Report on the Testing of the

Cinch Systems, Inc.
RF-HLTS-433; CLR-C1-HLT

FCC ID: 2ABBZ-RF-HLT-433
IC: 11817A-RFHLT433

In accordance with:
FCC 47 CFR Part 15.231
FCC 47 CFR Part 15.109
ISED RSS-210 Issue 10, December 2019
ISED RSS-GEN Issue 5 Amendment 2, February 2021

America

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Prepared for: Cinch Systems, Inc
12075 43rd St NE Ste 300
St Michael MN 55376

COMMERCIAL-IN-CONFIDENCE

Document Number: NC72171055.1 | Issue: 1

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NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
Brad Reasoner	EMC Technical Lead	**Authorized Signatory**	13 August 2021

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD America, Inc. document control rules.

FCC Accreditation Designation Number US1148 New Brighton, MN Test Laboratory	Innovation, Science, and Economic Development Canada Accreditation Site Number 4512A New Brighton, MN Test Laboratory

EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with the standards listed above and the tests shown in Table 1.3.1 of this report.

A2LA Cert. No. 2955.11

TÜV SÜD America Inc
141 14th Street NW
New Brighton, MN 55112

Phone: 651-631-2487
www.tuv-sud-america.com

Contents

1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Table 1.1-1 – Modification Record

Issue	Description of Change	Date of Issue
1	First Issue	13 August 2021

1.2 Introduction

Applicant	Cinch Systems
Manufacturer	Cinch Systems
Applicant's Email Address	jibril.aga@cinchsystems.com
Model Number(s)	RF-HLTS-433; CLR-C1-HLT
Serial Number(s)	156749; n/a
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15.231 FCC 47 CFR Part 15.109 ISED RSS-210 Issue 10, December 2019 ISED RSS-GEN Issue 5 Amendment 2, February 2021
Order Number	72171055
Date of Receipt of EUT	12 JUL 2021
Start of Test	12 JUL 2021
Finish of Test	12 JUL 2021
Related Document(s)	ANSI C63.10 2013 TUV_SUD_PIF-Quotes.pdf

1.3 Scope of Testing

To perform certification testing to confirm that the wireless device(s) meet the requirements of the applicable standards and guidance documents.

1.4 Summary of Results

A summary of the tests carried out in accordance with the specifications shown below.

Table 1.4-1 – Summary of Results

Report Section	Specification Clause		Test Description	Accredit -ation	Base Standard
2.1	15.203	RSS-GEN	Antenna Requirements	A2LA	FCC Part 15.203
2.2	15.231(a)(1), (2)	RSS-210 A.1.1 a, b	Deactivation Period	A2LA	ANSI C63.10:2013
2.3	15.231(a)(3)	RSS-210 A.1.1 c	Pulse Characteristics & Duty Cycle of Transmitter	A2LA	ANSI C63.10:2013
2.4	15.231(b)(1), (e)	RSS-210 A.1.2; A.1.4	Field Strength of Fundamental	A2LA	ANSI C63.10:2013
2.5	15.231(b)(1), (e)	RSS-210 A.1.2; A.1.4	Field Strength of Emissions	A2LA	ANSI C63.10:2013
2.6	15.231(c)	RSS-210 A.1.3	Occupied Bandwidth	A2LA	ANSI C63.10:2013
2.7	15.231(d)	RSS-GEN 6.11	Frequency Stability (40 MHz TX only)	A2LA	ANSI C63.10:2013

Table 1.4-2 – Test Accreditation

Test Name	Name of Tester(s)	Results / Comments
Antenna Requirements	Franklin Rose	Pass
Deactivation Period	Franklin Rose	Pass
Pulse Characteristics &	Franklin Rose	Pass
Duty Cycle of Transmitter	Franklin Rose	Pass
Field Strength of Fundamental	Franklin Rose	Pass
Field Strength of Emissions	Franklin Rose	Pass
Occupied Bandwidth	Franklin Rose	Pass
Frequency Stability (40 MHz TX only)	Franklin Rose	N/A

Note: Tests marked with N/A were not tested due to EUT not meeting the full requirements for test applicability and therefore are not required.

1.5 Product Information

1.5.1 Technical Description

The Equipment Under Test (EUT): Transmitters for periodic operations. transmission of a control signal such as those used with alarm security systems. Rate of rise sensor, Shock sensor, high and low temperature sensor and recess door window sensor

Table 1.5-1 – Wireless Module Technical Information

Detail	Description
FCC ID	2ABBZ-RF-HLT-433
IC	11817A-RFHLT433
Transceiver Model #	RF-HLTS-433; CLR-C1-HLT
Operating Frequency	433.95 MHz
Modulation Format	OOK
Antenna Type / Gain:	0.0

A full description and detailed product specification details are available from the manufacturer.

Table 1.5-2 – Cable Descriptions

Cable/Port	Description
n/a	n/a

Table 1.5-3 – Support Equipment Descriptions

Make/Model	Description
n/a	n/a

1.5.2 Modes of Operation

Table 1.5-4 – Test Frequencies & Modes of Operation

Channel	Frequency (MHz)
Single Channel Operation	433.95 MHz

1.6 Deviations from the Standard

No deviations from the applicable test standard were made during testing.

1.7 EUT Modification Record

The table below details modifications made to the EUT during the test program. The modifications incorporated during each test are recorded on the appropriate test pages.

Table 1.7-1 – Modification Record

Modification State	Description of Modification fitted to EUT	Modification Fitted By	Date Modification Fitted
0	Initial State		

1.8 Test Location

TÜV SÜD conducted the following tests at our New Brighton, MN Test Laboratory.
Office address:

TÜV SÜD America
141 14th Street NW
New Brighton, MN 55112 USA

2 Test Details

2.1 Antenna Requirements

2.1.1 Specification Reference

FCC 47 CFR Part 15 Subpart C, 15.203
RSS-GEN Issue 5

2.1.2 Equipment Under Test and Modification State

As shown in §1.4 with modification state “0”, as noted in §1.6.

2.1.3 Antenna Requirement

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§15.211, 15.213, 15.217, 15.219, 15.221, or §15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

Note: Above statement is taken from FCC Part 15 Subpart C §15.203

Table 2.1-1 – Antenna Used In EUT

Antenna Type	Connection Type	Antenna Gain
Integral	n/a	0.0

Note: The antenna and antenna connector are fully contained within the EUT and are inaccessible to the end user.

2.2 Deactivation Period

2.2.1 Specification Reference

FCC 47 CFR Part 15.231(a)(1), (2)
ISED RSS-210 A.1.1 a, b

2.2.2 Equipment Under Test and Modification State

As shown in §1.4 with modification state “0”, as noted in §1.6.

