

FCC and ISED Canada Testing of the

Endura Products Inc.
EntrySync

In accordance with FCC 47 CFR part 15.247 and
ISED Canada's Radio Standards Specifications
RSS-247

Prepared for: Endura Products Inc.
8817 W. Market St.
Colfax, NC 27235

FCC ID: 2A2PS-ESYNC1
IC: 27615-ESYNC1

COMMERCIAL-IN-CONFIDENCE

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America

Add value.
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RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Authorized Signatory	Peter Walsh	2021 -August-20	
Testing	Thierry Jean Charles	2021-August-20	

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD Product Service document control rules.

FCC Accreditation
Designation Number US1063 Tampa, FL Test Laboratory
Innovation, Science, and Economic Development Canada
Accreditation
Site Number 2087A-2 Tampa, FL Test Laboratory

EXECUTIVE SUMMARY

Samples of this product were tested and found to be in compliance with 15.247 and ISED Canada's RSS-247.



A2LA Cert. No. 2955.15

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Contents

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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.

Issue	Description of Change	Date of Issue
1	First Issue	2021-August-20

1.2 Introduction

The purpose of this report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations Section 15.247 and Innovation Science and Economic Development Canada's Radio Standards Specification RSS-247 for the tests documented herein.



Applicant	Endura Products Inc.
Manufacturer	Unikey Technologies Inc
Applicant's Email Address	entrysyncerts@enduraproducts.com
Model Number(s)	EntrySync
Serial Number(s)	N/A
FCC ID	2A2PS-ESYNC1
ISED Certification Number	27615-ESYNC1
Hardware Version(s)	4
Software Version(s)	1.9.71
Number of Samples Tested	1
Test Specification/Issue/Date	US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2021 Innovation, Science and Economic Development Canada Radio Standards Specification: RSS-247 — Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices, Issue 2, February 2017
Test Plan/Issue/Date	2021-February-25
Order Number	72171475
Date	2021-July-21
Date of Receipt of EUT	2021-July-19
Start of Test	2021-July-21
Finish of Test	2021-July-29
Name of Engineer(s)	Thierry Jean-Charles
Related Document(s)	ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices. US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2021. FCC OET KDB Publication 558074 D01 15.247 Meas Guidance v05r02: Guidance for Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating under Section 15.247 of the FCC Rules.



FCC KDB Publication 996369 D04 Module Integration Guide
v01: Modular Transmitter Integration Guide - Guidance for
Host Product Manufacturers, February 1, 2019.

Innovation, Science and Economic Development Canada
Radio Standards Specification: RSS-GEN - General
Requirements for Compliance of Radio Apparatus, Issue 5,
Amendment 1, March 2019.



1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC Part 15.247 and ISED Canada's RSS-247 is shown below.

Table 1.3-1: Test Result Summary

Test Parameter	Test Plan (Yes/No)	Test Result	FCC 47 CFR Rule Part	ISED Canada's RSS	Test Report Page No
Antenna Requirement	Yes	Pass	15.203, 15.204	-----	11
6 dB Bandwidth	Yes	Pass	15.247(a)(2)	RSS-247 5.2(a)	12
99% Bandwidth	Yes	Pass	-----	RSS-GEN 6.6	17
Peak Output Power	Yes	Pass	15.247(b)(3)	RSS-247 5.4(d)	22
Band-Edge Compliance of RF Conducted Emissions	Yes	Pass	15.247(d)	RSS-247 5.5	27
RF Conducted Spurious Emissions	Yes	Pass	15.247(d)	RSS-247 5.5	31
Radiated Spurious Emissions into Restricted Frequency Bands	Yes	Pass	15.205, 15.209	RSS-GEN 8.9, 8.10	36
Power Spectral Density	Yes	Pass	15.247(e)	RSS-247 5.2(b)	44
Power Line Conducted Emissions	No	-----	15.207	RSS-GEN 8.8	50



1.4 Product Information

1.4.1 Technical Description

EntrySync is a residential electronic lock. It allows the user to unlock the door through bluetooth

Technical Details provided by the Manufacturer

Mode of Operation: Bluetooth Low Energy
Frequency Range: 2402 MHz - 2480 MHz
Number of Channels: 40
Channel Separation: 2 MHz
Data Rate: 1 Mbps
Modulations: GFSK
Antenna Type/Gain: Patch Antenna (API P/N: PA202450025SALF) / 3.5 dBi
Input Power: 6 VDC (4 x AA batteries)

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

Table 1.4.1-1 – Cable Descriptions

Cable/Port	Description
None	

The EUT is a standalone equipment without provisions for connection to accessory equipment.

Table 1.4.1-2 – Support Equipment Descriptions

Make/Model	Description
None	

The EUT is a standalone equipment without provisions for connection to accessory equipment.



Declaration of Build Status

EQUIPMENT DESCRIPTION	
Model Name/Number	EntrySync
Part Number	17018
Hardware Version	4
Software Version	1.9.71
FCC ID (if applicable)	2A2PS-ESYNC1
ISED ID (if applicable)	27615-ESYNC1
Technical Description (Please provide a brief description of the intended use of the equipment)	Multi point smart door lock. Bluetooth enabled and motor actuated.

UN-INTENTIONAL RADIATOR	
Highest frequency generated or used in the device or on which the device operates or tunes	2.402 GHz
Lowest frequency generated or used in the device or on which the device operates or tunes	2.480 GHz
Class A Digital Device (Use in commercial, industrial or business environment) ☐	
Class B Digital Device (Use in residential environment only) ☒	

Power Source			
AC	Single Phase	Three Phase	Nominal Voltage
	☐	☐	
External DC	Nominal Voltage	Maximum Current	
Battery	Nominal Voltage	Battery Operating End Point Voltage	
	6 Volt	4.55 Volt	

EXTREME CONDITIONS			
Maximum temperature	+ 62	°C	Minimum temperature
			- 17 °C

Ancillaries
Please list all ancillaries which will be used with the device.

I hereby declare that the information supplied is correct and complete.

Name: Austin E Mundy

Position held: Jr Product Development Engineer, Endura Products

Date: 8/19/2021



1.4.2 Modes of Operation

The EUT was evaluated for the Bluetooth Low Energy (BLE) radio. The TX power setting used during the evaluation was 4. The measurements were performed for both transmit antenna configurations.

1.4.3 Monitoring of Performance

The EUT was evaluated to the requirements of FCC Part 15.247 and RSS-247.

The radiated spurious emissions the EUT was evaluated in the orientation of typical installation.

The RF conducted measurements were performed on the MCX port for the "out" antenna and on a temporary RF connector at the antenna port for the antenna "in" configuration.

1.4.4 Performance Criteria

The EUT was evaluated in accordance with the parameters listed below.

Table 1.4.4 -1: Performance Criteria

Parameter	Requirement
Antenna Requirement	FCC: Section 15.203. 15.204
6 dB Bandwidth	FCC: Section 15.247(a)(2); ISED Canada: RSS-247 5.2(a)
99% Bandwidth	ISED Canada: RSS-GEN 6.6
Peak Output Power	FCC: Section 15.247(b)(3); ISED Canada:RSS-247 5.4(d)
Band-Edge Compliance of RF Conducted Emissions	FCC: Section 15.247(d); ISED Canada: RSS-247 5.5
RF Conducted Spurious Emissions	FCC: Section 15.247(d); ISED Canada: RSS-247 5.5
Radiated Spurious Emissions into Restricted Frequency Bands	FCC: Sections 15.205, 15.209; ISED Canada: RSS-GEN 8.9, 8.10
Power Spectral Density	FCC: Section 15.247(e); ISED Canada: RSS-247(b)

1.5 Deviations from the Standard

The EUT was evaluated without any deviation from the test standards.

1.6 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.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
0 Ohm resistor	Population of R6 grounding pin 2 of LFB182G45BG5D920	Anders Johansson from Unikey	2021-July-26



1.7 Test Location

TÜV SÜD Product Service conducted the following tests at our Tampa FL Test Laboratory.

Test Name	Name of Engineer(s)	Accreditation
AC Powered Operating		
Antenna Requirement	Thierry Jean-Charles	A2LA
6 dB Bandwidth	Thierry Jean-Charles	A2LA
99% Bandwidth	Thierry Jean-Charles	A2LA
Peak Output Power	Thierry Jean-Charles	A2LA
Band-Edge Compliance of RF Conducted Emissions	Thierry Jean-Charles	A2LA
RF Conducted Spurious Emissions	Thierry Jean-Charles	A2LA
Radiated Spurious Emissions into Restricted Frequency Bands	Thierry Jean-Charles	A2LA
Power Spectral Density	Thierry Jean-Charles	A2LA

Office Address:

TÜV SÜD America, Inc.
5610 W. Sligh Ave, Suite 100
Tampa, FL 33634
USA



2 Test Details

2.1 Antenna Requirements

2.1.1 Specification Reference

FCC: Section 15.203, 15.204

2.1.2 Equipment Under Test and Modification State

S/N: N/A

2.1.3 Date of Test

7/19/2021

2.1.4 Test Method

N/A

2.1.5 Environmental Conditions

Ambient Temperature	N/A
Relative Humidity	N/A
Atmospheric Pressure	N/A

2.1.6 Test Results

Limit Clause FCC Sections: 15.203, 15.204

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 EUT uses two patch antennas.

The first antenna is soldered directly to the PCB. The second antenna is soldered to a daughter board which connects to the main PCB via an MCX connector. The EUT meets the requirements of FCC Section 15.203.

2.1.7 Test Location and Test Equipment Used

This test was carried out in TÜV SÜD America, Inc., 5610 W. Sligh Ave, Suite 100, Tampa, FL 33634, USA.

As this is a visual inspection, no test equipment was used.



2.2 6 dB Bandwidth

2.2.1 Specification Reference

FCC: Section 15.247(a)(2)
ISED Canada: RSS-247 5.2(a)

2.2.2 Equipment Under Test and Modification State

S/N: N/A

2.2.3 Date of Test

7/28/2021 to 7/29/2021

2.2.4 Test Method

The 6dB bandwidth was measured in accordance with ANSI C63.10 Subclause 11.8.1 Option 1. The RBW of the spectrum analyzer was set to 100 kHz and VBW 300 kHz. Span was set large enough to capture the emissions and >> RBW. A peak detector was used for the measurements.

2.2.5 Environmental Conditions

Ambient Temperature 24.5°C
Relative Humidity 44.1 %
Atmospheric Pressure 1015.9 mbar

2.2.6 Test Results

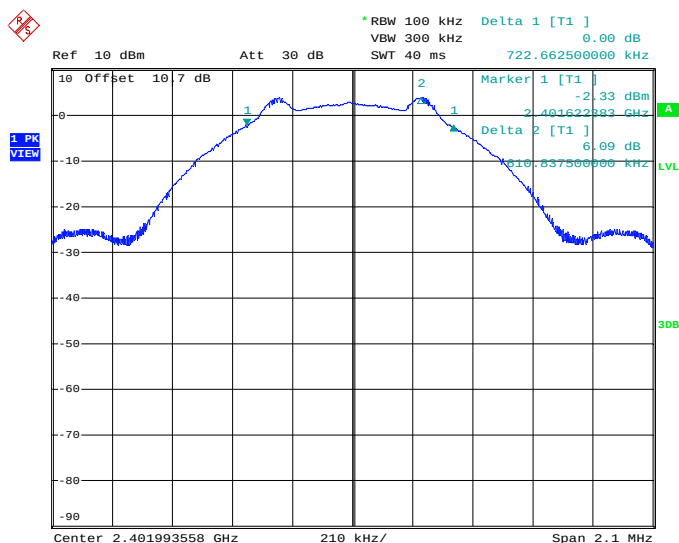
DC Powered Operating

Limit Clause FCC Part 15.247(a)(2), ISED RSS-247 5.2(a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

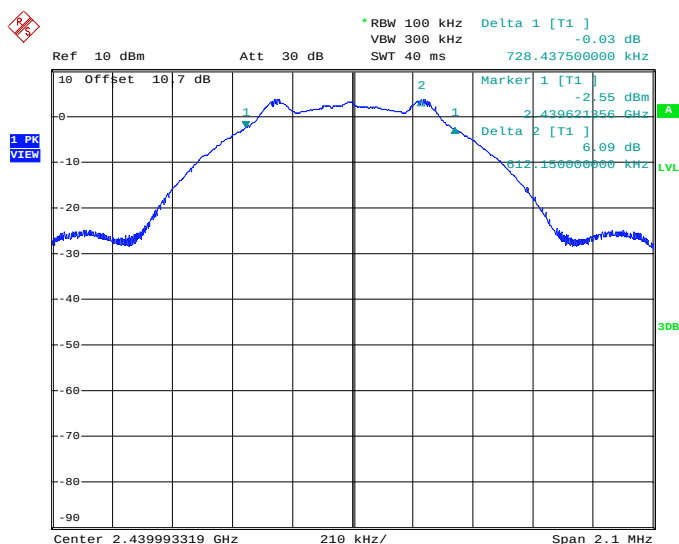
Table 2.2.6-1: 6 dB Bandwidth Test Results – Antenna "Out"

Frequency (MHz)	6 dB Bandwidth (kHz)
2402	722.66250
2440	728.43750
2480	736.96346



