FCC and ISED Canada Testing of the

Current Products Corp.
CP19CTRZ-01

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

America

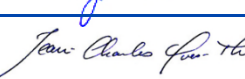
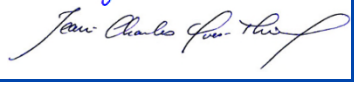
Add value.
Inspire trust.

Prepared for: Current Products Corp.
1995 Hollywood Ave.
Pensacola, FL 32505

FCC ID: 2AJXX100796
IC: 22151-CP19CTRZ01

COMMERCIAL-IN-CONFIDENCE

Date: 12. November 2019
Document Number: TP72151591.100 | Version Number: 01

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Authorized Signatory	Peter Walsh	2019 -November-12	
Testing	Thierry Jean Charles	2019-November-12	

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

TÜV SÜD America
5610 West Sligh Ave., Suite 100
Tampa, FL 33634

Phone: 813-284-2715
www.tuv-sud-america.com

Contents

1 Report Summary

1.1 Report Modification Record

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

Issue	Description of Change	Date of Issue
1	First Issue	2019-November-12

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	Current Products Corp.
Manufacturer	Current Products Corp.
Applicant's Email Address	cscott@currentproductscorp.com
Model Number(s)	CP19CTRZ-01
Serial Number(s)	N/A
FCC ID	2AJXX100796
ISED Certification Number	22151-CP19CTRZ01
Hardware Version(s)	Rev 5
Software Version(s)	1.0.2
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, 2019 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	2019-July-01
Order Number	72151591
Date	2019-July-19
Date of Receipt of EUT	2019-August-12
Start of Test	2019-August-23
Finish of Test	2019-October-22
Name of Engineer(s)	Thierry Jean-Charles, Jean N. Rene
Related Document(s)	ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Device. US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2019. 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	-------	9
6 dB Bandwidth	Yes	Pass	15.247(a)(2)	RSS-247 5.2(a)	10
99% Bandwidth	Yes	Pass	-------	RSS-GEN 6.6	13
Peak Output Power	Yes	Pass	15.247(b)(3)	RSS-247 5.4(d)	16
Band-Edge Compliance of RF Conducted Emissions	Yes	Pass	15.247(d)	RSS-247 5.5	19
RF Conducted Spurious Emissions	Yes	Pass	15.247(d)	RSS-247 5.5	22
Radiated Spurious Emissions into Restricted Frequency Bands	Yes	Pass	15.205, 15.209	RSS-GEN 8.9, 8.10	27
Power Spectral Density	Yes	Pass	15.247(e)	RSS-247 5.2(b)	34
Power Line Conducted Emissions	No	Not Tested	15.207	RSS-GEN 8.8	37

1.4 Product Information

1.4.1 Technical Description

The EUT is a standalone Zigbee remote control to operate Zigbee Drapery.

Technical Details
Mode of Operation: IEEE 802.15.4
Frequency Range: 2405 MHz - 2480 MHz
Number of Channels: 16
Channel Separation: 5 MHz
Data Rate: 250 kbps
Modulations: O-QPSK
Antenna Type/Gain: Whip Antenna / 5.19 dBi
Input Power: 3 VDC CR2450 Battery

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

Table 1.4.1-1 – Cable Descriptions

Cable/Port	Description
Power Leads	2 m, not shielded, EUT to DC Power Supply
Power Cord	Not shielded (DC Power Supply)

Note: The EUT is a standalone equipment operating from internal battery. The external power supply and power leads were used for testing purposes only.

Table 1.4.1-2 – Support Equipment Descriptions

Make/Model	Description
Hewlett Packard / 6291A	DC Power Supply, SN: 1926A05628

Note: The EUT is a standalone equipment operating from internal battery. The external power supply and power leads were used for testing purposes only.

Declaration of Build Status

EQUIPMENT DESCRIPTION	
Model Name/Number	Capacitive Touch Zigbee
Part Number	CP19CTRZ-01
Hardware Version	Rev 5
Software Version	1.0.2
FCC ID (if applicable)	2AJXX100796
ISED ID (if applicable)	22151-CP19CTRZ01
Technical Description (Please provide a brief description of the intended use of the equipment)	A Zigbee Remote to operate Zigbee Drapey.

UN-INTENTIONAL RADIATOR	
Highest frequency generated or used in the device or on which the device operates or tunes	**38.4 MHz**
Lowest frequency generated or used in the device or on which the device operates or tunes	
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
	3 V		2 V

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

Ancillaries
Please list all ancillaries which will be used with the device.
None

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

Name: Curtis Scott

Position held: Electrical Engineer Date: 9/12/2019

1.4.2 Modes of Operation

The EUT was set to continous TX mode using a test software power setting equal to 5.

1.4.3 Monitoring of Performance

Preliminary radiated emissions measurements were performed for the EUT with the flat back cover in three orthogonal orientations as well as with the alternate back cover (desk configuration). The overall worst-case configuration was used for the remaining radiated emission measurements as described below:

Radiated Band-Edge Emission Measurements: EUT on Side
Radiated Spurious Emission Measurements: EUT Flat

The RF conducted measurements were performed on a sample modified with an SMA connector to allow direct coupling to the spectrum analyzer.

1.4.4 Performance Criteria

The test report documents the compliance of the Zigbee radio with the FCC Section 15.247 and ISED Canada RSS-247 requirements.

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

A summary of the parameters that were evaluated is provided 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 assessed to the requirements 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

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
Radiated Spurious Emissions into Restricted Frequency Bands	Thierry Jean-Charles and Jean N. Rene	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

N/A

2.1.3 Date of Test

N/A

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 a 5.19 dBi integral whip antenna that is directly soldered to the PCB. The antenna is not removable and therefore 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 was 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

SN: N/A

2.2.3 Date of Test

9/11/2019

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	24.1°C
Relative Humidity	43.9 %
Atmospheric Pressure	1013.2 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	1693.125
2440	1691.625
2480	1690.500

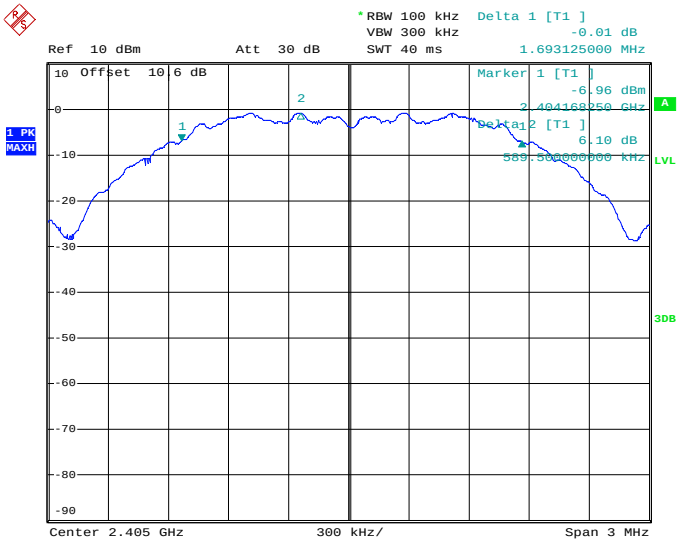


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Figure 2.2.6-1: 6 dB Bandwidth – Low Channel

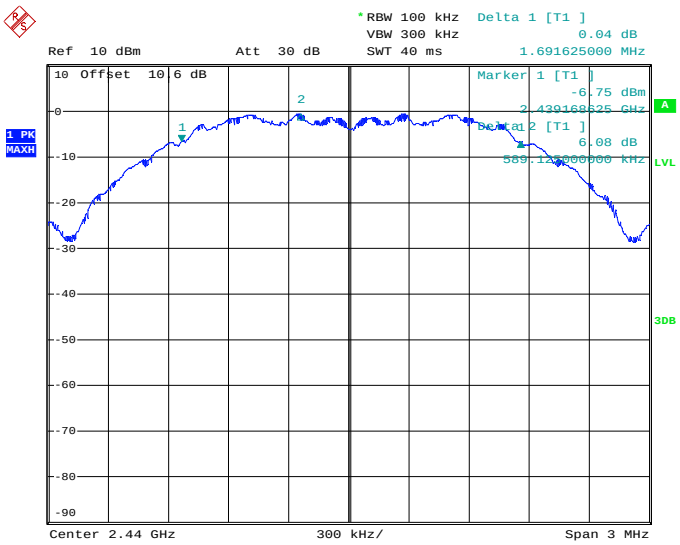

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Figure 2.2.6-2: 6 dB Bandwidth – Middle Channel

