Certification Test Report

FCC ID: SK9CAT3
IC: 864G-CAT3

FCC Rule Part: 15.247
ISED Canada Radio Standards Specification: RSS-247

Report Number: AT72167926-1C1

Manufacturer: Itron, Inc.
Model: CAT3

Test Begin Date: April 12, 2021
Test End Date: May 16, 2021

Report Issue Date: November 29, 2021

FOR THE SCOPE OF ACCREDITATION UNDER Certificate Number: 2955.09

This report must not be used by the client to claim product certification, approval, or endorsement by A2LA, NIST, or any agency of the Federal Government.

Prepared By:

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TÜV SÜD America Inc.

This report contains 23 pages

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1 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations and Innovation, Science and Economic Development Canada's Radio Standards Specification RSS-247 Certification for modular approval applying FCC KDB 484596 D01 Referencing Test Data v01.

Reference FCC ID: SK9CAT1
Reference ISED Canada Certification Number: IC: 864G-CAT1
Reference Test Report: AT72151409-2C2

Differences from Original: Removal of 802.11b/g/n radio

1.2 Product description

The Itron CAT3 is an electricity metering module which includes a 910 MHz to 921.8 MHz transceiver. The module operates on AC power which is supplied by a host device.

The module also contains an integrated pre-approved cellular modem (FCC ID: N7NHL78M / IC: 2417C-HL78M) which can transmit simultaneously. Simultaneous transmission is addressed in a separate report.

Technical Details:

Detail	Description
Frequency Range	910 – 914.8MHz / 917-921.8 MHz
Number of Channels	50
Channel Spacing	200kHz
Modulation Format	FSK
Data Rates	12.5kbps
Operating Voltage	120Vac, 60Hz
Antenna Type(s) / Gain(s)	PCB Trace / -4.21dBi Max

Manufacturer Information:
Itron, Inc.
313 N Hwy 11
West Union, SC 29696

Test Sample Serial Number: Not labeled

Test Sample Condition: The test samples were provided in good working order with no visible defects.

1.3 Test Methodology and Considerations

For the purpose of validating data for comparison to the original, and for justification of data reuse, only a single channel was evaluated. All parameters, with the exception of hopping characteristics, were evaluated. Hopping characteristics are not impacted by the removal of the 802.11b/g/n radio.

For radiated emissions, the EUT was evaluated the worst-case orientation which was the Y-position. The EUT was programmed to generate a continuously modulated signal.

For power line conducted emissions, the EUT was powered by 120Vac, 60Hz.

For RF Conducted measurements, the EUT was connected to the test equipment with an MMX to SMA adapter. The EUT was programmed to generate a continuously modulated signal.

Software power setting during test: 63

2 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following addresses:

TÜV SÜD America, Inc.
5945 Cabot Pkwy, Suite 100
Alpharetta, GA 30005
Phone: (678) 341-5900

2.2 Laboratory Accreditations/Recognitions/Certifications

TÜV SÜD America, Inc. is accredited to ISO/IEC 17025 by the American Association for Laboratory Accreditation/A2LA accreditation program and has been issued certificate number 2955.09 in recognition of this accreditation.

Unless otherwise specified, all tests methods described within this report are covered under the ISO/IEC 17025 scopes of accreditation.

The Semi-Anechoic Chamber Test Sites and Conducted Emissions Sites have been fully described, submitted to, and accepted by the FCC, ISED Canada and the Japanese Voluntary Control Council for Interference by information technology equipment.

FCC Designation Accreditation Number:	US1233
ISED Canada Lab Code:	23932
VCCI Member Number:	1831
• VCCI Registration Number	A-0295

2.3 Radiated Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site – Chamber A

The Semi-Anechoic Chamber Test Site consists of a 20' x 30' x 18' shielded enclosure. The chamber is lined with Toyo Ferrite Grid Absorber, model number FFG-1000. The ferrite tile grid is 101 x 101 x 19mm thick and weighs approximately 550 grams. These tiles are mounted on steel panels and installed directly on the inner walls of the chamber.

The turntable is 5' in diameter and is located 5'6" from the back wall of the chamber. The chamber is grounded via 1 - 8' copper ground rod, installed at the center of the back wall, it is bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is all steel, flush mounted EMCO Model 1060 installed in an all steel frame. The table is remotely operated from inside the control room located 25' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Behind the turntable is a 3' x 6' x 4' deep shielded pit used for support equipment if necessary. The pit is equipped with 1 - 4" PVC chase from the turntable to the pit that allows for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit, so cables can be supplied to the EUT from the pit.

The chamber rear wall is covered with a mixture of Siepel pyramidal absorber. The side walls of the chamber are partially covered with Siepel pyramidal absorber.

