



Canada

RF Test Report

As per

RSS-210 Issue 9:2016 & FCC Part 15 Subpart 15.209:2016

Low Power Licence Exempt Radio
Communication Devices
Intentional Radiators
on the

Lock N' Prox
Model: 3590

Issued by:

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Amir Emami,
Project Engineer

Testing produced for



RUTHERFORD CONTROLS

dormakaba Group

See Appendix A for full client &
EUT details.



Testing Laboratory
Certificate #2955.02



R-4023, G-506
C-4498, T-1246



Registration #
CA6844



Client	Rutherford Controls Int'l Inc. (RCI)	
Product	Lock N' Prox, Model 3590	
Standard(s)	RSS-210 Issue 9:2016 FCC Part 15 Subpart 15.209:2016	

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Client	Rutherford Controls Int'l Inc. (RCI)	
Product	Lock N' Prox, Model 3590	
Standard(s)	RSS-210 Issue 9:2016 FCC Part 15 Subpart 15.209:2016	

Report Scope

This report addresses the EMC verification testing and test results of the **Lock N' Prox** battery operated cabinet lock, Model: **3590**, herein referred to as EUT (Equipment Under Test). The EUT was tested for compliance against the following standards:


RSS-210 Issue 9:2016

FCC Part 15 Subpart C 15.209:2016

Test procedures, results, justifications, and engineering considerations, if any, follow later in this report.

This report does not imply product endorsement by any government, accreditation agency, or TÜV SÜD Canada Inc.

Opinions or interpretations expressed in this report, if any, are outside the scope of TÜV SÜD Canada Inc. accreditations. Any opinions expressed do not necessarily reflect the opinions of TÜV SÜD Canada Inc., unless otherwise stated.


Client	Rutherford Controls Int'l Inc. (RCI)	 Canada
Product	Lock N' Prox, Model 3590	
Standard(s)	RSS-210 Issue 9:2016 FCC Part 15 Subpart 15.209:2016	

Summary

The results contained in this report relate only to the item(s) tested.

EUT	Lock N' Prox, Model 3590
FCC Certification #, FCC ID:	2AED9-RR401
Industry Canada Certification #, IC:	20128-RR401
EUT passed all tests performed	Yes
Tests conducted by	Amir Emami


For testing dates, see "Testing Environmental Conditions and Dates".

Client	Rutherford Controls Int'l Inc. (RCI)	
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Standard(s)	RSS-210 Issue 9:2016 FCC Part 15 Subpart 15.209:2016	

Test Results Summary

Standard/Method	Description	Class/Limit	Result
FCC 15.203	Antenna Requirement	Unique	Pass See Justification
FCC 15.209 RSS-GEN (Table 4)	Transmitter Spurious Radiated Emissions	Quasi-Peak	Pass
FCC 15.207 RSS-GEN (Table 3)	Power Line Conducted Emissions	Quasi-Peak, Average	N/A, See Justification
FCC 15.215 (c) C63.10 Section 6.9	Occupied Bandwidth	20dB OBW	Pass
RSS-GEN Section 6.6	Occupied Bandwidth	99% OBW	Pass
Overall Result			Pass

If the product as tested or otherwise complies with the specification, the EUT is deemed to comply with the requirement and is deemed a 'PASS' grade. If not 'FAIL' grade will be issued. Note that 'PASS' / 'FAIL' grade is independent of any measurement uncertainties. A 'PASS' / 'FAIL' grade within measurement uncertainty is marked with a '*'.

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Notes, Justifications, or Deviations

The following notes, justifications for tests not performed or deviations from the above listed specifications apply:

For the antenna requirement specified in FCC 15.203, the unit uses a custom loop antenna which is also not meant to be replaceable by the user. Refer to Figure 4 of the Internal Photos exhibit.

For the Restricted Bands of operation, the EUT is designed to operate at 125 kHz.

The EUT was mounted in three orthogonal axis. Worst case results were obtained with the EUT in the Z-axis. Worst case results are presented. See Appendix B for axis details.

Power line conducted emissions was not applicable since the EUT is a battery operated device. It uses a 3V Lithium battery.

All the tests were performed with new battery installed.

The EUT does not have an antenna port and all measurements were performed using the radiated method.


Sample Calculation(s)

Radiated Emission Test

Margin = Limit – (Received Signal + Antenna Factor + Cable Loss – Pre-Amp Gain)


Margin = 50.5dB μ V/m – (50dB μ V + 10dB + 2.5dB – 20dB)

Margin = 8.0 dB (pass)

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Applicable Standards, Specifications and Methods

ANSI C63.4:2014	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 For Testing Unlicensed Wireless Devices
CFR 47 FCC 15 Subpart C:2016	Code of Federal Regulations – Radio Frequency Devices, Intentional Radiators
ICES-003 Issue 6 2016	Digital Apparatus - Spectrum Management and Telecommunications Policy Interference-Causing Equipment Standard
RSS-GEN Issue 4 2014	General Requirements and Information for the Certification of Radio Apparatus
RSS-210 Issue 9:2016	Licence-Exempt Radio Apparatus: Category I Equipment
ISO 17025:2005	General Requirements for the Competence of Testing and Calibration Laboratories

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Document Revision Status

Revision 0 - November 16, 2017
Initial Release

Client	Rutherford Controls Int'l Inc. (RCI)	
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Standard(s)	RSS-210 Issue 9:2016 FCC Part 15 Subpart 15.209:2016	

Definitions and Acronyms

The following definitions and acronyms are applicable in this report.
See also ANSI C63.14.

AE – Auxiliary Equipment. A digital accessory that feeds data into or receives data from another device (host) that in turn, controls its operation.

BW – Bandwidth. Unless otherwise stated, this refers to the 20 dB bandwidth.

EMC – Electro-Magnetic Compatibility. The ability of an equipment or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment.

EMI – Electro-Magnetic Immunity. The ability to maintain a specified performance when the equipment is subjected to disturbance (unwanted) signals of specified levels.


