



# SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd.

588 West Jindu Road, Songjiang District, Shanghai, China  
Telephone: +86 (0) 21 6191 5666  
Fax: +86 (0) 21 6191 5678  
ee.shanghai@sgs.com

Report No.: SHEM130900187202  
Page: 1 of 74

## 1 Cover Page

# FCC Part 15C TEST REPORT

Application No.:	SHEM1309001872RF
Applicant:	Robotime Technology (Suzhou) Co., Ltd.
Manufacturer:	Not supplied by the client.
Factory:	Not supplied by the client.
FCC ID:	2AA4AM001

### Equipment Under Test (EUT):

**NOTE:** The following sample(s) submitted was/were identified on behalf of the client as

Product Name:	Adult pleasure object
Model No.(EUT):	Efee-M001
Brand Name:	EFEELINK
Standards:	FCC PART 15 SUBPART C, Section 15.247:2012
Date of Receipt:	September 24, 2013
Date of Test:	September 25, 2013 to September 28, 2013
Date of Issue:	October 10, 2013
Test Result:	Pass*

\*In the configuration tested, the EUT detailed in this report complied with the standards specified above.

  
Tony Wu

E&E Section Manager

SGS-CSTC (Shanghai) Co., Ltd.

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government. All test results in this report can be traceable to National or International Standards.

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## 2 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
00	/	October 10, 2013	/	Original

Authorized for issue by:				
Engineer		Eddy Zong		
Clerk		Susie Liu		
Reviewer		Keny Xu		

### 3 Test Summary

Test Item	Test Requirement	Test method	Result
Antenna Requirement	FCC Part 15, Subpart C Section 15.203/15.247 (c)	---	PASS
AC Power Line Conducted Emission	FCC Part 15, Subpart C Section 15.207	ANSI C63.10 (2009) Section 6.2	PASS
20dB Occupied Bandwidth	FCC Part 15, Subpart C Section 15.247 (a)(1)	ANSI C63.10 (2009) Section 6.9.1	PASS
Conducted Peak Output Power	FCC Part 15, Subpart C Section 15.247 (b)(1)	ANSI C63.10 (2009) Section 6.10.1	PASS
Carrier Frequencies Separation	FCC Part 15, Subpart C Section 15.247 (a)(1)	ANSI C63.10 (2009) Section 7.7.2	PASS
Hopping Channel Number	FCC Part 15, Subpart C Section 15.247 (b)	ANSI C63.10 (2009) Section 7.7.3	PASS
Dwell Time	FCC Part 15, Subpart C Section 15.247 (a)(1)	ANSI C63.10 (2009) Section 7.7.4	PASS
RF Conducted Spurious Emissions	FCC Part 15, Subpart C Section 15.247(d)	ANSI C63.10 (2009) Section 7.7.10	PASS
Radiated Spurious Emissions and Band-edge	FCC Part 15, Subpart C Section 15.209 and Section 15.205	ANSI C63.10 (2009) Section 6.12	PASS

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## 5 General Information

### 5.1 Client Information

Applicant:	Robotime Technology (Suzhou) Co., Ltd.
Address of Applicant:	Room 607, Building A, 5# XingHan Road, Suzhou
Manufacturer:	Not supplied by the client.
Address of Manufacturer:	Not supplied by the client.
Factory:	Not supplied by the client.
Address of Factory:	Not supplied by the client.

### 5.2 General Description of E.U.T.

Product Name:	Adult pleasure object
Model No.(EUT):	Efee-M001
Brand Name:	EFEELINK
Product Description:	Portable Product

### 5.3 Technical Specifications:

Operation Frequency:	2402MHz~2480MHz
Bluetooth Version:	2.0+EDR
Modulation Technique:	FHSS (GFSK, π/4DQPSK, 8DPSK)
Number of Channel:	79
Antenna Type	Integral
Antenna Gain	-3 dBi

### 5.4 Accessories of Product:

USB Input:	DC 5V Via Adaptor(USB cable length about 80cm)
Rated AC Input:	AC 120V 60Hz
Battery:	DC 3.7V, 85mA (Supply the EUT with a new or fully charged Li-on Rechargeable Battery during the testing.)
Engineering Mode:	Using test software to control EUT working in continuous transmitting, and select channel and modulation type.



## 5.5 Description of Support Units

The EUT has been tested with associated equipment below.

Description	Manufacturer	Model No.	Serial No.	Supplied by
Adapter	Hisense	CE24W5068A	12D	SGS
Labtop	ThinkPad X100e	2876A65	/	SGS

Software name	Manufacturer	Supplied By
Blue Test3 (For CSR)	/	Client/SGS

## 5.6 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. E&E Lab  
No.588 West Jindu Road, Songjiang District, Shanghai, China. 201612.

Tel: +86 21 6191 5666

Fax: +86 21 6191 5678

No tests were sub-contracted.

## 5.7 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **CNAS (No. CNAS L0599)**

CNAS has accredited SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing. Date of expiry: 2014-07-26.

- **FCC – Registration No.: 402683**

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been registered and fully described in a report filed with the Federal Communications Commission (FCC). The acceptance letter from the FCC is maintained in our files. Registration No.: 402683, Expiry Date: 2015-02-22.

- **Industry Canada (IC) – IC Assigned Code: 8617A**

The 3m Semi-anechoic chamber of SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 8617A. Expiry Date: 2014-09-20.

- **VCCI (Member No.: 3061)**

The 3m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-3868 and C-4336 respectively. Date of Registration: 2012-05-29. Date of Expiry: 2015-05-28.

## 6 Equipments List

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Due date
1	Spectrum Analyzer	Rohde & Schwarz	FSP-30	2705121009	2014-2-22
2	EMI test receiver	Rohde & Schwarz	ESU40	100109	2014-02-22
3	Horn Antenna (1GHz to 18GHz)	SCHWARZBECK	BBHA9120D	9120D-679	2014-03-06
4	Horn Antenna (14GHz to 40GHz)	SCHWARZBECK	BBHA 9170	BBHA9170373	2014-03-06
5	ANTENNA (25MHz to 2GHz)	SCHWARZBECK	VULB9168	9168-313	2014-03-06
6	Ultra broadband antenna (30MHz to 3GHz)	Rohde & Schwarz	HL562	100227	2013-10-08
7	Horn Antenna (1GHz to 18GHz)	Rohde & Schwarz	HF906	100284	2014-06-01
8	Active Loop Antenna (9kHz to 30MHz)	Rohde & Schwarz	FMZB 1519	1519-034	2014-07-27
9	High-low temperature cabinet	Suzhou Zhihe	TL-40	50110050	2014-4-12
10	Tunable Notch Filter	Wainwright instruments GmbH	WRCT800.0 /880.0-0.2/40-SSK	9	2014-06-01
11	High pass Filter	FSCW	HP 12/2800-5AA2	19A45-02	2014-06-01
12	Low noise amplifier	TESEQ	LNA6900	70133	2014-02-22
13	Attenuator	HUAXIANG	TS2-6dB	11051002	/
14	Attenuator	HUAXIANG	TS2-6dB	11051001	/
15	AC power stabilizer	WOCEN	6100	51122	2014-06-01
16	DC power	QJE	QJ30003SII	611145	2014-06-01

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## 7 Test Results

### 7.1 E.U.T. test conditions

**Test Power:** DC 3.7V, 85mA

**Requirements:** 15.31(e) For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

**Operating Environment:**

**Temperature:** 20.0 -25.0 °C

**Humidity:** 35-75 % RH

**Atmospheric Pressure:** 992 -102.0 kPa

**Test frequencies:** According to the 15.31(m) Measurements on intentional radiators or receivers, other than TV broadcast receivers, shall be performed and, if required, reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table:

Frequency range over which device operates	Number of frequencies	Location in the range of operation
1 MHz or less	1	Middle
1 to 10 MHz	2	1 near top and 1 near bottom
More than 10 MHz	3	1 near top, 1 near middle and 1 near bottom

Pursuant to Part 15.31(c) For swept frequency equipment, measurements shall be made with the frequency sweep stopped at those frequencies chosen for the measurements to be reported.

Test frequency is the lowest channel: 0 channel (2402MHz), middle channel: 39 channel (2441MHz) and the highest channel: 78 channel (2480MHz) with fixed at channel.

## 7.2 Antenna Requirement

### Standard requirement

#### 15.203 requirement:

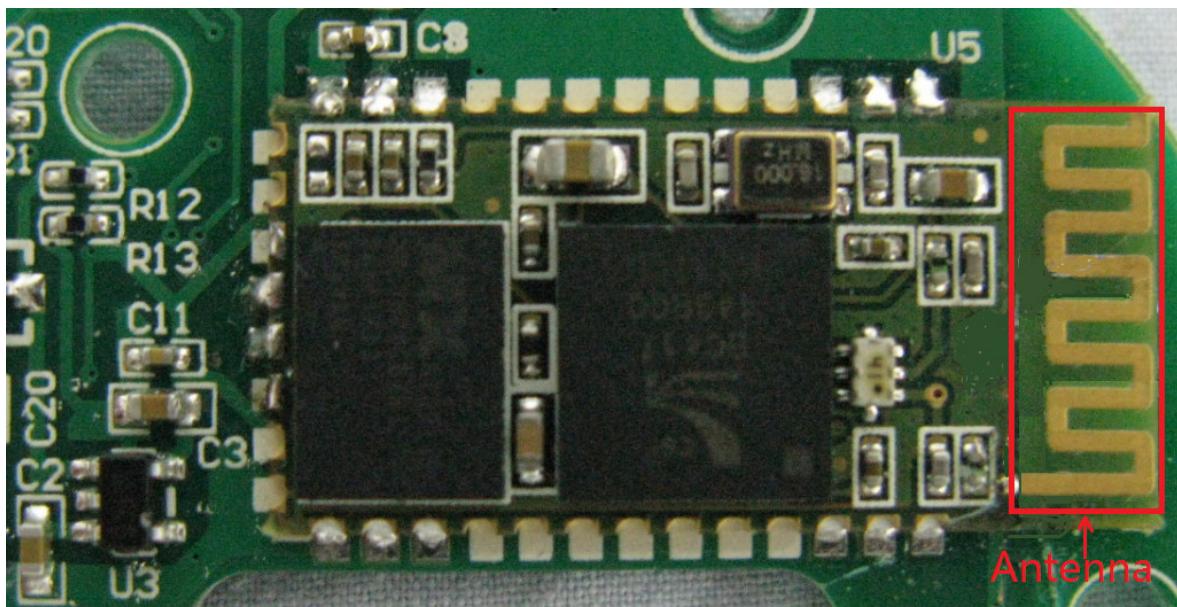
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

#### 15.247(b) (4) requirement:

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### EUT Antenna

The antenna is integrated on the main PCB and no consideration of replacement. The gain of the antenna is less than -3 dBi.



## 7.3 Conducted Emissions on Mains Terminals

**Test Requirement:** FCC Part 15C, Section 15.207

**Test Method:** ANSI C63.10:2009 Section 6.2

**Test Result:** Pass

**Frequency Range:** 150 KHz to 30 MHz

**Class/Severity:** Class B

**Test mode:** Engineering Mode:

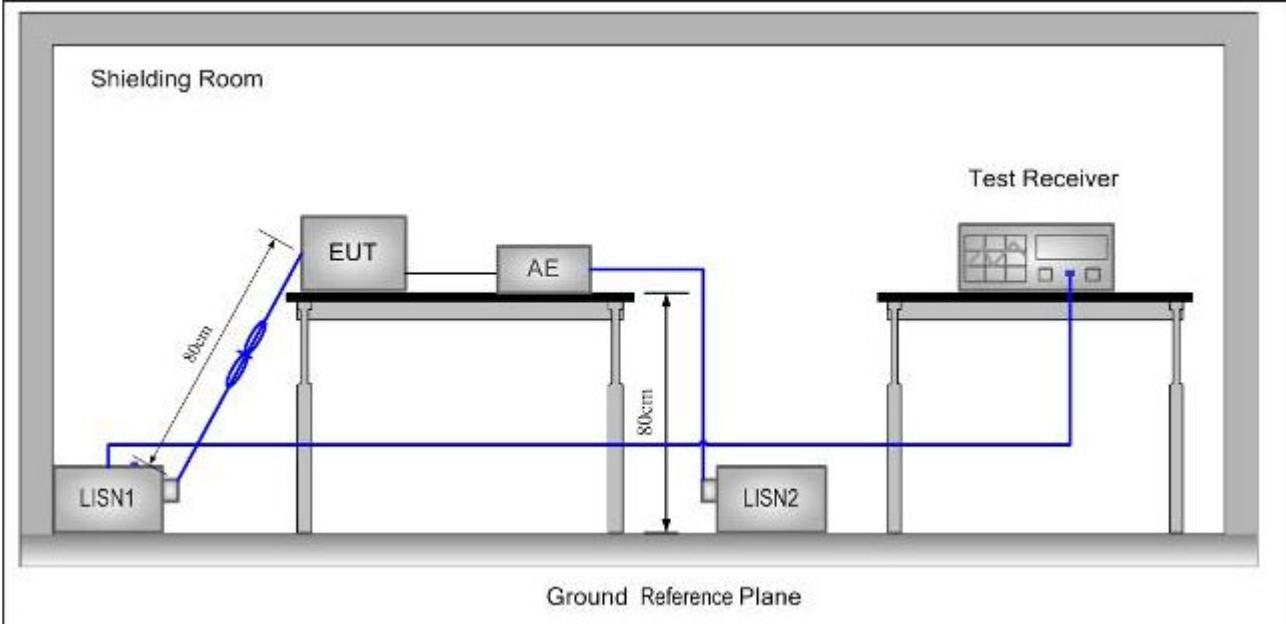
## Limit:

Frequency range MHz	Class B Limits dB ( $\mu$ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

Note1: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50MHz.

Note2: The lower limit is applicable at the transition frequency.

## Test Setup and Procedure



1. The mains terminal disturbance voltage was measured with the EUT in a shielded room.
2. The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides  $50\Omega/50\mu\text{H} + 5\Omega$  linear impedance. The power cable of all other units of the EUT was connected to a second LISN, which was bonded to the ground reference plane in the same way as the LISN for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded



3. The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, but separated from metallic contact with the ground reference plane by 0.1m of insulation.
4. The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISN mounted on top of the ground reference plane. This distance was between the closest points of the LISN and the EUT. The mains lead of EUT excess 0.8m was folded back and forth parallel to the lead so as to form a horizontal bundle with a length between 0.3m and 0.4m. All other units of the EUT and associated equipment was at least 0.8 m from the LISN.

**Measurement Data**

Pre-scan was performed with peak detected on all ports, Quasi-peak & average measurements were performed at the frequencies at which maximum peak emission level were detected.

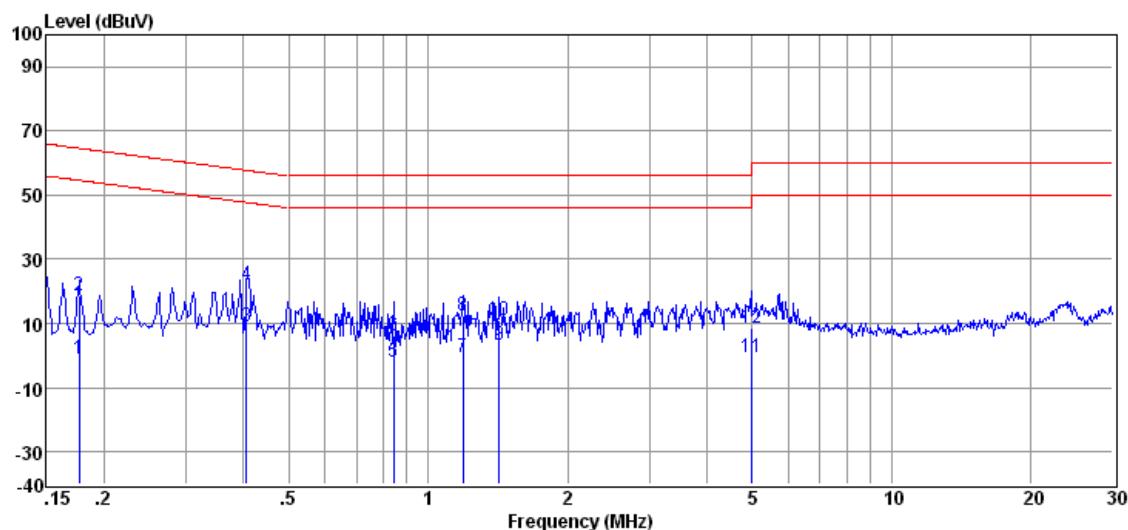
Please see the attached Quasi-peak and Average test results.

Pre-scan was charging mode, found normal operation is worst case.

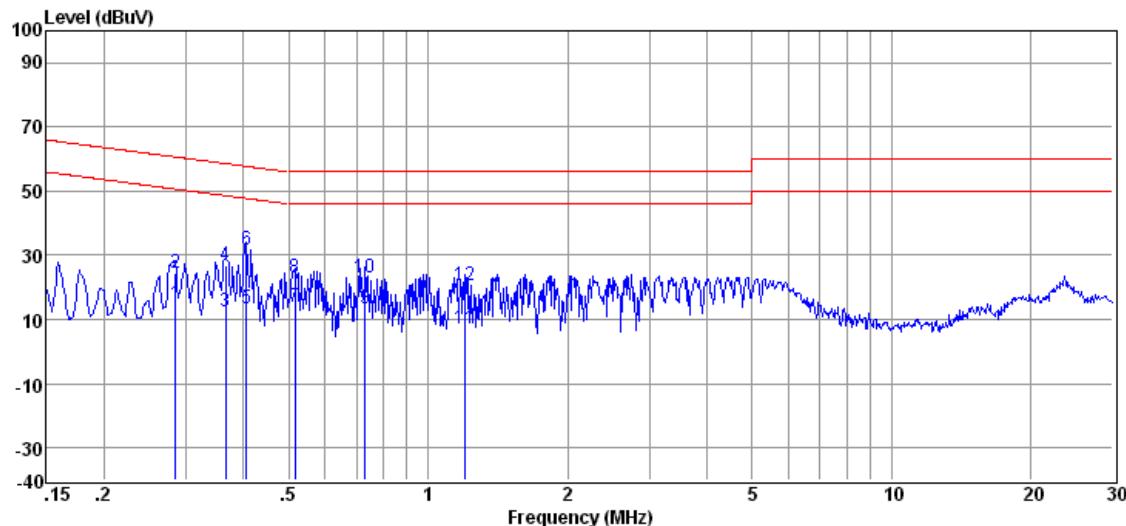
Level = Read Level + LISN/ISN Factor + Cable Loss.

**Test Mode:** Engineering Mode:

**Test Port:** AC Live Line



Item	Freq.	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Detector
(Mark)	(MHz)	(dB $\mu$ V)	(dB)	(dB)	(dB $\mu$ V)	(dB $\mu$ V)	(dB)	
1	0.177	-1.30	0.15	0.10	-1.05	54.64	-55.69	Average
2	0.177	18.34	0.15	0.10	18.59	64.64	-46.05	QP
3	0.406	9.04	0.17	0.10	9.31	47.73	-38.42	Average
4	0.406	21.79	0.17	0.10	22.06	57.73	-35.67	QP
5	0.844	-2.47	0.20	0.10	-2.17	46.00	-48.17	Average
6	0.844	5.75	0.20	0.10	6.05	56.00	-49.95	QP
7	1.191	-0.73	0.22	0.10	-0.41	46.00	-46.41	Average
8	1.191	12.11	0.22	0.10	12.43	56.00	-43.57	QP
9	1.426	2.95	0.24	0.10	3.29	46.00	-42.71	Average
10	1.426	10.60	0.24	0.10	10.94	56.00	-45.06	QP
11	4.978	-0.83	0.30	0.20	-0.33	46.00	-46.33	Average
12	4.978	7.89	0.30	0.20	8.39	56.00	-47.61	QP

**Test Mode:** Engineering Mode:**Test Port:** AC Neutral Line

Item	Freq.	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Detector
(Mark)	(MHz)	(dB $\mu$ V)	(dB)	(dB)	(dB $\mu$ V)	(dB $\mu$ V)	(dB)	
1	0.285	14.65	0.10	0.10	14.85	50.68	-35.83	Average
2	0.285	24.38	0.10	0.10	24.58	60.68	-36.10	QP
3	0.365	12.39	0.10	0.10	12.59	48.61	-36.02	Average
4	0.365	26.60	0.10	0.10	26.80	58.61	-31.81	QP
5	0.406	13.08	0.10	0.10	13.28	47.73	-34.45	Average
6	0.406	31.35	0.10	0.10	31.55	57.73	-26.18	QP
7	0.516	13.76	0.11	0.10	13.97	46.00	-32.03	Average
8	0.516	22.69	0.11	0.10	22.90	56.00	-33.10	QP
9	0.731	13.08	0.20	0.10	13.38	46.00	-32.62	Average
10	0.731	22.76	0.20	0.10	23.06	56.00	-32.94	QP
11	1.197	6.84	0.23	0.10	7.17	46.00	-38.83	Average
12	1.197	20.15	0.23	0.10	20.48	56.00	-35.52	QP

## 7.4 20dB Occupied Bandwidth

**Test Requirement:** FCC Part 15 C Section 15.247 (a)(1)

**Test Method:** ANSI C63.10:2009 Clause 6.9.1

**Test Procedure:**

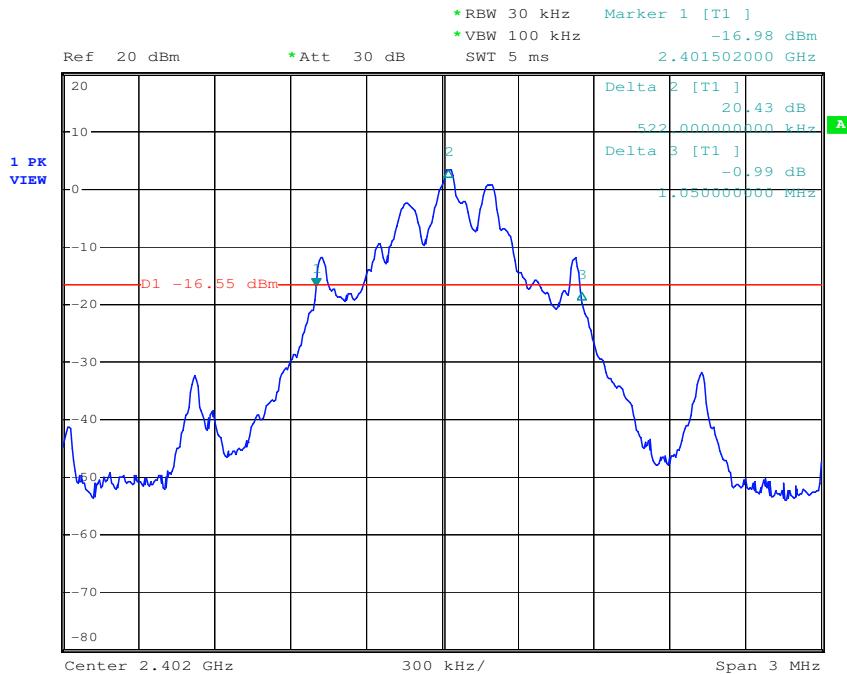
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: Span = approximately 2 to 3 times the 20dB bandwidth, centered on the hopping channel;
3. Set the spectrum analyzer: RBW 30kHz; VBW  $\geq$  RBW. Sweep = auto; Detector Function = Peak. Trace = Max Hold.
4. Mark the peak frequency and -20dB points.

