

FCC TEST REPORT

FCC ID: 2AHW8LT-BT707UC

Product Name : Bluetooth Speaker

Model Name : LT-BT707UC, BT-4023, LT-BT570UC, LT-BT701UC,
LT-BT702UC, LT-BT703UC, LT-BT708UC, LT-BT1649,
LT-1652BUF, LT-1701BUF, LT-1707UAR

Brand Name : NUTEK

Report No. : PTC-DQ-0317045330-FC01

Prepared for

LEOTEC ELECTRONICS CO.,LTD

No.106,Wentang North Road, Wenzhou Road, Dongcheng District, Dongguan, China

Prepared by

DongGuan Precise Testing Service Co.,Ltd.

Building D, Baoding Technology Park, Guangming Road 2, Guangming Community

Dongcheng District, Dongguan, Guangdong, China

1TEST RESULT CERTIFICATION

Applicant's name : LEOTEC ELECTRONICS CO.,LTD

Address : No.106,Wentang North Road, Wenzhou Road, Dongcheng District, Dongguan, China

Manufacture's name : LEOTEC ELECTRONICS CO.,LTD

Address : No.106,Wentang North Road, Wenzhou Road, Dongcheng District, Dongguan, China

Product name : Bluetooth Speaker

Model name : LT-BT707UC, BT-4023, LT-BT570UC, LT-BT701UC, LT-BT702UC, LT-BT703UC, LT-BT708UC, LT-BT1649, LT-1652BUF, LT-1701BUF, LT-1707UAR

Brand Name : NUTEK

Standards : FCC CFR47 Part 15 Section 15.247

Test procedure : ANSI C63.10:2013, DA 00-705

Test Date : May 23, 2017- June. 15, 2017

Date of Issue : June 16, 2017

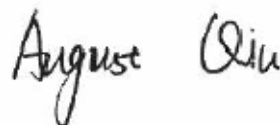
Test Result : Pass

This device described above has been tested by PTS, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

This report shall not be reproduced except in full, without the written approval of PTS, this document may be altered or revised by PTS, personal only, and shall be noted in the revision of the document.

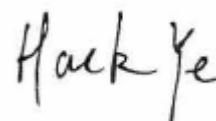
Testing Engineer

August Qiu



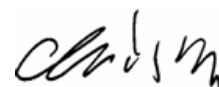
Technical Manager

Hack Ye



Authorized Signatory

Chris Du



Contents

	Page
1 TEST RESULT CERTIFICATION	2
2 TEST SUMMARY	5
3 GENERAL INFORMATION	6
3.1 GENERAL DESCRIPTION OF E.U.T	6
3.2 CHANNEL LIST	7
3.3 TEST MODE	8
4 EQUIPMENT DURING TEST	9
4.1 EQUIPMENTS LIST	9
4.2 MEASUREMENT UNCERTAINTY	10
5 CONDUCTED EMISSION	11
5.1 E.U.T. OPERATION	11
5.2 EUT SETUP	11
5.3 TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)	12
5.4 MEASUREMENT PROCEDURE:	12
5.5 CONDUCTED EMISSION LIMIT	12
5.6 MEASUREMENT DESCRIPTION	12
5.7 CONDUCTED EMISSION TEST RESULT	12
6 RADIATED SPURIOUS EMISSIONS	17
6.1 EUT OPERATION	17
6.2 TEST SETUP	18
6.3 SPECTRUM ANALYZER SETUP	19
6.4 TEST PROCEDURE	20
6.5 SUMMARY OF TEST RESULTS	21
7 CONDUCTED SPURIOUS & BAND EDGE EMISSION	26
7.1 REQUIREMENT	26
7.2 TEST PROCEDURE	26
7.3 TEST SETUP	26
7.4 EUT OPERATION CONDITIONS	26
7.5 TEST RESULTS	27
8 20 DB BANDWIDTH MEASUREMENT	39
8.1 TEST PROCEDURE	39
8.2 TEST RESULT	39



9	MAXIMUM PEAK OUTPUT POWER	46
9.1	TEST PROCEDURE.....	46
9.2	TEST RESULT	46
10	HOPPING CHANNEL SEPARATION.....	48
10.1	TEST PROCEDURE.....	48
10.2	TEST RESULT	49
11	NUMBER OF HOPPING FREQUENCY	55
11.1	TEST PROCEDURE.....	55
11.2	TEST RESULT	55
12	DWELL TIME.....	56
12.1	TEST PROCEDURE.....	56
12.2	TEST RESULT	56
13	ANTENNA REQUIREMENT.....	59
14	TEST PHOTOS.....	60
15	EUT PHOTOS.....	62



2 Test Summary

Test Items	Test Requirement	Result
Radiated Spurious Emissions	15.205(a) 15.209 15.247(d)	PASS
Band edge	15.247(d) 15.205(a)	PASS
Conduct Emission	15.207	PASS
20dB Bandwidth	15.247(a)(1)	PASS
Maximum Peak Output Power	15.247(b)(1)	PASS
Frequency Separation	15.247(a)(1)	PASS
Number of Hopping Frequency	15.247(a)(1)(iii)	PASS
Dwell time	15.247(a)(1)(iii)	PASS
Antenna Requirement	15.203	PASS

Remark:

N/A: Not Applicable

3 General Information

3.1 General Description of E.U.T.

Product Name	: Bluetooth Speaker
Model Name	: LT-BT707UC, BT-4023, LT-BT570UC, LT-BT701UC, LT-BT702UC, LT-BT703UC, LT-BT708UC, LT-BT1649, LT-1652BUF, LT-1701BUF, LT-1707UAR
Model Description	: All the same except model number and appearance color.
Bluetooth Version	: BT2.1+EDR
Operating frequency	: 2402-2480MHz
Numbers of Channel	: 79 channels
Antenna Type:	: Internal PCB Antenna
Antenna Gain:	: -0.68 dBi
Type of Modulation	: GFSK, Pi/4DQPSK, 8DPSK
Power supply	: DC 5V, 2A Battery
Supported Equipment for Test	Model: NSA12UH-050200 Input: AC100-240V, 50/60Hz, 0.5A Output: DC 5V, 2A



3.2 Channel List

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	1	2403	2	2404	3	2405
4	2406	5	2407	6	2408	7	2409
8	2410	9	2411	10	2412	11	2413
12	2414	13	2415	14	2416	15	2417
16	2418	17	2419	18	2420	19	2421
20	2422	21	2423	22	2424	23	2425
24	2426	25	2427	26	2428	27	2429
28	2430	29	2431	30	2432	31	2433
32	2434	33	2435	34	2436	35	2437
36	2438	37	2439	38	2440	39	2441
40	2442	41	2443	42	2444	43	2445
44	2446	45	2447	46	2448	47	2449
48	2450	49	2451	50	2452	51	2453
52	2454	53	2455	54	2456	55	2457
56	2458	57	2459	58	2460	59	2461
60	2462	61	2463	62	2464	63	2465
64	2466	65	2467	66	2468	67	2469
68	2470	69	2471	70	2472	71	2473
72	2474	73	2475	74	2476	75	2477
76	2478	77	2479	78	2480	-	-

3.3 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.

Test mode	Low channel	Middle channel	High channel
Transmitting	2402MHz	2441MHz	2480MHz
Hopping	2402-2480MHz		
Tests Carried Out Under FCC part 15.207			
Test Item	Test Mode		
Conduction Emission, 0.15MHz to 30MHz	BT Communication		

4 Equipment During Test

4.1 Equipments List

RF Conducted Test							
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	EMC Analyzer (9k~26.5GHz)	Agilent	E4407B	MY45109572	Aug.04, 2016	Aug.03, 2017	1 year
2	EXA Signal Analyzer	Keysight	N9010A	MY50520207 526B25MPB W7X	Aug.04, 2016	Aug.03, 2017	1 year
3	EMI Test Receiver	R&S	ESCI	101155	July 15, 2016	July 14, 2017	1 year
4	Humidity Chamber	GF	GTH-225-40-1P	IAA061225	July 15, 2016	July 14, 2017	1 year
5	USB RF power sensor	DARE	RPR3006W	15I00041SN O01	July 15, 2016	July 14, 2017	1 year
Radiated Emissions							
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	EMI Test Receiver	Rohde&Schwarz	ESCI	101417	July 15, 2016	July 14, 2017	1 year
2	Trilog Broadband Antenna	SCHWARZECK	VULB9160	9160-3355	July 15, 2016	July 14, 2017	1 year
3	Amplifier	EM	EM-30180	060538	July 15, 2016	July 14, 2017	1 year
4	Horn Antenna	SCHWARZECK	BBHA9120D	1246	July 15, 2016	July 14, 2017	1 year
5	Horn Antenna	SCHWARZECK	BBHA9170D	1412	July 15, 2016	July 14, 2017	1 year
6	Coaxial Cable(below 1GHz)	LARGE	CALB1	-	July 15, 2016	July 14, 2017	1 year
7	Coaxial Cable(above 1GHz)	LARGE	CALB2	-	July 15, 2016	July 14, 2017	1 year
Conducted Emissions							
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	EMI Test Receiver	R&S	ESCI	101155	July 15, 2016	July 14, 2017	1 year
2	LISN	SCHWARZECK	NSLK 8128	8128-289	July 15, 2016	July 14, 2017	1 year
3	Cable	LARGE	RF300	-	July 15, 2016	July 14, 2017	1 year



4.2 Measurement Uncertainty

Parameter	Uncertainty
RF output power, conducted	$\pm 1.0\text{dB}$
Power Spectral Density, conducted	$\pm 2.2\text{dB}$
Radio Frequency	$\pm 1 \times 10^{-6}$
Bandwidth	$\pm 1.5 \times 10^{-6}$
Time	$\pm 2\%$
Duty Cycle	$\pm 2\%$
Temperature	$\pm 1^{\circ}\text{C}$
Humidity	$\pm 5\%$
DC and low frequency voltages	$\pm 3\%$
Conducted Emissions (150kHz~30MHz)	$\pm 3.64\text{dB}$
Radiated Emission(30MHz~1GHz)	$\pm 5.03\text{dB}$
Radiated Emission(1GHz~25GHz)	$\pm 4.74\text{dB}$

5 Conducted Emission

Test Requirement: : FCC CFR 47 Part 15 Section 15.207
 Test Method: : ANSI C63.10:2013
 Test Result: : PASS
 Frequency Range: : 150kHz to 30MHz
 Class/Severity: : Class B
 Detector: : Peak for pre-scan (9kHz Resolution Bandwidth)

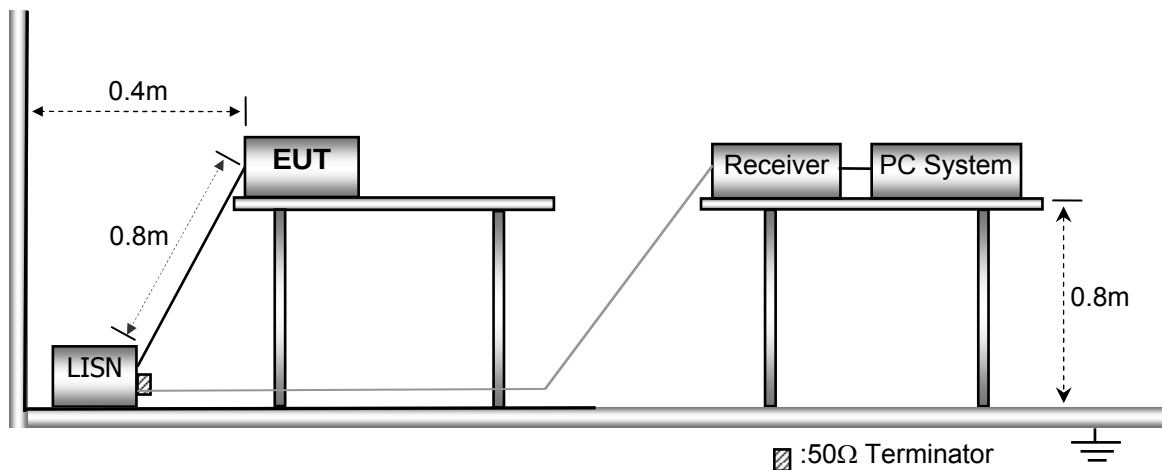
5.1 E.U.T. Operation

Operating Environment :

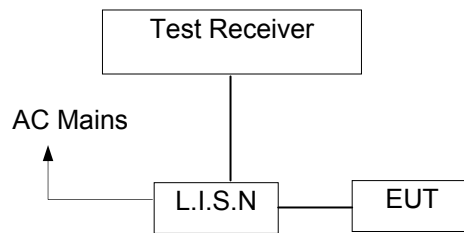
Temperature: : 25.5 °C
 Humidity: : 51 % RH
 Atmospheric Pressure: : 101.2kPa
 EUT Operation : : Refer to section 3.3

5.2 EUT Setup

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



5.3 Test SET-UP (Block Diagram of Configuration)



5.4 Measurement Procedure:

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured was complete.

5.5 Conducted Emission Limit

Conducted Emission

Frequency(MHz)	Quasi-peak	Average
0.15-0.5	66-56	56-46
0.5-5.0	56	46
5.0-30.0	60	50

Note:

1. The lower limit shall apply at the transition frequencies
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

5.6 Measurement Description

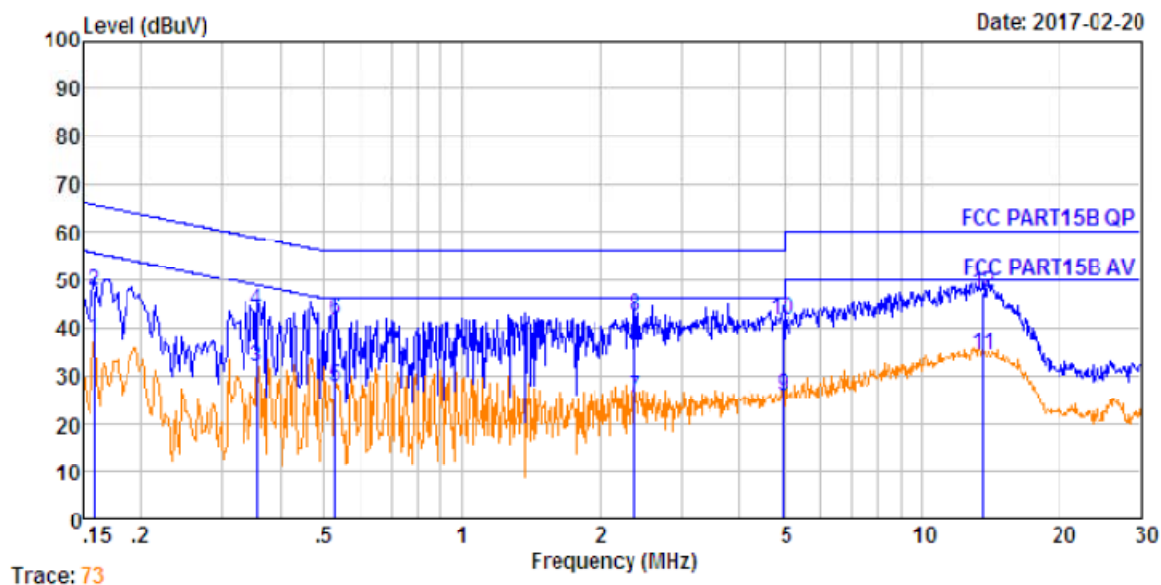
The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

5.7 Conducted Emission Test Result

Pass

Please find the following pages.

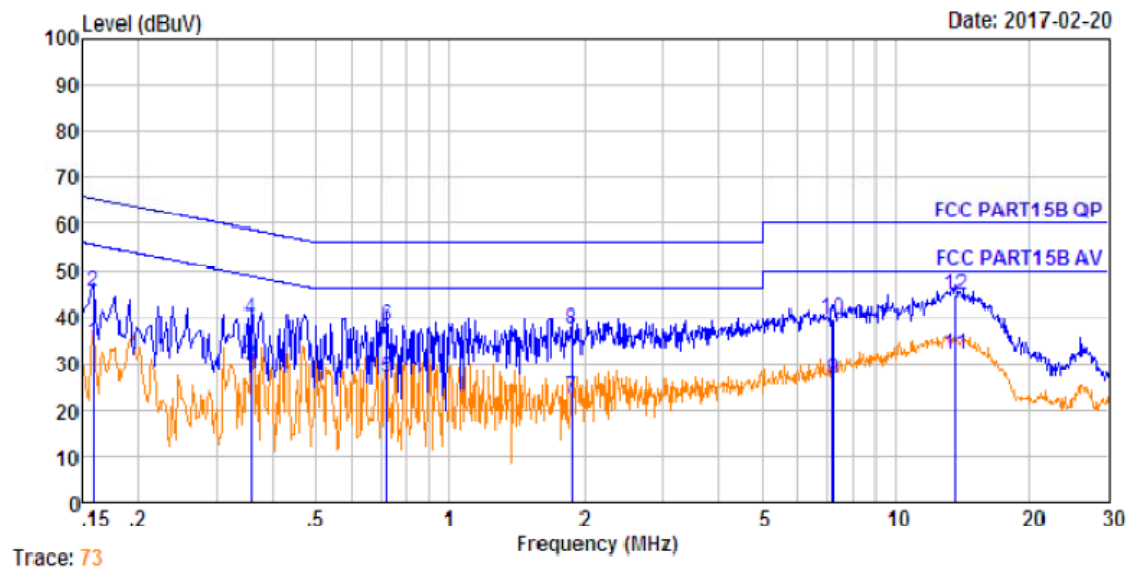
Line-120V:



No.	Freq MHz	Cable Loss dB	AMN Factor dB	Receiver Reading dBuV	Emission Level dBuV	Limit dBuV	Over Limit dB	Remark
1.	0.158	10.60	0.60	26.27	37.47	55.56	-18.09	Average
2.	0.158	10.60	0.60	36.27	47.47	65.56	-18.09	QP
3.	0.358	10.63	0.60	20.44	31.67	48.78	-17.11	Average
4.	0.358	10.63	0.60	32.44	43.67	58.78	-15.11	QP
5.	0.529	10.65	0.60	16.52	27.77	46.00	-18.23	Average
6.	0.529	10.65	0.60	30.52	41.77	56.00	-14.23	QP
7.	2.371	10.70	0.60	14.08	25.38	46.00	-20.62	Average
8.	2.371	10.70	0.60	31.08	42.38	56.00	-13.62	QP
9.	4.978	10.73	0.60	14.36	25.69	46.00	-20.31	Average
10.	4.978	10.73	0.60	30.36	41.69	56.00	-14.31	QP
11.	13.623	10.77	0.60	22.99	34.36	50.00	-15.64	Average
12.	13.623	10.77	0.60	35.99	47.36	60.00	-12.64	QP



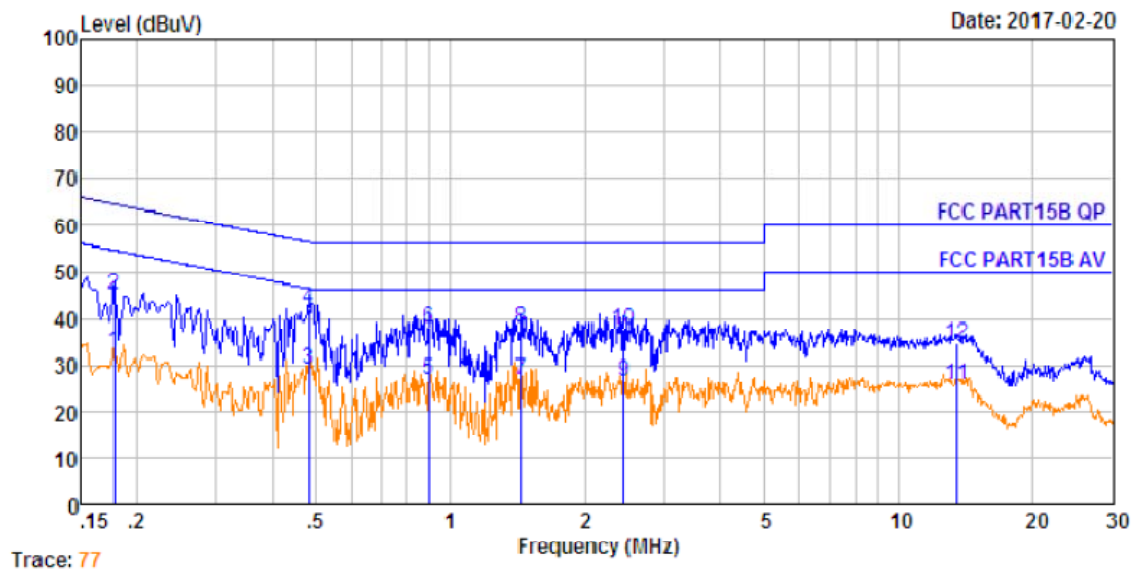
Neutral-120V:



No.	Freq MHz	Cable Loss dB	AMN Factor dB	Receiver Reading dBuV	Emission Level dBuV	Limit dBuV	Over Limit dB	Remark
1.	0.158	10.60	0.60	23.20	34.40	55.56	-21.16	Average
2.	0.158	10.60	0.60	34.20	45.40	65.56	-20.16	QP
3.	0.358	10.63	0.60	18.39	29.62	48.78	-19.16	Average
4.	0.358	10.63	0.60	28.39	39.62	58.78	-19.16	QP
5.	0.720	10.66	0.60	15.81	27.07	46.00	-18.93	Average
6.	0.720	10.66	0.60	26.81	38.07	56.00	-17.93	QP
7.	1.878	10.70	0.60	11.05	22.35	46.00	-23.65	Average
8.	1.878	10.70	0.60	26.05	37.35	56.00	-18.65	QP
9.	7.213	10.75	0.60	15.25	26.60	50.00	-23.40	Average
10.	7.213	10.75	0.60	28.25	39.60	60.00	-20.40	QP
11.	13.623	10.77	0.60	20.36	31.73	50.00	-18.27	Average
12.	13.623	10.77	0.60	33.36	44.73	60.00	-15.27	QP



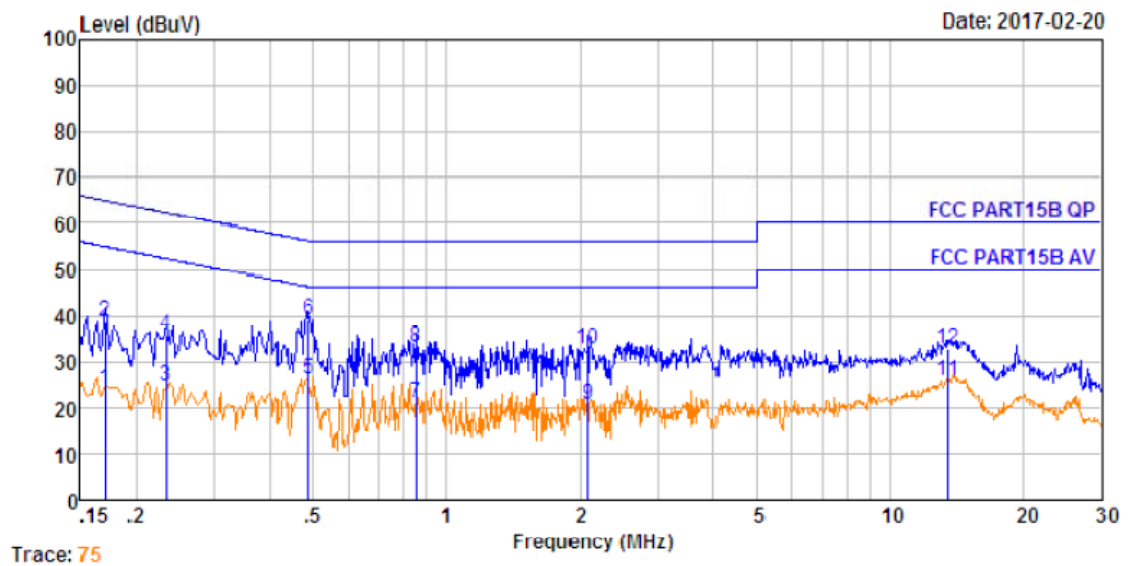
Line-240V:



No.	Freq MHz	Cable Loss dB	AMN Factor dB	Receiver Reading dBuV	Emission Level dBuV	Limit dBuV	Over Limit dB	Remark
1.	0.178	10.61	0.60	21.77	32.98	54.59	-21.61	Average
2.	0.178	10.61	0.60	33.77	44.98	64.59	-19.61	QP
3.	0.481	10.64	0.60	17.95	29.19	46.32	-17.13	Average
4.	0.481	10.64	0.60	30.95	42.19	56.32	-14.13	QP
5.	0.894	10.67	0.60	15.84	27.11	46.00	-18.89	Average
6.	0.894	10.67	0.60	26.84	38.11	56.00	-17.89	QP
7.	1.433	10.68	0.60	15.57	26.85	46.00	-19.15	Average
8.	1.433	10.68	0.60	26.57	37.85	56.00	-18.15	QP
9.	2.435	10.70	0.60	15.25	26.55	46.00	-19.45	Average
10.	2.435	10.70	0.60	26.25	37.55	56.00	-18.45	QP
11.	13.479	10.77	0.60	14.31	25.68	50.00	-24.32	Average
12.	13.479	10.77	0.60	23.31	34.68	60.00	-25.32	QP



Neutral-240V:



No.	Freq MHz	Cable Loss dB	AMN Factor dB	Receiver Reading dBuV	Emission Level dBuV	Limit dBuV	Over Limit dB	Remark
1.	0.170	10.60	0.60	12.60	23.00	54.94	-31.14	Average
2.	0.170	10.60	0.60	27.60	38.80	64.94	-26.14	QP
3.	0.234	10.62	0.60	13.68	24.90	52.30	-27.40	Average
4.	0.234	10.62	0.60	24.68	35.90	62.30	-26.40	QP
5.	0.483	10.64	0.60	14.90	26.14	46.19	-20.05	Average
6.	0.483	10.64	0.60	27.90	39.14	56.19	-17.05	QP
7.	0.857	10.67	0.60	9.88	21.15	46.00	-24.35	Average
8.	0.857	10.67	0.60	21.88	33.15	56.00	-22.85	QP
9.	2.077	10.70	0.60	9.44	20.74	46.00	-25.26	Average
10.	2.077	10.70	0.60	21.44	32.74	56.00	-23.26	QP
11.	13.551	10.77	0.60	14.39	25.76	50.00	-24.24	Average
12.	13.551	10.77	0.60	21.39	32.76	60.00	-27.24	QP

6 Radiated Spurious Emissions

Test Requirement: : FCC CFR47 Part 15 Section 15.209 & 15.247
 Test Method: : ANSI C63.10:2013
 Test Result: : PASS
 Measurement Distance: : 3m
 Limit: : See the follow table

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

6.1 EUT Operation

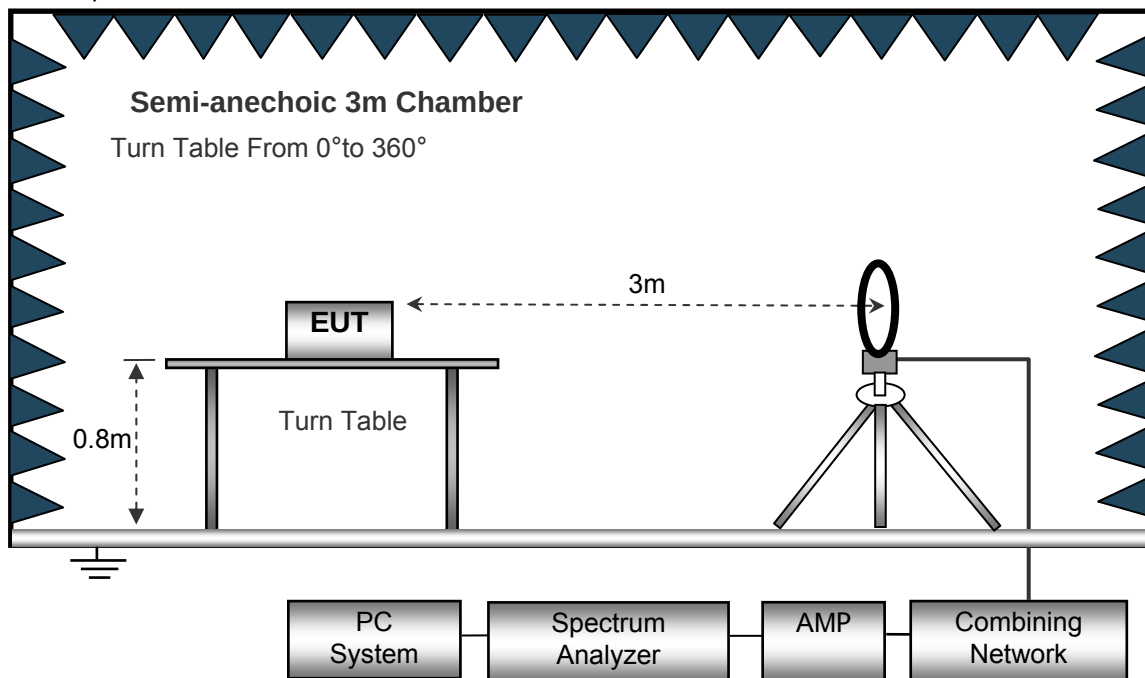
Operating Environment :

Temperature: : 23.5 °C
 Humidity: : 51.1 % RH
 Atmospheric Pressure: : 101.2kPa
 EUT Operation : : Refer to section 3.3

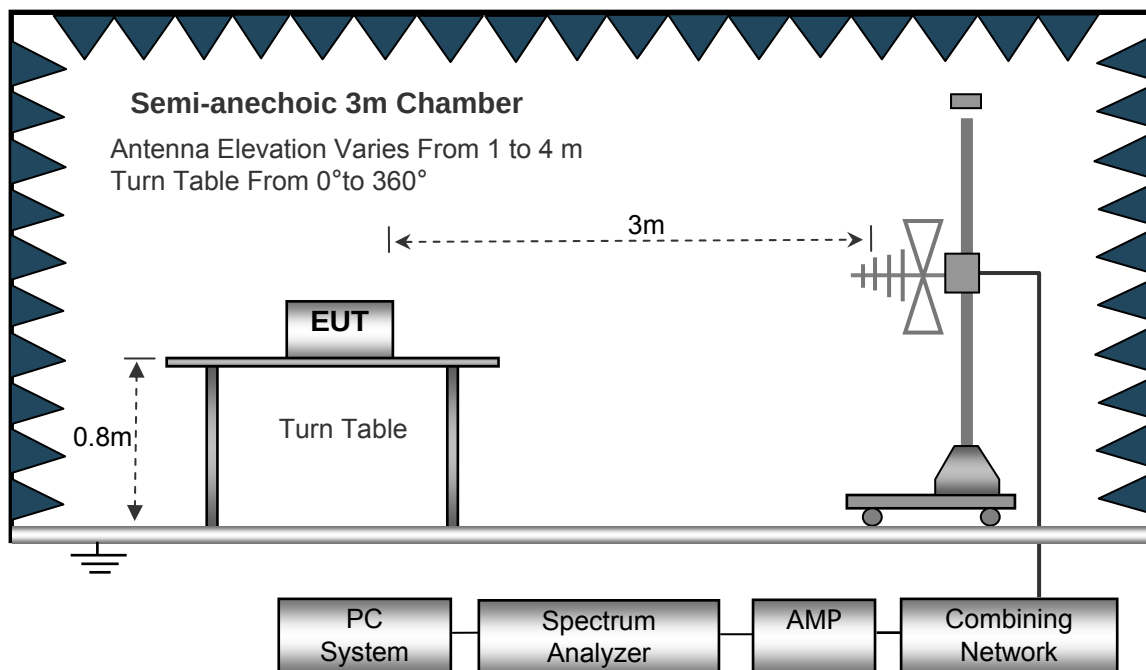
6.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site

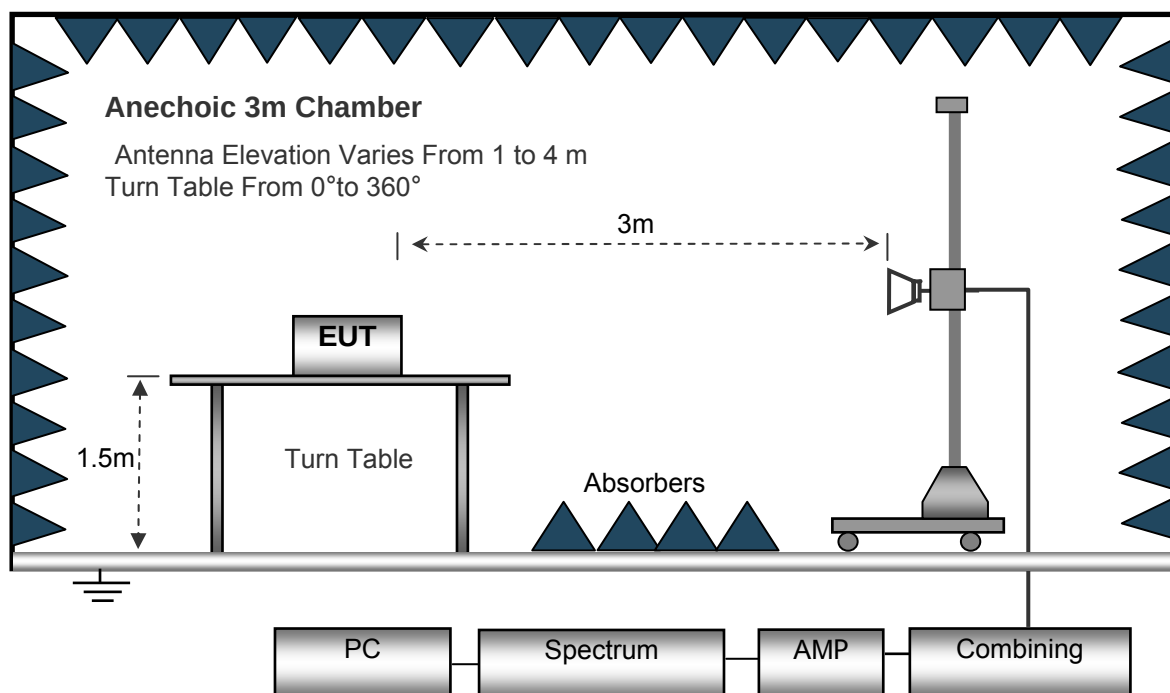
The test setup for emission measurement below 30MHz.



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



The test setup for emission measurement above 1 GHz.



6.3 Spectrum Analyzer Setup

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (emission in restricted band)	1 MHz / 1 MHz for Peak, 1 MHz / 10Hz for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

6.4 Test Procedure

1. The EUT is placed on a turntable, which is 0.8m 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. The spectrum was investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower. In the frequency above 1GHz, Place the measurement antenna 3m away from the EUT for each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
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 tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.



6.5 Summary of Test Results

Test Frequency: Below 30MHz

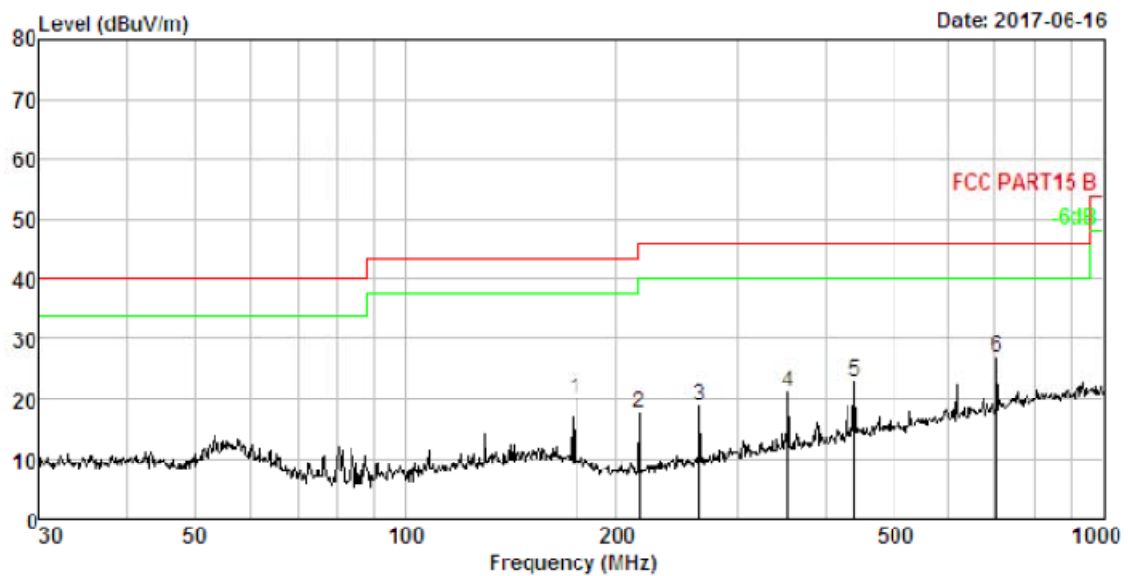
The measurements were more than 20 dB below the limit and not reported.