EUT – Equipment Under Test. A device or system being evaluated for compliance that is representative of a product to be marketed.

ITE – Information Technology Equipment with a primary function(s) of entry, storage, display, retrieval, transmission, processing, switching, or control, of data.

LISN – Line Impedance Stabilization Network

NCR – No Calibration Required

RF – Radio Frequency


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Testing Facility

Testing for EMC on the EUT was carried out at TÜV SÜD Canada labs near Toronto, Ontario. The testing lab consists of a 3m semi-anechoic chamber calibrated to be able to allow measurements on an EUT that has a maximum width or length of up to 2m and a height of up to 3m. The chamber is equipped with a turntable that is capable of testing devices up to 3300lb in weight. This facility is capable of testing products that are rated for 120Vac and 240Vac single phase, or devices that are rated for a 208Vac 3 phase input. DC capability is also available for testing. The chamber is equipped with a mast that controls the polarization and height of the antenna. Control of the mast occurs in the control room adjoining the shielded chamber. Radiated emission measurements are performed using a BiLog antenna and a Horn antenna where applicable. Conducted emissions, unless otherwise stated, are performed using a LISN and using the Vertical Ground plane if applicable.

Calibrations and Accreditations


The 3m semi-anechoic chamber is registered with Federal Communications Commission (FCC, CA6844), Industry Canada (IC, 6844A-3) and Voluntary Control Council for Interference (VCCI, R-4023, G-506, C-4498, and T-1246). This chamber was calibrated for Normalized Site Attenuation (NSA) using test procedures outlined in ANSI C63.4 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". The chamber is lined with ferrite tiles and absorption cones to minimize any undesired reflections. The NSA data is kept on file at TÜV SÜD Canada. For radiated susceptibility testing, a 16 point field calibration has been performed on the chamber. The field uniformity data is kept on file at TÜV SÜD Canada. TÜV SÜD Canada Inc is accredited to ISO 17025 by A2LA with Testing Certificate #2555.01. The laboratory's current scope of accreditation listing can be found as listed on the A2LA website. All measuring equipment is calibrated on an annual or bi-annual basis as listed for each respective test.

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Testing Environmental Conditions and Dates

Following environmental conditions were recorded in the facility during time of testing

Date	Test	Initials	Temperature (°C)	Humidity (%)	Pressure (kPa)
October 6, 2017	Radiated Emissions	AE	22.2	50.0	101.2

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Detailed Test Results Section

Client	Rutherford Controls Int'l Inc. (RCI)	
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Radiated Emission Field Strength

Purpose

The purpose of this test is to ensure that the RF energy emitted from the EUT does not exceed the limits listed below as defined in the applicable test standard, as measured from a receiving antenna. This helps protect other devices which may be using the same spectrum allocations for similar or other purposes and also ensures the transmit range of the device is within the pre-determined suitable range. This also ensures public safety by not exceeding a level which has been deemed safe for human exposure.

Limits and Method

The limits are defined in FCC Part 15.209(a).


Method is using a loop antenna and converting to voltage based on the impedance of free space.

Fundamental Frequency (kHz)	Field Strength Limit (uV/m) at 300m	Limit (dBuV/m)¹ at 3m
125kHz	2400/F (kHz)	105.66

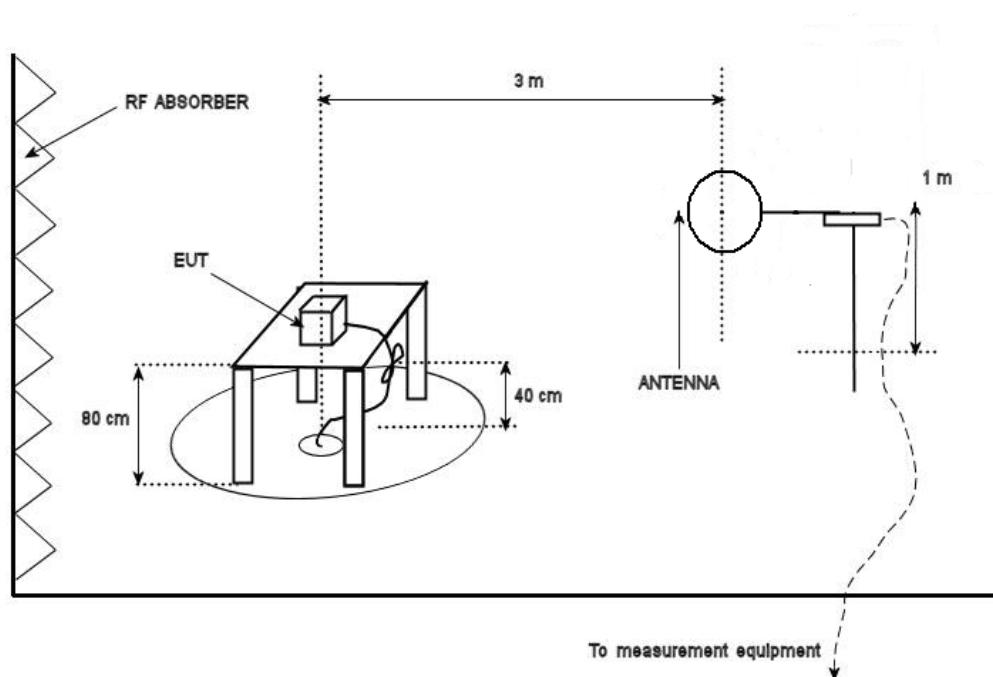
¹Limit is with a Quasi-Peak detector with bandwidths as defined in CISPR-16-1-1

Based on ANSI C63.4 Section 4.2, if the Peak detector measurements do not exceed the Quasi-Peak limits, where defined, then the EUT is deemed to have passed the requirements.

In accordance with FCC Part 15, section 15.31(f)(2), testing was performed at a 3 meter test distance and an extrapolation factor of 40 dB/decade was applied. For example, an extrapolation of 300m to 3m is $20\text{Log}(uV/m) + 40\text{Log}(300m/3m)$.