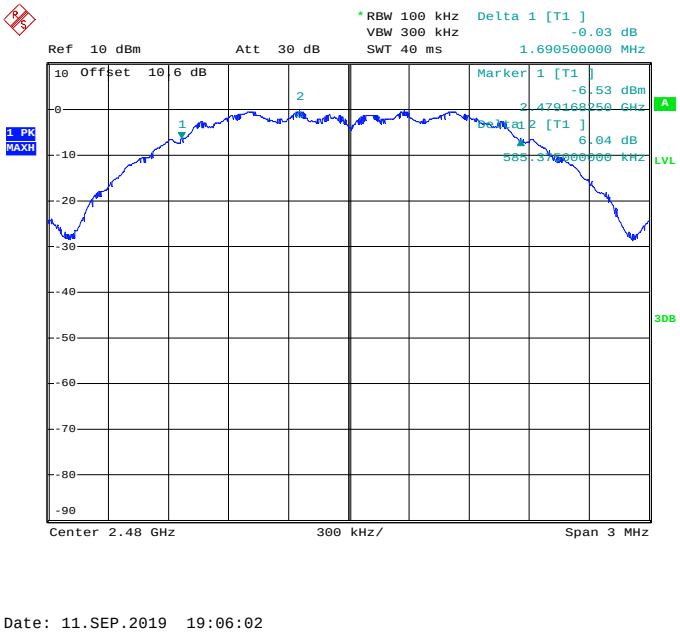

Figure 2.2.6-3: 6 dB Bandwidth – High Channel

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
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	27-Jul-2020
Duratest High Frequency CableMax. frequency 26.5GHz	Teledyne Storm Products	921-0101-036	BEMC02112	N/A	12	12-Oct-2020

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 6.6

2.3.2 Equipment Under Test and Modification State

SN: N/A

2.3.3 Date of Test

9/11/2019

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	24.1°C
Relative Humidity	43.9 %
Atmospheric Pressure	1013.2 mbar

2.3.6 Test Results

DC Powered Operating

Rated Output Power: 5 dBm

Limit Clause ISED RSS-GEN 6.7

Table 2.3.6-1: 99% Bandwidth Test Results

Frequency (MHz)	99% Bandwidth (kHz)
2405	2240.00
2440	2236.25
2480	2238.75

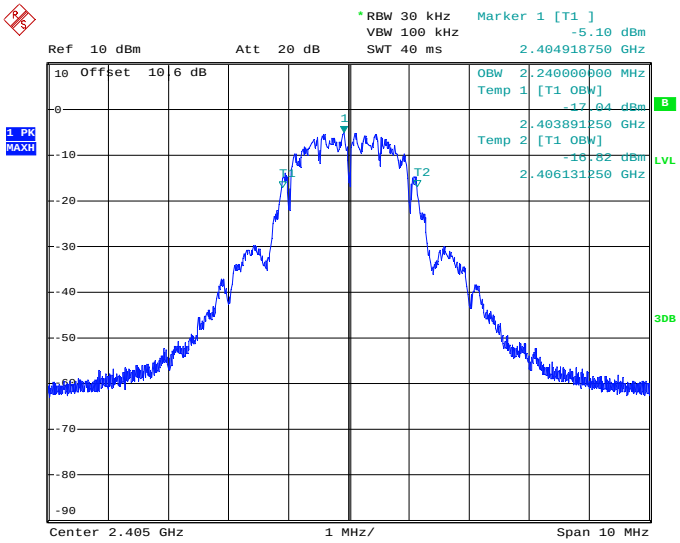

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Figure 2.3.6-1: 99% Bandwidth – Low Channel

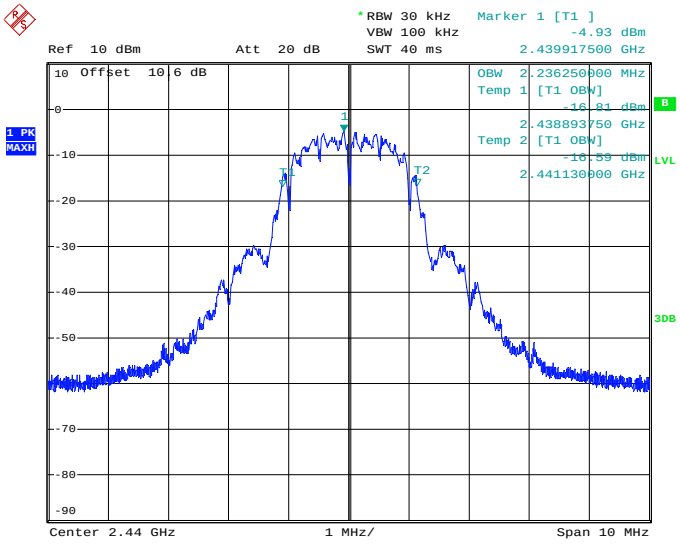

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Figure 2.3.6-2: 99% Bandwidth – Middle Channel

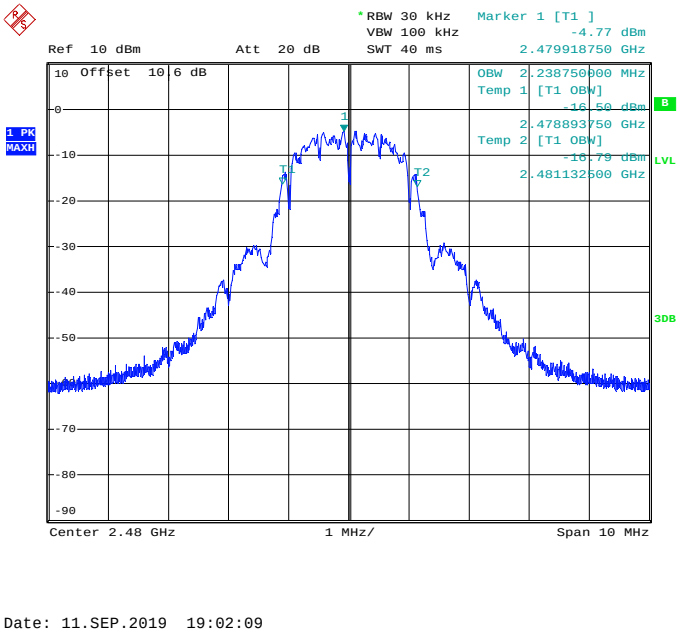

Figure 2.3.6-3: 99% Bandwidth – High Channel

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
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	27-Jul-2020
Duratest High Frequency CableMax. frequency 26.5GHz	Teledyne Storm Products	921-0101-036	BEMC02112	N/A	12	12-Oct-2020

TU - Traceability Unscheduled
O/P MON - Traceability Unscheduled
N/A - Not Applicable

2.4 Peak Output Power

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

2.4.1 Equipment Under Test and Modification State

SN: N/A

2.4.2 Date of Test

9/11/2019

2.4.3 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.

2.4.4 Environmental Conditions

Ambient Temperature	24.1°C
Relative Humidity	43.9 %
Atmospheric Pressure	1013.2 mbar

2.4.5 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: RF Output Power Test Results

Frequency (MHz)	Power (dBm)
2405	3.26
2440	3.51
2480	3.69

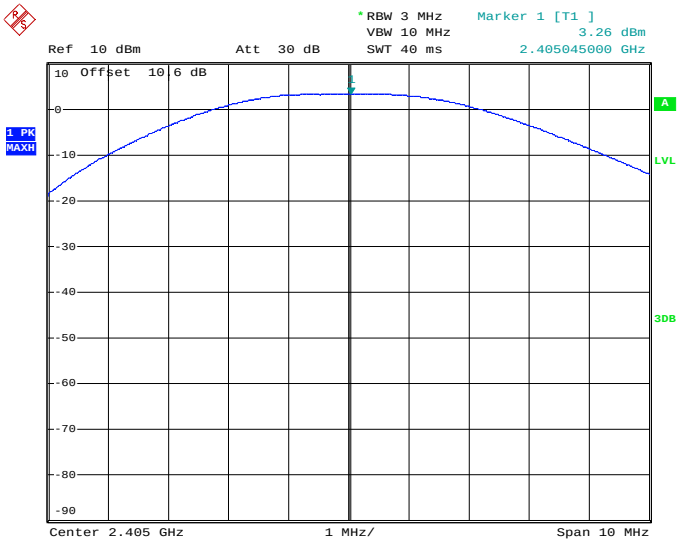

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Figure 2.4.6-1: RF Output Power – Low Channel

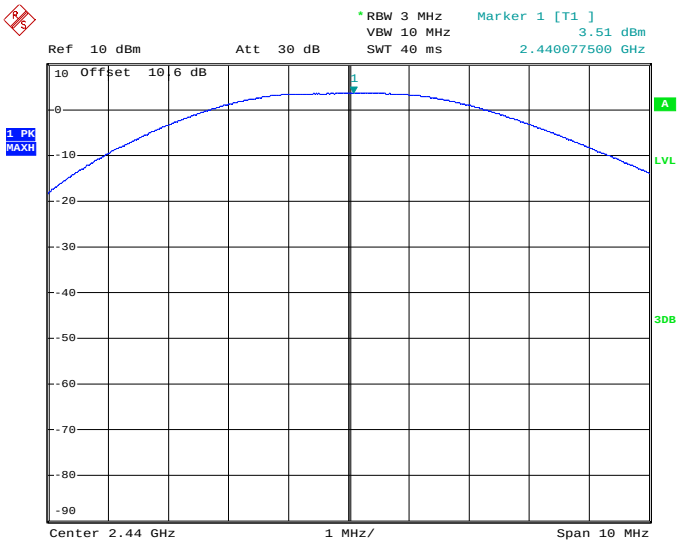

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Figure 2.4.6-2: RF Output Power – Middle Channel

