RF TEST REPORT

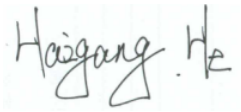
Report No.:	SET2015-02206
Product Name:	JAM TRANSIT CITY
FCC ID:	2AD8PHXHP150
Model No. :	HX-HP150
Applicant:	Dongguan Laccess Electronic Technology Ltd.
Address：	Huaxing Industrial Park,tianxin,Qiaotou Town,DongGuan, GuangDong,China
Issued by:	CCIC-SET
Lab Location:	Electronic Testing Building, Shahe Road, Xili, Nanshan District, Shenzhen, 518055, P. R. China **Tel:** 86 755 26627338 **Fax:** 86 755 26627238

This test report consists of **75** pages in total. It may be duplicated completely for legal use with the approval of the applicant. It should not be reproduced except in full, without the written approval of our laboratory. The client should not use it to claim product endorsement by CCIC-SET. The test results in the report only apply to the tested sample. The test report shall be invalid without all the signatures of testing engineers, reviewer and approver. Any objections must be raised to CCIC-SET within 20 days since the date when the report is received. It will not be taken into consideration beyond this limit.

Test Report

Product Name.....:	JAM TRANSIT CITY
Brand Name.....:	JAM
Trade Name.....:	JAM
Applicant.....:	Dongguan Laccess Electronic Technology Ltd.
Applicant Address.....:	Huaxing Industrial Park,tianxin,Qiaotou Town,DongGuan, GuangDong,China
Manufacturer.....:	Dongguan Laccess Electronic Technology Ltd.
Manufacturer Address .....:	Huaxing Industrial Park,tianxin,Qiaotou Town,DongGuan, GuangDong,China
Test Standards.....:	47 CFR Part 15 Subpart C 2013：Radio Frequency Devices ANSI C63.10:2014：American National Standard for Testing Unlicensed Wireless Devices DA 00-705: Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems
Test Result.....:	PASS

Tested by .....:



2015.02.28

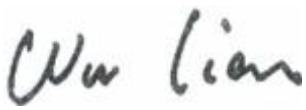
Haigang He， Test Engineer

Reviewed by .....:

2015.02.28

Zhu Qi, Senior Engineer

Approved by .....:



2015.02.28

Wu Li'an, Manager

Table of contents

Change History		
Issue	Date	Reason for change
1.0	2015.02.28	First edition

1. General Information

1.1. EUT Description

EUT Type	:	JAM TRANSIT CITY
Hardware Version	:	V04
Software Version	:	V01
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), π/4-DQPSK(EDR 2Mbps), 8-DPSK(EDR 3Mbps))
Antenna Type	:	PCB Antenna
Antenna Gain	:	0dBi

Note 1: The EUT is a JAM TRANSIT CITY, 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 are sponse 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.

Note 5: The antenna of EUT is designed with permanent attachment and no consideration of replacement. It is a PCB Antenna with a maximum gain of 0dBi, and it is used to radiate the RF emissions.

1.2. Support Equipment

No.	Equipment	Brand Name	Model Name	Manufacturer	Serial No.	Note
1	Notebook	DELL	PP11L	DELL	H5914A03	FCC DOC

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 2013	Radio Frequency Devices
2	ANSI C63.10 2014	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
11	1.1307(b)	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 was performed according to the method of measurements prescribed in ANSI C63.10 2014.

1.4. Frequency Hopping System Requirements

1.3.1 Standard Applicable

According to FCC Part 15.247(a)(1), The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

(g) Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

(h) The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

1.3.2 Frequency Hopping System

This transmitter device is frequency hopping device, and complies with FCC part 15.247 rule.

This device uses Bluetooth radio which operates in 2400-2483.5 MHz band. Bluetooth uses a radio technology called frequency-hopping spread spectrum, which chops up the data being sent and transmits chunks of it on up to 79 bands (1 MHz each; centred from 2402 to 2480 MHz) in the range 2,400-2,483.5 MHz. The transmitter switches hop frequencies 1,600 times per second to assure a high degree of data security. All Bluetooth devices participating in a given piconet are synchronized to the frequency-hopping channel for the piconet. The frequency hopping sequence is determined by the master's device address and the phase of the hopping sequence (the frequency to hop at a specific time) is determined by the master's internal clock. Therefore, all slaves in a piconet must know the master's device address and must synchronize their clocks with the master's clock.

Adaptive Frequency Hopping (AFH) was introduced in the Bluetooth specification to provide an effective way for a Bluetooth radio to counteract normal interference. AFH identifies "bad" channels, where either other wireless devices are interfering with the Bluetooth signal or the Bluetooth signal is interfering with another device. The AFH-enabled Bluetooth device will then communicate with other devices within its piconet to share details of any identified bad channels. The devices will then switch to alternative available "good" channels, away from the areas of interference, thus having no impact on the bandwidth used.

This device was tested with an bluetooth system receiver to check that the device maintained hopping synchronization, and the device complied with these requirements for DA 00-705 and FCC Part 15.247 rule.

1.3.3 EUT Pseudorandom Frequency Hopping Sequence

Pseudorandom Frequency Hopping Sequence Table as below:
Channel: 08, 24, 40, 56, 40, 56, 72, 09, 01, 09, 33, 41, 33, 41, 65, 73, 53, 69, 06, 22, 04, 20, 36, 52, 38, 46, 70, 78,68, 76, 21, 29, 10, 26, 42, 58, 44, 60, 76, 13, 03, 11, 35, 43, 37, 45, 69, 77, 55, 71, 08,

24, 08, 24, 40, 56, 40, 48,72, 01, 72, 01, 25, 33, 12, 28, 44, 60, 42, 58, 74, 11, 05, 13, 37, 45 etc.

The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

1.5. Facilities and Accreditations

1.5.1. 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, valid time is until October 28, 2017.

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.

1.5.2. Test Environment Conditions

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

Temperature (℃):	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: Integral antenna

An integral antenna was placed on PCB, can't be removed.

Antenna General Information:

No.	EUT Model	Ant. Cat.	Ant. Type	Gain(dBi)
1	HX-HP150	integral	PCB	0

2.1.3. Result: comply

The EUT has a permanently and irreplaceable attached antenna. Please refer to the EUT internal photos.

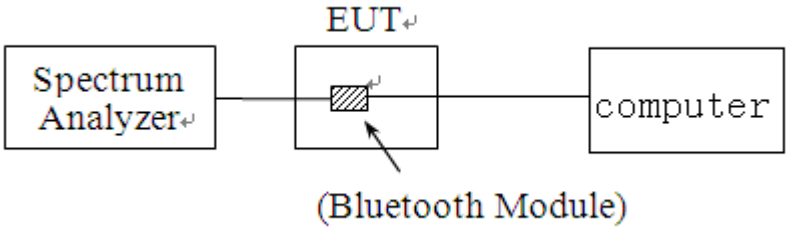
2.2. Number of Hopping Frequency

2.2.1. Requirement

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

2.2.2. Test Description

A. Test Setup:



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

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal.Date	Cal.Due Date
Spectrum Analyzer	R&S	FSP40	1164.4391.40	2014.07.07	2015.07.06

2.2.3. Test Procedure

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

Span = the frequency band of operation

RBW ≥ 1% of the span

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize

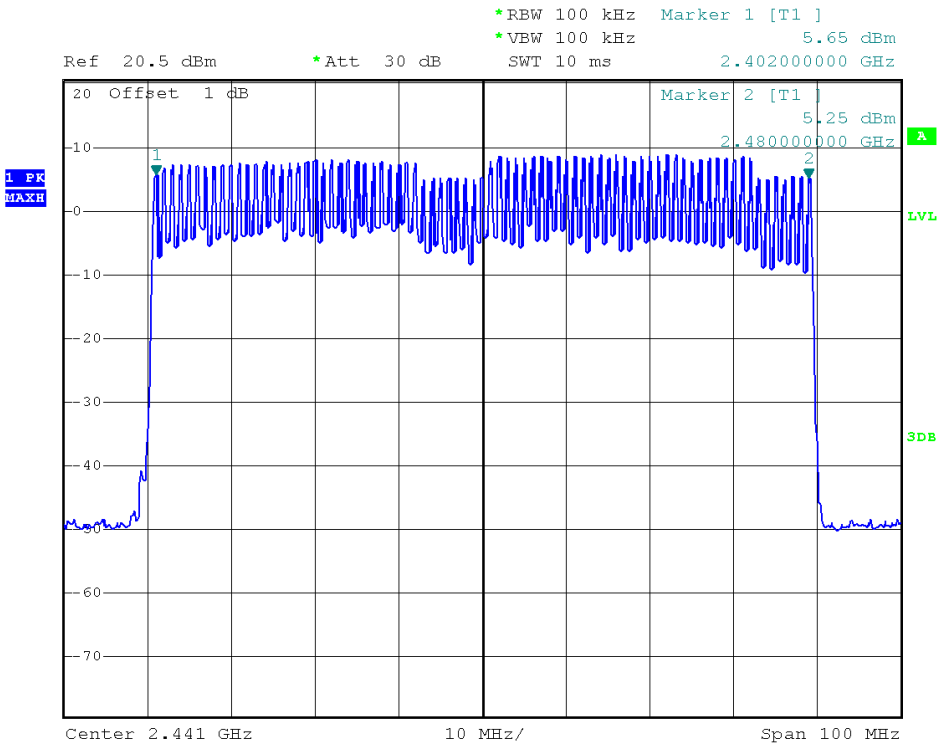
2.2.4. Test Result

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.

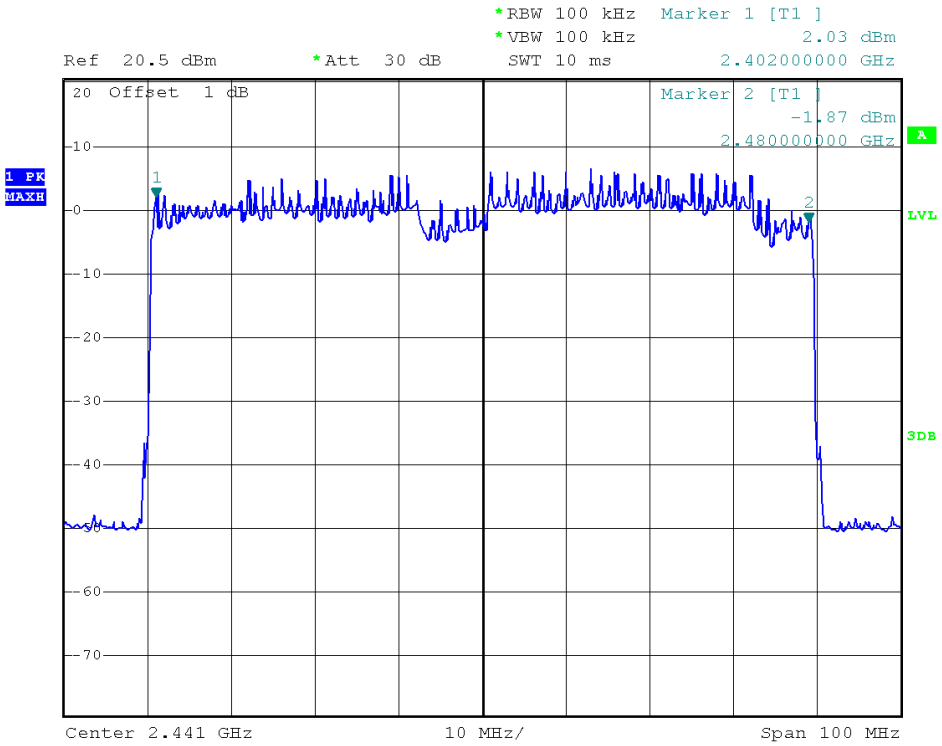
A. Test Verdict:

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

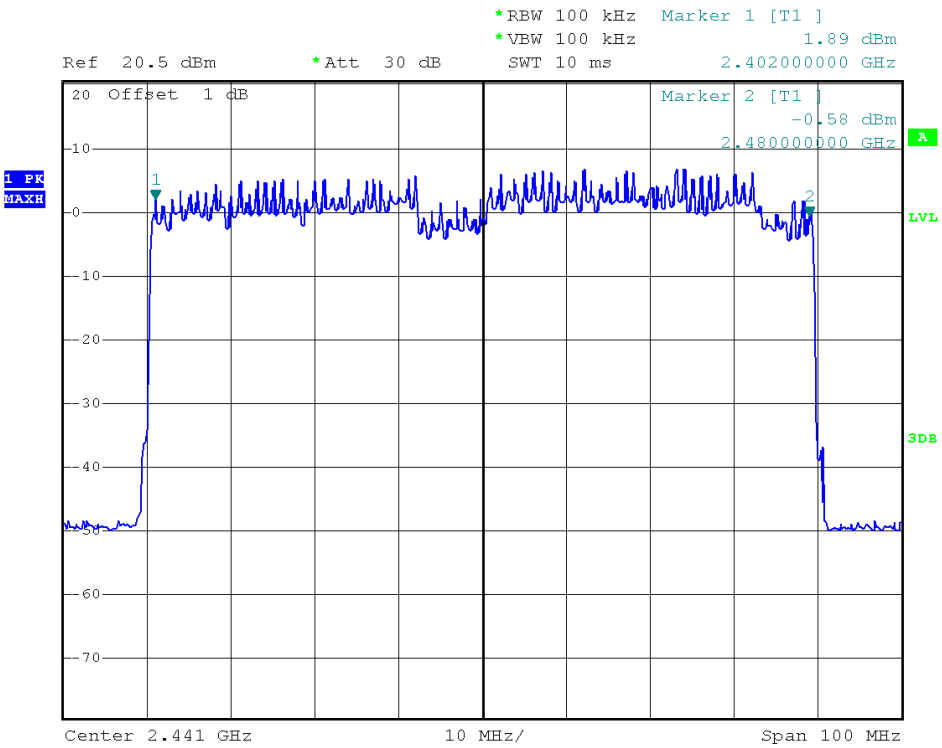
Test Plots:



(Plot A: GFSK)



(Plot B: π/4-DQPSK)



(Plot C: 8- DPSK)

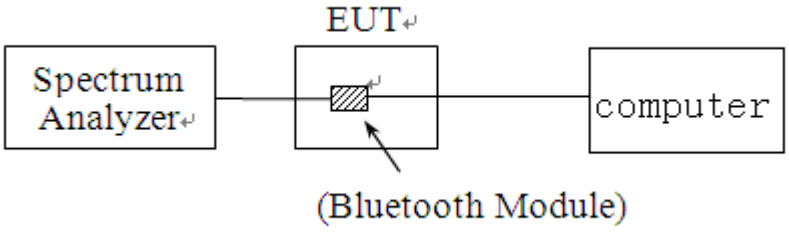
2.3. Peak Output Power

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.	Cal. Date	Cal.Due Date
Spectrum Analyzer	R&S	FSP40	1164.4391.40	2014.07.07	2015.07.06

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 Spectrum Analyzer.

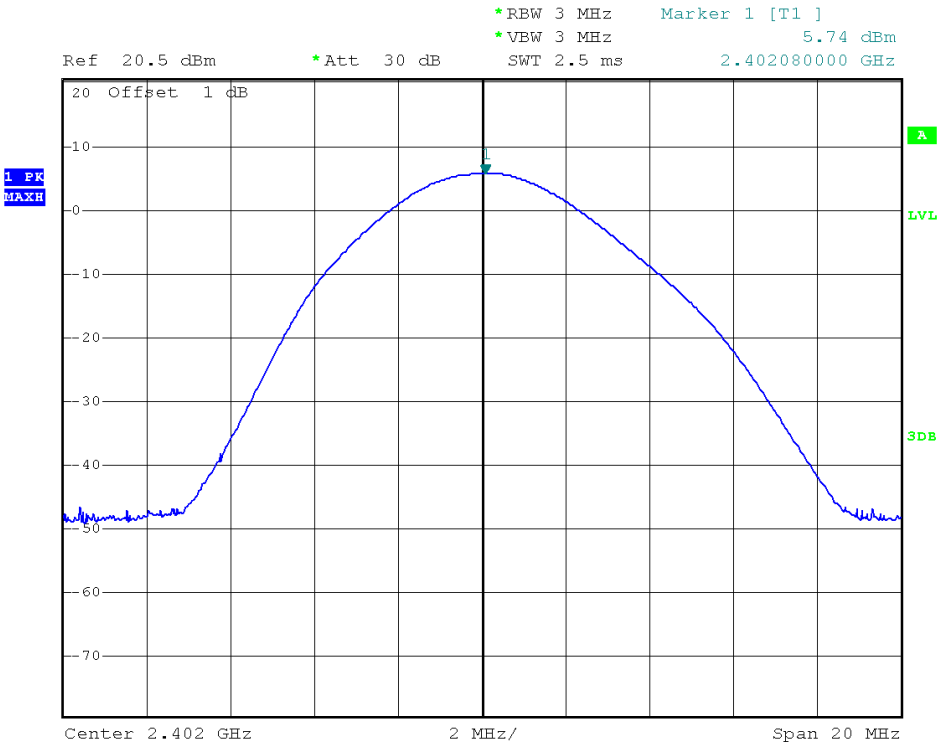
Note: The relevant measured result has the offset with cable loss already.

2.3.3.1. GFSK Mode

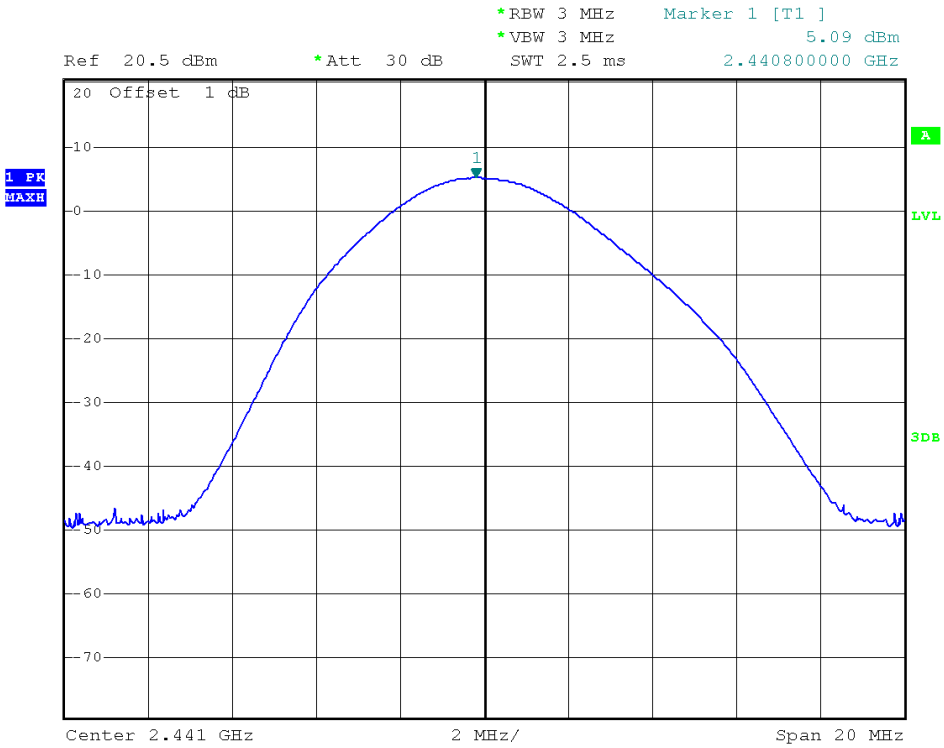
A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power	Limit	Refer to Plot	Verdict
		dBm	dBm		
0	2402	5.74	30	Plot A1	PASS
39	2441	5.09		Plot A2	PASS
78	2480	5.31		Plot A3	PASS

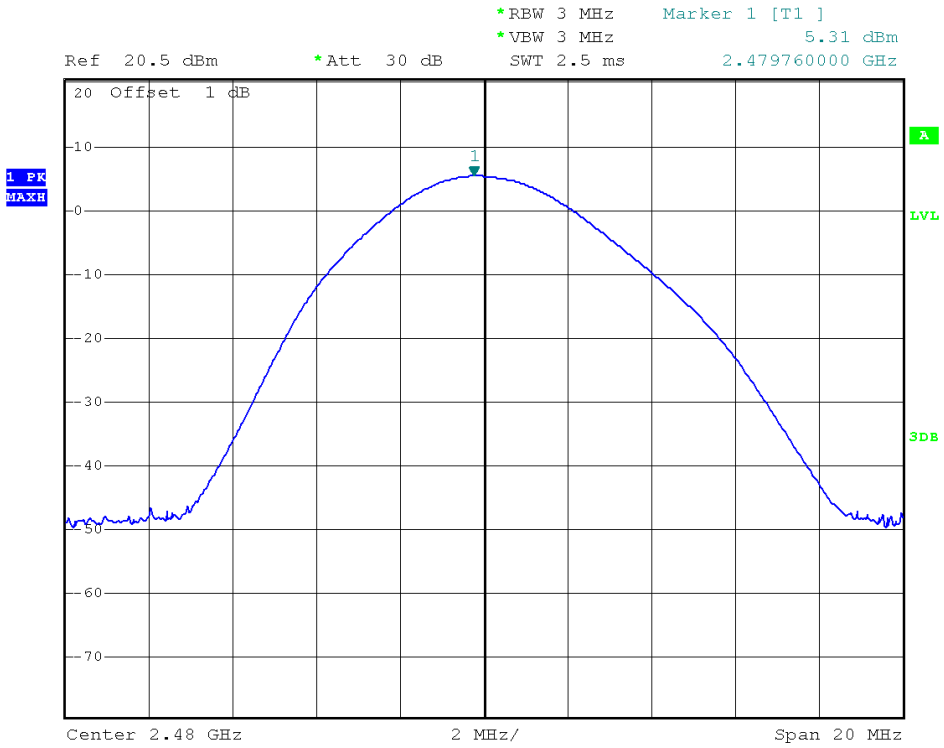
Test Plots:



Plot A1: GFSK



Plot A2: GFSK



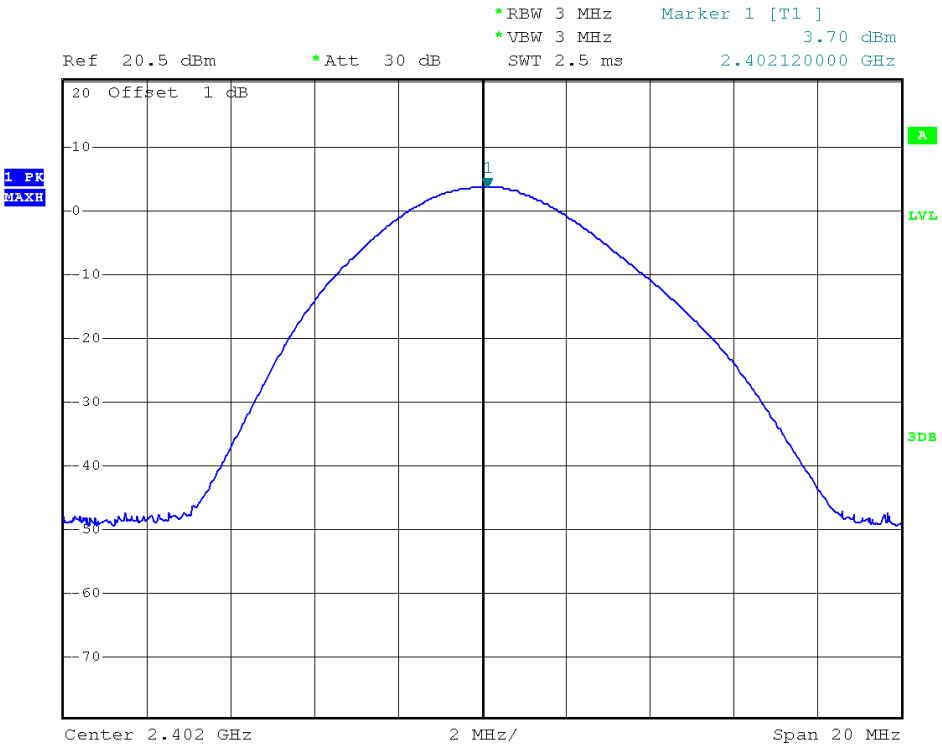
Plot A3: GFSK

2.3.3.2. π/4-DQPSK Mode

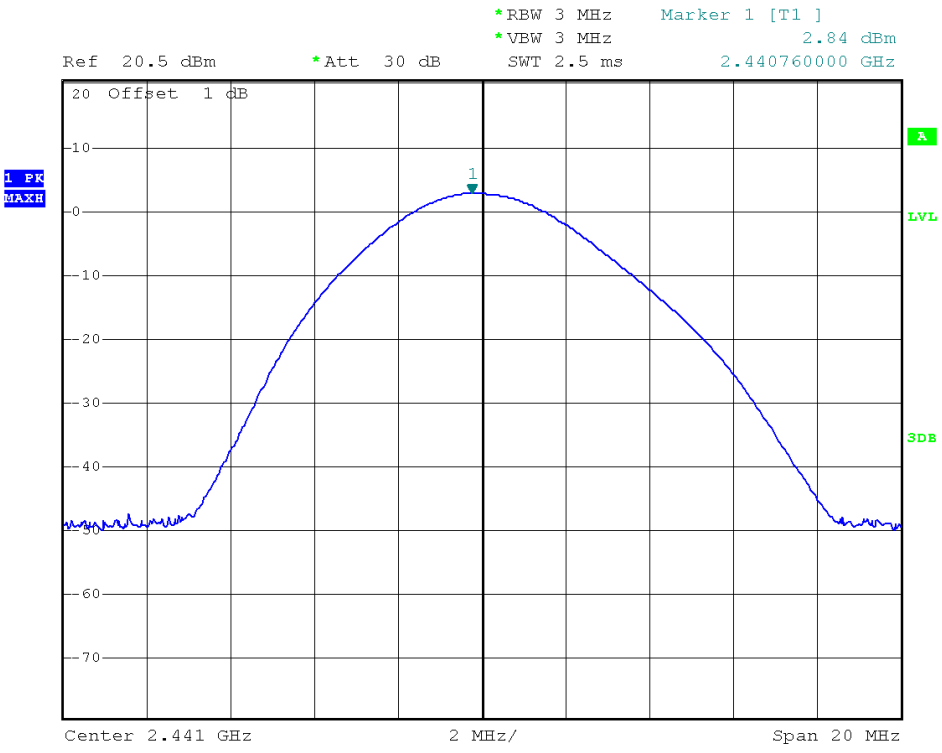
A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power	Limit	Refer to Plot	Verdict
		dBm	dBm		
0	2402	3.70	30	Plot B1	PASS
39	2441	2.84		Plot B2	PASS
78	2480	3.05		Plot B3	PASS

