

**FCC PART 15, SUBPART B and C; RSS-247, RSS-GEN
TEST REPORT**

for

LORA EDGE TRACKER REFERENCE DESIGN

MODEL NUMBER: LR1110TRK1CKS

Prepared for

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DATE: AUGUST 19, 2020

	REPORT BODY	APPENDICES					TOTAL
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GENERAL REPORT SUMMARY

This electromagnetic emission report is generated by Compatible Electronics Inc., which is an independent testing and consulting firm. The test report is based on testing performed by Compatible Electronics personnel according to the measurement procedures described in the test specifications given below and in the "Test Procedures" section of this report.

The measurement data and conclusions appearing herein relate only to the sample tested and this report may not be reproduced in any form except in full, without the written permission of Compatible Electronics.

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

Device Tested: LoRa Edge Tracker Reference Design
Model: LR1110TRK1CKS
S/N: None

Product Description: This is an industrial tracker for asset management systems. It consists of 900 – LoRaWAN transceiver radio operating in the frequency band 902.3 – 914.9 MHz and Bluetooth BLE 4.2 transceiver operating in the frequency band 2400 – 2480 MHz.
Highest Frequency: 2480 MHz (Dimensions: 52 x 85 x 27 mm / 2.05" x 3.35" x 1.06")

Modifications: The EUT was not modified during the testing in order to comply with the specifications.

Manufacturer: Semtech Corporation
200 Flynn Road
Camarillo, CA 93012

Test Dates: August 11-14, 2020



**Innovation, Science and Economic
Development Canada**

Lab Code 22209

Test Specifications covered by accreditation:

Emissions requirements
CFR Title 47, Part 15, Subpart B; and Subpart C,
sections 15.205, 15.207, 15.209, 15.247, RSS Gen
Issue 10 2019 and RSS 247 Issue 2 2017
Test Procedure: ANSI C63.4: 2014, ANSI C63.10:
2013 and KDB 558074 D01 v05r02

SUMMARY OF TEST RESULTS - DSS

TEST	DESCRIPTION	RESULTS
1	Conducted RF Emissions, 150 kHz - 30 MHz	This test was not performed because the EUT is battery powered only.
2	Radiated RF Emissions, 9 kHz – 24.8 GHz	Complies with the Class B limits of CFR Title 47, Part 15, Subpart B; and the limits of CFR Title 47, Part 15 Subpart C, 15.205, 15.209 and 15.247 (d)
3	20 dB Bandwidth	Complies with the requirements of CFR Title 47, Part 15, Subpart C, section 15.247 (a)(1)(i)
4	Peak Power Output	Complies with the requirements of CFR Title 47, Part 15, Subpart C, section 15.247 (a)(1)(i)
5	RF Conducted Antenna Test	Complies with the requirements of CFR Title 47, Part 15, Subpart C, section 15.247 (a)(1)(i)
6	Carrier Frequency Separation	Complies with the requirements of CFR Title 47, Part 15, Subpart C, section 15.247 (a)(1)(i)
7	Average Time of Occupancy	Complies with the requirements of CFR Title 47, Part 15, Subpart C, section 15.247 (a)(1)(i)
8	Number of Hopping Frequencies	Complies with the requirements of CFR Title 47, Part 15, Subpart C, section 15.247 (a)(1)(i)
9	Power Spectral Density from the Intentional Radiator to the Antenna	Complies with the requirements of CFR Title 47, Part 15, Subpart C, section 15.247 (f)

SUMMARY OF TEST RESULTS - DTS

TEST	DESCRIPTION	RESULTS
1	Conducted RF Emissions, 150 kHz – 30 MHz	This test was not performed because the EUT is battery powered only.
2	Spurious Radiated RF Emissions, 30 MHz – 1000 MHz	The EUT complies with the Class B limits of CFR Title 47, Part 15 Subpart B; the limits of CFR Title 47, Part 15, Subpart C, section 15.209 and 15.247
3	Spurious Radiated RF Emissions, 9 kHz – 30 MHz and 1000 MHz – 24.8 GHz	The EUT complies with the Class B limits of CFR Title 47, Part 15, Subpart B; CFR Title 47, Part 15, Subpart C, section 15.247(d); RSS-247 and RSS-Gen
4	Fundamental and Emissions produced by the intentional radiator in non-restricted bands, 9 kHz – 24.8 GHz	Complies with the requirements of CFR Title 47, Part 15, Subpart C, section 15.247(d)
5	Emissions produced by the intentional radiator in restricted bands, 9 kHz – 24.8 GHz	Complies with the requirements of CFR Title 47, Part 15, Subpart C, section 15.205, 15.209, section 15.247 (d)
6	DTS Bandwidth	Complies with the requirements of FCC Title 47, Part 15, Subpart C, section 15.247 (a)(2)
7	Maximum Conducted Output Power	Complies with the requirements of FCC Title 47, Part 15, Subpart C, section 15.247 (b)(3)
8	RF Conducted Antenna Test	This test was not performed because the emissions were all taken via the radiated method.
9	Power Spectral Density from the Intentional Radiator to the Antenna	Complies with the requirements of CFR Title 47, Part 15, Subpart C, section 15.247 (e)

1. PURPOSE

This document is a qualification test report based on the emissions tests performed on the LoRa Edge Tracker Reference Design, Model Number: LR1110TRK1CKS. The emissions measurements were performed according to the measurement procedure described in ANSI C63.10 and ANSI C63.4. The tests were performed in order to determine whether the electromagnetic emissions from the equipment under test, referred to as EUT hereafter, are within the **Class B** specification limits defined by **CFR** Title 47, Part 15, Subpart B and Subpart C, sections 15.205, 15.207, 15.209, and 15.247; RSS-247 and RSS-Gen.

1.1 DECISION RULE & RISK

If a measured value exceeds a specification limit it implies non-compliance. If the value is below a specification limit it implies compliance. Measurement uncertainty of the laboratory is reported with all measurement results but generally not taken into consideration unless a standard, rule or law requires it to be considered.

Qualification test reports are only produced for products that are in compliance with the test requirements, therefore results are always in conformity. Otherwise, an engineering report or just the data is provided to the customer.

When performing a measurement and making a statement of conformity, in or out-of-specification to manufacturer's specifications or Pass/Fail against a requirement, there are two possible outcomes:

- The result is reported as conforming with the specification
- The result is reported as not conforming with the specification

The decision rule is defined below.

When the test result is found to be below the limit but within our measurement uncertainty of the limit, it is our policy that the final acceptance decision is left to the customer, after discussing the implications and potential risks of the decision.

When the test result is found to be exactly on the specification, it is our policy, in the case of unwanted emissions measurements to consider the result non-compliant, however, the final decision is left to the customer, after discussing the implications and potential risks of the decision.

When the test result is found to be over the specification limit under any condition, it is our policy to consider the result non-compliant.

In terms of uncertainty of measurement, the laboratory is a calibrated and tightly controlled environment and generally exceptionally stable, the measurement uncertainties are evaluated without the consideration of the test sample. When it comes to the test sample however, as most testing is performed on a single sample rather than a sample population, and that sample is often a pre-production representation of the final product, that test sample represents a significantly higher source of measurement uncertainty. We advise our customers of this and that when in doubt (small test to limit margins), they may wish to perform statistical sampling on a population to gain a higher confidence in the results. All lab reported results are that of a single sample in any event.

2. ADMINISTRATIVE DATA

2.1 Location of Testing

The emissions tests described herein were performed at the test facility of Compatible Electronics, 1050 Lawrence Drive, Newbury Park, California 91320.

2.2 Traceability Statement

The calibration certificates of all test equipment used during the test are on file at the location of the test. The calibration is traceable to the National Institute of Standards and Technology (NIST).

2.3 Cognizant Personnel

Semtech Corporation

Steven Jillings

Senior RF Applications Engineer

Compatible Electronics Inc.

Reynald O. Ramirez
Ruby Hall

Sr. Test Engineer
Lab Manager

2.4 Date Test Sample Was Received

The test sample was received on August 14, 2020. Received as described in product description.

2.5 Disposition of the Test Sample

The test sample still remains with Compatible Electronics.

2.6 Abbreviations and Acronyms

The following abbreviations and acronyms may be used in this document.

RF	Radio Frequency
EMI	Electromagnetic Interference
EUT	Equipment Under Test
P/N	Part Number
S/N	Serial Number
HP	Hewlett Packard
ITE	Information Technology Equipment
CML	Corrected Meter Limit
LISN	Line Impedance Stabilization Network
N/A	Not Applicable
NCR	No Calibration Required

3. APPLICABLE DOCUMENTS

The following documents are referenced or used in the preparation of this emissions Test Report.

SPEC	TITLE
FCC Title 47, Part 15 Subpart C	FCC Rules - Radio frequency devices (including digital devices) – Intentional Radiators
RSS Gen, Issue 5: 2019	General Requirements for Compliance of Radio Apparatus
RSS-247, Issue 2: 2017	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices
ANSI C63.4 2014	Methods of measurement of radio-noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz
ANSI C63.10 2013	American National Standard for Testing Unlicensed Wireless Devices
FCC Title 47, Part 15 Subpart B	FCC Rules - Radio frequency devices (including digital devices) – Unintentional Radiators
KDB 558074 D01 v05r02	Guidance for Performing Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating Under Section 15.247 of the FCC Rules
EN 50147-2: 1997	Anechoic chambers. Alternative test site suitability with respect to site attenuation

4. DESCRIPTION OF TEST CONFIGURATION

4.1 Description of Test Configuration – Emissions

The EUT was tested in a tabletop configuration. The EUT was powered ON and a special program was used to command the EUT to hybrid mode or a specific channel depending on the test. All 3 orthogonal axis positions were tested. The EUT was tested with fresh batteries. The EUT was utilizing software version 1.0. The source code was developed by the Grenoble, FR team and is stored on Semtech's secure Gitlab repository (this is a password/credential secured domain), a DevOps lifecycle tool provides a Git-repository manager providing version control, wiki, issue-tracking and continuous integration and deployment pipeline. FW can be obtained by contacting the Applicant (Semtech (Interantional) AG) and in the case of ISED, the Agent (Semtech Corporation Canada).

The EUT transmits 900 MHZ LoRaWAN packets as well as BLE advertising and connection modes.

For direct measurement portion of the test – The EUT was directly connected to the EMI receiver. A special program was used to control the channel of the transmitter or to commit the unit to hybrid mode, depending on the nature of the specific test.

The radiated final as well as the conducted data for the EUT were taken in the worst-case configuration described above. Please see Appendix E for the data sheets.

4.1.1 Cable Construction and Termination

There are no external cables connected to the EUT.

5. LISTS OF EUT, ACCESSORIES AND TEST EQUIPMENT

5.1 EUT and Accessory List

EQUIPMENT	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID
LORA EDGE TRACKER REFERENCE DESIGN (EUT)	SEMTECH CORPORATION	LR1110TRK1CKS	N/A	FCC ID: 2AMUGLR1110TRK IC: 22980- LR1110TRK

5.2 Emissions Test Equipment

EQUIPMENT TYPE	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. DATE	CAL. DUE DATE
TDK Emissions Lab Software	TDK RF Solutions, Inc.	TDK Emissions Lab	Version: 10.78	NCR	NCR
EMI Receiver	Agilent	N9038A	MY51100115	Jan. 07, 2020	Jan. 07, 2021
Combi-Log Antenna	Com-Power	AC-220	10030030	Jan. 30, 2020	Jan. 30, 2022
Active Loop Antenna	Com-Power	AL-130	17067	Jun. 05, 2019	Jun. 05, 2021
Antenna Cable	Belden	RG-214/U	A/N: 6014	Apr. 08, 2020	Apr. 08, 2021
Horn Antenna	Com-Power	AH-118	071370	Jun. 29, 2020	Jun. 29, 2022
Horn Antenna	Com-Power	AH-826	081081	NCR	NCR
High Freq. Antenna Cables	SucoFlex	102_EA	A/N: 6012 & 6013	Apr. 08, 2020	Apr. 08, 2021
Turntable	EMCO	2088-2.03	None	NCR	NCR
Antenna Mast	EMCO	2075-2	None	NCR	NCR
Multi-Device Controller	ETS EMCO	2090	9511-1095	NCR	NCR
Temperature and Humidity Indicator	Abbeon	HTAB169B	3428	Mar. 24, 2020	Mar. 24, 2021
Barometer	Maximum	Predictor	3429	Jan. 17, 2020	Jan. 17, 2021
Computer	Dell	Vostro 3900	Asset# 3423	NCR	NCR

6. TEST SITE DESCRIPTION

6.1 Test Facility Description

Please refer to section 2.1 and 7.1 of this report for emissions test location.

6.2 EUT Mounting, Bonding and Grounding

For frequencies 1 GHz and below: The EUT was mounted on a 1.0 by 1.5 meter non-conductive table 0.8 meters above the ground plane.

For frequencies above 1 GHz: The EUT was mounted on a 1.0 by 1.5 meter non-conductive table 1.5 meters above the ground plane.

The EUT was not grounded.

6.3 Measurement Uncertainty

Compatible Electronics' U_{lab} value is less than U_{cispr} , thus based on this – compliance is deemed to occur if no measured disturbance exceeds the disturbance limit

$$u_c(y) = \sqrt{\sum_i c_i^2 u^2(x_i)}$$

Measurement		U_{cispr}	$U_{lab} = 2 u_c(y)$
Conducted disturbance (mains port)	(150 kHz – 30 MHz)	3.4 dB	2.73 dB
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(30 MHz – 1 000 MHz)	6.3 dB	3.24 dB
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(1 GHz - 6 GHz)	5.2 dB	3.23 dB
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(6 GHz – 18 GHz)	5.5 dB	3.23 dB
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(18 GHz – 26 GHz)	N/A	3.50 dB

7. CHARACTERISTICS OF THE TRANSMITTER

7.1 Channel Description and Frequencies

The EUT operates on 64 channels. The low channel is 902.3 MHz, the middle channel is 914.9 MHz and the high channel is 927.7 MHz. In addition, the EUT also operates at BLE frequencies 2402 MHz, 2426 MHz and 2480 MHz.

7.2 Antenna

The 900 MHz antenna has a gain of -1.8 dBi and the 2.4 GHz antenna has a gain of -0.5dBi.

8. TEST PROCEDURES

The following sections describe the test methods and the specifications for the tests. Test results are also included in this section.

8.1 RF Emissions

8.1.1 Conducted Emissions Test

Test Results:

This test was not performed because the EUT operates on battery power only and cannot be connected internally or externally to the AC public mains.

Had this test been applicable it would have been performed as described below.

The EMI Receiver was used as a measuring meter. A 10 dB Attenuator was used for the protection of the EMI Receiver input stage, and the offset was adjusted accordingly to read the actual data measured. The LISN output was measured using the EMI Receiver. The output of the second LISN was terminated by a 50-ohm termination. The effective measurement bandwidth used for this test was 9 kHz.

Please see section 6.2 of this report for mounting, bonding, and grounding of the EUT. The EUT was powered through the LISN, which was bonded to the ground plane. The LISN power was filtered and the filter was bonded to the ground plane. The EUT was set up with the minimum distances from any conductive surfaces as specified in ANSI C63.4. The excess power cord was wrapped in a figure eight pattern to form a bundle not exceeding 0.4 meters in length.

The conducted emissions from the EUT were maximized for operating mode as well as cable placement. The final data was collected under program control by computer software. The final qualification data is located in Appendix E.

8.1.2 Radiated Emissions (Spurious and Harmonics) Test

The EMI Receiver was used as the measuring meter. Below 1 GHz, a built-in, internal preamplifier was used to increase the sensitivity of the instrument. At frequencies above 1 GHz, external preamplifiers were used. The EMI Receiver was initially used with the Analyzer mode feature activated. In this mode, the EMI receiver can then record the actual frequency to be measured. This final reading is then taken accurately in the EMI Receiver mode, which takes into account the cable loss, amplifier gain and antenna factors, so that a true reading is compared to the true limit.

The frequencies above 1 GHz were averaged by using the linear average detector function on the EMI Receiver.

The measurement bandwidths and transducers used for the radiated emissions test were:

FREQUENCY RANGE	EFFECTIVE MEASUREMENT BANDWIDTH	TRANSDUCER
9 kHz to 150 kHz	200 Hz	Loop Antenna
150 kHz to 30 MHz	9 kHz	Loop Antenna
30 MHz to 1 GHz	120 kHz	Combilog Antenna
1 GHz to 25 GHz	1 MHz	Horn Antenna

The EMI test chamber of Compatible Electronics, Inc. was used for radiated emissions testing. This test site is in full compliance with ANSI C63.4. Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The turntable supporting the EUT is remote controlled using a motor. The turntable permits EUT rotation of 360 degrees in order to maximize emissions. Also, the antenna mast allows height variation of the antenna from 1 meter to 4 meters. Data was collected in the worst case (highest emission) configuration of the EUT. At each reading, the EUT was rotated 360 degrees and the antenna height was varied from 1 to 4 meters (for E field radiated field strength). The gunsight method was used when measuring with the horn antenna in order to ensure accurate results.

The six highest reading are listed in Table 1 and Table 2.

Test Results:

The EUT complies with the **Class B** limits of RSS-247, RSS-Gen, **CFR** Title 47, Part 15, Subpart B; the limits of CFR Title 47, Part 15, Subpart C, Sections 15.209 and 15.247 (d) for radiated emissions. Please see Appendix E for the data sheets.

8.1.3 RF Emissions Test Results

Table 1.0 RADIATED EMISSION RESULTS
LoRa Edge Tracker Reference Design
Model Number: LR1110TRK1CKS
902.3 MHz (worst case spurious emissions)

Frequency MHz	Corrected Reading* dBuV/m	Specification Limit dBuV/m	Delta (Cor. Reading – Spec. Limit) dB
653.90	38.66#	46.00	-7.34
738.90	39.57#	46.00	-6.43
754.20	39.59#	46.00	-6.41
881.10	39.94#	46.00	-6.06
934.20	42.73#	46.00	-3.27
939.80	42.14#	46.00	-3.86

Table 2.0 RADIATED EMISSION RESULTS
LoRa Edge Tracker Reference Design
Model Number: LR1110TRK1CKS
2402 MHz (worst case spurious emissions)

Frequency MHz	Corrected Reading* dBuV/m	Specification Limit dBuV/m	Delta (Cor. Reading – Spec. Limit) dB
619.20	38.68#	46.00	-7.32
764.30	39.80#	46.00	-6.20
828.80	40.73#	46.00	-5.27
834.20	40.67#	46.00	-5.33
931.50	43.16#	46.00	-2.84
934.60	42.83#	46.00	-3.17

Quasi-Peak Reading

8.1.4 Sample Calculations

A correction factor for the antenna, cable and a distance factor (if any) must be applied to the meter reading before a true field strength reading can be obtained. This Corrected Meter Reading is then compared to the specification limit in order to determine compliance with the limits.

Conversion to logarithmic terms: Specification limit ($\mu\text{V/m}$) $\log \times 20$ = Specification Limit in dBuV/m

To correct for distance when measuring at a distance other than the specification

For measurements below 30 MHz: (Specification distance / test distance) $\log \times 40$ = distance factor

For measurements above 30 MHz: (Specification distance / test distance) $\log \times 20$ = distance factor

Note: When using an Active Antenna, the Antenna factor shall be subtracted due to the combination of the internal amplification and antenna loss.

Corrected Meter Reading = meter reading + F – A + C

where: F = antenna factor

A = amplifier gain

C = cable loss

The correction factors for the antenna and the amplifier gain are attached in Appendix D of this report. The data sheets are attached in Appendix E.

The distance factor D is 0 when the test is performed at the required specification distance.

8.2 DTS Bandwidth

The DTS Bandwidth was measured using the EMI Receiver. The bandwidth was measured using a direct connection from the EUT. The following steps were performed for measuring the DTS Bandwidth.

1. Set RBW = 100 kHz
2. Set the video bandwidth (VBW) to equal or greater than 3 times the RBW
3. Detector = Peak
4. Trace Mode = Max Hold
5. Sweep = Auto Couple
6. Allow the trace to stabilize
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Test Results:

The EUT complies with the requirements of FCC Title 47, Part 15, Subpart C section 15.247 (a)(2).

8.3 Maximum Peak Conducted Output Power

The Maximum Peak Conducted Output Power was measured using the EMI Receiver. The Maximum Peak Conducted Output Power was measured using the procedure described in section 11.9.1.1 of ANSI C63.10. The Maximum Peak Conducted Output Power was then taken. The cable loss was also added back into the reading using the reference level offset. The following steps were performed for measuring the Maximum Peak Conducted Output Power.

1. Set the RBW $\geq$ DTS bandwidth
2. Set VBW $\geq$ [3 x RBW]
3. Set span $\geq$ [3 x RBW]
4. Sweep time = auto couple
5. Detector = peak
6. Trace mode = max hold
7. Allow trace to fully stabilize
8. Use peak marker function to determine the peak amplitude level

Test Results:

The EUT complies with the requirements of FCC Title 47, Part 15, Subpart C section 15.247 (b)(3).

8.4 Emissions in Non-Restricted Bands

The emissions in the non-restricted frequency bands measurements were performed using the EMI receiver directly connected to the EUT. The reference level was established by setting the instrument center frequency to the DTS channel center frequency. The span was set to ≥ 1.5 times the DTS bandwidth. The RBW was set to 100 kHz and the VBW was set to 300 kHz. A peak detector was used with sweep set to auto. A max hold trace was used and allowed to fully stabilize. The peak marker function was used to determine the reference level. For emission level measurement, the center frequency and span were set to encompass the frequency range to be measured. The RBW was set to 100 kHz and the VBW was set to 300 kHz. A peak detector was used with a sweep time set to auto. The number of measurement points were greater than the span/RBW. A max hold trace was used and allowed to fully stabilize. The peak marker function was used to determine the maximum amplitude level. The final qualification data sheets are located in Appendix E.

Test Results:

The EUT complies with the requirements of FCC Title 47, Part 15, Subpart C section 15.247 (d).

8.5 RF Band Edges

The RF band edges were taken at the edges of the ISM spectrum (2400 MHz when the EUT was on the low channel and 2480 MHz when the EUT was on the high channel) using the EMI Receiver. The RBW was set to 100 kHz and the VBW was set to 300 kHz. Plots of the fundamental were taken to ensure the amplitude at the band edges were at least 20 dB down from the peak of the fundamental emission. The plots were taken in both frequency hopping mode and single channel mode.

Test Results:

The EUT complies with the requirements of FCC Title 47, Part 15, Subpart C section 15.247 (d). The RF power at the band edges at 2400 MHz and 2480 MHz meet the requirements of FCC Title 47, Part 15, Subpart C section 15.247 (d). Please see the data sheets located in Appendix E.

8.6 Spectral Density Test

The spectrum density output was measured using the EMI Receiver. The spectral density output was measured using a direct connection from the RF out on the EUT into the input of the EMI Receiver. The following steps were performed for measuring the spectral density.

1. Set analyzer center frequency to DTS channel center frequency
2. Set the span to 1.5 times the OBW.
3. Set the RBW to $3 \text{ kHz} \leq \text{RBW} \leq 10 \text{ kHz}$
4. Set the VBW $\geq [3 \times \text{RBW}]$
5. Detector = peak
6. Sweep time = auto couple
7. Trace mode = max hold
8. Allow the trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

Test Results:

The EUT complies with the requirements of FCC Title 47, Part 15, Subpart C section 15.247 (e).

8.7 Variation of the Input Power

Test Results:

This test was not performed because the EUT operates on battery power only and cannot be connected internally or externally to the AC public mains.

Had this test been applicable it would have been performed as described below.

The variation of the input power test was performed using the EMI Receiver. The EUT input power was varied between 85% and 115% of the nominal rated supply voltage. The carrier frequency was monitored for any change in amplitude.

9. TEST PROCEDURES (CONTINUED)

9.1 20 dB Bandwidth

The 20 dB Bandwidth was measured using the EMI Receiver. The bandwidth was measured using a direct connection from the RF output of the EUT. The resolution bandwidth was $\geq 1\%$ of the bandwidth and the video bandwidth was $\geq$ RBW.

Test Results:

The EUT complies with the requirements of FCC Title 47, Part 15, Subpart C section 15.247 (a)(1)(i). The 20 dB bandwidth is less than the separation between channels. Please see the data sheets located in Appendix E.

9.2 Peak Output Power

The Peak Output Power was measured using the EMI Receiver. The peak output power was measured using a direct connection from the RF output of the EUT. The resolution bandwidth was greater than the 20 dB bandwidth and the video bandwidth was $\geq$ RBW. The cable loss was also added back into the reading using the reference level offset.

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (b)(2). The maximum peak output power is less than 1 watt. Please see the data sheets located in Appendix E.

9.3 RF Antenna Conducted Test

Test Results:

This test was not performed because the all of the emissions were taken via radiated methods.

Had this test been applicable it would have been performed as described below.

The RF antenna conducted test was performed using the EMI Receiver. The RF antenna conducted test measured using a direct connection from the RF out on the EUT into the input of the EMI Receiver. The resolution bandwidth was 100 kHz, and the video bandwidth was 300 kHz. The spans were wide enough to include all the harmonics and emissions that were produced by the intentional radiator.

TEST PROCEDURES (CONTINUED)

9.4 RF Band Edges

The RF band edges were taken at the edges of the ISM spectrum (902 MHz when the EUT was on the low channel and 928 MHz when the EUT was on the high channel) using the EMI Receiver. The RBW was set to 100 kHz and the VBW was set to 300 kHz. Plots of the fundamental were taken to ensure the amplitude at the band edges were at least 20 dB down from the peak of the fundamental emission. The plots were taken in both frequency hopping mode and single channel mode.

Test Results:

The EUT complies with the requirements of FCC Title 47, Part 15, Subpart C section 15.247 (d). The RF power at the band edges at 902 MHz and 928 MHz meet the requirements of FCC Title 47, Part 15, Subpart C section 15.247 (d). Please see the data sheets located in Appendix E.

