INTENTIONAL RADIATOR TEST REPORT

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

Report Reference Number:	E10788-2107_Cooper_TD110 900 MHz_**Rev 1.0**
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Laboratory Accreditations (per ISO/IEC 17025:2017)

CERT #3657.02

This report has been completed in accordance with the requirements of ISO/IEC 17025.
Test results contained in this report are within QAI Laboratories ISO/IEC 17025 accreditations.
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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):	TS110-9

Powering Business Worldwide

REVISION HISTORY

Date	Report Number	Details	Author's Initials
September 29, 2021	E10788-2107_Cooper_TD110 900 MHz_**Rev 1.0**	Final	RS
July 20, 2021	E10788-2107_Cooper_TD110 900 MHz_**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All previous versions of this report have been superseded by the latest dated revision as listed in the above table.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_TS110 900MHz_**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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QAI EMC ACCREDITATION

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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

Equipment Under Test (EUT)

EUT	TD110 900MHz, Wireless Remote
FCC ID	IA9TD1109
IC Number	1338B-TD1109
Manufacturer	Cooper Electrical Canada
Model No.	TS110-9
FVIN	V1.0(47812)

Equipment Under Test (EUT) – RF Information

RF device type	Transmitter
Frequency Range	902.2 MHZ – 927.7 MHz
Number of available channels/ Transmitter	256 (1/4 used at a time)
Channel separation	400 kHz
Channel Bandwidth	25kHz
Output power/Transmitter	11.5dBm (conducted) – non adjustable
Modulation type	2-level FSK
Test Channels (L, M, H)	902.2, 914.9, 927.7 MHz
Data Rate	4800 Baud
Adaptive	No
Geo-location capability	No
Number of Antennas	1
Antenna type	Chip (non-detachable)
Antenna gain	0.3 dBi

Equipment Under Test (EUT) - General Information

Tested as	Table-top
Dimensions	13.5 x 7.1 x 3.3 (cm)
Declared operating temperature range:	-20 °C to +60 °C
Input power	Internal battery
Grounded	No
Device use	Portable (within 20 cm of human body)

Note: EUT has no I/O cables.

Test Modes

Test	Transmitter state	Power
Pre-scans	1) Modulated fixed-frequency transmission	1) Battery-operated 2) Charging

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	21.4ºC
Relative Humidity	47.9%
Atmospheric Pressure	101 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	EMCO	3825/2	LISN (150kHz-30MHz)	9002-1601	N/A	2023-Oct-01
3	ETS Lindgren	2165	Turntable	00043677	N/A	N/A
4	ETS Lindgren	2125	Mast	00077487	N/A	N/A
5	ETS Lindgren	S201	5-meter Semi-Anechoic Chamber	1030	N/A	N/A
6	Hewlett Packard	8449B	Preamplifier (1-26 GHz)	2933A00198	N/A	2022-Jan-22
7	Rohde & Schwarz	ESU40	EMI Receiver	100011	EMC32 v10.35.10/ FV 4.73 SP4	2023-Jul-05
8	Rohde & Schwarz	ESCI	EMI Receiver	100123	EMC32 v10.01.00/ FV 4.42 SP3	2022-Mar-26
9	Sunol Sciences	DRH-118	Horn Antenna, 1.0-18 GHz	A050905	N/A	2023-07-28
10	Sunol Sciences	SM46C	Turntable	051204-2	N/A	N/A
11	Sunol Sciences	TWR95	Mast	TREML0001	N/A	N/A
12	Sunol Sciences	JB3	Biconilog Antenna 30MHz – 3GHz	A120106	N/A	2022-May-10
13	Sunol Sciences	JB3	Biconilog Antenna 30MHz – 3GHz	A042004	N/A	2023-Jul-30
14	TTi	HA1600A	Power Analyzer; Harm/Flicker	318801	N/A	2021-Oct-01
15	TTi	AC1000A	Power Supply, Low Distortion	317113	N/A	2021-Oct-01

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 "TS110-900 MHz" 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 Applicable Standards and Results

The following tests demonstrate the testimony to "FCC and ISED" Mark Electromagnetic compatibility testing for "TS110 900 MHz".

No.	Test	Applicable Standard	Result
1	Antenna Requirement	FCC 47 CFR Part 15.203 RSS-Gen Issue 5	Complies
2	Radiated Emissions Transmitter Mode	FCC CFR 47 Part 15.249 FCC CFR 47 Part 15.209 FCC CFR 47 Part 15.205 RSS-210 Issue 9 RSS-Gen Issue 5	Complies
3	Radiated Emissions Unintentional Radiator Mode	FCC CFR 47 Part 15.209 CFR Title 47 FCC Part 15 ICES-003 Issue 7 RSS-Gen Issue 4	Complies
4	Max. Peak Conducted Output Power	FCC 47 CFR Part 15.247(a)(1) RSS-247 Issue 2 (5.1) (b)	Complies
5	Time of Occupancy & Dwell Time	FCC 47 CFR Part 15.247(a)(1)(i) RSS-247 Issue 2 (5.1) (c)	Complies
6	20-dB Occupied Bandwidth	RSS-Gen Issue 5	Complies
7	99 % Occupied Bandwidth	RSS-Gen Issue 5	Complies
8	Out-of-Band Emissions (Bandedge)	FCC 47 CFR Part 15.249 RSS-210 Issue 9	Complies
9	Channel Separation	FCC 47 CFR Part 15.247(a)(1) RSS-247 Issue 2 (5.1) (b)	Complies
10	Number of Hopping Channels	FCC 47 CFR Part 15.247 RSS-247 Issue 2	Complies
11	RF Exposure Evaluation	FCC CFR 47 Part 15.203 RSS-Gen Issue 5 Section 7.1.2	Complies
12	Frequency Stability	FCC CFR 47 Part 15.215 RSS-Gen Issue 5	Complies

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 25, 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."

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

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.

3.2 Radiated Emissions Transmitter Mode

Date Performed: June 21, 22, 23, 2021

Test Standard: FCC CFR 47 Part 15.249
FCC CFR 47 Part 15.209
FCC CFR 47 Part 15.205
RSS-210 Issue 9
RSS-Gen Issue 5

Test Method: ANSI C63.10:2013

Test Requirement:

The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Frequency (MHz)	Field Strength of Fundamental		Field Strength of Harmonics	
	mV/m	dBµV/m	µV/m	dBµV/m
24.0-24.25	250	108	2500	68
902-928	50	94	500	54
2400-2483.5	50	94	500	54
5725-5875	50	94	500	54

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB 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
Above 960	500	54.0

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:

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			

(b) Except as provided in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in § 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in § 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in § 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in § 15.35 apply to these measurements.

RESTRICTED FREQUENCY BANDS (RSS-GEN ISSUE 4)

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 RF radiated emissions were measured in the frequency range of 150kHz to 18 GHz. 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.

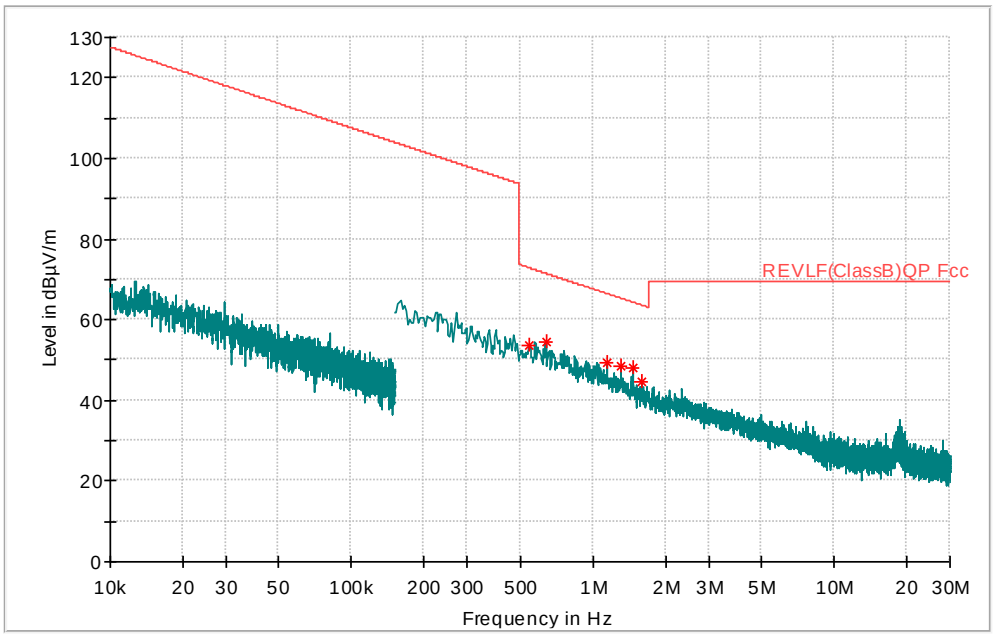
Measurement Method:

ANSI C63.10:2013 radiated emissions procedure was followed to demonstrate the compliance of Bluetooth low energy.

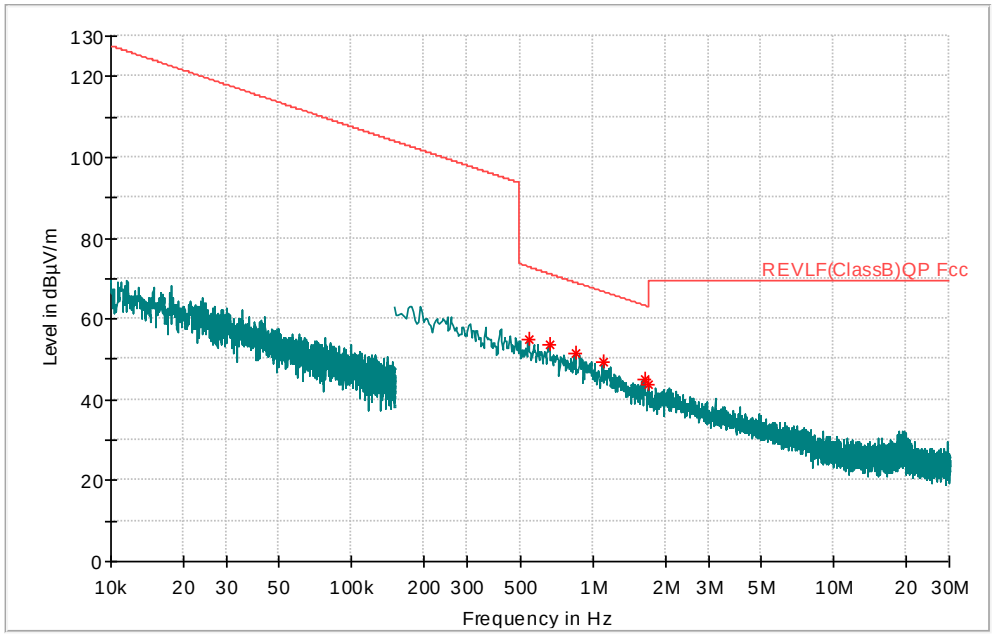
Modifications: No modification was required to comply for this test.

