CNAS L1659

RF TEST REPORT

Report No.:	SET2013-00915
Product Name:	Multifunctional Bluetooth Speaker
FCC ID:	SKJ-M7001
Model No. :	M7
Brand Name:	mctim
Applicant:	Shenzhen Heui Xint Technology Co., Ltd
Address:	2/ F, E Building, Huafeng Industry, Hangcheng Road, Xixiang town, Baoan district, Shenzhen, China
Issued by:	CCIC-SET
Lab Location:	Electronic Testing Building, Shahe Road, Xili, Nanshan District, Shenzhen, 518055, P. R. China
	Tel: 86 755 26627338 **Fax:** 86 755 26627238

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Test Report

Product Name ..... :	Multifunctional Bluetooth Speaker
Model No. ..... :	M7
Trade Name ..... :	mctim
Applicant ..... :	Shenzhen Heui Xint Technology Co., Ltd
Applicant Address ..... :	2/ F, E Building, Huafeng Industry, Hangcheng Road, Xixiang town, Baoan district, Shenzhen, China
Manufacturer ..... :	Shenzhen Heui Xint Technology Co., Ltd
Manufacturer Address ..... :	2/ F, E Building, Huafeng Industry, Hangcheng Road, Xixiang town, Baoan district, Shenzhen, China
Test Standards ..... :	47 CFR Part 15 Subpart C: Radio Frequency Devices ANSI C63.10:2009: American National Standard for Testing Unlicensed Wireless Devices DA 00-705: Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems
Test Result ..... :	PASS

Tested by ..... :

Lulei Apr 7, 2013

Lu Lei, Test Engineer

Reviewed by ..... :

Shuangwen Zhang Apr 7, 2013

Shuangwen Zhang, Senior Egineer

Approved by ..... :

Apr. 7. 2013

Wu Li'an, Manager

Southern Electronic Product Testing (Shenzhen) Co., Ltd. CCIC CCIC-SET

TABLE OF CONTENTS

Change History		
Issue	Date	Reason for change
1.0	March 30, 2013	First edition
2.0	April 7, 2013	Add the Conducted Emission test data

1. General Information

1.1. EUT Description

EUT Type ..... :	Multifunctional Bluetooth Speaker
Serial No..... :	(n.a, marked #1 by test site)
Hardware Version ..... :	M7
Software Version ..... :	CSR V2.0+edr
Applicant ..... :	Shenzhen Heui Xint Technology Co., Ltd 2/ F, E Building,Huafeng Industry, Hangcheng Road, Xixiang town, Baoan district, Shenzhen, China
Manufacturer ..... :	Shenzhen Heui Xint Technology Co., Ltd 2/ F, E Building,Huafeng Industry, Hangcheng Road, Xixiang town, Baoan district, Shenzhen, China
Frequency Range..... :	The frequency range used is 2402MHz - 2480MHz (79 channels, at intervals of 1MHz); The frequency block is 2400MHz to 2483.5MHz.
Modulation Type ..... :	Bluetooth: FHSS (GFSK(1Mbps), ∏/4-DQPSK(EDR 2Mbps), 8-DPSK(EDR 3Mbps))
Antenna Type..... :	PCB Antenna
Antenna Gain..... :	1.2dBi

Note 1: The EUT is a Multifunctional Bluetooth Speaker, it contains Bluetooth Module operating at 2.4GHz ISM band; the frequencies allocated for the Bluetooth Module is F(MHz)=2402+1*n (0<=n<=78). The lowest, middle, highest channel numbers of the Bluetooth Module used and tested in this report are separately 0 (2402MHz), 39 (2441MHz) and 78 (2480MHz).

Note 2: For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.

Note 3: a. When power on, the EUT will scan the whole frequency until a Connection command from the other BT devices.

b. When receiving the signal from the other BT devices, The EUT transmit aresponse signal.

c. The other devices receive the response signal and recognize it, then send a connection command to establish the connection.

d. After the connection establish successfully, the data transmission is beginning. At the same time, the both devices will shift frequencies in synchronization per a same pseudo randomly ordered list of hopping frequencies, the hopping rate is1600 times per second. This device conforms to the criteria in FCC Public Notice DA 00-705.

e. The bandwidth of the receiver, which is set to a fixed width by the software.

Note 4: Bluetooth signal has 9 packages DH1, DH3, DH5, 3DH1, 3DH3, 3DH5, 5DH1, 5DH3, 5DH5, DH5 package is largest, we are testing DH5 in the document.

Note5: The antenna of EUT is designed with permanent attachment and no consideration of replacement, it is printed on the circuit board with a maximum gain of 1.2dBi, and it is used to radiate the RF emissions

1.2. Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart C (Bluetooth, 2.4GHz ISM band radiators) for the EUT FCC ID Certification:

No.	Identity	Document Title
1	47 CFR Part 15 (10-1-09 Edition)	Radio Frequency Devices

Test detailed items/section required by FCC rules and results are as below:

No.	Section in CFR 47	Description	Result
1	15.203	Antenna Requirement	PASS
2	15.247(a)	Number of Hopping Frequency	PASS
3	15.247(b)	Peak Output Power	PASS
4	15.247(a)	20dB Bandwidth	PASS
5	15.247(a)	Carrier Frequency Separation	PASS
6	15.247(a)	Time of Occupancy (Dwell time)	PASS
7	15.247(d)	Conducted Spurious Emission	PASS
8	15.247(d)	Band Edge	PASS
9	15.207	Conducted Emission	PASS
10	15.209 15.247(c)	Radiated Emission	PASS

Note 1: The tests were performed according to the method of measurements prescribed in DA-00-705.

Note 2: The test of Radiated Emission and Conducted Spurious Emission were performed according to the method of measurements prescribed in ANSI C63.4 2009.

1.3. Facilities and Accreditations

1.3.1. Facilities

CNAS-Lab Code: L1659
CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd. CCIC is a third party testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L1659. A 12.8*6.8*6.4 (m) fully anechoic chamber was used for the radiated spurious emissions test.
FCC-Registration No.: 406086

CCIC Southern Electronic Product Testing (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 406086, Renewal date Nov. 19, 2011, valid time is until Nov. 18, 2014.

1.3.2. Test Environment Conditions

During the measurement, the environmental conditions were within the listed ranges:

Temperature (°C):	15 - 35
Relative Humidity (%):	30 -60
Atmospheric Pressure (kPa):	86KPa-106KPa

2. 47 CFR Part 15C Requirements

2.1. Antenna requirement

2.1.1. Applicable Standard

According to FCC 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. 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.

2.1.2. **Result:** Compliant

The antennas used for this product are PCB Antenna and that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is only 1.2dBi.

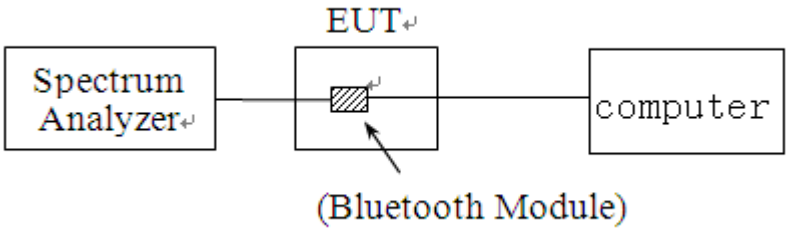
2.2. Number of Hopping Frequency

2.2.1. Requirement

According to FCC §15.247(a)(1)(iii), frequency hopping systems operating in the 2400MHz to 2483.5MHz bands shall use at least 15 hopping frequencies.

2.2.2. Test Description

A. Test Setup:



The Bluetooth Module of the EUT, which is powered by the Battery, is connected to the Spectrum Analyzer (SA), the path loss as the factor is calibrated to correct the reading. During the measurement, the Bluetooth Module of the EUT is activated and controlled by the PC, and is set to operate under test mode transmitting 339 bytes DH5 packages at maximum power.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date
Spectrum Analyzer	R&S	FSP40	1164.4391.40	2012.06.10

The Cal. Interval was one year.

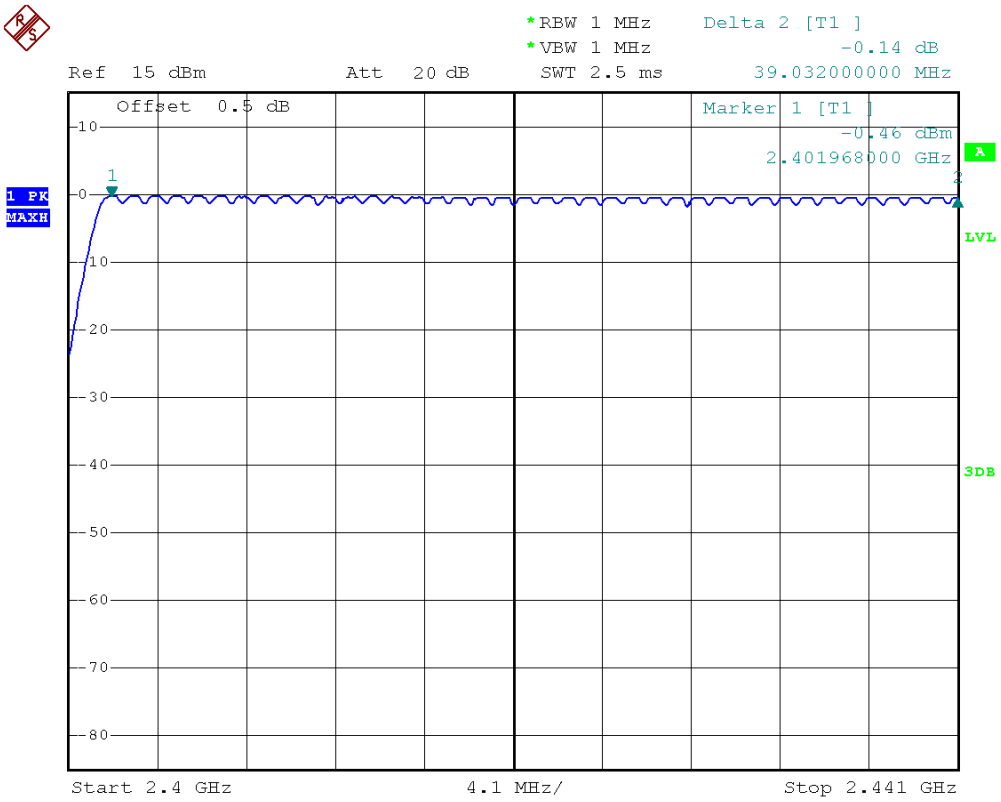
2.2.3. Test Result

The Bluetooth Module operates at hopping-on test mode; the frequencies number employed is counted to verify the Module's using the number of hopping frequency.

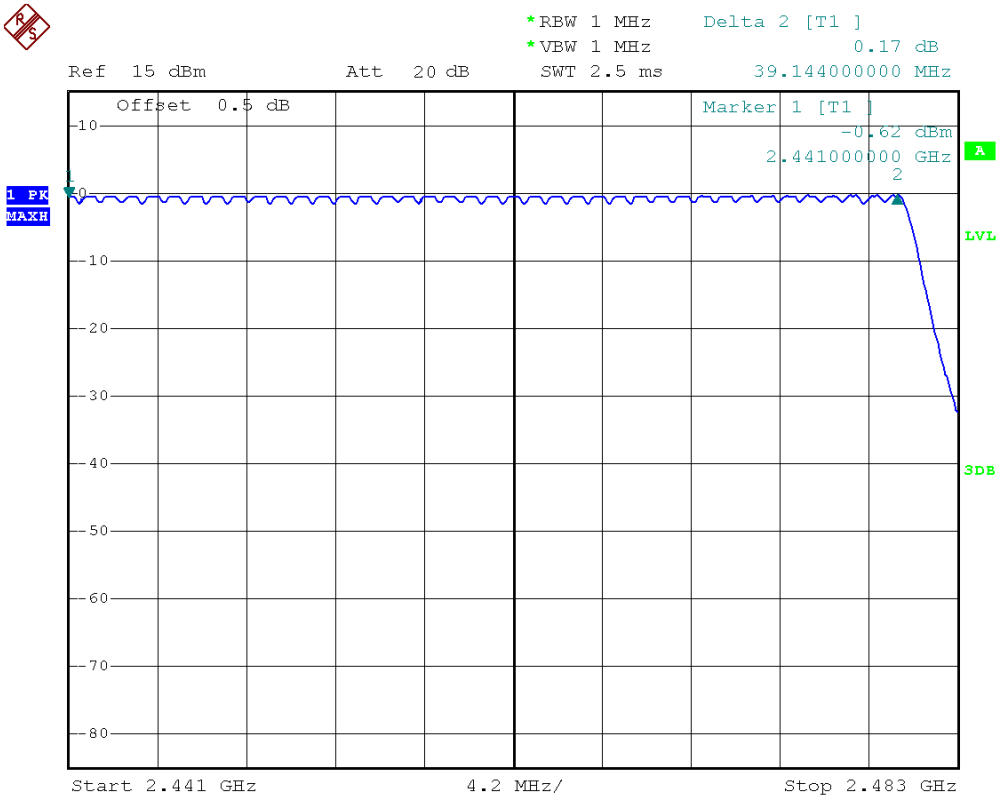
A. Test Verdict:

Test Mode	Frequency Block (MHz)	Measured Channel Numbers	Min. Limit	Refer to Plot	Verdict
GFSK	2400 - 2483.5	79	15	Plot A1/ Plot A2	PASS
Π/4-DQPSK	2400 - 2483.5	79	15	Plot B1/ Plot B2	PASS
8-DPSK	2400 - 2483.5	79	15	Plot C1/ Plot C2	PASS

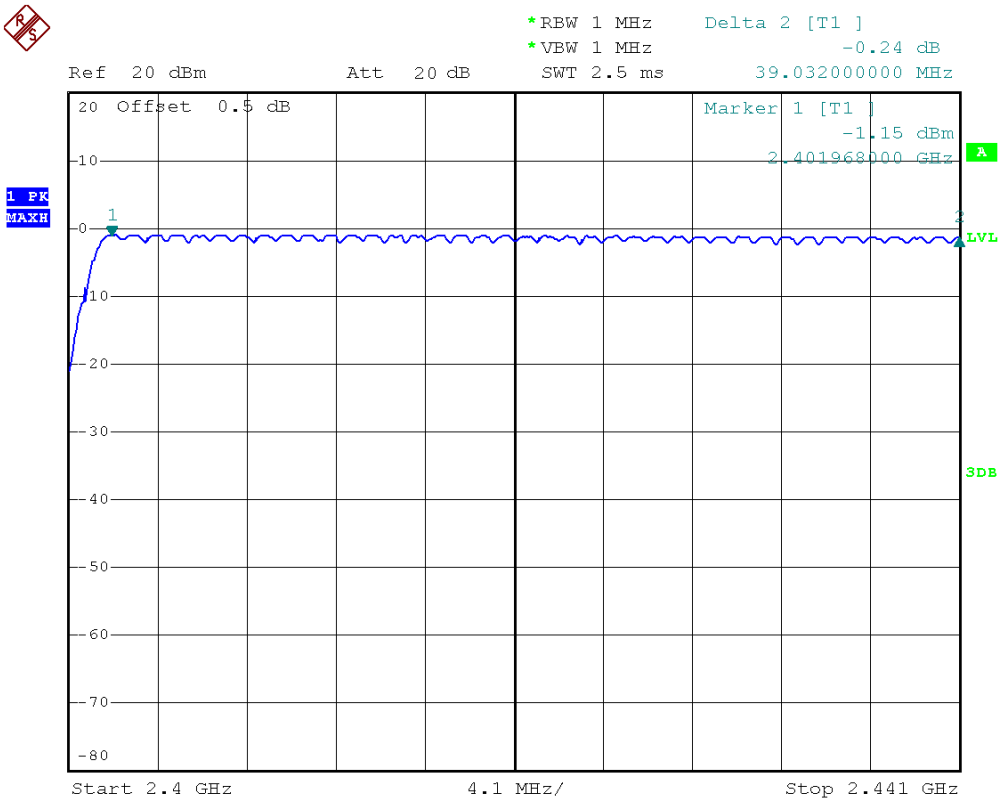
B. Test Plots:



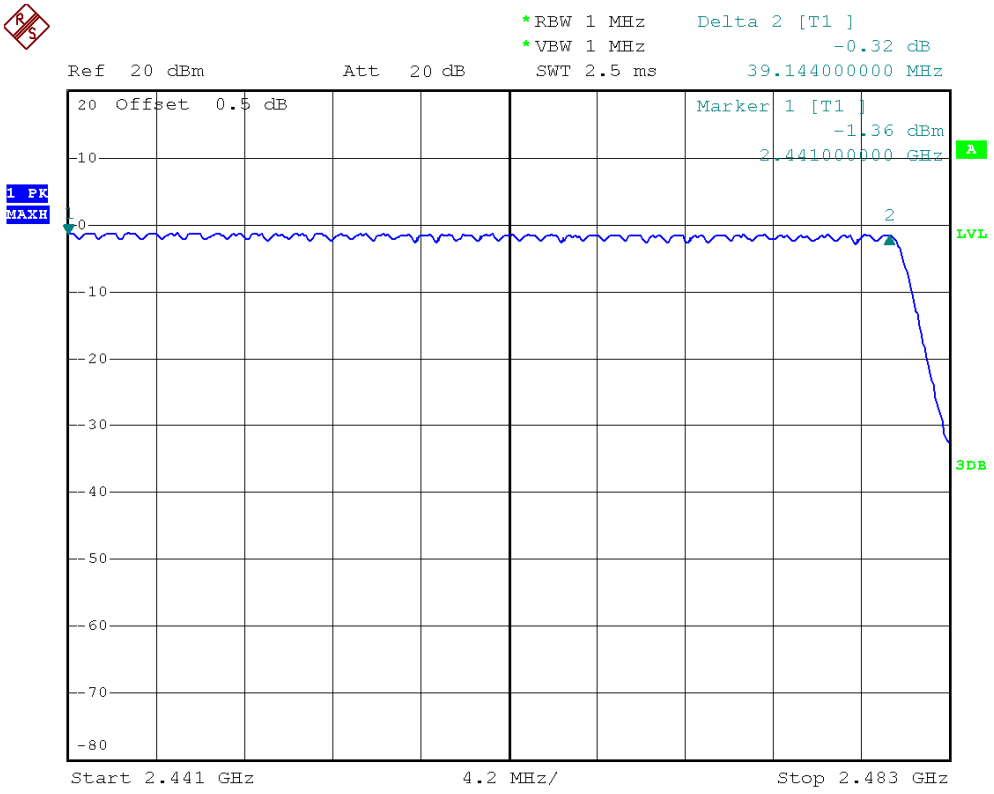
(Plot A1: GFSK)



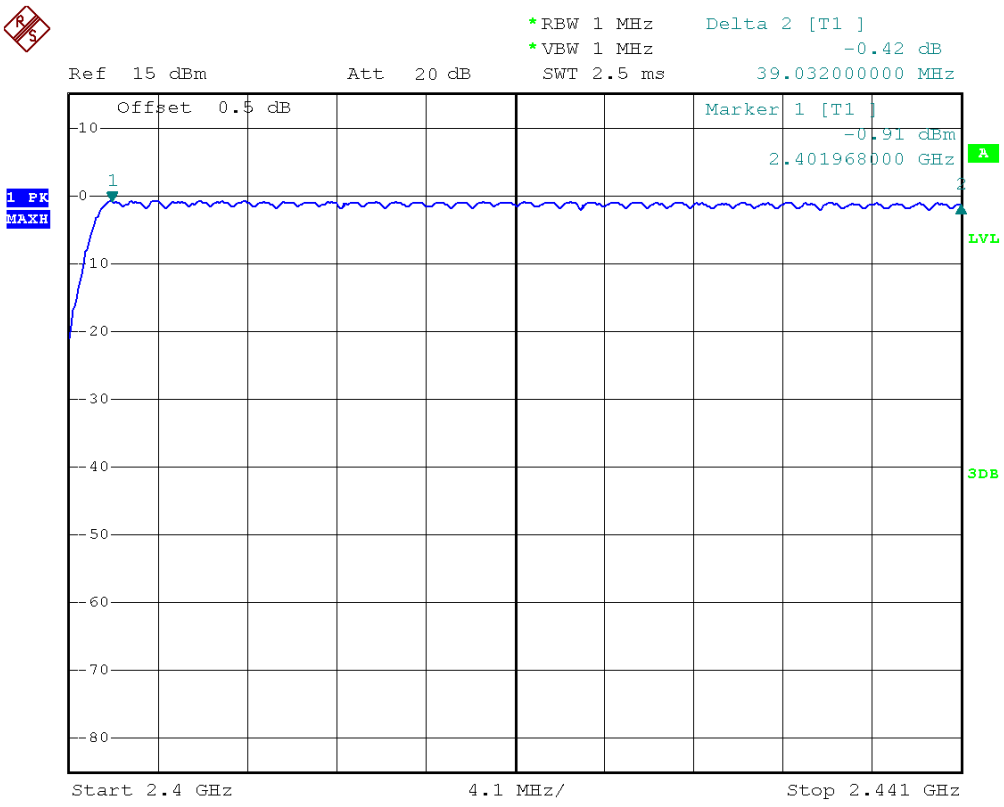
(Plot A2: GFSK)



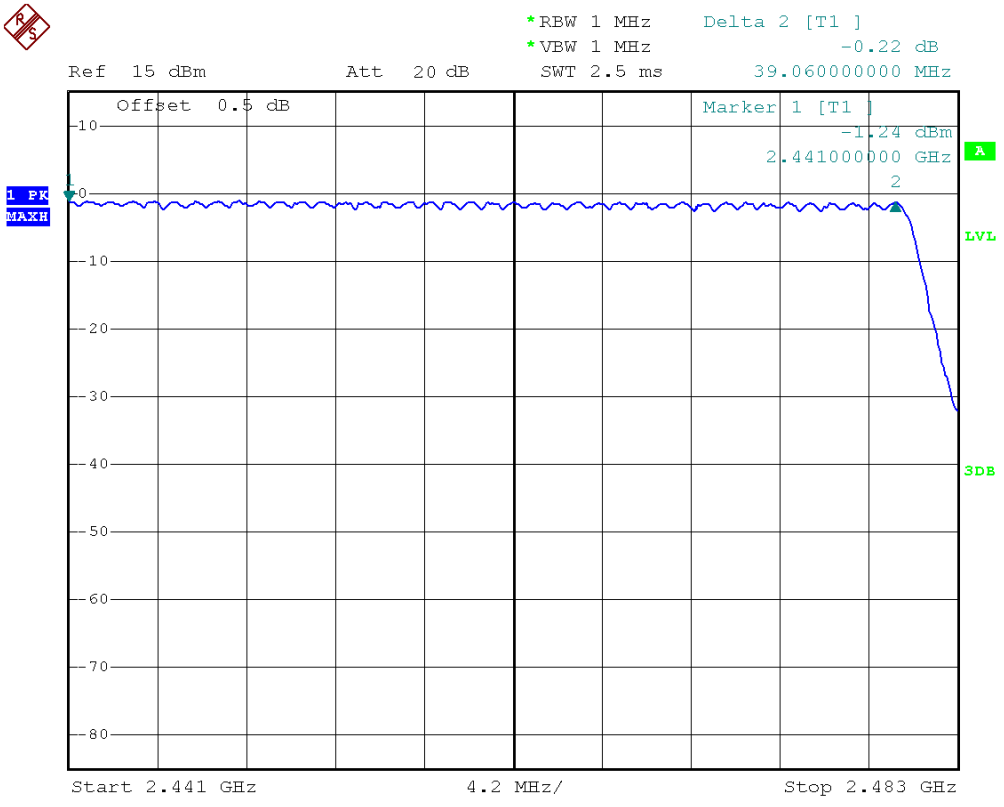
(Plot B1: ∏/4-DQPSK)



(Plot B2: ∏/4-DQPSK)



(Plot C1: 8- DPSK)



(Plot C2: 8- DPSK)

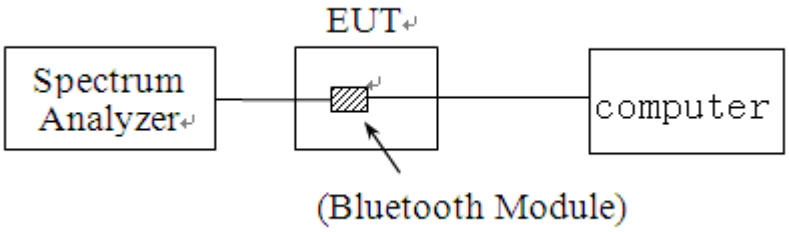
2.3. Peak Output Power

2.3.1. Requirement

According to FCC §15.247(b)(1), for frequency hopping systems that operates in the 2400MHz to 2483.5MHz band employing at least 75 hopping channels, the maximum peak output power of the intentional radiator shall not exceed 1Watt. For all other frequency hopping systems in the 2400MHz to 2483.5MHz band, it is 0.125Watts.

2.3.2. Test Description

A. Test Setup:



The Bluetooth Module of the EUT, which is powered by the Battery, is connected to the Spectrum Analyzer (SA), the path loss as the factor is calibrated to correct the reading. During the measurement, the Bluetooth Module of the EUT is activated and controlled by the PC, and is set to operate under test mode transmitting 339 bytes DH5 packages at maximum power.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date
Spectrum Analyzer	R&S	FSP40	1164.4391.40	2012.06.10

The Cal. Interval was one year.

2.3.3. Test Result

The Bluetooth Module operates at hopping-off test mode. The lowest, middle and highest channels are selected to perform testing to verify the conducted RF output peak power of the Module. The lowest, middle and highest channel were tested by Power meter.

2.3.3.1. GFSK Mode

A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict	Refer to Plot
		dBm	W	dBm	W		
0	2402	-0.07	0.000984	30	1	PASS	Plot A
39	2441	-0.25	0.000944			PASS	Plot B
78	2480	-0.18	0.000959			PASS	Plot C

2.3.3.2. ∏/4-DQPSK Mode

A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict	Refer to Plot
		dBm	W	dBm	W		
0	2402	-0.79	0.000834	30	1	PASS	Plot A
39	2441	-0.78	0.000836			PASS	Plot B
78	2480	-0.94	0.000805			PASS	Plot C

2.3.3.3. 8-DPSK Mode

A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict	Refer to Plot
		dBm	W	dBm	W		
0	2402	-0.32	0.000929	30	1	PASS	Plot A
39	2441	-0.50	0.000891			PASS	Plot B
78	2480	-0.80	0.000832			PASS	Plot C

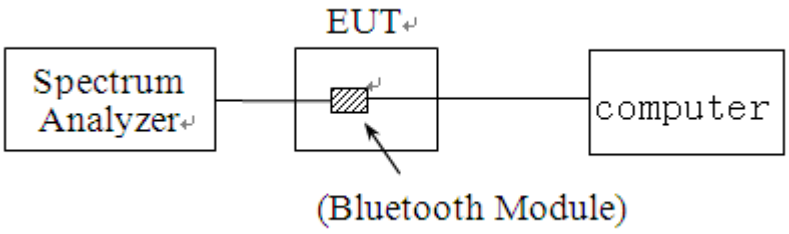
2.4. 20dB Bandwidth

2.4.1. Definition

According to FCC §15.247(a)(1), the 20dB bandwidth is known as the 99% emission bandwidth, or 20dB bandwidth (10*log1% = 20dB) taking the total RF output power.

2.4.2. Test Description

A. Test Setup:



The Bluetooth Module of the EUT, which is powered by the Battery, is connected to the Spectrum Analyzer (SA), the path loss as the factor is calibrated to correct the reading. During the measurement, the Bluetooth Module of the EUT is activated and controlled by the PC, and is set to operate under test mode transmitting 339 bytes DH5 packages at maximum power.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date
Spectrum Analyzer	R&S	FSP40	1164.4391.40	2012.06.10

The Cal. Interval was one year.

2.4.1. Test Procedure

Use the following spectrum analyzer settings:

Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel

RBW ≥ 1% of the 20 dB bandwidth

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

2.4.2. Test Result

The Bluetooth Module operates at hopping-off test mode. The lowest, middle and highest channels are selected to perform testing to record the 20dB bandwidth of the Module.

