41039 Boyce Road
Fremont, CA. 94538

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EMC Test Report

Application for FCC Grant of Equipment Authorization

FCC Part 15 Subpart C

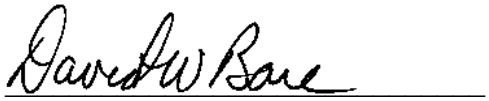
Model: 71100-702

FCC ID:	2AVRC-71100-702
APPLICANT:	Rugged Solutions, LLC 88360 Diamondhead Drive E Diamondhead, MS 39525
TEST SITE(S):	National Technical Systems 41039 Boyce Road. Fremont, CA. 94538-2435
PROJECT NUMBER:	PR104153
REPORT DATE:	March 10, 2020
RE-ISSUED DATE:	September 18, 2020
FINAL TEST DATES:	January 15, 27 and February 5 and September 14, 2020
TOTAL NUMBER OF PAGES:	30

A2LA ACCREDITED
Testing Cert #0214.26

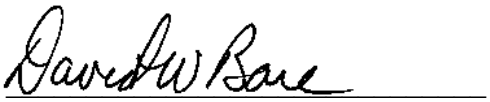
VALIDATING SIGNATORIES

PROGRAM MGR



David W. Bare
Chief Engineer

TECHNICAL REVIEWER:



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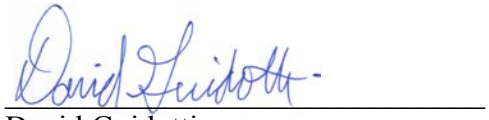

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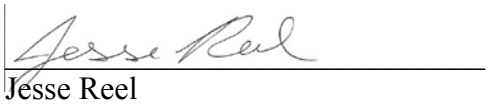
Senior Technical Writer

QUALITY ASSURANCE DELEGATE



Jesse Reel
Technical Writer

REVISION HISTORY

Rev#	Date	Comments	Modified By
-	March 10, 2020	First release	
1	September 14, 2020	Added results below 30 MHz	DWB
2	September 18, 2020	Added results to cover 30 kHz to 10 MHz emissions	DMG

TABLE OF CONTENTS

SCOPE

An electromagnetic emissions test has been performed on the Rugged Solutions, LLC model 71100-702, pursuant to the following rules:

FCC Part 15 Subpart C, §15.249

Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in the following reference standards and as outlined in National Technical Systems test procedures:

ANSI C63.10-2013

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant Industry Canada performance and procedural standards.

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

National Technical Systems is accredited by the A2LA, certificate number 0214.26, to perform the test(s) listed in this report, except where noted otherwise.

OBJECTIVE

The primary objective of the manufacturer is compliance with the regulations outlined in the previous section.

Prior to marketing in the USA, all unlicensed transmitters and transceivers require certification. Receive-only devices operating between 30 MHz and 960 MHz are subject to either certification or a manufacturer's declaration of conformity, with all other receive-only devices exempt from the technical requirements.

Prior to marketing in Canada, Class I transmitters, receivers and transceivers require certification. Class II devices are required to meet the appropriate technical requirements but are exempt from certification requirements.

Certification is a procedure where the manufacturer submits test data and technical information to a certification body and receives a certificate or grant of equipment authorization upon successful completion of the certification body's review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units, which are subsequently manufactured.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product which may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

STATEMENT OF COMPLIANCE

The tested sample of Rugged Solutions, LLC model 71100-702 complied with the requirements of the following regulations:

FCC Part 15 Subpart C

Maintenance of compliance is the responsibility of the manufacturer. Any modifications to the product should be assessed to determine their potential impact on the compliance status of the device with respect to the standards detailed in this test report.

The test results recorded herein are based on a single type test of Rugged Solutions, LLC model 71100-702 and therefore apply only to the tested sample. The sample was selected and prepared by Daniel Francis of Rugged Solutions, LLC.

DEVIATIONS FROM THE STANDARDS

No deviations were made from the published requirements listed in the scope of this report.

TEST RESULTS SUMMARY

OPERATION IN 902-928 MHZ BAND

FCC Rule Part		Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.203		RF Connector	Integral antenna	Unique or integral antenna required	Complies
15.207		AC Conducted Emissions	Testing was not performed as the EUT is battery powered.		
15.209		Spurious Emissions	47.1 dBµV/m @ 5435.7 MHz	54 dBµV/m	Complies
15.249		Fundamental Field Strength	89.7 dBµV/m	94.0 dBµV/m	Complies

MEASUREMENT UNCERTAINTIES

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level and were calculated in accordance with UKAS document LAB 34.

Measurement Type	Measurement Unit	Frequency Range	Expanded Uncertainty
Radiated emission (field strength)	dBµV/m	25 to 1000 MHz	± 3.6 dB
		1000 to 40000 MHz	± 6.0 dB

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Rugged Solutions, LLC model 71100-702 is a Tripwire Puck remote transceiver and detector that is designed to report in view motion to a receiver or another EUT and to provide a visual reference for trail marking. Since the EUT could be mounted to a tree during operation, the EUT was treated as tabletop equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 3 Volts DC, supplied by a replaceable battery.

The sample was received on January 15, 2020 and tested on January 15, 27 and February 5 and September 14, 2020. The EUT consisted of the following component(s):

Company	Model	Description	Serial Number	FCC ID
Rugged Solutions, LLC	71100-702	Tripwire Puck remote transceiver and detector	EDU002	2AVRC-71100-702

ANTENNA SYSTEM

The antenna system consists of an integral chip antenna.

ENCLOSURE

The EUT enclosure is primarily constructed of uncoated plastic. It measures approximately 6.5 x 3.9 x 14.5 cm.

MODIFICATIONS

No modifications were made to the EUT during the time the product was at NTS Silicon Valley.

SUPPORT EQUIPMENT

No support equipment was used during testing.

EUT INTERFACE PORTS

The I/O cabling configuration during testing was as follows:

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
None	-	-	-	-

EUT OPERATION

During emissions testing the EUT was configured to transmit a normal modulated signal continuously.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken at the test sites listed below. Pursuant to section 2.948 of the FCC's Rules and section 6.2 of RSS-GEN, NTS has been recognized as an accredited test laboratory by the Commission and Innovation, Science and Economic Development Canada. A description of the facilities employed for testing is maintained by NTS.

Site	Company / Registration Numbers		Location
	FCC	Canada	
Chamber 3	US1031	2845B (Wireless Test Lab #US0027)	41039 Boyce Road Fremont, CA 94538-2435
Chamber 4			
Chamber 5			

ANSI C63.4 recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement. The test site(s) contain separate areas for radiated and conducted emissions testing. Results from testing performed in this chamber have been correlated with results from an open area test site. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent requirements of ANSI C63.4.

