INTENTIONAL RADIATOR TEST REPORT

Report Reference Number:	E10788-2006_Cooper_TD110 2.4 GHz. **_Rev-1.0**
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Laboratory Accreditations (per ISO/IEC 17025:2017)

ACCREDITED
CERT #3657.02

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Manufacturer:	**Cooper Industries Electrical Inc**
Address:	74-1833 Coast Meridian Rd. Port Coquitlam BC, V3E 6G5 Canada.

Equipment Tested:	**TD110 2.4 GHz**
Model Number(s):	TD110-24
FCC ID:	IA9TD11024
ISED ID:	1338B-TD11024

Powering Business Worldwide

REVISION HISTORY

Date	Report Number	Details	Author's Initials
January 29, 2021	E10788-2006_Cooper_TD110 2.4 GHz_**Rev-1.0**	Final	AN
Nov 29, 2020	E10788-2006_Cooper_TD110 2.4 GHz. & Wireless Charging Pad_**Rev-0.0**	Draft	RS
All previous versions of this report have been superseded by the latest dated revision as listed in the above table. Please dispose of all previous electronic and paper printed revisions accordingly.			

REPORT AUTHORIZATION

The data documented in this report is for the test equipment provided by the manufacturer. The tests were conducted on the sample equipment as requested by the manufacturer for the purpose of demonstrating compliance with the standards outlined in Section I of this report as agreed upon by the Manufacturer under the quote 20SH10201R1.

The Manufacturer is responsible for the tested product configurations, continued product compliance, and for the appropriate auditing of subsequent products as required.

This report may comprise a partial list of tests that are required for FCC and ISED Declaration of Conformity can only be produced by the manufacturer. This is to certify that the following report is true and correct to the best of our knowledge.

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QAI EMC ACCREDITATION

QAI EMC is your one-stop regulatory compliance partner for electromagnetic compatibility (EMC) and electromagnetic interference (EMI). Products are tested to the latest and applicable EMC/EMI requirements for domestic and international markets. QAI EMC goes above and beyond being a testing facility—we are your regulatory compliance partner. QAI EMC has the capability to perform RF Emissions and Immunity for all types of electronics manufacturing including Industrial, Scientific, Medical, Information Technology, Telecom, Wireless, Automotive, Marine and Avionics.

EMC Laboratory Location	FCC Designation (3m SAC)	IC Registration (3m SAC)	A2LA Certificate
Burnaby, BC, Canada	CA9543	9543A	3657.02

EMC Facility Burnaby BC, Canada

TABLE OF CONTENTS

Section I: GENERAL INFORMATION

1.1 Product Description

The information provided in this section is for the Equipment Under Test (EUT) and the corresponding Auxiliary Equipment needed to perform the tests as a complete system.

Equipment Under Test (EUT)

EUT	TD110 2.4 GHz
FCC ID	IA9TD11024
IC Number	1338B-TD11024
Manufacturer	Cooper Industries (Electrical) Inc.
Model No./HVIN	TD110-24
PMN	TD110
FVIN	1.0(47166)
Frequency Range	2403.1 MHz. – 2479.8 MHz.

EUT – RF Information

RF device type	Transceiver
Number of available channels/Transmitter	768 (1/12 used at a time)
Channel separation	1200kHz
Channel Bandwidth	25kHz
Output power / Transmitter	12dBm (conducted) – Non-Adjustable
Modulation type	2-level FSK
Test Channels (L, M, H)	2403.1, 2441.4, 2479.8 MHz
Data Rate	10416 Baud
Adaptive	No
Geo-location-capable	No
Number of antennas	1
Antenna type	Chip (non-detachable)
Antenna gain	2.6 dBi
Antenna efficiency	-1.05 dB
Operating temperature range	-20 to +60C
Power source	Internal battery
Device use	Portable (within 20 cm of human body)

Auxiliary Equipment Information

EUT	Configurations	Count	Manufacturer	Model No.	Serial No.
Wireless Charging Cradle	Wireless Power Transfer (WPT) device	1	Cooper Industries (Electrical) Inc	TD110CR	-
Car Battery	Output: 12VDC	1	Nautilus	Marine/RV	NA

***Note: The TD110CR will be covered by a Supplier's Declaration of Conformity. Please refer to "E10788-2006_Cooper_RF Wireless Charging Pad_Rev-1.0" for applicable testing of this device.**

1.2 Environmental Conditions

The equipment under test was operated and tested under the following environmental conditions:

Parameter	Conditions
Location	Indoors
Temperature	21ºC
Relative Humidity	48 %
Atmospheric Pressure	101 kPa

1.3 Measurement Uncertainty

Parameter	Uncertainty
Radiated Emissions, 30MHz.-1GHz.	± 2.40 dB
Radiated Emissions, 1GHz.-40GHz.	± 2.48 dB
Conducted Emissions, 0.15MHz.-30MHz.	± 2.82 dB
Radio Frequency	±1.5 x 10-5 MHz.
Total RF Power Conducted	±1.36 dB
Spurious Emissions, Conducted	±1.36 dB
RF Power Density, Conducted	±1.36 dB
Temperature	±1ºC
Humidity	±5 %
DC and low frequency voltages	±3 %

1.4 Worst Test Case

Worst-case orientation was determined during the preliminary testing.
The final radiated emissions were performed in the worst-case orientation.

1.5 Sample Calculations of Emissions Data

Radiated and conducted emissions were performed using EMC32 software developed by Rohdes & Schwarz. Transducer factors like Antenna factors, Cable Losses and Amplifier gains were stored in the test templates which are used to perform the emissions measurements. After test is finished, data is generated from the EMC32 consisting of product details, emission plots and final data tables as shown below.

Frequency (MHz.)	Q-Peak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz.)	Ant. Ht. (cm)	Pol	Turntable Position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
42.663900	33.0	1000.000	120.000	100.0	H	70.0	13.2	7.5	40.5

Quasi-Peak reading shown in the table above is already corrected by the software using correction factor shown in column "Corr." The correction factor listed under "Corr." table calculated as:

Corr.(dB) = Antenna factor + Cable loss

Or

Corr.(dB) = Antenna factor + Cable Loss - Amp gain (if pre-amplifier was used)

The final Quasi peak reading shown in the data is calculated by the software using following equation:

Corrected Quasi-Peak (dBµV/m) = Raw Quasi-Peak Reading + Antenna factor + Cable loss

To obtain the final Quasi-Peak or Average reading during power line conducted emissions, transducer factors are included in the final measurement as shown below.

Frequency (MHz.)	Q-Peak (dBµV)	Meas. Time (ms)	Bandwidth (kHz.)	PE	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150	44.3	1000.000	9.000	GND	0.6	21.7	66.0

Frequency (MHz.)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz.)	PE	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150	27.2	1000.000	9.000	GND	0.6	28.8	56.0

Quasi Peak or Average reading shown in above table is already corrected by the software using the correction factor shown in column "Corr." The correction factor listed under "Corr." table calculated as:

Corr.(dB) = Antenna factor + Cable loss

The final Quasi-peak or Average reading shown in the data is calculated by the software using following equation:

Corr. Quasi-Peak/Average Reading (dBµV) = Raw Quasi-Peak/Average Reading + Antenna factor + Cable loss

The allowable margin from the limits, as per the standards, were calculated for both radiated and conducted emissions:

Margin(dB) = Limit – Quasi-Peak or Average reading

1.6 Test Equipment List

The tables below contain all the equipment used by QAI Laboratories in conducting all tests on the Equipment Under Test (EUT) as per Section 1.

Emissions Test Equipment

Sl. NO.	Manufacturer	Model	Description	Serial No.	S/W Version	Calibration Due Date
1	AH Systems	PAM118	Amplifier (10KHz.-18GHz.)	189	N/A	Conditional Use
2	TTi	HA1600A	Power Analyzer; Harm/Flicker	318801	N/A	2021-Oct-01
3	TTi	AC1000A	Power Supply, Low Distortion	317113	N/A	2021-Oct-01
4	EMCO	3825/2	LISN (150kHz.-30MHz.)	9002-1601	N/A	2023-Oct-01
5	Sunol Sciences	DRH-118	Horn Antenna, 1.0-18 GHz.	A050905	N/A	2023-07-28
6	ETS Lindgren	2165	Turntable	00043677	N/A	N/A
7	ETS Lindgren	2125	Mast	00077487	N/A	N/A
8	ETS Lindgren	S201	5-meter Semi-Anechoic Chamber	1030	N/A	N/A
9	Hewlett Packard	8449B	Preamplifier (1-26 GHz.)	2933A00198	N/A	2022-Jan-22
10	Rohde & Schwarz	ESU40	EMI Receiver	100011	EMC32 v10.35.10/ FV 4.73 SP4	2023-Jul-05
11	Rohde & Schwarz	ESCI	EMI Receiver	100123	EMC32 v10.01.00/ FV 4.42 SP3	2021-Mar-26
12	Sunol Sciences	SM46C	Turntable	051204-2	N/A	N/A
13	Sunol Sciences	TWR95	Mast	TREML0001	N/A	N/A
14	Sunol Sciences	JB3	Biconilog Antenna 30MHz. – 3GHz.	A120106	N/A	2022-May-10
15	Sunol Sciences	JB3	Biconilog Antenna 30MHz. – 3GHz.	A042004	N/A	2023-Jul-30

Measurement Software List

Sl. No.	Manufacturer	Model	Version	Description
1	Rhode & Schwarz	EMC 32	10.35.10	Emissions Test Software
2	TESEQ	WIN 3000	1.2.0	Surge, EFT & Voltage Dips Immunity Test Program
3	Thurlby Thandar Instruments	HA-PC Link Version	2.02	Harmonics and Flicker Test Program
4	VI Automation	Via EMC Immunity Executive	1.0.308	Radiated and Conducted Immunity Test Program

Note: Equipment listed above have 3 years calibration interval.

Section II: EXECUTIVE SUMMARY OF STANDARDS AND LIMITS

2.1 Purpose

The purpose of this report is to demonstrate and document the compliance of "TD110 2.4 GHz" as per Sections 1.2 & 1.3 of this report.

2.2 Scope

The information documented in this report is based on the test methods and levels as per Quote 20SH10201R1.

FCC Title 47 Part 15 – Radio Frequency Devices, Subpart C – Intentional Radiators.
15.247 Operation within the bands 902-928 MHz., 2400-2483.5 MHz. and 5725-5850 MHz.

CFR Title 47 FCC Part 15 – Radio Frequency Devices, Subpart B – Unintentional Radiators.
RSS-247 Issue 2 – Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence Exempt Local Area Network (LE-LAN) Devices
RSS-Gen Issue 5 – General Requirements for Compliance of Radio Apparatus.
ICES-003 Issue 6 – Information Technology Equipment (Including Digital Apparatus).
– Limits and Methods of Measurement.

2.3 Summary of Results

The following tests demonstrate the testimony to "FCC and ISED" Mark Electromagnetic compatibility testing for "TD110 2.4 GHz".

Test or Measurement	Applicable FCC and IC Standard	Result
Antenna Requirement	FCC CFR 47 Part 15.203 IC RSS-Gen Issue 5 Section 7.1.2	Comply
RF Peak Power Output	FCC Title 47 CFR Part 15: Subpart C - §15.247 (b)(1) RSS-247 Issue 2	Comply
Radiated Spurious Emissions	RSS-247-Issue 2 RSS-Gen Issue 5 FCC Subpart C §15.205, §15.209 & §15.247	Comply
20dB Occupied Bandwidth	RSS-247-Issue 2 RSS-Gen Issue 5 FCC Subpart C §15.247	Comply
99% Occupied Bandwidth	RSS-247 Issue 2 RSS-Gen Issue 5	Comply
Out-of-Band Emissions (Band Edge)	FCC Title 47 CFR Part 15: Subpart C - §15.247 (d) RSS-247-Issue 2	Comply
Channel Separation	FCC Title 47 CFR Part 15: Subpart C - §15.247 (a)(1) RSS-247-Issue 2	Comply
Number of Hopping Channels	FCC Title 47 CFR Part 15: Subpart C - §15.247 RSS-247-Issue 2	Comply
Dwell Time and Time Occupancy Per Frequency	FCC Title 47 CFR Part 15: Subpart C - §15.247 (a)(1)(iii) RSS-247-Issue 2	Comply
Unintentional Radiated Emissions	FCC Title 47 CFR Part 15: Subpart B - §15.109 ICES-003 Issue 6	Comply
	ICES-003 Issue 6	

Note: The gain of the antenna is provided by the client to measure or calculate test results and is not measured by QAI.

