



Engineering Solutions & Electromagnetic Compatibility Services

FCC Certification Application Report

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FCC ID	YL6-143SEM300PY	Test Report Date	January 16, 2024
Model / Variant	ADC-SEM-300 / Paraguay	RTL Work Order #	2023119
		RTL Quote #	QRTL23-119
American National Standard Institute	ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
FCC Classification	DXX – Part 15 Low Power Communication Device Transmitter		
FCC Rule Part(s)/ Guidance	15.249: Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz, and 24.0-24.25 GHz (09/23/2023)		
Frequency Range (MHz)	Output Power (W)	Frequency Tolerance	Emission Designator
919.8	N/A	N/A	N/A
921.4	N/A	N/A	N/A

I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this test report. No modifications were made to the equipment during testing in order to achieve compliance with these standards. Furthermore, there was no deviation from, additions to, or exclusions from, the applicable parts of FCC Part 2, FCC Part 15, and ANSI C63.10.

Signature: 

Date: January 16, 2024

Typed/Printed Name: Desmond A. Fraser

Position: President

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These test(s) are accredited under Rhein Tech Laboratories, Inc. ISO/IEC 17025 accreditation issued by ANAB. Refer to certificate and scope of accreditation AT-1445.

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1 General Information

1.1 Scope

This is an original FCC certification application request for Alarm.com Model: ADC-SEM-300, Variant: Paraguay.

Applicable Standards:

- FCC Part 15.249: Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz, and 24.0-24.25 GHz

1.2 Description of EUT

Equipment Under Test	Alarm.com System Enhancement Module (SEM)
Model / Variant	ADC-SEM-300 / Paraguay
Power Supply	12 VDC (external supply)
Modulation Type	FSK, GFSK
Frequency Range	919.8 and 921.4 MHz
Antenna Type	Internal Wire Monopole

1.3 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located at 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170.

1.4 Related Submittal(s)/Grant(s)

None.

1.5 Modifications

None.

2 Test Information

2.1 Description of Test Modes

In accordance with FCC 15.31(m), the following frequencies were tested.

Table 2-1: Channels Tested

Frequency (MHz)
919.8
921.4

2.2 Exercising the EUT

The EUT was programmed for continuous transmission at 919.8 and 921.4 MHz. The EUT was tested in all three orthogonal planes in order to determine worst-case emissions. The carrier was also checked to verify that information was being transmitted.

2.3 Test Result Summary

Table 2-2: Test Result Summary

Test	FCC Reference	Pass/Fail or N/A
AC Power Conducted Emissions	15.207	N/A
Radiated Emissions	15.209	Pass
Field Strength of Fundamental and Harmonics	15.249(a)	Pass
Band Edge	15.249(d)	Pass
99% Bandwidth		Pass

2.4 Test System Details

The test samples were received on October 16, 2023. The FCC identifiers for all applicable equipment, plus descriptions of all cables used in the tested system, are identified in the following table.

Table 2-3: Equipment Under Test

Part	Manufacturer	Model / Variant	Serial Number	FCC ID	Cable Description	RTL Bar Code
System Enhancement Module	Alarm.com	ADC-SEM-300 / Paraguay	3540231111 32357	YL6-143SEM300PY	N/A	24277

Table 2-4: Auxiliary Equipment

Part	Manufacturer	Model	Serial Number	Cable Description	RTL Bar Code
DC Supply	Hewlett Packard	291A	1928A05365	Unshielded	900773

2.5 Configuration of Tested System

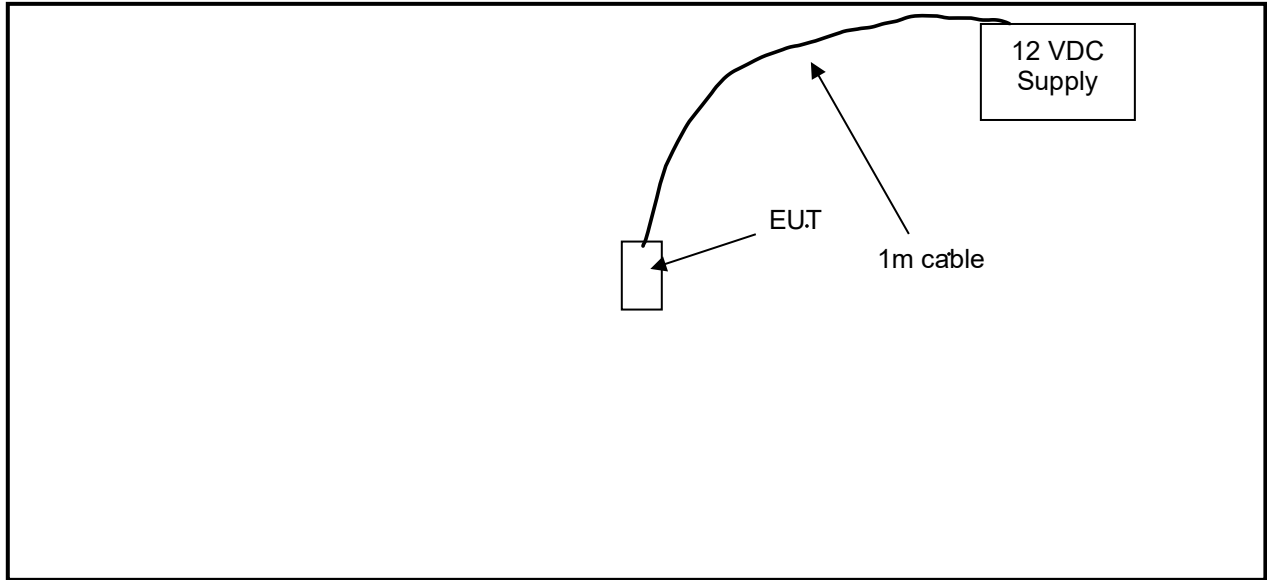


Figure 2-1: Configuration of System Under Test

3 Duty Cycle – FCC 15.209, 15.249(a)

3.1 Duty Cycle Calculation

A duty cycle correction factor of -8 dB ($=20 \cdot \text{LOG}(0.397)$) was used to arrive at average levels for the harmonics measured.

