FCC and ISED Canada Testing of the

Synapse Wireless Inc.
SM520

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

America

Add value.
Inspire trust.

Prepared for: Synapse Wireless Inc.
6723 Odyssey Dr NW
Huntsville, AL 35806

FCC ID: U9O-SM520
IC: 7084A-SM520

COMMERCIAL-IN-CONFIDENCE

Document Number: TP72173307.201 | Version Number: 02

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Authorized Signatory	Peter Walsh	2021 -November-23	
Testing	Thierry Jean Charles	2021-November-23	

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

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-November-22
2	Updated Figure Captions in Section 2.7.7	2021-November-23

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	Synapse Wireless Inc.
Manufacturer	Synapse Wireless Inc. (Contract Manufacturer: Panasonic Industrial Devices Europe GmbH)
Applicant's Email Address	jason.gurley@synapsewireless.com
Model Number(s)	SM520
Serial Number(s)	349C33 (Radiated and RF Conducted Emissions) 349C3A (Power Line Conducted Emissions)
FCC ID	U9O-SM520
ISED Certification Number	7084A-SM520
Hardware Version(s)	Rev B
Software Version(s)	7084A-SM520
Number of Samples Tested	2
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-August-24
Order Number	72173307
Date	2021-October-07
Date of Receipt of EUT	2021-November-08
Start of Test	2021-November-08
Finish of Test	2021-November-12
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 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.

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	-------	13
6 dB Bandwidth	Yes	Pass	15.247(a)(2)	RSS-247 5.2(a)	15
99% Bandwidth	Yes	Pass	-------	RSS-GEN 6.6	18
Peak Output Power	Yes	Pass	15.247(b)(3)	RSS-247 5.4(d)	21
Band-Edge Compliance of RF Conducted Emissions	Yes	Pass	15.247(d)	RSS-247 5.5	24
RF Conducted Spurious Emissions	Yes	Pass	15.247(d)	RSS-247 5.5	27
Conducted Spurious Emissions into Restricted Frequency Bands	Yes	Pass	15.205, 15.209	RSS-GEN 8.9, 8.10	30
Radiated Spurious Emissions into Restricted Frequency Bands	Yes	Pass	15.205, 15.209	RSS-GEN 8.9, 8.10	38
Power Spectral Density	Yes	Pass	15.247(e)	RSS-247 5.2(b)	50
Power Line Conducted Emissions	Yes	Pass	15.207	RSS-GEN 8.8	53

1.4 Product Information

1.4.1 Technical Description

The EUT was a 2.4 GHz ISM Wireless Sensor and Control Module. The EUT includes an RF switch which allows the selection of the integral PCB trace antenna or the on-board u.FL. connector for external antennas.

The RF parameters as described by the equipment manufacturer are provided below.

Technical Details

Mode of Operation:	IEEE 802.15.4 SNAP
Frequency Range:	2405 MHz - 2480 MHz
Number of Channels:	16
Channel Separation:	5 MHz
Data Rate:	250 kbps
Modulations:	O-QPSK
Antenna Type/Gain:	PCB Trace Antenna, -1.1 dBi
	Pulse W1027 Dipole Antenna, 3.2 dBi
	Pulse W1030 Dipole Antenna, 2.0 dBi
	Pulse W1038 Dipole Antenna, 4.7 dBi
	Pulse W5010 Dipole Antenna, 1.5 dBi
	Linx ANT-2.4-CW-RH-RPS Monopole Antenna, -0.9 dBi
	LCOM HG2405RD-RSP Colinear Dipole Antenna, 5 dBi
	Pulse RO2408NF Colinear Dipole Antenna, 8 dBi
Input Power:	3.6 VDC

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

Table 1.4.1-1 – Cable Descriptions

Cable/Port	Description
Power Cord	2 m, Not Shielded, AC Adapter to Prototyping Board
Power Cable	2.65 m, Twisted Pair, Not shielded, Power Supply to Prototyping Board

Note: The cables and accessories were used for testing purposes.

Table 1.4.1-2 – Support Equipment Descriptions

Make/Model	Description
Synapse / SN171	Break-out/prototyping Board
Tamura Corp. / 318AS09035	9 VDC AC Adapter
Hewlett Packard / 6291A	DC Power Supply, S/N: 1928A05628

Note: The cables and accessories were used for testing purposes.

Declaration of Build Status

EQUIPMENT DESCRIPTION	
Model Name/Number	SM520
Part Number	SM520UF1
Hardware Version	Rev B
Software Version	2.9.0
FCC ID (if applicable)	U9O-SM520
ISED ID (if applicable)	7084A-SM520
Technical Description (Please provide a brief description of the intended use of the equipment)	The SNAP Engine Model SM520 series consists of the SM520UF1 part number. It is an IEEE 802.15.4, low-power, highly reliable solution for embedded wireless control and monitoring networks requiring high data rates. It embeds Synapse's SNAP OS, the industry's first Internet-enabled, wireless mesh network operating system, into the Silabs Mighty Gecko microcontroller with an integrated transceiver that delivers up to 250Kbits/sec.

UN-INTENTIONAL RADIATOR	
Highest frequency generated or used in the device or on which the device operates or tunes	2480MHz
Lowest frequency generated or used in the device or on which the device operates or tunes	38.4MHz
Class A Digital Device (Use in commercial, industrial or business environment) ☐	

Power Source			
AC	Single Phase	Three Phase	Nominal Voltage
	☐	☐	
External DC	Nominal Voltage	Maximum Current	
	3.3	160mA	
Battery	Nominal Voltage	Battery Operating End Point Voltage	

EXTREME CONDITIONS					
Maximum temperature	+85	°C	Minimum temperature	-40	°C

Ancillaries
Please list all ancillaries which will be used with the device.
SN171 evaluation board, external DC power supply.

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

Name: Jason S Gurley

Position held: Principal Hardware Engineer Date: 10/28/2021

1.4.2 Modes of Operation

The EUT was set to the continuous transmit mode, 100% duty cycle, for the 2.4 GHz radio.

The test power settings were 60 for channel 15 (2480 MHz) and 252 for the other channels.

1.4.3 Monitoring of Performance

The EUT was evaluated for radiated, RF conducted and power line conducted emissions.

For the radiated emissions, preliminary measurements were performed for the EUT in three orthogonal orientations. The EUT set vertically as described in the test setup photos document was determined to be the worst case and was used for the final evaluation. The tests were performed for the EUT using the integral antenna as well as for the EUT transmitting through the u.FL. connector terminated with a 50-ohm load.

The RF conducted measurements were performed through the on-board u.FL. connector.

The power line conducted emissions measurements were performed using an off-the-shelf power supply. The EUT was transmitting through the integral trace antenna during the evaluation.

1.4.4 Performance Criteria

The following parameters were evaluated.

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
Conducted Spurious Emissions into Restricted Frequency Bands	FCC: Sections 15.205, 15.209; ISED Canada: RSS-GEN 8.9, 8.10
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)
Power Line Conducted Emissions	FCC: Section 15.207; ISED Canada: RSS-GEN 8.8

1.5 Deviations from the Standard

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

1.6 EUT Modification Record

The table below details modifications made to the EUT during the test programme. 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
None			

The equipment was tested as provided without any modifications.

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
DC 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
Conducted Spurious Emissions into Restricted Frequency Bands	Thierry Jean-Charles	A2LA
Radiated Spurious Emissions into Restricted Frequency Bands	Thierry Jean-Charles	A2LA
Power Spectral Density	Thierry Jean-Charles	A2LA
Power Line Conducted Emissions	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: 349C33

2.1.3 Date of Test

11/8/2021

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 provides an RF switch which allows the selection of an integral PCB antenna or a u.FL. connector.

The integral PCB trace antenna is not detachable and meets the requirements of FCC 15.203.

For the u.FL. connector, the EUT is marketed with antennas configured with RP-SMA connectors. The equipment manufacturer also supplies RP-SMA to u.FL. cables along with the antennas for connection with the module. The antenna and cable connectors are considered unique and therefore meet 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: 349C33

2.2.3 Date of Test

11/10/2021 to 11/11/2021

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	26.7°C
Relative Humidity	40.7 %
Atmospheric Pressure	1018.8 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

Frequency (MHz)	6 dB Bandwidth (kHz)
2405	1816.51
2440	1809.79
2480	1707.76

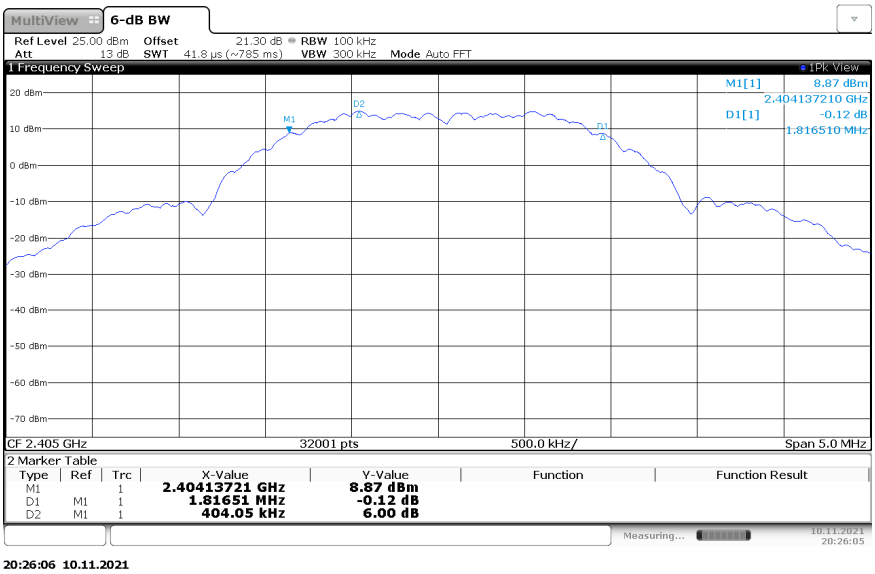

Figure 2.2.6-1: 6 dB Bandwidth Test Results Low Channel

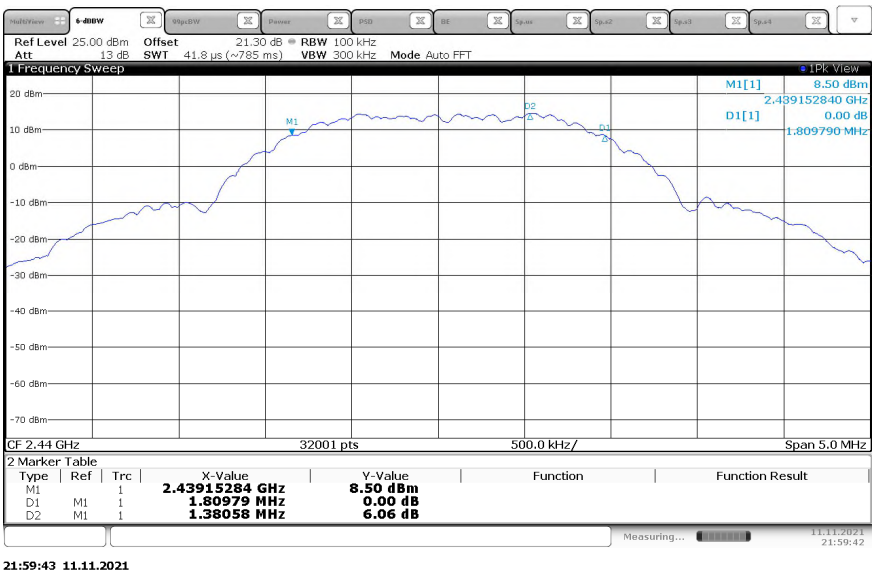

Figure 2.2.6-2: 6 dB Bandwidth Test Results Middle Channel

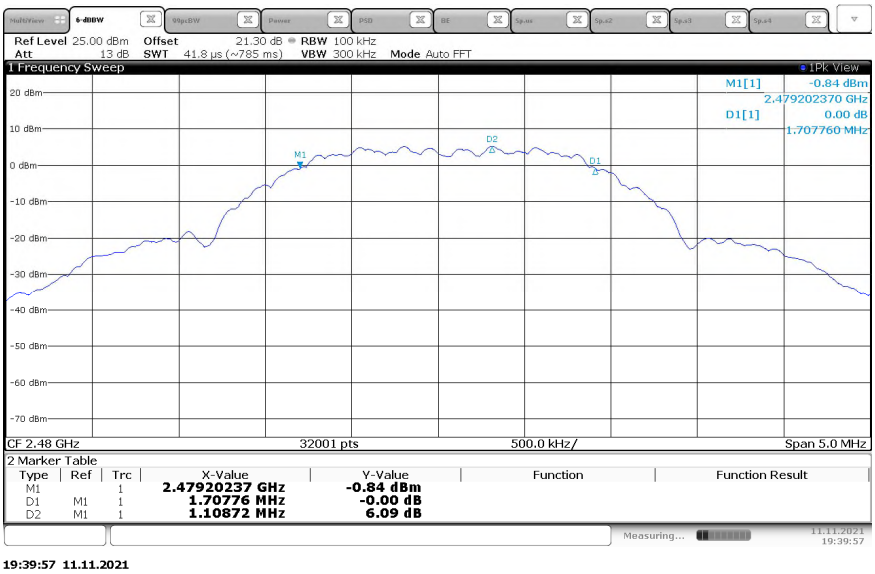

Figure 2.2.6-3: 6 dB Bandwidth Test Results High Channel

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
Atten 20dB 2.9mm-M/F, DC-26.5GH, 2W	Aeroflex Inmet	26AH-20	DEMC3049	N/A	12	07-Aug-2022
Signal & Spectrum Analyzer	Rohde & Schwarz	FSW43	DEMC3085	2.90 SP1	24	07-Dec-2022
DC Power Supply	Xantrex	XHR60-18	TEMC00001	N/A	N/A	NCR

TU - Traceability Unscheduled
O/P MON - Traceability Unscheduled
N/A - Not Applicable
NCR – No Calibration Required

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: 349C33

2.3.3 Date of Test

11/10/2021 to 11/11/2021

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	26.7°C
Relative Humidity	40.7 %
Atmospheric Pressure	1018.8 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

