Certification Test Report

FCC ID: AZ489FT6015
IC: 109U-89FT6015

FCC Rule Part: 15.247
ISED Canada Radio Standards Specification: RSS-247

ACS Report Number: 16-2052.W06.1B

Manufacturer: Motorola Solutions Sdn Bhd
Model(s): PMMN4096A

Test Begin Date: **October 18, 2016**
Test End Date: **November 7, 2016**

Report Issue Date: November 17, 2016

FOR THE SCOPE OF ACCREDITATION UNDER CERTIFICATE NUMBER AT-1533

This report must not be used by the client to claim product certification, approval, or endorsement by ANAB, ANSI, or any agency of the Federal Government.

Prepared by:

Thierry Jean-Charles
EMC Engineer
Advanced Compliance Solutions, Inc.

Reviewed by:

Ryan McGann
Wireless Program Manager
Advanced Compliance Solutions, Inc.

This report contains 62 pages

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1 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations and Innovation, Science and Economic Development Canada's Radio Standards Specification RSS-247 for the tests documented herein.

1.2 Product Description

The Operation Critical Wireless Remote Speaker Microphone (OCW-RSM), model PMMN4096A, is a Bluetooth transceiver for connectivity with PCR and TETRA radios for Push-to-Talk (PTT) and user programmable button features.

Technical Details

Mode of Operation:	Bluetooth 2.1 + Enhanced Data Rate (EDR)
Frequency Range:	2402 MHz - 2480 MHz
Number of Channels:	79
Channel Separation:	1 MHz
Modulations:	GFSK, π/4-DQPSK, 8DPSK
TX Data Rates:	1 Mbps (GFSK) 2 Mbps (π/4-DQPSK) 3 Mbps (8DPSK)
Antenna Type/Gain:	Planar Inverted-F Antenna (PIFA), 2.84 dBi

1.3 Manufacturer Information

Motorola Solutions Sdn Bhd
Plot 2 Bayan Lepas Innoplex,
Industrial Park Mukim 12 SWD
11900 Bayan Lepas, Penang Malaysia

Model Number: PMMN4096A

Test Sample Serial Number(s): CAI1681Z7B (radiated and power line conducted emissions), CAI1681YFR (RF Conducted Measurements)

Test Sample Condition: The equipment was provided in good condition without any physical damage.

1.4 Test Methodology and Considerations

The EUT was evaluated for RF conducted, radiated and power line conducted emissions for the 2.4 GHz Bluetooth transceiver.

The RF conducted measurements were performed with the EUT configured with a temporary SMA connector at the RF port.

The radiated emissions evaluation was performed up to the 10th harmonic for the EUT set in 3 orthogonal orientations and for the EUT set on the charging dock. The final measurements were performed for the EUT set vertically as the configuration leading to the highest emissions with respect to the limits.

The power line conducted measurements were performed for the three modulations and the results are reported for the configuration leading to the highest emissions.

The Bluetooth radio was configured using the CSR BlueTest3 Software. The test power settings were selected as listed below.

GFSK: TX PA Atten = 0; Power (1, 26)
π/4 DQPSK: TX PA Atten = 4; Power (1, 27)
8DPSK: TX PA Atten = 4; Power (1, 27)

The frequencies and data rates used during the evaluation are provided below.

Table 1.4-1: Bluetooth Radio Test configuration

Mode of Operations	Frequency [MHz)	Data Rate (kbps)
GFSK	2402	1000
	2441	1000
	2480	1000
π/4 DQPSK	2402	2000
	2441	2000
	2480	2000
8 DPSK	2402	3000
	2441	3000
	2480	3000

2 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following address:

Advanced Compliance Solutions, Inc.
3998 FAU Blvd, Suite 310
Boca Raton, Florida 33431
Phone: (561) 961-5585
Fax: (561) 961-5587
www.acstestlab.com

FCC Test Firm Registration #: 475089
Innovation, Science and Economic Development Canada Lab Code: 4175C

2.2 Laboratory Accreditations/Recognitions/Certifications

ACS is accredited to ISO/IEC 17025 by ANSI-ASQ National Accreditation Board under their ANAB program and has been issued certificate number AT-1533 in recognition of this accreditation. Unless otherwise specified, all test methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

2.3 Radiated & Conducted Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The EMC radiated test facility consists of an RF-shielded enclosure. The interior dimensions of the indoor semi-anechoic chamber are approximately 48 feet (14.6 m) long by 36 feet (10.8 m) wide by 24 feet (7.3 m) high and consist of rigid, 1/8 inch (0.32 cm) steel-clad, wood core modular panels with steel framing. In the shielded enclosure, the faces of the panels are galvanized and the chamber is self-supporting. 8-foot RF absorbing cones are installed on 4 walls and the ceiling. The steel-clad ground plane is covered with vinyl flooring.

The turntable is driven by pneumatic motor, which is capable of supporting a 2000 lb. load. The turntable is flush with the chamber floor which it is connected to, around its circumference, with a continuous metallic loaded spring. An EMCO Model 1060 Multi-device controller controls the turntable position.

A pneumatic motor is used to control antenna polarizations and height relative to the ground. The height information is displayed on the control unit EMCO Model 1050.

The control room is an RF shielded enclosure attached to the semi-anechoic chamber with two bulkhead panels for connecting RF, and control cables. The dimension of the room is 7.3 m x 4.9 m x 3 m high and the entrance doors of both control and conducted rooms are 3 feet (0.91 m) by 7 feet (2.13 m).

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3.1-1 below:

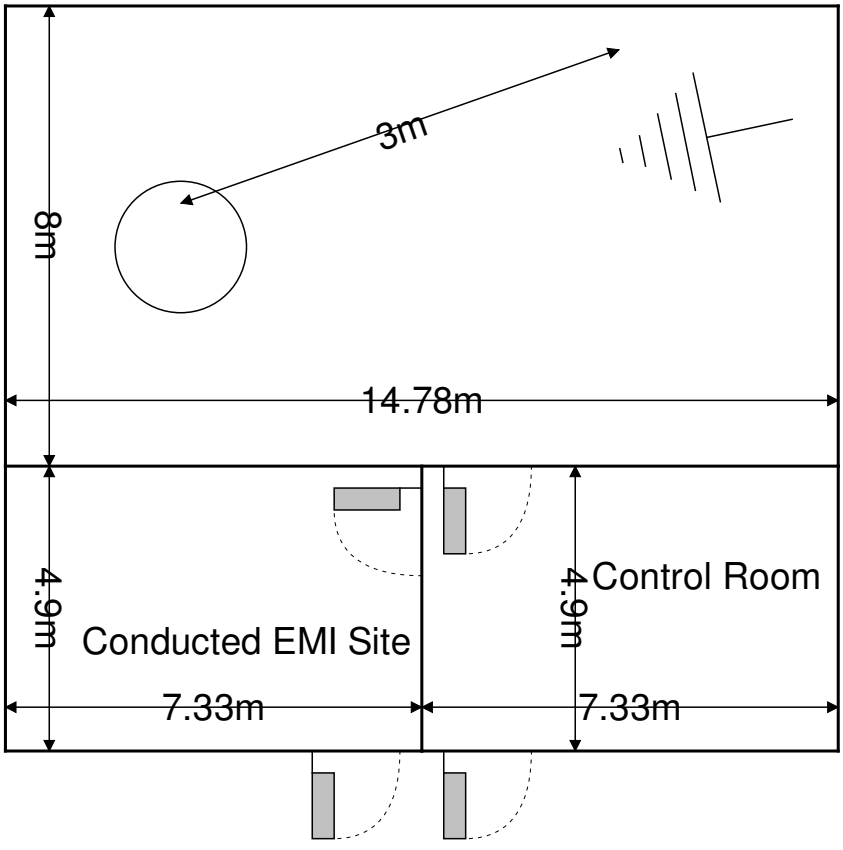

Figure 2.3.1-1: Semi-Anechoic Chamber Test Site

2.3.2 Conducted Emissions Test Site Description

The dimensions of the shielded conducted room are 7.3 x 4.9 x 3 m^3. The power line conducted emission site includes two LISNs: a Solar Model 8028-50 50 Ω/50 µH and an EMCO Model 3825/2R, which are installed as shown in the figure below. For evaluations requiring 230 V, 50 Hz AC input, a Polarad LISN (S/N 879341/048) is used in conjunction with a California Instruments signal generator Model 2001RP-OP1.

A diagram of the room is shown below in figure 2.3.2-1:

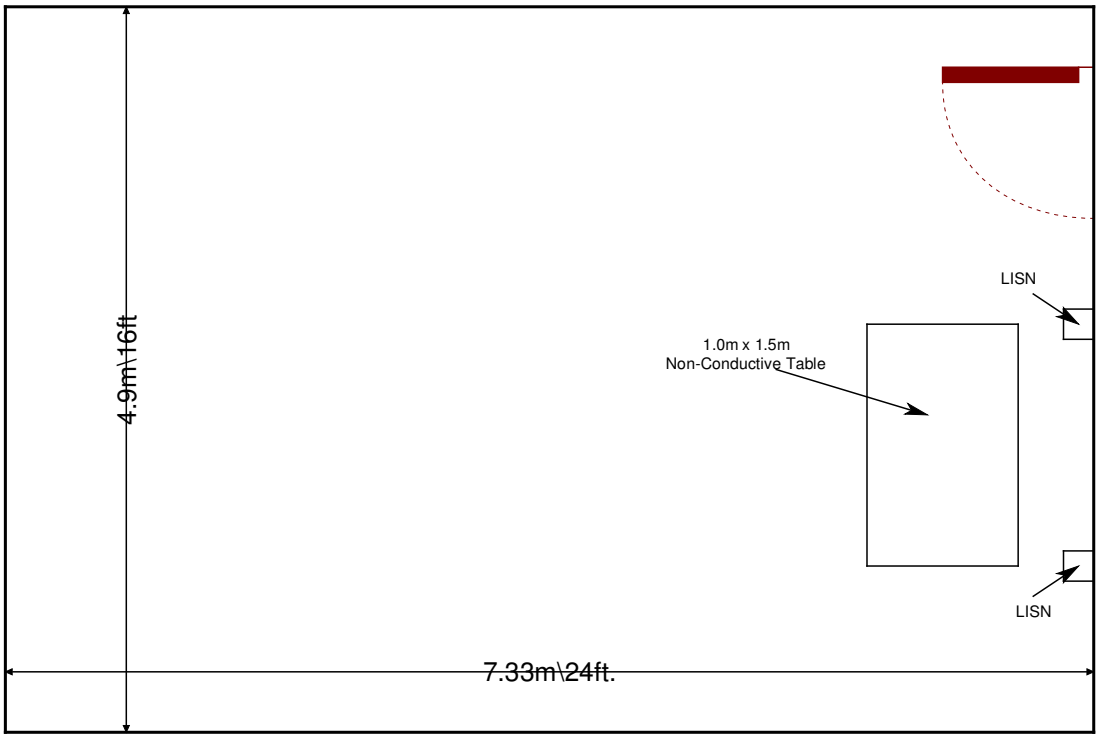

Figure 2.3.2-1: AC Mains Conducted EMI Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.4-2014: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9 kHz to 40 GHz.
- ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2016.
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2016
- Innovation, Science and Economic Development Canada Radio Standards Specification: RSS-247 — Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices, Issue 1, May 2015.
- Innovation, Science and Economic Development Canada Radio Standards Specification: RSS-GEN – General Requirements for Compliance of Radio Apparatus, Issue 4, November 2014.

4 LIST OF TEST EQUIPMENT

The calibration interval of test equipment is annually or the manufacturer's recommendations. Where the calibration interval deviates from the annual cycle based on the instrument manufacturer's recommendations, it shall be stated below.

Table 4-1: Test Equipment List

AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
78	EMCO	6502	Antennas	9104-2608	5/11/2016	5/11/2018
283	Rohde & Schwarz	FSP40	Spectrum Analyzers	1000033	7/21/2016	7/21/2018
523	Agilent	E7405	Spectrum Analyzers	MY45103293	12/26/2014	12/26/2016
653	Suhner	SF-102A	Cables	0944/2A	9/6/2016	9/6/2017
2002	EMCO	3108	Antennas	2147	11/19/2015	11/19/2017
2004	EMCO	3146	Antennas	1385	11/19/2015	11/19/2017
2006	EMCO	3115	Antennas	2573	4/14/2015	4/14/2017
2008	COM-Power	AH-826	Antennas	81009	NCR	NCR
2011	Hewlett-Packard	HP 8447D	Amplifiers	2443A03952	11/18/2015	11/18/2016
2022	EMCO	LISN3825/2R	LISN	1095	9/14/2015	9/14/2017
2045	ACS Boca	Conducted Cable Set	Cable Set	2045	11/11/2015	11/11/2016
2070	Mini Circuits	VHF-8400+	Filter	2070	11/17/2015	11/17/2016
2072	Mini Circuits	VHF-3100+	Filter	30737	11/17/2015	11/17/2016
2082	Teledyne Storm Products	90-010-048	Cables	2082	4/21/2016	4/21/2017
2086	Merrimac	FAN-6-10K	Attenuators	23148-83-1	11/16/2015	11/16/2016
2089	Agilent Technologies, Inc.	83017A	Amplifiers	3123A00214	12/9/2015	12/9/2016
2095	ETS Lindgren	TILE4! - Version 4.2.A	Software	85242	NCR	NCR
2111	Aeroflex Inmet	40AH2W-20	Attenuator	2111	7/20/2016	7/20/2017
2112	Teledyne Storm Products	921-0101-036	Cables	12-06-698	11/13/2015	11/13/2016
2121	ACS Boca	Radiated Cable Set	Cable Set	2121	8/1/2016	8/1/2017
3004	Teseq	CFL 9206A	Attenuators	34720	9/14/2016	9/14/2017

Note: NCR=No Calibration Required

5 SUPPORT EQUIPMENT

Table 5-1: EUT and Support Equipment Description (Radiated Emissions)

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	EUT	Motorola Solutions	PMMN4096A	CAI1681Z7B
2	Earpiece	Motorola Solutions	RLN4941A	N/A

Table 5-2: EUT and Support Equipment Description (Power Line Conducted Emissions)

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	EUT	Motorola Solutions	PMMN4096A	CAI1681Z7B
2	Earpiece	Motorola Solutions	RLN4941A	N/A
3	Two Way radio Multi Charger	Motorola Solutions	PMLN6714A	N/A
4	5 VDC I.T.E Power Supply	Motorola Solutions	MU15-M1050-A00S	11000927471602000733
5	3.7V Lithium Ion Battery	Motorola Solutions	PMNN4461A	50002CACDF35

Table 5-3: Cable Description (Radiated Emissions)

Cable #	Cable Type	Length	Shield	Termination
A	Audio	0.55 m	No	Earpiece to EUT

Table 5-4: Cable Description (Power Line Conducted Emissions)

Cable #	Cable Type	Length	Shield	Termination
A	Audio	0.55 m	No	Earpiece to EUT
B	Power	1.50 m	No	Multi charger to Power Supply
C	Extension Cord	2.7 m	No	Power Supply to AC Mains

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

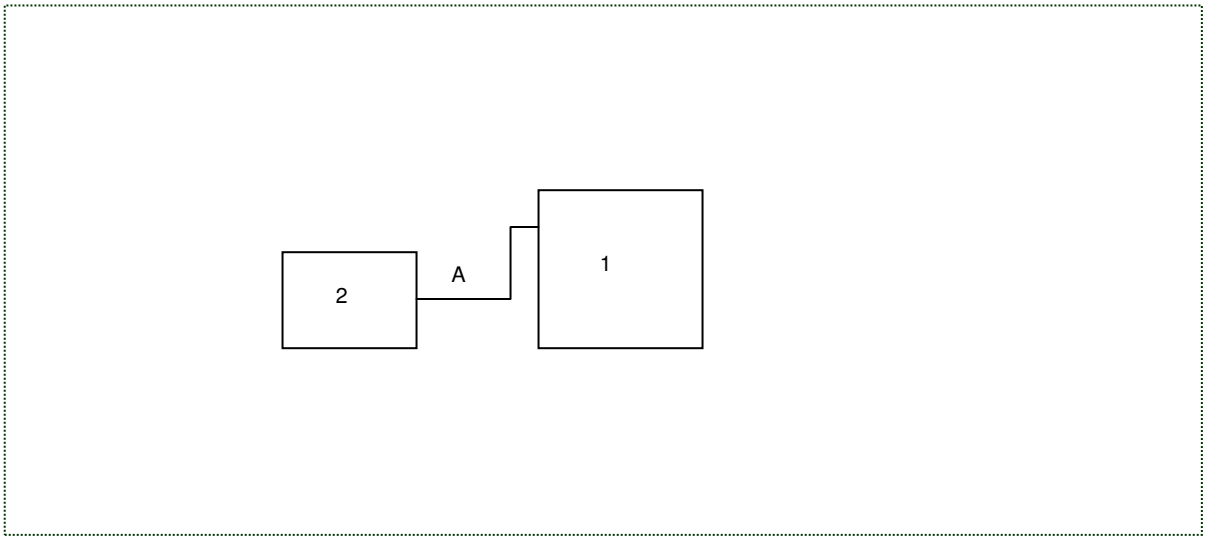

Figure 6-1: Radiated Emissions Test Setup

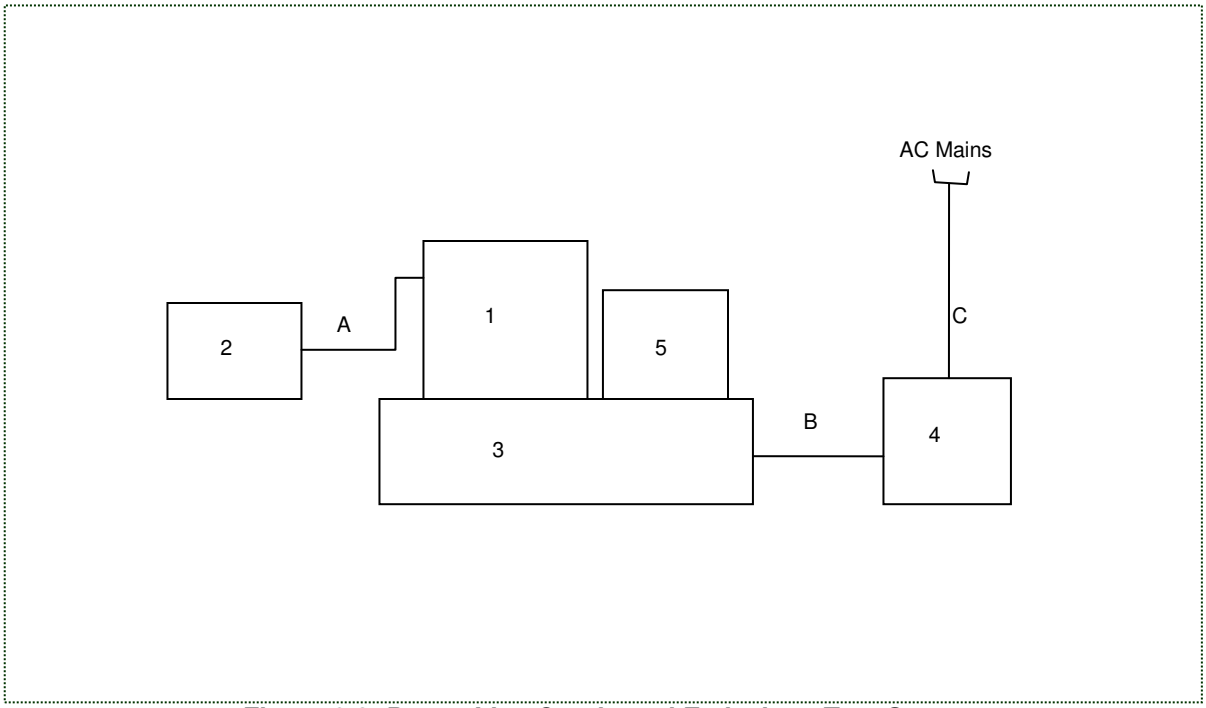

Figure 6-2: Power Line Conducted Emissions Test Setup

7 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

7.1 Antenna Requirement – FCC: Section 15.203

The EUT uses an internal 2.84 dBi planar inverted-F antenna (PIFA) for the Bluetooth radio. The antenna is not detachable, thus meeting the requirements of FCC 15.203.

