

FCC and ISED Canada Testing of the

Attenti US, Inc.

34204AL, 34204CL, 34204VL and 34204XL

In accordance with FCC 47 CFR part 15.231 and
ISED Canada's Radio Standards Specifications
RSS-210

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

FCC ID: NC3-34204AVL

IC: 23669-34204AVL



America

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Document Number: TP72149971.401 | Version Number: 02

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 15.231 and ISED Canada's RSS-210.



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-March-27
2	Revised Table Headers in Section 2.4.6 and 2.5.6 and 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 15.231 and Innovation Science and Economic Development Canada's Radio Standards Specification RSS-210 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, 50500187
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	3
Test Specification/Issue/Date	US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2019. ISED Canada Radio Standards Specification: RSS-210 — Licence-Exempt Radio Apparatus: Category I Equipment, Issue 10, December 2019.
Test Plan/Issue/Date	2020-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-March-20
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. ANSI C63.26: 2015: American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services. US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2018. 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 15.231 and ISED Canada's RSS-210 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
Periodic Operation	Yes	Pass	15.231(a)	RSS-210 A.1.1	11
Radiated Field Strength of Fundamental and Spurious Emissions	Yes	Pass	15.231(b)	RSS-210 A.1.2	16
20 dB Bandwidth	Yes	Pass	15.231 (c)	-----	26
99% Bandwidth	Yes	Pass	-----	RSS-210 A.1.3	29
Power Line Conducted Emissions	Yes	Pass	15.207	RSS-GEN 8.8	32



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 operating at 433 MHz (channel 1 and channel 2) with non-simultaneous transmission, a modular approved cellular module and a 2.4 GHz Wi-Fi radio. Representative samples were submitted for testing.

Technical Details

Mode of Operation: 433 MHz
 Frequency Range: 433.92 MHz
 Number of Channels: 1
 Channel Separation: N/A
 Data Rate: 76.8 kbps
 Modulations: GFSK
 Antenna Type/Gain: Helical Stub antenna/ 1.5 dBi (433.9 MHz Channel 1)
 Inverted-F Antenna / 0.75 dB (433.9 MHz Channel 2)
 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 set to transmit continuously on each of the 433 MHz transmitters. The two transmitters are not configured to operate simultaneously per the manufacturer. A test software power setting of 255 was used during the evaluation.

The radiated emissions evaluation of the EUT for all the co-located transmitters operating simultaneously is documented in a separate report.

1.4.3 Monitoring of Performance

The EUT was evaluated for radiated, RF conducted and power line conducted emissions for the 433 MHz transmitter.

The power line conducted emissions measurements were performed for all the transmitters operating simultaneously.

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

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
Periodic Operation	FCC; Section 15.231(a); ISED Canada: RSS-210 A.1.1
Radiated Field Strength of Fundamental and Spurious Emissions	FCC: Section 15.231(b); ISED Canada: RSS-210 A.1.2
20 dB Bandwidth	FCC: Section 15.231(c)
99% Bandwidth	ISED Canada: RSS-210 A.1.3
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
Periodic Operation	Thierry Jean-Charles	A2LA
Radiated Field Strength of Fundamental and Spurious Emissions	Thierry Jean-Charles	A2LA
20 dB Bandwidth	Thierry Jean-Charles	A2LA
99% Bandwidth	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: 50144804

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 internal 1.5 dBi stubby dipole antenna with an SMA connector and a 0.75 dBi F-Antenna internal to the device. The device is tamper proof and the antenna is not accessible to the end-user. The device 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 Periodic Operation

2.2.1 Specification Reference

FCC Sections: 15.231(a)(2);
ISED Canada: RSS-210 A.1.1(b)

2.2.2 Equipment Under Test and Modification State

S/N:50473744, 50500187

2.2.3 Date of Test

12/18/2019 to 3/20/2020

2.2.4 Test Method

A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released. A transmitter activated automatically shall cease transmission within 5 seconds after activation. The transmitter was activated automatically as well as manually and was evaluated using a spectrum analyzer at zero span.

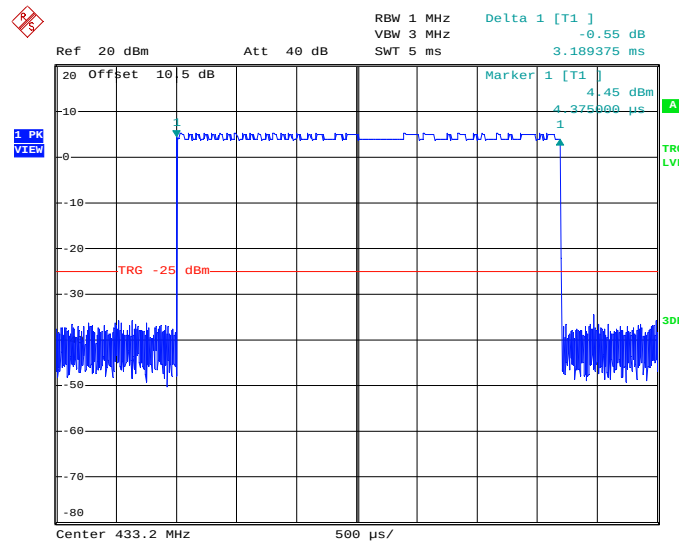
2.2.5 Environmental Conditions

Ambient Temperature	23.8 °C
Relative Humidity	35.7 %
Atmospheric Pressure	1024.5 mbar