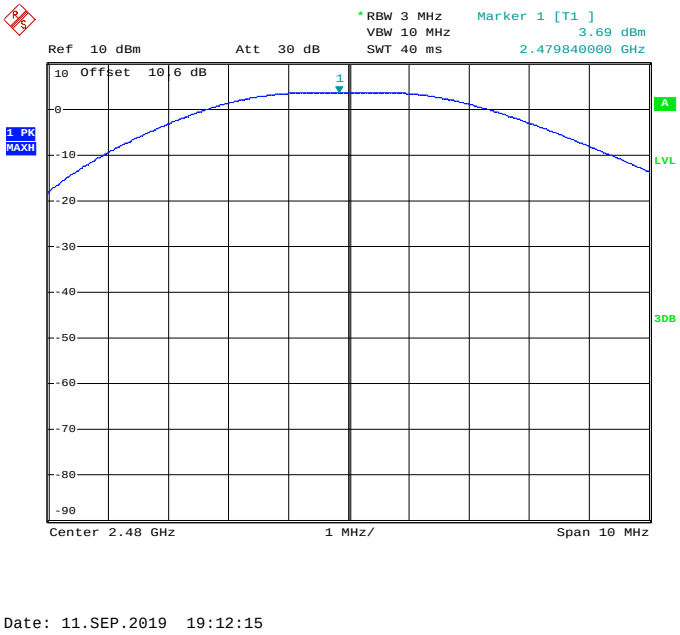

Figure 2.4.6-3: RF Output Power – High Channel

2.4.6 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	27-Jul-2020
Duratest High Frequency CableMax. frequency 26.5GHz	Teledyne Storm Products	921-0101-036	BEMC02112	N/A	12	12-Oct-2020

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

SN: N/A

2.5.3 Date of Test

9/11/2019

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	23.9 °C
Relative Humidity	43.5 %
Atmospheric Pressure	1013.2 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 e 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.

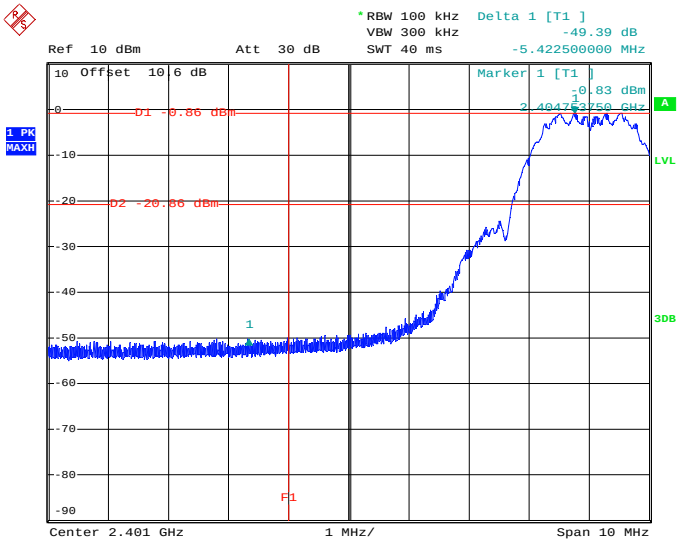

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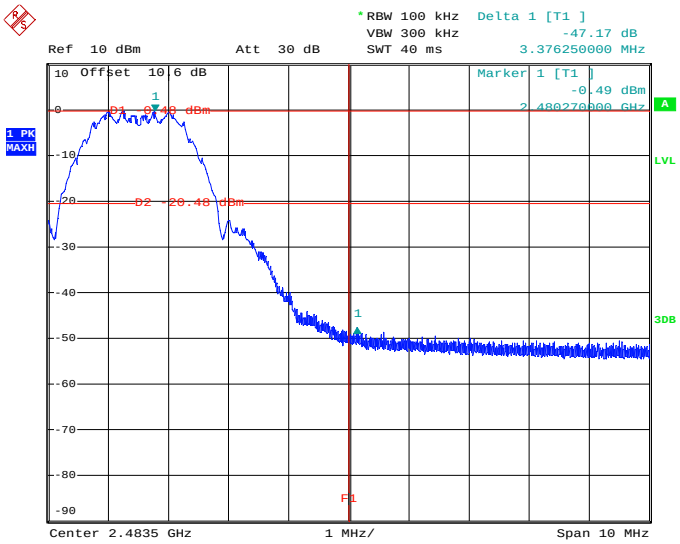
Figure 2.5.6-1: Lower Band-Edge



Date: 11.SEP.2019 19:16:17

Figure 2.5.6-2: Upper Band-Edge

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	27-Jul-2020
Duratest High Frequency CableMax. frequency 26.5GHz	Teledyne Storm Products	921-0101-036	BEMC02112	N/A	12	12-Oct-2020

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

SN: N/A

2.6.3 Date of Test

9/11/2019

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 26 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	23.9 °C
Relative Humidity	43.5 %
Atmospheric Pressure	1013.2 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 e 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.

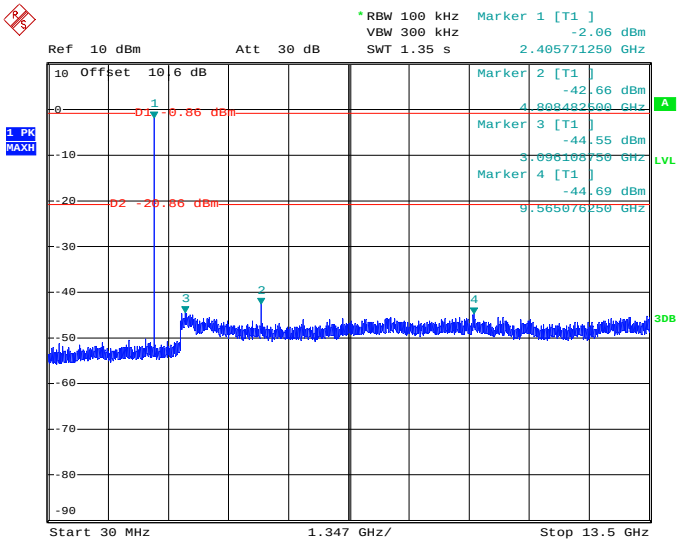


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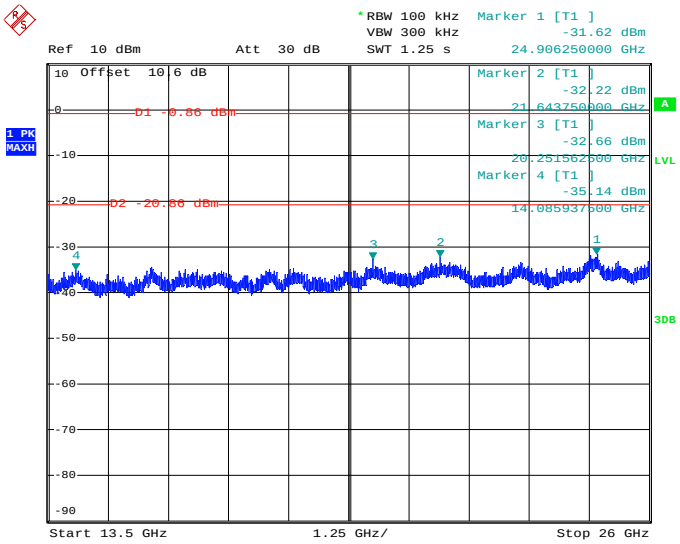
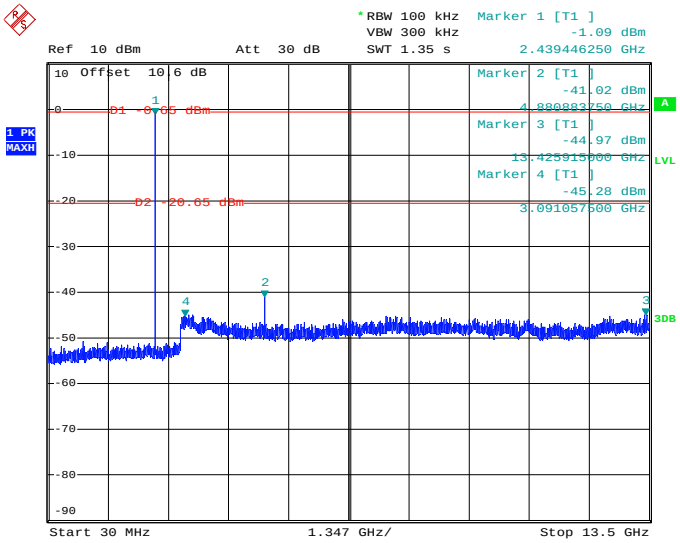
Figure 2.6.6-1: 30 MHz - 13.5 GHz – Low Channel



