FCC TEST REPORT

FCC ID	: WY9-BTS-70
Applicant	: Telnova Technology Co.,Ltd
Address	: F7,Block B, Jiuzhou Electronic Building, Southern No.12 Rd, High-tech Industrial Park, Nanshan District, Shenzhen ,Guangdong Province, China
Manufacturer	: The same as above
Address	: The same as above

Equipment Under Test (EUT) :

Product Name	: Bluetooth Receiver
Model No.	: BTS-70
Rules	: FCC CFR47 Part15 C Section 15.247:2010

Date of Test	: May 21 ~ 25, 2013
Date of Issue	: May 31, 2013
Test Result	: PASS*

Remark:

* The sample detailed above has been tested to the requirements of FCC rules mentioned above.

The test results have been reviewed against the directives above and found to meet their essential requirements.

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.

PERPARED BY:
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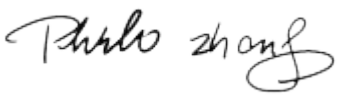
Compiled by:

Zero Zhou / Project Engineer

Approved by:



Philo Zhong / Manager

2 Test Summary

Test Items	Test Requirement	Result
Conducted Emissions	15.207	PASS
Radiated Emissions	15.205(a) 15.209 15.247(d)	PASS
Duty Cycle	15.35	PASS
Spurious RF Conducted Emissions from out of band	15.247(d)	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
Maximum Permissible Exposure (Exposure of Humans to RF Fields)	1.1307(b)(1)	PASS

3 Contents

4 General Information

4.1 General Description of E.U.T.

Product Name : Bluetooth Receiver

Model No. : BTS-70

Frequency Range : 2402-2480MHz, 79 Channels in total

Oscillator : Crystal 16MHz

Antenna installation : PCB Printed Antenna

Type of Modulation : GFSK,Pi/4DQPSK,8DQPSK

Note : All the modulation modes were tested, all the test data deeply conform to the standard and the data of the worst mode (GFSK) were recorded in the following pages. That all modulation methods do not exceed the above mentioned limits.

4.2 Details of E.U.T.

Technical Data : (1)DC 3.7V, 80mAh from battery
(2)DC 5V from USB charging

4.3 Description of Support Units

No.	Equipment	Manufacturer	Model No.	Serial No.
1	Notebook	IBM	2672-39C	99-8D3W4
2.				

4.4 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	-	-

4.5 Test Facility

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

- **IC – Registration No.: IC7760A**

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, July 12, 2012.

- **FCC – Registration No.: 880581**

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 880581, May 26, 2011.

4.6 Test Location

All the tests were performed at:
Waltek Services (Shenzhen) Co., Ltd. at 1/F, Fukangtai Building, West Baima Rd., Songgang Street, Baoan District, Shenzhen, China

4.7 General condition

Ambient Condition: 25.5 ℃ 51 %RH

4.7.1 Environmental condition of test site

For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

The follow condition is not applicable for adapter:

Test Voltage	Input voltage
Rated voltage-15%	
normal	
Rated voltage+15%	

The follow condition is applicable.

Test voltage	Test Voltage
Rated voltage	New Battery DC 3.7V

4.7.2 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	Lower channel	Middle channel	Upper channel
Transmitting	2402MHz	2441MHz	2480MHz
Receiving	2402 MHz	2441MHz	2480MHz

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	100947	Aug. 13,2012	Aug. 12,2013
2.	LISN	R&S	ENV216	101215	Aug. 13,2012	Aug. 12,2013
3.	Cable	Top	TYPE16(3.5M)	-	Aug.14,2012	Aug. 13,2013
3m Semi-anechoic Chamber for Radiation(TDK) (Test Frequency: 16MHz~1000MHz)						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No**	**Last Calibration Date**	**Calibration Due Date**
1	Test Receiver	R&S	ESCI	101296	Aug.09,2012	Aug.09,2013
2	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	Aug. 13,2012	Aug. 13,2013
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	Aug.11,2012	Aug.11,2013
4	Amplifier	Compliance pirection systems inc	PAP-0203	22024	Apr.07,2013	Apr.07,2014
5	Cable	HUBER+SUHNER	CBL2	525178	Sep.15,2012	Sep.15,2013
3m Semi-anechoic Chamber for Radiation Emissions (Test Frequency:Above 1GHz)						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1.	EMC Analyzer	Agilent	E7405A	MY45114943	Aug. 13,2012	Aug. 13,2013
2.	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	Aug. 13,2012	Aug. 13,2013
3.	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	399	Aug. 13,2012	Aug. 13,2013
4.	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	Apr.07,2013	Apr.07,2014
5.	Broadband Preamplifier	SCHWARZBECK	BBV 9718	9718-148	Aug. 13,2012	Aug. 13,2013
6.	10m Coaxial Cable with N- plug	SCHWARZBECK	AK 9515 H	-	Aug. 13,2012	Aug. 13,2013

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)
	± 4.74 dB (1000M~25000MHz)

5.3 Test Equipment Calibration

All the test equipments used are valid and calibrated by CEPREI Certification Body that address is No.110 Dongguan Zhuang RD. Guangzhou, P.R.China.

6 Conducted Emissions

Test Requirement:	FCC CFR 47 Part 15 Section 15.207
Test Method:	ANSI C63.4:2003
Test Result:	PASS
Frequency Range:	150kHz to 30MHz
Class:	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) Quasi-Peak & Average if maximised peak within 6dB of Average Limit

6.1 E.U.T. Operation

Operating Environment:

Temperature: 25.5 °C

Humidity: 51 % RH

Atmospheric Pressure: 1016 mbar

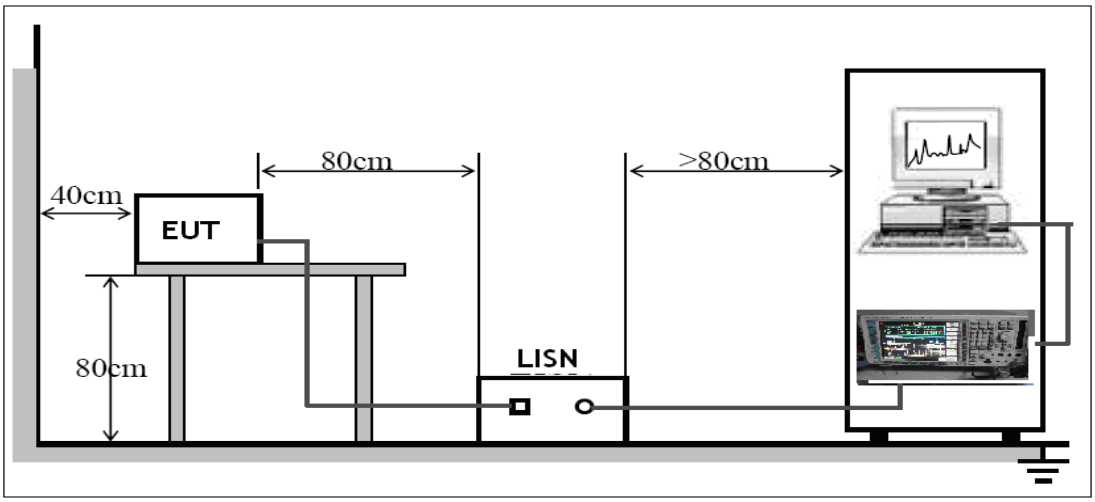
EUT Operation:

The EUT was tested according to ANSI C63.4:2003. The frequency spectrum from 150kHz to 30MHz was investigated.

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.

6.2 EUT Setup

The EUT was placed on the test table in shielding room.

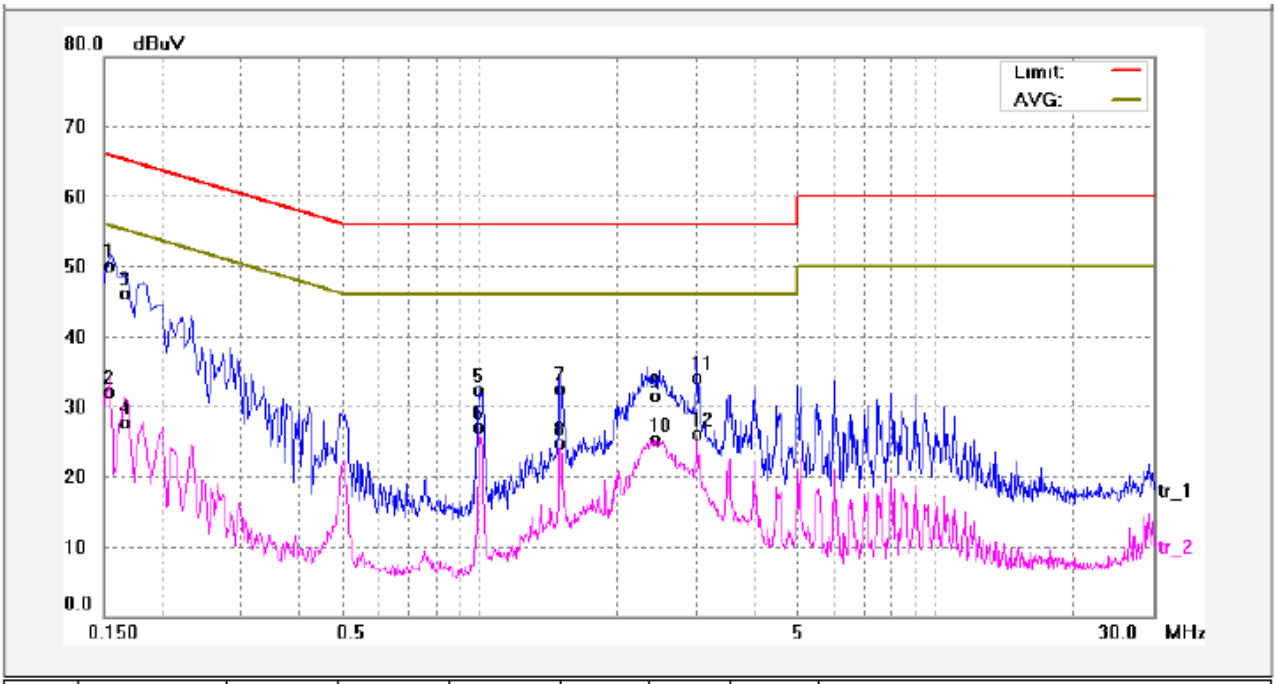


6.3 Conducted Emission Test Result

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

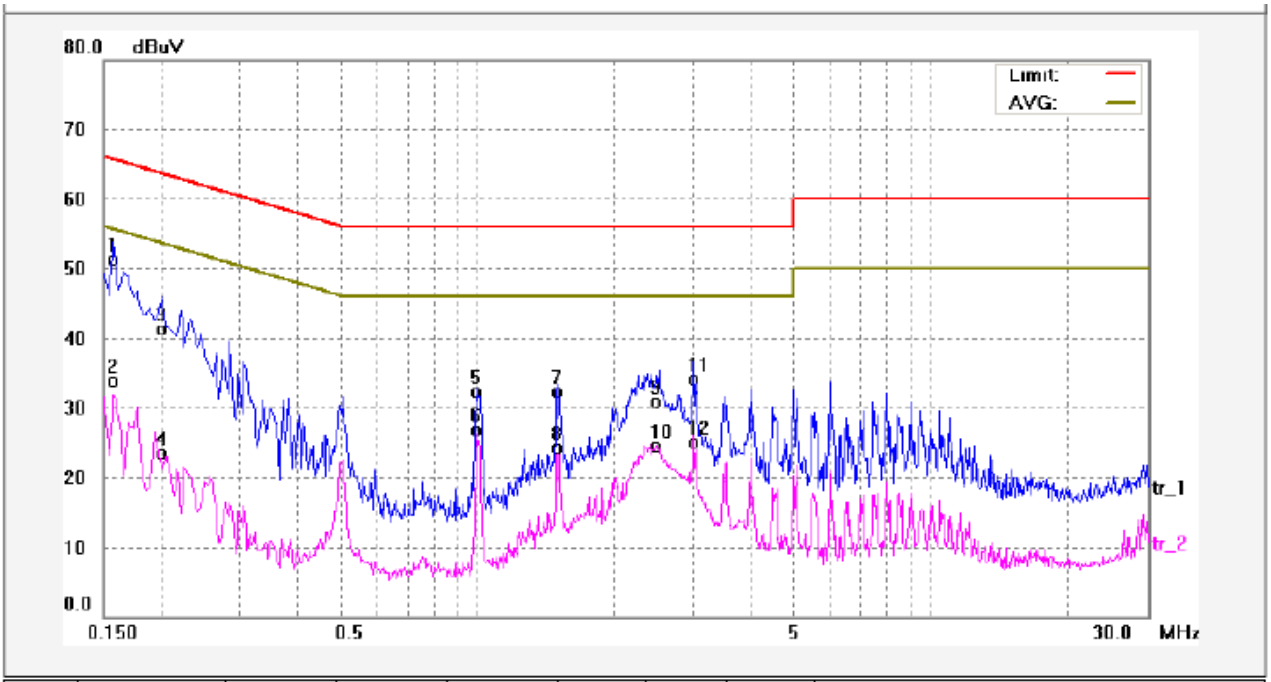
Test Mode: Charging(Connected to the PC)+BT Linking Mode

Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1539	39.59	9.80	49.39	65.78	-16.39	QP	
2	0.1539	21.55	9.80	31.35	55.78	-24.43	AVG	
3	0.1677	35.57	9.81	45.38	65.07	-19.69	QP	
4	0.1677	17.11	9.81	26.92	55.07	-28.15	AVG	
5	0.9980	21.60	10.00	31.60	56.00	-24.40	QP	
6	0.9980	16.30	10.00	26.30	46.00	-19.70	AVG	
7	1.4980	21.78	10.00	31.78	56.00	-24.22	QP	
8	1.4980	13.97	10.00	23.97	46.00	-22.03	AVG	
9	2.4219	20.64	10.01	30.65	56.00	-25.35	QP	
10	2.4219	14.42	10.01	24.43	46.00	-21.57	AVG	
11	2.9980	23.31	10.03	33.34	56.00	-22.66	QP	
12	2.9980	15.24	10.03	25.27	46.00	-20.73	AVG	

Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1580	40.73	9.81	50.54	65.56	-15.02	QP	
2	0.1580	23.38	9.81	33.19	55.56	-22.37	AVG	
3	0.2020	30.62	9.84	40.46	63.52	-23.06	QP	
4	0.2020	12.80	9.84	22.64	53.52	-30.88	AVG	
5	0.9980	21.49	10.00	31.49	56.00	-24.51	QP	
6	0.9980	16.15	10.00	26.15	46.00	-19.85	AVG	
7	1.4980	21.47	10.00	31.47	56.00	-24.53	QP	
8	1.4980	13.55	10.00	23.55	46.00	-22.45	AVG	
9	2.4940	20.11	10.02	30.13	56.00	-25.87	QP	
10	2.4940	13.77	10.02	23.79	46.00	-22.21	AVG	
11	2.9940	23.21	10.03	33.24	56.00	-22.76	QP	
12	2.9940	14.28	10.03	24.31	46.00	-21.69	AVG	

7 Radiated Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247
Test Method: DA 00-705
Test Result: PASS
Measurement Distance: 3m
15.209 Limit:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 -0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

15.247 (d) Limit:
(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.

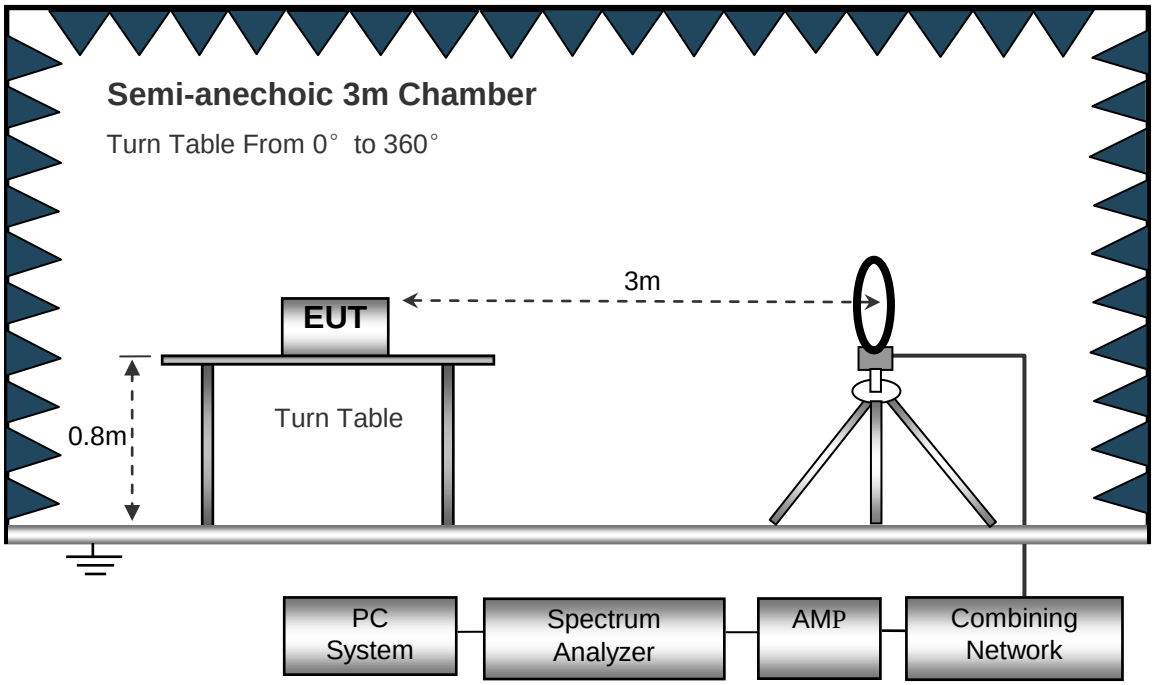
7.1 EUT Operation:

Operating Environment:

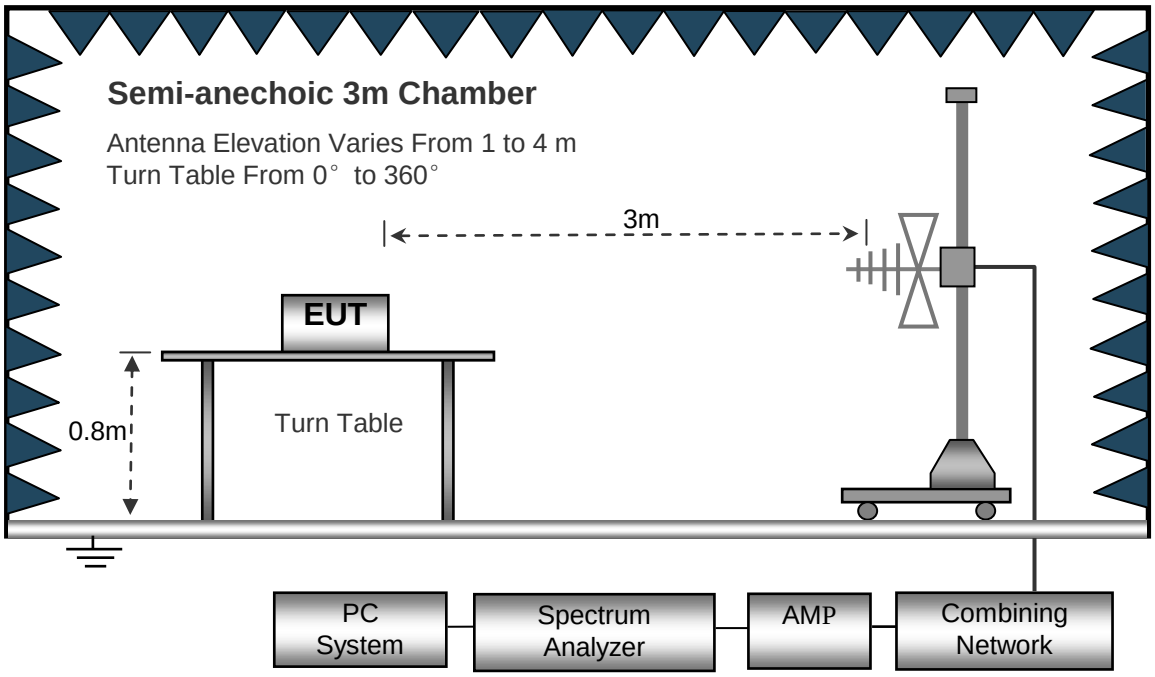
Temperature: 25.5 °C
Humidity: 51 % RH
Atmospheric Pressure: 1011 mbar

7.2 Test Setup

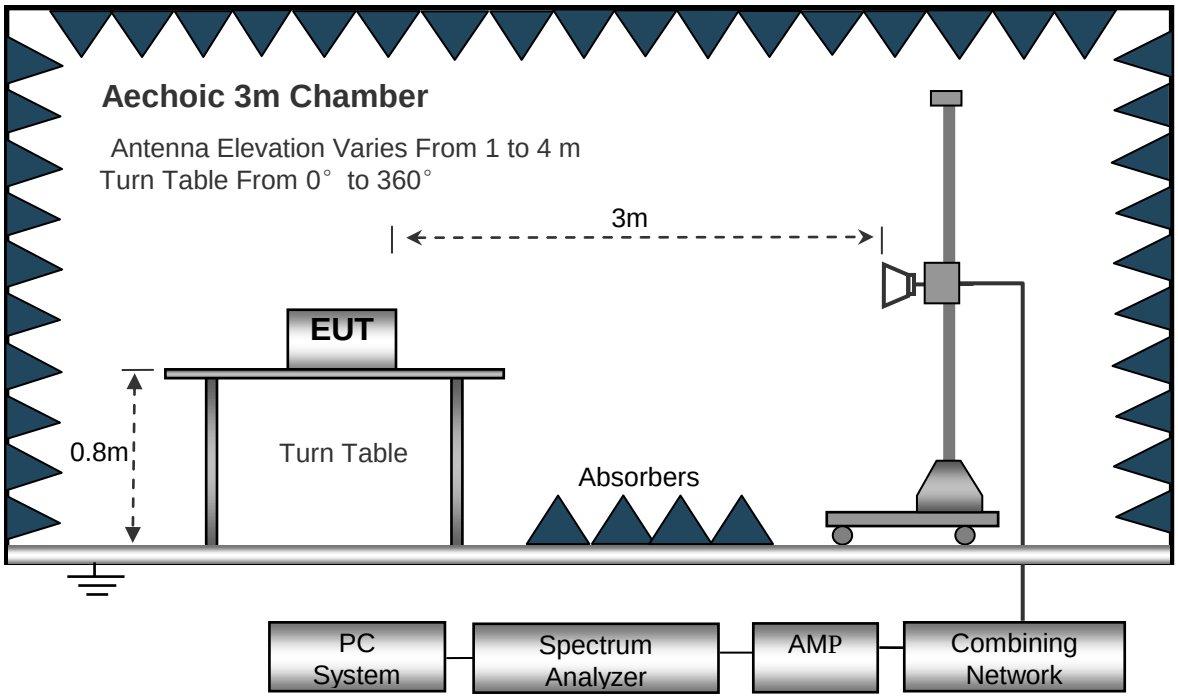
The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.4: 2003.
The test setup for emission measurement below 30MHz.



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



The test setup for emission measurement above 1 GHz.