Section III: DATA & TEST RESULTS

3.1 Antenna Requirements

Date Performed:	December 2, 2020
Test Standard:	FCC CFR 47 Part 15.203 IC RSS-Gen Issue 5 Section 7.1.2
Test Method:	ANSI C63.10:2013
Modifications:	No modification was required to comply for this test
Final Result:	This device uses a non-removable chip antenna. The EUT **Comply** with the applicable standard.

Applicable Regulations:

The purpose of this requirement is to make certain that no other antenna, except for that provided by the responsible party, shall be used with the Equipment-Under-Test (EUT) as defined in Section 1.1.

"An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. "The installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded."

Note: The gain of the antenna is provided by the client to measure or calculate test results and is not measured by QAI.

3.2 RF Peak Power Output

Date Performed:	November 19 & December 9, 2020
Test Standard:	FCC Title 47 CFR Part 15: Subpart C - §15.247 (b)(1) RSS-247 Issue 2
Test Method:	FCC KDB 558074 D01 DTS Measurement Guidance v04
Modifications:	No modification was required to Comply for this test
Final Result:	The EUT **Comply** with the applicable standard.

Test Setup:

The EUT was tested outside the SAC by output conducted emissions method.
The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Modifications: No modification was required to comply for this test.

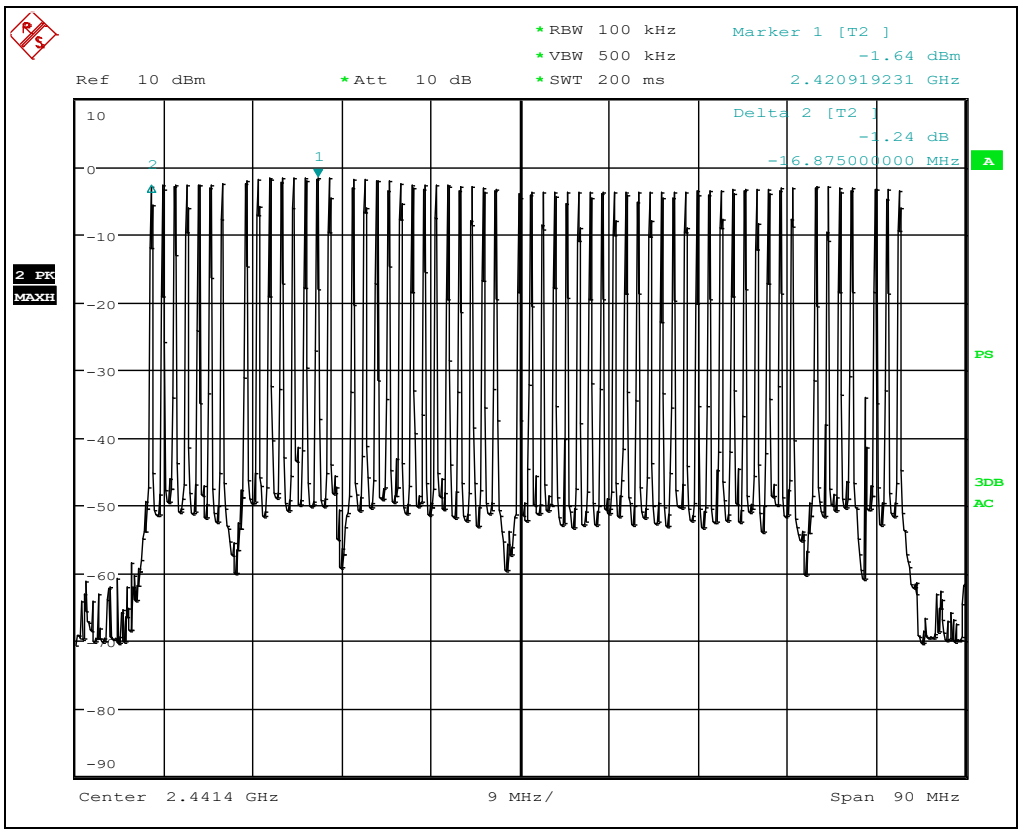
Final Result: The EUT **Comply** with the applicable standard.

Measurement Data and Plot:

Table 1: Data of RF Peak Power Output

Modulations	Carrier Frequency MHz.	Raw Peak dBm	Adapter Attenuation* dB	Corrected Peak Conducted Output Power dBm (1)	Limit dBm	Margin dB	Results
FSK	2403.1	9.78	1	10.78	30	19.22	Comply
	2441.4	8.78	1	9.78	30	20.22	Comply
	2479.8	9.05	1	10.05	30	19.95	Comply

*Including attenuators and 1 dB for cable and connector.



Plot 1: Spectrum of Frequency Hopping Transmitter measured on Peak Hold

As can be seen from Figure 3, the maximum output power is transmitted at 2.4209 GHz. The measured power is 1.24 dB above the power measured at the lowest frequency, that is 10.78dBm from Table 1. Therefore:

Maximum Output Power is 10.78dBm + 1.24dB =12.02 dBm.

The transmitter transmits only 15.03ms in any 20ms interval. Therefore, the maximum RF exposure is multiplying it with the duty cycle of 15/20 = 75%

3.3 Radiated Spurious Emissions

Date Performed: November 11, 13, 2020

Test Standard: RSS-247-Issue 2
RSS-Gen Issue 5
FCC Subpart C §15.205, 15.209 & 15.247

Test Method: ANSI C63.10:2013

Modifications: No modification was required to comply for this test

Final Result: The EUT **Comply** with the applicable standard.

Test Requirement:

1) Radiated emission limits; general requirements FCC Subpart C §15.209

The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Table 2: Unwanted emissions falling into restricted bands shall comply with the limits specified below

Frequency (MHz.)	Field Strength	
	uV/m @ 3-m	Calculated dBµV/m at 3m
0.009 – 0.490	2400/*f* (kHz.)	(20*log(2400/*f* (kHz.))) + 40 dB
0.490 – 1.705	24000/*f* (kHz.)	(20*log(24000/*f* (kHz.))) + 20 dB
30 – 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
Above 960	500	54.0

Note 1: The above field strength limits are specified at a distance of 3 meters.
The tighter limits apply at the band edges.

Note 2: The emissions limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz., 110-490 kHz. and above 1000 MHz.
Radiated emission limits in these three bands are based on measurements employing an average detector

2) Restricted bands of operation RSS-Gen Issue 5

Unwanted emissions that fall into the restricted bands specified on the table below shall comply with the limits specified on the table limits above as per §15.209 and Clause 8.9 of RSS-Gen.

Table 3: Restricted frequency Bands RSS-Gen Issue 5

MHz.	MHz.	GHz.
0.090 - 0.110	149.9 - 150.05	9.0 - 9.2
0.495 - 0.505	156.52475 - 156.52525	9.3 - 9.5
2.1735 - 2.1905	156.7 - 156.9	10.6 - 12.7
3.020 - 3.026	162.0125 - 167.17	13.25 - 13.4
4.125 - 4.128	167.72 - 173.2	14.47 - 14.5
4.17725 - 4.17775	240 - 285	15.35 - 16.2
4.20725 - 4.20775	322 - 335.4	17.7 - 21.4
5.677 - 5.683	399.9 - 410	22.01 - 23.12
6.215 - 6.218	608 - 614	23.6 - 24.0
6.26775 - 6.26825	960 - 1427	31.2 - 31.8
6.31175 - 6.31225	1435 - 1626.5	36.43 - 36.5
8.291 - 8.294	1645.5 - 1646.5	Above 38.6
8.362 - 8.366	1660 - 1710	Certain frequency bands listed in this table 3 and in bands above 38.6 GHz. are designated for licence-exempt applications. These frequency bands and the requirements that apply to related devices are set out in the 200 and 300 series of RSSs.
8.37625 - 8.38675	1718.8 - 1722.2	
8.41425 - 8.41475	2200 - 2300	
12.29 - 12.293	2310 - 2390	
12.51975 - 12.52025	2483.5 - 2500	
12.57675 - 12.57725	2655 - 2900	
13.36 - 13.41	3260 - 3267	
16.42 - 16.423	3332 - 3339	
16.69475 - 16.69525	3345.8 - 3358	
16.80425 - 16.80475	3500 - 4400	
25.5 - 25.67	4500 - 5150	
37.5 - 38.25	5350 - 5460	
73 - 74.6	7250 - 7750	
74.8 - 75.2	8025 - 8500	
108 - 138	--	

Note: The emission limits for the ranges 9-90 kHz. and 110-490 kHz. are based on measurements employing a linear average detector.

Table 4: FCC Restricted Bands FCC Subpart C §15.205

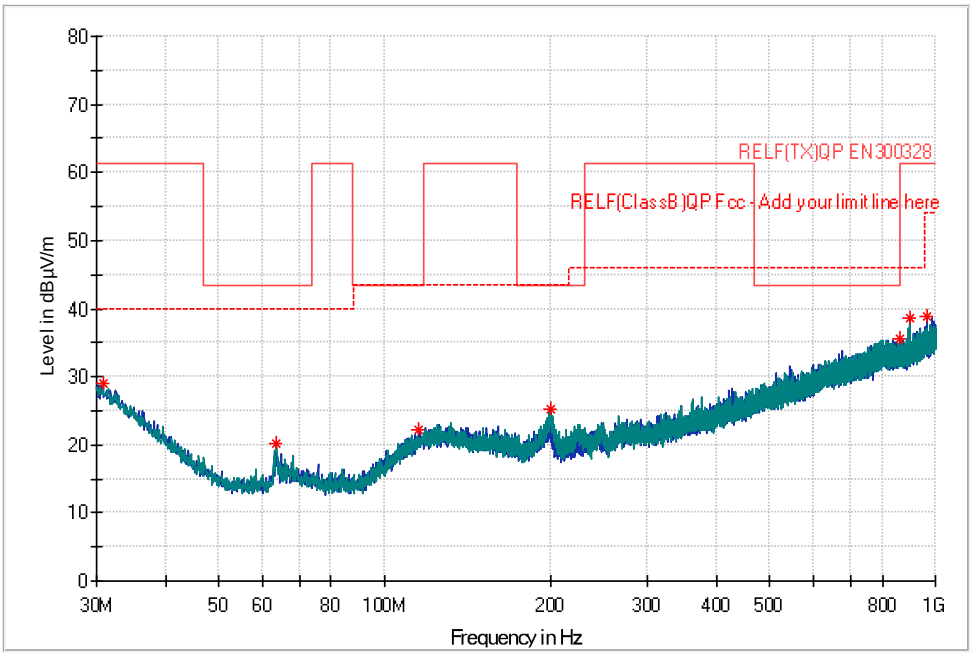
MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
[1]0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	([2])
13.36-13.41			

3) §15.247 (d) In any 100 kHz. bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz. bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

Test Setup:

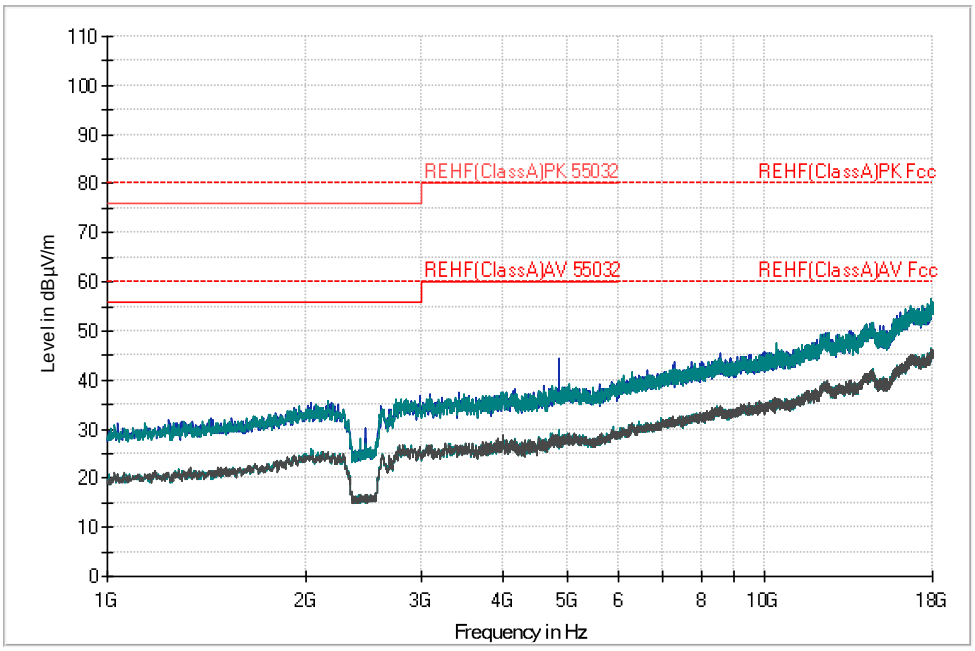
The EUT was tested in our 3 m SAC and was positioned on the center of the turntable. The transmitter was set for continuous transmission. The operating frequency of the device was measured for all radiated emissions 10 kHz. to 4 GHz up to the 10th harmonic of the highest fundamental frequency. The EUT was pre-scanned in 3 different orthogonal orientations and was found to radiate highest when placed flat on the tabletop as indicated in the test photos.

Measurement Data and Plot:



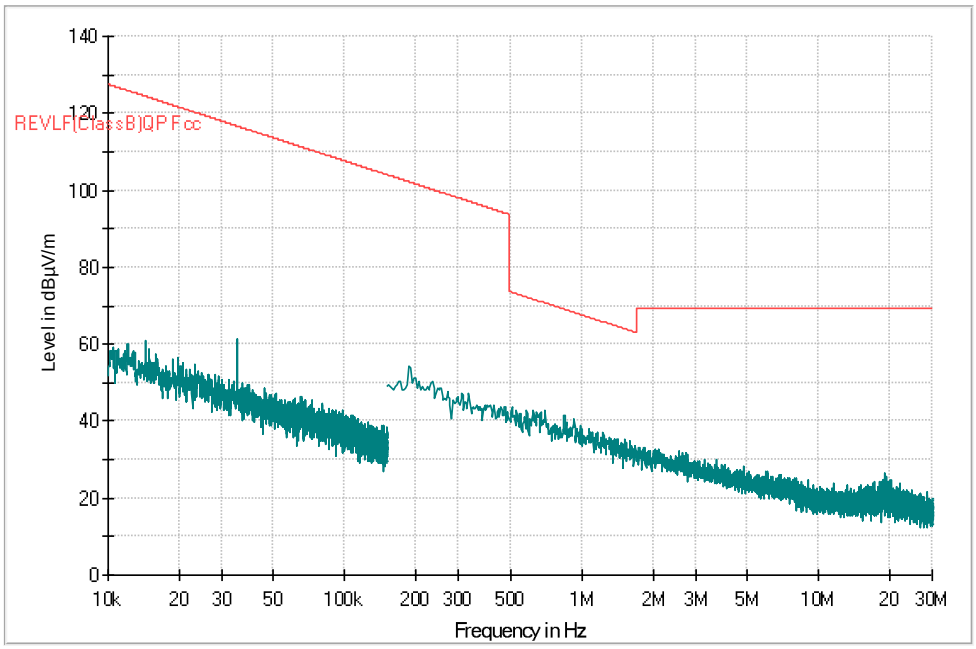
Plot 2: Radiated Spurious Emissions, 30M – 1G Hz and restricted band limit FSK

Note: No emission of significance were observed



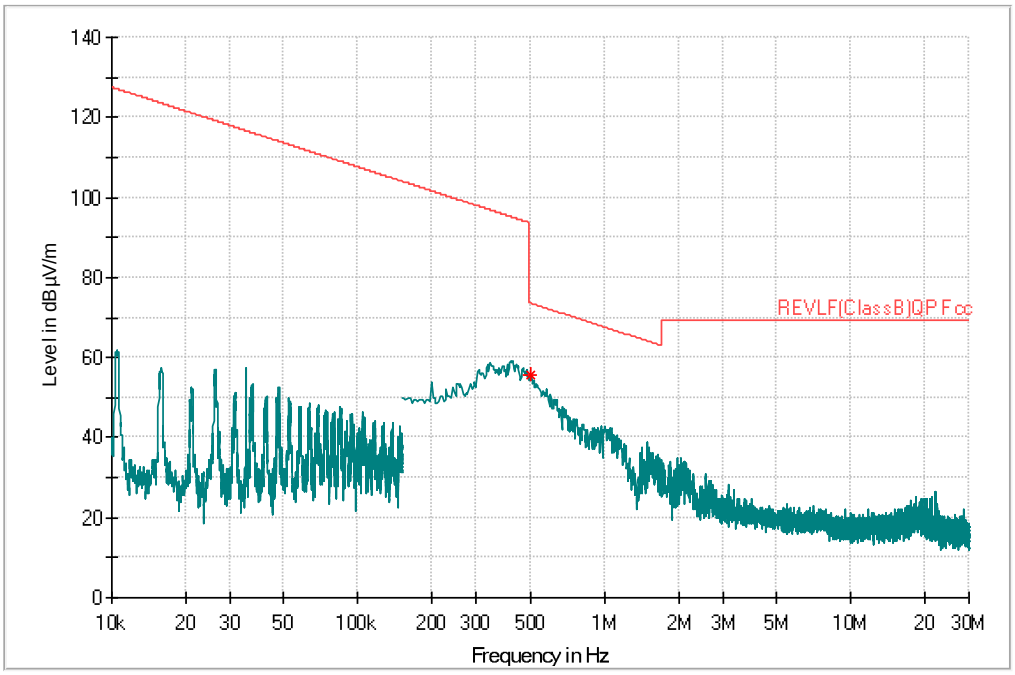
Plot 3: Radiated Spurious Emissions, 1G – 18G Hz, FSK

Note: No emission of significance were observed



Plot 4: Radiated Spurious Emissions, 10 kHz.– 30MHz, FSK, Polarization: perpendicular, Horizontal

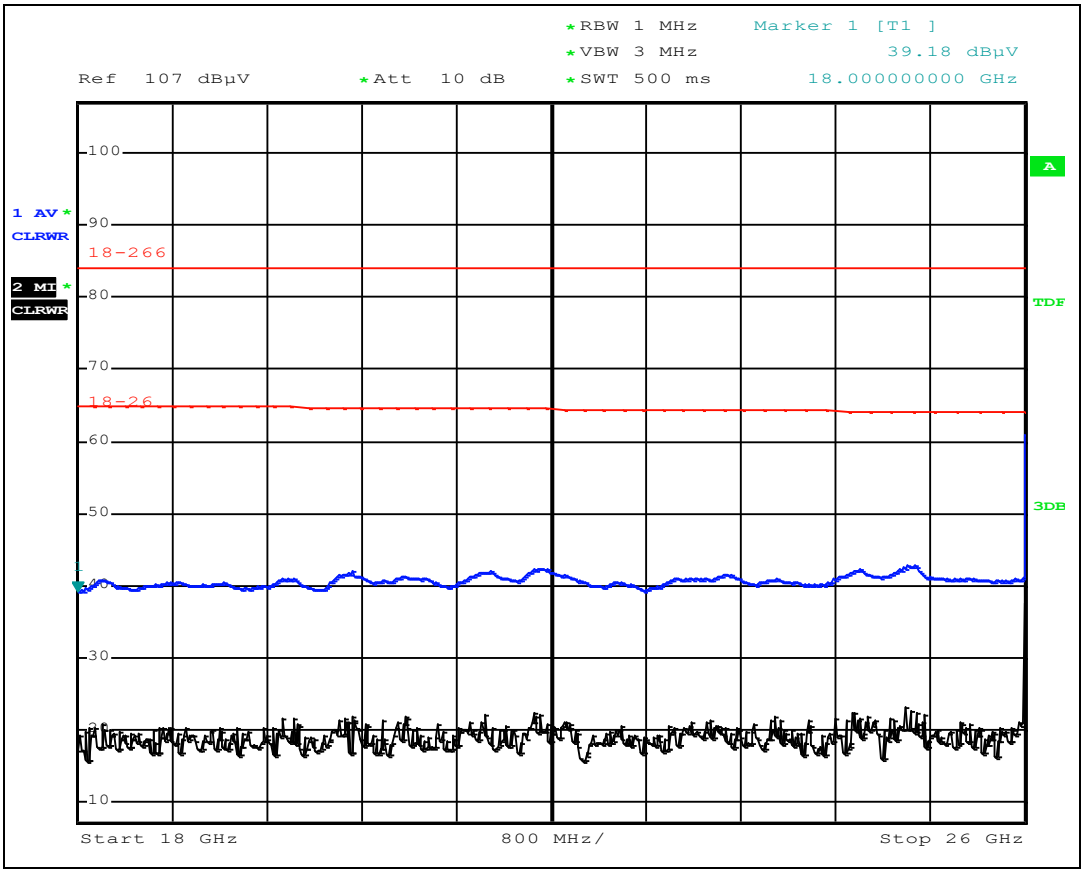
Note: No emission of significance were observed



Plot 5: Radiated Spurious Emissions, 10 kHz.– 30MHz, FSK, Polarization: perpendicular, Vertical

Table 5: Radiated Spurious Emissions, 10 kHz.– 30MHz, FSK, Polarization: perpendicular, Vertical

Frequency (MHz)	Max Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
0.5022	55.45	73.59	18.14	150.0	V	131	20.6



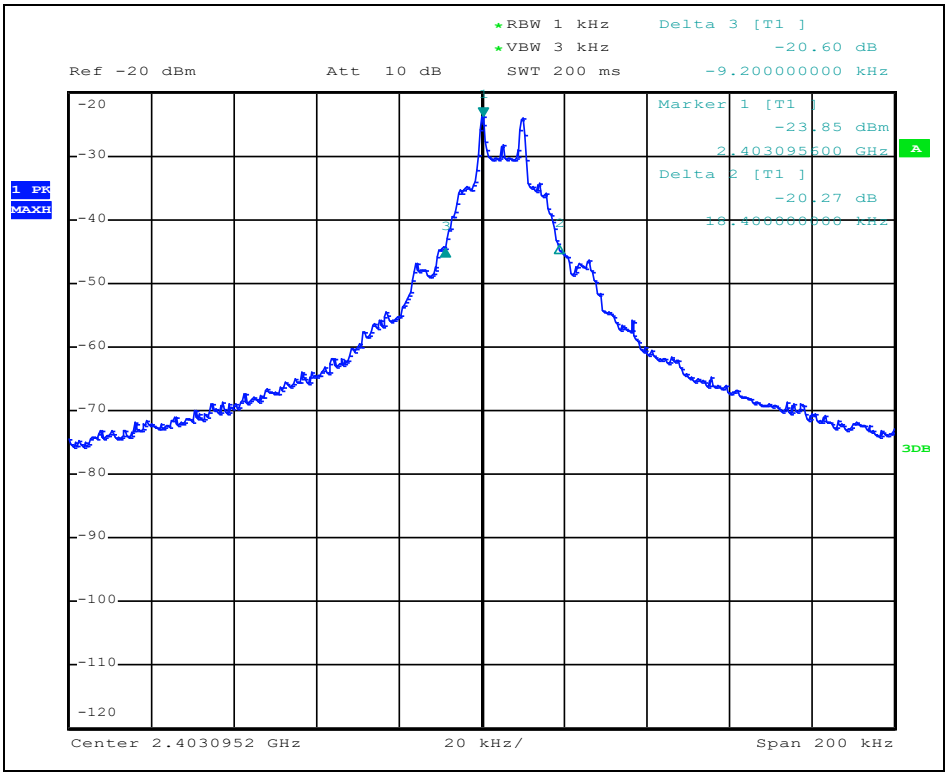
Plot 6: Spurious Emissions of Radio Collocation, 18G– 26G Hz, Tx on

