000/F(kHz)	$20\log^{(24000/F(kHz))} + 40$
1.705 ~ 30	30	30	100 * 30	$20\log^{(30)} + 40$
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

8.1 EUT Operation

Operating Environment **:**

Temperature: 23.5 °C

Humidity: 52.1 % RH

Atmospheric Pressure: 101.2kPa

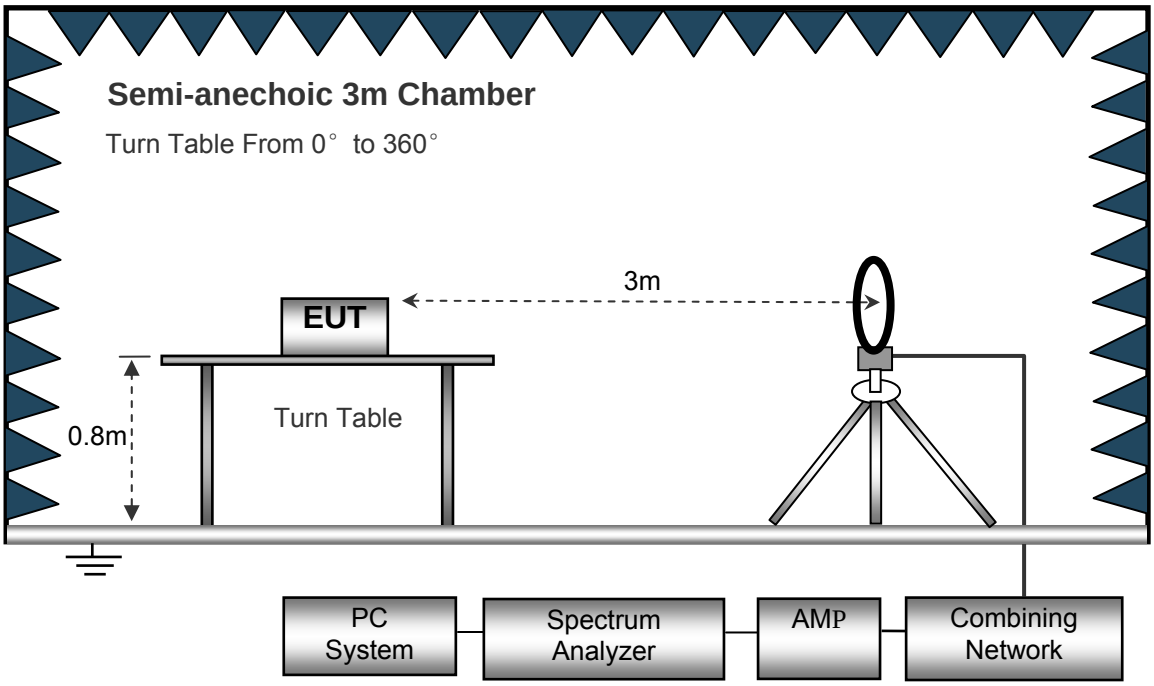
EUT Operation **:**

The test was performed in Bluetooth Transmitting mode, the test data were shown in the report.

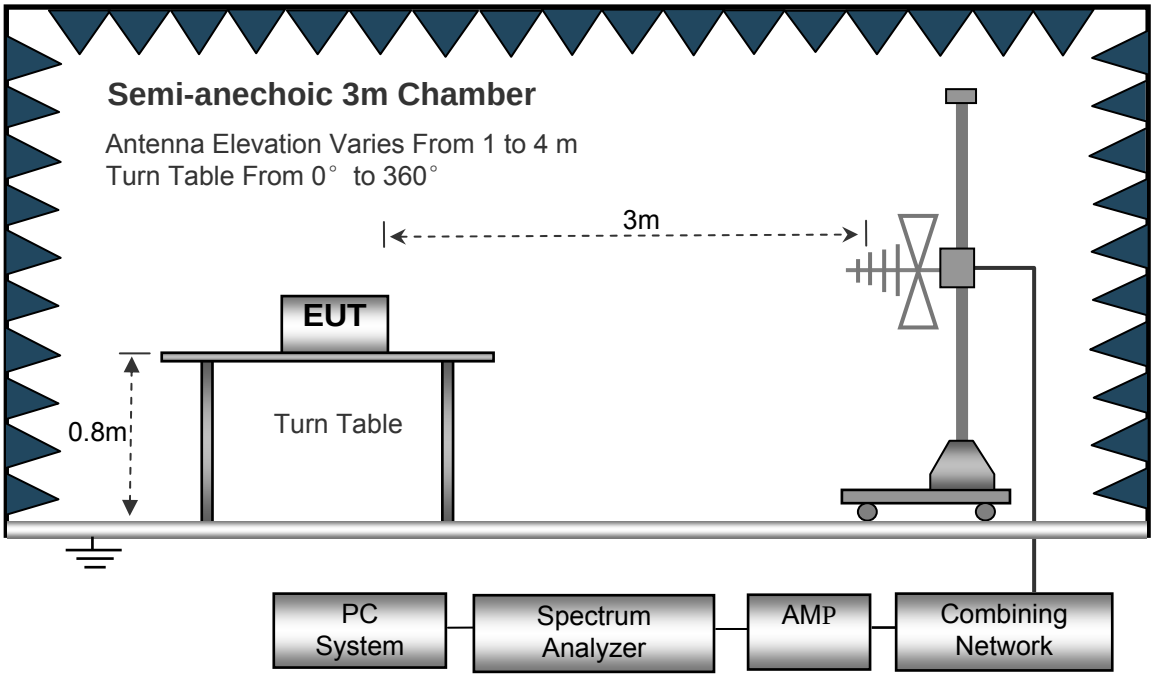
8.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.10:2013.

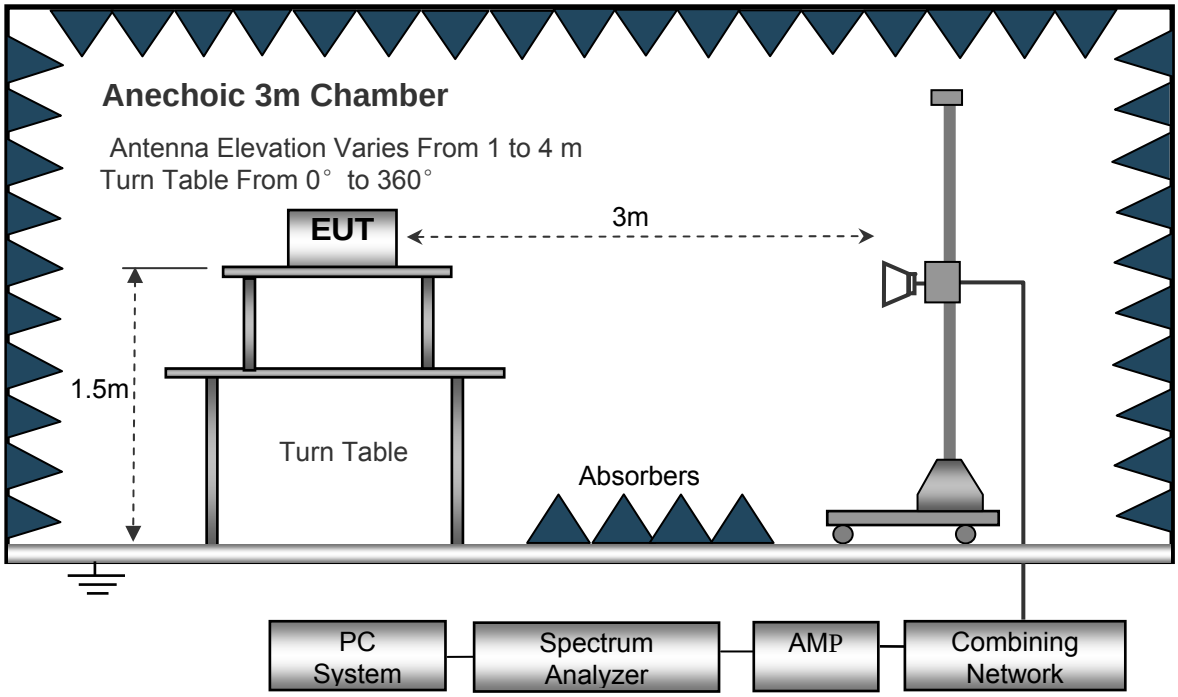
The test setup for emission measurement below 30MHz.



The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.



8.3 Spectrum Analyzer Setup

Below 30MHz

Sweep Speed	Auto
IF Bandwidth	10kHz
Video Bandwidth	10kHz
Resolution Bandwidth	10kHz

30MHz ~ 1GHz

Sweep Speed	Auto
Detector	PK
Resolution Bandwidth	100kHz
Video Bandwidth	300kHz

Above 1GHz

Sweep Speed	Auto
Detector	PK
Resolution Bandwidth	1MHz
Video Bandwidth	3MHz
Detector	Ave.
Resolution Bandwidth	1MHz
Video Bandwidth	10Hz

8.4 Test Procedure

1. The EUT is placed on a turntable. For below 1GHz, the EUT is 0.8m above ground plane; For above1GHz, the EUT is 1.5m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The radiation measurements are performed in X,Y and Z axis positioning(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand),the worst condition was tested putting the eut in X axis,so the worst data were shown as follow.
8. A 2.4GHz high –pass filter is used druing radiated emissions above 1GHz measurement.

8.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The “Margin” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

Margin = Corr. Ampl. – Limit

8.6 Summary of Test Results

Test Frequency: 9KHz ~ 30MHz

The measurements were more than 20 dB below the limit and not reported.

Test Frequency: 30MHz ~ 18GHz

Remark: only the worst data (GFSK modulation mode) were reported.

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK Low Channel 2402MHz									
252.06	35.23	QP	105	1.1	H	-13.35	21.88	46.00	-24.12
252.06	40.89	QP	358	1.8	V	-13.35	27.54	46.00	-18.46
4804.00	43.56	PK	49	1.3	V	-1.06	42.50	74.00	-31.50
4804.00	44.78	Ave	49	1.3	V	-1.06	43.72	54.00	-10.28
7206.00	41.36	PK	92	1.3	H	1.33	42.69	74.00	-31.31
7206.00	36.77	Ave	92	1.3	H	1.33	38.10	54.00	-15.90
2321.31	45.31	PK	146	1.1	V	-13.19	32.12	74.00	-41.88
2321.31	39.06	Ave	146	1.1	V	-13.19	25.87	54.00	-28.13
2371.23	43.03	PK	103	1.1	H	-13.14	29.89	74.00	-44.11
2371.23	37.11	Ave	103	1.1	H	-13.14	23.97	54.00	-30.03
2483.56	42.68	PK	288	1.5	V	-13.08	29.60	74.00	-44.40
2483.56	36.03	Ave	288	1.5	V	-13.08	22.95	54.00	-31.05

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK Middle Channel 2441MHz									
252.06	37.09	QP	338	1.9	H	-13.35	23.74	46.00	-22.26
252.06	42.45	QP	96	1.3	V	-13.35	29.10	46.00	-16.90
4882.00	46.20	PK	197	1.5	V	-0.62	45.58	74.00	-28.42
4882.00	42.23	Ave	197	1.5	V	-0.62	41.61	54.00	-12.39
7323.00	38.90	PK	69	1.8	H	2.21	41.11	74.00	-32.89
7323.00	34.56	Ave	69	1.8	H	2.21	36.77	54.00	-17.23
2338.86	45.49	PK	267	1.9	V	-13.19	32.30	74.00	-41.70
2338.86	38.48	Ave	267	1.9	V	-13.19	25.29	54.00	-28.71
2358.59	43.49	PK	107	1.0	H	-13.14	30.35	74.00	-43.65
2358.59	38.48	Ave	107	1.0	H	-13.14	25.34	54.00	-28.66
2496.13	42.60	PK	198	1.3	V	-13.08	29.52	74.00	-44.48
2496.13	36.42	Ave	198	1.3	V	-13.08	23.34	54.00	-30.66

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK High Channel 2480MHz									
252.06	38.22	QP	67	1.7	H	-13.35	24.87	46.00	-21.13
252.06	42.56	QP	146	1.4	V	-13.35	29.21	46.00	-16.79
4960.00	43.89	PK	357	1.6	V	-0.24	43.65	74.00	-30.35
4960.00	40.39	Ave	357	1.6	V	-0.24	40.15	54.00	-13.85
7440.00	39.26	PK	344	1.4	H	2.84	42.10	74.00	-31.90
7440.00	36.23	Ave	344	1.4	H	2.84	39.07	54.00	-14.93
2317.94	45.74	PK	125	1.8	V	-13.19	32.55	74.00	-41.45
2317.94	37.16	Ave	125	1.8	V	-13.19	23.97	54.00	-30.03
2385.89	44.01	PK	73	1.9	H	-13.14	30.87	74.00	-43.13
2385.89	37.68	Ave	73	1.9	H	-13.14	24.54	54.00	-29.46
2496.53	42.59	PK	319	1.2	V	-13.08	29.51	74.00	-44.49
2496.53	37.34	Ave	319	1.2	V	-13.08	24.26	54.00	-29.74

Test Frequency: 18GHz ~ 25GHz

The measurements were more than 20 dB below the limit and not reported.

9 Band Edge Measurement

Test Requirement:	Section 15.247(d) In addition, radiated emissions which fall in the restricted bands. as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).
Test Method:	ANSI C63.10
Test Limit:	Regulation 15.247 (d), In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).
Test Mode:	Transmitting

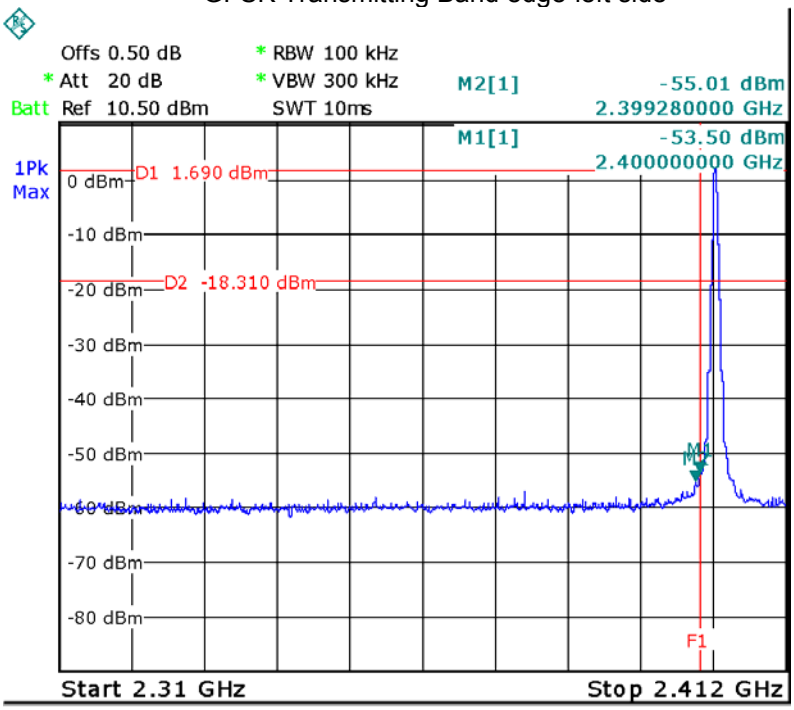
9.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100 kHz, VBW = 300 kHz, Sweep = auto
   Detector function = peak, Trace = max hold

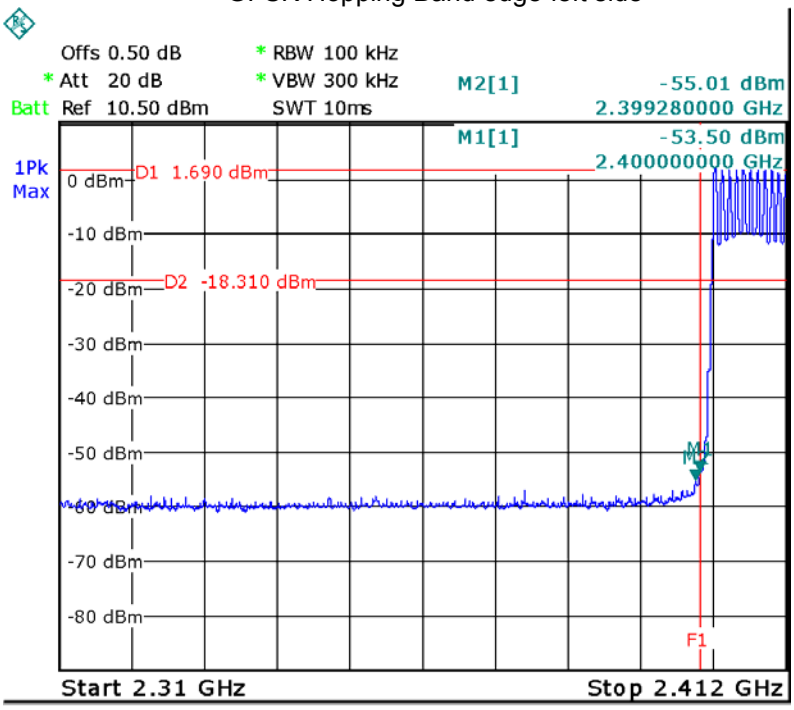
9.2 Test Result:

Test plots

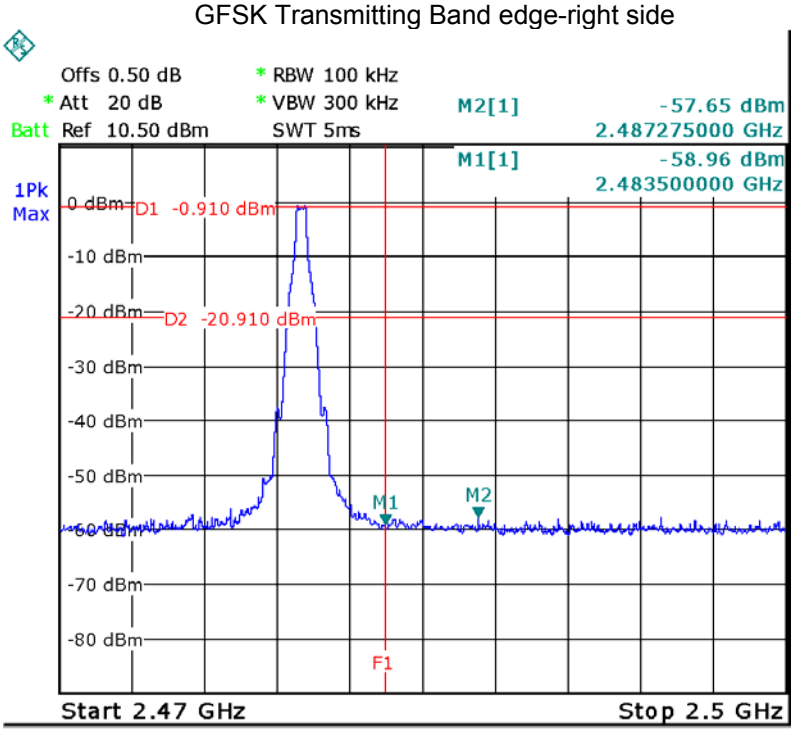
GFSK Transmitting Band edge-left side



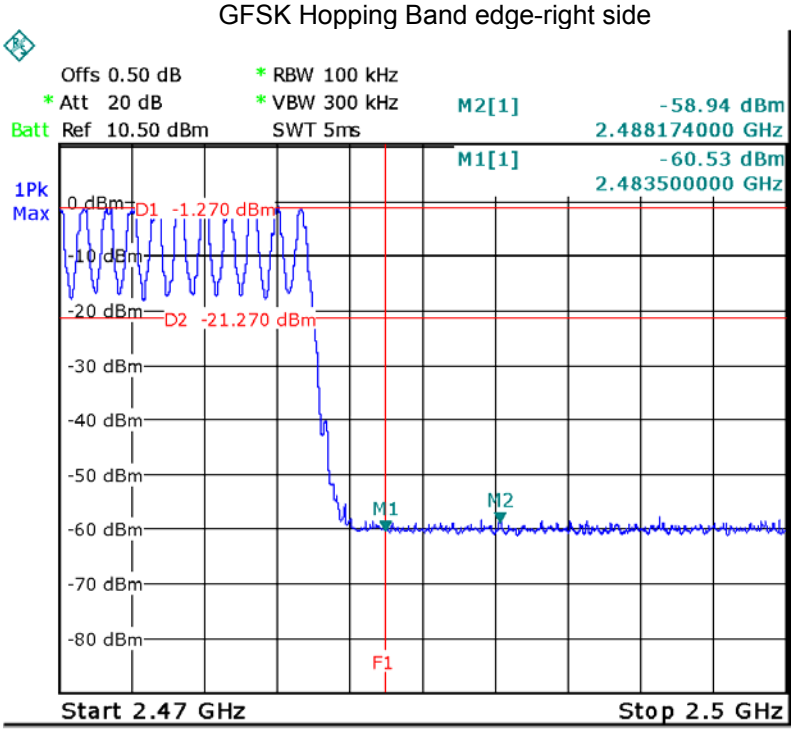
GFSK Hopping Band edge-left side



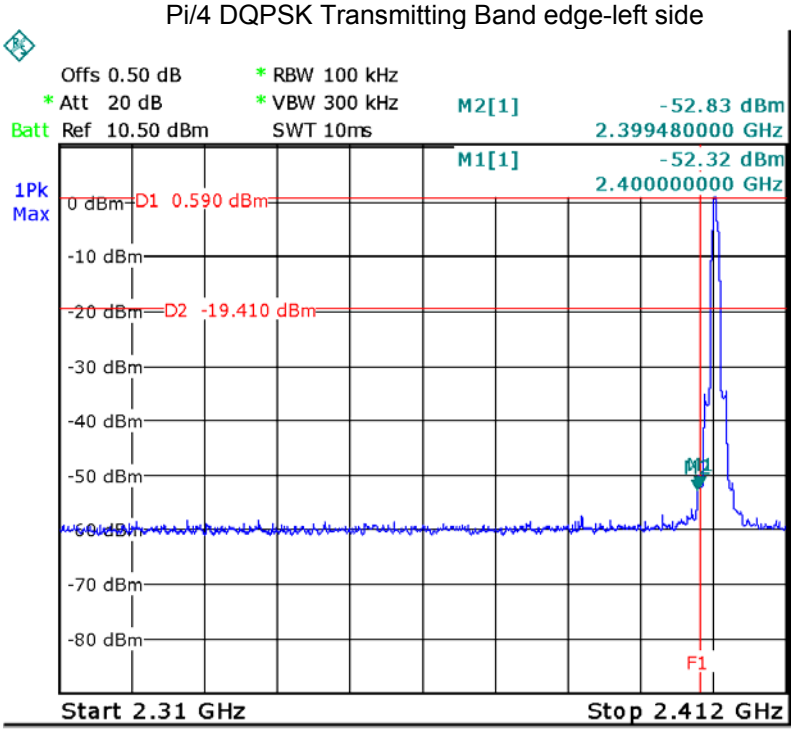
GFSK Transmitting Band edge-right side



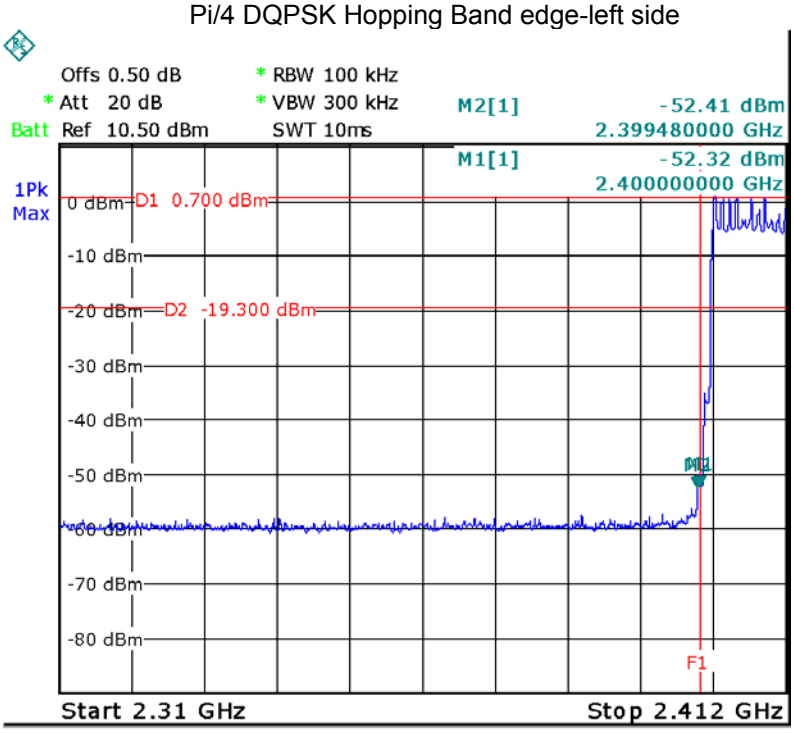
GFSK Hopping Band edge-right side



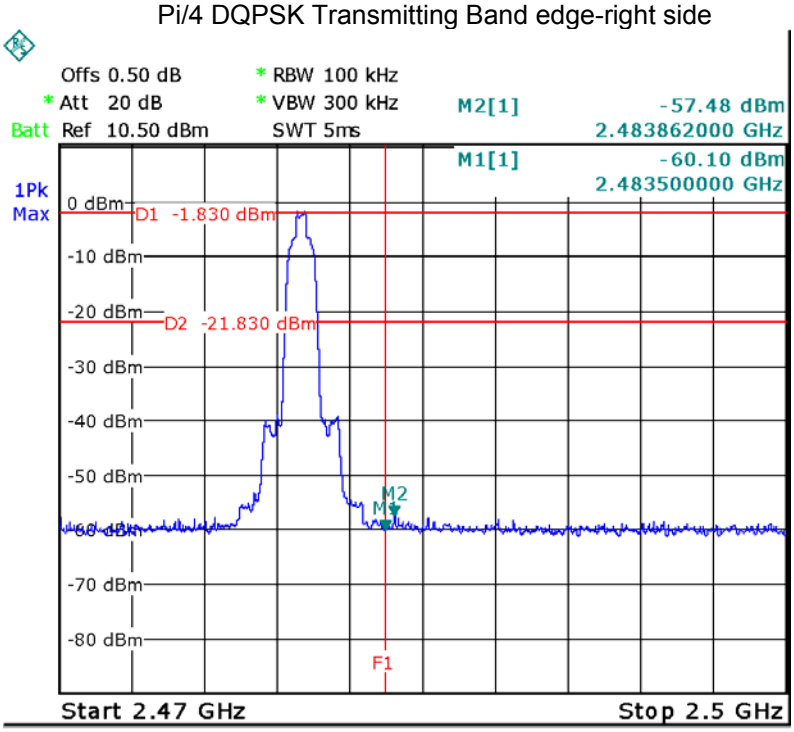
Pi/4 DQPSK Transmitting Band edge-left side



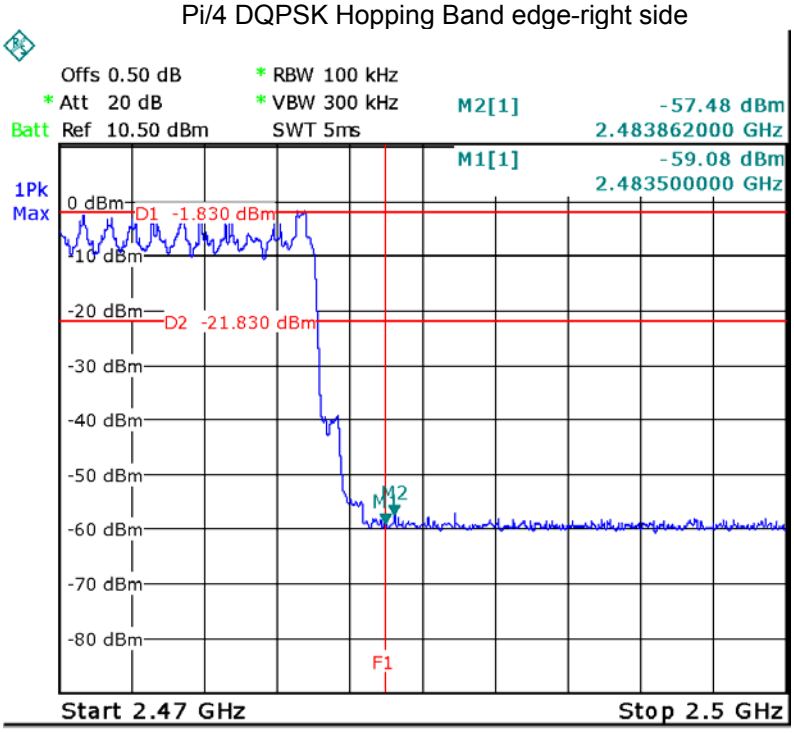
Pi/4 DQPSK Hopping Band edge-left side



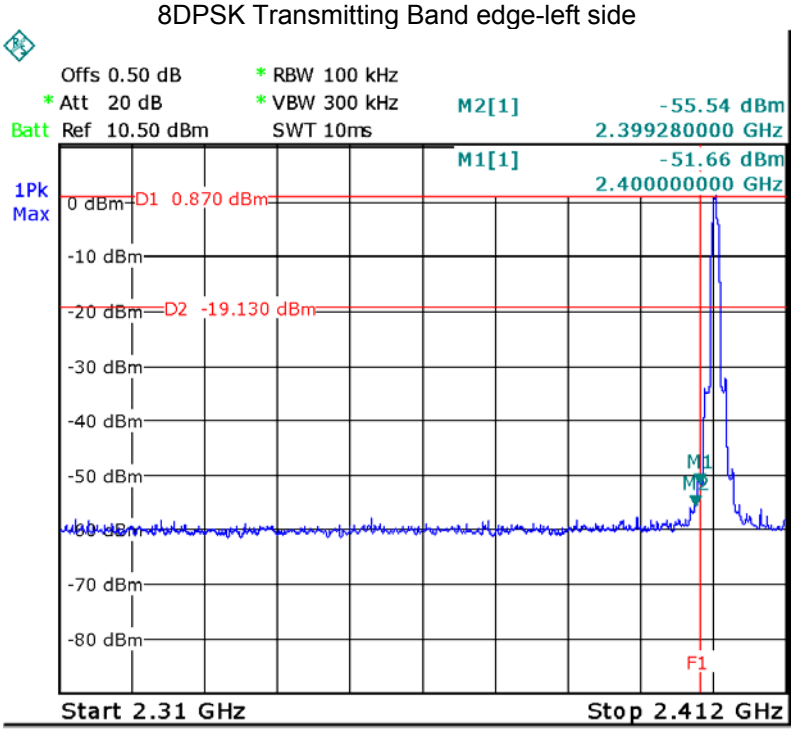
Pi/4 DQPSK Transmitting Band edge-right side



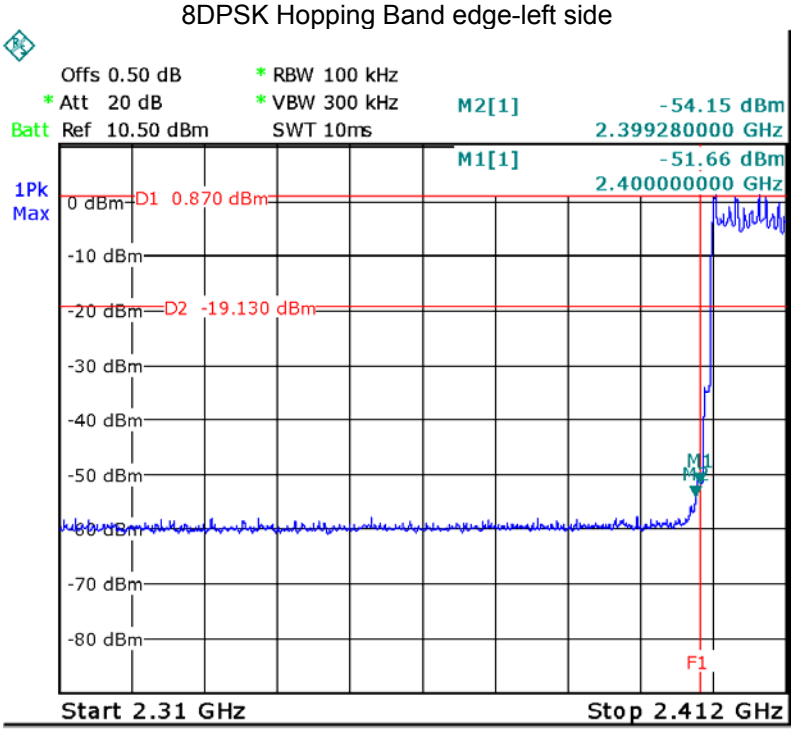
Pi/4 DQPSK Hopping Band edge-right side



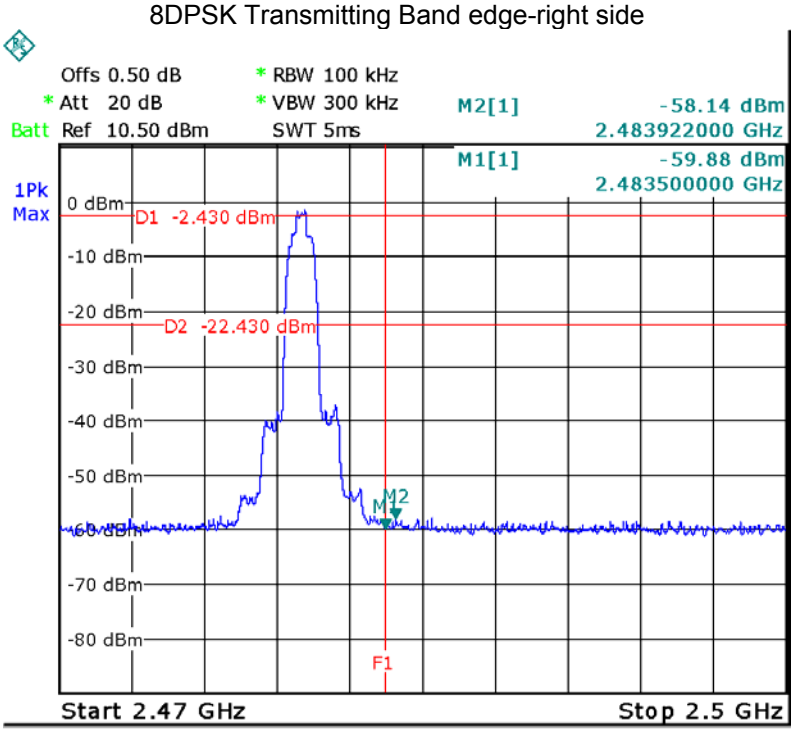
8DPSK Transmitting Band edge-left side



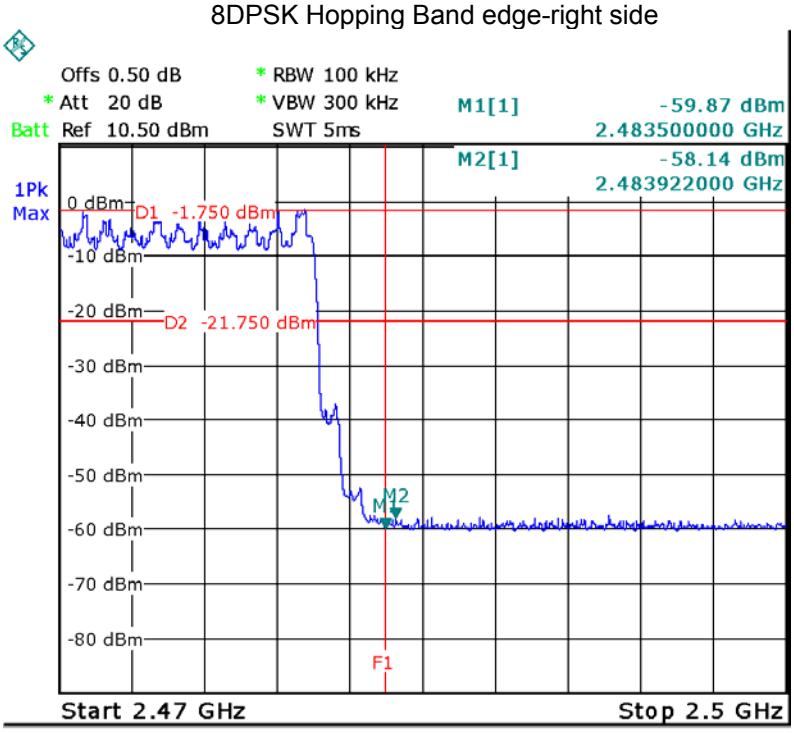
8DPSK Hopping Band edge-left side



8DPSK Transmitting Band edge-right side



8DPSK Hopping Band edge-right side



10 20 dB Bandwidth Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: ANSI C63.10:2013

Test Mode: Test in fixing operating frequency at low, Middle, high channel.

10.1 Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;

2. Set the spectrum analyzer: RBW = 30 kHz, VBW = 100 kHz

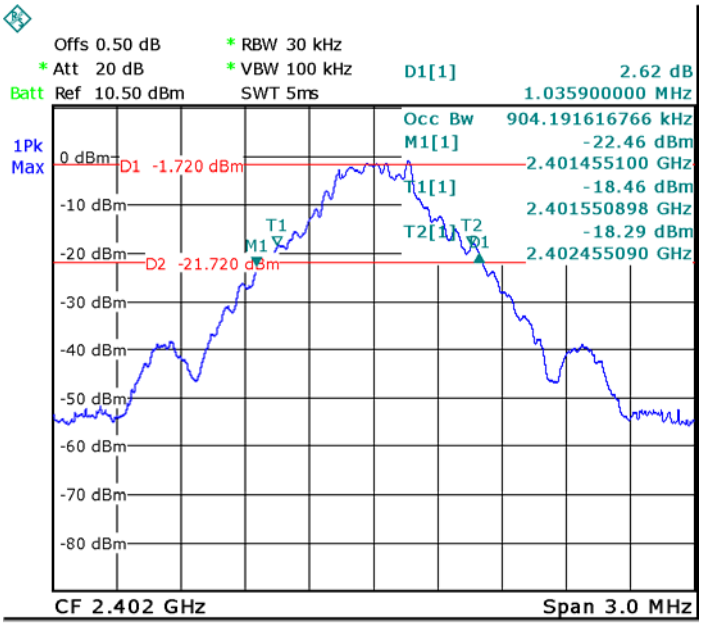
10.2 Test Result:

Modulation	Test Channel	Bandwidth(MHz)
GFSK	Low	1.036
	Middle	1.036
	High	1.036
Pi/4DQPSK	Low	1.305
	Middle	1.305
	High	1.305
8DPSK	Low	1.275
	Middle	1.275
	High	1.275

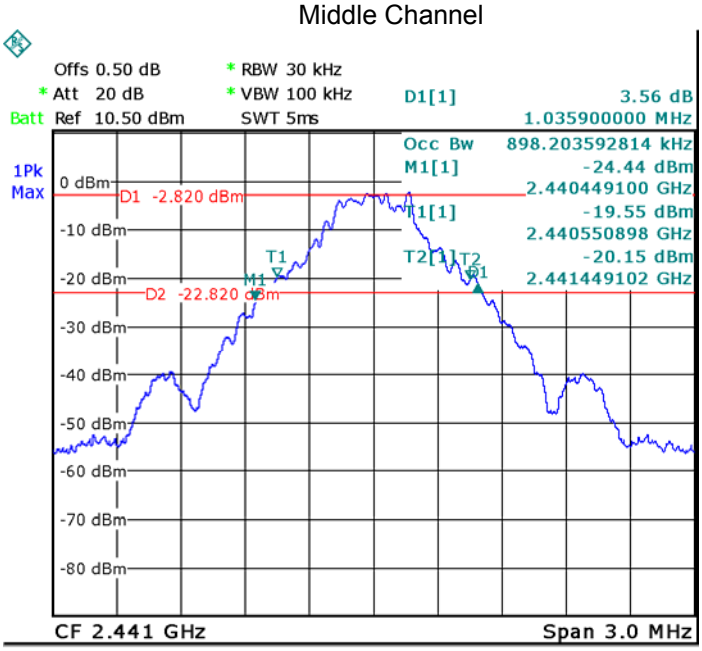
Test result plot as follows:

Modulation: GFSK

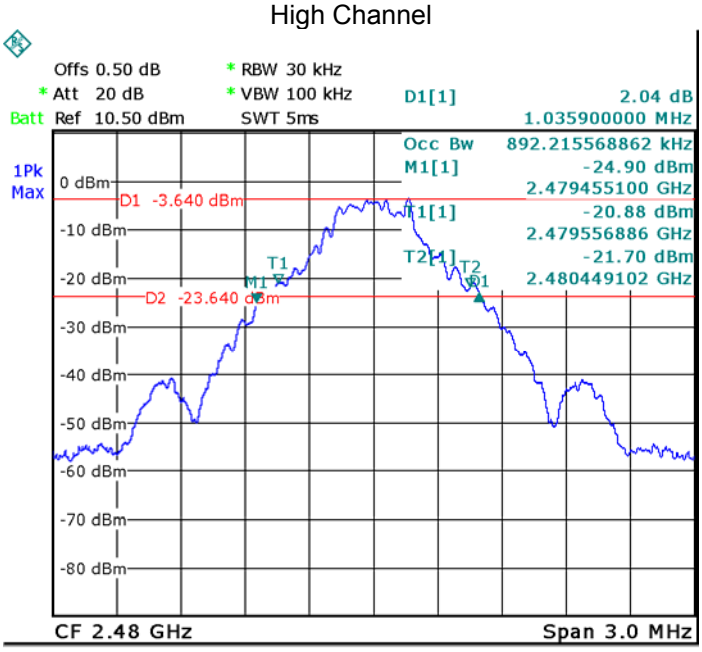
Low Channel



Middle Channel

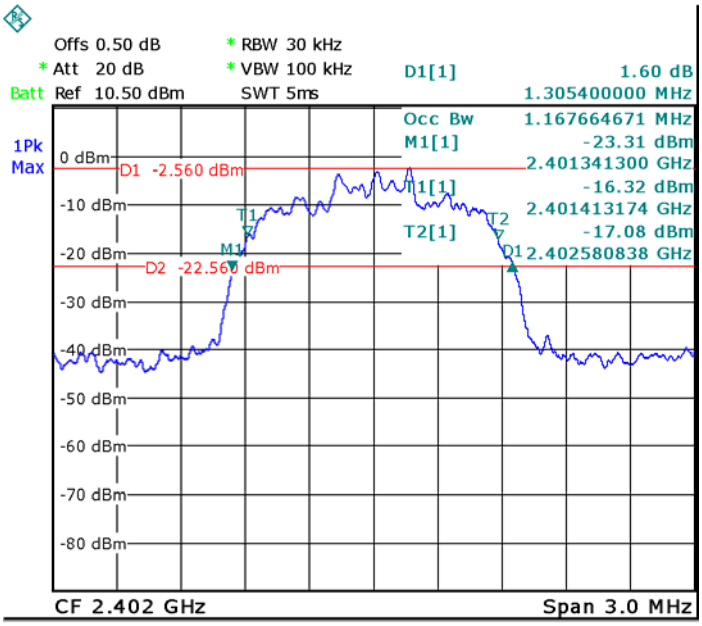


High Channel

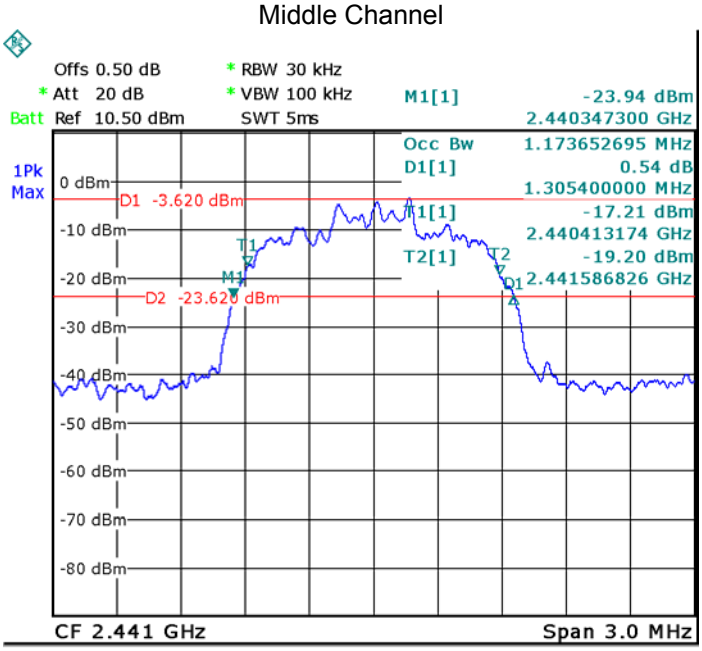


Modulation: Pi/4DQPSK

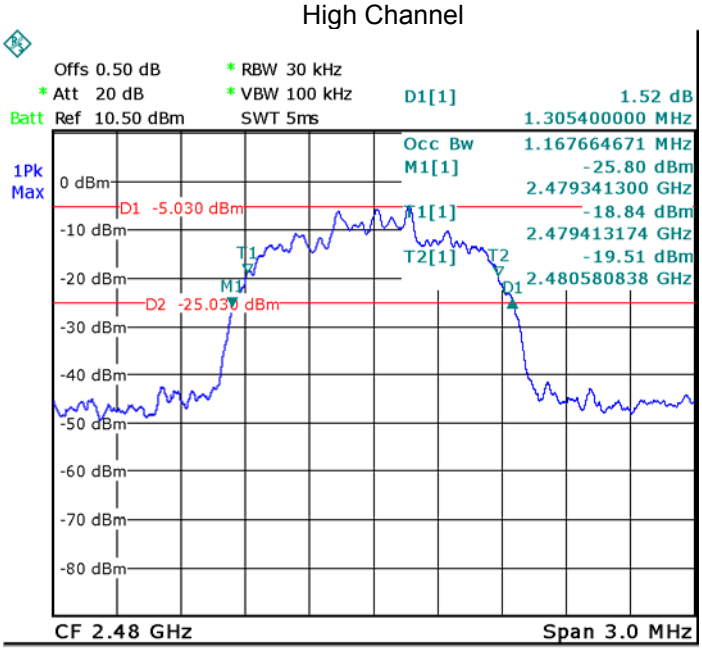
Low Channel



Middle Channel

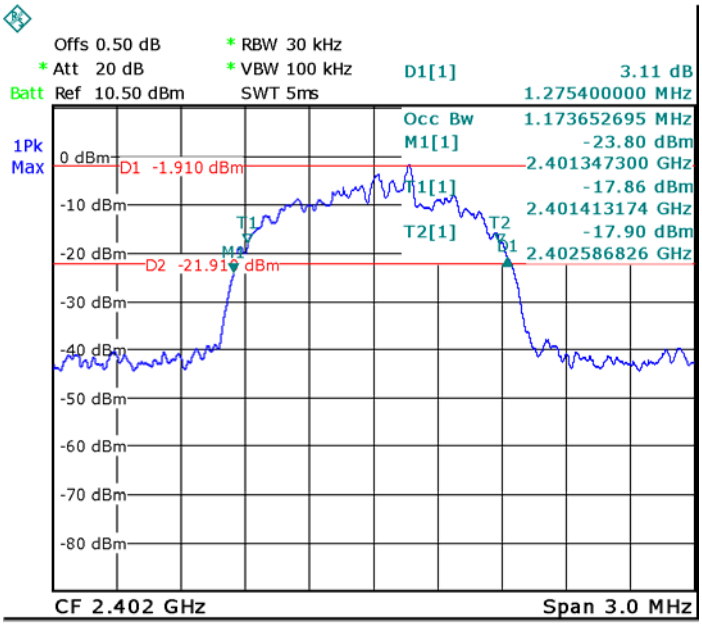


High Channel

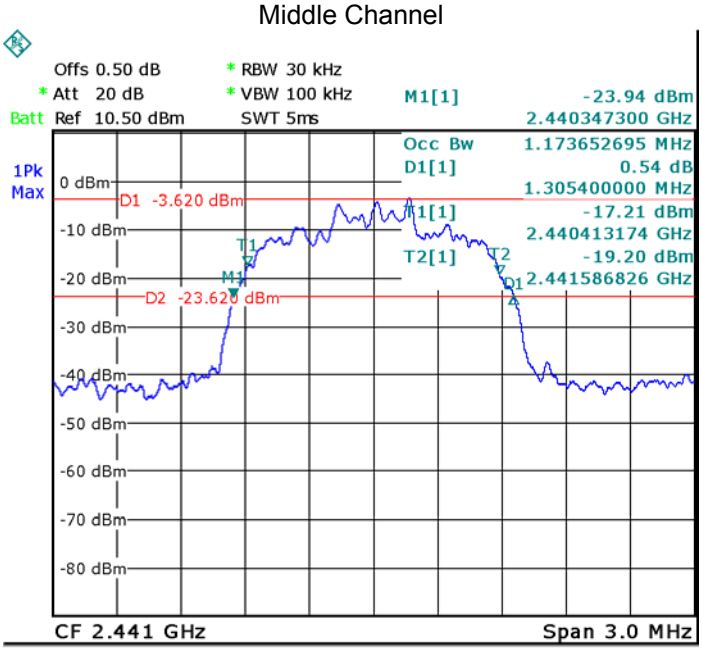


Modulation: 8DPSK

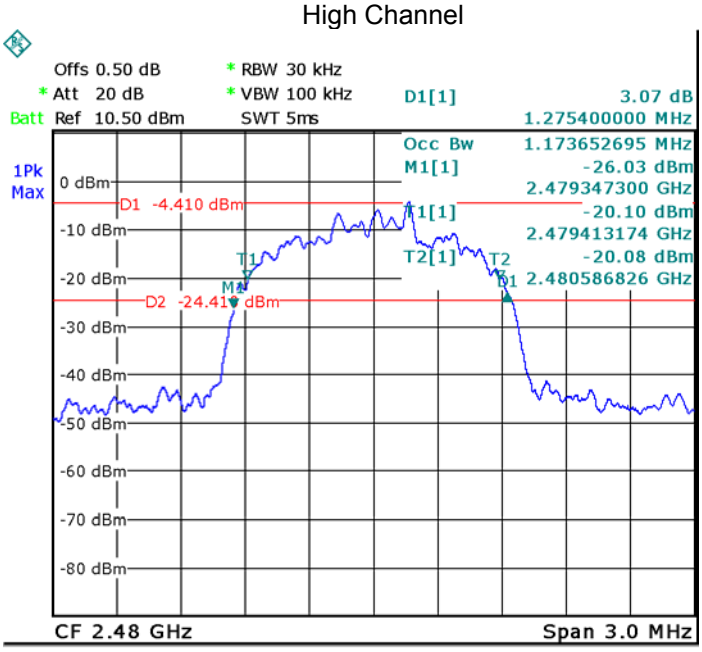
Low Channel



Middle Channel



High Channel



11 Maximum Peak Output Power

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: ANSI C63.10:2013

Test Limit: Regulation 15.247 (b)(1), 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.

Refer to the result “Number of Hopping Frequency” of this document. The 1watts (30 dBm) limit applies.

Test mode: Test in fixing frequency transmitting mode.

11.1 Test Procedure:

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

2. Set the spectrum analyzer: RBW = 3 MHz. VBW =3 MHz. Sweep = auto; Detector Function = Peak.

3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

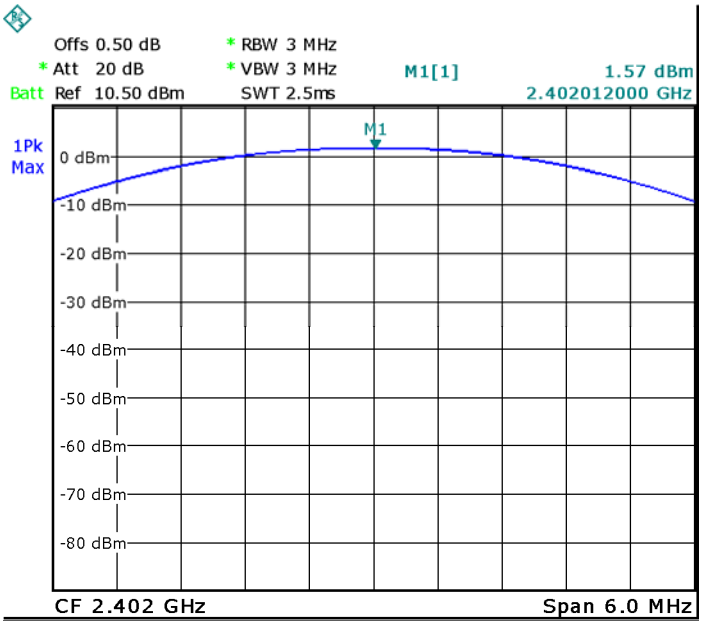
11.2 Test Result:

Test Mode	Data Rate	Peak Power(dBm)			Limit (dBm)
		Low Channel	Middle Channel	High Channel	
GFSK	1Mbps	1.57	0.18	-1.09	20.97
4*π4DQPSK	2Mbps	1.46	0.08	-1.21	20.97
8DPSK	3Mbps	1.55	0.19	-1.08	20.97

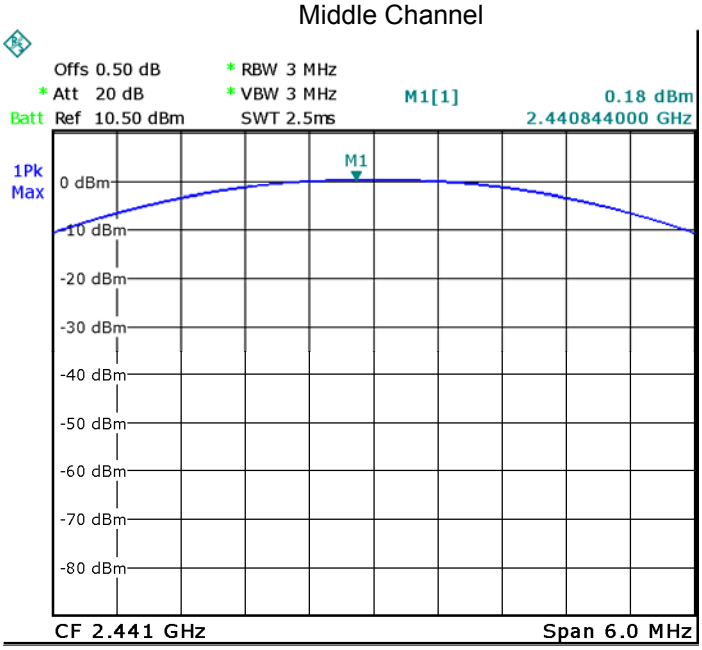
Test result plot as follows:

Modulation: GFSK

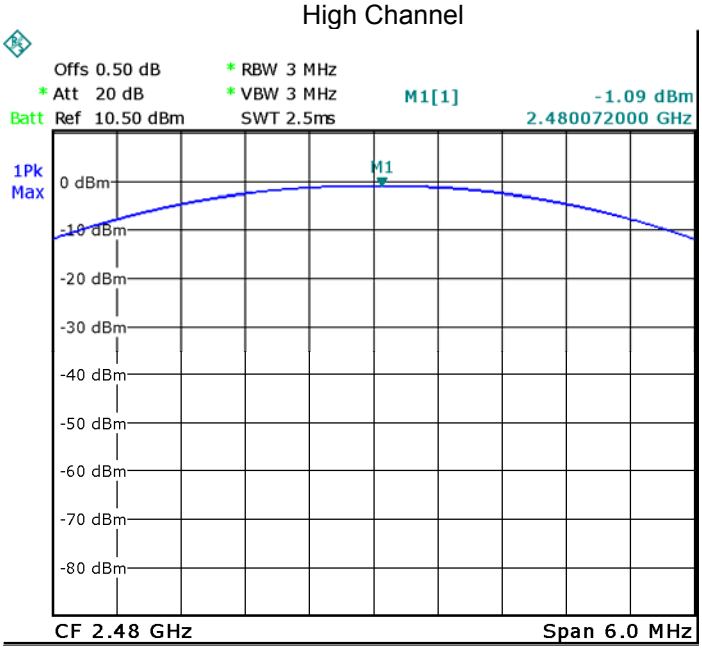
Low Channel



Middle Channel

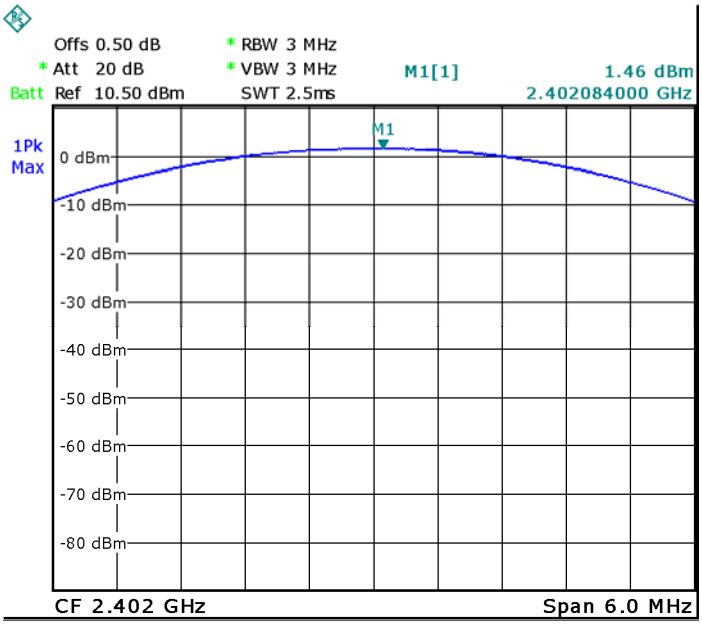


High Channel

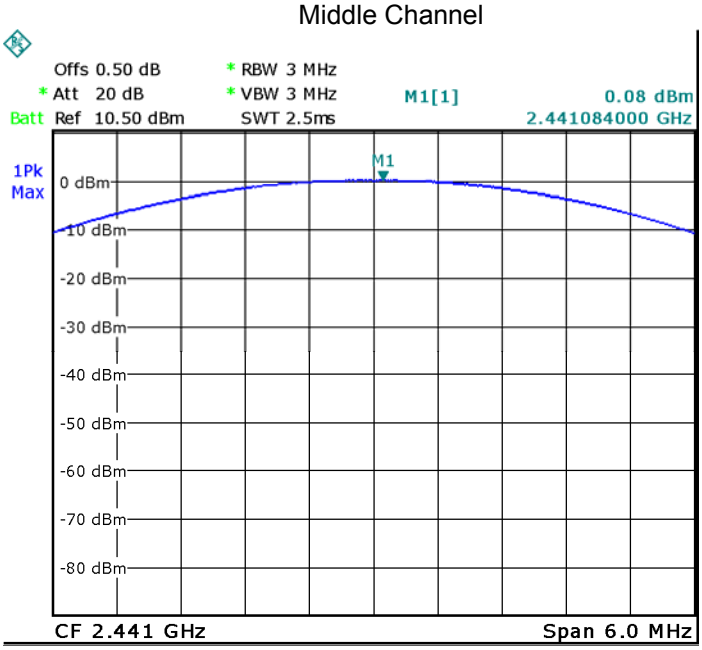


Modulation: Pi/4DQPSK

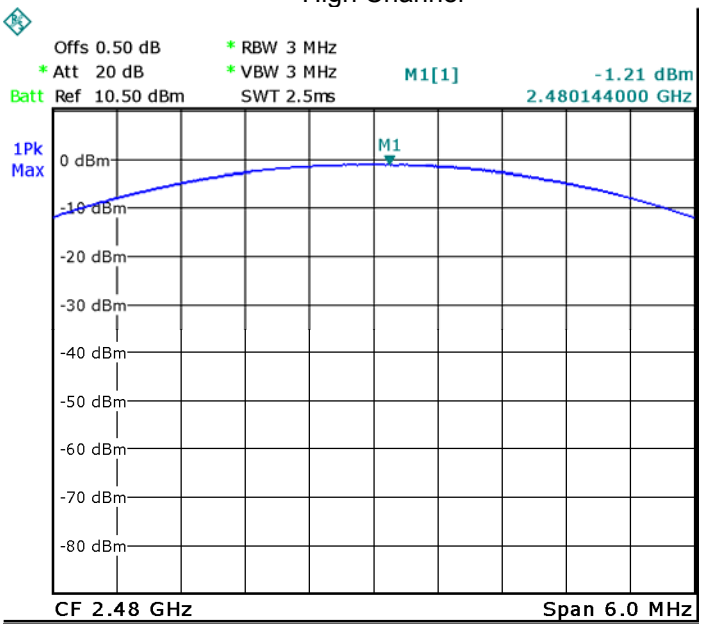
Low Channel



Middle Channel

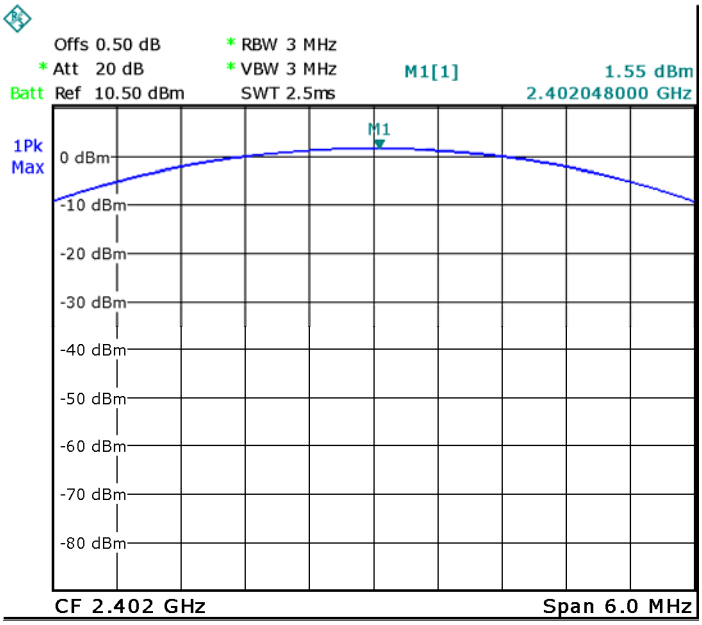


High Channel

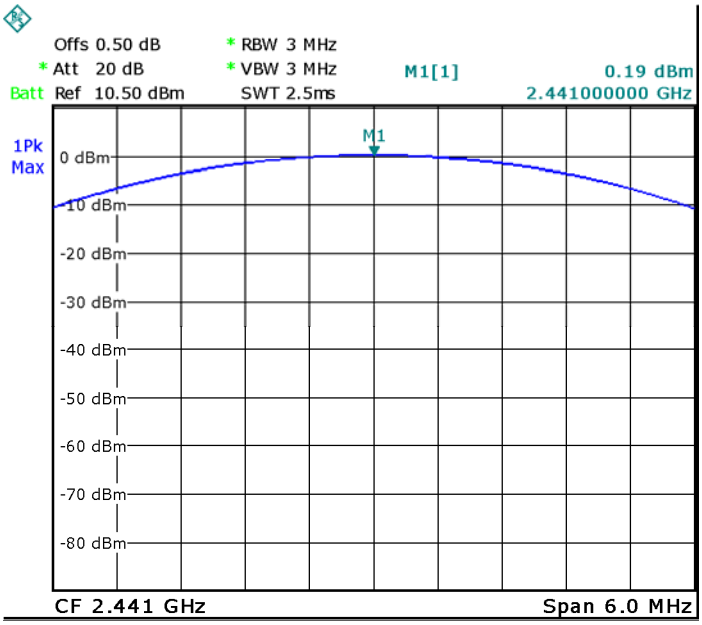


Modulation: 8DPSK

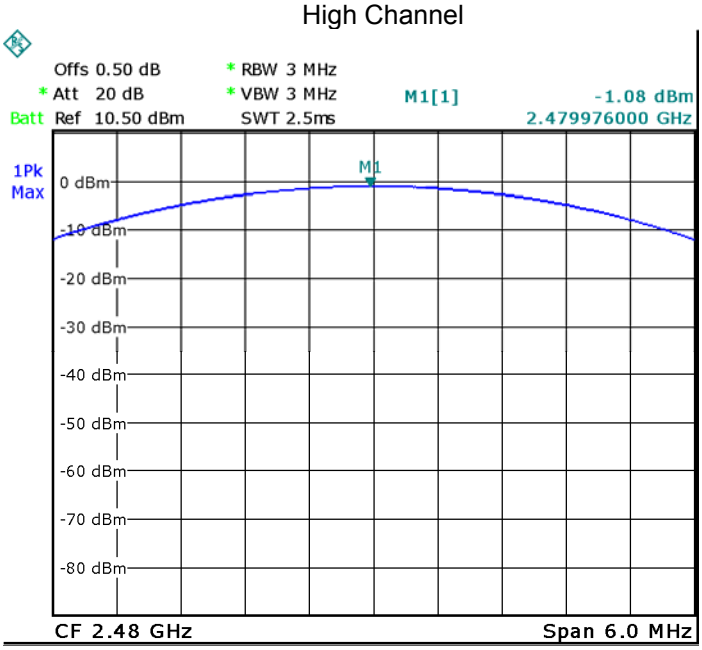
Low Channel



Middle Channel



High Channel



12 Hopping Channel Separation

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: ANSI C63.10:2013

Test Limit: Regulation 15.247(a)(1) 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 1W.