7.2 Peak Output Power - FCC Section 15.247(b)(1); ISED Canada RSS-247 5.4(2)

7.2.1 Measurement Procedure (Conducted Method)

The RF output port of the EUT was directly connected to the input of the spectrum analyzer through suitable attenuation. The span was set to approximately five times the 20 dB bandwidth. The peak power was measured by using the marker-to-peak function which set the marker at the peak of the emission.

7.2.2 Measurement Results

Results are shown below:

Table 7.2.2-1 RF Output Power (GFSK)

Frequency [MHz]	Power [dBm]
2402	17.15
2441	17.76
2480	16.73

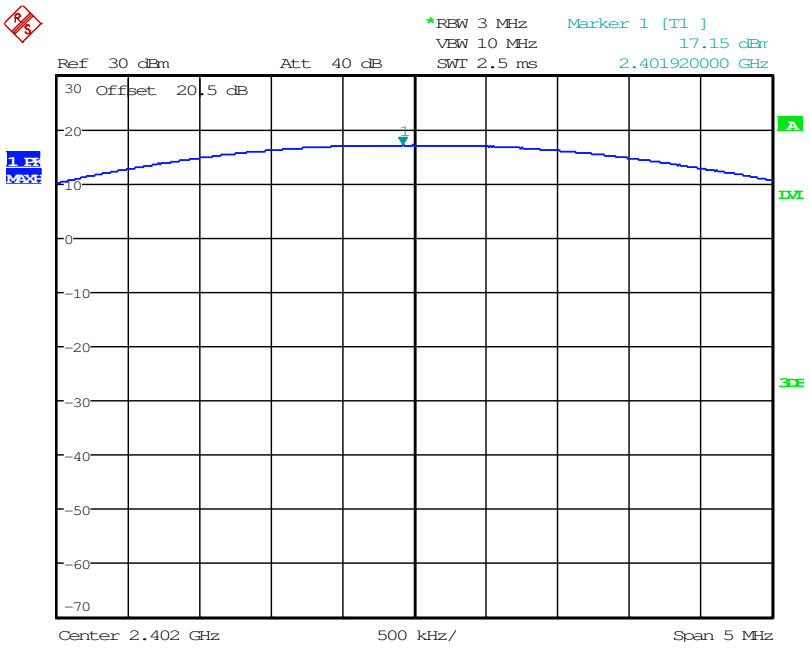

Figure 7.2.2-1: RF Output Power (GFSK) - Low Channel

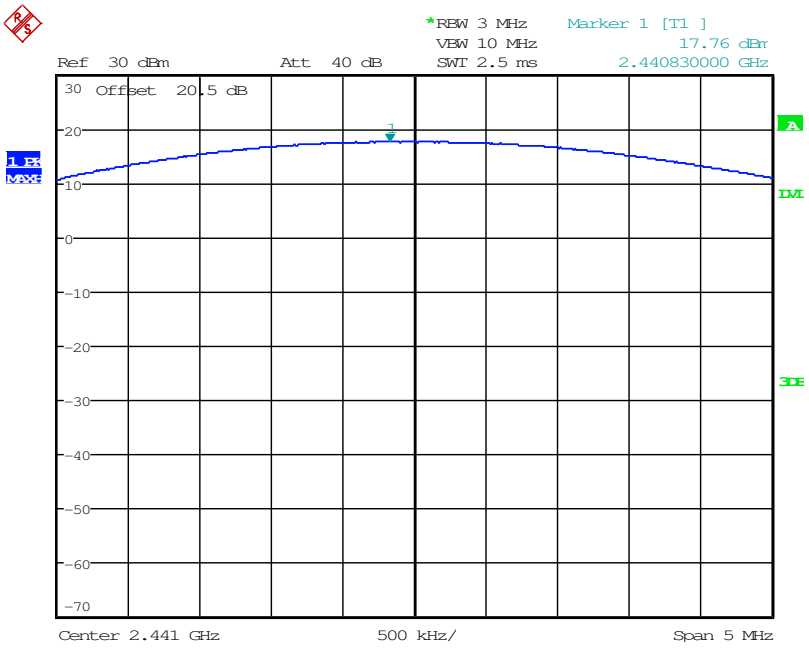

Figure 7.2.2-2: RF Output Power (GFSK) - Middle Channel

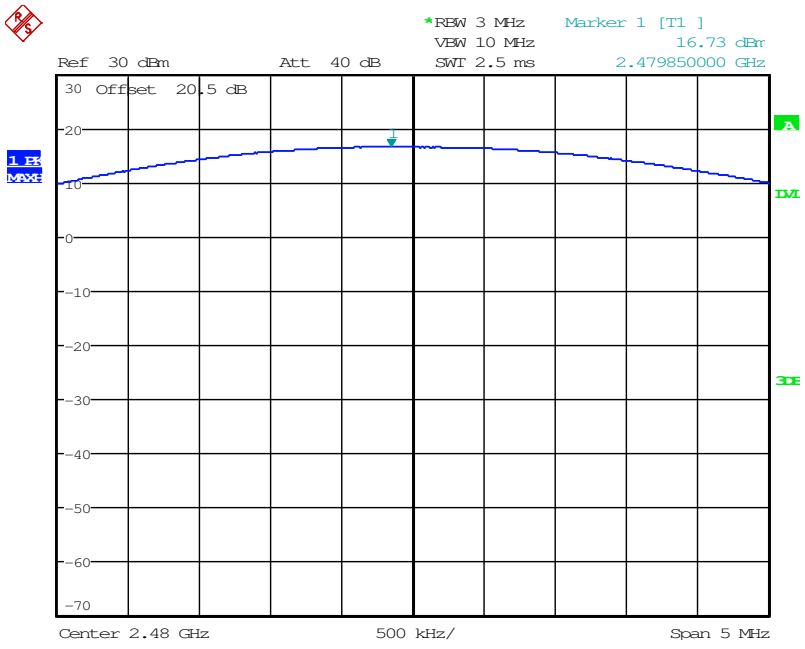

Figure 7.2.2-3: RF Output Power (GFSK) - High Channel

Table 7.2.2-2: RF Output Power (π/4 DQPSK)

Frequency [MHz]	Power [dBm]
2402	10.60
2441	11.46
2480	10.63

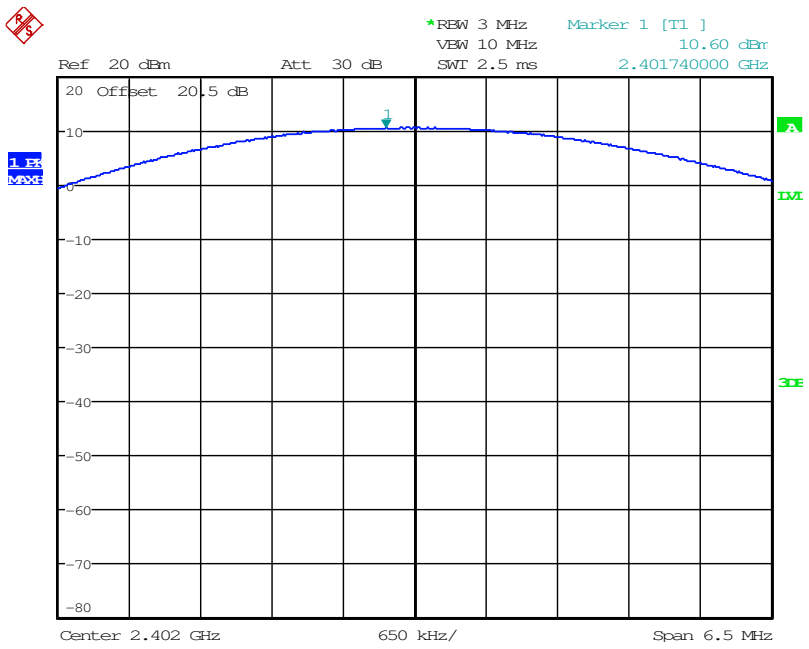

Figure 7.2.2-4: RF Output Power (π/4 DQPSK) - Low Channel

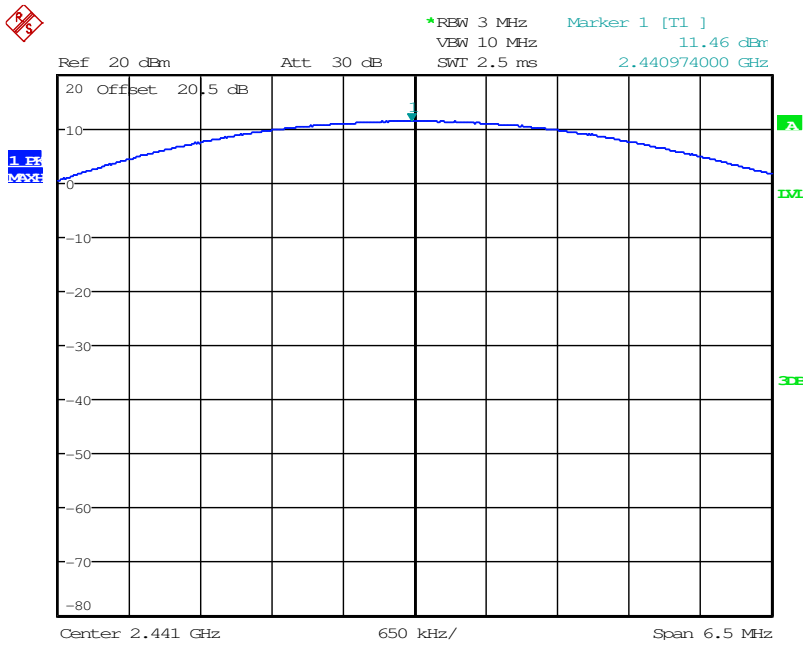

Figure 7.2.2-5: RF Output Power (π/4 DQPSK) - Middle Channel

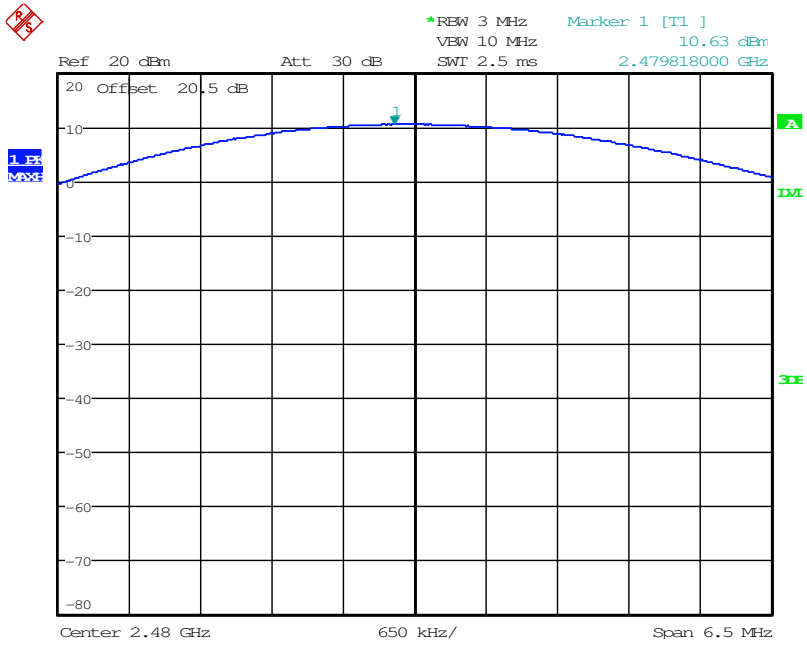

Figure 7.2.2-6: RF Output Power (π/4 DQPSK) - High Channel

Table 7.2.2-3: RF Output Power (8DPSK)

Frequency [MHz]	Power [dBm]
2402	10.76
2441	11.64
2480	10.63

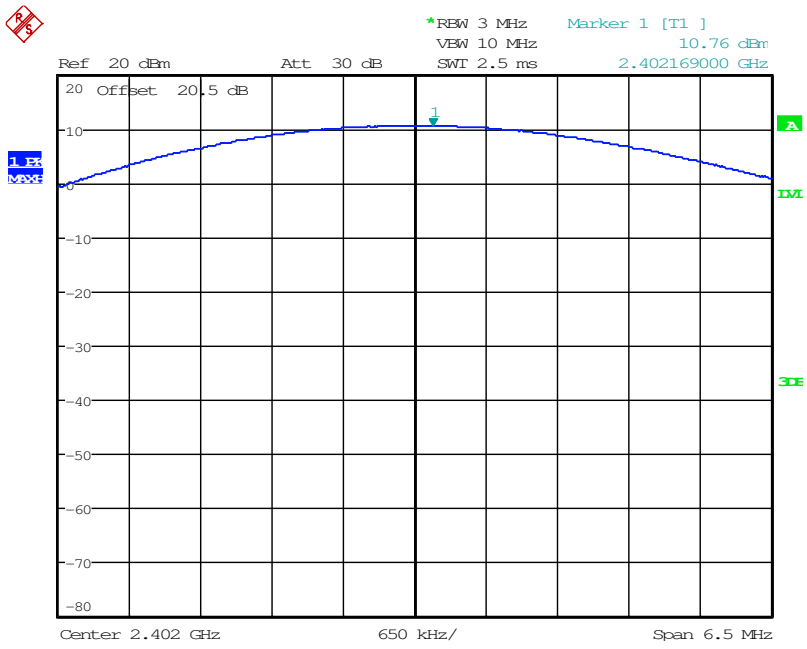

Figure 7.2.2-7: RF Output Power (8DPSK) - Low Channel

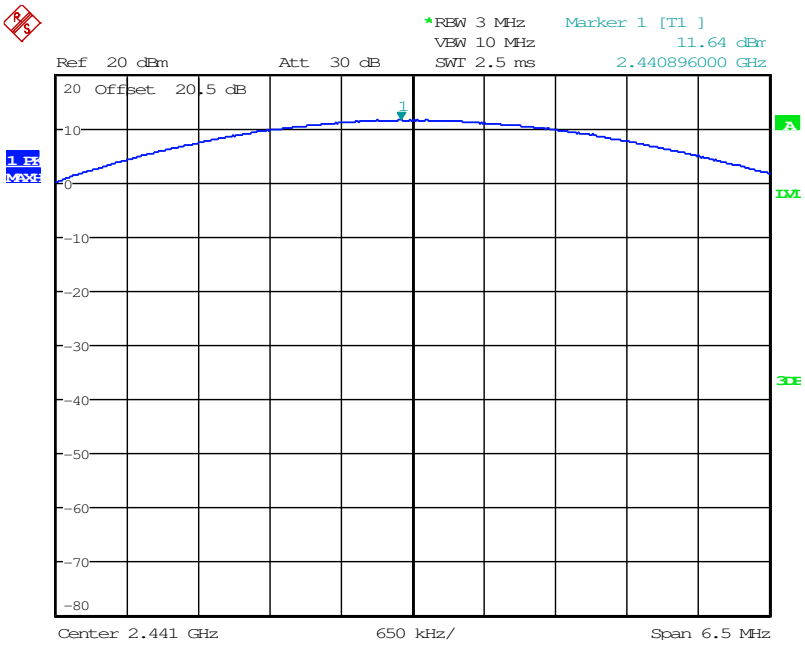

Figure 7.2.2-8: RF Output Power (8DPSK) - Middle Channel

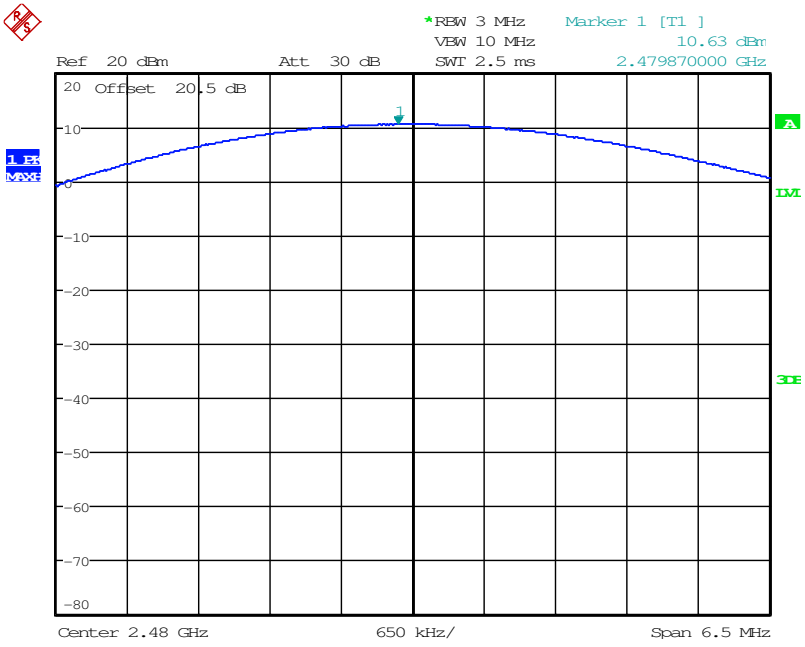

Figure 7.2.2-9: RF Output Power (8DPSK) - High Channel

7.3 Channel Usage Requirements

7.3.1 Carrier Frequency Separation – FCC Section 15.247(a)(1); ISED Canada: RSS-247 5.1(2)

7.3.1.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. The span of the spectrum analyzer was set wide enough to capture two adjacent peaks and the RBW and VBW were set to approximately 30% of the channel spacing. The marker-delta function was used to determine the separation between the peaks of the adjacent channels.

7.3.1.2 Measurement Results

Results are shown below:

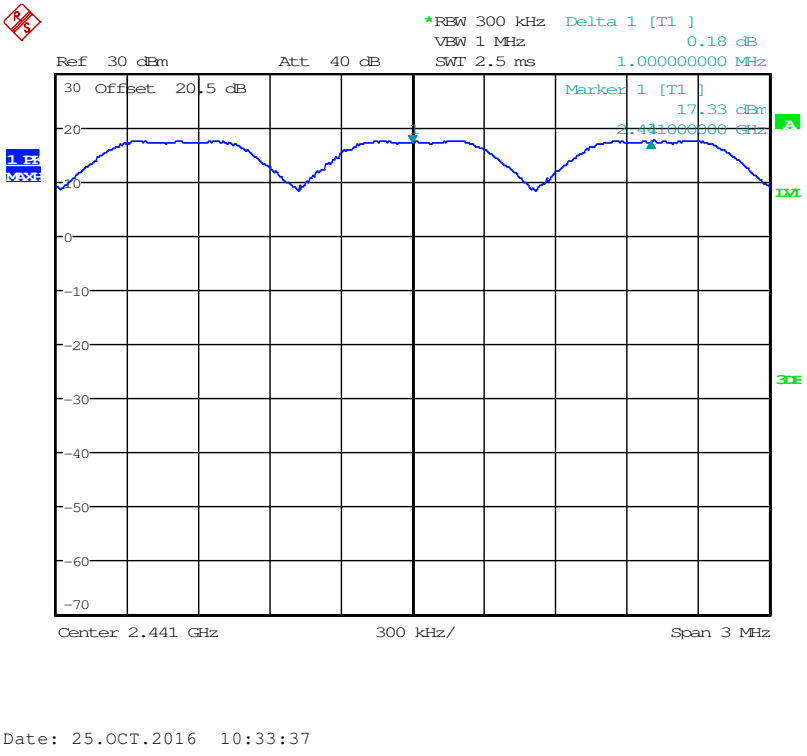

Figure 7.3.1.2-1: Carrier Frequency Separation

7.3.2 Number of Hopping Channels – FCC Section 15.247(a)(1)(iii); ISED Canada: RSS-247 5.1(4)

7.3.2.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. The span of the spectrum analyzer was set wide enough to capture the number of hopping channels. The resolution bandwidth was set to less than 30% of the channel spacing or the 20 dB bandwidth whichever was smaller. The peak detector max hold function was enabled for the measurements.

