

FCC and ISED Canada Testing of the

Attenti US, Inc.

34204AL, 34204CL, 34204VL and 34204XL

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

Prepared for: Attenti US, Inc.
1838 Gunn Highway
Odessa, FL 33556

FCC ID: NC3-34204AVL

IC: 23669-34204AVL



America

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RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Authorized Signatory	Peter Walsh	2020 -June-10	
Testing	Thierry Jean Charles	2020-June-10	

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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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	2020-February-19
2	Corrected Model Number, FCC ID, ISED Certification number	2020-April-01
3	Revised the Model Numbers	2020-June-10

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	Attenti US, Inc.
Manufacturer	Attenti US, Inc.
Applicant's Email Address	sdupont@attentigroup.com
Model Number(s)	34204AL, 34204CL, 34204VL and 34204XL
Serial Number(s)	50414804, 50473744
FCC ID	NC3-34204AVL
ISED Certification Number	23669-34204AVL
Hardware Version(s)	2.0
Software Version(s)	MBU3000_V0.1_Test
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, 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-April-17
Order Number	72149971
Date	2019-May-28
Date of Receipt of EUT	2019-December-04
Start of Test	2019-December-04
Finish of Test	2020-February-17
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, 2018. 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	-----	10
6 dB Bandwidth	Yes	Pass	15.247(a)(2)	RSS-247 5.2(a)	11
99% Bandwidth	Yes	Pass	-----	RSS-GEN 6.7	19
Peak Output Power	Yes	Pass	15.247(b)(3)	RSS-247 5.4(d)	27
Band-Edge Compliance of RF Conducted Emissions	Yes	Pass	15.247(d)	RSS-247 5.5	30
RF Conducted Spurious Emissions	Yes	Pass	15.247(d)	RSS-247 5.5	35
Radiated Spurious Emissions into Restricted Frequency Bands	Yes	Pass	15.205, 15.209	RSS-GEN 8.9, 8.10	41
Power Spectral Density	Yes	Pass	15.247(e)	RSS-247 5.2(b)	49
Power Line Conducted Emissions	Yes	Pass	15.207	RSS-GEN 8.8	57



1.4 Product Information

1.4.1 Technical Description

The EUT is a monitoring device that receives RF transmissions from transmitting devices and reports the status of the transmitter to a service center via PSTN or cellular communication. The unit incorporates two RF transceivers 433 MHz with non-simultaneous transmission, a modular approved cellular module and a 2.4 GHz Wi-Fi radio. A representative test sample was provided for testing.

Technical Details

Mode of Operation: 802.11b/g/n
 Frequency Range: 2412 MHz - 2462 MHz
 Number of Channels: 11
 Channel Separation: 5 MHz
 Data Rate: 802.11b: 1, 2, 5.5, 11 Mbps
 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps
 802.11n: 6.5, 13, 19.5, 26, 39, 52, 58.5, 65 Mbps
 Modulations: 802.11b: CCK, DSSS
 802.11g/n: OFDM
 Antenna Type/Gain: Embedded SMD PCB Mount On-Ground Antenna, 3.6 dBi
 Input Power: 12 VDC Power Supply, 7.4 VDC Rechargeable Li-Ion 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 Cord	1.5m, Not Shielded, Molded Ferrite, Power Supply to Base.
Handset Phone Cable	2 m, Not shielded, Handpiece to base
2 x Phone Cables	2.15 m, Not Shielded, Phone Cables

Table 1.4.1-2 – Support Equipment Descriptions

Make/Model	Description
JFEC/JF024WR-1200200UH	12 VDC AC Adapter



Declaration of Build Status

EQUIPMENT DESCRIPTION	
Model Name/Number	Model Name: BU3000 LTE Model Numbers: 34204AL, 34204CL, 34204VL, & 34204XL (Same FCC ID for all 4)
Part Number	34204AL, 34204CL, 34204VL, & 34204XL (The only difference between these Models / Part#'s are the Wireless Carrier SIM Cards.)
Hardware Version	2.0
Software Version	MBU3000_V0.1_Test (Device Firmware Version)
FCC ID (if applicable)	NC3-34204AVL
ISED ID (if applicable)	23669-34204AVL
Technical Description (Please provide a brief description of the intended use of the equipment)	Home Curfew Base Unit for Offender Monitoring. Uses POTS (land line phone service), LTE, GPS, Wi-Fi, and ISM Band Radio for monitoring and remote tracking.

UN-INTENTIONAL RADIATOR	
Highest frequency generated or used in the device or on which the device operates or tunes	During Normal Activated Transmitting Operation: 2.480 GHz (Wi-Fi ISM Band) During Idle Non-Activated Operation: 26 MHz (2- Crystals X1 & X2 for dual 433.92 MHz Transmitters)
Lowest frequency generated or used in the device or on which the device operates or tunes	32.768kHz RTC Crystal (Y1) and 12MHz MCU Clock (Y2)
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
	☒	☐	120VAC
External DC	Nominal Voltage		Maximum Current
	12VDC		2 Amps
Battery	Nominal Voltage		Battery Operating End Point Voltage
	3.7V		3.4 to 4.2V (Full Range)

EXTREME CONDITIONS			
Maximum temperature	+50	°C	Minimum temperature
			-20 °C

Ancillaries	
Please list all ancillaries which will be used with the device.	
1)	Wall Adapter (for both main power and Back-up Battery Charging Purposes)
2)	Ankle Bracelet (Basic single transmitter)

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

Name: **Stan DuPont**

Position held: **Electronics Engineer** Date: **6/09/20**



1.4.2 Modes of Operation

The EUT was tested for the IEEE 802.11b/g/n 2.4 GHz Wi-Fi. The EUT was evaluated in the transmit mode using a test software power setting of M3=72 corresponding to 18 dBm.

The evaluation was performed at the lowest data rate for each of the 2.4 GHz modes as representative of the worst case configuration.

1.4.3 Monitoring of Performance

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

The RF conducted emissions were performed on a unit configured with a U.FL. connector at the antenna port to allow direct coupling to a spectrum analyzer.

The power line conducted emissions evaluation was performed for all the co-located radios transmitting simultaneously.

The radiated emissions evaluation was performed for the EUT in the orientation of typical installation.

The EUT was also evaluated for radiated intermodulation products of all the co-located radios transmitting simultaneously. All intermodulation products were found to be in compliance to the requirements applicable to their respective radio sources.

1.4.4 Performance Criteria

The parameters evaluated are summarized 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)
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 deviation 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

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
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
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: 50414804

2.1.3 Date of Test

12/12/2019

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 an integral 3.6 dBi ceramic chip 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 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: 50473744

2.2.3 Date of Test

12/12/2019

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 $\gg$ RBW. A peak detector was used for the measurements.

2.2.5 Environmental Conditions

Ambient Temperature	24.7°C
Relative Humidity	41.5 %
Atmospheric Pressure	1020.5 mbar



2.2.6 Test Results

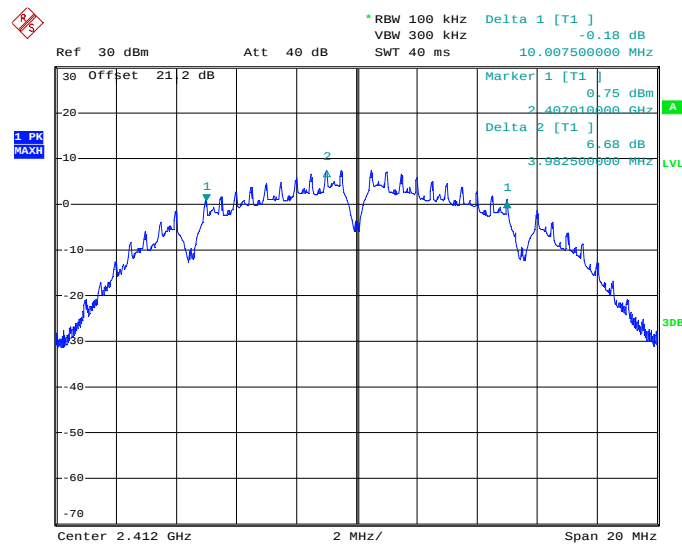
AC Powered Operating

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

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

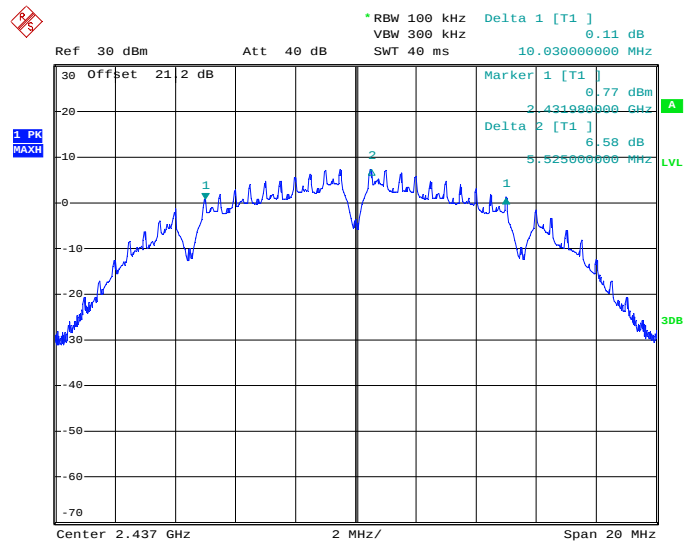
Table 2.2.6-1: 6 dB Bandwidth Test Results – 802.11b

Frequency (MHz)	6 dB Bandwidth (MHz)
2412	10.0075
2437	10.0300
2462	10.0025



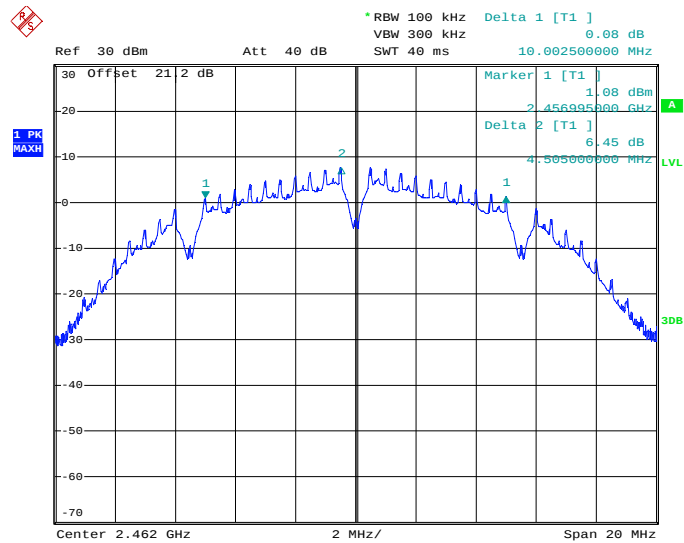
Date: 12.DEC.2019 17:55:54

Figure 2.2.6-1: 6 dB Bandwidth Test Results Low Channel – 802.11b



Date: 12.DEC.2019 18:06:09

Figure 2.2.6-2: 6 dB Bandwidth Test Results Middle Channel – 802.11b



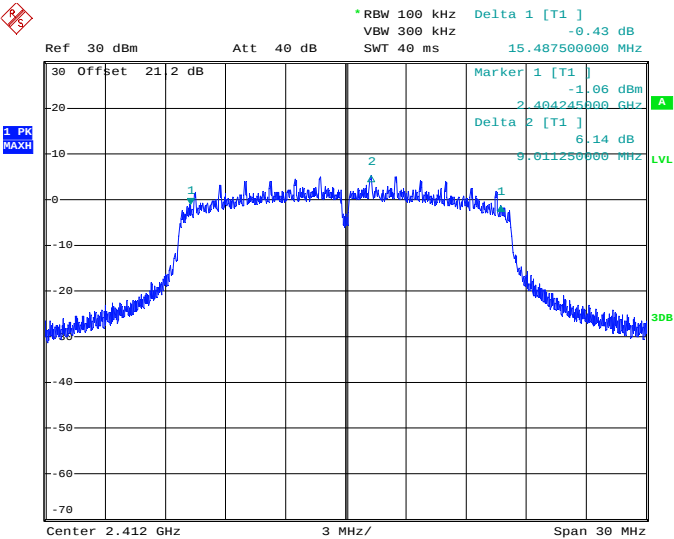
Date: 12.DEC.2019 18:16:33

Figure 2.2.6-3: 6 dB Bandwidth Test Results High Channel – 802.11b



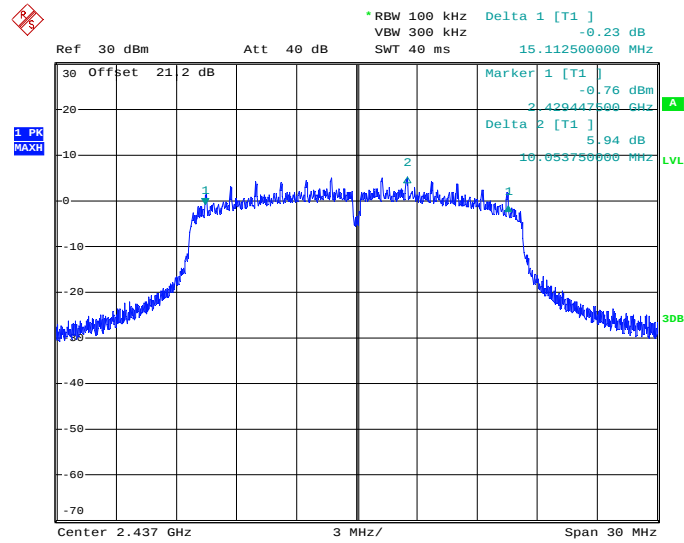
Table 2.2.6-2: 6 dB Bandwidth Test Results – 802.11g