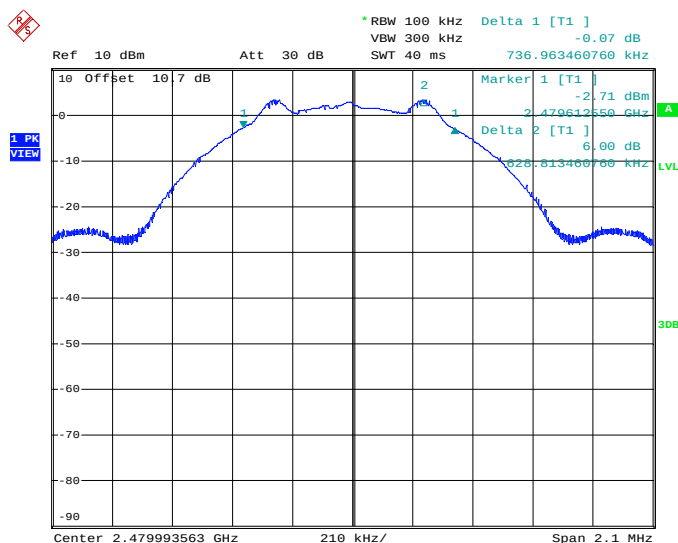
Date: 28.JUL.2021 23:01:12

Figure 2.2.6-1: 6 dB Bandwidth Test Results Low Channel - Antenna "Out"



Date: 28.JUL.2021 23:33:09

Figure 2.2.6-2: 6 dB Bandwidth Test Results Middle Channel - Antenna "Out"

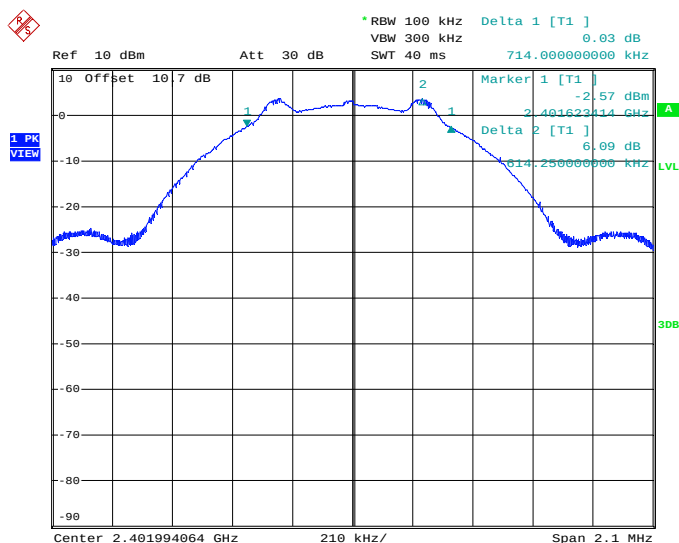


Date: 28.JUL.2021 23:57:11

Figure 2.2.6-3: 6 dB Bandwidth Test Results High Channel - Antenna "Out"

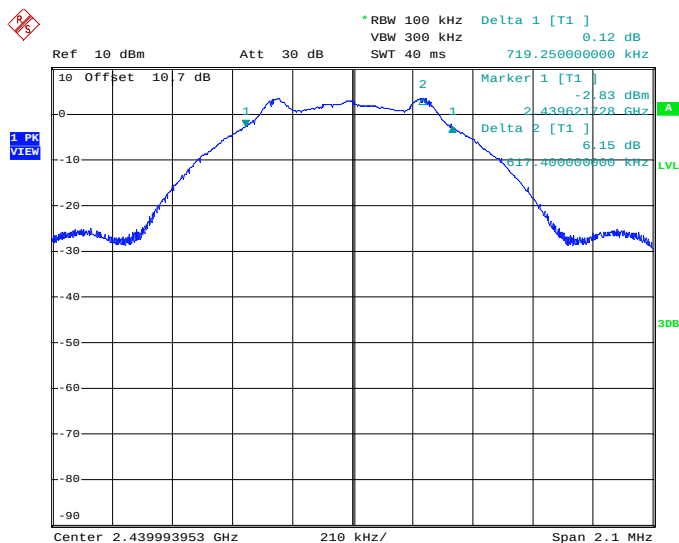
Table 2.2.6-2: 6 dB Bandwidth Test Results – Antenna "In"

Frequency (MHz)	6 dB Bandwidth (kHz)
2402	714.00000
2440	719.25000
2480	733.17275



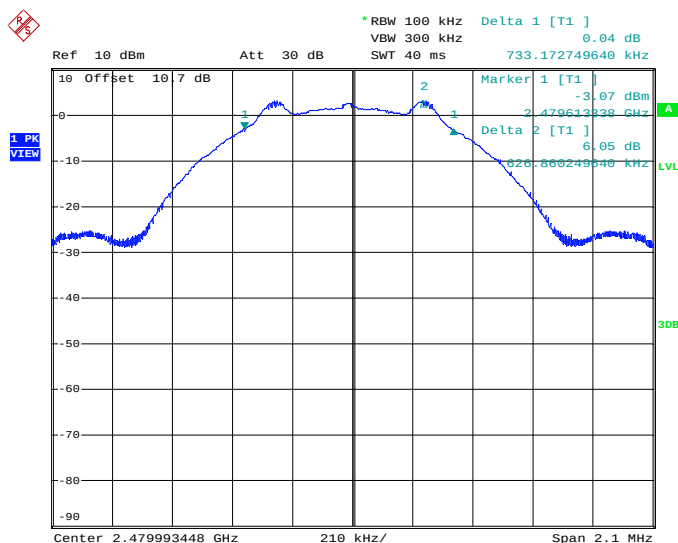
Date: 29.JUL.2021 14:16:47

Figure 2.2.6-4: 6 dB Bandwidth Test Results Low Channel - Antenna "In"



Date: 29.JUL.2021 14:50:08

Figure 2.2.6-5: 6 dB Bandwidth Test Results Middle Channel - Antenna "In"



Date: 29.JUL.2021 15:25:54

Figure 2.2.6-6: 6 dB Bandwidth Test Results High Channel - Antenna "In"

2.2.7 Test Location and Test Equipment Used

This test was carried out in TÜV SÜD America, Inc., 5610 W. Sligh Ave, Suite 100, Tampa, FL 33634, USA.

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
Spectrum Analyzer	Rohde & Schwarz	FSP40	BEMC00283	4.50 SP5	24	04-Oct-2021
Attenuator 10dB, 2.9 mm-M/F, DC-40GHz 2 W	Aeroflex Inmet	40AH2W-10	BEMC02110	N/A	12	08-Jul-2022

TU - Traceability Unscheduled

O/P MON - Traceability Unscheduled

N/A - Not Applicable



2.3 99% Bandwidth

2.3.1 Specification Reference

ISED Canada: RSS-GEN 6.7

2.3.2 Equipment Under Test and Modification State

S/N: N/A

2.3.3 Date of Test

7/28/2021 to 7/29/2021

2.3.4 Test Method

The 99% occupied bandwidth was measured with the spectrum analyzer span set to fully display the emission. The RBW was set to 1% to 5% of the approximated bandwidth. The occupied 99% bandwidth was measured by using 99% bandwidth equipment function of the spectrum analyzer using a peak detector.

2.3.5 Environmental Conditions

Ambient Temperature 24.5°C
Relative Humidity 44.1 %
Atmospheric Pressure 1015.9 mbar

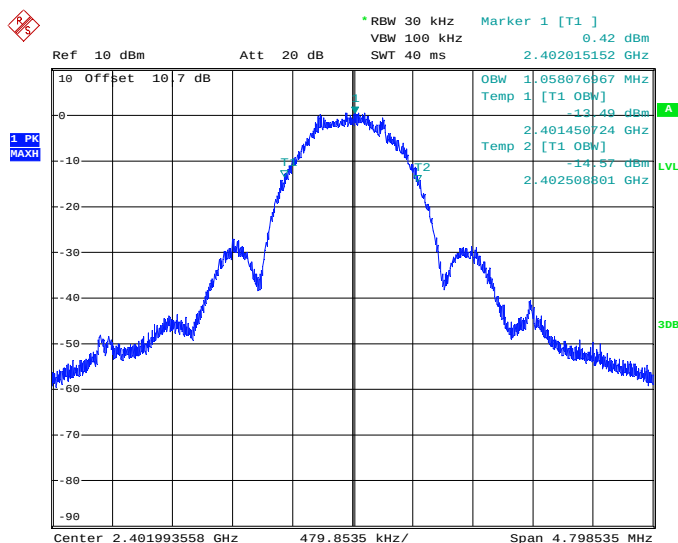
2.3.6 Test Results

DC Powered Operating

Limit Clause ISED RSS-GEN 6.7

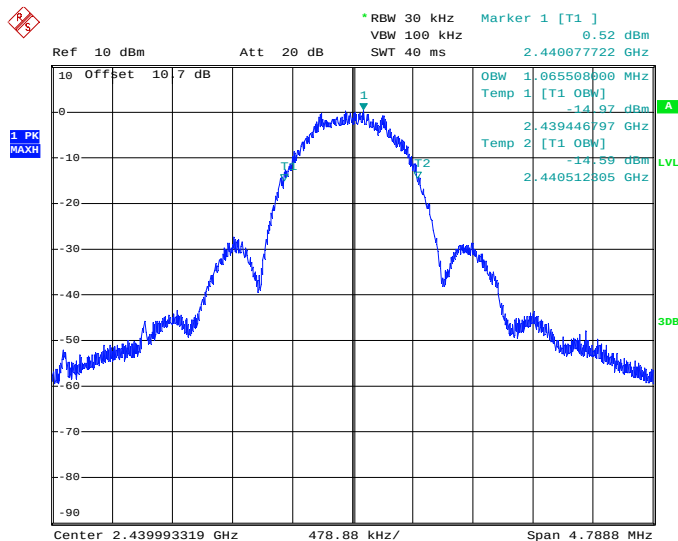
Table 2.3.6-1: 99% Bandwidth Test Results – Antenna "Out"

Frequency (MHz)	99% Bandwidth (MHz)
2402	1.05808
2440	1.06551
2480	1.07099



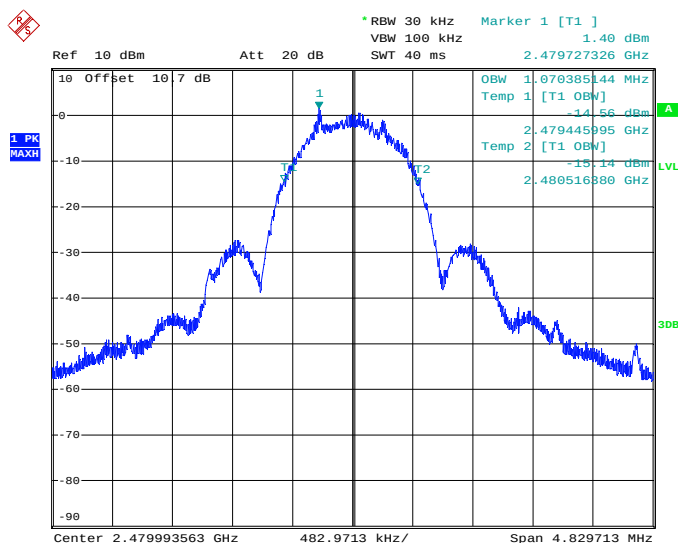
Date: 28.JUL.2021 23:02:52

Figure 2.3.6-1: 99% Bandwidth Test Results Low Channel – Antenna "Out"



Date: 28.JUL.2021 23:34:48

Figure 2.3.6-2: 99% Bandwidth Test Results Middle Channel – Antenna "Out"

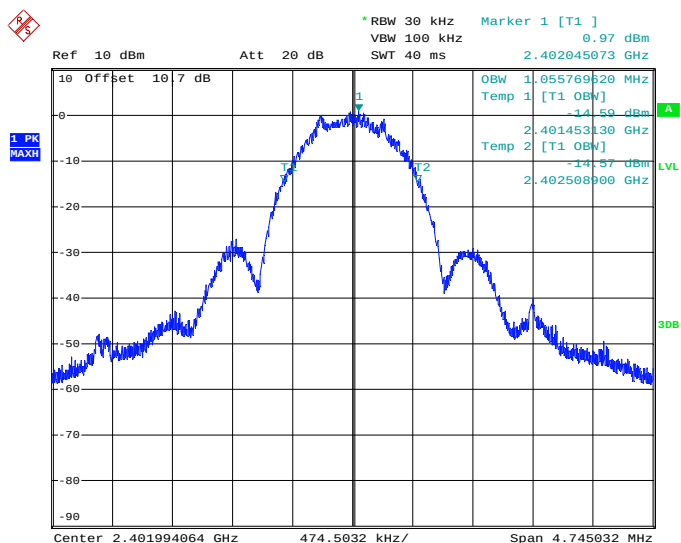


Date: 28.JUL.2021 23:58:50

Figure 2.3.6-3: 99% Bandwidth Test Results High Channel – Antenna "Out"