7.3.2.2 Measurement Results

Results are shown below:

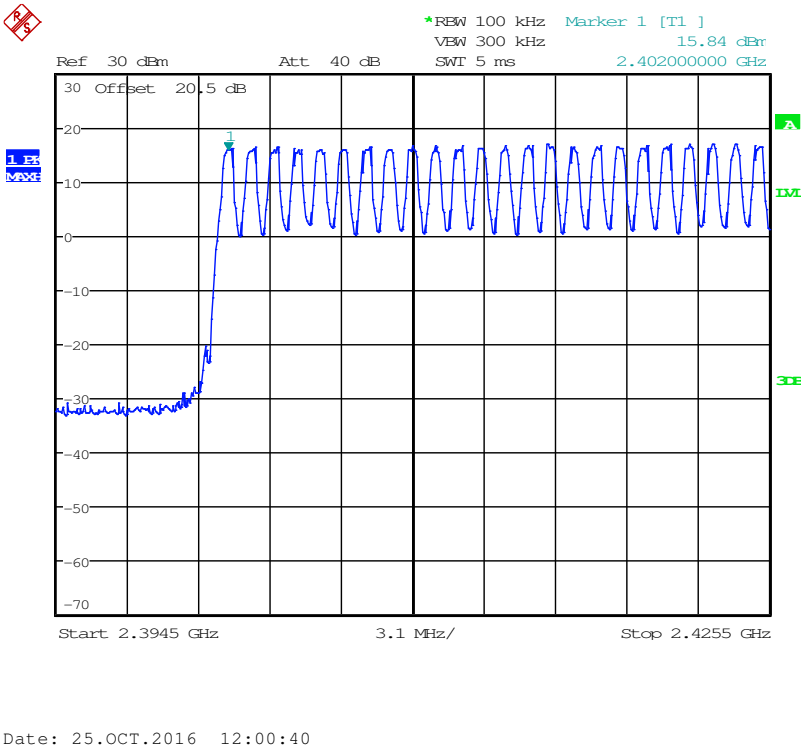

Figure 7.3.2.2-1: Number of Hopping Channels (1 – 24)

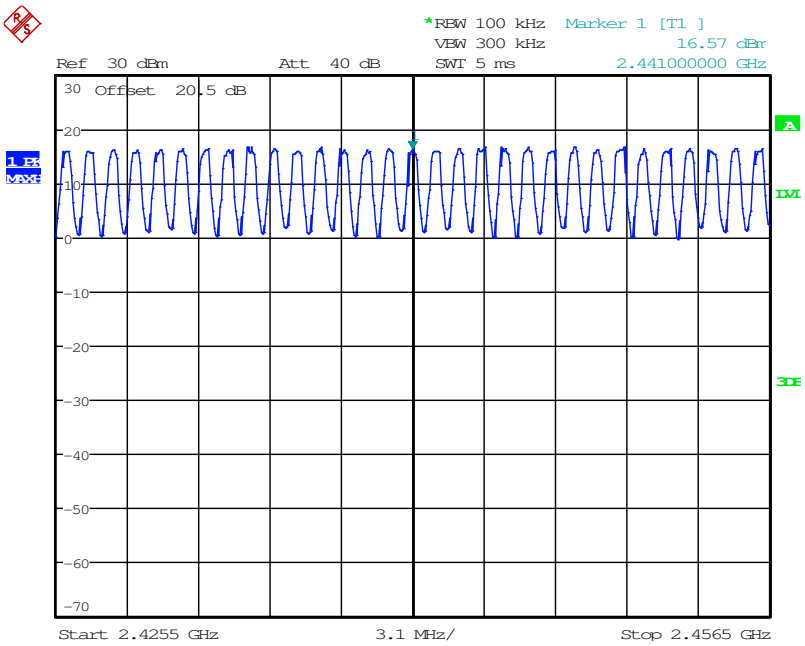

Figure 7.3.2.2-2: Number of Hopping Channels (25 – 55)

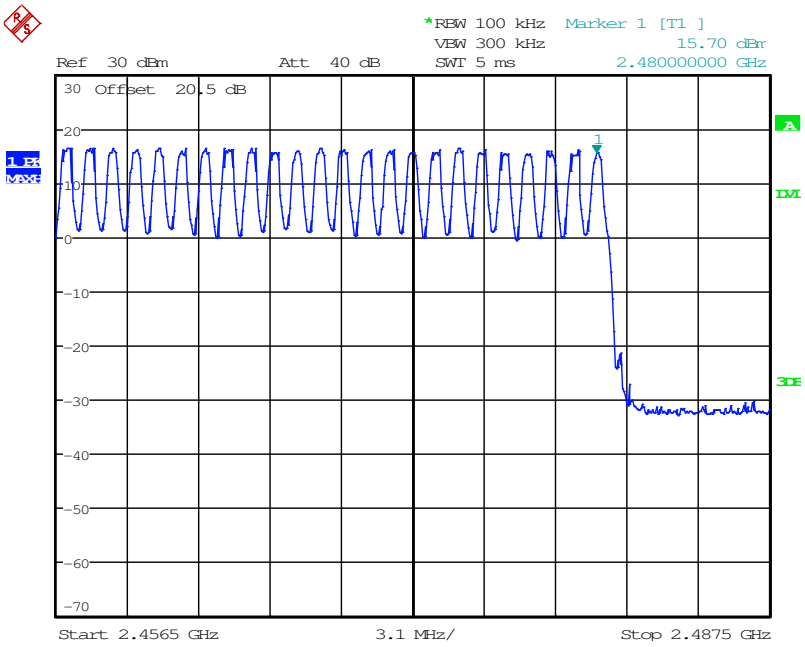

Figure 7.3.2.2-3: Number of Hopping Channels (56 – 79)

7.3.3 Channel Dwell Time – FCC Section 15.247(a)(1)(iii); ISED Canada RSS-247 5.1(4)

7.3.3.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. The span of the spectrum analyzer was set 0 Hz centered on a hopping channel. The RBW was set to less than the channel spacing and the sweep time adjusted to capture the entire dwell time per channel with peak detector max hold function.

7.3.3.2 Measurement Results

Results are shown below:

Table 7.3.3.2-1 Dwell Time on a 31.6s Second Cycle

Packet Format	Number of Hops Per Sec. (NHPS)	Number of Hops per Channel Per Sec. (NHPCPS)	Number of hops on a 31.6 s Cycle (NHPC)	Measured Dwell Times (ms)	Dwell Times on a 31.6 s Cycle	Limit (ms)	Status
DH1	800	10.13	320	0.52	166.40	400	PASS
DH3	400	5.06	160	1.78	284.80	400	PASS
DH5	266.67	3.38	106.67	3.04	324.28	400	PASS

*Notes:

NHPS = (1600 /sec)/ (NT+NR) (where NT and NR are the number of transmit and receive packets, respectively)
NHPCPS = NHPS/79
NHPC = NHPCPS * 31.6s
Dwell Time per Cycle = NHPC* Measured Dwell Time

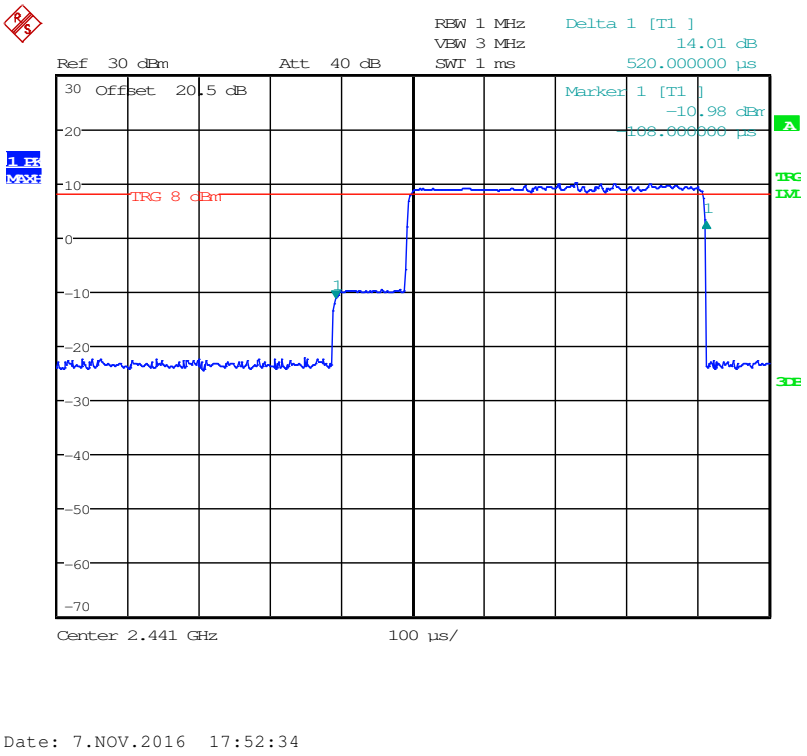

Figure 7.3.3.2-1: Channel Dwell Time – DH1

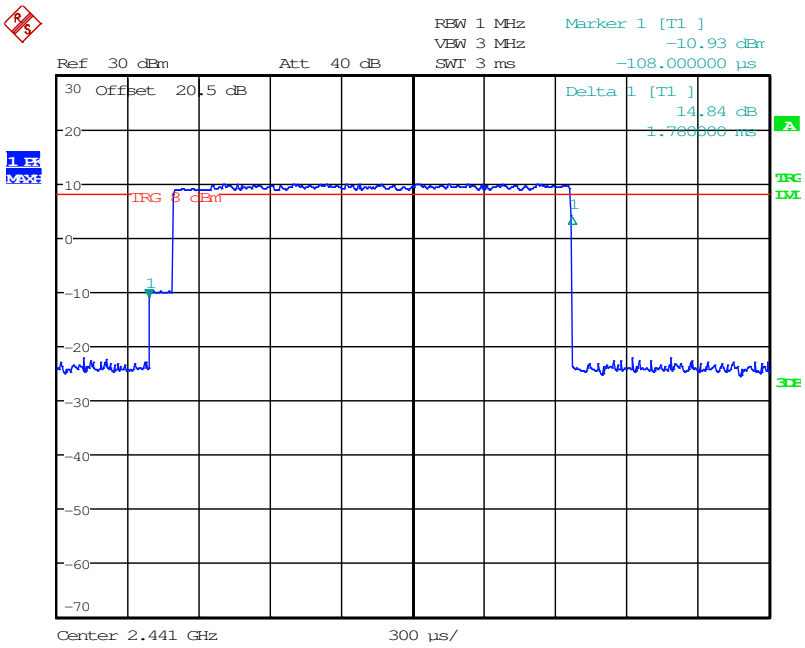

Figure 7.3.3.2-2: Channel Dwell Time – DH3

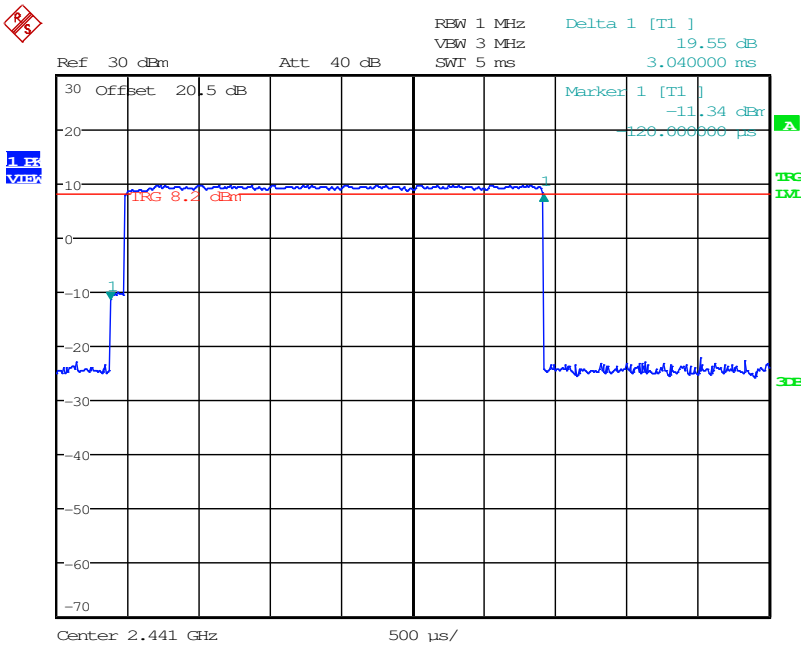

Figure 7.3.3.2-3: Channel Dwell Time – DH5

7.3.4 20dB / 99% Bandwidth - FCC Section 15.247(a)(1); ISED Canada RSS-247 5.1(1)

7.3.4.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. The spectrum analyzer span was set to 2 to 5 times the estimated bandwidth of the emission. The RBW was set to 1% to 5% of the estimated emission bandwidth. The trace was set to max hold with a peak detector active. The Delta function of the analyzer was utilized to determine the 20 dB bandwidth of the emissions.

The 99% occupied bandwidth was measured in accordance to RSS-Gen Section 6.6. The spectrum analyzer span set to fully display the emission. The RBW was set to 1% to 5% of the approximated bandwidth. The occupied 99% bandwidth was measured by using the 99% bandwidth equipment function of the spectrum analyzer.

7.3.4.2 Measurement Results

Results are shown below:

Table 7.3.4.2-1: 20dB / 99% Bandwidth

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
2402	966.0	894.0
2441	960.0	888.0
2480	954.0	888.0

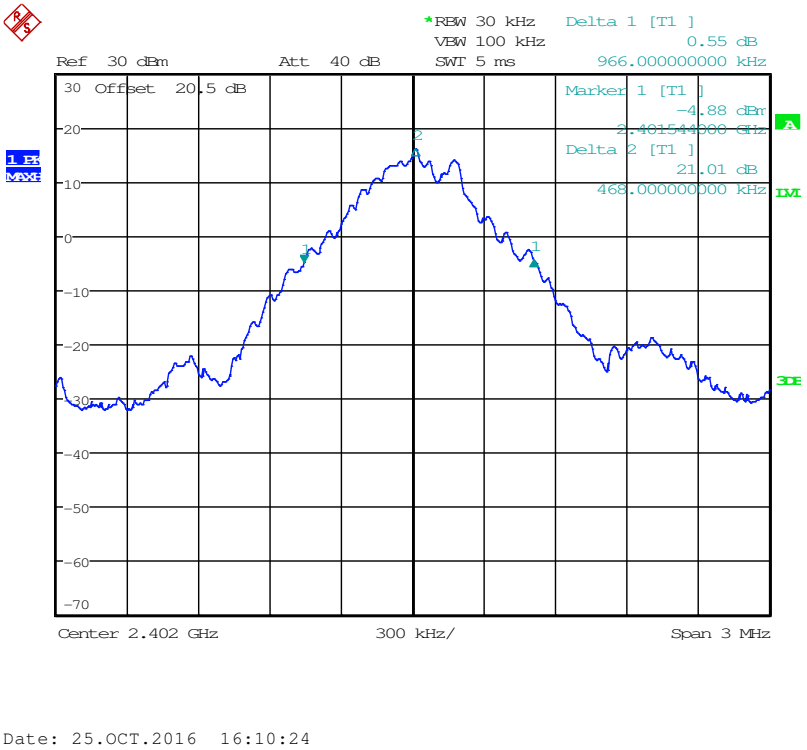

Figure 7.3.4.2-1: 20dB BW Low Channel (GFSK)

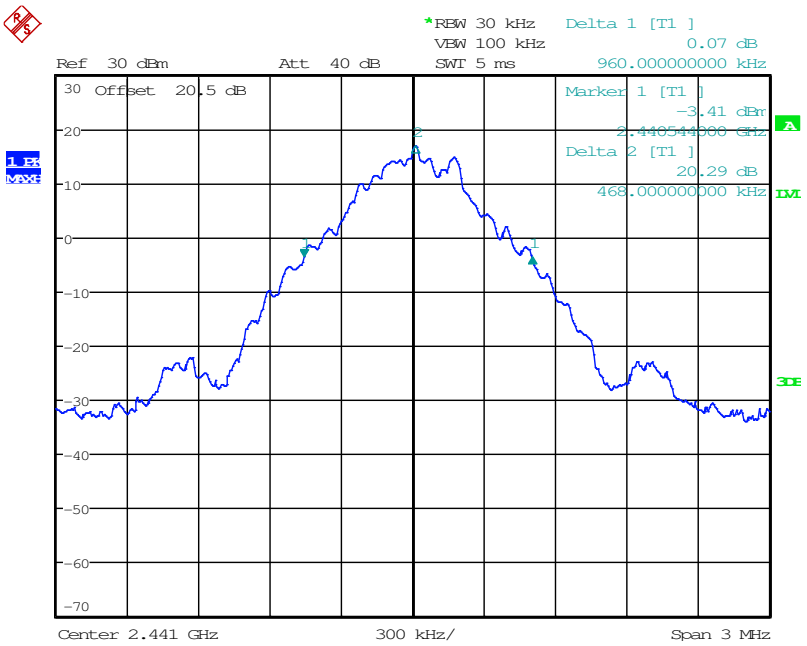

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Figure 7.3.4.2-2: 20dB BW Middle Channel (GFSK)

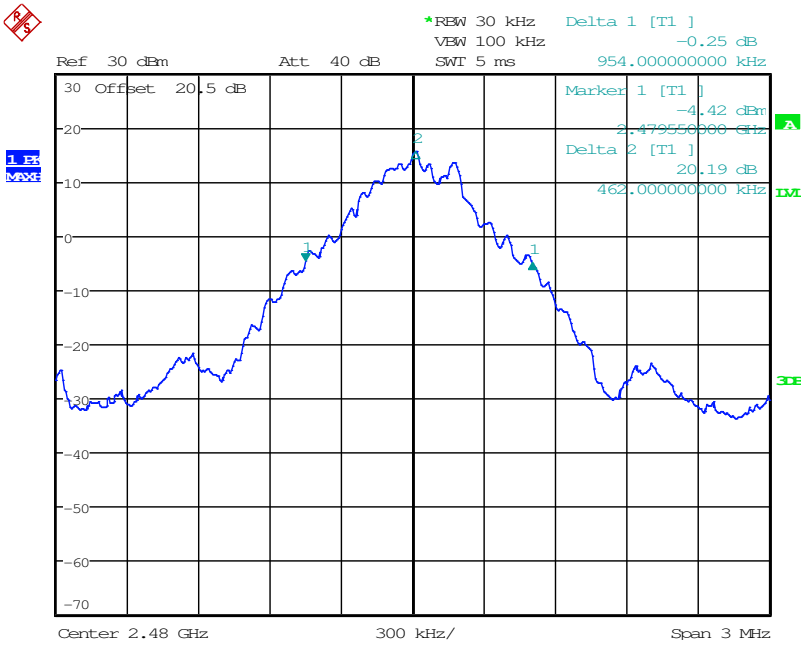

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Figure 7.3.4.2-3: 20dB BW High Channel (GFSK)