Test Mode: Test in hopping transmitting operating mode.

12.1 Test Procedure:

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

2. Set the spectrum analyzer: RBW = 30 KHz. VBW = 100 KHz , Span = 3 MHz Sweep = auto; Detector Function = Peak. Trace = Max hold.

3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.

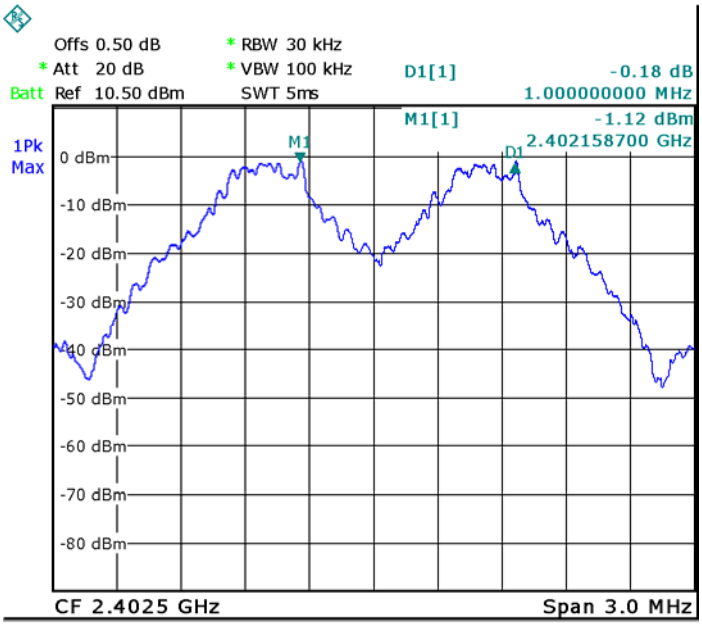
12.2 Test Result:

Modulation	Test Channel	Separation (MHz)
GFSK	Low	1.000
	Middle	1.000
	High	1.000
Pi/4DQPSK	Low	1.000
	Middle	1.000
	High	1.000
8DPSK	Low	1.000
	Middle	1.000
	High	1.000

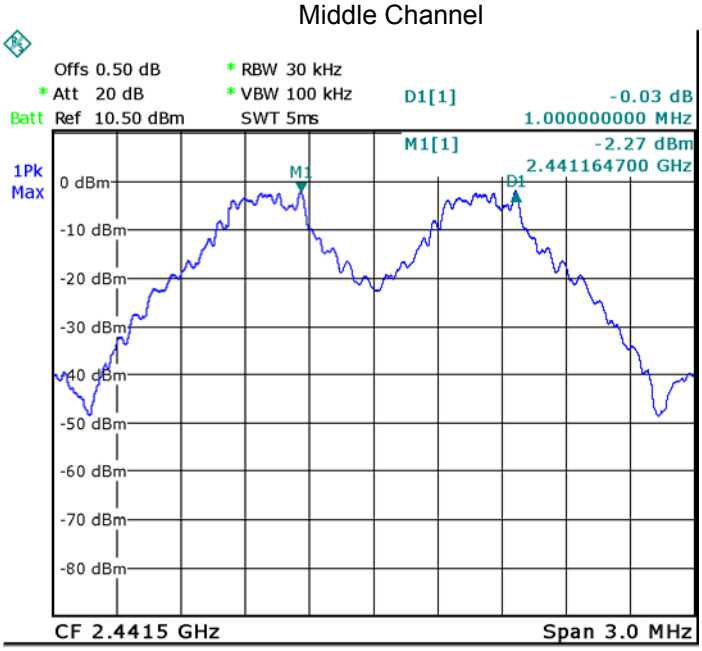
Test result plot as follows:

Modulation: GFSK

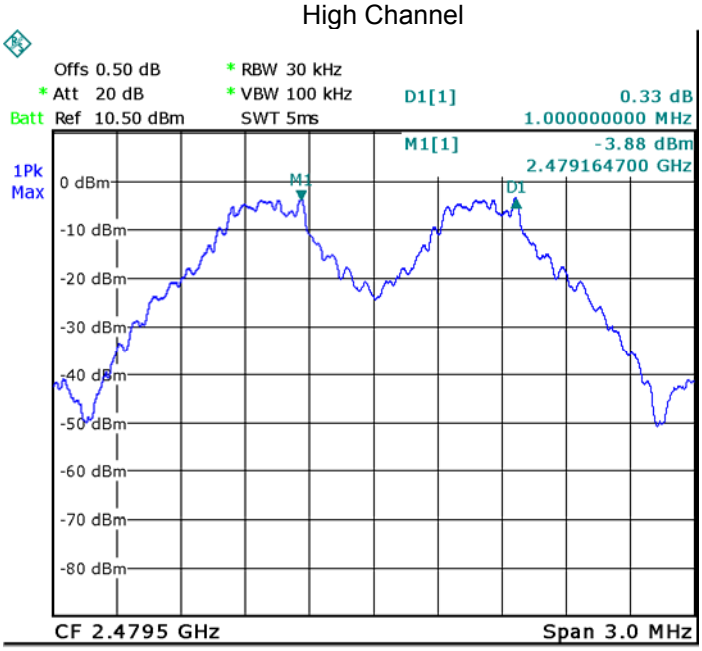
Low Channel



Middle Channel

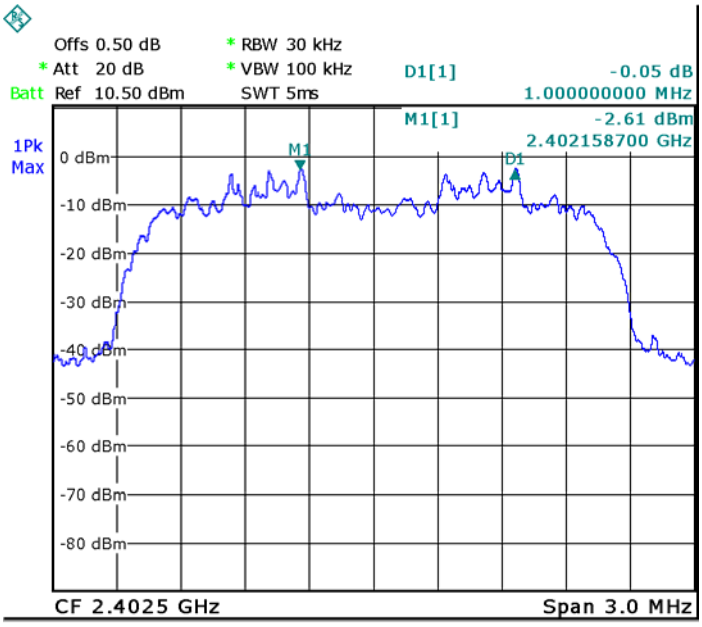


High Channel

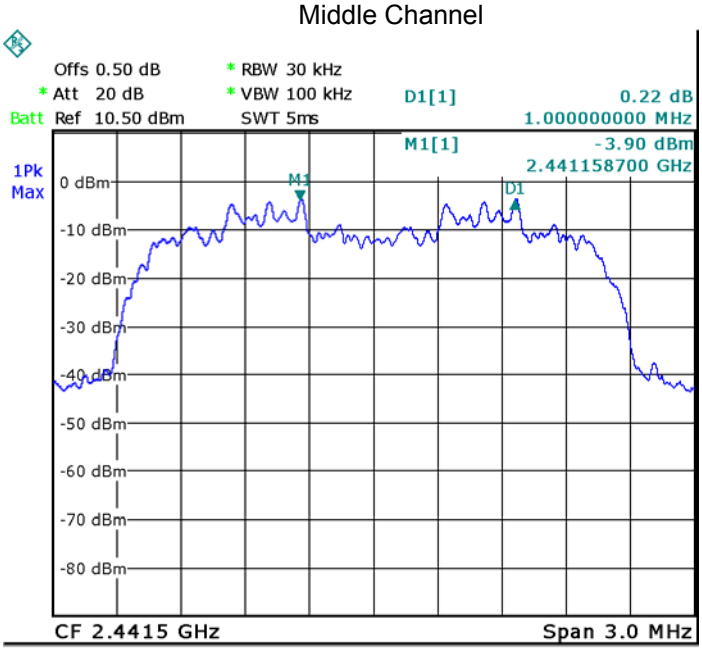


Modulation: Pi/4DQPSK

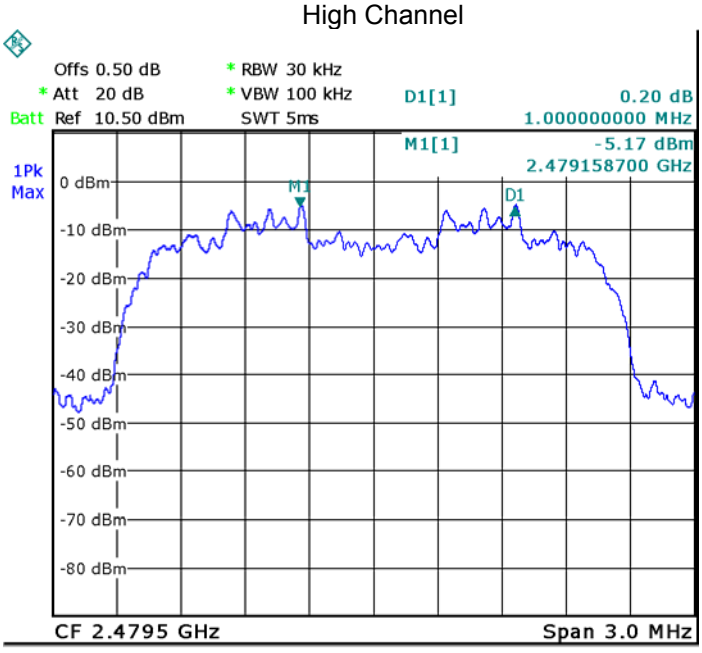
Low Channel



Middle Channel

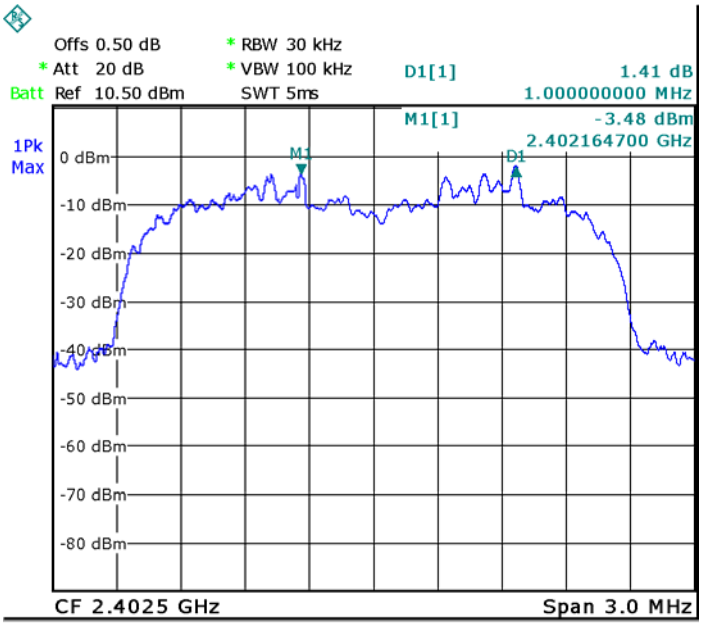


High Channel

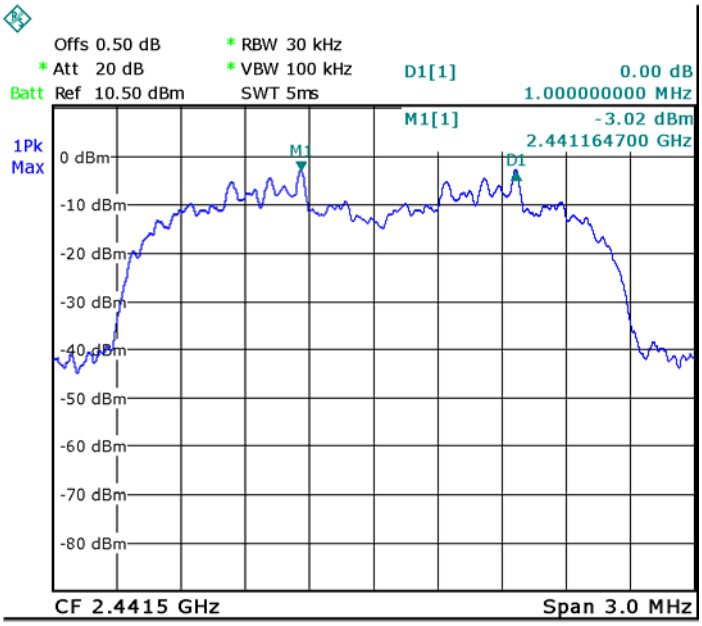


Modulation: 8DPSK

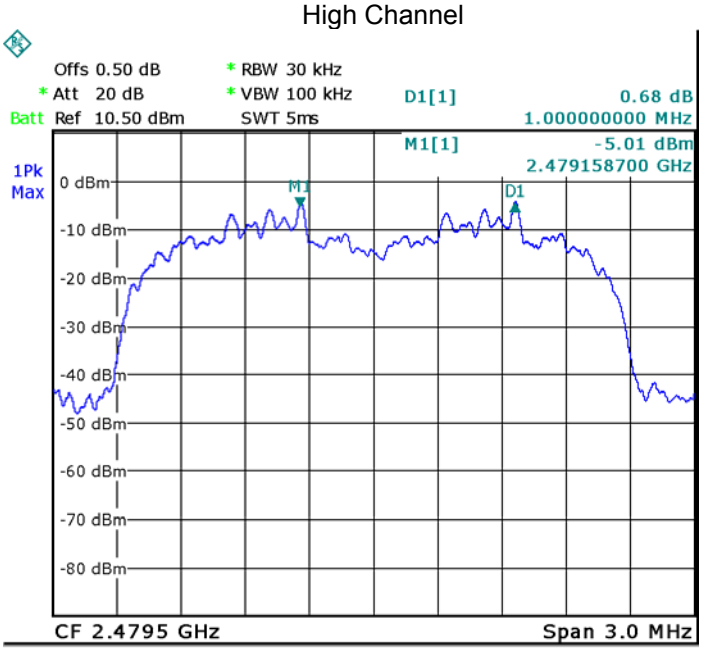
Low Channel



Middle Channel



High Channel



13 Number of Hopping Frequency

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	ANSI C63.10:2013
Test Limit:	Regulation 15.247 (a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.
Test Mode:	Test in hopping transmitting operating mode.

13.1 Test Procedure:

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

2. Set the spectrum analyzer: RBW = 1MHz. VBW = 1MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.

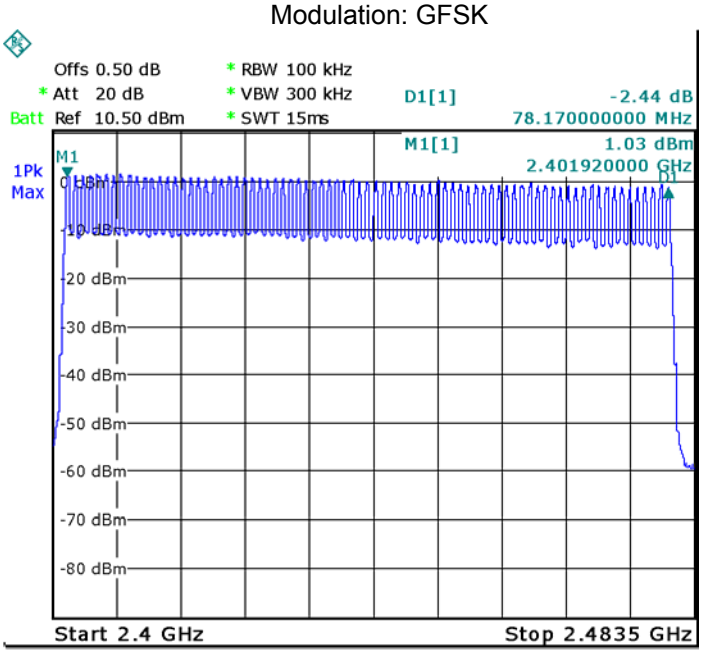
3. Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.

4. Set the spectrum analyzer: Start Frequency = 2.4GHz, Stop Frequency = 2.4835GHz. Sweep=auto;

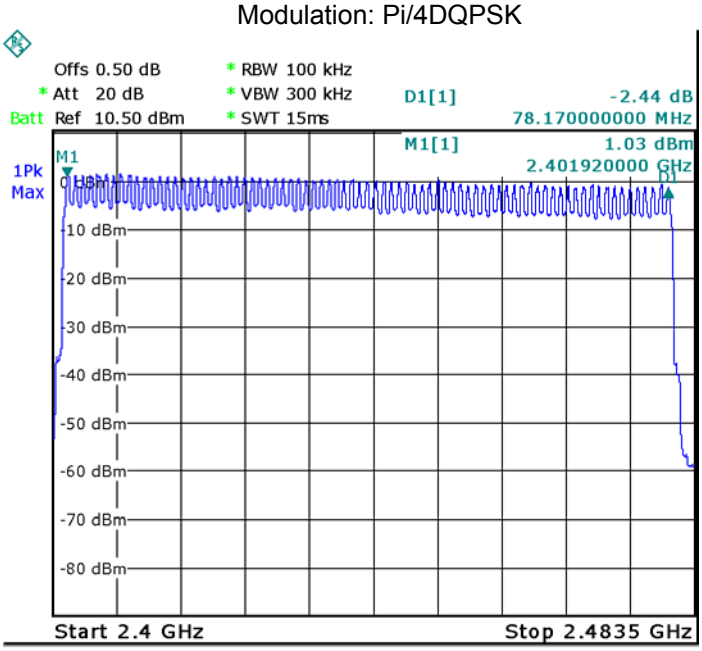
13.2 Test Result:

Total Channels are 79 Channels.