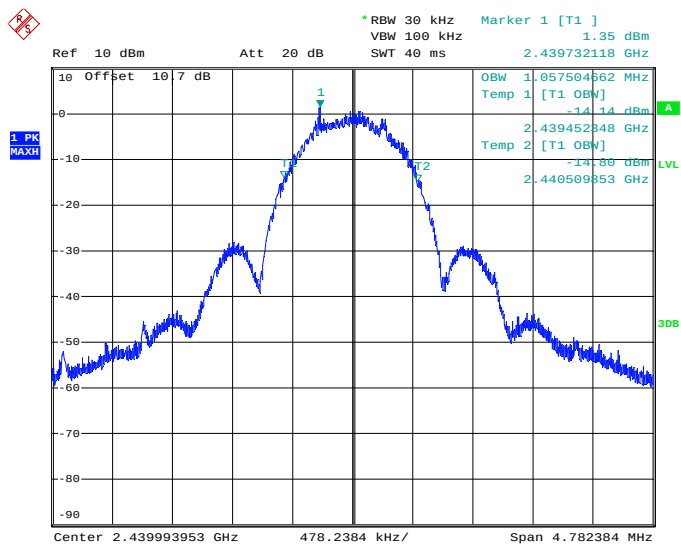
Table 2.3.6-2: 99% Bandwidth Test Results – Antenna "In"

Frequency (MHz)	99% Bandwidth (MHz)
2402	1.05518
2440	1.05750
2480	1.06409



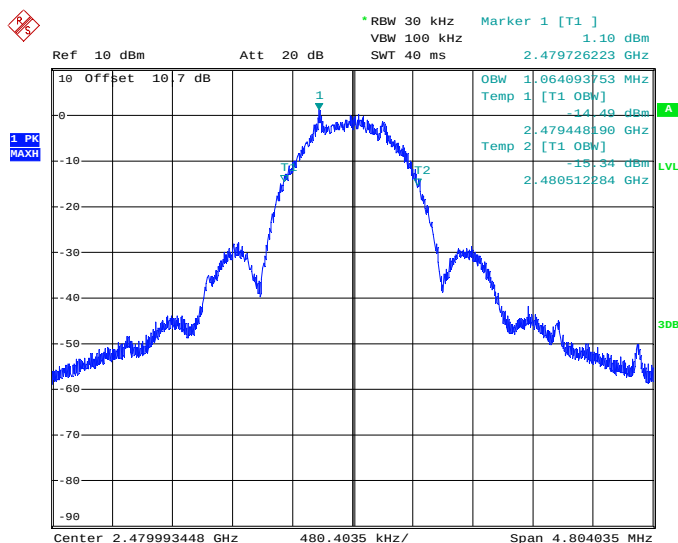
Date: 29.JUL.2021 14:18:27

Figure 2.3.6-4: 99% Bandwidth Test Results Low Channel – Antenna "In"



Date: 29.JUL.2021 14:51:48

Figure 2.3.6-5: 99% Bandwidth Test Results Middle Channel – Antenna "In"



Date: 29.JUL.2021 15:27:33

Figure 2.3.6-6: 99% Bandwidth Test Results High Channel – Antenna "In"

2.3.7 Test Location and Test Equipment Used

This test was carried out in TÜV SÜD America, Inc., 5610 W. Sligh Ave, Suite 100, Tampa, FL 33634, USA.

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
Spectrum Analyzer	Rohde & Schwarz	FSP40	BEMC00283	4.50 SP5	24	04-Oct-2021
Attenuator 10dB, 2.9 mm-M/F, DC-40GHz 2 W	Aeroflex Inmet	40AH2W-10	BEMC02110	N/A	12	08-Jul-2022

TU - Traceability Unscheduled

O/P MON - Traceability Unscheduled

N/A - Not Applicable



2.4 Peak Output Power

2.4.1 Specification Reference

FCC Section 15.247(b)(3)
ISED Canada: RSS-247 5.4(d)

2.4.2 Equipment Under Test and Modification State

S/N: N/A

2.4.3 Date of Test

7/28/2021 to 7/29/2021

2.4.4 Test Method

The fundamental emission output power was measured in accordance with ANSI C63.10 Subclause 11.9.1.1 RBW $\geq$ DTS bandwidth. The RF output of the equipment under test was directly connected to the input of the spectrum analyzer through suitable attenuation.

2.4.5 Environmental Conditions

Ambient Temperature 24.5°C
Relative Humidity 44.1 %
Atmospheric Pressure 1015.9 mbar

2.4.6 Test Results

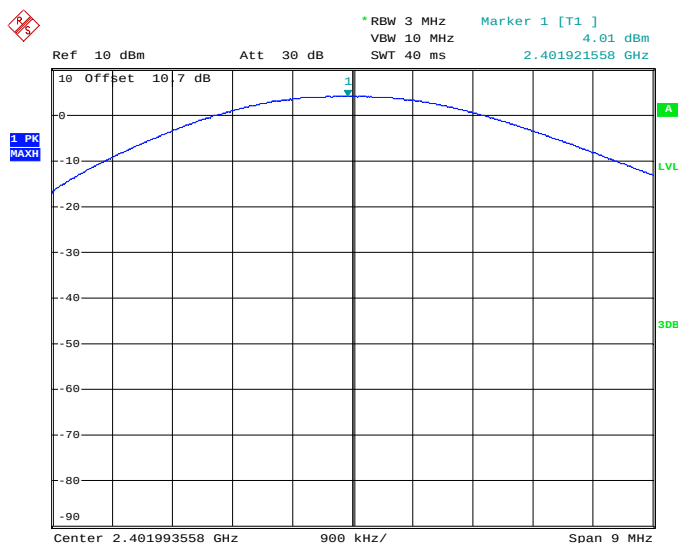
DC Powered Operating

Limit Clause FCC Part 15.247(b)(3), ISED RSS-247 5.4(d)

The Maximum Output Power allowed for systems using digital modulation is 1 Watt (30 dBm)

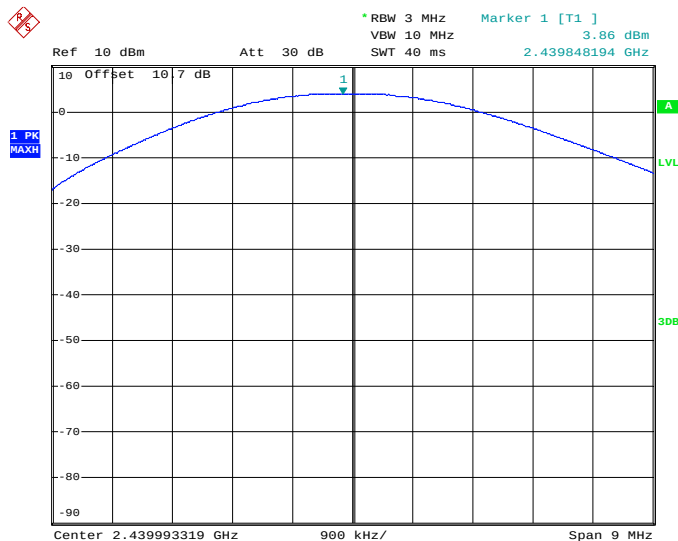
Table 2.4.6-1: Maximum Output Power Results – Antenna "Out"

Frequency (MHz)	Output Power (dBm)
2402	4.01
2440	3.86
2480	3.59



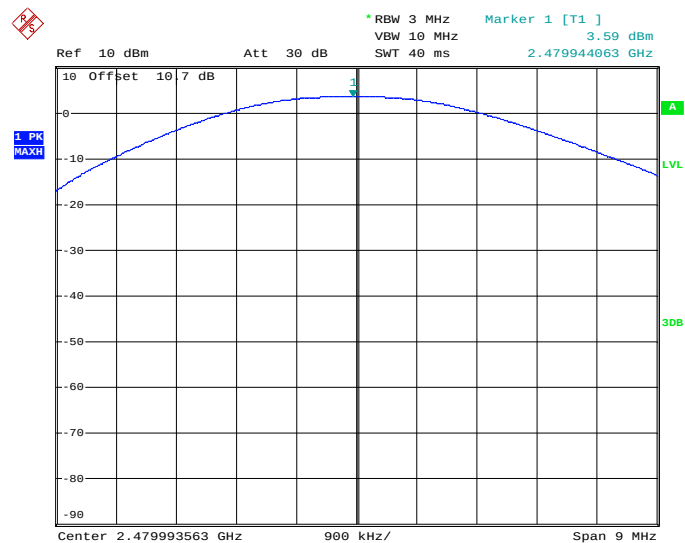
Date: 28.JUL.2021 23:04:28

Figure 2.4.6-1: Maximum Output Power Results Low Channel – Antenna "Out"



Date: 28.JUL.2021 23:36:25

Figure 2.4.6-2: Maximum Output Power Results Middle Channel – Antenna "Out"

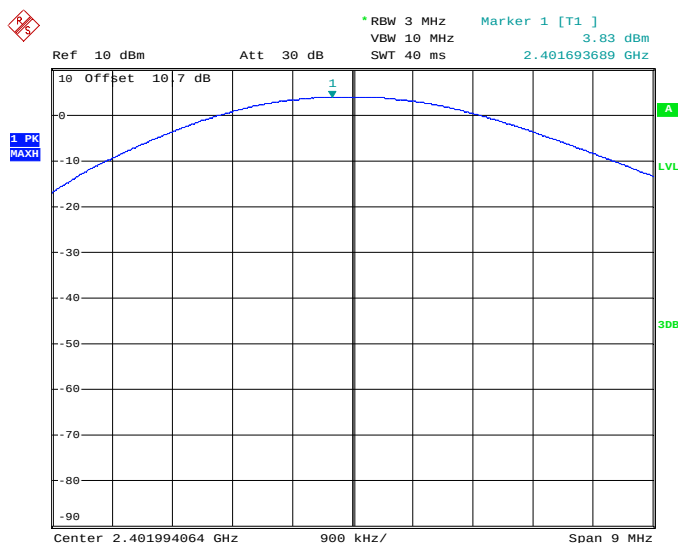


Date: 29.JUL.2021 00:00:27

Figure 2.4.6-3: Maximum Output Power Results High Channel – Antenna "Out"

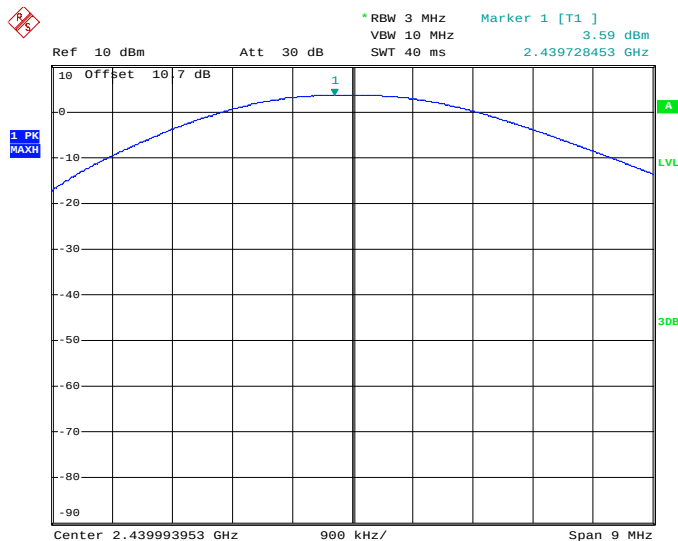
Table 2.4.6-2: Maximum Output Power Results – Antenna "In"

Frequency (MHz)	Output Power (dBm)
2402	3.83
2440	3.59
2480	3.28



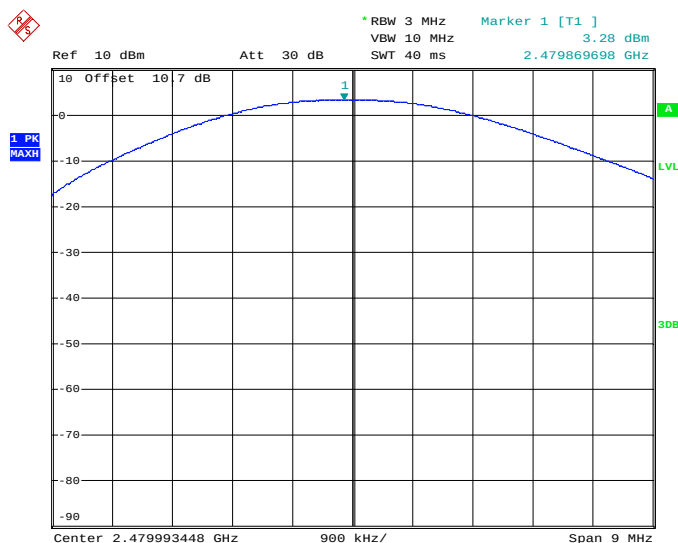
Date: 29.JUL.2021 14:20:04

Figure 2.4.6-4: Maximum Output Power Results Low Channel – Antenna "In"



Date: 29.JUL.2021 14:53:25

Figure 2.4.6-5: Maximum Output Power Results Middle Channel – Antenna "In"



Date: 29.JUL.2021 15:29:10

Figure 2.4.6-6: Maximum Output Power Results High Channel – Antenna "In"

2.4.7 Test Location and Test Equipment Used

This test was carried out in TÜV SÜD America, Inc., 5610 W. Sligh Ave, Suite 100, Tampa, FL 33634, USA.