The duty cycle factor was calculated as follows:

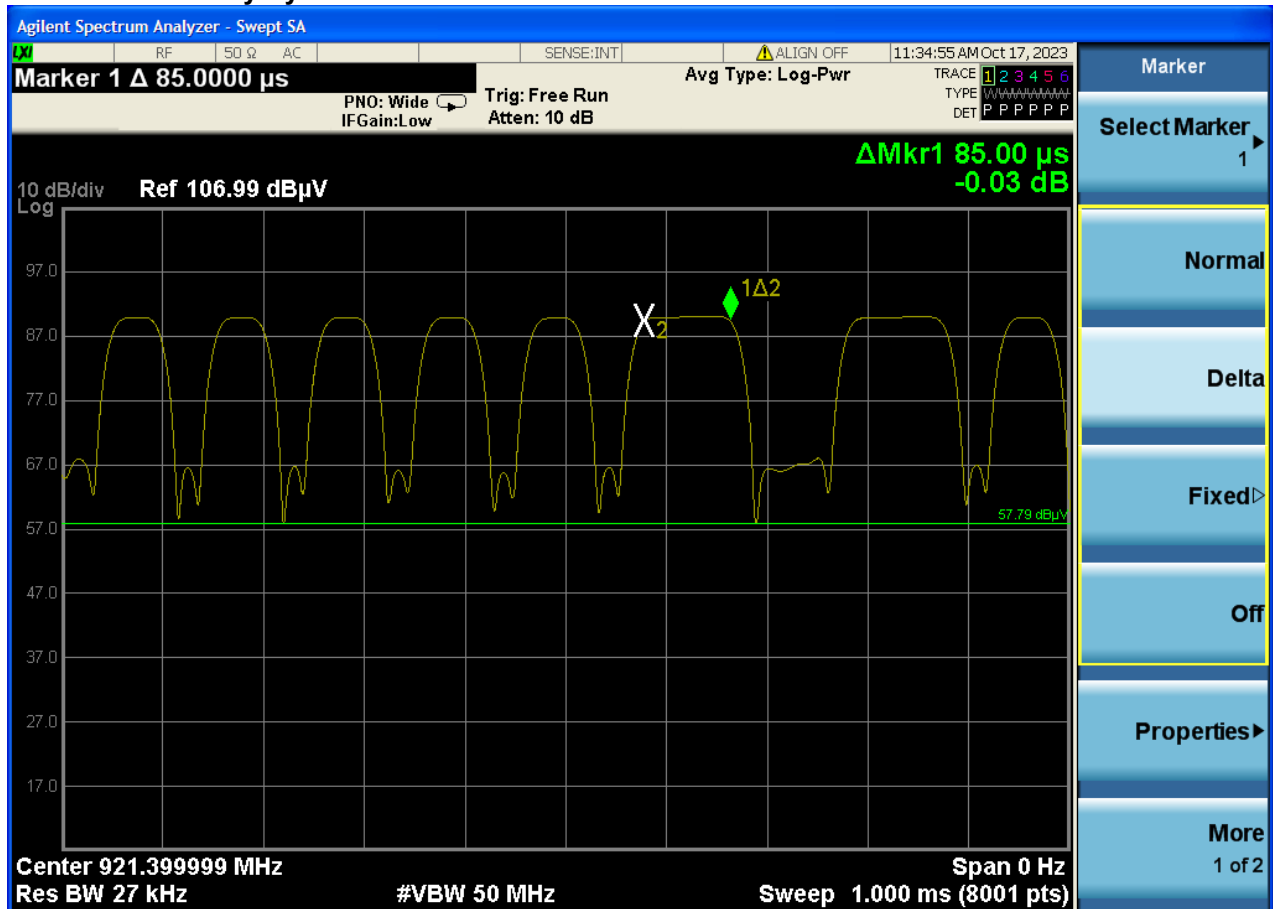
1. The wide pulse and narrow pulse respectively were measured in Plots 3-1 and 3-2 with values of 85 and 41 microseconds respectively.
2. All wide and narrow pulses in Plot 3-3 were counted which corresponded to a count of 30 for the wide pulses and 20 for the narrow pulses.
3. The duration of all the pulses were normalized over 100 milliseconds, which resulted in an on-time of 39.7 milliseconds over 100 milliseconds or 0.397.

