Test Report

FCC ID: 2AVE9-TRKR01
IC: 25817-TRKR01

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

Report Number: AT72154363-2C3

Manufacturer: Swarm Technologies
Product: Tracker
Model: TRKR01

Test Begin Date: January 7, 2020
Test End Date: January 16, 2020

Report Issue Date: April 23, 2020

FOR THE SCOPE OF ACCREDITATION UNDER Certificate Number: 2955.09

This report must not be used by the client to claim product certification, approval, or endorsement by A2LA, NIST, or any agency of the Federal Government.

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This report contains 37 pages

TABLE OF CONTENTS

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 Applicant Information

Swarm Technologies
435 N Whisman Road
Suite 100
Mountain View, California 94043

1.3 Product Description

The Tracker is a Remote 2-way data transfer device from anywhere on Earth via the Swarm satellite constellation. The Tracker connects to a third-party sensor and transmits the data to Swarm's space network. The Tracker contains a VHF satellite radio, GNSS Receiver, 802.11 WLAN radio, Bluetooth Classic, and Bluetooth Low Energy radio.

This report covers the compliance of the Bluetooth Classic radio only. All other radios are covered in separate reports accompanying this certification filing.

Technical Details:

Detail	Description
Frequency Range (MHz)	2402 – 2480
Number of Channels	79
Channel Spacing	1 MHz
Modulation Format	GFSK, π/4-DQPSK, 8DPSK
Data Rates	1 MBPS, 2 MBPS, 3 MBPS
Operating Voltage	5 VDC
Antenna Type(s) / Gain(s)	Ceramic Chip Antenna / 1 dBi

Test Sample Serial Number(s): C3 (Radiated measurements)
C7 (Antenna Port Conducted measurements)

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

1.4 Test Methodology and Considerations

All modes of operation, including all data rates, were evaluated and the data presented in this report represents the worst case where applicable. The worst-case packet types were DH3 for the GFSK modulation, 2-DH5 for π/4-DQPSK, and 3-DH1 for 8DPSK.

For radiated emissions, the EUT was evaluated in three orthogonal orientations. The worst-case orientation was the Y-orientation. A 50-ohm non-radiating termination was placed on the VHF antenna port.

For antenna port conducted emissions, the EUT was coupled to the measuring equipment through a temporary SMA Pigtail in place of the ceramic chip antenna with suitable attenuation. A 50-ohm non-radiating termination was placed on the VHF antenna port and GNSS Antenna port.

For power line conducted emissions, the EUT was programmed for continuous modulated transmission on the Bluetooth radio and the VHF radio. All combinations of VHF radio antennas were evaluated, and the worst case was with the quarter-wave antenna.

Radiated inter-modulation testing was performed for all combinations of simultaneous transmission and found to be compliant.

Power setting during test: 6

2 TEST FACILITIES

2.1 Location

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

TÜV SÜD America, Inc.
5945 Cabot Pkwy, Suite 100
Alpharetta, GA 30005
Phone: (678) 341-5900

2.2 Laboratory Accreditations/Recognitions/Certifications

TÜV SÜD America, Inc. is accredited to ISO/IEC 17025 by the American Association for Laboratory Accreditation/A2LA accreditation program and has been issued certificate number 2955.09 in recognition of this accreditation.

Unless otherwise specified, all tests methods described within this report are covered under the ISO/IEC 17025 scopes of accreditation.

The Semi-Anechoic Chamber Test Sites and Conducted Emissions Sites have been fully described, submitted to, and accepted by the FCC, ISED Canada and the Japanese Voluntary Control Council for Interference by information technology equipment.

FCC Designation Accreditation Number:	US1233
ISED Canada Lab Code:	23932
VCCI Member Number:	1831
• VCCI Registration Number	A-0295

2.3 Radiated Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site – Chamber A

The Semi-Anechoic Chamber Test Site consists of a 20’ x 30’ x 18’ shielded enclosure. The chamber is lined with Toyo Ferrite Grid Absorber, model number FFG-1000. The ferrite tile grid is 101 x 101 x 19mm thick and weighs approximately 550 grams. These tiles are mounted on steel panels and installed directly on the inner walls of the chamber.

The turntable is 5’ in diameter and is located 5’6” from the back wall of the chamber. The chamber is grounded via 1 - 8’ copper ground rod, installed at the center of the back wall, it is bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is all steel, flush mounted EMCO Model 1060 installed in an all steel frame. The table is remotely operated from inside the control room located 25’ from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Behind the turntable is a 3’ x 6’ x 4’ deep shielded pit used for support equipment if necessary. The pit is equipped with 1 - 4” PVC chase from the turntable to the pit that allows for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit.

The chamber rear wall is covered with a mixture of Siepel pyramidal absorber. The side walls of the chamber are partially covered with Siepel pyramidal absorber.

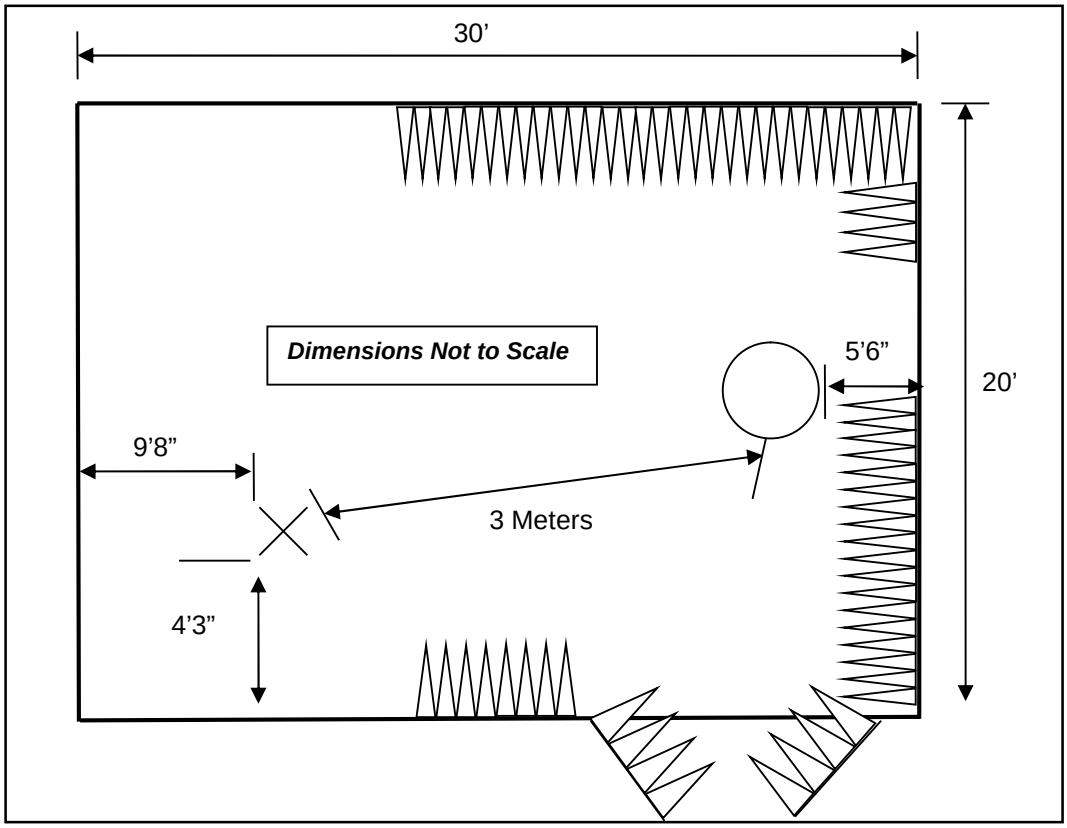


Figure 2.3.1-1: Semi-Anechoic Chamber Test Site – Chamber A

2.3.2 Semi-Anechoic Chamber Test Site – Chamber B

The Semi-Anechoic Chamber Test Site consists of a 20'W x 30'L x 20'H shielded enclosure. The chamber is lined with ETS-Lindgren Ferrite Absorber, model number FT-1500. The ferrite tile 600 mm x 600 mm (2.62 in x 23.62 in) panels and are mounted directly on the inner walls of the chamber shield.

The specular regions of the chamber are lined with additional ETS-Lindgren PS-600 hybrid absorber to extend its frequency range up to 18GHz and beyond.

The turntable is a 2m ETS-Lindgren Model 2170 and installed off the center axis is located 5'6" from the back wall of the chamber. The chamber is grounded via 1 - 8' copper ground rod, installed at the center of the back wall, it is bound to the shield using #8 solid copper wire.

The antenna mast is an EMCO 1060 and is remotely controlled from the control room for both antenna height and polarization.

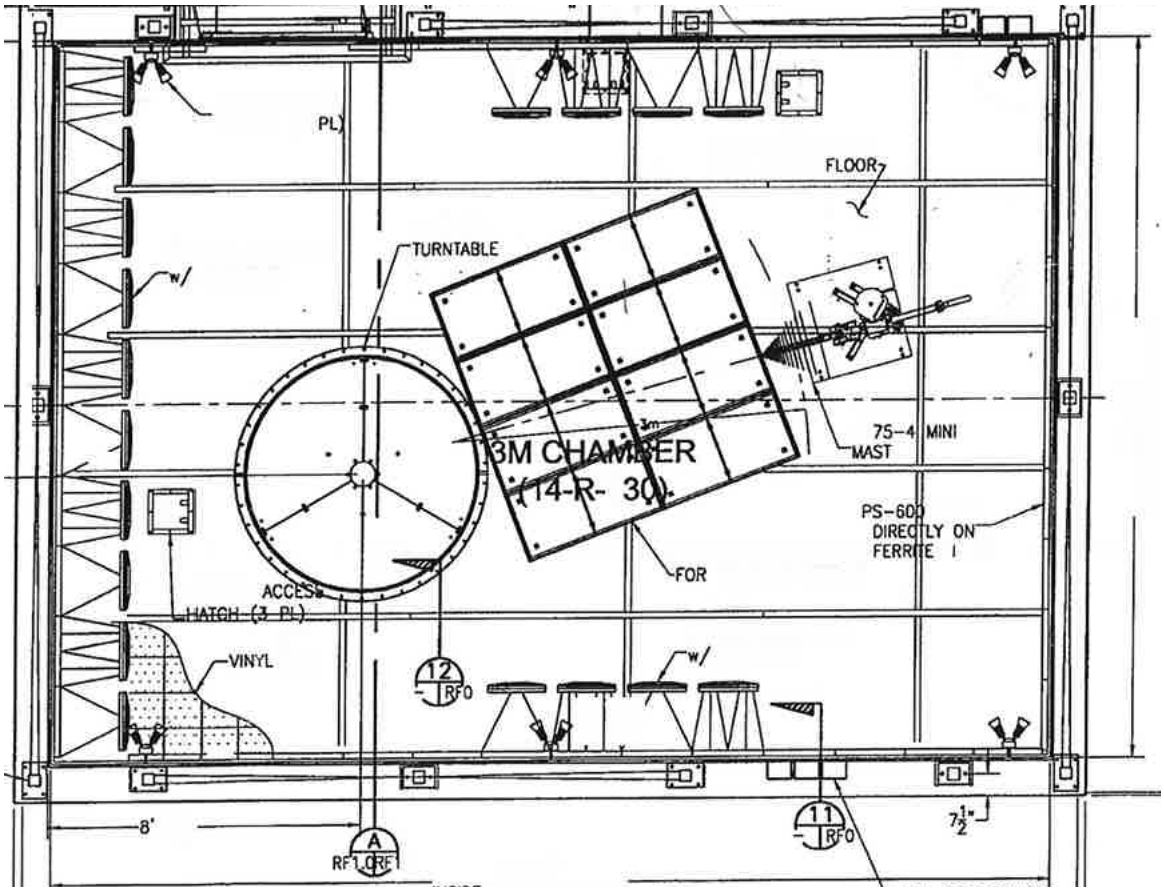


Figure 2.3.2-1: Semi-Anechoic Chamber Test Site – Chamber B

2.4 Conducted Emissions Test Site Description

2.4.1 Conducted Emissions Test Site

The AC mains conducted EMI site is located in the main EMC lab. It consists of a 12' x 10' horizontal coupling plane (HCP) as well as a 12'x8' vertical coupling plane (VCP). The HGP is constructed of 4' x 10' sheets of particle board sandwiched by galvanized steel sheets. These panels are bonded using 11AWG 1/8" x 2" by 10' galvanized sheet steel secured to the panels via by screws. The VCP is constructed of three 4'x8' sheets of 11AWG solid aluminum.