Test Frequency: 30MHz ~ 1GHz

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



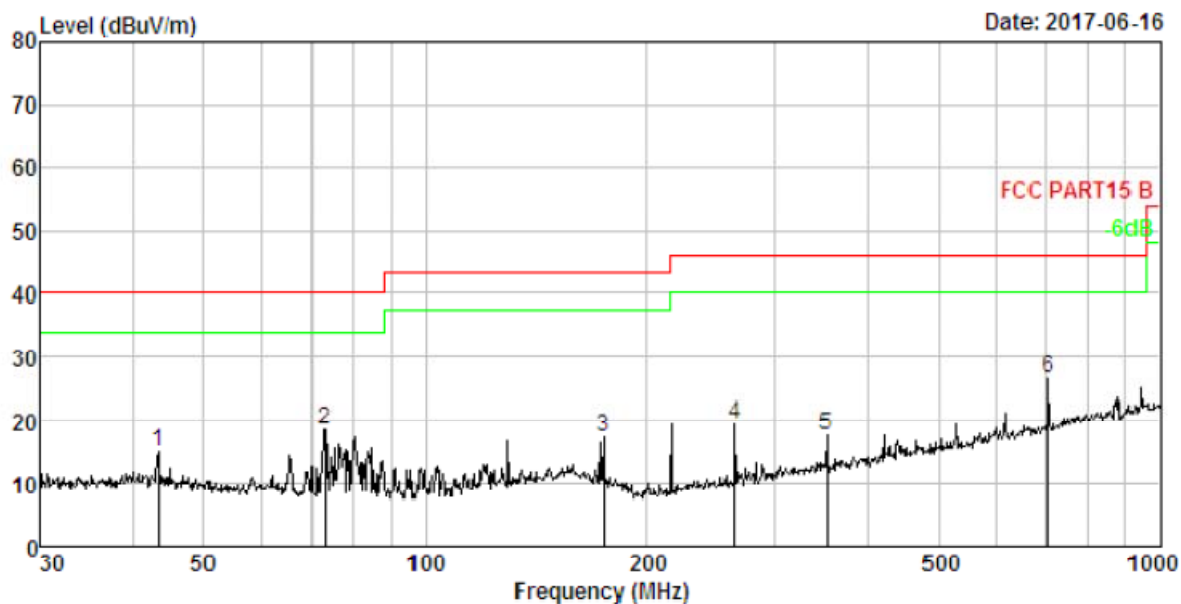
Test plot for Horizontal:



Remark: Absolute Level= Reading Level+ Factor, Margin= Limit- Absolute Level

No.	Freq MHz	Cable Loss dB	ANT Factor dB/m	Receiver Reading dBuV	Preamp Factor dB	Emission Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark
1.	175.652	2.66	12.62	35.11	30.58	20.01	43.50	-23.49	QP
2.	216.783	2.85	10.70	34.69	30.66	17.58	46.00	-28.42	QP
3.	263.819	3.02	12.26	34.29	30.73	18.84	46.00	-27.16	QP
4.	352.943	3.29	14.29	34.38	30.83	21.13	46.00	-24.87	QP
5.	440.196	3.49	16.21	34.22	30.90	23.02	46.00	-22.98	QP
6.	704.226	3.91	20.22	33.71	31.07	26.77	46.00	-19.23	QP

Test plot for Vertical:



Remark:

Absolute Level= Reading Level+ Factor, Margin= Limit- Absolute Level

No.	Freq MHz	Cable Loss dB	ANT Factor dB/m	Receiver Reading dBUV	Preamp Factor dB	Emission Level dBUV/m	Limit dBUV/m	Over Limit dB	Remark
1.	43.353	1.39	13.40	30.32	30.10	15.01	40.00	-24.99	QP
2.	73.103	1.86	9.91	37.18	30.28	18.67	40.00	-21.33	QP
3.	175.652	2.66	12.82	32.37	30.58	17.27	43.50	-26.23	QP
4.	263.819	3.02	12.26	34.36	30.73	19.41	46.00	-26.59	QP
5.	351.708	3.28	14.27	30.35	30.83	17.67	46.00	-28.33	QP
6.	704.226	3.91	20.22	33.53	31.07	26.69	46.00	-19.31	QP

Test Frequency: Above 1000MHz~10th Harmonics:

Operation Mode: GFSK (CH00: 2402MHz) Test Date : 2017-06-16

Freq.	Ant. Pol.	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Margin(dB)	
(MHz)	H/V	PK	AV	PK	AV	PK	AV
4804	H	65.25	45.33	74	54	-8.75	-8.67
7206	H	64.13	44.25	74	54	-9.87	-9.75
9608	H	63.05	43.16	74	54	-10.95	-10.84
12010	H	62.27	42.85	74	54	-11.73	-11.15
14412	H	61.08	41.04	74	54	-12.92	-12.96
16814	H	60.33	40.36	74	54	-13.67	-13.64
4804	V	66.25	44.38	74	54	-7.75	-9.62
7206	V	65.47	43.48	74	54	-8.53	-10.52
9608	V	64.35	42.84	74	54	-9.65	-11.16
12010	V	63.25	41.66	74	54	-10.75	-12.34
14412	V	62.17	40.69	74	54	-11.83	-13.31
16814	V	61.37	39.57	74	54	-12.63	-14.43

Operation Mode: GFSK (CH39: 2441MHz) Test Date : 2017-06-16

Freq.	Ant. Pol.	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Margin(dB)	
(MHz)	H/V	PK	AV	PK	AV	PK	AV
4882	H	66.35	46.35	74	54	-7.65	-7.65
7323	H	65.78	45.17	74	54	-8.22	-8.83
9764	H	64.00	44.25	74	54	-10.00	-9.75
12205	H	63.21	43.69	74	54	-10.79	-10.31
14646	H	62.27	42.17	74	54	-11.73	-11.83
17087	H	61.74	41.05	74	54	-12.26	-12.95
4882	V	66.59	46.28	74	54	-7.41	-7.72
7323	V	65.14	45.08	74	54	-8.86	-8.92
9764	V	64.33	44.17	74	54	-9.67	-9.83
12205	V	63.24	43.69	74	54	-10.76	-10.31
14646	V	62.17	42.20	74	54	-11.83	-11.80
17087	V	61.45	41.33	74	54	-12.55	-12.67



Operation Mode: GFSK (CH78: 2480MHz) Test Date : 2017-06-16

Freq.	Ant. Pol.	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Margin(dB)	
(MHz)	H/V	PK	AV	PK	AV	PK	AV
4960	H	67.33	46.82	74	54	-6.67	-7.18
7440	H	66.10	45.33	74	54	-7.90	-8.67
9920	H	65.92	44.15	74	54	-8.08	-9.85
12400	H	64.23	43.62	74	54	-9.77	-10.38
14880	H	63.05	42.05	74	54	-10.95	-11.95
17360	H	62.17	41.27	74	54	-11.83	-12.73
4960	V	66.35	46.72	74	54	-7.65	-7.28
7440	V	65.25	45.15	74	54	-8.75	-8.85
9920	V	64.37	44.33	74	54	-9.63	-9.67
12400	V	63.56	43.15	74	54	-10.44	-10.85
14880	V	62.17	42.05	74	54	-11.83	-11.95
17360	V	60.48	41.95	74	54	-13.52	-12.05

Note:

- 1) Scan with GFSK, $\pi/4$ -DQPSK, 8DPSK, the worst case is GFSK Mode
- 2) Factor = Antenna Factor + Cable Loss – Pre-amplifier.
Emission Level = Reading + Factor

7 CONDUCTED SPURIOUS & BAND EDGE EMISSION

7.1 REQUIREMENT

According to FCC section 15.247(d), in any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

7.2 TEST PROCEDURE

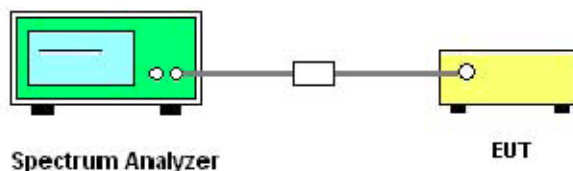
Spectrum Parameter	Setting
Detector	Peak
Start/Stop Frequency	30 MHz to 10th carrier harmonic
RB / VB (emission in restricted band)	100 KHz/300 KHz
Trace-Mode:	Max hold

For Band edge

Spectrum Parameter	Setting
Detector	Peak
Start/Stop Frequency	Lower Band Edge: 2300 – 2403 MHz Upper Band Edge: 2479 – 2500 MHz
RB / VB (emission in restricted band)	100 KHz/300 KHz
Trace-Mode:	Max hold

Remark : Hopping on and Hopping off mode all have been tested, only worst case hopping off is reported.

7.3 TEST SETUP



The EUT is coupled to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading. Make the measurement with the spectrum analyzer's resolution bandwidth(RBW) = 100 kHz. In order to make an accurate measurement, set the span greater than RBW.

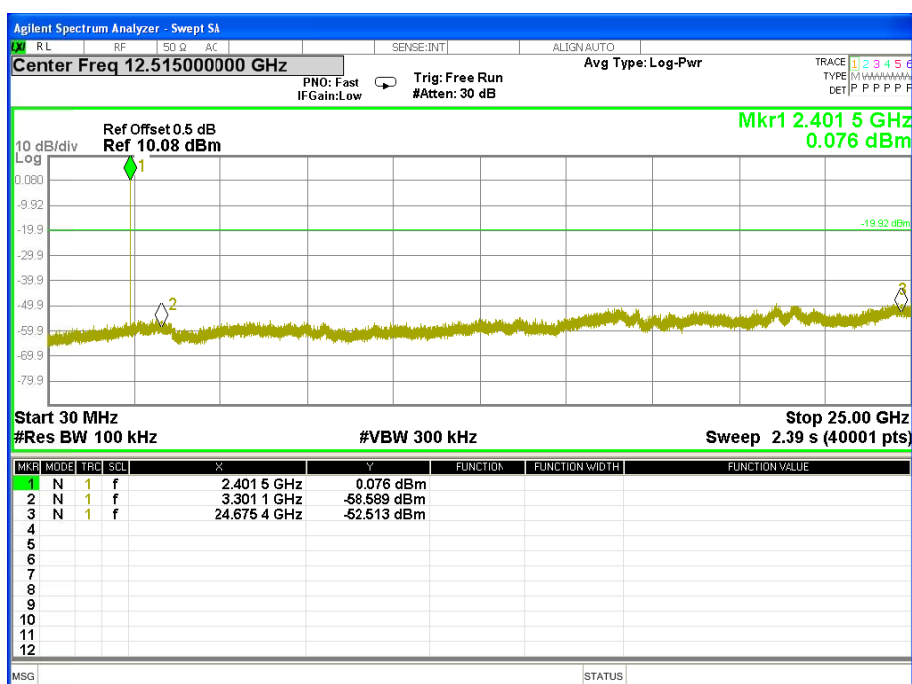
7.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.

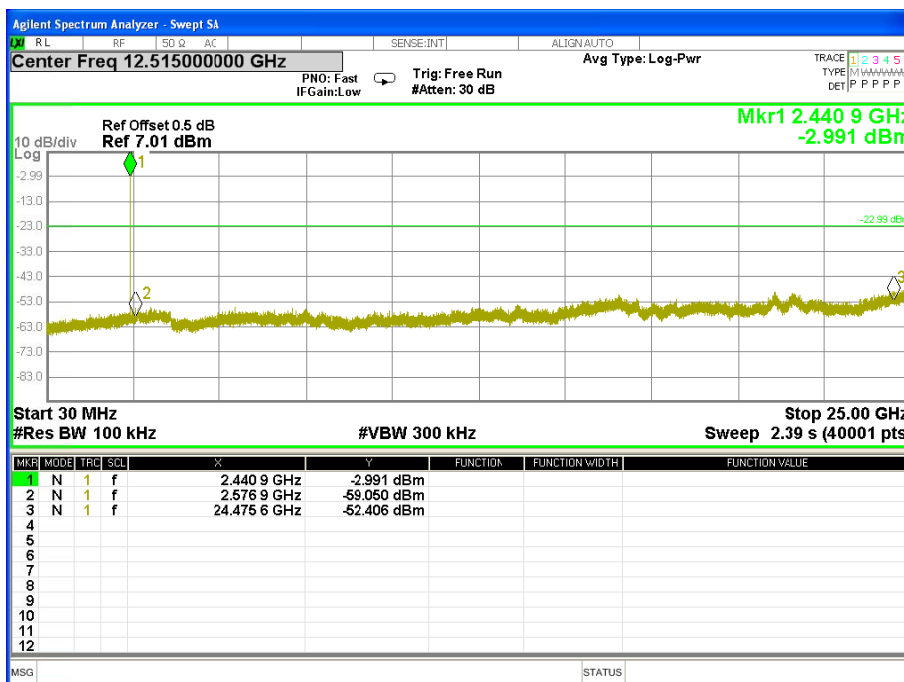
7.5 TEST RESULTS

Temperature:	25°C	Relative Humidity:	50%
Pressure:	1012 hPa	Test Voltage:	DC 5V
Test Mode:	GFSK(1Mbps)-00/39/78 CH		