Frequency (MHz)	99% Bandwidth (kHz)
2405	2272.85
2440	2254.34
2480	2257.79

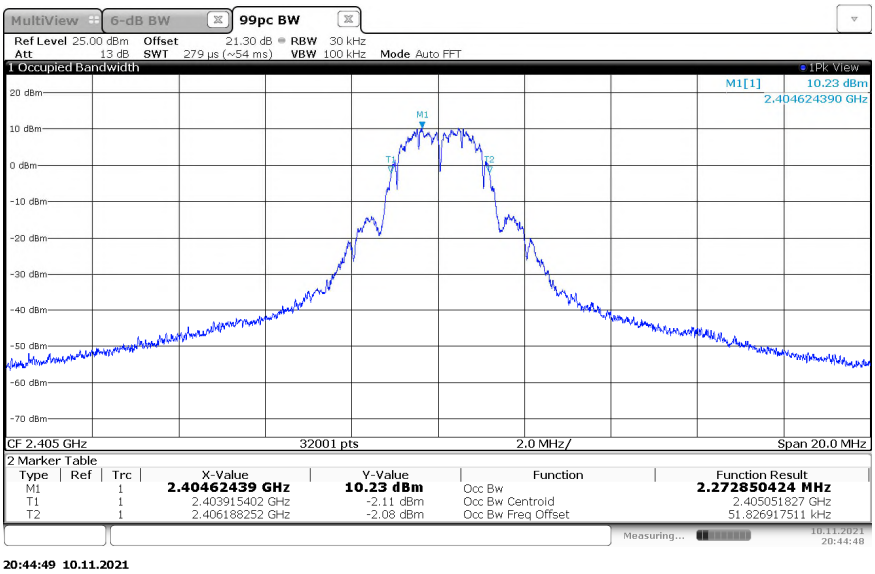

Figure 2.3.6-1: 99% Bandwidth Test Results Low Channel

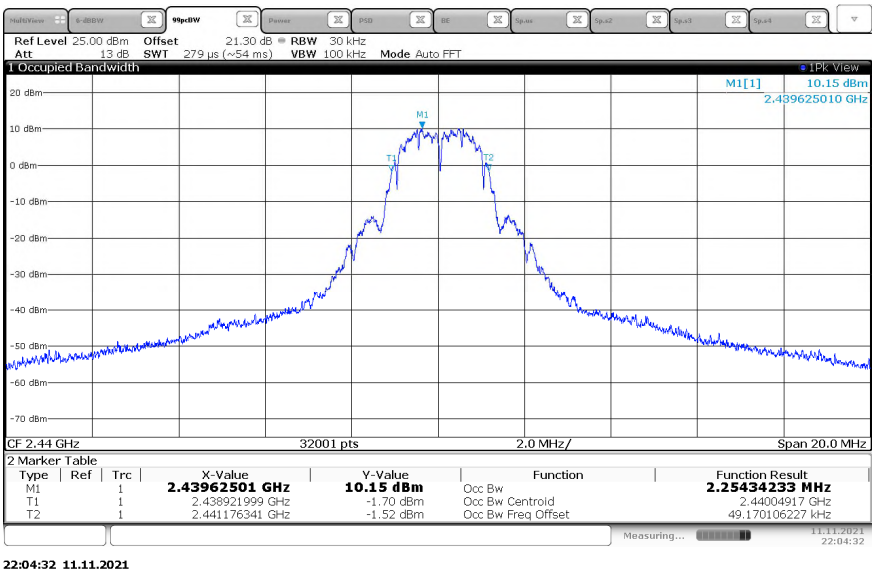

Figure 2.3.6-2: 99% Bandwidth Test Results Middle Channel

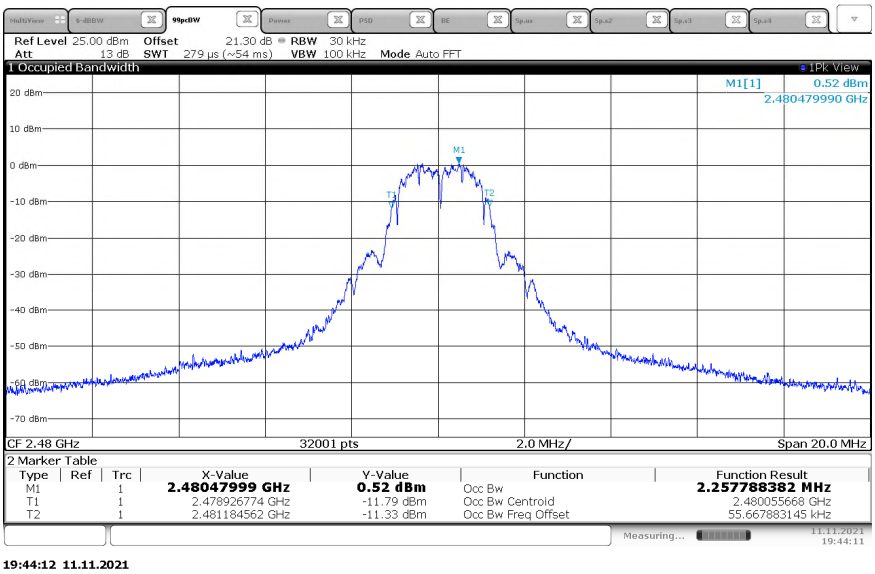

Figure 2.3.6-3: 99% Bandwidth Test Results High Channel

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
Atten 20dB 2.9mm-M/F, DC-26.5GH, 2W	Aeroflex Inmet	26AH-20	DEMC3049	N/A	12	07-Aug-2022
Signal & Spectrum Analyzer	Rohde & Schwarz	FSW43	DEMC3085	2.90 SP1	24	07-Dec-2022
DC Power Supply	Xantrex	XHR60-18	TEMC00001	N/A	N/A	NCR

TU - Traceability Unscheduled
O/P MON - Traceability Unscheduled
N/A - Not Applicable
NCR – No Calibration Required

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: 349C33

2.4.3 Date of Test

11/10/2021 to 11/11/2021

2.4.4 Test Method

The fundamental emission output power was measured in accordance with ANSI C63.10 Subclause 11.9.1.1 RBW ≥ 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	26.7°C
Relative Humidity	40.7 %
Atmospheric Pressure	1018.8 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

Frequency (MHz)	Output Power (dBm)
2405	19.18
2440	19.11
2480	7.89

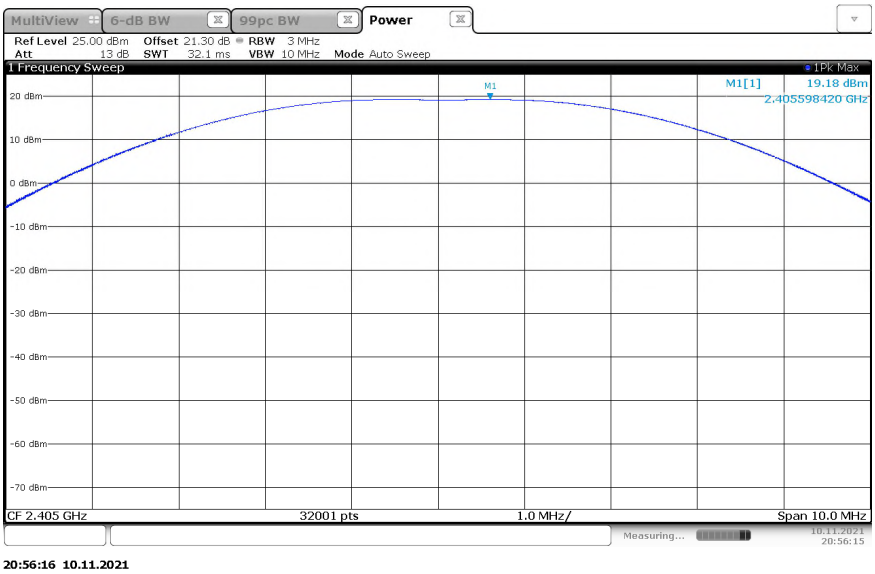

Figure 2.4.6-1: Maximum Output Power Results Low Channel

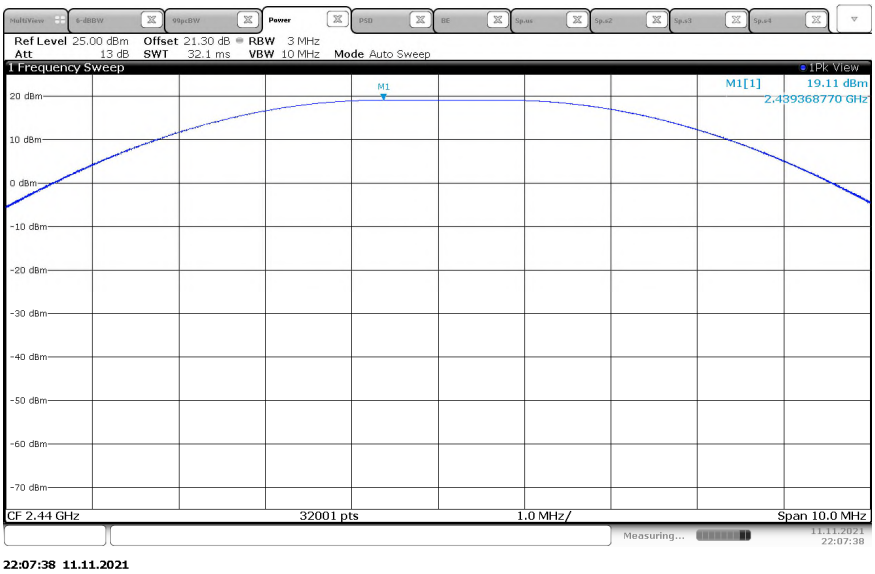

Figure 2.4.6-2: Maximum Output Power Results Middle Channel

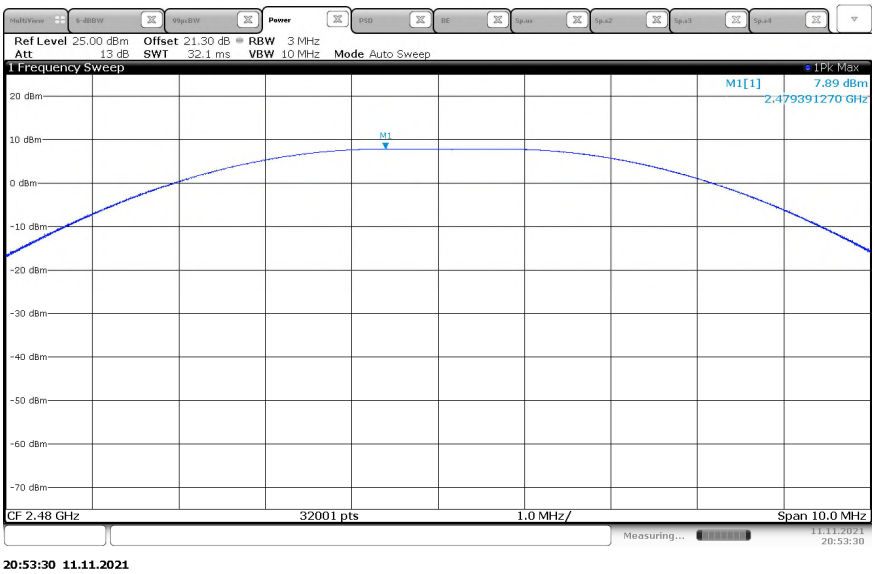

Figure 2.4.6-3: Maximum Output Power Results High Channel

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
Atten 20dB 2.9mm-M/F, DC-26.5GH, 2W	Aeroflex Inmet	26AH-20	DEMC3049	N/A	12	07-Aug-2022
Signal & Spectrum Analyzer	Rohde & Schwarz	FSW43	DEMC3085	2.90 SP1	24	07-Dec-2022
DC Power Supply	Xantrex	XHR60-18	TEMC00001	N/A	N/A	NCR

TU - Traceability Unscheduled
O/P MON - Traceability Unscheduled
N/A - Not Applicable
NCR – No Calibration Required

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: 349C33

2.5.3 Date of Test

11/10/2021 to 11/11/2021

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	26.7 °C
Relative Humidity	40.7 %
Atmospheric Pressure	1018.8 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.

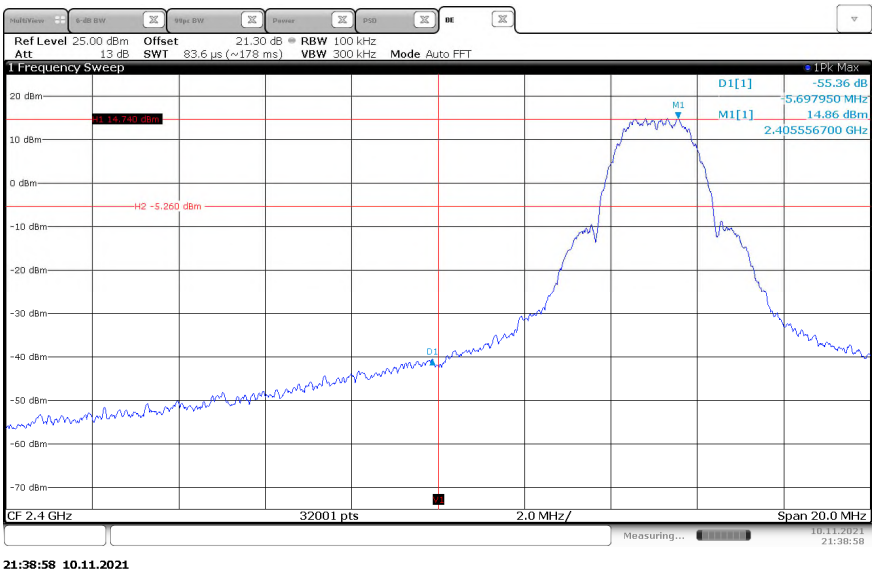

Figure 2.5.6-1: RF Conducted Band-Edge Results Low Channel

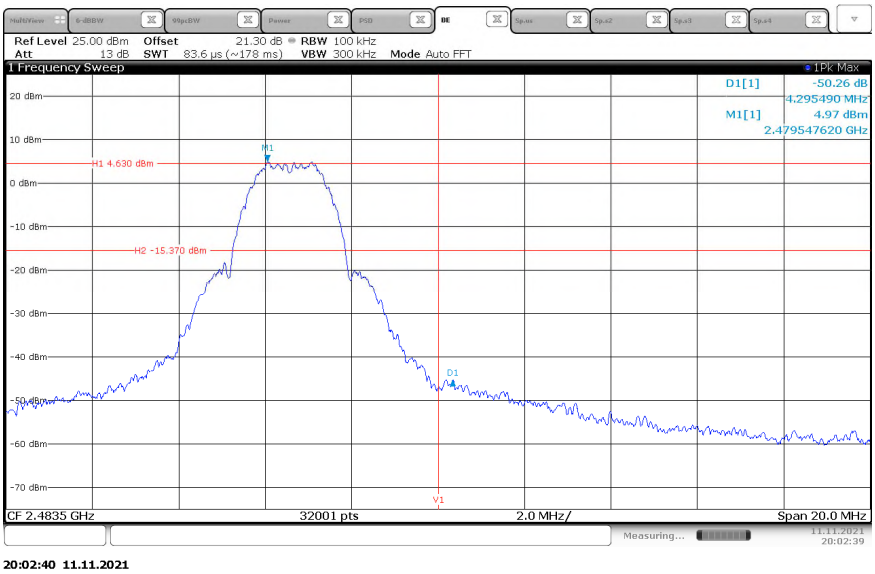

Figure 2.5.6-2: RF Conducted Band-Edge Results High Channel

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
Atten 20dB 2.9mm-M/F, DC-26.5GH, 2W	Aeroflex Inmet	26AH-20	DEMC3049	N/A	12	07-Aug-2022
Signal & Spectrum Analyzer	Rohde & Schwarz	FSW43	DEMC3085	2.90 SP1	24	07-Dec-2022
DC Power Supply	Xantrex	XHR60-18	TEMC00001	N/A	N/A	NCR

TU - Traceability Unscheduled
O/P MON - Traceability Unscheduled
N/A - Not Applicable
NCR – No Calibration Required

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: 349C33

2.6.3 Date of Test

11/10/2021 to 11/11/2021

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	26.7 °C
Relative Humidity	40.7 %
Atmospheric Pressure	1018.8 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.

