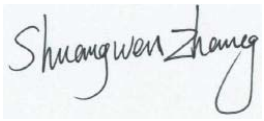
RF TEST REPORT

Report No.:	SET2013-07098
Product Name:	IP Phone
FCC ID:	YZZGXP2160
Model No. :	GXP2160
Applicant:	Grandstream Networks, INC
Address:	5F,Bldg #1,No.2 Kefa Rd.,Science & Technology Park, 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

Test Report

Product Name.....:	IP Phone
Brand Name.....:	Grandstream
Trade Name.....:	Grandstream
Applicant.....:	Grandstream Networks, INC
Applicant Address.....:	5F, Bldg #1, No.2 Kefa Rd., Science & Technology Park, Shenzhen, China
Manufacturer.....:	Grandstream Networks, INC
Manufacturer Address .....:	5F, Bldg #1, No.2 Kefa Rd., Science & Technology Park, 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 date.....:	Nov 13, 2013 - Nov 14, 2013
Test Result .....:	PASS
Tested by .....:	 2013.11.14 Lu lei, Test Engineer
Reviewed by .....:	 2013.11.14 Shuangwen Zhang, Senior Egineer
Approved by .....:	 2013.11.14 Wu Li'an, Manager

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Change History		
Issue	Date	Reason for change
1.0	Nov 13, 2013	First edition

1. General Information

1.1. EUT Description

EUT Type ..... :	IP Phone
Serial No. ..... :	(n.a, marked #1 by test site)
Hardware Version ..... :	N/A
Software Version ..... :	N/A
Applicant ..... :	Grandstream Networks, INC 5F, Bldg #1, No.2 Kefa Rd., Science & Technology Park, Shenzhen, China
Manufacturer ..... :	Grandstream Networks, INC 5F, Bldg #1, No.2 Kefa Rd., Science & Technology Park, Shenzhen, China
Frequency Range ..... :	The frequency range used is 2402MHz - 2480MHz (79 channels, at intervals of 1MHz);
Modulation Type ..... :	Bluetooth: FHSS (GFSK(1Mbps), ∏/4-DQPSK(EDR 2Mbps), 8-DPSK(EDR 3Mbps))
Antenna Type..... :	PIFA
Antenna Gain..... :	2.0dBi

Note 1: The EUT is a IP Phone, 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.

1.2. Support Equipment

No.	Equipment	Brand Name	Model Name	Manufacturer	Serial No.
1	Notebook	DELL	PP11L	DELL	H5914A03
2	Keyboard	lenovo	KU-0989	(n.a.)	(n.a.)
3	Mouse	logitech	(n.a.)	(n.a.)	(n.a.)

Remark :PC ,Keyboard,Mouse listed as above have FCC DOC approval

1.3. 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
2	ANSIC63.10-2009	American National Standard for Testing Unlicensed Wireless 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 C63.10 2009.

1.4. Facilities and Accreditations

1.4.1. 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.

1.4.2. 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.

And according to FCC 47 CFR section 15.247(c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

2.1.2. Antenna Information

Antenna Category: External antenna
An External antenna was soldered to EUT via an adaptor cable, can't be removed away.

Antenna General Information:

No.	EUT Model	Ant. Type	Ant. Model	Manufacturer	Gain(dBi)
1	GXP2160	PIFA	V1195	SHEN ZHEN VLG WIRELESS TECHNOLOGY CO.,LTD	2.0

2.1.3. Result: comply

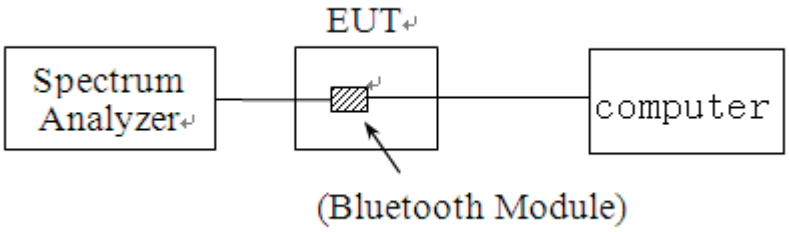
2.2. Number of Hopping Frequency

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.	Calibration Due. Date
Spectrum Analyzer	R&S	FSP40	1164.4391.40	2014.06.10

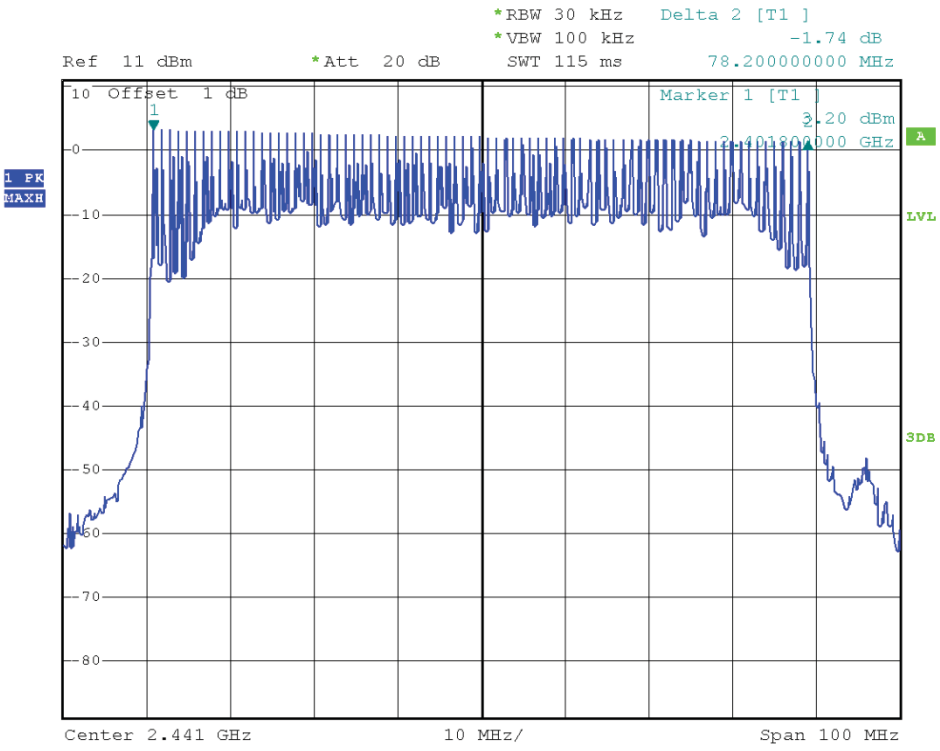
2.2.3. Test Result

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.

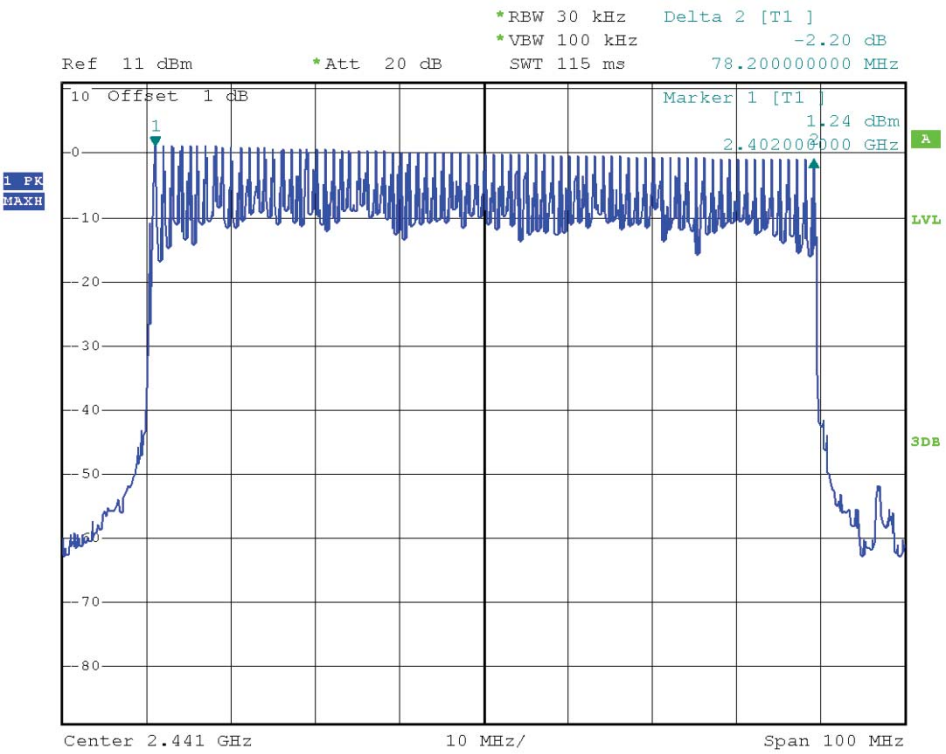
A. Test Verdict:

Test Mode	Frequency Block (MHz)	Measured Channel Numbers	Min. Limit	Refer to Plot	Verdict
GFSK	2400 - 2483.5	79	15	Plot A	PASS
π/4-DQPSK	2400 - 2483.5	79	15	Plot B	PASS
8-DPSK	2400 - 2483.5	79	15	Plot C	PASS

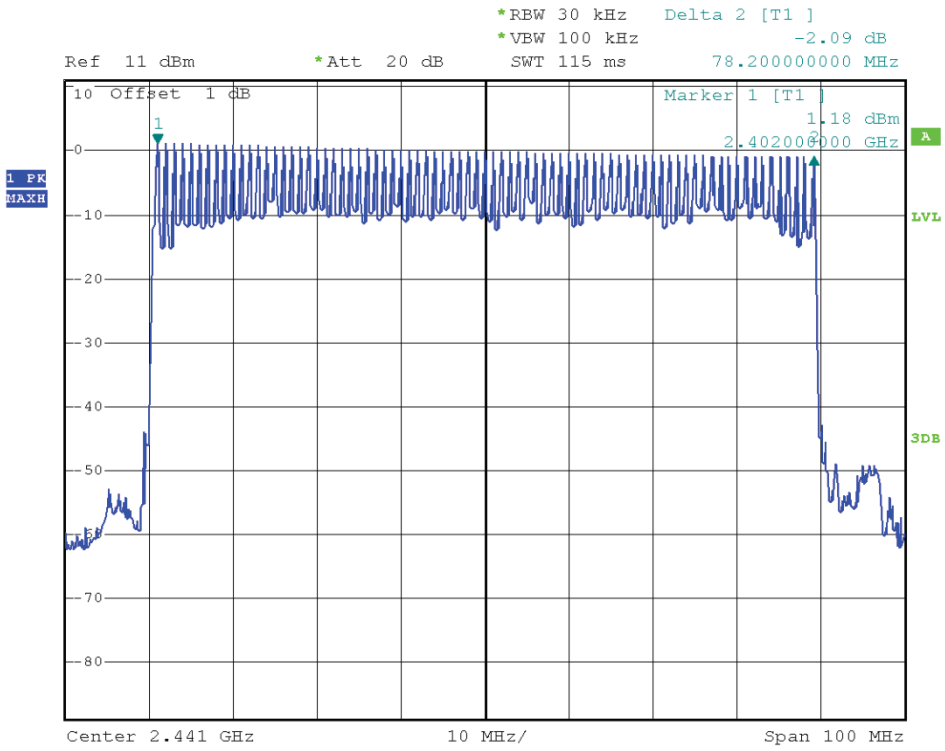
B. Test Plots:



(Plot A: GFSK)



(Plot B: ∏/4-DQPSK)


*RBW 30 kHz
*VBW 100 kHz
SWT 115 ms
Delta 2 [T1]
-2.09 dB
78.200000000 MHz
Ref 11 dBm
*Att 20 dB
10 Offset 1 dB
Marker 1 [T1]
1.18 dBm
2.402000000 GHz
1 PK
MAXH
A
LVL
3DB
Center 2.441 GHz
10 MHz/
Span 100 MHz

(Plot C: 8- DPSK)

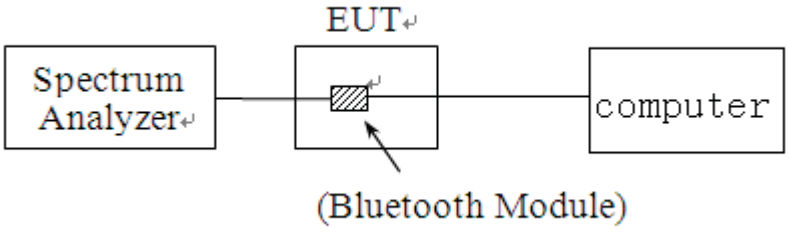
2.3. Peak Output Power

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.	Calibration Due. Date
Spectrum Analyzer	R&S	FSP40	1164.4391.40	2014.06.10

2.3.3. Test Result

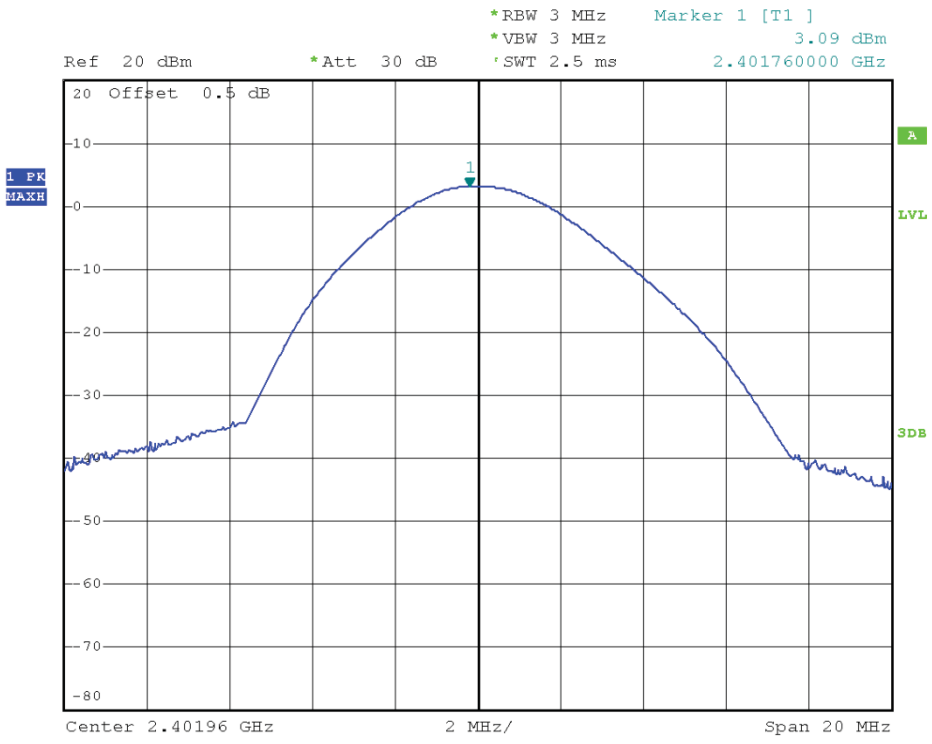
The Bluetooth Module operates at hopping-off test mode. The lowest, middle and highest channels are selected to perform testing to verify the conducted RF output peak power of the Module. The lowest, middle and highest channel were tested by Power meter.

2.3.3.1. GFSK Mode

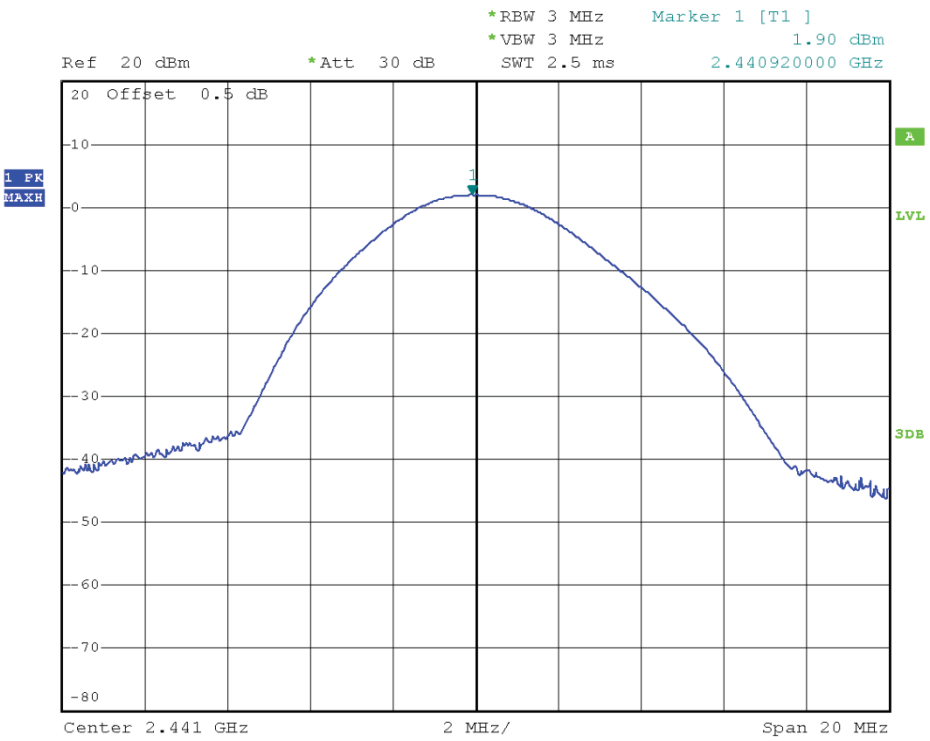
A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power	Limit	Verdict	Refer to Plot
		dBm	dBm		
0	2402	3.09	30	PASS	Plot A
39	2441	1.90		PASS	Plot B
78	2480	1.13		PASS	Plot C

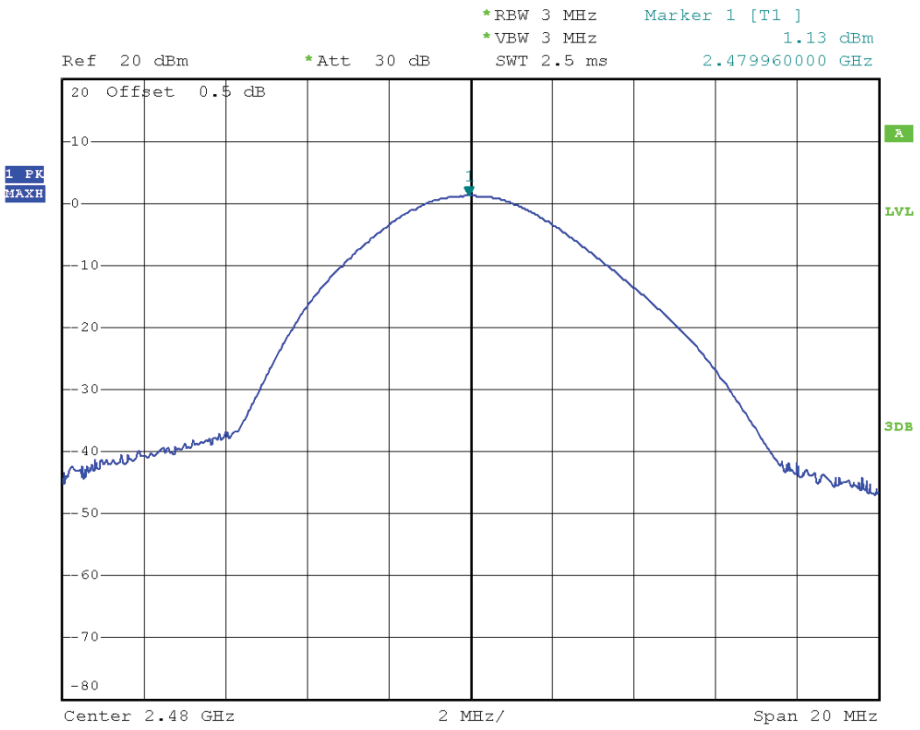
B. Test Plots:



(Plot A: Channel = 2402 @ GFSK)



(Plot B: Channel = 2441 @ GFSK)



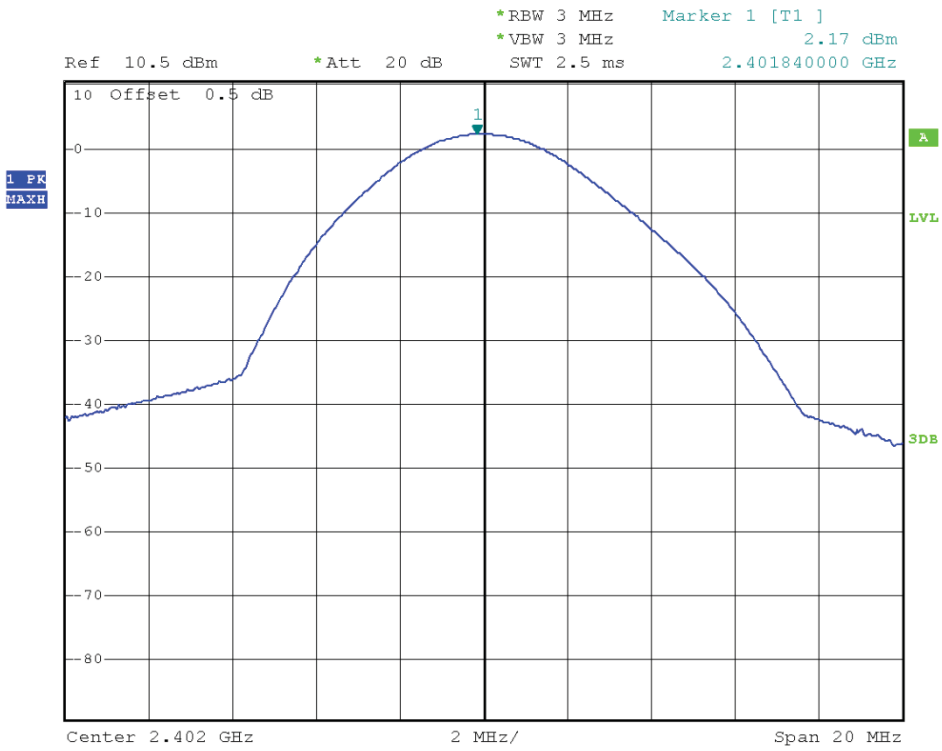
(Plot C: Channel = 2480 @ GFSK)