Frequency (MHz)	6 dB Bandwidth (MHz)
2412	15.4875
2437	15.1125
2462	15.1200



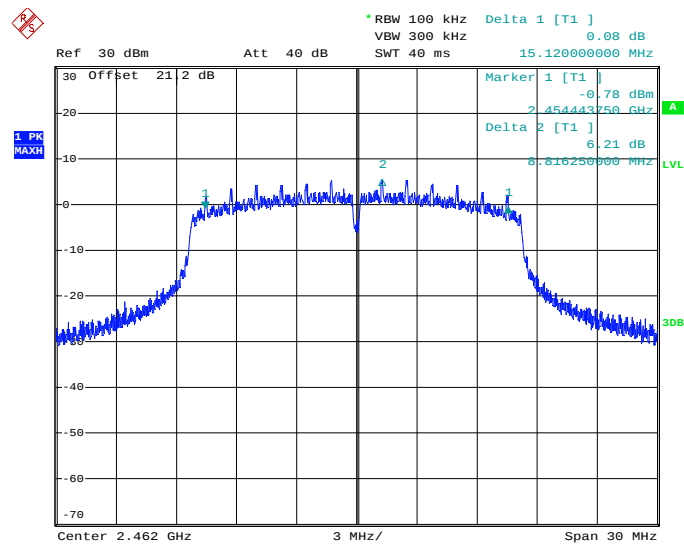
Date: 12.DEC.2019 16:17:49

Figure 2.2.6-4: 6 dB Bandwidth Test Results Low Channel – 802.11g



Date: 12.DEC.2019 16:58:52

Figure 2.2.6-5: 6 dB Bandwidth Test Results Middle Channel – 802.11g



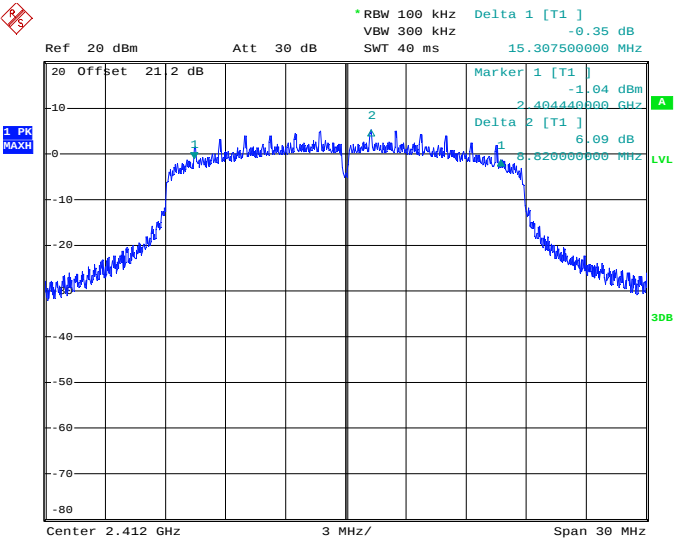
Date: 12.DEC.2019 17:46:49

Figure 2.2.6-6: 6 dB Bandwidth Test Results High Channel – 802.11g



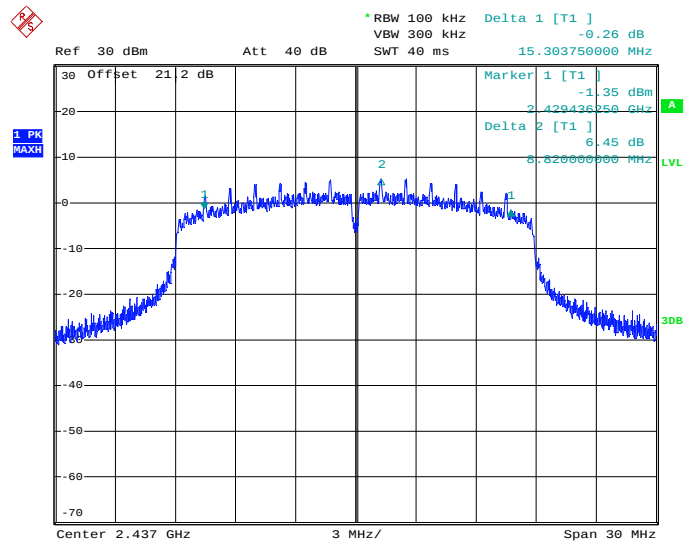
Table 2.2.6-3: 6 dB Bandwidth Test Results – 802.11n

Frequency (MHz)	6 dB Bandwidth (MHz)
2412	15.30750
2437	15.30375
2462	15.62250



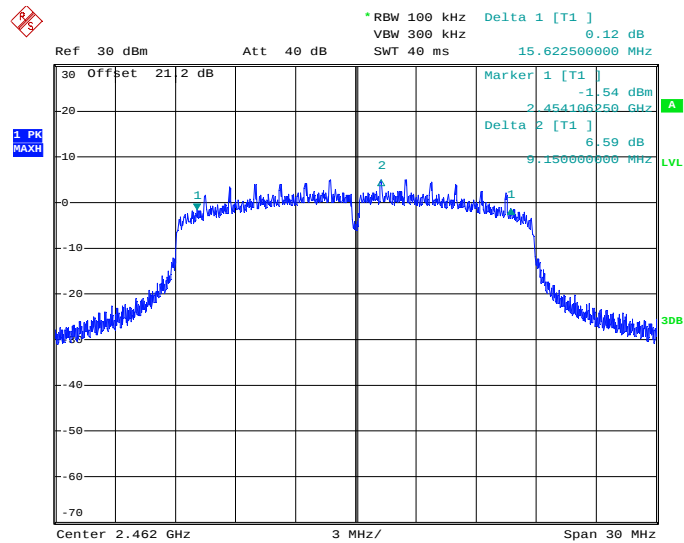
Date: 12.DEC.2019 13:44:22

Figure 2.2.6-7: 6 dB Bandwidth Test Results Low Channel – 802.11n



Date: 12.DEC.2019 11:31:59

Figure 2.2.6-8: 6 dB Bandwidth Test Results Middle Channel – 802.11n



Date: 12.DEC.2019 12:14:59

Figure 2.2.6-9: 6 dB Bandwidth Test Results High Channel – 802.11n



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 20dB, 2.9 mm-M/F, DC-40GHz 2 W	Aeroflex Inmet	40AH2W-20	BEMC02111	N/A	12	27-Jul-2020
Duratest High Frequency Cable Max. frequency 26.5GHz	Teledyne Storm Products	921-0101-036	BEMC02112	N/A	12	16-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 6.7

2.3.2 Equipment Under Test and Modification State

S/N: 50473744

2.3.3 Date of Test

12/13/2019

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	24.7°C
Relative Humidity	41.6 %
Atmospheric Pressure	1016.1 mbar



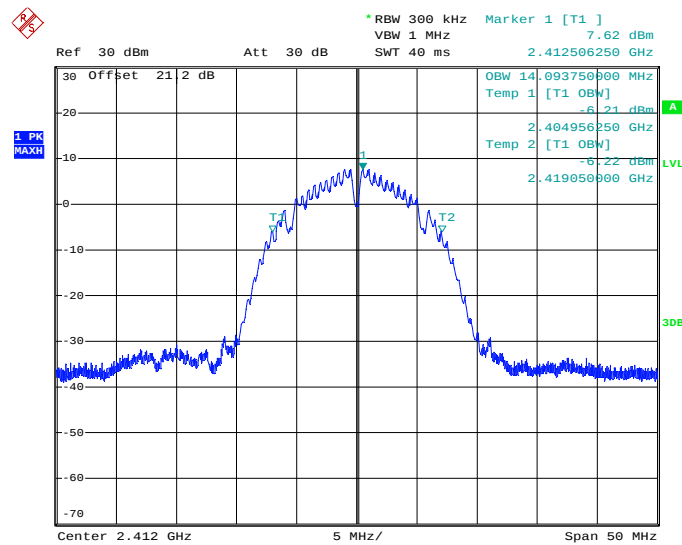
2.3.6 Test Results

AC Powered Operating

Limit Clause ISCED RSS-GEN 6.7

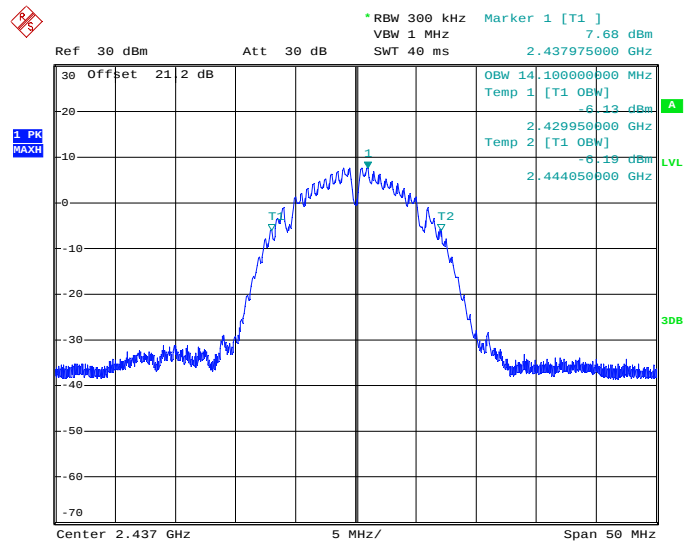
Table 2.3.6-1: 99% Bandwidth Test Results – 802.11b

Frequency (MHz)	99% Bandwidth (MHz)
2412	14.09375
2437	14.10000
2462	14.08750



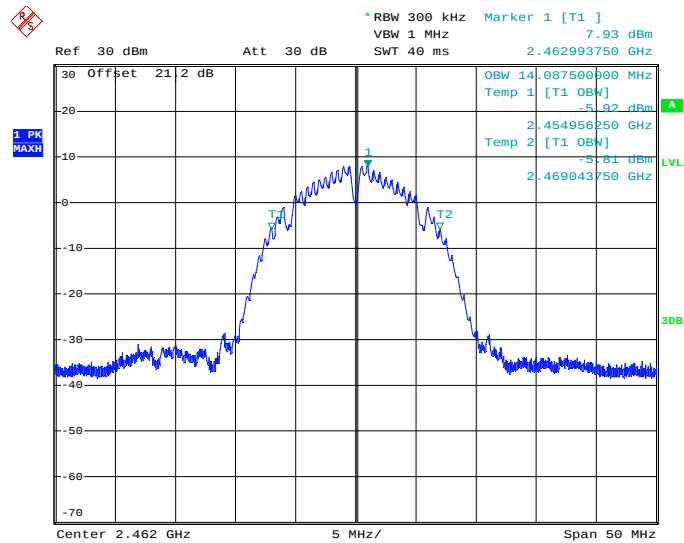
Date: 13.DEC.2019 09:20:16

Figure 2.3.6-1: 99% Bandwidth Test Results Low Channel – 802.11b



Date: 13.DEC.2019 09:23:45

Figure 2.3.6-2: 99% Bandwidth Test Results Middle Channel – 802.11b



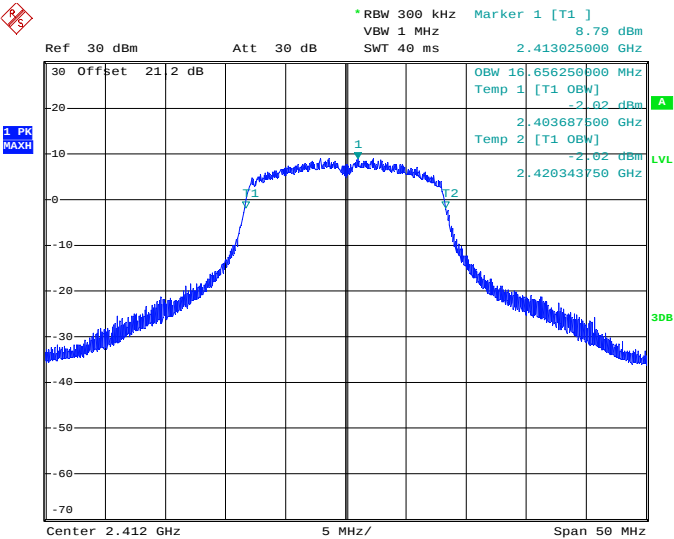
Date: 13.DEC.2019 09:48:38

Figure 2.3.6-3: 99% Bandwidth Test Results High Channel – 802.11b



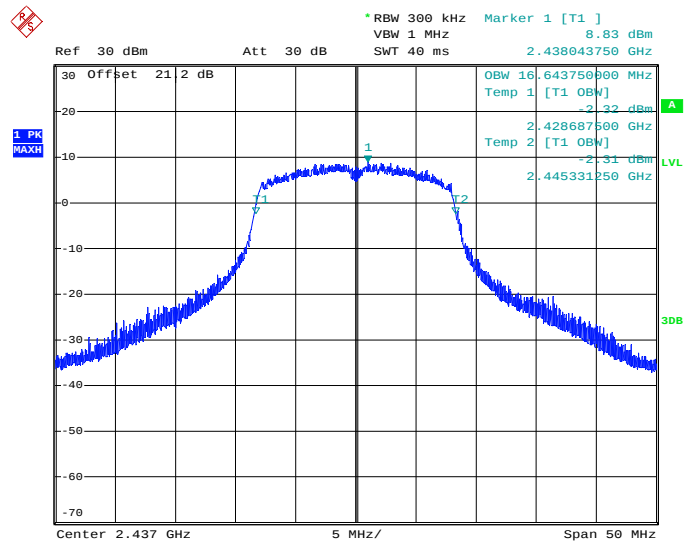
Table 2.3.6-2: 99% Bandwidth Test Results – 802.11g