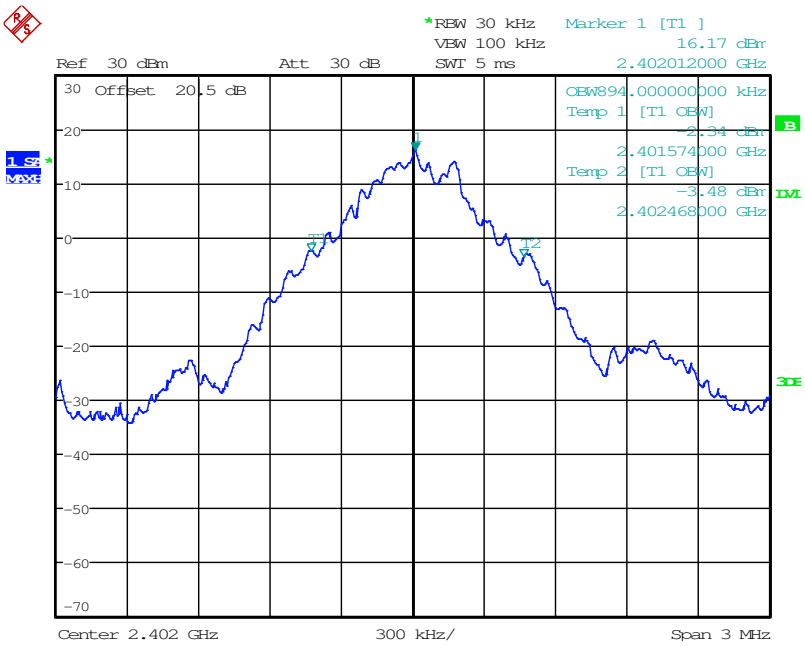

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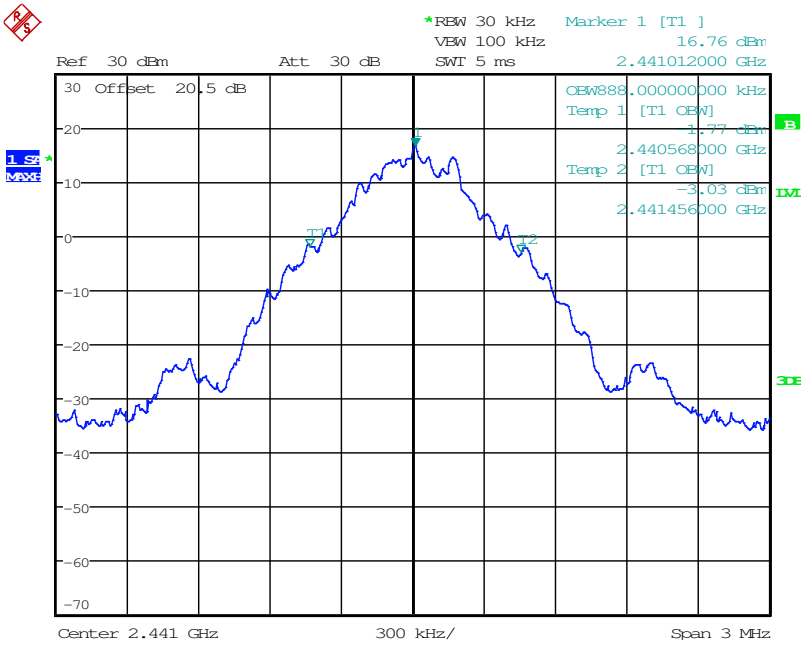
Figure 7.3.4.2-4: 99% OBW Low Channel (GFSK)



Date: 25.OCT.2016 16:16:17

Figure 7.3.4.2-5: 99% OBW Middle Channel (GFSK)

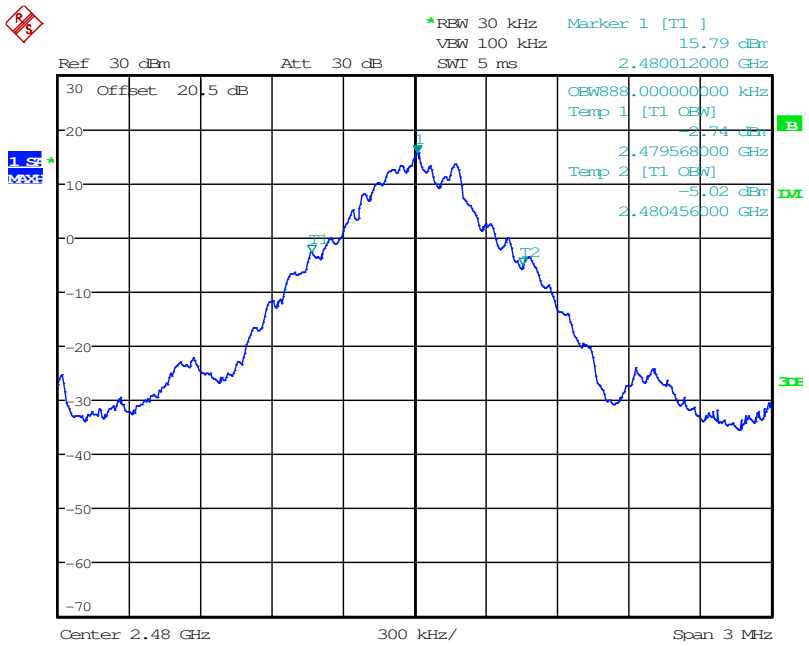


Figure 7.3.4.2-6: 99% OBW High Channel (GFSK)

Table: 7.3.4.2-2: 20dB / 99% Bandwidth (π/4 DQPSK)

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
2402	1340.0	1290.0
2441	1330.0	1300.0
2480	1330.0	1280.0

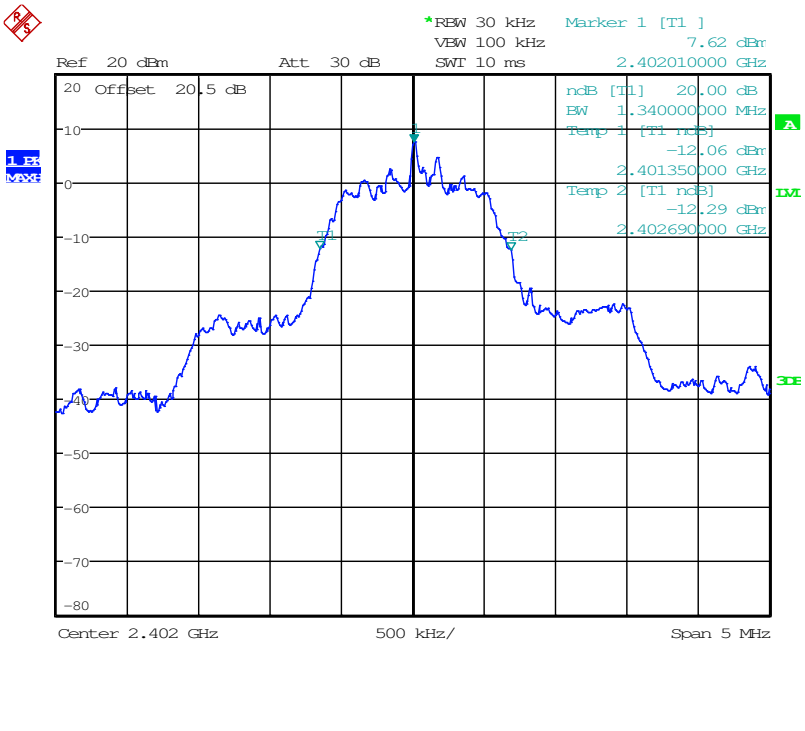


Figure 7.3.4.2-7: 20dB BW Low Channel (π/4 DQPSK)

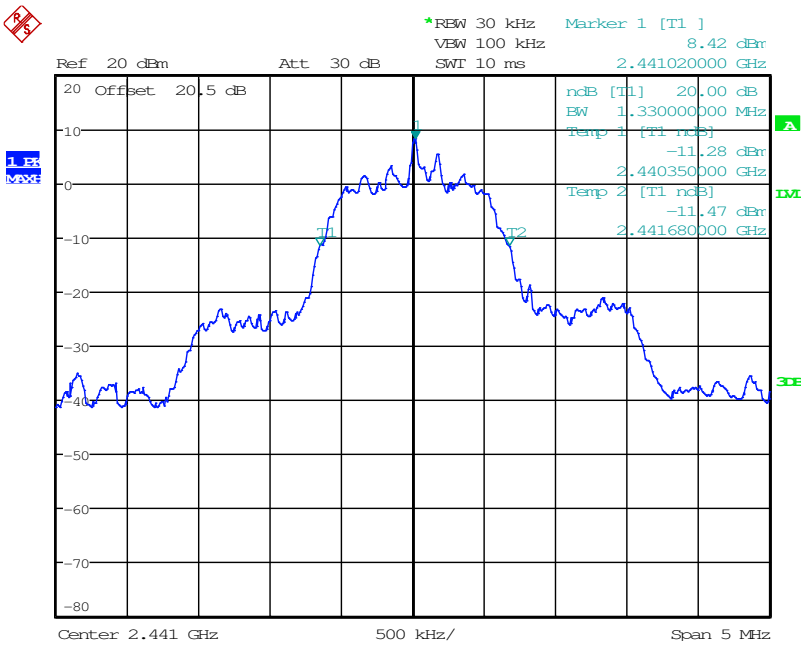


Figure 7.3.4.2-8: 20dB BW Middle Channel (π/4 DQPSK)

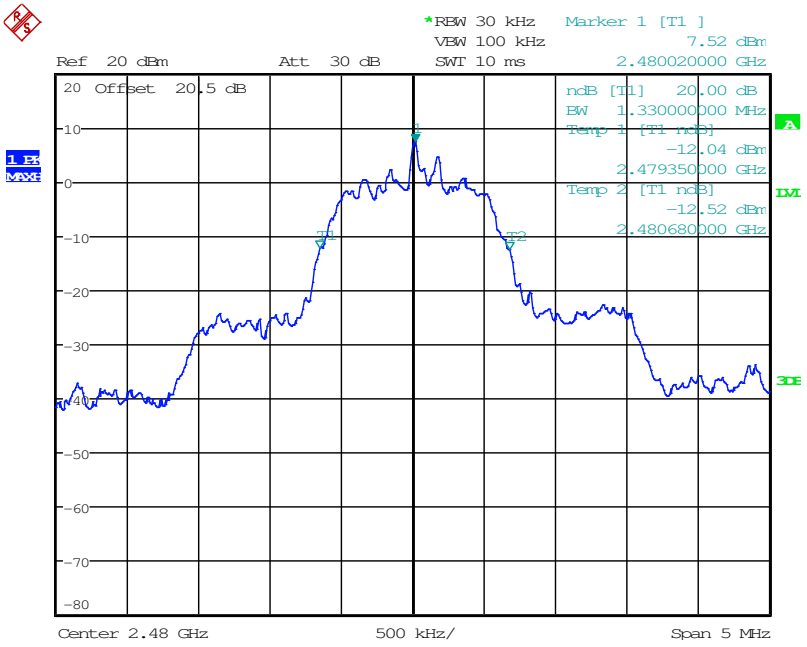


Figure 7.3.4.2-9: 20dB BW High Channel (π/4 DQPSK)

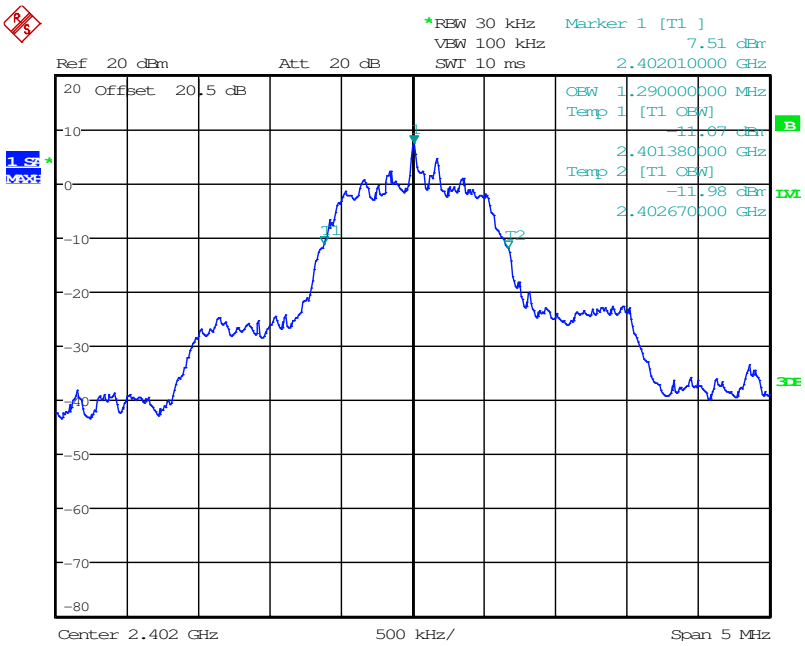


Figure 7.3.4.2-10: 99% OBW Low Channel (π/4 DQPSK)

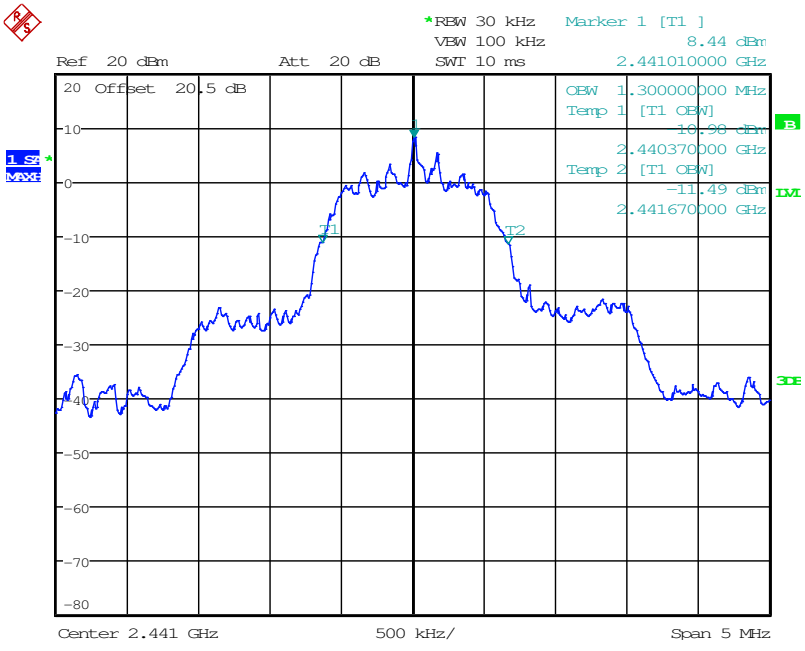


Figure 7.3.4.2-11: 99% OBW Middle Channel (π/4 DQPSK)

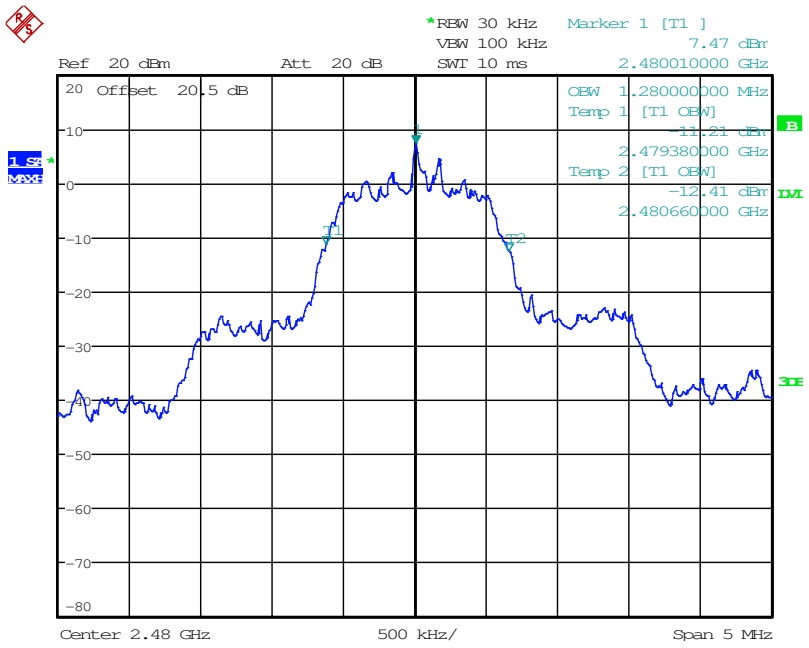


Figure 7.3.4.2-12: 99% OBW High Channel (π/4 DQPSK)

Table 7.3.4.2-3: 20dB / 99% Bandwidth (8DPSK)

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
2402	1320.0	1270.0
2441	1330.0	1270.0
2480	1320.0	1270.0

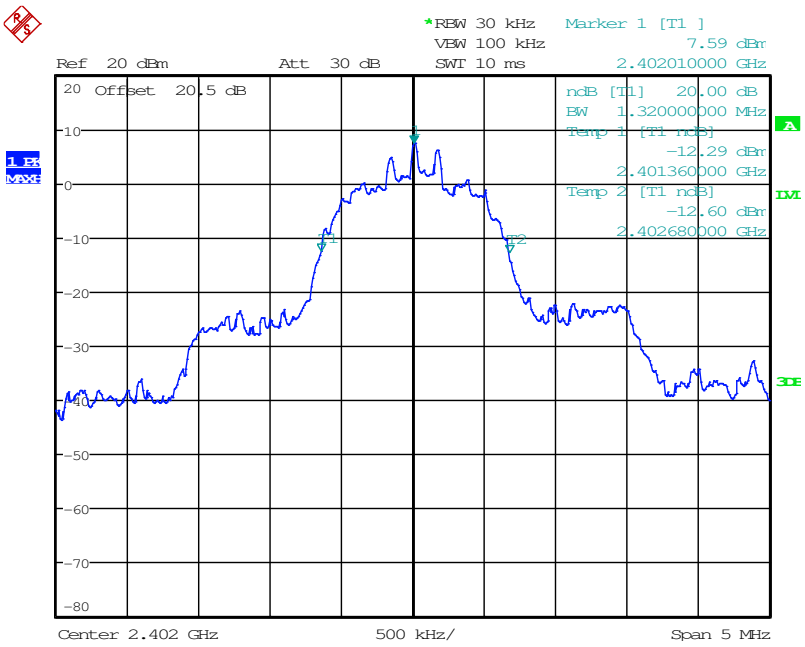


Figure 7.3.4.2-13: 20dB BW Low Channel (8DPSK)

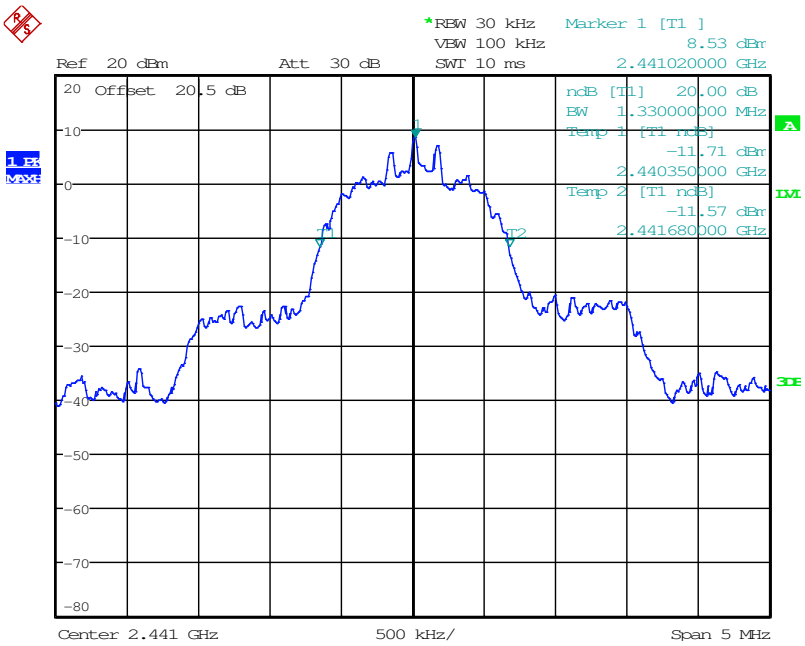


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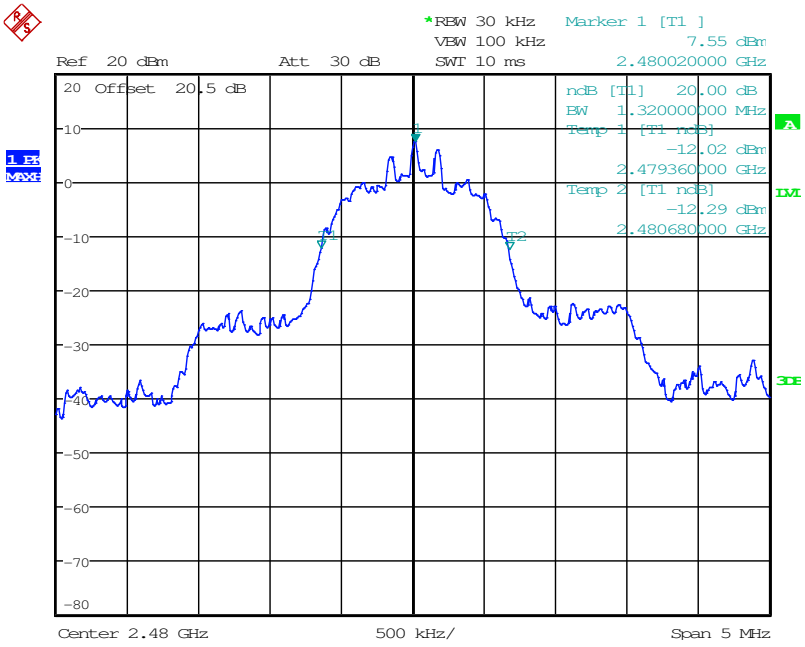
Figure 7.3.4.2-14: 20dB BW Middle Channel (8DPSK)