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Typical Radiated Emissions Setup




Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is $\pm 4.25\text{dB}$ for 30MHz – 1GHz and $\pm 4.93\text{dB}$ for 1GHz – 18GHz with a 'k=2' coverage factor and a 95% confidence level.

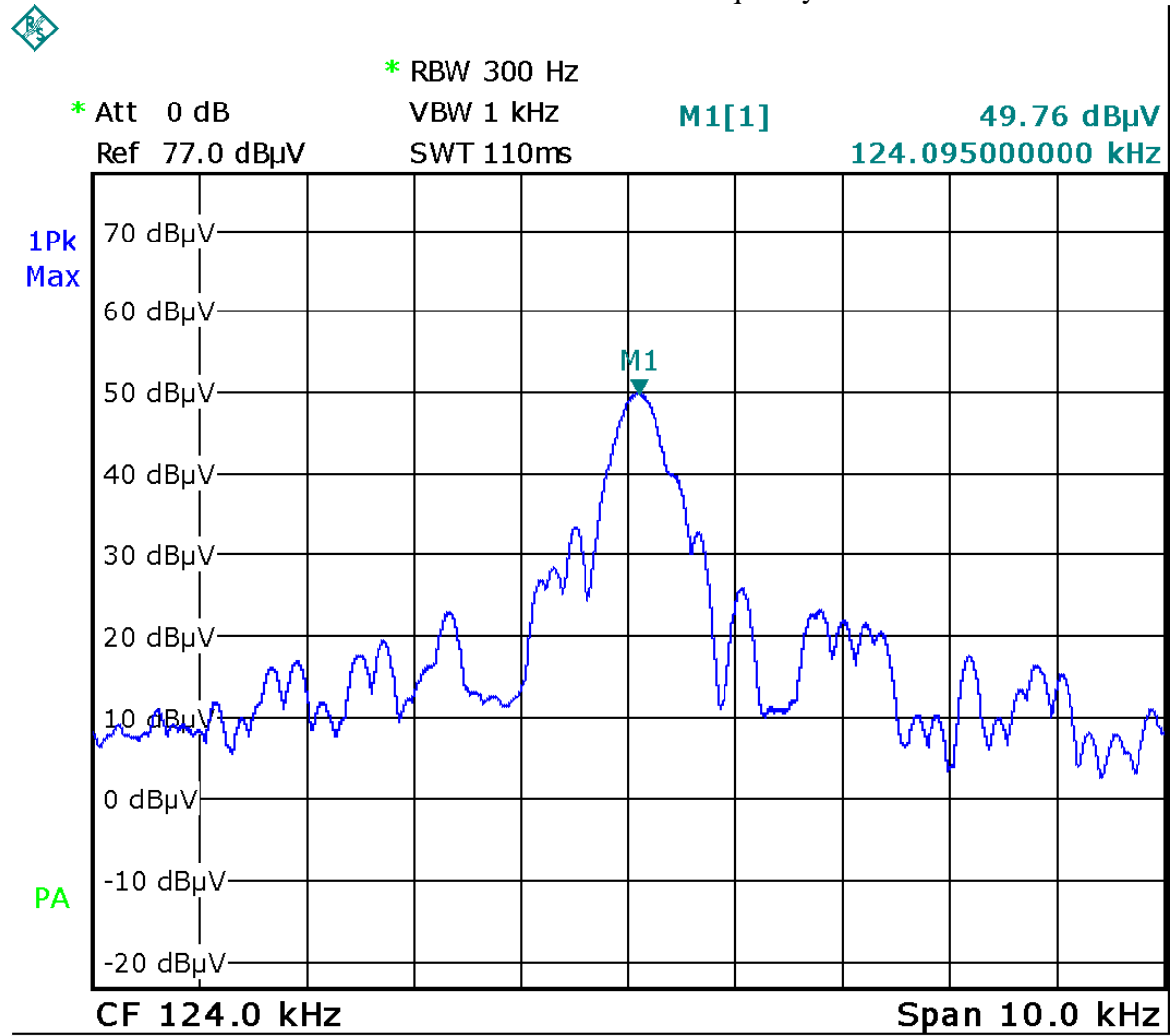
Preliminary Graphs


The graphs shown below are maximized peak measurement graphs over a full 0-360°. The loop was orientated at 0 degrees and 90 degrees and a maximized reading is shown. The marker shows the raw value. See the Final Measurements section below for corrected values.

To obtain the maximum emission, the loop antenna is positioned with its plane vertical and rotated about its vertical axis at the maximum azimuth position. This is then repeated with its plane horizontal, and rotated about the horizontal axis. The maximum obtained emission is presented.

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Peak Emission at Carrier Frequency



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Final Measurements

Test Frequency (MHz)	Detector Peak/QP	EUT Axis	Received Signal (dBμV)	dBuA/dBuV Conv. factor	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-Amp (dB)	Level (dBμV/m)	Emission Limit dB(μV/m)	Margin dB	Result
0.124	Peak	Y	49.8	51.5	3.8	0.3	-30.9	74.5	105.7	31.2	Pass
0.124	Peak	X	46.8	51.5	3.8	0.3	-30.9	71.5	105.7	34.2	Pass
0.124	Peak	Z	49.8	51.5	3.8	0.3	-30.9	74.5	105.7	31.2	Pass

Emissions Table

Note:


Peak = Peak measurement

QP = Quasi-Peak measurement

See 'Appendix B – EUT and Test Setup Photos' for photos showing the test set-up and EUT axis.