The HCP and VCP are electrically bonded together using 1"x1" angled aluminum secured with screws.

The site is of sufficient size to test tabletop and floor standing equipment in accordance with section 6.1.4 of ANSI C63.10.

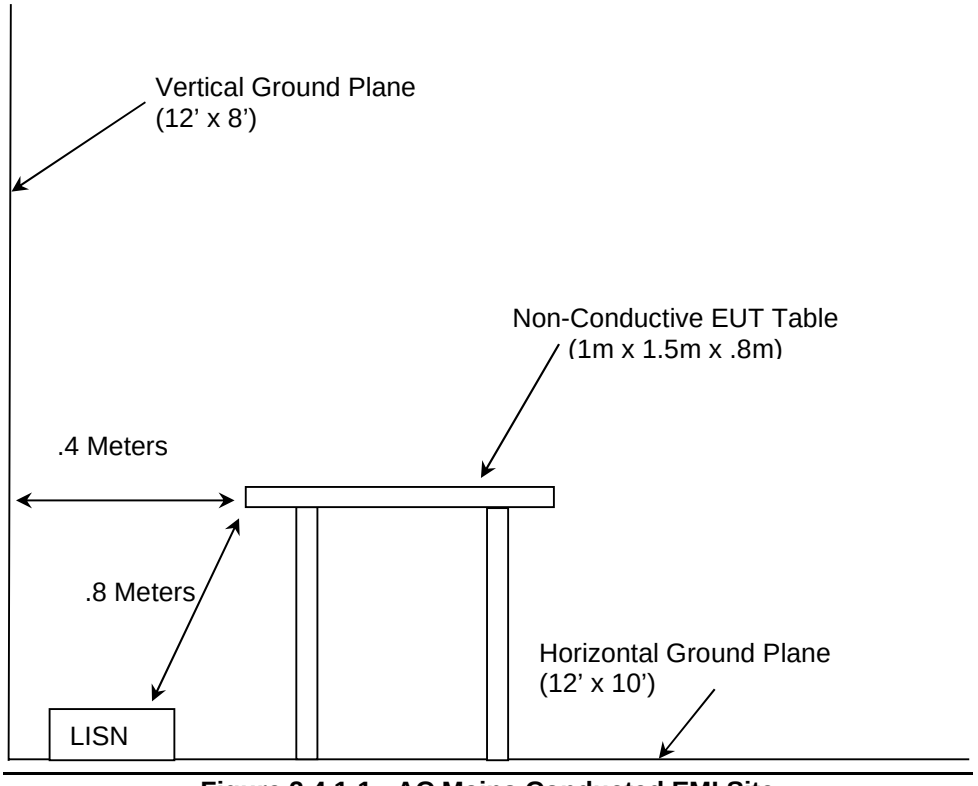


Figure 2.4.1-1: AC Mains Conducted EMI Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2020
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2020
- FCC KDB 558074 D01 15.247 Meas Guidance v05r02 - Guidance for Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating Under §15.247 of the FCC Rules, April 2, 2019
- ISED Canada Radio Standards Specification: RSS-247 – Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices, Issue 2, February 2017.
- ISED Canada Radio Standards Specification: RSS-GEN – General Requirements for Compliance of Radio Apparatus, Issue 5, April 2018 + Amendment 1, March 2019

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

Asset ID	Manufacturer	Model	Equipment Type	Serial Number	Last Calibration Date	Calibration Due Date
213	TEC	PA 102	Amplifier	44927	07/22/2019	07/22/2020
335	Suhner	SF-102A	Cable (40GHZ)	882/2A	07/08/2019	07/08/2020
338	Hewlett Packard	8449B	High Frequency Pre-Amp	3008A01111	07/15/2019	07/15/2021
432	Microwave Circuits	H3G020G4	Highpass Filter	264066	05/31/2019	05/31/2020
622	Rohde & Schwarz	FSV40 (v3.40)	FSV Signal Analyzer 10Hz to 40GHz	101338	07/30/2018	07/30/2020
628	EMCO	6502	Active Loop Antenna 10kHz-30MHz	9407-2877	02/11/2019	11/02/2021
638	Rohde & Schwarz	OSP 120	Open Switch and Control Unit	101229	06/11/2019	06/11/2021
651	Rohde & Schwarz	TS-PR26	18GHz to 26.5GHz Pre-Amplifier	100023	07/10/2019	07/10/2020
652	Rohde & Schwarz	3160-09	High Frequency Antenna 18GHz to 26.5GHz	060922-21894	NCR	NCR
819	Rohde & Schwarz	ESR26	EMI Test Receiver	101345	11/01/2019	05/01/2020
827	(-)	TS8997 Rack Cable Set	TS8997 Rack Cable Set	N/A	05/01/2019	05/01/2020
836	ETS Lindgren	SAC Cable Set	SAC Cable Set includes 620, 837, 838	N/A	05/01/2019	05/01/2020
853	Teseq	CBL 6112D; 6804.17.A	Bilog Antenna; Attenuator	51616; 20181110A	10/15/2018	10/15/2020
857	ETS Lindgren	3117	Horn Antenna 1-18GHz	00153608	11/12/2019	11/12/2021
RE880	Rhode & Schwarz USA	Test Recever	R&S ESW44	1206247	11/06/2019	11/06/2020

NCR = No Calibration Required
NOTE: All test equipment was used only during active calibration cycles as reported above.

5 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item	Equipment Type	Manufacturer	Model Number	Serial Number
1	EUT	Swarm Technologies	TRKR01	C3 (Radiated) C7 (RF Conducted)
2	Wall Wart Power Supply	Anker Innovations Limited	A2627	AFYQAJ0926171083
3	50-ohm Termination	Mini Circuits	ANNE-50+	N/A

Table 5-2: Cable Description

Item	Cable Type	Length	Shield	Termination
A	USB-C Cable	2 m	Yes	1 – 2

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

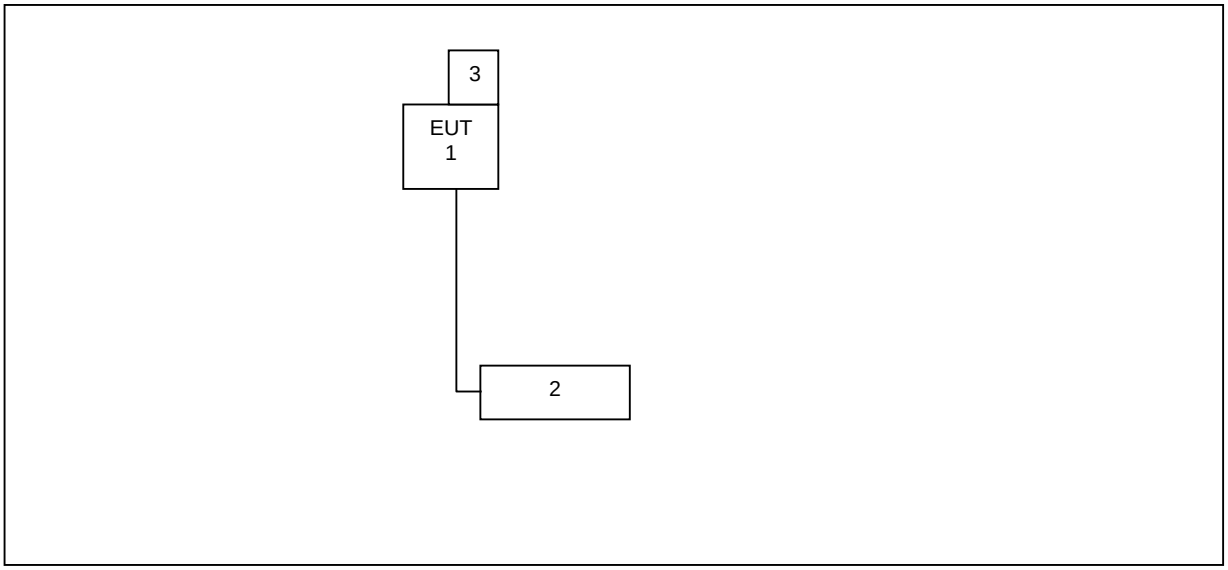


Figure 6-1: Test Setup Block Diagram

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 utilizes a Ceramic Chip Antenna. The antenna is integral to the device and cannot be removed or replaced by the end user. The gain of the antenna is 1 dBi.

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

7.2.1 Measurement Procedure

Conducted emissions were performed from 150kHz to 30MHz with the spectrum analyzer's resolution bandwidth set to 9kHz and the video bandwidth set to 30kHz. The calculation for the conducted emissions is as follows:

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

7.2.2 Measurement Results

Performed by: Eugene Sello

Table 7.2.2-1: Power Line Conducted Emissions – Line 1

Frequency (MHz)	Corrected Reading		Limit		Margin		Correction (dB)
	Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average	
	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dB)	
0.158	44.75	25.79	65.57	55.57	20.82	29.78	9.45
0.174	43.98	22.62	64.77	54.77	20.79	32.15	9.46
0.194	41.94	22.54	63.86	53.86	21.92	31.32	9.47
0.206	40.56	22.47	63.37	53.37	22.81	30.9	9.47
0.222	41.74	26.51	62.74	52.74	21	26.23	9.48
0.246	41.21	22.23	61.89	51.89	20.68	29.66	9.48
0.258	37.21	22.28	61.5	51.5	24.29	29.22	9.49
0.278	36.35	22.29	60.88	50.88	24.53	28.59	9.49
0.29	35.7	22.29	60.52	50.52	24.82	28.23	9.5
0.478	42.42	39.45	56.37	46.37	13.95	6.92	9.53

Table 7.2.2-2: Power Line Conducted Emissions – Line 2

Frequency (MHz)	Corrected Reading		Limit		Margin		Correction (dB)
	Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average	
	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dB)	
0.166	44.28	22.64	65.16	55.16	20.88	32.52	9.43
0.174	43.85	22.6	64.77	54.77	20.92	32.17	9.43
0.194	42.69	22.5	63.86	53.86	21.17	31.36	9.44
0.218	41.97	24.42	62.89	52.89	20.92	28.47	9.44
0.246	41.37	22.21	61.89	51.89	20.52	29.68	9.44
0.254	37.57	22.2	61.63	51.63	24.06	29.43	9.45
0.266	37.1	22.24	61.24	51.24	24.14	29	9.45
0.286	36.88	22.24	60.64	50.64	23.76	28.4	9.45
0.37	37.32	22.26	58.5	48.5	21.18	26.24	9.46
0.478	42.72	39.31	56.37	46.37	13.65	7.06	9.48

7.3 Peak Output Power – FCC: Section 15.247(b)(1); ISED Canada: RSS-247 Section 5.4(b)

7.3.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of a power meter. The device employs ≥ 75 channels therefore the power is limited to 1 Watt.