9.5 Carrier Frequency Separation

The Channel Hopping Separation Test was measured using the EMI Receiver. The EUT was operating in its normal operating mode. The resolution bandwidth was approximately 30% of the channel spacing, and the video bandwidth $\geq$ RBW. The frequency span was wide enough to include the peaks of two adjacent channels.

Test Results:

The EUT complies with the requirements of FCC Title 47, Part 15, Subpart C section 15.247 (a)(1). The Channel Hopping Separation is greater than the 20 dB bandwidth. Please see the data sheets located in Appendix E.

TEST PROCEDURES (CONTINUED)

9.6 Number of Hopping Frequencies

The Number of Hopping Frequencies was measured using the EMI Receiver. The EUT was operating in its normal operating mode. The resolution bandwidth was set to approximately 30% of the channel spacing, and the video bandwidth was $\geq$ RBW. The frequency span was wide enough to include all of the peaks in the frequency band of operation.

Test Results:

The EUT complies with the requirements of FCC Title 47, Part 15, Subpart C section 15.247 (a)(1) and 15.247 (a)(1)(i). Please see the data sheets located in Appendix E.

9.7 Average Time of Occupancy Test

The Average Time of Occupancy Test was measured using the EMI Receiver. The EUT was operating in normal operating mode. The frequency span was taken to 0 Hz to determine the time for each transmission and the number of transmissions over a 20 second period. The RBW was set to be less than the channel spacing.

Test Results:

The EUT complies with the requirements of FCC Title 47, Part 15, Subpart C section 15.247 (a)(1)(i). Please see the data sheets located in Appendix E.

9.8 Spectral Density Test

The spectrum density output was measured using the EMI Receiver. The spectral density output was measured using a direct connection from the RF out on the EUT into the input of the EMI Receiver. The following steps were performed for measuring the spectral density.

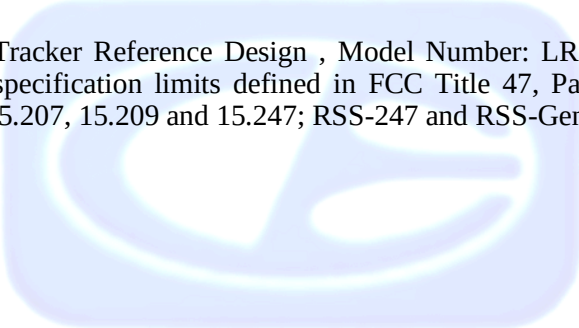
1. Set analyzer center frequency to DTS channel center frequency
2. Set the span to 1.5 times the OBW.
3. Set the RBW to $3 \text{ kHz} \leq \text{RBW} \leq 10 \text{ kHz}$
4. Set the VBW $\geq [3 \times \text{RBW}]$
5. Detector = peak
6. Sweep time = auto couple
7. Trace mode = max hold
8. Allow the trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

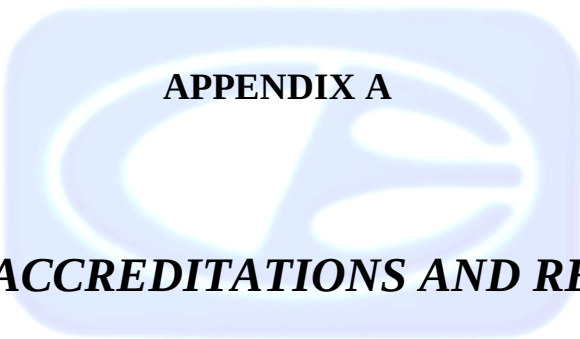
Test Results:

The EUT complies with the requirements of FCC Title 47, Part 15, Subpart C section 15.247 (f).

10 CONCLUSIONS

The LoRa Edge Tracker Reference Design , Model Number: LR1110TRK1CKS (EUT), as tested, meets all of the specification limits defined in FCC Title 47, Part 15, Subpart B, and Subpart C, sections 15.205, 15.207, 15.209 and 15.247; RSS-247 and RSS-Gen.





APPENDIX A

LABORATORY ACCREDITATIONS AND RECOGNITIONS

LABORATORY ACCREDITATIONS AND RECOGNITIONS

For US, Canada, Australia/New Zealand, Japan, Taiwan, Korea, and the European Union, Compatible Electronics is currently accredited by NVLAP to ISO/IEC 17025.

For the most up-to-date version of our scopes and certificates please visit

<http://celectronics.com/quality/scope/>



Quote from ISO-ILAC-IAF Communiqué on 17025:

"A laboratory's fulfilment of the requirements of ISO/IEC 17025:2005 means the laboratory meets both the technical competence requirements and management system requirements that are necessary for it to consistently deliver technically valid test results and calibrations. The management system requirements in ISO/IEC 17025:2005 (Section 4) are written in language relevant to laboratory operations and meet the principles of ISO 9001:2008 Quality Management Systems — Requirements."

APPENDIX B

MODIFICATIONS TO THE EUT

MODIFICATIONS TO THE EUT

There were no modifications made to the EUT.



APPENDIX C

ADDITIONAL MODELS

ADDITIONAL MODELS

Device Tested

LoRa Edge Tracker Reference Design
Model: LR1110TRK1CKS
S/N: None

No Additional models.



APPENDIX D

DIAGRAMS AND CHARTS

FIGURE 1: LAYOUT OF THE SEMI-ANECHOIC TEST CHAMBER

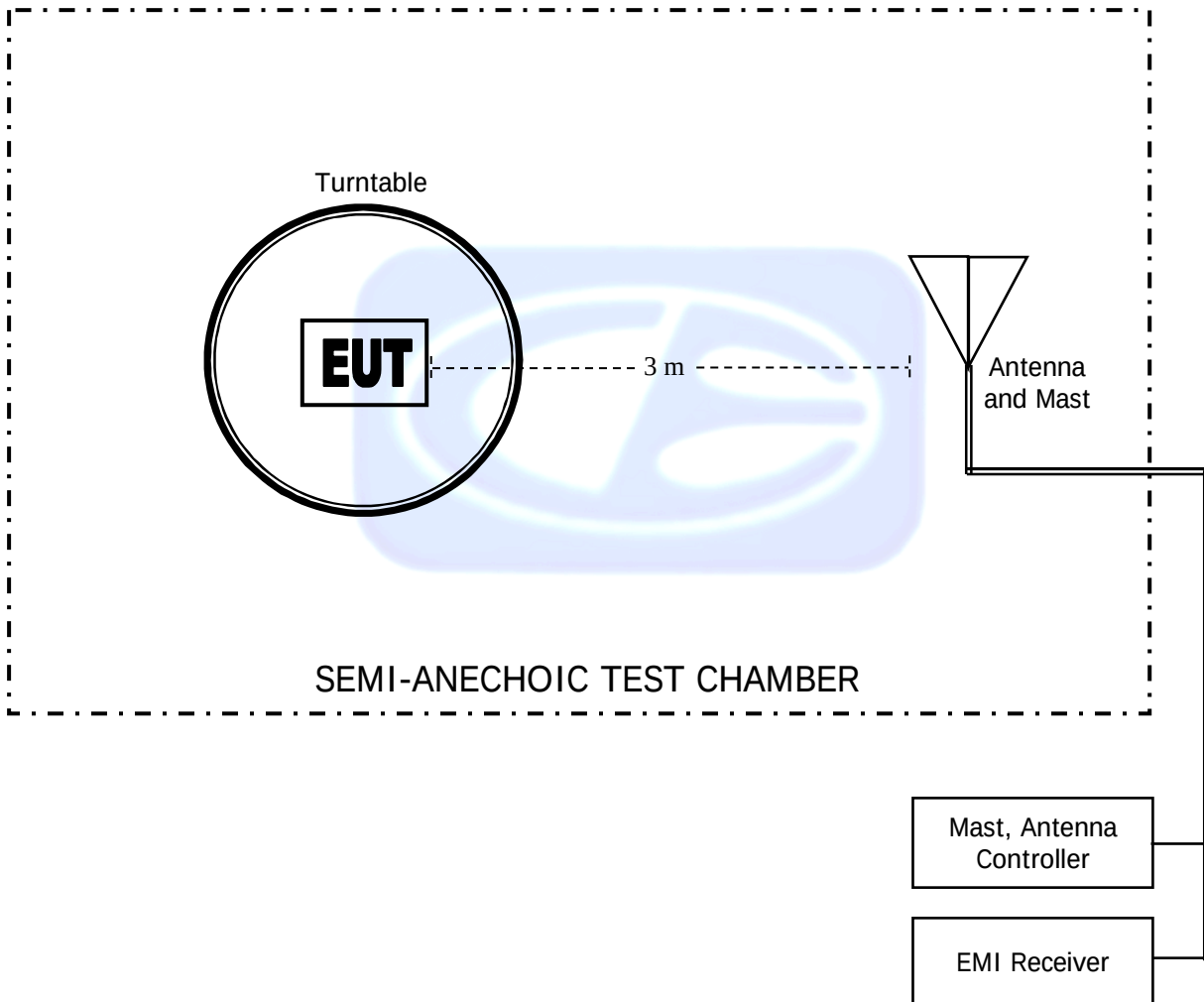
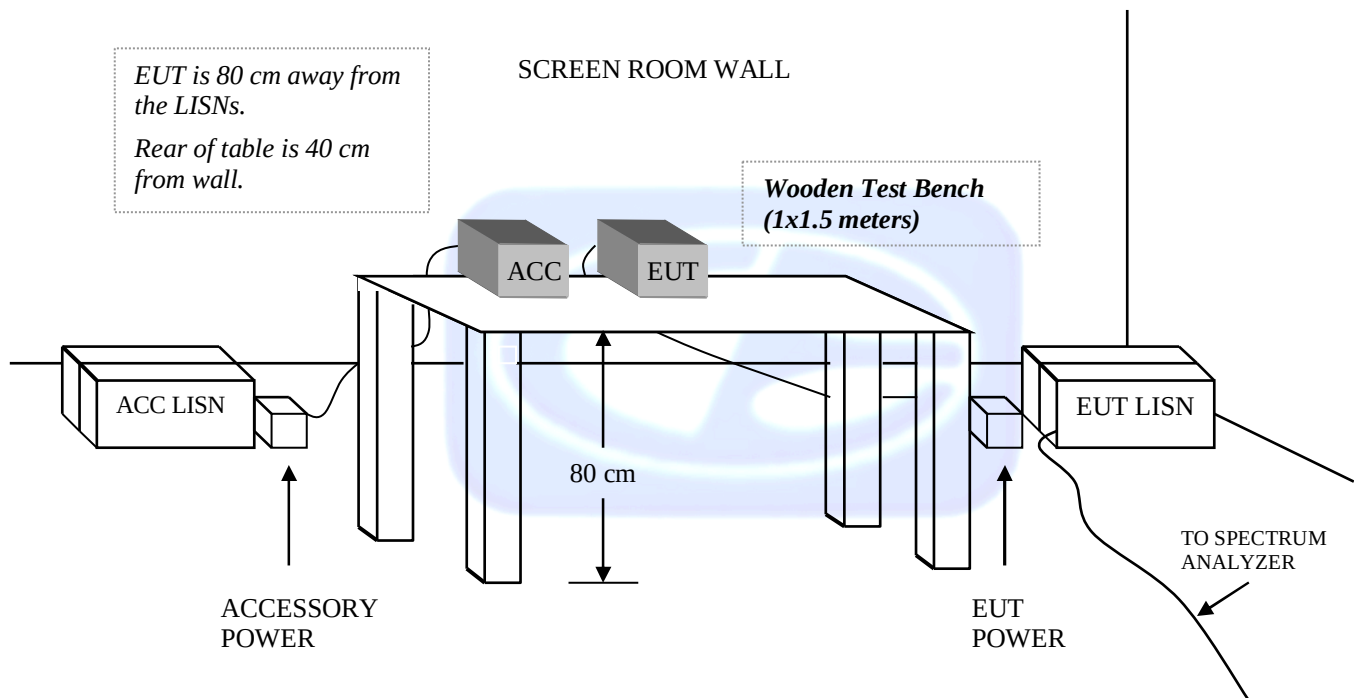


FIGURE 2: CONDUCTED EMISSIONS TEST SETUP



COM-POWER AL-130**ACTIVE LOOP ANTENNA****S/N: 17067****CALIBRATION DATE: JUNE 5, 2019**

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
0.009	10.69	1	10.75
0.01	10.09	2	10.82
0.02	8.49	3	10.89
0.03	9.19	4	11.04
0.04	8.59	5	11.03
0.05	10.77	6	11.00
0.06	10.97	7	11.12
0.07	10.67	8	11.27
0.08	10.67	9	11.38
0.09	10.69	10	11.69
0.1	10.29	15	12.28
0.2	10.32	20	10.13
0.3	10.19	25	9.12
0.4	10.22	30	11.31
0.5	10.40		
0.6	10.34		
0.7	10.42		
0.8	10.33		
0.9	10.53		

COM-POWER AC-220**COMBI-LOG ANTENNA****S/N: 10030030****ASSET: 6037****CALIBRATION DATE: JANUARY 30, 2020**

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
30	22.5	450	21.4
35	21.5	500	22.1
40	20.7	550	22.6
45	19.9	600	24.4
50	18.6	650	24.5
60	15.0	700	24.6
70	11.9	750	26.1
80	11.9	800	26.5
90	13.5	850	26.8
100	14.5	900	27.8
120	15.5	950	28.4
140	14.2	1000	28.2
160	13.9		
180	14.8		
200	15.3		
225	15.7		
250	16.7		
275	18.4		
300	18.3		
350	19.4		
400	20.5		

AH-118**DOUBLE RIDGE HORN ANTENNA****S/N: 071370****CALIBRATION DATE: JUNE 29, 2020**

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
1000	24.177	10000	39.425
1500	25.167	10500	39.679
2000	28.57	11000	39.435
2500	28.796	11500	40.078
3000	29.834	12000	40.509
3500	30.662	12500	40.308
4000	31.581	13000	40.259
4500	32.189	13500	40.394
5000	33.467	14000	40.695
5500	33.92	14500	42.451
6000	34.421	15000	41.913
6500	35.051	15500	39.324
7000	36.997	16000	39.617
7500	37.616	16500	39.303
8000	37.76	17000	41.265
8500	38.058	17500	43.367
9000	38.068	18000	45.279
9500	38.947		

AH-826

HORN ANTENNA

S/N: 081081

FREQUENCY (MHz)	FACTOR (dB)
18000	36.6
18500	36.0
19000	36.1
19500	19.0
20000	38.6
20500	37.2
21000	37.6
21500	37.6
22000	37.4
22500	37.9
23000	37.4
23500	36.7
24000	37.4
24500	37.7
25000	38.3
25500	38.0
26000	38.2
26500	38.1



FRONT VIEW

SEMTECH CORPORATION
LORA EDGE TRACKER REFERENCE DESIGN
MODEL NUMBER: LR1110TRK1CKS
FCC SUBPART B AND C – RADIATED EMISSIONS – BELOW 1 GHz

**PHOTOGRAPH SHOWING THE EUT CONFIGURATION
FOR MAXIMUM EMISSIONS**



REAR VIEW

SEMTECH CORPORATION
LORA EDGE TRACKER REFERENCE DESIGN
MODEL NUMBER: LR1110TRK1CKS
FCC SUBPART B AND C – RADIATED EMISSIONS – BELOW 1 GHz

**PHOTOGRAPH SHOWING THE EUT CONFIGURATION
FOR MAXIMUM EMISSIONS**



FRONT VIEW

SEMTECH CORPORATION
LORA EDGE TRACKER REFERENCE DESIGN
MODEL NUMBER: LR1110TRK1CKS
FCC SUBPART B AND C – RADIATED EMISSIONS – ABOVE 1 GHz

**PHOTOGRAPH SHOWING THE EUT CONFIGURATION
FOR MAXIMUM EMISSIONS**



REAR VIEW

SEMTECH CORPORATION
LORA EDGE TRACKER REFERENCE DESIGN
MODEL NUMBER: LR1110TRK1CKS
FCC SUBPART B AND C – RADIATED EMISSIONS – ABOVE 1 GHz

**PHOTOGRAPH SHOWING THE EUT CONFIGURATION
FOR MAXIMUM EMISSIONS**

APPENDIX E

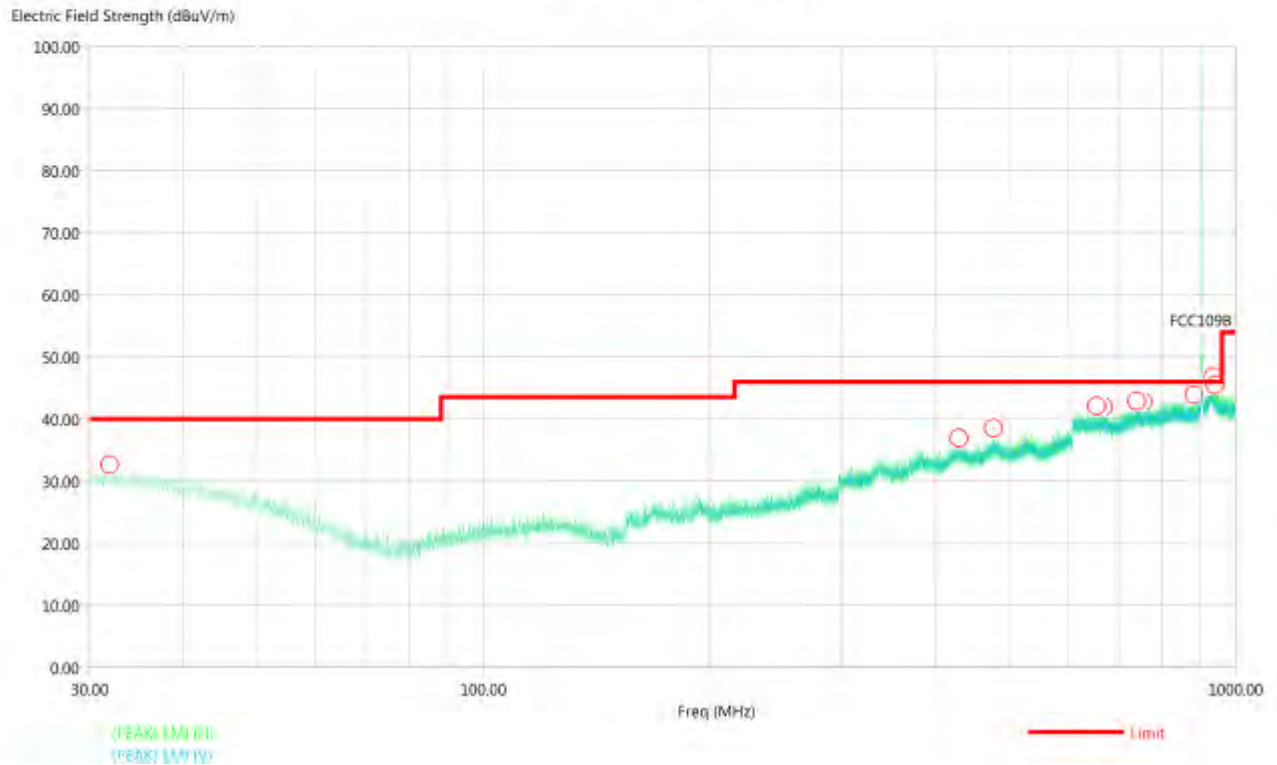
DATA SHEETS

***RADIATED EMISSIONS
DATA SHEETS***

Title: Radiated Pre-Scan 30-1000 MHz
File: Radiated Pre-Scan 30-1000 MHz fcc
Operator: R. Ramirez
EUT Type: LoRa Edge Tracker Reference Design
EUT Condition: 902.3 MHz, X axis (worst case)
Comments: Lab T
Clock Oscillators: 2480 MHz
Company: Semtech Corporation
Model: LR1110TRK1CKS
Temperature: 73 F Humidity: 55 % Pressure: 29.3 inHg
Tested to: 24.8 GHz (no frequencies found above 1 GHz)

8/12/2020 3:07:04 PM
Sequence: Preliminary Scan

Radiated Pre-Scan 30-1000 MHz



Title: Radiated Final 30-1000 MHz
File: Radiated Final 30-1000 MHz fcc - updated table
Operator: R. Ramirez
EUT Type: LoRa Edge Tracker Reference Design
EUT Condition: 902.3 MHz, X axis (worst case)
Comments: Lab T
Clock Oscillators: 2480 MHz
Company: Semtech Corporation
Model: LR1110TRK1CKS
Temperature: 73 F Humidity: 55 % Pressure: 29.3 inHg
Tested to: 24.8 GHz (no frequencies found above 1 GHz)

8/12/2020 3:33:51 PM
Sequence: Final Measurements

Data

Freq (MHz)	Pol	(PEAK) Trace (dBuV)	Cable (dB)	Transducer (dB)	(PEAK) EMI (dBuV/m)	(QP) EMI (dBuV/m)	Limit (dBuV/m)	(QP) Margin (dB)	Twr Ht (cm)	Ttbt Agl (deg)
31.90	V	10.87	0.48	22.10	33.46	30.71	40.00	-9.29	351.10	7.00
124.90	H	9.06	0.90	15.50	25.46	22.60	43.52	-20.92	159.00	300.80
176.80	V	75.29	3.31	27.83	28.04	24.67	43.52	-18.85	248.30	229.00
429.00	V	12.57	2.08	22.20	36.85	33.85	46.00	-12.15	232.30	133.60
476.80	V	13.04	2.20	23.00	38.24	34.71	46.00	-11.29	131.70	76.40
653.90	H	14.04	2.71	24.60	41.35	38.66	46.00	-7.34	324.20	221.20
667.90	H	15.32	2.74	24.70	42.76	38.66	46.00	-7.34	254.40	286.90
738.90	V	13.81	2.96	25.90	42.67	39.57	46.00	-6.43	346.20	154.00
754.20	H	15.33	3.01	26.10	44.44	39.59	46.00	-6.41	330.70	83.90
881.10	H	12.83	3.26	26.82	42.91	39.94	46.00	-6.06	342.10	57.20
934.20	H	17.22	3.44	29.55	45.55	42.73	46.00	-3.27	138.40	113.00
939.80	V	13.98	3.46	29.00	46.44	42.14	46.00	-3.86	216.60	147.30

HARMONIC EMISSIONS LOW CHANNEL

FCC 15.247

Company: Semtech Corporation

Date: 8/11/2020

EUT: LoRa Edge Tracker Ref

Lab: T

Model: LR1110TRK1CKS

Test ENG: R. Ramirez

Transmitting Frequency: 902.3 MHz

Axis: X

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
1804.60	50.13	H	73.97	-23.84	Peak	1.94	23.8	
1804.60	39.08	H	53.97	-14.89	Avg	1.94	23.8	
2706.90	53.73	H	73.97	-20.24	Peak	2.6	184.7	Restricted Band
2706.90	42.16	H	53.97	-11.81	Avg	2.6	184.7	Restricted Band
3609.20	52.15	H	73.97	-21.82	Peak	2.73	42.8	Restricted Band
3609.20	40.23	H	53.97	-13.74	Avg	2.73	42.8	Restricted Band
4511.50	53.78	H	73.97	-20.19	Peak	2.49	306.1	Restricted Band
4511.50	42.89	H	53.97	-11.08	Avg	2.49	306.1	Restricted Band
5413.80	58.29	H	73.97	-15.68	Peak	3	63.9	Restricted Band
5413.80	45.57	H	53.97	-8.40	Avg	3	63.9	Restricted Band
6316.10		H	73.97	-73.97	Peak			No emission found
6316.10		H	53.97	-53.97	Avg			
7218.40		H	73.97	-73.97	Peak			No emission found
7218.40		H	53.97	-53.97	Avg			
8120.70		H	73.97	-73.97	Peak			Restricted Band
8120.70		H	53.97	-53.97	Avg			No emission found
9023.00		H	73.97	-73.97	Peak			Restricted Band
9023.00		H	53.97	-53.97	Avg			No emission found

Test distance

3 meter

HARMONIC EMISSIONS LOW CHANNEL

FCC 15.247

Company: Semtech Corporation

Date: 8/11/2020

EUT: LoRa Edge Tracker Ref

Lab: T

Model: LR1110TRK1CKS

Test ENG: R. Ramirez

Transmitting Frequency: 902.3 MHz

Axis: X

Compatible Electronics, Inc. FAC-3 (Lab R)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
1804.60	50.47	V	73.97	-23.50	Peak	2.9	78.4	
1804.60	39.09	V	53.97	-14.88	Avg	2.9	78.4	
2706.90	54.19	V	73.97	-19.78	Peak	3.54	0.7	Restricted Band
2706.90	42.03	V	53.97	-11.94	Avg	3.54	0.7	Restricted Band
3609.20	58.58	V	73.97	-15.39	Peak	2.9	309	Restricted Band
3609.20	45.19	V	53.97	-8.78	Avg	2.9	309	Restricted Band
4511.50	53.64	V	73.97	-20.33	Peak	2.65	144.9	Restricted Band
4511.50	42.61	V	53.97	-11.36	Avg	2.65	144.9	Restricted Band
5413.80		V	73.97	-73.97	Peak			Restricted Band
5413.80		V	53.97	-53.97	Avg			No emission found
6316.10		V	73.97	-73.97	Peak			No emission found
6316.10		V	53.97	-53.97	Avg			
7218.40		V	73.97	-73.97	Peak			No emission found
7218.40		V	53.97	-53.97	Avg			
8120.70		V	73.97	-73.97	Peak			Restricted Band
8120.70		V	53.97	-53.97	Avg			No emission found
9023.00		V	73.97	-73.97	Peak			Restricted Band
9023.00		V	53.97	-53.97	Avg			No emission found