2.2.3 Date of Test

2021-July-12

2.2.4 Test Method

The spectrum analyzer was triggered to sweep on the TX of the device. Sweep time was set equal to or greater than the specified time for periodic operation. The device was manually activated and to confirm that it ceases transmission within the specified time of deactivation. Periodic transmissions at regular predetermined intervals were verified to not exist, except where regulatory requirements allow polling or supervision transmissions, including data, to determine system integrity. In addition to this test data, compliance is addressed by an attestation supported by the equipment theory of operation.

2.2.5 Environmental Conditions

The EUT was evaluated within the climatic range of the EUT as specified by the manufacturer. When the manufacturer does not specify climatic parameters for the EUT, all tests are performed within the ambient climatic conditions of the laboratory.

2.2.6 Test Results

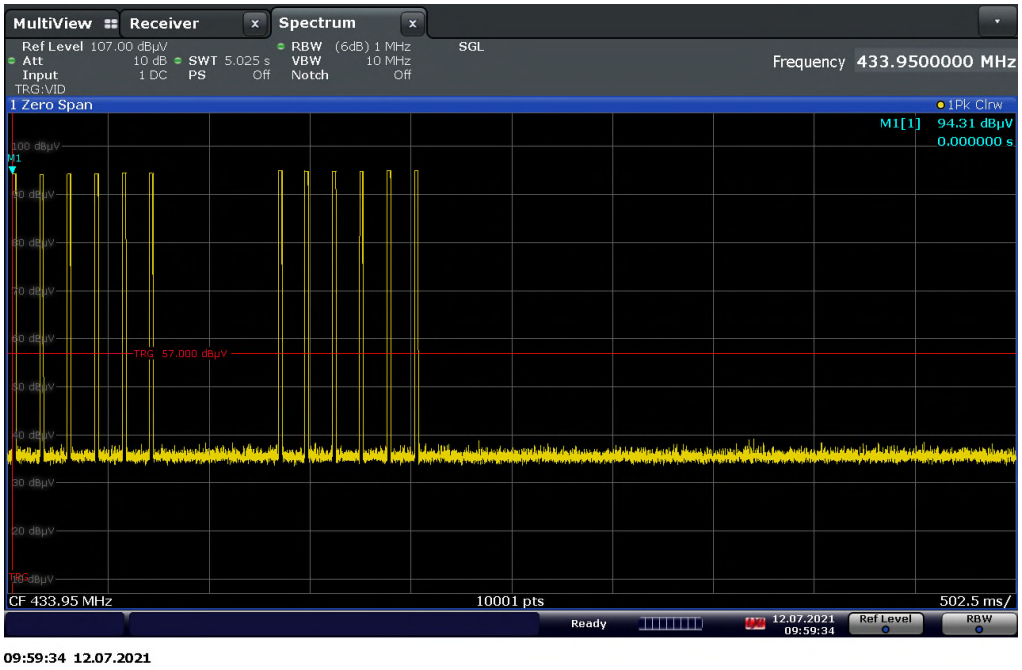

Figure 2-1 – Deactivation Period

Test Summary: The EUT operated as intended before, during, and after testing.

Test Result: Pass

2.2.7 Test Location and Test Equipment Used

The tests were carried out in New Brighton, MN.
Test Area: 3mSAC

Table 2.2-1 – Conducted Emissions Test Equipment List

Device #	Manufacturer	Description	Model	Serial #	Cal Code	Cal Date	Cal Due
WRLE10998	Rohde & Schwarz	Receiver, 20 Hz-26.5 GHz	ESU 26	100379	G	05/21/2021	11/20/2021
NBLE11141	Hewlett-Packard	Preamplifier, 100 kHz-1300 MHz	8447D	2944A08773	B	01/08/2021	01/08/2022
NBLE11645	SCHWARZBECK MESS-ELEKTRONIK	Antenna, Trilog Broadband, 30-7000 MHz	VULB 9162	0254	G	04/09/2021	04/09/2023

Cal Code G = Calibration performed by an accredited outside source.
Cal Code B = Calibration verification performed internally.
Cal Code Y = Passive Device, or Calibration not required when used with other calibrated equipment.

2.3 Pulse Characteristics / Duty Cycle

2.3.1 Specification Reference

FCC 47 CFR Part 15.231(a)(3)
ISED RSS-210 A.1.1 c

2.3.2 Equipment Under Test and Modification State

As shown in §1.4 with modification state “0”, as noted in §1.6.

2.3.3 Date of Test

2021-July-12

2.3.4 Test Method

The EUT switches, controls, or input data streams were adjusted to ensure that the EUT is transmitting or encoded to obtain the “worst-case” pulse ON time. A radiated, direct connection (i.e., conducted) or a “near-field” coupling method was used to assess the EUT. The RBW was adjusted to be equal or larger than the occupied bandwidth of the signal; the center frequency of the spectrum analyzer was set to the center of the RF signal, and the spectrum analyzer was put into Time Domain analysis (Zero Hz Span). The Sweep Time was adjusted to obtain at least a 100 ms period of time on the horizontal display axis of the spectrum analyzer.

The EUT pulse train is **aperiodic** (i.e., consists of a series of pulses that do not repeat in a characteristic pattern over a constant time period), or the period (T) is greater than 100 ms. The Trigger was set to capture at least 100 ms. The maximum pulse “On time” (tON) over 100 ms was chosen, and Total Pulse On time was determined by summing the duration of all of the pulses within the pulse train [i.e., tON = Σ(t1 + t2 + …tn), and the duty cycle was then determined by dividing the total maximum “ON time” by the period of the pulse train (tON/T).

The duty cycle correction factor was then determined by applying the following equation to the duty cycle determined in the preceding steps:

*20 * Log(numeric duty cycle) = Duty Correction (dB)*

2.3.5 Environmental Conditions

The EUT was evaluated within the climatic range of the EUT as specified by the manufacturer. When the manufacturer does not specify climatic parameters for the EUT, all tests are performed within the ambient climatic conditions of the laboratory.

2.3.6 Test Results

Table 2.3-1 – Pulse Characteristics Results

Burst Name / Number	Pulse Name / Number	Pulse Width (µs)	Occurrences in Period	Total On-time (µs)
1	1	100	43	4300
1	2	200	20	4000
			TOTAL	8300

Total On-Time: **8300 µs**

Aperiodic Duty Cycle: 8.3 ms / 100 ms = 0.083 = **8.3%**

Duty Correction Factor: 20 * Log(0.083) = **-21.62 dB**

Test Summary: The EUT was operating continuously during emissions testing. During normal operation the EUT will be limited to the operation specified in this section.