Date: 25.OCT.2016 15:50:20

Figure 7.3.4.2-15: 20dB BW High Channel (8DPSK)

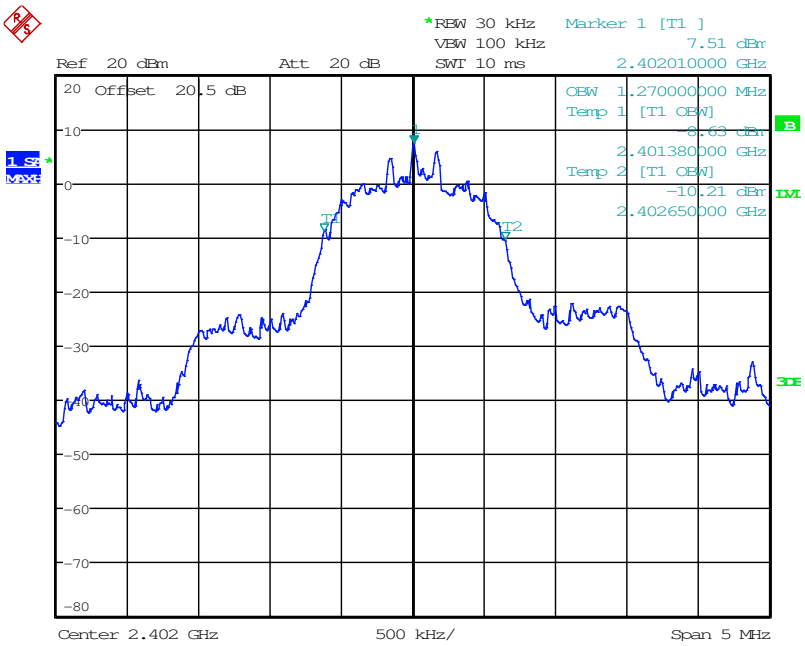


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Figure 7.3.4.2-16: 99% OBW Low Channel (8DPSK)

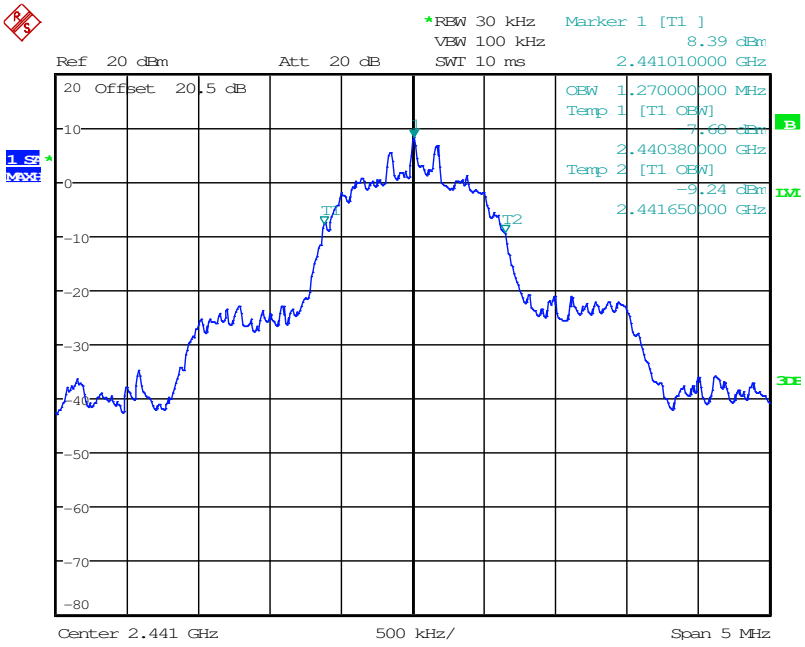

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Figure 7.3.4.2-17: 99% OBW Middle Channel (8DPSK)

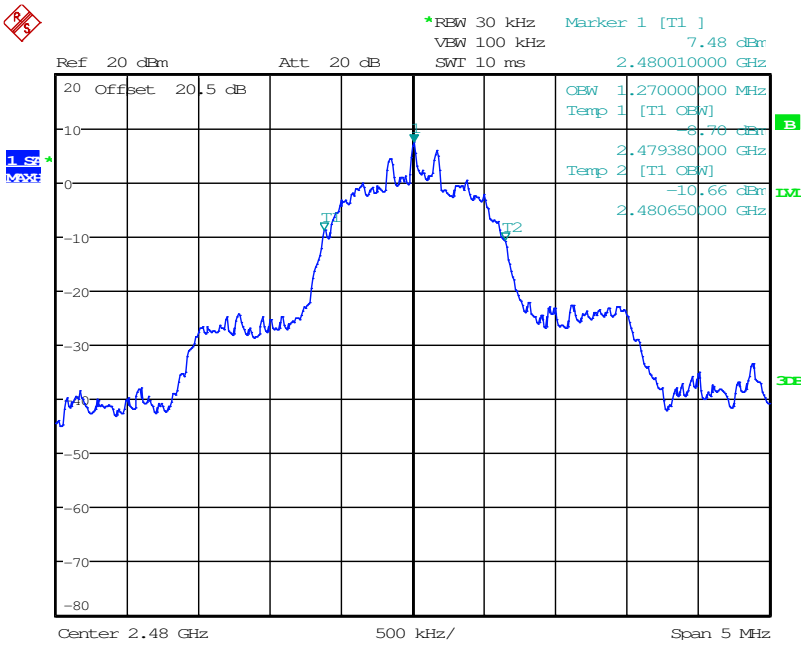


Figure 7.3.4.2-18: 99% OBW High Channel (8DPSK)

7.4 Band-Edge and Spurious Emissions

7.4.1 Band-Edge Compliance of RF Conducted Emissions - FCC Section 15.247(d); ISED Canada RSS-247 5.5

7.4.1.1 Measurement Procedure

The RF output port of the EUT was connected to the input of the spectrum analyzer through suitable attenuation. The EUT was investigated at the lowest and highest channel available to determine band-edge compliance. For each measurement the spectrum analyzer's RBW was set to 100 kHz and the VBW was set to >= 300 kHz.

7.4.1.2 Measurement Results

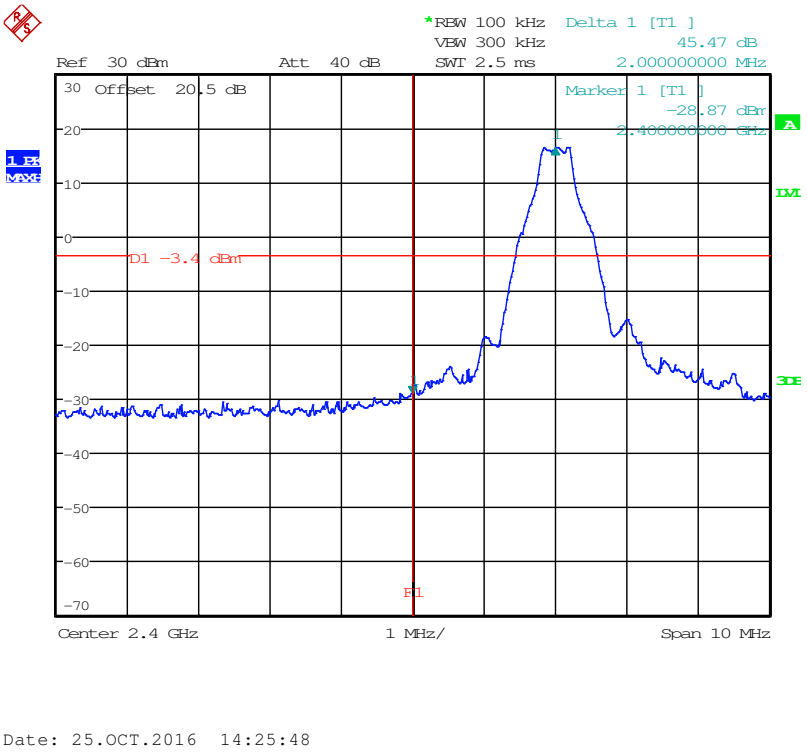
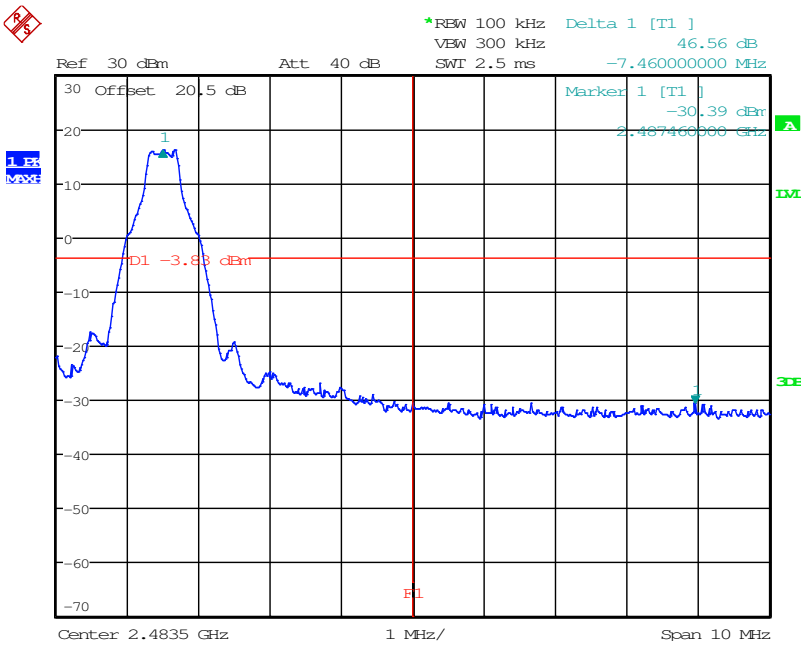
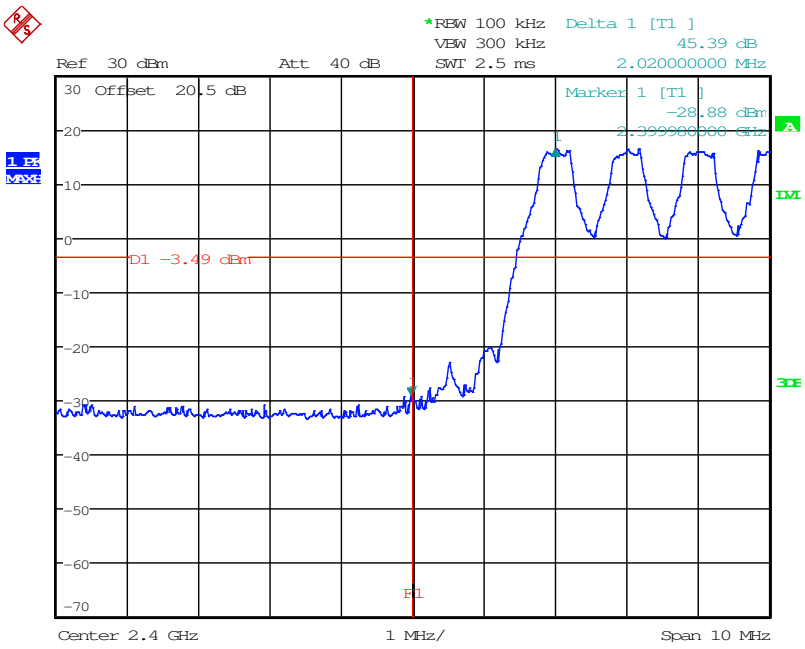


Figure 7.4.1.2-1: Lower Band-edge (GFSK)



Date: 25.OCT.2016 14:28:20

Figure 7.4.1.2-2: Upper Band-edge (GFSK)



Date: 25.OCT.2016 14:22:09

Figure 7.4.1.2-3: Lower Band-edge – Hopping Mode (GFSK)

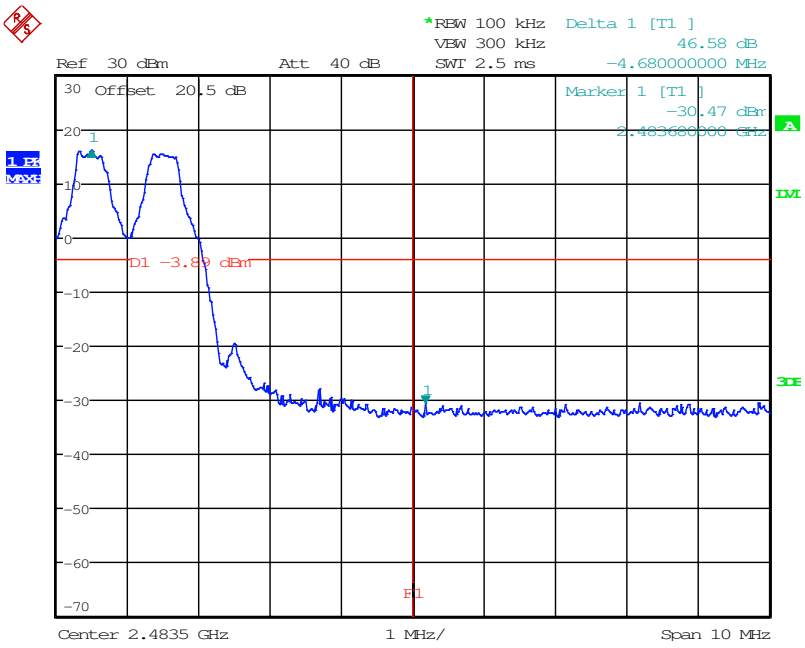
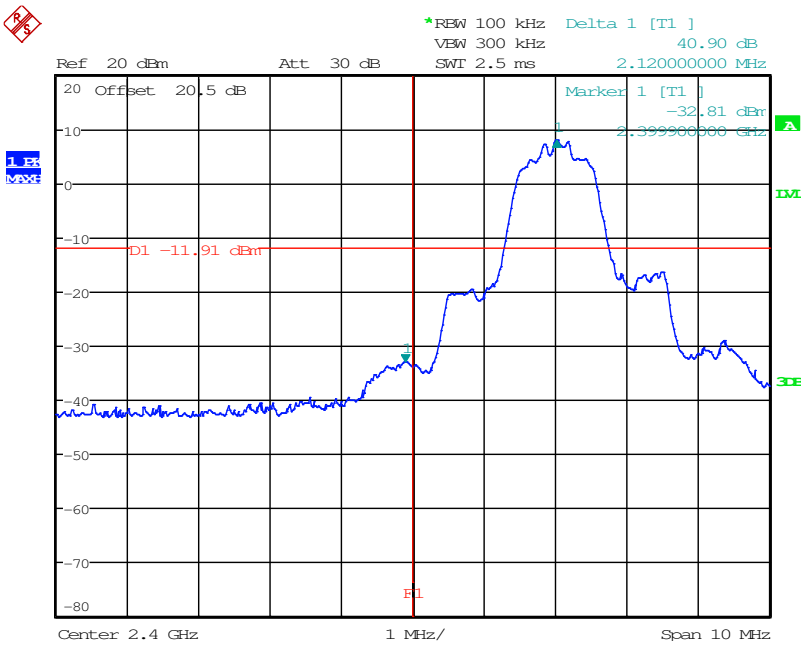
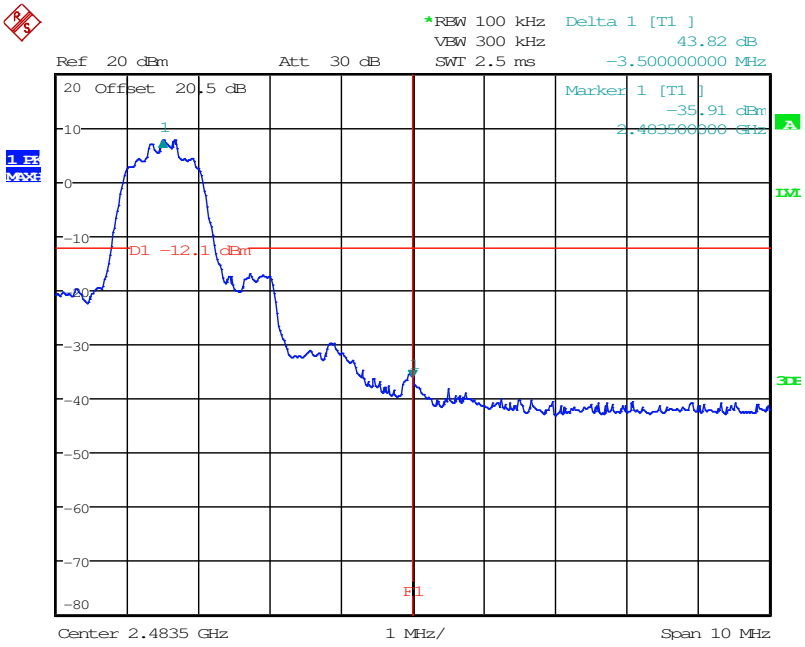


Figure 7.4.1.2-4: Upper Band-edge – Hopping Mode (GFSK)



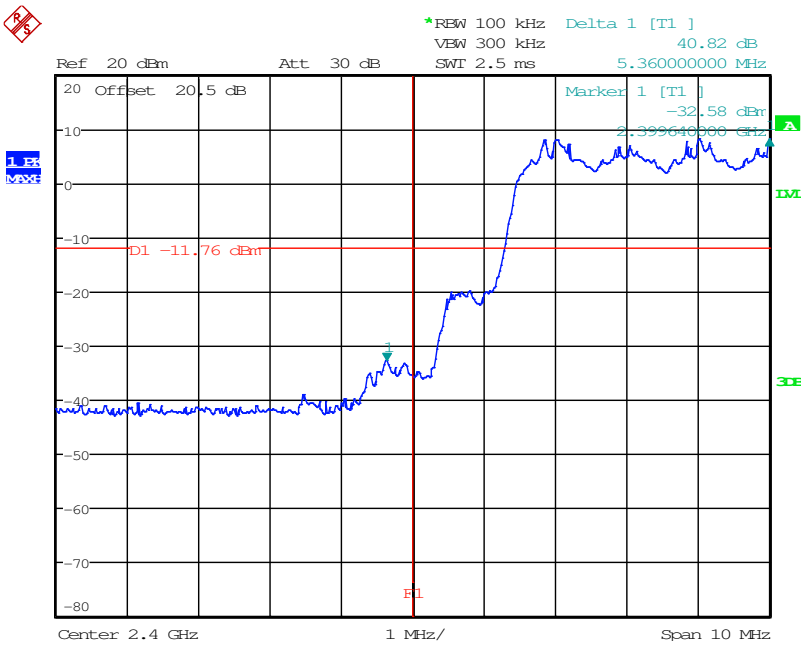
Date: 25.OCT.2016 15:13:40

Figure 7.4.1.2-5: Lower Band-edge (π/4 DQPSK)



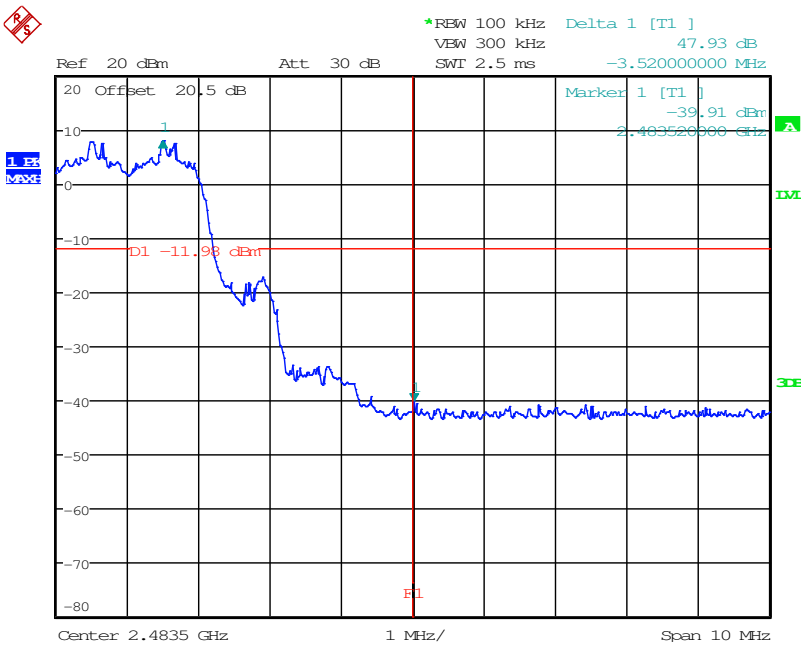
Date: 25.OCT.2016 14:33:22

Figure 7.4.1.2-6: Upper Band-edge (π/4 DQPSK)