Test distance

3 meter

HARMONIC EMISSIONS LOW CHANNEL

FCC 15.247

Company: Semtech Corporation

Date: 8/11/2020

EUT: LoRa Edge Tracker Ref

Lab: T

Model: LR1110TRK1CKS

Test ENG: R. Ramirez

Transmitting Frequency: 914.9 MHz

Axis: X

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
1829.80	50.35	H	73.97	-23.62	Peak	2.95	264	
1829.80	39.29	H	53.97	-14.68	Avg	2.95	264	
2744.70	53.68	H	73.97	-20.29	Peak	2.94	6.3	Restricted Band
2744.70	43.00	H	53.97	-10.97	Avg	2.94	6.3	Restricted Band
3659.60	55.66	H	73.97	-18.31	Peak	1.82	106.3	Restricted Band
3659.60	45.84	H	53.97	-8.13	Avg	1.82	106.3	Restricted Band
4574.50	54.69	H	73.97	-19.28	Peak	2.79	37.1	Restricted Band
4574.50	43.66	H	53.97	-10.31	Avg	2.79	37.1	Restricted Band
5489.40	57.57	H	73.97	-16.40	Peak	3.45	306.1	
5489.40	45.67	H	53.97	-8.30	Avg	3.45	306.1	
6404.30		H	73.97	-73.97	Peak			No emission found
6404.30		H	53.97	-53.97	Avg			
7319.20		H	73.97	-73.97	Peak			Restricted Band
7319.20		H	53.97	-53.97	Avg			No emission found
8234.10		H	73.97	-73.97	Peak			Restricted Band
8234.10		H	53.97	-53.97	Avg			No emission found
9149.00		H	73.97	-73.97	Peak			Restricted Band
9149.00		H	53.97	-53.97	Avg			No emission found

Test distance

3 meter

HARMONIC EMISSIONS MID CHANNEL

FCC 15.247

Company: Semtech Corporation

Date: 8/11/2020

EUT: LoRa Edge Tracker Ref

Lab: T

Model: LR1110TRK1CKS

Test ENG: R. Ramirez

Transmitting Frequency: 914.9 MHz

Axis: X

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
1829.80	50.91	V	73.97	-23.06	Peak	3.38	252	
1829.80	38.85	V	53.97	-15.12	Avg	3.38	252	
2744.70	52.98	V	73.97	-20.99	Peak	2.39	14.5	Restricted Band
2744.70	42.08	V	53.97	-11.89	Avg	2.39	14.5	Restricted Band
3659.60	51.75	V	73.97	-22.22	Peak	2.21	15.3	Restricted Band
3659.60	41.50	V	53.97	-12.47	Avg	2.21	15.3	Restricted Band
4574.50	53.46	V	73.97	-20.51	Peak	2.51	215	Restricted Band
4574.50	42.78	V	53.97	-11.19	Avg	2.51	215	Restricted Band
5489.40	56.75	V	73.97	-17.22	Peak	1.85	260	
5489.40	45.29	V	53.97	-8.68	Avg	1.85	260	
6404.30		V	73.97	-73.97	Peak			No emission found
6404.30		V	53.97	-53.97	Avg			
7319.20		V	73.97	-73.97	Peak			Restricted Band
7319.20		V	53.97	-53.97	Avg			No emission found
8234.10		V	73.97	-73.97	Peak			Restricted Band
8234.10		V	53.97	-53.97	Avg			No emission found
9149.00		V	73.97	-73.97	Peak			Restricted Band
9149.00		V	53.97	-53.97	Avg			No emission found

Test distance

3 meter

HARMONIC EMISSIONS HIGH CHANNEL

FCC 15.247

Company: Semtech Corporation

Date: 8/11/2020

EUT: LoRa Edge Tracker Ref

Lab: T

Model: LR1110TRK1CKS

Test ENG: R. Ramirez

Transmitting Frequency: 927.7 MHz

Axis: X

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
1855.40	51.07	H	73.97	-22.90	Peak	2.42	41.7	
1855.40	39.50	H	53.97	-14.47	Avg	2.42	41.7	
2783.10	53.06	H	73.97	-20.91	Peak	1.86	356.4	Restricted Band
2783.10	42.37	H	53.97	-11.60	Avg	1.86	356.4	Restricted Band
3710.80	51.36	H	73.97	-22.61	Peak	1.98	276.7	Restricted Band
3710.80	40.58	H	53.97	-13.39	Avg	1.98	276.7	Restricted Band
4638.50	54.81	H	73.97	-19.16	Peak	2.85	172.7	Restricted Band
4638.50	43.14	H	53.97	-10.83	Avg	2.85	172.7	Restricted Band
5566.20	57.37	H	73.97	-16.60	Peak	2	192.5	
5566.20	45.63	H	53.97	-8.34	Avg	2	192.5	
6493.90		H	73.97	-73.97	Peak			No emission found
6493.90		H	53.97	-53.97	Avg			
7421.60		H	73.97	-73.97	Peak			Restricted Band
7421.60		H	53.97	-53.97	Avg			No emission found
8349.30		H	73.97	-73.97	Peak			Restricted Band
8349.30		H	53.97	-53.97	Avg			No emission found
9277.00		H	73.97	-73.97	Peak			No emission found
9277.00		H	53.97	-53.97	Avg			

Test distance

3 meter

HARMONIC EMISSIONS HIGH CHANNEL

FCC 15.247

Company: Semtech Corporation

Date:

EUT: LoRa Edge Tracker Ref

Lab: T

Model: LR1110TRK1CKS

Test ENG: R. Ramirez

Transmitting Frequency: 927.7 MHz

Axis: X

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
1855.40	50.89	V	73.97	-23.08	Peak	1.72	67.8	
1855.40	39.58	V	53.97	-14.39	Avg	1.72	67.8	
2783.10	54.13	V	73.97	-19.84	Peak	2.54	16.5	Restricted Band
2783.10	42.44	V	53.97	-11.53	Avg	2.54	16.5	Restricted Band
3710.80	51.24	V	73.97	-22.73	Peak	1.94	7.3	Restricted Band
3710.80	40.38	V	53.97	-13.59	Avg	1.94	7.3	Restricted Band
4638.50	55.04	V	73.97	-18.93	Peak	1.64	344.7	Restricted Band
4638.50	43.77	V	53.97	-10.20	Avg	1.64	344.7	Restricted Band
5566.20	57.03	V	73.97	-16.94	Peak	3.08	315.5	
5566.20	45.62	V	53.97	-8.35	Avg	3.08	315.5	
6493.90		V	73.97	-73.97	Peak			No emission found
6493.90		V	53.97	-53.97	Avg			
7421.60		V	73.97	-73.97	Peak			Restricted Band
7421.60		V	53.97	-53.97	Avg			No emission found
8349.30		V	73.97	-73.97	Peak			Restricted Band
8349.30		V	53.97	-53.97	Avg			No emission found
9277.00		V	73.97	-73.97	Peak			No emission found
9277.00		V	53.97	-53.97	Avg			

Test distance

3 meter

HARMONIC EMISSIONS LOW CHANNEL

FCC 15.247

Company: Semtech Corporation

Date: 8/12/2020

EUT: LoRa Edge Tracker Ref

Lab: T

Model: LR1110TRK1CKS

Test ENG: R. Ramirez

Transmitting Frequency: 902.3 MHz

Axis: Y

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
1804.60	50.21	H	73.97	-23.76	Peak	2.59	203.3	
1804.60	39.36	H	53.97	-14.61	Avg	2.59	203.3	
2706.90	53.24	H	73.97	-20.73	Peak	2.46	18.9	Restricted Band
2706.90	42.26	H	53.97	-11.71	Avg	2.46	18.9	Restricted Band
3609.20	51.50	H	73.97	-22.47	Peak	2.78	200.3	Restricted Band
3609.20	40.22	H	53.97	-13.75	Avg	2.78	200.3	Restricted Band
4511.50	54.30	H	73.97	-19.67	Peak	3.04	0	Restricted Band
4511.50	42.68	H	53.97	-11.29	Avg	3.04	0	Restricted Band
5413.80	56.59	H	73.97	-17.38	Peak	3.16	123.2	Restricted Band
5413.80	45.36	H	53.97	-8.61	Avg	3.16	123.2	Restricted Band
6316.10		H	73.97	-73.97	Peak			No emission found
6316.10		H	53.97	-53.97	Avg			
7218.40		H	73.97	-73.97	Peak			No emission found
7218.40		H	53.97	-53.97	Avg			
8120.70		H	73.97	-73.97	Peak			Restricted Band
8120.70		H	53.97	-53.97	Avg			No emission found
9023.00		H	73.97	-73.97	Peak			Restricted Band
9023.00		H	53.97	-53.97	Avg			No emission found

Test distance

3 meter

HARMONIC EMISSIONS LOW CHANNEL

FCC 15.247

Company: Semtech Corporation

Date: 8/12/2020

EUT: LoRa Edge Tracker Ref

Lab: T

Model: LR1110TRK1CKS

Test ENG: R. Ramirez

Transmitting Frequency: 902.3 MHz

Axis: Y

Compatible Electronics, Inc. FAC-3 (Lab R)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
1804.60	50.53	V	73.97	-23.44	Peak	3.49	263.3	
1804.60	39.19	V	53.97	-14.78	Avg	3.49	263.3	
2706.90	52.97	V	73.97	-21.00	Peak	2.74	36.2	Restricted Band
2706.90	41.96	V	53.97	-12.01	Avg	2.74	36.2	Restricted Band
3609.20	52.07	V	73.97	-21.90	Peak	1.89	232.4	Restricted Band
3609.20	40.36	V	53.97	-13.61	Avg	1.89	232.4	Restricted Band
4511.50	54.36	V	73.97	-19.61	Peak	2.87	0.2	Restricted Band
4511.50	43.51	V	53.97	-10.46	Avg	2.87	0.2	Restricted Band
5413.80		V	73.97	-73.97	Peak			Restricted Band
5413.80		V	53.97	-53.97	Avg			No emission found
6316.10		V	73.97	-73.97	Peak			No emission found
6316.10		V	53.97	-53.97	Avg			
7218.40		V	73.97	-73.97	Peak			No emission found
7218.40		V	53.97	-53.97	Avg			
8120.70		V	73.97	-73.97	Peak			Restricted Band
8120.70		V	53.97	-53.97	Avg			No emission found
9023.00		V	73.97	-73.97	Peak			Restricted Band
9023.00		V	53.97	-53.97	Avg			No emission found

Test distance

3 meter

HARMONIC EMISSIONS LOW CHANNEL

FCC 15.247

Company: Semtech Corporation

Date: 8/12/2020

EUT: LoRa Edge Tracker Ref

Lab: T

Model: LR1110TRK1CKS

Test ENG: R. Ramirez

Transmitting Frequency: 914.9 MHz

Axis: Y

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
1829.80	50.91	H	73.97	-23.06	Peak	1.71	177.2	
1829.80	39.63	H	53.97	-14.34	Avg	1.71	177.2	
2744.70	53.82	H	73.97	-20.15	Peak	2.60	37.6	Restricted Band
2744.70	42.06	H	53.97	-11.91	Avg	2.60	37.6	Restricted Band
3659.60	50.25	H	73.97	-23.72	Peak	2.37	353.6	Restricted Band
3659.60	40.22	H	53.97	-13.75	Avg	2.37	353.6	Restricted Band
4574.50	54.81	H	73.97	-19.16	Peak	2.64	49.4	Restricted Band
4574.50	43.35	H	53.97	-10.62	Avg	2.64	49.4	Restricted Band
5489.40	56.68	H	73.97	-17.29	Peak	2.78	337.6	
5489.40	45.59	H	53.97	-8.38	Avg	2.78	337.6	
6404.30		H	73.97	-73.97	Peak			No emission found
6404.30		H	53.97	-53.97	Avg			
7319.20		H	73.97	-73.97	Peak			Restricted Band
7319.20		H	53.97	-53.97	Avg			No emission found
8234.10		H	73.97	-73.97	Peak			Restricted Band
8234.10		H	53.97	-53.97	Avg			No emission found
9149.00		H	73.97	-73.97	Peak			Restricted Band
9149.00		H	53.97	-53.97	Avg			No emission found

Test distance

3 meter

HARMONIC EMISSIONS MID CHANNEL

FCC 15.247

Company: Semtech Corporation

Date: 8/12/2020

EUT: LoRa Edge Tracker Ref

Lab: T

Model: LR1110TRK1CKS

Test ENG: R. Ramirez

Transmitting Frequency: 914.9 MHz

Axis: Y

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
1829.80	51.00	V	73.97	-22.97	Peak	2.53	220.7	
1829.80	39.03	V	53.97	-14.94	Avg	2.53	220.7	
2744.70	53.00	V	73.97	-20.97	Peak	2.33	102.8	Restricted Band
2744.70	42.27	V	53.97	-11.70	Avg	2.33	102.8	Restricted Band
3659.60	50.61	V	73.97	-23.36	Peak	3.5	19.1	Restricted Band
3659.60	40.23	V	53.97	-13.74	Avg	3.5	19.1	Restricted Band
4574.50	55.03	V	73.97	-18.94	Peak	2.11	238.3	Restricted Band
4574.50	43.51	V	53.97	-10.46	Avg	2.11	238.3	Restricted Band
5489.40	57.08	V	73.97	-16.89	Peak	2.36	130.1	
5489.40	45.49	V	53.97	-8.48	Avg	2.36	130.1	
6404.30		V	73.97	-73.97	Peak			No emission found
6404.30		V	53.97	-53.97	Avg			
7319.20		V	73.97	-73.97	Peak			Restricted Band
7319.20		V	53.97	-53.97	Avg			No emission found
8234.10		V	73.97	-73.97	Peak			Restricted Band
8234.10		V	53.97	-53.97	Avg			No emission found
9149.00		V	73.97	-73.97	Peak			Restricted Band
9149.00		V	53.97	-53.97	Avg			No emission found

Test distance

3 meter

HARMONIC EMISSIONS HIGH CHANNEL

FCC 15.247

Company: Semtech Corporation

Date: 8/12/2020

EUT: LoRa Edge Tracker Ref

Lab: T

Model: LR1110TRK1CKS

Test ENG: R. Ramirez

Transmitting Frequency: 927.7 MHz

Axis: Y

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
1855.40	53.75	H	73.97	-20.22	Peak	2.43	211.9	
1855.40	44.59	H	53.97	-9.38	Avg	2.43	211.9	
2783.10	53.20	H	73.97	-20.77	Peak	1.65	63.1	Restricted Band
2783.10	42.90	H	53.97	-11.07	Avg	1.65	63.1	Restricted Band
3710.80	50.87	H	73.97	-23.10	Peak	2.64	121.8	Restricted Band
3710.80	40.03	H	53.97	-13.94	Avg	2.64	121.8	Restricted Band
4638.50	56.36	H	73.97	-17.61	Peak	2.7	355.4	Restricted Band
4638.50	43.94	H	53.97	-10.03	Avg	2.7	355.4	Restricted Band
5566.20	56.10	H	73.97	-17.87	Peak	3.28	227.7	
5566.20	44.95	H	53.97	-9.02	Avg	3.28	227.7	
6493.90		H	73.97	-73.97	Peak			No emission found
6493.90		H	53.97	-53.97	Avg			
7421.60		H	73.97	-73.97	Peak			Restricted Band
7421.60		H	53.97	-53.97	Avg			No emission found
8349.30		H	73.97	-73.97	Peak			Restricted Band
8349.30		H	53.97	-53.97	Avg			No emission found
9277.00		H	73.97	-73.97	Peak			No emission found
9277.00		H	53.97	-53.97	Avg			

Test distance

3 meter

HARMONIC EMISSIONS HIGH CHANNEL

FCC 15.247

Company: Semtech Corporation
EUT: LoRa Edge Tracker Ref
Model: LR1110TRK1CKS
Transmitting Frequency: 927.7 MHz

Date: 8/12/2020
Lab: T
Test ENG: R. Ramirez
Axis: Y

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
1855.40	50.59	V	73.97	-23.38	Peak	1.83	281.8	
1855.40	39.62	V	53.97	-14.35	Avg	1.83	281.8	
2783.10	53.65	V	73.97	-20.32	Peak	2.54	196	Restricted Band
2783.10	43.01	V	53.97	-10.96	Avg	2.54	196	Restricted Band
3710.80	59.32	V	73.97	-14.65	Peak	2.23	295	Restricted Band
3710.80	47.52	V	53.97	-6.45	Avg	2.23	295	Restricted Band
4638.50	54.37	V	73.97	-19.60	Peak	2.91	103.1	Restricted Band
4638.50	43.50	V	53.97	-10.47	Avg	2.91	103.1	Restricted Band
5566.20	56.92	V	73.97	-17.05	Peak	3.64	45.9	
5566.20	45.58	V	53.97	-8.39	Avg	3.64	45.9	
6493.90		V	73.97	-73.97	Peak			No emission found
6493.90		V	53.97	-53.97	Avg			
7421.60		V	73.97	-73.97	Peak			Restricted Band
7421.60		V	53.97	-53.97	Avg			No emission found
8349.30		V	73.97	-73.97	Peak			Restricted Band
8349.30		V	53.97	-53.97	Avg			No emission found
9277.00		V	73.97	-73.97	Peak			No emission found
9277.00		V	53.97	-53.97	Avg			

Test distance
3 meter

HARMONIC EMISSIONS LOW CHANNEL

FCC 15.247

Company: Semtech Corporation

Date: 8/12/2020

EUT: LoRa Edge Tracker Ref

Lab: T

Model: LR1110TRK1CKS

Test ENG: R. Ramirez

Transmitting Frequency: 902.3 MHz

Axis: Z

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
1804.60	51.09	H	73.97	-22.88	Peak	2.74	223.6	
1804.60	39.37	H	53.97	-14.60	Avg	2.74	223.6	
2706.90	53.06	H	73.97	-20.91	Peak	96.2		Restricted Band
2706.90	42.30	H	53.97	-11.67	Avg	96.2		Restricted Band
3609.20	57.92	H	73.97	-16.05	Peak	2.19	144.4	Restricted Band
3609.20	47.11	H	53.97	-6.86	Avg	2.19	144.4	Restricted Band
4511.50	53.70	H	73.97	-20.27	Peak	1.82	268.4	Restricted Band
4511.50	42.45	H	53.97	-11.52	Avg	1.82	268.4	Restricted Band
5413.80	56.85	H	73.97	-17.12	Peak	2.44	174.7	Restricted Band
5413.80	45.02	H	53.97	-8.95	Avg	2.44	174.7	Restricted Band
6316.10		H	73.97	-73.97	Peak			No emission found
6316.10		H	53.97	-53.97	Avg			
7218.40		H	73.97	-73.97	Peak			No emission found
7218.40		H	53.97	-53.97	Avg			
8120.70		H	73.97	-73.97	Peak			Restricted Band
8120.70		H	53.97	-53.97	Avg			No emission found
9023.00		H	73.97	-73.97	Peak			Restricted Band
9023.00		H	53.97	-53.97	Avg			No emission found

Test distance

3 meter

HARMONIC EMISSIONS LOW CHANNEL

FCC 15.247

Company: Semtech Corporation

Date: 8/12/2020

EUT: LoRa Edge Tracker Ref

Lab: T

Model: LR1110TRK1CKS

Test ENG: R. Ramirez

Transmitting Frequency: 902.3 MHz

Axis: Z

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
1804.60	50.77	V	73.97	-23.20	Peak	2.26	72.1	
1804.60	39.40	V	53.97	-14.57	Avg	2.26	72.1	
2706.90	52.76	V	73.97	-21.21	Peak	1.91	313.6	Restricted Band
2706.90	42.02	V	53.97	-11.95	Avg	1.91	313.6	Restricted Band
3609.20	58.12	V	73.97	-15.85	Peak	3.38	296.2	Restricted Band
3609.20	47.29	V	53.97	-6.68	Avg	3.38	296.2	Restricted Band
4511.50	54.27	V	73.97	-19.70	Peak	2.43	22.6	Restricted Band
4511.50	42.58	V	53.97	-11.39	Avg	2.43	22.6	Restricted Band
5413.80	54.26	V	73.97	-19.71	Peak	1.88	145.1	Restricted Band
5413.80	45.40	V	53.97	-8.57	Avg	1.88	145.1	Restricted Band
6316.10		V	73.97	-73.97	Peak			No emission found
6316.10		V	53.97	-53.97	Avg			
7218.40		V	73.97	-73.97	Peak			No emission found
7218.40		V	53.97	-53.97	Avg			
8120.70		V	73.97	-73.97	Peak			Restricted Band
8120.70		V	53.97	-53.97	Avg			No emission found
9023.00		V	73.97	-73.97	Peak			Restricted Band
9023.00		V	53.97	-53.97	Avg			No emission found

Test distance

3 meter

HARMONIC EMISSIONS LOW CHANNEL

FCC 15.247

Company: Semtech Corporation
EUT: LoRa Edge Tracker Ref
Model: LR1110TRK1CKS
Transmitting Frequency: 914.9 MHz

Date: 8/12/2020
Lab: T
Test ENG: R. Ramirez
Axis: Z

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
1829.80	50.23	H	73.97	-23.74	Peak	1.74	30.8	
1829.80	39.51	H	53.97	-14.46	Avg	1.74	30.8	
2744.70	54.62	H	73.97	-19.35	Peak	2.63	76.7	Restricted Band
2744.70	42.51	H	53.97	-11.46	Avg	2.63	76.7	Restricted Band
3659.60	52.10	H	73.97	-21.87	Peak	1.60	269.9	Restricted Band
3659.60	40.07	H	53.97	-13.90	Avg	1.60	269.9	Restricted Band
4574.50	54.35	H	73.97	-19.62	Peak	2.51	297.4	Restricted Band
4574.50	43.47	H	53.97	-10.50	Avg	2.51	297.4	Restricted Band
5489.40	56.71	H	73.97	-17.26	Peak	1.91	287.8	
5489.40	45.66	H	53.97	-8.31	Avg	1.91	287.8	
6404.30		H	73.97	-73.97	Peak			No emission found
6404.30		H	53.97	-53.97	Avg			
7319.20		H	73.97	-73.97	Peak			Restricted Band
7319.20		H	53.97	-53.97	Avg			No emission found
8234.10		H	73.97	-73.97	Peak			Restricted Band
8234.10		H	53.97	-53.97	Avg			No emission found
9149.00		H	73.97	-73.97	Peak			Restricted Band
9149.00		H	53.97	-53.97	Avg			No emission found

Test distance
3 meter

HARMONIC EMISSIONS MID CHANNEL

FCC 15.247

Company: Semtech Corporation
 EUT: LoRa Edge Tracker Ref
 Model: LR1110TRK1CKS
 Transmitting Frequency: 914.9 MHz

Date: 8/12/2020
 Lab: T
 Test ENG: R. Ramirez
 Axis: Z

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
1829.80	51.15	V	73.97	-22.82	Peak	2.49	25.3	
1829.80	39.75	V	53.97	-14.22	Avg	2.49	25.3	
2744.70	54.48	V	73.97	-19.49	Peak	2.32	295	Restricted Band
2744.70	42.68	V	53.97	-11.29	Avg	2.35	295	Restricted Band
3659.60	51.73	V	73.97	-22.24	Peak	2.51	0.1	Restricted Band
3659.60	40.53	V	53.97	-13.44	Avg	2.51	0.1	Restricted Band
4574.50	53.76	V	73.97	-20.21	Peak	2.06	132.1	Restricted Band
4574.50	42.98	V	53.97	-10.99	Avg	2.06	132.1	Restricted Band
5489.40	56.70	V	73.97	-17.27	Peak	3.3	286.4	
5489.40	45.58	V	53.97	-8.39	Avg	3.3	286.4	
6404.30		V	73.97	-73.97	Peak			No emission found
6404.30		V	53.97	-53.97	Avg			
7319.20		V	73.97	-73.97	Peak			Restricted Band
7319.20		V	53.97	-53.97	Avg			No emission found
8234.10		V	73.97	-73.97	Peak			Restricted Band
8234.10		V	53.97	-53.97	Avg			No emission found
9149.00		V	73.97	-73.97	Peak			Restricted Band
9149.00		V	53.97	-53.97	Avg			No emission found

Test distance
 3 meter

HARMONIC EMISSIONS HIGH CHANNEL

FCC 15.247

Company: Semtech Corporation
EUT: LoRa Edge Tracker Ref
Model: LR1110TRK1CKS
Transmitting Frequency: 927.7 MHz

Date: 8/12/2020
Lab: T
Test ENG: R. Ramirez
Axis: Z

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
1855.40	51.19	H	73.97	-22.78	Peak	2.85	322.3	
1855.40	40.18	H	53.97	-13.79	Avg	2.85	322.2	
2783.10	53.81	H	73.97	-20.16	Peak	3.33	47.2	Restricted Band
2783.10	42.44	H	53.97	-11.53	Avg	3.33	47.2	Restricted Band
3710.80	51.09	H	73.97	-22.88	Peak	3.53	307.5	Restricted Band
3710.80	40.16	H	53.97	-13.81	Avg	3.53	307.5	Restricted Band
4638.50	53.67	H	73.97	-20.30	Peak	3.43	15	Restricted Band
4638.50	42.69	H	53.97	-11.28	Avg	3.43	15	Restricted Band
5566.20	57.34	H	73.97	-16.63	Peak	3.44	20	
5566.20	45.46	H	53.97	-8.51	Avg	3.44	20	
6493.90		H	73.97	-73.97	Peak			No emission found
6493.90		H	53.97	-53.97	Avg			
7421.60		H	73.97	-73.97	Peak			Restricted Band
7421.60		H	53.97	-53.97	Avg			No emission found
8349.30		H	73.97	-73.97	Peak			Restricted Band
8349.30		H	53.97	-53.97	Avg			No emission found
9277.00		H	73.97	-73.97	Peak			No emission found
9277.00		H	53.97	-53.97	Avg			

Test distance
3 meter

HARMONIC EMISSIONS HIGH CHANNEL

FCC 15.247

Company: Semtech Corporation
EUT: LoRa Edge Tracker Ref
Model: LR1110TRK1CKS
Transmitting Frequency: 927.7 MHz