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

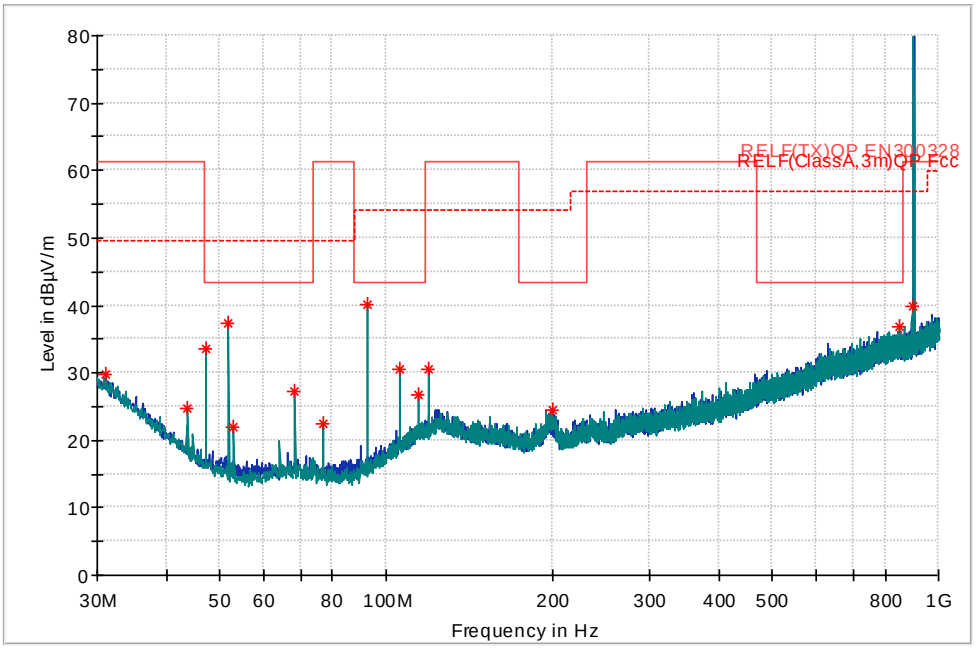
Measurement Data and Plot:



Plot 1: Radiated Spurious Emissions 10kHz - 30MHz (Horizontal)



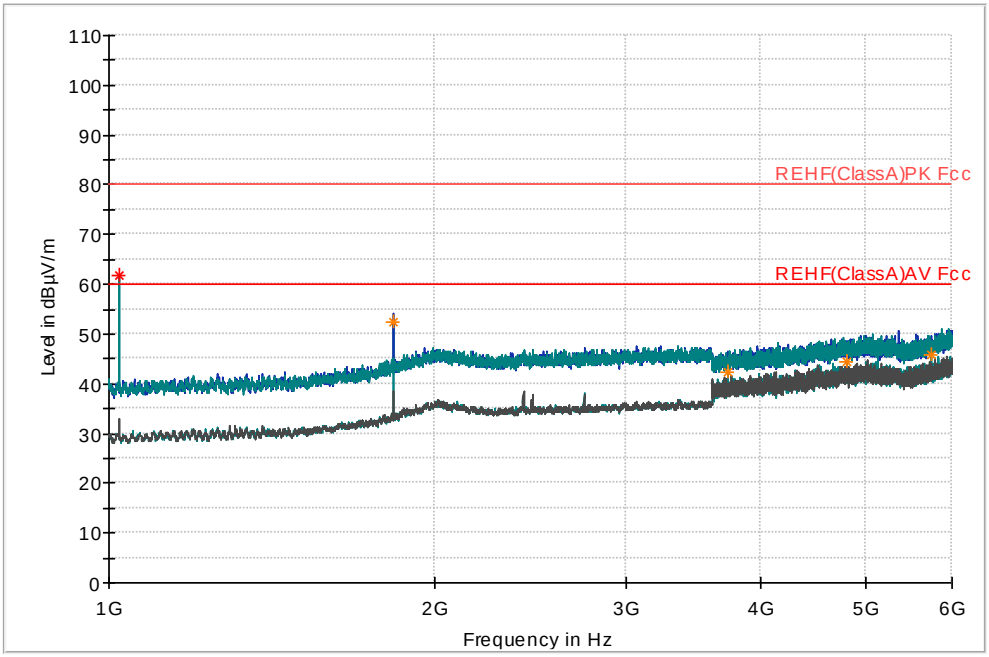
Plot 2: Radiated Spurious Emissions 10kHz - 30MHz (Vertical)



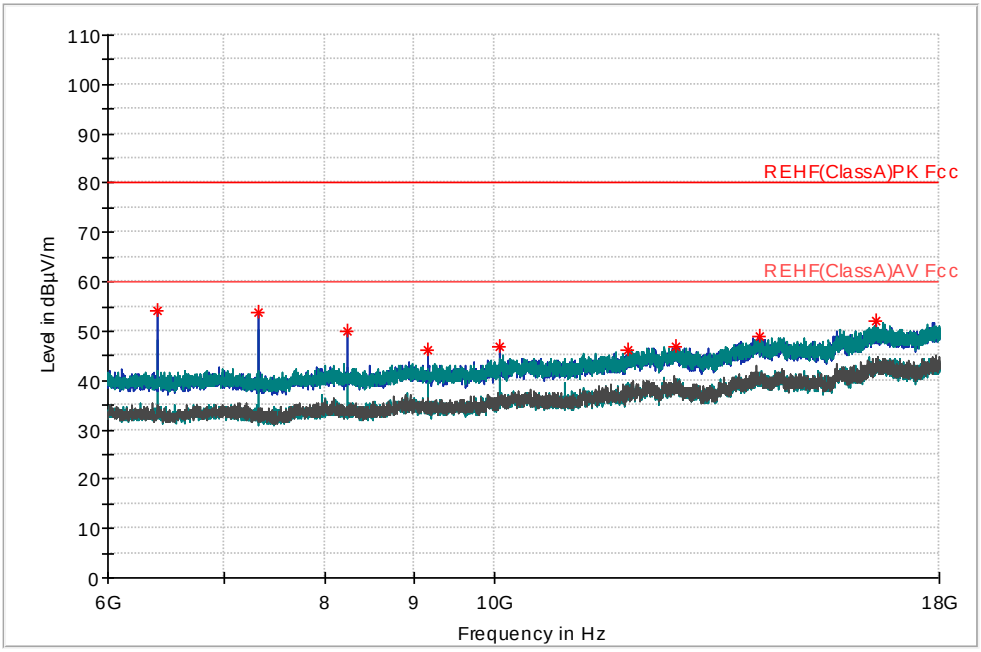
Plot 3: Radiated Spurious Emissions 30 - 1000MHz

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

Frequency (MHz)	Max. Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
0.541035	53.72	72.94	19.23	150.0	H	317.0	20.6
0.541035	55.08	72.94	17.86	150.0	V	61.0	20.6
0.636555	54.70	71.53	16.84	150.0	H	126.0	20.6
0.663420	53.59	71.18	17.58	150.0	V	314.0	20.6
0.845505	51.59	69.08	17.48	150.0	V	250.0	20.5
1.102215	49.46	66.78	17.32	150.0	V	156.0	20.9
1.138035	49.17	66.50	17.33	150.0	H	126.0	20.9
1.308180	48.28	65.30	17.02	150.0	H	349.0	20.8
1.466385	48.13	64.31	16.17	150.0	H	95.0	20.8
1.591755	44.57	63.60	19.02	150.0	H	284.0	20.7
1.639515	45.01	63.34	18.33	150.0	V	0.0	20.7
1.699215	43.84	63.03	19.19	150.0	V	30.0	20.7
31.1640	29.69	61.40	31.71	100.0	V	163	25.9
43.7740	24.78	61.40	36.62	100.0	V	286	16.7
47.1690	33.55	43.40	9.85	100.0	V	286	14.7
51.9220	37.34	43.40	6.06	100.0	V	286	13.0
52.9890	21.89	43.40	21.51	250.0	V	230	12.8
68.4120	27.28	43.40	16.12	100.0	V	298	13.5
77.1420	22.37	61.40	39.03	100.0	V	298	13.5
92.5650	40.08	43.40	3.32	200.0	V	59	13.7
106.0480	30.58	43.40	12.82	100.0	V	298	17.6
114.6810	26.66	43.40	16.74	200.0	V	0	19.1
119.7250	30.43	61.40	30.97	100.0	V	298	19.7
200.2350	24.56	43.40	18.84	150.0	H	40	19.6
848.7770	36.85	43.40	6.55	200.0	V	148	30.6
896.0160	39.80	61.40	21.60	200.0	V	81	31.0
902.2240	101.09	61.40	-39.69	150.0	H	348	31.2