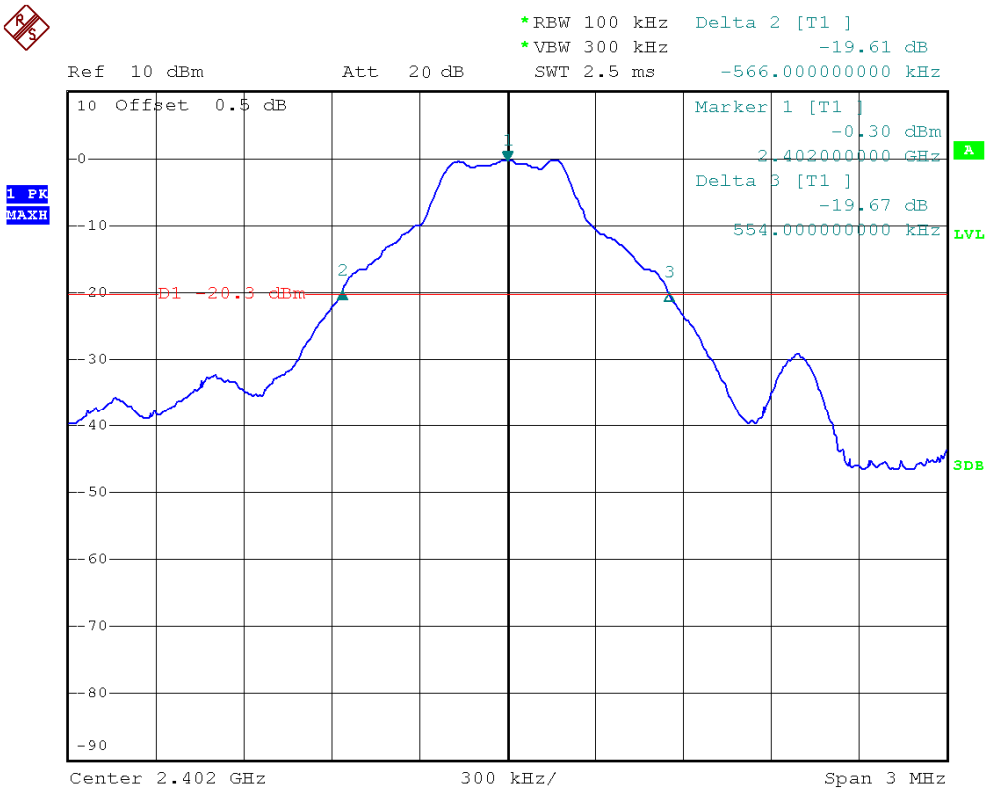
2.4.2.1. GFSK Mode

A. Test Verdict:

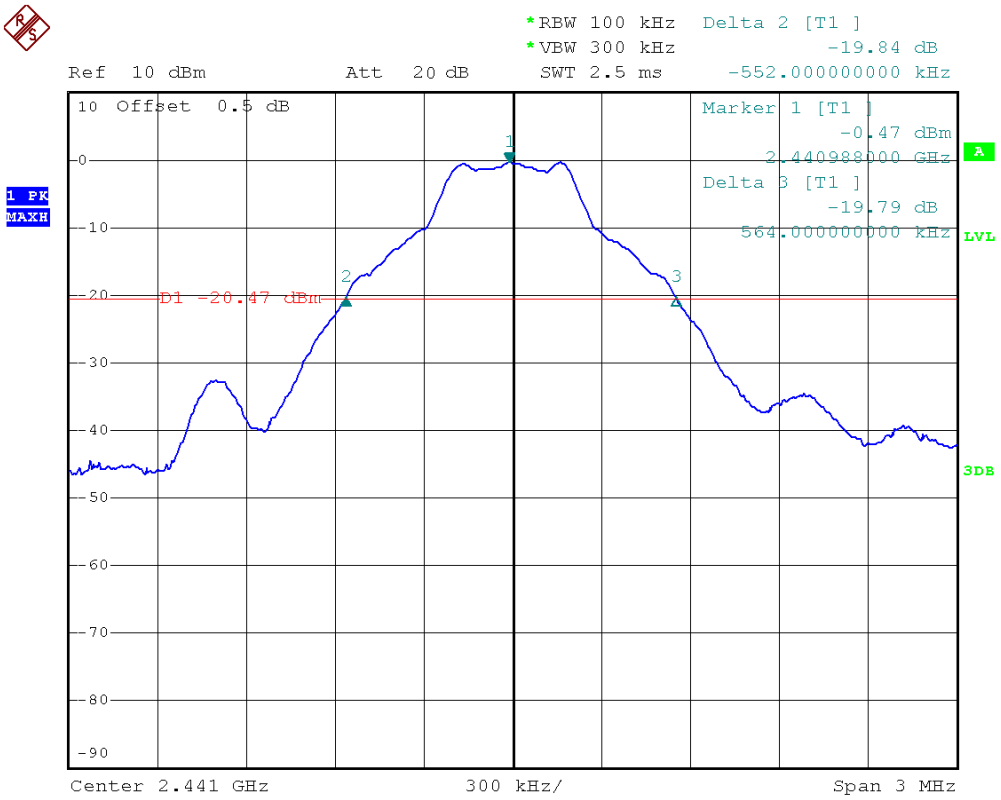
The maximum 20dB bandwidth measured is 1.120MHz according to the table below.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
0	2402	1.120	Plot A
39	2441	1.116	Plot B
78	2480	1.116	Plot C

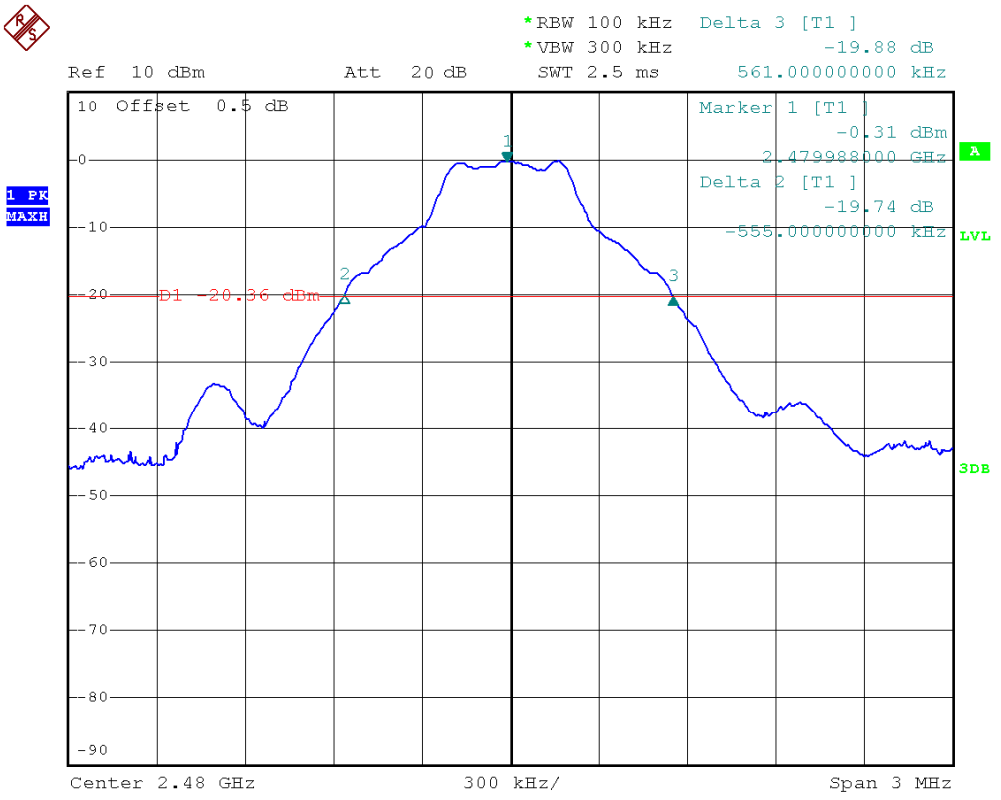
Test Plots:



(Plot A: Channel = 2402 @ GFSK)



(Plot B: Channel = 2441 @ GFSK)



(Plot C: Channel = 2480 @ GFSK)

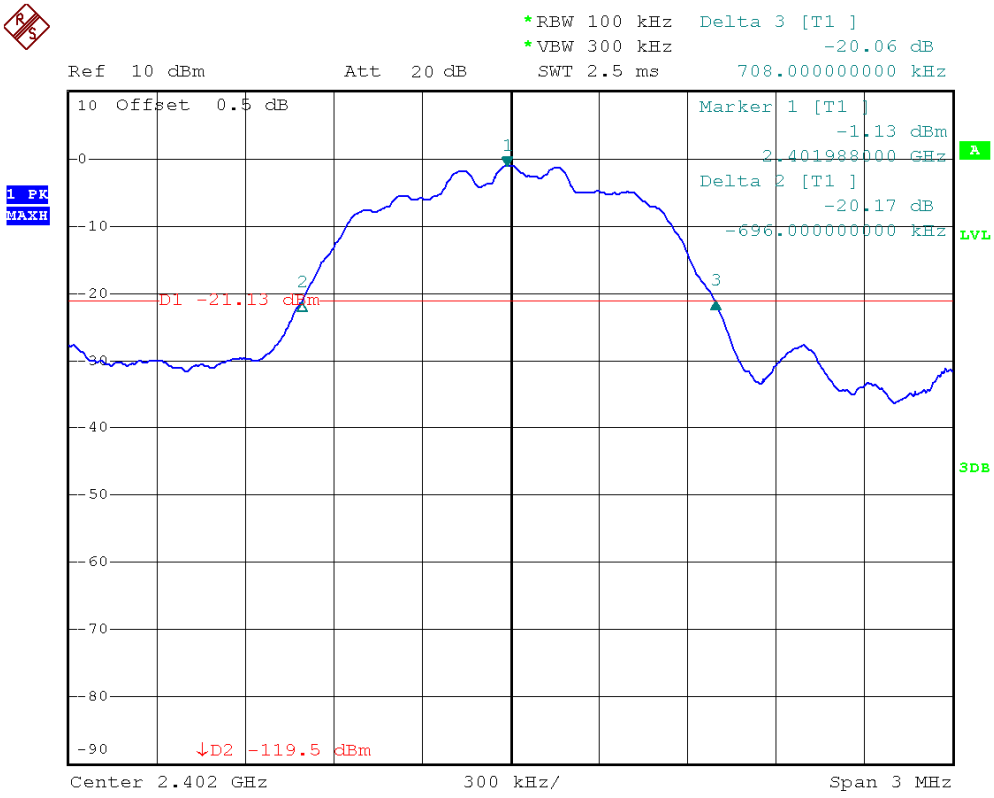
2.4.2.2. Π/4-DQPSK Mode

A. Test Verdict:

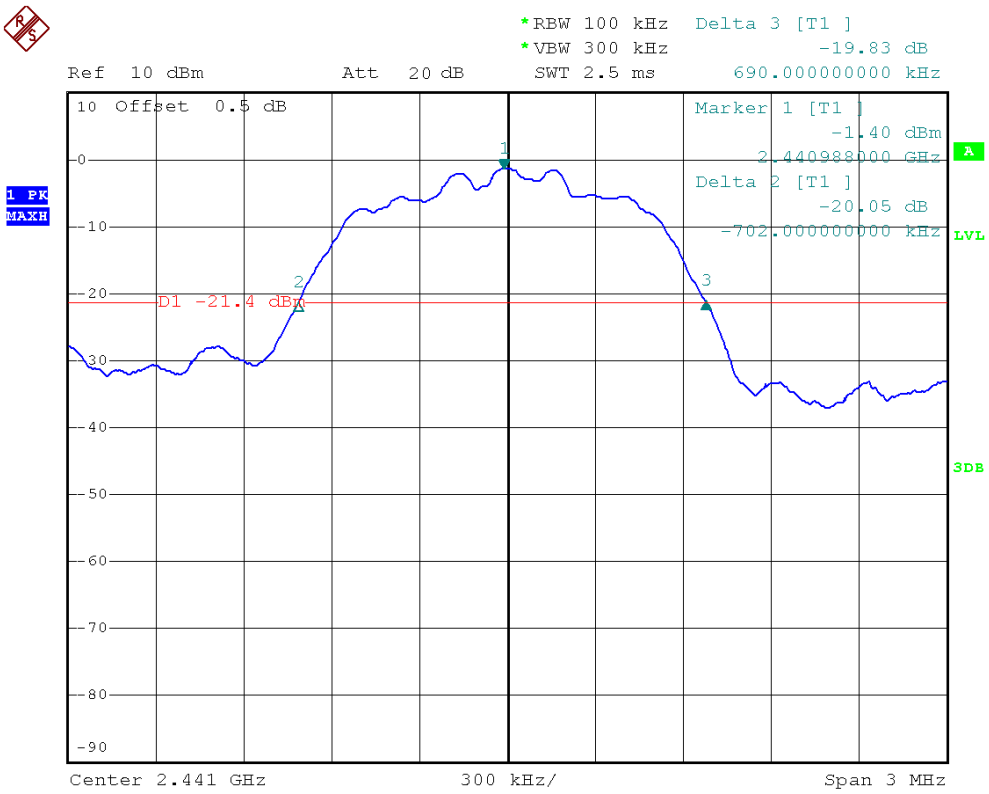
The maximum 20dB bandwidth measured is 1.404MHz according to the table below.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
0	2402	1.404	Plot D
39	2441	1.392	Plot E
78	2480	1.386	Plot F

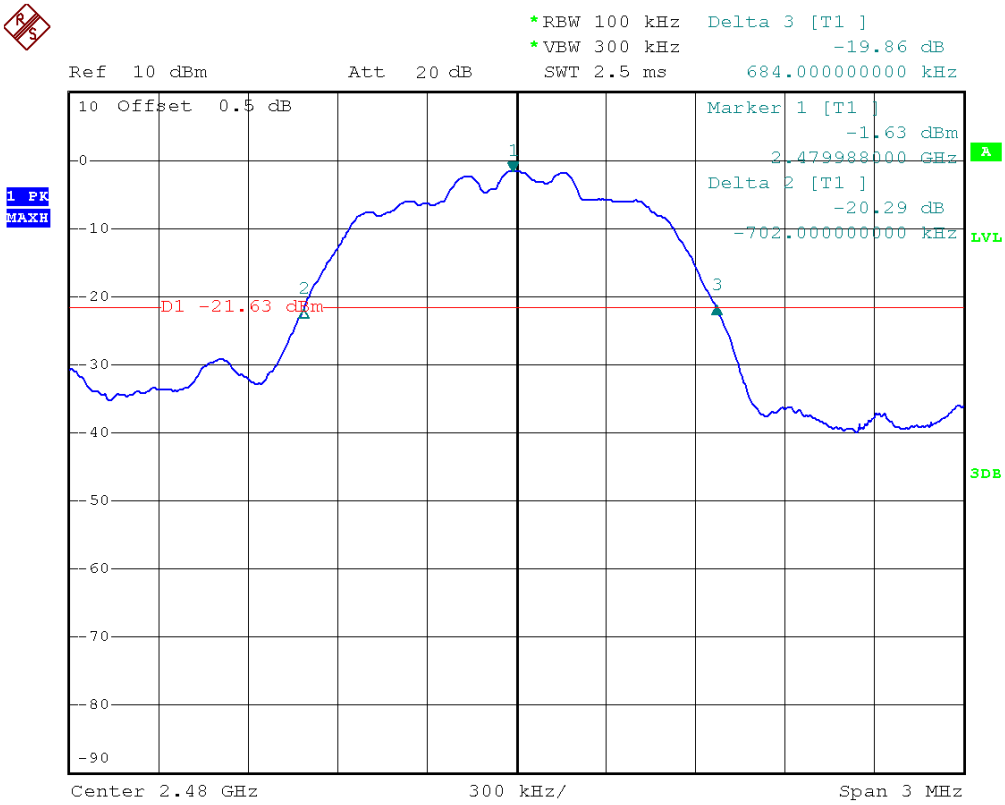
Test Plots:



(Plot D: Channel = 2402 @ Π/4-DQPSK)



(Plot E: Channel = 2441 @ ∏/4-DQPSK)



(Plot F: Channel = 2480 @ ∏/4-DQPSK)

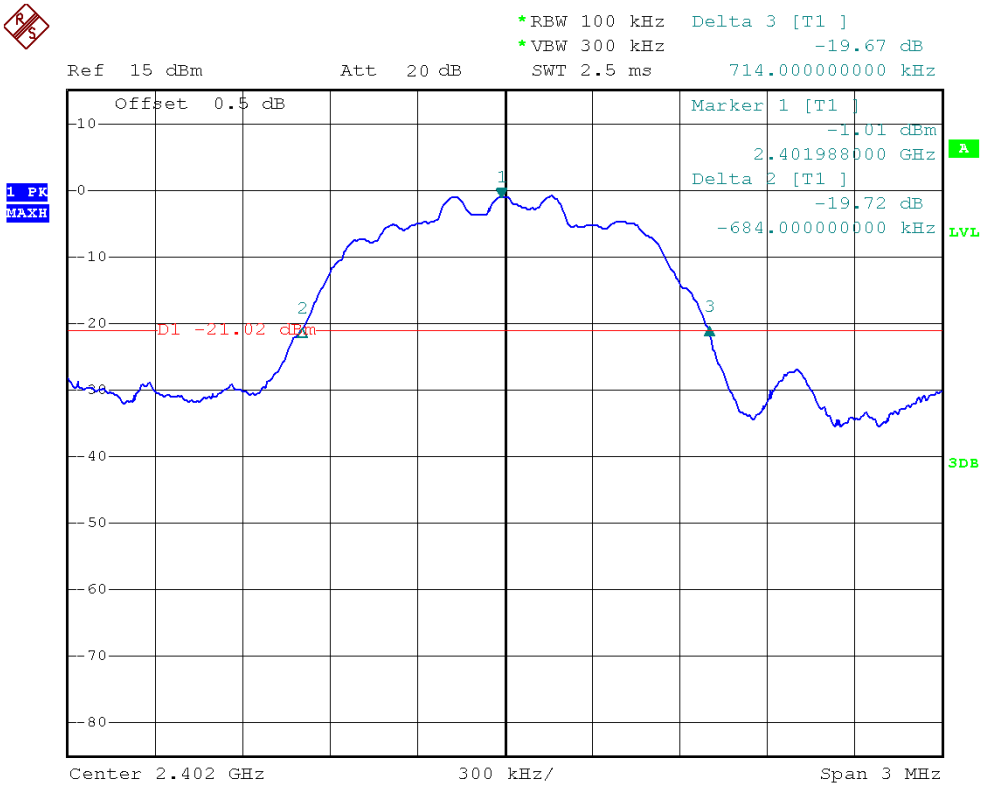
2.4.2.3. 8-DPSK Mode

A. Test Verdict:

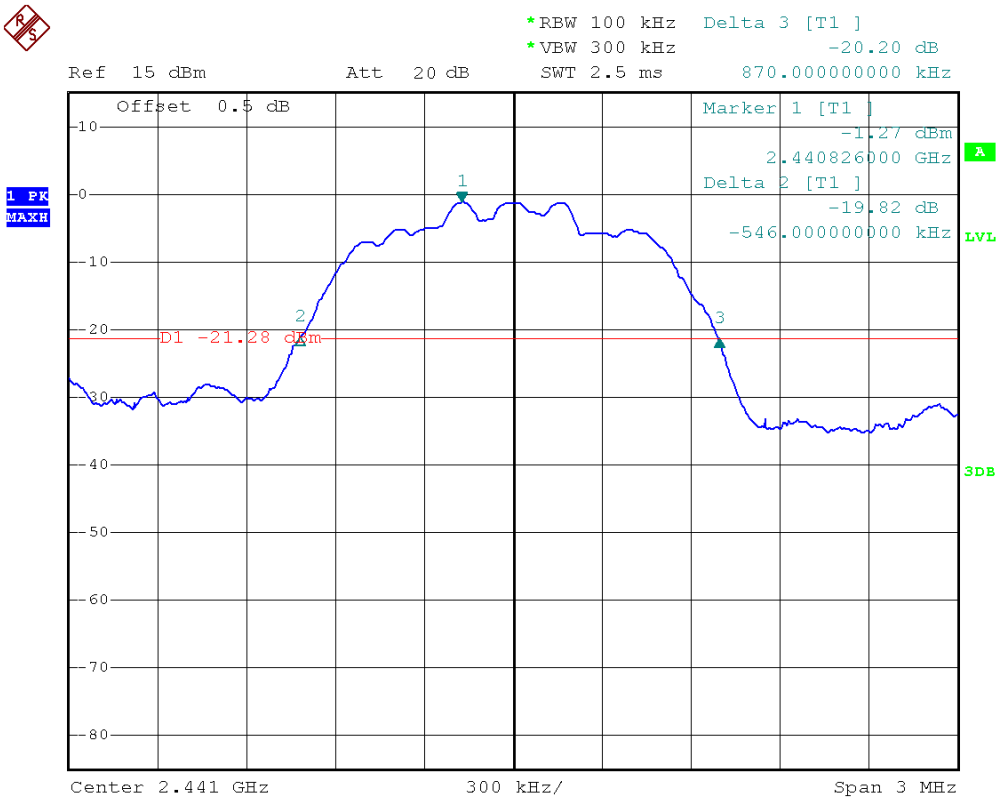
The maximum 20dB bandwidth measured is 1.416MHz according to the table below.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
0	2402	1.398	Plot G
39	2441	1.416	Plot H
78	2480	1.398	Plot I

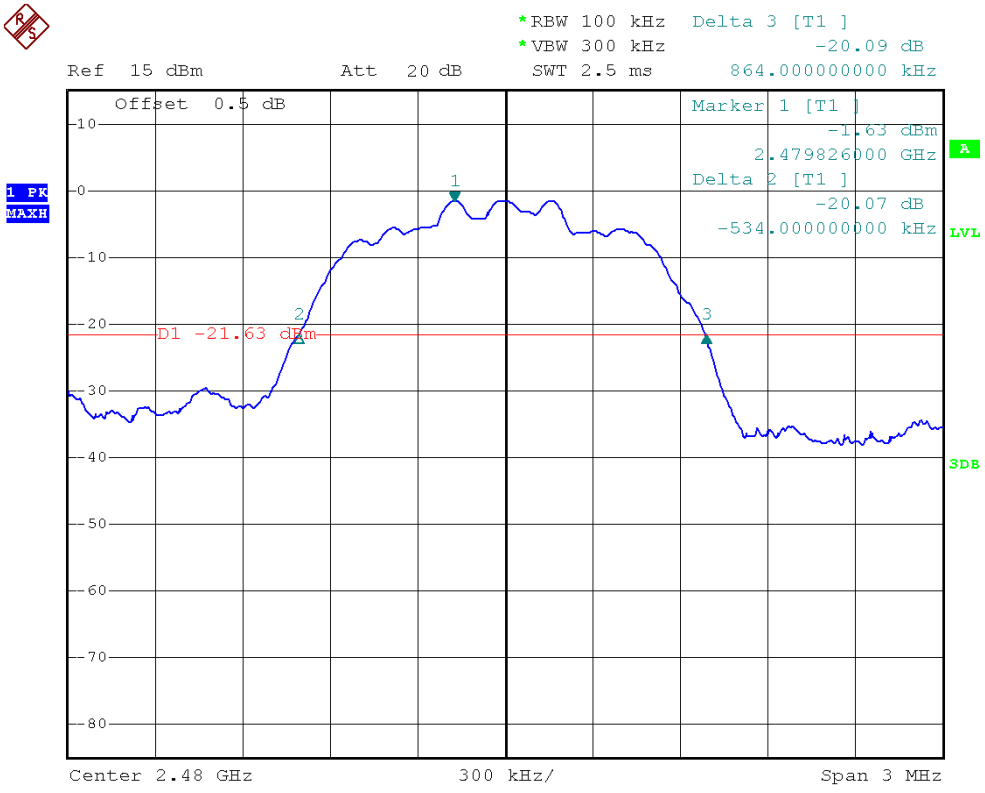
B. Test Plots:



(Plot G: Channel = 2402 @ 8-DPSK)



(Plot H: Channel = 2441 @ 8-DPSK)



(Plot I: Channel = 2480 @ 8-DPSK)

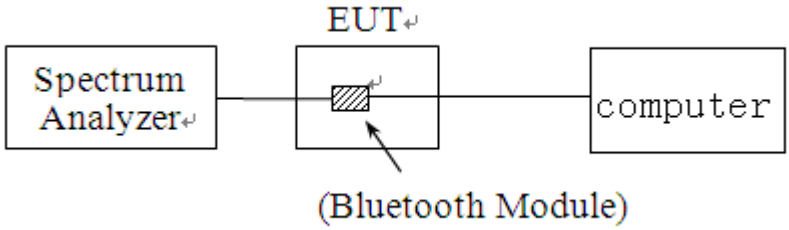
2.5. Carried Frequency Separation

2.5.1. Definition

According to FCC §15.247(a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater.

2.5.2. Test Description

A. Test Setup:



The Bluetooth Module of the EUT, which is powered by the Battery, is connected to the Spectrum Analyzer (SA), the path loss as the factor is calibrated to correct the reading. During the measurement, the Bluetooth Module of the EUT is activated and controlled by the PC, and is set to operate under test mode transmitting 339 bytes DH5 packages at maximum power.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date
Spectrum Analyzer	R&S	FSP40	1164.4391.40	2012.06.10

The Cal. Interval was one year.

2.5.3. Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = wide enough to capture the peaks of two adjacent channels

Resolution (or IF) Bandwidth (RBW) ≥ 1% of the span

Video (or Average) Bandwidth (VBW) ≥ RBW

Sweep = auto

Detector function = peak

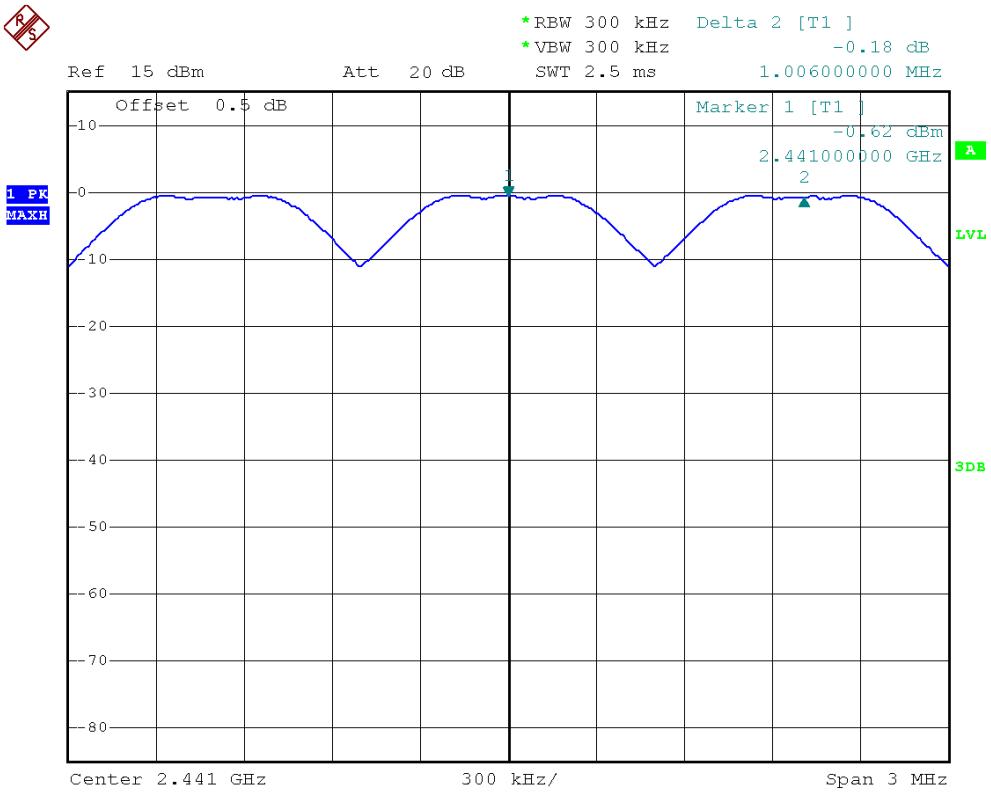
Trace = max hold

Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

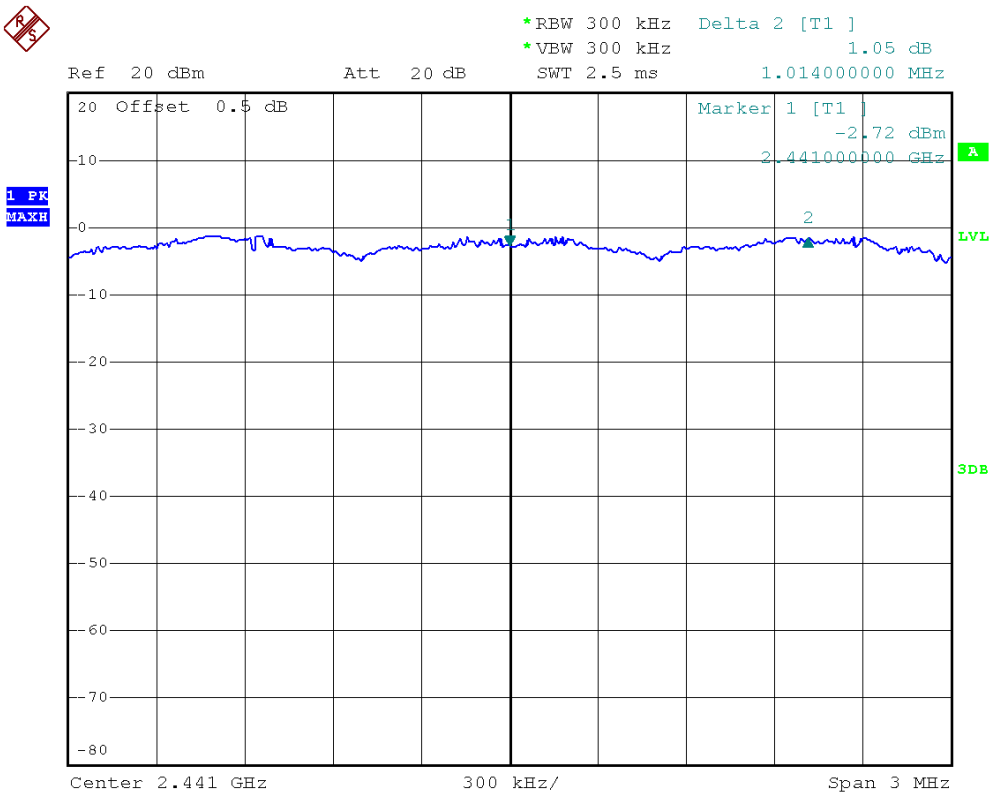
2.5.4. Test Result

The Bluetooth Module operates at hopping-on test mode.

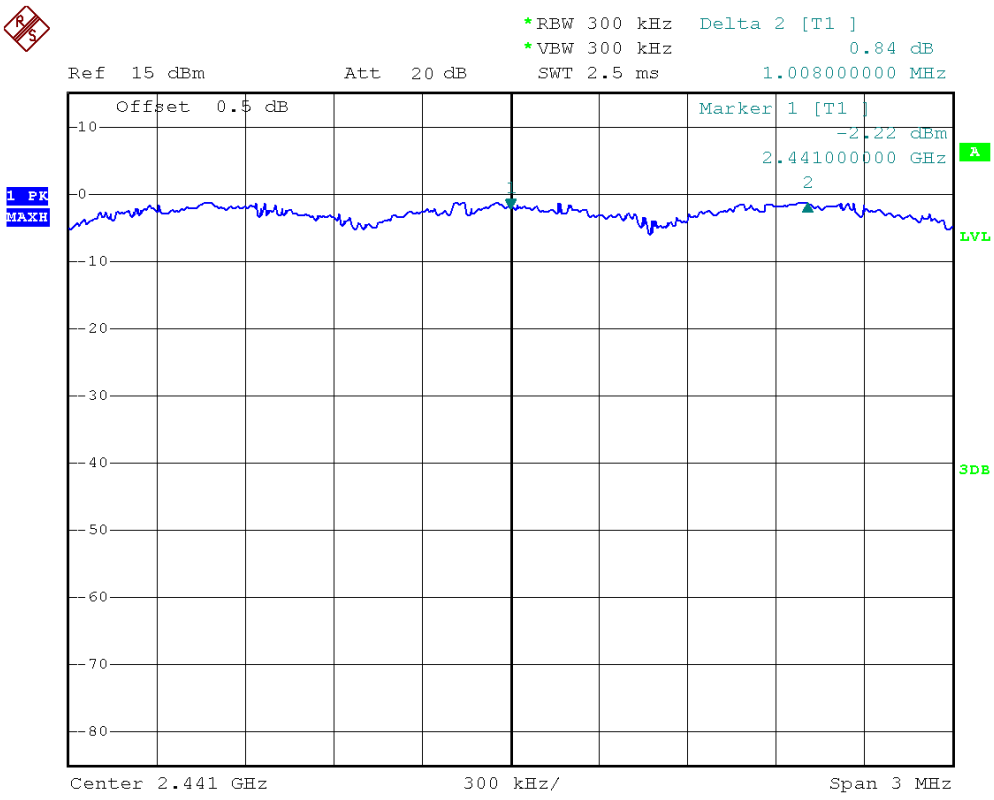
For any adjacent channels (e.g. the channel 39 and 40 as showed in the Plot A), the Module does have hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of the hopping channel (1.120MHz for GFSK mode, 1.404MHz for ∏/4-DQPSK mode and 1.416MHz for 8-DPSK mode, refer to section 2.4.1), whichever is greater. So, the verdict is PASSING



(Plot A: GFSK)



(Plot B: ∏/4-DQPSK)



(Plot C: 8-DPSK)

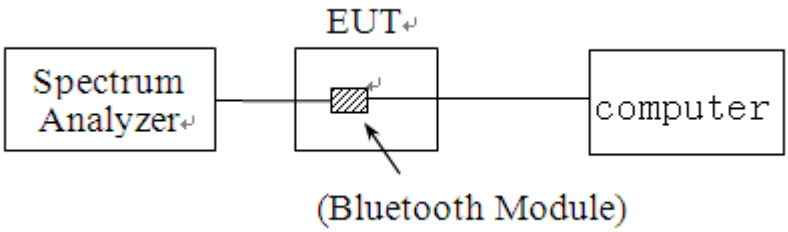
2.6. Time of Occupancy (Dwell time)

2.6.1. Requirement

According to FCC §15.247(a) (1) (iii), frequency hopping systems in the 2400 - 2483.5MHz band shall use at least 15 non-overlapping 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.