7.3 Spectrum Analyzer Setup

According to FCC Part15 Rules, the system was tested from 8 MHz to 25 GHz.

Below 30MHz

Sweep Speed .....Auto
IF Bandwidth.....10KHz
Video Bandwidth.....10KHz

Resolution Bandwidth.....10KHz

30MHz ~ 1GHz

Sweep Speed .....Auto
IF Bandwidth.....120 KHz
Video Bandwidth.....100KHz
Quasi-Peak Adapter Bandwidth .....120 KHz
Quasi-Peak Adapter Mode .....Normal
Resolution Bandwidth.....100KHz

Above 1GHz

Sweep Speed .....Auto
IF Bandwidth.....120 KHz
Video Bandwidth.....3MHz
Quasi-Peak Adapter Bandwidth .....120 KHz
Quasi-Peak Adapter Mode .....Normal
Resolution Bandwidth.....1MHz

7.4 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.
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.

7.5 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

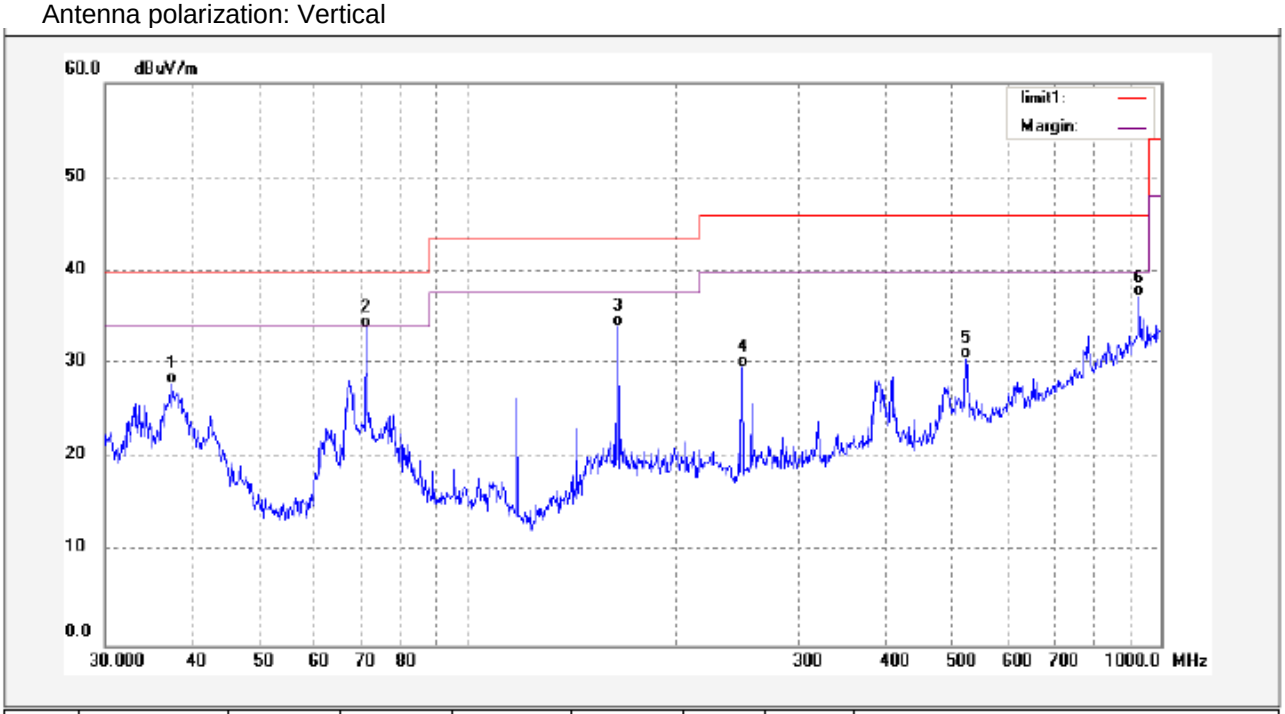
7.6 Summary of Test Results

Test Frequency : Below 30MHz

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

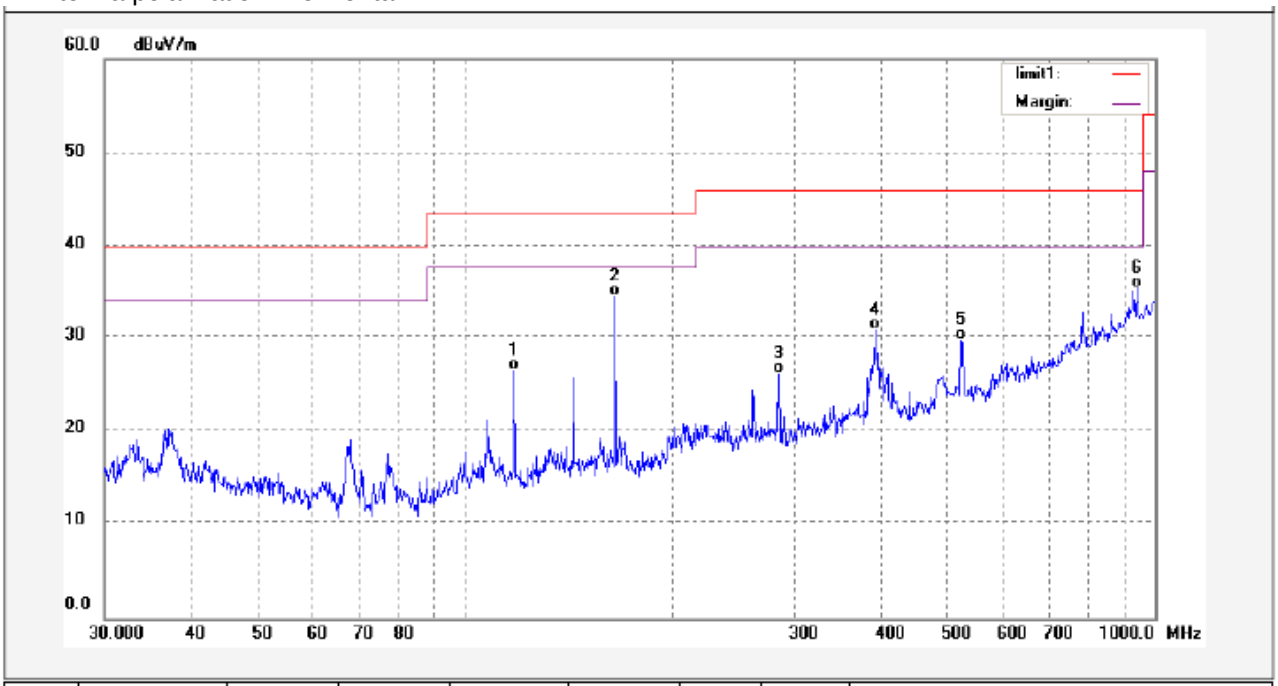
Test Frequency : 30MHz ~ 1000MHz
The Test Mode: (1)charging (Connected to the PC)+BT linking mode, (2)BT linking (battery)
Test mode as above, Only the worst mode were shown in the report.

Antenna polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	37.4330	11.24	16.62	27.86	40.00	-12.14	QP	
2	71.4539	24.10	9.75	33.85	40.00	-6.15	QP	
3	164.8912	22.19	11.83	34.02	43.50	-9.48	QP	
4	248.7319	14.68	14.92	29.60	46.00	-16.40	QP	
5	523.8763	7.35	23.17	30.52	46.00	-15.48	QP	
6	932.1405	5.74	31.36	37.10	46.00	-8.90	QP	

Antenna polarization: Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	117.6815	14.26	12.22	26.48	43.50	-17.02	QP	
2	164.8912	22.59	11.83	34.42	43.50	-9.08	QP	
3	285.2611	10.07	16.11	26.18	46.00	-19.82	QP	
4	392.7376	10.87	19.99	30.86	46.00	-15.14	QP	
5	523.8763	6.65	23.17	29.82	46.00	-16.18	QP	
6	945.3336	4.34	31.05	35.39	46.00	-10.61	QP	

Test Frequency: 1GHz ~ 25GHz radiation test data
And the below is the Fundamental and Harmonic

Frequency (MHz)	Detector	Antenna Polarization	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Turntable Angle (°)
Lower frequency							
2402.00	AV	Vertical	73.68	N/A	(Fund.)	1.1	110
4804.00	AV	Vertical	40.11	54.00	13.89	1.4	140
7206.00	AV	Vertical	36.26	54.00	17.74	1.6	170
9608.00	AV	Vertical	32.52	54.00	21.48	1.4	130
12010.00	AV	Vertical	30.05	54.00	23.95	1.8	185
14412.00	AV	Vertical	34.91	54.00	19.09	1.2	195
16814.00	AV	Vertical	30.02	54.00	23.98	1.9	160
19216.00	AV	Vertical	31.74	54.00	22.26	1.4	140
21618.00	AV	Vertical	30.22	54.00	23.78	1.4	30
24020.00	AV	Vertical	30.41	54.00	23.59	1.1	145
2402.00	AV	Horizontal	78.62	N/A	(Fund.)	1.7	70
4804.00	AV	Horizontal	42.54	54.00	11.46	1.2	180
7206.00	AV	Horizontal	36.07	54.00	17.93	1.4	100
9608.00	AV	Horizontal	31.81	54.00	22.19	1.4	195
12010.00	AV	Horizontal	32.15	54.00	21.85	1.6	110
14412.00	AV	Horizontal	33.64	54.00	20.36	1.2	190
16814.00	AV	Horizontal	32.02	54.00	21.98	1.7	150
19216.00	AV	Horizontal	30.74	54.00	23.26	1.6	175
21618.00	AV	Horizontal	31.56	54.00	22.44	1.4	160
24020.00	AV	Horizontal	29.84	54.00	24.16	1.4	90
2402.00	PK	Vertical	83.29	N/A	(Fund.)	1.3	30
4804.00	PK	Vertical	41.77	74.00	32.23	1.7	145
7206.00	PK	Vertical	31.62	74.00	42.38	2.1	160
9608.00	PK	Vertical	30.55	74.00	43.45	1.2	240
12010.00	PK	Vertical	29.41	74.00	44.59	1.1	100
14412.00	PK	Vertical	30.28	74.00	43.72	1.4	155
16814.00	PK	Vertical	31.45	74.00	42.55	1.5	185
19216.00	PK	Vertical	30.88	74.00	43.12	1.1	190
21618.00	PK	Vertical	31.73	74.00	42.27	1.9	110
24020.00	PK	Vertical	32.66	74.00	41.34	1.2	165
2402.00	PK	Horizontal	81.46	N/A	(Fund.)	2.0	120
4804.00	PK	Horizontal	42.51	74.00	31.49	1.7	170
7206.00	PK	Horizontal	32.72	74.00	41.28	1.6	90
9608.00	PK	Horizontal	30.64	74.00	43.36	1.1	85
12010.00	PK	Horizontal	32.11	74.00	41.89	1.7	205
14412.00	PK	Horizontal	30.84	74.00	43.16	1.0	60
16814.00	PK	Horizontal	32.71	74.00	41.29	1.7	220
19216.00	PK	Horizontal	31.23	74.00	42.77	1.7	155
21618.00	PK	Horizontal	30.18	74.00	43.82	1.3	170

Frequency (MHz)	Detector	Antenna Polarization	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Turntable Angle (°)
24020.00	PK	Horizontal	31.44	74.00	42.56	1.5	140
Middle frequency							
2441.00	AV	Vertical	71.68	N/A	(Fund.)	1.7	70
4882.00	AV	Vertical	37.12	54.00	16.88	1.4	185
7323.00	AV	Vertical	36.11	54.00	17.89	1.1	140
9764.00	AV	Vertical	34.52	54.00	19.48	1.5	70
12205.00	AV	Vertical	31.63	54.00	22.37	1.7	50
14646.00	AV	Vertical	33.45	54.00	20.55	1.4	225
17087.00	AV	Vertical	31.68	54.00	22.32	1.6	60
19528.00	AV	Vertical	32.58	54.00	21.42	1.5	80
21969.00	AV	Vertical	30.12	54.00	23.88	1.9	210
24410.00	AV	Vertical	29.66	54.00	24.34	1.7	175
2441.00	AV	Horizontal	78.53	N/A	(Fund.)	1.5	190
4882.00	AV	Horizontal	36.79	54.00	17.21	1.7	150
7323.00	AV	Horizontal	35.96	54.00	18.04	1.7	310
9764.00	AV	Horizontal	33.46	54.00	20.54	1.0	215
12205.00	AV	Horizontal	32.67	54.00	21.33	1.2	200
14646.00	AV	Horizontal	34.65	54.00	19.35	1.7	250
17087.00	AV	Horizontal	32.77	54.00	21.23	2.1	185
19528.00	AV	Horizontal	33.01	54.00	20.99	1.3	165
21969.00	AV	Horizontal	31.85	54.00	22.15	1.3	210
24410.00	AV	Horizontal	30.09	54.00	23.91	1.7	200
2441.00	PK	Vertical	82.93	N/A	(Fund.)	1.3	30
4882.00	PK	Vertical	45.01	74.00	28.99	1.7	175
7323.00	PK	Vertical	35.74	74.00	38.26	1.8	170
9764.00	PK	Vertical	37.09	74.00	36.91	1.4	180
12205.00	PK	Vertical	35.21	74.00	38.79	1.9	220
14646.00	PK	Vertical	34.87	74.00	39.13	1.0	95
17087.00	PK	Vertical	31.11	74.00	42.89	1.4	50
19528.00	PK	Vertical	32.55	74.00	41.45	1.9	190
21969.00	PK	Vertical	29.47	74.00	44.53	2.0	185
24410.00	PK	Vertical	30.12	74.00	43.88	1.4	195
2441.00	PK	Horizontal	85.27	N/A	(Fund.)	1.7	60
4882.00	PK	Horizontal	43.12	74.00	30.88	1.7	125
7323.00	PK	Horizontal	34.75	74.00	39.25	1.7	120
9764.00	PK	Horizontal	35.63	74.00	38.37	1.7	145
12205.00	PK	Horizontal	34.14	74.00	39.86	1.8	220
14646.00	PK	Horizontal	33.84	74.00	40.16	1.1	210
17087.00	PK	Horizontal	32.65	74.00	41.35	1.3	160
19528.00	PK	Horizontal	30.11	74.00	43.89	1.3	245
21969.00	PK	Horizontal	30.06	74.00	43.94	1.1	50
24410.00	PK	Horizontal	31.04	74.00	42.96	1.3	215

Frequency (MHz)	Detector	Antenna Polarization	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Turntable Angle (°)
Upper frequency							
2480.00	AV	Vertical	77.19	N/A	(Fund.)	1.2	220
4960.00	AV	Vertical	35.25	54.00	18.75	1.4	95
7440.00	AV	Vertical	31.64	54.00	22.36	1.3	170
9920.00	AV	Vertical	31.36	54.00	22.64	1.1	130
12400.00	AV	Vertical	31.47	54.00	22.53	2.0	140
14880.00	AV	Vertical	32.98	54.00	21.02	1.5	195
17360.00	AV	Vertical	31.26	54.00	22.74	1.2	160
19840.00	AV	Vertical	30.14	54.00	23.86	1.1	260
22320.00	AV	Vertical	32.11	54.00	21.89	1.5	150
24800.00	AV	Vertical	29.84	54.00	24.16	1.0	220
2480.00	AV	Horizontal	73.82	N/A	(Fund.)	1.5	190
4960.00	AV	Horizontal	36.46	54.00	17.54	2.3	210
7440.00	AV	Horizontal	32.61	54.00	21.39	1.4	160
9920.00	AV	Horizontal	32.86	54.00	21.14	1.3	275
12400.00	AV	Horizontal	32.77	54.00	21.23	1.2	185
14880.00	AV	Horizontal	31.97	54.00	22.03	1.5	190
17360.00	AV	Horizontal	30.67	54.00	23.33	1.9	230
19840.00	AV	Horizontal	31.12	54.00	22.88	1.5	135
22320.00	AV	Horizontal	33.24	54.00	20.76	1.4	150
24800.00	AV	Horizontal	30.84	54.00	23.16	2.4	170
2480.00	PK	Vertical	86.59	N/A	(Fund.)	1.3	210
4960.00	PK	Vertical	35.66	74.00	38.34	1.0	115
7440.00	PK	Vertical	33.26	74.00	40.74	2.5	180
9920.00	PK	Vertical	31.47	74.00	42.53	1.1	160
12400.00	PK	Vertical	33.46	74.00	40.54	1.6	130
14880.00	PK	Vertical	30.02	74.00	43.98	1.0	155
17360.00	PK	Vertical	31.69	74.00	42.31	1.2	140
19840.00	PK	Vertical	30.32	74.00	43.68	1.6	190
22320.00	PK	Vertical	32.86	74.00	41.14	2.1	170
24800.00	PK	Vertical	29.87	74.00	44.13	1.0	210
2480.00	PK	Horizontal	82.11	N/A	(Fund.)	1.8	240
4960.00	PK	Horizontal	34.21	74.00	39.79	1.4	140
7440.00	PK	Horizontal	35.74	74.00	38.26	1.6	150
9920.00	PK	Horizontal	32.19	74.00	41.81	1.5	265
12400.00	PK	Horizontal	32.68	74.00	41.32	1.6	160
14880.00	PK	Horizontal	30.22	74.00	43.78	1.6	150
17360.00	PK	Horizontal	32.61	74.00	41.39	2.1	190
19840.00	PK	Horizontal	31.41	74.00	42.59	1.3	245
22320.00	PK	Horizontal	33.26	74.00	40.74	1.9	170
24800.00	PK	Horizontal	30.84	74.00	43.16	1.6	260

Duty Cycle

Test Requirement: FCC Part 15.35

Test Mothed: ANSI C63.4:2003

Test Status: TX mode.

7.7 Test Procedure

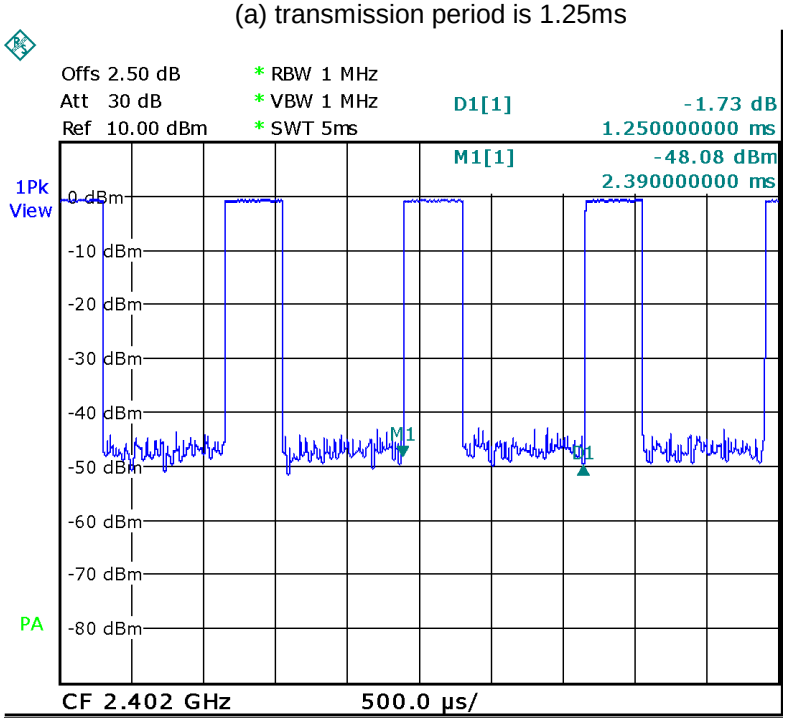
1. The EUT was placed on a turntable which is 0.8m above ground plane

2. Set EUT as normal wrking mode

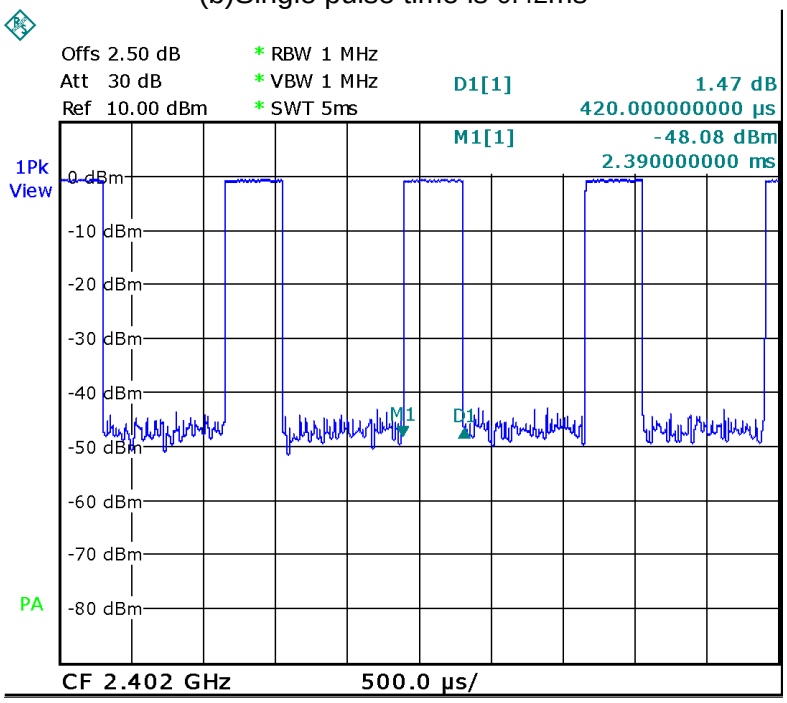
3. Set SPA center frequency = fundamental frequency, RBW = 100 kHz, VBW = 100 kHz, Span = 0 Hz, Adjacent sweep time.

7.8 Test Result

(a) transmission period is 1.25ms



(b)Single pulse time is 0.42ms



The EUT is auto. operation for transmitter，it is declared by the manufacturer as a duty cycle ratio of less than 100%.

The EUT's work time : T_{on} =pulse time=0.42 ms

The EUT's work period :$T=T_{ON}+T_{OFF}$= transmission period =1.25 ms

The EUT's duty cycle : $D = T_{on} /T = 0.42/1.25*100\% = 34\%$

Duty Cycle Correction Factor(dB)=$20 * Log_{10}$(Duty Cycle)=$20* Log_{10}$(34 %)

= -9dB

8 Spurious RF Conducted Emissions from out of band

Test Requirement: FCC Part 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.

Test Mothed: DA 00-705

Test Status: TX mode

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 to span from the lowest frequency generated in the device up to and including the tenth harmonic of the highest fundamental frequency.
3. Set RBW = 100kHz and VBW = 300kHz.Sweep =auto.
4. mark the worst point and record.

