RF TEST REPORT

Report No.:	SET2013-03220
Product Name:	2XL bluetooth
FCC ID:	Y22-2XL20130001
Model No. :	X7RGFZ-841, X7RGFZ-842, X7RGFZ-833
Applicant:	Skullcandy,Inc
Address:	1441 W.Ute Blvd Suite 250.Park City,UT,84098 United States
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

Test Report

Product Name.....:	2XL bluetooth
Model No. .....:	X7RGFZ-841, X7RGFZ-842, X7RGFZ-833
Trade Name.....:	Skullcandy
Brand Name.....:	2XL
Applicant.....:	Skullcandy,Inc
Applicant Address.....:	1441 W,Ute Blvd Suite 250.Park City,UT,84098 United States
Manufacturer .....:	Shenzhen Grandsun Electronic Co., Ltd.
Manufacturer Address .....:	Pingdi Gaoqiao Industry Zone, Longgang Distric, Shenzhen, Guangdong, China
Test Standards.....:	47 CFR Part 15 Subpart C RSS-GEN Issue 3, December 2010 RSS-210 Issue 8, December 2010 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 Date .....:	June 24, 2013 to July 17, 2013
Tested by .....:	Lu Lei, Test Engineer
Reviewed by .....:	Shuangwen Zhang, Senior Egineer
Approved by .....:	Wu Li'an, Manager

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Change History		
Issue	Date	Reason for change
1.0	July 23, 2013	First edition
2.0		

1. General Information

1.1. EUT Description

EUT Type	:	2XL bluetooth
Serial No.	:	(n.a, marked #1 by test site)
Hardware Version	:	1.0
Software Version	:	1.0
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	:	0.5dBi

Note 1: The EUT is a 2XL bluetooth, 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 6 packages DH1, DH3, DH5, 3DH1, 3DH3, 3DH5, 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 0.5dBi, 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 Subpart C 2012	Radio Frequency Devices
1	RSS-GEN: Issue 3, December 2010：	General Requirements and Information for the Certification of Radio Apparatus
2	RSS-210: Issue 8, December 2010:	Low-power Licence-exempt Radio communication Devices(All Frequency Bands): Category I Equipment

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

No.	Section in CFR 47	Section in RSS-GEN, RSS-210	Description	Result
1	15.203	7.1.2	Antenna Requirement	PASS
2	15.247(a)	A8.1 (d)	Number of Hopping Frequency	PASS
3	15.247(b)	A8.4 (2)	Peak Output Power	PASS
4	15.247(a)	A8.1 (a)	20dB Bandwidth	PASS
5	15.247(a)	A8.1 (b)	Carrier Frequency Separation	PASS
6	15.247(a)	A8.1 (d)	Time of Occupancy (Dwell time)	PASS
7	15.247(d)	A8.5	Conducted Spurious Emission	PASS
8	15.247(d)	A8.5	Band Edge	PASS
9	15.207	7.2.4	Conducted Emission	PASS
10	15.209 15.247(d)	7.2.5	Radiated Emission	PASS
11	15.247(i), 1.1307&2.1093	RSS-102	RF exposure evaluation	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.

IC-Registration No.: 11185A-1

CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd. EMC Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 11185A-1 on July. 15, 2013, valid time is until July. 15, 2016.

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 15.203and RSS-Gen 7.1.2, 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 0.5dBi.

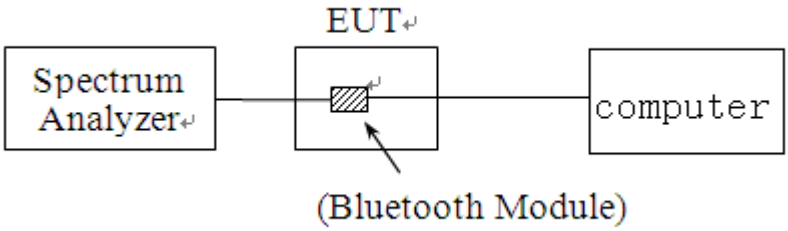
2.2. Number of Hopping Frequency

2.2.1. Requirement

According to FCC §15.247(a)(1)(iii) and RSS-210 A8.1 (d), 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	2013.06.10

The Cal. Interval was one year.

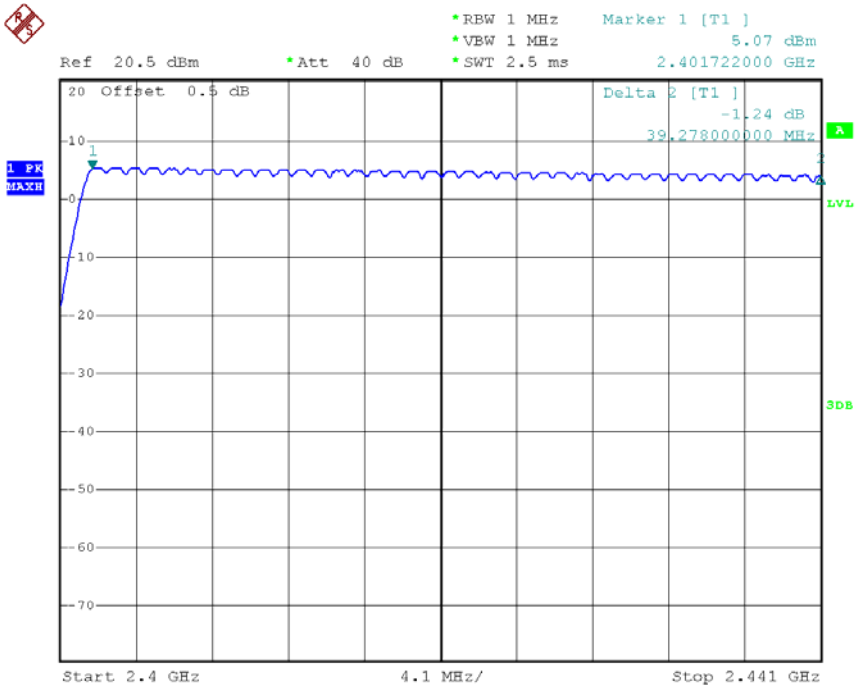
2.2.3. Test Result

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.

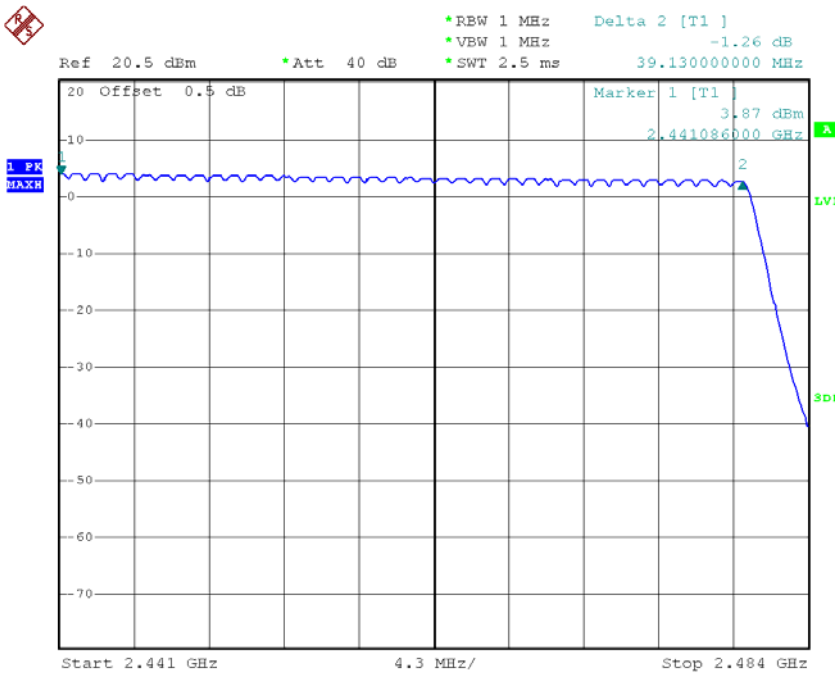
A. Test Verdict:

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

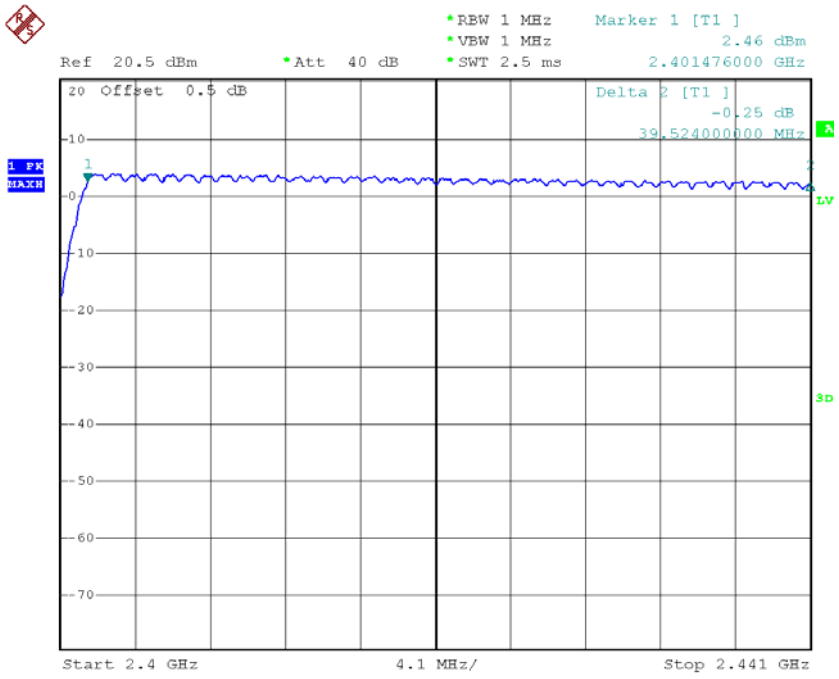
B. Test Plots:



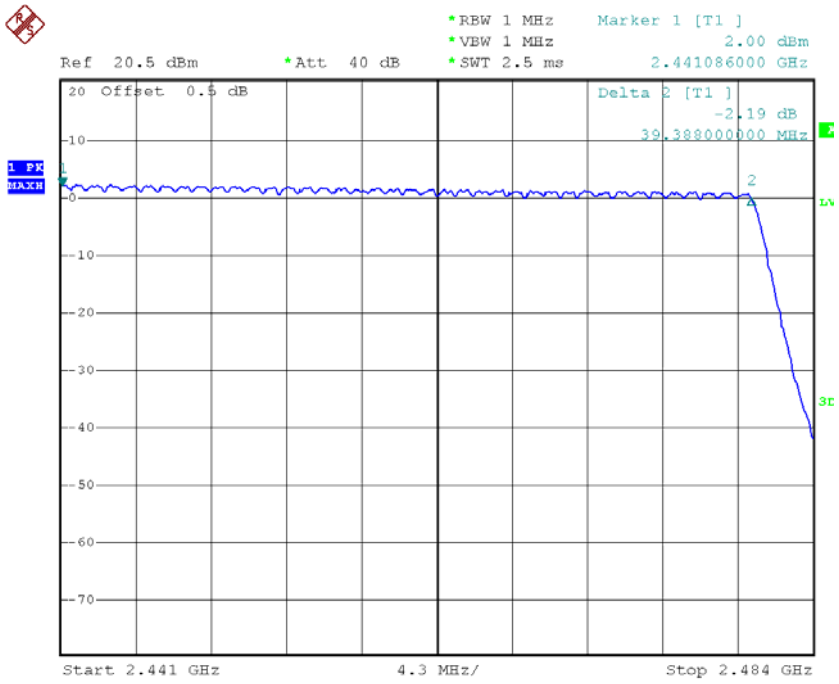
(Plot A1: GFSK)



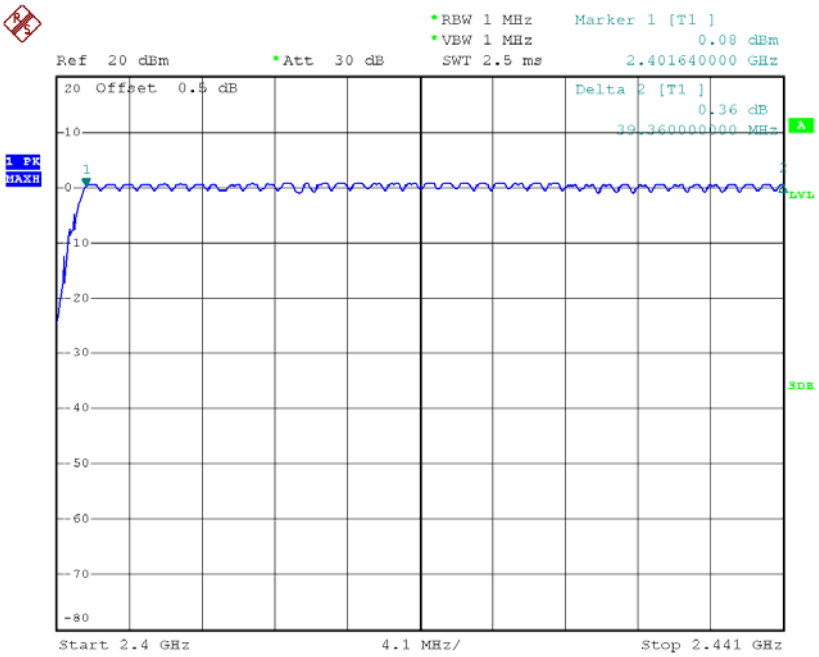
(Plot A2: GFSK)



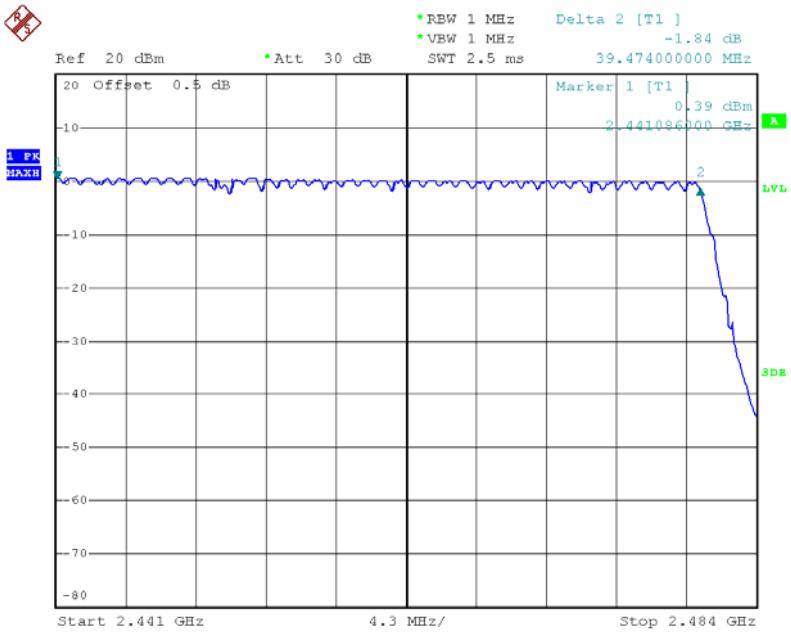
(Plot B1: ∏/4-DQPSK)



(Plot B2: ∏/4-DQPSK)



(Plot C1: 8-DPSK)



(Plot C2: 8-DPSK)

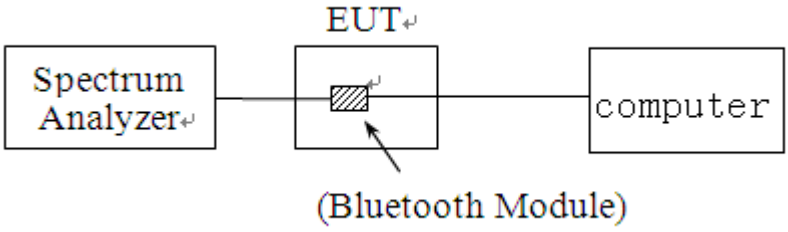
2.3. Peak Output Power

2.3.1. Requirement

According to FCC §15.247(b)(1) and RSS-210 A8.4 (2), 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	2013.06.10

The Cal. Interval was one year.

2.3.3. Test Result

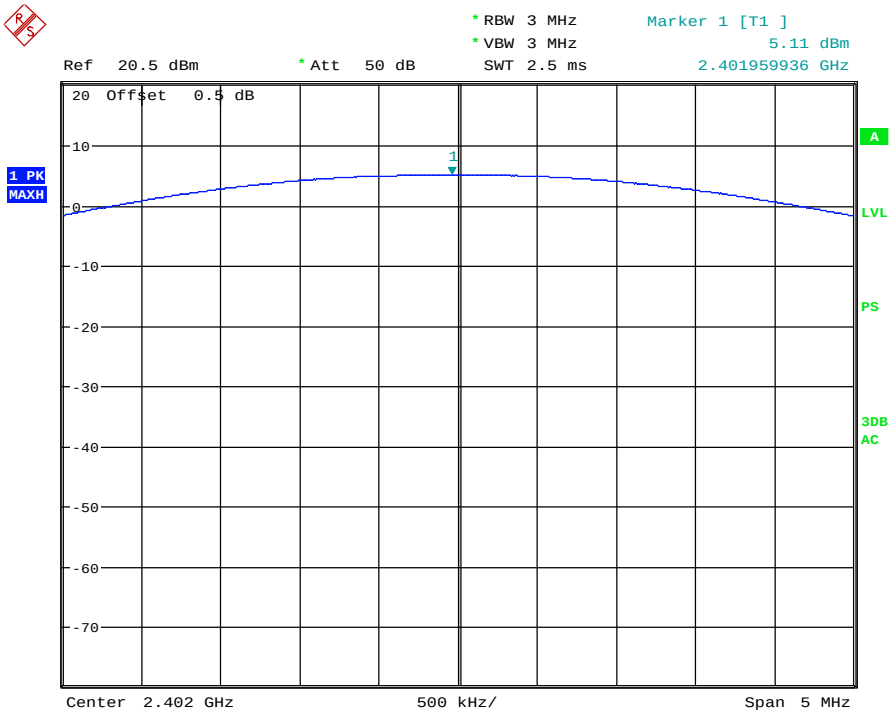
The Bluetooth Module operates at hopping-off test mode. The lowest, middle and highest channels are selected to perform testing to verify the conducted RF output peak power of the Module. The lowest, middle and highest channel were tested by Power meter.

2.3.3.1. GFSK Mode

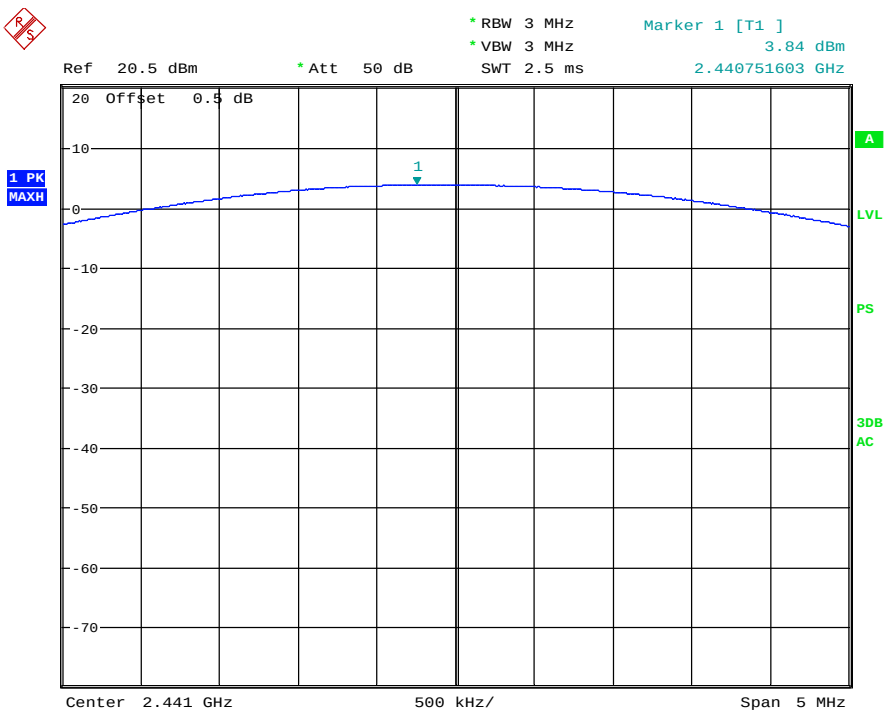
A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict	Refer to Plot
		dBm	W	dBm	W		
0	2402	5.11	0.003243	30	1	PASS	Plot A
39	2441	3.84	0.002421			PASS	Plot B
78	2480	2.45	0.001758			PASS	Plot C

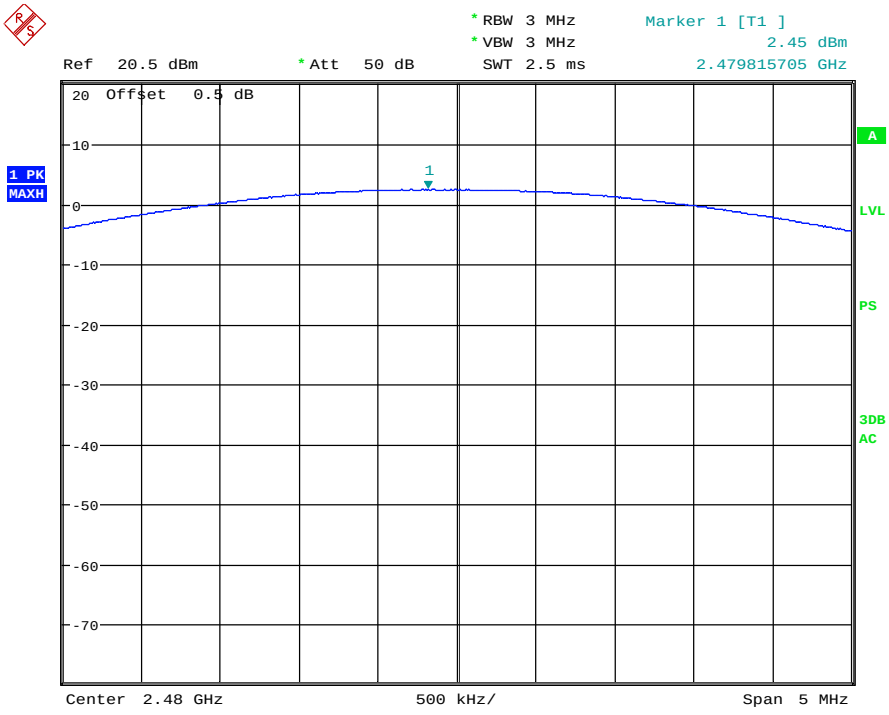
B. Test plots:



Plot A


RBW 3 MHz
VBW 3 MHz
SWT 2.5 ms
Marker 1 [T1]
3.84 dBm
2.440751603 GHz
Ref 20.5 dBm
Att 50 dB
20 Offset 0.5 dB
1 PK
MAXH
A
LVL
PS
3DB
AC
Center 2.441 GHz
500 kHz/
Span 5 MHz

Plot B


RBW 3 MHz
VBW 3 MHz
SWT 2.5 ms
Marker 1 [T1]
2.45 dBm
2.479815705 GHz
Ref 20.5 dBm
Att 50 dB
20 Offset 0.5 dB
1 PK
MAXH
A
LVL
PS
3DB
AC
Center 2.48 GHz
500 kHz/
Span 5 MHz