Date: 8/12/2020
Lab: T
Test ENG: R. Ramirez
Axis: Z

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
1855.40	53.26	V	73.97	-20.71	Peak	2.99	201.4	
1855.40	40.19	V	53.97	-13.78	Avg	2.99	201.4	
2783.10	54.46	V	73.97	-19.51	Peak	2.52	280.8	Restricted Band
2783.10	42.73	V	53.97	-11.24	Avg	2.52	280.8	Restricted Band
3710.80	51.29	V	73.97	-22.68	Peak	2.43	158.2	Restricted Band
3710.80	40.77	V	53.97	-13.20	Avg	2.43	158.2	Restricted Band
4638.50	54.51	V	73.97	-19.46	Peak	2.81	248	Restricted Band
4638.50	43.43	V	53.97	-10.54	Avg	2.81	248	Restricted Band
5566.20	55.70	V	73.97	-18.27	Peak	1.98	24	
5566.20	45.41	V	53.97	-8.56	Avg	1.98	24	
6493.90		V	73.97	-73.97	Peak			No emission found
6493.90		V	53.97	-53.97	Avg			
7421.60		V	73.97	-73.97	Peak			Restricted Band
7421.60		V	53.97	-53.97	Avg			No emission found
8349.30		V	73.97	-73.97	Peak			Restricted Band
8349.30		V	53.97	-53.97	Avg			No emission found
9277.00		V	73.97	-73.97	Peak			No emission found
9277.00		V	53.97	-53.97	Avg			

Test distance
3 meter

Title: Radiated Pre-Scan 30-1000 MHz
File: Radiated Pre-Scan 30-1000 MHz 2402 MHz Y axis
Operator: R. Ramirez
EUT Type: LoRa Edge Tracker Reference Design
EUT Condition: 2402 MHz Y axis
Comments: Lab T
Clock Oscillators: 2480 MHz
Company: Semtech Corporation
Model: LR1110TRK1CKS
Temperature: 75 F Humidity: 56 % Pressure: 29.3 inHg
Tested to: 24.8 GHz (no frequencies found above 1 GHz)

8/13/2020 1:20:31 PM
Sequence: Preliminary Scan

Radiated Pre-Scan 30-1000 MHz



Title: Radiated Final 30-1000 MHz
File: Radiated Final 30-1000 MHz fcc
Operator: R. Ramirez
EUT Type: LoRa Edge Tracker Reference Design
EUT Condition: 2402 MHz, Y axis, worst case
Comments: Lab T
Clock Oscillators: 2480 MHz
Company: Semtech Corporation
Model: LR1110TRK1CKS
Temperature: 73 F Humidity: 55 % Pressure: 29.3 inHg
Tested to: 24.8 GHz (no frequencies found above 1 GHz)

8/13/2020 1:33:24 PM
Sequence: Final Measurements

Data

Freq (MHz)	Pol	(PEAK) Trace (dBuV)	Cable (dB)	Transducer (dB)	(PEAK) EMI (dBuV/m)	(QP) EMI (dBuV/m)	Limit (dBuV/m)	(QP) Margin (dB)	Twr Ht (cm)	Ttbt Agl (deg)
30.50	V	11.58	0.49	22.32	34.39	31.50	40.00	-8.50	344.20	334.00
31.30	H	12.52	0.48	22.12	35.12	30.83	40.00	-9.17	302.40	53.20
431.20	V	13.66	2.09	22.00	37.75	33.95	46.00	-12.05	266.40	-65.20
535.10	H	13.16	2.27	23.30	38.73	34.85	46.00	-11.15	270.20	277.80
562.70	H	12.23	2.38	22.80	37.41	34.45	46.00	-11.55	196.60	282.30
619.20	V	16.07	2.64	24.10	42.81	38.68	46.00	-7.32	166.40	259.40
698.50	H	15.42	2.80	24.59	42.80	38.58	46.00	-7.42	251.70	169.70
764.30	V	13.74	3.03	26.10	42.87	39.80	46.00	-6.20	347.80	55.20
828.80	V	13.56	3.16	27.19	43.91	40.73	46.00	-5.27	133.50	349.50
834.20	H	14.09	3.17	27.10	44.36	40.67	46.00	-5.33	257.90	125.40
931.50	V	12.96	3.43	29.83	46.22	43.16	46.00	-2.84	342.30	182.20
934.60	H	12.83	3.44	29.50	45.77	42.83	46.00	-3.17	293.50	324.10

HARMONIC EMISSIONS LOW CHANNEL

FCC 15.247

Company: Semtech Corporation
EUT: LoRa Edge Tracker Ref
Model: LR1110TRK1CKS
Transmitting Frequency: 2402 MHz

Date: 8/14/2020
Lab: T
Test ENG: R. Ramirez
Axis: X

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4804.00	55.08	H	73.97	-18.89	Peak	3.46	339.7	Restricted Band
4804.00	44.62	H	53.97	-9.35	Avg	3.46	339.7	Restricted Band
7206.00		H	73.97	-73.97	Peak			No emission found
7206.00		H	53.97	-53.97	Avg			
9608.00		H	73.97	-73.97	Peak			No emission found
9608.00		H	53.97	-53.97	Avg			
12010.00		H	73.97	-73.97	Peak			Restricted Band
12010.00		H	53.97	-53.97	Avg			No emission found
14412.00		H	73.97	-73.97	Peak			No emission found
14412.00		H	53.97	-53.97	Avg			
16814.00		H	73.97	-73.97	Peak			No emission found
16814.00		H	53.97	-53.97	Avg			
19216.00		H	73.97	-73.97	Peak			Restricted Band
19216.00		H	53.97	-53.97	Avg			No emission found
21618.00		H	73.97	-73.97	Peak			No emission found
21618.00		H	53.97	-53.97	Avg			
24020.00		H	73.97	-73.97	Peak			No emission found
24020.00		H	53.97	-53.97	Avg			

Test distance
3 meter

HARMONIC EMISSIONS LOW CHANNEL

FCC 15.247

Company: Semtech Corporation
EUT: LoRa Edge Tracker Ref
Model: LR1110TRK1CKS
Transmitting Frequency: 2426 MHz

Date: 8/14/2020
Lab: T
Test ENG: R. Ramirez
Axis: X

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4852.00	44.21	H	73.97	-29.76	Peak	2.21	101	Restricted Band
4852.00	50.11	H	53.97	-3.86	Avg	2.21	101	Restricted Band
7278.00		H	73.97	-73.97	Peak			Restricted Band
7278.00		H	53.97	-53.97	Avg			No emission found
9704.00		H	73.97	-73.97	Peak			No emission found
9704.00		H	53.97	-53.97	Avg			
12130.00		H	73.97	-73.97	Peak			Restricted Band
12130.00		H	53.97	-53.97	Avg			No emission found
14556.00		H	73.97	-73.97	Peak			No emission found
14556.00		H	53.97	-53.97	Avg			
16982.00		H	73.97	-73.97	Peak			No emission found
16982.00		H	53.97	-53.97	Avg			
19408.00		H	73.97	-73.97	Peak			Restricted Band
19408.00		H	53.97	-53.97	Avg			No emission found
21834.00		H	73.97	-73.97	Peak			No emission found
21834.00		H	53.97	-53.97	Avg			
24260.00		H	73.97	-73.97	Peak			Restricted Band
24260.00		H	53.97	-53.97	Avg			No emission found

Test distance
3 meter

HARMONIC EMISSIONS MID CHANNEL

FCC 15.247

Company:	Semtech Corporation	Date:	8/14/2020
EUT:	LoRa Edge Tracker Ref	Lab:	T
Model:	LR1110TRK1CKS	Test ENG:	R. Ramirez
Transmitting Frequency:	2426 MHz	Axis:	X

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4852.00		V	73.97	-73.97	Peak			Restricted Band
4852.00		V	53.97	-53.97	Avg			Restricted Band
7278.00		V	73.97	-73.97	Peak			Restricted Band
7278.00		V	53.97	-53.97	Avg			Restricted Band
9704.00		V	73.97	-73.97	Peak			
9704.00		V	53.97	-53.97	Avg			
12130.00		V	73.97	-73.97	Peak			Restricted Band
12130.00		V	53.97	-53.97	Avg			Restricted Band
14556.00		V	73.97	-73.97	Peak			
14556.00		V	53.97	-53.97	Avg			
16982.00		V	73.97	-73.97	Peak			
16982.00		V	53.97	-53.97	Avg			
19408.00		V	73.97	-73.97	Peak			Restricted Band
19408.00		V	53.97	-53.97	Avg			Restricted Band
21834.00		V	73.97	-73.97	Peak			
21834.00		V	53.97	-53.97	Avg			
24260.00		V	73.97	-73.97	Peak			Restricted Band
24260.00		V	53.97	-53.97	Avg			Restricted Band

Test distance								
3 meter								

HARMONIC EMISSIONS HIGH CHANNEL

FCC 15.247

Company:	Semtech Corporation	Date:	8/14/2020
EUT:	LoRa Edge Tracker Ref	Lab:	T
Model:	LR1110TRK1CKS	Test ENG:	R. Ramirez
Transmitting Frequency:	2480 MHz	Axis:	X

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4960.00	56.17	H	73.97	-17.80	Peak	2.11	23.1	Restricted Band
4960.00	45.29	H	53.97	-8.68	Avg	2.11	23.1	Restricted Band
7440.00		H	73.97	-73.97	Peak			Restricted Band
7440.00		H	53.97	-53.97	Avg			No emission found
9920.00		H	73.97	-73.97	Peak			No emission found
9920.00		H	53.97	-53.97	Avg			
12400.00		H	73.97	-73.97	Peak			Restricted Band
12400.00		H	53.97	-53.97	Avg			No emission found
14880.00		H	73.97	-73.97	Peak			No emission found
14880.00		H	53.97	-53.97	Avg			
17360.00		H	73.97	-73.97	Peak			No emission found
17360.00		H	53.97	-53.97	Avg			
19840.00		H	73.97	-73.97	Peak			Restricted Band
19840.00		H	53.97	-53.97	Avg			No emission found
22320.00		H	73.97	-73.97	Peak			Restricted Band
22320.00		H	53.97	-53.97	Avg			No emission found
24800.00		H	73.97	-73.97	Peak			
24800.00		H	53.97	-53.97	Avg			

Test distance								
3 meter								

HARMONIC EMISSIONS HIGH CHANNEL

FCC 15.247

Company: Semtech Corporation

Date: 8/14/2020

EUT: LoRa Edge Tracker Ref

Lab: T

Model: LR1110TRK1CKS

Test ENG: R. Ramirez

Transmitting Frequency: 2480 MHz

Axis: X

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4960.00	55.43	V	73.97	-18.54	Peak	3.17	259.6	Restricted Band
4960.00	45.08	V	53.97	-8.89	Avg	3.17	259.6	Restricted Band
7440.00		V	73.97	-73.97	Peak			Restricted Band
7440.00		V	53.97	-53.97	Avg			No emission found
9920.00		V	73.97	-73.97	Peak			No emission found
9920.00		V	53.97	-53.97	Avg			
12400.00		V	73.97	-73.97	Peak			Restricted Band
12400.00		V	53.97	-53.97	Avg			No emission found
14880.00		V	73.97	-73.97	Peak			No emission found
14880.00		V	53.97	-53.97	Avg			
17360.00		V	73.97	-73.97	Peak			No emission found
17360.00		V	53.97	-53.97	Avg			
19840.00		V	73.97	-73.97	Peak			Restricted Band
19840.00		V	53.97	-53.97	Avg			No emission found
22320.00		V	73.97	-73.97	Peak			Restricted Band
22320.00		V	53.97	-53.97	Avg			No emission found
24800.00		V	73.97	-73.97	Peak			No emission found
24800.00		V	53.97	-53.97	Avg			

Test distance

3 meter

HARMONIC EMISSIONS LOW CHANNEL

FCC 15.247

Company: Semtech Corporation

Date: 8/14/2020

EUT: LoRa Edge Tracker Ref

Lab: T

Model: LR1110TRK1CKS

Test ENG: R. Ramirez

Transmitting Frequency: 2402 MHz

Axis: Y

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4804.00	56.60	H	73.97	-17.37	Peak	2.39	275.1	Restricted Band
4804.00	45.12	H	53.97	-8.85	Avg	2.39	275.1	Restricted Band
7206.00		H	73.97	-73.97	Peak			No emission found
7206.00		H	53.97	-53.97	Avg			
9608.00		H	73.97	-73.97	Peak			No emission found
9608.00		H	53.97	-53.97	Avg			
12010.00		H	73.97	-73.97	Peak			Restricted Band
12010.00		H	53.97	-53.97	Avg			No emission found
14412.00		H	73.97	-73.97	Peak			No emission found
14412.00		H	53.97	-53.97	Avg			
16814.00		H	73.97	-73.97	Peak			No emission found
16814.00		H	53.97	-53.97	Avg			
19216.00		H	73.97	-73.97	Peak			Restricted Band
19216.00		H	53.97	-53.97	Avg			No emission found
21618.00		H	73.97	-73.97	Peak			No emission found
21618.00		H	53.97	-53.97	Avg			
24020.00		H	73.97	-73.97	Peak			No emission found
24020.00		H	53.97	-53.97	Avg			

Test distance

3 meter

HARMONIC EMISSIONS LOW CHANNEL

FCC 15.247

Company:	Semtech Corporation	Date:	8/14/2020
EUT:	LoRa Edge Tracker Ref	Lab:	T
Model:	LR1110TRK1CKS	Test ENG:	R. Ramirez
Transmitting Frequency:	2402 MHz	Axis:	Y

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4804.00	55.20	V	73.97	-18.77	Peak	2.15	221.1	Restricted Band
4804.00	44.21	V	53.97	-9.76	Avg	2.15	221.1	Restricted Band
7206.00		V	73.97	-73.97	Peak			
7206.00		V	53.97	-53.97	Avg			No emission found
9608.00		V	73.97	-73.97	Peak			No emission found
9608.00		V	53.97	-53.97	Avg			
12010.00		V	73.97	-73.97	Peak			Restricted Band
12010.00		V	53.97	-53.97	Avg			No emission found
14412.00		V	73.97	-73.97	Peak			No emission found
14412.00		V	53.97	-53.97	Avg			
16814.00		V	73.97	-73.97	Peak			No emission found
16814.00		V	53.97	-53.97	Avg			
19216.00		V	73.97	-73.97	Peak			Restricted Band
19216.00		V	53.97	-53.97	Avg			No emission found
21618.00		V	73.97	-73.97	Peak			No emission found
21618.00		V	53.97	-53.97	Avg			
24020.00		V	73.97	-73.97	Peak			No emission found
24020.00		V	53.97	-53.97	Avg			

Test distance								
3 meter								

HARMONIC EMISSIONS LOW CHANNEL

FCC 15.247

Company: Semtech Corporation

Date: 8/14/2020

EUT: LoRa Edge Tracker Ref

Lab: T

Model: LR1110TRK1CKS

Test ENG: R. Ramirez

Transmitting Frequency: 2426 MHz

Axis: Y

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4852.00	54.55	H	73.97	-19.42	Peak	2.10	21.66	Restricted Band
4852.00	44.25	H	53.97	-9.72	Avg	2.10	21.66	Restricted Band
7278.00		H	73.97	-73.97	Peak			Restricted Band
7278.00		H	53.97	-53.97	Avg			No emission found
9704.00		H	73.97	-73.97	Peak			No emission found
9704.00		H	53.97	-53.97	Avg			
12130.00		H	73.97	-73.97	Peak			Restricted Band
12130.00		H	53.97	-53.97	Avg			No emission found
14556.00		H	73.97	-73.97	Peak			No emission found
14556.00		H	53.97	-53.97	Avg			
16982.00		H	73.97	-73.97	Peak			No emission found
16982.00		H	53.97	-53.97	Avg			
19408.00		H	73.97	-73.97	Peak			Restricted Band
19408.00		H	53.97	-53.97	Avg			No emission found
21834.00		H	73.97	-73.97	Peak			No emission found
21834.00		H	53.97	-53.97	Avg			
24260.00		H	73.97	-73.97	Peak			Restricted Band
24260.00		H	53.97	-53.97	Avg			No emission found

Test distance

3 meter

HARMONIC EMISSIONS MID CHANNEL

FCC 15.247

Company: Semtech Corporation

Date: 8/14/2020

EUT: LoRa Edge Tracker Ref

Lab: T

Model: LR1110TRK1CKS

Test ENG: R. Ramirez

Transmitting Frequency: 2426 MHz

Axis: Y

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4852.00	55.47	V	73.97	-18.50	Peak	2.1	289.7	Restricted Band
4852.00	43.69	V	53.97	-10.28	Avg	2.1	289.7	Restricted Band
7278.00		V	73.97	-73.97	Peak			Restricted Band
7278.00		V	53.97	-53.97	Avg			Restricted Band
9704.00		V	73.97	-73.97	Peak			
9704.00		V	53.97	-53.97	Avg			
12130.00		V	73.97	-73.97	Peak			Restricted Band
12130.00		V	53.97	-53.97	Avg			Restricted Band
14556.00		V	73.97	-73.97	Peak			
14556.00		V	53.97	-53.97	Avg			
16982.00		V	73.97	-73.97	Peak			
16982.00		V	53.97	-53.97	Avg			
19408.00		V	73.97	-73.97	Peak			Restricted Band
19408.00		V	53.97	-53.97	Avg			Restricted Band
21834.00		V	73.97	-73.97	Peak			
21834.00		V	53.97	-53.97	Avg			
24260.00		V	73.97	-73.97	Peak			Restricted Band
24260.00		V	53.97	-53.97	Avg			Restricted Band

Test distance

3 meter

HARMONIC EMISSIONS HIGH CHANNEL

FCC 15.247

Company: Semtech Corporation
EUT: LoRa Edge Tracker Ref
Model: LR1110TRK1CKS
Transmitting Frequency: 2480 MHz

Date: 8/14/2020
Lab: T
Test ENG: R. Ramirez
Axis: Y

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4960.00	53.69	H	73.97	-20.28	Peak	2.38	25.9	Restricted Band
4960.00	44.98	H	53.97	-8.99	Avg	2.38	25.9	Restricted Band
7440.00		H	73.97	-73.97	Peak			Restricted Band
7440.00		H	53.97	-53.97	Avg			No emission found
9920.00		H	73.97	-73.97	Peak			No emission found
9920.00		H	53.97	-53.97	Avg			
12400.00		H	73.97	-73.97	Peak			Restricted Band
12400.00		H	53.97	-53.97	Avg			No emission found
14880.00		H	73.97	-73.97	Peak			No emission found
14880.00		H	53.97	-53.97	Avg			
17360.00		H	73.97	-73.97	Peak			No emission found
17360.00		H	53.97	-53.97	Avg			
19840.00		H	73.97	-73.97	Peak			Restricted Band
19840.00		H	53.97	-53.97	Avg			No emission found
22320.00		H	73.97	-73.97	Peak			Restricted Band
22320.00		H	53.97	-53.97	Avg			No emission found
24800.00		H	73.97	-73.97	Peak			
24800.00		H	53.97	-53.97	Avg			

Test distance
3 meter

HARMONIC EMISSIONS HIGH CHANNEL

FCC 15.247

Company:	Semtech Corporation	Date:	8/14/2020
EUT:	LoRa Edge Tracker Ref	Lab:	T
Model:	LR1110TRK1CKS	Test ENG:	R. Ramirez
Transmitting Frequency:	2480 MHz	Axis:	Y

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4960.00	54.50	V	73.97	-19.47	Peak	2.55	221.1	Restricted Band
4960.00	45.90	V	53.97	-8.07	Avg	2.55	221.1	Restricted Band
7440.00		V	73.97	-73.97	Peak			Restricted Band
7440.00		V	53.97	-53.97	Avg			No emission found
9920.00		V	73.97	-73.97	Peak			No emission found
9920.00		V	53.97	-53.97	Avg			
12400.00		V	73.97	-73.97	Peak			Restricted Band
12400.00		V	53.97	-53.97	Avg			No emission found
14880.00		V	73.97	-73.97	Peak			No emission found
14880.00		V	53.97	-53.97	Avg			
17360.00		V	73.97	-73.97	Peak			No emission found
17360.00		V	53.97	-53.97	Avg			
19840.00		V	73.97	-73.97	Peak			Restricted Band
19840.00		V	53.97	-53.97	Avg			No emission found
22320.00		V	73.97	-73.97	Peak			Restricted Band
22320.00		V	53.97	-53.97	Avg			No emission found
24800.00		V	73.97	-73.97	Peak			No emission found
24800.00		V	53.97	-53.97	Avg			

Test distance								
3 meter								

HARMONIC EMISSIONS LOW CHANNEL

FCC 15.247

Company:	Semtech Corporation	Date:	8/14/2020
EUT:	LoRa Edge Tracker Ref	Lab:	T
Model:	LR1110TRK1CKS	Test ENG:	R. Ramirez
Transmitting Frequency:	2402 MHz	Axis:	Z

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4804.00	54.64	H	73.97	-19.33	Peak	2.13	78.9	Restricted Band
4804.00	43.76	H	53.97	-10.21	Avg	2.13	78.9	Restricted Band
7206.00		H	73.97	-73.97	Peak			No emission found
7206.00		H	53.97	-53.97	Avg			
9608.00		H	73.97	-73.97	Peak			No emission found
9608.00		H	53.97	-53.97	Avg			
12010.00		H	73.97	-73.97	Peak			Restricted Band
12010.00		H	53.97	-53.97	Avg			No emission found
14412.00		H	73.97	-73.97	Peak			No emission found
14412.00		H	53.97	-53.97	Avg			
16814.00		H	73.97	-73.97	Peak			No emission found
16814.00		H	53.97	-53.97	Avg			
19216.00		H	73.97	-73.97	Peak			Restricted Band
19216.00		H	53.97	-53.97	Avg			No emission found
21618.00		H	73.97	-73.97	Peak			No emission found
21618.00		H	53.97	-53.97	Avg			
24020.00		H	73.97	-73.97	Peak			No emission found
24020.00		H	53.97	-53.97	Avg			

Test distance
3 meter

HARMONIC EMISSIONS LOW CHANNEL

FCC 15.247

Company: Semtech Corporation

Date: 8/14/2020

EUT: LoRa Edge Tracker Ref

Lab: T

Model: LR1110TRK1CKS

Test ENG: R. Ramirez

Transmitting Frequency: 2402 MHz

Axis: Z

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4804.00	54.35	V	73.97	-19.62	Peak	2.11	201	Restricted Band
4804.00	43.21	V	53.97	-10.76	Avg	2.11	201	Restricted Band
7206.00		V	73.97	-73.97	Peak			
7206.00		V	53.97	-53.97	Avg			No emission found
9608.00		V	73.97	-73.97	Peak			No emission found
9608.00		V	53.97	-53.97	Avg			
12010.00		V	73.97	-73.97	Peak			Restricted Band
12010.00		V	53.97	-53.97	Avg			No emission found
14412.00		V	73.97	-73.97	Peak			No emission found
14412.00		V	53.97	-53.97	Avg			
16814.00		V	73.97	-73.97	Peak			No emission found
16814.00		V	53.97	-53.97	Avg			
19216.00		V	73.97	-73.97	Peak			Restricted Band
19216.00		V	53.97	-53.97	Avg			No emission found
21618.00		V	73.97	-73.97	Peak			No emission found
21618.00		V	53.97	-53.97	Avg			
24020.00		V	73.97	-73.97	Peak			No emission found
24020.00		V	53.97	-53.97	Avg			

Test distance

3 meter

HARMONIC EMISSIONS LOW CHANNEL

FCC 15.247

Company:	Semtech Corporation	Date:	8/14/2020
EUT:	LoRa Edge Tracker Ref	Lab:	T
Model:	LR1110TRK1CKS	Test ENG:	R. Ramirez
Transmitting Frequency:	2426 MHz	Axis:	Z

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4852.00	56.06	H	73.97	-17.91	Peak	2.02	76.2	Restricted Band
4852.00	44.50	H	53.97	-9.47	Avg	2.02	76.2	Restricted Band
7278.00		H	73.97	-73.97	Peak			Restricted Band
7278.00		H	53.97	-53.97	Avg			No emission found
9704.00		H	73.97	-73.97	Peak			No emission found
9704.00		H	53.97	-53.97	Avg			
12130.00		H	73.97	-73.97	Peak			Restricted Band
12130.00		H	53.97	-53.97	Avg			No emission found
14556.00		H	73.97	-73.97	Peak			No emission found
14556.00		H	53.97	-53.97	Avg			
16982.00		H	73.97	-73.97	Peak			No emission found
16982.00		H	53.97	-53.97	Avg			
19408.00		H	73.97	-73.97	Peak			Restricted Band
19408.00		H	53.97	-53.97	Avg			No emission found
21834.00		H	73.97	-73.97	Peak			No emission found
21834.00		H	53.97	-53.97	Avg			
24260.00		H	73.97	-73.97	Peak			Restricted Band
24260.00		H	53.97	-53.97	Avg			No emission found

Test distance								
3 meter								

HARMONIC EMISSIONS MID CHANNEL

FCC 15.247

Company: Semtech Corporation
EUT: LoRa Edge Tracker Ref
Model: LR1110TRK1CKS
Transmitting Frequency: 2426 MHz

Date: 8/14/2020
Lab: T
Test ENG: R. Ramirez
Axis: Z

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4852.00	55.36	V	73.97	-18.61	Peak	2.33	77.6	Restricted Band
4852.00	45.90	V	53.97	-8.07	Avg	2.33	77.6	Restricted Band
7278.00		V	73.97	-73.97	Peak			Restricted Band
7278.00		V	53.97	-53.97	Avg			Restricted Band
9704.00		V	73.97	-73.97	Peak			
9704.00		V	53.97	-53.97	Avg			
12130.00		V	73.97	-73.97	Peak			Restricted Band
12130.00		V	53.97	-53.97	Avg			Restricted Band
14556.00		V	73.97	-73.97	Peak			
14556.00		V	53.97	-53.97	Avg			
16982.00		V	73.97	-73.97	Peak			
16982.00		V	53.97	-53.97	Avg			
19408.00		V	73.97	-73.97	Peak			Restricted Band
19408.00		V	53.97	-53.97	Avg			Restricted Band
21834.00		V	73.97	-73.97	Peak			
21834.00		V	53.97	-53.97	Avg			
24260.00		V	73.97	-73.97	Peak			Restricted Band
24260.00		V	53.97	-53.97	Avg			Restricted Band