2.2.6 Test Results

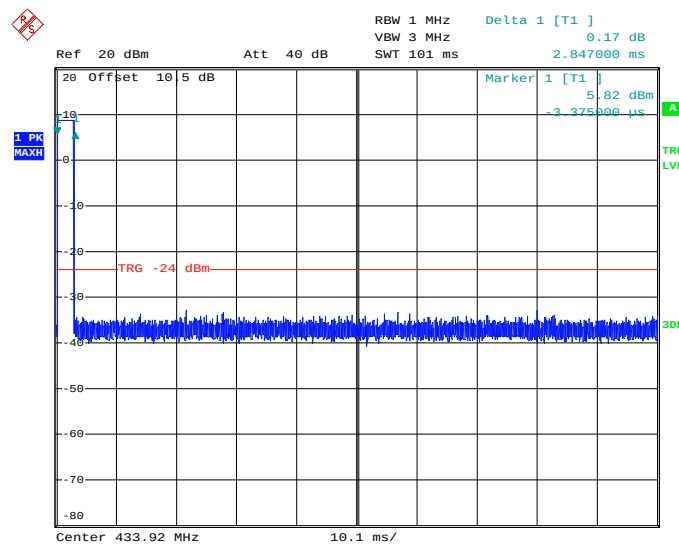
AC Powered Operating

Limit Clause FCC Sections 15.231(a), ISED Canada: RSS-210 A.1.1



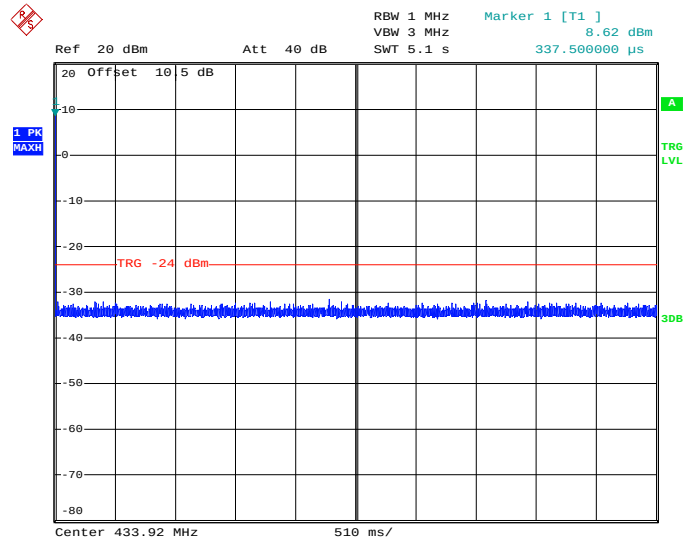
Date: 20.MAR.2020 16:51:39

Figure 2.2.6-1 Transmission Duration – 5 milliseconds – Channel 1



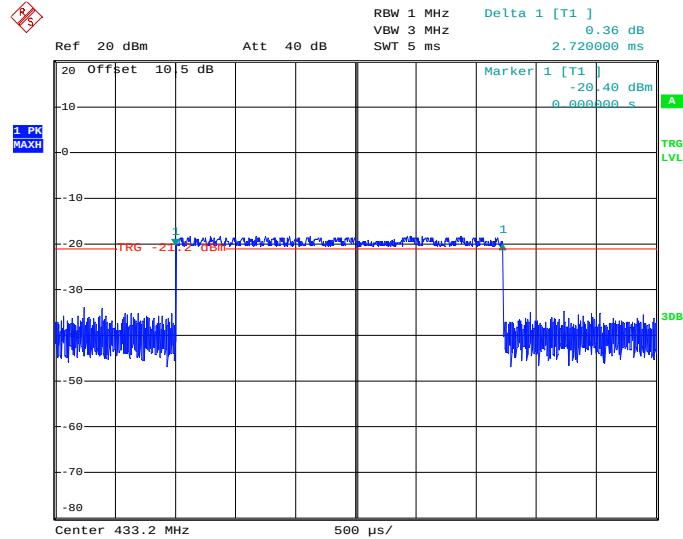
Date: 19.DEC.2019 20:39:11

Figure 2.2.6-2: Transmission Duration – 100 milliseconds – Channel 1



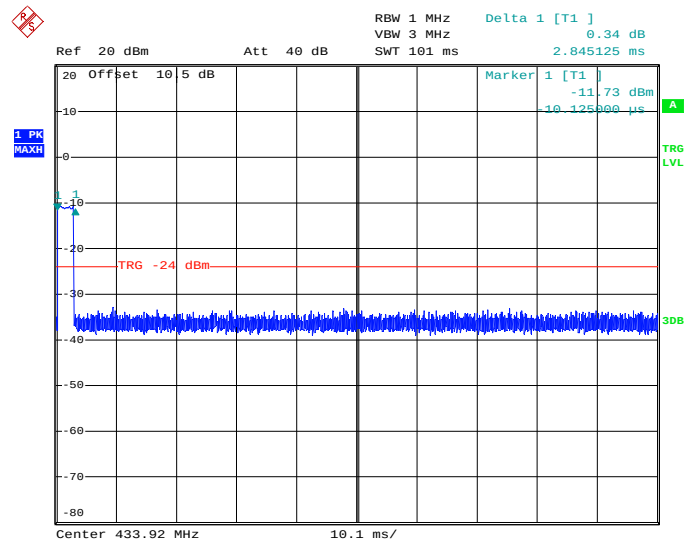
Date: 19.DEC.2019 20:36:20

Figure 2.2.6-3: Transmission Duration – 5 seconds – Channel 1



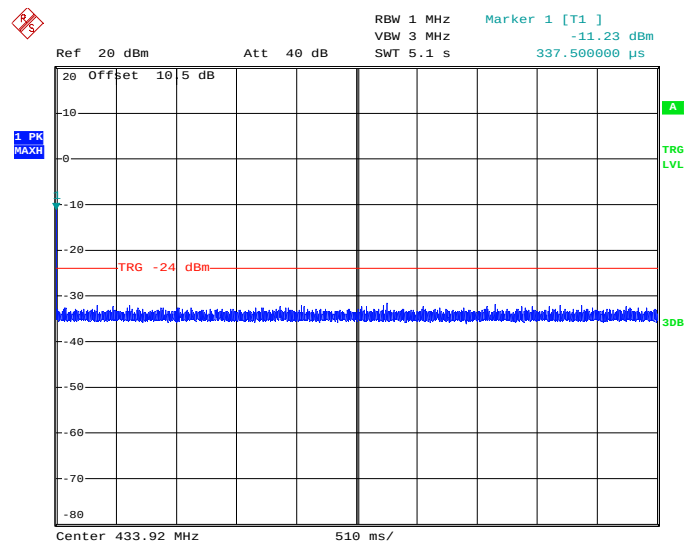
Date: 20.MAR.2020 17:06:14

Figure 2.2.6-4: Transmission Duration – 5 milliseconds – Channel 2



Date: 19.DEC.2019 20:28:17

Figure 2.2.6-5: Transmission Duration – 100 milliseconds – Channel 2



Date: 19.DEC.2019 20:30:39

Figure 2.2.6-6: Transmission Duration – 5 seconds – Channel 2



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
E & H Near Field Probe Set	ETS Lindgren (EMCO)	7405	BEMC00079	N/A	N/A	NCR
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

TU - Traceability Unscheduled

O/P MON - Traceability Unscheduled

N/A - Not Applicable

NCR - No Calibration Required



2.3 Radiated Field Strength and Spurious Emissions

2.3.1 Specification Reference

FCC Sections: 15.231(b);
ISED Canada: RSS-210 A.1.2

2.3.2 Equipment Under Test and Modification State

S/N: 50414804, 50500187

2.3.3 Date of Test

12/4/2019 to 3/20/2020

2.3.4 Test Method

Radiated emissions tests were made over the frequency range of 9 kHz to 10 GHz, at least 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.

An average detector was used for all measurement. The peak emissions were also compared to a limit corresponding to 20 dB above the maximum permitted average limit according to Part 15.35. The final measurements were then corrected by antenna correction factors and cable loss for comparison to the limits. Further, compliance with the provisions of 15.205 was demonstrated using the measurement instrumentation specified in that section where applicable.

2.3.5 Duty Cycle Correction

The EUT was configured to transmit at 100% duty cycle during the evaluation. A Duty Cycle Correction of 9.57% corresponding to $20 \cdot \log(9.57/100) = -20.38$ dB was applied to the average measurements for the corrected average results.

The duty cycle was calculated from the transmission duration multiplied by the number a transmission within 100 ms .

Single transmission duration: 3.189 ms
Total number of transmissions in 100 ms: 3
Transmission duration in 100 ms: $3.189 \cdot 3 = 9.57$ ms.

The justification of the duty cycle is provided in the equipment's theory of operation document.



2.3.6 Environmental Conditions

Ambient Temperature 23.9 °C
Relative Humidity 35.5 %
Atmospheric Pressure 1024.2 mbar

2.3.7 Test Results

AC Powered Operating

Limit Clause FCC Sections 15.231(a), ISED Canada: RSS-210 A.1.2

Fundamental Frequency (MHz)	Field Strength of Fundamental (microvolts/meter)	Field Strength of Spurious Emissions (microvolts/meter)
40.66-40.70	2,250	225
70-130	1,250	125
130-174	¹ 1,250 to 3,750	¹ 125 to 375
174-260	3,750	375
260-470	¹ 3,750 to 12,500	¹ 375 to 1250
Above 470	12,500	1250

¹Linear Interpolations



Table 2.3.7-1: Transmitter Radiated Emissions Test Results

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	avg			pk	avg	pk	avg	pk	avg
Channel 1										
Fundamental Frequency										
433.92	74.08	74.08	H	25.73	99.81	79.43	100.8	80.8	1.0	1.4
433.92	69.89	69.89	V	25.73	95.62	75.24	100.8	80.8	5.2	5.6
Spurious Emissions										
867.84	15.13	15.13	H	31.61	46.74	26.35	80.8	60.8	34.1	34.4
867.84	11.96	11.96	V	31.61	43.57	23.18	80.8	60.8	37.2	37.6
1301.76	48.27	48.27	H	-6.75	41.52	21.14	74	54	32.5	32.9
1301.76	46.93	46.93	V	-6.75	40.18	19.80	74	54	33.8	34.2
1735.68	41.73	41.73	H	-4.56	37.17	16.79	80.8	60.8	43.6	44.0
1735.68	41.59	41.59	V	-4.56	37.03	16.65	80.8	60.8	43.8	44.2
2603.52	40.89	40.89	H	-1.07	39.82	19.44	80.8	60.8	41.0	41.4
3905.28	40.41	40.41	H	1.68	42.09	21.71	74	54	31.9	32.3
3905.28	40.89	40.89	V	1.68	42.57	22.19	74	54	31.4	31.8
4339.2	40.94	40.94	H	3.39	44.33	23.95	74	54	29.7	30.1
4339.2	40.98	40.98	V	3.39	44.37	23.99	74	54	29.6	30.0
5207.04	39.69	39.69	H	6.09	45.78	25.40	80.8	60.8	35.0	35.4
5207.04	40.67	40.67	V	6.09	46.76	26.38	80.8	60.8	34.0	34.4
6074.88	37.39	37.39	H	8.71	46.10	25.71	80.8	60.8	34.7	35.1
6074.88	38.73	38.73	V	8.71	47.44	27.05	80.8	60.8	33.4	33.7
Channel 2										
Fundamental Frequency										
433.92	69.98	69.98	H	25.73	95.71	75.33	100.8	80.8	5.1	5.5
433.92	68.32	68.32	V	25.73	94.05	73.67	100.8	80.8	6.7	7.1
Spurious Emissions										
867.84	20.45	20.45	H	31.20	51.65	31.26	80.8	60.8	29.2	29.5
867.84	11.45	11.45	V	31.20	42.65	22.26	80.8	60.8	38.2	38.5
1301.76	48.67	48.67	H	-6.65	42.02	21.64	74	54	32.0	32.4
1301.76	44.25	44.25	V	-6.65	37.60	17.22	74	54	36.4	36.8
4339.2	38.05	38.05	H	3.38	41.43	21.05	74	54	32.6	33.0
4339.2	40.97	40.97	V	3.38	44.35	23.97	74	54	29.7	30.0
5207.04	39.68	39.68	H	6.39	46.07	25.68	80.8	60.8	34.7	35.1
5207.04	37.68	37.68	V	6.39	44.07	23.68	80.8	60.8	36.7	37.1
6074.88	36.27	36.27	H	8.73	45.00	24.62	80.8	60.8	35.8	36.2
6074.88	37.22	37.22	V	8.73	45.95	25.57	80.8	60.8	34.9	35.2

Note:

- The fundamental emissions were measured using RBW = 1 MHz, which is greater than the 99% bandwidth.
- A duty cycle correction factor corresponding to $20 \cdot \log(9.57/100) = -20.38$ dB was applied to the peak levels for the average measurements test results.