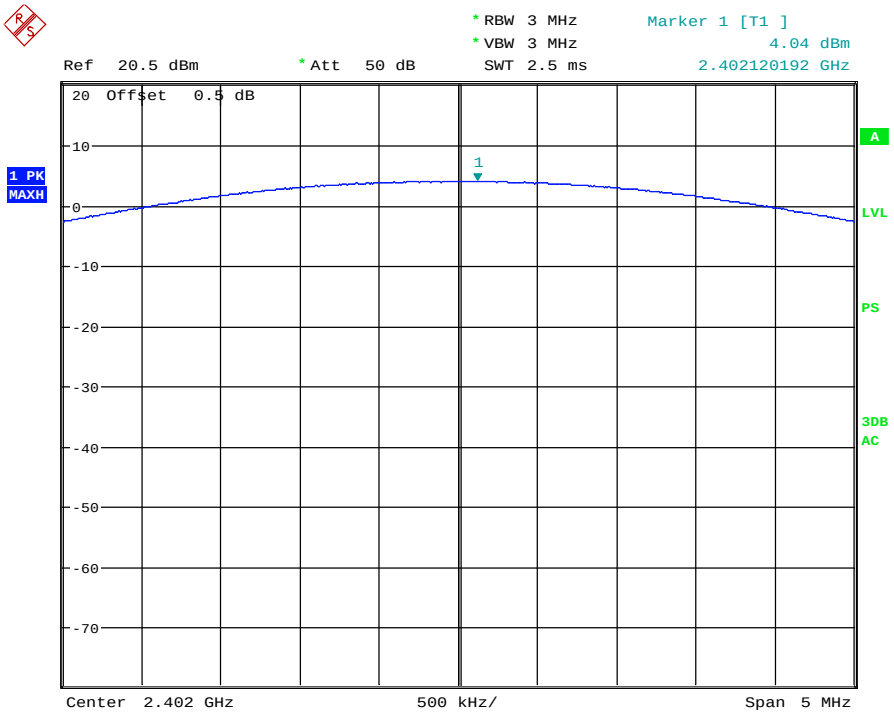
Plot C

2.3.3.2. ∏/4-DQPSK Mode

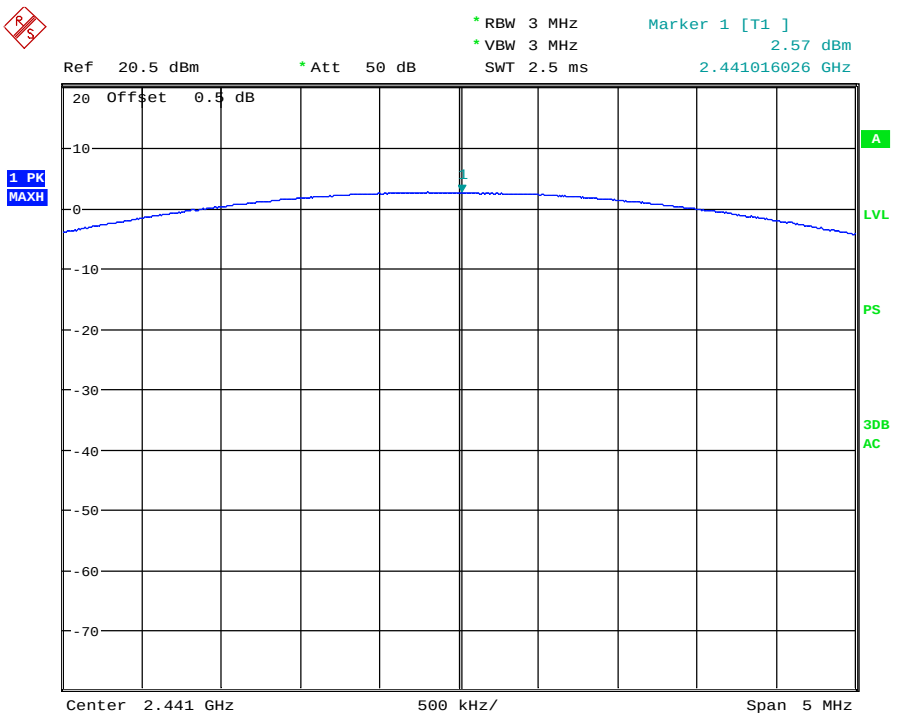
A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict	Refer to Plot
		dBm	W	dBm	W		
0	2402	4.04	0.002535	30	1	PASS	Plot A
39	2441	2.57	0.001807			PASS	Plot B
78	2480	0.96	0.001247			PASS	Plot C

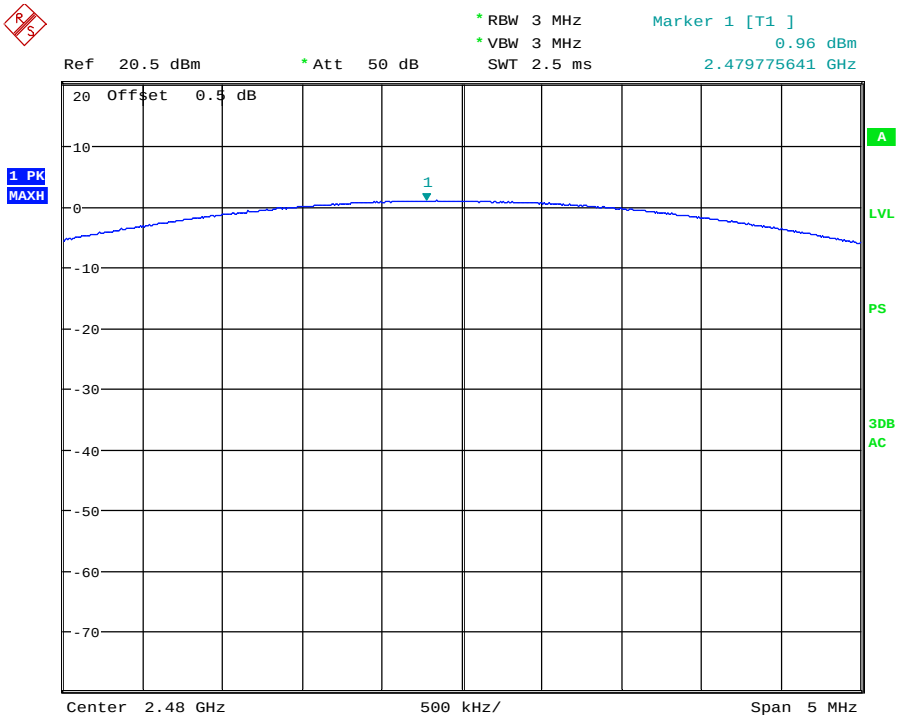
B. Test plots:



Plot A


RBW 3 MHz
VBW 3 MHz
SWT 2.5 ms
Marker 1 [T1]
2.57 dBm
2.441016026 GHz
Ref 20.5 dBm
Att 50 dB
20 Offset 0.5 dB
1 PK
MAXH
A
LVL
PS
3DB
AC
Center 2.441 GHz
500 kHz/
Span 5 MHz

Plot B


RBW 3 MHz
VBW 3 MHz
SWT 2.5 ms
Marker 1 [T1]
0.96 dBm
2.479775641 GHz
Ref 20.5 dBm
Att 50 dB
20 Offset 0.5 dB
1 PK
MAXH
A
LVL
PS
3DB
AC
Center 2.48 GHz
500 kHz/
Span 5 MHz

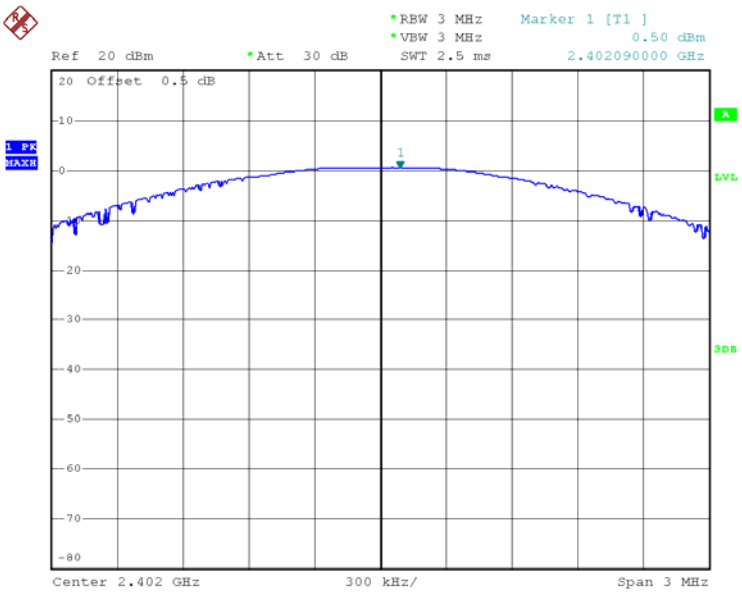
Plot C

2.3.3.3. 8-DPSK Mode

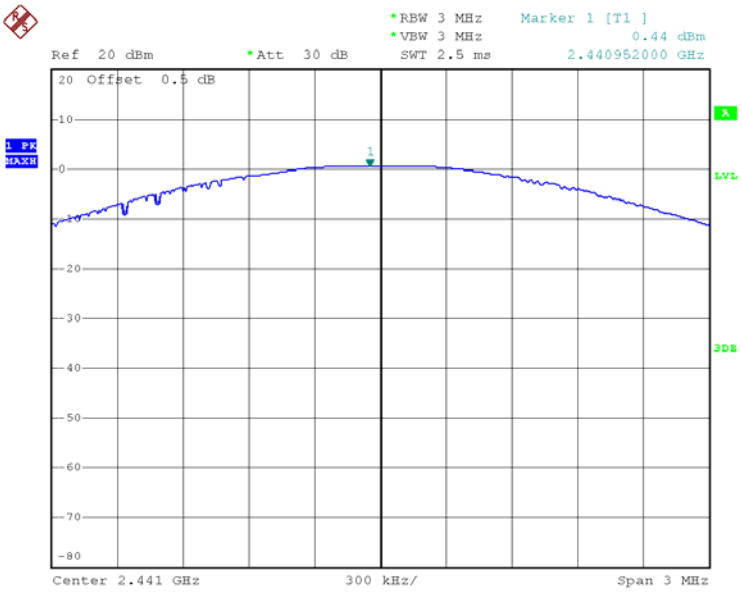
A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict	Refer to Plot
		dBm	W	dBm	W		
0	2402	0.50	0.001138	30	1	PASS	Plot A
39	2441	0.44	0.001127			PASS	Plot B
78	2480	0.11	0.000776			PASS	Plot C

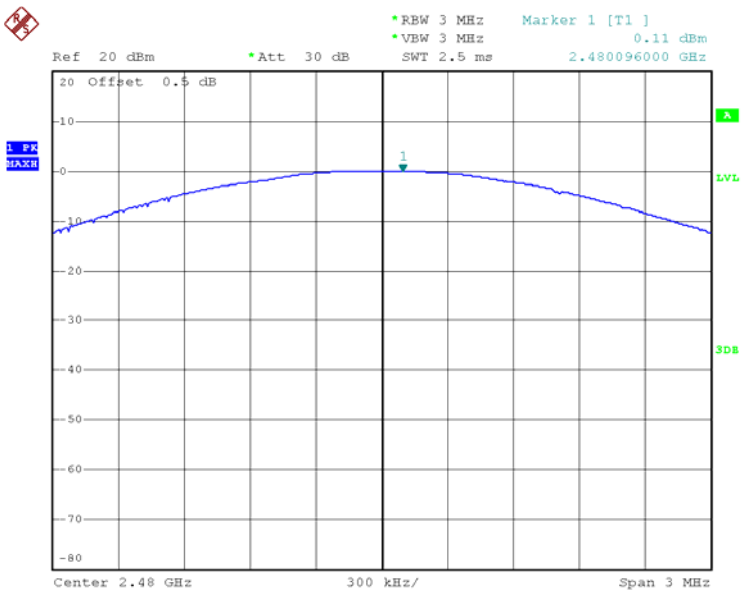
B. Test plots:



Plot A



Plot B


RBW 3 MHz
VBW 3 MHz
SWT 2.5 ms
Marker 1 [T1]
0.11 dBm
2.480096000 GHz
Ref 20 dBm
Att 30 dB
20 Offset 0.5 dB
1 PK
MAXH
A
LVL
3DB
Center 2.48 GHz
300 kHz/
Span 3 MHz

Plot C

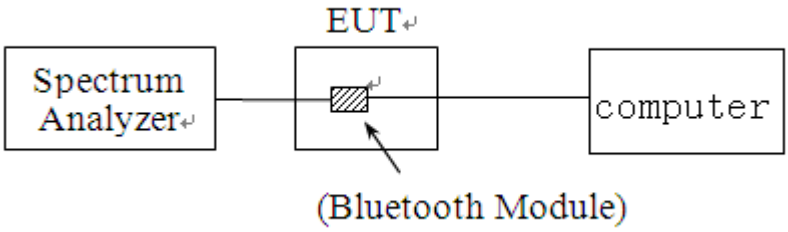
2.4. 20dB Bandwidth

2.4.1. Definition

According to FCC §15.247(a)(1) and RSS-210 A8.1(a), 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	2013.06.10

The Cal. Interval was one year.

2.4.3. 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

2.4.4. 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.

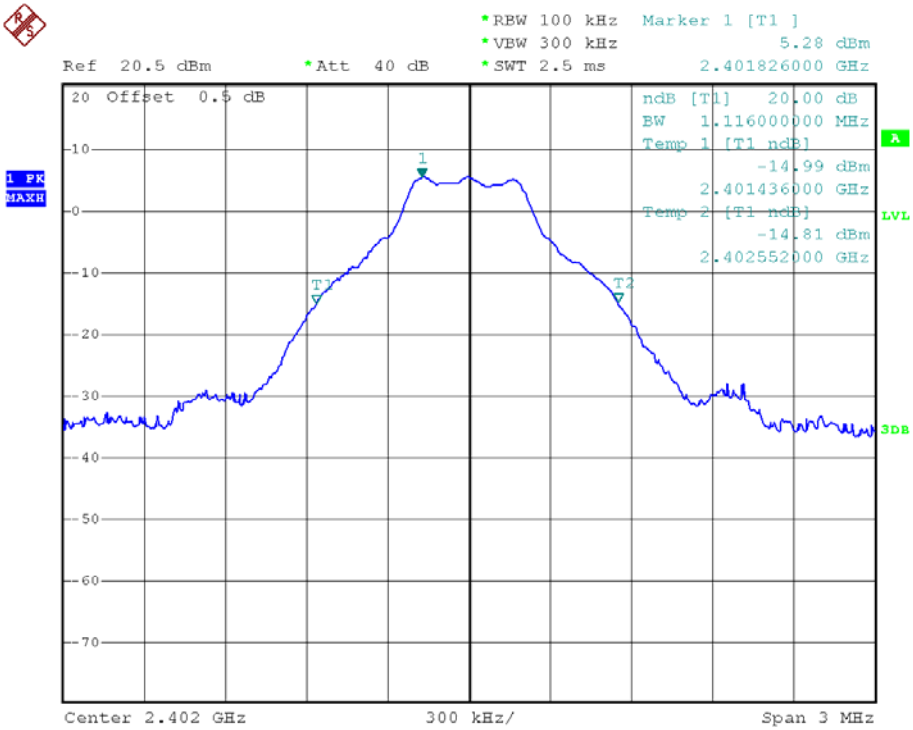
2.4.4.1. GFSK Mode

A. Test Verdict:

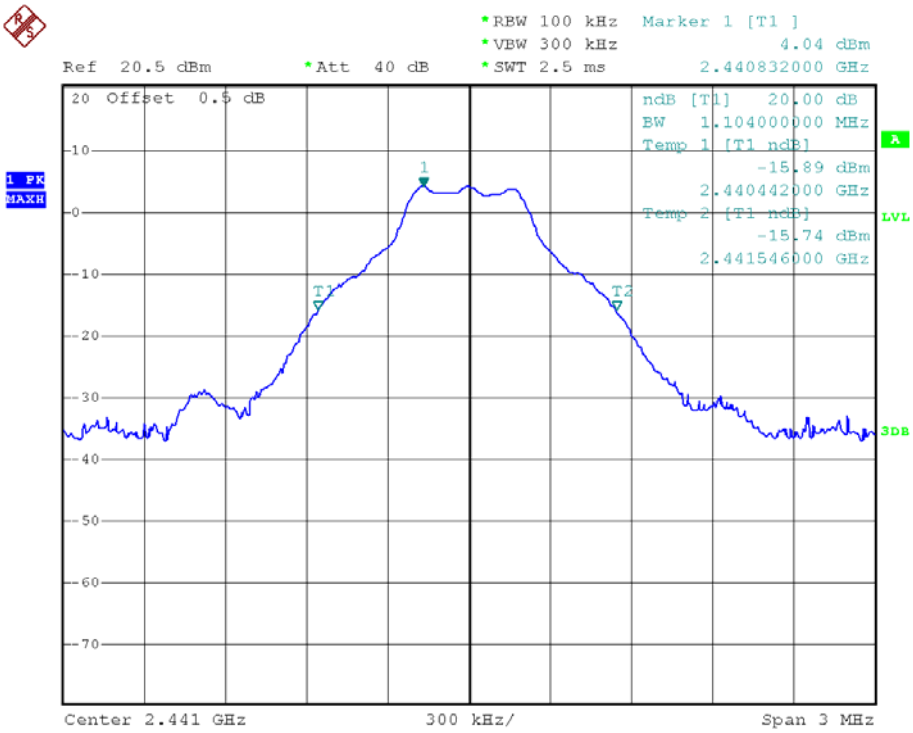
The maximum 20dB bandwidth measured is 1.116MHz according to the table below.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
0	2402	1.116	Plot A
39	2441	1.104	Plot B
78	2480	1.104	Plot C

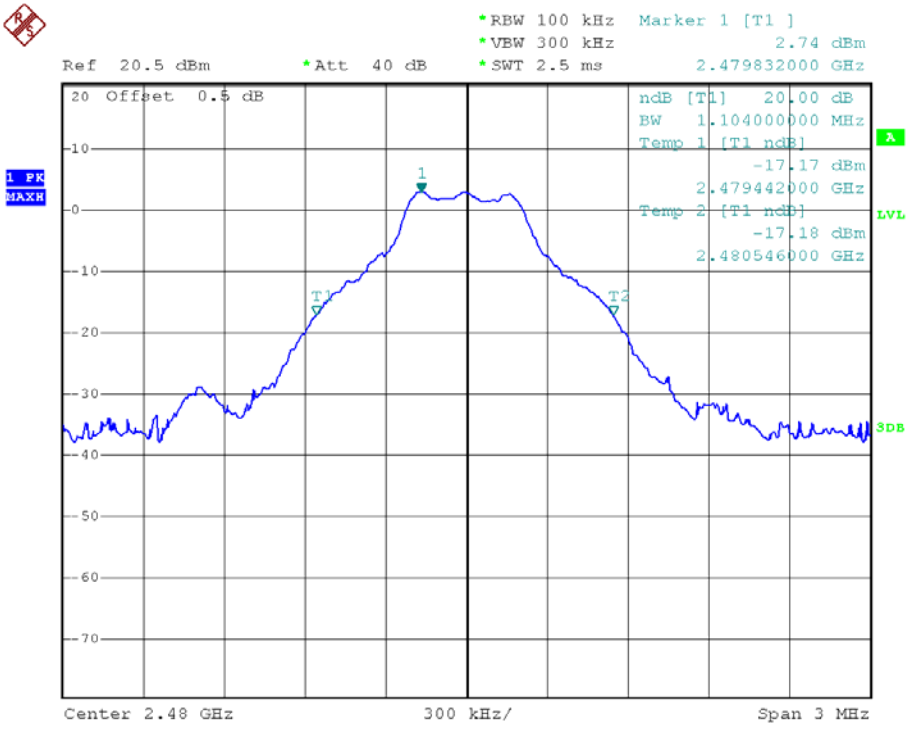
B. Test Plots:



(Plot A: Channel = 2402 @ GFSK)



(Plot B: Channel = 2441 @ GFSK)



(Plot C: Channel = 2480 @ GFSK)

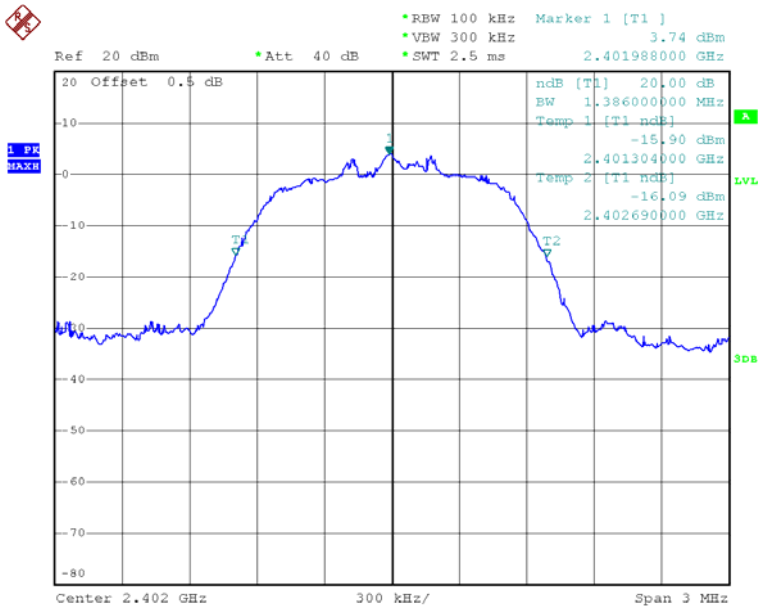
2.4.4.2. Π/4-DQPSK Mode

A. Test Verdict:

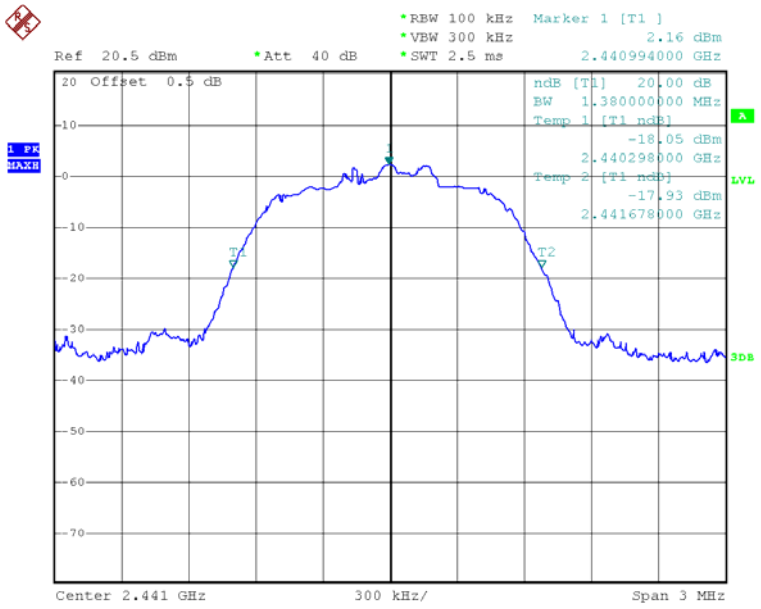
The maximum 20dB bandwidth measured is 1.386MHz according to the table below.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
0	2402	1.386	Plot D
39	2441	1.380	Plot E
78	2480	1.386	Plot F

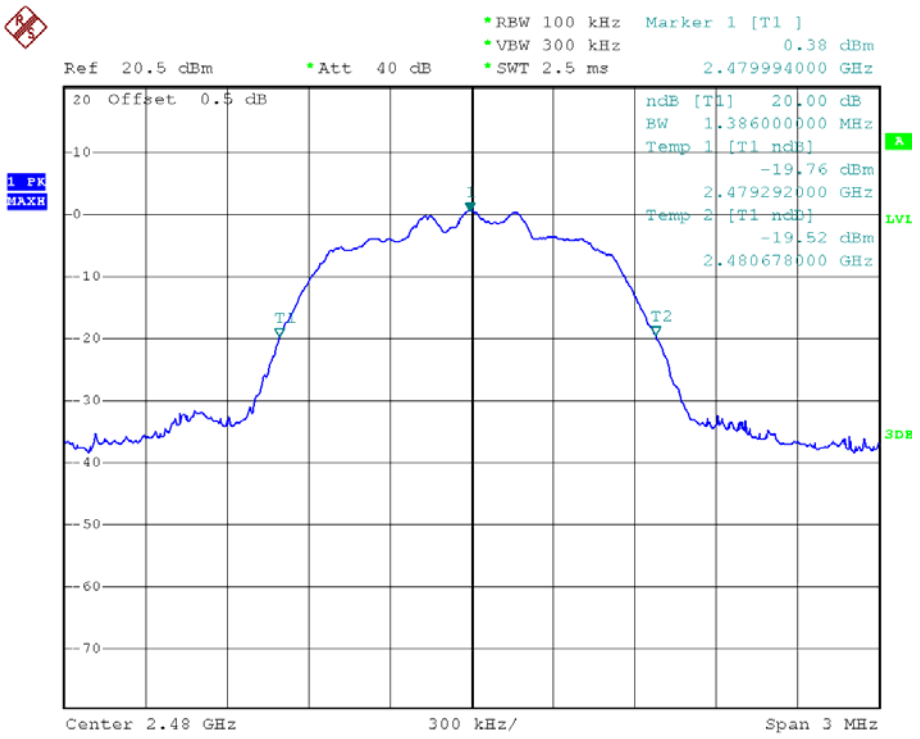
Test Plots:



(Plot D: Channel = 2402 @ Π/4-DQPSK)



(Plot E: Channel = 2441 @ Π/4-DQPSK)



(Plot F: Channel = 2480 @ ∏/4-DQPSK)

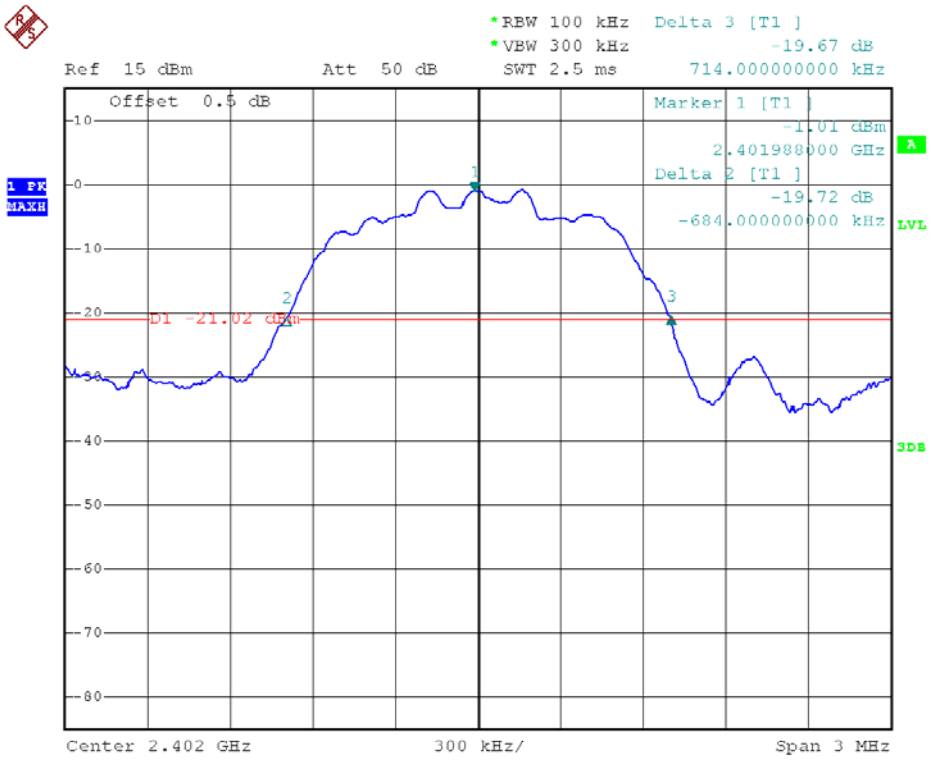
2.4.4.3. 8-DPSK Mode

A. Test Verdict:

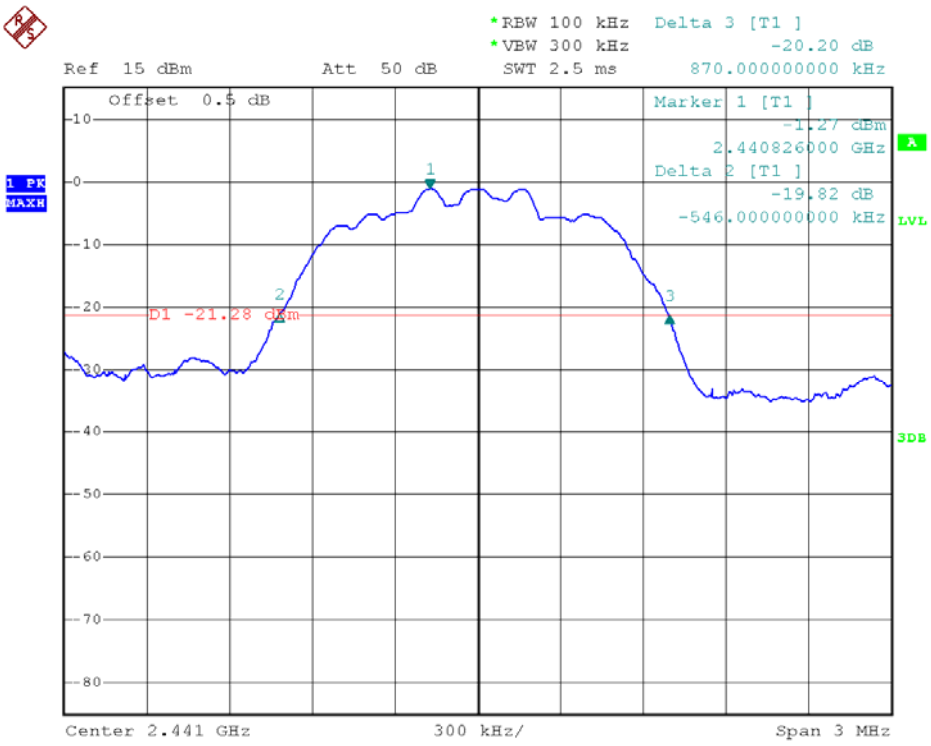
The maximum 20dB bandwidth measured is 1.284MHz according to the table below.