RADIATED EMISSIONS CONSIDERATIONS

The FCC has determined that radiation measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an open field environment or in a semi-anechoic chamber. The test sites are maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4 guidelines and meet the Normalized Site Attenuation (NSA) requirements of ANSI C63.4.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

An EMI receiver as specified in CISPR 16-1-1 is used for emissions measurements. The receivers used can measure over the frequency range of 9 kHz up to 2000 MHz. These receivers allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The receiver automatically sets the required bandwidth for the CISPR detector used during measurements. If the repetition frequency of the signal being measured is below 20Hz, peak measurements are made in lieu of Quasi-Peak measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis. Average measurements above 1000MHz are performed on the spectrum analyzer using the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz, unless the signal is pulsed in which case the average (or video) bandwidth of the measuring instrument is reduced to onset of pulse desensitization and then increased.

INSTRUMENT CONTROL COMPUTER

Software is used to view and convert receiver measurements to the field strength at an antenna or voltage developed at the LISN measurement port, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate. A personal computer is used to record all measurements made with the receivers. The software used for radiated and conducted emissions measurements is NTS EMI Test Software (rev 2.10)

LINE IMPEDANCE STABILIZATION NETWORK (LISN)

Line conducted measurements utilize a fifty microhenry Line Impedance Stabilization Network as the monitoring point. The LISN used also contains a 250 uH CISPR adapter. This network provides for calibrated radio frequency noise measurements by the design of the internal low pass and high pass filters on the EUT and measurement ports, respectively.

FILTERS/ATTENUATORS

External filters and precision attenuators are often connected between the receiving antenna or LISN and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

ANTENNAS

A loop antenna is used below 30 MHz. For the measurement range 30 MHz to 1000 MHz either a combination of a biconical antenna and a log periodic or a bi-log antenna is used. Above 1000 MHz, horn antennas are used. The antenna calibration factors to convert the received voltage to an electric field strength are included with appropriate cable loss and amplifier gain factors to determine an overall site factor, which is then programmed into the test receivers or incorporated into the test software.

ANTENNA MAST AND EQUIPMENT TURNTABLE

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height. Measurements below 30 MHz are made with the loop antenna at a fixed height of 1m above the ground plane.

ANSI C63.10 specifies that the test height above ground for table mounted devices shall be 80 centimeters for testing below 1 GHz and 1.5m for testing above 1 GHz. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor as specified in ANSI C63.4. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

INSTRUMENT CALIBRATION

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An exhibit of this report contains the list of test equipment used and calibration information.

TEST PROCEDURES

EUT AND CABLE PLACEMENT

The regulations require that interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.10, and the worst-case orientation is used for final measurements.

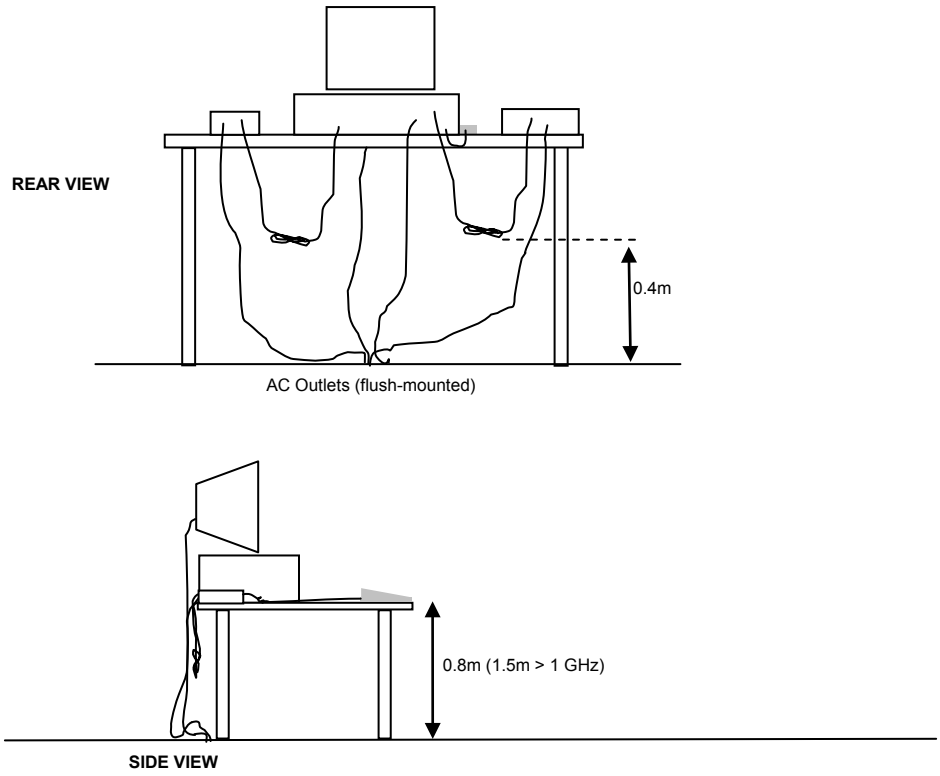
RADIATED EMISSIONS

A preliminary scan of the radiated emissions is performed in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed, one scan for each antenna polarization (horizontal and vertical; loop parallel and perpendicular to the EUT). During the preliminary scans, the EUT is rotated through 360˚, the antenna height is varied (for measurements above 30 MHz) and cable positions are varied to determine the highest emission relative to the limit. Preliminary scans may be performed in a fully anechoic chamber for the purposes of identifying the frequencies of the highest emissions from the EUT.

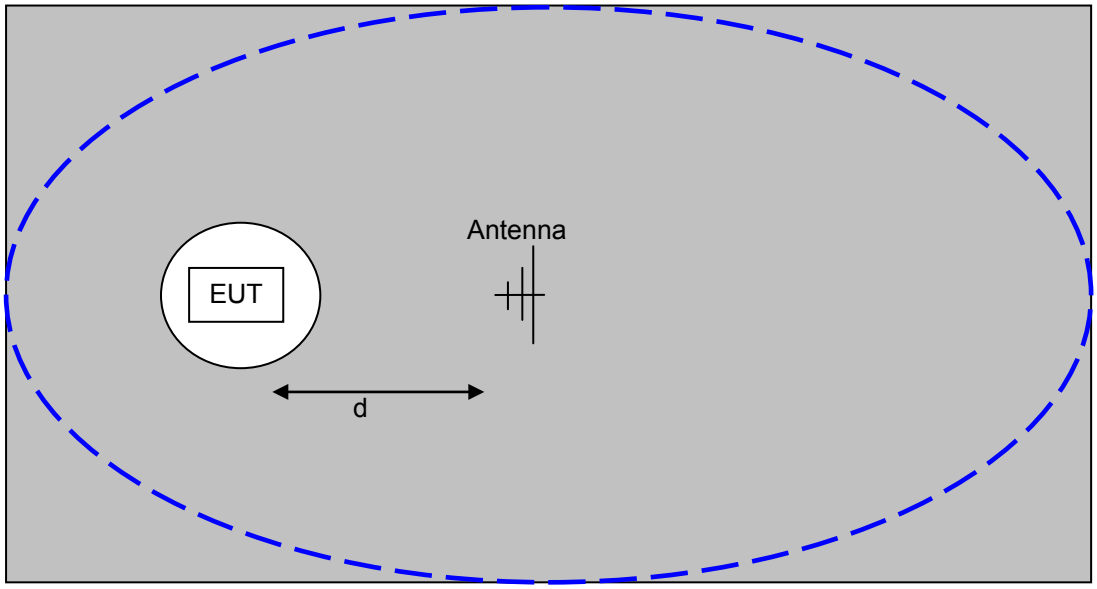
A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth, which results in the highest emission is then maintained while varying the antenna height from one to four meters (for measurements above 30 MHz, measurements below 30 MHz are made with the loop antenna at a fixed height of 1m). The result is the identification of the highest amplitude for each of the highest peaks. Each recorded level is corrected in the receiver using appropriate factors for cables, connectors, antennas, and preamplifier gain.

