INTENTIONAL RADIATOR TEST REPORT

(C2PC - Software change for Simplex Protocol with Lower Data Rate)

Report Reference Number:	E10788-2107_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:	**Wireless Remote**
Model Number(s):	TD110-24 GHz

Powering Business Worldwide

REVISION HISTORY

Date	Report Number	Details	Author's Initials
July 27, 2021	E10788-2107_Cooper_TD110 2.4 GHz_**Rev-1.0**	Final	RS
July 20, 2021	E10788-2107_Cooper_TD110 2.4 GHz_**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All previous versions of this report have been superseded by the latest dated revision as listed in the above table.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.			

Note: This report is an update to 'E10788-2102_Cooper_ TD110 2.4 GHz_**Rev-0.5**" as per Quotation 21SH01191R1.

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 21SH01191R1 & 21SH03311R2.

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

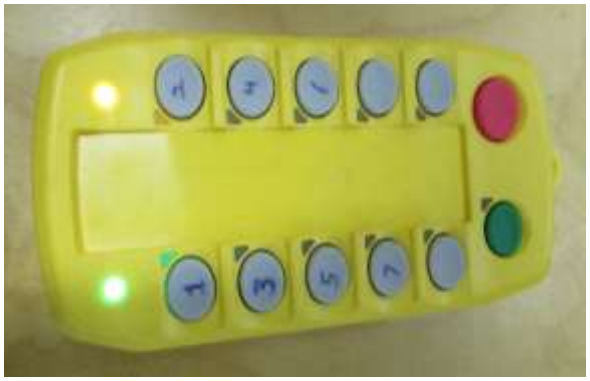
EMC Facility Burnaby BC, Canada

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.



EUT Front

EUT Back (connector attached)

Equipment Under Test (EUT)

EUT	TD110 2.4 GHz. & Wireless Remote
FCC ID	IA9TD11024
IC Number	1338B-TD11024
Manufacturer	Cooper Electrical Canada.
Model No.	TD110-24
FVIN	V1.0(47346)
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	24.36kHz
Output power / Transmitter	9.75dBm (conducted) – Non-Adjustable
Modulation type	2-level FSK
Test Channels (L, M, H)	2403.1, 2441.4, 2479.8 MHz
Data Rate	4800 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)

EUT Input Power

Type	Count	Description	Output	Manufacturer	Model #
Cylindrical LiFePO4 Battery	1	1200mAh Lithium Iron Phosphate	1200mAh 3.2V	Howell	14500-2P

1.2 Environmental Conditions

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

Parameter	Conditions
Location	Indoors
Temperature	22ºC
Relative Humidity	48.8 %
Atmospheric Pressure	102 kPa

1.3 Measurement Uncertainty

Parameter	Uncertainty
Radiated Emissions, 10kHz.-1GHz.	± 2.40 dB
Radiated Emissions, 1GHz.-40GHz.	± 2.48 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	2022-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

Note: Equipment listed above have 3 years calibration interval.

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

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 2.2 & 2.3 of this report.

2.2 Scope

The information documented in this report is based on the test methods and levels as per Quote 20SH09111 & 21SH03311R2.

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 and Information for the Certification of Radio Apparatus

ICES-003 Issue 7 – Information Technology Equipment (Including Digital Apparatus).

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
Radiated Emissions Transmitter Mode	RSS-247-Issue 2 RSS-Gen Issue 5 FCC Subpart C §15.205, §15.209 & §15.247	Comply
Radiated Emissions Unintentional Radiator Mode	ICES-003 Issue 7, F CC Title 47 CFR Part 15: Subpart B - §15.109	Comply
RF Peak Power Output	FCC Title 47 CFR Part 15: Subpart C - §15.247 (b)(1) RSS-247 Issue 2	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 of Occupancy	FCC Title 47 CFR Part 15: Subpart C - §15.247 (a)(1)(iii) RSS-247-Issue 2	Comply
RF Exposure Evaluation	ICES-003 Issue 7, F CC Title 47 CFR Part 15: Subpart B - §15.109	Comply
Frequency Stability	ICES-003 Issue 7, F CC Title 47 CFR Part 15: Subpart B - §15.109	Comply

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: June 21, 2021

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

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."

Test Method: ANSI C63.10:2013

Modifications: No modification was required to comply for this test

Final Result: This radio meets the requirements of FCC CFR 47 Part 15.203 & RSS-Gen Issue 5 as a professionally installed device.

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 Radiated Emissions Transmitter Mode

Date Performed: June 17, 28, 29, 2021

Test Standard: FCC CFR 47 Part 15.247
FCC CFR 47 Part 15.209
FCC CFR 47 Part 15.205
RSS-247 Issue 2
RSS-Gen Issue 5

Test Method: ANSI C63.10:2013

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:

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
1.705-30.0	30	70.0
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

FCC PART 15.205-RESTRICTED BANDS OF OPERATION

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

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)).

2) Restricted bands of operation 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 table 2 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	--	

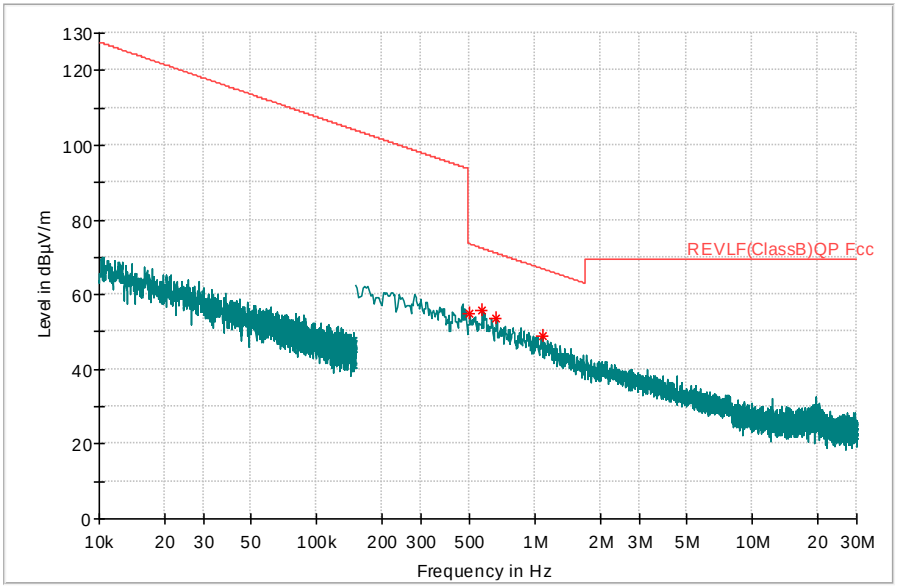
Test Setup: The EUT was tested in our 3 m SAC and was positioned on the center of the turntable. The transmitter was set for continuous transmission. The operating frequency of the device was measured for all radiated emissions 10 kHz. to 4 GHz up to the 10th harmonic of the highest fundamental frequency. 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 Method: ANSI C63.10:2013

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

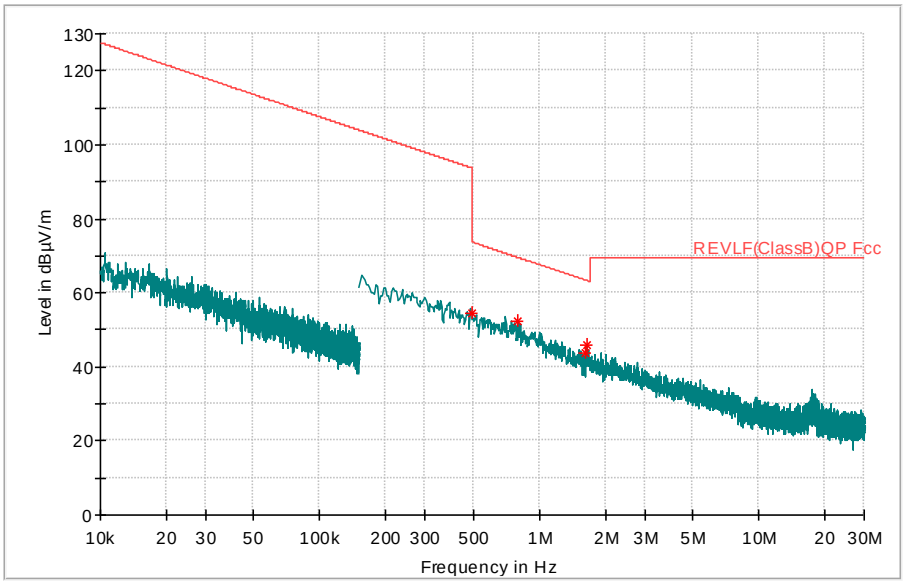
Final Result: The EUT **complies** with the applicable standard.

Measurement Data and Plot:



Plot 1: Radiated Spurious Emissions, 10 kHz.– 30MHz, FSK, Polarization: perpendicular, Horizontal

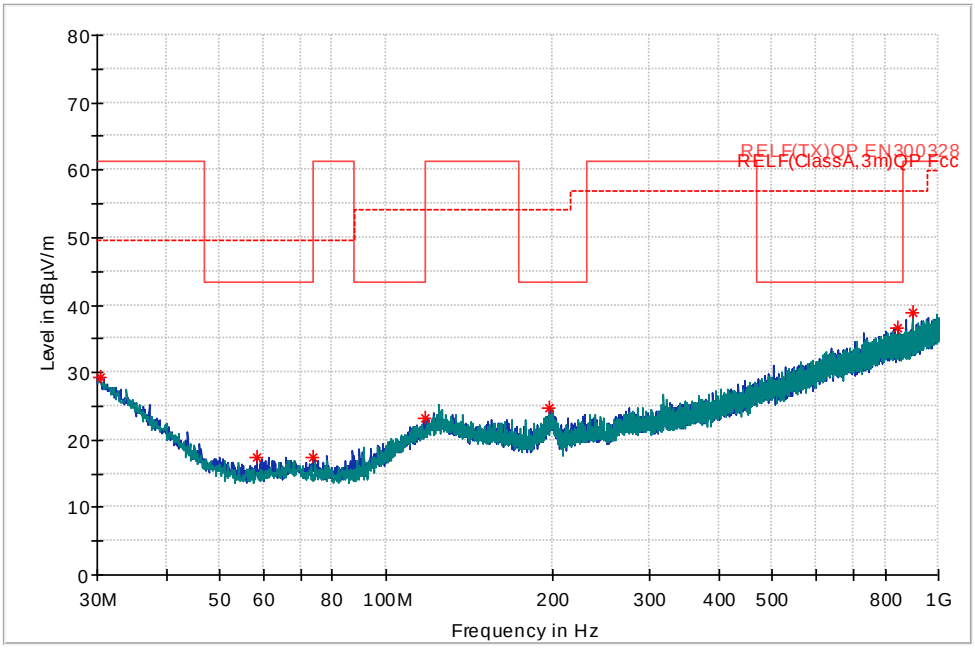
Note: No emission of significance were observed