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
Spectrum Analyzer	Rohde & Schwarz	FSP40	BEMC00283	4.50 SP5	24	04-Oct-2021
Attenuator 10dB, 2.9 mm-M/F, DC-40GHz 2 W	Aeroflex Inmet	40AH2W-10	BEMC02110	N/A	12	08-Jul-2022

TU - Traceability Unscheduled

O/P MON - Traceability Unscheduled

N/A - Not Applicable



2.5 Band-Edge Compliance of RF Conducted Emissions

2.5.1 Specification Reference

FCC: Section 15.247(d)
ISED Canada: RSS-247 5.5

2.5.2 Equipment Under Test and Modification State

S/N: N/A

2.5.3 Date of Test

7/28/2021 to 7/29/2021

2.5.4 Test Method

The RF Conducted Emissions at the Band-Edges were measured in accordance with Subclause 11.11 of ANSI C63.10. The RF output port of the EUT was connected to the input of the spectrum analyzer through suitable attenuation. The EUT was investigated at the lowest and highest channel available to determine band-edge compliance. For each measurement the spectrum analyzer's RBW was set to 100 kHz, and the VBW was set to ≥ 300 kHz.

2.5.5 Environmental Conditions

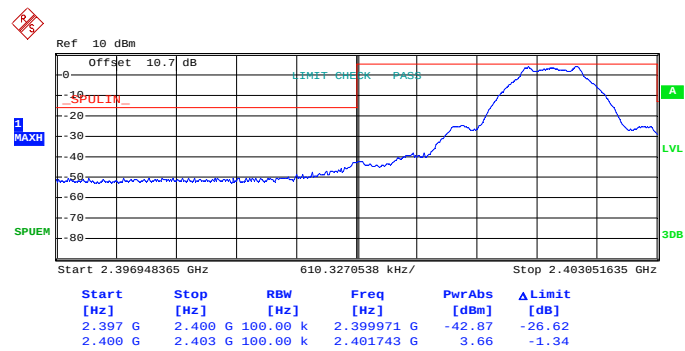
Ambient Temperature	24.5 °C
Relative Humidity	44.1 %
Atmospheric Pressure	1015.9 mbar

2.5.6 Test Results

DC Powered Operating

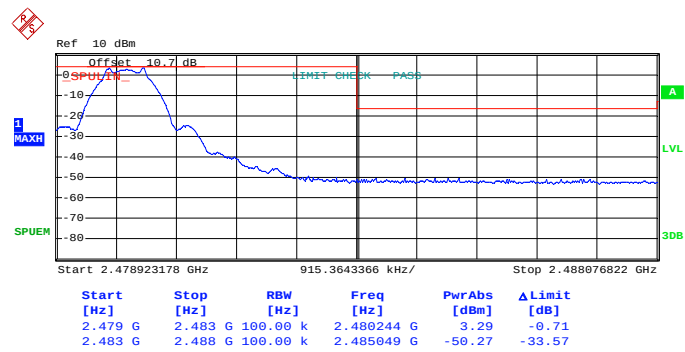
Limit Clause FCC Section 15.247(d), ISED Canada: RSS-247 5.5

In any 100 kHz bandwidth outside of the frequency band the radio frequency power shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required shall be 30 dB instead of 20 dB.



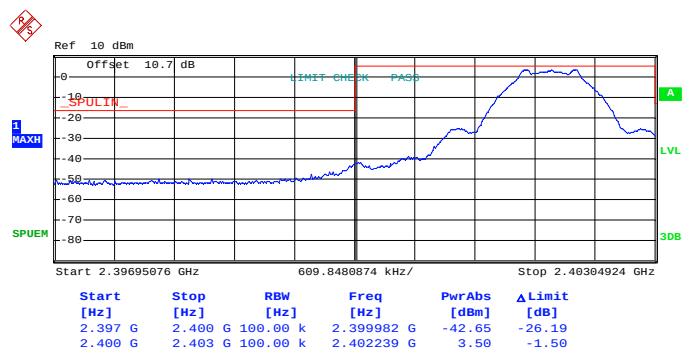
Date: 28.JUL.2021 23:09:21

Figure 2.5.6-1: RF Conducted Band-Edge Results Low Channel – Antenna "Out"



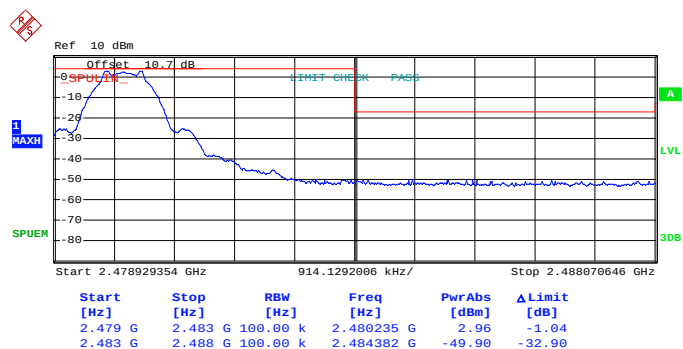
Date: 29.JUL.2021 00:05:19

Figure 2.5.6-2: RF Conducted Band-Edge Results High Channel – Antenna "Out"



Date: 29.JUL.2021 14:24:57

Figure 2.5.6-3: RF Conducted Band-Edge Results Low Channel – Antenna "In"



Date: 29.JUL.2021 15:34:03

Figure 2.5.6-4: RF Conducted Band-Edge Results High Channel – Antenna "In"



2.5.7 Test Location and Test Equipment Used

This test was carried out in TÜV SÜD America, Inc., 5610 W. Sligh Ave, Suite 100, Tampa, FL 33634, USA.

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
Spectrum Analyzer	Rohde & Schwarz	FSP40	BEMC00283	4.50 SP5	24	04-Oct-2021
Attenuator 10dB, 2.9 mm-M/F, DC-40GHz 2 W	Aeroflex Inmet	40AH2W-10	BEMC02110	N/A	12	08-Jul-2022

TU - Traceability Unscheduled

O/P MON - Traceability Unscheduled

N/A - Not Applicable



2.6 RF Conducted Spurious Emissions

2.6.1 Specification Reference

FCC: Section 15.247(d)
ISED Canada: RSS-247 5.5

2.6.2 Equipment Under Test and Modification State

S/N: N/A

2.6.3 Date of Test

7/28/2021 to 7/29/2021

2.6.4 Test Method

The RF Conducted Spurious Emissions were measured in accordance with Subclause 11.11 of ANSI C63.10. The RF output port of the equipment under test was directly connected to the input of the spectrum analyzer. The EUT was investigated for conducted spurious emissions from 30 MHz to 25 GHz, 10 times the highest fundamental frequency. Measurements were made at the low, center and high channels of the EUT. For each measurement, the spectrum analyzer's RBW was set to 100 kHz and the VBW was set to 300 kHz. The peak Max Hold function of the analyzer was utilized.

2.6.5 Environmental Conditions

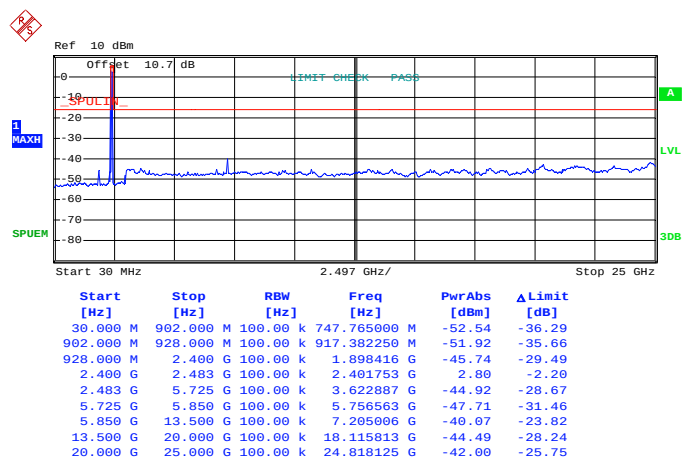
Ambient Temperature	24.5 °C
Relative Humidity	44.2 %
Atmospheric Pressure	1016.1 mbar

2.6.6 Test Results

DC Powered Operating

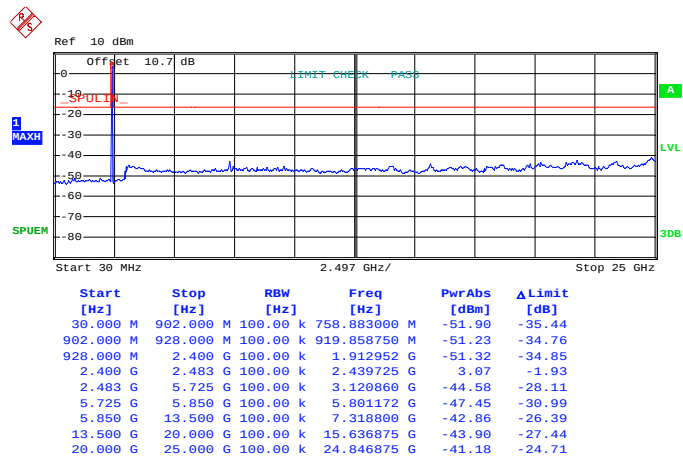
Limit Clause FCC Section 15.247(d), ISED Canada: RSS-247 5.5

In any 100 kHz bandwidth outside of the frequency band the radio frequency power shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required shall be 30 dB instead of 20 dB.



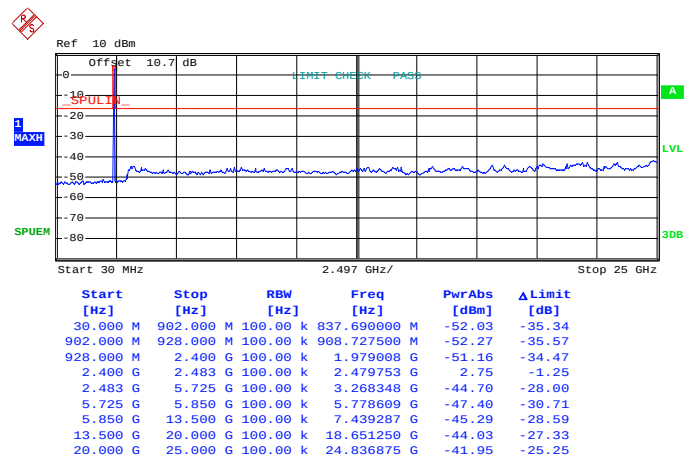
Date: 28.JUL.2021 23:11:35

Figure 2.6.6-1: RF Conducted Spurious Emissions Results - Low Channel – Antenna "Out"



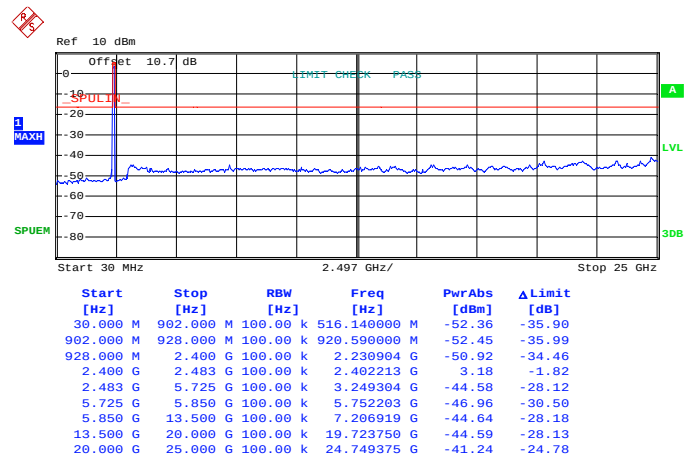
Date: 28.JUL.2021 23:43:31

Figure 2.6.6-2: RF Conducted Spurious Emissions Results - Middle Channel – Antenna "Out"



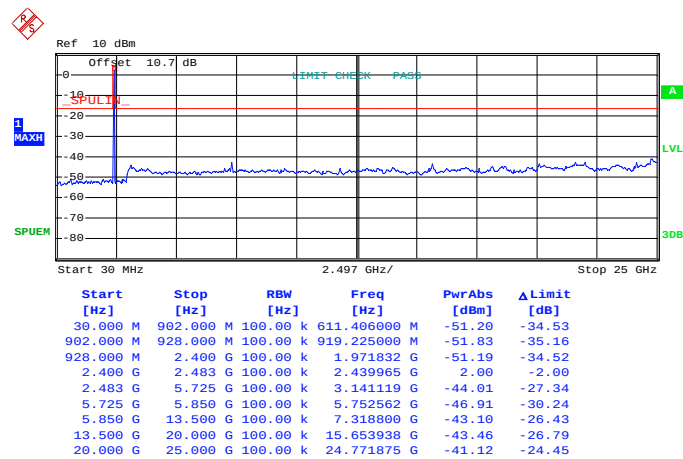
Date: 29.JUL.2021 00:07:33

Figure 2.6.6-3: RF Conducted Spurious Emissions Results - High Channel – Antenna "Out"



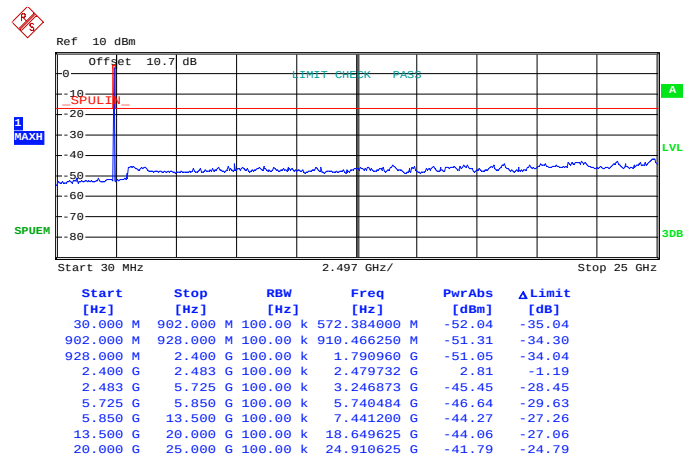
Date: 29.JUL.2021 14:27:11

Figure 2.6.6-4: RF Conducted Spurious Emissions Results - Low Channel – Antenna "In"



Date: 29.JUL.2021 15:00:32

Figure 2.6.6-5: RF Conducted Spurious Emissions Results - Middle Channel – Antenna "In"



Date: 29.JUL.2021 15:36:17

Figure 2.6.6-6: RF Conducted Spurious Emissions Results - High Channel – Antenna "In"



2.6.7 Test Location and Test Equipment Used

This test was carried out in TÜV SÜD America, Inc., 5610 W. Sligh Ave, Suite 100, Tampa, FL 33634, USA.