Table 3-1: Duty Cycle Environmental Conditions

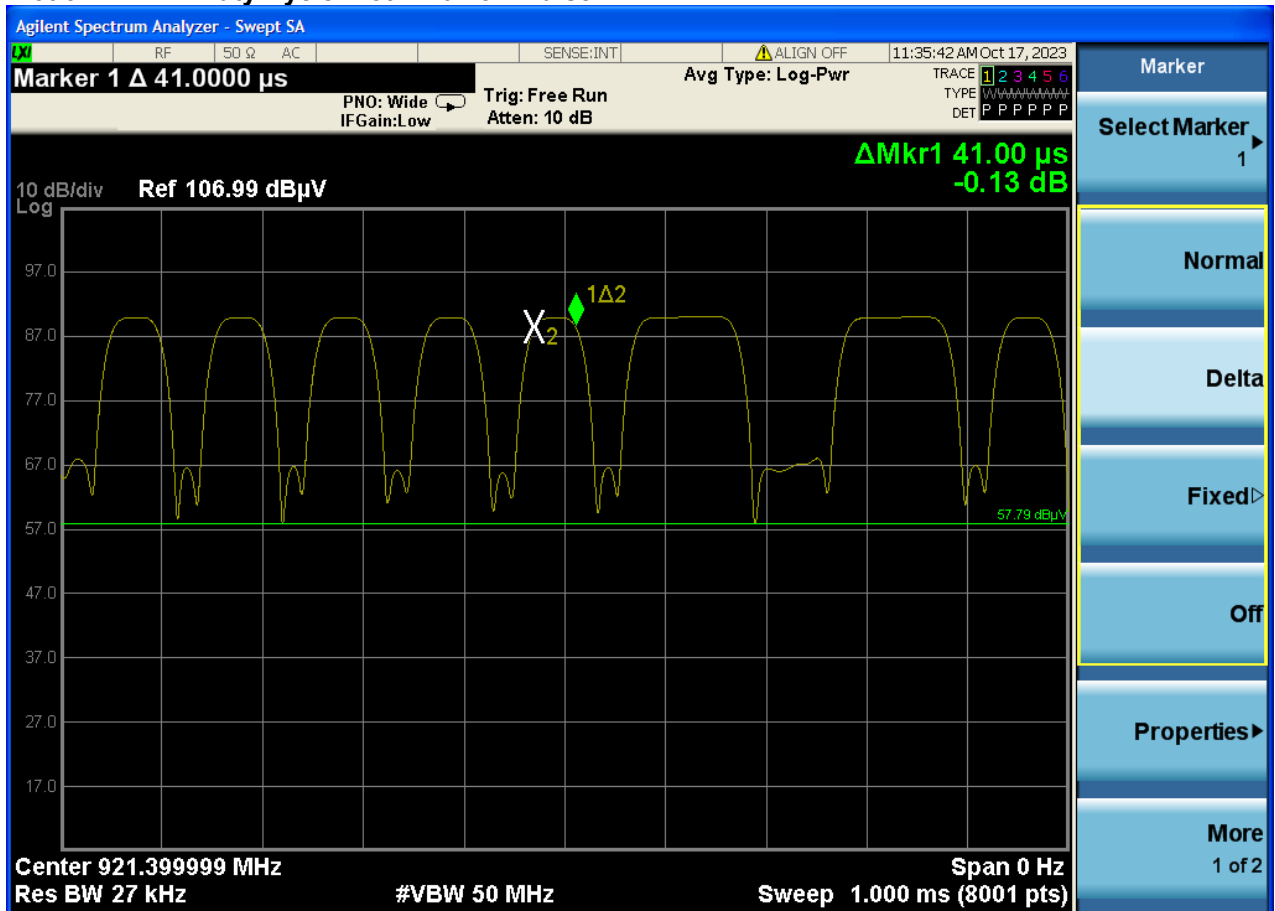
Date	Temperature (°C)	Humidity (%)	Pressure (kPa)
October 17, 2023	16.6	36	101.3