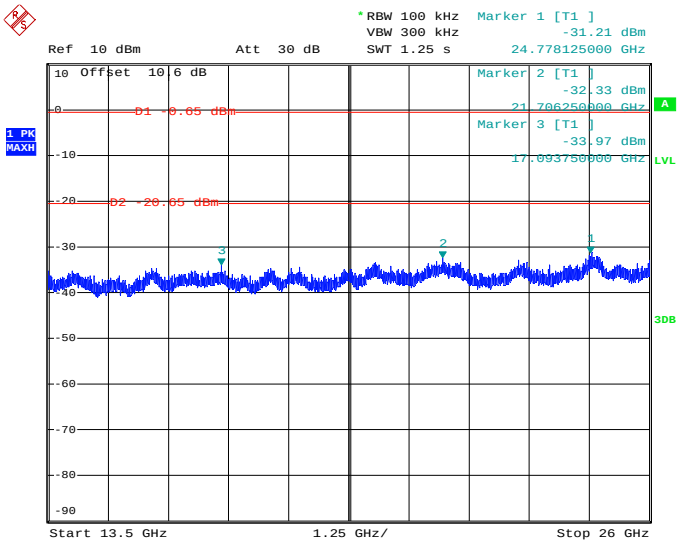
Date: 11.SEP.2019 18:32:40

Figure 2.6.6-2: 13.5 GHz - 26 GHz – Low Channel



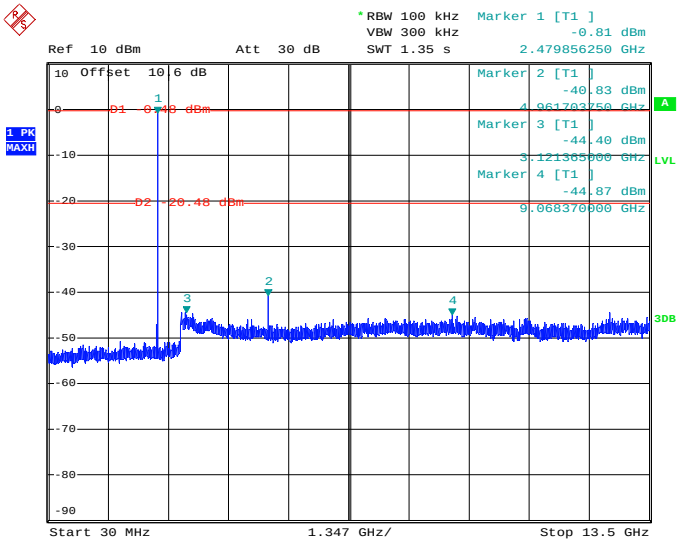
Date: 11.SEP.2019 18:54:37

Figure 2.6.6-3: 30 MHz - 13.5 GHz – Middle Channel



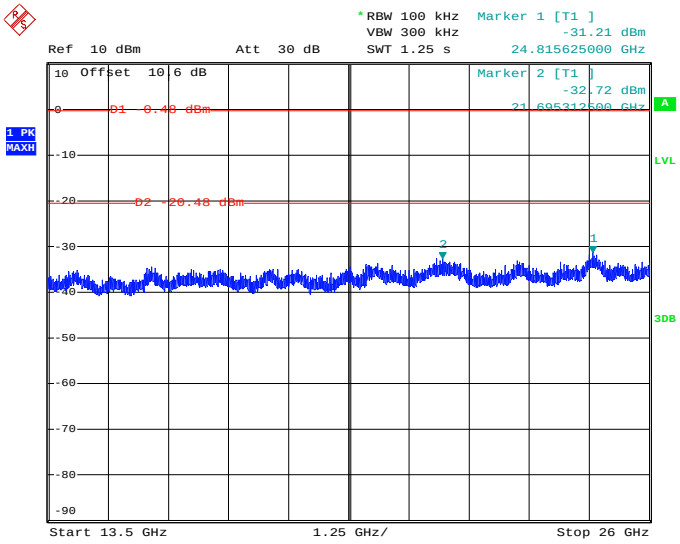
Date: 11.SEP.2019 18:57:47

Figure 2.6.6-4: 13.5 GHz - 26 GHz – Middle Channel



Date: 11.SEP.2019 19:19:26

Figure 2.6.6-5: 30 MHz - 13.5 GHz – High Channel



Date: 11.SEP.2019 19:21:37

Figure 2.6.6-6: 13.5 GHz - 26 GHz – 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
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	27-Jul-2020
Duratest High Frequency CableMax. frequency 26.5GHz	Teledyne Storm Products	921-0101-036	BEMC02112	N/A	12	12-Oct-2020

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

SN: N/A

2.7.3 Date of Test

8/23/2019 to 9/11/2019

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 was used for the average measurements.

2.7.6 Environmental Conditions

Ambient Temperature	24.3 °C
Relative Humidity	46.4 %
Atmospheric Pressure	1013.5 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: TX Radiated Spurious Emissions Results

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 (2405 MHz)										
4810	44.19	34.66	H	4.11	48.30	38.77	74.0	54.0	25.7	15.2
4810	40.61	29.38	V	4.11	44.72	33.49	74.0	54.0	29.3	20.5
Middle Channel (2440 MHz)										
4880	45.87	36.79	H	4.26	50.13	41.05	74.0	54.0	23.9	12.9
4880	41.31	30.15	V	4.26	45.57	34.41	74.0	54.0	28.4	19.6
7320	39.74	25.45	H	9.25	48.99	34.70	74.0	54.0	25.0	19.3
7320	39.62	25.02	V	9.25	48.87	34.27	74.0	54.0	25.1	19.7
High Channel (2480 MHz)										
2483.5	56.65	47.80	H	-1.91	54.74	45.89	74.0	54.0	19.3	8.1
2483.5	56.59	47.68	V	-1.91	54.68	45.77	74.0	54.0	19.3	8.2
4960	45.95	37.67	H	4.43	50.38	42.10	74.0	54.0	23.6	11.9
4960	41.98	32.00	V	4.43	46.41	36.43	74.0	54.0	27.6	17.6
7440	38.45	24.98	H	9.42	47.87	34.40	74.0	54.0	26.1	19.6
7440	38.22	24.78	V	9.42	47.64	34.20	74.0	54.0	26.4	19.8