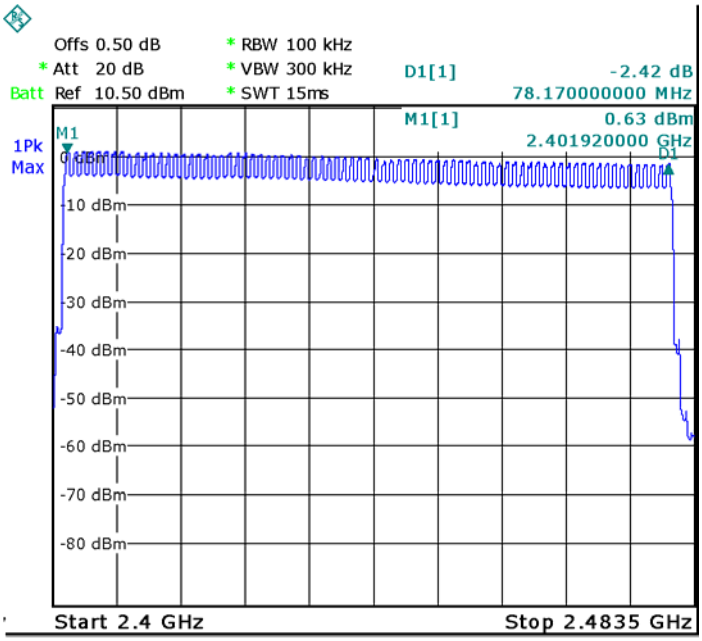
Modulation: GFSK



Modulation: Pi/4DQPSK



Modulation: 8DPSK



14 Dwell Time

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	ANSI C63.10:2013
Test Limit:	Regulation 15.247(a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.
Test Mode:	Test in hopping transmitting operating mode.

14.1 Test Procedure:

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

2.Set spectrum analyzer span = 0. centred on a hopping channel;

3.Set RBW = 1MHz and VBW = 1MHz. Sweep = as necessary to capture the entire dwell time per hopping channel.

4.Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g.. data rate. modulation format. etc.). repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

14.2 Test Result:

Dwell time = Pulse wide x (Hopping rate / Number of channels) x Period
The test period: T= 0.4(s) * 79 = 31.6 (s)
DH5 Packet permit maximum 1600 / 79 / 6 hops per second in each channel (5 time slots RX, 1 time slot TX).
DH3 Packet permit maximum 1600 / 79 / 4 hops per second in each channel (3 time slots RX, 1 time slot TX).

DH1 Packet permit maximum 1600 / 79 / 2 hops per second in each channel (1 time slot RX, 1 time slot TX). So, the Dwell Time can be calculated as follows:

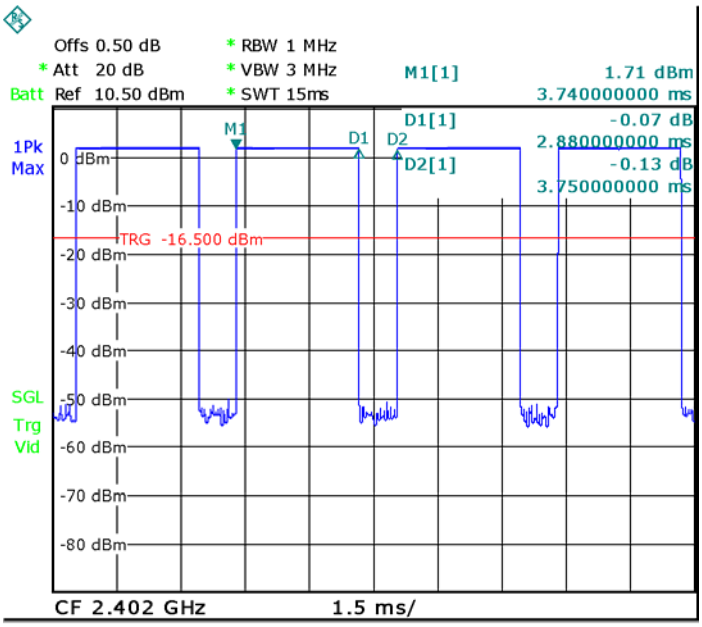
Data Packet	Dwell Time(s)
DH5	1600/79/6*31.6*(MkrDelta)/1000
DH3	1600/79/4*31.6*(MkrDelta)/1000
DH1	1600/79/2*31.6*(MkrDelta)/1000
Remark	Mkr Delta is single pulse time.

Modulation	Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
GFSK	DH5	Low	2.88	0.307	0.4
		middle	2.88	0.307	0.4
		High	2.88	0.307	0.4
Pi/4DQPSK	DH5	Low	2.88	0.307	0.4
		middle	2.88	0.307	0.4
		High	2.88	0.307	0.4
8DPSK	DH5	Low	2.88	0.307	0.4
		middle	2.88	0.307	0.4
		High	2.88	0.307	0.4

Modulation: GFSK

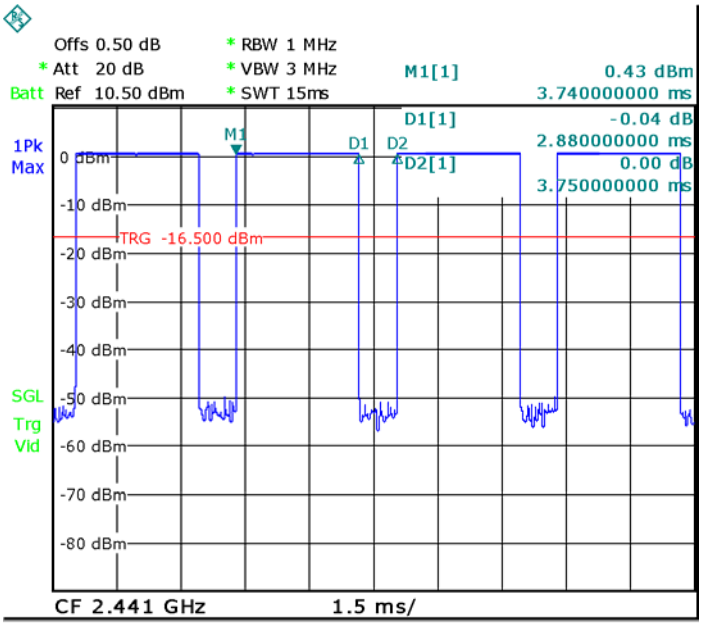
Data Packet:

DH5.Low channel



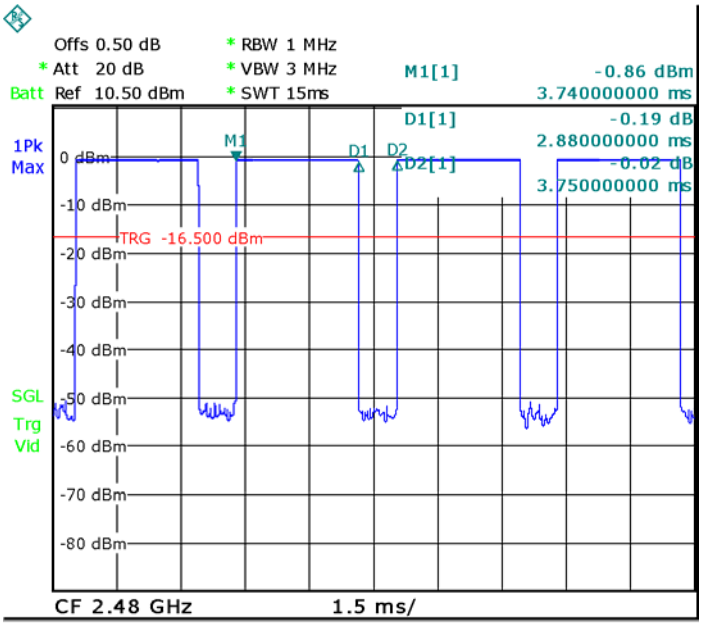
Data Packet:

DH5.Middle channel



Data Packet:

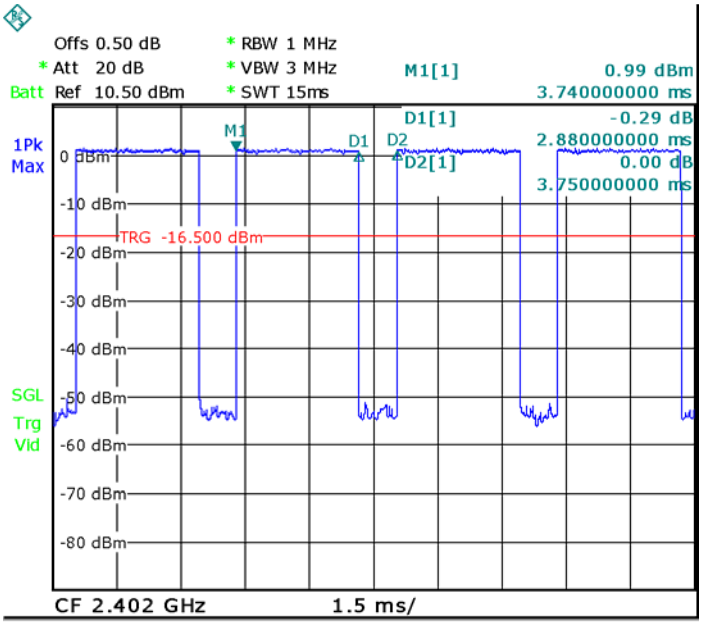
DH5, High channel



Pi/4DQPSK

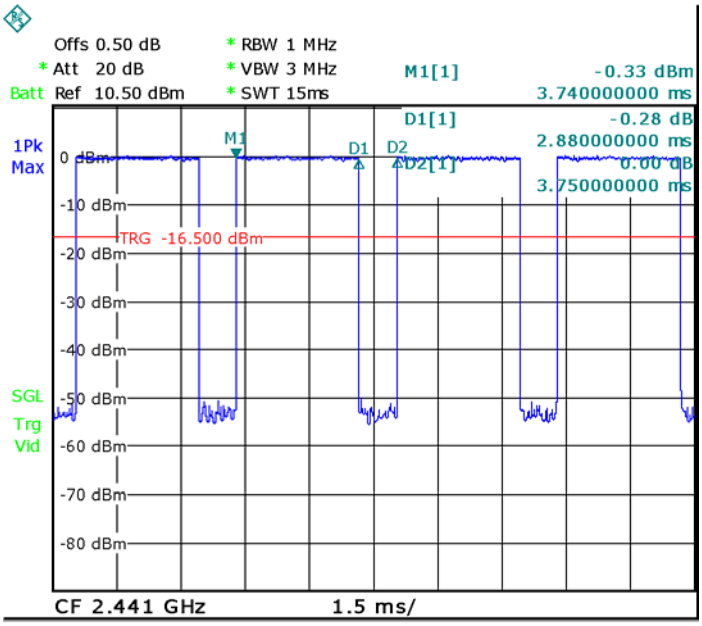
Data Packet:

DH5, Low channel



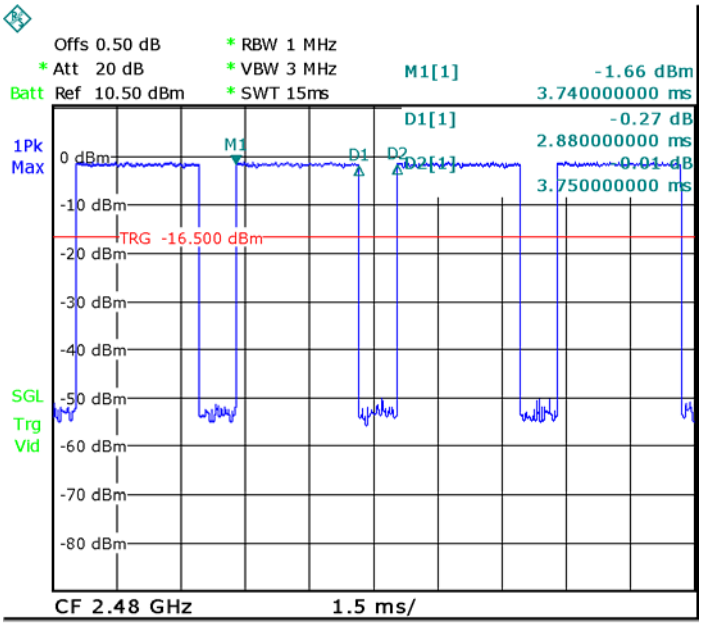
Data Packet:

DH5, Middle channel



Data Packet:

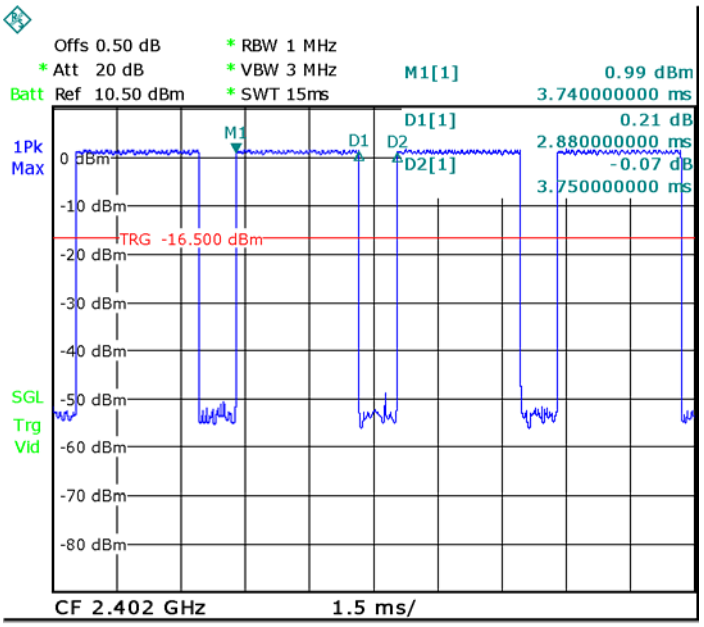
DH5, High channel



8DPSK

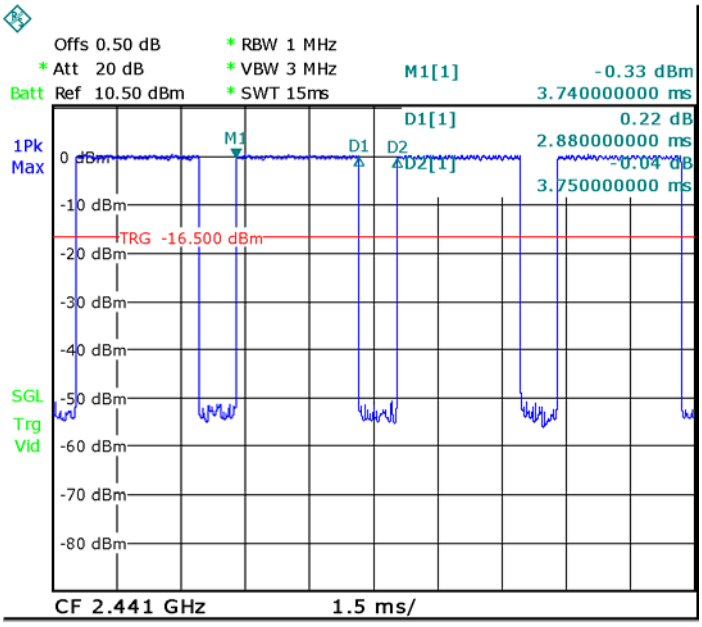
Data Packet:

DH5, Low channel



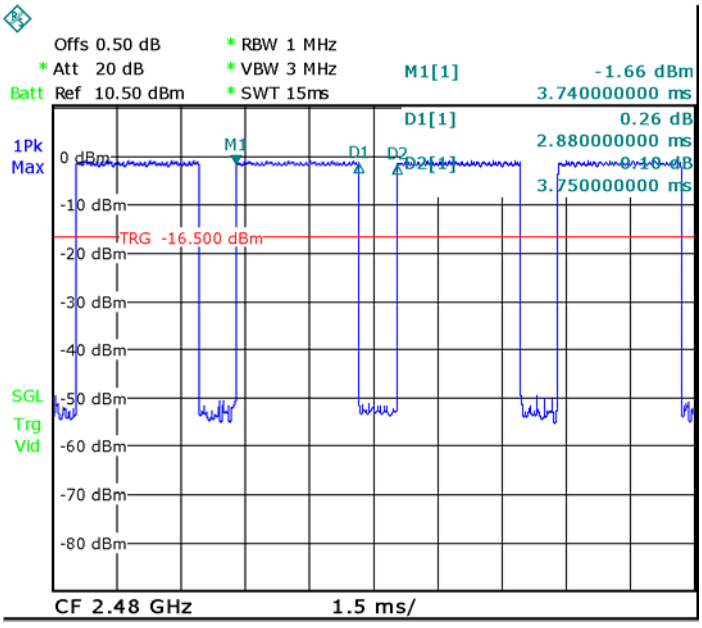
Data Packet:

DH5, Middle channel



Data Packet:

DH5, High channel



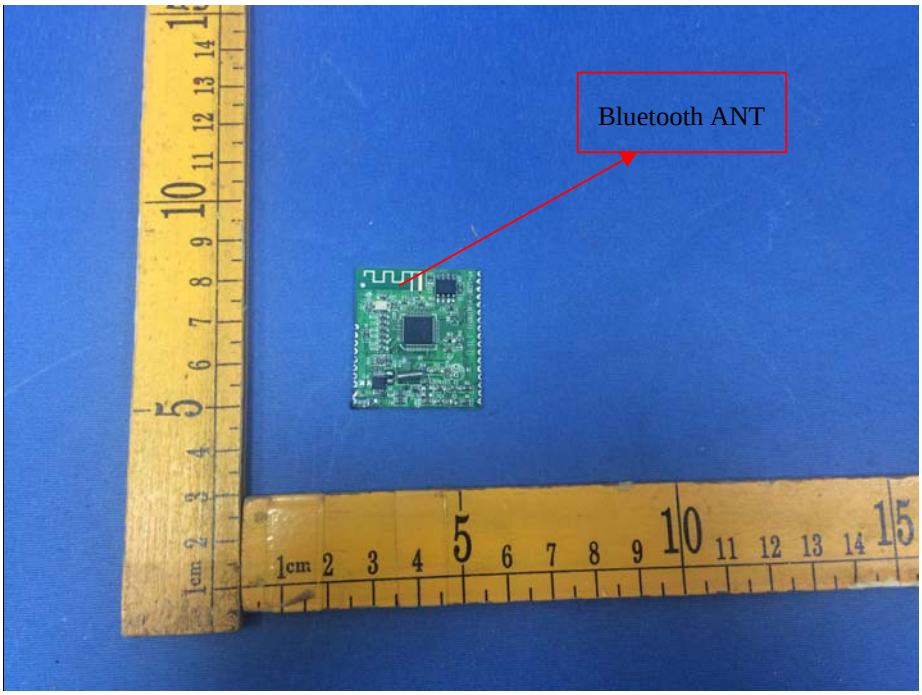
15 Antenna Requirement

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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

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.

Result:

The EUT has one PCB printed antenna, the gain is 0dBi. Meets the requirements of FCC 15.203.



16 RF Exposure

Test Requirement: FCC Part 1.1307

Evaluation Method: FCC Part 2.1091& KDB 447498 D01 General RF Exposure Guidance v06

16.1 Requirements

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2 m normally can be maintained between the user and the device.