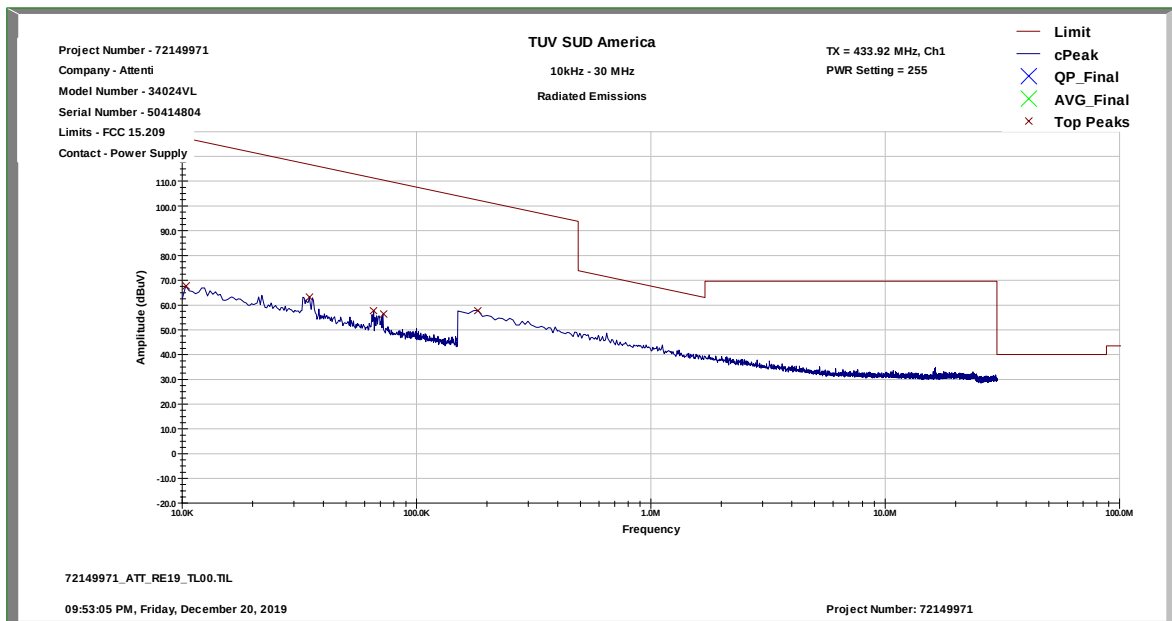


Figure 2.3.7-1: Radiated Emissions Results – 9 kHz – 30 MHz – Channel 1

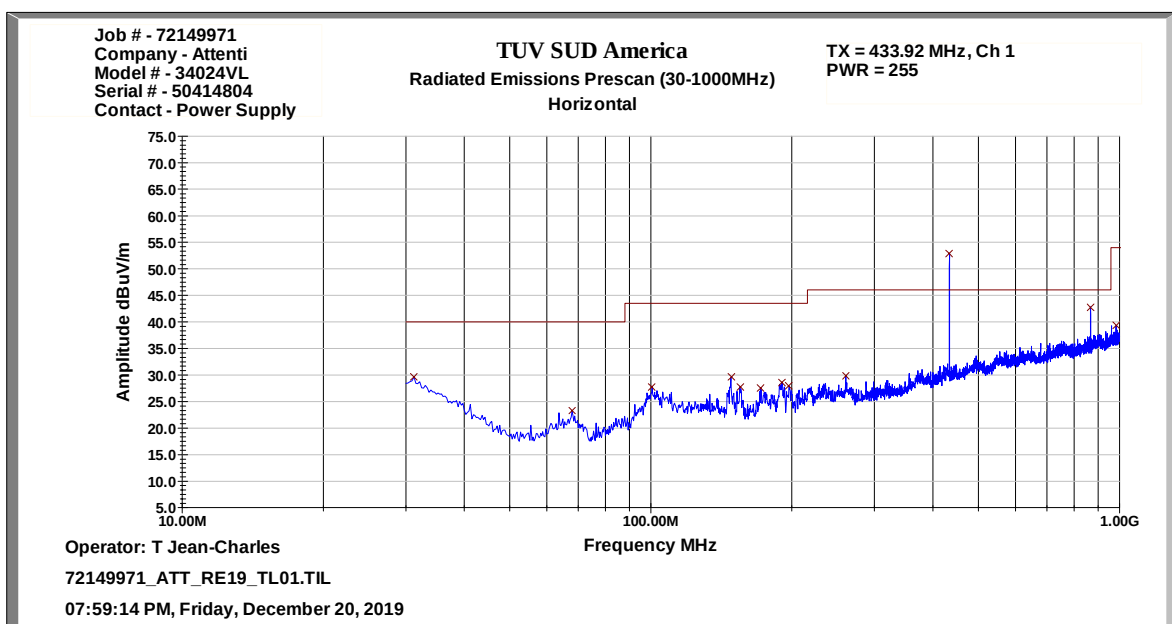


Figure 2.3.7-2: Radiated Emissions Results – 30 MHz – 1 GHz – Horizontal Polarization - Channel 1

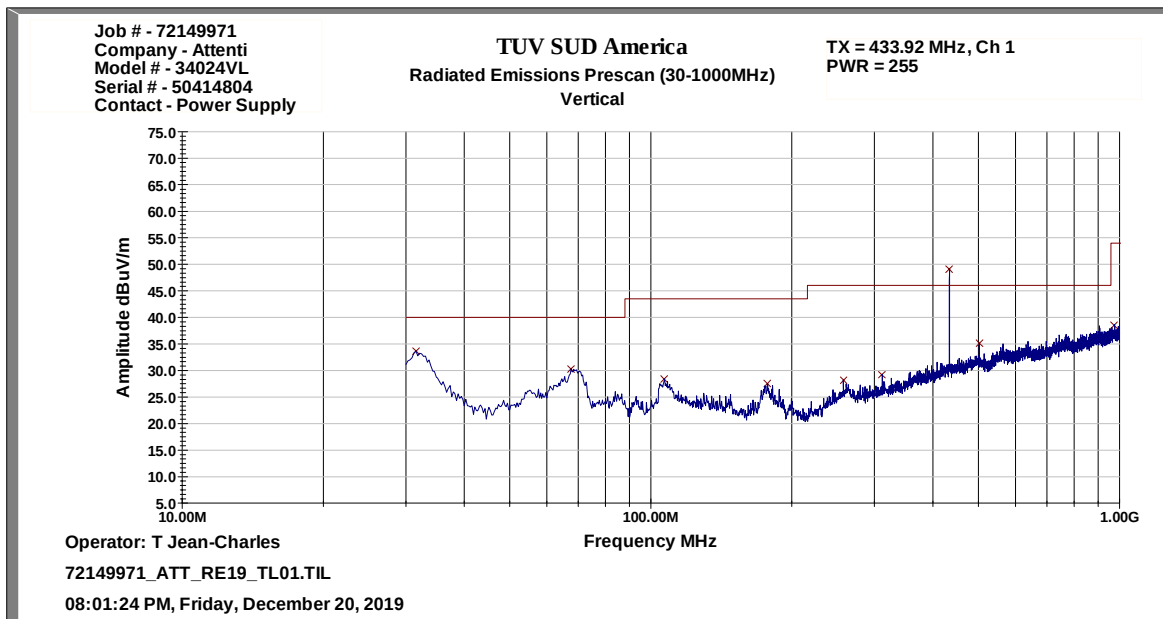


Figure 2.3.7-3: Radiated Emissions Results – 30 MHz – 1 GHz – Vertical Polarization - Channel 1