Test Result: Pass

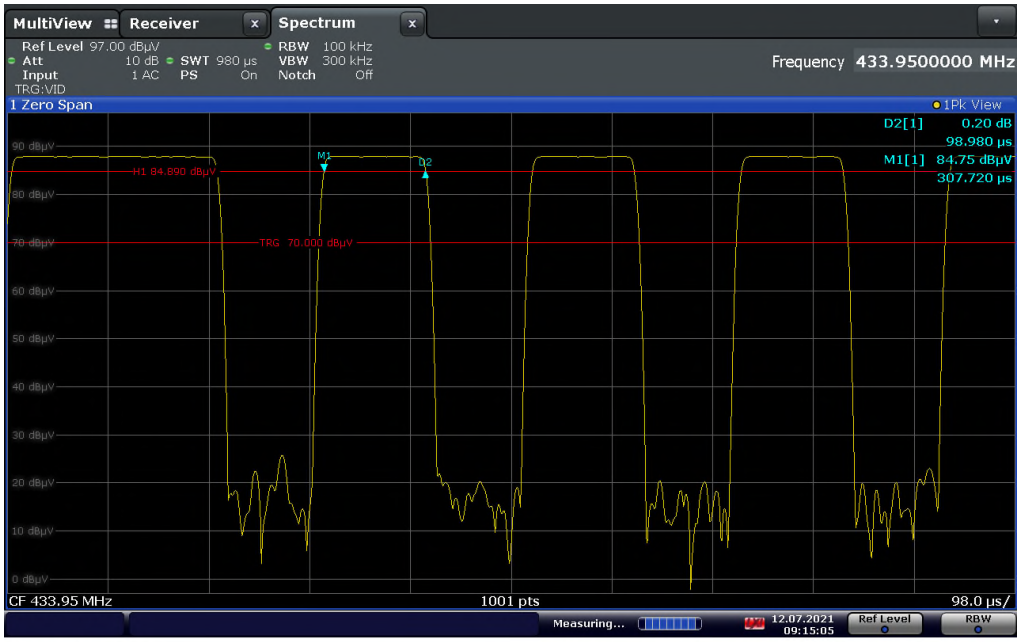

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Figure 2-2 – Pulse 1 Width - 100 us

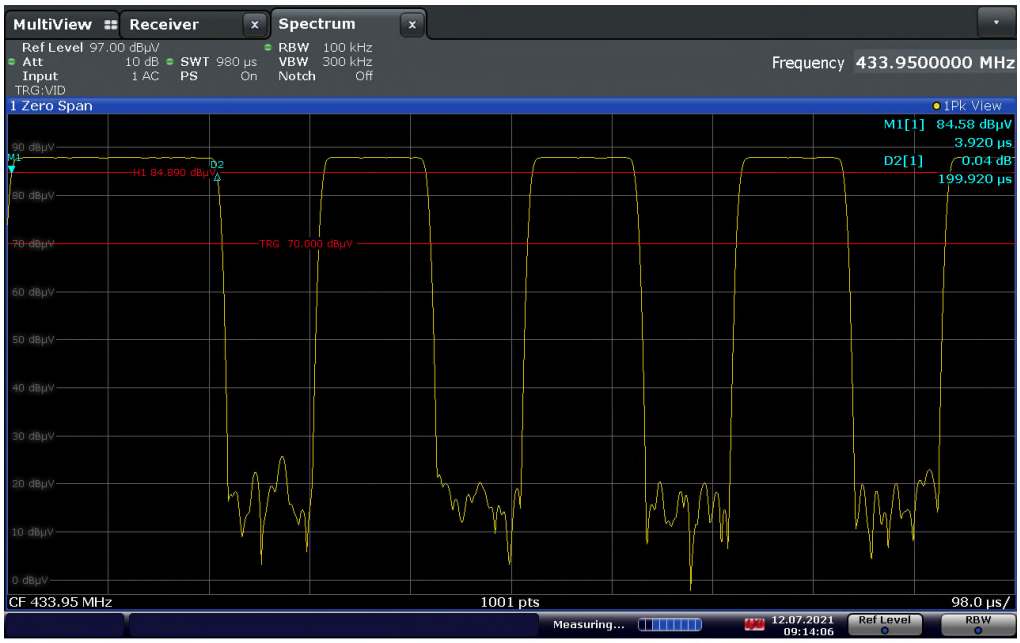

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Figure 2-3 – Pulse 2 Width – 200 us

