RHEIN TECH LABORATORIES, INC.

Engineering Solutions & Electromagnetic Compatibility Services

Modular Approval Certification Application Report
FCC Part 15.249 & ISED RSS-210

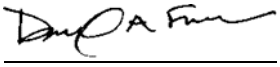
Test Lab:	Applicant:
Rhein Tech Laboratories, Inc. 360 Herndon Parkway Tel: 703-689-0368 Suite 1400 www.rheintech.com Herndon, VA 20170 (USA) Email: atcbinfo@rheintech.com	Alarm.com 8281 Greensboro Drive Tel: 703-584-7319 Suite 100 www.alarm.com Tysons, VA 22102 (USA)

Model/HVIN	ADC-480Q	**Test Report Date**	February 18, 2022
FCC ID	YL6-143480Q	**RTL Work Order #**	2021144
IC	9111A-143480Q	**RTL Quote**	QRTL21-144B

American National Standard Institute	ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
FCC Classification	DXT Part 15 Low Power Transceiver
FCC Rule Part(s)/ Guidance	FCC 15.249: Operation within the bands 902 – 928 MHz, 2400.0 – 2483.5 MHz, 5725 – 5875 MHz, and 24.00 – 24.25 GHz (10-01-20)
ISED Canada	RSS-210 Issue 10: Licence-Exempt Radio Apparatus: Category I Equipment (12-2019) RSS-Gen Issue 5: General Requirements for Compliance of Radio Apparatus with Amendment 1 and Amendment 2 (02-2021)

Frequency (MHz)	Output Power (mW)	Frequency Tolerance (%)	Emission Designator
908.4	N/A	N/A	112KF1D
916.0	N/A	N/A	112KF1D

I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this test report. No modifications were made to the equipment during testing to achieve compliance with these standards. Furthermore, there was no deviations from, additions to, or exclusions from, the applicable parts of ANSI 63.10, FCC Part 2, FCC Part 15, ISED RSS-210, and ISED RSS-Gen.

Signature:  Date: February 18, 2022

Type/Printed Name: Desmond A. Fraser Position: President

This report may not be reproduced, except in full, without the written approval of Rhein Tech Laboratories, Inc. and Alarm.com. The test results relate only to the item(s) tested. Replaces R2.2.

These test(s) are accredited under Rhein Tech Laboratories, Inc. ISO/IEC 17025 accreditation issued by ANAB. Refer to certificate and scope of accreditation AT-1445.

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1 General Information

1.1 Scope

This is an original FCC and ISED modular approval certification application request.

Applicable standards:

- FCC Part 15.249: Operation within the bands 902 – 928 MHz, 2400.0 – 2483.5 MHz, 5725 – 5875 MHz, and 24.00 – 24.25 GHz
- ISED RSS-210 Issue 10: Licence-Exempt Radio Apparatus: Category I Equipment
- ISED RSS-Gen Issue 5: General Requirements for Compliance of Radio Apparatus

1.2 Description of EUT

Equipment Under Test	Rev4.8 module
Model/HVIN	ADC-480Q
Input Power Rating	12 VDC Adapter
Modulation Type	FSK, GFSK
Frequency Ranges	908.4 MHz, 916.0 MHz
Antenna Type	Copper wire antennas (SEM, Concord and XT)

1.3 Test Facility

The open area test site (OATS) and conducted measurement facility used to collect the conducted and radiated data is located on the parking lot of Rhein Tech Laboratories, Inc., 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170 (USA).

1.4 Related Submittal(s)/ Grant(s)

This is an original certification application for Modular Approval for Alarm.com.

1.5 Modification(s) to EUT

No modification(s) was/were made to the EUT to achieve compliance.

1.6 Deviation(s) from Standard(s)

No deviation(s) from test method(s) and/ or standard(s).

1.7 Acronyms Used in this Document

AVG - Average
LISN - Line Impedance Stabilization Network
OBW - Occupied Channel Bandwidth
PK - Peak
QPK - Quasi-Peak
SCF - Site Correction Factor

2 Test Information

2.1 Exercising the EUT

The EUT was provided power through its 12 VDC adapter and adapter board.

For the Z-Wave measurements, the EUT was connected to a laptop with a cable provided by Alarm.com to configure the Z-Wave properties.

For unintentional emissions testing, the EUT was connected to a DHCP router via Ethernet cable and adapter cable provided by Alarm.com. A laptop was also connected to the router via Ethernet cable. The laptop was set to continuously ping the EUT.

For all tests, the EUT was operated in its most EMC-sensitive configuration, and GFSK was found to be the worst-case modulation and was the modulation used for the testing presented in this report.

2.2 Description of Test Mode(s)

In accordance with FCC Part 15.31(m), the following frequencies were tested:

Table 2-1: Test Frequencies

Channel (#)	Frequency (MHz)
1	908.4
2	916.0

Note: EUT was set to transmit at 100% duty cycle

2.3 Test Result Summary

Table 2-2: Test Result Summary

Test	FCC Reference	ISED Reference	Result
AC/DC Conducted Emissions	Part 15.207	RSS-Gen 8.8	PASS
Radiated Emissions	Part 15.209	RSS-Gen 8.9/8.10	PASS
Field Strength of Fundamental and Harmonics	Part 15.249(a)	RSS-210 B.1	PASS
Occupied Channel Bandwidth: 99%	N/A	RSS-Gen 6.7	PASS

2.4 Test System Details

The test sample(s) were received on November 19, 2021. The FCC identifiers for all applicable equipment and cable descriptions used in the tested system, are identified in the following table.

Note also that the ADC-480Q can contain the following cellular module and transmit simultaneously. Radiated emissions were investigated with both transmitters transmitting simultaneously and all emissions were compliant.

FCC ID: XMR202007BG95M6
IC: 10224A-2020BG95M6

FCC ID: XMR201909EG91NAX
IC: 10224A-2019EG91NAX

Table 2-3: EUT Module Variants

EUT Module	Modularly Approved Cellular Module	Z-Wave Antenna	DC Regulator
Variant 1	Quectel BG95-M6 Cat M1	SEM	DCR1
Variant 2			DCR2
Variant 3		Concord	DCR1
Variant 4		XT	DCR1
Variant 5	Quectel EG91-NAX, Cat 1	SEM	DCR1
Variant 6		Concord	DCR1
Variant 7		XT	DCR1

Table 2-4: Equipment Under Test

RTL Barcode	Part	Manufacturer	Model	Serial Number	FCC ID	Cable Description
23968	Rev4.8 Board	Alarm.com	Variant 1	N/A	YL6-143480Q	Unshielded I/O/Power
23969	Rev4.8 Board	Alarm.com	Variant 2	N/A	YL6-143480Q	Unshielded I/O/Power
23970	Rev4.8 Board	Alarm.com	Variant 3	N/A	YL6-143480Q	Unshielded I/O/Power
23971	Rev4.8 Board	Alarm.com	Variant 4	N/A	YL6-143480Q	Unshielded I/O/Power
23924	Power Adapter Board	Alarm.com	ADC-95-500020-000B-A-01	N/A	N/A	Unshielded Power
23925	Primary Cell Antenna	Alarm.com	N/A	N/A	N/A	N/A
23965	AC Adapter	TRIAD	WSU120-3000	N/A	N/A	N/A

Table 2-5: Auxiliary Equipment

RTL Barcode	Part	Manufacturer	Model	Serial Number	Cable Description
N/A	Router	NETGEAR	WNR2000	N/A	Unshielded I/O/ Power
N/A	Laptop	Hewlett Packard	Envy	N/A	Shielded I/O Unshielded Power

3 Conducted Emissions – FCC Part 15.207; ISED RSS-Gen 8.8

3.1 Conducted Emissions Test Procedure

The powerline conducted emissions measurement were performed in a Series 81 Type shielded enclosure manufactured by Rayproof. The EUT was assembled on a wooden table 80 cm high. Power was fed to the EUT through a 50 Ω/ 50 µH Line Impedance Stabilization Network (LISN). The EUT LISN was fed power through an AC filter box on the outside of the shielded enclosure. The filter box and EUT LISN housing are bonded to the ground plane of the shielded enclosure. A second LISN, the peripheral LISN, provides isolation for the EUT test peripherals. This peripheral LISN was also fed AC power. A metal power outlet box, which is bonded to the ground plane and electrically connected to the peripheral LISN, powers a DC power supply which powers the EUT.

The spectrum analyzer (SA) was connected to the AC line through an isolation transformer. The 50 Ω output of the LISN was connected to the SA input through a Solar 100 kHz high-pass filter. The filter is used to prevent overload of the SA from noise below 100 kHz. Conducted emission levels were measured on each current-carrying line with the SA operating in the CISPR quasi-peak (QPK) mode or peak (PK) mode if applicable.

The SA's 6 dB bandwidth was set to 9 kHz. Video bandwidth (VBW) filter less than 10 times the resolution bandwidth (RBW) is not used. Average (AVG) measurements are performed in linear mode using a 10 kHz RBW, 1 Hz VBW, and by increasing the sweep time in order to obtain a calibrated measurement. The emission spectrum was scanned from 150 kHz to 30 MHz. The highest emission amplitudes relative to the appropriate limits were measured and recorded.