Plot 2: Radiated Spurious Emissions, 10 kHz.– 30MHz, FSK, Polarization: perpendicular, Vertical

Table 1: Radiated Spurious Emissions, 10 kHz.– 30MHz, FSK, Polarization

Frequency (MHz)	Max Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1.642500	45.85	63.32	17.47	150.0	V	31.0	20.7
0.490290	54.64	73.80	19.16	150.0	V	64.0	20.6
0.794760	52.38	69.61	17.24	150.0	V	158.0	20.4
1.609665	43.70	63.50	19.80	150.0	V	283.0	20.7
0.502230	54.74	73.59	18.85	150.0	H	0.0	20.6
0.573870	55.70	72.43	16.73	150.0	H	31.0	20.6
0.663420	53.55	71.18	17.63	150.0	H	188.0	20.6
1.093260	48.99	66.85	17.86	150.0	H	188.0	20.9

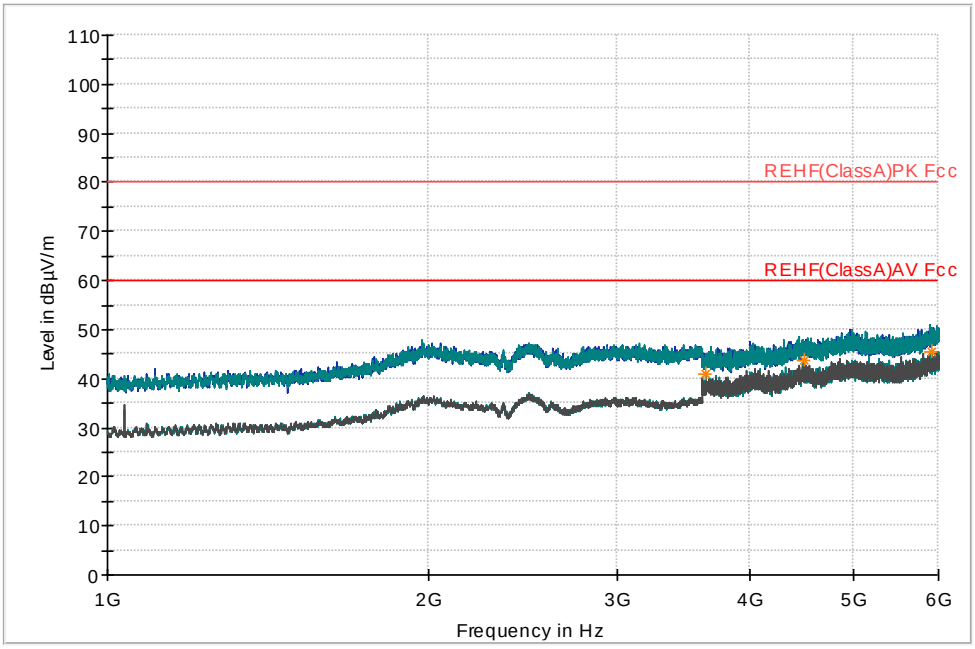


Plot 3: Radiated Spurious Emissions 30 - 1000MHz

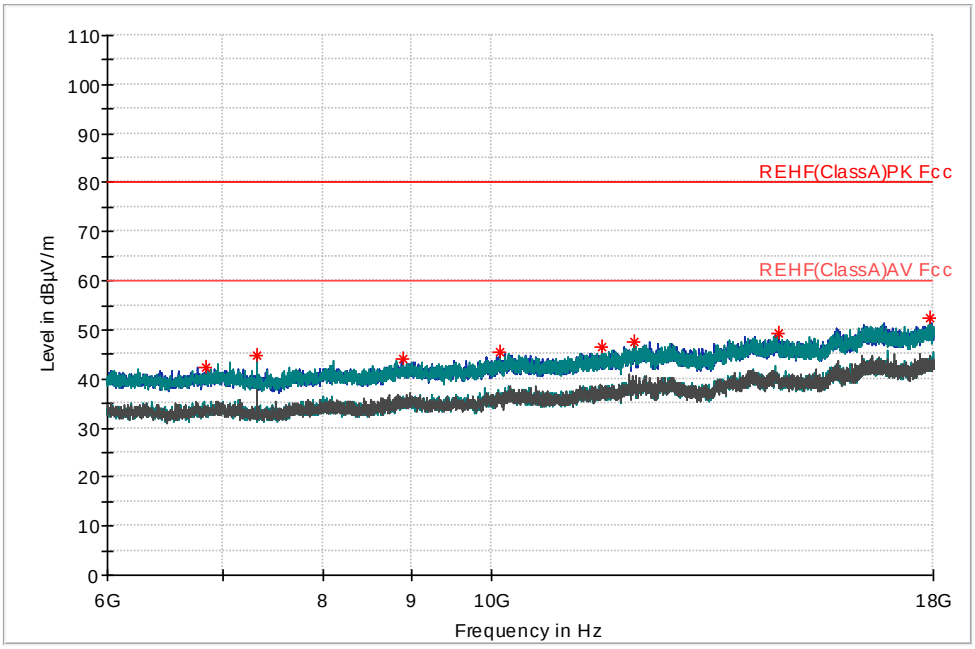
Note: No emission of significance were observed

Table 2: Radiated Spurious Emissions, 10 kHz – 1GHz

Frequency (MHz)	Max Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
896.1130	38.98	61.40	22.42	100.0	H	236	31.0
73.7470	17.52	43.40	25.88	150.0	H	170	13.6
58.4210	17.42	43.40	25.98	200.0	H	95	12.6
842.3750	36.51	43.40	6.89	200.0	H	330	30.5
198.1010	24.68	43.40	18.72	250.0	H	98	19.4
117.7850	23.18	43.40	20.22	250.0	H	256	19.4
30.3880	29.28	61.40	32.12	150.0	V	74	26.5



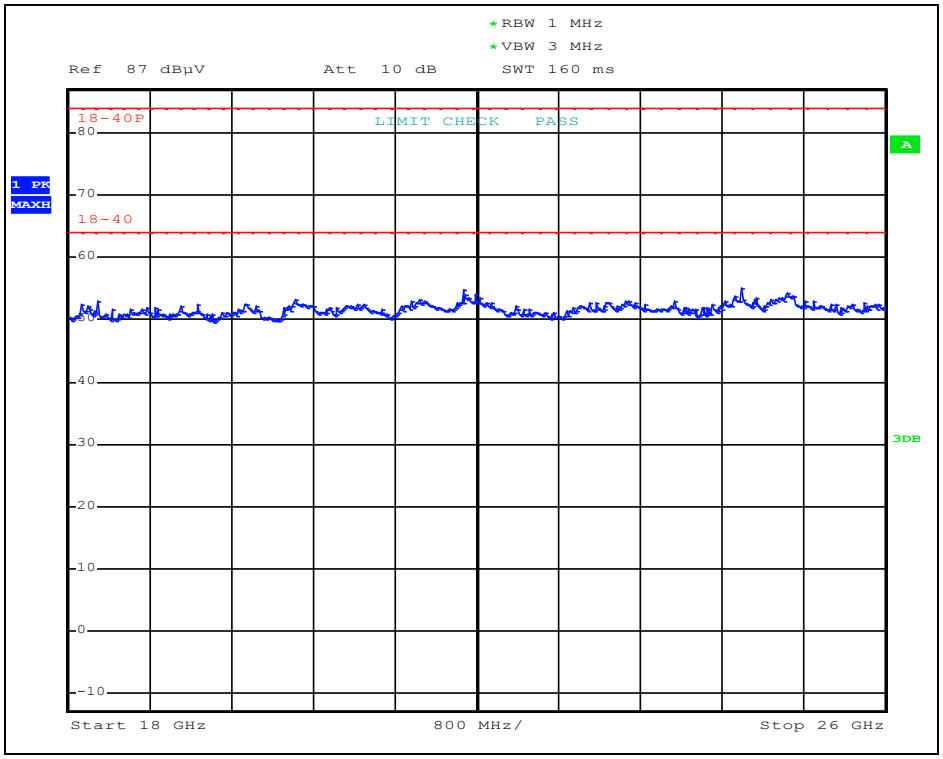
Plot 4: Unintentional Radiated Emissions: 1GHz-6GHz



Plot 5: Unintentional Radiated Emissions: 6GHz-18GHz

Table 3: Radiated Spurious Emissions, 1GHz – 18GHz

Frequency (MHz)	Max. Peak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3638.0000	---	41.07	60.0	18.93	100.0	H	30	1.3
4490.5000	---	43.81	60.0	16.19	200.0	V	281	3.6
5920.0000	---	45.47	60.0	14.53	250.0	V	315	5.6
6835.2000	42.39	---	60.0	17.61	200.0	H	84	-7.1
7323.6000	44.82	---	60.0	15.18	100.0	V	0	-6.0
8895.6000	44.03	---	60.0	15.97	100.0	H	0	-2.5
10122.0000	45.38	---	60.0	14.62	250.0	H	245	1.4
11590.8000	46.48	---	60.0	13.52	100.0	V	55	3.0
12086.4000	47.70	---	60.0	12.30	200.0	V	30	5.2
14637.6000	49.41	---	60.0	10.59	250.0	H	271	6.8
17923.2000	52.31	---	60.0	7.69	200.0	H	58	12.9



Plot 6: Radiated Spurious Emissions, 18G – 26G Hz, FSK- 1m distance limit line is used

Note: No emissions of significance were observed from 18 to 26GHz

3.3 Radiated Emissions Unintentional Radiator Mode

Date Performed: June 22, 25, 2021

Test Standard: CFR Title 47 Subpart B Part 15.109
ICES-003 Issue 7

Test Method: ANSI C63.4-2014

Test Requirement: Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least below the level of the fundamental or to the general field strength limits listed in Rss-Gen Issue 4, whichever is less stringent.

In measuring unwanted emissions, the spectrum shall be investigated from 30 MHz or the lowest radio frequency signal generated in the equipment, whichever is lower, without going below 9 kHz up to at least the frequency if the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

Unwanted emissions falling into restricted bands of shall comply with the limits specified below

Frequency (MHz)	Field Strength	
	uV/m @ 3-m	Calculated dBµV/m at 3m
30 – 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
960 - 1000	500	54.0

Test Setup: 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.