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
Spectrum Analyzer	Rohde & Schwarz	FSP40	BEMC00283	4.50 SP5	24	04-Oct-2021
Attenuator 10dB, 2.9 mm-M/F, DC-40GHz 2 W	Aeroflex Inmet	40AH2W-10	BEMC02110	N/A	12	08-Jul-2022

TU - Traceability Unscheduled

O/P MON - Traceability Unscheduled

N/A - Not Applicable



2.7 Radiated Spurious Emissions into Restricted Frequency Bands

2.7.1 Specification Reference

FCC Sections: 15.205, 15.209;
ISED Canada: RSS-GEN 8.9, 8.10

2.7.2 Equipment Under Test and Modification State

S/N: N/A

2.7.3 Date of Test

7/21/2021 to 7/28/2021

2.7.4 Test Method

Radiated emissions tests were made over the frequency range of 9 kHz to 26 GHz, 10 times the highest fundamental frequency. Each emission found to be in a restricted band as defined by section 15.205, including any emission at the operational band-edge, was compared to the radiated emission limits as defined in Section 15.209.

For measurements below 30 MHz, the receive antenna height was set to 1 m and the EUT was rotated through 360 degrees. The resolution bandwidth was set to 200 Hz below 150 kHz and to 9 kHz above 150 kHz.

The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. For frequencies below 1000 MHz, quasi-peak measurements were made using a resolution bandwidth RBW of 120 kHz and a video bandwidth VBW of 300 kHz. For frequencies above 1000 MHz, peak measurements are made with RBW of 1 MHz and VBW of 3 MHz. Average measurements are performed in the linear scale using VBW of 30 Hz.

2.7.5 Duty Cycle Correction

The EUT was configured to transmit at 100% duty cycle during the evaluation. No duty cycle correction factors were applied to the average measurements for the corrected average results.

2.7.6 Environmental Conditions

Ambient Temperature	24.1 °C
Relative Humidity	49.3 %
Atmospheric Pressure	1012.7 mbar



2.7.7 Test Results

DC Powered Operating

Limit Clause FCC Sections 15.205, 15.209, ISED Canada: RSS-GEN 8.9, 8.10

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009-0.490	2400/F(kHz)	300
0.4090-1.705	24000/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

Table 2.7.7-1: Radiated Emissions Test Results – Antenna "Out"

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel										
2390	56.19	43.36	H	-5.37	50.82	37.99	74.0	54.0	23.2	16.0
2390	55.43	42.09	V	-5.37	50.06	36.72	74.0	54.0	23.9	17.3
4804	48.72	40.97	H	-0.21	48.51	40.76	74.0	54.0	25.5	13.2
4804	46.77	38.28	V	-0.21	46.56	38.07	74.0	54.0	27.4	15.9
Middle Channel										
4880	47.30	39.34	H	-0.09	47.21	39.25	74.0	54.0	26.8	14.7
4880	45.84	34.78	V	-0.09	45.75	34.69	74.0	54.0	28.2	19.3
7320	54.20	47.09	H	5.11	59.31	52.20	74.0	54.0	14.7	1.8
7320	49.19	38.94	V	5.11	54.30	44.05	74.0	54.0	19.7	10.0
High Channel										
2483.5	60.45	53.68	H	-5.21	55.24	48.47	74.0	54.0	18.8	5.5
2483.5	59.43	52.11	V	-5.21	54.22	46.90	74.0	54.0	19.8	7.1
4960	49.88	42.89	H	0.04	49.92	42.93	74.0	54.0	24.1	11.1
4960	45.11	35.24	V	0.04	45.15	35.28	74.0	54.0	28.9	18.7
7440	53.04	45.70	H	5.32	58.36	51.02	74.0	54.0	15.6	3.0
7440	47.82	38.86	V	5.32	53.14	44.18	74.0	54.0	20.9	9.8

Notes:

All emissions above 7.44 GHz were attenuated below the limits and the noise floor of the measurement equipment.



Table 2.7.7-2: Radiated Emissions Test Results – Antenna "In"

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel										
2390	56.13	42.55	H	-5.37	50.76	37.18	74.0	54.0	23.2	16.8
2390	55.36	42.54	V	-5.37	49.99	37.17	74.0	54.0	24.0	16.8
4804	47.75	39.52	H	-0.21	47.54	39.31	74.0	54.0	26.5	14.7
4804	46.54	37.46	V	-0.21	46.33	37.25	74.0	54.0	27.7	16.7
Middle Channel										
4880	47.24	38.64	H	-0.09	47.15	38.55	74.0	54.0	26.8	15.4
4880	44.48	33.28	V	-0.09	44.39	33.19	74.0	54.0	29.6	20.8
7320	51.19	43.54	H	5.11	56.30	48.65	74.0	54.0	17.7	5.4
7320	47.91	38.27	V	5.11	53.02	43.38	74.0	54.0	21.0	10.6
High Channel										
2483.5	63.11	56.30	H	-5.21	57.90	51.09	74.0	54.0	16.1	2.9
2483.5	58.70	50.53	V	-5.21	53.49	45.32	74.0	54.0	20.5	8.7
4960	50.10	42.66	H	0.04	50.14	42.70	74.0	54.0	23.9	11.3
4960	45.47	35.38	V	0.04	45.51	35.42	74.0	54.0	28.5	18.6
7440	49.93	41.95	H	5.32	55.25	47.27	74.0	54.0	18.8	6.7
7440	46.10	35.33	V	5.32	51.42	40.65	74.0	54.0	22.6	13.4

Notes:

All emissions above 7.44 GHz were attenuated below the limits and the noise floor of the measurement equipment.

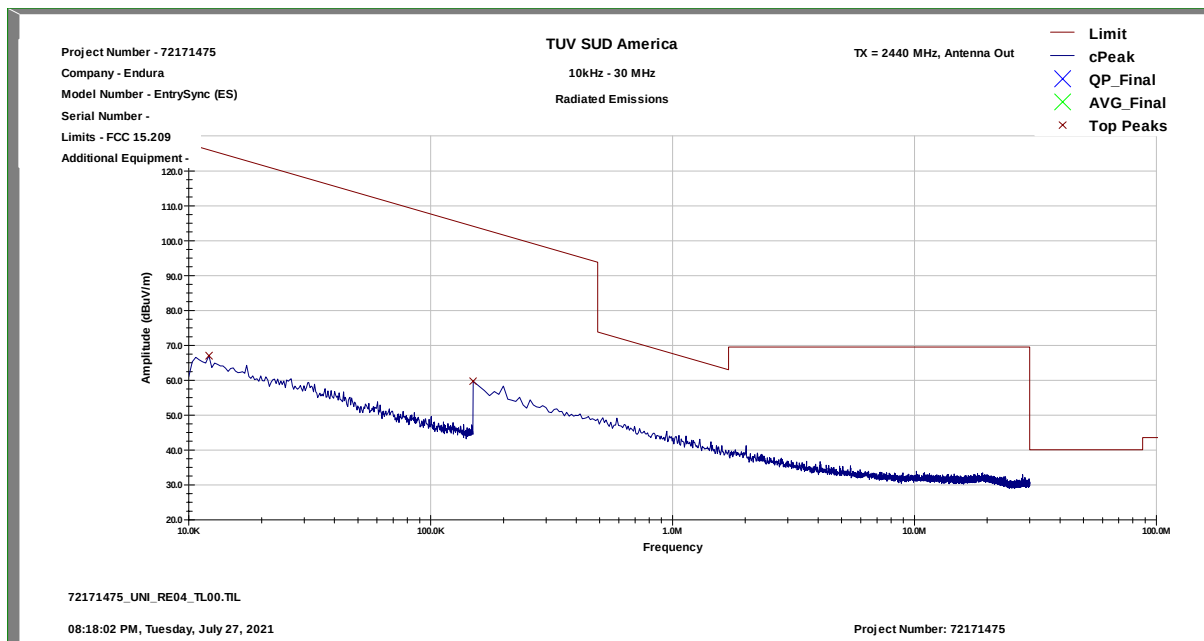


Figure 2.7.7-1: Radiated Emissions Representative Scan below 30 MHz – Antenna "Out"

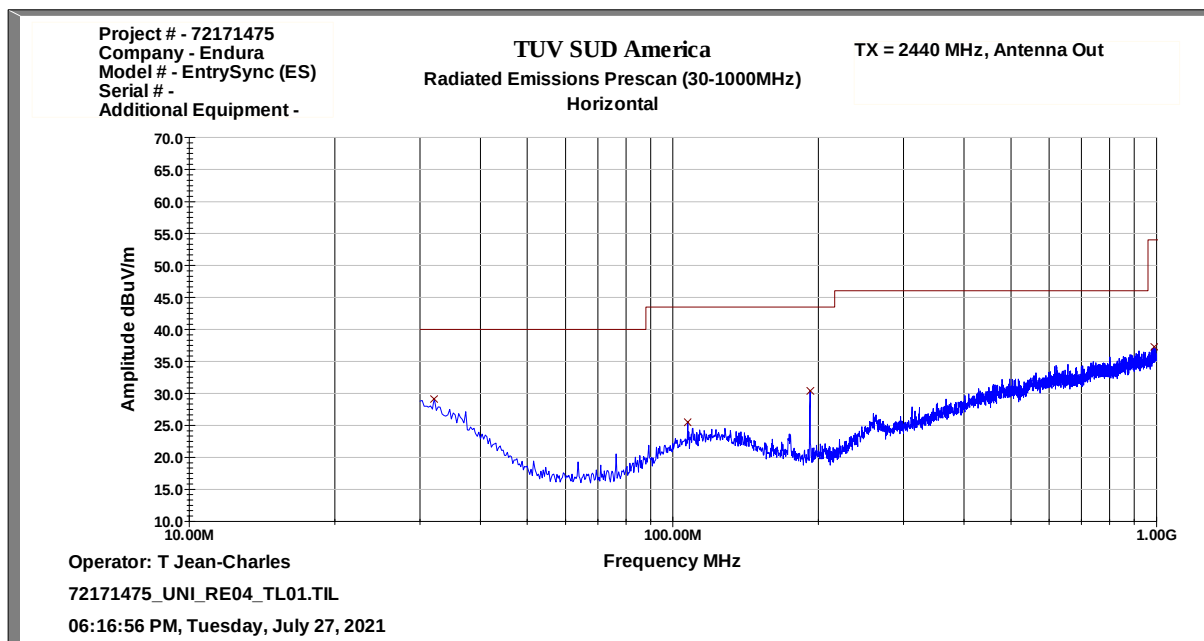


Figure 2.7.7-2: Radiated Emissions Representative – 30 MHz- 1 GHz – Horizontal Polarization – Antenna "Out"