Note: No emission of significance were observed

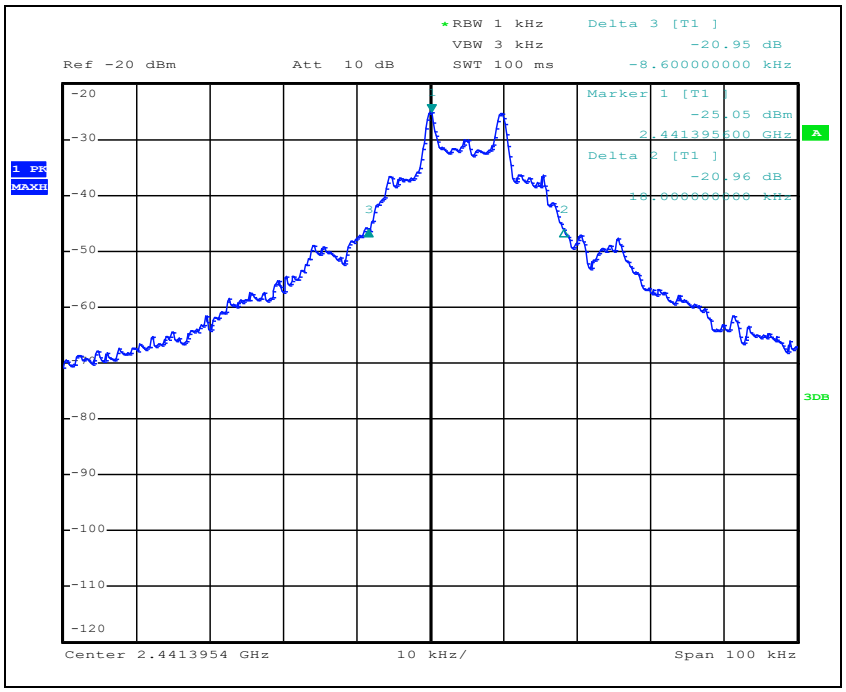
3.4 20dB Occupied Bandwidth

Date Performed:	December 16, 2020
Test Standard:	RSS-247-Issue 2 RSS-Gen Issue 5 FCC Subpart C §15.247
Test Method:	ANSI C63.10:2013
Modifications:	No modification was required to comply for this test
Final Result:	The EUT **Comply** with the applicable standard.

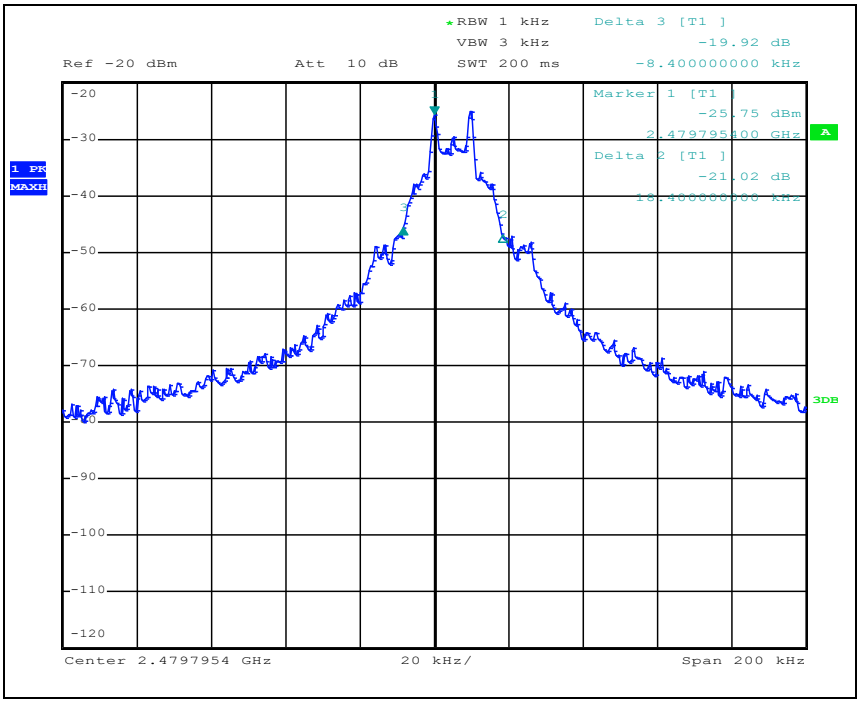
Measurement Data and Plot:



Plot 7: 20dB Occupied Bandwidth of Low Channel



Plot 8: 20dB Occupied Bandwidth of Mid Channel



Plot 9: 20dB Occupied Bandwidth of High Channel

Table 6: Data: Occupied Bandwidth

Channel	Frequency (MHz.)	20 dB Bandwidth (kHz.)
Low	2403.1	19.4
Middle	2441.4	19.6
High	2479.8	18.8

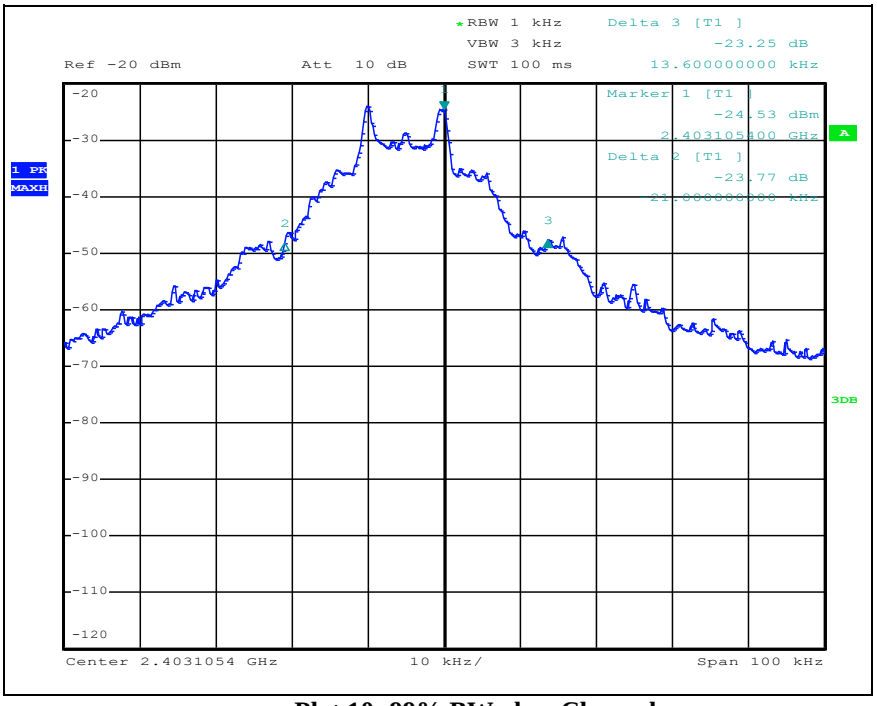
3.5 99% Occupied Bandwidth

Date Performed:	December 16, 2020
Test Standard:	RSS-247 Issue 2 RSS-Gen Issue 5
Test Method:	ANSI C63.10:2013
Modifications:	No modification was required to comply for this test
Final Result:	The EUT **Comply** with the applicable standard.

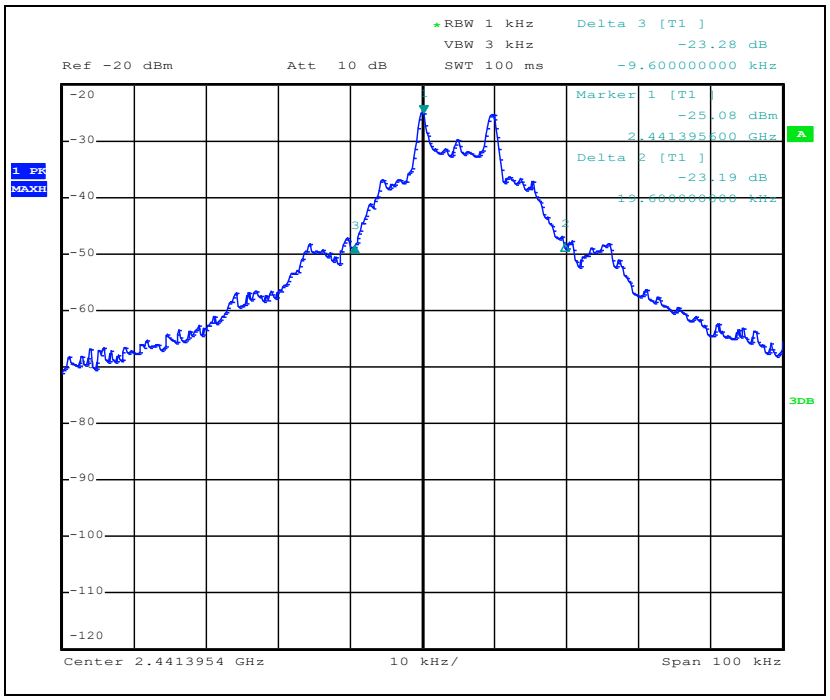
Test Requirement:

The Occupied Channel Bandwidth is the bandwidth that contains 99 % of the power of the signal. The bandwidth shall fall completely within the frequency range specified by the standard.

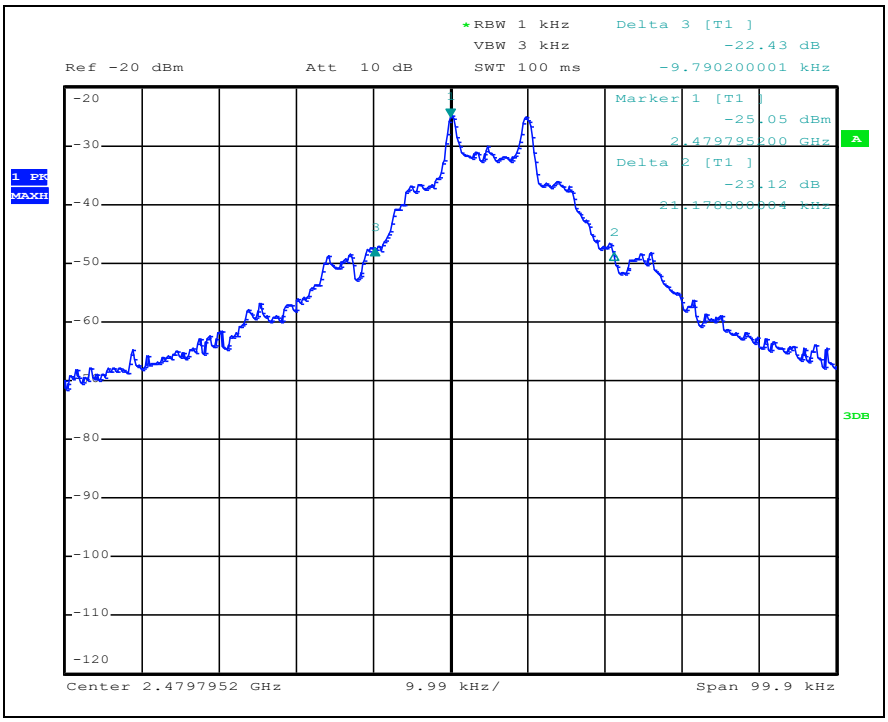
Measurement Data and Plot:



Plot 10: 99% BW, low Channel



Plot 11: 99% BW, Mid Channel



Plot 12: 99% BW, High Channel

Table 7: Data: 99% Occupied Bandwidth

Channel	Frequency (MHz.)	99% Bandwidth (kHz.)
Low	2403.1	34.6
Middle	2441.4	28.4
High	2479.8	30.8

