Test Report

Prepared for: A-West Security Systems

Model: AW-2020

Description: Screen Alarm Sensor

FCC ID: 2AV2RAW-2020

To

FCC Part 15.231

Date of Issue: December 2, 2020

On the behalf of the applicant:	**A-West Security Systems** **13215 Moorpark St. #14** **Sherman Oaks, CA 91423**
Attention of:	**Robert Fisher** **Ph: 818-730-0277** **E-mail: awestisbest@gmail.com**

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Project No: p1930015

Greg Corbin
Project Test Engineer

Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	December 2, 2020	Greg Corbin	Original Document

Table of Contents

Description **Page**

ANAB

Compliance Testing, LLC, has been accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to the joint ISO-ILAC-IAF Communiqué dated January 2009).

The tests results contained within this test report all fall within our scope of accreditation, unless noted below.

Please refer to http://www.compliancetesting.com/labscope.html for current scope of accreditation.

FCC Site Reg. #349717

IC Site Reg. #2044A-2

Non-accredited tests contained in this report:

N/A

The applicant has been cautioned as to the following

15.21: Information to User

The user's manual or instruction manual for an intentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

15.27(a): Special Accessories

Equipment marketed to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator the responsible part may employ other methods of ensuring that the special accessories are provided to the consumer, without an additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in § 2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.

Standard Test Conditions Engineering Practices
Except as noted herein, the following conditions and procedures were observed during the testing: FCC 15.231, RSS210, ANSI C63.10-2013

In accordance with ANSI C63.10-2013 and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10° to 40°C (50° to 104°F) unless the particular equipment requirements specified testing over a different temperature range. Also, unless otherwise indicated, the humidity levels were in the range of 10% to 90% relative humidity.

Measurement results, unless otherwise noted, are worst-case measurements.

Environmental Conditions		
Temperature (°C)	**Humidity (%)**	**Pressure (Mbar)**
25.8	12.3	961

EUT Description
Model: AW-2020
Description: window alarm sensor
Serial Number: 1
Highest Clock Frequency: 345 MHz

Additional Information:

The AW2020 is a battery powered supervised stationary transmitter designed for use in window alarm screen applications. The transmitter sends digitally coded wireless signals to the receiver in the security system control panel.
The operating frequency is 345 MHz.
The EUT is powered by a 3.2 vdc battery and includes an 18 inch wire antenna connected to the TX output.
The EUT and antenna are embedded in the window screen frame.

EUT Operation during Tests
The EUT starts transmitting as soon as the battery is connected.
The manufacturer provided the following description of the timing pulse train.
Normal Operation:
Wake up upon an event and send out a unique 128-bit message 6 times twice. Each message is separated by 0.1125 seconds, ZERO pattern. Or in general, over 100 milli-second. Time delay between groups of 6 messages is about 1.125 seconds. Or in general, over 1 second. This time is not precise. See attached "Timing-6 Messages 2 Groups.pdf". So overall, 2 groups of 6 messages each.

Special Test Code Operation:
The manufacturer provided test code to make the testing easier to perform.
A set of twelve pulses repeated every 5 seconds.

The EUT sends a 128 bit message. This message is sent 6 times (1 group) and repeated 1 time (2 groups total), for a total of 12 messages. Each group of 6 messages are separated by 1.16 seconds.
Timing plots for normal operation and the test code are provided in the technical requirements section on page 9.
An analysis of 1 complete message is provided after the timing plots.

Accessories: None

Cables: None

Modifications: None

Test Results Summary

Specification		Test Name	Pass, Fail, N/A	Comments
FCC	ISED			
15.231(a)(2)(3)	RSS-210 A.1.1 (b)(c)	Technical Requirements	Pass	
15.231(b)	RSS-210 A.1.2 (a)	Fundamental Field Strength	Pass	
15.231(b)	RSS-210 A.1.2 (b)	Out of Band Spurious Emissions	Pass	
15.231(c)	RSS-210 A.1.3	99% Occupied Bandwidth	Pass	

Statements of conformity

Statements of conformity are reported as:

- Pass - the measured value is below the acceptance limit, *acceptance limit = test limit*.
- Fail - the measured value is above the acceptance limit, *acceptance limit = test limit*.