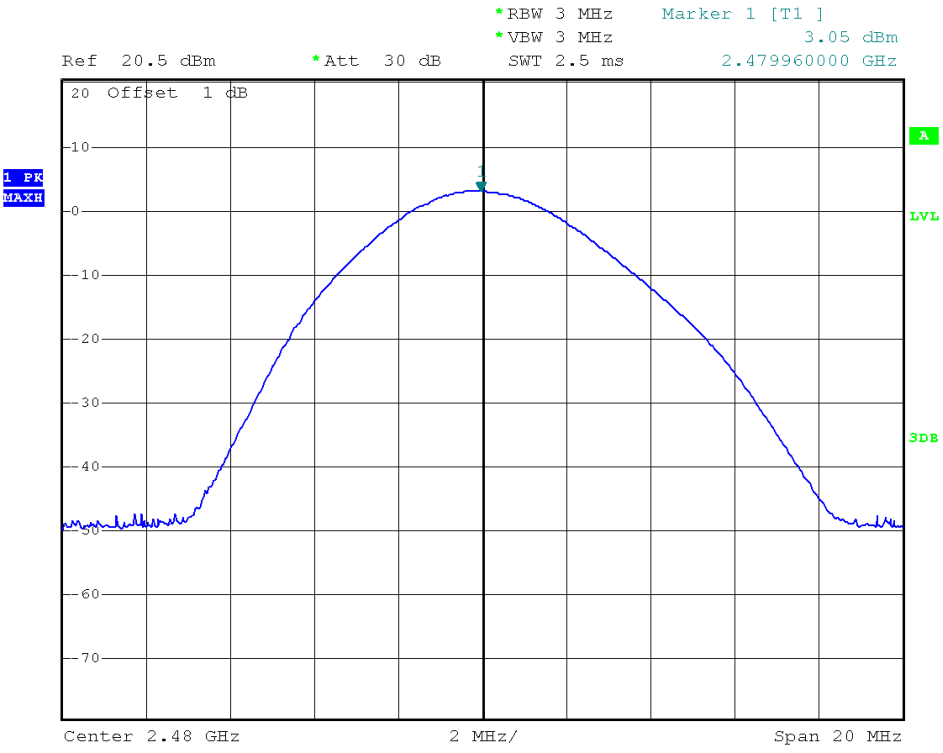
Test Plots:



Plot B1: π/4-DQPSK



Plot B2: π/4-DQPSK



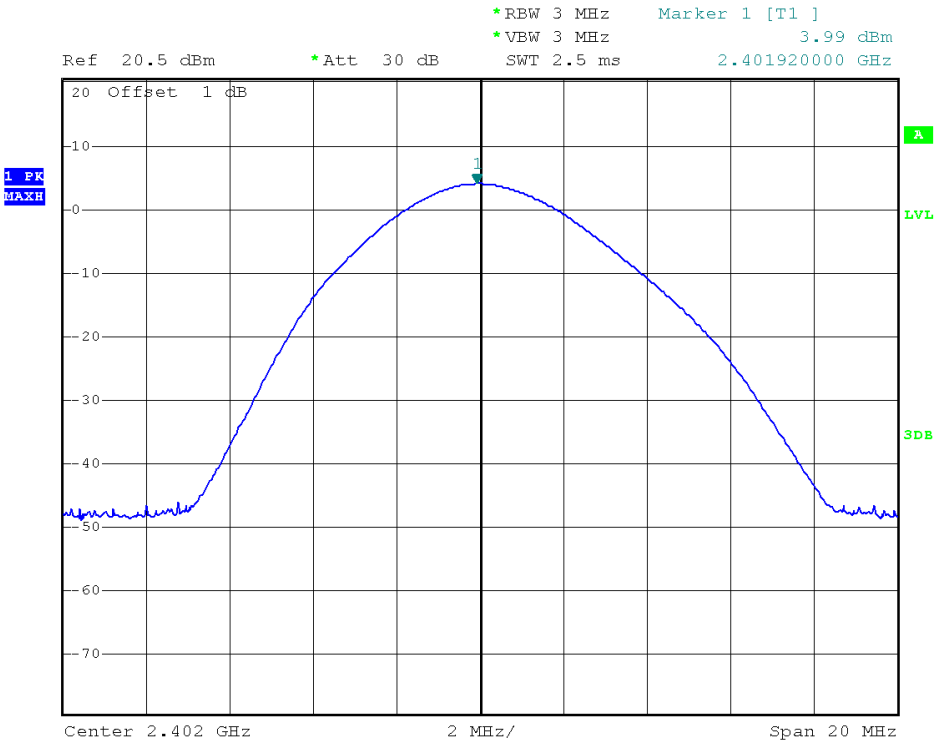
Plot B3: π/4-DQPSK

2.3.3.3. 8-DPSK Mode

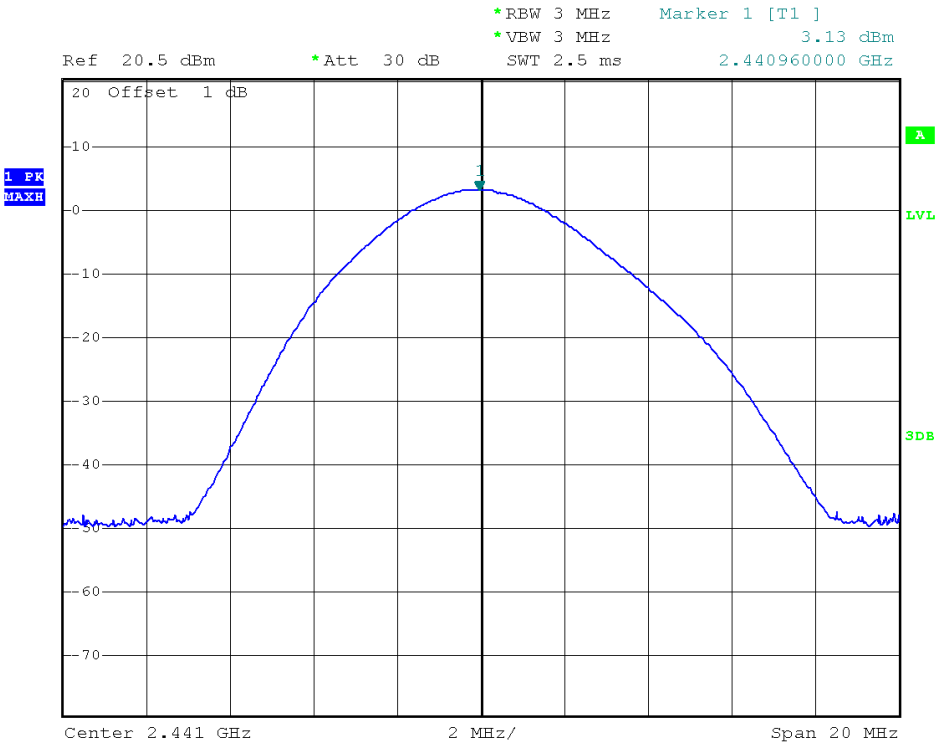
A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power	Limit	Refer to Plot	Verdict
		dBm	dBm		
0	2402	3.99	30	Plot C1	PASS
39	2441	3.13		Plot C2	PASS
78	2480	3.35		Plot C3	PASS

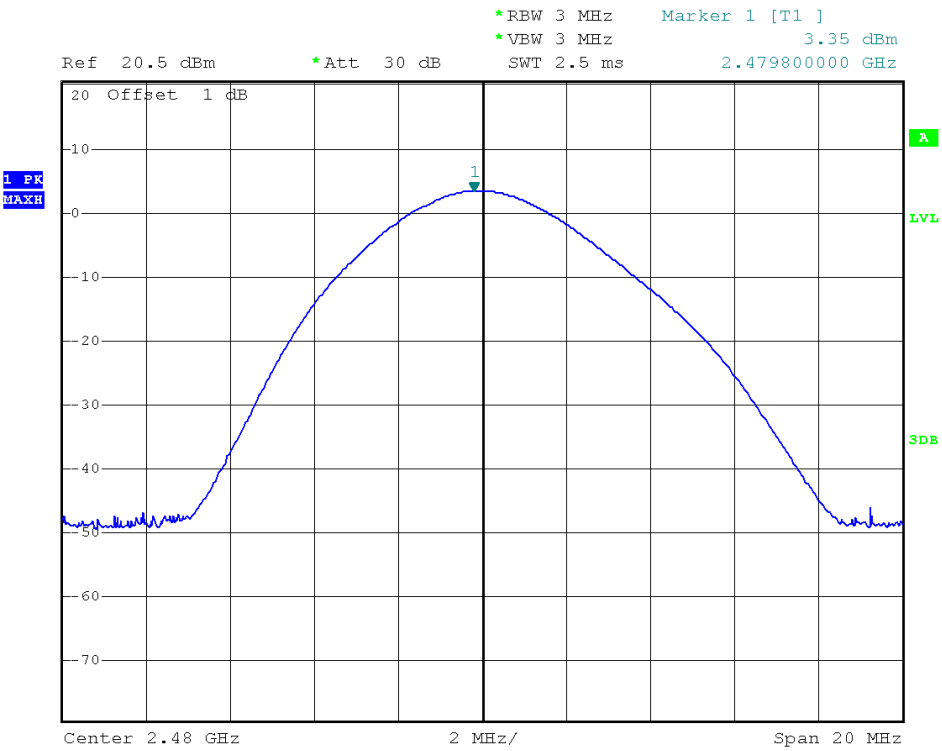
Test Plots:



Plot C1: 8-DPSK



Plot C2: 8-DPSK



Plot C3: 8-DPSK

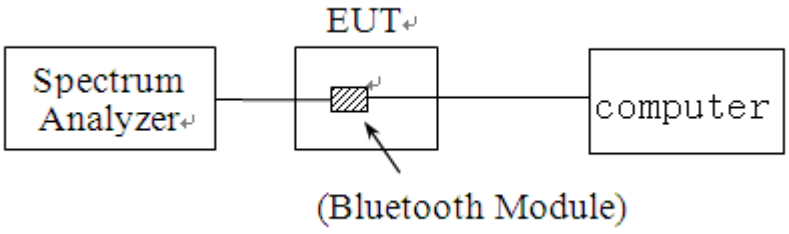
2.4. 20dB Bandwidth

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.	Cal.Date	Cal.Due Date
Spectrum Analyzer	R&S	FSP40	1164.4391.40	2014.07.07	2015.07.06

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.

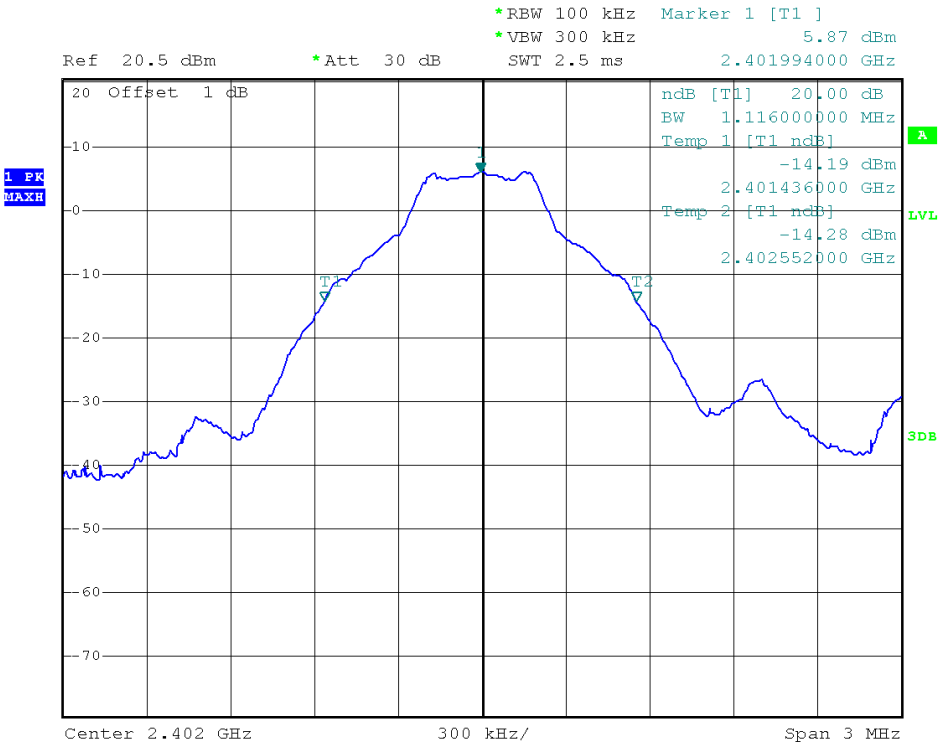
2.4.2.1. GFSK Mode

A. Test Verdict:

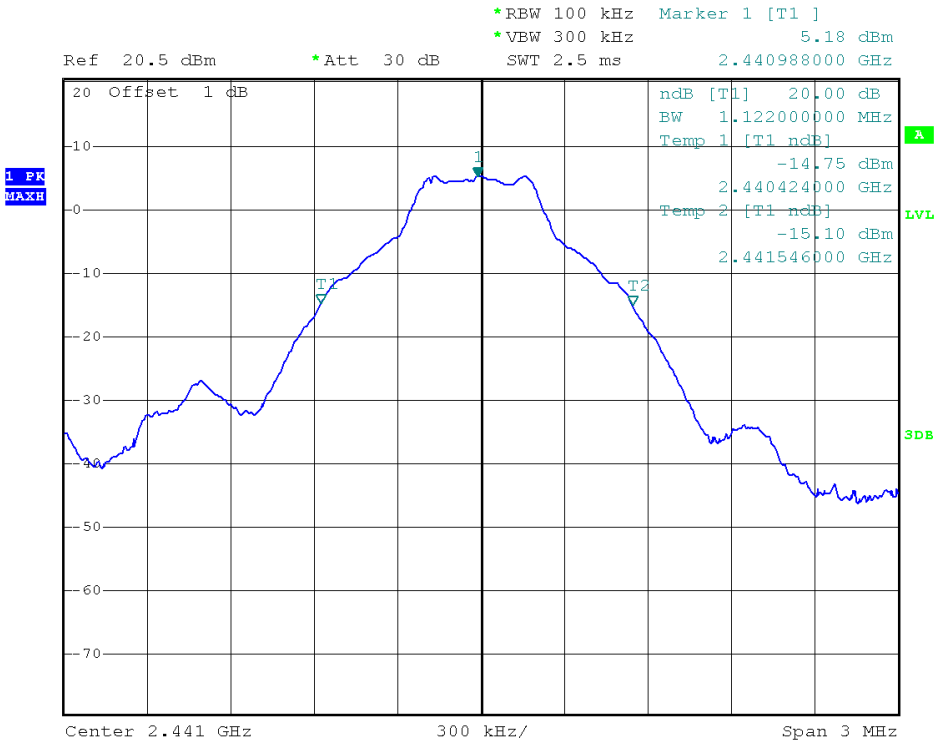
The maximum 20dB bandwidth measured is 1.122MHz according to the table below.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
0	2402	1.116	Plot A
39	2441	1.122	Plot B
78	2480	1.122	Plot C

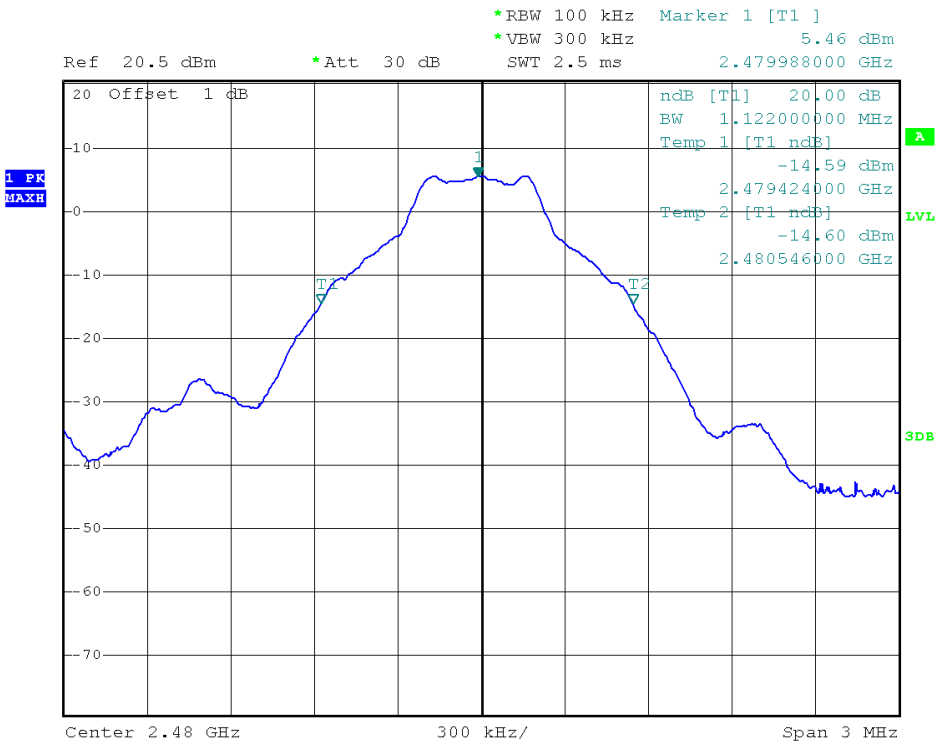
Test Plots:



(Plot A: Channel = 2402 @ GFSK)



(Plot B: Channel = 2441 @ GFSK)



(Plot C: Channel = 2480 @ GFSK)

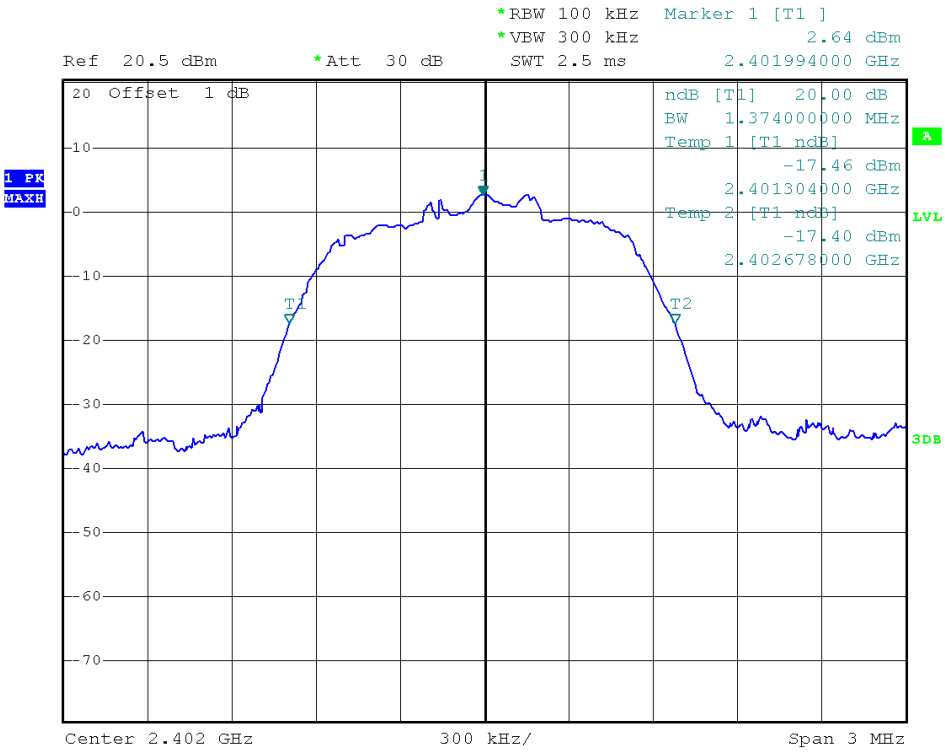
2.4.2.2. π/4-DQPSK Mode

A. Test Verdict:

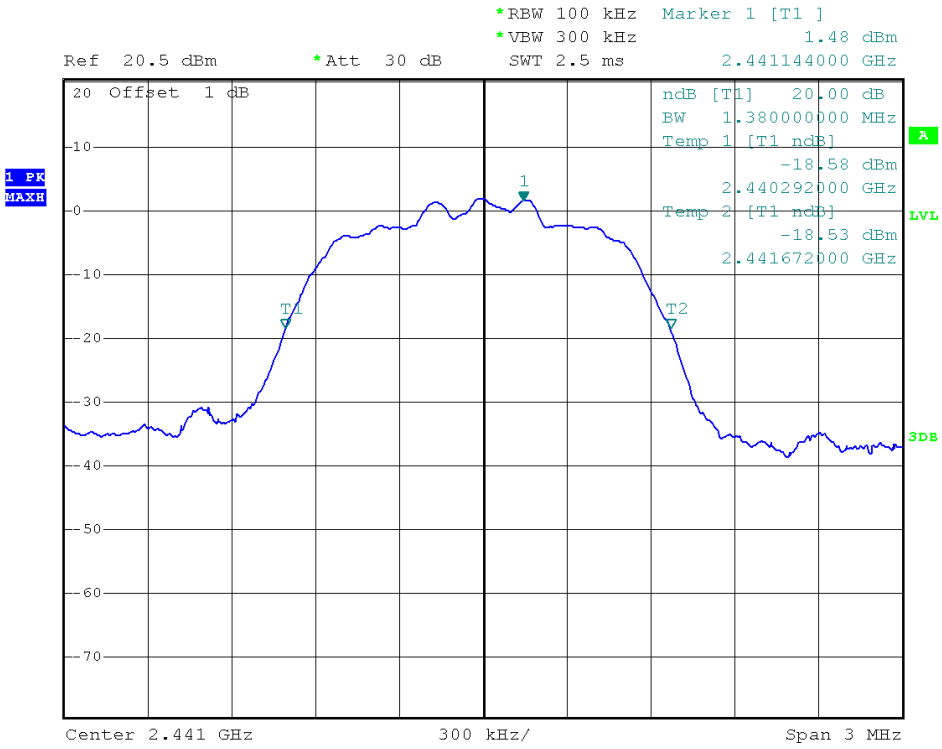
The maximum 20dB bandwidth measured is 1.380MHz according to the table below.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
0	2402	1.374	Plot D
39	2441	1.380	Plot E
78	2480	1.380	Plot F

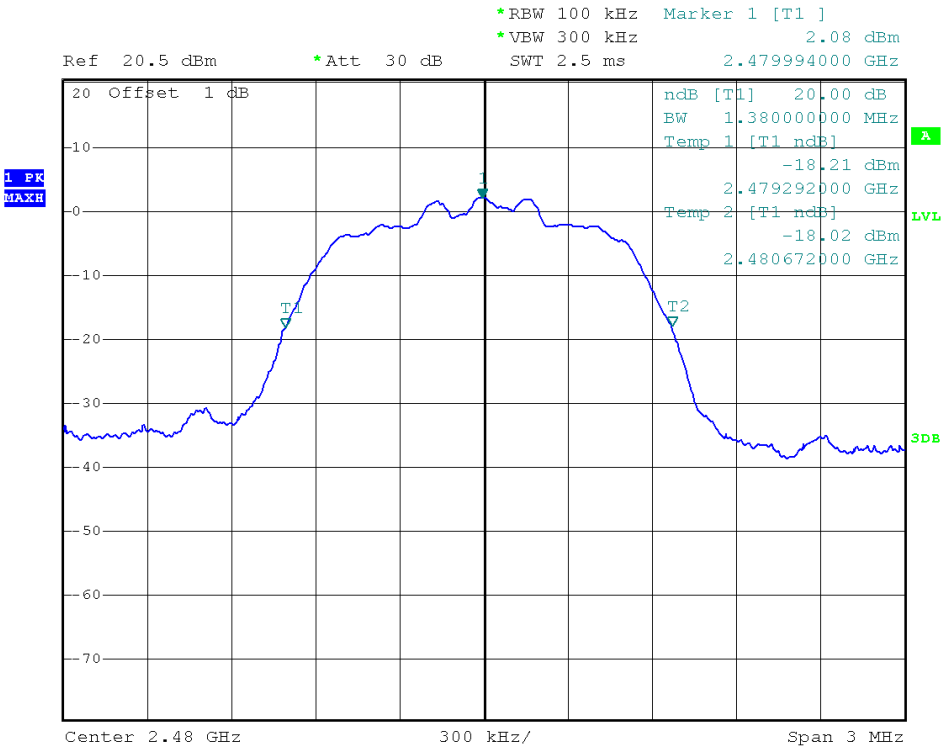
Test Plots:



(Plot D: Channel = 2402 @π/4-DQPSK)



(Plot E: Channel = 2441 @π/4-DQPSK)



(Plot F: Channel = 2480 @π/4-DQPSK)