Date: 25.OCT.2016 14:07:04

Figure 7.4.1.2-7: Lower Band-edge – Hopping Mode (π/4 DQPSK)



Date: 25.OCT.2016 14:09:58

Figure 7.4.1.2-8: Upper Band-edge – Hopping Mode (π/4 DQPSK)

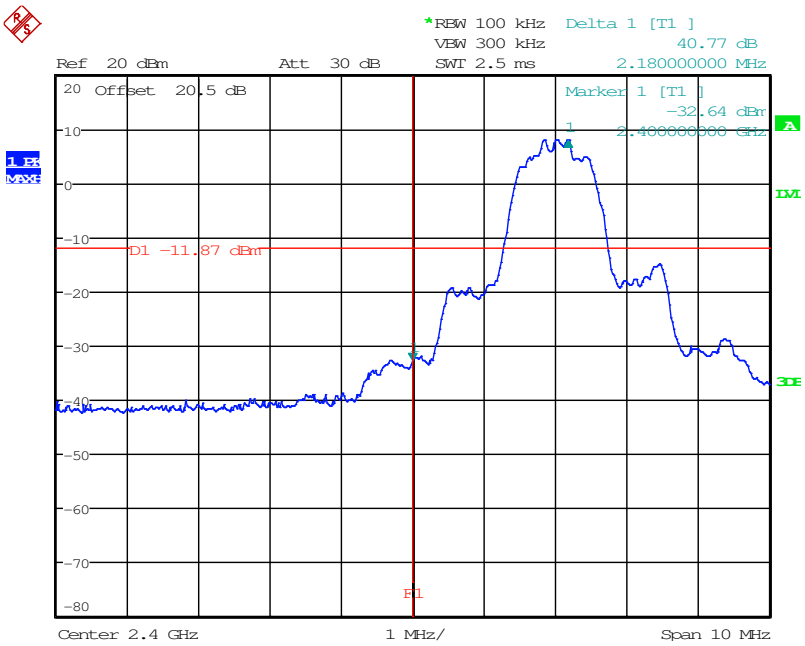


Figure 7.4.1.2-9: Lower Band-edge (8DPSK)

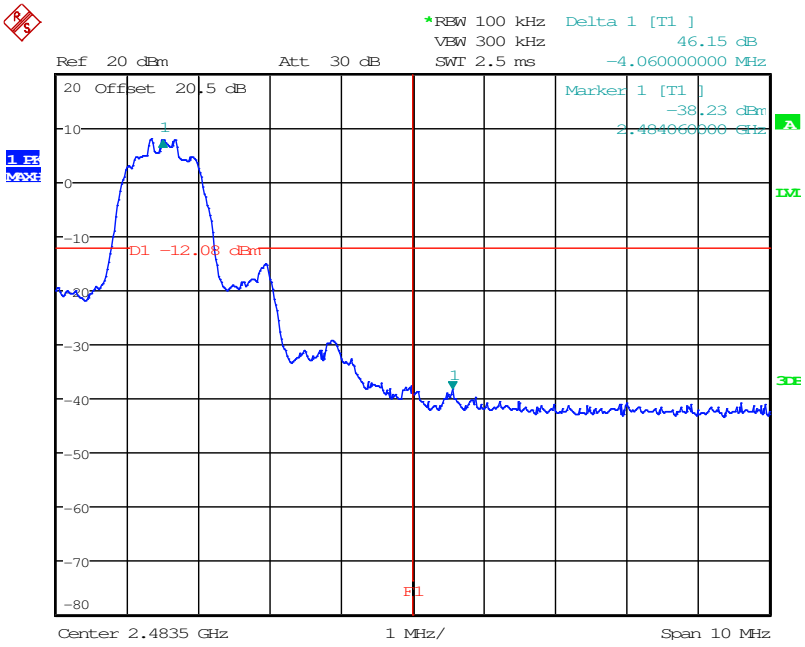


Figure 7.4.1.2-10: Upper Band-edge (8DPSK)

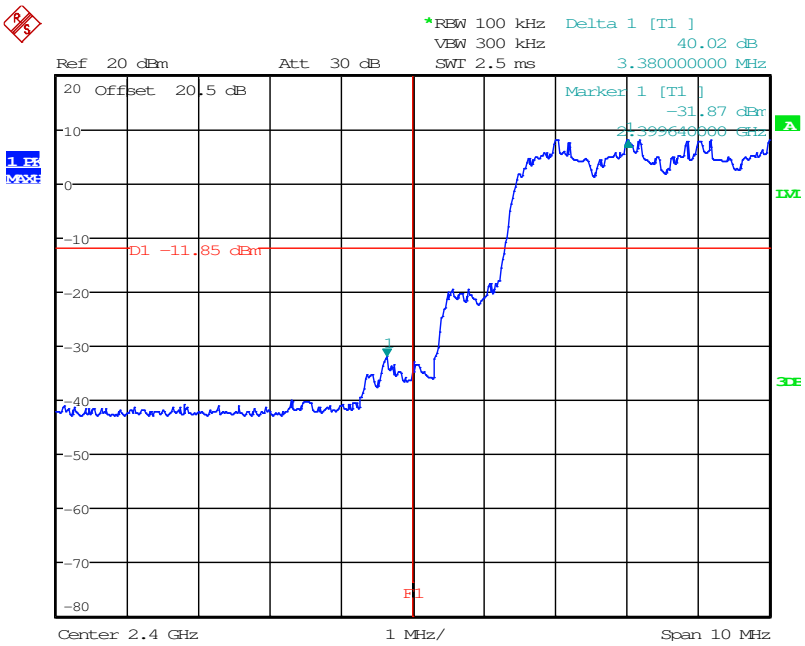


Figure 7.4.1.2-11: Lower Band-edge – Hopping Mode (8DPSK)

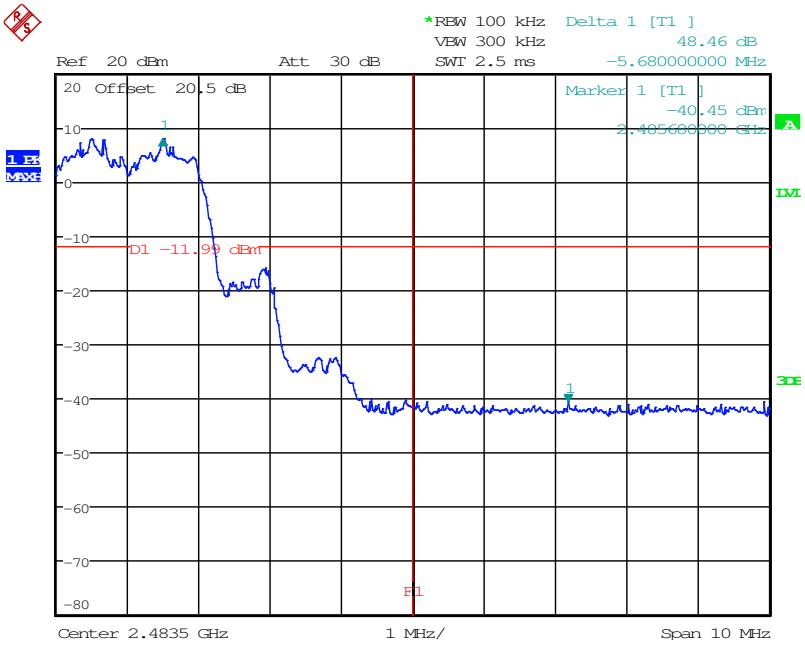


Figure 7.4.1.2-12: Upper Band-edge – Hopping Mode (8DPSK)

7.4.2 RF Conducted Spurious Emissions – FCC Section 15.247(d); ISED Canada RSS-247 5.5

7.4.2.1 Measurement Procedure

The RF output port of the EUT was connected to the spectrum analyzer. The EUT was investigated for conducted spurious emissions from 30MHz to 26 GHz, 10 times the highest fundamental frequency. Measurements were made at the low, center and high channels of the EUT. For each measurement, the spectrum analyzer's RBW was set to 100 kHz. A peak detector function was used with the trace set to max hold. The levels were corrected for cable and attenuator losses.

7.4.2.2 Measurement Results

Results are shown below:

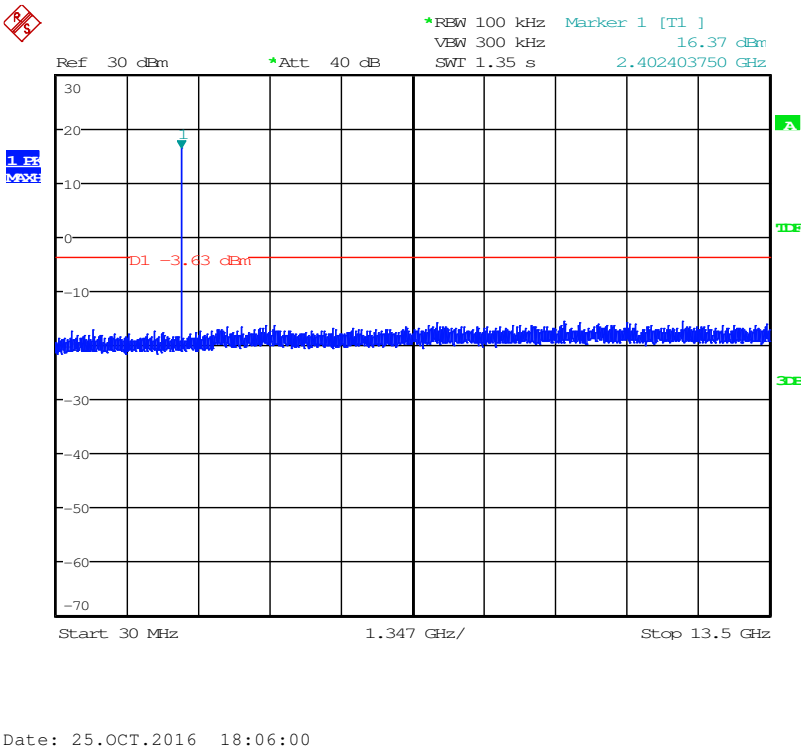
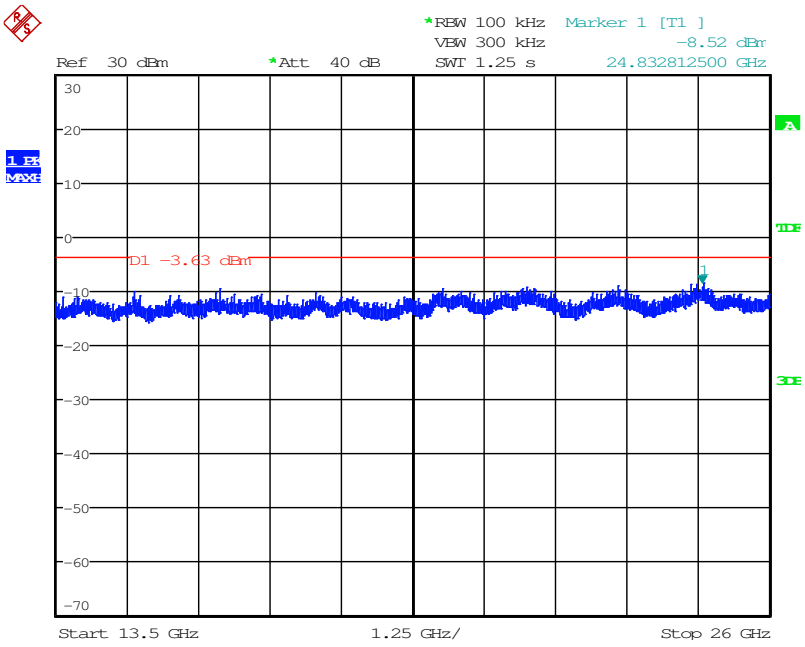
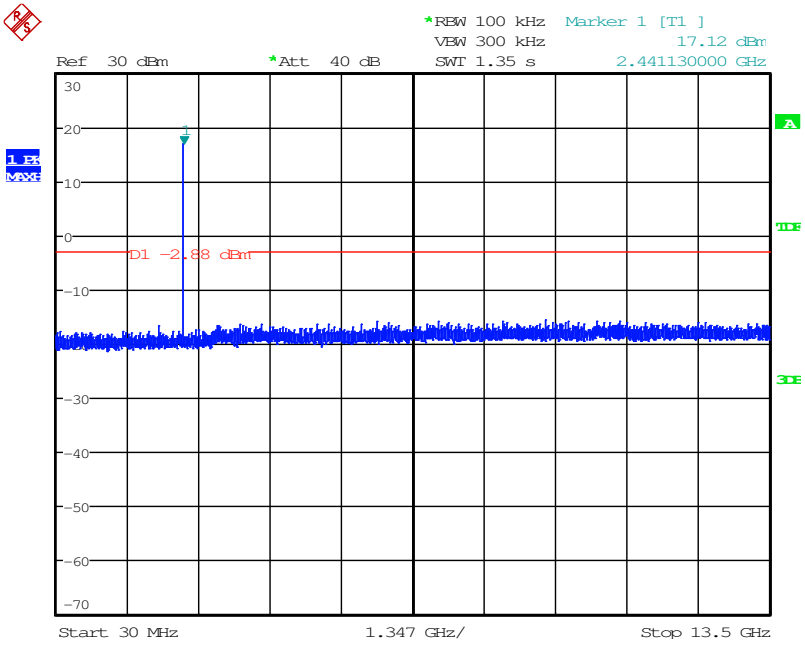


Figure 7.4.2.2-1: 30 MHz – 13.5 GHz – Low Channel (GFSK)



Date: 25.OCT.2016 18:09:05

Figure 7.4.2.2-2: 13.5 GHz –26 GHz – Low Channel (GFSK)



Date: 25.OCT.2016 18:15:51

Figure 7.4.2.2-3: 30 MHz – 13.5 GHz –Middle Channel (GFSK)

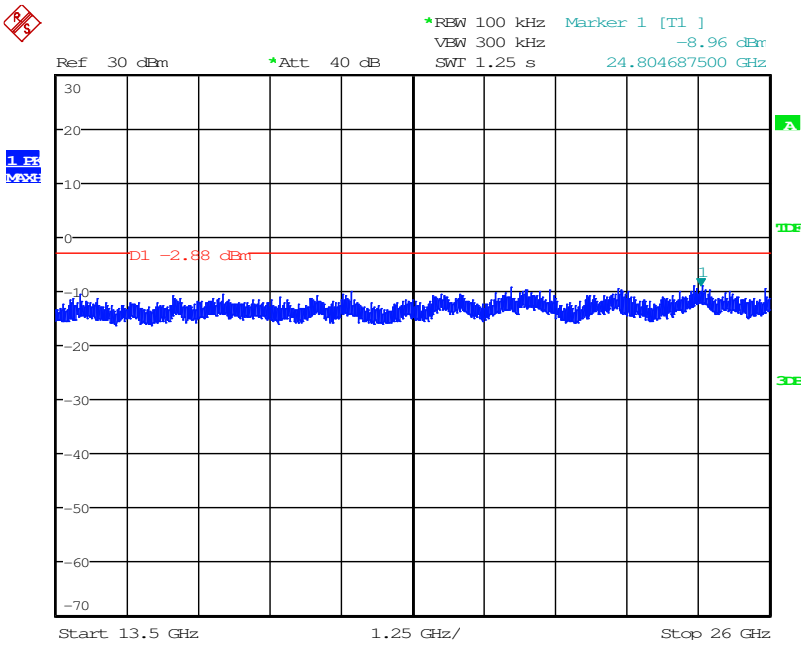


Figure 7.4.2.2-4: 13.5 GHz –26 GHz – Middle Channel (GFSK)

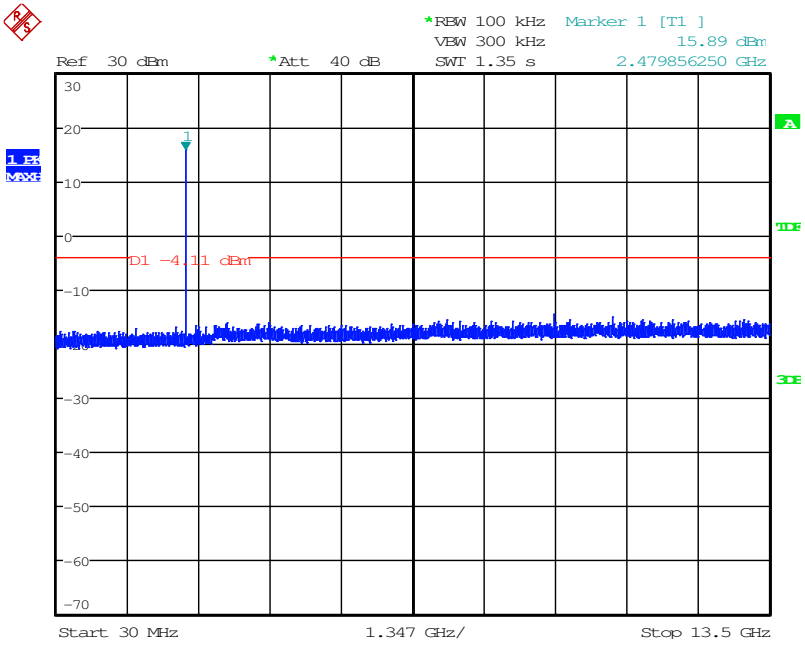
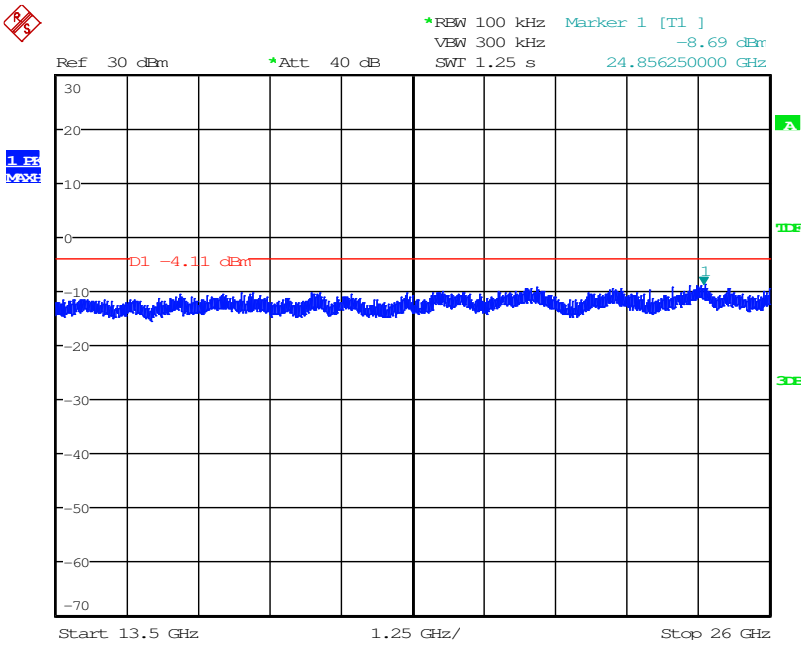


Figure 7.4.2.2-5: 30 MHz – 13.5 GHz – High Channel (GFSK)



Date: 25.OCT.2016 18:35:48

Figure 7.4.2.2-6: 13.5 GHz –26 GHz –High Channel (GFSK)

