41039 Boyce Road
Fremont, CA. 94538

510-578-3500 Phone
510-440-9525 Fax

EMC Test Report

Application for FCC Grant of Equipment Authorization
Canada Certification

Innovation, Science and Economic Development Canada
RSS-Gen Issue 5 / RSS-247 Issue 2
FCC Part 15 Subpart C

Model: LTE Hub

FCC ID:	2AS24 LTEHUB
APPLICANT:	RxCap Inc. 14 Russet Ln Lynnfield, MA 1940
TEST SITE(S):	National Technical Systems 41039 Boyce Road. Fremont, CA. 94538-2435
PROJECT NUMBER:	PR130924
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FINAL TEST DATES:	August 25 and 27 and October 13, 2021
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ACCREDITED
Testing Cert #0214.26

VALIDATING SIGNATORIES

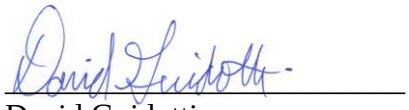
PROGRAM MGR

David W. Bare
Chief Engineer

TECHNICAL REVIEWER:

David W. Bare
Chief Engineer

FINAL REPORT PREPARER:



David Guidotti
Senior Technical Writer

QUALITY ASSURANCE DELEGATE

Gary Izard
Quality Assurance Representative

REVISION HISTORY

Rev#	Date	Comments	Modified By
-	September 1, 2021	First release	
1	November 16, 2021	Added test results from 30 kHz to 30 MHz	dwb

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SCOPE

An electromagnetic emissions test has been performed on the RxCap Inc. model LTE Hub, pursuant to the following rules:

RSS-GEN Issue 5 " General Requirements for Compliance of Radio Apparatus"
RSS 247 Issue 2 "Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSS) and Licence-Exempt Local Area Network (LE-LAN) Devices"
FCC Part 15 Subpart C

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
FCC DTS Measurement Guidance KDB558074

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 RxCap Inc. model LTE Hub complied with the requirements of the following regulations:

RSS-GEN Issue 5 " General Requirements for Compliance of Radio Apparatus"
RSS 247 Issue 2 "Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSS) and Licence-Exempt Local Area Network (LE-LAN) Devices"
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 RxCap Inc. model LTE Hub and therefore apply only to the tested sample. The sample was selected and prepared by David MacVittie of RxCap Inc..

DEVIATIONS FROM THE STANDARDS

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

TEST RESULTS SUMMARY

DIGITAL TRANSMISSION SYSTEMS (2400 – 2483.5MHz)

FCC Rule Part		Description	Measured Value / Comments	Limit / Requirement	Result
15.247(a)		Digital Modulation	Systems uses GFSK modulation	System must utilize a digital transmission technology	Complies
15.247 (a) (2)		6dB Bandwidth	742 kHz	>500kHz	Complies
15.247 (b) (3)		Output Power (multipoint systems)	3.3 dBm (0.002 Watts) EIRP = 0.0022 W Note 1	1Watt, EIRP limited to 4 Watts.	Complies
15.247(e)		Power Spectral Density	Peak power less than 8 dBm	8dBm/3kHz	Complies
15.247(d)		Antenna Port Spurious Emissions 30MHz – 25 GHz	Below -20dBc limit	< -20dBc	Complies
15.247(d) / 15.209		Radiated Spurious Emissions 30kHz – 25 GHz	52.9 dBµV/m @ 2484.4 MHz (-1.1 dB)	Refer to the limits section (p19) for restricted bands, all others < -20dBc	Complies
Note 1 EIRP calculated using antenna gains of 0.5 dBi for the highest EIRP system. Note 2 Pass/Fail criteria defined by standards listed above.					

GENERAL REQUIREMENTS APPLICABLE TO ALL BANDS

FCC Rule Part		Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.203		RF Connector	Integral antenna	Unique or integral antenna required	Complies
15.407 (b) (6)		AC Conducted Emissions LTE	38.9 dBµV @ 1.173 MHz (-17.1 dB)	Refer to page 19	Complies
		AC Conducted Emissions BLE	27.7 dBµV @ 0.500 MHz (-28.3 dB)		
15.247 (i) 15.407 (f)		RF Exposure Requirements	Refer to MPE calculations in separate exhibit, RSS 102 declaration and User Manual statements.	Refer to OET 65, FCC Part 1 and RSS 102	Complies
-		Occupied Bandwidth	1.083 MHz	Information only	N/A
Note 3 Pass/Fail criteria defined by standards listed above.					

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
RF power, conducted (power meter)	dBm	25 to 7000 MHz	± 0.52 dB
RF power, conducted (Spectrum analyzer)	dBm	25 to 7000 MHz	± 0.7 dB
Conducted emission of transmitter	dBm	25 to 26500 MHz	± 0.7 dB
Radiated emission (field strength)	dBµV/m	25 to 1000 MHz	± 3.6 dB
		1000 to 40000 MHz	± 6.0 dB
Conducted Emissions (AC Power)	dBµV	0.15 to 30 MHz	± 2.4 dB

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The RxCap Inc. model LTE Hub is a hub that is designed to bridge data from BLE devices to a cellular network. Since the EUT would be placed on a tabletop during operation, the EUT was treated as tabletop equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 3.7 Volts from a rechargeable battery. A standard USB charger would be used to charge the EUT.

The sample was received on January 13, 2021 and tested on August 25 and 27 and October 13, 2021. The EUT consisted of the following component(s):

Company	Model	Description	Serial Number	FCC ID
RxCap Inc.	LTE Hub	Hub	6CE33D82	2AS24 LTEHUB

OTHER EUT DETAILS

The following EUT details should be noted: The EUT uses a chip antenna for BLE radio and a planer PCB antenna for the LTE radio. The USB-C port is for charging only, no data.

ANTENNA SYSTEM

The antenna system consists of an integral antenna.

ENCLOSURE

The EUT enclosure is primarily constructed of plastic enclosure. It measures approximately 5 x 5 x 1 cm.

MODIFICATIONS

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

SUPPORT EQUIPMENT

The following equipment was used as local support equipment for testing:

Company	Model	Description	Serial Number	FCC ID
Fujifilm	DSA-5PFU1-05	Charger	-	-

The following equipment was used as remote support equipment for testing:

Company	Model	Description	Serial Number	FCC ID
Apple	Macbook Pro 16	Laptop	-	-

EUT INTERFACE PORTS

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

Port		Cable(s)		
From	To	Description	Shielded/Unshielded	Length(m)
Charge	Charger	Multiwire	Shielded	0.8

EUT OPERATION

During emissions testing the EUT was programmed to transmit continuously from the BLE radio. The LTE radio cannot simultaneously transmit with the BLE radio. A separate report details testing with the LTE radio operating.

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 & 7	US1031	2845B (Wireless Test Lab #US0027)	41039 Boyce Road Fremont, CA 94538-2435

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.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing is performed in conformance with ANSI C63.10. Measurements are made with the EUT connected to the public power network through a nominal, standardized RF impedance, which is provided by a line impedance stabilization network, known as a LISN. A LISN is inserted in series with each current-carrying conductor in the EUT power cord.

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.

CONDUCTED EMISSIONS

Conducted emissions are measured at the plug end of the power cord supplied with the EUT. Excess power cord length is wrapped in a bundle between 30 and 40 centimeters in length near the center of the cord. Preliminary measurements are made to determine the highest amplitude emission relative to the specification limit for all the modes of operation. Placement of system components and varying of cable positions are performed in each mode. A final peak mode scan is then performed in the position and mode for which the highest emission was noted on all current carrying conductors of the power cord.

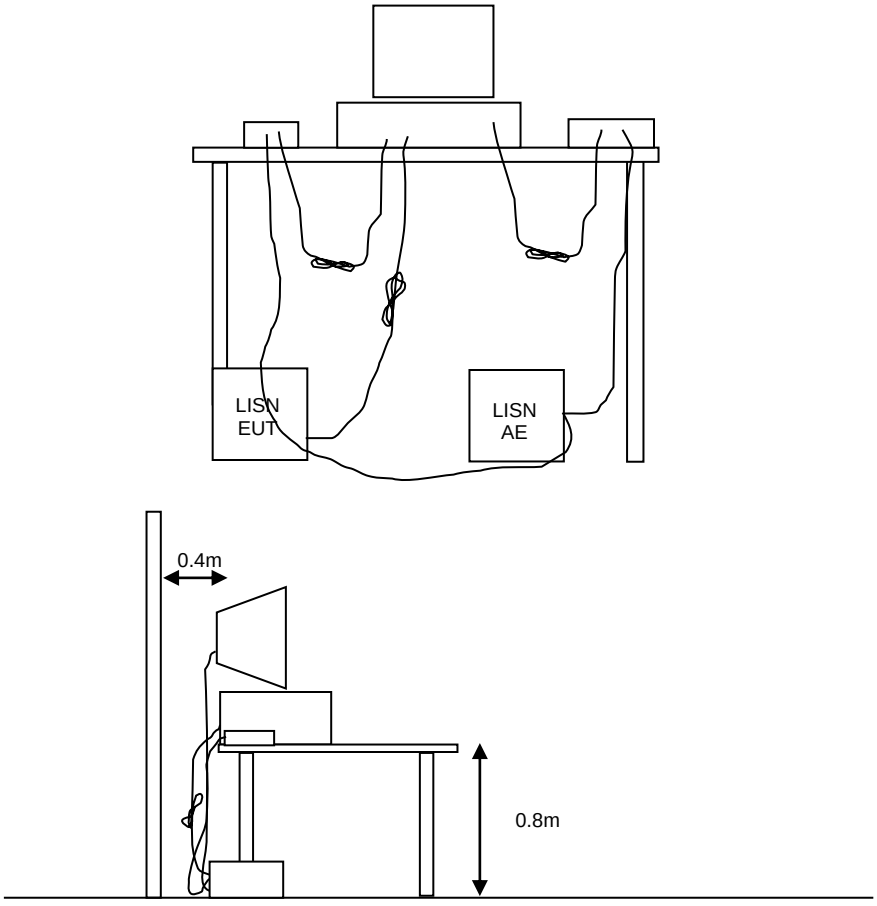


Figure 1 Typical Conducted Emissions Test Configuration

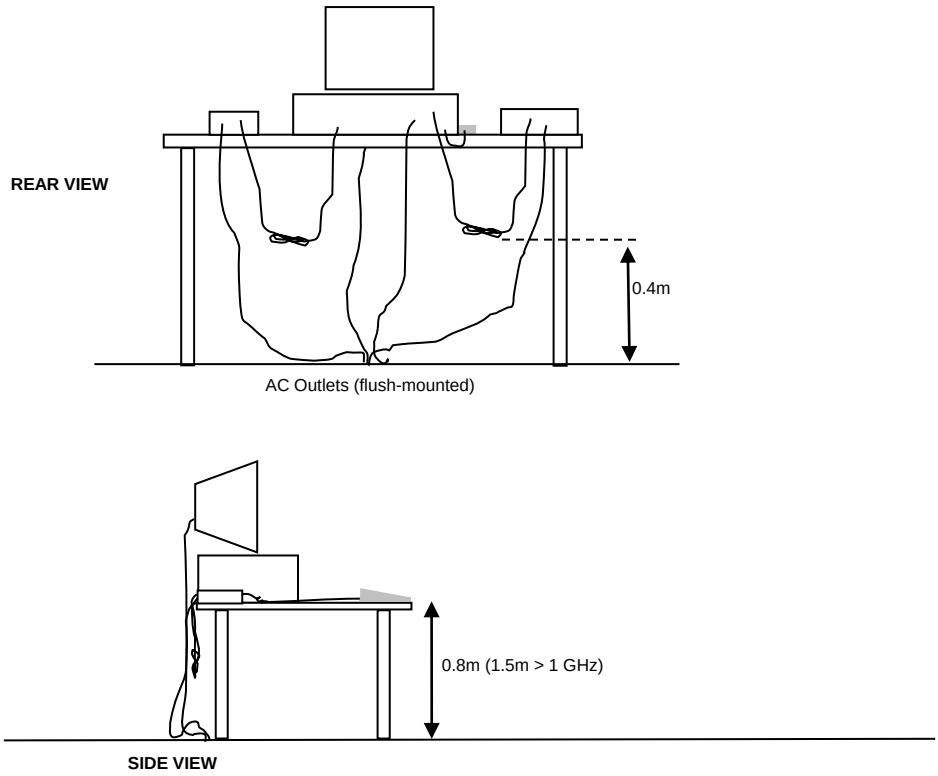
RADIATED EMISSIONS

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.