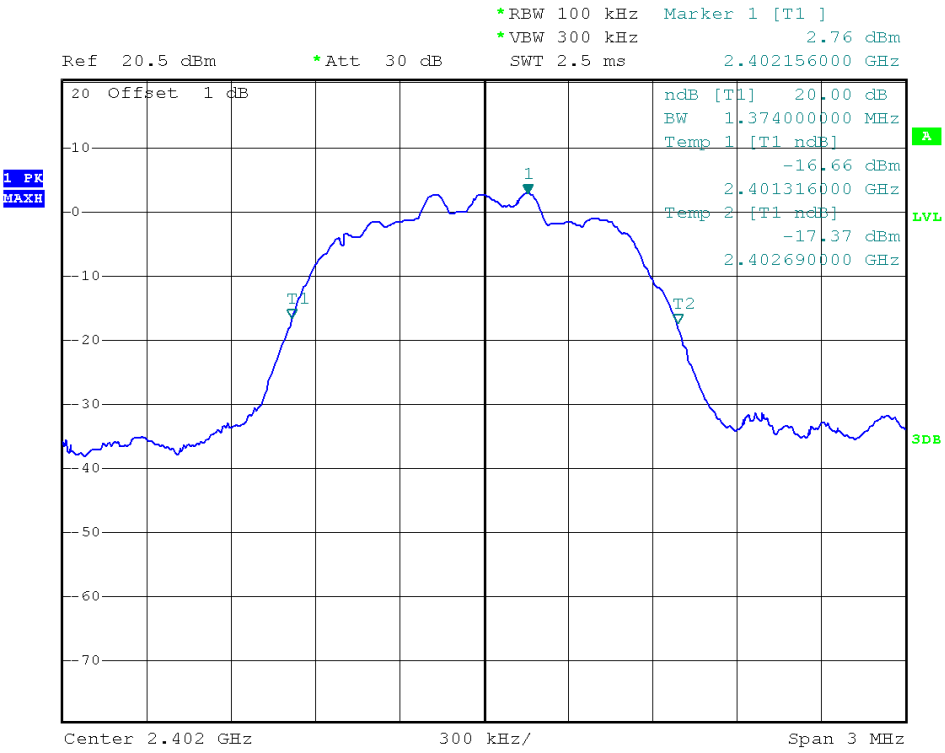
2.4.2.3. 8-DPSK Mode

A. Test Verdict:

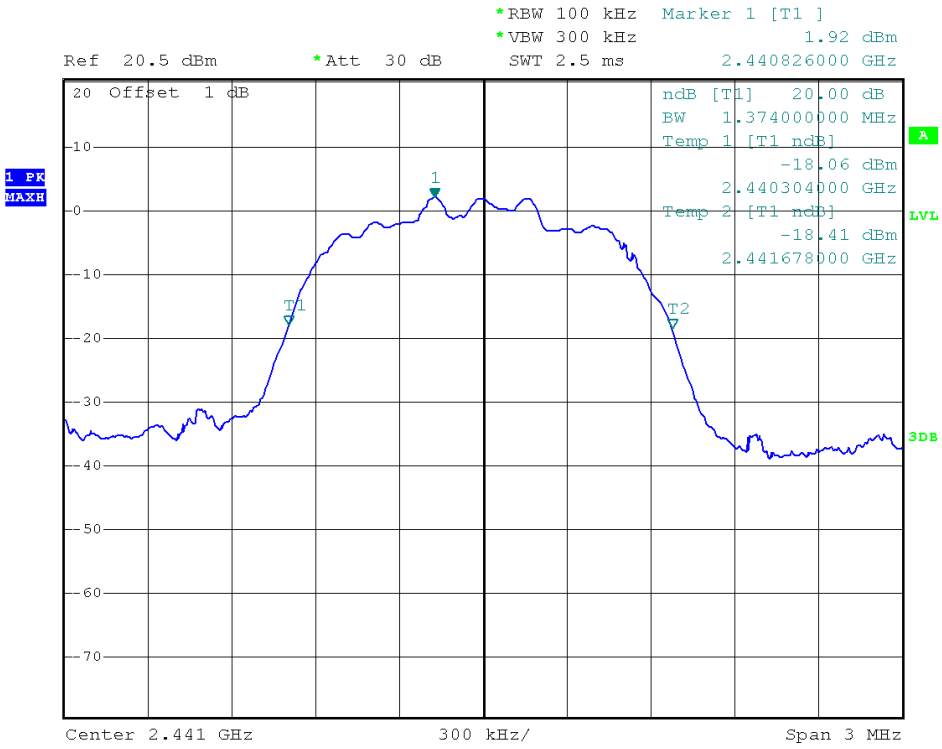
The maximum 20dB bandwidth measured is 1.374MHz according to the table below.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
0	2402	1.374	Plot G
39	2441	1.374	Plot H
78	2480	1.374	Plot I

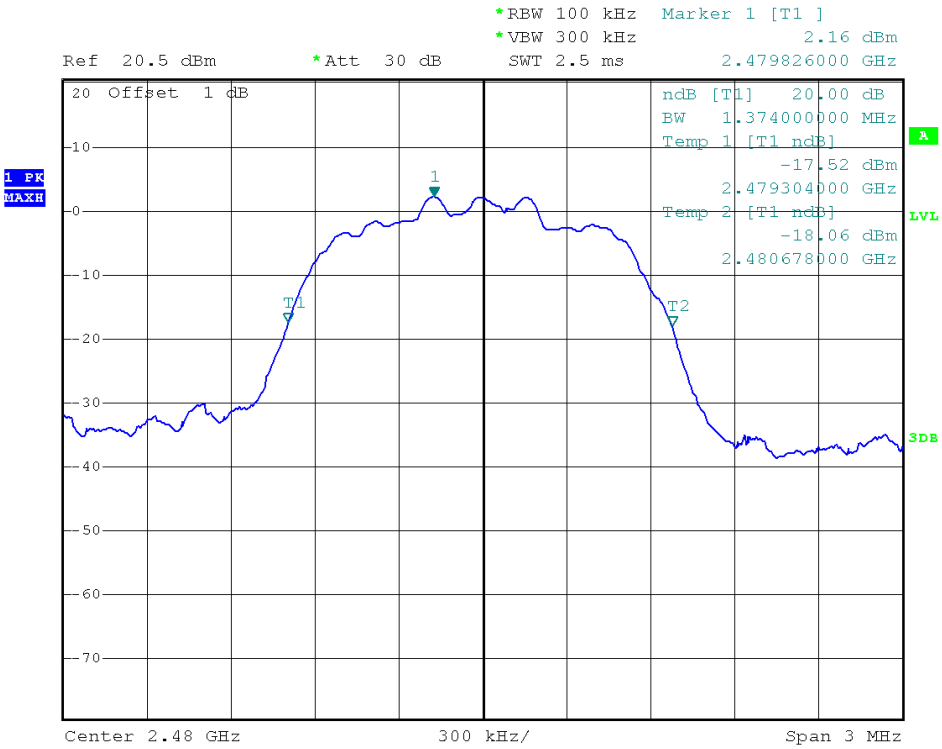
B. Test Plots:



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



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



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

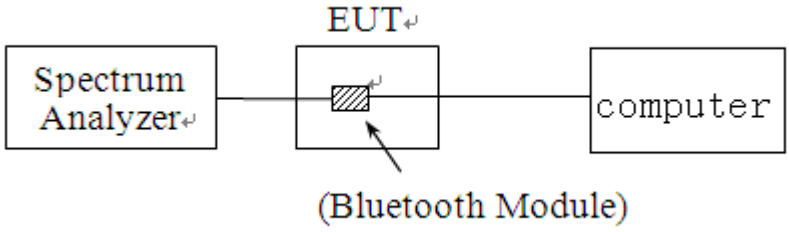
2.5. Carried Frequency Separation

2.5.1. Definition

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

2.5.2. Test Description

A. Test Setup:



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

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal.Date	Cal.Due Date
Spectrum Analyzer	R&S	FSP40	1164.4391.40	2014.07.07	2015.07.06

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

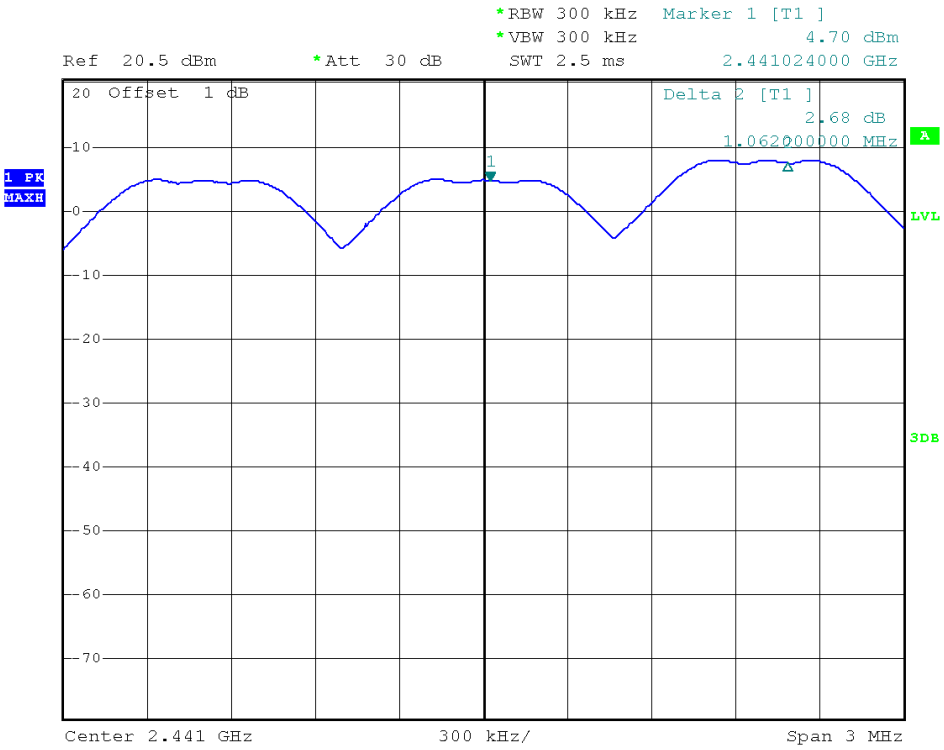
Trace = max hold

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

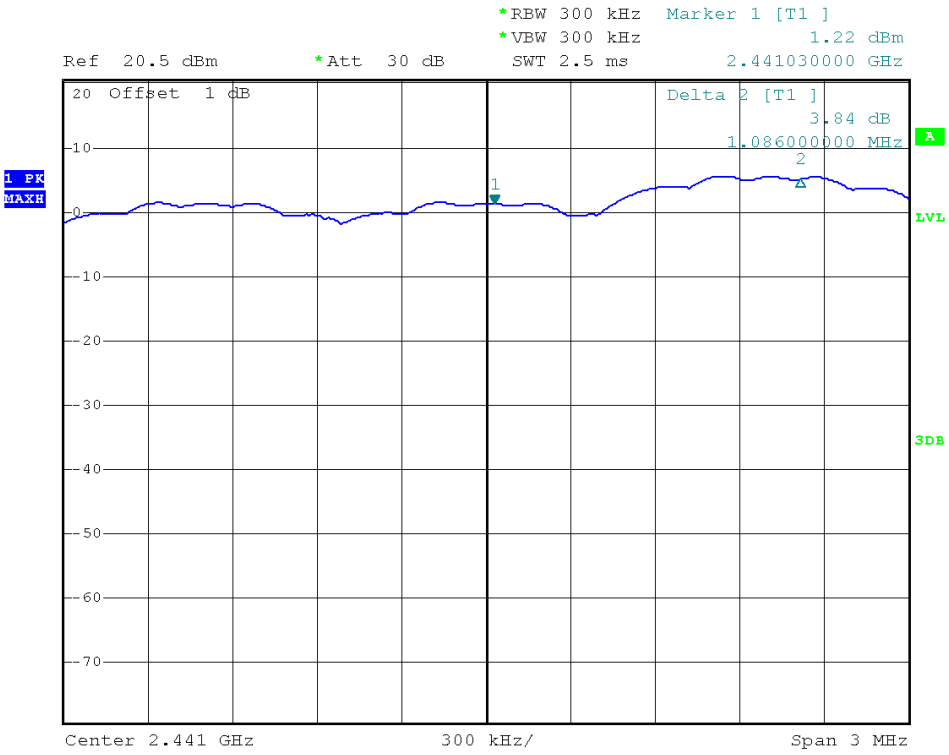
2.5.4. Test Result

The Bluetooth Module operates at hopping-on test mode.

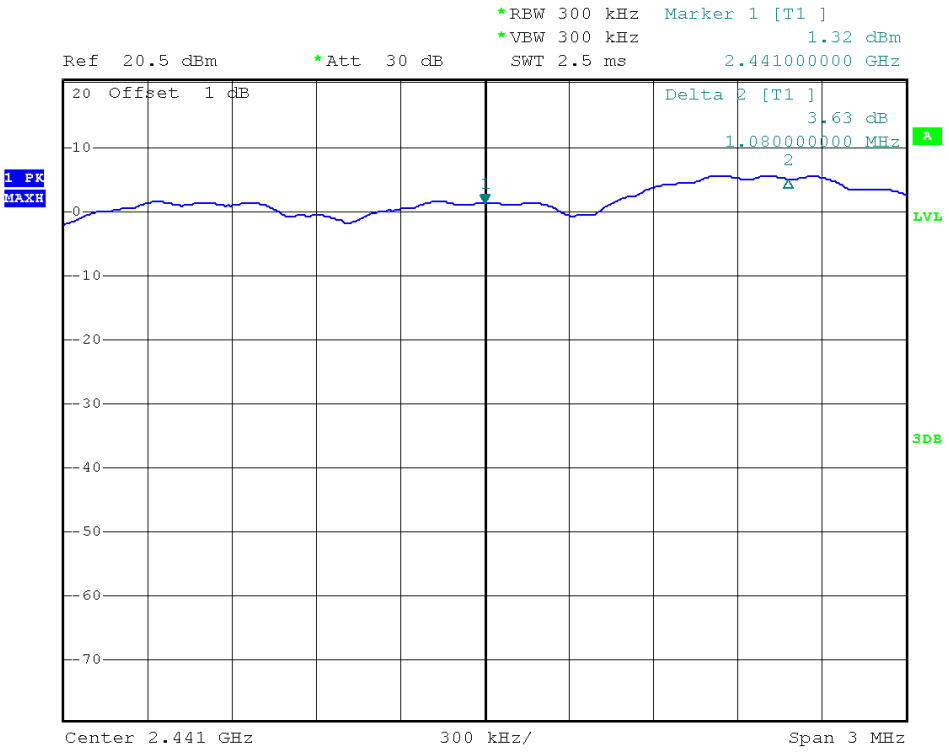
For any adjacent channels (e.g. the channel 39 and 40 as showed in the Plot A), the Module does have hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of the hopping channel (1.122MHz for GFSK mode, 1.380MHz for π/4-DQPSK mode and 1.374MHz for 8-DPSK mode, refer to section 2.4.1), whichever is greater. So, the verdict is PASSING



(Plot A: GFSK)



(Plot B: π/4-DQPSK)



(Plot C: 8-DPSK)

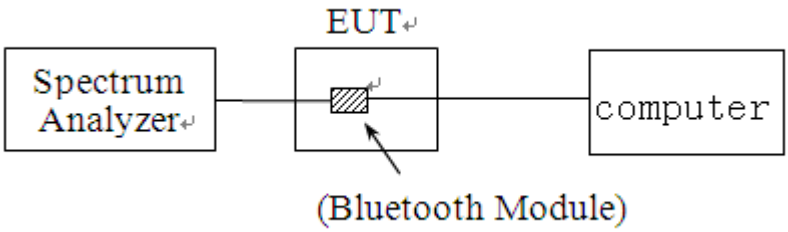
2.6. Time of Occupancy (Dwell time)

2.6.1. Requirement

According to FCC §15.247(a) (1) (iii), frequency hopping systems in the 2400 - 2483.5MHz band shall use at least 15 non-overlapping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

2.6.2. Test Description

A. Test Setup:



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

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal.Date	Cal.Due Date
Spectrum Analyzer	R&S	FSP40	1164.4391.40	2014.07.07	2015.07.06

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.

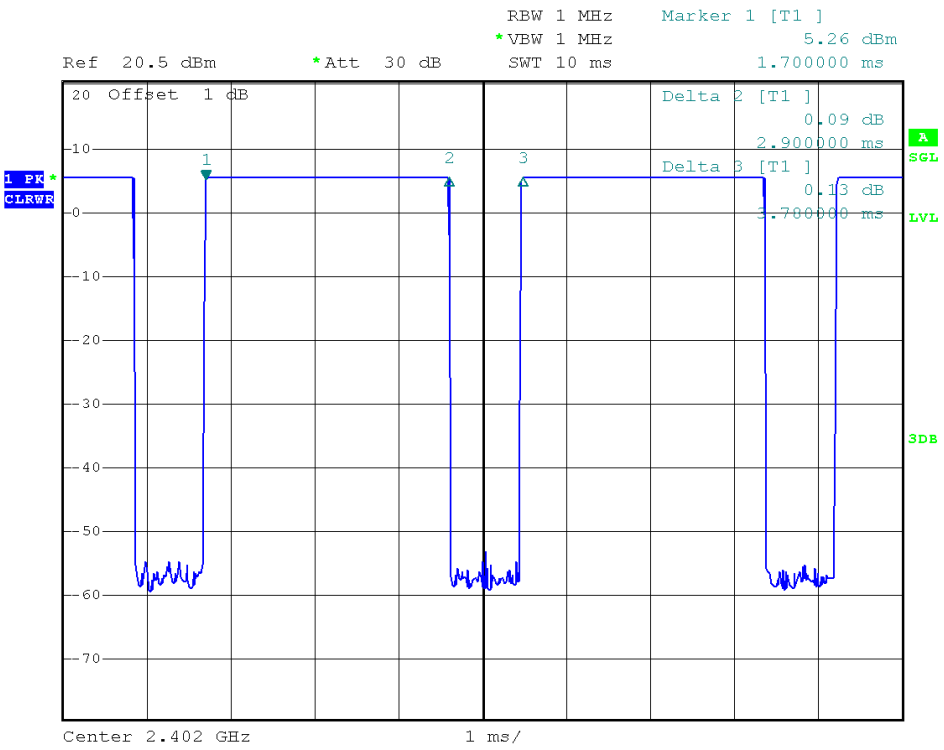
2.6.4.1. GFSK Mode

A. Test Verdict:

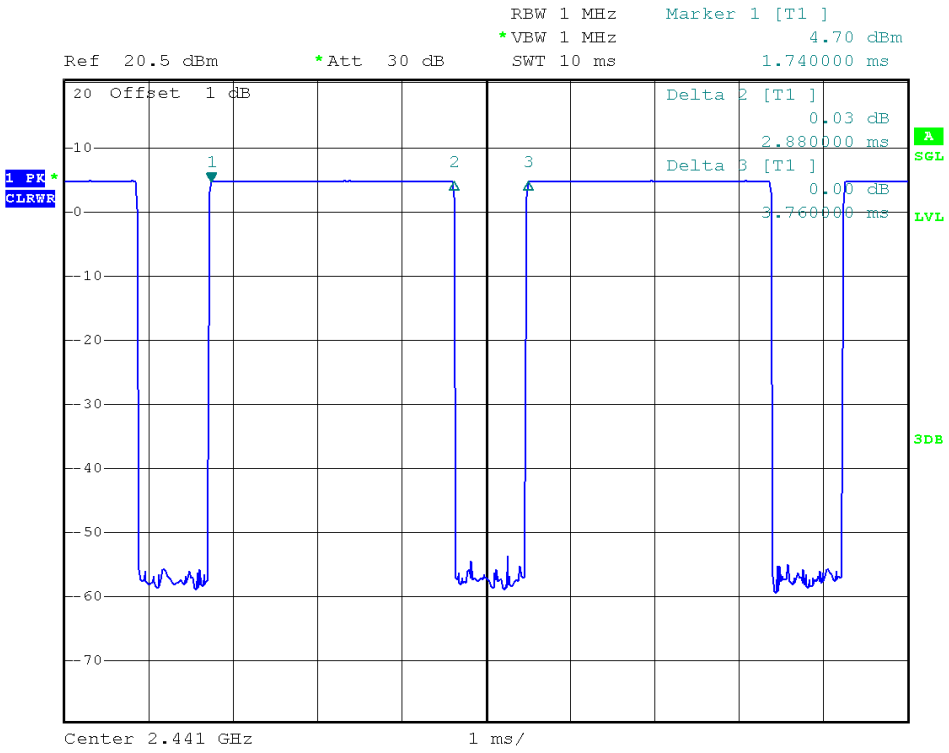
Channel	Frequency (MHz)	Pulse Time		Total of Dwell (ms)	Limit (ms)	Verdict
		ms	Refer to Plot			
0	2402	2.90	Plot A	309.333	400	PASS
39	2441	2.88	Plot B	307.200		PASS
78	2480	2.88	Plot C	307.200		PASS

Test Plots:

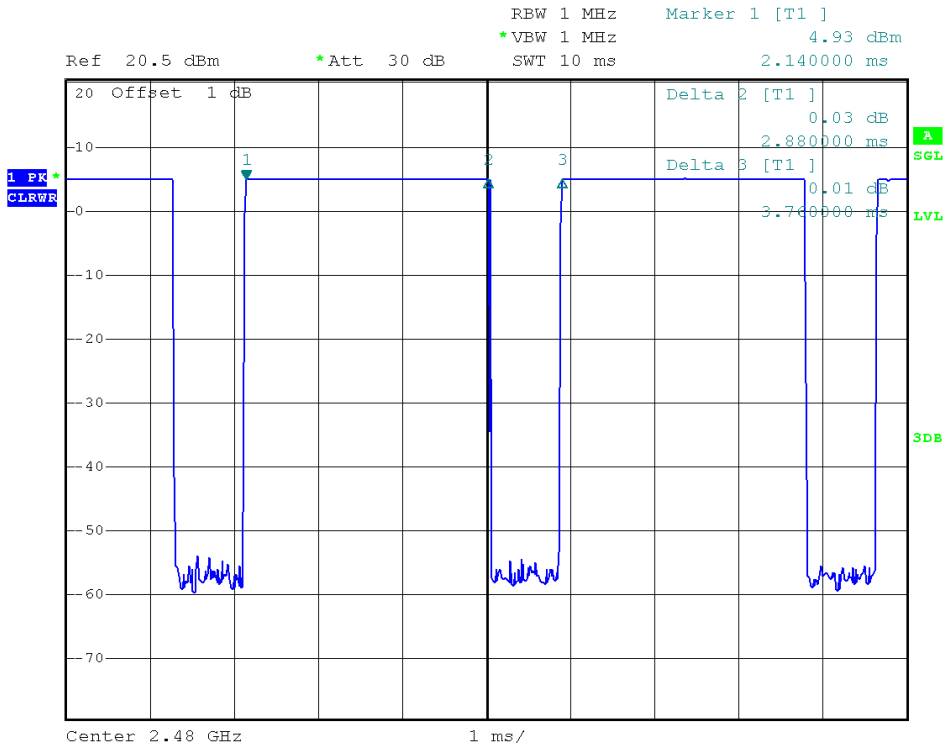
Note: the following plots record the Pulse Time of the Module carrier.



(Plot A: Channel = 2402 @ GFSK)



(Plot B: Channel = 2441 @ GFSK)



(Plot C: Channel = 2480 @ GFSK)

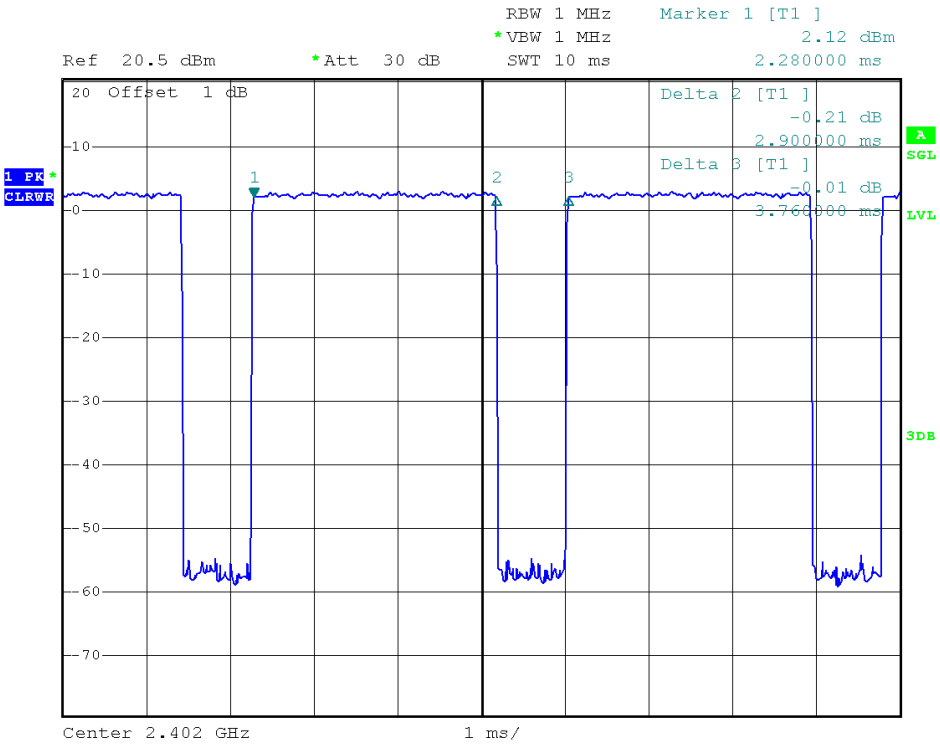
2.6.4.2. π/4-DQPSK Mode

A. Test Verdict:

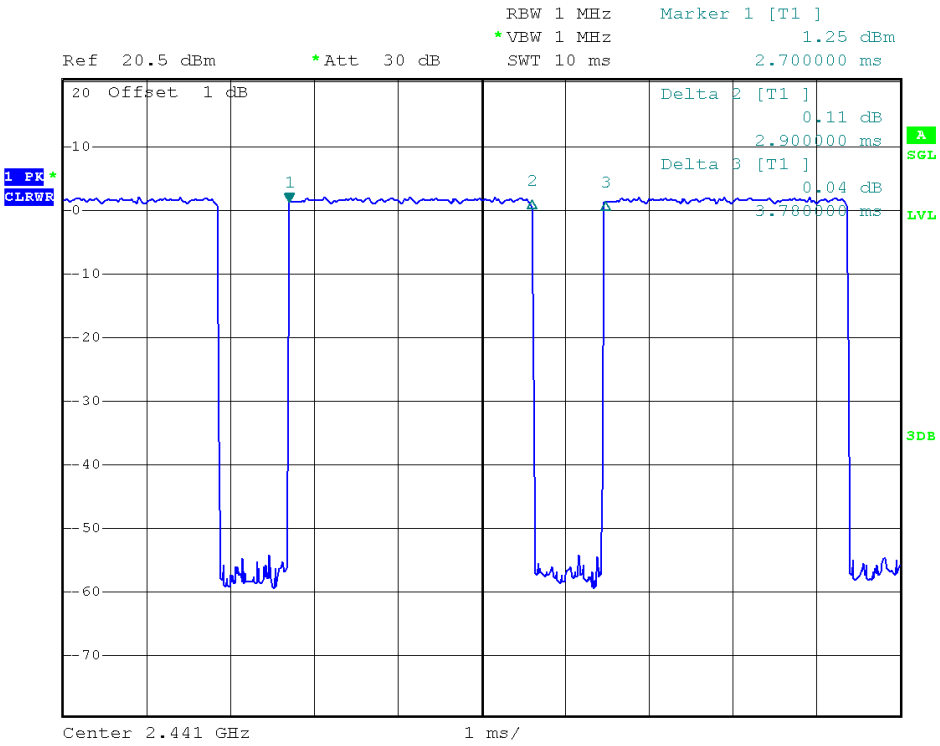
Channel	Frequency (MHz)	Pulse Time		Total of Dwell (ms)	Limit (ms)	Verdict
		ms	Refer to Plot			
0	2402	2.90	Plot D	309.333	400	PASS
39	2441	2.90	Plot E	309.333		PASS
78	2480	2.88	Plot F	307.200		PASS

Test Plots:

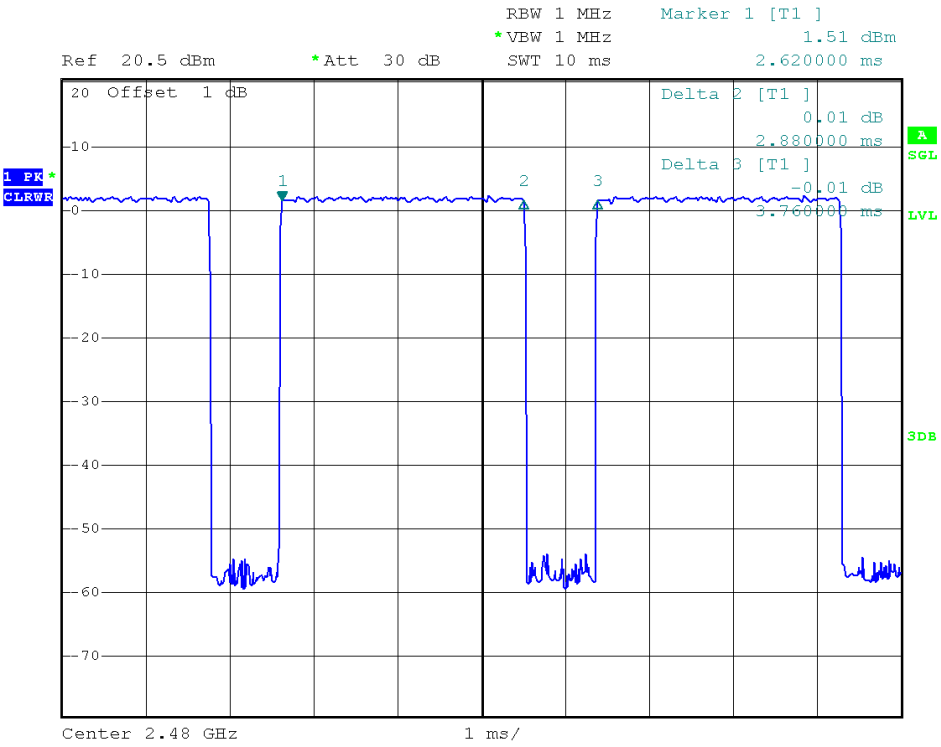
Note: the following plots record the Pulse Time of the Module carrier.