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

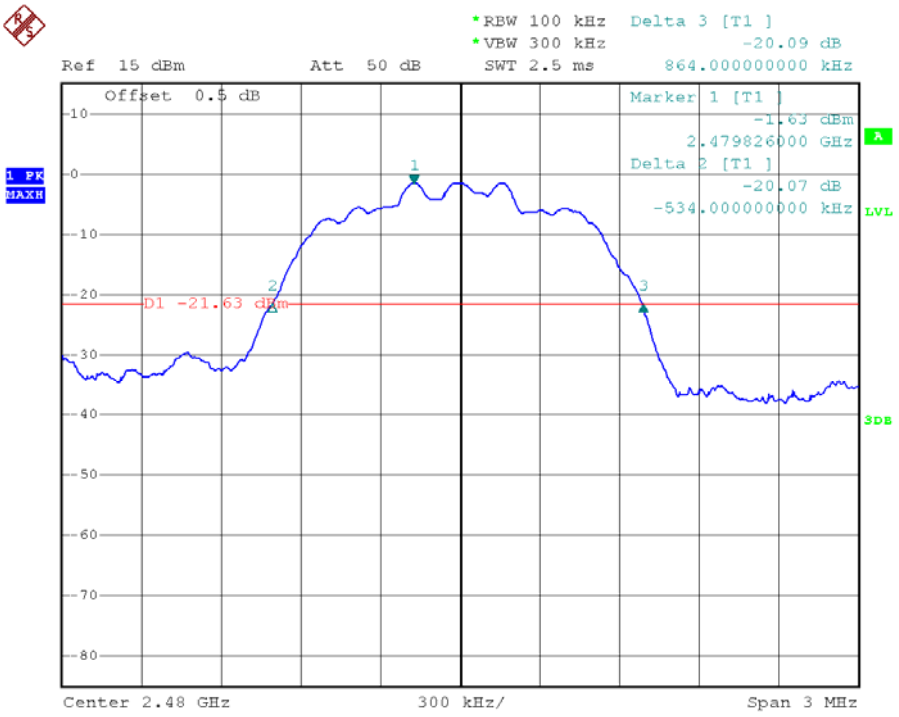
B. Test Plots:



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



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



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

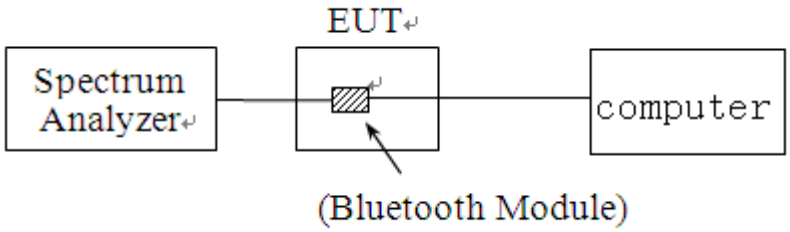
2.5. Carried Frequency Separation

2.5.1. Definition

According to FCC §15.247(a)(1) and RSS-210 A8.1(b), 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	2013.06.10

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

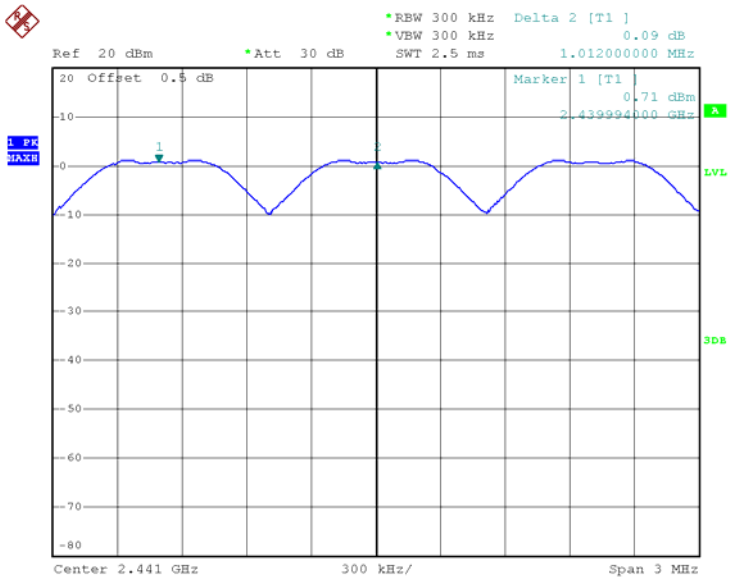
Trace = max hold

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

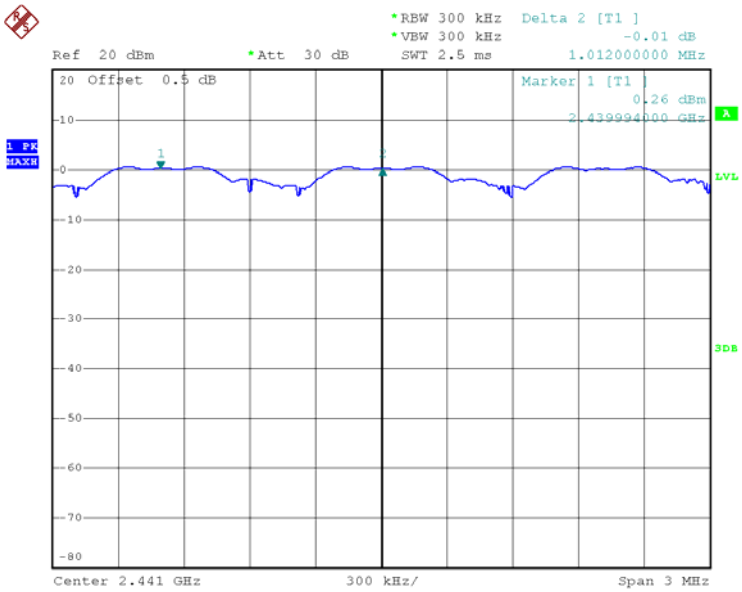
2.5.4. Test Result

The Bluetooth Module operates at hopping-on test mode.

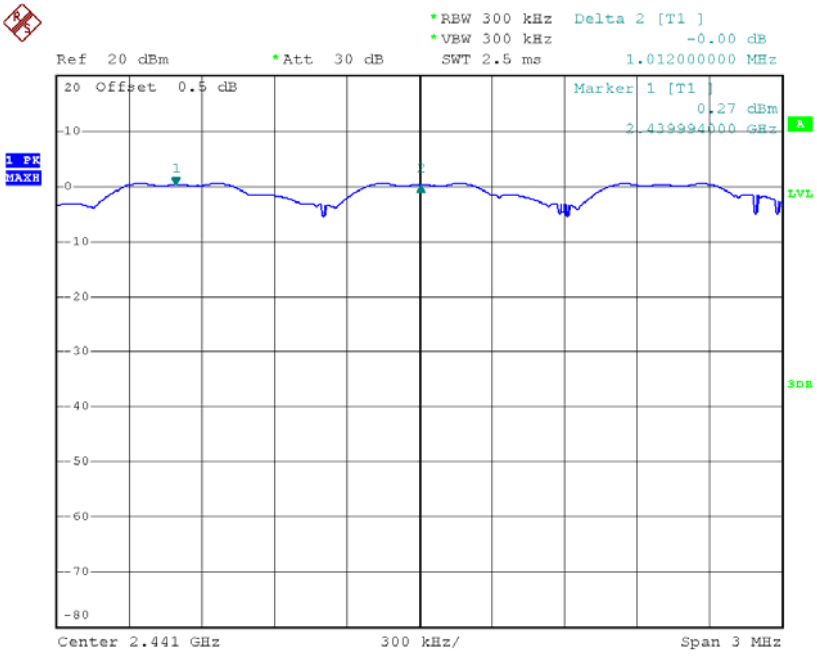
For any adjacent channels (e.g. the channel 39 and 40 as showed in the Plot A), the Module does have hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of the hopping channel (1.116MHz for GFSK mode, 1.386MHz for ∏/4-DQPSK mode, 1.284MHz for 8-DPSK mode, refer to section 2.4.3), whichever is greater. So, the verdict is PASSING



(Plot A: GFSK)



(Plot B: ∏/4-DQPSK)


*RBW 300 kHz
*VBW 300 kHz
SWT 2.5 ms
Delta 2 [T1]
-0.00 dB
1.012000000 MHz
Ref 20 dBm
*Att 30 dB
20 Offset 0.5 dB
Marker 1 [T1]
0.27 dBm
2.439994000 GHz
1 PK
MAXH
LVL
3DB
Center 2.441 GHz
300 kHz/
Span 3 MHz

(Plot C: 8-DPSK)

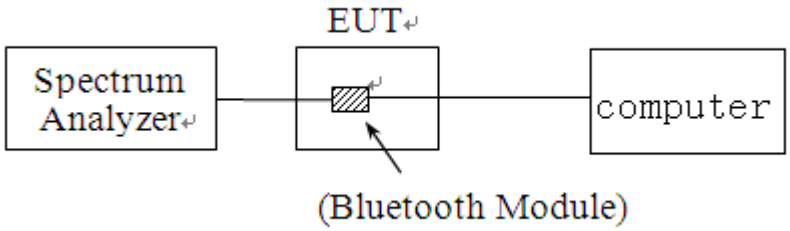
2.6. Time of Occupancy (Dwell time)

2.6.1. Requirement

According to FCC §15.247(a) (1) (iii) and RSS-210 A8.1(d), 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	2013.06.10

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.

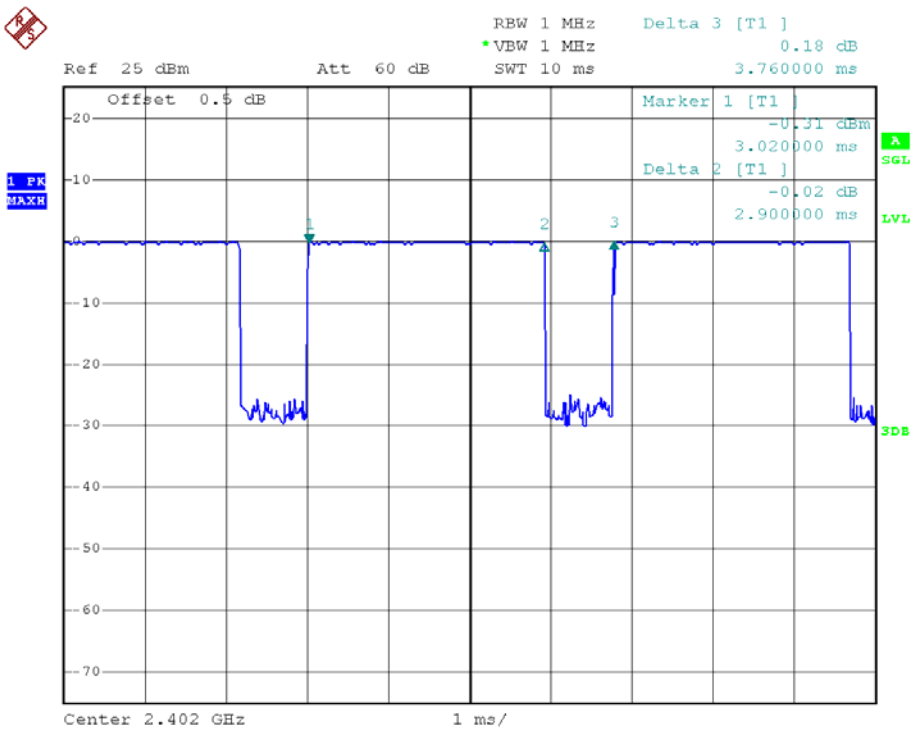
2.6.4.1. GFSK Mode

A. Test Verdict:

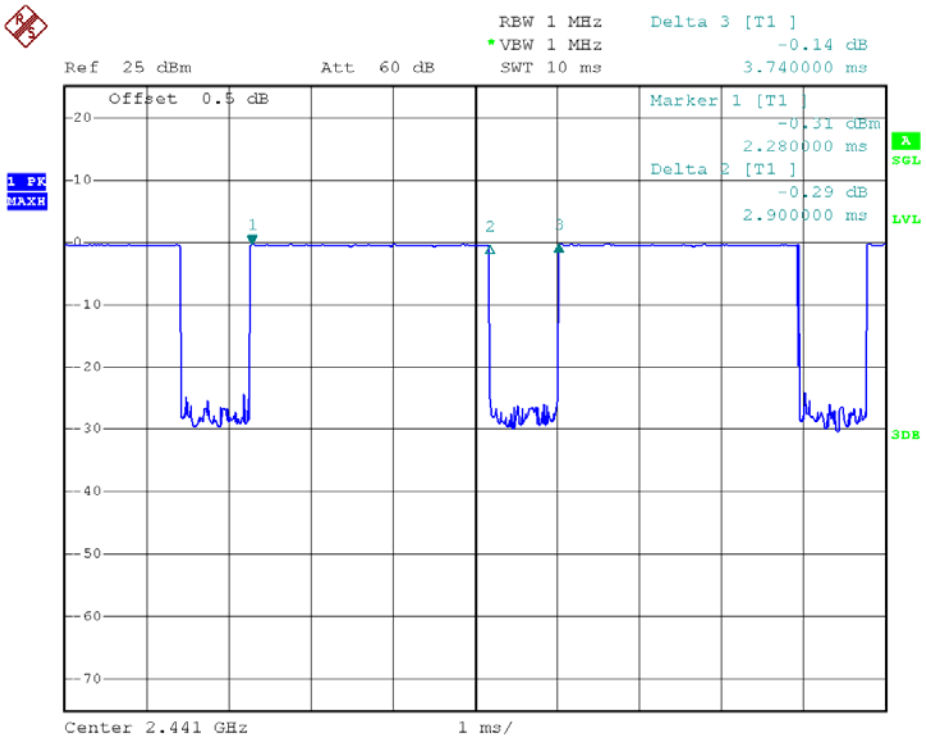
Channel	Frequency (MHz)	Pulse Time		Total of Dwell (ms)	Limit (ms)	Verdict
		ms	Refer to Plot			
0	2402	2.90	Plot A	309.333	400	PASS
39	2441	2.90	Plot B	309.333		PASS
78	2480	2.90	Plot C	309.333		PASS

B. Test Plots:

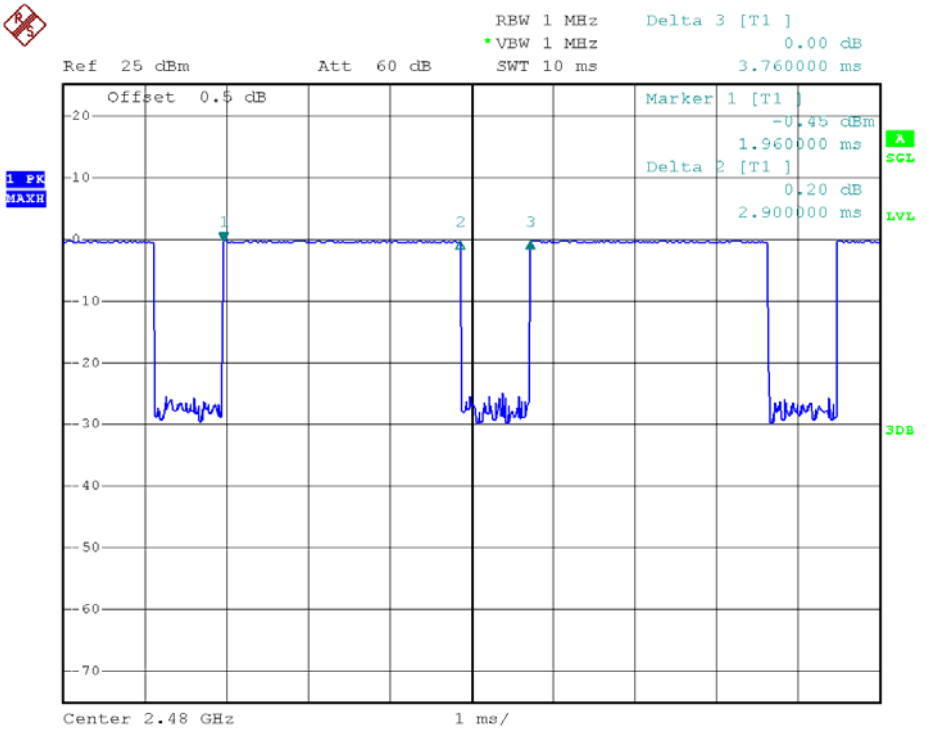
Note: the following plots record the Pulse Time of the Module carrier.



(Plot A: Channel = 2402 @ GFSK)



(Plot B: Channel = 2441 @ GFSK)



(Plot C: Channel = 2480 @ GFSK)

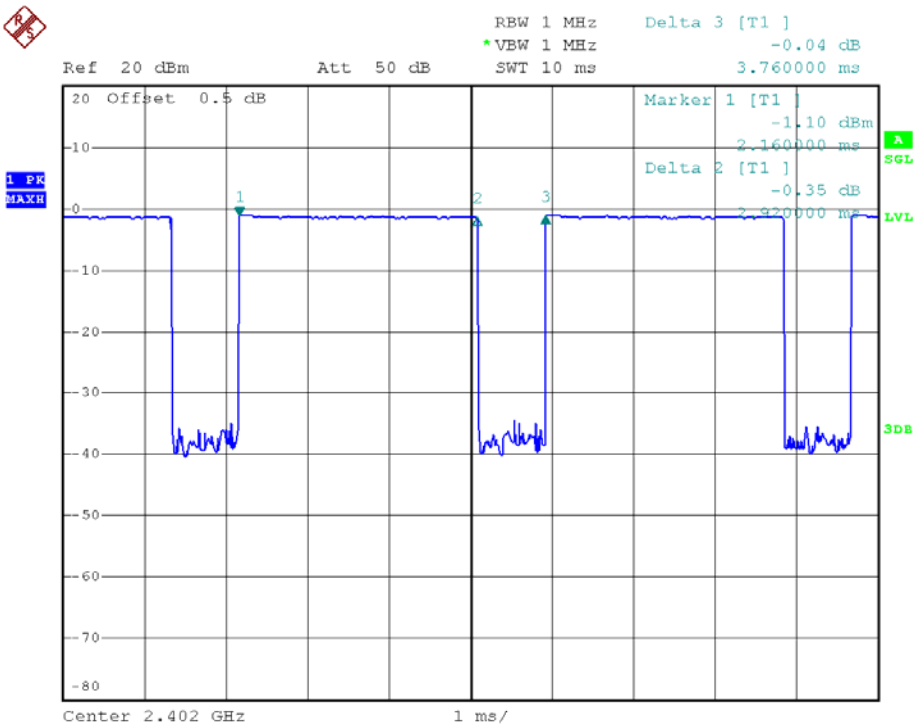
2.6.4.2. Π/4-DQPSK Mode

A. Test Verdict:

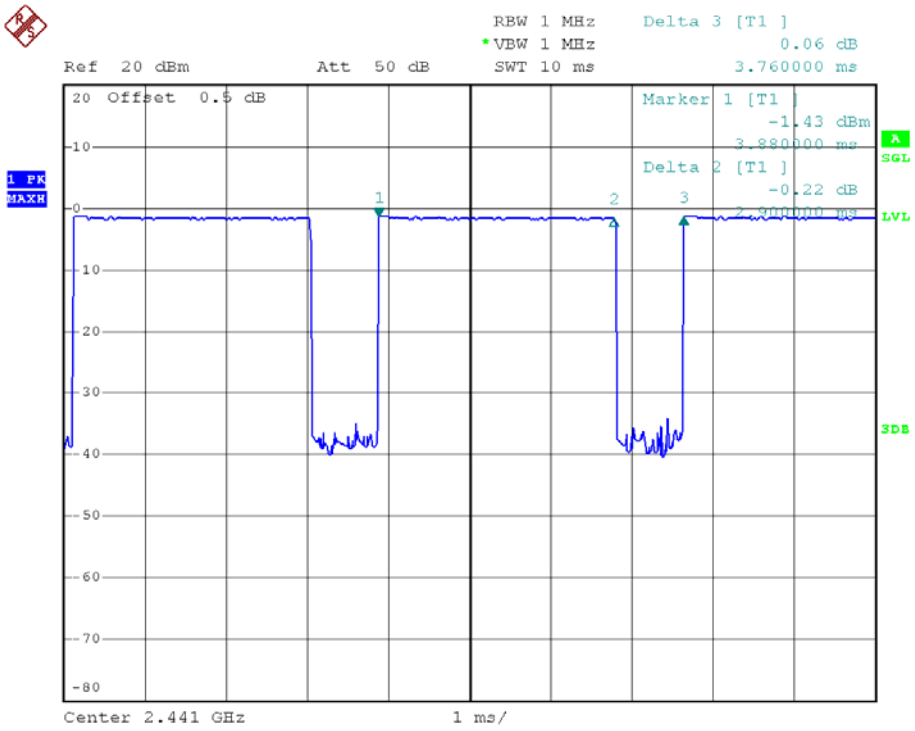
Channel	Frequency (MHz)	Pulse Time		Total of Dwell (ms)	Limit (ms)	Verdict
		ms	Refer to Plot			
0	2402	2.92	Plot D	311.467	400	PASS
39	2441	2.90	Plot E	309.333		PASS
78	2480	2.90	Plot F	309.333		PASS

B. Test Plots:

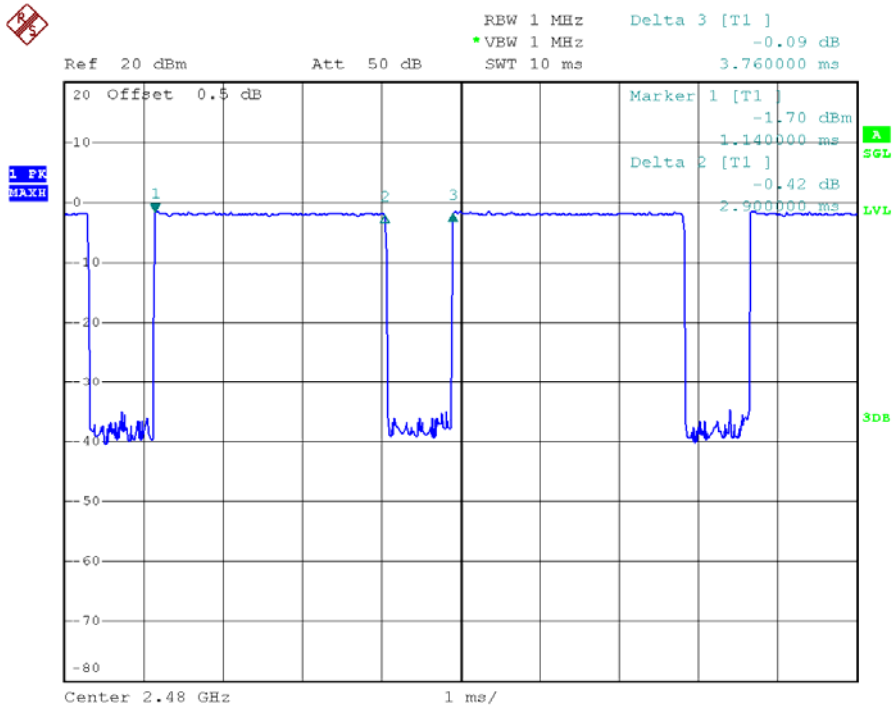
Note: the following plots record the Pulse Time of the Module carrier.