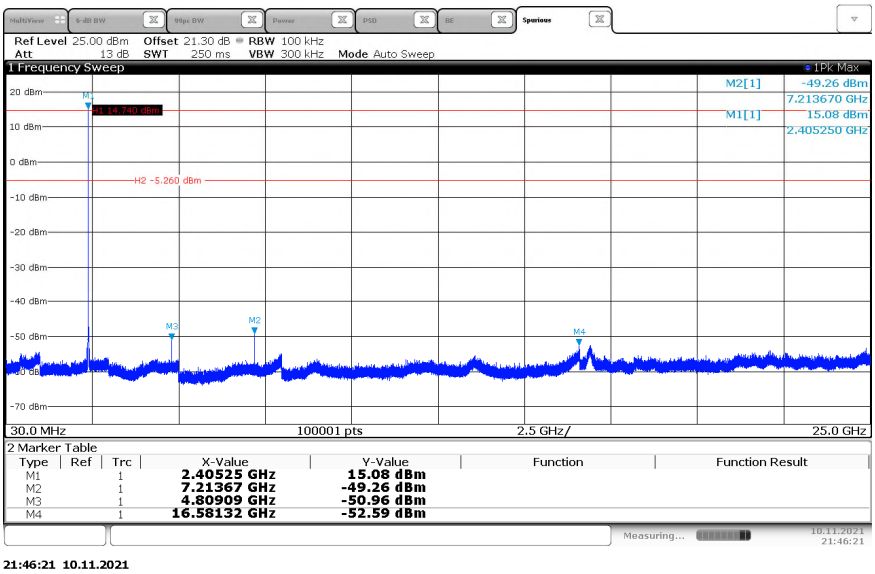

Figure 2.6.6-1: RF Conducted Spurious Emissions Results Low Channel

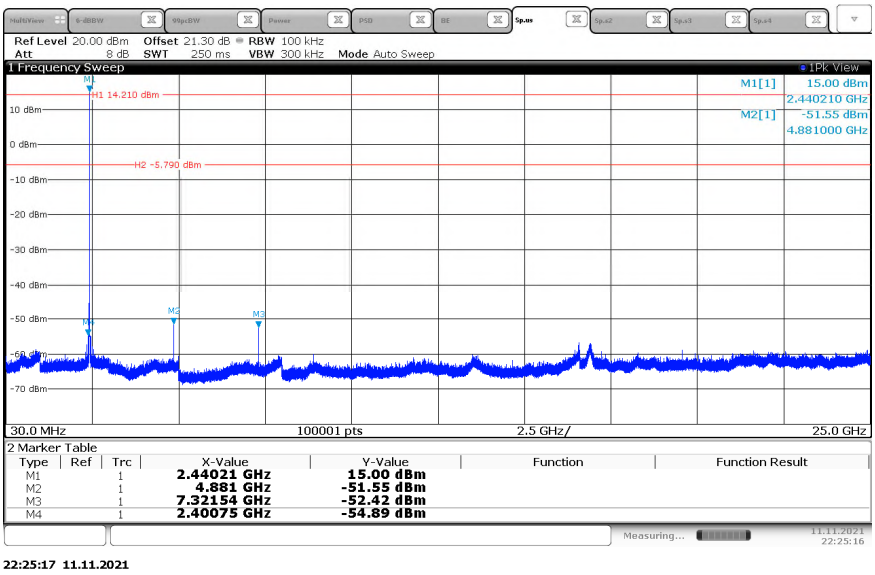

Figure 2.6.6-2: RF Conducted Spurious Emissions Results Middle Channel

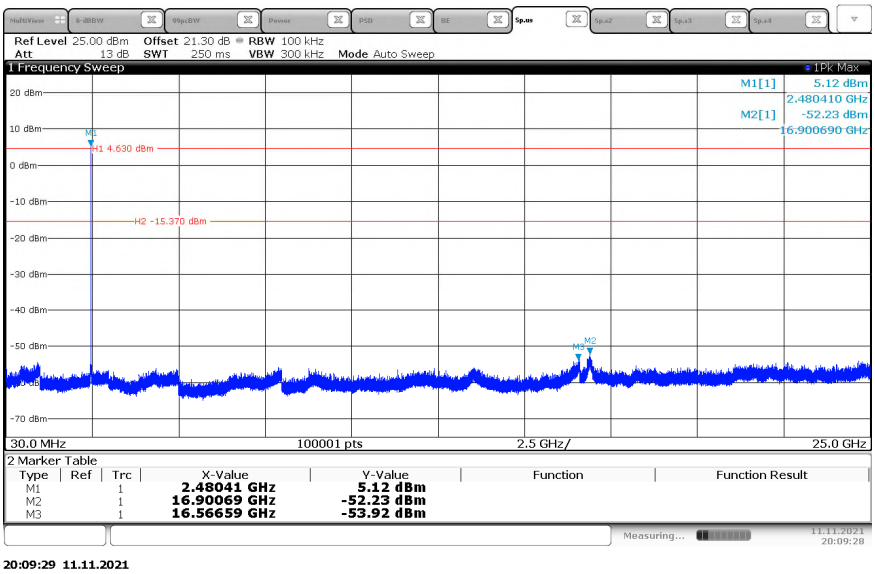

Figure 2.6.6-3: RF Conducted Spurious Emissions Results High Channel

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
Atten 20dB 2.9mm-M/F, DC-26.5GH, 2W	Aeroflex Inmet	26AH-20	DEMC3049	N/A	12	07-Aug-2022
Signal & Spectrum Analyzer	Rohde & Schwarz	FSW43	DEMC3085	2.90 SP1	24	07-Dec-2022
DC Power Supply	Xantrex	XHR60-18	TEMC00001	N/A	N/A	NCR

TU - Traceability Unscheduled
O/P MON - Traceability Unscheduled
N/A - Not Applicable
NCR – No Calibration Required

2.7 Conducted 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: 349C33

2.7.3 Date of Test

11/10/2021 to 11/11/2021

2.7.4 Test Method

RF Conducted emissions tests were made over the frequency range of 9 kHz to 25 GHz, 10 times the highest fundamental frequency in accordance with ANSI C63.10 Subclause 11.12.2.2. 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 resolution bandwidth was set to 200 Hz below 150 kHz and to 9 kHz above 150 kHz. 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 accordance with ANSI C63.10 Subclause 11.12.2.5.1 Trace Averaging with Continuous EUT Transmission at Full Power.

2.7.5 Duty Cycle Correction

The EUT was configured to transmit at 100% duty cycle during the evaluation. A Duty Cycle Correction of 17.024% corresponding to 10*log(17.024/100) = -7.689 dB was applied to the average measurements for the corrected average results. The justification for the duty cycle is provided in the Theory of Operations of the EUT.

2.7.6 Environmental Conditions

Ambient Temperature	26.7 °C
Relative Humidity	40.7 %
Atmospheric Pressure	1018.8 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: RF Conducted Emissions Test Results

Frequency (MHz)	Power (dBm)		Field Strength (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	Peak	Avg	Peak	Avg	Peak	Avg	Peak	Avg
Low Channel								
2328.36	-50.78	-59.44	52.48	36.13	74	54	21.52	17.87
2367.3	-45.28	-53.75	57.98	41.82	74	54	16.02	12.18
2390	-44.91	-56.48	58.35	39.09	74	54	15.65	14.91
4810	-44.93	-50.12	58.33	45.45	74	54	15.67	8.55
12025	-55.92	-67.49	47.34	28.08	74	54	26.66	25.92
Middle Channel								
2325.4	-51.08	-59.48	52.18	36.09	74	54	21.82	17.91
4880	-45.01	-50.33	58.25	45.24	74	54	15.75	8.76
7320	-46.7	-52.24	56.56	43.33	74	54	17.44	10.67
12200	-55.88	-66.82	47.38	28.75	74	54	26.62	25.25
High Channel								
2483.5	-30.79	-42.76	72.47	52.81	74	54	1.53	1.19
4960	-52.54	-60.07	50.72	35.5	74	54	23.28	18.5
7440	-57.83	-68.28	45.43	27.29	74	54	28.57	26.71

Note:

- All the emissions above 12.2 GHz were attenuated below the limits and the noise floor of the measurement equipment.
- The average Field strength levels were further corrected using a duty cycle correction factor of 10*log(17.024/100) = - 7.689 dB.

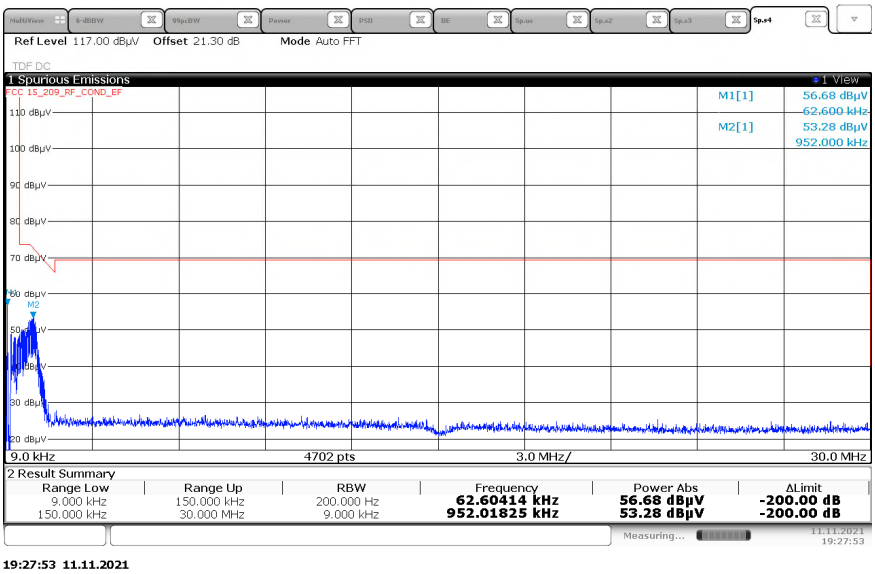

Figure 2.7.7-1: Conducted Emissions in the Restricted Bands 9 kHz – 30 MHz Low Channel

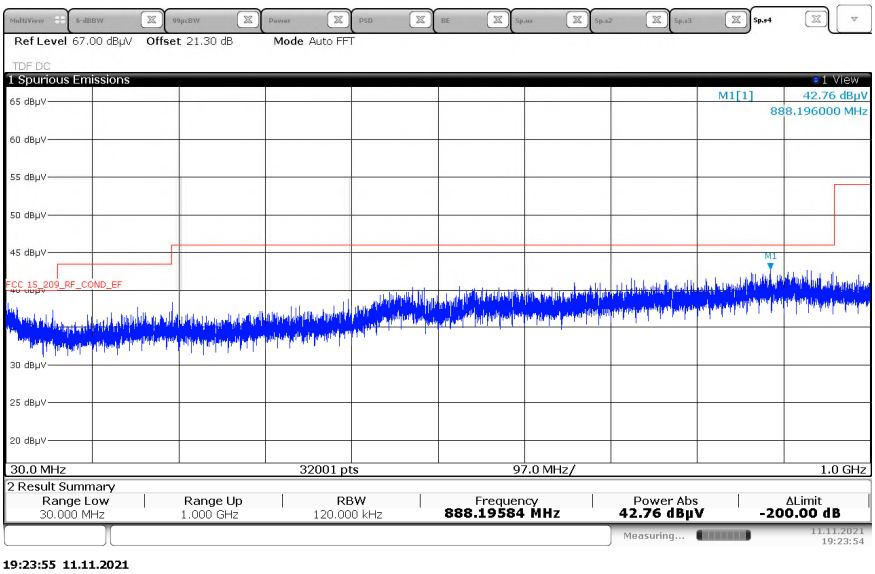

Figure 2.7.7-2: Conducted Emissions in the Restricted Bands 30 MHz – 1 GHz Low Channel

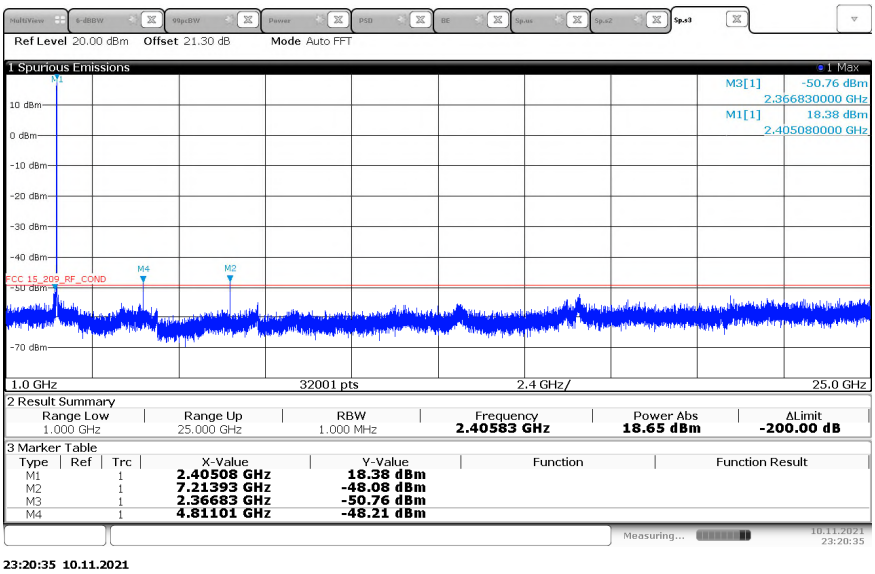

Figure 2.7.7-3: Conducted Emissions in the Restricted Bands 1 GHz – 25 GHz Low Channel

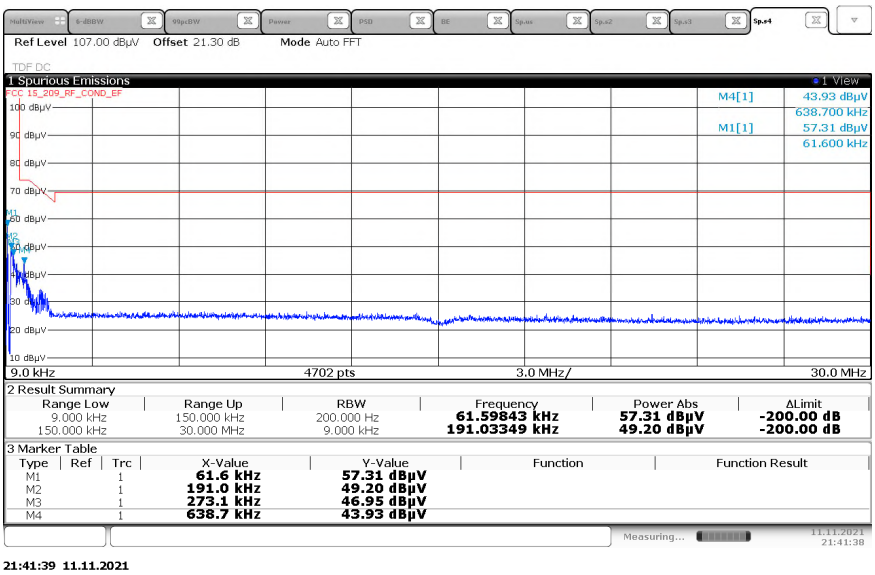

Figure 2.7.7-4: Conducted Emissions in the Restricted Bands 9 kHz – 30 MHz Middle Channel

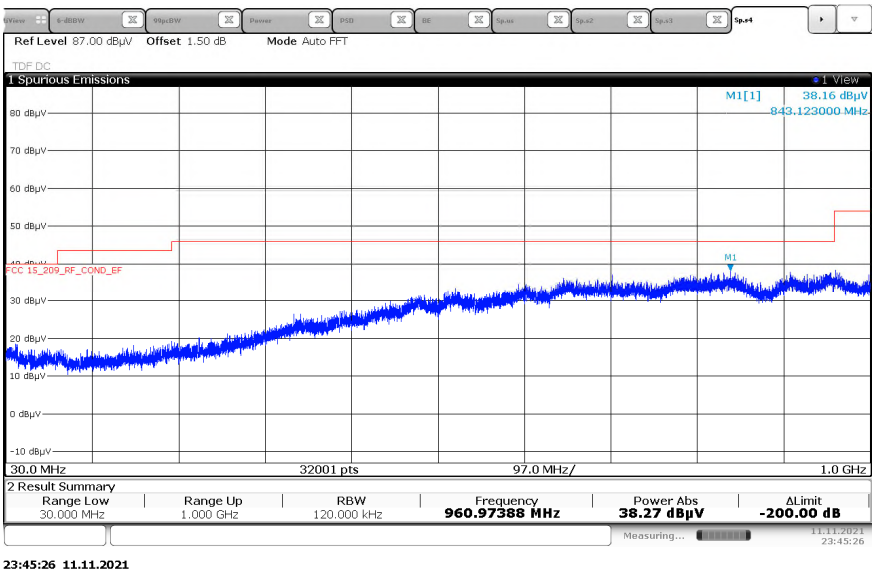

Figure 2.7.7-5: Conducted Emissions in the Restricted Bands 30 MHz – 1 GHz Middle Channel