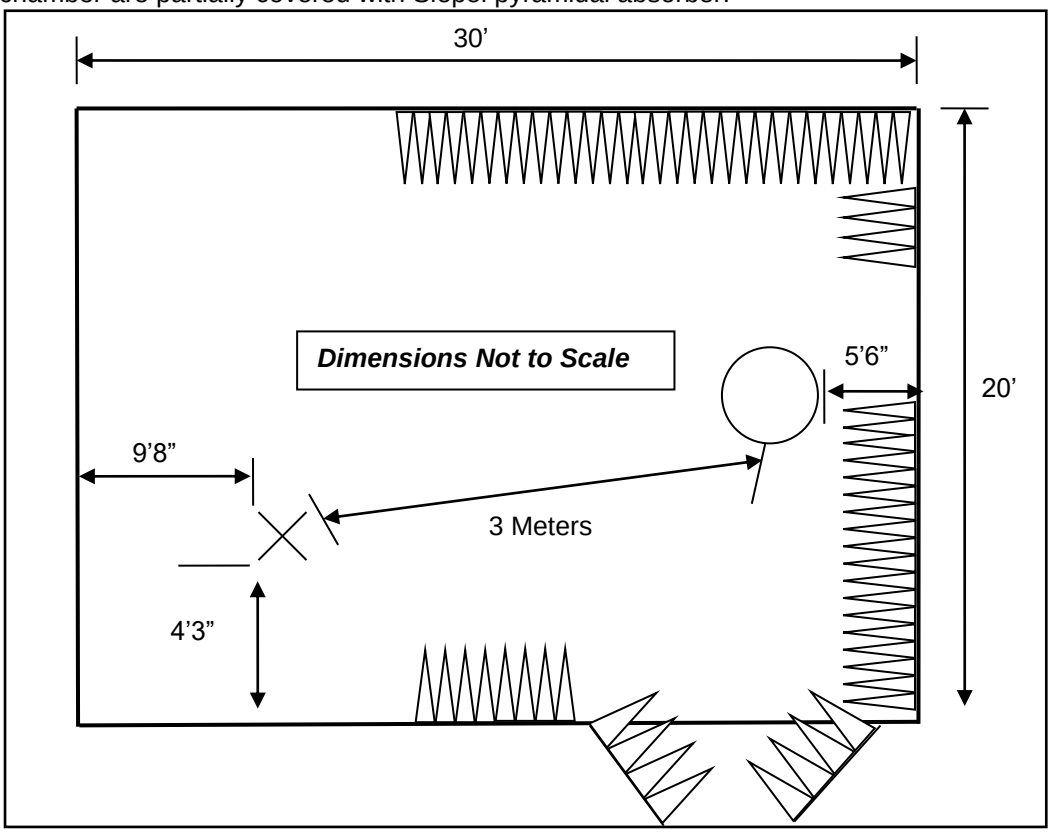

Figure 2.3.1-1: Semi-Anechoic Chamber Test Site – Chamber A

2.3.2 Semi-Anechoic Chamber Test Site – Chamber B

The Semi-Anechoic Chamber Test Site consists of a 20'W x 30'L x 20'H shielded enclosure. The chamber is lined with ETS-Lindgren Ferrite Absorber, model number FT-1500. The ferrite tile 600 mm x 600 mm (2.62 in x 23.62 in) panels and are mounted directly on the inner walls of the chamber shield.

The specular regions of the chamber are lined with additional ETS-Lindgren PS-600 hybrid absorber to extend its frequency range up to 18GHz and beyond.

The turntable is a 2m ETS-Lindgren Model 2170 and installed off the center axis is located 5'6" from the back wall of the chamber. The chamber is grounded via 1 - 8' copper ground rod, installed at the center of the back wall, it is bound to the shield using #8 solid copper wire.

The antenna mast is an EMCO 1060 and is remotely controlled from the control room for both antenna height and polarization.