Test distance
3 meter

HARMONIC EMISSIONS HIGH CHANNEL

FCC 15.247

Company: Semtech Corporation

Date: 8/14/2020

EUT: LoRa Edge Tracker Ref

Lab: T

Model: LR1110TRK1CKS

Test ENG: R. Ramirez

Transmitting Frequency: 2480 MHz

Axis: Z

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4960.00	55.16	H	73.97	-18.81	Peak	2.95	353.3	Restricted Band
4960.00	43.69	H	53.97	-10.28	Avg	2.95	353.3	Restricted Band
7440.00		H	73.97	-73.97	Peak			Restricted Band
7440.00		H	53.97	-53.97	Avg			No emission found
9920.00		H	73.97	-73.97	Peak			No emission found
9920.00		H	53.97	-53.97	Avg			
12400.00		H	73.97	-73.97	Peak			Restricted Band
12400.00		H	53.97	-53.97	Avg			No emission found
14880.00		H	73.97	-73.97	Peak			No emission found
14880.00		H	53.97	-53.97	Avg			
17360.00		H	73.97	-73.97	Peak			No emission found
17360.00		H	53.97	-53.97	Avg			
19840.00		H	73.97	-73.97	Peak			Restricted Band
19840.00		H	53.97	-53.97	Avg			No emission found
22320.00		H	73.97	-73.97	Peak			Restricted Band
22320.00		H	53.97	-53.97	Avg			No emission found
24800.00		H	73.97	-73.97	Peak			
24800.00		H	53.97	-53.97	Avg			

Test distance

3 meter

HARMONIC EMISSIONS HIGH CHANNEL

FCC 15.247

Company:	Semtech Corporation	Date:	8/14/2020
EUT:	LoRa Edge Tracker Ref	Lab:	T
Model:	LR1110TRK1CKS	Test ENG:	R. Ramirez
Transmitting Frequency:	2480 MHz	Axis:	Z

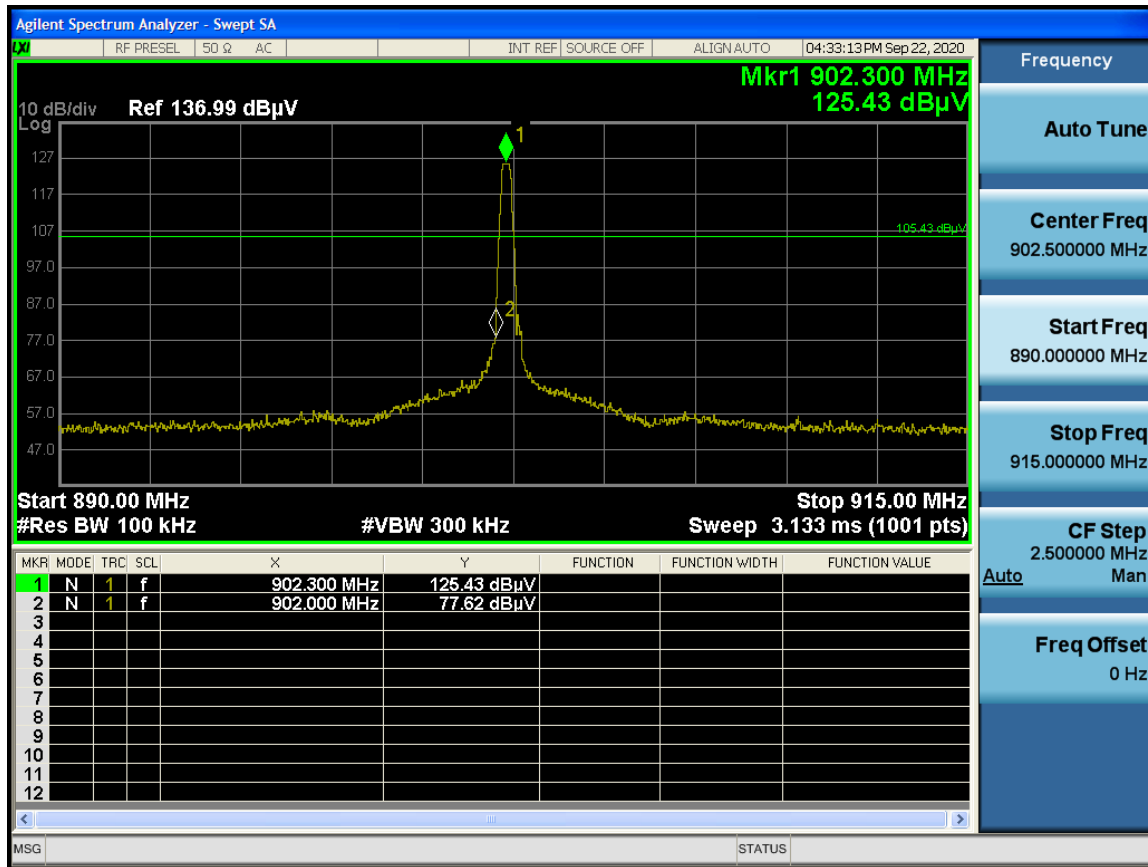
Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4960.00	54.33	V	73.97	-19.64	Peak	2.9	342.1	Restricted Band
4960.00	44.87	V	53.97	-9.10	Avg	2.9	342.1	Restricted Band
7440.00		V	73.97	-73.97	Peak			Restricted Band
7440.00		V	53.97	-53.97	Avg			No emission found
9920.00		V	73.97	-73.97	Peak			No emission found
9920.00		V	53.97	-53.97	Avg			
12400.00		V	73.97	-73.97	Peak			Restricted Band
12400.00		V	53.97	-53.97	Avg			No emission found
14880.00		V	73.97	-73.97	Peak			No emission found
14880.00		V	53.97	-53.97	Avg			
17360.00		V	73.97	-73.97	Peak			No emission found
17360.00		V	53.97	-53.97	Avg			
19840.00		V	73.97	-73.97	Peak			Restricted Band
19840.00		V	53.97	-53.97	Avg			No emission found
22320.00		V	73.97	-73.97	Peak			Restricted Band
22320.00		V	53.97	-53.97	Avg			No emission found
24800.00		V	73.97	-73.97	Peak			No emission found
24800.00		V	53.97	-53.97	Avg			

Test distance

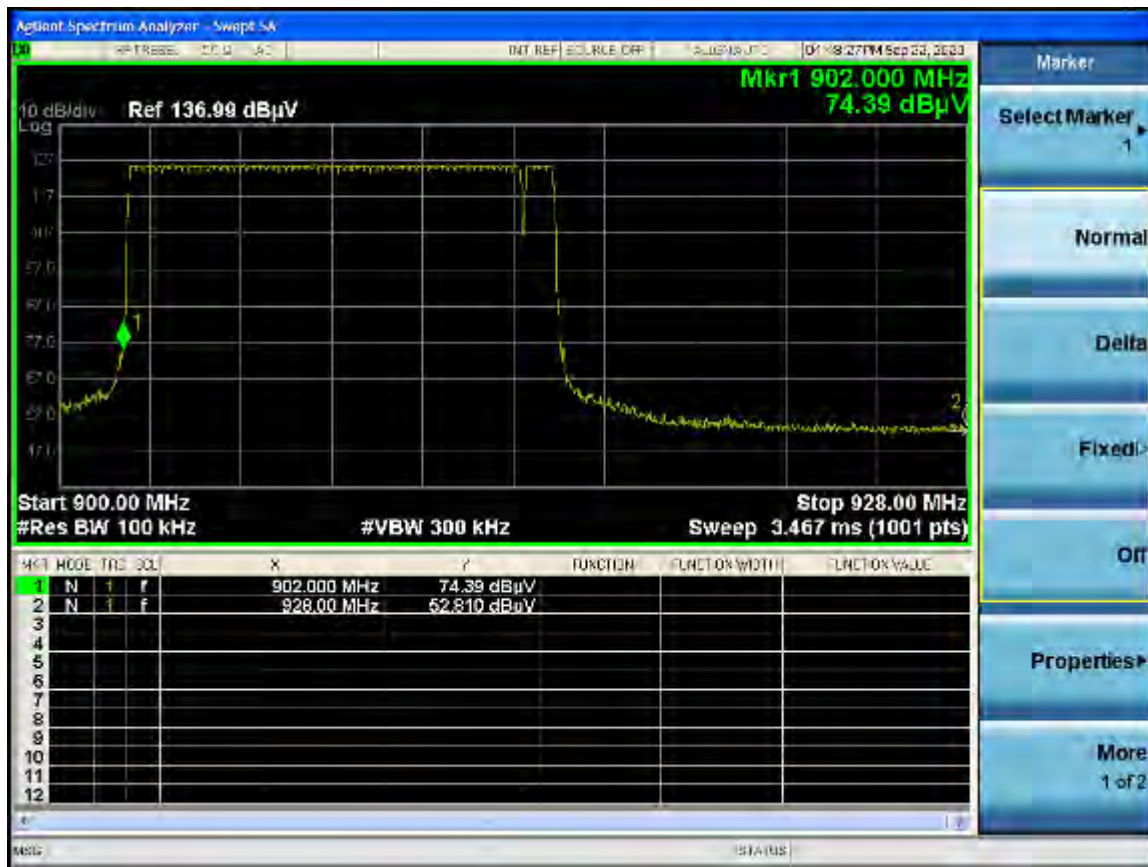
3 meter

***BAND EDGES
DATA SHEETS***



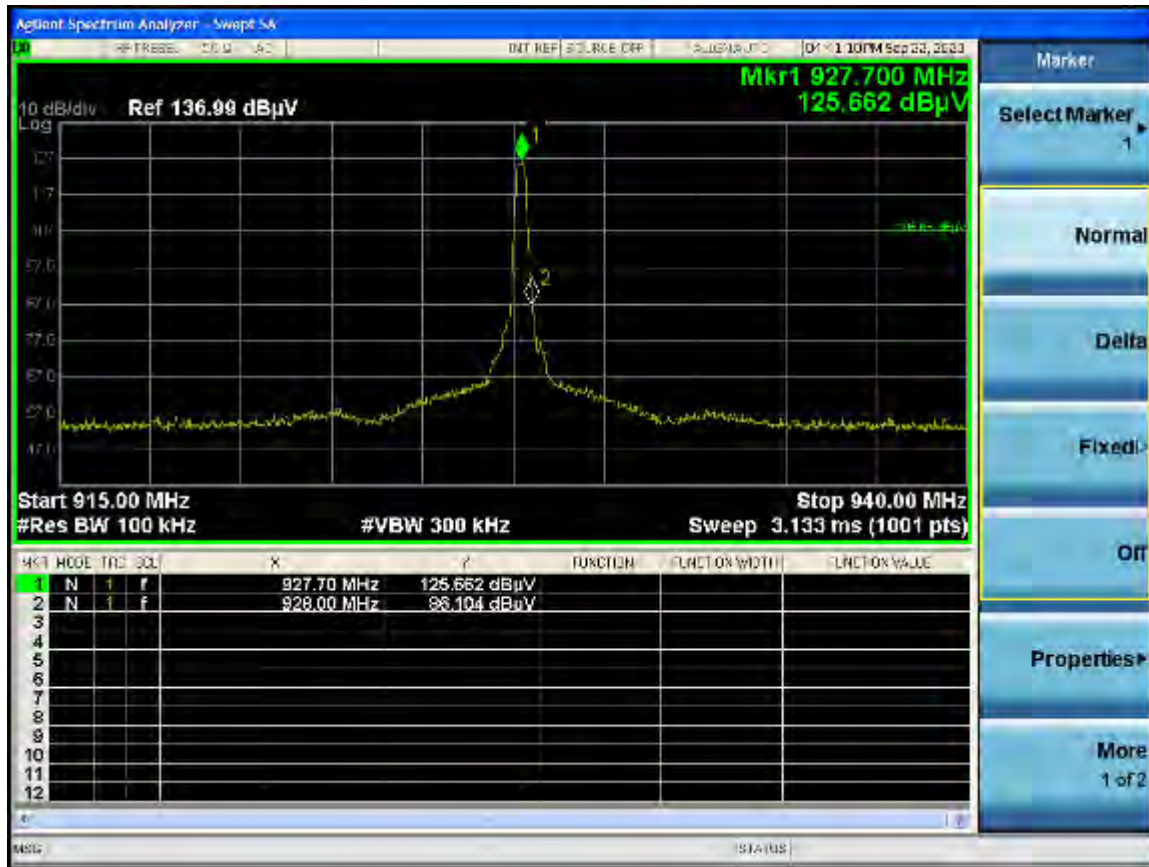
Band Edge – Low Channel – Fixed Frequency Mode

Note: Radiated emissions which fall in the restricted bands were verified with the limits under 15.209.



Band Edge – Frequency Hopping Mode

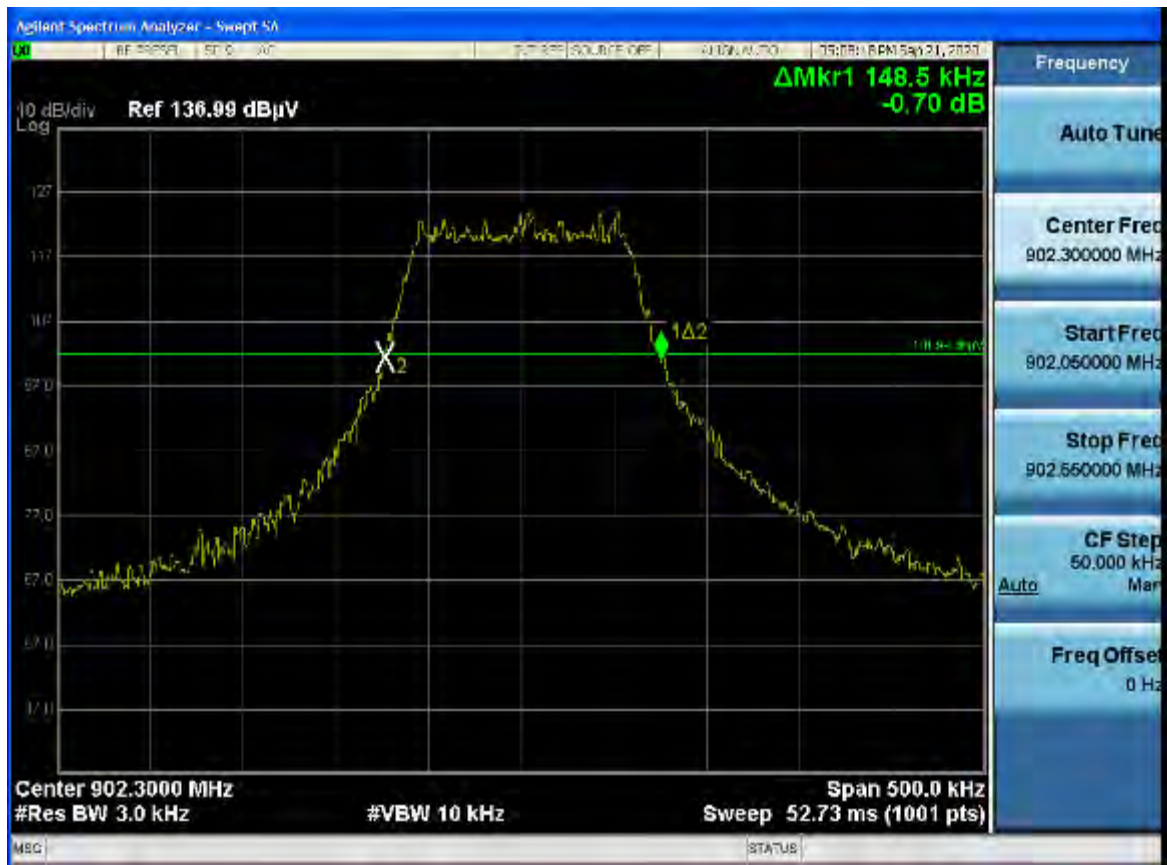
Note: Radiated emissions which fall in the restricted bands were verified with the limits under 15.209.



Band Edge – High Channel – Fixed Frequency Mode

Note: Radiated emissions which fall in the restricted bands were verified with the limits under 15.209.