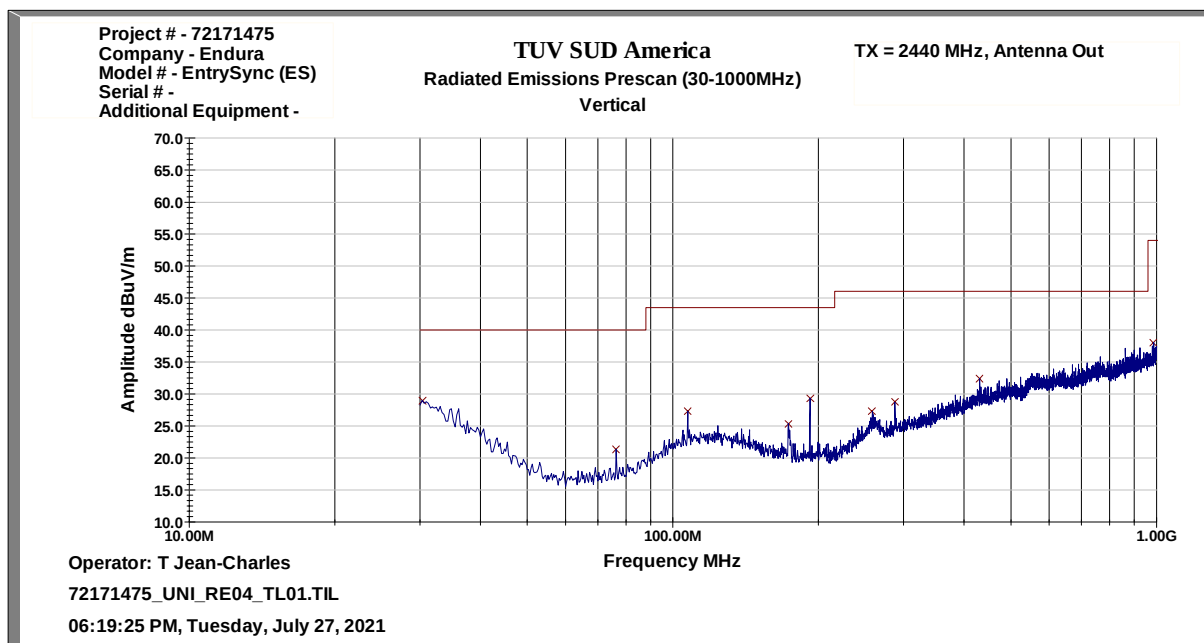


Figure 2.7.7-3: Radiated Emissions Representative – 30 MHz- 1 GHz – Vertical Polarization – Antenna "Out"

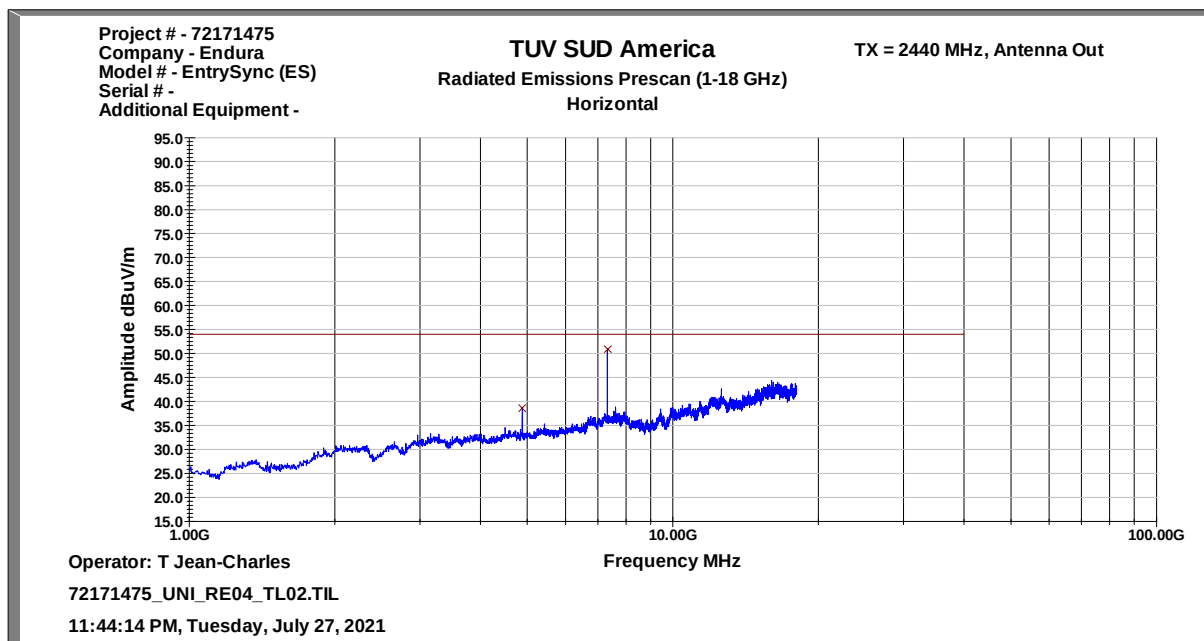


Figure 2.7.7-4: Radiated Emissions Representative – 1 GHz- 18 GHz – Horizontal Polarization – Antenna "Out"

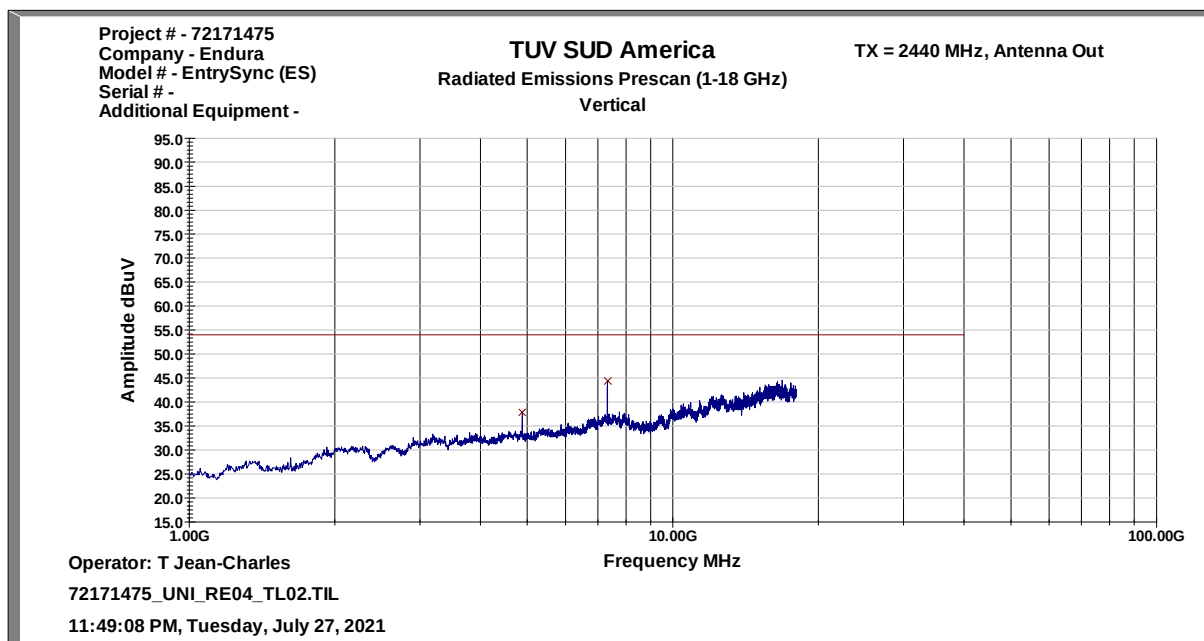


Figure 2.7.7-5: Radiated Emissions Representative – 1 GHz- 18 GHz – Vertical Polarization – Antenna "Out"

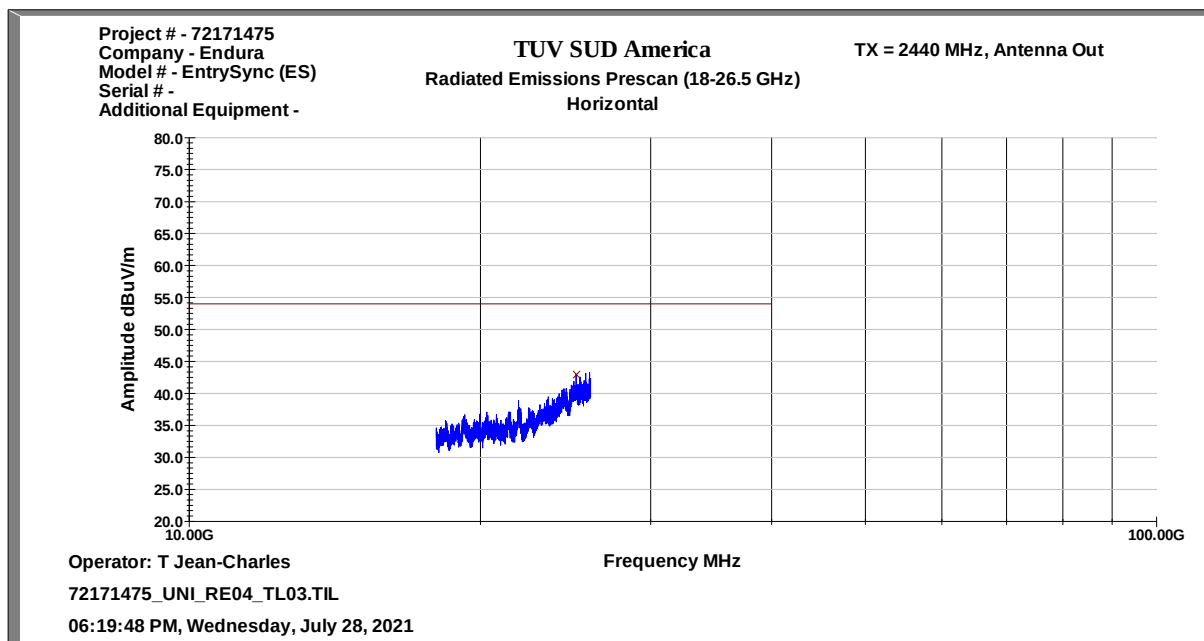


Figure 2.7.7-6: Radiated Emissions Representative – 1 GHz- 26 GHz – Horizontal Polarization – Antenna "Out"

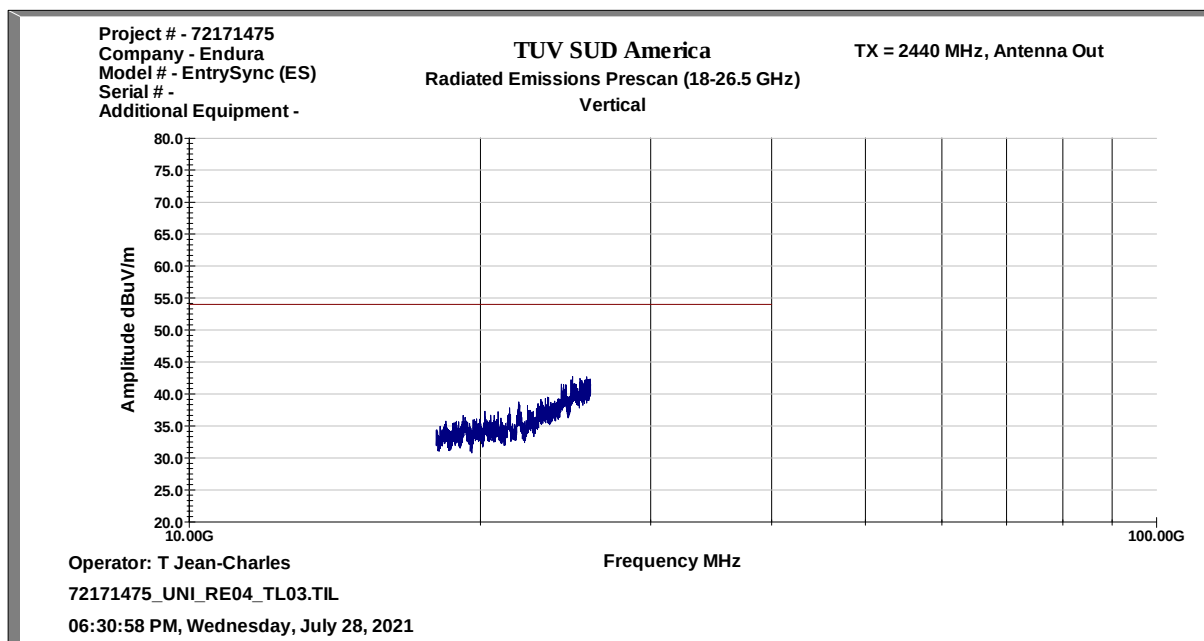


Figure 2.7.7-7: Radiated Emissions Representative – 1 GHz- 26 GHz – Vertical Polarization – Antenna "Out"



2.7.8 Sample Calculations

$$R_C = R_U + CF_T$$

Where:

CF_T	=	Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
R_U	=	Uncorrected Reading
R_C	=	Corrected Level
AF	=	Antenna Factor
CA	=	Cable Attenuation
AG	=	Amplifier Gain
DC	=	Duty Cycle Correction Factor

Example Calculation: Peak

Corrected Level: $56.19 + (-5.37) = 50.82 \text{ dB}\mu\text{V/m}$

Margin: $74 \text{ dB}\mu\text{V/m} - 50.82 \text{ dB}\mu\text{V/m} = 23.18 \text{ dB}$

Example Calculation: Average

Corrected Level: $43.36 + (-5.37) - 0 = 37.99 \text{ dB}\mu\text{V/m}$

Margin: $54 \text{ dB}\mu\text{V/m} - 37.99 \text{ dB}\mu\text{V/m} = 16.01 \text{ dB}$



2.7.9 Test Location and Test Equipment Used

This test was carried out in TÜV SÜD America, Inc., 5610 W. Sligh Ave, Suite 100, Tampa, FL 33634, USA.