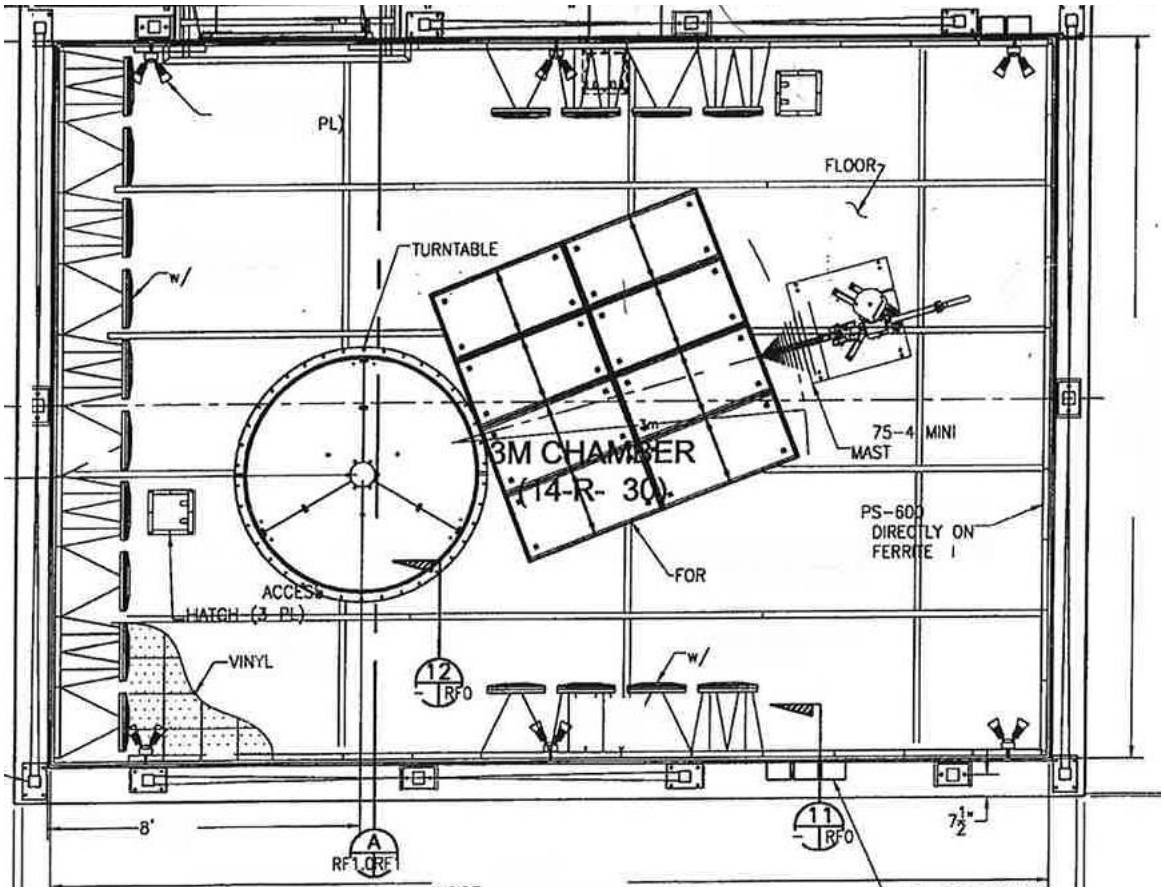

Figure 2.3.2-1: Semi-Anechoic Chamber Test Site – Chamber B

2.4 Conducted Emissions Test Site Description

2.4.1 Conducted Emissions Test Site

The AC mains conducted EMI site is located in the main EMC lab. It consists of a 12' x 10' horizontal coupling plane (HCP) as well as a 12'x8' vertical coupling plane (VCP). The HGP is constructed of 4' x 10' sheets of particle board sandwiched by galvanized steel sheets. These panels are bonded using 11AWG 1/8" x 2" by 10' galvanized sheet steel secured to the panels via by screws. The VCP is constructed of three 4'x8' sheets of 11AWG solid aluminum.

The HCP and VCP are electrically bonded together using 1"x1" angled aluminum secured with screws.

The site is of sufficient size to test table top and floor standing equipment in accordance with section 6.1.4 of ANSI C63.10.

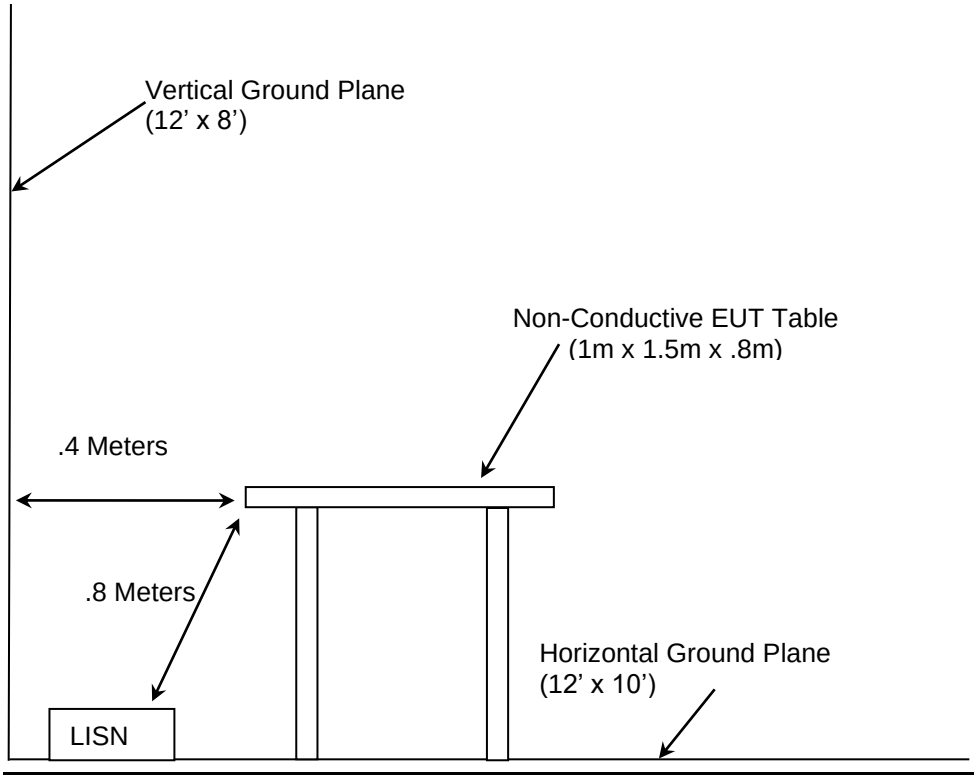

Figure 2.4.1-1: AC Mains Conducted EMI Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2021
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2021
- FCC KDB 558074 D01 15.247 Measure Guidance v05r02 – Guidance for Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating Under Section 15.247 of the FCC Rules, April 2, 2019
- FCC KDB 484596 D01 Referencing Test Data v01 Guidance for referencing EMC and Radio Parameter Test Data in Equipment Authorization Applications.
- ISED Canada Radio Standards Specification: RSS-247 – Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices, Issue 2, February 2017.
- ISED Canada Radio Standards Specification: RSS-GEN – General Requirements for Compliance of Radio Apparatus, Issue 5

4 LIST OF TEST EQUIPMENT

The calibration interval of test equipment is annually or the manufacturer's recommendations. Where the calibration interval deviates from the annual cycle based on the instrument manufacturer's recommendations, it shall be stated below.