16.2 The procedures / limit

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm^2)	Averaging Time $\|E\|^2$,$\|H\|^2$or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842 / f	4.89 / f	(900 / f)*	6
30-300	61.4	0.163	1.0	6
300-1500			F/300	6
1500-100,000			5	6

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm^2)	Averaging Time $\|E\|^2$,$\|H\|^2$ or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

Note: f = frequency in MHz ; *Plane-wave equivalent power density

16.3 MPE Calculation Method

$$S = \frac{P \times G}{4 \times \pi \times R^2}$$

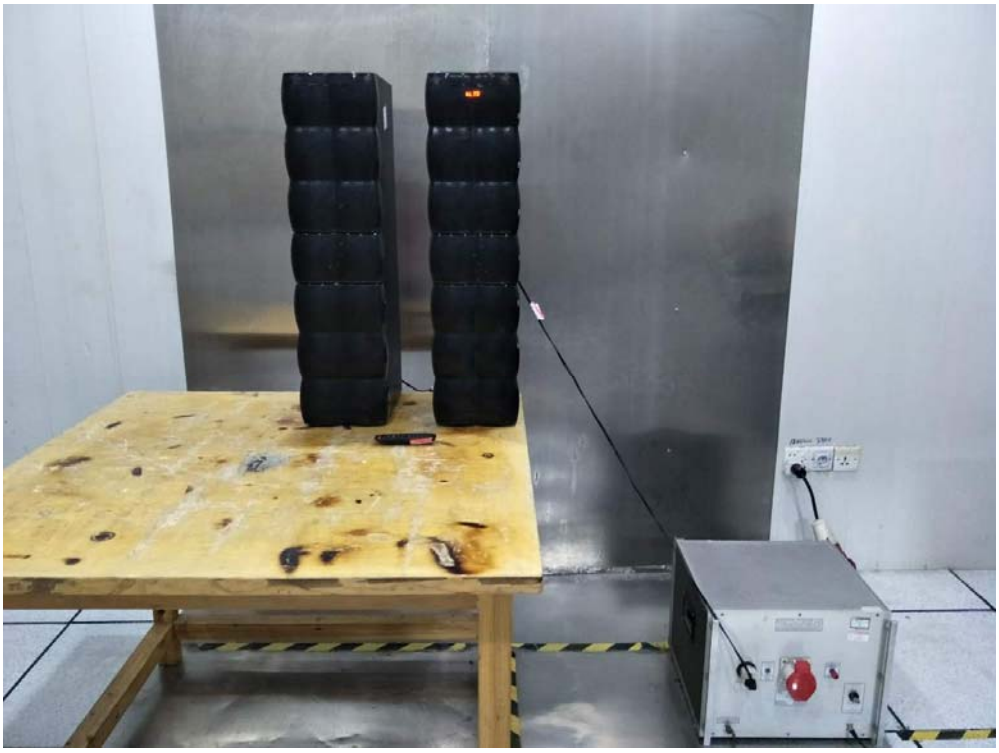
S = power density (in appropriate units, e.g. mW/cm^2)
P = output power to the antenna (in appropriate units, e.g., mW).
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

From the peak EUT RF output power, the minimum mobile separation distance, R=20cm, as well as the gain of the used antenna, the RF power density can be obtained

Antenna Gain (dBi)	Antenna Gain (numeric)	Max. Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (mW/cm2)	Limit of Power Density (mW/cm2)
0.00	1.000	1.57	1.44	0.000286	1

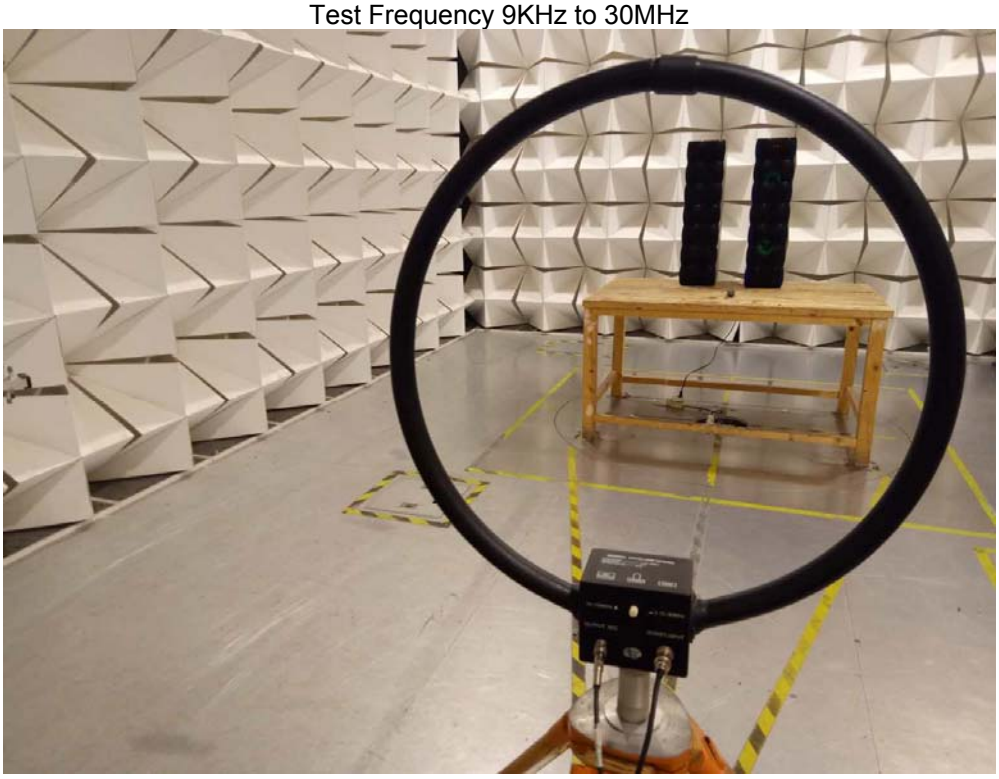
17 Photographs – Model HE-620700 Test Setup

17.1 Photograph-Conducted Emissions Test Setup

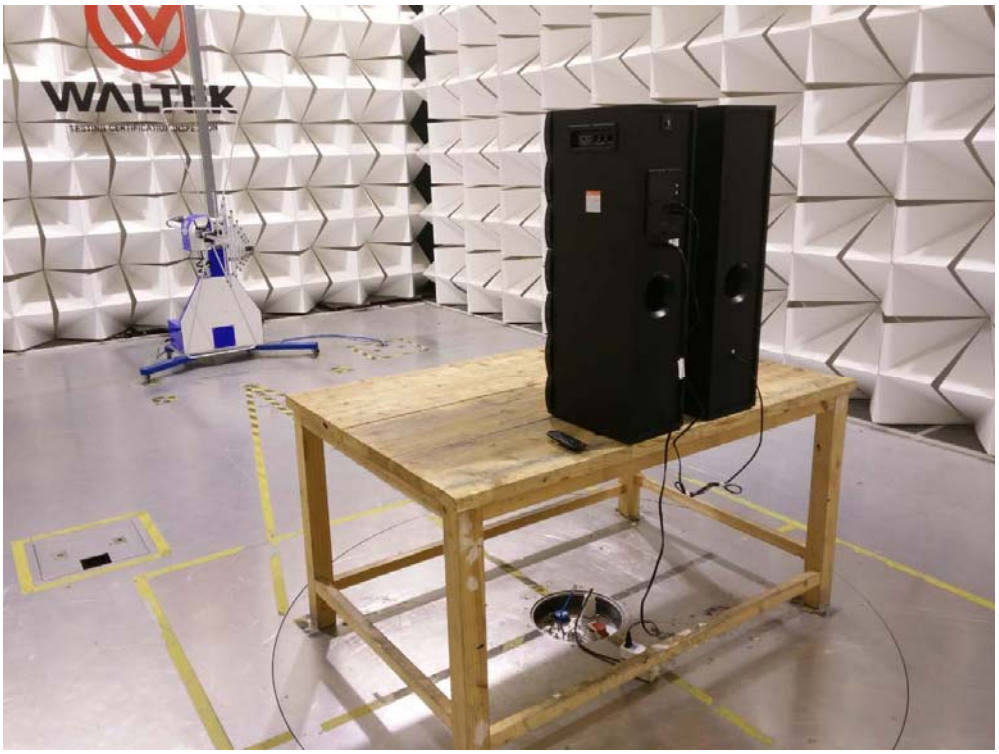


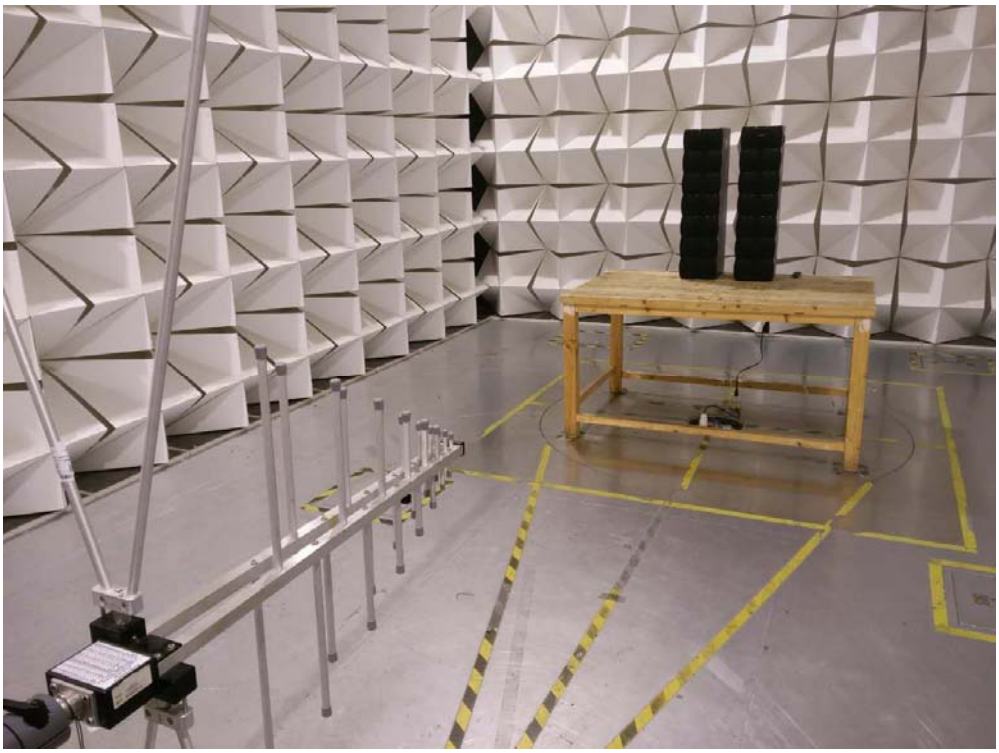
17.2 Photograph-Radiated Emissions

Test Frequency 9KHz to 30MHz

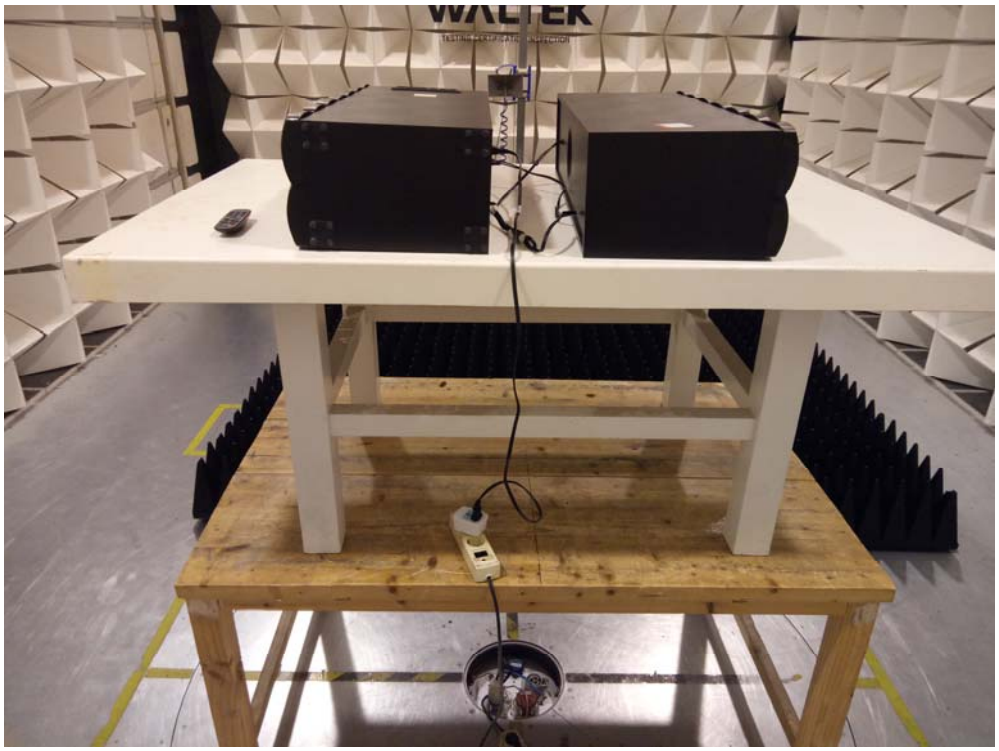


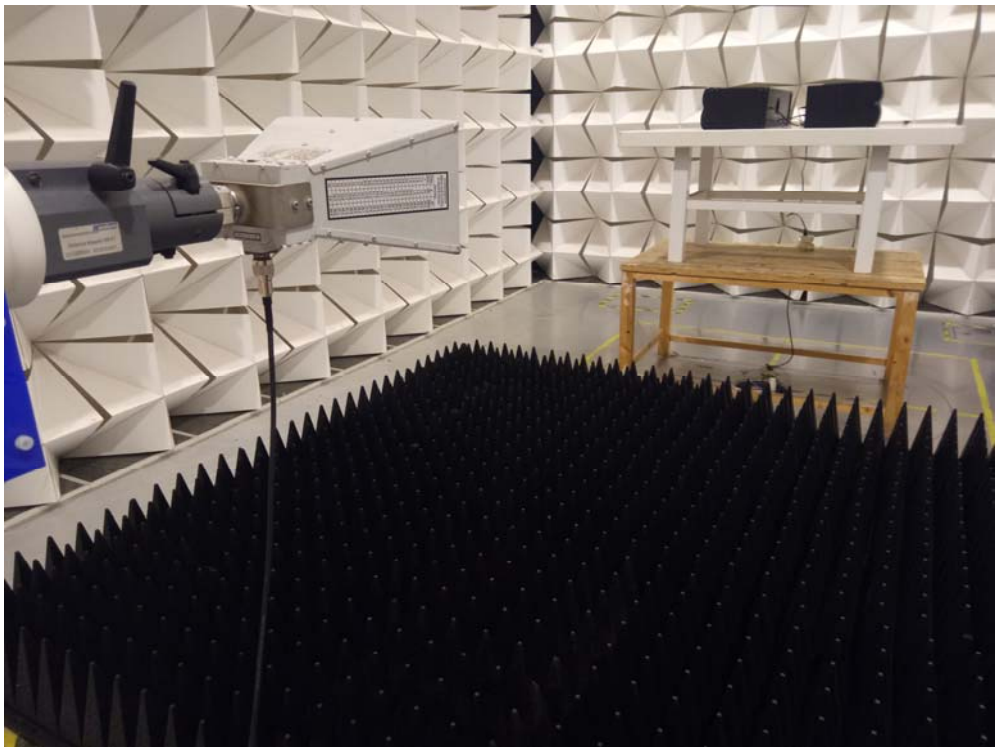
Test Frequency 30MHz to 1000MHz at Test Site 2#