Frequency (MHz)	99% Bandwidth (MHz)
2412	16.65625
2437	16.64375
2462	16.63750



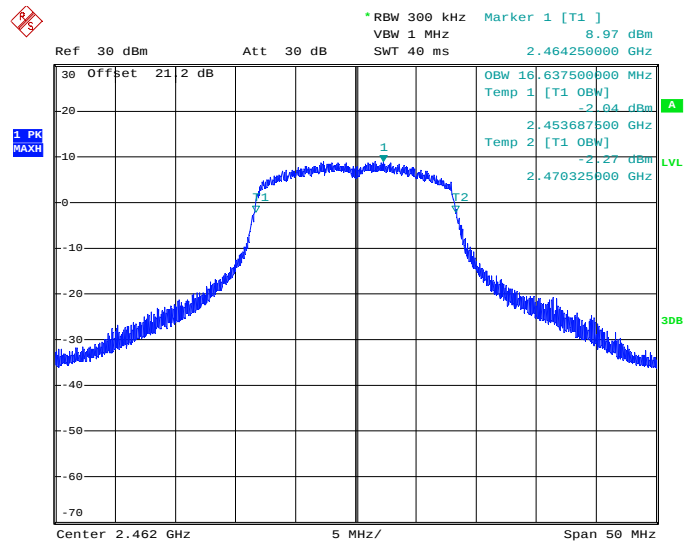
Date: 13.DEC.2019 09:56:04

Figure 2.3.6-4: 99% Bandwidth Test Results Low Channel – 802.11g



Date: 13.DEC.2019 09:59:45

Figure 2.3.6-5: 99% Bandwidth Test Results Middle Channel – 802.11g



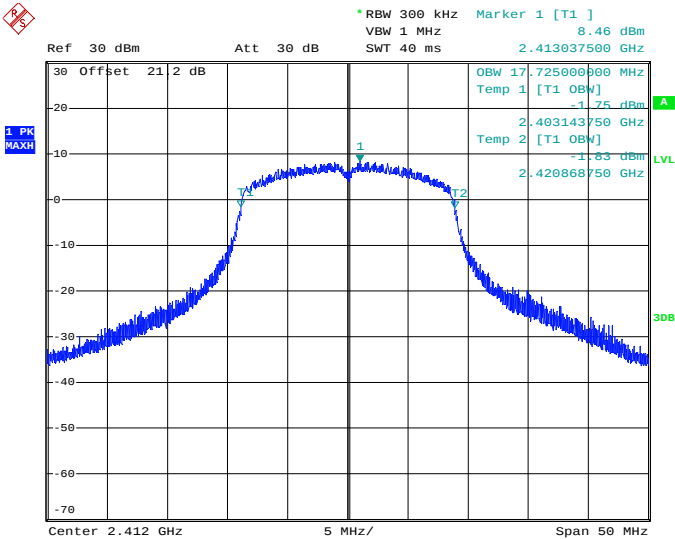
Date: 13.DEC.2019 10:03:42

Figure 2.3.6-6: 99% Bandwidth Test Results High Channel – 802.11g



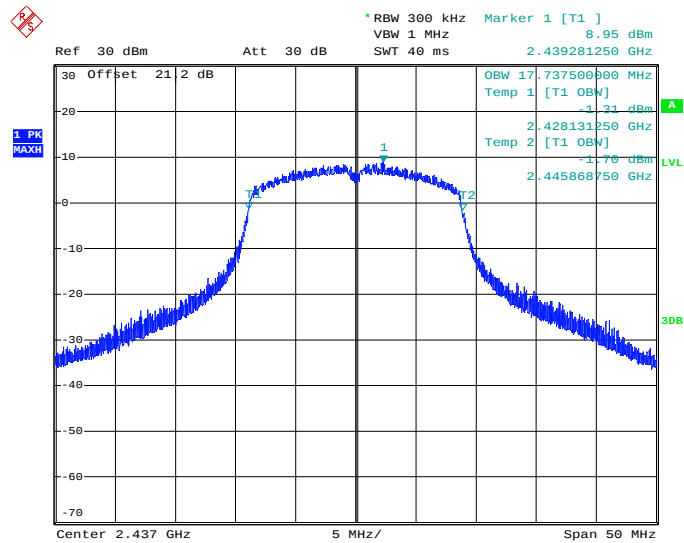
Table 2.3.6-3: 99% Bandwidth Test Results – 802.11n

Frequency (MHz)	99% Bandwidth (MHz)
2412	17.72500
2437	17.73750
2462	17.71875



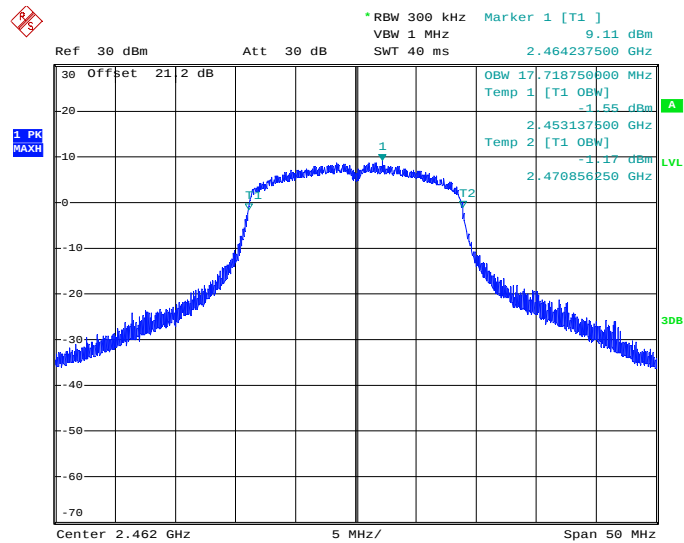
Date: 13.DEC.2019 10:07:59

Figure 2.3.6-7: 99% Bandwidth Test Results Low Channel – 802.11n



Date: 13.DEC.2019 10:11:10

Figure 2.3.6-8: 99% Bandwidth Test Results Middle Channel – 802.11n



Date: 13.DEC.2019 10:15:01

Figure 2.3.6-9: 99% Bandwidth Test Results High Channel – 802.11n



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 20dB, 2.9 mm-M/F, DC-40GHz 2 W	Aeroflex Inmet	40AH2W-20	BEMC02111	N/A	12	27-Jul-2020
Duratest High Frequency Cable Max. frequency 26.5GHz	Teledyne Storm Products	921-0101-036	BEMC02112	N/A	12	16-Oct-2020

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: 50473744

2.4.3 Date of Test

12/16/2019

2.4.4 Test Method

The fundamental emission output power was measured in accordance with ANSI C63.10 Subclause 11.9.1.3 PKPM1 Peak Power Meter Method. The RF output of the equipment under test was directly connected to the input of the power sensor through suitable attenuation.

2.4.5 Environmental Conditions

Ambient Temperature	21.4°C
Relative Humidity	44.5 %
Atmospheric Pressure	1021.1 mbar



2.4.6 Test Results

AC Powered Operating

Limit Clause FCC Part 15.247(b)(3), ISSED 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 – 802.11b

Frequency (MHz)	Output Power (dBm)
2412	17.83
2437	17.83
2462	17.92

Table 2.4.6-2: Maximum Output Power Results – 802.11g

Frequency (MHz)	Output Power (dBm)
2412	24.32
2437	24.36
2462	24.35

Table 2.4.6-3: Maximum Output Power Results – 802.11n

Frequency (MHz)	Output Power (dBm)
2412	24.11
2437	24.03
2462	24.24



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
Power Meter	Hewlett Packard	N1911A	267	N/A	24	26-Jul-2021
Power Sensor	Hewlett Packard	N1921A	268	N/A	24	26-Jul-2021
10dB Attenuator	Merrimac	FAN-6-10K	BEMC02093	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

S/N: 50473744

2.5.3 Date of Test

12/13/2019

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

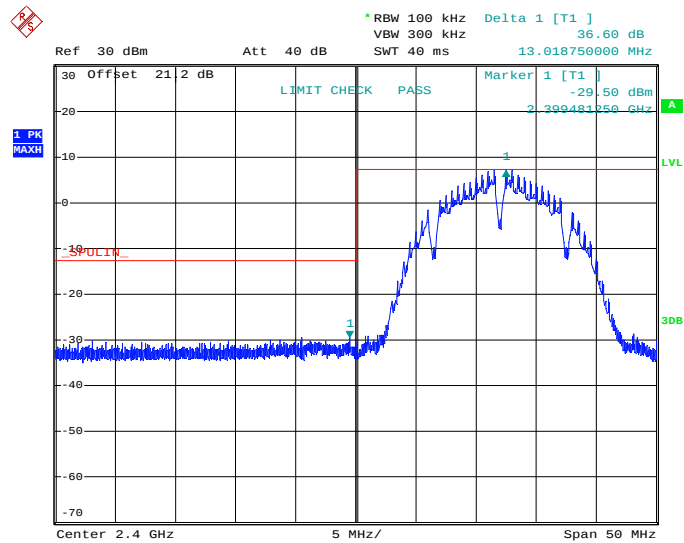
Ambient Temperature	24.5 °C
Relative Humidity	40.7 %
Atmospheric Pressure	1015.3 mbar

2.5.6 Test Results

AC Powered Operating

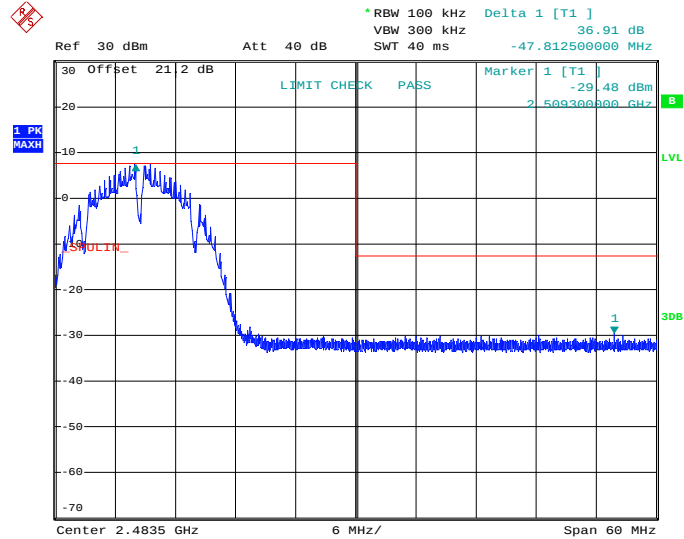
Limit Clause FCC Section 15.247(d), ISED Canada: RSS-247 5.5

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.



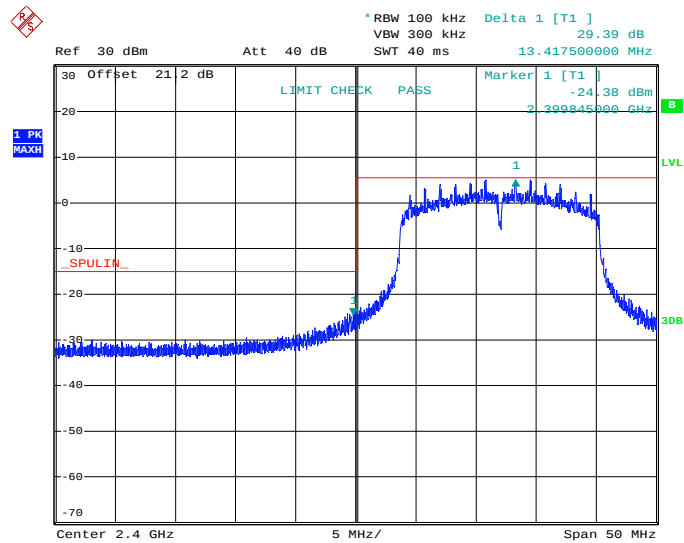
Date: 13.DEC.2019 12:11:19

Figure 2.5.6-1: RF Conducted Band-Edge Results Low Channel – 802.11b



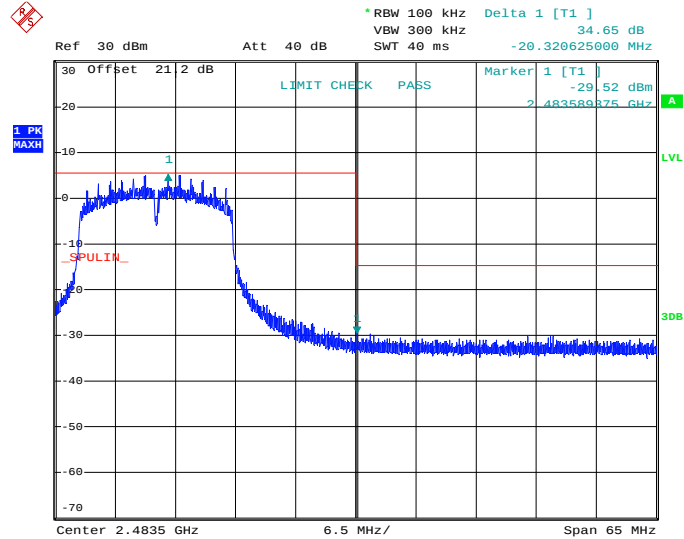
Date: 13.DEC.2019 14:54:10

Figure 2.5.6-2: RF Conducted Band-Edge Results High Channel – 802.11b



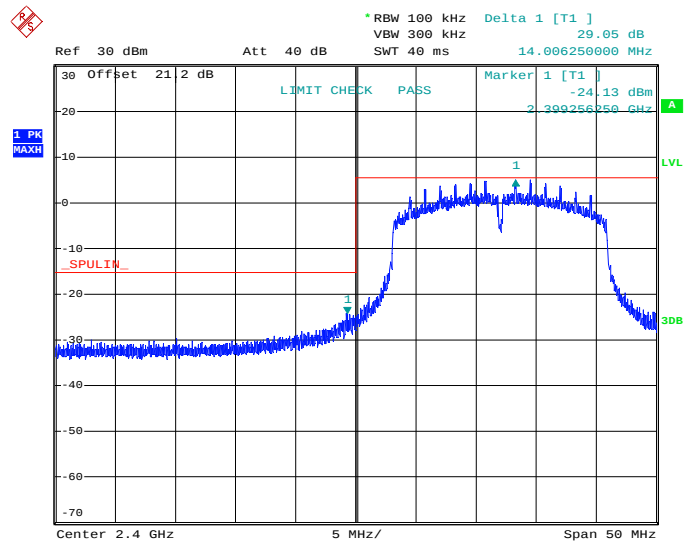
Date: 13.DEC.2019 11:53:45

Figure 2.5.6-3: RF Conducted Band-Edge Results Low Channel – 802.11g



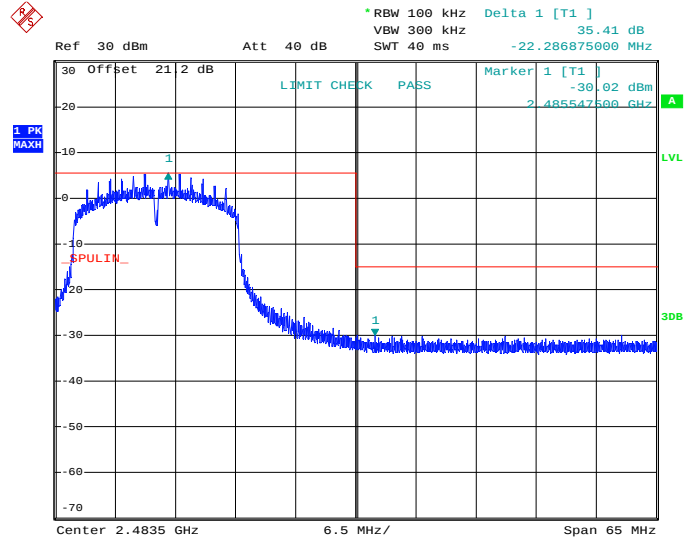
Date: 13.DEC.2019 11:17:37

Figure 2.5.6-4: RF Conducted Band-Edge Results High Channel – 802.11g



Date: 13.DEC.2019 10:57:44

Figure 2.5.6-5: RF Conducted Band-Edge Results Low Channel – 802.11n



Date: 13.DEC.2019 11:09:07

Figure 2.5.6-6: RF Conducted Band-Edge Results High Channel – 802.11n



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 20dB, 2.9 mm-M/F, DC-40GHz 2 W	Aeroflex Inmet	40AH2W-20	BEMC02111	N/A	12	27-Jul-2020
Duratest High Frequency Cable Max. frequency 26.5GHz	Teledyne Storm Products	921-0101-036	BEMC02112	N/A	12	16-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