2.3.3.2. ∏/4-DQPSK Mode

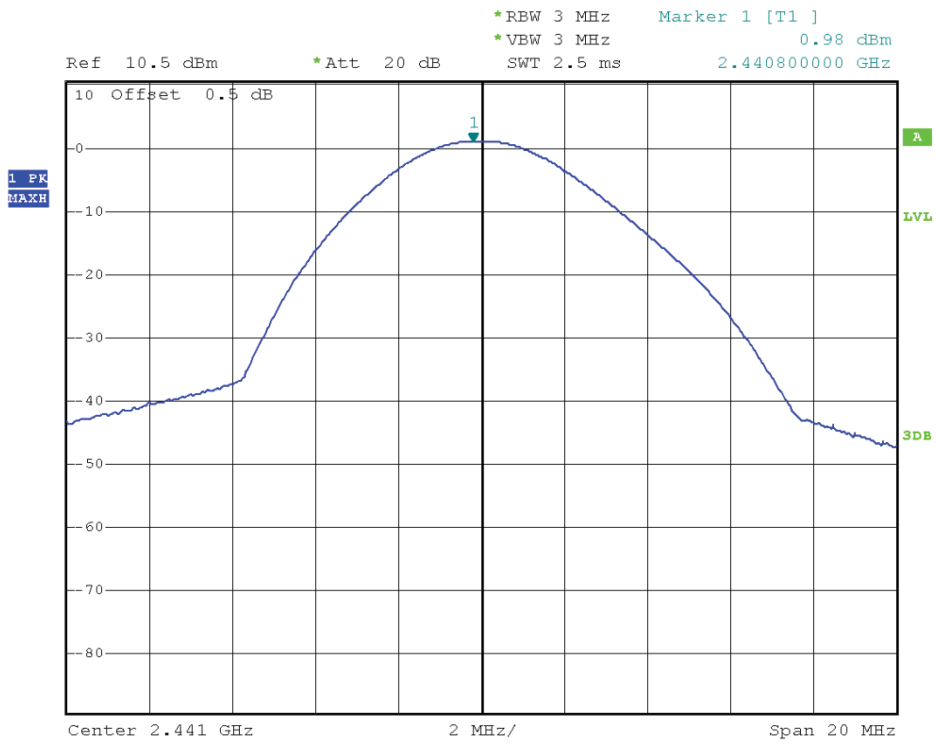
A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power	Limit	Verdict	Refer to Plot
		dBm	dBm		
0	2402	2.17	30	PASS	Plot A
39	2441	0.98		PASS	Plot B
78	2480	0.19		PASS	Plot C

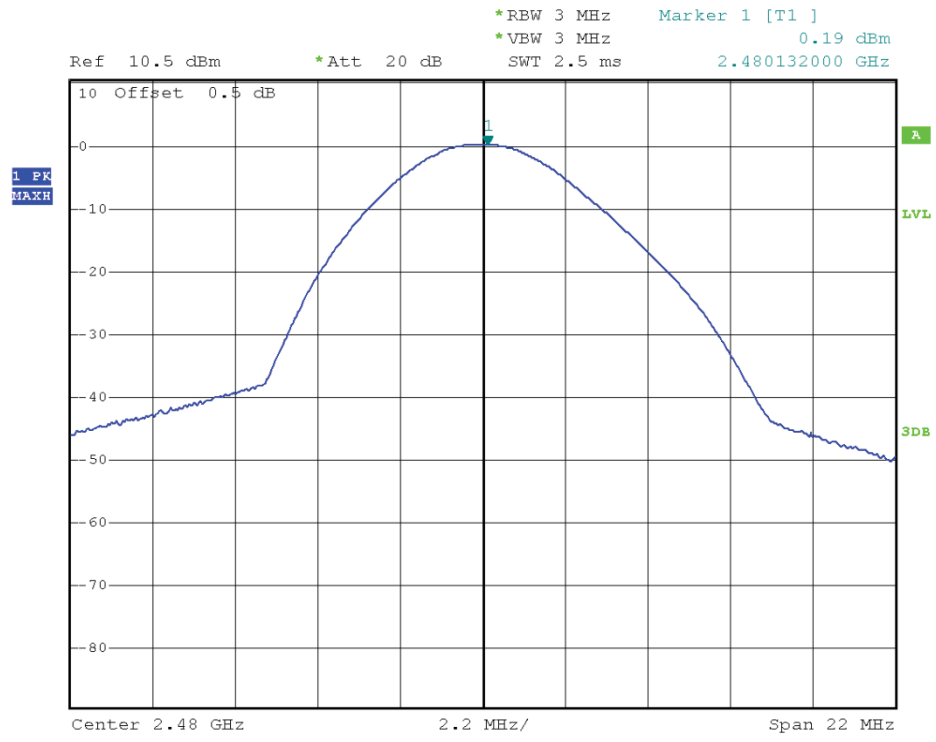
B. Test Plots:



(Plot A: Channel = 2402 @∏/4-DQPSK)



(Plot B: Channel = 2441 @ ∏/4-DQPSK)



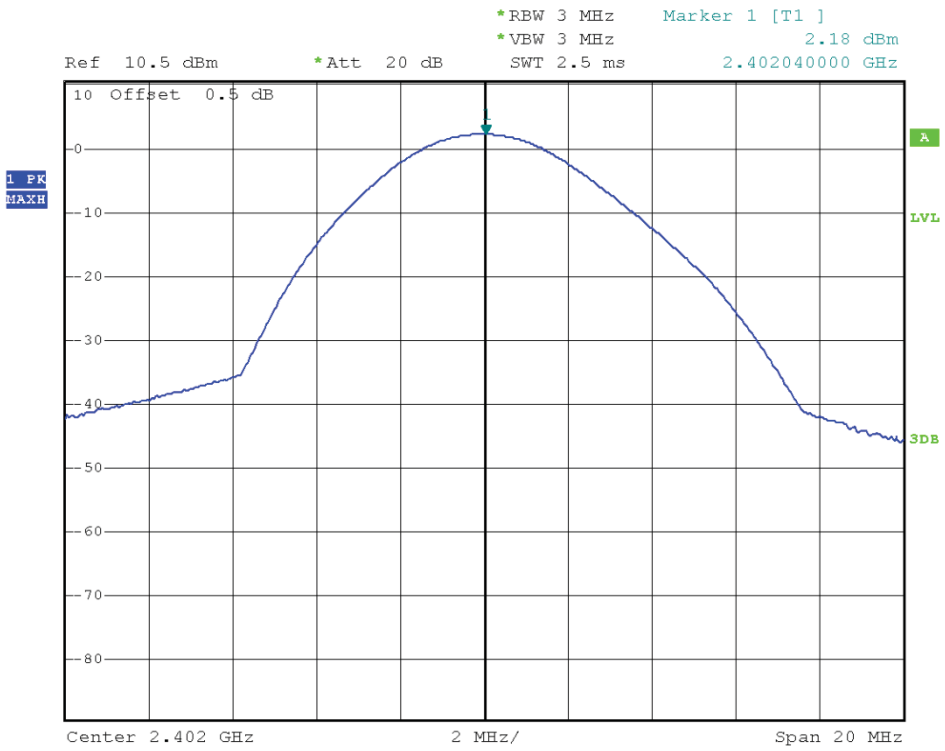
(Plot C: Channel = 2480 @ ∏/4-DQPSK)

2.3.3.3. 8-DPSK Mode

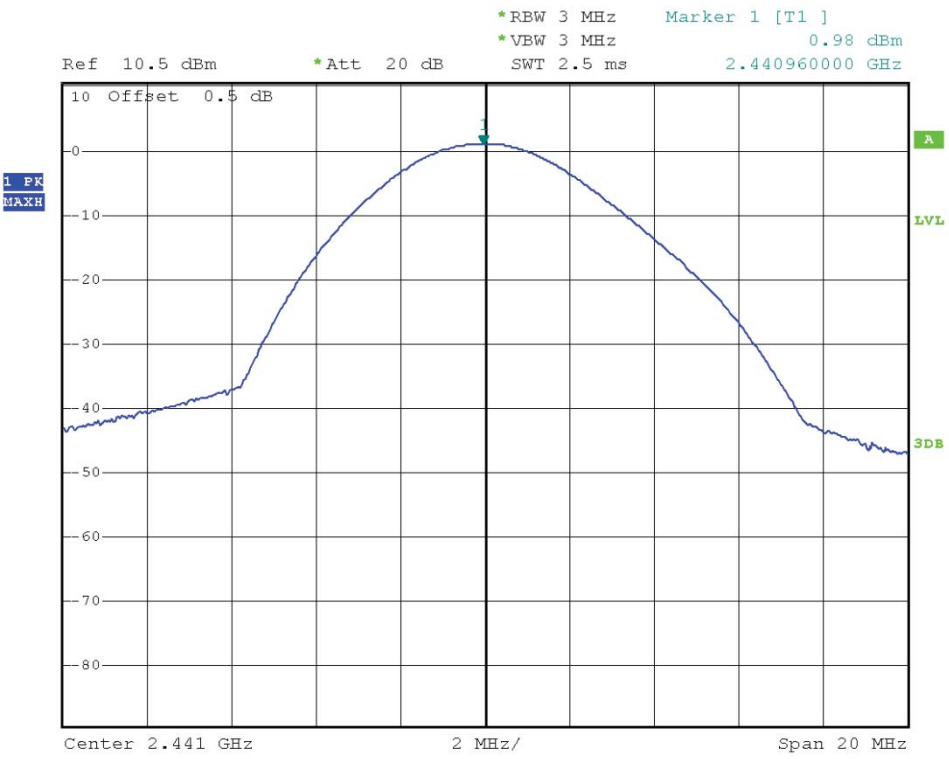
A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power	Limit	Verdict	Refer to Plot
		dBm	dBm		
0	2402	2.18	30	PASS	Plot A
39	2441	0.98		PASS	Plot B
78	2480	0.34		PASS	Plot C

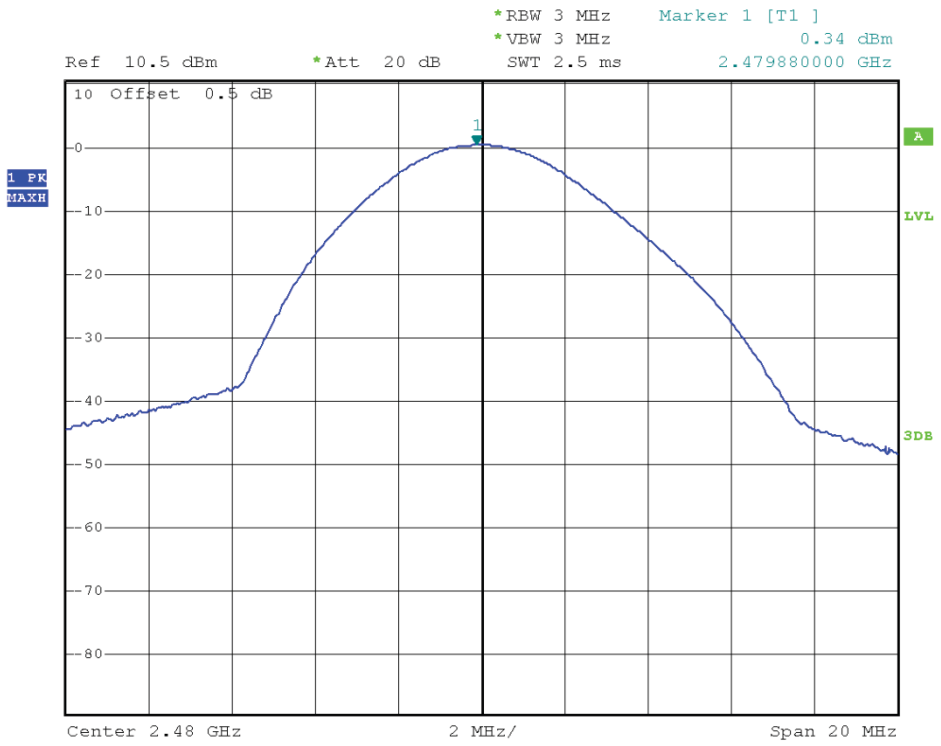
B. Test Plots:



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



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



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

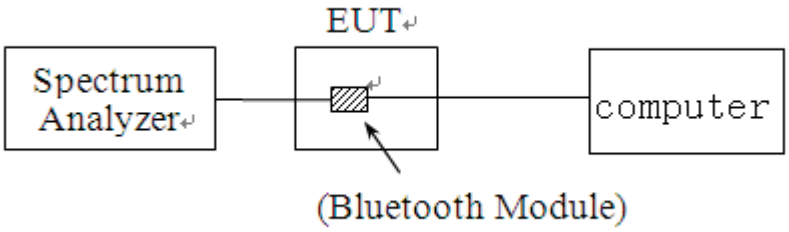
2.4. 20dB Bandwidth

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.	Calibration Due. Date
Spectrum Analyzer	R&S	FSP40	1164.4391.40	2014.06.10

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.

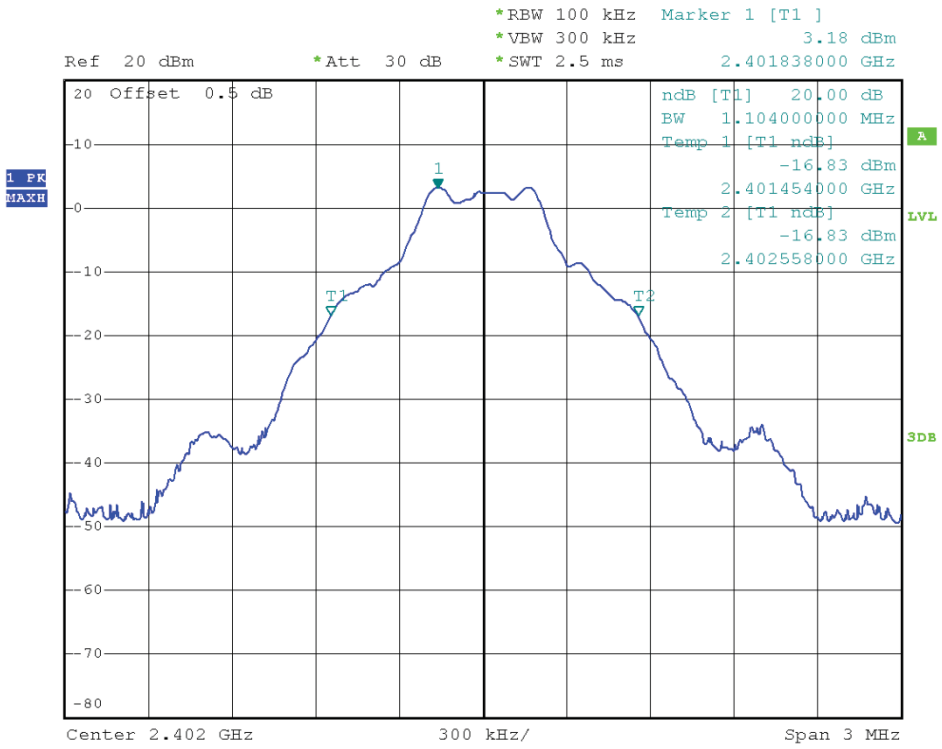
2.4.2.1. GFSK Mode

A. Test Verdict:

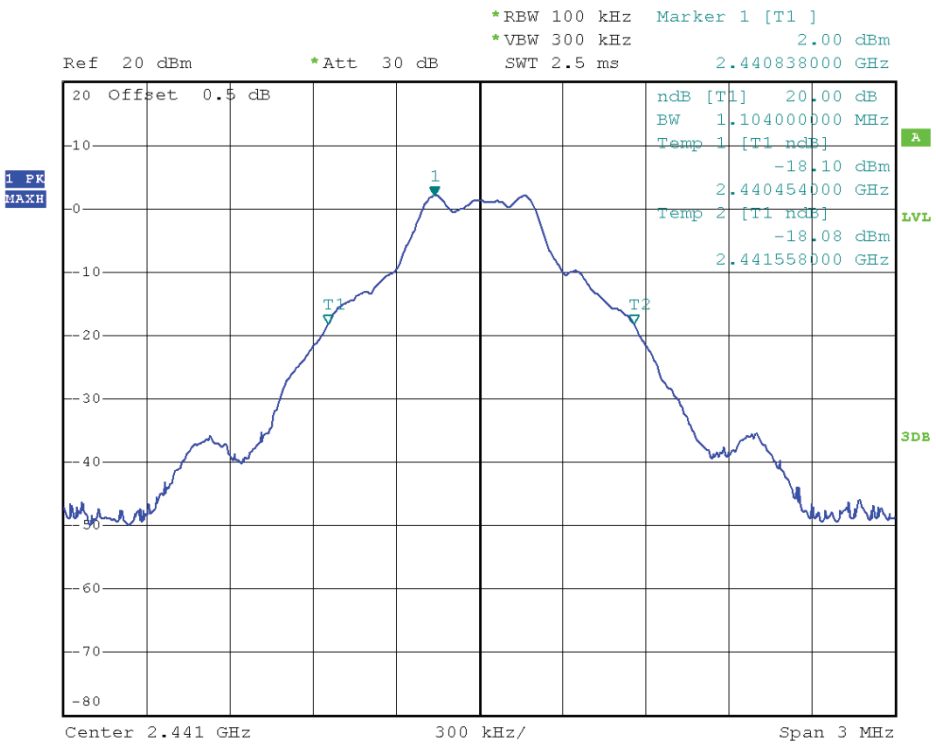
The maximum 20dB bandwidth measured is 1.104MHz according to the table below.

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

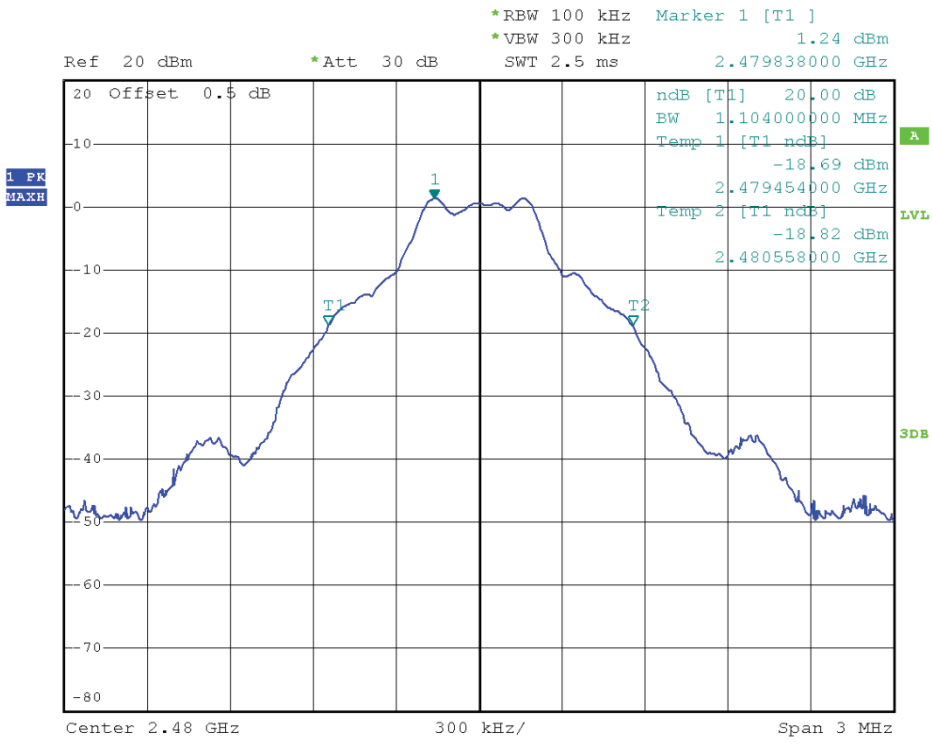
C. Test Plots:



(Plot A: Channel = 2402 @ GFSK)



(Plot B: Channel = 2441 @ GFSK)



(Plot C: Channel = 2480 @ GFSK)

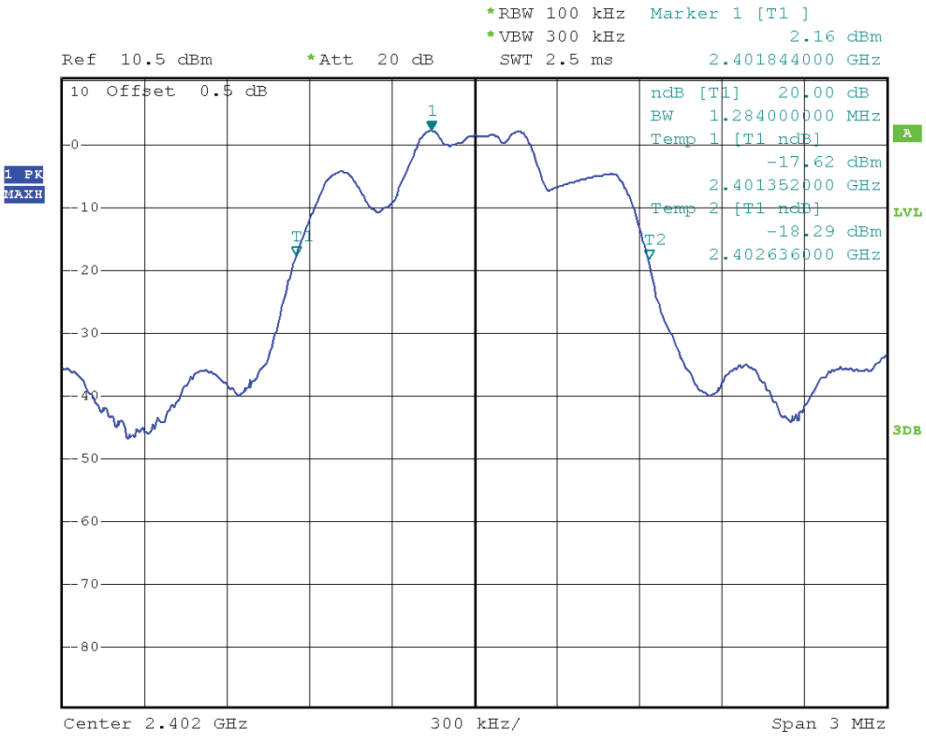
2.4.2.2. Π/4-DQPSK Mode

A. Test Verdict:

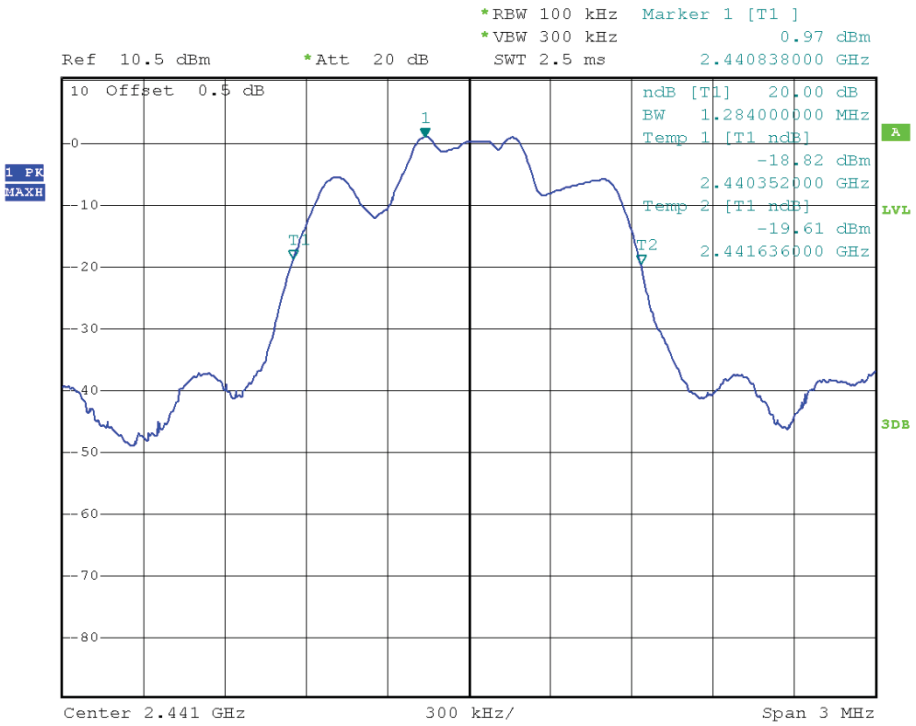
The maximum 20dB bandwidth measured is 1.284MHz according to the table below.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
0	2402	1.284	Plot A
39	2441	1.284	Plot B
78	2480	1.284	Plot C