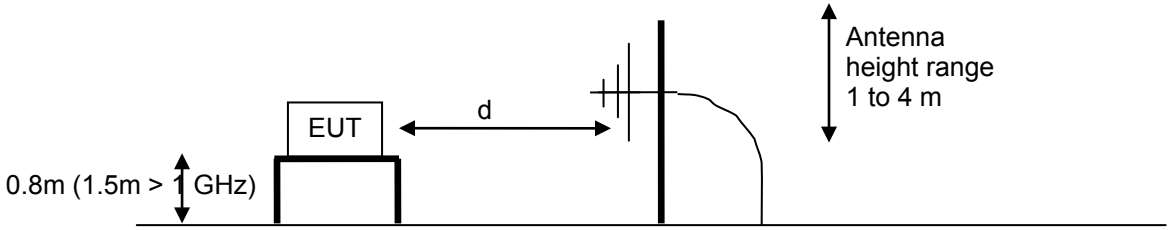
When testing above 18 GHz, the receive antenna is located at 1meter from the EUT and the antenna height is restricted to a maximum of 2.5 meters.



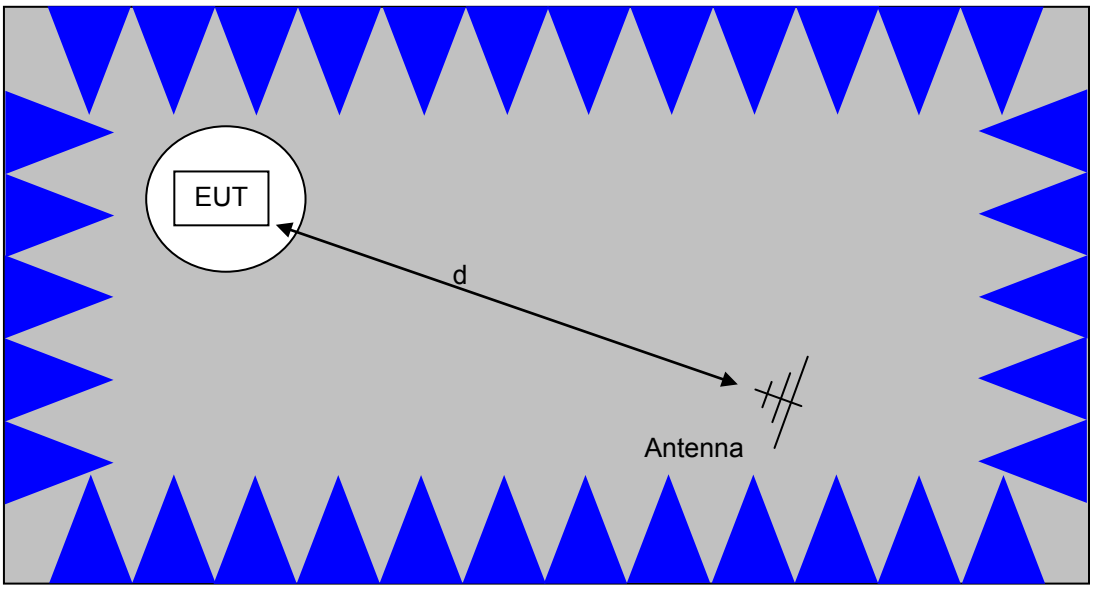
Typical Test Configuration for Radiated Field Strength Measurements



The ground plane extends beyond the ellipse defined in CISPR 16 / CISPR 22 / ANSI C63.4 and is large enough to accommodate test distances (d) of 3m and 10m. Refer to the test data tables for the actual measurement distance.

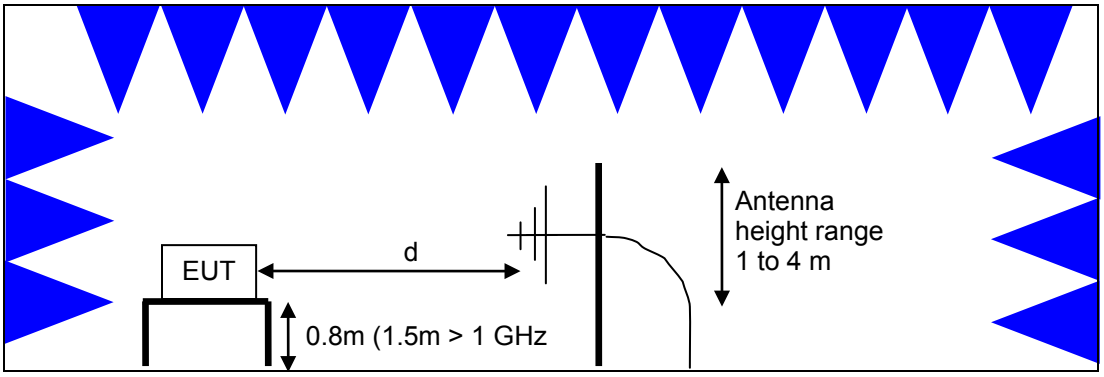


Test Configuration for Radiated Field Strength Measurements
OATS- Plan and Side Views



The anechoic materials on the walls and ceiling ensure compliance with the normalized site attenuation requirements of CISPR 16 / CISPR 22 / ANSI C63.4 for an alternate test site at the measurement distances used.

Floor-standing equipment is placed on the floor with insulating supports between the unit and the ground plane.



Test Configuration for Radiated Field Strength Measurements
Semi-Anechoic Chamber, Plan and Side Views

BANDWIDTH MEASUREMENTS

The 6dB, 20dB, 26dB and/or 99% signal bandwidth are measured using the bandwidths recommended by ANSI C63.10 and RSS GEN.