7.3.2 Measurement Results

Performed by: Ryan McGann

Table 7.3.2-1: RF Output Power

Modulation	Frequency [MHz]	Peak Power [dBm]
GFSK	2402	5.3
	2440	5.5
	2480	5.9
π/4-DQPSK	2402	7.6
	2440	7.9
	2480	8.5
8DPSK	2402	7.7
	2440	8.2
	2480	7.7

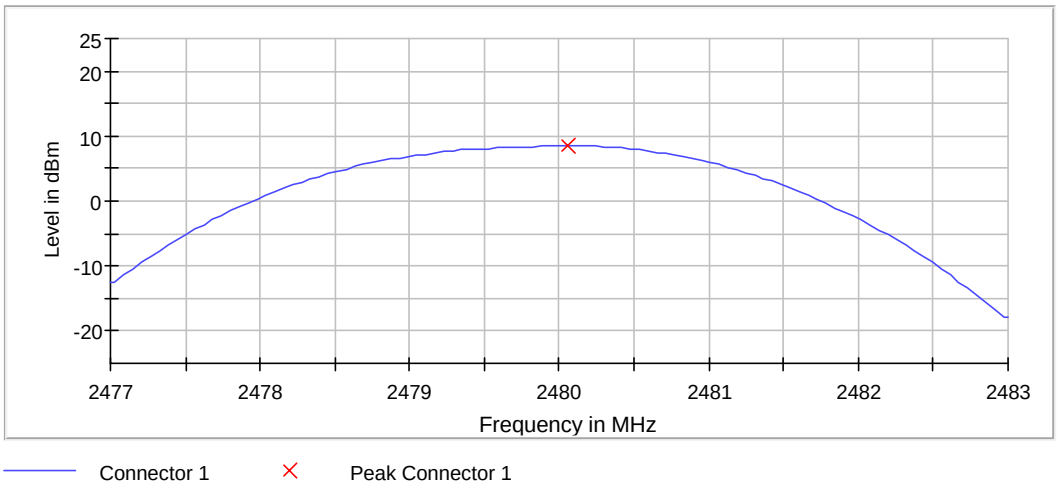


Figure 7.4.2-1: Sample Plot

Table 7.4.2-2: Sample Measurement Settings

Setting	Instrument Value	Target Value
Start Frequency	2.47700 GHz	2.47700 GHz
Stop Frequency	2.48300 GHz	2.48300 GHz
Span	6.000 MHz	6.000 MHz
RBW	2.000 MHz	>= 1.350 MHz
VBW	10.000 MHz	>= 6.000 MHz
SweepPoints	101	~ 101
Sweeptime	953.450 ns	AUTO
Reference Level	10.000 dBm	10.000 dBm
Attenuation	30.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	9 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.00 dB	0.50 dB

7.4 Channel Usage Requirements

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

7.4.1.1 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 was set for 30% of the channel spacing and adjusted as necessary to best identify the center of each channel. The VBW was set to ≥ RBW.

7.4.1.2 Measurement Results

Performed by: Ryan McGann

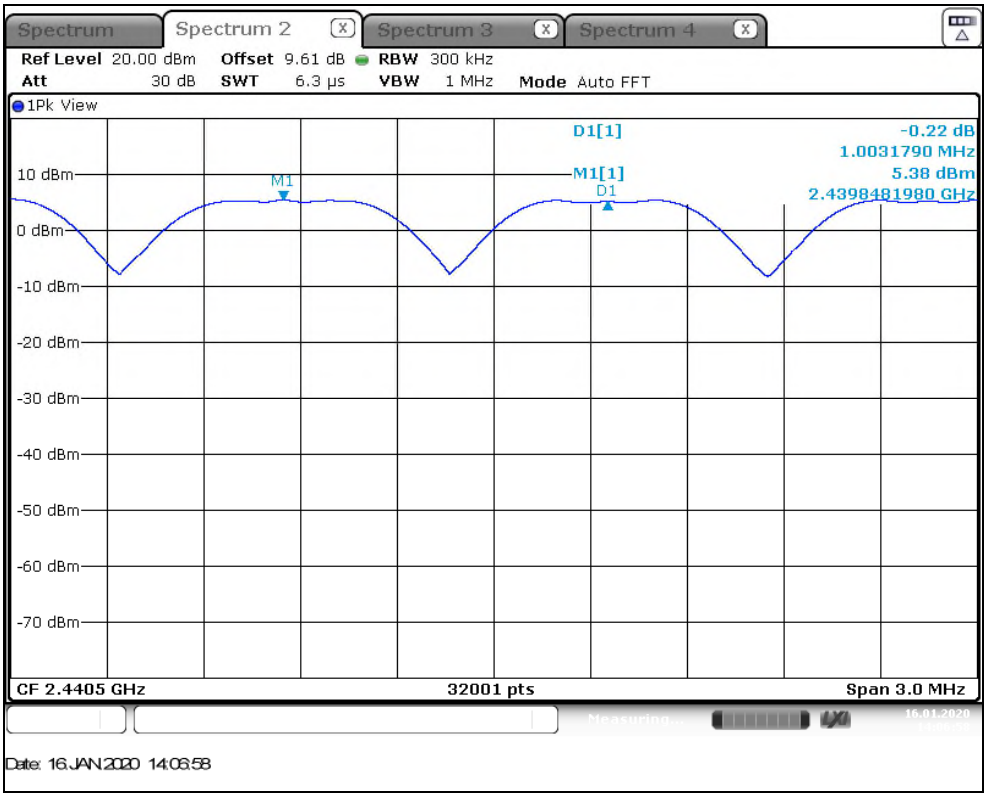


Figure 7.4.1.2-1: Carrier Frequency Separation

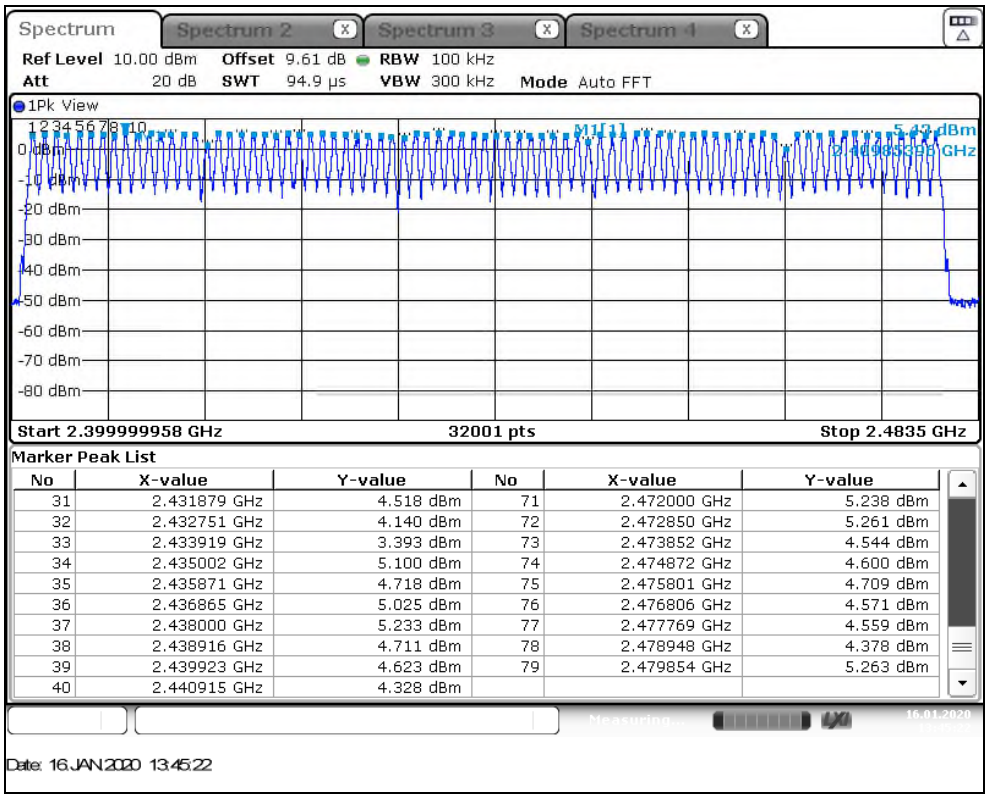
7.4.2 Number of Hopping Channels – FCC: Section 15.247(a)(1)(iii); ISED Canada: RSS-247 Section 5.1(d)

7.4.2.1 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 frequency band of operation. The RBW was set to < 30% of the channel spacing. The VBW was set to ≥ RBW.

7.4.2.2 Measurement Results

Performed by: Ryan McGann



No	X-value	Y-value	No	X-value	Y-value
31	2.431879 GHz	4.518 dBm	71	2.472000 GHz	5.238 dBm
32	2.432751 GHz	4.140 dBm	72	2.472850 GHz	5.261 dBm
33	2.433919 GHz	3.393 dBm	73	2.473852 GHz	4.544 dBm
34	2.435002 GHz	5.100 dBm	74	2.474872 GHz	4.600 dBm
35	2.435871 GHz	4.718 dBm	75	2.475801 GHz	4.709 dBm
36	2.436865 GHz	5.025 dBm	76	2.476806 GHz	4.571 dBm
37	2.438000 GHz	5.233 dBm	77	2.477769 GHz	4.559 dBm
38	2.438916 GHz	4.711 dBm	78	2.478948 GHz	4.378 dBm
39	2.439923 GHz	4.623 dBm	79	2.479854 GHz	5.263 dBm
40	2.440915 GHz	4.328 dBm			

Figure 7.4.2.2-1: Number of Hopping Channels

7.4.3 Channel Dwell Time – FCC: Section 15.247(a)(1)(iii); ISED Canada: RSS-247 Section 5.1(d)

There are 79 hopping channels therefore the average time of occupancy on any channel is limited to 400ms multiplied by 79 hopping channels or 31.6 seconds. See the theory of operation for detailed justification of the channel dwell time. Maximum channel dwell time on any given single channel is 366.4ms.

7.4.4 20dB / 99% Bandwidth – FCC: Section 15.247(a)(1)(i); ISED Canada: RSS-247 Section 5.1(a), RSS-Gen Section 6.7

7.4.4.1 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 display was set between two times and five times the occupied bandwidth (OBW) of the emission. The RBW of the spectrum analyzer was set to approximately 1 % to 5 % of the OBW and the VBW was set to three times the RBW. The trace was set to max hold with a peak detector active. The Delta function of the analyzer was utilized to determine the 20dB bandwidth of the emission.

The occupied bandwidth measurement function of the analyzer was used for the 99% bandwidth. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The RBW of the spectrum analyzer was set to approximately 1 % to 5 % of the OBW and the VBW was set to three times the RBW. A peak detector was used.

7.4.4.2 Measurement Results

Performed by: Ryan McGann

Table 7.4.4.2-1: 20dB / 99% Bandwidth

Modulation	Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
GFSK	2402	925.000	835.000
	2440	925.000	865.000
	2480	925.000	865.000
π/4-DQPSK	2402	1340.000	1180.000
	2440	1340.000	1230.000
	2480	1350.000	1250.000
8DPSK	2402	1270.000	1160.000
	2440	1320.000	1220.000
	2480	1340.000	1250.000

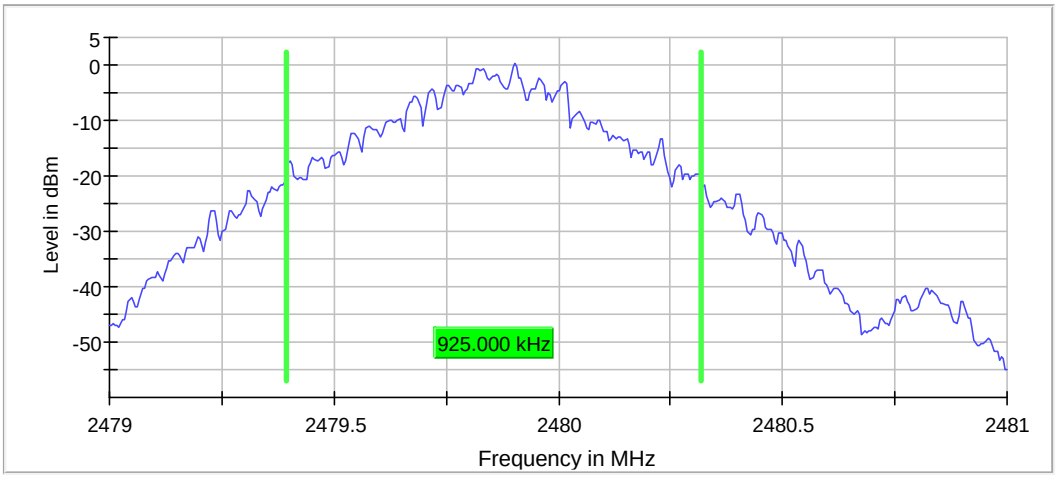


Figure 7.4.4.2-1: Sample Plot - 20dB BW – GFSK

Table 7.4.4.2-2: Sample Measurement Settings (6dB BW) – GFSK

Setting	Instrument Value	Target Value
Start Frequency	2.47900 GHz	2.47900 GHz
Stop Frequency	2.48100 GHz	2.48100 GHz
Span	2.000 MHz	2.000 MHz
RBW	10.000 kHz	>= 10.000 kHz
VBW	30.000 kHz	>= 30.000 kHz
SweepPoints	400	~ 400
Sweeptime	189.648 µs	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	200	200
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	9 / max. 150	max. 150
Stable	5 / 5	5
Max Stable Difference	0.25 dB	0.50 dB