3.2 Duty Cycle Plots

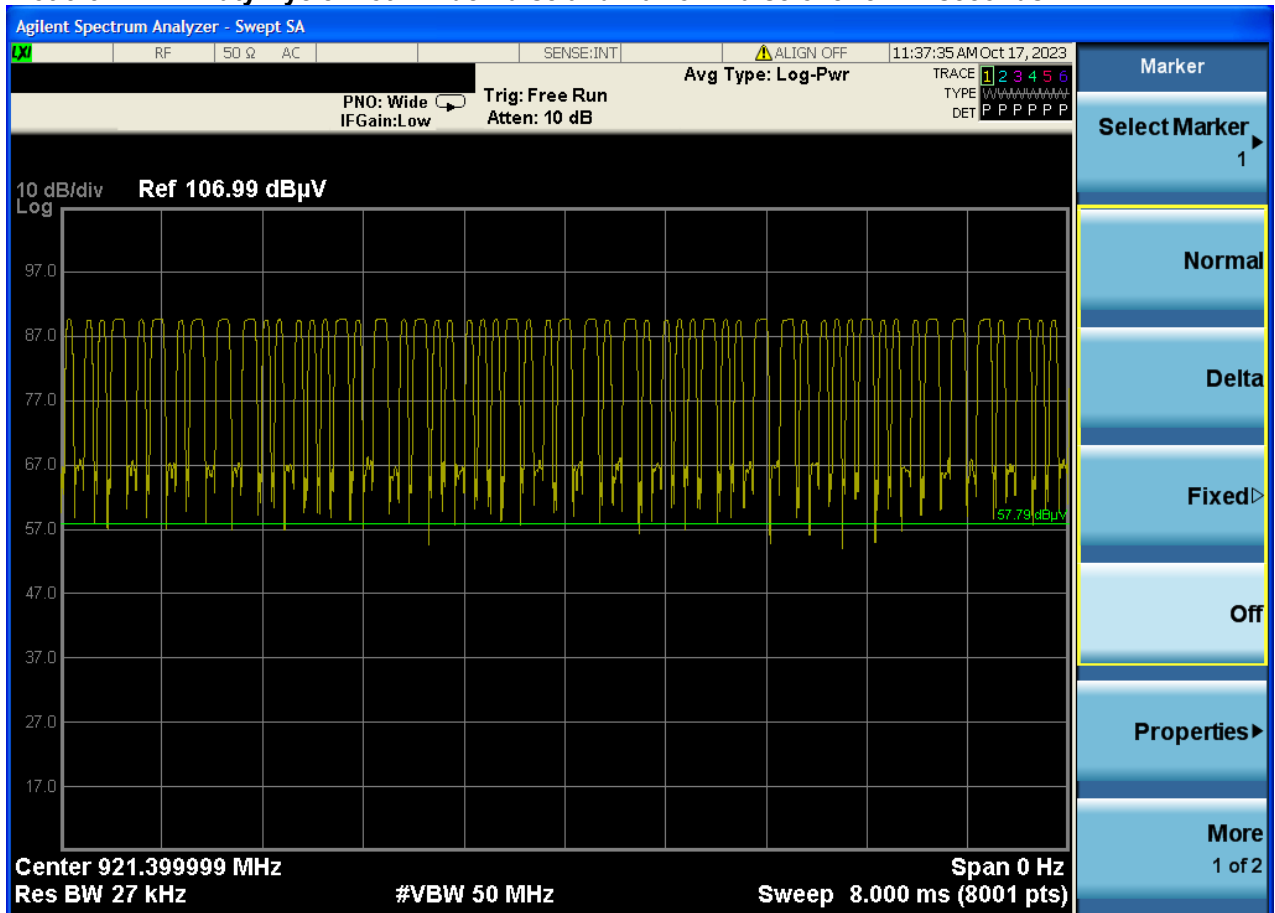
Plot 3-1: Duty Cycle Plot – Wide Pulse



Plot 3-2: Duty Cycle Plot – Narrow Pulse



Plot 3-3: Duty Cycle Plot - Wide Pulse and Narrow Pulse over 8 Milliseconds



Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor $k = 2$.

Measurement uncertainty: +4.6 dB

Result: Pass

Test Personnel

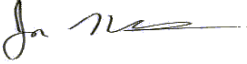
Jon Wilson Test Engineer	 Signature	October 17, 2023 Date of Test
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Table 3-2: Duty Cycle Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901583	Agilent	N9010A	EXA Signal Analyzer	MY51250846	10/04/2024

4 Radiated Emissions – FCC 15.209, 15.249(a)

4.1 Limits of Radiated Emissions Measurement

Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009-0.490	2400/f (kHz)	300
0.490-1.705	2400/f (kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

As shown in 15.35(b), for frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any circumstances of modulation.

4.1.1 Radiated Emissions Measurement Test Procedure

Before final measurements of radiated emissions were made on the open-field three/ten-meter range, the EUT was scanned indoors at one- and three-meter distances. This was done in order to determine its emissions spectrum signature. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emissions measurements on the open-field range, at each frequency, in order to ensure that maximum emission amplitudes were attained.

Final radiated emissions measurements were made on the three/ten-meter, open-field test site. The EUT was placed on a nonconductive turntable 0.8 m (< 1 GHz) / 1.5 m (> 1 GHz) above the ground plane. The spectrum was examined from 9 kHz to the 10th harmonic of the highest fundamental transmitter frequency (9.16 GHz).

At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations. For frequencies between 30 and 1000 MHz, the spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. For emissions above 1000 MHz, emissions are measured using the average detector function with a minimum resolution bandwidth of 1 MHz. No video filter less than 10 times the resolution bandwidth was used. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

Table 4-1: Radiated and Colocated Emissions Spurious Environmental Conditions

Date	Temperature (°C)	Humidity (%)	Pressure (kPa)
October 16, 2023	18	38	101.5

4.2 Radiated Emissions Test Results

Table 4-2: Radiated Emissions Test Data – Quasi-Peak

Emission Frequency (MHz)	Quasi-Peak Detector Level (dBuV/m) (120 kHz RBW/ 300 kHz VBW)	Site Correction Factor (dB/m)	Quasi-Peak Corrected (dBuV/m)	Quasi-Peak Limit (dBuV/m)	Margin (dB)
919.8	47.1	44.2	91.3	94.0	-2.7
921.4	47.5	44.3	91.8	94.0	-2.2

Note: Testing performed at 3m

4.3 Radiated Emissions Harmonics/Spurious Test Data

Table 4-3: Radiated Emissions Harmonics – 919.8 MHz; Peak

Emission Frequency (MHz)	Peak Detector (dBuV/m) (1 MHz RBW/ 3 MHz VBW)	Site Correction Factor (dB/m)	Peak Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
1839.6	38.3	3.2	41.5	74.0	-32.5
2759.4	56.5	-6.0	50.5	74.0	-23.5
3679.2	38.9	-7.6	31.3	74.0	-42.7
4599.0	38.4	-1.5	36.9	74.0	-37.1
5518.8	38.5	-0.3	38.2	74.0	-35.8
6438.6	38.2	1.0	39.2	74.0	-34.8
7358.4	38.0	1.2	39.2	74.0	-34.8
8278.2	36.9	7.5	44.4	74.0	-29.6
9198.0	39.4	7.8	47.2	74.0	-26.8

Table 4-4: Radiated Emissions Harmonics – 919.8 MHz; Average

Emission Frequency (MHz)	Average Detector (dBuV/m) (1 MHz RBW/ 3 MHz VBW)	Site Correction Factor (dB/m)	Average Corrected (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
1839.6	30.3	3.2	33.5	54.0	-20.5
2759.4	48.5	-6.0	42.5	54.0	-11.5
3679.2	30.9	-7.6	23.3	54.0	-30.7
4599.0	30.4	-1.5	28.9	54.0	-25.1
5518.8	30.5	-0.3	30.2	54.0	-23.8
6438.6	30.2	1.0	31.2	54.0	-22.8
7358.4	30.0	1.2	31.2	54.0	-22.8
8278.2	28.9	7.5	36.4	54.0	-17.6
9198.0	31.4	7.8	39.2	54.0	-14.8

Table 4-5: Radiated Emissions Spurious – 919.8 MHz; Quasi-Peak

Emission Frequency (MHz)	Quasi-Peak (dBuV/m) (120 kHz RBW/ 300 kHz VBW)	Site Correction Factor (dB/m)	Quasi-Peak Corrected (dBuV/m)	Limit (dBuV/m)	Margin (dB)
160.0	53.7	-16.9	36.8	43.5	-6.7