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

The limits for conducted emissions are given in units of microvolts, and the limits for radiated emissions are given in units of microvolts per meter at a specified test distance. Data is measured in the logarithmic form of decibels relative to one microvolt, or dB microvolts (dBuV). For radiated emissions, the measured data is converted to the field strength at the antenna in dB microvolts per meter (dBuV/m). The results are then converted to the linear forms of uV and uV/m for comparison to published specifications.

For reference, converting the specification limits from linear to decibel form is accomplished by taking the base ten logarithm, then multiplying by 20. These limits in both linear and logarithmic form are as follows:

GENERAL TRANSMITTER RADIATED EMISSIONS SPECIFICATION LIMITS

The table below shows the limits for the spurious emissions from transmitters that fall in restricted bands[1].

Frequency Range (MHz)	Limit (uV/m)	Limit (dBuV/m @ 3m)
0.009-0.490	$2400/F_{KHz}$ @ 300m	$67.6-20*\log_{10}(F_{KHz})$ @ 300m
0.490-1.705	$24000/F_{KHz}$ @ 30m	$87.6-20*\log_{10}(F_{KHz})$ @ 30m
1.705 to 30	30 @ 30m	29.5 @ 30m
30 to 88	100 @ 3m	40 @ 3m
88 to 216	150 @ 3m	43.5 @ 3m
216 to 960	200 @ 3m	46.0 @ 3m
Above 960	500 @ 3m	54.0 @ 3m

[1] The restricted bands are detailed in FCC 15.205 and RSS-Gen Table 7

SAMPLE CALCULATIONS - RADIATED EMISSIONS

Receiver readings are compared directly to the specification limit (decibel form). The receiver internally corrects for cable loss, preamplifier gain, and antenna factor. The calculations are in the reverse direction of the actual signal flow, thus cable loss is added and the amplifier gain is subtracted. The Antenna Factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

A distance factor, when used for electric field measurements above 30MHz, is calculated by using the following formula:

$$F_d = 20*LOG_{10} (D_m/D_s)$$

where:

F_d = Distance Factor in dB
D_m = Measurement Distance in meters
D_s = Specification Distance in meters

For electric field measurements below 30MHz the extrapolation factor is either determined by making measurements at multiple distances or a theoretical value is calculated using the formula:

$$F_d = 40*LOG_{10} (D_m/D_s)$$

Measurement Distance is the distance at which the measurements were taken and Specification Distance is the distance at which the specification limits are based. The antenna factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

The margin of a given emission peak relative to the limit is calculated as follows:

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:

R_r = Receiver Reading in dBuV/m
F_d = Distance Factor in dB
R_c = Corrected Reading in dBuV/m
L_s = Specification Limit in dBuV/m
M = Margin in dB Relative to Spec

Appendix A Test Equipment Calibration Data

Radiated Emissions, 1,000 - 9,300 MHz, 15-Jan-20

Manufacturer	Description	Model	Asset #	Calibrated	Cal Due
National Technical Systems	NTS EMI Software (rev 2.10)	N/A	WC022452	N/A	
Hewlett Packard	Spectrum Analyzer (Purple)	8564E	WC055660	7/24/2019	7/24/2020
EMCO	Antenna, Horn, 1-18 GHz (SA40-Red)	3115	WC064432	9/18/2018	9/18/2020
Hewlett Packard	High Pass filter, 1.5 GHz	84300-80037	WC064494	7/15/2019	7/15/2020
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	WC064574	7/19/2019	7/19/2020

Radiated Emissions, 30 - 1,000 MHz, 27-Jan-20

Manufacturer	Description	Model	Asset #	Calibrated	Cal Due
National Technical Systems	NTS EMI Software (rev 2.10)	N/A	WC022452	N/A	
National Technical Systems	NTS Capture Analyzer Software (rev 4.0)	N/A	WC022706	N/A	
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	WC064536	10/24/2018	1/9/2021
Rhode & Schwarz	EMI Test Receiver 20Hz-26.5GHz	ESI	WC071498	4/9/2019	4/9/2020
Com-Power	RF Preamplifier	PAM-103	WC072429	10/25/2019	10/25/2020

Radiated Emissions, 30 - 2,800 MHz, 05-Feb-20

Manufacturer	Description	Model	Asset #	Calibrated	Cal Due
National Technical Systems	NTS EMI Software (rev 2.10)	N/A	WC022452	N/A	
EMCO	Antenna, Horn, 1-18 GHz	3115	WC064404	8/9/2018	8/9/2020
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	WC064454	3/11/2019	3/11/2021
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB 7	WC064492	6/22/2019	6/22/2020
Hewlett Packard	9KHz-1300MHz pre-amp	8447F	WC064718	12/2/2019	12/2/2020
Rohde & Schwarz	EMI test receiver	ESI 40	WC068000	3/15/2019	3/15/2020

Radiated Emissions, 10 - 30 MHz, 14-Sep-20

National Technical Systems	NTS EMI Software (rev 2.10)	N/A	WC022452	N/A	
Rhode & Schwarz	Loop Antenna	HFH2-Z2	WC062457	1/23/2020	1/23/2022
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB 7	WC064989	11/4/2019	11/4/2020

Appendix B Test Data

TL104153-RA Puck Pages 20 – 29

Client:	Rugged Nature, LLC	PR Number:	PR104153
Product	71100-702	T-Log Number:	TL104153-RA
System Configuration:	-	Project Manager:	Deepa Shetty
Contact:	Daniel Francis	Project Engineer:	David Bare
Emissions Standard(s):	FCC part 15.249, RSS-210	Class:	-
Immunity Standard(s):		Environment:	Radio

EMC Test Data

For The

Rugged Nature, LLC

Product

71100-702

Date of Last Test: 9/18/2020

Client:	Rugged Nature, LLC	PR Number:	PR104153
Model:	71100-702	T-Log Number:	TL104153-RA
		Project Manager:	Deepa Shetty
Contact:	Daniel Francis	Project Engineer:	David Bare
Standard:	FCC part 15.249, RSS-210	Class:	-

Radiated Emissions

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 9/14 & 9/18/2020
Test Engineer: David Bare
Test Location: Fremont Chamber #4 & 5
Config. Used: 1
Config Change: None
EUT Voltage: Battery

General Test Configuration

The EUT and any local support equipment were located on the turntable for radiated emissions testing.
The test distance and extrapolation factor (if used) are detailed under each run description.
Note, preliminary testing indicates that the emissions were maximized by orientation of the EUT and elevation of the measurement antenna. Maximized testing indicated that the emissions were maximized by orientation of the EUT, elevation of the measurement antenna, and manipulation of the EUT's interface cables.

