INTENTIONAL RADIATOR (C2PC)
TEST REPORT

Report Reference Number:	E10783-2004_Douglas Lighting_BTM-RDR-A_**Rev-1.0**
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Laboratory Accreditations (per ISO/IEC 17025:2017)

CERT #3657.02

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Manufacturer:	**Douglas Lighting Controls**
Address:	280-3605 Gilmore Way, Burnaby, BC

Equipment Tested:	**Sensor & Controller**
Model Number(s):	BTM-RDR-A
FCC ID:	2AV38-BTMRDRA
IC ID:	25994-BTMRDRA
Contains FCC ID:	2ADDD-FFV580P02A
Contains IC ID:	21036-58GHZMOTION

REVISION HISTORY

Date	Report Number	Details	Author's Initials
February 17, 2021	E10783-2004_Douglas Lighting_BT-RDR-A_**Rev-1.0**	Final	RS
January 8, 2021	E10783-2004_Douglas Lighting_BT-RDR-A_**Rev-0.3**	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All previous versions of this report have been superseded by the latest dated revision as listed in the above table.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 20SH10261.

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

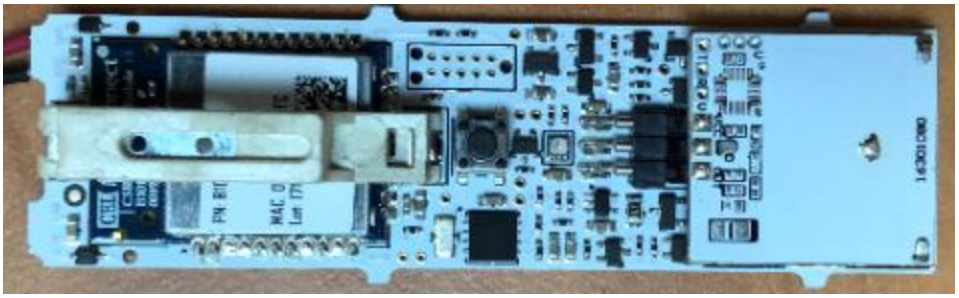
EMC Facility Burnaby BC, Canada

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.



EUT – BTM-RDR-A

Radio 1- 2.4GHz BT (C2PC, Antenna Change)

EUT	Sensor & Controller
FCC ID	2AV38-BTMRDRA
IC Number	25994-BTMRDRA
Manufacturer	Mesh Connect
Model No./HVIN	BTM-RDR-A
PMN	BTM-RDR-A
Frequency Range	2402-2480 MHz

Radio 2- 5.8GHz Microwave – No Change Made

EUT	Sensor & Controller
FCC ID	2ADDD-FFV580P02A
IC Number	21036-58GHZMOTION
Manufacturer	Sky Microwave
Frequency Range	5.8 GHz

Technical Specifications

CAPACITY/Performance	Configurations	One physical configuration; operating configuration set by mobile app
	RF Output Power	- 2.4GHz – 81dBuV @ 3m, measured at QAI
		- 5.8GHz- 85.1 dBuV/m @3m
Frequency BANDs	Supported Bands	2402MHz-2480MHz & 5725MHz-5875MHz
PROTOCOL SUPPORT	Signaling	GFSK
INTERFACES	Antenna Connectors	None
HARDWARE	Dimensions	75.0mm x 21.0mm (omitting tabs)
	Weight	0.25kg
	Input Voltage	12 VDC
	Power Consumption	0.4W
	Options	None
ENVIRONMENTAL	Temperature	-30 to +80C
	Humidity	Non-condensing
Antenna Gain	Simulation	+4.6 dBi

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	49.9 %
Atmospheric Pressure	101.2 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

Manufacturer	Model	Description	Serial No.	Calibration Due Date
AH Systems	PAM118	Amplifier 10KHz-18GHz	189	Conditional Use
EMCO	6502	Loop Antenna	6502	2021-Nov-13
ETS Lindgren	2165	Turntable	00043677	N/A
ETS Lindgren	2125	Mast	00077487	N/A
ETS Lindgren	S201	5-meter Semi-Anechoic Chamber	1030	N/A
Insulated Wire Inc.	SPS-1753-1140-SPS	Yellow cable, 3m	102395	N/A
Insulated Wire Inc.	SPS-1753-2400-SPS	Yellow cable, 6m	091096	N/A
Rohde & Schwarz	ESU40	EMI Receiver	100011	2023-Jul-05
Sunol Sciences	SM46C	Turntable	051204-2	N/A
Sunol Sciences	TWR95	Mast	TREML0001	N/A
Sunol Sciences	JB1	Biconilog Antenna 30MHz – 2GHz	A070209	2021-Aug-16
Sunol Sciences	DRH-118	Horn Antenna 1GHz-18GHz	A050905	2021-Mar-10
WEINSCHEL ENGINEERING	44	6db attenuator	665	N/A

Note: Equipment listed above have 1 years calibration interval.

Measurement Software List

Manufacturer	Model	Version	Description
Rhode & Schwarz	EMC 32	10.35.10	Emissions Test Software

Section II: EXECUTIVE SUMMARY OF STANDARDS AND LIMITS

2.1 Purpose

The purpose of this report is to demonstrate and document the compliance of "BTM-RDR-A" 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 20SH10261.

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*
Annex B.10 Bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz and 24-24.25 GHz

RSS-Gen Issue 5 – General Requirements and Information for the Certification of Radio Apparatus

ICES-003 Issue 6 – Information Technology Equipment (Including Digital Apparatus)
– Limits and Methods of Measurement

RSP-100 Issue 12 – Certification of Radio Apparatus and Broadcasting Equipment
–10.2 Class II Permissive Change to add new antenna type to BLE module.

2.3 Summary of Results

The following tests demonstrate the testimony to "FCC and ISED" Mark Electromagnetic compatibility testing for "BTM-RDR-A Sensor & Controller.