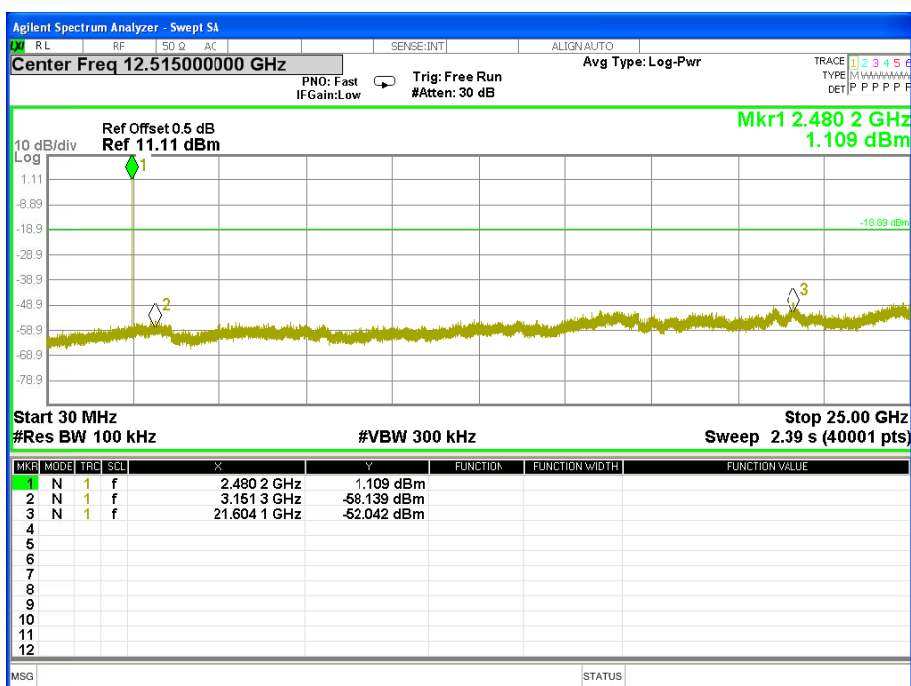
00 CH



39 CH

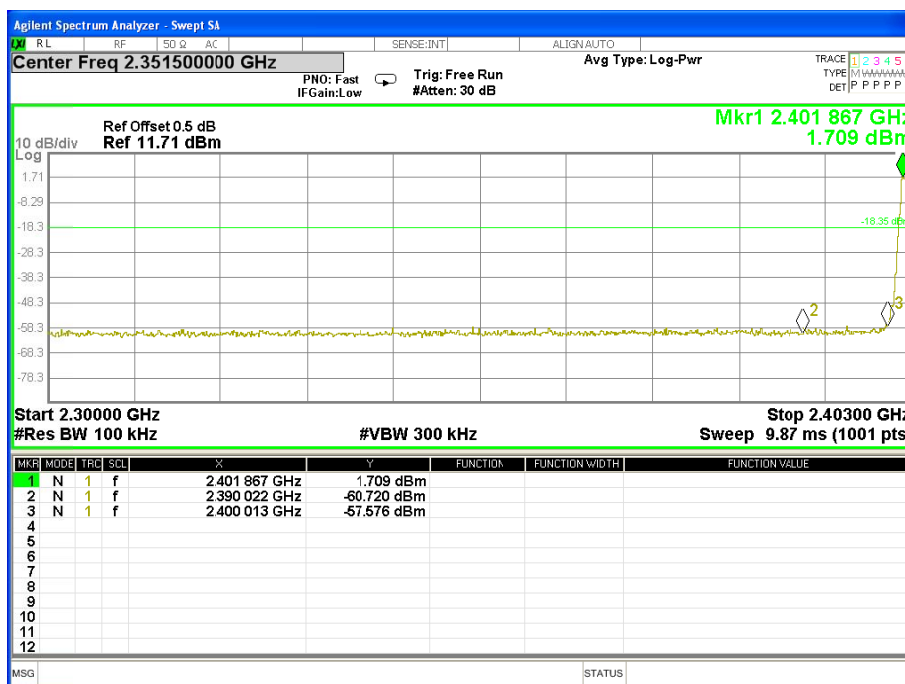


78 CH

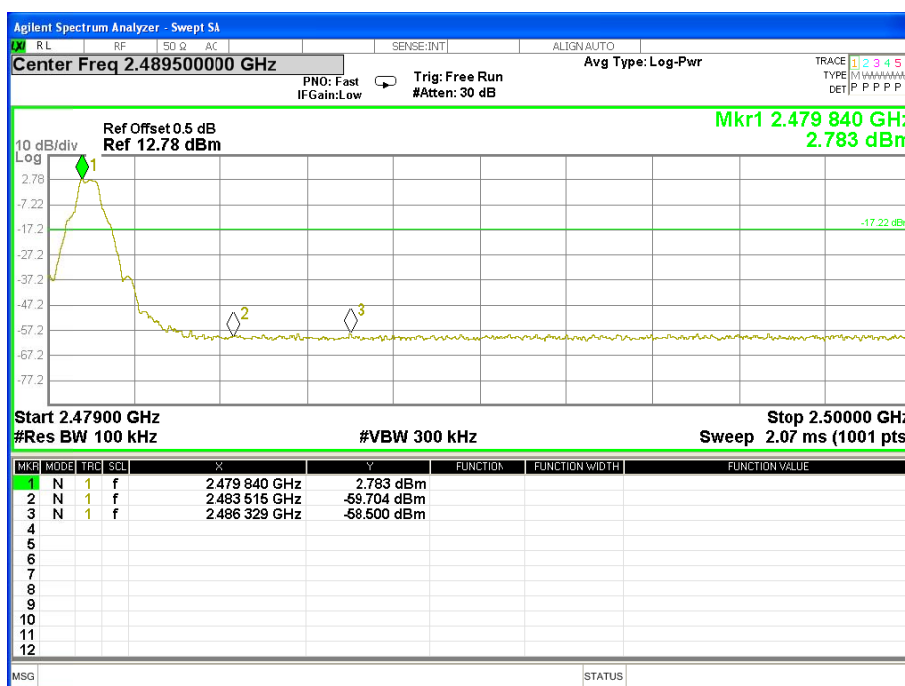


For Band edge

00 CH

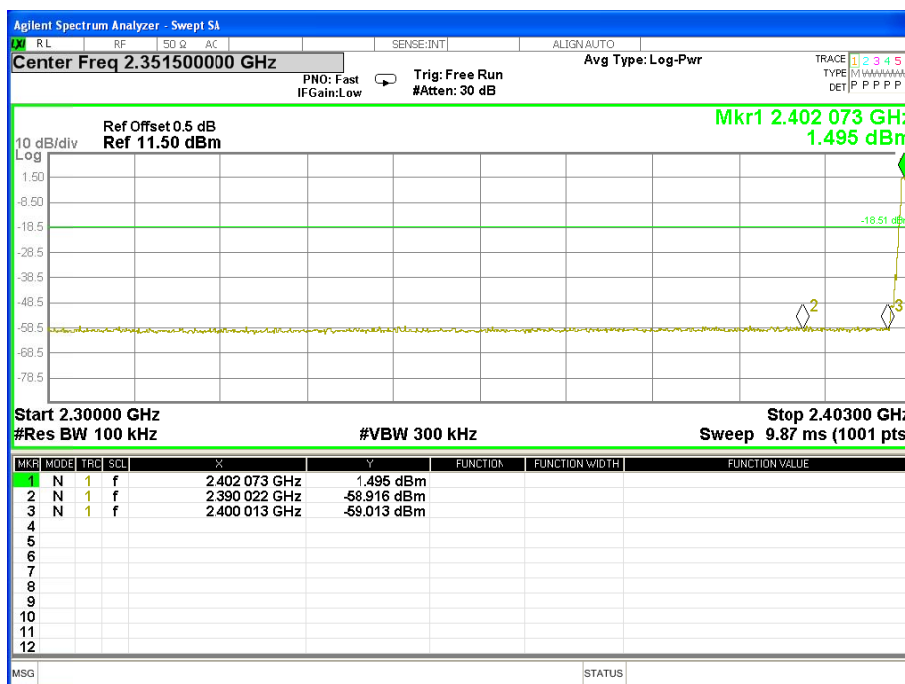


78 CH

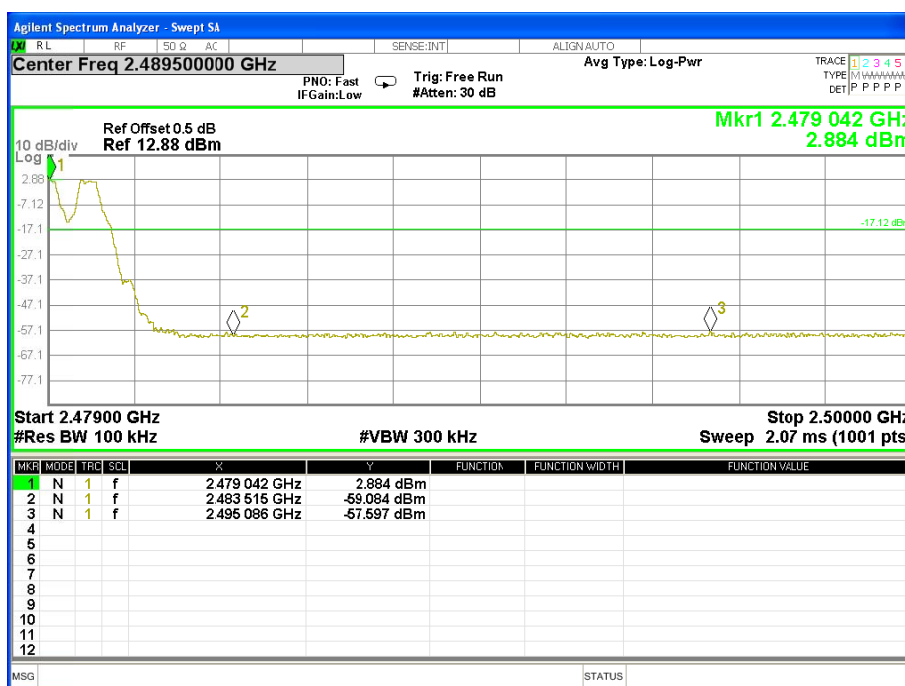


For Hopping Band edge

00 CH

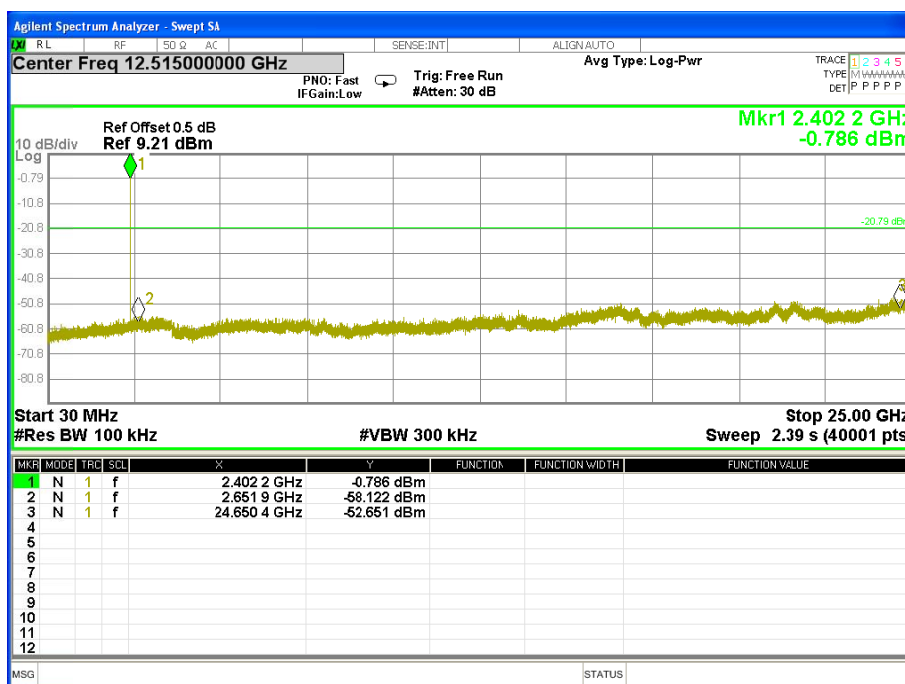


78 CH

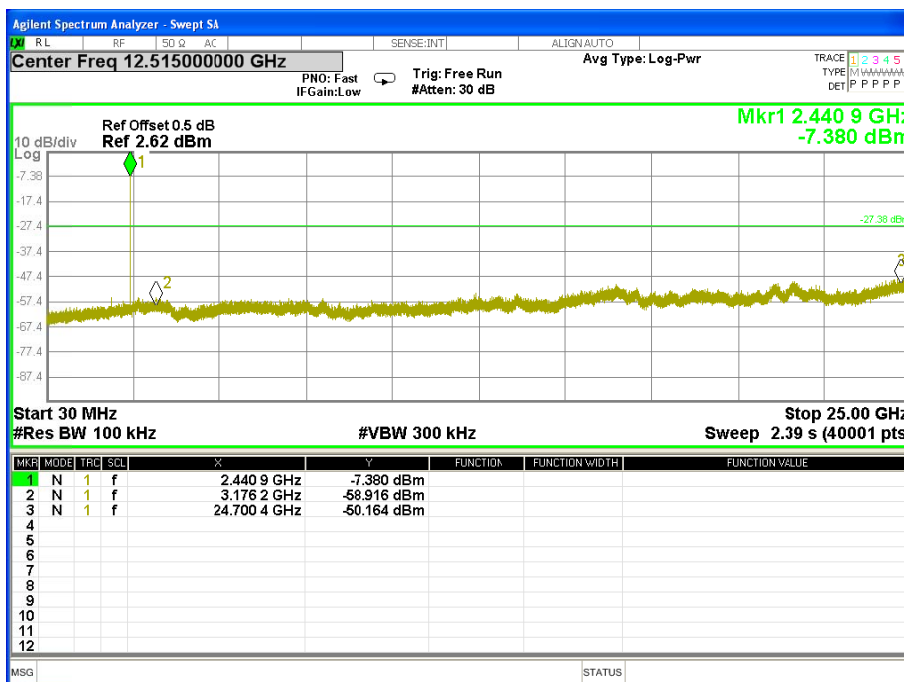


Temperature:	25°C	Relative Humidity:	50%
Pressure:	1012 hPa	Test Voltage:	DC 5V
Test Mode:	$\pi/4$ -DQPSK(2Mbps) -00/39/78 CH		

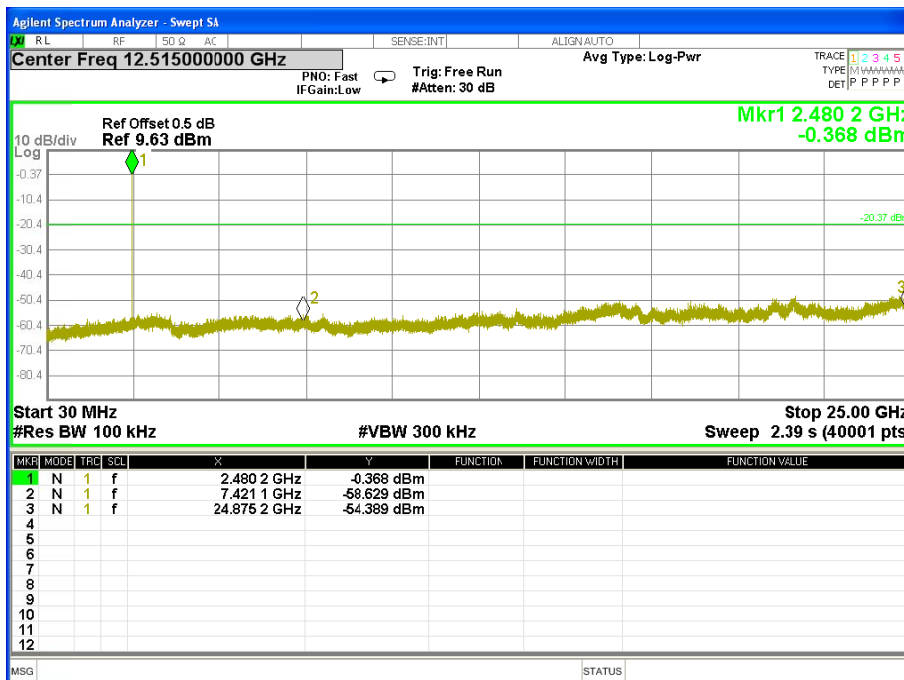
00 CH



39 CH

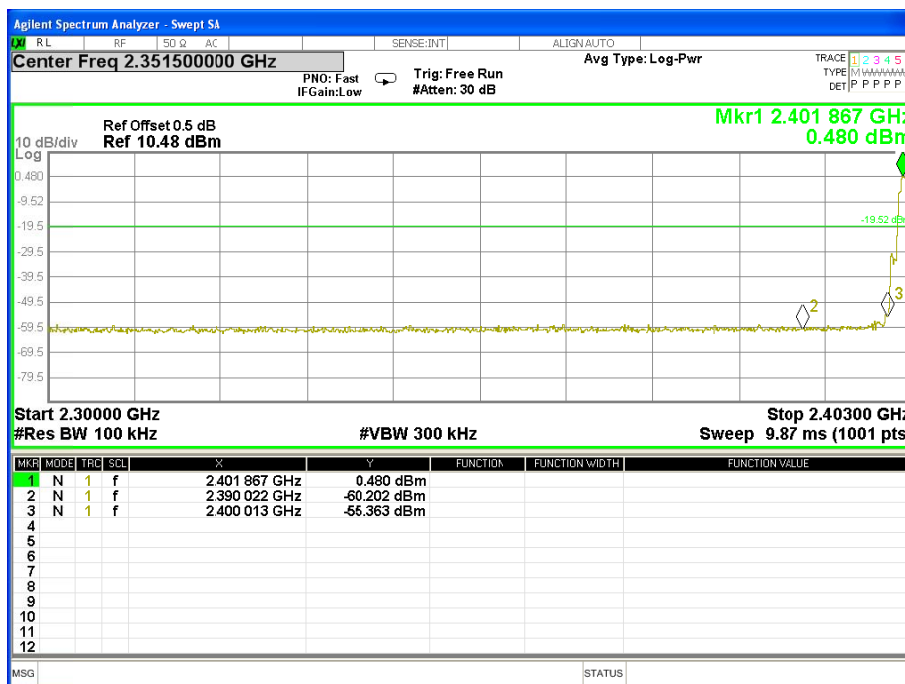


78 CH

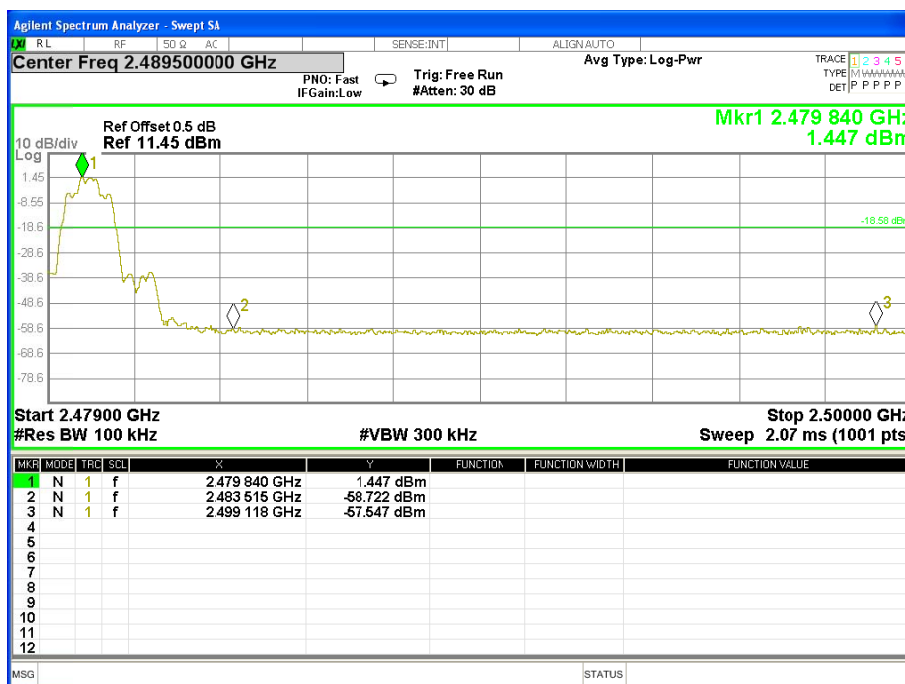


For Band edge

00 CH

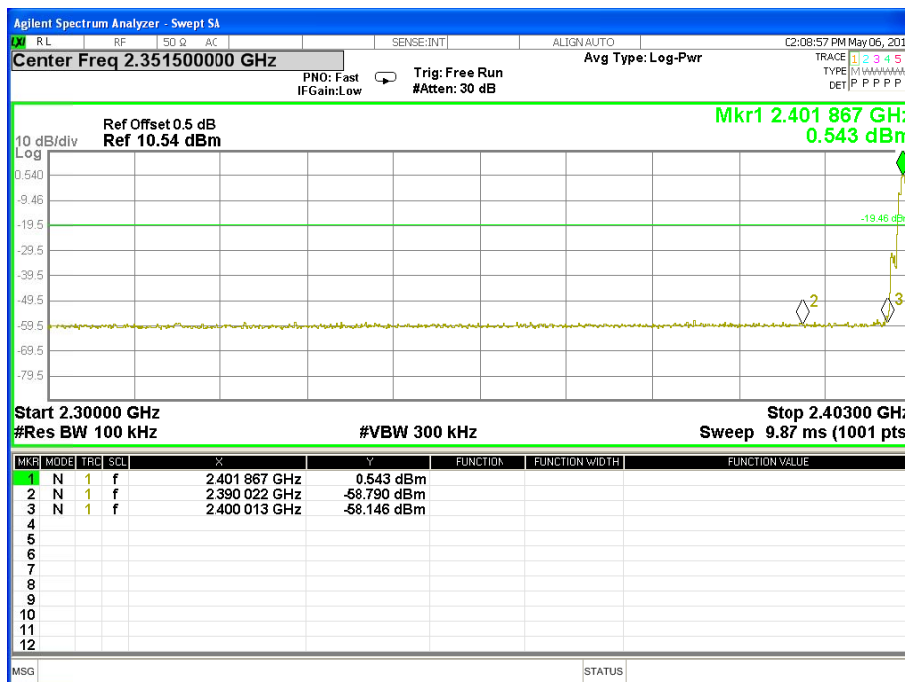


78 CH

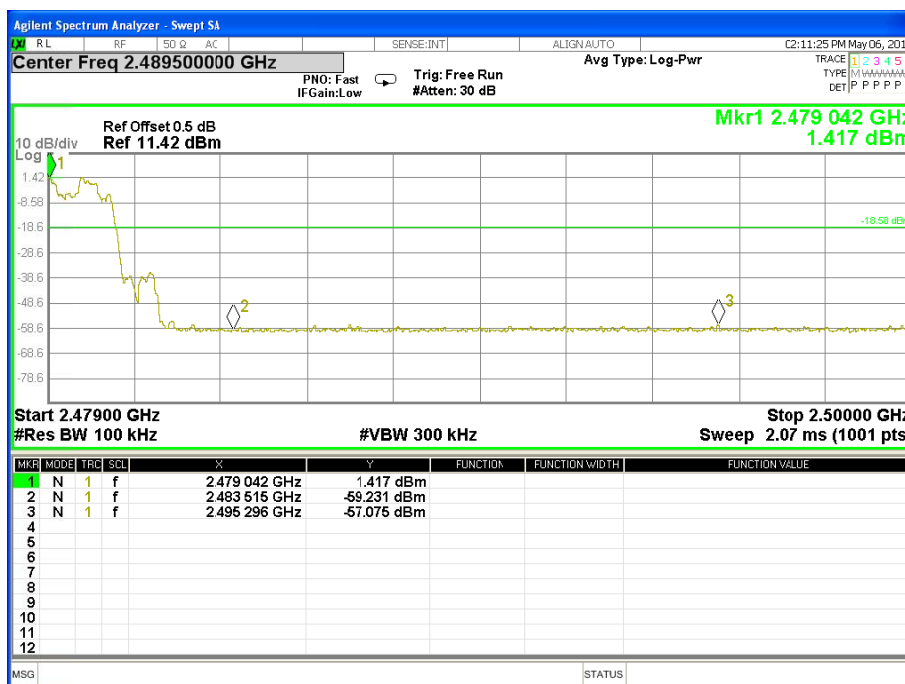


For Hopping Band edge

00 CH



78 CH



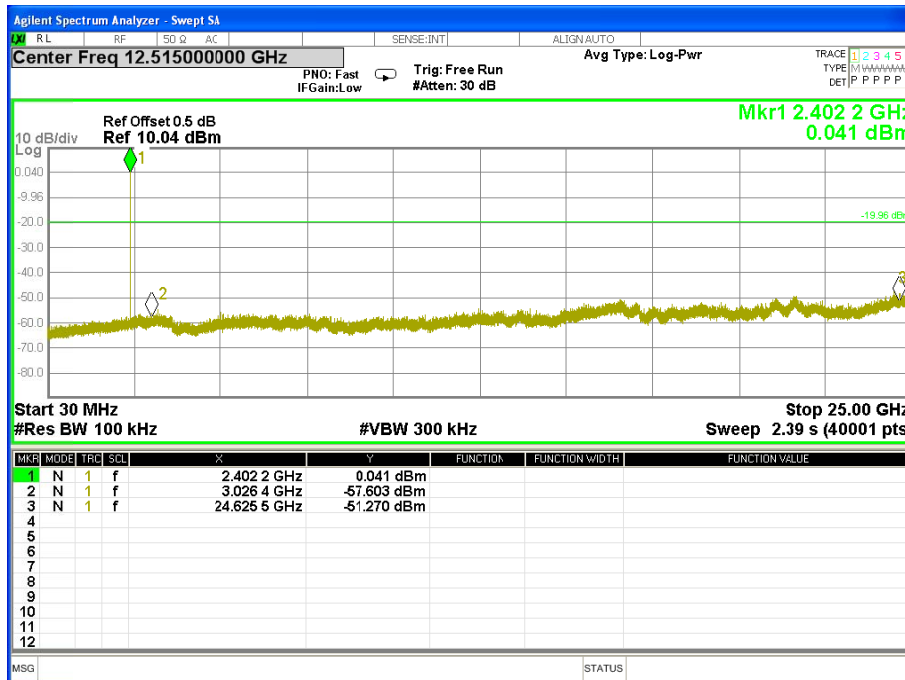


PRECISE TESTING

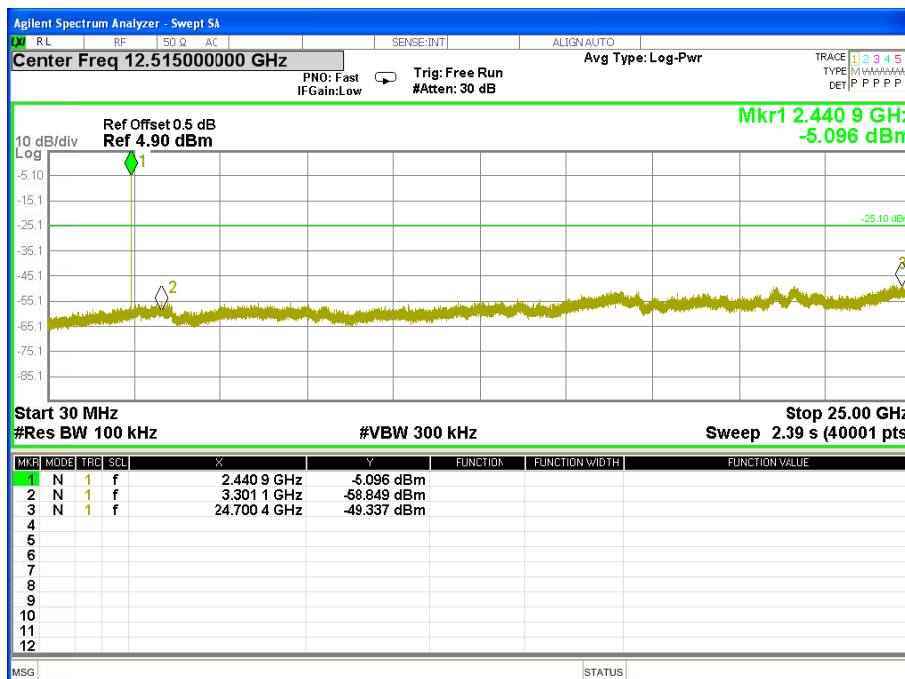
Report No.: PTC-DQ-03170453301-FC01

Temperature:	25°C	Relative Humidity:	50%
Pressure:	1012 hPa	Test Voltage:	DC 5V
Test Mode:	8DPSK(3Mbps) -00/39/78 CH		