2.6.2. Test Description

A. Test Setup:



The Bluetooth Module of the EUT, which is powered by the Battery, is connected to the Spectrum Analyzer (SA), the path loss as the factor is calibrated to correct the reading. During the measurement, the Bluetooth Module of the EUT is activated and controlled by the PC, and is set to operate under test mode transmitting 339 bytes DH5 packages at maximum power.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date
Spectrum Analyzer	R&S	FSP40	1164.4391.40	2012.06.10

The Cal. Interval was one year.

2.6.3. Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = zero span, centered on a hopping channel

RBW = 1 MHz

VBW ≥ RBW

Sweep = as necessary to capture the entire dwell time per hopping channel

Detector function = peak

Trace = max hold

2.6.4. Test Result

The average time of occupancy on any channel within the Period can be calculated with formulas (for DH5 package type):

{Total of Dwell} = {Pulse Time} * (1600 / 6) / {Number of Hopping Frequency} * {Period}
{Period} = 0.4s * {Number of Hopping Frequency}

The lowest, middle and highest channels are selected to perform testing to record the dwell time of each occupation measured in this channel, which is called Pulse Time here.

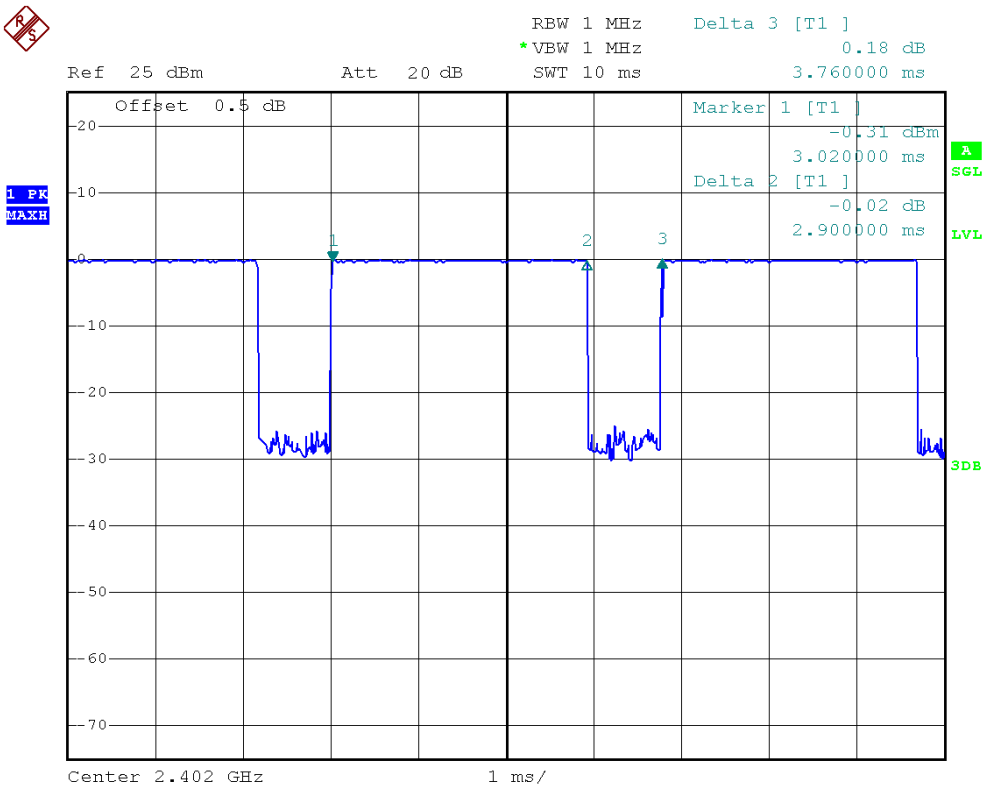
2.6.4.1. GFSK Mode

A. Test Verdict:

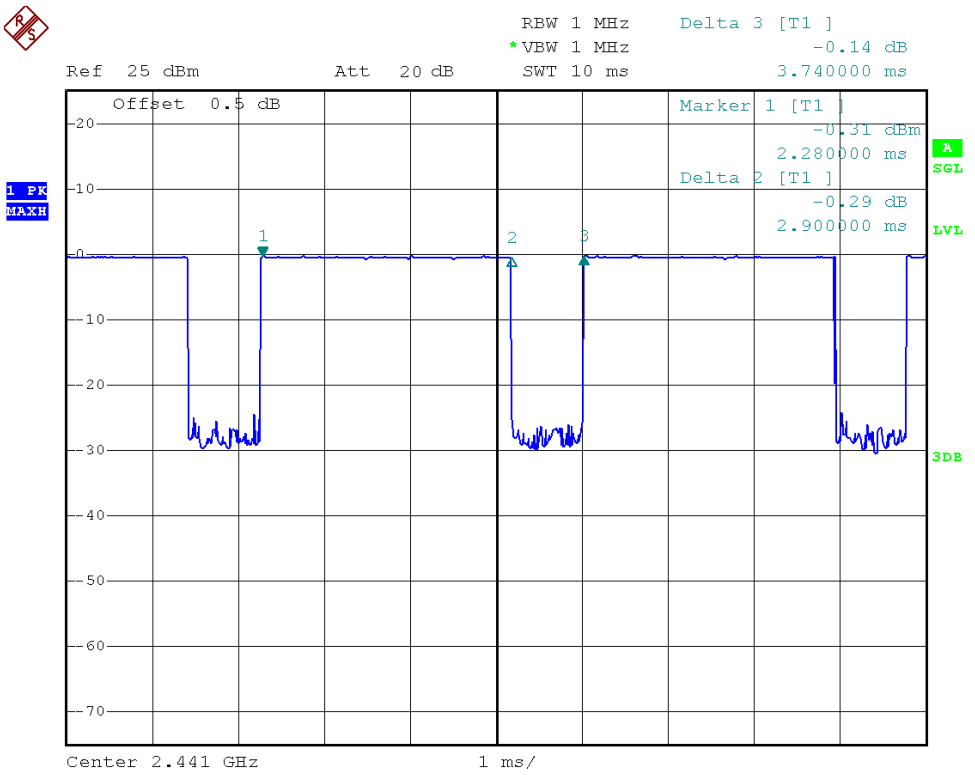
Channel	Frequency (MHz)	Pulse Time		Total of Dwell (ms)	Limit (ms)	Verdict
		ms	Refer to Plot			
0	2402	2.900	Plot A	309.334	400	PASS
39	2441	2.920	Plot B	311.468		PASS
78	2480	2.900	Plot C	309.334		PASS

Test Plots:

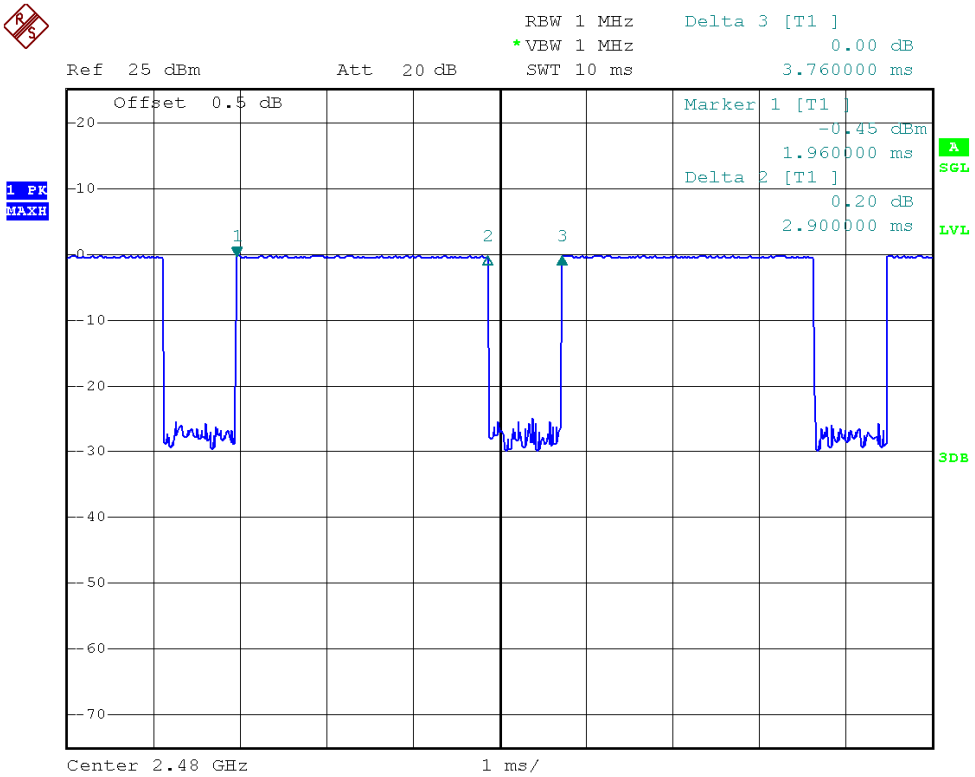
Note: the following plots record the Pulse Time of the Module carrier.



(Plot A: Channel = 2402 @ GFSK)



(Plot B: Channel = 2441 @ GFSK)



(Plot C: Channel = 2480 @ GFSK)

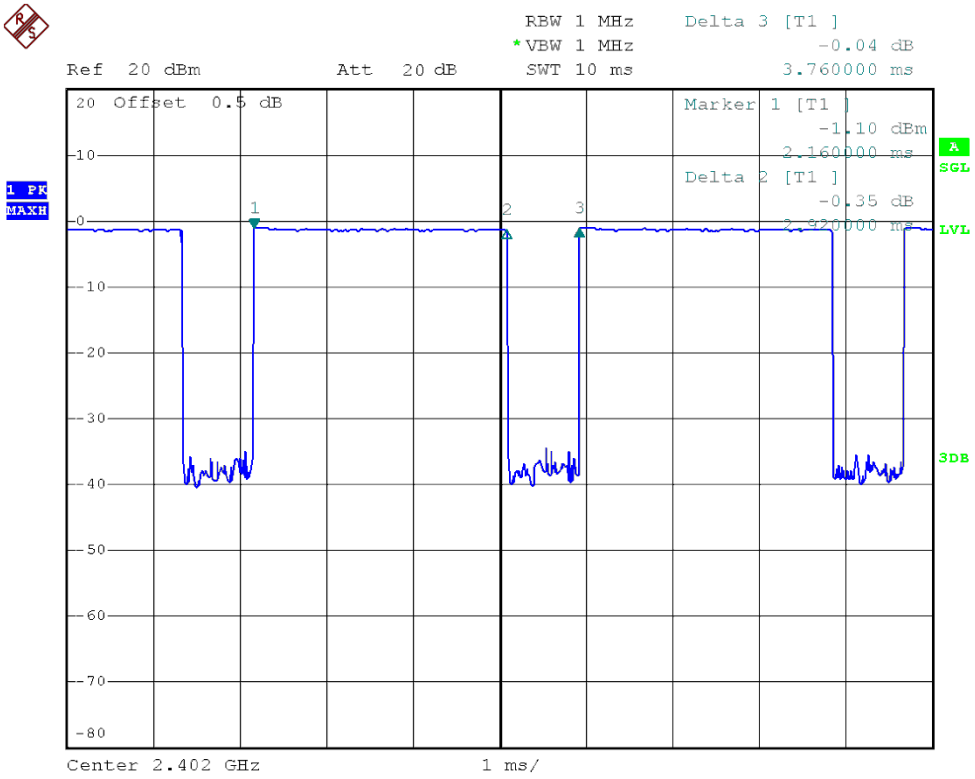
2.6.4.2. Π/4-DQPSK Mode

A. Test Verdict:

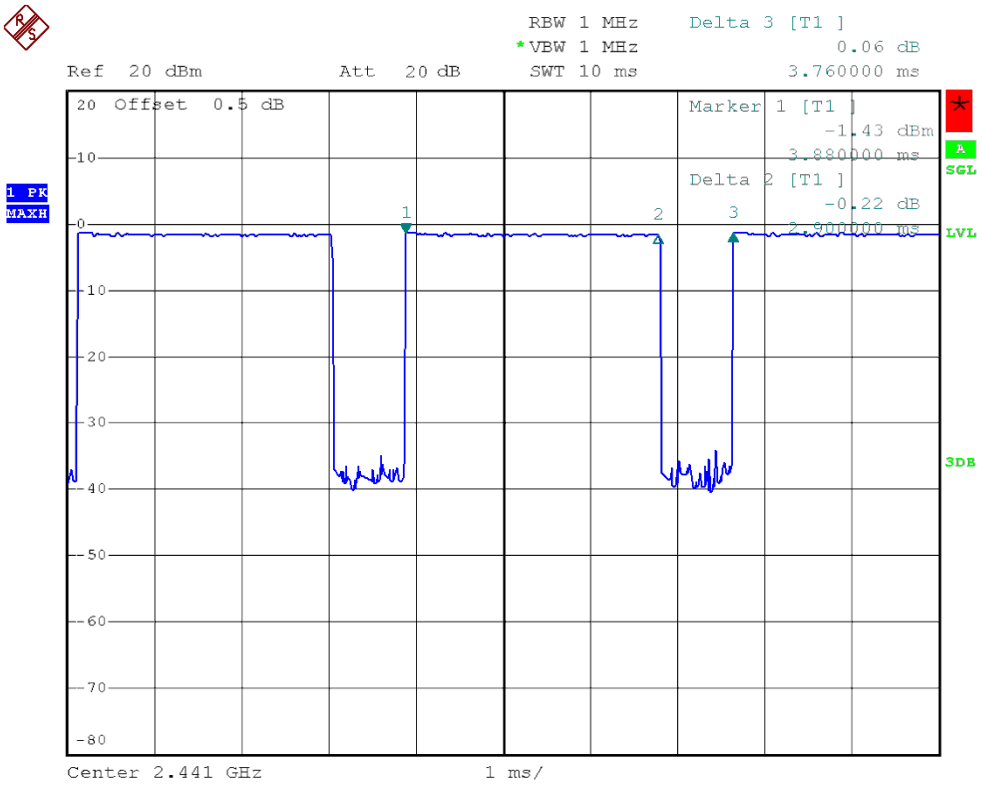
Channel	Frequency (MHz)	Pulse Time		Total of Dwell (ms)	Limit (ms)	Verdict
		ms	Refer to Plot			
0	2402	2.920	Plot D	311.468	400	PASS
39	2441	2.900	Plot E	309.334		PASS
78	2480	2.900	Plot F	309.334		PASS

Test Plots:

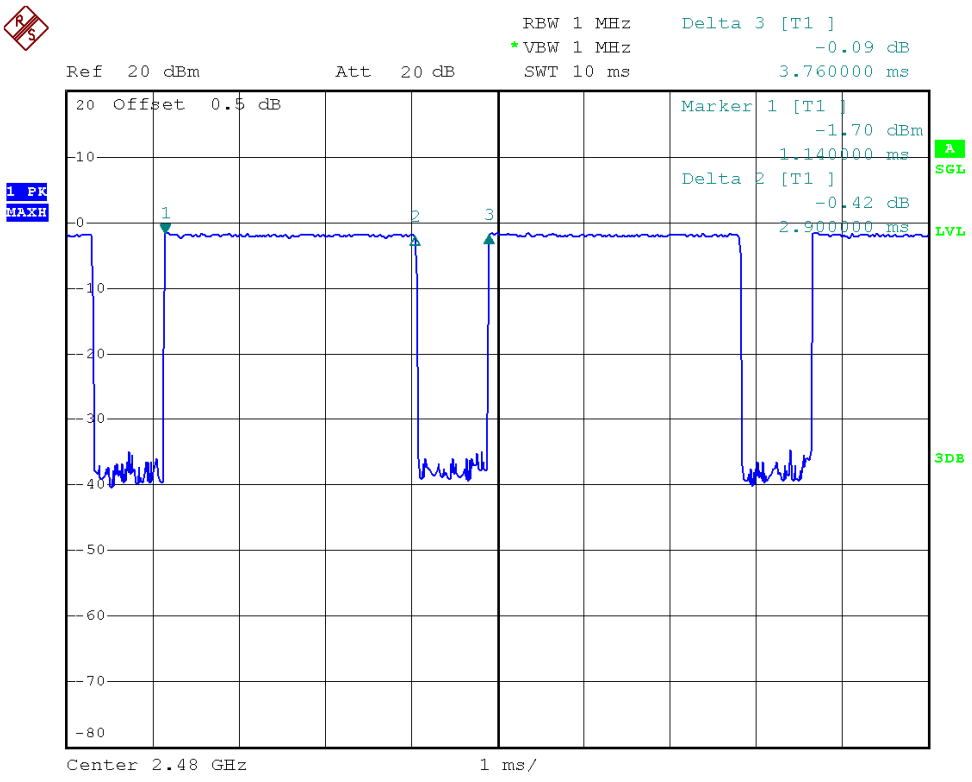
Note: the following plots record the Pulse Time of the Module carrier.



(Plot D: Channel = 2402 @ Π/4-DQPSK)



(Plot E: Channel = 2441 @ ∏/4-DQPSK)



(Plot F: Channel = 2480 @ ∏/4-DQPSK)

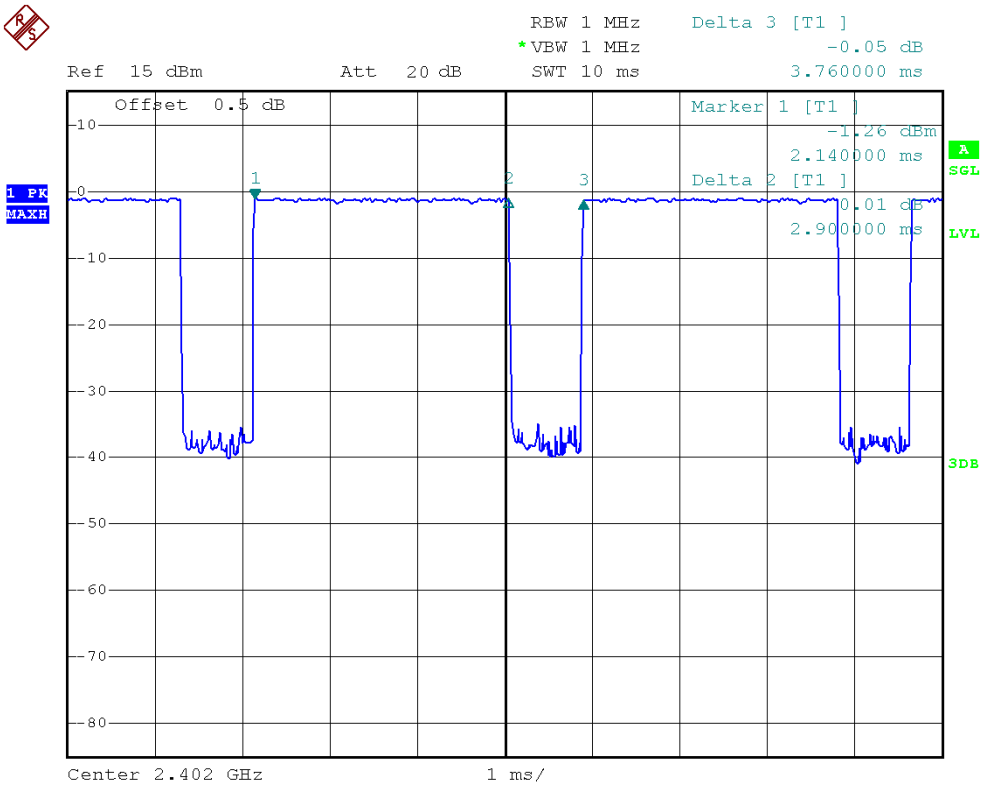
2.6.4.3. 8-DPSK mode

A. Test Verdict:

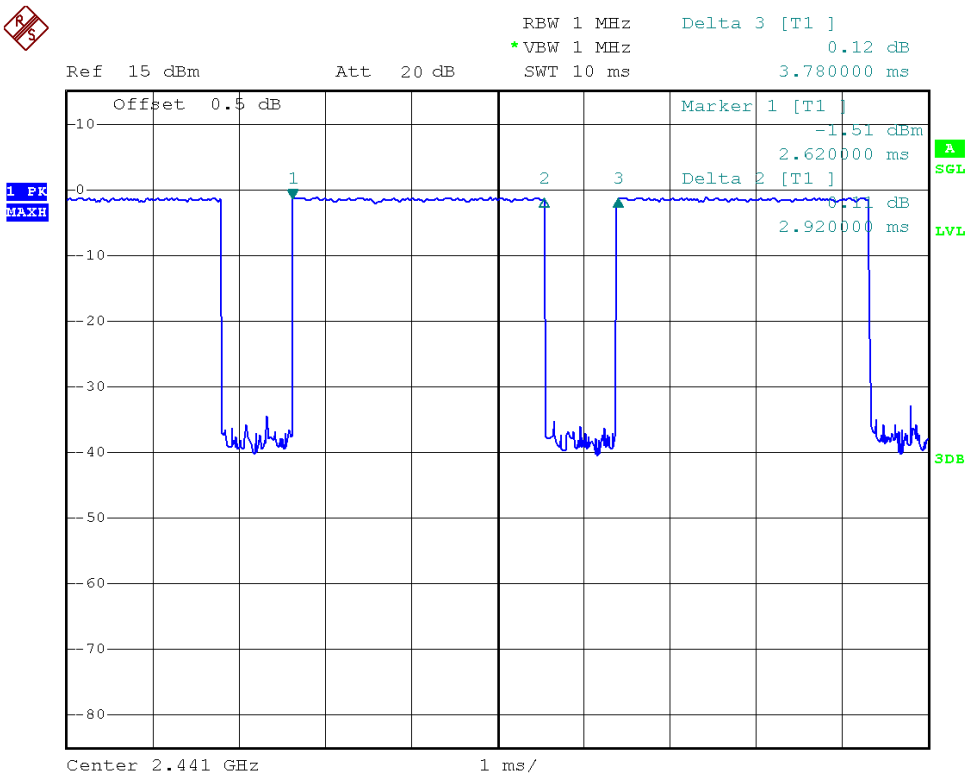
Channel	Frequency (MHz)	Pulse Time		Total of Dwell (ms)	Limit (ms)	Verdict
		ms	Refer to Plot			
0	2402	2.900	Plot G	309.334	400	PASS
39	2441	2.920	Plot H	311.468		PASS
78	2480	2.900	Plot I	309.334		PASS

Test Plots:

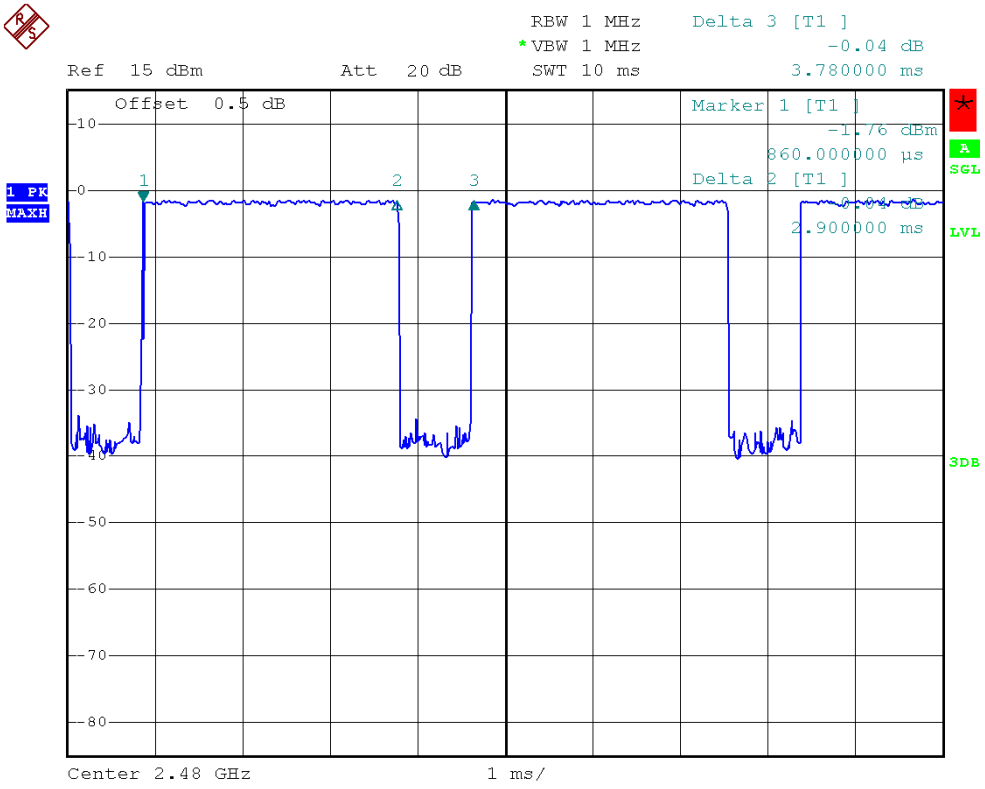
Note: the following plots record the Pulse Time of the Module carrier.



(Plot G: Channel = 2402 @ 8-DPSK)



(Plot H: Channel = 2441 @ 8-DPSK)



(Plot I: Channel = 2480 @ 8-DPSK)

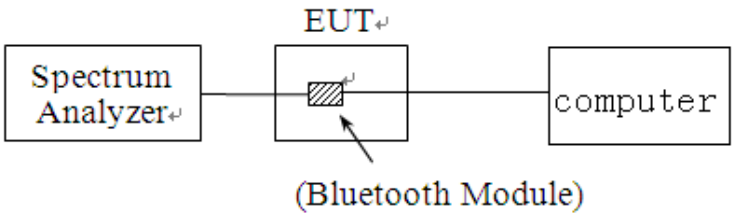
2.7. Conducted Spurious Emissions

2.7.1. Requirement

According to FCC §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.

2.7.2. Test Description

A. Test Setup:



The Bluetooth Module of the EUT, which is powered by the Battery, is connected to the Spectrum Analyzer (SA), the path loss as the factor is calibrated to correct the reading. During the measurement, the Bluetooth Module of the EUT is activated and controlled by the PC, and is set to operate under test mode transmitting 339 bytes DH5 packages at maximum power.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date
Spectrum Analyzer	R&S	FSP40	1164.4391.40	2012.06.10

The Cal. Interval was one year.

2.7.3. Test Procedure

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.

RBW = 100 kHz

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize.

2.7.4. Test Result

The Bluetooth Module operates at hopping-off test mode. The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions.

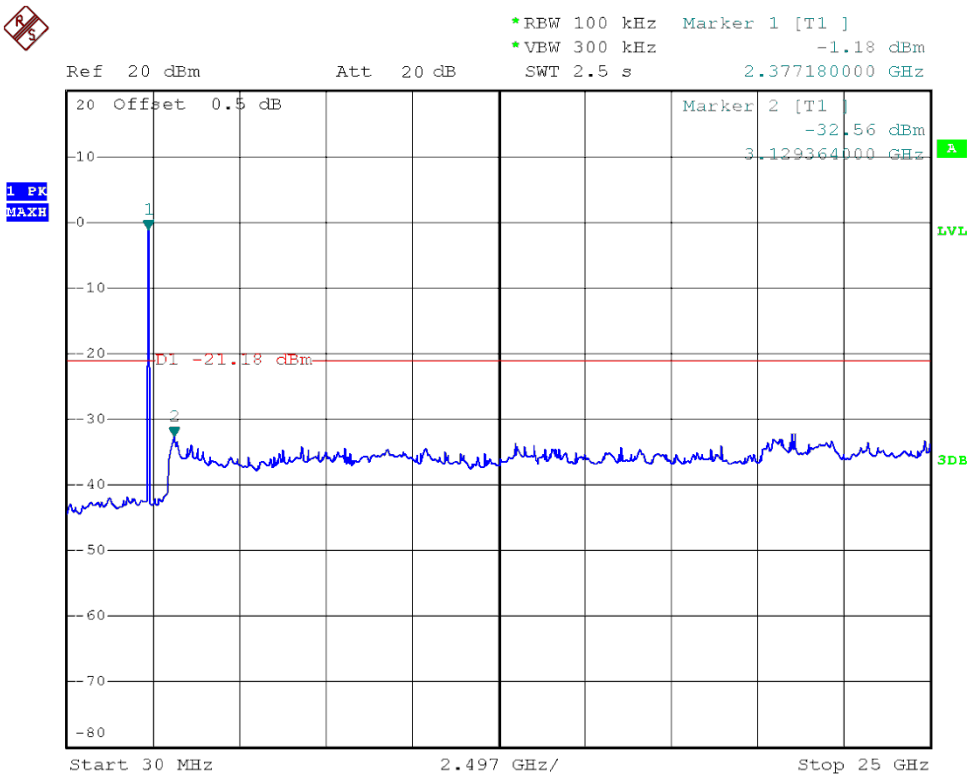
2.7.4.1. GFSK Mode

A. Test Verdict:

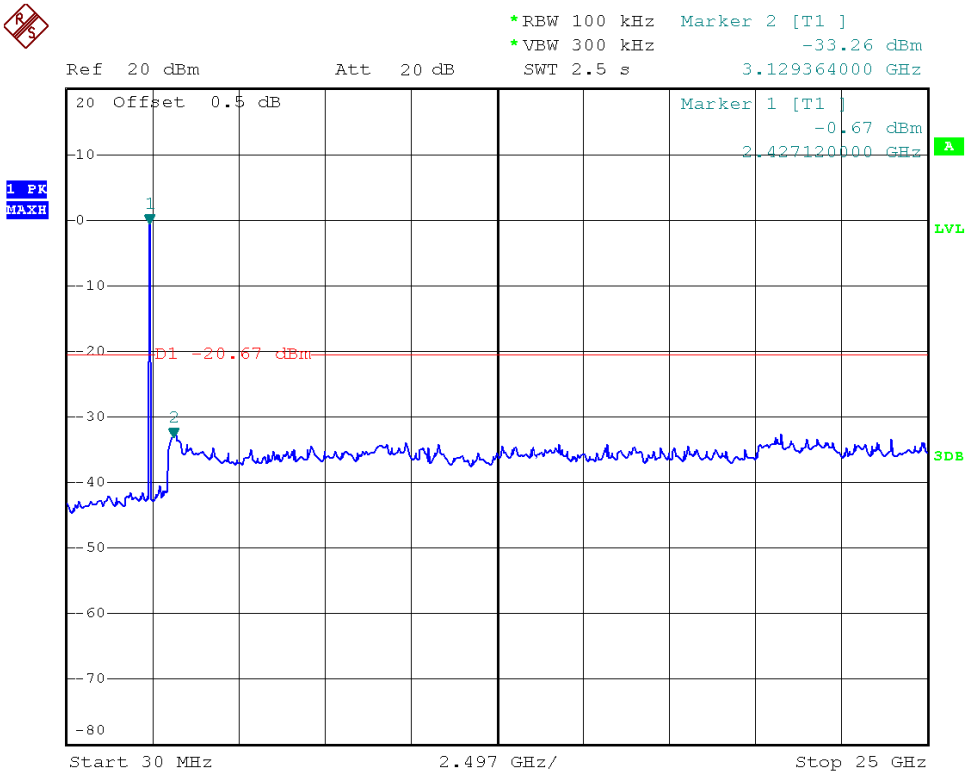
Channel	Frequency (MHz)	Measured Max. Out of Band EmissiondBm)	Refer to Plot	Limit (dBm)		Verdict
				Carrier Level	Calculated -20dBc Limit	
0	2402	-32.56	Plot A.1	-1.18	-21.18	PASS
39	2441	-33.26	Plot B.1	-0.67	-20.67	PASS
78	2480	-33.54	Plot C.1	-1.13	-21.13	PASS

B. Test Plots:

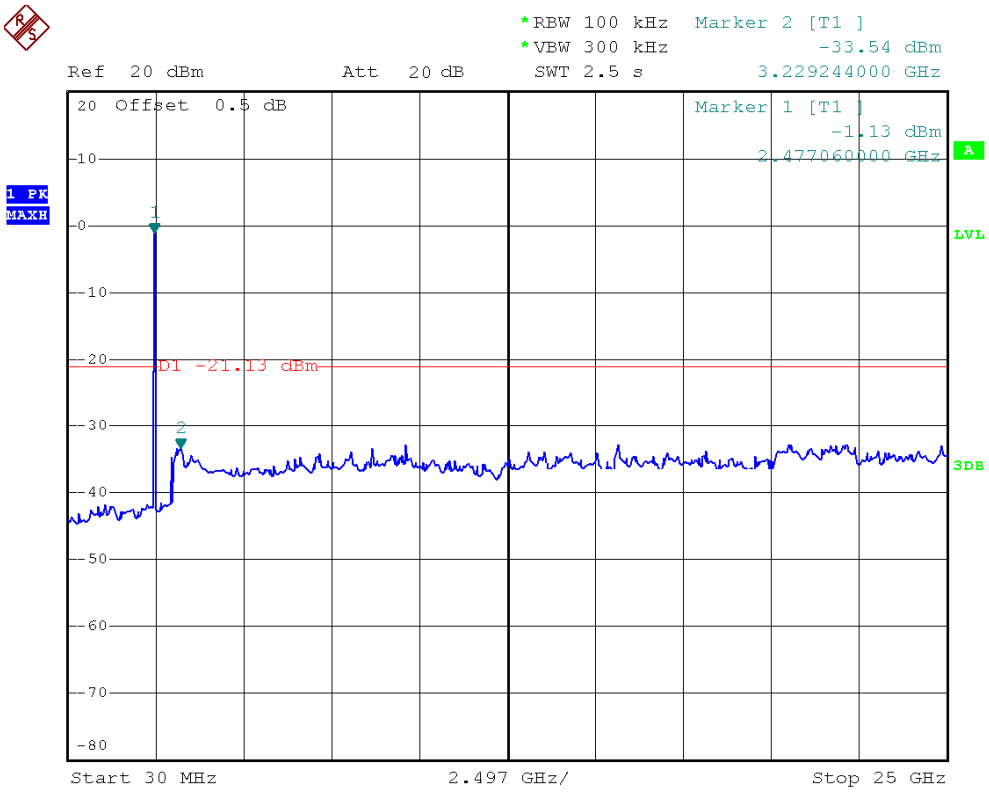
Note: the power of the Module transmitting frequency should be ignored.



