RF TEST REPORT

Report No.:	UNI-15021502
Product Name:	Bluetooth speaker
FCC ID:	2ADJD-LN-2010
Model No. :	LN-2060, LN-2010, LN-2020, LN-2030, LN-2040, LN-2050, LN-2070,LN-2080, LN-2090, LN-2000,LN-3020, LN-3050, LN-3060, LN-3080, LN-3090,LN-1020, LN-1050,LN-1060, LN-1080, LN-1090
Applicant:	Liontronic (Shenzhen) Co.,ltd
Address:	5F, B block, Baoyunda industrial park, Xixiang, Baoan district, Shenzhen, P.R.China
Issued by:	Shenzhen United Testing Technology Co.,Ltd
Lab Location:	Room 317-319, Block 1, University Town Technology Park, 5th Zone South Section, Honghualing Industrial Park, Nanshan District, Shenzhen, PRC
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Test Report

Product Name.....:	Bluetooth speaker
Trade Name.....:	LIONTRONIC
Applicant.....:	Liontronic (Shenzhen) Co.,ltd
Applicant Address.....:	5F, B block, Baoyunda industrial park, Xixiang, Baoan district, Shenzhen, P.R.China
Manufacturer .....:	Liontronic (Shenzhen) Co.,ltd
Manufacturer Address .....:	5F, B block, Baoyunda industrial park, Xixiang, Baoan district, Shenzhen, P.R.China
Test Standards.....:	47 CFR Part 15 Subpart C：Radio Frequency Devices ANSI C63.10:2009：American National Standard for Testing Unlicensed Wireless Devices DA 00-705: Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems
Test Result.....:	PASS
Tested by .....:	Michael Su 2015.02.15 Michael Su, Test Engineer
Reviewed by .....:	Mike Yong 2015.02.15 Mike Yong, Senior Engineer
Approved by .....:	Hoffer Lau 2015.02.15 Hoffer Lau，Manager

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Change History		
Issue	Date	Reason for change
1.0	Feb 15, 2015	First edition

1. General Information

1.1. EUT Description

EUT Type	:	Bluetooth speaker
FCC ID	:	2ADJD-LN-2010
Serial No.	:	2015010601586
Hardware Version	:	V1.0
Software Version	:	20150106
Bluetooth version	:	2.1
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	:	-1dBi

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

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

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

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

Note5: The antenna of EUT is designed with permanent attachment and no consideration of replacement, it is printed on the circuit board with a maximum gain of -1dBi, and it is used to radiate the RF emissions.

Note 6: The EUT was programmed to be in continuously transmitting mode.

Note 7: The Bluetooth speaker has twenty serials models, called LN-2060, LN-2010, LN-2020, LN-2030, LN-2040, LN-2050, LN-2070, LN-2080, LN-2090, LN-2000, LN-3020, LN-3050, LN-3060, LN-3080, LN-3090, LN-1020, LN-1050, LN-1060, LN-1080 and LN-1090. All of them share with the same appearance and design, just with different models. In this report, test EUT is the LN-2060.

1.2. Support Equipment

Equipment type	Manufacturer	Model	FCC ID/Doc
Notebook	ASUS	A53S	FCC DOC approved
Notebook Adaptor	ASUS	ADP-90YD B	FCC approved

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 2014	Radio Frequency Devices
2	ANSI C63.10 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 was performed according to the method of measurements prescribed in ANSI C63.10 2009.

1.4. Facilities and Accreditations

1.4.1. Facilities

The test facility is recognized, certified, or accredited by the following organizations: Shenzhen BCTC Technology Co., Ltd. Add. : No.101,Yousong Road,Longhua New District, Shenzhen,China FCC Registered No.: 187086

1.4.2. Test Location

All tests were performed at:
Shenzhen BCTC Technology Co., Ltd. No.101,Yousong Road,Longhua New District, Shenzhen,China

1.4.3. 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

1.4.4. Test Instruments list

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due Date
Test Receiver	R&S	ESPI	10318	2014.06.07	2015.06.06
Spectrum Analyzer	R&S	FSEM	848597/001	2014.07.03	2015.07.02
Spectrum Analyzer	Agilent	E4407B	MY45108040	2014.07.06	2015.07.05
Bilog Antenna	TESEQ	CBL6111D	31216	2014.07.06	2015.07.05
50Ω Coaxial Switch	Anritsu	MP59B	6200264416	2014.06.07	2015.06.06
Spectrum Analyzer	ADVANTEST	R3132	150900201	2014.06.07	2015.06.06
Horn Antenna	EM	EM-AH-10180	2011071402	2014.07.06	2015.07.05
Horn Ant	Schwarzbeck	BBHA 9170	9170-181	2014.07.06	2015.07.05

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due Date
Amplifier	EM	EM-30180	060538	2014.12.22	2015.12.21
Loop Antenna	ARA	PLA-1030/B	1029	2014.06.08	2015.06.07
Power Meter	R&S	NRVS	100696	2014.07.06	2015.07.05
Power Sensor	R&S	URV5-Z4	0395.1619.05	2014.07.06	2015.07.05
RF cables	R&S	RS001	20150105	2014.07.06	2015.07.05
Antenna connector	JET	N-KFB3-07	20141229	2015.01.08	2016.01.07
Coaxial Cable	BCTC	BCTC01	20150106	2014.07.06	2015.07.05
Test Receiver	R&S	ESCI	101160	2014.06.06	2015.06.05
LISN	R&S	ENV216	101313	2014.08.24	2015.08.23
LISN	EMCO	3816/2	00042990	2014.08.24	2015.08.23
50Ω Coaxial Switch	Anritsu	MP59B	6200264417	2014.07.06	2015.07.05
Passive Voltage Probe	R&S	ESH2-Z3	100196	2014.06.07	2015.06.06
Absorbing clamp	R&S	MOS-21	100423	2014.06.08	2015.06.07
RF cables	R&S	RS002	20150107	2014.06.07	2015.06.06
Coaxial Cable	BCTC	BCTC02	20150108	2014.06.07	2015.06.06

1.4.5. Measurement Unertainty

The reported uncertainty of measurement y±U，where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2，providing a level of confidence of approximately 95 %。

No.	Item	Uncertainty
1	Conducted Emission Test	±1.38dB
2	Temperature	±0.5℃
3	Humidity	±2.0%
4	RF power, conducted	±0.16dB
5	Spurious emissions, conducted	±0.21 dB
6	All emissions, radiated(<1G)	±4.68 dB
7	All emissions, radiated(>1G)	±4.89 dB

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: Internal antenna

An Internal antenna was soldered to the antenna port of EUT, can't be removed.

Antenna General Information:

No.	EUT Model	Ant. Cat.	Ant. Type	Gain(dBi)
1	Bluetooth speaker	Internal	PCB	-1

2.1.3. Result: comply

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

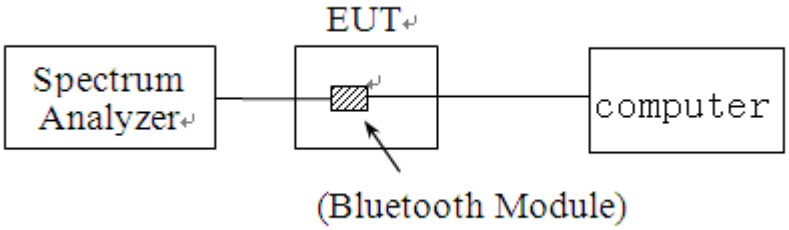
2.2. Number of Hopping Frequency

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

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.

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

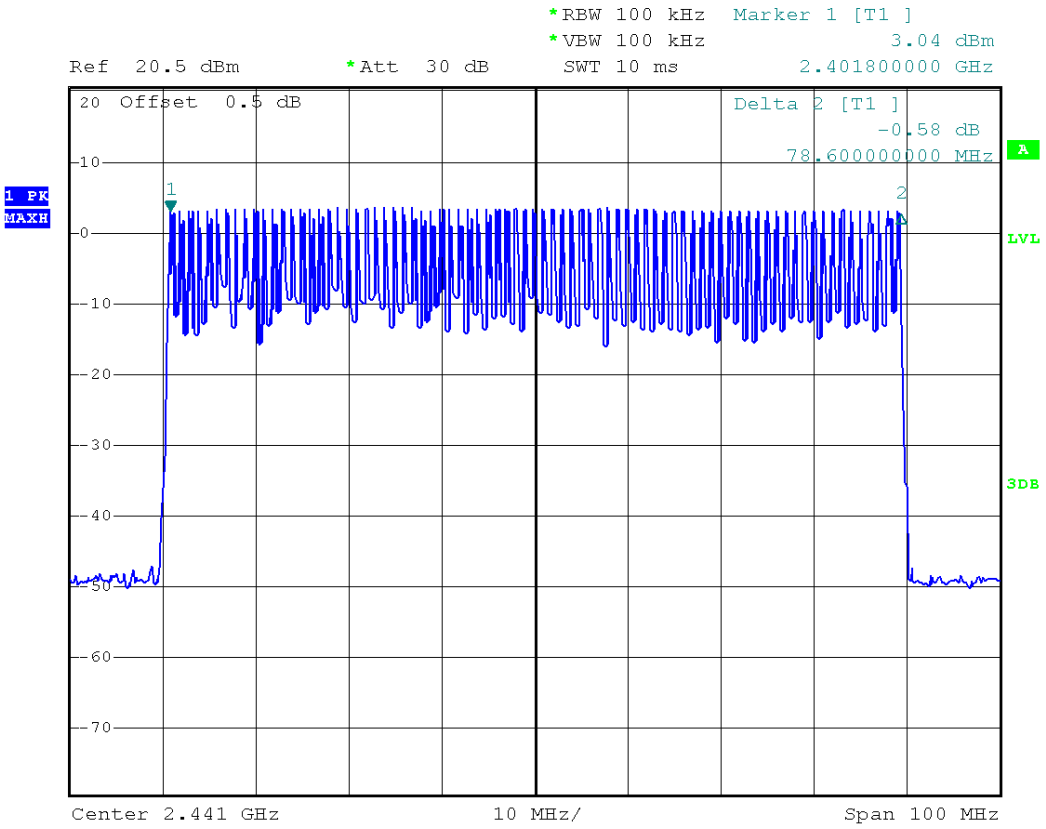
2.2.4. Test Result

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.

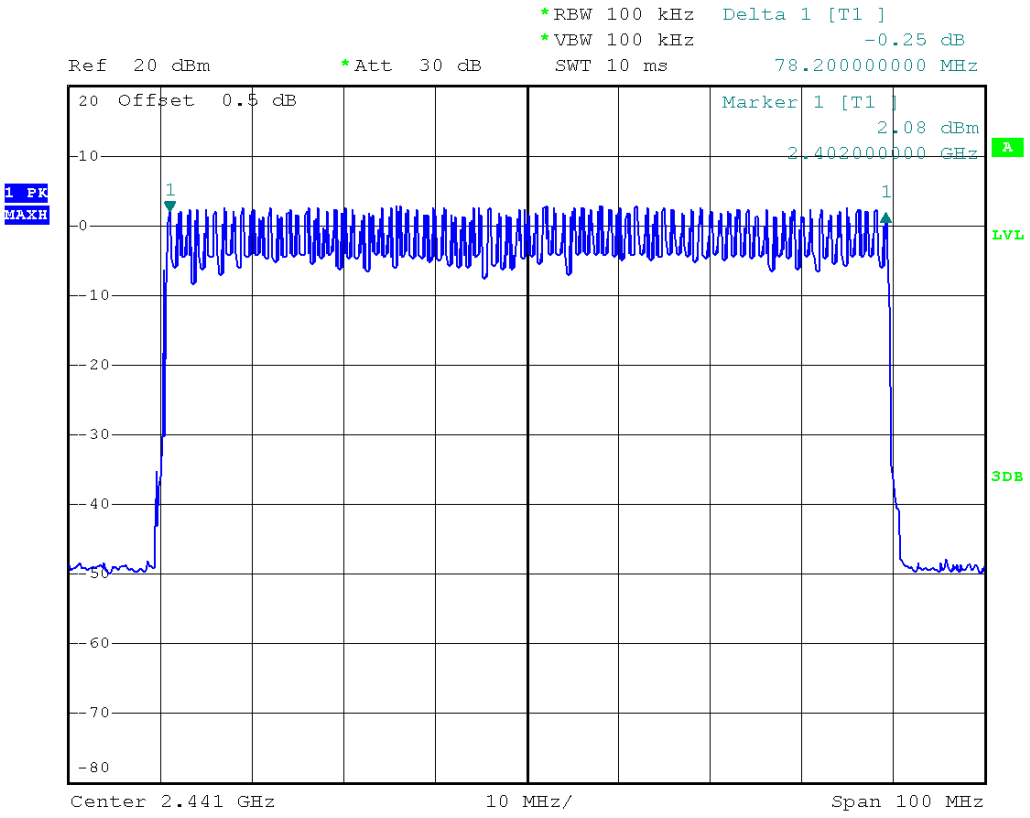
A. Test Verdict:

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

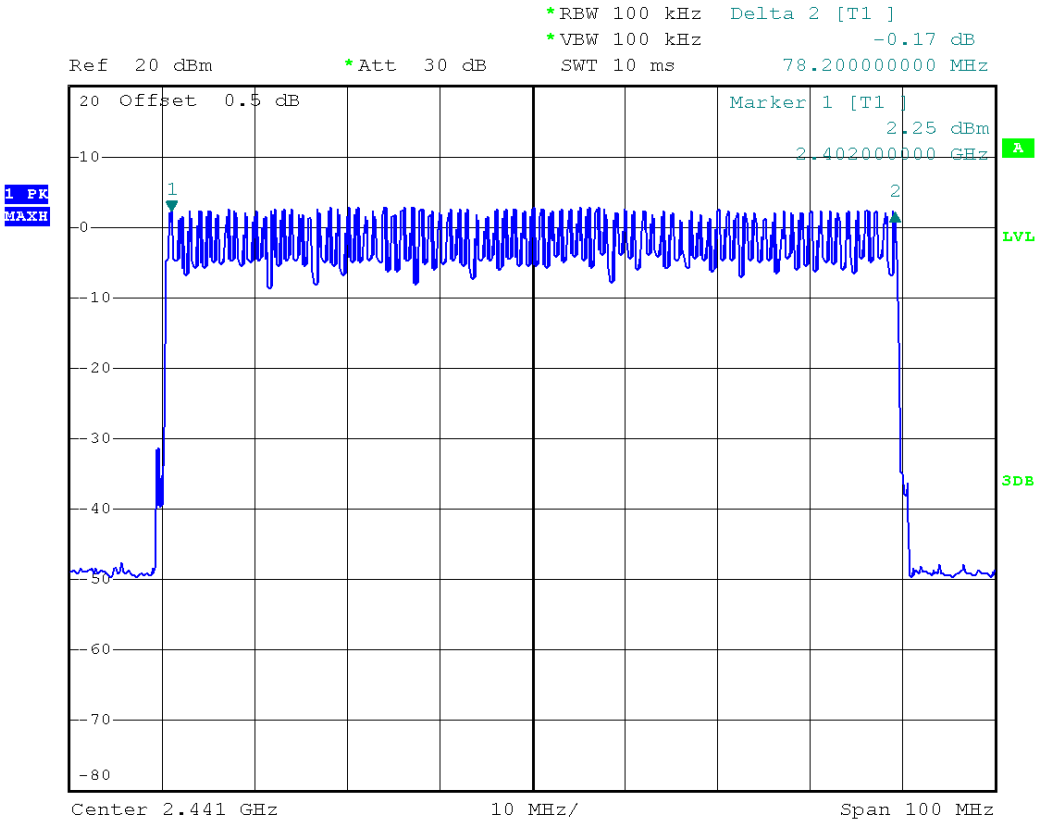
Test Plots:



(Plot A: GFSK)



(Plot B: π/4-DQPSK)



(Plot C: 8- DPSK)

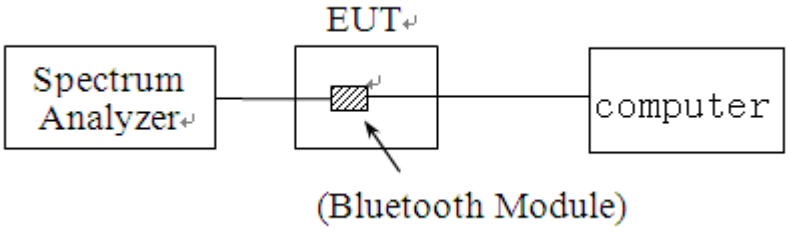
2.3. Peak Output Power

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

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.

2.3.3. Test Result

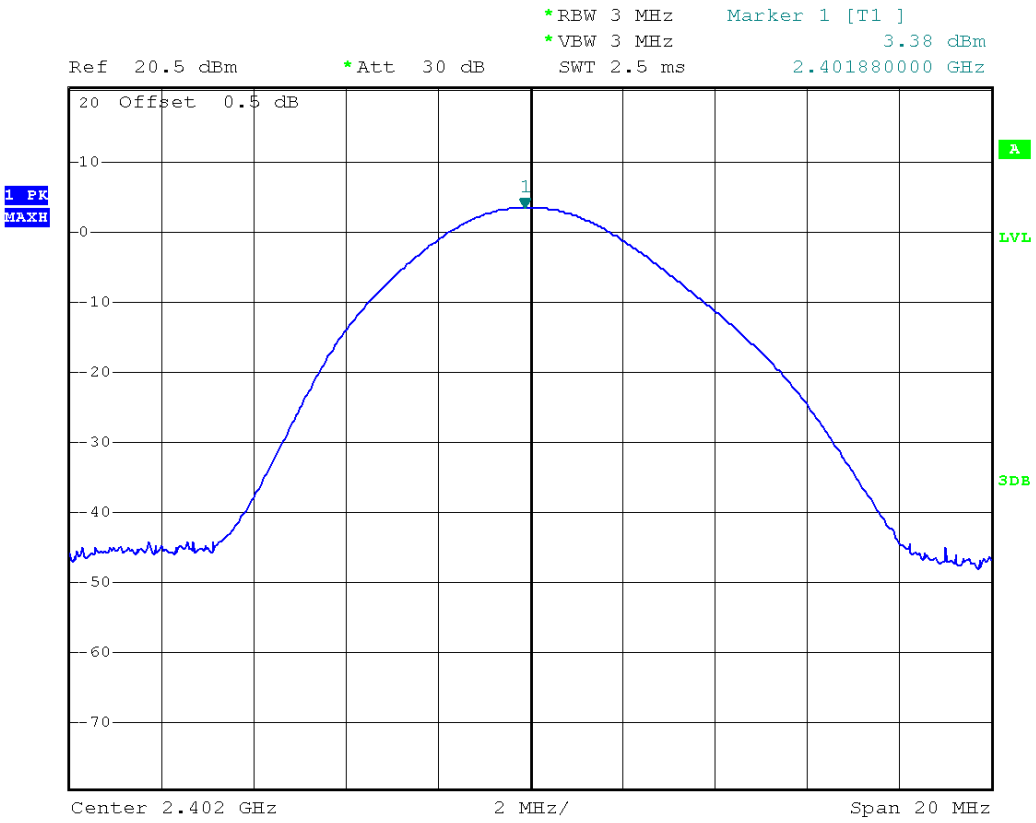
The Bluetooth Module operates at hopping-off test mode. The lowest, middle and highest channels are selected to perform testing to verify the conducted RF output peak power of the Module. The lowest, middle and highest channel were tested by Spectrum Analyzer.

2.3.3.1. GFSK Mode

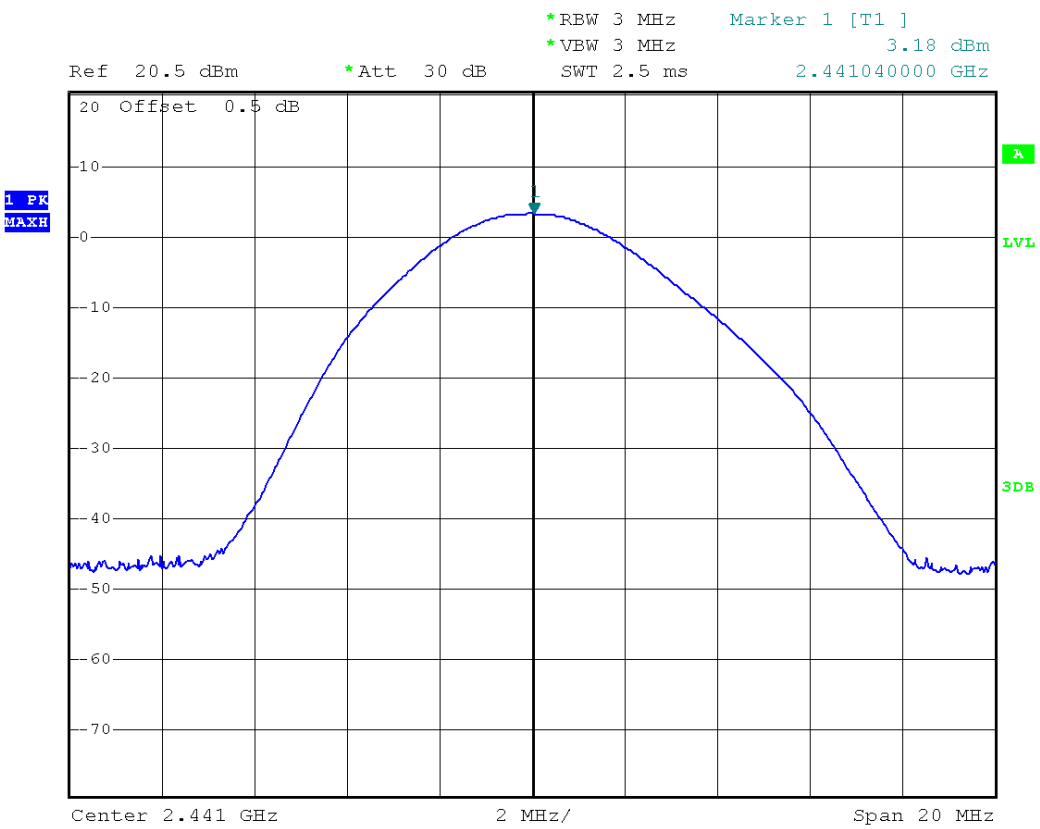
A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power（dBm）	Limit（dBm）	Refer to Plot	Verdict
0	2402	3.38	30	Plot A1	PASS
39	2441	3.18		Plot A2	PASS
78	2480	2.88		Plot A3	PASS

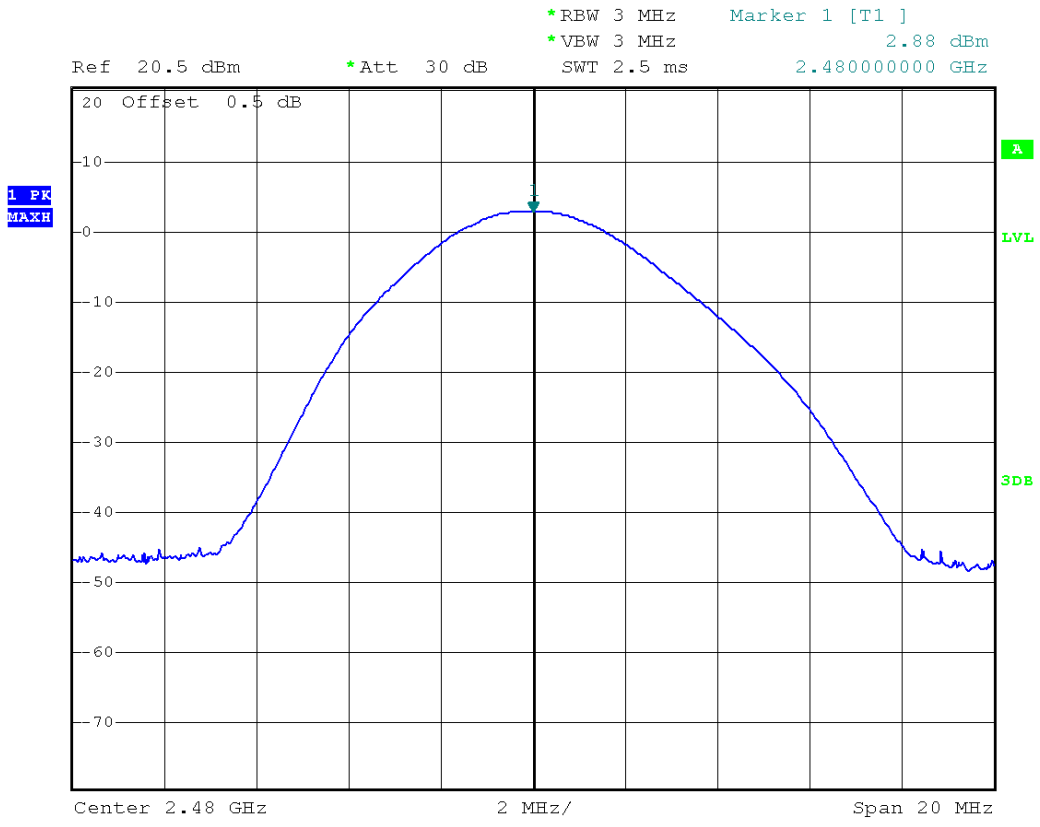
Test Plots:



Plot A1: GFSK



Plot A2: GFSK



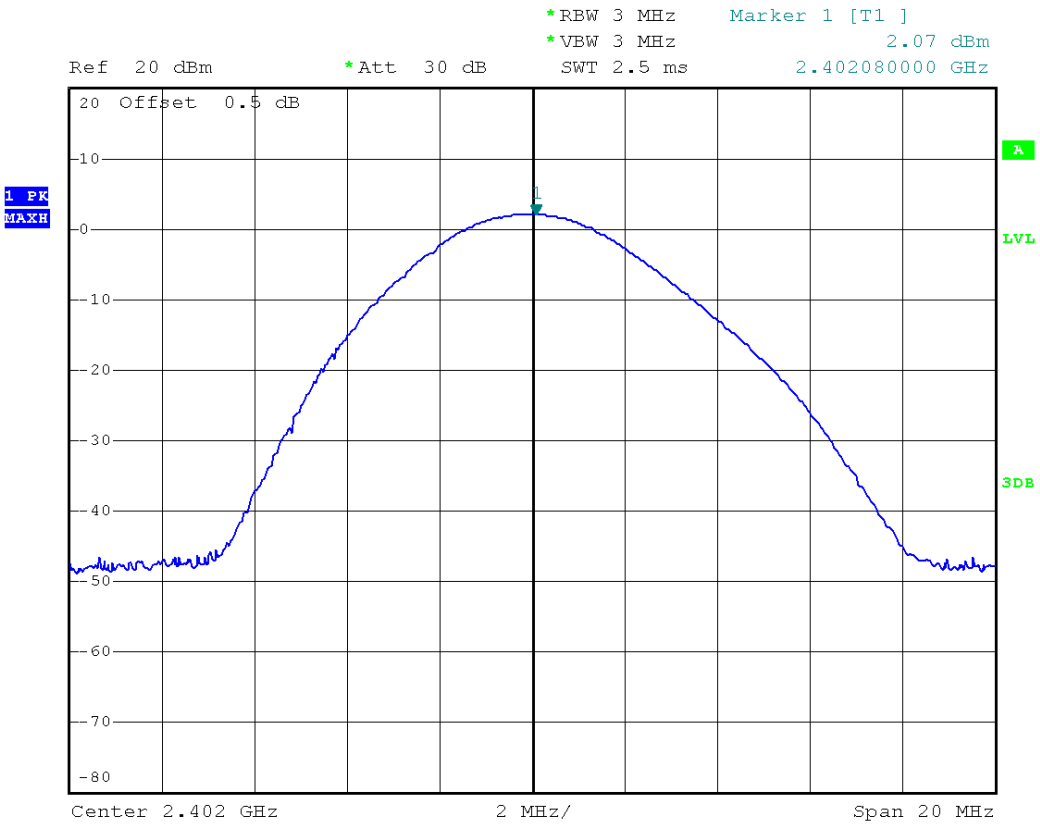
Plot A3: GFSK

2.3.3.2. π/4-DQPSK Mode

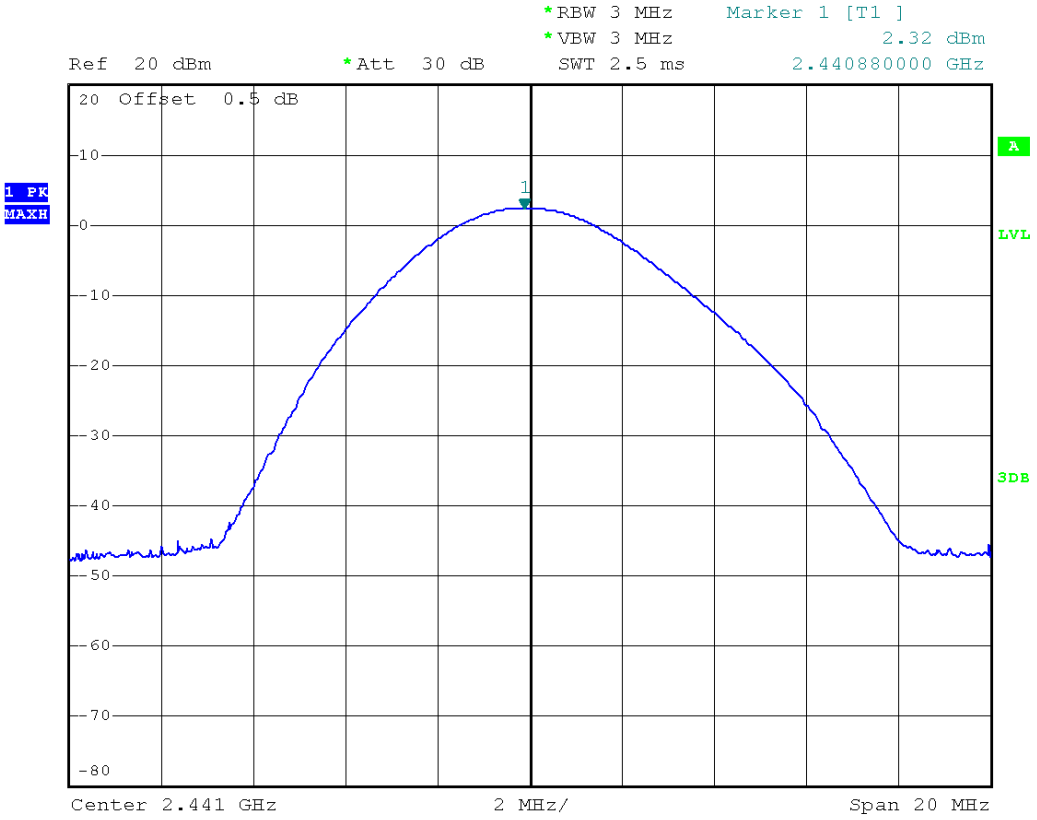
A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power (dBm)	Limit (dBm)	Refer to Plot	Verdict
0	2402	2.07	21	Plot B1	PASS
39	2441	2.32		Plot B2	PASS
78	2480	2.22		Plot B3	PASS