S/N: 50473744

2.6.3 Date of Test

12/13/2019

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 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

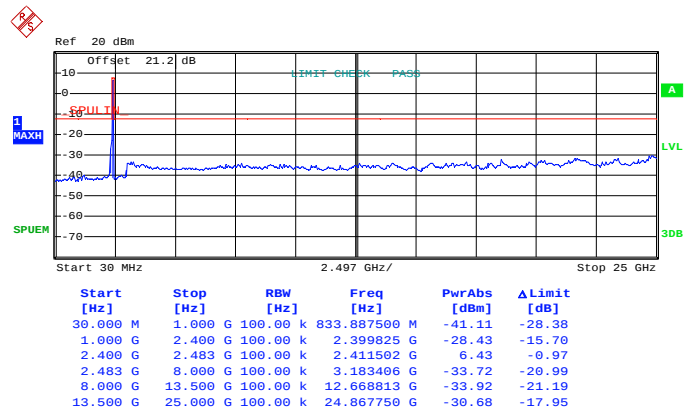
Ambient Temperature	24.7 °C
Relative Humidity	41.0 %
Atmospheric Pressure	1015.1 mbar

2.6.6 Test Results

AC Powered Operating

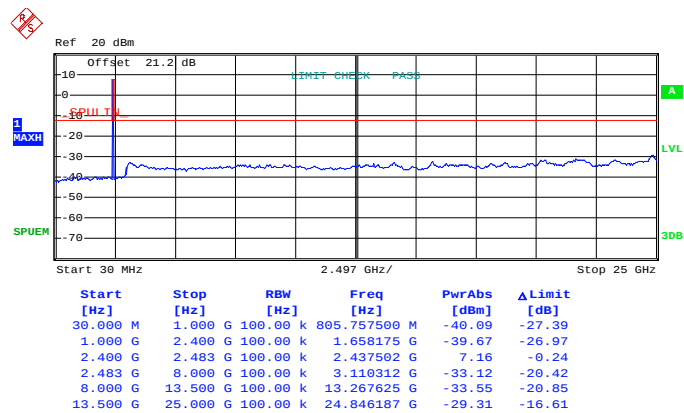
Limit Clause FCC Section 15.247(d), ISED Canada: RSS-247 5.5

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.



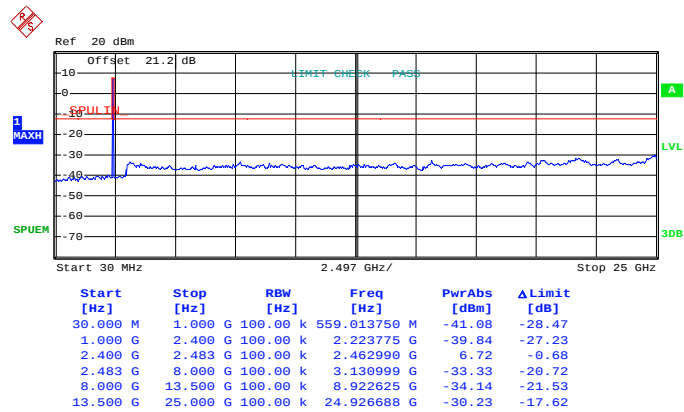
Date: 13.DEC.2019 12:06:19

Figure 2.6.6-1: RF Conducted Spurious Emissions Results Low Channel – 802.11b



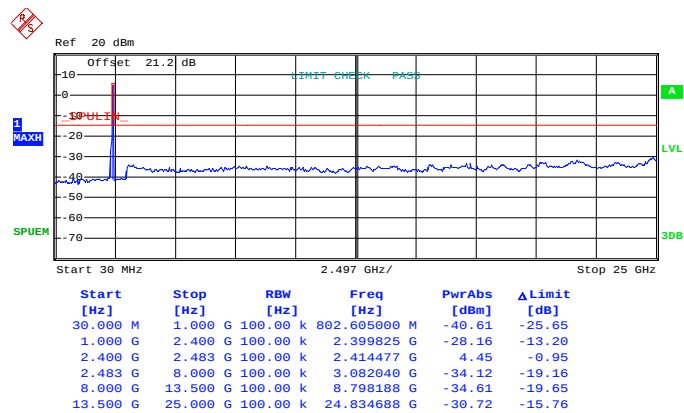
Date: 13.DEC.2019 14:07:35

Figure 2.6.6-2: RF Conducted Spurious Emissions Results Middle Channel – 802.11b



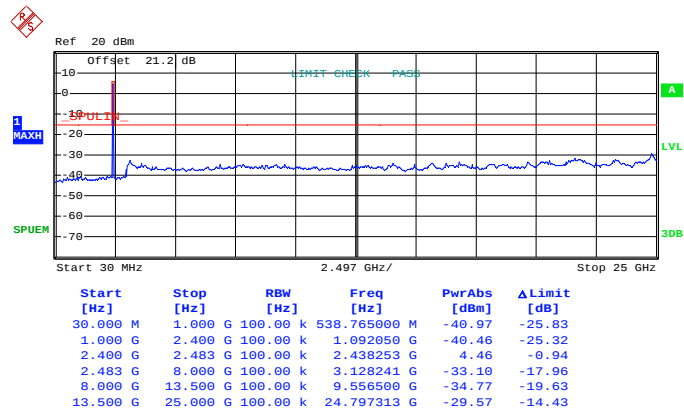
Date: 13.DEC.2019 14:40:46

Figure 2.6.6-3: RF Conducted Spurious Emissions Results High Channel – 802.11b



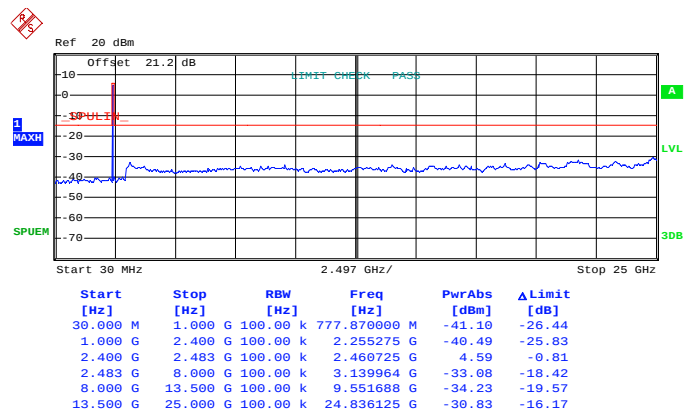
Date: 13.DEC.2019 11:43:21

Figure 2.6.6-4: RF Conducted Spurious Emissions Results Low Channel – 802.11g



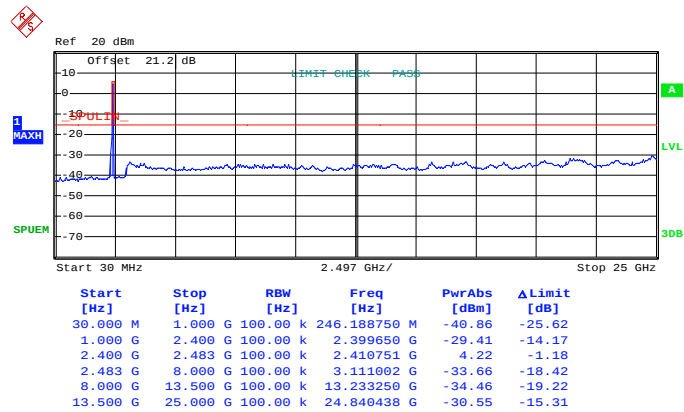
Date: 13.DEC.2019 11:34:35

Figure 2.6.6-5: RF Conducted Spurious Emissions Results Middle Channel – 802.11g



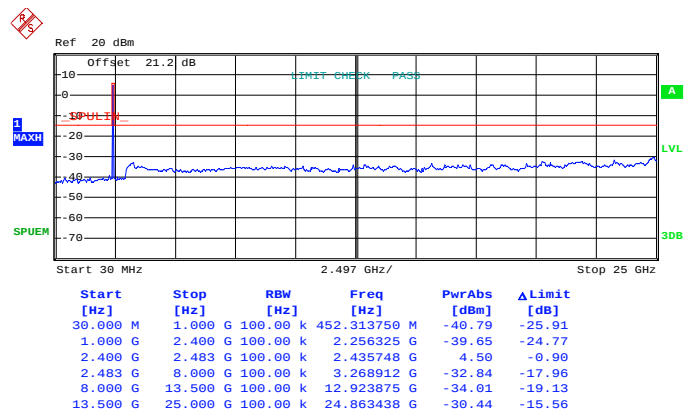
Date: 13.DEC.2019 11:27:26

Figure 2.6.6-6: RF Conducted Spurious Emissions Results High Channel – 802.11g



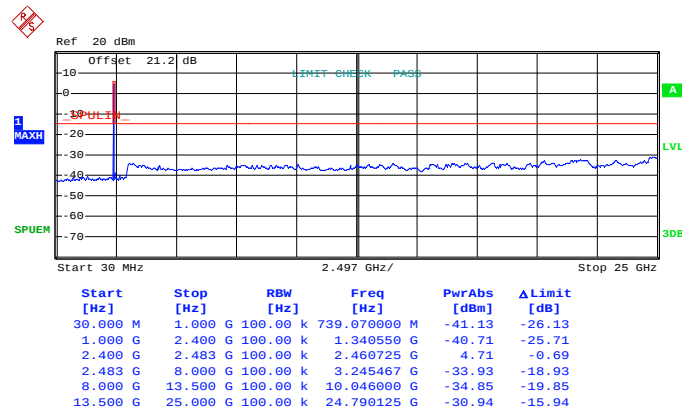
Date: 13.DEC.2019 10:50:32

Figure 2.6.6-7: RF Conducted Spurious Emissions Results Low Channel – 802.11n



Date: 13.DEC.2019 10:37:33

Figure 2.6.6-8: RF Conducted Spurious Emissions Results Middle Channel – 802.11n



Date: 13.DEC.2019 10:25:11

Figure 2.6.6-9: RF Conducted Spurious Emissions Results High Channel – 802.11n

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 20dB, 2.9 mm-M/F, DC-40GHz 2 W	Aeroflex Inmet	40AH2W-20	BEMC02111	N/A	12	27-Jul-2020
Duratest High Frequency Cable Max. frequency 26.5GHz	Teledyne Storm Products	921-0101-036	BEMC02112	N/A	12	16-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

S/N: 50414804

2.7.3 Date of Test

12/4/2019 to 1/8/2020

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 > 98% duty cycle during the evaluation. No duty cycle correction factor was used during the radiated emissions evaluation.

2.7.6 Environmental Conditions

Ambient Temperature	23.7 °C
Relative Humidity	39.2 %
Atmospheric Pressure	1019.9 mbar



2.7.7 Test Results

AC Powered Operating

Limit Clause FCC Sections 15.205, 15.209, ISCED 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 – 802.11b

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	56.85	48.42	H	-2.12	54.73	46.30	74.0	54.0	19.3	7.7
2390	57.96	49.05	V	-2.12	55.84	46.93	74.0	54.0	18.2	7.1
4824	38.48	26.81	H	4.14	42.62	30.95	74.0	54.0	31.4	23.0
4824	37.82	26.63	V	4.14	41.96	30.77	74.0	54.0	32.0	23.2
Middle Channel										
4874	37.50	26.16	H	4.25	41.75	30.41	74.0	54.0	32.3	23.6
4874	37.95	25.84	V	4.25	42.20	30.09	74.0	54.0	31.8	23.9
High Channel										
2483.5	54.06	44.22	H	-1.91	52.15	42.31	74.0	54.0	21.9	11.7
2483.5	55.55	45.52	V	-1.91	53.64	43.61	74.0	54.0	20.4	10.4
4924	36.79	25.69	H	4.35	41.14	30.04	74.0	54.0	32.9	24.0
4924	37.36	27.11	V	4.35	41.71	31.46	74.0	54.0	32.3	22.5

Note: All the emissions above 4.93 GHz were attenuated below the limits and the noise floor of the measurement equipment.