(Plot A.1: Channel = 0, 30MHz to 25GHz @ GFSK Mode)



(Plot B.1: Channel = 39, 30MHz to 25GHz @ GFSK Mode)



(Plot C.1: Channel = 78, 30MHz to 25GHz @ GFSK Mode)

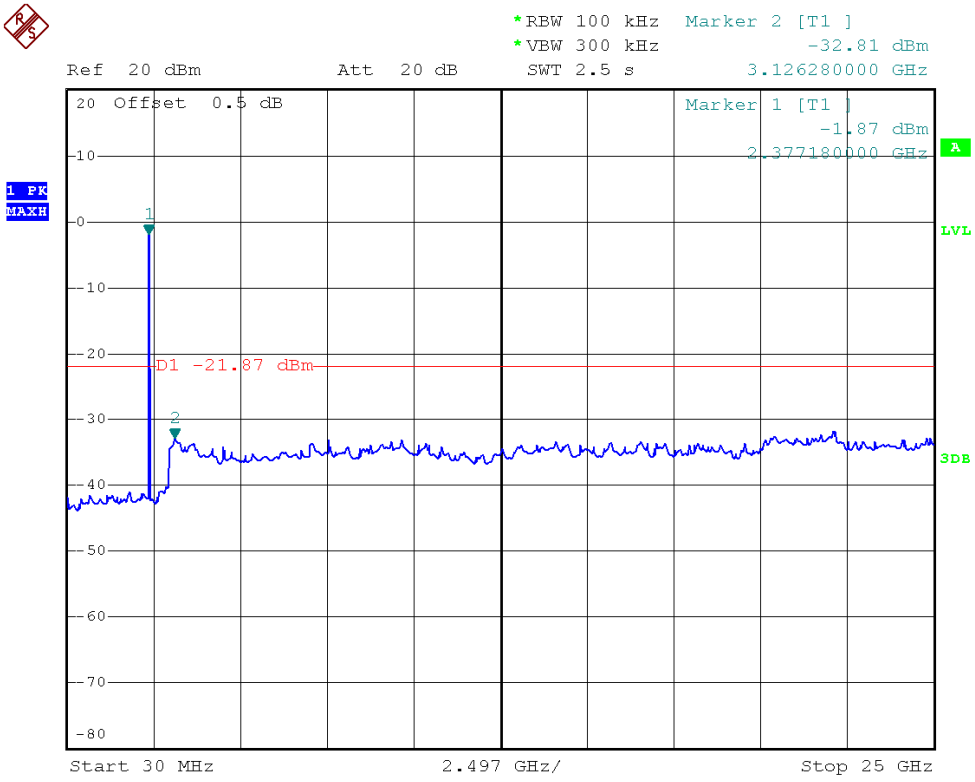
2.7.4.2. ∏/4-DQPSK Mode

A. Test Verdict:

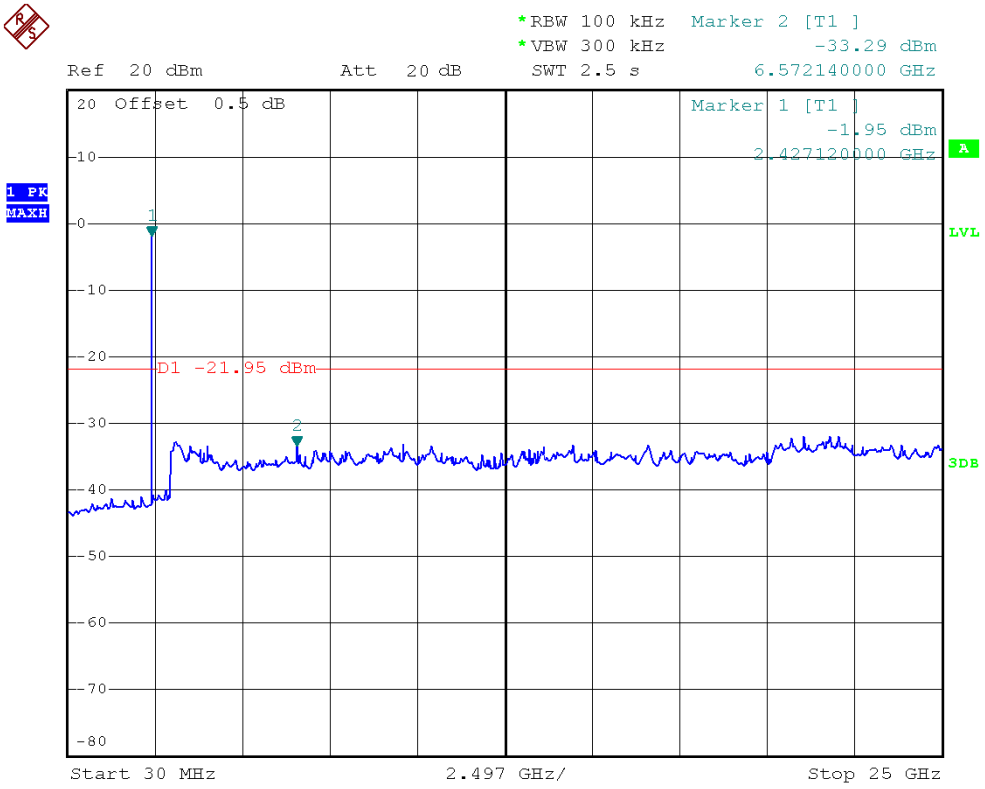
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Refer to Plot	Limit (dBm)		Verdict
				Carrier Level	Calculated -20dBc Limit	
0	2402	-32.81	Plot D.1	-1.87	-21.87	PASS
39	2441	-33.29	Plot E.1	-1.95	-21.95	PASS
78	2480	-30.61	Plot F.1	-1.58	-21.58	PASS

B. Test Plots:

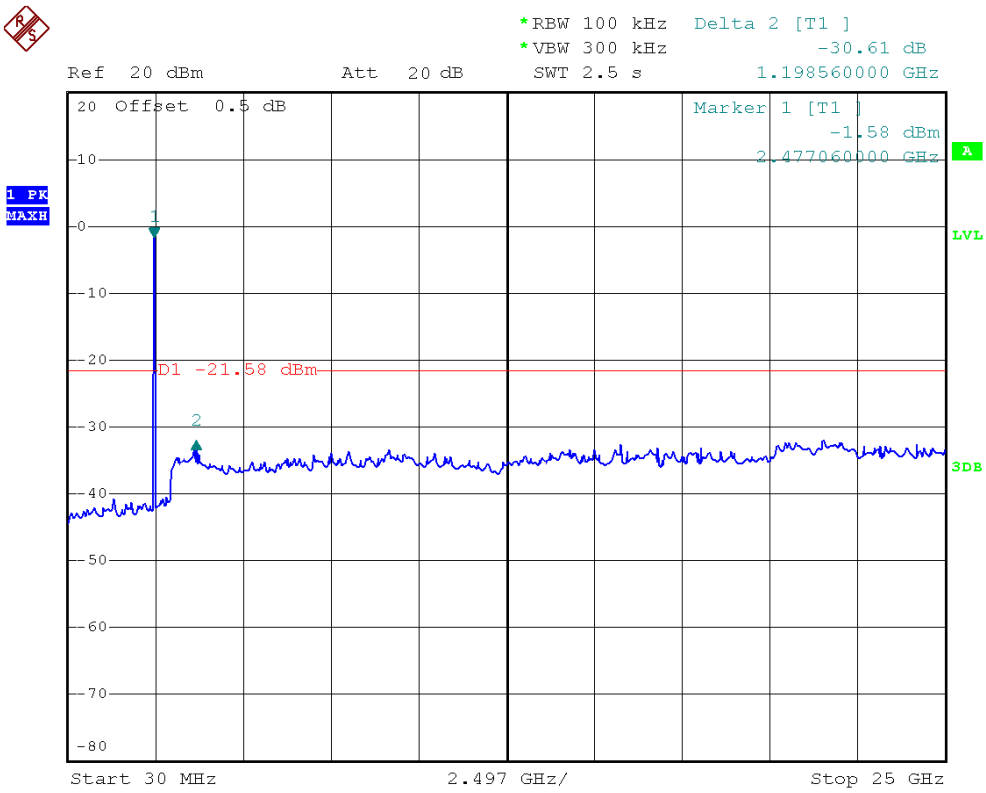
Note: the power of the Module transmitting frequency should be ignored.



(Plot D.1: Channel = 0, 30MHz to 25GHz @ ∏/4-DQPSK)



(Plot E.1: Channel = 39, 30MHz to 25GHz @ ∏/4-DQPSK)



(Plot F.1: Channel = 78, 30MHz to 25GHz @ ∏/3-DQPSK)

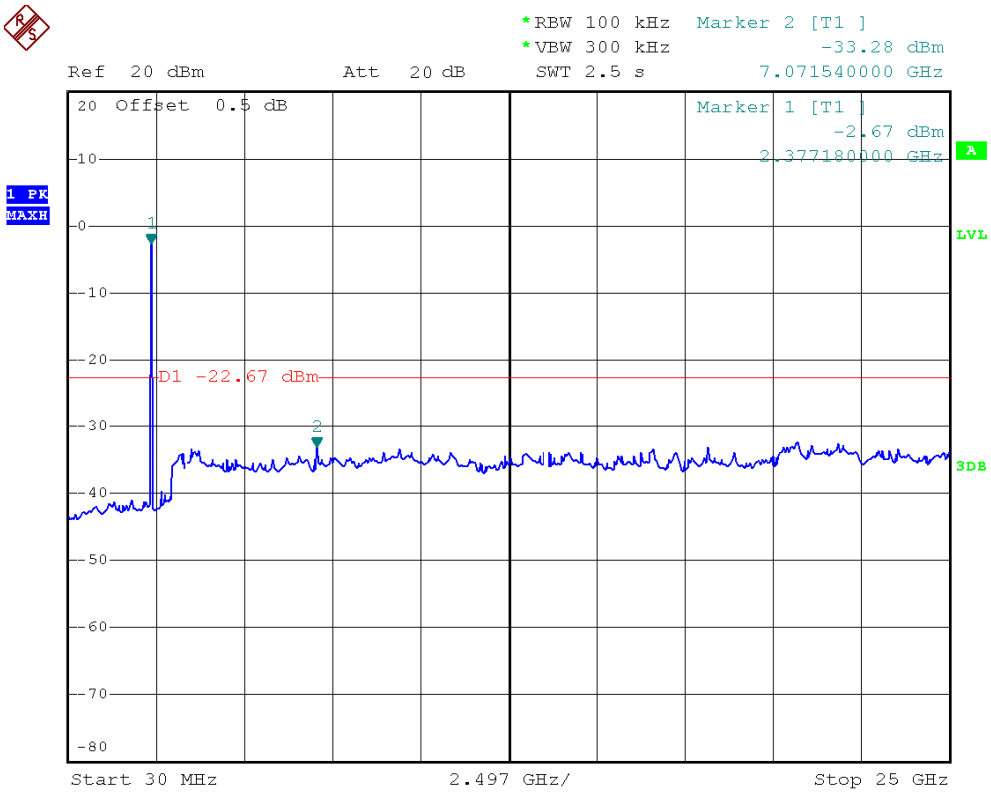
2.7.4.3. 8-DPSK Mode

A. Test Verdict:

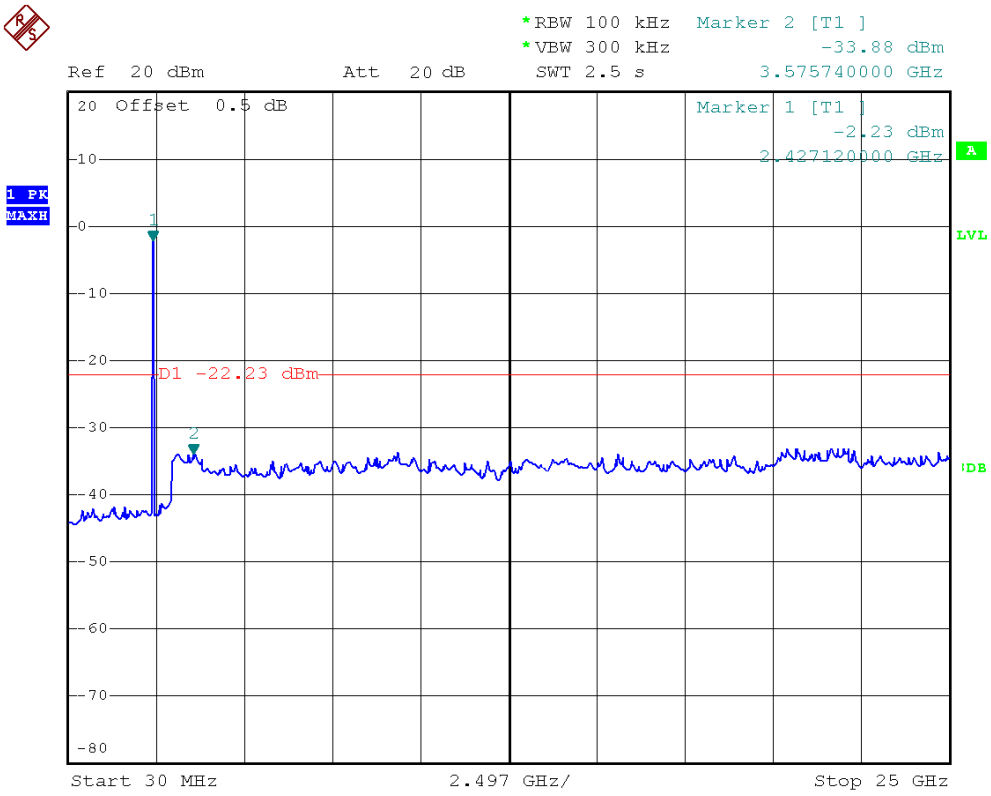
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Refer to Plot	Limit (dBm)		Verdict
				Carrier Level	Calculated -20dBc Limit	
0	2402	-33.28	Plot G.1	-2.67	-22.67	PASS
39	2441	-33.88	Plot H.1	-2.23	-22.23	PASS
78	2480	-31.30	Plot I.1	-1.80	-21.80	PASS

B. Test Plots:

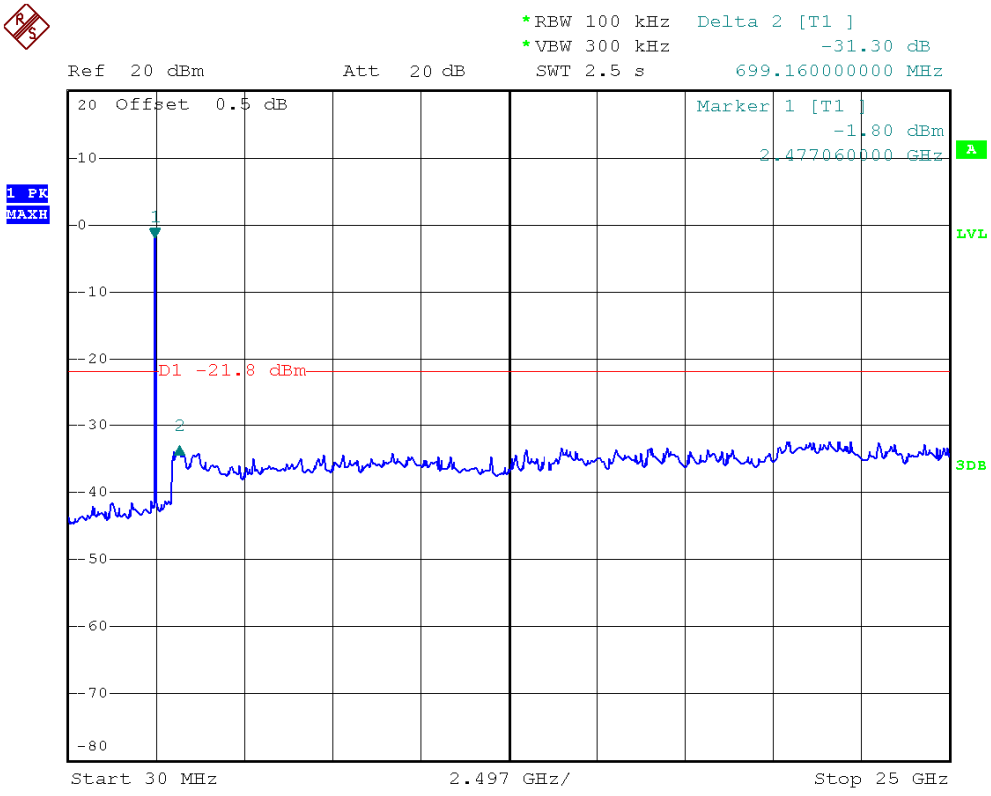
Note: the power of the Module transmitting frequency should be ignored.



(Plot G.1: Channel = 0, 30MHz to 25GHz @ 8-DPSK)



(Plot H.1: Channel = 39, 30MHz to 25GHz @ 8-DPSK)



(Plot I.1: Channel = 78, 30MHz to 25GHz @ 8-DPSK)

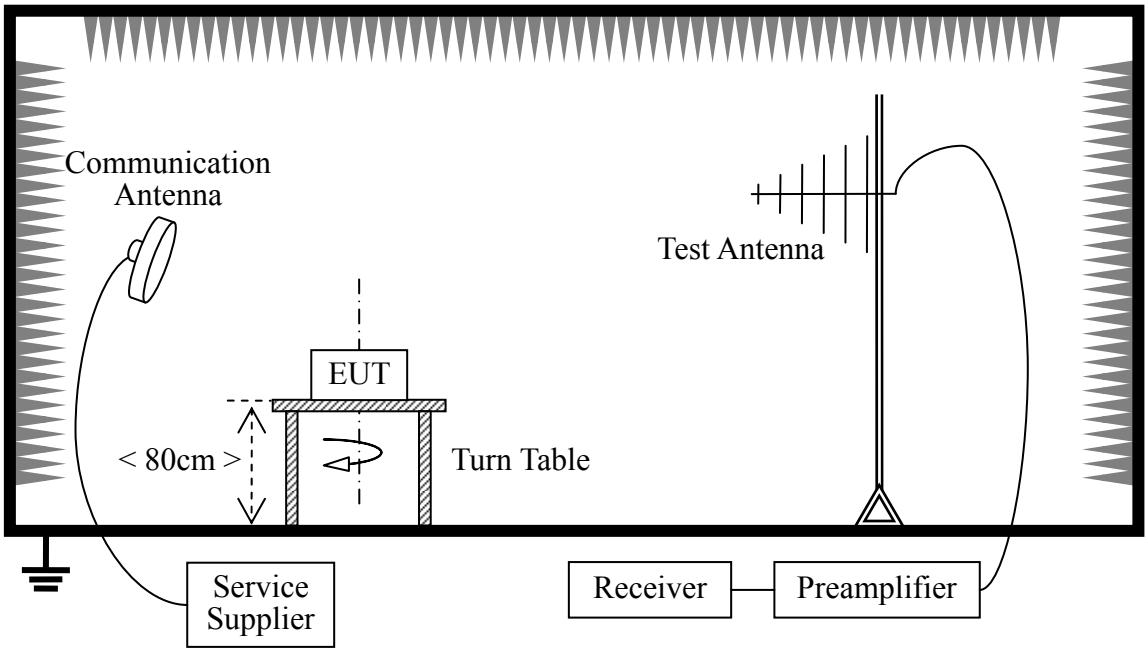
2.8. Band Edge

2.8.1. 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.

2.8.2. Test Description

A. Test Setup:



The Bluetooth Module of the EUT is powered by the Battery. The Module is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading. During the measurement, the Bluetooth Module is activated and controlled by the Bluetooth Service Supplier (SS) via a Common Antenna, and is set to operate under hopping-on test mode transmitting 339 bytes DH5 packages at maximum power.

For the Test Antenna:

Horn Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date
Receiver	R&S	FSP40	1164.4391.40	2012.06.10
Full-Anechoic Chamber	Albatross	12.8m*6.8m*6.4m	A0412372	2012.06.10
Double ridge horn antenna	R&S	HF906	100150	2012.06.10

Description	Manufacturer	Model	Serial No.	Cal. Date
Ultra-wideband antenna	R&S	HL562	A0304224	2012.06.10
Ampilier 1G~18GHz	R&S	MITEQ AFS42-00101800	25-S-42	2012.06.10

2.8.3. Test Procedure

Span = wide enough to capture the peak level of the emission operating on the channel closest to the bandedge, as well as any modulation products which fall outside of the authorized band of operation

RBW ≥ 1% of the span

VBW ≥ RBW

Sweep = auto

Detector function = peak /AV

Trace = max hold

Allow the trace to stabilize.

2.8.4. Test Result

The Bluetooth Module operates at hopping-off test mode. The lowest and highest channels are tested to verify the band edge emissions.

The measurement results are obtained as below:
E [dBμV/m] =U_R + A_T + A_{Factor} [dB]; A_T =$L_{Cable\ loss}$ [dB]-G_{preamp} [dB]
A_T: Total correction Factor except Antenna
U_R: Receiver Reading
G_{preamp}: Preamplifier Gain
A_{Factor}: Antenna Factor at 3m

Note: The red vertical lines “F1” in the following charts is to indicate the frequencies 2400MHz and 2483.5MHz respectively

2.8.4.1. GFSK Mode

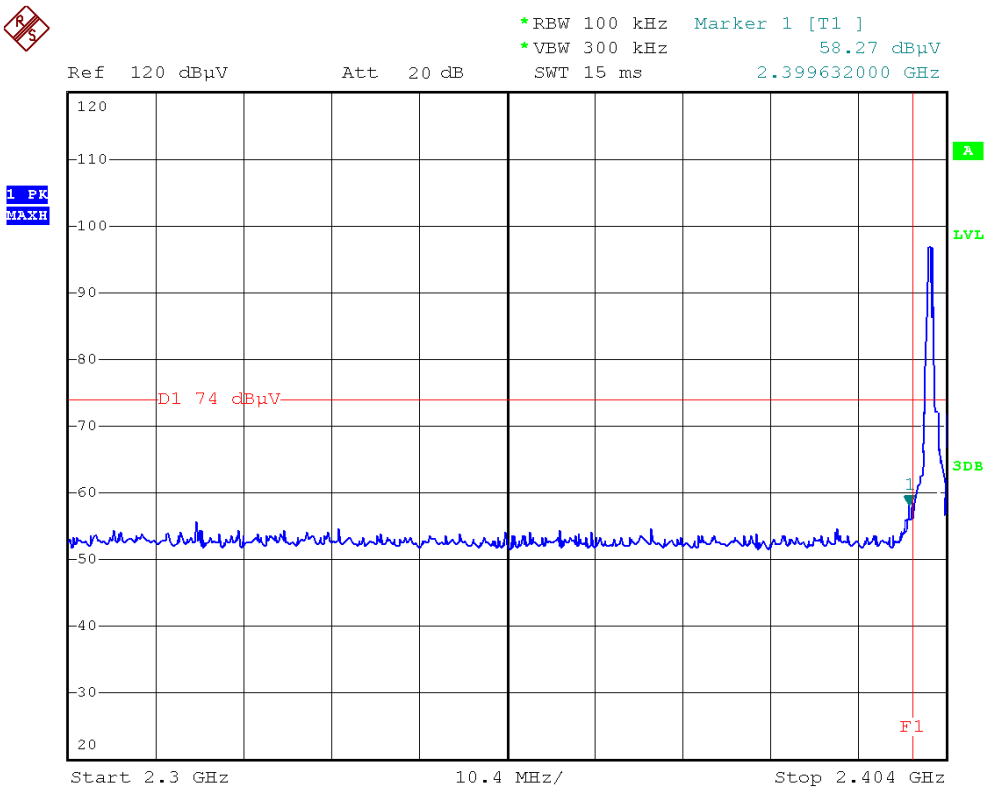
A. Test Verdict:

(Un-hopping)

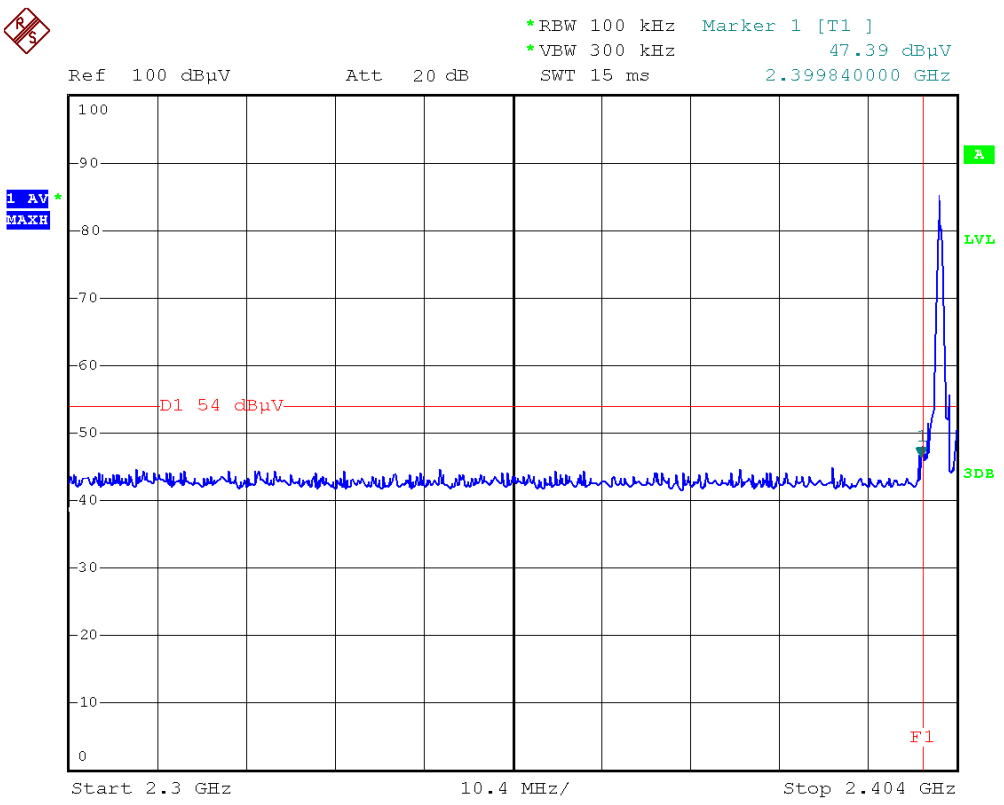
Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading UR (dBuV)	AT (dB)	AFactor (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
0	2399.632	PK	58.27	-31.70	28.3	54.87	74	Pass

Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading UR (dBuV)	AT (dB)	AFactor (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
0	2399.840	AV	47.39	-31.70	28.3	43.99	54	Pass
78	2486.976	PK	54.16	-29.45	29.2	53.91	74	Pass
78	2487.107	AV	45.07	-29.45	29.2	44.82	54	Pass