3.2 Conducted Emissions Limits

Table 3-1: Conducted Emissions Limits per FCC Part 15.207 and RSS-Gen 8.8

Frequency (MHz)	QPK (dBµV)	AVG (dBµV)
0.15 – 0.50	66 – 56	56 – 46
0.5 – 5.0	56	46
5 – 30	60	50

3.3 Measurement Uncertainty

Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor k = 2.

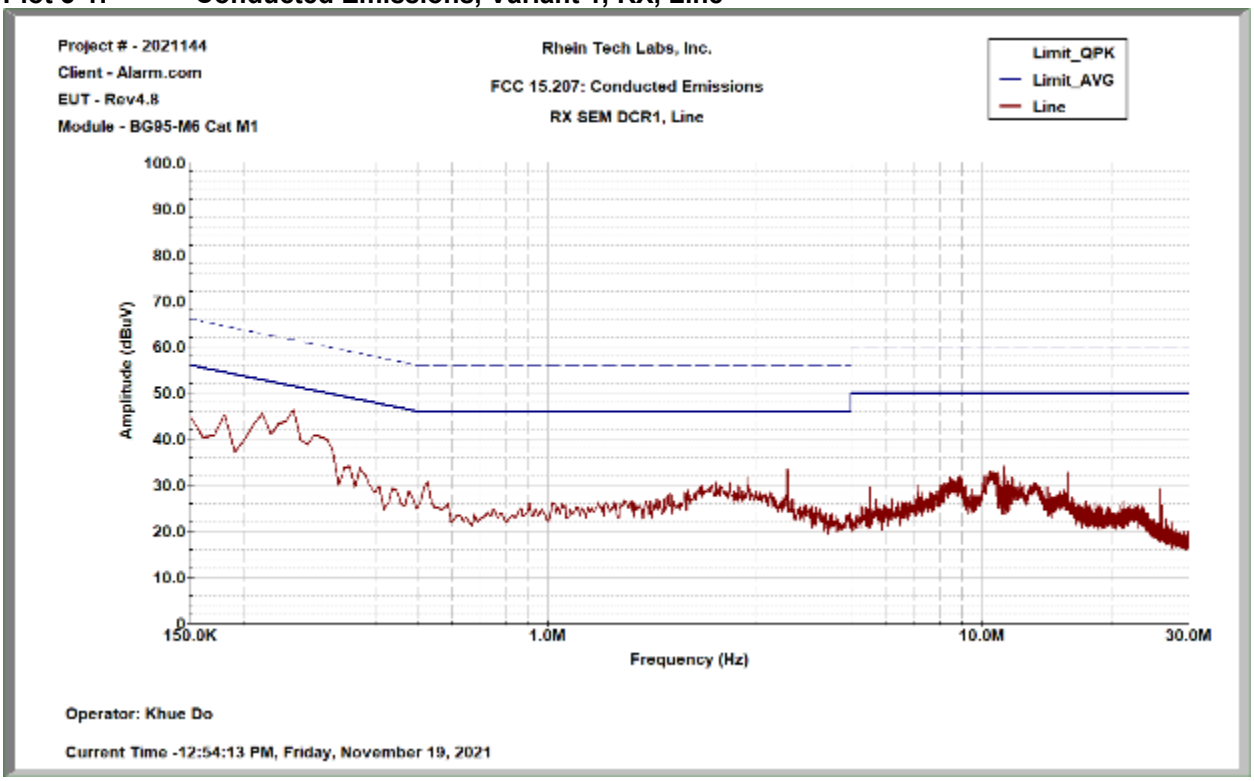
Conducted Emissions: ±3.6 dB

3.4 Conducted Emissions Test Data

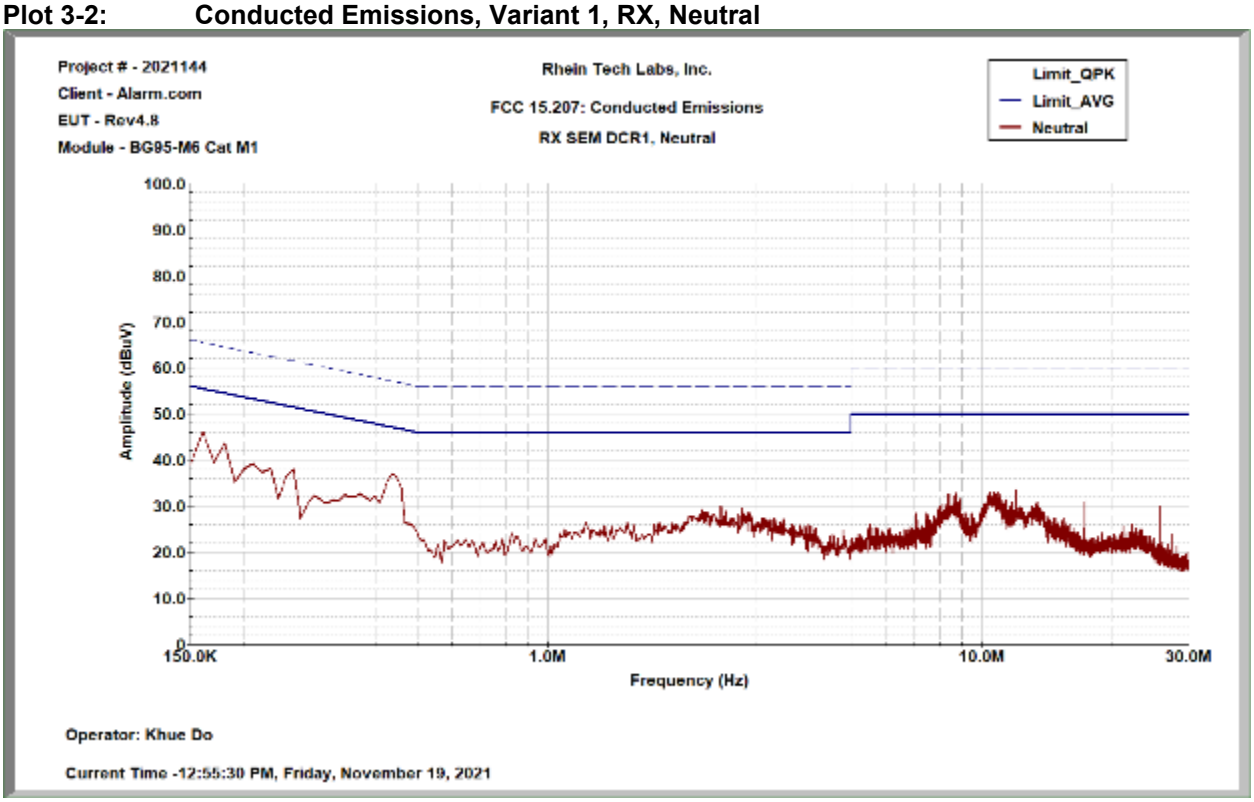
Table 3-2: Conducted Emissions Environmental Conditions

Date	Temperature (°C)	Humidity (%)	Pressure (kPa)
11/19/2021	23.3	28	100.9

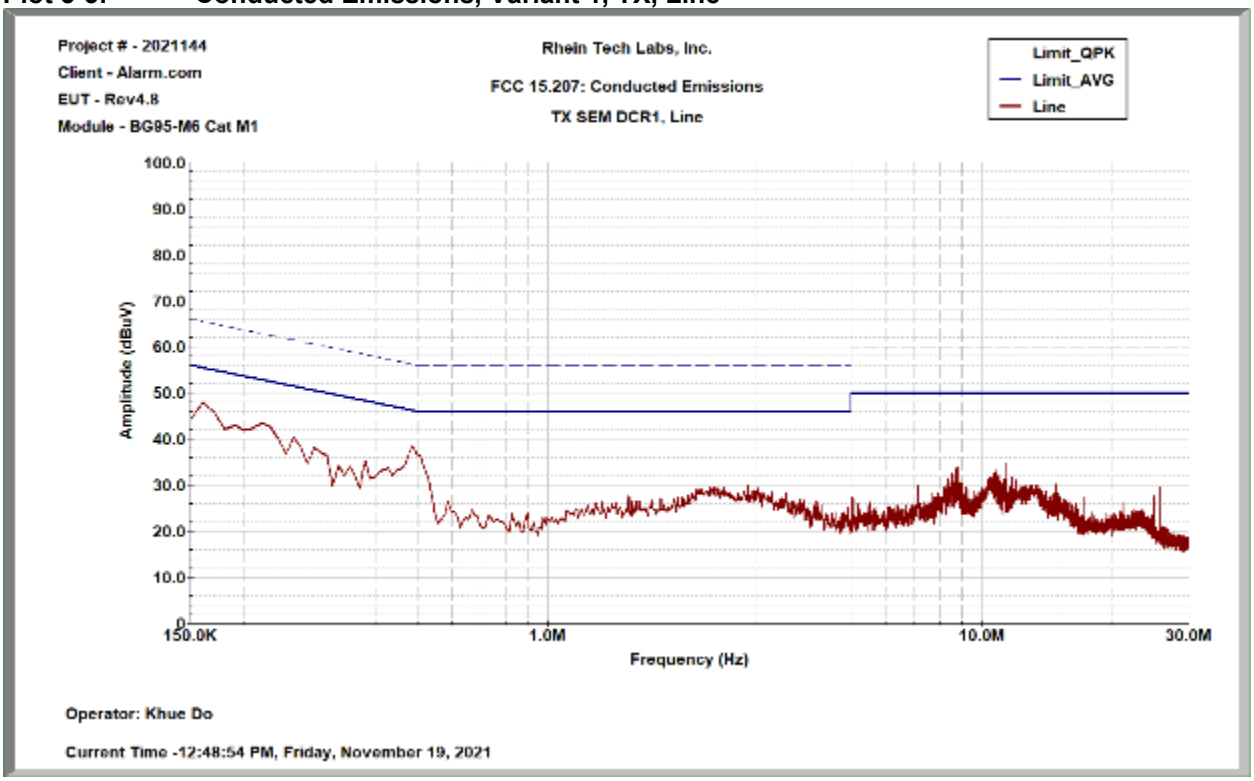
Plot 3-1: Conducted Emissions, Variant 1, RX, Line