(Plot D: Channel = 2402 @ Π/4-DQPSK)



(Plot E: Channel = 2441 @ ∏/4-DQPSK)



(Plot F: Channel = 2480 @ ∏/4-DQPSK)

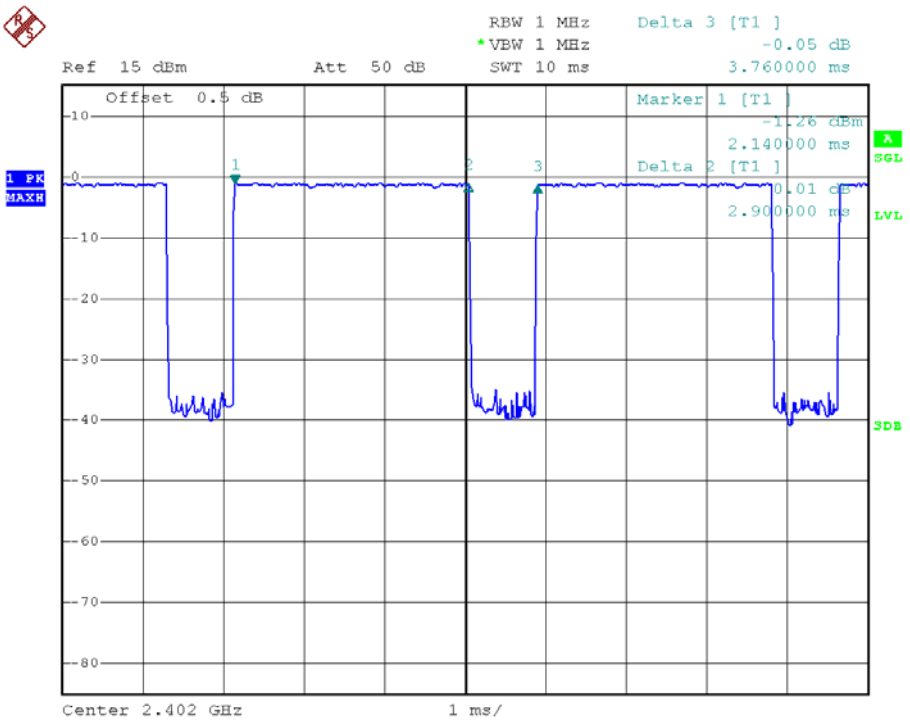
2.6.4.3. 8-DPSK Mode

A. Test Verdict:

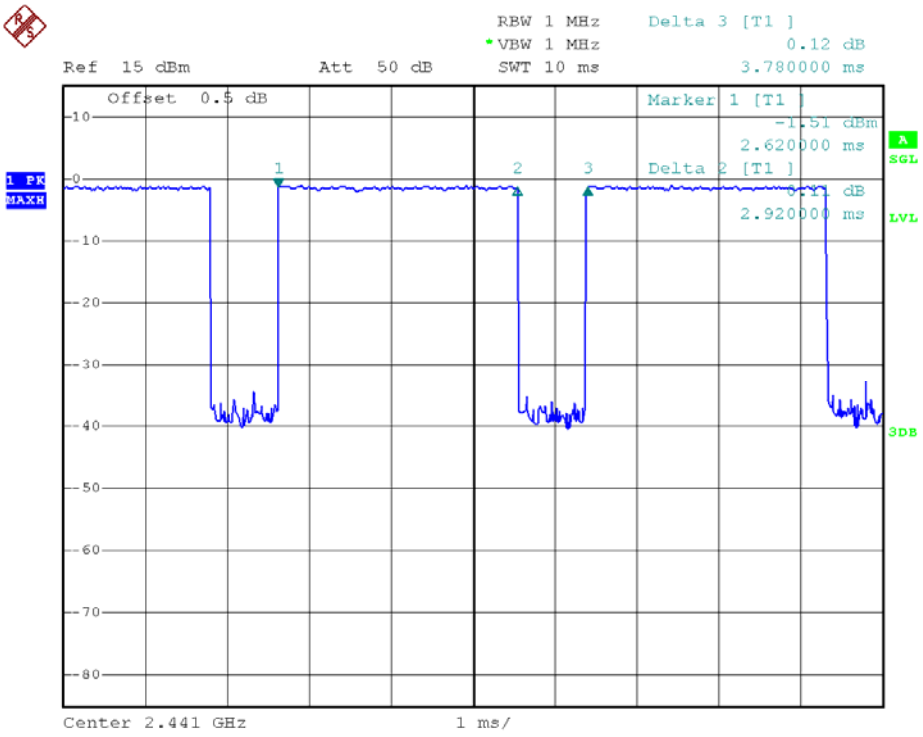
Channel	Frequency (MHz)	Pulse Time		Total of Dwell (ms)	Limit (ms)	Verdict
		ms	Refer to Plot			
0	2402	2.90	Plot G	309.333	400	PASS
39	2441	2.92	Plot H	311.467		PASS
78	2480	2.90	Plot I	309.333		PASS

B. Test Plots:

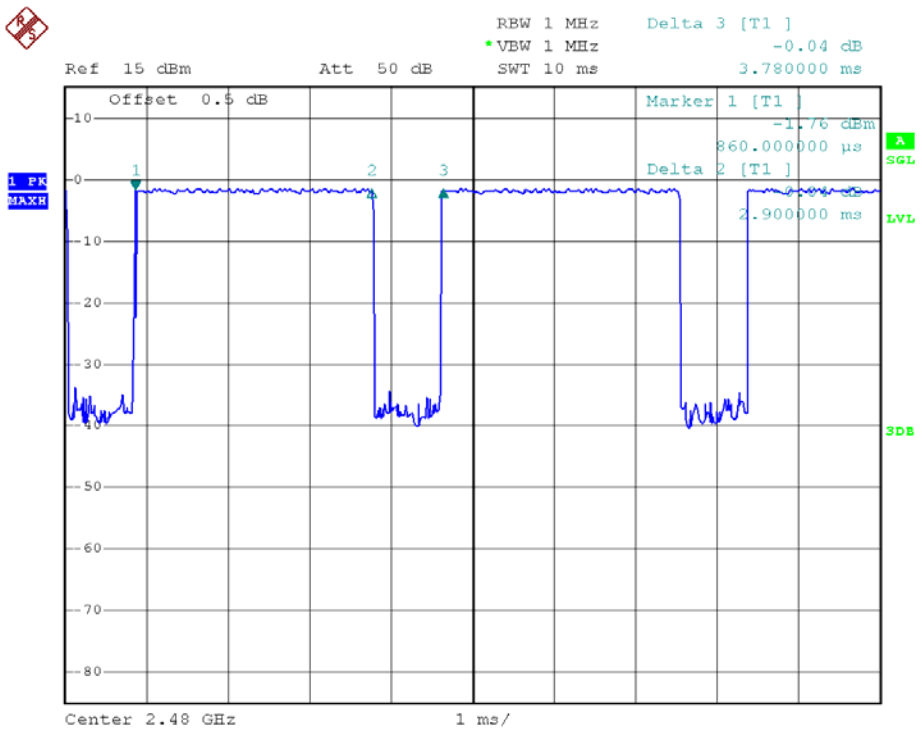
Note: the following plots record the Pulse Time of the Module carrier.



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



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



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

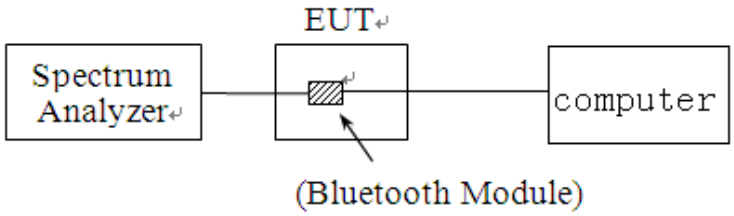
2.7. Conducted Spurious Emissions

2.7.1. Requirement

According to FCC §15.247(d) and RSS-210 A8.5, 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	2013.06.10

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.

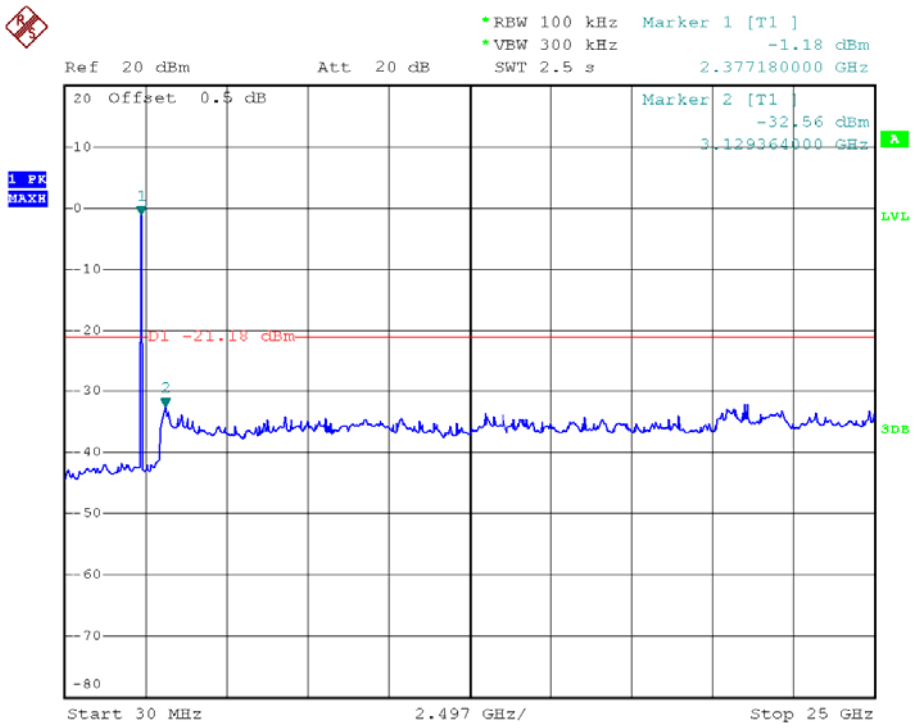
2.7.4.1. GFSK Mode

A. Test Verdict:

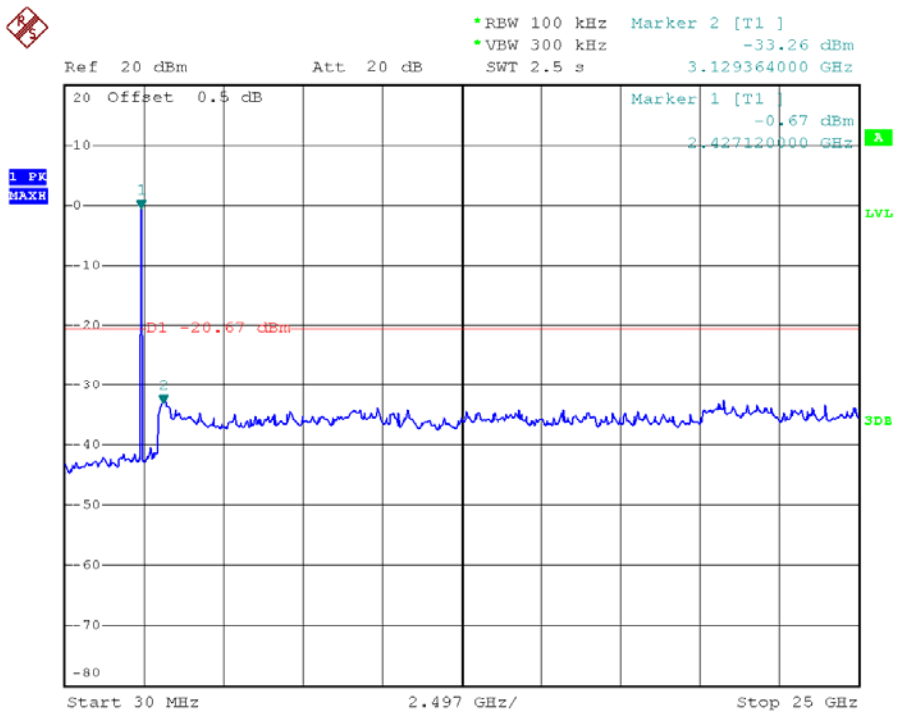
Channel	Frequency (MHz)	Measured Max. Out of Band EmissiondBm)	Refer to Plot	Limit (dBm)		Verdict
				Carrier Level	Calculated -20dBc Limit	
0	2402	-32.56	Plot A.1	-1.18	-21.18	PASS
39	2441	-33.26	Plot B.1	-0.67	-20.67	PASS
78	2480	-33.54	Plot C.1	-1.13	-21.13	PASS

B. Test Plots:

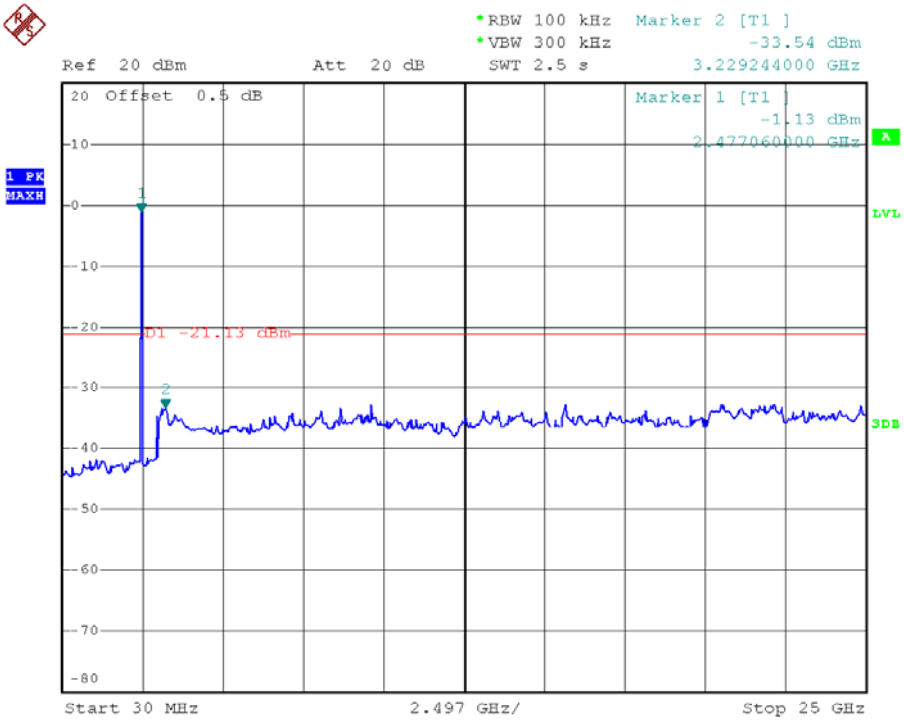
Note: the power of the Module transmitting frequency should be ignored.



(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)

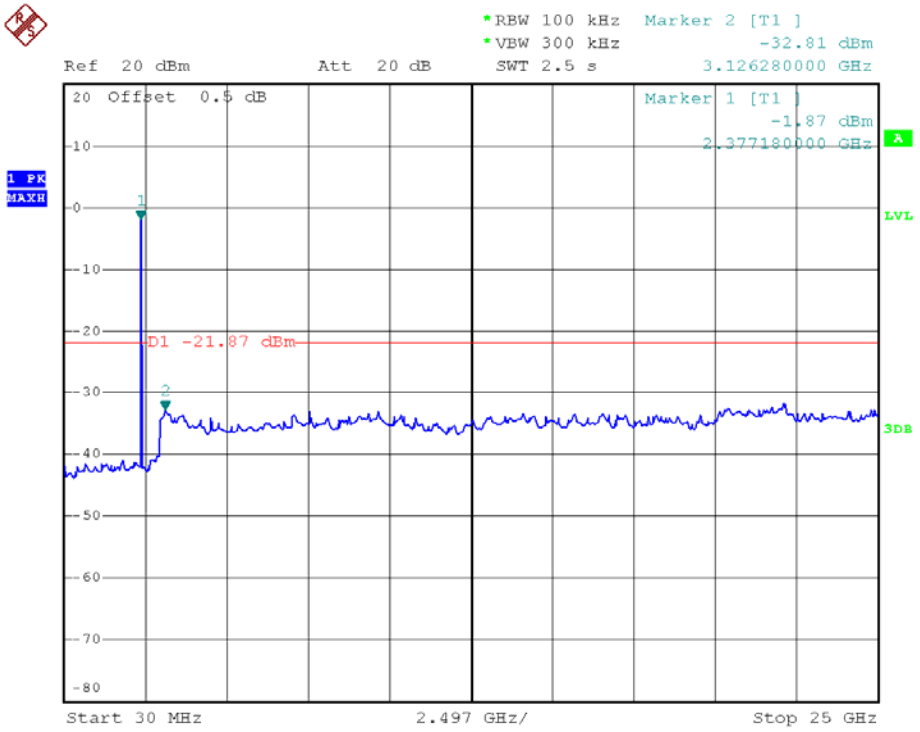
2.7.4.2. ∏/4-DQPSK Mode

A. Test Verdict:

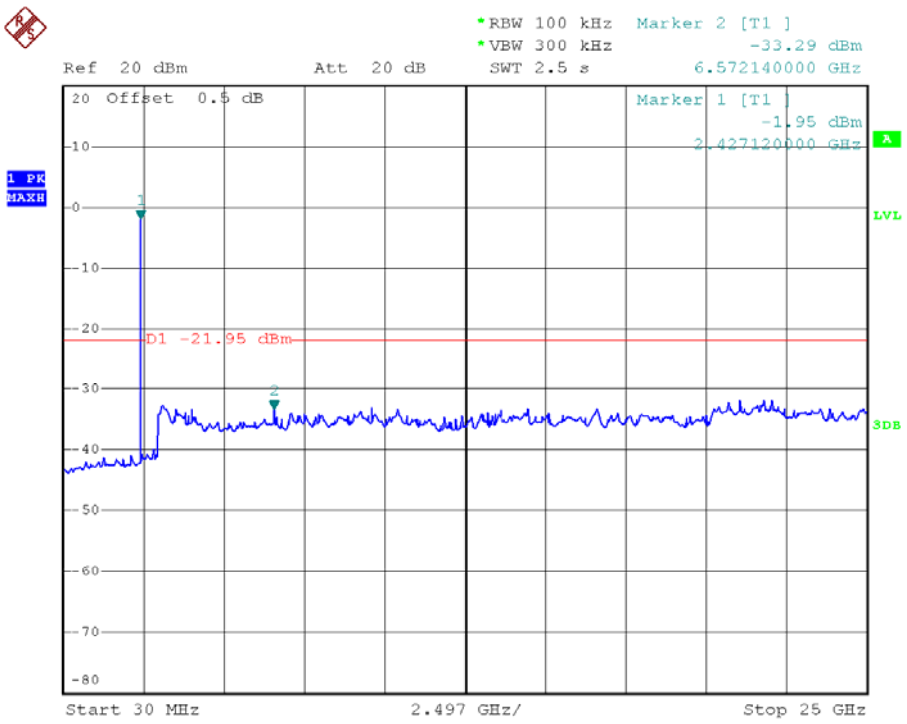
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Refer to Plot	Limit (dBm)		Verdict
				Carrier Level	Calculated -20dBc Limit	
0	2402	-32.81	Plot D.1	-1.87	-21.87	PASS
39	2441	-33.29	Plot E.1	-1.95	-21.95	PASS
78	2480	-30.61	Plot F.1	-1.58	-21.58	PASS

B. Test Plots:

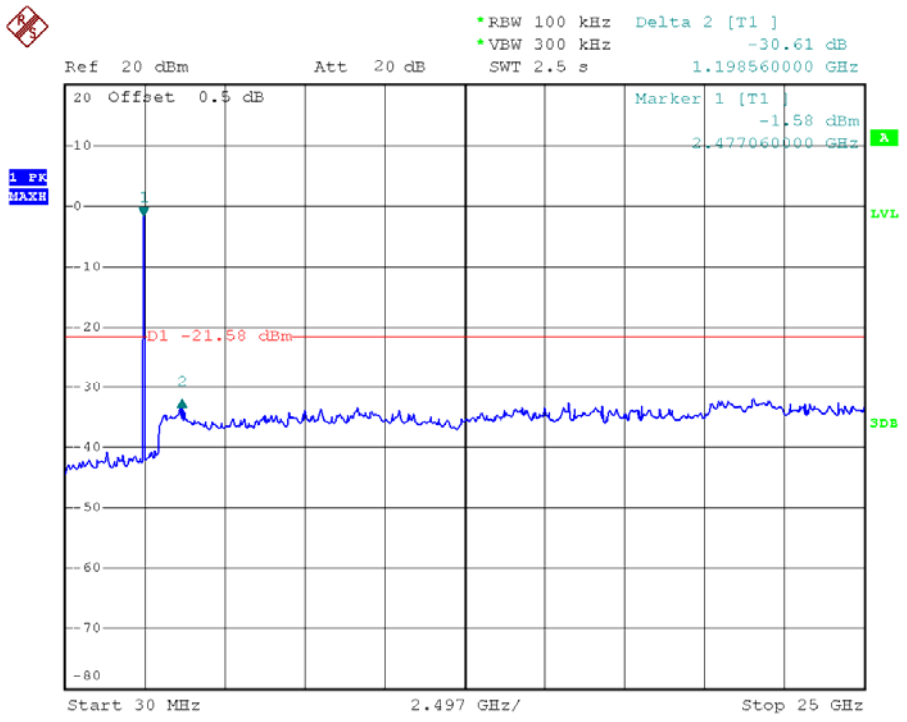
Note: the power of the Module transmitting frequency should be ignored.