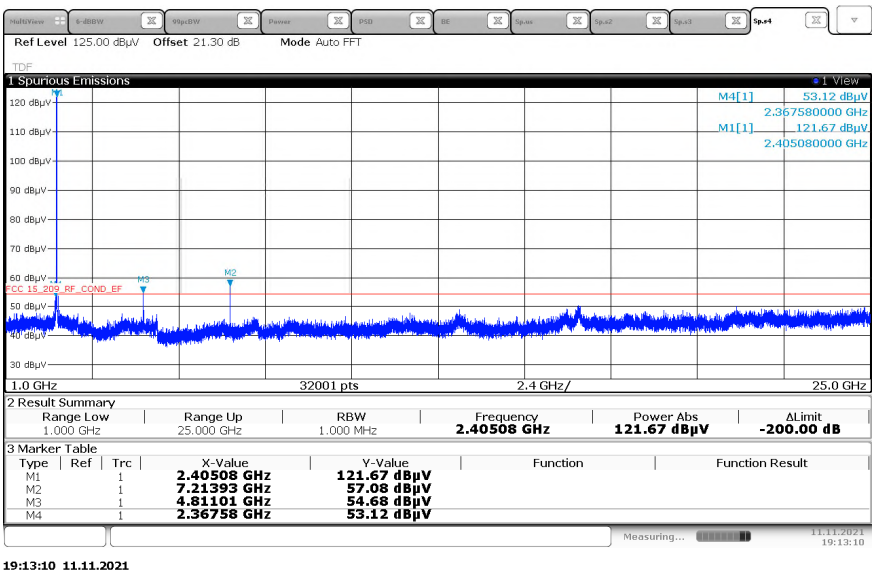

Figure 2.7.7-6: Conducted Emissions in the Restricted Bands 1 GHz – 25 GHz Middle Channel

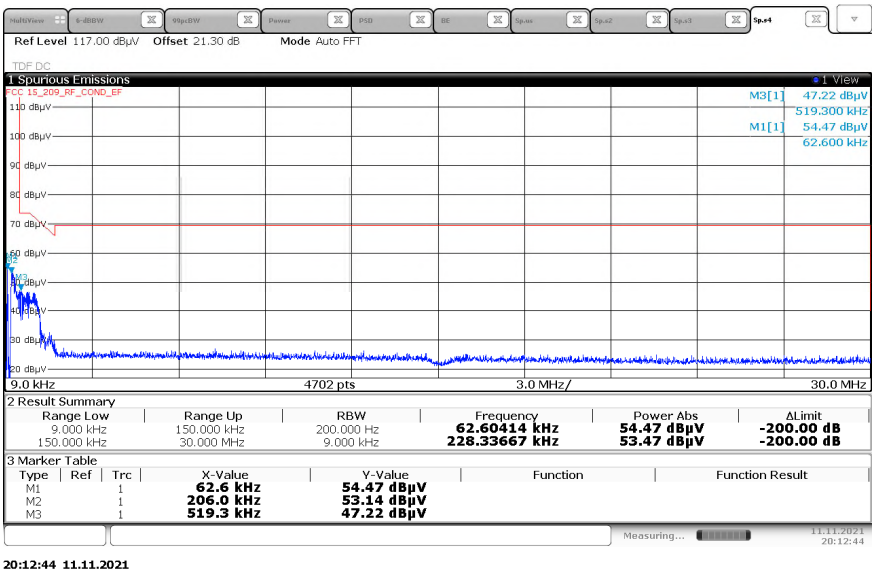

Figure 2.7.7-7: Conducted Emissions in the Restricted Bands 9 kHz – 30 MHz High Channel

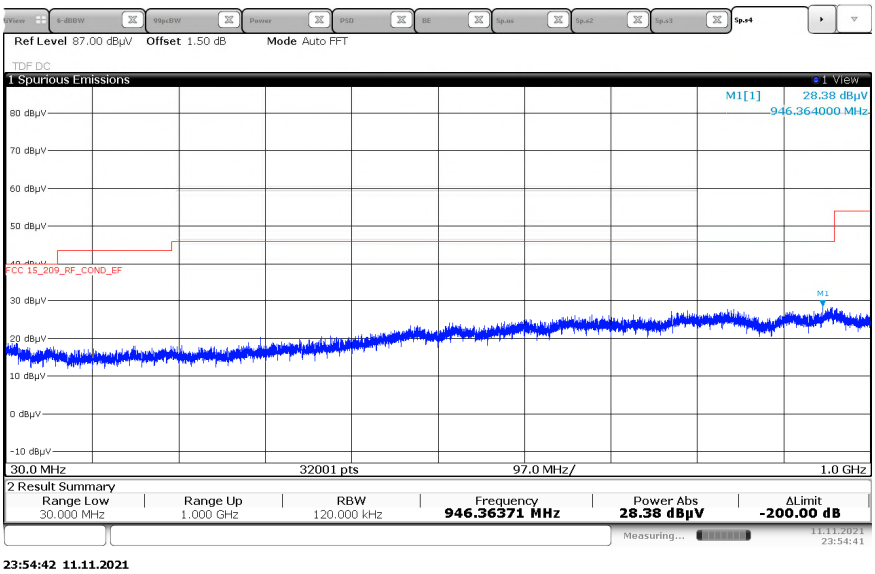

Figure 2.7.7-8: Conducted Emissions in the Restricted Bands 30 MHz – 1 GHz High Channel

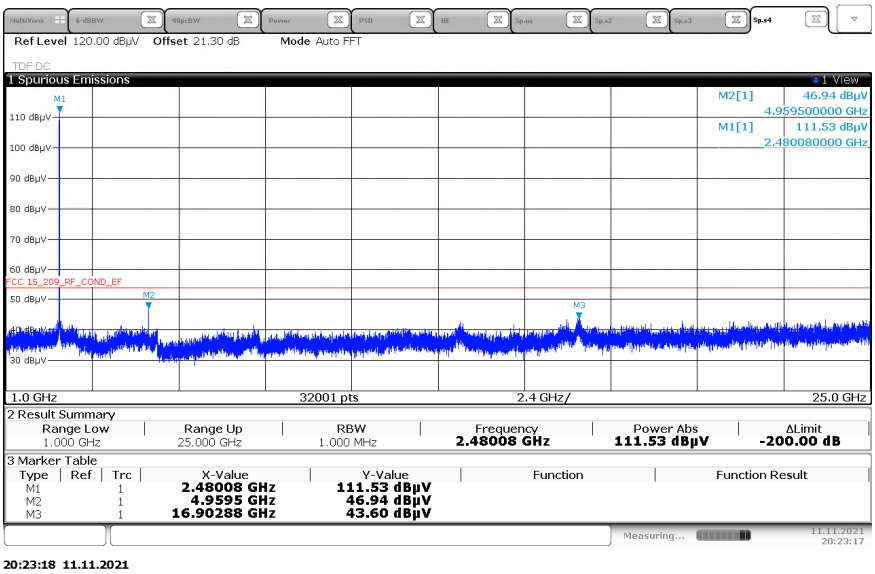

Figure 2.7.7-9: Conducted Emissions in the Restricted Bands 1 GHz – 25 GHz High Channel

2.7.8 Sample Calculations

$R_C = R_U + CF_T$

Where:

CF_T	=	Total Correction Factor (G+GRF+95.2)-DC (Average Measurements Only)
R_U	=	Uncorrected Reading
R_C	=	Corrected Level
GRF	=	Ground Reflection Factor
G	=	Antenna Gain
DC	=	Duty Cycle Correction Factor

Correction Factor: 8 + 0 + 95.26 = 103.26

Example Calculation: Peak
Corrected Level: -50.78 + 103.26 = 52.48 dBµV/m
Margin: 74 dBµV/m – 52.48 dBµV/m = 21.52 dB

Example Calculation: Average
Corrected Level: -59.44 + 103.26 -7.689 = 36.13 dBµV/m
Margin: 54 dBµV/m – 36.13 dBµV/m = 17.87 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
Atten 20dB 2.9mm-M/F, DC-26.5GH, 2W	Aeroflex Inmet	26AH-20	DEMC3049	N/A	12	07-Aug-2022
Signal & Spectrum Analyzer	Rohde & Schwarz	FSW43	DEMC3085	2.90 SP1	24	07-Dec-2022
DC Power Supply	Xantrex	XHR60-18	TEMC00001	N/A	N/A	NCR
DC-1000 MHz Low Pass Filter	Mini-Circuits	NLP-1200+	TEMC00202	N/A	12	30-Mar-2022

TU - Traceability Unscheduled
O/P MON - Traceability Unscheduled
N/A - Not Applicable
NCR – No Calibration Required

2.8 Radiated Spurious Emissions into Restricted Frequency Bands

2.8.1 Specification Reference

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

2.8.2 Equipment Under Test and Modification State

S/N: 349C33

2.8.3 Date of Test

11/8/2021 to 11/11/2021

2.8.4 Test Method

Radiated emissions tests were made over the frequency range of 9 kHz to 25 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.

2.8.5 Duty Cycle Correction

The EUT was configured to transmit at 100% duty cycle during the evaluation. A Duty Cycle Correction of 17.024% corresponding to 20*log(17.024/100) = -15.37 dB was applied to the average measurements for the corrected average results.

2.8.6 Environmental Conditions

Ambient Temperature	25 °C
Relative Humidity	39.9 %
Atmospheric Pressure	1021.6 mbar

2.8.7 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 2.8.7-1: Radiated Emissions Test Results – Trace Antenna

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel										
2367.1	57.16	45.52	H	-5.41	51.75	24.73	74.0	54.0	22.3	29.3
2367.1	57.74	46.76	V	-5.41	52.33	25.97	74.0	54.0	21.7	28.0
2390	55.18	43.33	H	-5.37	49.81	22.58	74.0	54.0	24.2	31.4
2390	55.77	43.07	V	-5.37	50.40	22.32	74.0	54.0	23.6	31.7
4810	48.70	38.91	H	-0.20	48.50	23.33	74.0	54.0	25.5	30.7
4810	47.75	37.95	V	-0.20	47.55	22.37	74.0	54.0	26.4	31.6
Middle Channel										
4880	47.03	37.26	H	-0.09	46.94	21.79	74.0	54.0	27.1	32.2
4880	47.27	37.35	V	-0.09	47.18	21.88	74.0	54.0	26.8	32.1
7320	44.17	32.73	H	5.11	49.28	22.46	74.0	54.0	24.7	31.5
7320	47.08	35.25	V	5.11	52.19	24.98	74.0	54.0	21.8	29.0
High Channel										
2483.5	70.18	61.66	H	-5.21	64.97	41.08	74.0	54.0	9.0	12.9
2483.5	70.61	62.91	V	-5.21	65.40	42.33	74.0	54.0	8.6	11.7
4960	45.17	34.56	H	0.04	45.21	19.22	74.0	54.0	28.8	34.8
4960	43.63	31.80	V	0.04	43.67	16.46	74.0	54.0	30.3	37.5

Notes:

- All the emissions above 7.32 GHz were attenuated below the limits and the noise floor of the measurement equipment.
- A protocol specific duty cycle correction factor of 17.024% was used for the corrected average levels. The justification for the duty cycle correction factor is provided in the theory of operation of the device.

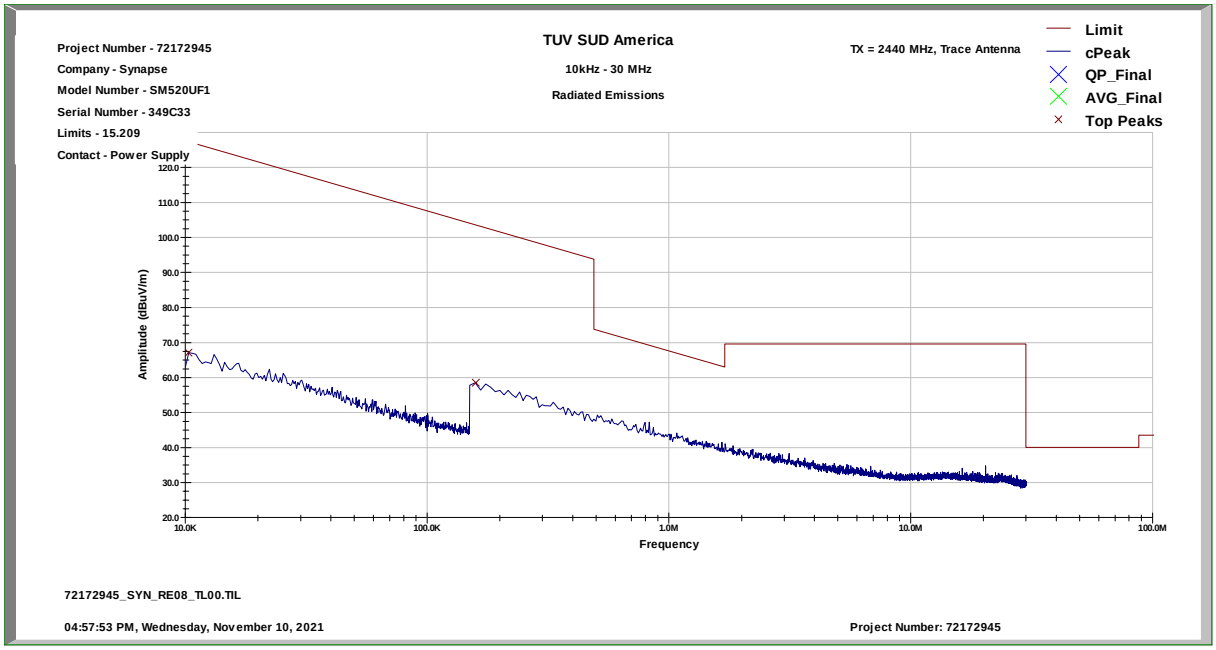

Figure 2.8.7-1: Radiated Emissions Representative Scan below 30 MHz – Trace Antenna