Technical Requirements
Engineer: Greg Corbin
Test Date: 11/30/2020

Test Procedure

The EUT was set to transmit and the timing information was captured using the Amplitude vs Time function of a real time spectrum analyzer.
Screenshots of the pulse train are provided after the manufacturer description

The manufacturer provided the following description of the timing pulse train.

Normal Operation:
Wake up upon an event and send out a unique 128-bit message 6 times twice. Each message is separated by 0.1125 seconds, ZERO pattern. Or in general, over 100 milli-second. Time delay between groups of 6 messages is about 1.125 seconds. Or in general, over 1 second. This time is not precise. See attached "Timing-6 Messages 2 Groups.pdf". So overall, 2 groups of 6 messages each.
Notes:

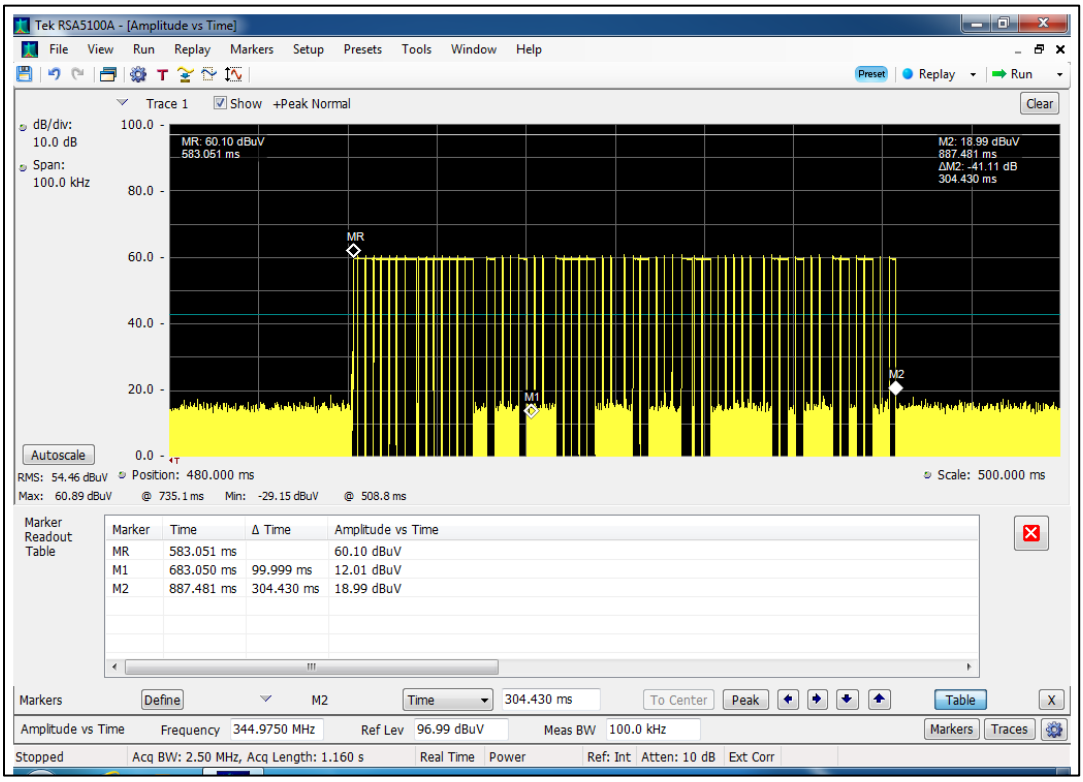
Special Test Code Operation:

A set of twelve pulses repeated every 5 seconds.