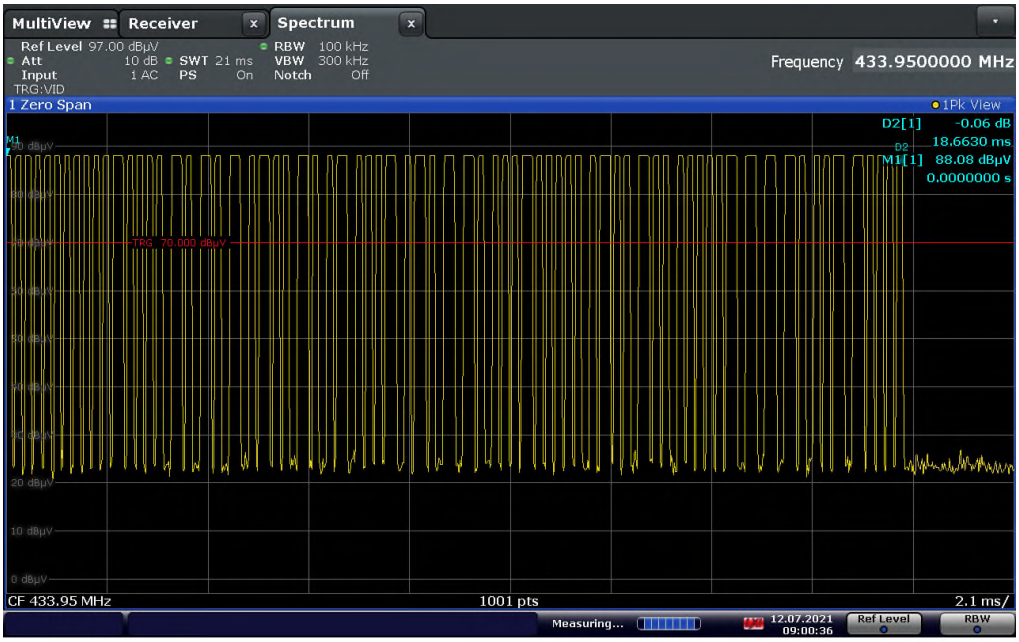

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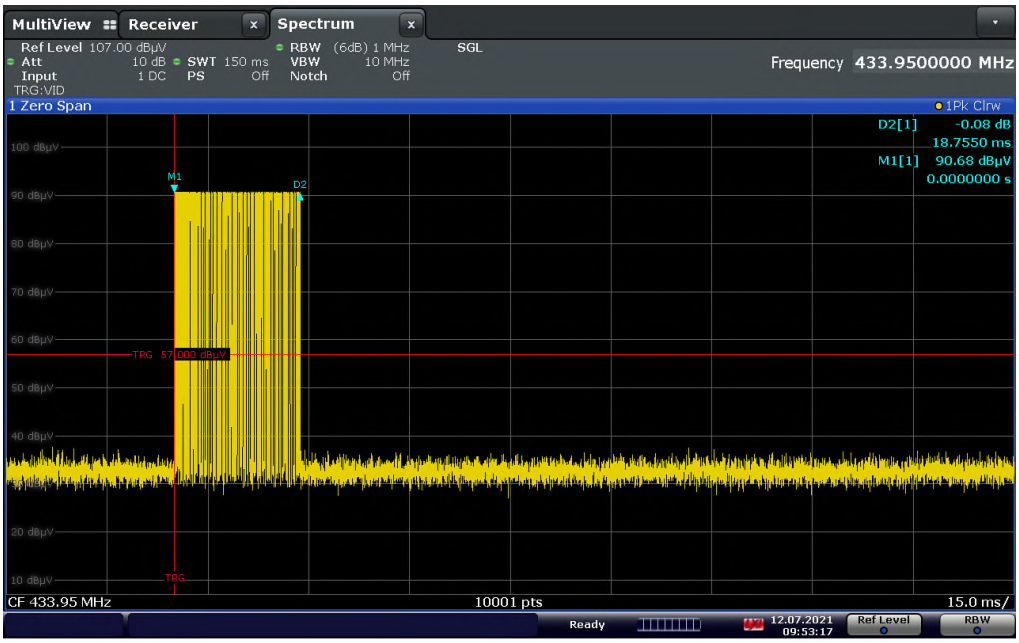
Figure 2-4 – Burst 1



09:53:17 12.07.2021

Figure 2-5 – Bursts in 100 ms

2.3.7 Test Location and Test Equipment Used

The tests were carried out in New Brighton, MN.
Test Area: 3mSAC

Table 2.3-2 – Conducted Emissions Test Equipment List

Device #	Manufacturer	Description	Model	Serial #	Cal Code	Cal Date	Cal Due
WRLE10998	Rohde & Schwarz	Receiver, 20 Hz-26.5 GHz	ESU 26	100379	G	05/21/2021	11/20/2021
NBLE11141	Hewlett-Packard	Preamplifier, 100 kHz-1300 MHz	8447D	2944A08773	B	01/08/2021	01/08/2022
NBLE11645	SCHWARZBECK MESS-ELEKTRONIK	Antenna, Trilog Broadband, 30-7000 MHz	VULB 9162	0254	G	04/09/2021	04/09/2023

Cal Code G = Calibration performed by an accredited outside source.
Cal Code B = Calibration verification performed internally.
Cal Code Y = Passive Device, or Calibration not required when used with other calibrated equipment.

2.4 Radiated Fundamental Field Strength

2.4.1 Specification Reference

FCC 47 CFR Part 15.231(b)(1), (e)
ISED RSS-210 A.1.2; A.1.4

2.4.2 Equipment Under Test and Modification State

As shown in §1.4 with modification state “0”, as noted in §1.6.

2.4.3 Date of Test

2021-July-12

2.4.4 Test Method

The EUT was set up in a semi-anechoic chamber on a remotely controlled turntable and placed on a non-conductive table 0.8 m above a reference ground plane for 30-1000 MHz and 1.5m above the ground plane for above 1 GHz.

For 30-1000 MHz a pre-scan of the EUT emissions profile was made while varying the antenna-to-EUT azimuth and antenna-to-EUT polarization using a peak detector; measurements were taken at a 3m distance.

For above 1 GHz a pre-scan of the EUT emissions profile was made while varying the antenna-to-EUT azimuth and antenna-to-EUT polarization using peak and average detectors; measurements were taken at a 3m distance.

For all frequency ranges the final readings were maximized by adjusting the antenna height, polarization and turntable azimuth, in accordance with the specification. For final measurements below 1 GHz a quasi-peak detector was used and above 1 GHz final measurements were re-measured with peak and average detectors.

2.4.5 Environmental Conditions

The EUT was evaluated within the climatic range of the EUT as specified by the manufacturer. When the manufacturer does not specify climatic parameters for the EUT, all tests are performed within the ambient climatic conditions of the laboratory.

2.4.6 Additional Observations

The highest frequency to which the DUT was measured in accordance with §15.33(a)(1).

Automated measurements used BAT-EMC (v3.18) software. Measurements were done at a 3m distance. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only.

2.4.7 Sample Computation (Radiated Emissions)

Measuring equipment raw measurement (dBµV) @ 30 MHz			20.0
Correction Factor (dB)	Cable 2	0.24	18.94
	TEMC00011 (antenna)	18.70	
Reported Quasi-peak Final Measurement (dBµV/m) @ 30 MHz			38.94

2.4.8 Test Results

Test Summary: Measurements between 1-18 GHz were taken with a attenuator in front of the pre-amp to prevent overloading. EUT operated as intended before, during, and after testing. The EUT was measured in accordance with both 15.231(b)(2) and 15.35(c), and the duty cycle correction factor has been applied.

Test Result: Pass

Table 2.4-1 – Fundamental Emission 433.95 MHz

Tuned Frequency (MHz)	Detector	Meter Reading (dBµV)	Antenna Polarity	Duty Cycle Correction (dB)	Correction Factor (dB)	Distance (m)	Field Strength (dBµV/m)	15.231 Fundamental Limit (dBuV/m)	Margin (dB)
433.95	PK	92.91	H	-21.62	4.02	3.00	75.31	80.83	-5.52

2.4.9 Test Location and Test Equipment Used

The tests were carried out in New Brighton, MN.
Test Area: 3mSAC

Table 2.4-2 – Radiated Emissions Equipment List

Device #	Manufacturer	Description	Model	Serial #	Cal Code	Cal Date	Cal Due
WRLE10998	Rohde & Schwarz	Receiver, 20 Hz-26.5 GHz	ESU 26	100379	G	05/21/2021	11/20/2021
NBLE11141	Hewlett-Packard	Preamplifier, 100 kHz-1300 MHz	8447D	2944A08773	B	01/08/2021	01/08/2022
NBLE11645	SCHWARZBECK MESS-ELEKTRONIK	Antenna, Trilog Broadband, 30-7000 MHz	VULB 9162	0254	G	04/09/2021	04/09/2023

Cal Code G = Calibration performed by an accredited outside source.
Cal Code B = Calibration verification performed internally.
Cal Code Y = Passive Device, or Calibration not required when used with other calibrated equipment.

2.5 Radiated Spurious Emissions

2.5.1 Specification Reference

FCC 47 CFR Part 15.231(b)(1), (e)
ISED RSS-210 A.1.2; A.1.4

2.5.2 Equipment Under Test and Modification State

As shown in §1.4 with modification state “0”, as noted in §1.6.

2.5.3 Date of Test

2021-July-12

2.5.4 Test Method

The EUT was set up in a semi-anechoic chamber on a remotely controlled turntable and placed on a non-conductive table 0.8 m above a reference ground plane for 30-1000 MHz and 1.5m above the ground plane for above 1 GHz.