8.2 Test Result

Test Frequency: Below 30MHz

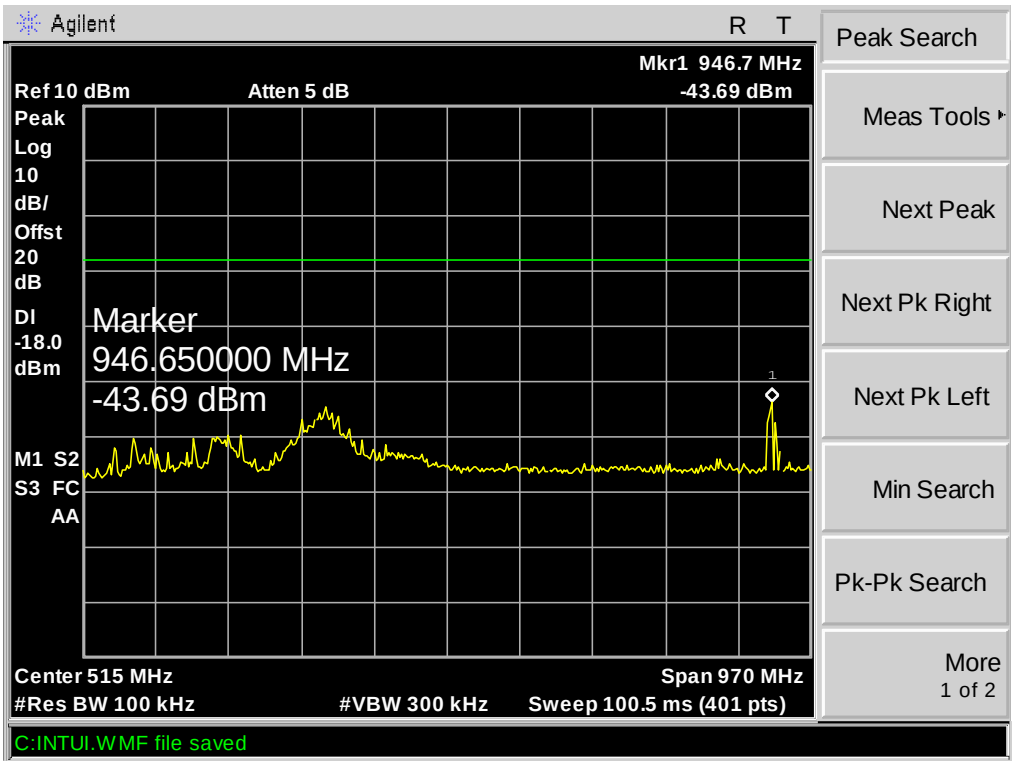
Remark: For emissions below 30MHz,no emission higher than background level, so the data does not show in the report.

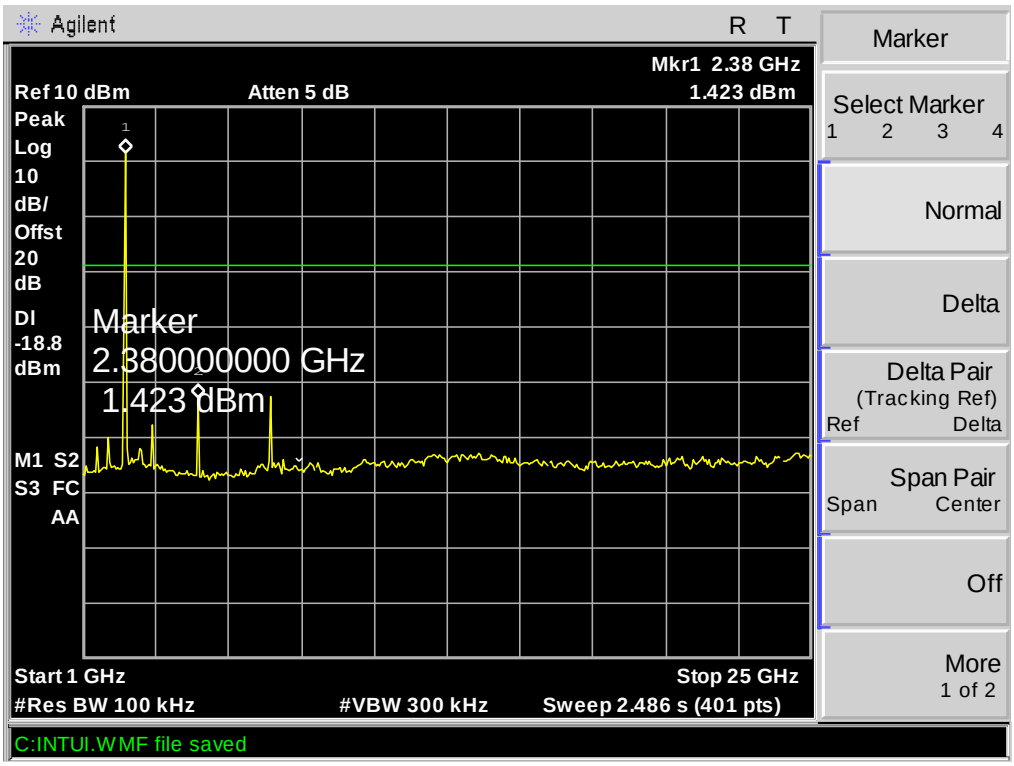
Test Frequency: 30MHz ~ 25GHz

Test result plots shown as follows:

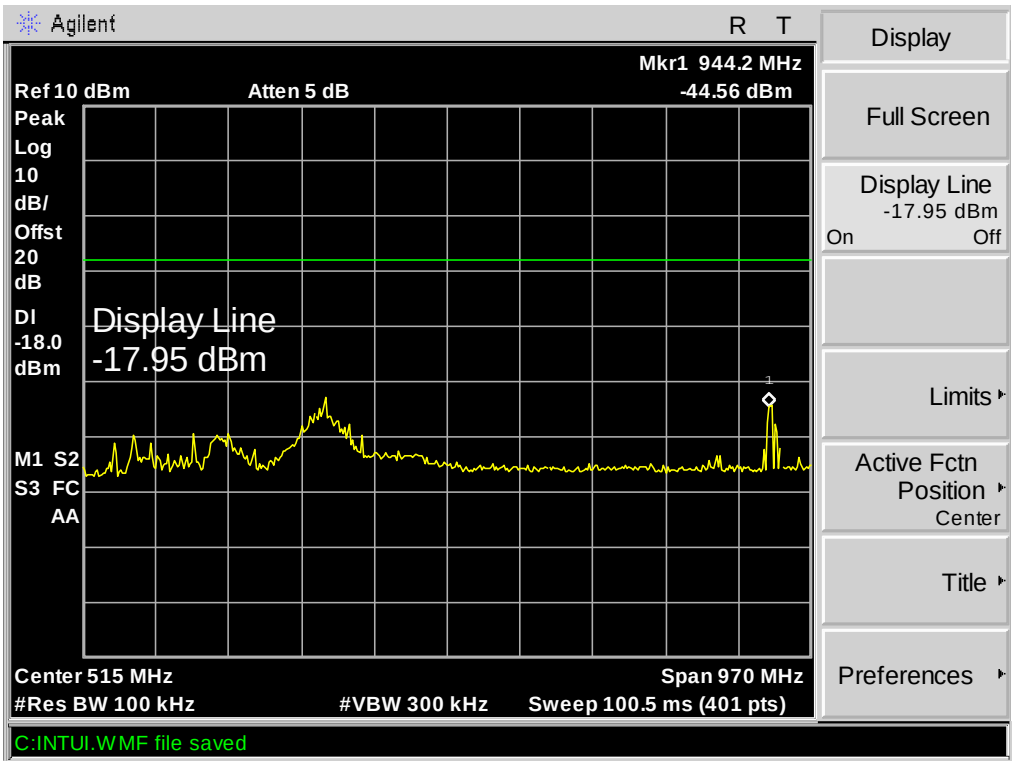
Modulation:GFSK

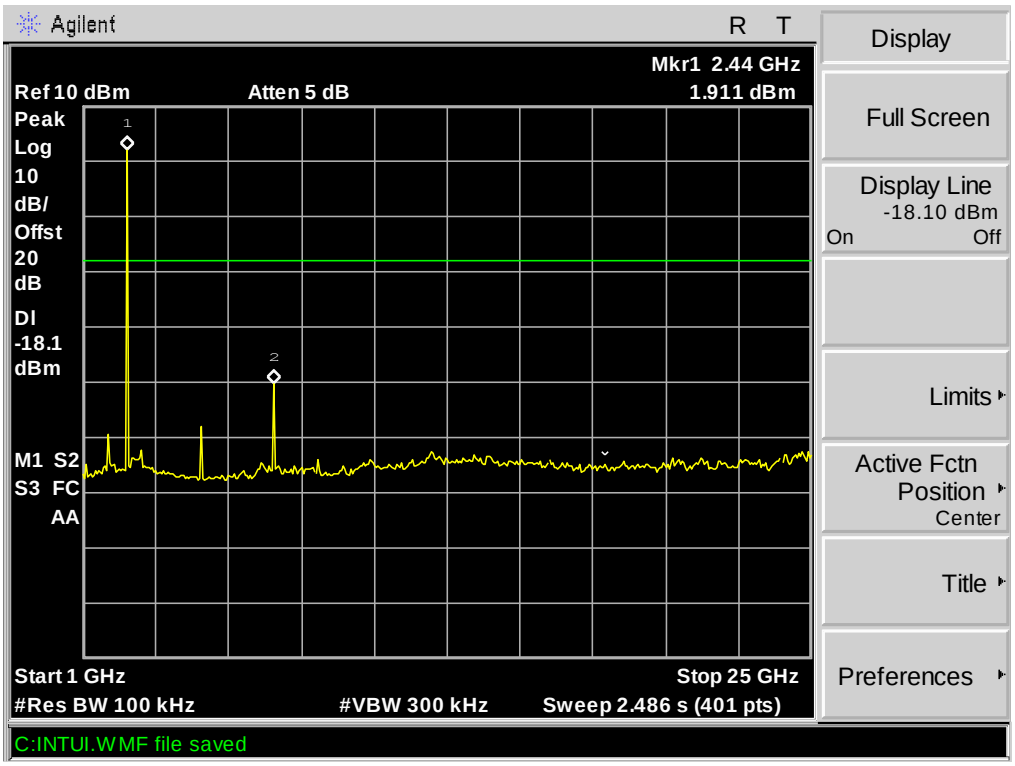
Lower Channel



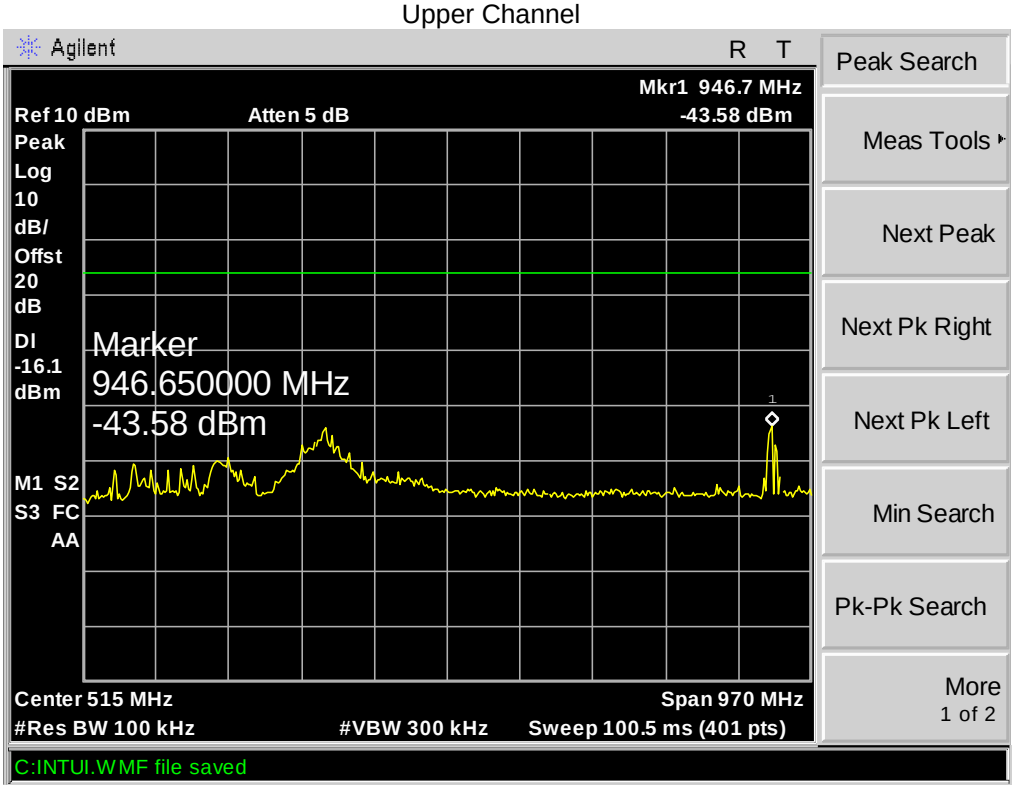


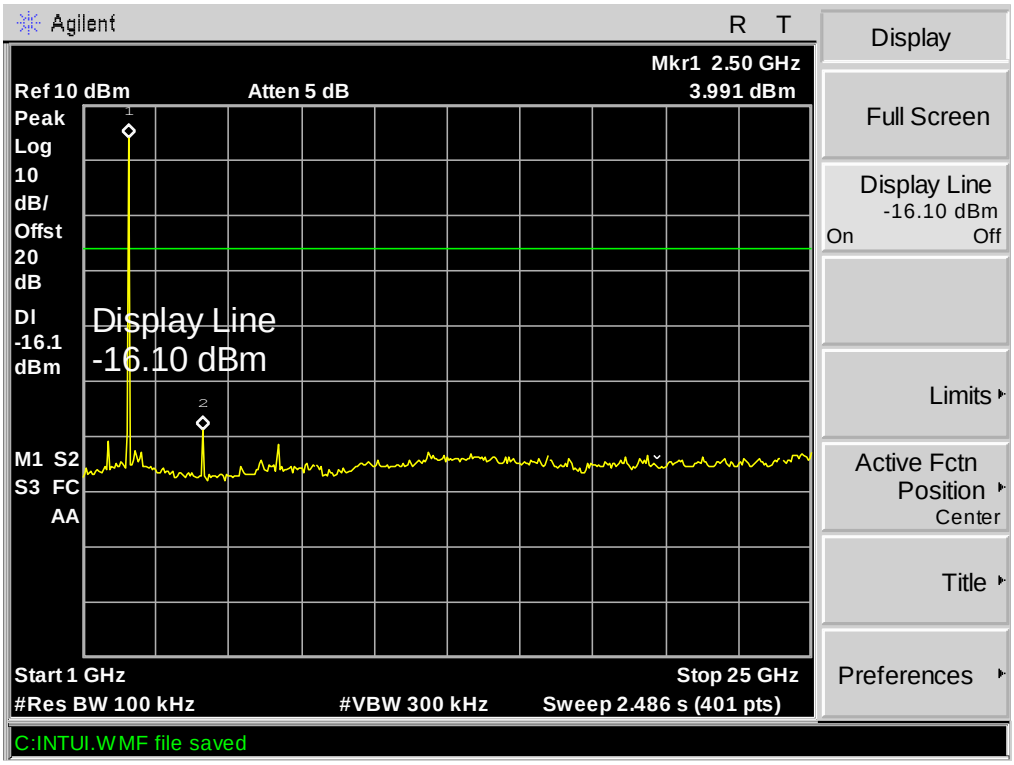
Middle Channel





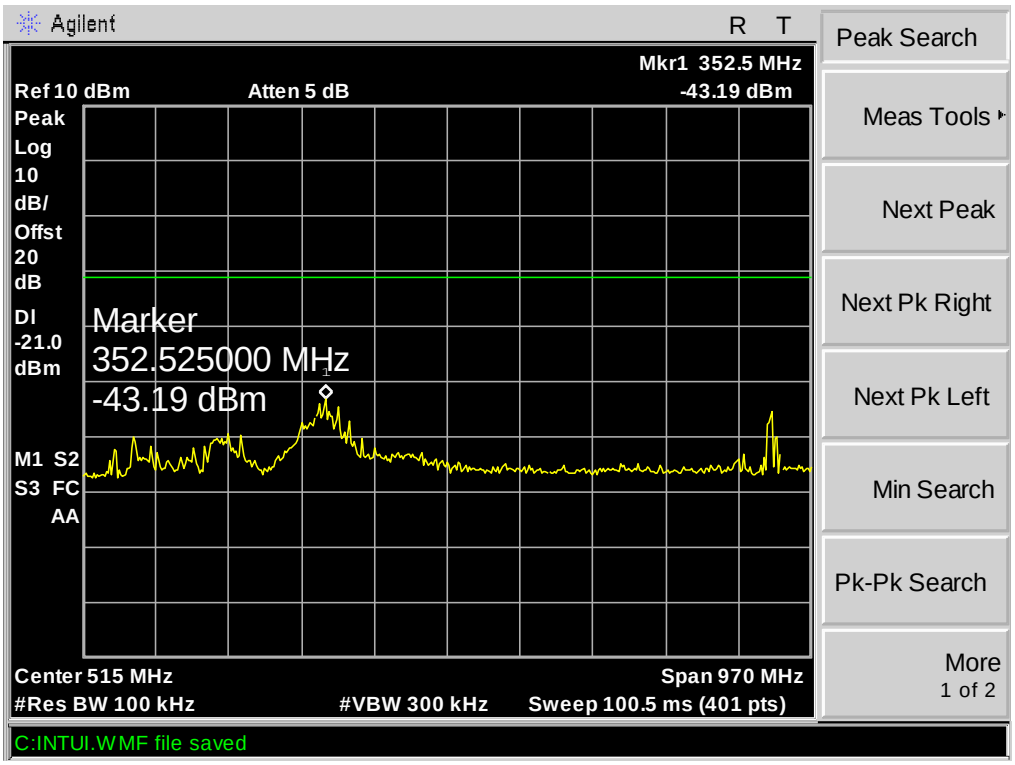
Upper Channel

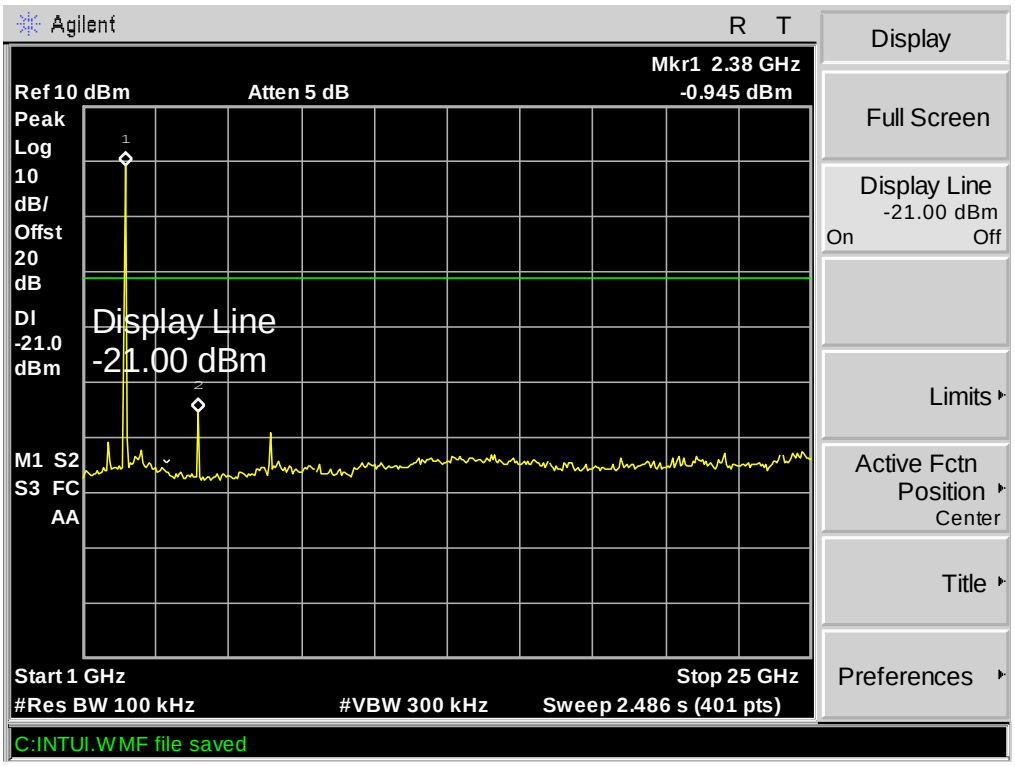




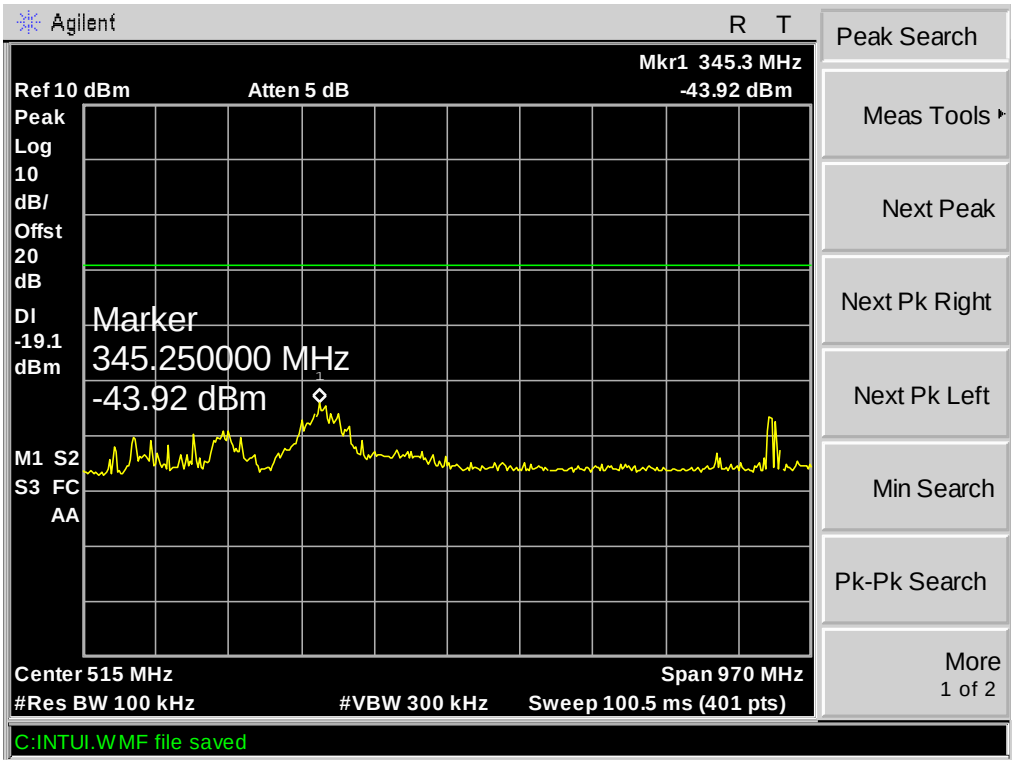
Modulation: Pi/4DQPSK

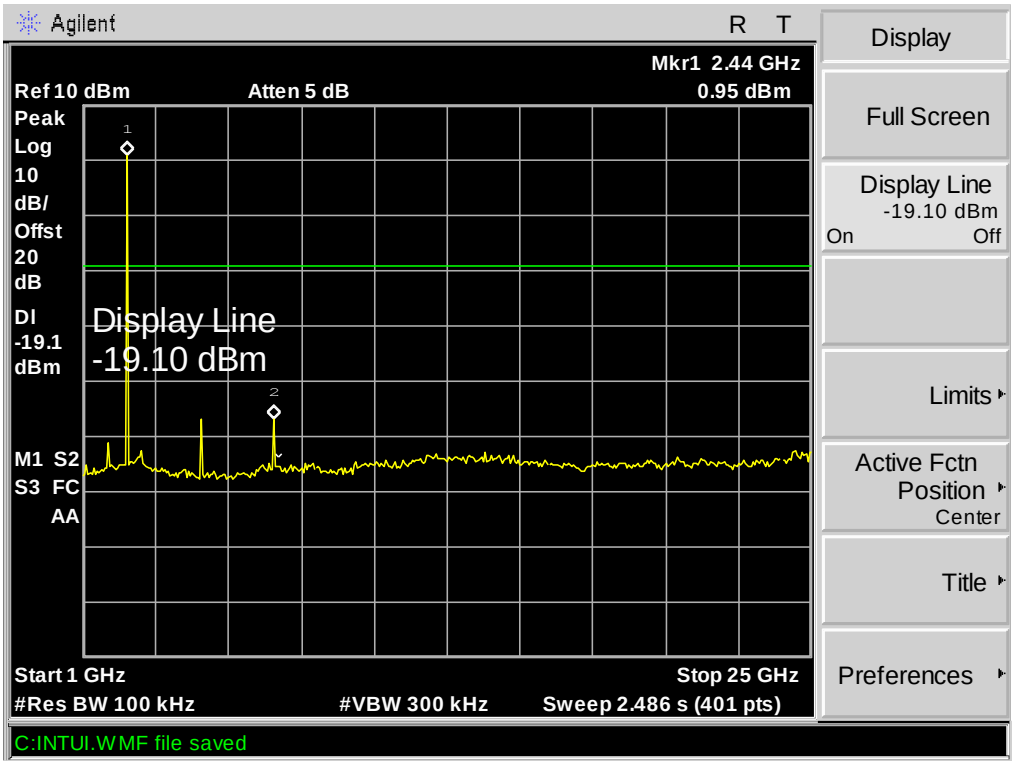
Lower Channel



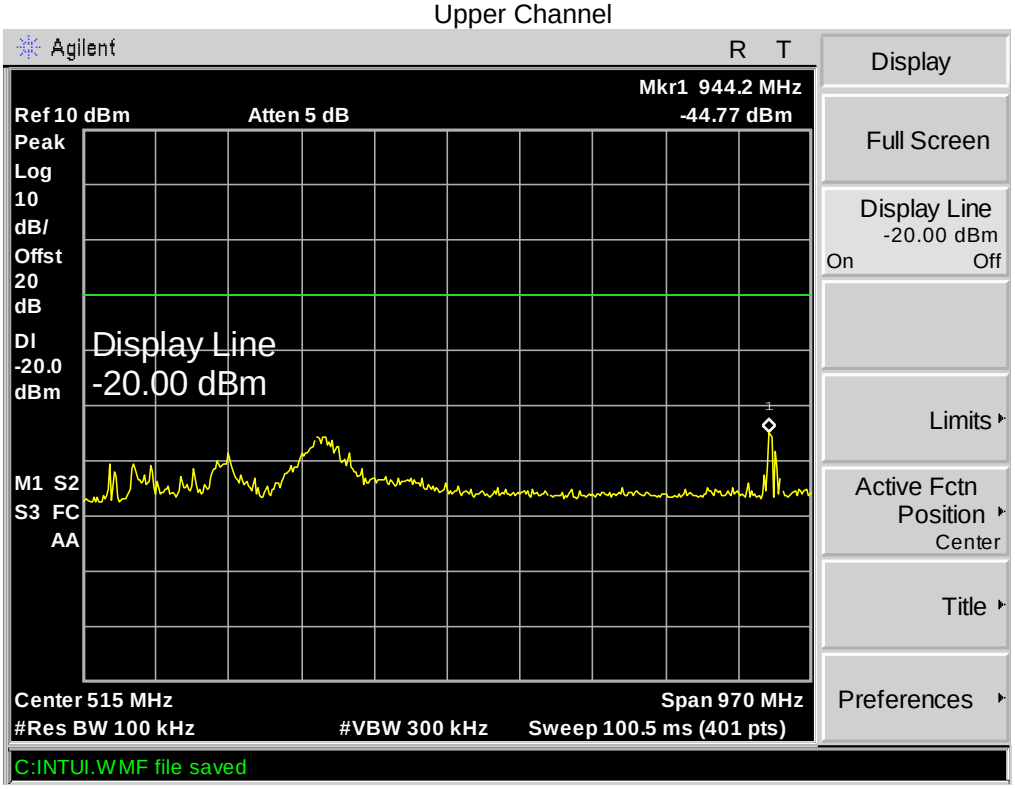


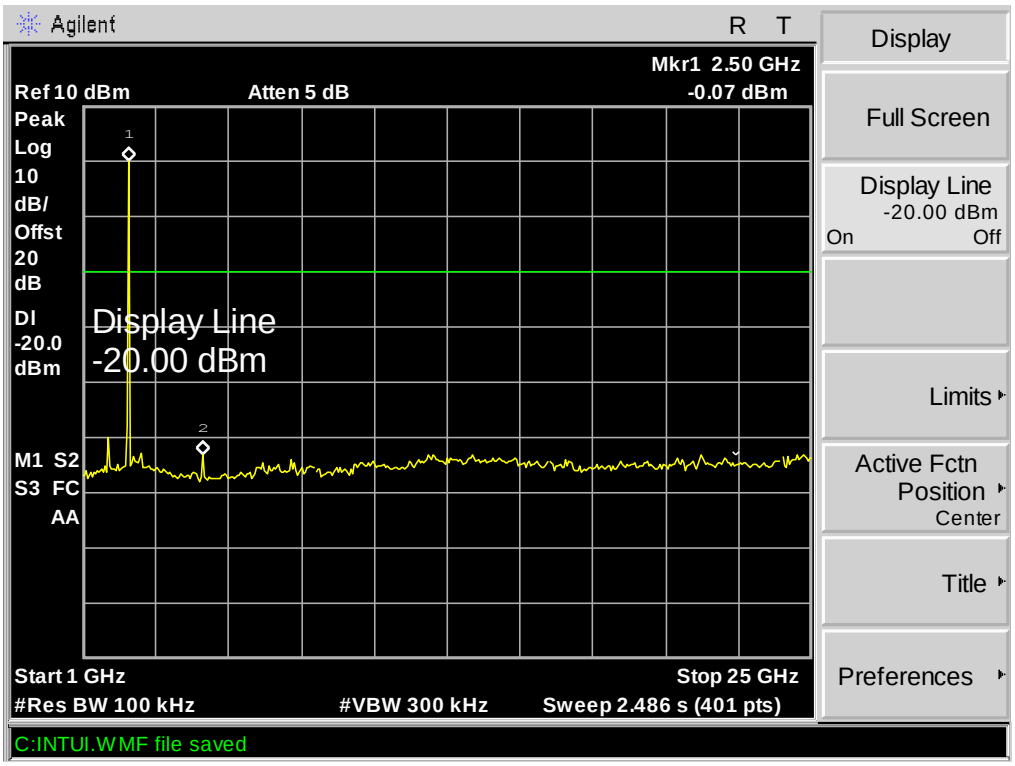
Middle Channel





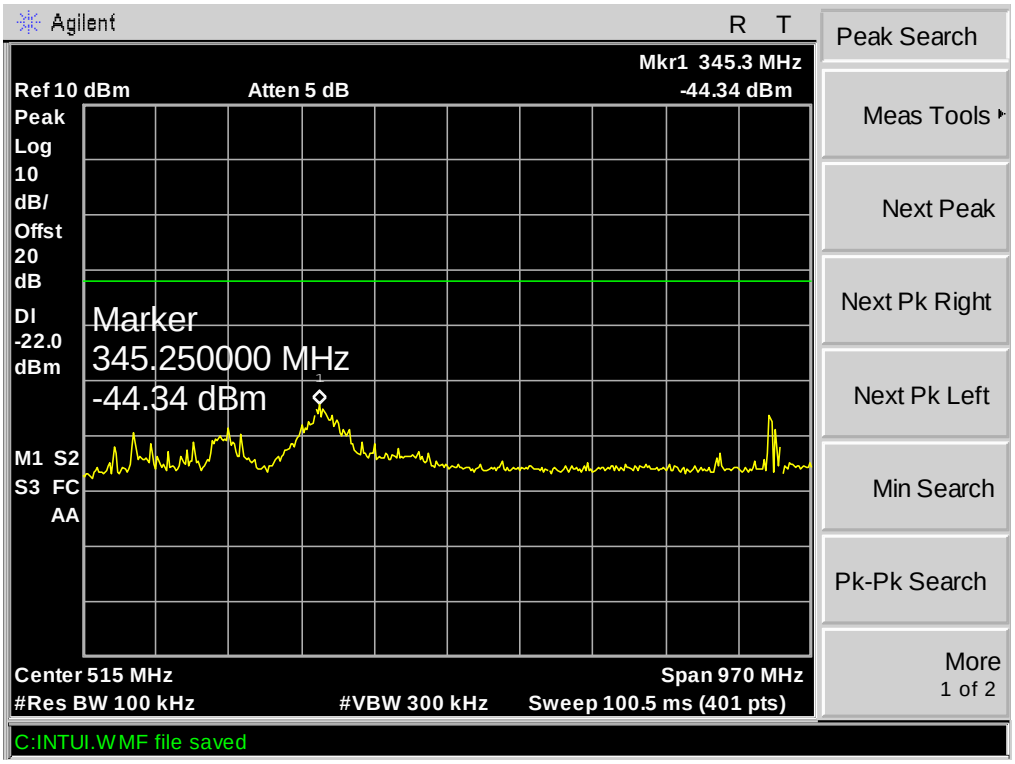
Upper Channel

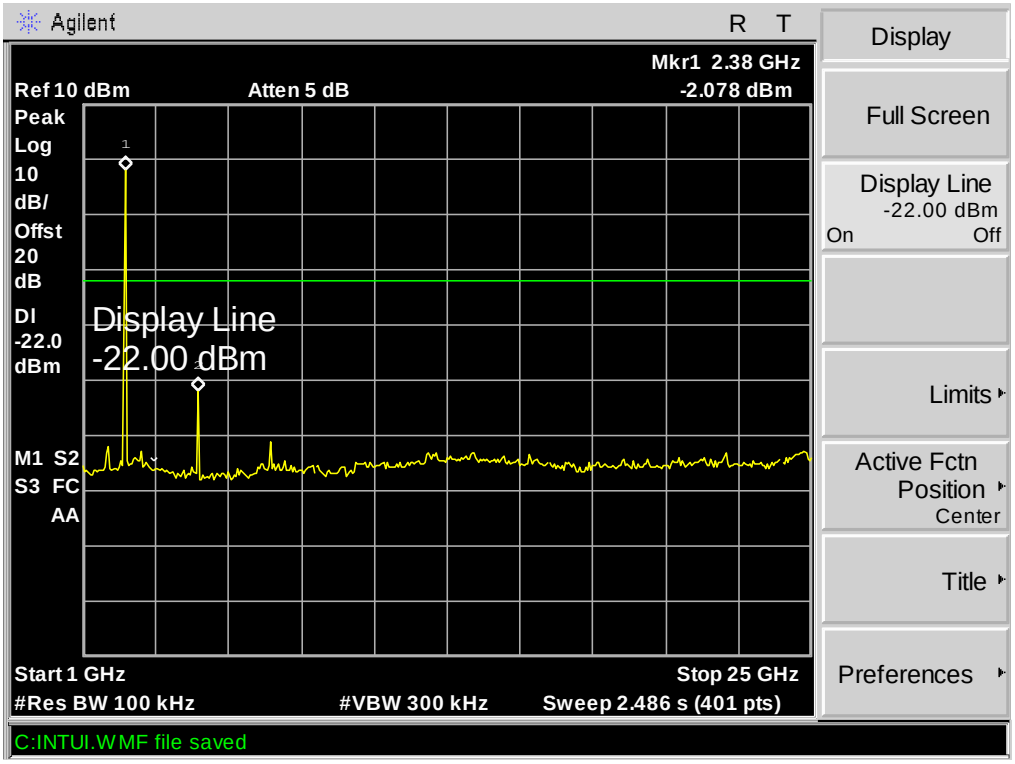




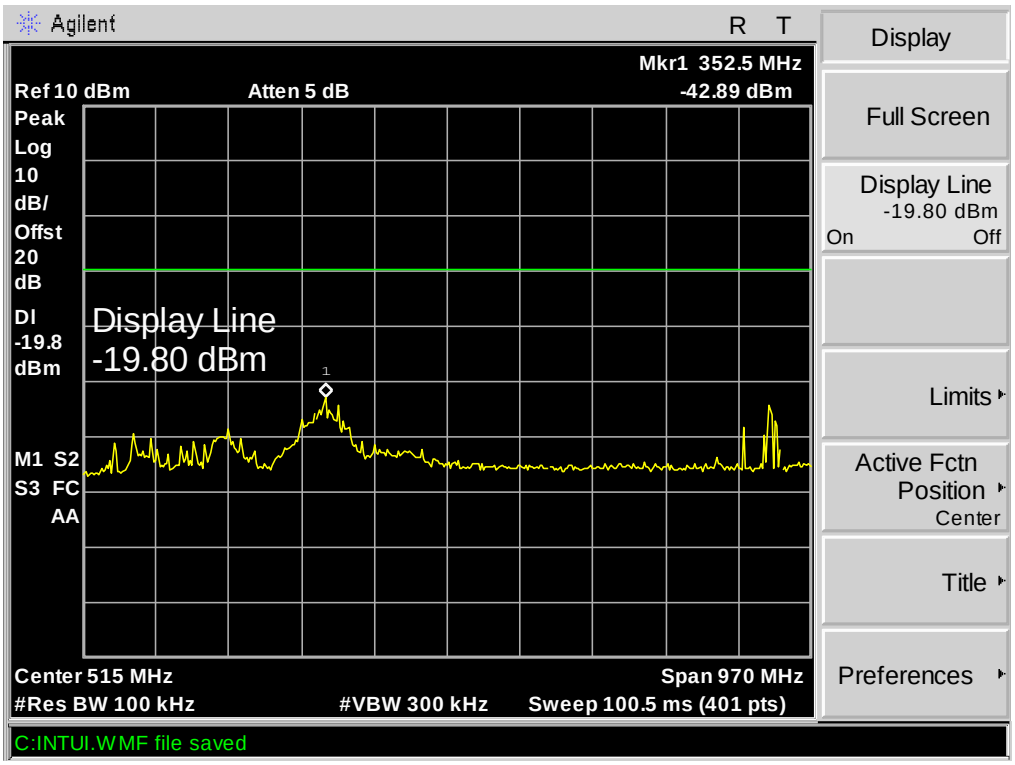
Modulation: 8DPSK

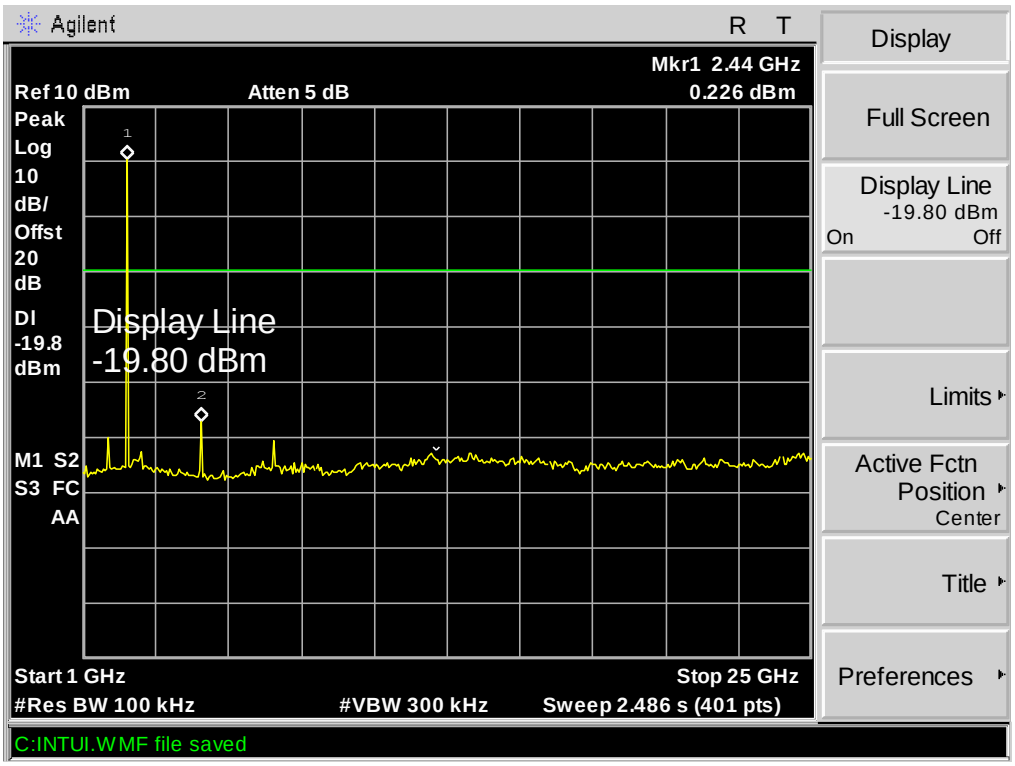
Lower Channel



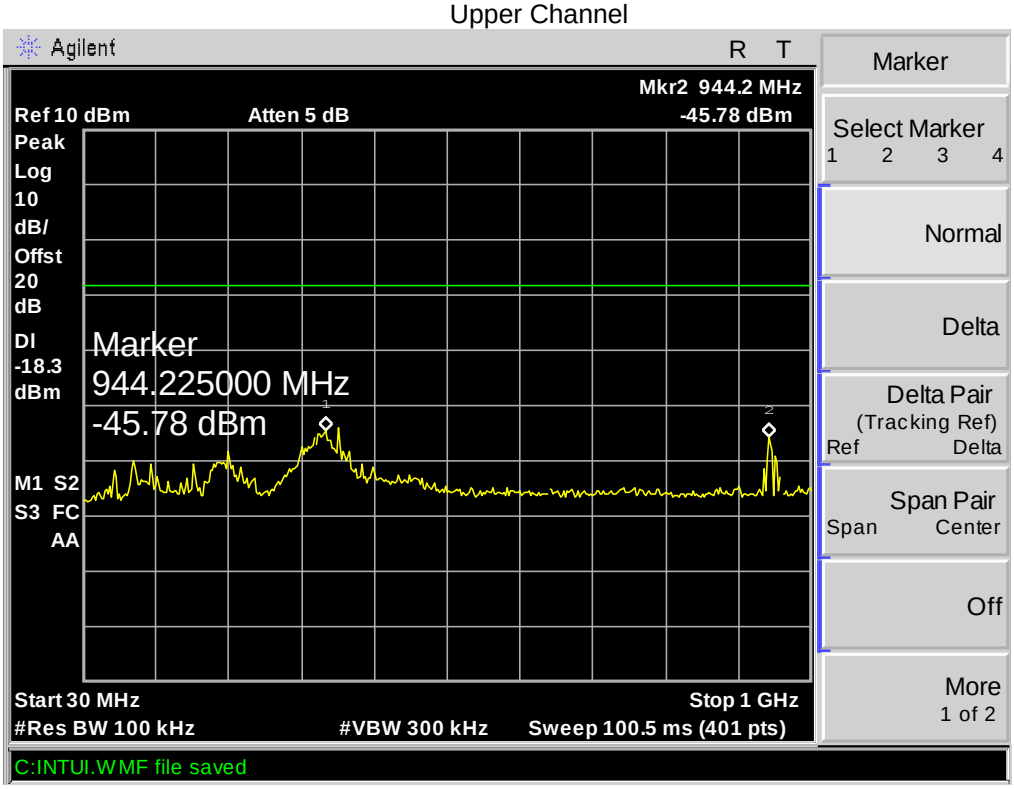


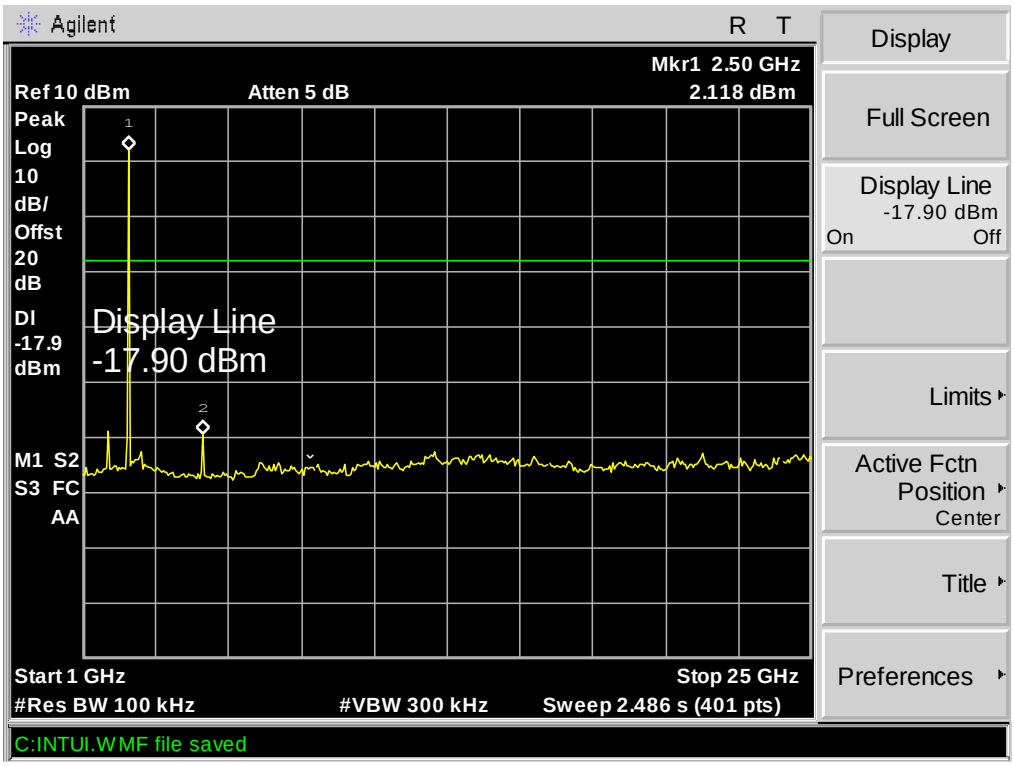
Middle Channel





Upper Channel





9 Band Edge Measurements

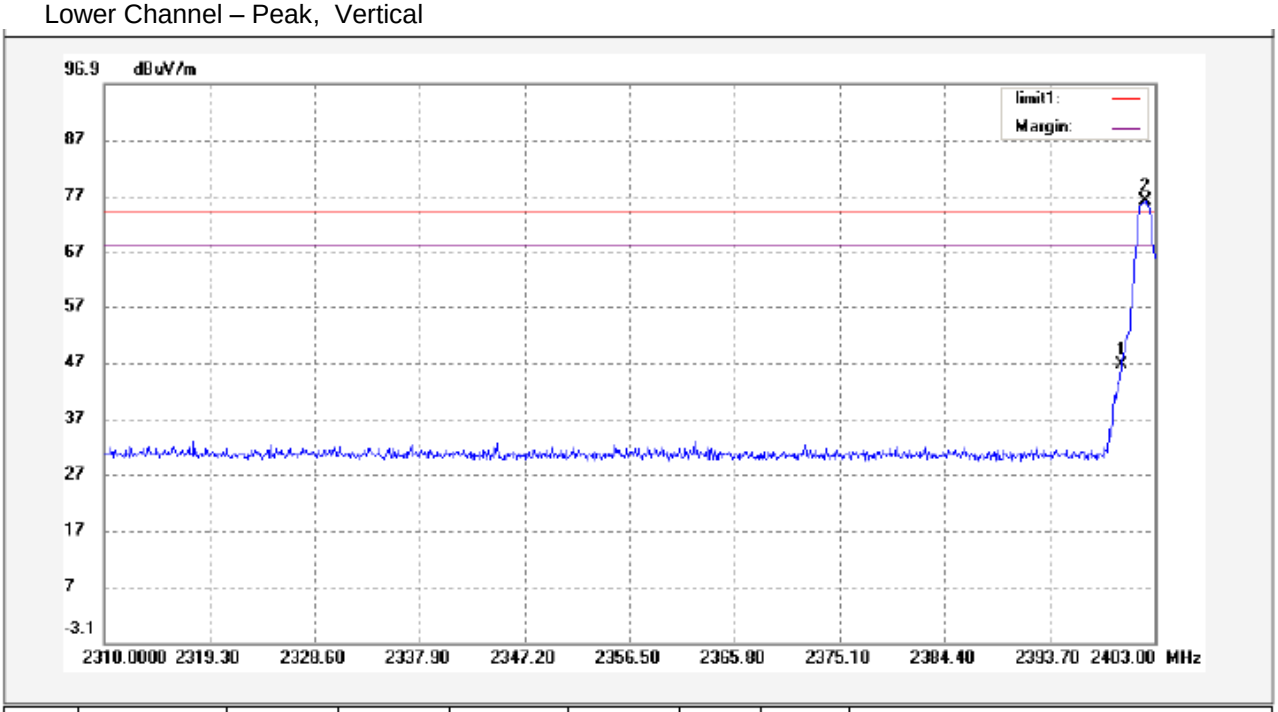
Test Requirement:	Section 15.247(d) In addition, radiated emissions which fall in the restricted bands. As defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).
Test Method:	DA 00-705
Measurement Distance:	3m
Limit:	40.0 dBuV/m between 30MHz & 88MHz; 43.5 dBuV/m between 88MHz & 216MHz; 46.0 dBuV/m between 216MHz & 960MHz; 54.0 dBuV/m above 960MHz. 74.0 dBuV/m for peak above 1GHz 54.0 dBuV/m for AVG above 1GHz

9.1 Test Procedure:

Detector:	For Peak value: RBW = 1 MHz for f ≥ 1 GHz VBW ≥ RBW; Sweep = auto Detector function = peak Trace = max hold For AVG value: RBW = 1 MHz for f ≥ 1 GHz VBW = 10Hz; Sweep = auto Detector function = AVG Trace = max hold
Test mode:	Test in fixing operating frequency at lower and upper channel.