3.6 Out-of-Band Emissions (Band Edge)

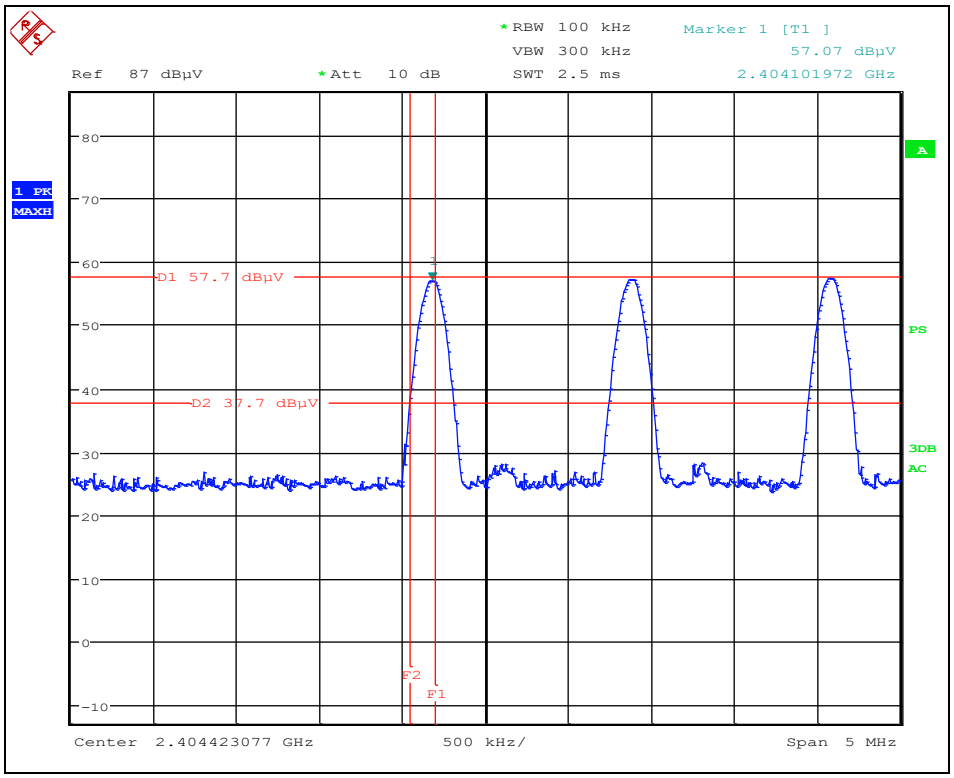
Date Performed:	November 18, 2020
Test Standard:	RSS-247-Issue 2 FCC Title 47 CFR Part 15: Subpart C - §15.247 (d)
Test Method:	ANSI C63.10:2013
Modifications:	No modification was required to comply for this test
Final Result:	The EUT **Comply** with the applicable standard.

Test Requirement:

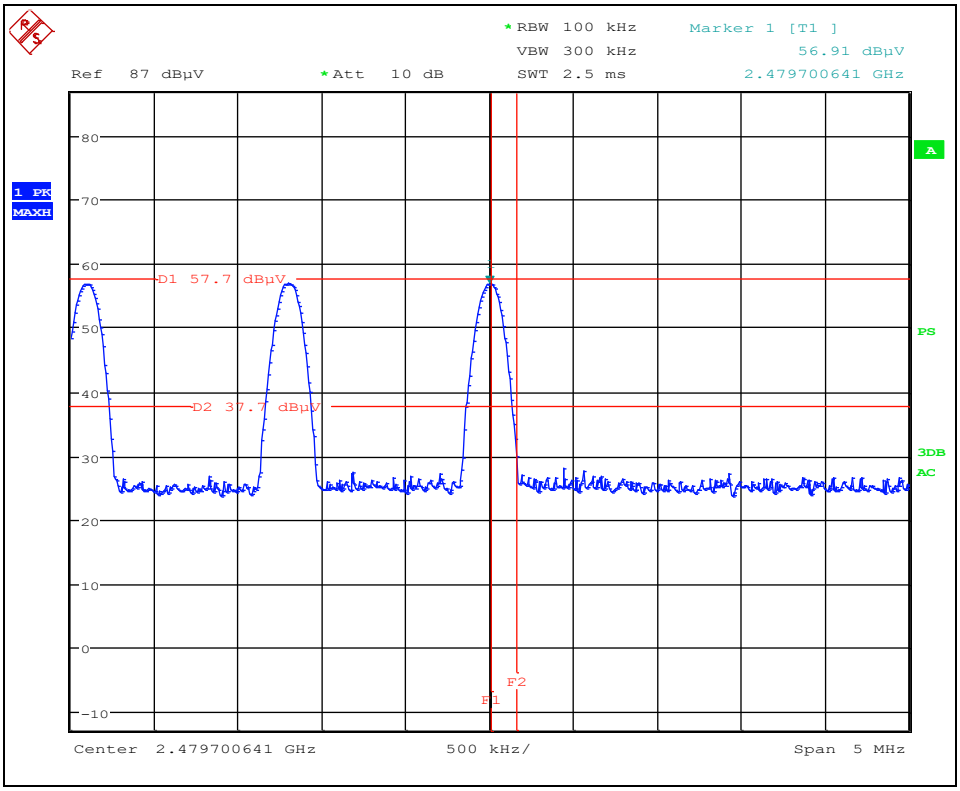
In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, shall be at least 20 dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section A8.4 (4) of the standard, the attenuation required shall be 30 dB instead of 20dB.

Measurement Data and Plot:

FSK (Hopping Mode)

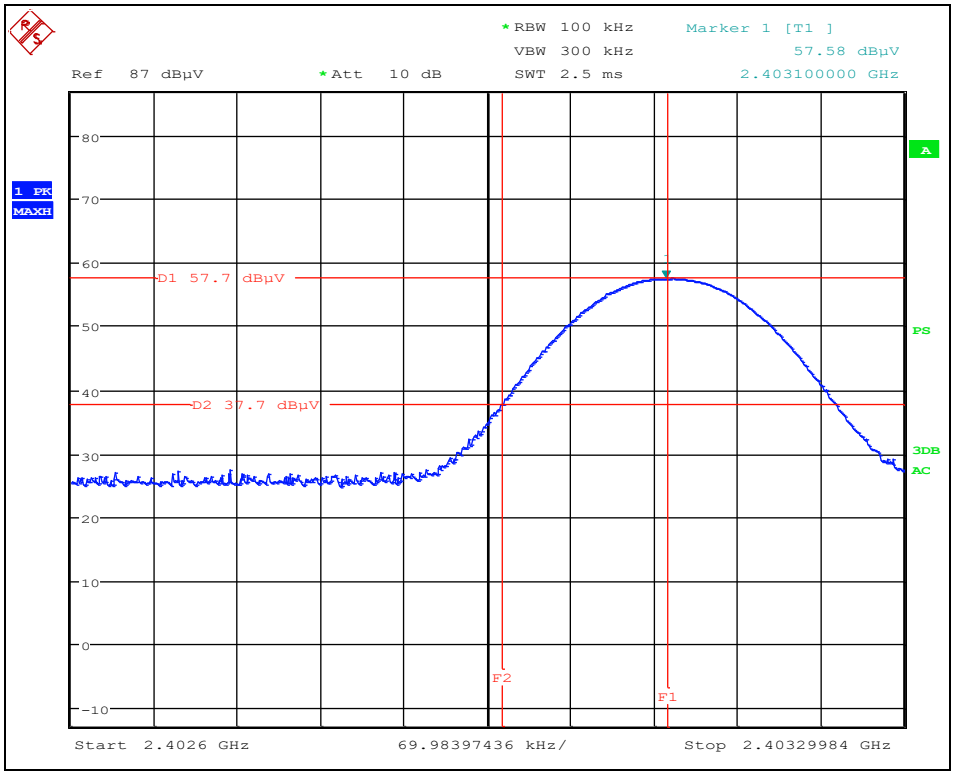


Plot 13: Low Channel

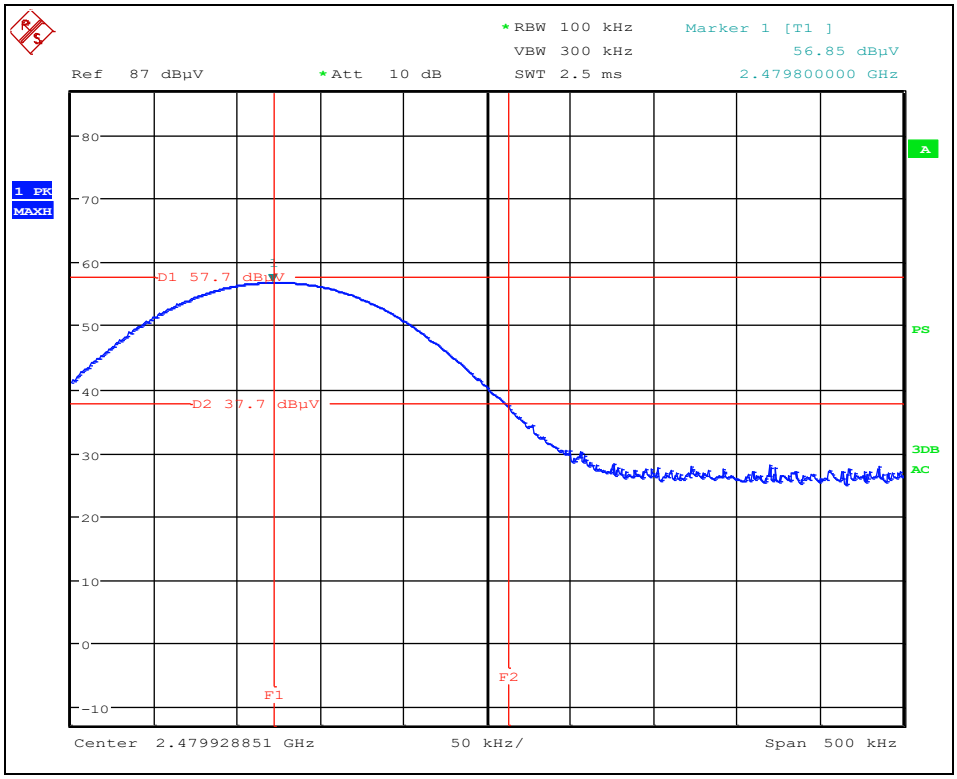


Plot 14: High Channel

FSK (Single Channels)



Plot 15: Low Channel



Plot 16: High Channel

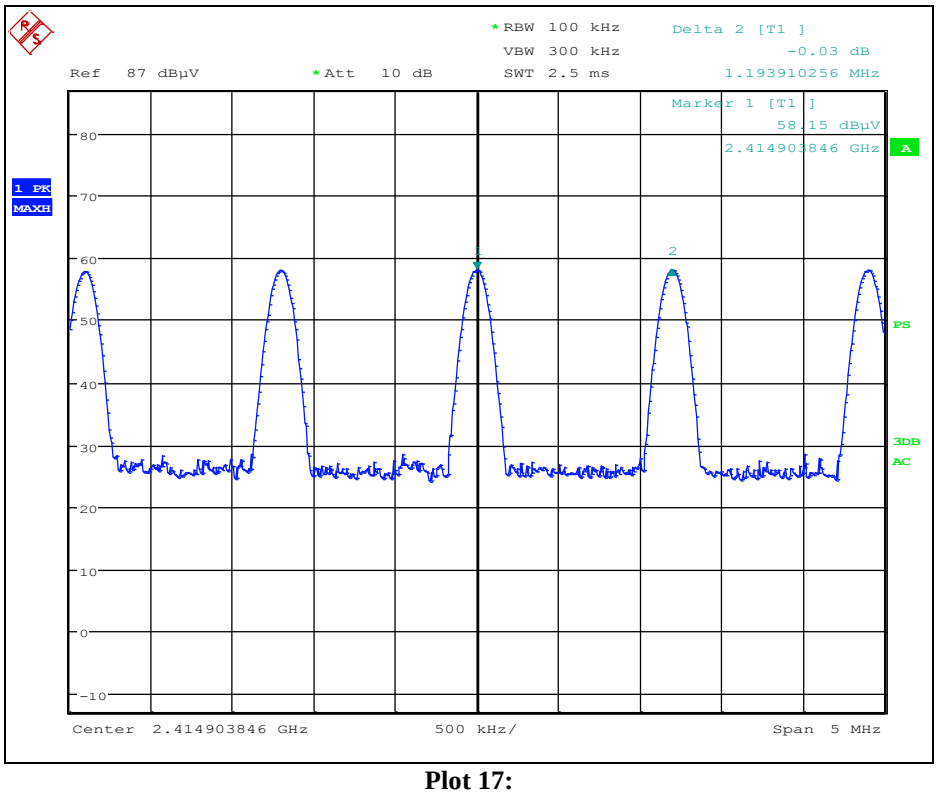
3.7 Channel Separation

Date Performed:	November 18, 2020
Test Standard:	FCC Title 47 CFR Part 15: Subpart C - §15.247 (a)(1) RSS-247-Issue 2
Test Method:	ANSI C63.10:2013
Modifications:	No modification was required to comply for this test
Final Result:	The EUT **Comply** with the applicable standard.