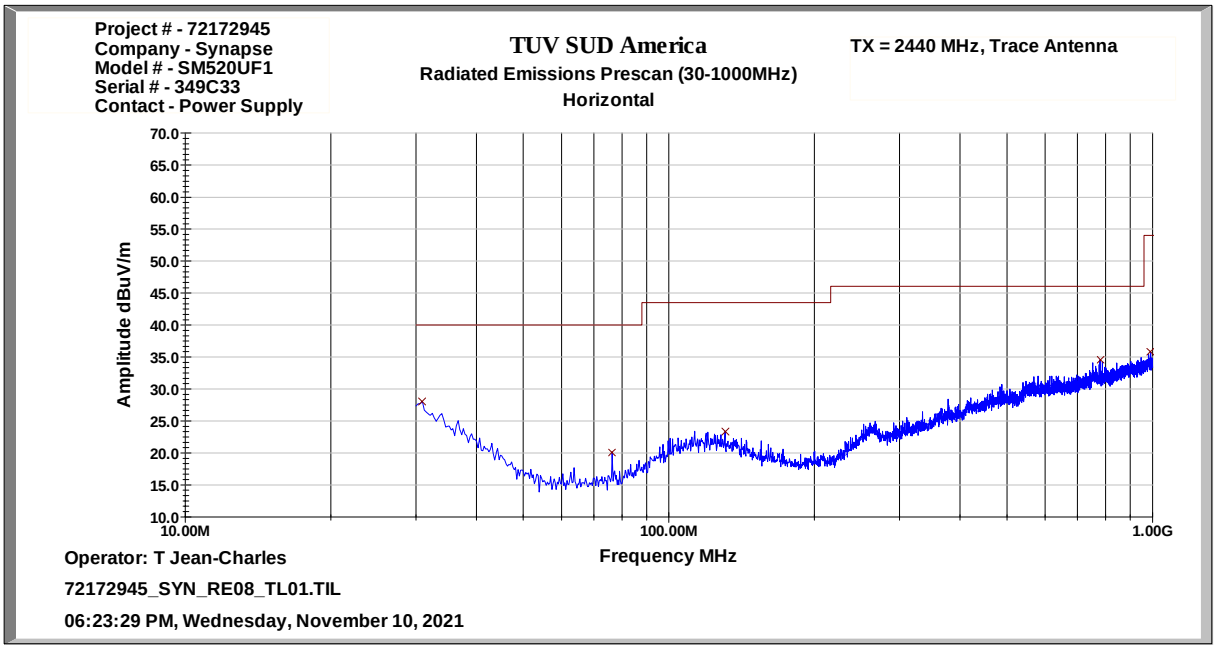

Figure 2.8.7-2: Radiated Emissions Representative Scan 30 MHz – 1 GHz Horizontal Polarization – Trace Antenna

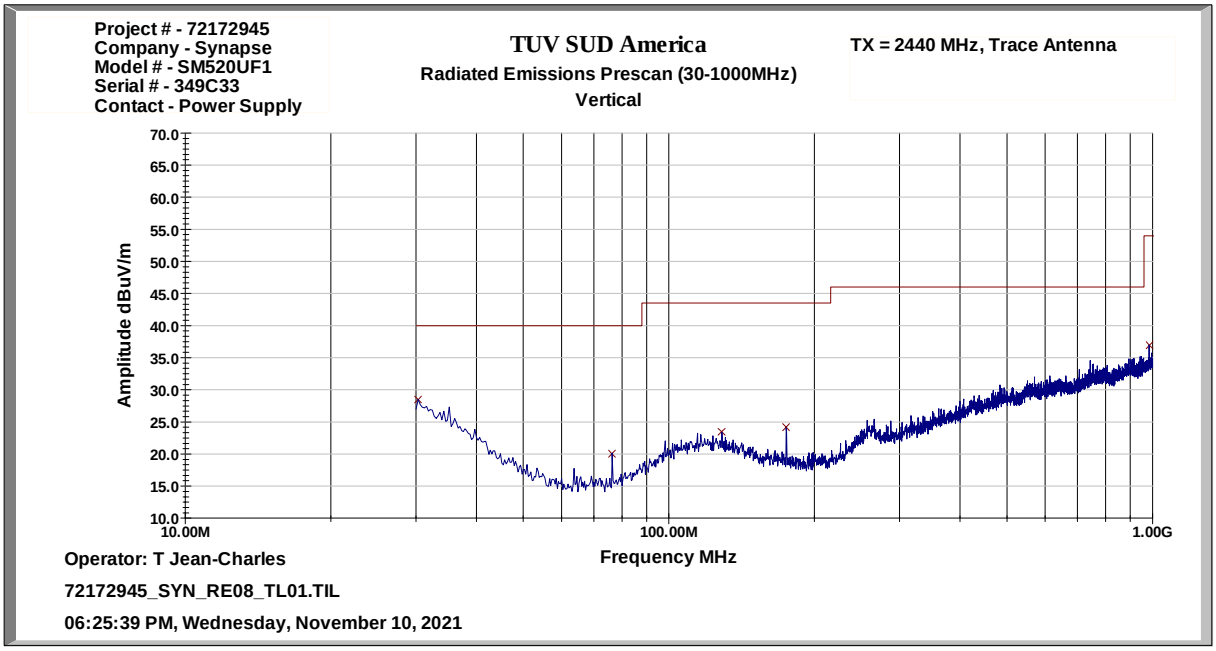

Figure 2.8.7-3: Radiated Emissions Representative Scan 30 MHz – 1 GHz Vertical Polarization – Trace Antenna

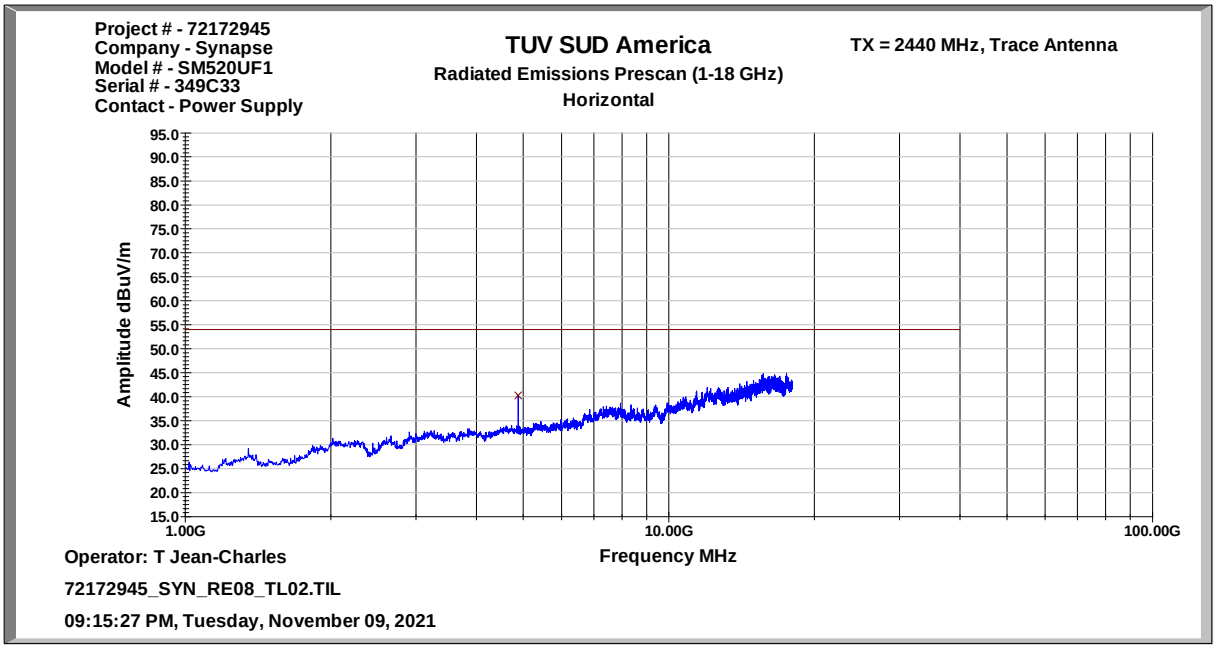

Figure 2.8.7-4: Radiated Emissions Representative Scan 1 GHz – 18 GHz Horizontal Polarization – Trace Antenna

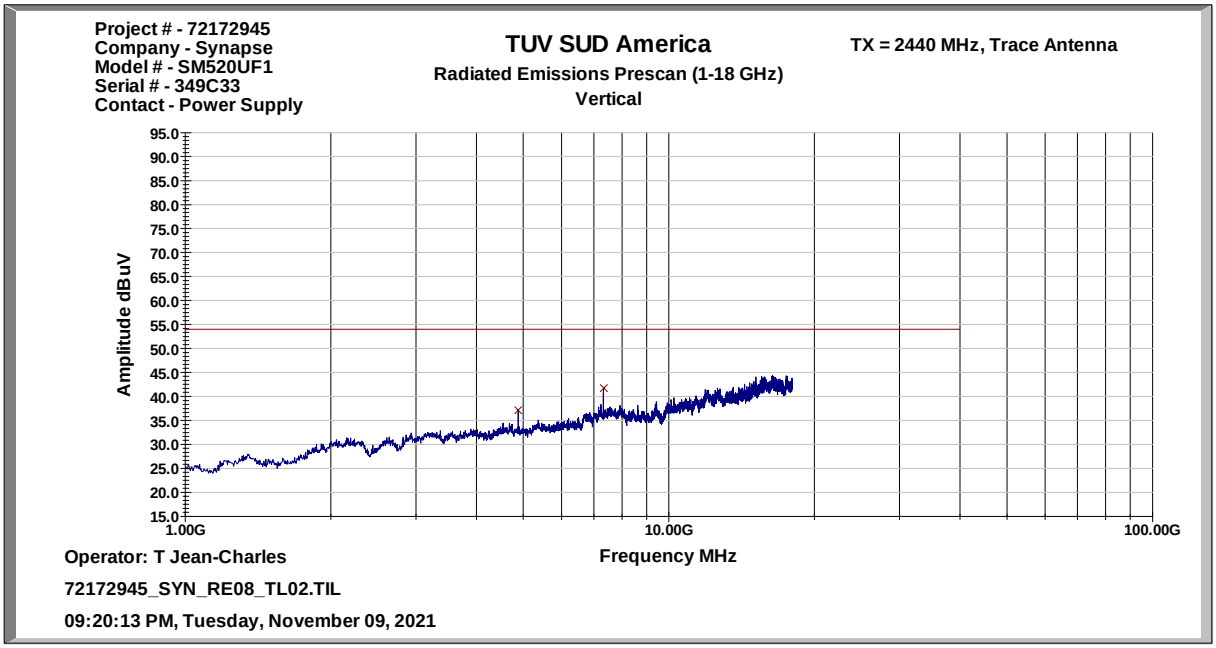

Figure 2.8.7-5: Radiated Emissions Representative Scan 1 GHz – 18 GHz Vertical Polarization – Trace Antenna

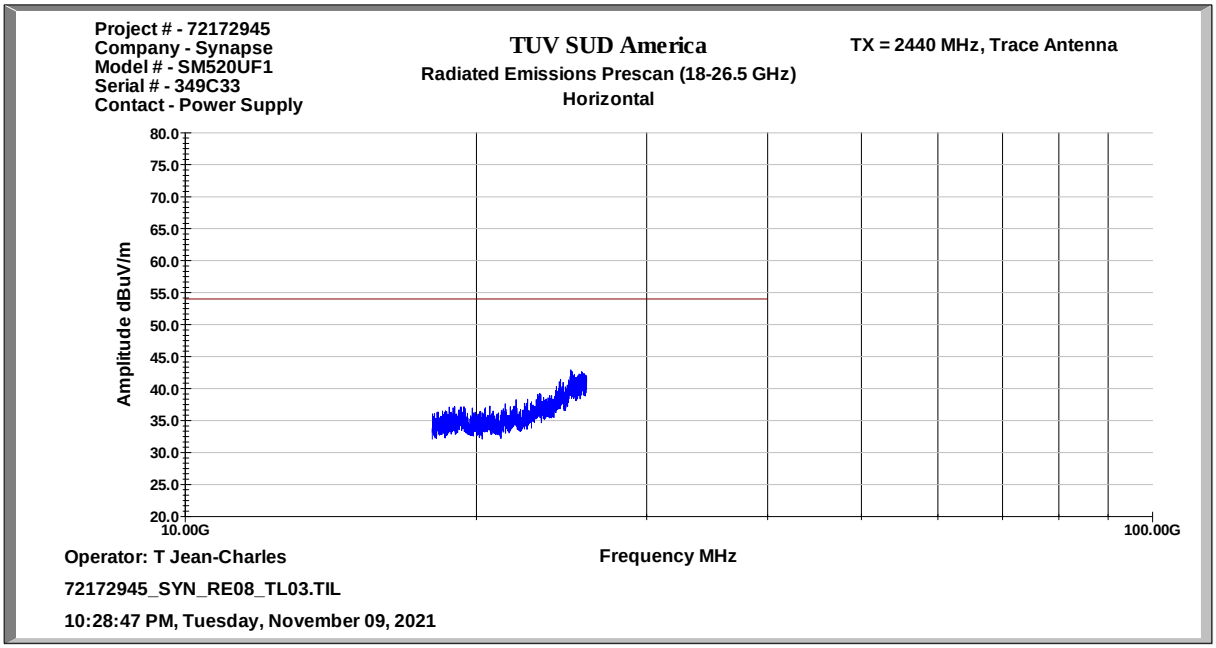

Figure 2.8.7-6: Radiated Emissions Representative Scan 18 GHz – 26 GHz Horizontal Polarization – Trace Antenna

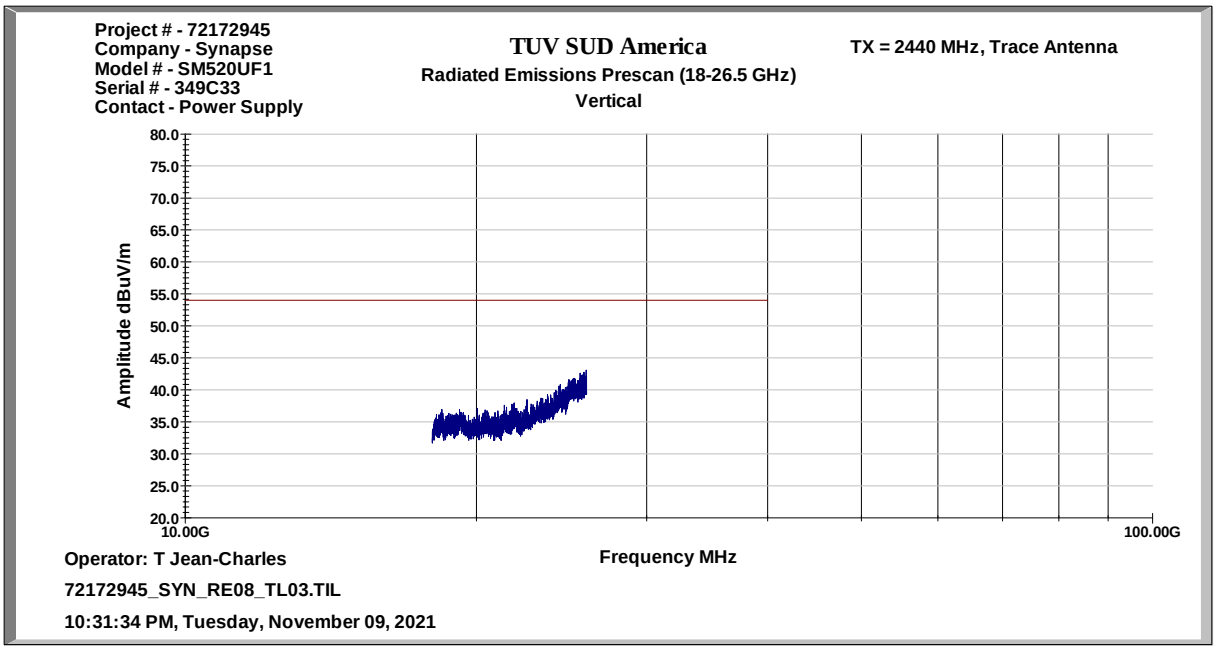

Figure 2.8.7-7: Radiated Emissions Representative Scan 18 GHz – 26 GHz Vertical Polarization – Trace Antenna

Table 2.8.7-2: Radiated Emissions Test Results – 50 Ohm Load

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel										
2390	55.37	42.01	H	-5.37	50.00	21.26	74.0	54.0	24.0	32.7
2390	56.04	42.01	V	-5.37	50.67	21.26	74.0	54.0	23.3	32.7
4810	48.81	39.90	H	-0.20	48.61	24.32	74.0	54.0	25.4	29.7
4810	48.10	38.85	V	-0.20	47.90	23.27	74.0	54.0	26.1	30.7
Middle Channel										
4880	48.62	39.91	H	-0.09	48.53	24.44	74.0	54.0	25.5	29.6
4880	47.00	37.73	V	-0.09	46.91	22.26	74.0	54.0	27.1	31.7
7320	43.31	30.18	H	5.11	48.42	19.91	74.0	54.0	25.6	34.1
7320	44.00	31.52	V	5.11	49.11	21.25	74.0	54.0	24.9	32.8
High Channel										
2483.5	56.52	43.22	H	-5.21	51.31	22.64	74.0	54.0	22.7	31.4
2483.5	56.19	43.10	V	-5.21	50.98	22.52	74.0	54.0	23.0	31.5
4960	44.77	33.55	H	0.04	44.81	18.21	74.0	54.0	29.2	35.8
4960	43.62	31.75	V	0.04	43.66	16.41	74.0	54.0	30.3	37.6

Notes:
All the emissions above 7.32 GHz were attenuated below the limits and the noise floor of the measurement equipment.
A protocol specific duty cycle correction factor of 17.024% was used for the corrected average levels. The justification for the duty cycle correction factor is provided in the theory of operation of the device.