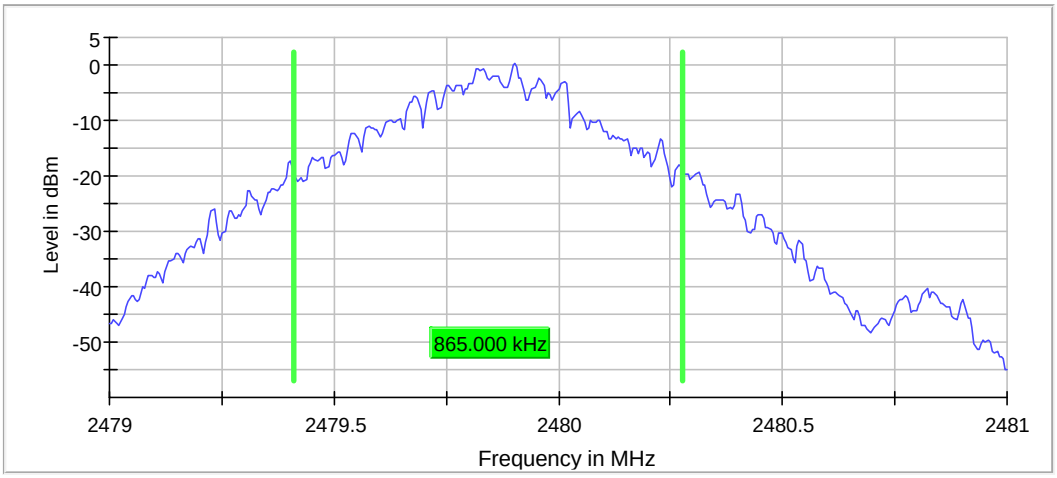


Figure 7.4.4.2-2: Sample Plot - 99% OBW – GFSK

Table 7.4.4.2-3: Sample Measurement Settings (OBW) – GFSK

Setting	Instrument Value	Target Value
Start Frequency	2.47900 GHz	2.47900 GHz
Stop Frequency	2.48100 GHz	2.48100 GHz
Span	2.000 MHz	2.000 MHz
RBW	10.000 kHz	>= 10.000 kHz
VBW	30.000 kHz	>= 30.000 kHz
SweepPoints	400	~ 400
Sweeptime	189.648 µs	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	500	500
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.30 dB	0.30 dB
Run	6 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.08 dB	0.30 dB

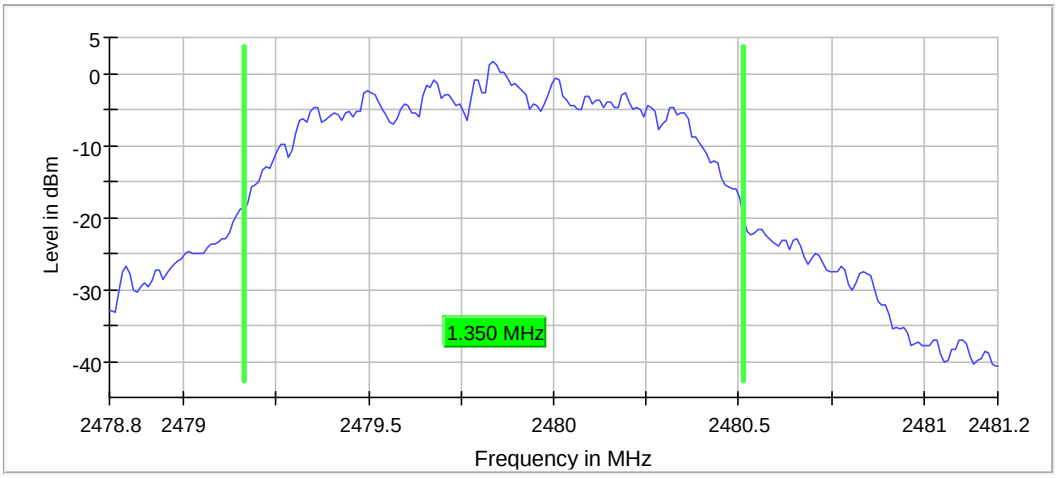


Figure 7.4.4.2-3: Sample Plot - 20dB BW– π/4-DQPSK

Table 7.4.4.2-4: Sample Measurement Settings (6dB BW) – π/4-DQPSK

Setting	Instrument Value	Target Value
Start Frequency	2.47880 GHz	2.47880 GHz
Stop Frequency	2.48120 GHz	2.48120 GHz
Span	2.400 MHz	2.400 MHz
RBW	20.000 kHz	>= 12.000 kHz
VBW	100.000 kHz	>= 60.000 kHz
SweepPoints	240	~ 240
Sweeptime	94.727 µs	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	200	200
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	17 / max. 150	max. 150
Stable	5 / 5	5
Max Stable Difference	0.15 dB	0.50 dB

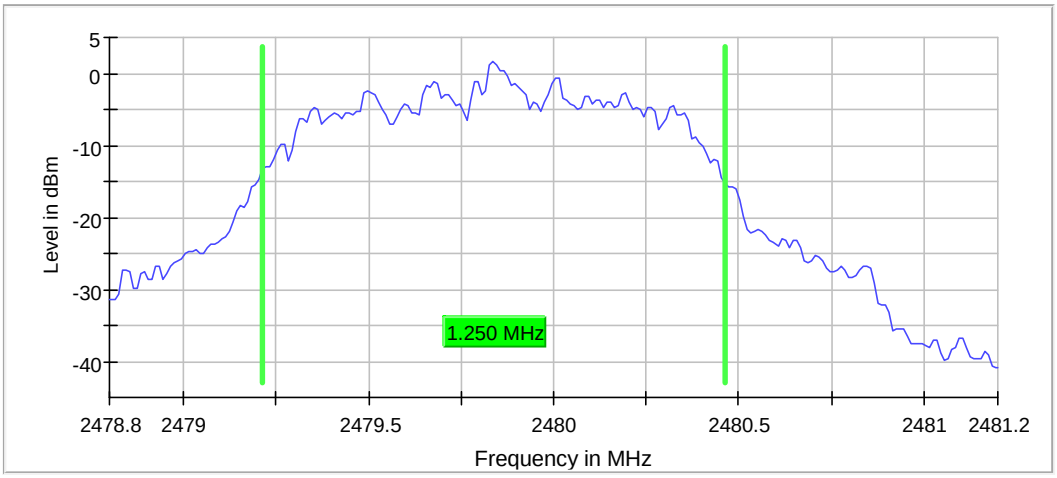


Figure 7.4.4.2-4: Sample Plot - 99% OBW – π/4-DQPSK

Table 7.4.4.2-5: Sample Measurement Settings (OBW) – π/4-DQPSK

Setting	Instrument Value	Target Value
Start Frequency	2.47880 GHz	2.47880 GHz
Stop Frequency	2.48120 GHz	2.48120 GHz
Span	2.400 MHz	2.400 MHz
RBW	20.000 kHz	>= 12.000 kHz
VBW	100.000 kHz	>= 60.000 kHz
SweepPoints	240	~ 240
Sweeptime	94.727 µs	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	500	500
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.30 dB	0.30 dB
Run	10 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.09 dB	0.30 dB

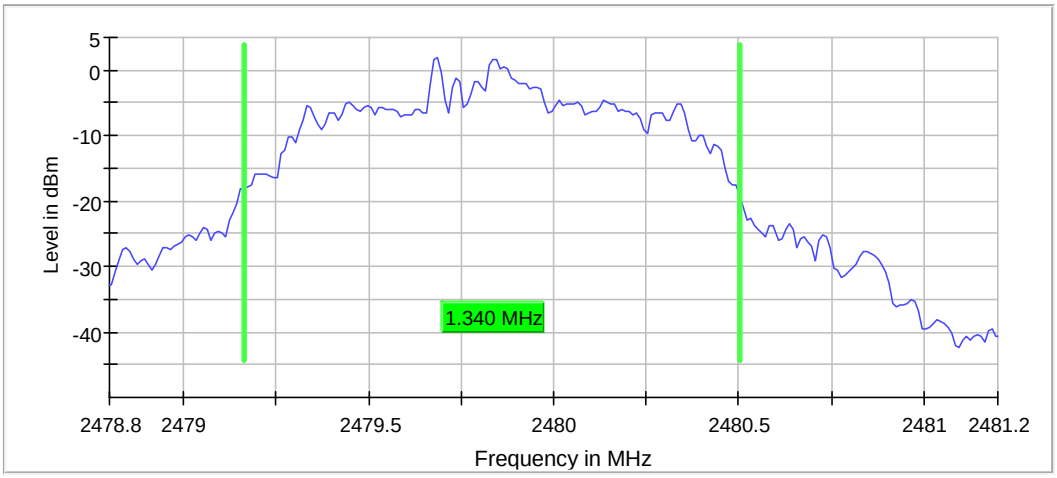


Figure 7.4.4.2-5: Sample Plot - 20dB BW – 8DPSK

Table 7.4.4.2-6: Sample Measurement Settings (6dB BW) – 8DPSK

Setting	Instrument Value	Target Value
Start Frequency	2.47880 GHz	2.47880 GHz
Stop Frequency	2.48120 GHz	2.48120 GHz
Span	2.400 MHz	2.400 MHz
RBW	20.000 kHz	>= 12.000 kHz
VBW	100.000 kHz	>= 60.000 kHz
SweepPoints	240	~ 240
Sweeptime	94.727 µs	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	200	200
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	19 / max. 150	max. 150
Stable	5 / 5	5
Max Stable Difference	0.31 dB	0.50 dB

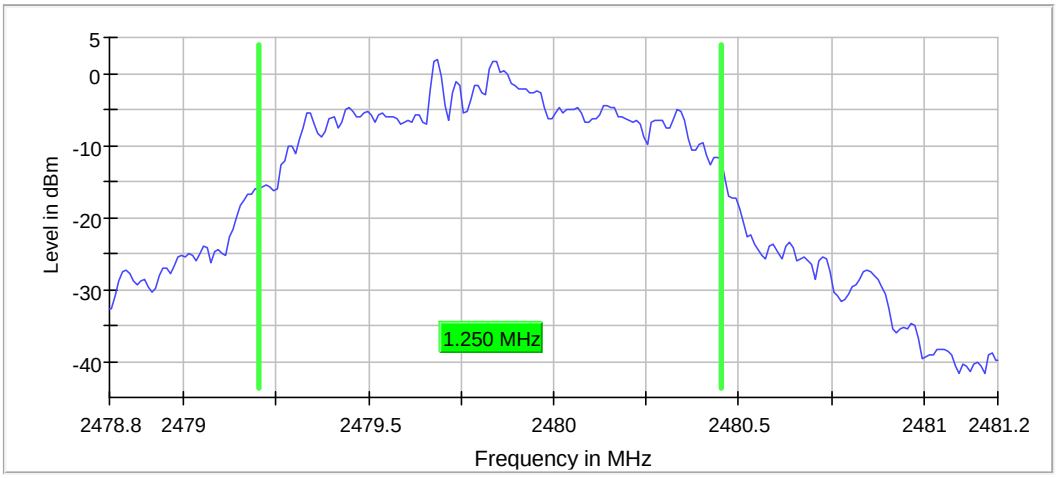


Figure 7.4.4.2-6: Sample Plot - 99% OBW– 8DPSK

Table 7.4.4.2-7: Sample Measurement Settings (OBW) – 8DPSK

Setting	Instrument Value	Target Value
Start Frequency	2.47880 GHz	2.47880 GHz
Stop Frequency	2.48120 GHz	2.48120 GHz
Span	2.400 MHz	2.400 MHz
RBW	20.000 kHz	>= 12.000 kHz
VBW	100.000 kHz	>= 60.000 kHz
SweepPoints	240	~ 240
Sweeptime	94.727 µs	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	500	500
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.30 dB	0.30 dB
Run	13 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.08 dB	0.30 dB

7.5 Band-Edge Compliance and Spurious Emissions

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

7.5.1.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. 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. A peak detector was used with a max hold trace. The band edge measurements were tested on both single channels and with the EUT hopping.