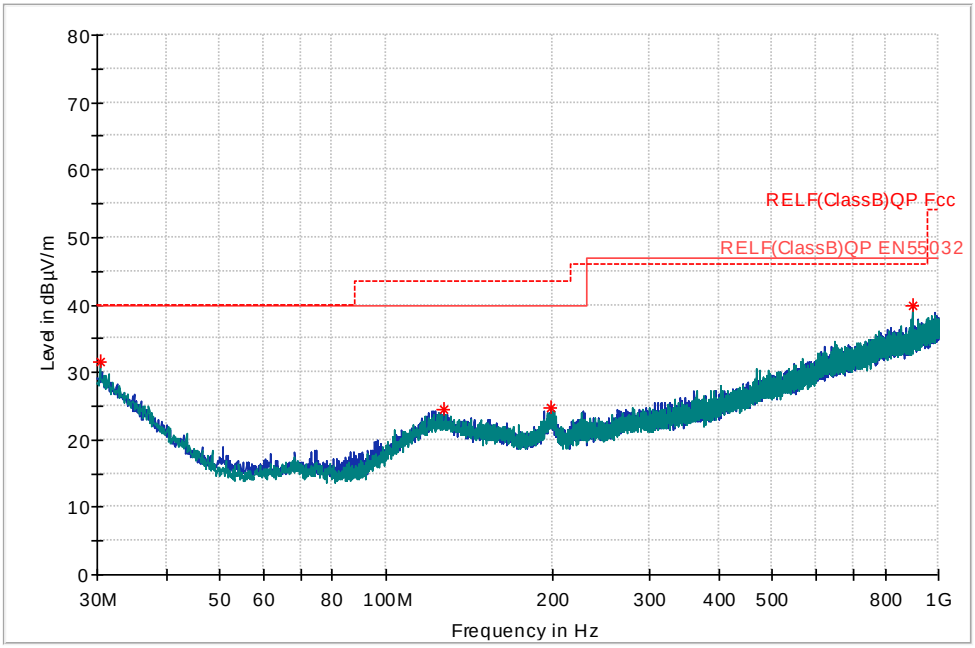
Measurement Method: Emissions in both horizontal and vertical polarizations were measured while rotating the Equipment Under Test (EUT) on the turntable to maximize signal strength. In the case of high ambient noises, the measurements are performed at a closer distance and the limit is adjusted per the 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

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

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

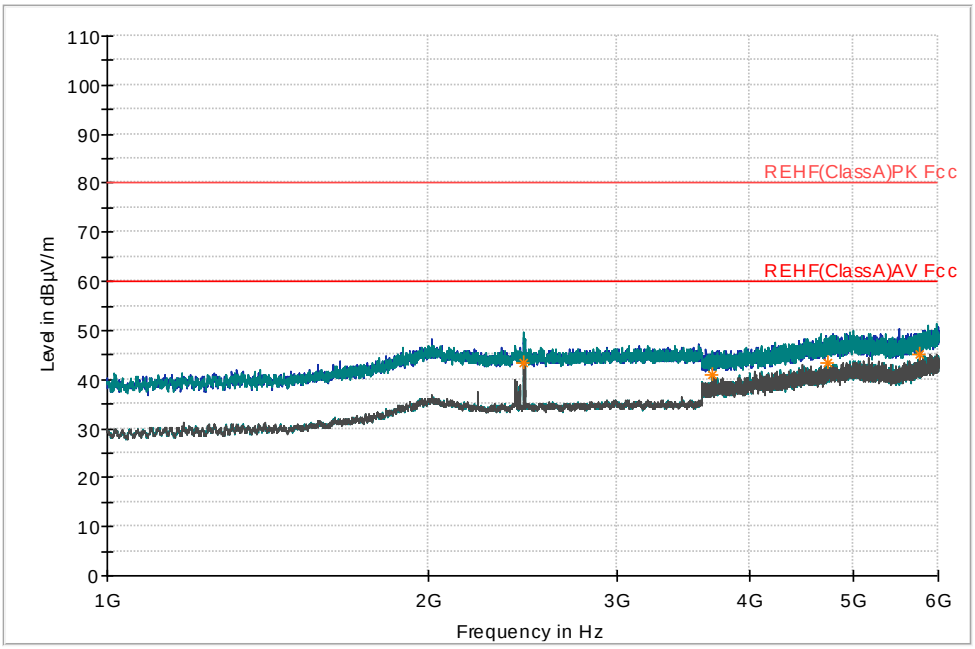
Measurement Data and Plot:



Plot 7: Unintentional Radiated Emissions: 30-1000MHz

Table 4: 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)
30.3880	31.44	40.00	8.56	250.0	V	228	26.5
127.0000	24.47	40.00	15.53	100.0	H	15	19.9
198.5860	24.78	40.00	15.22	150.0	V	0	19.5
896.0160	39.81	47.00	7.19	250.0	H	326	31.0



Plot 8: 1GHz – 18GHz Unintentional Radiated Emissions scanned at 3m SAC, Class A limit

Note: No emission of significance were observed
2.4 Band Reject filter is used

Table 5: 1GHz – 18GHz Unintentional Radiated Emissions scanned at 3m SAC, Class A limit

Frequency (MHz)	Max. Peak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2457.5000	---	43.41	60.00	16.59	150.0	V	166	-0.6
3688.5000	---	40.98	60.00	19.02	200.0	H	182	1.5
4720.5000	---	43.20	60.00	16.80	250.0	V	310	4.0
5770.0000	---	45.15	60.00	14.85	200.0	V	69	5.4

3.4 RF Peak Power Output

Date Performed: June 21, 25, 2021

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

Test Setup: The EUT was tested outside the SAC by output conducted emissions method.

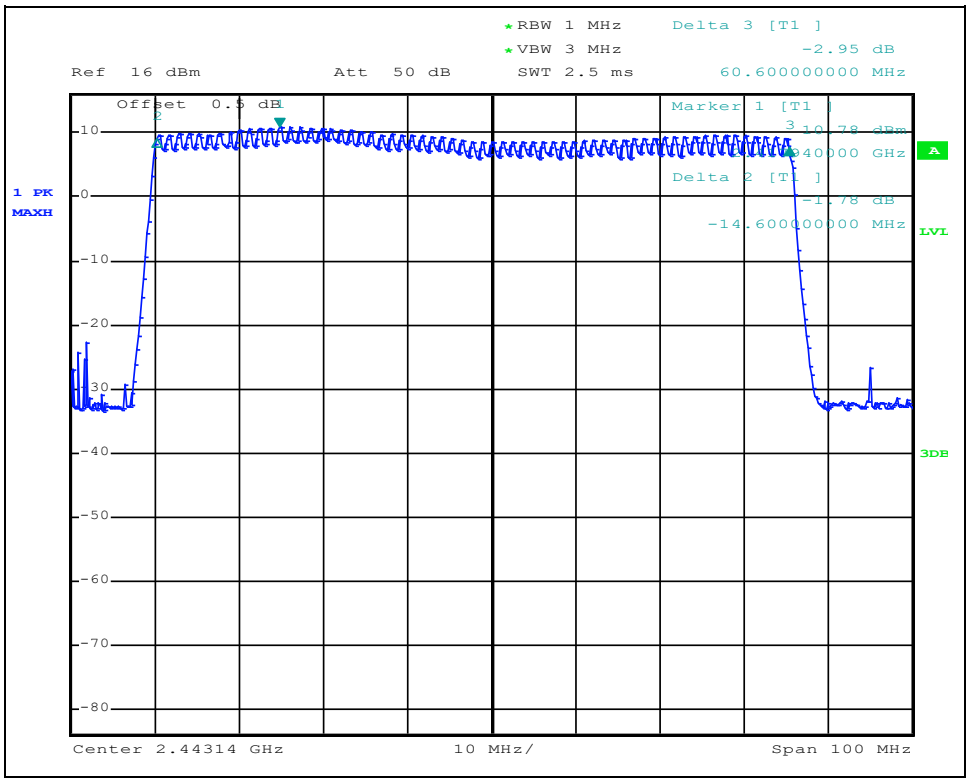
Modification: No modification was required to Comply for this test.

Result: The EUT Comply with the applicable standard.

Measurement Data and Plot:

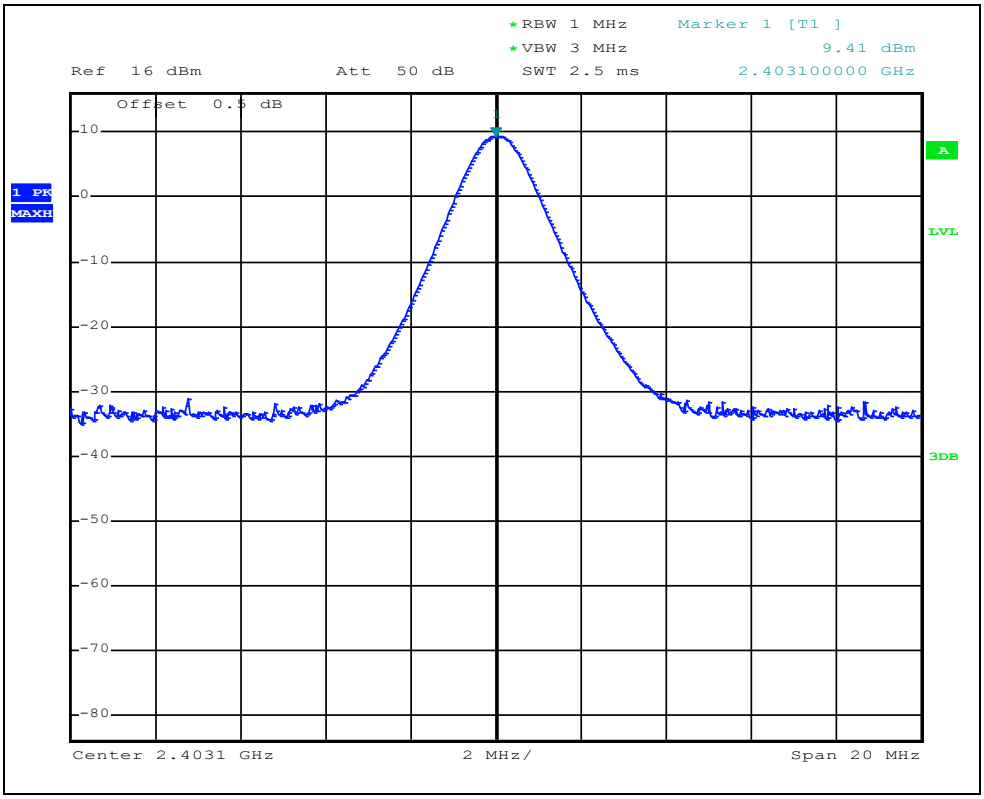
Table 6: Data of RF Peak Power Output

Modulations	Carrier Frequency MHz.	Peak dBm (1)	Antenna Gain dB	EIRP dBm (1)	Limit dBm	Margin dB	Results
FSK	2403.1	9.41	0	9.75	30	20.25	Comply
	2441.4	8.37	0	8.88	30	21.12	Comply
	2479.8	8.77	0	9.43	30	20.57	Comply
	Max @ 2417.9	10.70	0	10.78	30	9.22	Comply