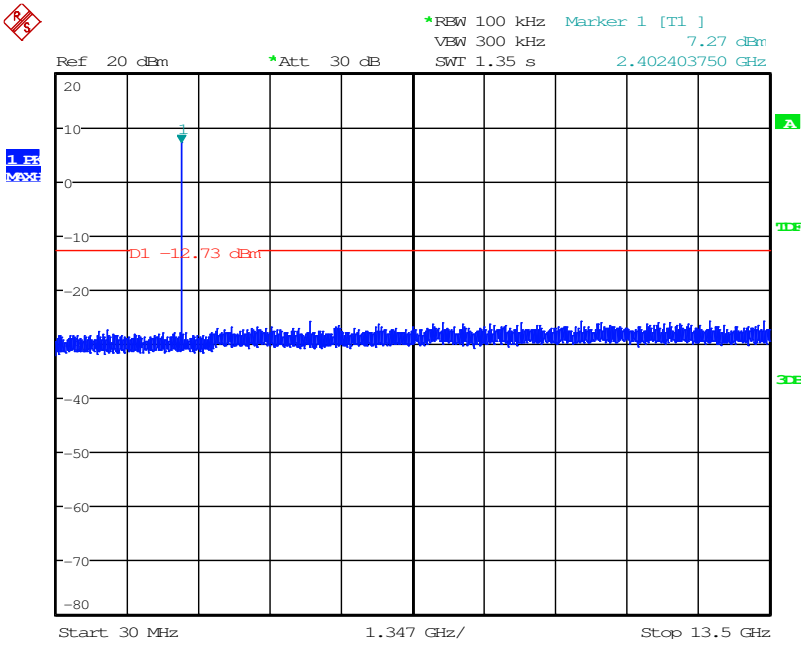


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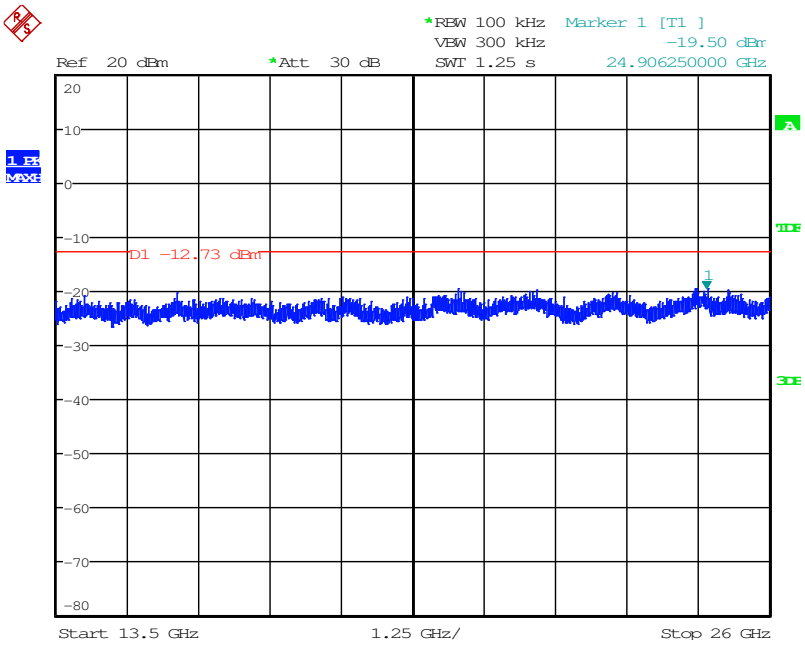
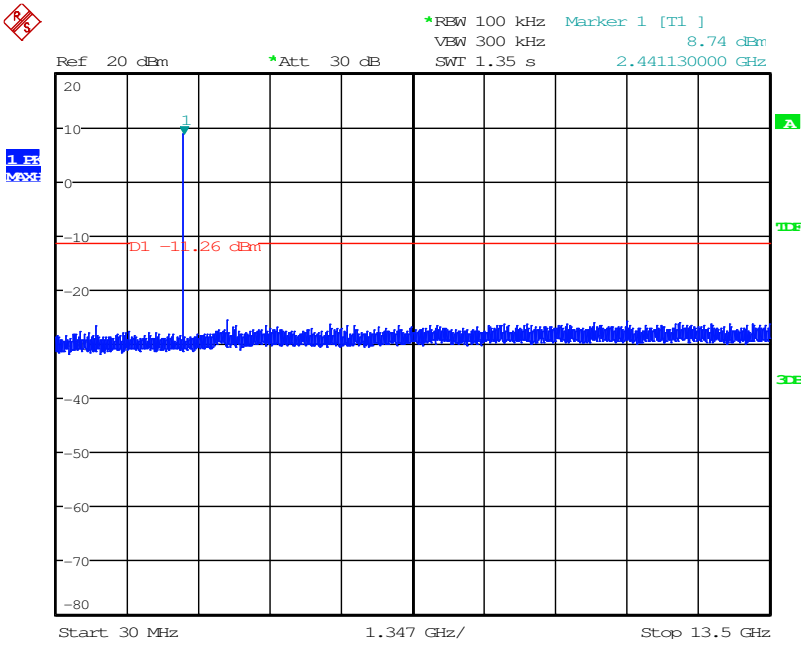
Figure 7.4.2.2-7: 30 MHz – 13.5 GHz – Low Channel (π/4 DQPSK)



Date: 25.OCT.2016 18:00:59

Figure 7.4.2.2-8: 13.5 GHz –26 GHz – Low Channel (π/4 DQPSK)



Date: 25.OCT.2016 17:54:21

Figure 7.4.2.2-9: 30 MHz – 13.5 GHz –Middle Channel (π/4 DQPSK)

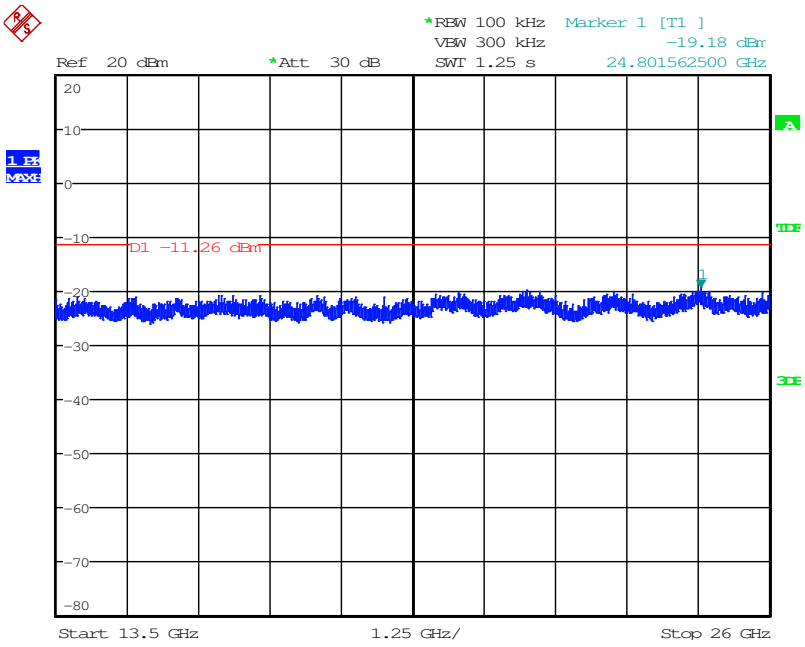


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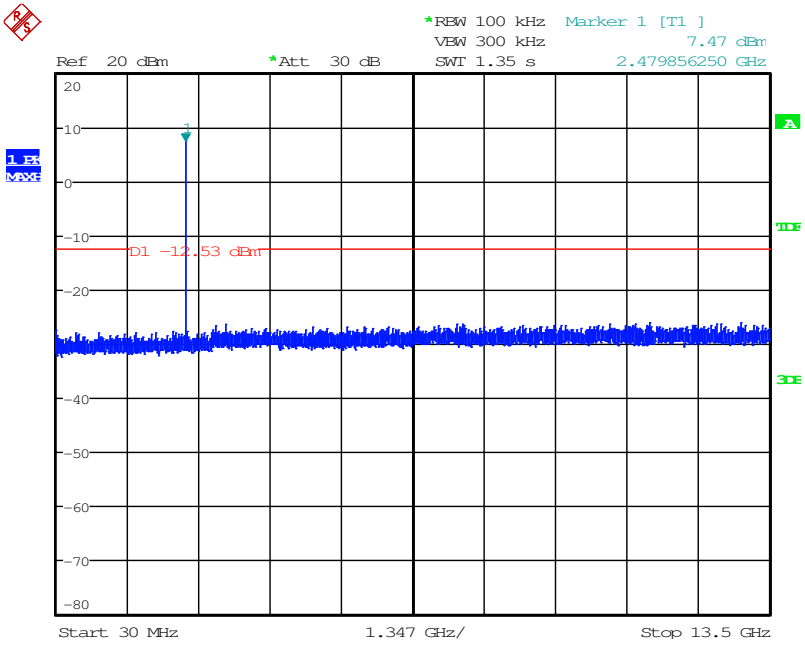
Figure 7.4.2.2-10: 13.5 GHz –26 GHz – Middle Channel (π/4 DQPSK)



Date: 25.OCT.2016 17:48:16

Figure 7.4.2.2-11: 30 MHz – 13.5 GHz – High Channel (π/4 DQPSK)

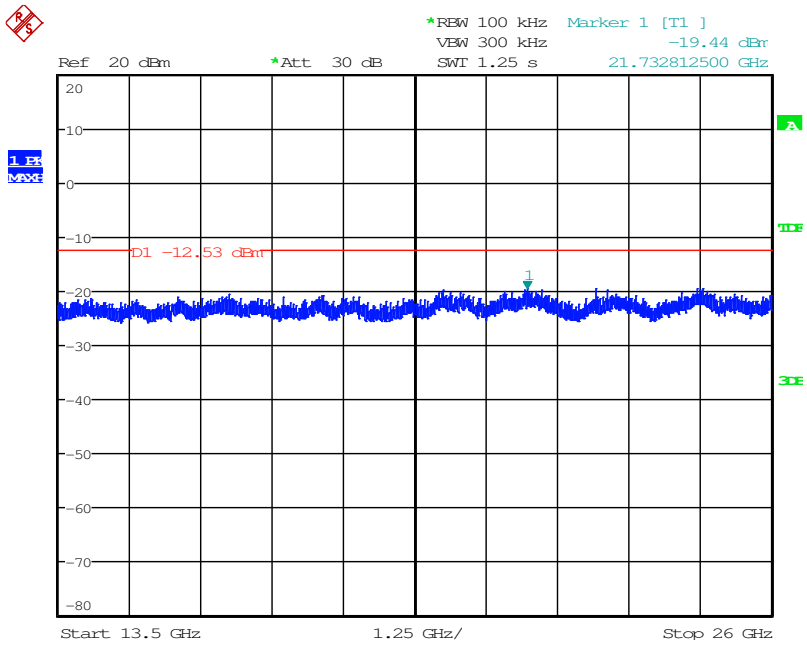


Figure 7.4.2.2-12: 13.5 GHz –26 GHz –High Channel (π/4 DQPSK)

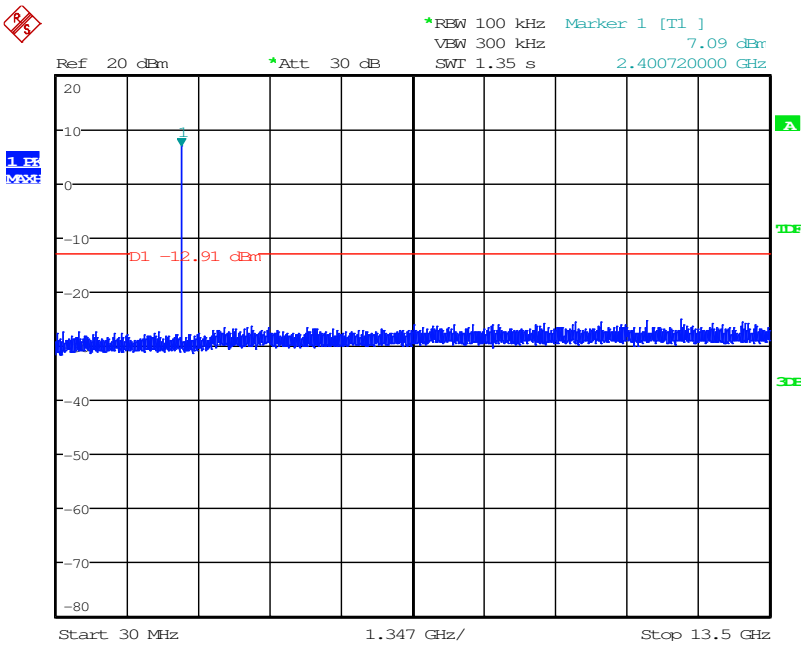


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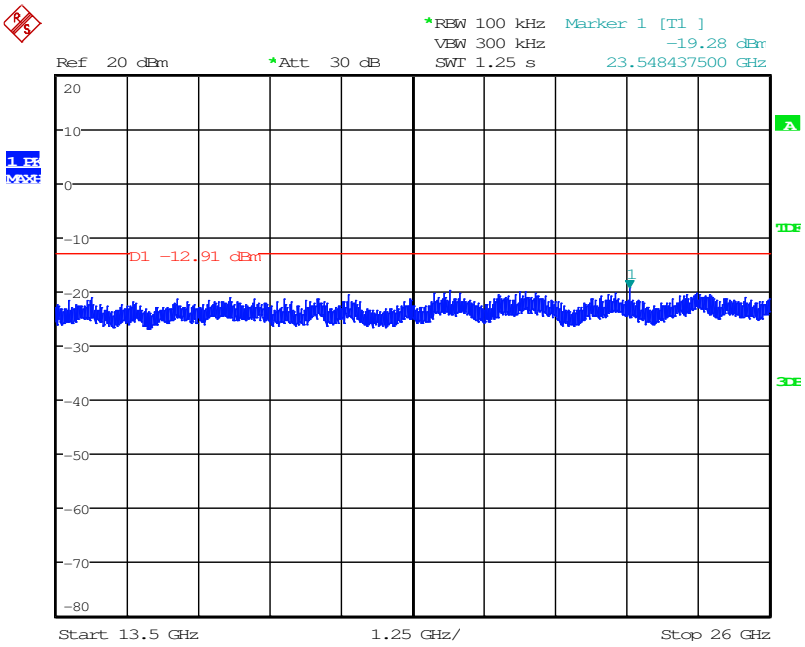
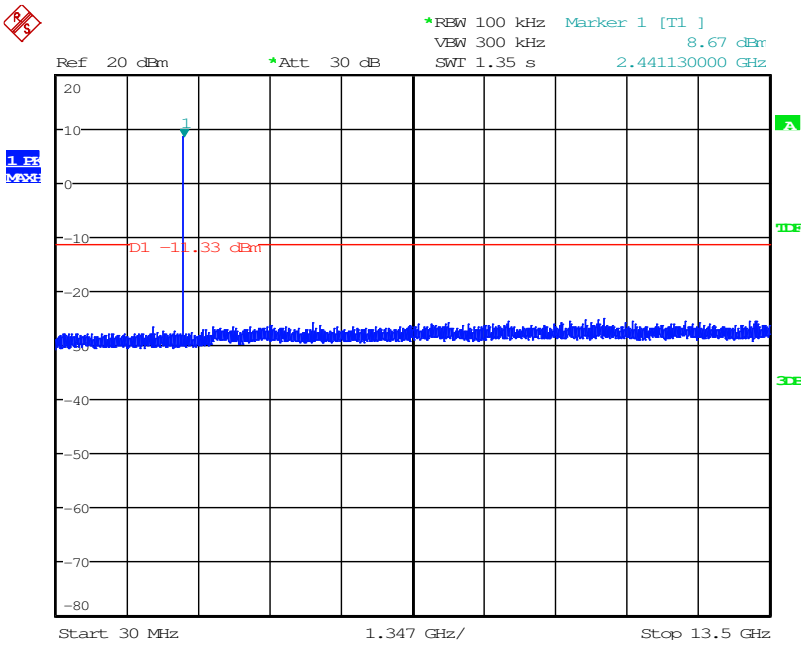
Figure 7.4.2.2-13: 30 MHz – 13.5 GHz – Low Channel (8DPSK)



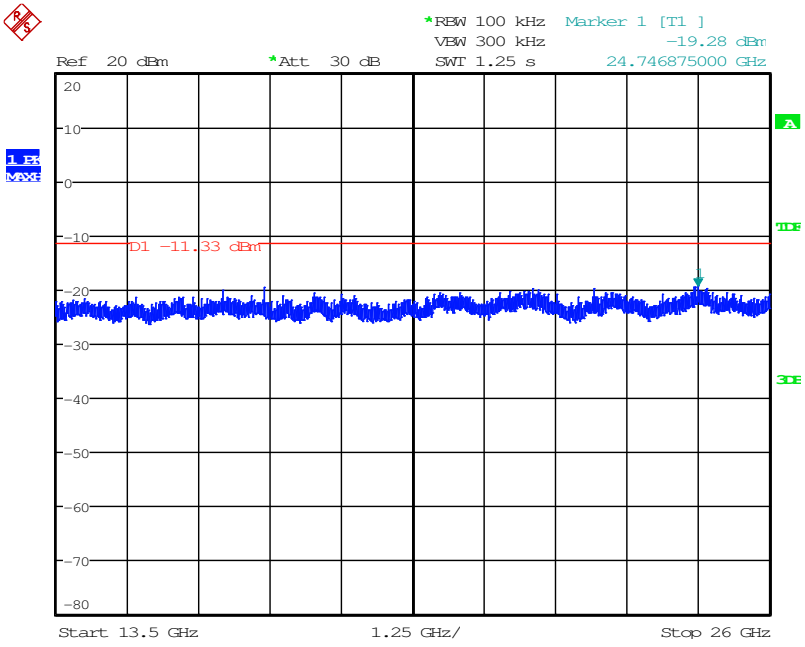
Date: 25.OCT.2016 17:25:59

Figure 7.4.2.2-14: 13.5 GHz –26 GHz – Low Channel (8DPSK)



Date: 25.OCT.2016 17:39:30

Figure 7.4.2.2-15: 30 MHz – 13.5 GHz –Middle Channel (8DPSK)



Date: 25.OCT.2016 17:41:07

Figure 7.4.2.2-16: 13.5 GHz –26 GHz – Middle Channel (8DPSK)

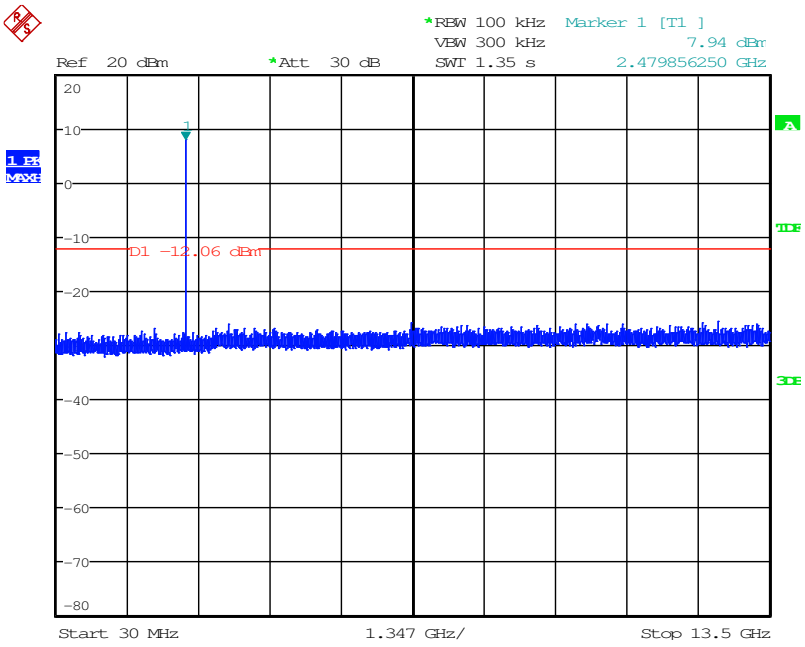


Figure 7.4.2.2-17: 30 MHz – 13.5 GHz – High Channel (8DPSK)

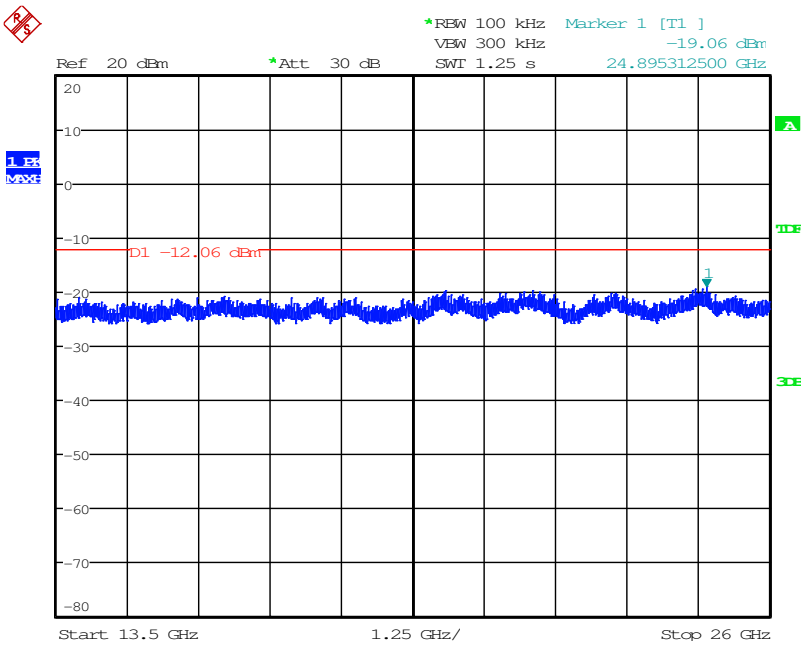


Figure 7.4.2.2-18: 13.5 GHz –26 GHz –High Channel (8DPSK)

7.4.3 Radiated Spurious Emissions within the Restricted Bands - FCC Sections 15.205, 15.209; ISED Canada RSS-Gen 8.9, 8.10

7.4.3.1 Measurement Procedure

Radiated emissions tests were made over the frequency range of 9 kHz to 26 GHz, 10 times the highest fundamental frequency. Each emission found to be in a restricted band as defined by section 15.205, including any emission at the operational band-edge, was compared to the radiated emission limits as defined in section 15.209.