(Plot D: Channel = 2402 @π/4-DQPSK)



(Plot E: Channel = 2441 @π/4-DQPSK)



(Plot F: Channel = 2480 @π/4-DQPSK)

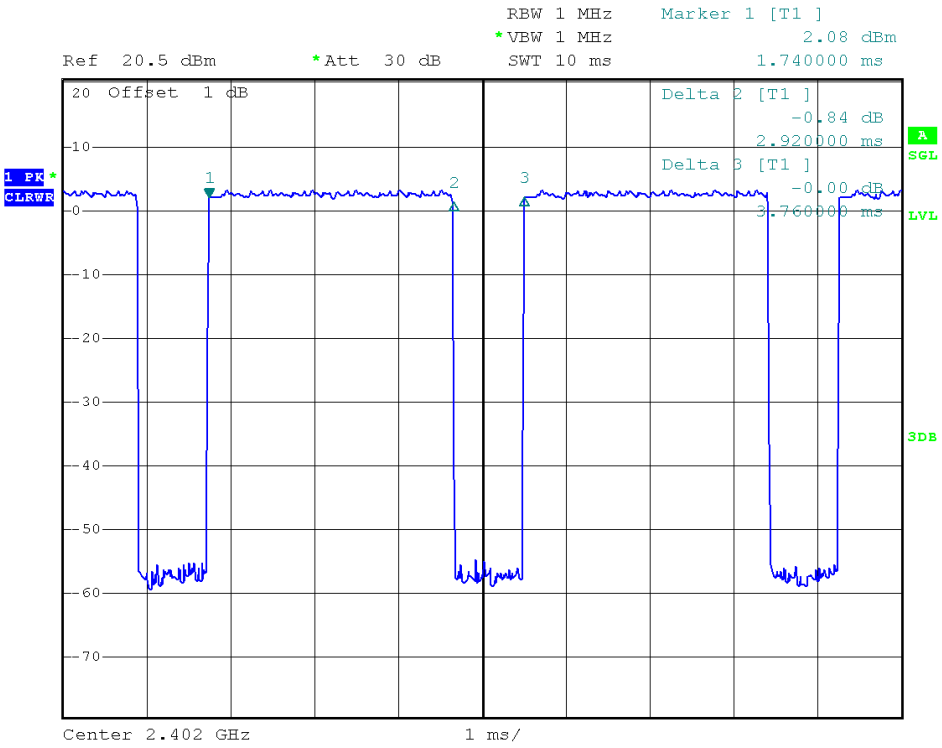
2.6.4.3. 8-DPSK mode

A. Test Verdict:

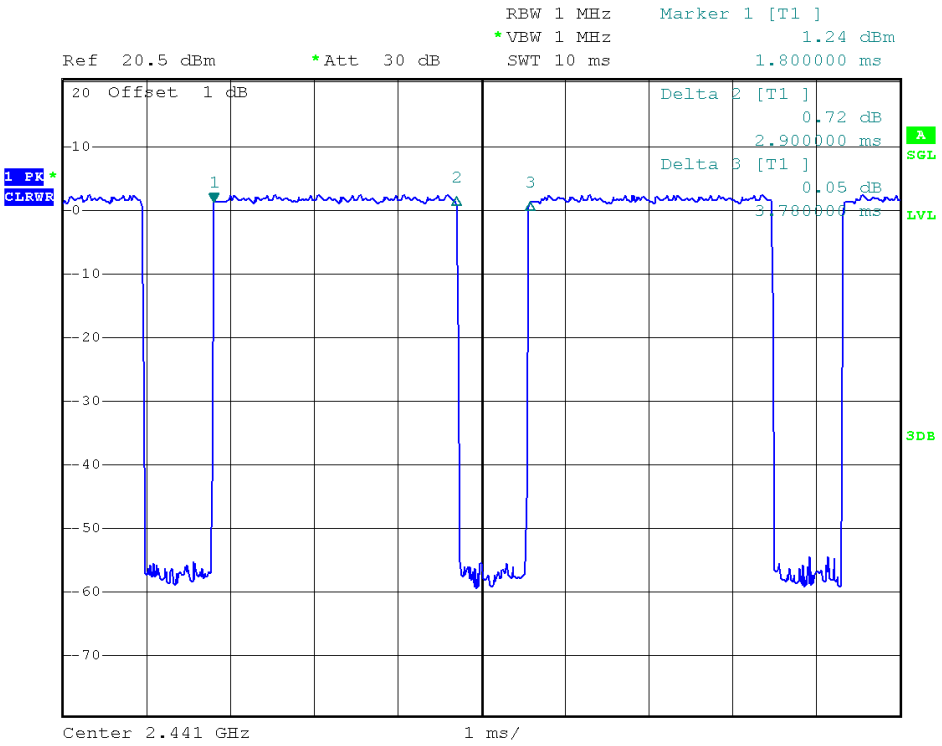
Channel	Frequency (MHz)	Pulse Time		Total of Dwell (ms)	Limit (ms)	Verdict
		ms	Refer to Plot			
0	2402	2.92	Plot G	311.467	400	PASS
39	2441	2.90	Plot H	309.333		PASS
78	2480	2.90	Plot I	309.333		PASS

Test Plots:

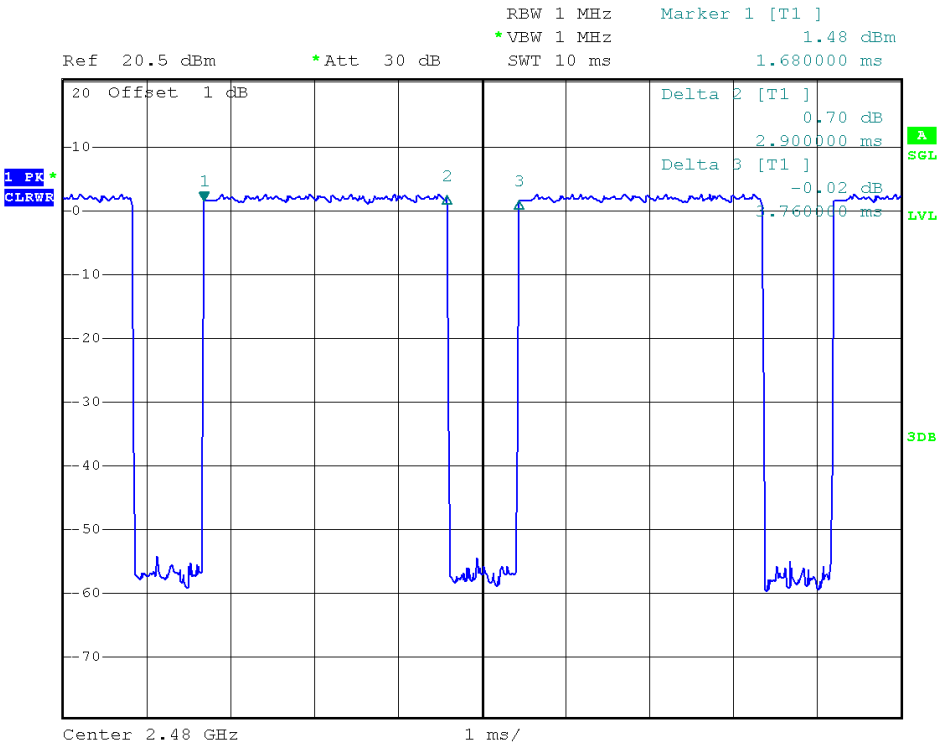
Note: the following plots record the Pulse Time of the Module carrier.



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



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



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

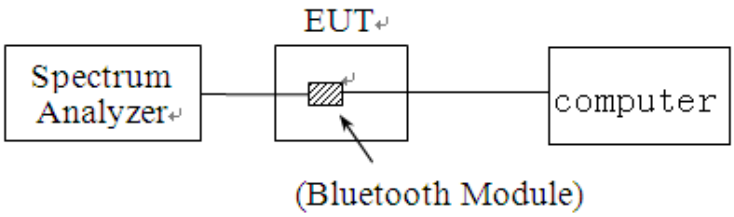
2.7. Conducted Spurious Emissions

2.7.1. Requirement

According to FCC §15.247(d), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

2.7.2. Test Description

A. Test Setup:



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

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal.Date	Cal.Due Date
Spectrum Analyzer	R&S	FSP40	1164.4391.40	2014.07.07	2015.07.06

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.

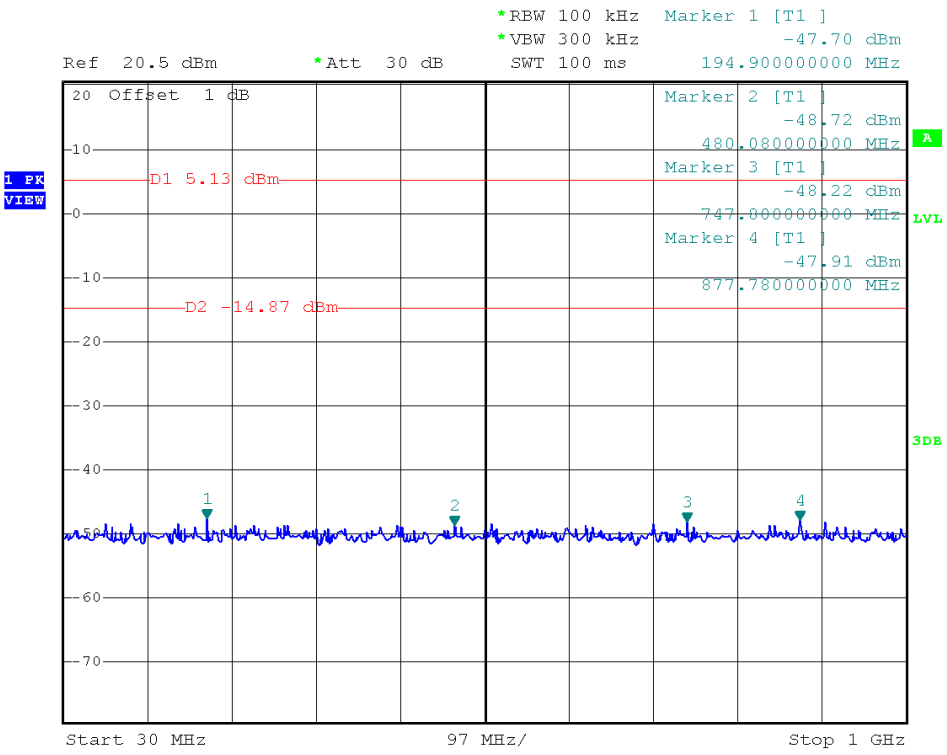
2.7.4.1. GFSK Mode

A. Test Verdict:

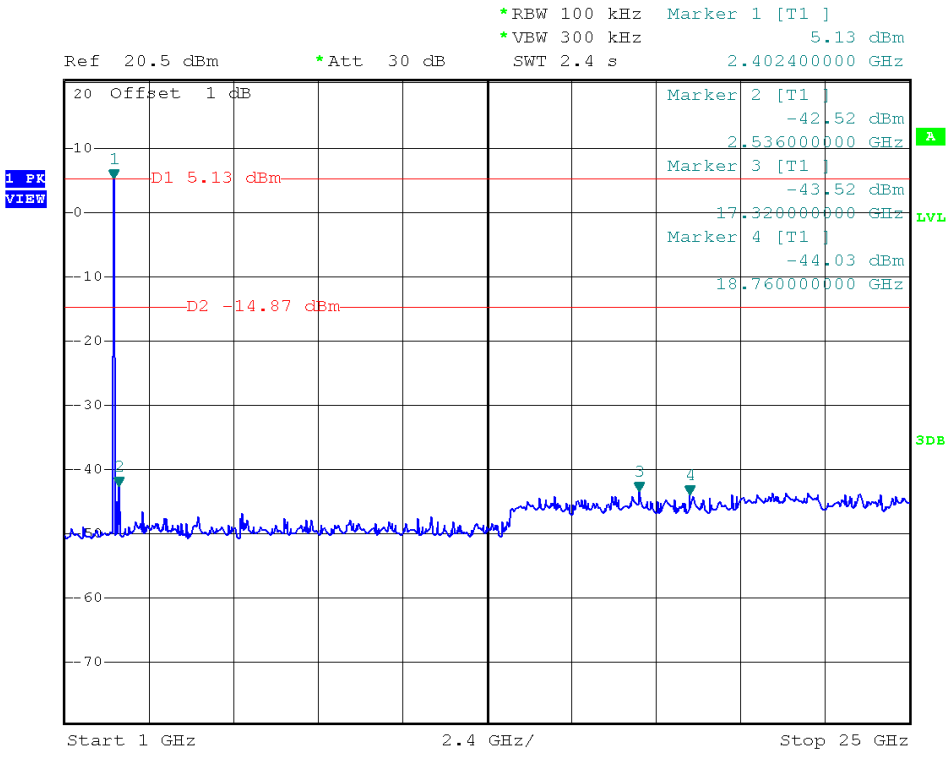
Channel	Frequency (MHz)	Refer to Plot	Limit (dBc)	Verdict
0	2402	Plot 2.4 A1/A2	-20	PASS
39	2441	Plot 2.4 B1/B2	-20	PASS
78	2480	Plot 2.4 C1/C2	-20	PASS

B. Test Plots:

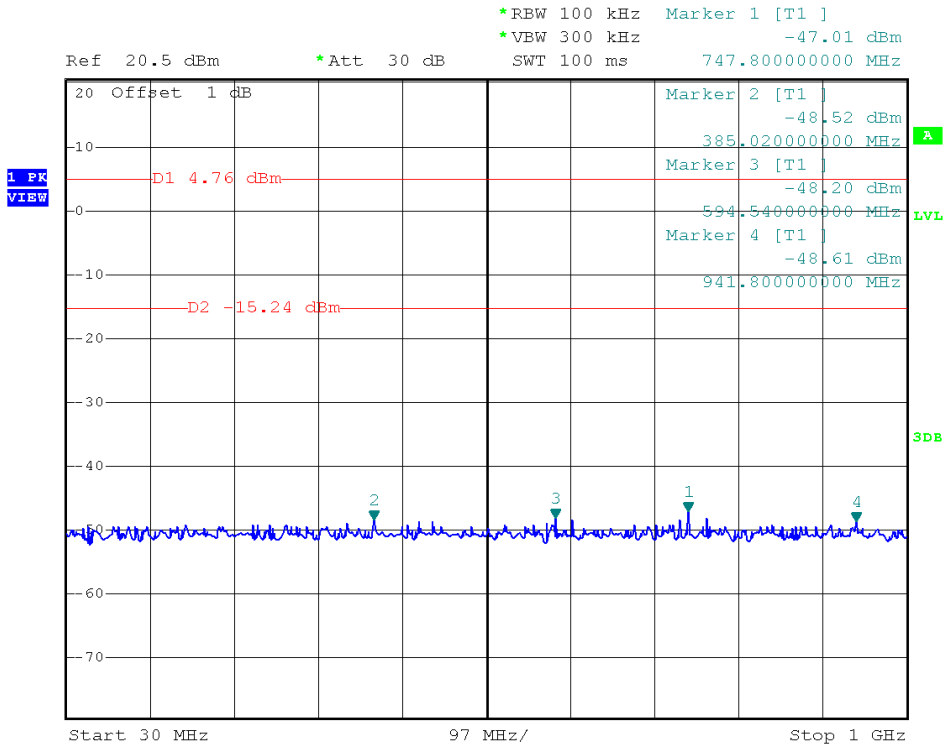
Note: the power of the Module transmitting frequency should be ignored.



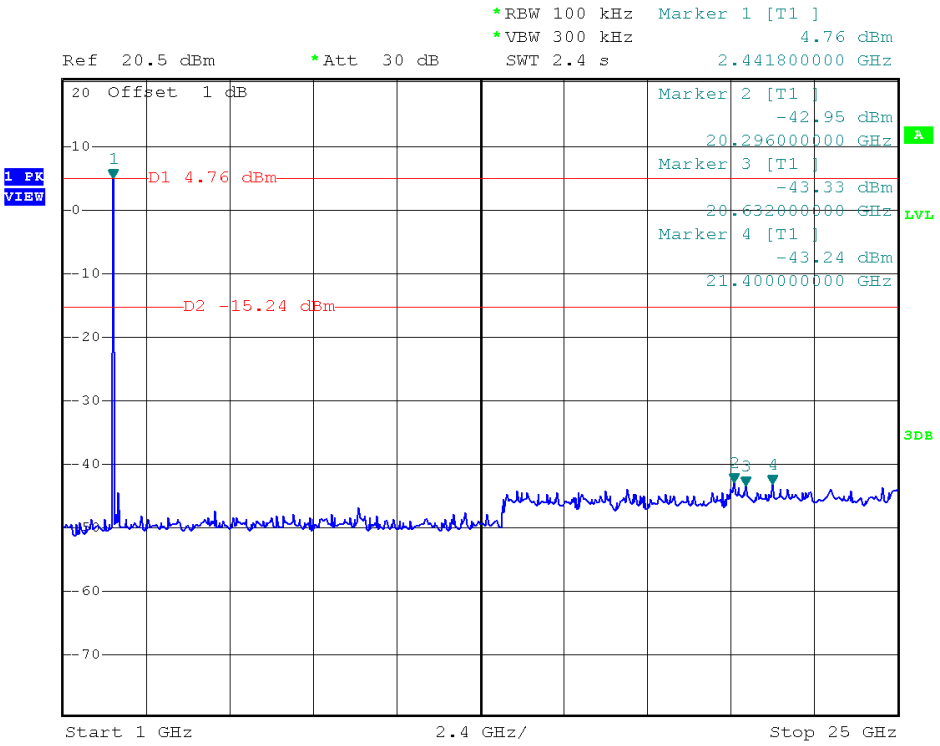
(Plot A.1: Channel = 0, 30MHz to 1GHz @ GFSK Mode)



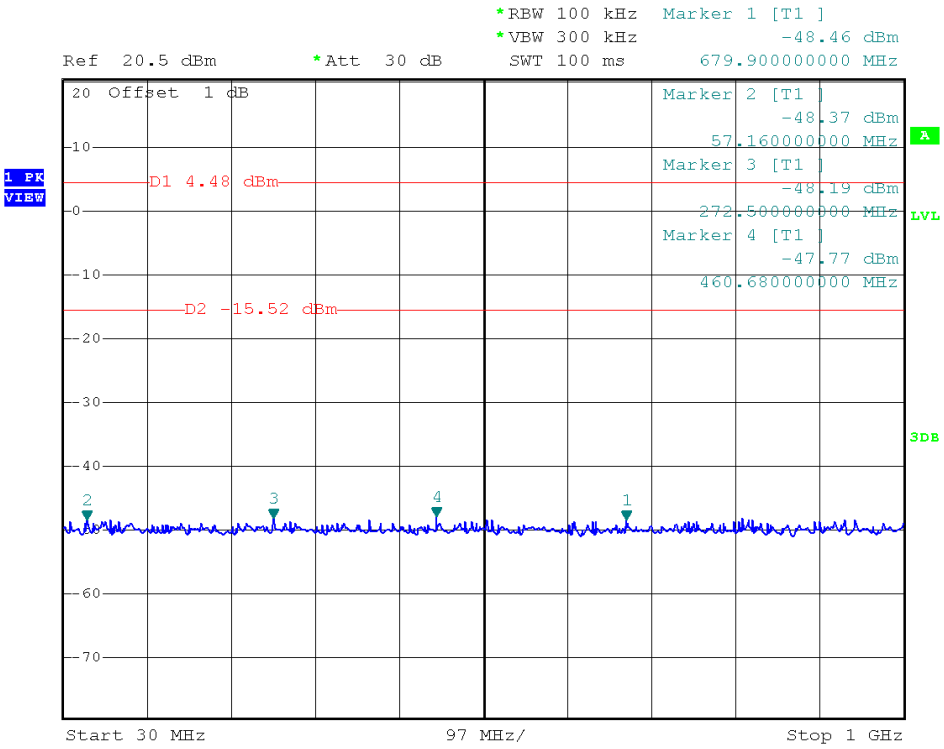
(Plot A.2: Channel = 0, 1GHz to 25GHz @ GFSK Mode)



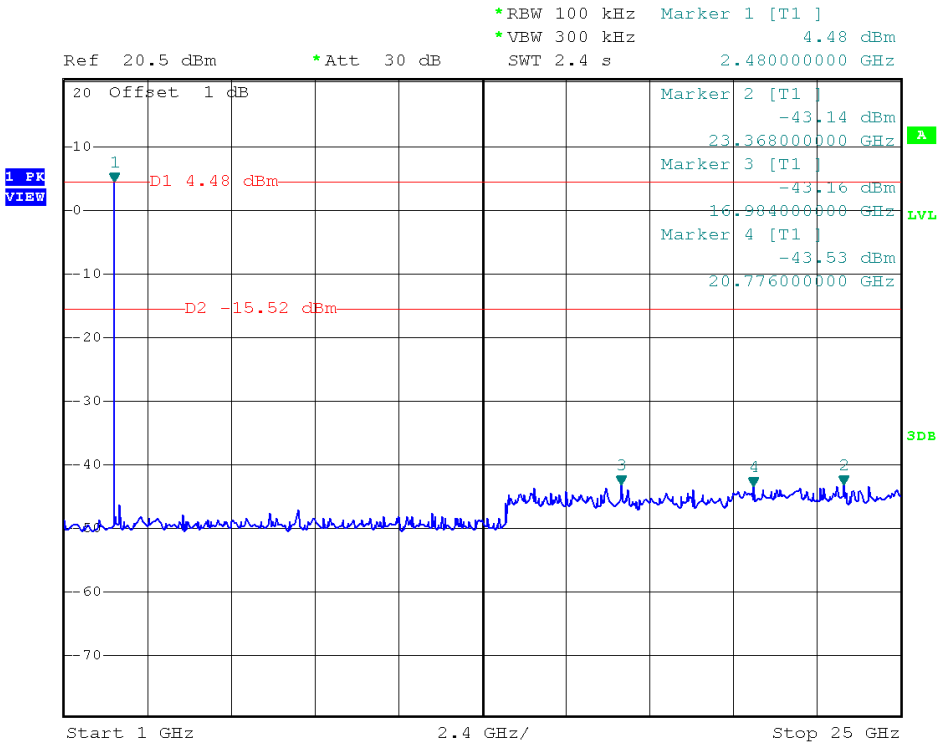
(Plot B.1: Channel = 39, 30MHz to 1GHz @ GFSK Mode)



(Plot B.2: Channel = 39, 1GHz to 25GHz @ GFSK Mode)



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



(Plot C.2: Channel = 78, 1GHz to 25GHz @ GFSK Mode)