Table 4-6: Radiated Emissions Harmonics – 921.4 MHz; Peak

Emission Frequency (MHz)	Peak Detector (dBuV/m) (1 MHz RBW/ 3 MHz VBW)	Site Correction Factor (dB/m)	Peak Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
1842.8	36.0	3.2	39.2	74.0	-34.8
2764.2	56.3	-6.0	50.3	74.0	-23.7
3685.6	40.0	-7.4	32.6	74.0	-41.4
4607.0	37.9	-1.5	36.4	74.0	-37.6
5528.4	38.5	-0.3	38.2	74.0	-35.8
6449.8	39.4	1.0	40.4	74.0	-33.6
7371.2	38.6	1.2	39.8	74.0	-34.2
8292.6	38.3	7.5	45.8	74.0	-28.2
9214.0	38.4	7.8	46.2	74.0	-27.8

Table 4-7: Radiated Emissions Harmonics – 921.4 MHz; Average

Emission Frequency (MHz)	Average Detector (dBuV/m) (1 MHz RBW/ 3 MHz VBW)	Site Correction Factor (dB/m)	Average Corrected (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
1842.8	28.0	3.2	31.2	54.0	-22.8
2764.2	48.3	-6.0	42.3	54.0	-11.7
3685.6	32.0	-7.4	24.6	54.0	-29.4
4607.0	29.9	-1.5	28.4	54.0	-25.6
5528.4	30.5	-0.3	30.2	54.0	-23.8
6449.8	31.4	1.0	32.4	54.0	-21.6
7371.2	30.6	1.2	31.8	54.0	-22.2
8292.6	30.3	7.5	37.8	54.0	-16.2
9214.0	30.4	7.8	38.2	54.0	-15.8

Table 4-8: Radiated Emissions Spurious – 921.4 MHz; Quasi-Peak

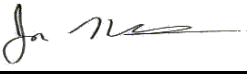
Emission Frequency (MHz)	Quasi-Peak (dBuV/m) (120 kHz RBW/ 300 kHz VBW)	Site Correction Factor (dB/m)	Quasi-Peak Corrected (dBuV/m)	Limit (dBuV/m)	Margin (dB)
160.0	53.7	-16.9	36.8	43.5	-6.7

Note: Testing performed at 3m

Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor k = 2. Measurement uncertainty: +4.6 dB

Result: Pass

Test Personnel

Jon Wilson Test Engineer	 Signature	October 16, 2023 Date of Test
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4.4 Colocation Radiated Emissions

The radiated emissions were investigated with the uncertified Z-Wave module and the Telit cellular module LE910C1-LA, FCC ID: RI7LE910CXLA, collocated and transmitting simultaneously.

No non-compliant emissions were found; per FCC guidance, no data is being reported.

Table 4-9: Radiated Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901669	ETS-Lindgren	3142E	Antenna (.26 - 6 GHz)	00166065	07/11/2025
900772	EMCO	3161-02	Horn Antenna (2 - 4 GHz)	9804-1044	08/05/2024
900321	EMCO	3161-03	Horn Antenna (4 - 8.2 GHz)	9528-1020	08/05/2024
900323	EMCO	3160-07	Horn Antenna (8.2 - 12.4 GHz)	9605-1024	08/05/2024
901583	Agilent	N9010A	EXA Signal Analyzer	MY51250846	10/04/2024
900905	Rhein Tech Laboratories, Inc.	PR-1040	Pre-Amp (30 - 2000 MHz)	1006	01/30/2024
900932	Hewlett Packard	8449B	Preamplifier (1 - 26.5 GHz)	3008A00505	01/30/2024
901334	RF Depot	30-ft SMA	Cable	No	02/03/2024
901668	RF Depot	3-ft SMA	Cable	No	03/21/2024

5 Compliance with the Band Edge – FCC 15.249(d)

5.1 Band Edge Test Procedure

Radiated measurements were taken. The span was set wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation. The spectrum analyzer was set to the following:

RBW > = 100 kHz
 VBW > = RBW
 Sweep = auto
 Detector function = peak
 Trace = max hold

The trace was allowed to stabilize. A display line was compared to the 20 dBc requirement of 15.209 (when using peak emissions), in band emissions.