**Test date**

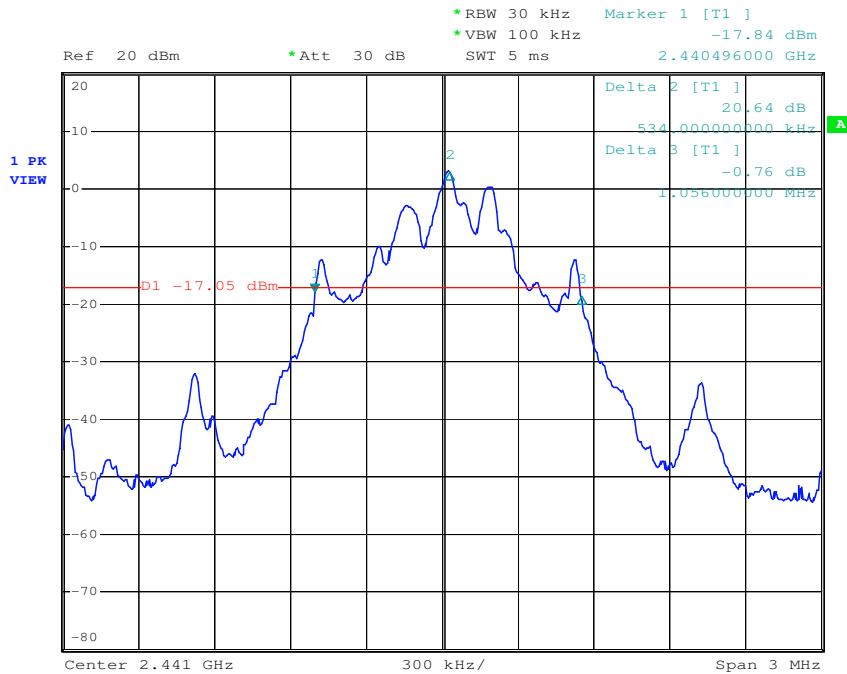
Test Channel	Channel Frequency (MHz)	Modulation	Bandwidth(MHz)
Low	2402	GFSK	1.050
Middle	2441	GFSK	1.056
High	2480	GFSK	1.050
Low	2402	$\pi/4$ DQPSK	1.116
Middle	2441	$\pi/4$ DQPSK	1.110
High	2480	$\pi/4$ DQPSK	1.116
Low	2402	8DPSK	1.182
Middle	2441	8DPSK	1.170
High	2480	8DPSK	1.170

**Test plot as follows:**

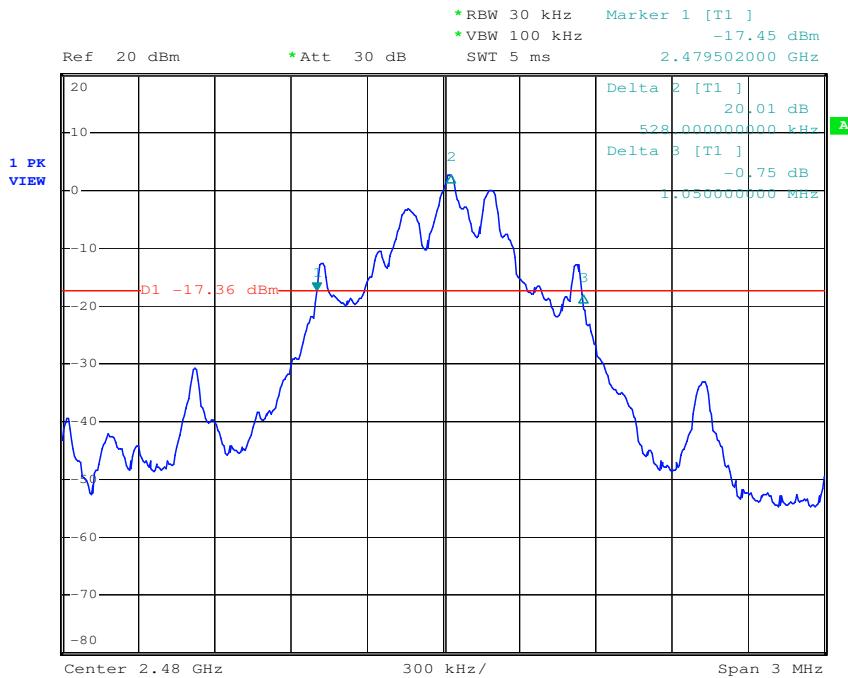
Test mode:	GFSK	Test channel:	Lowest
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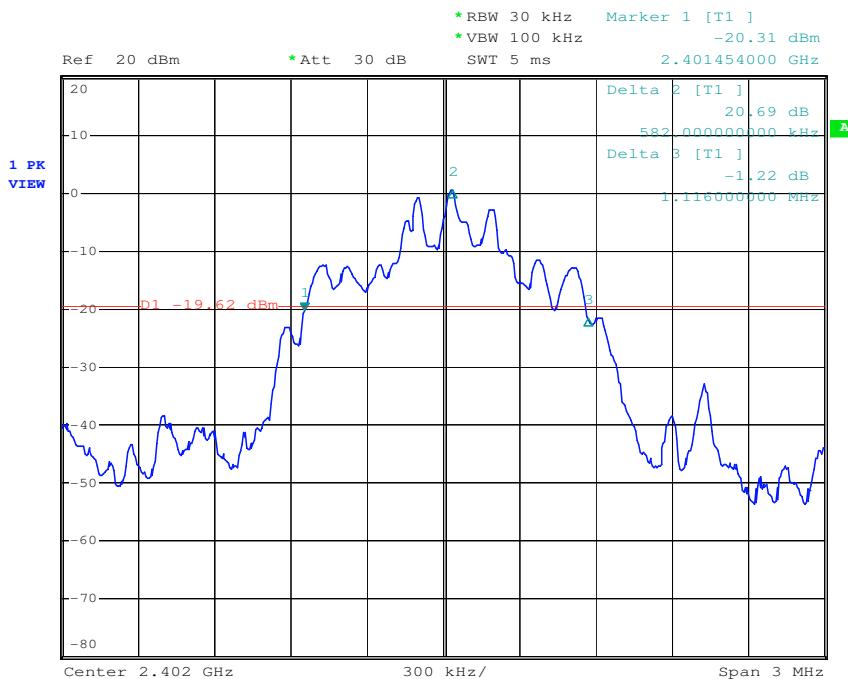
Test mode:	GFSK	Test channel:	Middle
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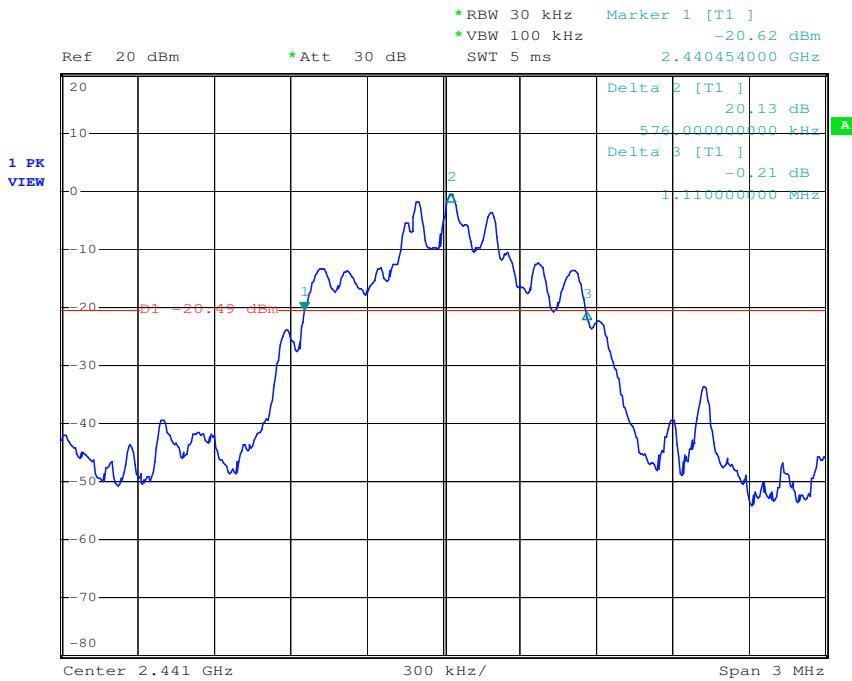
Test mode:	GFSK	Test channel:	Highest
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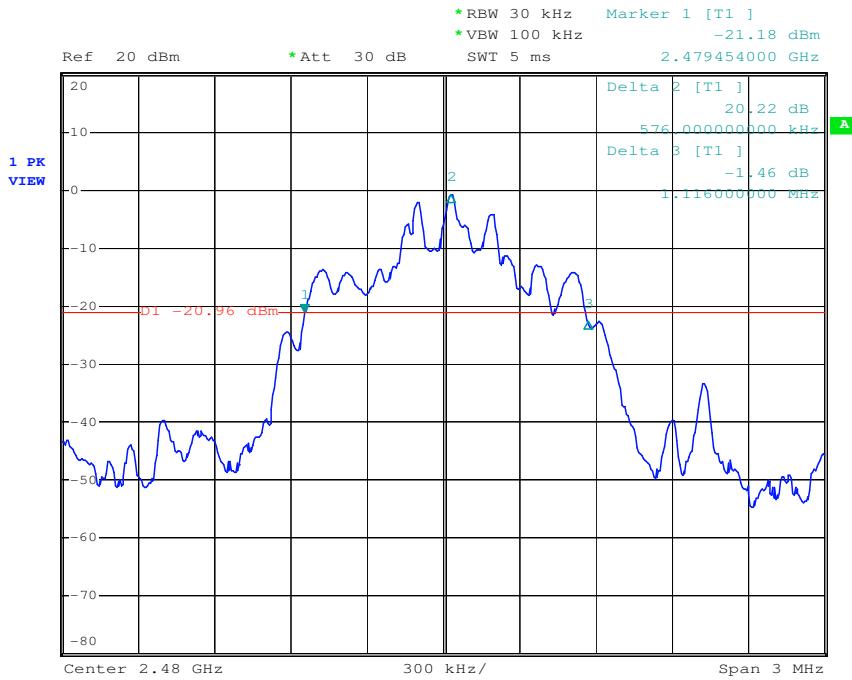
Test mode:	$\pi/4$ DQPSK	Test channel:	Lowest
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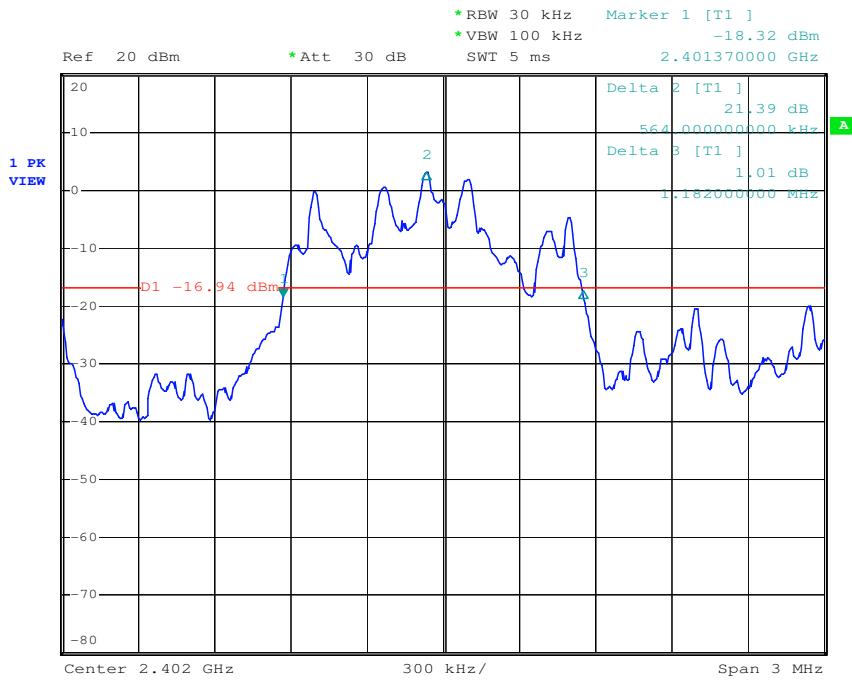
Test mode:	$\pi/4$ DQPSK	Test channel:	Middle
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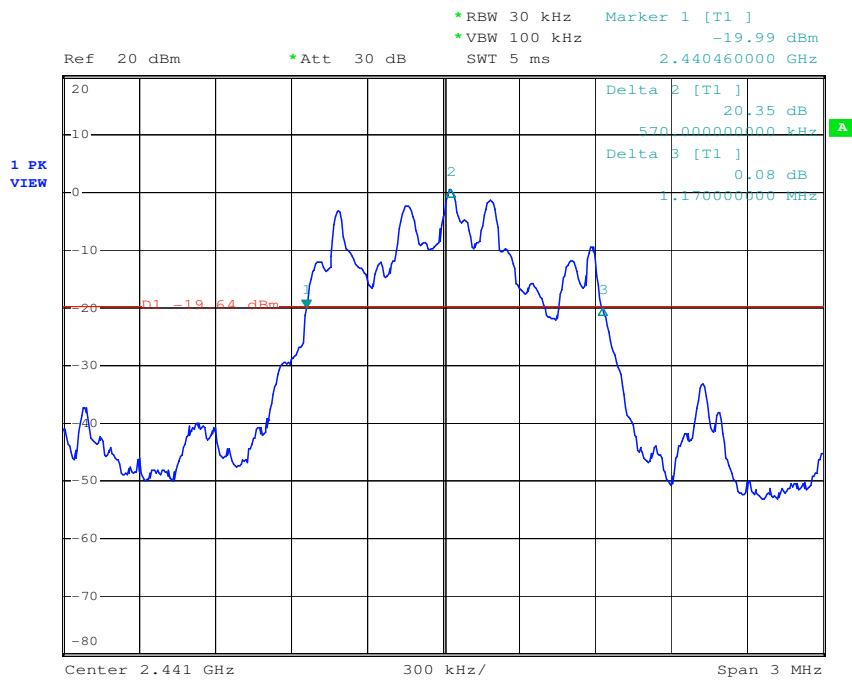
Test mode:	$\pi/4$ DQPSK	Test channel:	Highest
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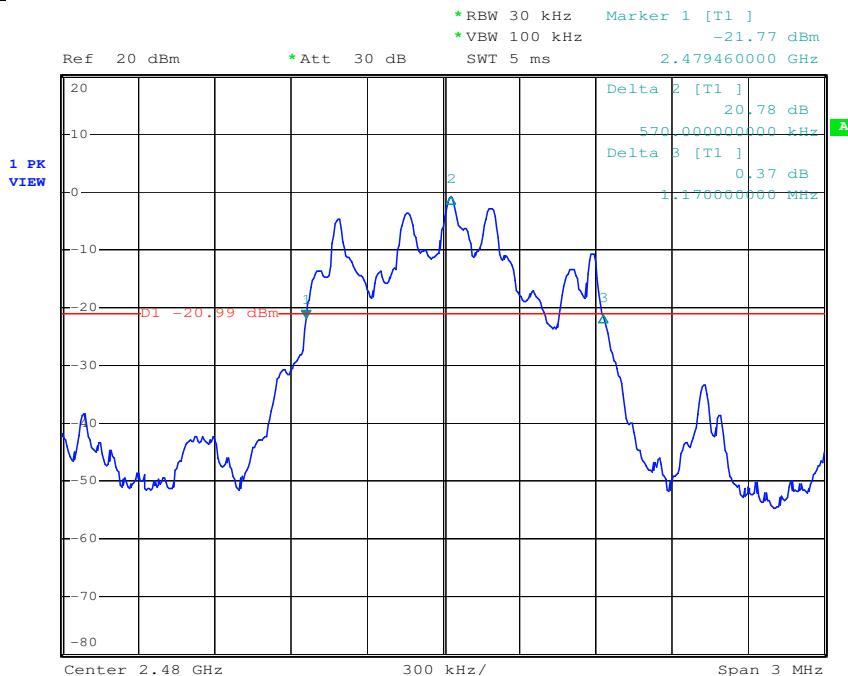
Test mode: 8DPSK Test channel: Lowest



Test mode:	8DPSK	Test channel:	Middle
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Test mode:	8DPSK	Test channel:	Highest
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## 7.5 Conducted Peak Output Power

**Test Requirement:** FCC Part 15.247 Section 15.247(b)(1)

**Test Method:** ANSI C64.10:2009 Section 6.10.1

**Test Result:** Pass

**Test Limit:** Regulation 15.247 (b)(1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

Refer to the result "Hopping channel number" of this document. The 0.125 watt (20.0dBm) limit applies.

**Test Procedure:**

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 1 MHz. VBW = 3 MHz. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, middle and highest channel individually. Record the max value.

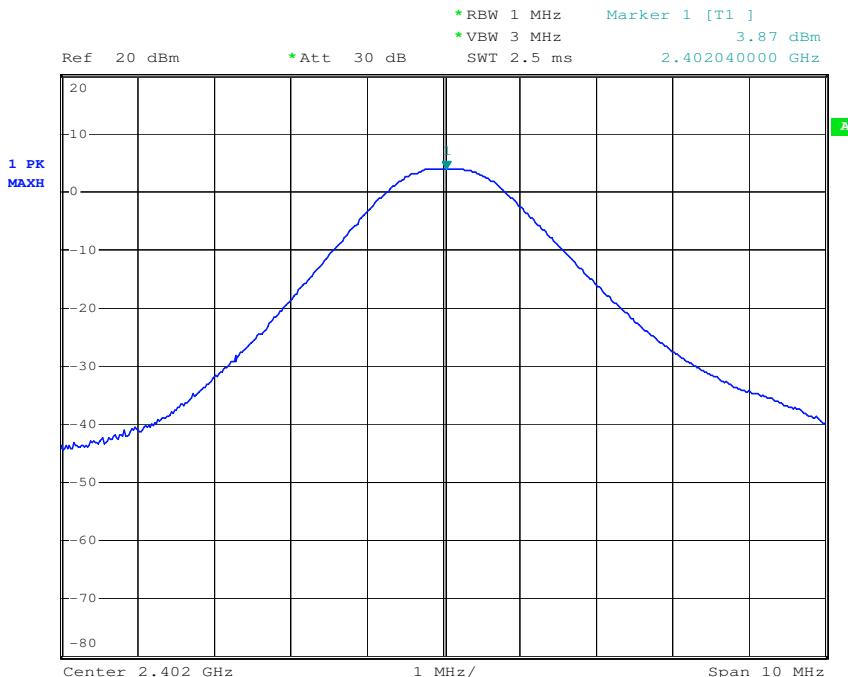
**Test Results record:**

Test Channel	Modulation	Fundamental Frequency (MHz)	Reading Power (dBm)	Cable Loss (dB)	Output Power (dBm)	Limit (dBm)	Result
Lowest	GFSK	2402	3.87	0.5	4.37	30	Pass
Middle	GFSK	2441	3.39	0.5	3.89	30	Pass
Highest	GFSK	2480	3.03	0.5	3.53	30	Pass
Lowest	$\pi/4$ DQPSK	2402	1.84	0.5	2.34	30	Pass
Middle	$\pi/4$ DQPSK	2441	0.98	0.5	1.48	30	Pass
Highest	$\pi/4$ DQPSK	2480	0.60	0.5	1.10	30	Pass
Lowest	8DPSK	2402	2.01	0.5	2.51	30	Pass
Middle	8DPSK	2441	0.91	0.5	1.41	30	Pass
Highest	8DPSK	2480	0.62	0.5	1.12	30	Pass

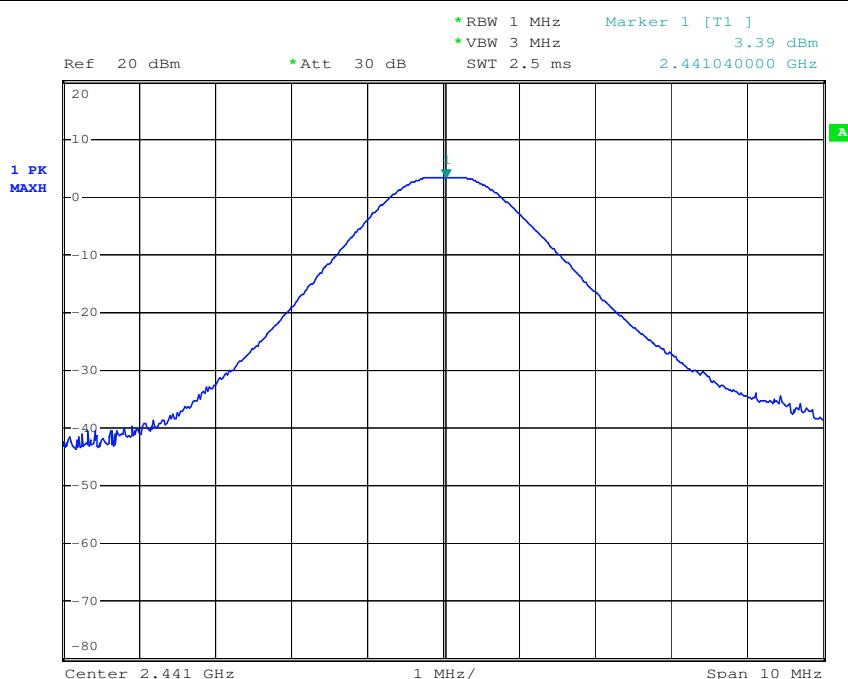
Remark: Output Power= Reading Power + Cable Loss