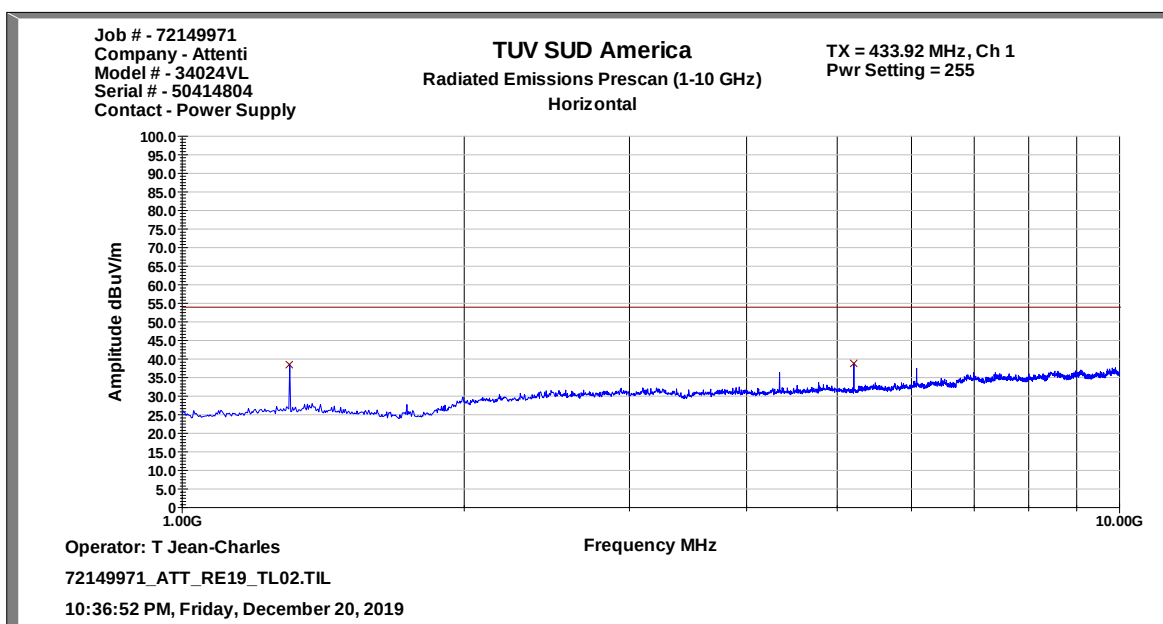


Figure 2.3.7-4: Radiated Emissions Results – 1 GHz – 10 GHz – Horizontal Polarization - Channel 1

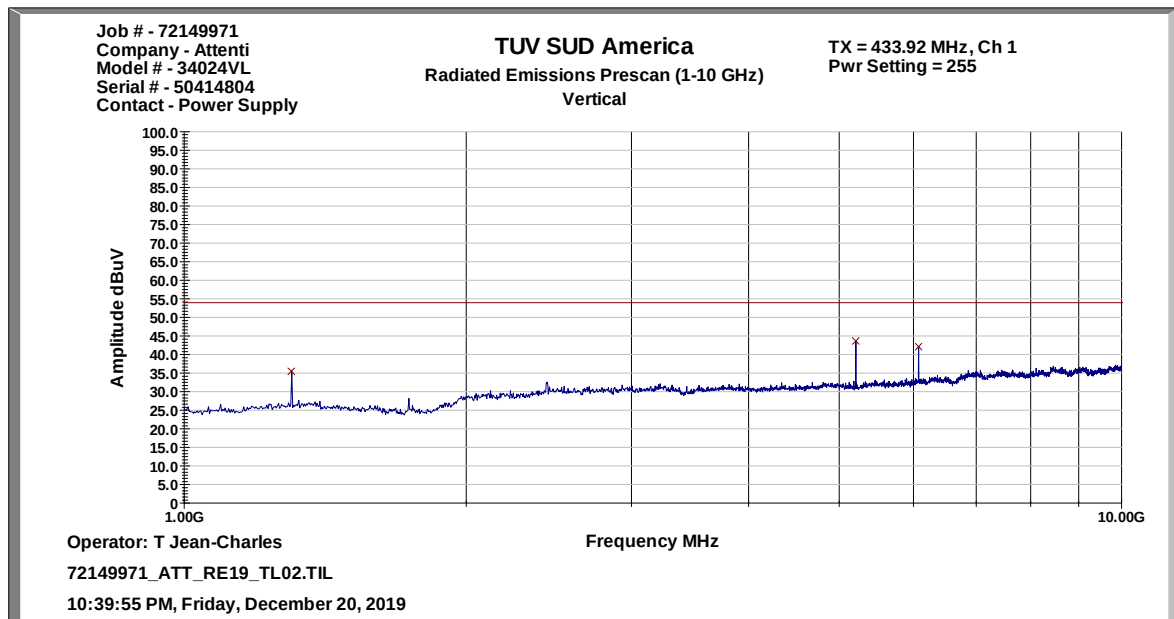


Figure 2.3.7-5: Radiated Emissions Results – 1 GHz – 10 GHz – Vertical Polarization - Channel 1

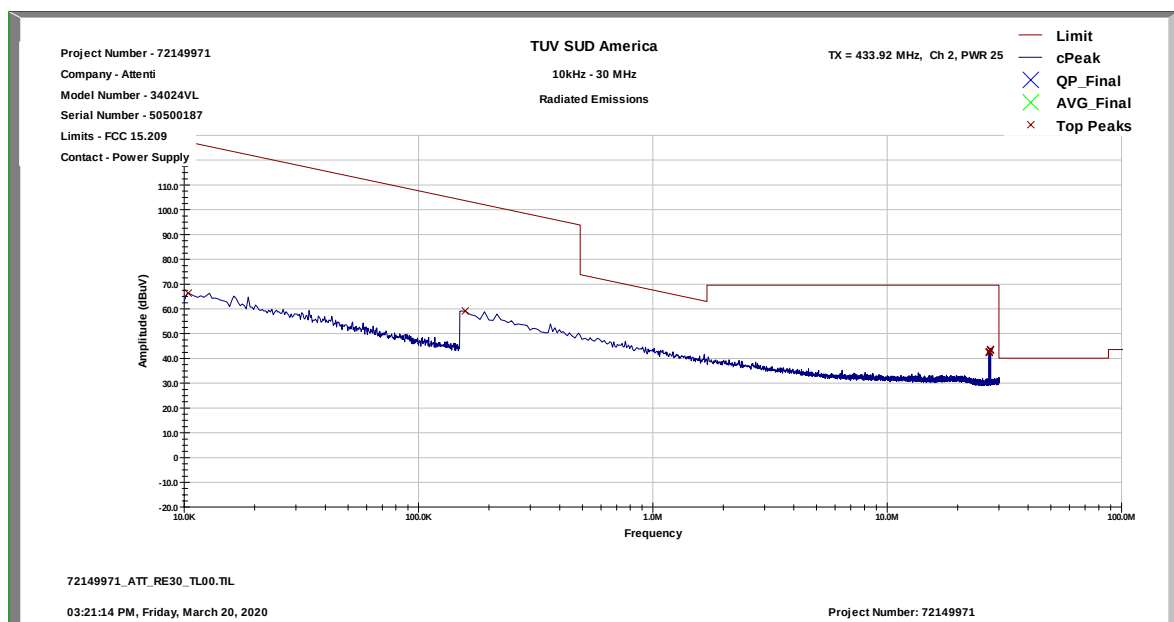


Figure 2.3.7-6: Radiated Emissions Results – 9 kHz – 30 MHz – Channel 2

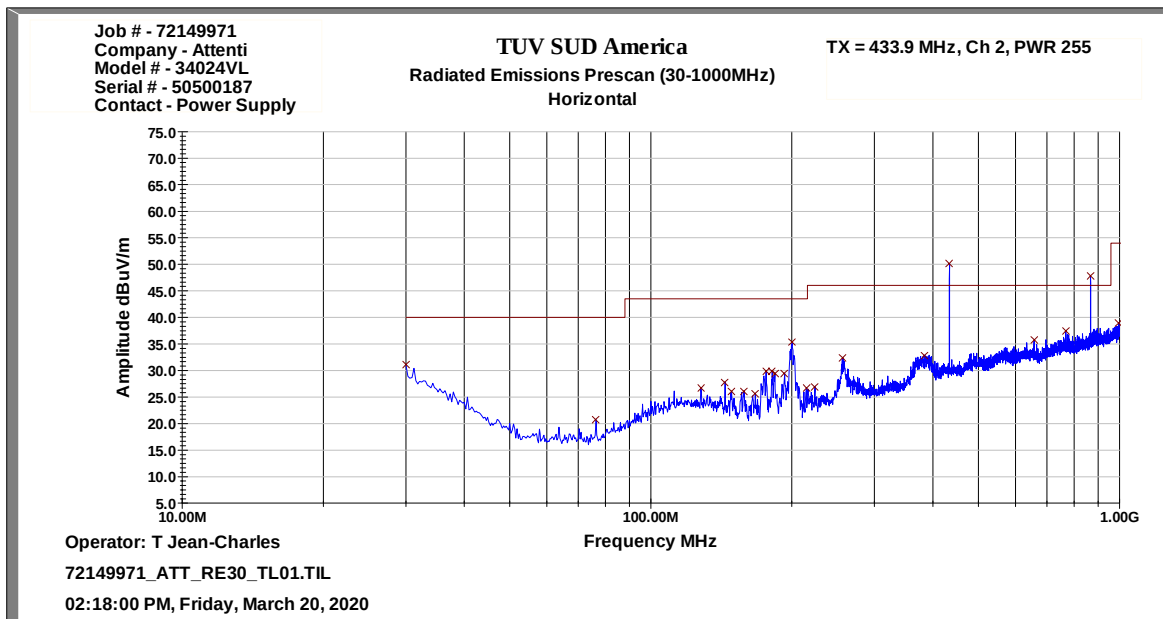


Figure 2.3.7-7: Radiated Emissions Results – 30 MHz – 1 GHz – Horizontal Polarization - Channel 2