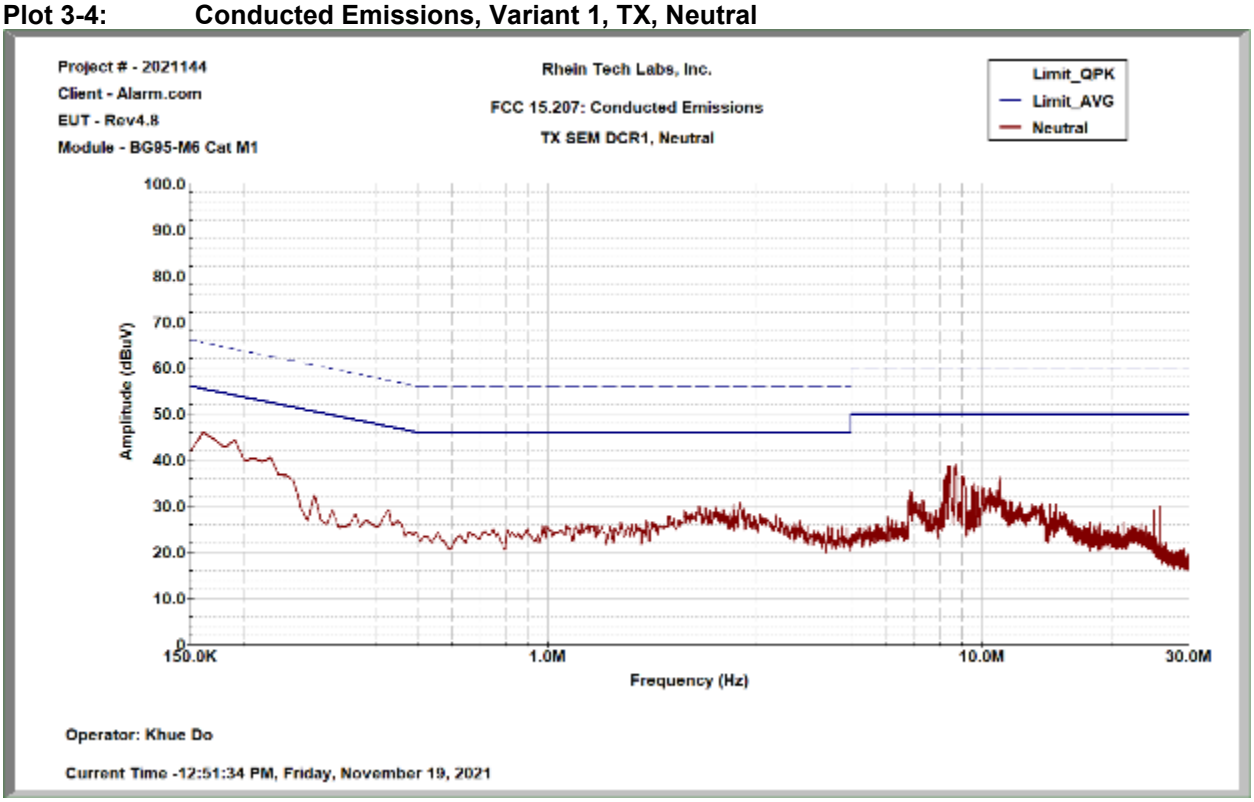
Plot 3-2: Conducted Emissions, Variant 1, RX, Neutral



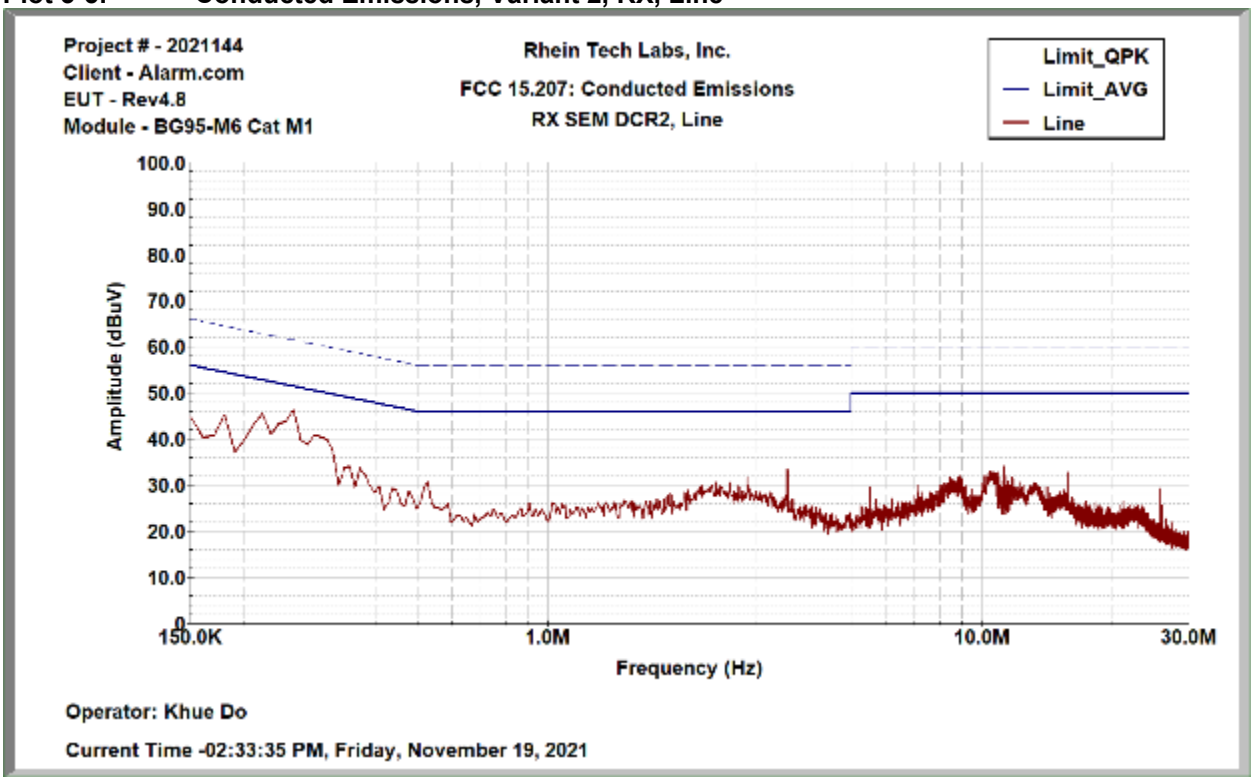
Plot 3-3: Conducted Emissions, Variant 1, TX, Line