Table 5-1: Band Edge Environmental Conditions

Date	Temperature (°C)	Humidity (%)	Pressure (kPa)
01/16/24	21.4	20	101.2

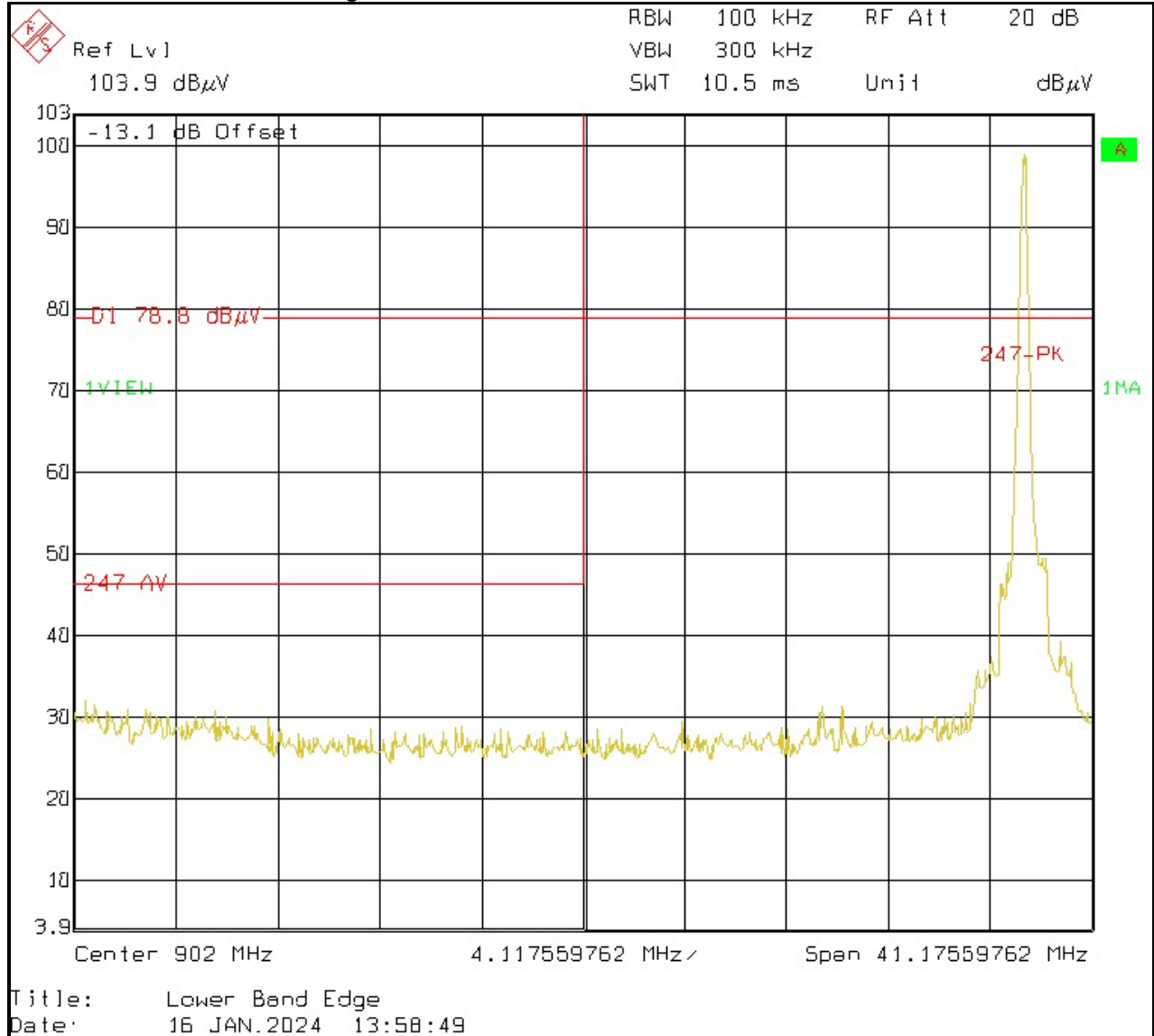
Table 5-2: Band Edge Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901672	Rohde & Schwarz	FSEM30	Spectrum Analyzer	FSEM30	04/25/24
900905	Rhein Tech Laboratories, Inc.	PR-1040	OATS 1 Preamplifier 40dB (30 MHz – 2 GHz)	1006	01/30/24
901727	Insulated Wire Inc.	KPS-1503-360-KPR	SMK RF Cables 36"	NA	11/30/24
901477	Micro-Coax	UFA210A-0-0360-300300	RF cable 0.04 - 18 GHz	212349-002	04/12/23
900725	Antenna Research Associates, Inc.	LPB-2520	Log Periodic / Biconal Antenna	1036	02/10/25