**Test result plot as follows:**

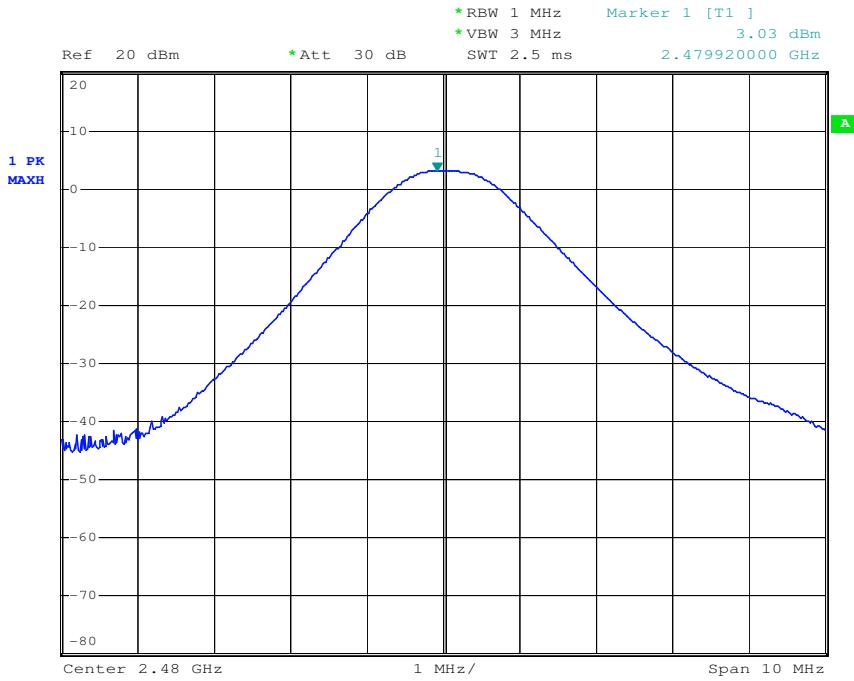
Test mode:	GFSK	Test channel:	Lowest
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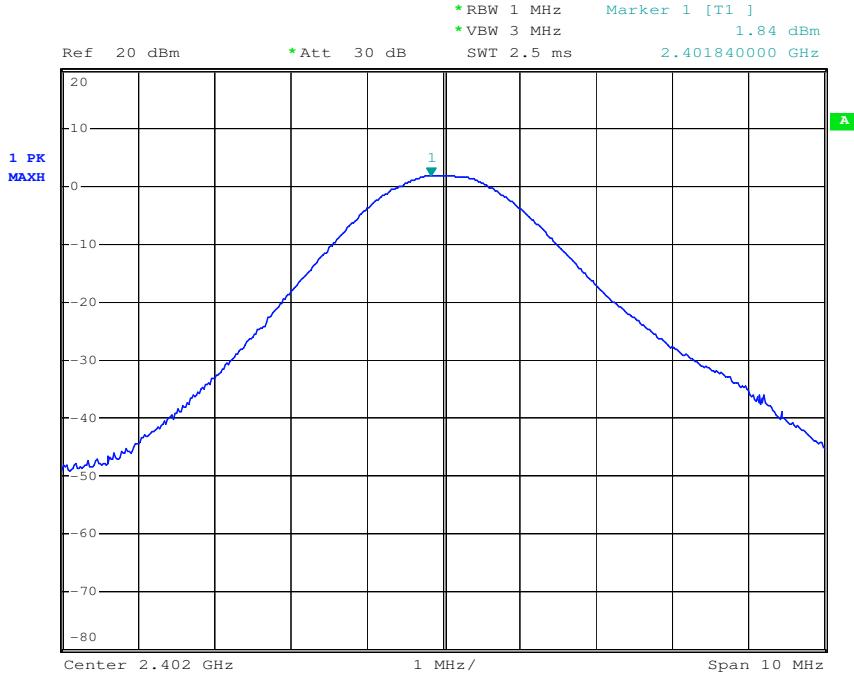
Test mode:	GFSK	Test channel:	Middle
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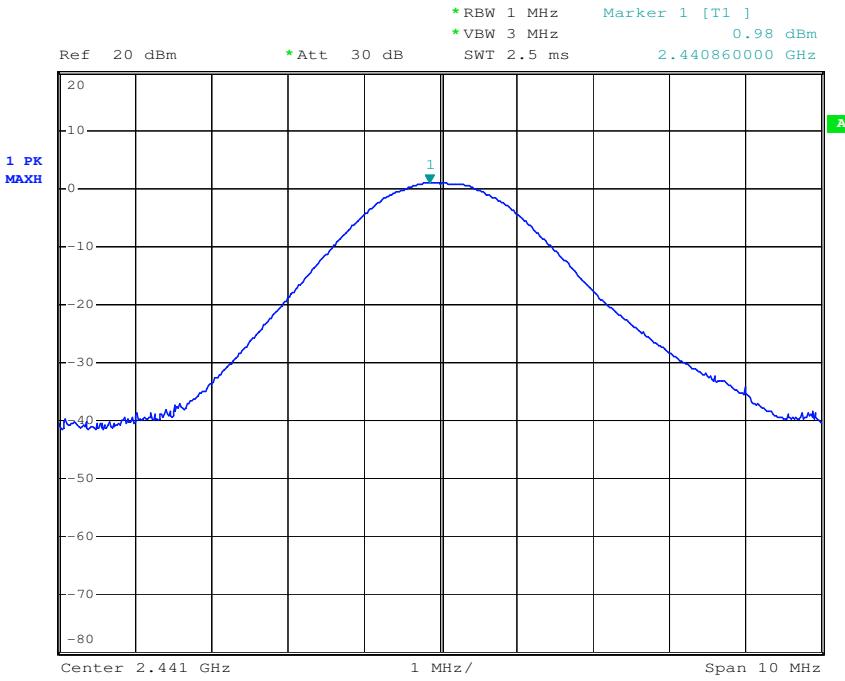
Test mode:	GFSK	Test channel:	Highest
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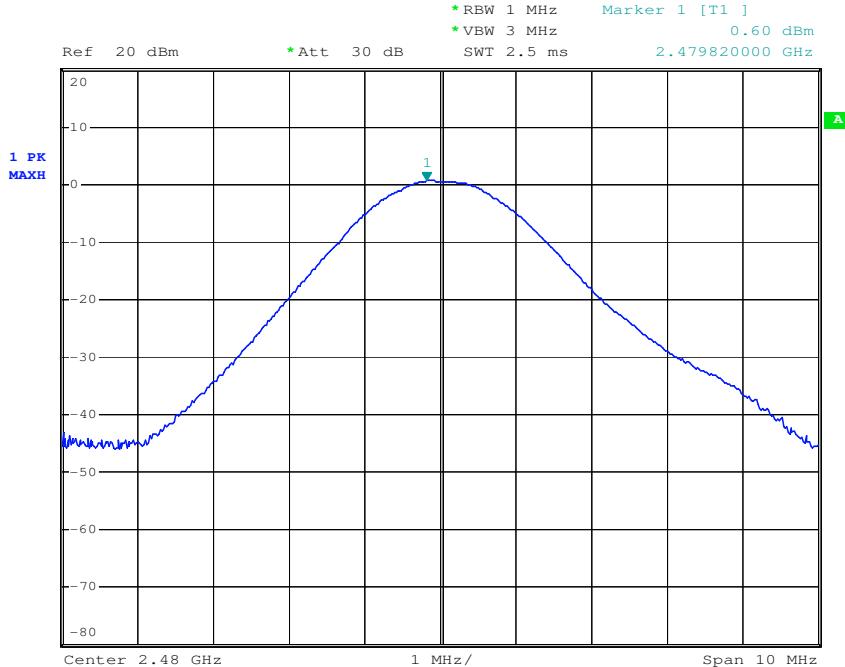
Test mode:	$\pi/4$ DQPSK	Test channel:	Lowest
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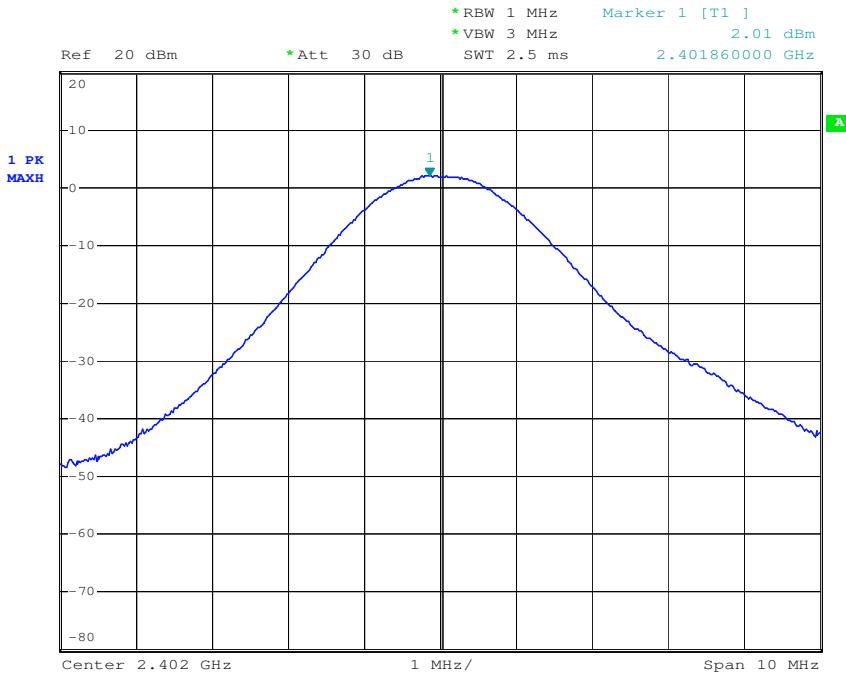
Test mode:	$\pi/4$ DQPSK	Test channel:	Middle
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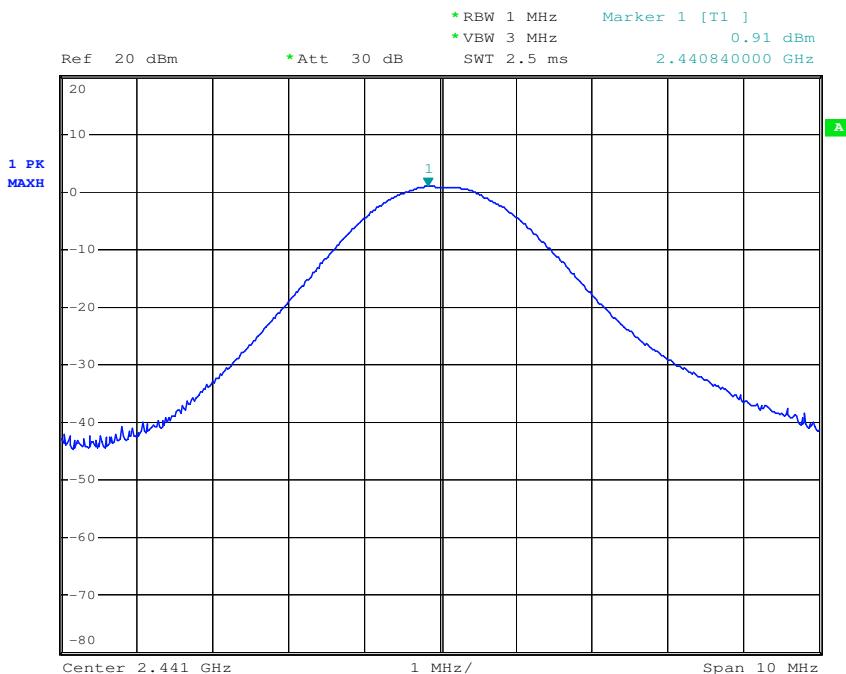
Test mode:	$\pi/4$ DQPSK	Test channel:	Highest
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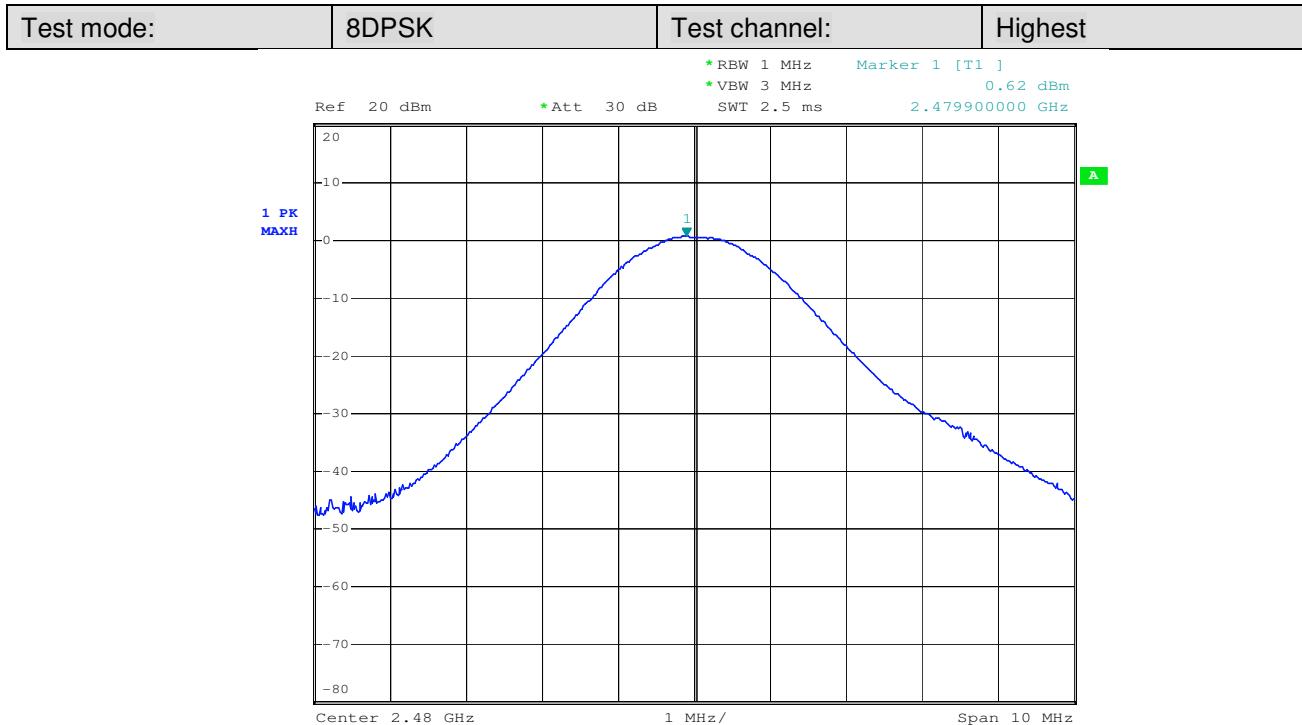


Test mode:	8DPSK	Test channel:	Lowest
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Test mode:	8DPSK	Test channel:	Middle
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## 7.6 Carrier Frequencies Separated

**Test Requirement:** FCC Part 15 C Section 15.247 (a)(1)

**Test Method:** ANSI C63.10:2009 Clause 7.7.2

**Limit:** 0.025MHz or 2/3 of the 20dB bandwidth (whichever is greater)

**Test result:** Pass

**Test Procedure:**

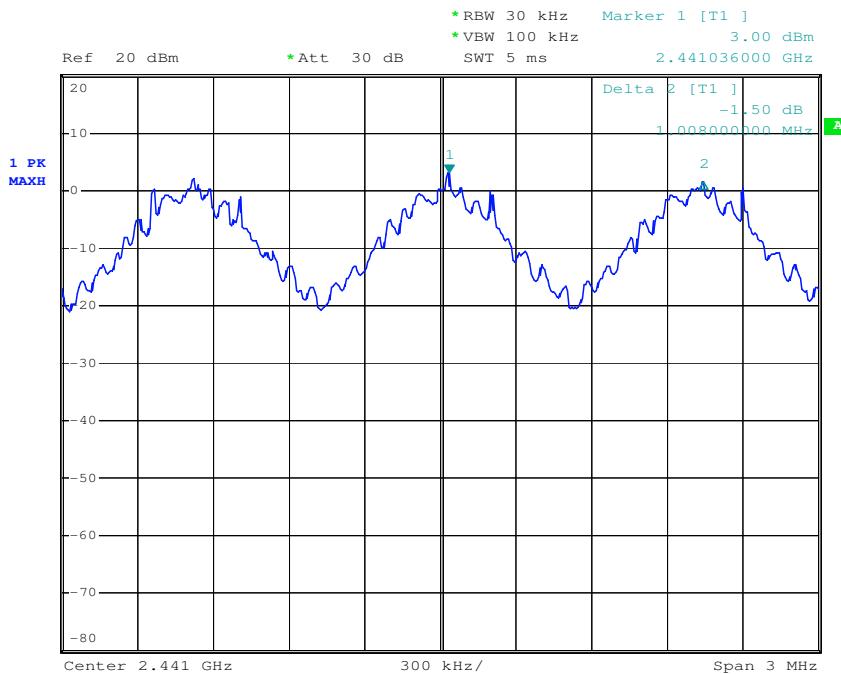
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW =100 kHz. VBW  $\geq$  RBW, Span = 3MHz. Sweep = auto; Detector Function = Peak. Trace = Maxhold.
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section. Submit this plot.

Test Channel	Modulation	Carrier Frequencies Separated (MHz)	Limit (25kHz or two-thirds of the 20 dB bandwidth)	Results
Middle Channels (channel 39 and channel 40)	GFSK	1.008	25kHz/704kHz	PASS
Middle Channels (channel 39 and channel 40)	$\pi/4$ DQPSK	1.002	25kHz/744kHz	PASS
Middle Channels (channel 39 and channel 40)	8DPSK	1.002	25kHz/788kHz	PASS

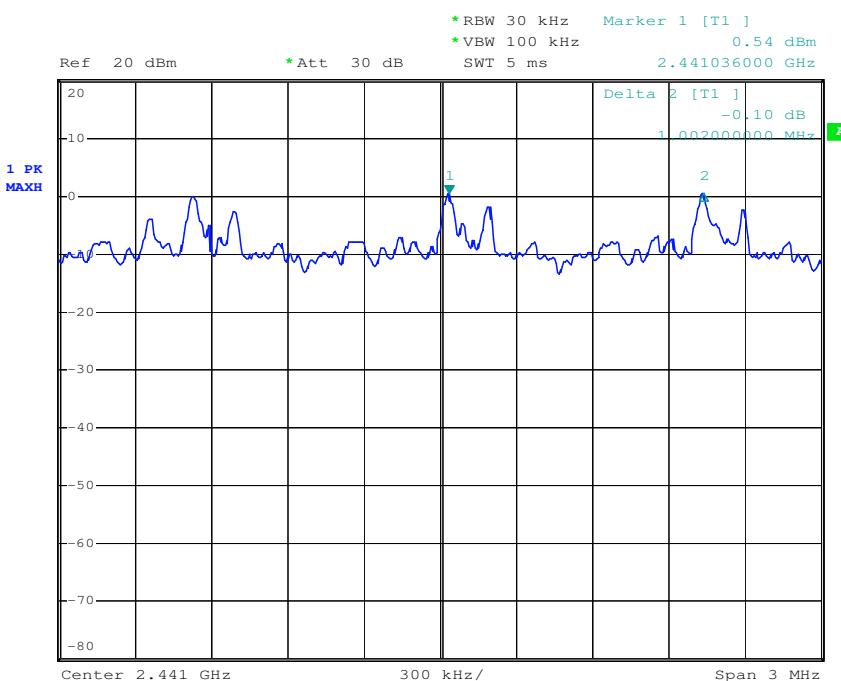
Note: 20dB bandwidth reference Section 7.4

**Test plot as follows:**

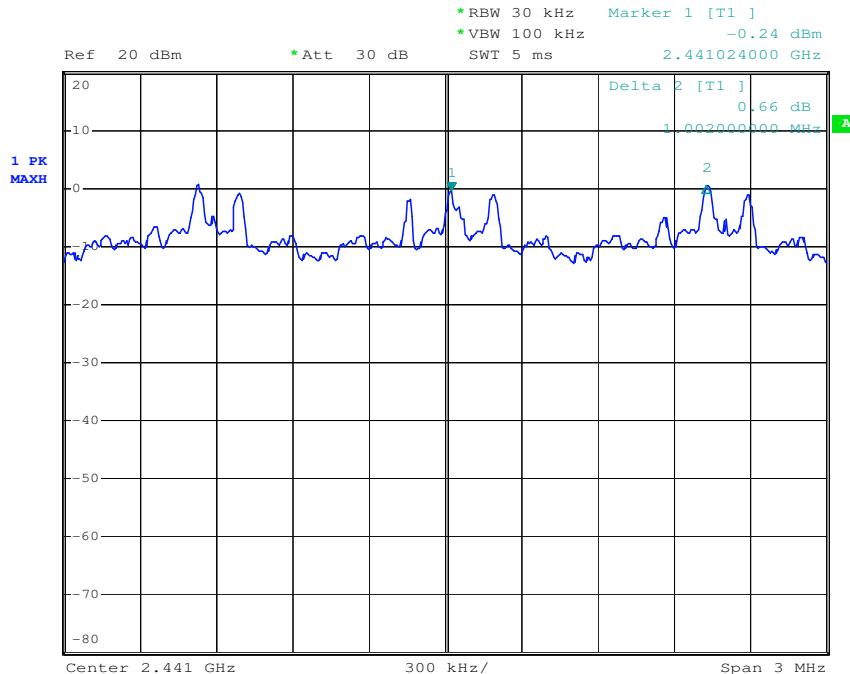
Test mode:	GFSK	Test channel:	Middle
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Test mode:	$\pi/4$ DQPSK	Test channel:	Middle
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Test mode:	8DPSK	Test channel:	Middle
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## 7.7 Hopping Channel Number

**Test Requirement:** FCC Part15 C Section 15.247(b)

**Test Method:** ANSI C63.10:2009 Clause 7.7.3

**Limit:** At least 15 channels

**Test Result:** Pass

**Test Mode:** Hopping transmitting with all kind of modulation

**Test Procedure:**

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 100 kHz. VBW  $\geq$  300 kHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.
4. Set the spectrum analyzer: start frequency = 2400MHz. stop frequency = 2483.5MHz. Submit the test result graph.