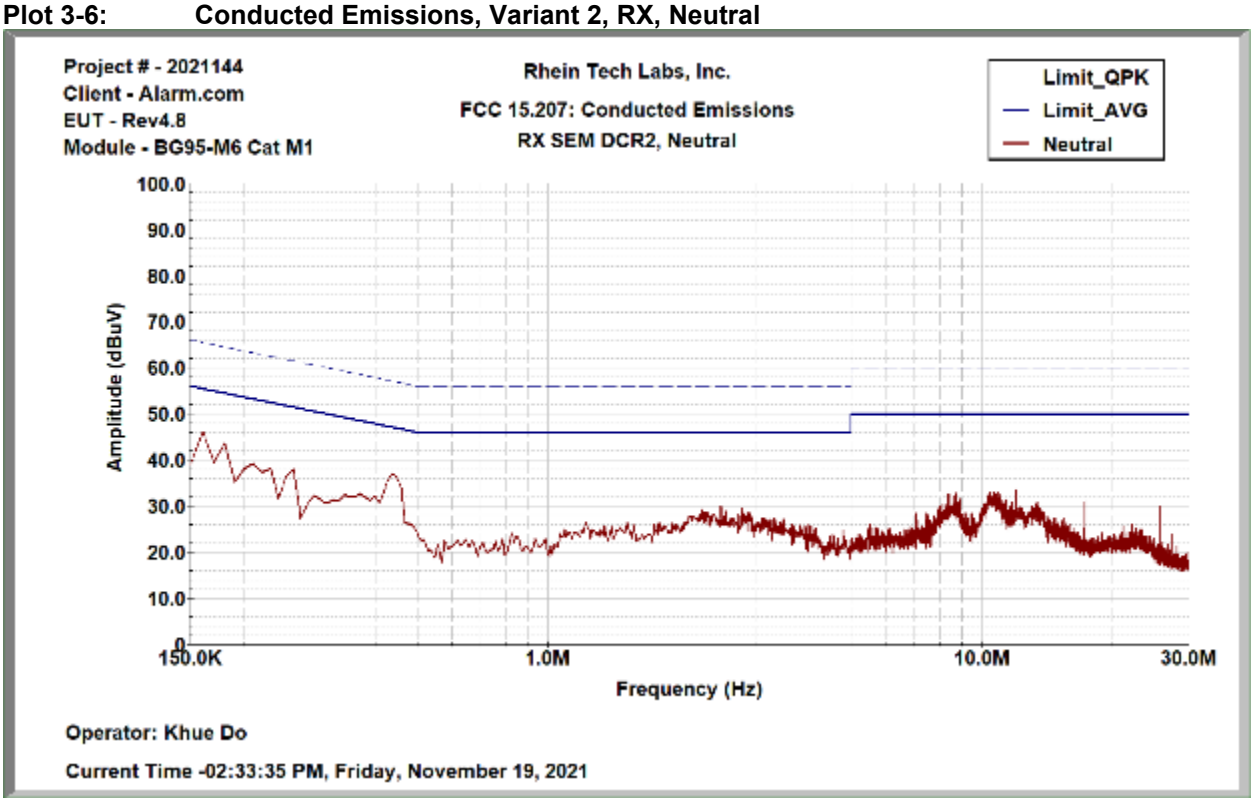
Plot 3-4: Conducted Emissions, Variant 1, TX, Neutral



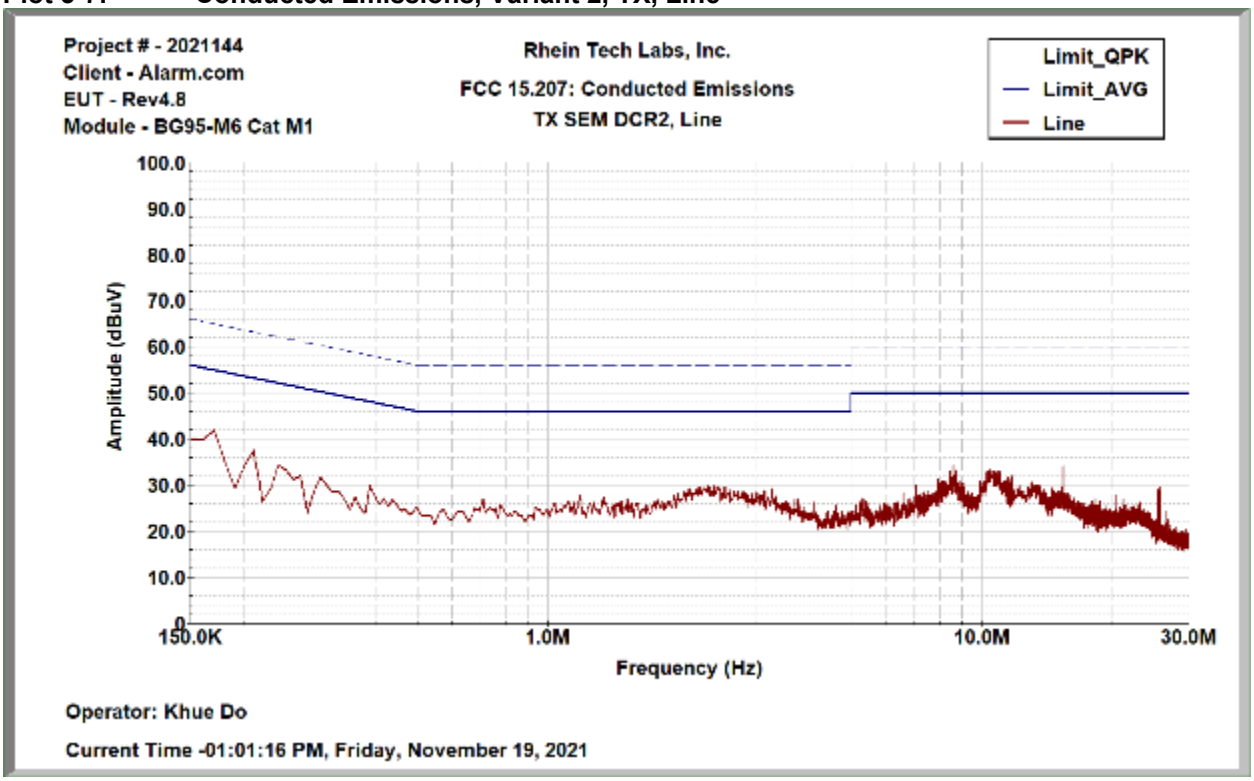
Plot 3-5: Conducted Emissions, Variant 2, RX, Line



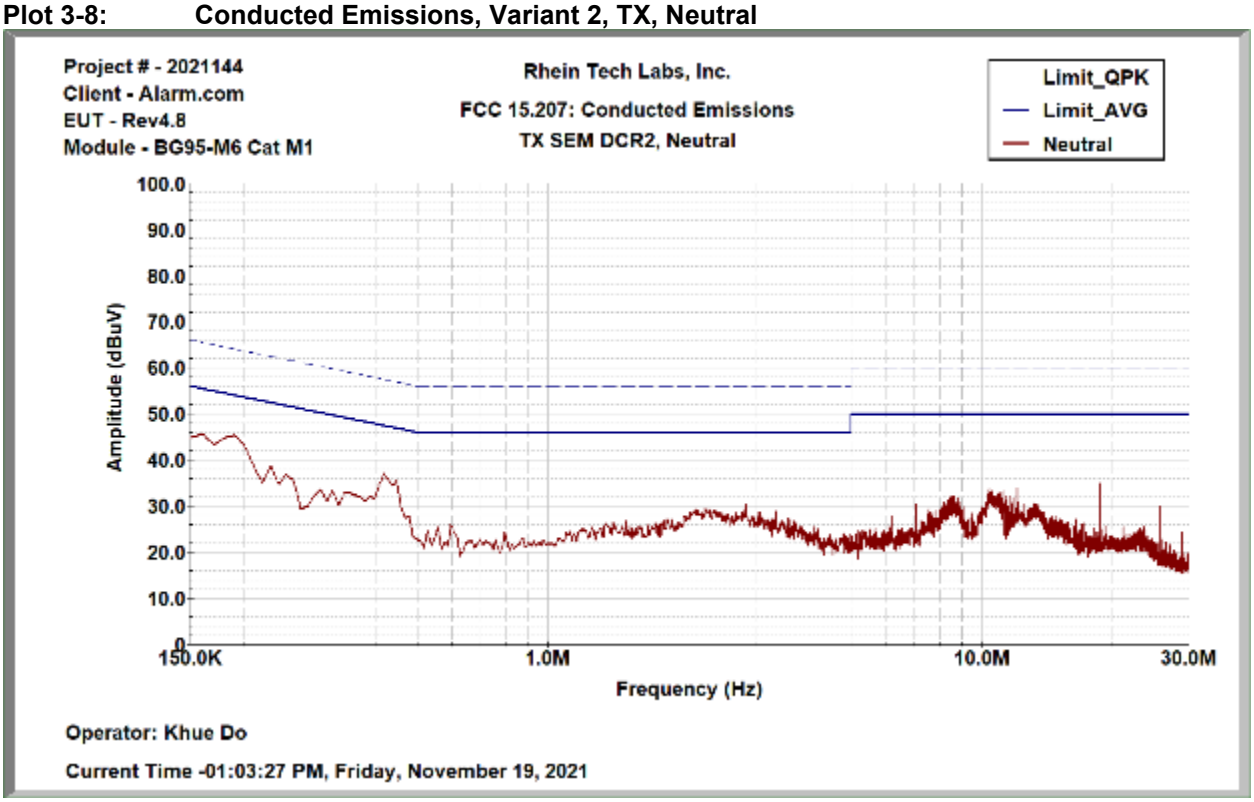
Plot 3-6: Conducted Emissions, Variant 2, RX, Neutral