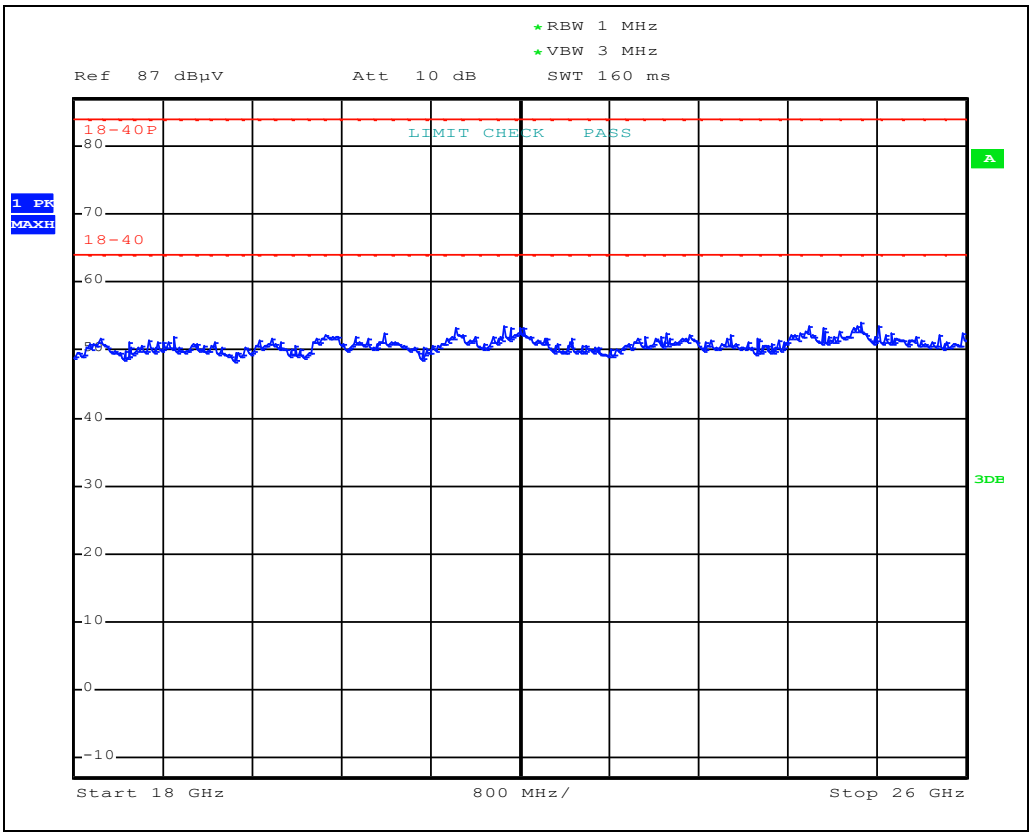
Plot 4: Unintentional Radiated Emissions: 1GHz-6GHz



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

Table 2: 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)
1022.5000	61.64	---	80.00	18.36	150.0	V	350	-8.4
1829.5000	---	52.22	60.00	7.78	150.0	H	0	-2.5
3727.0000	---	42.27	60.00	17.73	150.0	H	15	1.7
4791.5000	---	44.32	60.00	15.68	100.0	V	50	4.1
5736.0000	---	45.97	60.00	14.03	250.0	H	138	5.4
6403.2000	54.26	---	60.00	5.74	150.0	H	17	-7.8
7318.8000	53.74	---	60.00	6.26	150.0	H	17	-6.0
8234.4000	50.08	---	60.00	9.92	150.0	H	0	-4.1
9148.8000	46.12	---	60.00	13.88	150.0	H	29	-2.0
10063.2000	46.97	---	60.00	13.03	150.0	H	17	1.3
11920.8000	46.04	---	60.00	13.96	200.0	V	28	5.0
12698.4000	46.88	---	60.00	13.12	250.0	V	149	4.7
14196.0000	49.05	---	60.00	10.95	100.0	H	234	7.3
16543.2000	52.14	---	60.00	7.86	100.0	H	173	10.2



Plot 6: Unintentional Radiated Emissions: 18GHz-26GHz

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

3.3 Radiated Emissions Unintentional Radiator Mode

Date Performed: June 21, 2021

Test Standard: FCC CFR 47 Part 15.209
CFR Title 47 FCC Part 15 - Radio Frequency Devices, Subpart B
ICES-003
Issue 6RSS-Gen Issue 4

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 tested in our 3 m SAC and was positioned on the center of the turntable. The transmitter was set for continuous transmission. The lowest, middle, and highest channels in the 2400-2483.5 MHz band were measured for all radiated emissions 10kHz to 18 GHz. 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:

Measurements were made using spectrum analyser and receiver, 200Hz RBW average detector for the frequency range 9-150KHz; 9kHz RBW average detector for the Frequency range 150kHz to 30MHz; 120kHz RBW quasi-peak detector using the appropriate antennas, amplifiers and filters.

The measurement results are obtained as described below:

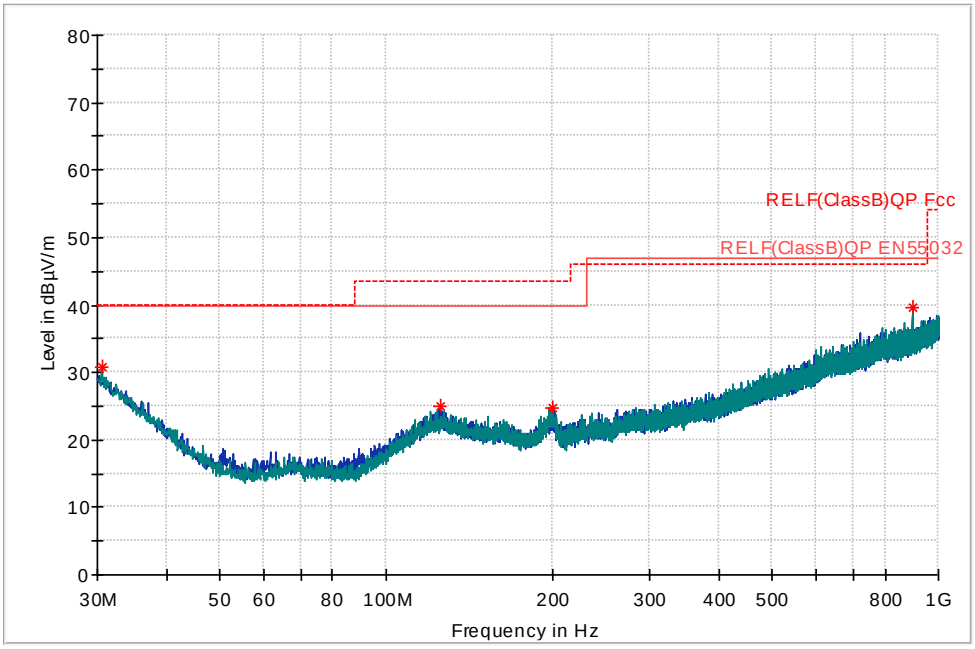
E [dBµV/m] = Un-Corrected Value + ATOT

Where ATOT is total correction factor including cable loss, antenna factor and preamplifier gain (ATOT = LCABLES + AF - AMP).

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

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

Measurement Data and Plot:

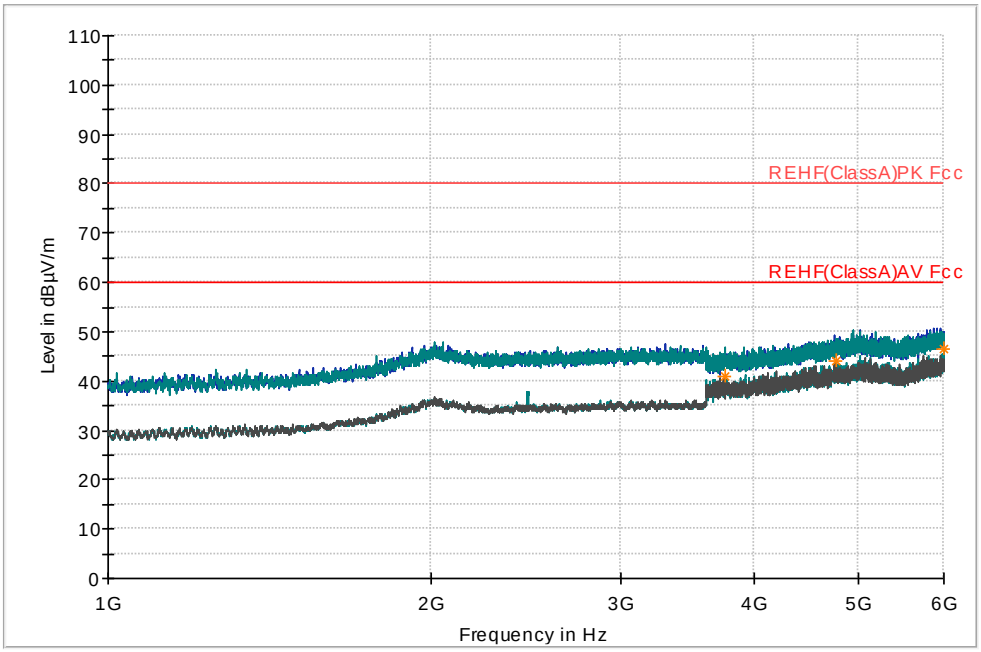


Plot 7: Unintentional Radiated Emissions: 30-1000MHz

Table 3: Radiated Emissions Receiver Mode, 30MHz – 1GHz

Frequency (MHz)	Max. Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.5820	30.78	40.00	9.22	---	100.0	V	0	26.3
125.0600	25.08	40.00	14.92	---	250.0	H	97	19.9
200.7200	24.81	40.00	15.19	---	100.0	V	0	19.5
896.1130	39.65	47.00	7.35	---	200.0	V	66	31.0

Note: Quasi-peaks were 20dB or greater below the limit line and were not included in this report.