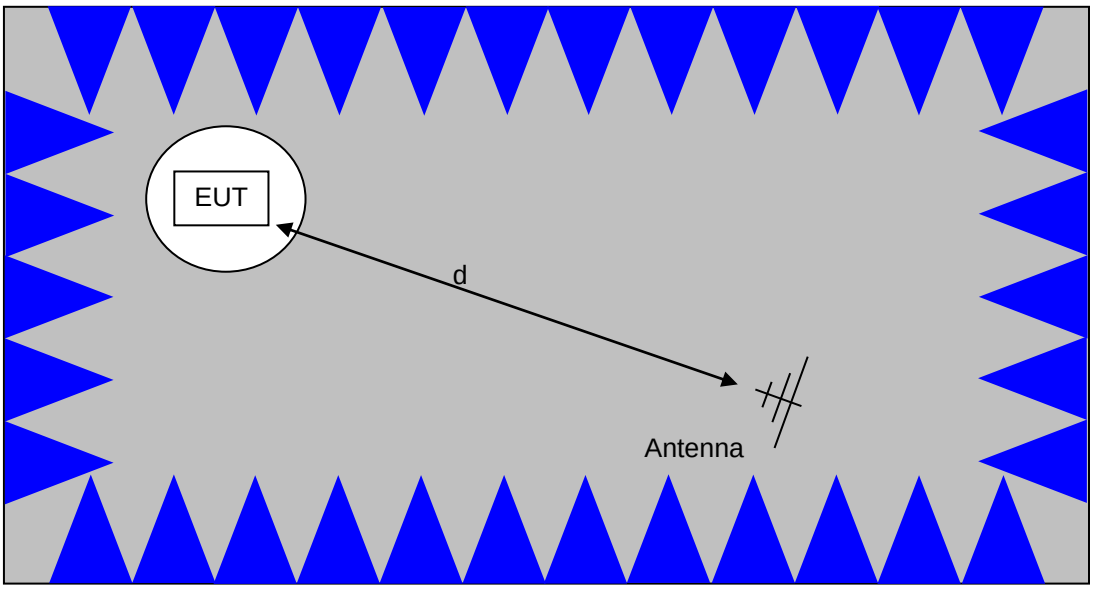
A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

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.

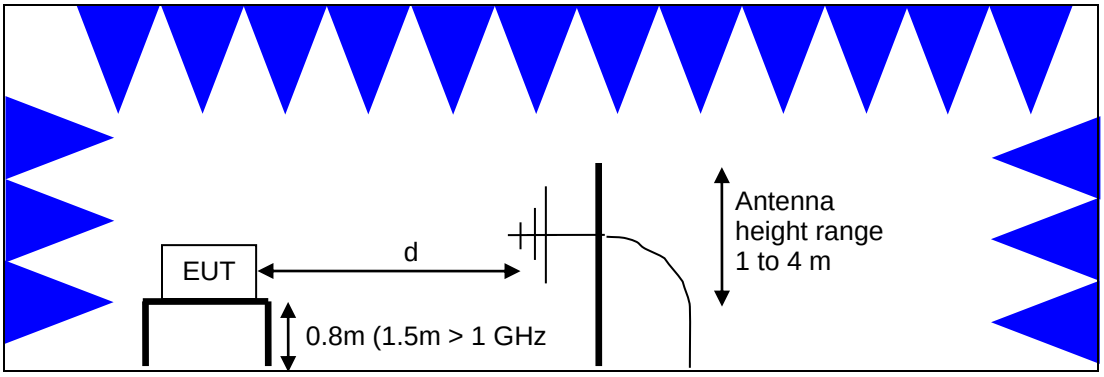


Typical Test Configuration for Radiated Field Strength Measurements



The 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.

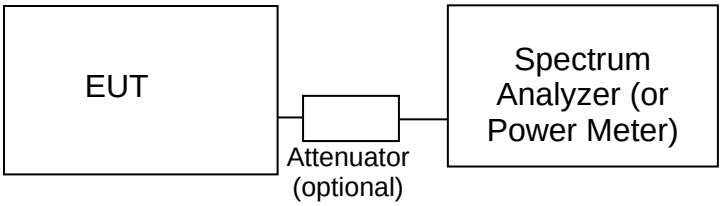
Floor-standing equipment is placed on the floor with insulating supports between the unit and the ground plane.



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

CONDUCTED EMISSIONS FROM ANTENNA PORT

Direct measurements of power, bandwidth and power spectral density are performed, where possible, with the antenna port of the EUT connected to either the power meter or spectrum analyzer via a suitable attenuator and/or filter. These are used to ensure that the front end of the measurement instrument is not overloaded by the fundamental transmission.



Test Configuration for Antenna Port Measurements

Measurement bandwidths (video and resolution) are set in accordance with the relevant standards and NTS Silicon Valley's test procedures for the type of radio being tested. When power measurements are made using a resolution bandwidth less than the signal bandwidth the power is calculated by summing the power across the signal bandwidth using either the analyzer channel power function or by capturing the trace data and calculating the power using software. In both cases the summed power is corrected to account for the equivalent noise bandwidth (ENBW) of the resolution bandwidth used.

If power averaging is used (typically for certain digital modulation techniques), the EUT is configured to transmit continuously. Power averaging is performed using either the built-in function of the analyzer or, if the analyzer does not feature power averaging, using external software. In both cases the average power is calculated over a number of sweeps (typically 100). When the EUT cannot be configured to continuously transmit then either the analyzer is configured to perform a gated sweep to ensure that the power is averaged over periods that the device is transmitting or power averaging is disabled and a max-hold feature is used.

If a power meter is used to make output power measurements the sensor head type (peak or average) is stated in the test data table.

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:

CONDUCTED EMISSIONS SPECIFICATION LIMITS: FCC 15.207; RSS GEN

The table below shows the limits for the emissions on the AC power line from an intentional radiator and a receiver.

Frequency (MHz)	Average Limit (dBuV)	Quasi Peak Limit (dBuV)
0.150 to 0.500	Linear decrease on logarithmic frequency axis between 56.0 and 46.0	Linear decrease on logarithmic frequency axis between 66.0 and 56.0
0.500 to 5.000	46.0	56.0
5.000 to 30.000	50.0	60.0

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

OUTPUT POWER LIMITS – DIGITAL TRANSMISSION SYSTEMS

The table below shows the limits for output power and output power density. Where the signal bandwidth is less than 20 MHz the maximum output power is reduced to the power spectral density limit plus 10 times the log of the bandwidth (in MHz).

Operating Frequency (MHz)	Output Power	Power Spectral Density
902 – 928	1 Watt (30 dBm)	8 dBm/3kHz
2400 – 2483.5	1 Watt (30 dBm)	8 dBm/3kHz
5725 – 5850	1 Watt (30 dBm)	8 dBm/3kHz

The maximum permitted output power is reduced by 1dB for every dB the antenna gain exceeds 6dBi. For FCC, fixed point to point applications using the 2400-2483.5 MHz band may use antennas with more than 6 dBi gain but output power is reduced by 1 dB for every 3dB that the antenna gain exceeds 6 dBi. For Canada, fixed point-to-point applications using the 2400-2483.5 MHz band are not subject to this restriction. Fixed point-to-point applications using the 5725 – 5850 MHz band are also not subject to this restriction. Certification of DTS systems operating in the 5725-5850 MHz band is no longer allowed under FCC Rules per §15.37(h).

TRANSMIT MODE SPURIOUS RADIATED EMISSIONS LIMITS – FHSS and DTS SYSTEMS

The limits for unwanted (spurious) emissions from the transmitter falling in the restricted bands are those specified in the general limits sections of FCC Part 15 and RSS GEN. All other unwanted (spurious) emissions shall be at least 20dB below the level of the highest in-band signal level (30dB if the power is measured using the sample detector/power averaging method).

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

Receiver readings are compared directly to the conducted emissions specification limit (decibel form) as follows:

$$R_r - S = M$$

where:
R_r = Receiver Reading in dBuV
S = Specification Limit in dBuV
M = Margin to Specification in +/- dB

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

SAMPLE CALCULATIONS - FIELD STRENGTH TO EIRP CONVERSION

Where the radiated electric field strength is expressed in terms of the equivalent isotropic radiated power (eirp), or where a field strength measurement of output power is made in lieu of a direct measurement, the following formula is used to convert between eirp and field strength at a distance of d (meters) from the equipment under test:

$$E = \frac{1000000 \sqrt{30 P}}{d} \quad \text{microvolts per meter}$$

where P is the eirp (Watts)

For a measurement at 3m the conversion from a logarithmic value for field strength (dBuV/m) to an eirp power (dBm) is -95.3dB.

Appendix A Test Equipment Calibration Data

Manufacturer	Description	Model	Asset #	Calibrated	Cal Due
Conducted and Radiated Emissions, 15-Jan-21					
National Technical Systems	NTS EMI Software (rev 2.10)	N/A	WC022452	N/A	
Hewlett Packard	Spectrum Analyzer (Red)	8564E (84125C)	WC055584	10/9/2020	10/9/2021
Hewlett Packard	Microwave Preamplifier Head, 18-40 GHz (Red)	84125C EMI Test Head	WC055586	10/20/2020	10/20/2021
EMCO	Horn Antenna	3115	WC062584	6/5/2019	6/5/2021
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	WC064455	2/11/2020	2/11/2021
Fischer Custom Communications	LISN, 25A, 150kHz to 30MHz, 25 Amp,	FCC-LISN-50-25-2-09	WC064532	8/2/2020	8/2/2021
A. H. Systems	Antenna, Horn, 18-40GHz	SAS-574	WC064553	10/19/2020	10/19/2022
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	WC068124	12/2/2020	12/2/2021
Rohde & Schwarz	Pulse Limiter	ESH3-Z2	WC072358	7/6/2020	7/5/2021
K&L Microwave	3.3GHz Hi Pass Filter	11SH10	WC072564	11/2/2020	11/2/2021
Radiated Spurious Emissions, 30 - 25,000 MHz, 25-Aug-21					
National Technical Systems	NTS EMI Software (rev 2.10)	N/A	WC022452	N/A	
ETS-Lindgren	EMC Chamber #5	FACT-5	WC055567	10/9/2019	10/9/2022
Hewlett Packard	Spectrum Analyzer (Blue)	8564E	WC055592	12/2/2020	12/2/2021
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	WC064416	8/19/2021	8/19/2022
EMCO	Antenna, Horn, 1-18 GHz	3115	WC064432	12/21/2020	12/21/2022
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	WC064481	11/6/2020	11/6/2021
Rohde & Schwarz	EMI test receiver, 20Hz-40GHz	ESI	WC068000	6/23/2021	6/23/2022
Radio Antenna Port (Power and Spurious Emissions), 27-Aug-21					
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	
National Technical Systems	EMC Lab #4B	None	WC055575	N/A	
Agilent Technologies	PSA Spectrum Analyzer	E4446A	WC055670	8/17/2021	8/31/2022
Rohde & Schwarz	Peak Power Sensor 100 uW - 2 Watts (w/ 20 dB attenuator, SN BJ5155)	NRV-Z32	WC064459	6/17/2021	6/17/2022
Rohde & Schwarz	Power Meter, Dual Channel	NRVD	WC064499	6/18/2021	6/18/2022

Radiated Emissions, 30 kHz - 30 MHz, 13-Oct-21

Manufacturer	Description	Model	Asset #	Calibrated	Cal Due
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, 20Hz-7GHz	ESIB 7	WC064989	11/16/2020	11/16/2021

Appendix B Test Data

TL130924-RA Pages 26 – 56

Client:	RxCap Inc.	PR Number:	PR130924
Product	LTE Hub	T-Log Number:	TL130924-RA-Hub
System Configuration:	-	Project Manager:	Christine Krebill
Contact:	David MacVittie	Project Engineer:	David Bare
Emissions Standard(s):	FCC Part 15, Subpart B and §15.247	Class:	-
Immunity Standard(s):	-	Environment:	Radio

EMC Test Data

For The

RxCap Inc.

Product

LTE Hub

Date of Last Test: 10/13/2021

Client:	RxCap Inc.	PR Number:	PR130924
Model:	LTE Hub	T-Log Number:	TL130924-RA-Hub
		Project Manager:	Christine Krebill
Contact:	David MacVittie	Project Engineer:	David Bare
Standard:	FCC Part 15, Subpart B and §15.247	Class:	-

Conducted Emissions

(NTS Silicon Valley, Fremont Facility, Semi-Anechoic Chamber)

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: 1/15/2021
Test Engineer: David Bare
Test Location: Fremont Chamber #7

Config. Used: 1
Config Change: None
Power Adapter Voltage: 120V/60Hz

General Test Configuration

For tabletop equipment, the EUT was located on a table inside the semi-anechoic chamber, 40 cm from a vertical coupling plane and 80cm from the LISN. The power adapter is not part og the EUT so it was connecte directly to the LISN per ANSI C63.10.