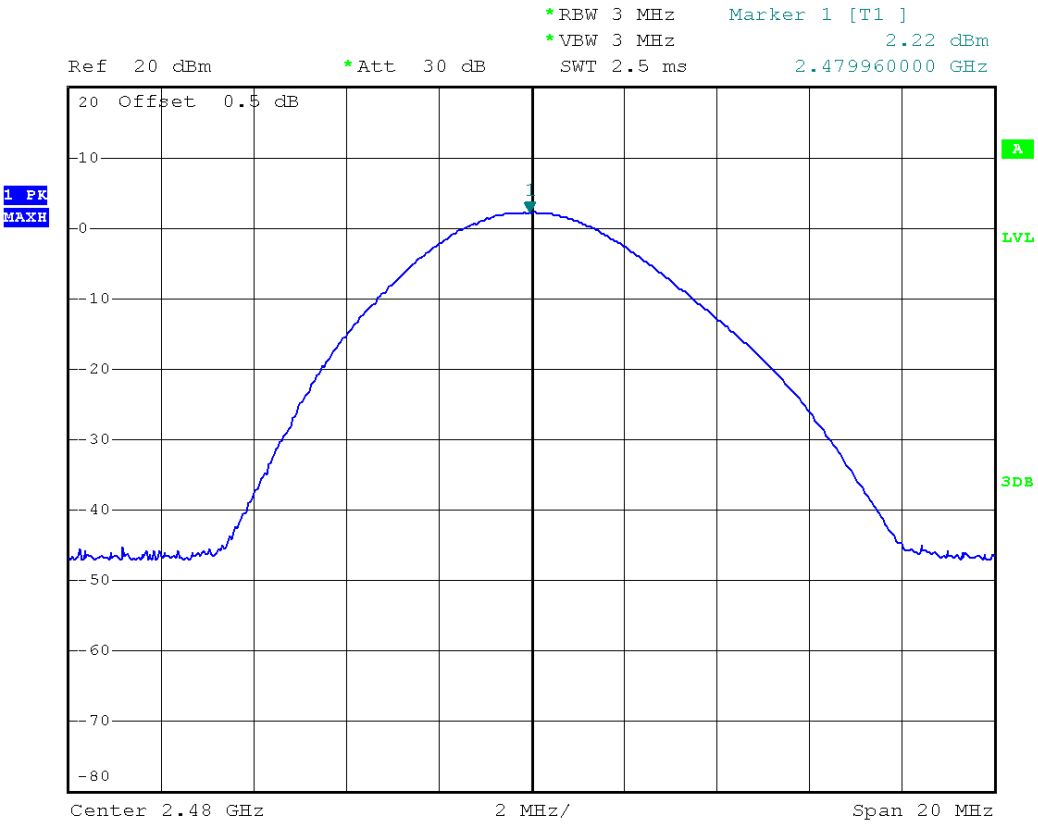
Test Plots:



Plot B1: π/4-DQPSK



Plot B2: π/4-DQPSK



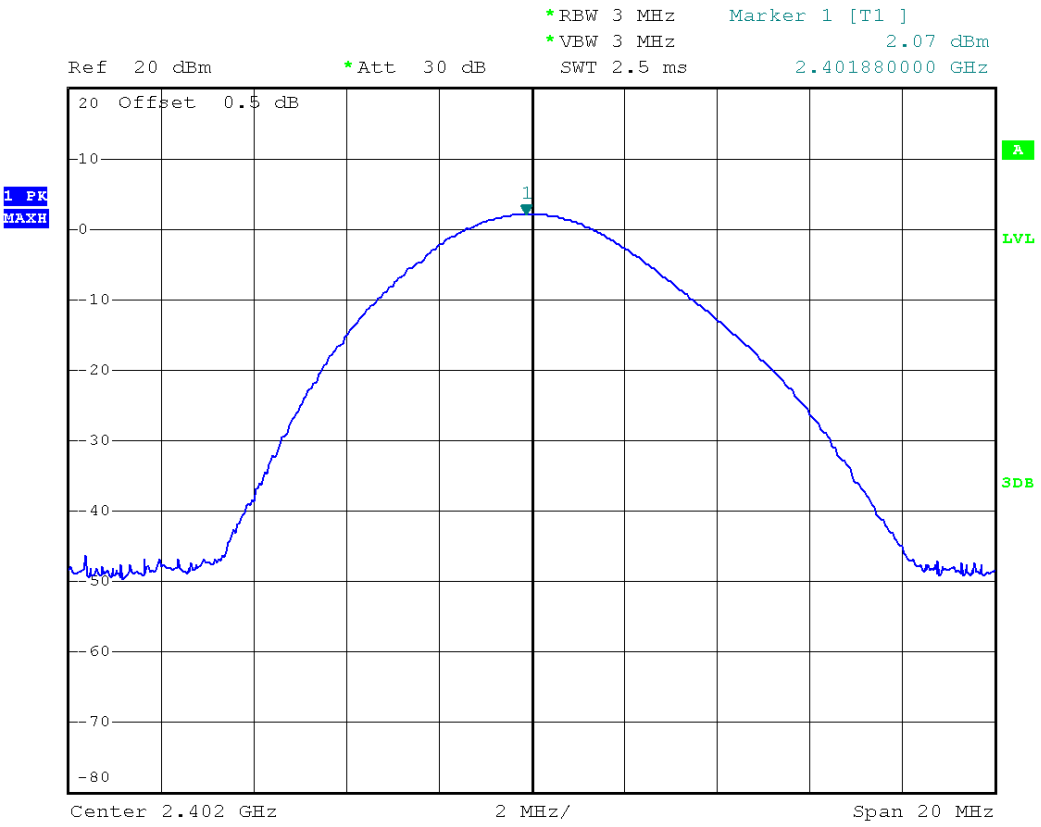
Plot B3: π/4-DQPSK

2.3.3.3. 8-DPSK Mode

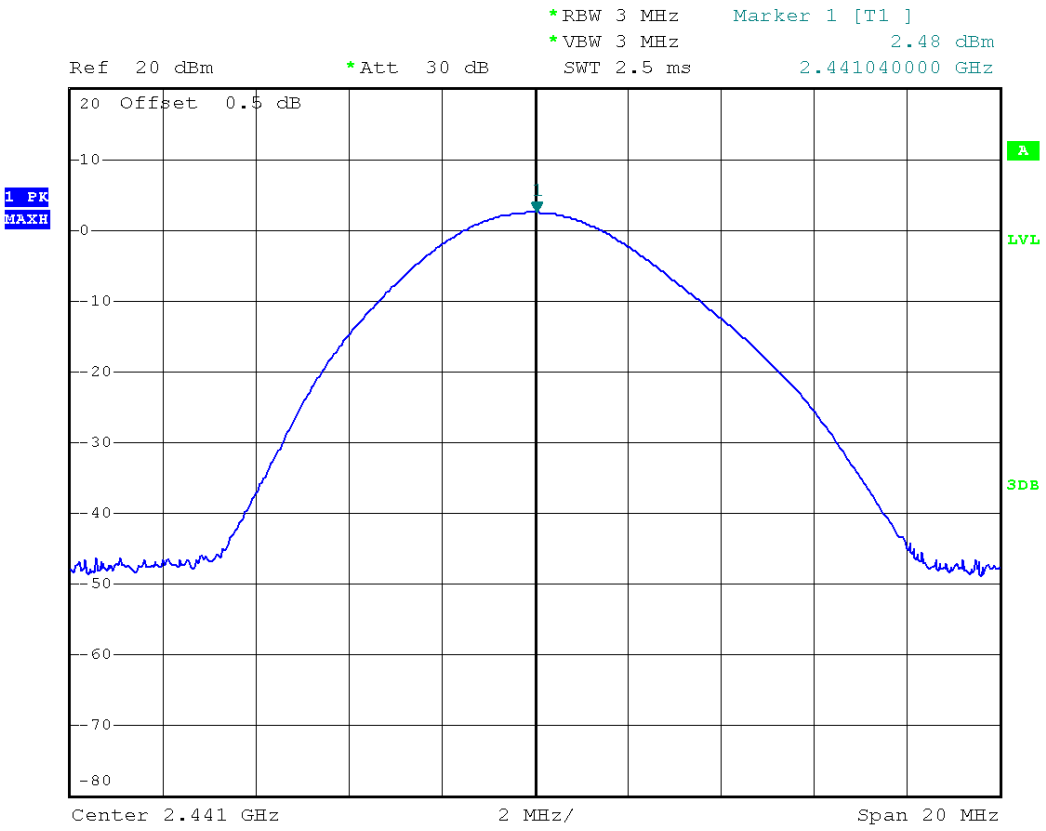
A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power (dBm)	Limit (dBm)	Refer to Plot	Verdict
0	2402	2.07	21	Plot C1	PASS
39	2441	2.48		Plot C2	PASS
78	2480	2.14		Plot C3	PASS

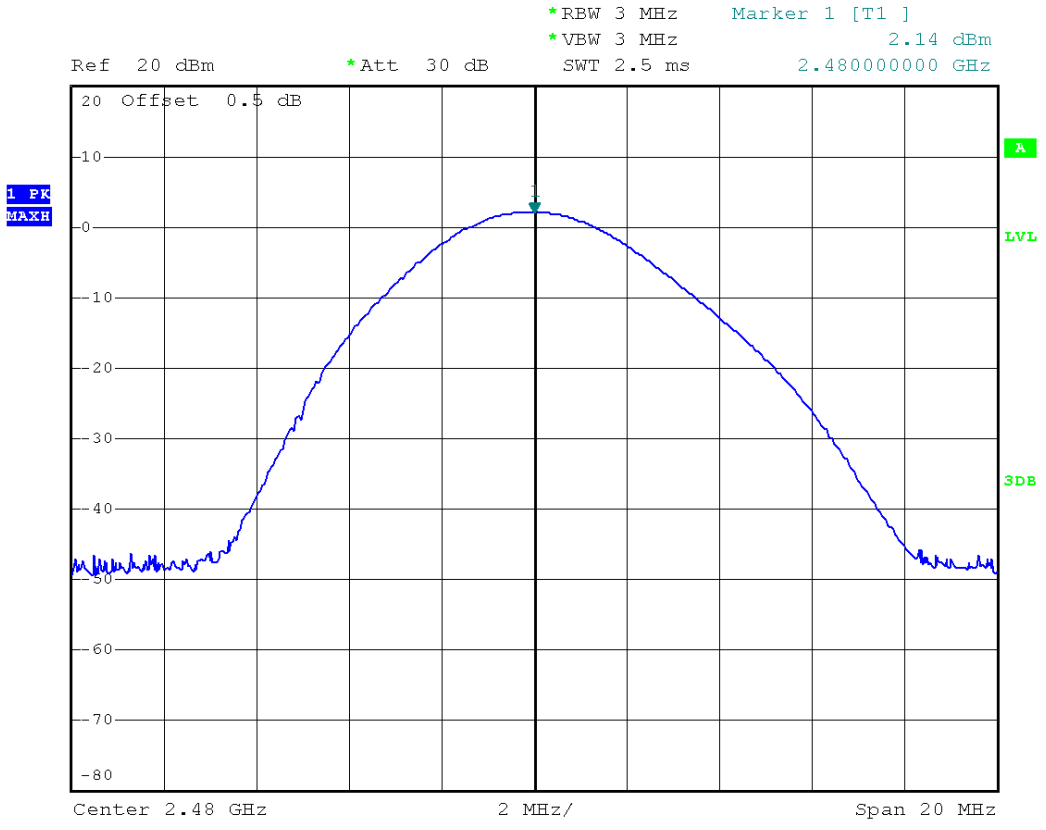
Test Plots:



Plot C1: 8-DPSK



Plot C2: 8-DPSK



Plot C3: 8-DPSK

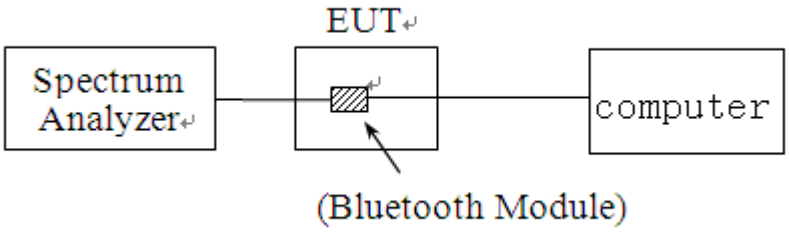
2.4. 20dB Bandwidth

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

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.

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.

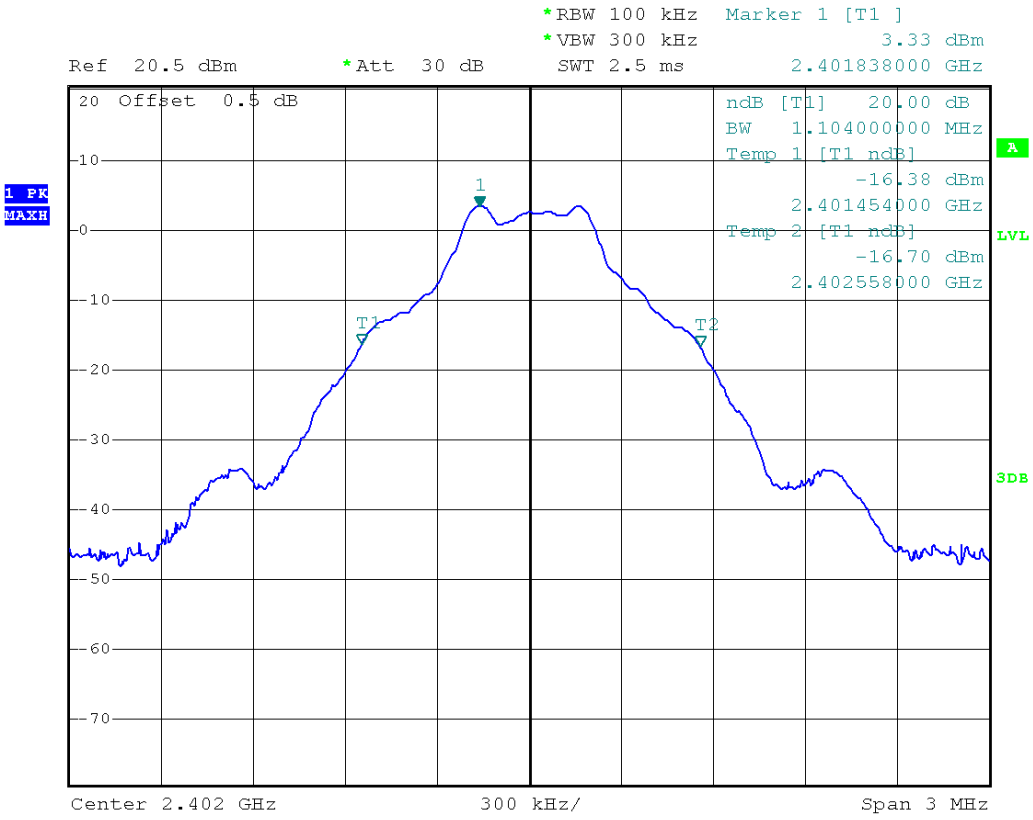
2.4.2.1. GFSK Mode

A. Test Verdict:

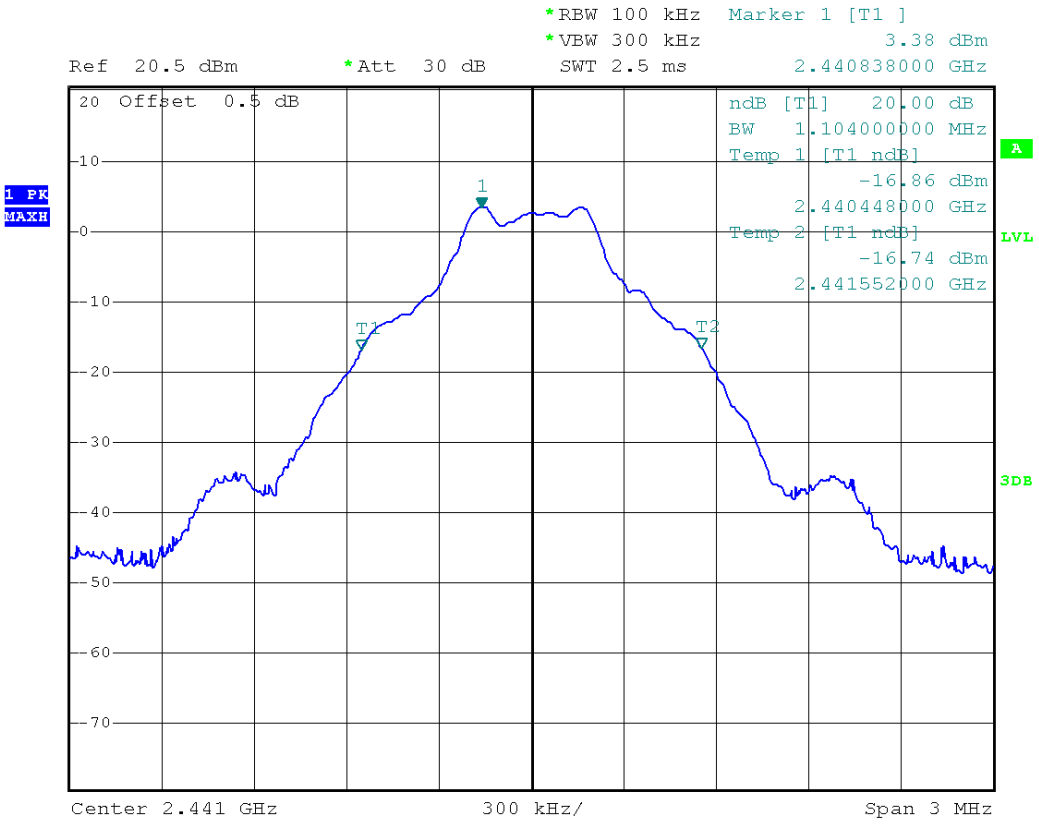
The maximum 20dB bandwidth measured is 1.110MHz according to the table below.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
0	2402	1.104	Plot A
39	2441	1.104	Plot B
78	2480	1.110	Plot C

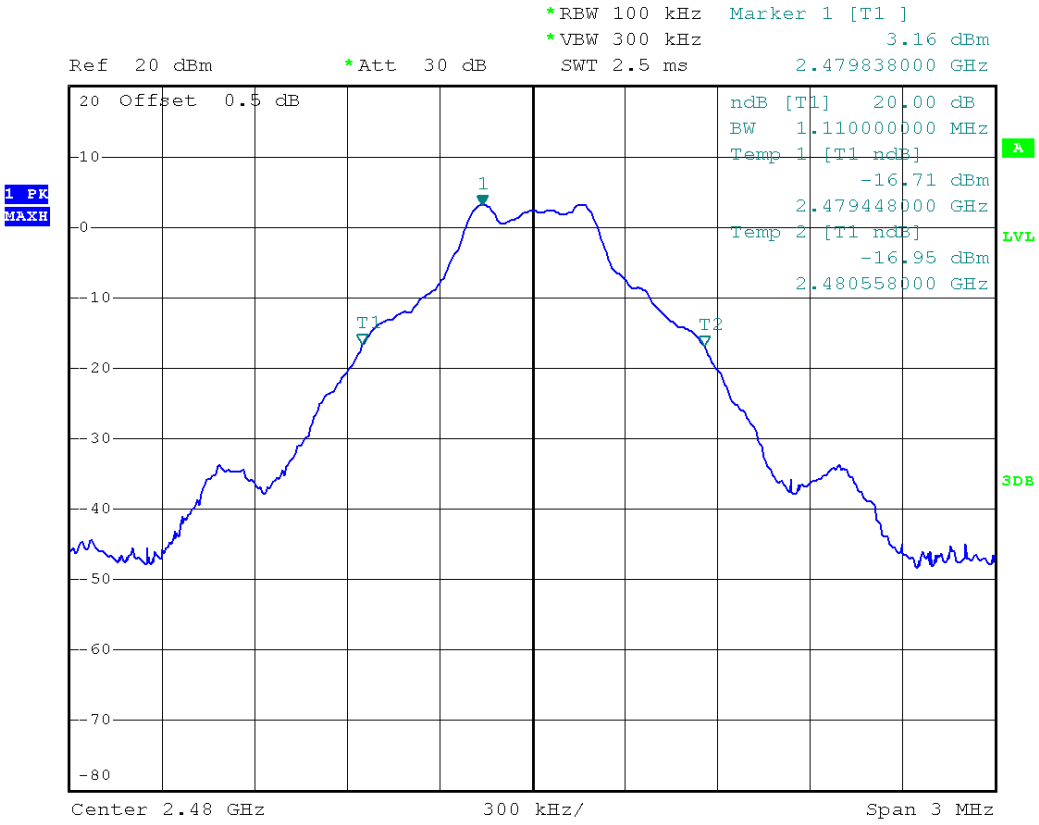
Test Plots:



(Plot A: Channel = 2402 @ GFSK)



(Plot B: Channel = 2441 @ GFSK)



(Plot C: Channel = 2480 @ GFSK)

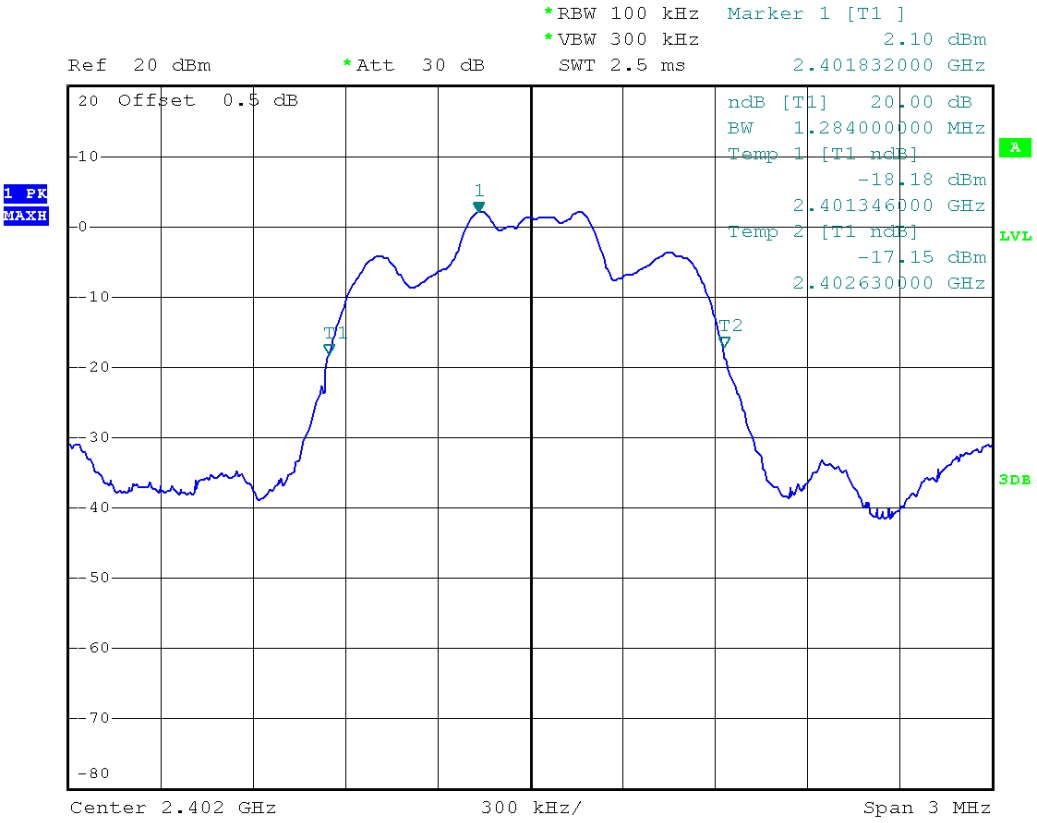
2.4.2.2. π/4-DQPSK Mode

A. Test Verdict:

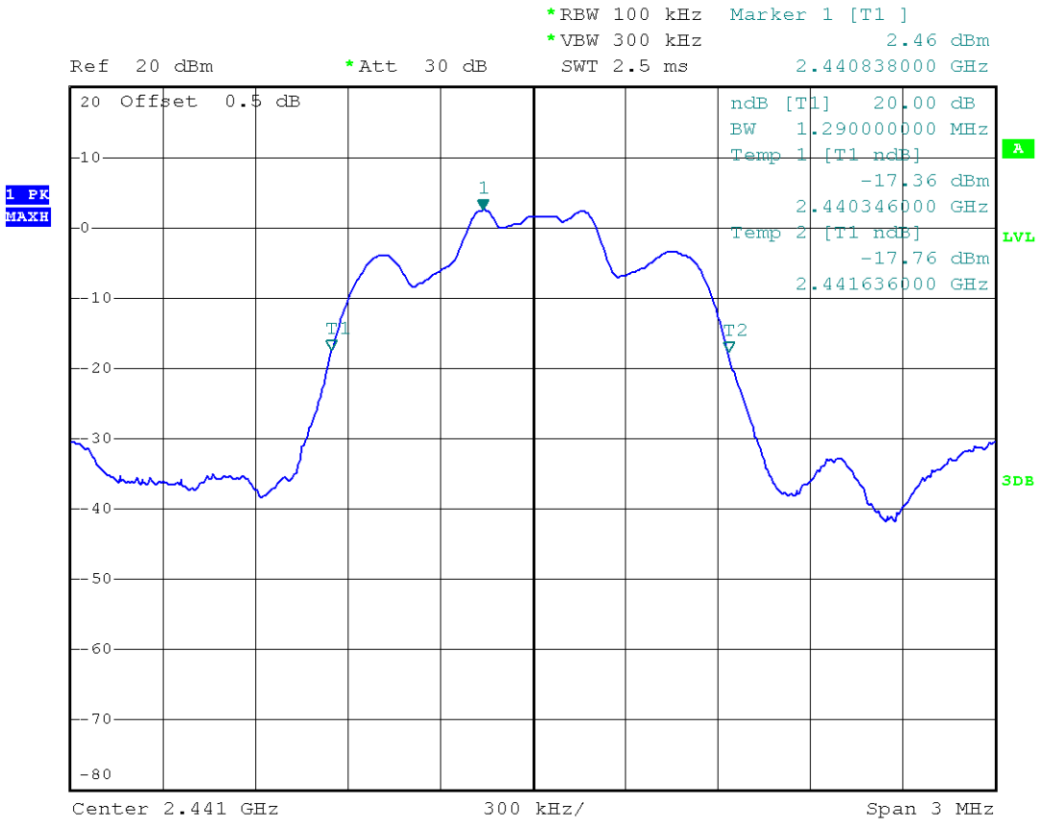
The maximum 20dB bandwidth measured is 1.290MHz according to the table below.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
0	2402	1.284	Plot D
39	2441	1.290	Plot E
78	2480	1.290	Plot F