Test Requirement:

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Measurement Data and Plot:



Plot 17:

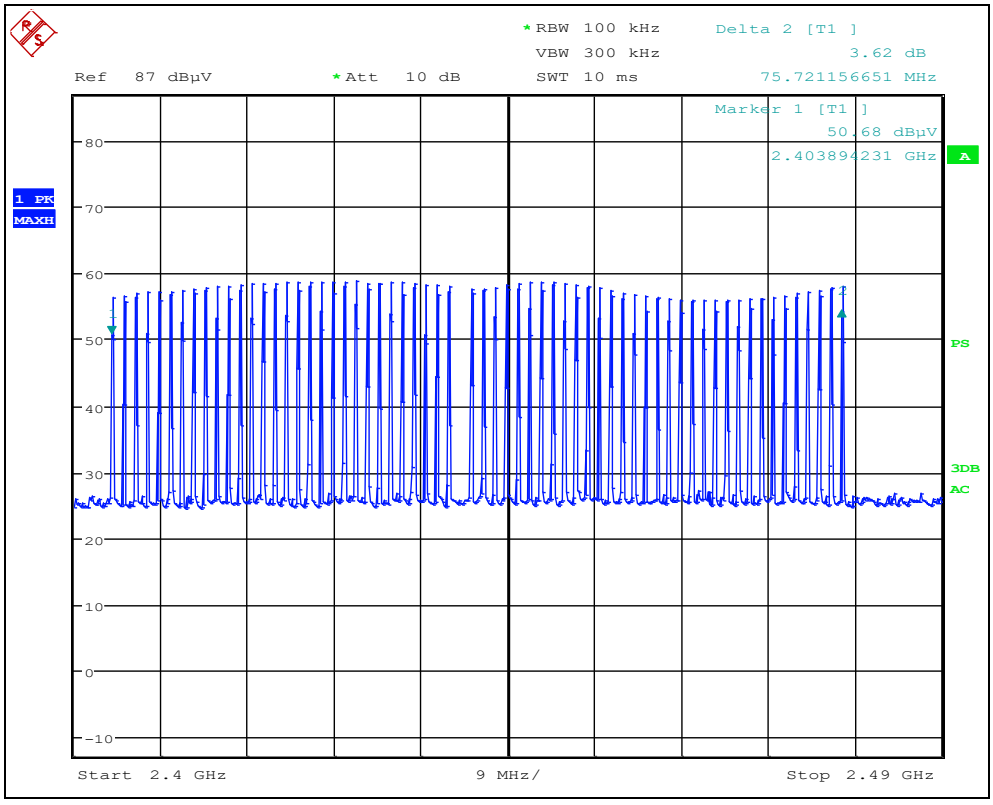
Table 8: Channel Separation

Modulation	Channel Separation kHz	20 dB Bandwidth kHz	Results
FSK	1194	112	Complies

3.8 Number of Hopping Channels

Date Performed:	November 18, 2020
Test Standard:	FCC Title 47 CFR Part 15: Subpart C - §15.247 RSS-247-Issue 2
Test Method:	ANSI C63.10:2013
Modifications:	No modification was required to comply for this test
Final Result:	This device will only be used by 'Cooper Electrical Canada' as an OEM device that will be professionally installed. The EUT **Comply** with the applicable standard.

Measurement Data and Plot:



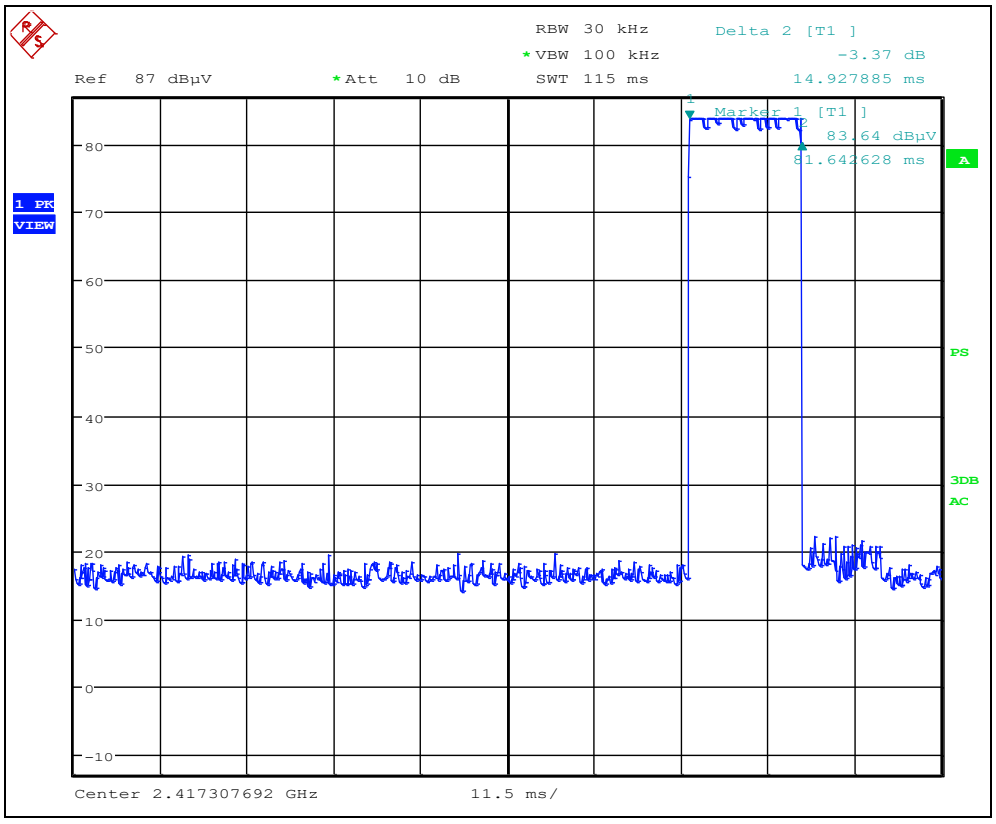
Plot 18: The number of Hopping: 63

3.9 Dwell Time and Time of Occupancy

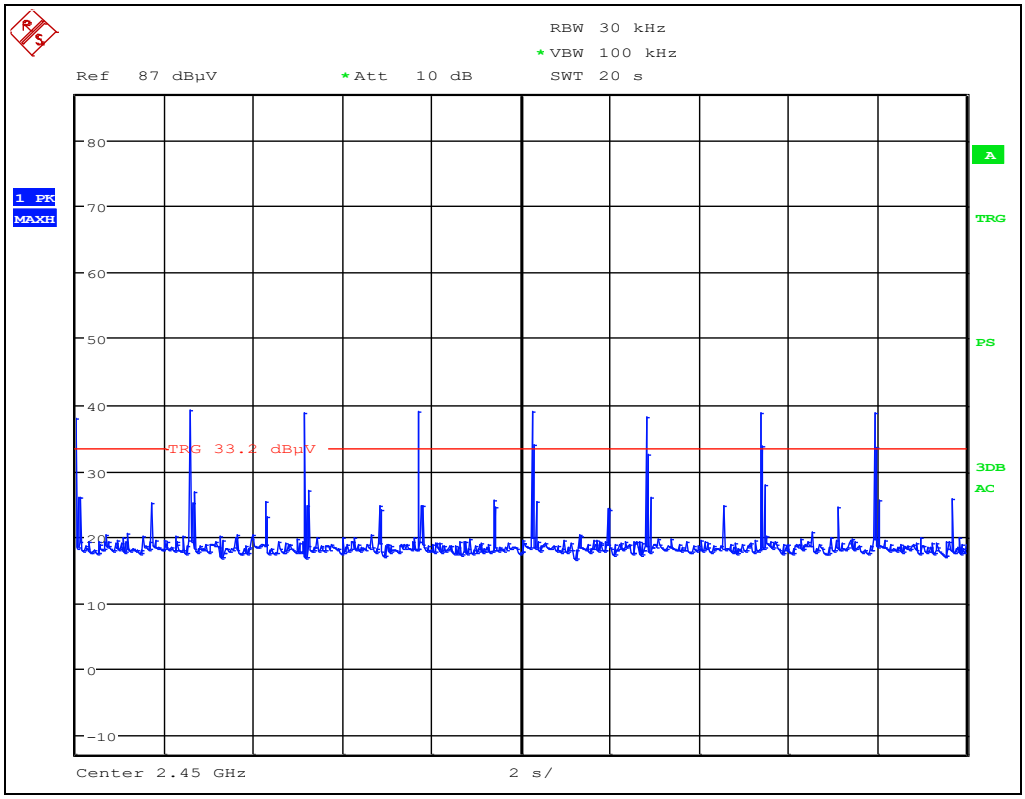
Date Performed:	November 19, 20, & December 14,15 2020
Test Standard:	FCC CFR 47 Part 15.203 IC RSS-Gen Issue 5 Section 7.1.2
Test Method:	ANSI C63.10:2013
Modifications:	No modification was required to comply for this test
Final Result:	The EUT **Comply** with the applicable standard.

Test Requirement: Frequency hopping systems in the 2400–2483.5 MHz band use 15 channels, the average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels (15) employed (<6ms).

Measurement Data and Plot:



Plot 19: Bursts in 20 s- Dwelling time 14.93 ms



Plot 20: Duty cycle of each burst – 0 Span

Table 9: Dwell Time and Time Occupancy Per Frequency

Modulation	Number Of Burst in 20 s	Burst Duty Cycle ms	Time of Occupancy ms	Max Limit ms	Results
FSK	8	14.93	119.44	400	Complies

3.10 Unintentional Radiated Emissions- Receiver Mode

Date Performed: November 13, 2020

Test Standard: FCC Title 47 CFR Part 15: Subpart B - §15.109
ICES-003 Issue 6

Test Method: ANSI C63.10:2014

Modifications: No modification was required to comply for this test

Final Result: The EUT **Comply** with the applicable standard.

Method of Measurement:

The EUT was positioned in the center of the turntable in the SAC. The EUT was then measured for all the radiated emissions in the frequency range of 30MHz – 1GHz. Measurements were made using the spectrum analyzer and receiver using the appropriate antennas, amplifiers, attenuators, and filters.

Emissions in both horizontal and vertical polarizations were measured while rotating the Equipment Under Test (EUT) on the turntable to maximize signal strength. In the case of high ambient noises, the measurements are performed at a closer distance and the limit is adjusted per the equation below. The result is added or subtracted to the required emission level to ensure compliance at the new distance.