Test or Measurement	Applicable FCC and IC Standard	Performance Criteria
Antenna Requirement	FCC CFR 47 Part 15.203 RSS-Gen Issue 4	Comply
Intentional Radiated Emissions	FCC CFR 47 Part 15.247 FCC CFR 47 Part 15.209 FCC CFR 47 Part 15.205 RSS-Gen Issue 4	Comply
6 dB Occupied Bandwidth	FCC CFR 47 Part 15.247 RSS-247 Issue 2 RSS-Gen Issue 4	Comply
Band Edge	FCC CFR 47 Part 15.247 RSS-247 Issue 2	Comply
Unintentional Radiated Emissions or	FCC CFR 47 Part 15.209 (a) ICES-003 Issue 6 RSS-Gen Issue 4	Comply
RF Exposure Evaluation	FCC CFR 47 Part 1.131 RSS-Gen 3.4 RSS-102 Issue 5	Comply

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

This report demonstrates and documents compliance of "BTM-RDR-A" module with FCC ID: 2AV38-BTMRDRA and IC ID: 25994-BTMRDRA by Douglas Lighting Controls to CFR 47 FCC Part 15 Subpart C - 15.247, CFR 47 FCC Part 15 Subpart B, RSS-247 Issue 2 and ICES-003 Issue 6 for the purpose of a Class II Permissive Change (CIIPC) in accordance with additional reference KDBs. This CIIPC is required to allow addition of an alternate antenna type with similar or lower gain.

The "BTM-RDR-A" module will be installed in lighting fixture, it will use Bluetooth Low Energy (FCC ID: 2AV38-BTMRDRA and IC ID: 25994-BTMRDRA) for communication and 5.8 GHz microwave module for sensing motion.

Degradation of EMC parameters and are not allowed under a CIIPC. Any increase in the fundamental emission for output power rated devices or increase in maximum output power rating requires a new grant of certification (i.e., new FCC ID). A spurious emission increase of up to 3 dB from the original authorization is allowed if the emission level is compliant.

2.4 Reference Standards

The following standards are included as normative references.

ANSI C63.4-2014 – American National Standard For Methods Of Measurement Of Radio-Noise Emissions From Low-Voltage Electrical And Electronic Equipment In The Range Of 9 KHz To 40 GHz

ANSI C63.10-2013 – American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

KDB 178919 D01 v06 – Permissive Change Policy

KDB 412172 D01 v01r01 – Determining ERP and EIRP

FCC KDB 447498 D01: v06 – General RF Exposure Guidance

- 7.2 – Transmitter used in mobile device exposure conditions for simultaneous transmission operations

Note: MPE Calculation only for simultaneous transmission. This line item does not include any test time.
If testing is required a separate quote will be provided.
This quote does not include any SAR testing or an MPE compliance evaluation by measurement or computational modelling

Section III: DATA & TEST RESULTS

3.1 Antenna Requirements

Date Performed: December 10, 2020

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

Test Method: ANSI C63.10:2013

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
FCC CFR 47 Part 15.203 & RSS-Gen Issue 5:

"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: The antenna was soldered to the circuit board and was not accessible to the end-user. No other modification was required to comply for this test

Final Result: .

EUT meets antenna requirement.

3.2 Intentional Radiated Emissions

Date Performed: December 10, 2020 & February 17, 2021

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

Test Method: ANSI C63.10

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
902-928	50	94	500	54
2400-2483.5	50	94	500	54
5725-5875	50	94	500	54
24.0-24.25	250	108	2500	68

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 7 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.

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 radiated emissions procedure was followed to demonstrate the compliance of Bluetooth low energy.

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

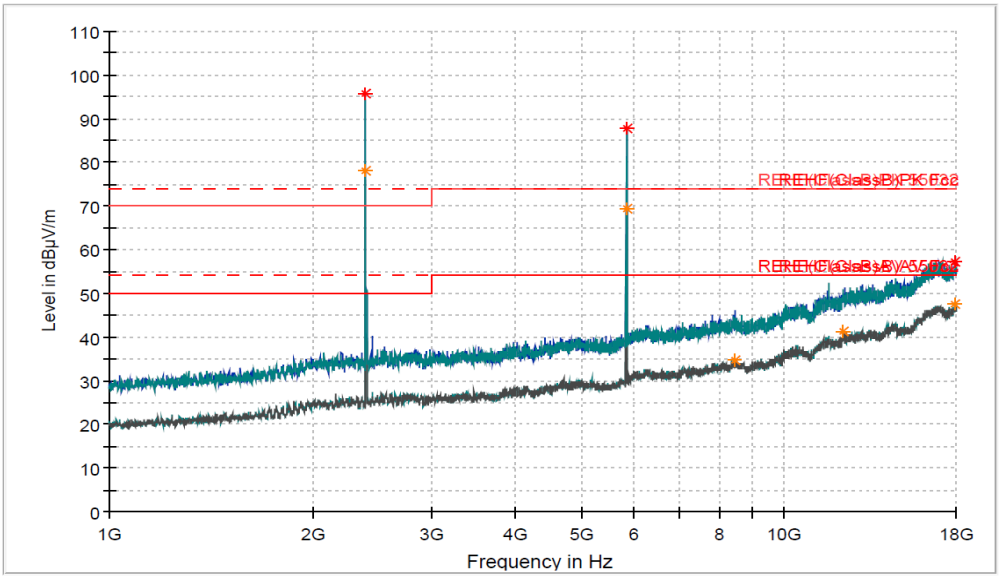
Final Result: The EUT complies with the applicable standard.

Measurement Data and Plot:

Mode 1 & Mode 7, TX 2402MHz – On & 5.8GHz – On

Data of Field Strength of Fundamental Frequency

Frequency MHz	Peak (dBuV/m)	AVG (dBuV/m)	Correction Factor (dB)	Peak Limit (dBuV/m)	Peak Margin (dB)	AVG Limit (dBuV/m)	AVG Margin (dB)	Antenna Pol	Antenna Height (m)	Azimuth (Deg)
2400.8	95.90		-1.2	114	18.1			H	1.5	0
		78.36	-1.2			94	15.64	H	1.5	0



TX Mode (Low Channel)– Radiated Emissions: 1GHz-18GHz

In addition, radiated emissions which fall within restricted bands must comply with the restricted band limit. Within the 2400-2483.5 MHz band, the adjacent restricted bands at 2310-2390 MHz and 2483.5-2500 MHz were examined if applicable.