9.2 Test Result:

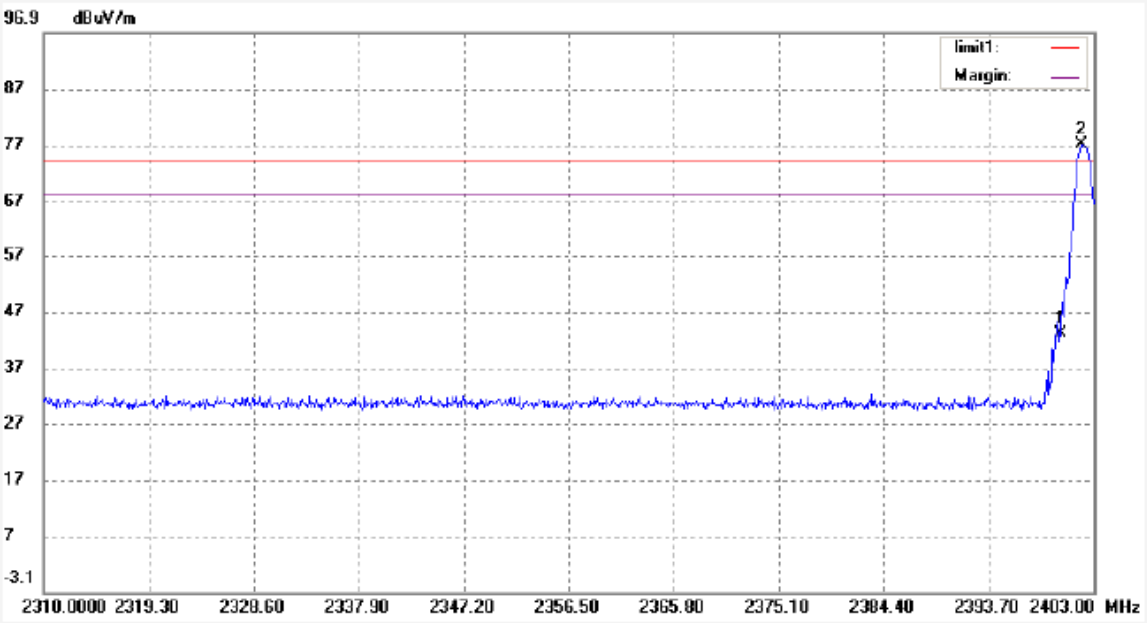
Lower Channel – Peak, Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2400.000	62.10	-15.58	46.52	74.00	-27.48	peak	
2	2402.163	91.71	-15.59	76.12	74.00	2.12	peak	

No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2400.000	-9	37.52	54.00	-16.48	AV	
2	2402.000	-9	67.12	54.00	13.12	AV	

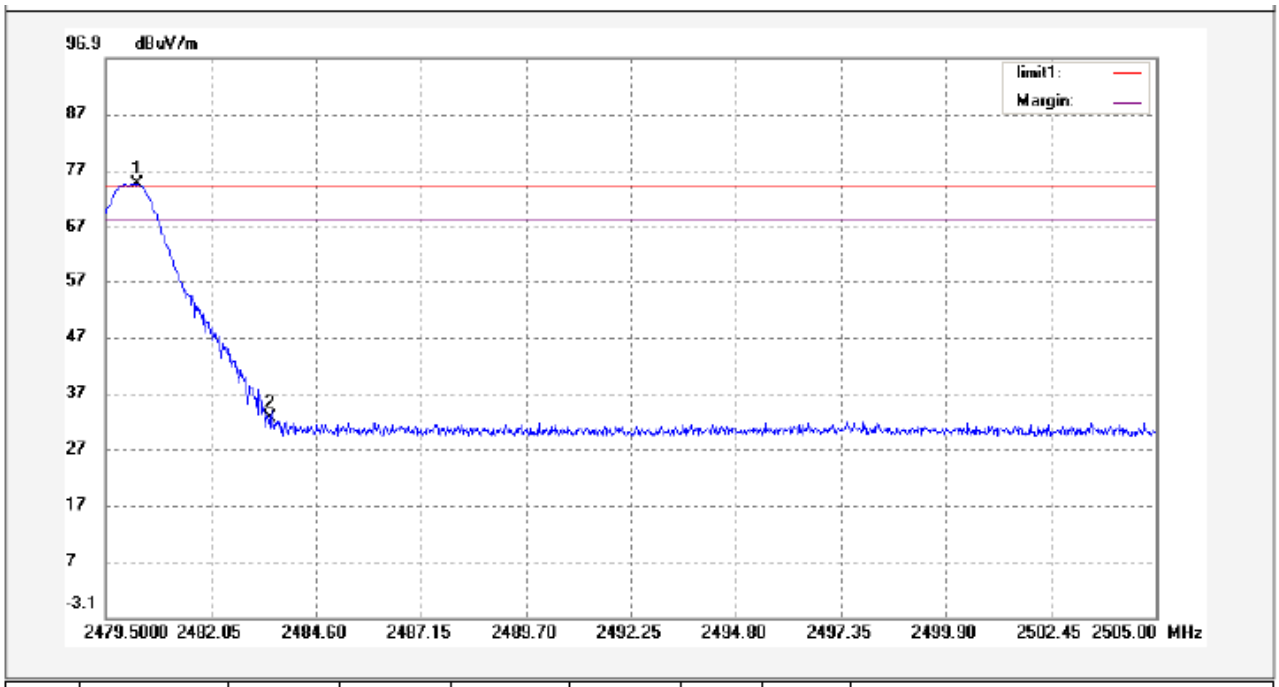
Lower Channel – Peak, Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2400.000	58.60	-15.58	43.02	74.00	-30.98	peak	
2	2401.977	92.54	-15.58	76.96	74.00	2.96	peak	

No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2400.000	-9	34.02	54.00	-19.98	AV	
2	2401.977	-9	67.96	54.00	13.96	AV	

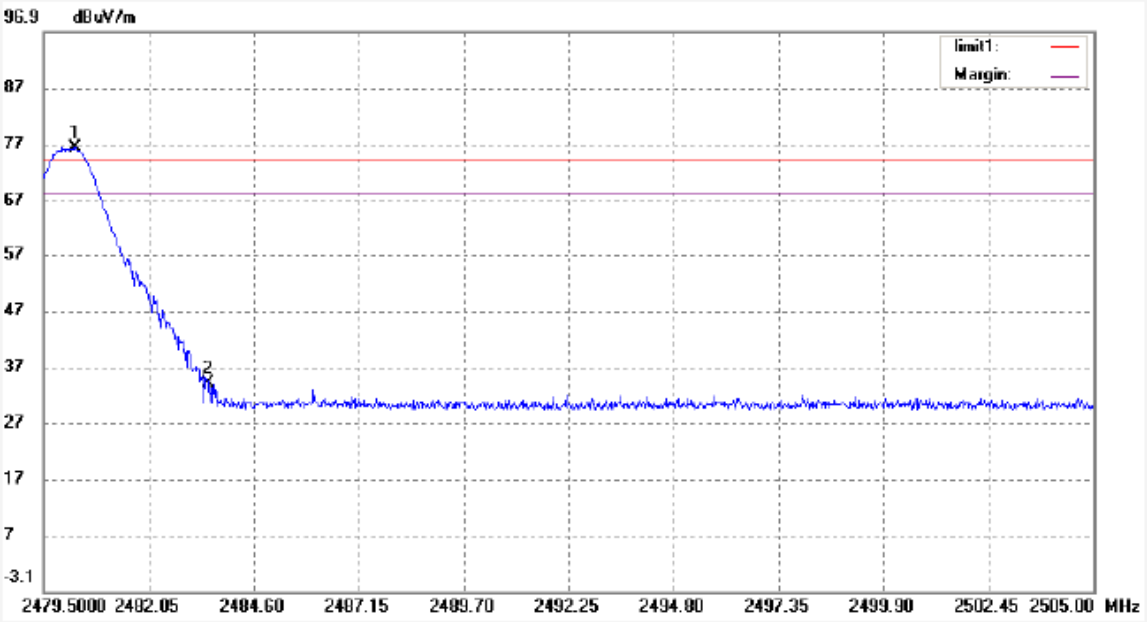
Upper Channel – Peak, Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2480.240	90.25	-15.68	74.57	74.00	0.57	peak	
2	2483.500	48.28	-15.67	32.61	74.00	-41.39	peak	

No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2480.240	-9	65.57	54.00	11.57	AV	
2	2483.500	-9	23.61	54.00	-30.39	AV	

Upper Channel – Peak, Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2480.240	91.90	-15.68	76.22	74.00	2.22	peak	
2	2483.500	49.58	-15.67	33.91	74.00	-40.09	peak	

No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2480.240	-9	67.22	54.00	13.22	AV	
2	2483.500	-9	24.91	54.00	-29.09	AV	

10 20 dB Bandwidth Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.247
Test Method: DA 00-705
Test Mode: Test in fixing operating frequency at lower, middle, upper 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 = 100kHz, VBW = 100kHz

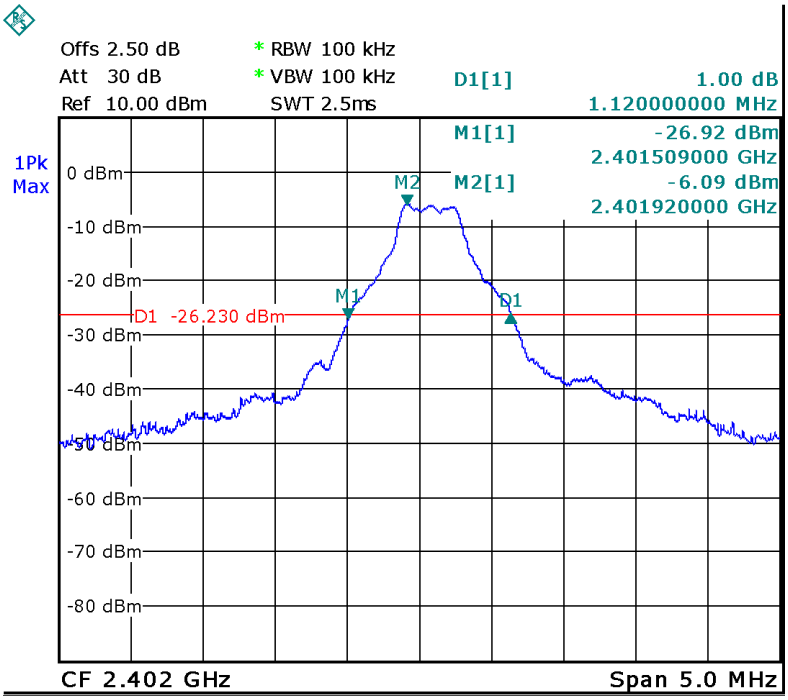
10.2 Test Result:

Modulation	Test Channel	Bandwidth(MHz)
GFSK	Lower	1.120
	Middle	1.128
	Upper	1.128
Pi/4DQPSK	Lower	1.367
	Middle	1.357
	Upper	1.376
8DPSK	Lower	1.356
	Middle	1.356
	Upper	1.346

Test result plot as follows:

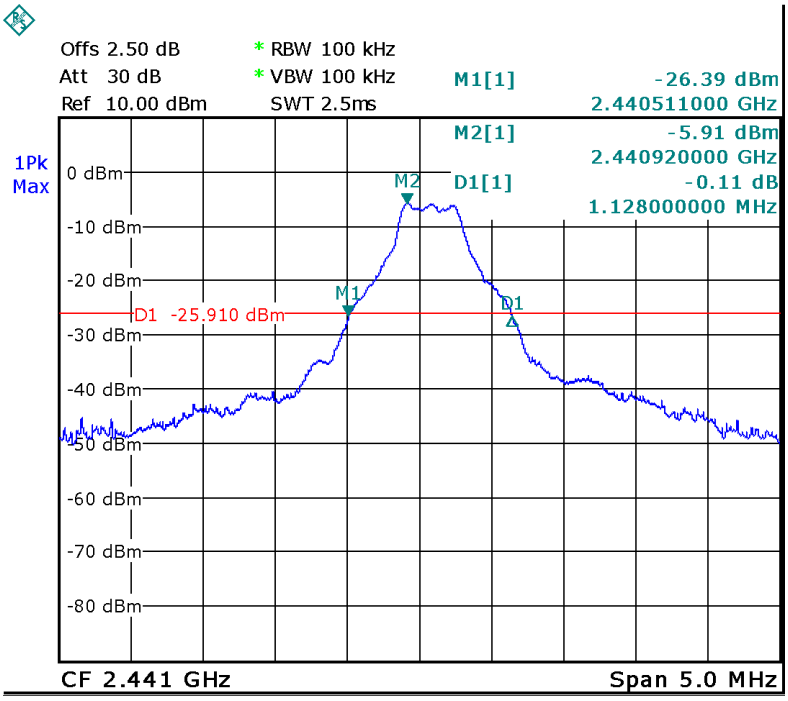
Modulation:GFSK

Lower Channel



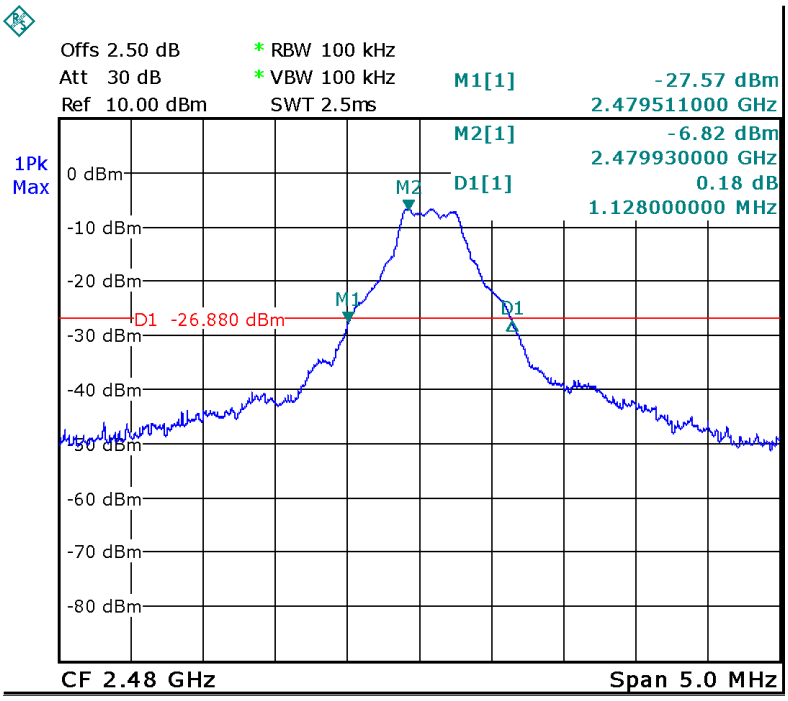
Date: 27.MAY.2013 16:16:16

Middle Channel



Date: 27.MAY.2013 16:19:58

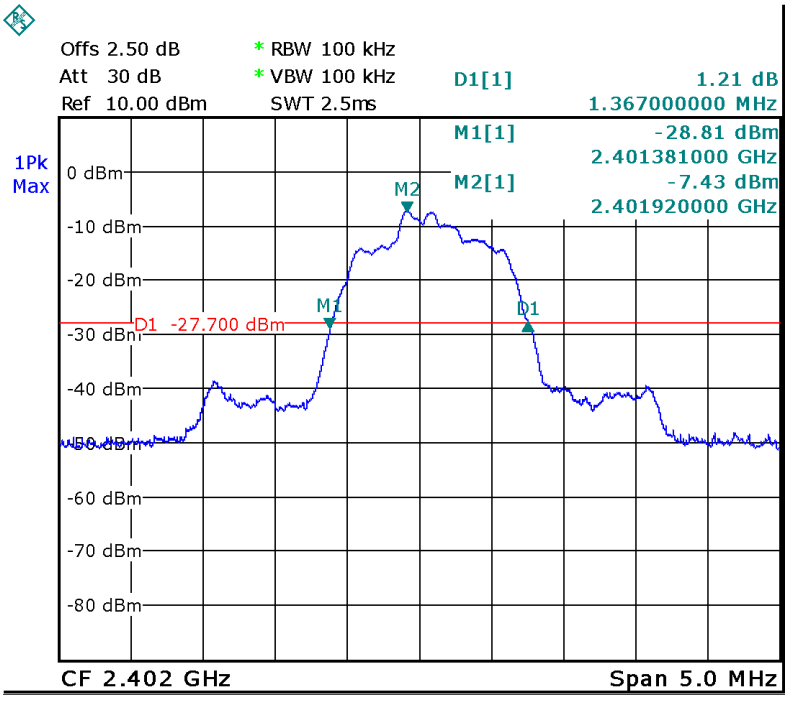
Upper Channel



Date: 27.MAY.2013 16:20:53

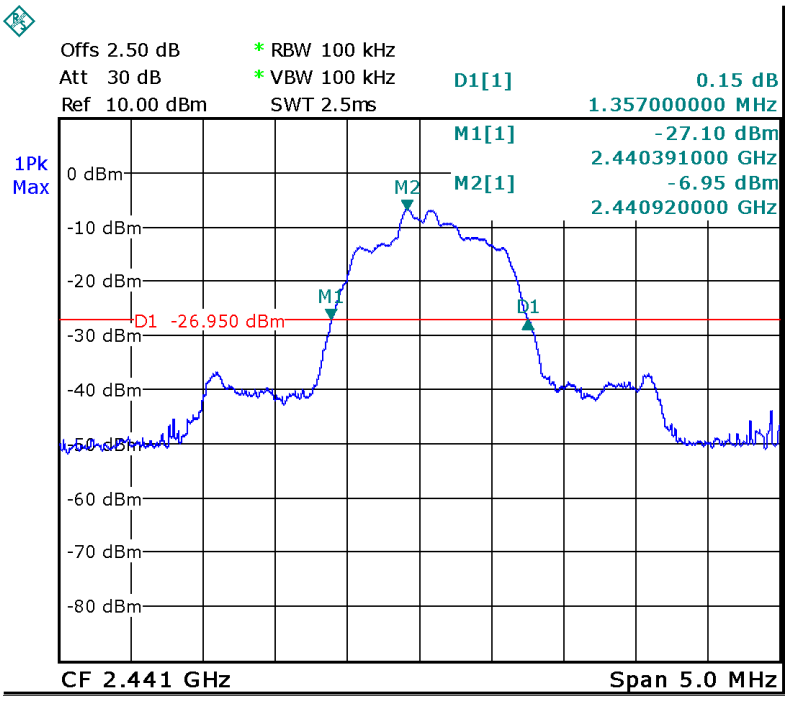
Modulation: Pi/4DQPSK

Lower Channel



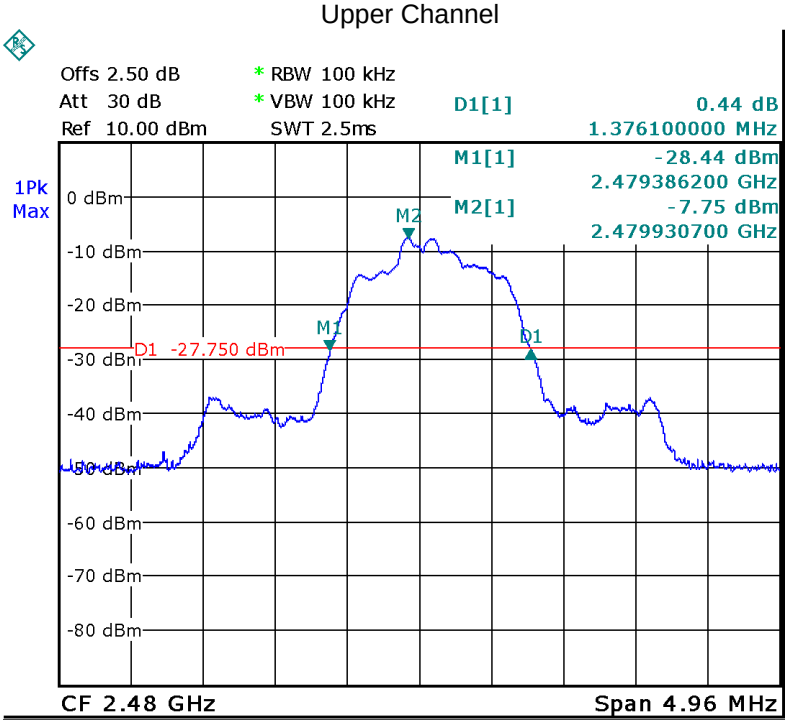
Date: 27.MAY.2013 16:22:43

Middle Channel



Date: 27.MAY.2013 16:23:51

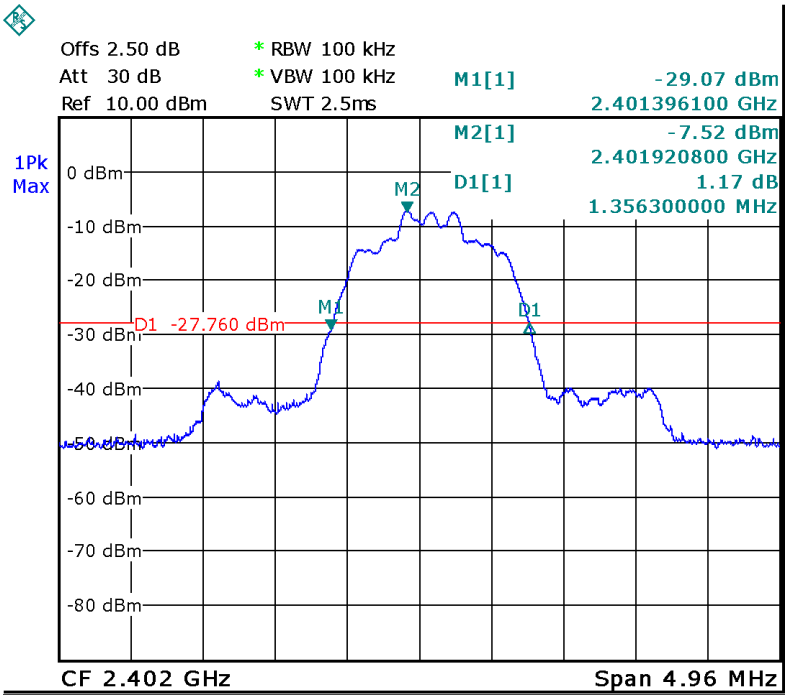
Upper Channel



Date: 27.MAY.2013 16:25:00

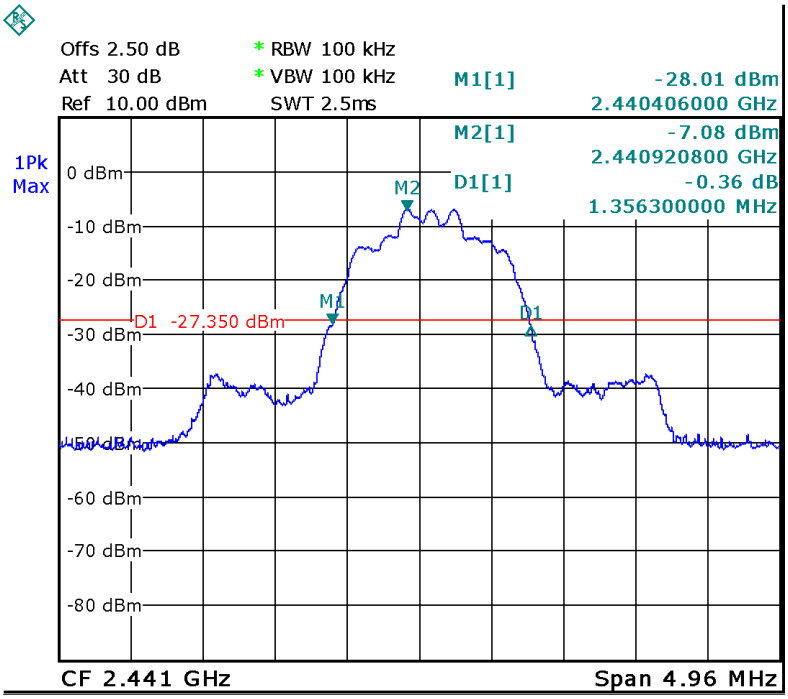
Modulation: 8DPSK

Lower Channel



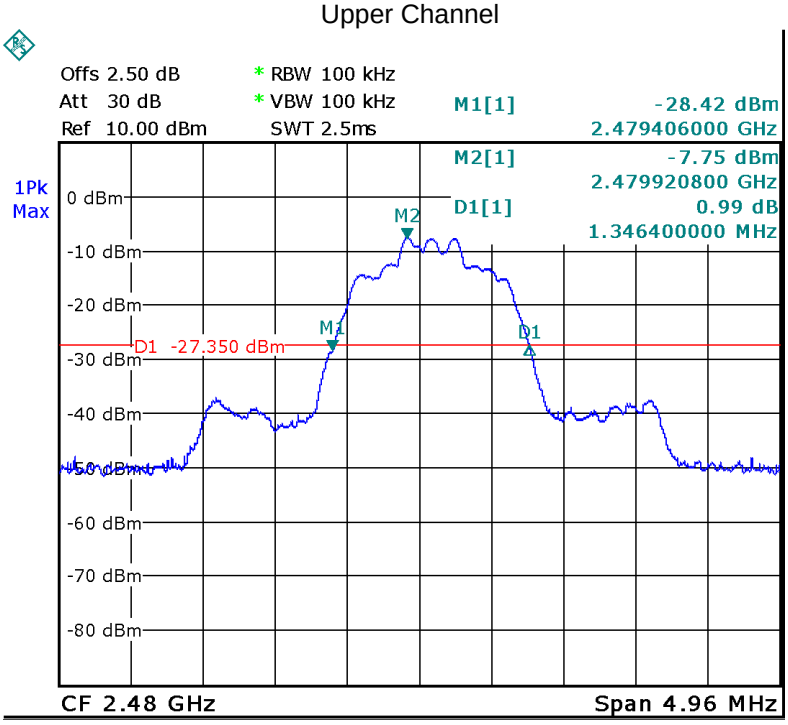
Date: 27.MAY.2013 16:26:33

Middle Channel



Date: 27.MAY.2013 16:27:25

Upper Channel



Date: 27.MAY.2013 16:28:17

11 Maximum Peak Output Power

Test Requirement: FCC CFR47 Part 15 Section 15.247
Test Method: ANSI C63.4:2003
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 operating frequency at lower, middle, upper channel.

11.1 Test Procedure:

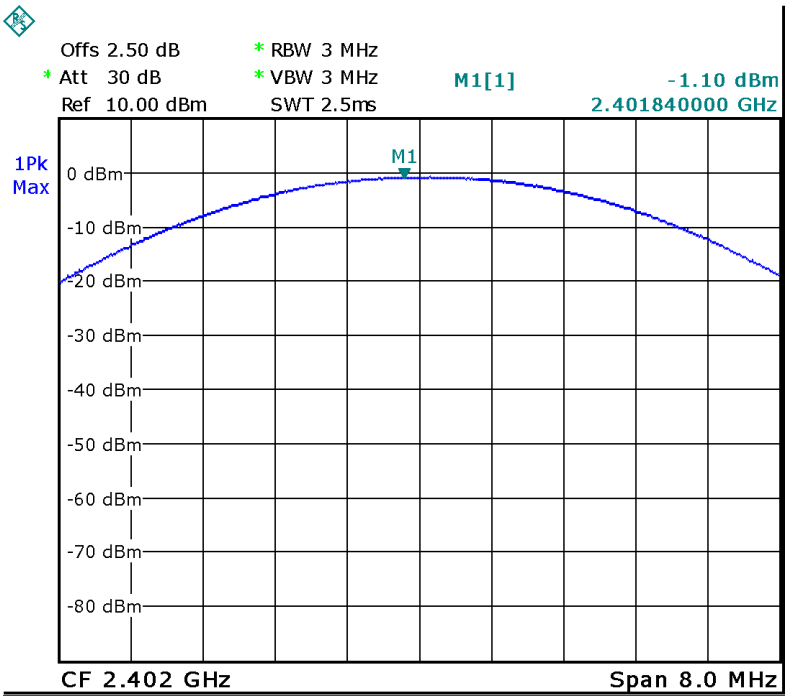
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 3MHz. VBW = 3MHz. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

11.2 Test Result:

Modulation	Test Channel	Output Power (dBm)	Limit (dBm)
GFSK	Lower	-1.10	30
	Middle	-0.97	30
	Upper	-1.69	30
Pi/4DQPSK	Lower	-2.37	30
	Middle	-2.09	30
	Upper	-2.61	30
8DPSK	Lower	-2.34	30
	Middle	-2.13	30
	Upper	-2.60	30

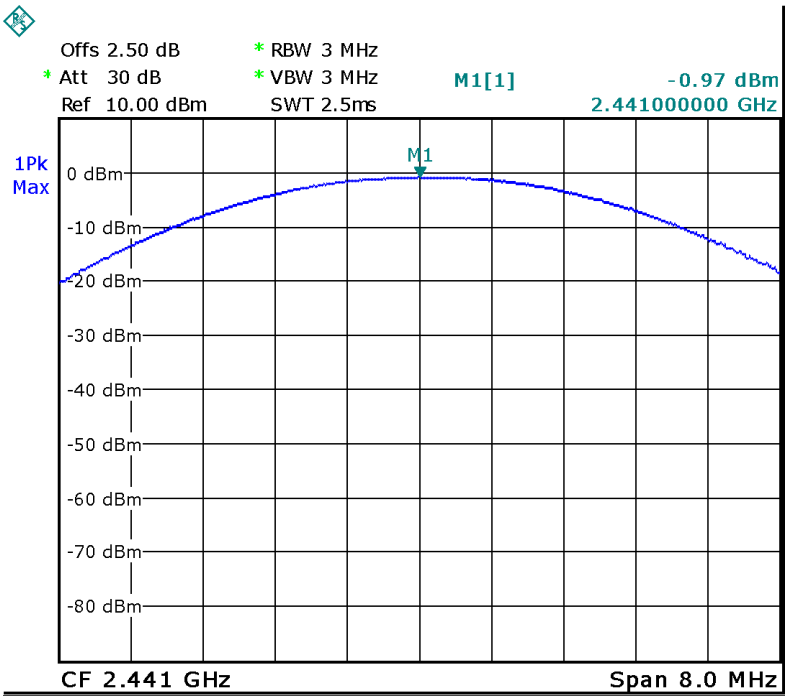
Modulation:GFSK

Lower Channel



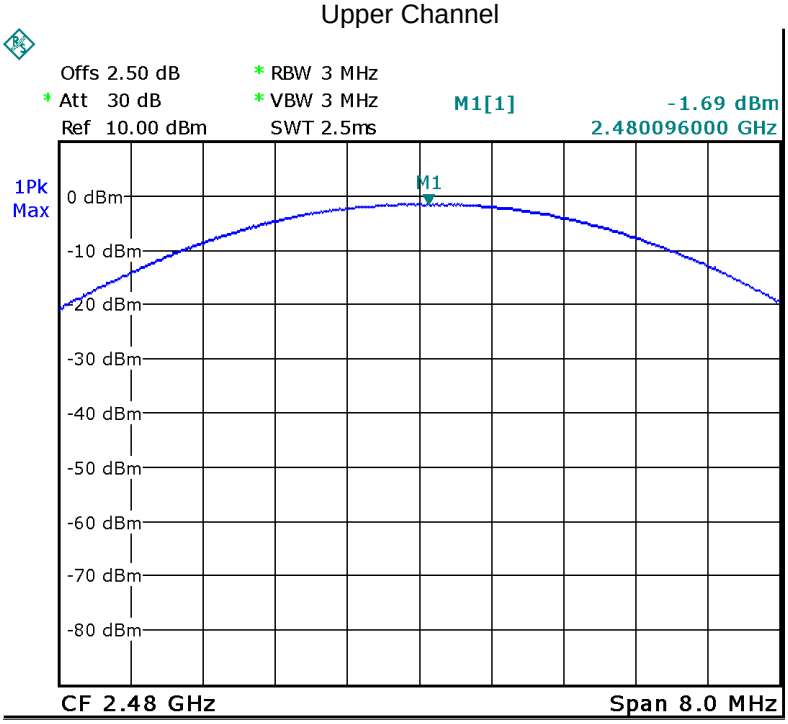
Date: 27.MAY.2013 16:47:02

Middle Channel



Date: 27.MAY.2013 16:47:27

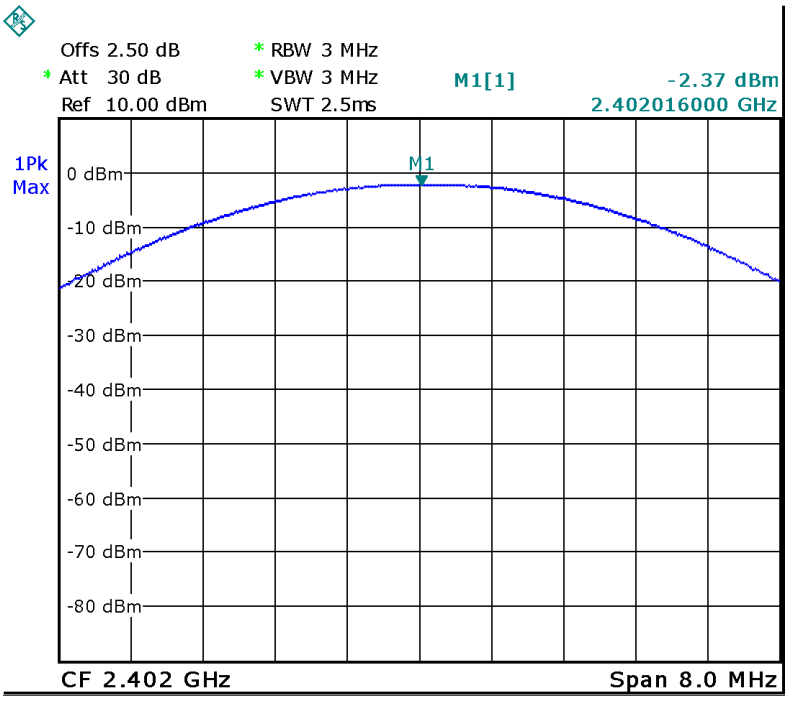
Upper Channel



Date: 27.MAY.2013 16:47:56

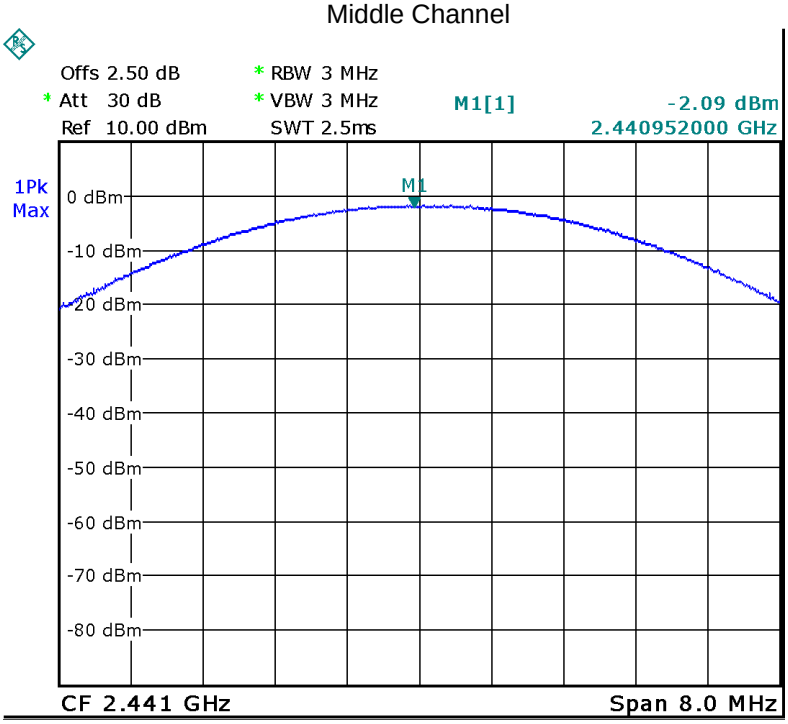
Modulation: Pi/4DQPSK

Lower Channel



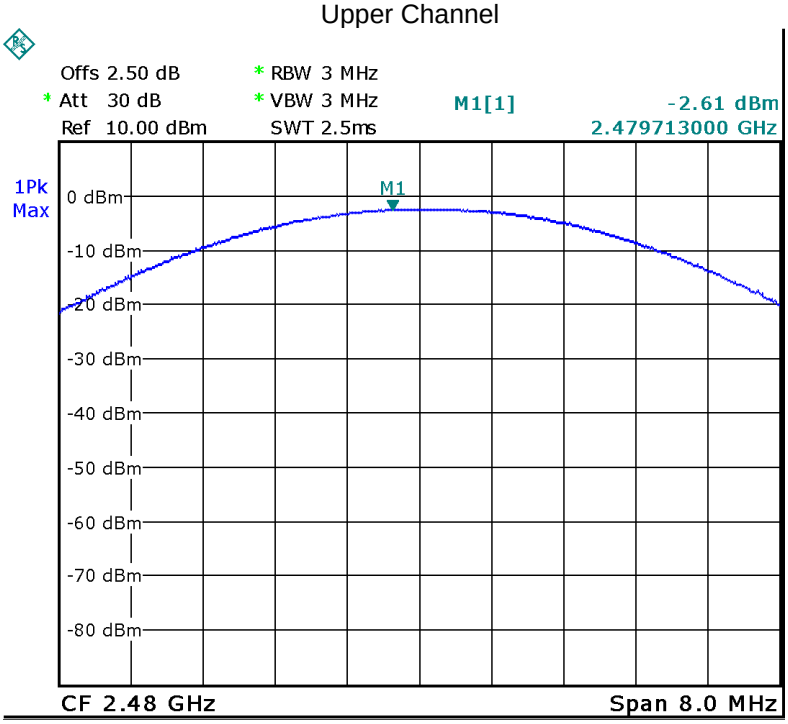
Date: 27.MAY.2013 16:48:38

Middle Channel



Date: 27.MAY.2013 16:48:59

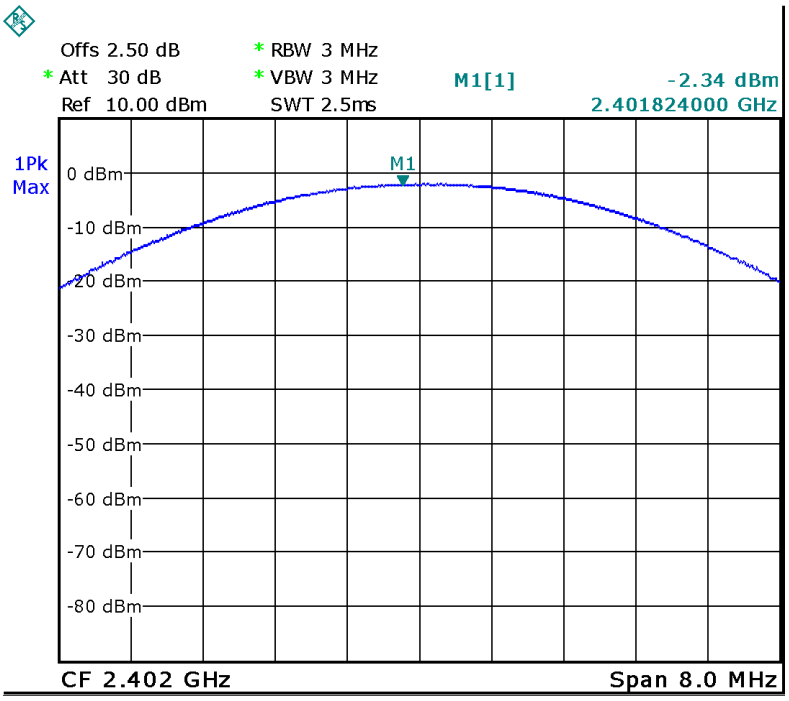
Upper Channel



Date: 27.MAY.2013 16:49:18

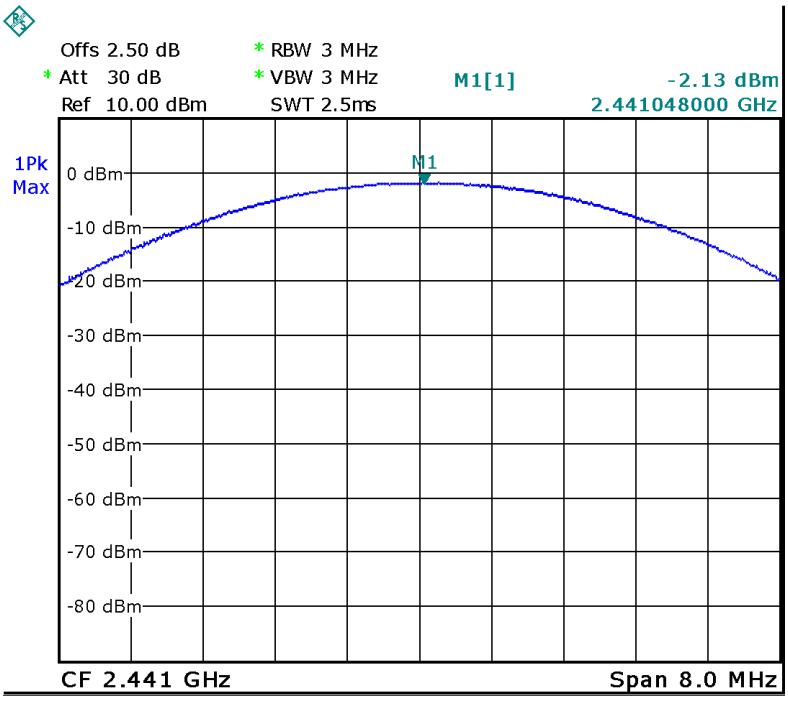
Modulation: 8DPSK

Lower Channel



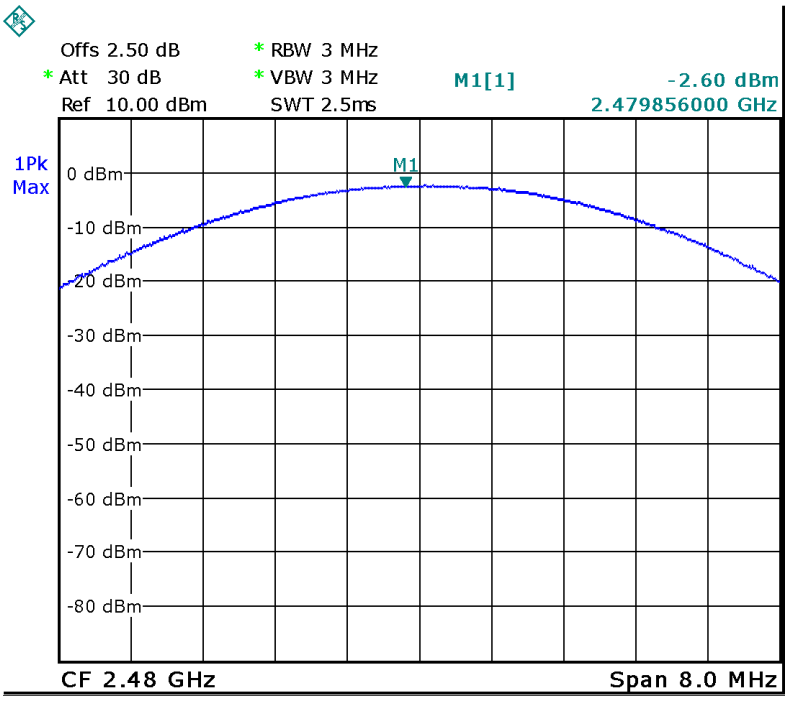
Date: 27.MAY.2013 16:49:45

Middle Channel



Date: 27.MAY.2013 16:50:08

Upper Channel



12 Hopping Channel Separation

Test Requirement: FCC CFR47 Part 15 Section 15.247
Test Method: 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 2400-2483.5 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.
Test Mode: Test in fixing operating frequency at lower, middle, upper channel.