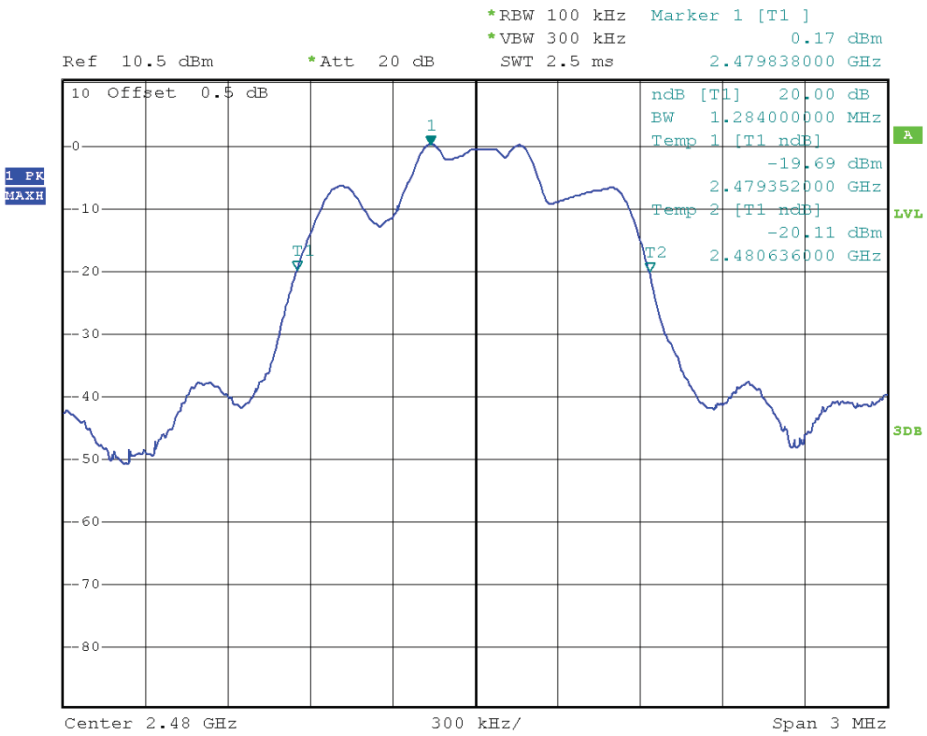
Test Plots:



(Plot A: Channel = 2402 @ Π/4-DQPSK)



(Plot B: Channel = 2441 @ ∏/4-DQPSK)



(Plot C: Channel = 2480 @ ∏/4-DQPSK)

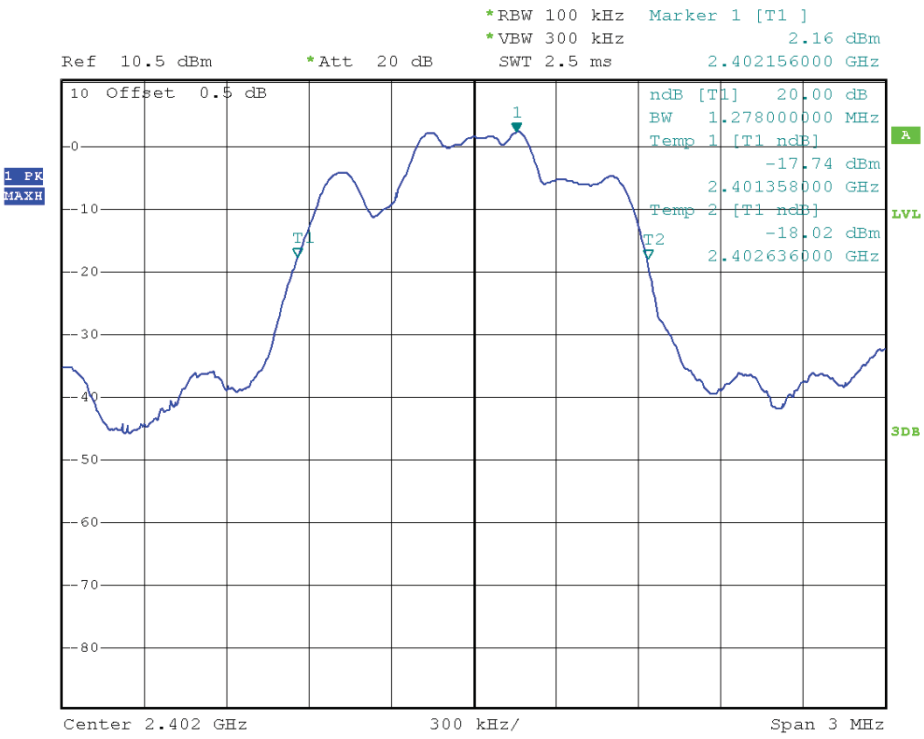
2.4.2.3. 8-DPSK Mode

A. Test Verdict:

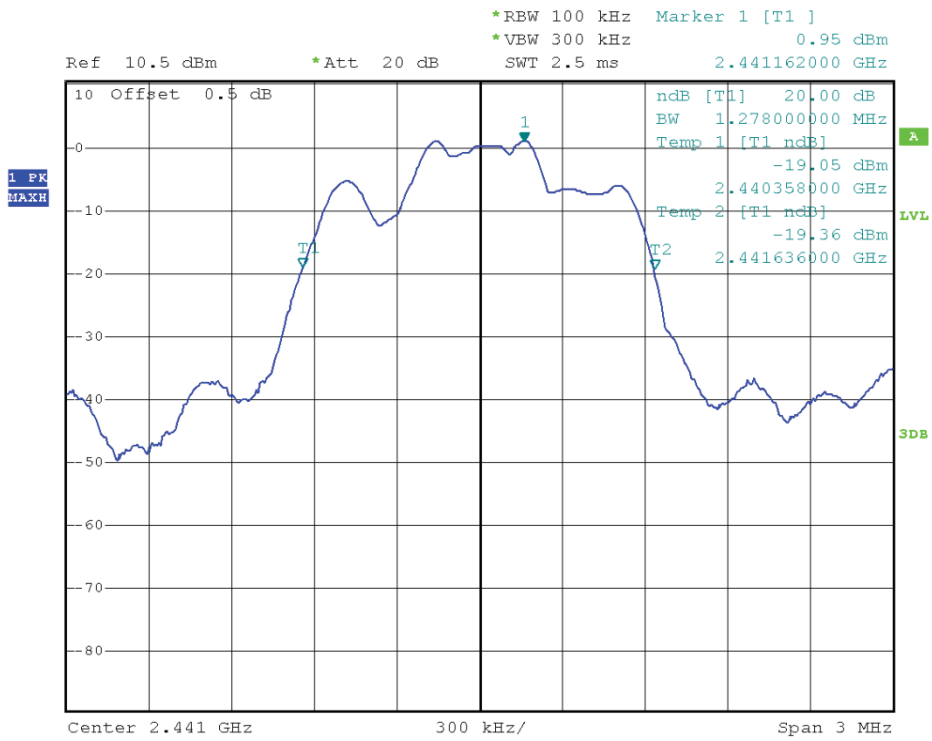
The maximum 20dB bandwidth measured is 1.278MHz according to the table below.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
0	2402	1.278	Plot A
39	2441	1.278	Plot B
78	2480	1.278	Plot C

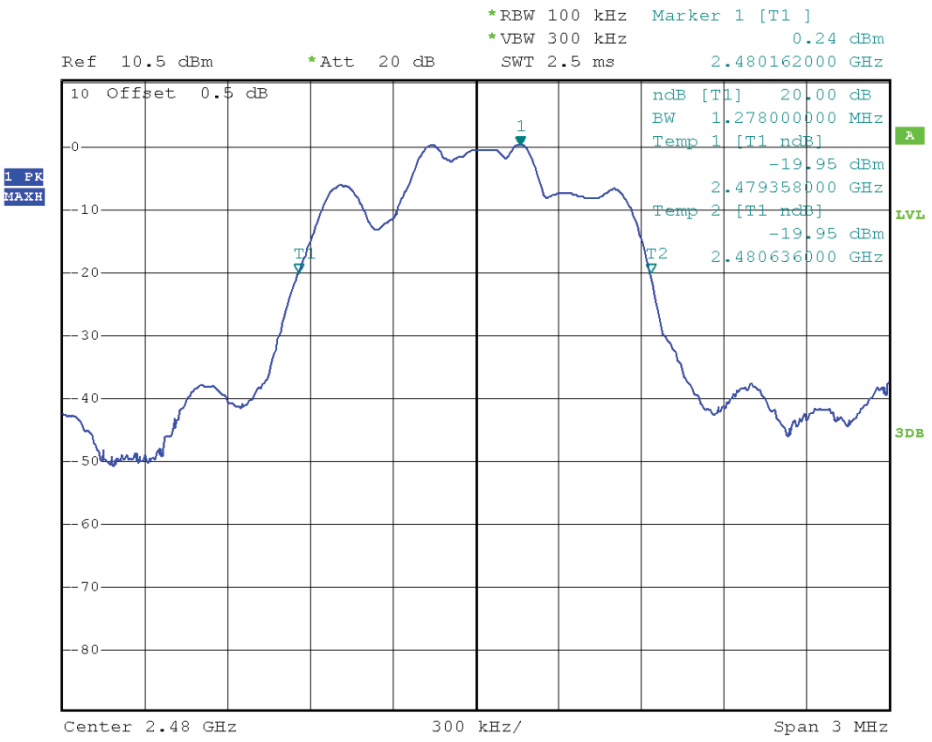
B. Test Plots:



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



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



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

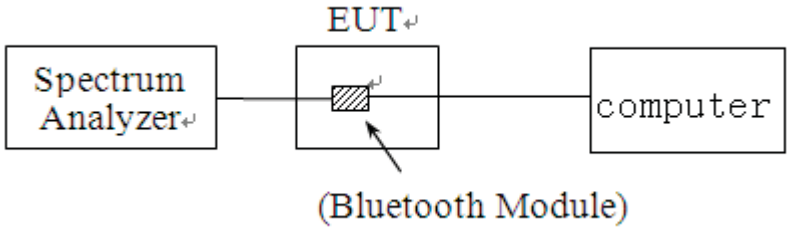
2.5. Carried Frequency Separation

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.	Calibration Due. Date
Spectrum Analyzer	R&S	FSP40	1164.4391.40	2014.06.10

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

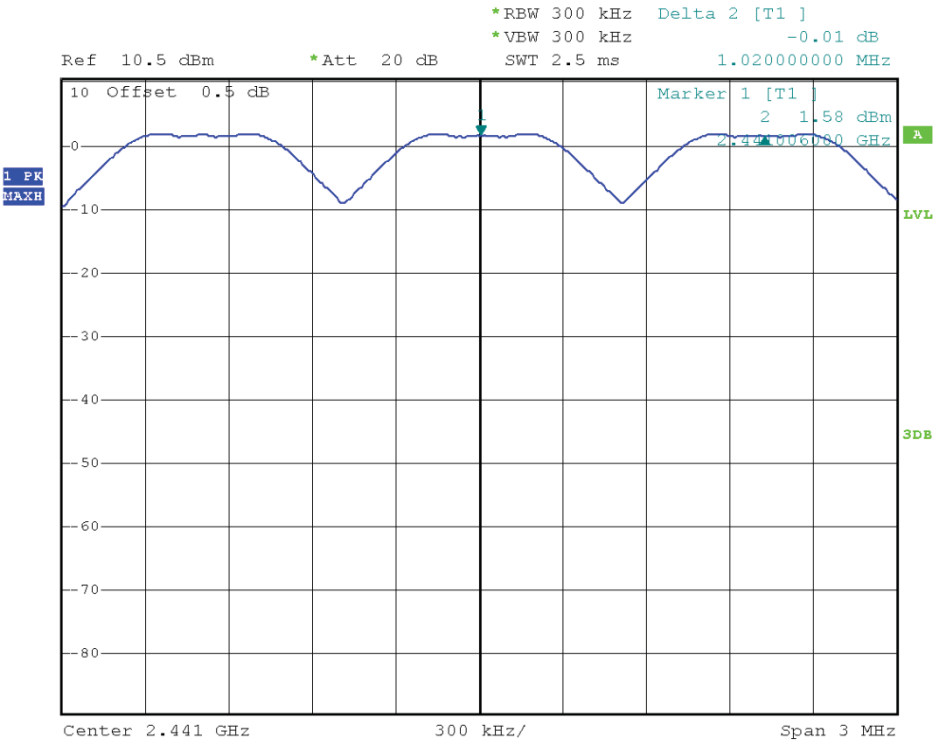
Trace = max hold

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

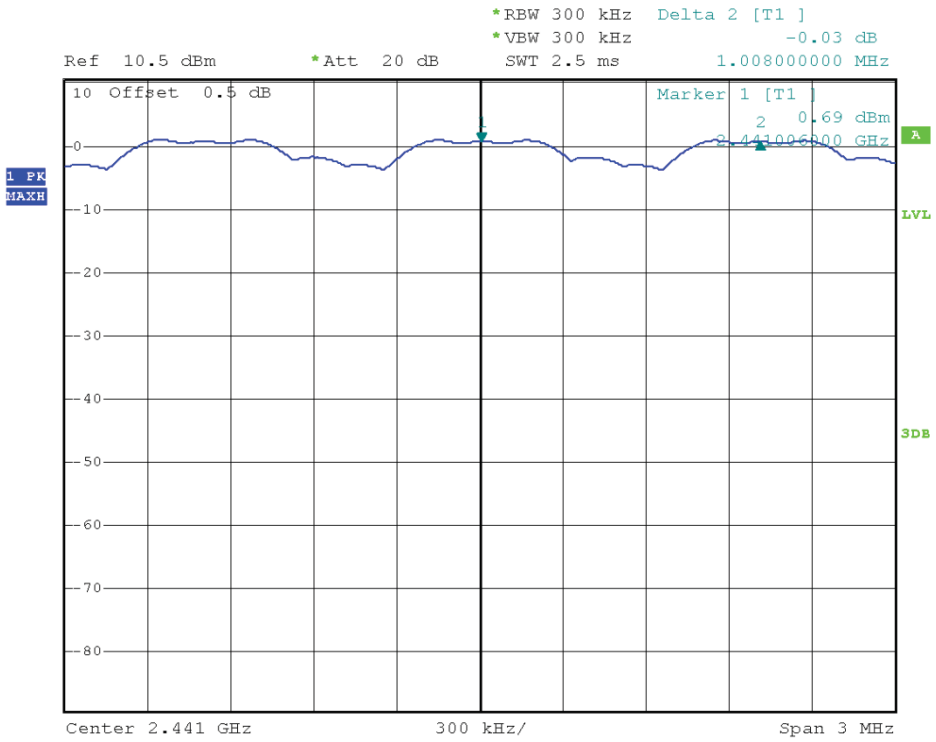
2.5.4. Test Result

The Bluetooth Module operates at hopping-on test mode.

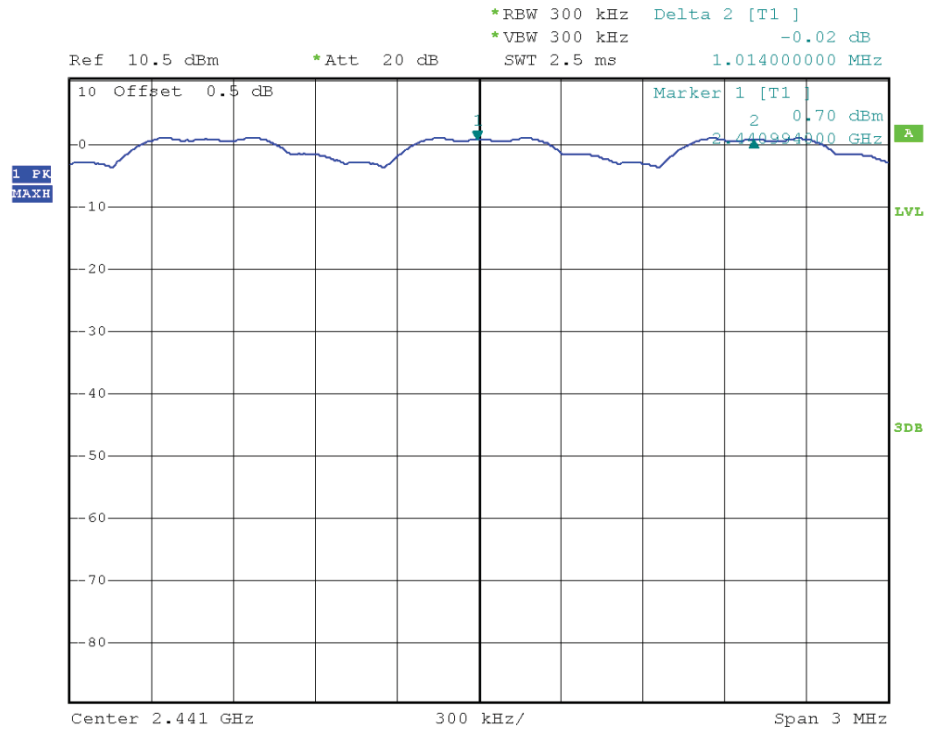
For any adjacent channels (e.g. the channel 39 and 40 as showed in the Plot A), the Module does have hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of the hopping channel (1.104MHz for GFSK mode, 1.284MHz for ∏/4-DQPSK mode and 1.278MHz for 8-DPSK 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)

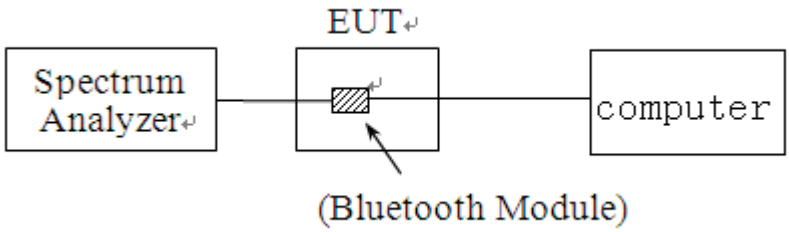
2.6. Time of Occupancy (Dwell time)

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 PC 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.	Calibration Due. Date
Spectrum Analyzer	R&S	FSP40	1164.4391.40	2014.06.10

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.

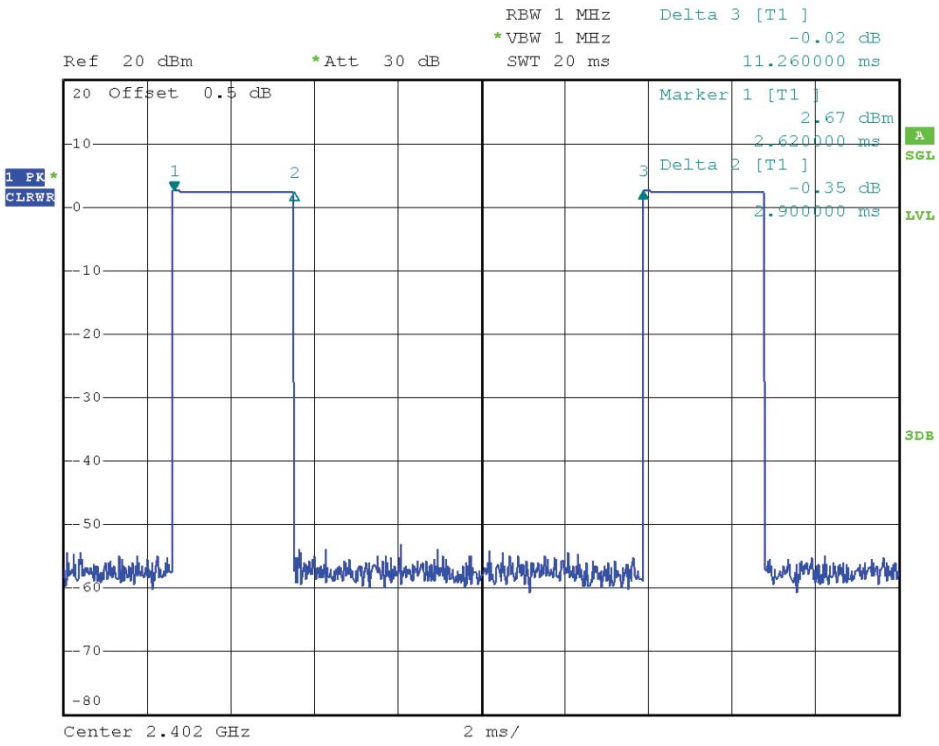
2.6.4.1. GFSK Mode

A. Test Verdict:

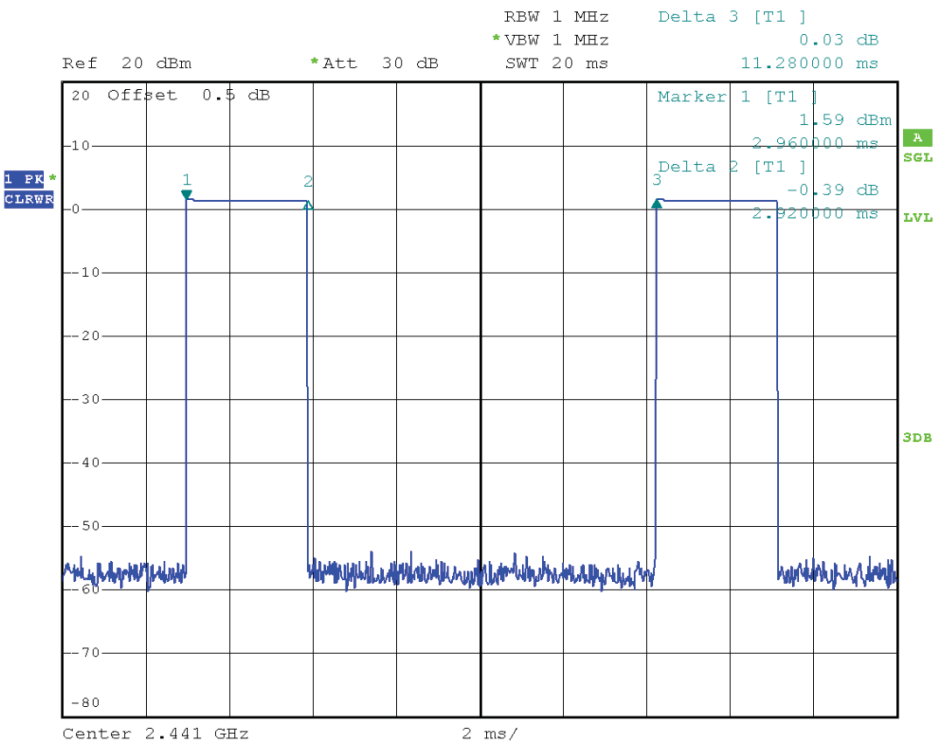
Channel	Frequency (MHz)	Pulse Time		Total of Dwell (ms)	Limit (ms)	Verdict
		ms	Refer to Plot			
0	2402	2.90	Plot A	309.333	400	PASS
39	2441	2.92	Plot B	311.467		PASS
78	2480	2.90	Plot C	309.333		PASS

B. Test Plots:

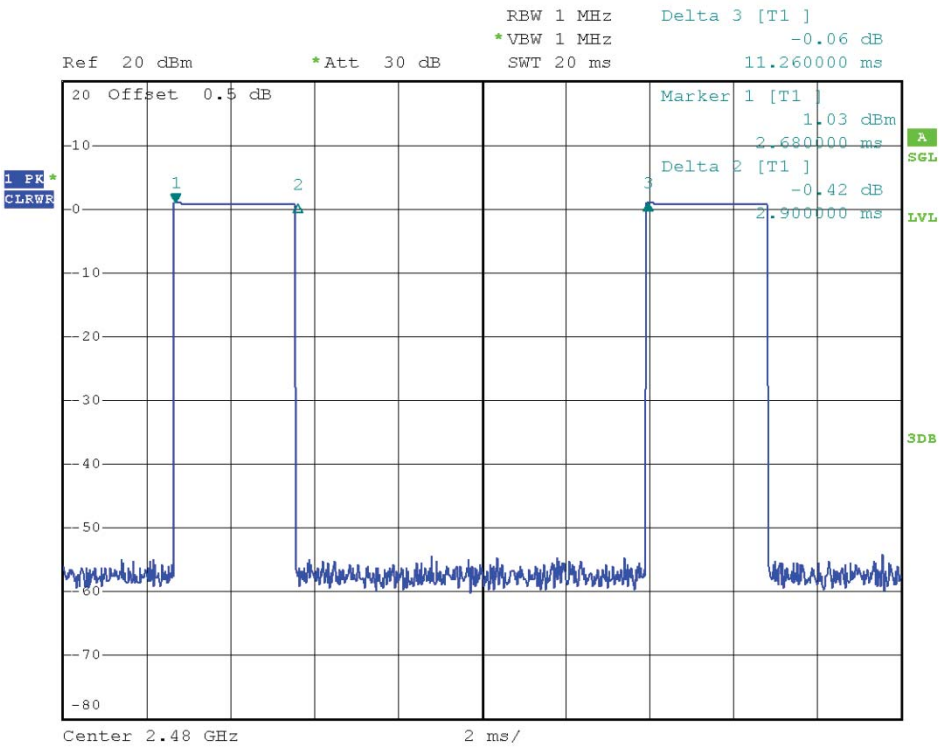
Note: the following plots record the Pulse Time of the Module carrier.