Where D1 = Current Distance
D2 = Required Distance

Required Limit:

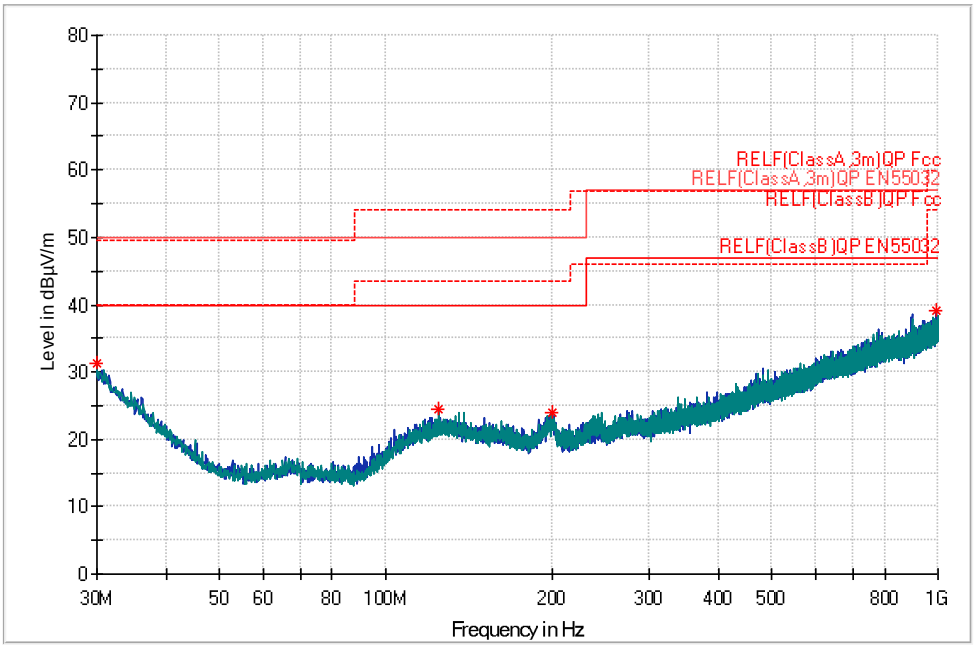
The field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency (MHz.)	Field Strength Calculated dBµV/m at 3m
30 – 88	40.0
88 - 216	43.5
216 - 960	46.0
Above 960	54.0

Note 1: The above field strength limits are specified at a distance of 3 meters.
The tighter limits apply at the band edges.

Note 2: The emissions limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz., 110-490 kHz. and above 1000 MHz.
Radiated emission limits in these three bands are based on measurements employing an average detector

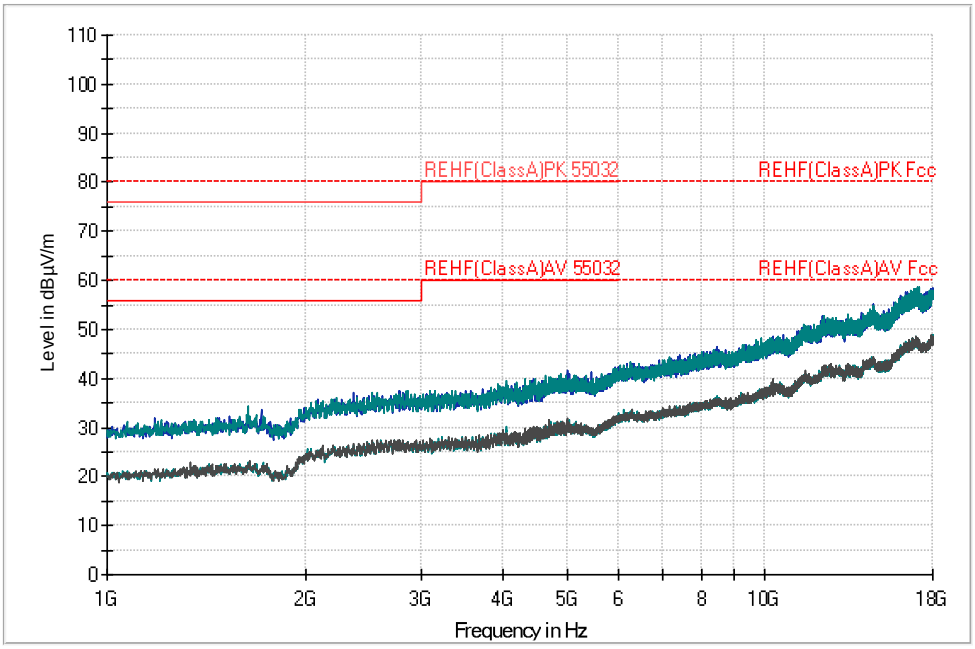
Measurement Data and Plot:



Plot 21: 30MHz – 1GHz Unintentional Radiated Emissions scanned at 3m SAC, Class A limit

Table 10: 30MHz – 1GHz Unintentional Radiated Emissions scanned at 3m SAC, Class A limit

Frequency (MHz)	Max Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
990.1060	39.07	57.00	17.93	300.0	H	282	32.0
199.8470	23.91	50.00	26.09	100.0	V	86	19.3
124.9630	24.50	50.00	25.50	100.0	V	348	19.7
30.0000	31.32	50.00	18.68	250.0	V	0	26.7



Plot 22: 1GHz – 18GHz Unintentional Radiated Emissions scanned at 3m SAC, Class A limit
Note: No emission of significance were observed

3.11 RF Exposure Evaluation

Date Performed: November 24, 30, 2020

Test Standard: FCC CFR 47 Part 15.203
IC RSS-Gen Issue 5 Section 7.1.2

Test Method: ANSI C63.10:2013

Modifications: No modification was required to comply for this test

Final Result: The EUT **Comply** with the applicable standard.

Data from 3.2 RF Peak Power Output

Maximum Output Power is 10.78dBm + 1.24dB =12.02 dBm= 15.92mW

A) KDB 447498

Table 11: FCC RF Exposure

Carrier Frequency (GHz)	Peak Conducted Output Power (mW)	Conducted Output Power Exposure (75% duty cycle factor) (mW)	Minimum radiation Separation distance (mm)	Separation distance per KDB 4.1 (f) (mm)	Exclusion Threshold Calculation per KDB 4.3.1 (a)	Limit 10-g SAR	FCC SAR Exempt
2.4209	15.92	11.94	7.96	5	3.715	7.5	Complies

(1) 4.3.1 (a) When the minimum test separation distance is < 5 mm, a distance of 5 mm according to 4.1 (f) is applied to determine SAR test exclusion.

$$SAR = \frac{11.94}{5}.SQR\ (2.4209) = 3.715$$

B) RSS-102 Section: 2.5.1

Table 12: ISED RF Exposure

Carrier Freq (GHz)	Peak Conducted Output Power (mW)	Peak Conducted Output Power (dBm)	Antenna Gain (dBi)	Equivalent isotopically power (e.i.r.p) (dBm)	Equivalent isotopically power (e.i.r.p) (mW)	Conducted Output Power Exposure (75% duty cycle factor) (mW)	Minimum Separation distance (mm)	Exclusion Thresholds Per table 1 for given freq (mW)	Controlled Used devices (1)	ISED SAR Exempt
2.4209	15.92	12.02	2.6	14.62	**28.97**	21.7	7.96	6.0	30.0	Complies

1) For controlled use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in Table 1 (ISED RS 102) are multiplied by a factor of 5 (6.0 x 5 = 30).