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
9kHz-26.5GHz EMC analyzer/HYZ	Agilent	E7405A	BEMC00523	A.14.06	12	25-Feb-2022
10dB Attenuator	Merrimac	FAN-6-10K	BEMC02086	N/A	12	19-Oct-2021
Tile Automation Software	ETS Lindgren	TILE4! - Version 4.2.A	BEMC02095	4.2A	N/A	NCR
BI LOG PERIODIC, ANTENNA	Schaffner	CBL6112B	TEMC00005	N/A	24	31-Oct-2021
Loop Antenna	Com Power	AL-130	TEMC00025	N/A	24	26-Sep-2021
Horn Antenna	Schwarzbeck	BBHA-9170	TEMC00029	N/A	60	23-Aug-2021
EMC Chamber	Panasheild	N/A	TEMC00031	N/A	36	28-Jan-2024
Double Ridge Guide Horn	ETS Lindgren	3117	TEMC00061	N/A	24	07-Feb-2022
18 GHz-40 GHz Microwave Preamplifier	COM-power	PAM-840A	TEMC00147	N/A	12	29-Jun-2022
PAM-118A	Com-Power Corporation	PAM-118A	TEMC00160	N/A	12	10-Apr-2022
2.4 GHz Notch Filter	Micro-Tronics	BRM50702-01	TEMC00176	N/A	12	09-Mar-2022
A81-0303 18 GHz Cable Set	Teledyne Storm Products	A81-0303-360/96	TEMC00201	N/A	12	10-Apr-2022

TU - Traceability Unscheduled

O/P MON - Traceability Unscheduled

N/A - Not Applicable

NCR – No Calibration Required



2.8 Power Spectral Density

2.8.1 Specification Reference

FCC: Section 15.247(e)
ISED Canada: RSS-247 5.2(b)

2.8.2 Equipment Under Test and Modification State

S/N: N/A

2.8.3 Date of Test

7/28/2021 to 7/29/2021

2.8.4 Test Method

The power spectral density was measured in accordance with ANSI C63.10 Subclause 11.10.2 Method PKPSD (peak PSD). The RF output port of the EUT was directly connected to the input of the spectrum analyzer. Offset values were input for cable and external attenuation. The spectrum analyzer's RBW was set to 3 kHz and VBW to 10 kHz. The Span was adjusted to 1.5 times the DTS bandwidth and the sweep time was set to auto. The measurements were performed using a Peak detector.

2.8.5 Environmental Conditions

Ambient Temperature 24.5 °C
Relative Humidity 44.1 %
Atmospheric Pressure 1015.9 mbar

2.8.6 Test Results

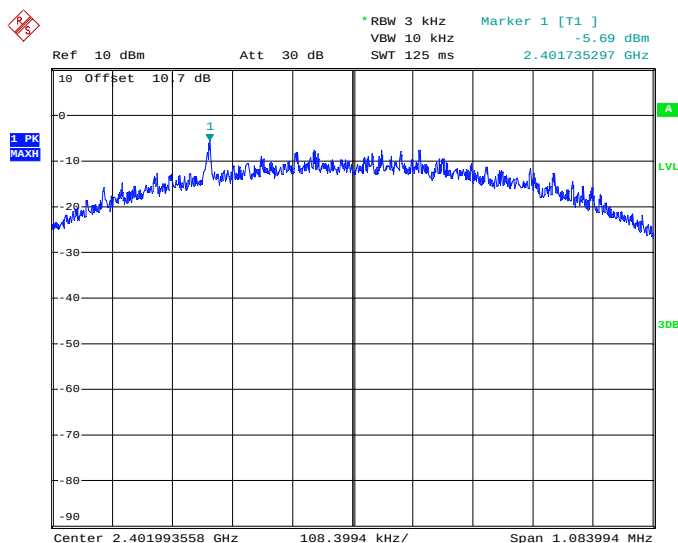
DC Powered Operating

Limit FCC: Section 15.247(e), ISED Canada: RSS-247 5.2(b)

The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time of continuous transmission.

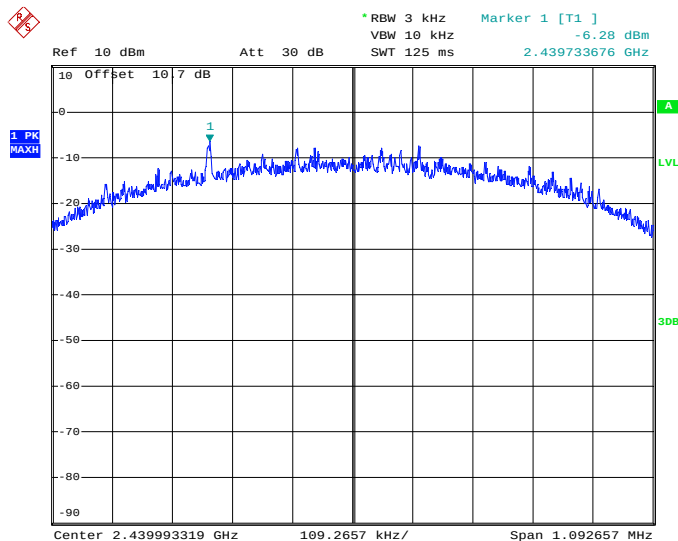
Table 2.8.6-1: Power Spectral Density Results – Antenna "Out"

Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
2402	-5.69	8	13.69
2440	-6.28	8	14.28
2480	-7.08	8	15.08



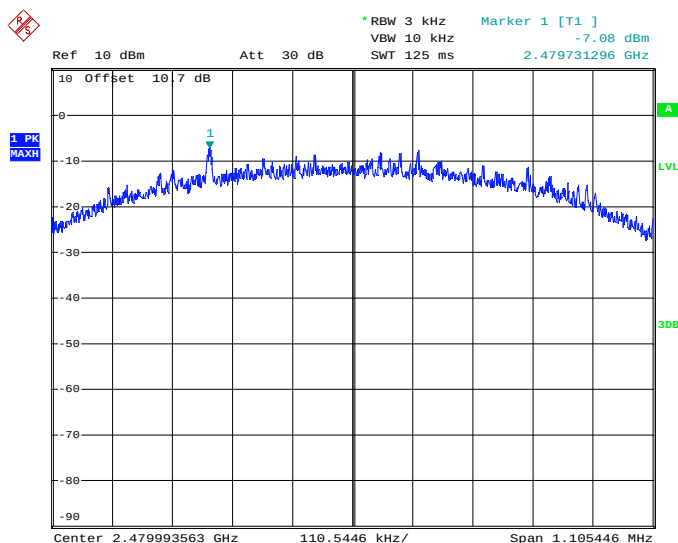
Date: 28.JUL.2021 23:07:42

Figure 2.8.6-1: Power Spectral Density Results – Low Channel – Antenna "Out"



Date: 28.JUL.2021 23:39:38

Figure 2.8.6-2: Power Spectral Density Results – Middle Channel – Antenna "Out"

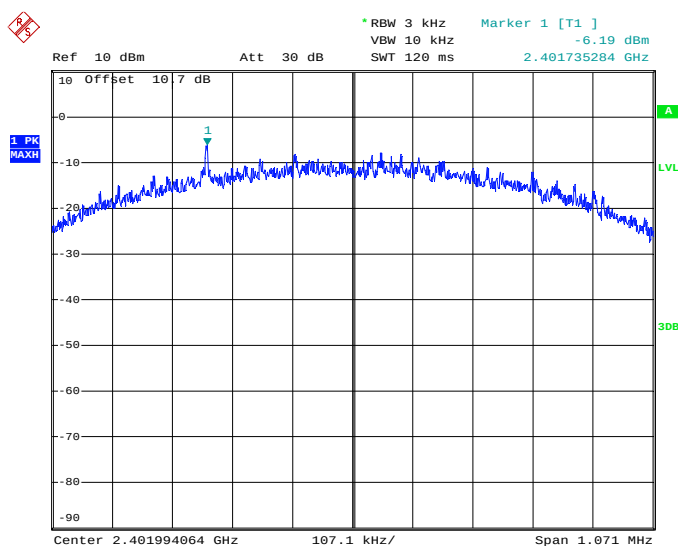


Date: 29.JUL.2021 00:03:40

Figure 2.8.6-3: Power Spectral Density Results – High Channel – Antenna "Out"

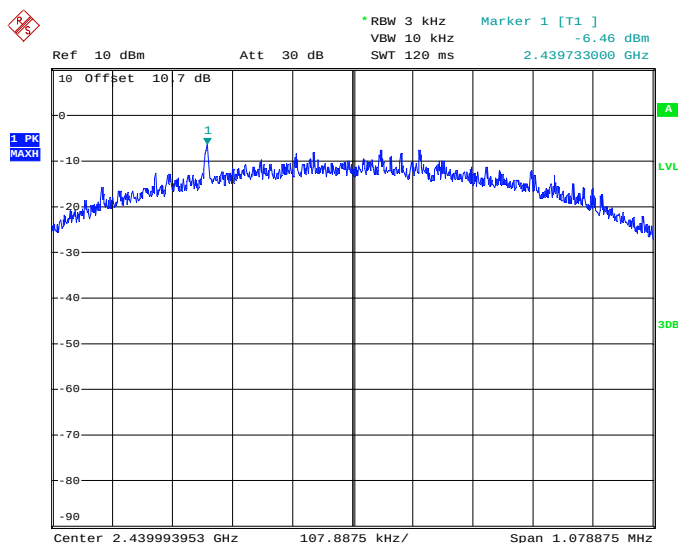
**Table 2.8.6-2: Power Spectral Density Results – Antenna "In"**

Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
2402	-6.19	8	14.19
2440	-6.46	8	14.46
2480	-7.40	8	15.40



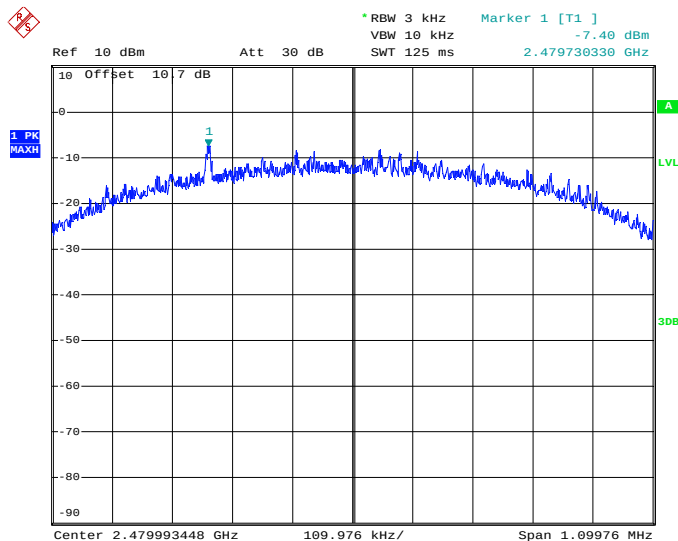
Date: 29.JUL.2021 14:23:17

Figure 2.8.6-4: Power Spectral Density Results – Low Channel – Antenna "In"



Date: 29.JUL.2021 14:56:39

Figure 2.8.6-5: Power Spectral Density Results – Middle Channel – Antenna "In"



Date: 29.JUL.2021 15:32:24

Figure 2.8.6-6: Power Spectral Density Results – High Channel – Antenna "In"



2.8.7 Test Location and Test Equipment Used

This test was carried out in TÜV SÜD America, Inc., 5610 W. Sligh Ave, Suite 100, Tampa, FL 33634, USA.

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
Spectrum Analyzer	Rohde & Schwarz	FSP40	BEMC00283	4.50 SP5	24	04-Oct-2021
Attenuator 10dB, 2.9 mm-M/F, DC-40GHz 2 W	Aeroflex Inmet	40AH2W-10	BEMC02110	N/A	12	08-Jul-2022

TU - Traceability Unscheduled

O/P MON - Traceability Unscheduled

N/A - Not Applicable



2.9 Power Line Conducted Emissions

2.9.1 Specification Reference

FCC: Section 15.207
ISED Canada; RSS-GEN 8.8

2.9.2 Test Results

N/A - Not Applicable

The EUT is battery powered only without any provisions for connection to the AC mains. The EUT is exempted from the power line conducted emissions requirements.