Ambient Conditions:

Temperature: 20 °C
Rel. Humidity: 47 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, AC Power,120V/60Hz	Class B	Pass	38.9 dBµV @ 1.173 MHz (-17.1 dB)

Modifications Made During Testing

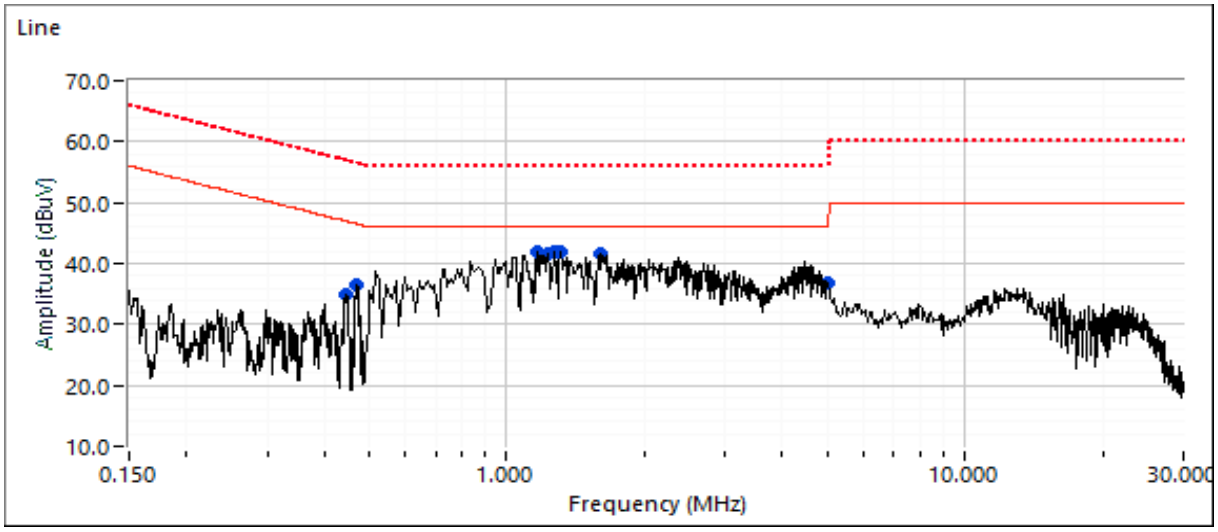
No modifications were made to the EUT during testing

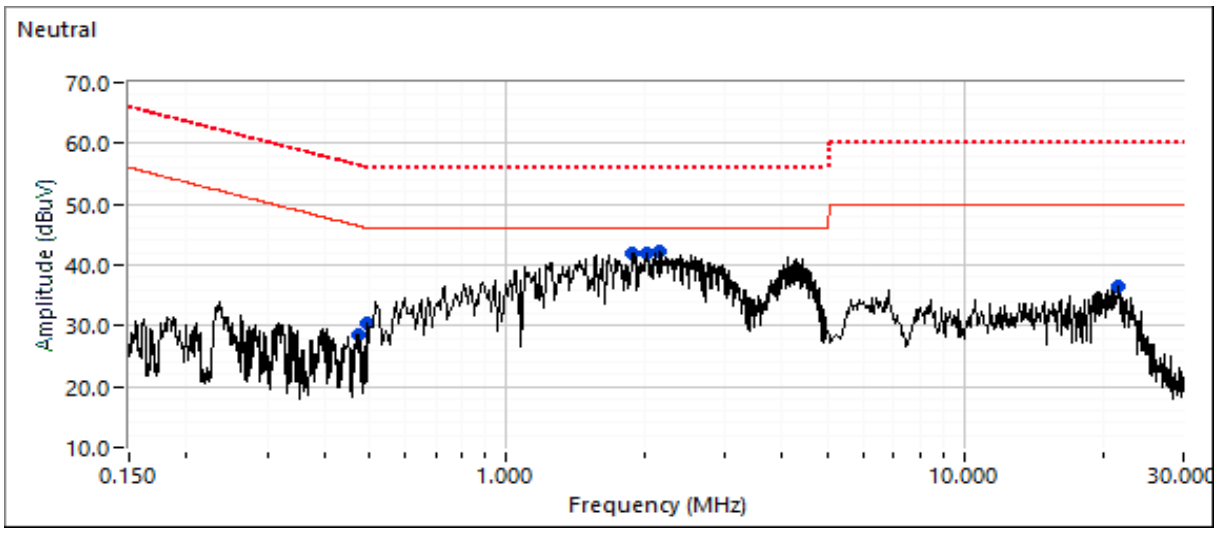
Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	RxCap Inc.	PR Number:	PR130924
Model:	LTE Hub	T-Log Number:	TL130924-RA-Hub
		Project Manager:	Christine Krebill
Contact:	David MacVittie	Project Engineer:	David Bare
Standard:	FCC Part 15, Subpart B and §15.247	Class:	-

Run #2: AC Power Port Conducted Emissions, 0.15 - 30MHz, 120V/60Hz





Client:	RxCap Inc.	PR Number:	PR130924
Model:	LTE Hub	T-Log Number:	TL130924-RA-Hub
		Project Manager:	Christine Krebill
Contact:	David MacVittie	Project Engineer:	David Bare
Standard:	FCC Part 15, Subpart B and §15.247	Class:	-

Preliminary peak readings captured during pre-scan (peak readings vs. average limit)

Frequency	Level	AC	Class B		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
0.473	28.6	Neutral	46.5	-17.9	Peak	
0.497	30.4	Neutral	46.0	-15.6	Peak	
1.886	42.0	Neutral	46.0	-4.0	Peak	
2.040	42.0	Neutral	46.0	-4.0	Peak	
2.167	42.3	Neutral	46.0	-3.7	Peak	
21.588	36.6	Neutral	50.0	-13.4	Peak	
0.445	35.0	Line 1	47.0	-12.0	Peak	
0.471	36.6	Line 1	46.5	-9.9	Peak	
1.173	41.8	Line 1	46.0	-4.2	Peak	
1.223	41.5	Line 1	46.0	-4.5	Peak	
1.276	41.9	Line 1	46.0	-4.1	Peak	
1.306	41.8	Line 1	46.0	-4.2	Peak	
1.591	41.6	Line 1	46.0	-4.4	Peak	
4.991	36.7	Line 1	46.0	-9.3	Peak	

Client:	RxCap Inc.	PR Number:	PR130924
Model:	LTE Hub	T-Log Number:	TL130924-RA-Hub
		Project Manager:	Christine Krebill
Contact:	David MacVittie	Project Engineer:	David Bare
Standard:	FCC Part 15, Subpart B and §15.247	Class:	-

Final quasi-peak and average readings

Frequency	Level	AC	Class B		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
0.445	24.3	Line 1	47.0	-22.7	AVG	AVG (0.10s)
0.445	35.1	Line 1	57.0	-21.9	QP	QP (1.00s)
0.471	24.5	Line 1	46.5	-22.0	AVG	AVG (0.10s)
0.471	35.8	Line 1	56.5	-20.7	QP	QP (1.00s)
1.173	25.8	Line 1	46.0	-20.2	AVG	AVG (0.10s)
1.173	38.9	Line 1	56.0	-17.1	QP	QP (1.00s)
1.223	24.1	Line 1	46.0	-21.9	AVG	AVG (0.10s)
1.223	38.1	Line 1	56.0	-17.9	QP	QP (1.00s)
1.276	24.4	Line 1	46.0	-21.6	AVG	AVG (0.10s)
1.276	37.7	Line 1	56.0	-18.3	QP	QP (1.00s)
1.306	24.4	Line 1	46.0	-21.6	AVG	AVG (0.10s)
1.306	38.1	Line 1	56.0	-17.9	QP	QP (1.00s)
1.591	26.4	Line 1	46.0	-19.6	AVG	AVG (0.10s)
1.591	38.8	Line 1	56.0	-17.2	QP	QP (1.00s)
4.991	22.7	Line 1	46.0	-23.3	AVG	AVG (0.10s)
4.991	31.1	Line 1	56.0	-24.9	QP	QP (1.00s)
0.473	23.2	Neutral	46.5	-23.3	AVG	AVG (0.10s)
0.473	28.3	Neutral	56.5	-28.2	QP	QP (1.00s)
0.497	22.2	Neutral	46.1	-23.9	AVG	AVG (0.10s)
0.497	30.9	Neutral	56.1	-25.2	QP	QP (1.00s)
1.886	22.6	Neutral	46.0	-23.4	AVG	AVG (0.10s)
1.886	37.0	Neutral	56.0	-19.0	QP	QP (1.00s)
2.040	25.3	Neutral	46.0	-20.7	AVG	AVG (0.10s)
2.040	37.7	Neutral	56.0	-18.3	QP	QP (1.00s)
2.167	25.7	Neutral	46.0	-20.3	AVG	AVG (0.10s)
2.167	38.1	Neutral	56.0	-17.9	QP	QP (1.00s)
21.588	14.0	Neutral	50.0	-36.0	AVG	AVG (0.10s)
21.588	30.2	Neutral	60.0	-29.8	QP	QP (1.00s)

Client:	RxCap Inc.	PR Number:	PR130924
Model:	LTE Hub	T-Log Number:	TL130924-RA-Hub
		Project Manager:	Christine Krebill
Contact:	David MacVittie	Project Engineer:	David Bare
Standard:	FCC Part 15, Subpart B and §15.247	Class:	-

Conducted Emissions

(NTS Silicon Valley, Fremont Facility, Semi-Anechoic Chamber)

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: 1/15/2021
Test Engineer: David Bare
Test Location: Fremont Chamber #7
Config. Used: 1
Config Change: None
Power Adapter Voltage: 120V/60Hz

General Test Configuration

For tabletop equipment, the EUT was located on a table inside the semi-anechoic chamber, 40 cm from a vertical coupling plane and 80cm from the LISN. The power adapter is not part og the EUT so it was connecte directly to the LISN per ANSI C63.10.

Ambient Conditions:

Temperature: 20 °C
Rel. Humidity: 47 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, AC Power,120V/60Hz	Class B	Pass	27.7 dBµV @ 0.500 MHz (-28.3 dB)

Modifications Made During Testing

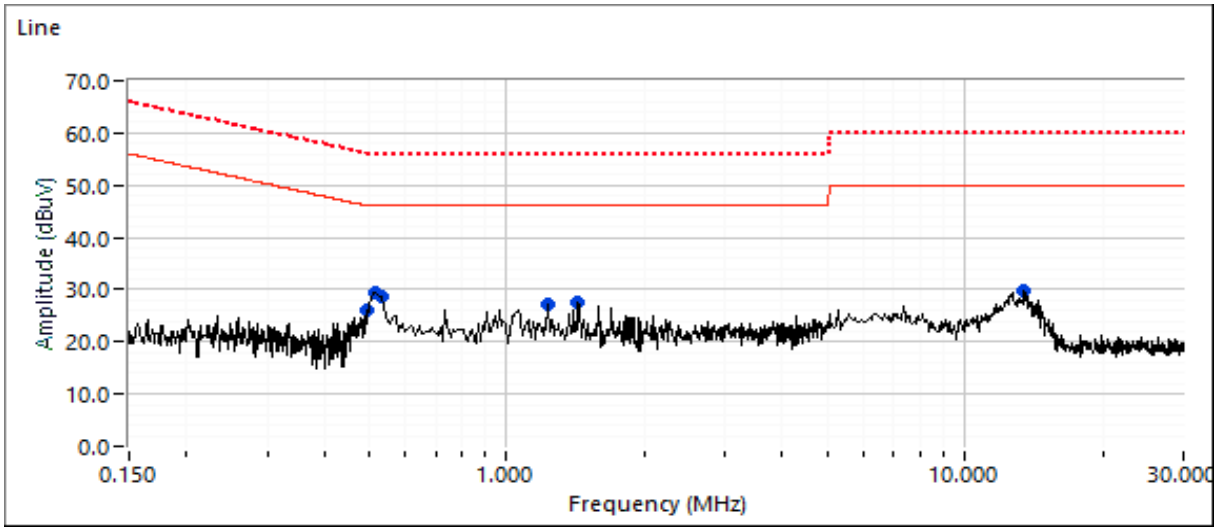
No modifications were made to the EUT during testing

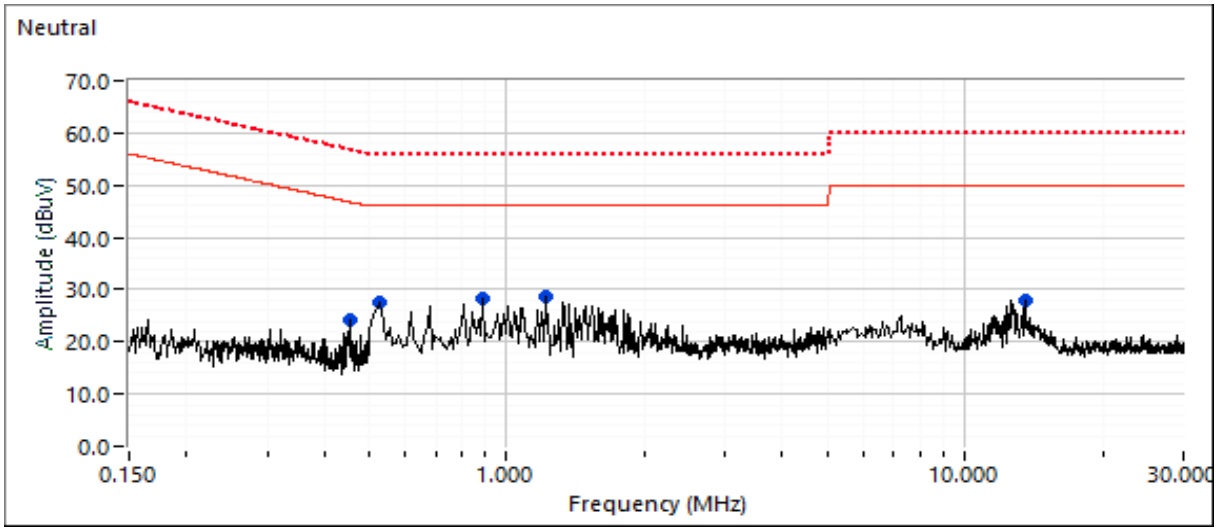
Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	RxCap Inc.	PR Number:	PR130924
Model:	LTE Hub	T-Log Number:	TL130924-RA-Hub
		Project Manager:	Christine Krebill
Contact:	David MacVittie	Project Engineer:	David Bare
Standard:	FCC Part 15, Subpart B and §15.247	Class:	-