Table 4-1: Test Equipment

Asset ID	Manufacturer	Model	Equipment Type	Serial Number	Last Calibration Date	Calibration Due Date
331	Microwave Circuits	H1G513G1	Microwave Bandpass Filter	31417	06/09/2020	06/09/2021
22	Hewlett Packard	8449B	High Frequency Pre-Amp	3008A00526	10/19/2020	10/19/2021
836	ETS Lindgren	SAC Cable Set	SAC Cable Set includes 620, 837, 838	N/A	05/11/2020	05/11/2021
882	Rohde & Schwarz	ESW44	ESW44 EMI TEST RECEIVER	101961	07/28/2020	07/28/2021
857	ETS Lindgren	3117	Horn Antenna 1-18GHz	00153608	11/12/2019	11/12/2021
628	EMCO	6502	Active Loop Antenna 10kHz-30MHz	9407-2877	02/11/2019	05/11/2021
3161	Teseq; Huber+Suhner	CBL6112D;6804-17-A	Bilog Antenna; Attenuator	51323;01252019A	3/19/2021	3/19/2022
622	Rohde & Schwarz	FSV40 (v3.40)	FSV Signal Analyzer 10Hz to 40GHz	101338	08/24/2020	08/24/2021
827	Rohde & Schwarz	TS8997 Rack Cable Set	TS8997 Rack Cable Set	N/A	09/04/2020	09/04/2021
321	Hewlett Packard	HPC 8447D	Low Freq. Pre-Amp	1937A02809	08/10/2020	08/10/2021
168	Hewlett Packard	11947A	Transient Pulse Limiter	44829	03/03/2021	03/03/2022
861	Com-Power Corporation	LI-1100C	Line Impedance Stabilization Network	20180038	02/26/2021	2/26/2022
862	Com-Power Corporation	LI01100C	Line Impedance Stabilization Network	20180039	02/26/2021	02/26/2022
813	PMM	9010	EMI Receiver; RF Input 50ohm; 10Hz-50MHz; 10Hz-30MHz	697WW30606	03/03/2020	06/03/2021
871	TUV SUD	RF Cable	RF Cable(CE Cable)	871	04/23/2020	04/23/2021

NOTE: All test equipment was used only during active calibration cycles.

5 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item	Equipment Type	Manufacturer	Model/Part Number	Serial Number
1	Interface Board	Not labeled	Not labeled	N/A
2	AC/DC Adapter	Phihong	PSM08A-052	N/A

Table 5-2: Cable Description

Cable	Cable Type	Length	Shield	Termination
A	DC Power	1.75m	No	Interface Board to AC/DC Adapter
B	AC Power Cable	1.8m	No	EUT to AC Mains

Note: AC power cable only present during radiated measurements and AC port conducted emissions.

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

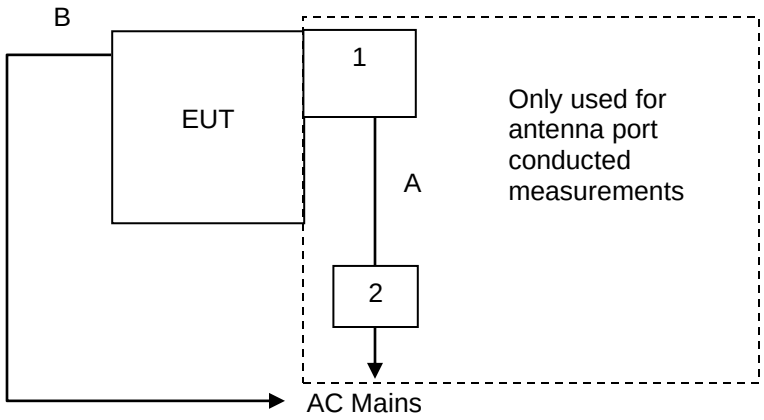

Figure 6-1: Test Setup Block Diagram

7 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

7.1 Antenna Requirement – FCC: Section 15.203

The EUT utilizes a PCB trace antenna. The antenna is integral to the device and cannot be removed or replaced by the end user. The gain of the antenna is -4.21dBi Max.

7.2 Power Line Conducted Emissions – FCC: Section 15.207; ISED Canada: RSS-Gen 8.8

7.2.1 Measurement Procedure

ANSI C63.10 was the guiding document for this evaluation. Conducted emissions were performed from 150kHz to 30MHz with the spectrum analyzer's resolution bandwidth set to 9kHz and the video bandwidth set to 30kHz. The calculation for the conducted emissions is as follows:

Corrected Reading = Analyzer Reading + LISN Loss + Cable Loss
Margin = Corrected Reading - Applicable Limit

7.2.2 Measurement Results

Performed by: Sean Vick

Table 7.2.2-1: Conducted EMI Results – 240VAC/60Hz – Line 1

Frequency (MHz)	Corrected Reading		Limit		Margin		Correction (dB)
	Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average	
	(dBµV)	(dBµV)	(dBµV)	(dBµV)	(dB)	(dB)	
0.154	37.96	26.41	65.78	55.78	-27.82	-29.37	9.68
0.174	34.75	20.41	64.77	54.77	-30.02	-34.36	9.68
0.186	35.21	21.36	64.21	54.21	-29	-32.85	9.68
0.206	38.27	24.17	63.37	53.37	-25.1	-29.2	9.67
0.214	39.27	25.98	63.05	53.05	-23.78	-27.07	9.67
0.222	37.06	22.21	62.74	52.74	-25.68	-30.53	9.67
0.27	37.26	27.7	61.12	51.12	-23.86	-23.42	9.66
0.342	36.03	22.54	59.15	49.15	-23.12	-26.61	9.66
0.35	30.4	21.5	58.96	48.96	-28.56	-27.46	9.66
0.406	31.43	23.84	57.73	47.73	-26.3	-23.89	9.65

Table 7.2.2-2: Conducted EMI Results – 240VAC/60Hz - Neutral

Frequency (MHz)	Corrected Reading		Limit		Margin		Correction (dB)
	Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average	
	(dBµV)	(dBµV)	(dBµV)	(dBµV)	(dB)	(dB)	
0.15	38.28	30.59	66	56	-27.72	-25.41	9.68
0.154	37.04	29.49	65.78	55.78	-28.74	-26.29	9.67
0.174	34.08	18.41	64.77	54.77	-30.69	-36.36	9.67
0.186	34.05	19.99	64.21	54.21	-30.16	-34.22	9.67
0.202	39.57	25.51	63.53	53.53	-23.96	-28.02	9.67
0.214	38.48	23.45	63.05	53.05	-24.57	-29.6	9.67
0.238	37.02	14.17	62.17	52.17	-25.15	-38	9.67
0.274	34.98	21.76	61	51	-26.02	-29.24	9.66
2.986	24.54	10.89	56	46	-31.46	-35.11	9.79
29.982	22.22	13.88	60	50	-37.78	-36.12	10.12