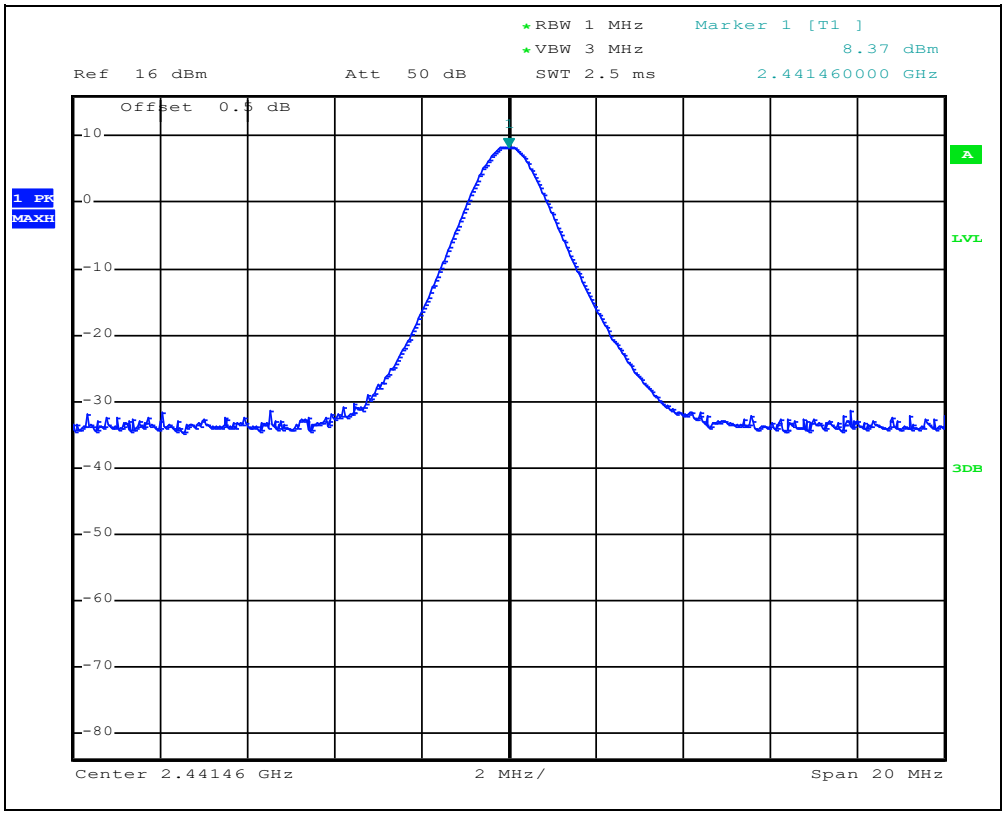


Plot 9: Spectrum of Frequency Hopping Transmitter measured on Peak Hold

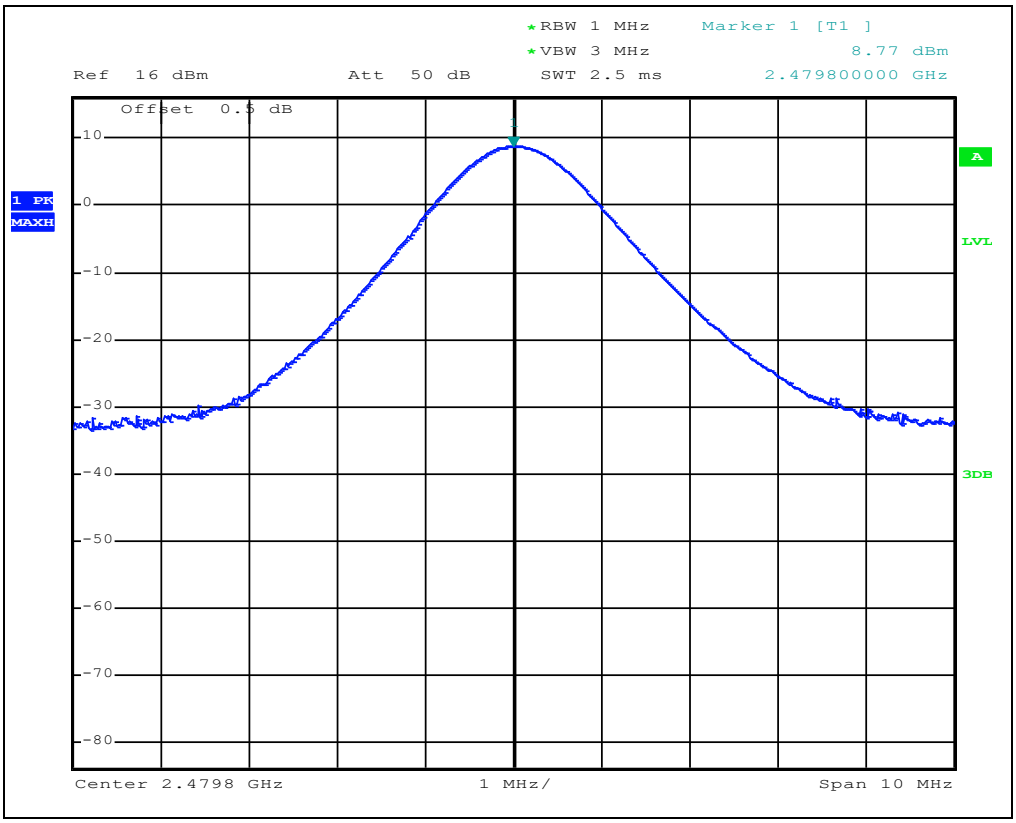
Note: As can be seen from Plot 9 the maximum output power is transmitted at 2.4179 GHz with amplitude of 10.70 dBm. The transmitter transmits only 18.60ms in any 100ms interval.



Plot 10: Max. Peak Conducted RF Power Output at Low Channel



Plot 11: Max. Peak Conducted RF Power Output at Mid Channel



Plot 12: Max. Peak Conducted RF Power Output at High Channel

3.5 20dB Occupied Bandwidth

Date Performed: June 22, 2021

Test Standard: RSS-Gen Issue 5

Test Method: ANSI C63.10-2013

Test Requirement:

The emission bandwidth (20dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated 20dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3× the resolution bandwidth.

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.

Measurement Method: As called in ANSI C63.10-2013.

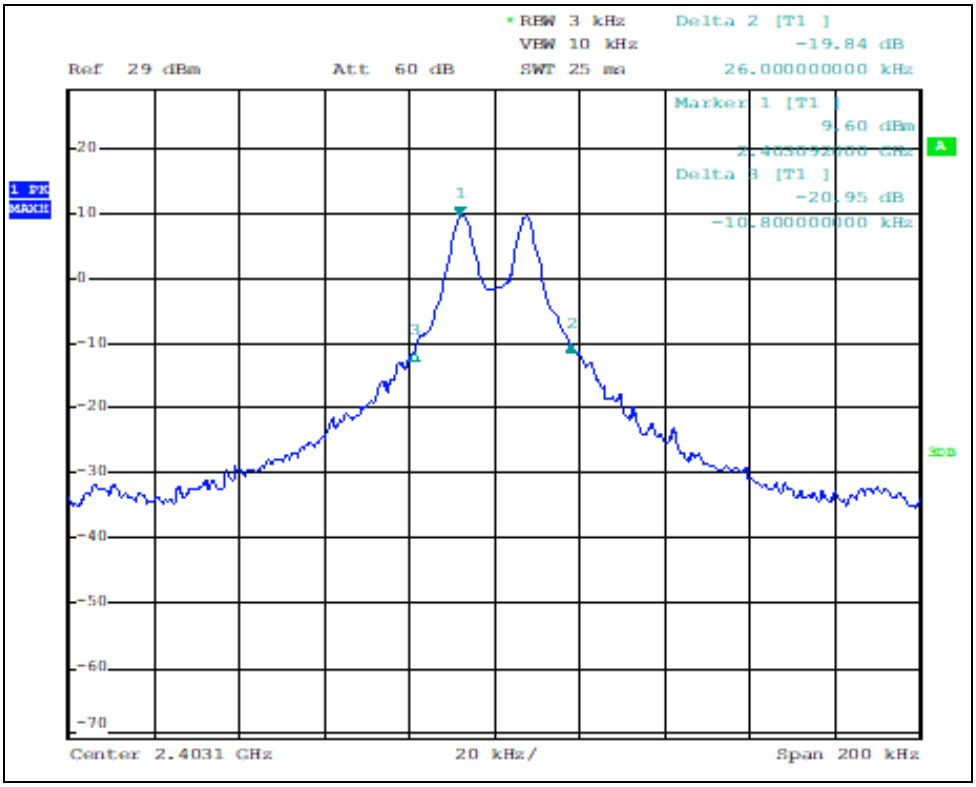
Modifications: No modification was required to comply for this test.