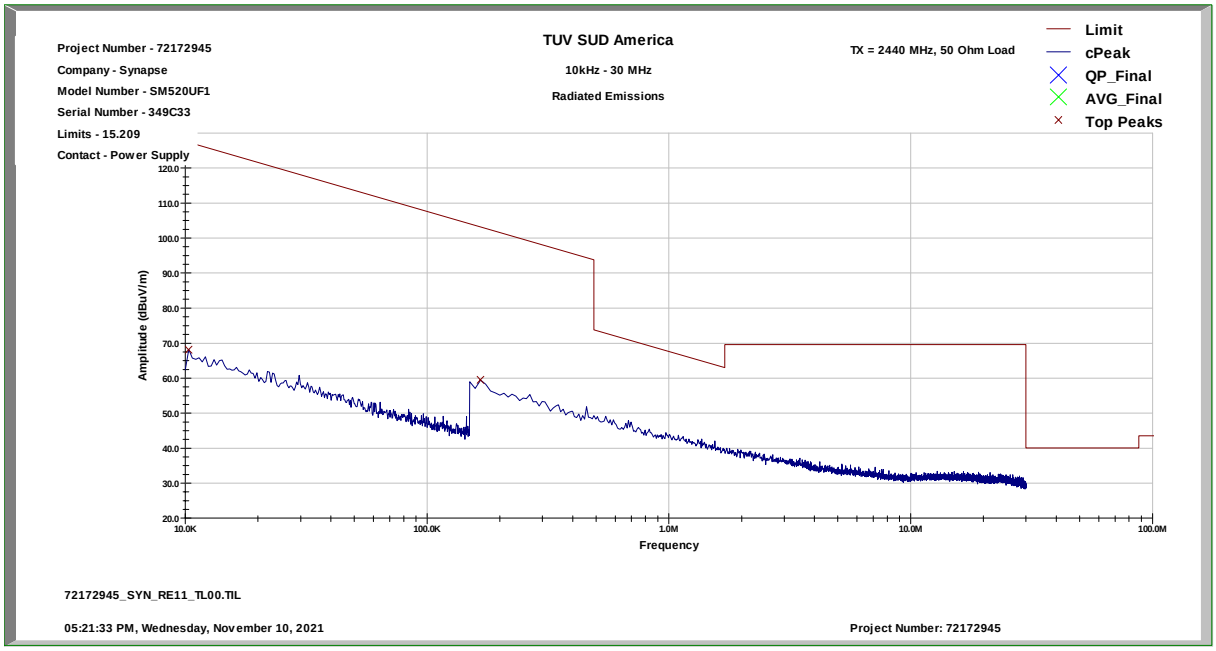

Figure 2.8.7-8: Radiated Emissions Representative Scan below 30 MHz – 50 Ohm Load

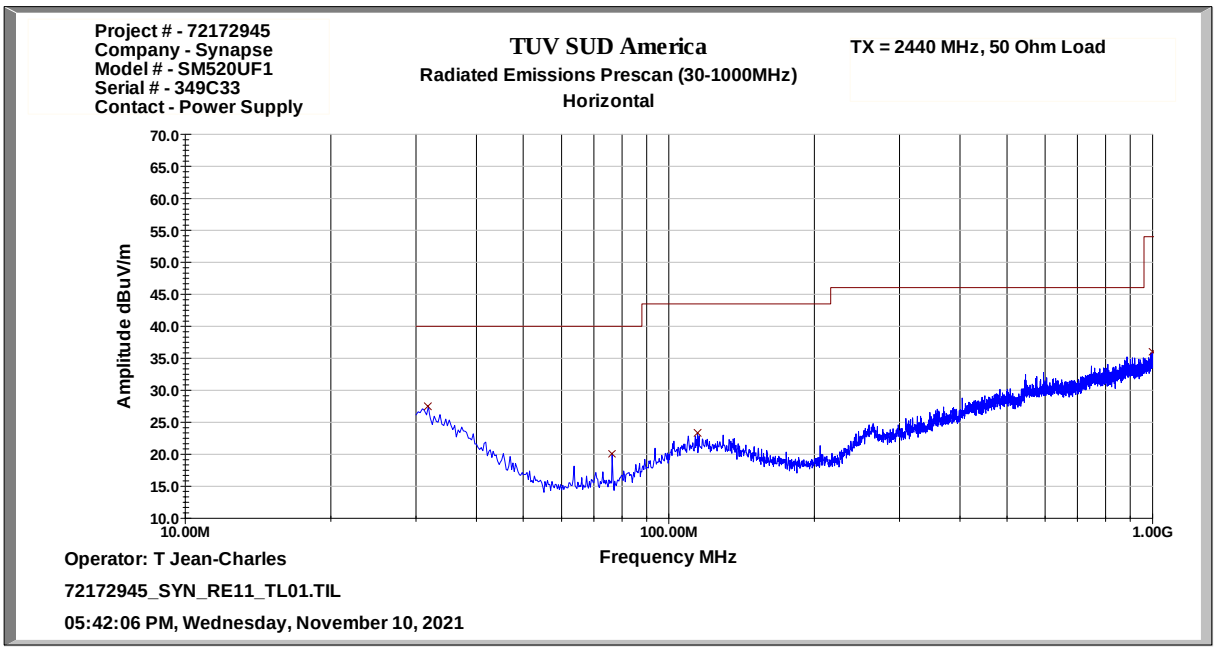

Figure 2.8.7-9: Radiated Emissions Representative Scan 30 MHz – 1 GHz Horizontal Polarization – 50 Ohm Load

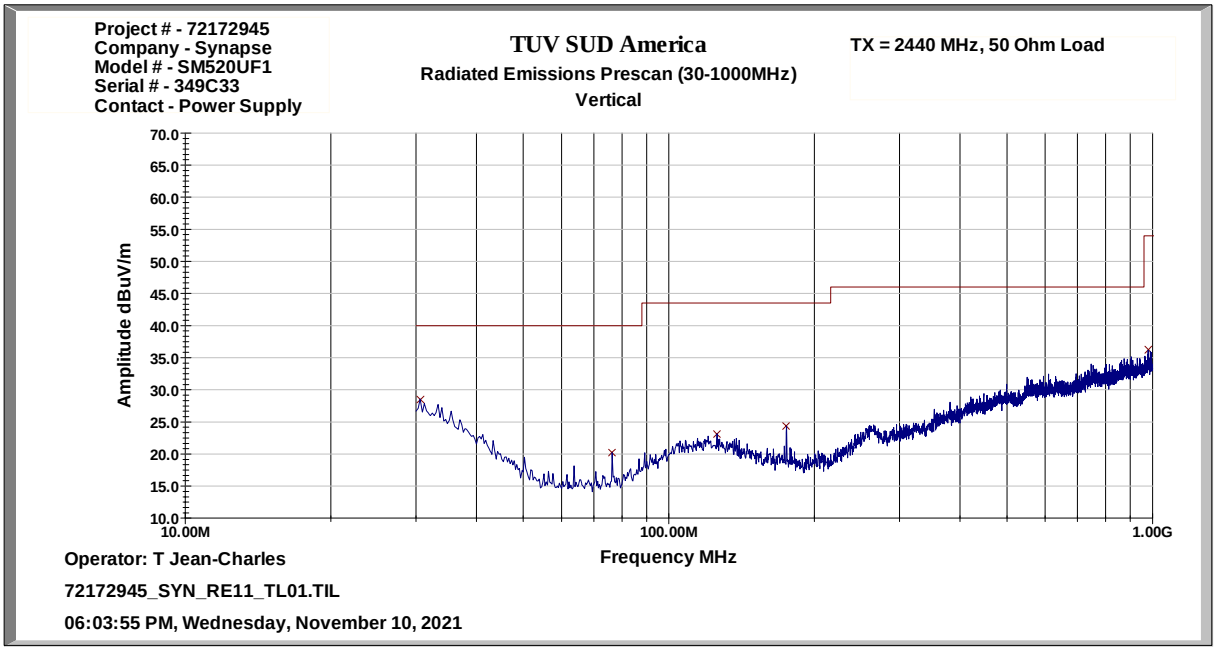

Figure 2.8.7-10: Radiated Emissions Representative Scan 30 MHz – 1 GHz Vertical Polarization – 50 Ohm Load

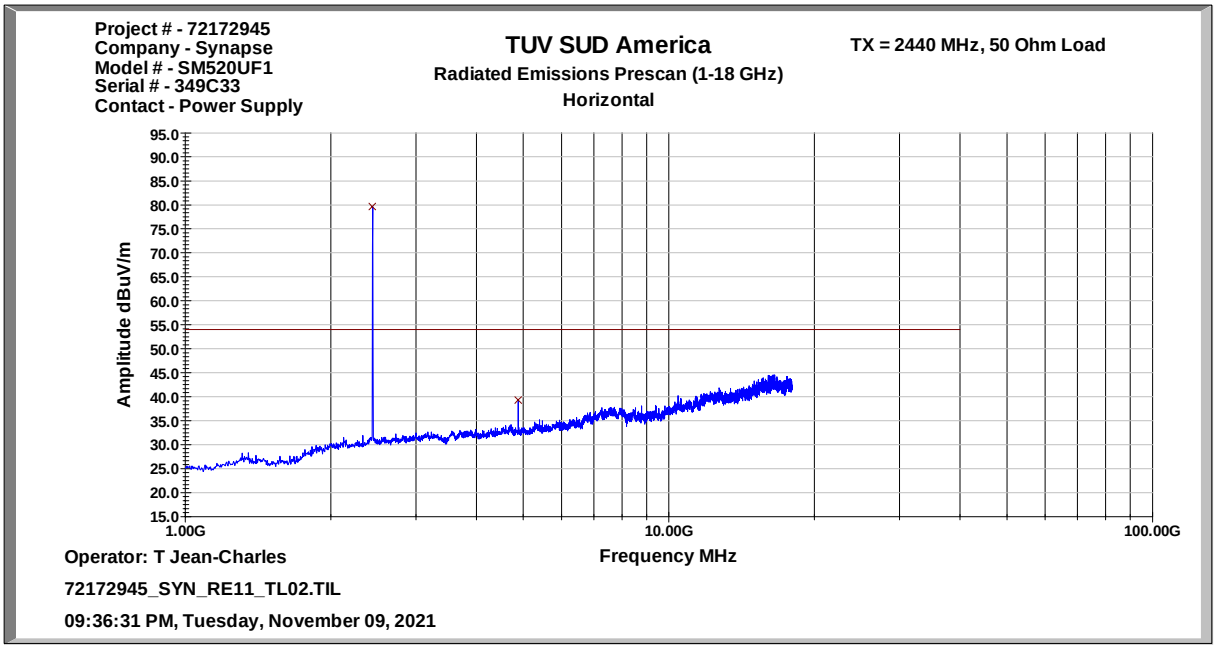

Figure 2.8.7-11: Radiated Emissions Representative Scan 1 GHz – 18 GHz Horizontal Polarization – 50 Ohm Load

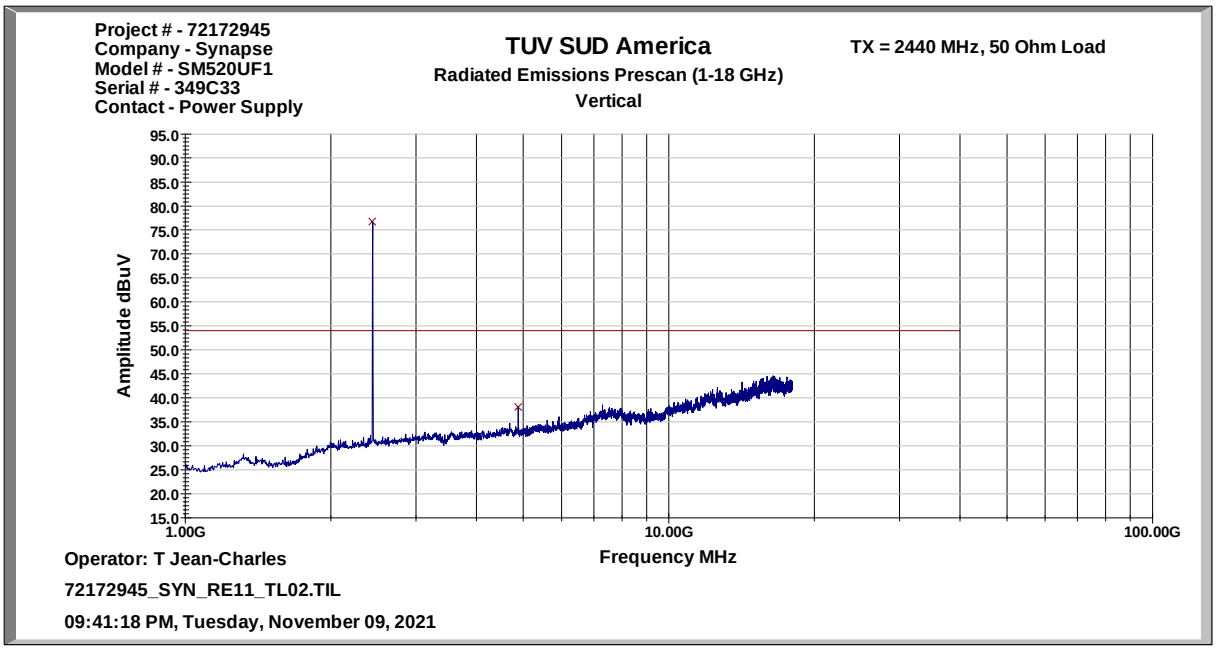

Figure 2.8.7-12: Radiated Emissions Representative Scan 1 GHz – 18 GHz Vertical Polarization – 50 Ohm Load