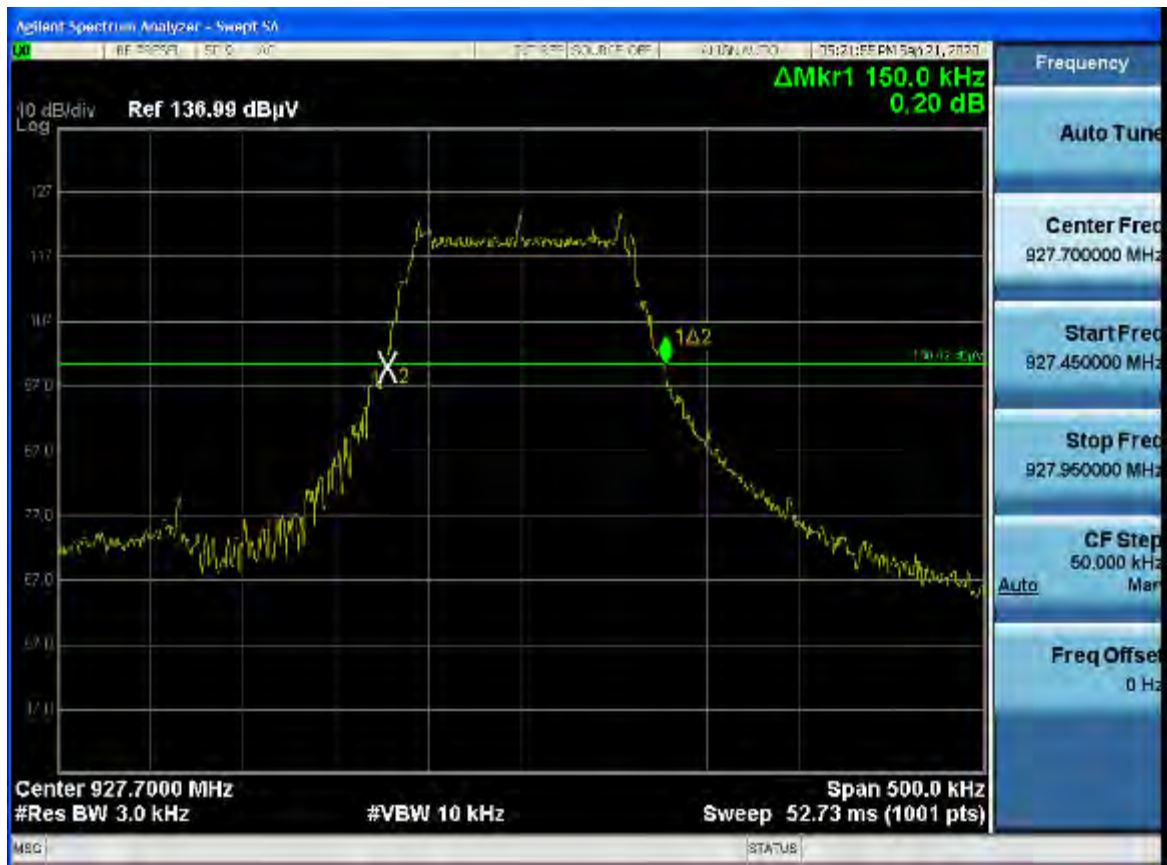
***-20 DB BANDWIDTH
DATA SHEETS***



-20 dB Bandwidth – Low Channel

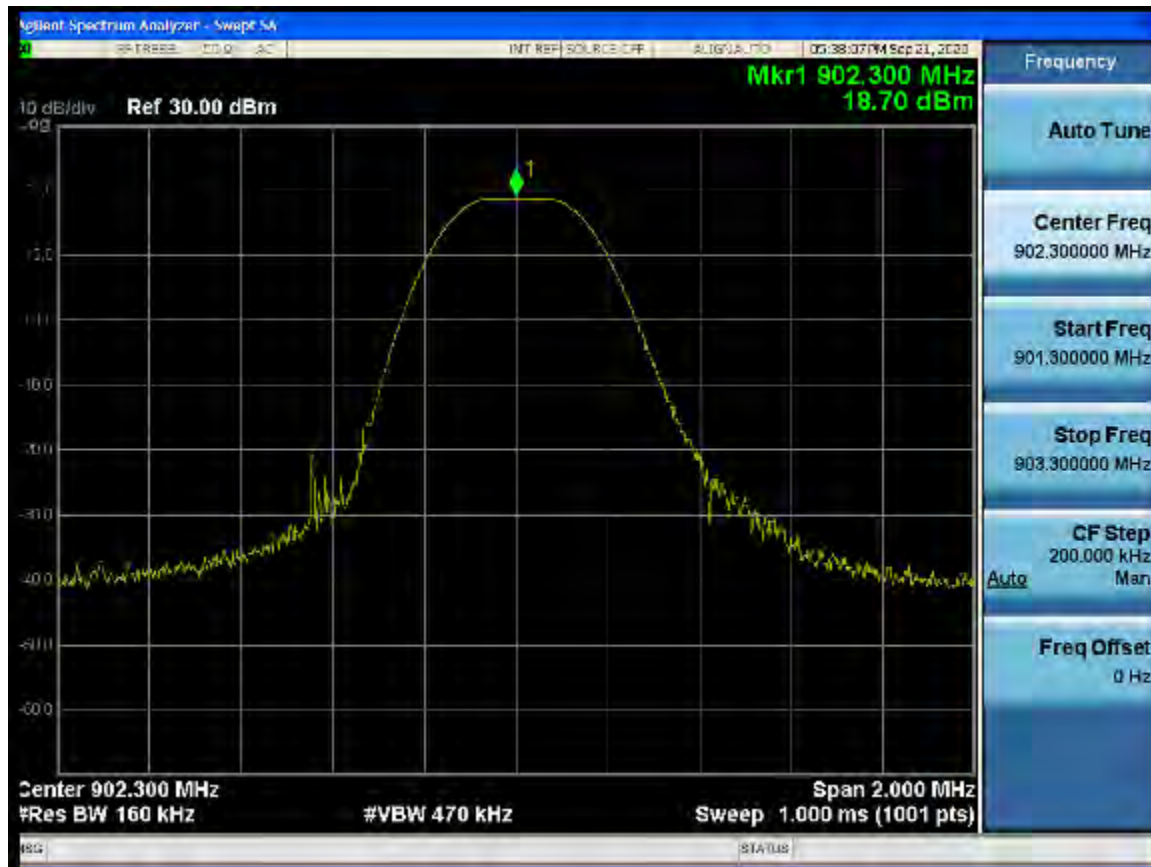


-20 dB Bandwidth – Middle Channel

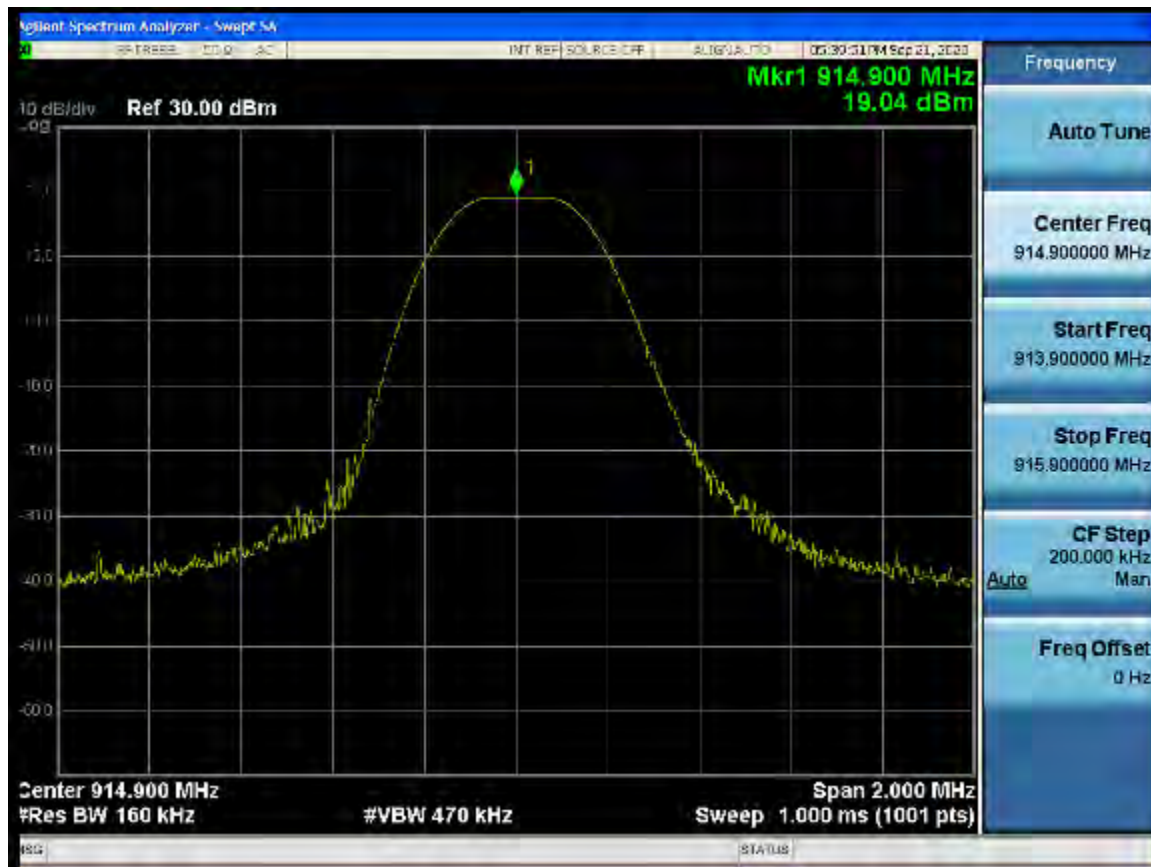


-20 dB Bandwidth – High Channel

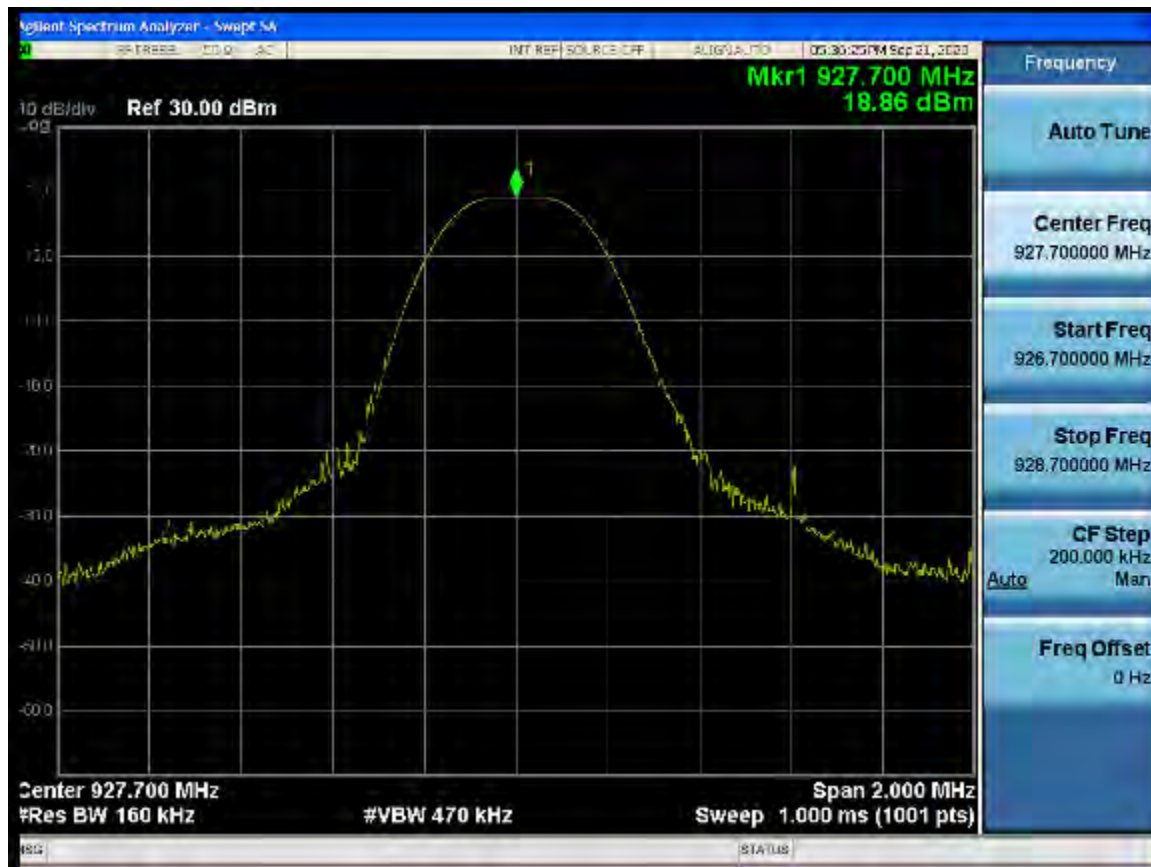
***PEAK POWER OUTPUT
DATA SHEETS***



Peak Output Power – Low Channel



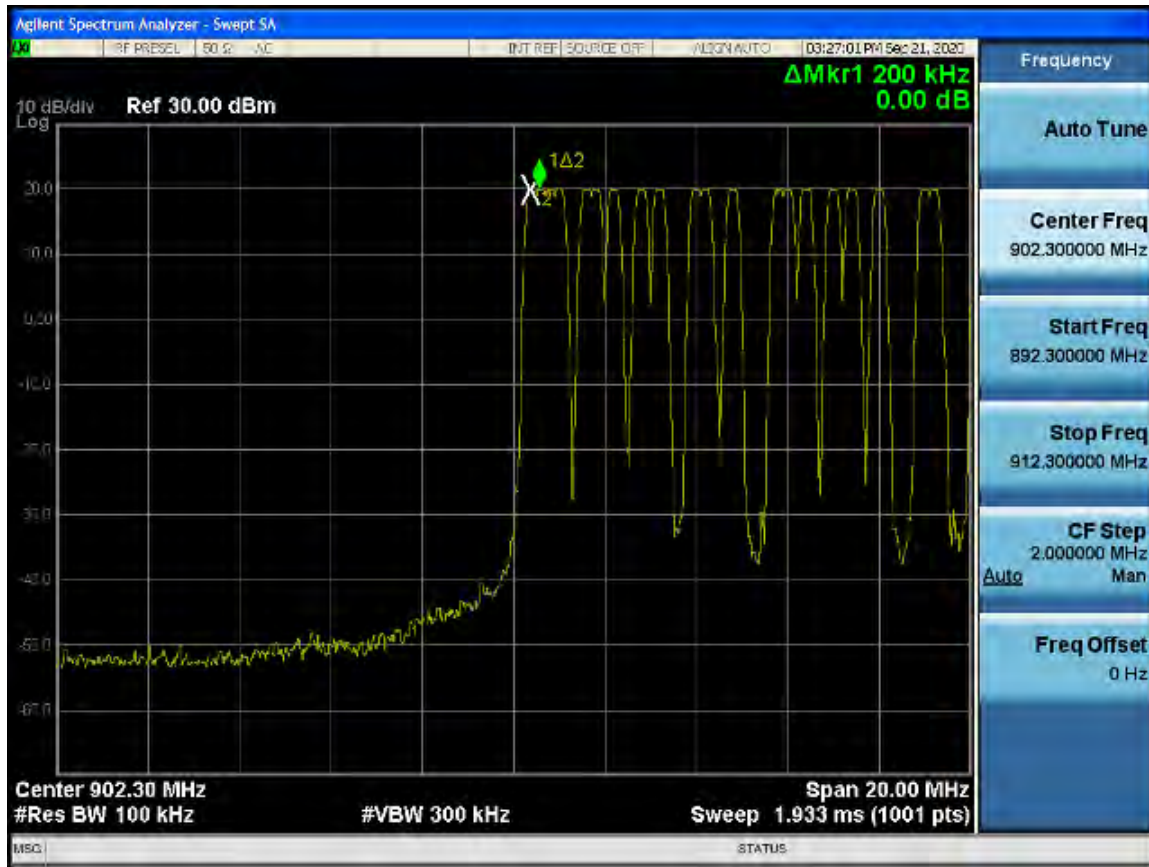
Peak Output Power – Middle Channel



Peak Output Power – High Channel

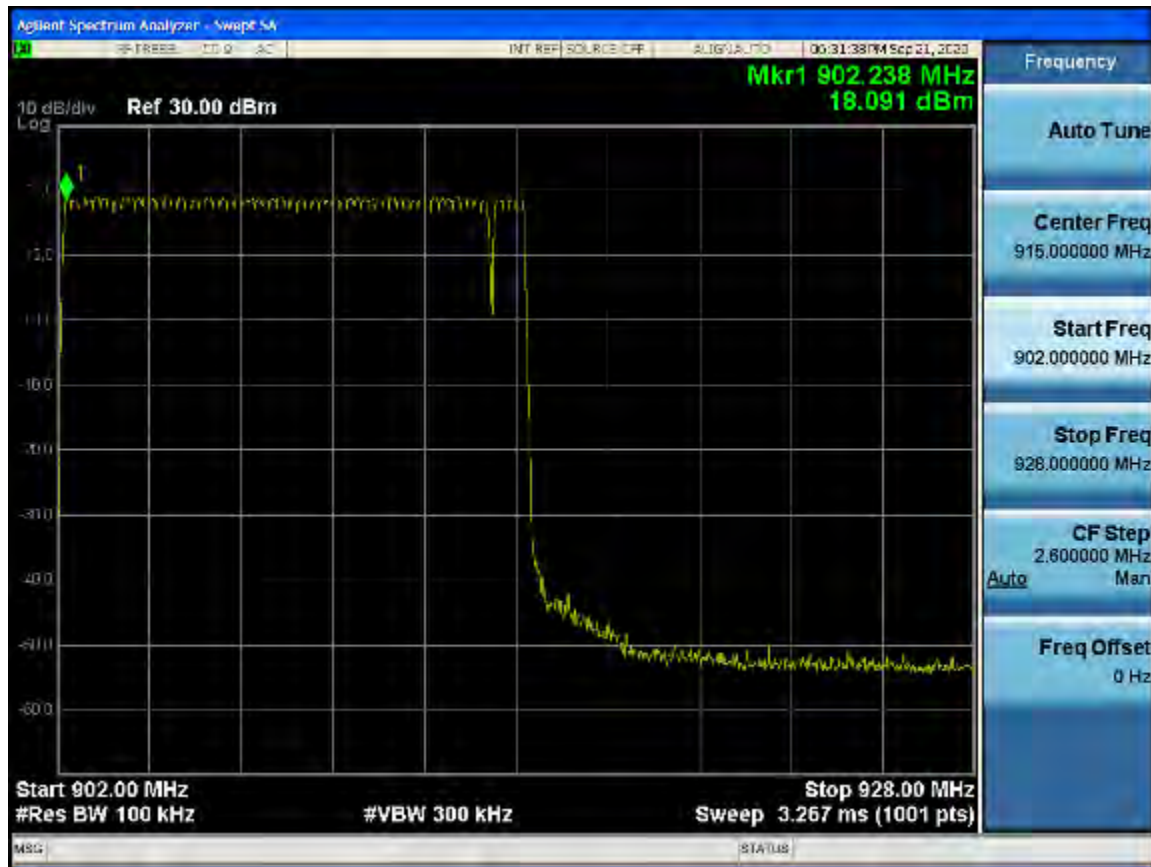
***CHANNEL FREQUENCY SEPARATION
DATA SHEET***





Channel Frequency Separation

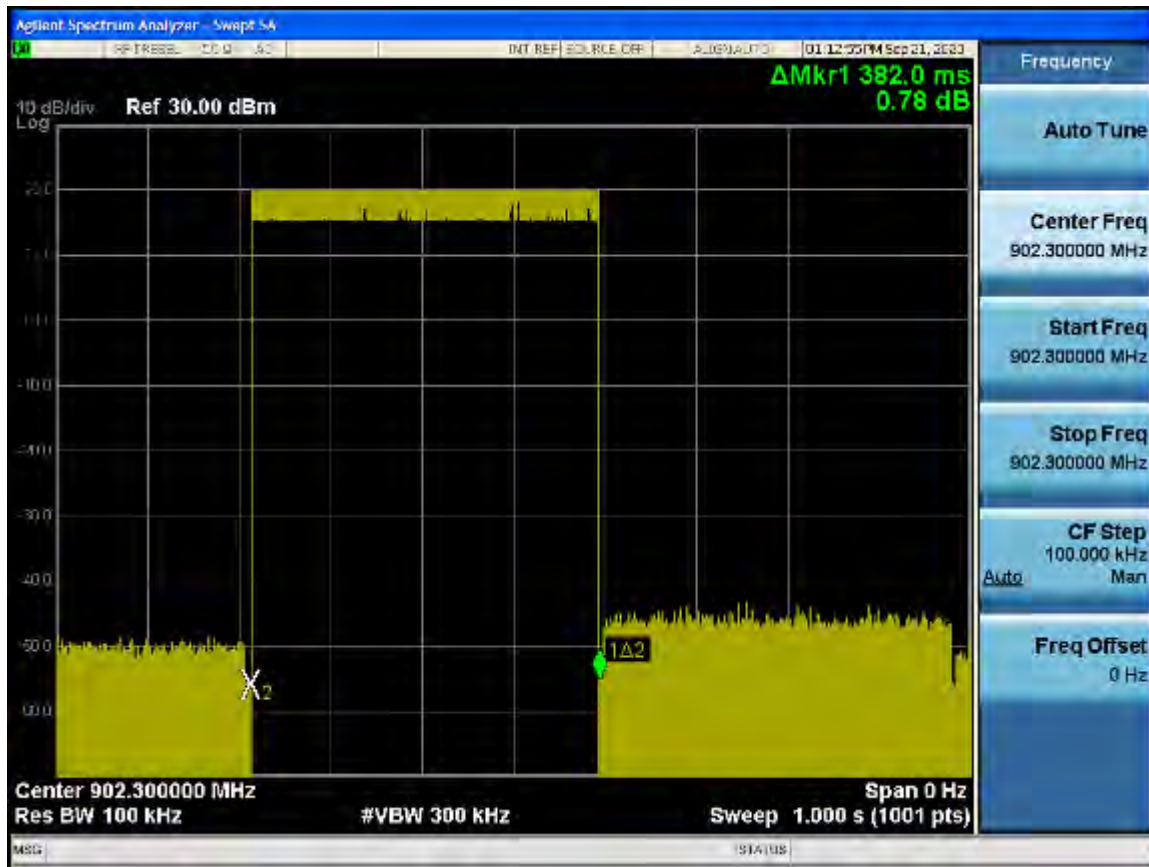
***NUMBER OF FREQUENCIES
DATA SHEET***



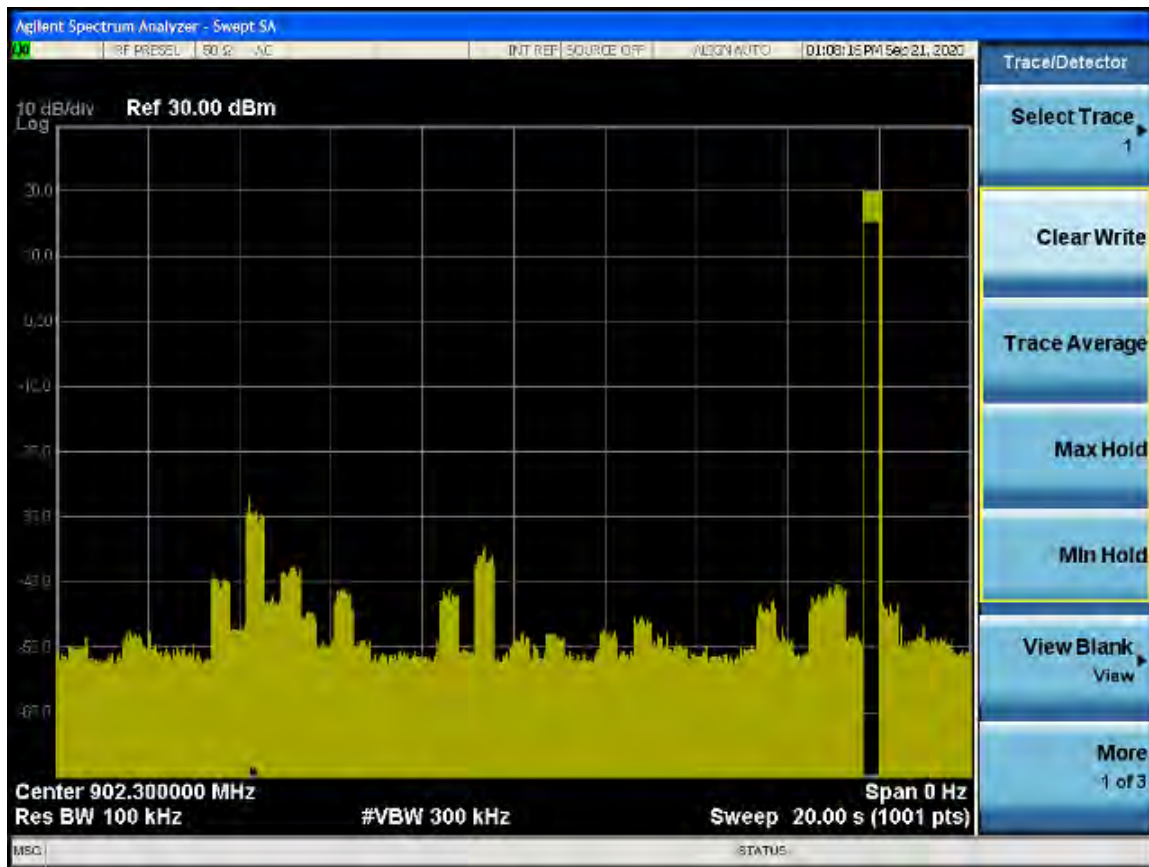
Number of Channels is 64 (maximum)

TIME OF OCCUPANCY

DATA SHEET



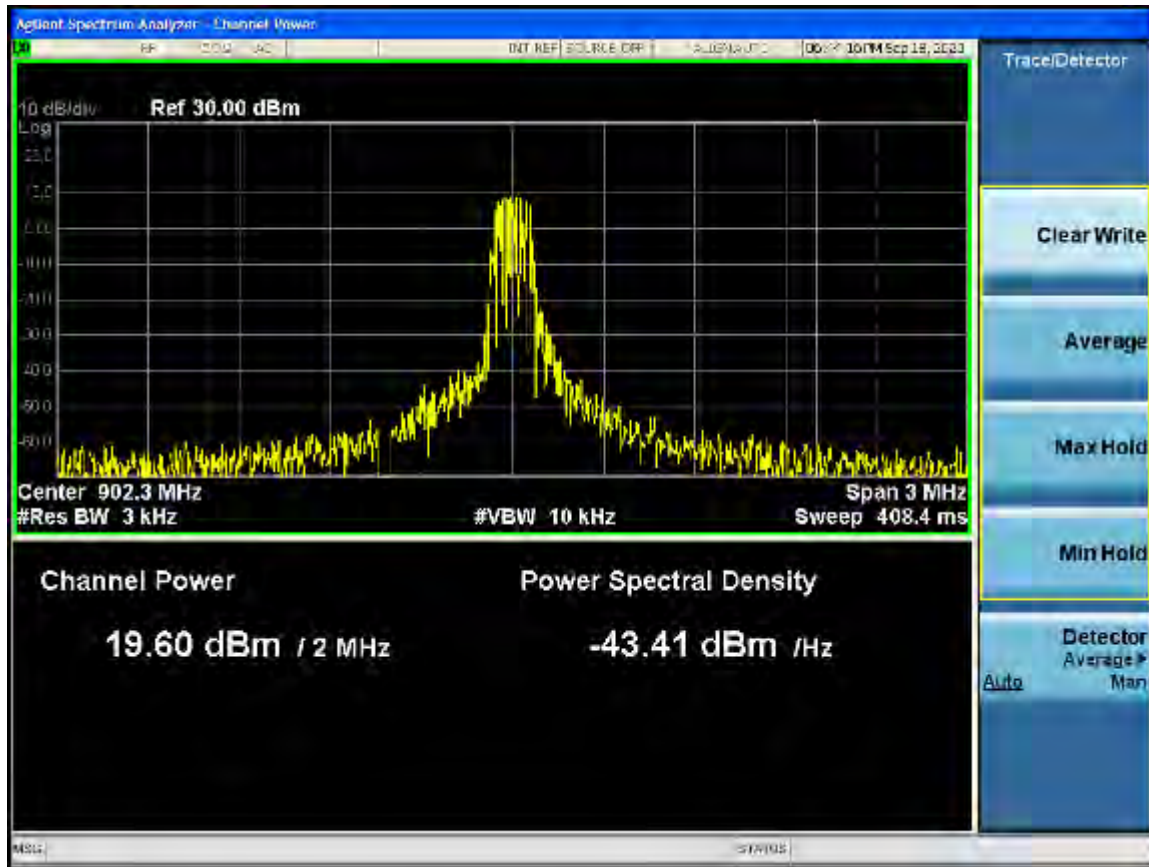
Time of One Pulse = 382 ms



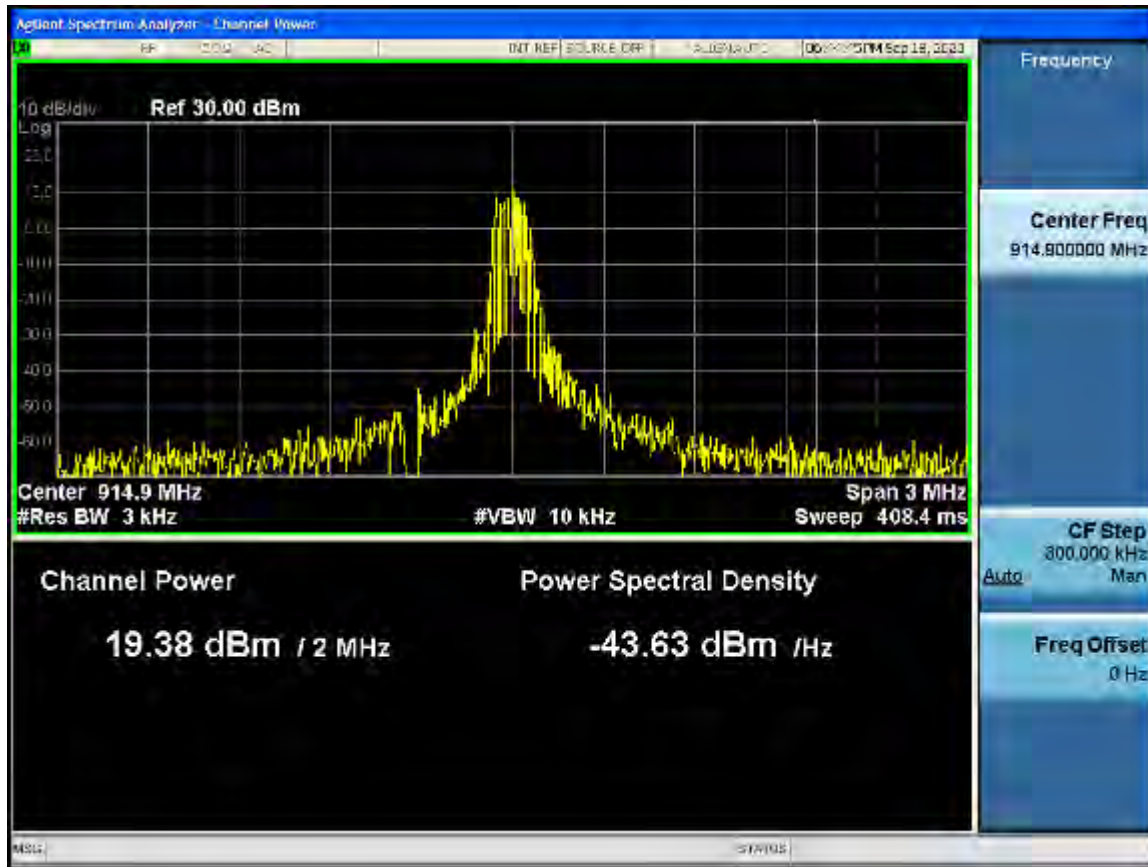
Worst Case of 1 pulse in 20 seconds
Total Dwell Time = $386 \times 1 = 382$ ms
Limit = 400 ms in a 20 second period