Table 2.7.7-2: Radiated Emissions Test Results – 802.11g

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	69.50	53.51	H	-2.12	67.38	51.39	74.0	54.0	6.6	2.6
2390	69.94	53.65	V	-2.12	67.82	51.53	74.0	54.0	6.2	2.5
Middle Channel										
Noise Floor										
High Channel										
2483.5	70.14	52.15	H	-1.91	68.23	50.24	74.0	54.0	5.8	3.8
2483.5	72.41	53.70	V	-1.91	70.50	51.79	74.0	54.0	3.5	2.2

Note: All the emissions above 2.485 GHz were attenuated below the limits and the noise floor of the measurement equipment.

Table 2.7.7-3: Radiated Emissions Test Results – 802.11n

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	70.58	54.23	H	-2.12	68.46	52.11	74.0	54.0	5.5	1.9
2390	71.74	54.82	V	-2.12	69.62	52.70	74.0	54.0	4.4	1.3
Middle Channel										
Noise Floor										
High Channel										
2483.5	74.06	53.27	H	-1.91	72.15	51.36	74.0	54.0	1.9	2.6
2483.5	75.12	54.77	V	-1.91	73.21	52.86	74.0	54.0	0.8	1.1

Note: All the emissions above 2.485 GHz were attenuated below the limits and the noise floor of the measurement equipment.

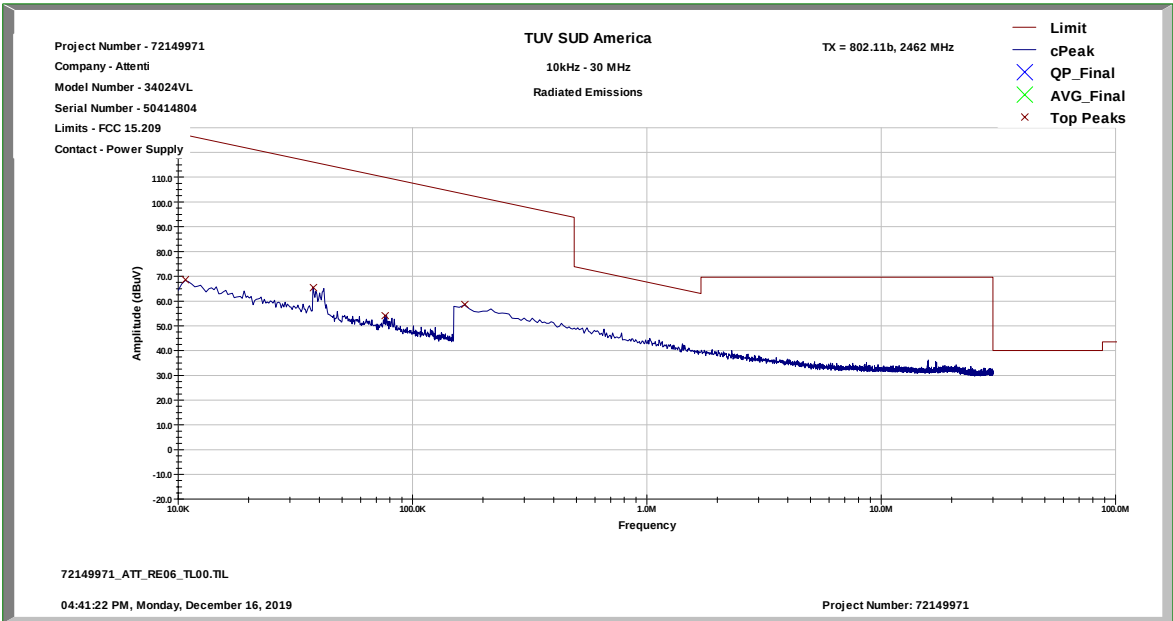


Figure 2.7.7-1: Radiated Emissions Representative Scan below 30 MHz

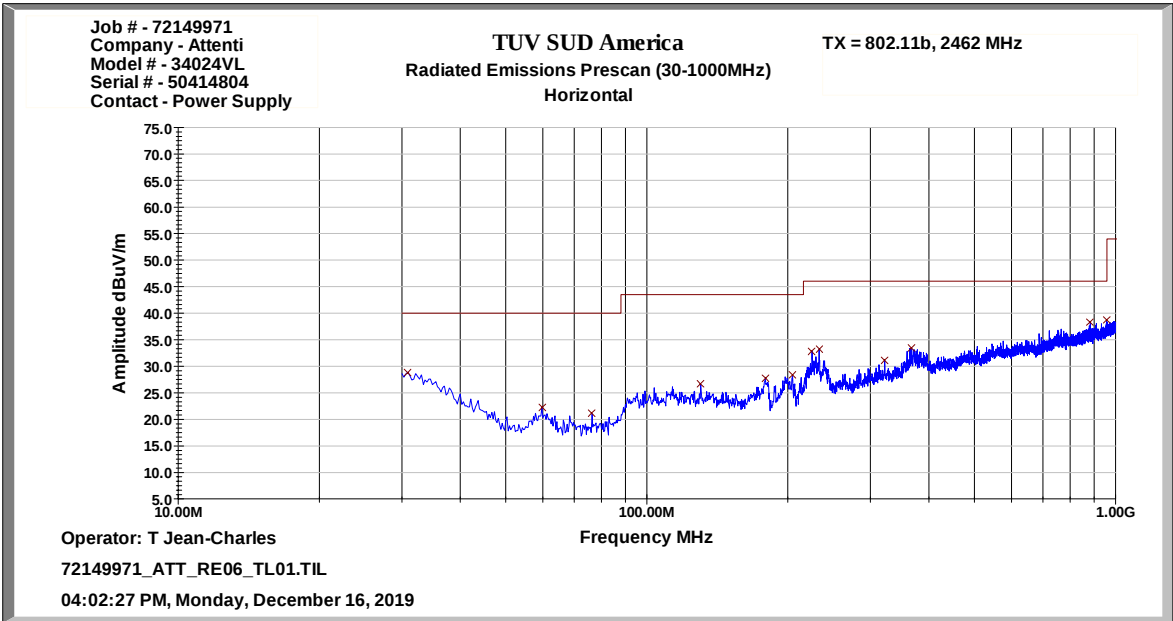


Figure 2.7.7-2: Radiated Emissions Representative Scan 30 MHz – 1 GHz – Horizontal Polarization

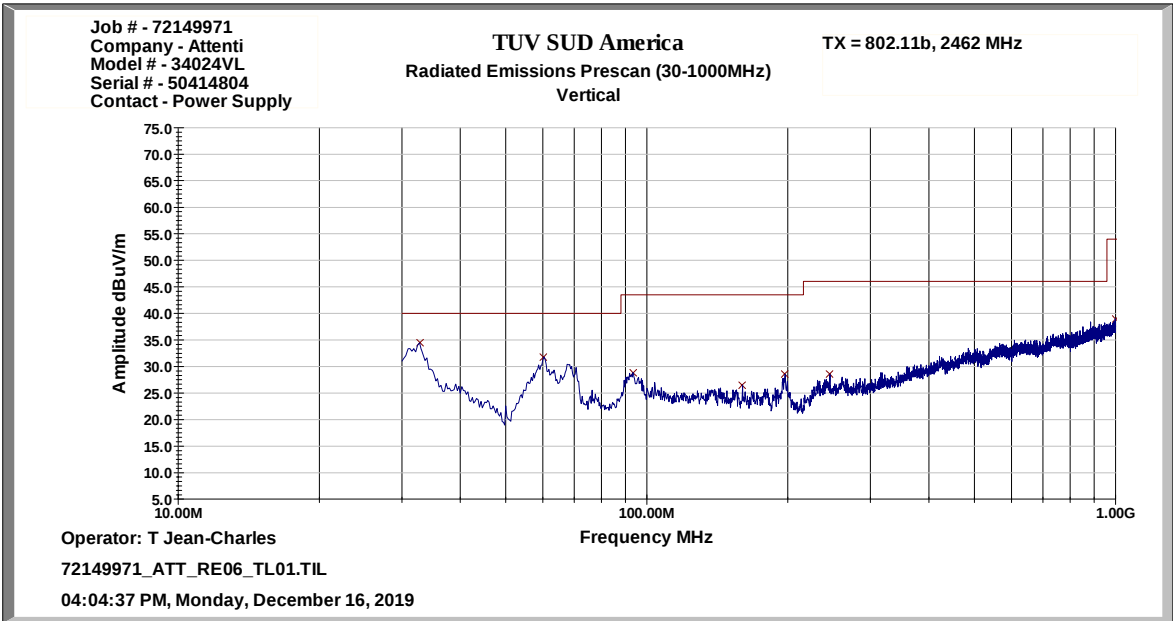


Figure 2.7.7-3: Radiated Emissions Representative Scan 30 MHz – 1 GHz – Vertical Polarization

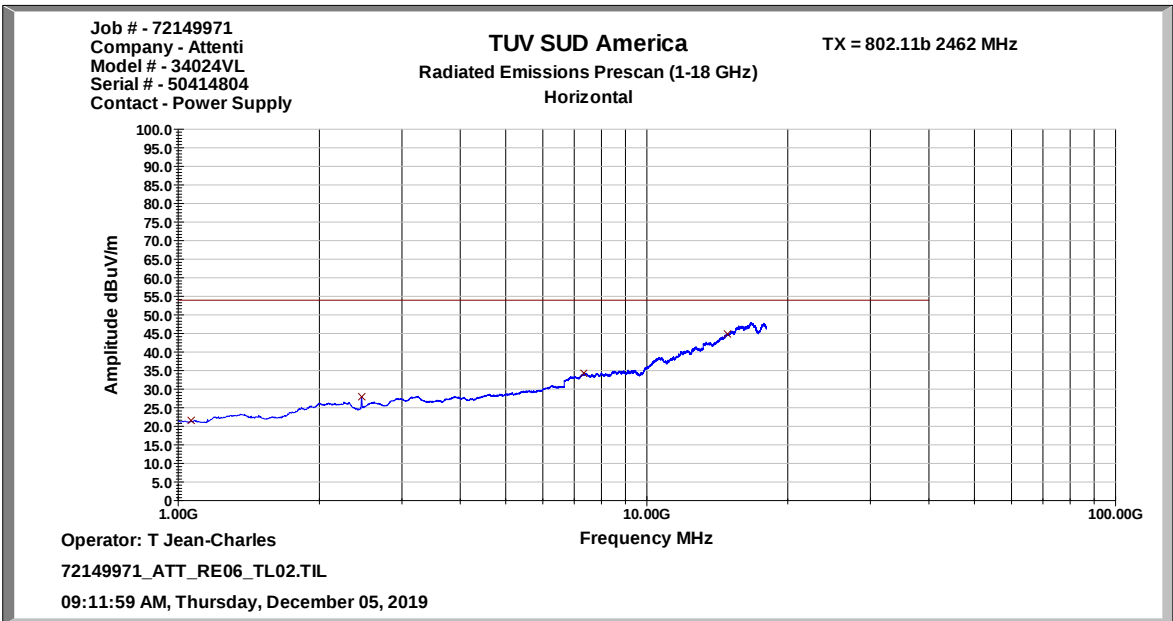


Figure 2.7.7-4: Radiated Emissions Representative Scan 1 GHz – 18 GHz – Horizontal Polarization

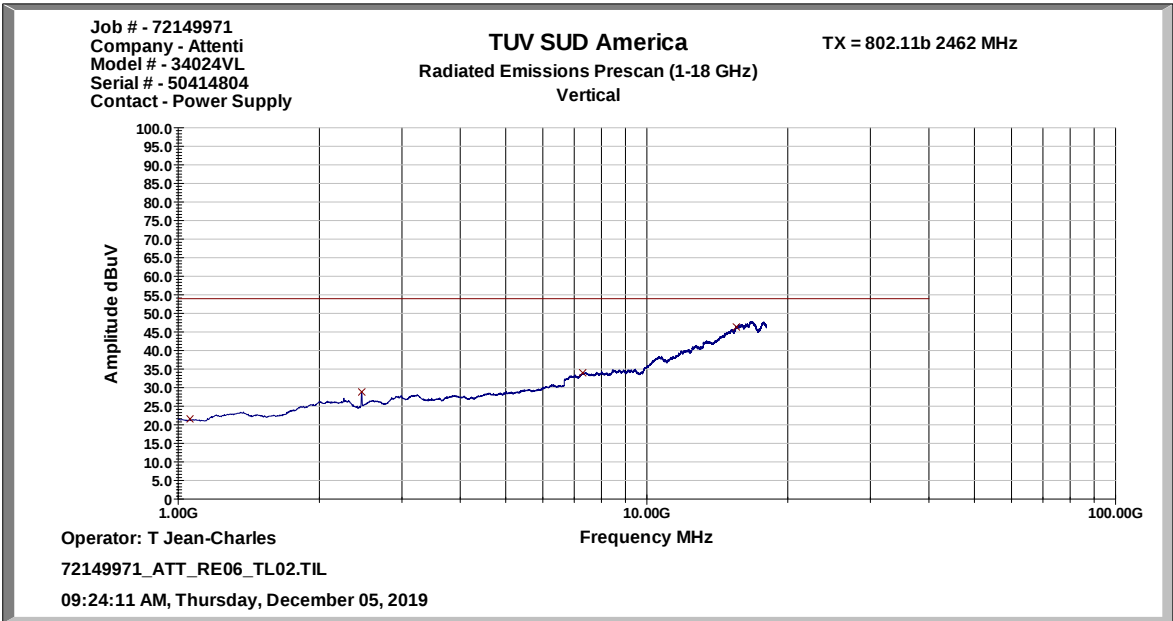


Figure 2.7.7-5: Radiated Emissions Representative Scan 1 GHz – 18 GHz – Vertical Polarization