(Plot A: Channel = 2402 @ GFSK)



(Plot B: Channel = 2441 @ GFSK)



(Plot C: Channel = 2480 @ GFSK)

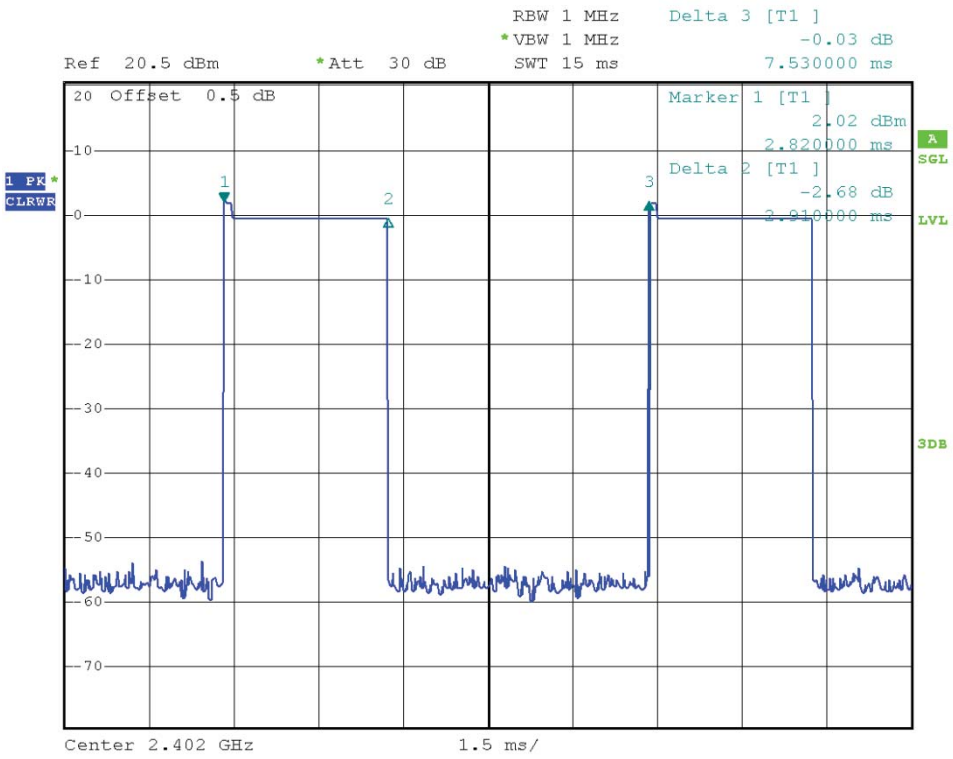
2.6.4.2. Π/4-DQPSK Mode

A. Test Verdict:

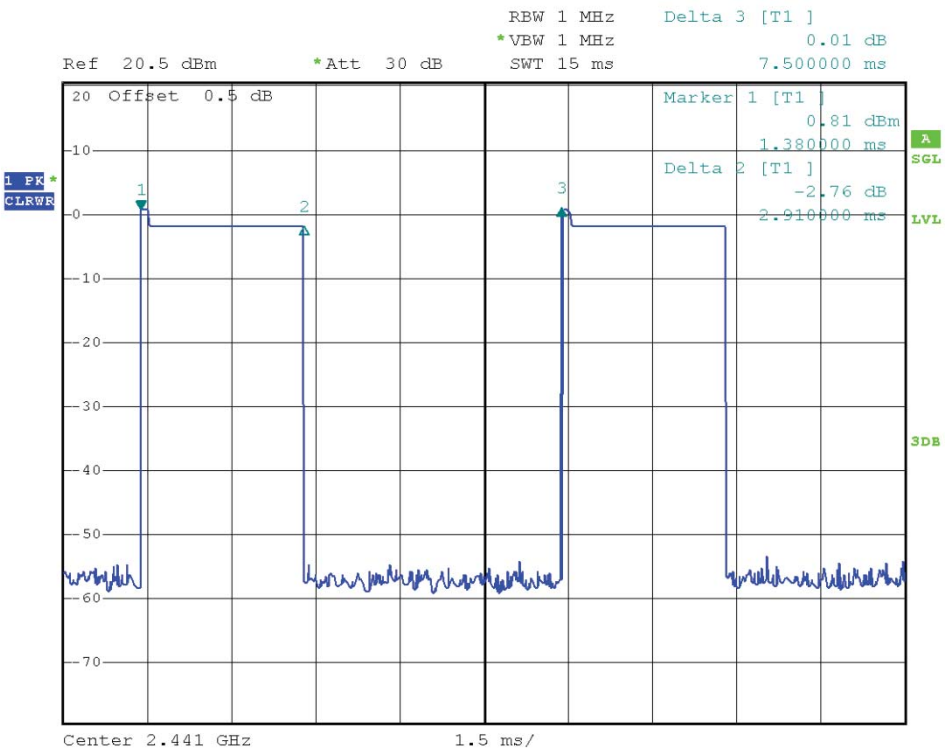
Channel	Frequency (MHz)	Pulse Time		Total of Dwell (ms)	Limit (ms)	Verdict
		ms	Refer to Plot			
0	2402	2.91	Plot A	310.400	400	PASS
39	2441	2.91	Plot B	310.400		PASS
78	2480	2.90	Plot C	309.333		PASS

B. Test Plots:

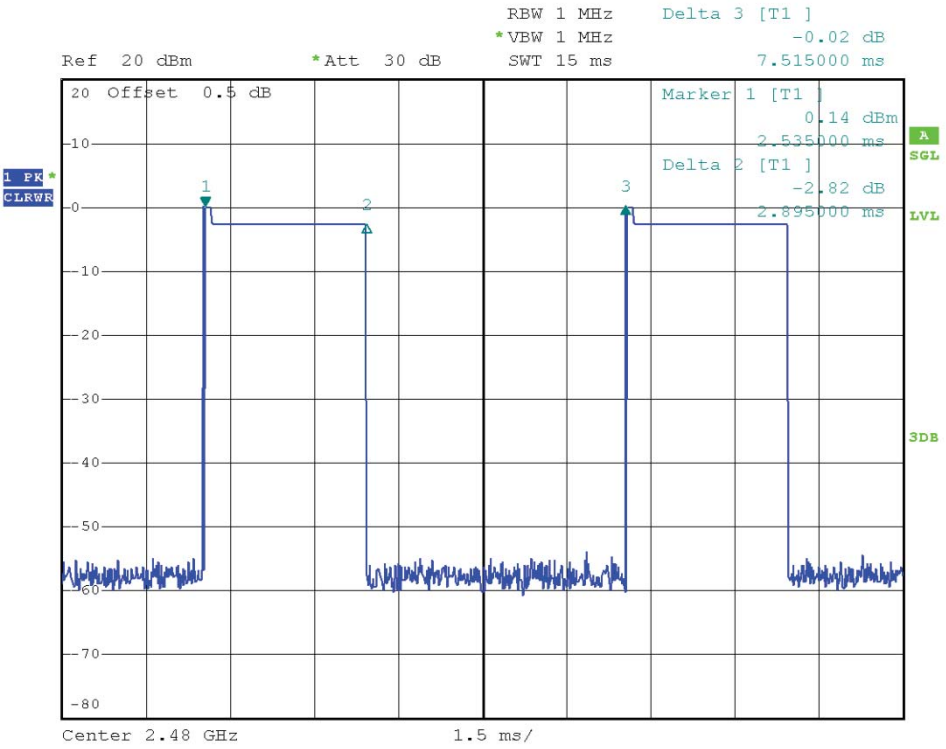
Note: the following plots record the Pulse Time of the Module carrier.



(Plot A: Channel = 2402 @ Π/4-DQPSK)



(Plot B: Channel = 2441 @ ∏/4-DQPSK)



(Plot C: Channel = 2480 @ ∏/4-DQPSK)

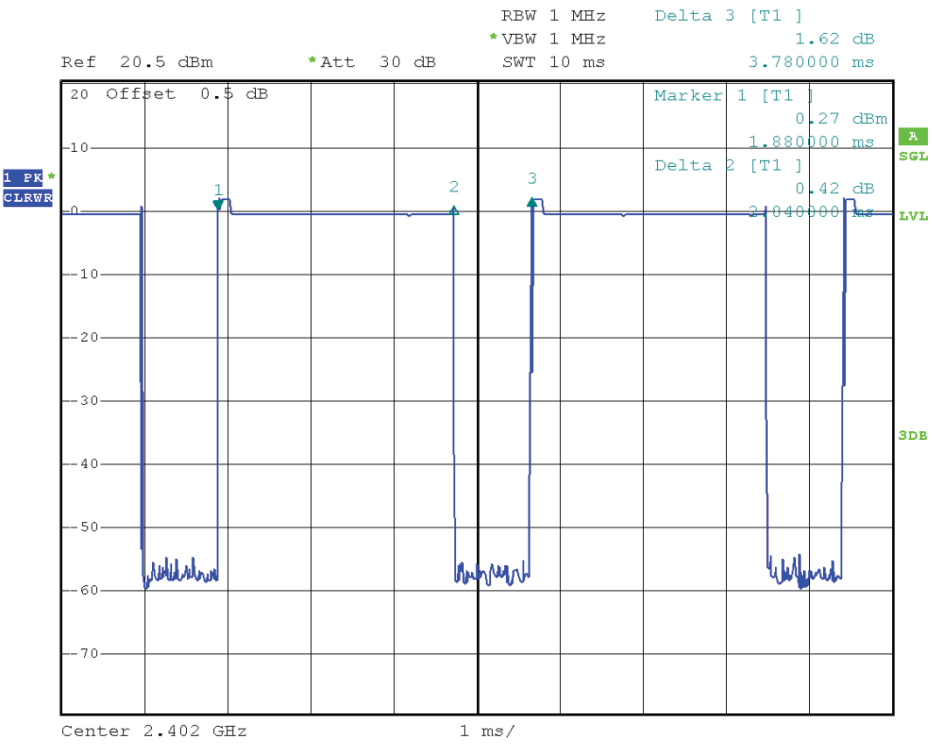
2.6.4.3. 8-DPSK mode

A. Test Verdict:

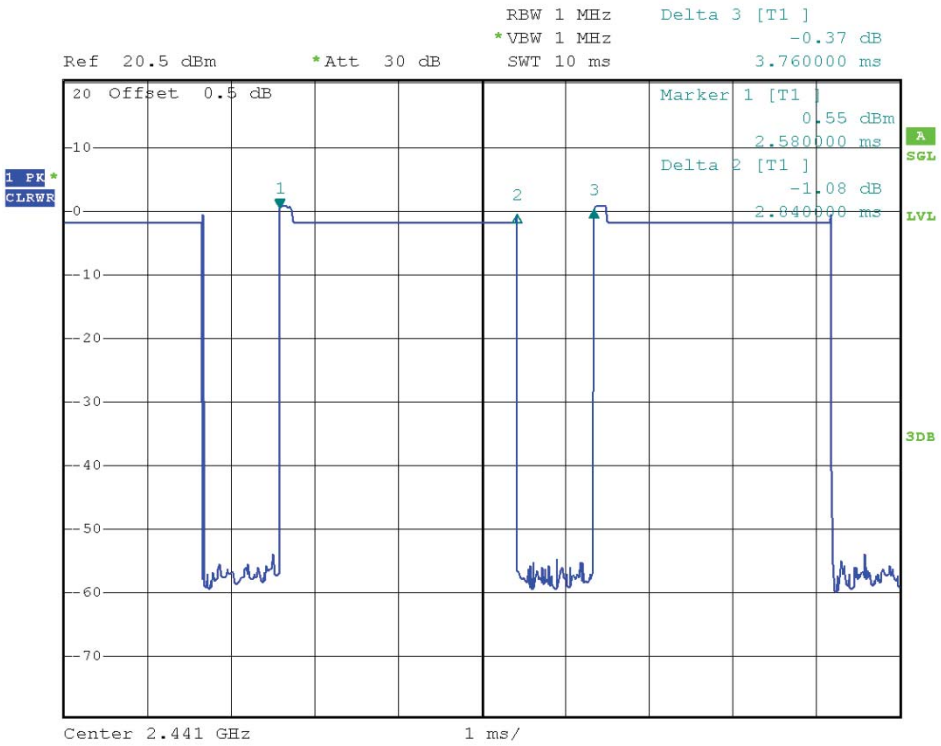
Channel	Frequency (MHz)	Pulse Time		Total of Dwell (ms)	Limit (ms)	Verdict
		ms	Refer to Plot			
0	2402	2.84	Plot A	302.933	400	PASS
39	2441	2.84	Plot B	302.933		PASS
78	2480	2.84	Plot C	302.933		PASS

B. Test Plots:

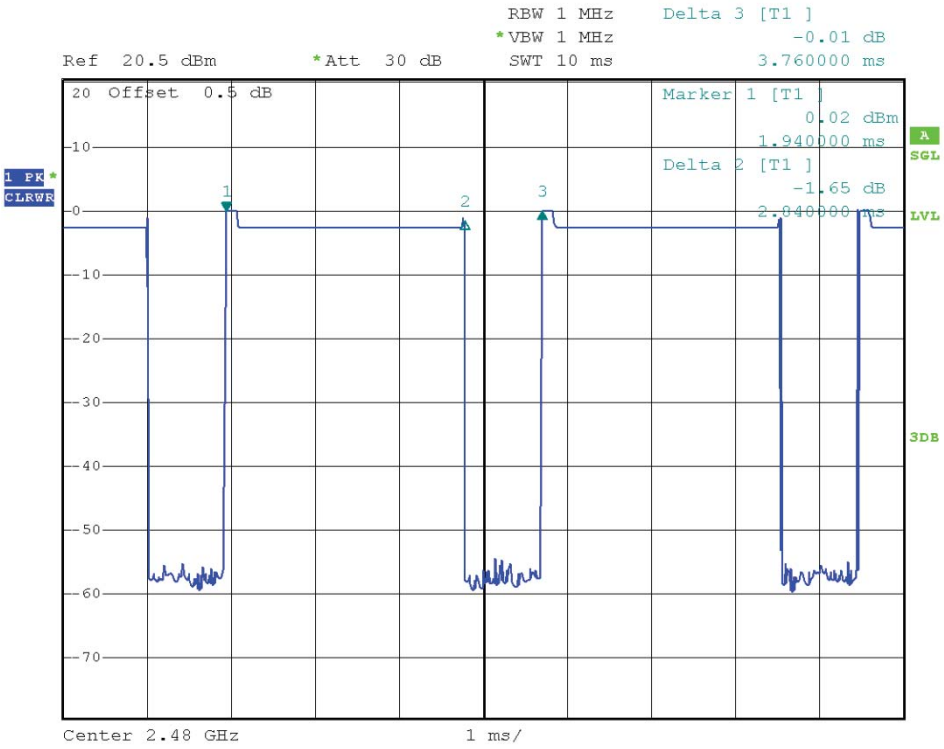
Note: the following plots record the Pulse Time of the Module carrier.



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



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



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

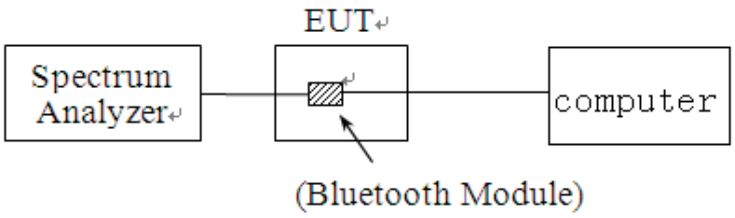
2.7. Conducted Spurious Emissions

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.	Calibration Due. Date
Spectrum Analyzer	R&S	FSP40	1164.4391.40	2014.06.10

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.

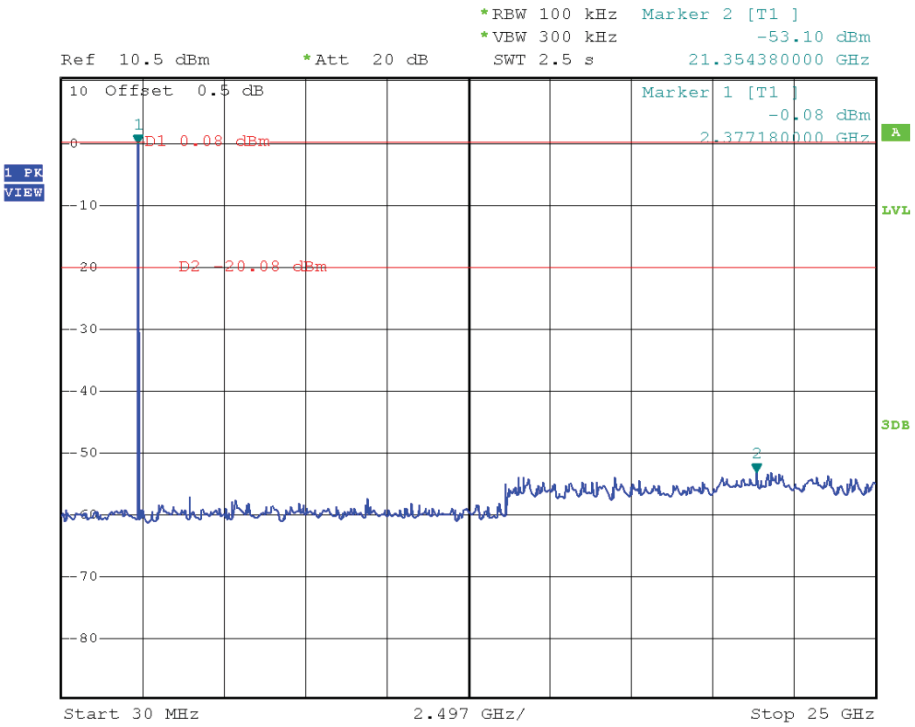
2.7.4.1. GFSK Mode

A. Test Verdict:

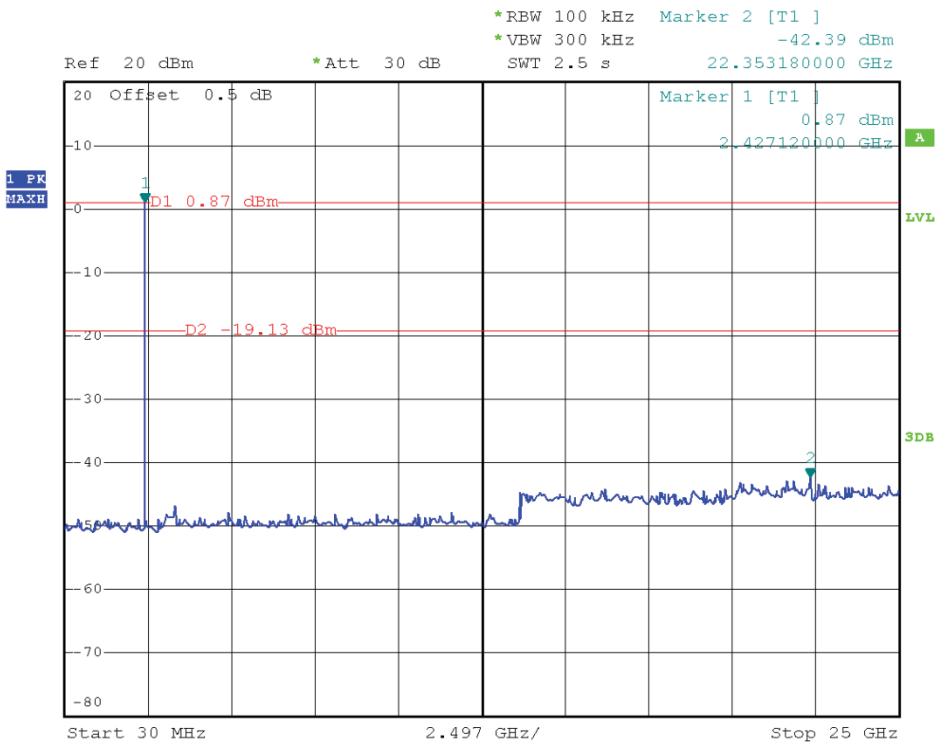
Channel	Frequency (MHz)	Measured Max. Out of Band EmissiondBm)	Refer to Plot	Limit (dBm)		Verdict
				Carrier Level	Calculated -20dBc Limit	
0	2402	-53.10	Plot A	-0.08	-20.08	PASS
39	2441	-42.39	Plot B	0.87	-19.13	PASS
78	2480	-43.18	Plot C	-2.54	-22.54	PASS

B. Test Plots:

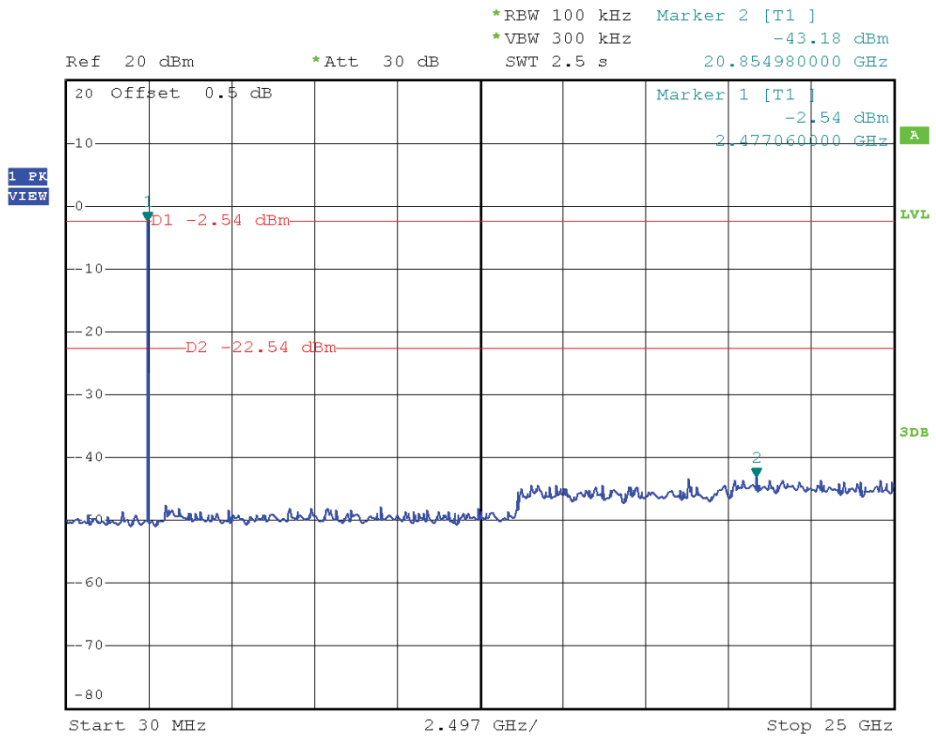
Note: the power of the Module transmitting frequency should be ignored.