Plot 3-7: Conducted Emissions, Variant 2, TX, Line



Plot 3-8: Conducted Emissions, Variant 2, TX, Neutral



Result: PASS

Table 3-3: Conducted Emissions Test Equipment

RTL Barcode	Part	Manufacturer	Model	Serial Number	Calibration Due Date
900339	Quasi-Peak Adapter (30 Hz – 1 GHz)	Hewlett Packard	85650A	2521A00743	09/16/2024
900728	High Pass Filter	Solar Electronics Co.	Type 8130	947305	04/30/2023
900930	Spectrum Analyzer Display	Hewlett Packard	85662A	3144A20839	N/A
900931	Spectrum Analyzer (100 Hz – 22 GHz)	Hewlett Packard	8566B	3138A07771	02/26/2023
901083	Line Impedance Stabilization Network	AFJ International	LS16	16010020081	02/16/2023
901599	RF Cable	RF Depot	SR2	N/A	06/09/2022
N/A	Test Software	ETS Lindgren	TILE! 7	7.1.3.20	N/A

Test Personnel:

Khue N. Do		November 19, 2021
EMC Test Engineer	**Signature**	**Date of Test**

4 Radiated Emissions – FCC Part 15.209, 15.249(a); ISED RSS-210 B.10, RSS-Gen 8.9/8.10

4.1 Radiated Emissions Test Procedure

Before final radiated emissions measurements were made on the OATS, the EUT was scanned indoors at 1 and 3 meter distances. This was done in order to determine its emissions spectrum signature. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emissions measurements on the OATS, at each frequency, in order to ensure that maximum amplitudes were attained.

Final radiated emissions measurements were made on the OATS. The EUT was placed on a non-conductive turntable 0.8 m (for frequencies < 1 GHz)/ 1.5 m (for frequencies > 1 GHz) above the ground plane. The spectrum was examined from 9 kHz to the 10th harmonic of the highest fundamental transmitter frequency 9160 MHz.

At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered between 1 and 5 meters in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarization. For frequencies between 30 and 1000 MHz, the SA 6 dB bandwidth was set to 120 kHz, and the SA was operated in the CISPR QPK detection mode. For emissions above 1 GHz, measurements were taken using the AVG detector functions with a minimum RBW of 1 MHz. No VBW less than 10 times the RBW was used. The highest emission amplitudes relative to the appropriate limit were measured and recorded.

4.2 Radiated Emissions Limits

Table 4-1: Radiated Emissions Limits per FCC Part 15.209 and RSS-Gen 8.9

Frequency (MHz)	Field Strength (µV/m)	Measure Distance (m)
0.009 – 0.490	2400/ f (kHz)	300
0.490 – 1.705	2400/ f (kHz)	30
1.705 – 30.000	30	30
30 – 88	100	3
88 – 216	150	3
216 – 960	200	3
Above 960	500	3

As shown in 15.35(b), for frequencies above 1 GHz, the field strength limits are based on AVG detector, however, the PK field strength of any emission shall not exceed the maximum permitted AVG limits specified above by more than 20 dB under any circumstances of modulation.

Table 4-2: Radiated Emissions Limits per FCC Part 15.249(a) and RSS-210 F.1

Frequency (MHz)	Field Strength Fundamental (mV/m)	Field Strength Harmonics (µV/m)
902 – 928	50	500
2400.0 – 2483.5	50	500
5725 – 5875	50	500
24000 – 24250	250	2500

Notes: Field strength limits are specified at a distance of 3 meters.

100 µV/m ≈ 40.0 dB µV/m 150 µV/m ≈ 43.5 dB µV/m 200 µV/m ≈ 46.0 dB µV/m

500 µV/m ≈ 54.0 dB µV/m 50 mV/m ≈ 94.0 dB µV/m

4.3 Measurement Uncertainty

Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor k = 2.

Radiated Emissions: ±4.6 dB

4.4 Radiated Emissions Test Data

Table 4-3: Radiated Emissions Environmental Conditions

Date	Temperature (°C)	Humidity (%)	Pressure (kPa)
11/22/2021	9.0	70	101.3
11/23/2021	5.6	39	103.5

Table 4-4: Power Settings

Variant	Frequency (MHz)	Power Setting
1	908.4	7
	916.0	8
3	908.4	14
	916.0	13
4	908.4	12
	916.0	10

Note: EUT was set to transmit at 100% duty cycle

Table 4-5: Radiated Emissions, Fundamental, Variant 1

Emission Frequency (MHz)	QPK Raw (dBµV)	SCF (dB/m)	QPK Corrected (dBµV/m)	QPK Limit (dBµV/m)	QPK Margin (dB)
908.4	48.4	44.3	92.7	94.0	-1.3
916.0	47.9	44.5	92.4	94.0	-1.6

Table 4-6: Radiated Emissions, Fundamental, Variant 3

Emission Frequency (MHz)	QPK Raw (dBµV)	SCF (dB/m)	QPK Corrected (dBµV/m)	QPK Limit (dBµV/m)	QPK Margin (dB)
908.4	48.2	44.3	92.5	94.0	-1.5
916.0	47.6	44.5	92.1	94.0	-1.9

Table 4-7: Radiated Emissions, Fundamental, Variant 4

Emission Frequency (MHz)	QPK Raw (dBµV)	SCF (dB/m)	QPK Corrected (dBµV/m)	QPK Limit (dBµV/m)	QPK Margin (dB)
908.4	48.0	44.3	92.3	94.0	-1.7
916.0	46.6	44.5	91.1	94.0	-2.9

Table 4-8: Harmonics/Spurious, Variant 1, 908.4 MHz, Average

Frequency (MHz)	AVG Raw (dBµV)	SCF (dB/m)	AVG Corrected (dBµV/m)	AVG Limit (dBµV/m)	Margin (dB)
2725.2	52.6	-7.4	45.2	54.0	-8.8
3633.6	45.6	-5.2	40.4	54.0	-13.6
4542.0	46.8	0.6	47.4	54.0	-6.6
5450.4	44.4	2.4	46.8	54.0	-7.2
7267.2	43.9	5.0	48.9	54.0	-5.1
8175.6	53.8	-5.3	48.5	54.0	-5.5
9084.0	44.7	-5.8	38.9	54.0	-15.1

Table 4-9: Harmonics/Spurious, Variant 1, 908.4 MHz, Peak

Frequency (MHz)	PK Raw (dBµV)	SCF (dB/m)	PK Corrected (dBµV/m)	PK Limit (dBµV/m)	Margin (dB)
2725.2	53.8	-7.4	46.4	74.0	-27.6
3633.6	48.0	-5.2	42.8	74.0	-31.2
4542.0	47.7	0.6	48.3	74.0	-25.7
5450.4	47.3	2.4	49.7	74.0	-24.3
7267.2	46.1	5.0	51.1	74.0	-22.9
8175.6	54.5	-5.3	49.2	74.0	-24.8
9084.0	46.1	-5.8	40.3	74.0	-33.7

Table 4-10: Harmonics/Spurious, Variant 1, 916.0 MHz, Average

Frequency (MHz)	AVG Raw (dBµV)	SCF (dB/m)	AVG Corrected (dBµV/m)	AVG Limit (dBµV/m)	Margin (dB)
2748.0	55.5	-7.3	48.2	54.0	-5.8
3664.0	45.4	-5.2	40.2	54.0	-13.8
4580.0	45.0	0.6	45.6	54.0	-8.4
7328.0	44.7	5.1	49.8	54.0	-4.2
8244.0	54.3	-5.3	49.0	54.0	-5.0
9160.0	44.6	-5.4	39.2	54.0	-14.8

Table 4-11: Harmonics/Spurious, Variant 1, 916.0 MHz, Peak

Frequency (MHz)	PK Raw (dBµV)	SCF (dB/m)	PK Corrected (dBµV/m)	PK Limit (dBµV/m)	Margin (dB)
2748.0	57.4	-7.3	50.1	74.0	-23.9
3664.0	47.5	-5.2	42.3	74.0	-31.7
4580.0	46.9	0.6	47.5	74.0	-26.5
7328.0	46.7	5.1	51.8	74.0	-22.2
8244.0	54.7	-5.3	49.4	74.0	-24.6
9160.0	46.8	-5.4	41.4	74.0	-32.6

Table 4-12: Harmonics/Spurious, Variant 3, 908.4 MHz, Average

Frequency (MHz)	AVG Raw (dBµV)	SCF (dB/m)	AVG Corrected (dBµV/m)	AVG Limit (dBµV/m)	Margin (dB)
2725.2	52.1	-7.4	44.7	54.0	-9.3
3633.6	46.8	-5.2	41.6	54.0	-12.4
4542.0	44.6	0.6	45.2	54.0	-8.8
5450.4	44.7	2.4	51.1	54.0	-2.9
7267.2	44.2	5.0	49.2	54.0	-4.8
8175.6	54.0	-5.3	48.7	54.0	-5.3
9084.0	44.1	-5.8	38.3	54.0	-15.7