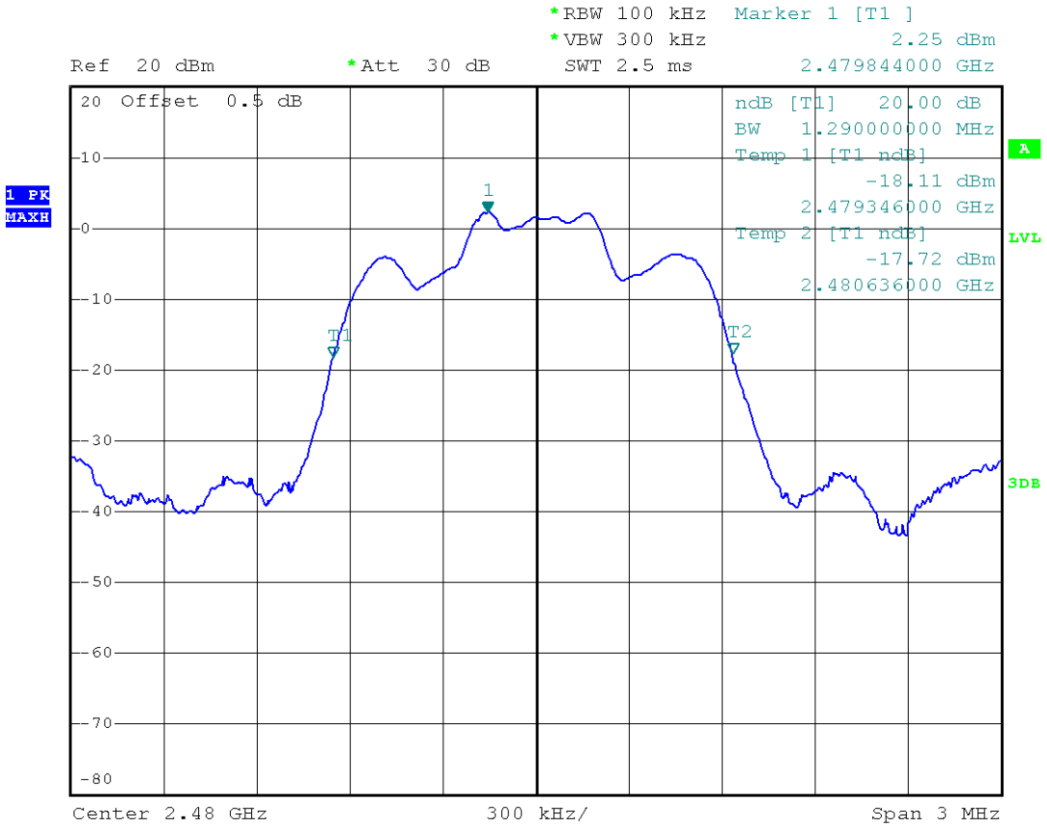
Test Plots:



(Plot D: Channel = 2402 @π/4-DQPSK)



(Plot E: Channel = 2441 @π/4-DQPSK)



(Plot F: Channel = 2480 @π/4-DQPSK)

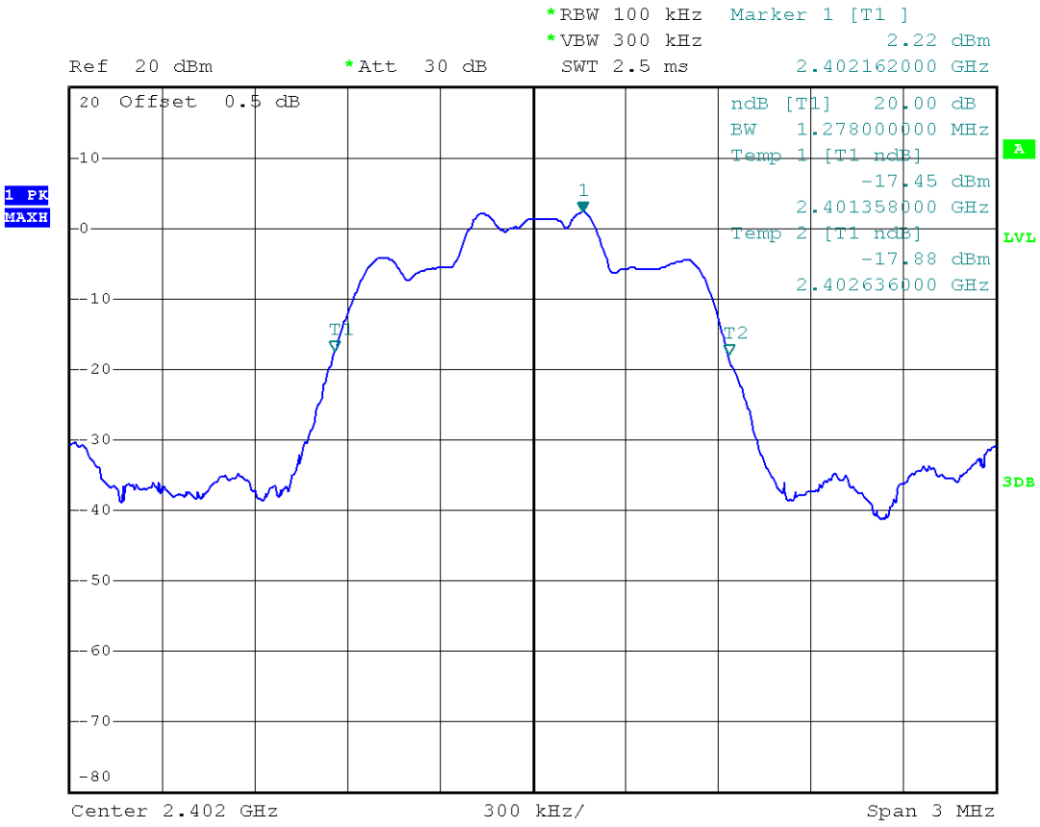
2.4.2.3. 8-DPSK Mode

A. Test Verdict:

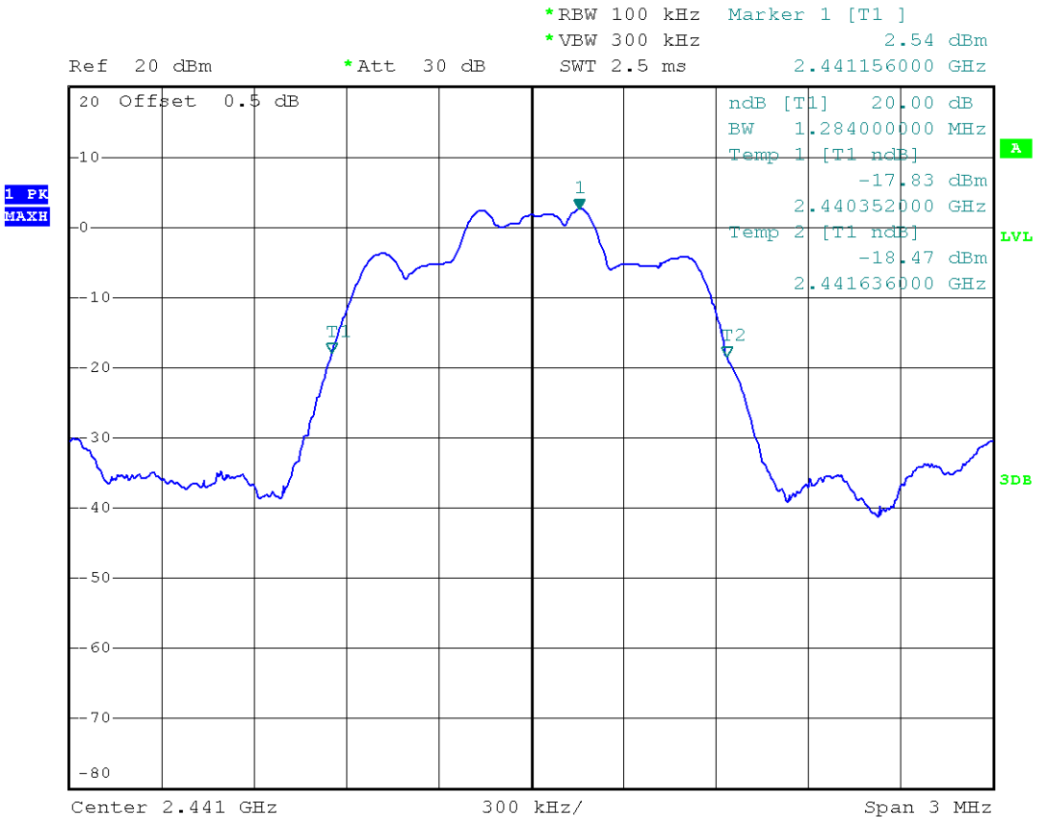
The maximum 20dB bandwidth measured is 1.284MHz according to the table below.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
0	2402	1.278	Plot G
39	2441	1.284	Plot H
78	2480	1.284	Plot I

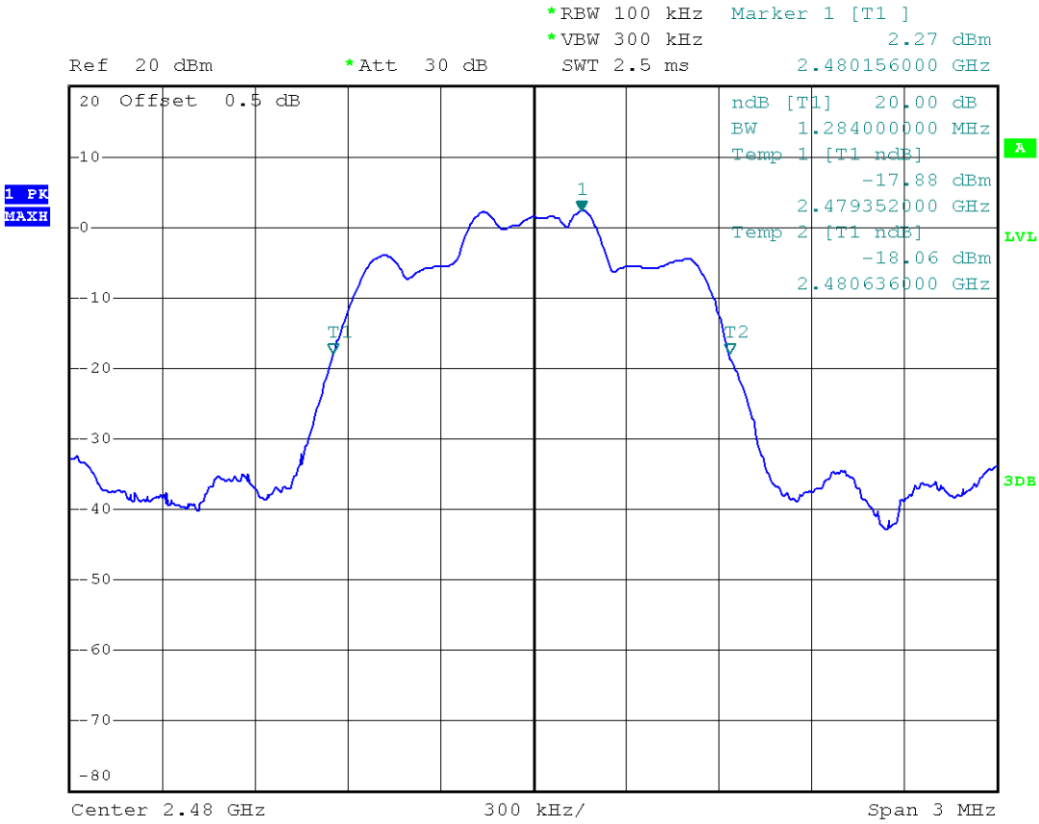
Test Plots:



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



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



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

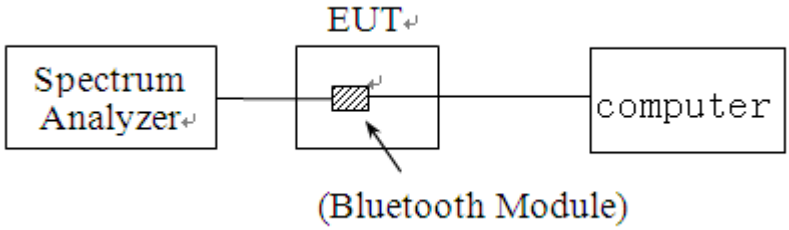
2.5. Carried Frequency Separation

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

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.

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

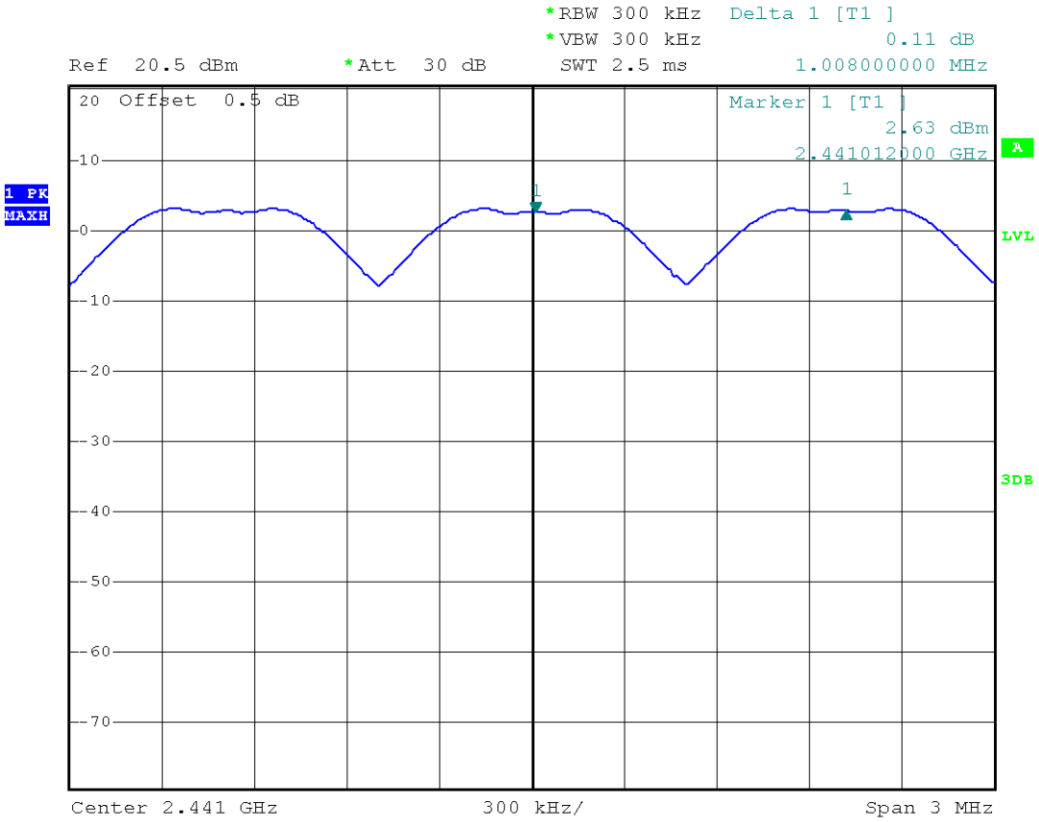
Trace = max hold

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

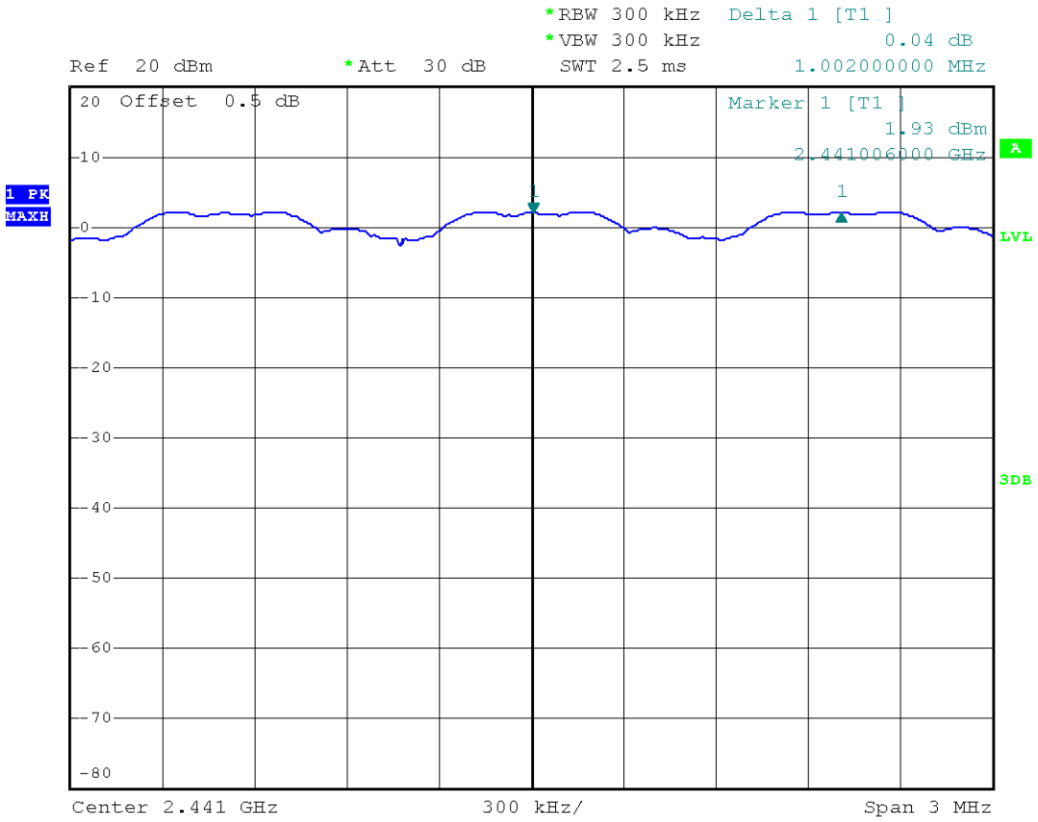
2.5.4. Test Result

The Bluetooth Module operates at hopping-on test mode.

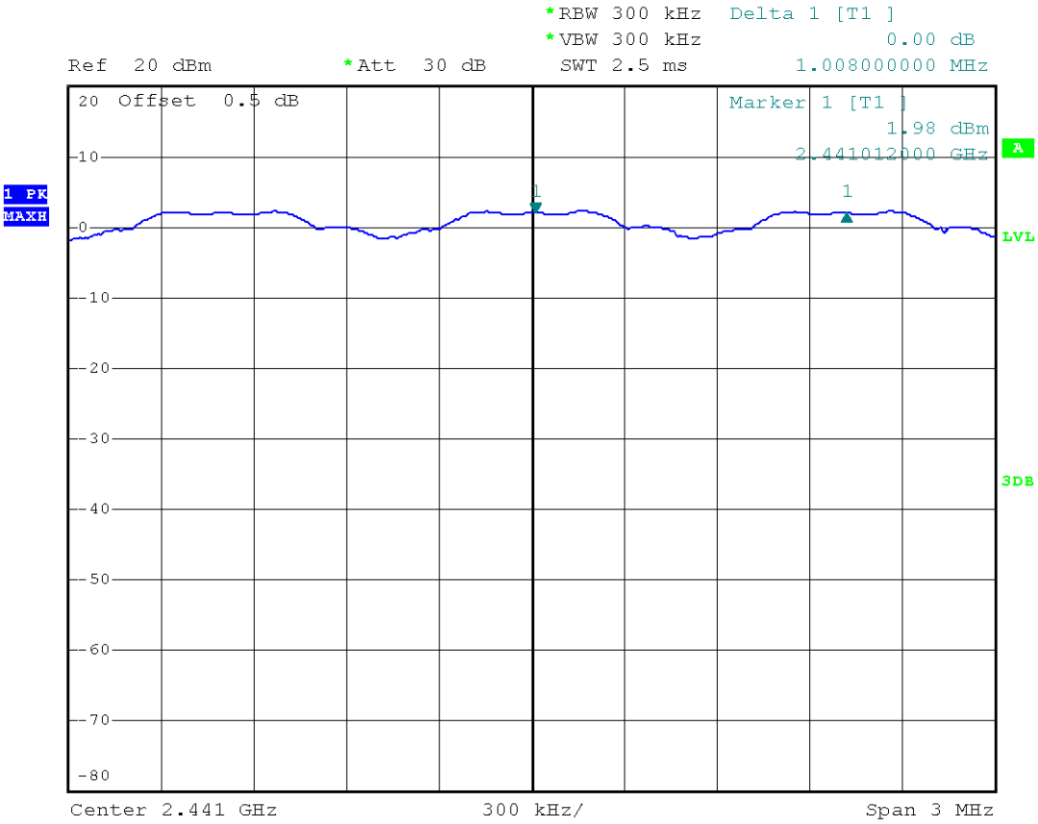
For any adjacent channels (e.g. the channel 39 and 40 as showed in the Plot A), the Module does have hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of the hopping channel (1.110MHz for GFSK mode, 1.290MHz for π/4-DQPSK mode and 1.284MHz for 8-DPSK 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)

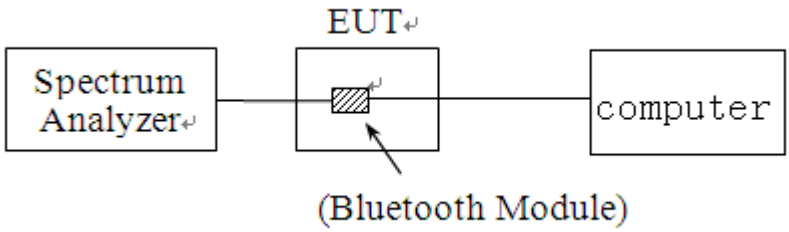
2.6. Time of Occupancy (Dwell time)

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

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.

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.

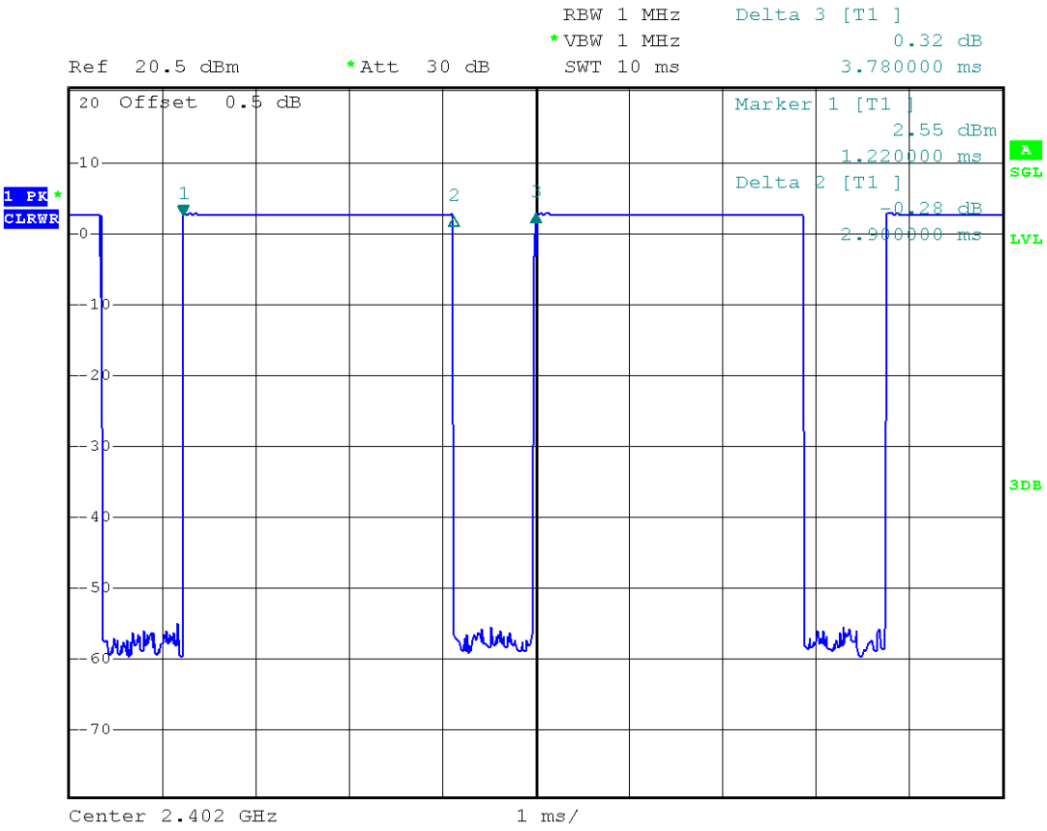
2.6.4.1. GFSK Mode

A. Test Verdict:

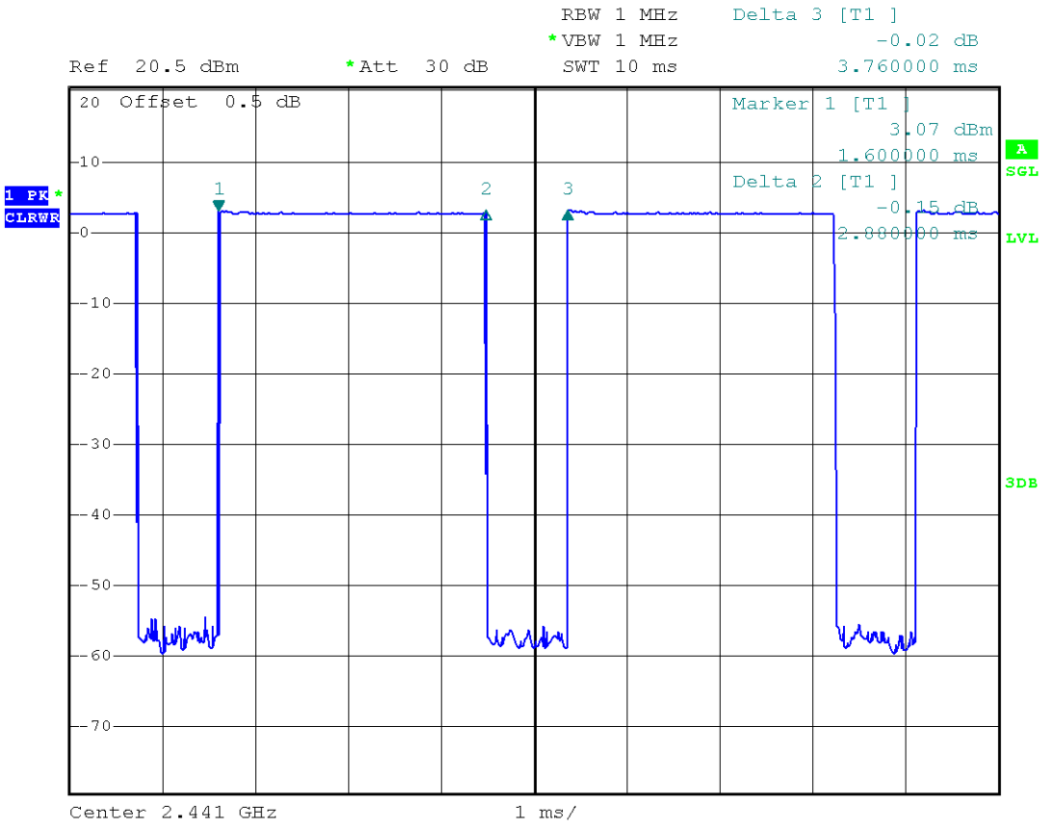
Channel	Frequency (MHz)	Pulse Time		Total of Dwell (ms)	Limit (ms)	Verdict
		ms	Refer to Plot			
0	2402	2.90	Plot A	309.333	400	PASS
39	2441	2.88	Plot B	307.200		PASS
78	2480	2.88	Plot C	307.200		PASS

Test Plots:

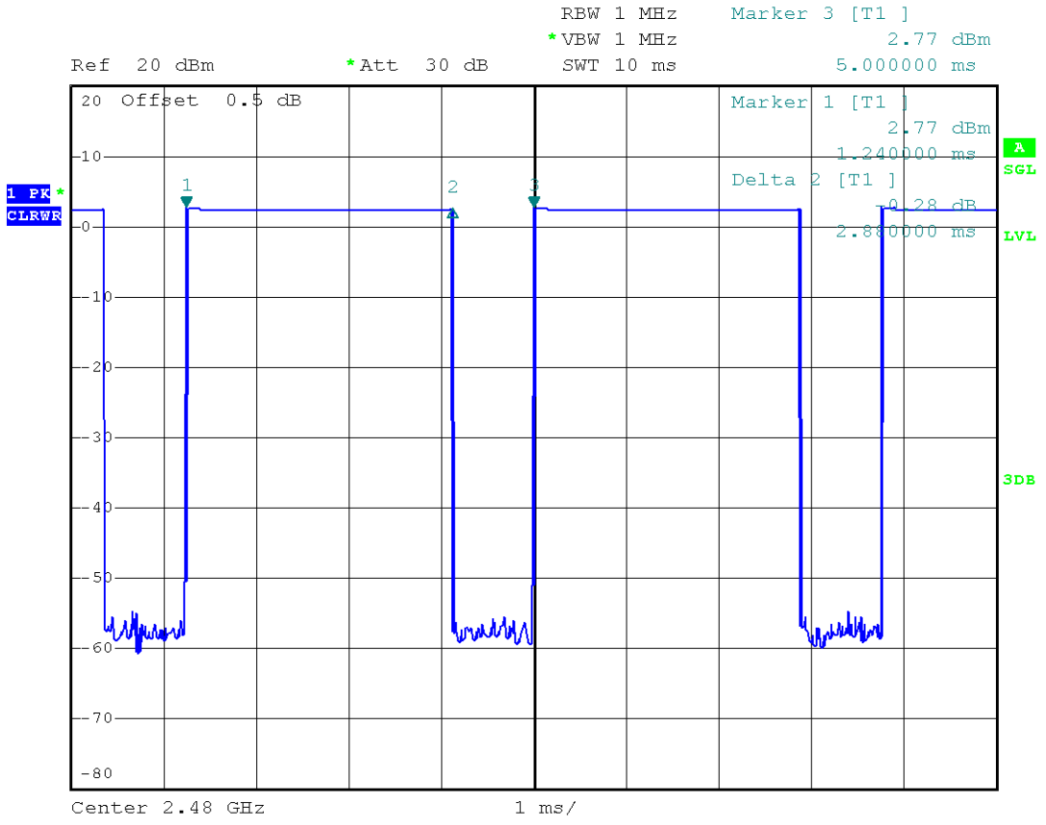
Note: the following plots record the Pulse Time of the Module carrier.