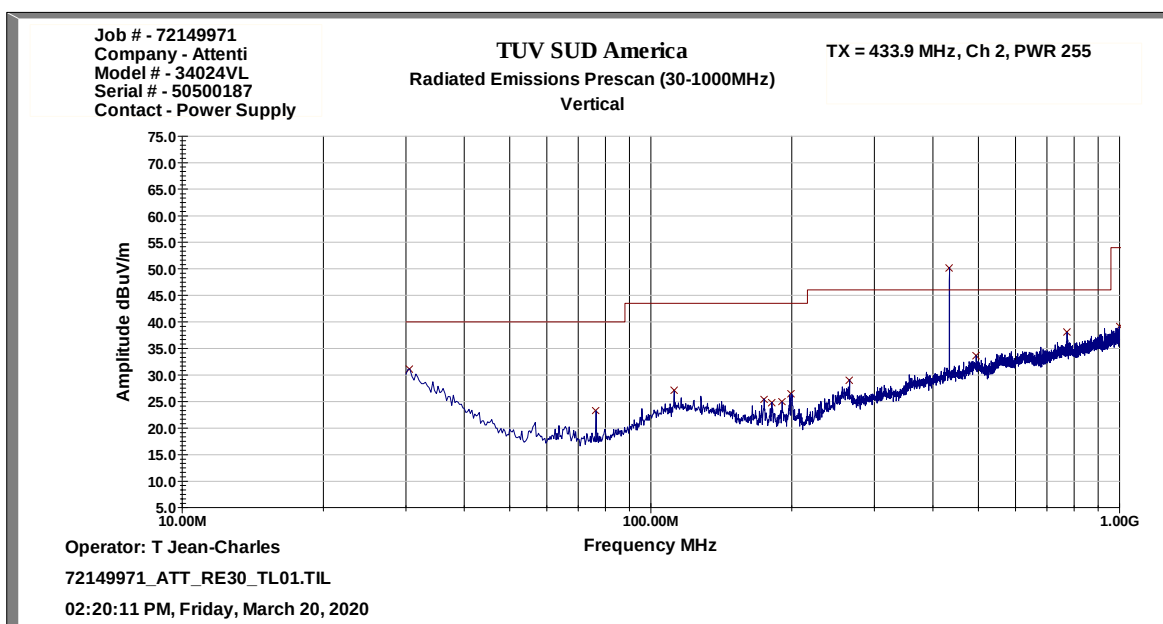


Figure 2.3.7-8: Radiated Emissions Results – 30 MHz – 1 GHz – Vertical Polarization - Channel 2

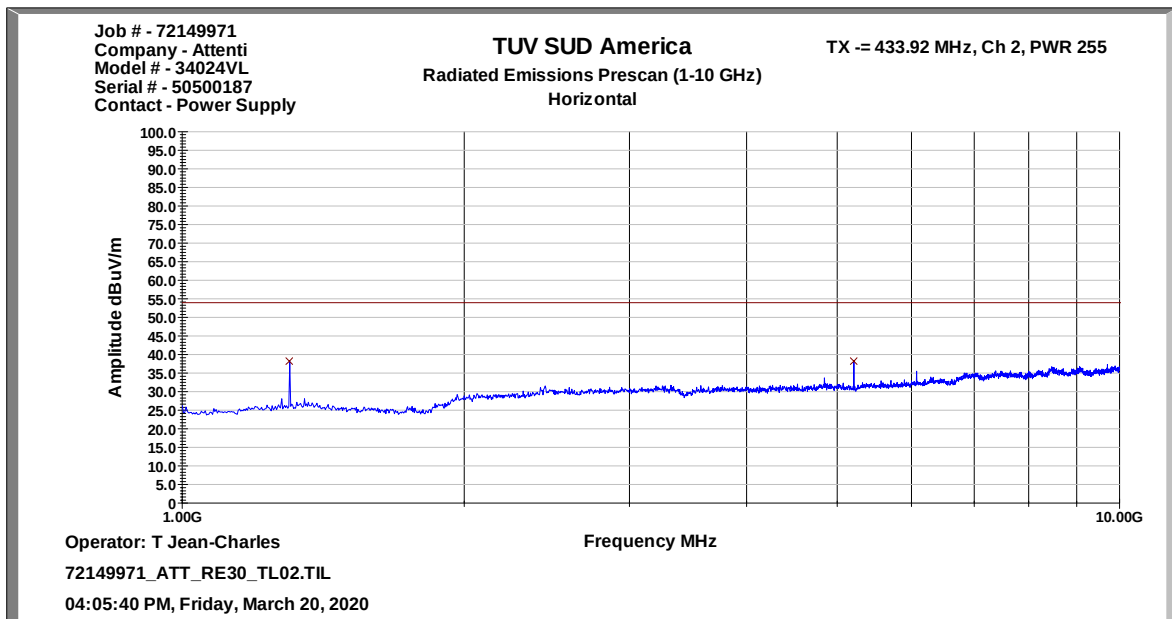


Figure 2.3.7-9: Radiated Emissions Results – 1 GHz – 10 GHz – Horizontal Polarization - Channel 2

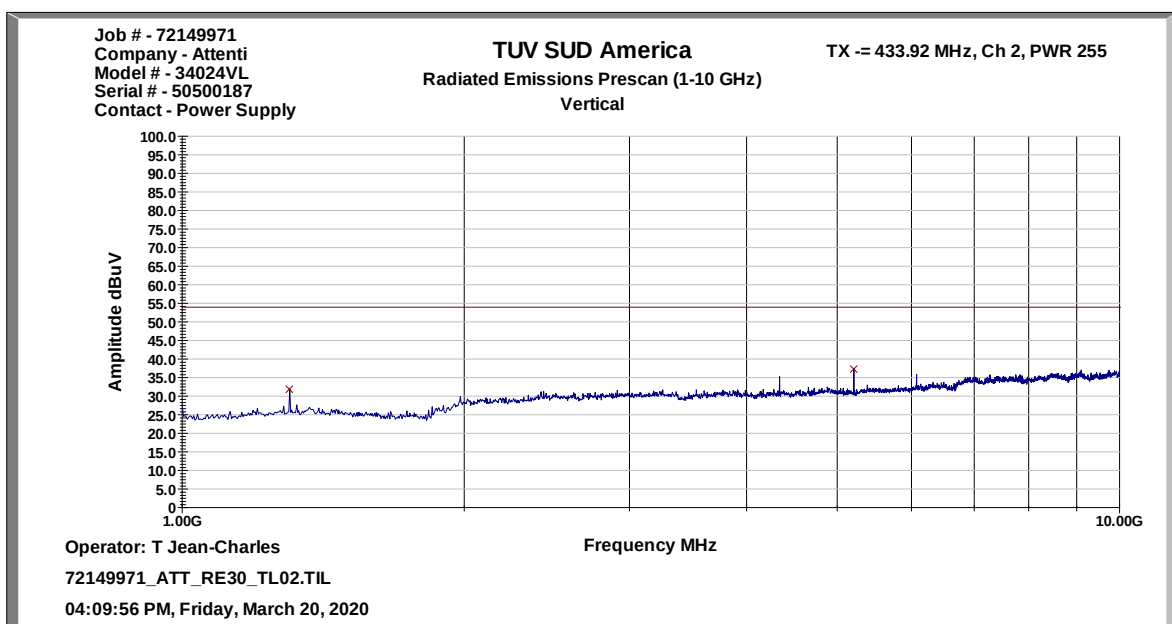


Figure 2.3.7-10: Radiated Emissions Results – 1 GHz – 10 GHz – Vertical Polarization - Channel 2



2.3.8 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: $48.27 + -6.75 = 41.52 \text{ dB}\mu\text{V/m}$

Margin: $74 \text{ dB}\mu\text{V/m} - 41.52 \text{ dB}\mu\text{V/m} = 32.48 \text{ dB}$

Example Calculation: Average

Corrected Level: $48.27 + -6.75 - 20.38 = 21.14 \text{ dB}\mu\text{V/m}$

Margin: $54 \text{ dB}\mu\text{V/m} - 21.14 \text{ dB}\mu\text{V/m} = 32.86 \text{ dB}$



2.3.9 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
800 MHz High Pass Filter	Mini-Circuits	NHP-800	BEMC02073	N/A	12	22-Jan-2021
600 MHz High Pass Filter	Mini-Circuits	NHP-600	BEMC02083	N/A	12	03-May-2020
High Pass Filter, 1000-3000 MHz, 50 OHM	Mini Circuits	SHP-1000+	BEMC02094	N/A	12	22-Jan-2021
Tile Automation Software	ETS Lindgren	TILE4! - Version 4.2.A	BEMC02095	4.2A	N/A	NCR
BI LOG PERIODIC, ANTENNA	Schaffner	CBL6112B	TEMC00005	N/A	24	31-Oct-2021
Loop Antenna	Com Power	AL-130	TEMC00025	N/A	24	26-Sep-2021
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
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
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



2.4 20 dB Bandwidth

2.4.1 Specification Reference

FCC: Section 15.215

2.4.2 Equipment Under Test and Modification State

S/N: 50473744

2.4.3 Date of Test

12/18/2019

2.4.4 Test Method

The spectrum analyzer span was set to 2 to 5 times the estimated bandwidth of the emission. The RBW was set from 1% to 5% of the estimated emission bandwidth. The trace was set to max hold with a peak detector active. The 20-dB function of the analyzer was utilized to determine the 20 dB bandwidth of the emission.