5.2 Band Edge Test Results

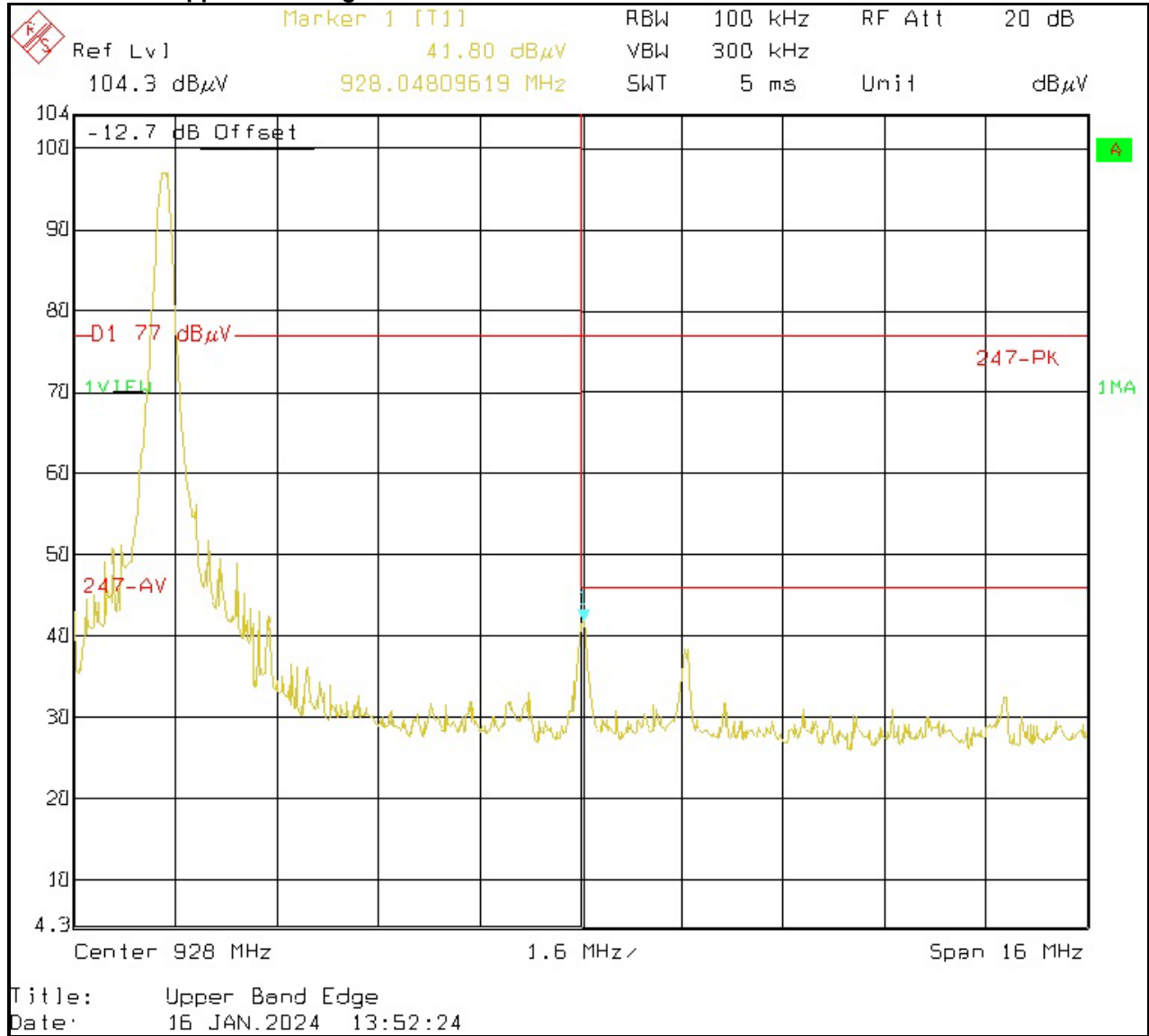
5.2.1 Lower Band Edge

Plot 5-1: Lower Band Edge



5.2.2 Upper Band Edge

Plot 5-2: Upper Band Edge



Measurement uncertainties shown for these tests are expanded Gaussian uncertainties expressed at 95% confidence level using a coverage factor $k = 1.96$. Measurement uncertainty = 0.5 dB.

Result: Pass

Test Personnel:

Daniel W. Baltzell
 Test Engineer

Signature

January 16, 2024
 Date of Test

6 Occupied Channel Bandwidth

6.1 Occupied Bandwidth 99% Test Procedure

The Occupied Bandwidths 99% were measured using a 50 Ω SA. The following settings were used:

Span: 500 kHz 1.5 to 5.0 times the OBW
 RBW: 4.7 kHz 1% to 5% of the OBW
 VBW: 47 kHz ≥ RBW
 Sweep: Auto
 Detector: Peak
 Trace: Max Hold
 Reference: Peak of emission must be more than [10 log(OBW / RBW)] below the reference level

The measurements were repeated a few times until the RBW and VBW follow the above requirement.

6.2 Occupied Bandwidth 99% Limits

No applicable limits.

6.3 Measurement Uncertainty

Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor $k = 2$.

OBW: $\pm 1.0 \times 10^{-6}$ Hz

6.4 Occupied Bandwidth Test Data

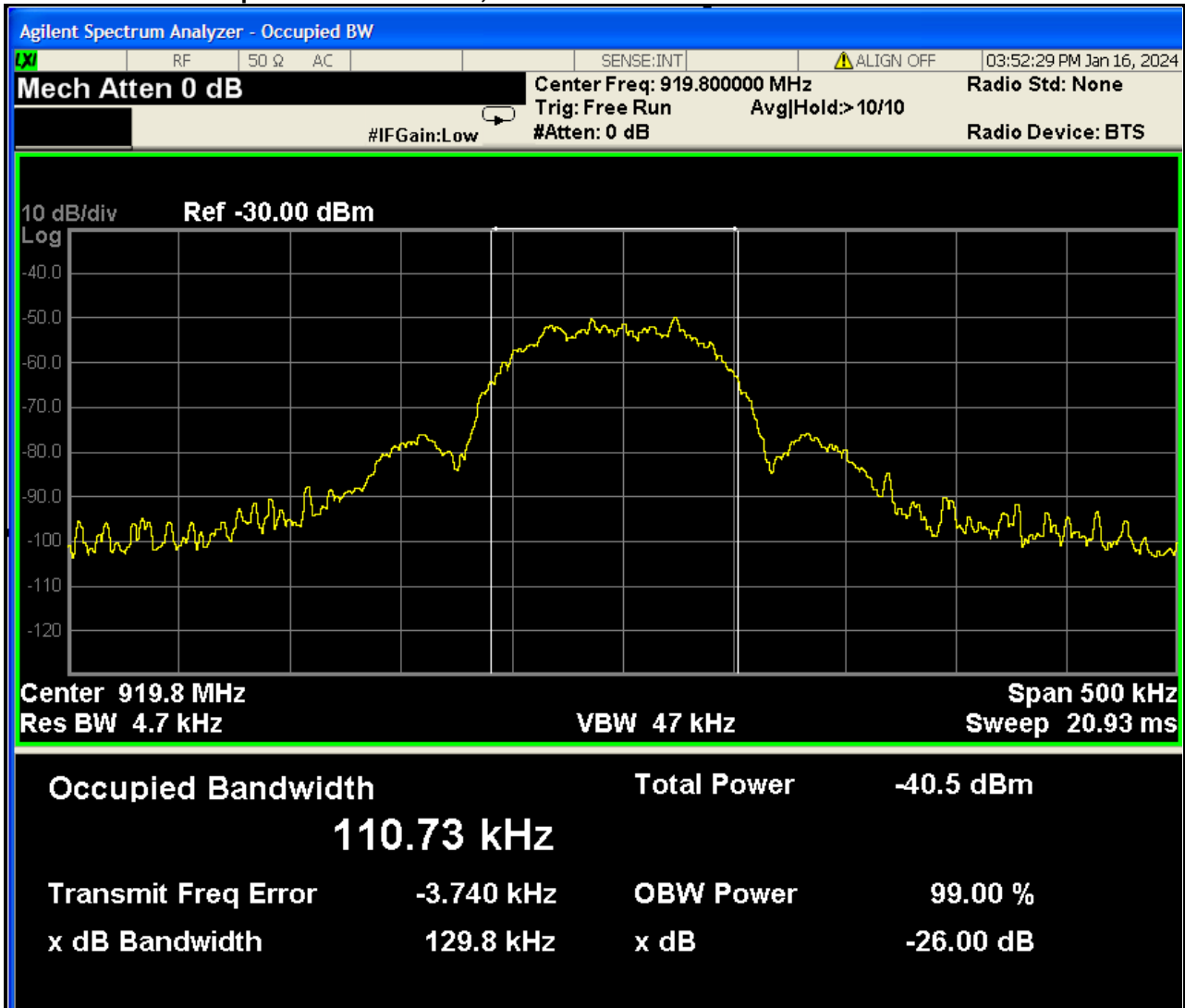
Table 6-1: Occupied Bandwidth Environmental Conditions