(Plot A: Channel = 2402 @ GFSK)



(Plot B: Channel = 2441 @ GFSK)



(Plot C: Channel = 2480 @ GFSK)

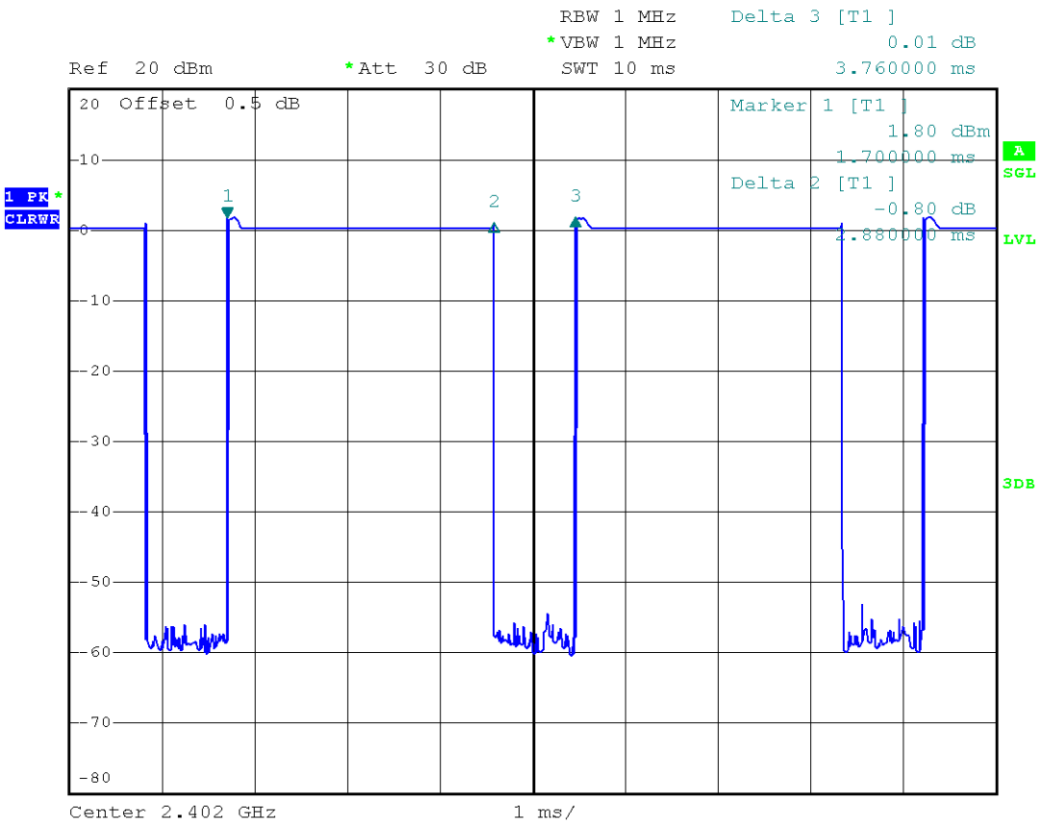
2.6.4.2. π/4-DQPSK Mode

A. Test Verdict:

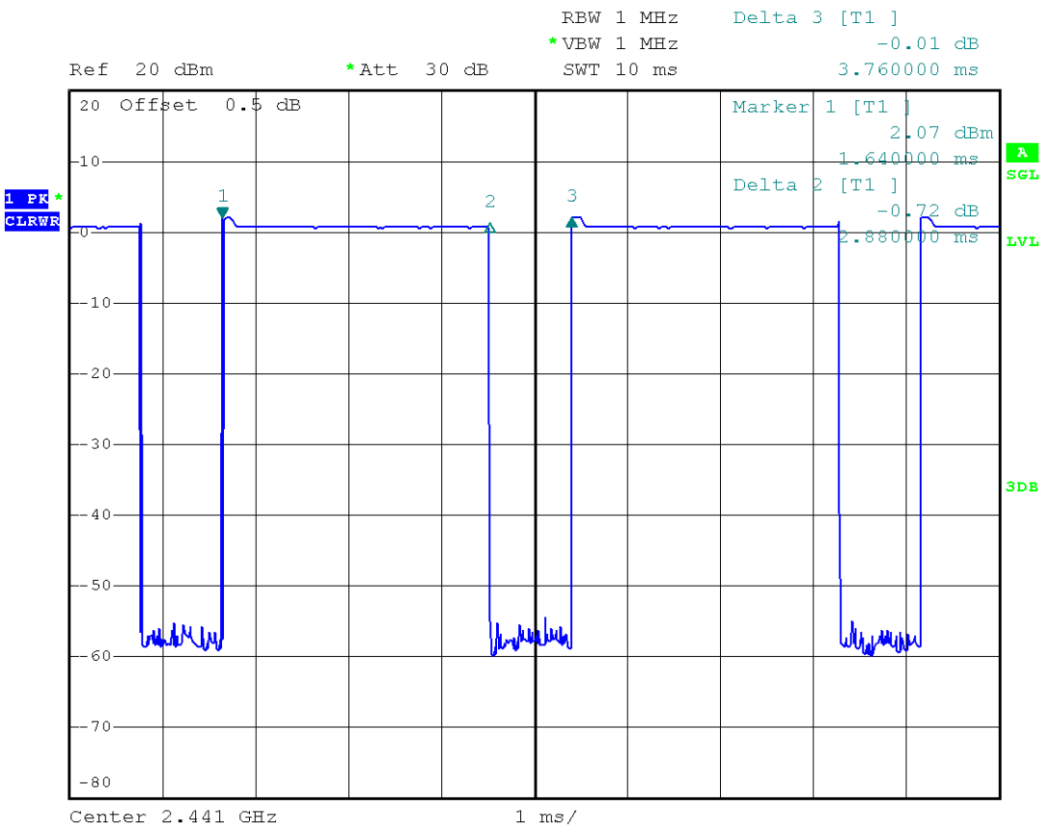
Channel	Frequency (MHz)	Pulse Time		Total of Dwell (ms)	Limit (ms)	Verdict
		ms	Refer to Plot			
0	2402	2.88	Plot D	307.200	400	PASS
39	2441	2.88	Plot E	307.200		PASS
78	2480	2.88	Plot F	307.200		PASS

Test Plots:

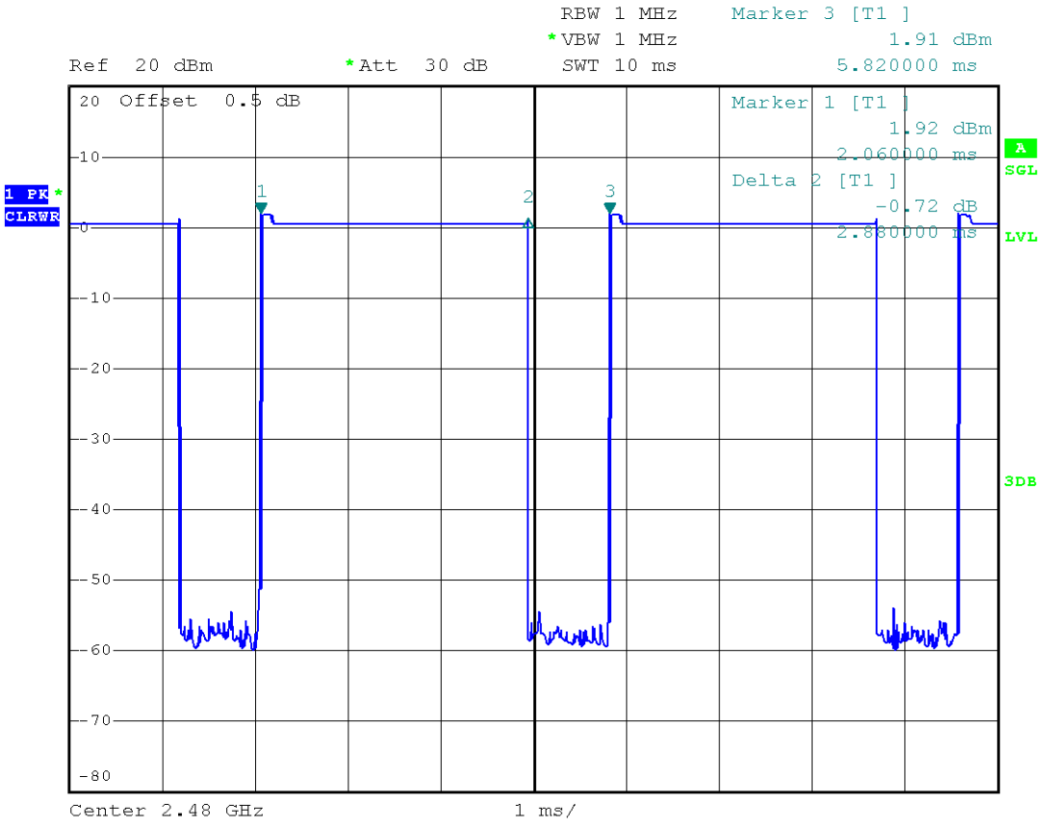
Note: the following plots record the Pulse Time of the Module carrier.



(Plot D: Channel = 2402 @π/4-DQPSK)



(Plot E: Channel = 2441 @π/4-DQPSK)



(Plot F: Channel = 2480 @π/4-DQPSK)

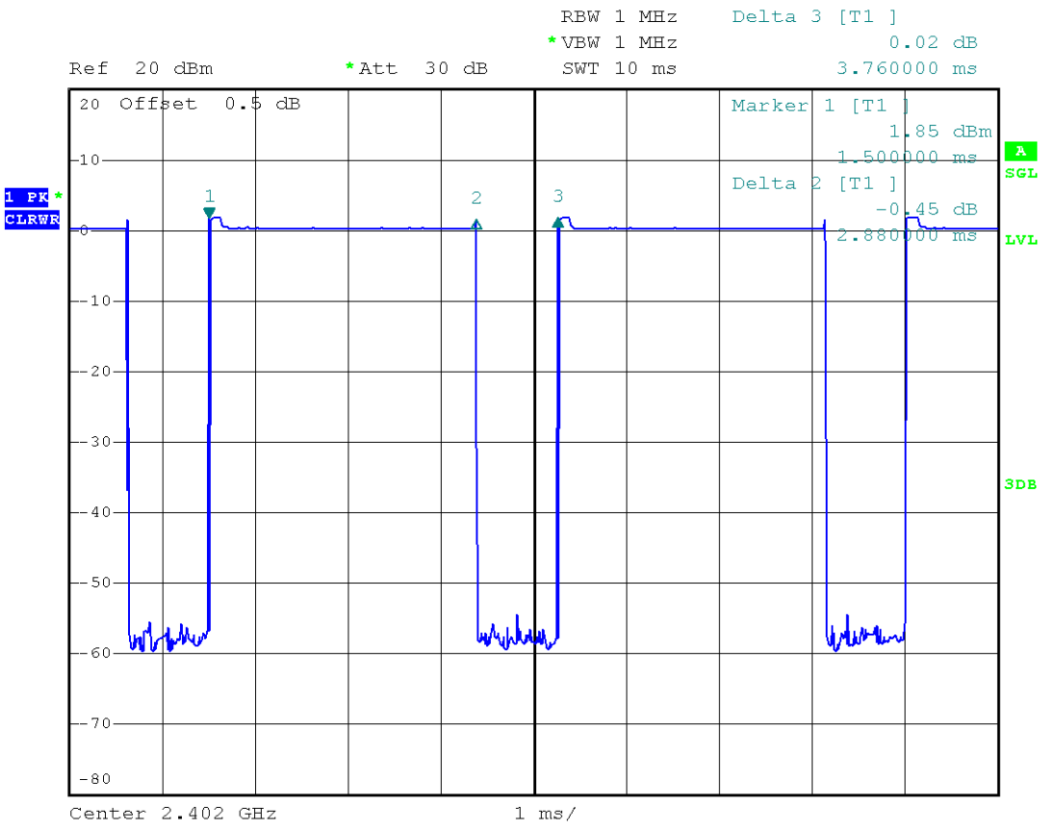
2.6.4.3. 8-DPSK mode

A. Test Verdict:

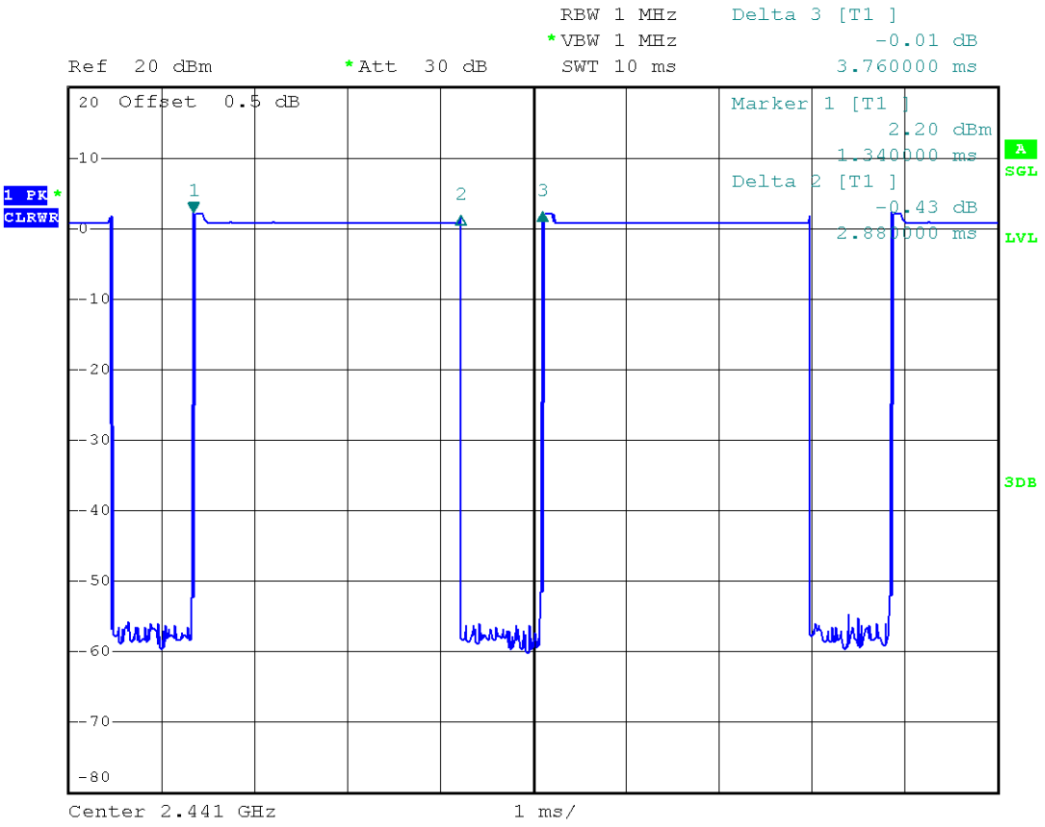
Channel	Frequency (MHz)	Pulse Time		Total of Dwell (ms)	Limit (ms)	Verdict
		ms	Refer to Plot			
0	2402	2.88	Plot G	307.200	400	PASS
39	2441	2.88	Plot H	307.200		PASS
78	2480	2.88	Plot I	307.200		PASS

Test Plots:

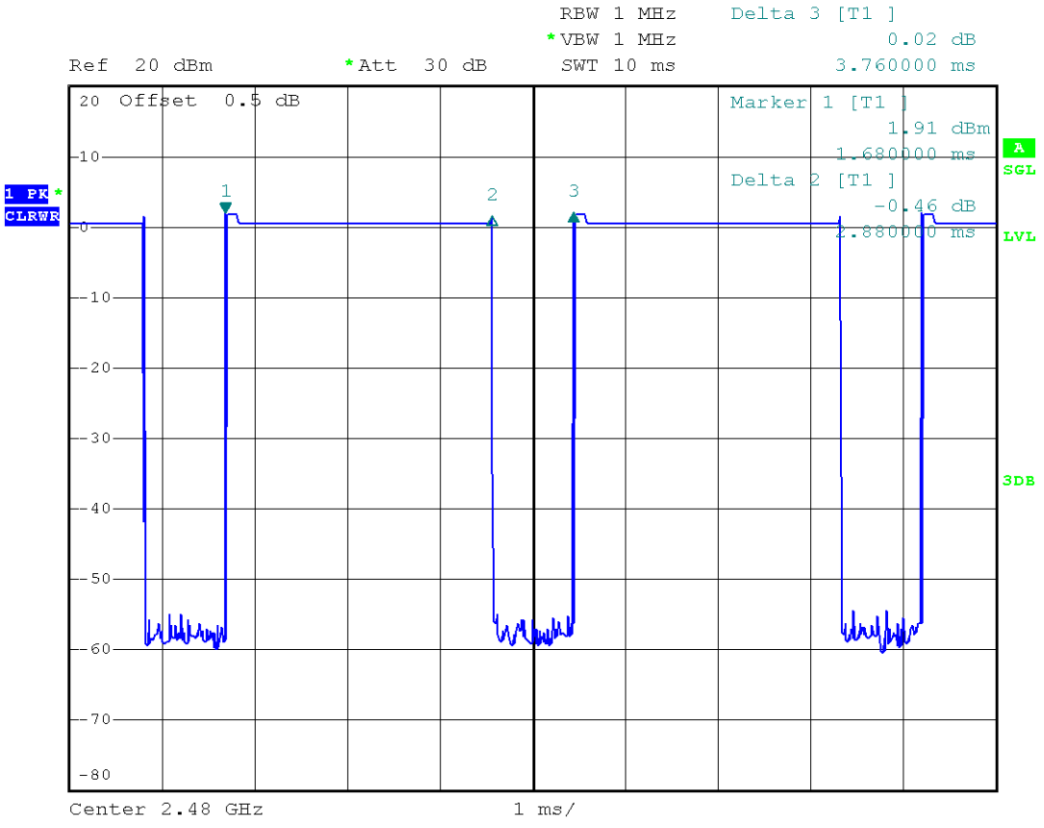
Note: the following plots record the Pulse Time of the Module carrier.



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



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



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

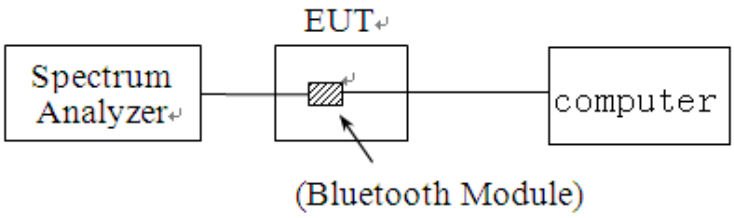
2.7. Conducted Spurious Emissions

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

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.

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

Sweep Points(30 MHz to 1 000 MHz): ≥9 970

Sweep Points(1GHz to 25GHz): ≥240000

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.

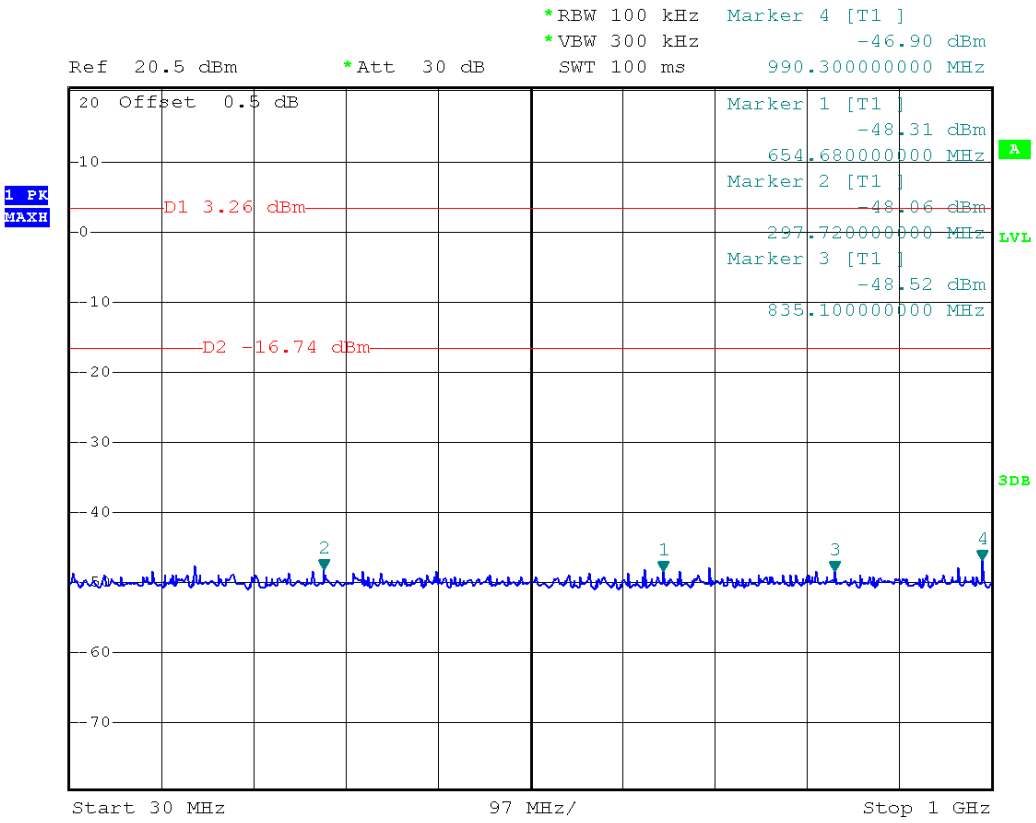
2.7.4.1. GFSK Mode

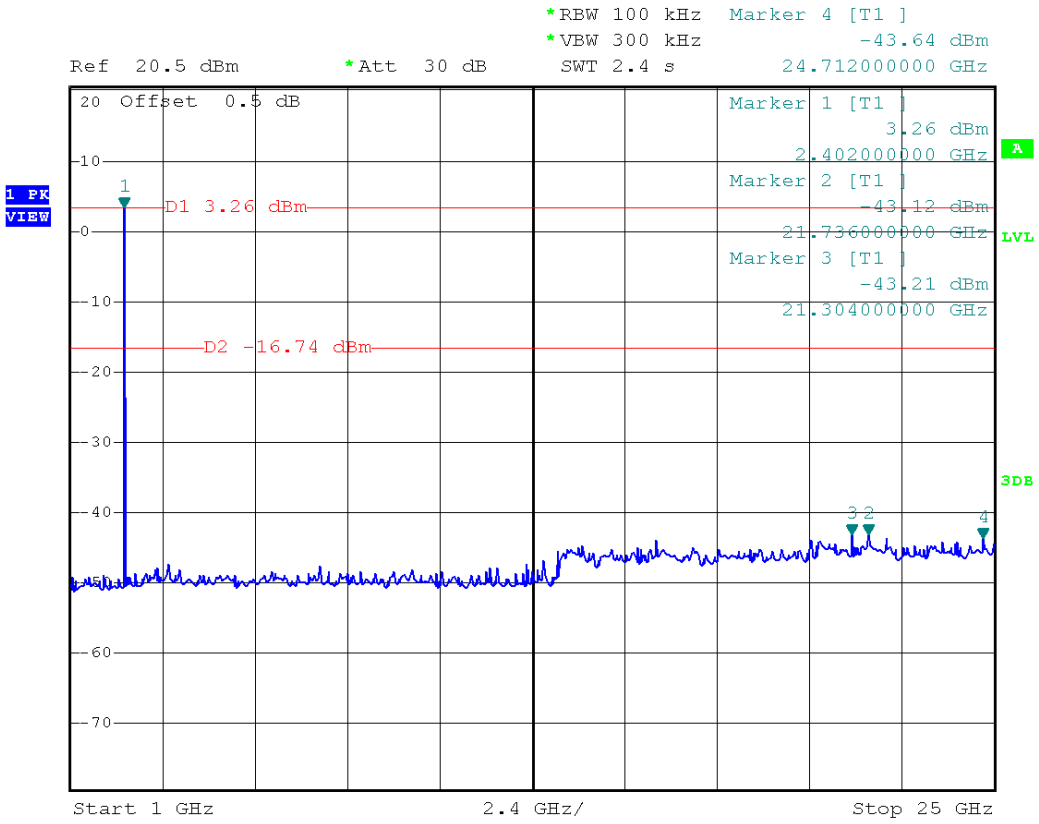
A. Test Verdict:

Channel	Frequency (MHz)	Refer to Plot	Limit (dBc)	Verdict
0	2402	Plot A.1	-20	PASS
39	2441	Plot B.1	-20	PASS
78	2480	Plot C.1	-20	PASS

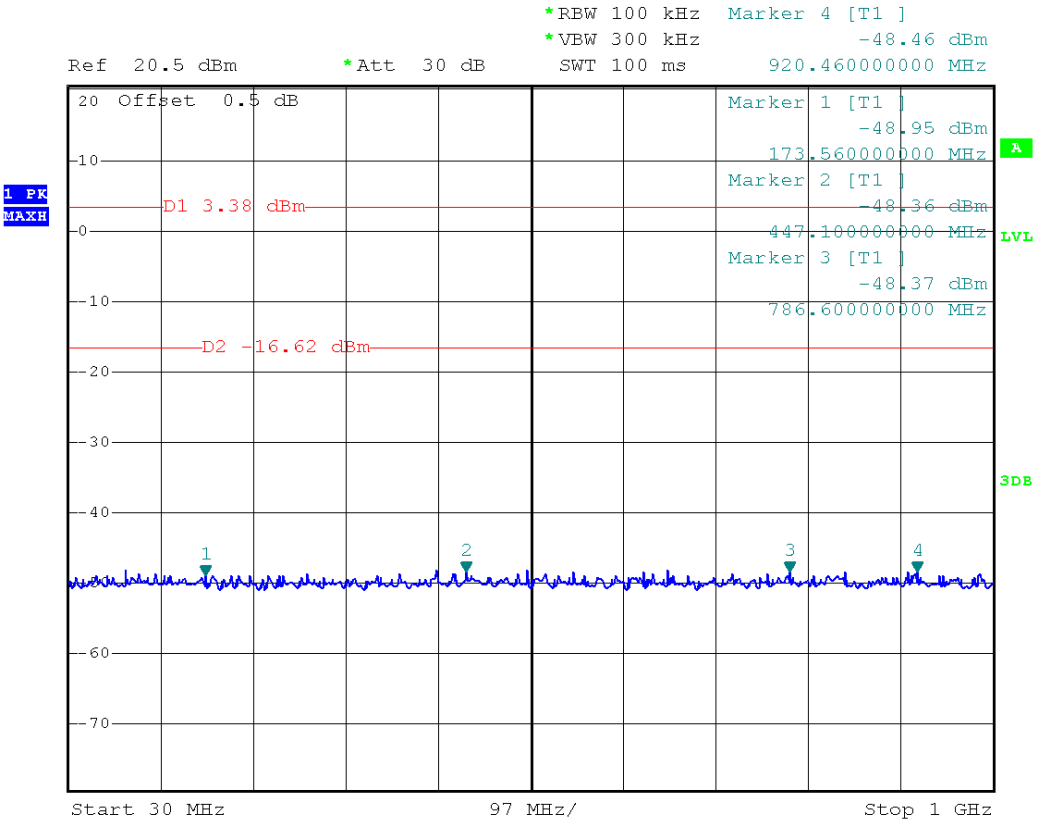
B. Test Plots:

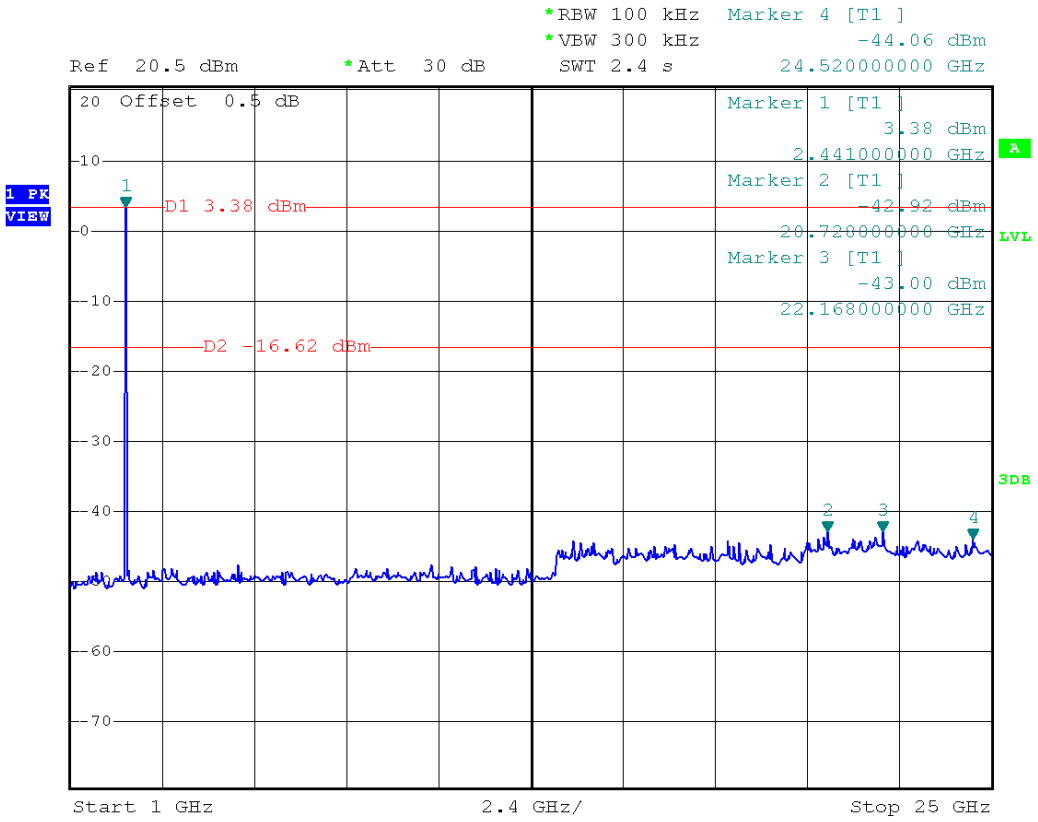
Note: the power of the Module transmitting frequency should be ignored.