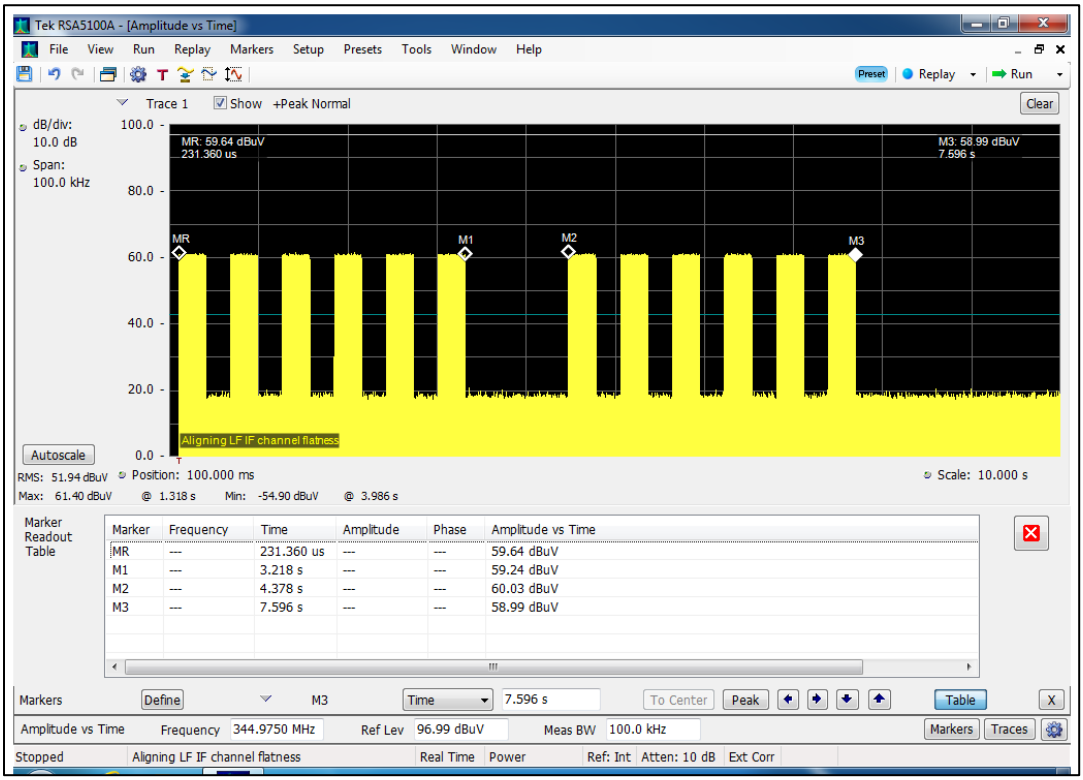
The EUT sends a 128 bit message. This message is sent 6 times (1 group) and repeated 1 time (2 groups total), for a total of 12 messages. Each group of 6 messages are separated by 1.16 seconds.

Normal operation and the test code are provided below.
An analysis of 1 complete message is provided after the timing plots.