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

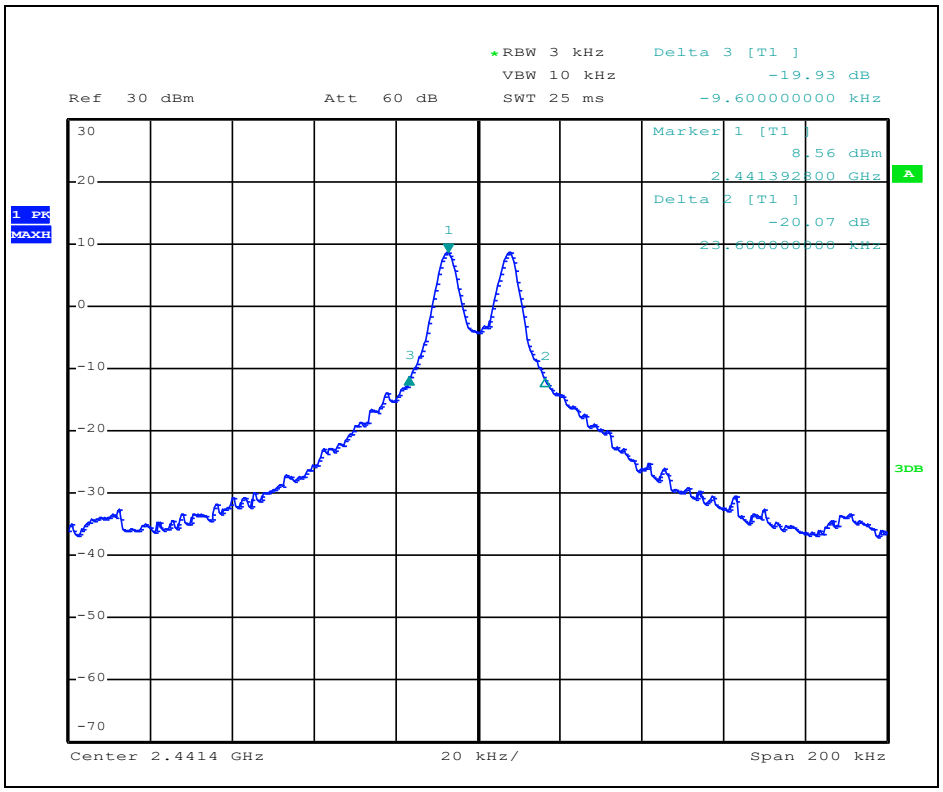
Measurement Data and Plot:

Table 7: Data 20dB Occupied Bandwidth

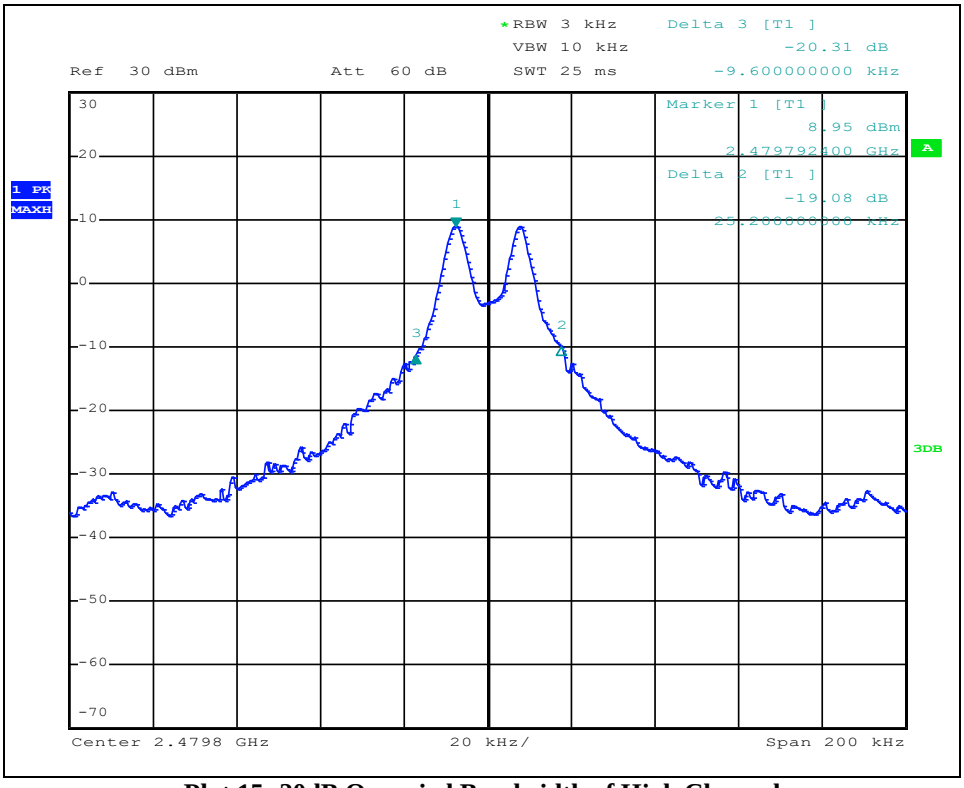
Channel	Frequency (MHz)	20dB Bandwidth (kHz)
Low	2403.1	36.8
Middle	2441.4	33.2
High	2479.8	34.8



Plot 13: 20dB Occupied Bandwidth of Low Channel



Plot 14: 20dB Occupied Bandwidth of Mid Channel



Plot 15: 20dB Occupied Bandwidth of High Channel

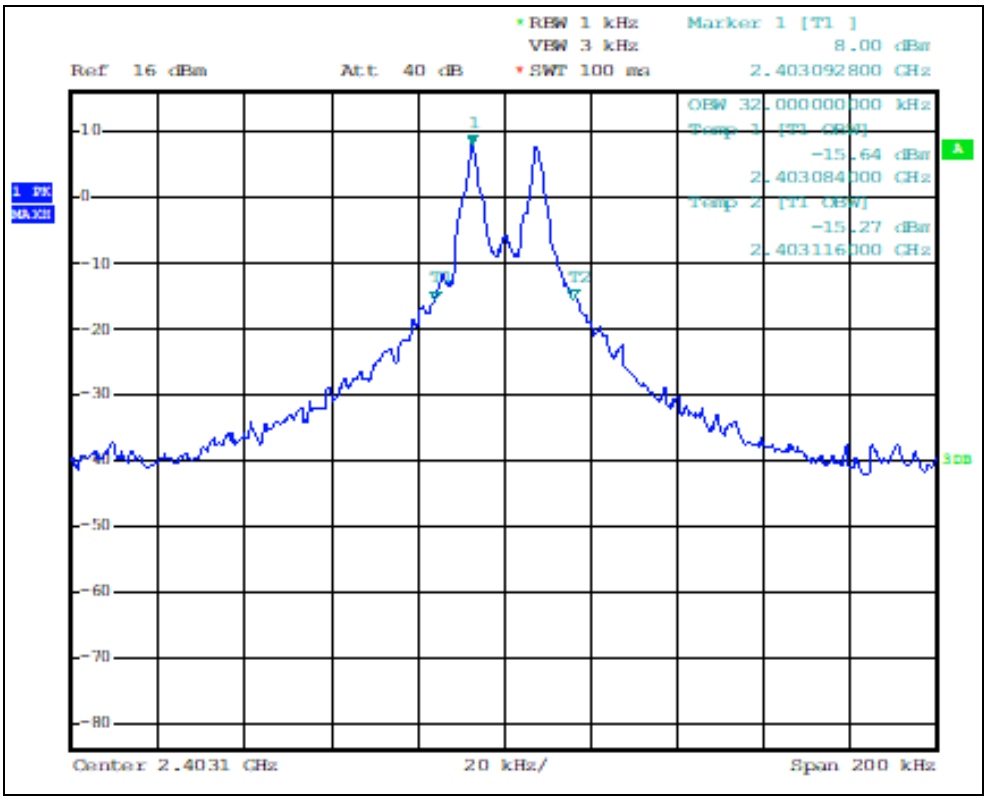
3.6 99% Occupied Bandwidth

Date Performed:	June 23, 2021
Test Standard:	RSS-Gen Issue 5 RSS-247 Issue 2
Test Method:	ANSI C63.10-2013
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 Method:	As called in ANSI C63.10-2013.
Modifications:	No modification was required to comply for this test.
Final Result:	The EUT **complies** with the applicable standard.

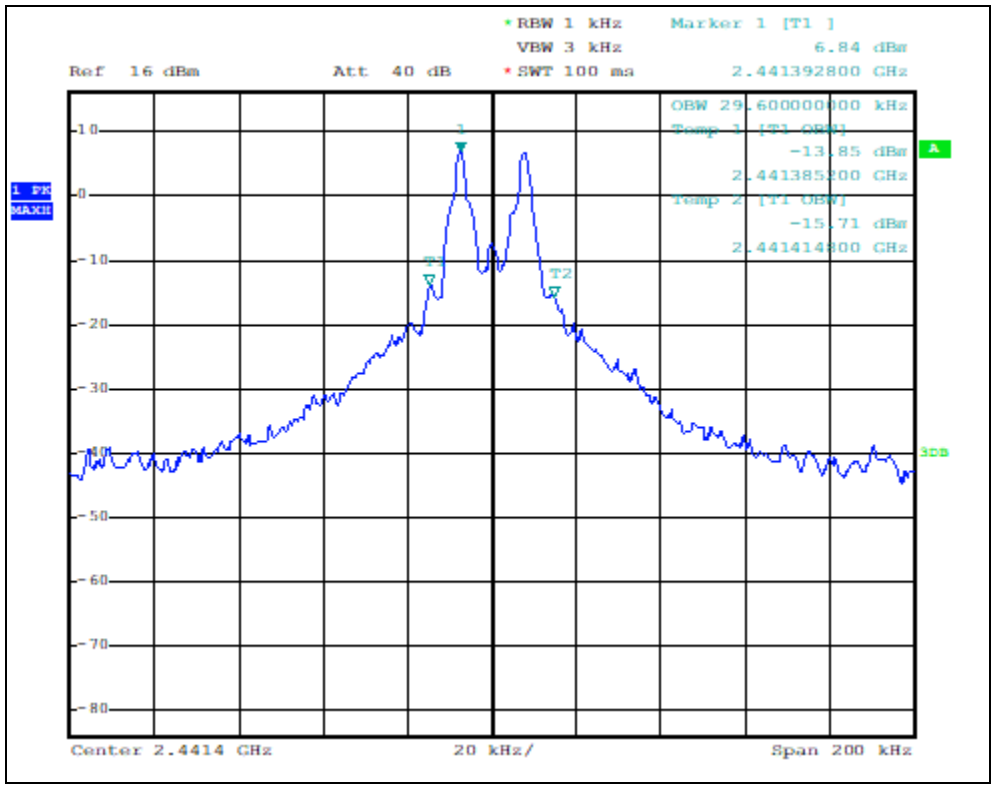
Measurement Data and Plot:

Table 8: Data 99% Occupied Bandwidth

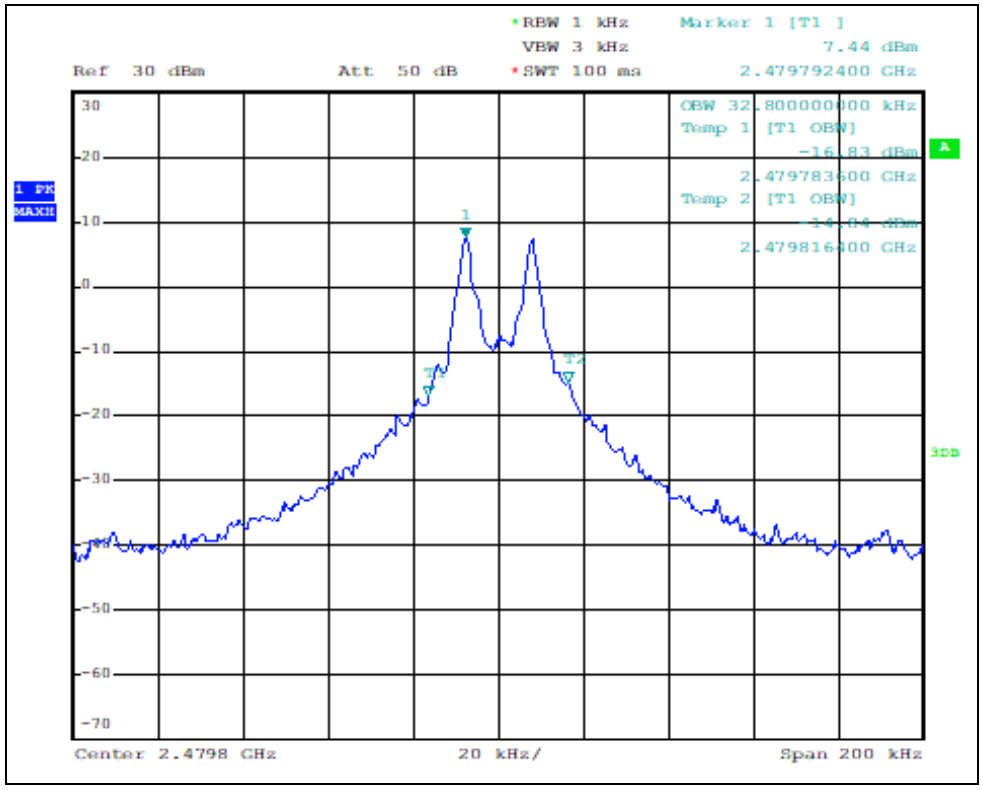
Channel	Frequency (MHz)	99% Bandwidth (kHz)
Low	2403.1	32.0
Middle	2441.4	29.6
High	2479.8	32.8



Plot 16: 99% Occupied Bandwidth of Low Channel



Plot 17: 99% Occupied Bandwidth of Mid Channel



Plot 18: 99% Occupied Bandwidth of High Channel

3.7 Out-of-Band Emissions (Band Edge)

Date Performed: June 23, July 6, 2021

Test Standard: RSS-247-Issue 2
FCC Title 47 CFR Part 15: Subpart C - §15.247 (d)

Test Method: ANSI C63.10-2013

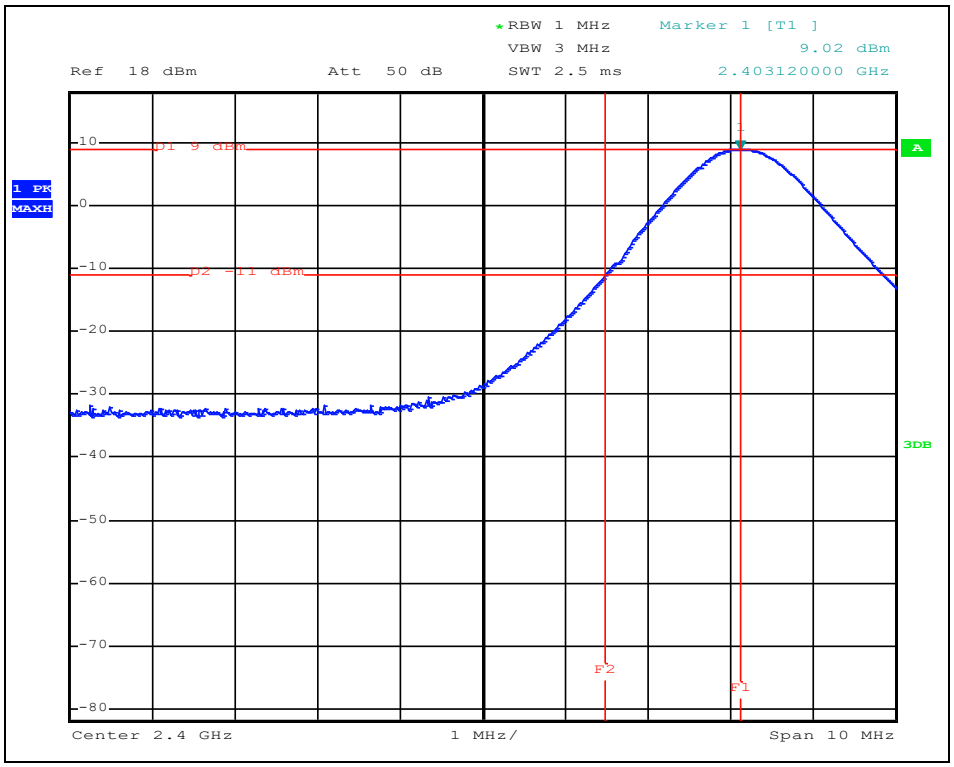
Test Requirement: In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, shall be at least 20 dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted 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 Method: ANSI C63.10-2013

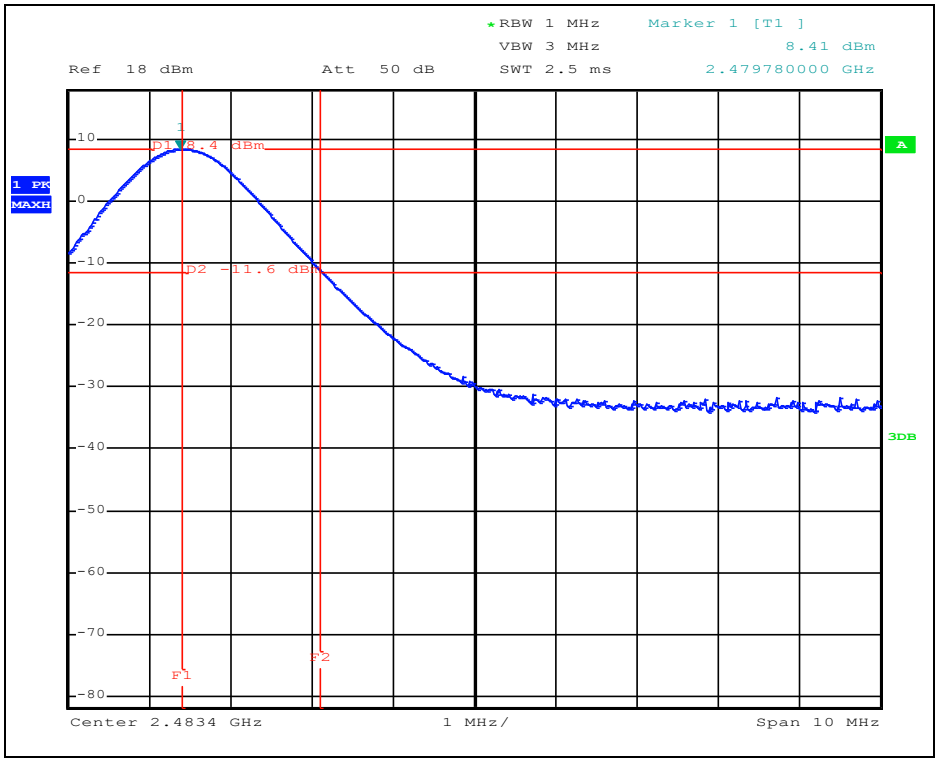
Modifications: No modification was required to comply for this test.

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

Measurement Data and Plot:



Plot 19: Band edge, Low Channel FSK (Hopping Mode)



Plot 20: Band edge, High channel FSK (Hopping Mode)

3.8 Channel Separation

Date Performed: June 23, 2021

Test Standard: FCC Title 47 CFR Part 15: Subpart C - §15.247 (a)(1)
RSS-247-Issue 2

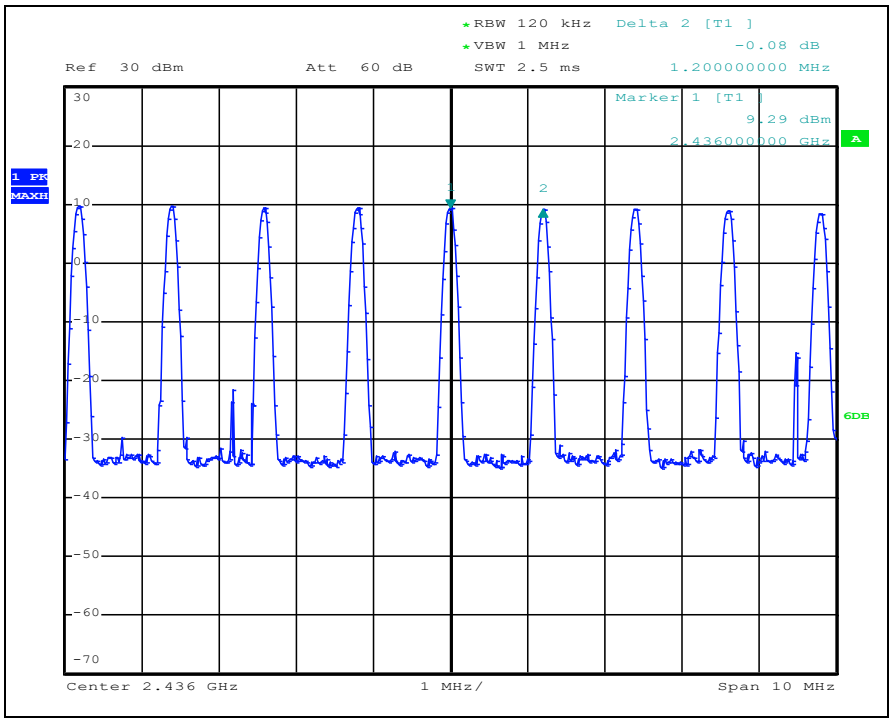
Test Method: ANSI C63.10:2013

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 21: Channel Separation

Table 9: Channel Separation

Modulation	Channel Separation kHz	20 dB Bandwidth kHz (Min Limit or 25 kHz whichever is greater)	Results
FSK	1200	112	Complies