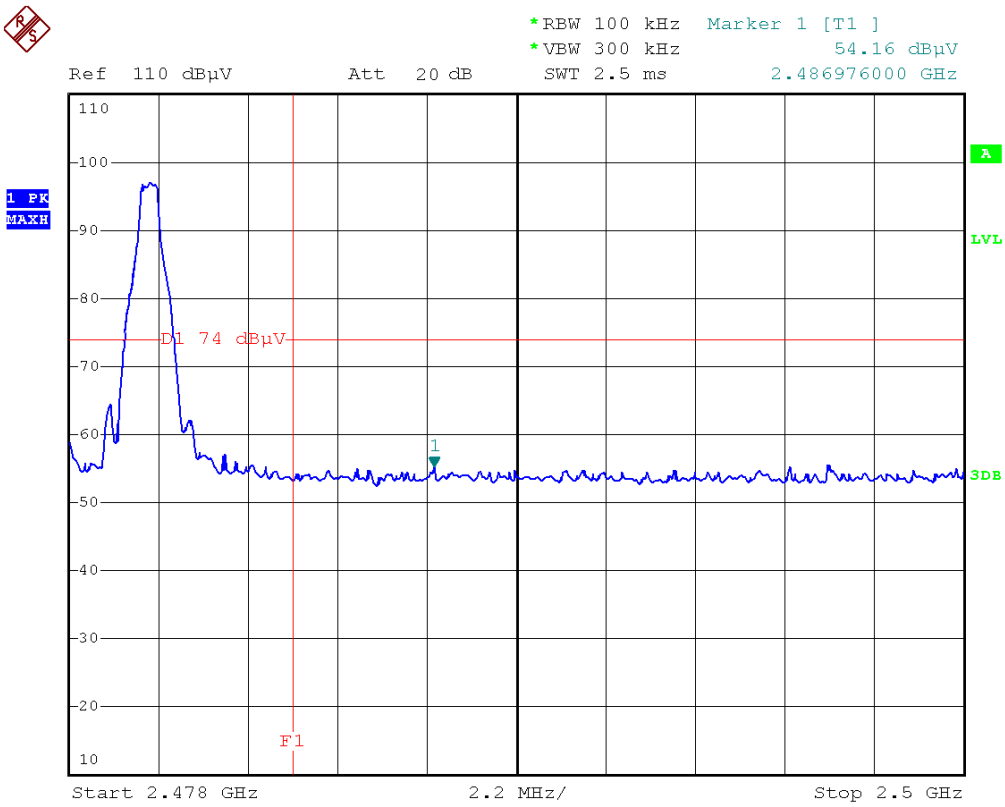
B. Test Plots:



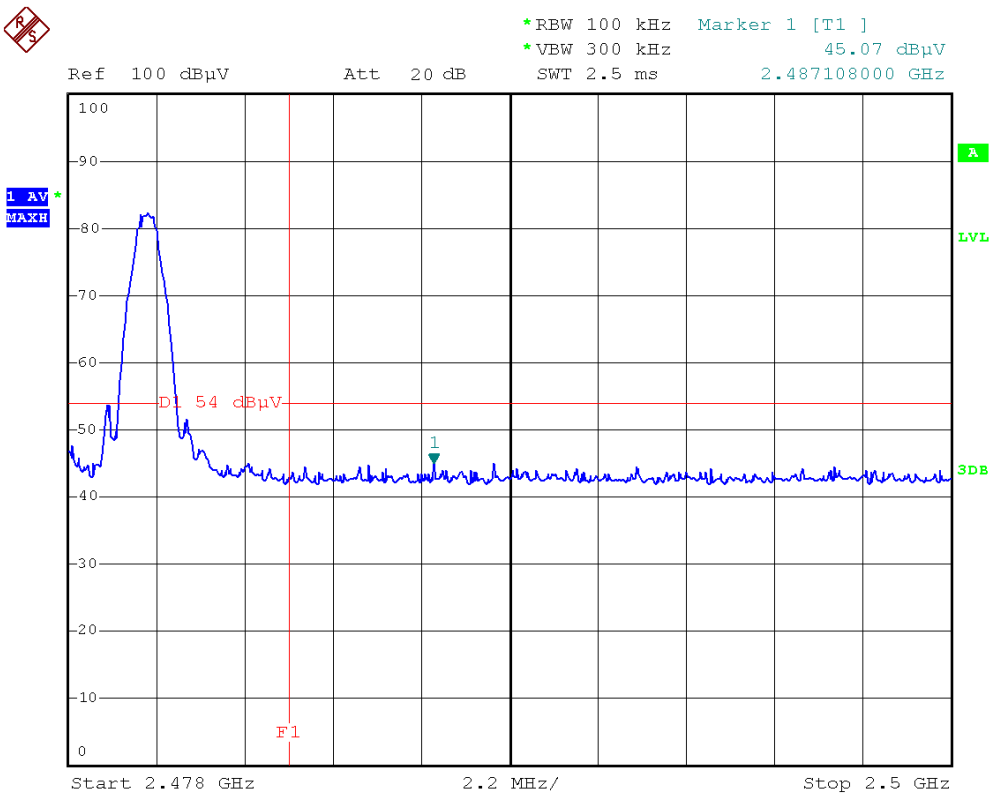
(Plot A1: Channel = 0 PEAK @ GFSK)



(Plot A2: Channel = 0 AVERAGE @ GFSK)



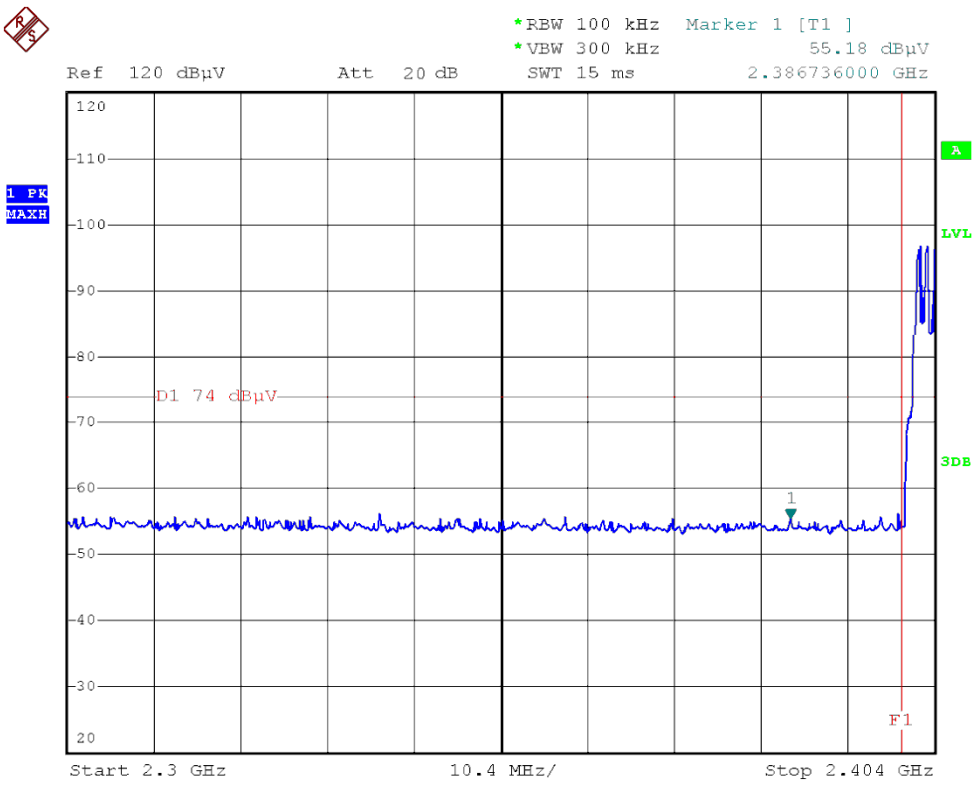
(Plot B1: Channel = 78 PEAK @ GFSK)



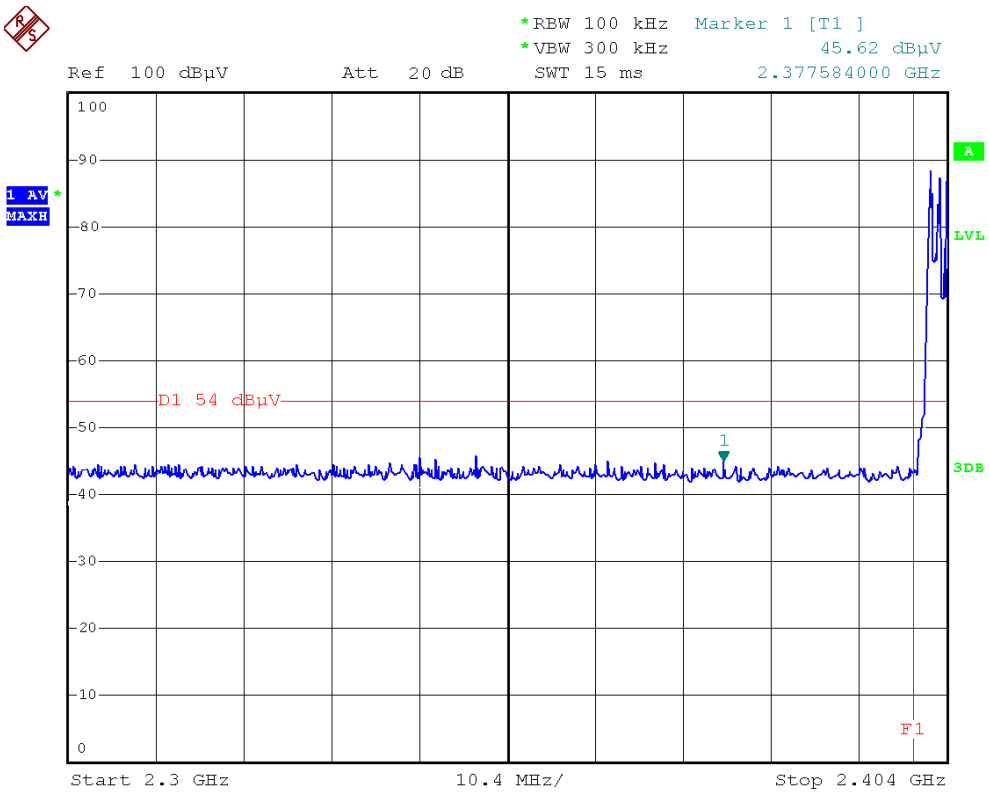
(Plot B2: Channel = 78 AVERAGE @ GFSK)

(hopping)

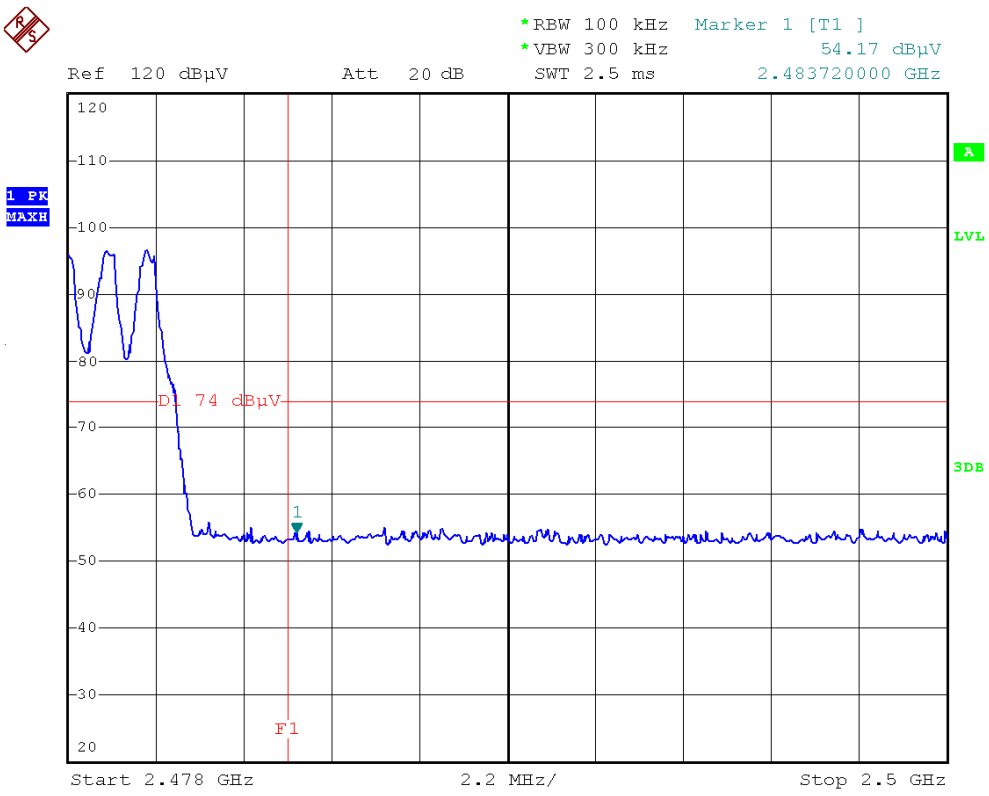
Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading UR (dBuV)	AT (dB)	AFactor (dB@3m)	Max. Emission E (dBµV/m)	Limit (dBµV/m)	Verdict
0	2386.736	PK	55.18	-31.70	28.3	51.78	74	Pass
0	2377.584	AV	45.62	-31.70	28.3	42.22	54	Pass
78	2483.720	PK	54.17	-29.45	29.2	53.92	74	Pass
78	2483.984	AV	44.78	-29.45	29.2	44.53	54	Pass



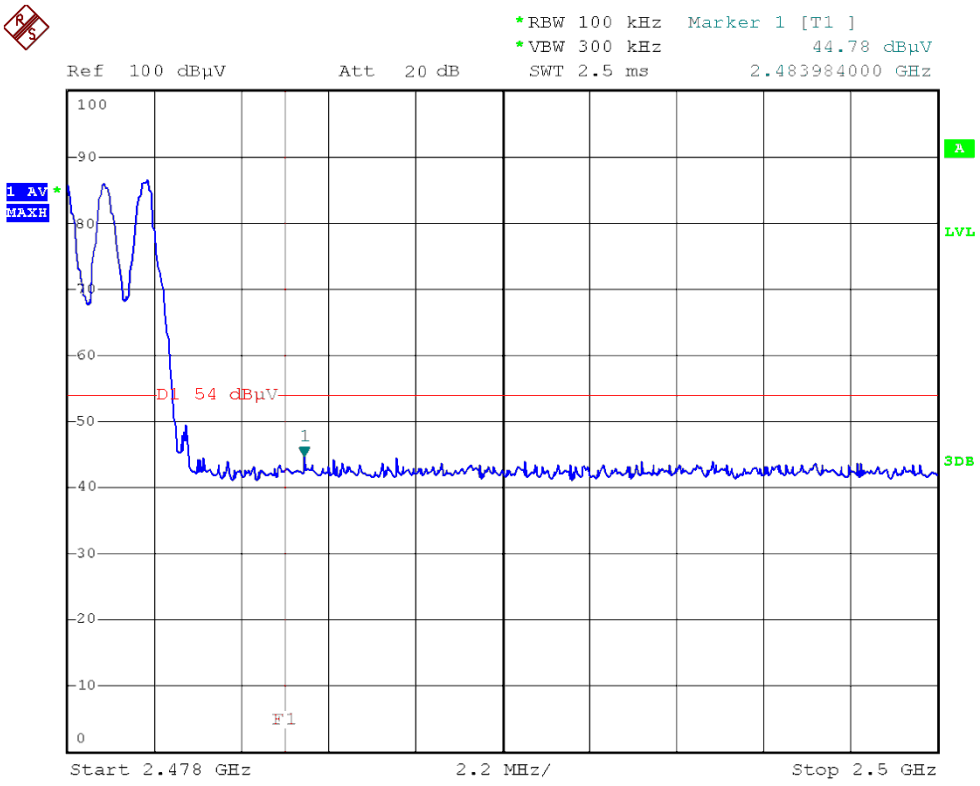
(Plot A1-1: Channel = 0 PEAK)



(Plot A2-1: Channel = 0 AVERAGE)



(Plot B1-1: Channel = 78 PEAK)



(Plot B2-1: Channel = 78 AVERAGE)

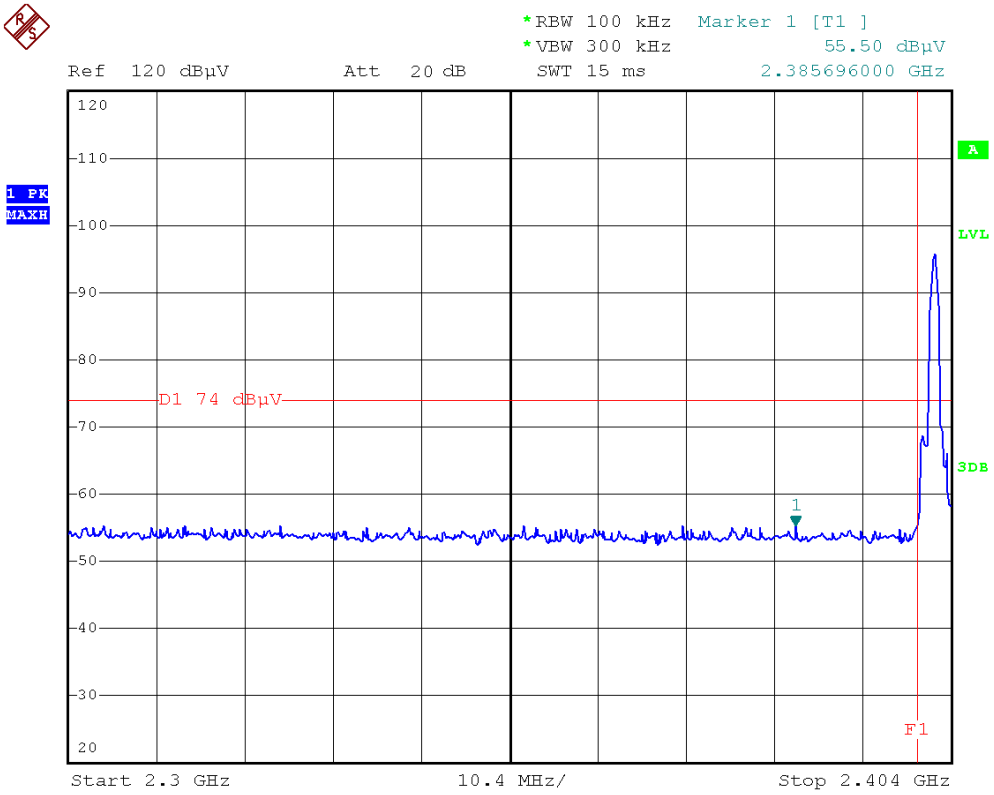
2.8.4.2. ∏/4-DQPSK Mode

A. Test Verdict:

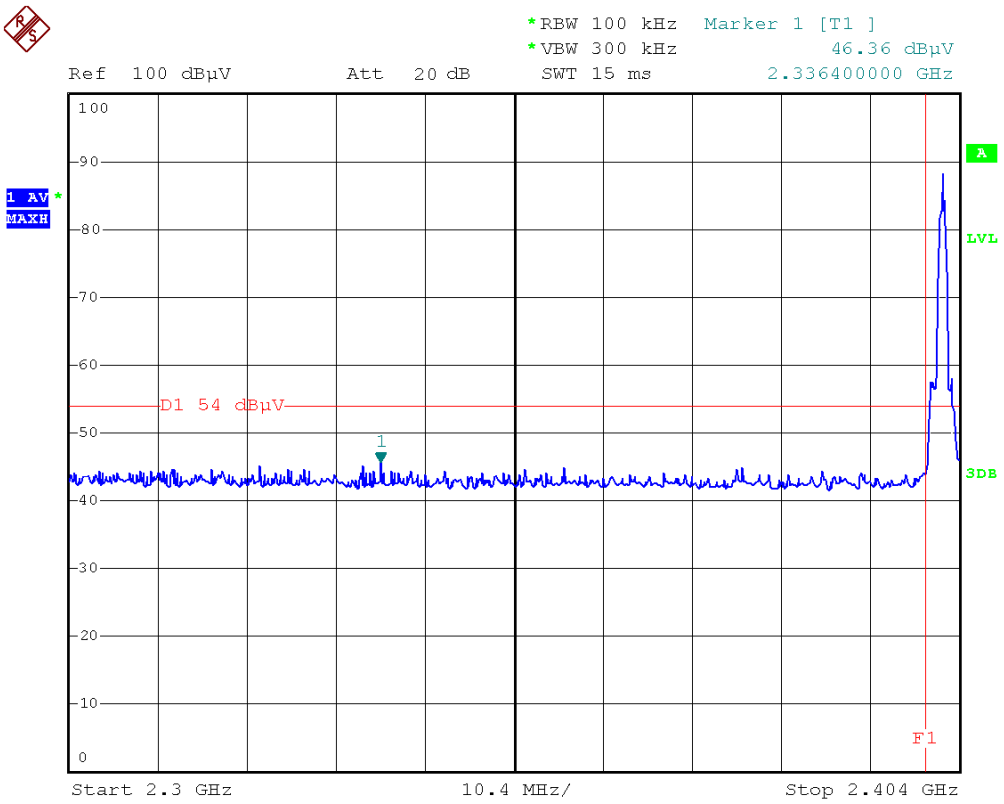
(Un-hopping)

Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading UR (dBuV)	AT (dB)	AFactor (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
0	2346.28	PK	55.50	-31.70	28.3	52.1	74	Pass
0	2379.56	AV	46.36	-31.70	28.3	42.96	54	Pass
78	2498.35	PK	55.92	-29.45	29.2	55.67	74	Pass
78	2496.862	AV	45.07	-29.45	29.2	44.82	54	Pass

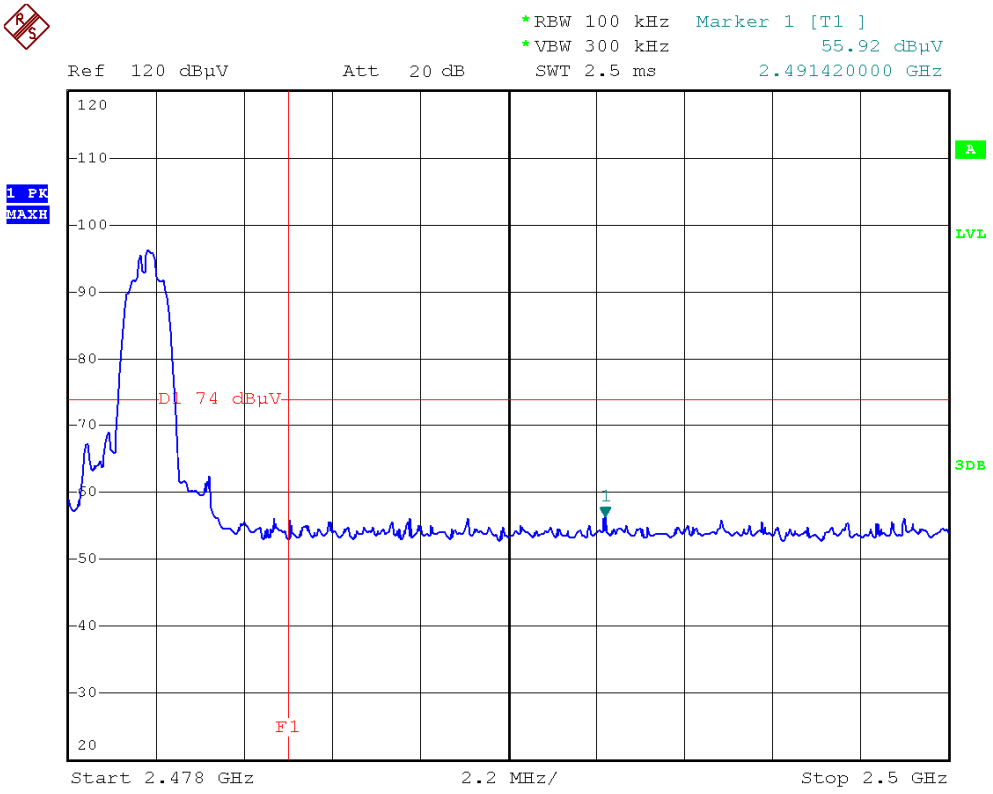
B. Test Plots:



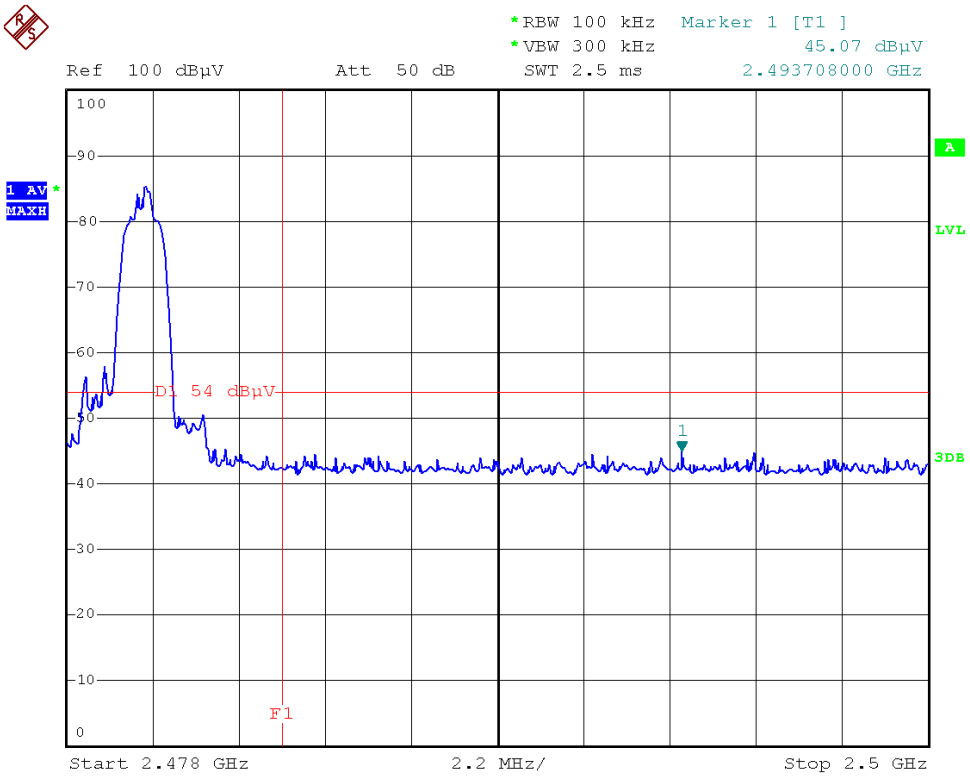
(Plot C1: Channel = 0 PEAK @ ∏/4-DQPSK)



(Plot C2: Channel = 0 AVERAGE @ ∏/4-DQPSK)



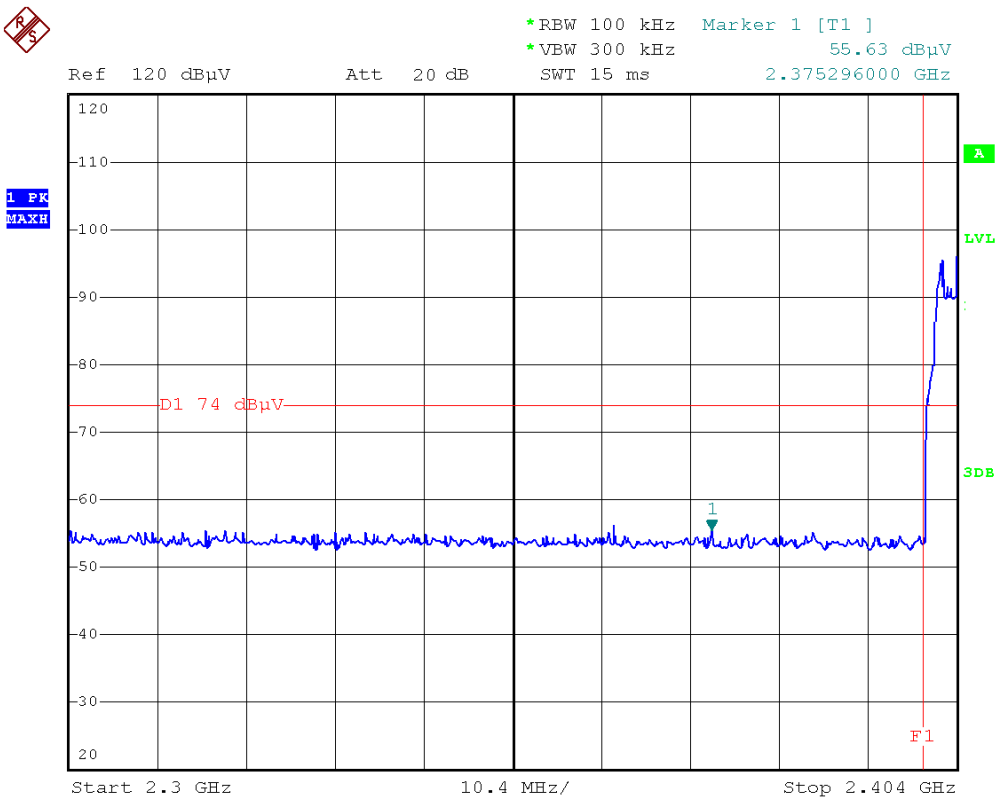
(Plot D1: Channel = 78 PEAK @ ∏/4-DQPSK)



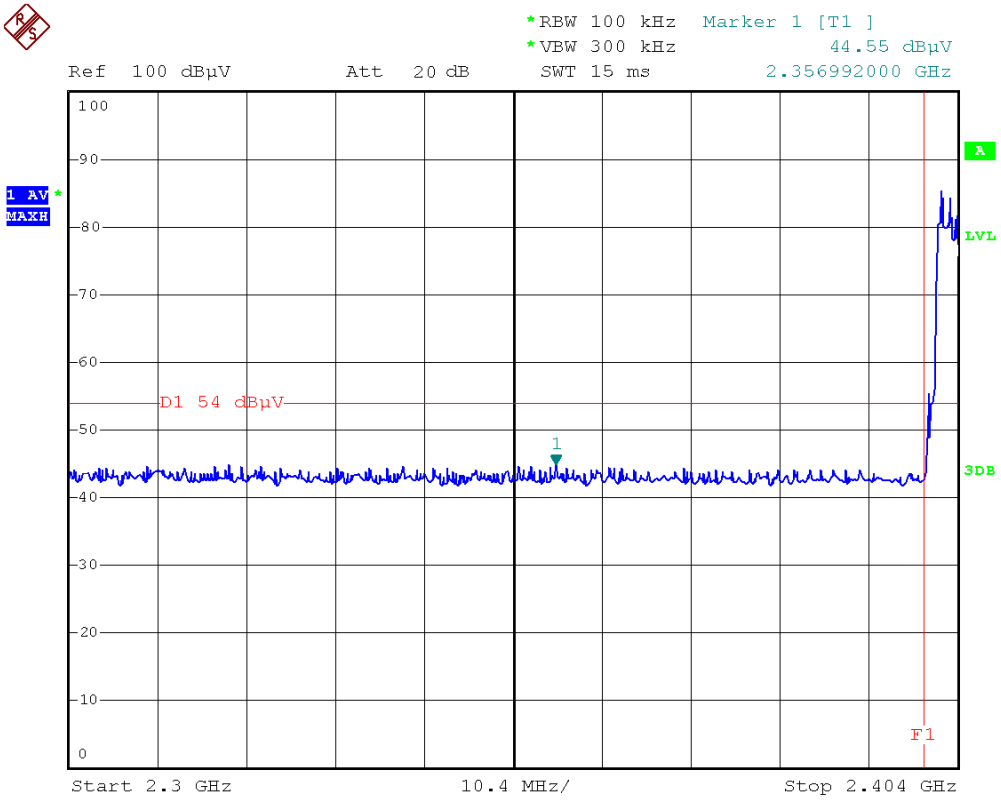
(Plot D2: Channel = 78 AVERAGE @ Π/4-DQPSK)