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	ESU 40	Rohde & Schwarz	Jan. 6, 2016	Jan. 6, 2018	GEMC 233
Pre-Amp	LNA-1450	RF Bay Inc.	Oct. 11, 2016	Oct. 11, 2018	GEMC 221
Loop Antenna	EM 6871	Electro-Metrics	Feb 13, 2017	Feb 13, 2019	GEMC 70
RF Cable 10m	LMR-400-10M-50Ω-MN-MN	LexTec	Feb. 20, 2017	Feb. 20, 2018	GEMC 274
RF Cable 2m	Sucoflex 104A	Huber+Suhner	Feb. 20, 2017	Feb. 20, 2018	GEMC 272

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Transmitter Spurious Radiated Emissions

Purpose

The purpose of this test is to ensure that the RF energy unintentionally emitted from the EUT does not exceed the limits listed below as defined in the applicable test standard, as measured from a receiving antenna. This helps protect broadcast radio services such as television, FM radio, pagers, cellular telephones, emergency services, and so on, from unwanted interference.

Limits and Method

The limits are as defined in FCC Part 15 Section 15.209(a). The method is as defined in ANSI C63.10.

The limits apply for those emissions that fall in the restricted bands, as defined in Section 15.205(a). These emissions must comply with the radiated emission limits specified in Section 15.209(a).


Frequency	Limit at 3m (dBuV/m)
0.009 MHz – 0.490 MHz	128.5 to 93.8 ¹
0.490 MHz – 1.705 MHz	73.8 to 63 ¹
1.705 MHz – 30 MHz	69.5 ¹
30 MHz – 88 MHz	40.0 ¹
88 MHz – 216 MHz	43.5 ¹
216 MHz – 960 MHz	46.0 ¹
Above 960 MHz	54.0 ¹
Above 1000 MHz	54.0 ²
Above 1000 MHz	74.0 ³

¹Limit is with Quasi-Peak detector with bandwidths as defined in CISPR-16-1-1 except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz where an Average detector is used.

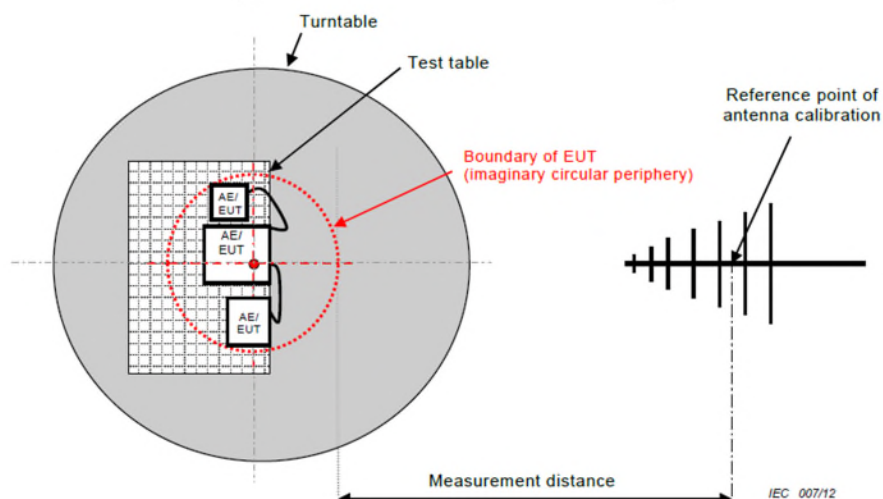
²Limit is with 1 MHz measurement bandwidth and using an Average detector

³Limit is with 1 MHz measurement bandwidth and using a Peak detector

Based on ANSI C63.4 Section 4.2, if the Peak detector measurements do not exceed the Quasi-Peak limits, where defined, then the EUT is deemed to have passed the requirements

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Typical Radiated Emissions Setup



Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is $\pm 4.25\text{dB}$ for 30MHz – 1GHz and $\pm 4.93\text{dB}$ for 1GHz – 18GHz with a 'k=2' coverage factor and a 95% confidence level.


Preliminary Graphs

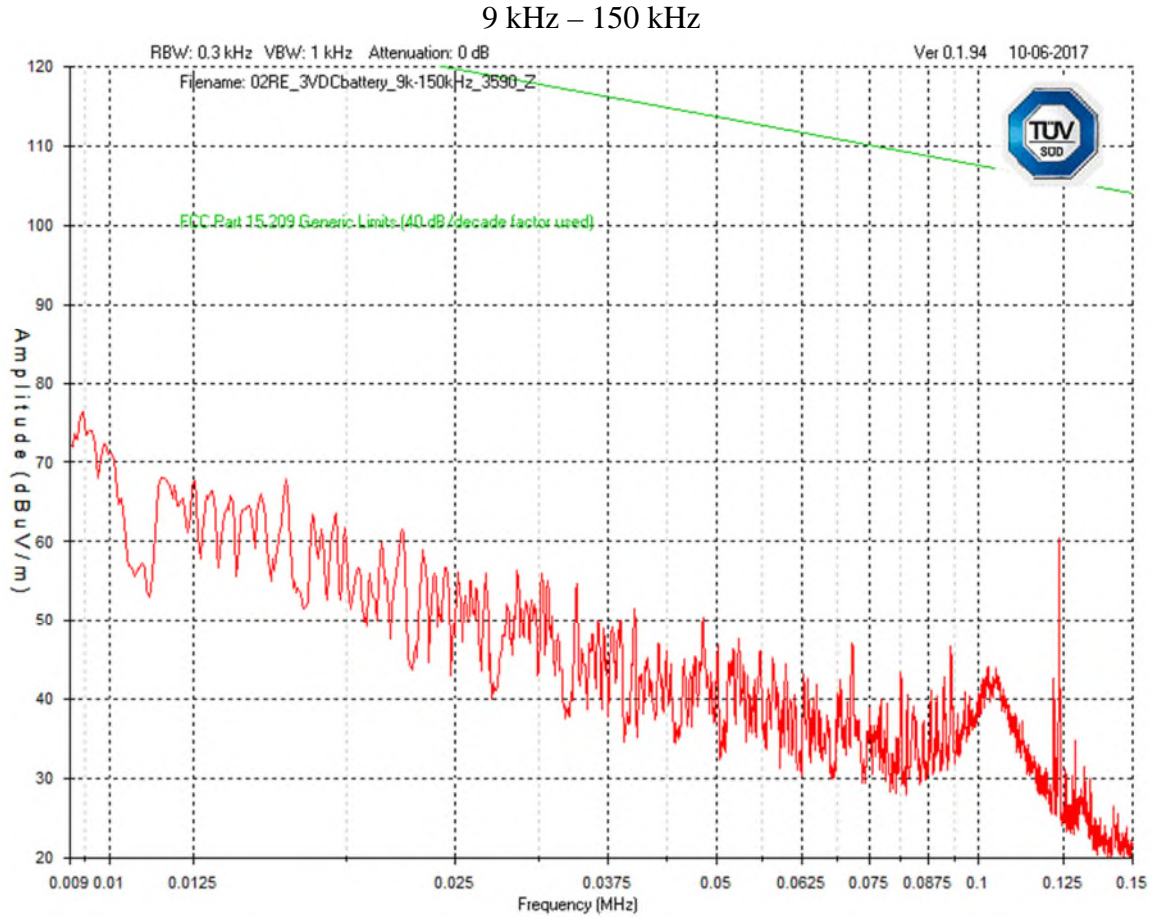
The graphs shown below are obtained at a 3m test distance and are maximized peak measurement graphs measured with a resolution bandwidth greater than or equal to the final required detector over a full 0-360°. This peaking process is done as a worst case measurement and enables the detection of frequencies of concern for final measurement. For final measurements with the appropriate detector, where applicable, please refer to the tables under Final Measurements.