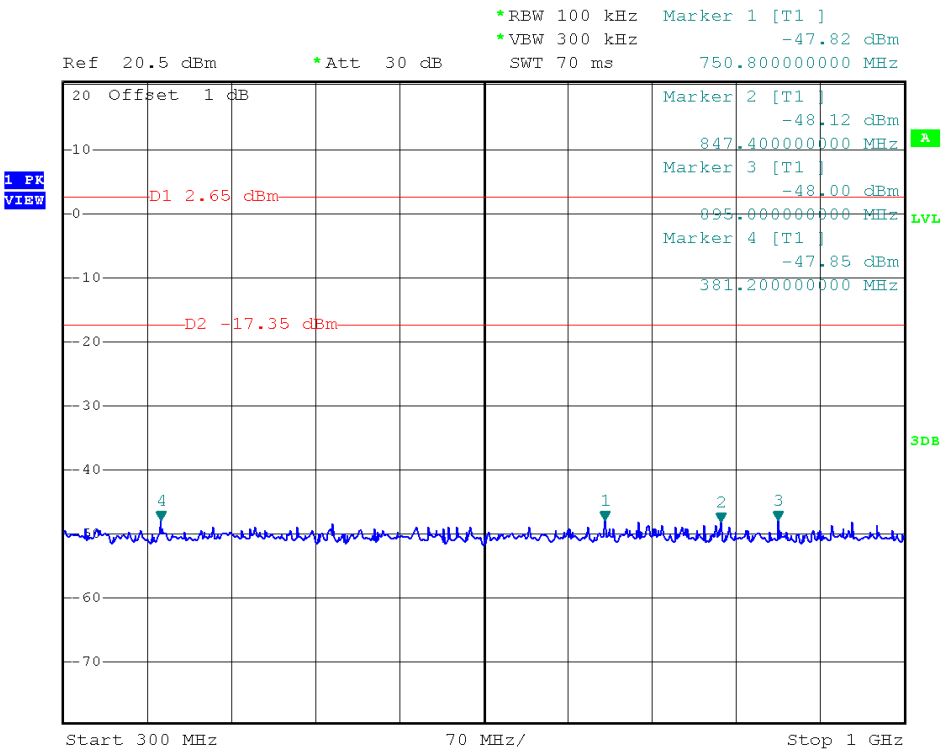
2.7.4.2. π/4-DQPSK Mode

A. Test Verdict:

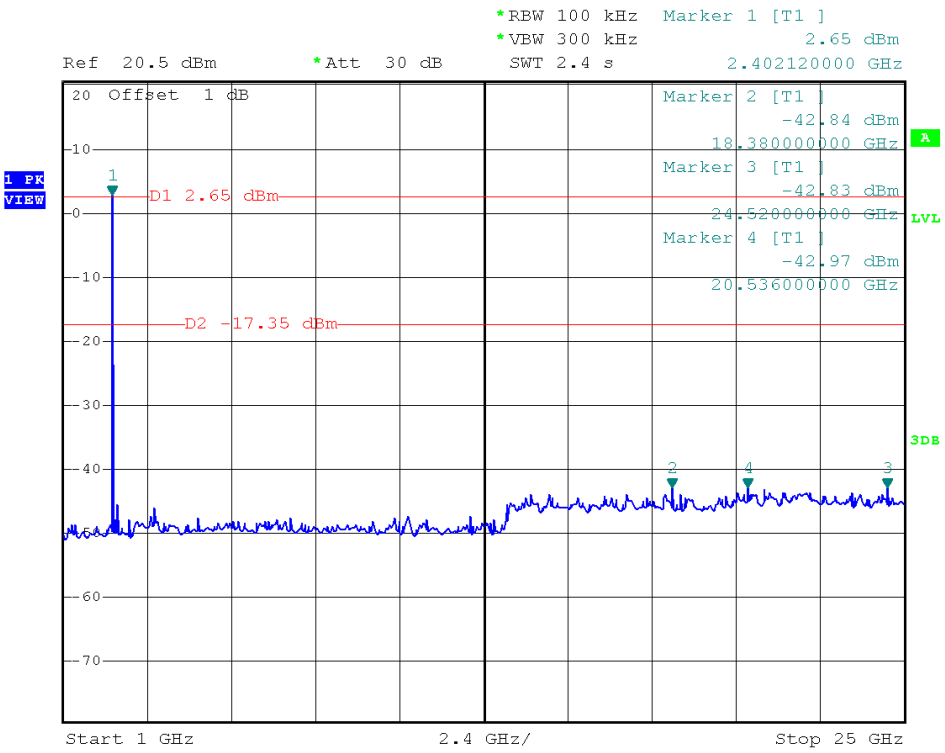
Channel	Frequency (MHz)	Refer to Plot	Limit (dBc)	Verdict
0	2402	Plot 2.4 D1/D2	-20	PASS
39	2441	Plot 2.4 E1/E2	-20	PASS
78	2480	Plot 2.4 F1/F2	-20	PASS

B. Test Plots:

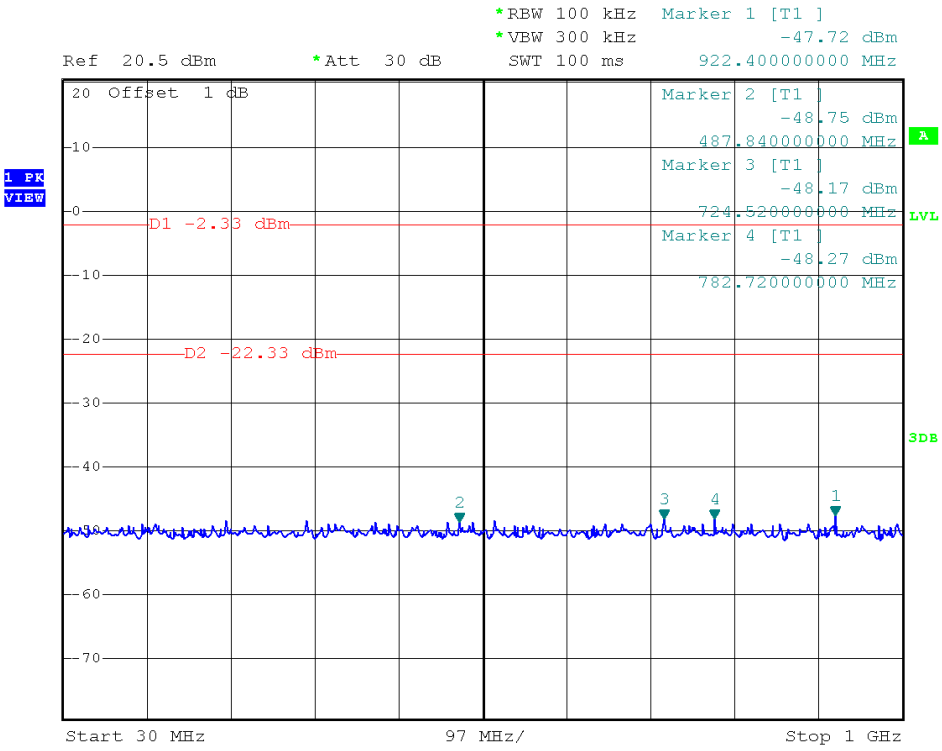
Note: the power of the Module transmitting frequency should be ignored.



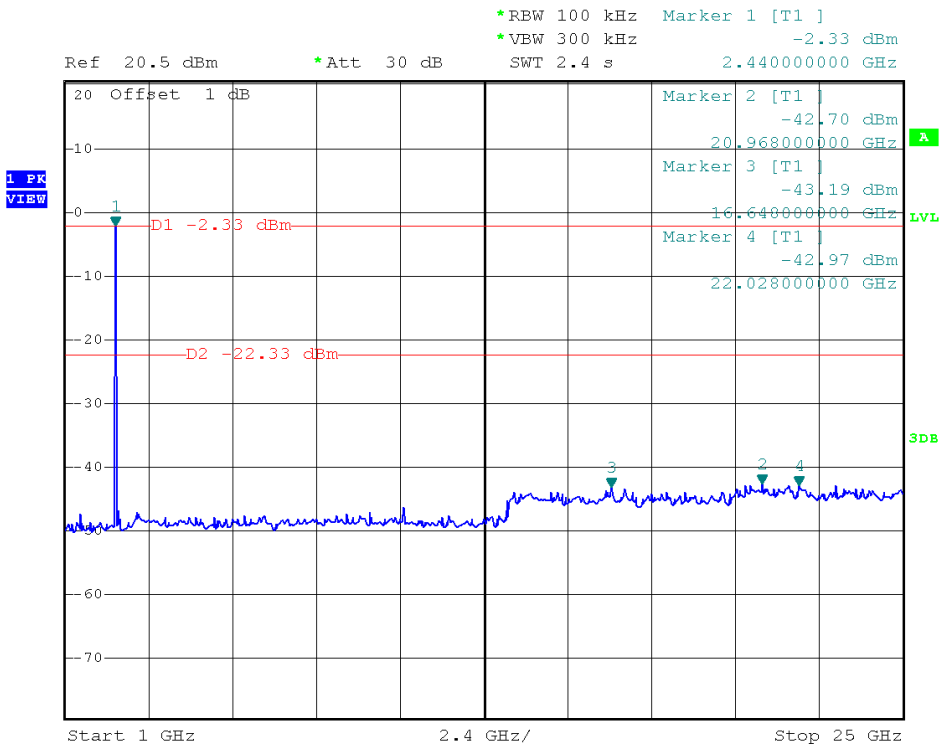
(Plot D.1: Channel = 0, 30MHz to 1GHz @π/4-DQPSK)



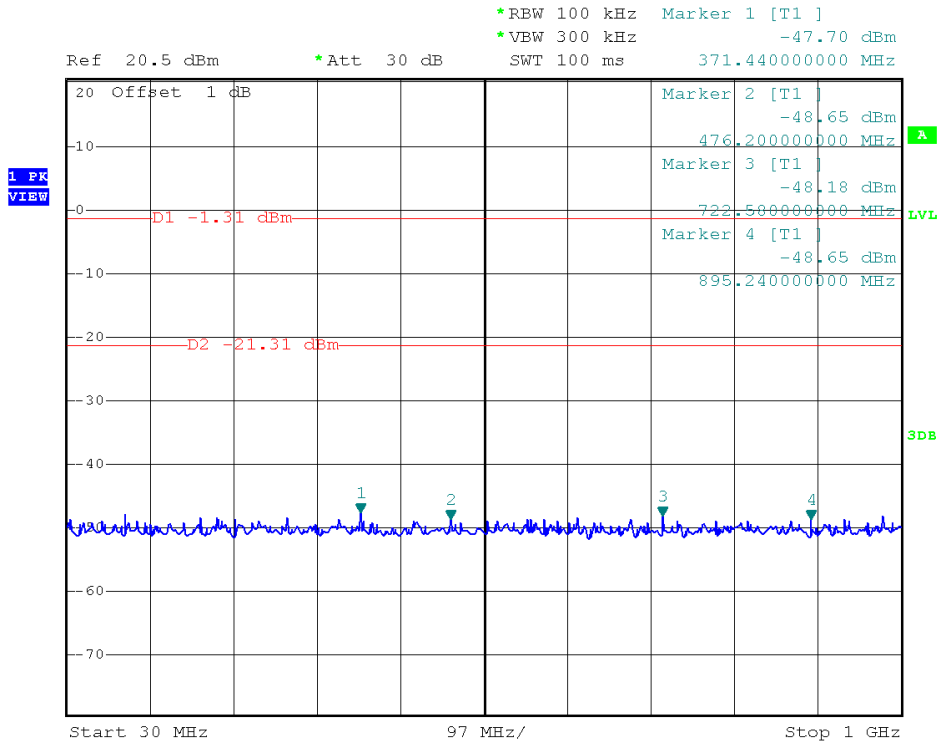
(Plot D.2: Channel = 0, 1GHz to 25GHz @π/4-DQPSK)



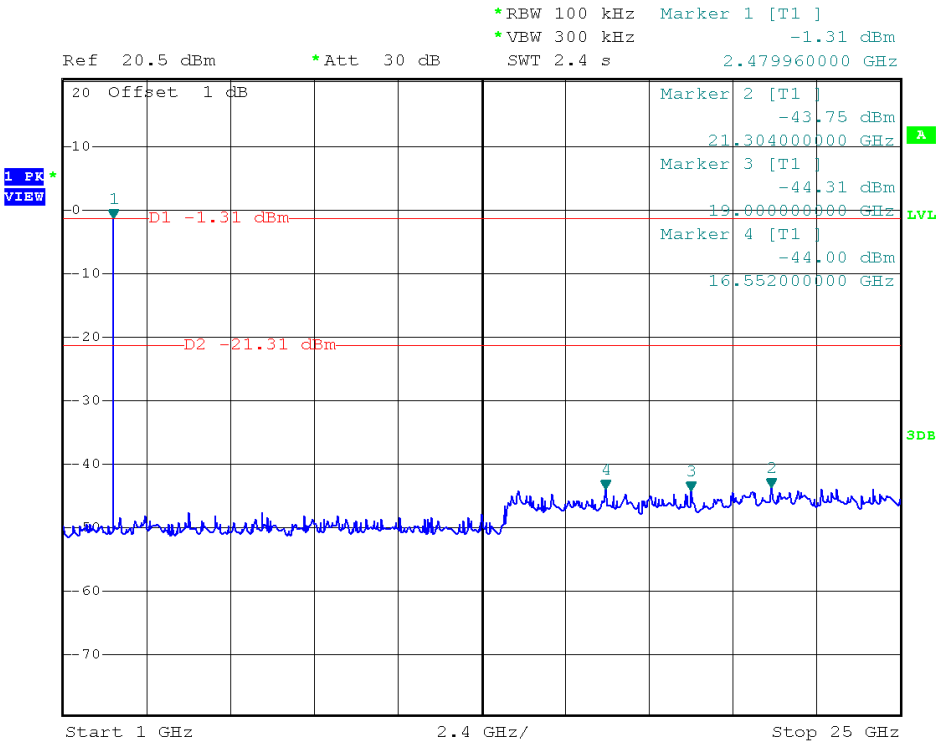
(Plot E.1: Channel = 39, 30MHz to 1GHz @π/4-DQPSK)



(Plot E.2: Channel = 39, 1GHz to 25GHz @π/4-DQPSK)



(Plot F.1: Channel = 78, 30MHz to 1GHz @π/4-DQPSK)



(Plot F.2: Channel = 78, 1GHz to 25GHz @π/4-DQPSK)

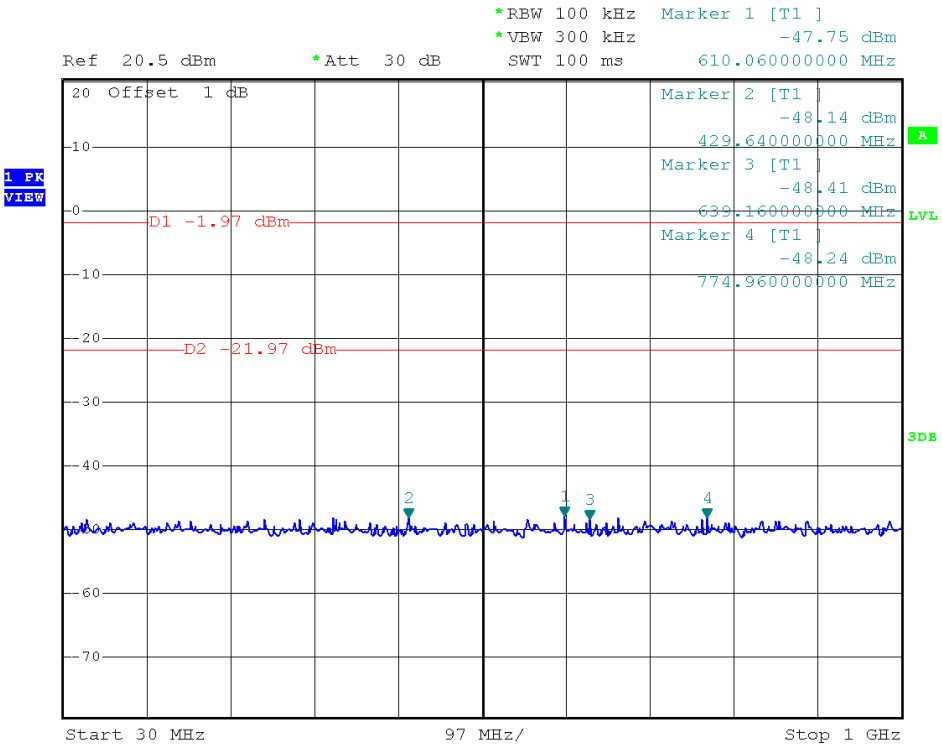
2.7.4.3. 8-DPSK Mode

A. Test Verdict:

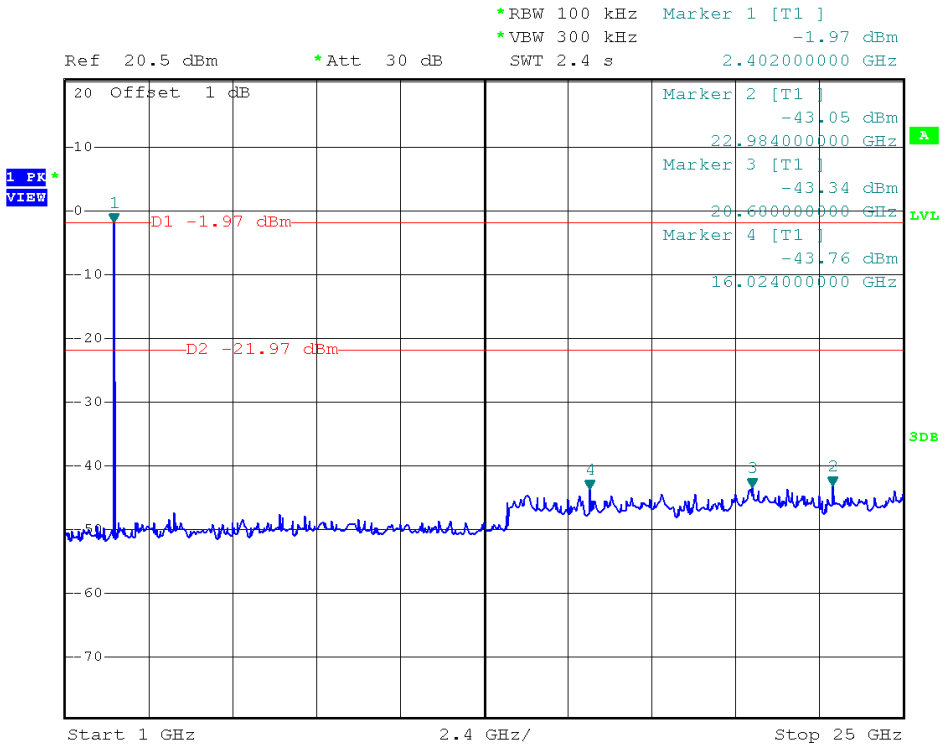
Channel	Frequency (MHz)	Refer to Plot	Limit (dBc)	Verdict
0	2402	Plot 2.4 G1/G2	-20	PASS
39	2441	Plot 2.4 H1/H2	-20	PASS
78	2480	Plot 2.4 I1/I2	-20	PASS

Test Plots:

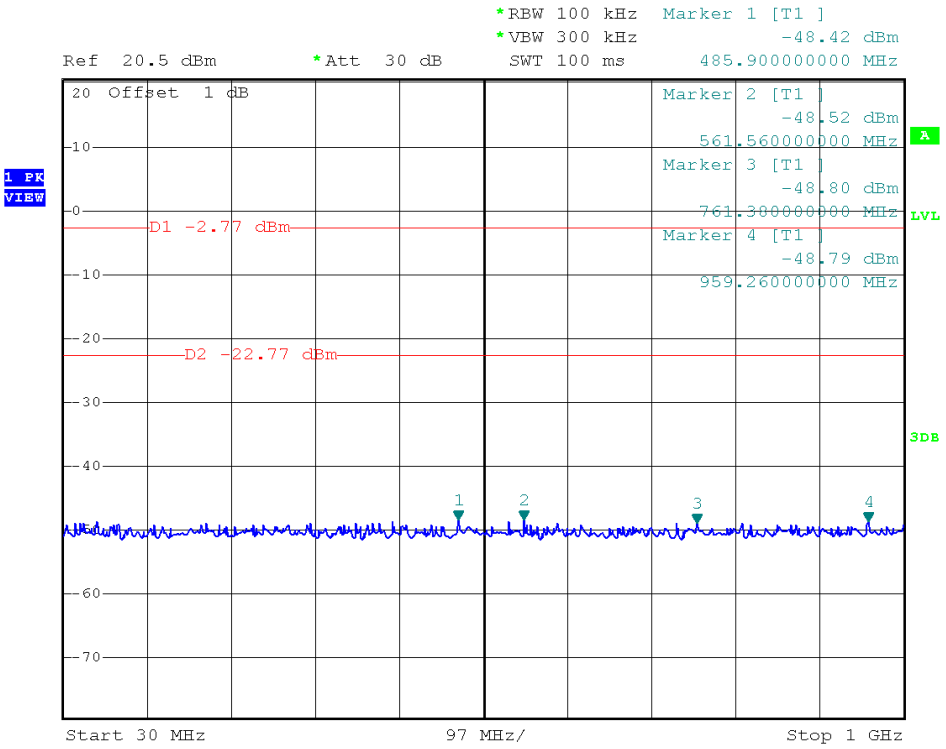
Note: the power of the Module transmitting frequency should be ignored.



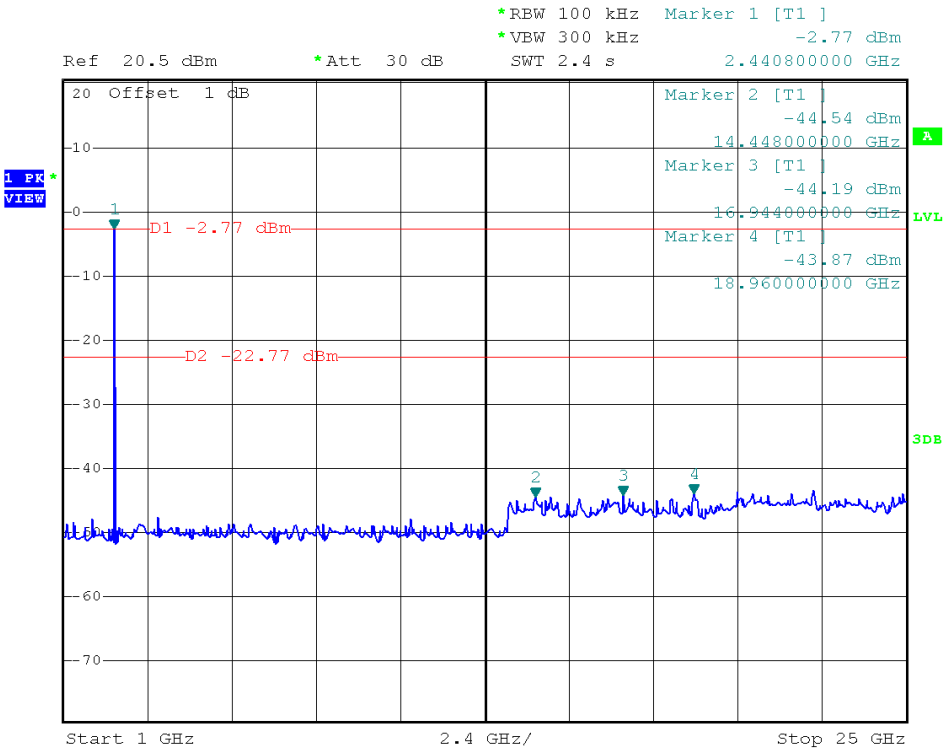
(Plot G.1: Channel = 0, 30MHz to 1GHz @ 8-DPSK)



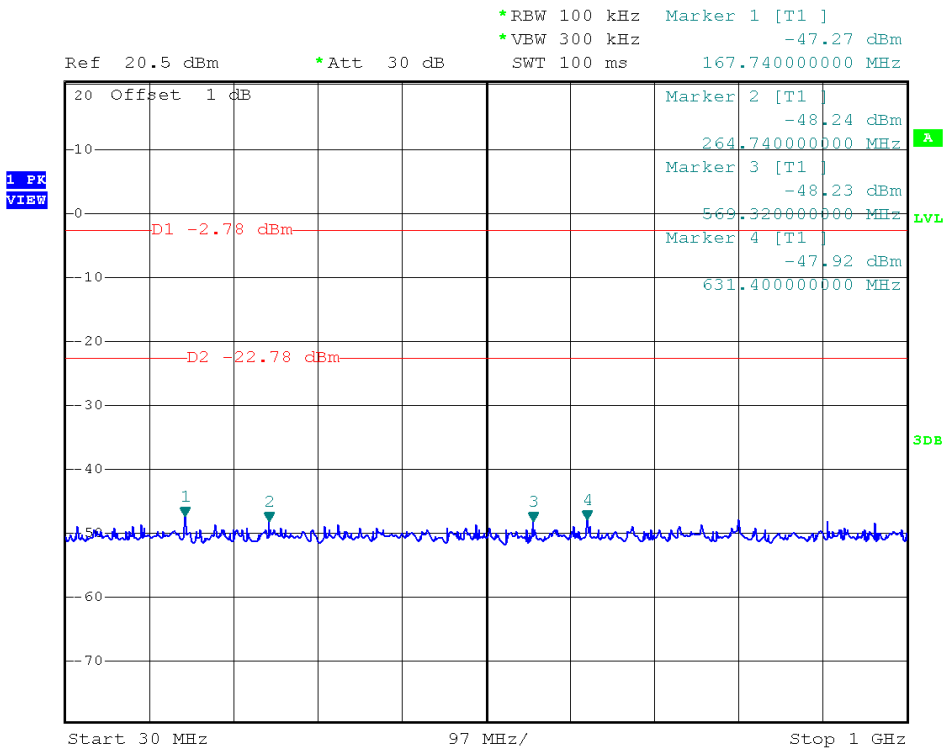
(Plot G.2: Channel = 0, 1GHz to 25GHz @ 8-DPSK)