Ambient Conditions:

	9/14/2020	9/18/2020
Temperature:	25 °C	22 °C
Rel. Humidity:	43 %	46 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	30 kHz - 30 MHz	FCC 15.209	Pass	More than 30 dB

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

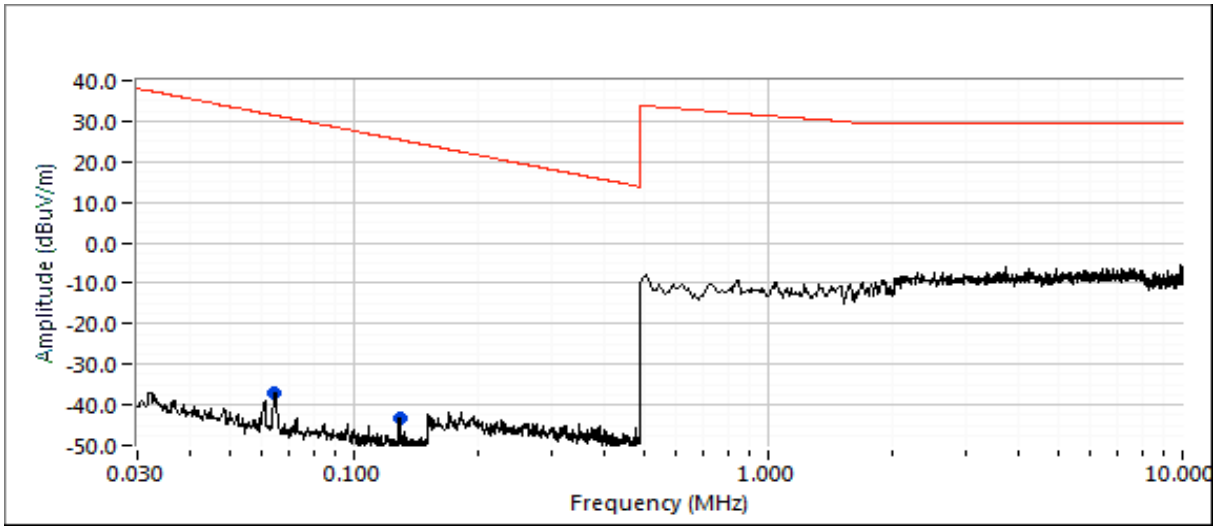
No deviations were made from the requirements of the standard.

Client:	Rugged Nature, LLC	PR Number:	PR104153
Model:	71100-702	T-Log Number:	TL104153-RA
		Project Manager:	Deepa Shetty
Contact:	Daniel Francis	Project Engineer:	David Bare
Standard:	FCC part 15.249, RSS-210	Class:	-

Run #1: Radiated Emissions, 30 kHz - 30 MHz, FCC 15.209

Frequency Range	Test Distance	Limit Distance	Extrapolation Factor
30 kHz - 490 kHz	3	300	-80.0
490 kHz - 30.0 MHz	3	30	-40.0

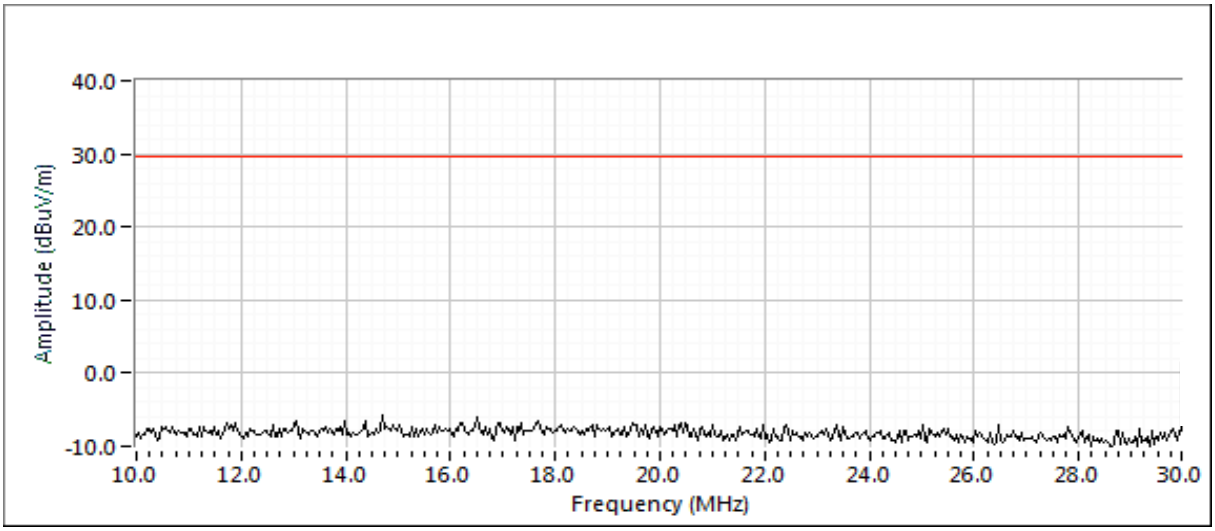
Note - the extrapolation factor is based on 40log(test distance/limit distance) as permitted by FCC 15.31



Preliminary readings

Frequency	Level	Pol	FCC 15.209		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
0.064	-36.9	V	31.4	-68.3	Peak	275	1.0	
0.129	-43.2	V	25.4	-68.6	Peak	55	1.0	
All observed emissions more than 60 dB below the limit								

Client:	Rugged Nature, LLC	PR Number:	PR104153
Model:	71100-702	T-Log Number:	TL104153-RA
		Project Manager:	Deepa Shetty
Contact:	Daniel Francis	Project Engineer:	David Bare
Standard:	FCC part 15.249, RSS-210	Class:	-



Preliminary readings

Frequency	Level	Pol	FCC 15.209		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
No emissions observed above the noise floor of the test equipment								

Client:	Rugged Nature, LLC	PR Number:	PR104153
Model:	71100-702	T-Log Number:	TL104153-RA
		Project Manager:	Deepa Shetty
Contact:	Daniel Francis	Project Engineer:	David Bare
Standard:	FCC part 15.249, RSS-210	Class:	N/A

RSS-210 and FCC 15.249 Radiated Spurious Emissions

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing.
For radiated emissions testing the measurement antenna was located 3 meters from the EUT, unless otherwise noted.