In accordance with FCC Part 15, Subpart A, Section 15.33(a), the device is scanned to at least the 10th harmonic (A minimum of 1.25MHz).

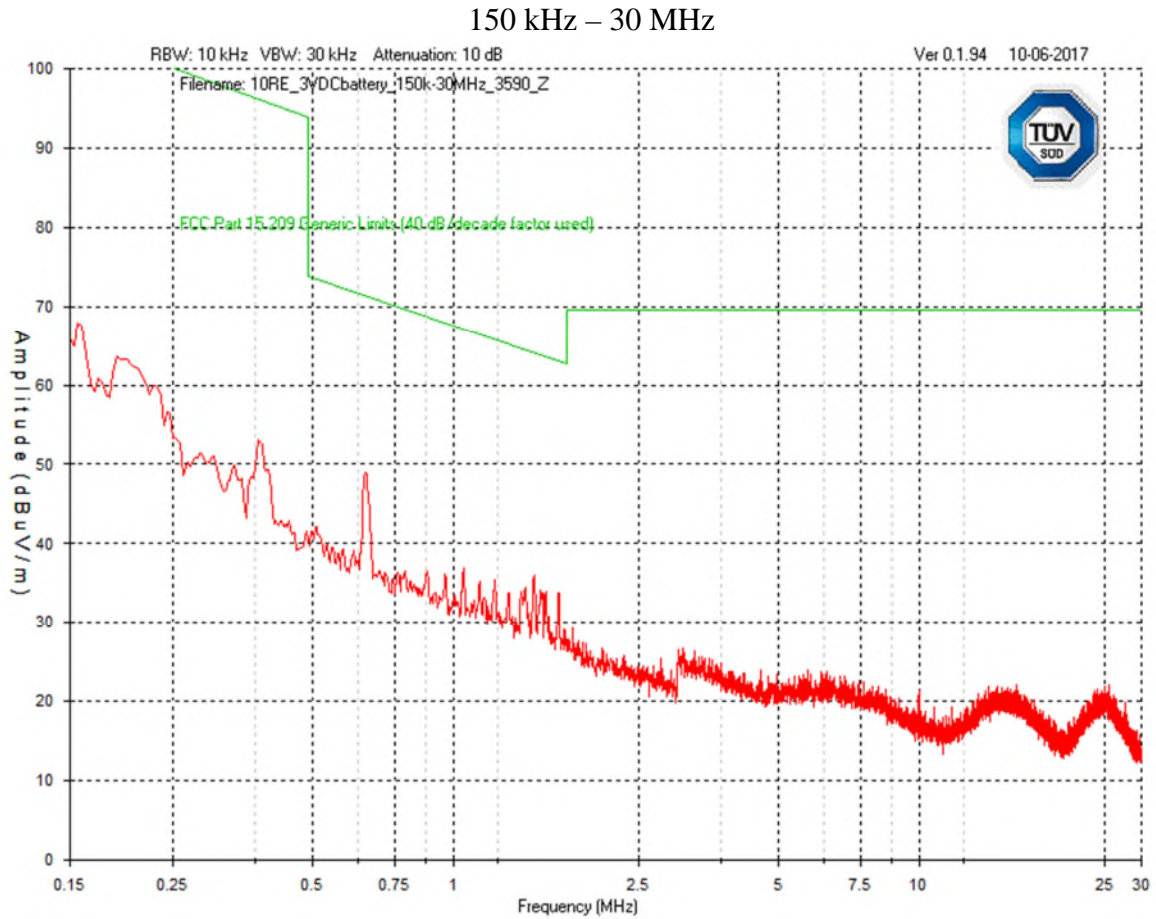
Devices scanned may be scanned at alternate test distances, and in accordance with FCC Part 15, Subpart A, Section 15.31(f), an extrapolation factor of 20 dB/decade was used above 30 MHz and 40 dB/decade below 30 MHz. For example, an extrapolation of 30m to 3m for frequencies below 30MHz is $20\text{Log}(uV/m) + 40\text{Log}(30m/3m)$.


The EUT was checked in three orthogonal axes. However, the worst case graphs are presented from the Z-axis.