For conducted measurements above 1000 MHz within the restricted bands, the EIRP (dBm) shall be measured and then field strength E (dBuV/m) shall be calculated (see KDB Publication 789033 D02).

Power (dBuV/m) at 3m = EIRP (dBm)-20log d(m) + 104.77 + A(dB)

Where: E = field strength d = distance at which field
d = strength limit is specified in the rules A[dB]
A(dB) = 2TX CDD Directional Gain (Beamforming) in excess of 6 dBi

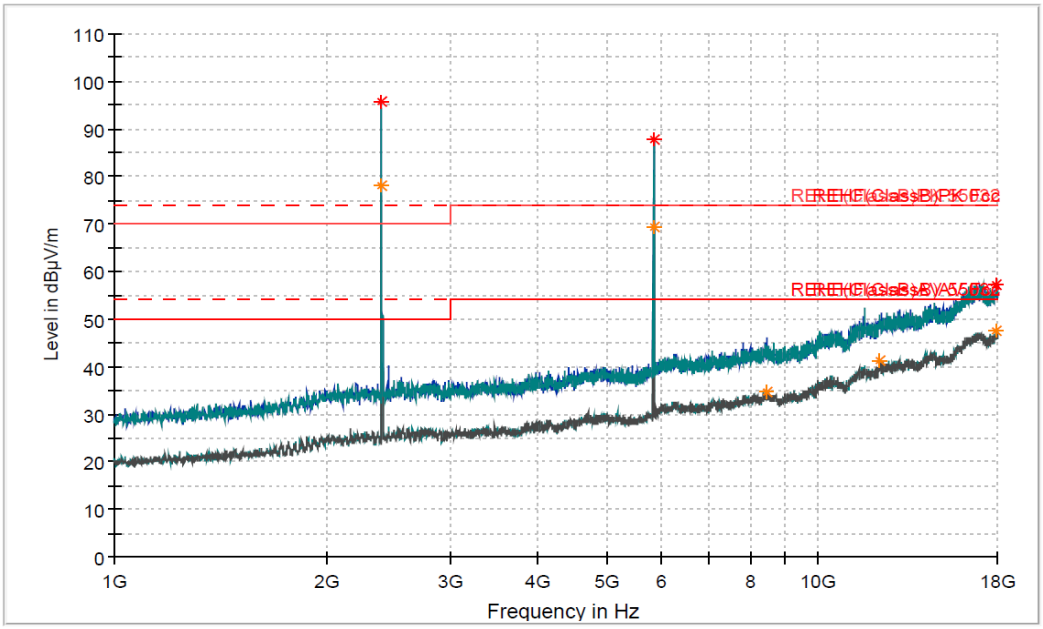
95.90 = EIRP (dBm)-9.5+104.8
P(dBm) = -104.8+9.5+95.90
EIRP (dBm) = 0.60 dBm

Note: All Peak (74dBuV/m) & Average (54dBuV/m) harmonics were well below the limit line.

Mode 2 & Mode 8, TX 2440MHz – On & 5.8GHz – On

Data: Field Strength of Fundamental Frequency

Frequency MHz	Peak (dBuV/m)	AVG (dBuV/m)	Correction Factor (dB)	Peak Limit (dBuV/m)	Peak Margin (dB)	AVG Limit (dBuV/m)	AVG Margin (dB)	Antenna Pol	Antenna Height (m)	Azimuth (Deg)
2440	94.79		-1.0	114	19.21			H	2.0	0
		81.07	-1.0			94	12.93	H	2.0	0



TX Mode (Mid Channel)– Radiated Emissions: 1GHz-18GHz

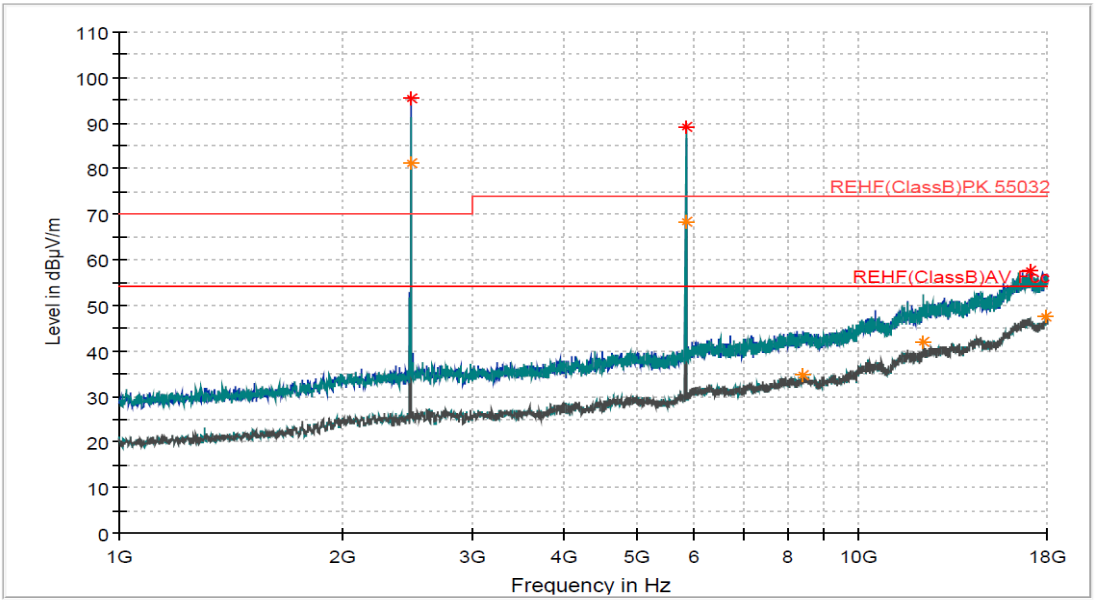
Power at 3m = P(dBm)-20logd(m)+104.8
94.79 =EIRP (dBm)-9.5+104.8
P(dBm) = -104.8+9.5+94.79
P(dBm) = -0.51 dBm

Note: All Peak (74dBuV/m) & Average (54dBuV/m) harmonics were well below the limit line.