(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)

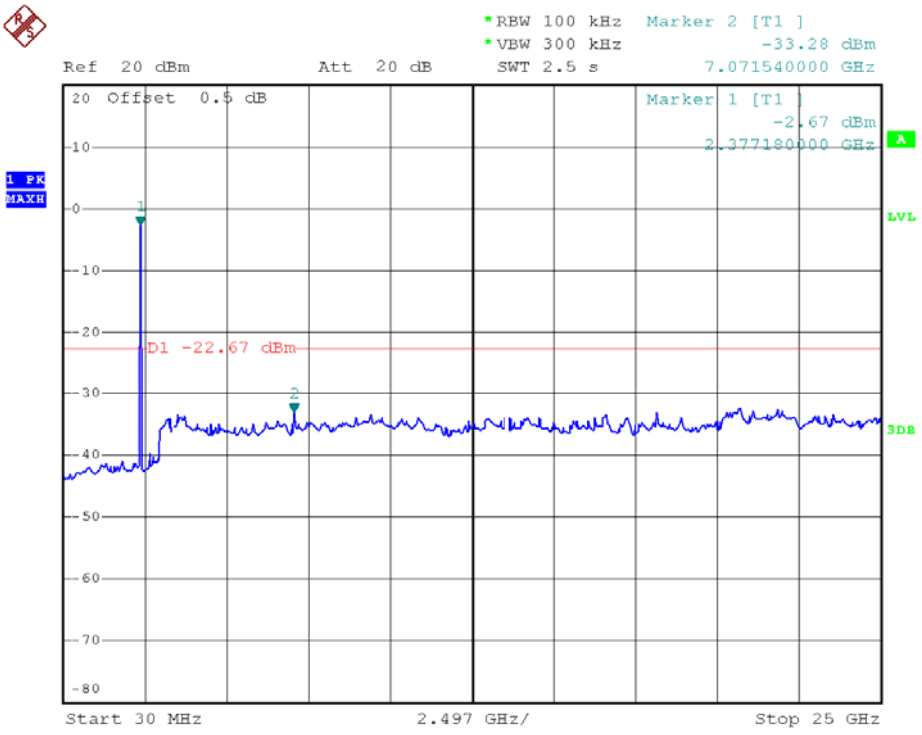
2.7.4.3. 8-DPSK Mode

A. Test Verdict:

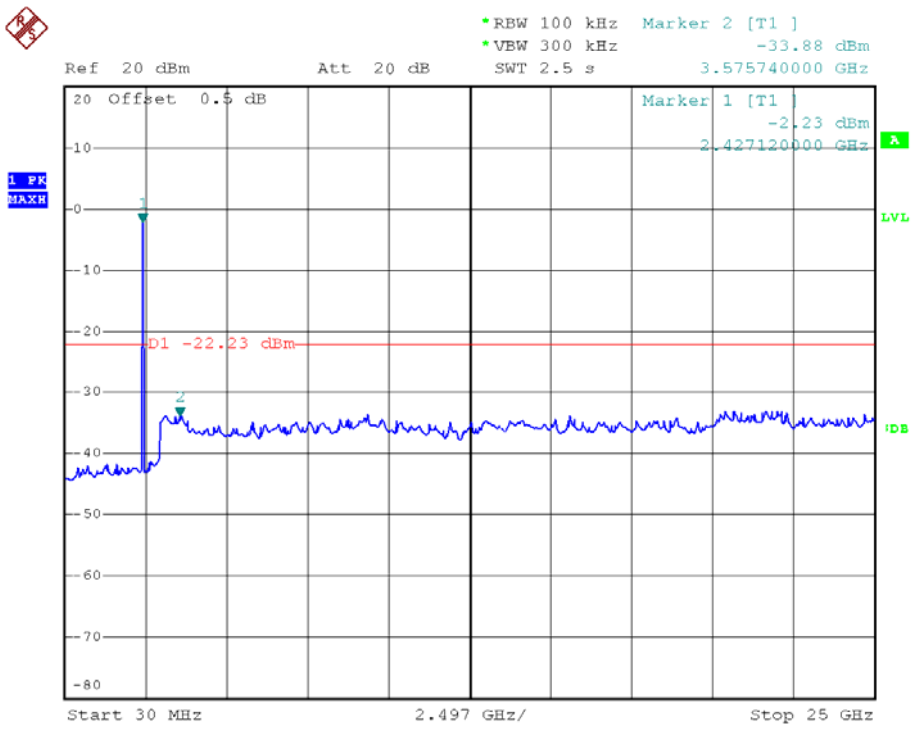
Channel	Frequency (MHz)	Measured Max. Out of Band EmissiondBm)	Refer to Plot	Limit (dBm)		Verdict
				Carrier Level	Calculated -20dBc Limit	
0	2402	-33.28	Plot G.1	-2.67	-22.67	PASS
39	2441	-33.88	Plot H.1	-2.23	-22.23	PASS
78	2480	-31.30	Plot I.1	-1.80	-21.80	PASS

B. Test Plots:

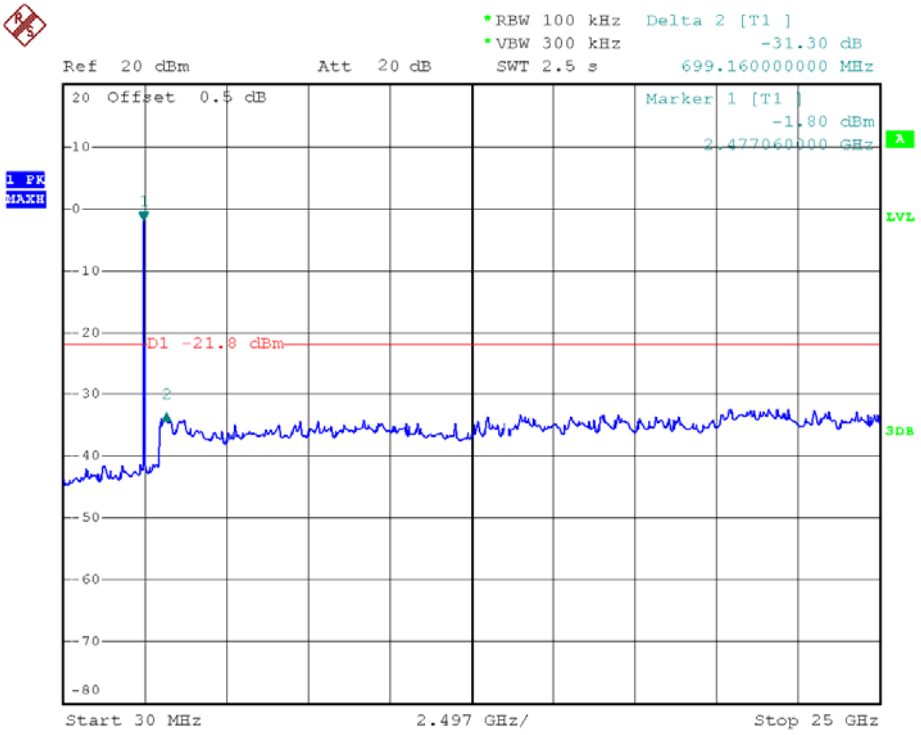
Note: the power of the Module transmitting frequency should be ignored.



(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)

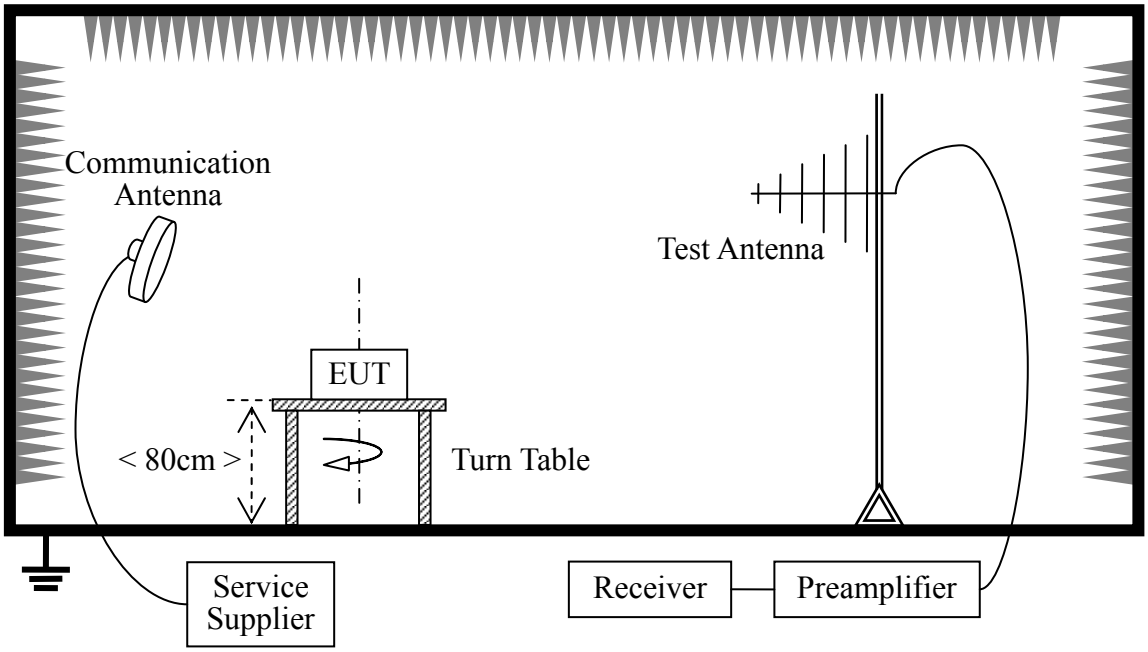
2.8. Band Edge

2.8.1. Requirement

According to FCC section 15.247(d) and RSS-210 A8.5, 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	2013.06.10
Full-Anechoic Chamber	Albatross	12.8m*6.8m*6.4m	A0412372	2013.06.07
Double ridge horn antenna	R&S	HF906	100150	2013.06.10
Ultra-wideband antenna	R&S	HL562	A0304224	2013.06.07
Ampilier 1G~18GHz	R&S	MITEQ AFS42-00101800	25-S-42	2013.06.05

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:
$E\ [dB\mu V/m] = U_R + A_T + A_{Factor}\ [dB]$; $A_T = L_{Cable\ loss}\ [dB] - G_{preamp}\ [dB]$
A_T: Total correction Factor except Antenna
U_R: Receiver Reading
G_{preamp}: Preamplifier Gain
A_{Factor}: Antenna Factor at 3m

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

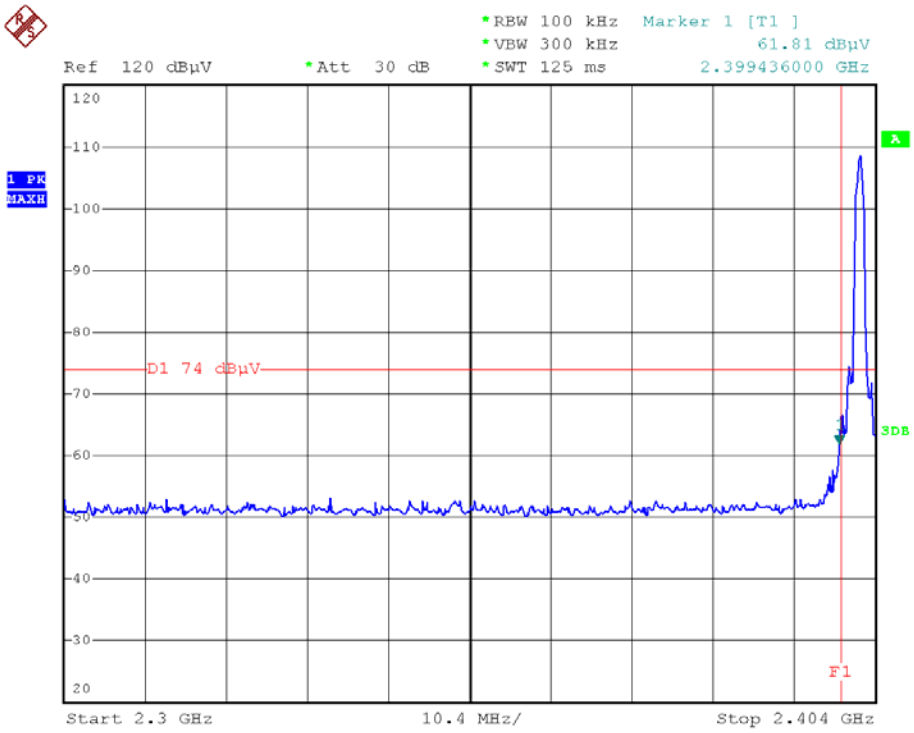
2.8.4.1. GFSK Mode

A. Test Verdict:

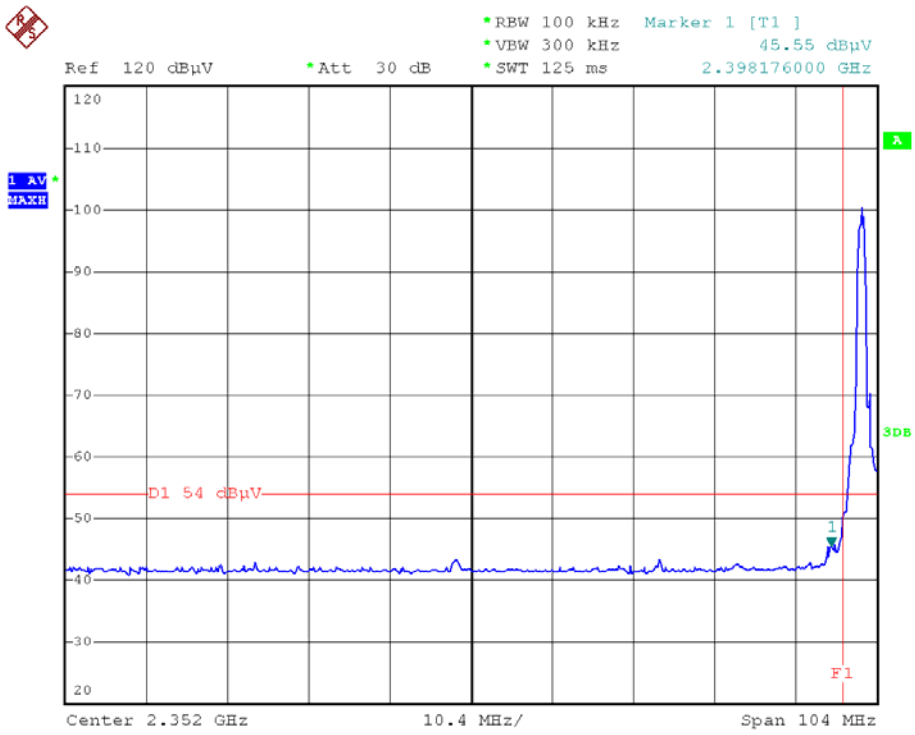
(Un-hopping)

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	61.81	-31.70	28.3	58.41	74	Pass
0	2399.840	AV	45.55	-31.70	28.3	42.15	54	Pass
78	2486.976	PK	65.16	-29.45	29.2	64.91	74	Pass
78	2487.107	AV	49.29	-29.45	29.2	49.04	54	Pass

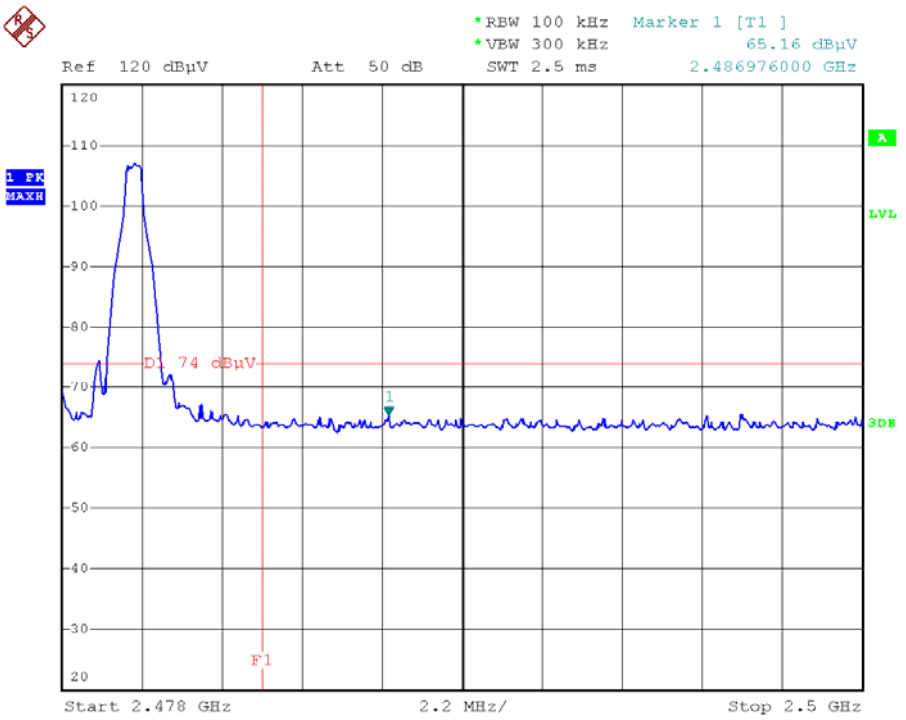
B. Test Plots:



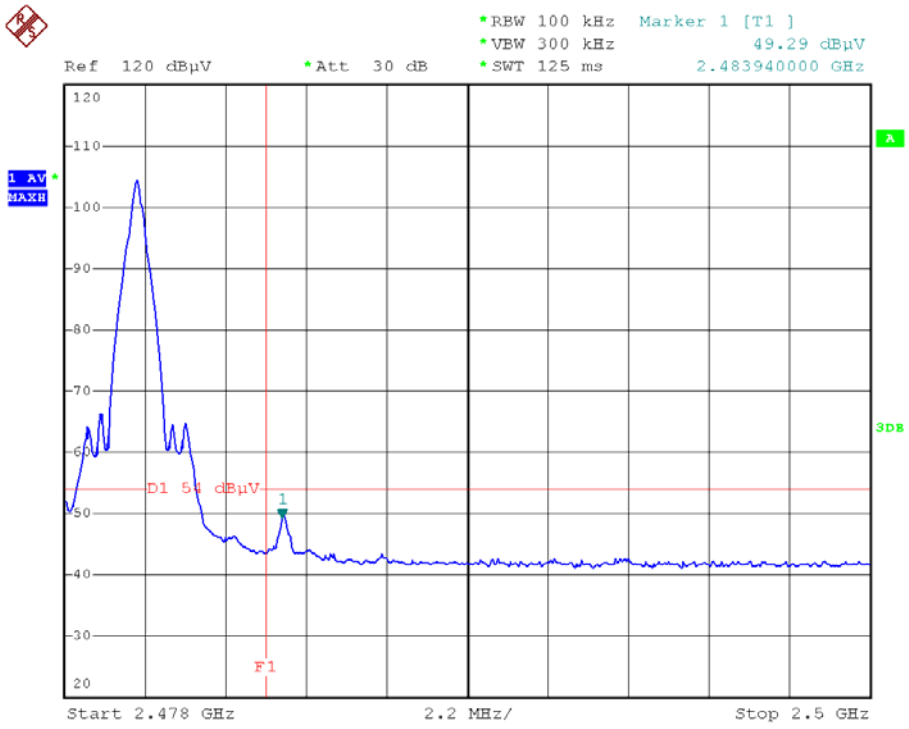
(Plot A1: Channel = 0 PEAK @ GFSK)



(Plot A2: Channel = 0 AVERAGE @ GFSK)



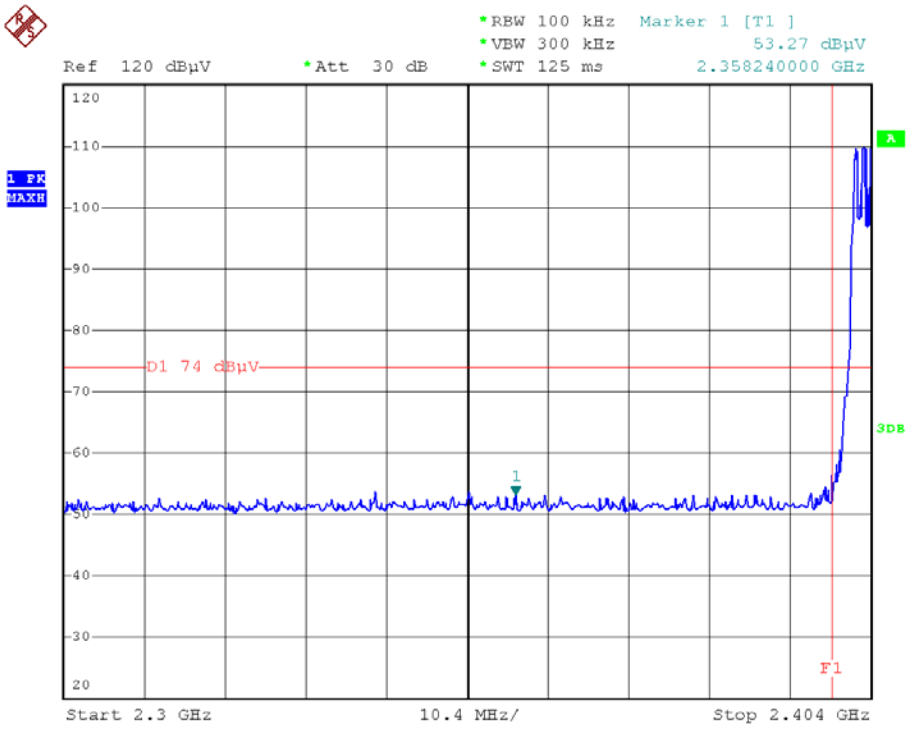
(Plot B1: Channel = 78 PEAK @ GFSK)



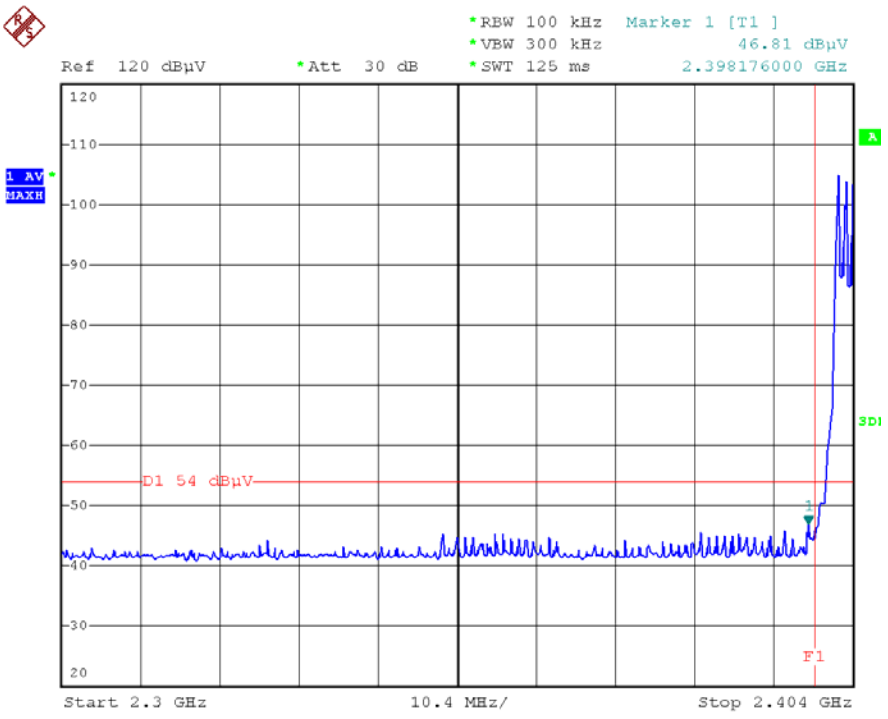
(Plot B2: Channel = 78 AVERAGE @ GFSK)

(hopping)

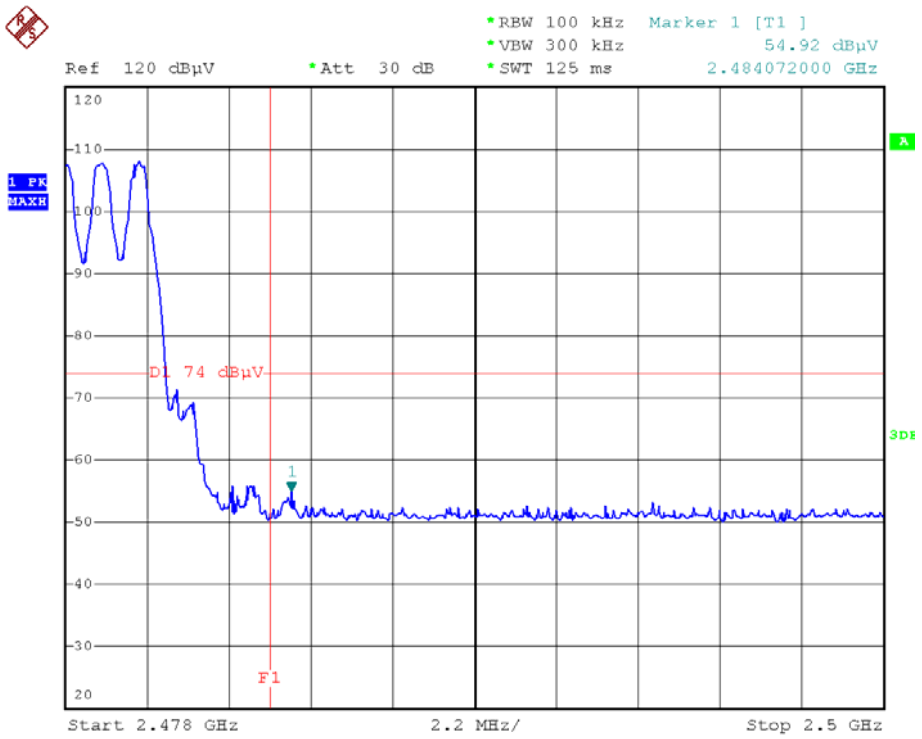
Channel	Frequency (MHz)	Detector	Receiver Reading UR (dBuV)	AT (dB)	AFactor (dB@3m)	Max. Emission E (dBµV/m)	Limit (dBµV/m)	Verdict
		PK/ AV						
0	2386.736	PK	53.27	-31.70	28.3	49.87	74	Pass
0	2377.584	AV	46.81	-31.70	28.3	43.41	54	Pass
78	2483.720	PK	54.92	-29.45	29.2	54.67	74	Pass
78	2483.984	AV	44.99	-29.45	29.2	44.74	54	Pass