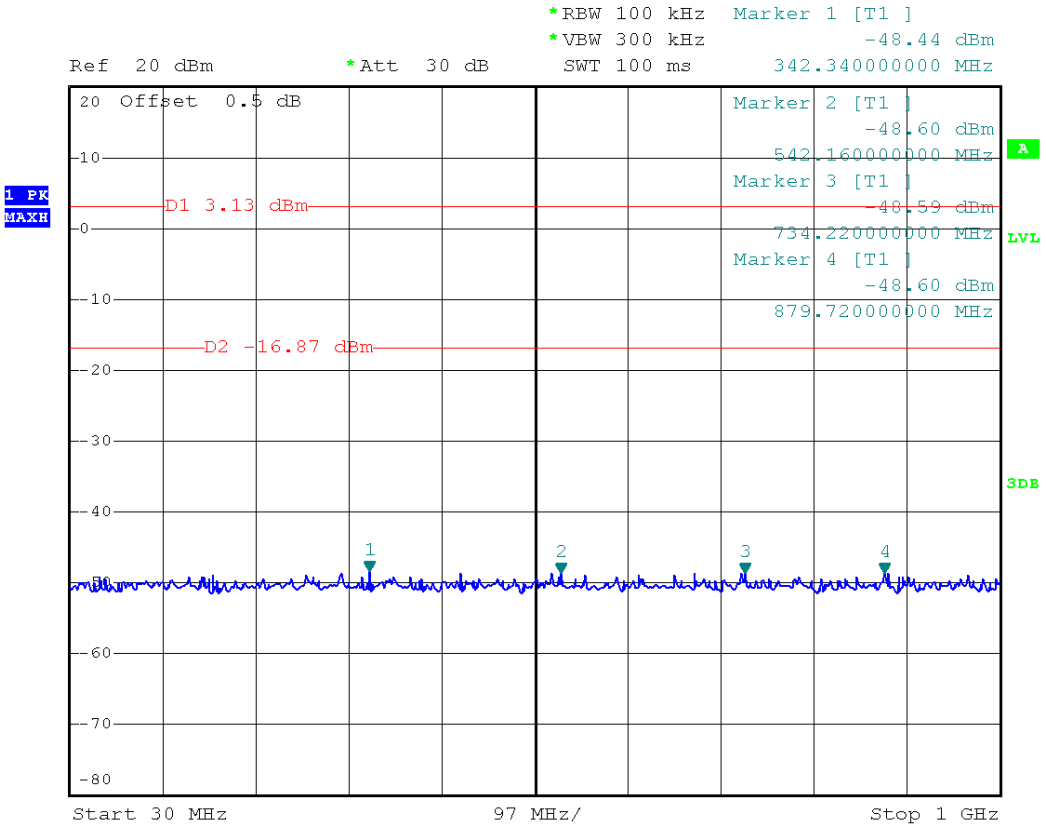


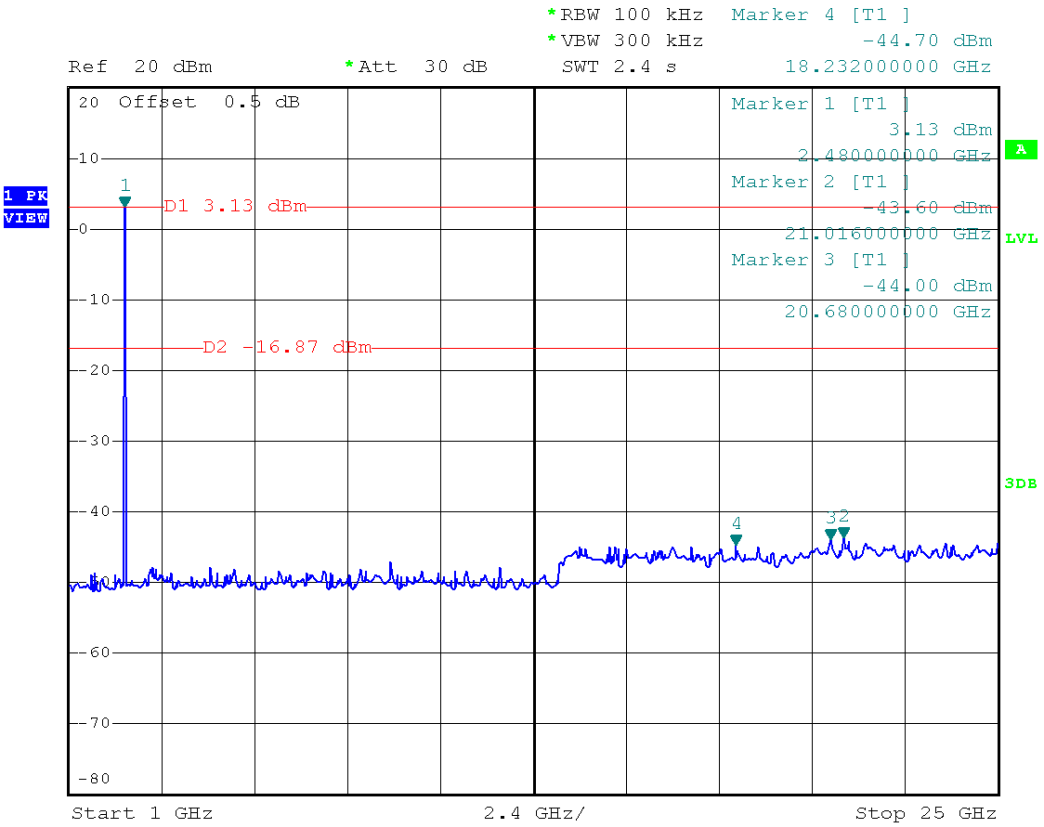
(Plot A.1: Channel = 0, 30MHz to 25GHz @ GFSK Mode)





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





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

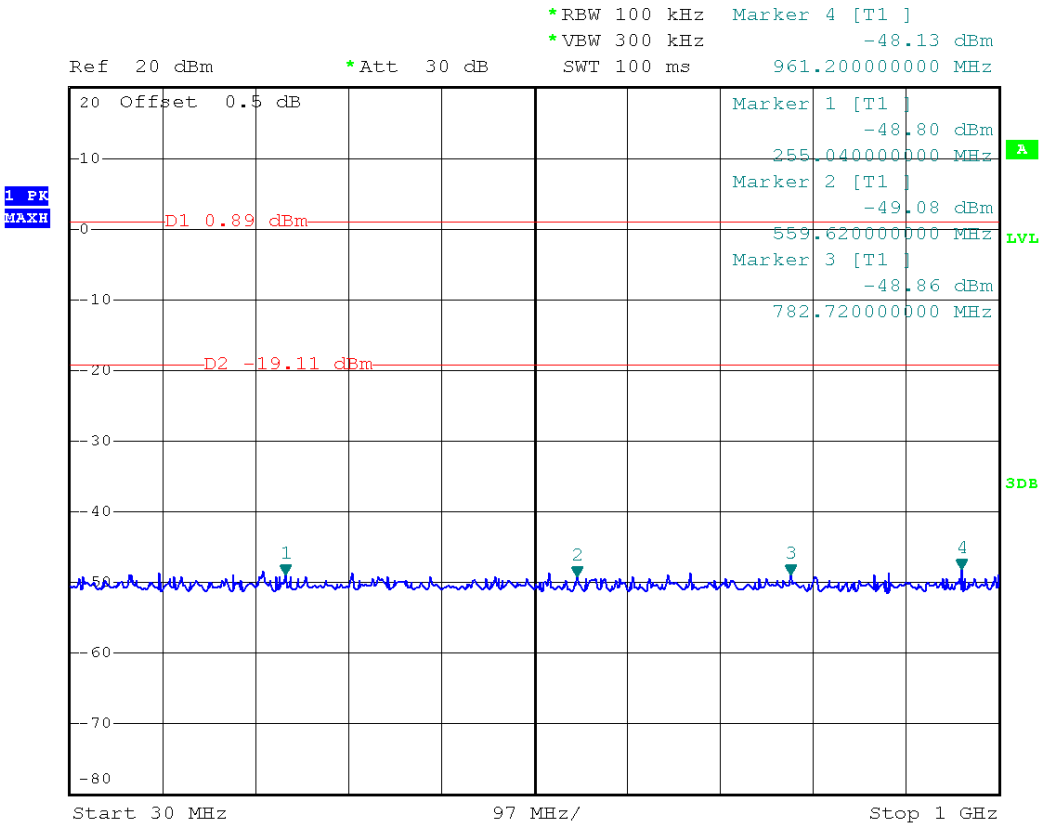
2.7.4.2. π/4-DQPSK Mode

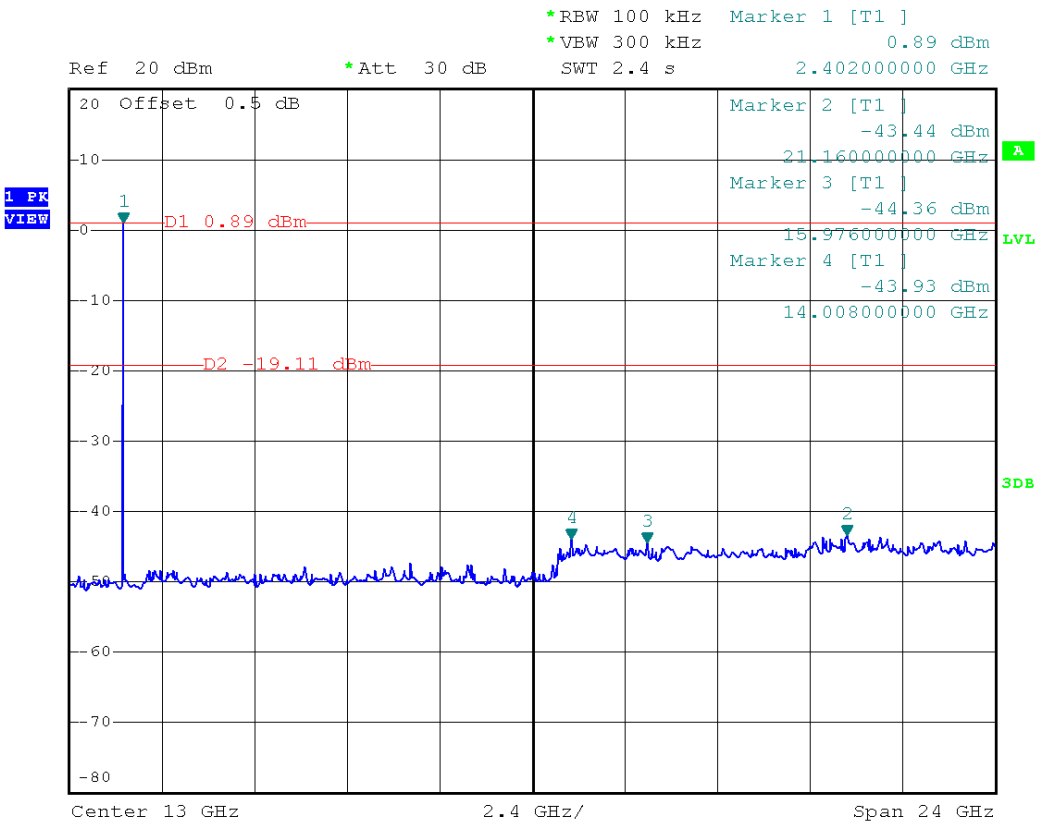
A. Test Verdict:

Channel	Frequency (MHz)	Refer to Plot	Limit (dBc)	Verdict
0	2402	Plot D.1	-20	PASS
39	2441	Plot E.1	-20	PASS
78	2480	Plot F.1	-20	PASS

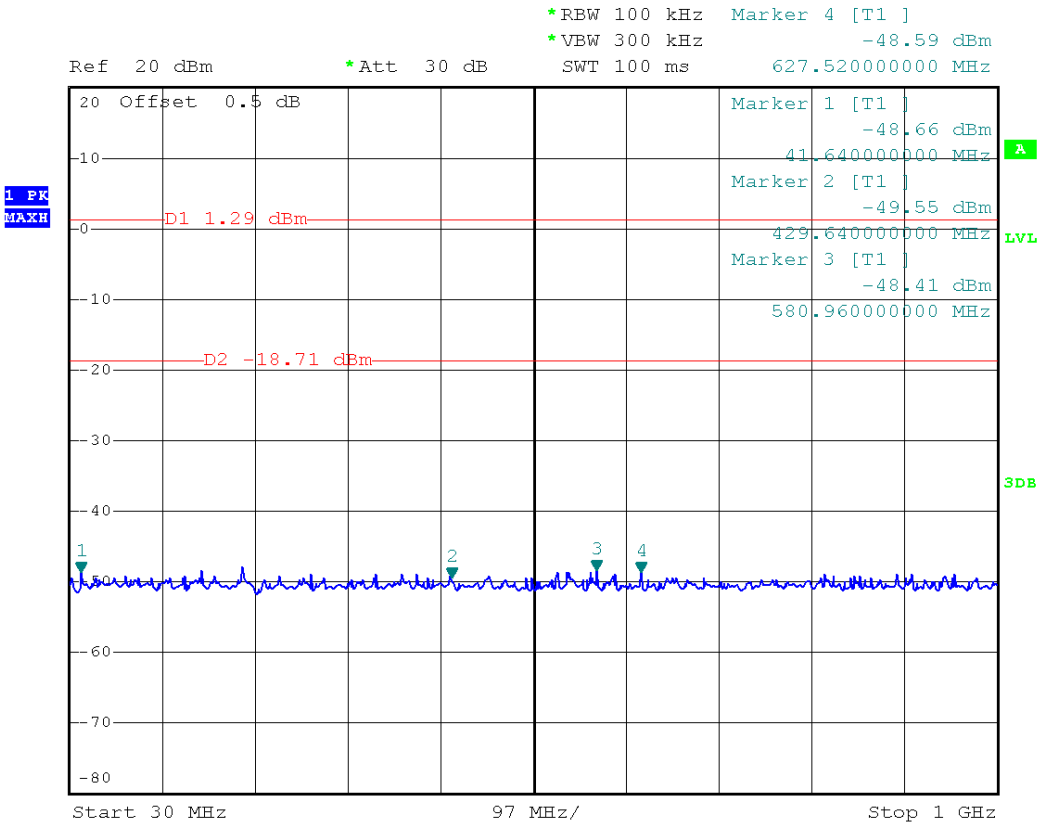
B. Test Plots:

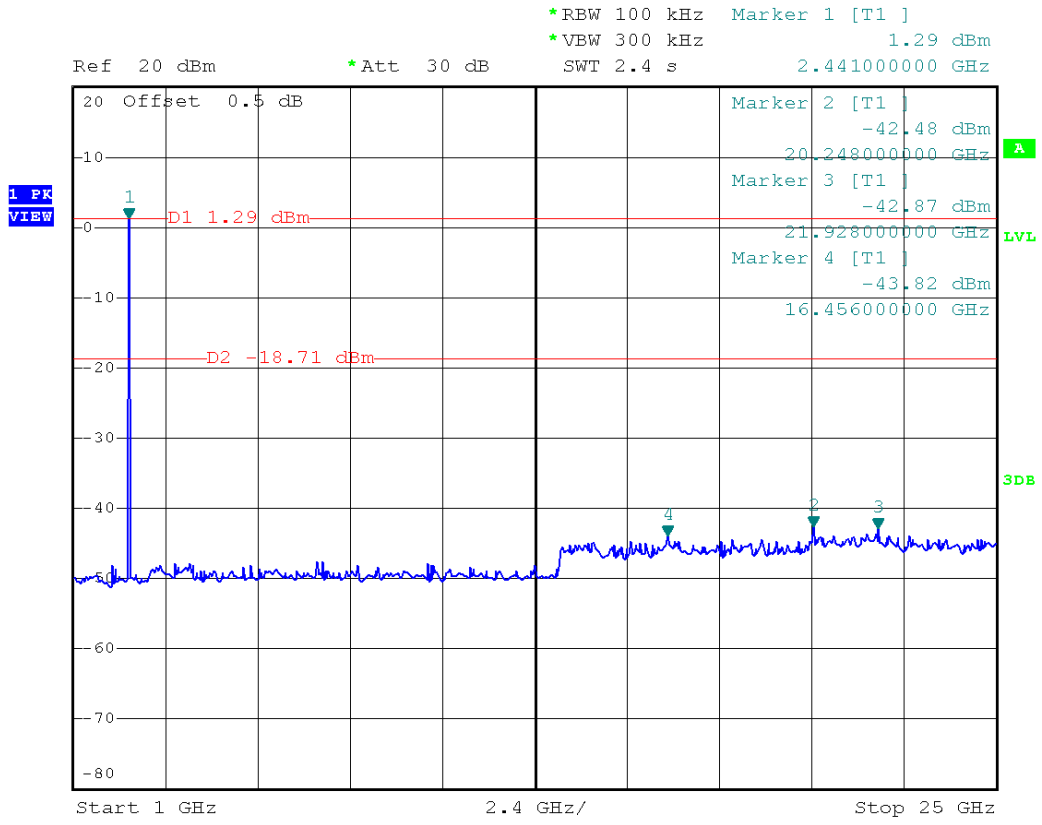
Note: the power of the Module transmitting frequency should be ignored.



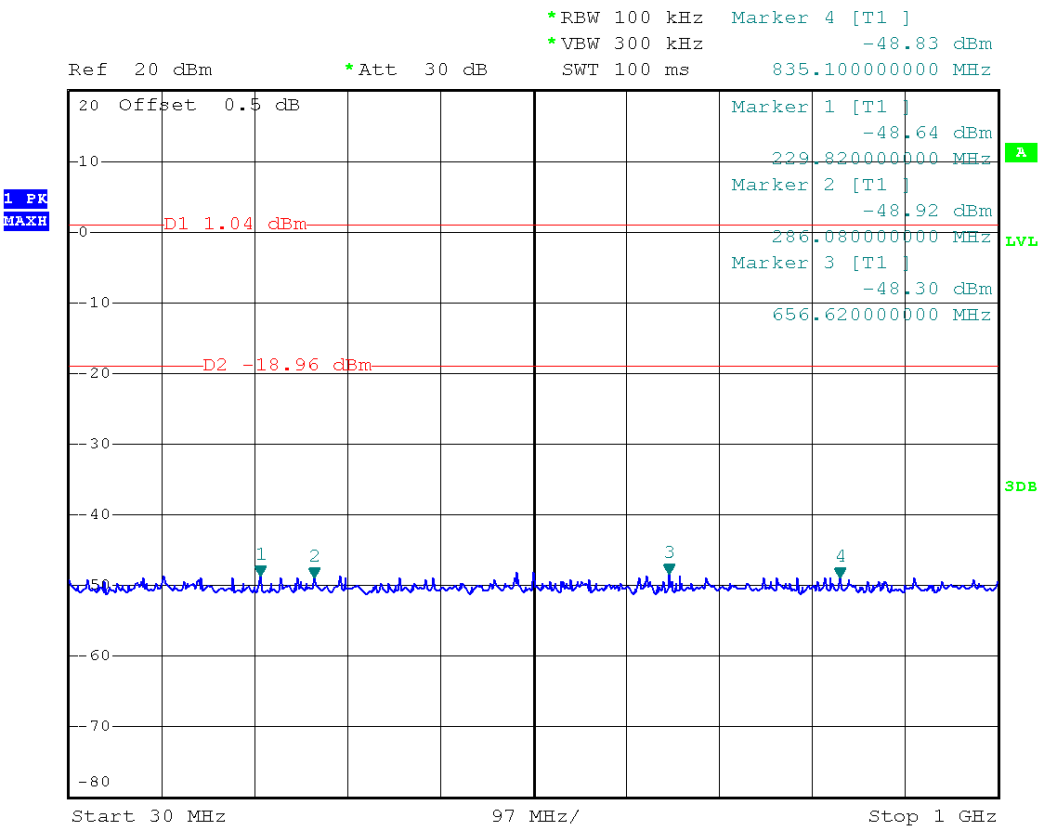


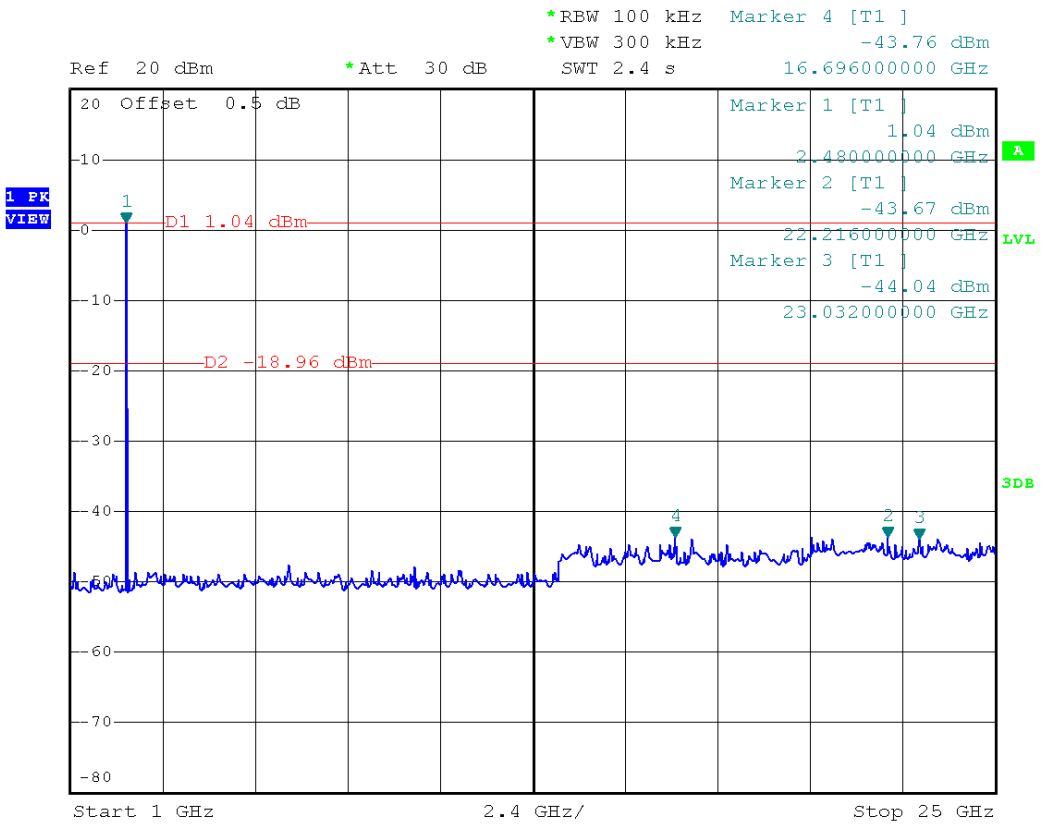
(Plot D.1: Channel = 0, 30MHz to 25GHz @π/4-DQPSK)





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





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

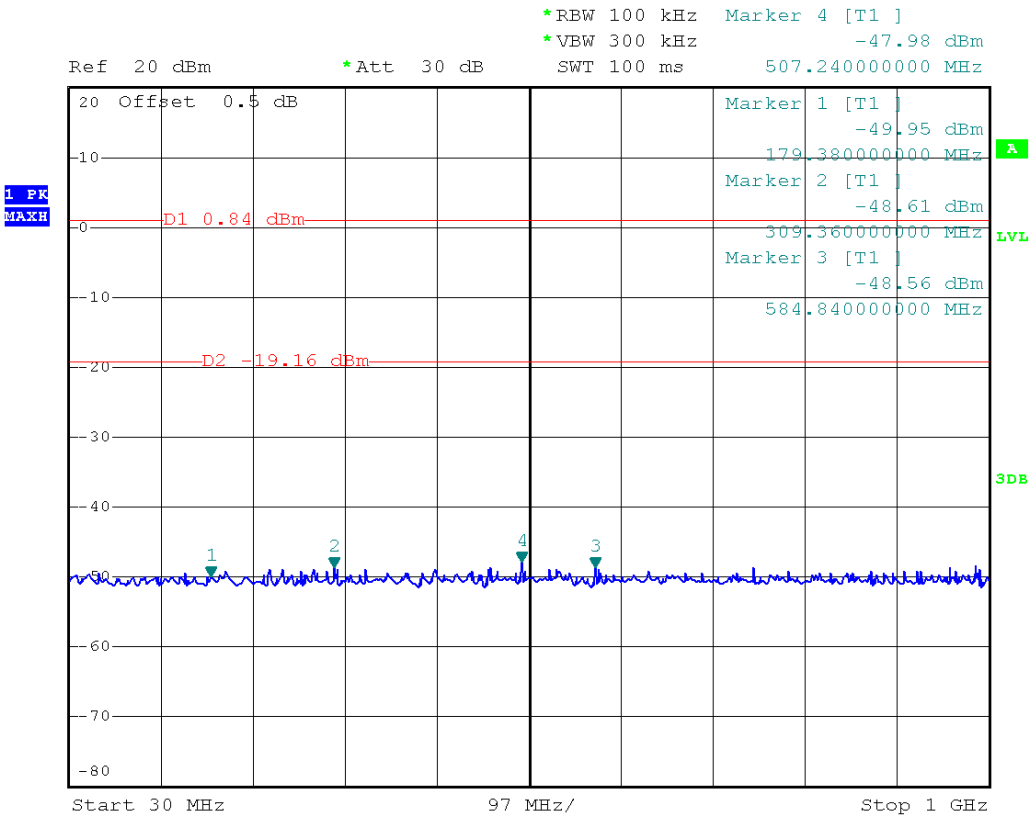
2.7.4.3. 8-DPSK Mode

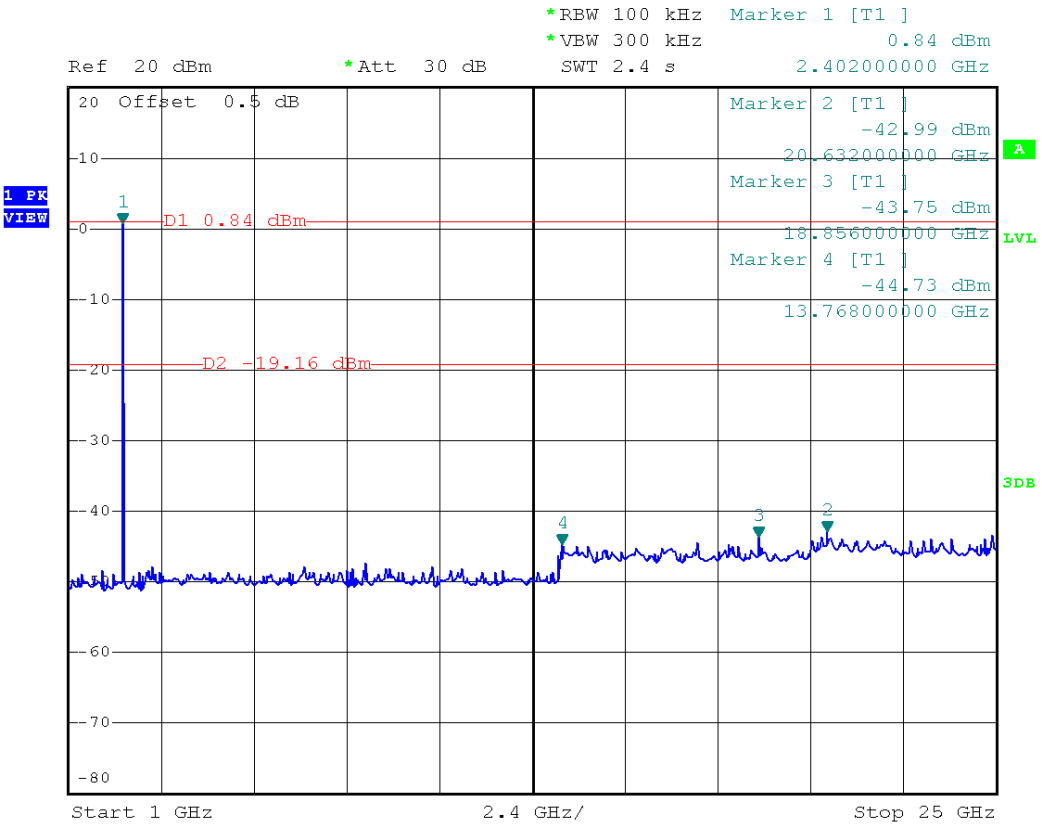
A. Test Verdict:

Channel	Frequency (MHz)	Refer to Plot	Limit (dBc)	Verdict
0	2402	Plot G.1	-20	PASS
39	2441	Plot H.1	-20	PASS
78	2480	Plot I.1	-20	PASS