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



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



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

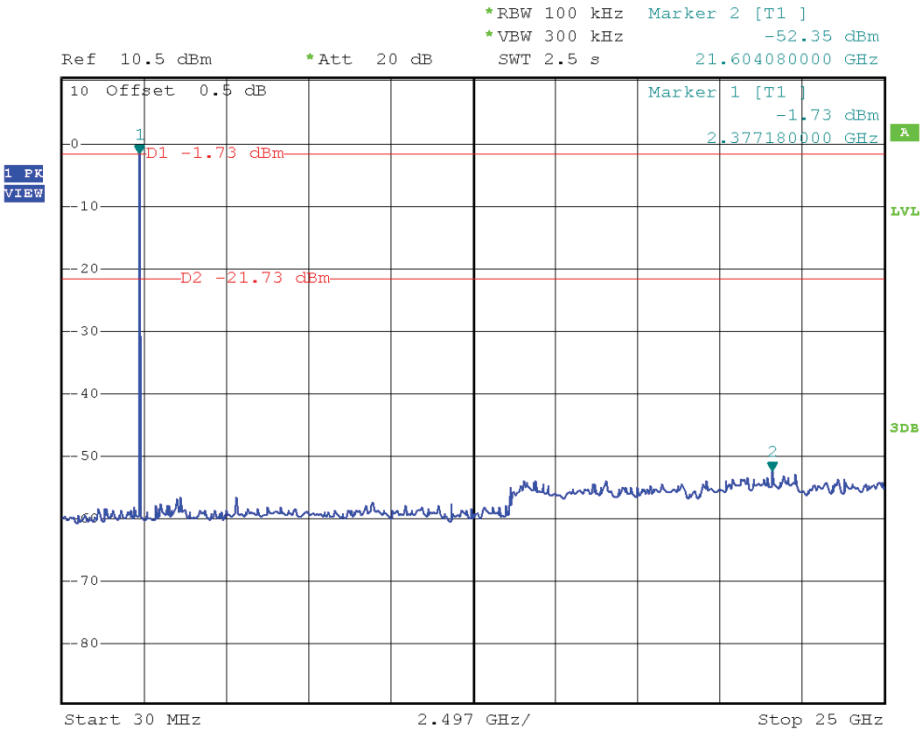
2.7.4.2. ∏/4-DQPSK Mode

A. Test Verdict:

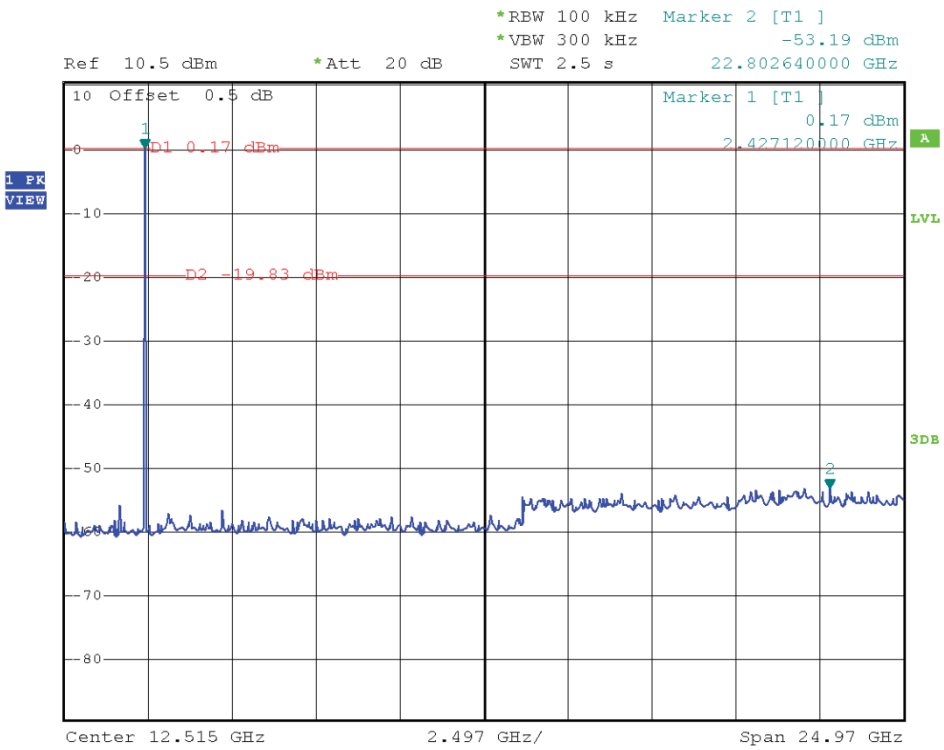
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Refer to Plot	Limit (dBm)		Verdict
				Carrier Level	Calculated -20dBc Limit	
0	2402	-52.35	Plot A	-1.73	-21.73	PASS
39	2441	-53.19	Plot B	0.17	-19.83	PASS
78	2480	-53.27	Plot C	-2.29	-22.29	PASS

B. Test Plots:

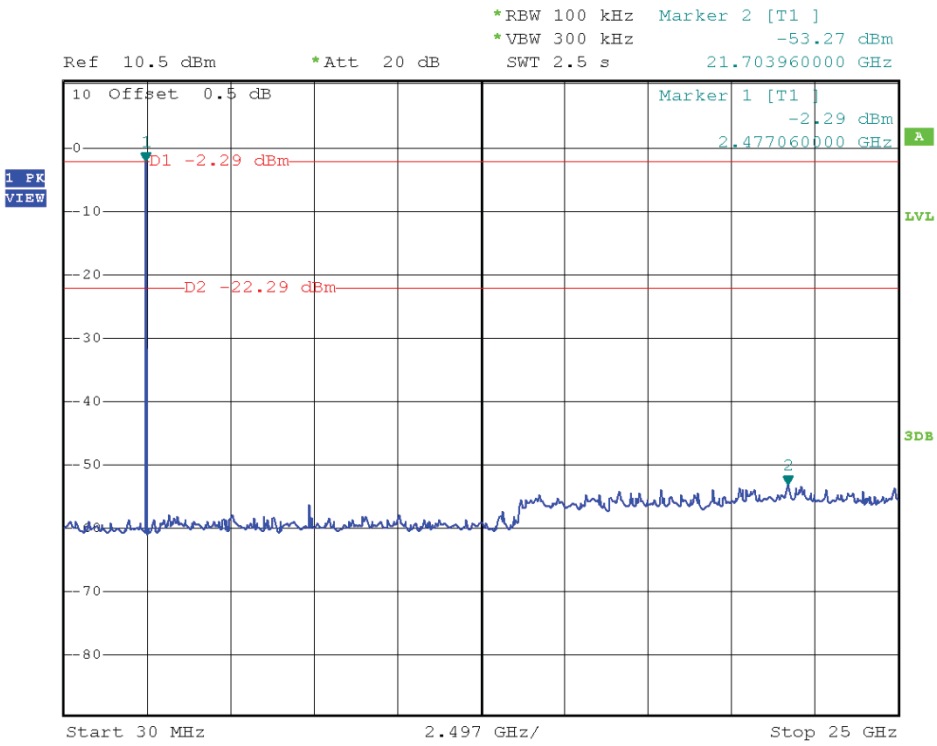
Note: the power of the Module transmitting frequency should be ignored.



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



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



(PlotC: Channel = 78, 30MHz to 25GHz @ ∏/3-DQPSK)

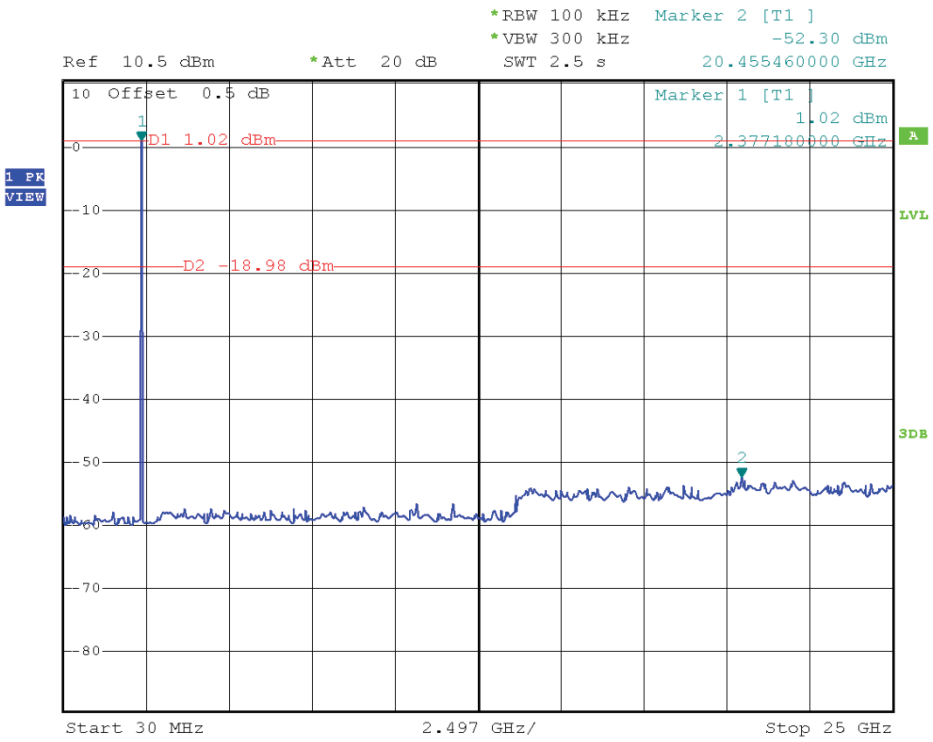
2.7.4.3. 8-DPSK Mode

A. Test Verdict:

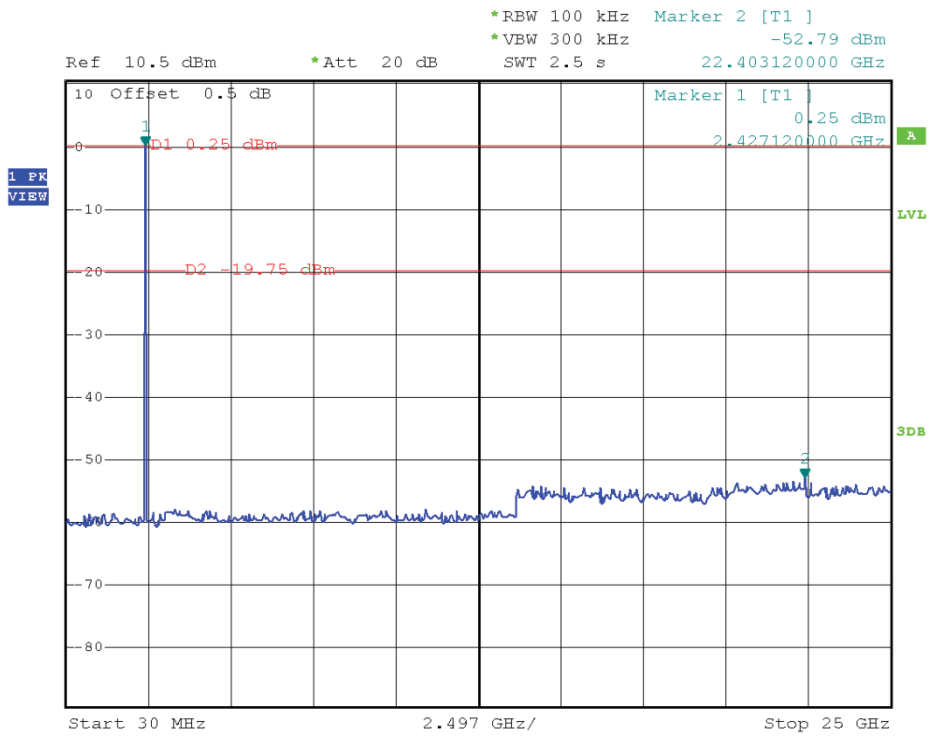
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Refer to Plot	Limit (dBm)		Verdict
				Carrier Level	Calculated -20dBc Limit	
0	2402	-52.30	Plot G.1	1.02	-18.98	PASS
39	2441	-52.79	Plot H.1	0.25	-19.75	PASS
78	2480	-52.66	Plot I.1	-1.94	-21.94	PASS

B. Test Plots:

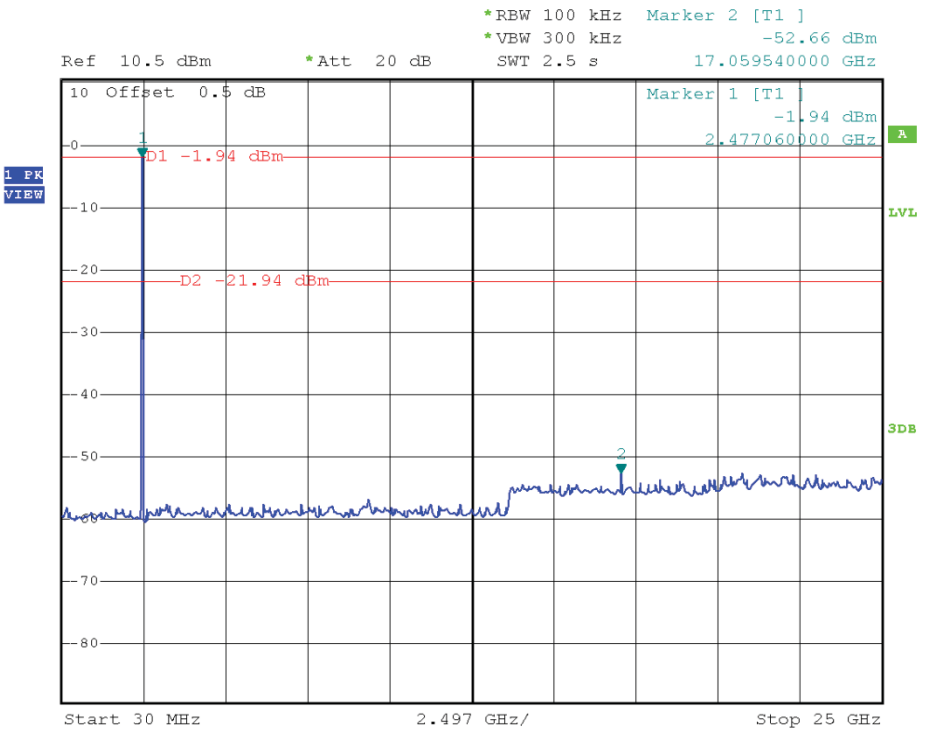
Note: the power of the Module transmitting frequency should be ignored.



(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)

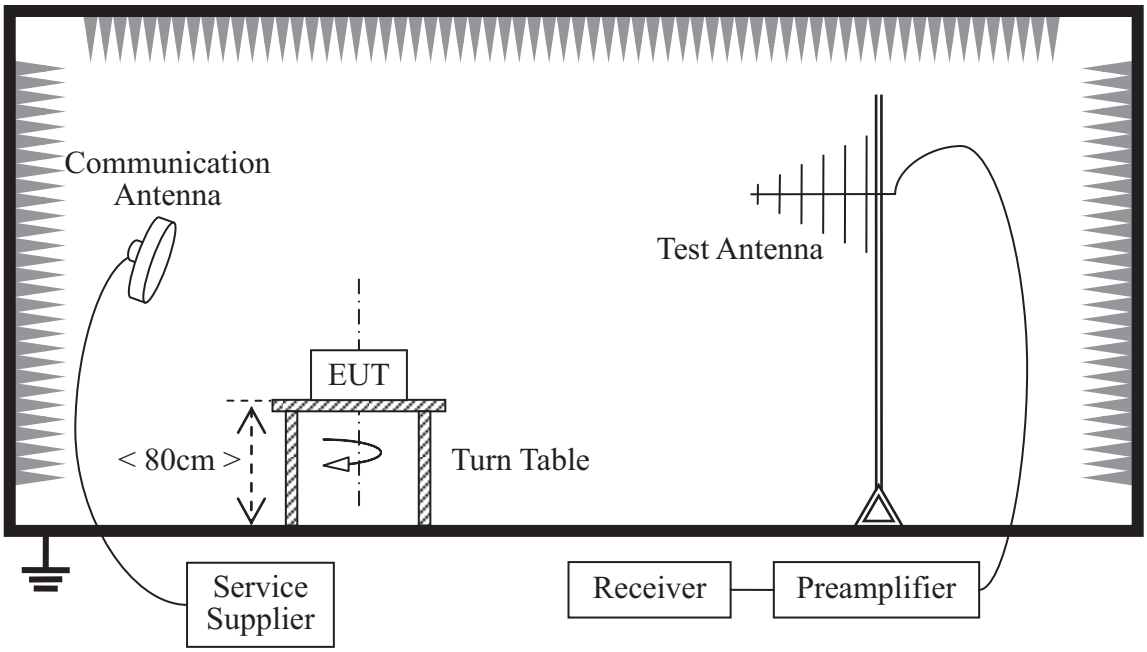
2.8. Band Edge

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.	Calibration Due. Date
Receiver	R&S	ESIB26	A0304218	2014.06.07
Full-Anechoic Chamber	Albatross	12.8m*6.8m*6.4m	A0412372	2014.06.07
Double ridge horn antenna	R&S	HF906	A0304225	2014.06.10
Ultra-wideband antenna	R&S	HL562	A0304224	2014.06.10
Ampilier 1G~18GHz	R&S	MITEQ AFS42-00101800	25-S-42	2014.06.05

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

For Radiated emission reading :
RBW=1MHz ,VBW=3MHz ,PK detector
for PK value
RBW =1MHz,VBW=10Hz, PK detector
for AV value

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

Note1: The red vertical lines “F1” in the following charts is to indicate the frequencies 2400MHz and 2483.5MHz respectively.
Note2: Both horizontal and vertical polarization direction of the antenna has been performed, only the worst case recorded in this report.

Remark : All emission out of band comply with 15.209.