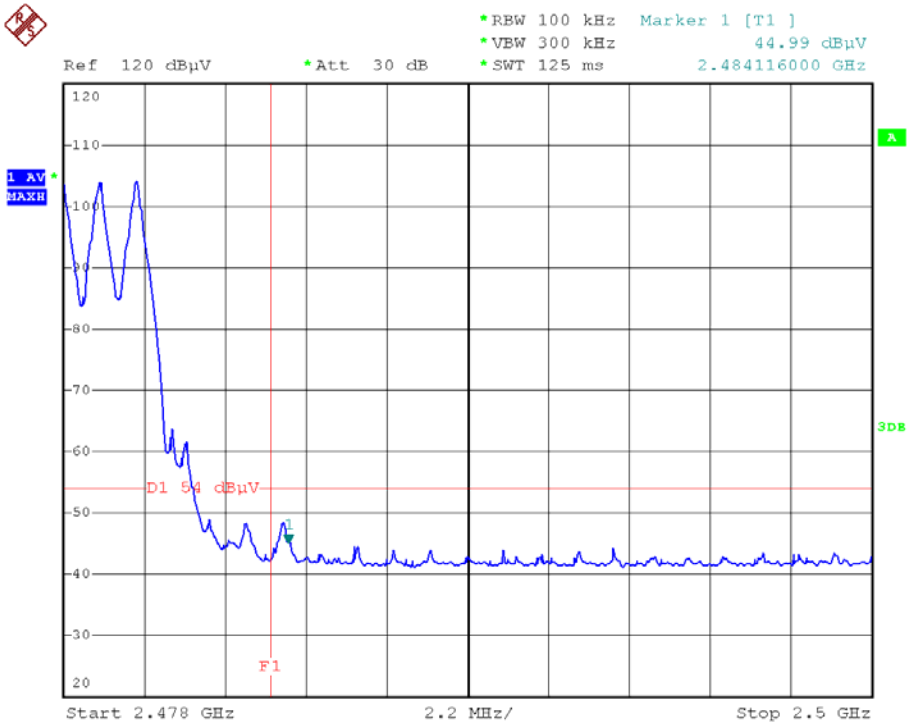
(Plot A1-1: Channel = 0 PEAK)



(Plot A2-1: Channel = 0 AVERAGE)



(Plot B1-1: Channel = 78 PEAK)



(Plot B2-1: Channel = 78 AVERAGE)

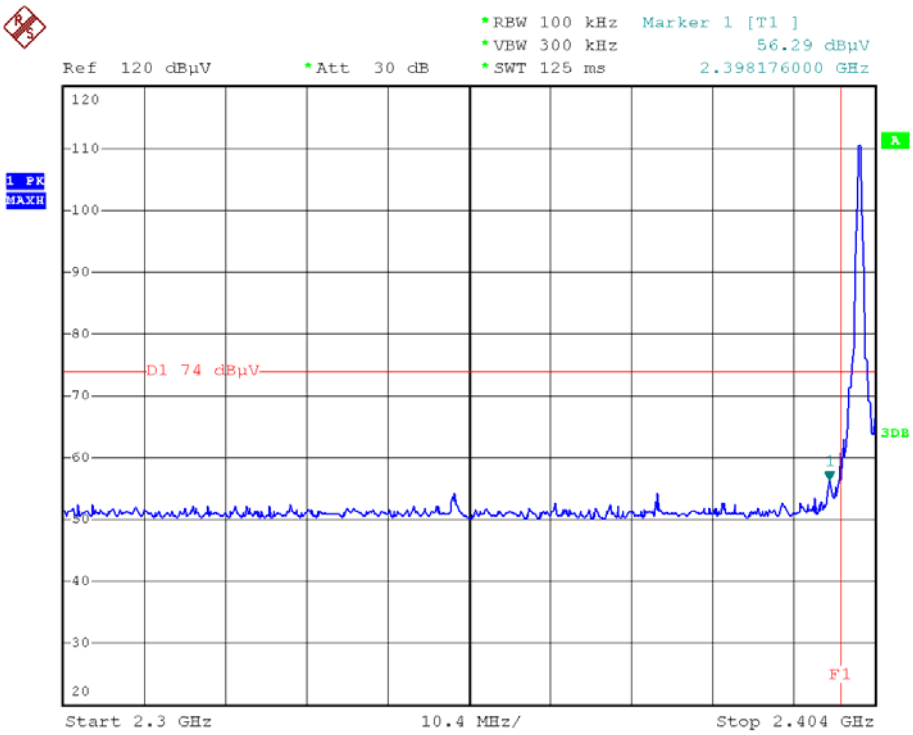
2.8.4.2. ∏/4-DQPSK Mode

A. Test Verdict:

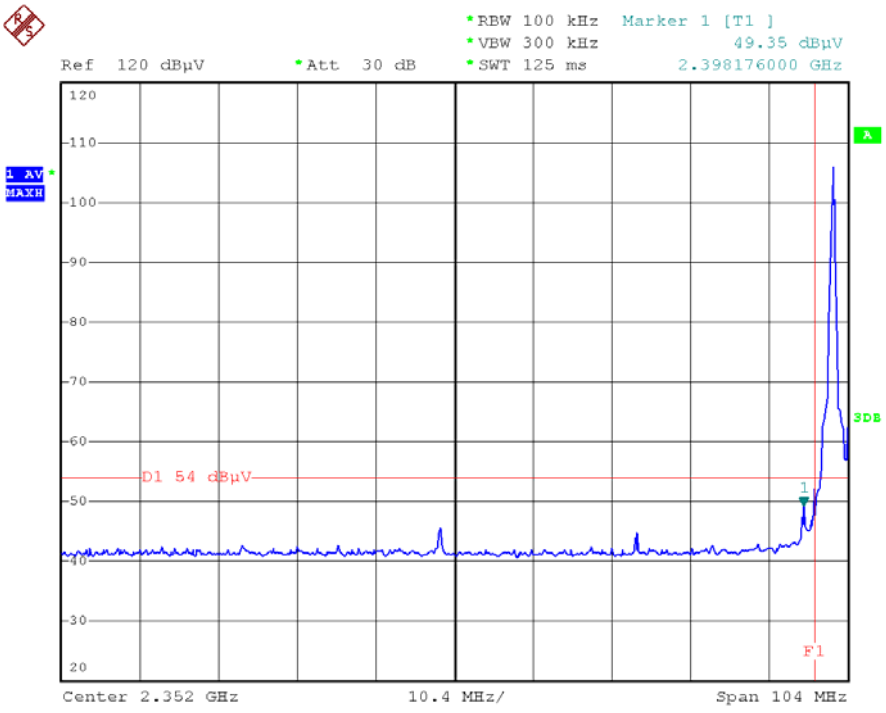
(Un-hopping)

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	56.29	-31.70	28.3	52.89	74	Pass
0	2379.56	AV	49.35	-31.70	28.3	45.95	54	Pass
78	2498.35	PK	54.68	-29.45	29.2	54.43	74	Pass
78	2496.862	AV	45.10	-29.45	29.2	44.85	54	Pass

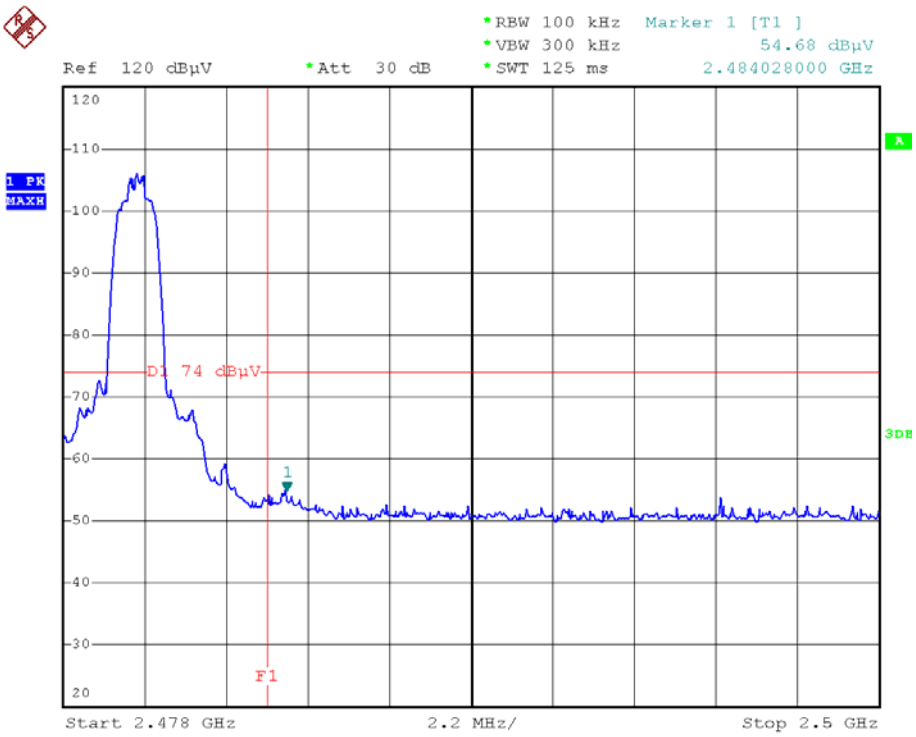
B. Test Plots:



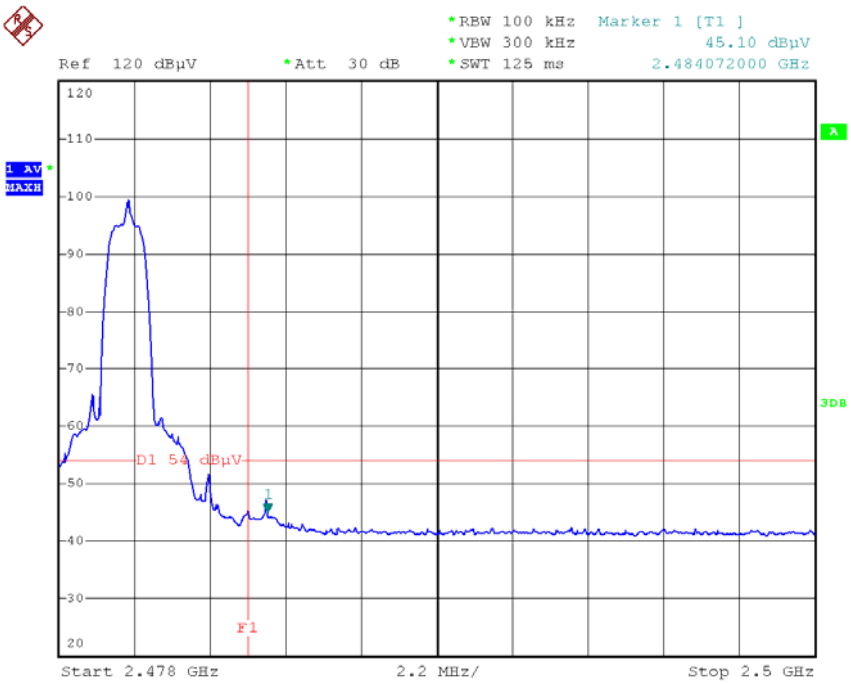
(Plot C1: Channel = 0 PEAK @ ∏/4-DQPSK)



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



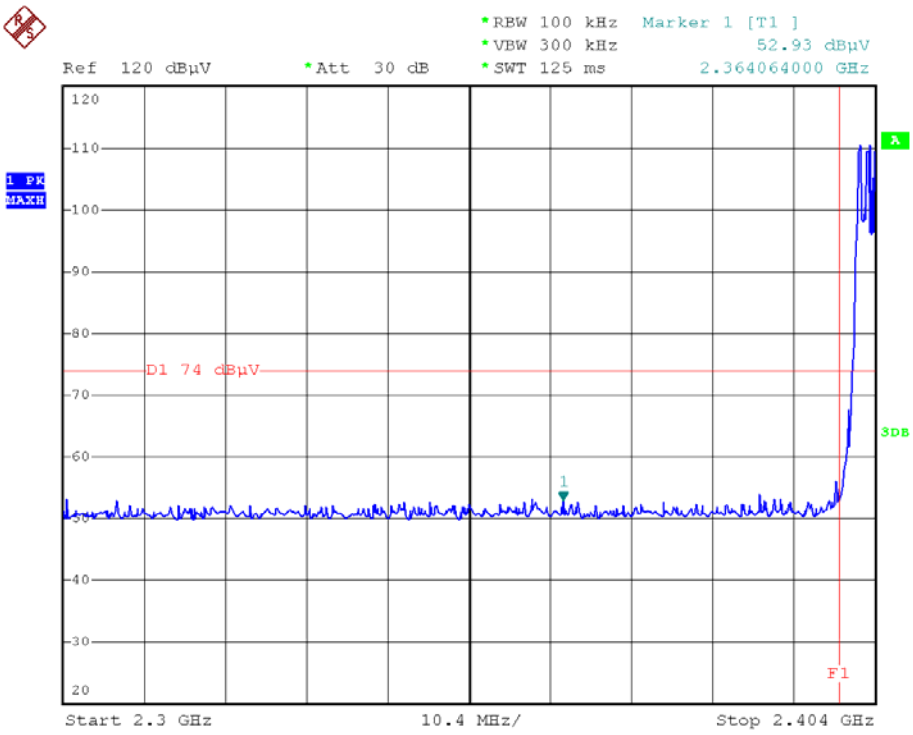
(Plot D1: Channel = 78 PEAK @ ∏/4-DQPSK)



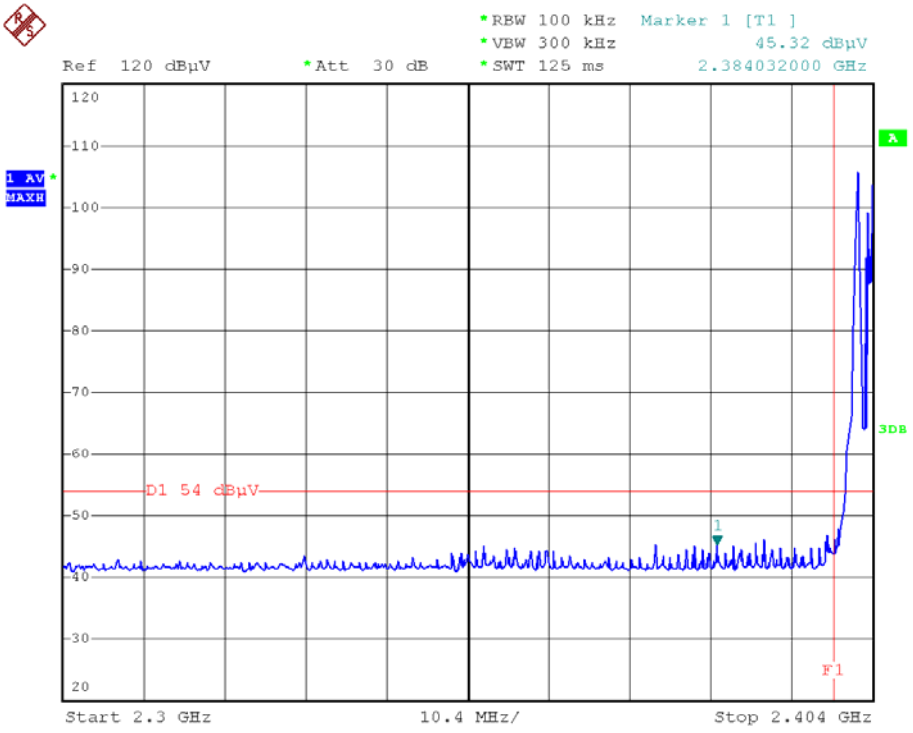
(Plot D2: Channel = 78 AVERAGE @ Π/4-DQPSK)

(hopping)

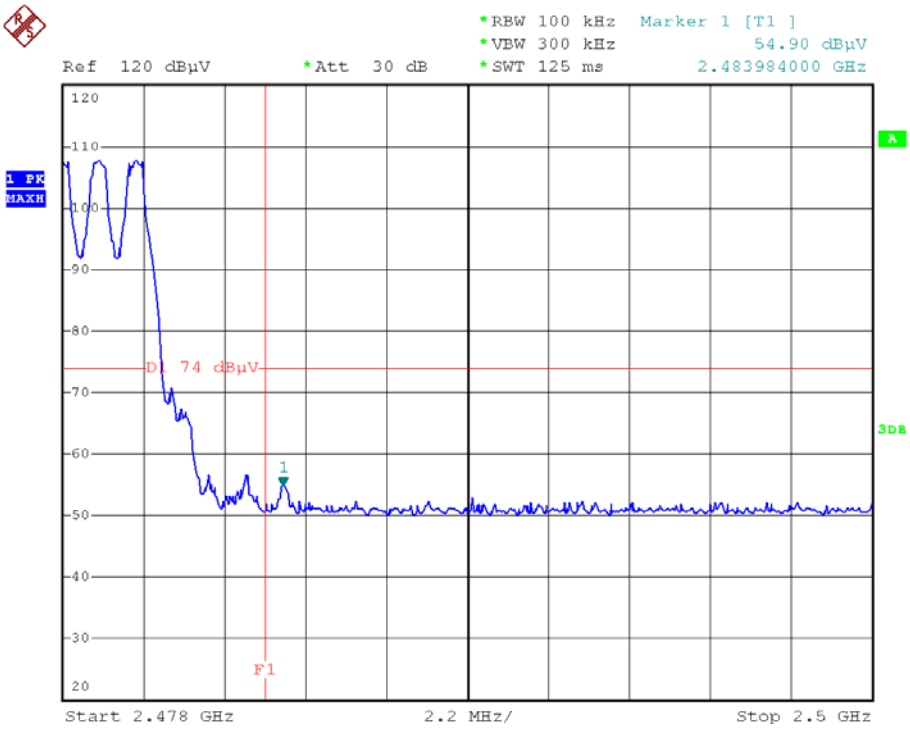
Channel	Frequency (MHz)	Detector	Receiver Reading UR (dBuV)	AT (dB)	AFactor (dB@3m)	Max. Emission E (dBµV/m)	Limit (dBµV/m)	Verdict
		PK/ AV						
0	2354.60	PK	52.93	-31.70	28.3	49.53	74	Pass
0	2325.74	AV	45.32	-31.70	28.3	41.92	54	Pass
78	2495.82	PK	54.90	-29.45	29.2	54.65	74	Pass
78	2498.845	AV	44.90	-29.45	29.2	44.65	54	Pass



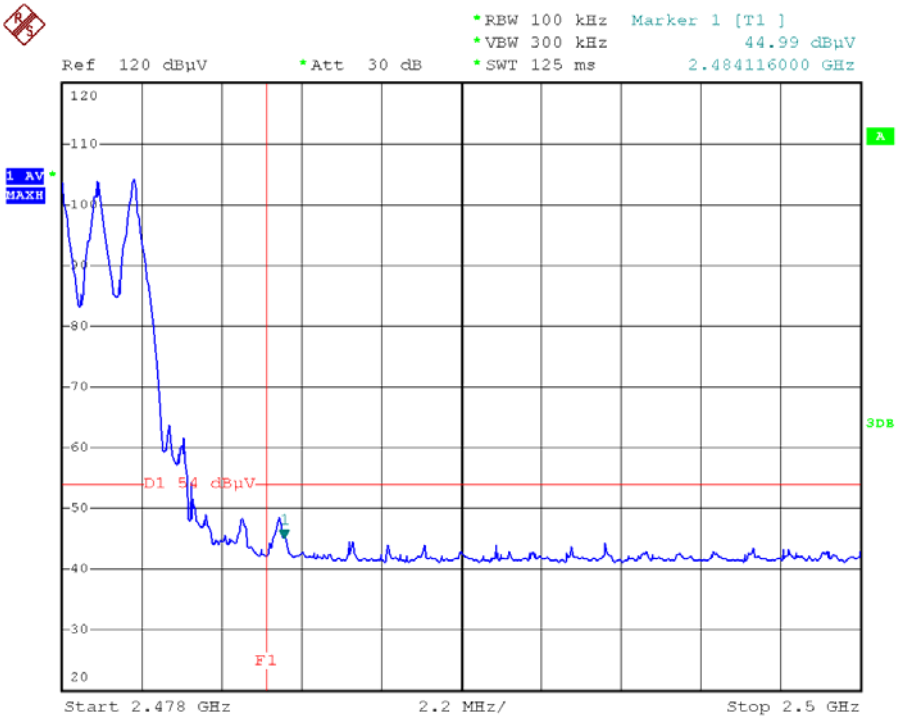
(Plot C1-1: Channel = 0 PEAK)



(Plot C2-1: Channel = 0 AVERAGE)



(Plot D1-1: Channel = 78 PEAK)



(Plot D2-1: Channel = 78 AVERAGE)

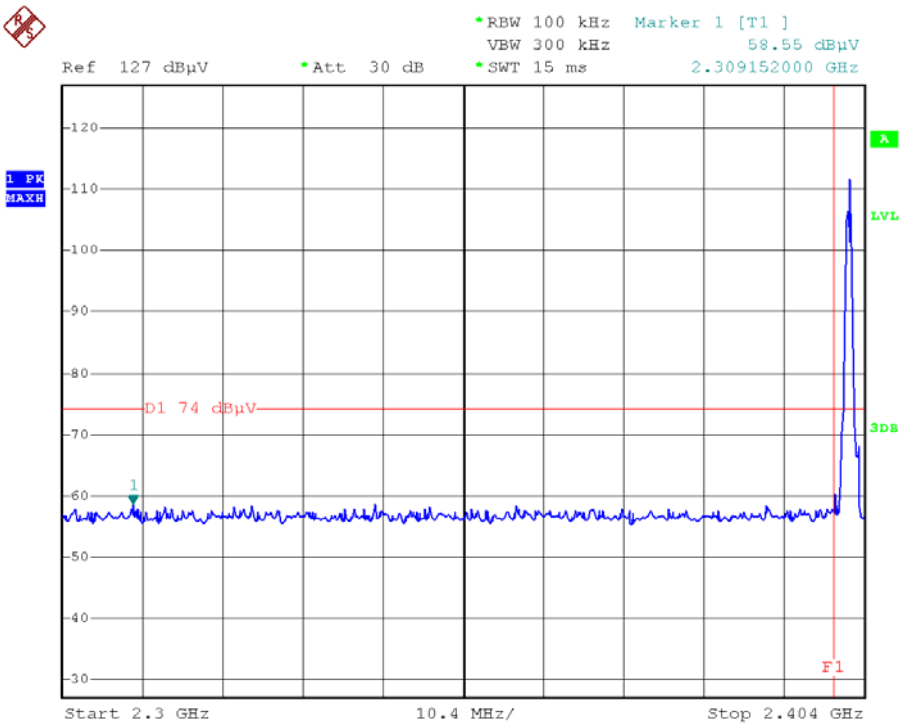
2.8.4.3. 8-DPSK Mode

A. Test Verdict:

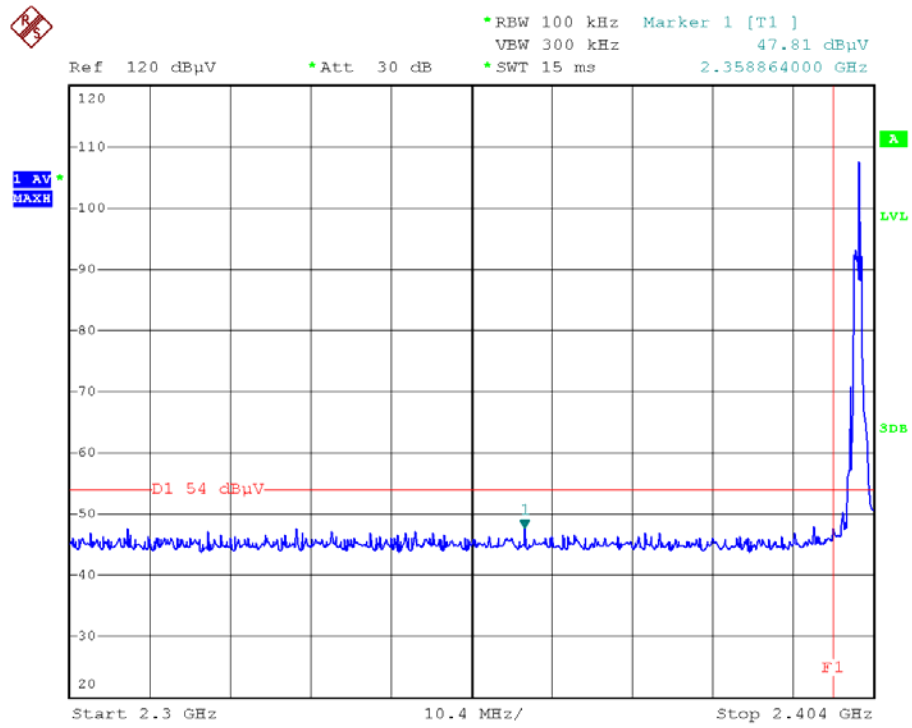
(Un-hopping)

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	2309.152	PK	58.55	-31.81	28.1	54.84	74	Pass
0	2358.864	AV	47.81	-31.70	28.3	44.41	54	Pass
78	2486.140	PK	64.03	-29.45	29.2	63.78	74	Pass
78	2484.336	AV	43.57	-29.45	29.2	43.32	54	Pass