7.5.1.2 Measurement Results

Performed by: Ryan McGann

NON-HOPPING MODE:

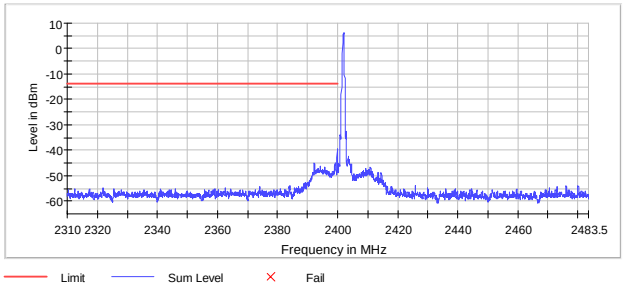


Figure 7.5.1.2-1: Lower Band-edge – GFSK

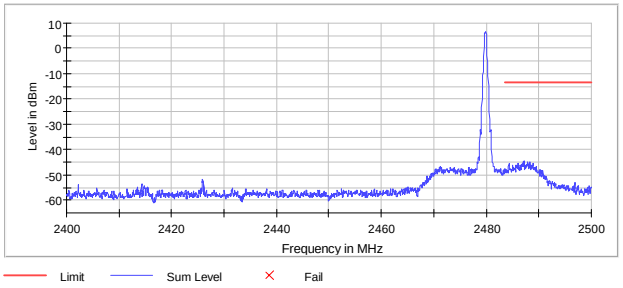


Figure 7.5.1.2-2: Upper Band-edge – GFSK

Table 7.5.1.2-1: Lower Band-edge- Low Channel – GFSK

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.875000	-39.6	25.6	-14.0	PASS
2399.825000	-39.8	25.8	-14.0	PASS
2399.925000	-41.9	27.9	-14.0	PASS
2399.775000	-42.7	28.7	-14.0	PASS
2392.225000	-45.1	31.1	-14.0	PASS
2399.175000	-45.2	31.2	-14.0	PASS
2392.275000	-45.3	31.3	-14.0	PASS
2399.225000	-45.5	31.5	-14.0	PASS
2399.325000	-45.5	31.5	-14.0	PASS
2399.125000	-45.5	31.5	-14.0	PASS
2399.275000	-45.7	31.6	-14.0	PASS
2399.375000	-46.1	32.1	-14.0	PASS
2399.075000	-46.2	32.2	-14.0	PASS
2394.225000	-46.4	32.4	-14.0	PASS
2394.275000	-46.6	32.6	-14.0	PASS

Table 7.5.1.2-2: Upper Band-edge – High Channel – GFSK

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2487.225000	-44.4	31.1	-13.3	PASS
2486.975000	-44.6	31.3	-13.3	PASS
2487.025000	-44.8	31.5	-13.3	PASS
2488.275000	-44.8	31.5	-13.3	PASS
2488.325000	-44.9	31.6	-13.3	PASS
2487.275000	-45.0	31.6	-13.3	PASS
2487.925000	-45.1	31.8	-13.3	PASS
2487.175000	-45.2	31.8	-13.3	PASS
2487.975000	-45.2	31.9	-13.3	PASS
2484.325000	-45.3	32.0	-13.3	PASS
2484.375000	-45.4	32.1	-13.3	PASS
2486.075000	-45.5	32.1	-13.3	PASS
2488.875000	-45.5	32.2	-13.3	PASS
2486.125000	-45.6	32.3	-13.3	PASS
2488.025000	-45.7	32.4	-13.3	PASS

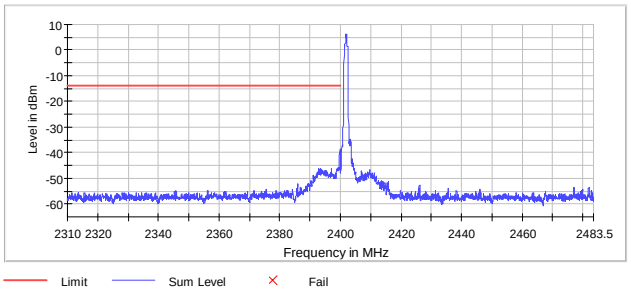


Figure 7.5.1.2-3: Lower Band-edge – π/4-DQPSK

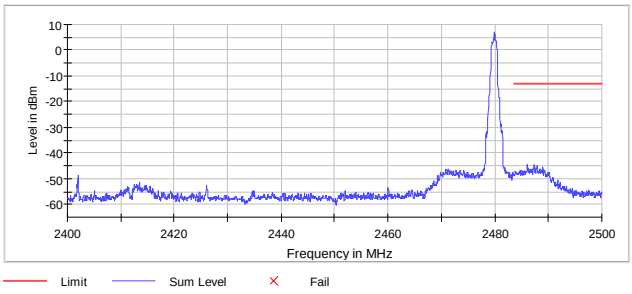


Figure 7.5.1.2-4: Upper Band-edge – π/4-DQPSK

Table 7.5.1.2-3: Lower Band-edge- Low Channel – π/4-DQPSK

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.875000	-38.4	24.5	-13.9	PASS
2399.825000	-38.5	24.6	-13.9	PASS
2399.925000	-40.5	26.6	-13.9	PASS
2399.775000	-40.9	27.0	-13.9	PASS
2399.975000	-43.7	29.8	-13.9	PASS
2399.725000	-44.0	30.1	-13.9	PASS
2399.125000	-45.8	31.9	-13.9	PASS
2399.175000	-45.9	32.0	-13.9	PASS
2399.525000	-46.0	32.1	-13.9	PASS
2399.675000	-46.0	32.1	-13.9	PASS
2398.775000	-46.1	32.2	-13.9	PASS
2399.375000	-46.1	32.2	-13.9	PASS
2399.425000	-46.1	32.2	-13.9	PASS
2398.825000	-46.1	32.2	-13.9	PASS
2397.225000	-46.2	32.3	-13.9	PASS

Table 7.5.1.2-4: Upper Band-edge – High Channel – π/4-DQPSK

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2486.075000	-44.7	31.6	-13.1	PASS
2487.325000	-44.7	31.6	-13.1	PASS
2486.025000	-44.8	31.6	-13.1	PASS
2487.875000	-45.1	32.0	-13.1	PASS
2487.375000	-45.2	32.1	-13.1	PASS
2487.275000	-45.5	32.4	-13.1	PASS
2488.975000	-45.5	32.4	-13.1	PASS
2487.925000	-45.8	32.6	-13.1	PASS
2487.175000	-45.8	32.6	-13.1	PASS
2486.175000	-45.8	32.7	-13.1	PASS
2487.825000	-46.0	32.8	-13.1	PASS
2486.575000	-46.1	32.9	-13.1	PASS
2487.125000	-46.1	33.0	-13.1	PASS
2487.225000	-46.2	33.0	-13.1	PASS
2487.775000	-46.2	33.0	-13.1	PASS

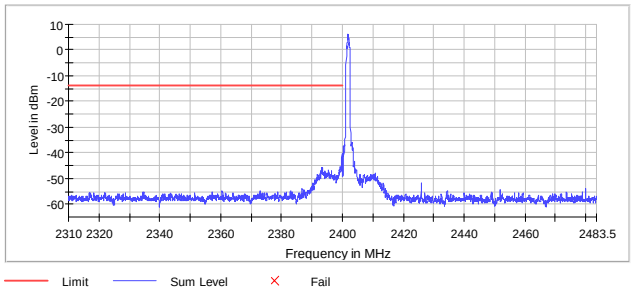


Figure 7.5.1.2-5: Lower Band-edge – 8DPSK

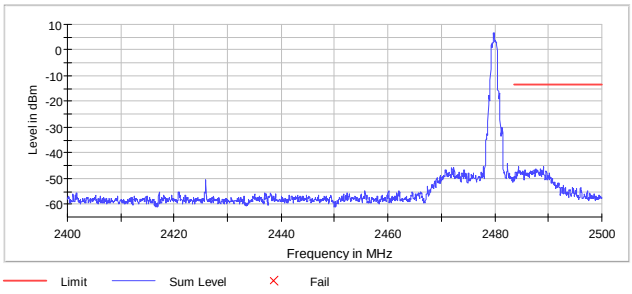


Figure 7.5.1.2-6: Upper Band-edge – 8DPSK

Table 7.5.1.2-5: Lower Band-edge- Low Channel – 8DPSK

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.825000	-40.3	26.4	-13.9	PASS
2399.875000	-40.4	26.5	-13.9	PASS
2399.925000	-42.1	28.3	-13.9	PASS
2399.775000	-42.1	28.3	-13.9	PASS
2399.175000	-45.4	31.5	-13.9	PASS
2399.625000	-45.4	31.5	-13.9	PASS
2399.975000	-45.6	31.8	-13.9	PASS
2399.225000	-45.6	31.8	-13.9	PASS
2399.725000	-45.8	31.9	-13.9	PASS
2393.175000	-45.8	31.9	-13.9	PASS
2399.675000	-45.8	32.0	-13.9	PASS
2393.575000	-45.8	32.0	-13.9	PASS
2393.625000	-46.0	32.1	-13.9	PASS
2393.225000	-46.1	32.2	-13.9	PASS
2399.575000	-46.1	32.2	-13.9	PASS

Table 7.5.1.2-6: Upper Band-edge – High Channel – 8DPSK

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2484.375000	-45.6	32.3	-13.2	PASS
2489.075000	-45.6	32.4	-13.2	PASS
2484.325000	-45.8	32.6	-13.2	PASS
2489.025000	-45.9	32.7	-13.2	PASS
2487.725000	-46.0	32.8	-13.2	PASS
2487.675000	-46.1	32.9	-13.2	PASS
2489.125000	-46.3	33.1	-13.2	PASS
2488.525000	-46.4	33.1	-13.2	PASS
2487.925000	-46.5	33.2	-13.2	PASS
2488.575000	-46.6	33.3	-13.2	PASS
2488.775000	-46.6	33.3	-13.2	PASS
2487.525000	-46.6	33.4	-13.2	PASS
2484.425000	-46.6	33.4	-13.2	PASS
2485.575000	-46.6	33.4	-13.2	PASS
2488.725000	-46.7	33.5	-13.2	PASS

HOPPING MODE:

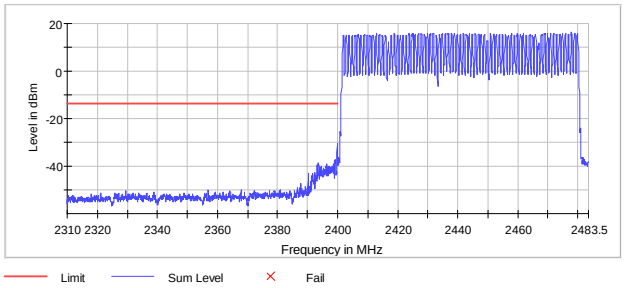


Figure 7.5.1.2-7: Lower Band-edge – GFSK

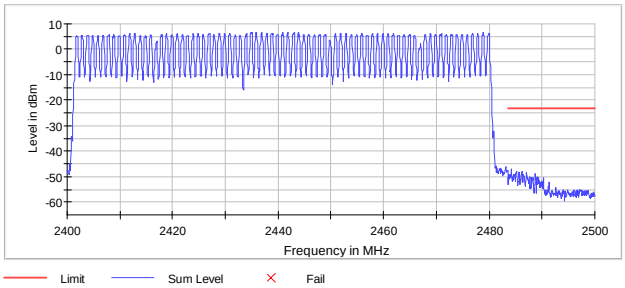


Figure 7.5.1.2-8: Upper Band-edge – GFSK

Table 7.5.1.2-7: Lower Band-edge- Low Channel – GFSK

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.875000	-30.7	16.9	-13.8	PASS
2399.825000	-30.8	17.0	-13.8	PASS
2399.925000	-32.4	18.6	-13.8	PASS
2399.775000	-34.2	20.4	-13.8	PASS
2399.975000	-36.8	23.0	-13.8	PASS
2399.125000	-37.4	23.6	-13.8	PASS
2399.225000	-37.7	23.9	-13.8	PASS
2399.075000	-37.8	24.0	-13.8	PASS
2399.275000	-38.1	24.3	-13.8	PASS
2399.175000	-38.5	24.7	-13.8	PASS
2393.625000	-38.6	24.8	-13.8	PASS
2399.025000	-38.6	24.8	-13.8	PASS
2393.575000	-38.7	24.9	-13.8	PASS
2393.675000	-38.8	25.0	-13.8	PASS
2399.325000	-38.9	25.1	-13.8	PASS