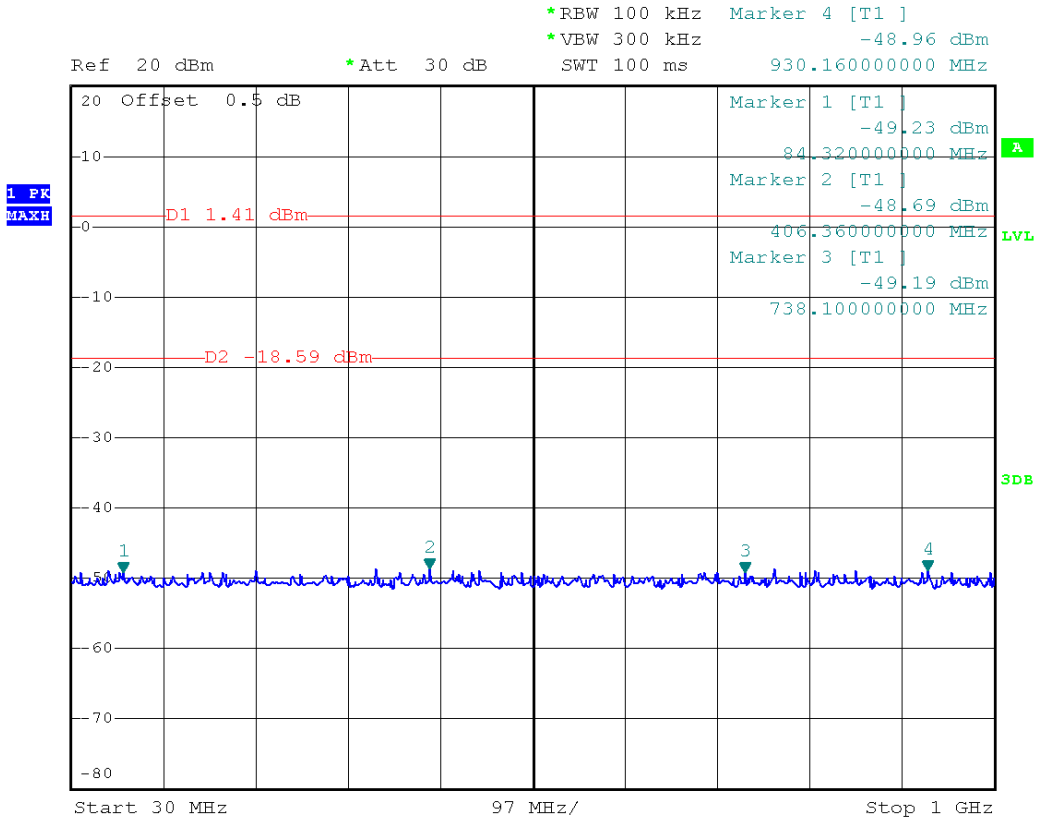
Test Plots:

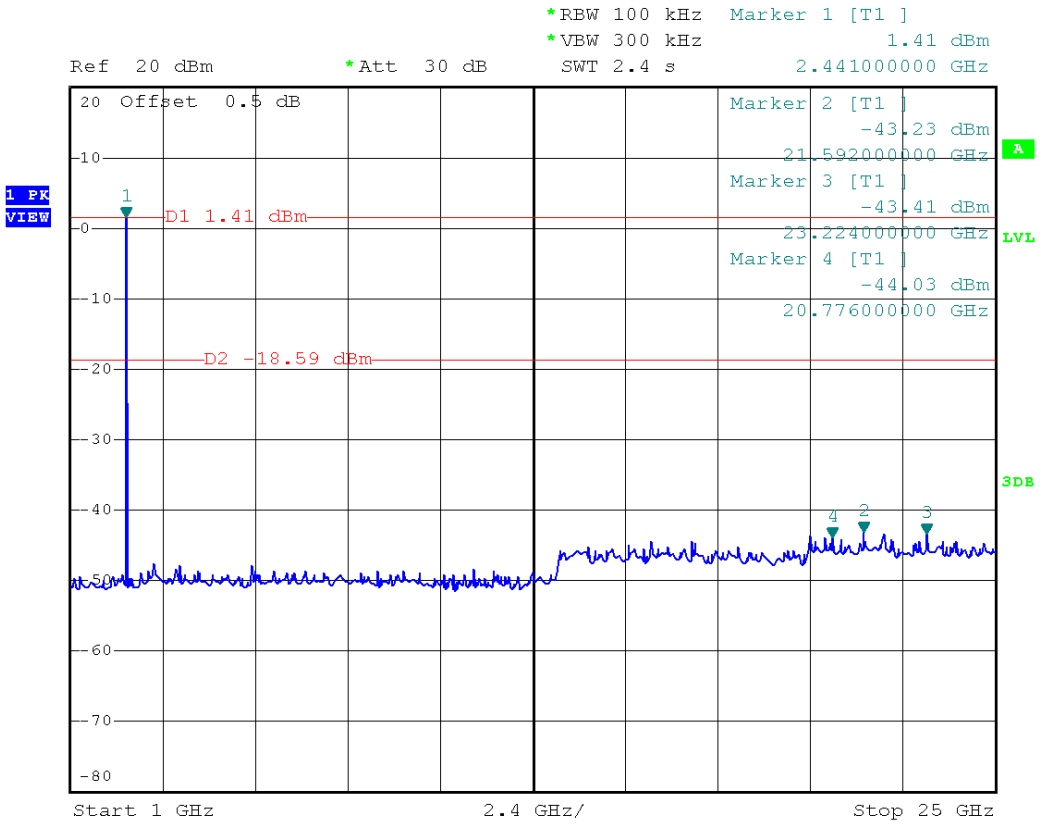
Note: the power of the Module transmitting frequency should be ignored.



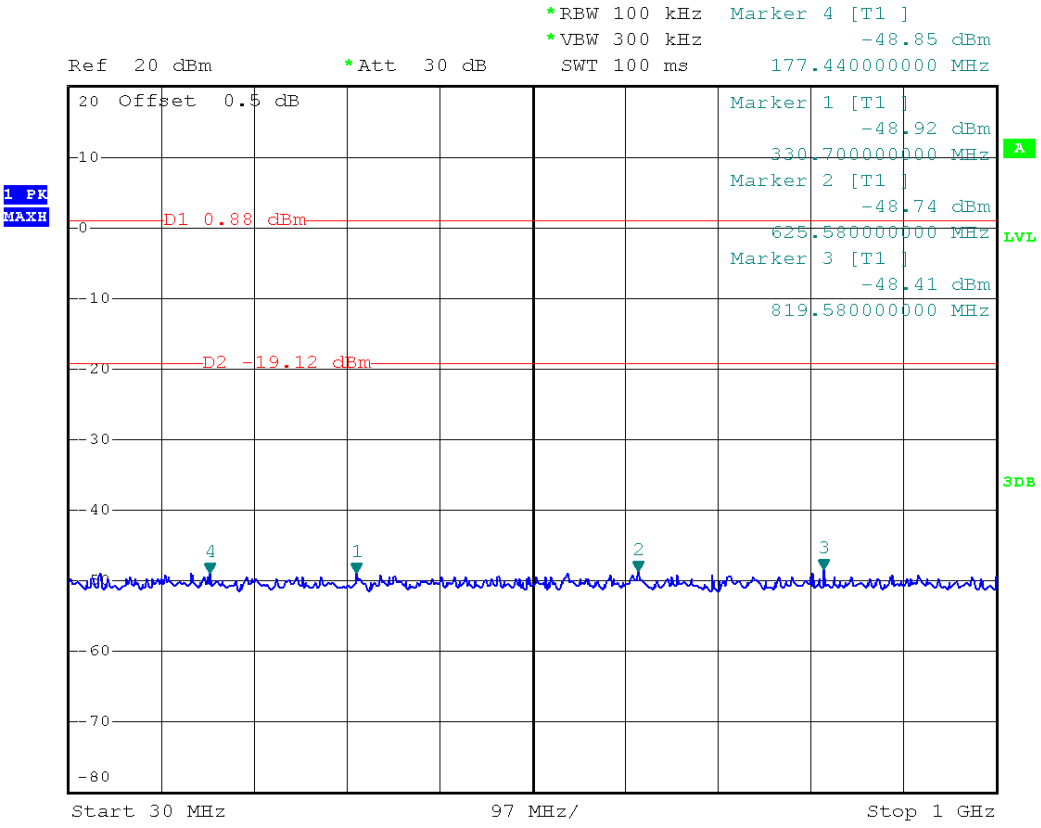


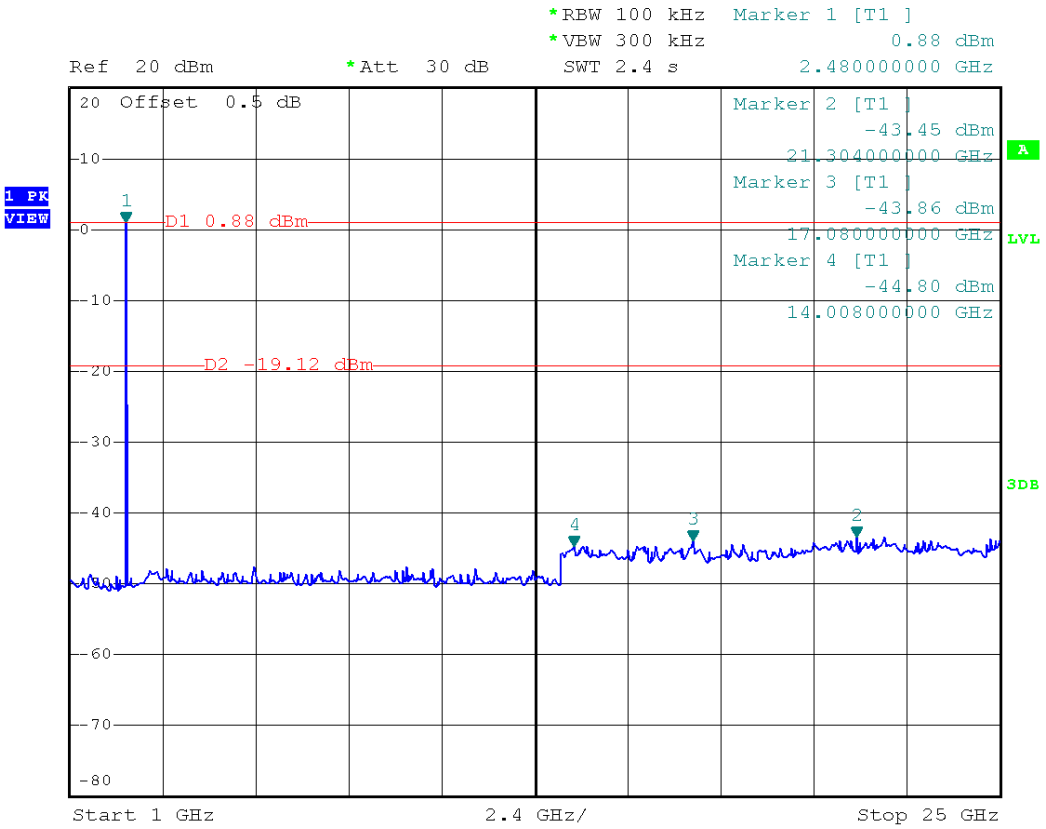
(Plot G.1: Channel = 0, 30MHz to 25GHz @ 8-DPSK)





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





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

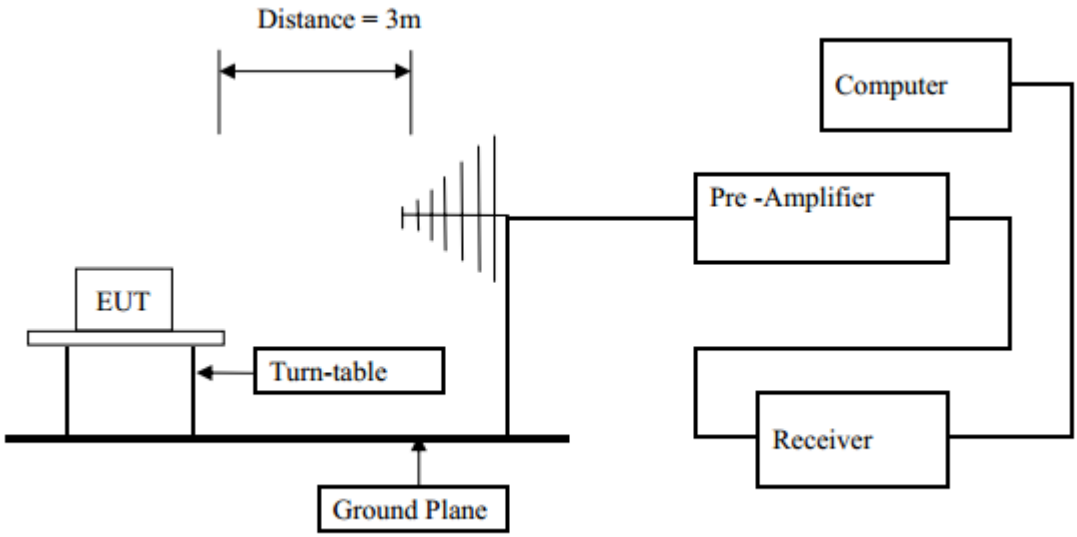
2.8. Band Edge

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

Test Setup for radiated：

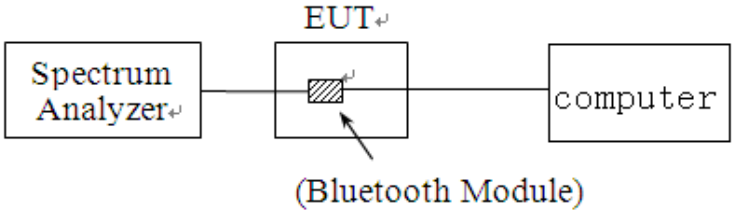


The Bluetooth Module of the EUT is powered by the Battery. The Module is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading. During the measurement, the Bluetooth Module is activated and controlled by the Bluetooth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

Test Setup for conducted:



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.

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 test

RBW =1MHz ,VBW=3MHz PK detector for PK value ，

RBW=1MHz VBW=10Hz ， PK detector for AV value

Trace = max hold

Allow the trace to stabilize

For conducted test

RBW = 100 kHz , VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize.

2.8.4. Test Result

The Bluetooth Module operates at hopping-on and 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.

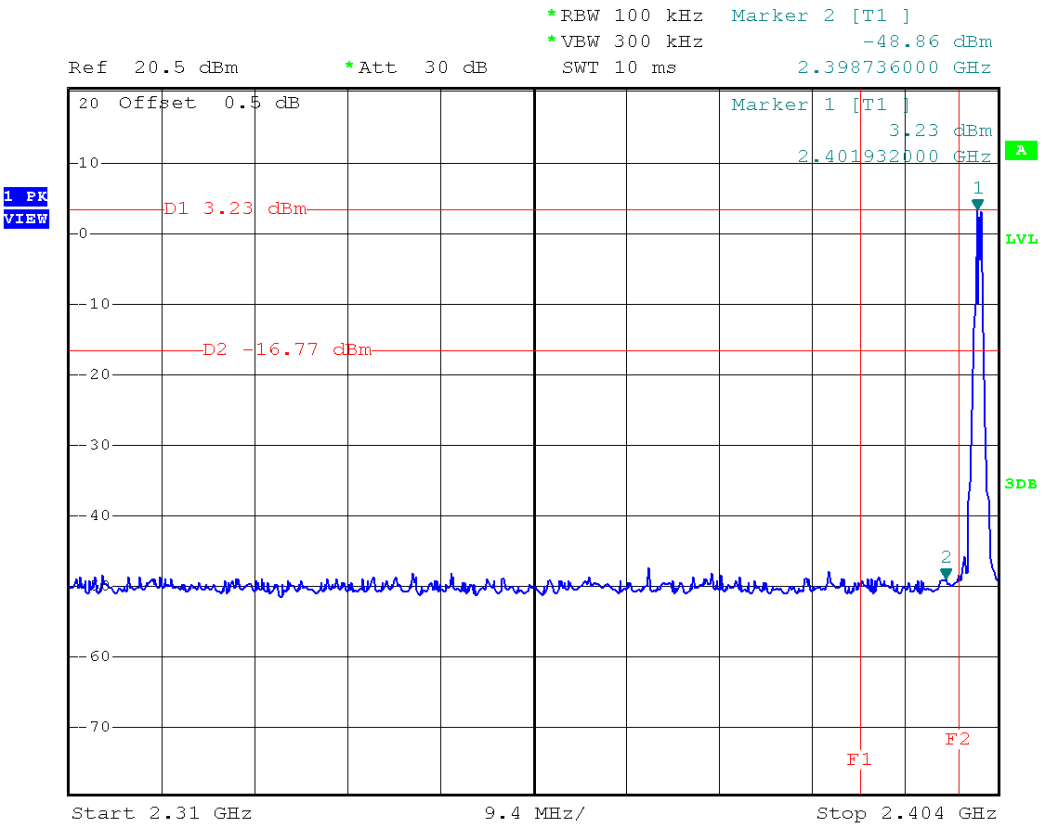
2.8.4.1. GFSK Mode

Test Verdict:

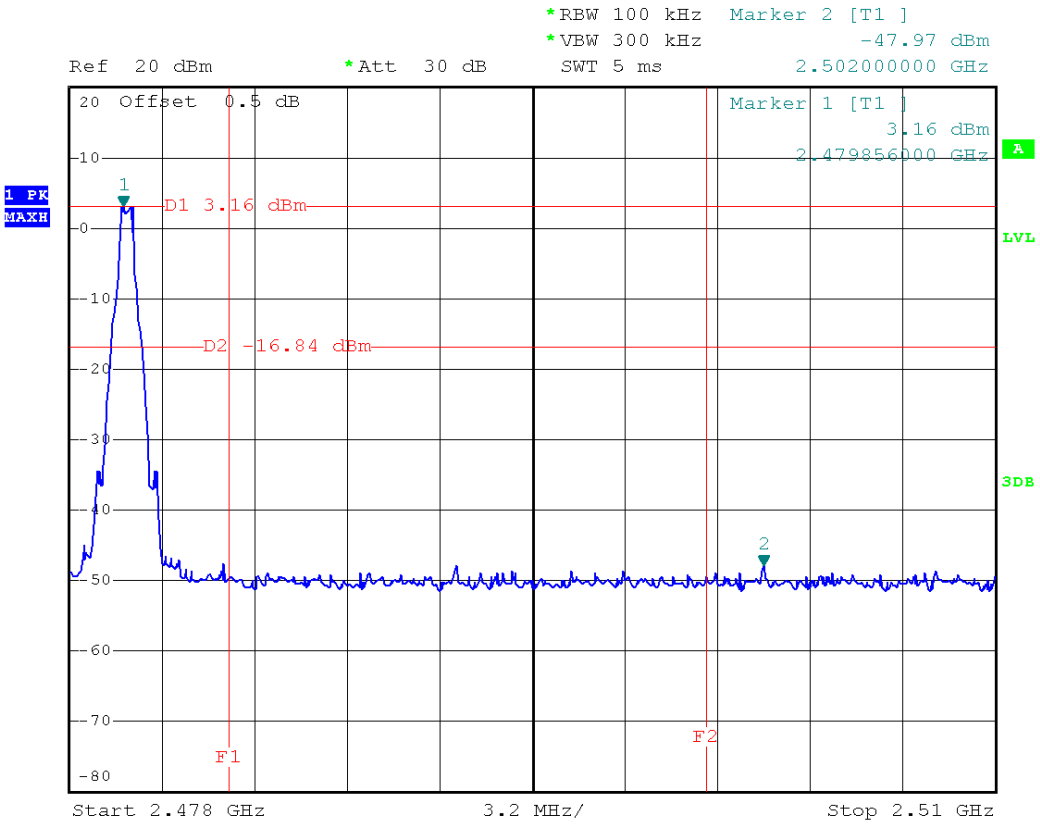
(Un-hopping)

Channel	Frequency (MHz)	Detector	Read Level (dBμV)	Correction Factor (dB)	Level (dBμV/m)	Limit (dBμV/m)	Over Limit (dB)
		PK/ AV					
0	2372.465	PK	58.96	-12.84	46.12	74.00	-27.20
0	2372.465	AV	46.13	-12.84	33.29	54.00	-19.63
39	2488.879	PK	59.33	-12.77	46.56	74.00	-28.48
39	2488.879	AV	47.64	-12.77	34.87	54.00	-19.94

Test Plots:



(Plot A1: Channel = 0 PEAK @ GFSK)

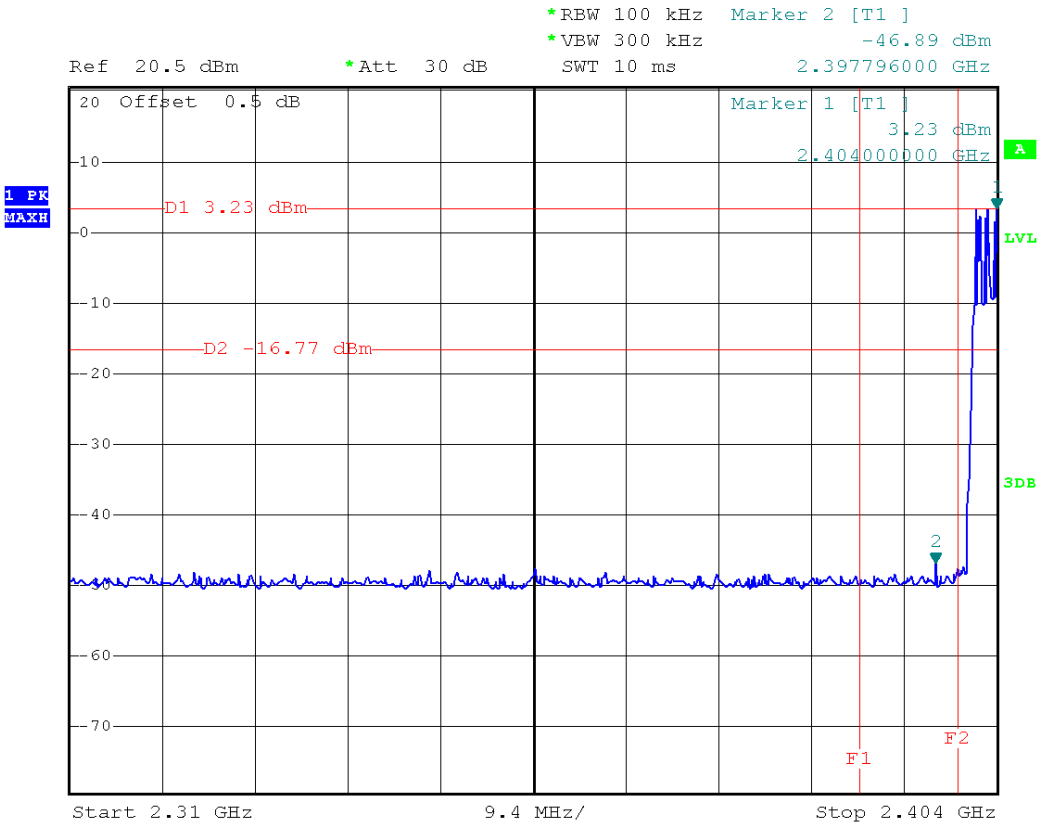


(Plot B1: Channel = 78 PEAK @ GFSK)

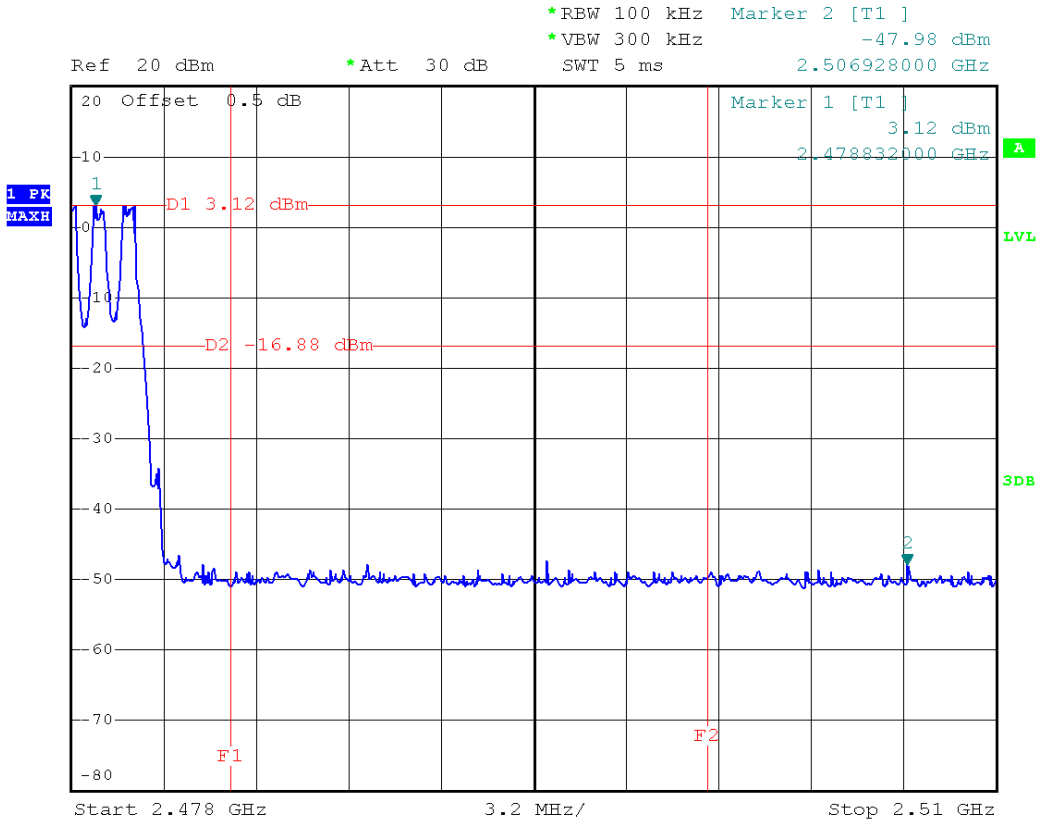
(hopping)

Channel	Frequency (MHz)	Detector PK/ AV	Read Level (dBμV)	Correction Factor (dB)	Level (dBμV/m)	Limit (dBμV/m)	Over Limit (dB)
0	2363.549	PK	58.42	-12.84	45.58	74.00	-28.42
0	2363.549	AV	46.07	-12.84	33.23	54.00	-20.77
39	2496.521	PK	57.55	-12.77	44.78	74.00	-29.22
39	2496.521	AV	45.38	-12.77	32.61	54.00	-21.39

Test Plots:



(Plot A1-1: Channel = 0 PEAK)



(Plot B1-1: Channel = 78 PEAK)

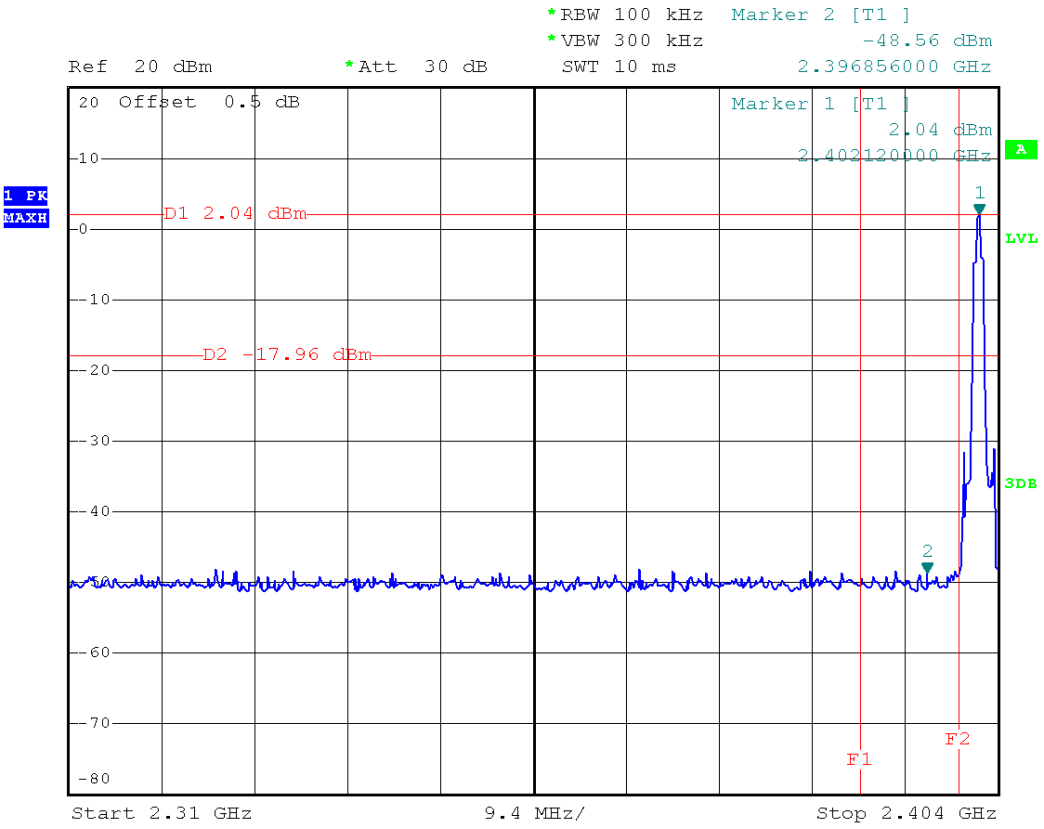
2.8.4.2. π/4-DQPSK Mode

Test Verdict:

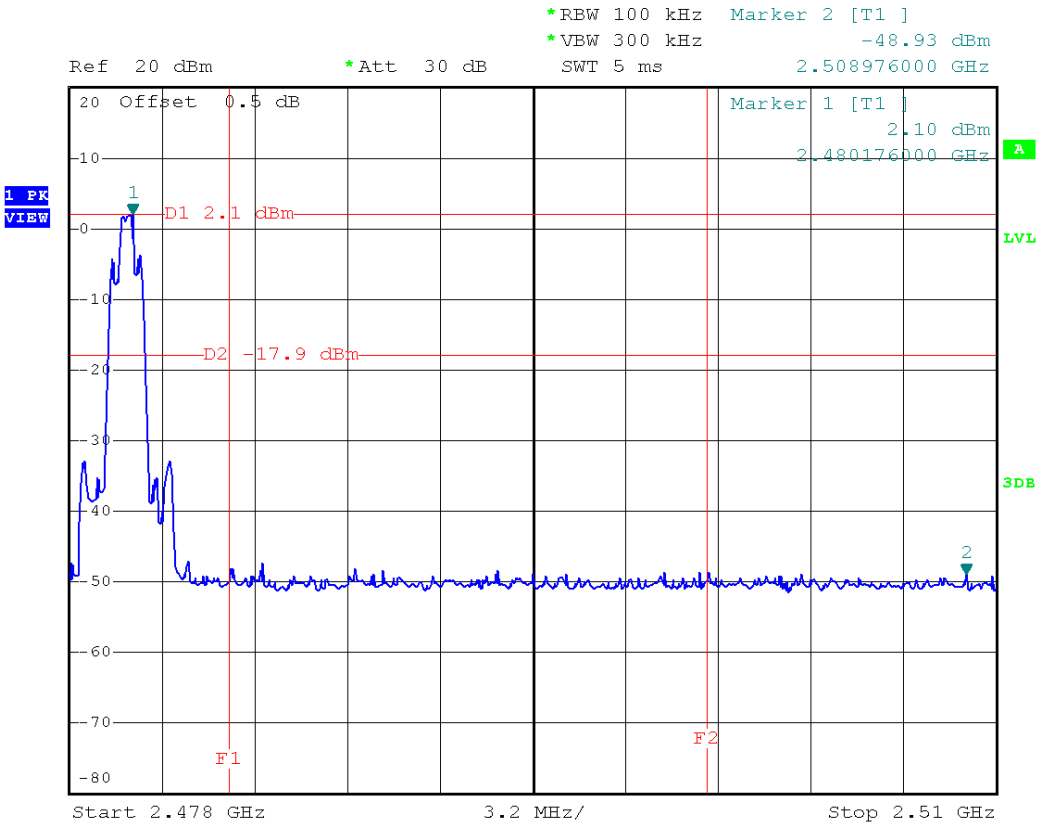
(Un-hopping)

Channel	Frequency (MHz)	Detector PK/ AV	Read Level (dBμV)	Correction Factor (dB)	Level (dBμV/m)	Limit (dBμV/m)	Over Limit (dB)
0	2352.794	PK	57.29	-12.84	44.45	74.00	-29.55
0	2352.794	AV	47.86	-12.84	35.02	54.00	-18.98
39	2495.968	PK	55.83	-12.77	43.06	74.00	-30.94
39	2495.968	AV	46.82	-12.77	34.05	54.00	-19.95

Test Plots:



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

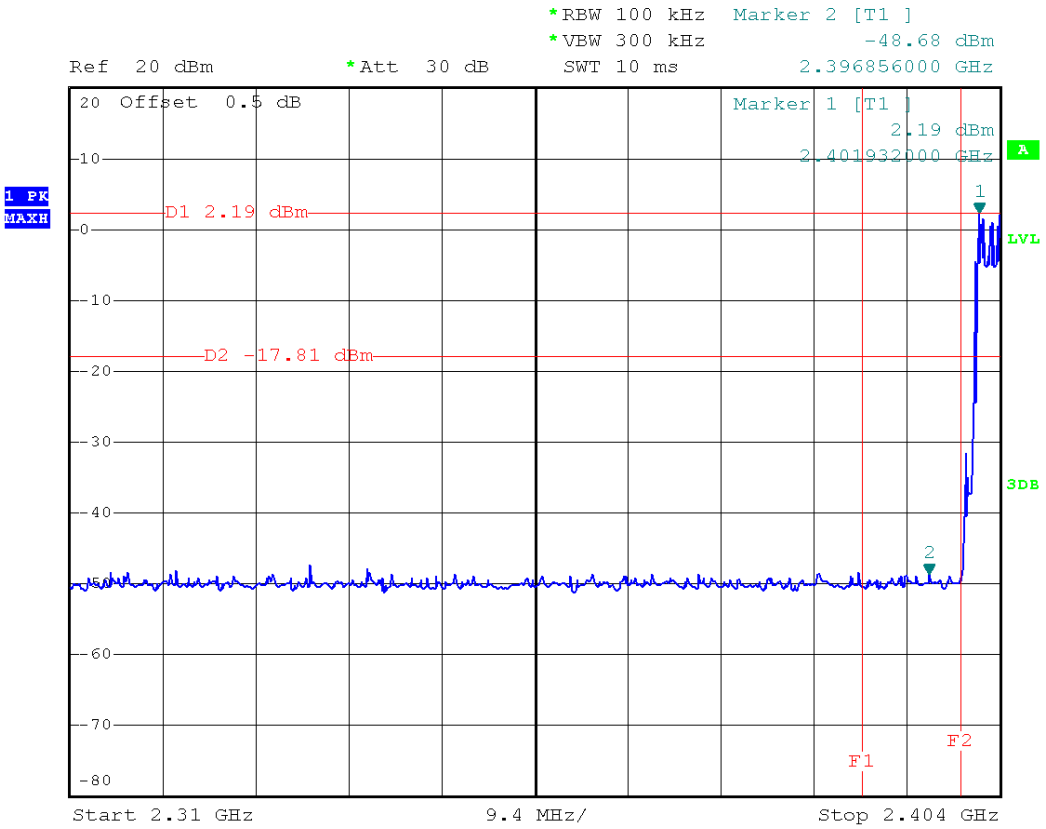


(Plot D1: Channel = 78 PEAK @π/4-DQPSK)

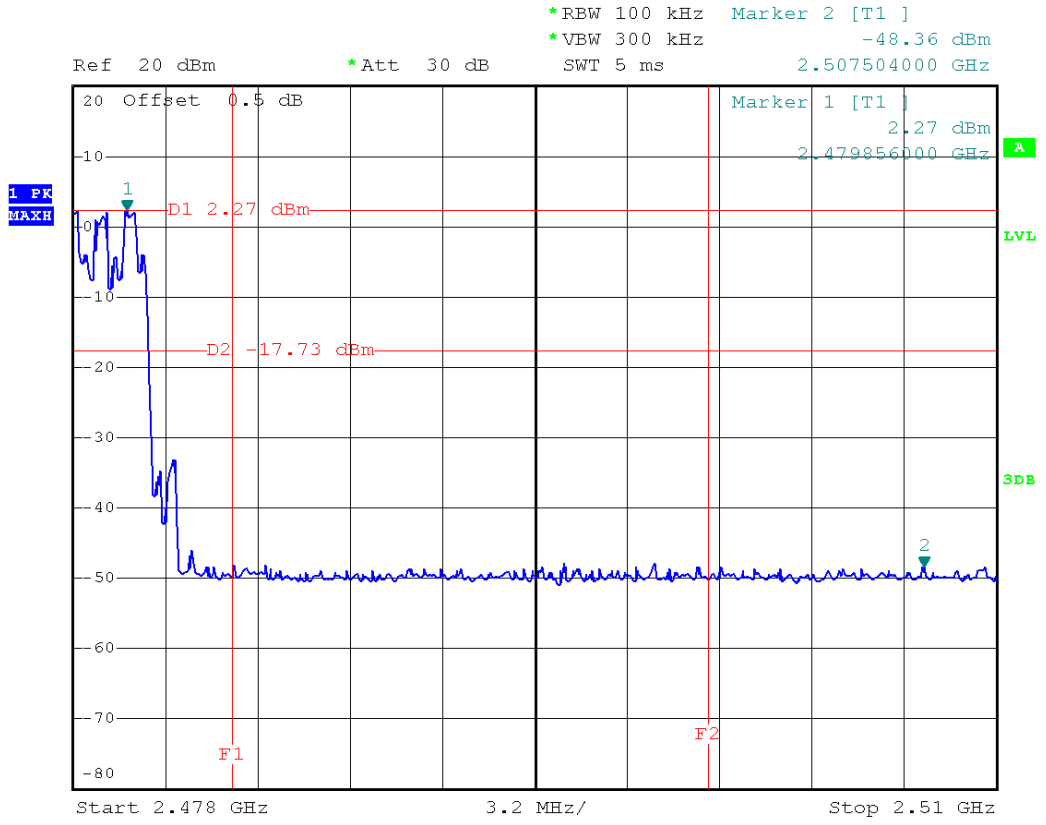
(hopping)

Channel	Frequency (MHz)	Detector	Read Level (dBμV)	Correction Factor (dB)	Level (dBμV/m)	Limit (dBμV/m)	Over Limit (dB)
		PK/ AV					
0	2372.692	PK	56.83	-12.84	43.99	74.00	-30.01
0	2372.692	AV	45.91	-12.84	33.07	54.00	-20.93
39	2488.563	PK	55.79	-12.77	43.02	74.00	-30.98
39	2488.563	AV	44.23	-12.77	31.46	54.00	-22.54

Test Plots:



(Plot C1-1: Channel = 0 PEAK)



(Plot D1-1: Channel = 78 PEAK)

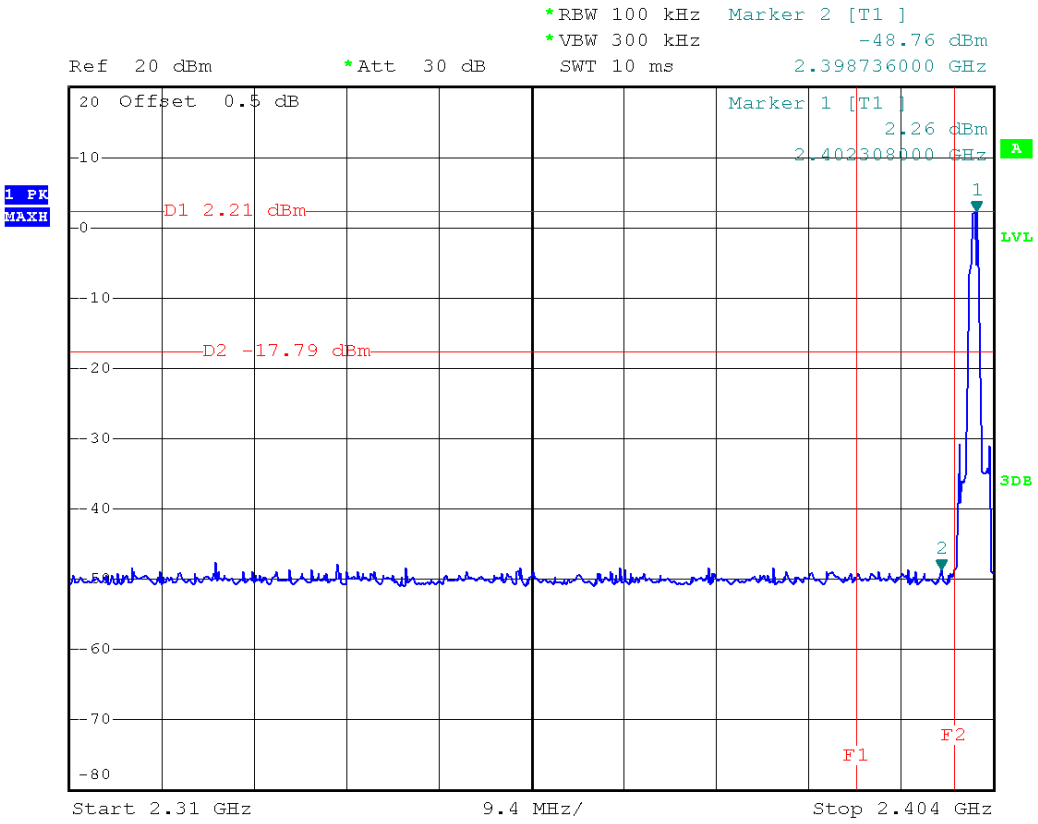
2.8.4.3. 8-DPSK Mode

Test Verdict:

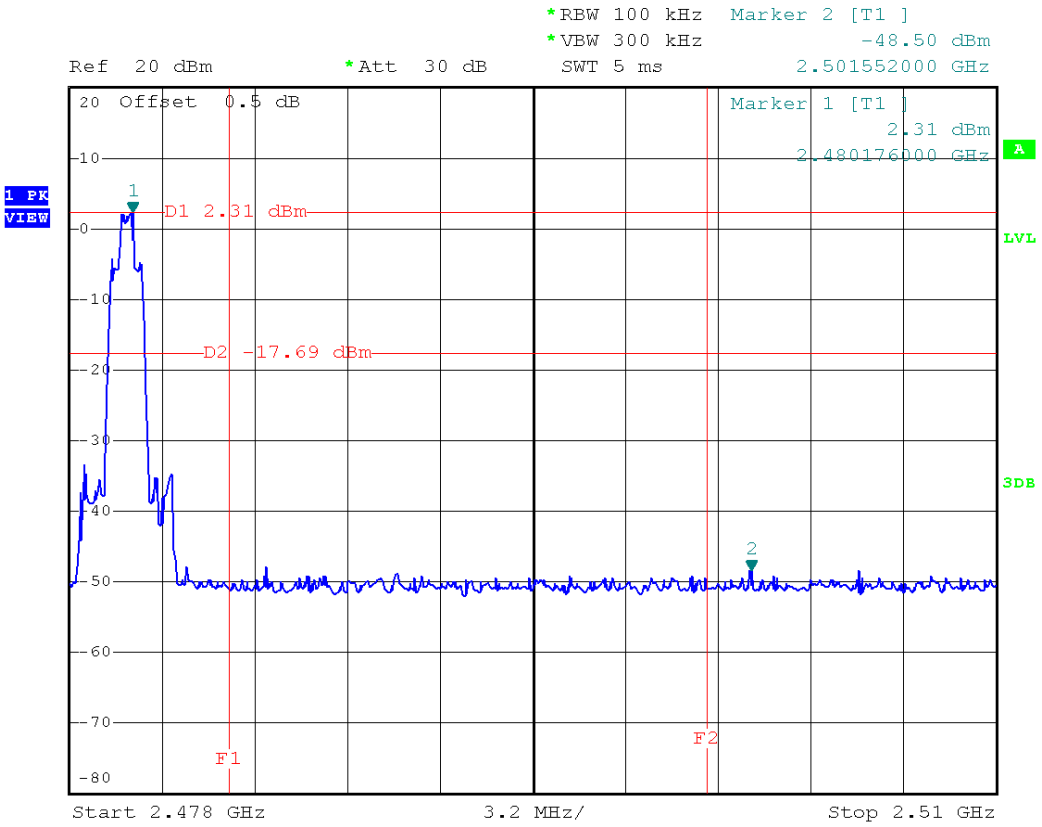
(Un-hopping)

Channel	Frequency (MHz)	Detector PK/ AV	Read Level (dBμV)	Correction Factor (dB)	Level (dBμV/m)	Limit (dBμV/m)	Over Limit (dB)
0	2347.763	PK	58.12	-12.84	45.28	74.00	-28.72
0	2347.763	AV	47.03	-12.84	34.19	54.00	-19.81
39	2492.562	PK	57.63	-12.77	44.86	74.00	-29.14
39	2492.562	AV	46.94	-12.77	34.17	54.00	-19.83

Test Plots:



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

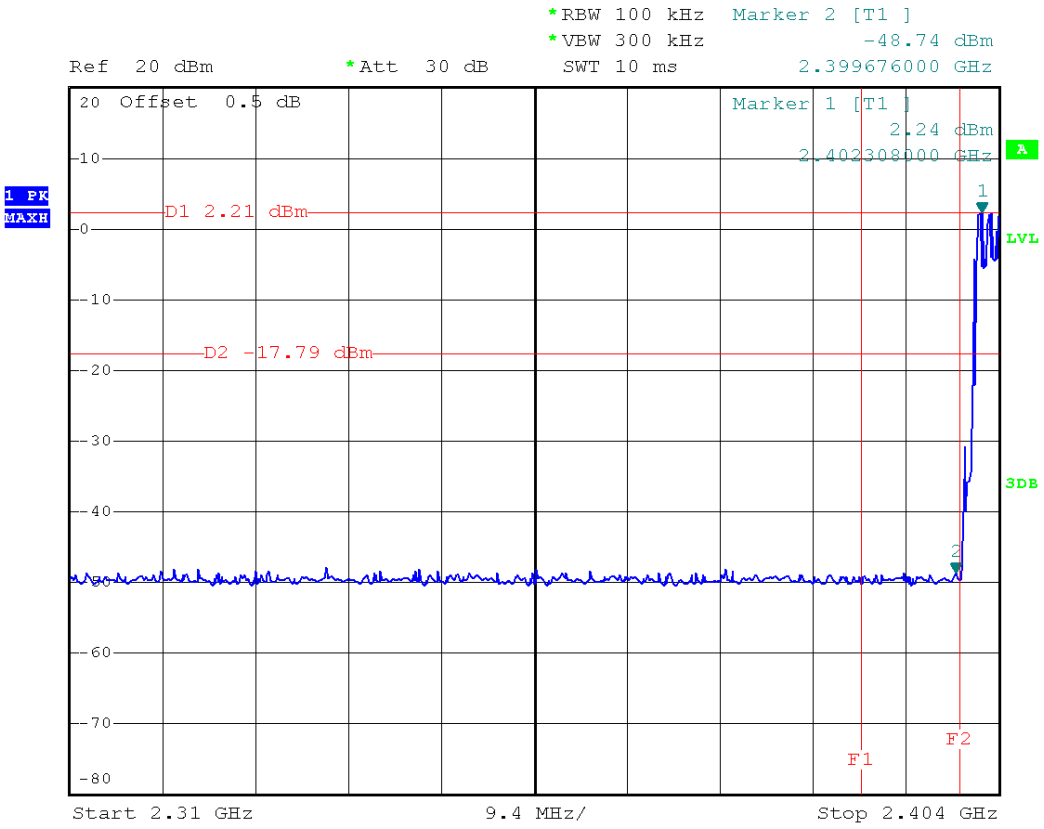


(Plot F1: Channel = 78 PEAK @ 8-DPSK Mode)

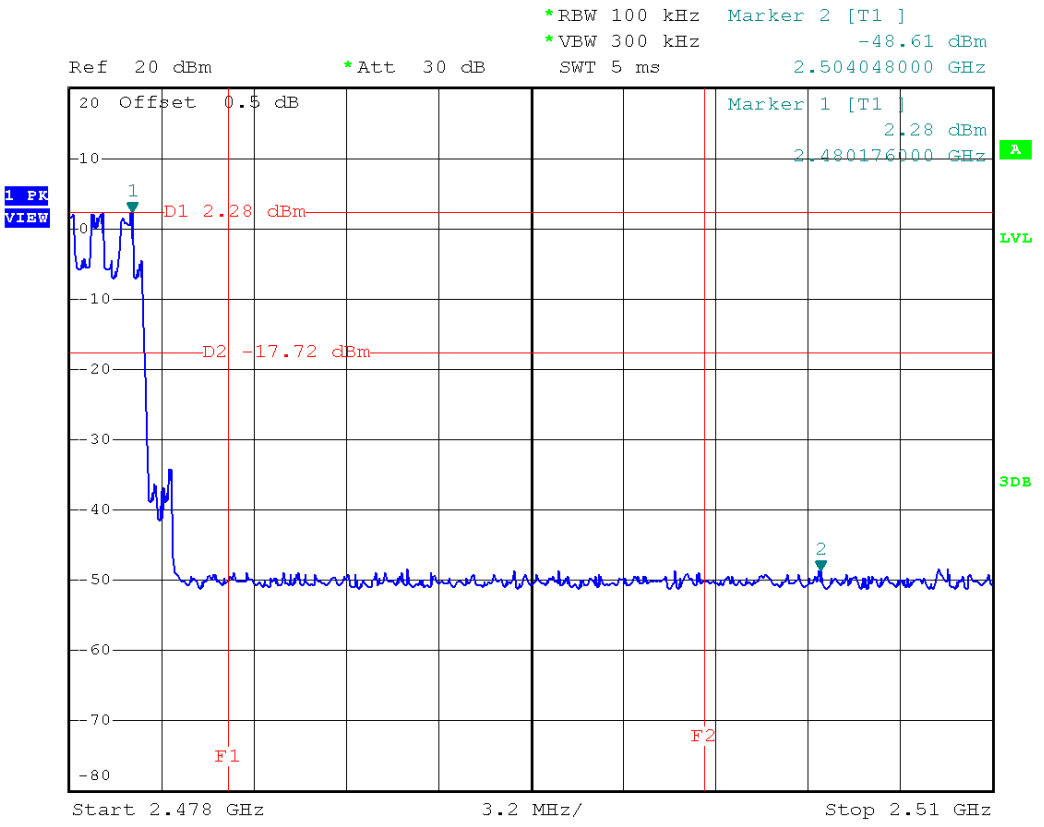
(hopping)

Channel	Frequency (MHz)	Detector	Read Level (dBμV)	Correction Factor (dB)	Level (dBμV/m)	Limit (dBμV/m)	Over Limit (dB)
		PK/ AV					
0	2385.312	PK	58.69	-12.84	45.85	74.00	-28.15
0	2385.312	AV	47.34	-12.84	34.50	54.00	-19.50
39	2486.969	PK	59.01	-12.77	46.24	74.00	-27.76
39	2486.898	AV	47.79	-12.77	35.02	54.00	-18.98

Test Plots:



(Plot E1-1: Channel = 0 PEAK)



(Plot F1-1: Channel = 78 PEAK)

2.9. Conducted Emission

2.9.1. Requirement

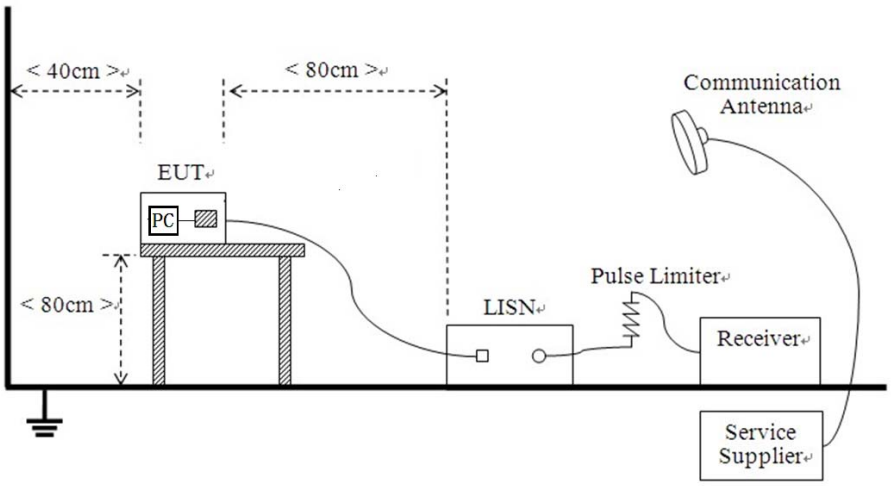
According to FCC section 15.207, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz shall not exceed the limits in the following 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
5 - 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

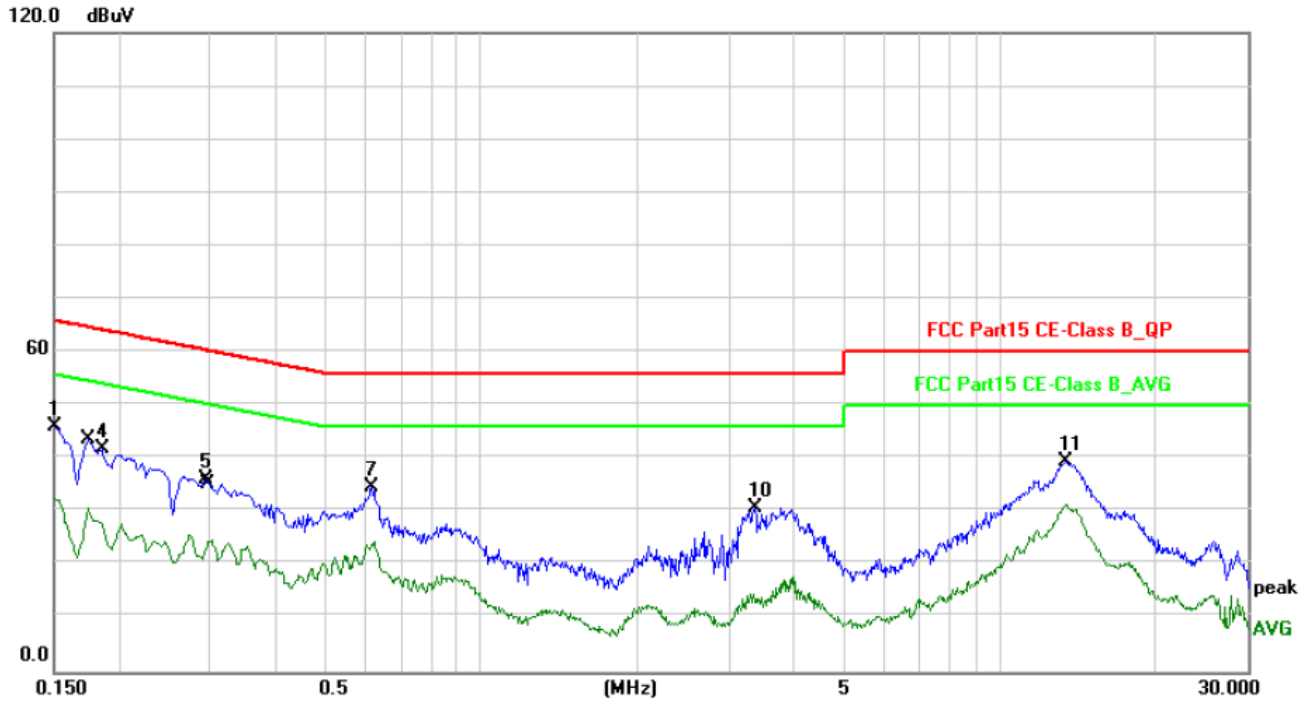
Test Setup:



The Table-top EUT was placed upon a non-metallic table 0.8m above the horizontal metal reference ground plane. EUT was connected to Laptop by USB cable, Laptop was connected to LISN and LISN was connected to reference Ground Plane. EUT was 80cm from LISN. The voltage of the test is 120V/60Hz.The set-up and test methods were according to ANSI C63.10:2009:2009

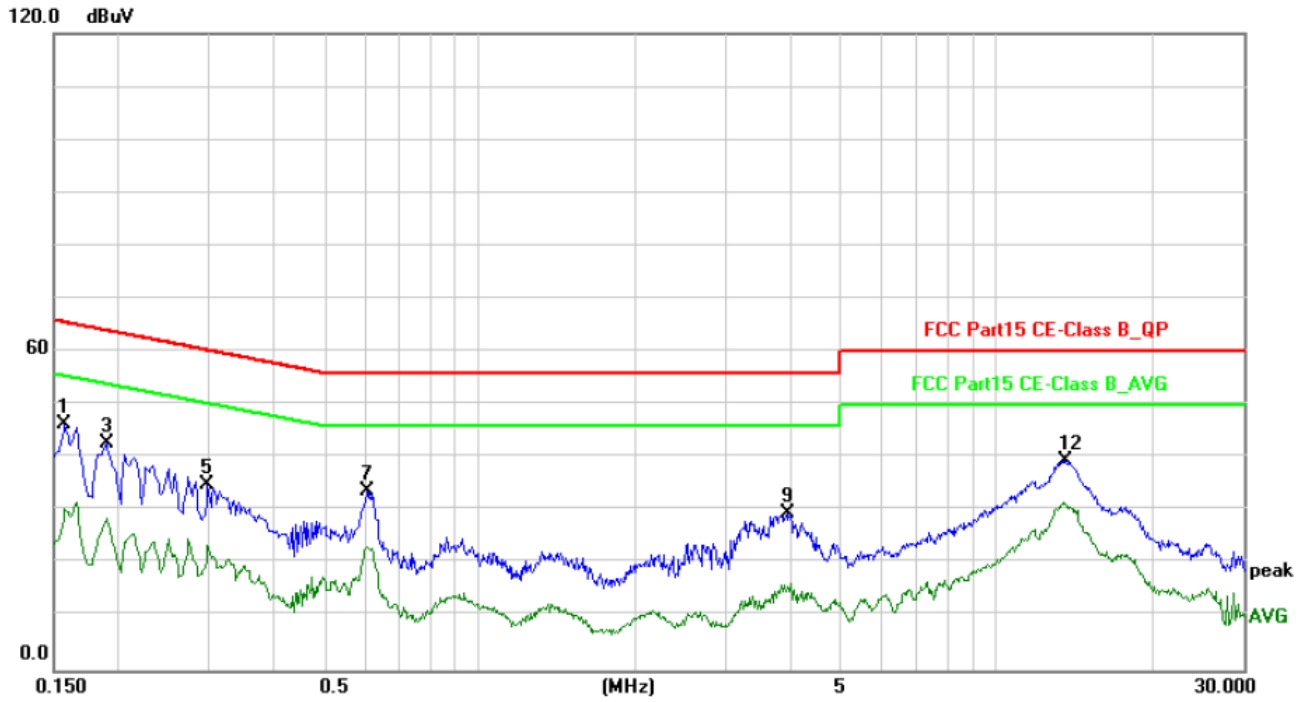
2.9.3. Test Result

Charger mode



(Plot A: L Phase)