Mode 3 & Mode 9, TX 2480MHz – On & 5.8GHz – On

Data: Field Strength of Fundamental Frequency

Frequency MHz	Peak (dBuV/m)	AVG (dBuV/m)	Correction Factor (dB)	Peak Limit (dBuV/m)	Peak Margin (dB)	AVG Limit (dBuV/m)	AVG Margin (dB)	Antenna Pol	Antenna Height (m)	Azimuth (Deg)
2480	95.63		-0.9	114	18.37			H	2.0	0
		81.31	-0.9			94	12.69	H	1.0	344



TX Mode (High Channel)– Radiated Emissions: 1GHz-18GHz

Power at 3m = P(dBm)-20logd(m)+104.8
95.63 =EIRP (dBm)-9.5+104.8
P(dBm) = -104.8+9.5+95.63
P(dBm) = 0.33 dBm

Note: All Peak (74dBuV/m) & Average (54dBuV/m) harmonics were well below the limit line.

3.3 Occupied Bandwidth

Date Performed: December 15, 2020

Test Standard: FCC CFR 47 Part 15.247
RSS-247 Issue 2

Test Method: ANSI C63.10

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

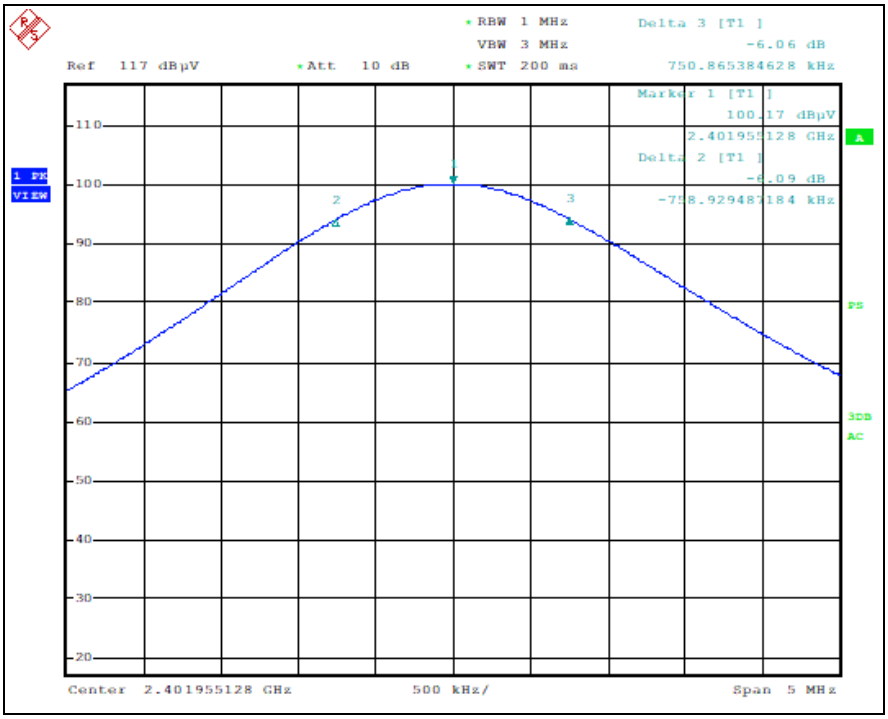
Modifications: No modification was required to comply for this test.

Final Result: The EUT complies with the applicable standard.

Measurement Data and Plot:

Data: 6dB Occupied Bandwidth

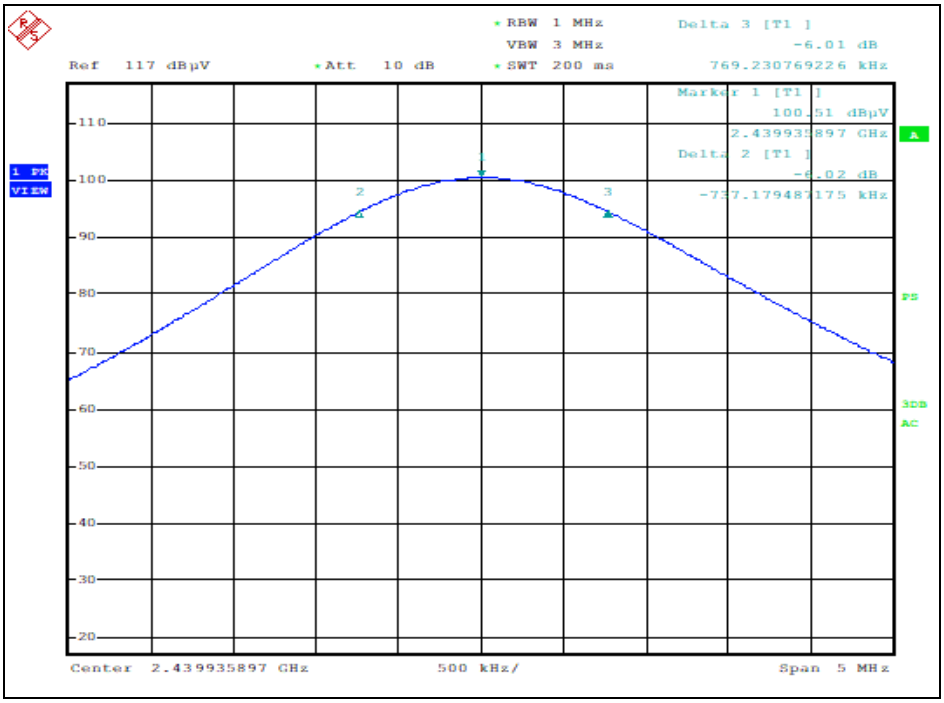
Frequency (MHz)	OBW (MHz)
2402	1.5



Plot: 6dB Occupied Bandwidth of Low Channel

Data: 6dB Occupied Bandwidth

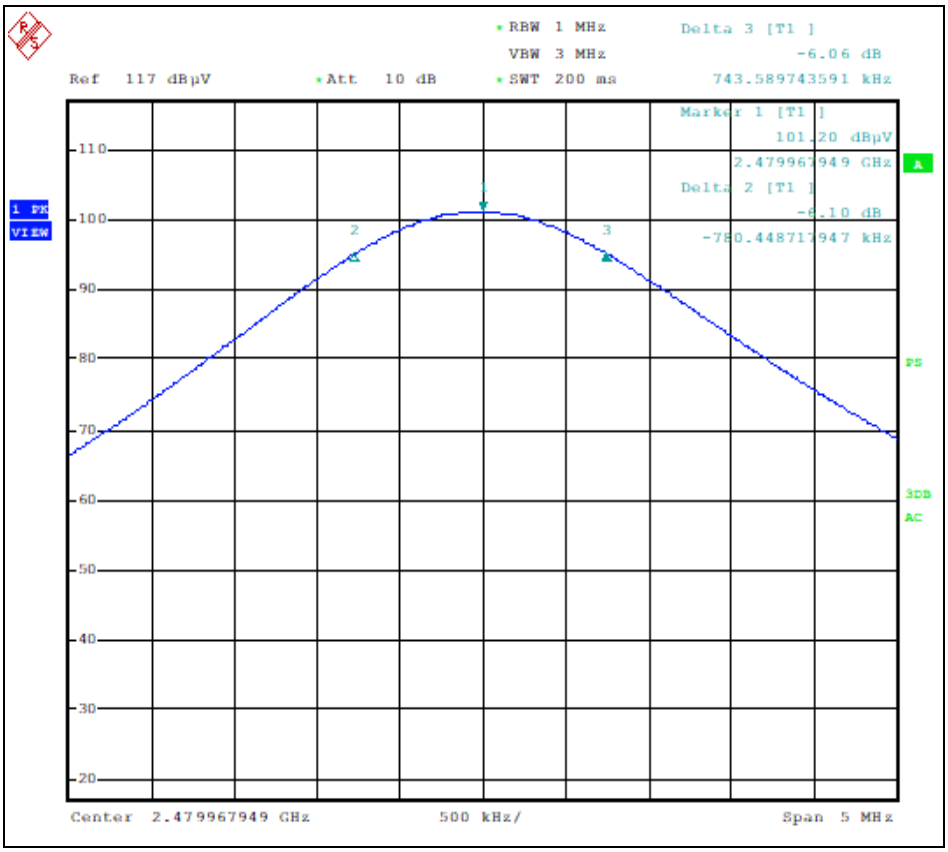
Frequency (MHz)	OBW (MHz)
2440	1.5



Plot: 6dB Occupied Bandwidth of Mid Channel

Data: 6dB Occupied Bandwidth

Frequency (MHz)	OBW (MHz)
2480	1.52



Plot: 6dB Occupied Bandwidth of High Channel

3.4 Band Edge

Date Performed: December 15, 2020

Test Standard: FCC CFR 47 Part 15.247
RSS-247 Issue 2

Test Method: ANSI C63.10

Test Requirement:

As per §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.

As per RSS-247 Issue 2:

Emissions radiated outside of the specified frequency bands, except for harmonic emissions, shall be attenuated by at least 50 dB below the level of the fundamental emissions or to the general field strength limits specified in RSS-Gen, whichever is less stringent.

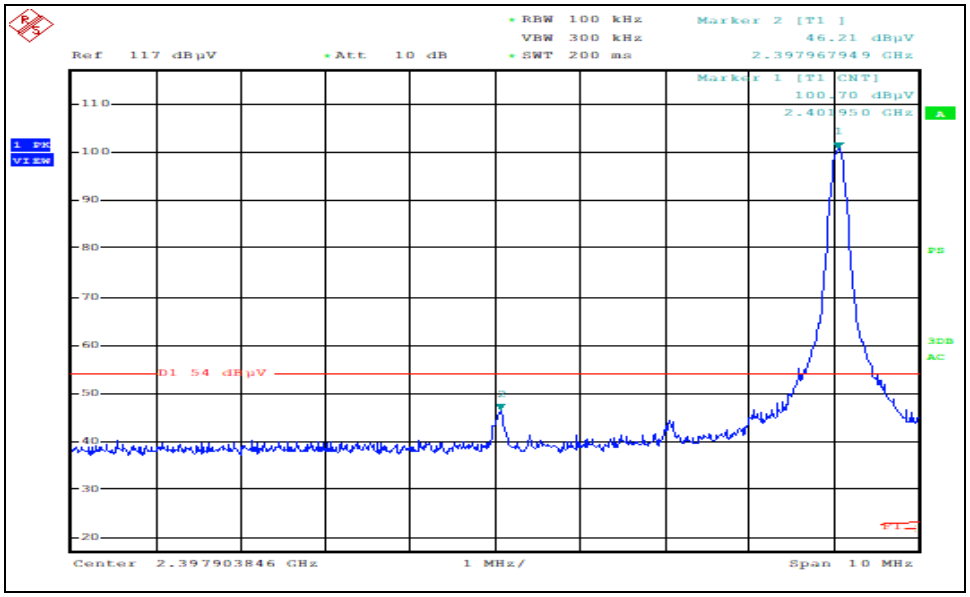
Measurement Method:

The measurement method used was Section 6.10.6.2 Marker-delta Method of ANSI C63.10standard.