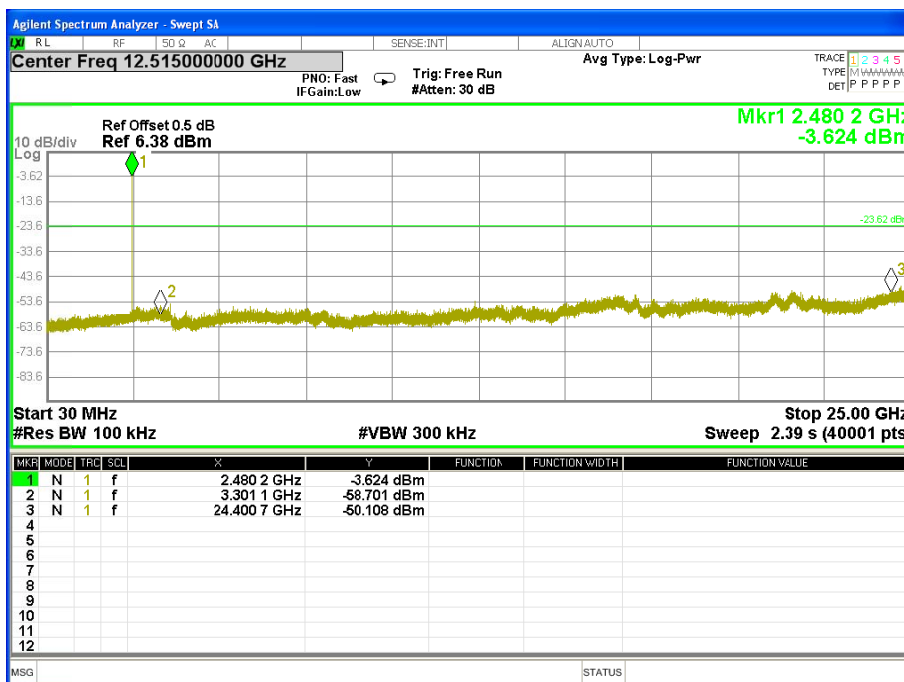
00 CH



39 CH

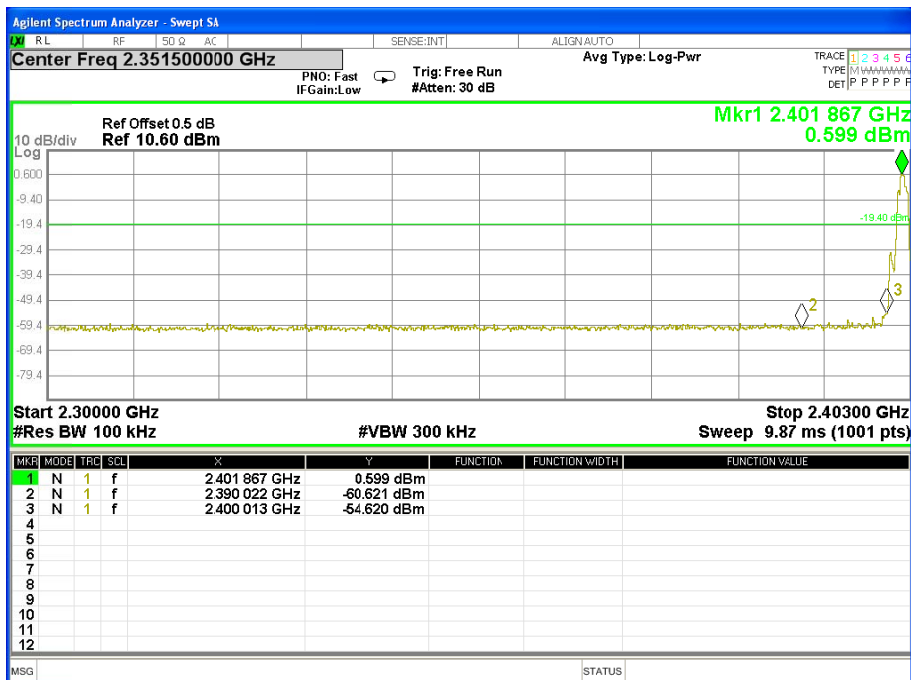


78 CH

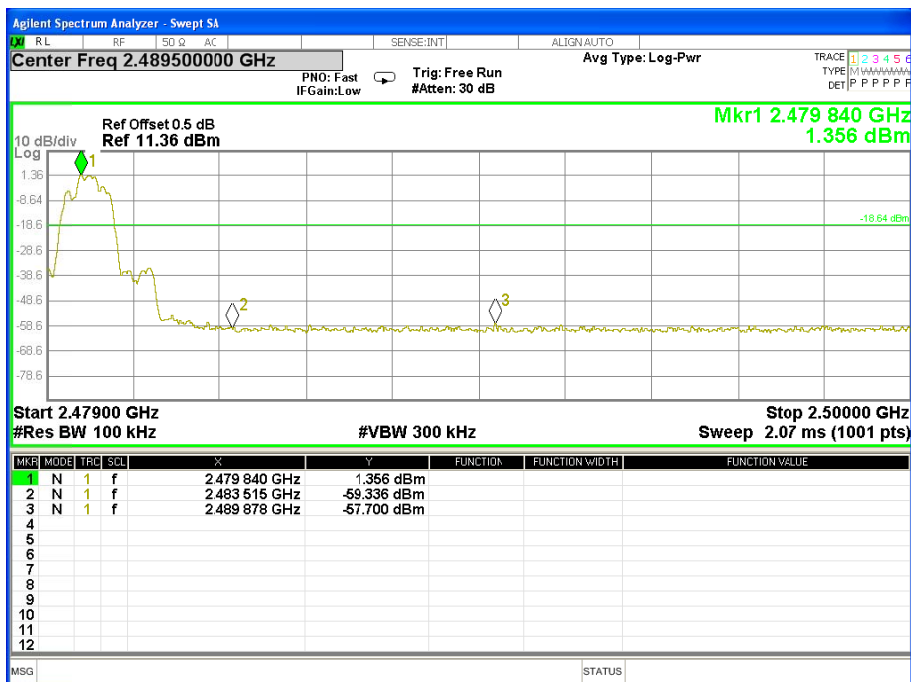


For Band edge

00 CH

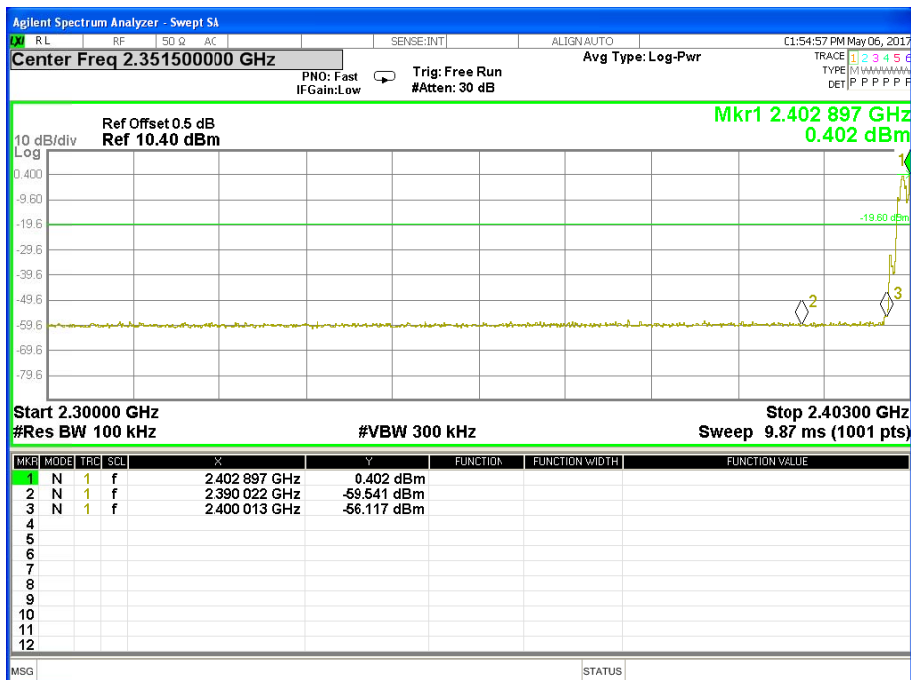


78 CH

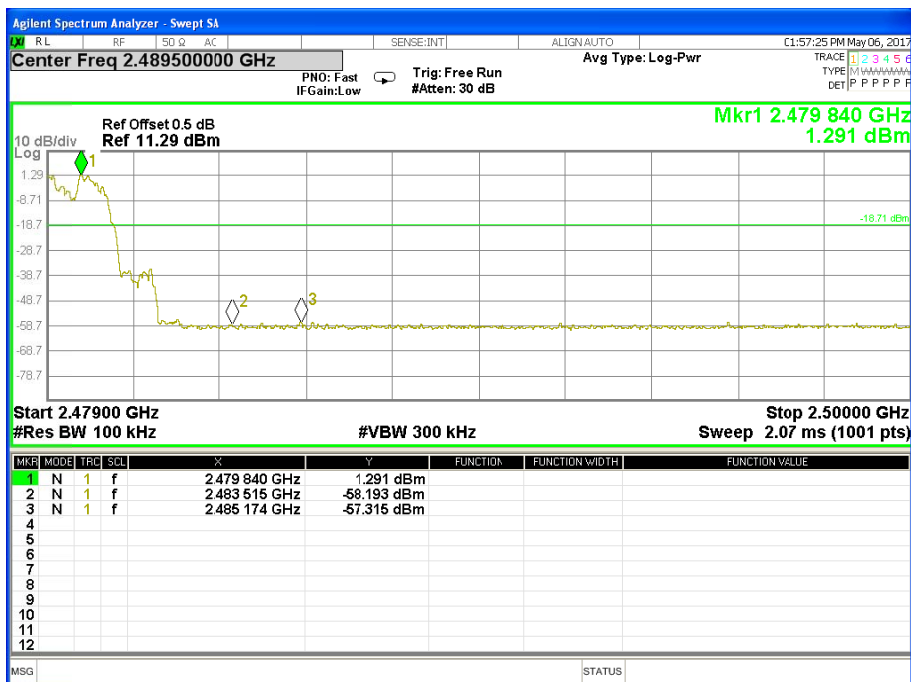


For Hopping Band edge

00 CH



78 CH





8 20 dB Bandwidth Measurement

Test Requirement : FCC CFR47 Part 15 Section 15.247
Test Method : ANSI C63.10:2013, DA 00-705
Test Mode : Refer to section 3.3

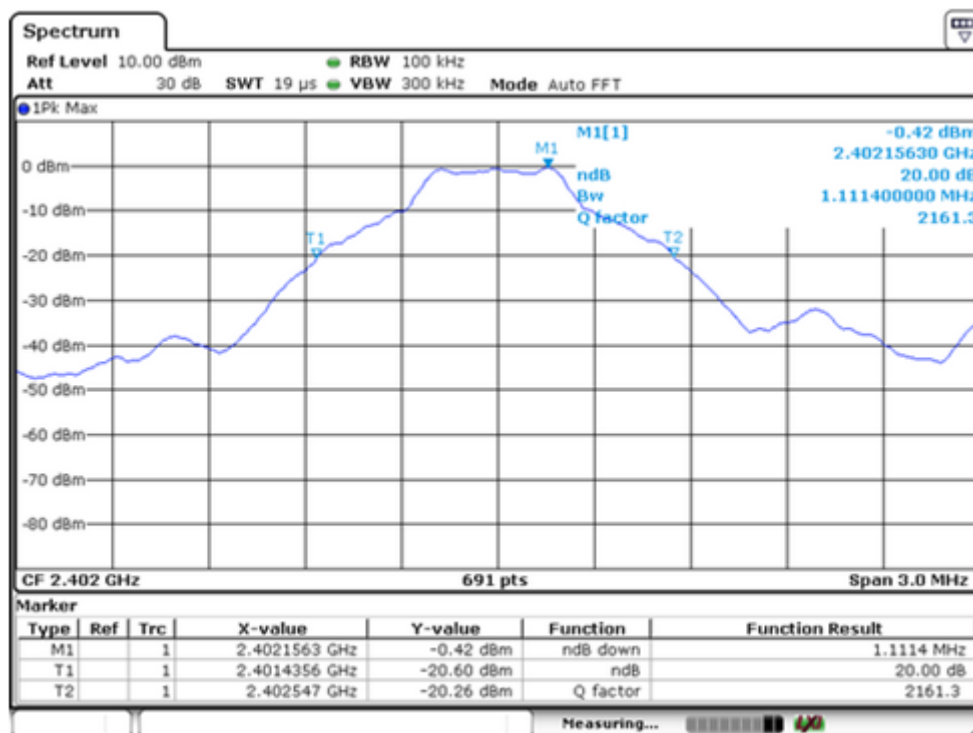
8.1 Test Procedure

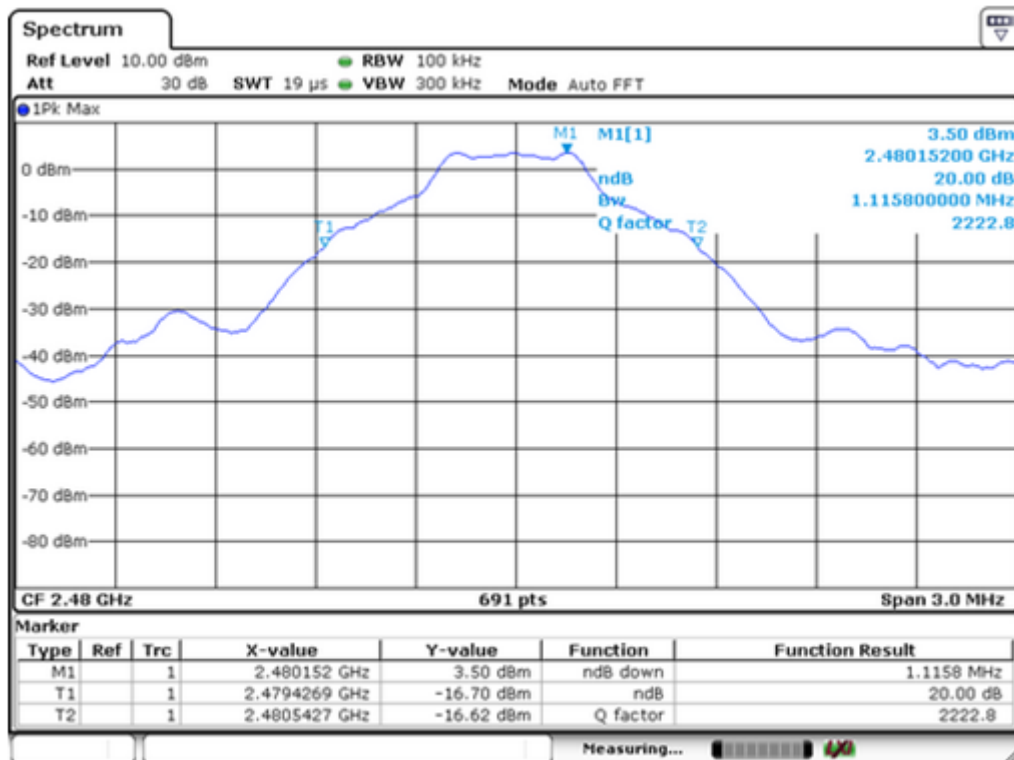
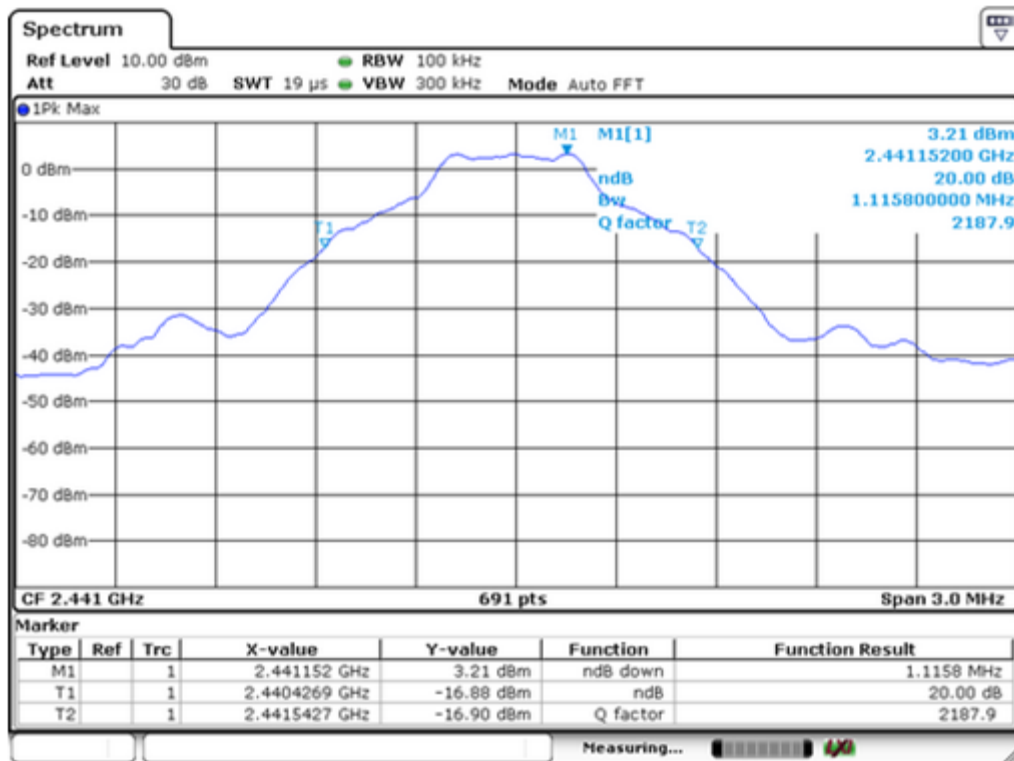
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 30kHz, VBW = 100kHz

8.2 Test Result

Test Mode: CH00 / CH39 / CH78 (GFSK/(1Mbps)Mode)

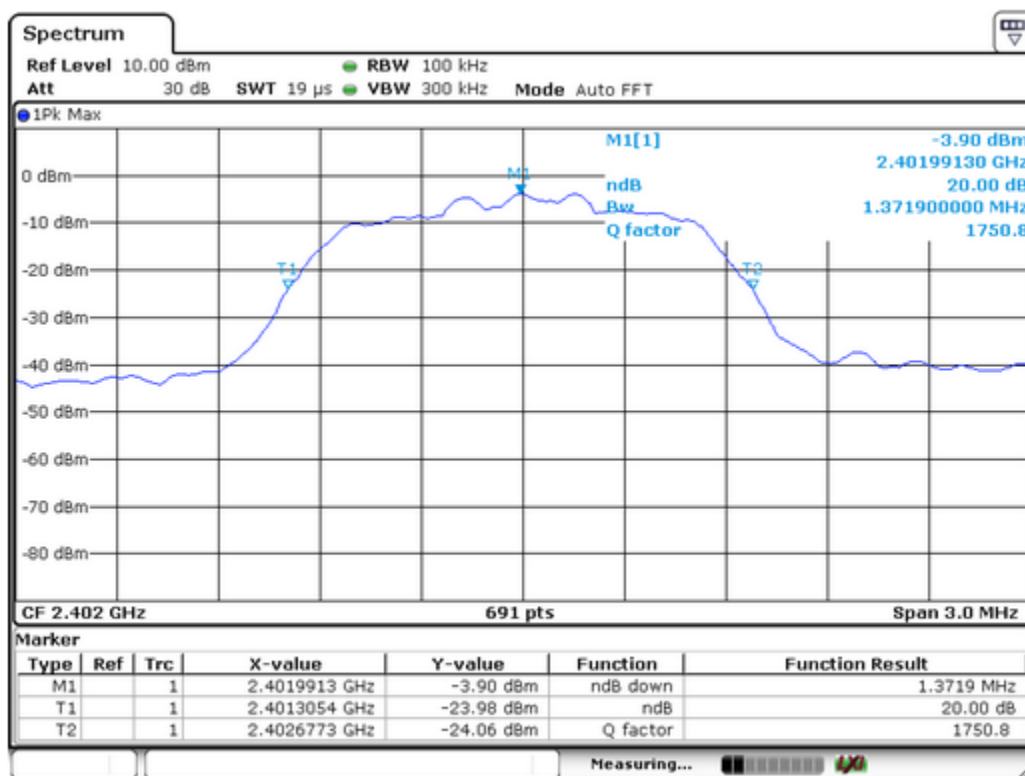
Channel number	Channel frequency (MHz)	20dB Down BW(kHz)
00	2402	1111
39	2441	1116
78	2480	1116