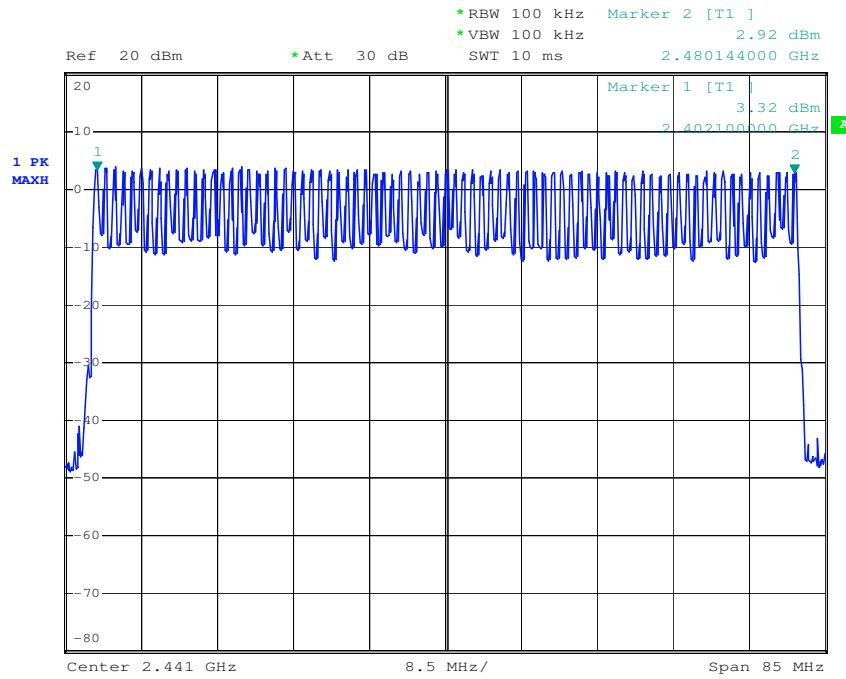
### Measurement Data

Mode	Hopping channel numbers	Limit	Results
GFSK	79	$\geq$ 15	Pass
$\pi/4$ DQPSK	79	$\geq$ 15	Pass
8DPSK	79	$\geq$ 15	Pass

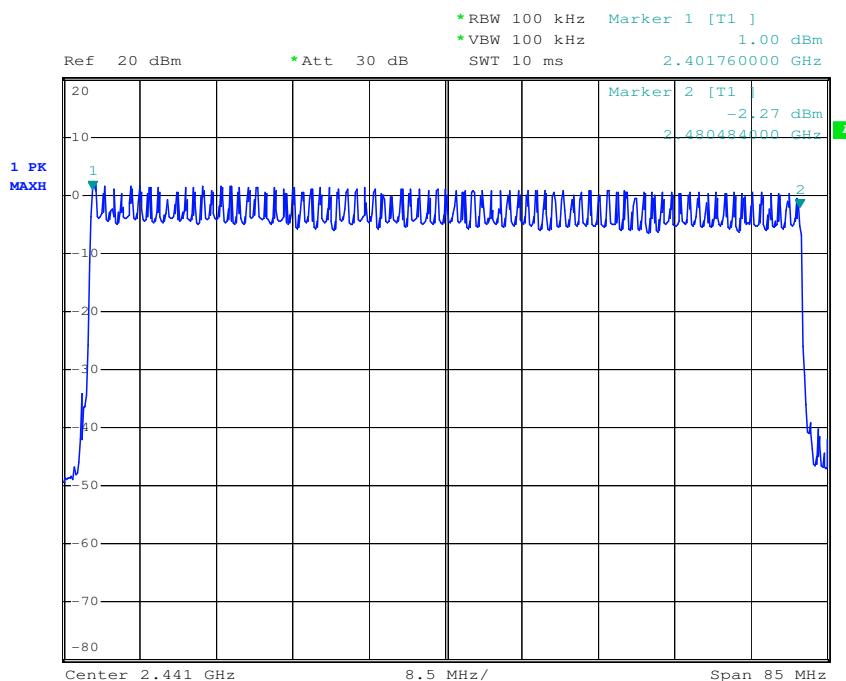
**Test plot as follows:**

Test mode:

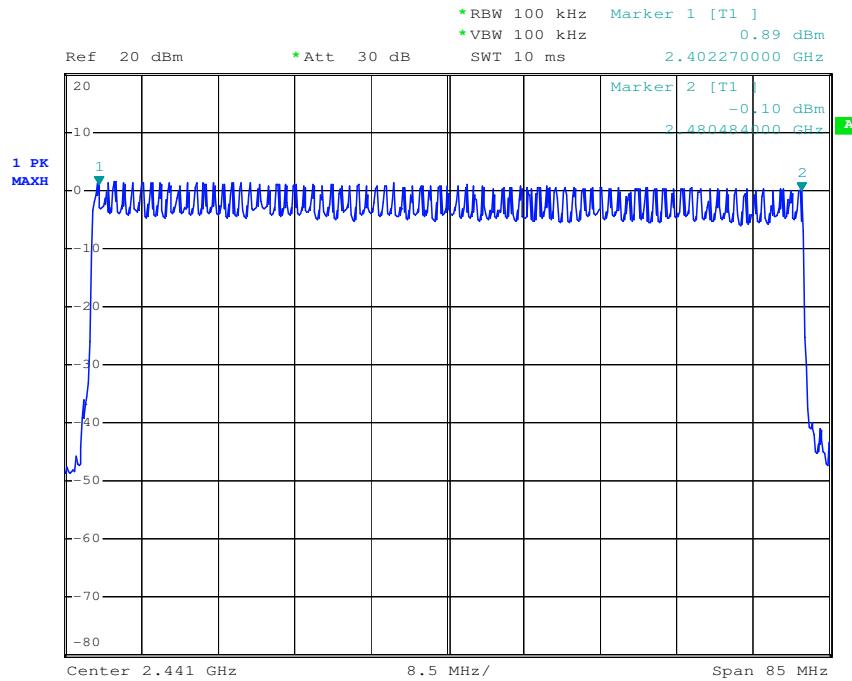
GFSK



Test mode:

 $\pi/4$ DQPSK

Test mode:	8DPSK
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## 7.8 Dwell Time

**Test Requirement:** FCC Part 15 C Section 15.247(a)(1)

**Test Method:** ANSI C63.10:2009 Clause 7.7.4

**Limit:** Regulation 15.247(a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 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.

**Test Status:** Hopping transmitting with all kind of modulation.

**Test Result:** Pass

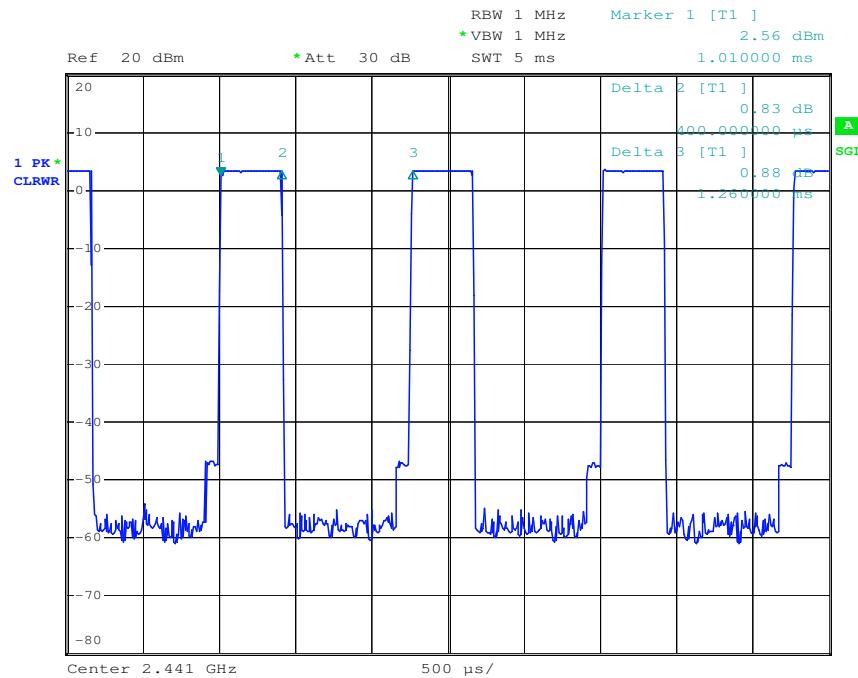
**Test Procedure:**

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set spectrum analyzer span = 0. centered on a hopping channel;
3. Use Emission width \* No. of Hopping Channels in 31.6s to determine the dwell time.

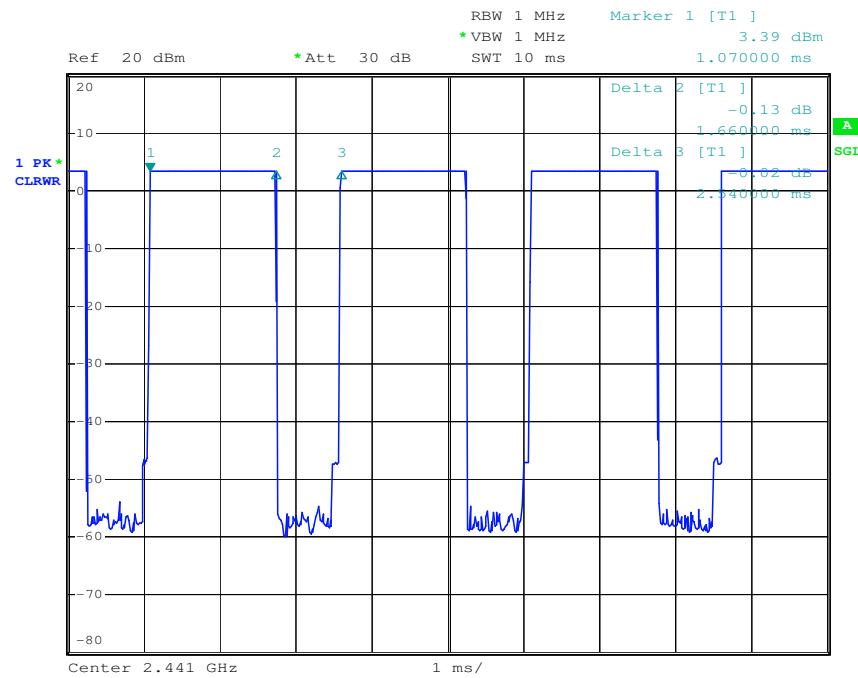
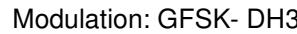
Frequency (MHz)	Modulation	Packet	Emission Width (ms)	Number of Hopping Channel in 31.6s	Average Time of Occupancy(s)	Limit(s)	Result
2441	GFSK	DH1	1.260	198	0.249	0.4	Pass
		DH3	2.540	229	0.582	0.4	Pass
		DH5	3.770	111	0.418	0.4	Pass
2441	$\pi/4$ DQPSK	2DH1	1.250	212	0.265	0.4	Pass
		2DH3	2.510	111	0.279	0.4	Pass
		2DH5	2.510	90	0.226	0.4	Pass
2441	8DPSK	3DH1	1.250	121	0.151	0.4	Pass
		3DH3	2.510	99	0.248	0.4	Pass
		3DH5	3.770	105	0.396	0.4	Pass

**Test plot as follows::**

Frequency 2441MHz:

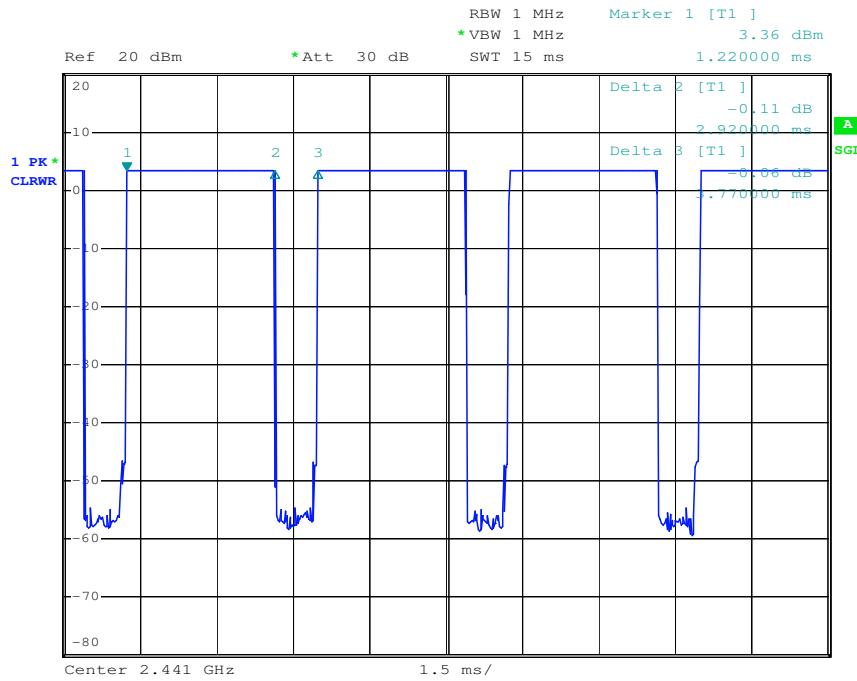


Frequency 2441MHz:

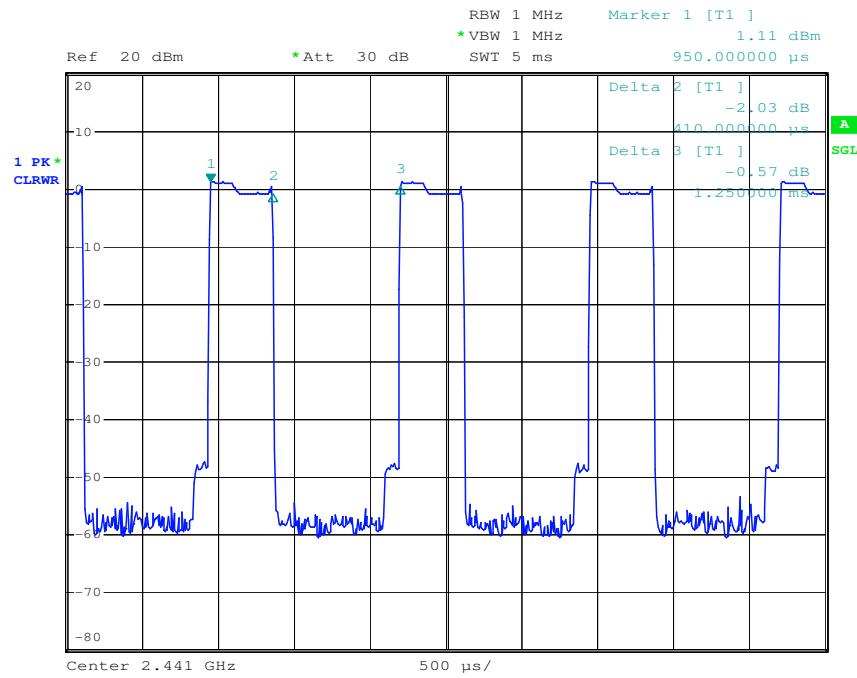


Frequency 2441MHz:

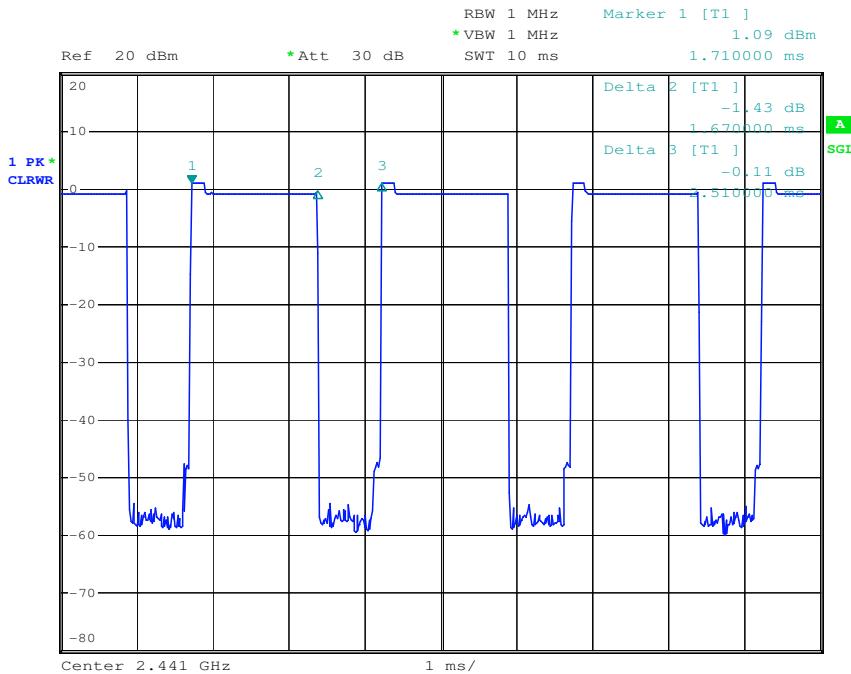
Modulation: GFSK- DH5



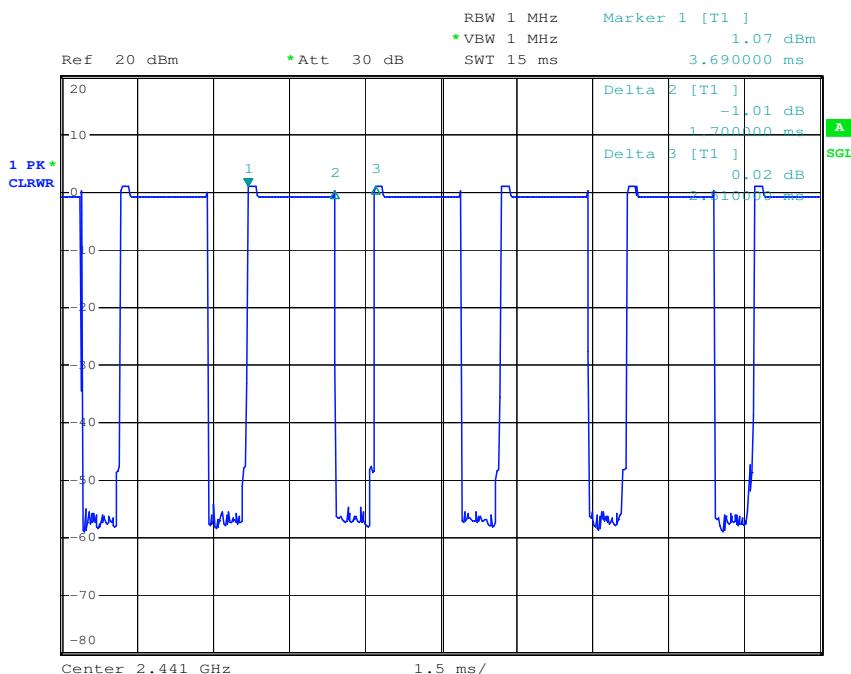
Frequency 2441MHz:

Modulation:  $\pi/4$ DQPSK-2DH1


Frequency 2441MHz:

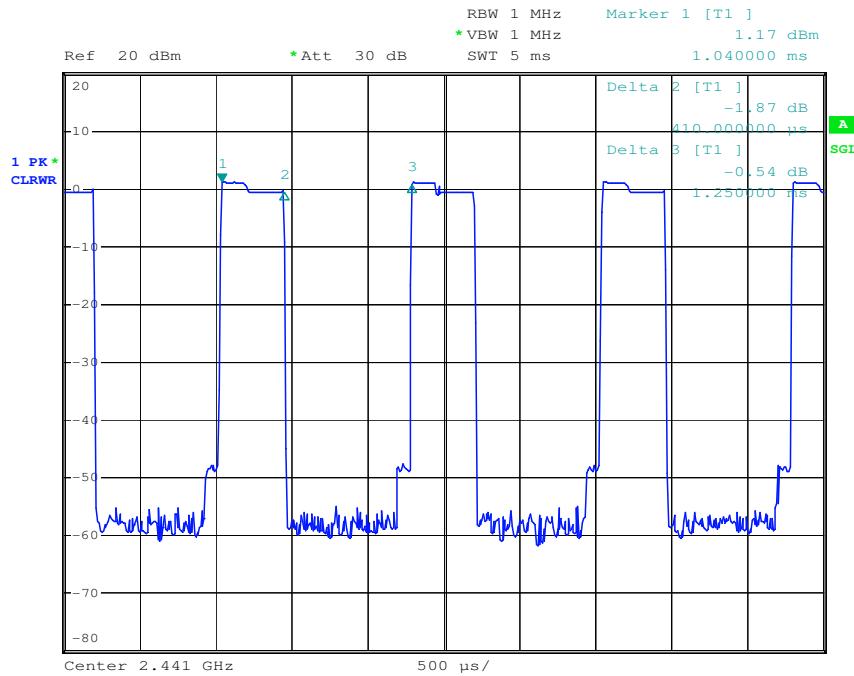
Modulation:  $\pi/4$ DQPSK-2DH3


Frequency 2441MHz:

Modulation:  $\pi/4$ DQPSK-2DH5


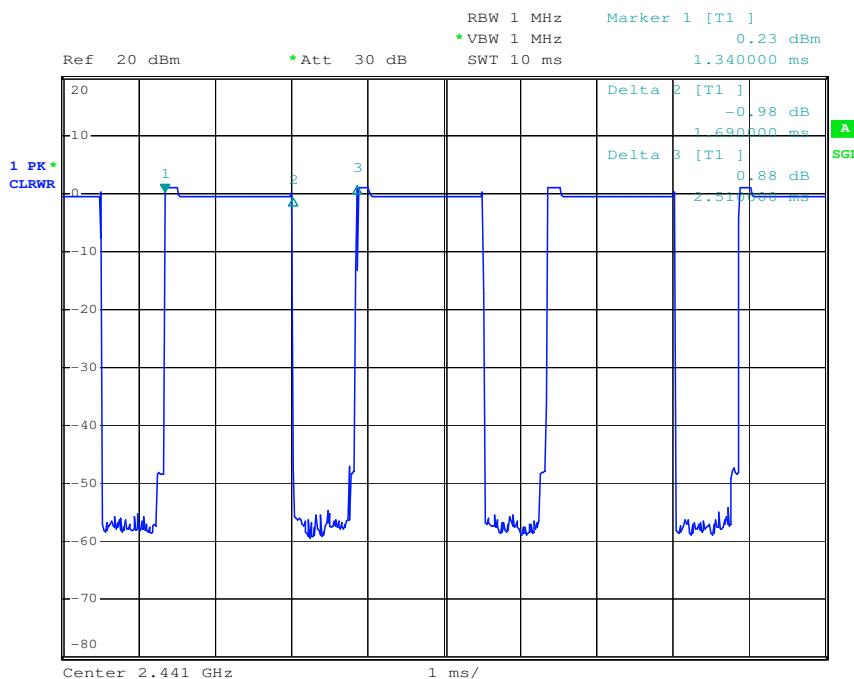
Frequency 2441MHz:

Modulation: 8DPSK-3DH1



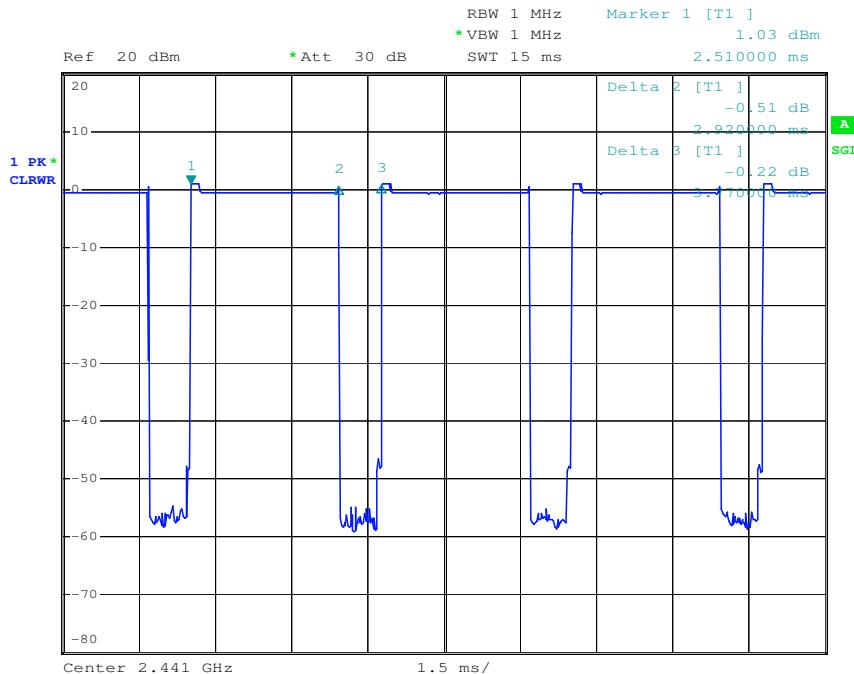
Frequency 2441MHz:

Modulation: 8DPSK-3DH3



Frequency 2441MHz:

Modulation: 8DPSK-3DH5



## 7.9 Conducted Spurious Emissions

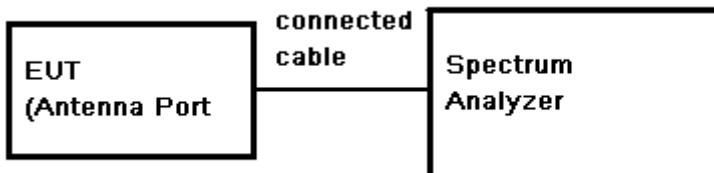
**Test Requirement:** FCC Part 15 Section 15.247(d)

**Test Method:** ANSI C63.10:2009 Clause 7.7.10

**Limit:** (d) In any 100 kHz 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 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

**Test Result:** Pass

**Test Configuration:**



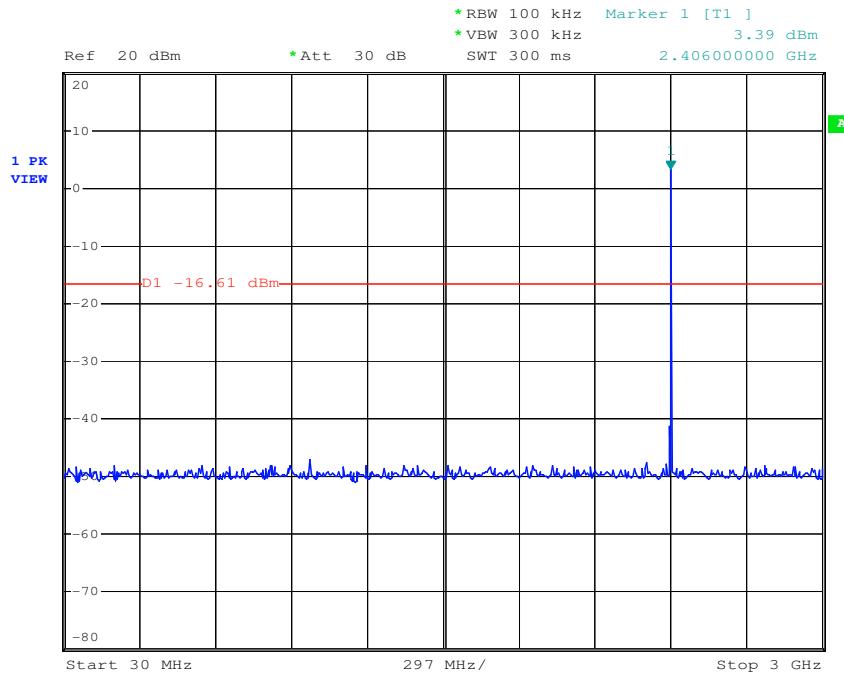
**Test Procedure:**

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 100KHz. VBW >= RBW. Sweep = auto; Detector Function = Peak (Max. hold).