(hopping)

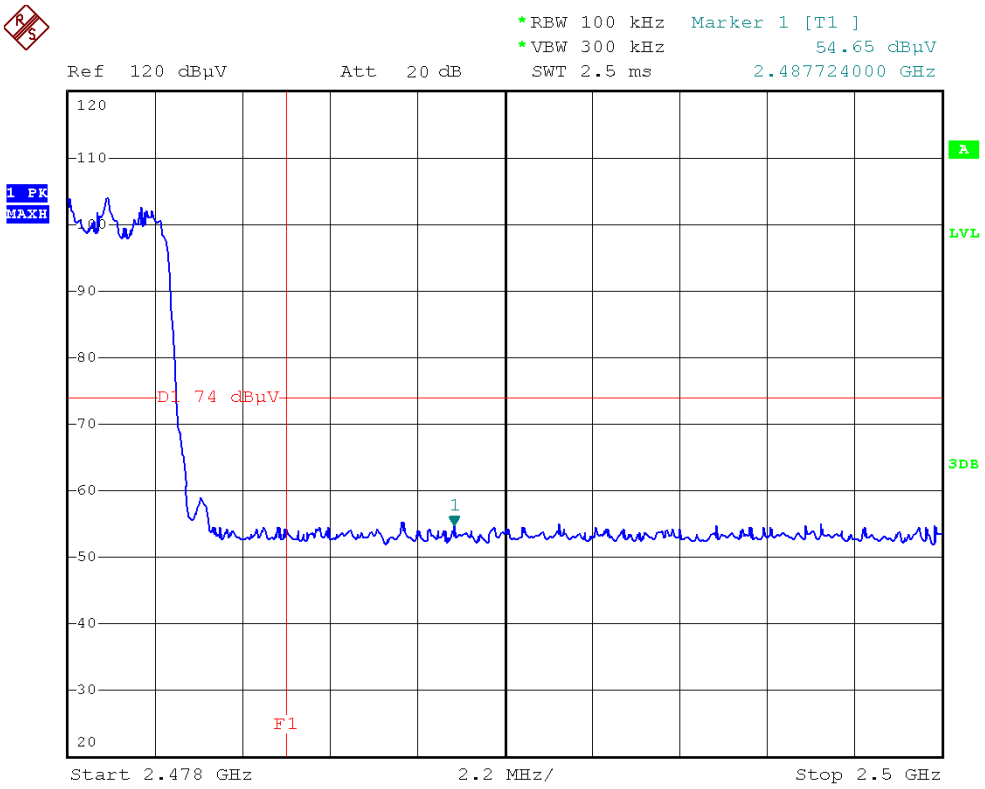
Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading UR (dBuV)	AT (dB)	AFactor (dB@3m)	Max. Emission E (dBµV/m)	Limit (dBµV/m)	Verdict
0	2354.60	PK	55.63	-31.70	28.3	52.23	74	Pass
0	2325.74	AV	44.55	-31.70	28.3	41.15	54	Pass
78	2495.82	PK	54.65	-29.45	29.2	54.4	74	Pass
78	2498.845	AV	44.17	-29.45	29.2	43.92	54	Pass



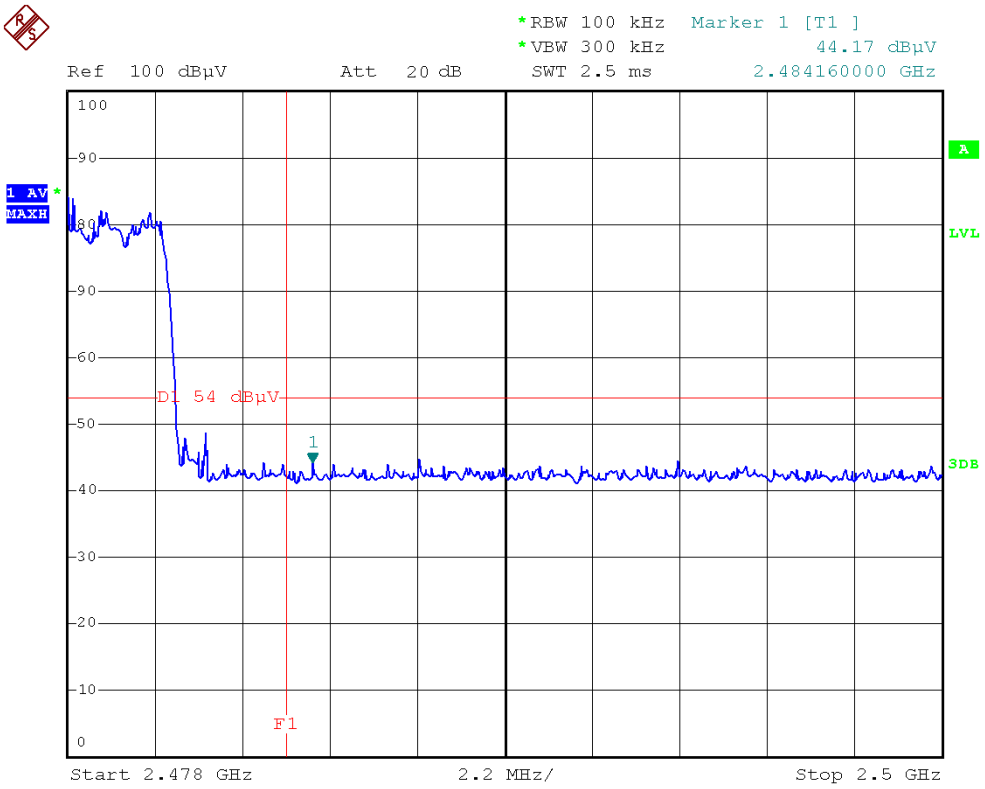
(Plot C1-1: Channel = 0 PEAK)



(Plot C2-1: Channel = 0 AVERAGE)



(Plot D1-1: Channel = 78 PEAK)



(Plot D2-1: Channel = 78 AVERAGE)

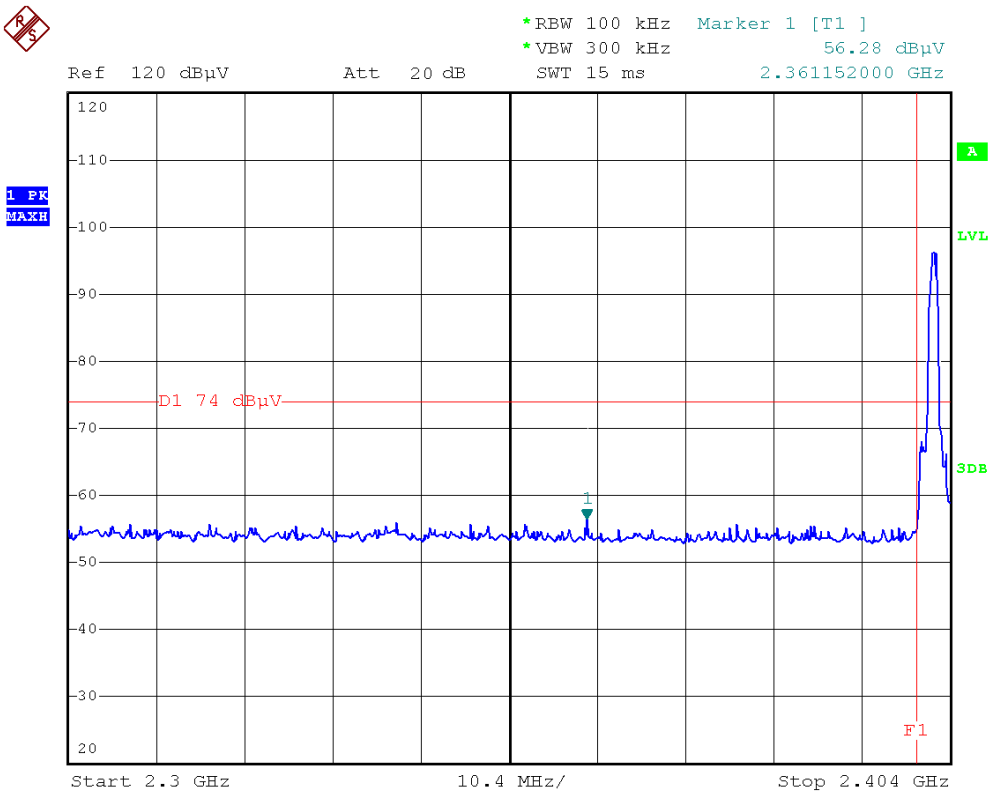
2.8.4.3. 8-DPSK Mode

A. Test Verdict:

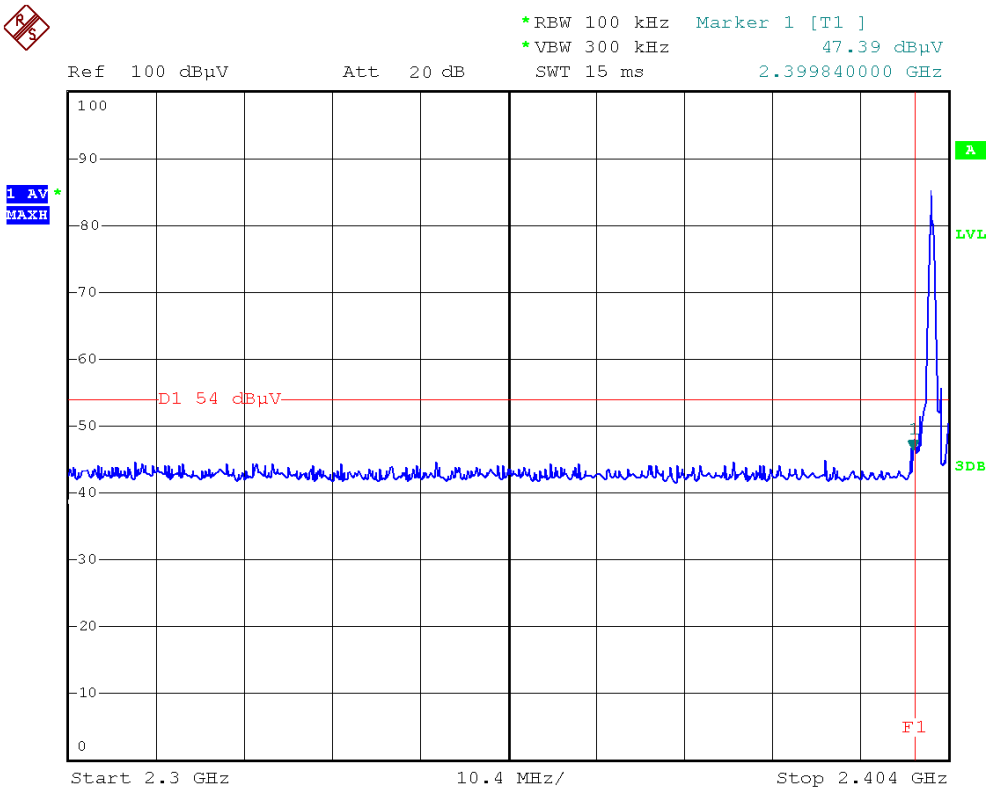
(Un-hopping)

Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading UR (dBuV)	AT (dB)	AFactor (dB@3m)	Max. Emission E (dBµV/m)	Limit (dBµV/m)	Verdict
0	2351.22	PK	56.28	-31.70	28.3	52.88	74	Pass
0	2372.80	AV	47.39	-31.70	28.3	43.99	54	Pass
78	2499.67	PK	54.03	-29.45	29.2	53.78	74	Pass
78	2490.045	AV	43.57	-29.45	29.2	43.32	54	Pass

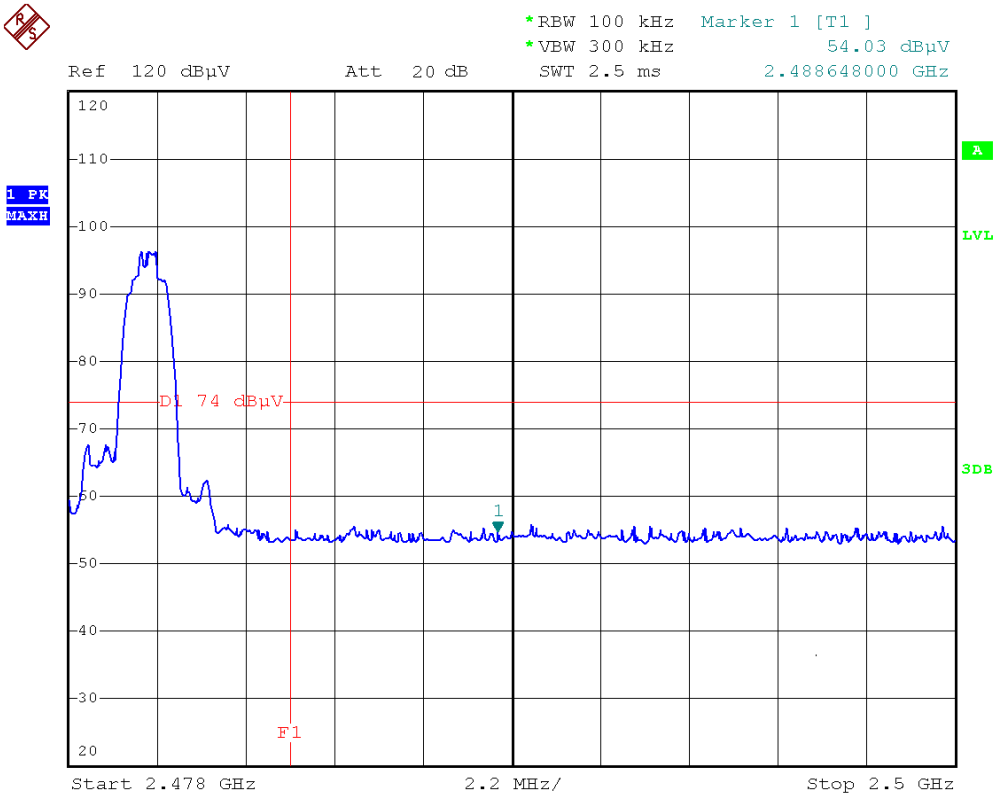
B. Test Plots:



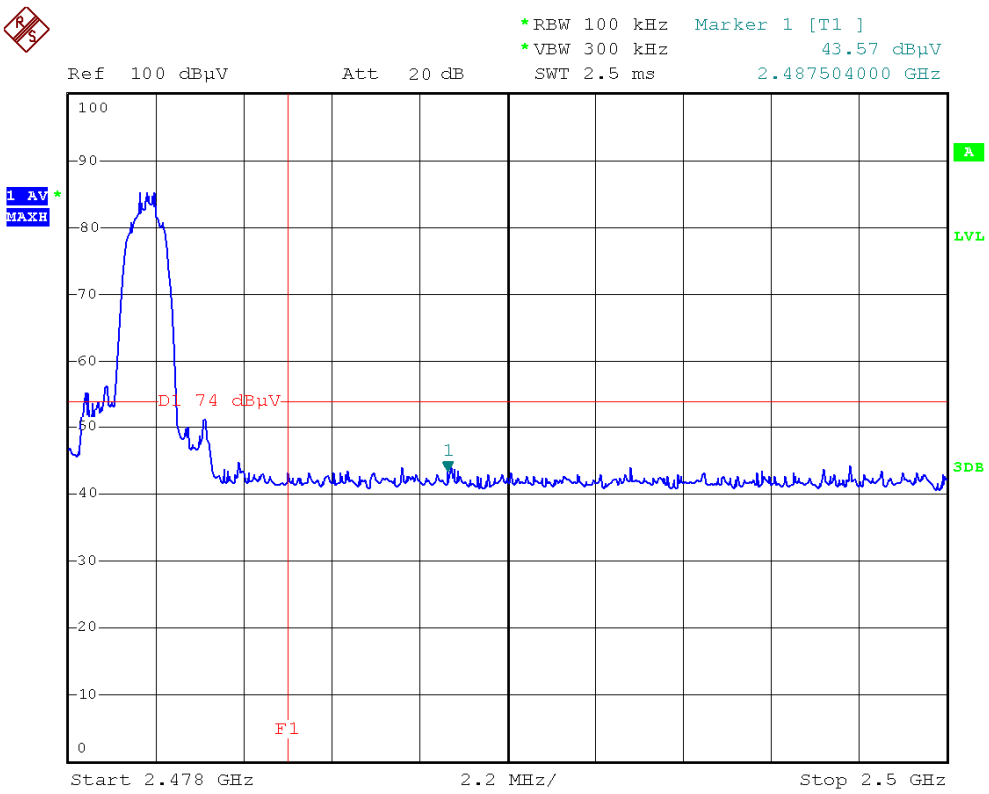
(Plot E1: Channel = 0 PEAK @ 8-DPSK Mode)



(Plot E2: Channel = 0 AVERAGE @ 8-DPSK Mode)



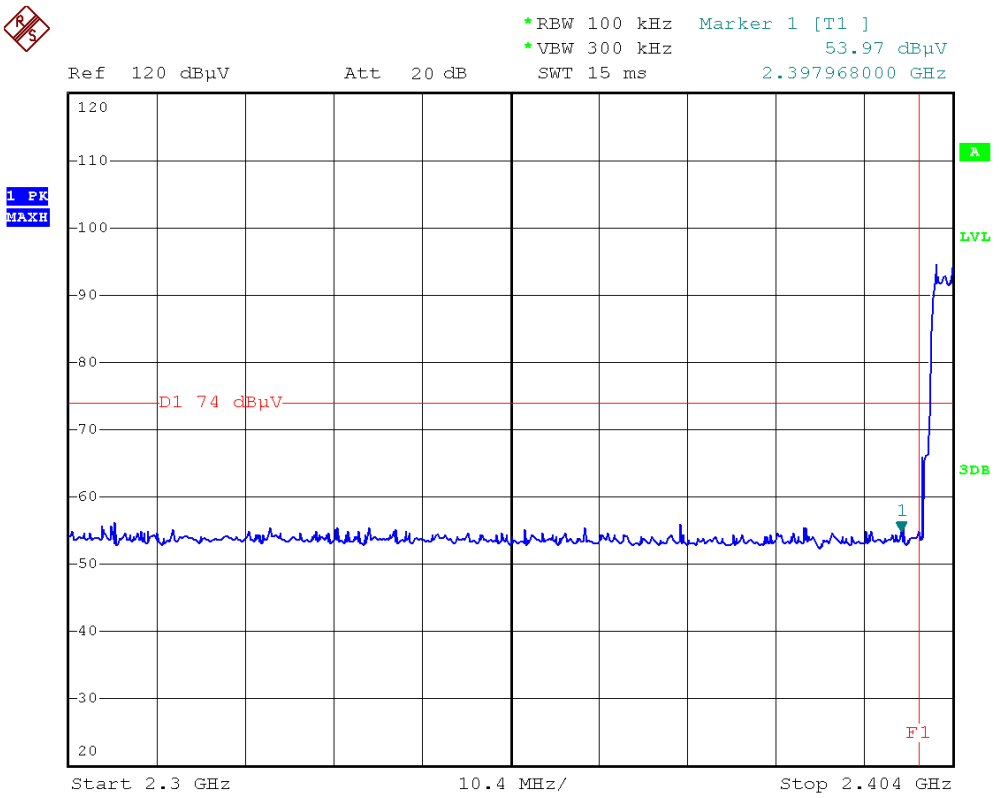
(Plot F1: Channel = 78 PEAK @ 8-DPSK Mode)



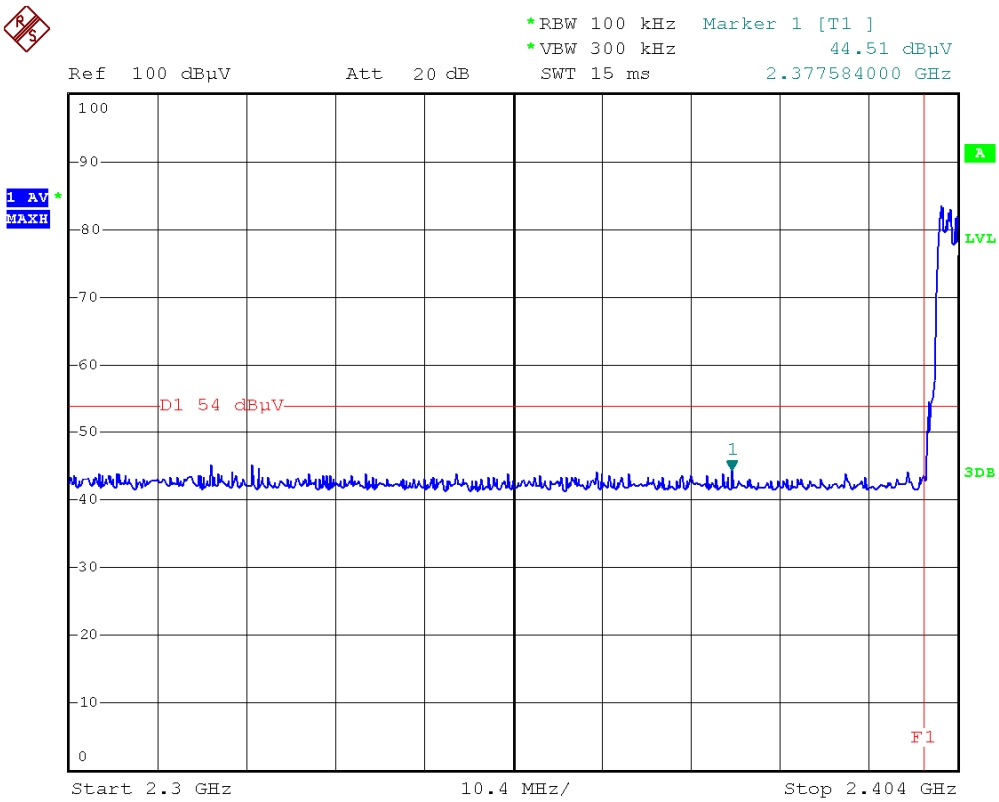
(Plot F2: Channel = 78 AVERAGE @ 8-DPSK Mode)

(hopping)

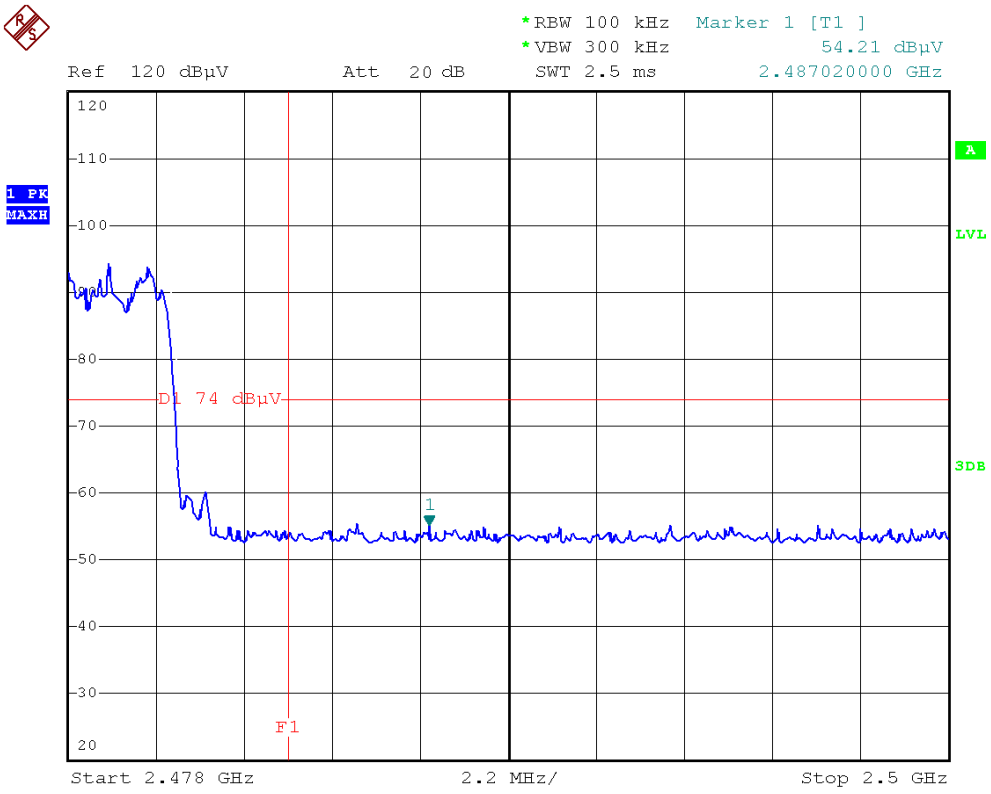
Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading UR (dBuV)	AT (dB)	AFactor (dB@3m)	Max. Emission E (dBµV/m)	Limit (dBµV/m)	Verdict
0	2367.08	PK	53.97	-31.70	28.3	50.57	74	Pass
0	2341.08	AV	44.51	-31.70	28.3	41.11	54	Pass
78	2494.885	PK	54.21	-29.45	29.2	53.96	74	Pass
78	2498.79	AV	45.36	-29.45	29.2	45.11	54	Pass



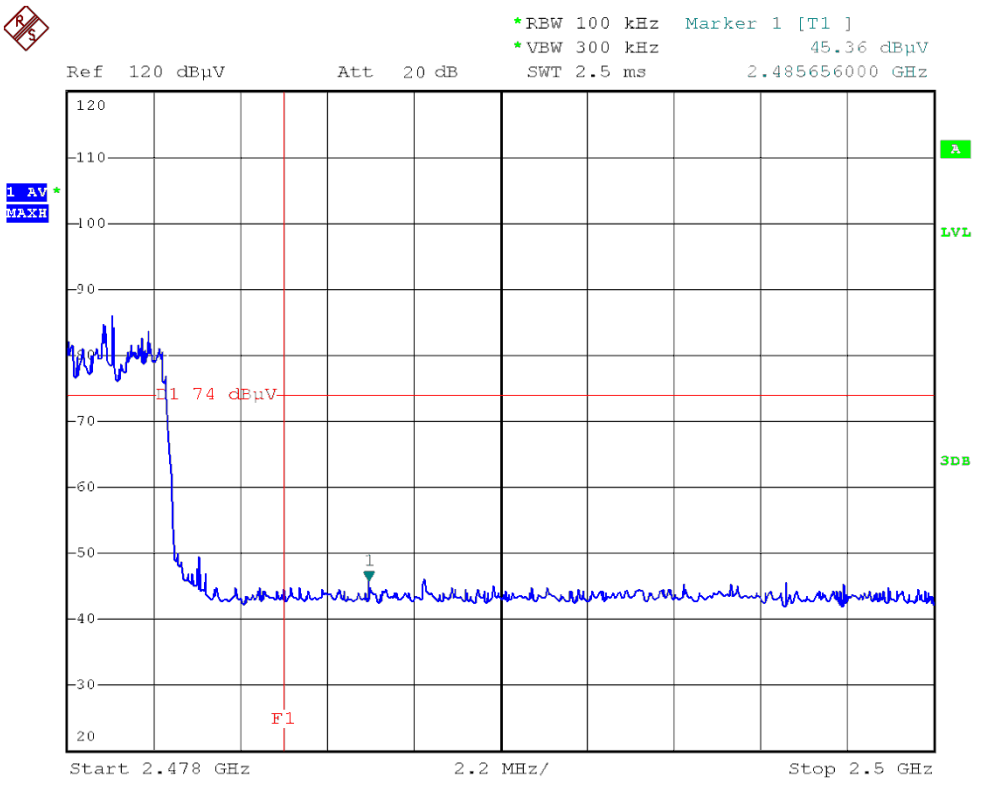
(Plot E1-1: Channel = 0 PEAK)



(Plot E2-1: Channel = 0 AVERAGE)



(Plot F1-1: Channel = 78 PEAK)



(Plot F2-1: Channel = 78 AVERAGE)

2.9. Conducted Emission

2.9.1. Requirement

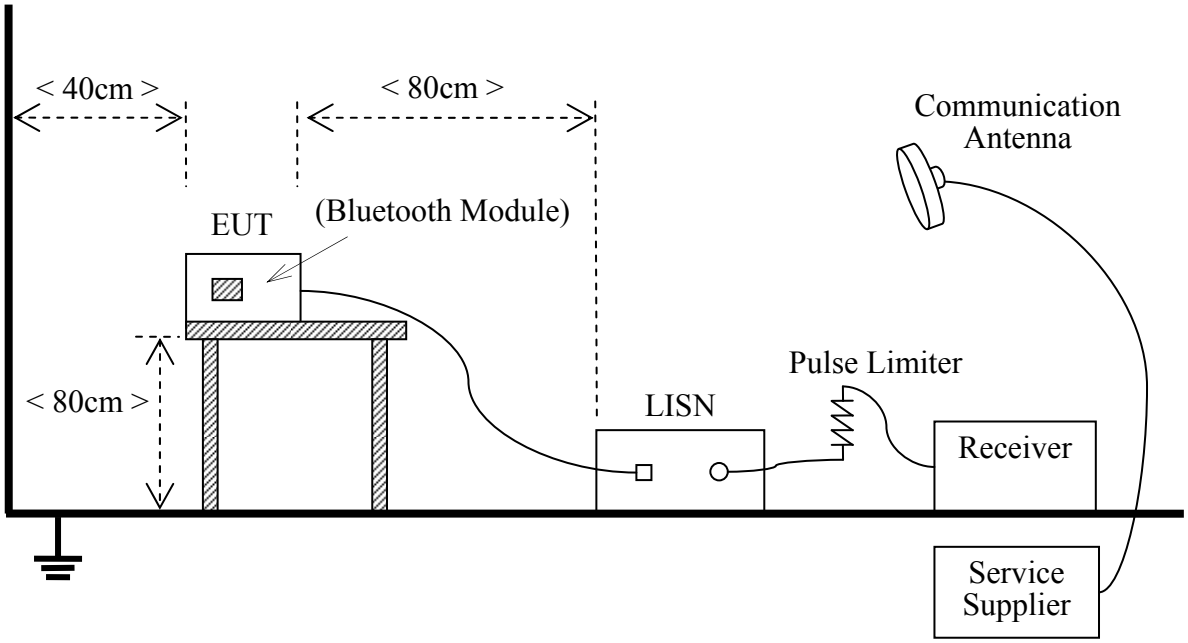
According to FCC section 15.207, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN).