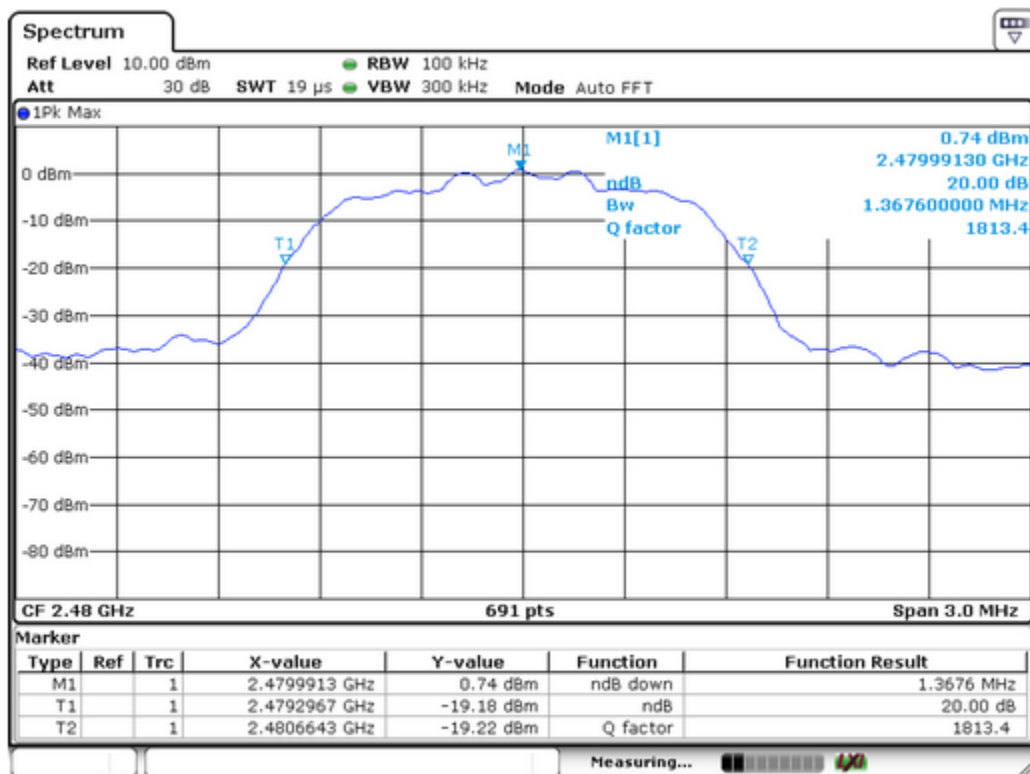
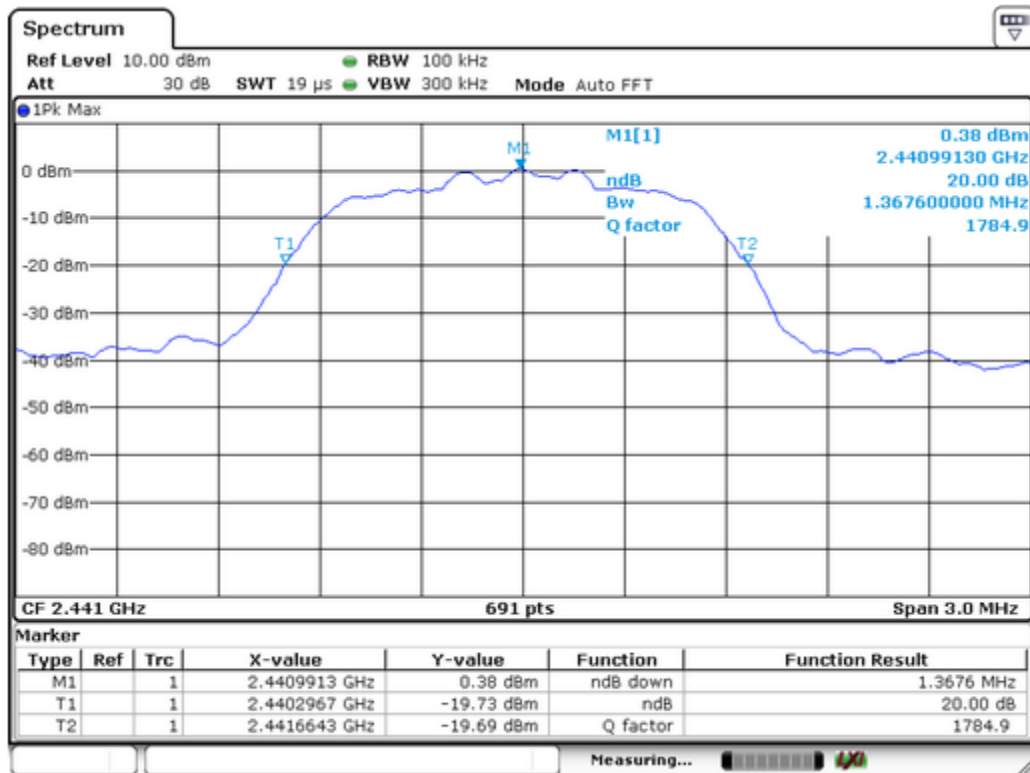




Test Mode: CH00 / CH39 / CH78 ($\pi/4$ -DQPSK / (2Mbps)Mode)

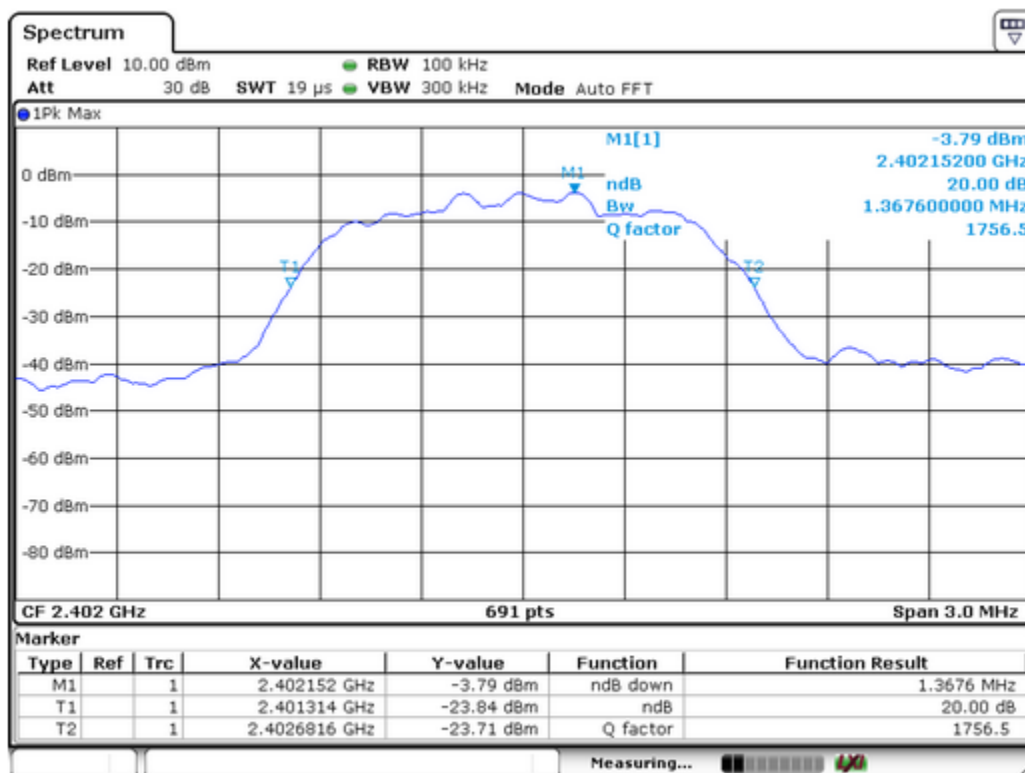
Channel number	Channel frequency (MHz)	20dB Down BW(kHz)
00	2402	1372
39	2441	1368
78	2480	1368

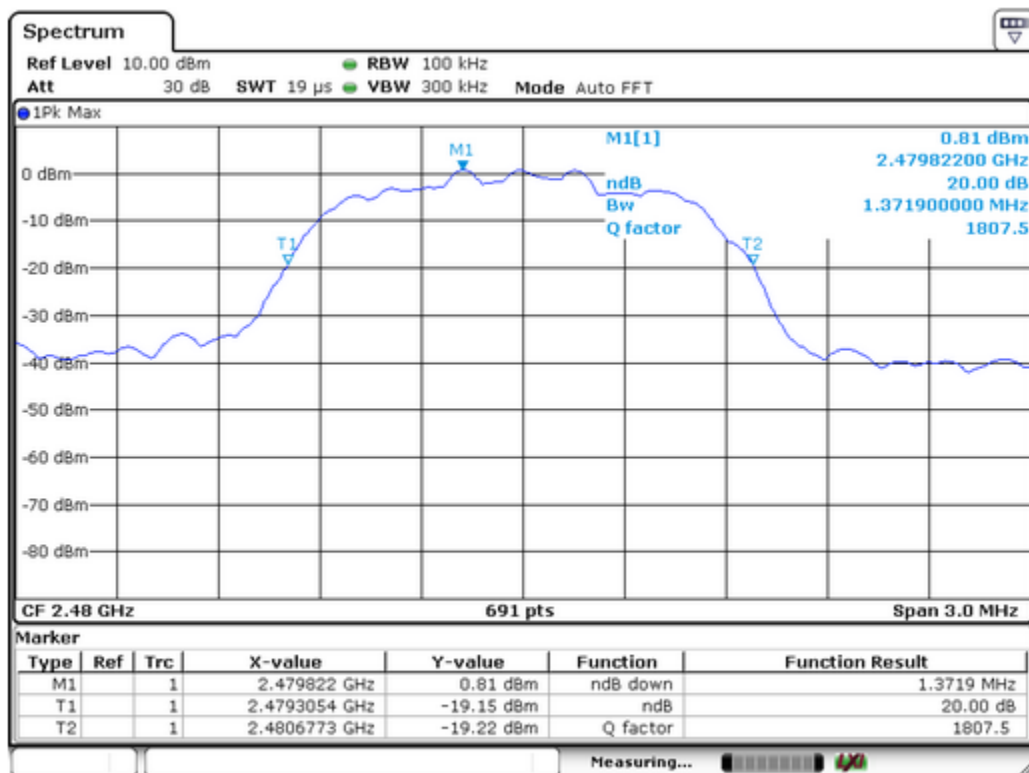
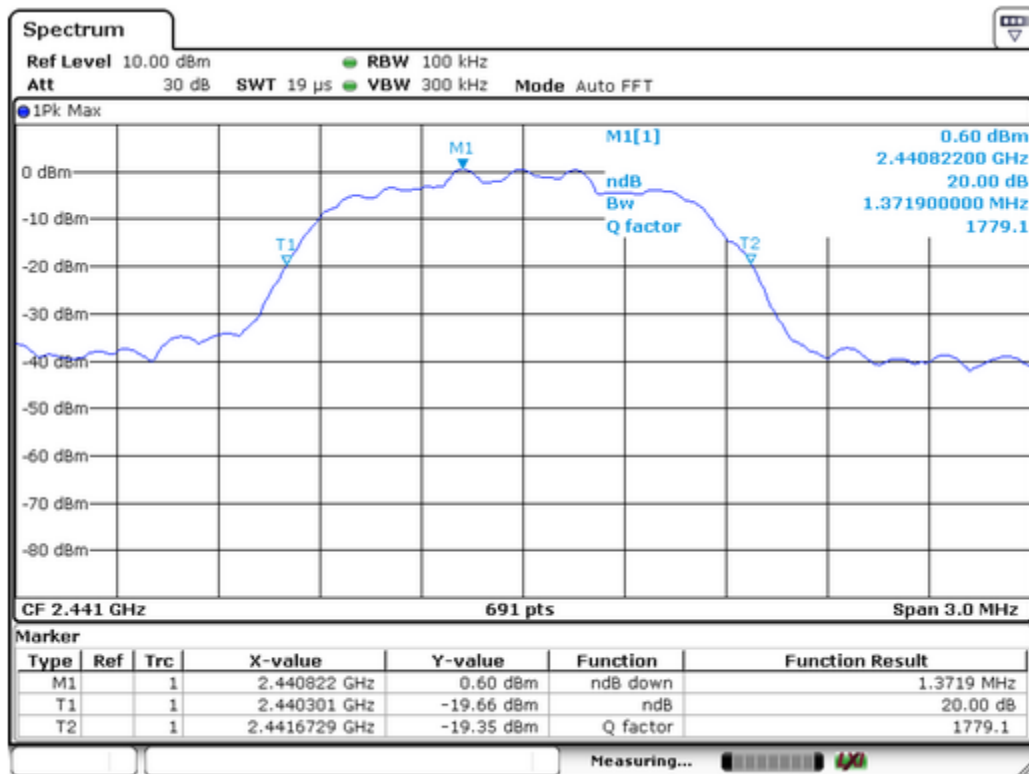




Test Mode: CH00 / CH39 / CH78 (8DPSK(3Mbps)Mode)

Channel number	Channel frequency (MHz)	20dB Down BW(kHz)
00	2402	1368
39	2441	1372
78	2480	1372





9 Maximum Peak Output Power

Test Requirement : FCC CFR47 Part 15 Section 15.247

Test Method : ANSI C63.10:2013, DA 00-705

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 (30dBm). 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 0.125watts (20.97 dBm) limit applies.

Test Mode : Refer to section 3.3

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 analyser: 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.

9.2 Test Result

GFSK(1Mbps)					
Test Channel	Frequency	Conducted Output Peak Power	Conducted Output Peak Power	LIMIT	Pass/Fail
	(MHz)	(dBm)	(mW)	(mW)	
CH00	2402	-0.33	0.927	1000	Pass
CH39	2441	3.38	2.178	1000	Pass
CH78	2480	3.78	2.388	1000	Pass

Note: the channel separation > bandwidth

$\pi/4$ QPSK(2Mbps)					
Test Channel	Frequency	Conducted Output Peak Power	Conducted Output Peak Power	LIMIT	Pass/Fail
	(MHz)	(dBm)	(mW)	(mW)	
CH00	2402	-2.64	0.545	125	Pass
CH39	2441	1.59	1.442	125	Pass
CH78	2480	1.76	1.500	125	Pass

Note: the channel separation >2/3 bandwidth

8DPSK(3Mbps)					
Test Channel	Frequency	Conducted Output Peak Power	Conducted Output Peak Power	LIMIT	Pass/Fail
	(MHz)	(dBm)	(mW)	(mW)	
CH00	2402	-2.57	0.553	125	Pass
CH39	2441	1.98	1.578	125	Pass
CH78	2480	2.19	1.656	125	Pass

Note: the channel separation >2/3 bandwidth

10 Hopping Channel Separation

Test Requirement	: FCC CFR47 Part 15 Section 15.247
Test Method	: ANSI C63.10:2013, DA 00-705
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 2400-2483.5MHz 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	: Hopping

10.1 Test Procedure

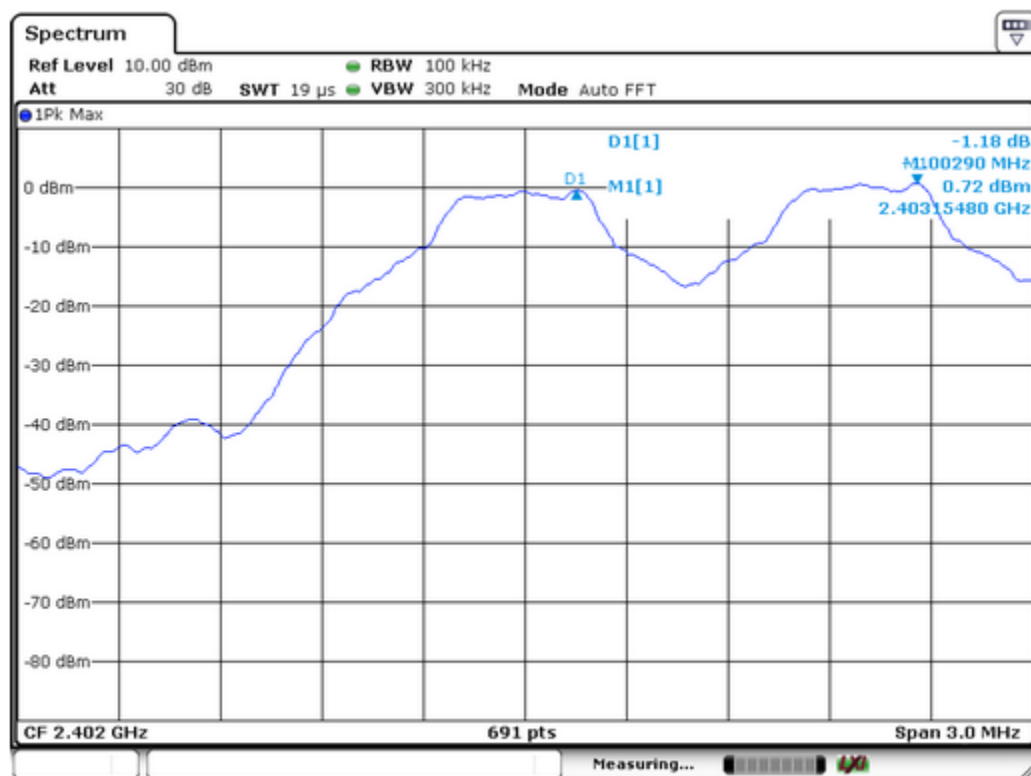
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 30KHz. VBW = 100KHz , Span = 3MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to 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.