3.9 Number of Hopping Channels

Date Performed: June 23, 2021

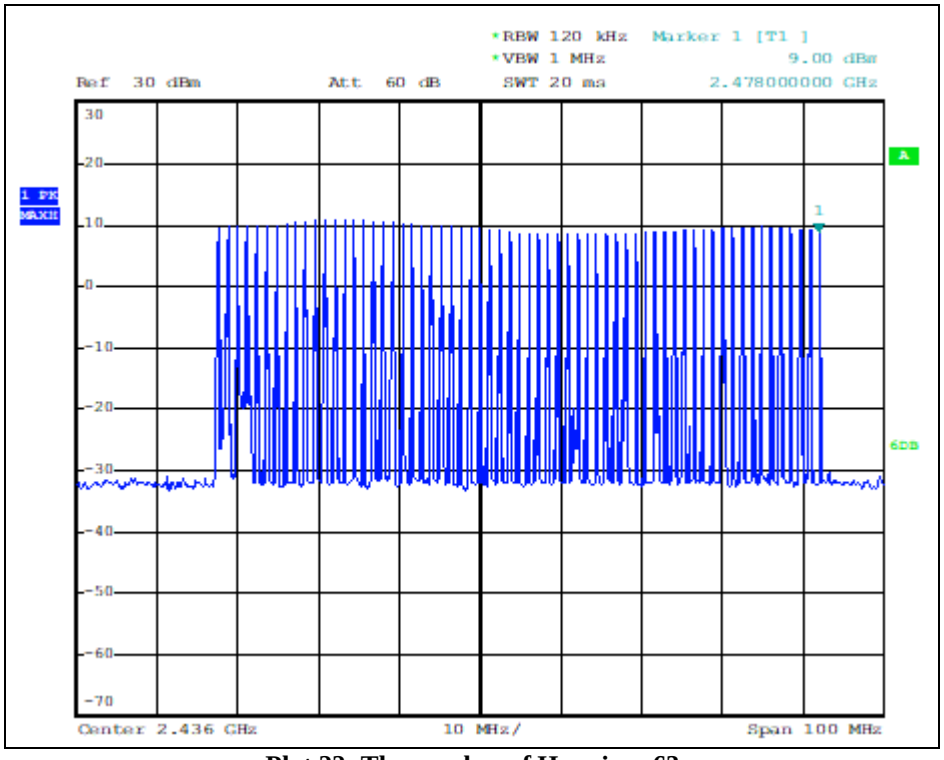
Test Standard: FCC Title 47 CFR Part 15: Subpart C - §15.247
RSS-247-Issue 2

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 22: The number of Hopping: 63

3.10 Dwell Time & Time of Occupancy

Date Performed: June 21, 2021

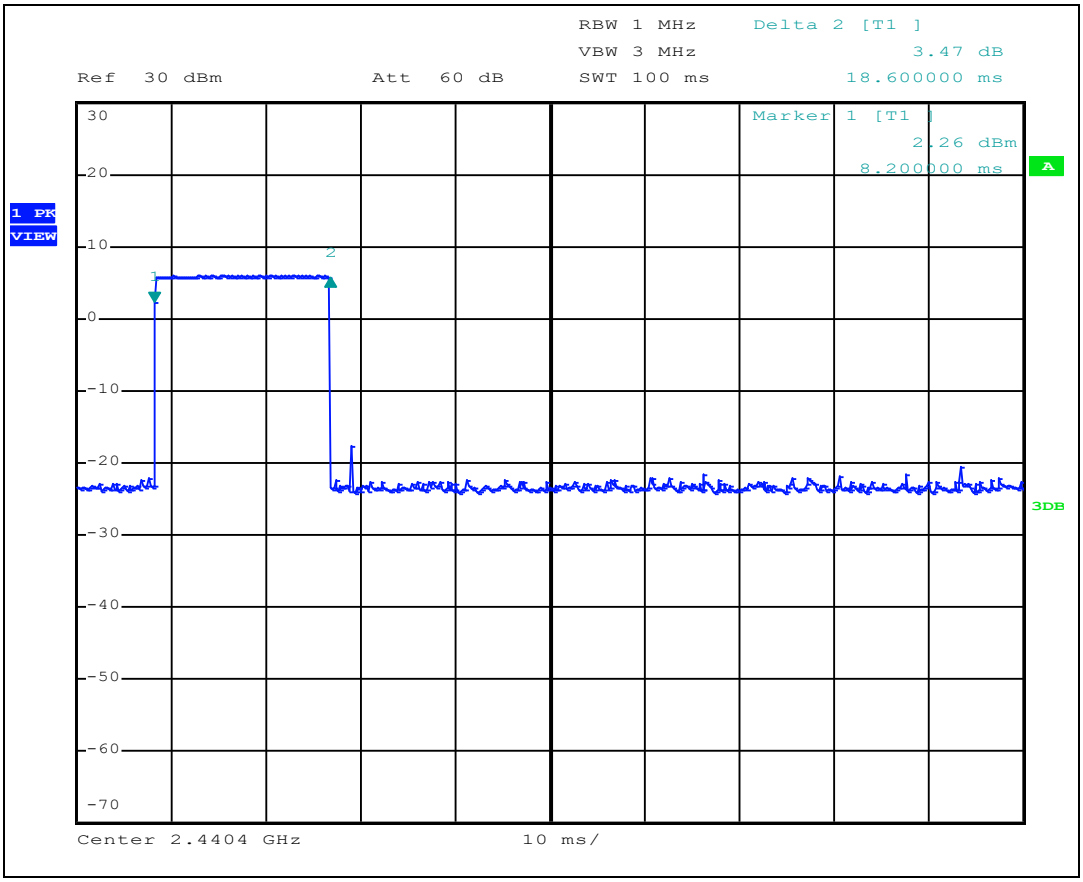
Test Requirement: Frequency hopping systems in the 2400–2483.5 MHz band use 15 channels, the average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels (15) employed (<6ms).

Test Method: ANSI C63.10:2013

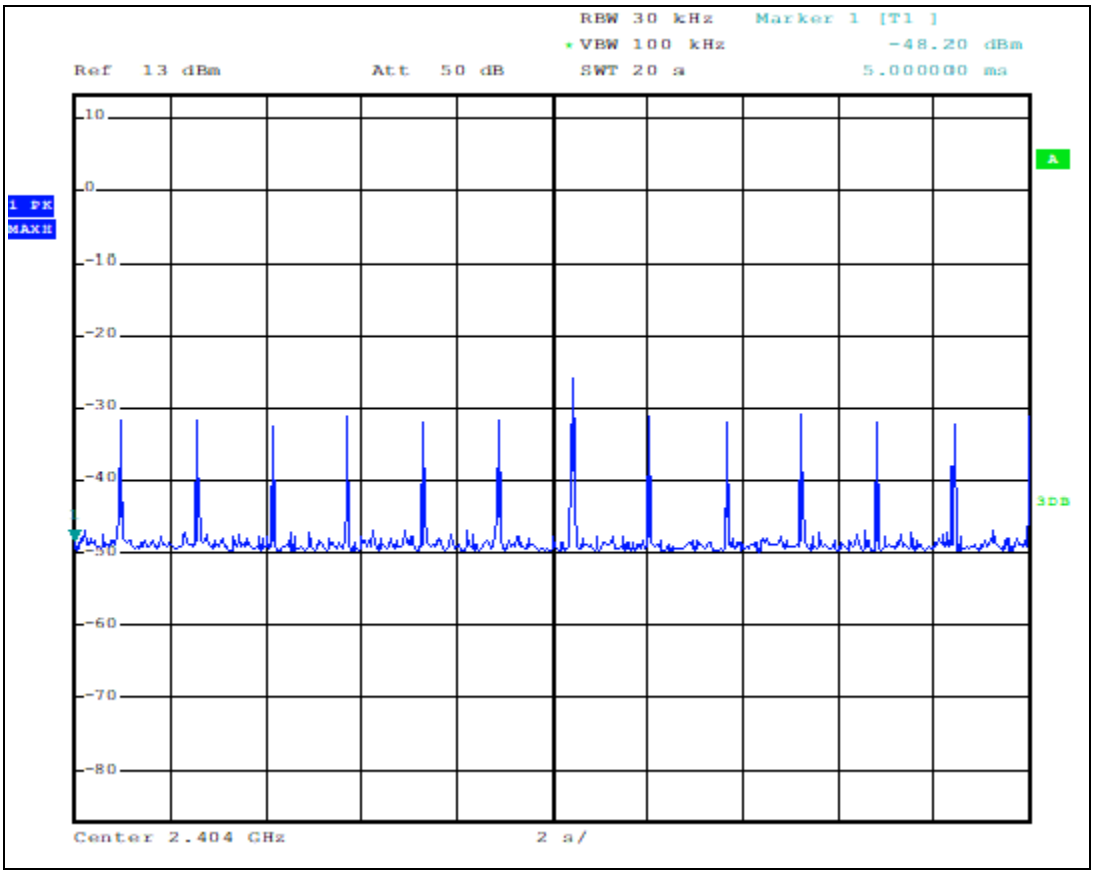
Modifications: No modification was required to comply for this test

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

Measurement Data and Plot:



Plot 23: Bursts in 100ms- Dwelling time 18.60 ms



Plot 24: 12 Burst in 20 s

Table 10: Data of Bursts in 20 seconds and duty cycle of each burst

Modulation	Number Of Burst in 20 s	Burst Duty Cycle ms	Burst Duty Cycle %	Time of Occupancy ms	Max Limit ms	Results
FSK	12	18.60	18.60	223.2	400	Complies

3.11 RF Exposure Evaluation

Date Performed: July 6, 2021

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.

Table 11: Data of RF Peak Power Output

Modulations	Carrier Frequency MHz.	Peak dBm (1)	Antenna Gain dB	EIRP dBm (1)	Limit dBm	Margin dB	Results
FSK	2403.1	9.41	0	9.75	30	20.25	Comply
	2441.4	8.37	0	8.88	30	21.12	Comply
	2479.8	8.77	0	9.43	30	20.57	Comply
	2417.9	10.70	0	10.78	30	9.22	Comply

A) KDB 447498

4.2.3. Extremity exposure conditions: Devices that are designed or intended for use on extremities, or mainly operated in extremity only exposure conditions, i.e., hands, wrists, feet and ankles, may require extremity SAR evaluation. When the device also operates in close proximity to the user's body, SAR compliance for the body is also required. The 1-g body and 10-g extremity SAR Test Exclusion Thresholds in 4.3 should be applied to determine SAR test requirements.

4.3. General SAR test exclusion guidance: (a) For 100 MHz to 6 GHz and test separation distances ≤ 50 mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following:
[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR, and ≤ 7.5 for 10-g extremity SAR,30 where f(GHz) is the RF channel transmit frequency in GHz.
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.

Table 12: FCC RF Exposure

Carrier Frequency (GHz)	Peak Conducted Output Power (dBm)	EIRP (dBm)	EIRP (mW)	Exclusion Thresholds Calculated	Limit 1-g SAR	Limit 10-g SAR	Result (1)
2.4798	10.70	10.70	11.74	2.322540827	3.0	7.5	SAR Exempt for both 1g and 10-g

The shortest distance between the radio and the outside surface of the unit for 2400MHz is 7.96mm.

B) RSS-102 Section: 2.5.1

2.5.1 SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in Table 12 below.

Table 13: ISED RF Exposure

Carrier Frequency (GHz)	Peak Conducted Output Power (dBm)	EIRP (dBm)	EIRP (mW)	Limit 1-g SAR 5.5x5 (mW)	Limit 10-g SAR 5.5x2.5 (mW)	Result (1)
2.4798	10.70	10.7	11.74	27.5	13.75	SAR Exempt for both 1g and 10-g

1) The shortest distance between the radio and the outside surface of the unit for 900MHz is 5.82mm.