Run #2: AC Power Port Conducted Emissions, 0.15 - 30MHz, 120V/60Hz





Client:	RxCap Inc.	PR Number:	PR130924
Model:	LTE Hub	T-Log Number:	TL130924-RA-Hub
		Project Manager:	Christine Krebill
Contact:	David MacVittie	Project Engineer:	David Bare
Standard:	FCC Part 15, Subpart B and §15.247	Class:	-

Preliminary peak readings captured during pre-scan (peak readings vs. average limit)

Frequency	Level	AC	Class B		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
0.500	27.8	Line 1	46.0	-18.2	Peak	
0.527	29.5	Line 1	46.0	-16.5	Peak	
0.529	28.8	Line 1	46.0	-17.2	Peak	
1.237	27.2	Line 1	46.0	-18.8	Peak	
1.426	27.6	Line 1	46.0	-18.4	Peak	
13.439	29.9	Line 1	50.0	-20.1	Peak	
0.455	24.1	Neutral	46.8	-22.7	Peak	
0.529	27.7	Neutral	46.0	-18.3	Peak	
0.882	28.2	Neutral	46.0	-17.8	Peak	
1.218	28.6	Neutral	46.0	-17.4	Peak	
13.564	28.0	Neutral	50.0	-22.0	Peak	

Final quasi-peak and average readings

Frequency	Level	AC	Class B		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
0.500	27.7	Line 1	56.0	-28.3	QP	QP (1.00s)
0.500	11.5	Line 1	46.0	-34.5	AVG	AVG (0.10s)
0.527	15.5	Line 1	46.0	-30.5	AVG	AVG (0.10s)
0.527	26.3	Line 1	56.0	-29.7	QP	QP (1.00s)
0.529	15.1	Line 1	46.0	-30.9	AVG	AVG (0.10s)
0.529	26.0	Line 1	56.0	-30.0	QP	QP (1.00s)
1.237	7.7	Line 1	46.0	-38.3	AVG	AVG (0.10s)
1.237	17.3	Line 1	56.0	-38.7	QP	QP (1.00s)
1.426	6.8	Line 1	46.0	-39.2	AVG	AVG (0.10s)
1.426	16.2	Line 1	56.0	-39.8	QP	QP (1.00s)
13.439	9.6	Line 1	50.0	-40.4	AVG	AVG (0.10s)
13.439	21.5	Line 1	60.0	-38.5	QP	QP (1.00s)
0.455	6.5	Neutral	46.8	-40.3	AVG	AVG (0.10s)
0.455	13.6	Neutral	56.8	-43.2	QP	QP (1.00s)
0.529	13.4	Neutral	46.0	-32.6	AVG	AVG (0.10s)
0.529	23.1	Neutral	56.0	-32.9	QP	QP (1.00s)
0.882	6.9	Neutral	46.0	-39.1	AVG	AVG (0.10s)
0.882	16.4	Neutral	56.0	-39.6	QP	QP (1.00s)
1.218	6.6	Neutral	46.0	-39.4	AVG	AVG (0.10s)
1.218	17.3	Neutral	56.0	-38.7	QP	QP (1.00s)
13.564	7.4	Neutral	50.0	-42.6	AVG	AVG (0.10s)
13.564	16.7	Neutral	60.0	-43.3	QP	QP (1.00s)

Client:	RxCap Inc.	PR Number:	PR130924
Model:	LTE Hub	T-Log Number:	TL130924-RA-Hub
		Project Manager:	Christine Krebill
Contact:	David MacVittie	Project Engineer:	David Bare
Standard:	FCC Part 15, Subpart B and §15.247	Class:	N/A

RSS-247 and FCC 15.247 (DTS) Antenna Port Measurements

Power, PSD, Bandwidth and 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.

Date of Test: 8/27/2021
Test Engineer: M. Birgani
Test Location: Lab #4

Config. Used: 1
Config Change: -
EUT Voltage: Battery

General Test Configuration

The EUT was connected to the spectrum analyzer or power meter via a suitable attenuator. All measurements were made on a single chain.

All measurements have been corrected to allow for the external attenuators used.

Ambient Conditions:

Temperature: 24-25 °C
Rel. Humidity: 43-44 %

Summary of Results

Run #	Pwr setting	Test Performed	Limit	Pass / Fail	Result / Margin
1	5	Output Power	15.247(b)	Pass	3.8 dBm EIRP
2	5	Power spectral Density (PSD)	15.247(d)	Pass	Peak power less than 8 dBm
3	5	Minimum 6dB Bandwidth	15.247(a)	Pass	742 kHz
3	5	99% Bandwidth	RSS GEN	-	1.083 MHz
4	5	Spurious emissions	15.247(b)	Pass	Below -20dBc limit

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

Sample Notes

Sample S/N: 632ACB64

Client:	RxCap Inc.	PR Number:	PR130924
Model:	LTE Hub	T-Log Number:	TL130924-RA-Hub
		Project Manager:	Christine Krebill
Contact:	David MacVittie	Project Engineer:	David Bare
Standard:	FCC Part 15, Subpart B and §15.247	Class:	N/A

Run #1: Output Power

Power Setting[2]	Frequency (MHz)	Output Power (dBm) [1]	Output Power mW	Antenna Gain (dBi)	Result	EIRP dBm	EIRP W	Output Power (dBm) [3]	Output Power mW
5	2402	3.0	2.0	0.5	Pass	3.5	0.0022		
5	2440	3.0	2.0	0.5	Pass	3.5	0.0022		
5	2480	3.3	2.1	0.5	Pass	3.8	0.0024		

Note 1:	Output power measured using a peak power meter, spurious limit is -20dBc.
Note 2:	Power setting - the software power setting used during testing, included for reference only.

Run #2: Power spectral Density

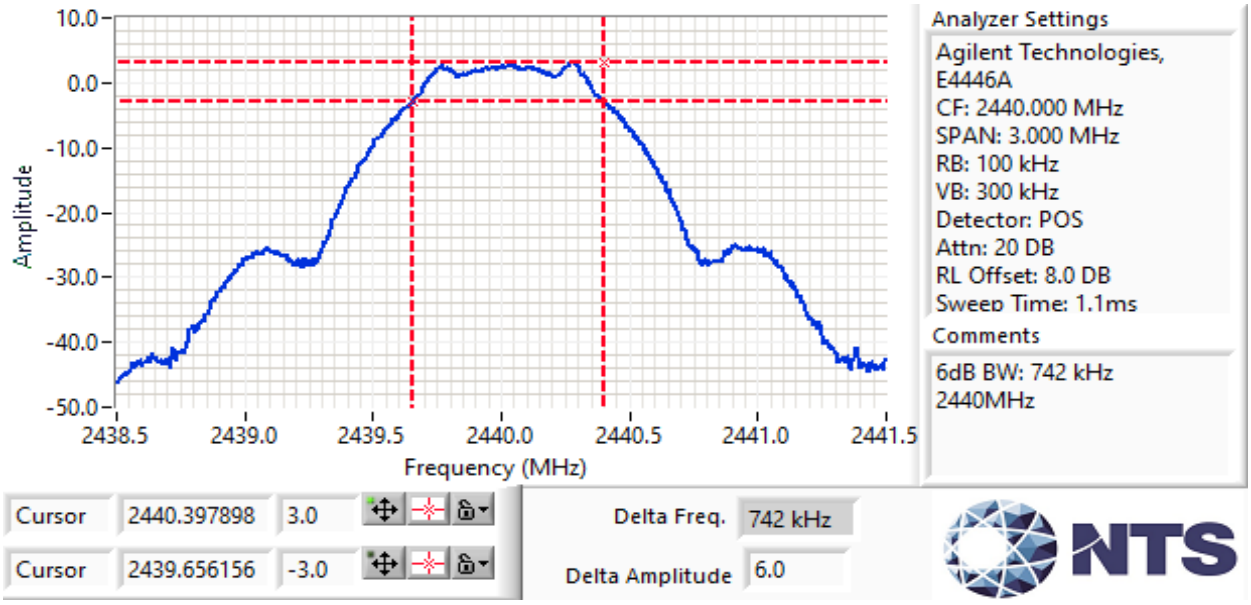
Note 1:	Maximum peak power measured on run 1 is less than power density limit.

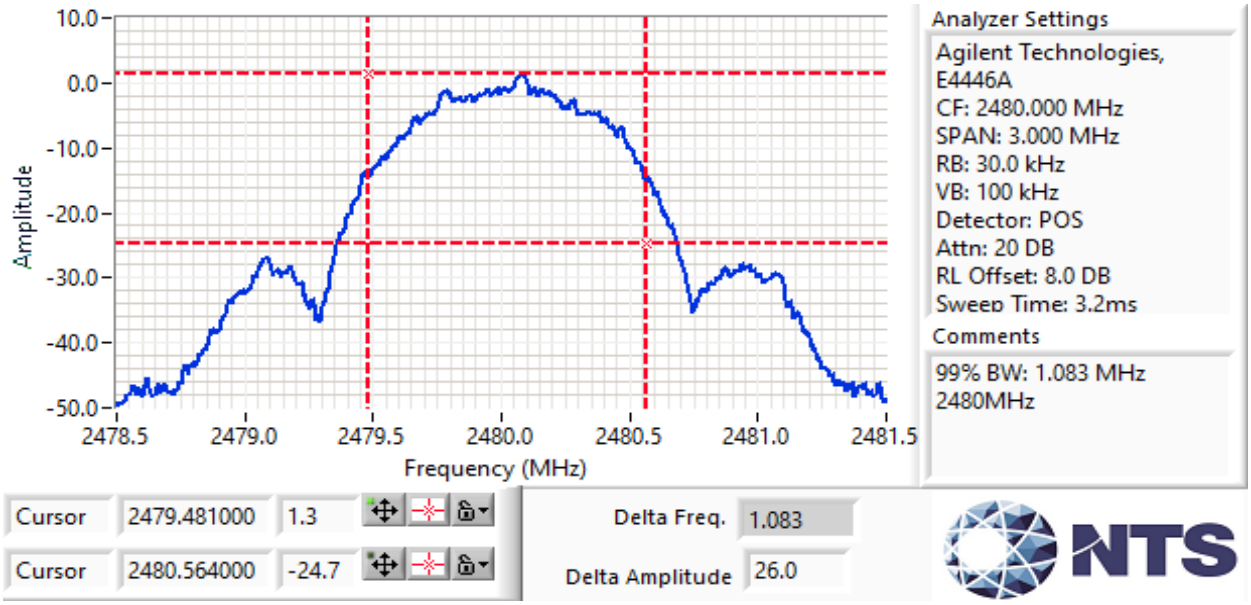
Run #3: Signal Bandwidth

Power Setting	Frequency (MHz)	Bandwidth (MHz) 6dB	Bandwidth (MHz) 99%	RBW Setting (MHz) 6dB	RBW Setting (MHz) 99%
5	2402	0.763	1.074	100	30
5	2440	0.742	1.068	100	30
5	2480	0.742	1.083	100	30

Note 1:	DTS BW: RBW=100kHz, VBW ≥ 3*RBW, peak detector, max hold, auto sweep time, Span 2-5 times measured BW. 99% BW: RBW=1-5% of 99%BW, VBW ≥ 3*RBW, peak detector, max hold, auto sweep time. Span 1.5-5 times OBW.