Table 4-13: Harmonics/Spurious, Variant 3, 908.4 MHz, Peak

Frequency (MHz)	PK Raw (dBµV)	SCF (dB/m)	PK Corrected (dBµV/m)	PK Limit (dBµV/m)	Margin (dB)
2725.2	54.2	-7.4	46.8	74.0	-27.2
3633.6	49.0	-5.2	43.8	74.0	-30.2
4542.0	47.0	0.6	47.6	74.0	-26.4
5450.4	52.3	2.4	54.7	74.0	-19.3
7267.2	46.9	5.0	51.9	74.0	-22.1
8175.6	56.7	-5.3	51.4	74.0	-22.6
9084.0	46.1	-5.8	40.3	74.0	-33.7

Table 4-14: Harmonics/Spurious, Variant 3, 916.0 MHz, Average

Frequency (MHz)	AVG Raw (dBµV)	SCF (dB/m)	AVG Corrected (dBµV/m)	AVG Limit (dBµV/m)	Margin (dB)
2748.0	48.6	-7.3	41.3	54.0	-12.7
3664.0	45.9	-5.2	40.7	54.0	-13.3
4580.0	45.1	0.6	45.7	54.0	-8.3
7328.0	44.7	5.1	49.8	54.0	-4.2
8244.0	54.3	-5.3	49.0	54.0	-5.0
9160.0	44.5	-5.4	39.1	54.0	-14.9

Table 4-15: Harmonics/Spurious, Variant 3, 916.0 MHz, Peak

Frequency (MHz)	PK Raw (dBµV)	SCF (dB/m)	PK Corrected (dBµV/m)	PK Limit (dBµV/m)	Margin (dB)
2748.0	50.9	-7.3	43.6	74.0	-30.4
3664.0	48.4	-5.2	43.2	74.0	-30.8
4580.0	46.6	0.6	47.2	74.0	-26.8
7328.0	46.8	5.1	51.9	74.0	-22.1
8244.0	55.9	-5.3	50.6	74.0	-23.4
9160.0	47.4	-5.4	42.0	74.0	-32.0

Table 4-16: Harmonics/Spurious, Variant 4, 908.4 MHz, Average

Frequency (MHz)	AVG Raw (dBµV)	SCF (dB/m)	AVG Corrected (dBµV/m)	AVG Limit (dBµV/m)	Margin (dB)
2725.2	52.6	-7.4	45.2	54.0	-8.8
3633.6	45.3	-5.2	40.1	54.0	-13.9
4542.0	47.3	0.6	47.9	54.0	-6.1
5450.4	44.2	2.4	46.6	54.0	-7.4
7267.2	43.1	5.0	48.1	54.0	-5.9
8175.6	53.6	-5.3	38.3	54.0	-5.7
9084.0	44.7	-5.8	38.9	54.0	-15.1

Table 4-17: Harmonics/Spurious, Variant 4, 908.4 MHz, Peak

Frequency (MHz)	PK Raw (dBµV)	SCF (dB/m)	PK Corrected (dBµV/m)	PK Limit (dBµV/m)	Margin (dB)
2725.2	55.9	-7.4	48.5	74.0	-25.5
3633.6	47.6	-5.2	42.4	74.0	-31.6
4542.0	49.8	0.6	50.4	74.0	-23.6
5450.4	45.9	2.4	48.3	74.0	-25.7
7267.2	46.8	5.0	51.8	74.0	-22.2
8175.6	55.8	-5.3	40.5	74.0	-23.5
9084.0	46.5	-5.8	40.7	74.0	-33.3

Table 4-18: Harmonics/Spurious, Variant 4, 916.0 MHz, Average

Frequency (MHz)	AVG Raw (dBµV)	SCF (dB/m)	AVG Corrected (dBµV/m)	AVG Limit (dBµV/m)	Margin (dB)
2748.0	50.4	-7.3	43.1	54.0	-10.9
3664.0	44.8	-5.2	39.6	54.0	-14.4
4580.0	47.0	0.6	47.6	54.0	-6.4
7328.0	44.6	5.1	49.7	54.0	-4.3
8244.0	53.1	-5.3	38.8	54.0	-6.2
9160.0	44.9	-5.4	39.5	54.0	-14.5

Table 4-19: Harmonics/Spurious, Variant 4, 916.0 MHz, Peak

Frequency (MHz)	PK Raw (dBµV)	SCF (dB/m)	PK Corrected (dBµV/m)	PK Limit (dBµV/m)	Margin (dB)
2748.0	51.7	-7.3	44.4	74.0	-29.6
3664.0	46.9	-5.2	41.7	74.0	-32.3
4580.0	47.8	0.6	48.4	74.0	-25.6
7328.0	46.6	5.1	51.7	74.0	-22.3
8244.0	56.2	-5.3	40.9	74.0	-23.1
9160.0	47.0	-5.4	41.6	74.0	-32.4

Table 4-20: Radiated Emissions, Digital Unintentional/ Receiver

Emission Frequency (MHz)	Antenna Polarity (H / V)	Antenna Height (m)	Table Azimuth (°)	QPK Raw (dBµV)	SCF (dB/m)	QPK Corrected (dBµV/m)	QPK Limit (dBµV/m)	QPK Margin (dB)
110.556	H	2.0	180	58.6	-19.6	39.0	43.5	-4.5
112.244	V	1.0	180	47.1	-19.6	27.5	43.5	-16.0
137.193	H	2.5	180	59.2	-19.1	40.1	43.5	-3.4
165.990	H	2.0	180	52.8	-17.4	35.4	43.5	-8.1
235.975	V	1.0	180	49.1	-14.6	34.5	46.0	-11.5
250.000	V	2.0	135	52.1	-14.3	37.8	46.0	-8.2
285.163	V	3.0	180	53.8	-13.3	40.5	46.0	-5.5
300.000	V	1.0	0	39.5	-12.2	27.3	46.0	-18.7
450.000	V	3.0	180	46.5	-7.2	39.3	46.0	-6.7
500.000	V	1.0	270	41.2	-5.5	35.7	46.0	-10.3
900.000	V	1.0	0	37.9	3.3	41.2	46.0	-4.8

Result: PASS

Table 4-21: Radiated Emissions Test Equipment

RTL Barcode	Part	Manufacturer	Model	Serial Number	Calibration Due Date
900321	Horn Antenna (4.0 – 8.2 GHz)	EMCO	3161-03	9528-1020	08/05/2024
900323	Horn Antenna (8.2 – 12.4 GHz)	EMCO	3160-07	9605-1024	08/05/2024
900772	Horn Antenna (2 – 4 GHz)	EMCO	3161-02	9804-1044	08/05/2024
900905	Preamplifier (30 MHz – 2 GHz)	Rhein Tech Laboratories, Inc.	PR-1040	1006	09/30/2022
900913	EMI Receiver RF Section (9.0 kHz – 6.5 GHz)	Hewlett Packard	85462A	3325A00159	09/16/2024
900914	RF Filter Section (100.0 kHz – 6.5 GHz)	Hewlett Packard	85460A	3330A00107	09/16/2024
901288	RF Cable	Signa Wave	4LC-NANA-0360	N/A	04/20/2022
901583	Spectrum Analyzer (10 Hz – 26.5 GHz)	Agilent Technologies	EXA N9010A	MY51250846	10/04/2024
901669	Bilog Antenna (26 MHz – 6 GHz)	ETS Lindgren	3142E	00166065	04/24/2022
901723	Preamplifier (1.0 – 26.5 GHz)	Hewlett Packard	8449B	3008A00762	09/30/2022
901726	RF Cable	Insulated Wire Inc.	KPS-1503-360-KPS	N/A	09/20/2022
901730	RF Cable	Insulated Wire Inc.	KPS-1503-3600-KPS	N/A	09/20/2022

Test Personnel:

Khue N. Do		November 22 – 23, 2021
EMC Test Engineer	**Signature**	**Dates of Test**

5 Band Edge – FCC Part 15.249(d); ISED RSS-210 B.10(b)

5.1 Band Edge Test Procedure

The Band Edges were measured using a 50 Ω SA. The following settings were used:

Span: Enough to encompass the low/high fundamental
RBW: 100 kHz
VBW: 300 kHz
Sweep: Auto
Detector: Peak
Trace: Max Hold

5.2 Band Edge Limits

Emissions radiated outside of the specified frequency bands (902 MHz to 928 MHz), except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental emissions or to the general field strength limits listed in FCC Part 15.209; RSS-Gen, whichever is the lesser attenuation.

The less stringent limit shall be 46.0 dBµV/m at 3 m.

5.3 Measurement Uncertainty

Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor k = 2.

Band Edge: ±4.6 dB

5.4 Band Edge Test Data

Table 5-1: Band Edge Environmental Conditions

Date	Temperature (°C)	Humidity (%)	Pressure (kPa)
02/09/2022	23.3	28	100.9

Notes: Variant 1 was tested.
Radiated test setup was implemented.