7.3 Peak Output Power – FCC: Section 15.247(b)(2); ISED Canada: RSS-247 5.4(a)

7.3.1 Measurement Procedure (Conducted Method)

The maximum conducted peak output power was measured in accordance with Subclause 7.8.5 of ANS 63.10. The RF output of the equipment under test was directly connected to the input of the spectrum analyzer applying suitable attenuation. The Resolution Bandwidth (RBW) of the spectrum analyzer was set to > 20dB bandwidth of the fundamental emission. The Video Bandwidth (VBW) was set to ≥ 3 times the RBW. The spectrum analyzer was configured with a peak detector and placed in max hold until the trace stabilized. The resulting peak value was recorded.

The device employs 50 channels at any given time therefore the power is limited to 1 Watt.

7.3.2 Measurement Results

Performed by: Divya Adusumilli

Table 7.3.2-1: Maximum Conducted Output Power (Peak)

Frequency (MHz)	Level (dBm)
910	27.95

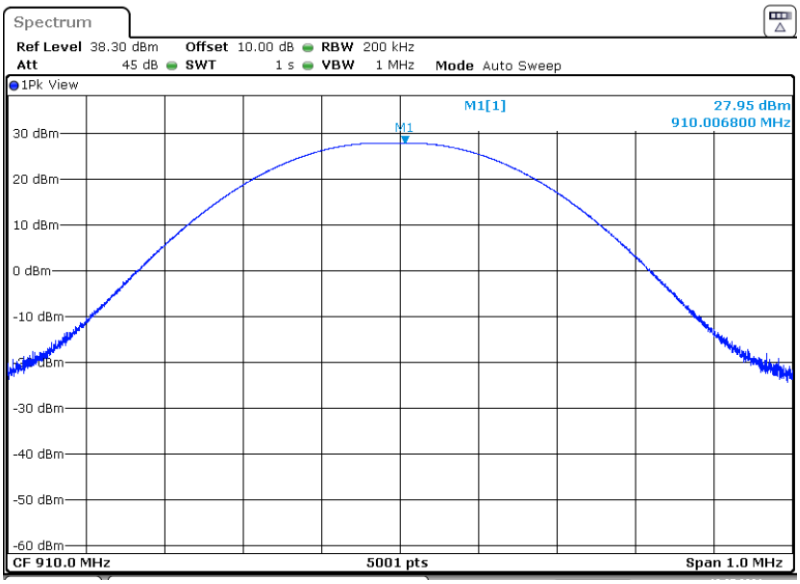

Figure 7.3.2.1- Peak Power LCH

7.4 Channel Usage Requirements

7.4.1 20dB / 99% Bandwidth – FCC: Section 15.247(a)(1)(i); ISED Canada: RSS-247 5.1(c) / RSS-GEN 6.7

7.4.1.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer with suitable attenuation. The span of the spectrum analyzer display was set between two times and five times the occupied bandwidth (OBW) of the emission. The RBW of the spectrum analyzer was set to approximately 1 % to 5 % of the OBW. The trace was set to max hold with a peak detector active. The ndB down function of the analyzer was utilized to determine the 20 dB bandwidth of the emission.

The occupied bandwidth measurement function of the spectrum analyzer was used to measure the 99% bandwidth. The span of the analyzer was set to capture all products of the modulation process, including the emission sidebands. The resolution bandwidth was set to 1% to 5% of the occupied bandwidth. The video bandwidth was set to 3 times the resolution bandwidth. A peak detector was used.