Ambient Conditions:

Temperature: 19 °C
Rel. Humidity: 38 %

Summary of Results - Device Operating in the 900 MHz Band

Run #	Test Performed	Limit	Result	Value / Margin
1	Fundamental Signal Field Strength	FCC 249 RSS 210 Annex B.10	Pass	89.7 dBµV/m @ 905.97 MHz (Margin: -4.3 dB)
1	Transmitter Radiated Spurious Emissions, 30 - 1,000 MHz	FCC 15.209 & 15.249 RSS 210/RSS GEN	Pass	34.8 dBµV/m @ 957.96 MHz (Margin: -11.2 dB)
2	Transmitter Radiated Spurious Emissions, 1,000 - 9,300 MHz	FCC 15.209 & 15.249 RSS 210/RSS GEN	Pass	47.1 dBµV/m @ 5435.7 MHz (Margin: -6.9 dB)
3	Receiver Radiated Spurious Emissions, 30 - 2,800 MHz	FCC 15.109	Pass	20.8 dBµV/m @ 30.54 MHz (Margin: -19.2 dB)

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Procedure Comments:

Measurements performed in accordance with ANSI C63.10
Peak measurements above 1 GHz performed with: RBW=1MHz, VBW=3MHz, peak detector, max hold, auto sweep time
Unless otherwise stated/noted, the test samples emission duty cycle is 94%. The average value was calculated by subtracting a duty cycle correction factor of 10 dB as normal operation has a fixed duty cycle of 31.4 %.

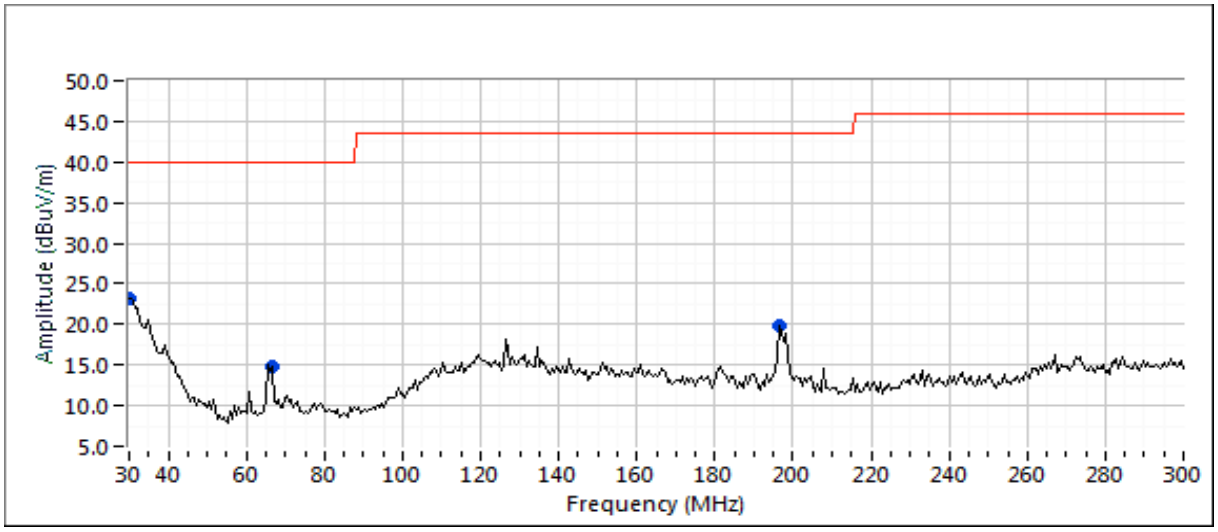
Sample Notes

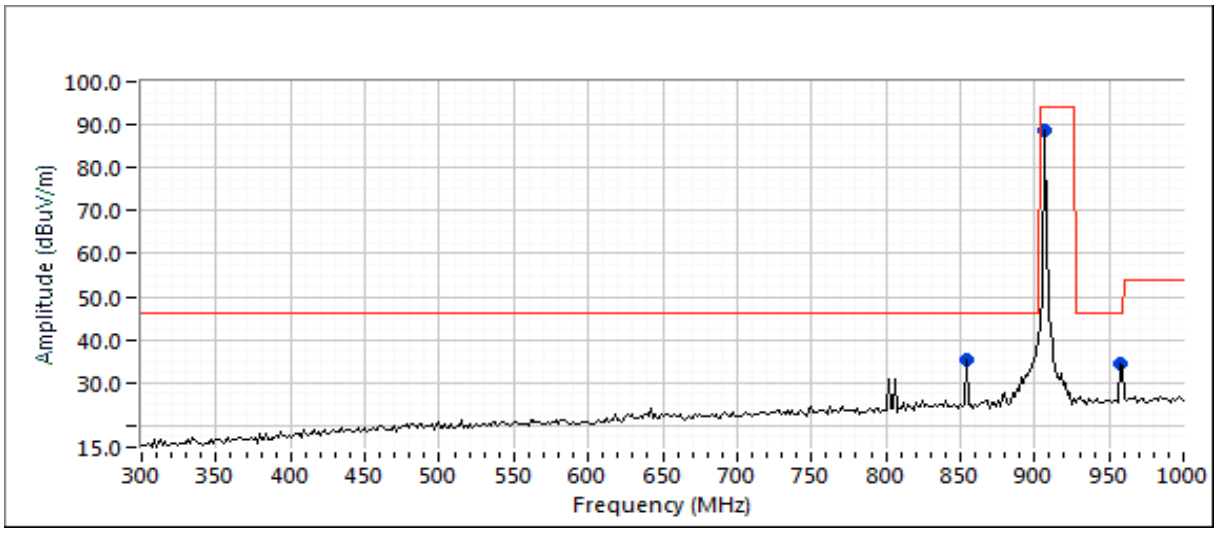
Sample S/N: None

Client:	Rugged Nature, LLC	PR Number:	PR104153
Model:	71100-702	T-Log Number:	TL104153-RA
		Project Manager:	Deepa Shetty
Contact:	Daniel Francis	Project Engineer:	David Bare
Standard:	FCC part 15.249, RSS-210	Class:	N/A

Run #1: Preliminary Radiated Emissions, 30-9,200 MHz, Transmitter Spurious Emissions

Date of Test: 1/27/2020 Config. Used: 1
Test Engineer: M. Birgani Config Change: None
Test Location: FT Chamber #3 EUT Voltage: Battery (3V)





Client:	Rugged Nature, LLC	PR Number:	PR104153
Model:	71100-702	T-Log Number:	TL104153-RA
		Project Manager:	Deepa Shetty
Contact:	Daniel Francis	Project Engineer:	David Bare
Standard:	FCC part 15.249, RSS-210	Class:	N/A

Run #1: Preliminary Radiated Emissions, 30-9,200 MHz, Transmitter Spurious Emissions

Date of Test: 1/27/2020 Config. Used: 1

Test Engineer: M. Birgani Config Change: None

Test Location: FT Chamber #3 EUT Voltage: Battery (3V)

Fundamental Field Strength

Frequency	Level	Pol	RSS 210 / FCC 15.209		Detector	Azimuth	Height	Comments	Orientation
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters		
905.970	89.7	H	94.0	-4.3	QP	58	1.1	QP (1.00s)	back
905.970	78.1	V	94.0	-15.9	QP	122	3.7	QP (1.00s)	back