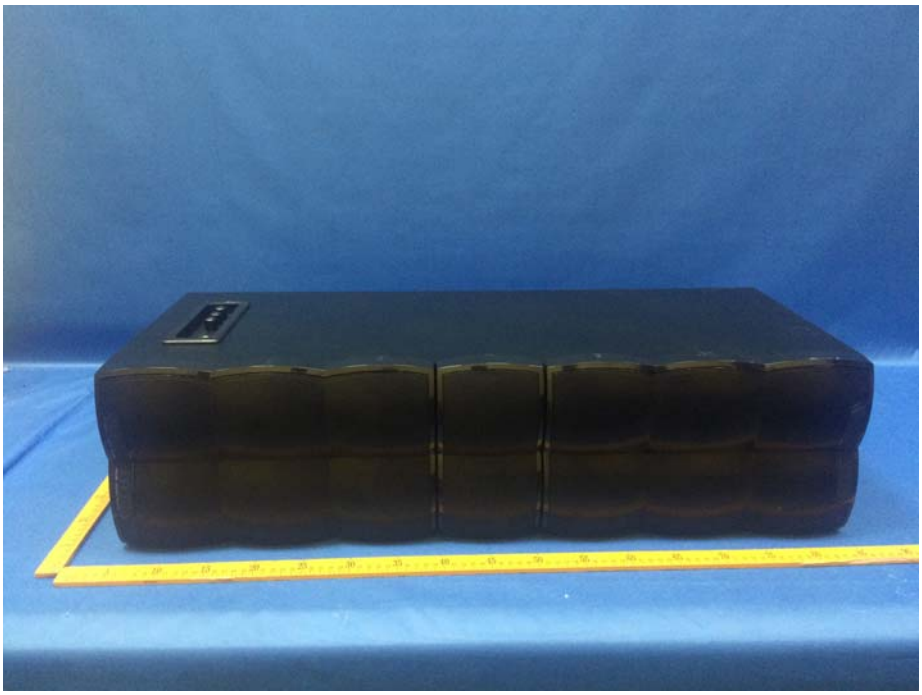
Test Frequency above 1GHz Test Site 1#





18 Photographs – Constructional Details

18.1 Model HE-620700 – External Photos




USB
ST-BY/MI
SOURCE
VOL-
VOL+

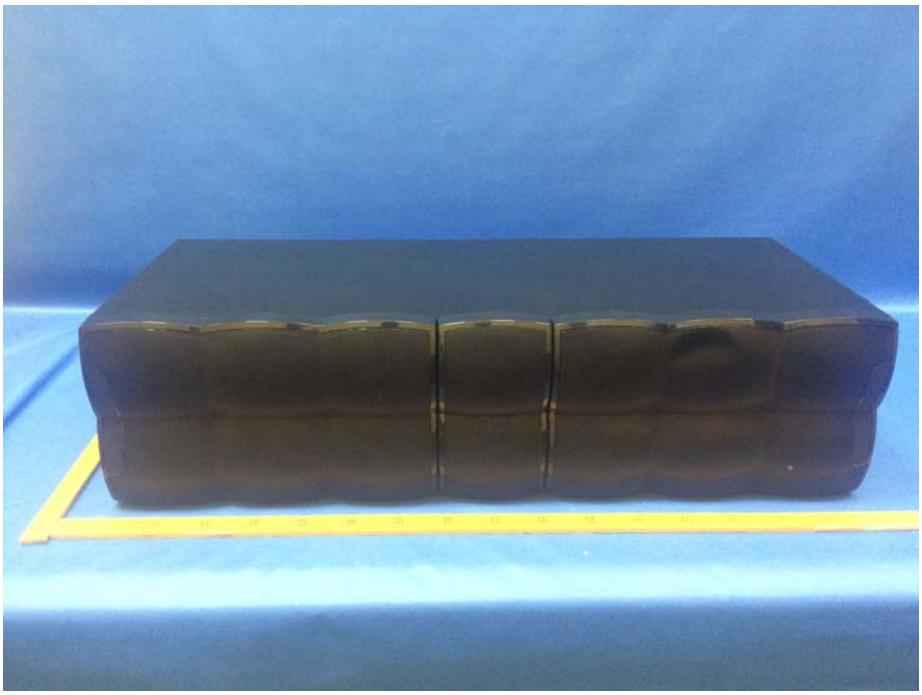

ST-BY/PI
SOURCE
I◀◀/TUN-
▶▶I/TUN+
VOL-
VOL+

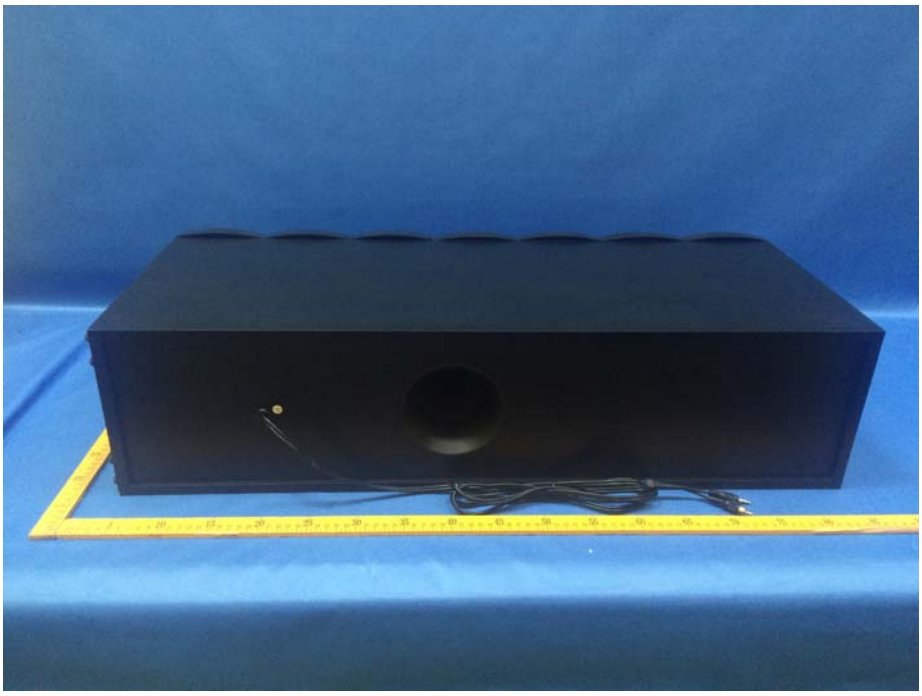

ANTENNA


OFX

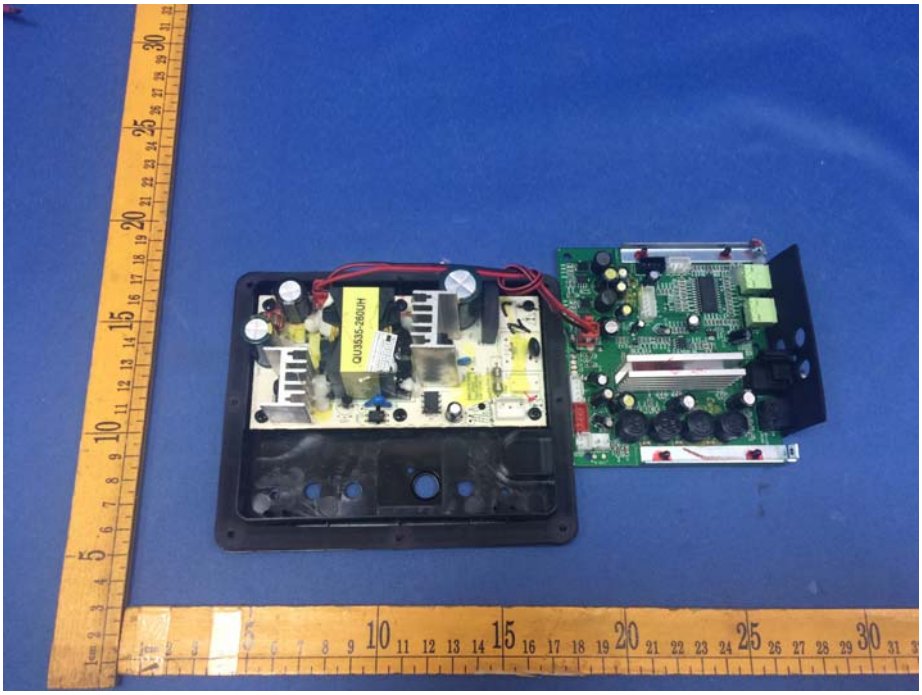

OFX

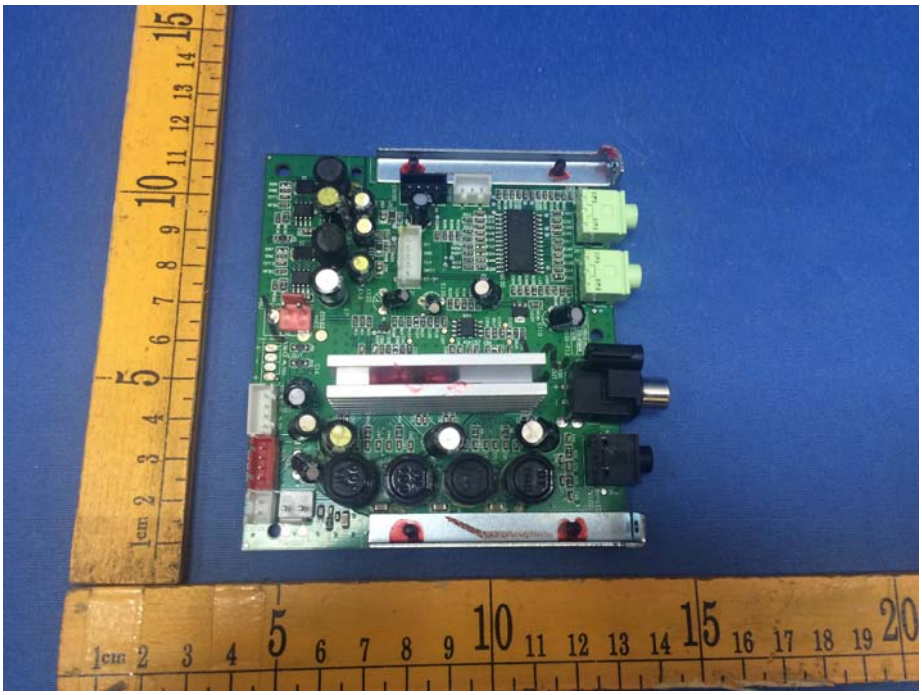

1
2
MIC
VOLUME

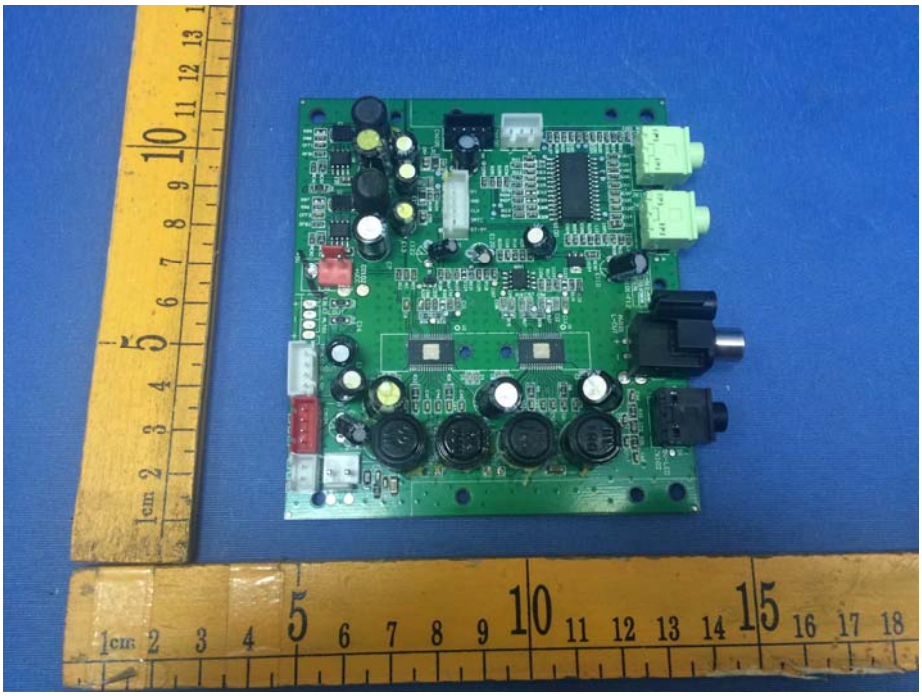


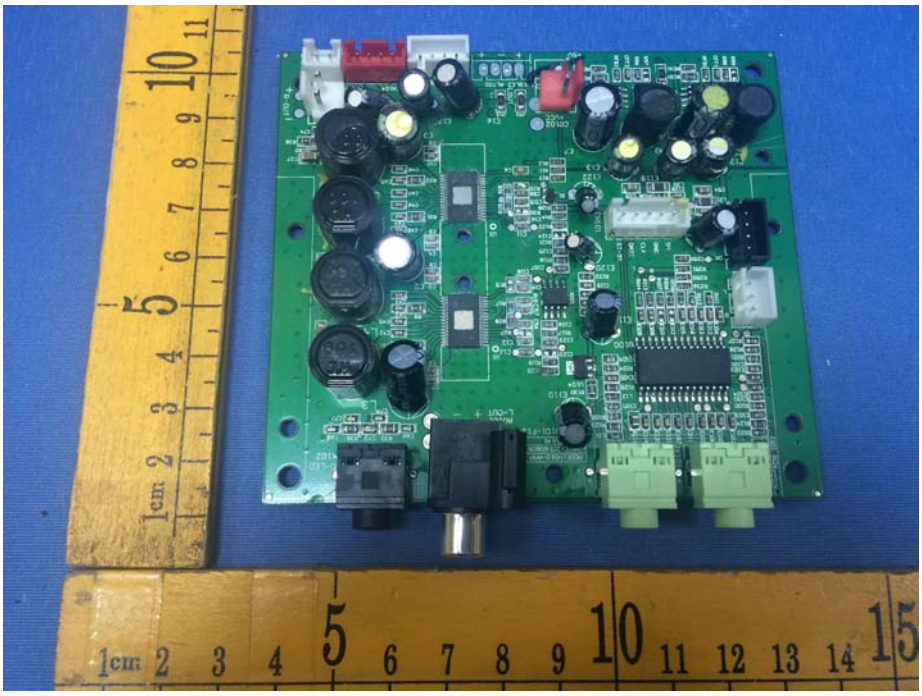


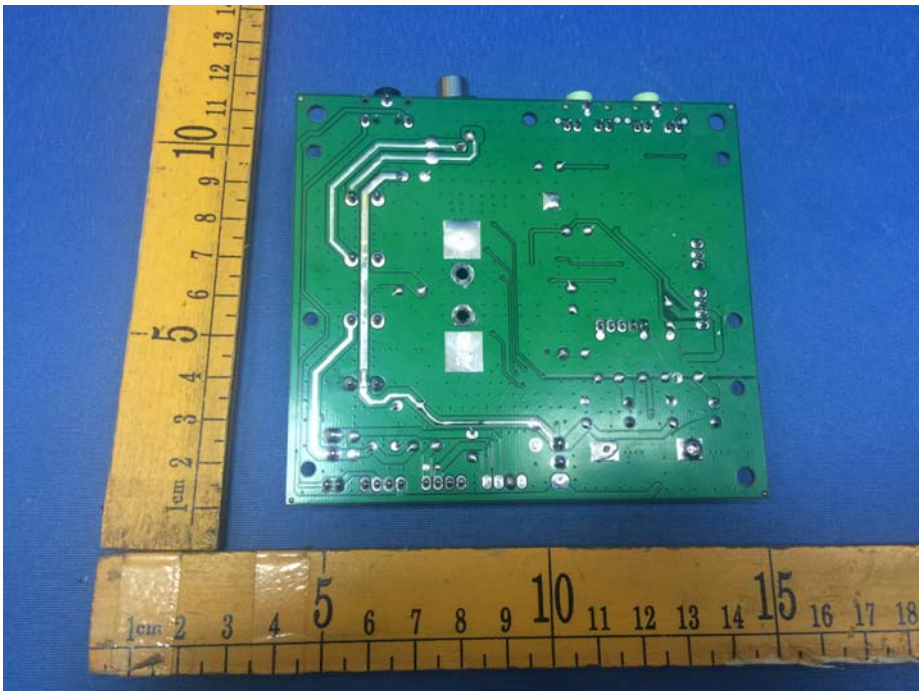
18.2 Model HE-620700 – Internal Photos



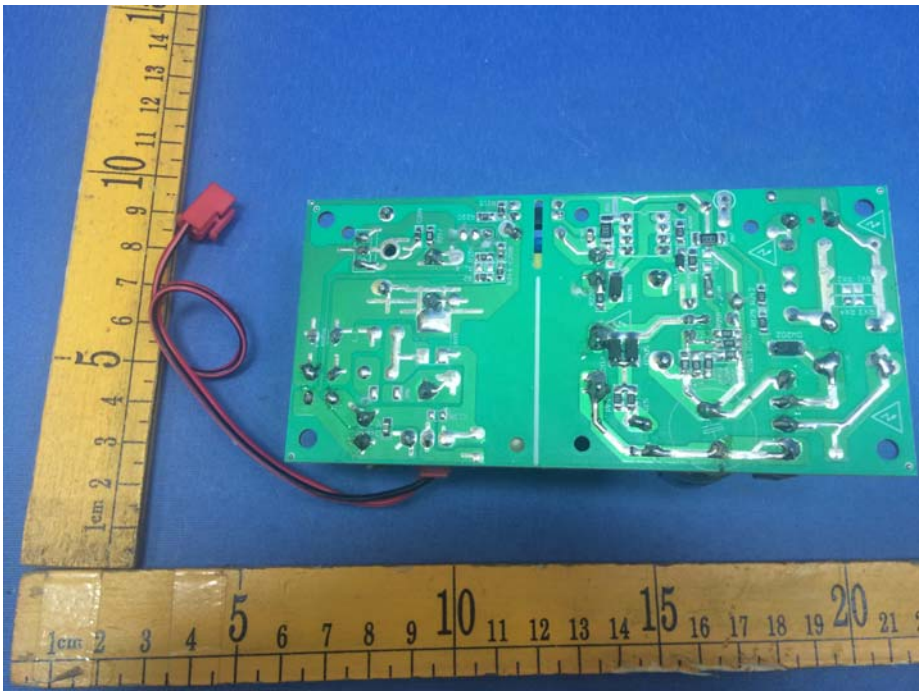


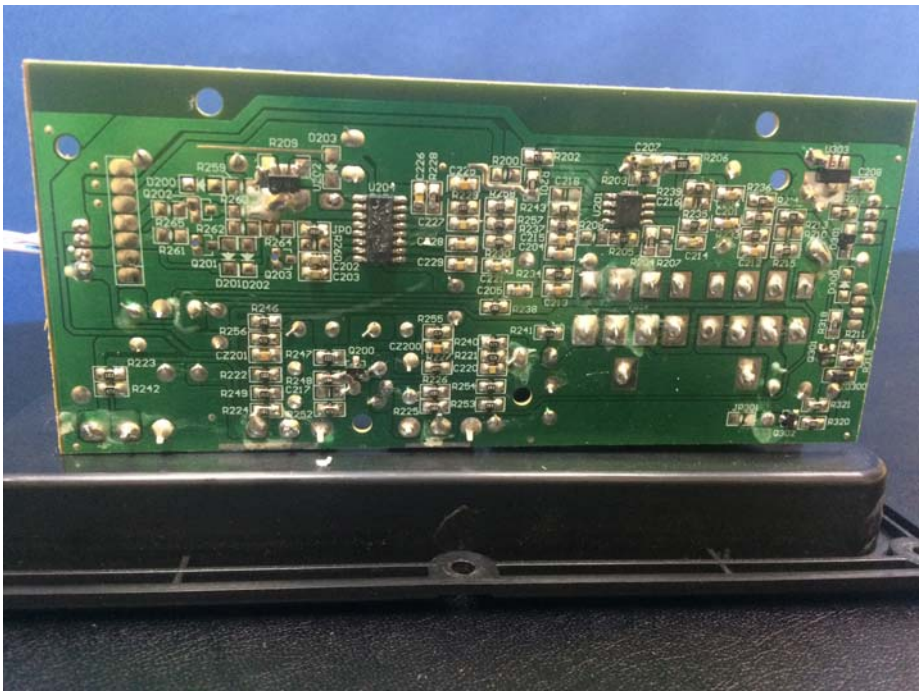


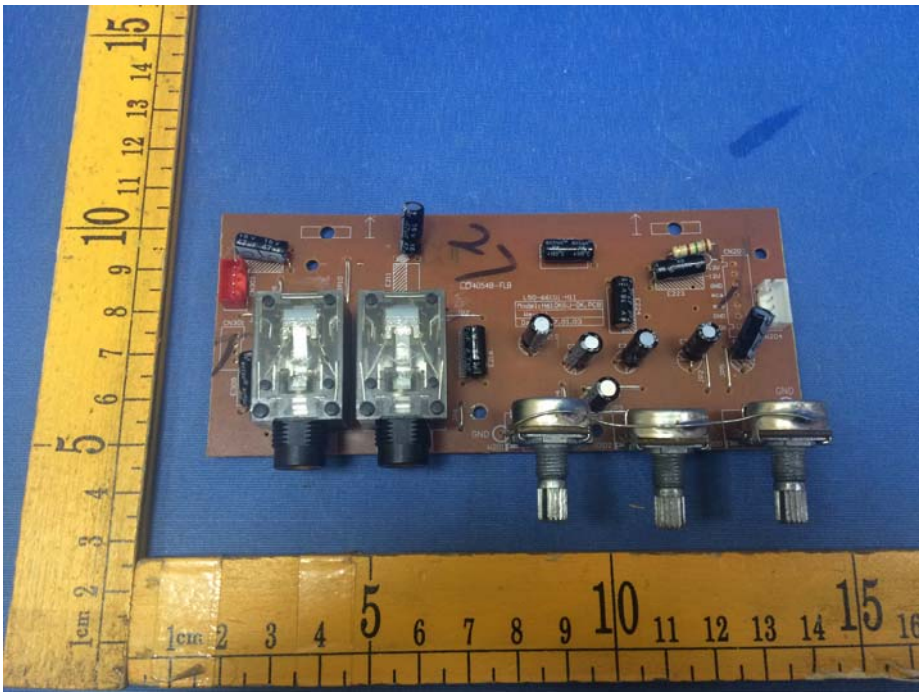