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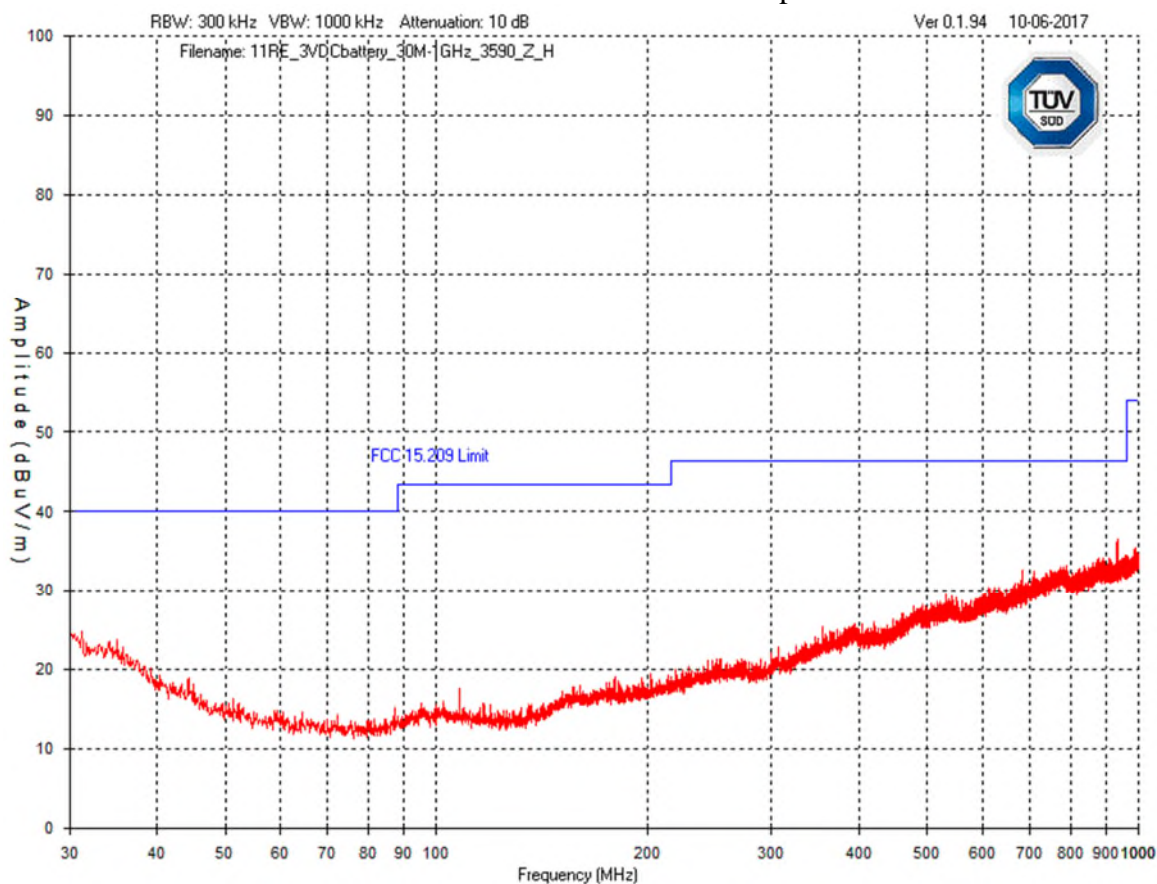



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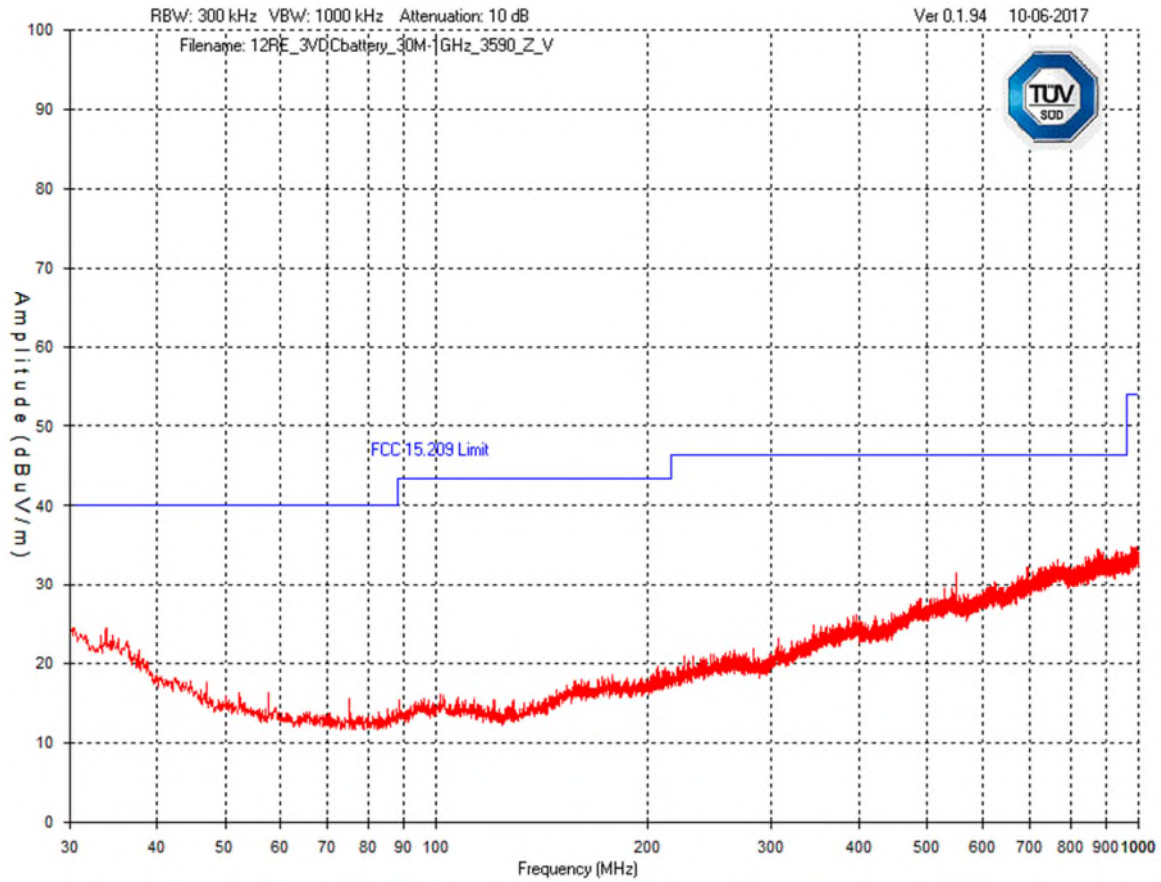
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30 MHz – 1 GHz
Horizontal - Peak Emission Graph



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30 MHz – 1 GHz
Vertical - Peak Emission Graph



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Final Measurements

The EUT passed. No quasi-peak measurement is required as all peak emissions are more than 10dB below the limit.