Table 7.5.1.2-8: Upper Band-edge – High Channel – GFSK

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2484.175000	-47.3	23.9	-23.4	PASS
2486.175000	-47.9	24.4	-23.4	PASS
2484.225000	-47.9	24.4	-23.4	PASS
2486.225000	-47.9	24.5	-23.4	PASS
2485.175000	-48.1	24.7	-23.4	PASS
2485.125000	-48.1	24.7	-23.4	PASS
2487.125000	-48.2	24.8	-23.4	PASS
2485.625000	-48.4	24.9	-23.4	PASS
2487.075000	-48.5	25.0	-23.4	PASS
2485.225000	-48.6	25.2	-23.4	PASS
2485.675000	-48.7	25.2	-23.4	PASS
2488.775000	-48.8	25.3	-23.4	PASS
2484.125000	-48.8	25.4	-23.4	PASS
2488.725000	-48.9	25.5	-23.4	PASS
2485.075000	-48.9	25.5	-23.4	PASS

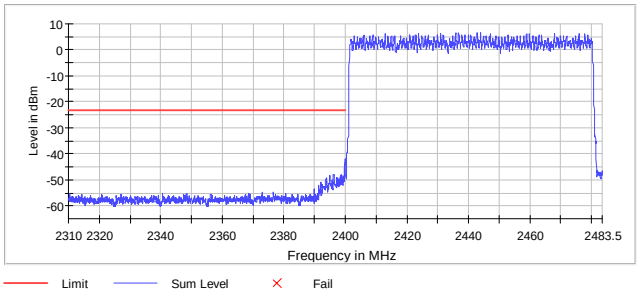


Figure 7.5.1.2-9: Lower Band-edge – π/4-DQPSK

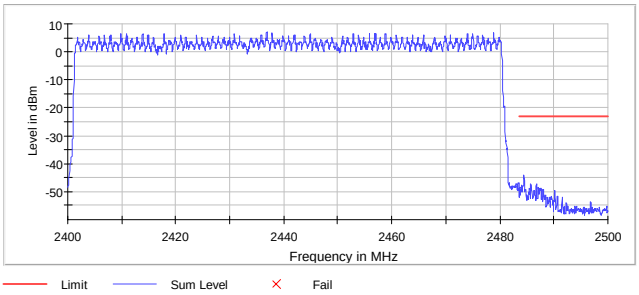


Figure 7.5.1.2-10: Upper Band-edge – π/4-DQPSK

Table 7.5.1.2-9: Lower Band-edge- Low Channel – π/4-DQPSK

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.875000	-42.0	18.6	-23.4	PASS
2399.825000	-42.2	18.8	-23.4	PASS
2399.925000	-43.5	20.1	-23.4	PASS
2399.775000	-45.4	22.0	-23.4	PASS
2399.975000	-47.4	24.0	-23.4	PASS
2396.175000	-47.8	24.4	-23.4	PASS
2398.725000	-47.9	24.4	-23.4	PASS
2396.225000	-47.9	24.5	-23.4	PASS
2398.775000	-48.5	25.0	-23.4	PASS
2394.925000	-48.5	25.0	-23.4	PASS
2394.875000	-48.5	25.1	-23.4	PASS
2398.675000	-48.5	25.1	-23.4	PASS
2399.575000	-48.6	25.1	-23.4	PASS
2398.375000	-48.6	25.1	-23.4	PASS
2399.525000	-48.7	25.3	-23.4	PASS

Table 7.5.1.2-10: Upper Band-edge – High Channel – π/4-DQPSK

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2484.425000	-44.2	21.2	-23.0	PASS
2484.475000	-44.4	21.5	-23.0	PASS
2484.375000	-44.9	22.0	-23.0	PASS
2484.525000	-46.1	23.2	-23.0	PASS
2486.775000	-47.3	24.3	-23.0	PASS
2485.725000	-47.4	24.4	-23.0	PASS
2484.325000	-47.6	24.6	-23.0	PASS
2484.075000	-47.8	24.8	-23.0	PASS
2485.775000	-47.9	24.9	-23.0	PASS
2484.125000	-47.9	24.9	-23.0	PASS
2486.825000	-48.1	25.1	-23.0	PASS
2486.725000	-48.1	25.1	-23.0	PASS
2485.675000	-48.2	25.2	-23.0	PASS
2487.075000	-48.3	25.3	-23.0	PASS
2484.225000	-48.4	25.4	-23.0	PASS

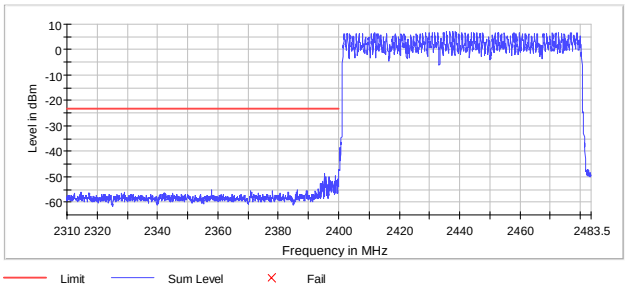


Figure 7.5.1.2-11: Lower Band-edge – 8DPSK

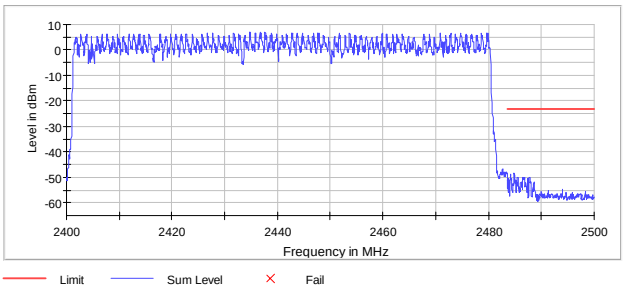


Figure 7.5.1.2-12: Upper Band-edge – 8DPSK

Table 7.5.1.2-11: Lower Band-edge- Low Channel – 8DPSK

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2395.225000	-49.0	25.9	-23.1	PASS
2395.175000	-49.5	26.4	-23.1	PASS
2398.975000	-49.8	26.7	-23.1	PASS
2395.775000	-50.0	26.8	-23.1	PASS
2395.725000	-50.1	27.0	-23.1	PASS
2396.775000	-50.3	27.2	-23.1	PASS
2395.275000	-50.3	27.2	-23.1	PASS
2398.925000	-50.4	27.2	-23.1	PASS
2399.025000	-50.4	27.3	-23.1	PASS
2396.825000	-50.6	27.5	-23.1	PASS
2399.675000	-50.8	27.6	-23.1	PASS
2399.725000	-50.9	27.7	-23.1	PASS
2395.825000	-51.0	27.9	-23.1	PASS
2396.725000	-51.1	28.0	-23.1	PASS
2399.975000	-51.2	28.1	-23.1	PASS

Table 7.5.1.2-12: Upper Band-edge – High Channel – 8DPSK

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2484.875000	-48.3	25.3	-23.1	PASS
2484.825000	-48.4	25.3	-23.1	PASS
2484.175000	-49.0	25.9	-23.1	PASS
2484.925000	-49.2	26.1	-23.1	PASS
2484.125000	-49.3	26.2	-23.1	PASS
2484.775000	-49.8	26.7	-23.1	PASS
2485.475000	-50.0	26.9	-23.1	PASS
2486.625000	-50.0	26.9	-23.1	PASS
2486.825000	-50.0	27.0	-23.1	PASS
2486.525000	-50.1	27.0	-23.1	PASS
2484.225000	-50.1	27.0	-23.1	PASS
2485.525000	-50.1	27.0	-23.1	PASS
2487.775000	-50.1	27.0	-23.1	PASS
2485.425000	-50.1	27.1	-23.1	PASS
2487.825000	-50.2	27.1	-23.1	PASS

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

7.5.2.1 Measurement Procedure

The unwanted emissions into non-restricted bands were measured conducted in accordance with FCC KDB 558074 D01 Section 9. The RF output of the equipment under test was directly connected to the input of the spectrum analyzer applying suitable attenuation. The Resolution Bandwidth (RBW) of the spectrum analyzer was set to 100 kHz. The Video Bandwidth (VBW) was set to ≥ 300 kHz. The resulting spectrum analyzer peak level was used to determine the reference level with respect to the 20 dBc limit. The spectrum span was then adjusted for the measurement of spurious emissions from 30MHz to 25GHz, 10 times the highest fundamental frequency.