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

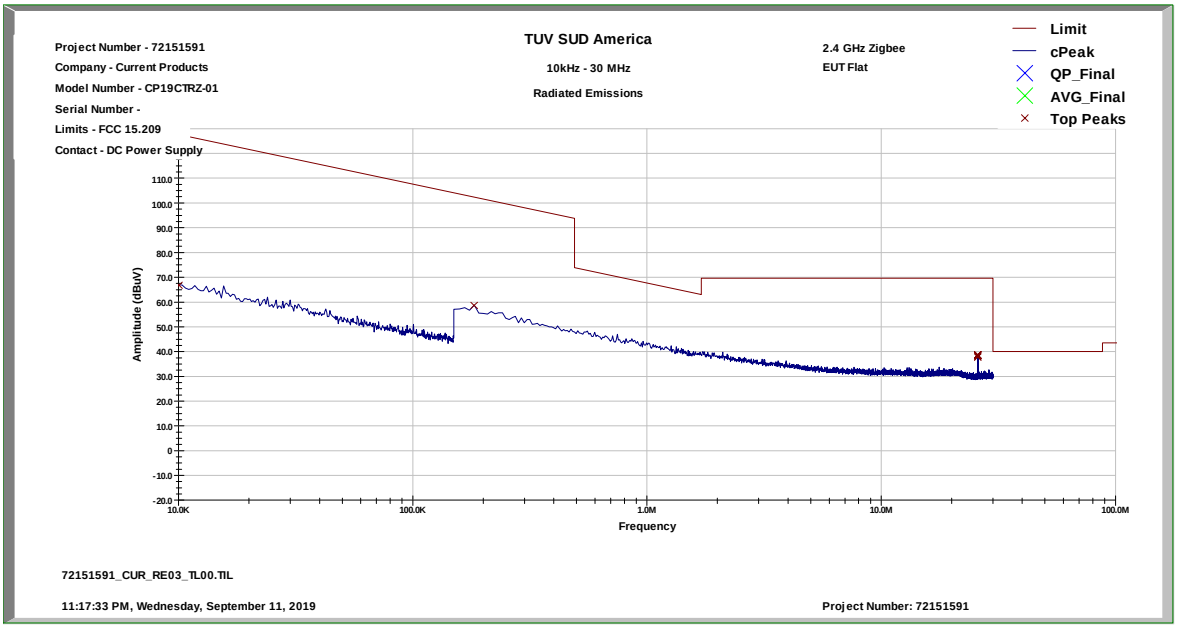


Figure 2.7.7-1: Worst Case Radiated Emissions Pre-Scan Plot below 30 MHz

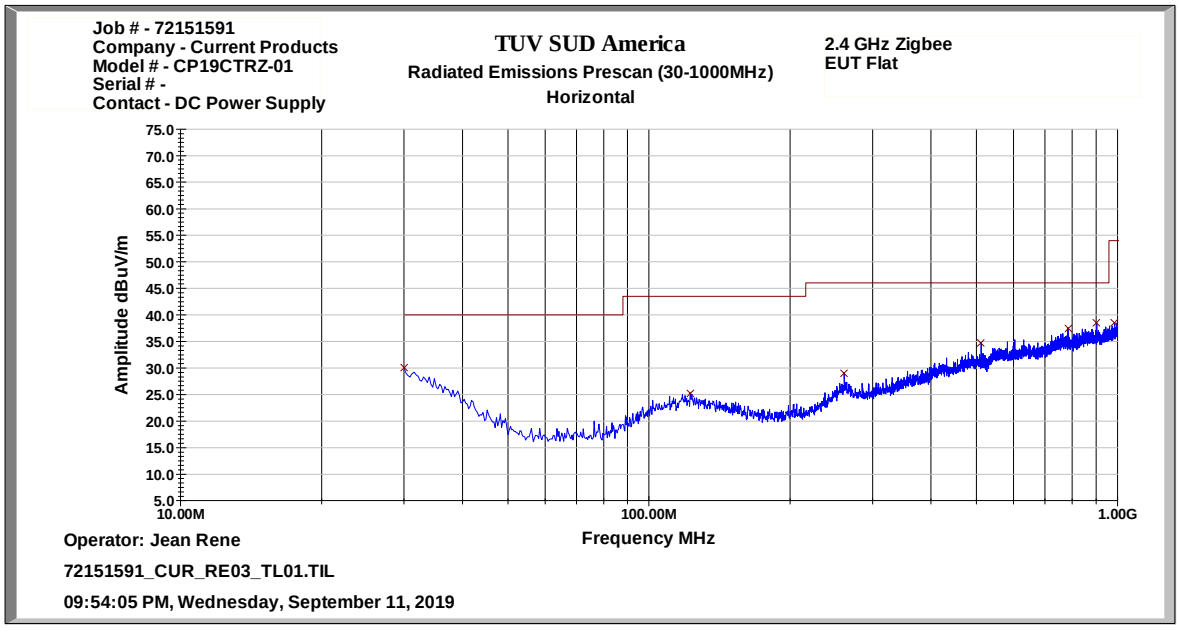


Figure 2.7.7-2: Worst Case Radiated Emissions Pre-Scan Plot 30 MHz – 1 GHz – Horizontal Polarization

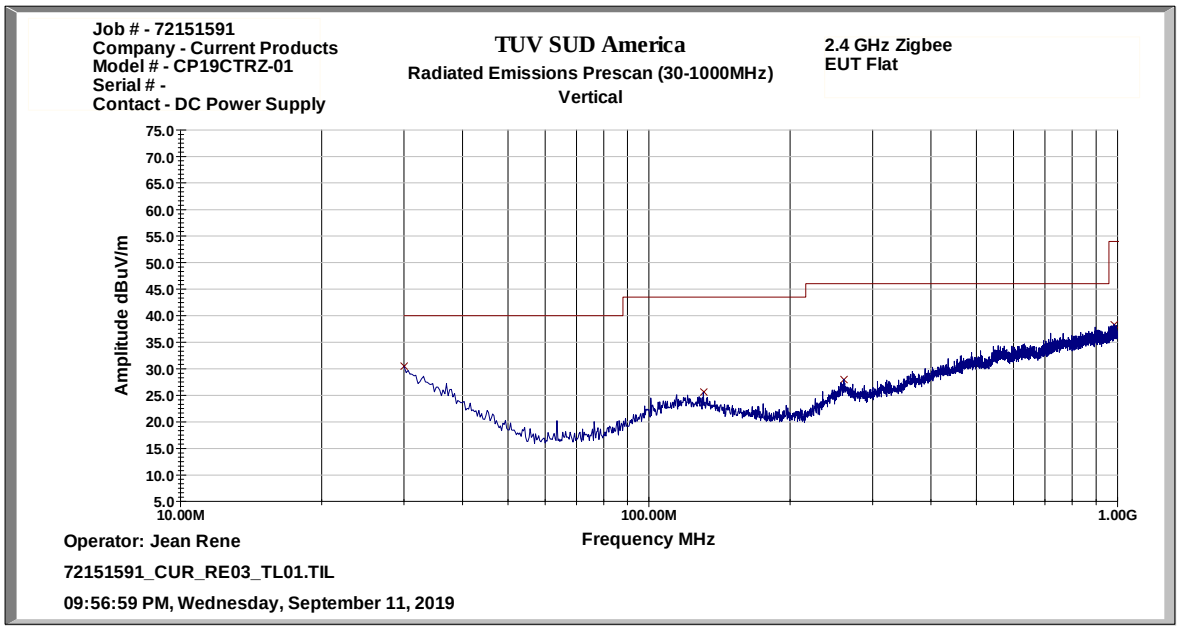


Figure 2.7.7-3: Worst Case Radiated Emissions Pre-Scan Plot 30 MHz – 1 GHz – Vertical Polarization

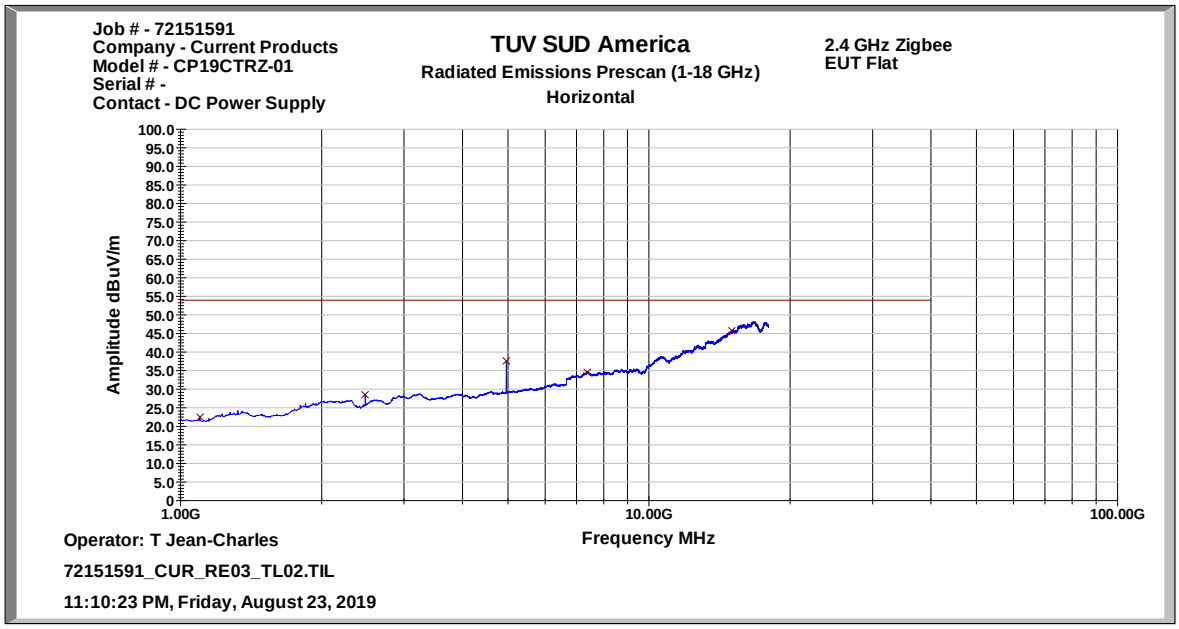


Figure 2.7.7-4: Worst Case Radiated Emissions Pre-Scan Plot 1 GHz – 18 GHz – Horizontal Polarization