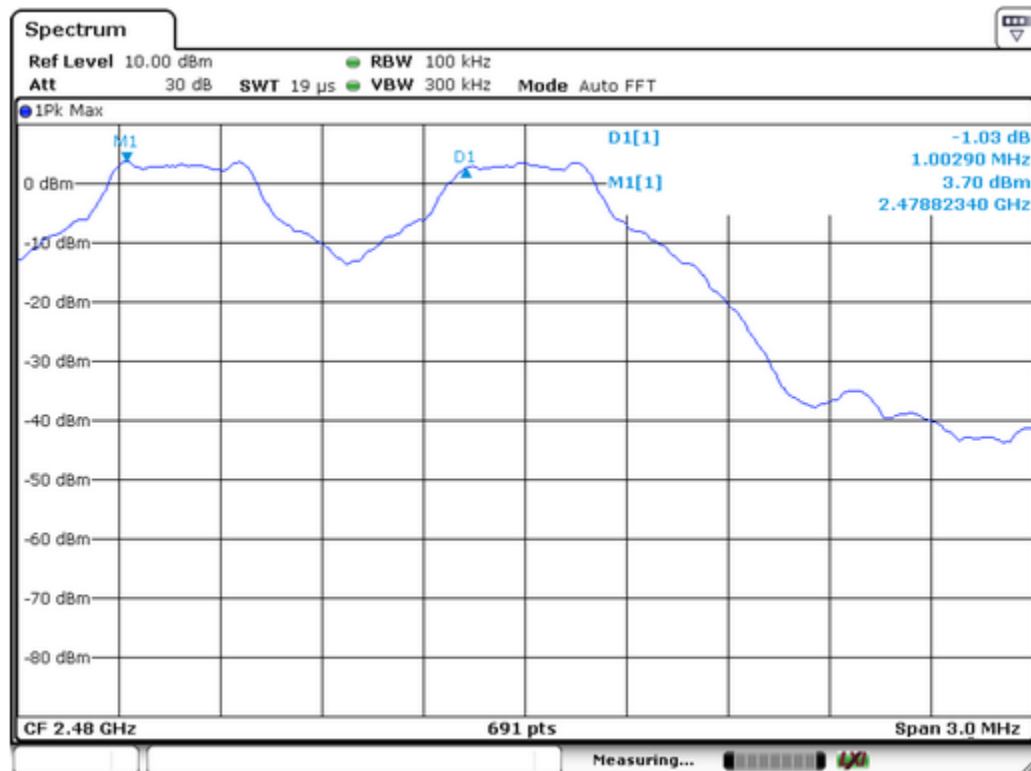
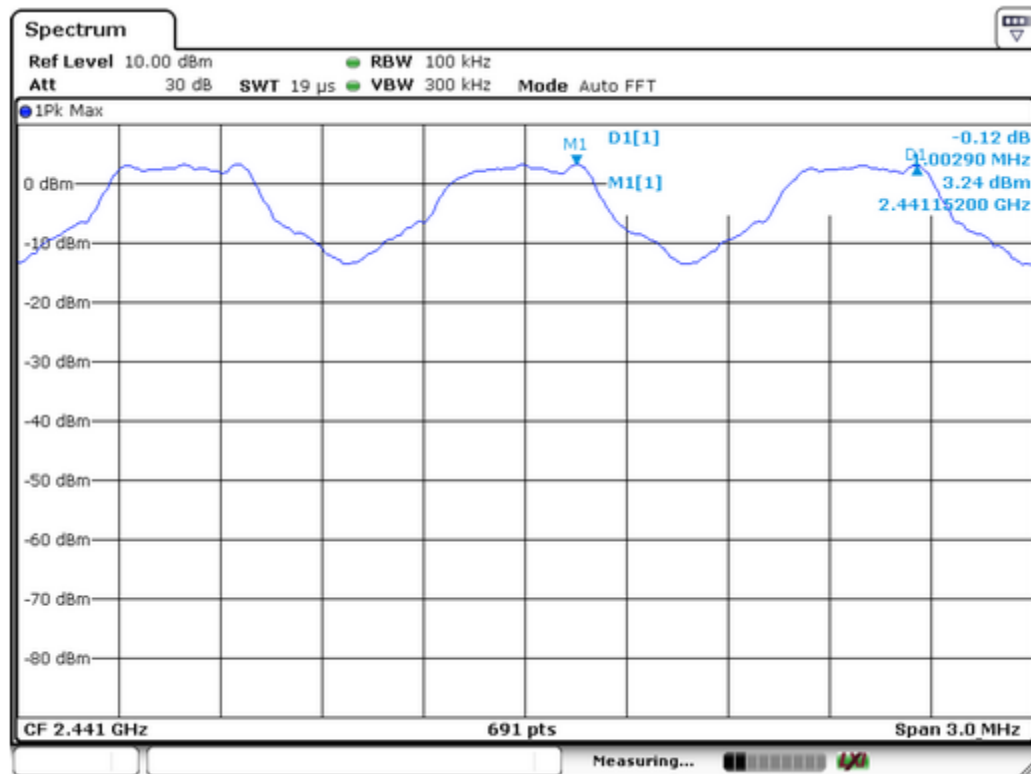


10.2 Test Result

Test Mode:	CH00 / CH39 / CH78 (GFSK(1Mbps) Mode)
------------	---------------------------------------

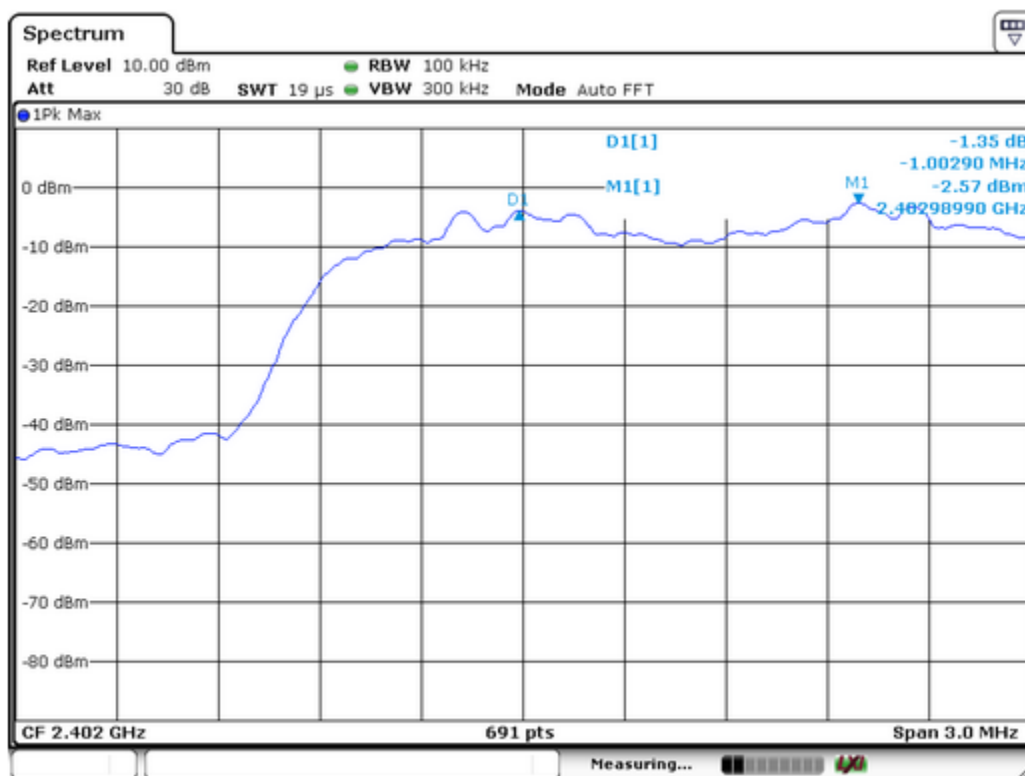
Channel number	Channel frequency (MHz)	Separation Read Value (kHz)	Separation Limit (kHz)
1	2402	1003	>741
40	2441	1003	>744
79	2480	1003	>744

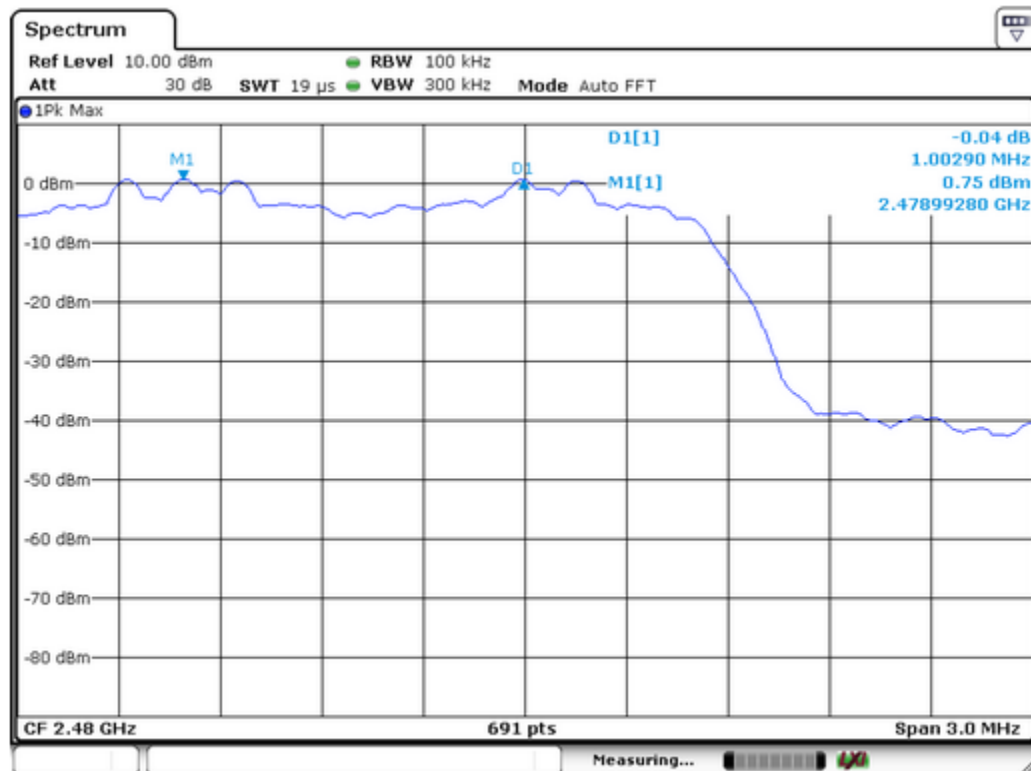
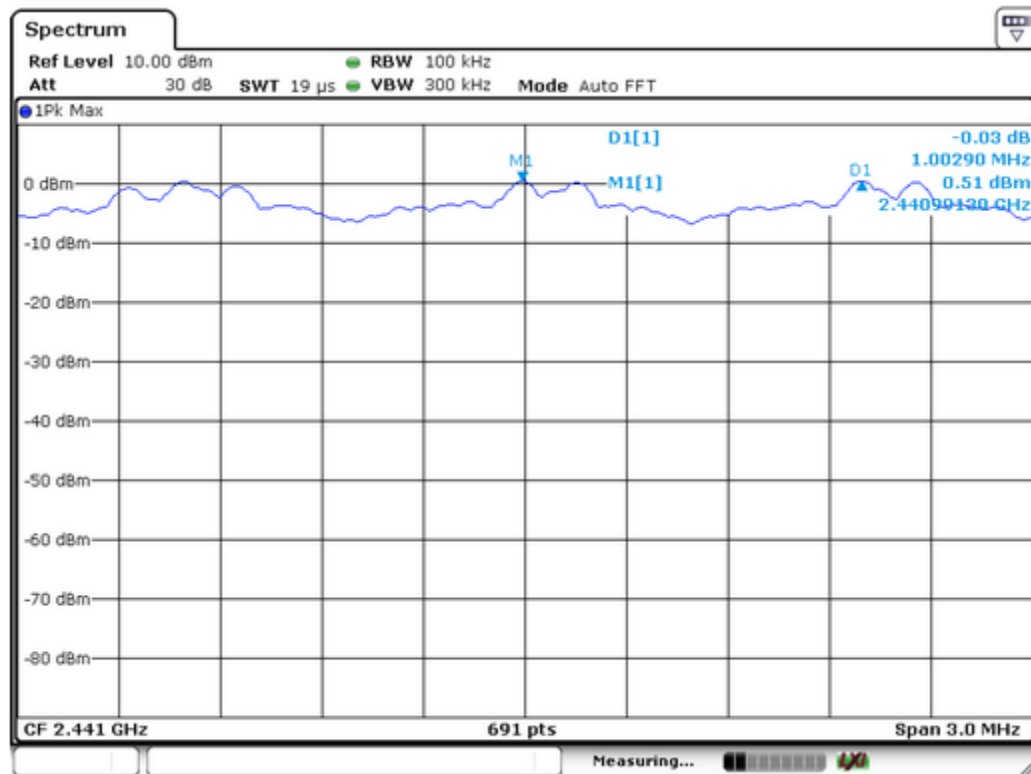




Test Mode:	CH00 / CH39 / CH78 ($\pi/4$ -DQPSK(2Mbps) Mode)
------------	--

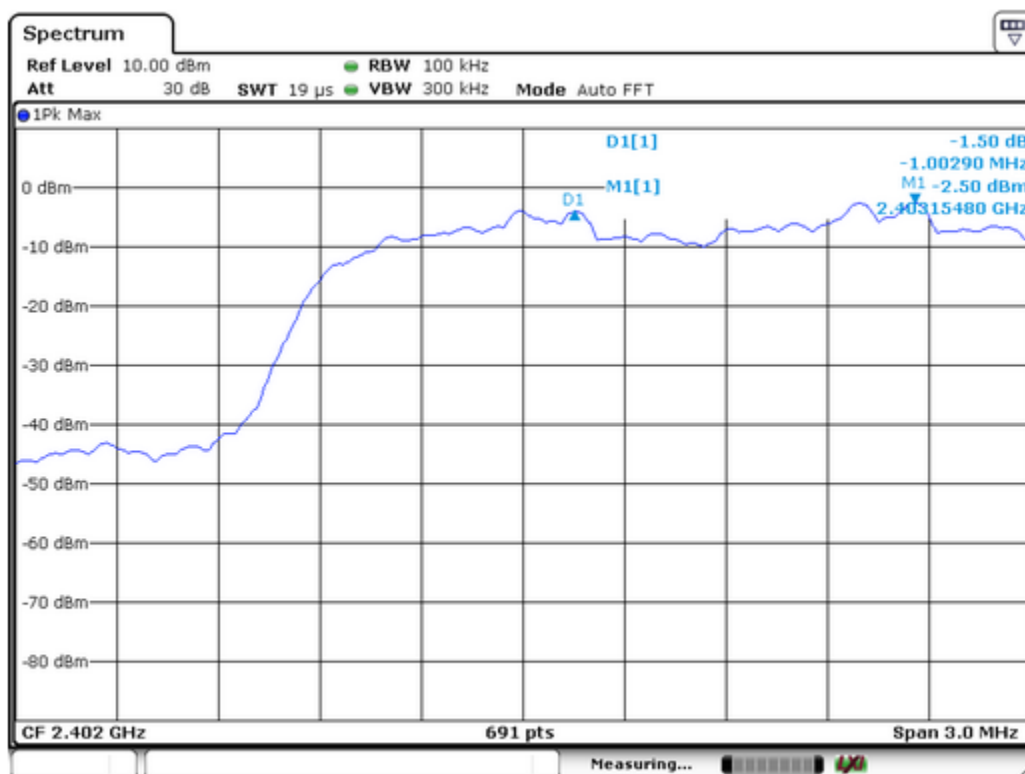
Channel number	Channel frequency (MHz)	Separation Read Value (kHz)	Separation Limit 2/3 20dB Down BW(kHz)
1	2402	1003	>915
40	2441	1003	>912
79	2480	1003	>912

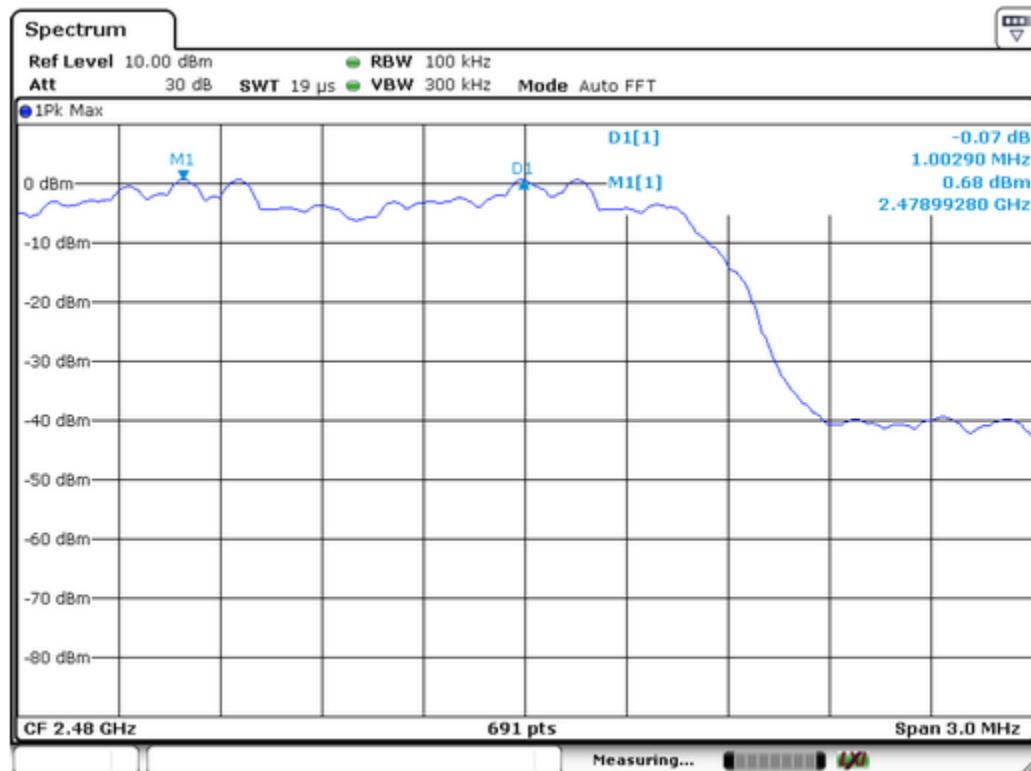
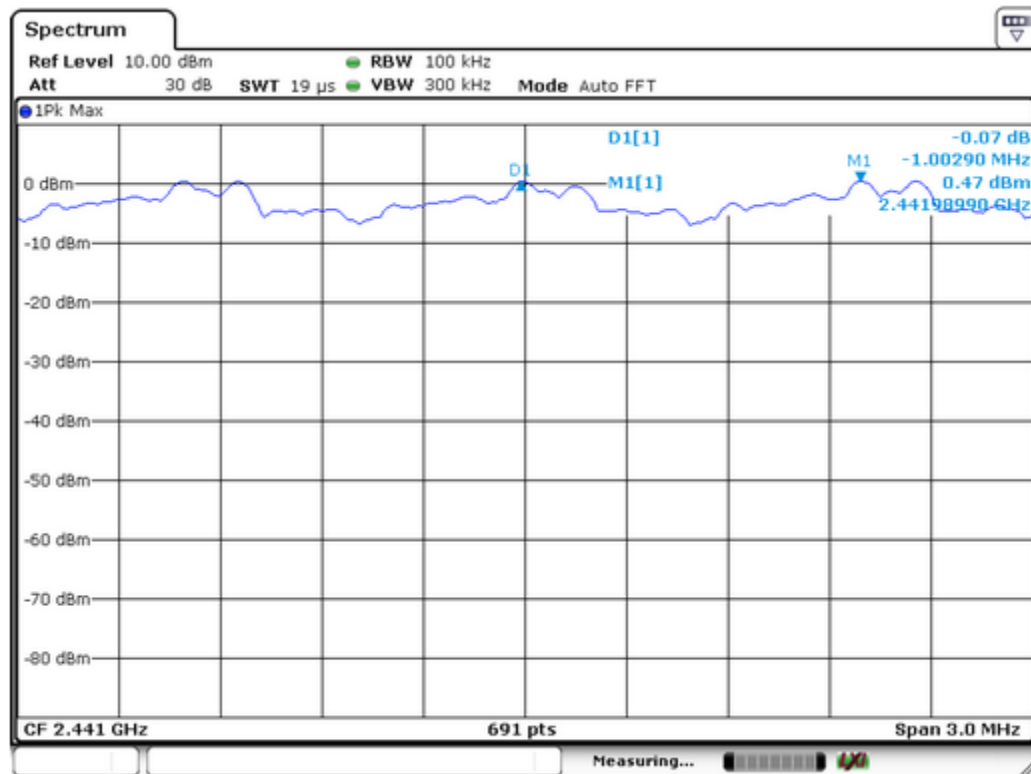




Test Mode:	CH00 / CH39 / CH78 (8DPSK(3Mbps)Mode)
------------	---------------------------------------

Channel number	Channel frequency (MHz)	Separation Read Value (kHz)	Separation Limit 2/3 20dB Down BW(kHz)
1	2402	1003	>912
40	2441	1003	>915
79	2480	1003	>915





11 Number of Hopping Frequency

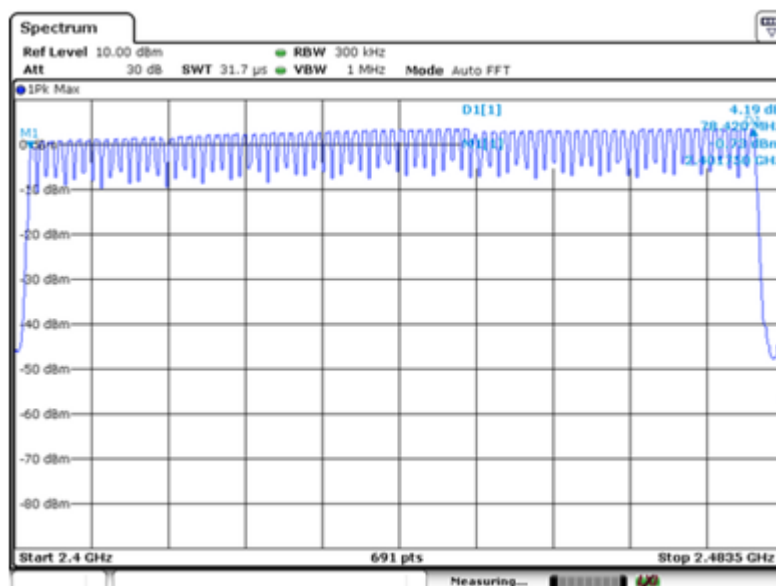
Test Requirement	: FCC CFR47 Part 15 Section 15.247
Test Method	: ANSI C63.10:2013, DA 00-705
Test Limit	: Regulation 15.247 (a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.
Test Mode	: Hopping(GFSK)

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 = 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 = 2.483GHz. Sweep=auto;

11.2 Test Result

Channel Number	Limit
79	≥ 15



12 Dwell Time

Test Requirement	: FCC CFR47 Part 15 Section 15.247
Test Method	: ANSI C63.10:2013, DA 00-705
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.
Test Mode	: Hopping
Remark	: The worst case(8DPSK,DH5) was recorded

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 spectrum analyzer span = 0. Centred on a hopping channel;
3. Set RBW = 1MHz and VBW = 3MHz.Sweep = as necessary to capture the entire dwell time per hopping channel. Set the EUT for DH5, DH3 and DH1 packet transmitting.
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).