12.1 Test Procedure:

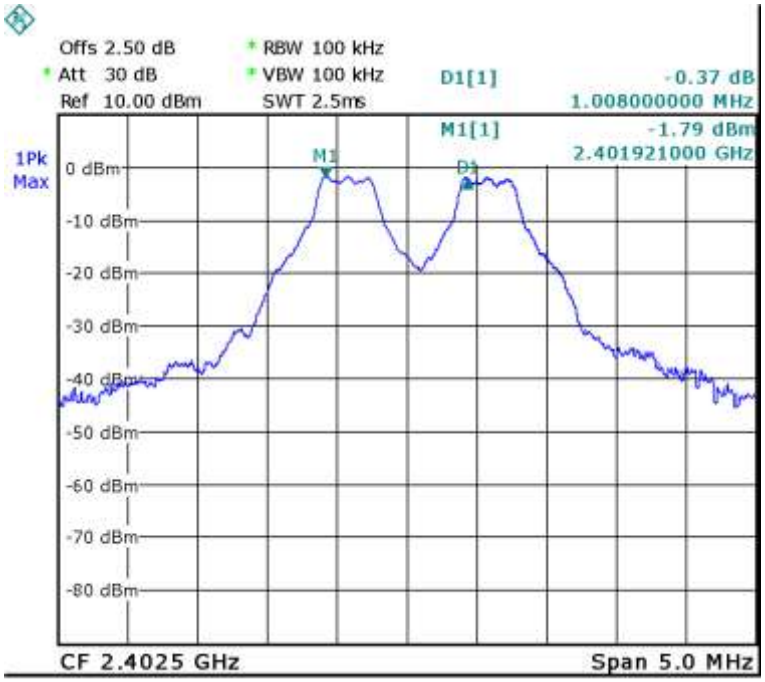
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 100kHz. VBW = 100kHz, Span = 10MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to 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:

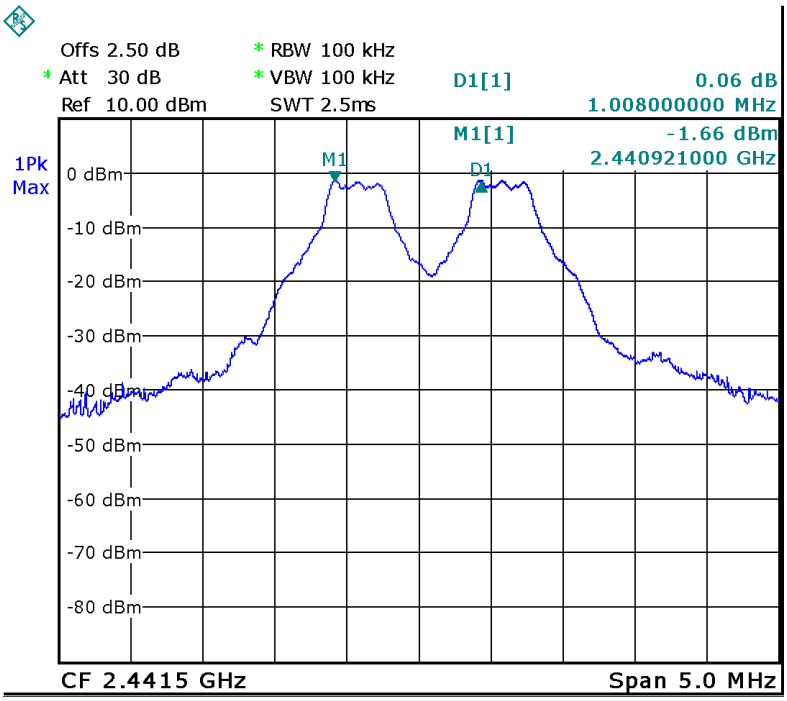
Test Channel	Separation (MHz)	Result
Lower	1.008	PASS
Middle	1.008	PASS
Upper	1.008	PASS

Test result plot as follows:

Modulation:GFSK
Lower Channel:

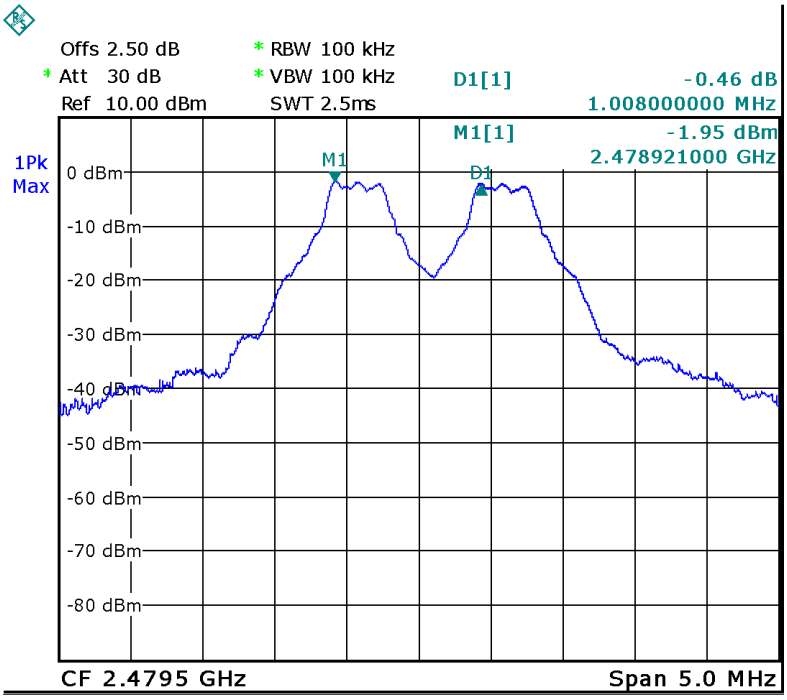


Middle Channel



Date: 27.MAY.2013 17:08:49

Upper Channel



Date: 27.MAY.2013 17:13:07

13 Number of Hopping Frequency

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	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:	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.

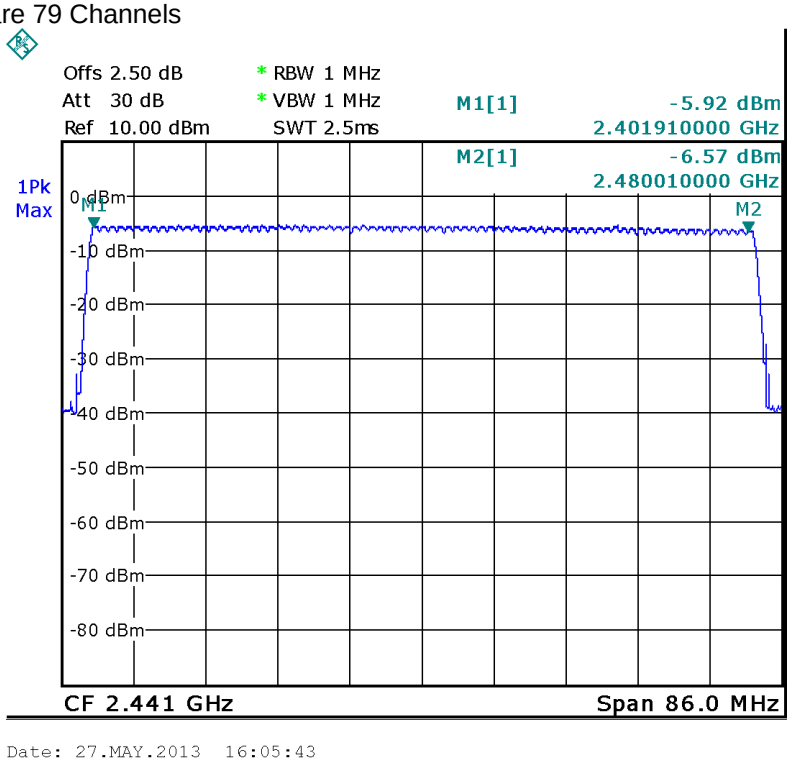
2. Set the spectrum analyzer: RBW = 1000 kHz. VBW = 3000 kHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.

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: Center Frequency = 2441MHz, Span = 100MHz. Submit the test result graph.

13.2 Test Result:

Total Channels are 79 Channels



14 Dwell Time

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	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:	Test in fixing operating frequency at lower, middle, upper channel.

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. Centered 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:

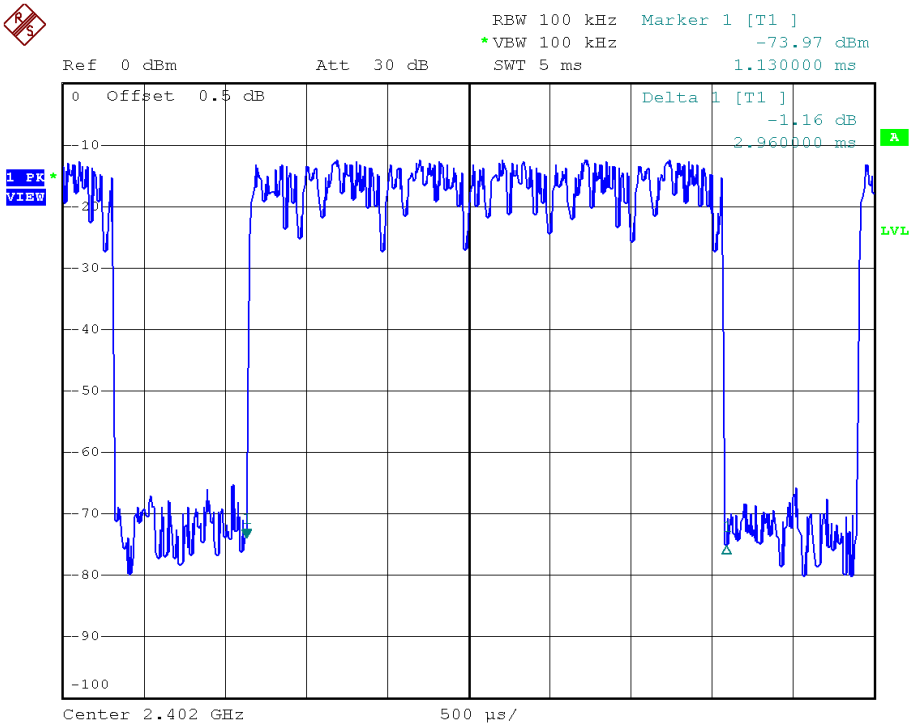
Data Packet	Dwell Time(s)
DH5	1600/79/6*31.6*(MkrDelta)/1000
DH3	1600/79/4*31.6*(MkrDelta)/1000
DH1	1600/79/2*31.6*(MkrDelta)/1000

Note: Mkr Delta is once pulse time.

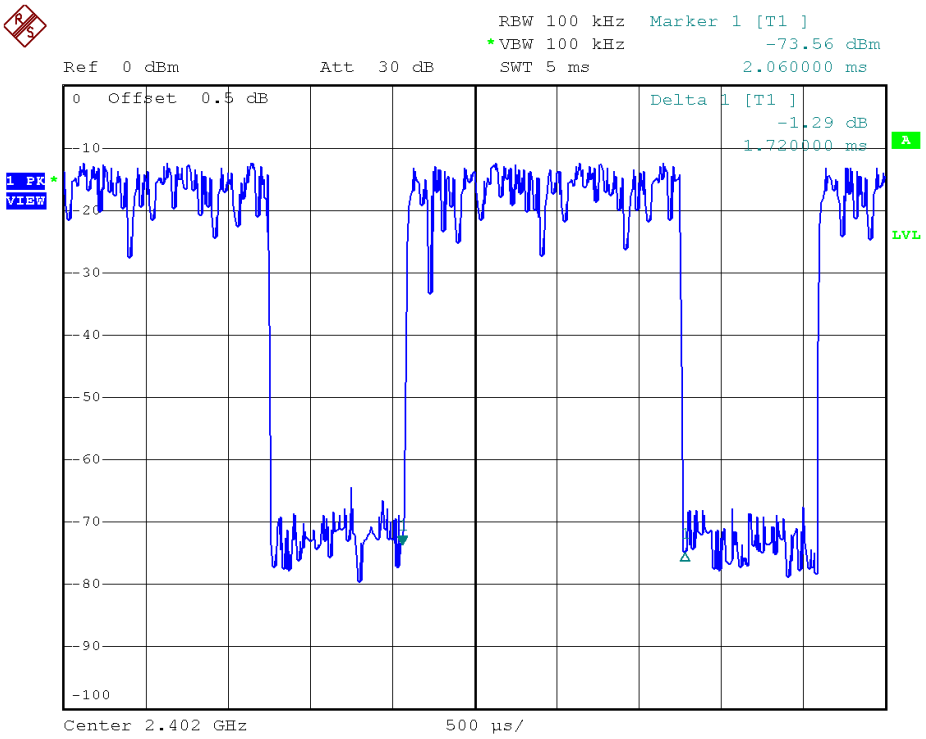
Dwell time of each occupation in this channel as follows:

Data Packet	Channel	Mkr Delta(ms)	Dwell Time(s)	Limits(s)	Result
DH5	Lower	2.96	0.316	0.400	Pass
DH3	Lower	1.72	0.275	0.400	Pass
DH1	Lower	0.48	0.154	0.400	Pass

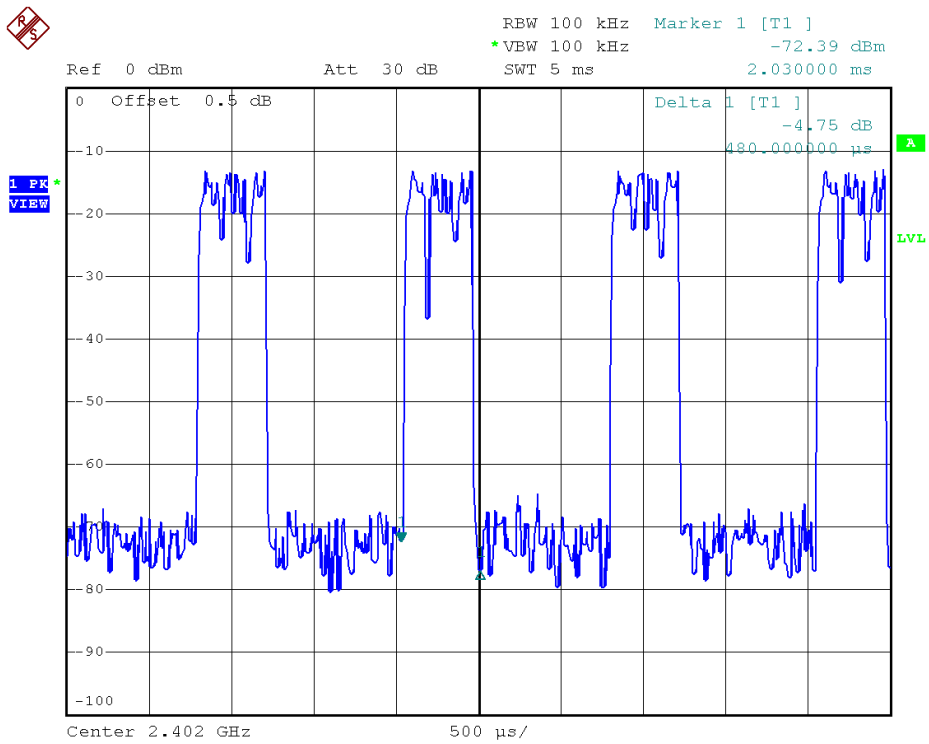
Mode: DH5



Mode: DH3

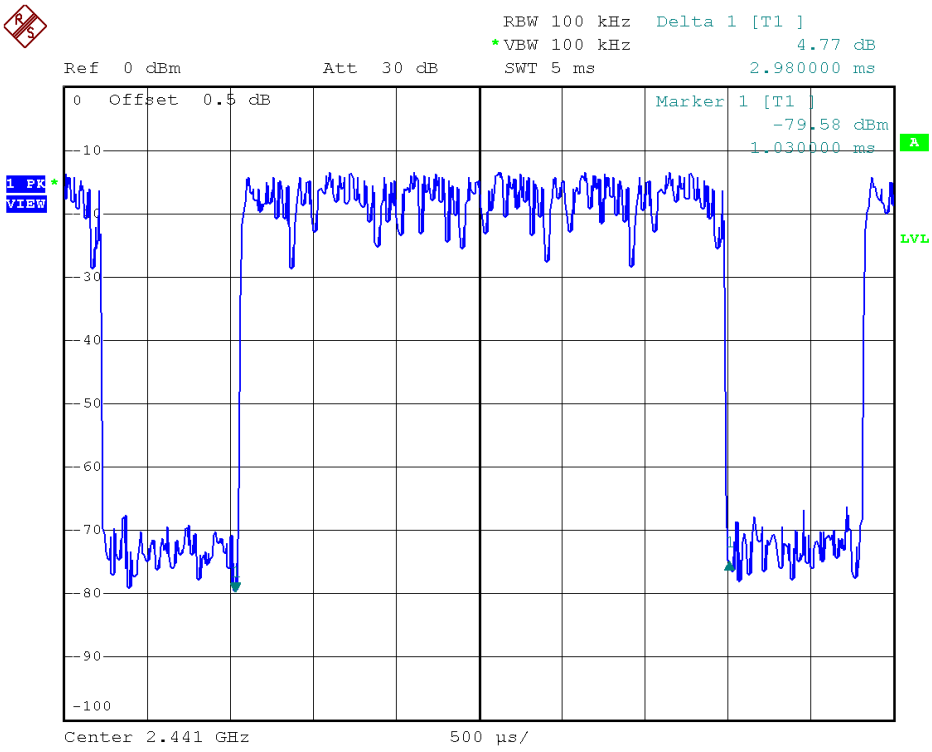


Mode: DH1

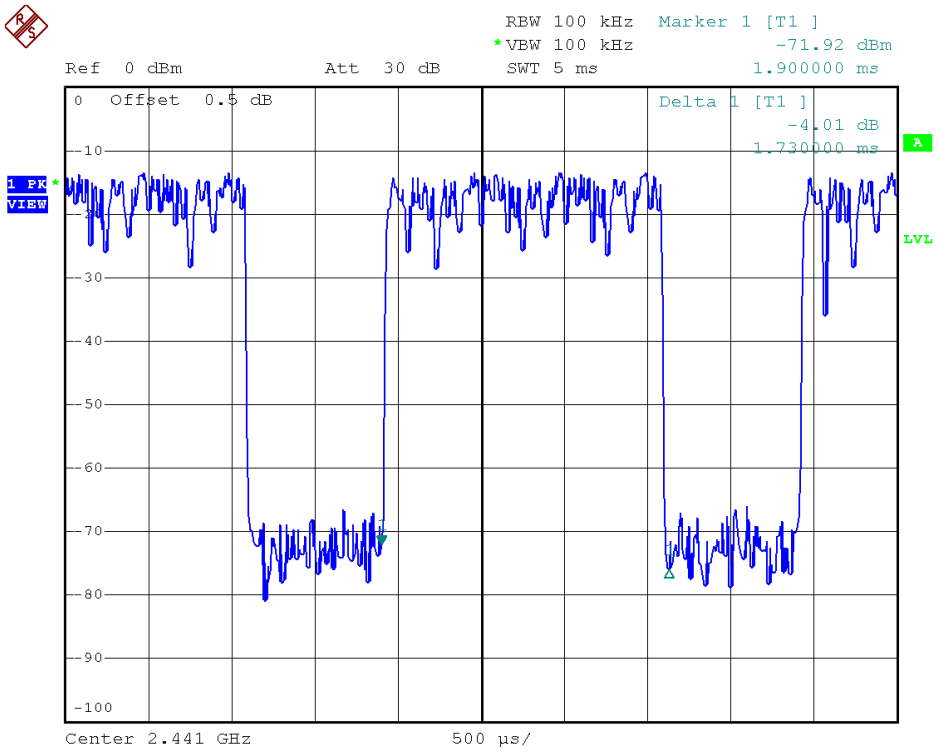


Data Packet	Channel	Mkr Delta(ms)	Dwell Time(s)	Limits(s)	Result
DH5	Middle	2.98	0.318	0.400	Pass
DH3	Middle	1.73	0.277	0.400	Pass
DH1	Middle	0.46	0.147	0.400	Pass