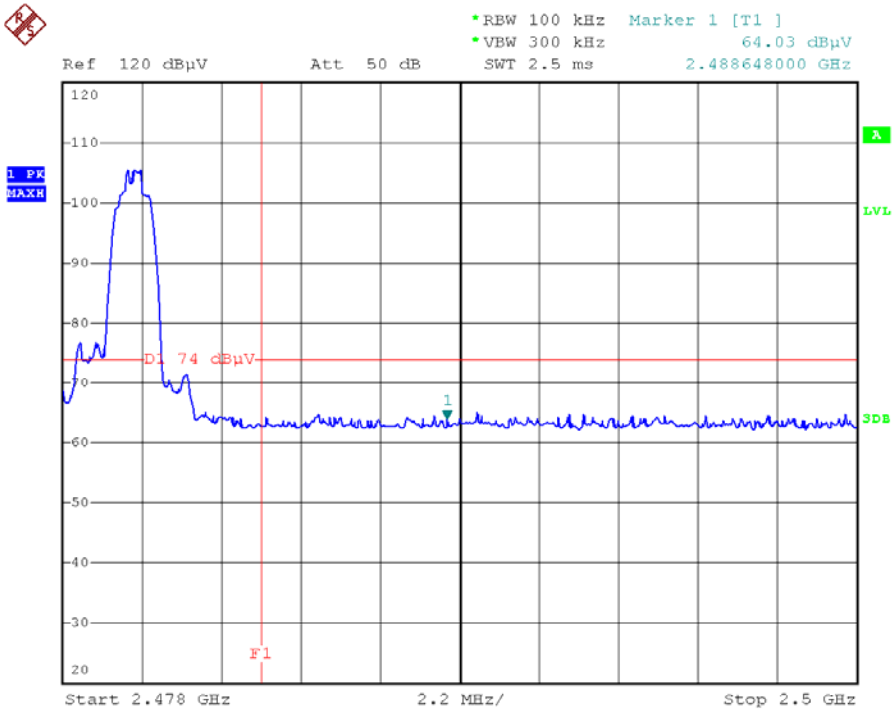
B. Test Plots:



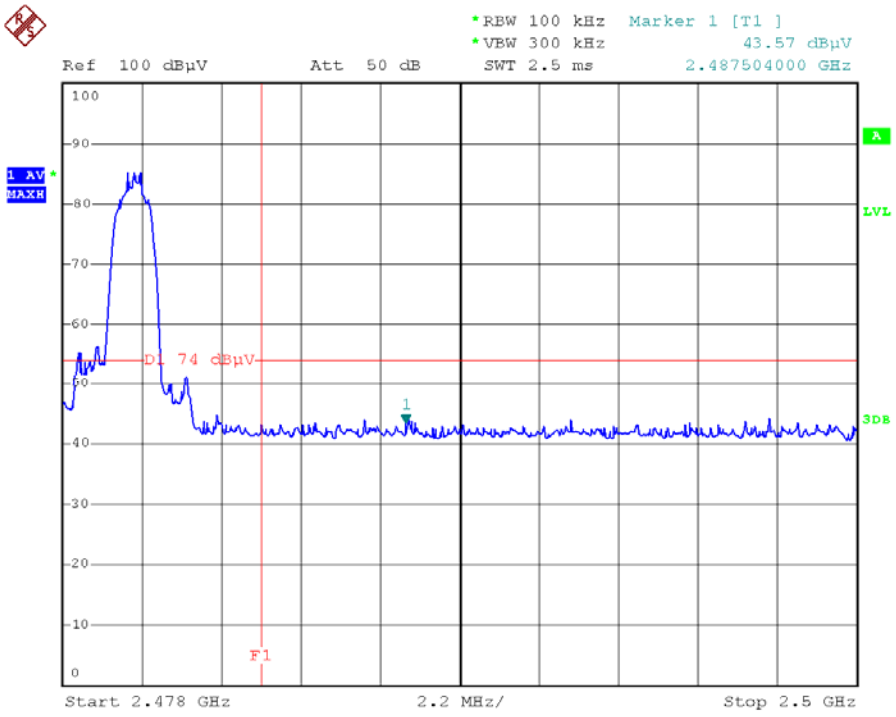
(Plot E1: Channel = 0 PEAK @ 8-DPSK Mode)



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



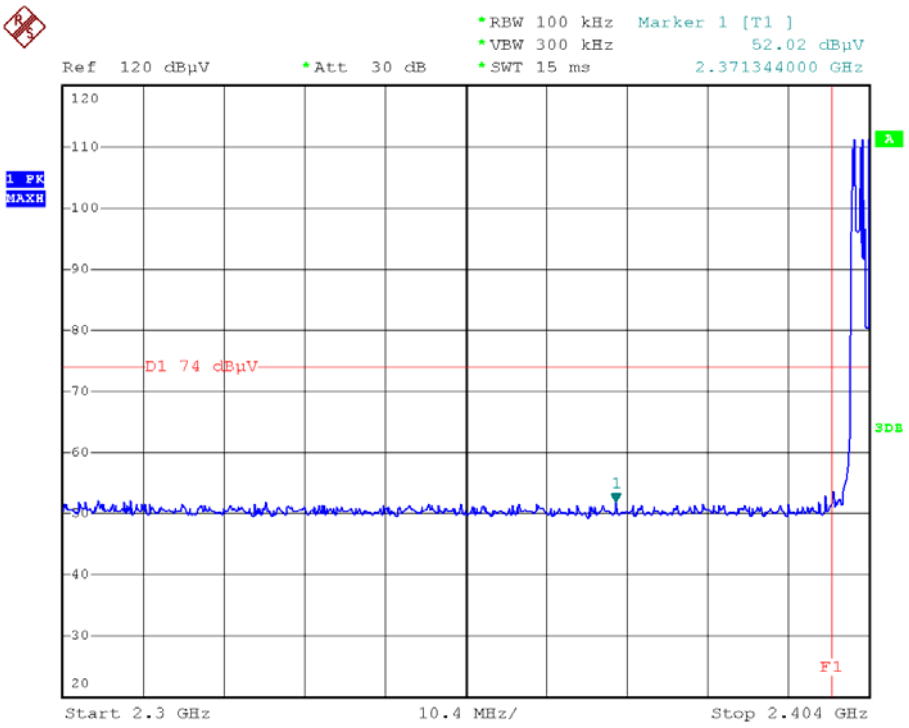
(Plot F1: Channel = 78 PEAK @ 8-DPSK Mode)



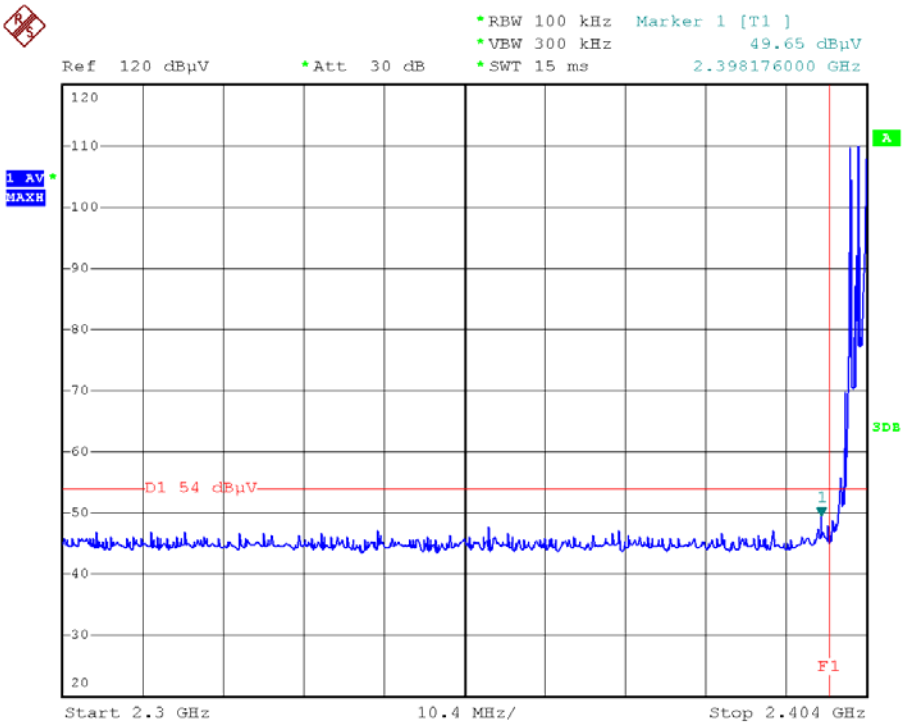
(Plot F2: Channel = 78 AVERAGE @ 8-DPSK Mode)

(hopping)

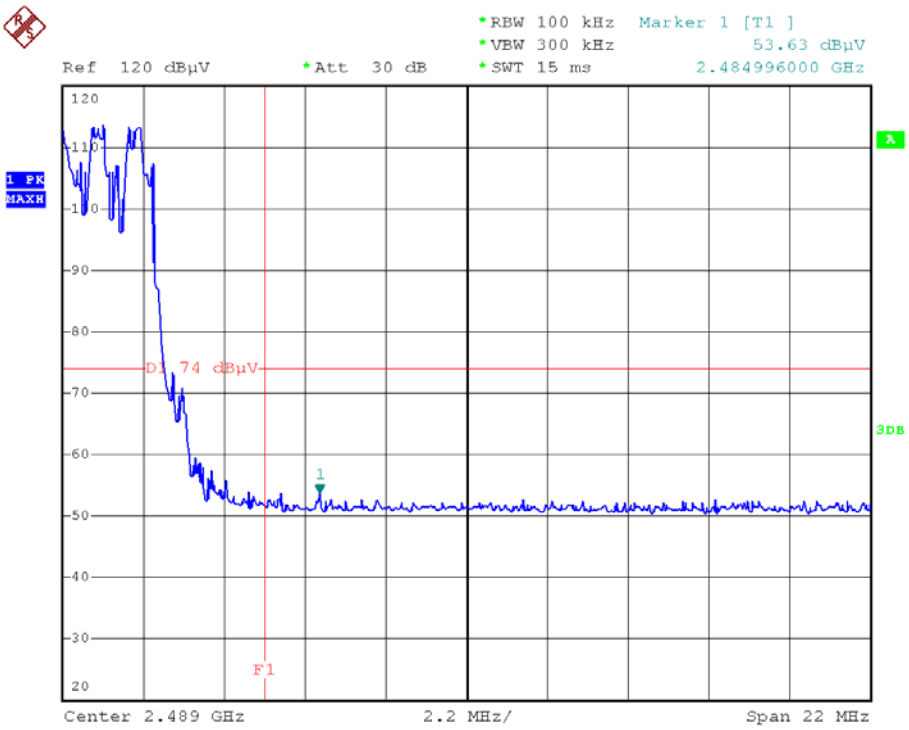
Channel	Frequency (MHz)	Detector	Receiver Reading UR (dBuV)	AT (dB)	AFactor (dB@3m)	Max. Emission E (dBµV/m)	Limit (dBµV/m)	Verdict
		PK/ AV						
0	2371.344	PK	52.02	-31.70	28.3	48.62	74	Pass
0	2398.176	AV	49.65	-31.70	28.3	46.25	54	Pass
78	2484.996	PK	53.63	-29.45	29.2	53.38	74	Pass
78	2492.740	AV	47.18	-29.25	29.3	47.23	54	Pass



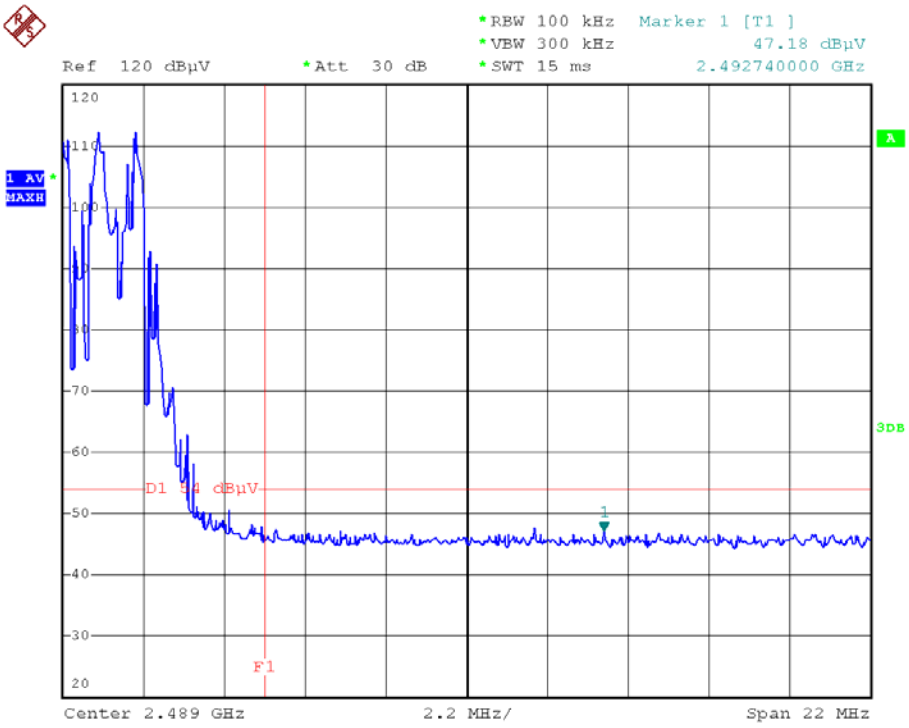
(Plot E1-1: Channel = 0 PEAK)



(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

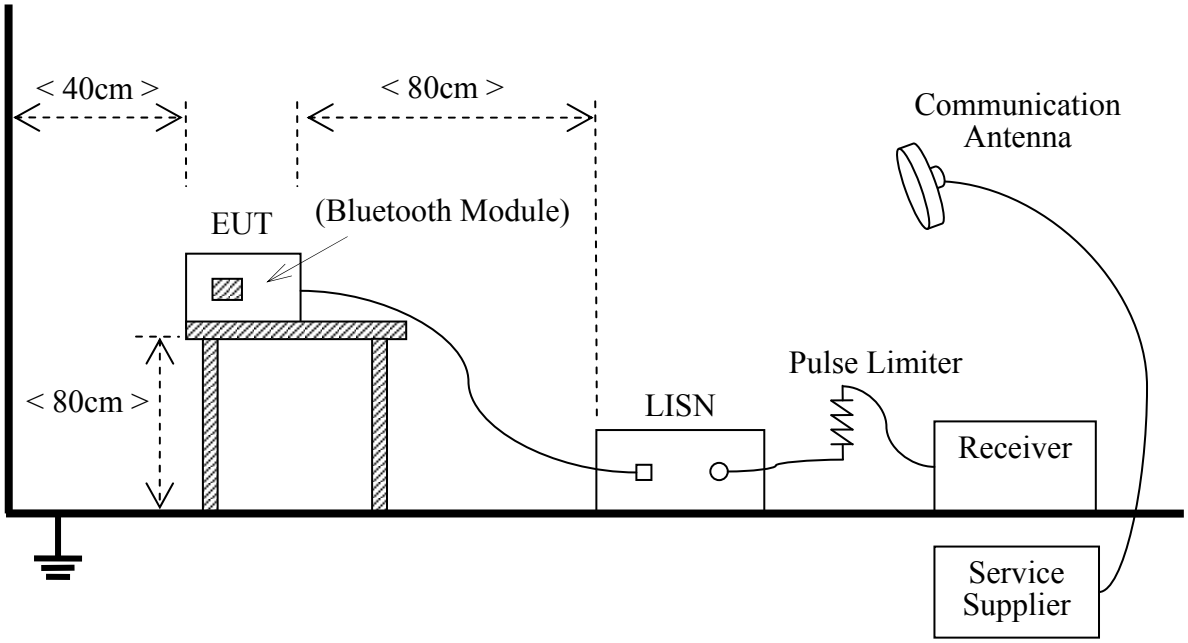
According to FCC section 15.207 and RSS- Gen section 7.2.4, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz shall not exceed the 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

C. 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:

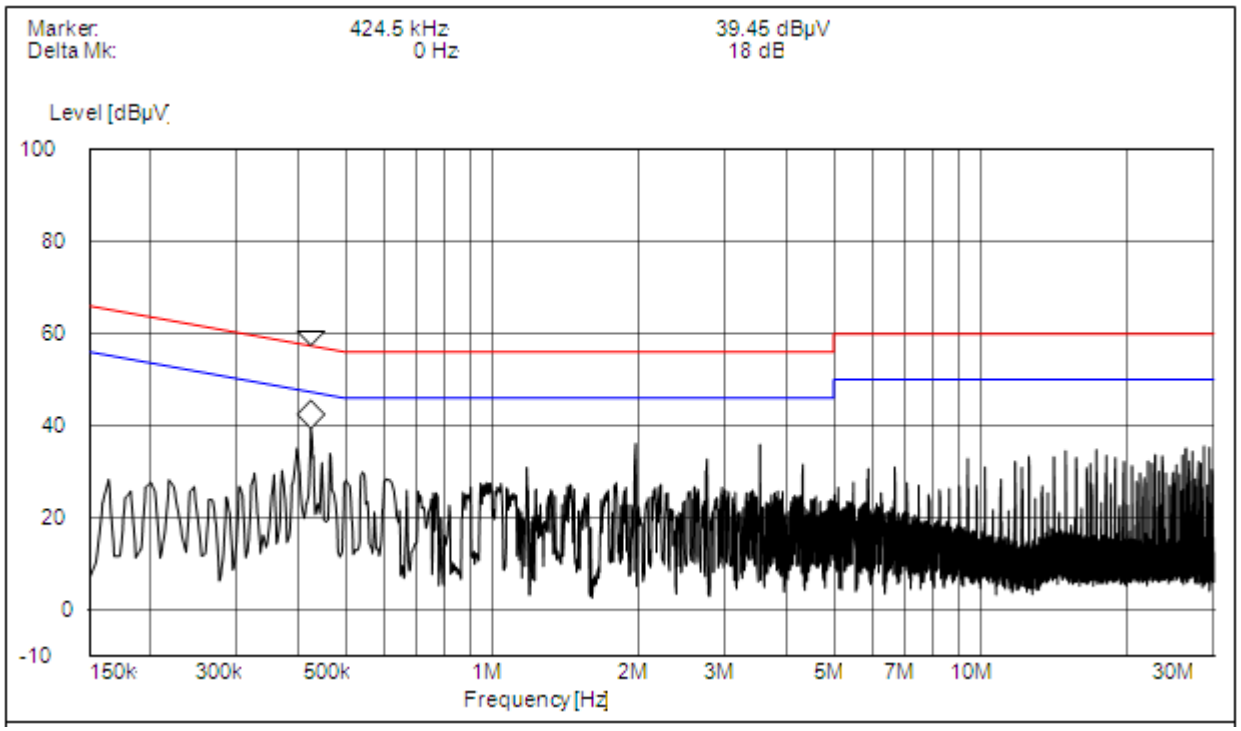
Description	Manufacturer	Model	Serial No.	Cal. Date
Test Receiver	ROHDE&SCHWARZ	ESCS30	A0304260	2012.06.10
LISN	ROHDE&SCHWARZ	ESH2-Z5	A0304221	2012.06.10

2.9.3. Test Result

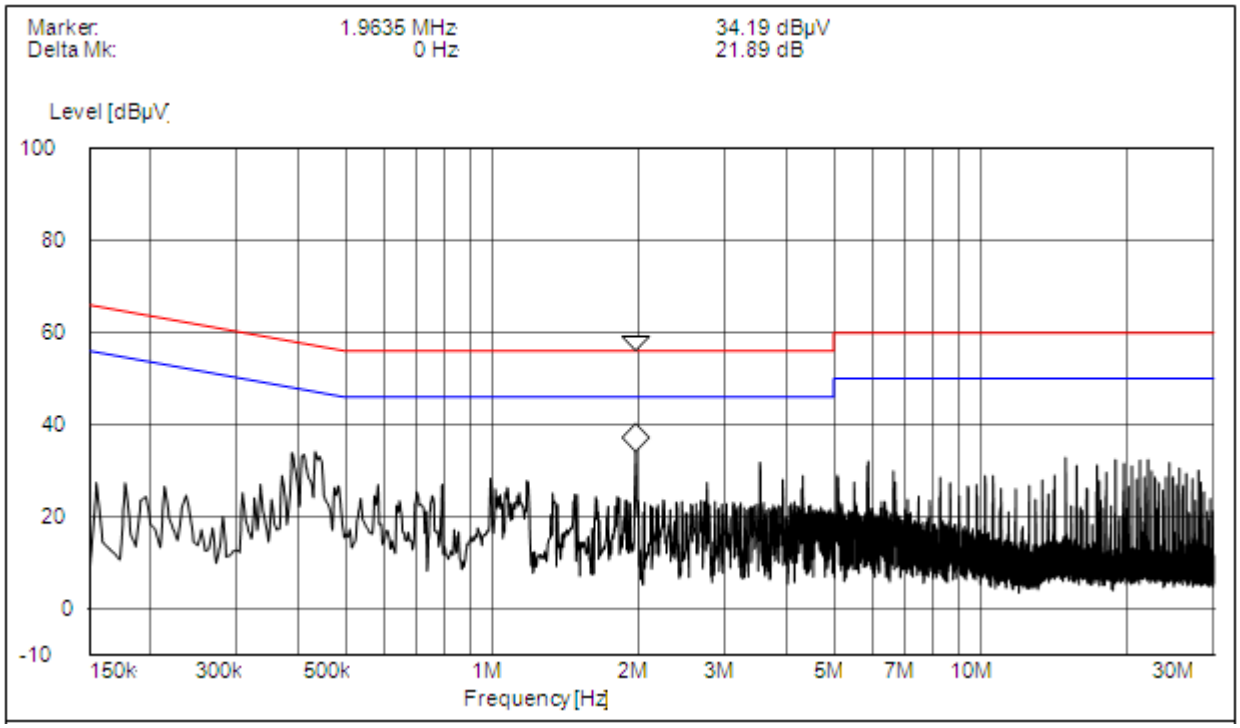
A. Test setup:

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

B. Test Plots:



(Plot A: L Phase)



(Plot B: N Phase)

2.10. Radiated Emission

2.10.1. Requirement

According to FCC section 15.247(c) and RSS- Gen section 7.2.5, 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:

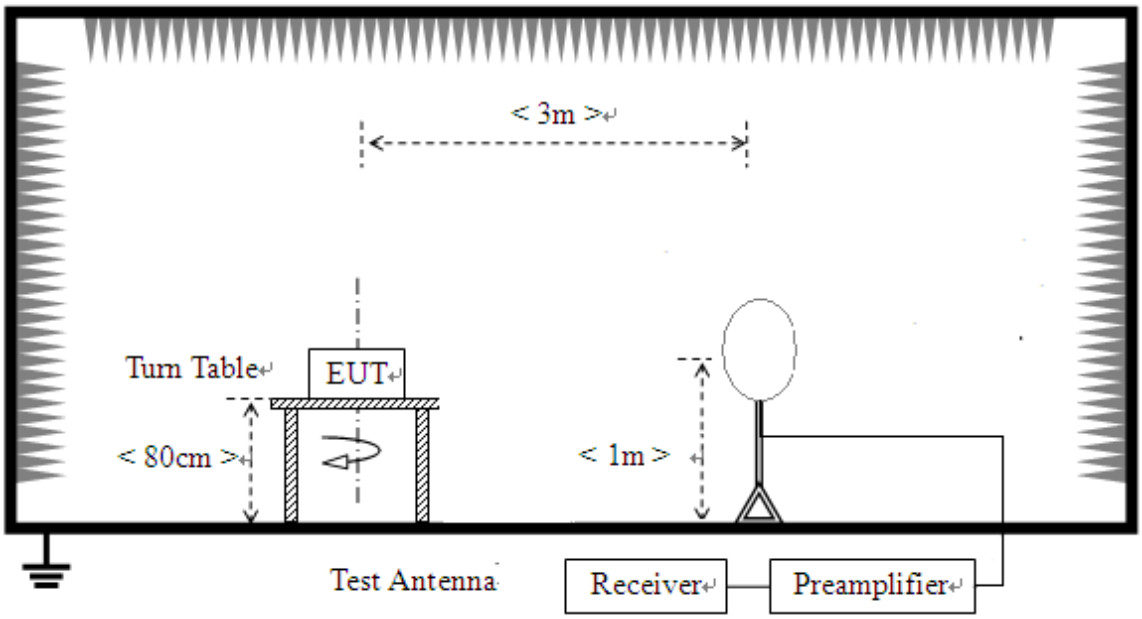
1. For Above 1000MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
2. For above 1000MHz, limit field strength 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)