Plot 5-1: Band Edge, Lower 902 MHz, Variant 1

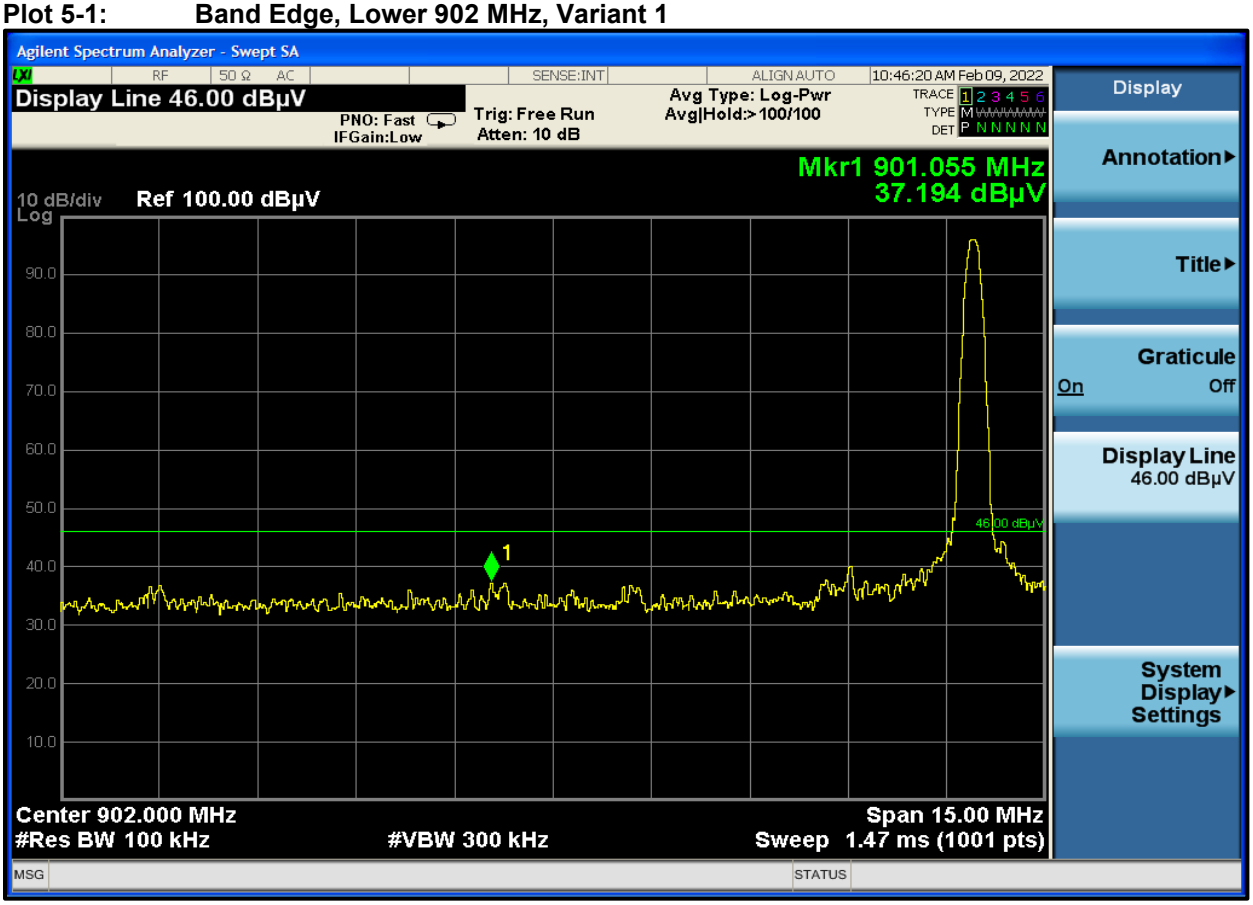


Table 5-2: Band Edge Results, Lower 902 MHz

Frequency (MHz)	Raw Level (dBµV)	SCF (dB/m)	Corrected Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
901.055	37.2	-8.1	29.1	46.0	-16.9

Plot 5-2: Band Edge, Upper 928 MHz, Variant 1

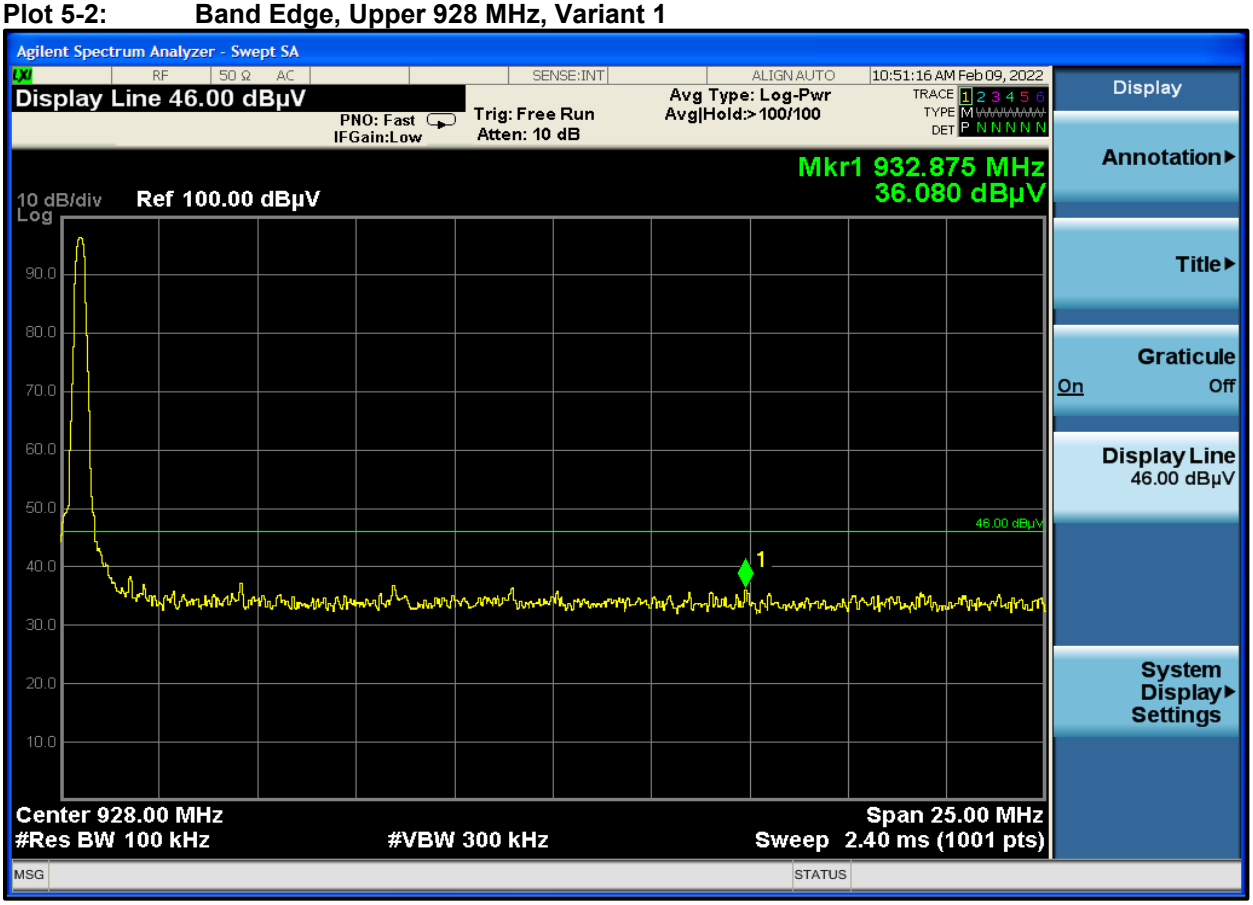


Table 5-3: Band Edge Results, Upper 928 MHz

Frequency (MHz)	Raw Level (dBµV)	SCF (dB/m)	Corrected Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
932.875	36.1	-7.3	28.8	46.0	-17.2

Table 5-4: Band Edge Test Equipment

RTL Barcode	Part	Manufacturer	Model	Serial Number	Calibration Due Date
900905	Preamplifier (30 MHz – 2 GHz)	Rhein Tech Laboratories, Inc.	PR-1040	1006	09/30/2022
901583	Spectrum Analyzer (10 Hz – 26.5 GHz)	Agilent Technologies	EXA N9010A	MY51250846	10/04/2024
901669	Bilog Antenna (26 MHz – 6 GHz)	ETS Lindgren	3142E	00166065	04/24/2022
901726	RF Cable	Insulated Wire Inc.	KPS-1503-360-KPS	N/A	09/20/2022
901730	RF Cable	Insulated Wire Inc.	KPS-1503-3600-KPS	N/A	09/20/2022

Test Personnel:

Khue N. Do		February 9, 2022
EMC Test Engineer	**Signature**	**Date of Test**

6 Occupied Channel Bandwidth – ISED RSS-Gen 6.7

6.1 Occupied Bandwidth 99% Test Procedure

The Occupied Bandwidth 99% were measured using a 50 Ω SA. The following settings were used:

Span:	500 kHz	1.5 to 5.0 times the OBW
RBW:	5.1 kHz	1% to 5% of the OBW
VBW:	15 kHz	3 times RBW
Sweep:	Auto	
Detector:	Peak	
Trace:	Max Hold	
Reference:	100 dBµV	Peak of emission must be more than [10 log(OBW / RBW)] below the reference level

The measurements were repeated a few times until the RBW and VBW follow the above requirement.