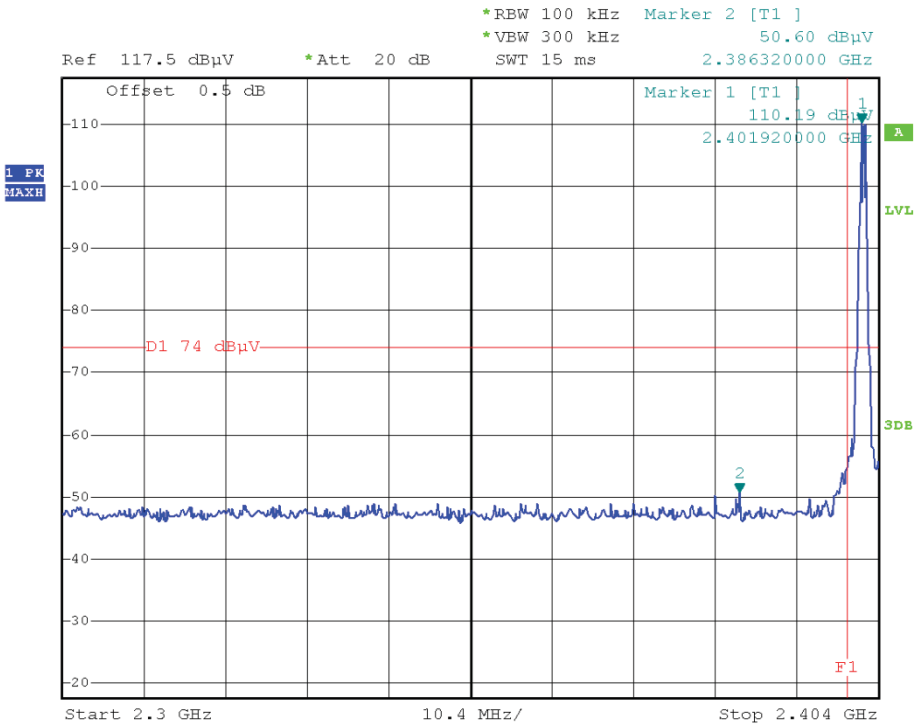
2.8.4.1. GFSK Mode

A. Test Verdict:

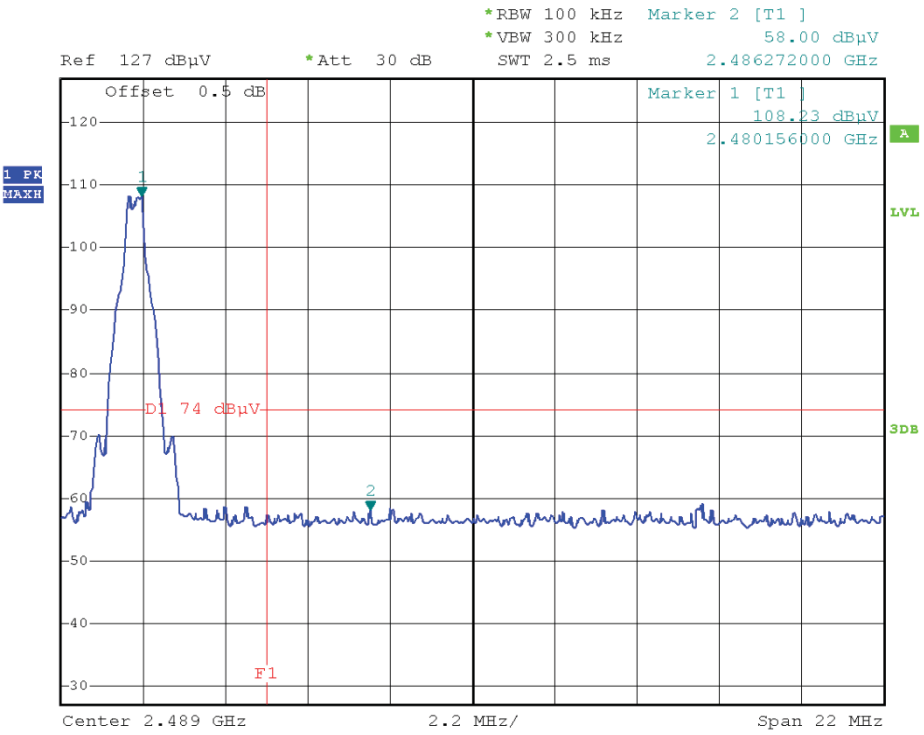
(Un-hopping)

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	2386.320	PK	50.60	-31.70	28.3	47.20	74	Pass
0	2386.320	AV	45.37	-31.70	28.3	41.97	54	Pass
0	2399.84	PV	49.58	-31.70	28.3	46.18	74	Pass
0	2399.84	AV	46.36	-31.70	28.3	42.96	54	Pass
78	2486.272	PK	58.00	-29.45	29.2	57.75	74	Pass
78	2486.272	AV	48.32	-29.45	29.2	48.07	54	Pass
78	2495.864	PV	56.62	-29.45	29.2	56.37	74	Pass
78	2495.864	AV	49.18	-29.45	29.2	48.93	54	Pass

B. Test Plots:



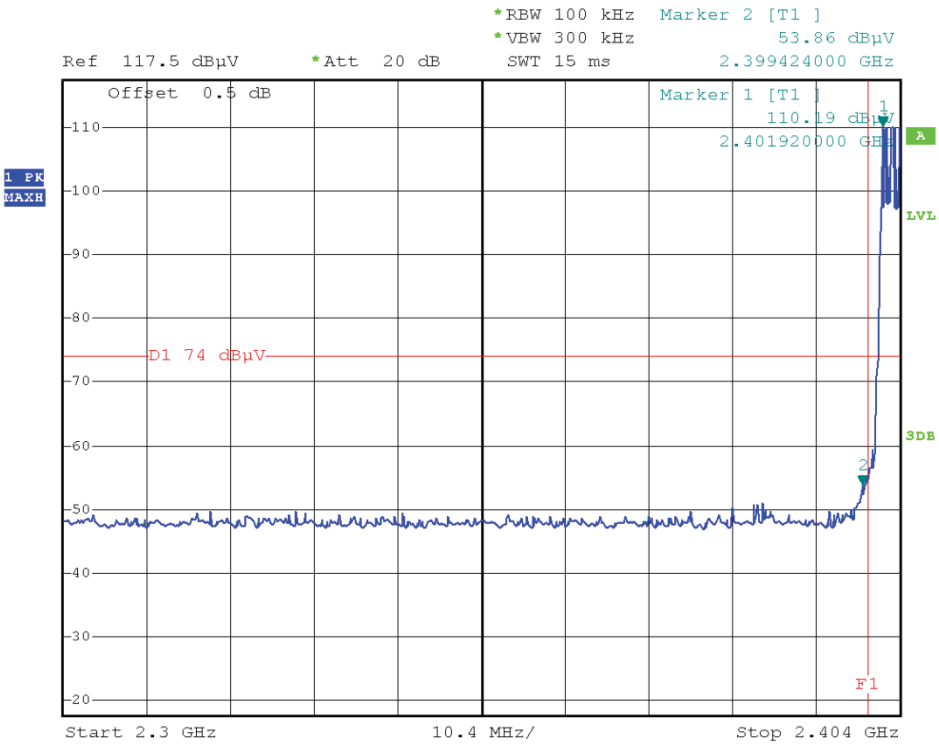
(Plot A1: Channel = 0 PEAK @ GFSK)



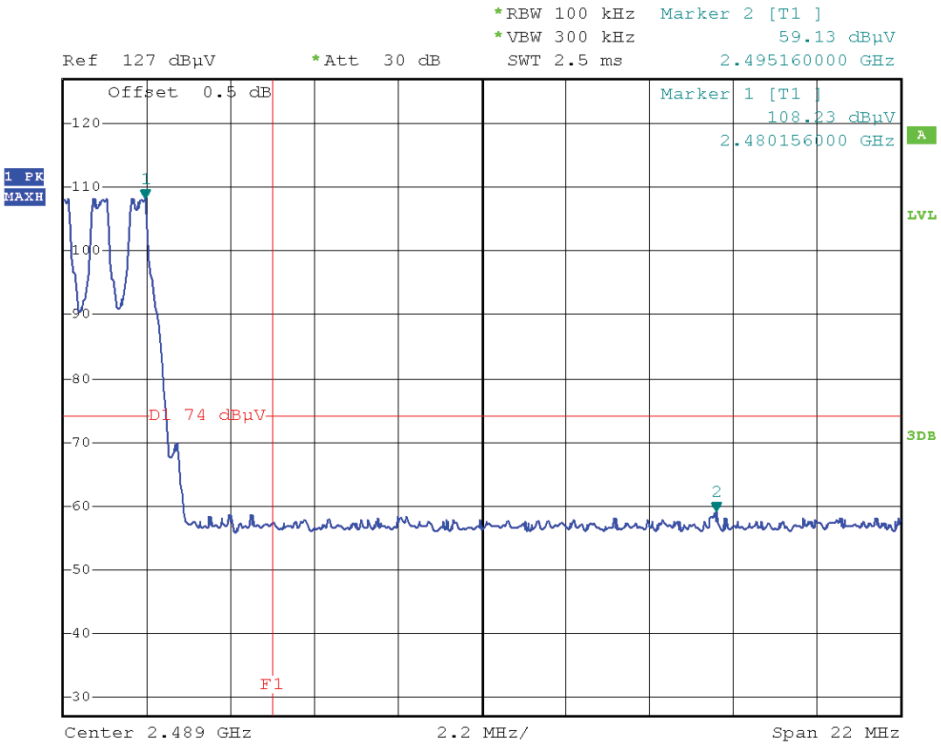
(Plot B1: Channel = 78 PEAK @ GFSK)

(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	2398.800	PK	52.47	-31.78	28.2	48.89	74	Pass
0	2398.800	AV	46.12	-31.78	28.2	42.54	54	Pass
0	2399.424	PK	45.64	-31.78	28.2	42.06	74	Pass
0	2399.424	AV	53.86	-31.78	28.2	50.28	54	Pass
78	2487.944	PK	57.93	-29.45	29.2	57.68	74	Pass
78	2487.944	AV	48.32	-29.45	29.2	48.07	54	Pass
78	2495.160	PK	59.13	-29.24	29.3	59.19	74	Pass
78	2495.160	AV	47.52	-29.24	29.3	47.58	54	Pass



(Plot A1-1: Channel = 0 PEAK)



(Plot B1-1: Channel = 78 PEAK)

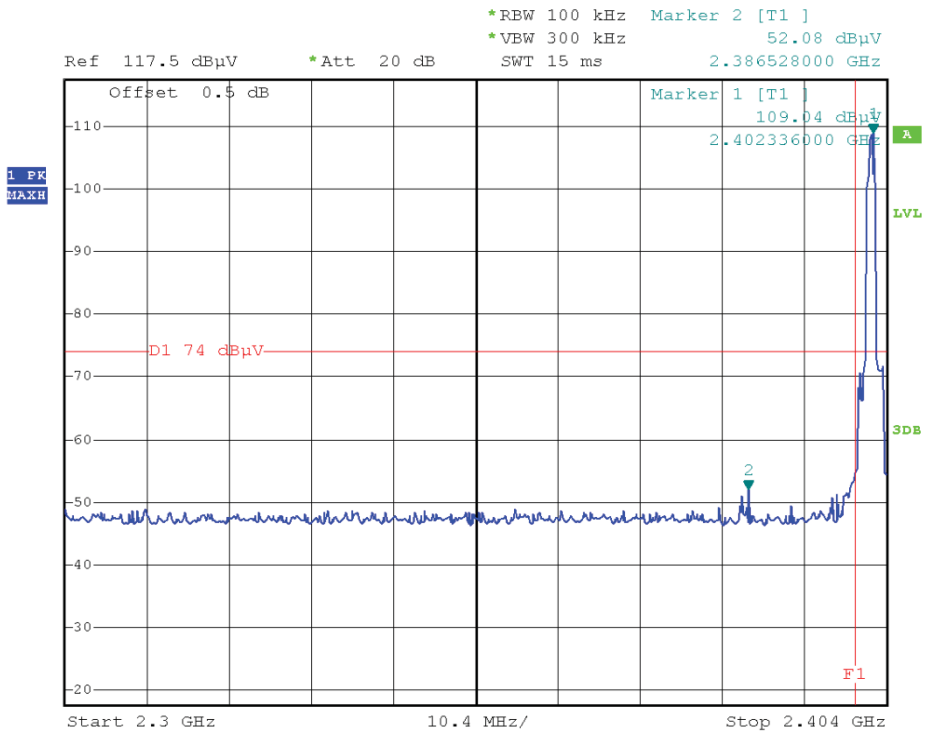
2.8.4.2. ∏/4-DQPSK Mode

A. Test Verdict:

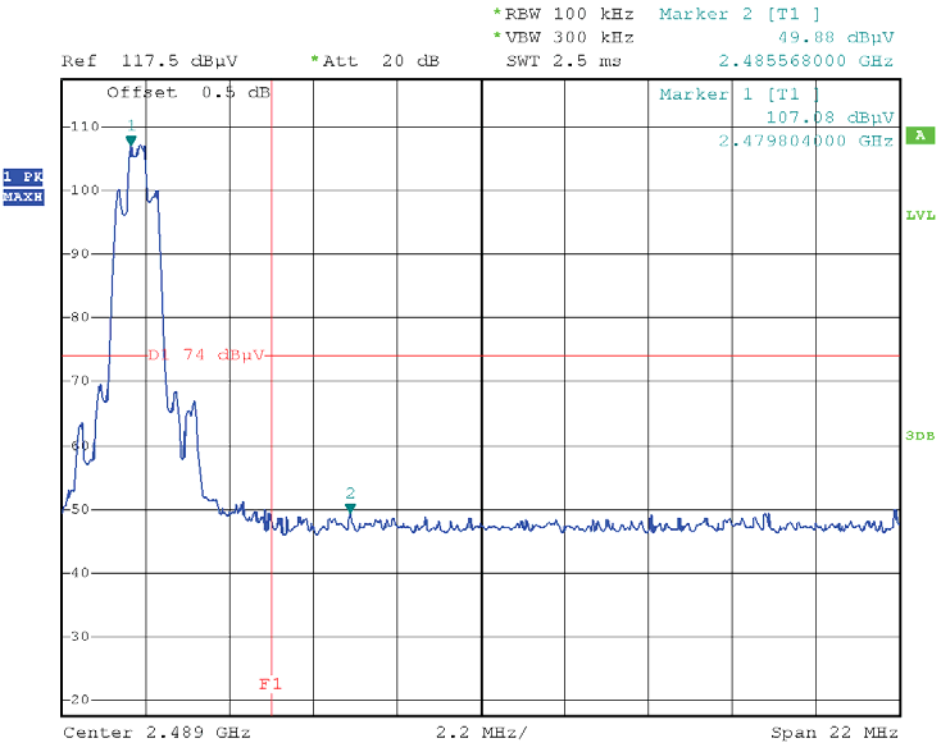
(Un-hopping)

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	2386.528	PK	52.08	-31.75	28.2	48.53	74	Pass
0	2386.528	AV	44.58	-31.74	28.2	41.04	54	Pass
78	2485.568	PK	49.88	-29.45	29.2	49.63	74	Pass
78	2485.568	AV	49.28	-29.45	29.2	49.03	54	Pass
78	2495.547	PK	49.62	-29.45	29.2	49.37	74	Pass
78	2495.547	AV	49.50	-29.45	29.2	49.25	54	Pass

B. Test Plots:



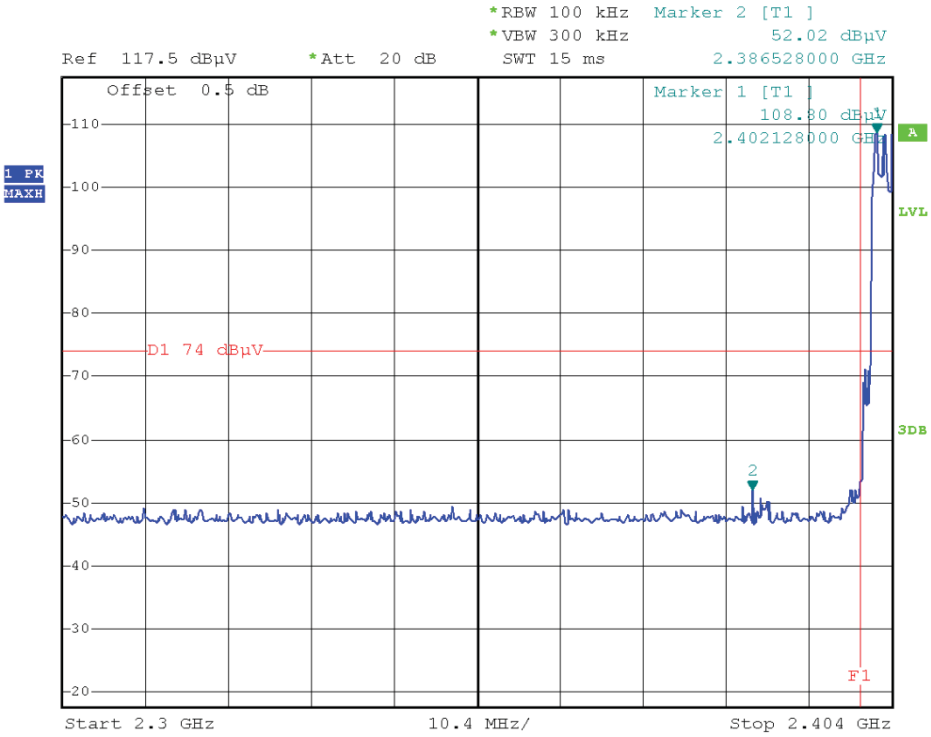
(Plot C1: Channel = 0 PEAK @ ∏/4-DQPSK)



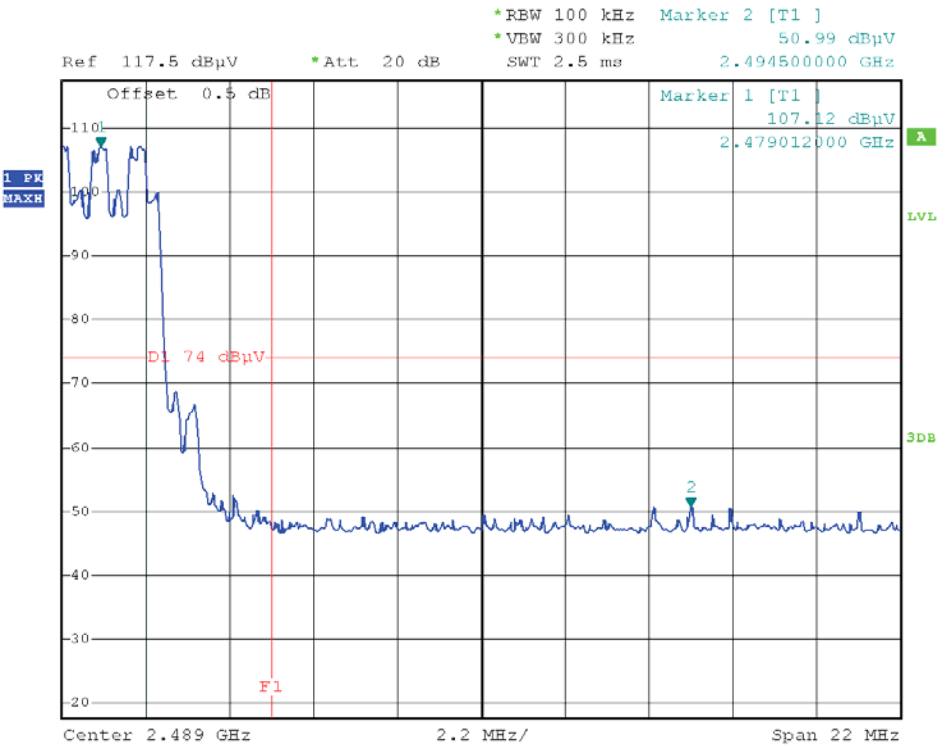
(Plot D1: Channel = 78 PEAK @ Π/4-DQPSK)

(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	2386.528	PK	52.02	-31.65	28.5	48.87	74	Pass
0	2386.528	AV	45.82	-31.65	28.5	42.67	54	Pass
0	2399.632	PK	51.33	-31.82	28.1	47.61	74	Pass
0	2399.632	AV	46.07	-31.82	28.1	42.35	54	Pass
78	2483.500	PK	48.95	-29.45	29.2	48.70	74	Pass
78	2483.500	AV	47.32	-29.45	29.2	47.07	54	Pass
78	2491.500	PK	50.99	-29.45	29.2	50.74	74	Pass
78	2491.500	AV	50.63	-29.45	29.2	50.38	54	Pass
78	2495.512	PK	50.97	-29.45	29.2	50.72	74	Pass
78	2495.512	AV	50.78	-29.45	29.2	50.53	54	Pass



(Plot C1-1: Channel = 0 PEAK)



(Plot D1-1: Channel = 78 PEAK)

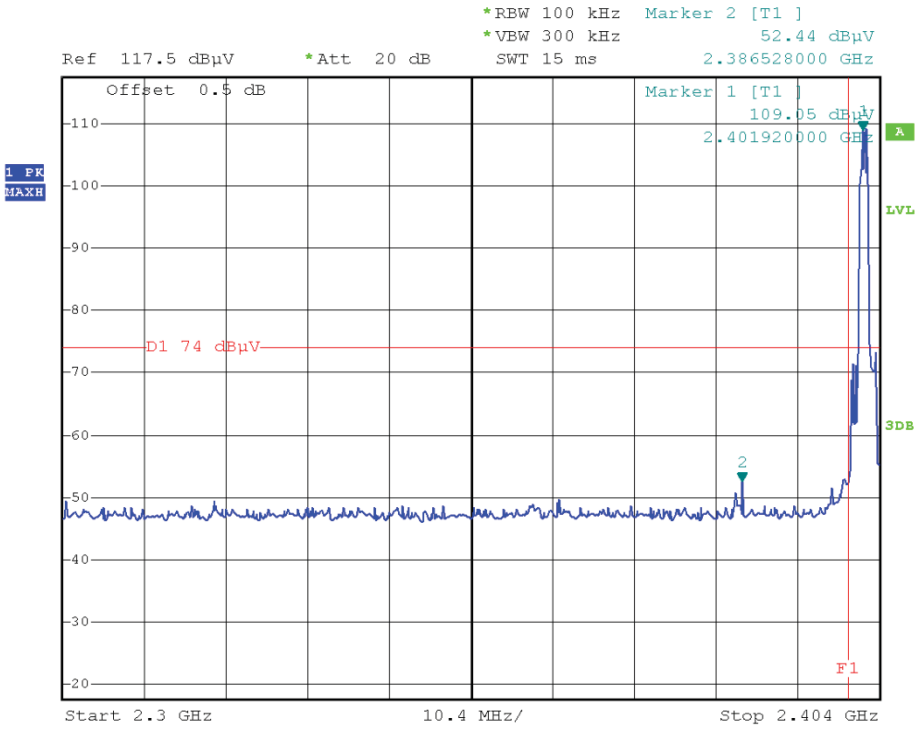
2.8.4.3. 8-DPSK Mode

A. Test Verdict:

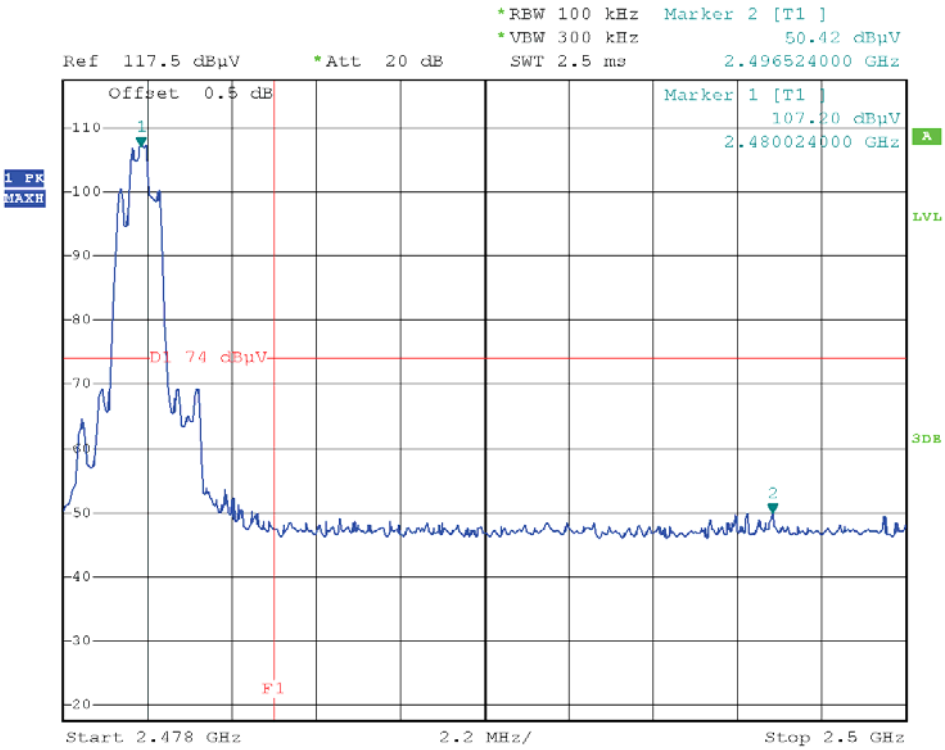
(Un-hopping)