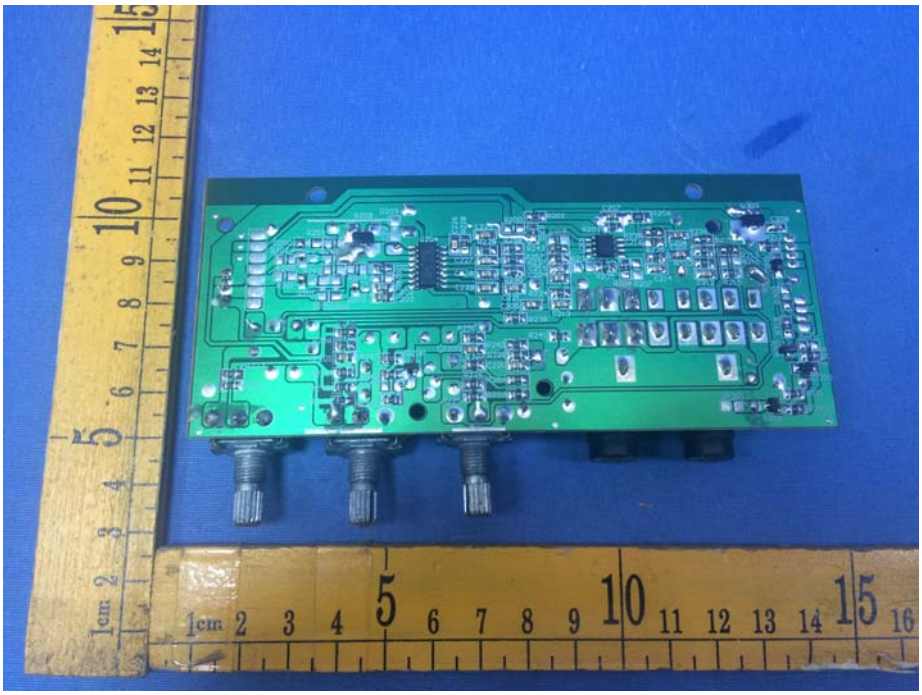


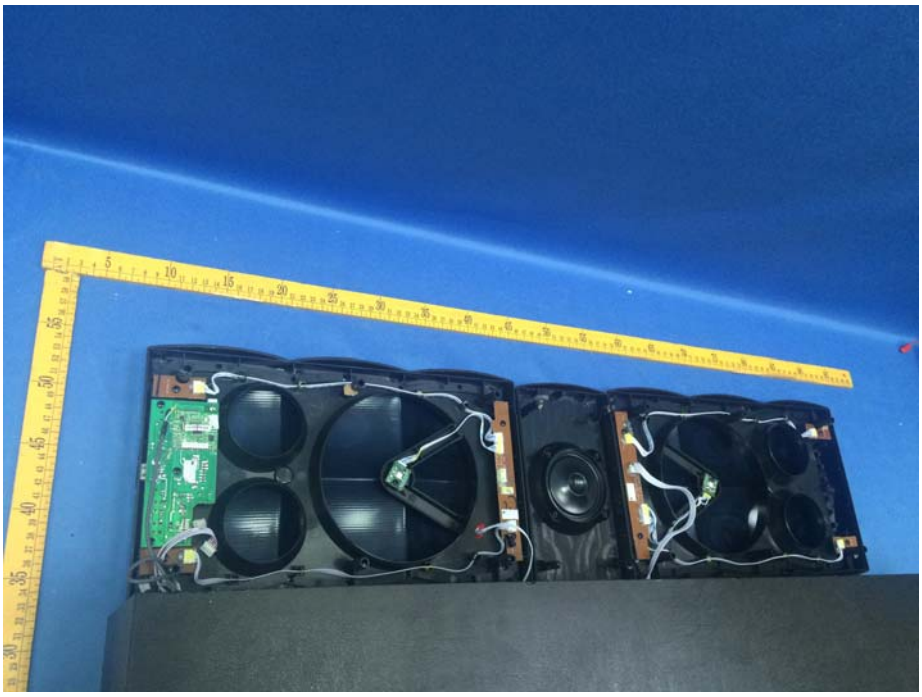

QU3535-260UH

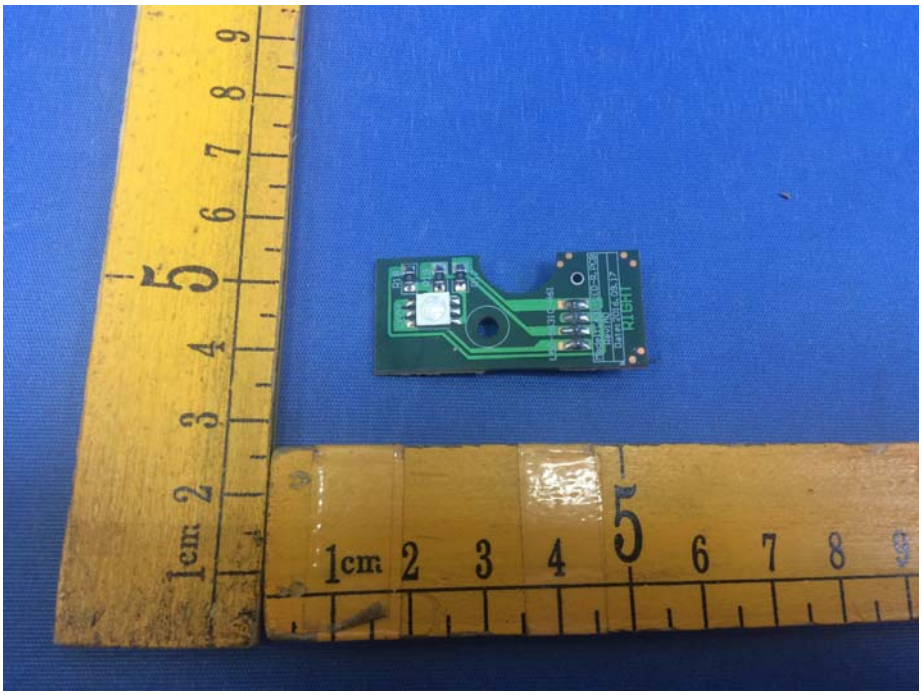


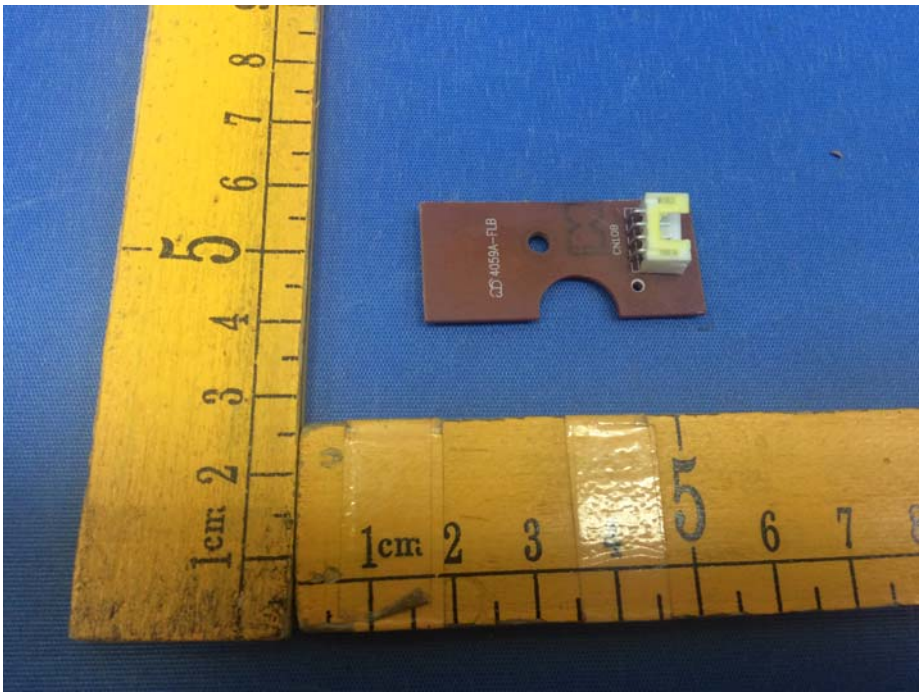


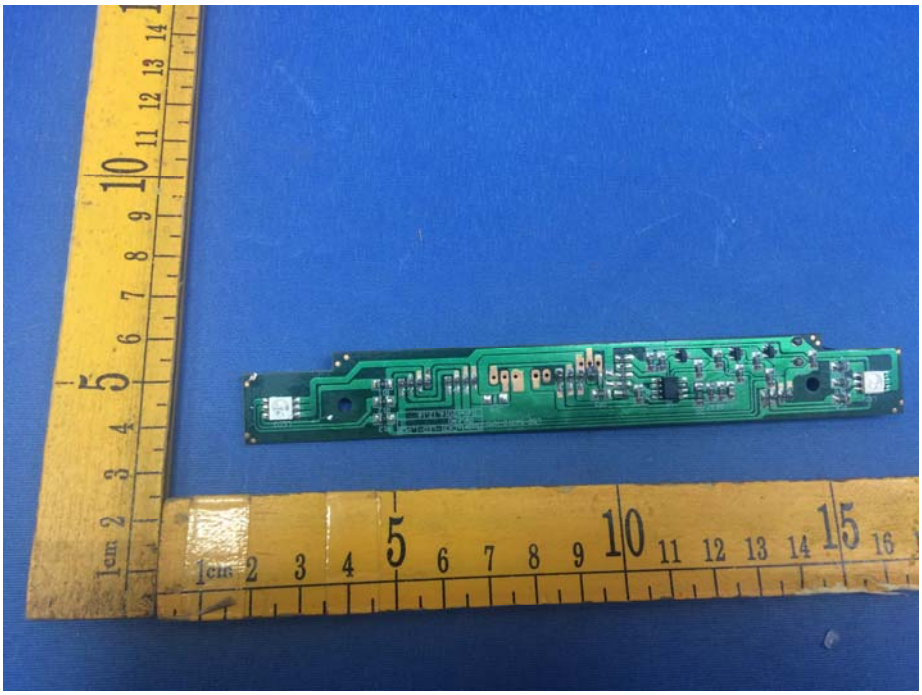


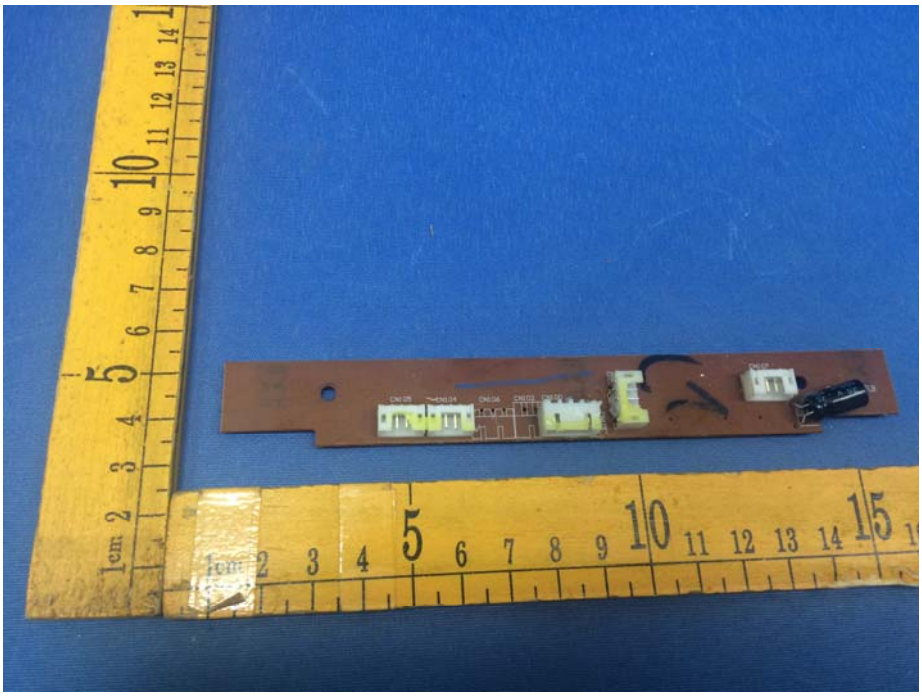


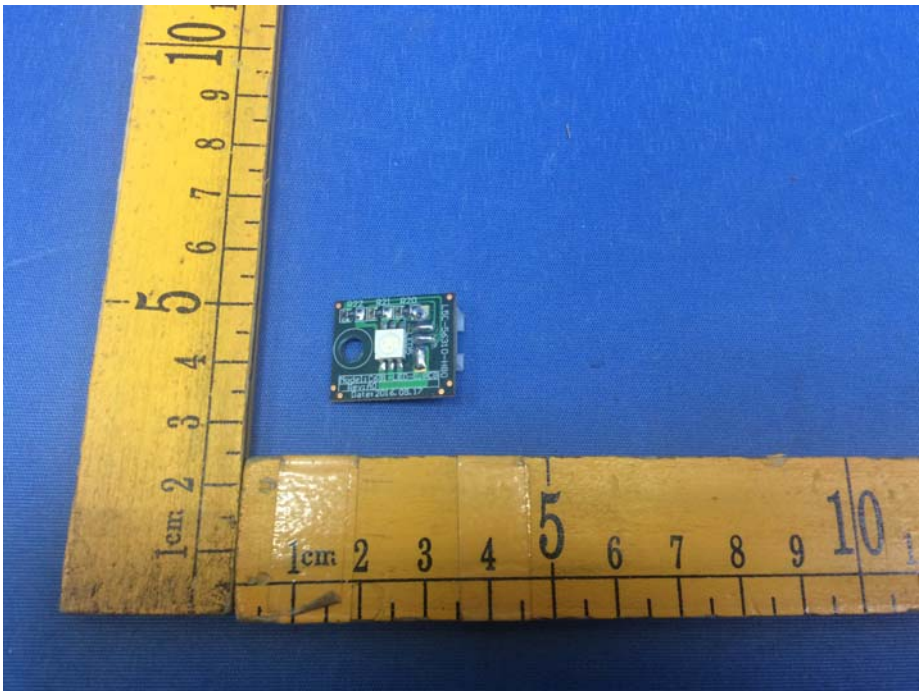


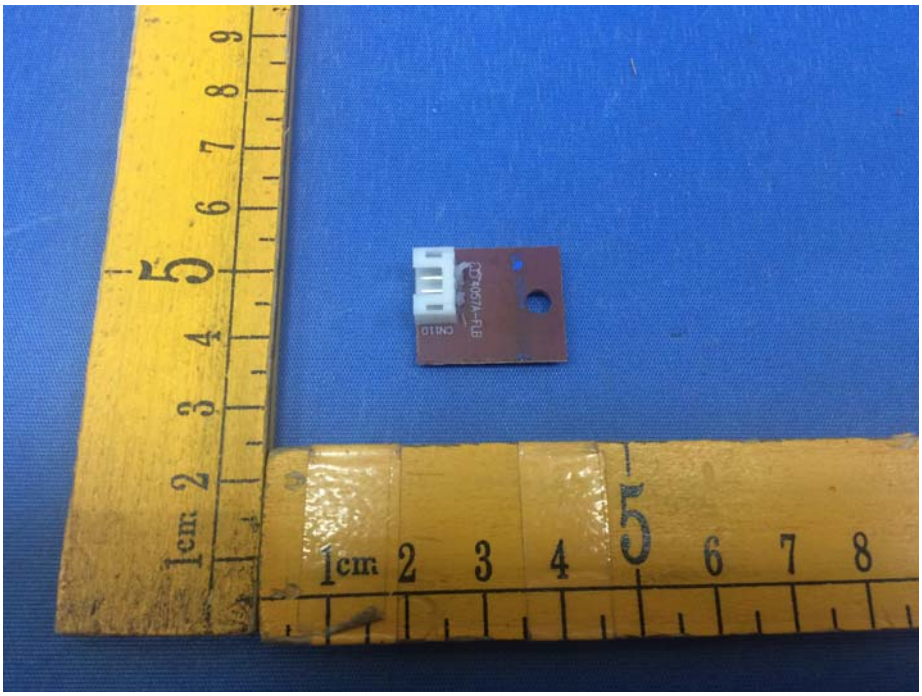

RIGHT
1cm 2 3 4 5 6 7 8

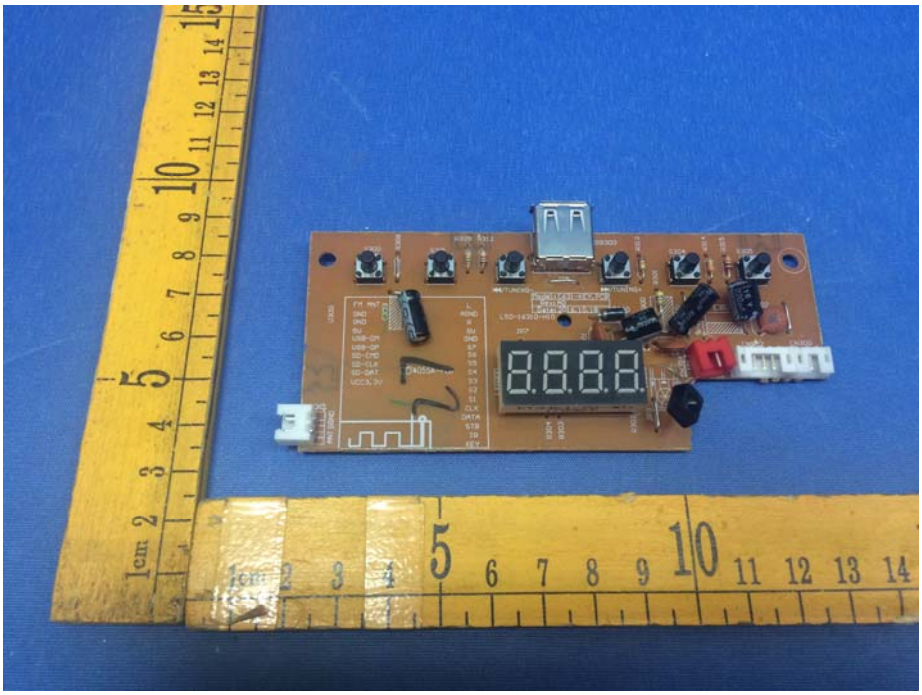

CJD 4059A-T1B
CN1/28
1cm 2 3 6 7

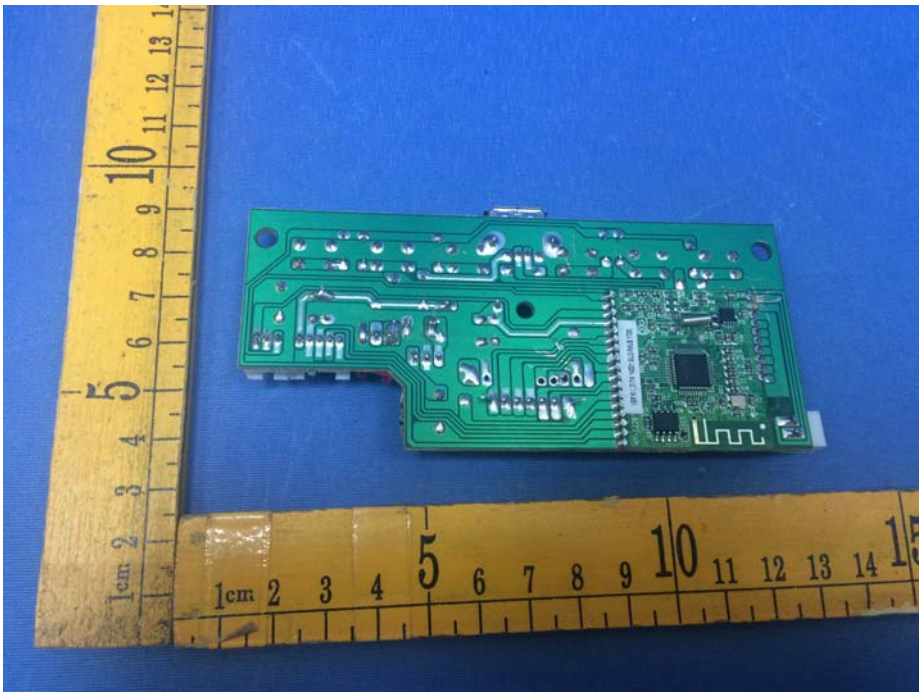


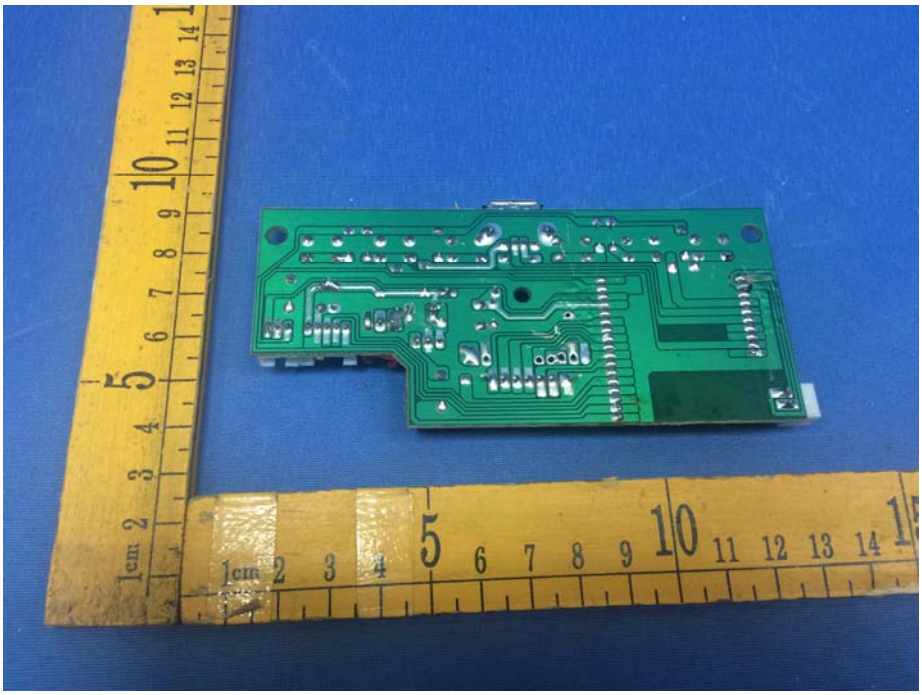


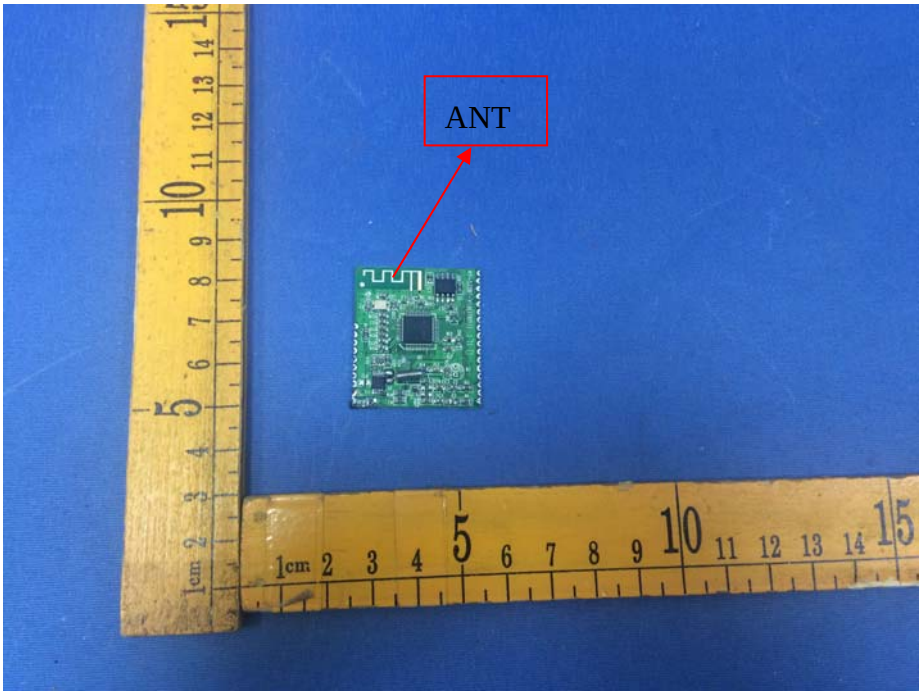








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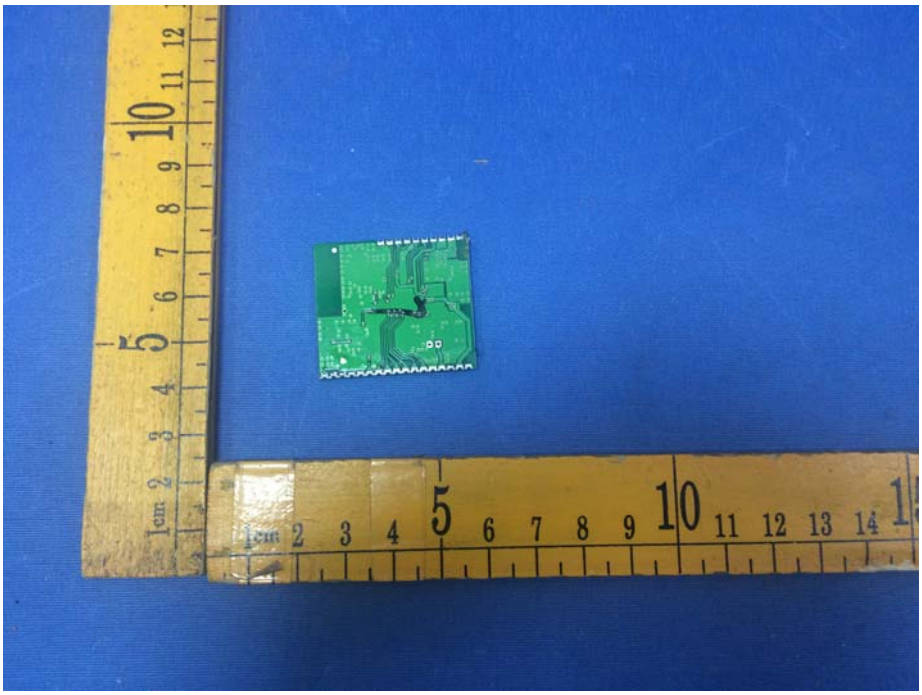

======End of Report======