Plot 8: Unintentional Radiated Emissions: 1GHz-6GHz

Table 4: Radiated Emissions Receiver Mode, 1GHz – 6GHz

Frequency (MHz)	Max. Peak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3753.0000	---	40.93	60.00	19.07	200.0	V	349	1.7
4767.0000	---	44.03	60.00	15.97	150.0	V	178	4.1
5994.0000	---	46.39	60.00	13.61	150.0	H	229	5.6

3.4 Max. Peak Conducted RF Output Power

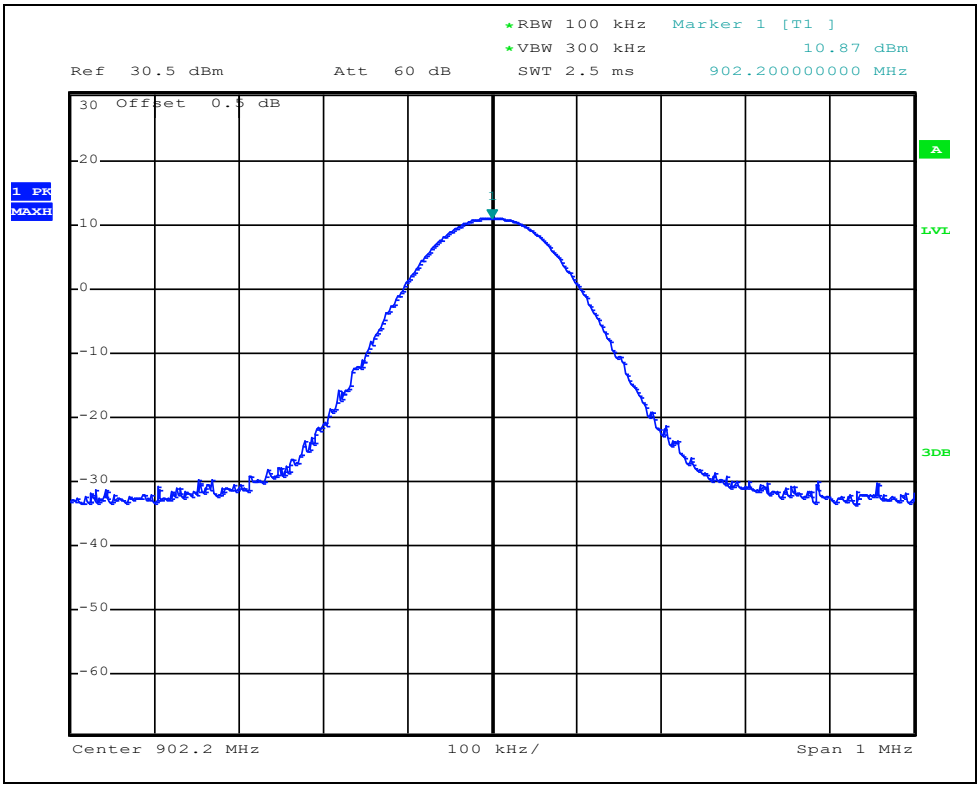
Date Performed: June 22, 2021

Test Requirement: The maximum peak conducted output power of the intentional radiator shall not exceed the following: For frequency hopping systems operating in the 902-928 MHz band: 1 watt (30 dBm) for systems employing at least 50 hopping channels.

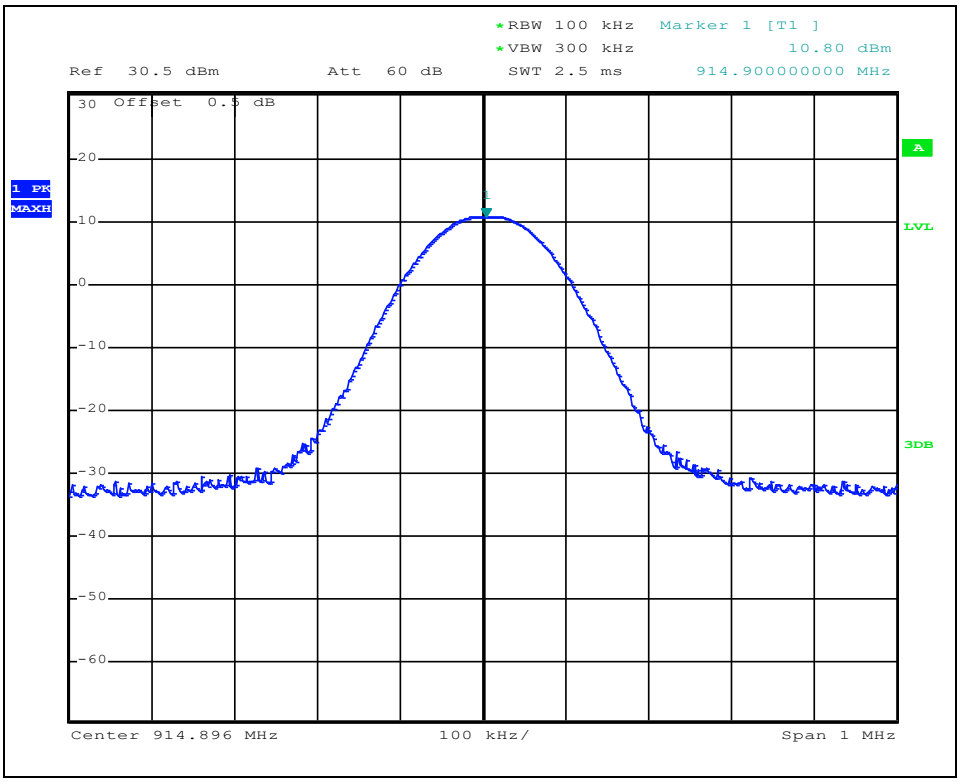
Test Set-up: Conducted measurement at antenna port using spectrum analyzer.
Span = 1 MHz, RBW = 100 kHz, VBW = 300 kHz
Trace stabilization time: 3.5 minutes.

Result: Max. peak conducted output power is < 30 dBm. EUT **complies**.

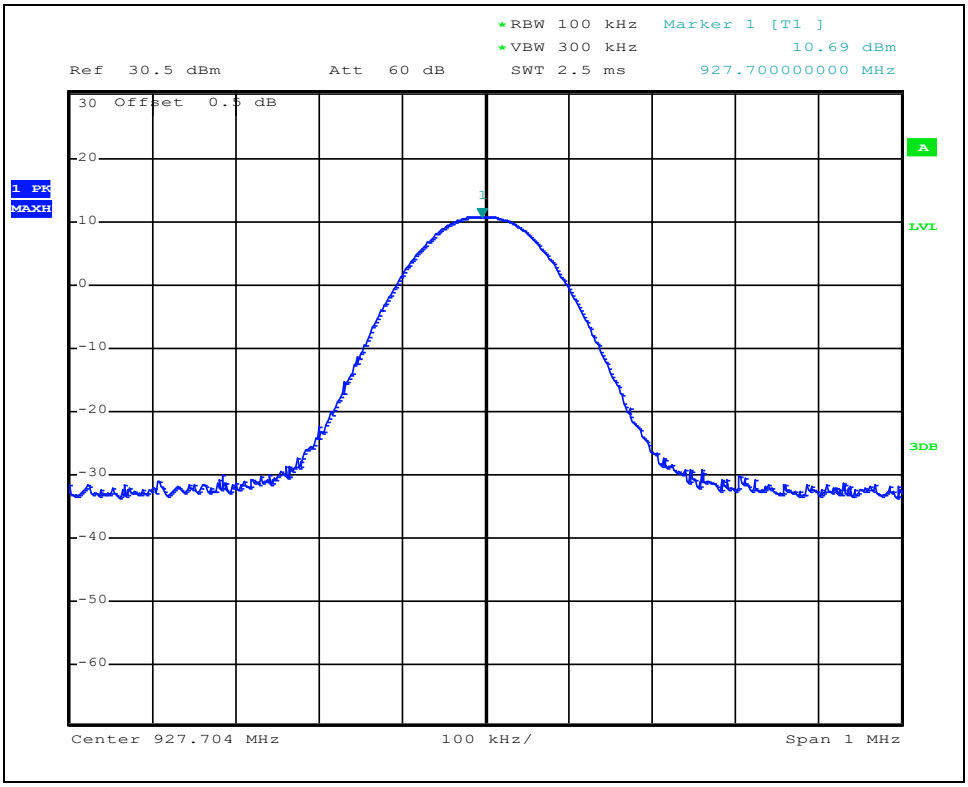
Measurement Data and Plot:



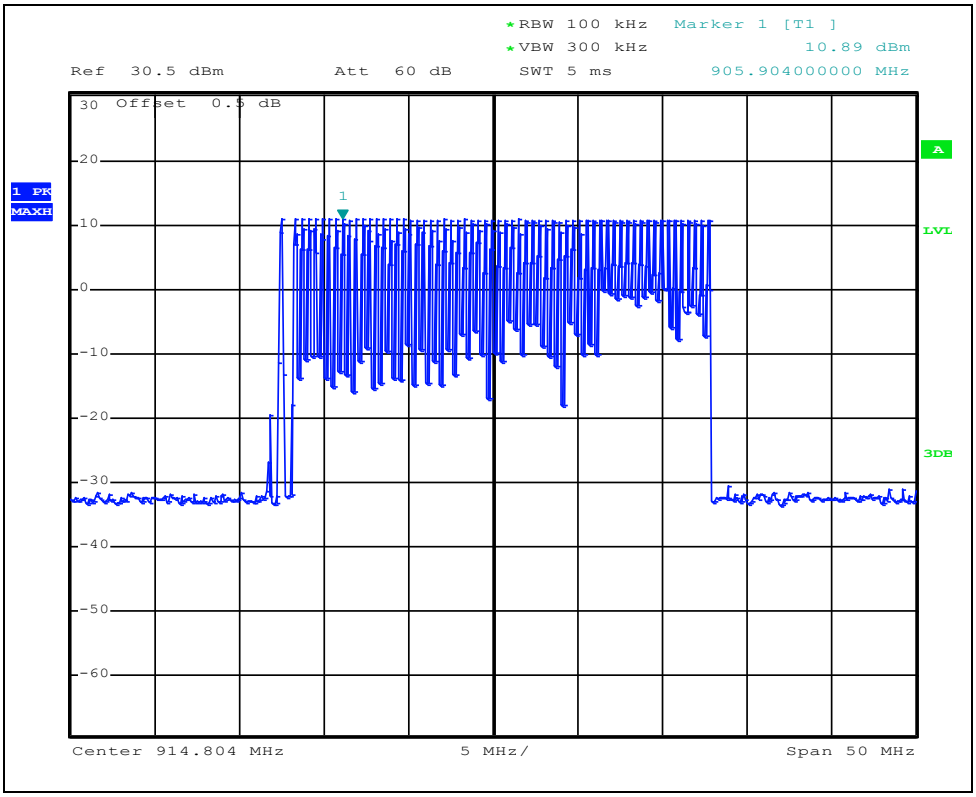
Plot 9: Max. Peak Conducted RF Power Output at Low Channel



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



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



Plot 12: Max. Peak Conducted RF Power Output

Table 5: Data of RF Peak Power Output

Carrier Frequency (MHz)	Raw Peak (dBm)	Antenna Gain dB	EIRP dBm (1)	Limit dBm	Margin dB	Results
902.2	10.87	0	10.87	30	19.13	Comply
914.9	10.8	0	10.8	30	19.20	Comply
927.7	10.69	0	10.69	30	19.31	Comply
Maximum @ 905.90	10.89	0	10.89	30	19.11	Comply