Client:	RxCap Inc.	PR Number:	PR130924
Model:	LTE Hub	T-Log Number:	TL130924-RA-Hub
		Project Manager:	Christine Krebill
Contact:	David MacVittie	Project Engineer:	David Bare
Standard:	FCC Part 15, Subpart B and §15.247	Class:	N/A





Client:	RxCap Inc.	PR Number:	PR130924
Model:	LTE Hub	T-Log Number:	TL130924-RA-Hub
		Project Manager:	Christine Krebill
Contact:	David MacVittie	Project Engineer:	David Bare
Standard:	FCC Part 15, Subpart B and §15.247	Class:	N/A

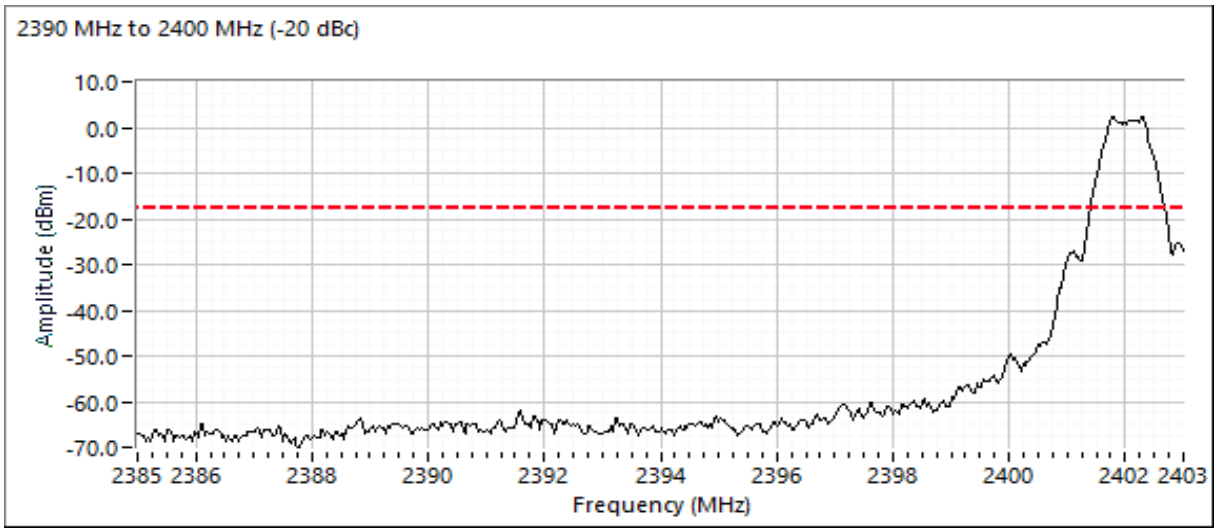
Run #4a: Out of Band Spurious Emissions

Frequency (MHz)	Power Setting	Mode	Limit	Result
2402	5	BLE	-20dBc	Pass
2440	5	BLE	-20dBc	Pass
2480	5	BLE	-20dBc	Pass

RBW = 100 kHz and VBW = 300 kHz for all plots.

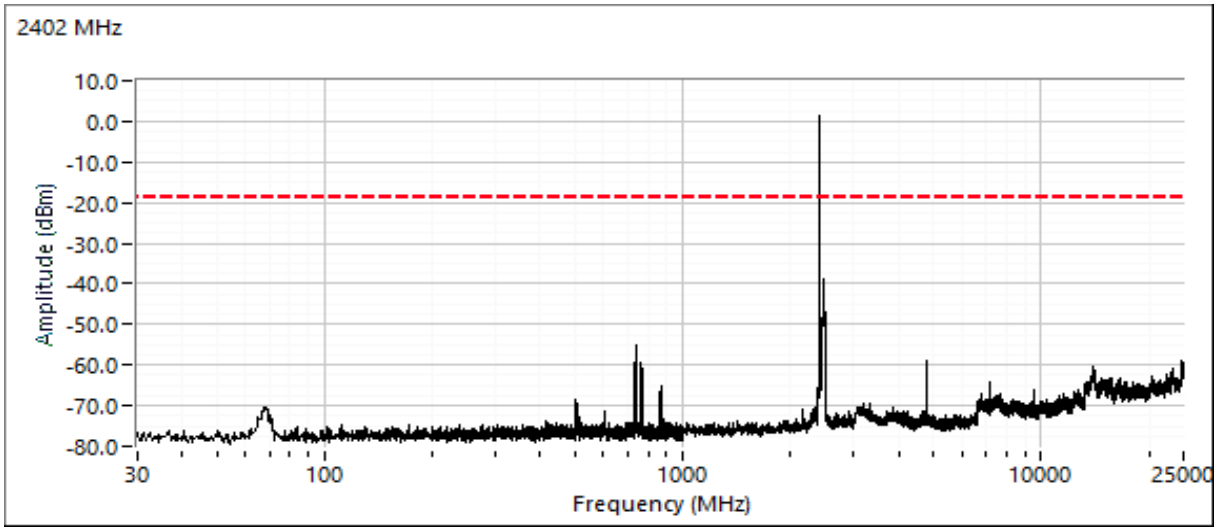
Plots for low channel

Additional plot showing compliance with -20dBc limit from 2390 MHz to 2400 MHz. Radiated measurements used to show compliance with the limits in the restricted band below 2390 MHz.

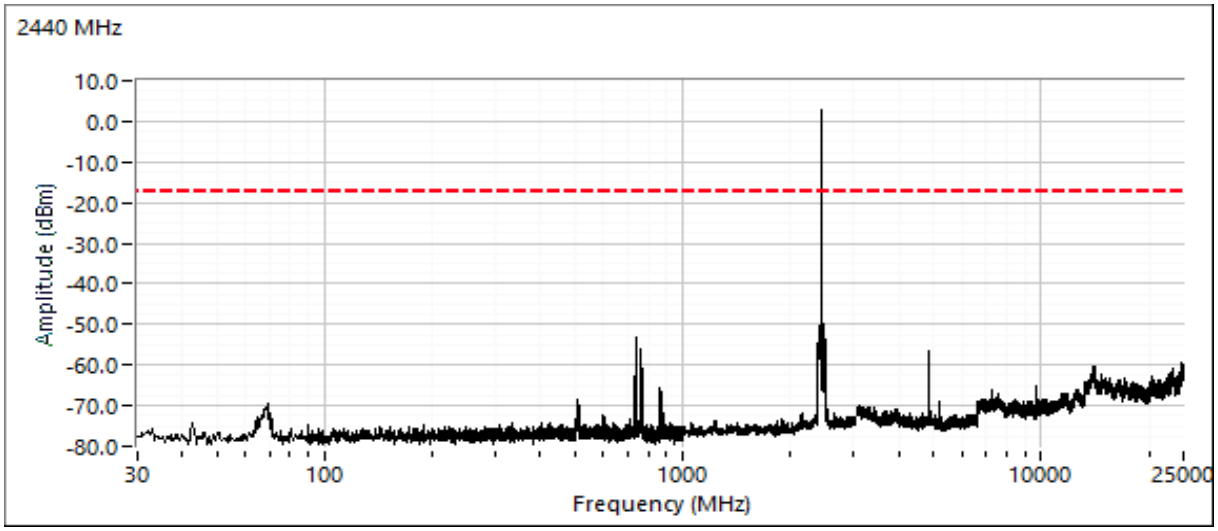


Client:	RxCap Inc.	PR Number:	PR130924
Model:	LTE Hub	T-Log Number:	TL130924-RA-Hub
		Project Manager:	Christine Krebill
Contact:	David MacVittie	Project Engineer:	David Bare
Standard:	FCC Part 15, Subpart B and §15.247	Class:	N/A

Plots for low channel

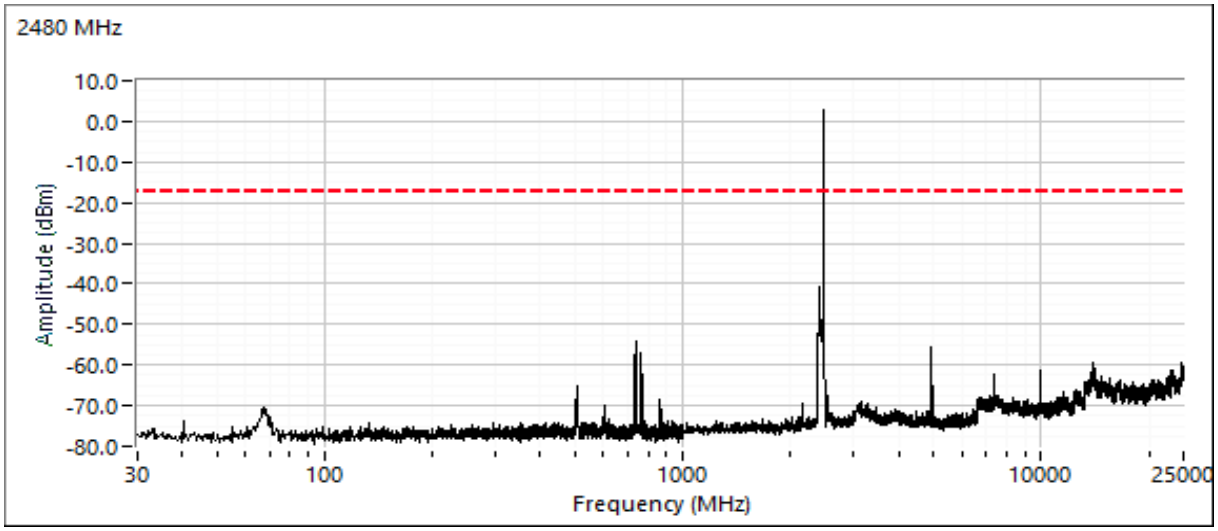


Plots for center channel



Client:	RxCap Inc.	PR Number:	PR130924
Model:	LTE Hub	T-Log Number:	TL130924-RA-Hub
		Project Manager:	Christine Krebill
Contact:	David MacVittie	Project Engineer:	David Bare
Standard:	FCC Part 15, Subpart B and §15.247	Class:	N/A

Plots for high channel



Client:	RxCap Inc.	PR Number:	PR130924
Model:	LTE Hub	T-Log Number:	TL130924-RA-Hub
		Project Manager:	Christine Krebill
Contact:	David MacVittie	Project Engineer:	David Bare
Standard:	FCC Part 15, Subpart B and §15.247	Class:	N/A

RSS-247 and FCC 15.247 (DTS) 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: 25 °C
Rel. Humidity: 43 %

Summary of Results - Device Operating in the 2400-2483.5 MHz Band

Run #	Mode	Channel	Target Power	Power Setting	Test Performed	Limit	Result / Margin
1	BLE	37 2402 MHz		5	Restricted Band Edge (2390 MHz)	FCC Part 15.209 / 15.247(c)	52.9 dBµV/m @ 2484.4 MHz (-1.1 dB)
		39 2480 MHz			Restricted Band Edge (2483.5 MHz)		47.2 dBµV/m @ 2390.0 MHz (-6.8 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.

Sample Notes

Sample S/N: 6CE33D82

Procedure Comments:

Measurements performed in accordance with ANSI C63.10
Peak measurements performed with: RBW=1MHz, VBW=3MHz, peak detector, max hold, auto sweep time
Unless otherwise stated/noted, emission has a duty cycle ≥ 98% and was measured using RBW=1MHz, VBW=10Hz, peak detector, linear voltage average, auto sweep time, max hold.

Client:	RxCap Inc.	PR Number:	PR130924
Model:	LTE Hub	T-Log Number:	TL130924-RA-Hub
		Project Manager:	Christine Krebill
Contact:	David MacVittie	Project Engineer:	David Bare
Standard:	FCC Part 15, Subpart B and §15.247	Class:	N/A

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
BLE	1 Mbps	1.00	Yes	0	0	0	#DIV/0!