Spurious Emissions

Frequency	Level	Pol	RSS 210 / FCC 15.209		Detector	Azimuth	Height	Comments	Orientation
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters		
957.958	34.8	H	46.0	-11.2	QP	259	2.0	QP (1.00s)	back
30.373	18.3	H	40.0	-21.7	QP	211	3.5	QP (1.00s)	back
65.297	12.0	V	40.0	-28.0	QP	54	1.0	QP (1.00s)	back
196.637	9.3	V	43.5	-34.2	QP	52	2.0	QP (1.00s)	back

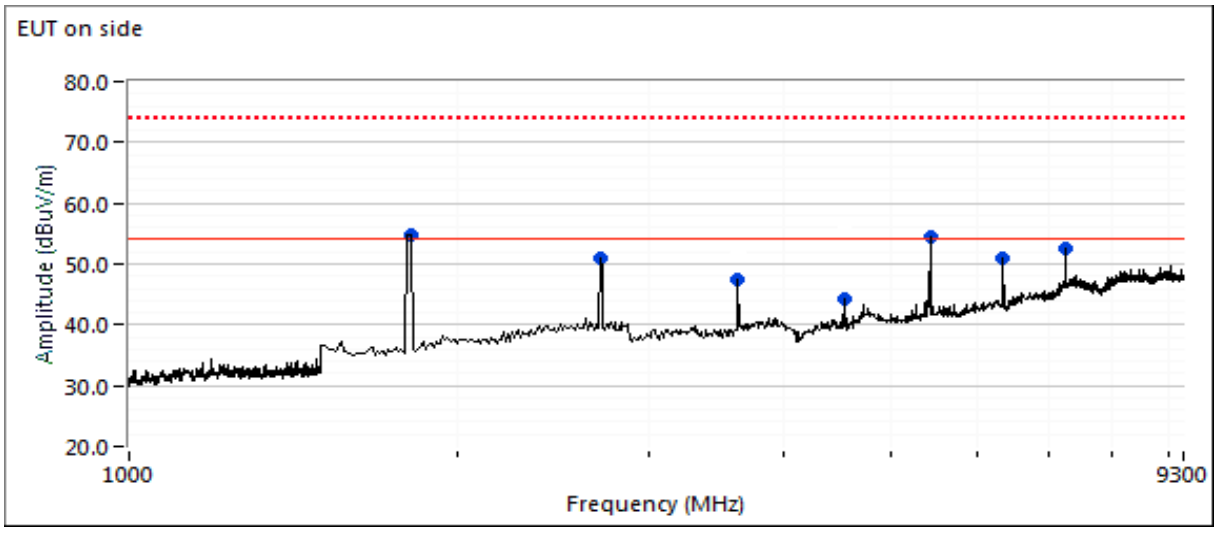
Client:	Rugged Nature, LLC	PR Number:	PR104153
Model:	71100-702	T-Log Number:	TL104153-RA
		Project Manager:	Deepa Shetty
Contact:	Daniel Francis	Project Engineer:	David Bare
Standard:	FCC part 15.249, RSS-210	Class:	N/A

Run #1: Radiated Spurious Emissions, 1,000 - 9,300 MHz

Date of Test: 01/15/20 Config. Used: 1
Test Engineer: David Bare Config Change: None
Test Location: Fremont Chamber #4 EUT Voltage: Battery

Spurious Emissions, EUT on back (worst case orientation)

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
5435.710	47.1	H	54.0	-6.9	AVG	107	1.1	Peak corrected by duty cycle
5435.730	57.1	H	74.0	-16.9	PK	107	1.1	RB 1 MHz;VB 3 MHz back
7247.620	47.1	V	54.0	-6.9	AVG	309	1.0	Peak corrected by duty cycle
7247.650	57.1	V	74.0	-16.9	PK	309	1.0	RB 1 MHz;VB 3 MHz back
1811.920	46.6	H	54.0	-7.4	AVG	250	2.2	Peak corrected by duty cycle
1811.970	56.6	H	74.0	-17.4	PK	250	2.2	RB 1 MHz;VB 3 MHz back
6341.690	45.0	V	54.0	-9.0	AVG	44	1.2	Peak corrected by duty cycle
6341.810	55.0	V	74.0	-19.0	PK	44	1.2	RB 1 MHz;VB 3 MHz back
2717.870	44.2	H	54.0	-9.8	AVG	158	1.3	Peak corrected by duty cycle
2717.800	54.2	H	74.0	-19.8	PK	158	1.3	RB 1 MHz;VB 3 MHz back
3623.790	40.7	V	54.0	-13.3	AVG	103	1.0	Peak corrected by duty cycle
3623.730	50.7	V	74.0	-23.3	PK	103	1.0	RB 1 MHz;VB 3 MHz back
4529.720	38.3	V	54.0	-15.7	AVG	173	1.1	Peak corrected by duty cycle
4529.780	48.3	V	74.0	-25.7	PK	173	1.1	RB 1 MHz;VB 3 MHz back



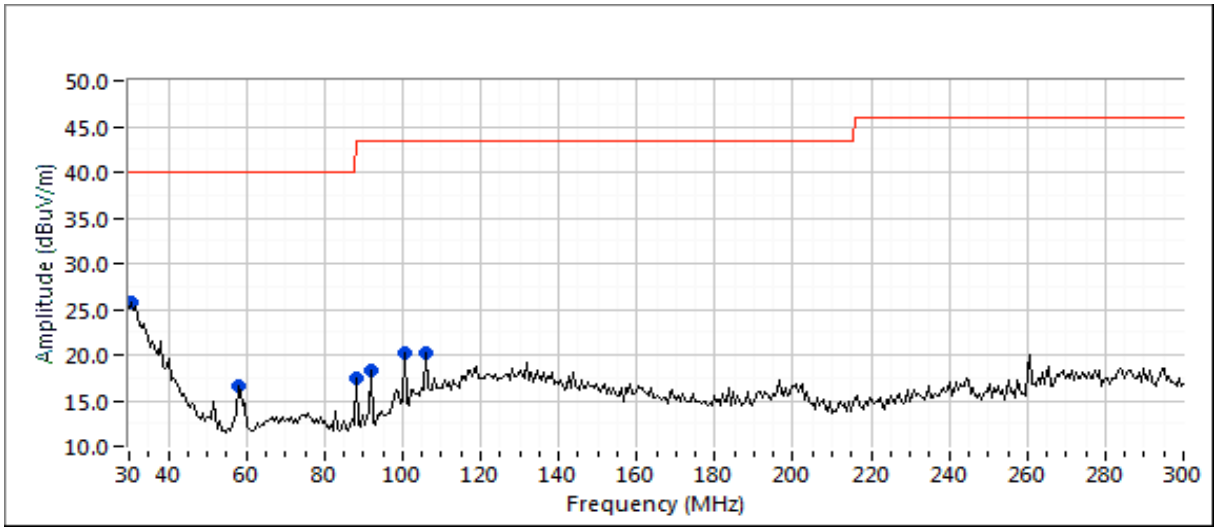
Client:	Rugged Nature, LLC	PR Number:	PR104153
Model:	71100-702	T-Log Number:	TL104153-RA
		Project Manager:	Deepa Shetty
Contact:	Daniel Francis	Project Engineer:	David Bare
Standard:	FCC part 15.249, RSS-210	Class:	N/A