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	2386.528	PK	52.44	-31.81	28.1	48.73	74	Pass
0	2386.528	AV	45.09	-31.70	28.3	41.69	54	Pass
78	2483.500	PK	47.69	-29.45	29.2	47.44	74	Pass
78	2483.500	AV	46.82	-29.45	29.2	46.57	54	Pass
78	2496.524	PK	50.42	-29.45	29.2	50.17	74	Pass
78	2496.524	AV	50.00	-29.45	29.2	49.75	54	Pass

B. Test Plots:



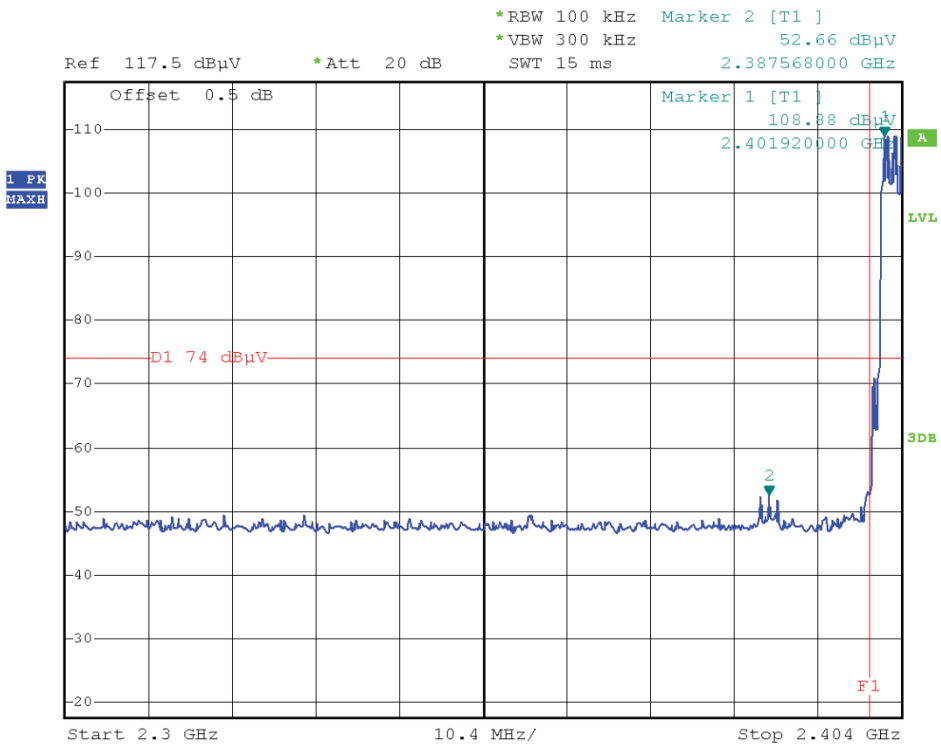
(Plot E1: Channel = 0 PEAK @ 8-DPSK Mode)



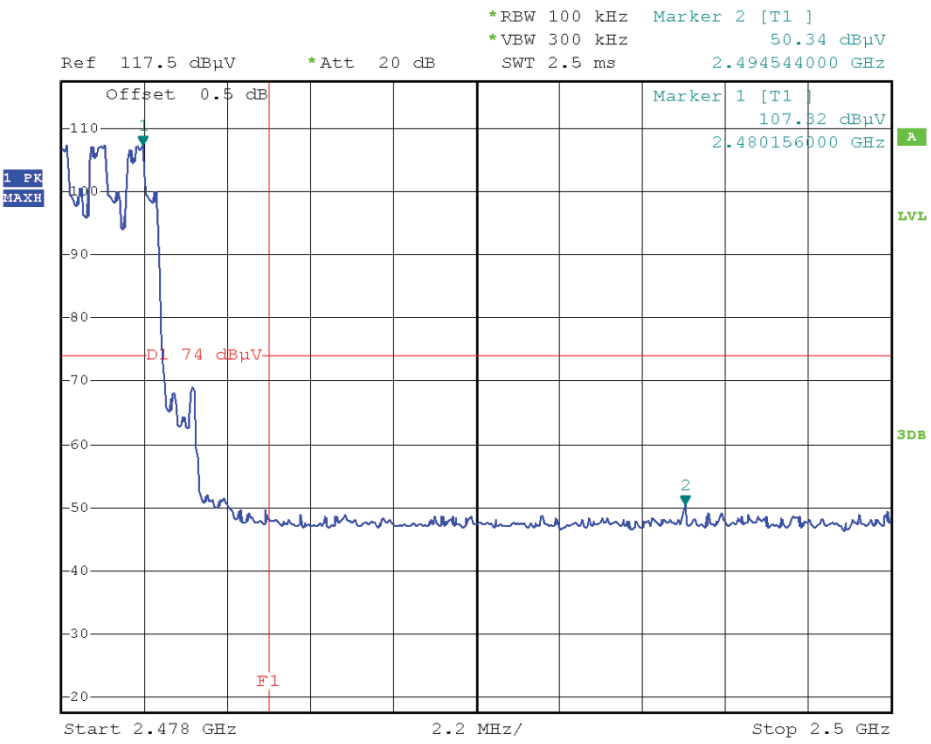
(Plot F1: Channel = 78 PEAK @ 8-DPSK Mode)

(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	2380.704	PK	51.38	-31.70	28.3	47.98	74	Pass
0	2380.704	AV	45.22	-31.70	28.3	41.82	54	Pass
0	2387.568	PK	52.66	-31.70	28.3	49.26	74	Pass
0	2387.568	AV	45.19	-31.70	28.3	41.79	54	Pass
78	2484.028	PK	49.98	-29.25	29.3	50.03	74	Pass
78	2484.028	AV	49.01	-29.25	29.3	49.06	54	Pass
78	2494.544	PK	50.34	-29.45	29.2	50.09	74	Pass
78	2494.544	AV	48.26	-29.45	29.2	48.01	54	Pass



(Plot E1-1: Channel = 0 PEAK)



(Plot F1-1: Channel = 78 PEAK)

2.9. Conducted Emission

2.9.1. Requirement

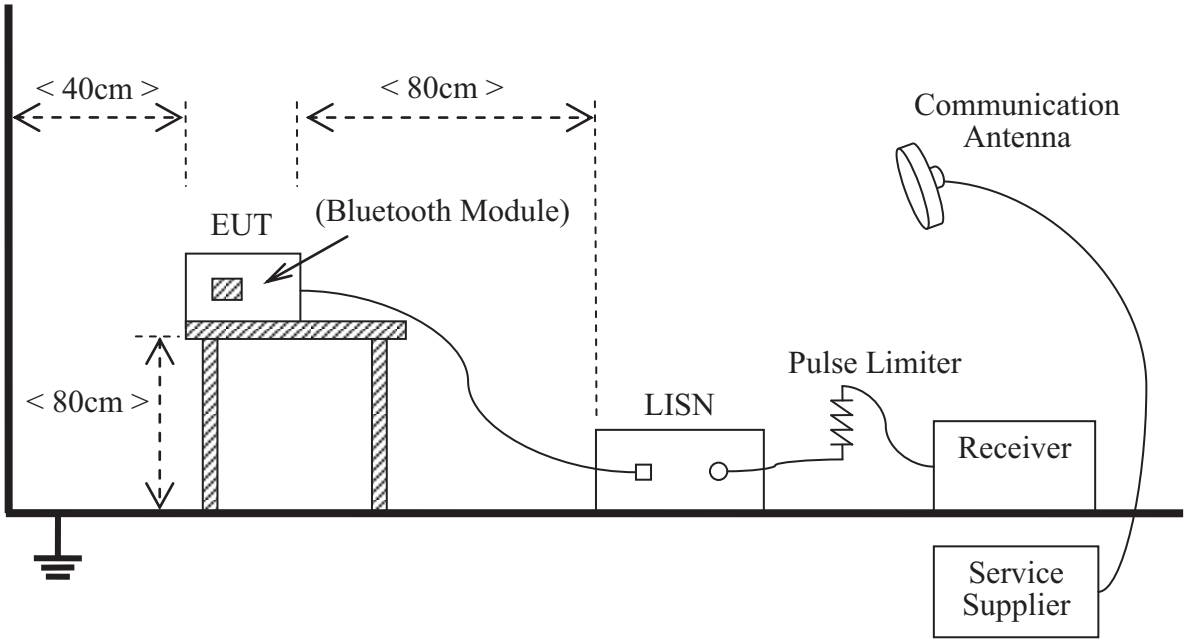
According to FCC section 15.207, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz shall not exceed the limits in the following 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 PC. 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.	Calibration Due. Date
Test Receiver	ROHDE&SCHWARZ	ESCS30	A0304260	2014.06.10
LISN	ROHDE&SCHWARZ	ESH2-Z5	A0304221	2014.06.10

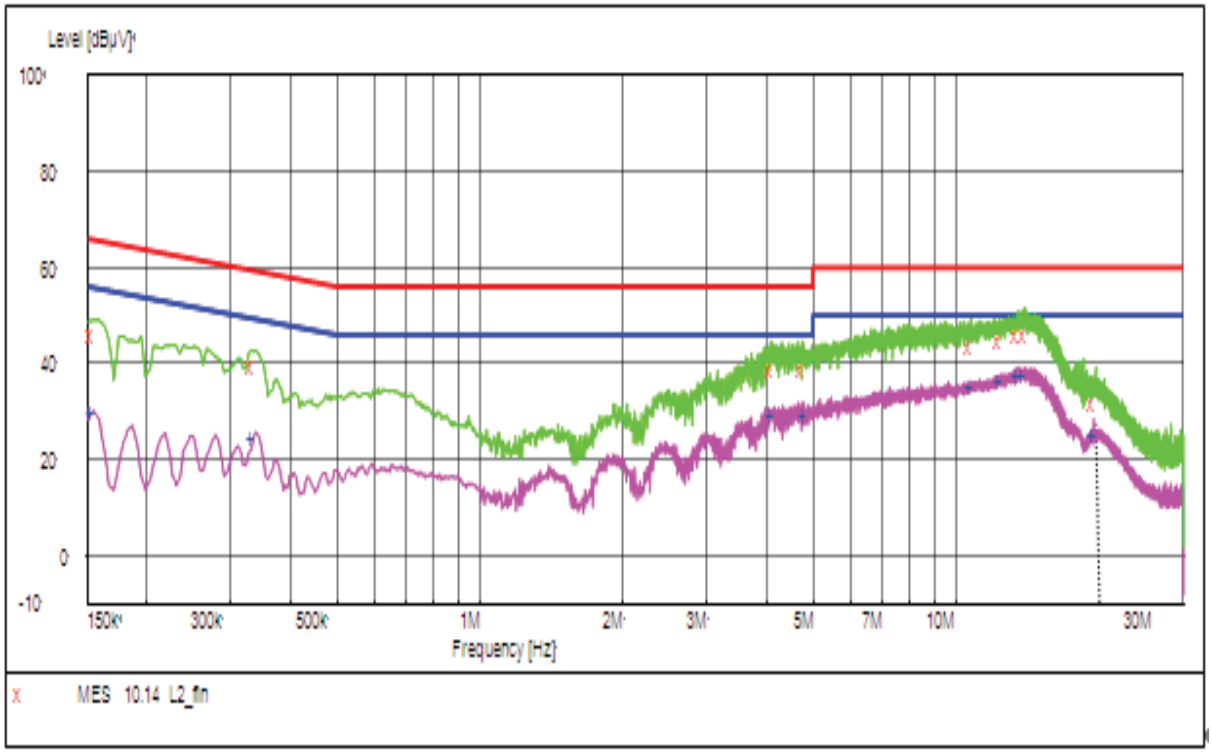
2.9.3. Test Result

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:

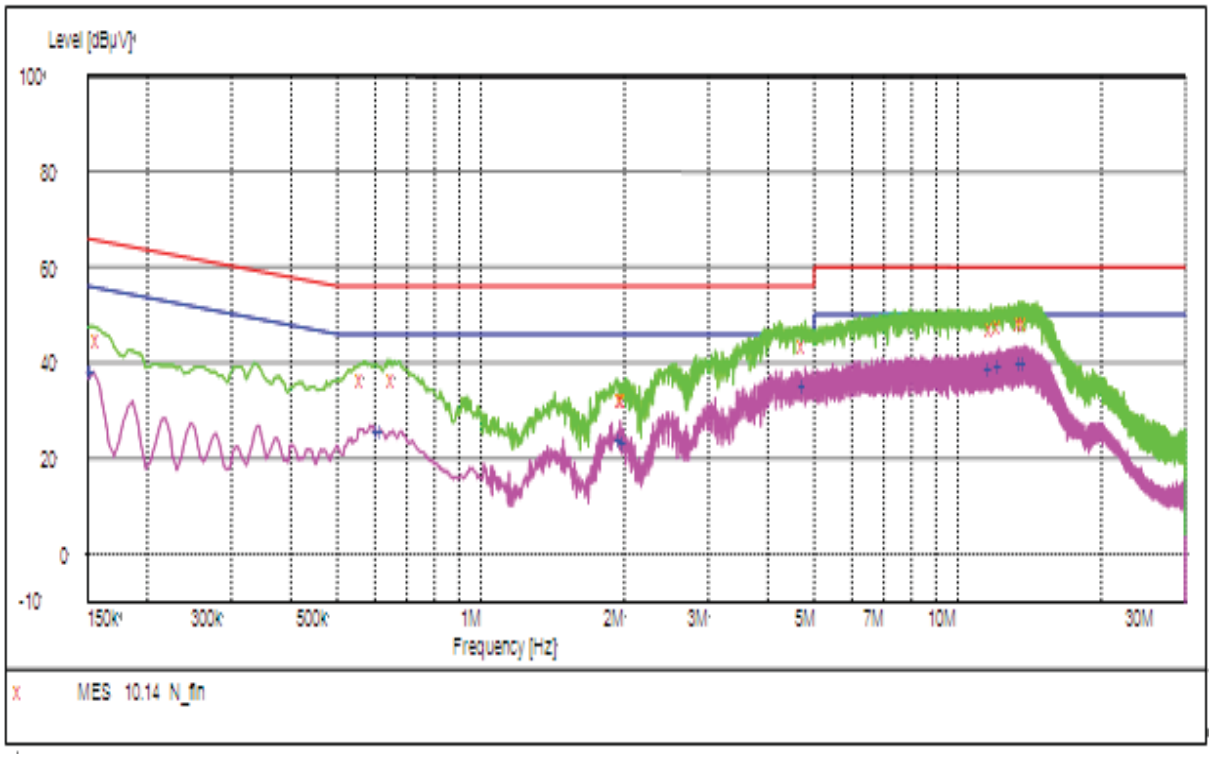
The EUT configuration of the emission tests is Keeping TX mode

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)
0.1540	66	45.90	20.10	0.1540	56	29.80	26.20
4.7680	56	38.90	17.10	4.7680	46	29.10	16.90
13.9520	60	45.90	14.10	13.9520	50	37.80	12.20
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)
0.1580	66	44.70	21.30	0.1540	56	38.40	17.60
4.7600	56	43.70	12.30	4.7600	46	35.20	10.80
13.7800	60	48.50	11.5	13.7800	50	40.30	9.7
N Test Curve							

(Plot B: N Phase)

Test Result: PASS

2.10. Radiated Emission

2.10.1. Requirement

According to FCC section 15.247(c), 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:

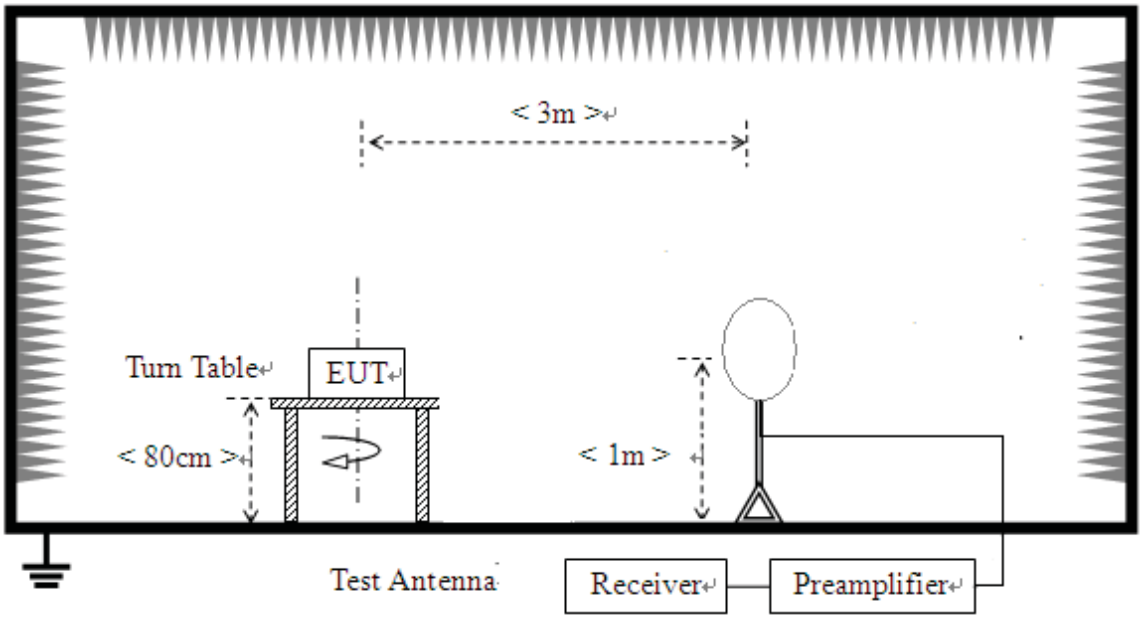
1. For Above 1000MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
2. For above 1000MHz, limit field strength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

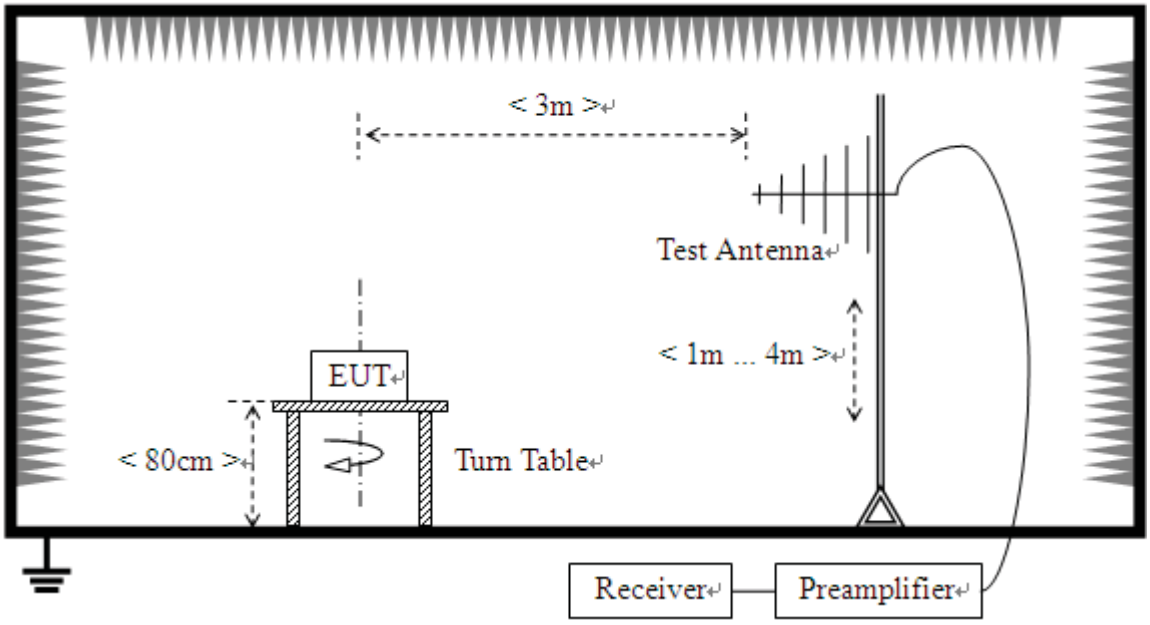
2.10.2. Test Description

A. Test Setup:

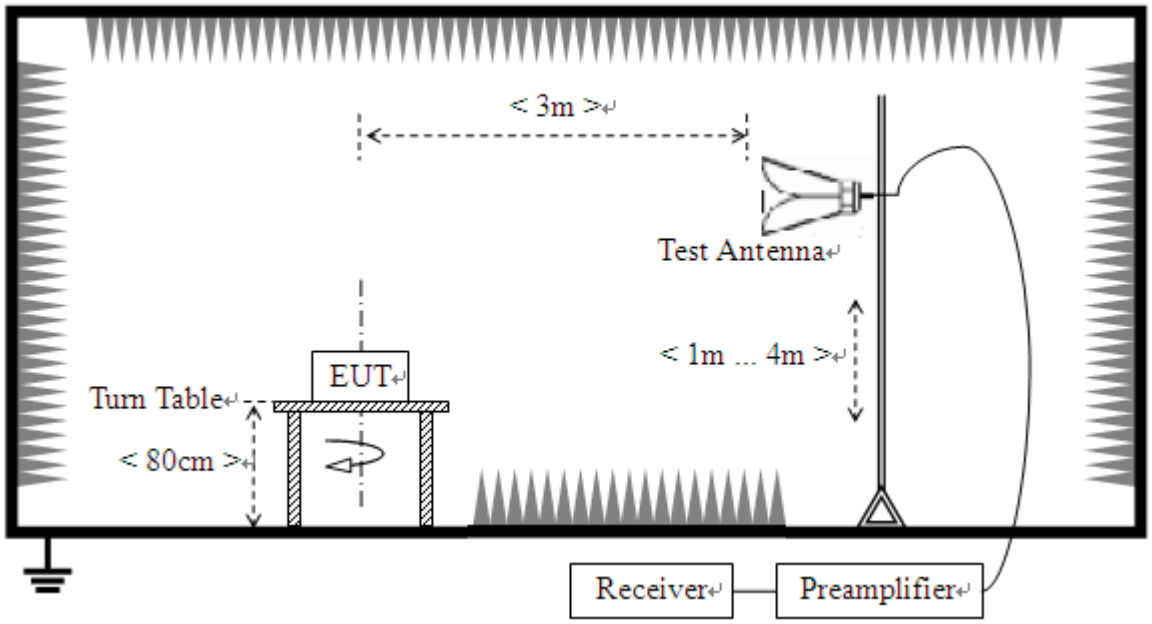
1) For radiated emissions from 9kHz to 30MHz



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 EUT is powered by the PC. 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 frequency hopping operation of the hybrid system, with the direct sequence operation turned off, the Module is activated and controlled by the PC, 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.	Calibration Due. Date
Receiver	R&S	ESIB26	A0304218	2014.06.07
Full-Anechoic Chamber	Albatross	12.8m*6.8m*6.4m	A0412372	2014.06.07
Test Antenna - Bi-Log	Schwarzbeck	VULB 9163	9163-274	2014.06.09
Test Antenna - Horn	R&S	BBHA 9120D	9120C-963	2014.06.09
Test Antenna - Horn	R&S	HF960	100150	2014.06.10
Test Antenna – Horn (18-25GHz)	ETS	UG-596A/U	A0902607	2014.06.05
Test Antenna -Loop	Schwarzbeck	HFH2-Z2	100047	2014.06.02
Ampilier 1G~18GHz	R&S	MITEQ AFS42-00101800	25-S-42	2014.06.05
Ampilier 18G~40GHz	R&S	JS42-18002600-28-5A	12111.0980.00	2014.06.05
amplifier 20M~3GHz	R&S	PAP-0203H	22018	2014.06.10

2.10.3. Test Procedure

For Radiated emission reading above 1GHz:
RBW=1MHz ,VBW=3MHz ,PK detector for PK value and
RBW =1MHz,VBW=10Hz, PK detector for AV value
For Radiated emission reading below 1GHz:
RBW=120kHz ,VBW=300KHz ,QP detector for QP value

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.