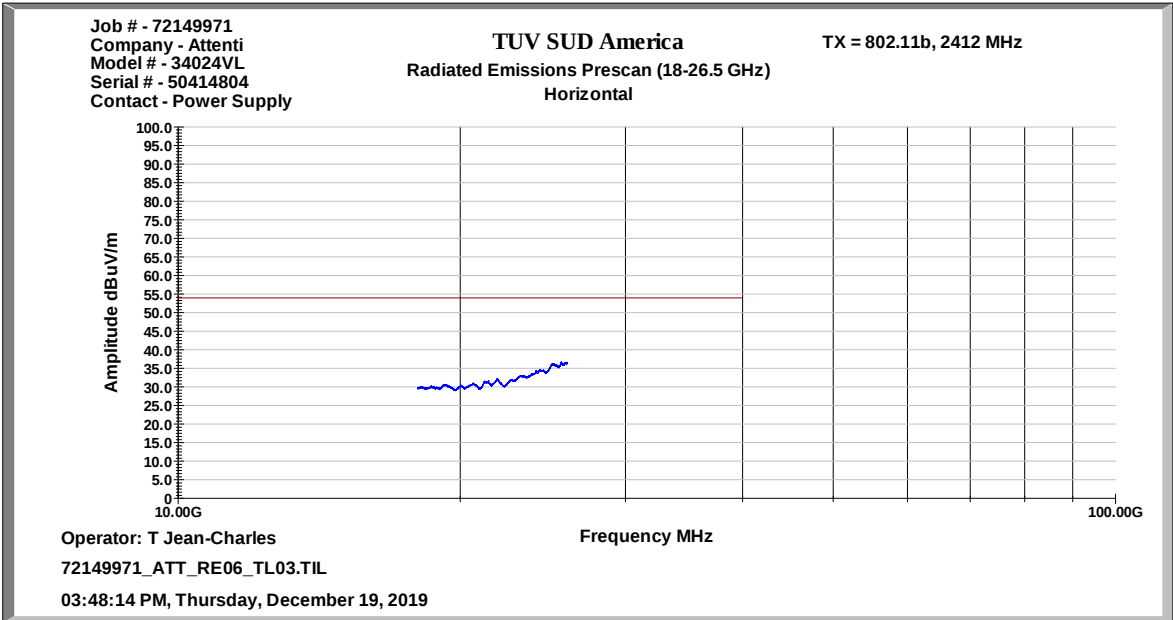


Figure 2.7.7-6: Radiated Emissions Representative Scan 18 GHz – 26 GHz – Horizontal Polarization

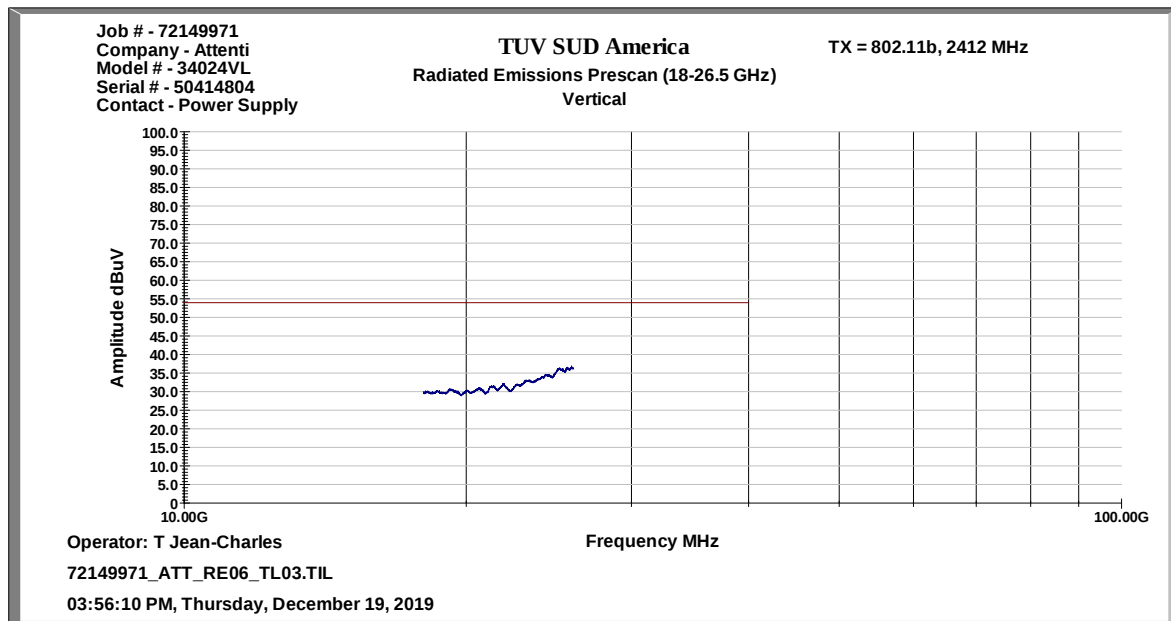


Figure 2.7.7-7: Radiated Emissions Representative Scan 18 GHz – 26 GHz – Vertical Polarization

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: $56.85 + (-2.12) = 54.73 \text{ dB}\mu\text{V/m}$

Margin: $74 \text{ dB}\mu\text{V/m} - 54.73 \text{ dB}\mu\text{V/m} = 19.27 \text{ dB}$

Example Calculation: Average

Corrected Level: $48.42 + (-2.12) - 0 = 46.30 \text{ dB}\mu\text{V/m}$

Margin: $54 \text{ dB}\mu\text{V/m} - 46.30 \text{ dB}\mu\text{V/m} = 7.70 \text{ dB}$



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	24	27-Nov-2020
10dB Attenuator	Merrimac	FAN-6-10K	BEMC02086	N/A	12	12-Oct-2020
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	Panashield	N/A	TEMC00031	N/A	36	28-Jan-2021
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	24	30-May-2020
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

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: 50473744

2.8.3 Date of Test

12/12/2019

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	24.7 °C
Relative Humidity	41.5 %
Atmospheric Pressure	1020.5 mbar



2.8.6 Test Results

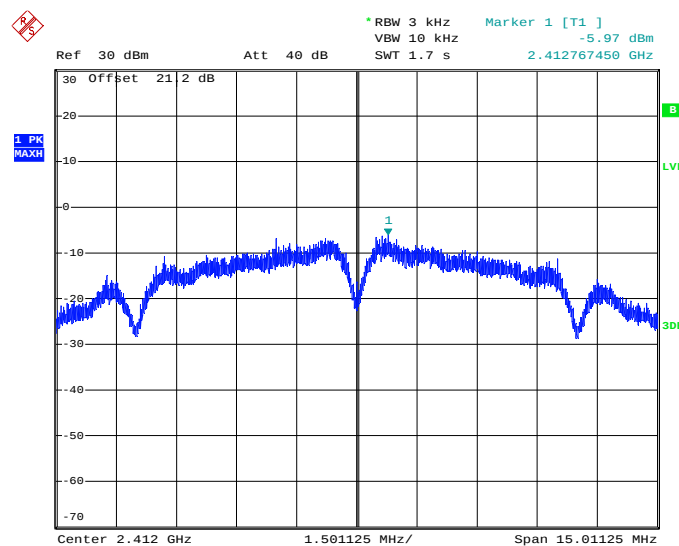
AC Powered Operating

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.

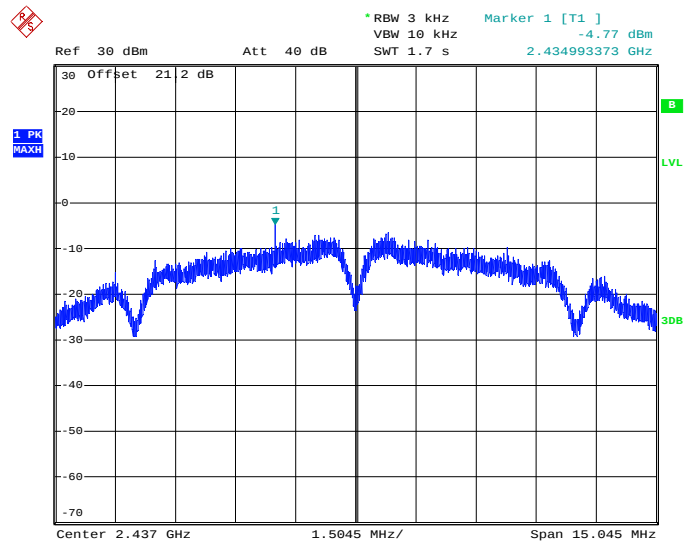
Table 2.8.6-1: Power Spectral Density Results – 802.11b

Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
2412	-5.97	8.0	13.97
2437	-4.77	8.0	12.77
2462	-6.37	8.0	14.37



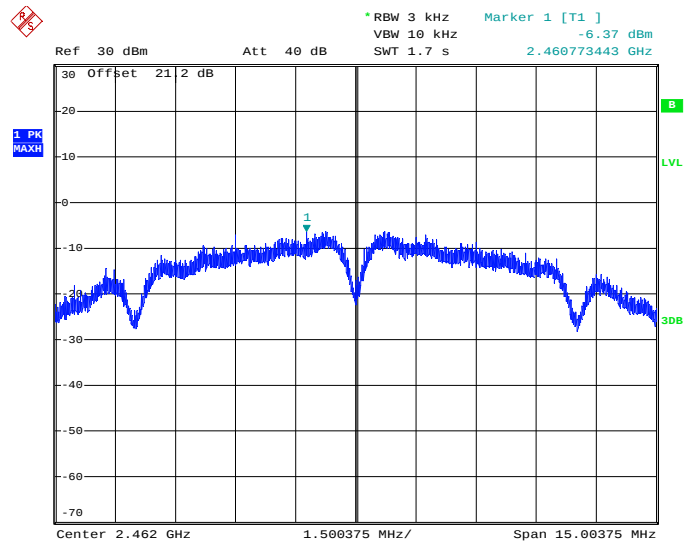
Date: 12.DEC.2019 18:00:58

Figure 2.8.6-1: Power Spectral Density Results – Low Channel – 802.11b



Date: 12.DEC.2019 18:09:34

Figure 2.8.6-2: Power Spectral Density Results – Middle Channel – 802.11b



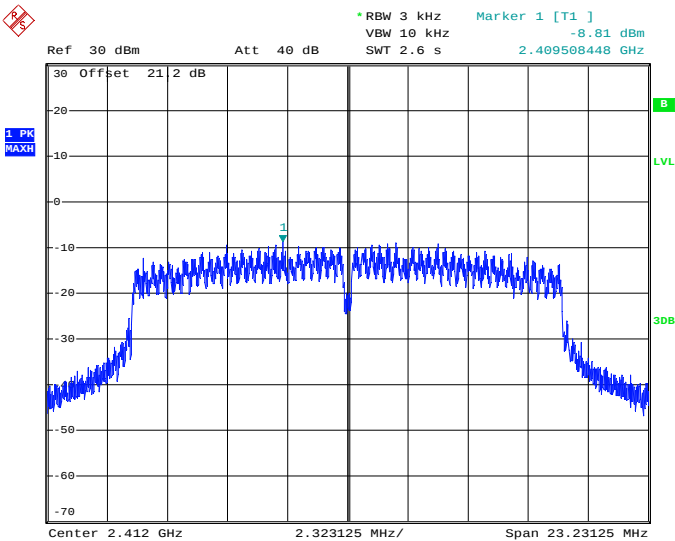
Date: 12.DEC.2019 18:22:38

Figure 2.8.6-3: Power Spectral Density Results – High Channel – 802.11b



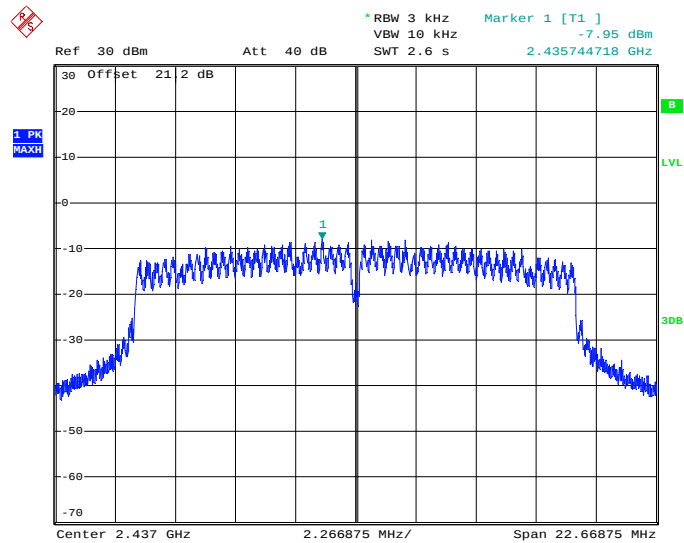
Table 2.8.6-2: Power Spectral Density Results – 802.11g

Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
2412	-8.81	8.0	16.81
2437	-7.95	8.0	15.95
2462	-8.92	8.0	16.92