Appendix A: TEST SETUP PHOTOS

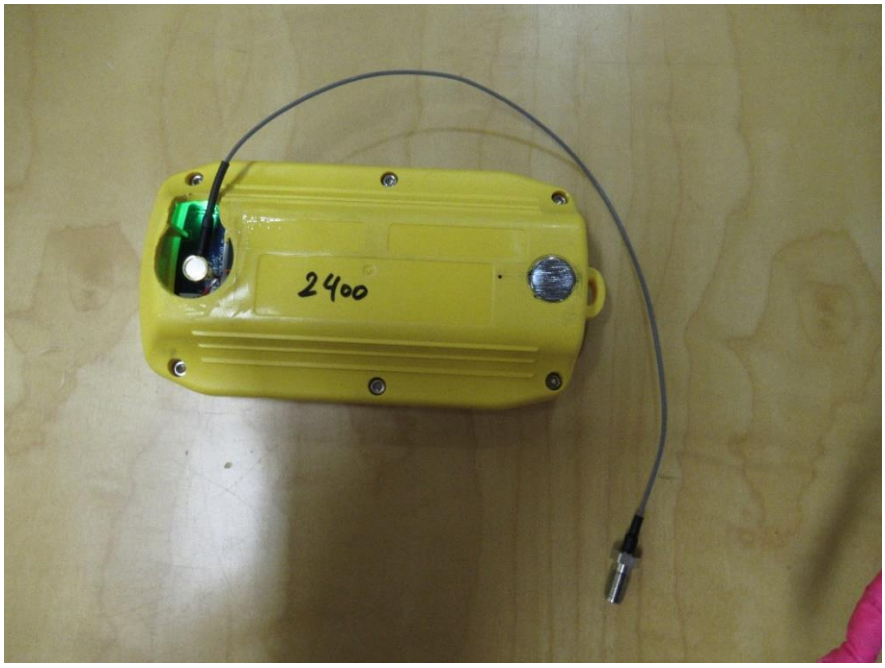


Figure 1: Conducted Radio Testing Set up

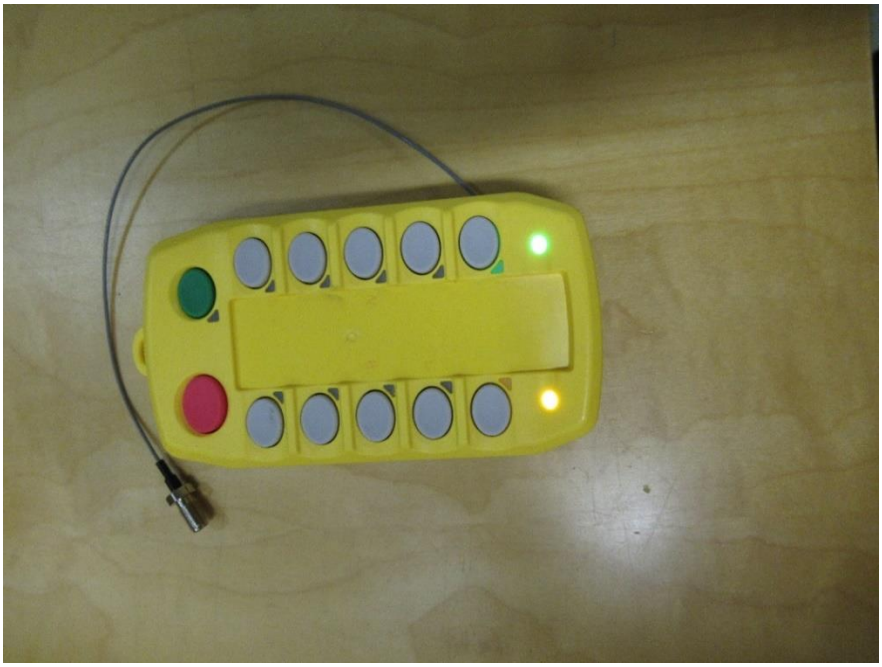


Figure 2: EUT with an attached connector

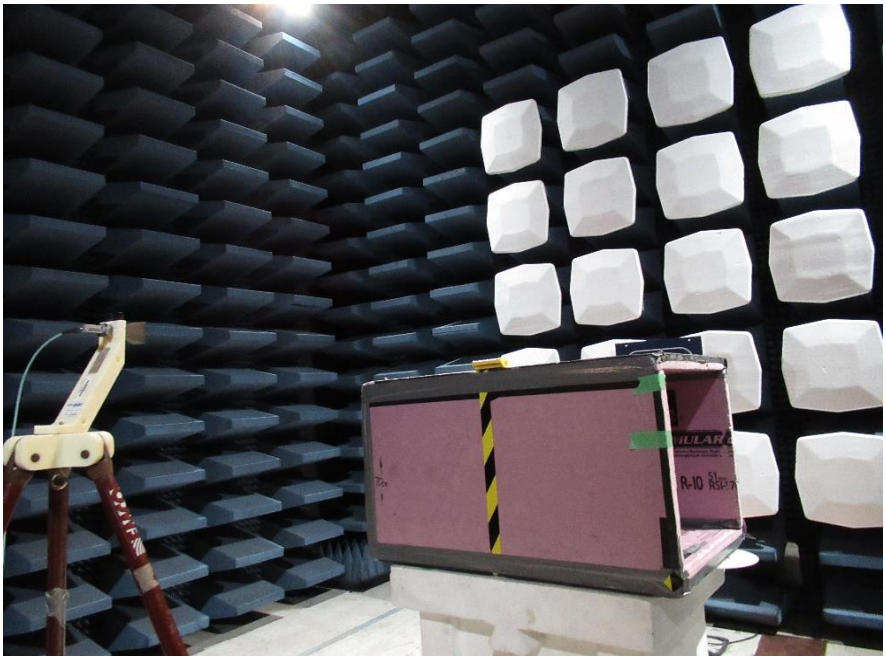


Figure 3: Radiated Emissions performed at the 1m, above 18 -25 GHz

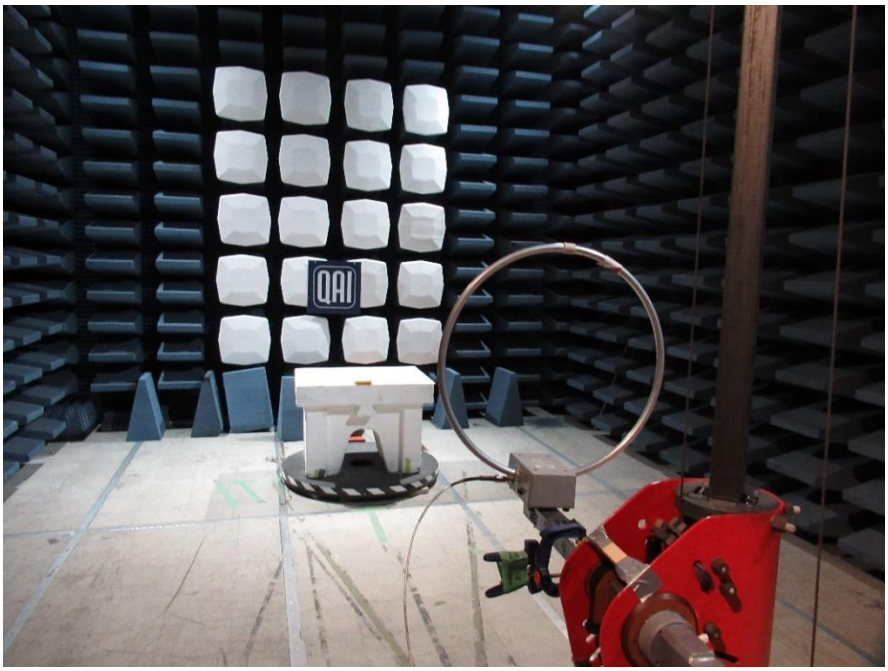


Figure 4: Radiated Emissions performed at the 3m SAC, 150kHz – 30MHz

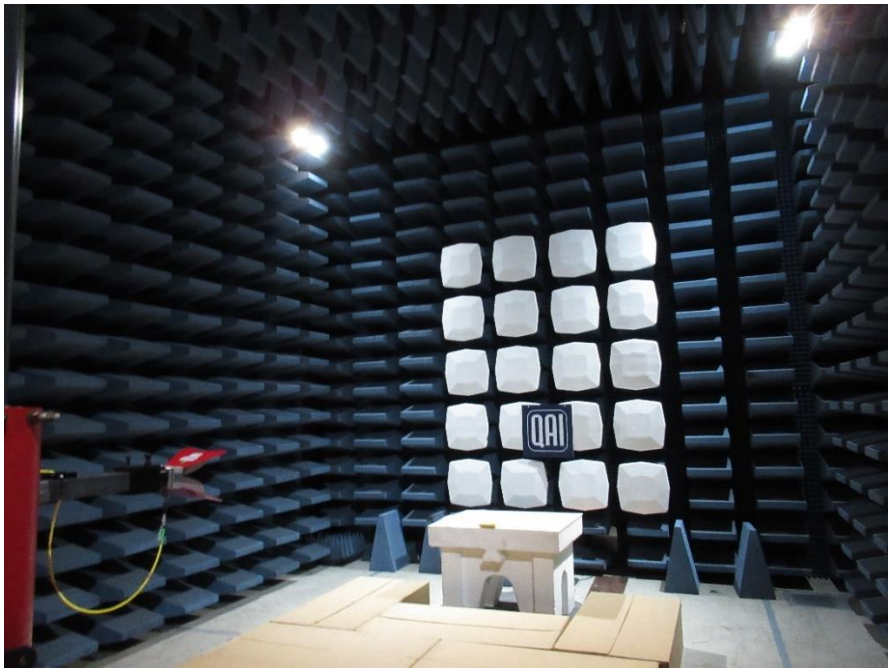


Figure 5: Radiated Emissions performed at the 3m, 1 -18 GHz

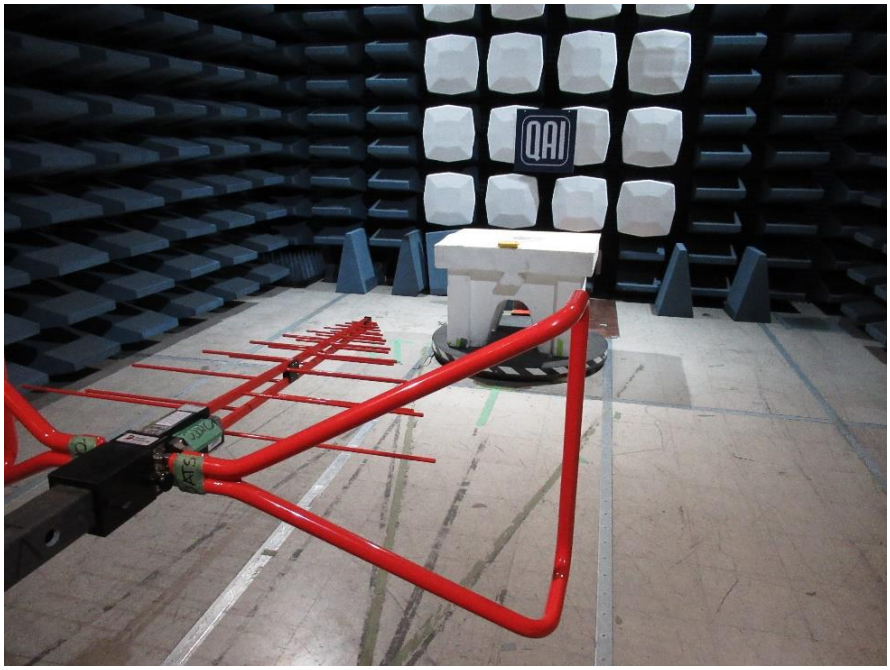


Figure 6: Radiated Emissions performed at the 3m SAC, 30MHz – 1GHz

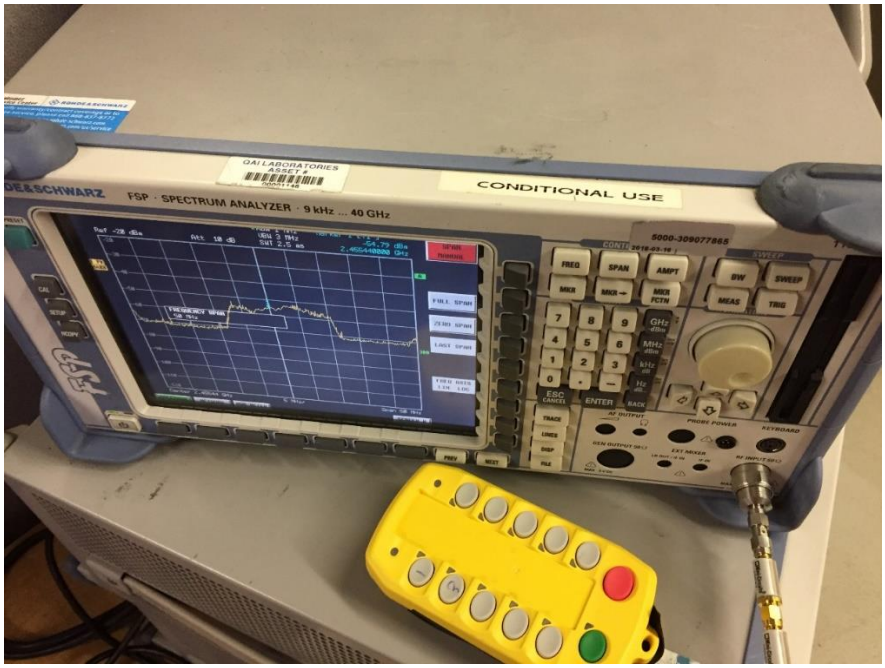


Figure 7: Radio Testing Set up

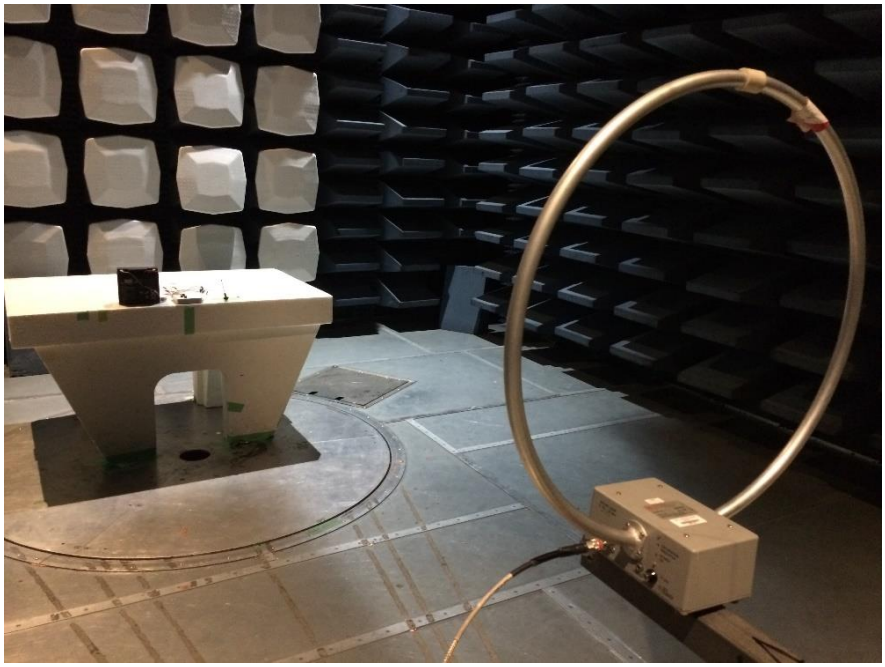


Figure 8: Radiated Emissions Below 30MHz.

Figure 9: Radiated Emissions 30MHz. – 1GHz.

Figure 10: Radiated Emissions above 1GHz.

Appendix B: ABBREVIATIONS

Abbreviation	Definition
AC	Alternating Current
AM	Amplitude Modulation
CE	European Conformity
CISPR	Comité International Spécial des Perturbations Radioélectriques (International Special Committee on Radio Interference)
DC	Direct Current
EFT	Electrical Fast Transient
EMC	Electro Magnetic Compatibility
EMI	Electro Magnetic Interference
ESD	Electrostatic Discharge
EUT	Equipment Under Test
FCC	Federal Communications Commission
FVIN	Firmware Version Identification Number FVIN
IC	Industry Canada
ICES	Interference Causing Equipment Standard
IEC	International Electrotechnical Commission
LISN	Line Impedance Stabilizing Network
OATS	Open Area Test Site
RF	Radio Frequency
RMS	Root-Mean-Square
SAC	Semi-Anechoic Chamber

END OF REPORT