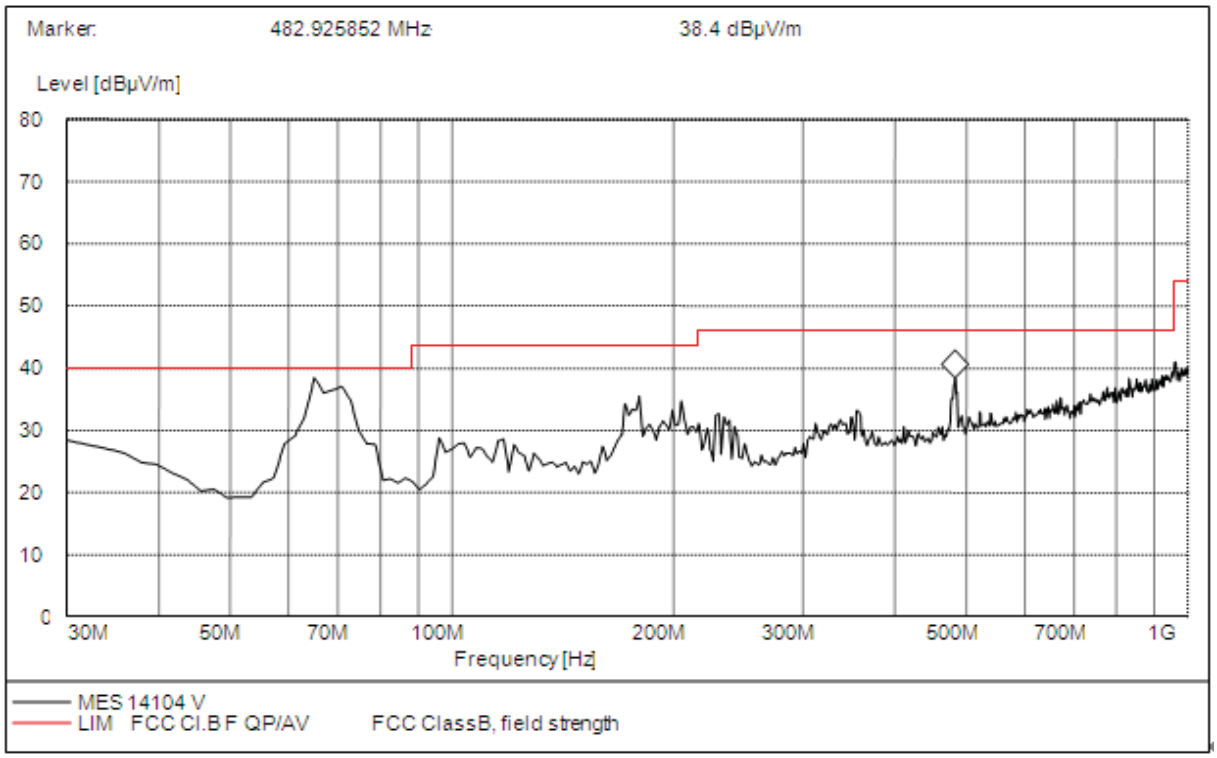
Note: All radiated emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

2.10.4.1. GFSK Mode:

For 9KHz to 30MHz

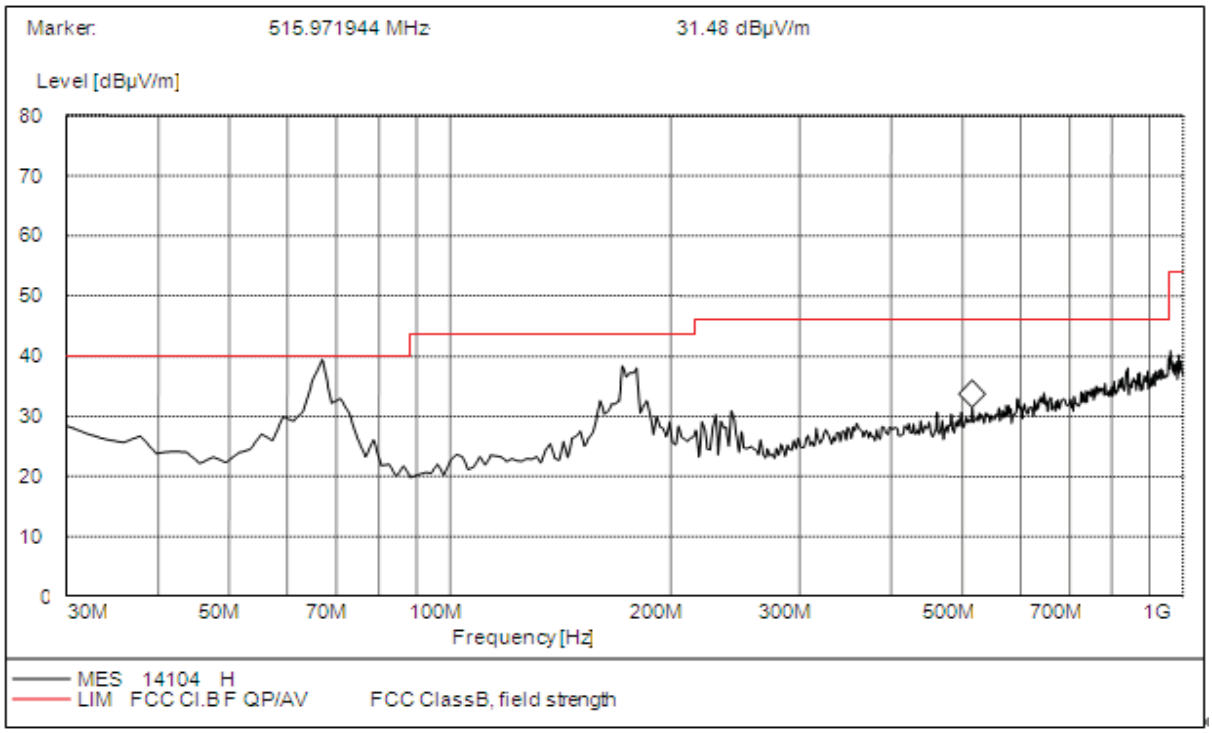
The test has been performed, and the Radiated Emission level is too low to the limit.

For 30MHz to 1000 MHz



Frequency (MHz)	QuasiPeak (dBµ V/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dBµ V/m)	Margin (dB)	Antenna	Verdict
64.989900	38.47	120.000	100.0	40.00	1.53	Vertical	Pass
179.679000	35.54	120.000	100.0	43.50	7.96	Vertical	Pass
482.925000	38.40	120.000	100.0	46.00	7.60	Vertical	Pass

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



Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dBµV/m)	Margin (dB)	Antenna	Verdict
66.933000	39.43	120.000	100.0	40.00	0.57	Horizontal	Pass
171.903000	38.38	120.000	100.0	43.50	5.12	Horizontal	Pass
515.971000	31.48	120.000	100.0	46.00	14.52	Horizontal	Pass

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

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	*2402.00	104.66	PK	/	/	1.00 H	112	108.06	28.3	4.90	-36.6
1	*2402.00	97.86	AV	/	/	1.00 H	112	101.26	28.3	4.90	-36.6
2	4804.00	48.44	PK	74	25.56	1.00 H	254	45.24	32.7	7.00	-36.5
2	4804.00	42.04	AV	54	11.96	1.00 H	254	38.84	32.7	7.00	-36.5
3	7206.00	49.98	PK	74	24.02	1.00 H	104	40.58	35.8	8.90	-35.3
3	7206.00	44.44	AV	54	9.56	1.00 H	104	35.04	35.8	8.90	-35.3
4	9608.00	48.91	PK	74	25.09	1.00 H	10	36.31	37.2	10.20	-34.8
4	9608.00	45.23	AV	54	8.77	1.00 H	10	32.63	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	103.65	PK	/	/	1.00 V	84	107.05	28.3	4.90	-36.6
1	*2402.00	95.57	AV	/	/	1.00 V	84	98.97	28.3	4.90	-36.6
2	4804.00	48.58	PK	74	25.42	1.00 V	109	45.38	32.7	7.00	-36.5
2	4804.00	45.2	AV	54	8.8	1.00 V	109	42.00	32.7	7.00	-36.5
3	7206.00	49.65	PK	74	24.35	1.00 V	22	40.25	35.8	8.90	-35.3
3	7206.00	42.8	AV	54	11.2	1.00 V	22	33.4	35.8	8.90	-35.3
4	9608.00	50.94	PK	74	23.06	1.00 V	323	38.34	37.2	10.20	-34.8
4	9608.00	44.69	AV	54	9.31	1.00 V	323	32.09	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	104.86	PK	/	/	1.00 H	15	108.06	28.3	5.10	-36.6
1	*2441.00	98.54	AV	/	/	1.00 H	15	101.74	28.3	5.10	-36.6
2	4882.00	46.92	PK	74	27.08	1.00 H	28	43.52	32.3	7.60	-36.5
2	4882.00	42.71	AV	54	11.29	1.00 H	28	39.31	32.3	7.60	-36.5
3	7323.00	51.82	PK	74	22.18	1.00 H	39	42.42	36.1	8.60	-35.3
3	7323.00	46.05	AV	54	7.95	1.00 H	39	36.65	36.1	8.60	-35.3
4	9764.00	50.37	PK	74	23.63	1.00 H	205	37.77	37.2	10.20	-34.8
4	9764.00	45.15	AV	54	8.85	1.00 H	205	32.55	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	104.84	PK	/	/	1.00 V	87	108.04	28.3	5.10	-36.6
1	*2441.00	96.95	AV	/	/	1.00 V	87	100.15	28.3	5.10	-36.6
2	4882.00	47.99	PK	74	26.01	1.00 V	112	44.59	32.3	7.60	-36.5
2	4882.00	41.83	AV	54	12.17	1.00 V	112	38.43	32.3	7.60	-36.5
3	7323.00	54.4	PK	74	19.60	1.00 V	91	45.00	36.1	8.60	-35.3
3	7323.00	46.88	AV	54	7.12	1.00 V	91	37.48	36.1	8.60	-35.3
4	9764.00	49.61	PK	74	24.39	1.00 V	336	37.01	37.2	10.20	-34.8
4	9764.00	44.71	AV	54	9.29	1.00 V	336	32.11	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	105.63	PK	/	/	1.00 H	15	108.93	28.6	4.70	-36.6
1	*2480.00	98.28	AV	/	/	1.00 H	15	101.58	28.6	4.70	-36.6
2	4960.00	51.04	PK	74	22.96	1.00 H	99	47.24	33.0	7.00	-36.2
2	4960.00	43.8	AV	54	10.2	1.00 H	99	40.00	33.0	7.00	-36.2
3	7440.00	49.97	PK	74	24.03	1.00 H	215	40.57	36.2	8.50	-35.3
3	7440.00	43.49	AV	54	10.51	1.00 H	215	34.09	36.2	8.50	-35.3
4	9920.00	50.86	PK	74	23.14	1.00 H	9	38.26	37.2	10.20	-34.8
4	9920.00	41.69	AV	54	12.31	1.00 H	9	29.09	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	104.88	PK	/	/	1.00 V	29	108.18	28.6	4.70	-36.6
1	*2480.00	97.68	AV	/	/	1.00 V	29	100.98	28.6	4.70	-36.6
2	4960.00	50.00	PK	74	24.00	1.00 V	114	46.20	33.0	7.00	-36.2
2	4960.00	48.10	AV	54	5.90	1.00 V	114	44.3	33.0	7.00	-36.2
3	7440.00	49.85	PK	74	24.15	1.00 V	87	40.45	36.2	8.50	-35.3
3	7440.00	44.29	AV	54	9.71	1.00 V	87	34.89	36.2	8.50	-35.3
4	9920.00	49.77	PK	74	24.23	1.00 V	168	37.17	37.2	10.20	-34.8
4	9920.00	44.98	AV	54	9.02	1.00 V	168	32.38	37.2	10.20	-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	*2402.00	103.83	PK	/	/	1.00 H	106	107.23	28.3	4.90	-36.6
1	*2402.00	95.98	AV	/	/	1.00 H	106	99.38	28.3	4.90	-36.6
2	4804.00	49.9	PK	74	24.1	1.00 H	88	46.7	32.7	7.00	-36.5
2	4804.00	42.56	AV	54	11.44	1.00 H	88	39.36	32.7	7.00	-36.5
3	7206.00	50.99	PK	74	23.01	1.00 H	305	41.59	35.8	8.90	-35.3
3	7206.00	43.55	AV	54	10.45	1.00 H	305	34.15	35.8	8.90	-35.3
4	9608.00	49.62	PK	74	24.38	1.00 H	1	37.02	37.2	10.20	-34.8
4	9608.00	45.77	AV	54	8.23	1.00 H	1	33.17	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	104.06	PK	/	/	1.00 V	7	107.46	28.3	4.90	-36.6
1	*2402.00	95.54	AV	/	/	1.00 V	7	98.94	28.3	4.90	-36.6
2	4804.00	50.20	PK	74	23.80	1.00 V	118	47.00	32.7	7.00	-36.5
2	4804.00	43.88	AV	54	10.12	1.00 V	118	40.68	32.7	7.00	-36.5
3	7206.00	50.02	PK	74	23.98	1.00 V	215	40.62	35.8	8.90	-35.3
3	7206.00	44.78	AV	54	9.22	1.00 V	215	35.38	35.8	8.90	-35.3
4	9608.00	48.75	PK	74	25.25	1.00 V	43	36.15	37.2	10.20	-34.8
4	9608.00	45.36	AV	54	8.64	1.00 V	43	32.76	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	104.3	PK	/	/	1.00 H	196	107.5	28.3	5.10	-36.6
1	*2441.00	98.31	AV	/	/	1.00 H	196	101.51	28.3	5.10	-36.6
2	4882.00	51.99	PK	74	22.01	1.00 H	75	48.59	32.3	7.60	-36.5
2	4882.00	45.81	AV	54	8.19	1.00 H	75	42.41	32.3	7.60	-36.5
3	7323.00	50.1	PK	74	23.9	1.00 H	178	40.7	36.1	8.60	-35.3
3	7323.00	44.54	AV	54	9.46	1.00 H	178	35.14	36.1	8.60	-35.3
4	9764.00	51.79	PK	74	22.21	1.00 H	150	39.19	37.2	10.20	-34.8
4	9764.00	45.10	AV	54	8.9	1.00 H	150	32.5	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	105.04	PK	/	/	1.00 V	357	108.24	28.3	5.10	-36.6
1	*2441.00	95.36	AV	/	/	1.00 V	357	98.56	28.3	5.10	-36.6
2	4882.00	51.77	PK	74.00	22.23	1.00 V	21	48.37	32.3	7.60	-36.5
2	4882.00	47.33	AV	54.00	6.67	1.00 V	21	43.93	32.3	7.60	-36.5
3	7323.00	53.88	PK	74.00	20.12	1.00 V	95	44.48	36.1	8.60	-35.3
3	7323.00	47.05	AV	54.00	6.95	1.00 V	95	37.65	36.1	8.60	-35.3
4	9764.00	55.21	PK	74.00	18.79	1.00 V	327	42.61	37.2	10.20	-34.8
4	9764.00	48.65	AV	54.00	5.35	1.00 V	327	36.05	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	105.54	PK	/	/	1.00 H	17	108.84	28.6	4.70	-36.6
1	*2480.00	95.6	AV	/	/	1.00 H	17	98.9	28.6	4.70	-36.6
2	4960.00	51.11	PK	74	22.89	1.00 H	209	47.31	33	7.00	-36.2
2	4960.00	43.99	AV	54	10.01	1.00 H	209	40.19	33	7.00	-36.2
3	7440.00	53.09	PK	74	20.91	1.00 H	188	43.69	36.2	8.50	-35.3
3	7440.00	44.43	AV	54	9.57	1.00 H	188	35.03	36.2	8.50	-35.3
4	9920.00	51.55	PK	74	22.45	1.00 H	34	38.95	37.2	10.20	-34.8
4	9920.00	43.39	AV	54	10.61	1.00 H	34	30.79	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	105.71	PK	/	/	1.00 V	59	109.01	28.6	4.70	-36.6
1	*2480.00	93.89	AV	/	/	1.00 V	59	97.19	28.6	4.70	-36.6
2	4960.00	51.12	PK	74.00		1.00 V	102	47.32	33.0	7.00	-36.2
2	4960.00	44.02	AV	54.00		1.00 V	102	40.22	33.0	7.00	-36.2
3	7440.00	55.28	PK	74.00		1.00 V	134	45.88	36.2	8.50	-35.3
3	7440.00	43.97	AV	54.00		1.00 V	134	34.57	36.2	8.50	-35.3
4	9920.00	50.25	PK	74.00		1.00 V	304	37.65	37.2	10.20	-34.8
4	9920.00	44.07	AV	54.00		1.00 V	304	31.47	37.2	10.20	-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	*2402.00	105.53	PK	/	/	1.00 H	20	108.93	28.3	4.90	-36.6
1	*2402.00	93.73	AV	/	/	1.00 H	20	97.13	28.3	4.90	-36.6
2	4804.00	51.86	PK	74	22.14	1.00 H	309	48.66	32.7	7.00	-36.5
2	4804.00	43.52	AV	54	10.48	1.00 H	309	40.32	32.7	7.00	-36.5
3	7206.00	51.00	PK	74	23.00	1.00 H	164	41.6	35.8	8.90	-35.3
3	7206.00	44.82	AV	54	9.18	1.00 H	164	35.42	35.8	8.90	-35.3
4	9608.00	50.1	PK	74	23.9	1.00 H	199	37.5	37.2	10.20	-34.8
4	9608.00	43.67	AV	54	10.33	1.00 H	199	31.07	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	105.09	PK	/	/	1.00 V	51	108.49	28.3	4.90	-36.6
1	*2402.00	92.95	AV	/	/	1.00 V	51	96.35	28.3	4.90	-36.6
2	4804.00	50.67	PK	74.00	23.33	1.00 V	176	47.47	32.7	7.00	-36.5
2	4804.00	43.88	AV	54.00	10.12	1.00 V	176	40.68	32.7	7.00	-36.5
3	7206.00	52.03	PK	74.00	21.97	1.00 V	85	42.63	35.8	8.90	-35.3
3	7206.00	43.78	AV	54.00	10.22	1.00 V	85	34.38	35.8	8.90	-35.3
4	9608.00	50.86	PK	74.00	23.14	1.00 V	332	38.26	37.2	10.20	-34.8
4	9608.00	45.05	AV	54.00	8.95	1.00 V	332	32.45	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	105.98	PK	/	/	1.00 H	57	109.18	28.3	5.10	-36.6
1	*2441.00	98.00	AV	/	/	1.00 H	57	101.2	28.3	5.10	-36.6
2	4882.00	49.99	PK	74.00	24.01	1.00 H	169	46.59	32.3	7.60	-36.5
2	4882.00	43.01	AV	54.00	10.99	1.00 H	169	39.61	32.3	7.60	-36.5
3	7323.00	51.38	PK	74.00	22.62	1.00 H	76	41.98	36.1	8.60	-35.3
3	7323.00	45.01	AV	54.00	8.99	1.00 H	76	35.61	36.1	8.60	-35.3
4	9764.00	52.07	PK	74.00	21.93	1.00 H	111	39.47	37.2	10.20	-34.8
4	9764.00	45.00	AV	54.00	9.00	1.00 H	111	32.4	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	105.33	PK	/	/	1.00 V	61	108.53	28.3	5.10	-36.6
1	*2441.00	93.79	AV	/	/	1.00 V	61	96.99	28.3	5.10	-36.6
2	4882.00	50.77	PK	74.00	23.23	1.00 V	175	47.37	32.3	7.60	-36.5
2	4882.00	45.02	AV	54.00	8.98	1.00 V	175	41.62	32.3	7.60	-36.5
3	7323.00	51.66	PK	74.00	22.34	1.00 V	34	42.26	36.1	8.60	-35.3
3	7323.00	43.69	AV	54.00	10.31	1.00 V	34	34.29	36.1	8.60	-35.3
4	9764.00	51.87	PK	74.00	22.13	1.00 V	309	39.27	37.2	10.20	-34.8
4	9764.00	45.99	AV	54.00	8.01	1.00 V	309	33.39	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	106.01	PK	/	/	1.00 H	83	109.31	28.6	4.70	-36.6
1	*2480.00	98.07	AV	/	/	1.00 H	83	101.37	28.6	4.70	-36.6
2	4960.00	52.41	PK	74.00	21.59	1.00 H	174	48.61	33.0	7.00	-36.2
2	4960.00	46.07	AV	54.00	7.93	1.00 H	174	42.27	33.0	7.00	-36.2
3	7440.00	53.42	PK	74.00	20.58	1.00 H	152	44.02	36.2	8.50	-35.3
3	7440.00	48.06	AV	54.00	5.94	1.00 H	152	38.66	36.2	8.50	-35.3
4	9920.00	51.75	PK	74.00	22.25	1.00 H	337	39.15	37.2	10.20	-34.8
4	9920.00	46.09	AV	54.00	7.91	1.00 H	337	33.49	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	105.98	PK	/	/	1.00 V	118	109.28	28.6	4.70	-36.6
1	*2480.00	96.12	AV	/	/	1.00 V	118	99.42	28.6	4.70	-36.6
2	4960.00	50.49	PK	74	23.51	1.00 V	92	46.69	33.0	7.00	-36.2
2	4960.00	42.88	AV	54	11.12	1.00 V	92	39.08	33.0	7.00	-36.2
3	7440.00	51.49	PK	74	22.51	1.00 V	13	42.09	36.2	8.50	-35.3
3	7440.00	44.07	AV	54	9.93	1.00 V	13	34.67	36.2	8.50	-35.3
4	9920.00	53.09	PK	74	20.91	1.00 V	67	40.49	37.2	10.20	-34.8
4	9920.00	43.66	AV	54	10.34	1.00 V	67	31.06	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. The other emission levels were very low against the limit.

4. Margin value = Limit value- Emission level.

5. The limit value is defined as per 15.247

6. " * " : Fundamental frequency

** END OF REPORT **