7.4.1.2 Measurement Results

Performed by: Divya Adusumilli

Table 7.4.1.2-1: 20dB / 99% Bandwidth

Frequency (MHz)	20dB Bandwidth (kHz)	99% Bandwidth (kHz)
910	160.45	161.73

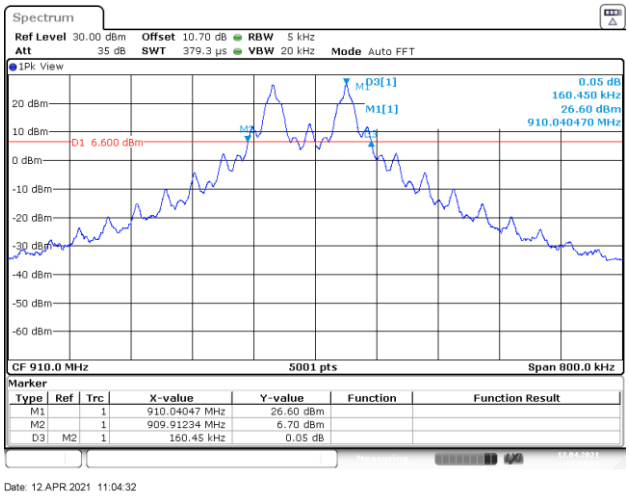

Figure 7.4.1.2-1: 20dB Bandwidth – LCH

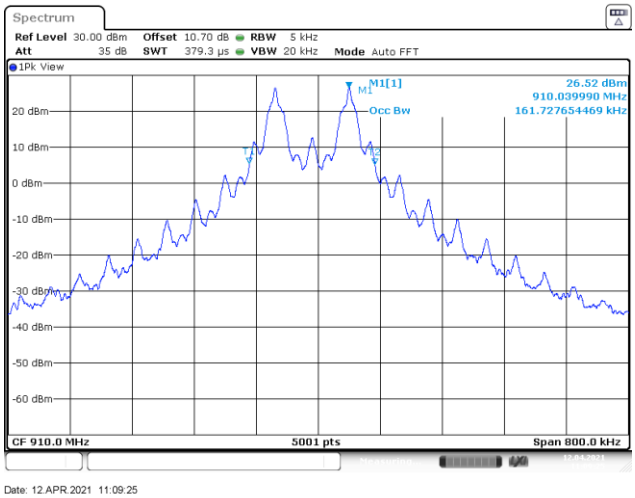

Figure 7.4.1.2-2: 99% Occupied Bandwidth – LCH

7.5 Band-Edge Compliance and Spurious Emissions

7.5.1 Band-Edge Compliance of RF Conducted Emissions – FCC: Section 15.247(d); ISED Canada: RSS-247 5.5

7.5.1.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer with suitable attenuation. The EUT was investigated at the lowest and highest channel available to determine band-edge compliance. For each measurement, the spectrum analyzer's RBW was set to 100kHz and the VBW was set to 300kHz.

Band-edge was evaluated for only for low channel.

7.5.1.2 Measurement Results

Performed by: Divya Adusumilli

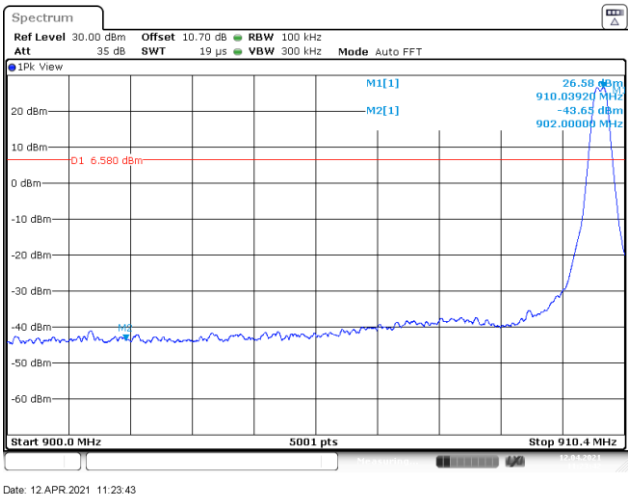

Figure 7.5.1.2-1: Lower Band-edge

7.5.2 RF Conducted Spurious Emissions – FCC: Section 15.247(d); ISED Canada: RSS-247 5.5

7.5.2.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. The EUT was investigated for conducted spurious emissions from 30MHz to 10GHz, 10 times the highest fundamental frequency. Measurements were made at the low, center and high channels of the EUT. For each measurement, the spectrum analyzer's RBW was set to 100kHz. A peak detector function was used with the trace set to max hold.

7.5.2.2 Measurement Results

Performed by: Divya Adusumilli

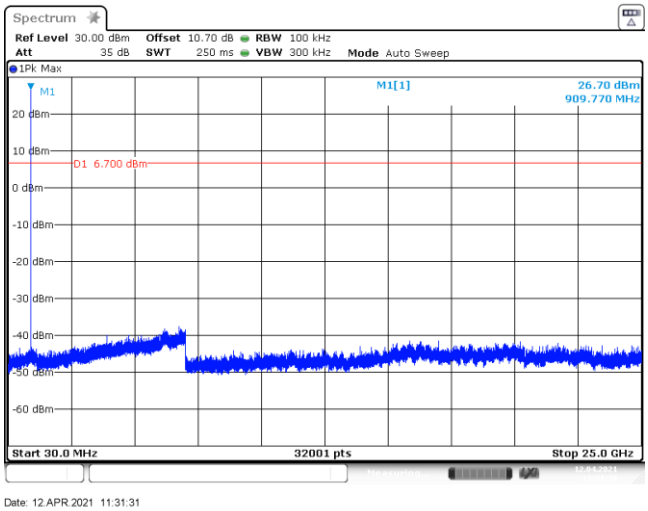

Figure 7.5.2.2-1: 30 MHz – 10 GHz – Low Channel

7.5.3 Radiated Spurious Emissions – FCC: Section 15.205, 15.209; ISED Canada: RSS-Gen 8.9/8.10

7.5.3.1 Measurement Procedure

Radiated emissions tests were made over the frequency range of 9kHz to 10GHz, 10 times the highest fundamental frequency.

The EUT was rotated through 360° and the receive antenna height was varied from 1 meter to 4 meters so that the maximum radiated emissions level would be detected. For frequencies below 1000 MHz, quasi-peak measurements were made using a resolution bandwidth RBW of 120 kHz and a video bandwidth VBW of 300 kHz. For frequencies above 1000 MHz, peak and average measurements were made with RBW and VBW of 1 MHz and 3 MHz respectively.

The EUT was caused to generate a continuous modulated carrier on the hopping channel.

Each emission found to be in a restricted band was compared to the applicable radiated emission limits.

Emissions not reported were below the noise floor of the measurement system. Peak data below 30MHz was more than 20dB below the applicable limits.