Date	Temperature (°C)	Humidity (%)	Pressure (kPa)
01/16/24	21.4	20	101.2

Table 6-2: Occupied Bandwidth Test Results

Frequency (MHz)	Occupied Bandwidth 99% (kHz)
919.8	110.7
921.4	112.1

Plot 6-1: Occupied Bandwidth 99%, 919.8 MHz



Plot 6-2: Occupied Bandwidth 99%, 921.4 MHz

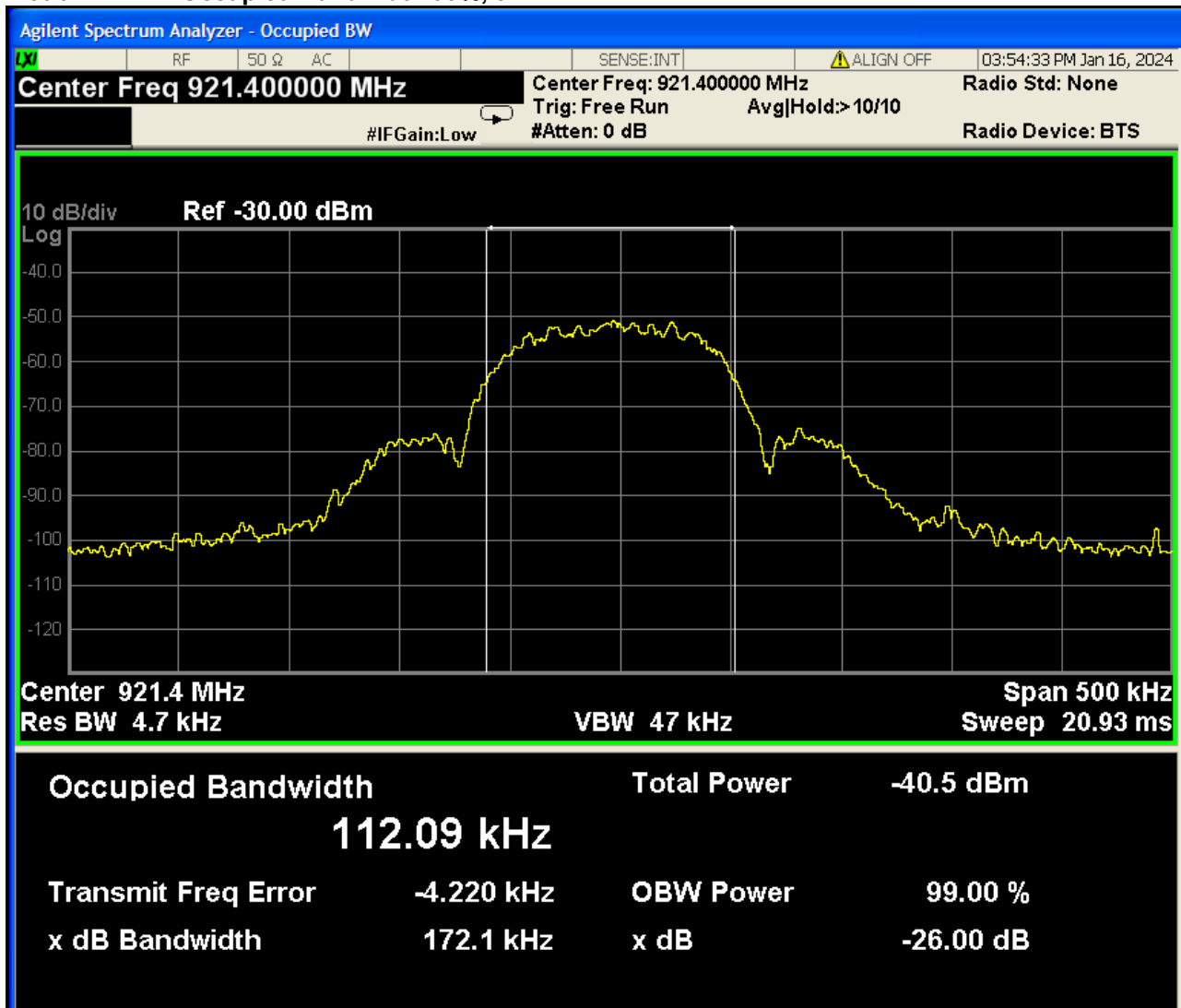


Table 6-3: Occupied Bandwidth Test Equipment

RTL Barcode	Part	Manufacturer	Model	Serial Number	Calibration Due Date
901583	Spectrum Analyzer (10 Hz – 26.5 GHz)	Agilent Technologies	EXA N9010A	MY51250846	10/04/2024

Result: Pass

Test Personnel:

Daniel W. Baltzell
 Test Engineer

Signature

January 16, 2024
 Date of Test

Rhein Tech Laboratories, Inc.
360 Herndon Parkway
Suite 1400
Herndon, VA 20170
<http://www.rheintech.com>

Client: Alarm.com Inc.
Model: ADC-SEM-300 (Paraguay)
Standard: FCC 15.249
FCC ID: YL6-143SEM300PY
Report #: 2023119

7 AC Conducted Emissions - FCC 15.207

The device is powered by external 12 VDC, no AC conducted emissions are required.

8 Conclusion

The data in this measurement report shows that the EUT as tested, Alarm.com Incorporated Model: ADC-SEM-300, Variant: Paraguay, FCC ID: YL6-143SEM300PY, complies with the applicable requirements of Parts 2 and 15 of the FCC Rules and Regulations.