Client:	RxCap Inc.	PR Number:	PR130924
Model:	LTE Hub	T-Log Number:	TL130924-RA-Hub
		Project Manager:	Christine Krebill
Contact:	David MacVittie	Project Engineer:	David Bare
Standard:	FCC Part 15, Subpart B and §15.247	Class:	N/A

Run #1: Radiated Bandedge Measurements

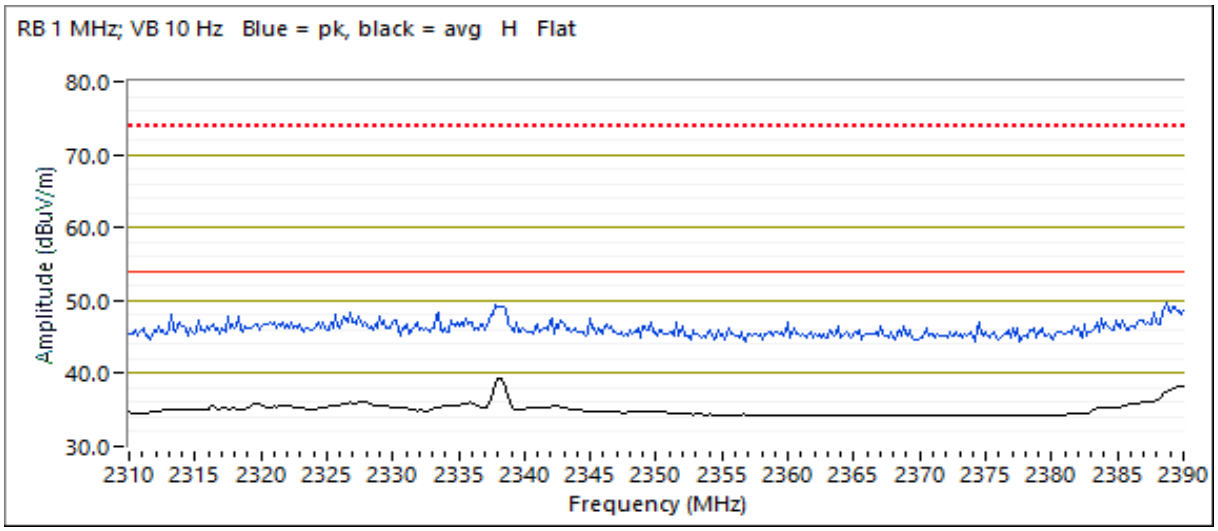
Date of Test: 8/25/2021 0:00 Config. Used: 1
Test Engineer: John Caizzi Config Change: none
Test Location: Chamber 5 EUT Voltage: 3.7 VDC internal battery

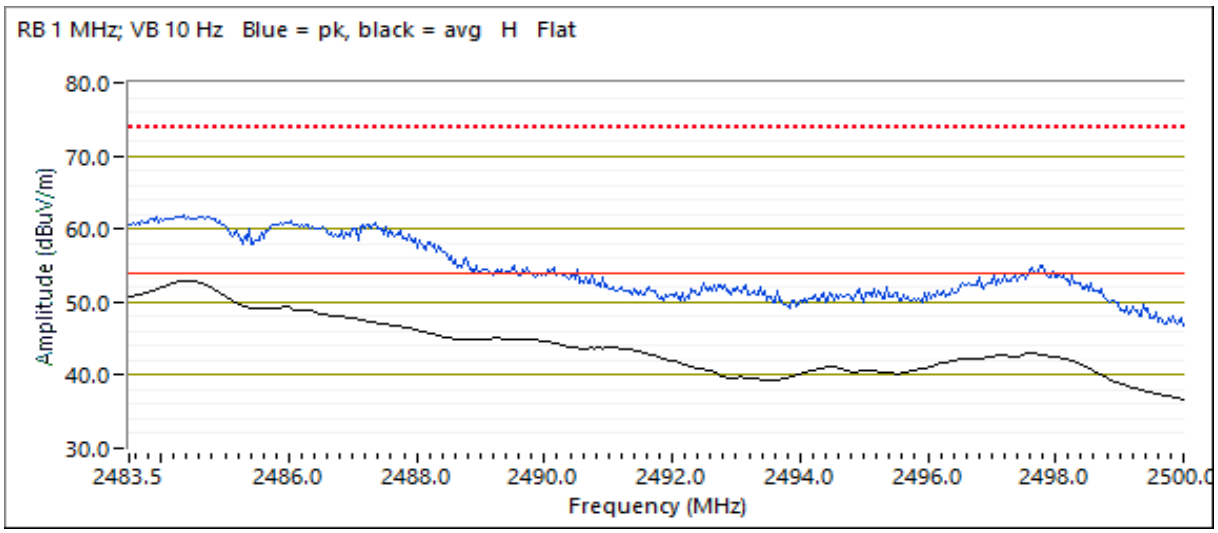
Channel: 37 Mode: BLE Pwr Setting: 5 dBm

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
Flat								
2338.060	39.4	H	54.0	-14.6	AVG	190	1.52	8 dBm, flat
2337.900	50.5	H	74.0	-23.5	PK	190	1.52	8 dBm, flat
2389.680	35.6	V	54.0	-18.4	AVG	193	1.00	8 dBm, flat
2388.720	47.5	V	74.0	-26.5	PK	193	1.00	8 dBm, flat
2484.4300	52.9	H	54.0	-1.1	AVG	192	1.60	Flat
2484.1900	63.5	H	74.0	-10.5	PK	192	1.60	Flat
2484.4300	46.3	V	54.0	-7.7	AVG	166	1.08	Flat
2484.2600	56.6	V	74.0	-17.4	PK	166	1.08	Flat
Side with USB jack on side								
2338.0600	36.2	H	54.0	-17.8	AVG	240	1.65	
2389.6800	47.8	H	74.0	-26.2	PK	240	1.65	
2338.0600	35.9	V	54.0	-18.1	??	221	1.00	
2388.7200	48.2	V	74.0	-25.8	PK	221	1.00	
2484.4300	51.1	H	54.0	-2.9	AVG	239	1.54	
2484.1900	60.4	H	74.0	-13.6	PK	239	1.54	
2484.4600	50.6	V	54.0	-3.4	AVG	223	1.25	
2484.4300	60.7	V	74.0	-13.3	PK	223	1.25	
Side with USB jack on top								
2338.0600	35.7	H	54.0	-18.3	AVG	113	1.00	
2338.0600	48.1	H	74.0	-25.9	PK	113	1.00	
2338.0600	37.1	V	54.0	-16.9	AVG	228	1.01	
2335.6500	48.8	V	74.0	-25.2	PK	228	1.01	
2484.4300	47.8	H	54.0	-6.2	AVG	130	1.47	
2484.2300	57.4	H	74.0	-16.6	PK	130	1.47	
2484.4300	52.3	V	54.0	-1.7	AVG	219	1.00	
2484.3600	61.5	V	74.0	-12.5	PK	219	1.00	

Client:	RxCap Inc.	PR Number:	PR130924
Model:	LTE Hub	T-Log Number:	TL130924-RA-Hub
		Project Manager:	Christine Krebill
Contact:	David MacVittie	Project Engineer:	David Bare
Standard:	FCC Part 15, Subpart B and §15.247	Class:	N/A



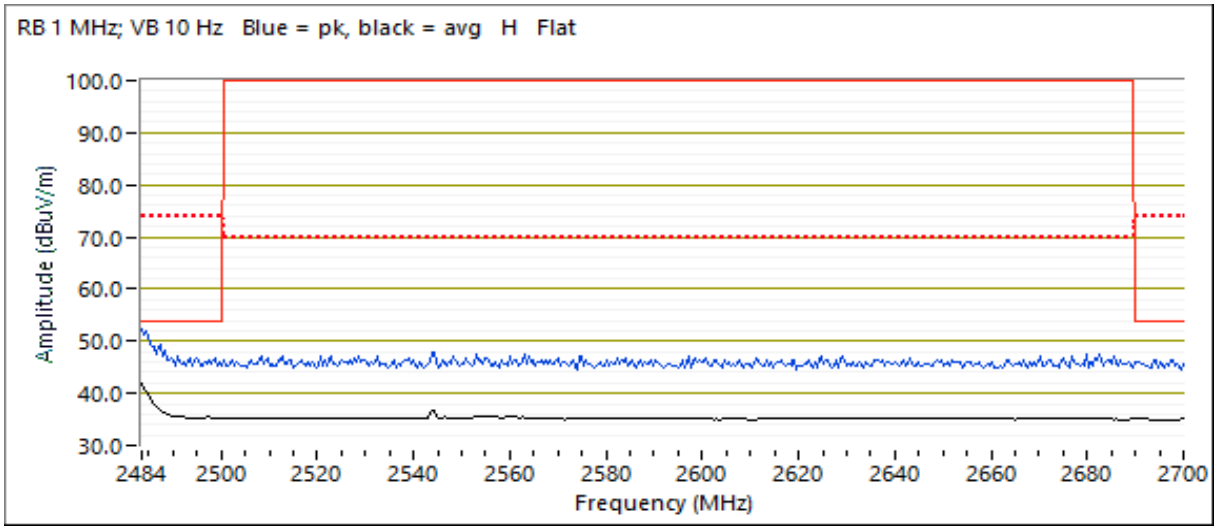


Client:	RxCap Inc.	PR Number:	PR130924
Model:	LTE Hub	T-Log Number:	TL130924-RA-Hub
		Project Manager:	Christine Krebill
Contact:	David MacVittie	Project Engineer:	David Bare
Standard:	FCC Part 15, Subpart B and §15.247	Class:	N/A

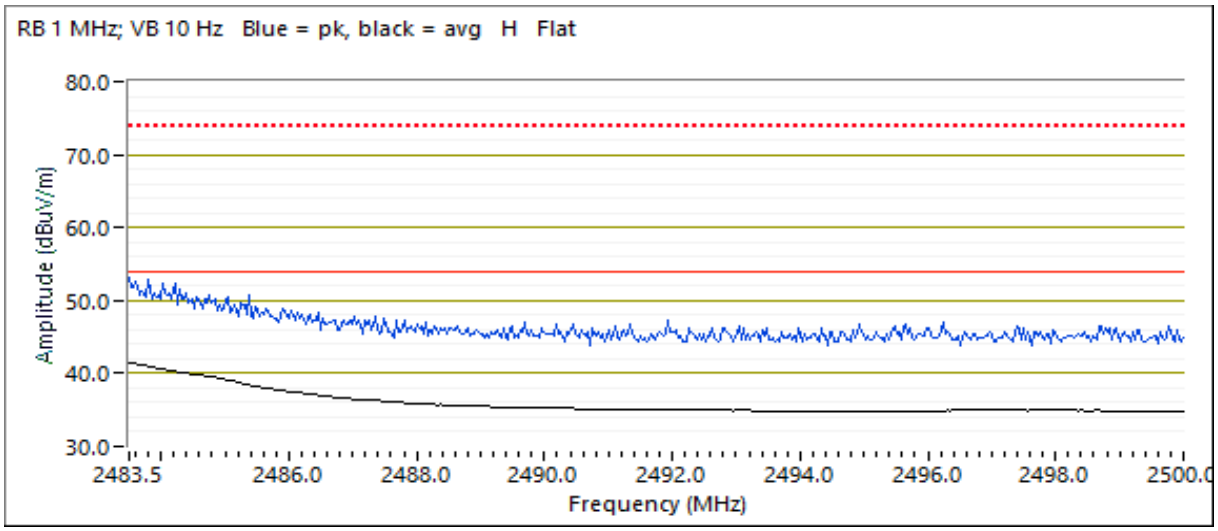
Channel: 39 Mode: BLE Pwr Setting: 5 dBm

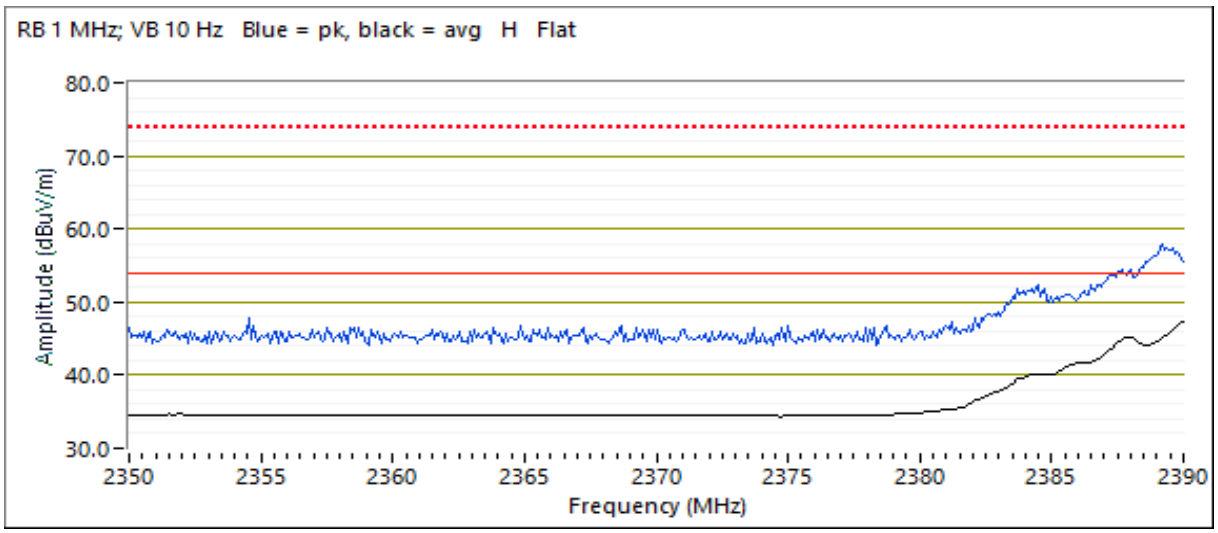
Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
2483.500	41.5	H	54.0	-12.5	AVG	189	1.95	
2484.290	53.1	H	74.0	-20.9	PK	189	1.95	
2390.000	47.2	H	54.0	-6.8	AVG	192	1.52	
2389.520	57.7	H	74.0	-16.3	PK	192	1.52	



Client:	RxCap Inc.	PR Number:	PR130924
Model:	LTE Hub	T-Log Number:	TL130924-RA-Hub
		Project Manager:	Christine Krebill
Contact:	David MacVittie	Project Engineer:	David Bare
Standard:	FCC Part 15, Subpart B and §15.247	Class:	N/A





Client:	RxCap Inc.	PR Number:	PR130924
Model:	LTE Hub	T-Log Number:	TL130924-RA-Hub
		Project Manager:	Christine Krebill
Contact:	David MacVittie	Project Engineer:	David Bare
Standard:	FCC Part 15, Subpart B and §15.247	Class:	N/A

RSS-247 and FCC 15.247 (DTS) 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: 24-26 °C
Rel. Humidity: 38-40 %

Summary of Results - Device Operating in the 2400-2483.5 MHz Band

Run #	Mode	Channel		Power Setting	Test Performed	Limit	Result / Margin
1	BLE	37 2402MHz		8	Radiated Emissions, 30 MHz - 25 GHz	FCC Part 15.209 / 15.247(c)	48.6 dBµV/m @ 7206.8 MHz (-5.4 dB)
		17 2440MHz		8	Radiated Emissions, 30 MHz - 25 GHz	FCC Part 15.209 / 15.247(c)	49.8 dBµV/m @ 7320.8 MHz (-4.2 dB)
		39 2480MHz		8	Radiated Emissions, 30 MHz - 25 GHz	FCC Part 15.209 / 15.247(c)	47.3 dBµV/m @ 7440.8 MHz (-6.7 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:	RxCap Inc.	PR Number:	PR130924
Model:	LTE Hub	T-Log Number:	TL130924-RA-Hub
		Project Manager:	Christine Krebill
Contact:	David MacVittie	Project Engineer:	David Bare
Standard:	FCC Part 15, Subpart B and §15.247	Class:	N/A

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
BLE	1 Mbps	1.00	-	100	0	0	10

Measurement Specific Notes:

Note 1:	Emission in non-restricted band, but limit of 15.209 used.