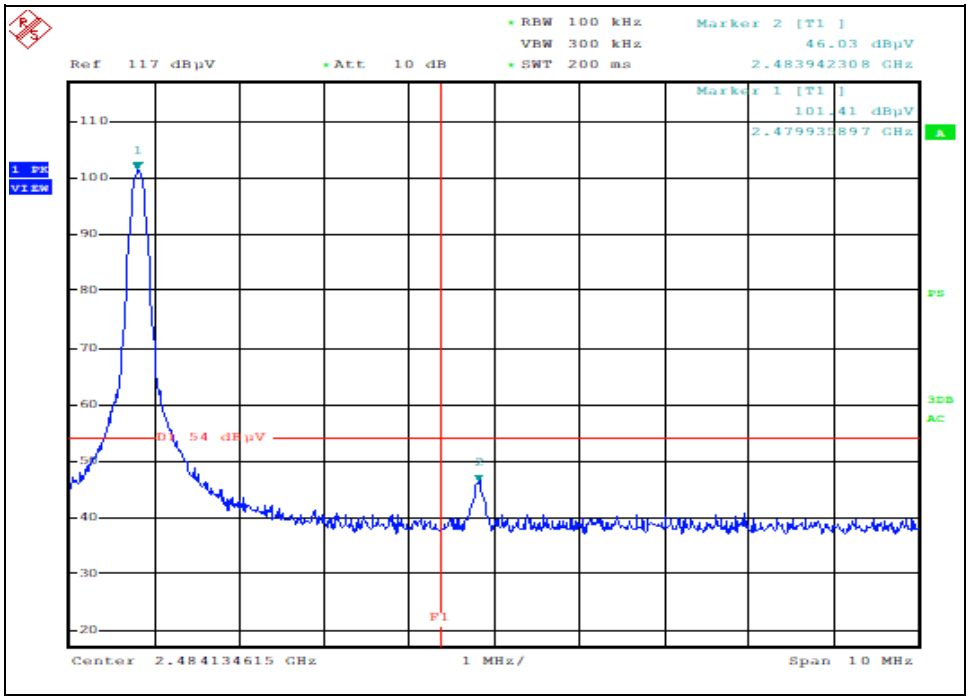
Modifications: No modification was required to comply for this test.

Final Result: The EUT complies with the applicable standard.

Measurement Data and Plot:



Band edge, Low side



Band edge, High side

3.5 Unintentional Radiated Emissions

Date Performed: December 10, 2020

Test Standard: FCC CFR 47 Part 15.209
CFR Title 47 FCC Part 15 - Radio Frequency Devices, Subpart B
ICES-003 Issue 6
RSS-Gen Issue 5

Test Method: ANSI C63.4

Test Requirement:

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20 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
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 table top 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

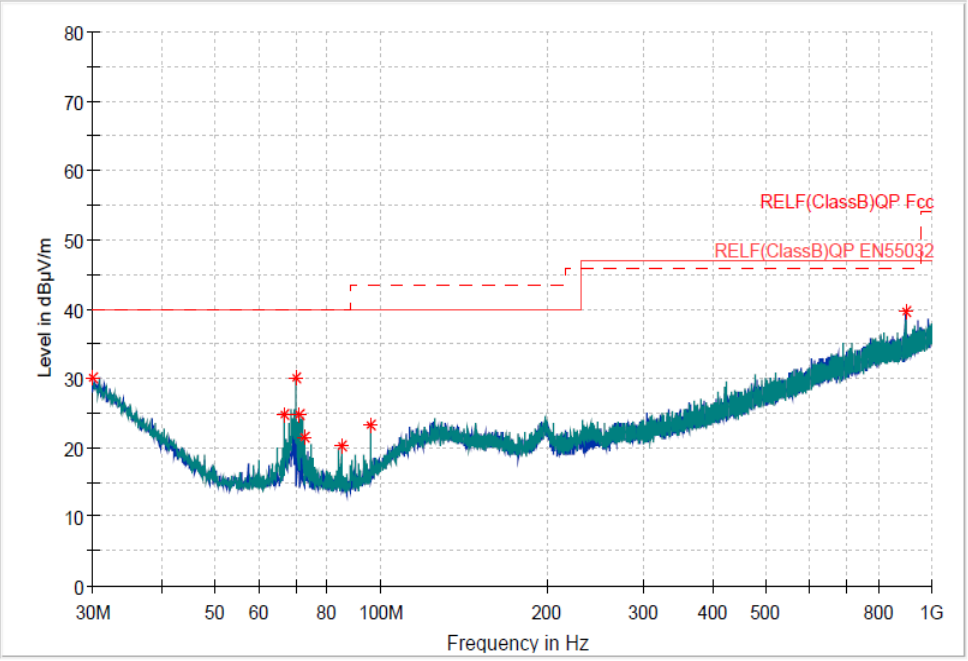
Where ATOT is total correction factor including cable loss, antenna factor and preamplifier gain (ATOT = LCABLES + AF - AMP).

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

Final Result: The EUT complies with the applicable standard.

Measurement Data and Plot:

Mode 1 & Mode 7, TX 2402MHz – On & 5.8GHz – On

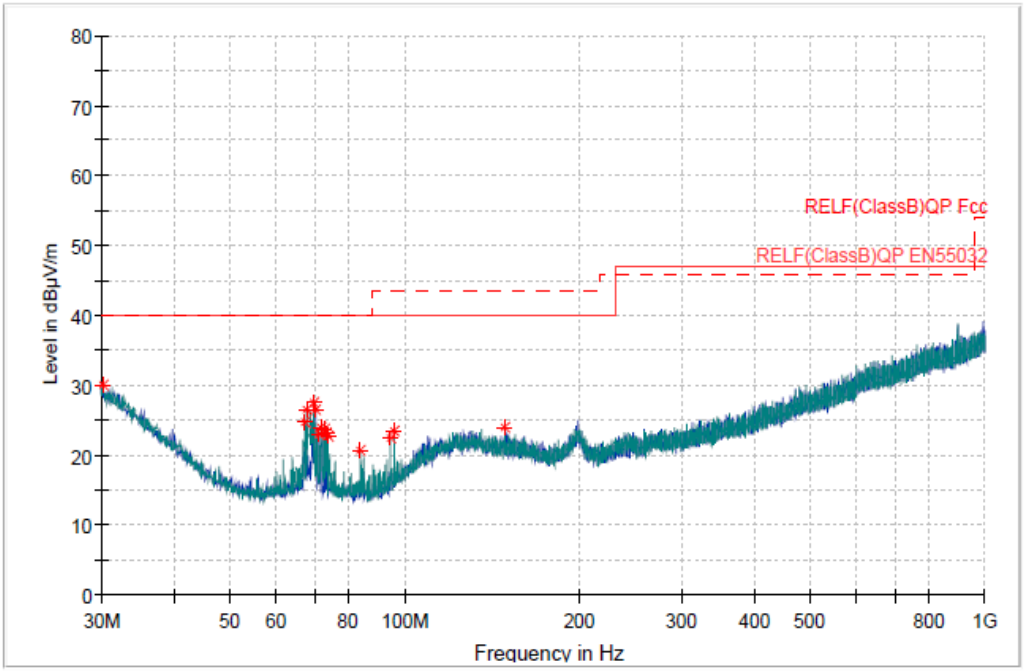


Unintentional Radiated Emissions: 30-1000MHz

Frequency (MHz)	Max Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.0000	30.12	40.0	9.88	400.0	H	61	26.7
66.7630	24.65	40.0	15.35	250.0	V	236	13.3
70.1580	30.05	40.0	9.95	300.0	V	140	13.4
71.1280	24.67	40.0	15.33	250.0	V	154	13.4
72.7770	21.52	40.0	18.48	200.0	V	0	13.4
84.8050	20.14	40.0	19.86	400.0	V	217	12.9
95.9600	23.22	40.0	16.78	150.0	V	314	14.4
896.0160	39.67	47.0	7.33	200.0	H	269	30.7

Plots above 1GHz are similar to section 3.2 (Intentional Radiated Emissions)

Mode2, Tx-2440MHz – On

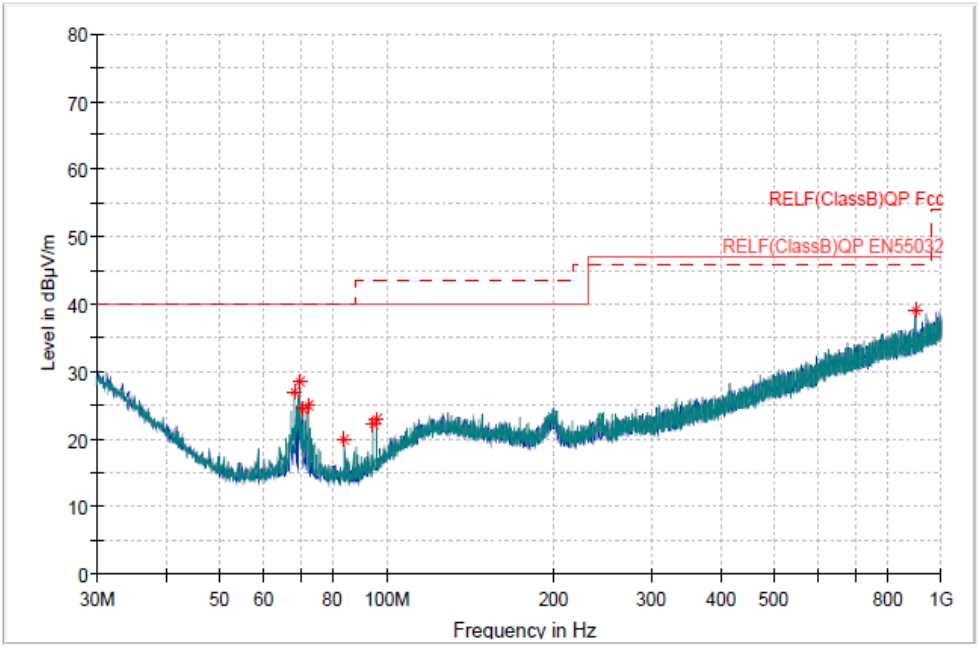


Unintentional Radiated Emissions: 30-1000MHz

Frequency (MHz)	Max Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.1940	30.16	40.0	9.84	250.0	V	116	26.5
67.1510	24.77	40.0	15.23	300.0	V	239	13.3
67.6360	26.59	40.0	13.41	100.0	V	260	13.3
69.7700	27.47	40.0	12.53	300.0	V	86	13.4
70.1580	26.48	40.0	13.52	350.0	H	61	13.4
71.2250	23.02	40.0	16.98	350.0	H	328	13.4
71.9040	23.97	40.0	16.03	200.0	V	0	13.4
72.6800	23.81	40.0	16.19	100.0	V	0	13.4
73.1650	23.27	40.0	16.73	150.0	V	0	13.4
73.6500	22.76	40.0	17.24	200.0	V	26	13.4
83.9320	20.73	40.0	19.27	200.0	V	26	12.9
94.5050	22.46	40.0	17.54	100.0	V	38	14.0
95.9600	23.55	40.0	16.45	100.0	V	271	14.4
148.3400	24.00	40.0	16.00	350.0	V	134	18.6

Plots above 1GHz are similar to section 3.2 (Intentional Radiated Emissions)

Mode 3, 2480MHz



Frequency (MHz)	Max Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
68.2180	26.99	40.0	13.01	150.0	V	260	13.3
69.5760	28.55	40.0	11.45	300.0	V	229	13.4
70.6430	24.47	40.0	15.53	350.0	H	0	13.4
72.0010	24.88	40.0	15.12	150.0	V	0	13.4
83.9320	20.02	40.0	19.98	150.0	V	0	12.9
94.5050	22.16	40.0	17.84	100.0	V	17	14.0
95.9600	22.84	40.0	17.16	150.0	V	316	14.4
896.0160	39.18	47.0	7.82	200.0	H	20	30.7

Plots above 1GHz are similar to section 3.2 (Intentional Radiated Emissions)

3.6 RF Exposure Evaluation

Date Performed: February 17, 2021

Test Standard: FCC CFR 47 Part 1.131
RSS-Gen 3.4
RSS-102.4

Test Method: ANSI C63.10:2013

This requirement ensures the Equipment Under Test (EUT) complies with the RF exposure requirements of CFR 47 FCC Part 1.131, and RSS-Gen 3.4, RSS-102 4.
FCC Part 1.1310 defines radio frequency radiation exposure limits for General Population/Uncontrolled Exposure within frequency range 1500 - 100,000 MHz: as 1.0 mW/cm^2.