For 30-1000 MHz a pre-scan of the EUT emissions profile was made while varying the antenna-to-EUT azimuth and antenna-to-EUT polarization using a peak detector; measurements were taken at a 3m distance.

For above 1 GHz a pre-scan of the EUT emissions profile was made while varying the antenna-to-EUT azimuth and antenna-to-EUT polarization using peak and average detectors; measurements were taken at a 3m distance.

For all frequency ranges the final readings were maximized by adjusting the antenna height, polarization and turntable azimuth, in accordance with the specification. For final measurements below 1 GHz a quasi-peak detector was used and above 1 GHz final measurements were re-measured with peak and average detectors.

2.5.5 Environmental Conditions

The EUT was evaluated within the climatic range of the EUT as specified by the manufacturer. When the manufacturer does not specify climatic parameters for the EUT, all tests are performed within the ambient climatic conditions of the laboratory.

2.5.6 Additional Observations

The highest frequency to which the DUT was measured in accordance with §15.33(a)(1).

Automated measurements used BAT-EMC (v3.18) software. Measurements were done at a 3m distance. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only.

2.5.7 Sample Computation (Radiated Emissions)

Measuring equipment raw measurement (dBµV) @ 30 MHz			20.0
Correction Factor (dB/m)	Cable 2	0.24	18.94
	TEMC00011 (antenna)	18.70	
Reported Quasi-peak Final Measurement (dBµV/m) @ 30 MHz			38.94

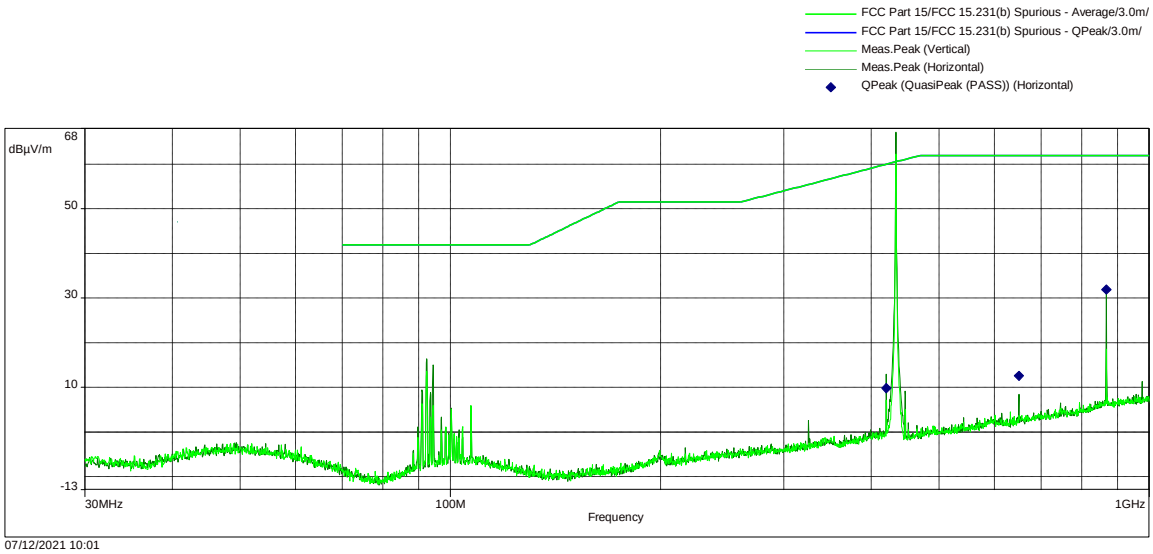
2.5.8 Test Results

Test Summary: Measurements between 1-18 GHz were taken with a attenuator in front of the pre-amp to prevent overloading. EUT operated as intended before, during, and after testing. The EUT was measured in accordance with both 15.231(b)(2) and 15.35(c), and the duty cycle correction factor has been applied.

Test Result: Pass

See data below for detailed results.

Frequency Range	Polarity	Antenna Distance	RBW	Step Size	Sweep Time
30MHz- 1GHz	Vertical	3m	100kHz	18001Pts	Auto
30MHz- 1GHz	Horizontal	3m	100kHz	18001Pts	Auto



Limit:
FCC §15.231

Test Results:
Pass

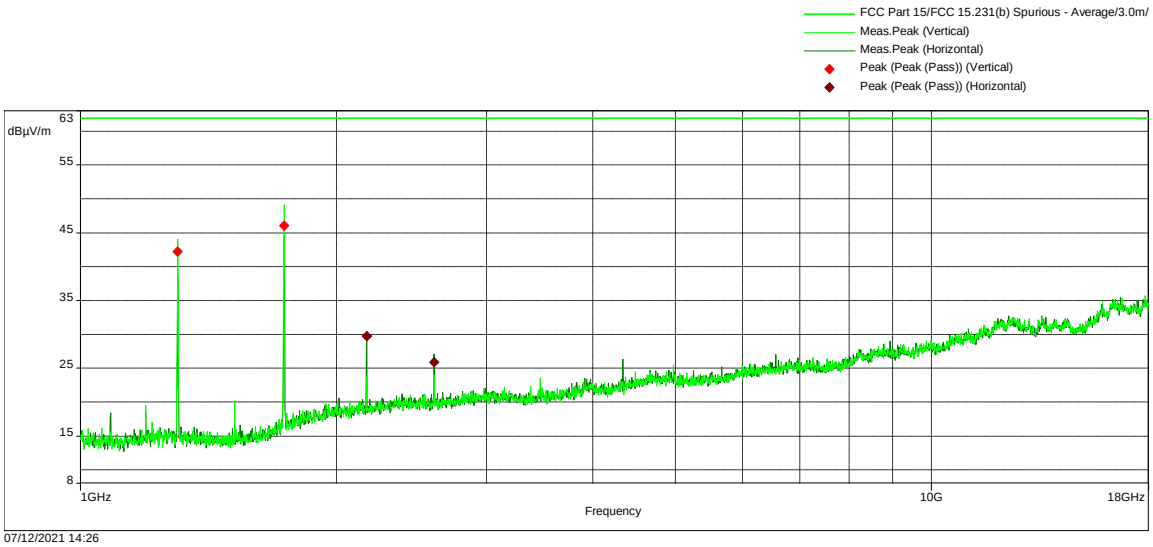
Test Notes: The emissions shown have been duty cycle corrected. The emission at 433.95 MHz is the fundamental and is not subject to this limit. Emissions in the vicinity of 100 MHz were also noted to be environmental radio noise and were therefore disregarded.