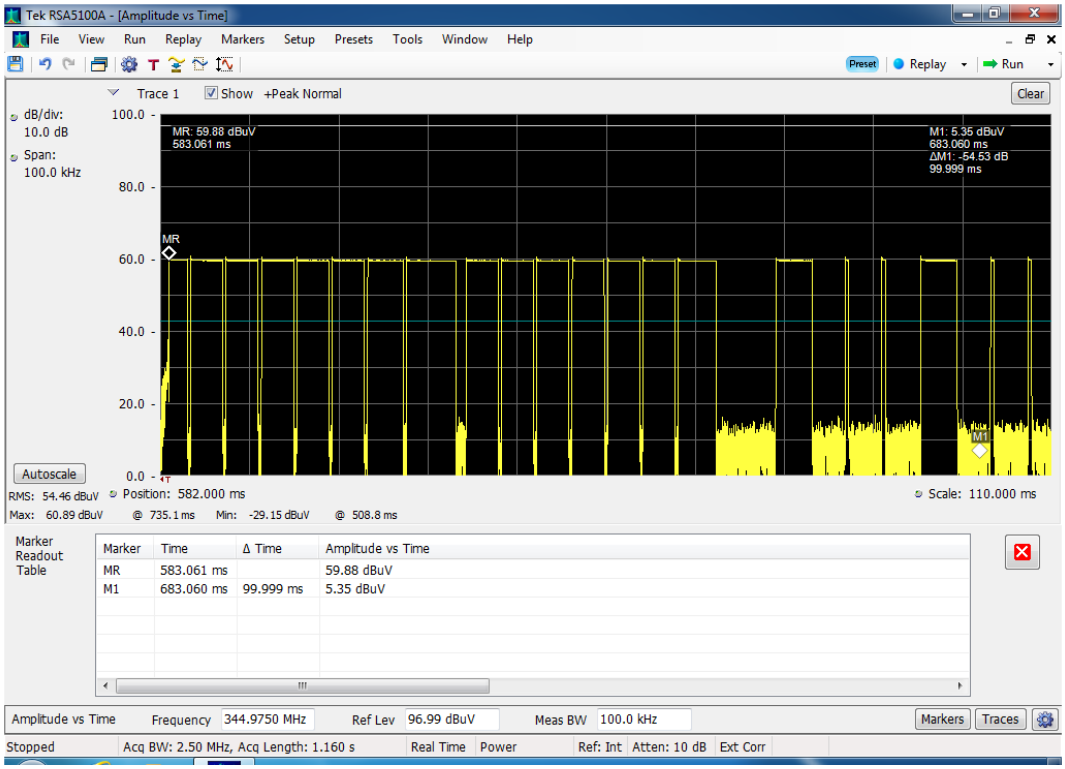
Normal Operation
1 complete message



2 groups of 6 messages

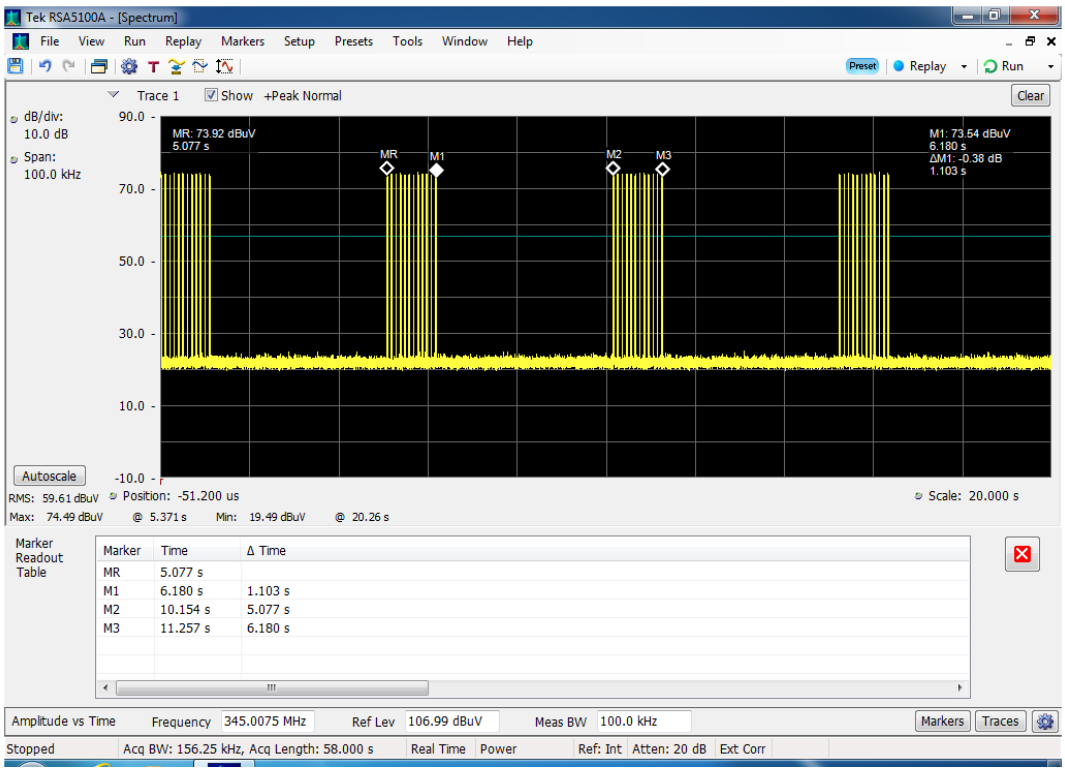


100 ms of 1 message used to calculate Duty Cycle Correction Factor



Test Code

1 set of 12 pulses repeated approximately every 5 seconds



Timing analysis of 1st 100 ms of the message.
There are 19 pulses in 100 ms of the message. The width of each pulse was recorded.

Pulse #	OnTime (ms)
1	2.212
2	3.937
3	3.932
4	3.932
5	3.932
6	3.932
7	4.352
8	6.446
9	3.901
10	3.937
11	3.932
12	9.932
13	9.932
14	9.932
15	4.633
16	4.46
17	0.409
18	0.409
19	4.5
Total	**88.652**

Total transmit time for normal operation	
Each Message (ms)	304.4
Number of messages	6
Total time for 1 group of 6 messages (ms)	1826.4
Number of groups	2
2 groups of 6 messages (ms)	3652.8
Time between groups	1160
Total Transmit time (ms)	**4812.8**
Limit (ms)	**5000**
Pass / Fail	**Pass**

Fundamental Field Strength

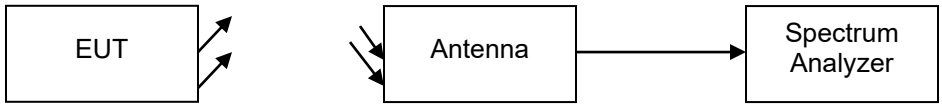
Engineer: Greg Corbin

Test Date: 11/30/2020

Test Procedure

The EUT was tested in a semi-anechoic chamber at a distance of 3 meters from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements for Fundamental Field Strength.

Test Setup



Spectrum Analyzer Settings

Detector Settings	RBW	VBW	Span
Peak	120 kHz	300 kHz	As Necessary

Sample Calculations:
Correction Factors include antenna correction factor, amplifier gain, and cable insertion loss.
Measured Level includes correction factors that were entered into the spectrum analyzer before recording test data.