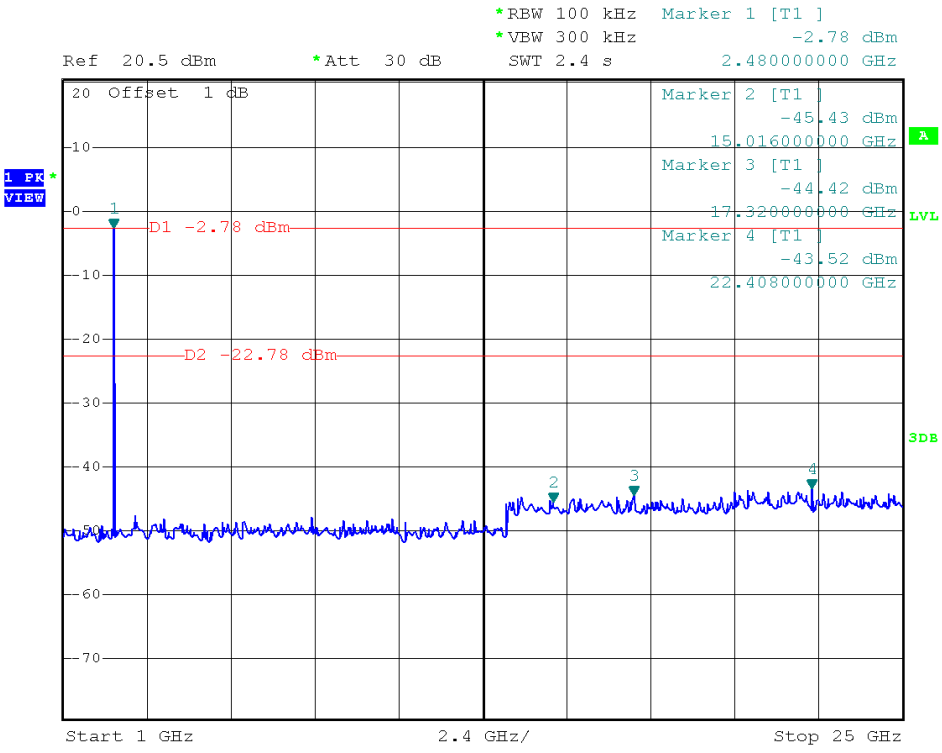
(Plot H.1: Channel = 39, 30MHz to 1GHz @ 8-DPSK)



(Plot H.2: Channel = 39, 1GHz to 25GHz @ 8-DPSK)



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



(Plot I.2: Channel = 78, 1GHz to 25GHz @ 8-DPSK)

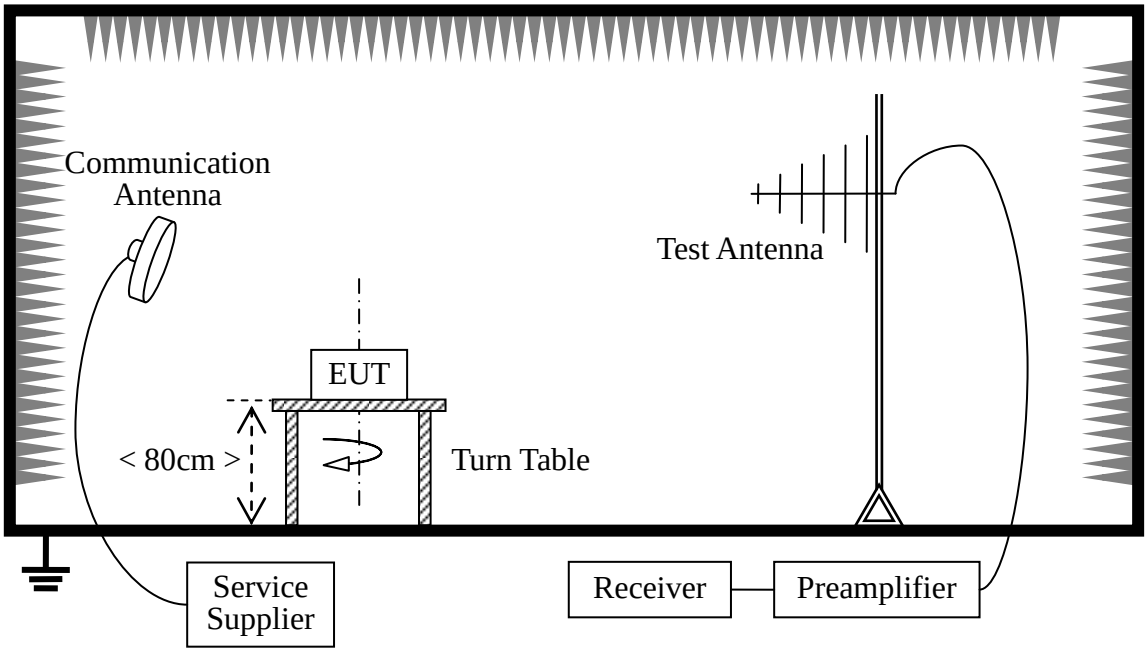
2.8. Band Edge

2.8.1. Requirement

According to FCC section 15.247(d), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

2.8.2. Test Description

A. Test Setup:



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

For the Test Antenna:

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

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due Date
Receiver	R&S	FSP40	1164.4391.40	2014.07.07	2015.07.06
Full-Anechoic Chamber	Albatross	12.8m*6.8m *6.4m	A0412372	2015.01.05	2016.01.04

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due Date
Double ridge horn antenna	R&S	HF906	100150	2014.06.11	2015.06.10
Ultra-wideband antenna	R&S	HL562	A0304224	2014.06.11	2015.06.10
Amplifier 1G~18GHz	R&S	MITEQ AFS42-0010 1800	25-S-42	2014.06.11	2015.06.10
Cable	SUNHNER	SUCOFLEX 100	/	2014.06.05	2015.06.04
Cable	SUNHNER	SUCOFLEX 104	/	2014.06.05	2015.06.04

2.8.3. Test Procedure

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

RBW ≥ 1% of the span

VBW ≥ RBW

Sweep = auto

Detector function = peak /AV

Trace = max hold

Allow the trace to stabilize.

2.8.4. Test Result

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

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

Note: Restricted Frequency Bands were performed when antenna was at vertical and horizontal polarity, and only the worse test condition (vertical) was recorded in this test report.

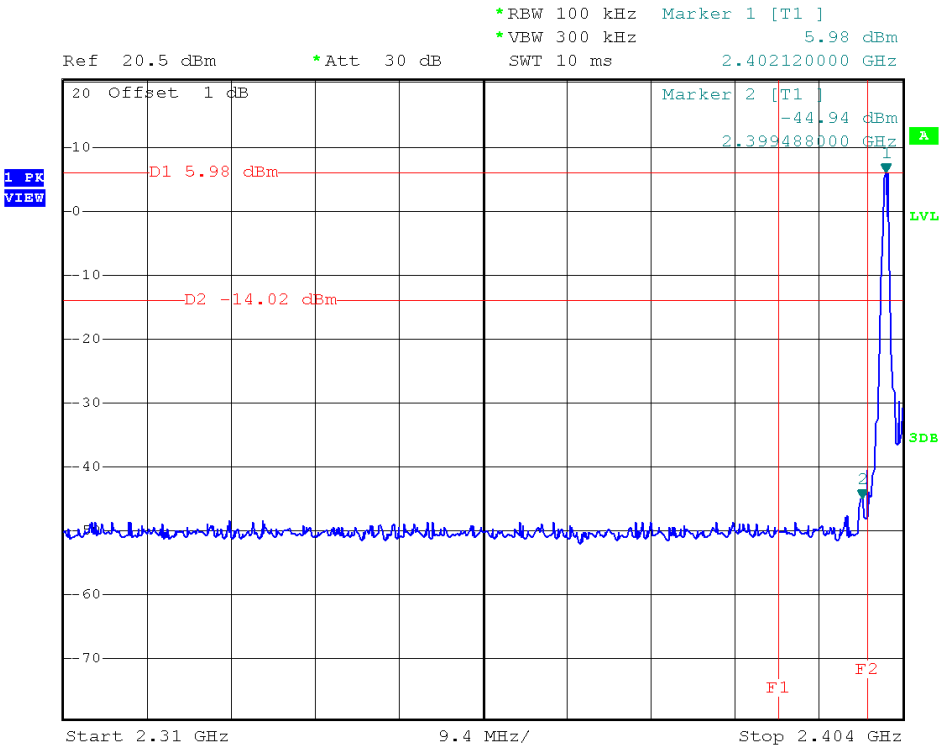
2.8.4.1. GFSK Mode

Test Verdict:

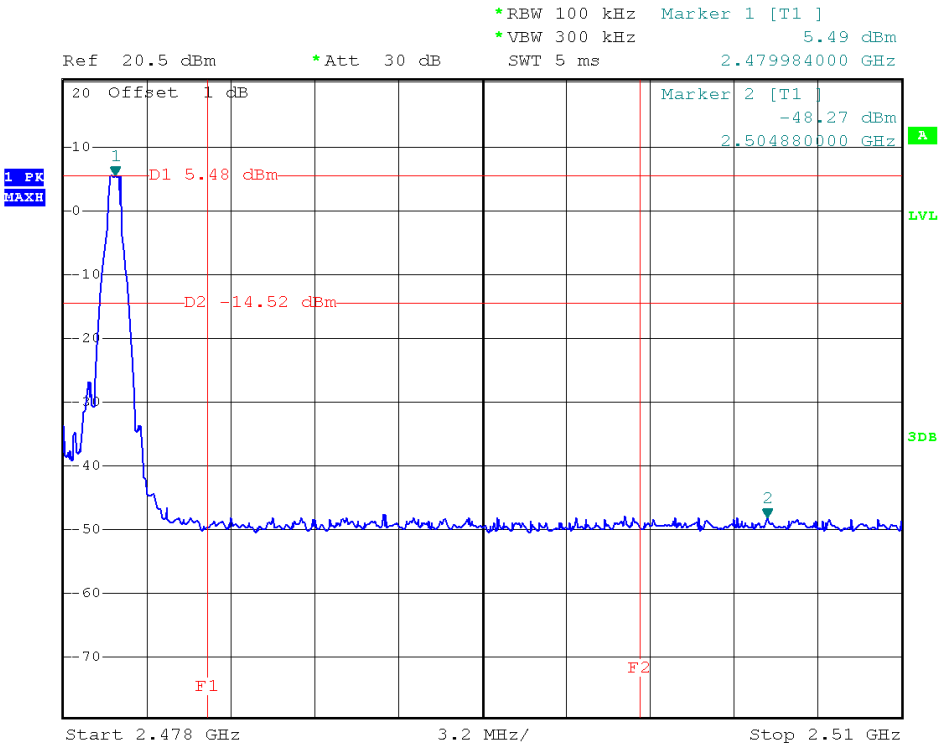
(Un-hopping)

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	2354.695	PK	57.87	-31.7	28.3	54.47	74.00	Pass
0	2354.695	AV	45.51	-31.7	28.3	42.11	54.00	Pass
78	2491.231	PK	56.27	-29.45	29.2	56.02	74.00	Pass
78	2491.231	AV	42.34	-29.45	29.2	42.09	54.00	Pass

Test Plots:



(Plot A1: Channel = 0 PEAK @ GFSK)

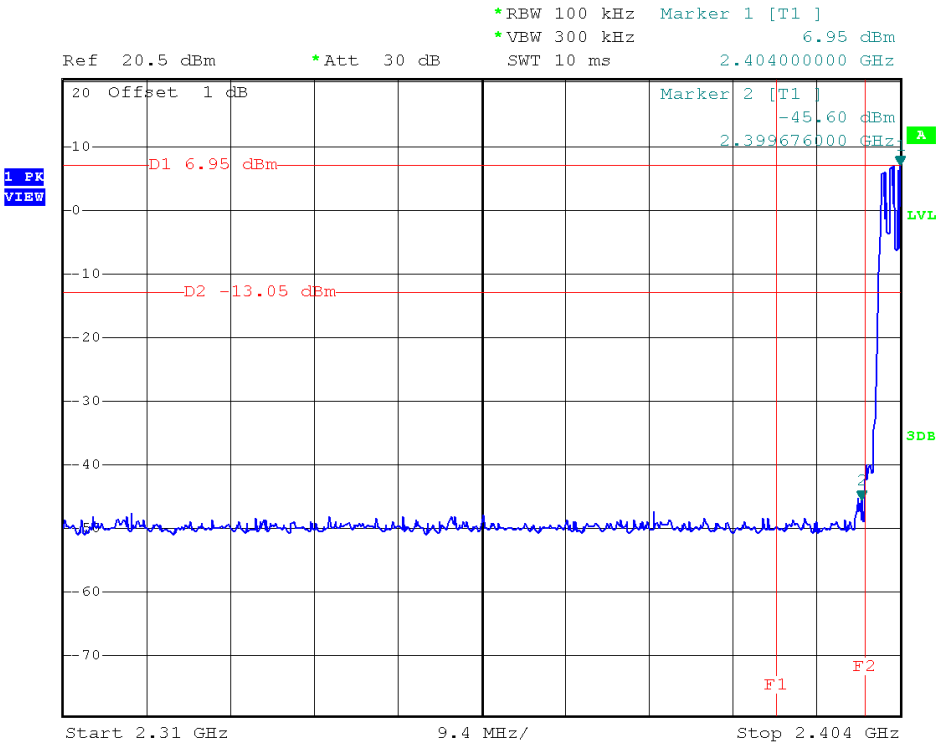


(Plot B1: Channel = 78 PEAK @ GFSK)

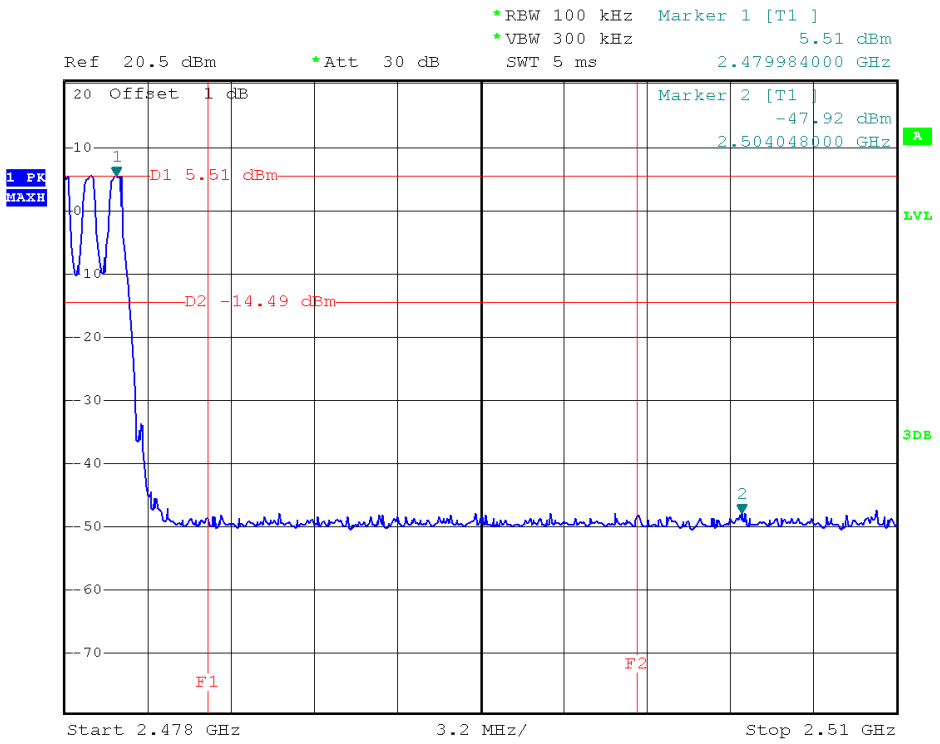
(hopping)

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	2388.625	PK	57.61	-31.7	28.3	54.21	74.00	Pass
0	2388.625	AV	49.85	-31.7	28.3	46.45	54.00	Pass
78	2492.783	PK	55.29	-29.45	29.2	55.07	74.00	Pass
78	2492.783	AV	48.69	-29.45	29.2	48.44	54.00	Pass

Test Plots:



(Plot A1-1: Channel = 0 PEAK)



(Plot B1-1: Channel = 78 PEAK)

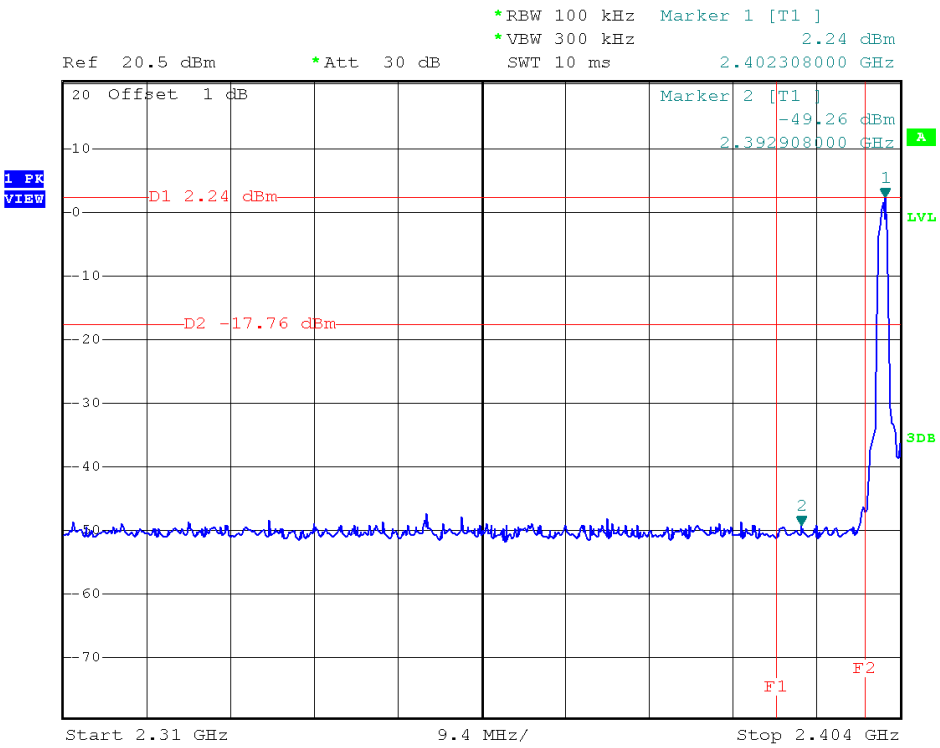
2.8.4.2. π/4-DQPSK Mode

Test Verdict:

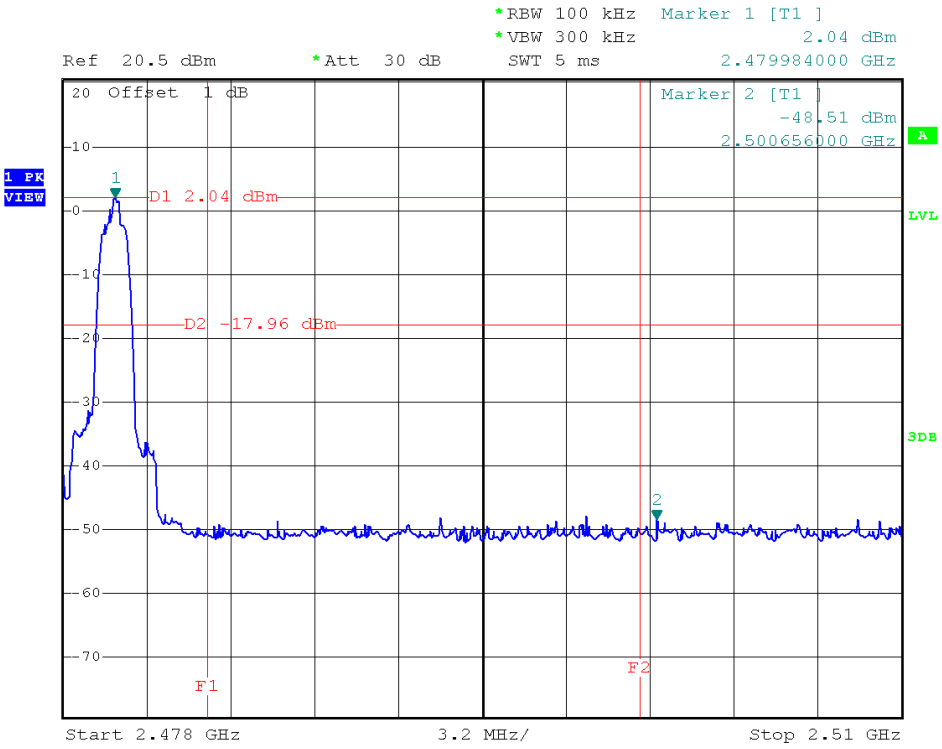
(Un-hopping)

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	2384.285	PK	58.54	-31.7	28.3	55.14	74.00	Pass
0	2384.285	AV	46.79	-31.7	28.3	43.39	54.00	Pass
78	2498.044	PK	58.10	-29.45	29.2	57.85	74.00	Pass
78	2498.044	AV	48.65	-29.45	29.2	48.40	54.00	Pass

Test Plots:



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

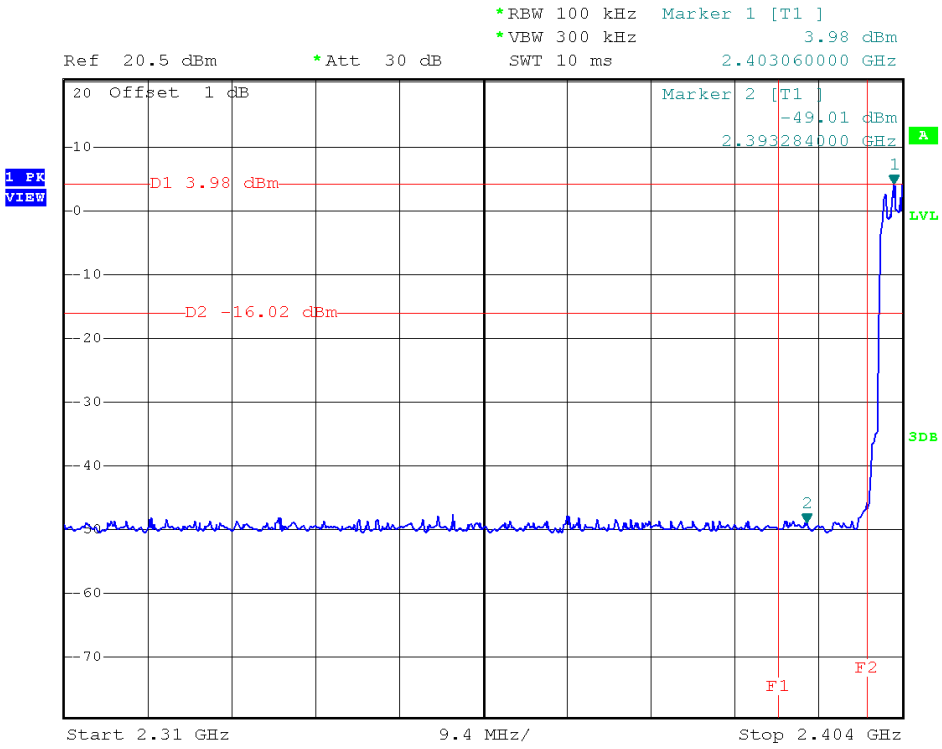


(Plot D1: Channel = 78 PEAK @π/4-DQPSK)

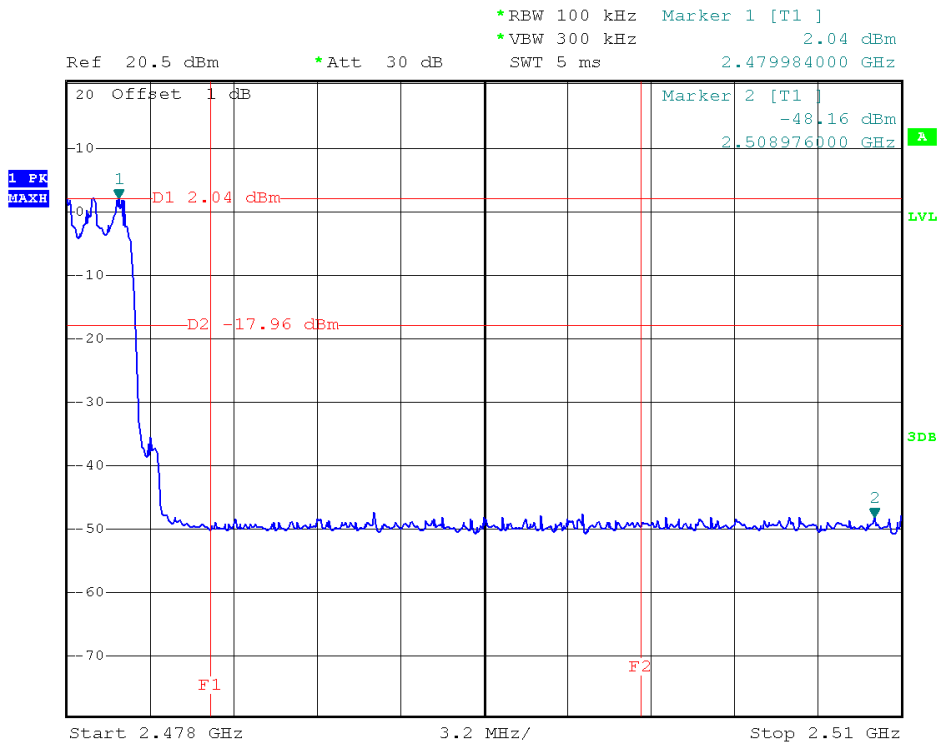
(hopping)

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	2395.257	PK	57.53	-31.7	28.3	54.13	74.00	Pass
0	2395.257	AV	47.82	-31.7	28.3	44.42	54.00	Pass
78	2485.256	PK	56.89	-29.45	29.2	56.64	74.00	Pass
78	2485.256	AV	46.78	-29.45	29.2	46.53	54.00	Pass

Test Plots:



(Plot C1-1: Channel = 0 PEAK)



(Plot D1-1: Channel = 78 PEAK)