Figure 2-6 – RE Spurious Emissions 30-1000 MHz

Table 2.5-1 – RE Spurious Emissions 30-1000 MHz

Frequency	Quasi-Peak Level (dBuV/m)	Quasi-Peak Limit (dBuV/m)	Quasi-Peak Margin (dB)	Azimuth (º)	Height (m)	Polarity	Quasi-Peak Result
420.35994MHz	9.75	59.97	-50.22	137.00	1.00	Horizontal	PASS
650.91779MHz	12.59	61.94	-49.35	277.00	1.39	Horizontal	PASS
867.89038MHz	31.89	61.94	-30.05	288.00	1.00	Horizontal	PASS

Frequency Range	Polarity	Antenna Distance	RBW	Step Size	Sweep Time
1GHz- 18GHz	Vertical	3m	1MHz	18001Pts	Auto
1GHz- 18GHz	Horizontal	3m	1MHz	18001Pts	Auto



Limit:
FCC §15.231

Test Results:
Pass

Test Notes: The emissions shown have been duty cycle corrected.

Figure 2-7 – RE Spurious Emissions 1-18 GHz

Table 2.5-2 – RE Spurious Emissions 1-18 GHz

Frequency	**Average** (DC Corrected Peak Level) **(dBuV/m)**	Average Limit (dBuV/m)	Average Margin (dB)	Azimuth (º)	Height (m)	Polarity	Average Result
1.3012778GHz	42.22	61.94	-19.72	123.00	1.39	Vertical	PASS
1.7347778GHz	46.07	61.94	-15.87	123.00	1.90	Vertical	PASS
2.1692222GHz	29.72	61.94	-32.22	35.00	1.00	Horizontal	PASS
2.6027222GHz	25.92	61.94	-36.02	6.00	1.80	Horizontal	PASS

2.5.9 Test Location and Test Equipment Used

The tests were carried out in New Brighton, MN.
Test Area: 3mSAC

Table 2.5-3 – Radiated Emissions Equipment List

Device #	Manufacturer	Description	Model	Serial #	Cal Code	Cal Date	Cal Due
WRLE10998	Rohde & Schwarz	Receiver, 20 Hz-26.5 GHz	ESU 26	100379	G	05/21/2021	11/20/2021
NBLE11141	Hewlett-Packard	Preamplifier, 100 kHz-1300 MHz	8447D	2944A08773	B	01/08/2021	01/08/2022
NBLE11645	SCHWARZBECK MESS-ELEKTRONIK	Antenna, Trilog Broadband, 30-7000 MHz	VULB 9162	0254	G	04/09/2021	04/09/2023
NBLE11630	ETS-Lindgren	Antenna - DRG	3117	218816	G	09/04/2020	09/04/2022
WRLE11519	Com-Power	Preamplifier - PAM-118A	PAM-118A	18040002	G	01/08/2021	01/08/2022

Cal Code G = Calibration performed by an accredited outside source.
Cal Code B = Calibration verification performed internally.
Cal Code Y = Passive Device, or Calibration not required when used with other calibrated equipment.

2.6 Occupied Bandwidth

2.6.1 Specification Reference

FCC 47 CFR Part 15.231(c)
ISED RSS-210 A.1.3

2.6.2 Equipment Under Test and Modification State

As shown in §1.4 with modification state “0”, as noted in §1.6.

2.6.3 Date of Test

2021-July-12

2.6.4 Test Method

A signal source was connected to the input of the EUT and configured to transmit the appropriate test signal as specified by the standard(s). The center frequency of the Spectrum Analyzer was set to the nominal EUT channel center frequency. The span range for the spectrum analyzer was set between 2 × to 5 × the EBW (or OBW). The RBW was set to 1% to 5% of the anticipated OBW, and the VBW shall be set ≥ 3 × RBW. The reference level of the spectrum analyzer was set to accommodate the maximum input amplitude level, with the detection mode set to peak, and trace mode set to max hold. The OBW automatic measurement function in the spectrum analyzer was utilized to produce either the Power Bandwidth or XdB down Bandwidth.

2.6.5 Environmental Conditions

The EUT was evaluated within the climatic range of the EUT as specified by the manufacturer. When the manufacturer does not specify climatic parameters for the EUT, all tests are performed within the ambient climatic conditions of the laboratory.

2.6.6 Test Results

Table 2.6-1 – Occupied Bandwidth

Frequency (MHz)	Occupied Bandwidth Type	Occupied Bandwidth (kHz)	Limit (kHz)	Margin (kHz)
433.95	99% OBW	143.5	1084.88	941.38