12.2 Test Result

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:

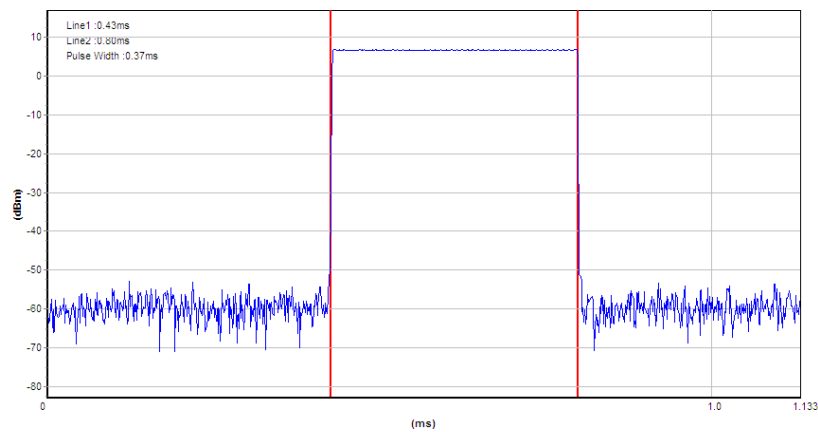
Data Packet	Dwell Time(s)
3DH5	$1600/79/6*0.4*79*(MkrDelta)/1000$
3DH3	$1600/79/4*0.4*79*(MkrDelta)/1000$
3DH1	$1600/79/2*0.4*79*(MkrDelta)/1000$
Remark: Mkr Delta is once pulse time. Only the worst data(DH5) were show as follow.	



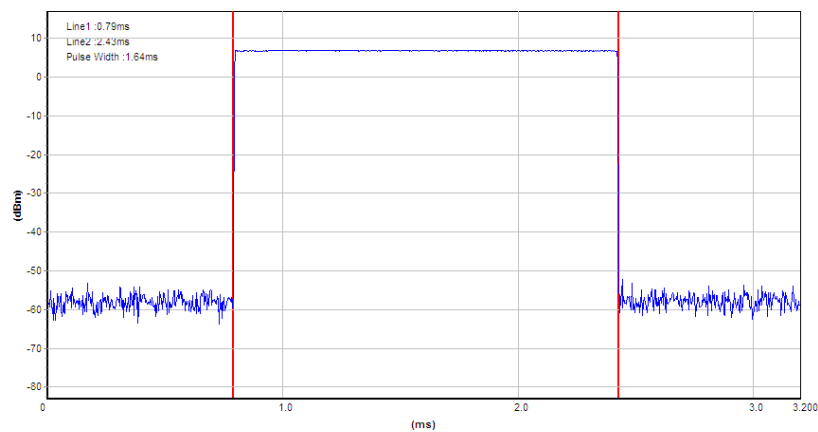
Test Mode:	n/4-DQPSK(2Mbps) –2DH1/2DH3/2DH5
------------	----------------------------------

Data Packet	Frequency	Pulse Duration(ms)	Dwell Time(s)	Limits(s)
DH1	2441 MHz	0.370	0.118	0.4
DH3	2441 MHz	1.640	0.262	0.4
DH5	2441 MHz	2.880	0.307	0.4

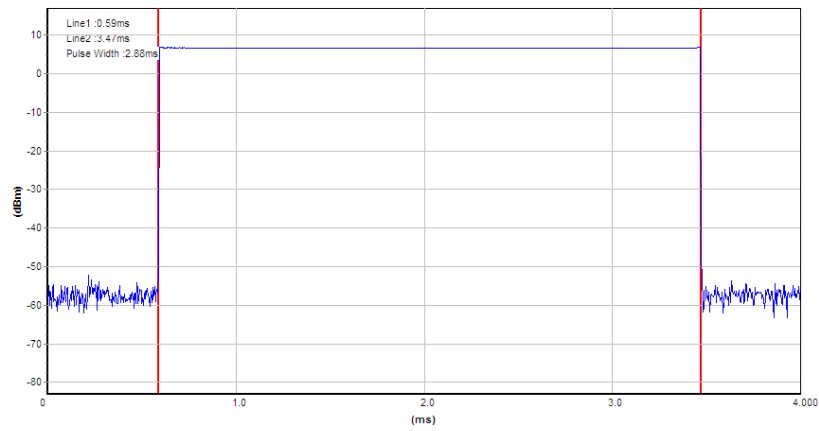
CH39-DH1



CH39-DH3



CH39-DH5



13 Antenna Requirement

According to the FCC part15.203, a transmitter can only be sold or operated with antennas with which it was approved. This product has an internal PCB Antenna, it meet the requirement of this section.

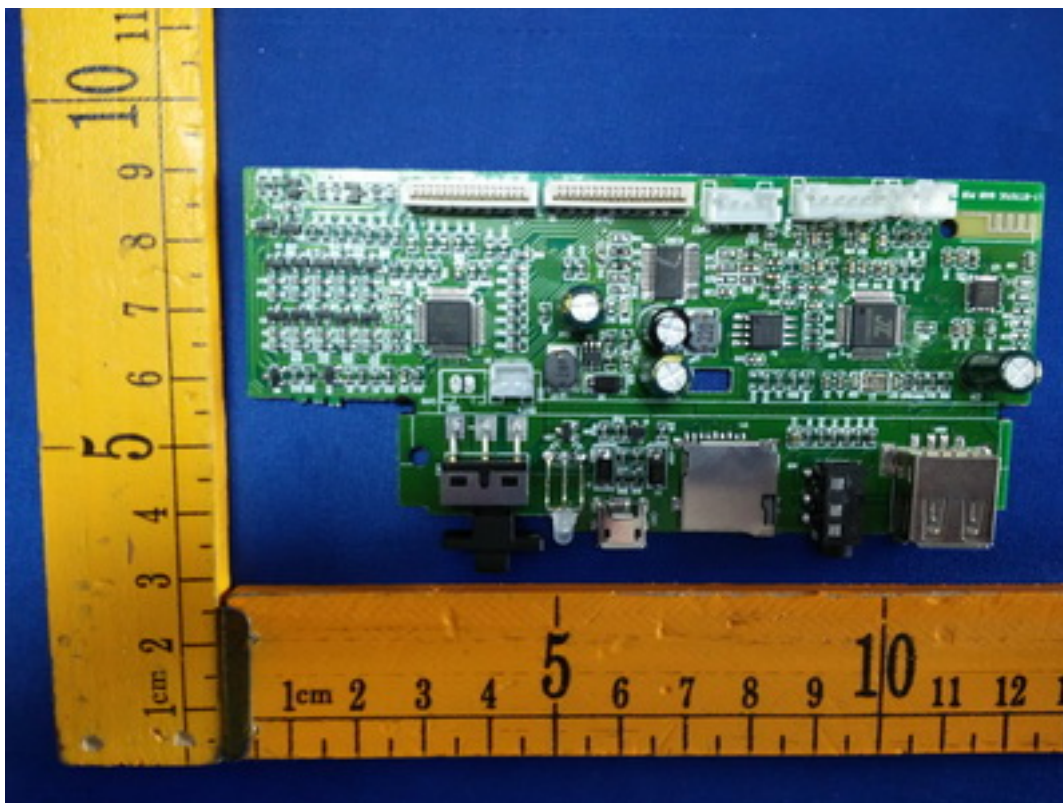
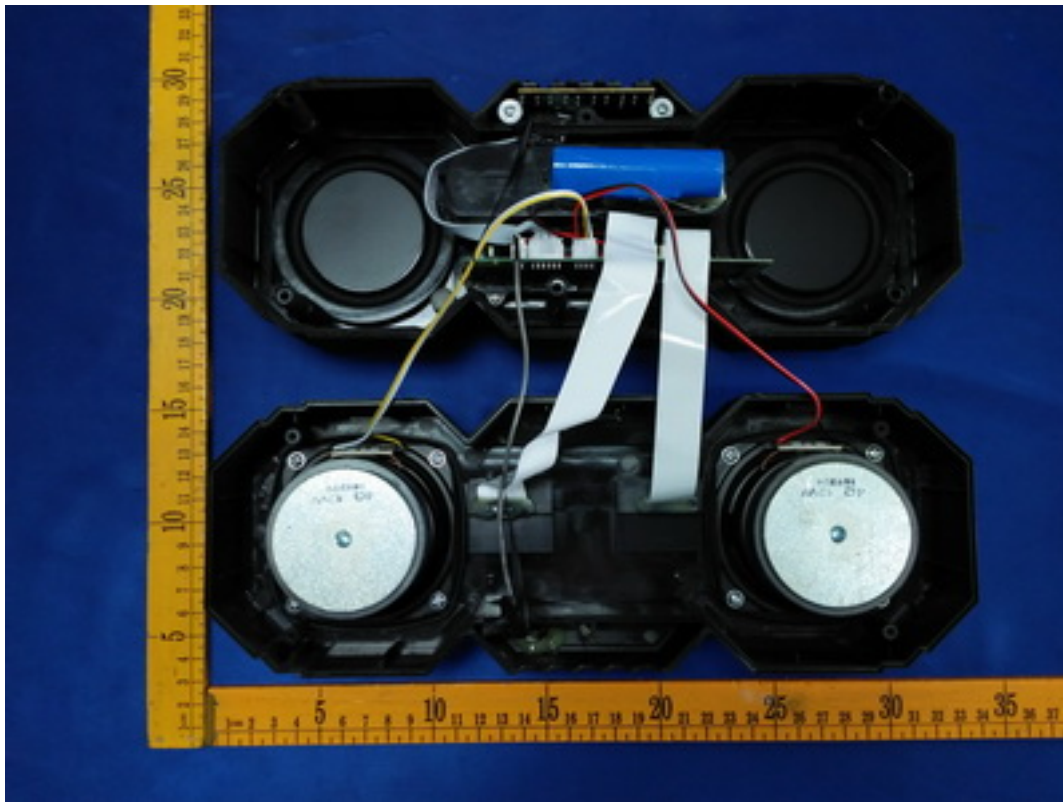
14 TEST PHOTOS

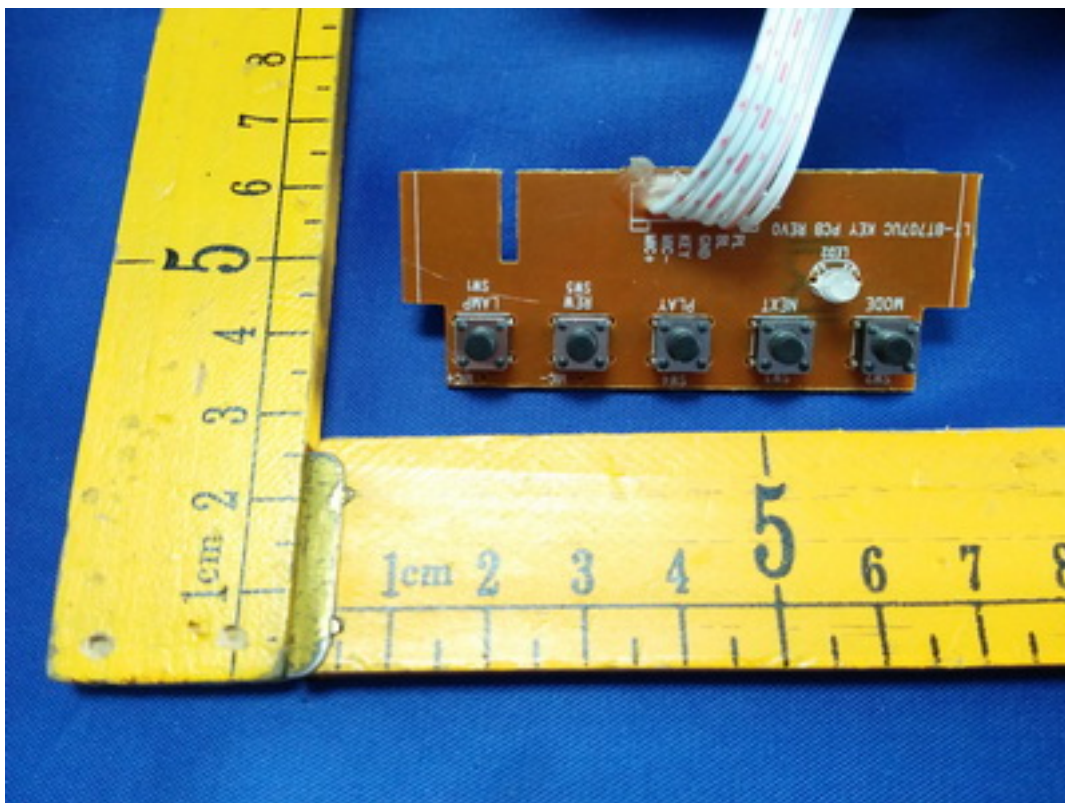
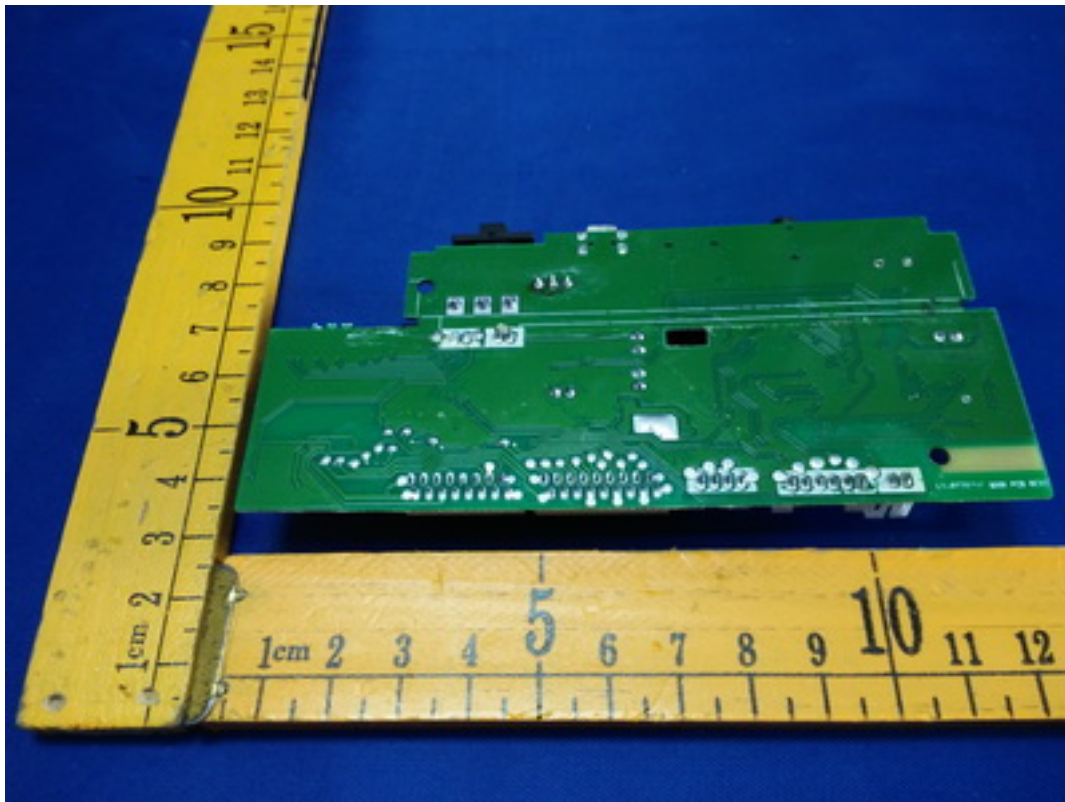


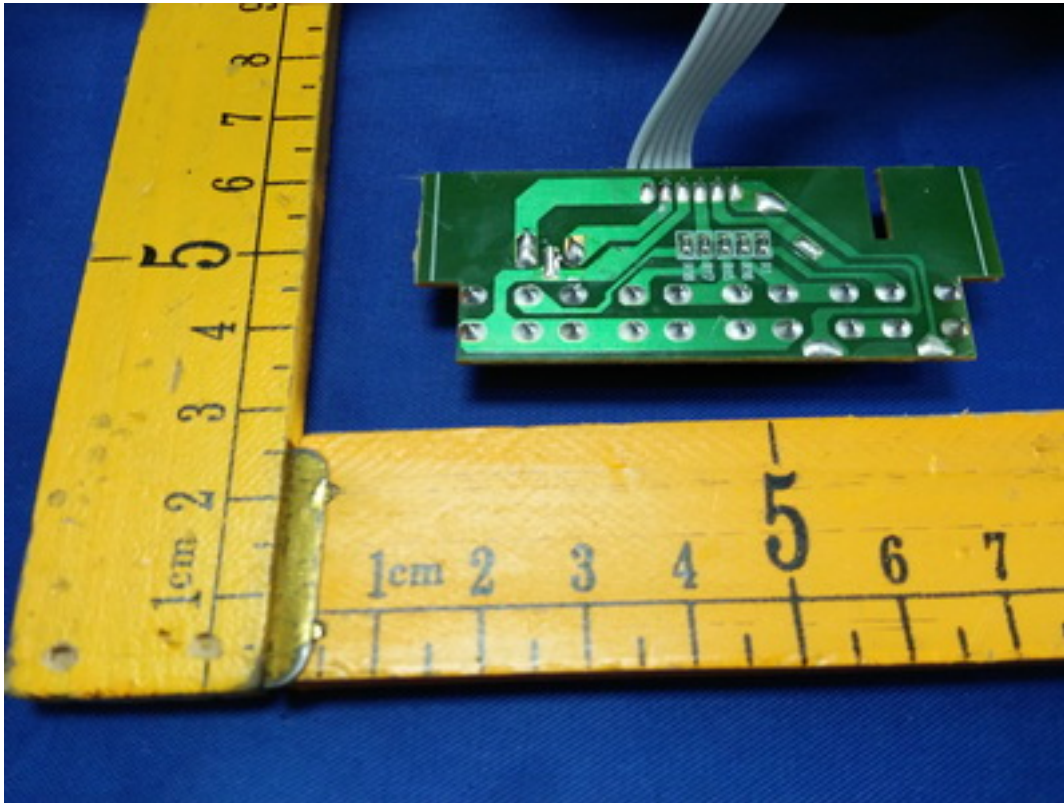


15 EUT PHOTOS









*****THE END REPORT*****