2.4.5 Environmental Conditions

Ambient Temperature	24.5°C
Relative Humidity	36.1 %
Atmospheric Pressure	1016.8 mbar

2.4.6 Test Results

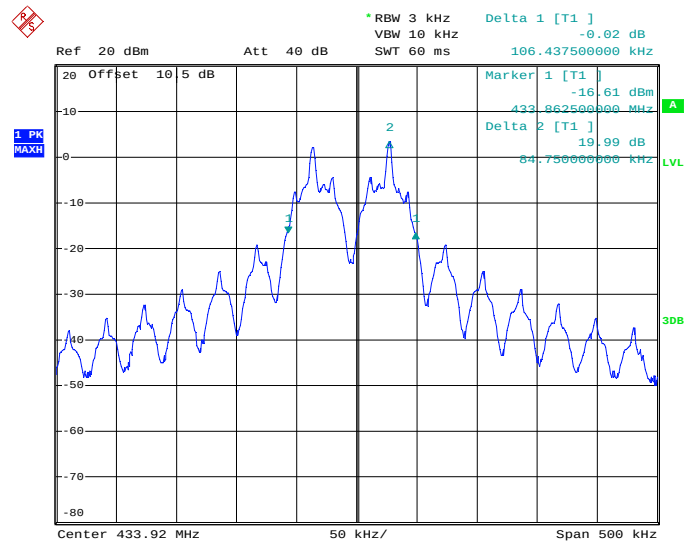
AC Powered Operating

Limit Clause FCC Part 15.231(c)

The 20 dB Bandwidth limit is calculated as 0.25% of the 433.92 MHz center frequency. The limit is equal to 1.08 MHz. Therefore the 20 dB bandwidth of the emission are less than 0.25% of the center frequency.

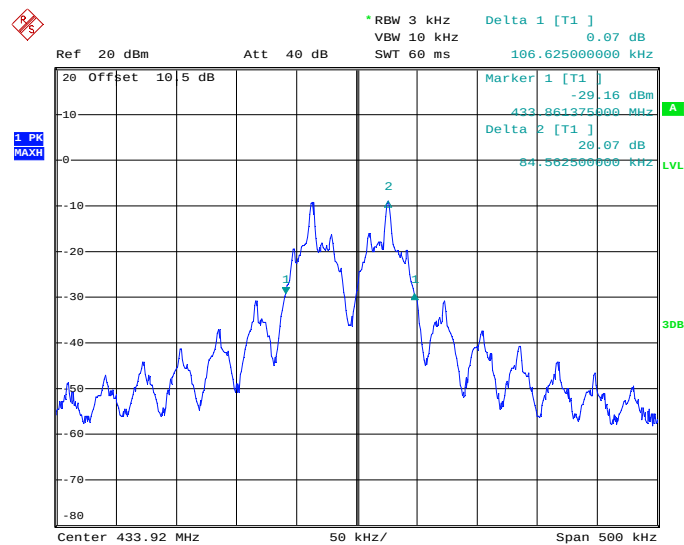
Table 2.4.6-1: 20 dB Bandwidth Test Results

Frequency (kHz)	20 dB Bandwidth (kHz)
433.92	106.4375
433.92	106.6250



Date: 18.DEC.2019 15:55:03

Figure 2.4.6-1: 20 dB Bandwidth – Channel 1



Date: 18.DEC.2019 16:03:07

Figure 2.4.6-2: 20 dB Bandwidth – Channel 2



2.4.7 Test Location and Test Equipment Used

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

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
Spectrum Analyzer	Rohde & Schwarz	FSP40	BEMC00283	4.50 SP5	24	04-Oct-2021
Attenuator 10dB, 2.9 mm-M/F, DC-40GHz 2 W	Aeroflex Inmet	40AH2W-10	BEMC02110	N/A	12	27-Jul-2020
Duratest High Frequency Cable Max. 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

NCR - No Calibration Required



2.5 99% Bandwidth

2.5.1 Specification Reference

ISED Canada: RSS-210 A.1.3

2.5.2 Equipment Under Test and Modification State

S/N: 50473744

2.5.3 Date of Test

12/18/2019

2.5.4 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.

2.5.5 Environmental Conditions

Ambient Temperature	24.5°C
Relative Humidity	36.1 %
Atmospheric Pressure	1016.8 mbar

2.5.6 Test Results

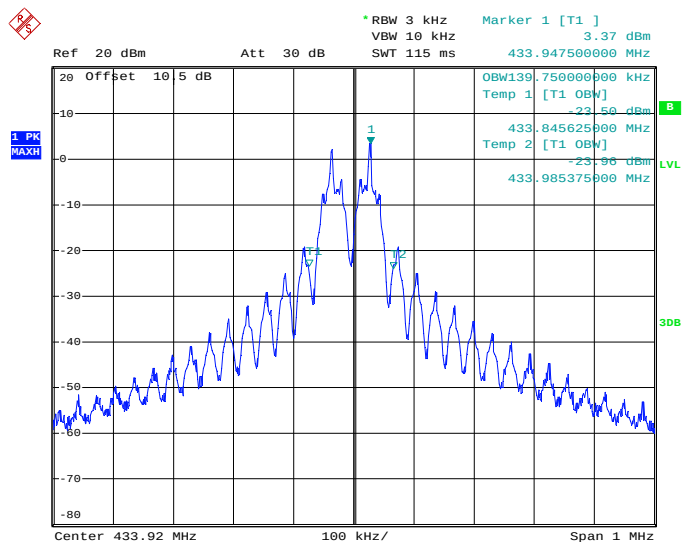
AC Powered Operating

Limit Clause ISED RSS-210 A.1.3

The 99% Occupied Bandwidth limit is calculated as 0.25% of the 433.92 MHz center frequency. The limit is equal to 1.08 MHz. Therefore the 99% bandwidth of the emission are less than 0.25% of the center frequency.

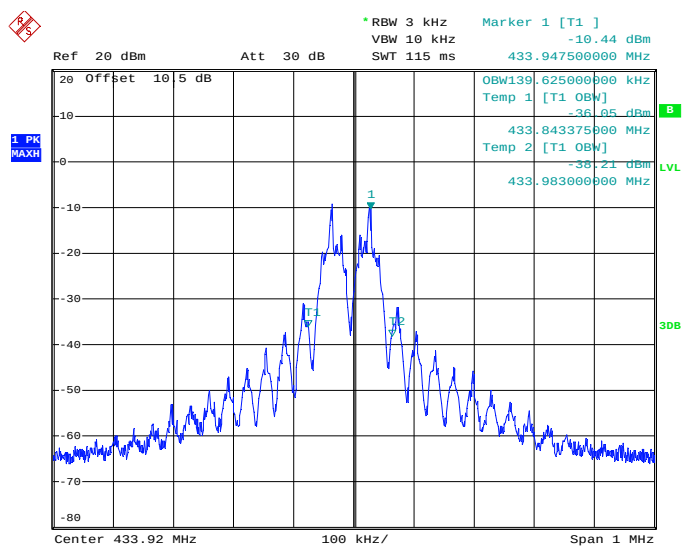
Table 2.5.6-1: 99% Bandwidth Test Results

Frequency (kHz)	99% Bandwidth (kHz)
433.92	139.750
433.92	139.625



Date: 18.DEC.2019 15:49:12

Figure 2.5.6-1: 99% Bandwidth Test Results – Channel 1



Date: 18.DEC.2019 16:06:59

Figure 2.5.6-2: 99% Bandwidth Test Results – Channel 2



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 Cable Max. 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