Note:

See 'Appendix B – EUT and Test Setup Photos' for photos showing the test set-up for the highest radiated emission.

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	ESU 40	Rohde & Schwarz	Jan. 06, 2016	Jan. 06, 2018	GEMC 233
Pre-Amp	LNA-1450	RF Bay Inc.	Oct. 11, 2016	Oct. 11, 2018	GEMC 221
Loop Antenna	EM 6871	Electro-Metrics	Feb 13, 2017	Feb 13, 2019	GEMC 70
Loop Antenna	EM 6872	Electro-Metrics	Feb 13, 2017	Feb 13, 2019	GEMC 71
BiLog Antenna	3142-C	ETS	Feb. 22, 2017	Feb. 22, 2019	GEMC 137
RF Cable 10m	LMR-400-10M-50Ω-MN-MN	LexTec	June 16, 2017	June 16, 2018	GEMC 274
RF Cable 2m	Sucoflex 104A	Huber+Suhner	June 16, 2017	June 16, 2018	GEMC 271
Emissions Software	0.1.94	Global EMC	NCR	NCR	GEMC 58

FCC - 15.209 - Radiated Emissions_Rev1

Client	Rutherford Controls Int'l Inc. (RCI)	
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20dB and 99% Occupied Bandwidth

Purpose

The purpose of this test is to verify that intentional radiators operating under the alternative provisions to the general emission limits are designed to ensure the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. This helps ensure the utilization of the frequency allocation and prevent corruption of data by ensuring adequate data separation to distinguish the reception of the intended information.


Limits and Method

The limit is as specified in FCC Part 15.215(c) and RSS-GEN Section 6.6 and the method is given in ANSI C63.10.

Results

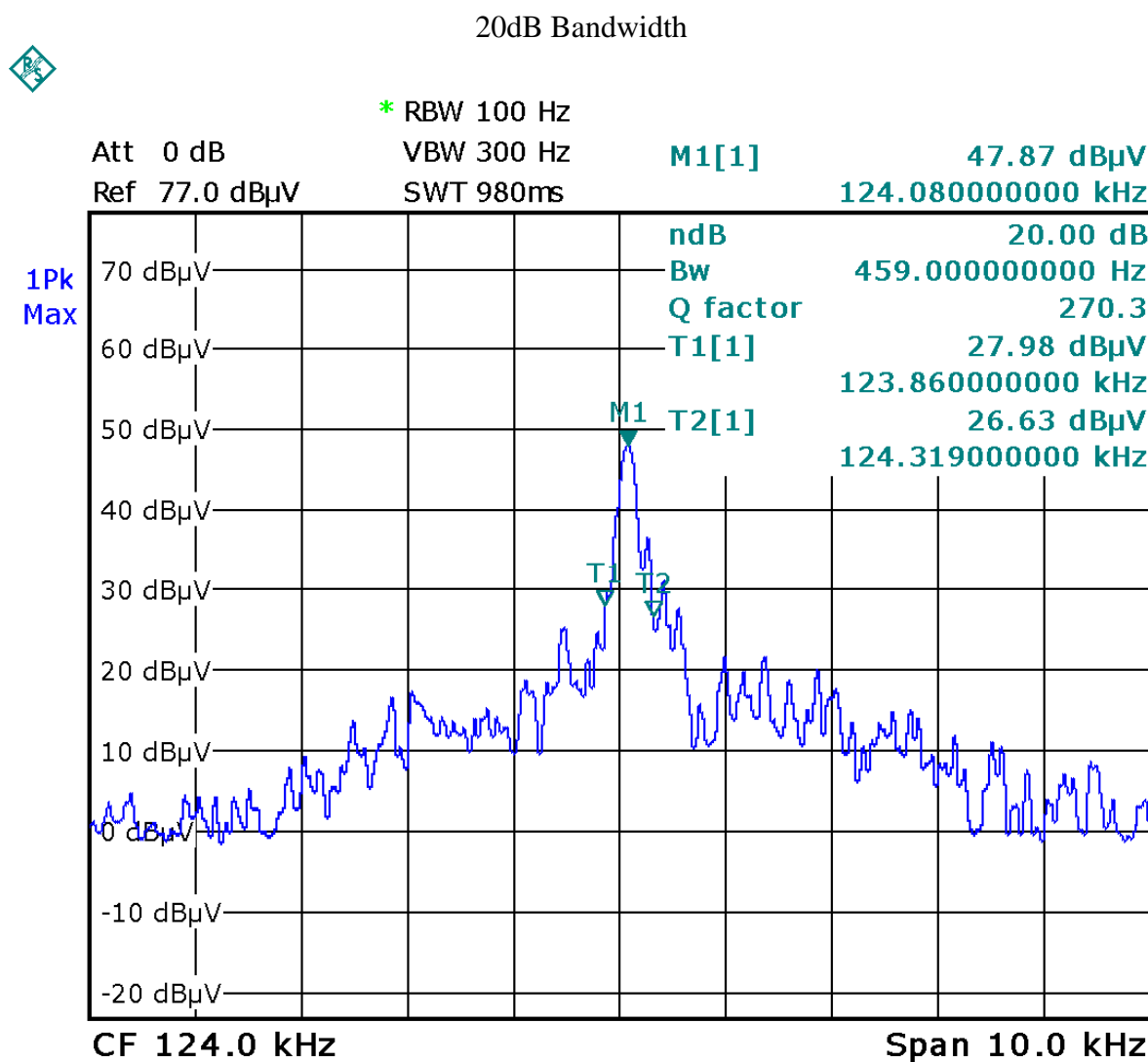
The 99% BW was measured using the 99% BW function of the spectrum analyzer.