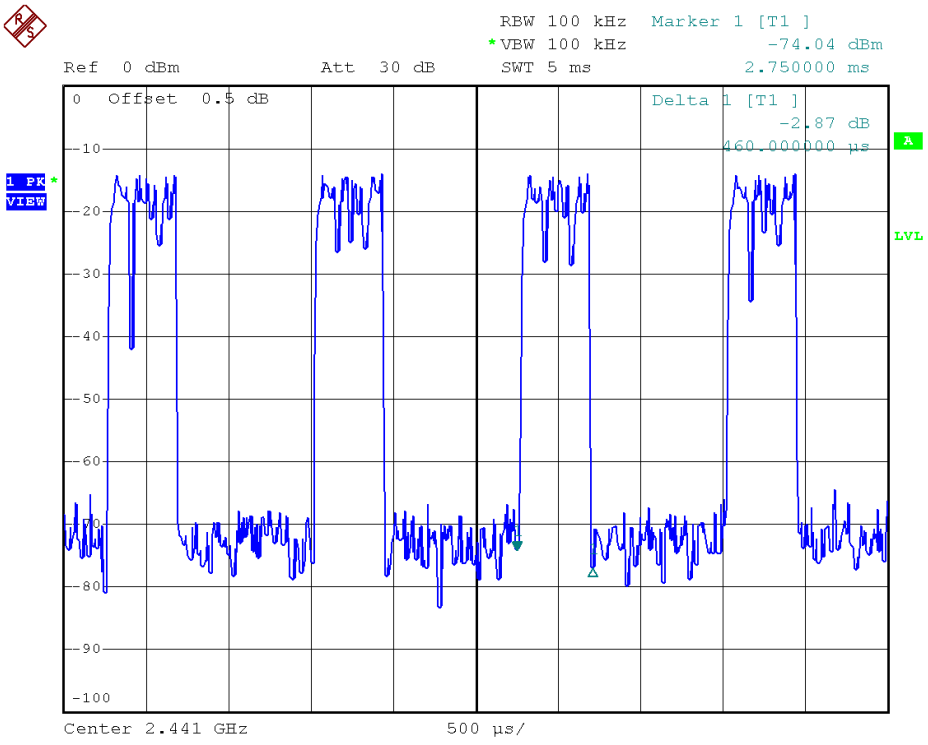
Mode: DH5



Mode: DH3

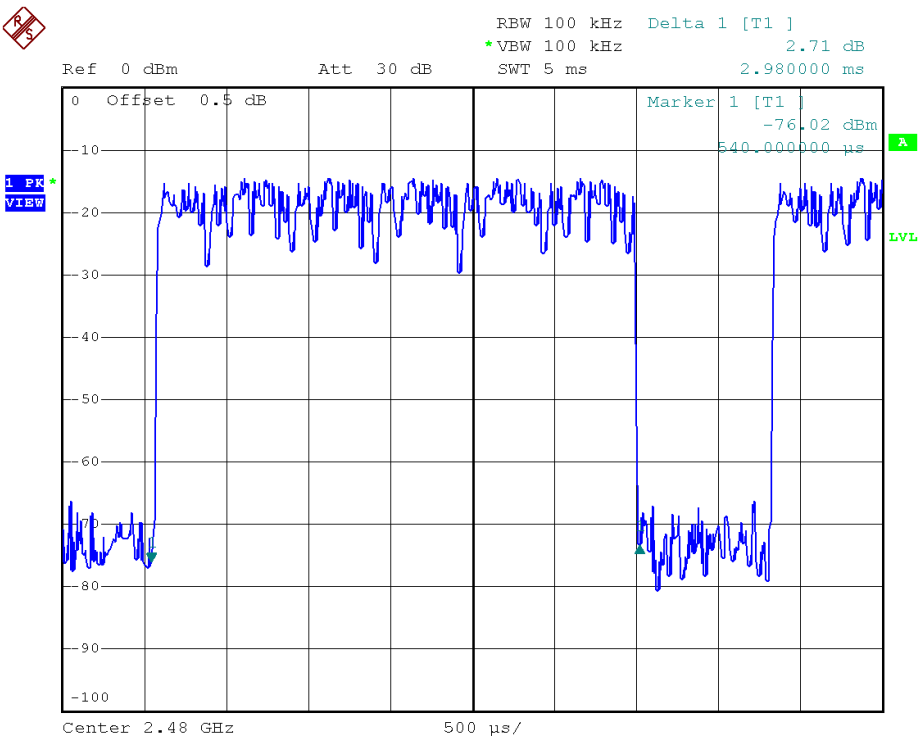


Mode: DH 1

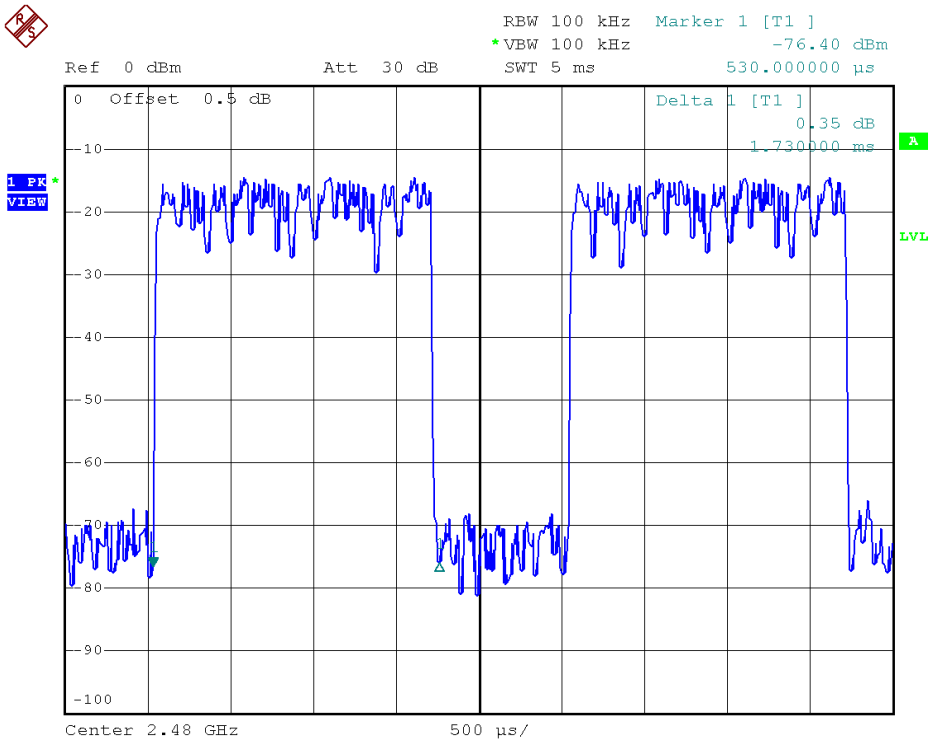


Data Packet	Channel	Mkr Delta(ms)	Dwell Time(s)	Limits(s)	Result
DH5	Upper	2.98	0.318	0.400	Pass
DH3	Upper	1.73	0.277	0.400	Pass
DH1	Upper	0.45	0.144	0.400	Pass

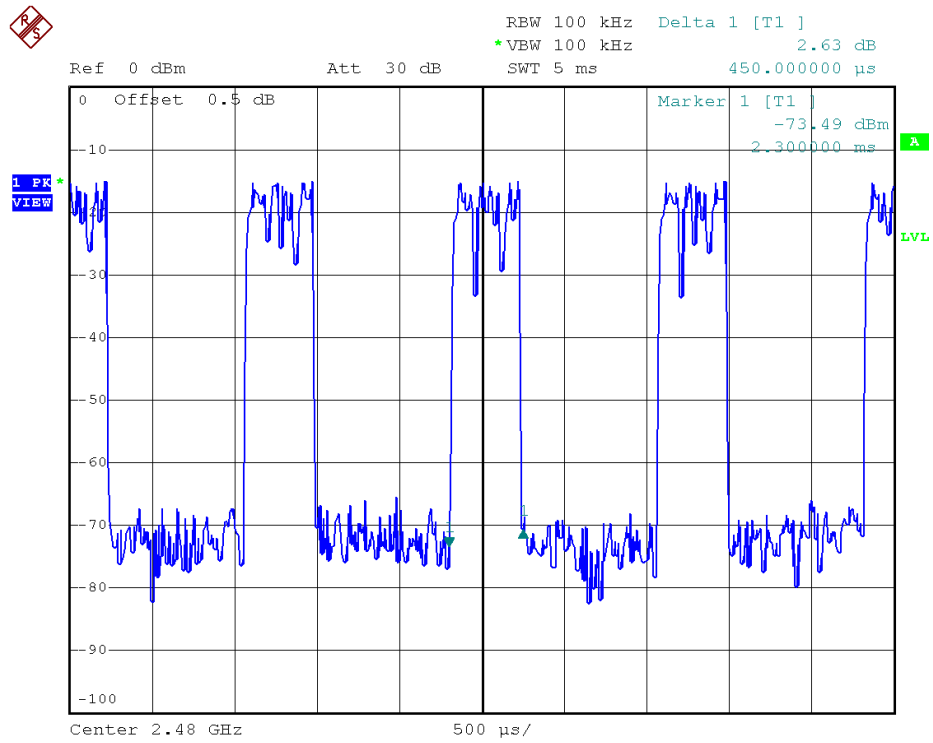
Mode: DH5



Mode: DH3



Mode: DH1



15 Antenna Requirement

According to the FCC Part 15 Paragraph 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. This product has a integrated antenna, fulfil the requirement of this section.

16 RF Exposure

Test Requirement: FCC Part 1.1307

Test Mode: The EUT work in test mode(Tx).

16.1 Requiments:

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

$$\text{E (V/m)} = \frac{\sqrt{30 \times P \times G}}{d} \qquad \text{Power Density: } Pd \text{ (W/m²)} = \frac{E^2}{377}$$

E = Electric field (V/m)
P = Peak RF output power (W)
G = EUT Antenna numeric gain (numeric) ,$Gain_{numeric}=10^{(dBi/10)}$
d = Separation distance between radiator and human body (m)
The formula can be changed to

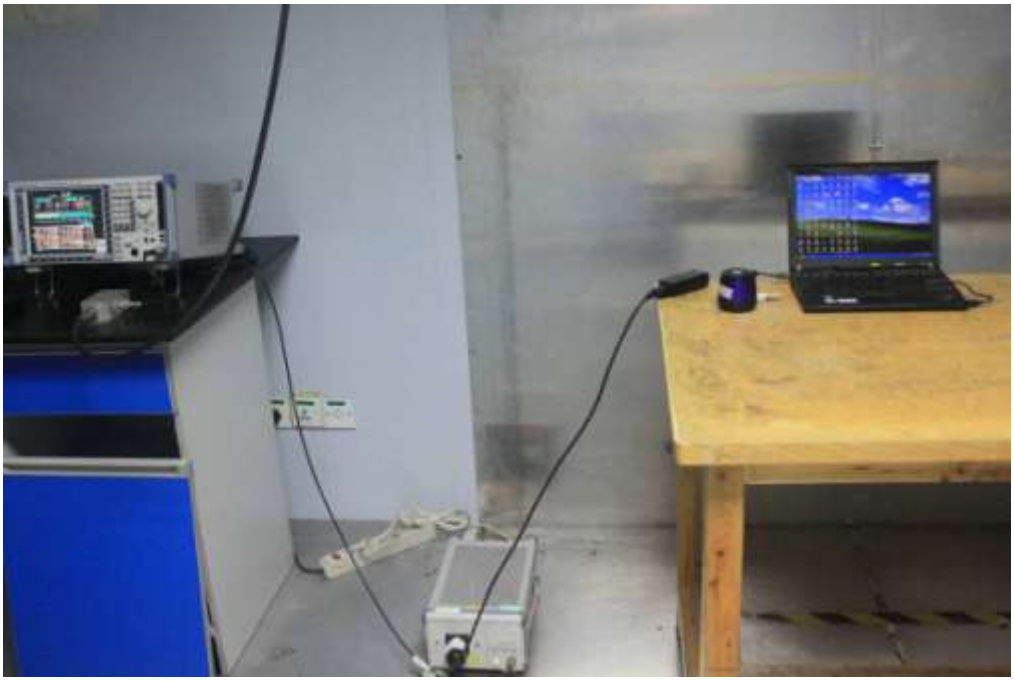
$$\boldsymbol{Pd} = \frac{30 \times P \times G}{377 \times d^2}$$

From the peak EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained

Modulation	Antenna Gain (dBi)	Antenna Gain (numeric)	Max. Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm^2)	Limit of Power Density (S) (mW/cm^2)
GFSK	0	1	-0.97	0.800	0.000159	1
Pi/4DQPSK	0	1	-2.09	0.618	0.000123	1
8DPSK	0	1	-2.13	0.612	0.000124	1

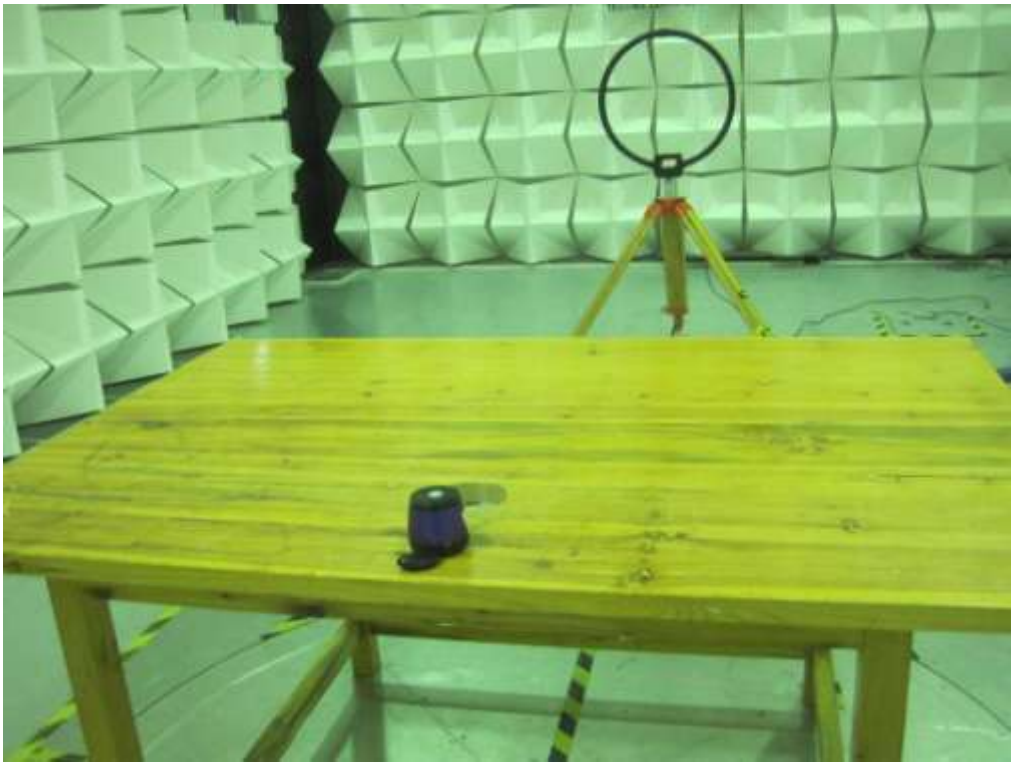
17 Photographs –Test Setup

17.1 Photograph – Conducted Emission Test Setup

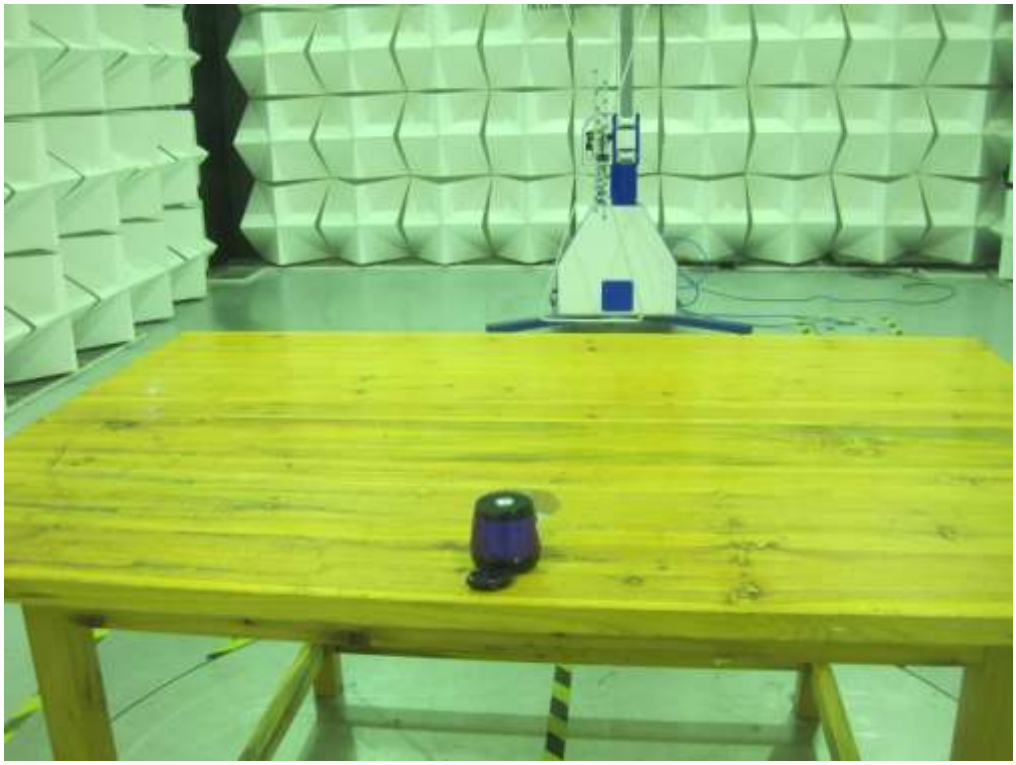


17.2 Radiated Emissions

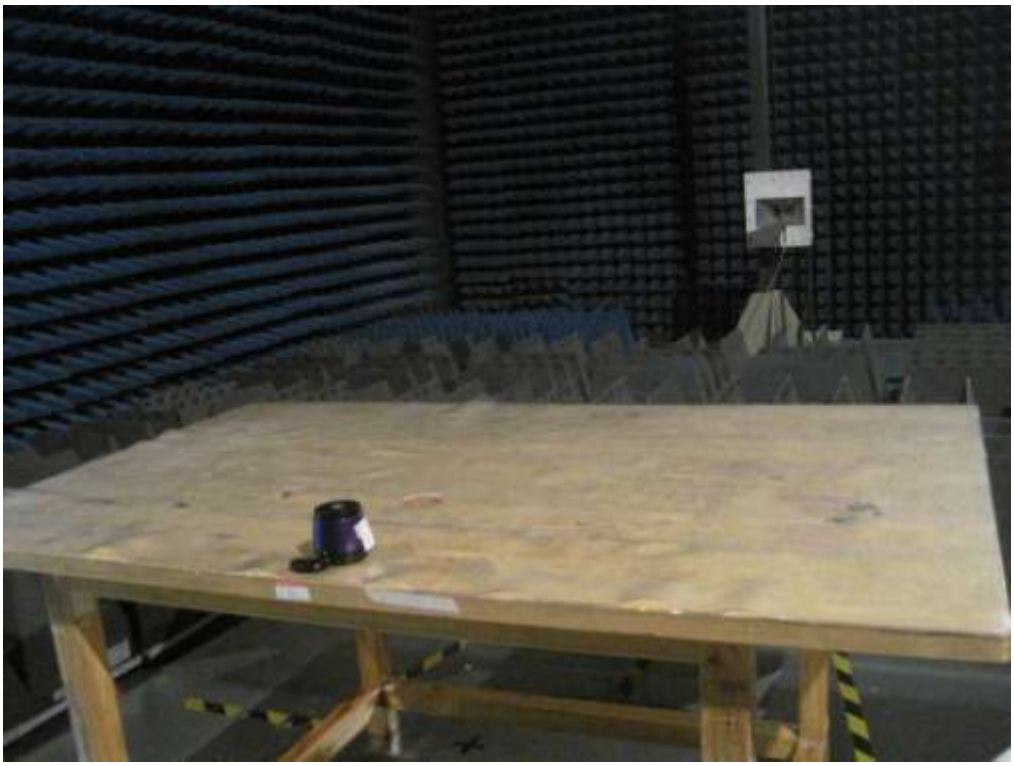
Below 30MHz



From 30-1000MHz



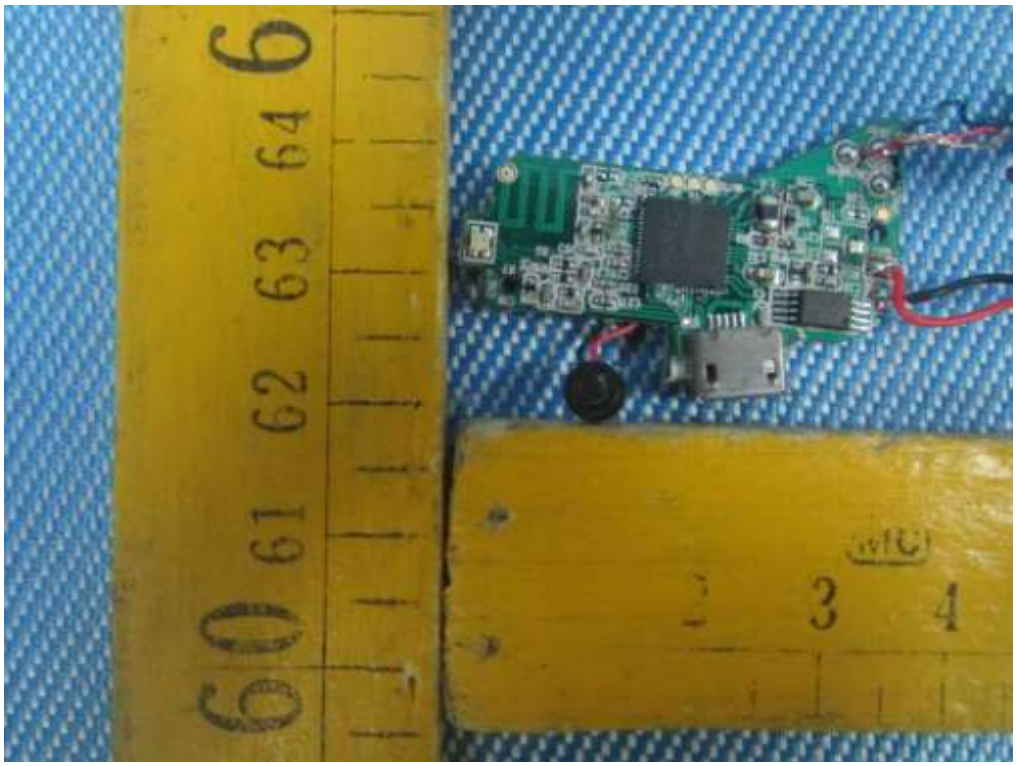
Above 1GHz

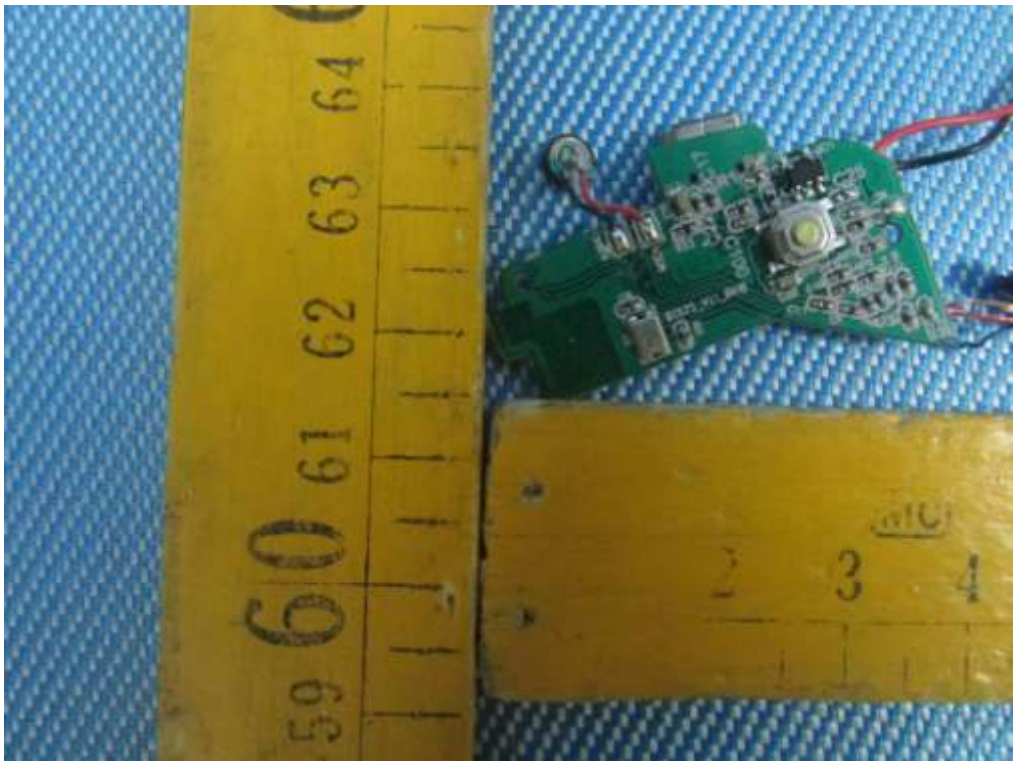


18 Photographs - Constructional Details

18.1 EUT – External View

18.2 EUT- Internal View





=End of test report==