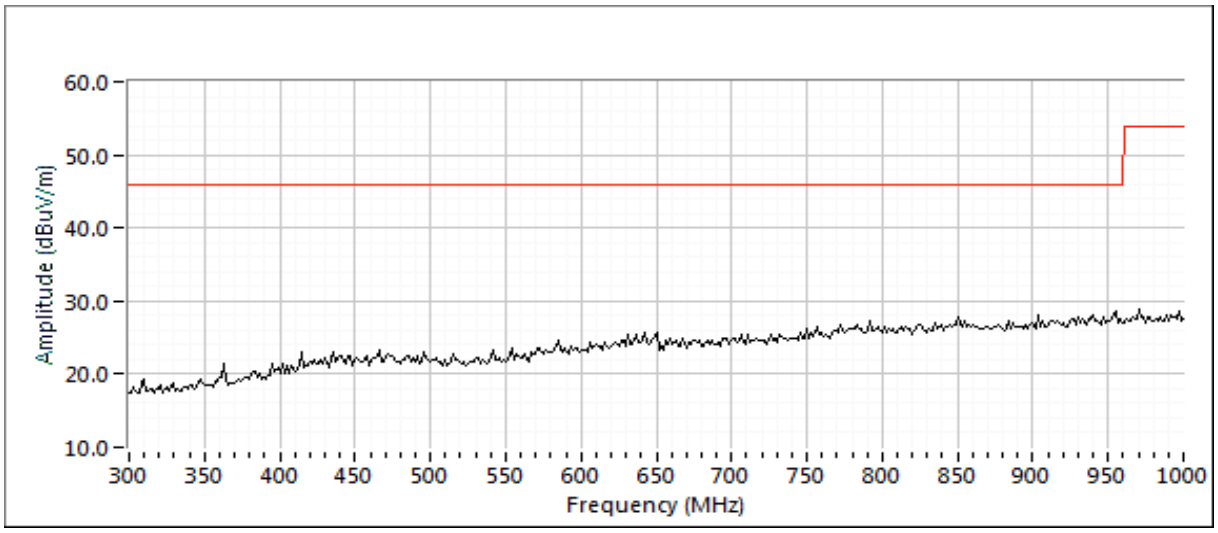
Run #3: Receiver Spurious Emissions

Date of Test: 2/5/2020 Config. Used: 1

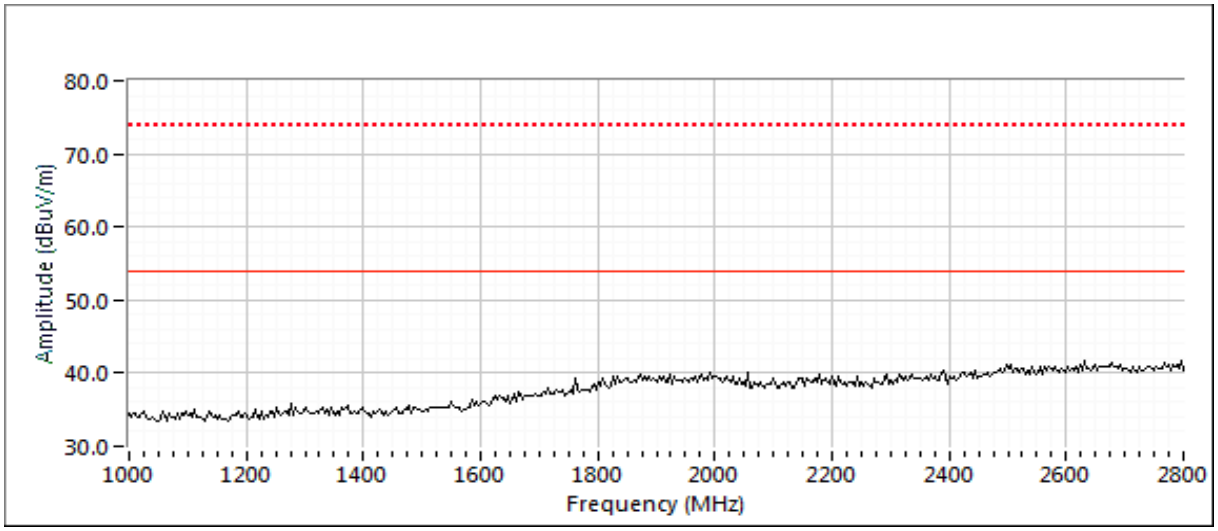
Test Engineer: M. Birgani Config Change: None

Test Location: FT Chamber #4 EUT Voltage: Battery (3V)





Client:	Rugged Nature, LLC	PR Number:	PR104153
Model:	71100-702	T-Log Number:	TL104153-RA
		Project Manager:	Deepa Shetty
Contact:	Daniel Francis	Project Engineer:	David Bare
Standard:	FCC part 15.249, RSS-210	Class:	N/A



Run #4: Receiver Spurious Emissions

Preliminary Emissions

Frequency	Level	Pol	FCC 15.109		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
30.541	25.7	V	40.0	-14.3	Peak	325	1.5	EUT on its Back
56.906	16.7	H	40.0	-23.3	Peak	203	4.0	EUT on its Back
88.505	17.5	H	43.5	-26.0	Peak	257	3.0	EUT on its Back
92.370	18.4	H	43.5	-25.1	Peak	336	4.0	EUT on its Back
100.253	20.2	H	43.5	-23.3	Peak	161	4.0	EUT on its Back
105.710	20.2	H	43.5	-23.3	Peak	53	2.5	EUT on its Back

Maximized Emissions

Frequency	Level	Pol	FCC 15.109		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
30.541	20.8	V	40.0	-19.2	QP	324	1.5	EUT on its Side
100.253	19.2	H	43.5	-24.3	QP	160	4.0	EUT on its Side
105.710	18.1	H	43.5	-25.4	QP	54	2.5	EUT on its Side
92.370	15.8	H	43.5	-27.7	QP	335	4.0	EUT on its Side
88.505	13.9	H	43.5	-29.6	QP	257	3.0	EUT on its Side
56.906	8.6	H	40.0	-31.4	QP	203	4.0	EUT on its Side

End of Report

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