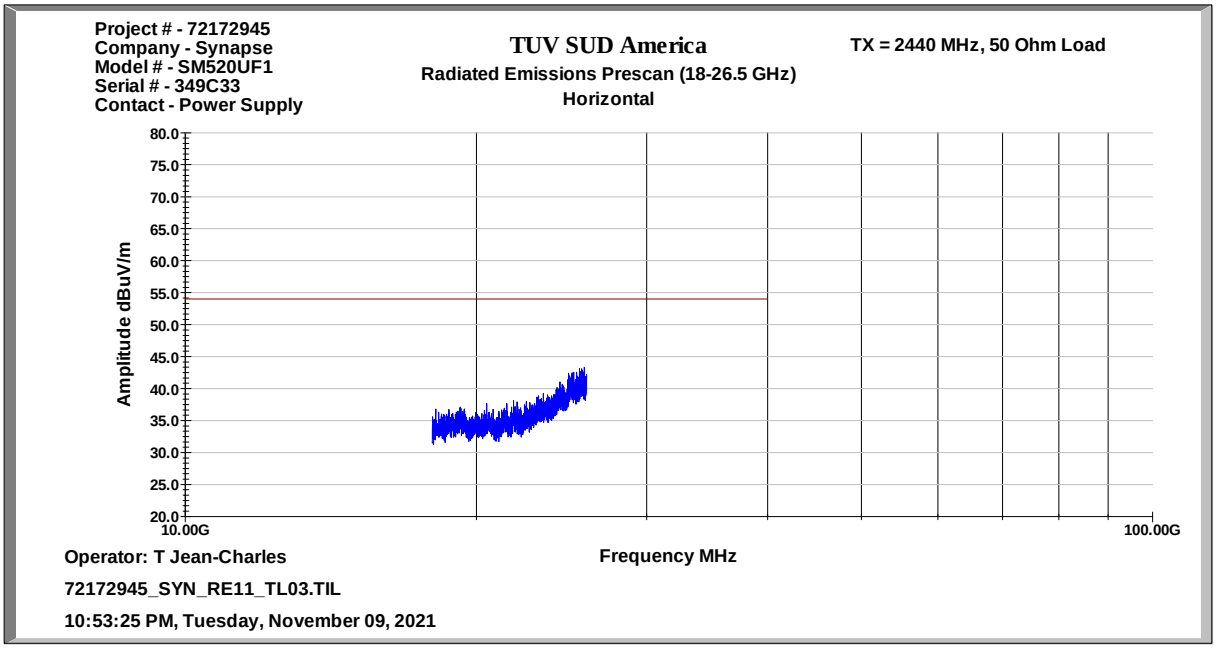

Figure 2.8.7-13: Radiated Emissions Representative Scan 18 GHz – 26 GHz Horizontal Polarization – 50 Ohm Load

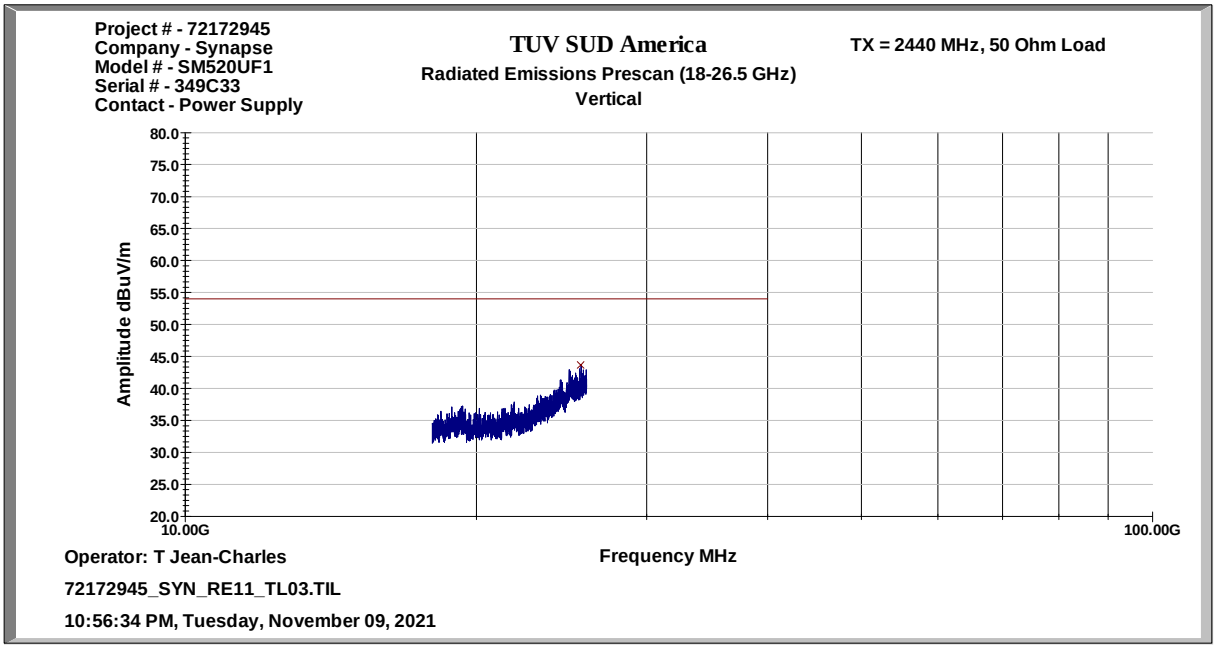

Figure 2.8.7-14: Radiated Emissions Representative Scan 18 GHz – 26 GHz Vertical Polarization – 50 Ohm Load

2.8.8 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: 57.16 + -5.41 = 51.75 dBµV/m
Margin: 74 dBµV/m – 51.75 dBµV/m = 22.25 dB

Example Calculation: Average
Corrected Level: 45.52 + -5.41 -15.37 = 24.74 dBµV/m
Margin: 54 dBµV/m – 24.74 dBµV/m = 29.26 dB

2.8.9 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
Bilog Antenna	Chase EMC	CBL 6112D	853	N/A	12	15-Jul-2022
9kHz-26.5GHz EMC analyzer/HYZ	Agilent	E7405A	BEMC00523	A.14.06	12	21-Apr-2022
Tile Automation Software	ETS Lindgren	TILE4! - Version 4.2.A	BEMC02095	4.2A	N/A	NCR
Loop Antenna	Com Power	AL-130	TEMC00025	N/A	24	14-Oct-2023
Horn Antenna	Schwarzbeck	BBHA-9170	TEMC00029	N/A	120	23-Aug-2026
EMC Chamber	Panashield	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

2.9 Power Spectral Density

2.9.1 Specification Reference

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

2.9.2 Equipment Under Test and Modification State

S/N: 349C33

2.9.3 Date of Test

11/10/2021 to 11/11/2021

2.9.4 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.

2.9.5 Environmental Conditions

Ambient Temperature	26.7 °C
Relative Humidity	40.7 %
Atmospheric Pressure	1018.8 mbar

2.9.6 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 2.9.6-1: Power Spectral Density Results

Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
2405	3.80	8	4.20
2440	3.77	8	4.23
2480	-5.89	8	13.89

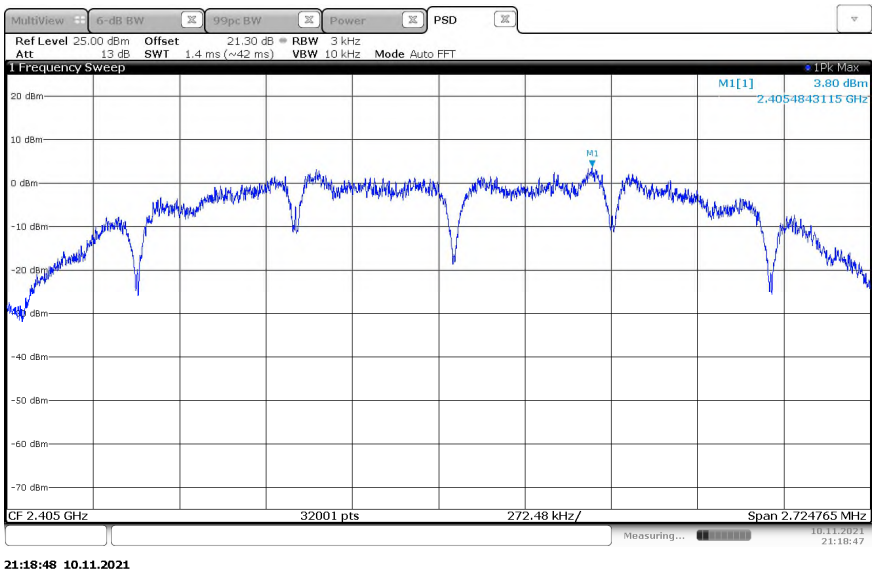

Figure 2.9.6-1: Power Spectral Density Results – Low Channel

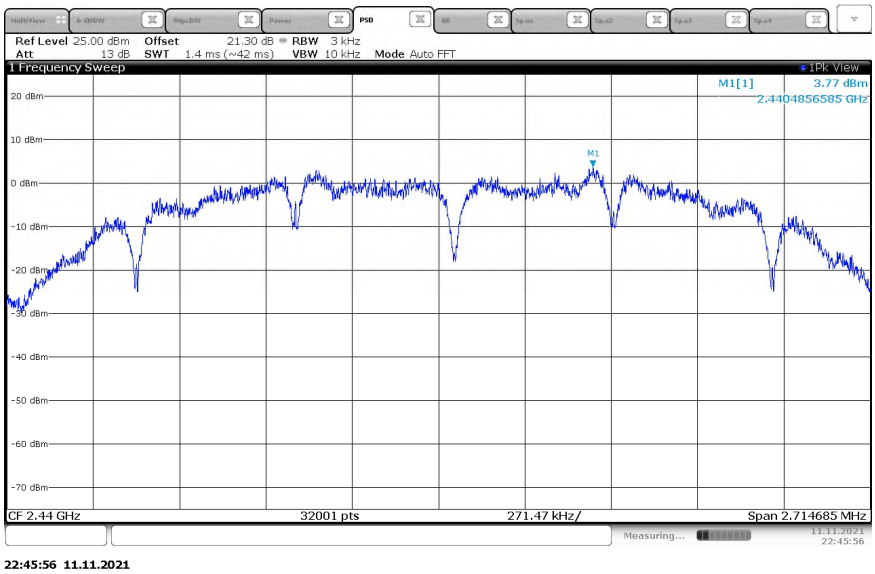

Figure 2.9.6-2: Power Spectral Density Results – Middle Channel

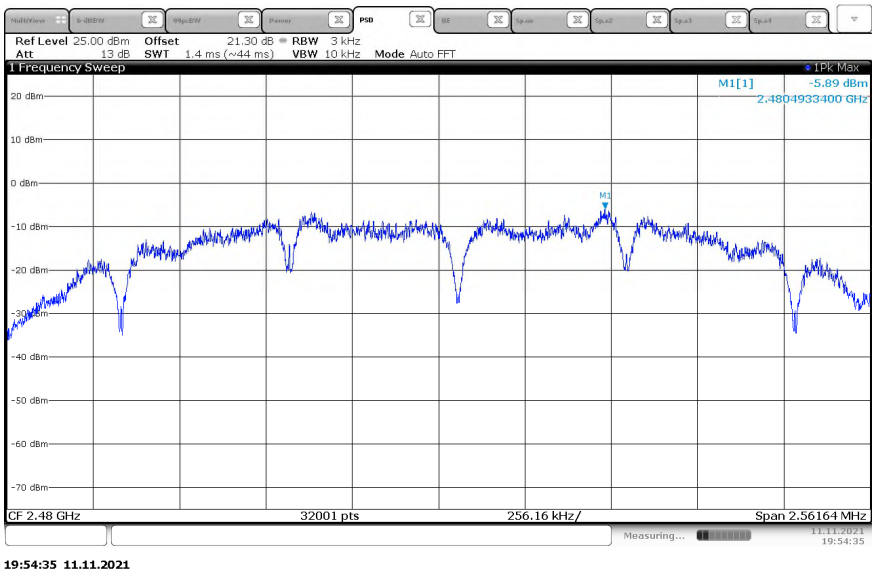

Figure 2.9.6-3: Power Spectral Density Results – High Channel

2.9.7 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
Atten 20dB 2.9mm-M/F, DC-26.5GH, 2W	Aeroflex Inmet	26AH-20	DEMC3049	N/A	12	07-Aug-2022
Signal & Spectrum Analyzer	Rohde & Schwarz	FSW43	DEMC3085	2.90 SP1	24	07-Dec-2022
DC Power Supply	Xantrex	XHR60-18	TEMC00001	N/A	N/A	NCR

TU - Traceability Unscheduled
O/P MON - Traceability Unscheduled
N/A - Not Applicable
NCR – No Calibration Required

2.10 Power Line Conducted Emissions

2.10.1 Specification Reference

FCC: Section 15.207
ISED Canada; RSS-GEN 8.8

2.10.2 Equipment Under Test and Modification State

S/N: 349C3A

2.10.3 Date of Test

11/10/2021

2.10.4 Test Method

ANSI C63.10 section 6.2 was the guiding document for this evaluation. Conducted emissions were performed from 150 kHz to 30 MHz with the spectrum analyzer's resolution bandwidth set to 9 kHz and the video bandwidth set to 30 kHz. The calculation for the conducted emissions is as follows:

Corrected Reading = Analyzer Reading + LISN Loss + Cable Loss
Margin = Applicable Limit - Corrected Reading

2.10.5 Environmental Conditions

Ambient Temperature	26.7 °C
Relative Humidity	40.7 %
Atmospheric Pressure	1018.8 mbar

2.10.6 Test Results

Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

Table 2.10.6-1: Power Line Conducted Emissions – Quasi-Peak Detector Results

Frequency (MHz)	Quasi-peak (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.168000	33.95	L1	9.9	31.10	65.06
0.217500	32.51	N	10.3	30.41	62.91
0.505500	24.16	L1	10.0	31.84	56.00
0.906000	21.41	N	10.4	34.59	56.00
1.207500	19.09	N	10.5	36.91	56.00

Note: The quasi-peak emissions reported are also compliant to the conducted average limits.