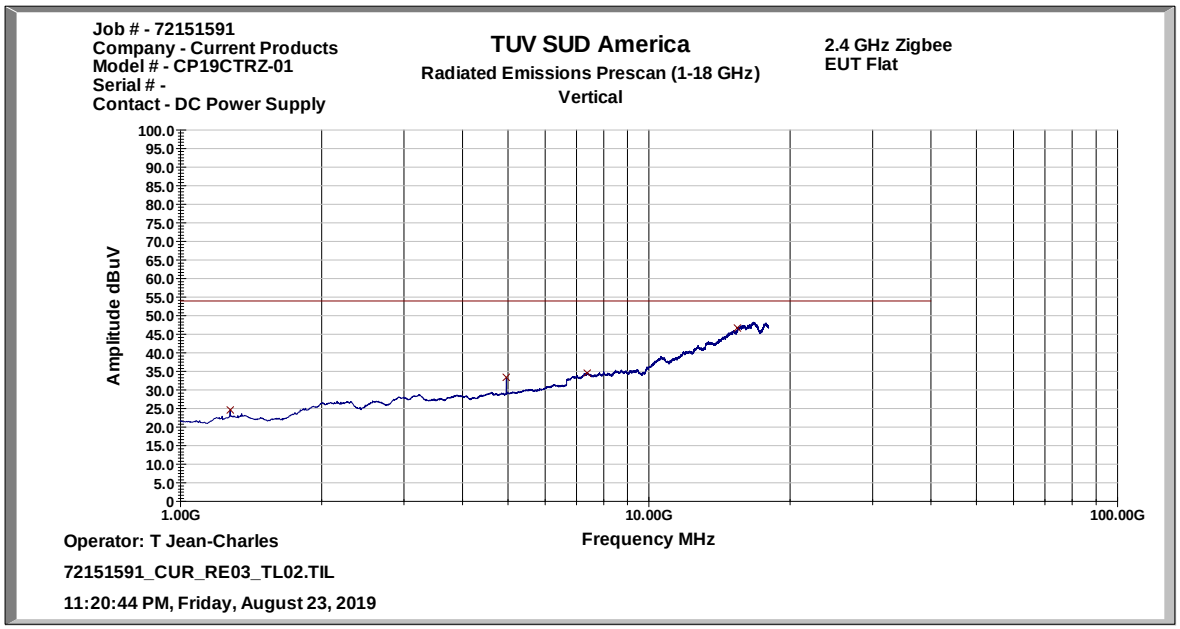


Figure 2.7.7-5: Worst Case Radiated Emissions Pre-Scan Plot 1 GHz – 18 GHz – Vertical Polarization

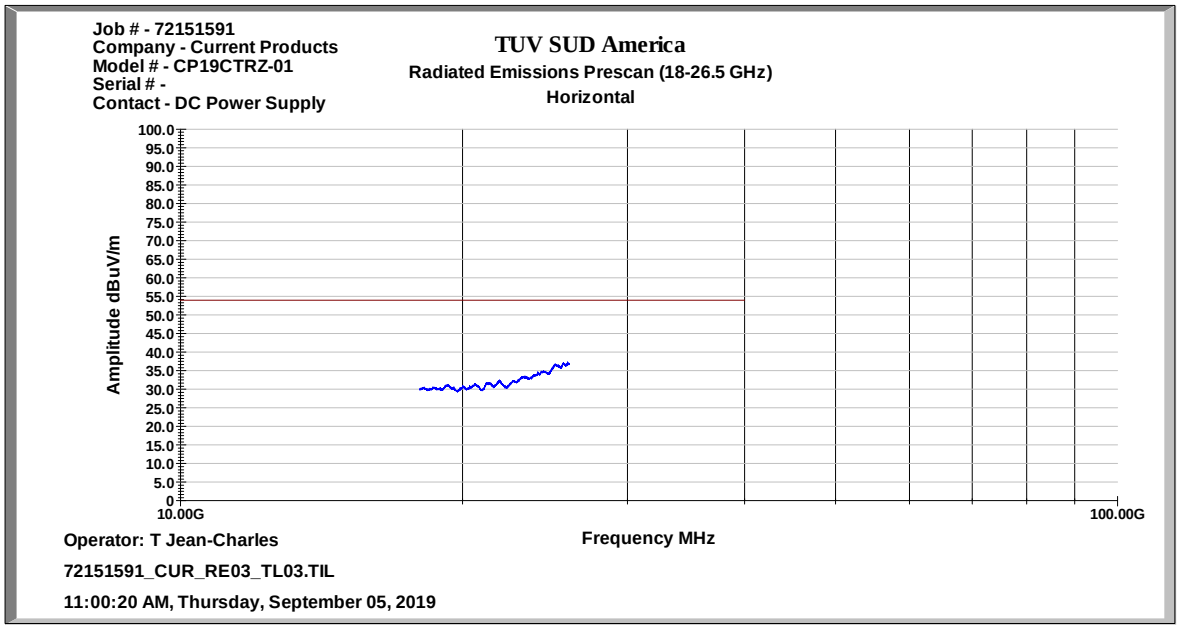


Figure 2.7.7-6: Worst Case Radiated Emissions Pre-Scan Plot 18 GHz – 26.5 GHz – Horizontal Polarization

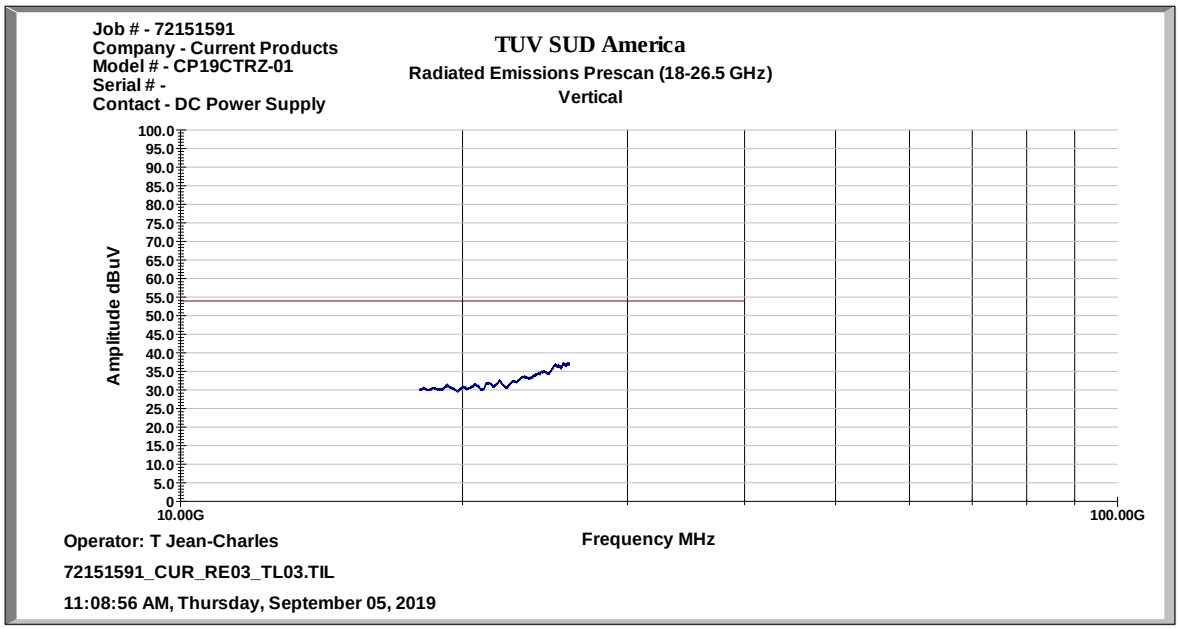


Figure 2.7.7- 7: Worst Case Radiated Emissions Pre-Scan Plot 18 GHz – 26.5 GHz – Vertical Polarization

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: 44.19 + 4.11 = 48.3 dBµV/m
Margin: 74 dBµV/m – 48.3 dBµV/m = 25.7 dB

Example Calculation: Average
Corrected Level: 34.66 + 4.11 - 0= 38.77 dBµV/m
Margin: 54 dBµV/m – 38.77 dBµV/m = 15.23 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	24	27-Nov-2020
10dB Attenuator	Merrimac	FAN-6-10K	BEMC02086	N/A	12	17-Oct-2019
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	19-Dec-2019
Loop Antenna	Com Power	AL-130	TEMC00025	N/A	24	07-Nov-2019
Horn Antenna	Schwarzbeck	BBHA-9170	TEMC00029	N/A	60	23-Aug-2021
EMC Chamber	Panasheild	N/A	TEMC00031	N/A	24	28-Jan-2021
Double Ridge Guide Horn	ETS Lindgren	3117	TEMC00061	N/A	24	13-Feb-2020
EMI Test Receiver	Rohde & Schwarz	ESIB 40	TEMC00128	4.35	24	04-Oct-2021
PAM-118A	Com-Power Corporation	PAM-118A	TEMC00160	N/A	12	27-Apr-2020
4A & 4B Test Cables	MegaPhase, LLC	1GVT4	TEMC00171	N/A	24	30-May-2020
2.4 GHz Notch Filter	Micro-Tronics	BRM50702-01	TEMC00176	N/A	12	10-Apr-2020
Radiated Cable Set 30 MHz - 1 GHz	TUV SUD Tampa	Cable 2	TEMC00179	N/A	12	07-May-2020
Radiated Cable Set 9 kHz - 30 MHz	TUV SUD Tampa	Cable 2	TEMC00186	N/A	12	08-May-2020

TU - Traceability Unscheduled
O/P MON - Traceability Unscheduled
N/A - Not Applicable

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

SN: N/A

2.8.3 Date of Test

9/11/2019

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 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	24.1 °C
Relative Humidity	43.9 %
Atmospheric Pressure	1013.2 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 Test Results

Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
2405	-12.13	8	20.13
2440	-11.91	8	19.91
2480	-11.74	8	19.74