3.5 Time of Occupancy & Dwell Time

Date Performed: June 22 2021

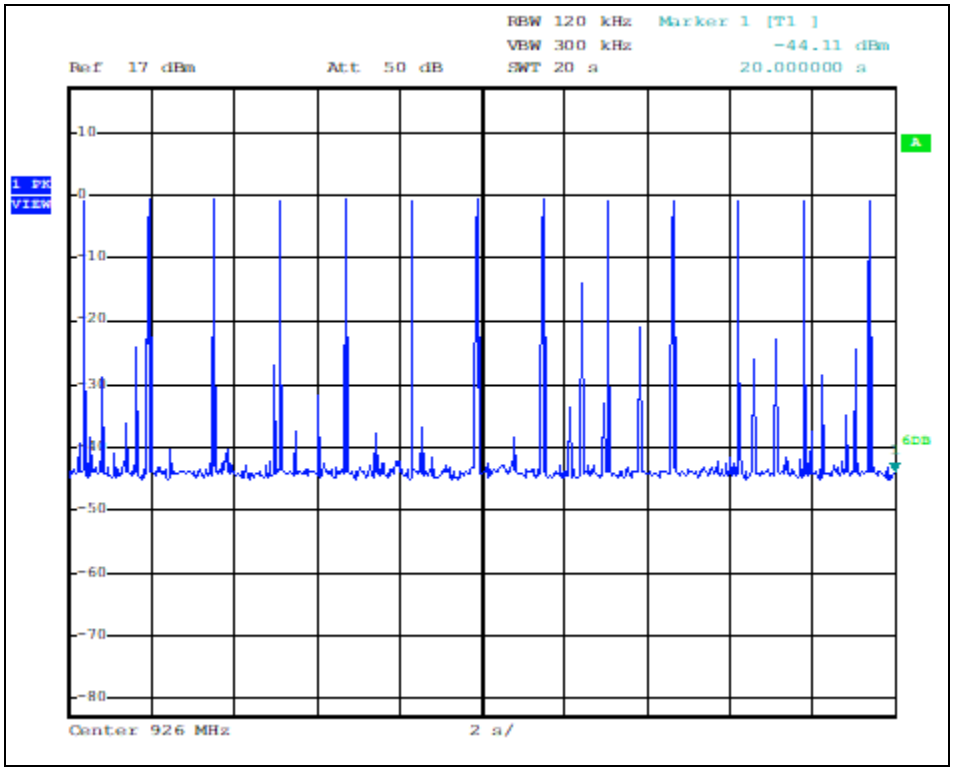
Test Requirement: For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.

Test Set-up: Conducted measurement at antenna port using spectrum analyzer.
Span = 0 Hz, RBW = 120 kHz, VBW = 300 kHz

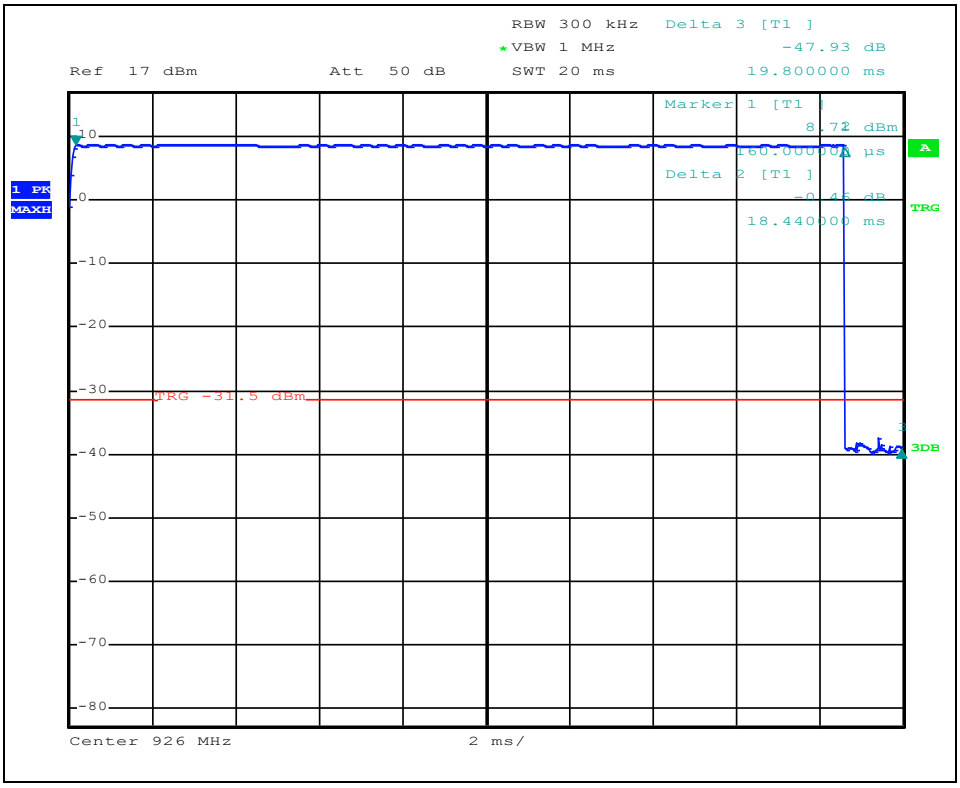
Modifications: None

Result: EUT **complies**.

Measurement Data and Plot:



Plot 12: Bursts in 20 seconds



Plot 13: Duty cycle of each burst

Table 6: Data of Bursts in 20 seconds and duty cycle of each burst

Test Channel (MHz)	Number of Bursts in 20 seconds	Burst Duty Cycle (ms)	Burst Duty Cycle On/(On+Off) (%)	Time of Occupancy (ms)	Max Limit (ms)	Results
914.5	13	18.44	92.2	239.72	400	Complies

3.6 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.

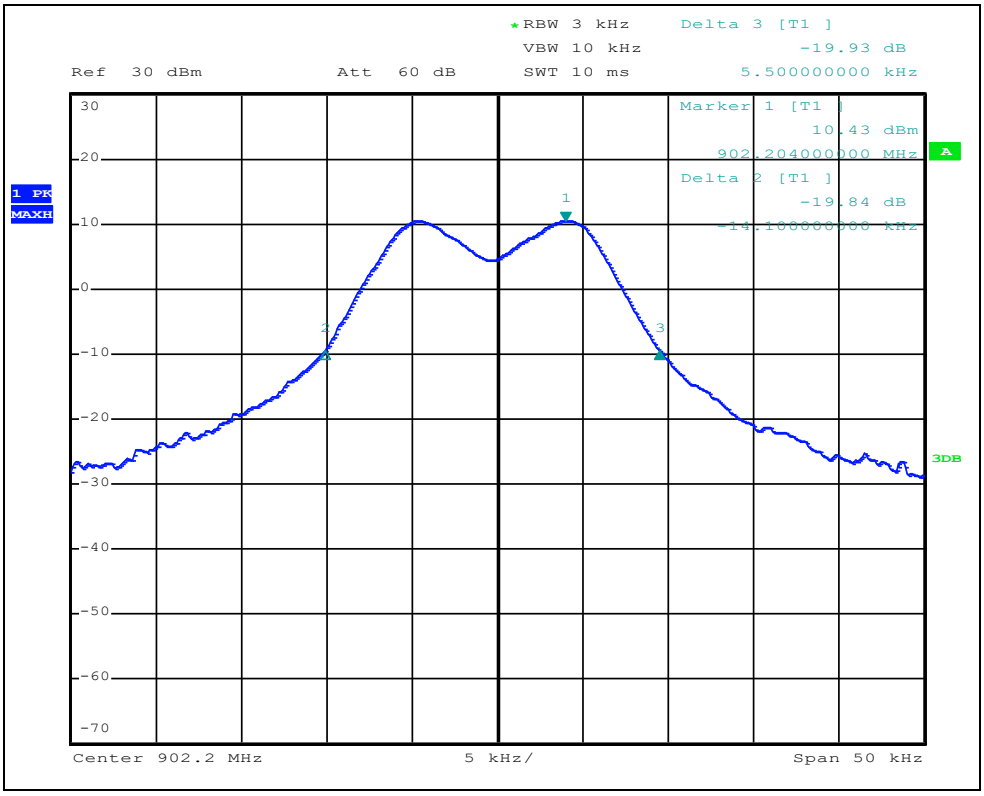
Modifications: No modification was required to comply for this test.

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

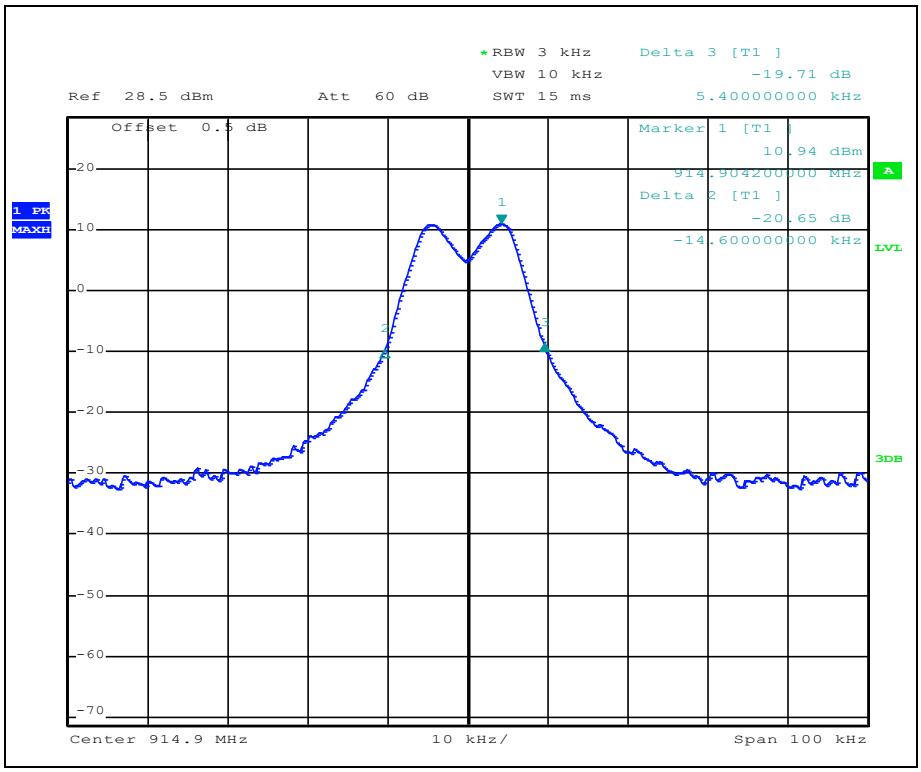
Measurement Data and Plot:

Table 7: Data 20dB Occupied Bandwidth

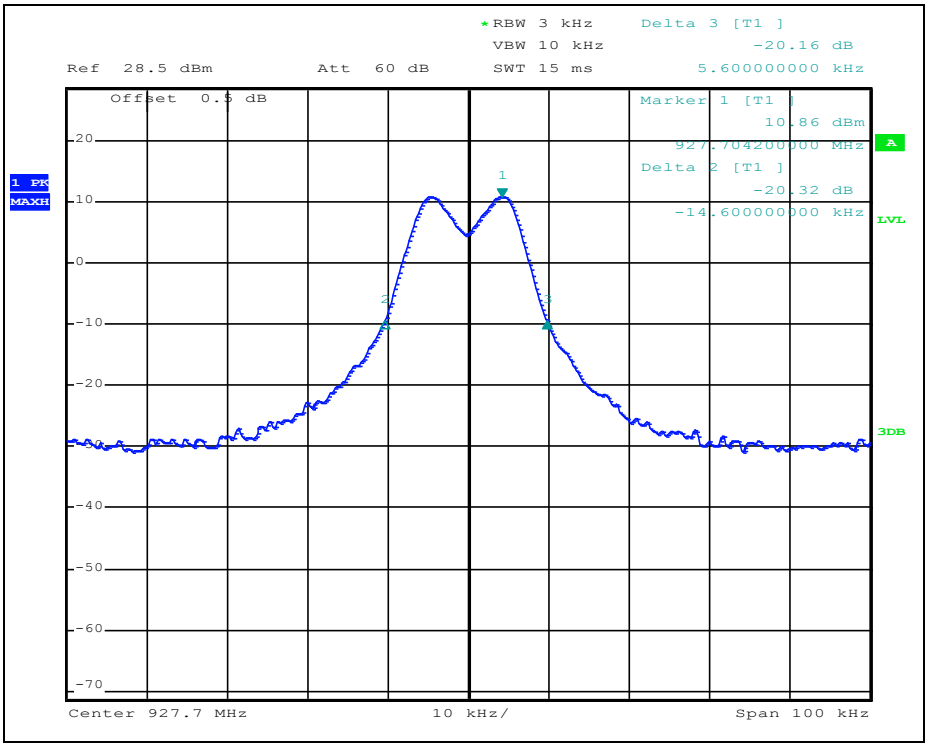
Channel	Frequency (MHz)	20dB Bandwidth (kHz)
Low	902.2	19.68
Middle	914.9	20.00
High	927.7	20.20



Plot 14: 20dB Occupied Bandwidth of Low Channel



Plot 15: 20dB Occupied Bandwidth of Mid Channel



Plot 16: 20dB Occupied Bandwidth of High Channel

3.7 99% Occupied Bandwidth

Date Performed: June 22, 30 2021

Test Standard: RSS-Gen Issue 5

Test Method: ANSI C63.10-2013

Test Setup:

RSS-Gen Issue 4: Section 6.6 – A peak, or peak hold, may be used in place of the sampling detector as this may produce a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold may be necessary to determine the occupied bandwidth if the device is not transmitting continuously.

The trace data points are recovered and are directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded.

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

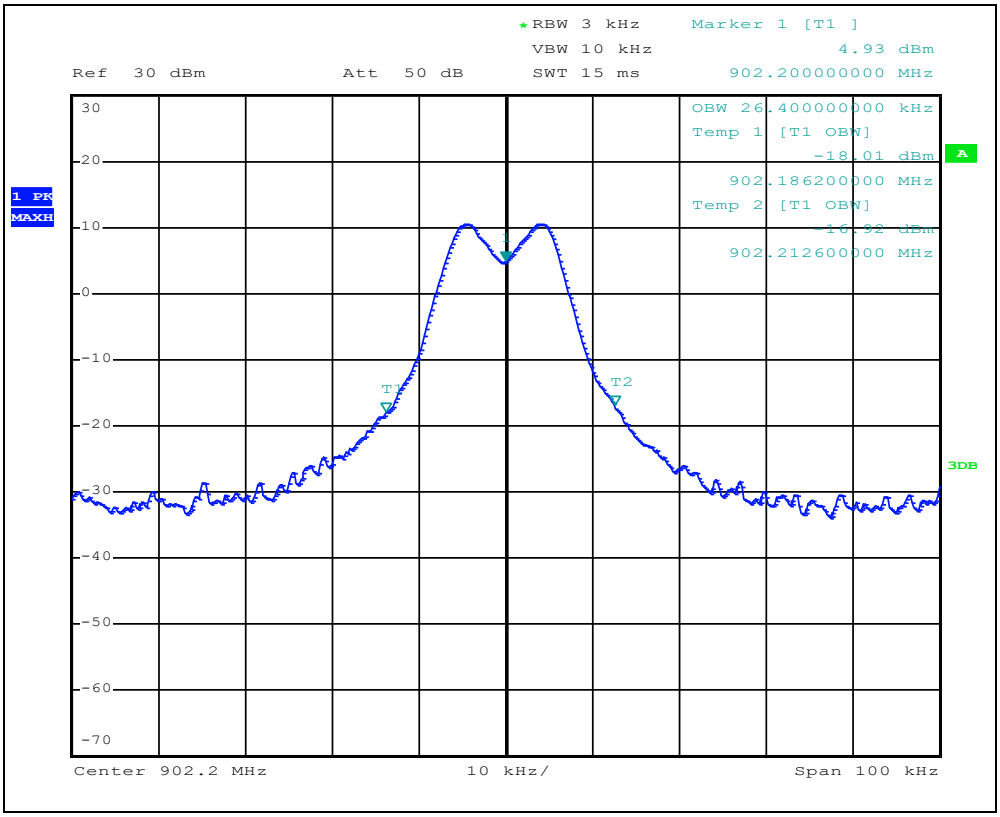
Modifications: No modification was required to comply for this test.

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

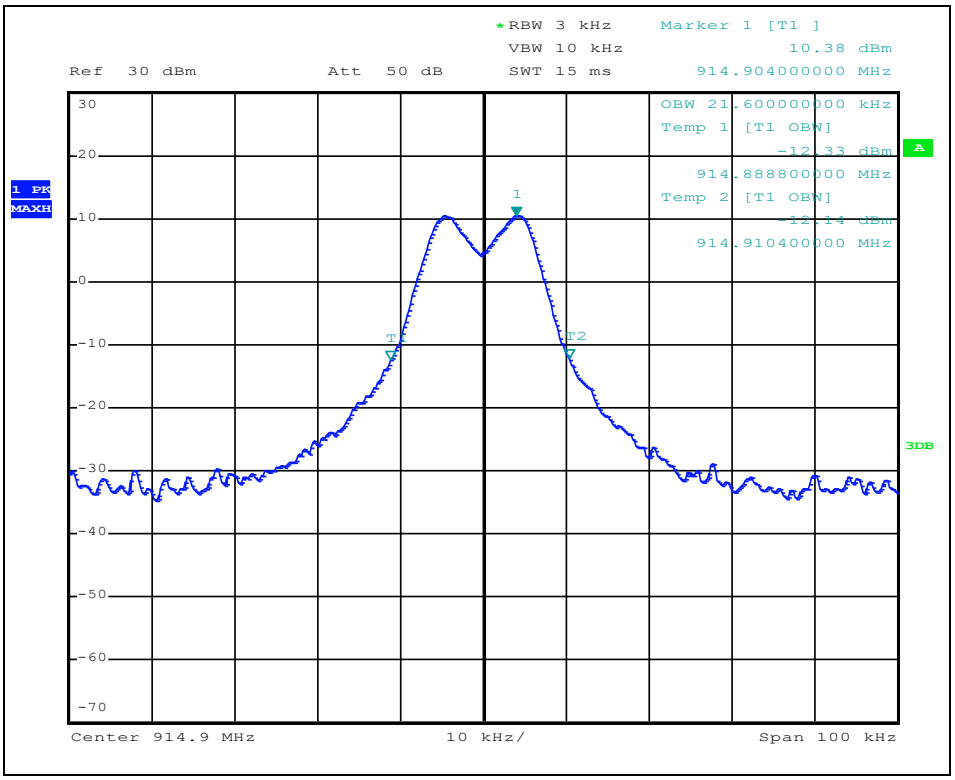
Measurement Data and Plot:

Table 8: Data 99% Occupied Bandwidth

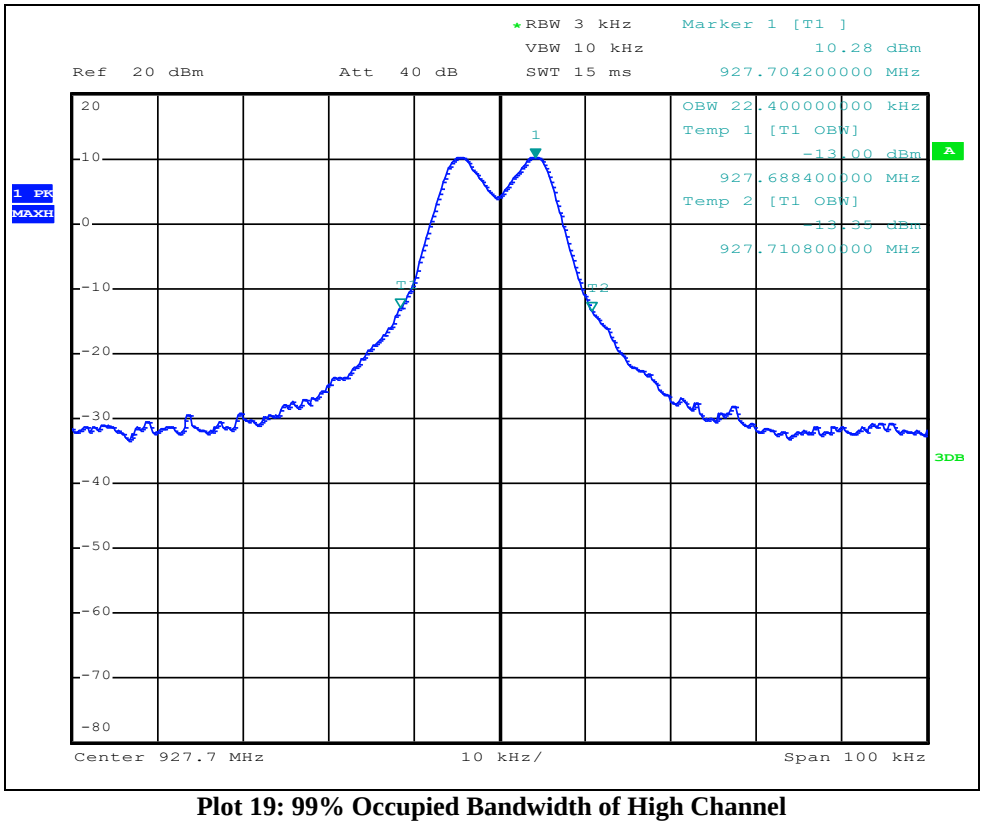
Channel	Frequency (MHz)	99% Bandwidth (kHz)
Low	902.5	26.4
Middle	914.5	21.6
High	927	22.4