7.5.3.2 Measurement Results

Performed by: Paul Villarreal

Table 7.5.3.2-1: Radiated Spurious Emissions Tabulated Data

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Channel 36 (910 MHz)										
2730	36.50	26.60	H	5.88	42.38	32.48	74.0	54.0	31.6	21.5
2730	39.00	30.90	V	5.88	44.88	36.78	74.0	54.0	29.1	17.2
3640	39.40	31.40	H	7.49	46.89	38.89	74.0	54.0	27.1	15.1
3640	38.10	28.90	V	7.49	45.59	36.39	74.0	54.0	28.4	17.6
7280	39.40	28.80	H	12.94	52.34	41.74	74.0	54.0	21.7	12.3
7280	35.10	23.60	V	12.94	48.04	36.54	74.0	54.0	26.0	17.5

7.5.3.3 Sample Calculation:

$R_C = R_U + CF_T$

Where:

CF_T	=	Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
R_U	=	Uncorrected Reading
R_C	=	Corrected Level
AF	=	Antenna Factor
CA	=	Cable Attenuation
AG	=	Amplifier Gain
DC	=	Duty Cycle Correction Factor

Example Calculation: Peak

Corrected Level: 39.4 + 12.94 = 52.34dBuV/m
Margin: 74dBuV/m – 52.34dBuV/m = 21.7dB

Example Calculation: Average

Corrected Level: 31.40+ 7.49 - 0 = 38.89dBuV
Margin: 54dBuV – 38.89dBuV = 15.1dB

8 ESTIMATION OF MEASUREMENT UNCERTAINTY

The expanded laboratory measurement uncertainty figures (U_{Lab}) provided below correspond to an expansion factor (coverage factor) k = 1.96 which provide confidence levels of 95%.

Table 8-1: Estimation of Measurement Uncertainty

Parameter	U_{lab}
Occupied Channel Bandwidth	± 0.009 %
RF Conducted Output Power	± 0.349 dB
Power Spectral Density	± 0.372 dB
Antenna Port Conducted Emissions	± 1.264 dB
Radiated Emissions ≤ 1 GHz	± 5.814 dB
Radiated Emissions > 1 GHz	± 4.318 dB
Temperature	± 0.860 °C
Radio Frequency	± 2.832 x 10^{-8}
AC Power Line Conducted Emissions	± 3.360 dB

9 CONCLUSION

In the opinion of TÜV SÜD America, Inc. the CAT3, manufactured by Itron, Inc. meets the requirements of FCC Part 15 subpart C and Innovation, Science and Economic Development Canada's Radio Standards Specification RSS-247 for the tests documented herein and with comparison to the original test data.

Appendix A: Plots

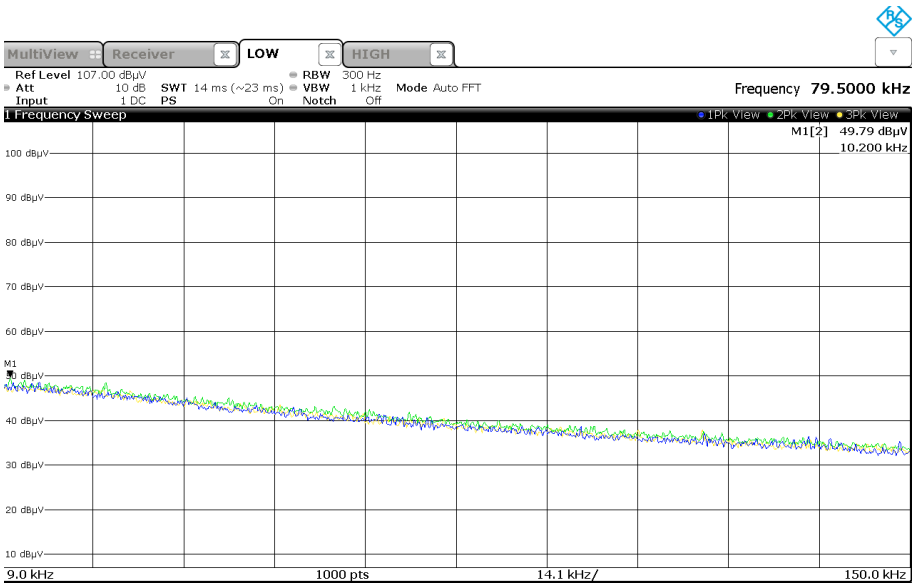

Figure A-1: 9kHz-150kHz

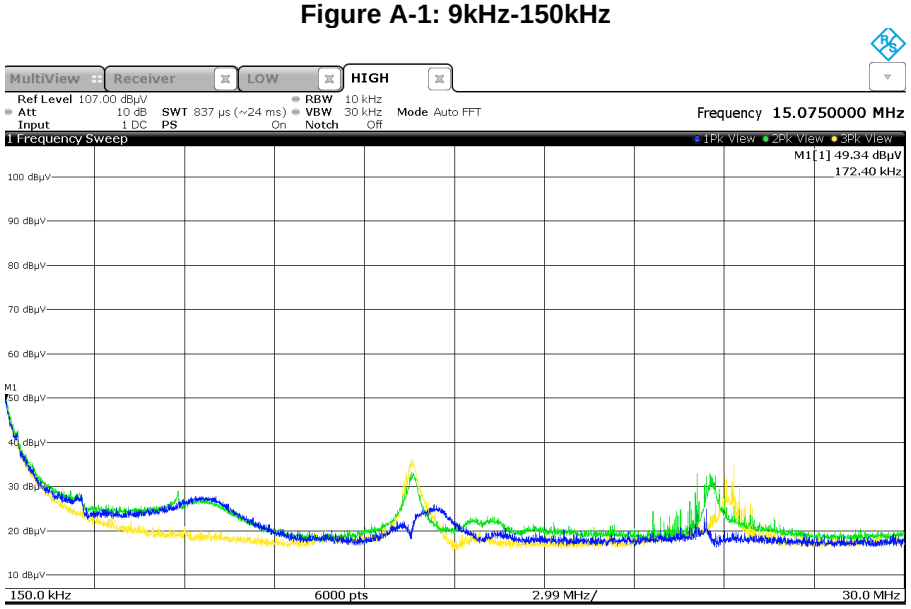

Figure A-2: 150kHz-30MHz

Note: Emissions above the noise floor are ambient not associated with the EUT.