The field strength was calculated and compared to the limit in
Electric field (dBuV/m) = Measured level (dBuV) + ACF + Cable Loss – Amplifier Gain

Average measurement:
Per Ansi C63.10 when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 s (100 ms).
The average field strength may be found by measuring the peak pulse amplitude (in log equivalent units) and determining the duty cycle correction factor (in dB) associated with the pulse modulation as shown below:

$\delta(dB) = 20\log(\Delta)$
where
δ is the duty cycle correction factor (dB)
Δ is the duty cycle (dimensionless)

This correction factor may then be subtracted from the peak pulse amplitude (in dB) to find the average emission. This correction may be applied to all emissions that demonstrate the same pulse timing characteristics as the fundamental emission

ANSI C63.10-2013, section 7.6 (Evaluation of certain unlicensed wireless devices with periodic emissions against limits) was used to calculate the Duty Cycle Correction Factor.
ANSI C63.10-2013_Equation 13 was used to calculate the Duty Cycle Correction Factor based on the pulses measured in the table above.

Duty Cycle Correction Factor (DCCF)	
=20LOG(ON Time / Total time)	
On Time (88.652 ms)	88.652
Total Time (304.43 ms)	100
Total time is greater than 100 ms, so 100 ms is used	
Duty Cycle Correction Factor (DCCF)	-1.04623

The Limit is a linear interpolation calculated with the following formula:

Limit (uV/m) = L1 + [(Fo-F1)(L2-L1)/(F2-F1)]

L1 = Limit 1 (uV/m)
L2= Limit 2 (uV/m)
F1 = Low Frequency (MHz)
F2 – High Frequency (MHz)
Fo = Measured Frequency (MHz)