Plot 17: 99% Occupied Bandwidth of Low Channel



Plot 18: 99% Occupied Bandwidth of Mid Channel



Plot 19: 99% Occupied Bandwidth of High Channel

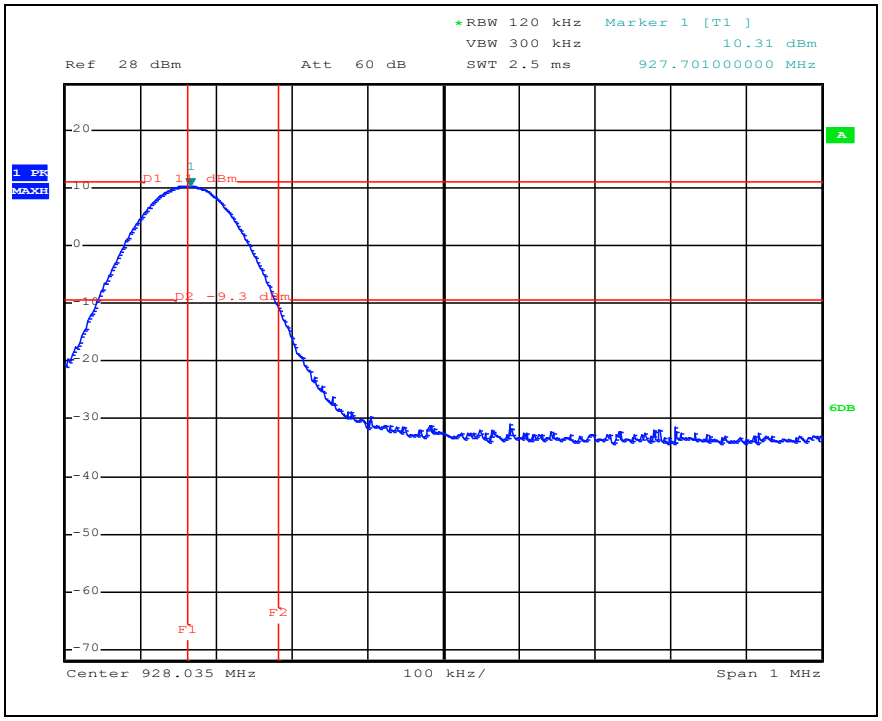
3.8 Out-of-Band Emissions (Band Edge)

Date Performed:	23, 29, 2021
Test Standard:	247-Issue 2 Title 47 CFR Part 15: Subpart C - §15.247 (d)
Test Method:	I C63.10:2013
Modifications:	ıodification was required to comply for this test
Final Result:	The EUT **Comply** with the applicable standard.

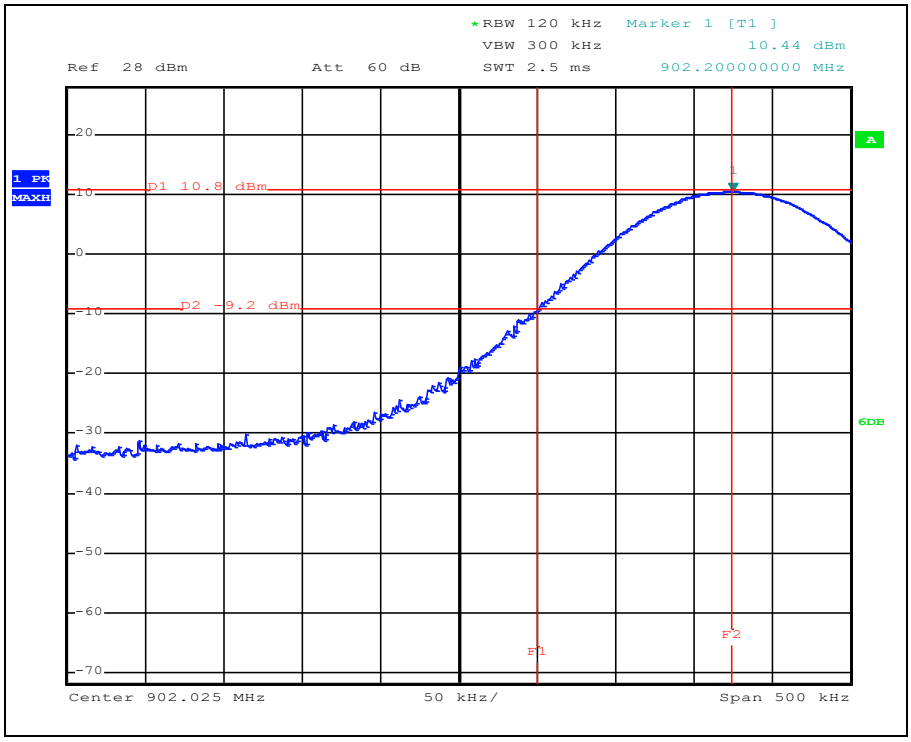
Test Requirement:

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:



Plot 20: Band edge, High channel



Plot 21: Band edge, Low Channel

3.9 Channel Separation

Date Performed: June 23, 29, 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

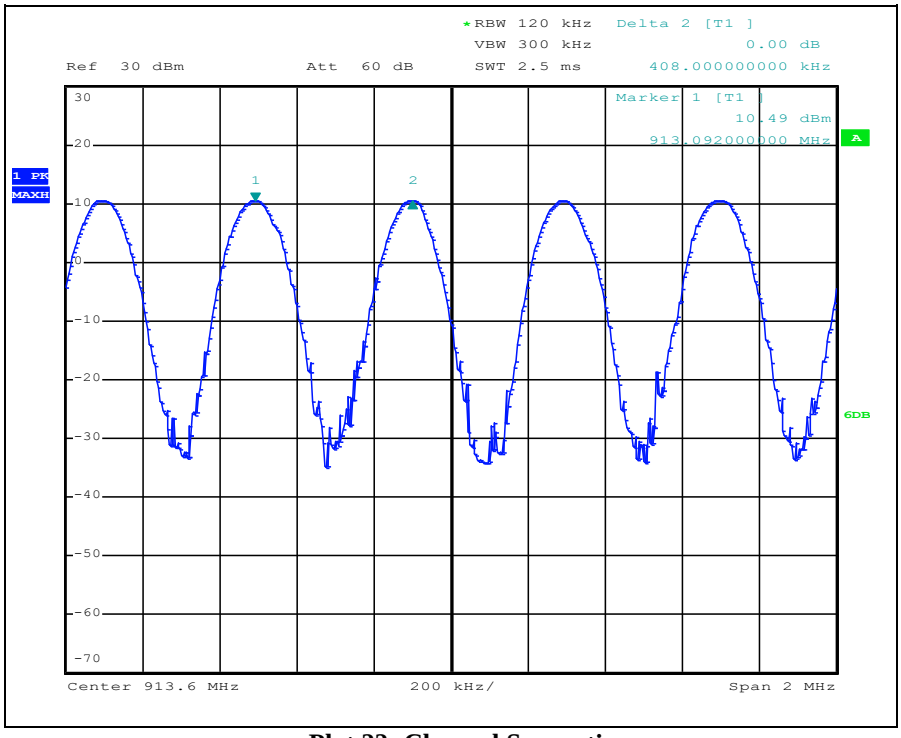
Modifications: No modification was required to comply for this test

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 22: Channel Separation

Table 9: Channel Separation

Modulation	Channel Separation kHz	Min Limit Either 20 dB Bandwidth kHz	Or 25 kHz	Results
FSK	408	20.2	25	Complies

3.10 Number of Hopping Channels

Date Performed: June 23, 2021

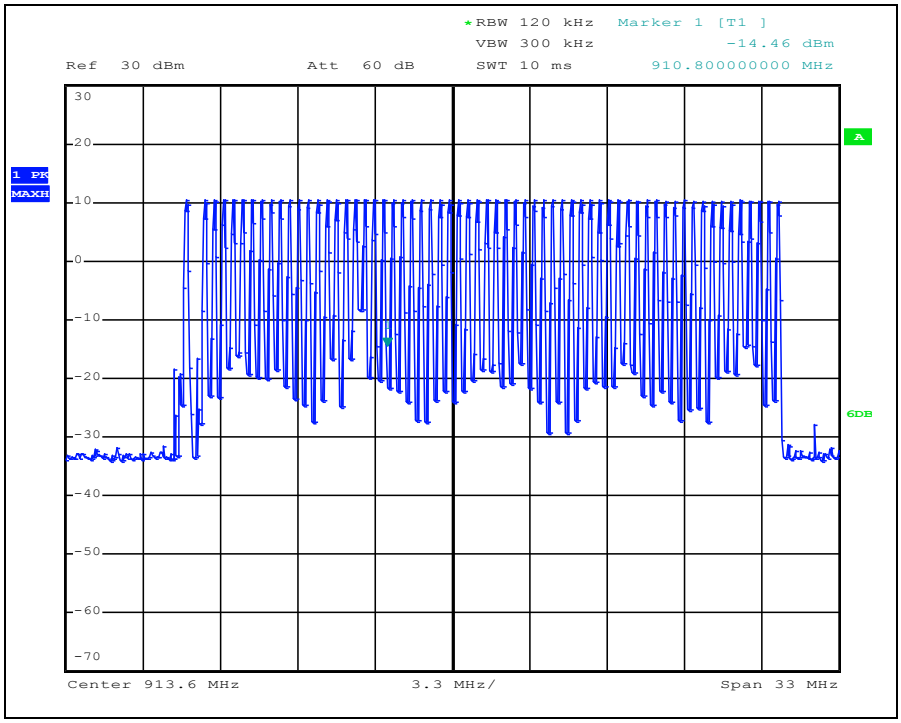
Test Standard: FCC Title 47 CFR Part 15: Subpart C - §15.247
RSS-247-Issue 2

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 23: The number of Hopping: 63

3.11 RF Exposure Evaluation

Date Performed: June 28,30, 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 10: Data of RF Peak Power Output

Carrier Frequency (MHz)	Raw Peak (dBm)	Antenna Gain dB	EIRP dBm (1)	Limit dBm	Margin dB	Results
902.2	10.87	0	10.87	30	19.13	Comply
914.9	10.8	0	10.8	30	19.2	Comply
927.7	10.69	0	10.69	30	19.31	Comply
Maximum @ 905.90	10.89	0	10.89	30	19.11	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 11: 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)
905.90	10.89	10.89	12.27439	2.007322088	3.0	7.5	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.