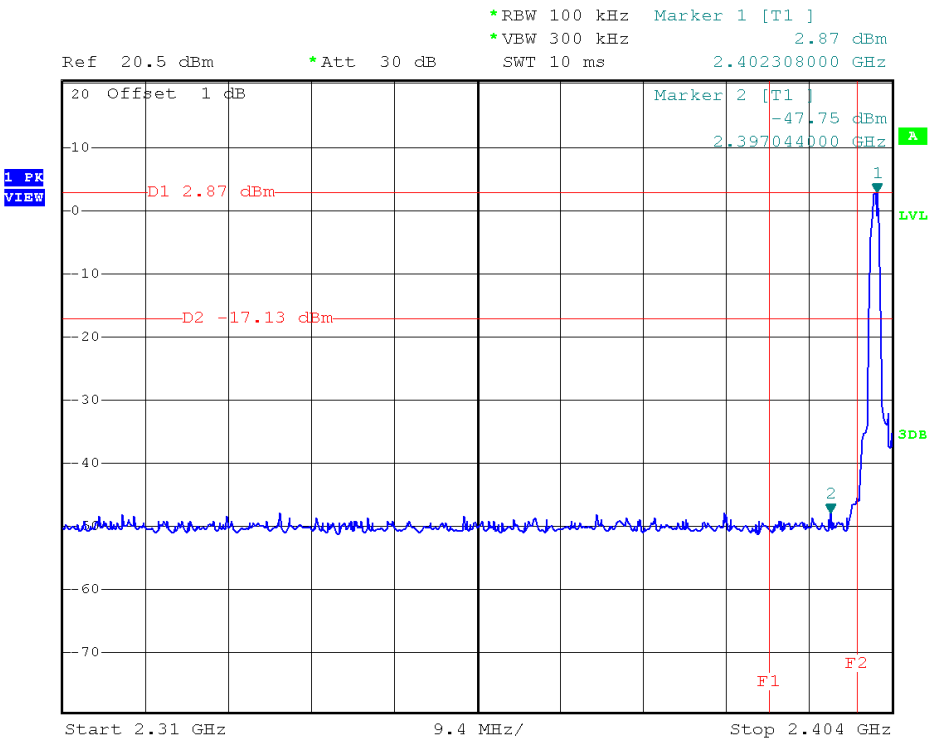
2.8.4.3. 8-DPSK Mode

Test Verdict:

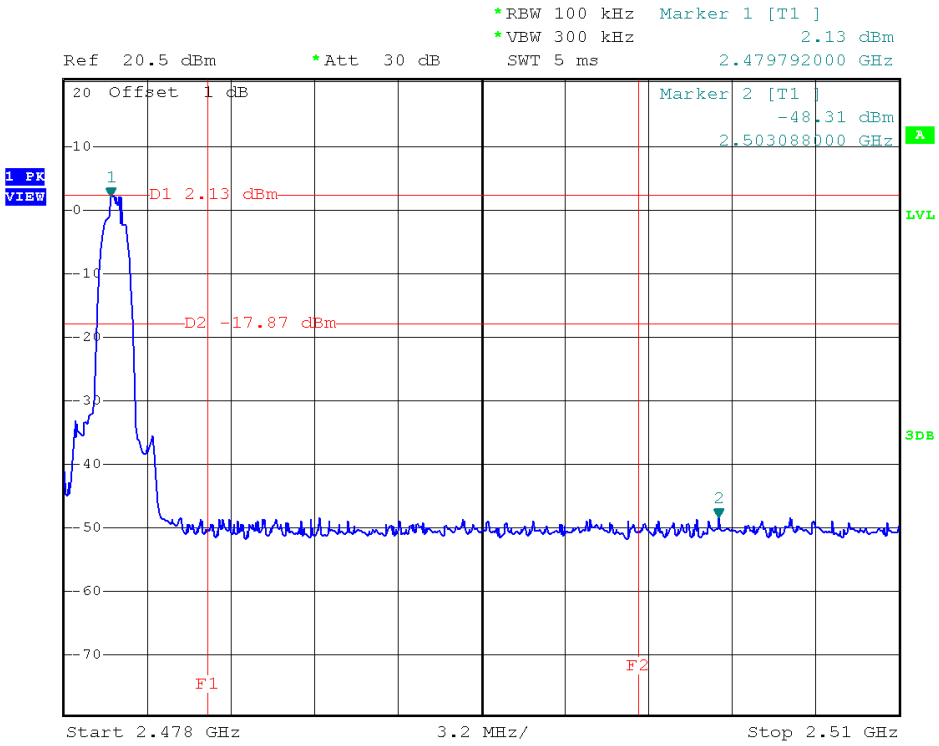
(Un-hopping)

Channel	Frequency (MHz)	Detector	Receiver Reading UR (dBuV)	AT (dB)	A Factor (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
		PK/ AV						
0	2384.843	PK	57.62	-31.7	28.3	54.22	74.00	Pass
0	2384.843	AV	49.60	-31.7	28.3	46.20	54.00	Pass
78	2495.617	PK	56.33	-29.45	29.2	56.08	74.00	Pass
78	2495.617	AV	47.42	-29.45	29.2	47.17	54.00	Pass

Test Plots:



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

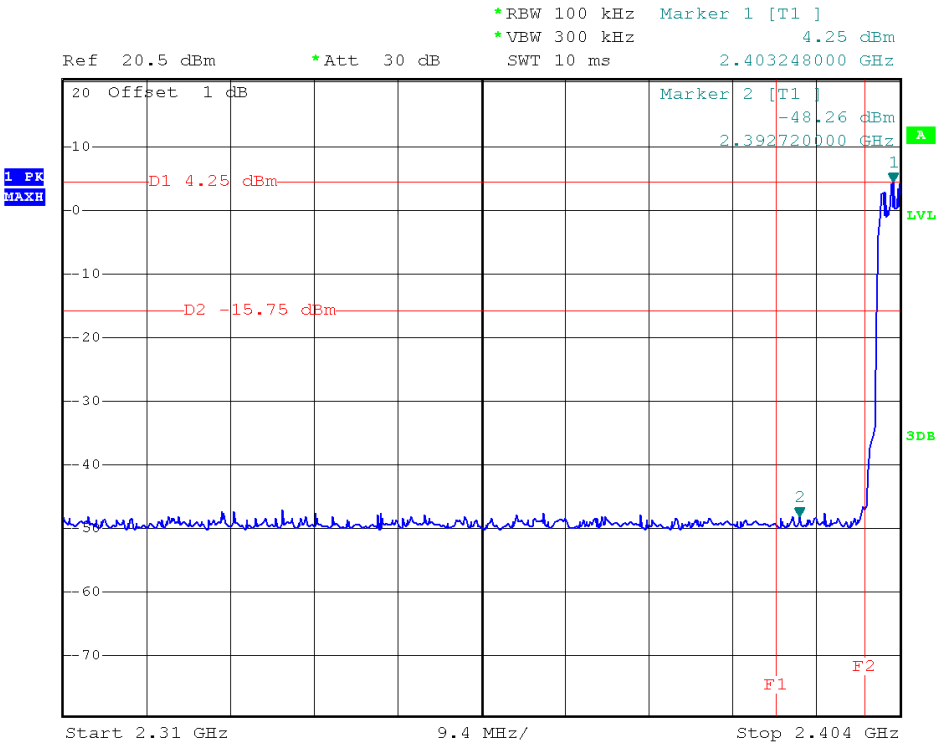


(Plot F1: Channel = 78 PEAK @ 8-DPSK Mode)

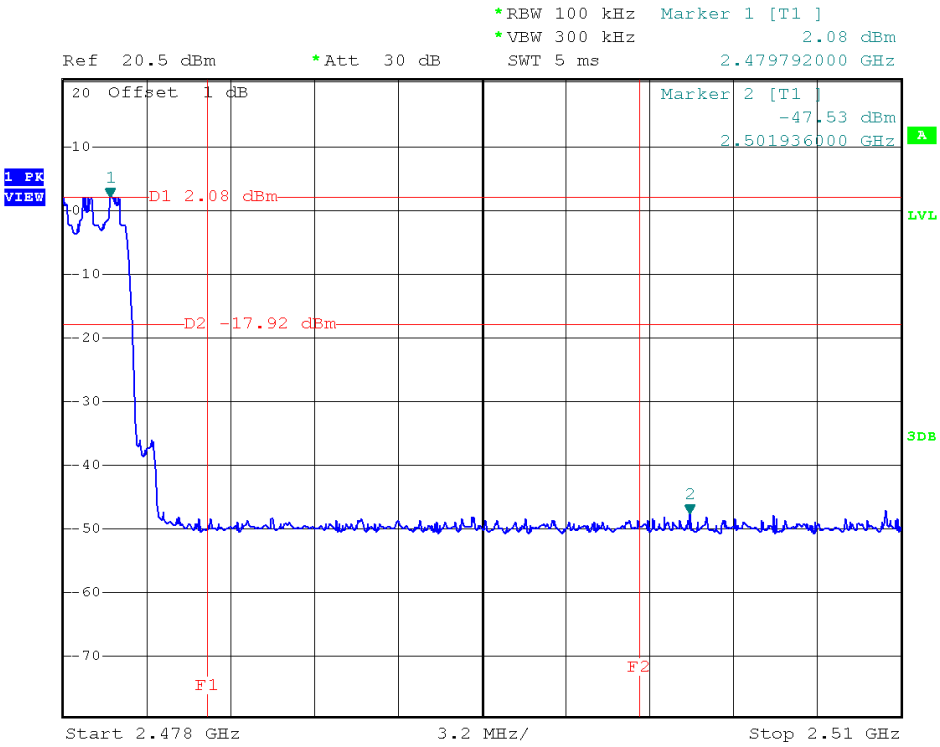
(hopping)

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	2379.428	PK	58.52	-31.7	28.3	55.12	74.00	Pass
0	2379.428	AV	49.62	-31.7	28.3	46.22	54.00	Pass
78	2495.625	PK	57.61	-29.45	29.2	57.36	74.00	Pass
78	2495.625	AV	48.23	-29.25	29.3	47.98	54.00	Pass

Test Plots:



(Plot E1-1: Channel = 0 PEAK)



(Plot F1-1: Channel = 78 PEAK)

2.9. Conducted Emission

2.9.1. Requirement

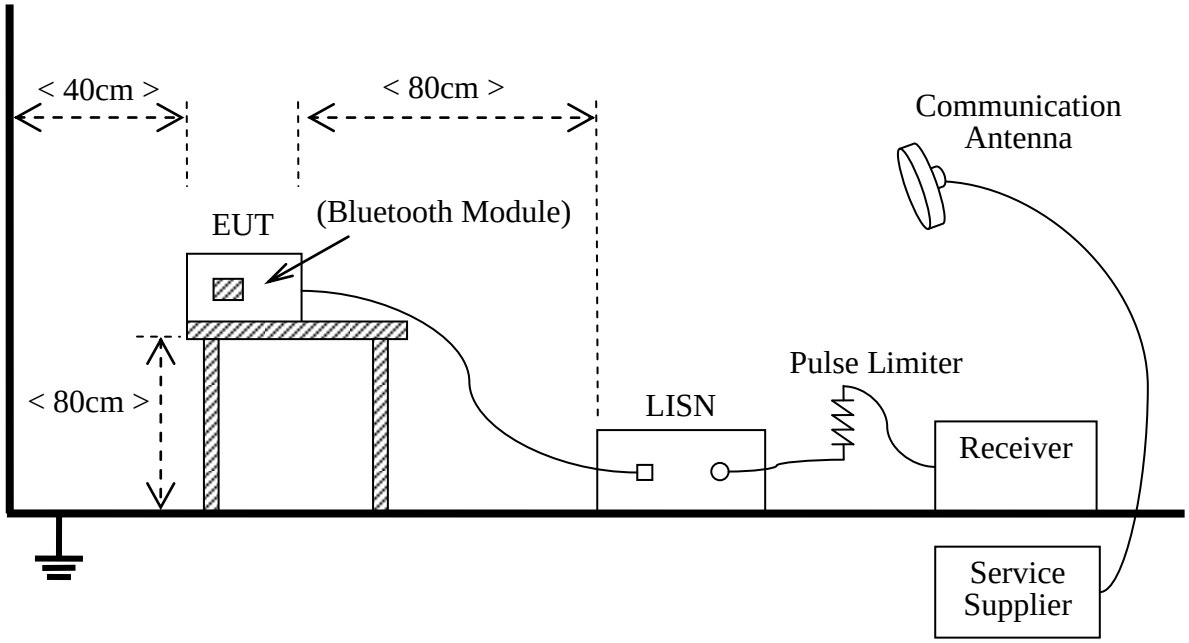
According to FCC section 15.207 and RSS- Gen section 7.2.4, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz shall not exceed the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

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 C63.4:2014

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.

B. Equipments List:

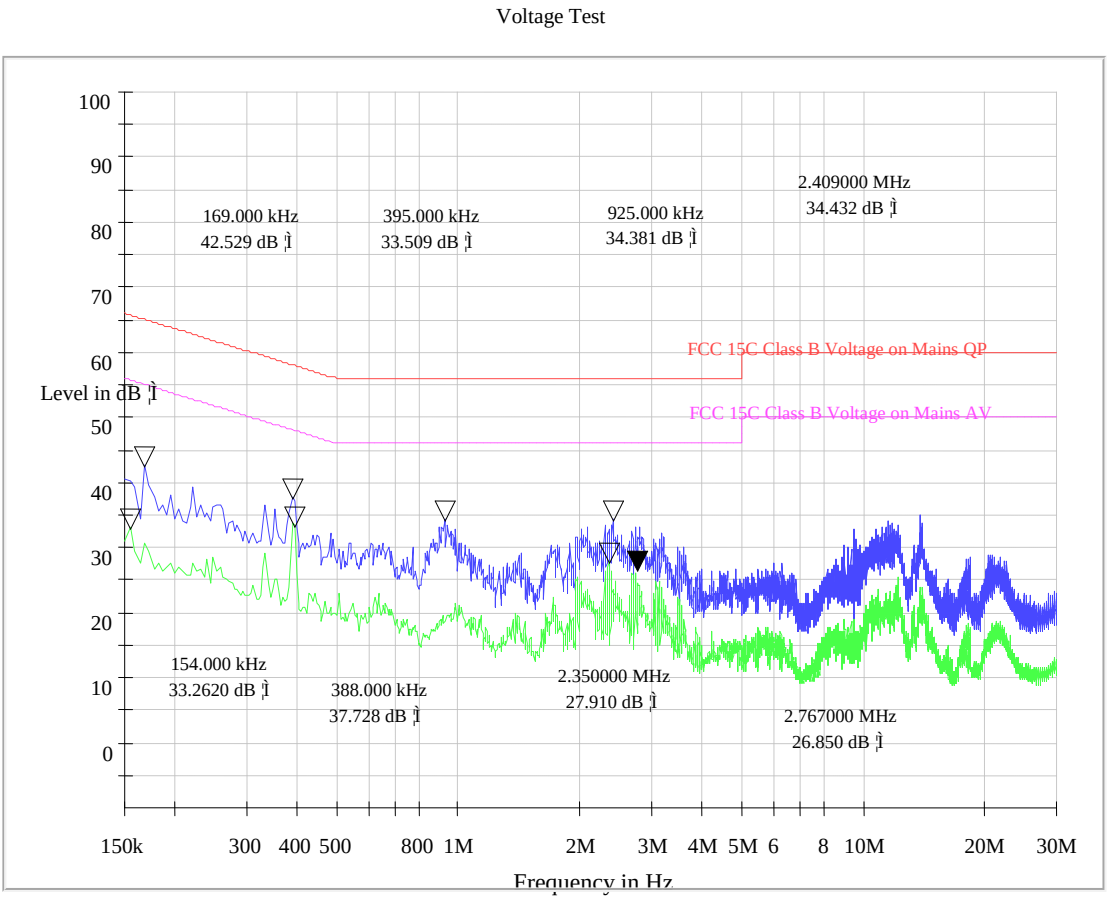
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due Date
Test Receiver	R&S	ESCS30	A0304260	2014.06.11	2015.06.10
LISN	R&S	ESH2-Z5	A0304221	2014.06.11	2015.06.10
Service Supplier	R&S	CMU200	A0304252	2014.06.11	2015.06.10
Pulse Limiter (20dB)	Schwarzbeck	VTSD 9561-D	A0304291	(n.a.)	(n.a.)
Cable	MATCHING PAD	W7	/	2014.06.05	2015.06.04

2.9.3. Test Result

A. Test setup:

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

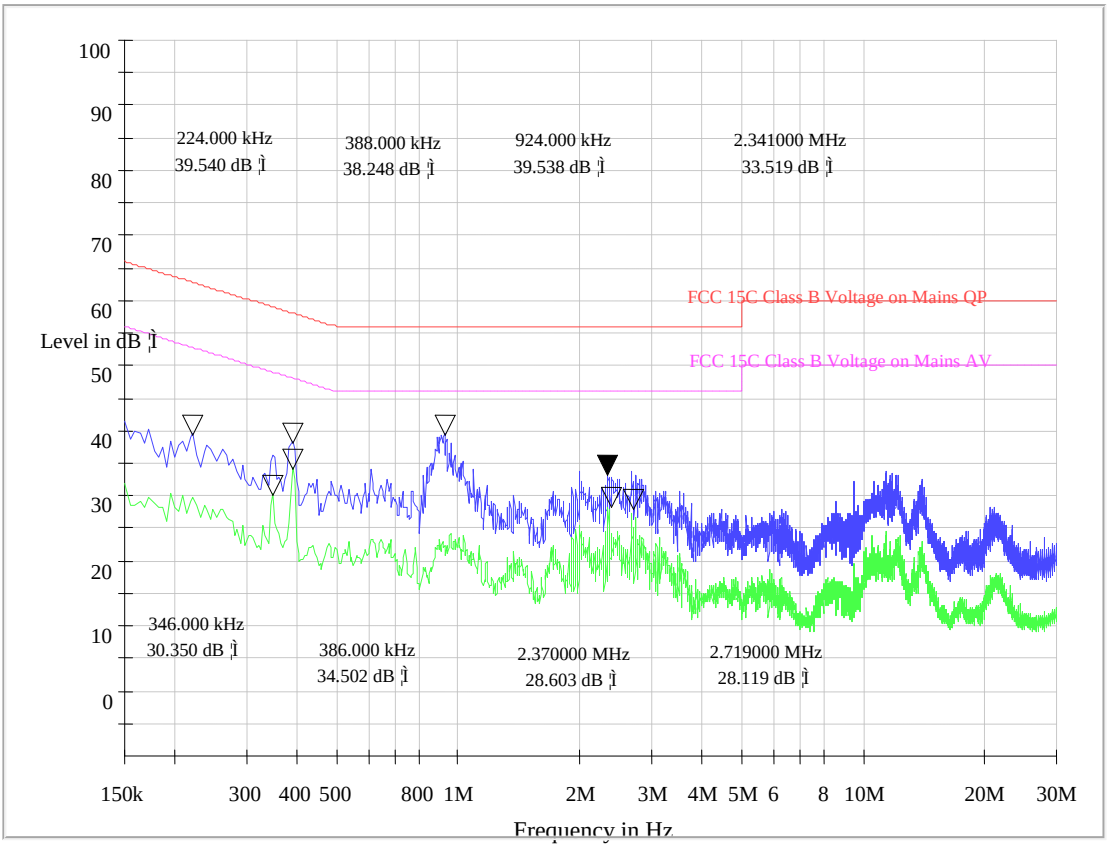
B. Test Plots:



(Plot A: L Phase)

Conducted Disturbance at Mains Terminals					
L Test Data					
QP			AV		
Frequency (MHz)	Limits (dBμV)	Measurement Value (dBμV)	Frequency (MHz)	Limits (dBμV)	Measurement Value (dBμV)
0.169	65.1	42.53	0.154	55.7	33.26
0.395	58.0	33.51	0.388	48.1	37.73
0.925	56.0	34.38	2.350	46.0	27.91
2.409	56.0	34.43	2.767	46.0	26.85

Voltage Test



Conducted Disturbance at Mains Terminals					
N Test Data					
QP			AV		
Frequency (MHz)	Limits (dBμV)	Measurement Value (dBμV)	Frequency (MHz)	Limits (dBμV)	Measurement Value (dBμV)
0.224	62.7	39.54	0.346	49.0	30.35
0.388	58.1	38.25	0.386	48.1	34.50
0.924	56.0	39.54	2.370	46.0	28.60
2.341	56.0	33.52	2.719	46.0	28.12

(Plot B: N Phase)

Test Result: PASS

2.10. Radiated Emission

2.10.1. Requirement

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

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

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

Note:

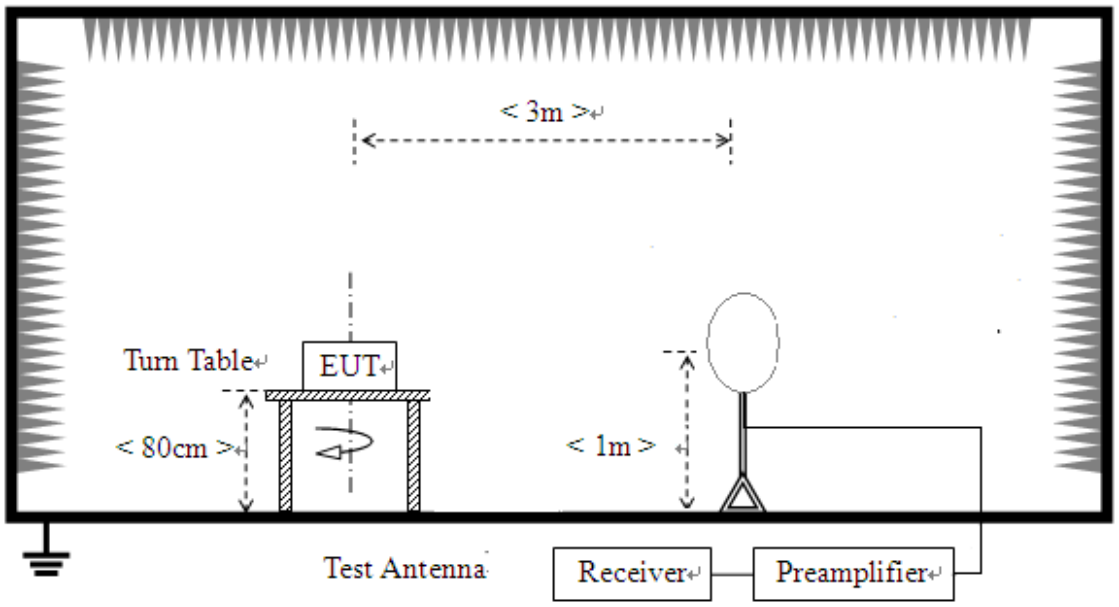
1. For Above 1000MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
2. For above 1000MHz, limit field strength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

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

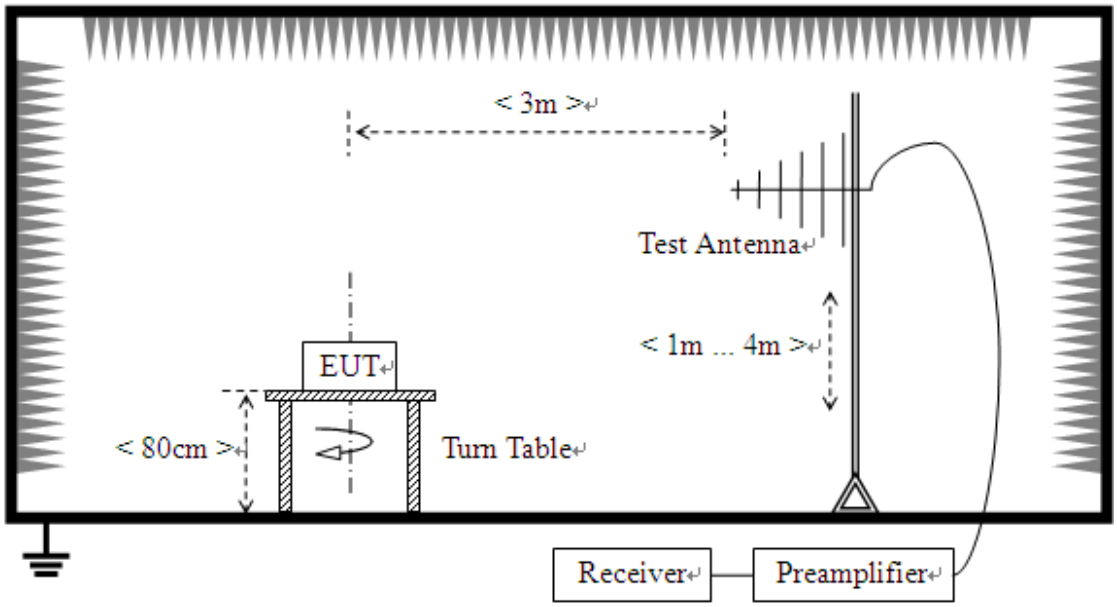
2.10.2. Test Description

A. Test Setup:

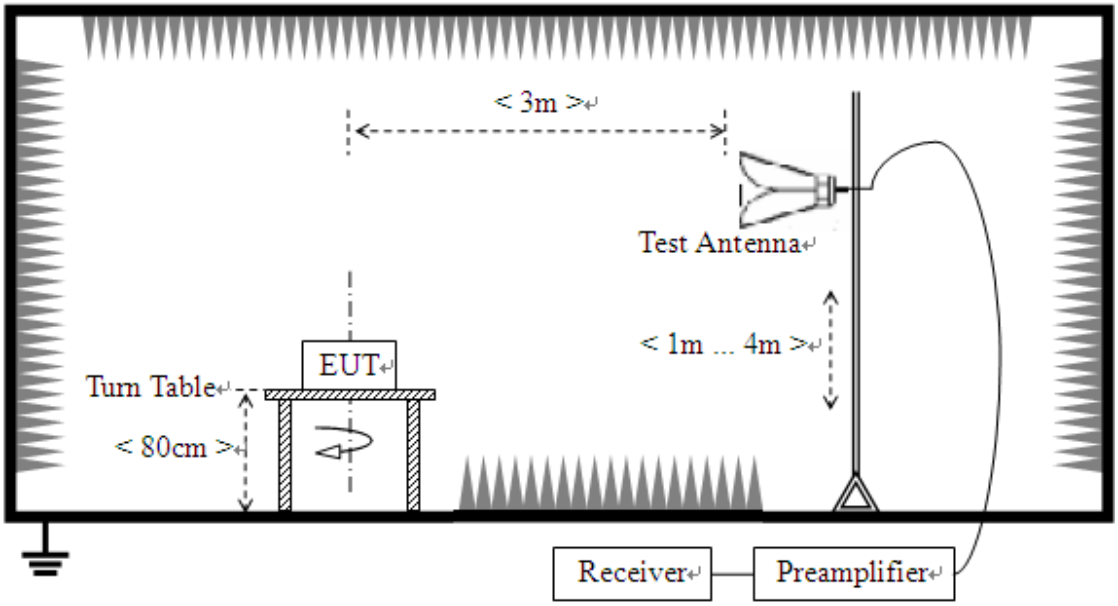
1) For radiated emissions from 9kHz to 30MHz



2) For radiated emissions from 30MHz to1GHz



3) For radiated emissions above 1GHz



The test site semi-anechoic chamber has met the requirement of NSA tolerance 4dB according to the standards: ANSI C63.4 (2014). 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	Cal. Due Date
Receiver	R&S	ESIB26	A0304218	2014.06.07	2015.06.06
Full-Anechoic Chamber	Albatross	12.8m*6.8m*6.4m	A0412372	2014.06.07	2015.06.06
Test Antenna - Bi-Log	Schwarzbeck	VULB 9163	9163-274	2014.06.09	2015.06.08
Test Antenna - Horn	R&S	BBHA 9120D	9120C-963	2014.06.09	2015.06.08
Test Antenna - Horn	R&S	HF960	100150	2014.06.09	2015.06.08
Test Antenna – Horn (18-25GHz)	ETS	UG-596A/U	A0902607	2014.06.05	2015.06.04
Test Antenna -Loop	Schwarzbeck	HFH2-Z2	100047	2014.06.02	2015.06.01
Ampilier 1G~18GHz	R&S	MITEQ AFS42-00101800	25-S-42	2014.06.05	2015.06.04
Ampilier 18G~40GHz	R&S	JS42-18002600-28-5A	12111.0980.00	2014.06.05	2015.06.04
amplifier 20M~3GHz	R&S	PAP-0203H	22018	2014.06.10	2015.06.09
Cable	SUNHNER	SUCOFLEX 100	/	2014.06.05	2015.06.04
Cable	SUNHNER	SUCOFLEX 104	/	2014.06.05	2015.06.04

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.