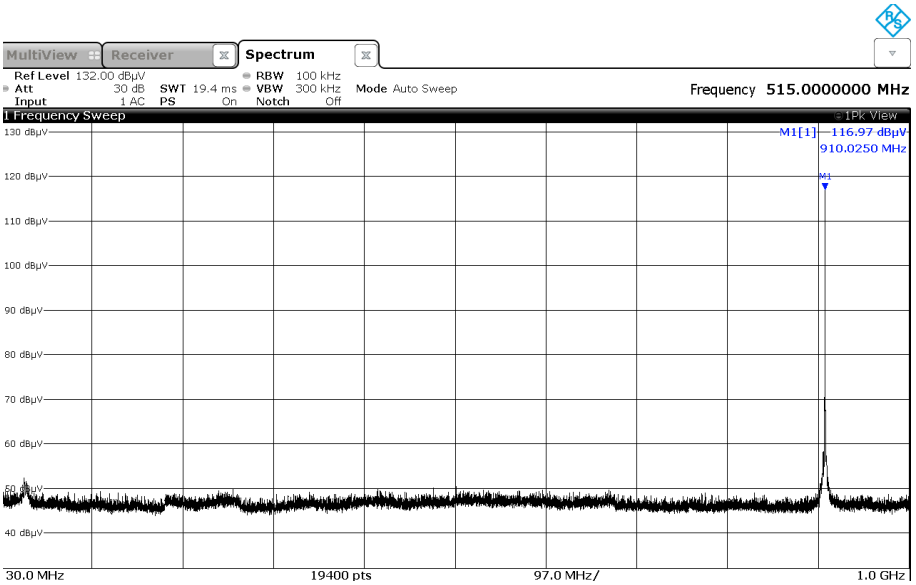

Figure A-3: 30MHz-1GHz

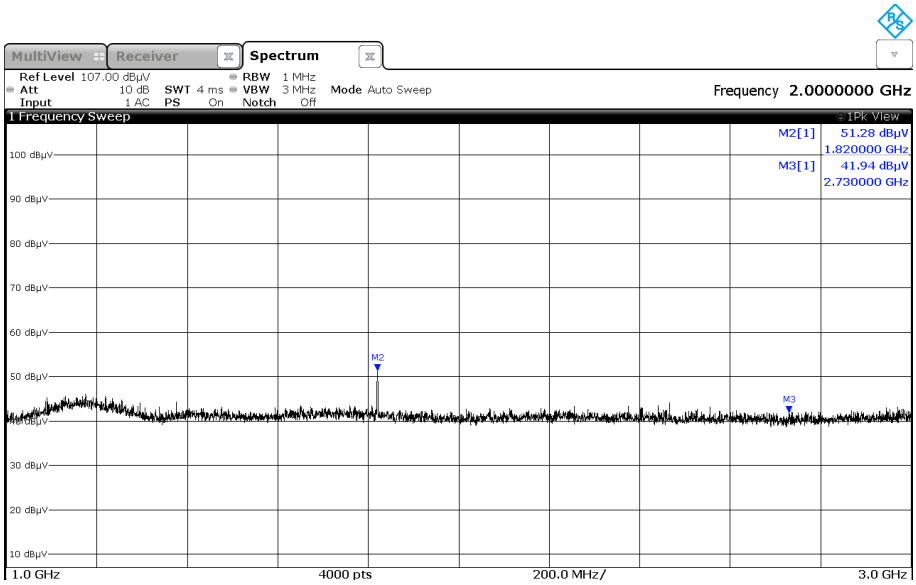

Figure A-4: 1GHz-3GHz

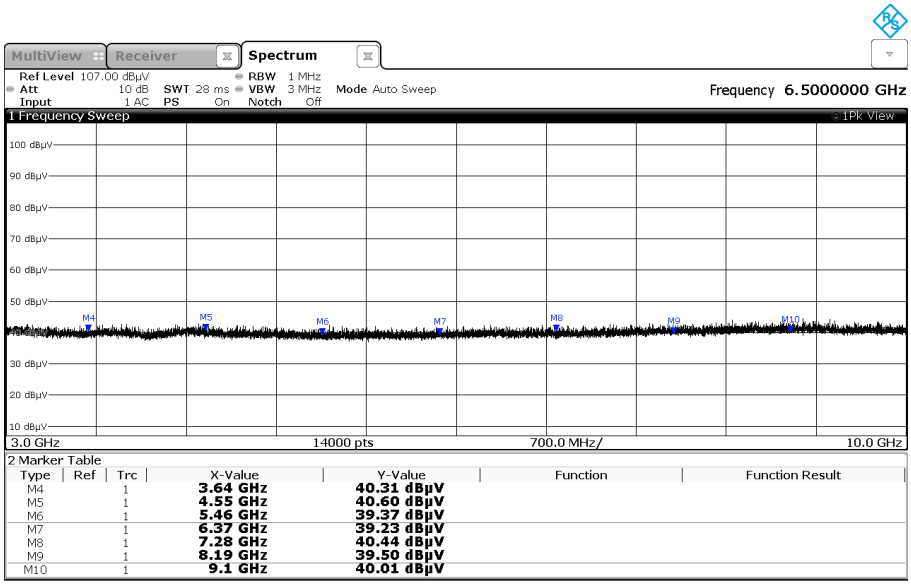

Figure A-5: 3GHz-10GHz

END REPORT