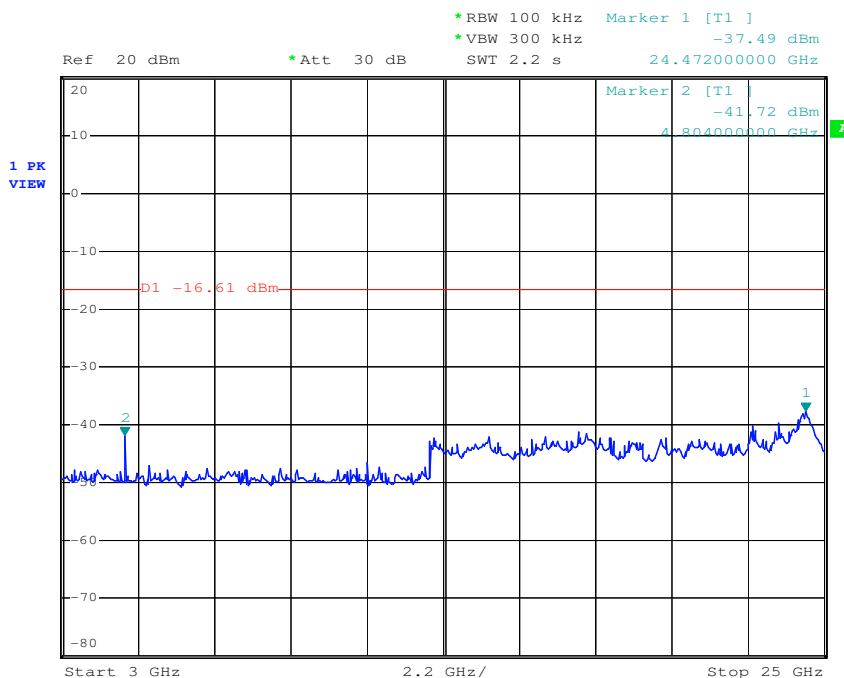
**Test plot as follows:**

Test mode:	GFSK	Test channel:	Lowest
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30MHz to 3GHz:

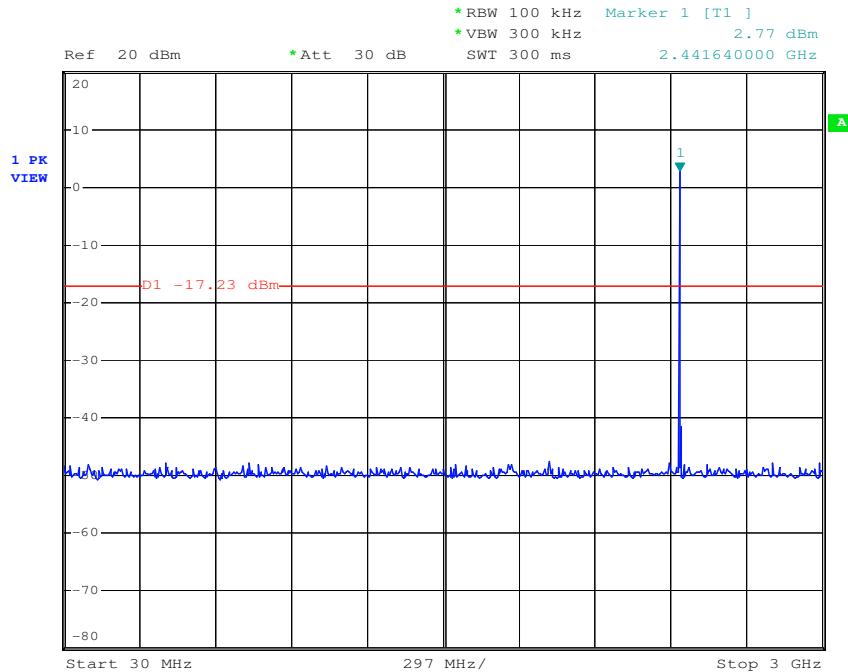


3GHz to 25GHz:

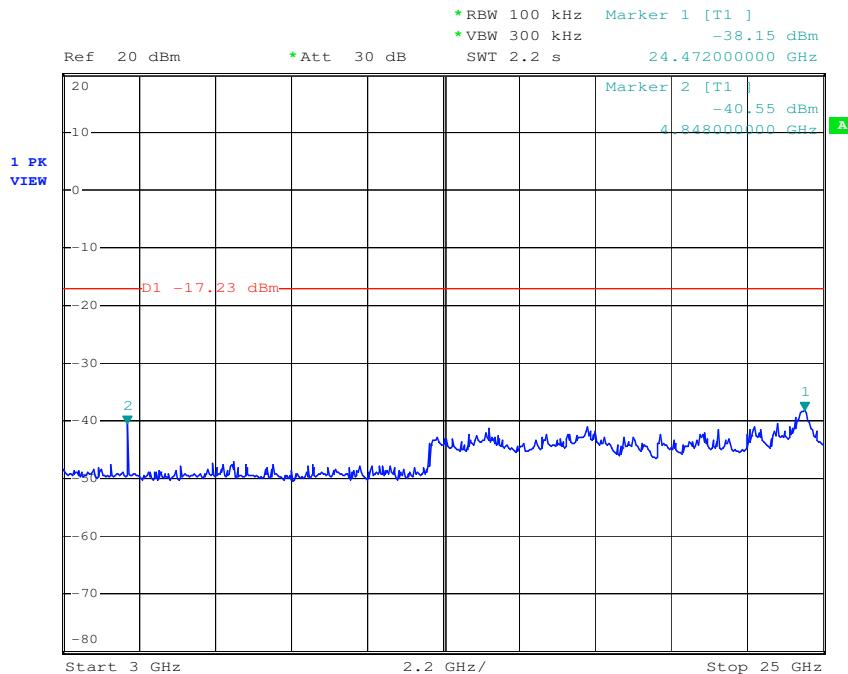


Test mode:	GFSK	Test channel:	Middle
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30MHz to 3GHz:

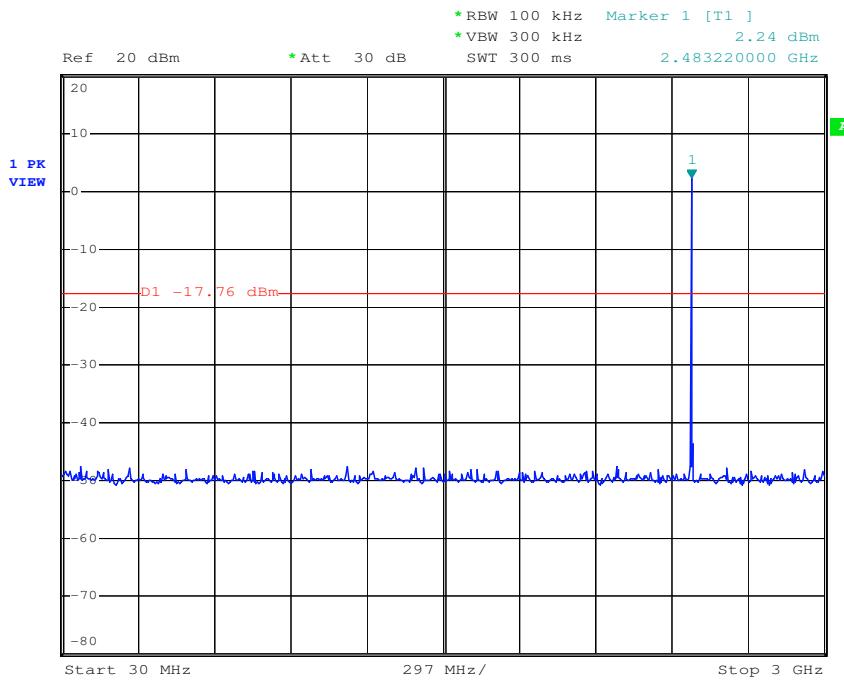


3GHz to 25GHz:

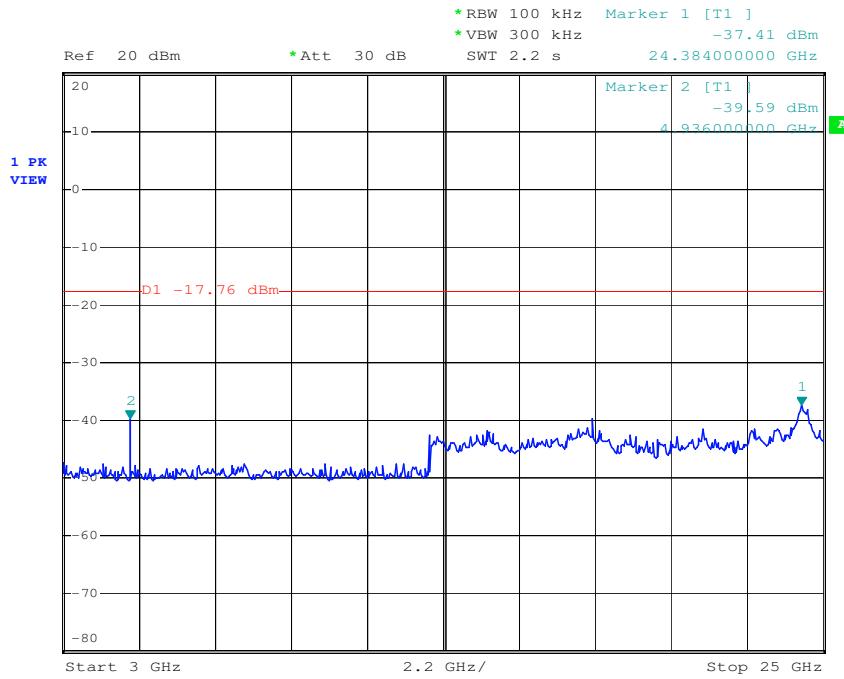


Test mode:	GFSK	Test channel:	Highest
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30MHz to 3GHz:

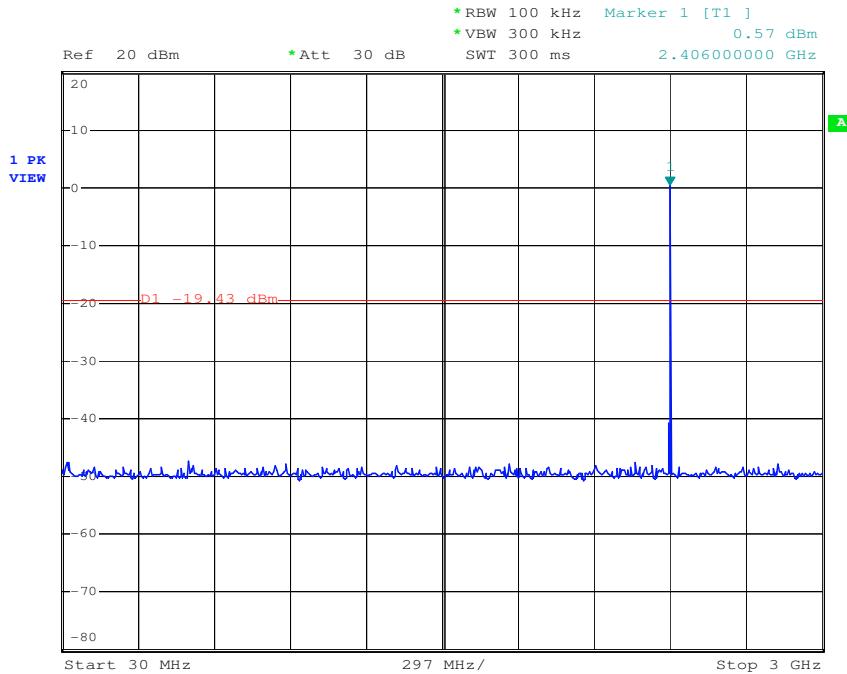


3GHz to 25GHz:

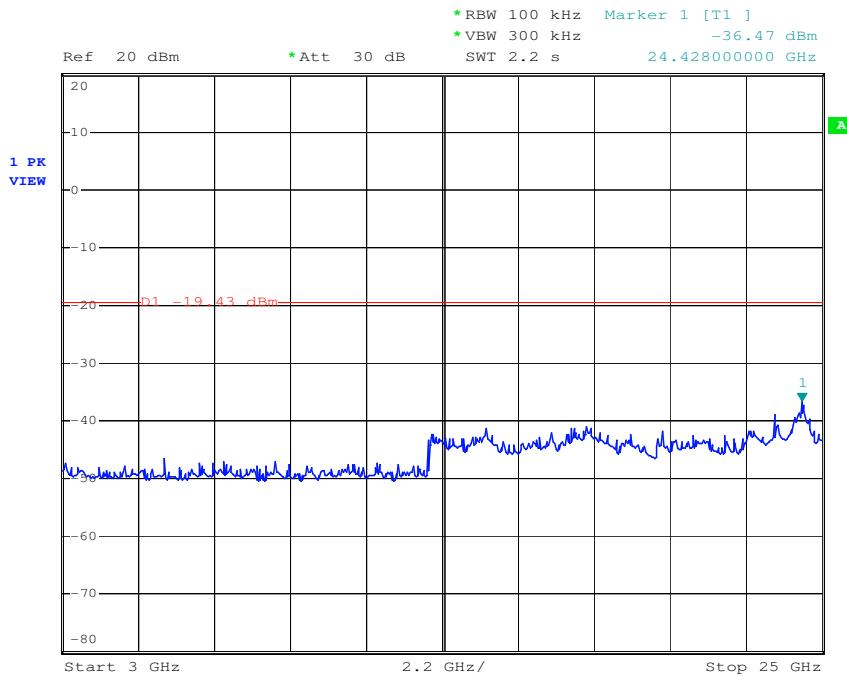


Test mode:	$\pi/4$ DQPSK	Test channel:	Lowest
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30MHz to 3GHz:

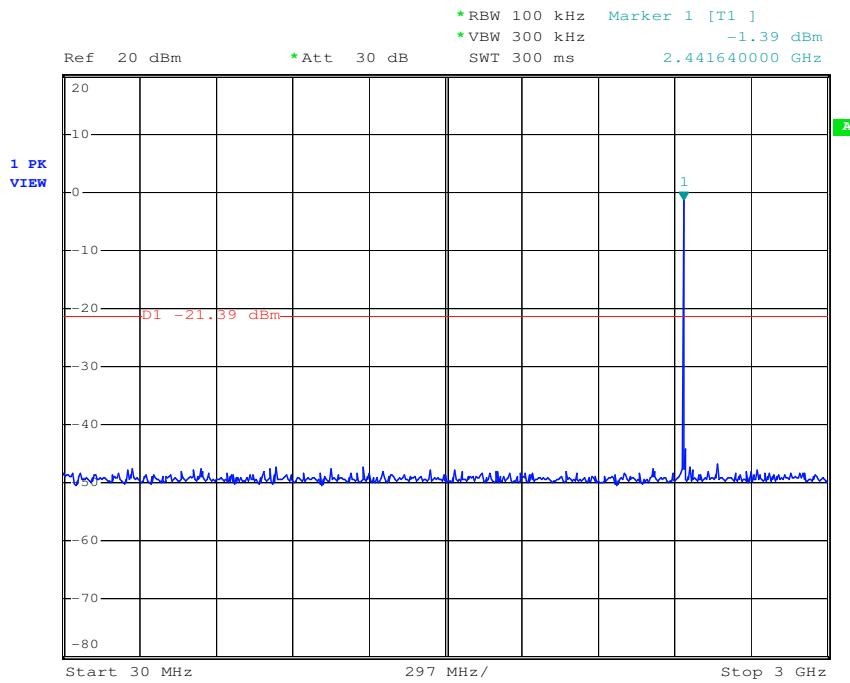


3GHz to 25GHz:

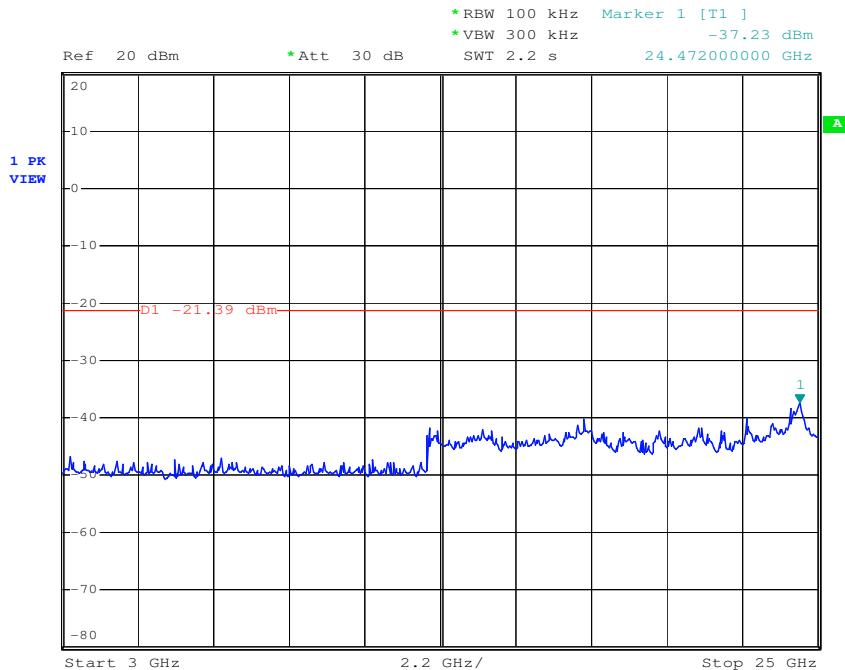


Test mode:	$\pi/4$ DQPSK	Test channel:	Middle
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30MHz to 3GHz:

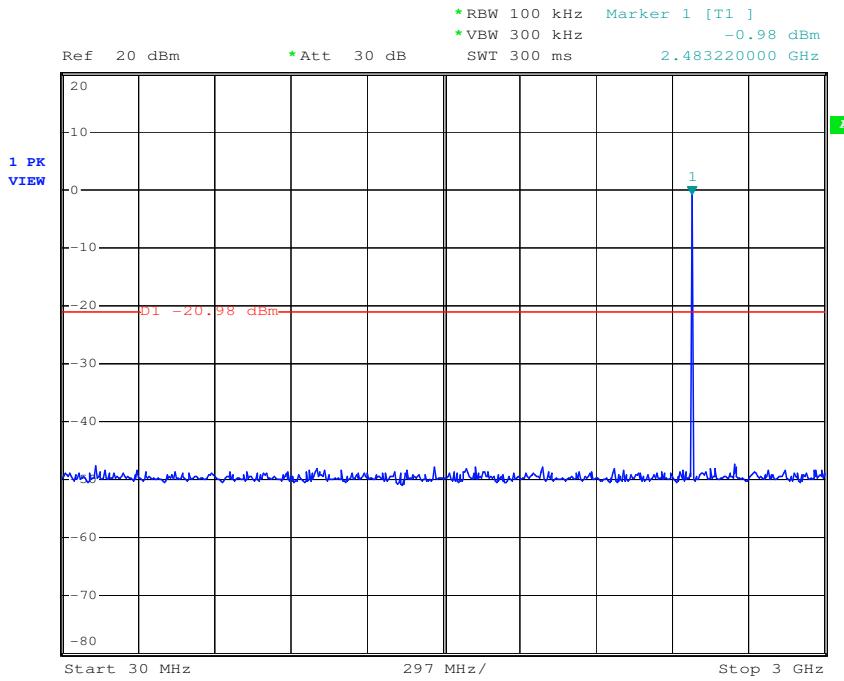


3GHz to 25GHz:

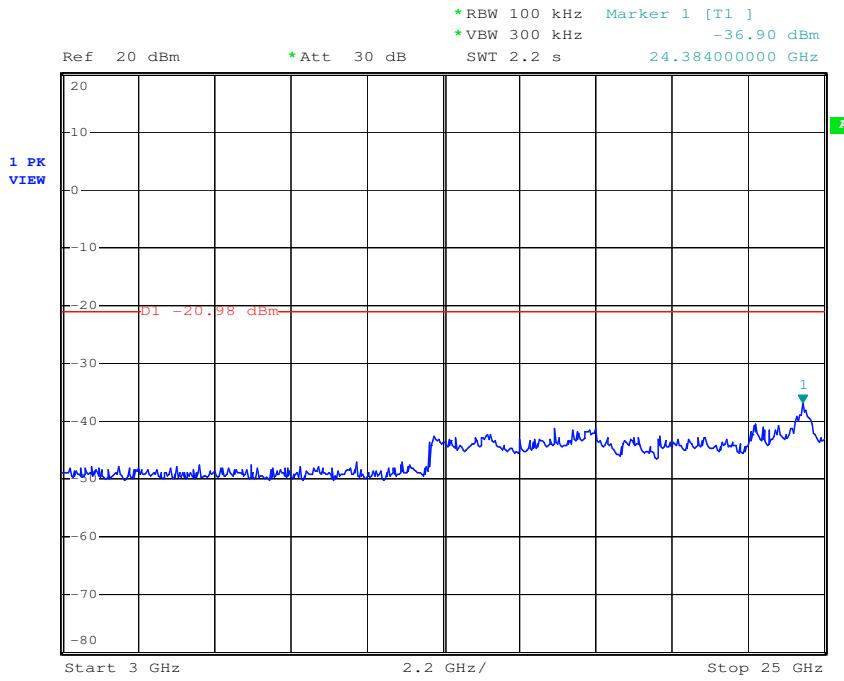


Test mode:	$\pi/4$ DQPSK	Test channel:	Highest
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30MHz to 3GHz:

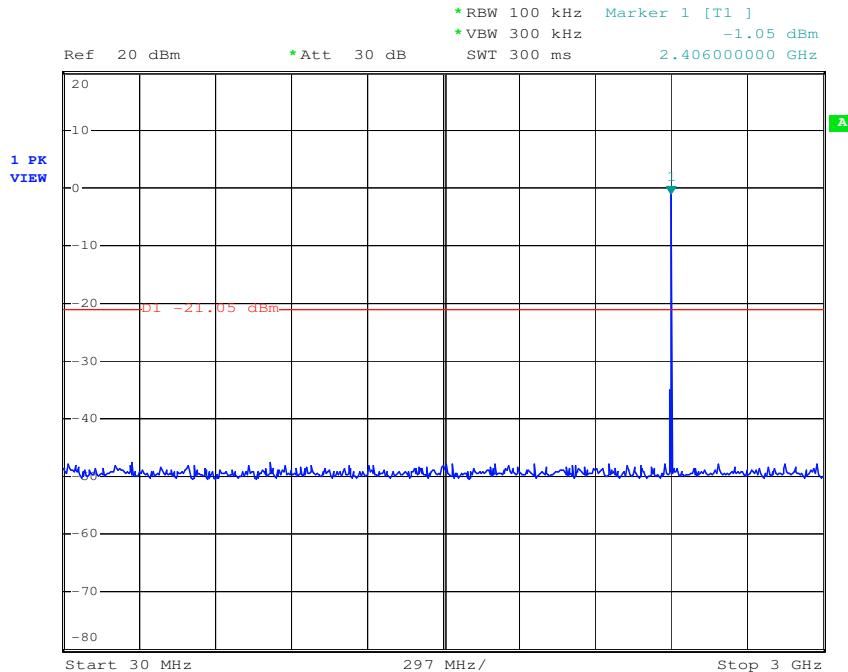


3GHz to 25GHz:

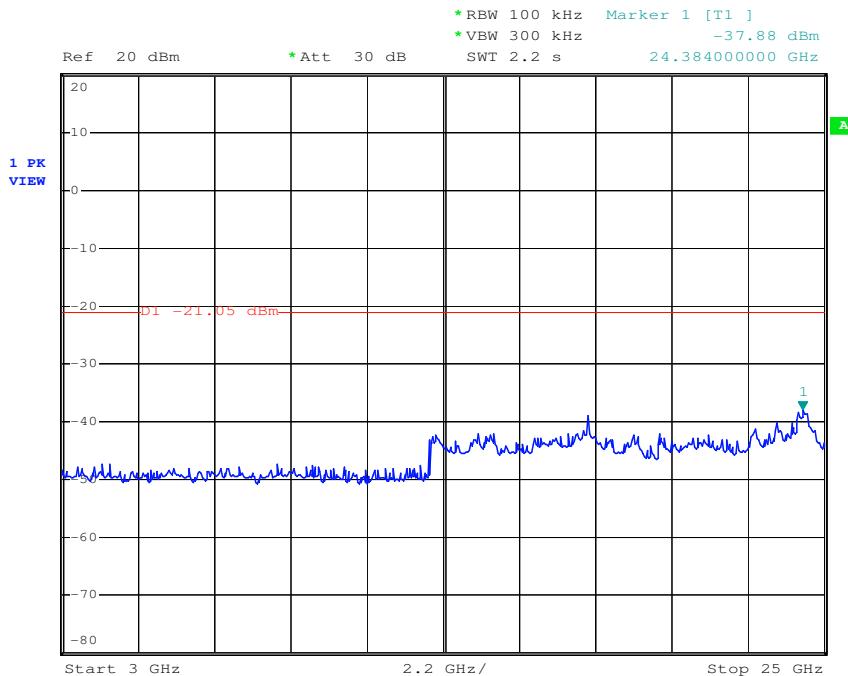


Test mode:	8DPSK	Test channel:	Lowest
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30MHz to 3GHz:

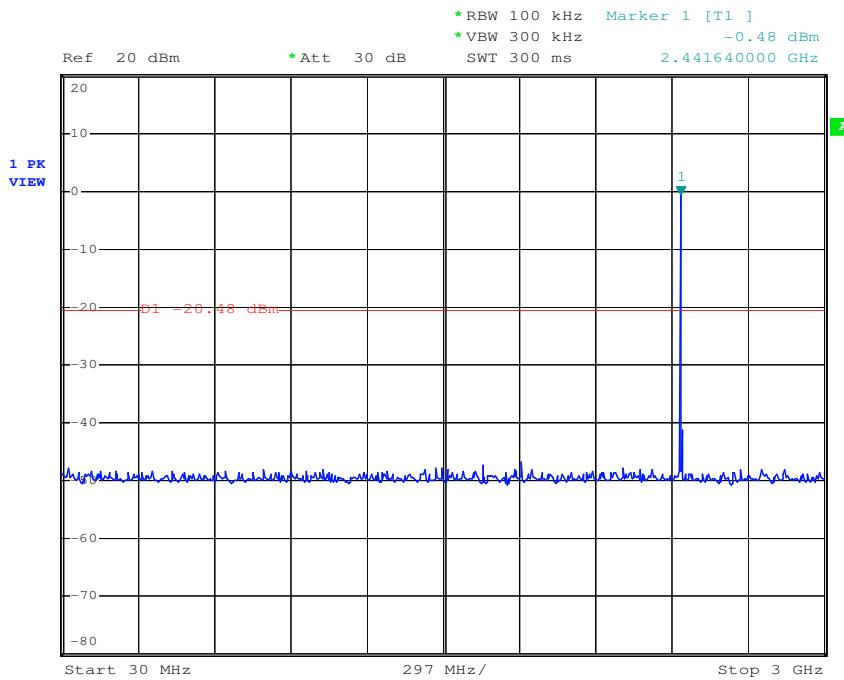


3GHz to 25GHz:

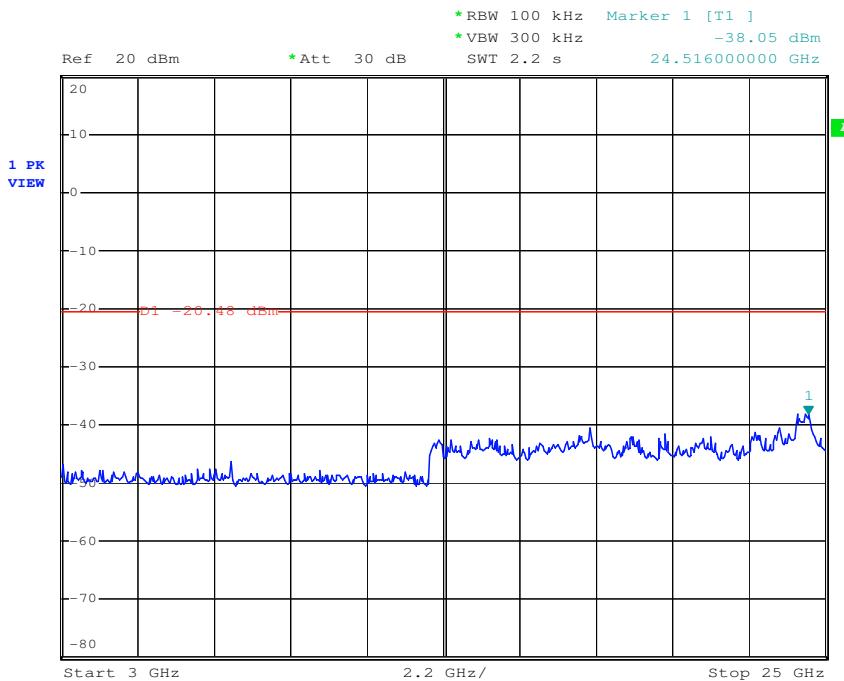


Test mode:	8DPSK	Test channel:	Middle
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30MHz to 3GHz:

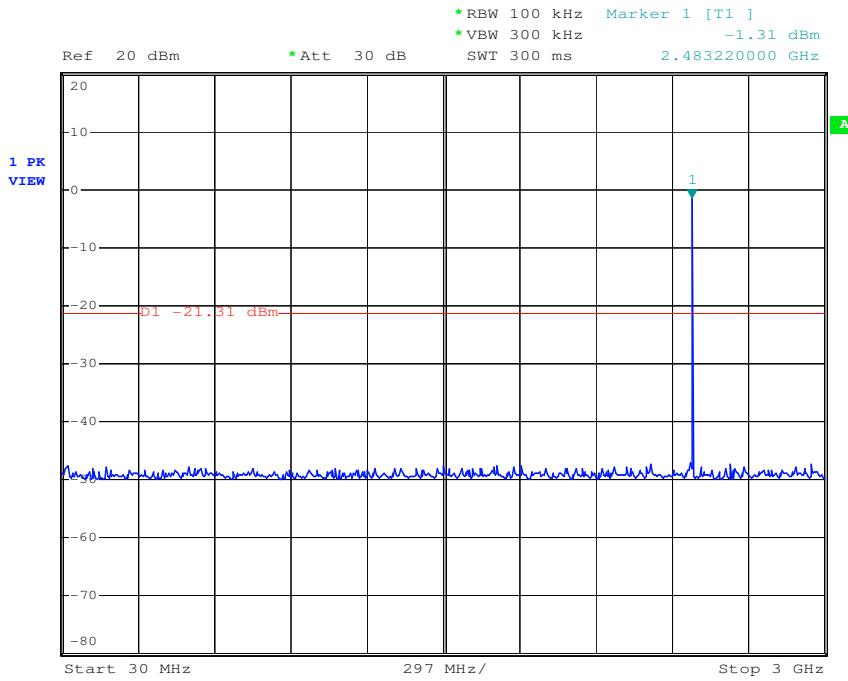


3GHz to 25GHz:

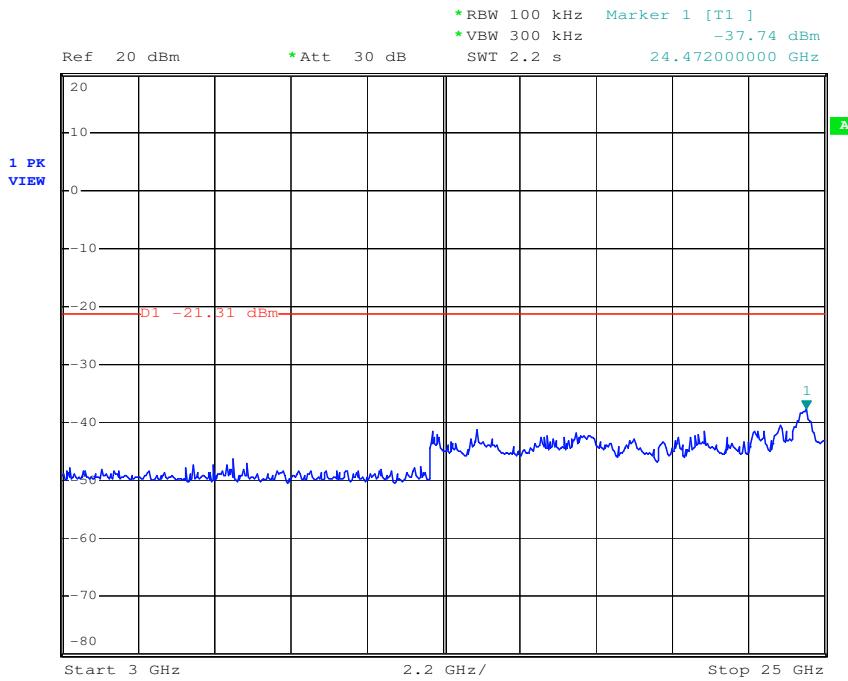


Test mode:	8DPSK	Test channel:	Highest
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30MHz to 3GHz:



3GHz to 25GHz:



## 7.10 Radiated Spurious Emissions and Band edge

**Test Requirement:** FCC Part 15 Section 15.209 and Section 15.205

**Test Method:** ANSI C63.10:2009 Clause 6.12

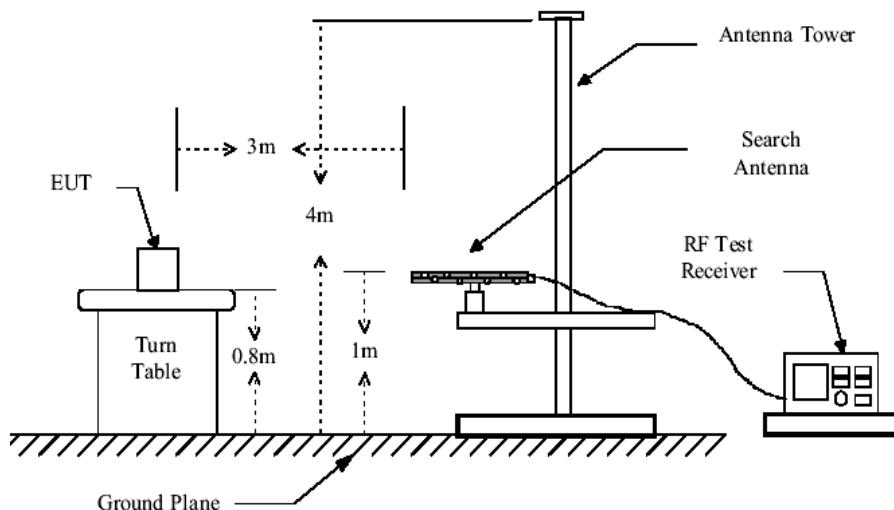
**Test site/setup:** Measurement Distance: 3m (Semi-Anechoic Chamber)

Test instrumentation set-up:

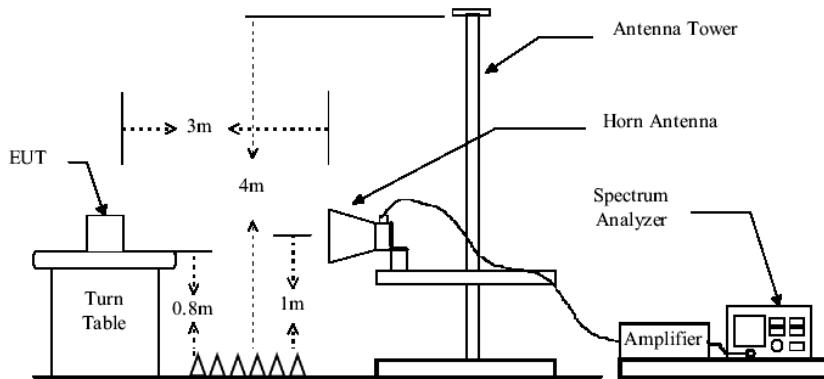
Quasi-Peak	RBW=120KHz	VBW $\geq$ RBW	30MHz to 1GHz	
Peak	RBW=1MHz	VBW $\geq$ RBW	Above 1GHz	
Average		VBW=10Hz		
Detector		Quasi-Peak	30MHz to 1GHz	
		Peak	Above 1GHz	
Sweep=Auto				

**15.209 Limit:** Receive antenna scan height 1 m - 4 m. polarization Vertical / Horizontal  
40.0 dB $\mu$ V/m between 30MHz & 88MHz  
43.5 dB $\mu$ V/m between 88MHz & 216MHz  
46.0 dB $\mu$ V/m between 216MHz & 960MHz  
54.0 dB $\mu$ V/m above 960MHz

**Test Configuration:**



**Figure 1. 30MHz to 1GHz radiated emissions test configuration**

**Figure 2. Above 1GHz radiated emissions test configuration****Test Procedure:**

The procedure used was ANSI Standard C63.10:2009. The receiver was scanned from 30MHz to 25GHz. When an emission was found, the table was rotated to produce the maximum signal strength. An initial pre-scan was performed for in peak detection mode using the receiver. The EUT was measured for both the Horizontal and Vertical polarities and performed a pre-test three orthogonal planes. For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. The worst case emissions were reported.

Low noise amplifier was used below 1GHz, High pass Filter was used above 3GHz.

Between 1G and 3GHz, we did not use any amplifier or filter.

Pre-test was performed on normal operation and charging mode and only normal operation mode, Compliance test was performed on worse case (GFSK mode with Engineering Mode).

Test were performed for their spatial orthogonal(X, Y, Z), the worst test data (X orthogonal) was submitted.

1) For this intentional radiator operates below 25 GHz. the spectrum shall be investigated to the tenth harmonic of the highest fundamental frequency. And above the third harmonic of this intentional radiator, the disturbance is very low. So the test result only displays to 5rd harmonic.

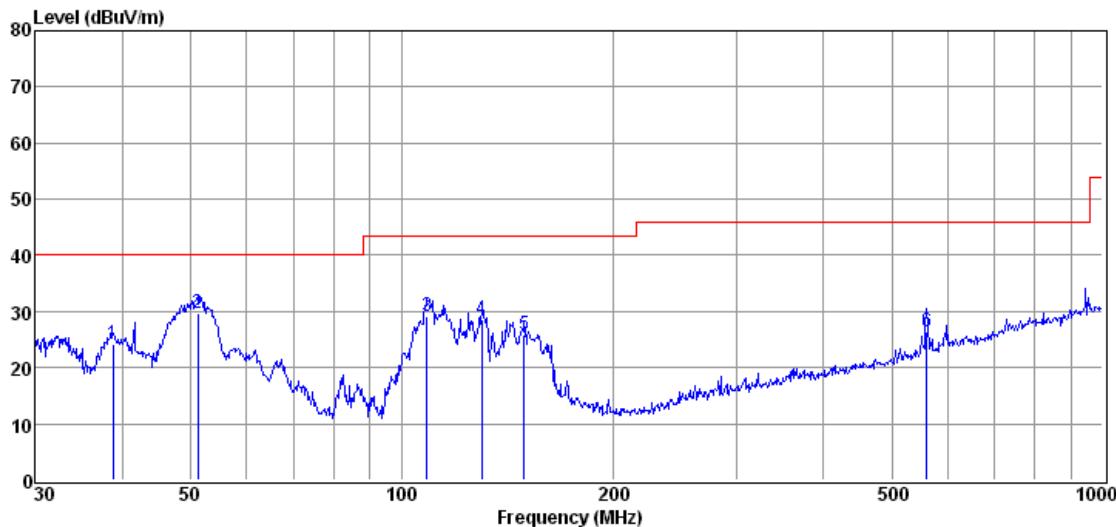
As shown in Section, for frequencies above 1000 MHz, the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

The test only perform the EUT in transmitting status since the test frequencies were over 1GHz only required transmitting status.

GFSK with Engineering Mode test data as follows:

30MHz~1GHz Spurious Emission,Quasi-Peak Measurement

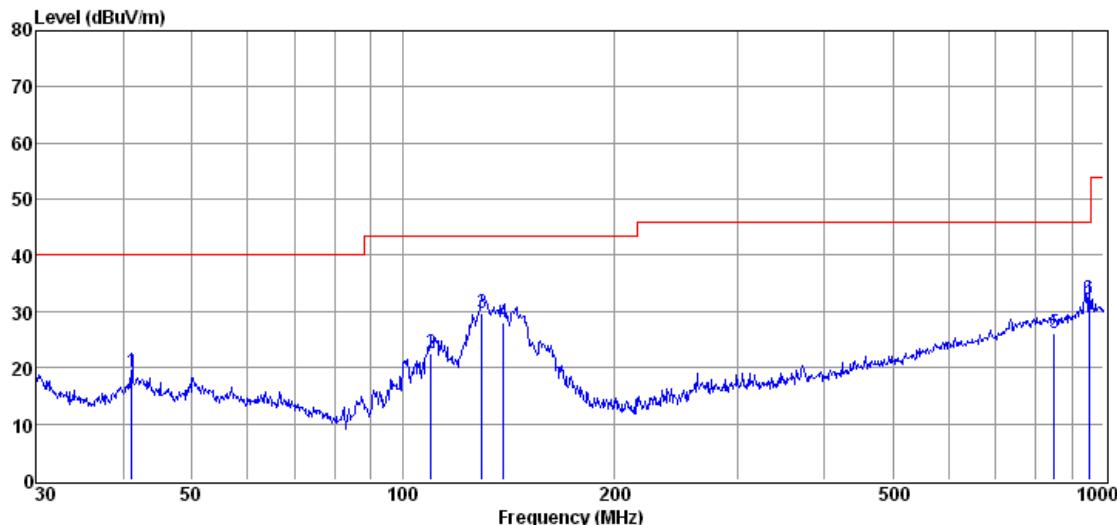
Vertical



Item	Freq.	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Result Level	Limit Line	Over Limit	Detector
(Mark)	(MHz)	(dB $\mu$ V)	(dB/m)	(dB)	(dB)	(dB $\mu$ V/m)	(dB $\mu$ V/m)	(dB)	
1	38.75	35.23	13.08	24.70	0.54	24.15	40.00	-15.85	QP
2	51.12	40.94	12.73	24.70	0.66	29.63	40.00	-10.37	QP
3	108.65	42.85	9.98	24.70	1.08	29.21	43.50	-14.29	QP
4	129.92	41.52	10.60	24.70	1.18	28.60	43.50	-14.90	QP
5	149.49	36.71	12.67	24.70	1.27	25.95	43.50	-17.55	QP
6	560.69	29.72	18.20	24.26	2.78	26.44	46.00	-19.56	QP

## 30MHz~1GHz Spurious Emission,Quasi-Peak Measurement

Horizontal



Item	Freq.	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Result Level	Limit Line	Over Limit	Detector
(Mark)	(MHz)	(dB $\mu$ V)	(dB/m)	(dB)	(dB)	(dB $\mu$ V/m)	(dB $\mu$ V/m)	(dB)	
1	41.07	30.05	13.26	24.70	0.57	19.18	40.00	-20.82	QP
2	109.80	35.97	10.08	24.70	1.09	22.44	43.50	-21.06	QP
3	129.58	41.55	11.58	24.70	1.18	29.61	43.50	-13.89	QP
4	139.32	39.56	12.07	24.70	1.23	28.16	43.50	-15.34	QP
5	849.63	23.84	22.60	23.90	3.56	26.10	46.00	-19.90	QP
6	952.09	28.31	23.92	23.79	3.80	32.24	46.00	-13.76	QP

Remark: No other radiation has been found.