Sample Notes

Sample S/N: 6CE33D82

Procedure Comments:

Measurements performed in accordance with ANSI C63.10
Peak measurements performed with: RBW=1MHz, VBW=3MHz, peak detector, max hold, auto sweep time
Unless otherwise stated/noted, emission has duty cycle ≥ 98% and was measured using RBW=1MHz, VBW=10Hz, peak detector, linear voltage average, auto sweep time, max hold.
2.4GHz band reject filter used

Client:	RxCap Inc.	PR Number:	PR130924
Model:	LTE Hub	T-Log Number:	TL130924-RA-Hub
		Project Manager:	Christine Krebill
Contact:	David MacVittie	Project Engineer:	David Bare
Standard:	FCC Part 15, Subpart B and §15.247	Class:	N/A

Run #1: Radiated Spurious Emissions, 30 - 25000 MHz.

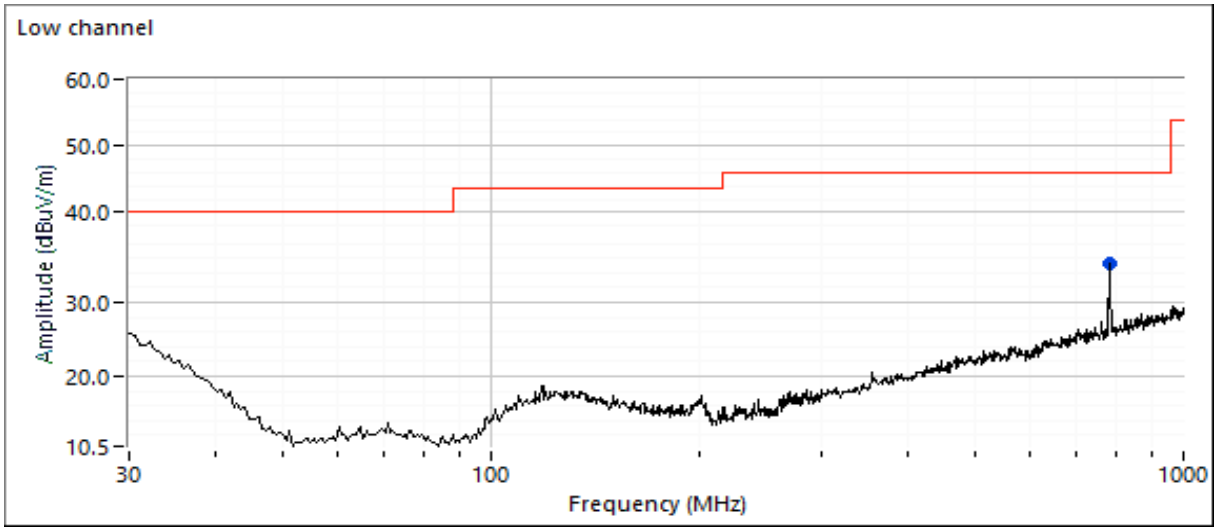
Date of Test: 08/25/21 Config. Used: 1
Test Engineer: J.Caizzi & M.Birgani Config Change: None
Test Location: Chamber 5 Adapter Voltage: 120V, 60Hz

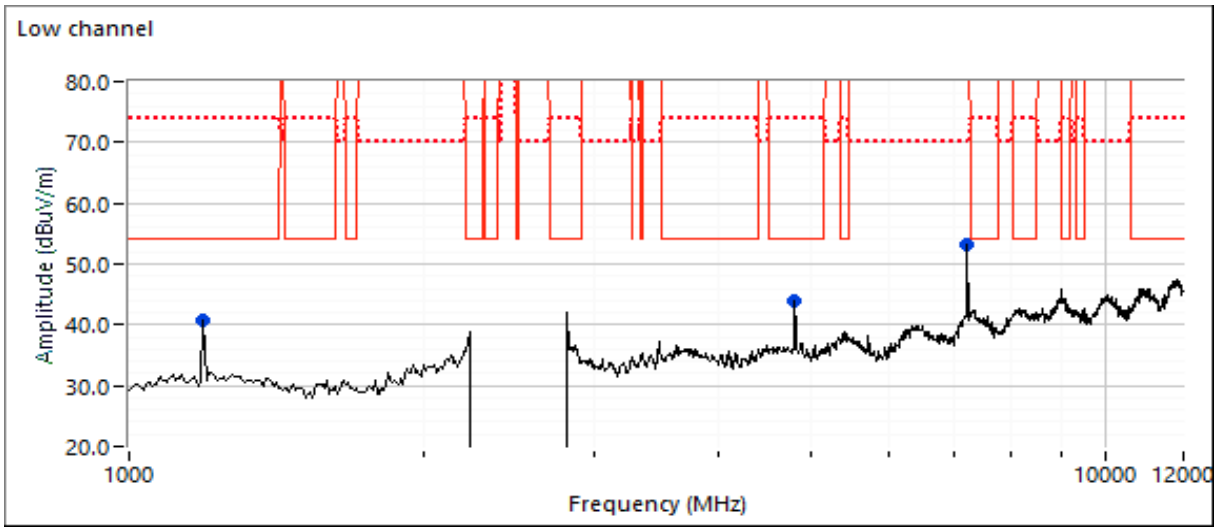
Run #1a: Low Channel
Channel: 37 Mode: BLE Pwr Setting: 8 dBm

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
7206.820	48.6	V	54.0	-5.4	AVG	0	2.30	Note 1: RB 1 MHz;VB 10 Hz
782.565	35.2	H	46.0	-10.8	Peak	288	2.5	Note 1: Peak reading with QP limit
1198.020	39.4	V	54.0	-14.6	AVG	289	1.89	
4804.080	38.8	H	54.0	-15.2	AVG	326	1.90	RB 1 MHz;VB 10 Hz
7205.580	57.0	V	74.0	-17.0	PK	0	2.30	Note 1: RB 1 MHz;VB 3 MHz
1198.090	48.6	V	74.0	-25.4	PK	289	1.89	
4804.830	47.3	H	74.0	-26.7	PK	326	1.90	RB 1 MHz;VB 3 MHz

Note: Scans made between 12 - 25 GHz with the measurement antenna moved around the EUT 30cm from the device indicated there were no significant emissions in this frequency range.

Client:	RxCap Inc.	PR Number:	PR130924
Model:	LTE Hub	T-Log Number:	TL130924-RA-Hub
		Project Manager:	Christine Krebill
Contact:	David MacVittie	Project Engineer:	David Bare
Standard:	FCC Part 15, Subpart B and §15.247	Class:	N/A





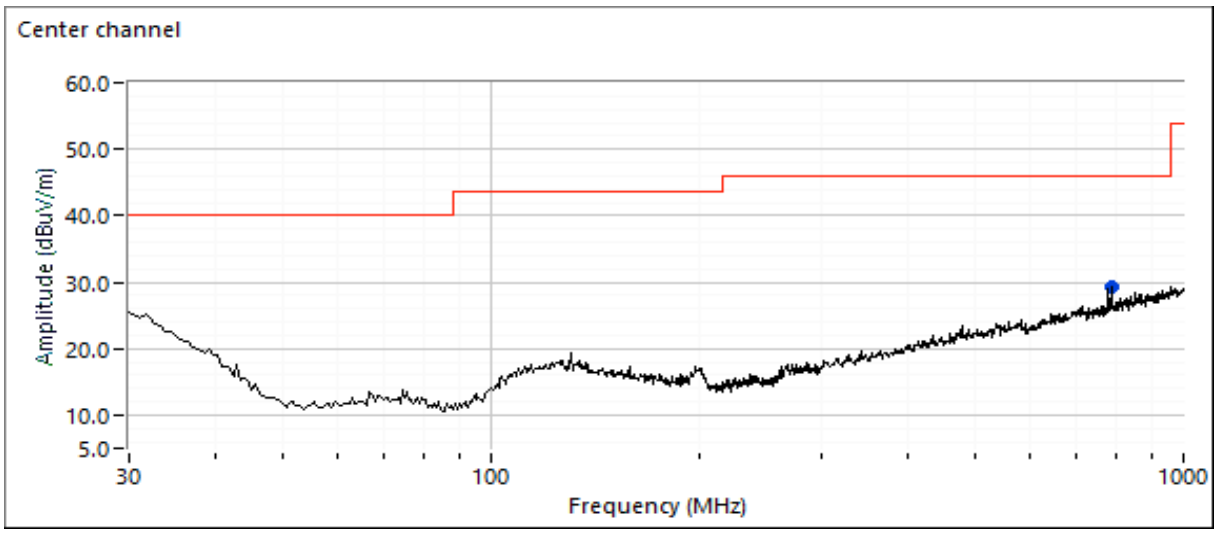
Client:	RxCap Inc.	PR Number:	PR130924
Model:	LTE Hub	T-Log Number:	TL130924-RA-Hub
		Project Manager:	Christine Krebill
Contact:	David MacVittie	Project Engineer:	David Bare
Standard:	FCC Part 15, Subpart B and §15.247	Class:	N/A

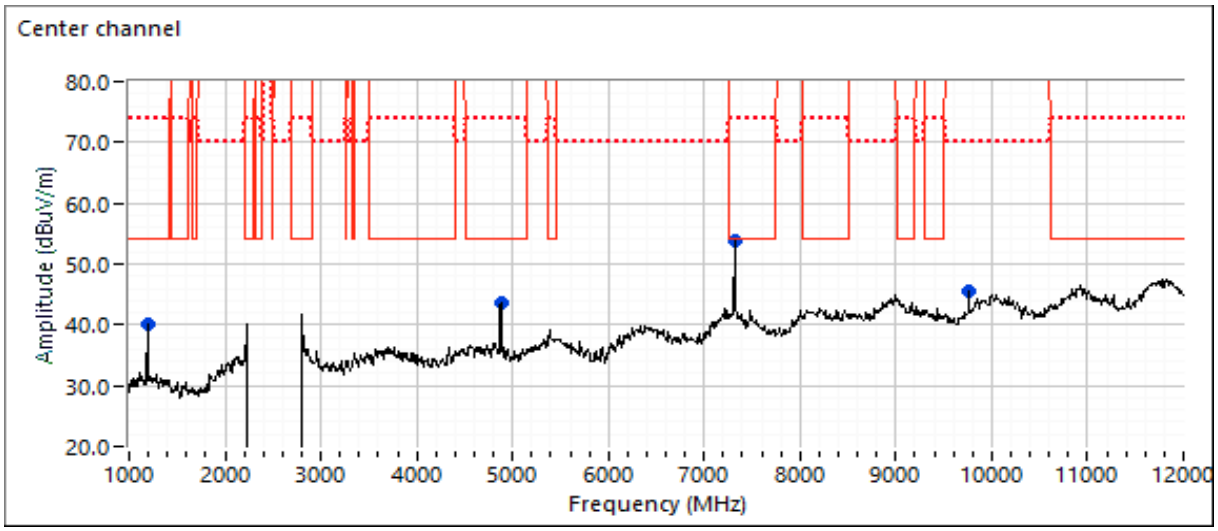
Run #1b: Center Channel
Channel: 17 Mode: BLE Pwr Setting: 8 dBm

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
7320.750	49.8	V	54.0	-4.2	AVG	1	2.49	RB 1 MHz;VB 10 Hz
9761.080	43.7	V	54.0	-10.3	AVG	146	1.00	RB 1 MHz;VB 10 Hz
4879.980	41.1	V	54.0	-12.9	AVG	287	1.51	RB 1 MHz;VB 10 Hz
1191.670	40.0	H	54.0	-14.0	Peak	62	2.0	Measured in run 1c.
786.774	29.4	V	46.0	-16.6	Peak	285	2.0	Note 1: Peak reading with QP limit
7321.020	57.1	V	74.0	-16.9	PK	1	2.49	RB 1 MHz;VB 3 MHz
9761.380	52.5	V	74.0	-21.5	PK	146	1.00	RB 1 MHz;VB 3 MHz
4880.410	48.5	V	74.0	-25.5	PK	287	1.51	RB 1 MHz;VB 3 MHz

Note: As there were no emisisons observed from the BLE radio on channels 37 and 39 below 1 GHz, there would not be any on channel 17. Therefore no scan of this band is required for channel 17.