Frequency range (MHz)	Conducted Limit (dBμV)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
0.50 - 30	60	50

NOTE:
(a) The lower limit shall apply at the band edges.
(b) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

2.9.2. Test Description

A. Test Setup:



The Table-top EUT was placed upon a non-metallic table 0.8m above the horizontal metal reference ground plane. EUT was connected to LISN and LISN was connected to reference Ground Plane. EUT was 80cm from LISN. The set-up and test methods were according to ANSI C63.4:2009

The Bluetooth Module of the EUT is powered by the Battery charged with USB port of PC, PC is powered by 120V, 60Hz AC mains supply. The factors of the site are calibrated to correct the reading. During the measurement, the Bluetooth Module is activated and controlled by the Bluetooth Service Supplier (SS) via a Common Antenna, and is set to operate under hopping-on test mode transmitting 339 bytes DH5 packages at maximum power.

Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date
Test Receiver	ROHDE&SCHWARZ	ESCS30	A0304260	2012.06.10
LISN	ROHDE&SCHWARZ	ESH2-Z5	A0304221	2012.06.10
System Simulator	ROHDE&SCHWARZ	CMU200	A0304212	2012.06.10

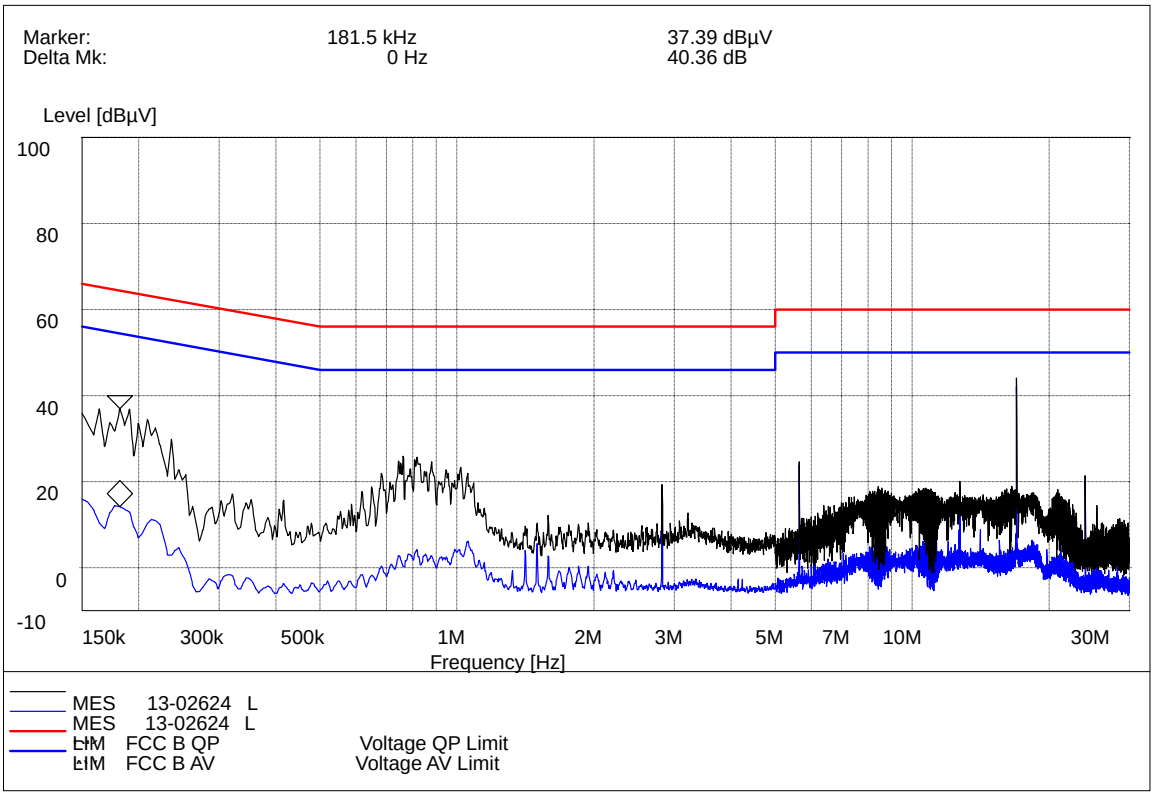
2.9.3. Test Result

The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Refer to recorded points and plots below.

A. Test setup:

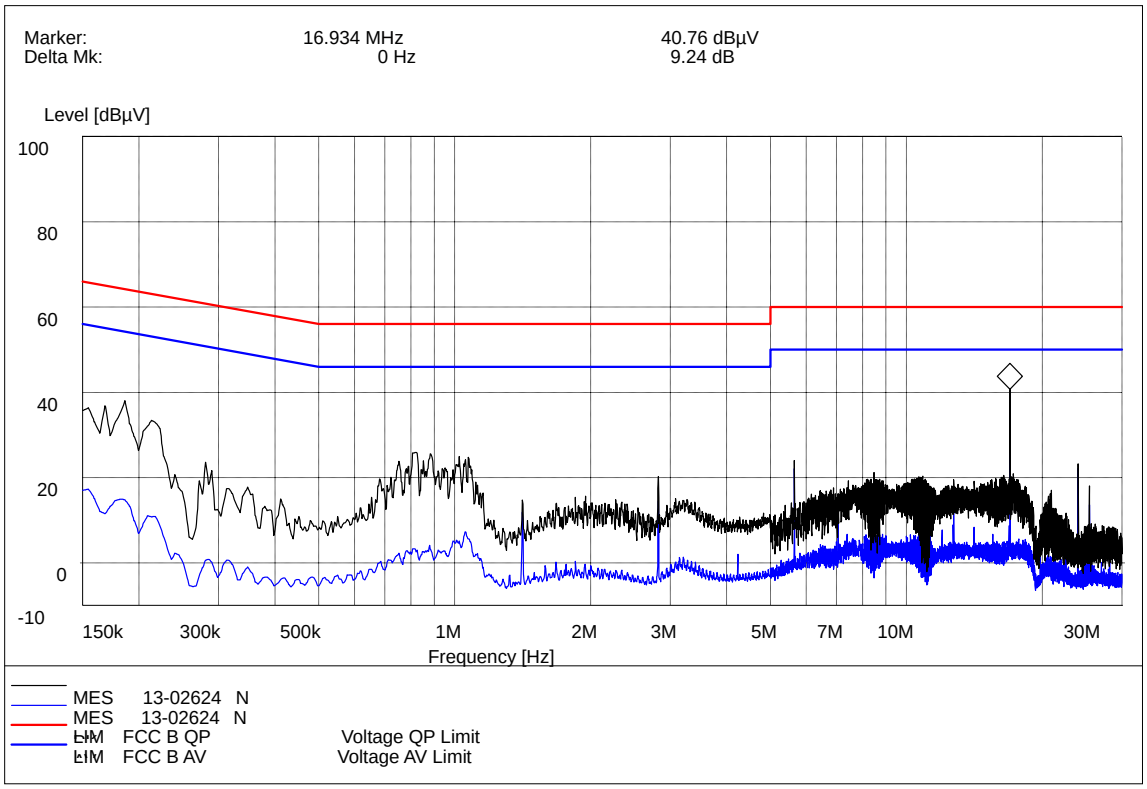
The EUT configuration of the emission tests is EUT + PC.

B. Test Plots:



Conducted Disturbance at Mains Terminals							
L Test Data							
QP				AV			
Frequency (MHz)	Limits (dBμV)	Measurement Value (dBμV)	Margin (dB)	Frequency (MHz)	Limits (dBμV)	Measurement Value (dBμV)	Margin (dB)
0.1815	64.4	37.39	27.01	0.1815	54.4	17.50	36.90
5.6435	60	23.81	36.19	5.6435	50	22.81	21.19
16.934	60	45.30	14.70	16.934	50	44.22	5.78
L Test Curve							

(Plot A: L Phase)



Conducted Disturbance at Mains Terminals							
N Test Data							
QP				AV			
Frequency (MHz)	Limits (dBμV)	Measurement Value (dBμV)	Margin (dB)	Frequency (MHz)	Limits (dBμV)	Measurement Value (dBμV)	Margin (dB)
0.1870	64.20	40.10	24.10	0.1870	54.20	18.40	35.80
5.6435	60	23.80	36.20	5.6435	50	22.40	27.60

16.934	60	40.76	19.24	16.934	50	39.50	10.50
N Test Curve							

(Plot B: N Phase)

2.10. Radiated Emission

2.10.1. Requirement

According to FCC section 15.247(c) and RSS-A8.5, radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
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

Note:

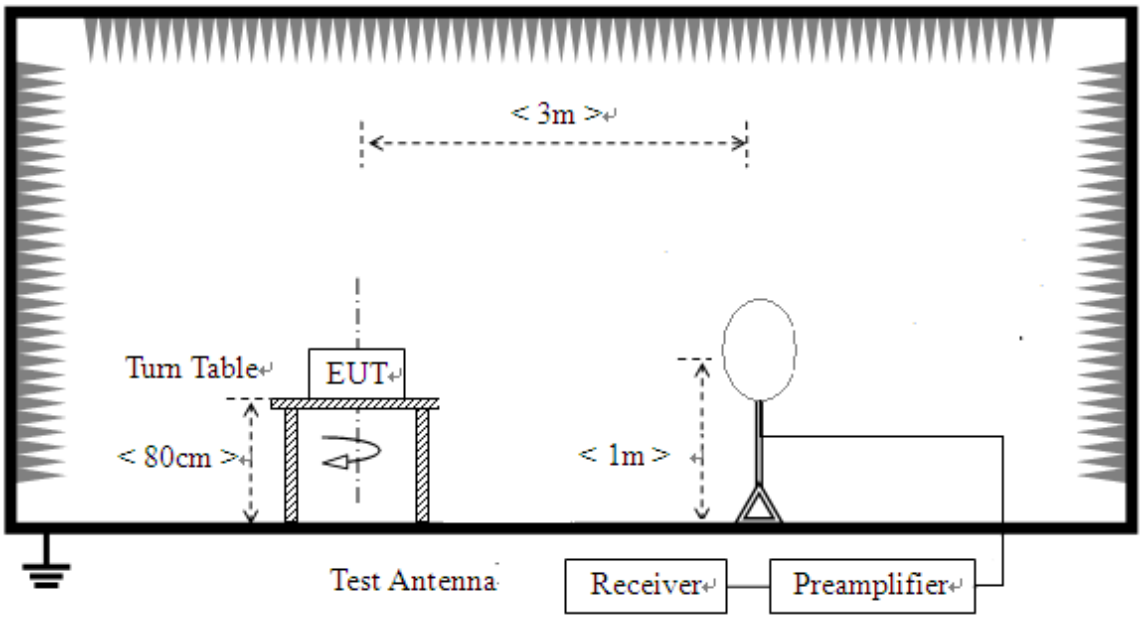
1. For Above 1000MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
2. For above 1000MHz, limit field strength of harmonics: 54dBuV/m@3m (AV) and 74dBuV/m@3m (PK)

In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), also should comply with the radiated emission limits specified in Section 15.209(a)(above table)

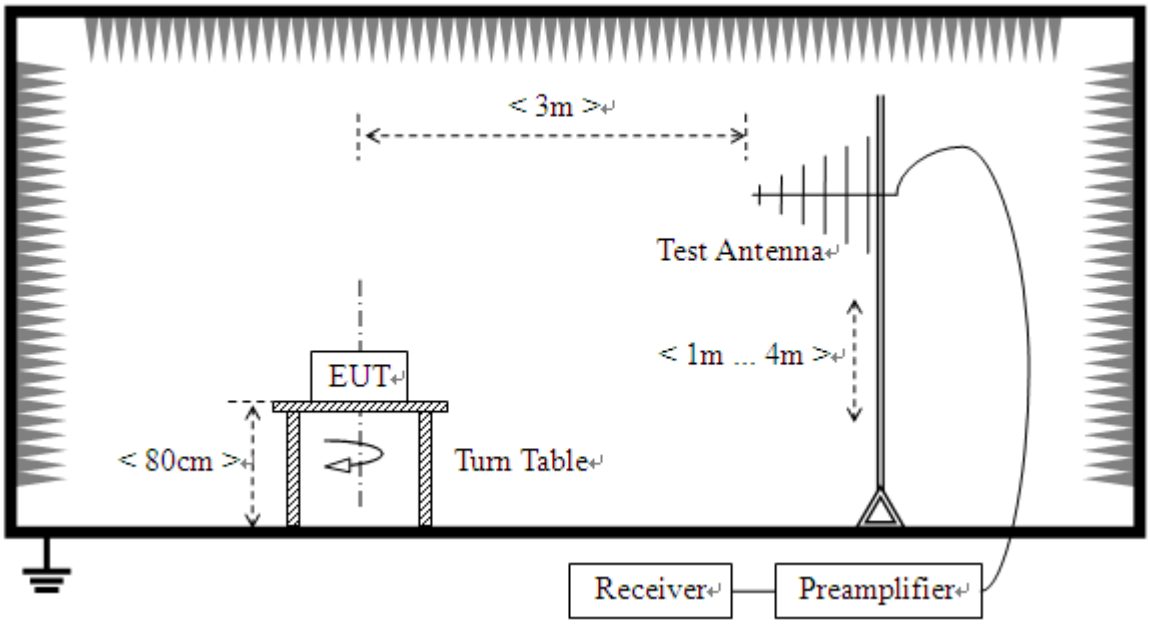
2.10.2. Test Description

A. Test Setup:

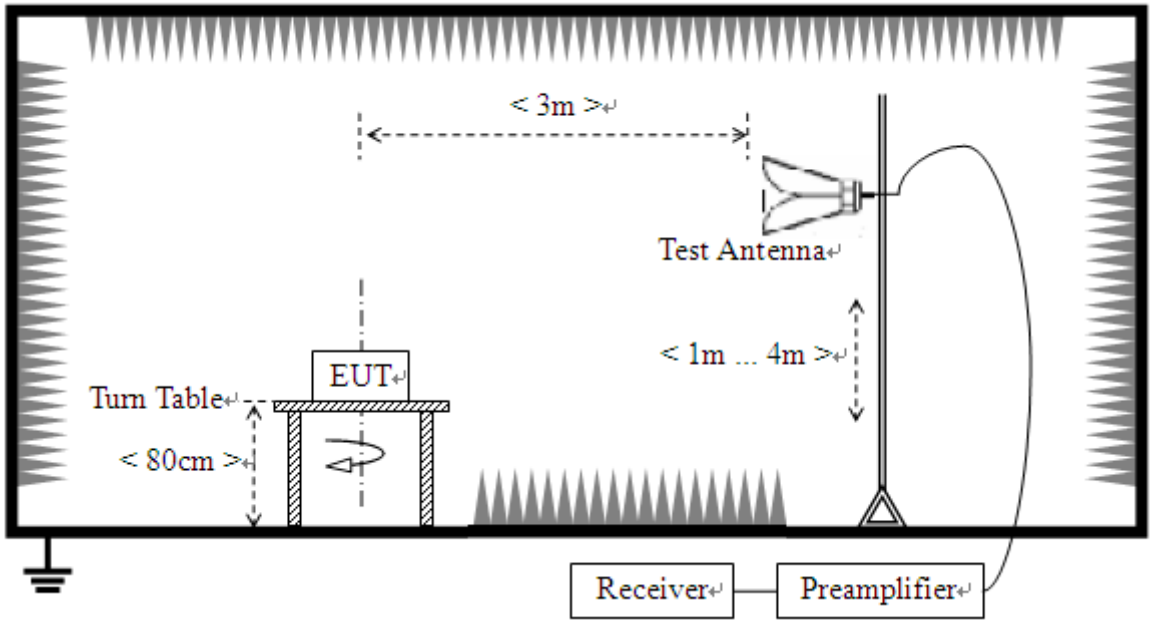
1) For radiated emissions from 9kHz to 30MHz



2) For radiated emissions from 30MHz to1GHz



3) For radiated emissions above 1GHz



The test site semi-anechoic chamber has met the requirement of NSA tolerance 4dB according to the standards: ANSI C63.4 (2009). The EUT was set-up on insulator 80cm above the Ground Plane. The set-up and test methods were according to ANSI C63.4.

The Bluetooth Module of the EUT is powered by the Battery. The Module is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading. During the measurement, the Bluetooth Module is activated and controlled by the Bluetooth Service Supplier (SS) via a Common Antenna, and is set to operate under hopping-on test mode transmitting 339 bytes DH5 packages at maximum power.

For the Test Antenna:

(a) In the frequency range of 9kHz to 30MHz, magnetic field is measured with Loop Test Antenna. The Test Antenna is positioned with its plane vertical at 1m distance from the EUT. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
(b) In the frequency range above 30MHz, Bi-Log Test Antenna (30MHz to 2GHz) and Horn Test Antenna (above 2GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength. The emission levels at both horizontal and vertical polarizations should be tested.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date
System Simulator	R&S	CMU200	100448	2012.06.10
Receiver	R&S	ESIB26	A0304218	2012.06.10
Full-Anechoic Chamber	Albatross	12.8m*6.8m*6.4m	A0412372	2012.06.10
Test Antenna - Bi-Log	Schwarzbeck	VULB 9163	9163-274	2012.06.10
Test Antenna - Horn	Schwarzbeck	BBHA 9120D	9120C-963	2012.06.10

Description	Manufacturer	Model	Serial No.	Cal. Date
Test Antenna - Horn	R&S	HL050S7	71688	2012.06.10
Test Antenna -Loop	Schwarzbeck	HFH2-Z2	100047	2012.06.10
Ampilier 1G~18GHz	R&S	MITEQ AFS42-00101800	25-S-42	2012.06.10
amplifier 20M~3GHz	R&S	PAP-0203H	22018	2012.06.10

Note: The Cal. Interval was one year.

2.10.3. Test Procedure

Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

2.10.4. Test Result

According to ANSI C63.4 selection 4.2.2, because of peak detection will yield amplitudes equal to or greater than amplitudes measured with the quasi-peak (or average) detector, the measurement data from a spectrum analyzer peak detector will represent the worst-case results, if the peak measured value complies with the quasi-peak limit, it is unnecessary to perform an quasi-peak measurement.

The measurement results are obtained as below:

$E\ [dB\mu V/m] = U_R + A_T + A_{Factor}\ [dB]$; $A_T = L_{Cable\ loss}\ [dB] - G_{preamp}\ [dB]$

A_T: Total correction Factor except Antenna

U_R: Receiver Reading

G_{preamp}: Preamplifier Gain

A_{Factor}: Antenna Factor at 3m

During the test, the total correction Factor AT and A_{Factor} were built in test software.

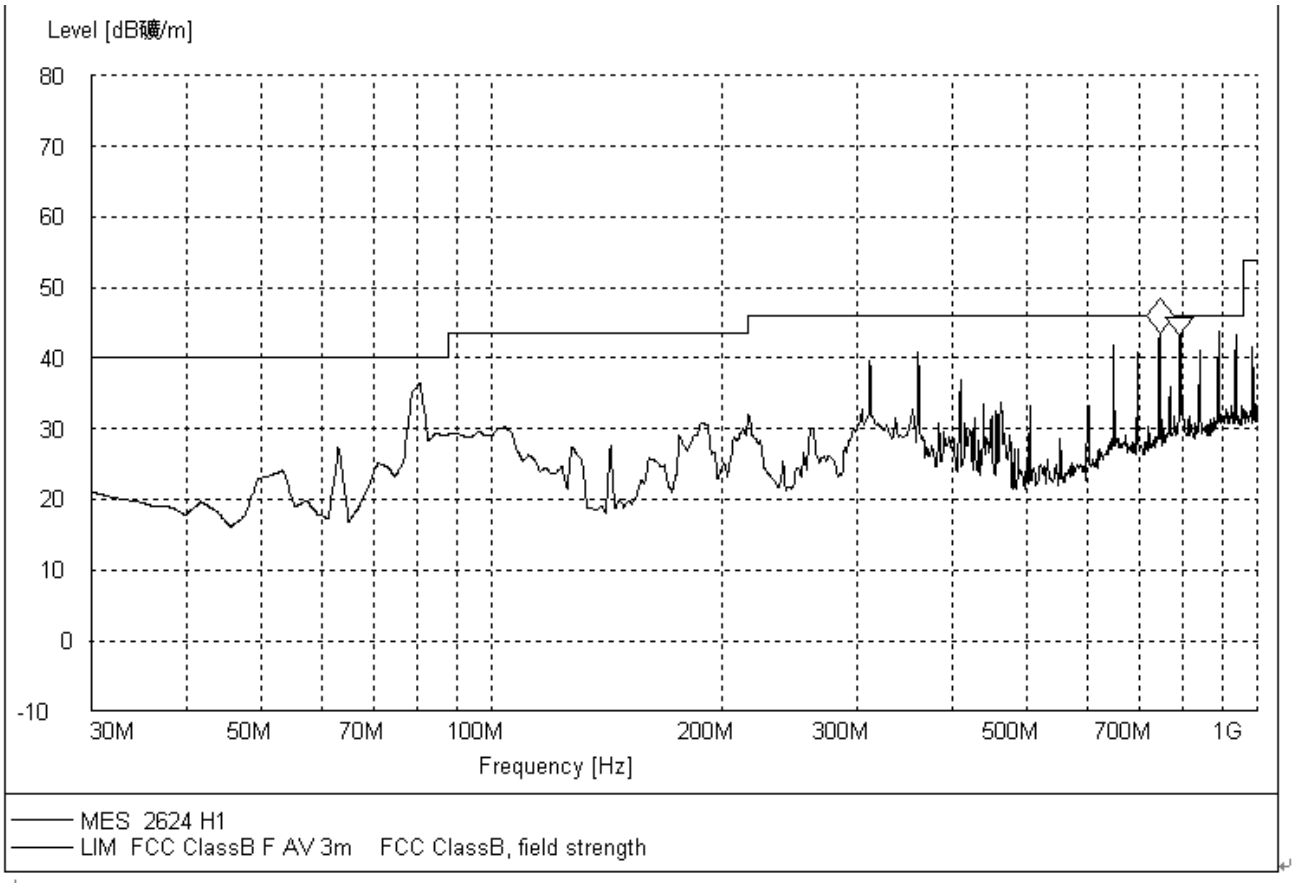
Note: All radiated emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

2.10.4.1. GFSK Mode:

For 9KHz to 30MHz

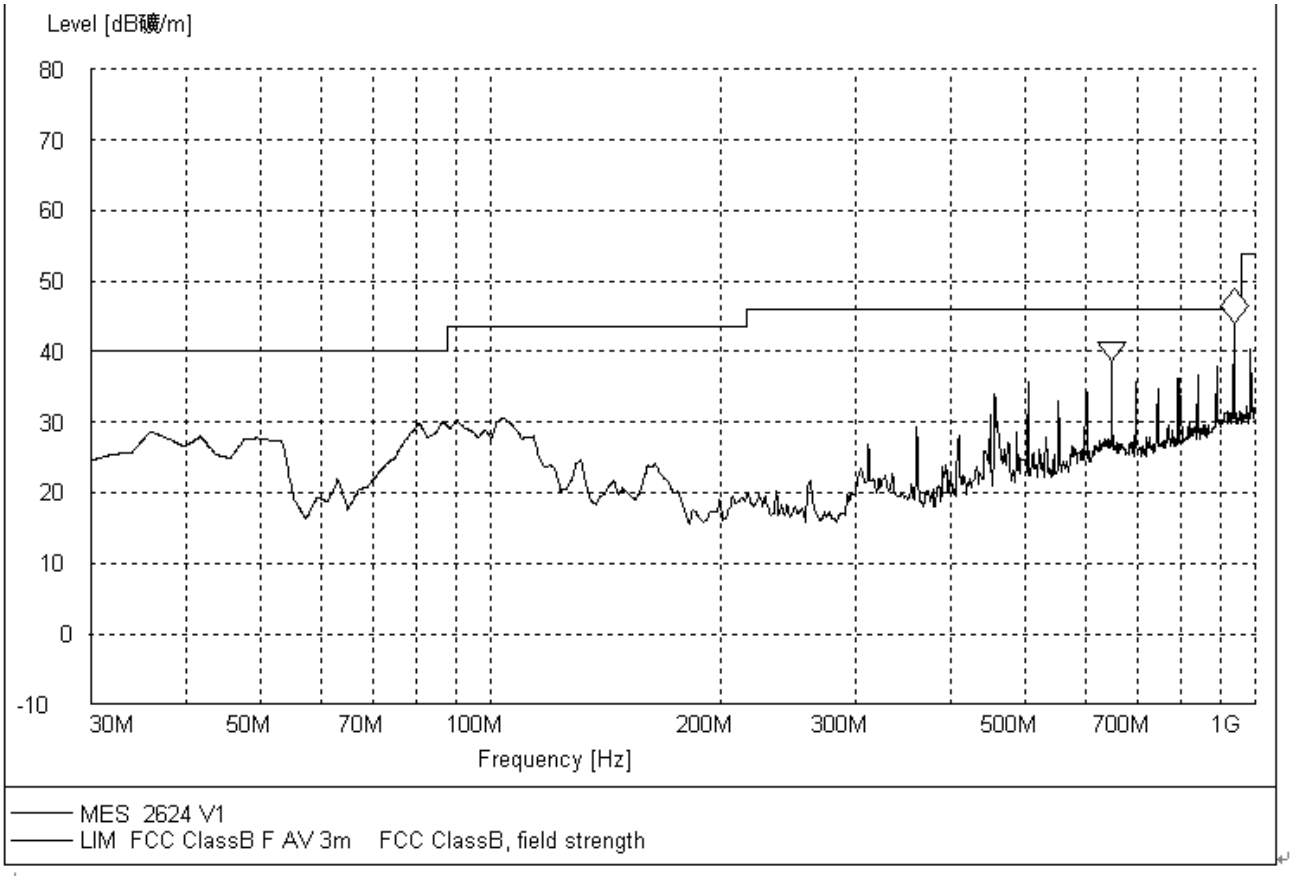
Frequency (MHz)	Corrected Reading (dBμV/m)@3m	FCC Limit (dBμV/m) @3m	Margin (dB)	Detector	Verdict
0.63	49.57	71.21	21.64	QP	Pass
1.62	42.89	63.05	20.16	QP	Pass
12.00	43.05	69.54	26.49	QP	Pass
24.00	51.17	69.54	18.37	QP	Pass

For 30MHz to 1000 MHz



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Degree	Antenna	Verdict
745.351	43.58	41.60	38.55	N.A	46.0	N.A	56.9	Horizontal	PASS
791.46	43.21	39.06	37.11	N.A	46.0	N.A	77.5	Horizontal	PASS

(Plot A: 30MHz to 1GHz, Antenna Horizontal @ GFSK)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Degree	Antenna	Verdict
648.153	47.66	40.15	35.49	N.A	46.0	N.A	106.4	Vertical	PASS
937.795	43.91	39.84	38.40	N.A	46.0	N.A	78.9	Vertical	PASS

(Plot B: 30MHz to 1GHz, Antenna Vertical)

For 1GHz to 25GHz

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（0CH_2402MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2402.00	103.32	PK	/	/	1.00 H	360	106.72	28.3	4.90	-36.6
1	*2402.00	92.81	AV	/	/	1.00 H	360	96.21	28.3	4.90	-36.6
2	4804.00	49.18	PK	74.00	24.82	1.00 H	359	45.98	32.7	7.00	-36.5
2	4804.00	40.06	AV	54.00	13.94	1.00 H	359	36.86	32.7	7.00	-36.5
3	7206.00	51.94	PK	74.00	22.06	1.00 H	152	42.54	35.8	8.90	-35.3
3	7206.00	43.92	AV	54.00	10.08	1.00 H	152	34.52	35.8	8.90	-35.3
4	9608.00	50.02	PK	74.00	23.98	1.00 H	140	37.42	37.2	10.20	-34.8
4	9608.00	45.42	AV	54.00	8.58	1.00 H	140	32.82	37.2	10.20	-34.8

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（0CH_2402MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2402.00	101.75	PK	/	/	1.00 V	124	105.15	28.3	4.90	-36.6
1	*2402.00	90.44	AV	/	/	1.00 V	124	93.84	28.3	4.90	-36.6
2	4804.00	49.85	PK	74.00	24.15	1.00 V	339	46.65	32.7	7.00	-36.5
2	4804.00	44.02	AV	54.00	9.98	1.00 V	339	40.82	32.7	7.00	-36.5
3	7206.00	50.06	PK	74.00	23.94	1.00 V	340	40.66	35.8	8.90	-35.3
3	7206.00	41.82	AV	54.00	12.18	1.00 V	340	32.42	35.8	8.90	-35.3
4	9608.00	52.26	PK	74.00	21.74	1.00 V	20	39.66	37.2	10.20	-34.8
4	9608.00	44.84	AV	54.00	9.16	1.00 V	20	32.24	37.2	10.20	-34.8

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（39CH_2441MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2441.00	104.49	PK	/	/	1.00 H	153	107.69	28.3	5.10	-36.6
1	*2441.00	92.08	AV	/	/	1.00 H	153	95.28	28.3	5.10	-36.6
2	4882.00	46.22	PK	74.00	27.78	1.00 H	202	42.82	32.3	7.60	-36.5
2	4882.00	35.12	AV	54.00	18.88	1.00 H	202	31.72	32.3	7.60	-36.5
3	7323.00	50.08	PK	74.00	23.92	1.00 H	355	40.68	36.1	8.60	-35.3
3	7323.00	42.44	AV	54.00	11.56	1.00 H	355	33.04	36.1	8.60	-35.3
4	9764.00	50.16	PK	74.00	23.84	1.00 H	28	37.56	37.2	10.20	-34.8
4	9764.00	41.96	AV	54.00	12.04	1.00 H	28	29.36	37.2	10.20	-34.8

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（39CH_2441MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2441.00	103.33	PK	/	/	1.00 V	121	106.53	28.3	5.10	-36.6
1	*2441.00	92.08	AV	/	/	1.00 V	121	95.28	28.3	5.10	-36.6
2	4882.00	47.94	PK	74.00	26.06	1.00 V	97	44.54	32.3	7.60	-36.5
2	4882.00	37.04	AV	54.00	16.96	1.00 V	97	33.64	32.3	7.60	-36.5
3	7323.00	56.88	PK	74.00	17.12	1.00 V	288	47.48	36.1	8.60	-35.3
3	7323.00	42.73	AV	54.00	11.27	1.00 V	288	33.33	36.1	8.60	-35.3
4	9764.00	50.08	PK	74.00	23.92	1.00 V	89	37.48	37.2	10.20	-34.8
4	9764.00	35.01	AV	54.00	18.99	1.00 V	89	22.41	37.2	10.20	-34.8

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（78CH_2480MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2480.00	104.10	PK	/	/	1.00 H	154	107.4	28.6	4.70	-36.6
1	*2480.00	90.09	AV	/	/	1.00 H	154	93.39	28.6	4.70	-36.6
2	4960.00	50.02	PK	74.00	23.98	1.00 H	100	46.22	33.0	7.00	-36.2
2	4960.00	35.27	AV	54.00	18.73	1.00 H	100	31.47	33.0	7.00	-36.2
3	7440.00	51.22	PK	74.00	22.78	1.00 H	190	41.82	36.2	8.50	-35.3
3	7440.00	42.17	AV	54.00	11.83	1.00 H	190	32.77	36.2	8.50	-35.3
4	9920.00	50.14	PK	74.00	23.86	1.00 H	113	37.54	37.2	10.20	-34.8
4	9920.00	37.16	AV	54.00	16.84	1.00 H	113	24.56	37.2	10.20	-34.8