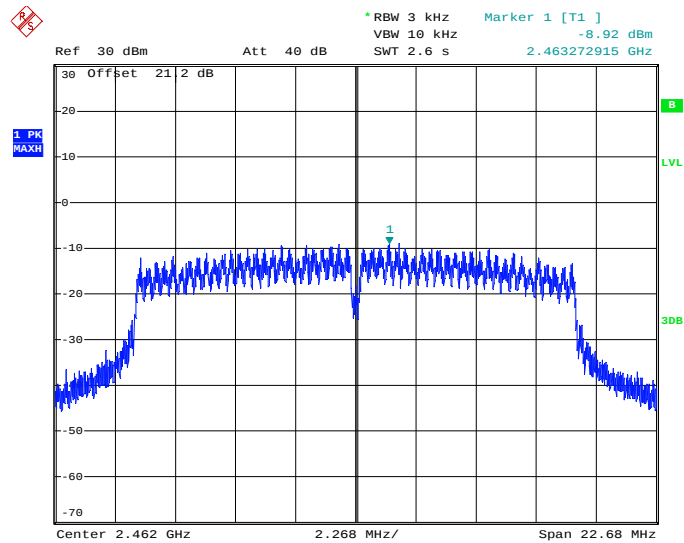
Date: 12.DEC.2019 16:19:58

Figure 2.8.6-4: Power Spectral Density Results – Low Channel – 802.11g



Date: 12.DEC.2019 17:40:59

Figure 2.8.6-5: Power Spectral Density Results – Middle Channel – 802.11g



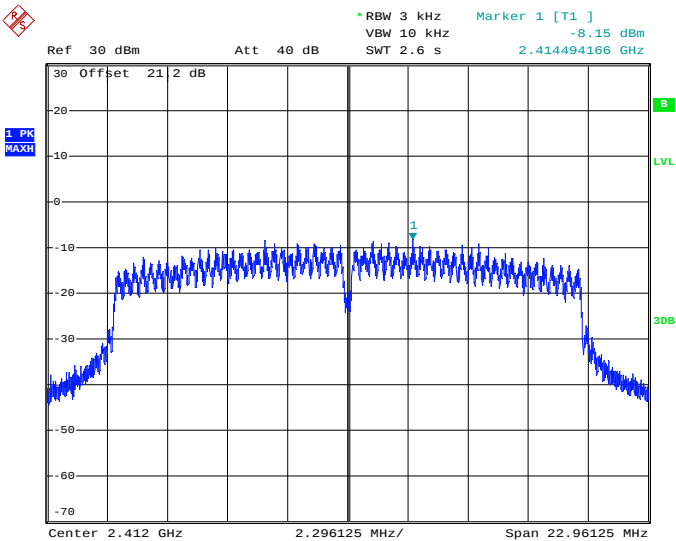
Date: 12.DEC.2019 17:49:24

Figure 2.8.6-6: Power Spectral Density Results – High Channel – 802.11g



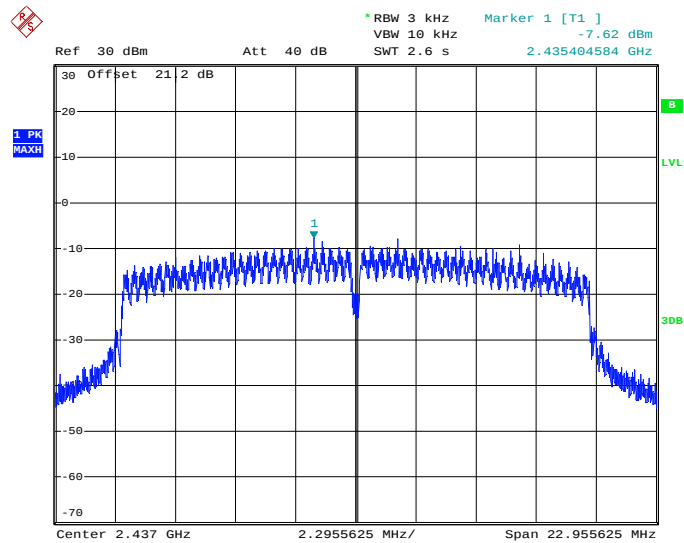
Table 2.8.6-3: Power Spectral Density Results – 802.11n

Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
2412	-8.15	8.0	16.15
2437	-7.62	8.0	15.62
2462	-8.50	8.0	16.50



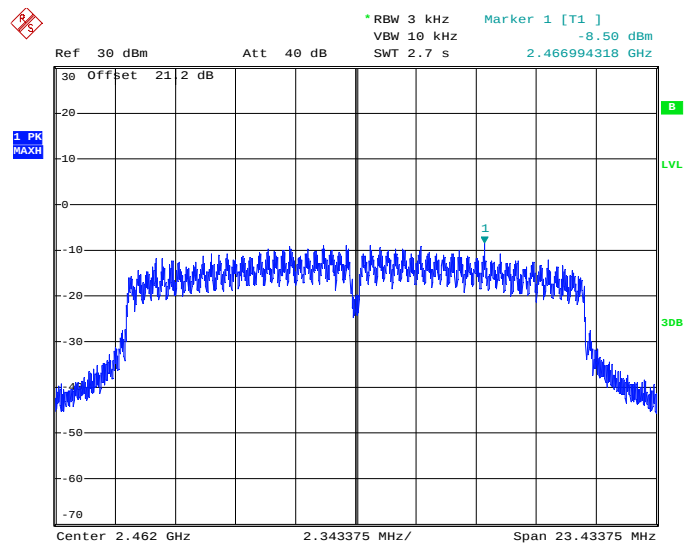
Date: 12.DEC.2019 13:50:54

Figure 2.8.6-7: Power Spectral Density Results – Low Channel – 802.11n



Date: 12.DEC.2019 11:37:25

Figure 2.8.6-8: Power Spectral Density Results – Middle Channel – 802.11n



Date: 12.DEC.2019 12:17:02

Figure 2.8.6-9: Power Spectral Density Results – High Channel – 802.11n



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 20dB, 2.9 mm-M/F, DC-40GHz 2 W	Aeroflex Inmet	40AH2W-20	BEMC02111	N/A	12	27-Jul-2020
Duratest High Frequency Cable Max. frequency 26.5GHz	Teledyne Storm Products	921-0101-036	BEMC02112	N/A	12	16-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

S/N: 50414804

2.9.3 Date of Test

12/20/2019

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 Environmental Conditions

Ambient Temperature 25.9 °C
Relative Humidity 39.9 %
Atmospheric Pressure 1023.1 mbar

2.9.6 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 2.9.6-1: Power Line Conducted Emissions – Quasi-Peak Detector Results**

Frequency (MHz)	Quasi-peak (dBμV)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.159	33.96	L1	9.9	31.55	65.52
0.447	40.26	N	10.3	16.67	56.93
0.4515	41.06	N	10.3	15.79	56.85
1.212	40.14	L1	10.2	15.86	56
1.5765	40.66	L1	10.2	15.34	56
3.4845	41.56	L1	10.3	14.44	56
4.0335	38.36	L1	10.3	17.64	56
8.2365	42.56	L1	10.7	17.44	60
10.5675	40.99	L1	10.8	19.01	60
21.7905	34.62	L1	11.6	25.38	60

Table 2.9.6-2: Power Line Conducted Emissions – Average Detector Results

Frequency (MHz)	Average (dBμV)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.231	29.06	L1	9.9	23.35	52.41
0.375	28.98	L1	10	19.41	48.39
0.546	29.44	L1	10	16.56	46
1.266	29.82	L1	10.2	16.18	46
1.725	30.95	L1	10.2	15.05	46
3.318	33.11	L1	10.3	12.89	46
5.019	30.81	L1	10.4	19.19	50
8.34	34.22	L1	10.7	15.78	50
10.5225	32.85	L1	10.8	17.15	50
21.7635	27.49	L1	11.6	22.51	50

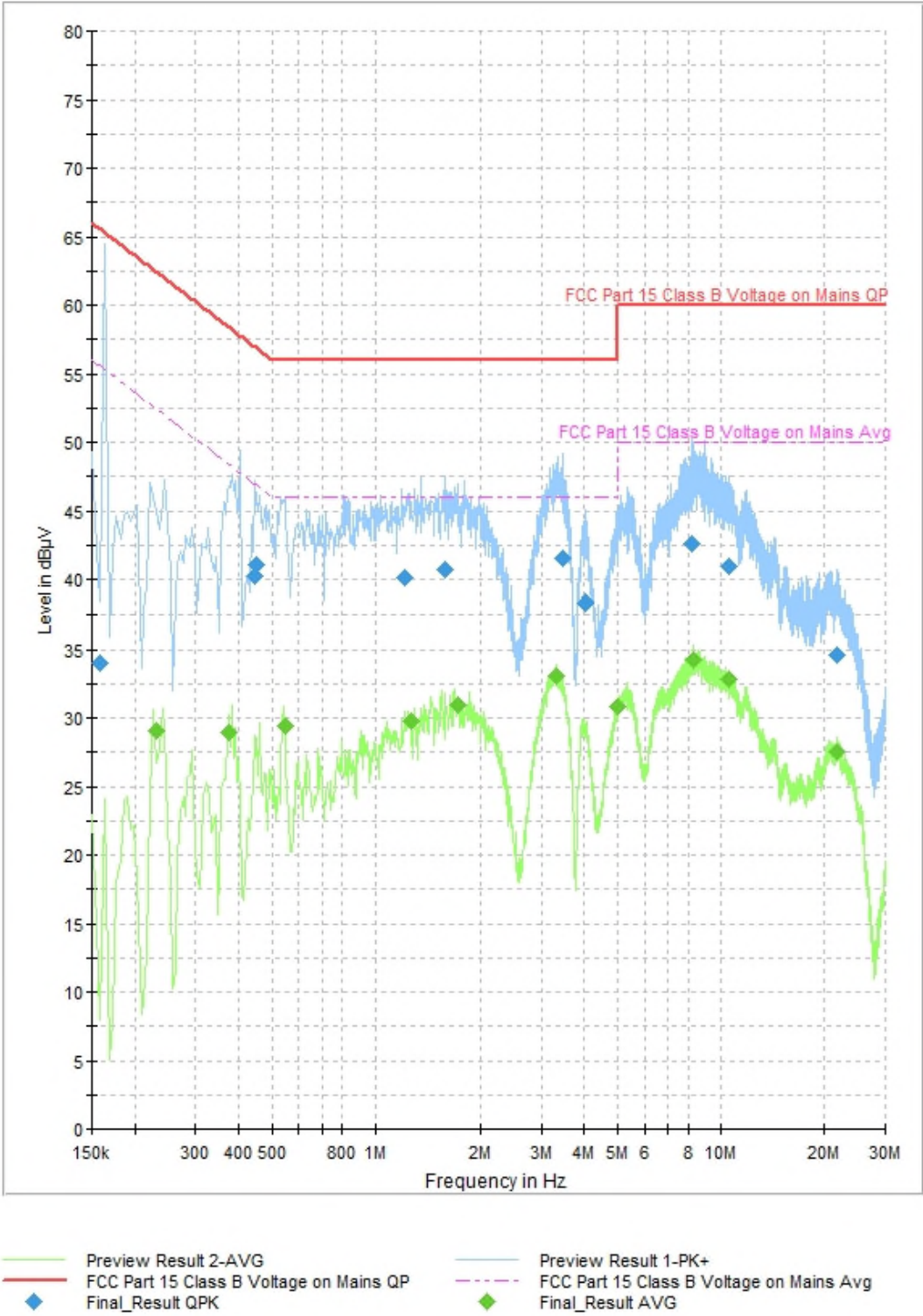


Figure 2.9.6-1: Composite Power Line Conducted Emissions Plots



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
LISN	Rohde & Schwarz	ESH3-Z5	TEMC00002	N/A	24	30-Sep-2021
EMI Test Receiver	Rohde & Schwarz	ESCS30	TEMC00011	2.3002.01 02.36	24	03-Oct-2021
Test Software	Rohde & Schwarz	EMC32	TEMC00184	10.50.00	N/A	NCR
RFI/EMI Shielded Enclosure	UNIVERSAL SHIELDING CORP.	N/A	TEMC00100	N/A	N/A	NCR

TU - Traceability Unscheduled

O/P MON - Traceability Unscheduled

N/A - Not Applicable

NCR – No Calibration Required



2.10 Duty Cycle

2.10.1 Specification Reference

N/A

2.10.2 Equipment Under Test and Modification State

S/N: 50473744

2.10.3 Date of Test

12/12/2019

2.10.4 Test Method

The Duty Cycle was measured in accordance with ANSI C63.10 Subclause 11.6 Duty cycle (D), transmission duration (T), and maximum power control level. The unit was connected directly to the input of the spectrum analyzer via suitable attenuation. The RBW and VBW were set to 10 MHz and the number of sweep points across duration T was set to exceed 100.

2.10.5 Environmental Conditions

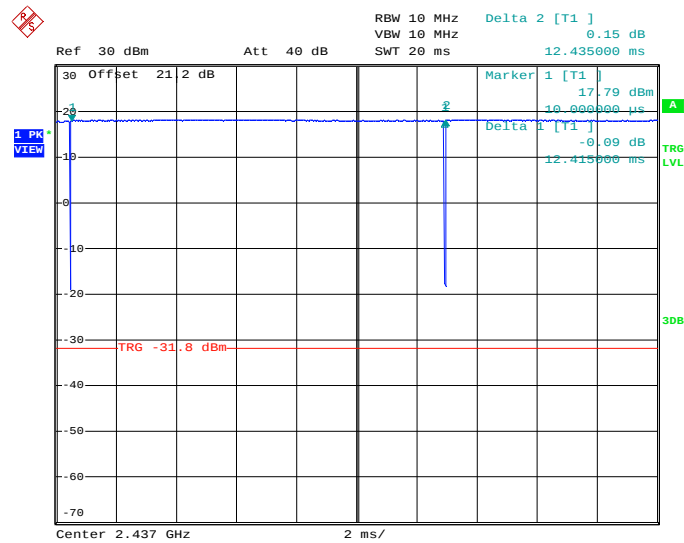
Ambient Temperature 24.6 °C
Relative Humidity 42.2 %
Atmospheric Pressure 1023.2 mbar

2.10.6 Test Results

AC Powered Operating

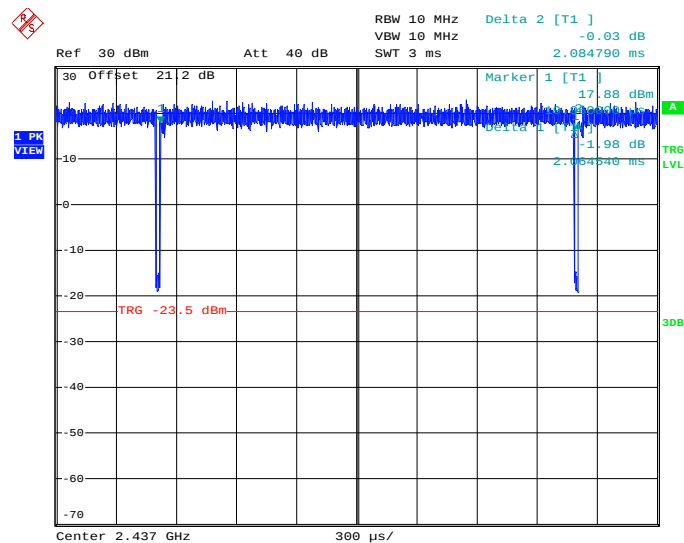
Table 2.10.6-1: Duty Cycle Test Results

Mode	Time on (ms)	Period (ms)	Duty Cycle (%)
802.11b	12.41500	12.43500	99.84
802.11g	2.06454	2.08479	99.03
802.11n	1.92064	1.94379	98.81