3 Test Equipment Information

3.1 General Test Equipment Used

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
Spectrum Analyzer	Rohde & Schwarz	FSP40	BEMC00283	4.50 SP5	24	04-Oct-2021
9kHz-26.5GHz EMC analyzer/HYZ	Agilent	E7405A	BEMC00523	A.14.06	12	25-Feb-2022
10dB Attenuator	Merrimac	FAN-6-10K	BEMC02086	N/A	12	19-Oct-2021
Tile Automation Software	ETS Lindgren	TILE4! - Version 4.2.A	BEMC02095	4.2A	N/A	NCR
Attenuator 10dB, 2.9 mm-M/F, DC-40GHz 2 W	Aeroflex Inmet	40AH2W-10	BEMC02110	N/A	12	08-Jul-2022
BI LOG PERIODIC, ANTENNA	Schaffner	CBL6112B	TEMC00005	N/A	24	31-Oct-2021
Loop Antenna	Com Power	AL-130	TEMC00025	N/A	24	26-Sep-2021
Horn Antenna	Schwarzbeck	BBHA-9170	TEMC00029	N/A	60	23-Aug-2021
EMC Chamber	Panasheild	N/A	TEMC00031	N/A	36	28-Jan-2024
Double Ridge Guide Horn	ETS Lindgren	3117	TEMC00061	N/A	24	07-Feb-2022
18 GHz-40 GHz Microwave Preamplifier	COM-power	PAM-840A	TEMC00147	N/A	12	29-Jun-2022
PAM-118A	Com-Power Corporation	PAM-118A	TEMC00160	N/A	12	10-Apr-2022
2.4 GHz Notch Filter	Micro-Tronics	BRM50702-01	TEMC00176	N/A	12	09-Mar-2022
A81-0303 18 GHz Cable Set	Teledyne Storm Products	A81-0303-360/96	TEMC00201	N/A	12	10-Apr-2022

TU - Traceability Unscheduled

O/P MON - Traceability Unscheduled

N/A - Not Applicable

NCR – No Calibration Required

4 Diagram of Test Set-ups

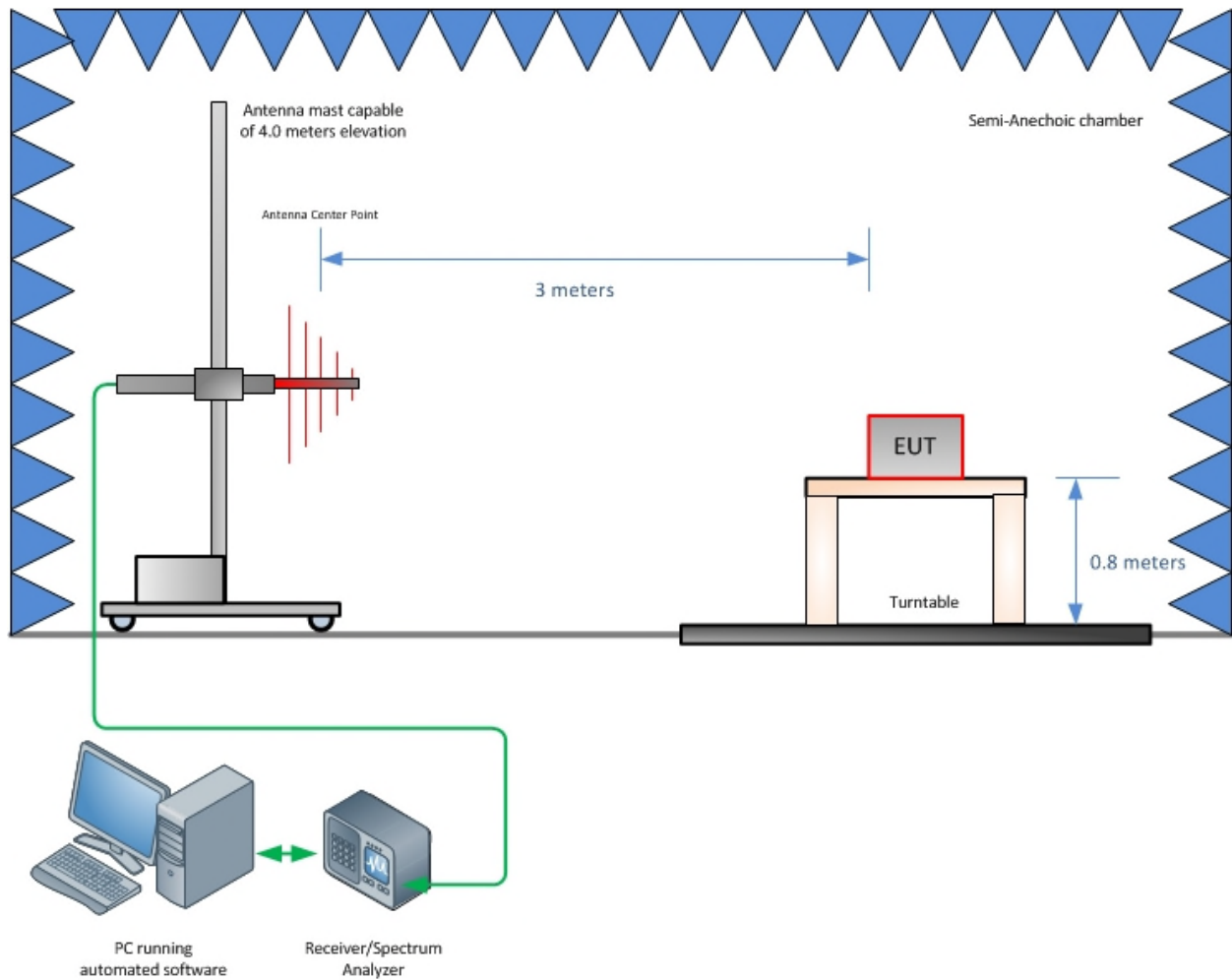


Figure 4-1 - Radiated Emissions Test Setup up to 1 GHz

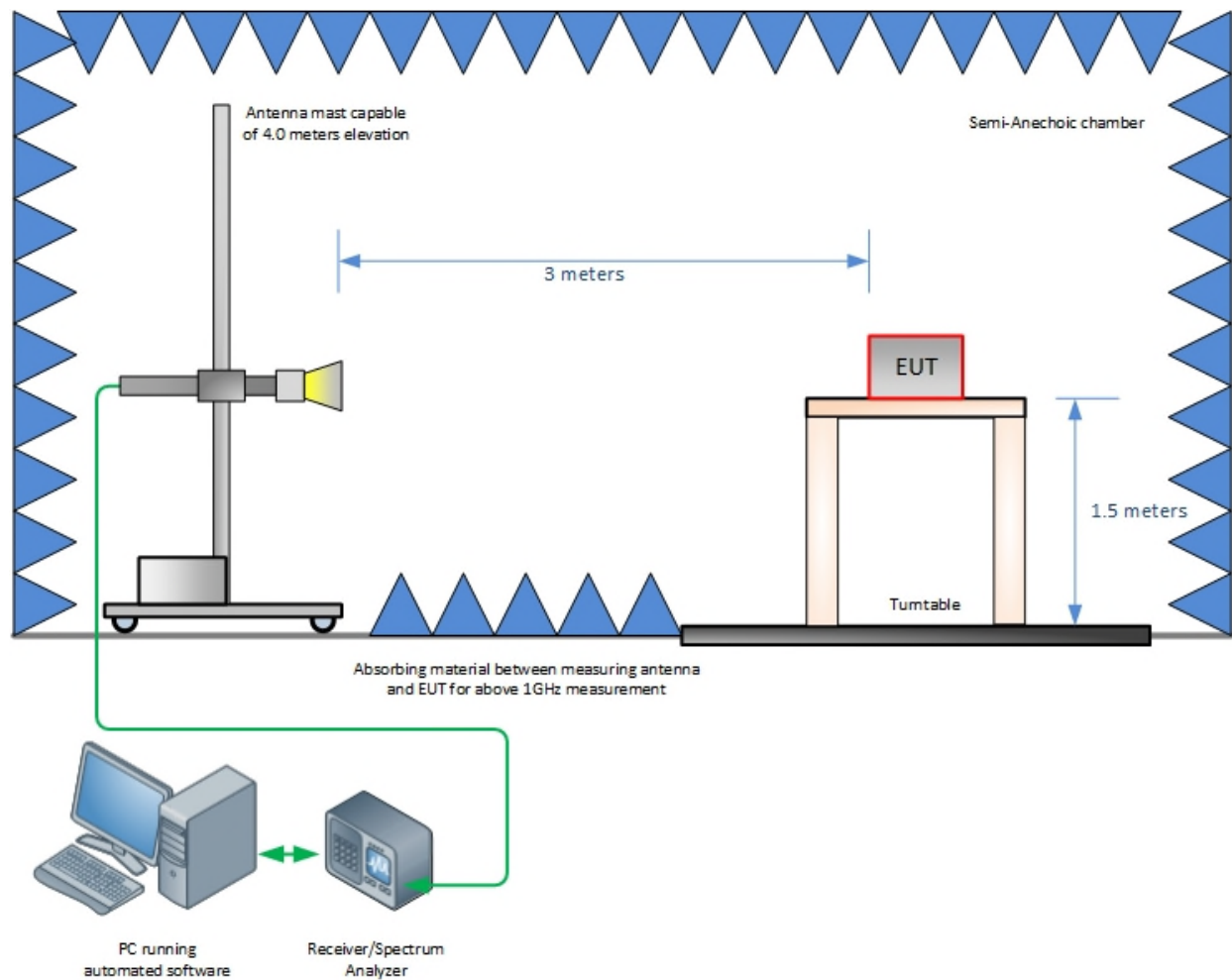


Figure 4-2 - Radiated Emissions Test Setup above 1 GHz

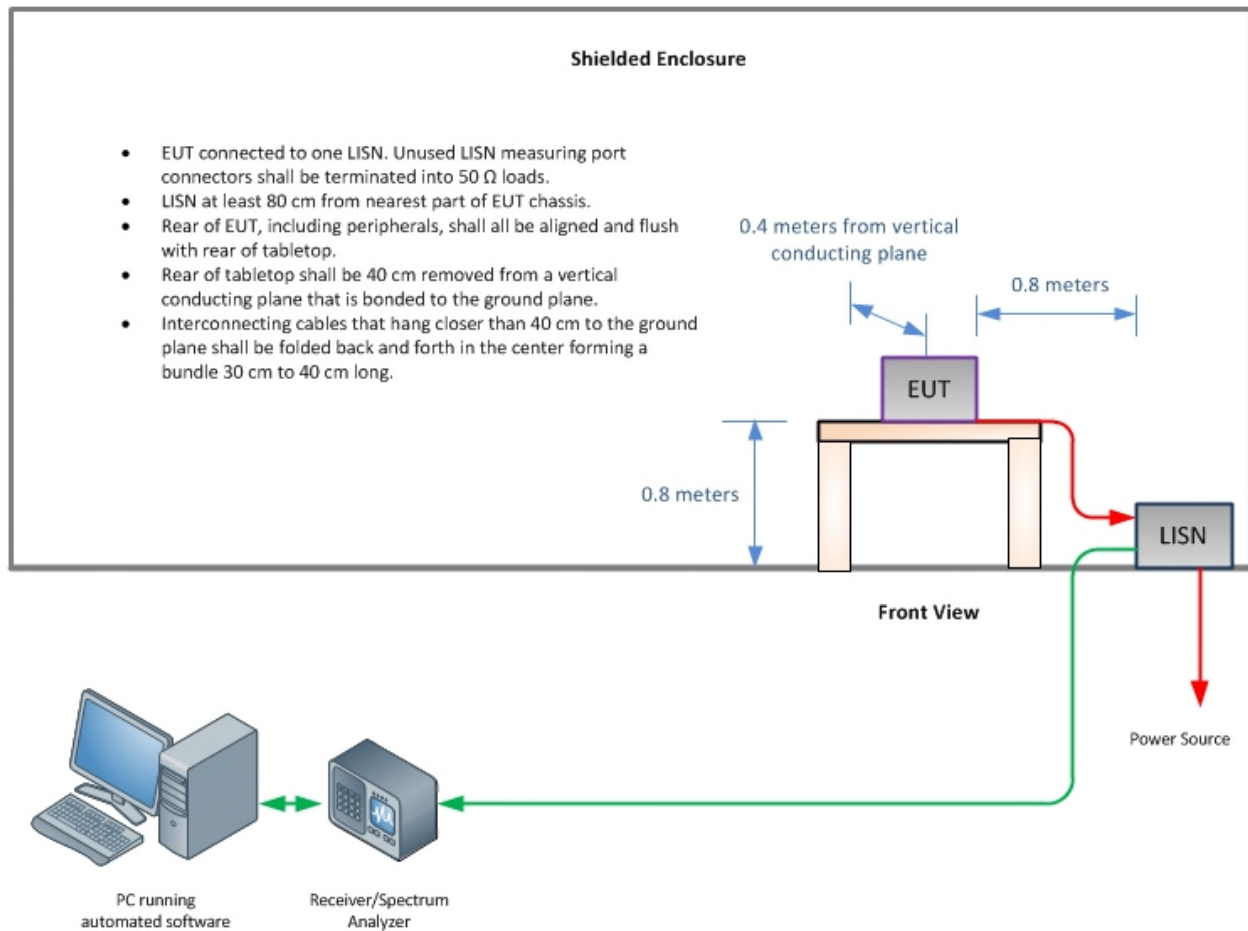


Figure 4-3 – Conducted Emissions Test Setup



5 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

Table 5-1 - Values of U_{CISPR} and U_{Lab}

Measurement	U_{CISPR}	U_{Lab}
Conducted disturbance (mains port) (9 kHz – 150 kHz) (150 kHz – 30 MHz)	3.8 dB 3.4 dB	3.71 dB 3.31 dB
Conducted disturbance (telecom port) (150 kHz – 30 MHz 55 dB LCL) (150 kHz – 30 MHz 65 dB LCL) (150 kHz – 30 MHz 75 dB LCL)	5.0 dB 5.0 dB 5.0 dB	4.11 dB 4.50 dB 4.94 dB
Radiated disturbance (electric field strength on an open area test site or alternative test site) (30 MHz – 1 000 MHz) (1 – 6 GHz) (6-18 GHz)	6.3 dB 5.2 dB 5.5 dB	5.85 dB 4.48 dB 4.48 dB

Notes:

U_{CISPR} resembles a value of measurement uncertainty for a specific test, which was determined by considering uncertainties associated with the quantities listed in CISPR 16-4-2:2011.



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