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（78CH_2480MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2480.00	99.11	PK	/	/	1.00 V	247	102.41	28.6	4.70	-36.6
1	*2480.00	87.37	AV	/	/	1.00 V	247	90.67	28.6	4.70	-36.6
2	4960.00	52.19	PK	74.00	21.81	1.00 V	90	48.39	33.0	7.00	-36.2
2	4960.00	47.02	AV	54.00	6.98	1.00 V	90	43.22	33.0	7.00	-36.2
3	7440.00	53.29	PK	74.00	20.71	1.00 V	29	43.89	36.2	8.50	-35.3
3	7440.00	42.12	AV	54.00	11.88	1.00 V	29	32.72	36.2	8.50	-35.3
4	9920.00	51.05	PK	74.00	22.95	1.00 V	222	38.45	37.2	10.20	-34.8
4	9920.00	40.55	AV	54.00	13.45	1.00 V	222	27.95	37.2	10.20	-34.8

REMARKS: 1. Emission level (dBuV/m)=Raw Value(dBuV) +Antenna Factor (dB/m) + Cable Factor (dB) +Pre-amplifier Factor

2. The other emission levels were very low against the limit.

3. Margin value = Limit value- Emission level.

4. The limit value is defined as per 15.247

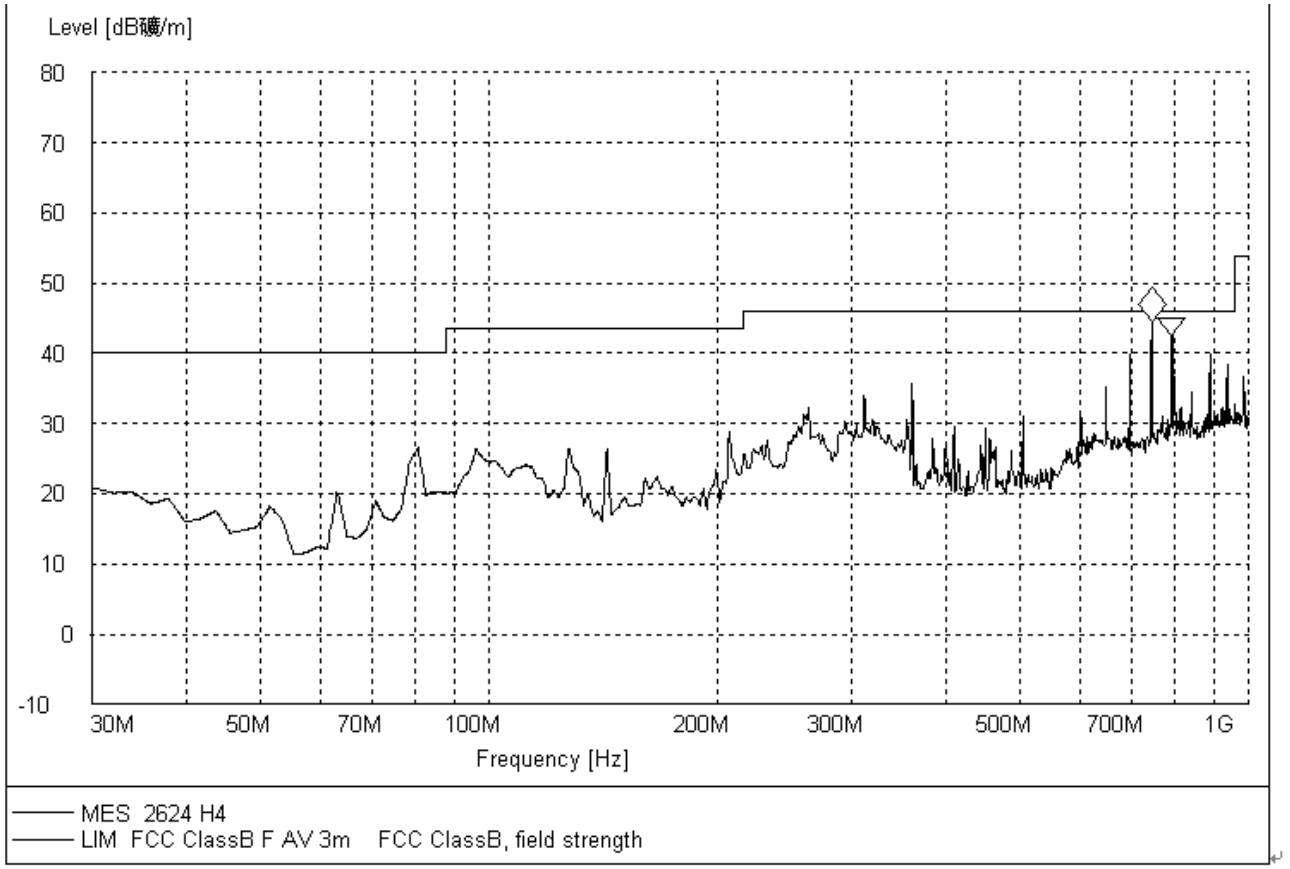
5. “* “: Fundamental frequency

2.10.4.2. ∏/4-DQPSK Mode：

For 9KHz to 30MHz

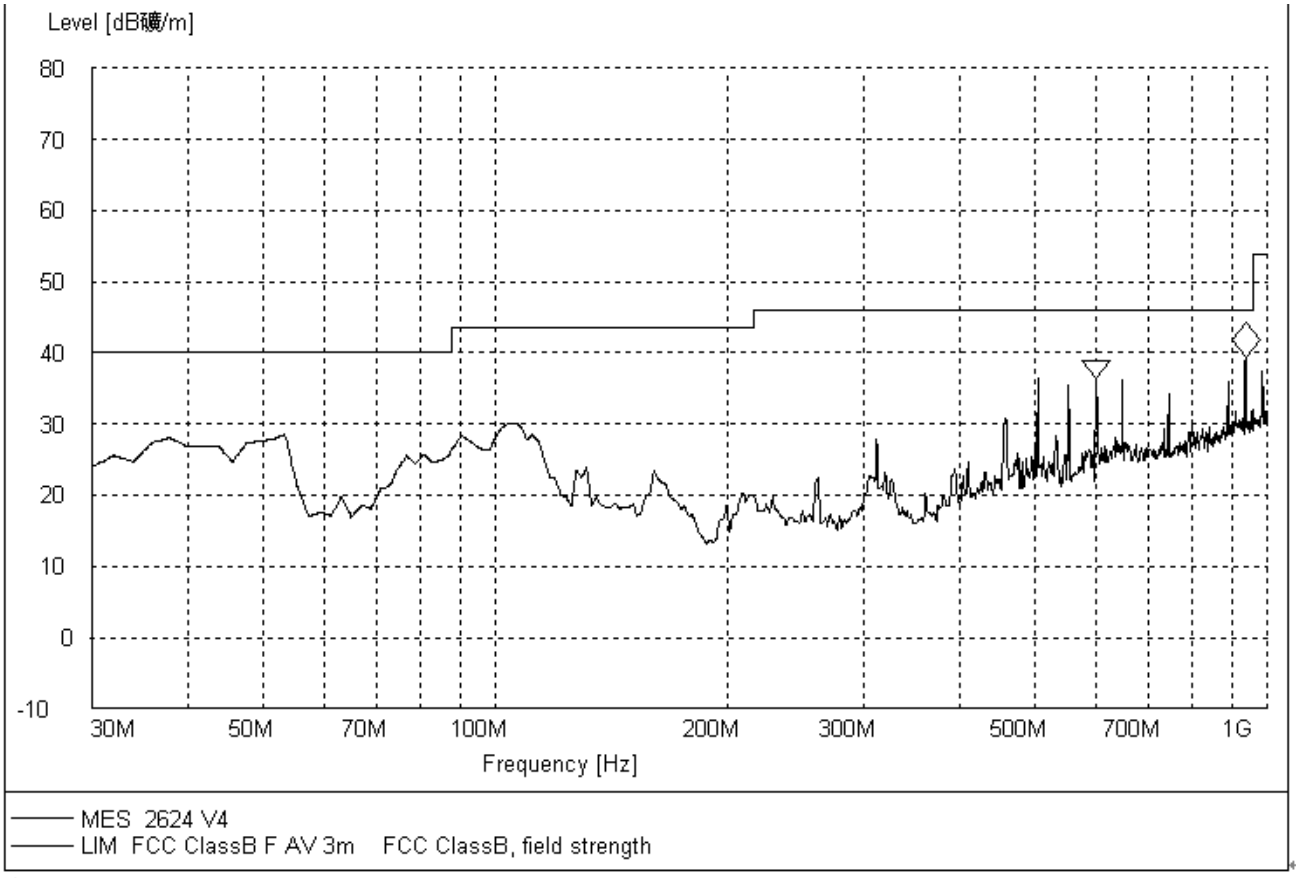
Frequency (MHz)	Corrected Reading (dBμV/m)@3m	FCC Limit (dBμV/m) @3m	Margin (dB)	Detector	Verdict
0.63	49.51	71.21	21.7	QP	Pass
1.62	42.78	63.05	20.27	QP	Pass
12.00	43.11	69.54	26.43	QP	Pass
24.00	51.12	69.54	18.42	QP	Pass

For 30MHz to 1000 MHz



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Degree	Antenna	Verdict
745.351	44.49	41.51	37.87	N.A	46.0	N.A	126.3	Horizontal	PASS
791.672	42.52	38.03	36.44	N.A	46.0	N.A	19.8	Horizontal	PASS

(Plot C: 30MHz to 1GHz, Antenna Horizontal @ ∏/4-DQPSK Mode)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Degree	Antenna	Verdict
601.257	36.78	N.A	N.A	N.A	46.0	N.A	114.2	Vertical	PASS
937.795	39.29	N.A	N.A	N.A	46.0	N.A	85.6	Vertical	PASS

(Plot D: 30MHz to 1GHz, Antenna Vertical @ ∏/4-DQPSK Mode)

For 1GHz to 25GHz

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（0CH_2402MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2402.00	101.32	PK	/	/	1.00 H	360	104.72	28.3	4.90	-36.6
1	*2402.00	87.89	AV	/	/	1.00 H	360	91.29	28.3	4.90	-36.6
2	4804.00	48.11	PK	74.00	25.89	1.00 H	359	44.91	32.7	7.00	-36.5
2	4804.00	39.96	AV	54.00	14.04	1.00 H	359	36.76	32.7	7.00	-36.5
3	7206.00	50.24	PK	74.00	23.76	1.00 H	152	40.84	35.8	8.90	-35.3
3	7206.00	40.91	AV	54.00	13.09	1.00 H	152	31.51	35.8	8.90	-35.3
4	9608.00	50.12	PK	74.00	23.88	1.00 H	140	37.52	37.2	10.20	-34.8
4	9608.00	42.92	AV	54.00	11.08	1.00 H	140	30.32	37.2	10.20	-34.8

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（0CH_2402MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2402.00	99.99	PK	/	/	1.00 V	124	103.39	28.3	4.90	-36.6
1	*2402.00	85.98	AV	/	/	1.00 V	124	89.38	28.3	4.90	-36.6
2	4804.00	49.45	PK	74.00	24.55	1.00 V	339	46.25	32.7	7.00	-36.5
2	4804.00	40.37	AV	54.00	13.63	1.00 V	339	37.17	32.7	7.00	-36.5
3	7206.00	50.16	PK	74.00	23.84	1.00 V	340	40.76	35.8	8.90	-35.3
3	7206.00	42.33	AV	54.00	11.67	1.00 V	340	32.93	35.8	8.90	-35.3
4	9608.00	50.21	PK	74.00	23.79	1.00 V	20	37.61	37.2	10.20	-34.8
4	9608.00	43.64	AV	54.00	10.36	1.00 V	20	31.04	37.2	10.20	-34.8

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（39CH_2441MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2441.00	102.41	PK	/	/	1.00 H	153	105.61	28.3	5.10	-36.6
1	*2441.00	90.16	AV	/	/	1.00 H	153	93.36	28.3	5.10	-36.6
2	4882.00	46.13	PK	74.00	27.87	1.00 H	202	42.73	32.3	7.60	-36.5
2	4882.00	35.87	AV	54.00	18.13	1.00 H	202	32.47	32.3	7.60	-36.5
3	7323.00	50.18	PK	74.00	23.82	1.00 H	355	40.78	36.1	8.60	-35.3
3	7323.00	41.09	AV	54.00	12.91	1.00 H	355	31.69	36.1	8.60	-35.3
4	9764.00	50.90	PK	74.00	23.1	1.00 H	28	38.3	37.2	10.20	-34.8
4	9764.00	43.16	AV	54.00	10.84	1.00 H	28	30.56	37.2	10.20	-34.8

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（39CH_2441MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2441.00	100.18	PK	/	/	1.00 V	121	103.38	28.3	5.10	-36.6
1	*2441.00	89.78	AV	/	/	1.00 V	121	92.98	28.3	5.10	-36.6
2	4882.00	46.24	PK	74.00	27.76	1.00 V	97	42.84	32.3	7.60	-36.5
2	4882.00	33.21	AV	54.00	20.79	1.00 V	97	29.81	32.3	7.60	-36.5
3	7323.00	52.81	PK	74.00	21.19	1.00 V	288	43.41	36.1	8.60	-35.3
3	7323.00	41.71	AV	54.00	12.29	1.00 V	288	32.31	36.1	8.60	-35.3
4	9764.00	51.18	PK	74.00	22.82	1.00 V	89	38.58	37.2	10.20	-34.8
4	9764.00	39.71	AV	54.00	14.29	1.00 V	89	27.11	37.2	10.20	-34.8

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（78CH_2480MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2480.00	99.19	PK	/	/	1.00 H	154	102.49	28.6	4.70	-36.6
1	*2480.00	85.88	AV	/	/	1.00 H	154	89.18	28.6	4.70	-36.6
2	4960.00	49.07	PK	74.00	24.93	1.00 H	100	45.27	33.0	7.00	-36.2
2	4960.00	34.26	AV	54.00	19.74	1.00 H	100	30.46	33.0	7.00	-36.2
3	7440.00	52.08	PK	74.00	21.92	1.00 H	190	42.68	36.2	8.50	-35.3
3	7440.00	43.61	AV	54.00	10.39	1.00 H	190	34.21	36.2	8.50	-35.3
4	9920.00	50.51	PK	74.00	23.49	1.00 H	113	37.91	37.2	10.20	-34.8
4	9920.00	38.60	AV	54.00	15.4	1.00 H	113	26.00	37.2	10.20	-34.8

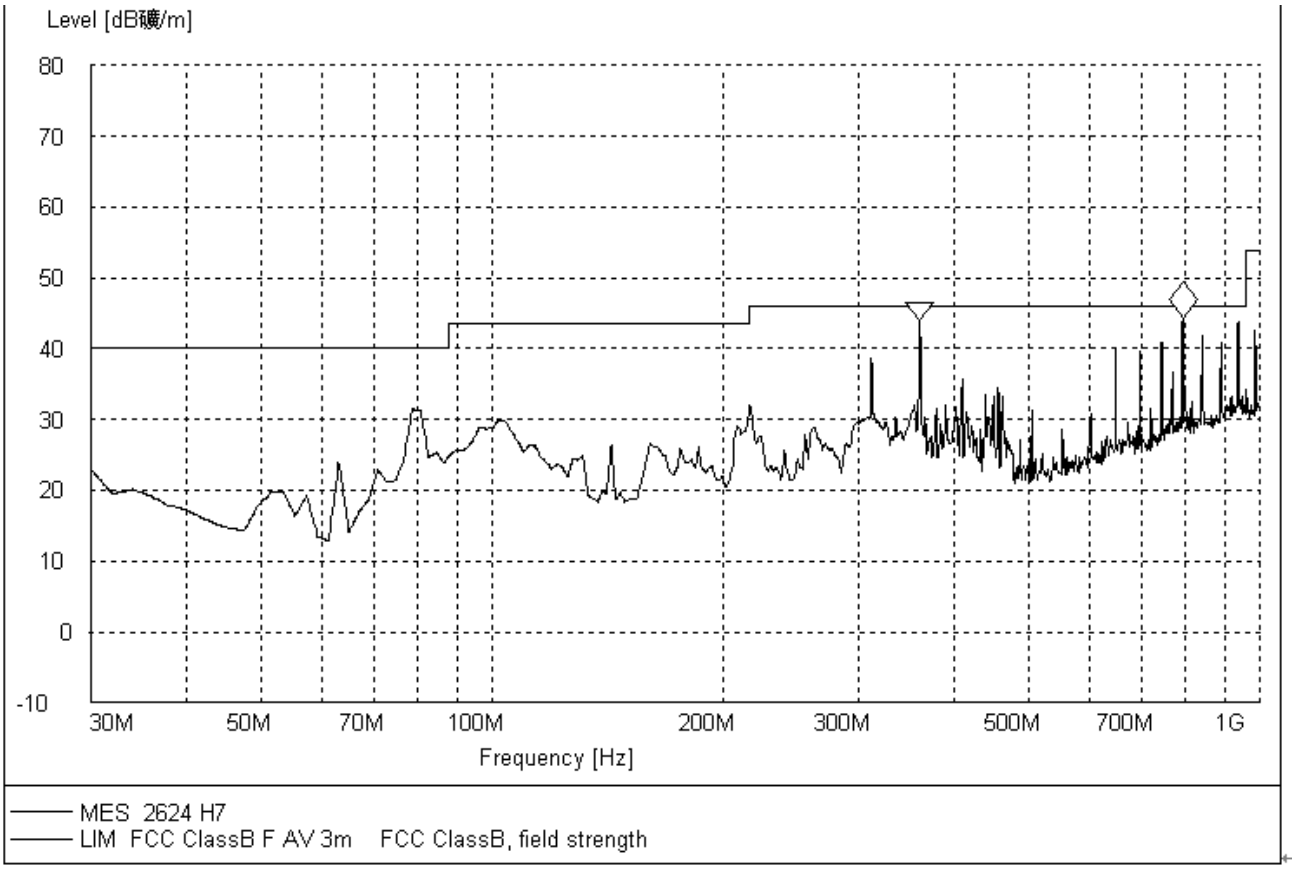
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（78CH_2480MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2480.00	102.01	PK	/	/	1.00 V	247	105.31	28.6	4.70	-36.6
1	*2480.00	91.31	AV	/	/	1.00 V	247	94.61	28.6	4.70	-36.6
2	4960.00	51.09	PK	74.00	22.91	1.00 V	90	47.29	33.0	7.00	-36.2
2	4960.00	43.82	AV	54.00	10.18	1.00 V	90	40.02	33.0	7.00	-36.2
3	7440.00	56.09	PK	74.00	17.91	1.00 V	29	46.69	36.2	8.50	-35.3
3	7440.00	43.64	AV	54.00	10.36	1.00 V	29	34.24	36.2	8.50	-35.3
4	9920.00	52.27	PK	74.00	21.73	1.00 V	222	39.67	37.2	10.20	-34.8
4	9920.00	43.78	AV	54.00	10.22	1.00 V	222	31.18	37.2	10.20	-34.8

2.10.4.3. 8-DPSK Mode：

For 9KHz to 30MHz

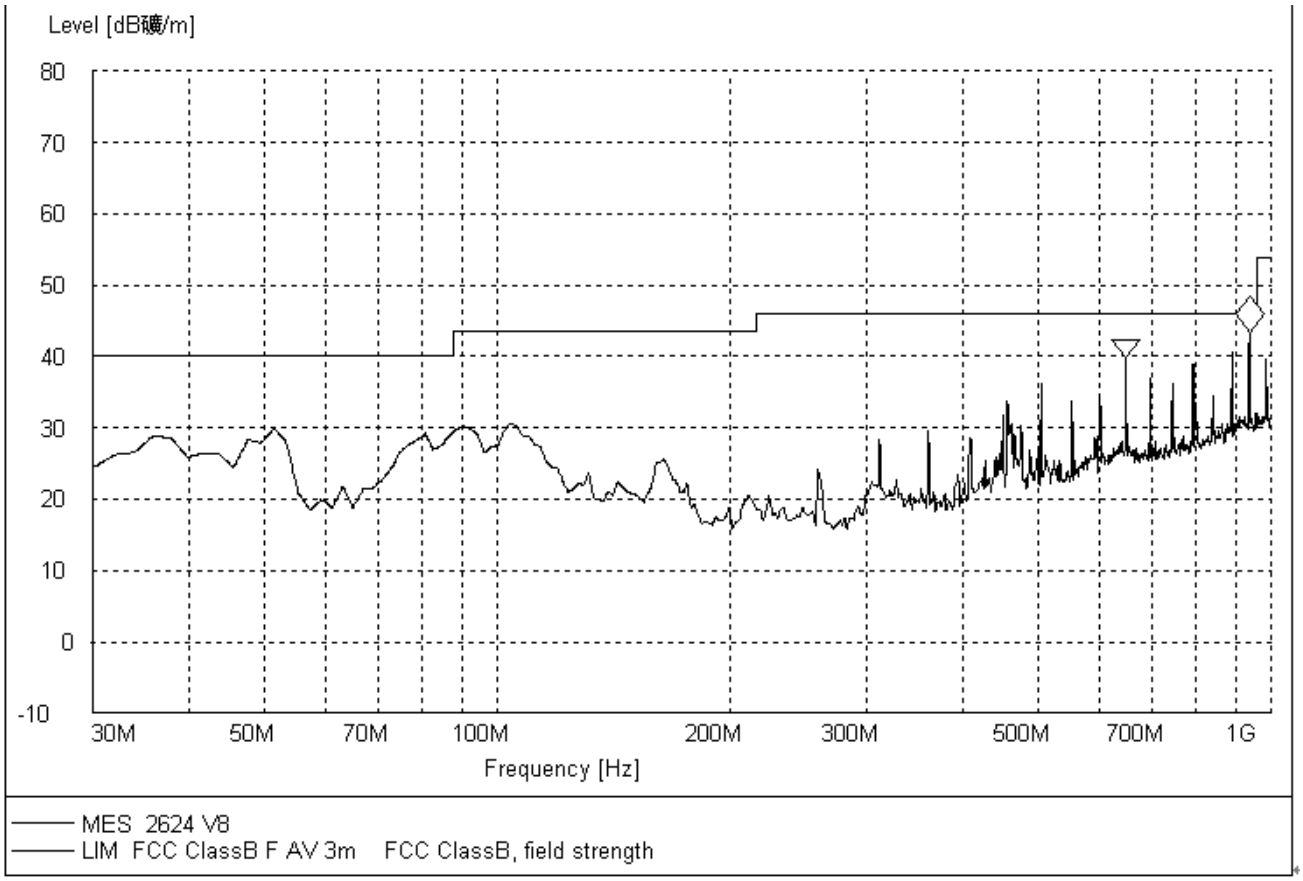
Frequency (MHz)	Corrected Reading (dBμV/m)@3m	FCC Limit (dBμV/m) @3m	Margin (dB)	Detector	Verdict
0.63	49.47	71.21	21.74	QP	Pass
1.62	42.72	63.05	20.33	QP	Pass
12.00	43.25	69.54	26.29	QP	Pass
24.00	51.09	69.54	18.45	QP	Pass

For 30MHz to 1000 MHz



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Degree	Antenna	Verdict
360.527	42.93	40.23	37.05	N.A	46.0	N.A	0.0	Horizontal	PASS
793.947	44.41	42.85	38.11	N.A	46.0	N.A	29.7	Horizontal	PASS

(Plot E: 30MHz to 1GHz, Antenna Horizontal @8-DPSK)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Degree	Antenna	Verdict
652.384	39.98	N.A	N.A	N.A	46.0	N.A	0.0	Horizontal	PASS
937.795	43.43	41.03	38.97	N.A	46.0	N.A	0.0	Horizontal	PASS

(Plot F: 30MHz to 1GHz, Antenna Vertical @ 8-DPSK)

For 1GHz to 25GHz

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（0CH_2402MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2402.00	101.02	PK	/	/	1.00 H	360	104.42	28.3	4.90	-36.6
1	*2402.00	90.84	AV	/	/	1.00 H	360	94.24	28.3	4.90	-36.6
2	4804.00	50.11	PK	74.00	23.89	1.00 H	359	46.91	32.7	7.00	-36.5
2	4804.00	40.16	AV	54.00	13.84	1.00 H	359	36.96	32.7	7.00	-36.5
3	7206.00	50.04	PK	74.00	23.96	1.00 H	152	40.64	35.8	8.90	-35.3
3	7206.00	44.19	AV	54.00	9.81	1.00 H	152	34.79	35.8	8.90	-35.3
4	9608.00	50.12	PK	74.00	23.88	1.00 H	140	37.52	37.2	10.20	-34.8
4	9608.00	44.02	AV	54.00	9.98	1.00 H	140	31.42	37.2	10.20	-34.8

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（0CH_2402MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2402.00	101.15	PK	/	/	1.00 V	124	104.55	28.3	4.90	-36.6
1	*2402.00	93.05	AV	/	/	1.00 V	124	96.45	28.3	4.90	-36.6
2	4804.00	51.27	PK	74.00	22.73	1.00 V	339	48.07	32.7	7.00	-36.5
2	4804.00	41.87	AV	54.00	12.13	1.00 V	339	38.67	32.7	7.00	-36.5
3	7206.00	50.76	PK	74.00	23.24	1.00 V	340	41.36	35.8	8.90	-35.3
3	7206.00	40.99	AV	54.00	13.01	1.00 V	340	31.59	35.8	8.90	-35.3
4	9608.00	51.84	PK	74.00	22.16	1.00 V	20	39.24	37.2	10.20	-34.8
4	9608.00	44.24	AV	54.00	9.76	1.00 V	20	31.64	37.2	10.20	-34.8

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（39CH_2441MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2441.00	99.97	PK	/	/	1.00 H	153	103.17	28.3	5.10	-36.6
1	*2441.00	90.06	AV	/	/	1.00 H	153	93.26	28.3	5.10	-36.6
2	4882.00	48.13	PK	74.00	25.87	1.00 H	202	44.73	32.3	7.60	-36.5
2	4882.00	37.07	AV	54.00	16.93	1.00 H	202	33.67	32.3	7.60	-36.5
3	7323.00	50.18	PK	74.00	23.82	1.00 H	355	40.78	36.1	8.60	-35.3
3	7323.00	41.41	AV	54.00	12.59	1.00 H	355	32.01	36.1	8.60	-35.3
4	9764.00	50.06	PK	74.00	23.94	1.00 H	28	37.46	37.2	10.20	-34.8
4	9764.00	43.06	AV	54.00	10.94	1.00 H	28	30.46	37.2	10.20	-34.8

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（39CH_2441MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2441.00	100.01	PK	/	/	1.00 V	121	103.21	28.3	5.10	-36.6
1	*2441.00	90.78	AV	/	/	1.00 V	121	93.98	28.3	5.10	-36.6
2	4882.00	47.74	PK	74.00	26.26	1.00 V	97	44.34	32.3	7.60	-36.5
2	4882.00	35.42	AV	54.00	18.58	1.00 V	97	32.02	32.3	7.60	-36.5
3	7323.00	50.64	PK	74.00	23.36	1.00 V	288	41.24	36.1	8.60	-35.3
3	7323.00	41.09	AV	54.00	12.91	1.00 V	288	31.69	36.1	8.60	-35.3
4	9764.00	50.01	PK	74.00	23.99	1.00 V	89	37.41	37.2	10.20	-34.8
4	9764.00	36.31	AV	54.00	17.69	1.00 V	89	23.71	37.2	10.20	-34.8

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（78CH_2480MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2480.00	99.79	PK	/	/	1.00 H	154	103.09	28.6	4.70	-36.6
1	*2480.00	82.34	AV	/	/	1.00 H	154	85.64	28.6	4.70	-36.6
2	4960.00	50.00	PK	74.00	24.00	1.00 H	100	46.2	33.0	7.00	-36.2
2	4960.00	36.12	AV	54.00	17.88	1.00 H	100	32.32	33.0	7.00	-36.2
3	7440.00	52.08	PK	74.00	21.92	1.00 H	190	42.68	36.2	8.50	-35.3
3	7440.00	41.97	AV	54.00	12.03	1.00 H	190	32.57	36.2	8.50	-35.3
4	9920.00	50.31	PK	74.00	23.69	1.00 H	113	37.71	37.2	10.20	-34.8
4	9920.00	36.65	AV	54.00	17.35	1.00 H	113	24.05	37.2	10.20	-34.8

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（78CH_2480MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2480.00	99.19	PK	/	/	1.00 V	247	102.49	28.6	4.70	-36.6
1	*2480.00	90.07	AV	/	/	1.00 V	247	93.37	28.6	4.70	-36.6
2	4960.00	51.19	PK	74.00	22.81	1.00 V	90	47.39	33.0	7.00	-36.2
2	4960.00	47.02	AV	54.00	6.98	1.00 V	90	43.22	33.0	7.00	-36.2
3	7440.00	52.17	PK	74.00	21.83	1.00 V	29	42.77	36.2	8.50	-35.3
3	7440.00	43.92	AV	54.00	10.08	1.00 V	29	34.52	36.2	8.50	-35.3
4	9920.00	51.01	PK	74.00	22.99	1.00 V	222	38.41	37.2	10.20	-34.8
4	9920.00	42.31	AV	54.00	11.69	1.00 V	222	29.71	37.2	10.20	-34.8

2.11. RF exposure evaluation

According to § 1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy lever in excess of Commission's guideline.

According to 447498 D01 General RF Exposure Guidance v05, exclusion threshold values at selected frequencies and distances table as following.

MHz	5	10	15	20	25	mm
150	39	77	116	155	194	SAR Test Exclusion Threshold (mW)
300	27	55	82	110	137	
450	22	45	67	89	112	
835	16	33	49	66	82	
900	16	32	47	63	79	
1500	12	24	37	49	61	
1900	11	22	33	44	54	
2450	10	19	29	38	48	
3600	8	16	24	32	40	
5200	7	13	20	26	33	
5400	6	13	19	26	32	
5800	6	12	19	25	31	

MHz	30	35	40	45	50	mm
150	232	271	310	349	387	SAR Test Exclusion Threshold (mW)
300	164	192	219	246	274	
450	134	157	179	201	224	
835	98	115	131	148	164	
900	95	111	126	142	158	
1500	73	86	98	110	122	
1900	65	76	87	98	109	
2450	57	67	77	86	96	
3600	47	55	63	71	79	
5200	39	46	53	59	66	
5400	39	45	52	58	65	
5800	37	44	50	56	62	

Routine SAR evaluation refers to the specifically required by § 2.1093, using measurements or computer simulation. When routine SAR evolution is not required, the portable transmitters with

output power greater than the applicable low threshold SAR evolution to qualify for TCB approval.

Result:

This is portable device and the Max conducted peak output power is -0.07dBm, the maximum gain of antenna is1.2dBi, the maximum output power is -0.07dBm (0.984mW), which is lower than the exclusion threshold 10mW, at frequency 2450MHz, and distance is 5mm.

The SAR measurement is not required.

** END OF REPORT **