Frequency (kHz)	20dB Bandwidth (kHz)	99% Bandwidth (kHz)
124	0.459	2.994

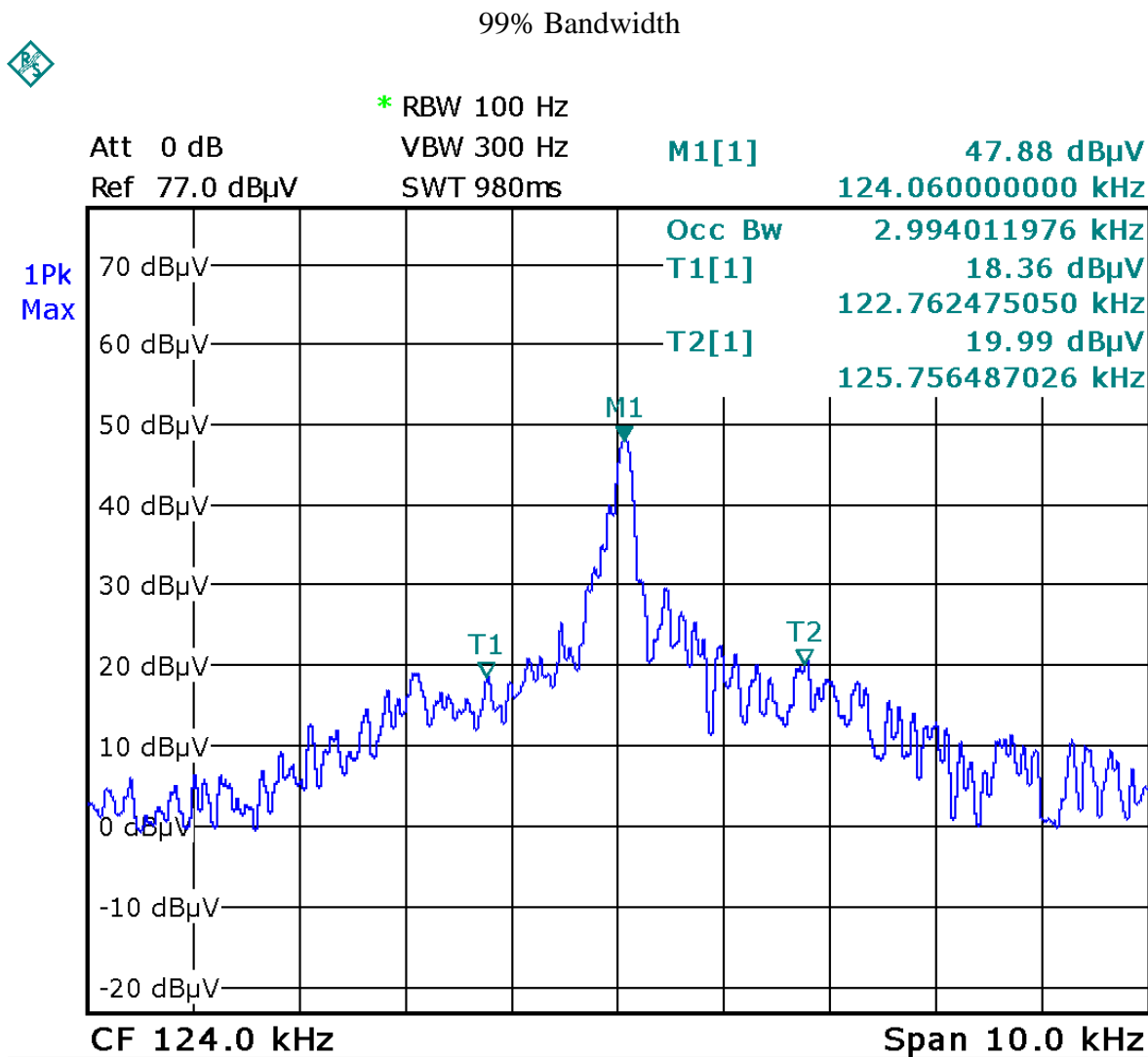
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Graphs


The graphs showed below shows the OBW during the operation of the device. This is measured by a max hold on the spectrum analyzer and the highest resolution bandwidth that is sufficiently low to exhibit the bandwidth of a channel during operation of the EUT. Max hold is performed for a duration of not less than 1 minute.



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Note: See 'Appendix B – EUT & Test Setup Photos' for photos showing the test set-up.


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Loop Antenna	EM 6871	Electro-Metrics	Feb 13, 2017	Feb 13, 2019	GEMC 70
RF Cable 10m	LMR-400-10M-50Ω-MN-MN	LexTec	Feb. 20, 2017	Feb. 20, 2018	GEMC 274
RF Cable 2m	Sucoflex 104A	Huber+Suhner	Feb. 20, 2017	Feb. 20, 2018	GEMC 272

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Appendix A – EUT Summary


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For further details for filing purposes, refer to filing package.

General EUT Description

Client	
Organization / Address	Rutherford Controls Int'l (RCI) 210 Shearson Crescent Cambridge, ON N1T 1J6
Phone	519-621-7651
EUT Details	
EUT Name	Lock N' Prox
EUT Model	3590
Equipment Category	RFID
Basic EUT Functionality	Battery operated cabinet lock with RFID keys and/or fobs
Input Voltage	3VDC
Connectors available on EUT	None
Peripherals Required for Test	125kHz RFID tag
Release type	Final
Intentional Radiator Frequency	125kHz for RFID applications
EUT Configuration	Wireless configured to transmit under normal operation

Note the EUT is considered to have been received the date of the commencement of the first test, unless otherwise stated. For a close-up picture of the EUT, see 'Appendix B – EUT and Test Setup Photos'.

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Appendix B – EUT and Test Setup Photos

See the Test Setup exhibit which is separate from this test report for the EUT and Test Setup photos.