For measurements below 30 MHz, the receive antenna height was set to 1m and the EUT was rotated through 360 degrees. The resolution bandwidth was set to 200 Hz below 150 kHz and to 9 kHz above 150 kHz.

For measurements above 30 MHz, the EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. For frequencies below 1000MHz, quasi-peak measurements were made using a resolution bandwidth RBW of 120 kHz and a video bandwidth VBW of 300 kHz. For frequencies above 1000 MHz, peak measurements made with RBW and VBW of 1 MHz and 3 MHz respectively. Average measurements were collected in the linear amplitude scale with VBW of 30 Hz. The average measurements were further corrected by using a duty cycle correction factor corresponding to the logarithm of the worst case dwell time over 100 ms.

DC = 20*log(3.04/100) = -30.34 dB

The EUT was caused to generate a continuous carrier signal on the hopping channel.

7.4.3.2 Measurement Results

Band-edge and radiated spurious emissions found in the restricted bands of 9 kHz to 26 GHz are reported in the tables below.

Table 7.4.3.2-1: Radiated Spurious Emissions Tabulated Data – GFSK

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel										
2390	60.90	46.11	H	-5.35	55.55	10.42	74.0	54.0	18.5	43.6
2390	60.12	45.56	V	-5.35	54.77	9.87	74.0	54.0	19.2	44.1
4804	48.60	40.62	H	3.21	51.81	13.49	74.0	54.0	22.2	40.5
4804	47.44	38.66	V	3.21	50.65	11.53	74.0	54.0	23.4	42.5
19216	44.06	31.59	H	10.88	54.94	12.12	83.5	63.5	28.6	51.4
19216	44.93	32.86	V	10.88	55.81	13.39	83.5	63.5	27.7	50.1
Middle Channel										
4882	50.06	43.81	H	3.49	53.55	16.96	74.0	54.0	20.4	37.0
4882	49.59	43.27	V	3.49	53.08	16.42	74.0	54.0	20.9	37.6
7323	51.69	44.34	H	9.46	61.15	23.46	74.0	54.0	12.8	30.5
7323	53.77	47.19	V	9.46	63.23	26.31	74.0	54.0	10.8	27.7
19528	44.57	31.87	H	11.00	55.57	12.52	83.5	63.5	27.9	51.0
19528	45.12	32.87	V	11.00	56.12	13.52	83.5	63.5	27.4	50.0
High Channel										
2483.5	75.88	65.00	H	-4.89	70.99	29.76	74.0	54.0	3.0	24.2
2483.5	73.40	62.97	V	-4.89	68.51	27.73	74.0	54.0	5.5	26.3
4960	49.88	43.91	H	3.77	53.65	17.34	74.0	54.0	20.3	36.7
4960	49.93	43.57	V	3.77	53.70	17.00	74.0	54.0	20.3	37.0
7440	51.29	43.53	H	9.80	61.09	22.98	74.0	54.0	12.9	31.0
7440	54.23	47.76	V	9.80	64.03	27.21	74.0	54.0	10.0	26.8
19840	44.92	32.46	H	12.01	56.93	14.13	83.5	63.5	26.6	49.4
19840	45.69	33.84	V	12.01	57.70	15.51	83.5	63.5	25.8	48.0

Notes:

- **All emissions above 19.84 GHz were attenuated below the limits and the noise floor of the measurement equipment.**
- **The measurements above 10 GHz were performed at a test distance of 1m. The limits are corrected accordingly using a distance factor of 20*log(3/1) dB.**
- **The average measurements were further corrected using a duty cycle correction factor corresponding to the logarithm of the dwell time over 100 ms.**

Table 7.4.3.2-2: Radiated Spurious Emissions Tabulated Data – (π/4) DQPSK

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel										
2390	57.12	43.91	H	-5.35	51.77	8.22	74.0	54.0	22.2	45.8
2390	56.86	43.79	V	-5.35	51.51	8.10	74.0	54.0	22.5	45.9
4804	44.34	31.53	H	3.21	47.55	4.40	74.0	54.0	26.5	49.6
4804	43.88	31.32	V	3.21	47.09	4.19	74.0	54.0	26.9	49.8
Middle Channel										
4882	44.61	33.11	H	3.49	48.10	6.26	74.0	54.0	25.9	47.7
4882	44.60	32.23	V	3.49	48.09	5.38	74.0	54.0	25.9	48.6
7323	44.95	33.09	H	9.46	54.41	12.21	74.0	54.0	19.6	41.8
7323	46.06	34.81	V	9.46	55.52	13.93	74.0	54.0	18.5	40.1
High Channel										
2483.5	68.35	54.99	H	-4.89	63.46	19.75	74.0	54.0	10.5	34.2
2483.5	66.63	53.81	V	-4.89	61.74	18.57	74.0	54.0	12.3	35.4
4960	44.50	32.51	H	3.77	48.27	5.94	74.0	54.0	25.7	48.1
4960	44.68	32.43	V	3.77	48.45	5.86	74.0	54.0	25.5	48.1
7440	44.53	32.49	H	9.80	54.33	11.94	74.0	54.0	19.7	42.1
7440	45.69	35.30	V	9.80	55.49	14.75	74.0	54.0	18.5	39.2

Note:

- **All emissions above 7.44 GHz were attenuated below the limits and the noise floor of the measurement equipment.**
- **The measurements above 10 GHz were performed at a test distance of 1m. The limits are corrected accordingly using a distance factor of 20*log(3/1) dB.**
- **The average measurements were further corrected using a duty cycle correction factor corresponding to the logarithm of the dwell time over 100 ms.**

Table 7.4.3.2-3: Radiated Spurious Emissions Tabulated Data – 8DPSK

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel										
2390	57.70	43.95	H	-5.35	52.35	8.26	74.0	54.0	21.7	45.7
2390	57.28	43.80	V	-5.35	51.93	8.11	74.0	54.0	22.1	45.9
4804	44.05	31.80	H	3.21	47.26	4.67	74.0	54.0	26.7	49.3
4804	43.86	31.22	V	3.21	47.07	4.09	74.0	54.0	26.9	49.9
Middle Channel										
4882	44.88	33.25	H	3.49	48.37	6.40	74.0	54.0	25.6	47.6
4882	44.31	32.33	V	3.49	47.80	5.48	74.0	54.0	26.2	48.5
7323	45.24	33.15	H	9.46	54.70	12.27	74.0	54.0	19.3	41.7
7323	46.68	34.59	V	9.46	56.14	13.71	74.0	54.0	17.9	40.3
High Channel										
2483.5	70.63	58.79	H	-4.89	65.74	23.55	74.0	54.0	8.3	30.4
2483.5	68.71	57.05	V	-4.89	63.82	21.81	74.0	54.0	10.2	32.2
4960	43.99	32.77	H	3.77	47.76	6.20	74.0	54.0	26.2	47.8
4960	43.85	32.20	V	3.77	47.62	5.63	74.0	54.0	26.4	48.4
7440	44.76	32.33	H	9.80	54.56	11.78	74.0	54.0	19.4	42.2
7440	46.08	34.98	V	9.80	55.88	14.43	74.0	54.0	18.1	39.6

Note:

- **All emissions above 7.44 GHz were attenuated below the limits and the noise floor of the measurement equipment.**
- **The measurements above 10 GHz were performed at a test distance of 1m. The limits are corrected accordingly using a distance factor of 20*log(3/1) dB.**
- **The average measurements were further corrected using a duty cycle correction factor corresponding to the logarithm of the dwell time over 100 ms.**

7.4.3.3 Sample Calculation:

$R_C = R_U + CF_T$

Where:

CF_T	=	Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
R_U	=	Uncorrected Reading
R_C	=	Corrected Level
AF	=	Antenna Factor
CA	=	Cable Attenuation
AG	=	Amplifier Gain
DC	=	Duty Cycle Correction Factor

DC = 20*log(3.04/100) = -30.34 dB

Example Calculation: Peak
Corrected Level: 60.9 + (-5.35) = 55.55 dBµV/m
Margin: 74 dBµV/m – 55.55 dBµV/m = 18.5 dB

Example Calculation: Average
Corrected Level: 46.11 + (-5.35) - 30.34 = 10.42 dBµV/m
Margin: 54 dBµV/m – 10.42 dBµV/m = 43.6 dB

7.5 Power Line Conducted Emissions – FCC Section 15.207; ISED Canada RSS-Gen 8.8

7.5.1 Measurement Procedure

ANSI C63.10 section 6.2 was the guiding document for this evaluation. Conducted emissions were performed from 150 kHz to 30 MHz with the spectrum analyzer's resolution bandwidth set to 9 kHz and the video bandwidth set to 30 kHz. The calculation for the conducted emissions is as follows:

Corrected Reading = Analyzer Reading + LISN Loss + Cable Loss
Margin = Applicable Limit - Corrected Reading

7.5.2 Measurement Results

Results of the test corresponding to the EUT configuration leading to the worse case emissions are shown below:

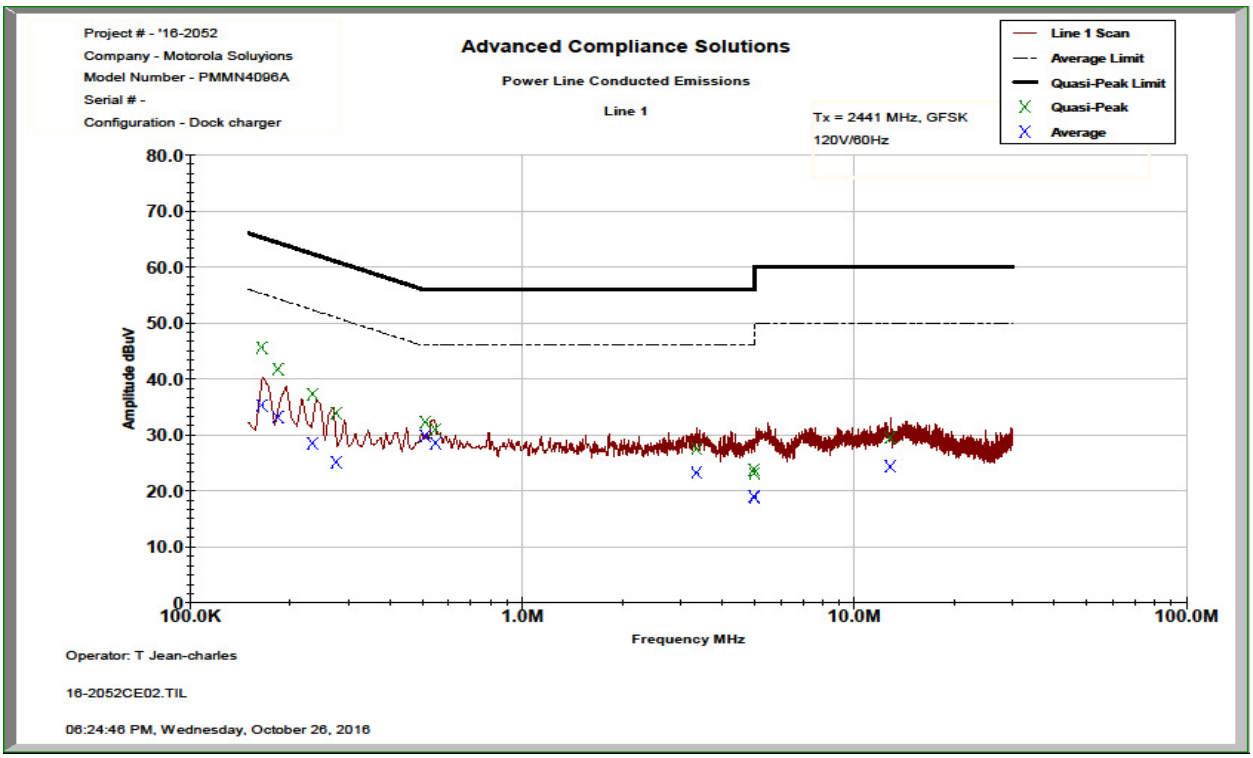


Figure 7.5.2-1: Conducted Emissions Results – Line 1

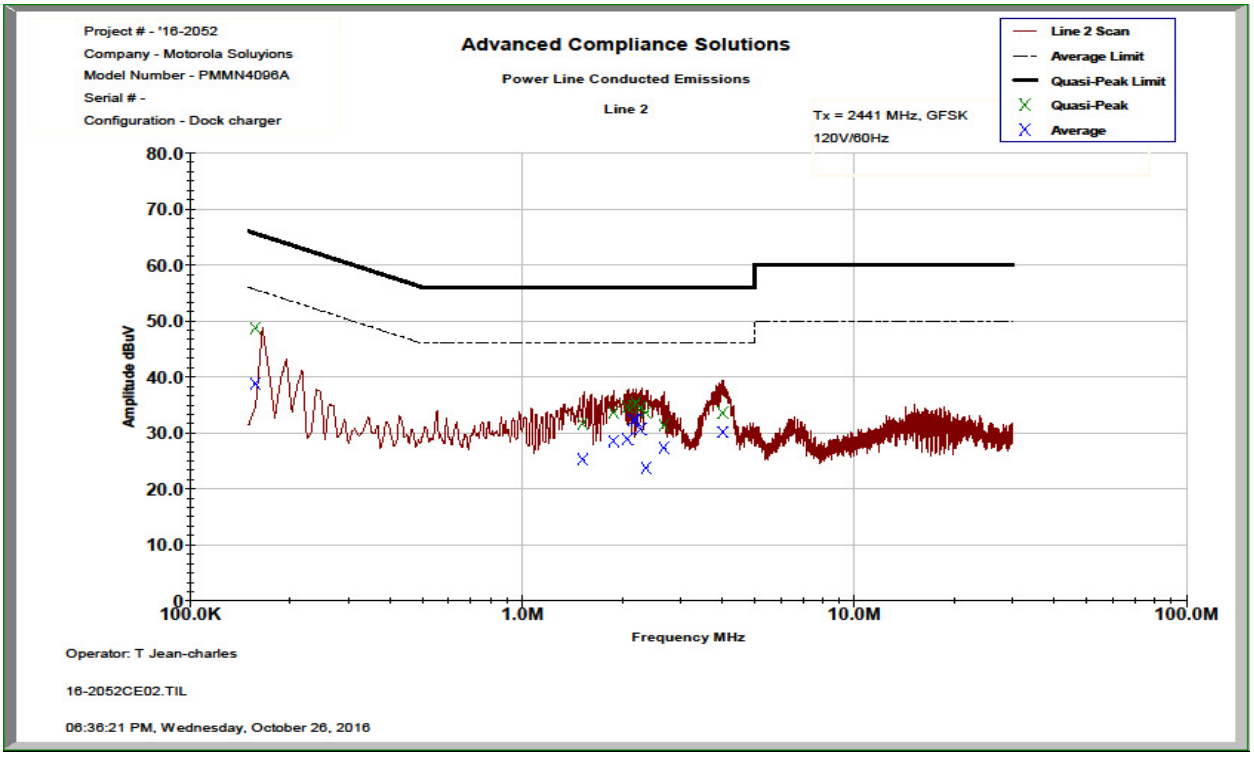


Figure 7.5.2-2: Conducted Emissions Results – Line 2

Table 7.5.2-1: Conducted EMI Results

☒ Line 1 ☒ Line 2 ☐ Line 3
☐ Line 4
☐ To Ground ☒ Floating
☐ Telecom Port _____
☒ dBµV ☐ dBµA

Plot Number: 16-2052CE02
Power Supply Description:
5VDC MU15-M1050-A00S

Frequency (MHz)	Uncorrected Reading		Total Correction Factor (dB)	Corrected Level		Limit		Margin (dB)	
	Quasi-Peak	Average		Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
Line 1									
0.164175	35.386	25.06	10.25	45.63	35.31	65.25	55.25	19.6	19.9
0.183825	31.549	22.936	10.23	41.78	33.16	64.31	54.31	22.5	21.1
0.233949	27.071	18.305	10.24	37.31	28.54	62.31	52.31	25.0	23.8
0.275649	23.69	14.882	10.23	33.92	25.11	60.95	50.95	27.0	25.8
0.51105	22.031	19.628	10.23	32.26	29.86	56.00	46.00	23.7	16.1
0.54915	20.751	18.329	10.23	30.98	28.56	56.00	46.00	25.0	17.4
3.34975	17.105	12.794	10.43	27.53	23.22	56.00	46.00	28.5	22.8
4.99445	13.306	8.499	10.48	23.79	18.98	56.00	46.00	32.2	27.0
5.00385	12.666	8.321	10.53	23.19	18.85	60.00	50.00	36.8	31.2
12.8402	18.593	13.471	10.86	29.45	24.33	60.00	50.00	30.5	25.7
Line 2									
0.157308	38.52	28.533	10.26	48.78	38.79	65.60	55.60	16.8	16.8
1.52116	21.345	14.88	10.33	31.67	25.21	56.00	46.00	24.3	20.8
1.88651	23.29	18.182	10.33	33.62	28.51	56.00	46.00	22.4	17.5
2.07279	24.254	18.461	10.41	34.66	28.87	56.00	46.00	21.3	17.1
2.16286	24.45	21.845	10.41	34.86	32.25	56.00	46.00	21.1	13.8
2.19994	25.033	21.913	10.41	35.44	32.32	56.00	46.00	20.6	13.7
2.27332	24.045	20.259	10.41	34.45	30.66	56.00	46.00	21.6	15.3
2.36147	23.214	13.36	10.41	33.62	23.77	56.00	46.00	22.4	22.2
2.67052	20.924	16.88	10.41	31.33	27.29	56.00	46.00	24.7	18.7
4.02156	23.039	19.621	10.53	33.57	30.15	56.00	46.00	22.4	15.9

8 CONCLUSION

In the opinion of ACS, Inc., the model PMMN4096A manufactured by Motorola Solutions Sdn Bhd meets the requirements of FCC Part 15 subpart C and Innovation, Science and Economic Development Canada's Radio Standards Specification RSS-247 for the test procedures documented in the test report.

END REPORT