SPECTRAL DENSITY OUTPUT

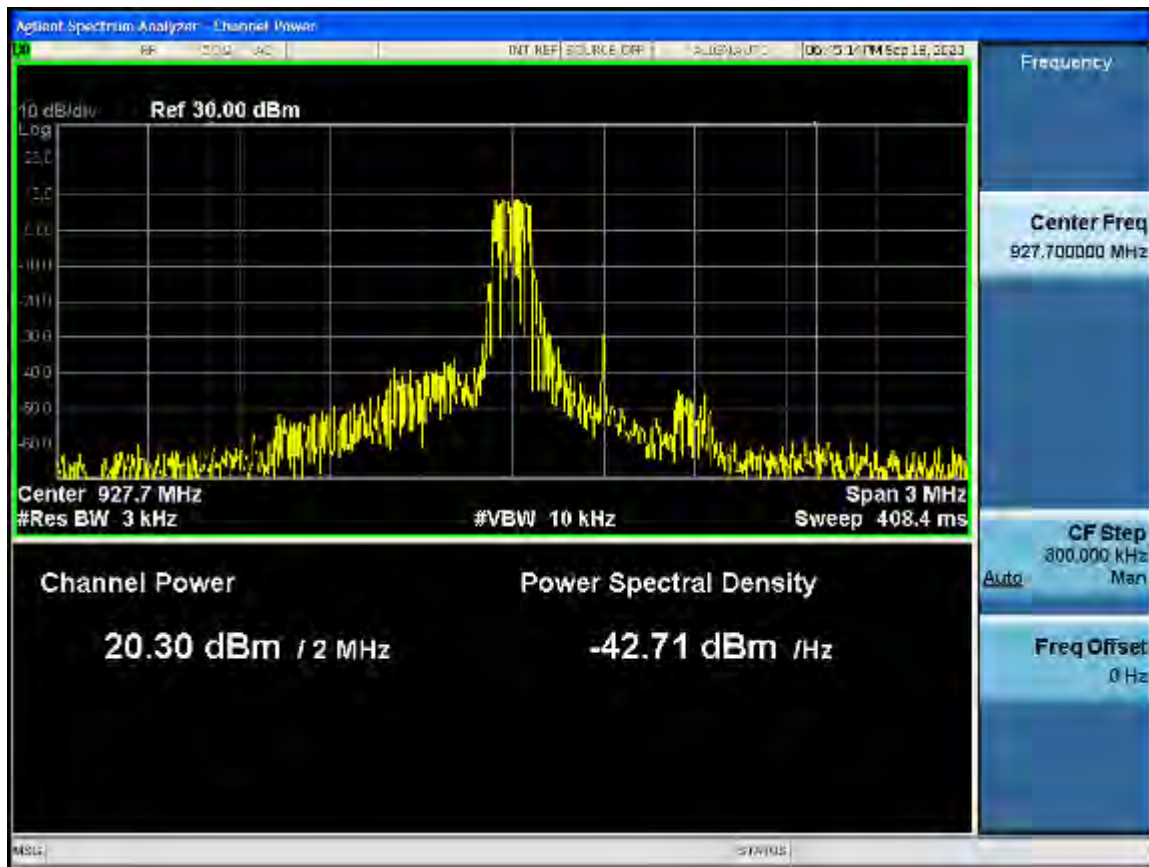
DATA SHEETS



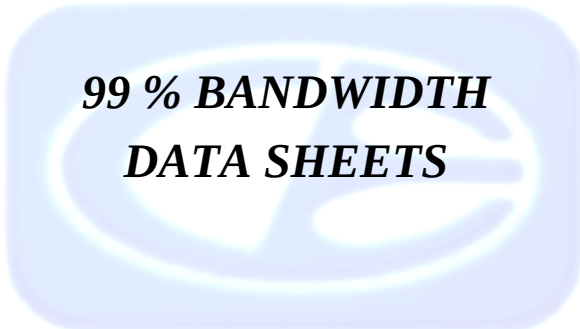
Power Spectral Density – Low Channel



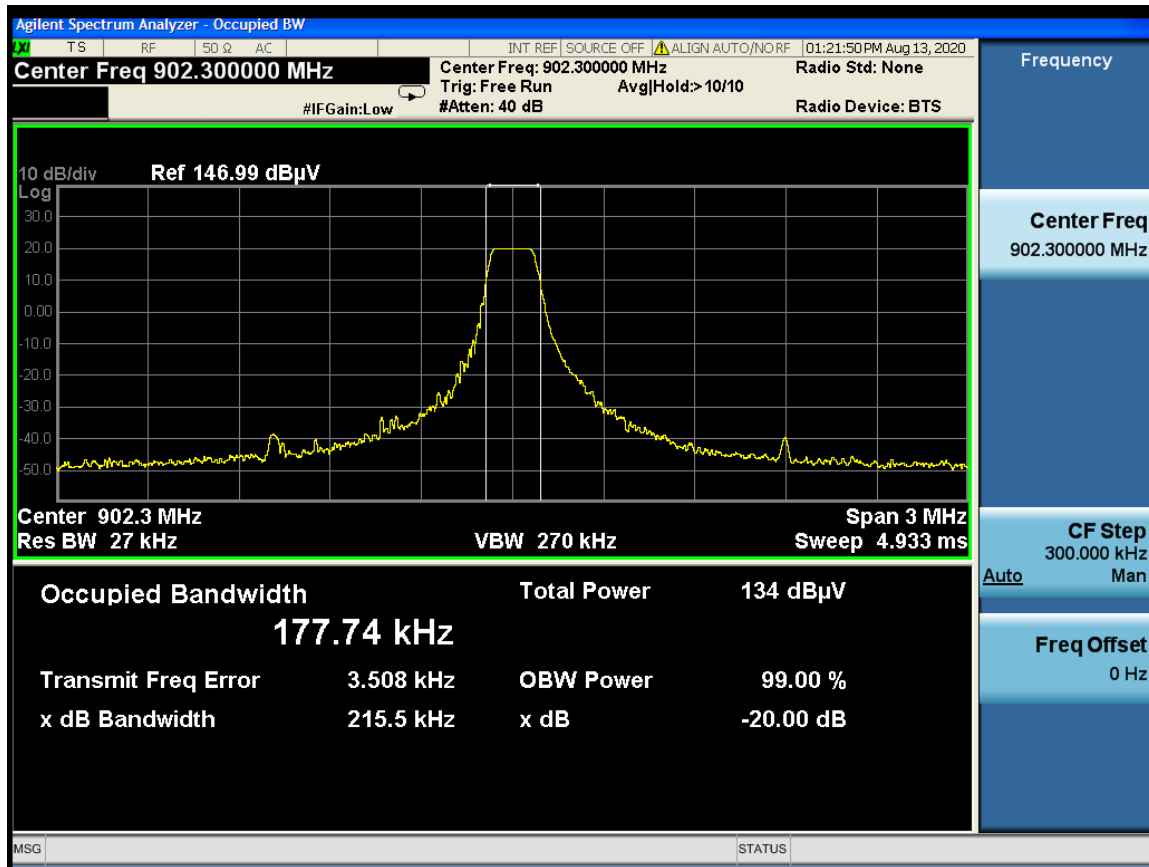
Power Spectral Density – Mid Channel



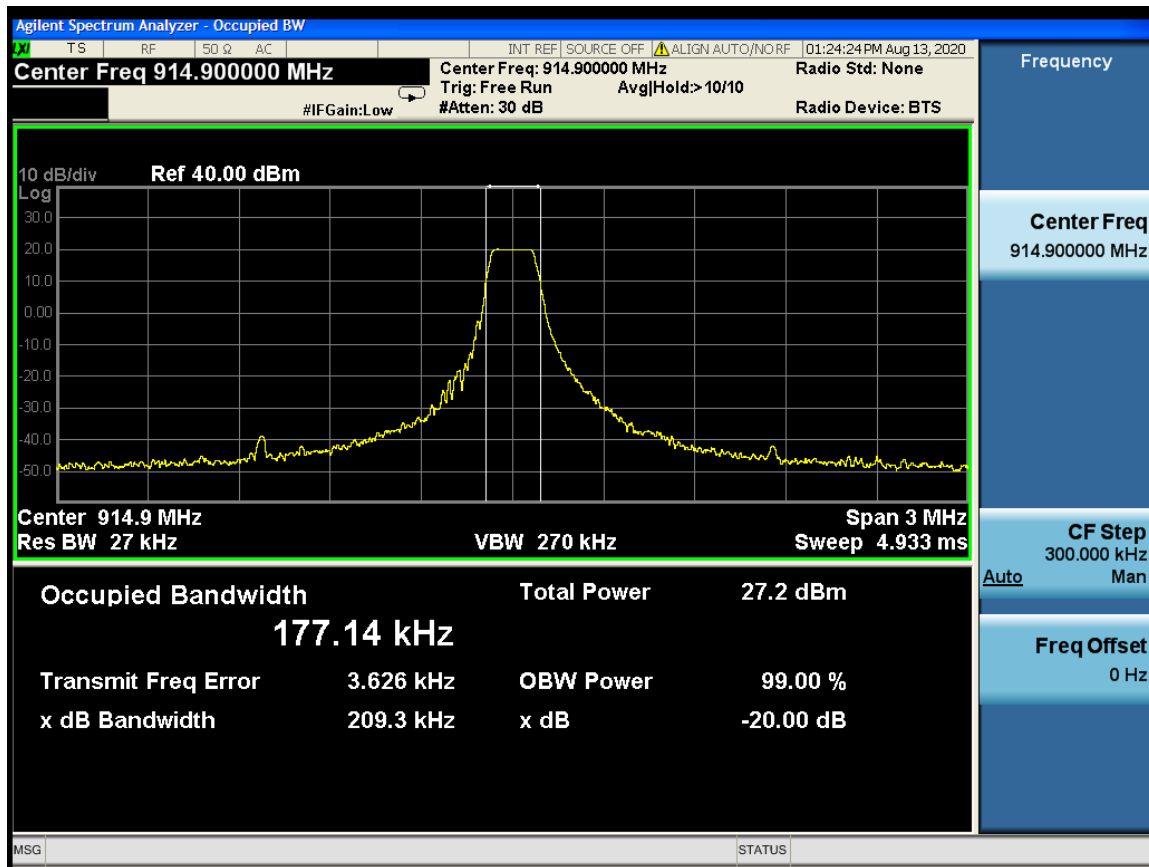
Power Spectral Density – High Channel



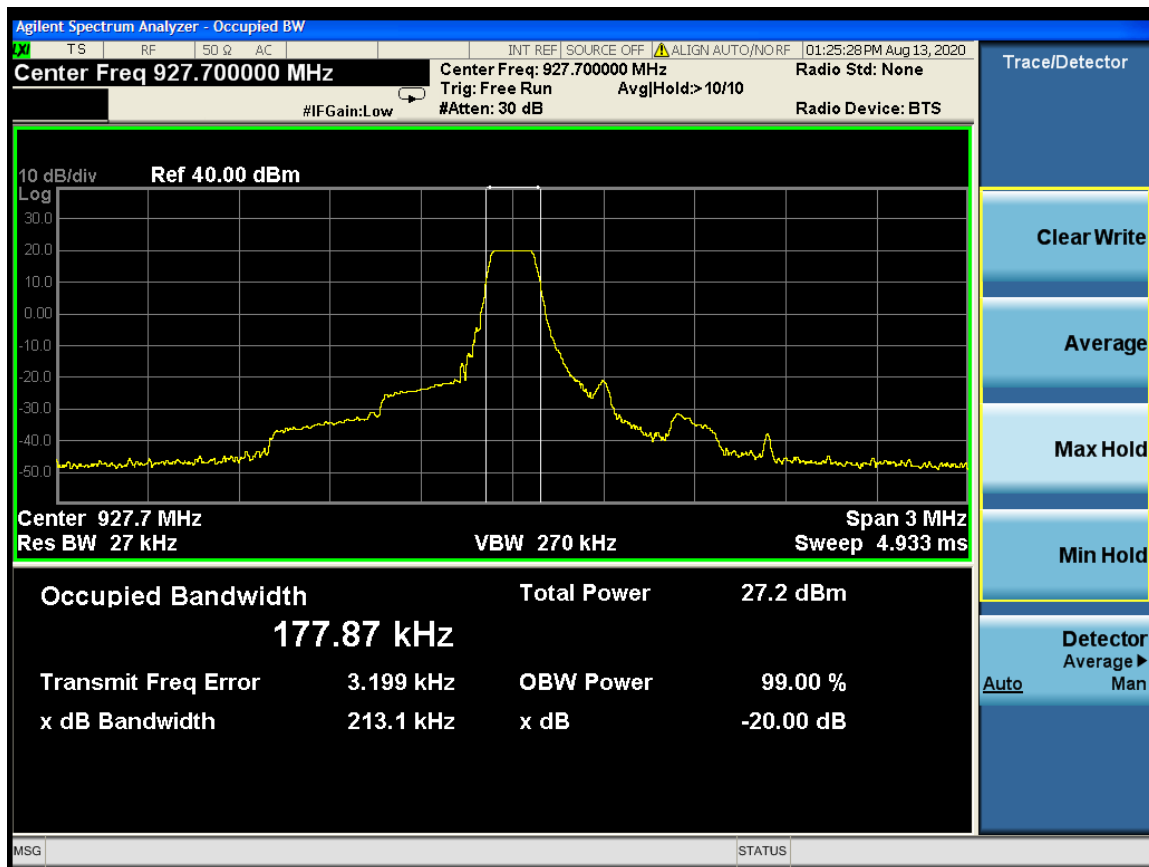
**99 % BANDWIDTH
DATA SHEETS**



99 Percent BW – 902.3 MHz – Low Channel



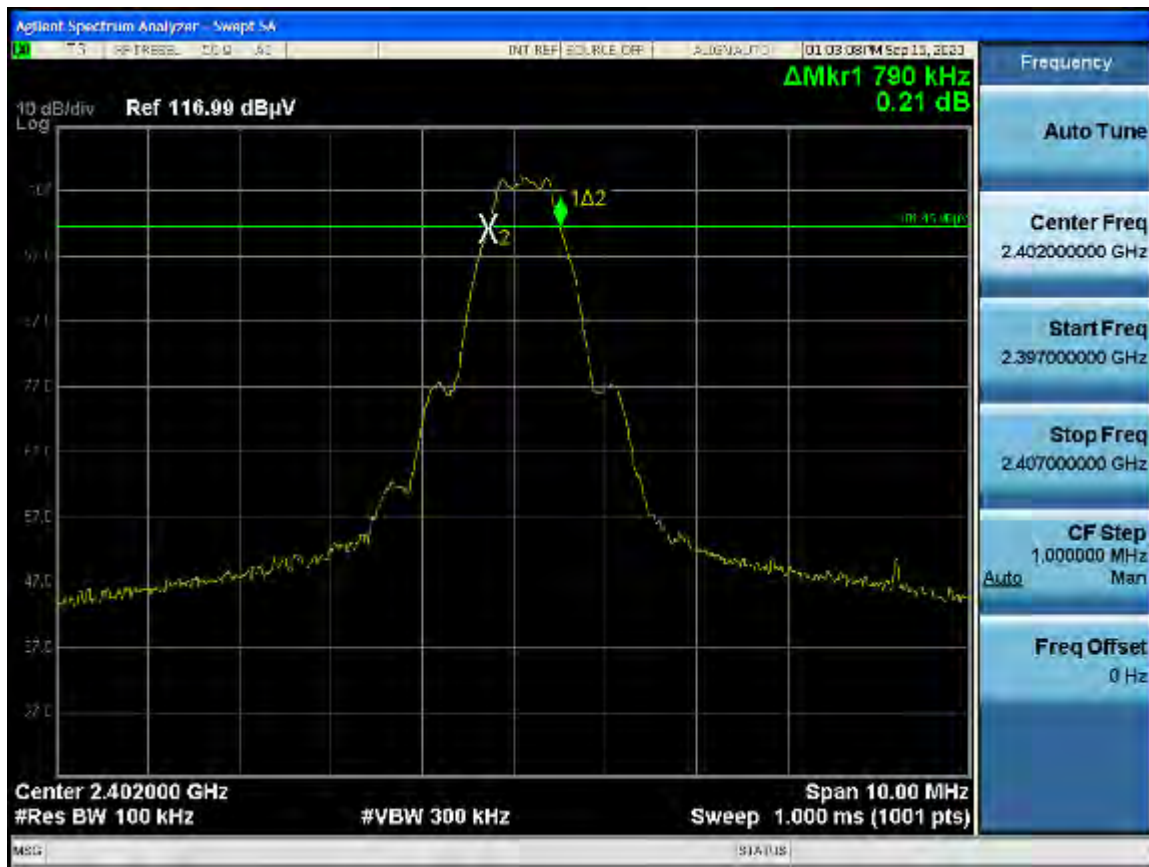
99 Percent BW – 914.9 MHz – Middle Channel



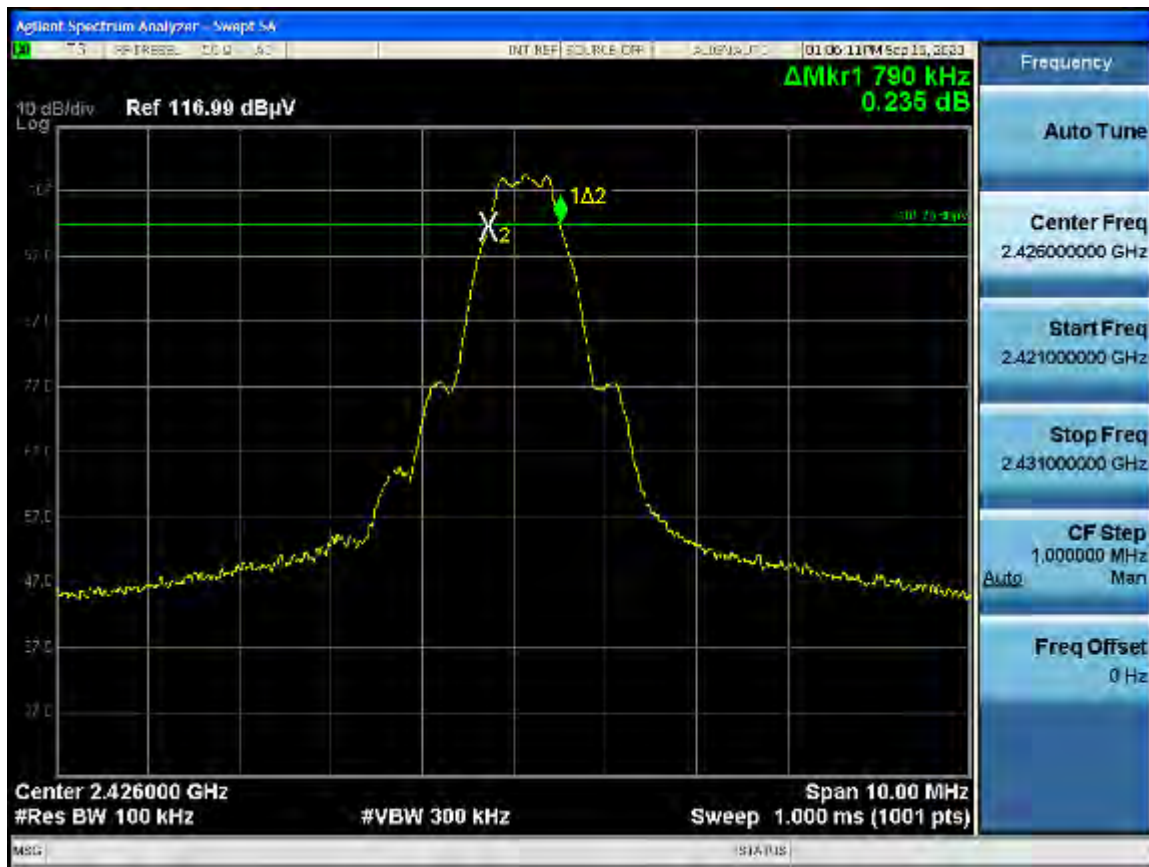
99 Percent BW – 927.7 MHz – High Channel