7.5.2.2 Measurement Results

Performed by: Ryan McGann

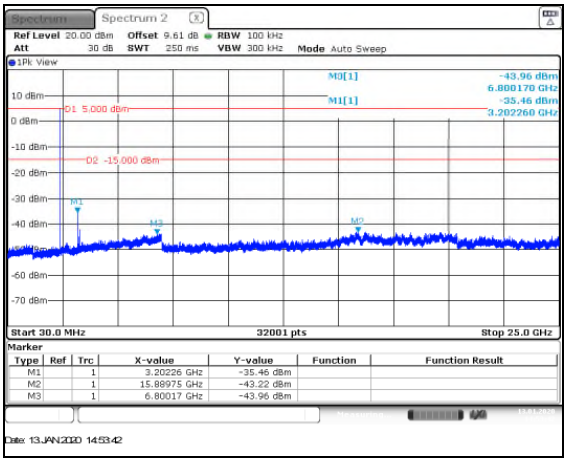


Figure 7.5.2.2-1: LCH – 30MHz–25GHz – GFSK

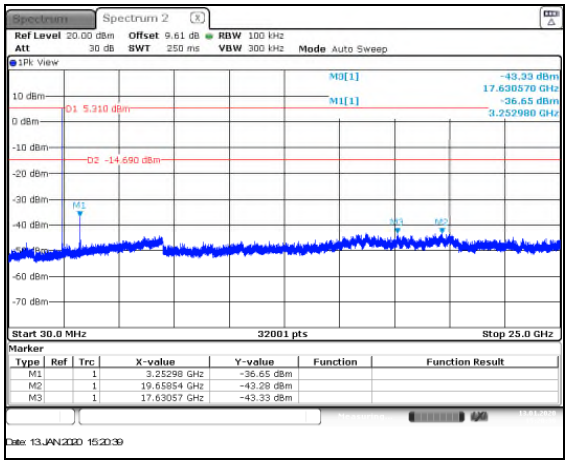


Figure 7.5.2.2-2: MCH – 30MHz–25GHz – GFSK

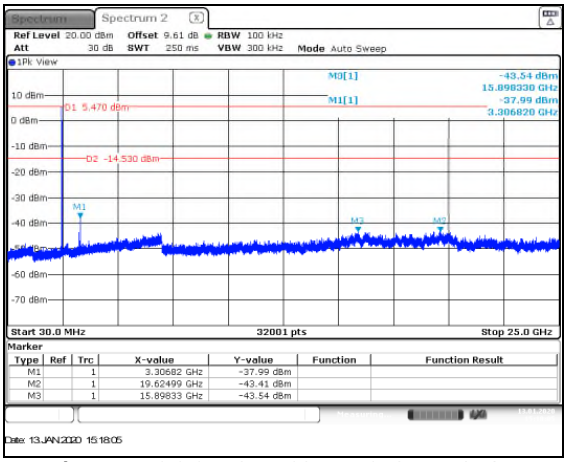


Figure 7.5.2.2-3: HCH – 30MHz–25GHz – GFSK

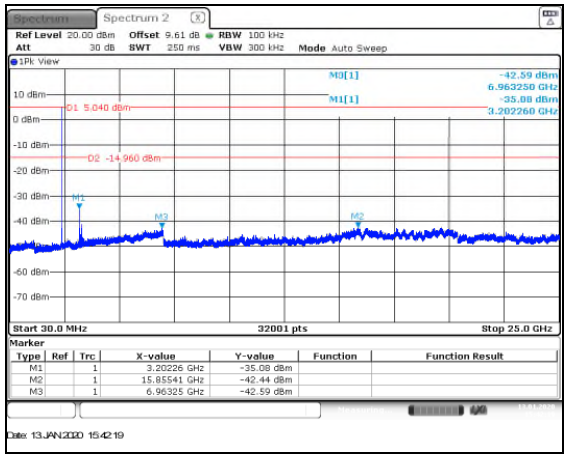


Figure 7.5.2.2-4: LCH – 30MHz–25GHz – π/4-DQPSK

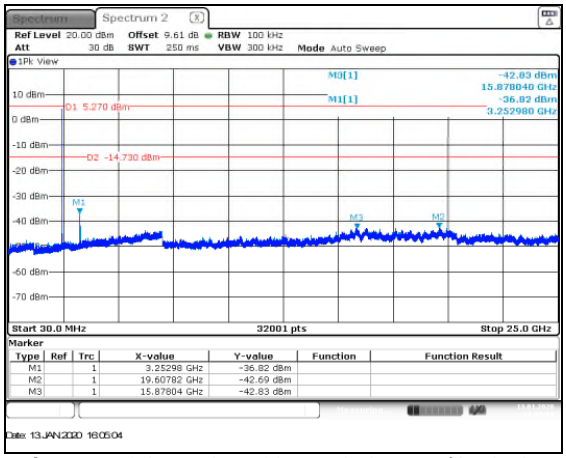


Figure 7.5.2.2-5: MCH – 30MHz–25GHz – π/4-DQPSK

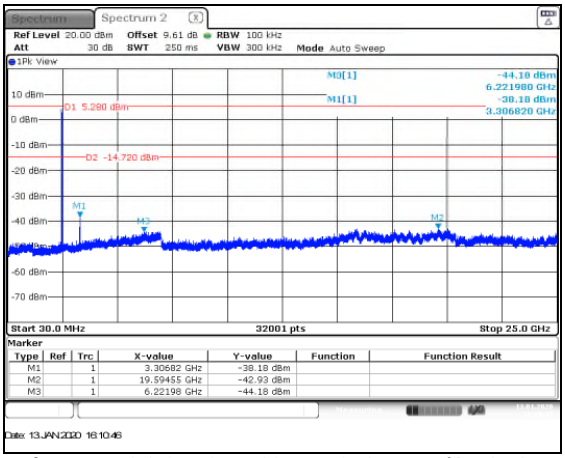


Figure 7.5.2.2-6: HCH – 30MHz–25GHz – π/4-DQPSK

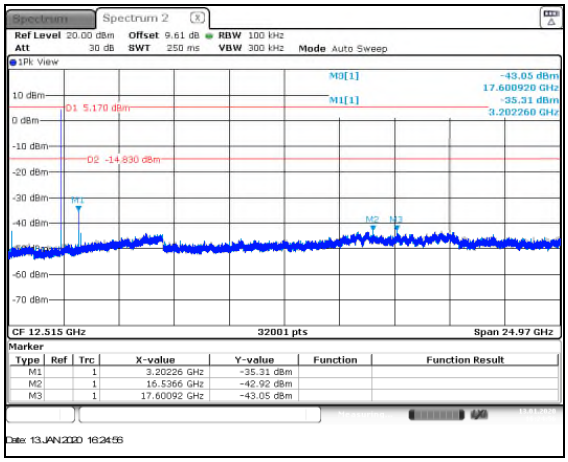


Figure 7.5.2.2-7: LCH – 30MHz–25GHz – 8DPSK

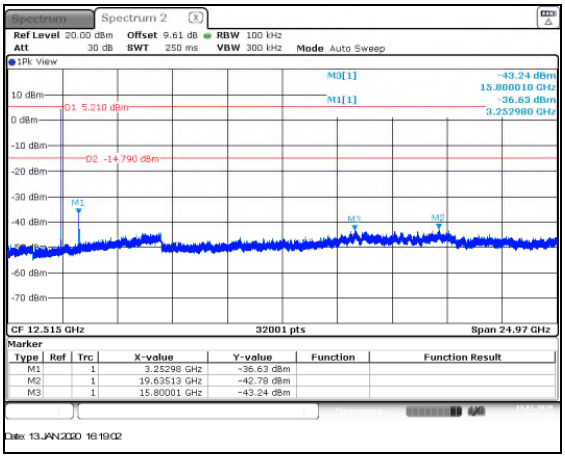


Figure 7.5.2.2-8: MCH – 30MHz–25GHz – 8DPSK

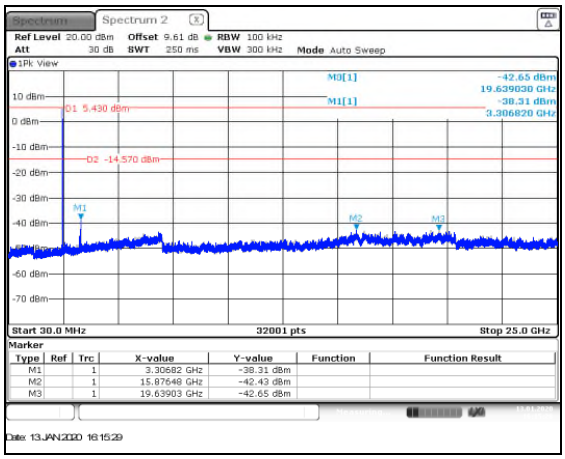


Figure 7.5.2.2-9: HCH – 30MHz–25GHz – 8DPSK

7.5.3 Radiated Spurious Emissions – FCC: Section 15.205, 15.209; ISED Canada: RSS-Gen Section 8.9 / 8.10

7.5.3.1 Measurement Procedure

The unwanted emissions into restricted bands were measured radiated over the frequency range of 30MHz to 25GHz, 10 times the highest fundamental frequency.

The EUT was rotated through 360° and the receive antenna height was varied from 1 meter to 4 meters so that the maximum radiated emissions level would be detected. For frequencies below 1000 MHz, 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 and average measurements were made with RBW and VBW of 1 MHz and 3 MHz respectively.

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

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.

7.5.3.2 Measurement Results

Performed by: Jeremy Pickens

Table 7.5.3.2-1: 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
Channel 0 (2402MHz)										
2390	51.9	43	H	-1.17	50.73	41.83	74.0	54.0	23.3	12.2
2390	52	42.9	V	-1.17	50.83	41.73	74.0	54.0	23.2	12.3
4804	48.4	42.6	H	3.29	51.69	45.89	74.0	54.0	22.3	8.1
4804	49	41.6	V	3.29	52.29	44.89	74.0	54.0	21.7	9.1
Channel 39 (2440MHz)										
4882	49.1	42.5	H	3.34	52.44	45.84	74.0	54.0	21.6	8.2
4882	48.4	41.9	V	3.34	51.74	45.24	74.0	54.0	22.3	8.8
Channel 79 (2480MHz)										
2483.5	56.90	46.70	H	-0.96	55.94	45.74	74.0	54.0	18.1	8.3
2483.5	52.40	43.00	V	-0.96	51.44	42.04	74.0	54.0	22.6	12.0
4960	50.30	43.70	H	3.38	53.68	47.08	74.0	54.0	20.3	6.9
4960	48.60	42.60	V	3.38	51.98	45.98	74.0	54.0	22.0	8.0

Table 7.5.3.2-3: 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
Channel 0 (2402MHz)										
2390	55.90	44.80	H	-1.17	54.73	43.63	74.0	54.0	19.3	10.4
2390	50.60	41.00	V	-1.17	49.43	39.83	74.0	54.0	24.6	14.2
4804	50.70	45.80	H	3.29	53.99	49.09	74.0	54.0	20.0	4.9
4804	48.80	44.90	V	3.29	52.09	48.19	74.0	54.0	21.9	5.8
Channel 39 (2440MHz)										
4882	50.8	43.1	H	3.34	54.14	46.44	74.0	54.0	19.9	7.6
4882	48	42.1	V	3.34	51.34	45.44	74.0	54.0	22.7	8.6
Channel 79 (2480MHz)										
2483.5	59.60	50.40	H	-0.96	58.64	49.44	74.0	54.0	15.4	4.6
2483.5	56.30	44.90	V	-0.96	55.34	43.94	74.0	54.0	18.7	10.1
4960	47.4	42	H	3.38	50.78	45.38	74.0	54.0	23.2	8.6
4960	48	42.1	V	3.38	51.38	45.48	74.0	54.0	22.6	8.5

7.5.3.3 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

Example Calculation: Peak – 8DPSK – Channel 80

Corrected Level: 59.60 - 0.96 = 58.64dBuV/m
Margin: 74dBuV/m – 58.64dBuV/m = 15.4dB

Example Calculation: Average – 8DPSK – Channel 80

Corrected Level: 50.40 - 0.96 - 0 = 49.44dBuV
Margin: 54dBuV – 49.44dBuV = 4.6dB

8 ESTIMATION OF MEASUREMENT UNCERTAINTY

The expanded laboratory measurement uncertainty figures (U_{Lab}) provided below correspond to an expansion factor (coverage factor) k = 1.96 which provide confidence levels of 95%.

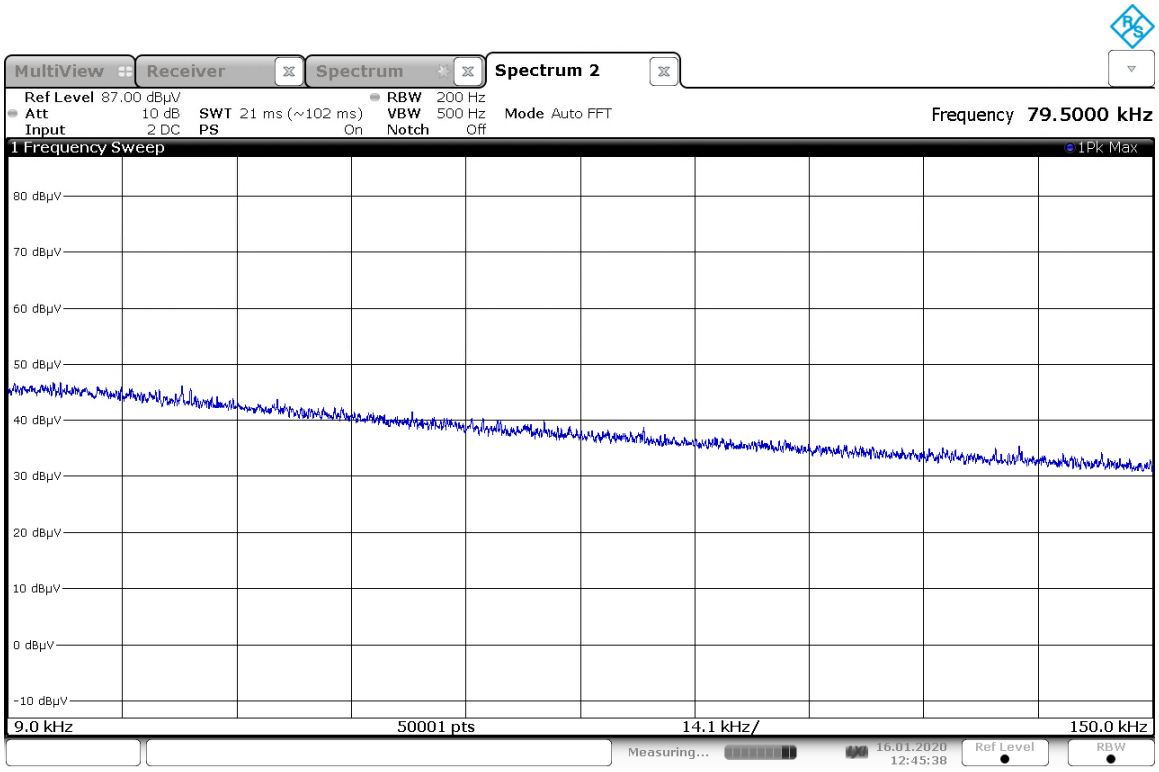
Table 8-1: Estimation of Measurement Uncertainty