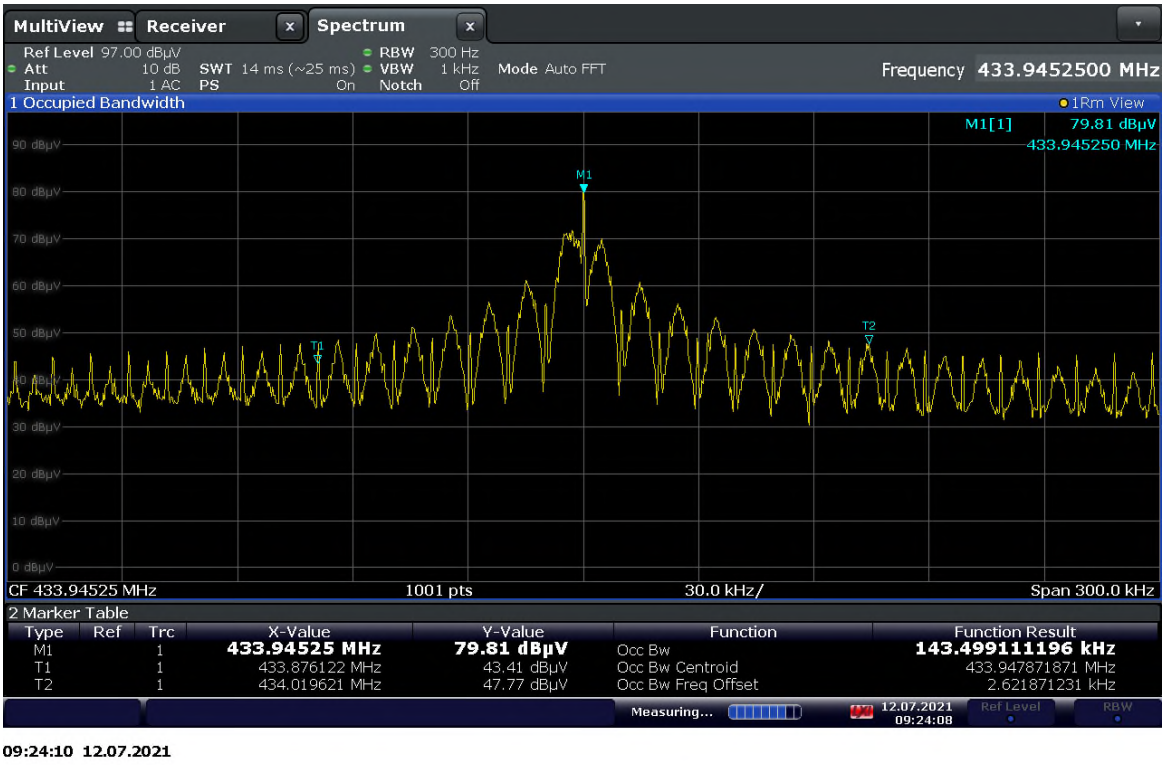


Figure 2-8 – Occupied Bandwidth – 433.95MHz

2.6.7 Test Location and Test Equipment Used

The tests were carried out in New Brighton, MN.
Test Area: 3mSAC

Table 2.6-2 – Conducted Emissions Test Equipment List

Device #	Manufacturer	Description	Model	Serial #	Cal Code	Cal Date	Cal Due
WRLE10998	Rohde & Schwarz	Receiver, 20 Hz-26.5 GHz	ESU 26	100379	G	05/21/2021	11/20/2021
NBLE11141	Hewlett-Packard	Preamplifier, 100 kHz-1300 MHz	8447D	2944A08773	B	01/08/2021	01/08/2022
NBLE11645	SCHWARZBECK MESS-ELEKTRONIK	Antenna, Trilog Broadband, 30-7000 MHz	VULB 9162	0254	G	04/09/2021	04/09/2023

Cal Code G = Calibration performed by an accredited outside source.
Cal Code B = Calibration verification performed internally.
Cal Code Y = Passive Device, or Calibration not required when used with other calibrated equipment.

2.7 Frequency Stability

2.7.1 Specification Reference

FCC 47 CFR Part 15.231(d)
ISED RSS-GEN 6.11

2.7.2 Test Method

The equipment under test is placed inside an environmental chamber. The RF output is directly coupled to the input of the measurement equipment and a power supply is attached to the primary supply voltage.

Frequency measurements were made at the extremes of the of temperature range -30º C to +50º C and at intervals of 10º C at normal supply voltage. Sufficient time to stabilize all components of the equipment was allowed at each frequency measurement. At a temperature 20º C the supply voltage was reduced to the battery operating endpoint. The maximum variation of frequency was recorded.

2.7.3 Environmental Conditions

Ambient Temperature	26.7 °C
Relative Humidity	36.8 %
Atmospheric Pressure	1017.4 mbar

2.7.4 Test Results

N/A. EUT does not operate at 40 MHz.