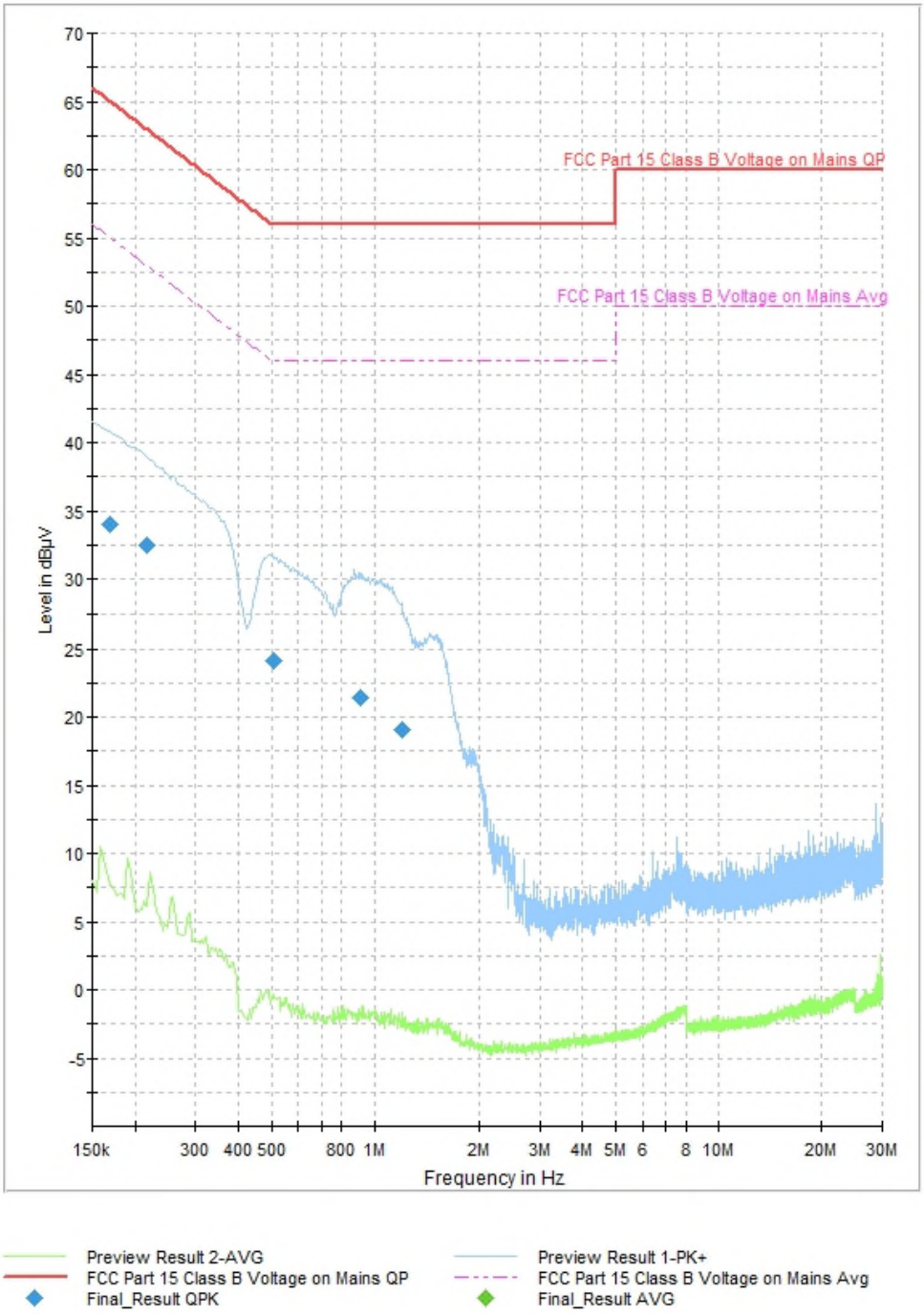

Figure 2.10.6-1: Composite Power Line Conducted Emissions Plots

2.10.7 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
LISN	Rohde & Schwarz	ESH3-Z5	TEMC00002	N/A	12	04-Feb-2022
EMI Test Receiver	Rohde & Schwarz	ESCS30	TEMC00011	2.3002.0102.36	12	04-Feb-2022
RFI/EMI Shielded Enclosure	UNIVERSAL SHIELDING CORP.	N/A	TEMC00100	N/A	N/A	NCR
Test Software	Rohde & Schwarz	EMC32	TEMC00184	10.50.00	N/A	NCR

TU - Traceability Unscheduled
O/P MON - Traceability Unscheduled
N/A - Not Applicable
NCR – No Calibration Required

3 Test Equipment Information

3.1 General 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
LISN	Rohde & Schwarz	ESH3-Z5	TEMC00002	N/A	12	04-Feb-2022
EMI Test Receiver	Rohde & Schwarz	ESCS30	TEMC00011	2.3002.0102.36	12	04-Feb-2022
RFI/EMI Shielded Enclosure	UNIVERSAL SHIELDING CORP.	N/A	TEMC00100	N/A	N/A	NCR
Test Software	Rohde & Schwarz	EMC32	TEMC00184	10.50.00	N/A	NCR
Atten 20dB 2.9mm-M/F, DC-26.5GH, 2W	Aeroflex Inmet	26AH-20	DEMC3049	N/A	12	07-Aug-2022
Signal & Spectrum Analyzer	Rohde & Schwarz	FSW43	DEMC3085	2.90 SP1	24	07-Dec-2022
DC Power Supply	Xantrex	XHR60-18	TEMC00001	N/A	N/A	NCR
DC-1000 MHz Low Pass Filter	Mini-Circuits	NLP-1200+	TEMC00202	N/A	12	30-Mar-2022
Bilog Antenna	Chase EMC	CBL 6112D	853	N/A	12	15-Jul-2022
9kHz-26.5GHz EMC analyzer/HYZ	Agilent	E7405A	BEMC00523	A.14.06	12	21-Apr-2022
Tile Automation Software	ETS Lindgren	TILE4! - Version 4.2.A	BEMC02095	4.2A	N/A	NCR
Loop Antenna	Com Power	AL-130	TEMC00025	N/A	24	14-Oct-2023
Horn Antenna	Schwarzbeck	BBHA-9170	TEMC00029	N/A	120	23-Aug-2026
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

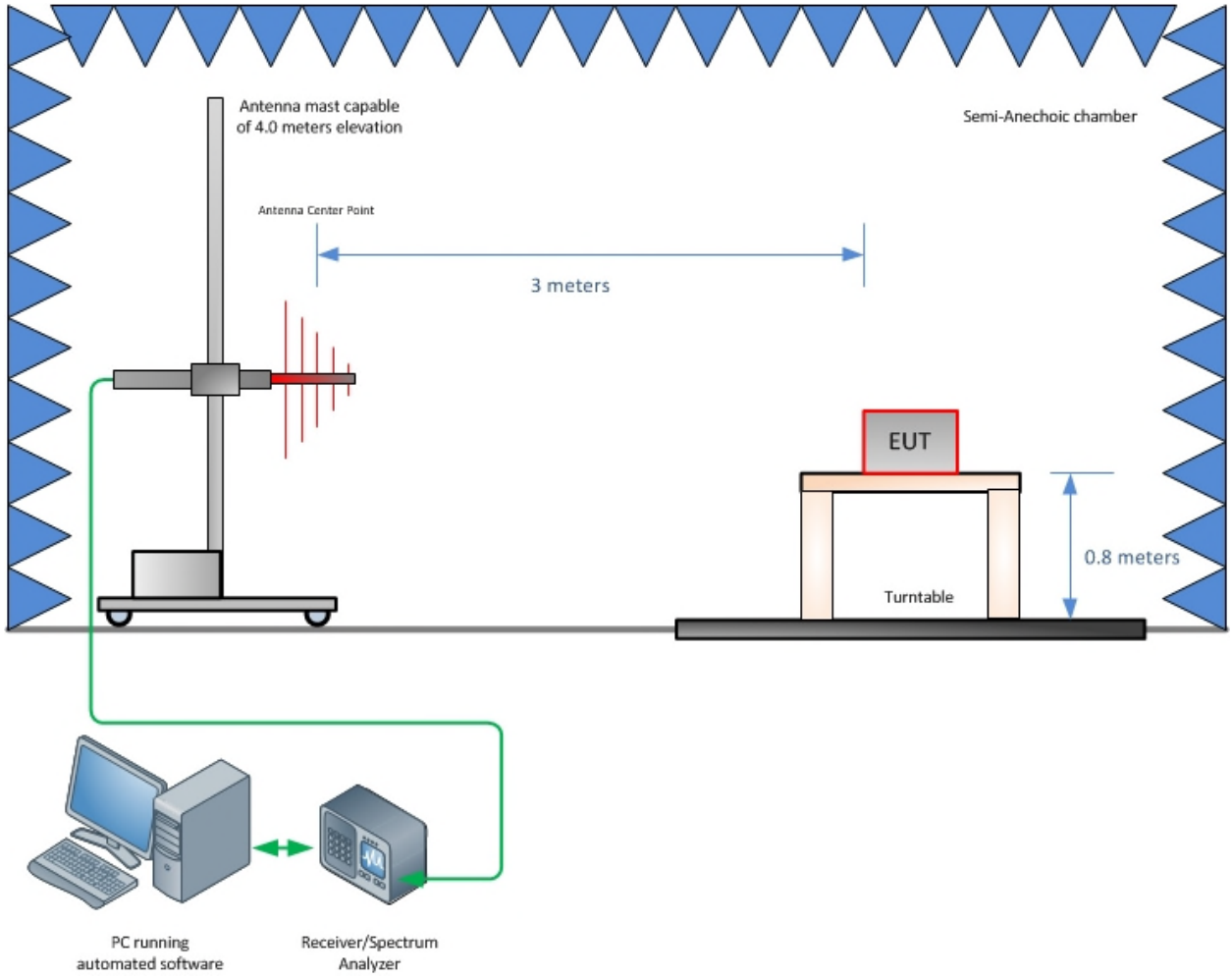

Figure 4-1 - Radiated Emissions Test Setup up to 1 GHz

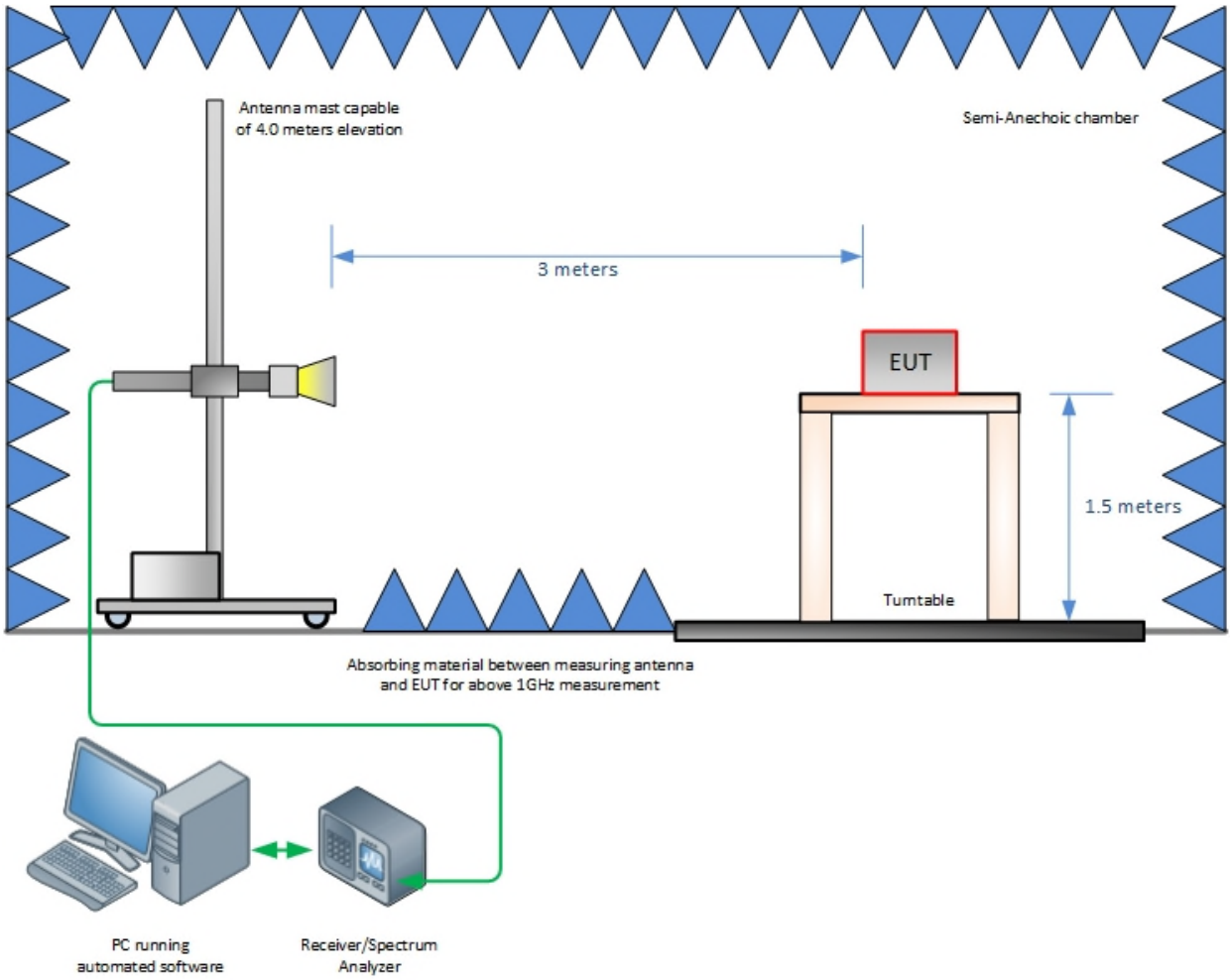

Figure 4-2 - Radiated Emissions Test Setup above 1 GHz

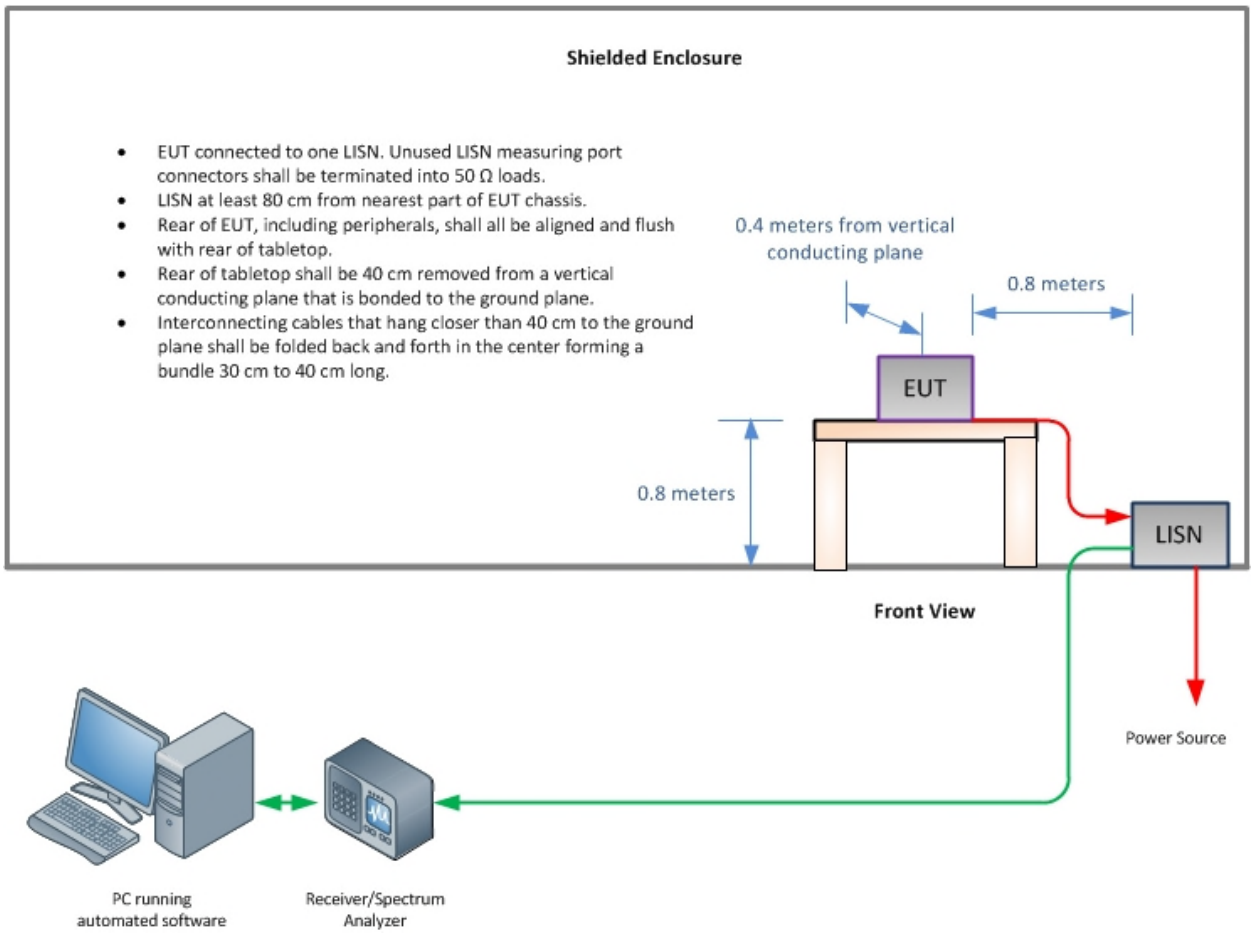

Figure 4-3 – Conducted Emissions Test Setup

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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