2) ISED: For controlled use devices where the 8 W/kg for 1 gram of tissue applies the exemption limits for routine evaluation in Table 12 are multiplied by a factor of 5. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 2.5. If the operating frequency of the device is between two frequencies located in Table 1, linear interpolation shall be applied for the applicable separation distance. For test separation distance less than 5 mm, the exemption limits for a separation distance of 5 mm can be applied to determine if a routine evaluation is required.

3.12 Frequency Stability

Date Performed: July 2, 2021

Test Standard: FCC CFR 47 Part 15.215RSS-Gen Issue 5

Test Method: ANSI C63.10-2013

Test Setup: **FCC (15.215(c)):**

The 20dB bandwidth must remain within the designated frequency band over the expected variations in temperature and voltage range.

Rss-Gen Issue 5 (8.8):

Transmitter frequency stability for license-exempt radio apparatus shall be measured in accordance with Section 6.11. For license-exempt radio apparatus, the frequency stability shall be measured at temperatures of -20°C (-4°F), +20°C (+68°F) and +50°C (+122°F) instead of at the temperatures specified in Section 6.11. If the frequency stability of the license-exempt radio apparatus is not specified in the applicable standard (RSS), measurement of the frequency stability is not required provided that the occupied bandwidth of the license-exempt radio apparatus lies entirely outside the restricted bands and the prohibited TV bands of 54-72 MHz, 76-88 MHz, 174-216 MHz, 470-608 MHz and 614-806 MHz. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation. Each device that implements time division for the purposes of maintaining a duplex connection on a given frequency carrier shall maintain a frame repetition rate with a frequency stability of at least 50 parts per million (ppm). Each device which further divides access in time in order to support multiple communication links on a given frequency carrier shall maintain a frame repetition rate with a frequency stability of at least 10 ppm.

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

Performance: **Complies** with the applicable standard.

Measurement Data and Plot:

Table 14: Frequency Stability

Temp (C)	Carrier Frequency (MHz)	Frequency reading (MHz)	Deviation (PPM)
-20	2479.802	2479.811	3.6
-10	2479.802	2479.792	4.0
0	2479.802	2479.812	4.0
10	2479.802	2479.812	4.0
20	2479.802	2479.802	0.0
40	2479.802	2479.803	0.4

Appendix A: TEST SETUP PHOTOS

Figure 1: Radiated Emissions performed at the 3m SAC, 10kHz – 30MHz

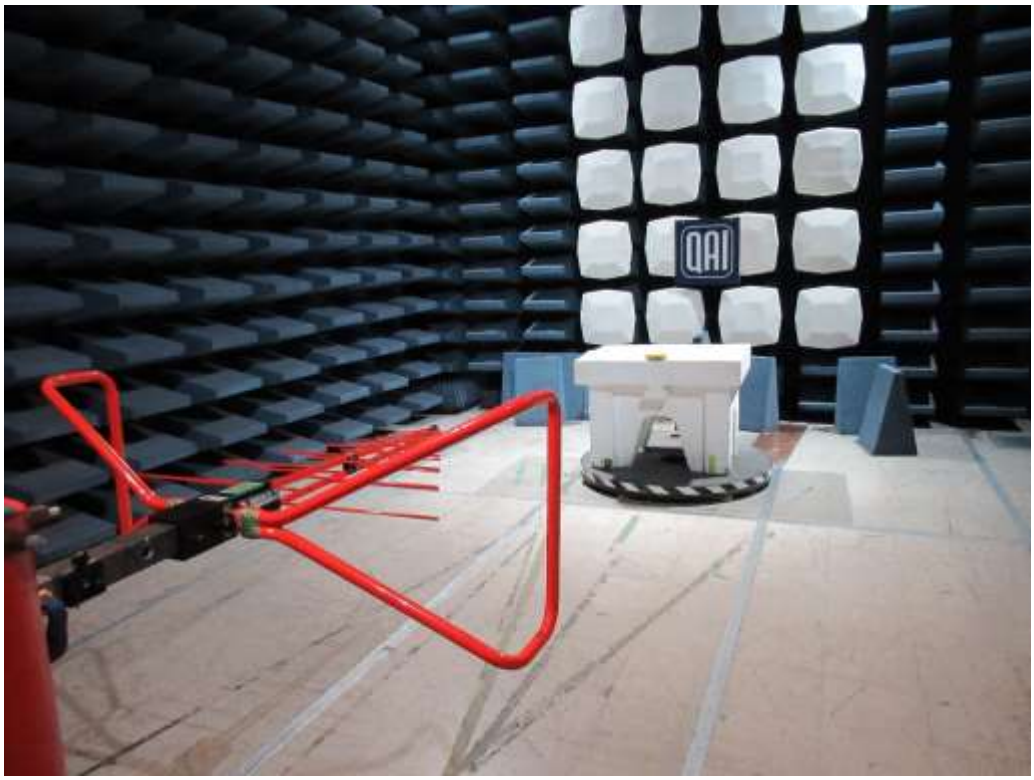


Figure 2: Radiated Emissions 30MHz – 1GHz

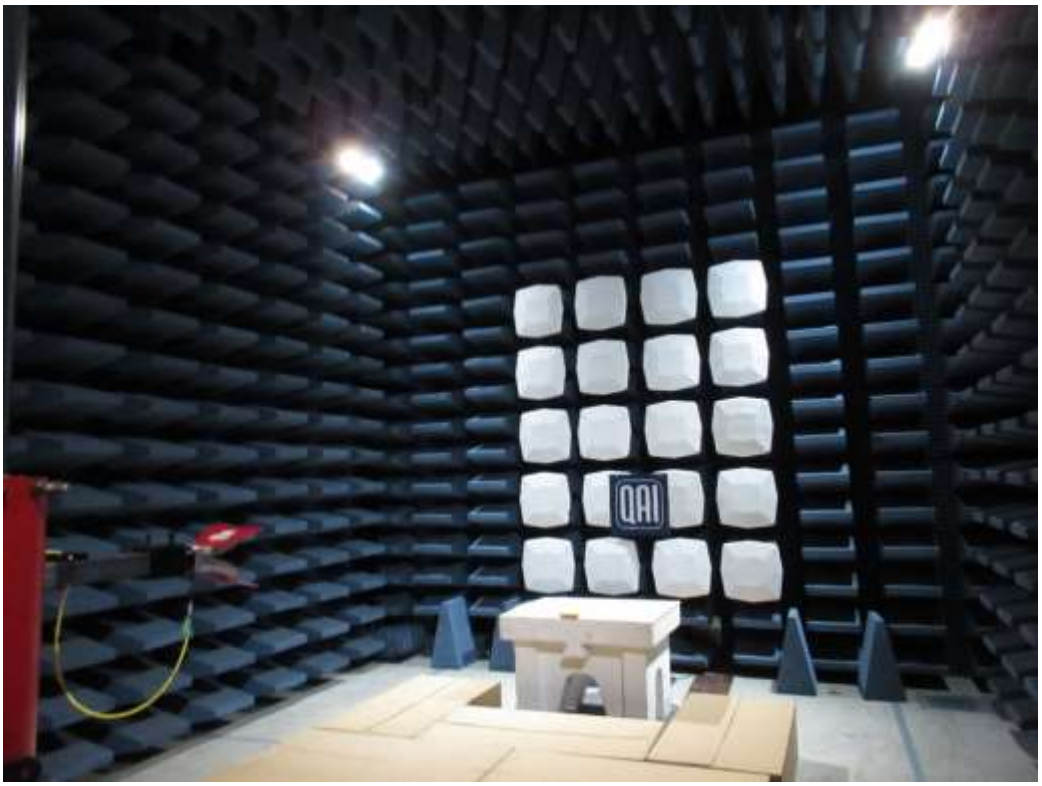


Figure 3: Radiated Emissions 1GHz to 18 GHz

Figure 4: Radiated Emissions 18GHz to 26 GHz

Figure 5: Radio Testing Station

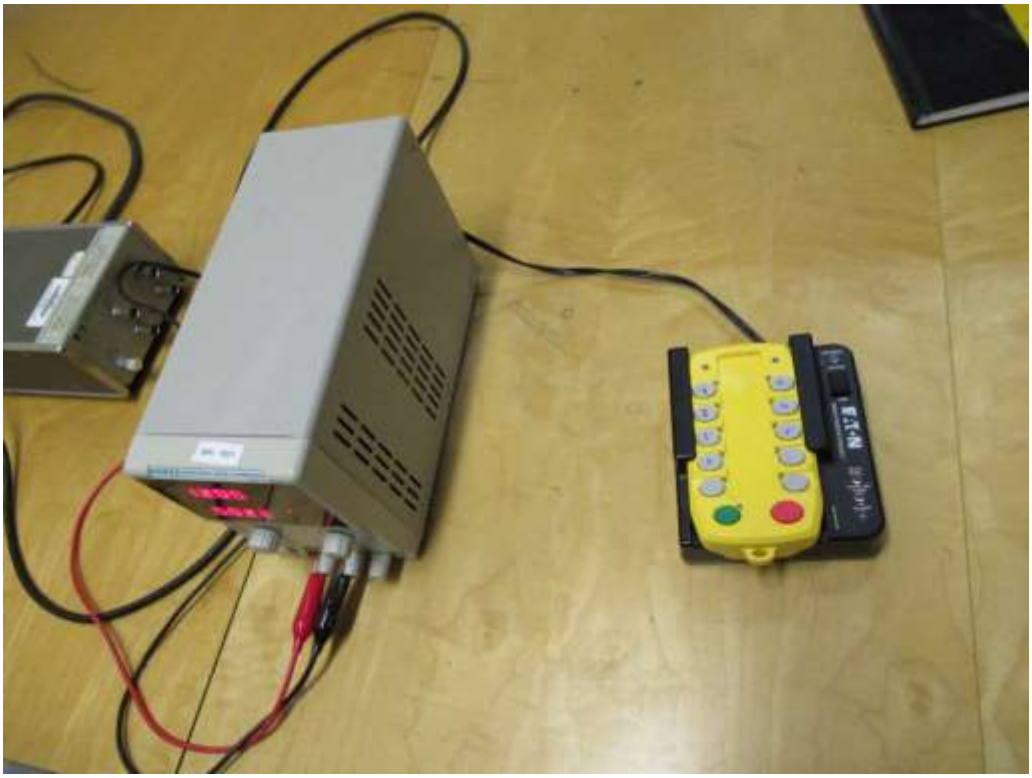


Figure 6: EUT and Charging Base

Figure 7: Frequency Stability Testing

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