Parameter	U_{lab}
Occupied Channel Bandwidth	± 0.009 %
RF Conducted Output Power	± 0.349 dB
Power Spectral Density	± 0.372 dB
Antenna Port Conducted Emissions	± 1.264 dB
Radiated Emissions ≤ 1 GHz	± 5.814 dB
Radiated Emissions > 1 GHz	± 4.318 dB
Temperature	± 0.860 °C
Radio Frequency	± 2.832 x 10^{-8}
AC Power Line Conducted Emissions	± 3.360 dB

9 CONCLUSION

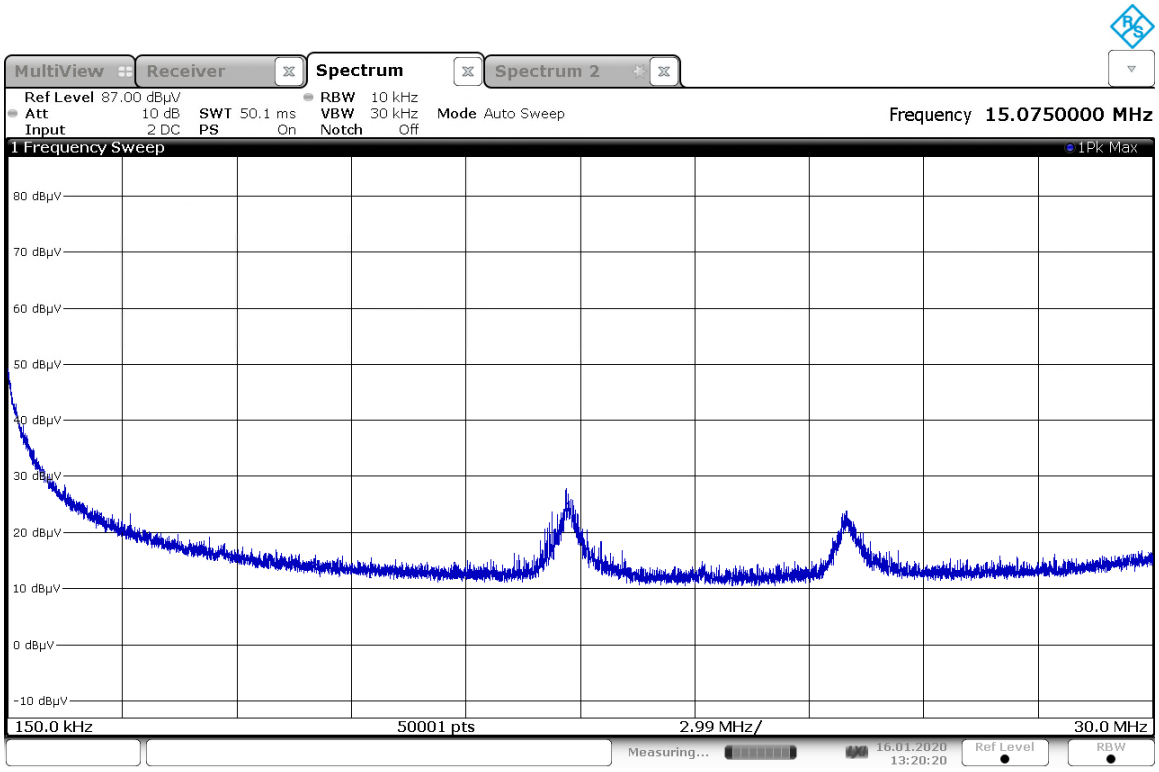
In the opinion of TUV SUD the Tracker, manufactured by Swarm Technologies meets the requirements of FCC Part 15 subpart C and ISED Canada's Radio Standards Specification RSS-247 for the tests documented herein.

Appendix A: Plots



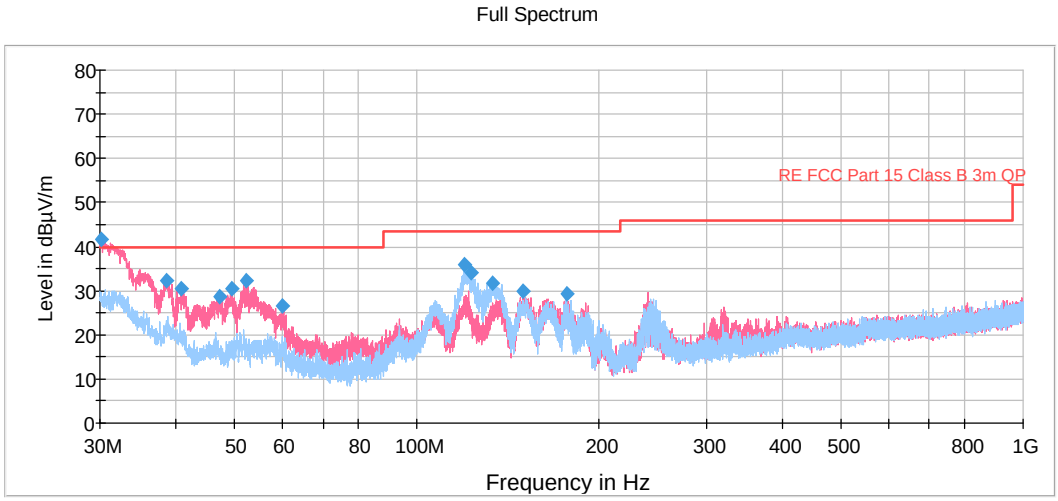
12:45:38 16.01.2020

Figure A-1: 9kHz-150kHz



13:20:21 16.01.2020

Figure A-2: 150kHz-30MHz



Note: Emissions above the noise floor are from the digital sections of the DUT and not associated with the radio.

Figure A-3: 30MHz-1GHz

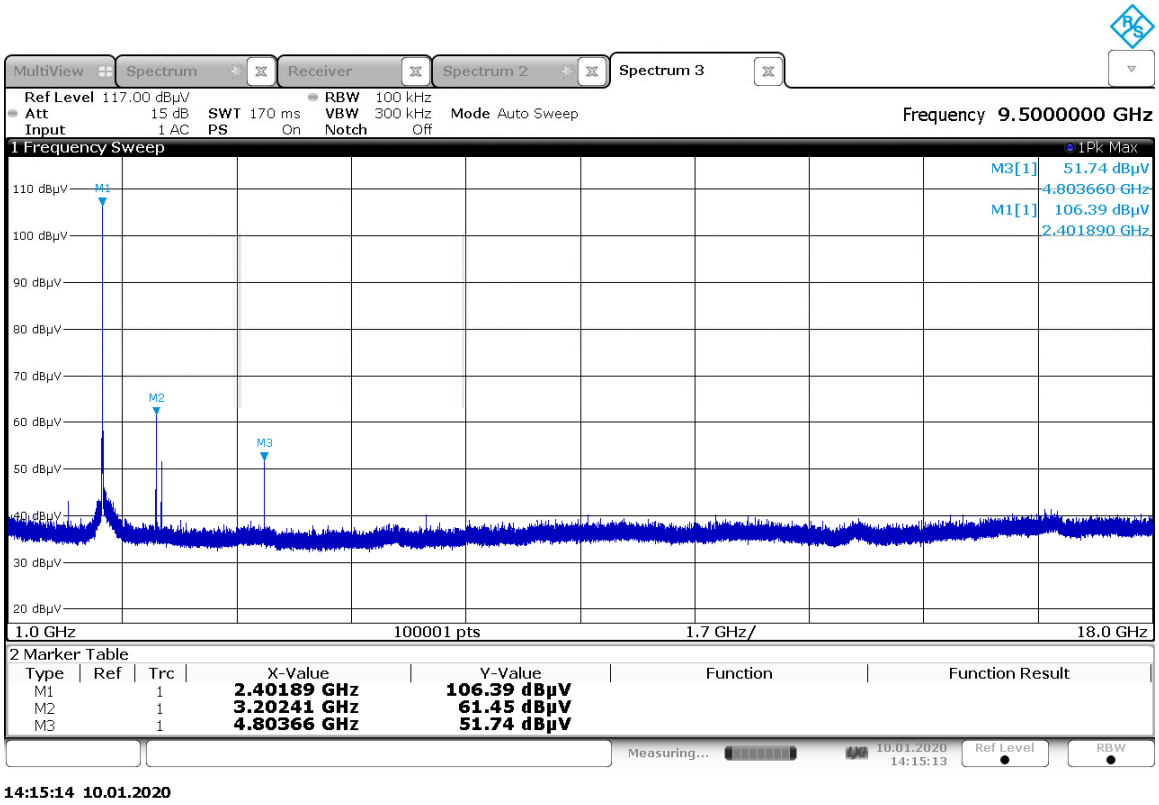


Figure A-4: 1GHz-18GHz

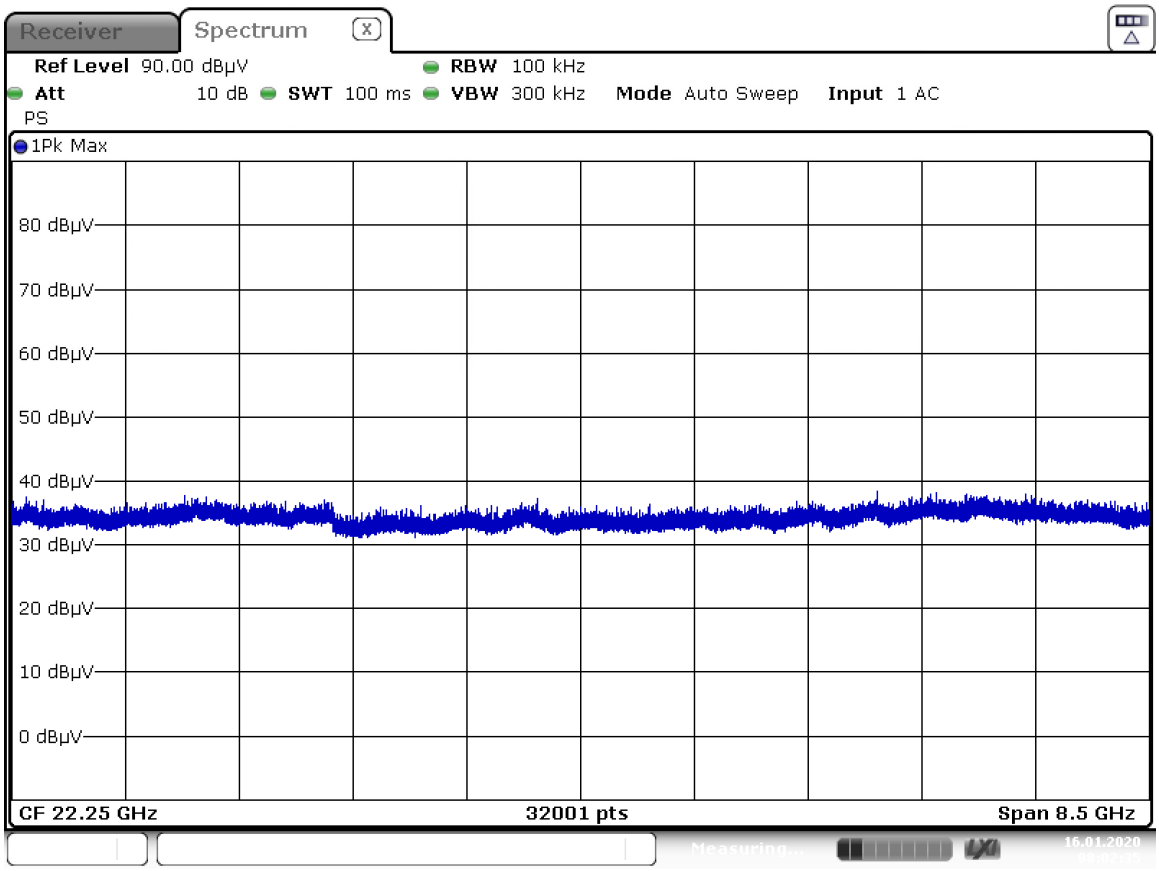


Figure A-4: 18GHz-25GHz

END REPORT