Test in **Channel Low** in transmitting status- **Vertical** polarization

1GHz-12GHz:

Mark	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Emission (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector
1	4830.50	43.16	8.53	51.69	54	-2.31	peak
2	7215.75	41.38	10.65	52.03	54	-1.97	peak
3	9612.75	41.88	14.24	52.12	54	-1.88	peak

Test in **Channel Low** in transmitting status- **Horizontal** polarization

1GHz-12GHz:

Mark	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Emission (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector
1	4830.50	41.79	8.53	50.32	54	-2.68	peak
2	7215.75	42.46	10.65	51.11	54	-2.89	peak
3	9612.75	42.58	14.24	52.82	54	-1.18	peak

Remark: No other radiation has been found.

Test in **Channel Middle** in transmitting status- **Vertical** polarization

1GHz-12GHz:

Mark	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Emission (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector
1	4865.75	41.90	8.76	50.66	54	-3.34	peak
2	7321.50	42.83	10.9	50.73	54	-3.27	peak
3	9800.75	42.04	14.49	51.53	54	-2.47	peak

Test in **Channel Middle** in transmitting status- **Horizontal** polarization

1GHz-12GHz:

Mark	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Emission (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector
1	4865.75	41.25	8.76	50.01	54	-3.99	peak
2	7321.20	43.60	10.90	50.50	54	-3.50	peak
3	9800.75	42.46	14.49	51.95	54	-2.05	peak

Test in **Channel High** in transmitting status- **Vertical** polarization

1GHz-12GHz:

Mark	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Emission (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector
1	4959.75	43.29	8.94	52.23	54	-21.77	peak
2	7415.50	43.44	11.10	51.54	54	-2.46	peak
3	9941.75	41.75	14.73	52.48	54	-1.52	peak

Test in **Channel High** in transmitting status- **Horizontal** polarization

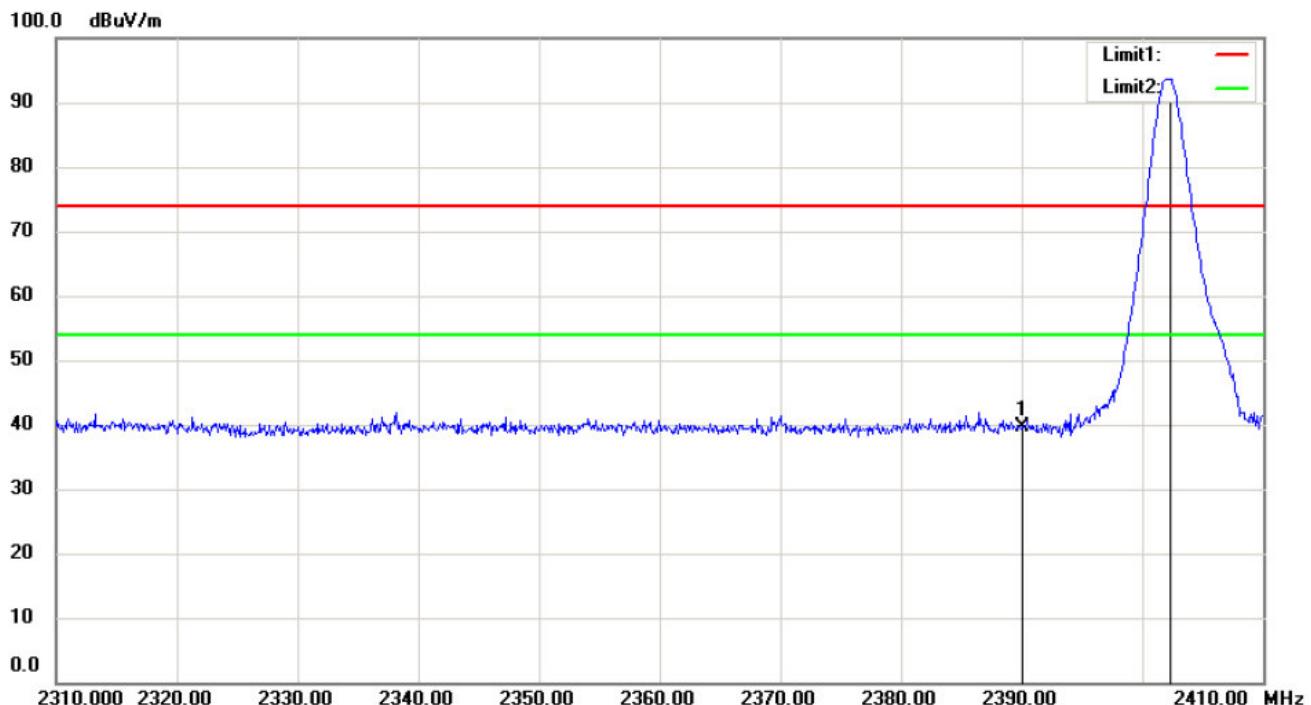
1GHz-12GHz:

Mark	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Emission (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector
1	4959.75	42.75	8.94	51.69	54	-2.31	peak
2	7415.50	43.29	11.10	51.39	54	-2.61	peak
3	9941.75	41.50	14.73	52.23	54	-1.77	peak

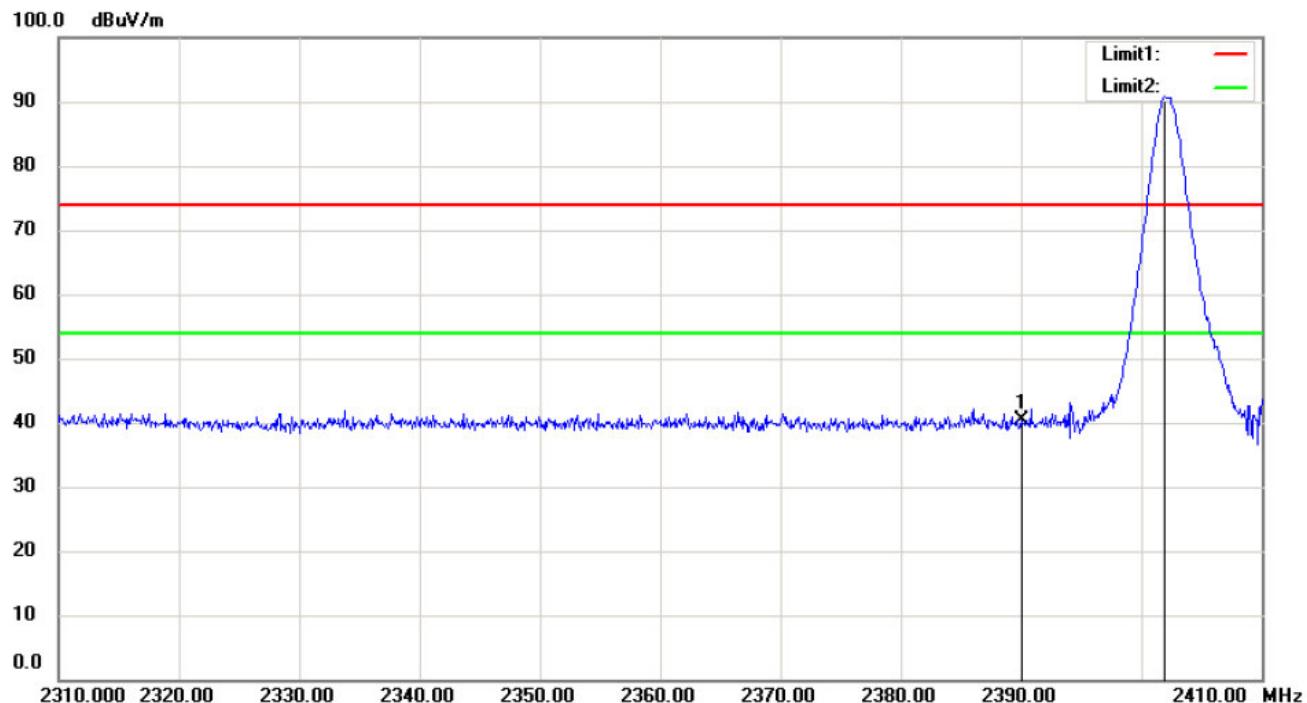
Remark: No other radiation has been found.

Because of the Peak value below the AV Limit, so the AV test doesn't perform for this submission.

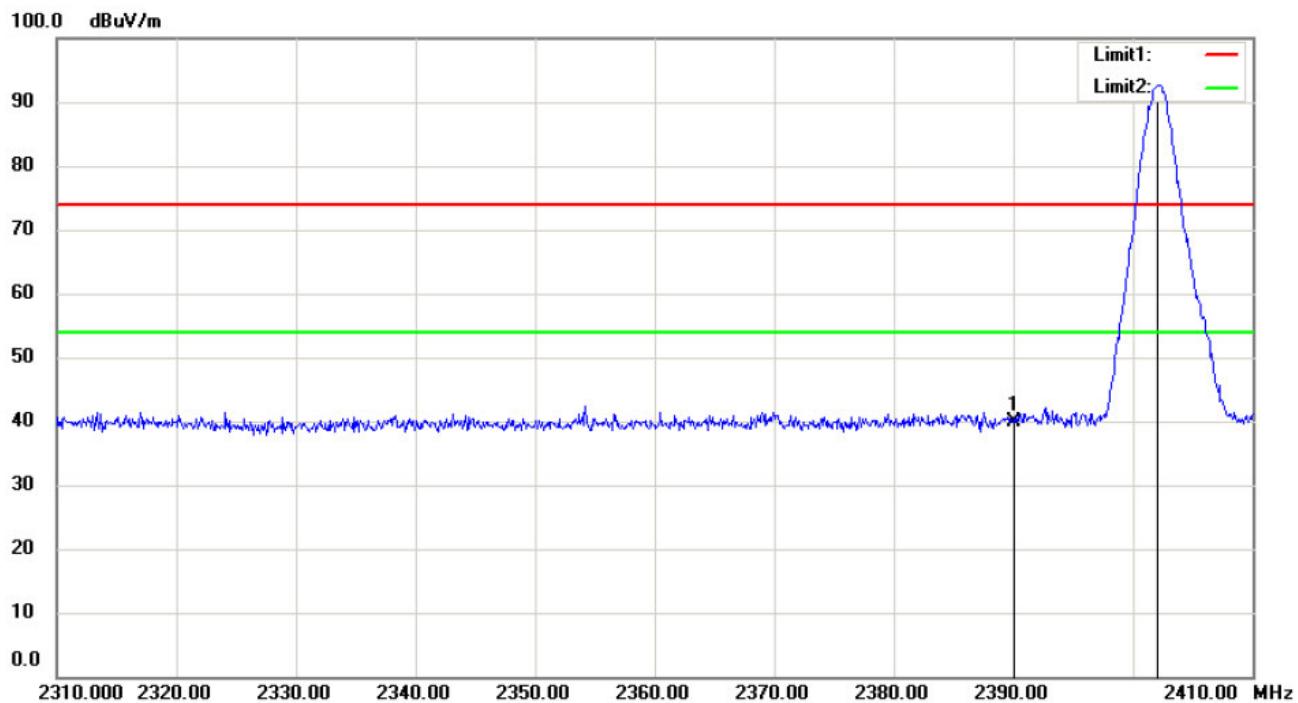
Band-edge:

**Test Result:** The EUT does meet the FCC requirements.**Measurement Result:****CH Low 2402MHz Radiated Band edge****Modulation: GFSK****Horizontal, Peak Detector:**

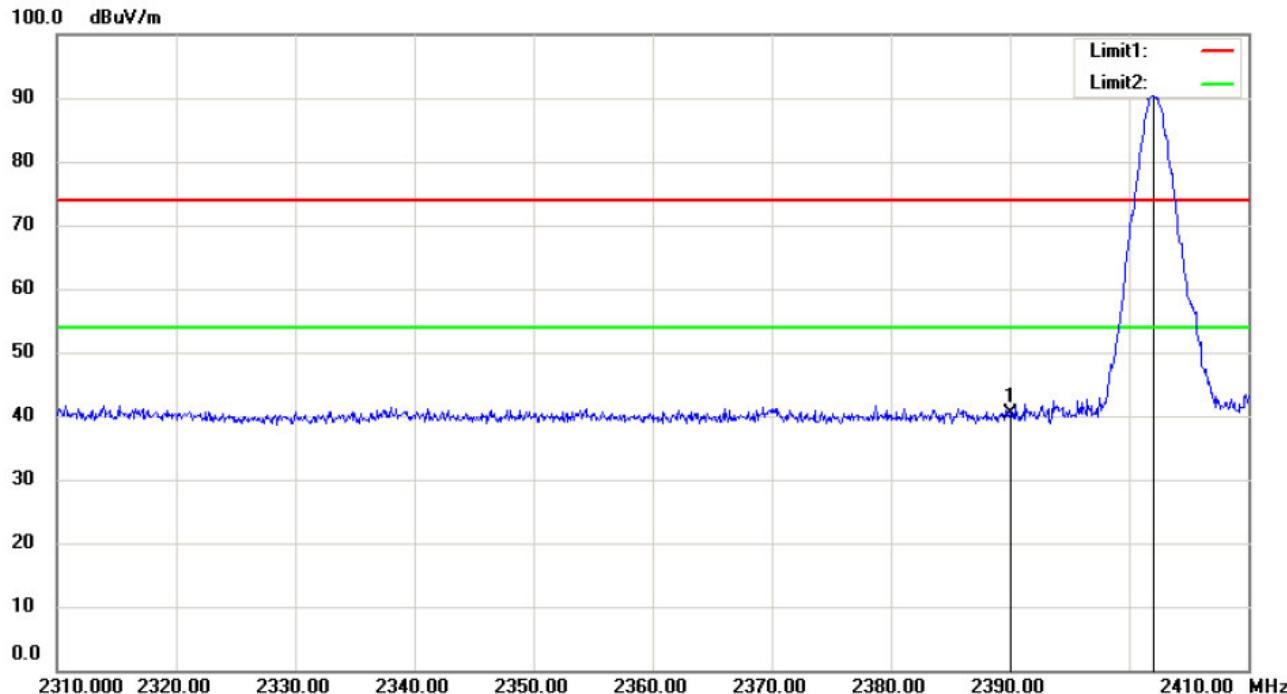
MK.	Frequency (MHz)	Reading (dBuV/m)	Corrected factor(dB)	Result (dB uV/m)	Limit (dB uV/m)	Over Limit (dB)	Detector
1	2390.000	40.23	-0.56	39.67	54	-14.33	Peak
2	2402.300	94.26	-0.63	93.63	54	39.63	Peak

**Vertical, Peak Detector:**

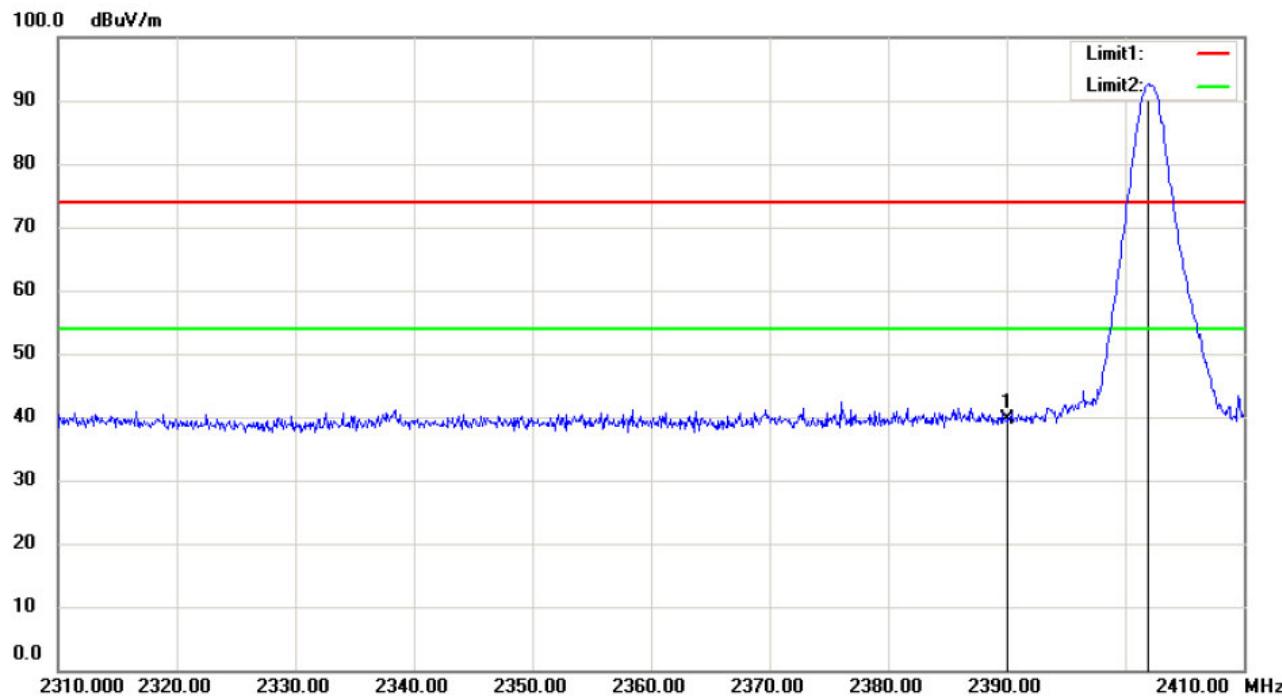
MK.	Frequency (MHz)	Reading (dBuV/m)	Corrected factor(dB)	Result (dB uV/m)	Limit (dB uV/m)	Over Limit (dB)	Detector
1	2390.000	40.91	-0.56	40.35	54	-13.65	Peak
2	2401.900	91.37	-0.62	90.75	54	36.75	Peak

**CH Low 2402MHz Radiated Bandedge****Modulation:  $\pi/4$ DQPSK****Horizontal, Peak Detector:**

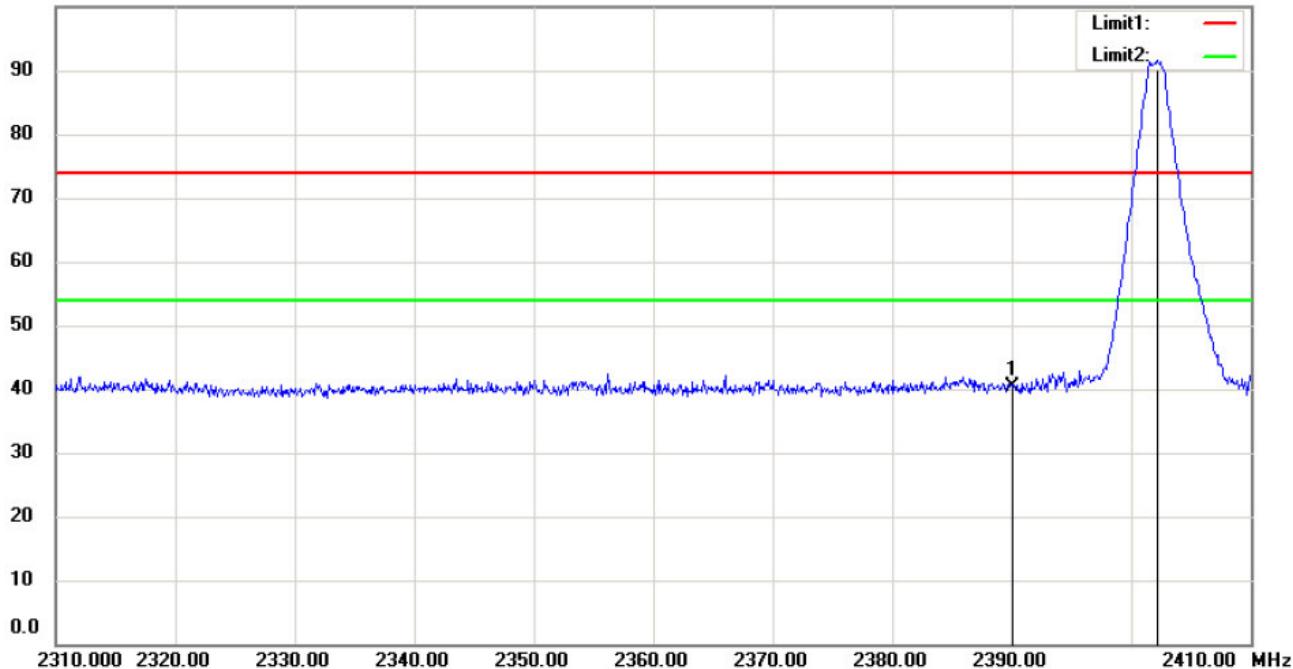
MK.	Frequency (MHz)	Reading (dBuV/m)	Corrected factor(dB)	Result (dB uV/m)	Limit (dB uV/m)	Over Limit (dB)	Detector
1	2390.000	40.55	-0.56	39.99	54	-14.01	Peak
2	2402.100	93.32	-0.63	92.69	54	38.69	Peak

**Vertical, Peak Detector:**

MK.	Frequency (MHz)	Reading (dB $\mu$ V/m)	Corrected factor(dB)	Result (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Over Limit (dB)	Detector
1	2390.000	40.97	-0.56	40.41	54	-13.59	Peak
2	2402.000	90.97	-0.62	90.35	54	36.35	Peak

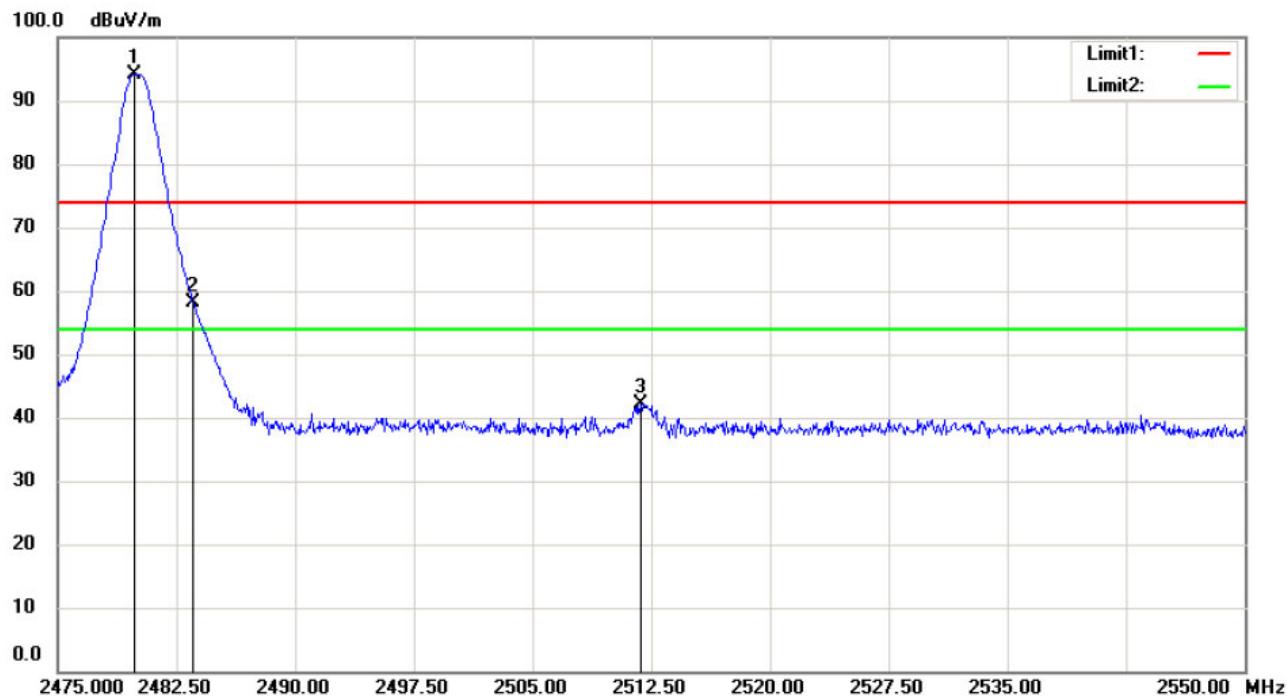
**CH Low 2402MHz Radiated Bandedge****Modulation: 8DPSK****Horizontal, Peak Detector:**