Client:	RxCap Inc.	PR Number:	PR130924
Model:	LTE Hub	T-Log Number:	TL130924-RA-Hub
		Project Manager:	Christine Krebill
Contact:	David MacVittie	Project Engineer:	David Bare
Standard:	FCC Part 15, Subpart B and §15.247	Class:	N/A





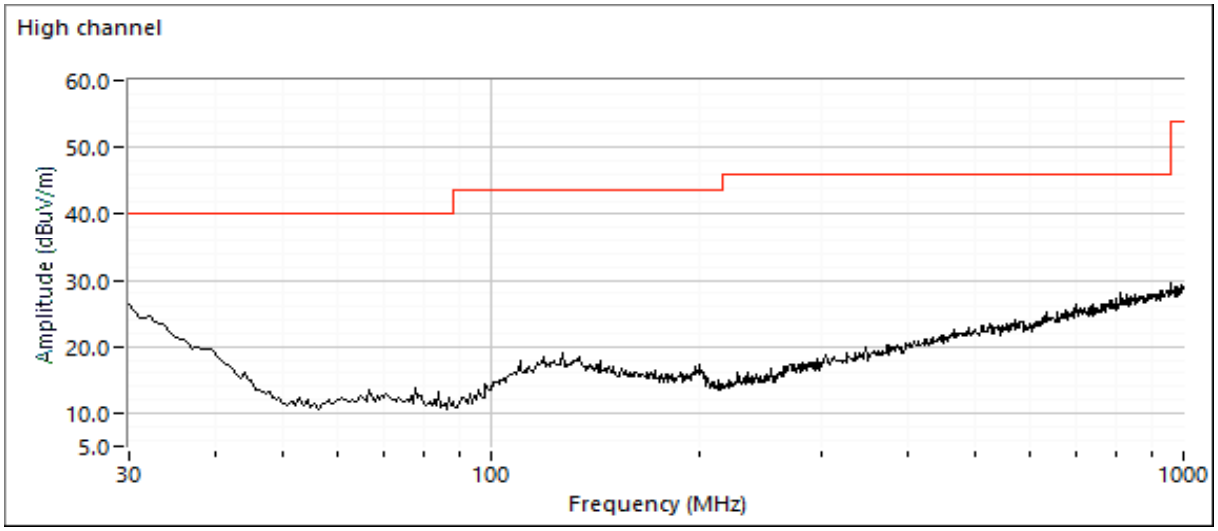
Client:	RxCap Inc.	PR Number:	PR130924
Model:	LTE Hub	T-Log Number:	TL130924-RA-Hub
		Project Manager:	Christine Krebill
Contact:	David MacVittie	Project Engineer:	David Bare
Standard:	FCC Part 15, Subpart B and §15.247	Class:	N/A

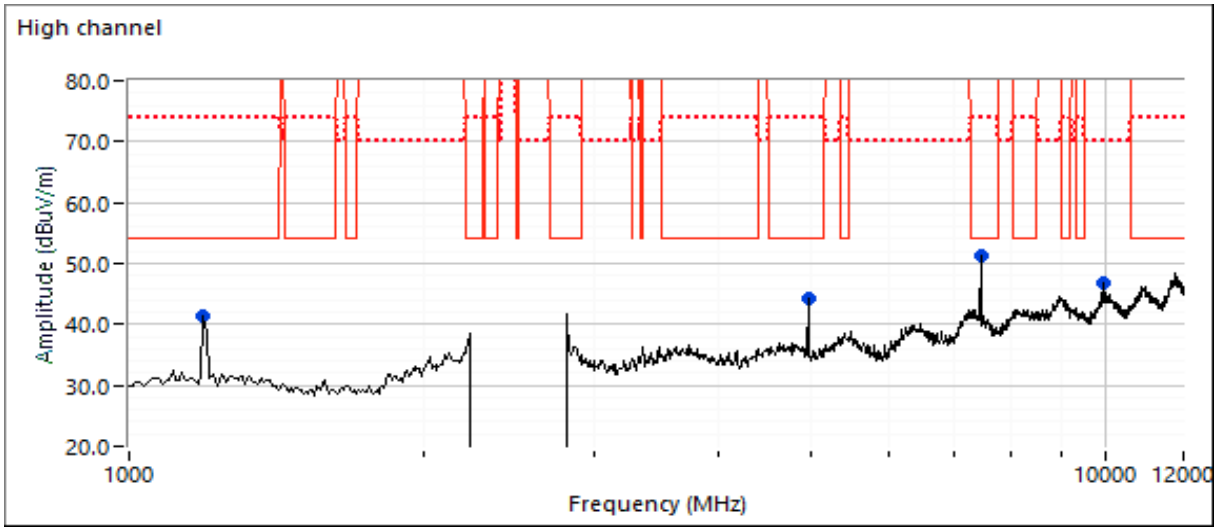
Run #1c: High Channel

Channel: 39 Mode: BLE Pwr Setting: 8 dBm

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
7440.800	47.3	V	54.0	-6.7	AVG	312	2.3	RB 1 MHz;VB 10 Hz
9919.250	44.3	V	54.0	-9.7	AVG	154	1.00	Note 1
4960.100	40.7	V	54.0	-13.3	AVG	168	1.00	RB 1 MHz;VB 10 Hz
1198.020	39.4	V	54.0	-14.6	AVG	289	1.89	RB 1 MHz;VB 10 Hz
7440.920	54.8	V	74.0	-19.2	PK	312	2.3	RB 1 MHz;VB 3 MHz
9921.200	53.6	V	74.0	-20.4	PK	154	1.00	Note 1
1198.090	48.6	V	74.0	-25.4	PK	289	1.89	RB 1 MHz;VB 3 MHz
4959.610	47.7	V	74.0	-26.3	PK	168	1.00	RB 1 MHz;VB 3 MHz

Client:	RxCap Inc.	PR Number:	PR130924
Model:	LTE Hub	T-Log Number:	TL130924-RA-Hub
		Project Manager:	Christine Krebill
Contact:	David MacVittie	Project Engineer:	David Bare
Standard:	FCC Part 15, Subpart B and §15.247	Class:	N/A





Client:	RxCap Inc.	PR Number:	PR130924
Model:	LTE Hub	T-Log Number:	TL130924-RA-Hub
		Project Manager:	Christine Krebill
Contact:	David MacVittie	Project Engineer:	David Bare
Standard:	FCC Part 15, Subpart B and §15.247	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: 10/13/2021
Test Engineer: David Bare
Test Location: Fremont Chamber #7

Config. Used: 1
Config Change: None
EUT Voltage: 120V/60Hz

General Test Configuration

The EUT and any local support equipment were located on the turntable for radiated emissions testing. Remote support equipment was located ????

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:

Temperature: 23 °C
Rel. Humidity: 19 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	30 kHz - 30 MHz	FCC 15.209	Pass	Refer to individual runs

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

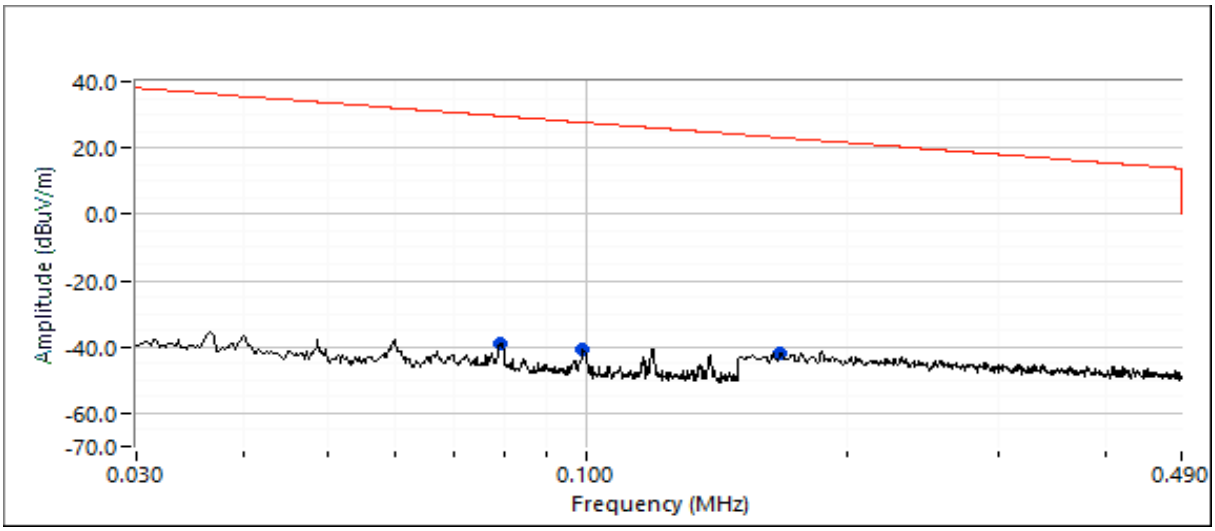
No deviations were made from the requirements of the standard.

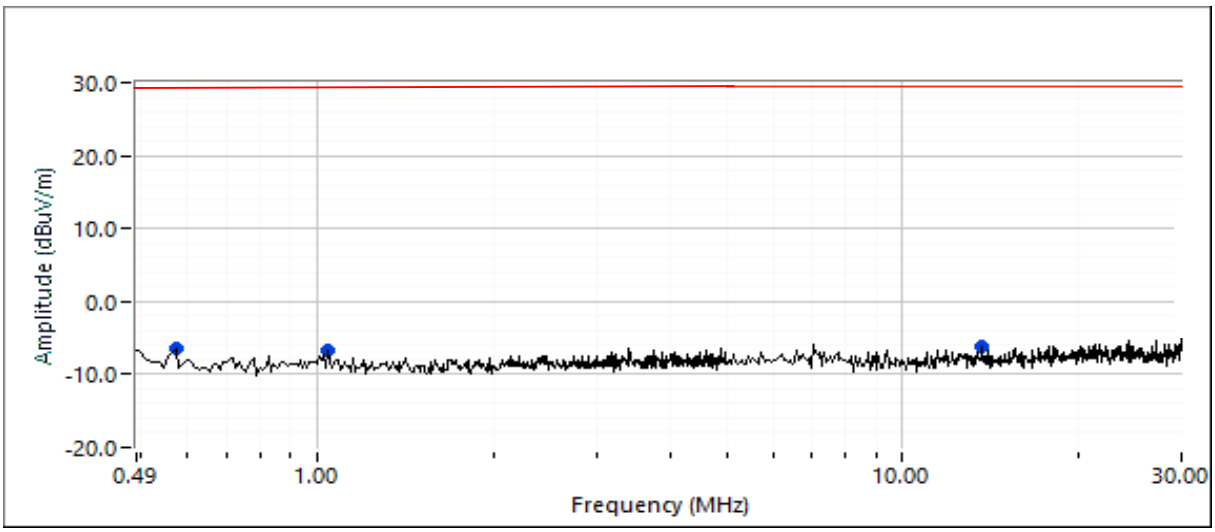
Client:	RxCap Inc.	PR Number:	PR130924
Model:	LTE Hub	T-Log Number:	TL130924-RA-Hub
		Project Manager:	Christine Krebill
Contact:	David MacVittie	Project Engineer:	David Bare
Standard:	FCC Part 15, Subpart B and §15.247	Class:	-

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

Frequency Range	Test Distance	Limit Distance	Extrapolation Factor
0.009 - 0.490 MHz	3	300	-80.0
0.490 - 1.705 MHz	3	30	-40.0
1.705 - 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





Client:	RxCap Inc.	PR Number:	PR130924
Model:	LTE Hub	T-Log Number:	TL130924-RA-Hub
		Project Manager:	Christine Krebill
Contact:	David MacVittie	Project Engineer:	David Bare
Standard:	FCC Part 15, Subpart B and §15.247	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	
0.080	-39.0	H	29.6	-68.6	Peak	192	1.2	
0.099	-40.5	H	27.7	-68.2	Peak	207	1.2	
0.168	-41.9	H	23.1	-65.0	Peak	194	1.2	
1.041	-6.8	H	29.5	-36.3	Peak	336	1.7	
0.571	-6.5	H	29.5	-36.0	Peak	188	1.2	
13.717	-6.2	H	29.5	-35.7	Peak	11	1.2	

Note 1:	The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, with a peak limit 20dB above the average limit.

Maximized readings from Run #1

All observed emissions more than 30 dB below the limit from preliminary scan.

Frequency	Level	Pol	FCC 15.209		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
1.041	-15.4	H	31.2	-46.6	QP	336	1.7	QP (1.00s)

Note 1:	The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, with a peak limit 20dB above the average limit.

End of Report

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