3 Diagram of Test Setups

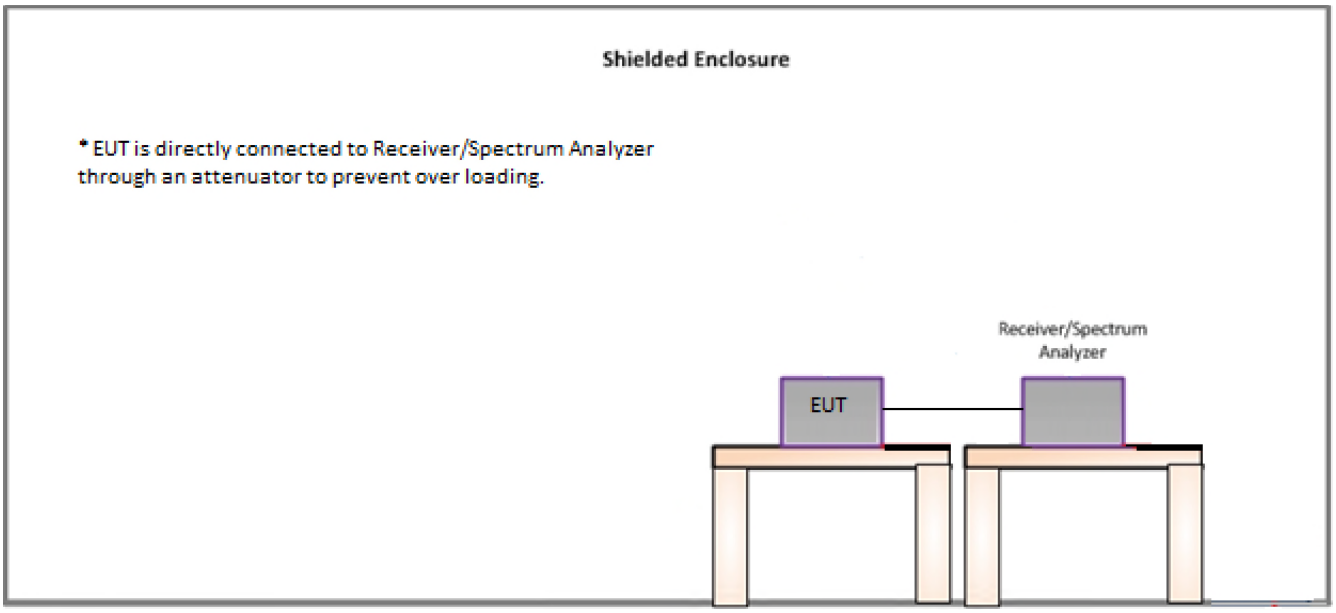


Figure 3-1 – Conducted Test Setup

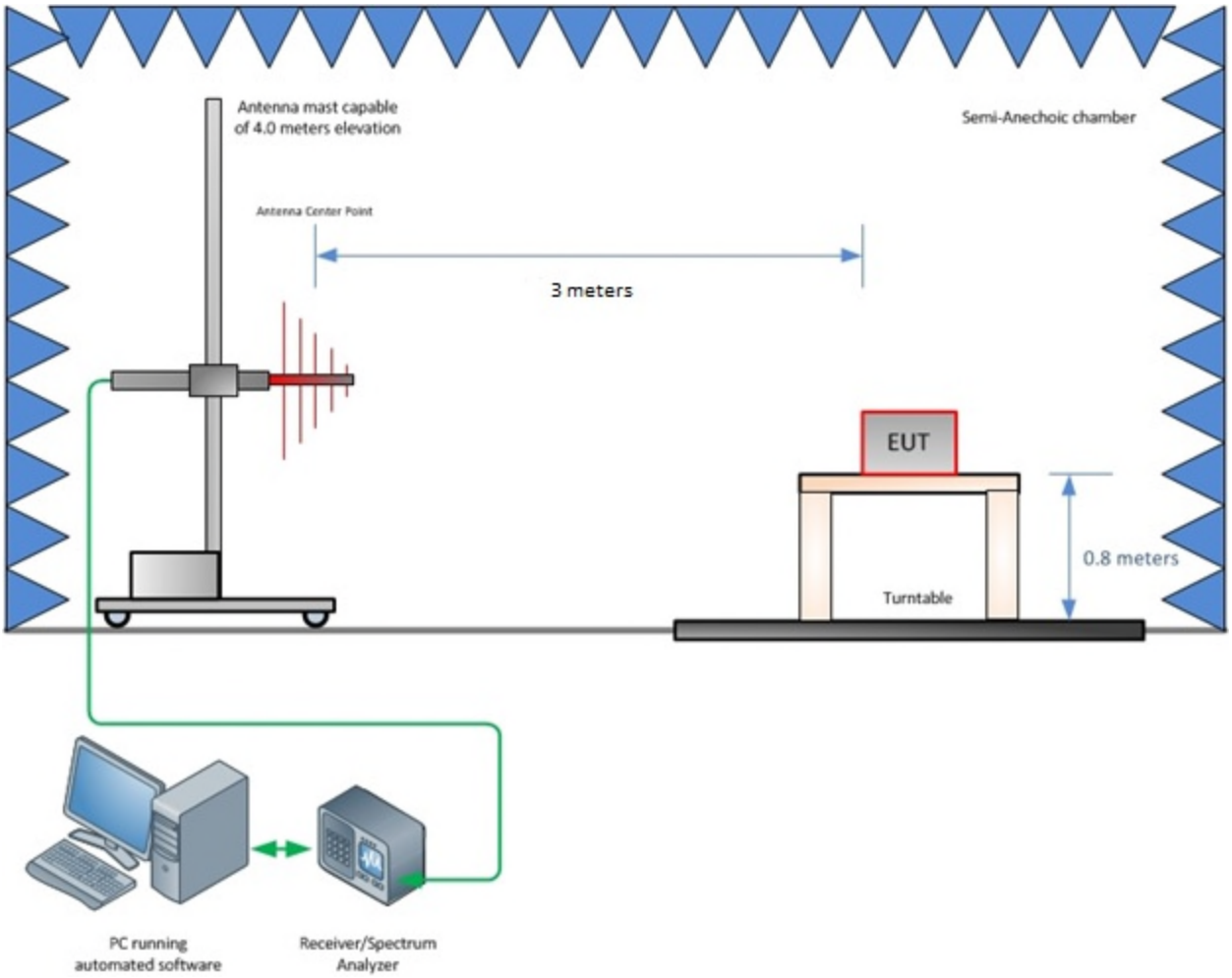


Figure 3-2 – Radiated Emissions Test Setup up to 1 GHz

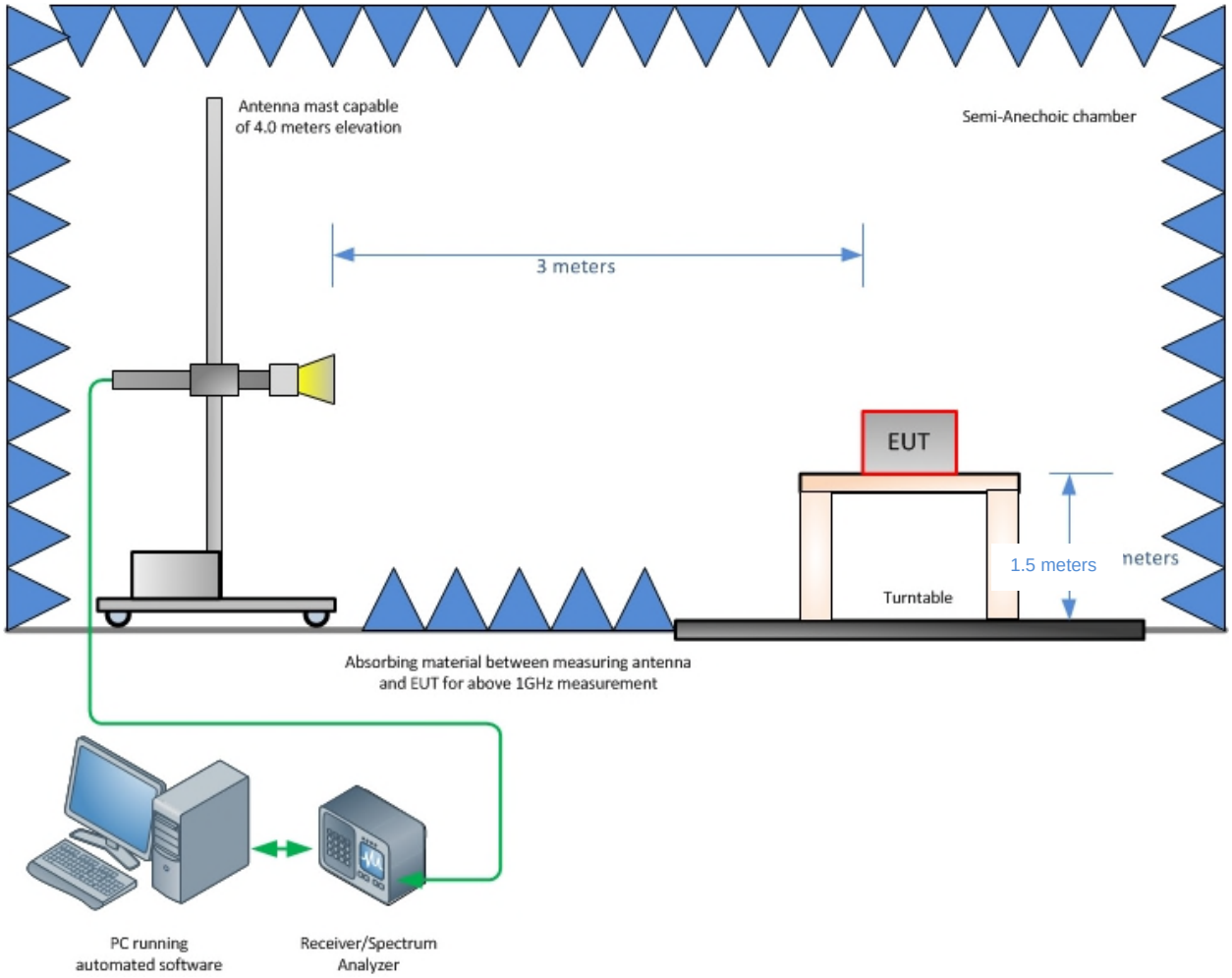


Figure 3-3 – Radiated Emissions Test Setup above 1 GHz

4 Accreditation, Disclaimers and Copyright

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STATEMENT OF MEASUREMENT UNCERTAINTY – Emissions

The test system for conducted emissions is defined as the LISN, tuned receiver or spectrum analyzer, and coaxial cable. This test system has a measurement uncertainty of ±3.30 dB. The test system for radiated emissions is defined as the antenna, the pre-amplifier, the spectrum analyzer and the coaxial cable. This test system for 30 MHz-1000 MHz has a measurement uncertainty of ±5.88 dB and above 1 GHz a measurement uncertainty of ±4.47 dB. The measurement uncertainty values for conducted and radiated emissions meet the requirements as expressed in CISPR 16-4-2. The equipment comprising the test systems is calibrated on an annual basis.

TEST EQUIPMENT

All measurement instrumentation is traceable to the National Institute of Standards and Technology and is calibrated to meet test method standard requirements and/or manufacturer's specifications