NCR - No Calibration Required



2.6 Power Line Conducted Emissions

2.6.1 Specification Reference

FCC: Section 15.207
ISED Canada; RSS-GEN 8.8

2.6.2 Equipment Under Test and Modification State

S/N: 50414804

2.6.3 Date of Test

12/20/2019

2.6.4 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

2.6.5 Environmental Conditions

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

2.6.6 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

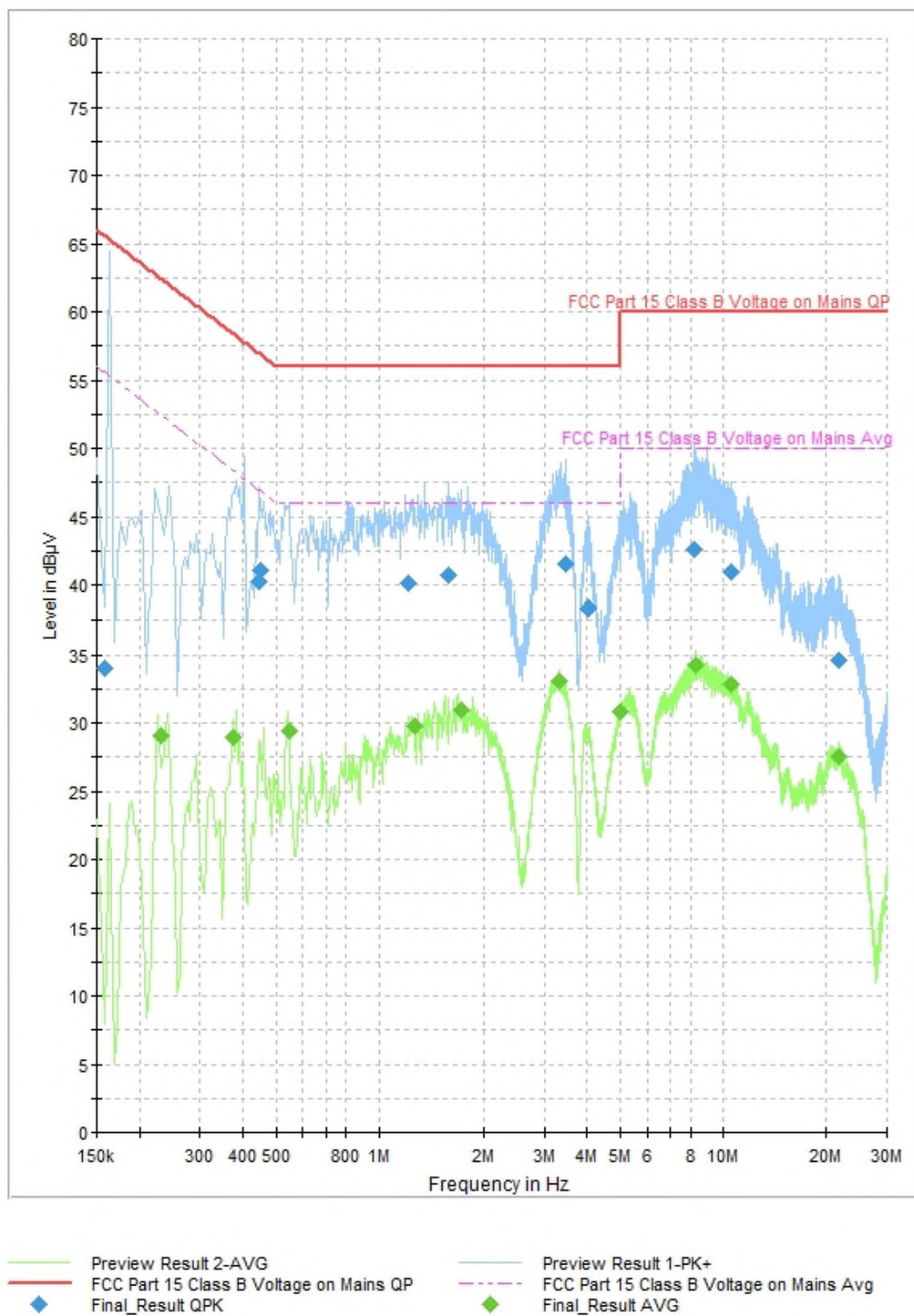
*Decreases with the logarithm of the frequency.

**Table 2.6.6-1: 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 2.6.6-2: 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 2.6.6-1: Composite Power Line Conducted Emissions**



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
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



3 Test Equipment Information

3.1 General Test Equipment Used

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
E & H Near Field Probe Set	ETS Lindgren (EMCO)	7405	BEMC00079	N/A	N/A	NCR
Spectrum Analyzer	Rohde & Schwarz	FSP40	BEMC00283	4.50 SP5	24	04-Oct-2021
9kHz-26.5GHz EMC analyzer/HYZ	Agilent	E7405A	BEMC00523	A.14.06	24	27-Nov-2020
800 MHz High Pass Filter	Mini-Circuits	NHP-800	BEMC02073	N/A	12	22-Jan-2021
600 MHz High Pass Filter	Mini-Circuits	NHP-600	BEMC02083	N/A	12	03-May-2020
High Pass Filter, 1000-3000 MHz, 50 OHM	Mini Circuits	SHP-1000+	BEMC02094	N/A	12	22-Jan-2021
Tile Automation Software	ETS Lindgren	TILE4! - Version 4.2.A	BEMC02095	4.2A	N/A	NCR
Attenuator 10dB, 2.9 mm-M/F, DC-40GHz 2 W	Aeroflex Inmet	40AH2W-10	BEMC02110	N/A	12	27-Jul-2020
Duratest High Frequency Cable Max. frequency 26.5GHz	Teledyne Storm Products	921-0101-036	BEMC02112	N/A	12	12-Oct-2020
LISN	Rohde & Schwarz	ESH3-Z5	TEMC00002	N/A	24	30-Sep-2021
BI LOG PERIODIC, ANTENNA	Schaffner	CBL6112B	TEMC00005	N/A	24	31-Oct-2021
EMI Test Receiver	Rohde & Schwarz	ESCS30	TEMC00011	2.3002.0102.36	24	03-Oct-2021
Loop Antenna	Com Power	AL-130	TEMC00025	N/A	24	26-Sep-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
RFI/EMI Shielded Enclosure	UNIVERSAL SHIELDING CORP.	N/A	TEMC00100	N/A	N/A	NCR
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
Radiated Cable Set 30 MHz - 1 GHz	TUV SUD Tampa	Cable 2	TEMC00179	N/A	12	07-May-2020
Test Software	Rohde & Schwarz	EMC32	TEMC00184	10.50.00	N/A	NCR
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