MK.	Frequency (MHz)	Reading (dBuV/m)	Corrected factor(dB)	Result (dB uV/m)	Limit (dB uV/m)	Over Limit (dB)	Detector
1	2390.000	40.24	-0.56	39.68	54	-14.32	Peak
2	2401.900	93.19	-0.62	92.57	54	38.57	Peak

**Vertical, Peak Detector:**100.0 dB<sub>uV/m</sub>

MK.	Frequency (MHz)	Reading (dB <sub>uV/m</sub> )	Corrected factor(dB)	Result (dB <sub>uV/m</sub> )	Limit (dB <sub>uV/m</sub> )	Over Limit (dB)	Detector
1	2390.000	41.01	-0.56	40.45	54	-13.55	Peak
2	2402.200	92.25	-0.63	91.62	54	37.62	Peak

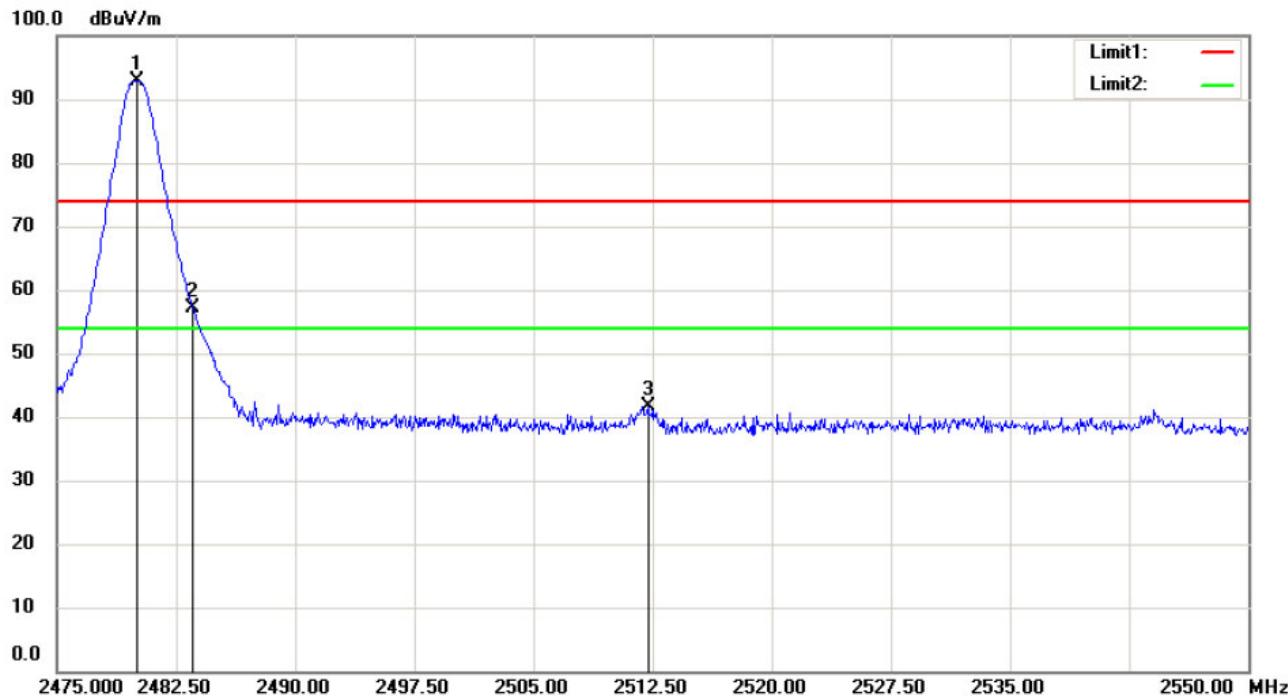
Remark: Because of the Peak value below the AV Limit, so the AV test doesn't perform for this submission.

**CH Low 2480MHz Radiated Bandedge****Modulation: GFSK****Horizontal, Peak Detector:**

MK.	Frequency (MHz)	Reading (dBuV/m)	Corrected factor(dB)	Result (dB uV/m)	Limit (dB uV/m)	Over Limit (dB)	Detector
1	2479.875	95.20	-0.99	94.21	74	20.21	Peak
2	2483.500	59.16	-1.01	58.15	74	-15.85	Peak
3	2511.825	43.20	-0.97	42.23	74	-31.77	Peak

**Horizontal, Average Detector:**

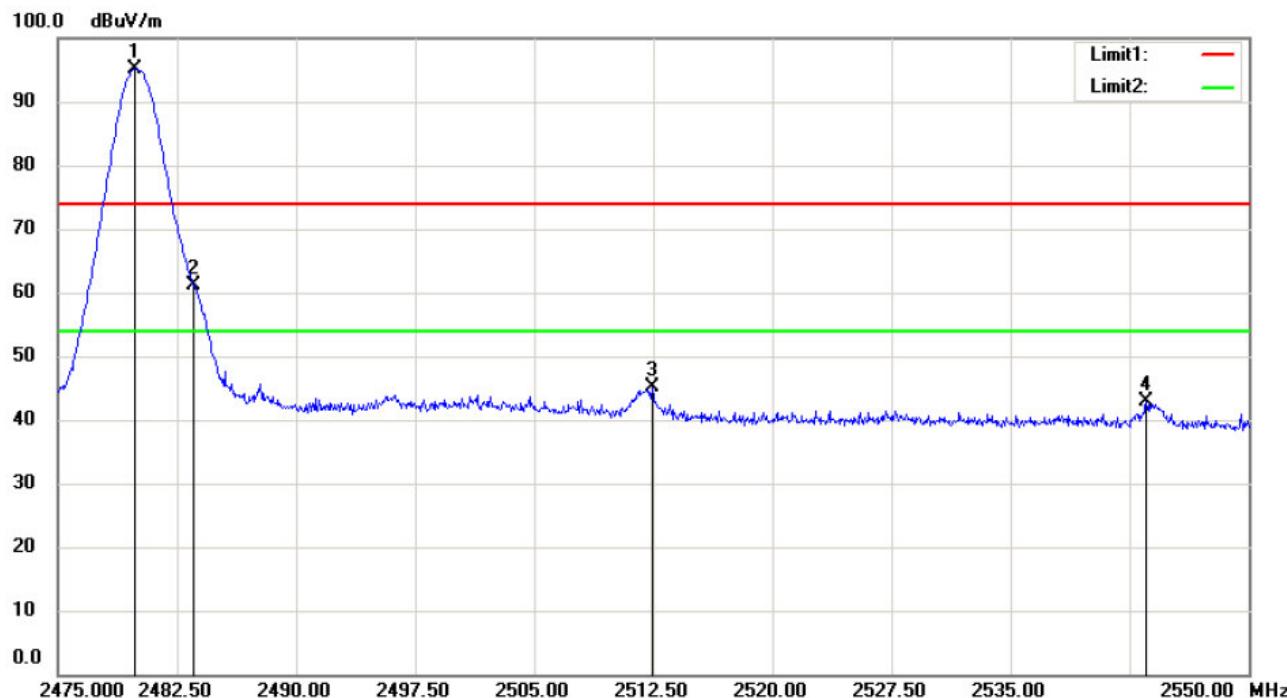
MK.	Frequency (MHz)	Reading (dBuV/m)	Corrected factor(dB)	Result (dB uV/m)	Limit (dB uV/m)	Over Limit (dB)	Detector
1	2480.025	81.04	-0.99	80.05	54	26.05	Peak
2	2483.500	48.32	-1.01	47.31	54	-6.69	Peak
3	2512.050	33.66	-0.97	32.69	54	-21.31	Peak
4	2544.150	29.73	-0.62	29.11	54	-24.89	Peak

**Vertical, Peak Detector:**

MK.	Frequency (MHz)	Reading (dBuV/m)	Corrected factor(dB)	Result (dB uV/m)	Limit (dB uV/m)	Over Limit (dB)	Detector
1	2480.025	93.92	-0.99	92.93	74	18.93	Peak
2	2483.500	58.12	-1.01	57.11	74	-16.89	Peak
3	2512.200	42.57	-0.97	41.60	74	-32.4	Peak

**Vertical, Average Detector:**

MK.	Frequency (MHz)	Reading (dBuV/m)	Corrected factor(dB)	Result (dB uV/m)	Limit (dB uV/m)	Over Limit (dB)	Detector
1	2480.175	79.40	-0.99	78.41	54	24.41	Peak
2	2483.500	47.36	-1.01	46.35	54	-7.65	Peak
3	2512.050	31.44	-0.97	30.47	54	-23.53	Peak
4	2544.075	28.80	-0.62	28.18	54	-25.82	Peak

**CH Low 2480MHz Radiated Bandedge****Modulation:  $\pi/4$ DQPSK****Horizontal, Peak Detector:**

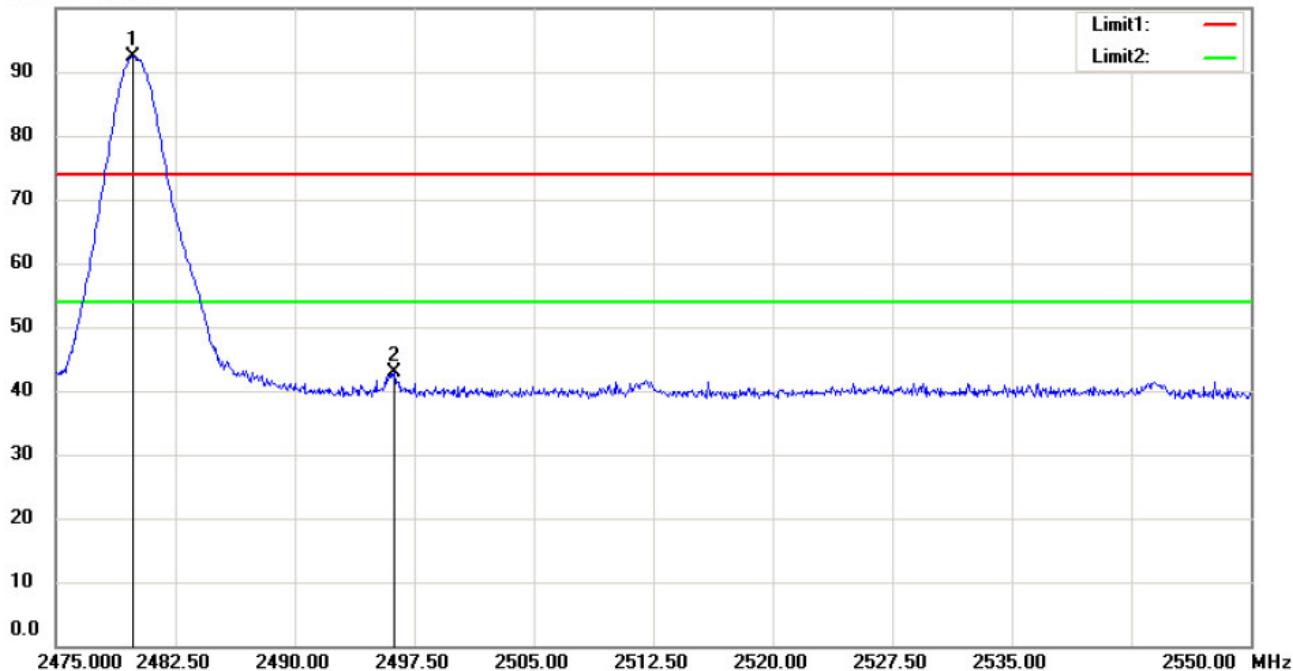
MK.	Frequency (MHz)	Reading (dBuV/m)	Corrected factor(dB)	Result (dB uV/m)	Limit (dB uV/m)	Over Limit (dB)	Detector
1	2479.800	96.17	-0.99	95.18	74	21.18	Peak
2	2483.500	62.18	-1.01	61.17	74	-12.83	Peak
3	2512.425	45.98	-0.97	45.03	74	-28.97	Peak
4	2543.550	43.54	-0.62	42.92	74	-31.08	Peak

**Horizontal, Average Detector:**

MK.	Frequency (MHz)	Reading (dBuV/m)	Corrected factor(dB)	Result (dB uV/m)	Limit (dB uV/m)	Over Limit (dB)	Detector
1	2480.100	74.32	-0.99	73.33	54	19.33	Peak
2	2483.500	44.80	-1.01	43.79	54	-10.21	Peak
3	2511.900	34.04	-0.97	33.07	54	-20.93	Peak
4	2544.000	30.58	-0.62	29.96	54	-24.04	Peak

**Vertical, Peak Detector:**

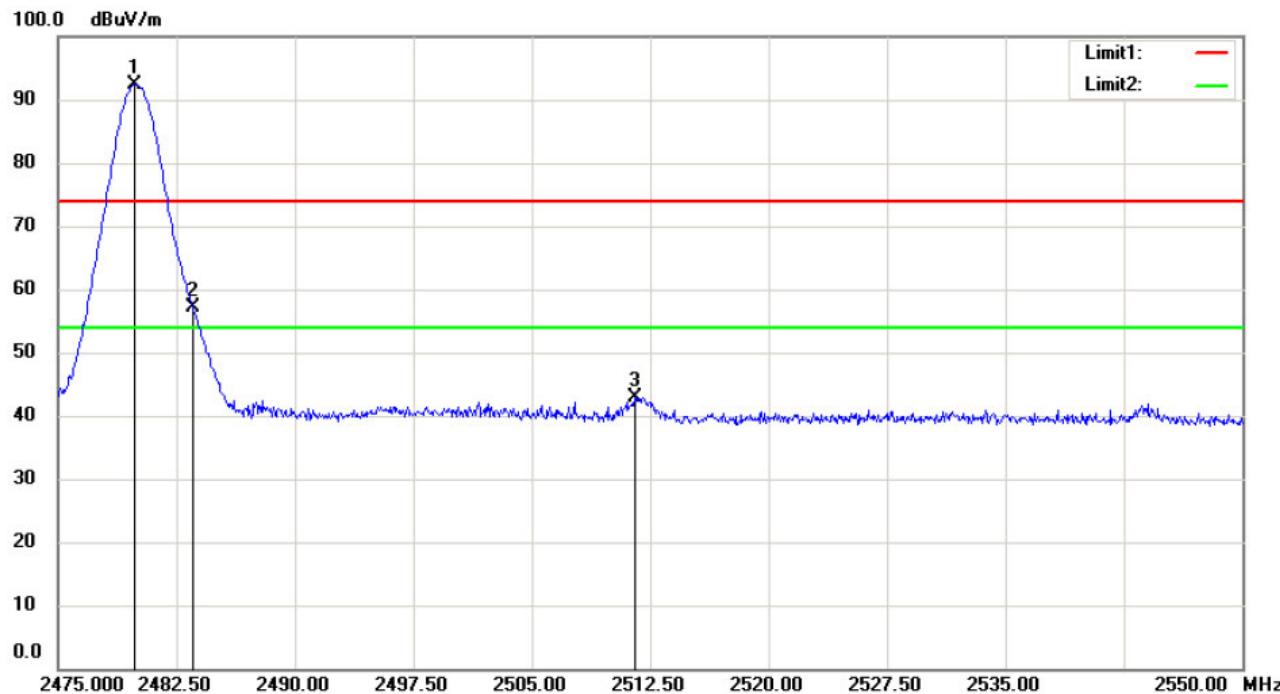
100.0 dBuV/m



MK.	Frequency (MHz)	Reading (dBuV/m)	Corrected factor(dB)	Result (dB uV/m)	Limit (dB uV/m)	Over Limit (dB)	Detector
1	2479.800	93.33	-0.99	92.34	74	18.34	Peak
2	2496.225	43.92	-1.07	42.85	74	-31.15	Peak

**Vertical, Average Detector:**

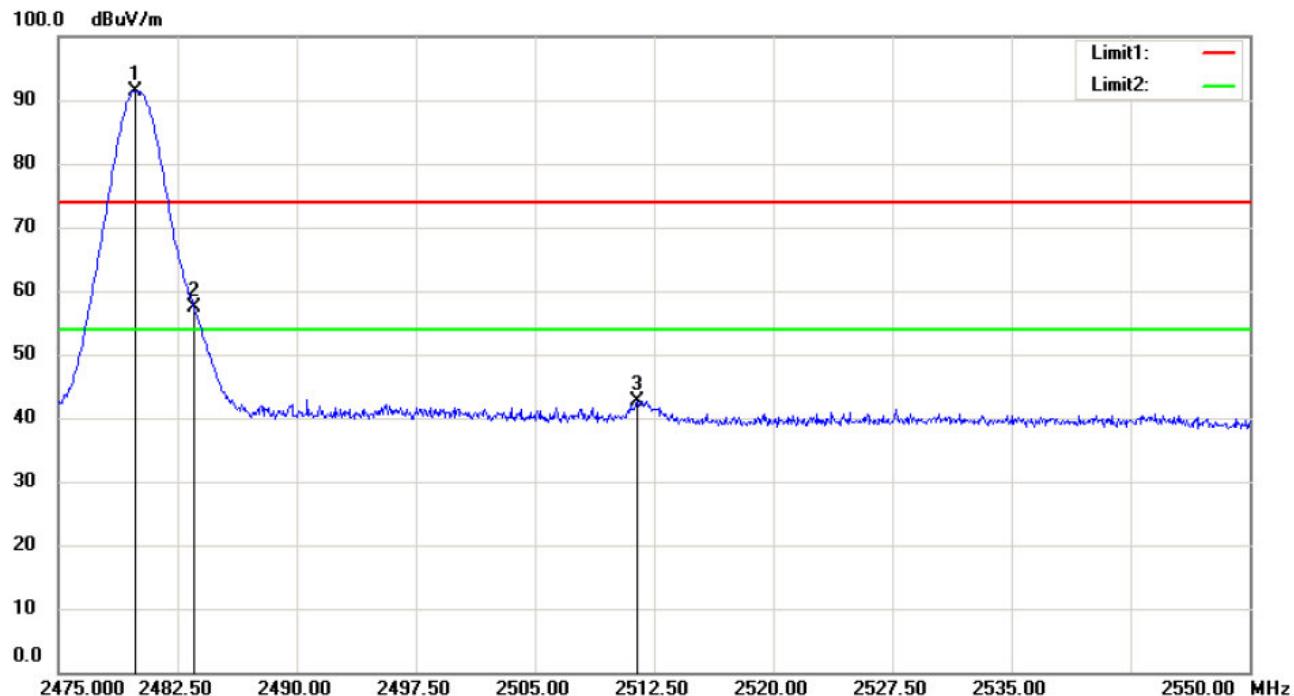
MK.	Frequency (MHz)	Reading (dBuV/m)	Corrected factor(dB)	Result (dB uV/m)	Limit (dB uV/m)	Over Limit (dB)	Detector
1	2480.025	75.04	-0.99	74.05	54	20.05	Peak
2	2483.500	42.46	-1.01	41.45	54	-12.55	Peak
3	2511.900	29.56	-0.97	28.59	54	-25.41	Peak
4	2543.925	29.94	-0.62	29.32	54	-24.68	Peak

**CH Low 2480MHz Radiated Bandedge****Modulation: 8DPSK****Horizontal, Peak Detector:**

MK.	Frequency (MHz)	Reading (dBuV/m)	Corrected factor(dB)	Result (dB uV/m)	Limit (dB uV/m)	Over Limit (dB)	Detector
1	2479.875	93.41	-0.99	92.42	74	18.42	Peak
2	2483.500	58.13	-1.01	57.12	74	-16.88	Peak
3	2511.525	43.84	-0.97	42.87	74	-31.13	Peak

**Horizontal, Average Detector:**

MK.	Frequency (MHz)	Reading (dBuV/m)	Corrected factor(dB)	Result (dB uV/m)	Limit (dB uV/m)	Over Limit (dB)	Detector
1	2480.025	75.92	-0.99	74.93	54	20.93	Peak
2	2483.500	45.75	-1.01	44.74	54	-9.26	Peak
3	2511.825	31.20	-0.97	30.23	54	-23.77	Peak
4	2543.850	29.18	-0.62	28.56	54	-25.44	Peak

**Vertical, Peak Detector:**

MK.	Frequency (MHz)	Reading (dBuV/m)	Corrected factor(dB)	Result (dB uV/m)	Limit (dB uV/m)	Over Limit (dB)	Detector
1	2479.800	92.48	-0.99	91.49	74	17.49	Peak
2	2483.500	58.31	-1.01	57.30	74	-16.70	Peak
3	2511.450	43.66	-0.97	42.69	74	-31.31	Peak

**Vertical, Average Detector:**

MK.	Frequency (MHz)	Reading (dBuV/m)	Corrected factor(dB)	Result (dB uV/m)	Limit (dB uV/m)	Over Limit (dB)	Detector
1	2480.175	75.69	-0.99	74.70	54	20.70	Peak
2	2483.500	45.83	-1.01	44.82	54	-9.18	Peak
3	2511.750	31.63	-0.97	30.66	54	-23.34	Peak
4	2543.850	28.61	-0.62	27.99	54	-26.01	Peak

Remark: No any other emission which fall in restricted bands can be detected and be reported.

Test Level = Receiver Reading + Antenna Factor + Cable Loss- Preamplifier Factor

Remark: No any other emissions level which are attenuated less than 20dB below the limit.

According to 15.31(o), The amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators which are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this Part. Hence there no other emissions have been reported.

All frequencies within the "Restricted bands" have been evaluated to compliance. Section 15.205 Restricted bands of operation.



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Except as shown in paragraph of this section. Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
<sup>1</sup> 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 -	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.52525	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	
13.36 - 13.41	322 - 335.4		

## **8 Test Setup Photographs**

Refer to the < Efee-M001\_Test Setup photos>.

## **9 EUT Constructional Details**

Refer to the < Efee-M001\_External Photos > & < Efee-M001\_Internal Photos >.

**--End of the Report--**