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 12: ISED RF Exposure

Carrier Frequency (GHz)	Peak Conducted Output Power (dBm)	EIRP (dBm)	EIRP (mW)	Limit 1-g SAR 14x5 (mW)	Limit 10-g SAR 14x2.5 (mW)	Result (1)
905.90	10.89	10.89	12.27439	60	30	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 13:

Temp (C)	Carrier Frequency (MHz)	Frequency reading (MHz)	Deviation (PPM)
-20	902.2	902.200	0.0
-10	902.2	902.202	2.2
0	902.2	902.202	2.2
10	902.2	902.200	0.0
20	902.2	902.200	0.0
30	902.2	902.200	0.0

Appendix A: TEST SETUP PHOTOS

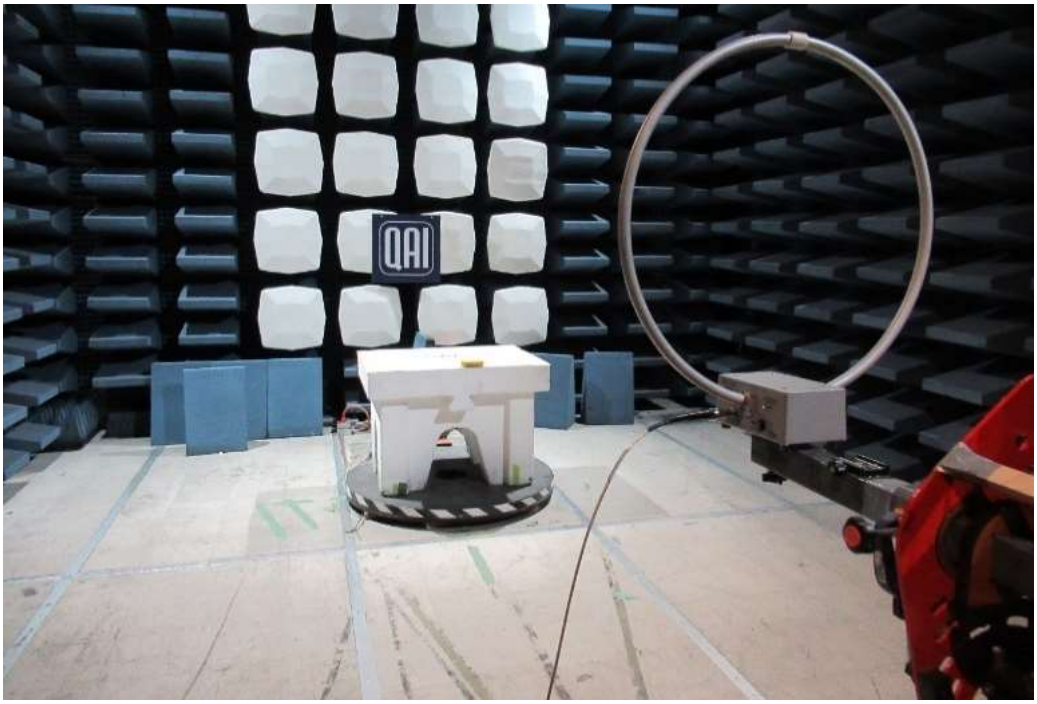


Figure 1: Radiated Emissions performed at the 3m SAC, 150kHz – 30MHz

Figure 2: Radiated Emissions 30MHz – 1GHz

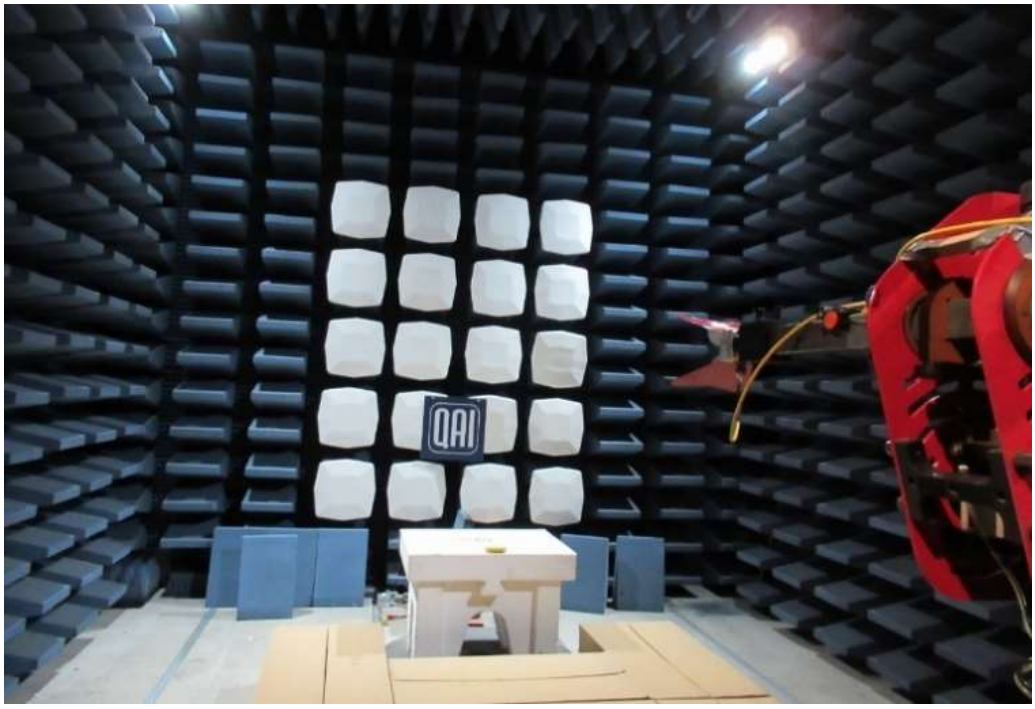


Figure 3: Radiated Emissions 1GHz to 18 GHz

Figure 4: Radiated Emissions 18GHz to 26 GHz

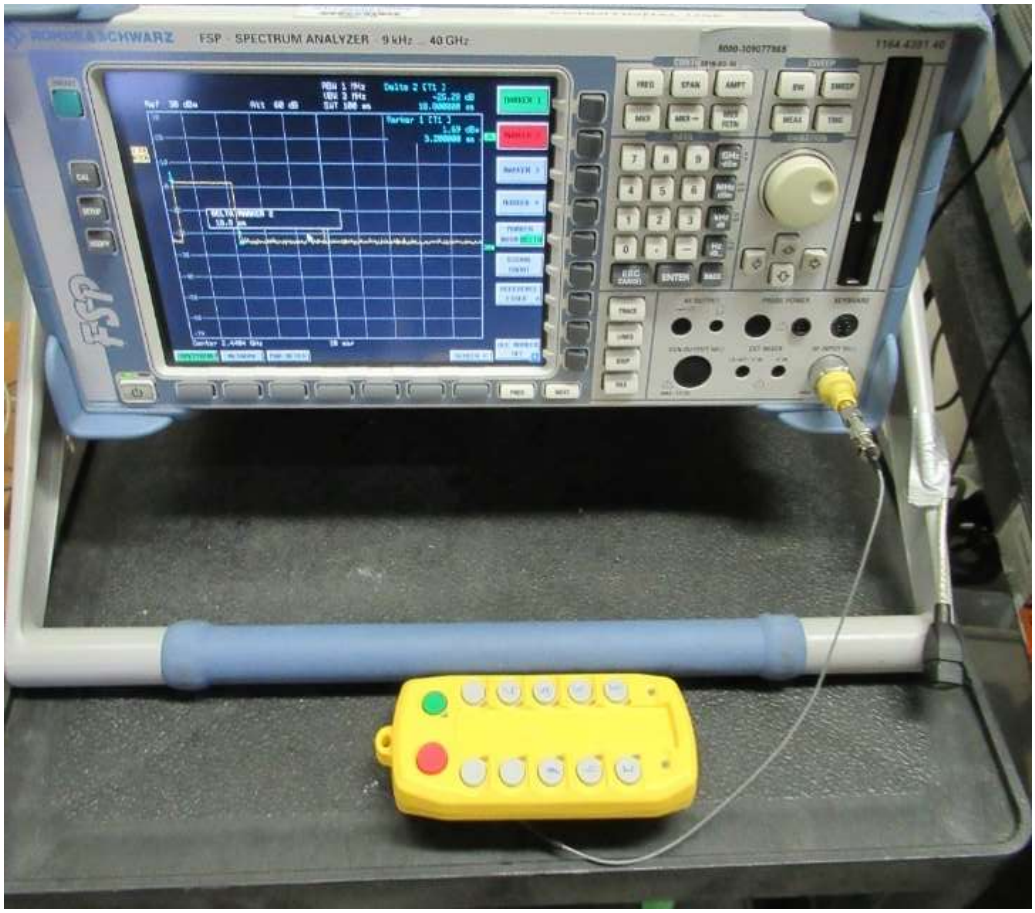


Figure 5: Radio Testing Station

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