All following limits were converted to dBuV/m by the calculation stated below:

20*LOG(uV/m)

15.231 (b) Limits

Fundamental Frequency (MHz)	**Field Strength of Fundamental (uV/m)**	**Field Strength of Spurious Emissions (uV/m)**
260 - 470	3750 to 12500	375 to 1250
Fundamental Frequency (MHz)	**Field Strength of Fundamental (dBuV/m)**	**Field Strength of Spurious Emissions (dBuV/m)**
260 - 470	71.48 – 81.94	51.48 – 61.94

*Linear interpolations

Fundamental Field Strength

Tuned Frequency (MHz)	**Peak Measured Level (dBuV/m)**	**DCCF (dB)**	**Avg Measured Level (dBuV/m)**	**Avg. Limit (dBuV/m)**	**Result**
345	72.92	-1.04	71.88	77.25	Pass

Radiated Spurious Emissions

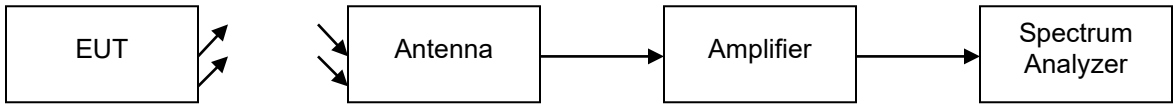
Engineer: Greg Corbin

Test Date: 11/30/2020

Test Procedure

The EUT was tested in a semi-anechoic chamber set 3m from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the limits for Radiated Spurious Emissions. The antenna, amplifier and cable correction factors were input into the spectrum analyzer before recording data. The spectrum for each tuned frequency was examined to the 10^{th} harmonic.

Test Setup



Spectrum analyzer settings:

RBW = 120 kHz below 1 GHz
RBW = 1 MHz above 1 GHz
VBW = 3 x RBW

Detectors:
QP below 1 GHz
Peak and Average above 1 GHz

Sample Calculations:

Correction Factors include Antenna, pre-amplifier, and cable insertion loss correction factors.
Measured Level includes correction factors that were input to the spectrum analyzer before recording test data.

Radiated Spurious Emissions

Spurious Freq (MHz)	Measured Value (dBuV)	Detector	Restricted Band (Y/N)	Limit (dBuV)	Margin (dB)
345	71.6	QP	n	77.2	-5.6
690	35.4	QP	n	57.2	-21.8
1034.8	44.6	Avg	y	54	-9.4
1379.8	39.74	Avg	y	54	-14.26
1724.8	45.7	Avg	n	57.2	-11.5
2069.8	53.9	Avg	n	57.2	-3.3
2414.8	50.1	Avg	n	57.2	-7.1
2759.9	50.9	Avg	y	54	-3.1
3104.9	47.5	Avg	n	57.2	-9.7
3449.9	46.8	Avg	n	57.2	-10.4
345 (fund)	72.9	Peak	n	97.2	-24.3
690	37.6	Peak	n	77.2	-39.6
1034.8	43.7	Peak	y	74	-30.3
1380.2	39.5	Peak	y	74	-34.5
1724.5	45.5	Peak	n	77.2	-31.7
2070.2	51.7	Peak	n	77.2	-25.5
2414.5	49.65	Peak	n	77.2	-27.55
2759.9	50.3	Peak	y	74	-23.7
3104.9	48.6	Peak	n	77.2	-28.6
3449.9	46.7	Peak	n	77.2	-30.5