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1500	35.99	10.13	46.12	65.99	-19.87	peak	
2		0.1500	22.55	10.13	32.68	55.99	-23.31	AVG	
3		0.1758	19.61	10.12	29.73	54.68	-24.95	AVG	
4		0.1860	31.61	10.12	41.73	64.21	-22.48	peak	
5		0.2940	26.00	10.11	36.11	60.41	-24.30	peak	
6		0.3020	14.51	10.11	24.62	50.19	-25.57	AVG	
7		0.6140	24.56	10.07	34.63	56.00	-21.37	peak	
8		0.6220	14.41	10.07	24.48	46.00	-21.52	AVG	
9		3.3540	4.57	10.12	14.69	46.00	-31.31	AVG	
10		3.3700	20.62	10.12	30.74	56.00	-25.26	peak	
11		13.3620	29.15	10.29	39.44	60.00	-20.56	peak	
12	*	13.4380	21.11	10.29	31.40	50.00	-18.60	AVG	



(Plot B: N Phase)

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1580	36.11	10.13	46.24	65.56	-19.32	peak	
2		0.1580	20.18	10.13	30.31	55.56	-25.25	AVG	
3		0.1900	32.58	10.12	42.70	64.03	-21.33	peak	
4		0.1900	18.65	10.12	28.77	54.03	-25.26	AVG	
5		0.2980	24.89	10.11	35.00	60.30	-25.30	peak	
6		0.2980	13.41	10.11	23.52	50.30	-26.78	AVG	
7		0.6060	23.53	10.07	33.60	56.00	-22.40	peak	
8		0.6060	13.14	10.07	23.21	46.00	-22.79	AVG	
9		3.9460	19.49	10.12	29.61	56.00	-26.39	peak	
10		3.9980	6.25	10.13	16.38	46.00	-29.62	AVG	
11	*	13.4620	21.30	10.29	31.59	50.00	-18.41	AVG	
12		13.6220	29.23	10.29	39.52	60.00	-20.48	peak	

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:

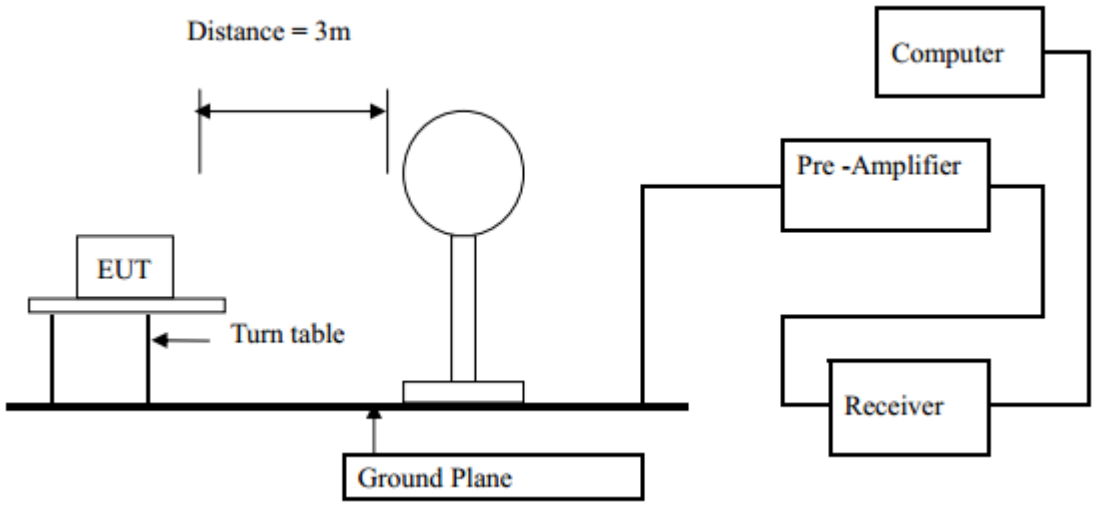
1. For Above 1000MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
2. For above 1000MHz, limit field strength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

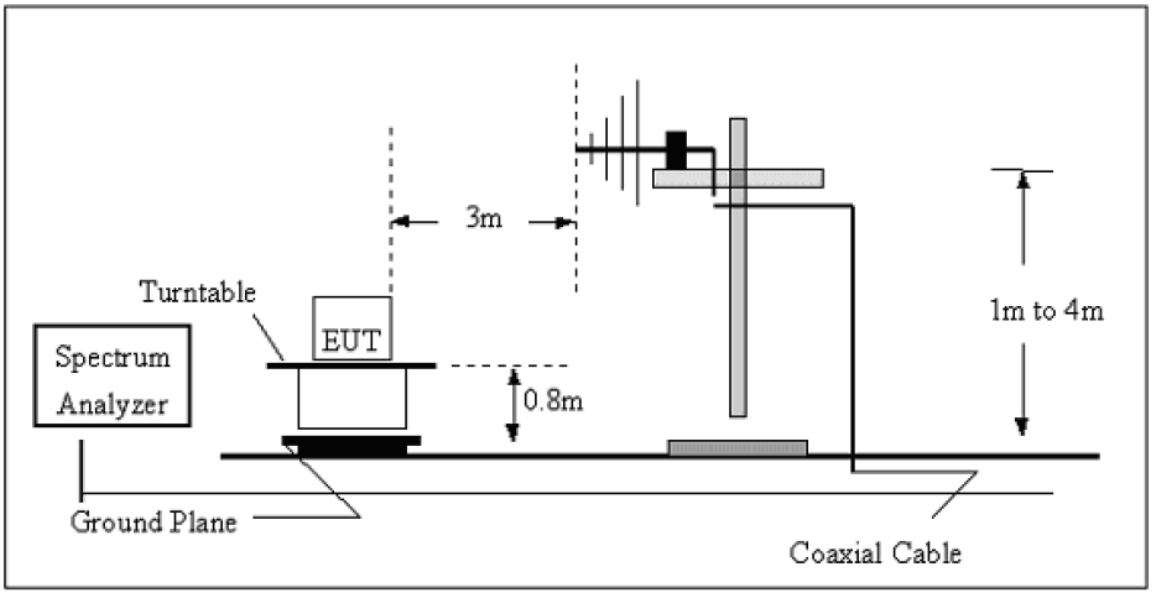
2.10.2. Test Description

A. Test Setup:

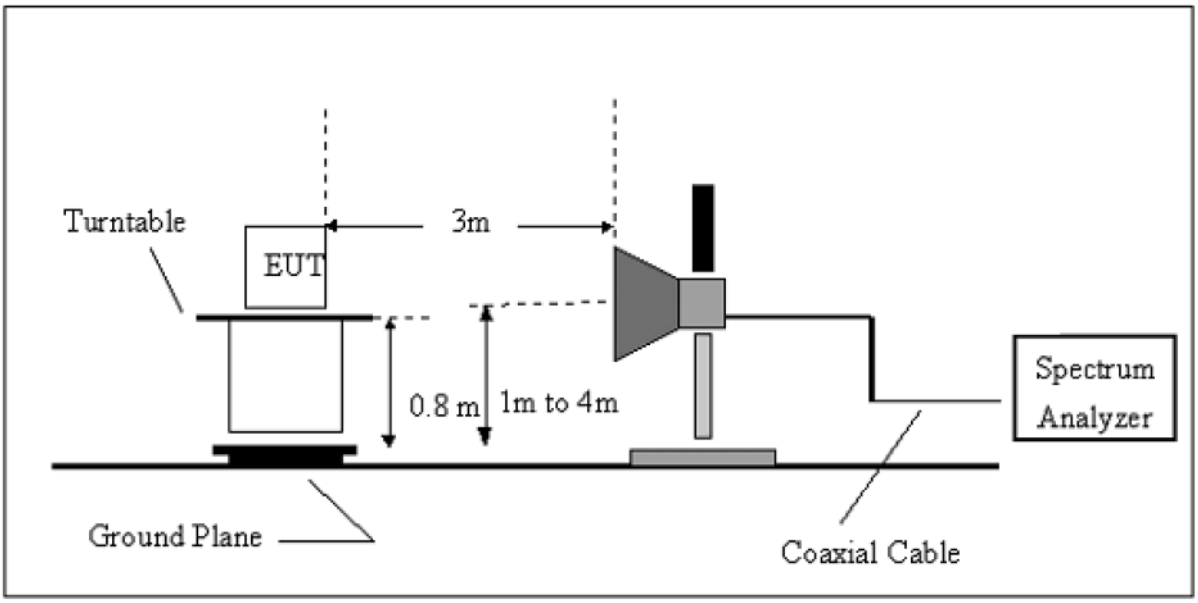
1) For radiated emissions from 9kHz to 30MHz



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 (2009). The EUT was set-up on insulator 80cm above the Ground Plane. The set-up and test methods were according to ANSI C63.4.

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

For the Test Antenna:

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

B. 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

2.10.3. 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:

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

C_{Factor}: Correction Factor

U_R: Receiver Reading

G_{preamp}: Preamplifier Gain

A_{Factor}: Antenna Factor at 3m

During the test, the C_{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.

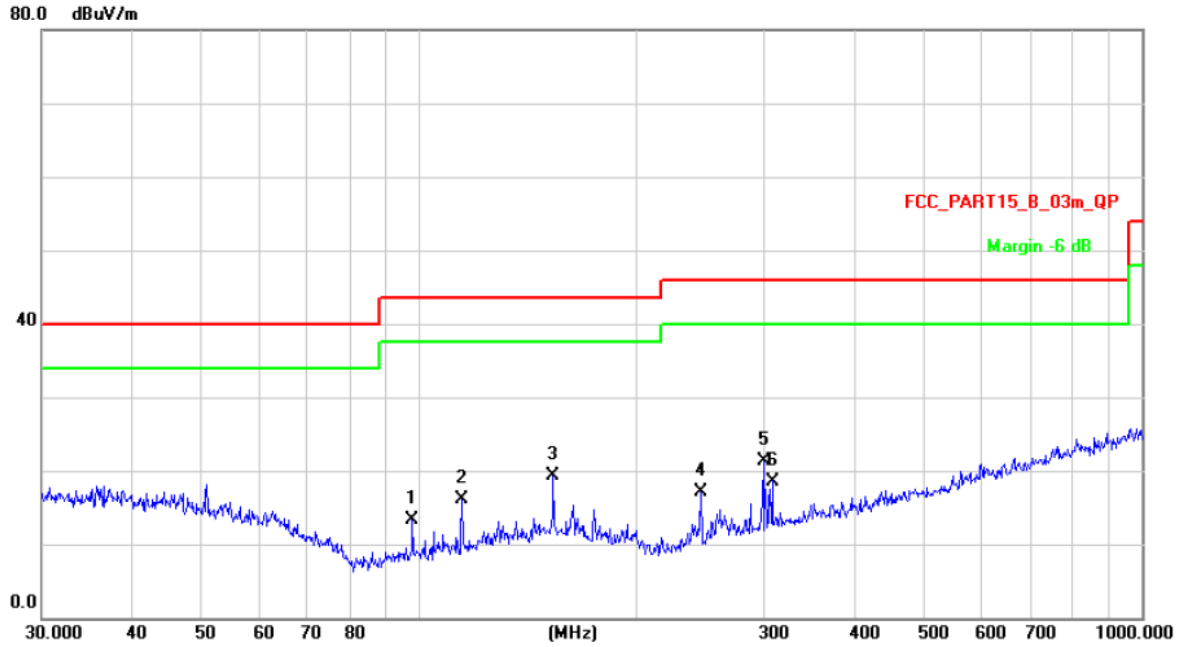
Test plots for the whole measurement frequency range：

Y axis for below 1 GHz

For 9KHz to 30MHz

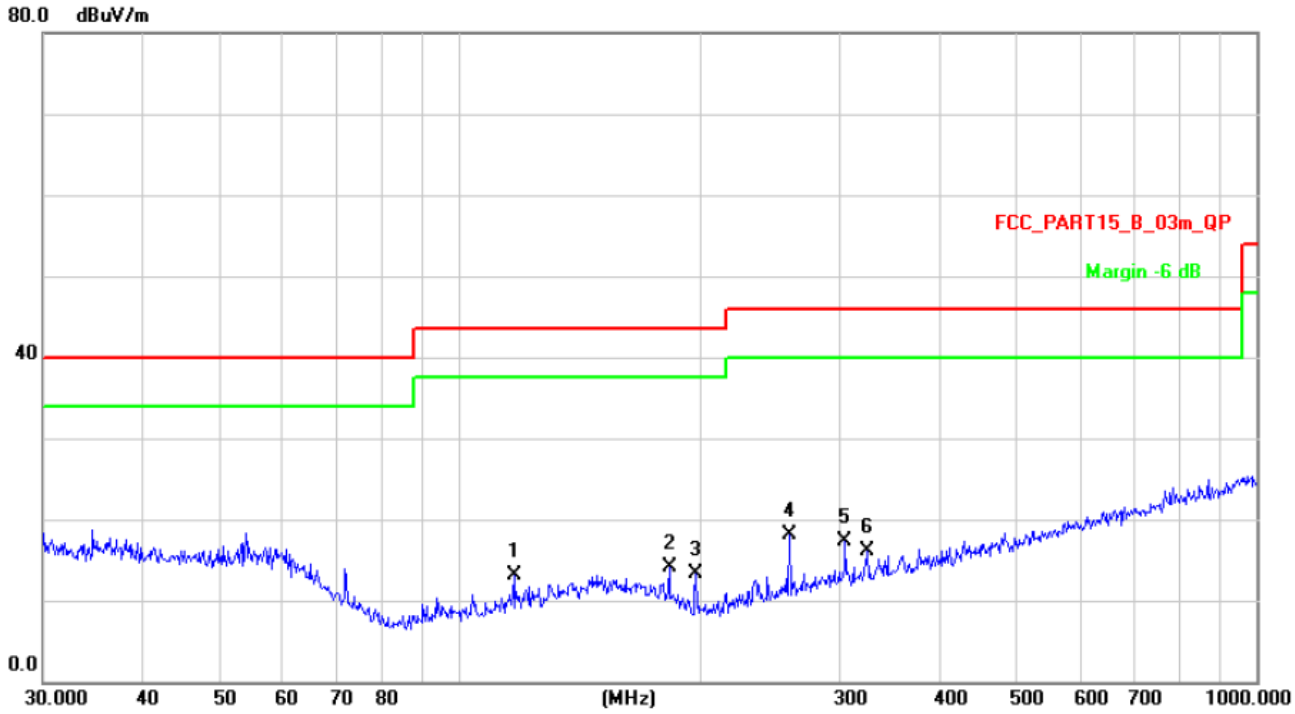
The test has been performed， and the Radiated Emission level is too low to the limit.

For 30MHz to 1000MHz



Frequency (MHz)	QuasiPeak (dB μ V/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dB μ V/m)	Antenna	Verdict
97.7983	13.31	120.000	100.0	43.50	Vertical	Pass
114.5146	16.09	120.000	100.0	43.50	Vertical	Pass
153.2004	19.30	120.000	100.0	43.50	Vertical	Pass
245.0900	17.02	120.000	100.0	46.00	Vertical	Pass
299.3158	21.36	120.000	100.0	46.00	Vertical	Pass
307.8313	18.60	120.000	100.0	46.00	Vertical	Pass

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



Frequency (MHz)	QuasiPeak (dB μ V/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dB μ V/m)	Antenna	Verdict
116.9495	13.19	120.000	100.0	43.50	Horizontal	Pass
183.2005	14.04	120.000	100.0	43.50	Horizontal	Pass
197.8928	13.26	120.000	100.0	43.50	Horizontal	Pass
259.2338	18.15	120.000	100.0	46.00	Horizontal	Pass
304.6099	17.37	120.000	100.0	46.00	Horizontal	Pass
324.4561	16.06	120.000	100.0	46.00	Horizontal	Pass

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

Y axis for above 1 GHz

For 1GHz to 25GHz

GFSK Mode

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（0CH_2402MHz）							
No.	Frequency (MHz)	Read Level (dBuV)		Correction Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)
1	4804.00	48.16	PK	-3.64	44.52	74.00	-29.48
1	4804.00	35.32	AV	-3.64	31.68	54.00	-22.32
2	7206.00	47.93	PK	-0.95	46.98	74.00	-27.02
2	7206.00	34.82	AV	-0.95	33.87	54.00	-20.13
3	9608.00	47.13	PK	0.79	47.92	74.00	-26.08
3	9608.00	34.66	AV	0.79	35.45	54.00	-18.55
4	12010.00	*	PK	*	*	74.00	*

4	12010.00	*	AV	*	*	54.00	*
5	14412.00	*	PK	*	*	74.00	*
5	14412.00	*	AV	*	*	54.00	*

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（0CH_2402MHz）

No.	Frequency (MHz)	Read Level (dBuV)		Correction Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)
1	4804.00	47.82	PK	-3.64	44.18	74.00	-29.82
1	4804.00	34.15	AV	-3.64	30.51	54.00	-23.49
2	7206.00	47.09	PK	-0.95	46.14	74.00	-27.86
2	7206.00	33.58	AV	-0.95	32.63	54.00	-21.37
3	9608.00	47.96	PK	0.79	48.75	74.00	-25.25
3	9608.00	34.25	AV	0.79	35.04	54.00	-18.96
4	12010.00	*	PK	*	*	74.00	*
4	12010.00	*	AV	*	*	54.00	*
5	14412.00	*	PK	*	*	74.00	*
5	14412.00	*	AV	*	*	54.00	*

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（39CH_2441MHz）

No.	Frequency (MHz)	Read Level (dBuV)		Correction Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)
1	4882.00	48.03	PK	-3.67	44.36	74.00	-29.64
1	4882.00	34.22	AV	-3.67	30.55	54.00	-23.45
2	7323.00	47.69	PK	-0.82	46.87	74.00	-27.13
2	7323.00	33.52	AV	-0.82	32.70	54.00	-21.30
3	9764.00	48.09	PK	0.84	48.93	74.00	-25.07
3	9764.00	34.07	AV	0.84	34.91	54.00	-19.09
4	12205.00	*	PK	*	*	74.00	*
4	12205.00	*	AV	*	*	54.00	*
5	14646.00	*	PK	*	*	74.00	*
5	14646.00	*	AV	*	*	54.00	*

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（39CH_2441MHz）

No.	Frequency (MHz)	Read Level (dBuV)		Correction Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)
1	4882.00	48.52	PK	-3.67	44.85	74.00	-29.15
1	4882.00	34.63	AV	-3.67	30.96	54.00	-23.04
2	7323.00	48.27	PK	-0.82	47.45	74.00	-26.55
2	7323.00	34.69	AV	-0.82	33.87	54.00	-20.13
3	9764.00	47.36	PK	0.84	48.20	74.00	-25.80
3	9764.00	33.59	AV	0.84	34.43	54.00	-19.57
4	12205.00	*	PK	*	*	74.00	*
4	12205.00	*	AV	*	*	54.00	*
5	14646.00	*	PK	*	*	74.00	*
5	14646.00	*	AV	*	*	54.00	*

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（78CH_2480MHz）							
No.	Frequency (MHz)	Read Level (dBuV)		Correction Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)
1	4960.00	47.69	PK	-3.59	44.10	74.00	-29.90
1	4960.00	33.67	AV	-3.59	30.08	54.00	-23.92
2	7440.00	46.12	PK	-0.68	45.44	74.00	-28.56
2	7440.00	33.83	AV	-0.68	33.15	54.00	-20.85
3	9920.00	47.96	PK	0.91	48.87	74.00	-25.13
3	9920.00	34.21	AV	0.91	35.12	54.00	-18.88
4	12400.00	*	PK	*	*	74.00	*
4	12400.00	*	AV	*	*	54.00	*
5	14880.00	*	PK	*	*	74.00	*
5	14880.00	*	AV	*	*	54.00	*

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（78CH_2480MHz）							
No.	Frequency (MHz)	Read Level (dBuV)		Correction Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)
1	4960.00	48.73	PK	-3.59	45.14	74.00	-28.86
1	4960.00	34.29	AV	-3.59	30.70	54.00	-23.30
2	7440.00	49.23	PK	-0.68	48.55	74.00	-25.45
2	7440.00	35.55	AV	-0.68	34.87	54.00	-19.13
3	9920.00	48.62	PK	0.91	49.53	74.00	-24.47
3	9920.00	34.11	AV	0.91	35.02	54.00	-18.98
4	12400.00	*	PK	*	*	74.00	*
4	12400.00	*	AV	*	*	54.00	*
5	14880.00	*	PK	*	*	74.00	*
5	14880.00	*	AV	*	*	54.00	*

π/4-DQPSK Mode

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（0CH_2402MHz）							
No.	Frequency (MHz)	Read Level (dBuV)		Correction Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)
1	4804.00	47.23	PK	-3.64	43.59	74.00	-30.41
1	4804.00	34.22	AV	-3.64	30.58	54.00	-23.42
2	7206.00	46.11	PK	-0.95	45.16	74.00	-28.84
2	7206.00	32.87	AV	-0.95	31.92	54.00	-22.08
3	9608.00	46.17	PK	0.79	46.96	74.00	-27.04
3	9608.00	33.24	AV	0.79	34.03	54.00	-19.97
4	12010.00	*	PK	*	*	74.00	*
4	12010.00	*	AV	*	*	54.00	*
5	14412.00	*	PK	*	*	74.00	*
5	14412.00	*	AV	*	*	54.00	*

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（0CH_2402MHz）

No.	Frequency (MHz)	Read Level (dBuV)		Correction Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)
1	4804.00	47.24	PK	-3.64	43.60	74.00	-30.40
1	4804.00	33.75	AV	-3.64	30.11	54.00	-23.89
2	7206.00	47.29	PK	-0.95	46.34	74.00	-27.66
2	7206.00	32.92	AV	-0.95	31.97	54.00	-22.03
3	9608.00	47.16	PK	0.79	47.95	74.00	-26.05
3	9608.00	32.96	AV	0.79	33.75	54.00	-20.25
4	12010.00	*	PK	*	*	74.00	*
4	12010.00	*	AV	*	*	54.00	*
5	14412.00	*	PK	*	*	74.00	*
5	14412.00	*	AV	*	*	54.00	*

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（39CH_2441MHz）

No.	Frequency (MHz)	Read Level (dBuV)		Correction Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)
1	4882.00	47.26	PK	-3.67	43.59	74.00	-30.41
1	4882.00	34.56	AV	-3.67	30.89	54.00	-23.11
2	7323.00	47.59	PK	-0.82	46.77	74.00	-27.23
2	7323.00	33.12	AV	-0.82	32.30	54.00	-21.70
3	9764.00	46.29	PK	0.84	47.13	74.00	-26.87
3	9764.00	32.56	AV	0.84	33.40	54.00	-20.60
4	12205.00	*	PK	*	*	74.00	*
4	12205.00	*	AV	*	*	54.00	*
5	14646.00	*	PK	*	*	74.00	*
5	14646.00	*	AV	*	*	54.00	*

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（39CH_2441MHz）

No.	Frequency (MHz)	Read Level (dBuV)		Correction Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)
1	4882.00	47.14	PK	-3.67	43.47	74.00	-30.53
1	4882.00	32.51	AV	-3.67	28.84	54.00	-25.16
2	7323.00	45.83	PK	-0.82	45.01	74.00	-28.99
2	7323.00	32.65	AV	-0.82	31.83	54.00	-22.17
3	9764.00	46.64	PK	0.84	47.48	74.00	-26.52
3	9764.00	33.24	AV	0.84	34.08	54.00	-19.92
4	12205.00	*	PK	*	*	74.00	*
4	12205.00	*	AV	*	*	54.00	*
5	14646.00	*	PK	*	*	74.00	*
5	14646.00	*	AV	*	*	54.00	*

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（78CH_2480MHz）

No.	Frequency (MHz)	Read Level (dBuV)		Correction Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)
1	4960.00	48.01	PK	-3.59	44.42	74.00	-29.58
1	4960.00	33.96	AV	-3.59	30.37	54.00	-23.63
2	7440.00	46.29	PK	-0.68	45.61	74.00	-28.39

2	7440.00	32.71	AV	-0.68	32.03	54.00	-21.97
3	9920.00	48.10	PK	0.91	49.01	74.00	-24.99
3	9920.00	33.86	AV	0.91	34.77	54.00	-19.23
4	12400.00	*	PK	*	*	74.00	*
4	12400.00	*	AV	*	*	54.00	*
5	14880.00	*	PK	*	*	74.00	*
5	14880.00	*	AV	*	*	54.00	*

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（78CH_2480MHz）

No.	Frequency (MHz)	Read Level (dBuV)		Correction Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)
1	4960.00	48.47	PK	-3.59	44.88	74.00	-29.12
1	4960.00	34.13	AV	-3.59	30.54	54.00	-23.46
2	7440.00	46.65	PK	-0.68	45.97	74.00	-28.03
2	7440.00	32.61	AV	-0.68	31.93	54.00	-22.07
3	9920.00	46.86	PK	0.91	47.77	74.00	-26.23
3	9920.00	32.88	AV	0.91	33.79	54.00	-20.21
4	12400.00	*	PK	*	*	74.00	*
4	12400.00	*	AV	*	*	54.00	*
5	14880.00	*	PK	*	*	74.00	*
5	14880.00	*	AV	*	*	54.00	*

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ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（0CH_2402MHz）

No.	Frequency (MHz)	Read Level (dBuV)		Correction Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)
1	4804.00	47.31	PK	-3.64	43.67	74.00	-30.33
1	4804.00	33.98	AV	-3.64	30.34	54.00	-23.66
2	7206.00	45.46	PK	-0.95	44.51	74.00	-29.49
2	7206.00	32.31	AV	-0.95	31.36	54.00	-22.64
3	9608.00	46.48	PK	0.79	47.27	74.00	-26.73
3	9608.00	33.87	AV	0.79	34.66	54.00	-19.34
4	12010.00	*	PK	*	*	74.00	*
4	12010.00	*	AV	*	*	54.00	*
5	14412.00	*	PK	*	*	74.00	*
5	14412.00	*	AV	*	*	54.00	*

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（0CH_2402MHz）

No.	Frequency (MHz)	Read Level (dBuV)		Correction Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)
1	4804.00	47.41	PK	-3.64	43.77	74.00	-30.23
1	4804.00	33.92	AV	-3.64	30.28	54.00	-23.72
2	7206.00	47.41	PK	-0.95	46.46	74.00	-27.54
2	7206.00	32.81	AV	-0.95	31.86	54.00	-22.14
3	9608.00	46.90	PK	0.79	47.69	74.00	-26.31
3	9608.00	32.48	AV	0.79	33.27	54.00	-20.73

4	12010.00	*	PK	*	*	74.00	*
4	12010.00	*	AV	*	*	54.00	*
5	14412.00	*	PK	*	*	74.00	*
5	14412.00	*	AV	*	*	54.00	*

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（39CH_2441MHz）

No.	Frequency (MHz)	Read Level (dBuV)		Correction Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)
1	4882.00	47.85	PK	-3.67	44.18	74.00	-29.82
1	4882.00	34.62	AV	-3.67	30.95	54.00	-23.05
2	7323.00	46.87	PK	-0.82	46.05	74.00	-27.95
2	7323.00	32.60	AV	-0.82	31.78	54.00	-22.22
3	9764.00	46.60	PK	0.84	47.44	74.00	-26.56
3	9764.00	33.00	AV	0.84	33.84	54.00	-20.16
4	12205.00	*	PK	*	*	74.00	*
4	12205.00	*	AV	*	*	54.00	*
5	14646.00	*	PK	*	*	74.00	*
5	14646.00	*	AV	*	*	54.00	*

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（39CH_2441MHz）

No.	Frequency (MHz)	Read Level (dBuV)		Correction Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)
1	4882.00	46.86	PK	-3.67	43.19	74.00	-30.81
1	4882.00	32.49	AV	-3.67	28.82	54.00	-25.18
2	7323.00	45.90	PK	-0.82	45.08	74.00	-28.92
2	7323.00	32.53	AV	-0.82	31.71	54.00	-22.29
3	9764.00	47.02	PK	0.84	47.86	74.00	-26.14
3	9764.00	33.51	AV	0.84	34.35	54.00	-19.65
4	12205.00	*	PK	*	*	74.00	*
4	12205.00	*	AV	*	*	54.00	*
5	14646.00	*	PK	*	*	74.00	*
5	14646.00	*	AV	*	*	54.00	*

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（78CH_2480MHz）

No.	Frequency (MHz)	Read Level (dBuV)		Correction Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)
1	4960.00	48.11	PK	-3.59	44.52	74.00	-29.48
1	4960.00	34.56	AV	-3.59	30.97	54.00	-23.03
2	7440.00	46.55	PK	-0.68	45.87	74.00	-28.13
2	7440.00	33.11	AV	-0.68	32.43	54.00	-21.57
3	9920.00	47.60	PK	0.91	48.51	74.00	-25.49
3	9920.00	33.18	AV	0.91	34.09	54.00	-19.91
4	12400.00	*	PK	*	*	74.00	*
4	12400.00	*	AV	*	*	54.00	*
5	14880.00	*	PK	*	*	74.00	*
5	14880.00	*	AV	*	*	54.00	*

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（78CH_2480MHz）							
No.	Frequency (MHz)	Read Level (dBuV)		Correction Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)
1	4960.00	48.26	PK	-3.59	44.67	74.00	-29.33
1	4960.00	34.42	AV	-3.59	30.83	54.00	-23.17
2	7440.00	46.66	PK	-0.68	45.98	74.00	-28.02
2	7440.00	32.69	AV	-0.68	32.01	54.00	-21.99
3	9920.00	46.41	PK	0.91	47.32	74.00	-26.68
3	9920.00	32.43	AV	0.91	33.34	54.00	-20.66
4	12400.00	*	PK	*	*	74.00	*
4	12400.00	*	AV	*	*	54.00	*
5	14880.00	*	PK	*	*	74.00	*
5	14880.00	*	AV	*	*	54.00	*

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 **