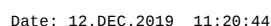
Date: 12.DEC.2019 11:03:22

Figure 2.10.6-1: Duty Cycle Test Results – 802.11b



Date: 12.DEC.2019 11:10:52

Figure 2.10.6-2: Duty Cycle Test Results – 802.11b



2.10.7 Test Location and 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 20dB, 2.9 mm-M/F, DC-40GHz 2 W	Aeroflex Inmet	40AH2W-20	BEMC02111	N/A	12	27-Jul-2020
Duratest High Frequency Cable Max. frequency 26.5GHz	Teledyne Storm Products	921-0101-036	BEMC02112	N/A	12	16-Oct-2020

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



3 Test Equipment Information

3.1 General Test Equipment Used

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
LISN	Rohde & Schwarz	ESH3-Z5	TEMC00002	N/A	24	30-Sep-2021
EMI Test Receiver	Rohde & Schwarz	ESCS30	TEMC00011	2.3002.01 02.36	24	03-Oct-2021
Test Software	Rohde & Schwarz	EMC32	TEMC00184	10.50.00	N/A	NCR
RFI/EMI Shielded Enclosure	UNIVERSAL SHIELDING CORP.	N/A	TEMC00100	N/A	N/A	NCR
Power Meter	Hewlett Packard	N1911A	267	N/A	24	26-Jul-2021
Power Sensor	Hewlett Packard	N1921A	268	N/A	24	26-Jul-2021
Spectrum Analyzer	Rohde & Schwarz	FSP40	BEMC00283	4.50 SP5	24	04-Oct-2021
10dB Attenuator	Merrimac	FAN-6-10K	BEMC02093	N/A	12	12-Oct-2020
Attenuator 20dB, 2.9 mm-M/F, DC-40GHz 2 W	Aeroflex Inmet	40AH2W-20	BEMC02111	N/A	12	27-Jul-2020
Duratest High Frequency Cable Max. frequency 26.5GHz	Teledyne Storm Products	921-0101-036	BEMC02112	N/A	12	16-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	12-Oct-2020
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	Panashield	N/A	TEMC00031	N/A	36	28-Jan-2021
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	24	30-May-2020
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
NCR – No Calibration Required



4 **Diagram of Test Set-ups**

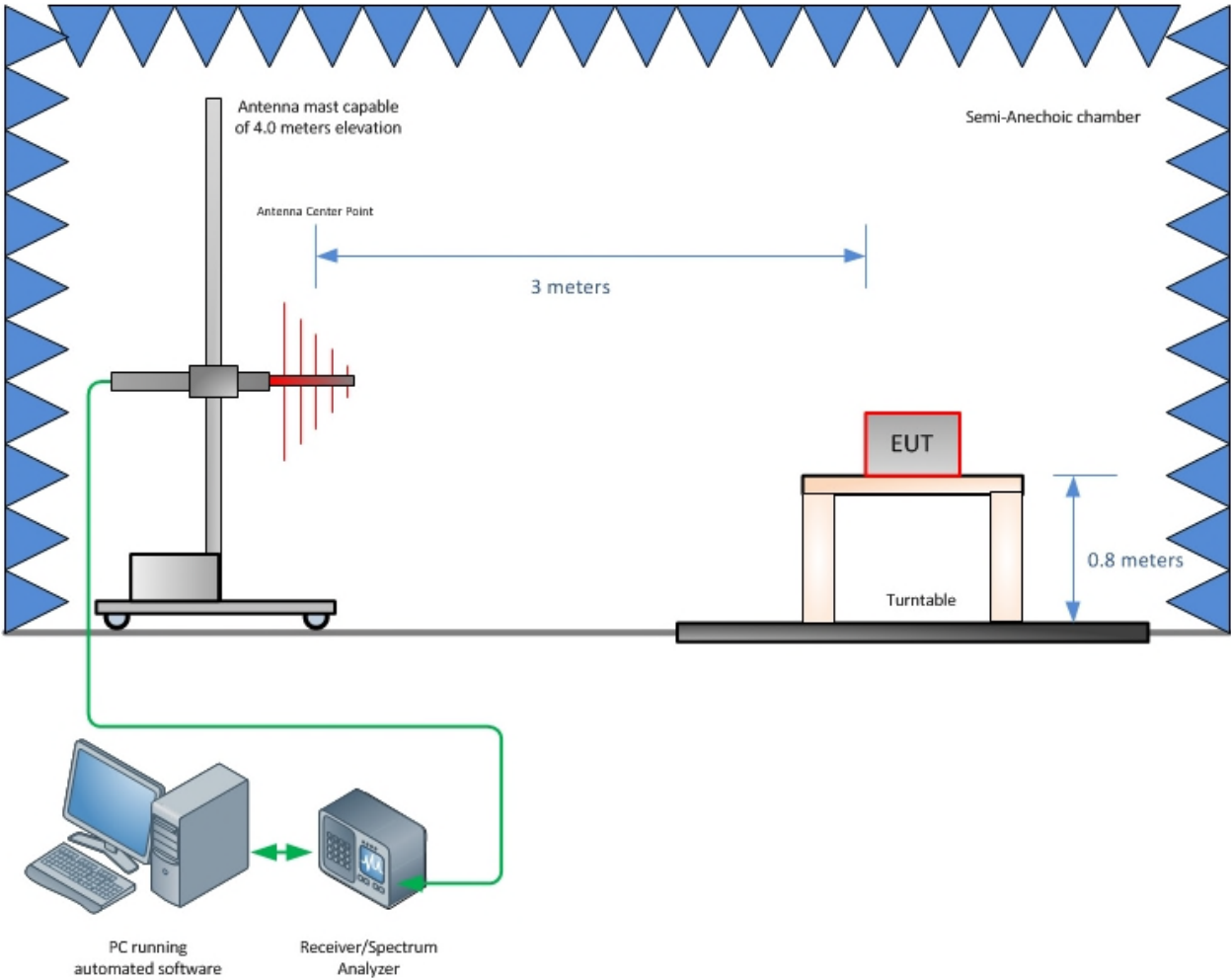


Figure 4-1 - Radiated Emissions Test Setup up to 1 GHz

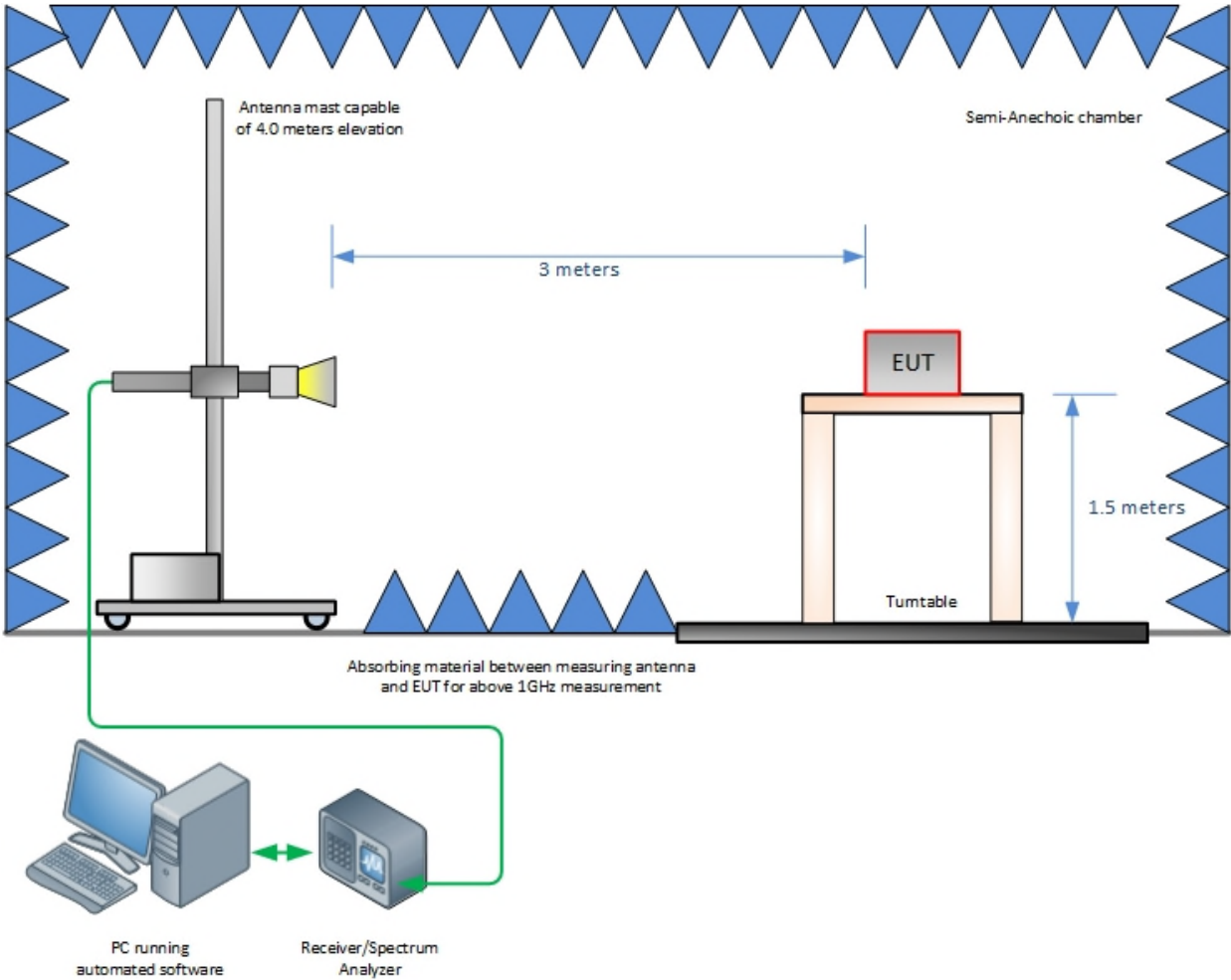


Figure 4-2 - Radiated Emissions Test Setup above 1 GHz

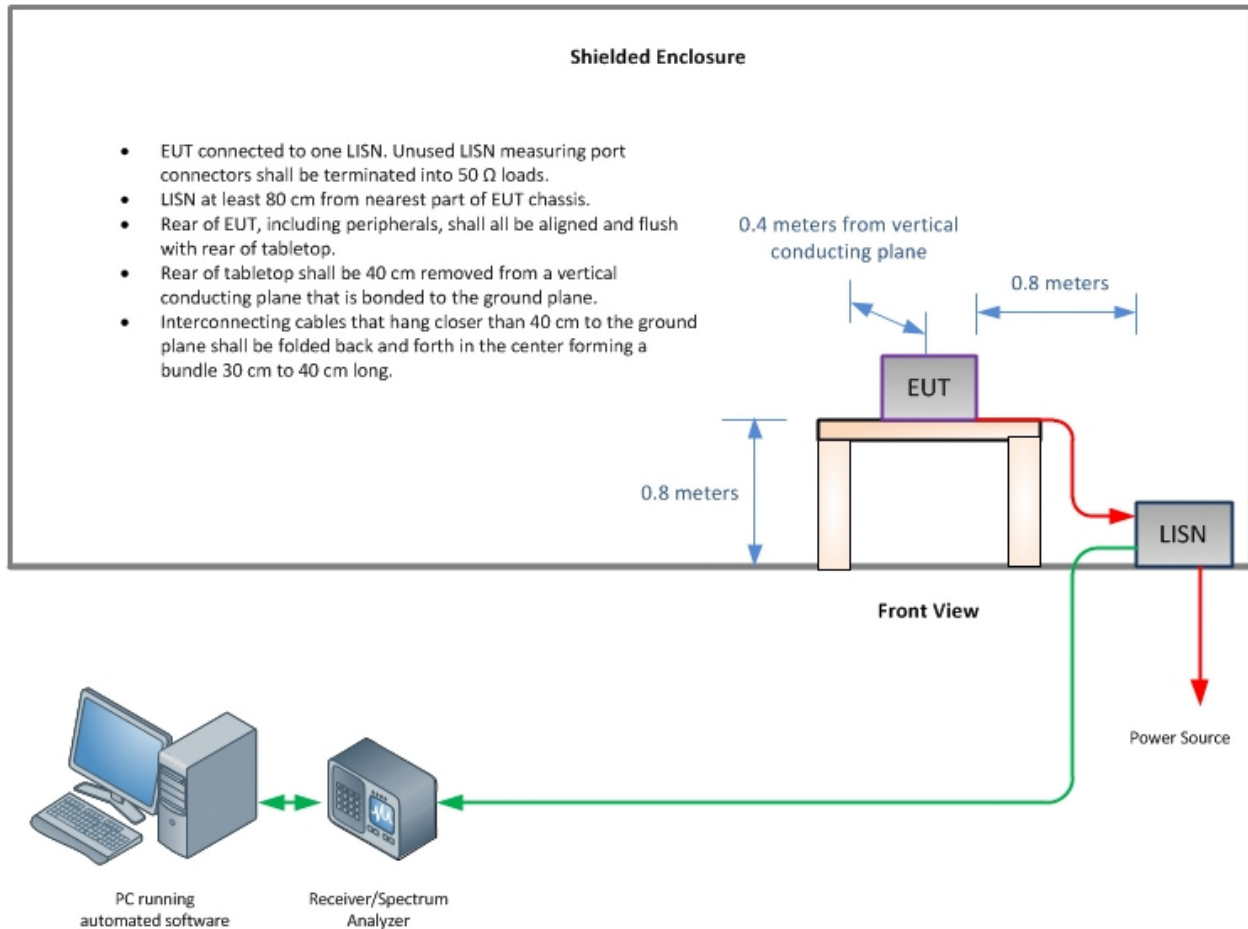


Figure 4-3 – Conducted Emissions Test Setup



5 Measurement Uncertainty

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

Table 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.



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