99% Occupied Bandwidth

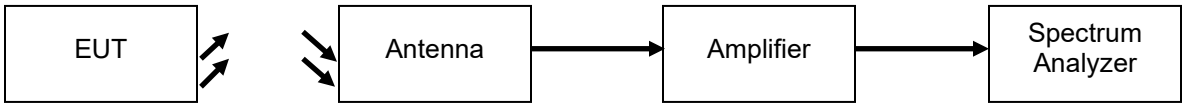
Engineer: Greg Corbin

Test Date: 11/30/2020

Test Procedure

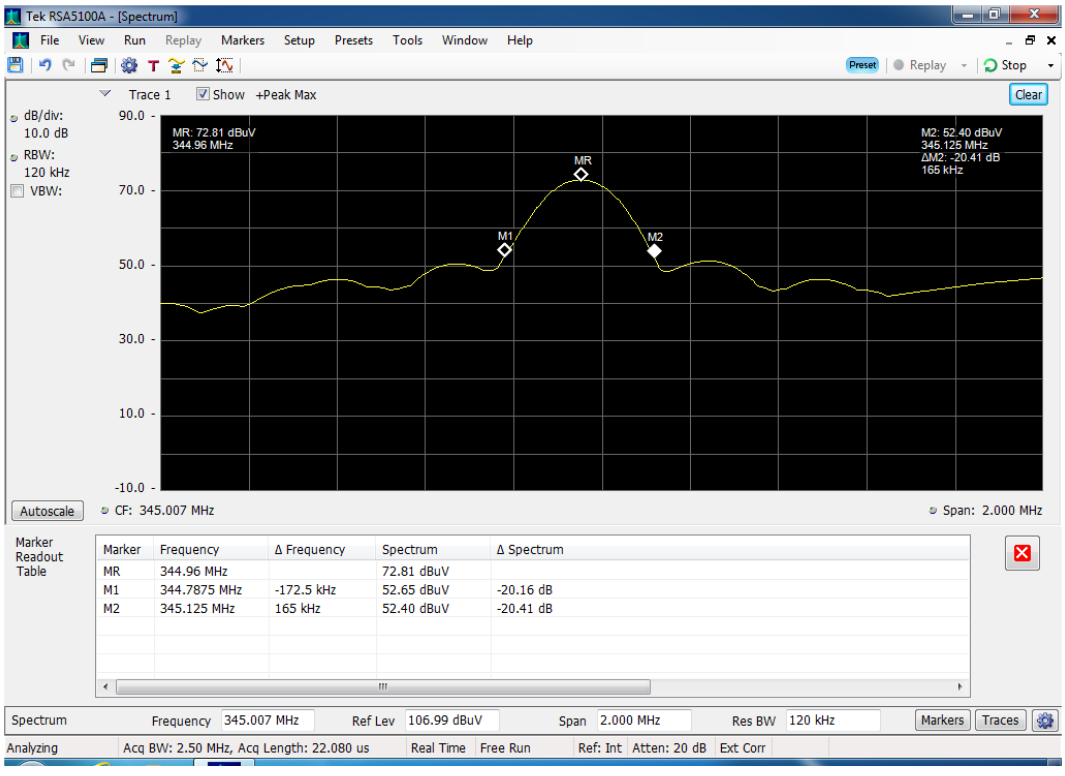
The EUT was tested in a semi-anechoic chamber at a distance of 3 meter from the receiving antenna. The Span was set wide enough to capture the entire transmit spectrum and the resolution bandwidth was set to at least 1% of the span. The analyzer was set to max hold while the occupied bandwidth was measured.

Test Setup



Occupied Bandwidth Summary

Frequency (MHz)	Recorded Measurement (kHz)	Limit (kHz)	Result
345	337.5	862.5	Pass



Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
Bi-Log Antenna	Schaffner	CBL 6111D	i00267	8/28/20	8/28/22
Horn Antenna	ARA	DRG-118/A	i00271	8/3/20	8/3/21
Humidity / Temp Meter	Newport	IBTHX-W-5	i00282	8/28/20	8/28/21
*EMI Analyzer	Agilent	E7405A	i00379	1/21/20	1/21/21
Spectrum Analyzer	Textronix	RSA5126A	i00424	8/3/20	8/3/21
3 Meter Semi-Anechoic Chamber	Panashield	3 Meter Semi-Anechoic Chamber	i00428	7/17/20	7/17/21

In addition to the above listed equipment standard RF connectors and cables were utilized in the testing of the described equipment. Prior to testing these components were tested to verify proper operation.

END OF TEST REPORT