6.2 Occupied Bandwidth 99% Limits

No applicable limits.

6.3 Measurement Uncertainty

Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor k = 2.

OBW: $\pm 1.0 \times 10^{-6}$ Hz

6.4 Occupied Bandwidth Test Data

Table 6-1: Occupied Bandwidth Environmental Conditions

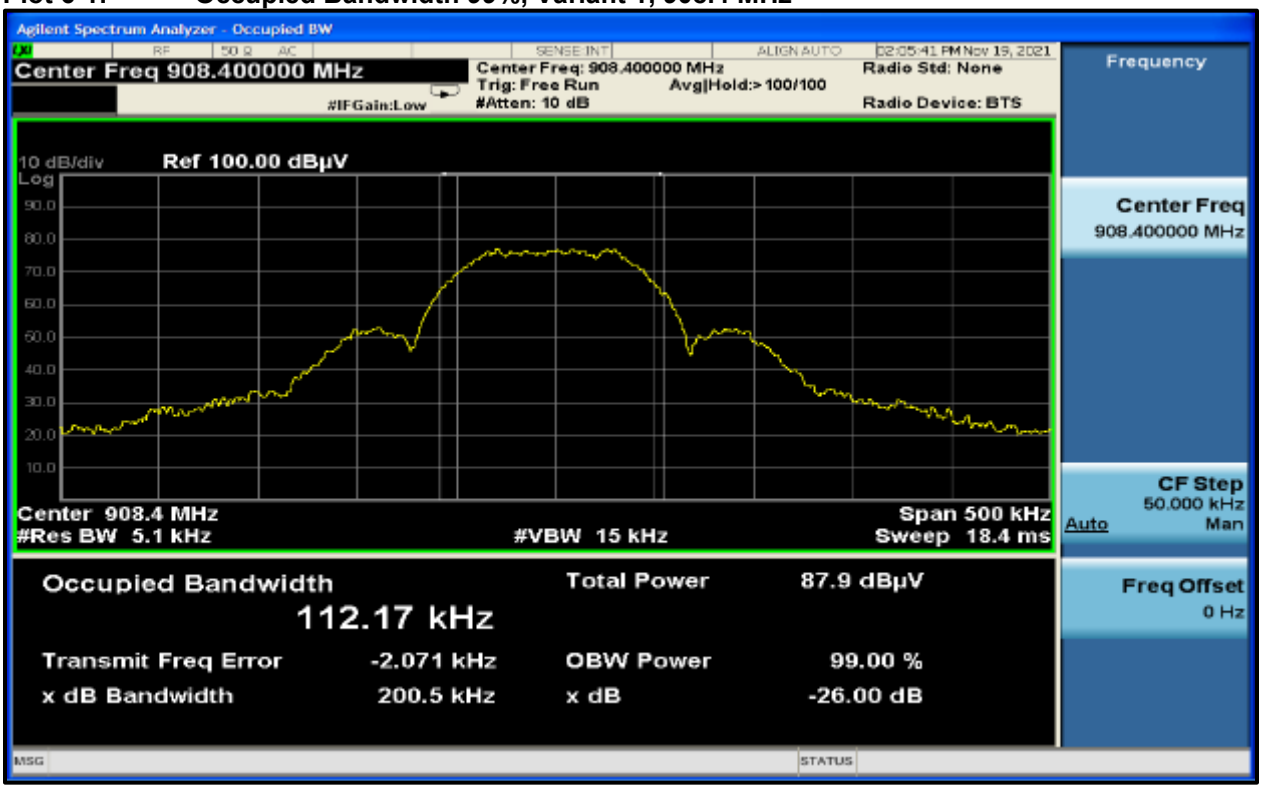
Date	Temperature (°C)	Humidity (%)	Pressure (kPa)
11/19/2021	23.3	28	100.9

Table 6-2: Occupied Bandwidth Test Results

Frequency (MHz)	Occupied Bandwidth 99% (kHz)
908.4	112.17
916.0	112.16

Notes: Variant 1 was tested.
Radiated test setup was implemented.

Plot 6-1: Occupied Bandwidth 99%, Variant 1, 908.4 MHz



Plot 6-2: Occupied Bandwidth 99%, Variant 1, 916.0 MHz

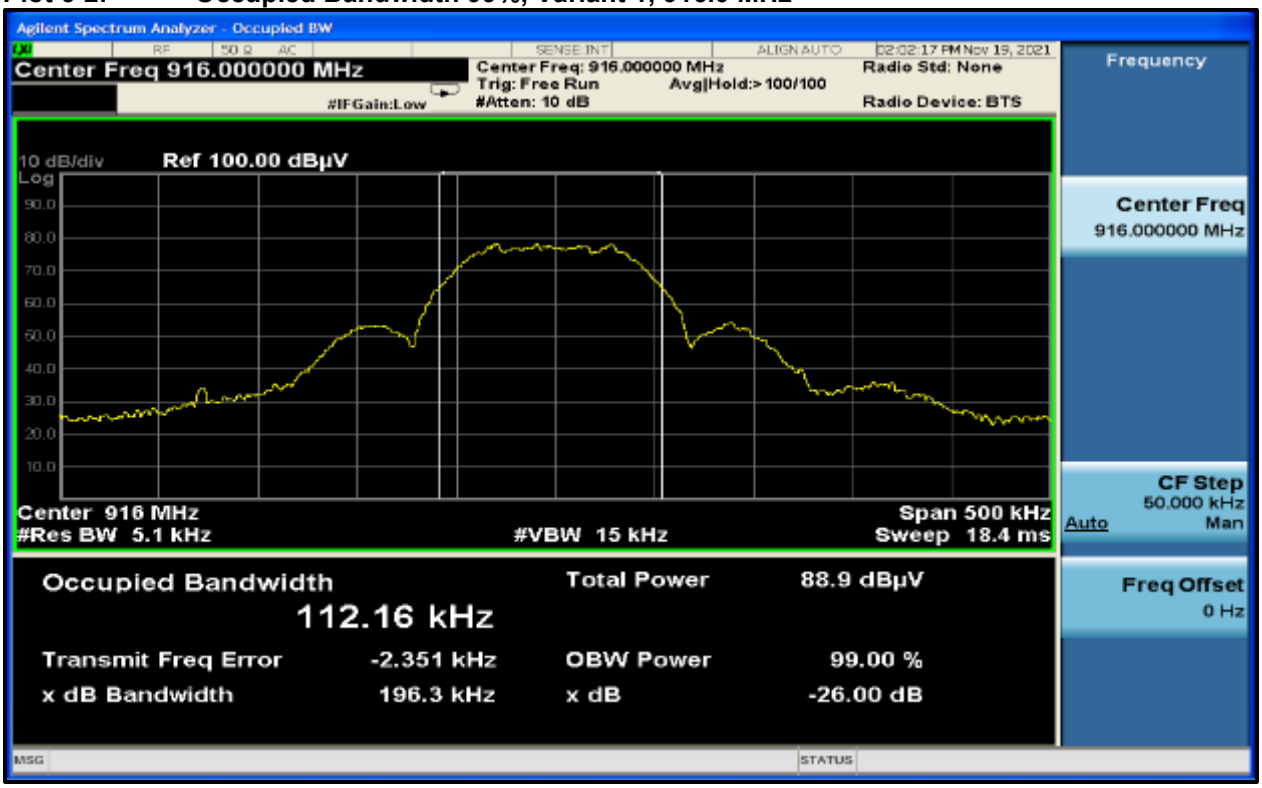


Table 6-3: Occupied Bandwidth Test Equipment

RTL Barcode	Part	Manufacturer	Model	Serial Number	Calibration Due Date
900905	Preamplifier (30 MHz – 2 GHz)	Rhein Tech Laboratories, Inc.	PR-1040	1006	09/30/2022
901583	Spectrum Analyzer (10 Hz – 26.5 GHz)	Agilent Technologies	EXA N9010A	MY51250846	10/04/2024
901669	Bilog Antenna (26 MHz – 6 GHz)	ETS Lindgren	3142E	00166065	04/24/2022
901726	RF Cable	Insulated Wire Inc.	KPS-1503-360-KPS	N/A	09/20/2022
901730	RF Cable	Insulated Wire Inc.	KPS-1503-3600-KPS	N/A	09/20/2022

Test Personnel:

Khue N. Do		November 19, 2021
EMC Test Engineer	**Signature**	**Date of Test**

7 Conclusion

The data presented in this report shows that the EUT as tested, Alarm.com, Model/HVIN: ADC-480Q, FCC ID: YL6-143480Q, IC: 9111A-143480Q, complies with the applicable requirements of FCC Rules and Regulations Parts 2 and 15, and ISED RSS-210 and RSS-Gen for full modular approval.