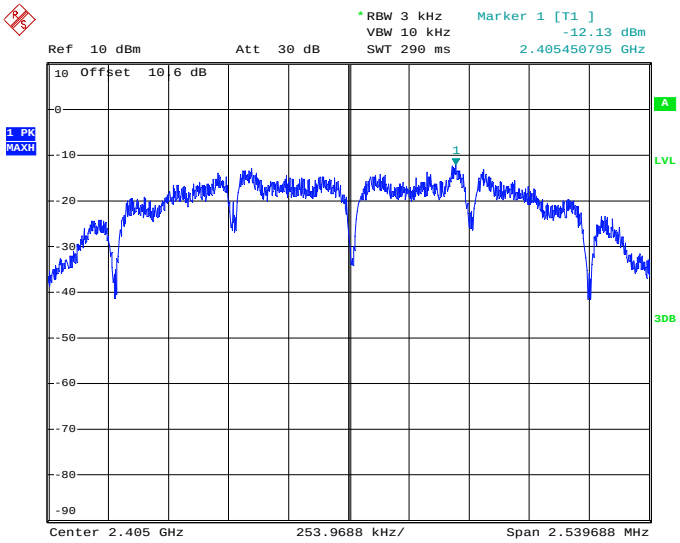


Figure 2.8.6-1: Power Spectral Density – Low Channel

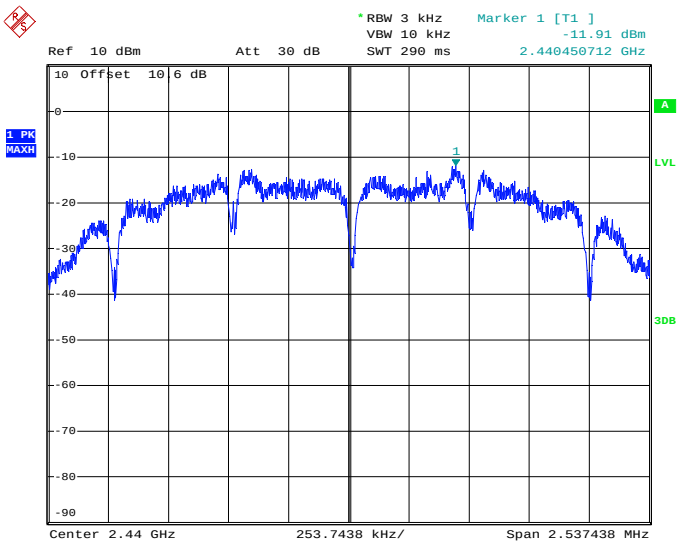


Figure 2.8.6-2: Power Spectral Density – Middle Channel

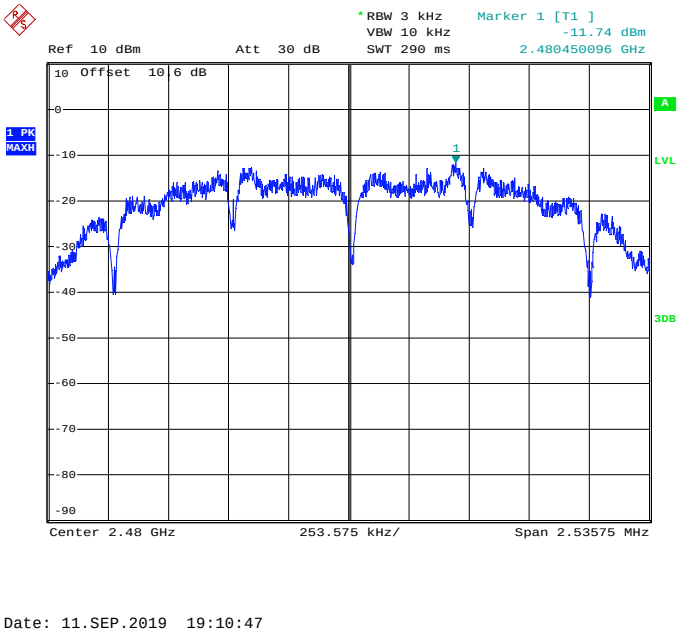


Figure 2.8.6-3: Power Spectral Density – High Channel

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	27-Jul-2020
Duratest High Frequency CableMax. frequency 26.5GHz	Teledyne Storm Products	921-0101-036	BEMC02112	N/A	12	12-Oct-2020

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 Equipment Under Test and Modification State

SN: N/A

2.9.3 Date of Test

N/A

2.9.4 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

2.9.5 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.

The EUT is stand-alone battery-operated equipment without any provision 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
Attenuator 10dB, 2.9 mm-M/F, DC-40GHz 2 W	Aeroflex Inmet	40AH2W-10	BEMC02110	N/A	12	27-Jul-2020
Duratest High Frequency Cable Max. frequency 26.5GHz	Teledyne Storm Products	921-0101-036	BEMC02112	N/A	12	12-Oct-2020
9kHz-26.5GHz EMC analyzer/HYZ	Agilent	E7405A	BEMC00523	A.14.06	24	27-Nov-2020
10dB Attenuator	Merrimac	FAN-6-10K	BEMC02086	N/A	12	17-Oct-2019
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	03-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	24	28-Jan-2021
Double Ridge Guide Horn	ETS Lindgren	3117	TEMC00061	N/A	24	13-Feb-2020
EMI Test Receiver	Rohde & Schwarz	ESIB 40	TEMC00128	4.35	24	03-Oct-2021
PAM-118A	Com-Power Corporatio	PAM-118A	TEMC00160	N/A	12	27-Apr-2020
4A & 4B Test Cables	MegaPhase, LLC	1GVT4	TEMC00171	N/A	24	30-May-2020
2.4 GHz Notch Filter	Micro-Tronics	BRM50702-01	TEMC00176	N/A	12	10-Apr-2020
Radiated Cable Set 30 MHz - 1 GHz	TUV SUD Tampa	Cable 2	TEMC00179	N/A	12	07-May-2020
Radiated Cable Set 9 kHz - 30 MHz	TUV SUD Tampa	Cable 2	TEMC00186	N/A	12	08-May-2020

TU - Traceability Unscheduled
O/P MON - Traceability Unscheduled
N/A - Not Applicable