RSS-102 Section 2.5.2 defines RF exposure evaluation as required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates at or above 300 MHz and below 6 GHz , the source-based, time-averaged maximum EIRP of the device is equal to or less than 1.31 x 10-2 *f*^0.6834 W (adjusted for tune-up tolerance), where *f* is in MHz.
In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the EIRP was derived. RSS-102 Issue 5 Annex A 9(d) was used to report the evaluation data.

RF exposure, (power density) is calculated using the following formula.

Power Density (mW/cm^2) = EIRP (mW) / (4 * PI * r^2)

RF Exposure Limits

Band	Worst-Case (Lowest) Frequency in Band (MHz)	RSS-102-2.5.2 Power Density Limit at 20 cm (mW/cm^2)	CFR 47 FCC 1.1310 Power Density Limit at 20 cm (mW/cm^2)
2G4	2400	2.7	1.0

RF Exposure Evaluation

Band	Highest Measured Peak (dBuV/m)	Highest Calculated EIRP (dBm)	Highest Calculated EIRP (mW)	Power Density at 20 cm (mW/cm^2)
2.4GHz	95.90	0.60	1.15	0.000229
5.8GHz	90.81	-4.49	0.356	0.000071

In all cases, the Power Density reported is significantly less than the applicable limits.

The measurements and calculations for RF Exposure were performed on March 25, 2019 and the EUT complies with CFR 47 FCC Part 1.131, and RSS-Gen 3.4, RSS-102 4.

Appendix A: TEST SETUP PHOTOS

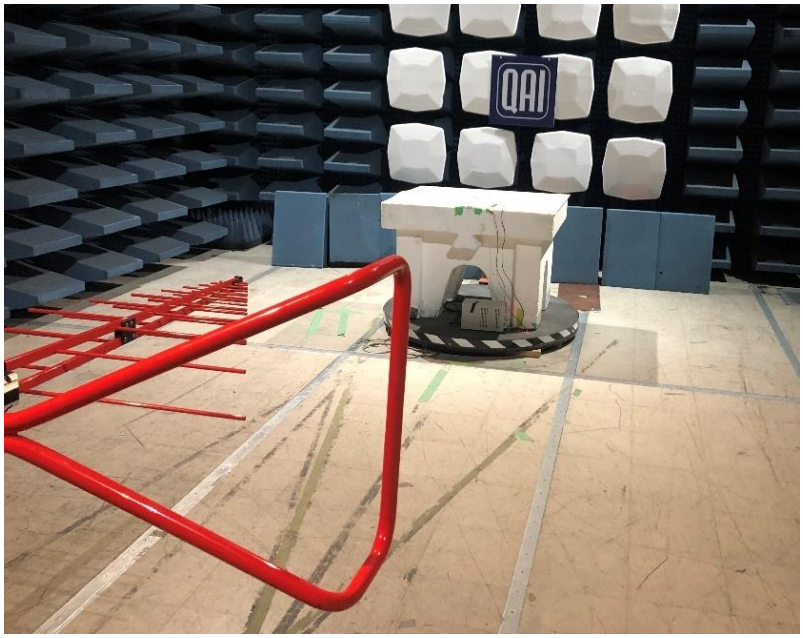


Figure 1: Radiated Emissions 30MHz – 1GHz

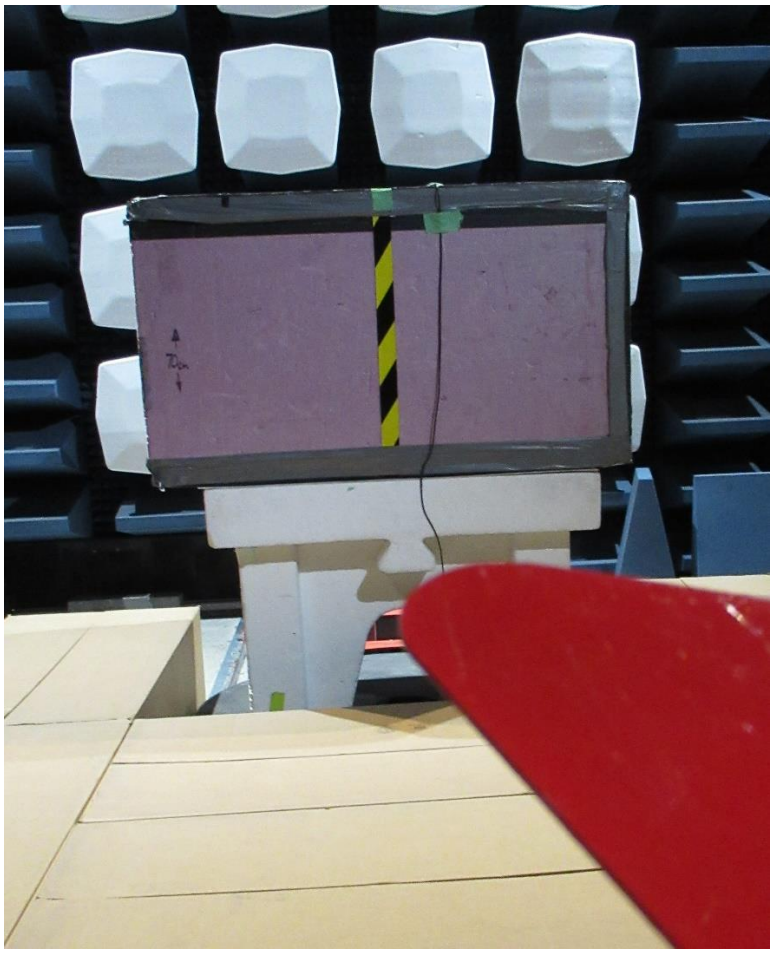


Figure 2: Radiated Emissions above 1GHz

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
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