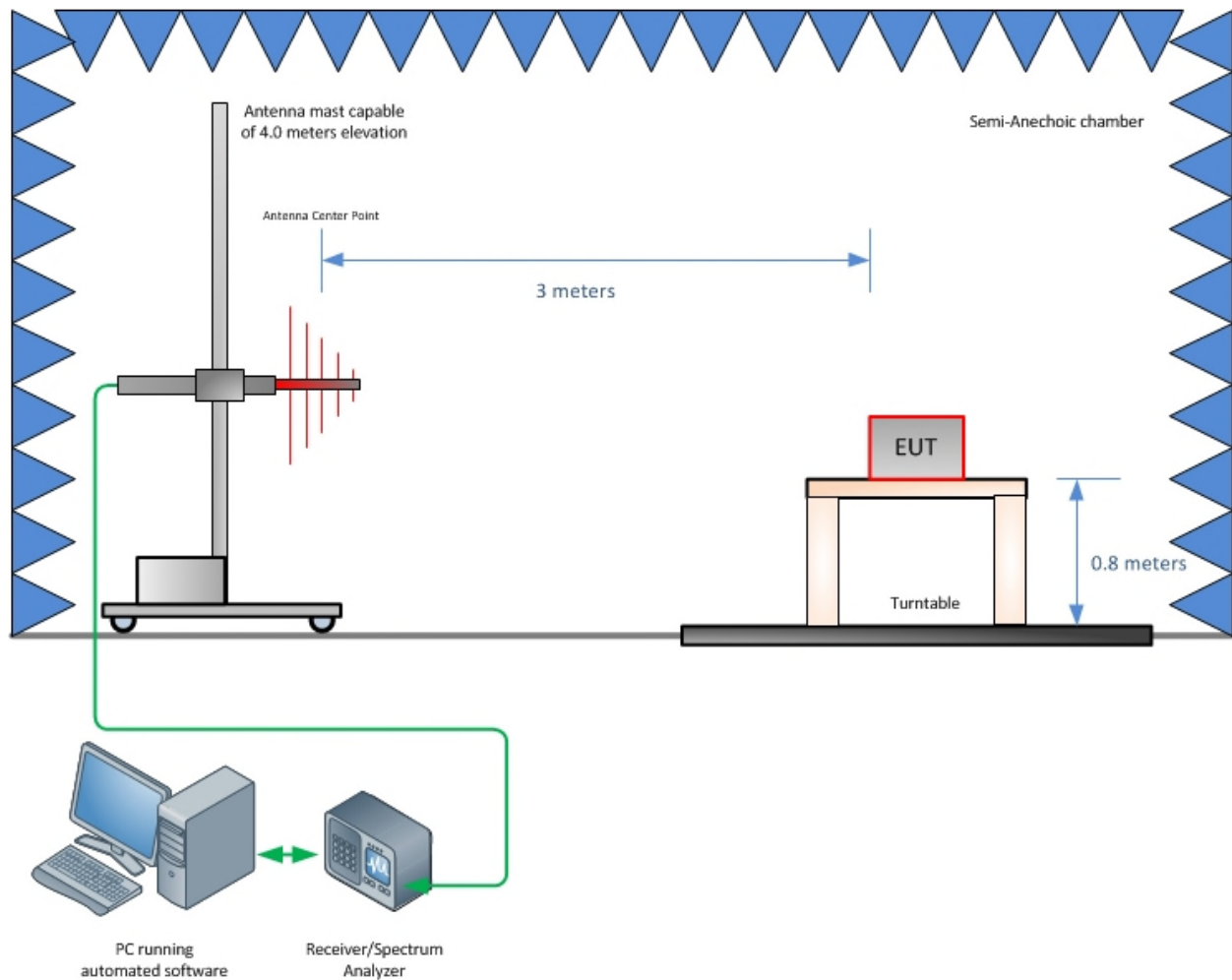


Figure 4-1 - Radiated Emissions Test Setup up to 1 GHz

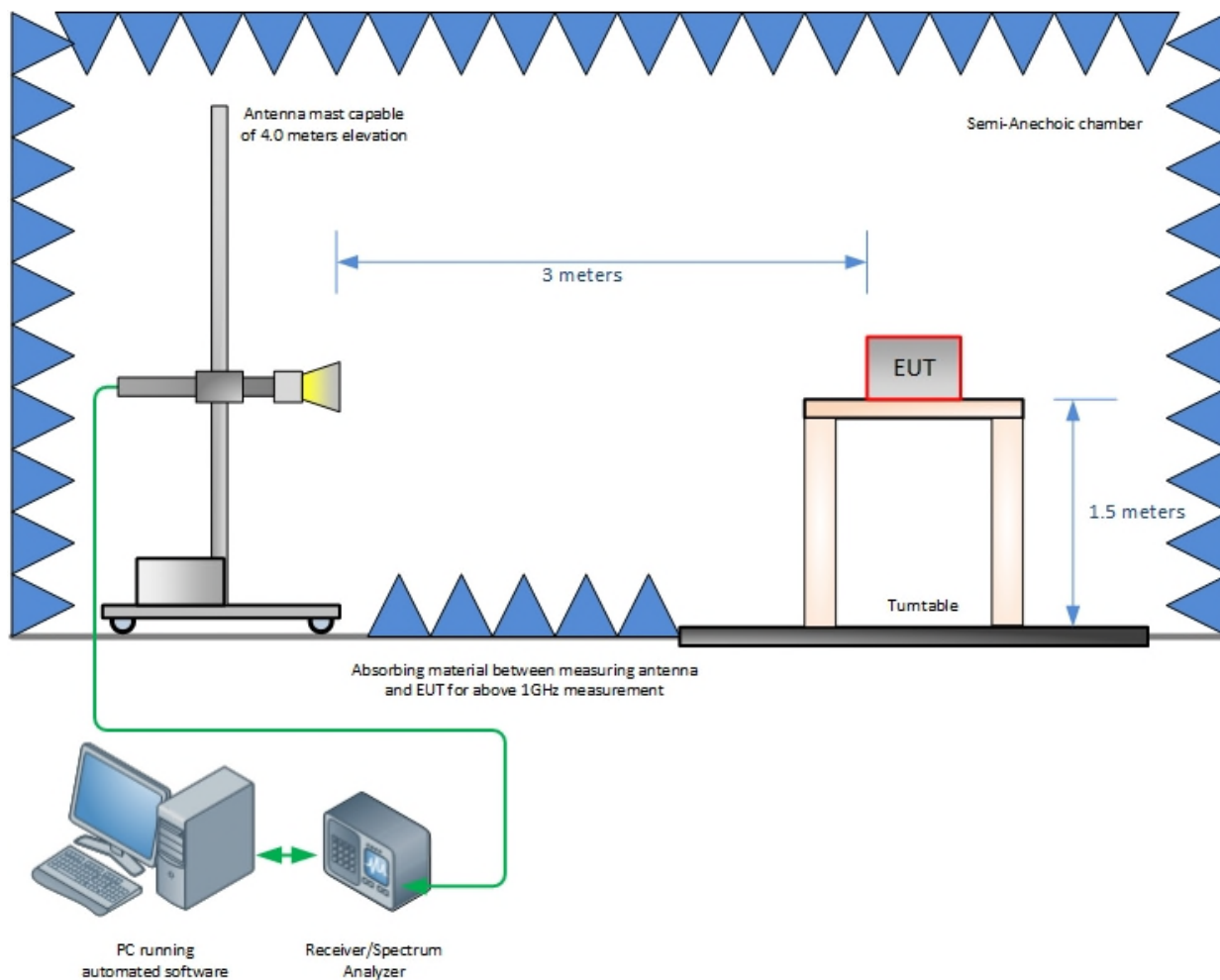


Figure 4-2 - Radiated Emissions Test Setup above 1 GHz

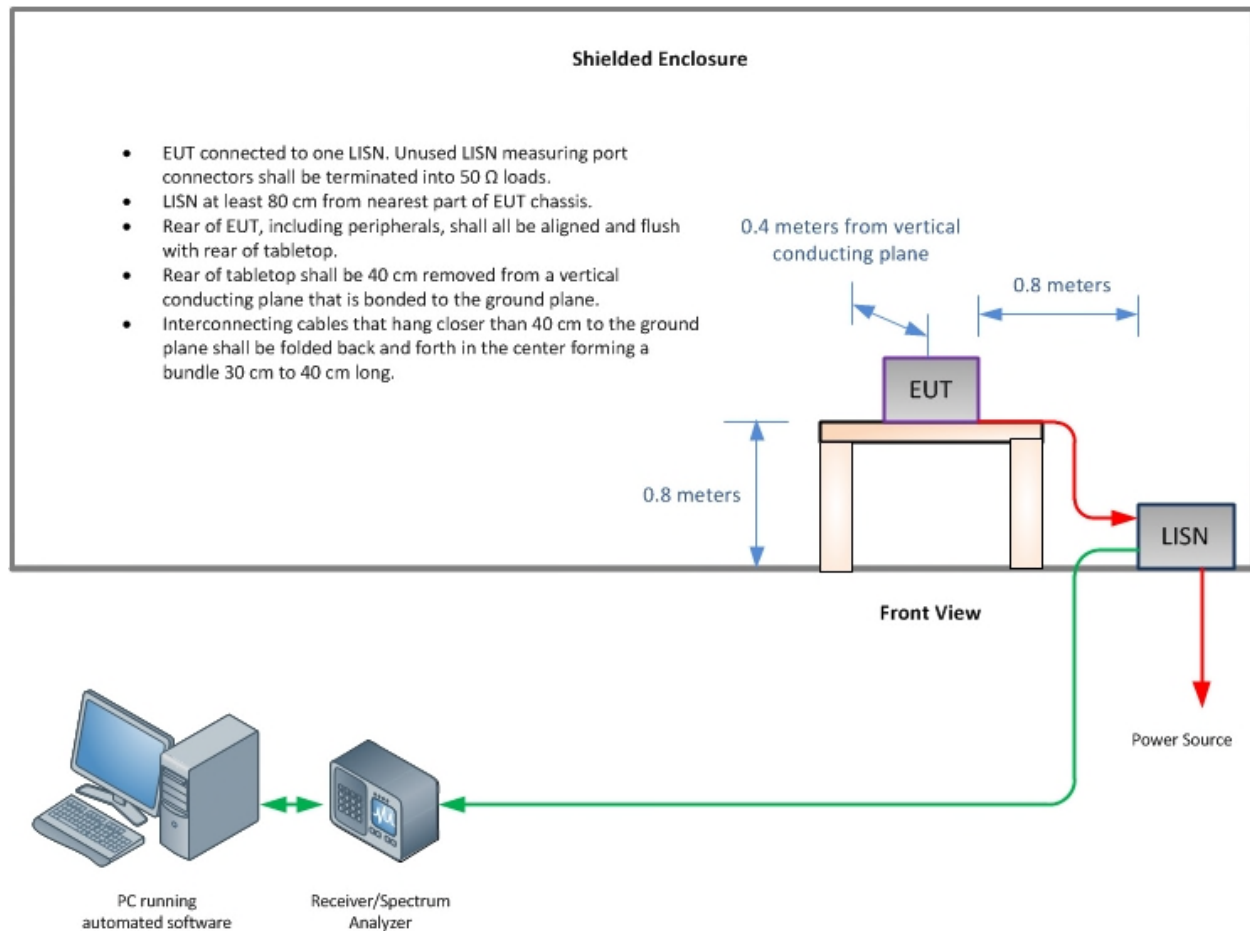


Figure 4-3 – Conducted Emissions Test Setup

5 Measurement Uncertainty

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

Table 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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