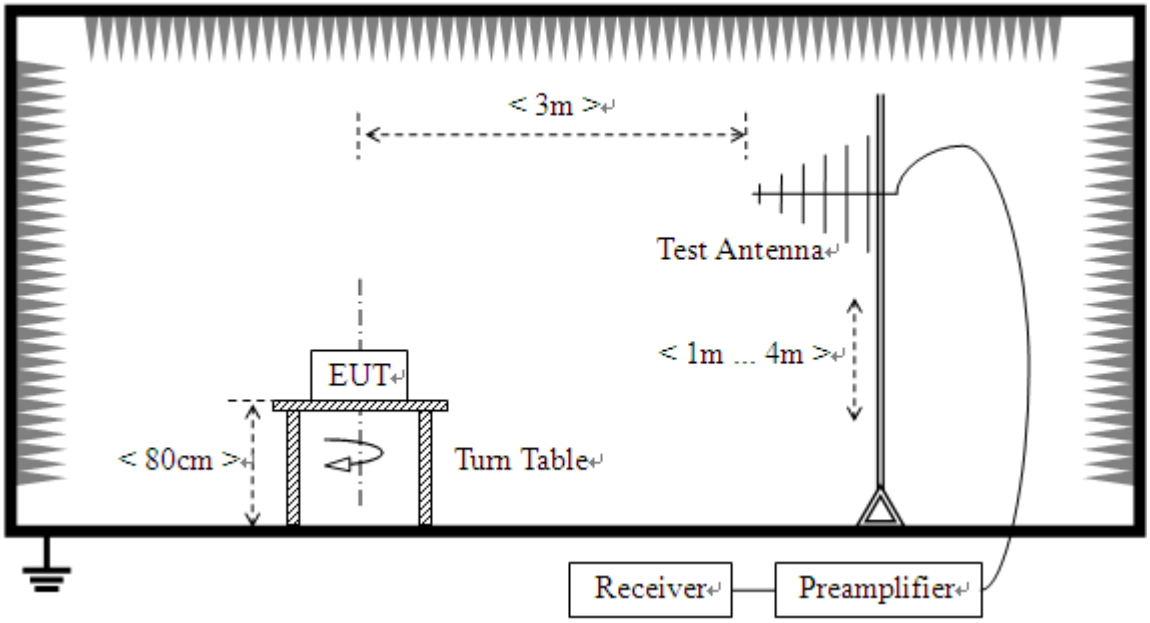
2.10.2. Test Description

A. Test Setup:

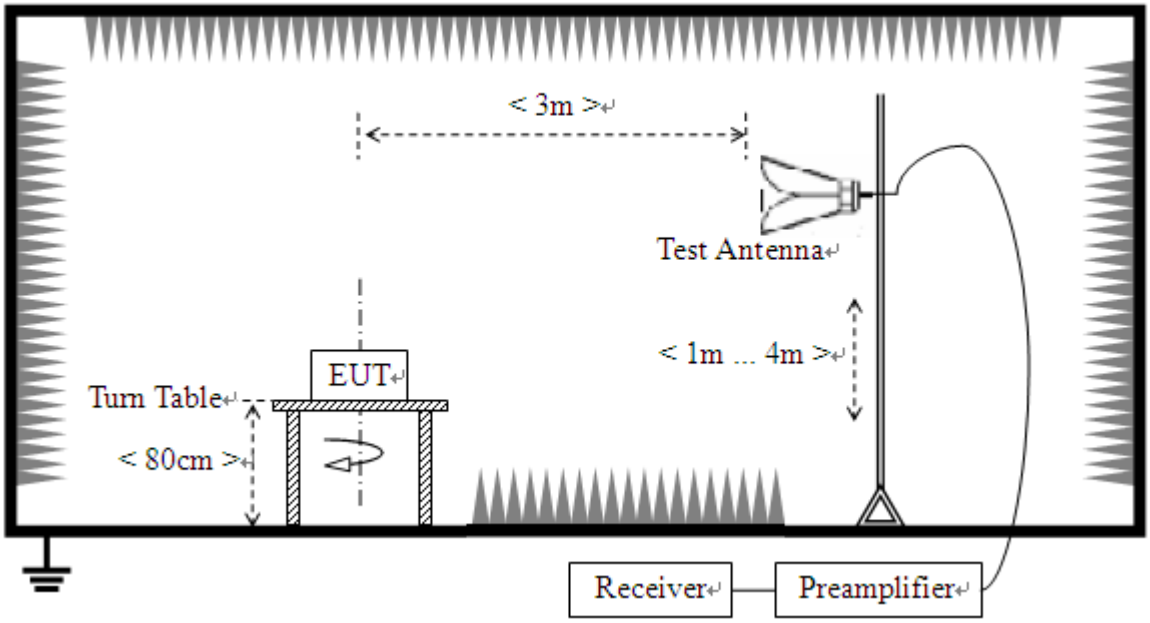
1) For radiated emissions from 9kHz to 30MHz



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 1GHz) and Horn Test Antenna (above 1GHz) 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	2013.06.10
Receiver	R&S	ESIB26	A0304218	2013.06.07
Full-Anechoic Chamber	Albatross	12.8m*6.8m*6.4m	A0412372	2013.06.07

Description	Manufacturer	Model	Serial No.	Cal. Date
Test Antenna - Bi-Log	Schwarzbeck	VULB 9163	9163-274	2013.06.09
Test Antenna - Horn	Schwarzbeck	BBHA 9120D	9120C-963	2013.06.09
Test Antenna - Horn	R&S	HL050S7	71688	2013.06.09
Test Antenna - Horn	ETS	UG-596A/U	A0902607	2013.06.05
Test Antenna -Loop	Schwarzbeck	HFH2-Z2	100047	2013.06.02
Ampilier 1G~18GHz	R&S	MITEQ AFS42-00101800	25-S-42	2013.06.05
Ampilier 18G~26GHz	R&S	JS42-18002600-28-5A	12111.0980.00	2013.06.05
amplifier 20M~3GHz	R&S	PAP-0203H	22018	2013.06.10

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

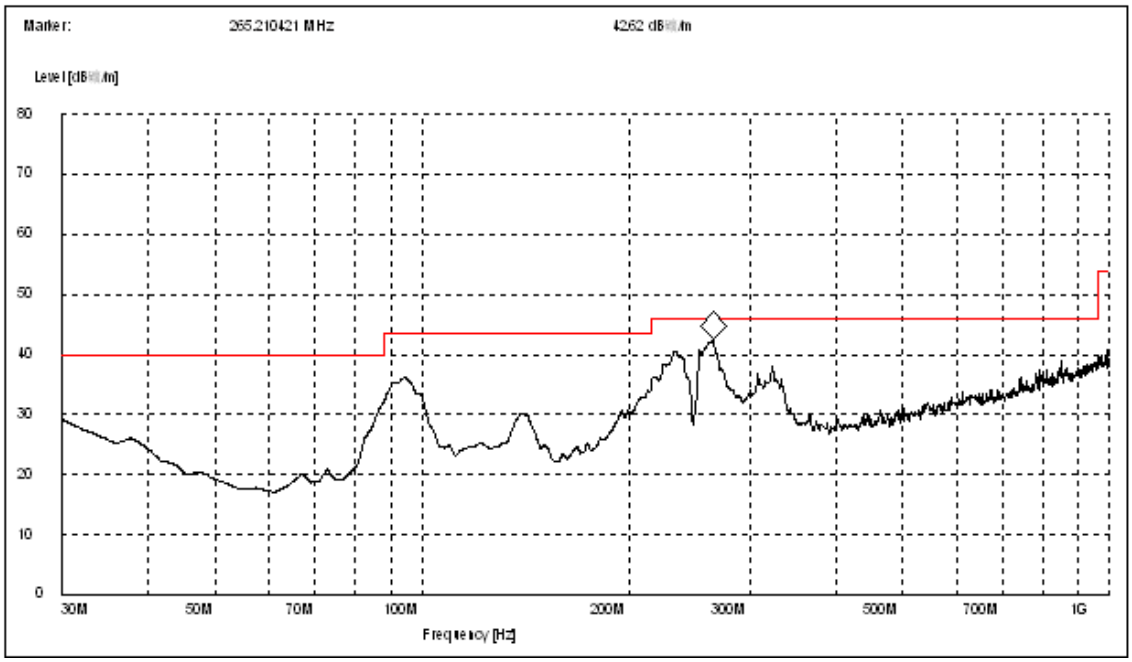
During the test, the total correction Factor AT and A_{Factor} were built in test software.

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.

For 9KHz to 30MHz

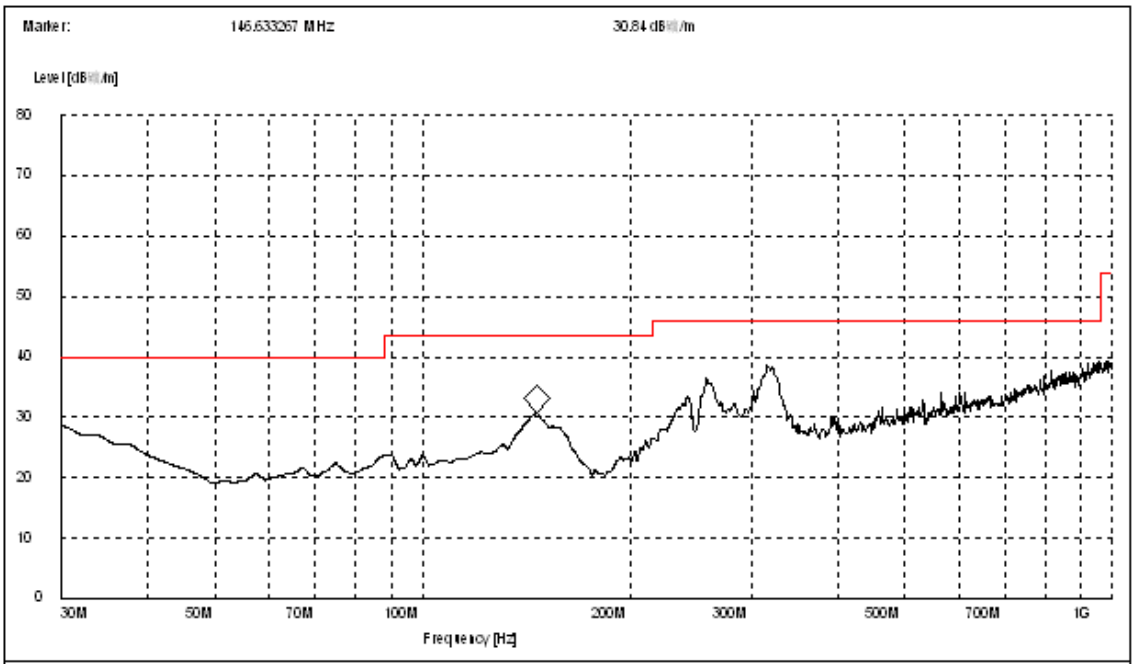
The test has been performed, and the Radiated Emission level is too low to the limit.

For 30MHz to 1000 MHz



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Degree	Antenna	Verdict
265.210	42.62	N.A	N.A	N.A	46.0	N.A	116.2	Horizontal	PASS

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



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Degree	Antenna	Verdict
146.633	30.84	N.A	N.A	N.A	43.5	N.A	57.0	Vertical	PASS

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

For 1GHz to 25GHz

GFSK Mode：

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	107.45	PK	/	/	1.00 H	91	110.65	28.2	5.2	-36.6
1	*2402	96.74	AV	/	/	1.00 H	91	99.94	28.2	5.2	-36.6
2	4804	54.81	PK	74	19.19	1.00 H	295	51.01	33	7	-36.2
2	4804	47.20	AV	54	6.80	1.00 H	295	43.40	33	7	-36.2
3	7206	54.86	PK	74	19.14	1.00 H	121	45.46	36.2	8.5	-35.3
3	7206	47.15	AV	54	6.85	1.00 H	121	37.75	36.2	8.5	-35.3
4	9608	52.03	PK	74	21.97	1.00 H	214	39.43	37.3	10.1	-34.8
4	9608	44.33	AV	54	9.67	1.00 H	214	31.73	37.3	10.1	-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	109.83	PK	/	/	1.00 V	277	113.03	28.2	5.2	-36.6
1	*2402	100.50	AV	/	/	1.00 V	277	103.70	28.2	5.2	-36.6
2	4804	54.81	PK	74	19.19	1.00 V	197	51.01	33	7	-36.2
2	4804	47.81	AV	54	6.19	1.00 V	197	44.01	33	7	-36.2
3	7206	52.74	PK	74	21.26	1.00 V	72	43.34	36.2	8.5	-35.3
3	7206	45.88	AV	54	8.12	1.00 V	72	36.48	36.2	8.5	-35.3
4	9608	54.62	PK	74	19.38	1.00 V	265	42.02	37.3	10.1	-34.8
4	9608	47.68	AV	54	6.32	1.00 V	265	35.08	37.3	10.1	-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	112.83	PK	/	/	1.00 H	237	116.03	28.2	5.2	-36.6
1	*2441	102.66	AV	/	/	1.00 H	237	105.86	28.2	5.2	-36.6
2	4882	50.42	PK	74	23.58	1.00 H	155	46.62	33	7	-36.2
2	4882	42.61	AV	54	11.39	1.00 H	155	38.81	33	7	-36.2
3	7323	51.66	PK	74	22.34	1.00 H	258	42.26	36.2	8.5	-35.3
3	7323	44.63	AV	54	9.37	1.00 H	258	35.23	36.2	8.5	-35.3
4	9764	51.60	PK	74	22.40	1.00 H	131	39.00	37.3	10.1	-34.8
4	9764	44.15	AV	54	9.85	1.00 H	131	31.55	37.3	10.1	-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	110.17	PK	/	/	1.00 V	185	113.37	28.2	5.2	-36.6
1	*2441	101.00	AV	/	/	1.00 V	185	104.20	28.2	5.2	-36.6
2	4882	50.42	PK	74	23.58	1.00 V	51	46.62	33	7	-36.2
2	4882	43.14	AV	54	10.86	1.00 V	51	39.34	33	7	-36.2
3	7323	53.23	PK	74	20.77	1.00 V	236	43.83	36.2	8.5	-35.3
3	7323	46.86	AV	54	7.14	1.00 V	236	37.46	36.2	8.5	-35.3
4	9764	52.37	PK	74	21.63	1.00 V	294	39.77	37.3	10.1	-34.8
4	9764	44.77	AV	54	9.23	1.00 V	294	32.17	37.3	10.1	-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	109.20	PK	/	/	1.00 H	341	112.40	28.2	5.2	-36.6
1	*2480	99.34	AV	/	/	1.00 H	341	102.54	28.2	5.2	-36.6
2	4960	52.06	PK	74	21.94	1.00 H	357	48.26	33	7	-36.2
2	4960	45.26	AV	54	8.74	1.00 H	357	41.46	33	7	-36.2
3	7440	53.81	PK	74	20.19	1.00 H	104	44.41	36.2	8.5	-35.3
3	7440	47.11	AV	54	6.89	1.00 H	104	37.71	36.2	8.5	-35.3
4	9920	53.42	PK	74	20.58	1.00 H	60	40.82	37.3	10.1	-34.8
4	9920	45.84	AV	54	8.16	1.00 H	60	33.24	37.3	10.1	-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	107.58	PK	/	/	1.00 V	116	110.78	28.2	5.2	-36.6
1	*2480	97.53	AV	/	/	1.00 V	116	100.73	28.2	5.2	-36.6
2	4960	54.67	PK	74	19.33	1.00 V	38	50.87	33	7	-36.2
2	4960	47.31	AV	54	6.69	1.00 V	38	43.51	33	7	-36.2
3	7440	51.37	PK	74	22.63	1.00 V	120	41.97	36.2	8.5	-35.3
3	7440	43.80	AV	54	10.20	1.00 V	120	34.40	36.2	8.5	-35.3
4	9920	53.08	PK	74	20.92	1.00 V	167	40.48	37.3	10.1	-34.8
4	9920	46.67	AV	54	7.33	1.00 V	167	34.07	37.3	10.1	-34.8

∏/4-DQPSK Mode：

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	110.70	PK	/	/	1.00 H	101	113.90	28.2	5.2	-36.6
1	*2402	100.48	AV	/	/	1.00 H	101	103.68	28.2	5.2	-36.6
2	4804	53.77	PK	74	20.23	1.00 H	254	49.97	33	7	-36.2
2	4804	46.03	AV	54	7.97	1.00 H	254	42.23	33	7	-36.2
3	7206	52.58	PK	74	21.42	1.00 H	227	43.18	36.2	8.5	-35.3
3	7206	44.94	AV	54	9.06	1.00 H	227	35.54	36.2	8.5	-35.3
4	9608	51.35	PK	74	22.65	1.00 H	346	38.75	37.3	10.1	-34.8
4	9608	44.74	AV	54	9.26	1.00 H	346	32.14	37.3	10.1	-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	112.17	PK	/	/	1.00 V	87	115.37	28.2	5.2	-36.6
1	*2402	102.48	AV	/	/	1.00 V	87	105.68	28.2	5.2	-36.6
2	4804	51.64	PK	74	22.36	1.00 V	77	47.84	33	7	-36.2
2	4804	44.27	AV	54	9.73	1.00 V	77	40.47	33	7	-36.2
3	7206	51.55	PK	74	22.45	1.00 V	219	42.15	36.2	8.5	-35.3
3	7206	44.48	AV	54	9.52	1.00 V	219	35.08	36.2	8.5	-35.3
4	9608	53.91	PK	74	20.09	1.00 V	56	41.31	37.3	10.1	-34.8
4	9608	46.07	AV	54	7.93	1.00 V	56	33.47	37.3	10.1	-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	107.96	PK	/	/	1.00 H	89	111.16	28.2	5.2	-36.6
1	*2441	97.39	AV	/	/	1.00 H	89	100.59	28.2	5.2	-36.6
2	4882	50.45	PK	74	23.55	1.00 H	349	46.65	33	7	-36.2
2	4882	43.89	AV	54	10.11	1.00 H	349	40.09	33	7	-36.2
3	7323	52.97	PK	74	21.03	1.00 H	325	43.57	36.2	8.5	-35.3
3	7323	46.08	AV	54	7.92	1.00 H	325	36.68	36.2	8.5	-35.3
4	9764	50.43	PK	74	23.57	1.00 H	107	37.83	37.3	10.1	-34.8
4	9764	44.34	AV	54	9.66	1.00 H	107	31.74	37.3	10.1	-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	110.81	PK	/	/	1.00 V	300	114.01	28.2	5.2	-36.6
1	*2441	100.28	AV	/	/	1.00 V	300	103.48	28.2	5.2	-36.6
2	4882	53.54	PK	74	20.46	1.00 V	340	49.74	33	7	-36.2
2	4882	47.20	AV	54	6.80	1.00 V	340	43.40	33	7	-36.2
3	7323	53.70	PK	74	20.30	1.00 V	62	44.30	36.2	8.5	-35.3
3	7323	47.01	AV	54	6.99	1.00 V	62	37.61	36.2	8.5	-35.3
4	9764	53.42	PK	74	20.58	1.00 V	271	40.82	37.3	10.1	-34.8
4	9764	45.95	AV	54	8.05	1.00 V	271	33.35	37.3	10.1	-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	107.86	PK	/	/	1.00 H	250	111.06	28.2	5.2	-36.6
1	*2480	97.10	AV	/	/	1.00 H	250	100.30	28.2	5.2	-36.6
2	4960	50.17	PK	74	23.83	1.00 H	149	46.37	33	7	-36.2
2	4960	43.95	AV	54	10.05	1.00 H	149	40.15	33	7	-36.2
3	7440	53.90	PK	74	20.10	1.00 H	224	44.50	36.2	8.5	-35.3
3	7440	46.71	AV	54	7.29	1.00 H	224	37.31	36.2	8.5	-35.3
4	9920	52.32	PK	74	21.68	1.00 H	102	39.72	37.3	10.1	-34.8
4	9920	45.64	AV	54	8.36	1.00 H	102	33.04	37.3	10.1	-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	112.87	PK	/	/	1.00 V	67	116.07	28.2	5.2	-36.6
1	*2480	102.88	AV	/	/	1.00 V	67	106.08	28.2	5.2	-36.6
2	4960	53.89	PK	74	20.11	1.00 V	280	50.09	33	7	-36.2
2	4960	47.41	AV	54	6.59	1.00 V	280	43.61	33	7	-36.2
3	7440	54.91	PK	74	19.09	1.00 V	288	45.51	36.2	8.5	-35.3
3	7440	48.31	AV	54	5.69	1.00 V	288	38.91	36.2	8.5	-35.3
4	9920	52.67	PK	74	21.33	1.00 V	238	40.07	37.3	10.1	-34.8
4	9920	45.98	AV	54	8.02	1.00 V	238	33.38	37.3	10.1	-34.8

8-DPSK Mode：

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	108.81	PK	/	/	1.00 H	101	112.01	28.2	5.2	-36.6
1	*2402	98.55	AV	/	/	1.00 H	101	101.75	28.2	5.2	-36.6
2	4804	53.51	PK	74	20.49	1.00 H	254	49.71	33	7	-36.2
2	4804	45.72	AV	54	8.28	1.00 H	254	41.92	33	7	-36.2
3	7206	52.36	PK	74	21.64	1.00 H	227	42.96	36.2	8.5	-35.3
3	7206	44.79	AV	54	9.21	1.00 H	227	35.39	36.2	8.5	-35.3
4	9608	51.09	PK	74	22.91	1.00 H	346	38.49	37.3	10.1	-34.8
4	9608	44.43	AV	54	9.57	1.00 H	346	31.83	37.3	10.1	-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	109.94	PK	/	/	1.00 V	87	113.14	28.2	5.2	-36.6
1	*2402	100.17	AV	/	/	1.00 V	87	103.37	28.2	5.2	-36.6
2	4804	51.13	PK	74	22.87	1.00 V	77	47.33	33	7	-36.2
2	4804	44.04	AV	54	9.96	1.00 V	77	40.24	33	7	-36.2
3	7206	51.09	PK	74	22.91	1.00 V	219	41.69	36.2	8.5	-35.3
3	7206	44.04	AV	54	9.96	1.00 V	219	34.64	36.2	8.5	-35.3
4	9608	53.56	PK	74	20.44	1.00 V	56	40.96	37.3	10.1	-34.8
4	9608	45.60	AV	54	8.40	1.00 V	56	33.00	37.3	10.1	-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	105.84	PK	/	/	1.00 H	89	109.04	28.2	5.2	-36.6
1	*2441	95.17	AV	/	/	1.00 H	89	98.37	28.2	5.2	-36.6
2	4882	50.00	PK	74	24.00	1.00 H	349	46.20	33	7	-36.2
2	4882	43.73	AV	54	10.27	1.00 H	349	39.93	33	7	-36.2
3	7323	52.63	PK	74	21.37	1.00 H	325	43.23	36.2	8.5	-35.3
3	7323	45.7	AV	54	8.30	1.00 H	325	36.30	36.2	8.5	-35.3
4	9764	50.07	PK	74	23.93	1.00 H	107	37.47	37.3	10.1	-34.8
4	9764	43.96	AV	54	10.04	1.00 H	107	31.36	37.3	10.1	-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	109.69	PK	/	/	1.00 V	300	112.89	28.2	5.2	-36.6
1	*2441	98.39	AV	/	/	1.00 V	300	101.59	28.2	5.2	-36.6
2	4882	53.31	PK	74	20.69	1.00 V	340	49.51	33	7	-36.2
2	4882	46.98	AV	54	7.02	1.00 V	340	43.18	33	7	-36.2
3	7323	53.44	PK	74	20.56	1.00 V	62	44.04	36.2	8.5	-35.3
3	7323	46.77	AV	54	7.23	1.00 V	62	37.37	36.2	8.5	-35.3
4	9764	53.14	PK	74	20.86	1.00 V	271	40.54	37.3	10.1	-34.8
4	9764	45.72	AV	54	8.28	1.00 V	271	33.12	37.3	10.1	-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	105.63	PK	/	/	1.00 H	250	108.83	28.2	5.2	-36.6
1	*2480	95.09	AV	/	/	1.00 H	250	98.29	28.2	5.2	-36.6
2	4960	49.53	PK	74	24.47	1.00 H	149	45.73	33	7	-36.2
2	4960	43.37	AV	54	10.63	1.00 H	149	39.57	33	7	-36.2
3	7440	53.34	PK	74	20.66	1.00 H	224	43.94	36.2	8.5	-35.3
3	7440	46.17	AV	54	7.83	1.00 H	224	36.77	36.2	8.5	-35.3
4	9920	51.77	PK	74	22.23	1.00 H	102	39.17	37.3	10.1	-34.8
4	9920	45.08	AV	54	8.92	1.00 H	102	32.48	37.3	10.1	-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	110.74	PK	/	/	1.00 V	67	113.94	28.2	5.2	-36.6
1	*2480	100.85	AV	/	/	1.00 V	67	104.05	28.2	5.2	-36.6
2	4960	53.24	PK	74	20.76	1.00 V	280	49.44	33	7	-36.2
2	4960	47.06	AV	54	6.94	1.00 V	280	43.26	33	7	-36.2
3	7440	54.45	PK	74	19.55	1.00 V	288	45.05	36.2	8.5	-35.3
3	7440	47.75	AV	54	6.25	1.00 V	288	38.35	36.2	8.5	-35.3
4	9920	52.39	PK	74	21.61	1.00 V	238	39.79	37.3	10.1	-34.8
4	9920	45.61	AV	54	8.39	1.00 V	238	33.01	37.3	10.1	-34.8

2.11. RF exposure evaluation

According to § 1.1307(b)(1) and RSS-102 Issue 4 § 2.5.1, 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 5.11dBm, the maximum gain of antenna is0.5dBi, the maximum output power is 5.11dBm (3.243mW), which is lower than the exclusion threshold 10mW, at frequency 2450MHz, and distance is 5mm.

The SAR measurement is not required.

** END OF REPORT **