Note: 1.The radiated measurement are performed the each test mode (GFSK/ π /4-DQPSK /8-DPSK) and channel (low/mid/high), the datum recorded below (GFSK mode, the middle channel) is the worst case for all the test mode and channel.

2. ULTRA-BROADBAND ANTENNA for the radiation emission test below 1G.

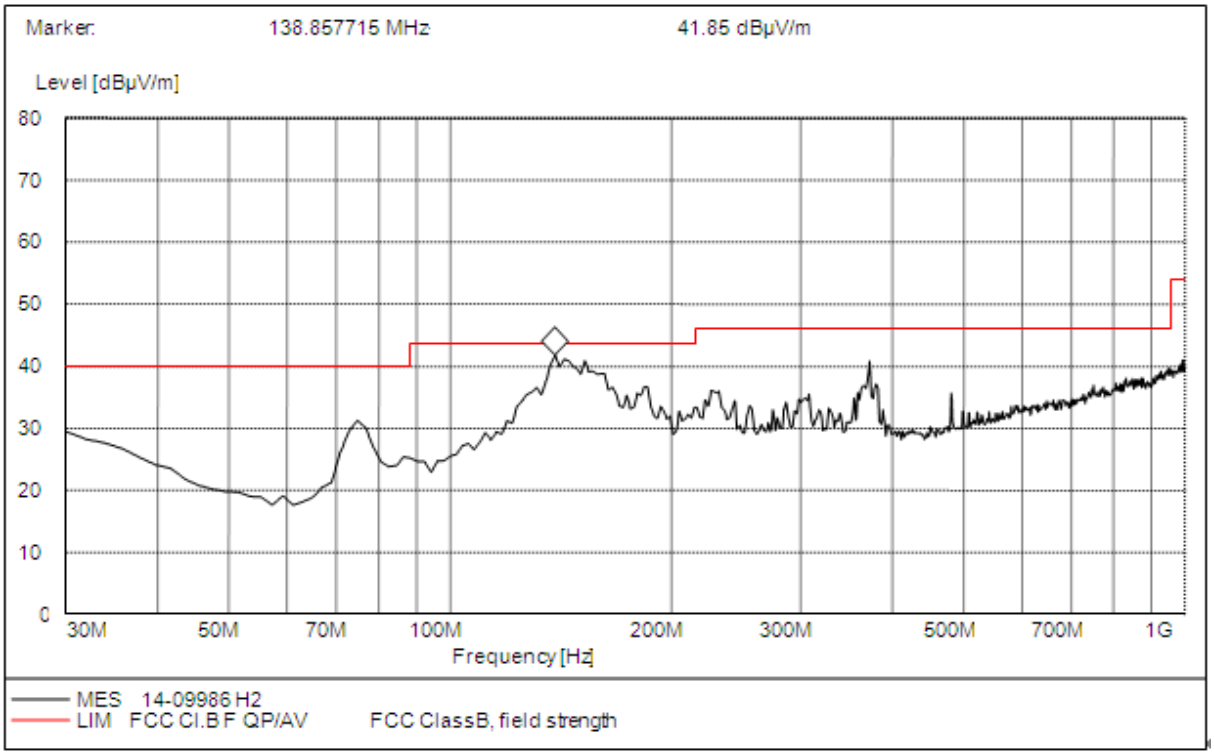
3. HORN ANTENNA for the radiation emission test above 1G.

Test plots for the whole measurement frequency range：

For 9KHz to 30MHz

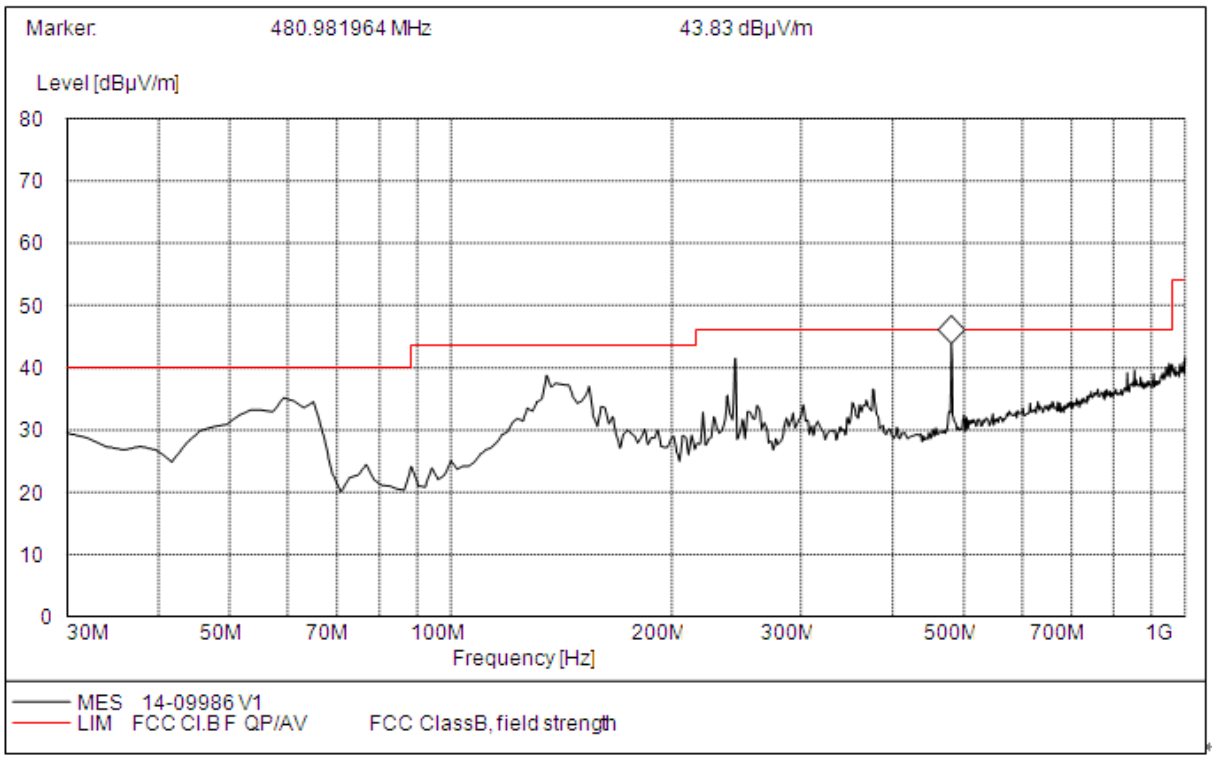
The test has been performed， and the Radiated Emission level is too low to the limit.

For 30MHz to 1000MHz



Frequency (MHz)	QuasiPeak (dBμ V/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dBμ V/m)	Antenna	Verdict
74.710000	31.27	120.000	100.0	40.00	8.73	Horizontal
138.850000	40.15	120.000	100.0	43.50	3.35	Horizontal
152.460000	40.02	120.000	100.0	43.50	5.98	Horizontal
372.124000	40.56	120.000	100.0	46.00	5.54	Horizontal
580.120000	33.45	120.000	100.0	46.00	13.58	Horizontal

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



Frequency (MHz)	QuasiPeak (dBμV/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dBμV/m)	Antenna	Verdict
59.150000	32.68	120.000	100.0	40.00	7.32	Vertical
138.260000	38.56	120.000	100.0	43.50	4.94	Vertical
239.450000	40.35	120.000	100.0	46.00	5.65	Vertical
480.240000	43.26	120.000	100.0	46.00	2.74	Vertical

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

For 1GHz to 25GHz

GFSK Mode

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（GFSK-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	103.11	PK	/	/	1.00 H	360	106.51	28.3	4.90	-36.6
1	*2402.00	92.69	AV	/	/	1.00 H	360	96.09	28.3	4.90	-36.6
2	4804.00	48.95	PK	74.00	25.05	1.00 H	359	45.75	32.7	7.00	-36.5
2	4804.00	39.92	AV	54.00	14.08	1.00 H	359	36.72	32.7	7.00	-36.5
3	7206.00	51.82	PK	74.00	22.18	1.00 H	152	42.42	35.8	8.90	-35.3
3	7206.00	43.79	AV	54.00	10.21	1.00 H	152	34.39	35.8	8.90	-35.3
4	9608.00	49.88	PK	74.00	24.12	1.00 H	140	37.28	37.2	10.20	-34.8
4	9608.00	45.30	AV	54.00	8.70	1.00 H	140	32.7	37.2	10.20	-34.8

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（GFSK_2402MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2402.00	101.54	PK	/	/	1.00 V	124	104.94	28.3	4.90	-36.6
1	*2402.00	90.32	AV	/	/	1.00 V	124	93.72	28.3	4.90	-36.6
2	4804.00	49.62	PK	74.00	24.38	1.00 V	339	46.42	32.7	7.00	-36.5
2	4804.00	43.88	AV	54.00	10.12	1.00 V	339	40.68	32.7	7.00	-36.5
3	7206.00	49.94	PK	74.00	24.06	1.00 V	340	40.54	35.8	8.90	-35.3
3	7206.00	41.69	AV	54.00	12.31	1.00 V	340	32.29	35.8	8.90	-35.3
4	9608.00	52.12	PK	74.00	21.88	1.00 V	20	39.52	37.2	10.20	-34.8
4	9608.00	44.72	AV	54.00	9.28	1.00 V	20	32.12	37.2	10.20	-34.8

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（GFSK_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	104.28	PK	/	/	1.00 H	153	107.48	28.3	5.10	-36.6
1	*2441.00	91.96	AV	/	/	1.00 H	153	95.16	28.3	5.10	-36.6
2	4882.00	45.99	PK	74.00	28.01	1.00 H	202	42.59	32.3	7.60	-36.5
2	4882.00	34.98	AV	54.00	19.02	1.00 H	202	31.58	32.3	7.60	-36.5
3	7323.00	49.96	PK	74.00	24.04	1.00 H	355	40.56	36.1	8.60	-35.3
3	7323.00	42.31	AV	54.00	11.69	1.00 H	355	32.91	36.1	8.60	-35.3
4	9764.00	50.02	PK	74.00	23.98	1.00 H	28	37.42	37.2	10.20	-34.8
4	9764.00	41.84	AV	54.00	12.16	1.00 H	28	29.24	37.2	10.20	-34.8

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（GFSK_2441MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2441.00	103.12	PK	/	/	1.00 V	121	106.32	28.3	5.10	-36.6
1	*2441.00	91.96	AV	/	/	1.00 V	121	95.16	28.3	5.10	-36.6
2	4882.00	47.71	PK	74.00	26.29	1.00 V	97	44.31	32.3	7.60	-36.5
2	4882.00	36.90	AV	54.00	17.10	1.00 V	97	33.5	32.3	7.60	-36.5
3	7323.00	56.76	PK	74.00	17.24	1.00 V	288	47.36	36.1	8.60	-35.3
3	7323.00	42.60	AV	54.00	11.40	1.00 V	288	33.2	36.1	8.60	-35.3
4	9764.00	49.94	PK	74.00	24.06	1.00 V	89	37.34	37.2	10.20	-34.8
4	9764.00	34.89	AV	54.00	19.11	1.00 V	89	22.29	37.2	10.20	-34.8

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（GFSK_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	103.89	PK	/	/	1.00 H	154	107.19	28.6	4.70	-36.6
1	*2480.00	89.97	AV	/	/	1.00 H	154	93.27	28.6	4.70	-36.6
2	4960.00	49.79	PK	74.00	24.21	1.00 H	100	45.99	33	7.00	-36.2
2	4960.00	35.13	AV	54.00	18.87	1.00 H	100	31.33	33	7.00	-36.2
3	7440.00	51.10	PK	74.00	22.90	1.00 H	190	41.7	36.2	8.50	-35.3
3	7440.00	42.04	AV	54.00	11.96	1.00 H	190	32.64	36.2	8.50	-35.3
4	9920.00	50.00	PK	74.00	24.00	1.00 H	113	37.4	37.2	10.20	-34.8
4	9920.00	37.04	AV	54.00	16.96	1.00 H	113	24.44	37.2	10.20	-34.8

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（GFSK_2480MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2480.00	99.13	PK	/	/	1.00 V	247	102.43	28.60	4.70	-36.60
1	*2480.00	87.49	AV	/	/	1.00 V	247	90.79	28.60	4.70	-36.60
2	4960.00	52.57	PK	74.00	21.43	1.00 V	90	48.77	33.00	7.00	-36.20
2	4960.00	47.65	AV	54.00	6.35	1.00 V	90	43.85	33.00	7.00	-36.20
3	7440.00	53.62	PK	74.00	20.38	1.00 V	29	44.22	36.20	8.50	-35.30
3	7440.00	42.87	AV	54.00	11.13	1.00 V	29	33.47	36.20	8.50	-35.30
4	9920.00	51.28	PK	74.00	22.72	1.00 V	222	38.68	37.20	10.20	-34.80
4	9920.00	41.20	AV	54.00	12.80	1.00 V	222	28.60	37.20	10.20	-34.80

π/4-DQPSK Mode

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（π /4-DQPSK_2402MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2402.00	101.11	PK	/	/	1.00 H	360	104.51	28.3	4.90	-36.6
1	*2402.00	87.77	AV	/	/	1.00 H	360	91.17	28.3	4.90	-36.6
2	4804.00	47.88	PK	74.00	26.12	1.00 H	359	44.68	32.7	7.00	-36.5
2	4804.00	39.82	AV	54.00	14.18	1.00 H	359	36.62	32.7	7.00	-36.5
3	7206.00	50.12	PK	74.00	23.88	1.00 H	152	40.72	35.8	8.90	-35.3
3	7206.00	40.78	AV	54.00	13.22	1.00 H	152	31.38	35.8	8.90	-35.3
4	9608.00	49.98	PK	74.00	24.02	1.00 H	140	37.38	37.2	10.20	-34.8
4	9608.00	42.80	AV	54.00	11.20	1.00 H	140	30.2	37.2	10.20	-34.8

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（π /4-DQPSK_2402MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2402.00	99.78	PK	/	/	1.00 V	124	103.18	28.3	4.90	-36.6
1	*2402.00	85.86	AV	/	/	1.00 V	124	89.26	28.3	4.90	-36.6
2	4804.00	49.22	PK	74.00	24.78	1.00 V	339	46.02	32.7	7.00	-36.5
2	4804.00	40.23	AV	54.00	13.77	1.00 V	339	37.03	32.7	7.00	-36.5
3	7206.00	50.04	PK	74.00	23.96	1.00 V	340	40.64	35.8	8.90	-35.3
3	7206.00	42.20	AV	54.00	11.80	1.00 V	340	32.8	35.8	8.90	-35.3
4	9608.00	50.07	PK	74.00	23.93	1.00 V	20	37.47	37.2	10.20	-34.8
4	9608.00	43.52	AV	54.00	10.48	1.00 V	20	30.92	37.2	10.20	-34.8

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（π /4-DQPSK_2441MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2441.00	102.20	PK	/	/	1.00 H	153	105.4	28.3	5.10	-36.6
1	*2441.00	90.04	AV	/	/	1.00 H	153	93.24	28.3	5.10	-36.6
2	4882.00	45.90	PK	74.00	28.10	1.00 H	202	42.5	32.3	7.60	-36.5
2	4882.00	35.73	AV	54.00	18.27	1.00 H	202	32.33	32.3	7.60	-36.5
3	7323.00	50.06	PK	74.00	23.94	1.00 H	355	40.66	36.1	8.60	-35.3
3	7323.00	40.96	AV	54.00	13.04	1.00 H	355	31.56	36.1	8.60	-35.3
4	9764.00	50.76	PK	74.00	23.24	1.00 H	28	38.16	37.2	10.20	-34.8
4	9764.00	43.04	AV	54.00	10.96	1.00 H	28	30.44	37.2	10.20	-34.8

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（π /4-DQPSK_2441MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2441.00	99.97	PK	/	/	1.00 V	121	103.17	28.3	5.10	-36.6
1	*2441.00	89.66	AV	/	/	1.00 V	121	92.86	28.3	5.10	-36.6
2	4882.00	46.01	PK	74.00	27.99	1.00 V	97	42.61	32.3	7.60	-36.5
2	4882.00	33.07	AV	54.00	20.93	1.00 V	97	29.67	32.3	7.60	-36.5
3	7323.00	52.69	PK	74.00	21.31	1.00 V	288	43.29	36.1	8.60	-35.3
3	7323.00	41.58	AV	54.00	12.42	1.00 V	288	32.18	36.1	8.60	-35.3
4	9764.00	51.04	PK	74.00	22.96	1.00 V	89	38.44	37.2	10.20	-34.8
4	9764.00	39.59	AV	54.00	14.41	1.00 V	89	26.99	37.2	10.20	-34.8

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（π /4-DQPSK_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	98.98	PK	/	/	1.00 H	154	102.28	28.6	4.70	-36.6
1	*2480.00	85.76	AV	/	/	1.00 H	154	89.06	28.6	4.70	-36.6
2	4960.00	48.84	PK	74.00	25.16	1.00 H	100	45.04	33	7.00	-36.2
2	4960.00	34.12	AV	54.00	19.88	1.00 H	100	30.32	33	7.00	-36.2
3	7440.00	51.96	PK	74.00	22.04	1.00 H	190	42.56	36.2	8.50	-35.3
3	7440.00	43.48	AV	54.00	10.52	1.00 H	190	34.08	36.2	8.50	-35.3
4	9920.00	50.37	PK	74.00	23.63	1.00 H	113	37.77	37.2	10.20	-34.8
4	9920.00	38.48	AV	54.00	15.52	1.00 H	113	25.88	37.2	10.20	-34.8

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（π /4-DQPSK_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	101.80	PK	/	/	1.00 V	247	105.1	28.6	4.70	-36.6
1	*2480.00	91.19	AV	/	/	1.00 V	247	94.49	28.6	4.70	-36.6
2	4960.00	50.86	PK	74.00	23.14	1.00 V	90	47.06	33	7.00	-36.2
2	4960.00	43.68	AV	54.00	10.32	1.00 V	90	39.88	33	7.00	-36.2
3	7440.00	55.97	PK	74.00	18.03	1.00 V	29	46.57	36.2	8.50	-35.3
3	7440.00	43.51	AV	54.00	10.49	1.00 V	29	34.11	36.2	8.50	-35.3
4	9920.00	52.13	PK	74.00	21.87	1.00 V	222	39.53	37.2	10.20	-34.8
4	9920.00	43.66	AV	54.00	10.34	1.00 V	222	31.06	37.2	10.20	-34.8

8-DPSK Mode

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（8-DPSK_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	100.81	PK	/	/	1.00 H	360	104.21	28.3	4.90	-36.6
1	*2402.00	90.72	AV	/	/	1.00 H	360	94.12	28.3	4.90	-36.6
2	4804.00	49.88	PK	74.00	24.12	1.00 H	359	46.68	32.7	7.00	-36.5
2	4804.00	40.02	AV	54.00	13.98	1.00 H	359	36.82	32.7	7.00	-36.5
3	7206.00	49.92	PK	74.00	24.08	1.00 H	152	40.52	35.8	8.90	-35.3
3	7206.00	44.06	AV	54.00	9.94	1.00 H	152	34.66	35.8	8.90	-35.3
4	9608.00	49.98	PK	74.00	24.02	1.00 H	140	37.38	37.2	10.20	-34.8
4	9608.00	43.90	AV	54.00	10.10	1.00 H	140	31.3	37.2	10.20	-34.8

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（8-DPSK_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	100.94	PK	/	/	1.00 V	124	104.34	28.3	4.90	-36.6
1	*2402.00	92.93	AV	/	/	1.00 V	124	96.33	28.3	4.90	-36.6
2	4804.00	51.04	PK	74.00	22.96	1.00 V	339	47.84	32.7	7.00	-36.5
2	4804.00	41.73	AV	54.00	12.27	1.00 V	339	38.53	32.7	7.00	-36.5
3	7206.00	50.64	PK	74.00	23.36	1.00 V	340	41.24	35.8	8.90	-35.3
3	7206.00	40.86	AV	54.00	13.14	1.00 V	340	31.46	35.8	8.90	-35.3
4	9608.00	51.70	PK	74.00	22.30	1.00 V	20	39.1	37.2	10.20	-34.8
4	9608.00	44.12	AV	54.00	9.88	1.00 V	20	31.52	37.2	10.20	-34.8

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（8-DPSK_2441MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2441.00	99.76	PK	/	/	1.00 H	153	102.96	28.3	5.10	-36.6
1	*2441.00	89.94	AV	/	/	1.00 H	153	93.14	28.3	5.10	-36.6
2	4882.00	47.90	PK	74.00	26.10	1.00 H	202	44.5	32.3	7.60	-36.5
2	4882.00	36.93	AV	54.00	17.07	1.00 H	202	33.53	32.3	7.60	-36.5
3	7323.00	50.06	PK	74.00	23.94	1.00 H	355	40.66	36.1	8.60	-35.3
3	7323.00	41.28	AV	54.00	12.72	1.00 H	355	31.88	36.1	8.60	-35.3
4	9764.00	49.92	PK	74.00	24.08	1.00 H	28	37.32	37.2	10.20	-34.8
4	9764.00	42.94	AV	54.00	11.06	1.00 H	28	30.34	37.2	10.20	-34.8

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（8-DPSK_2441MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2441.00	99.80	PK	/	/	1.00 V	121	103	28.3	5.10	-36.6
1	*2441.00	90.66	AV	/	/	1.00 V	121	93.86	28.3	5.10	-36.6
2	4882.00	47.51	PK	74.00	26.49	1.00 V	97	44.11	32.3	7.60	-36.5
2	4882.00	35.28	AV	54.00	18.72	1.00 V	97	31.88	32.3	7.60	-36.5
3	7323.00	50.52	PK	74.00	23.48	1.00 V	288	41.12	36.1	8.60	-35.3
3	7323.00	40.96	AV	54.00	13.04	1.00 V	288	31.56	36.1	8.60	-35.3
4	9764.00	49.87	PK	74.00	24.13	1.00 V	89	37.27	37.2	10.20	-34.8
4	9764.00	36.19	AV	54.00	17.81	1.00 V	89	23.59	37.2	10.20	-34.8

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（8-DPSK_2480MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2480.00	99.58	PK	/	/	1.00 H	154	102.88	28.6	4.70	-36.6
1	*2480.00	82.22	AV	/	/	1.00 H	154	85.52	28.6	4.70	-36.6
2	4960.00	49.77	PK	74.00	24.23	1.00 H	100	45.97	33	7.00	-36.2
2	4960.00	35.98	AV	54.00	18.02	1.00 H	100	32.18	33	7.00	-36.2
3	7440.00	51.96	PK	74.00	22.04	1.00 H	190	42.56	36.2	8.50	-35.3
3	7440.00	41.84	AV	54.00	12.16	1.00 H	190	32.44	36.2	8.50	-35.3
4	9920.00	50.17	PK	74.00	23.83	1.00 H	113	37.57	37.2	10.20	-34.8
4	9920.00	36.53	AV	54.00	17.47	1.00 H	113	23.93	37.2	10.20	-34.8

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（8-DPSK_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	98.98	PK	/	/	1.00 V	247	102.28	28.6	4.70	-36.6
1	*2480.00	89.95	AV	/	/	1.00 V	247	93.25	28.6	4.70	-36.6
2	4960.00	50.96	PK	74.00	23.04	1.00 V	90	47.16	33	7.00	-36.2
2	4960.00	46.88	AV	54.00	7.12	1.00 V	90	43.08	33	7.00	-36.2
3	7440.00	52.05	PK	74.00	21.95	1.00 V	29	42.65	36.2	8.50	-35.3
3	7440.00	43.79	AV	54.00	10.21	1.00 V	29	34.39	36.2	8.50	-35.3
4	9920.00	50.87	PK	74.00	23.13	1.00 V	222	38.27	37.2	10.20	-34.8
4	9920.00	42.19	AV	54.00	11.81	1.00 V	222	29.59	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

2.11. RF exposure evaluation

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

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

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

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

Routine SAR evaluation refers to the specifically required by § 2.1093, using measurements or computer simulation. When routine SAR evolution is not required, the portable transmitters with output power greater than the applicable low threshold SAR evolution to qualify for TCB approval.

Result:

This is portable device and the Max conducted peak output power is 5.74dBm, the maximum gain of antenna is 0dBi, the maximum output power is 5.74dBm (3.75mW), which is lower than the exclusion threshold 10mW, at frequency 2450MHz, and distance is 5mm.

The SAR measurement is not required.

** END OF REPORT **