DTS BANDWIDTH

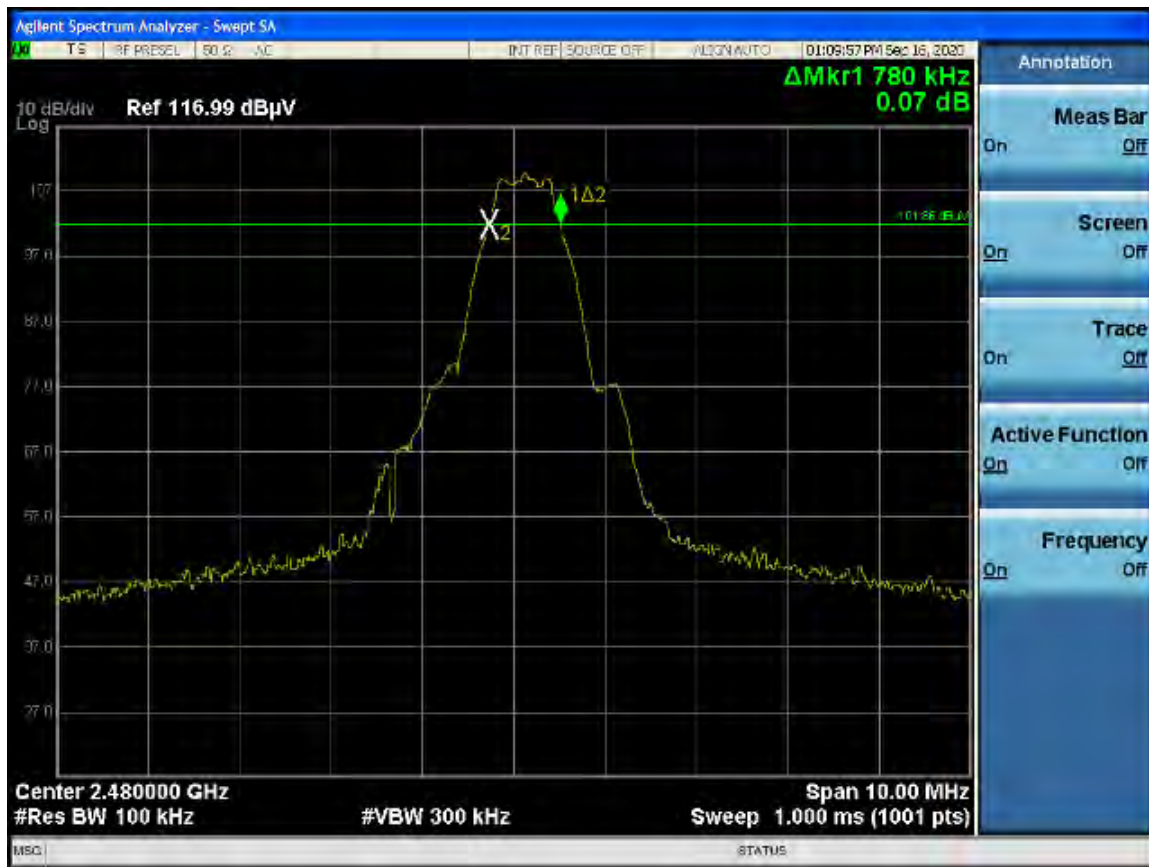




DTS Bandwidth – Low Channel



DTS Bandwidth – Middle Channel



DTS Bandwidth – High Channel

SPECTRAL DENSITY OUTPUT

DATA SHEETS



Power Spectral Density – Low Channel



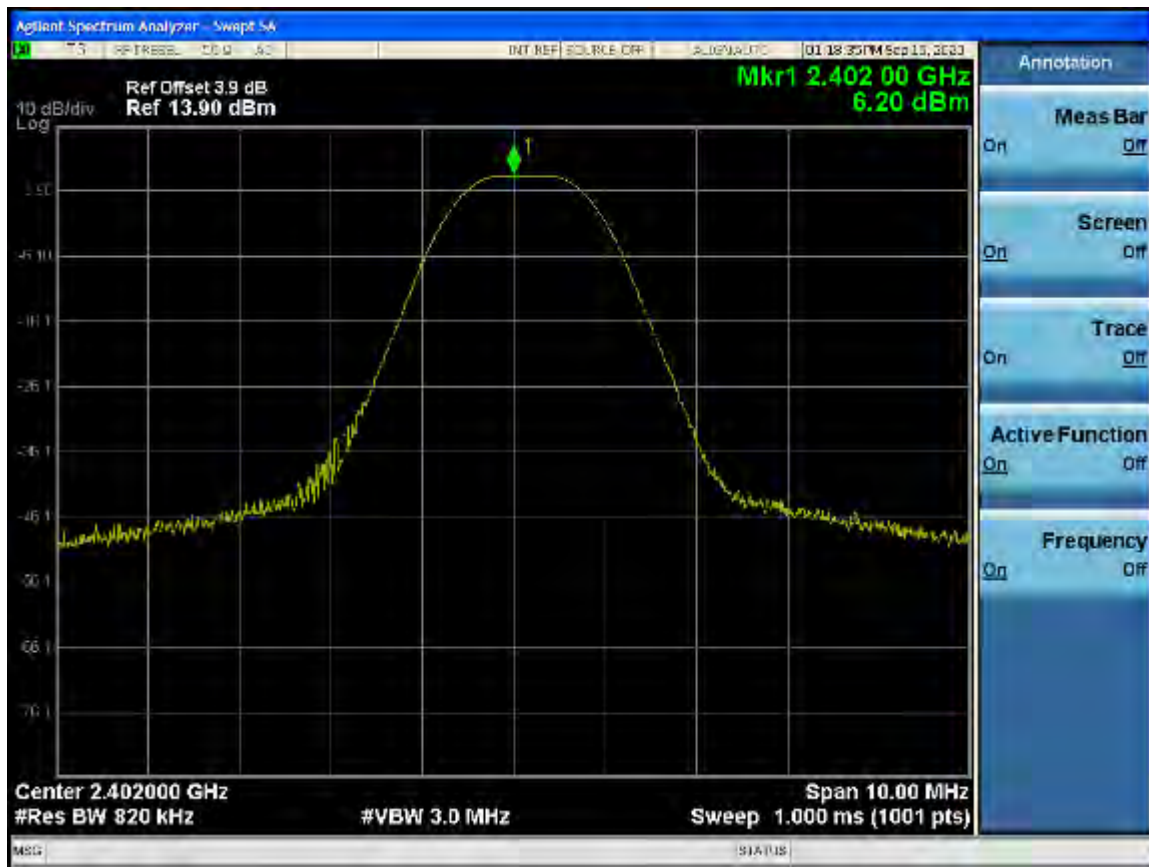
Power Spectral Density – Middle Channel



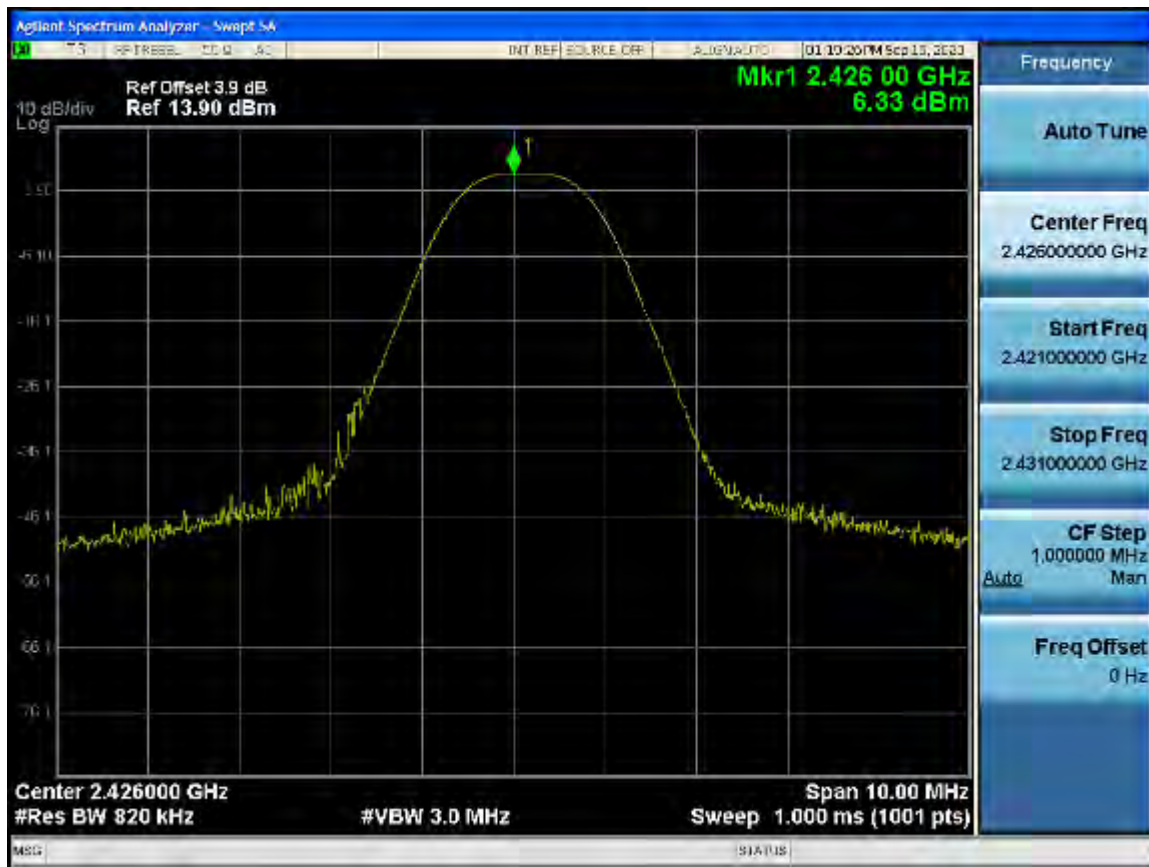
Power Spectral Density – High Channel

PEAK OUTPUT POWER

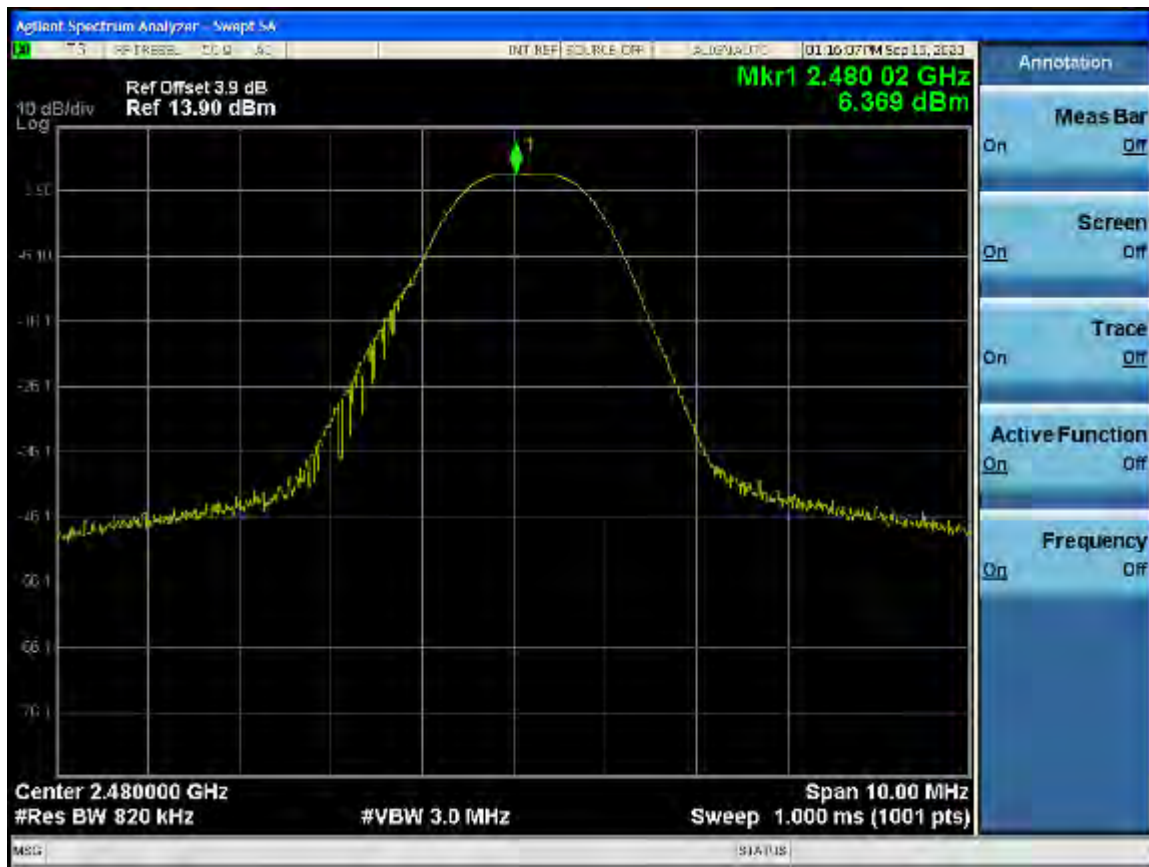
DATA SHEETS



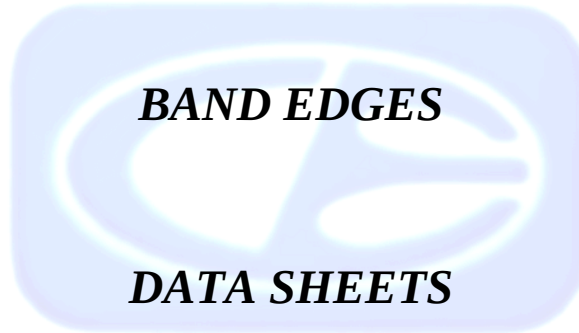
Peak Output Power – Low Channel

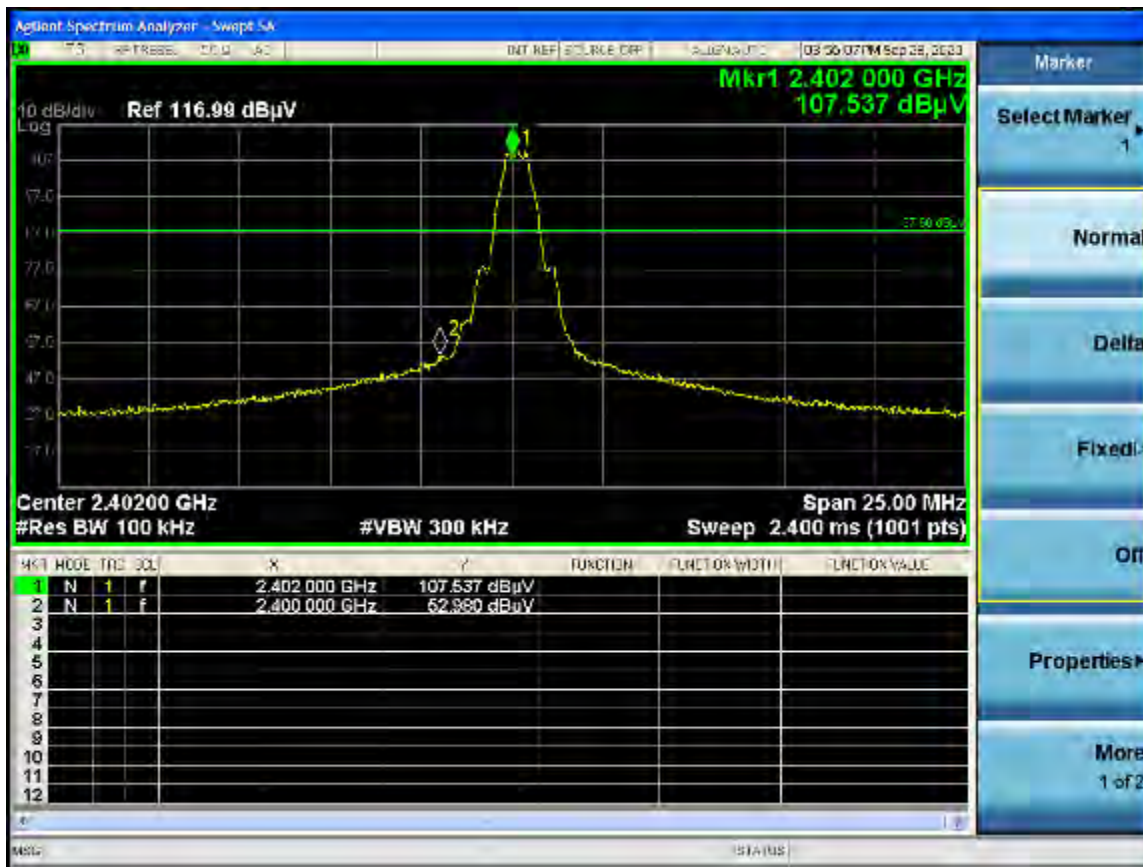


Peak Output Power – Middle Channel



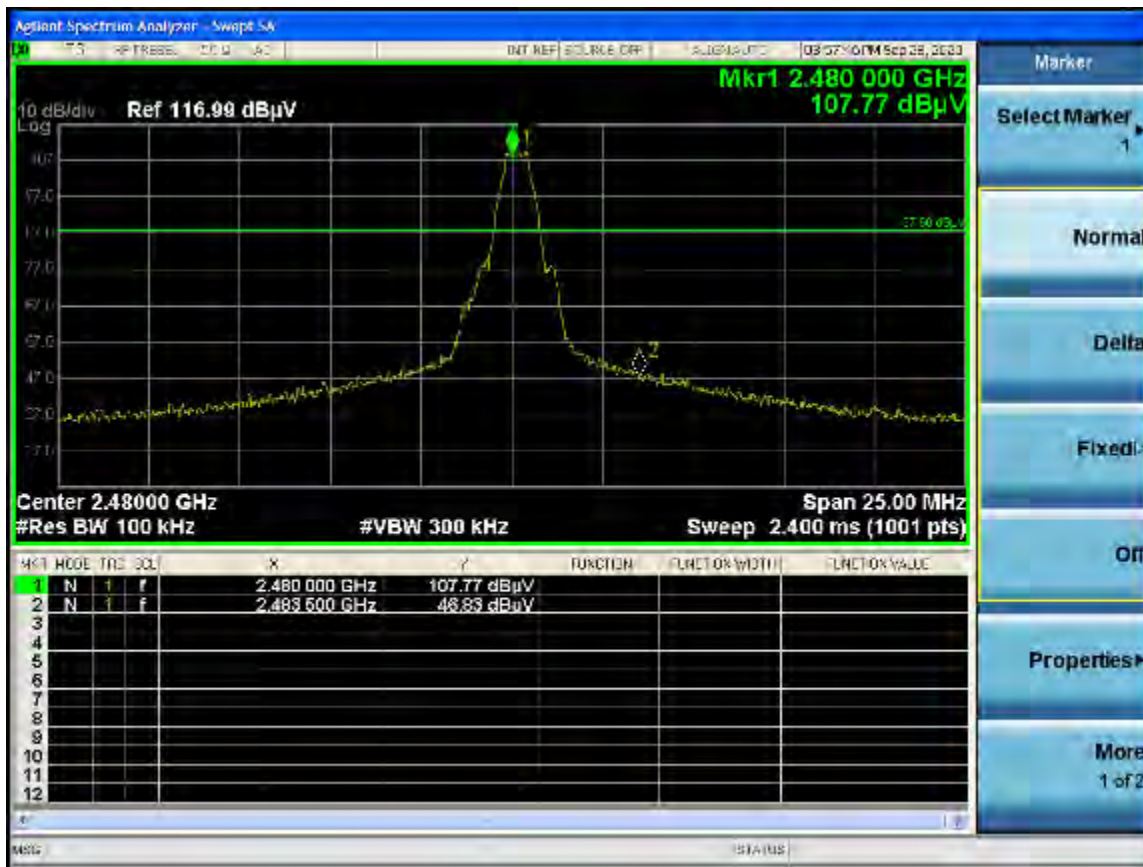
Peak Output Power – High Channel





Band Edges – Low channel

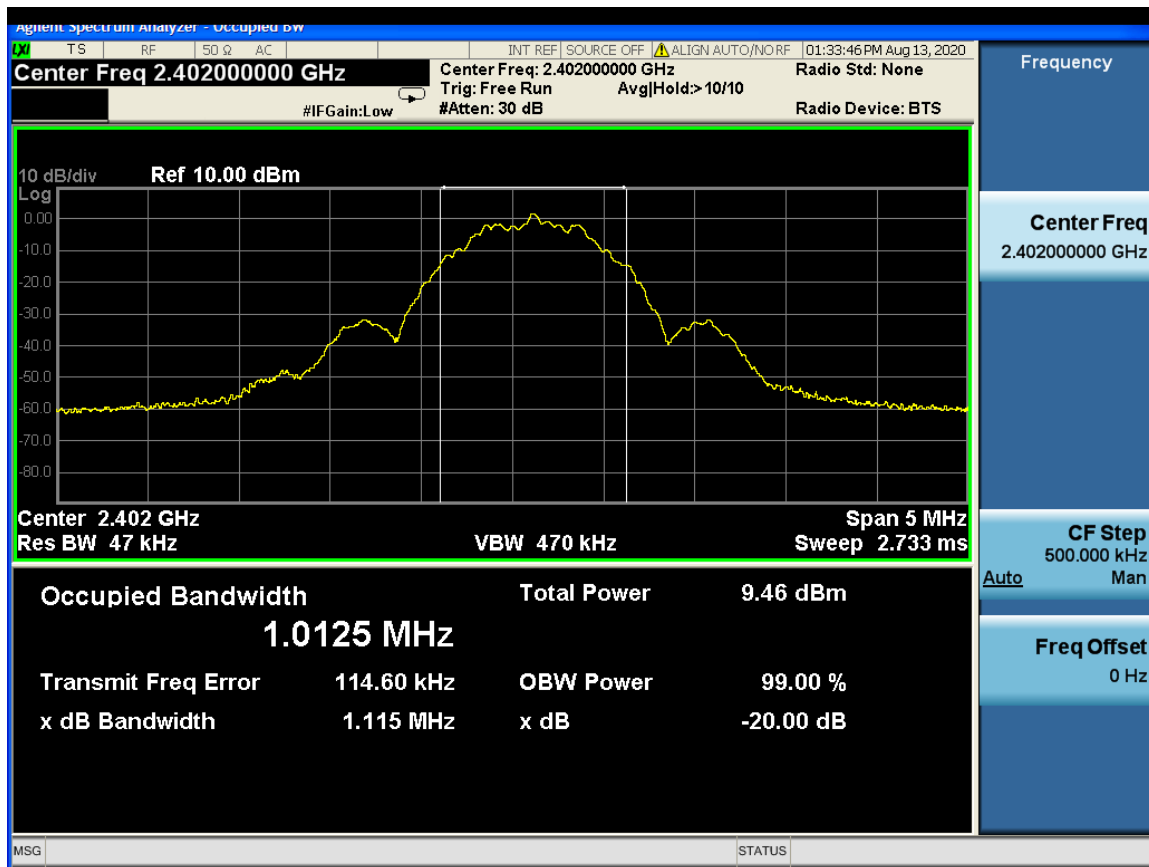
Note: Radiated emissions which fall in the restricted bands were verified with the limits under 15.209.



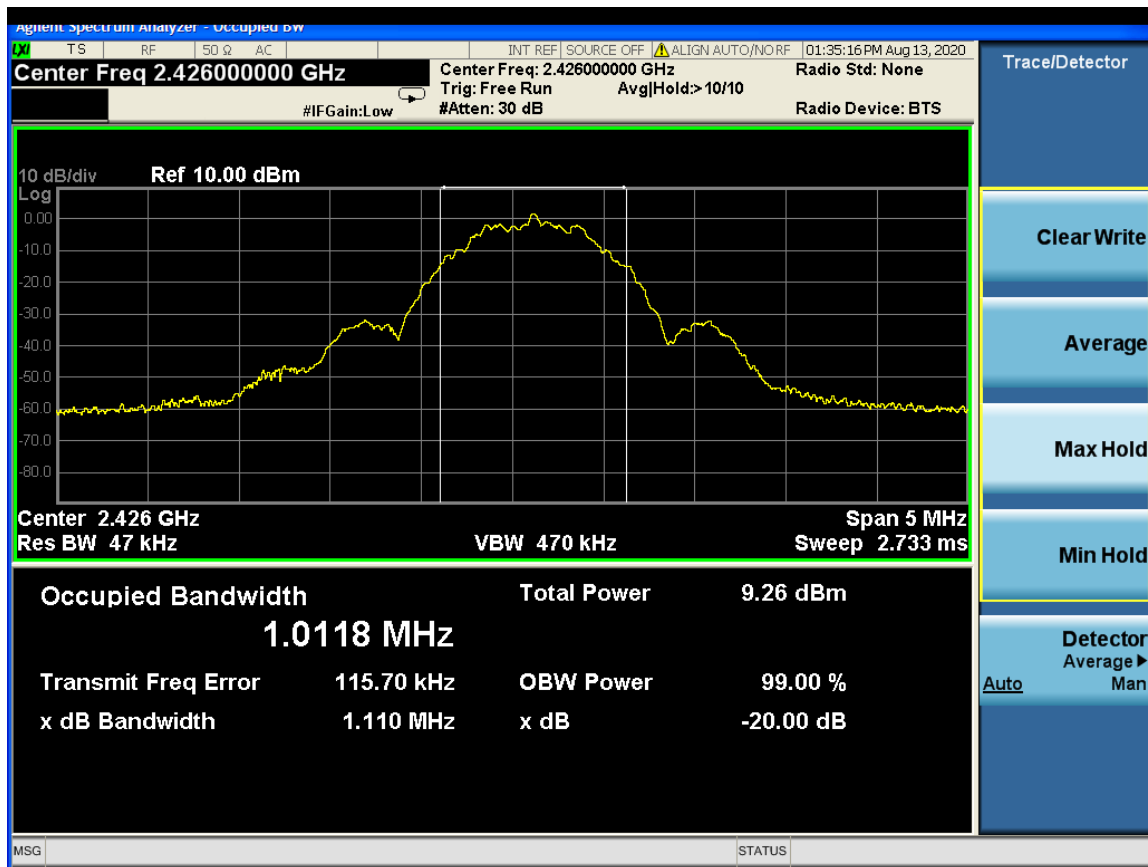
Band Edges – High channel

Note: Radiated emissions which fall in the restricted bands were verified with the limits under 15.209.

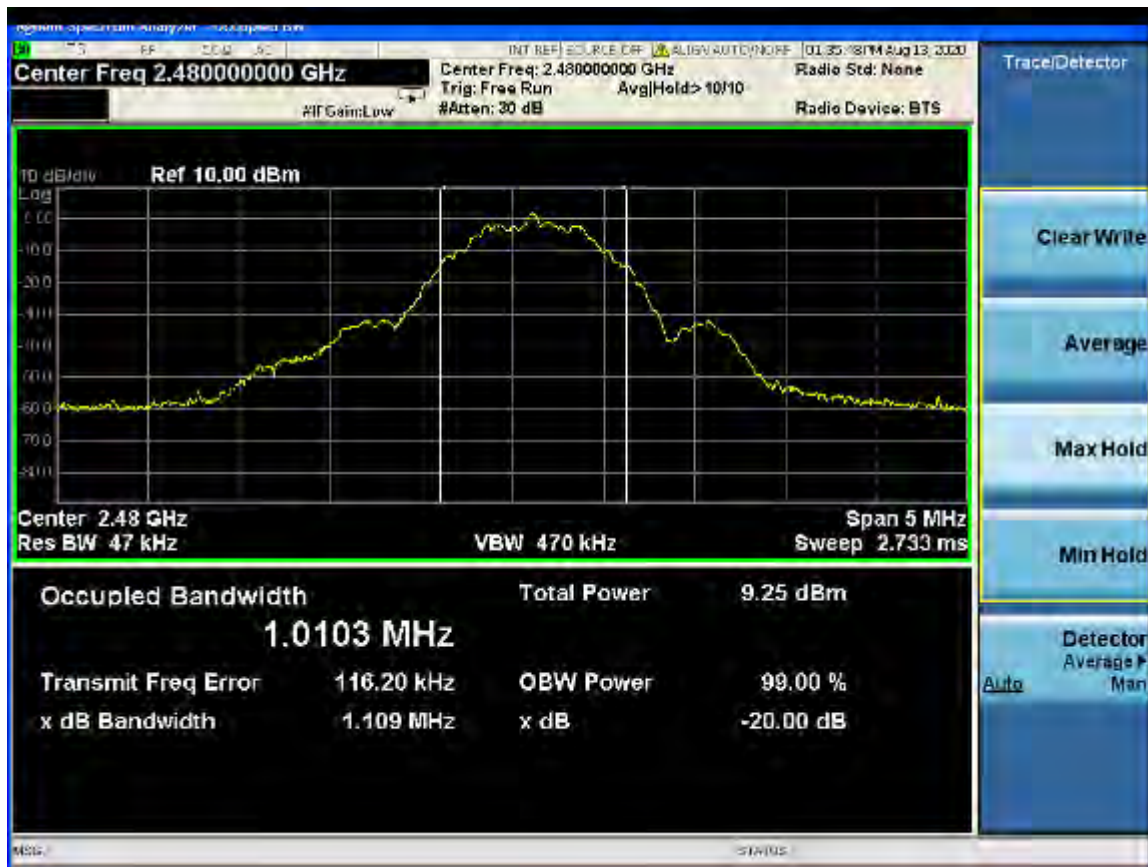
**99 % BANDWIDTH
DATA SHEETS**



99 Percent BW – 2402 MHz – Low Channel



99 Percent BW – 2426 MHz – Mid Channel

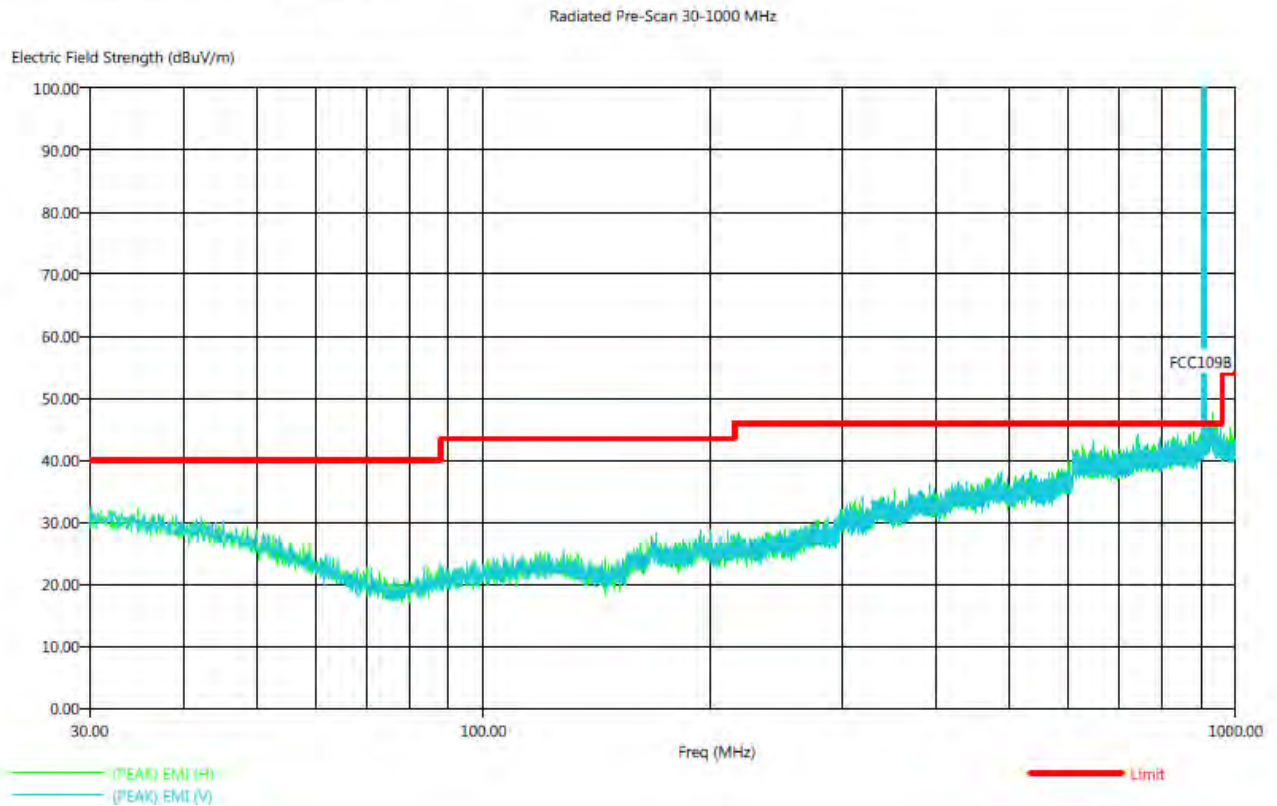


99 Percent BW – 2480 MHz – High Channel

***HYBRID SYSTEM RADIATED EMISSIONS
DATA SHEETS***

Title: Radiated Pre-Scan 30-1000 MHz
File: Radiated Pre-Scan 30-1000 MHz both radios active
Operator: R. Ramirez
EUT Type: LoRa Edge Tracker Reference Design
EUT Condition: Both radios active
Comments: Lab T
Clock Oscillators: 2480 MHz
Company: Semtech Corporation
Model: LR1110TRK1CKS
Temperature: 75 F Humidity: 56 % Pressure: 29.3 inHg
Tested to: 24.8 GHz (no frequencies found above 1 GHz)

8/13/2020 4:00:54 PM
Sequence: Preliminary Scan



Both radios active spurious emissions

Title: Radiated Final 30-1000 MHz
File: Radiated Final 30-1000 MHz both radios active
Operator: R. Ramirez
EUT Type: LoRa Edge Tracker Reference Design
EUT Condition: Both radios active
Comments: Lab T
Clock Oscillators: 2480 MHz
Company: Semtech Corporation
Model: LR1110TRK1CKS
Temperature: 75 F Humidity: 56 % Pressure: 29.3 inHg
Tested to: 24.8 GHz (no frequencies found above 1 GHz)

8/13/2020 4:15:15 PM
Sequence: Final Measurements

Data

Freq (MHz)	Pol	(PEAK) Trace (dBuV)	Cable (dB)	Transducer (dB)	(PEAK) EMI (dBuV/m)	(QP) EMI (dBuV/m)	Limit (dBuV/m)	(QP) Margin (dB)	Twr Ht (cm)	Ttbt Agl (deg)
34.80	H	12.58	0.45	21.52	34.55	30.14	40.00	-9.86	325.10	12.20
352.70	H	12.28	1.71	19.30	33.29	30.61	46.00	-15.39	250.30	358.70
392.40	V	13.29	1.87	20.70	35.86	32.18	46.00	-13.82	194.20	100.00
428.20	H	12.99	2.07	22.20	37.26	33.91	46.00	-12.09	365.10	1.80
440.00	V	14.32	2.14	21.70	38.16	34.44	46.00	-11.56	280.00	1.90
468.80	H	13.39	2.20	22.31	37.90	34.10	46.00	-11.90	295.70	72.10
483.00	H	13.92	2.20	22.80	38.92	34.49	46.00	-11.51	134.60	151.60
489.30	V	12.67	2.20	22.56	37.43	34.16	46.00	-11.84	220.30	356.30
536.40	H	12.39	2.27	23.30	37.96	34.70	46.00	-11.30	313.50	6.60
646.60	V	15.37	2.69	24.50	42.56	38.53	46.00	-7.47	173.30	195.40
741.10	V	14.67	2.96	26.00	43.63	39.60	46.00	-6.40	250.50	334.80
792.90	V	13.72	3.09	26.22	43.03	39.66	46.00	-6.34	228.10	357.60
836.50	V	13.77	3.17	27.05	44.00	40.41	46.00	-5.59	355.30	170.00

Both radios active spurious emissions