4 Diagram of Test Set-ups

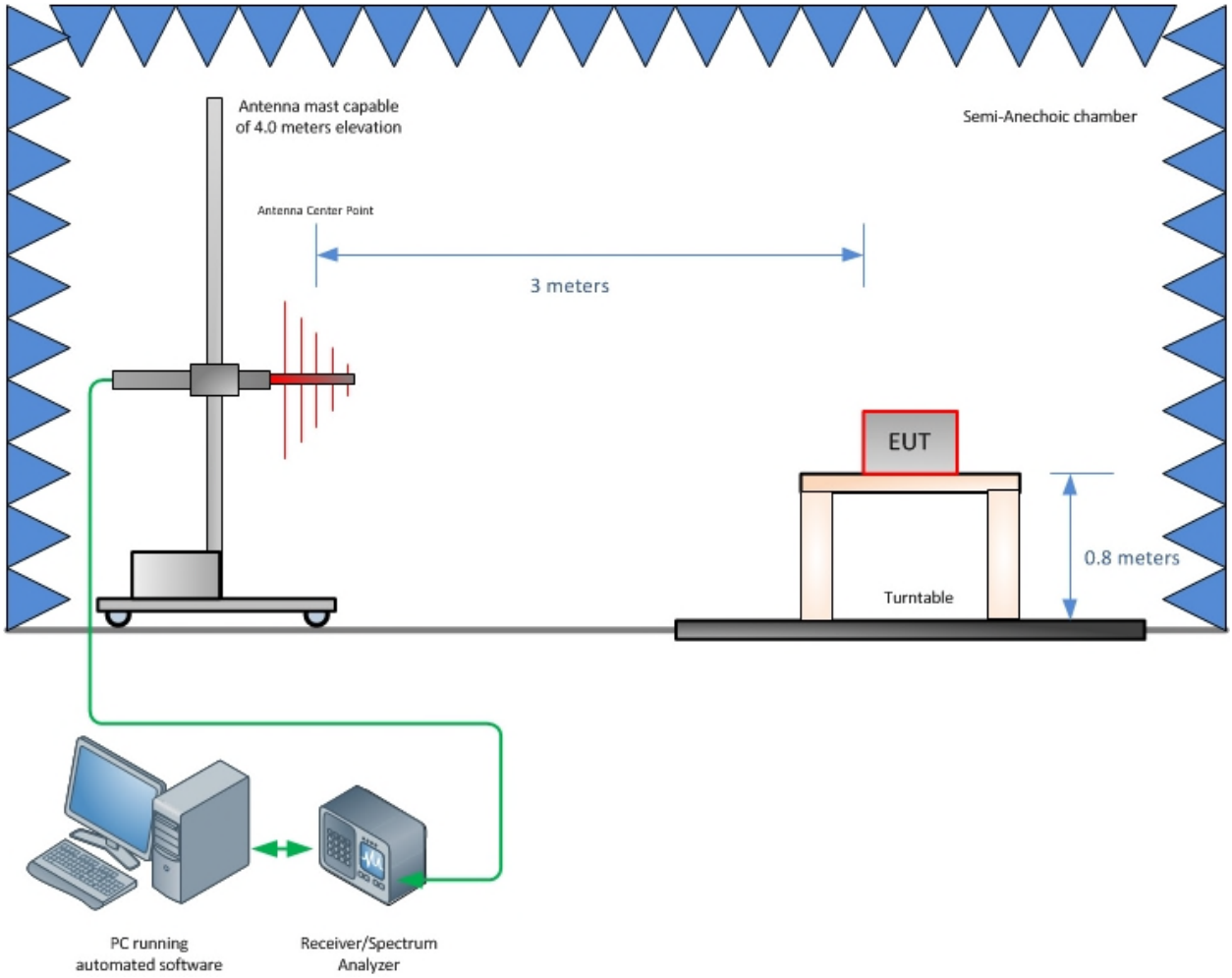


Figure 4-1 - Radiated Emissions Test Setup up to 1 GHz

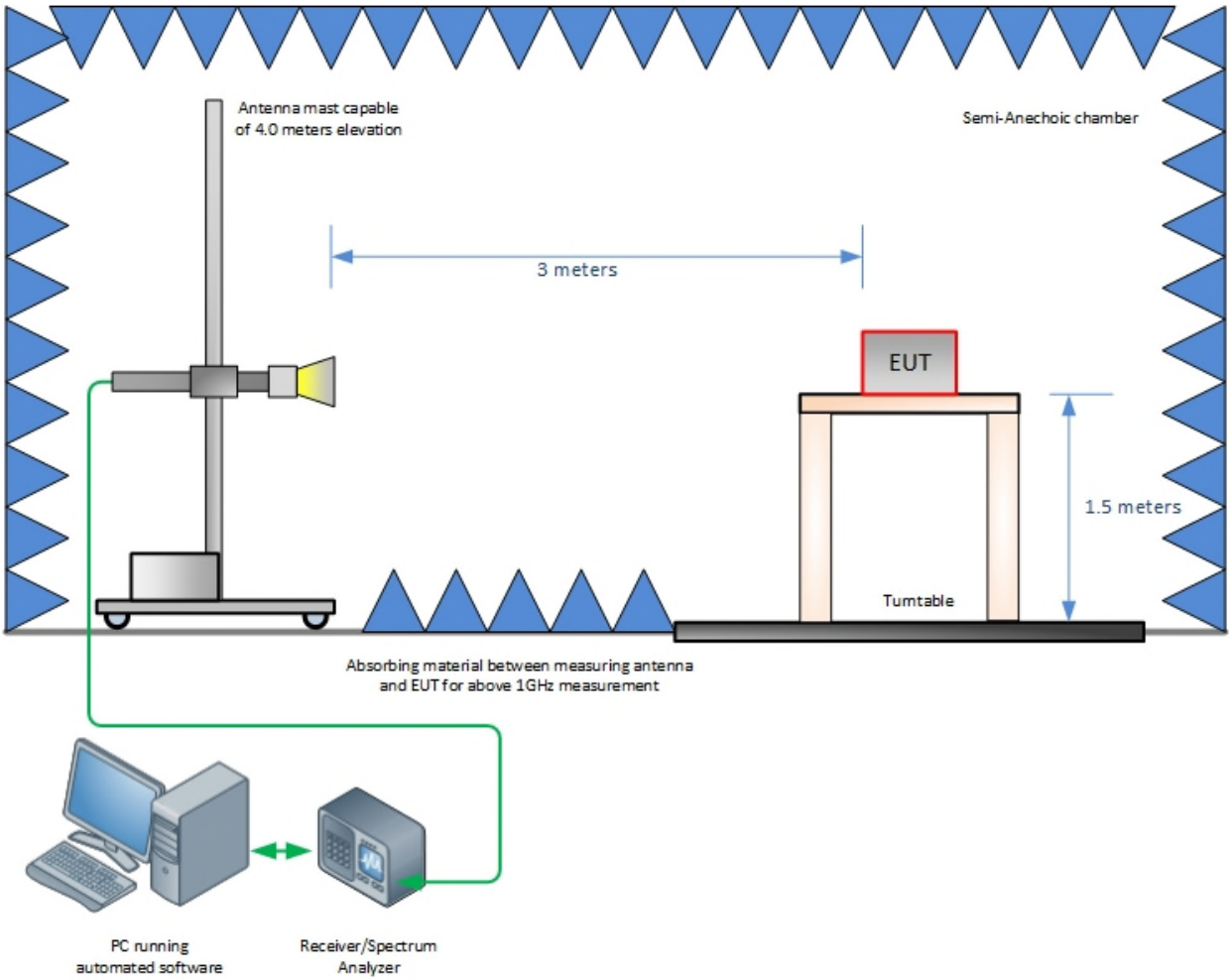


Figure 4-2 - Radiated Emissions Test Setup above 1 GHz

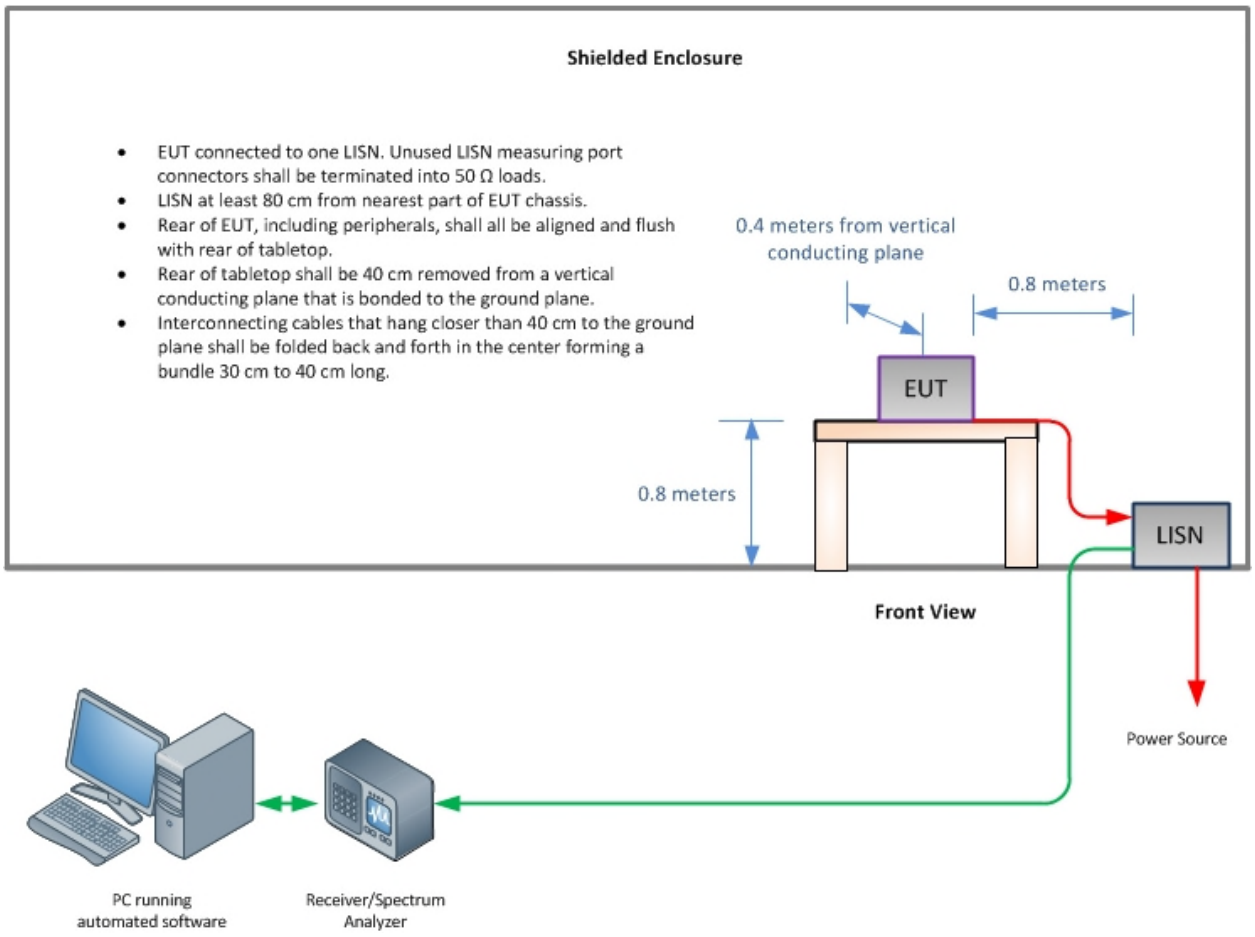


Figure 4-3 – Conducted Emissions Test Setup

5 Measurement Uncertainty

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

Table 6-1 - 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.

6 Accreditation, Disclaimers and Copyright

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