

FCC and ISCED Canada Testing of the

Bogen Communications LLC
Nyquist NQ-SERPAIR

In accordance with FCC 47 CFR part 15.225 and
ISCED Canada's Radio Standards Specifications
RSS-210

Prepared for: Bogen Communications LLC
3862 Quadrangle Blvd Suite 150
Orlando, FL 32817

FCC ID: CD2-NQSERPAIR01
IC: 1727A-NQSERPAIR

COMMERCIAL-IN-CONFIDENCE

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RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Authorized Signatory	Dave Ernest	2025 -May-21	
Testing	Thierry Jean-Charles	2025-May-16	

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
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EXECUTIVE SUMMARY

Samples of this product were tested and found to be in compliance with FCC Part 15.225 and ISCED Canada's RSS-210.

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

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



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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	2025-May-21

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 15.225 and Innovation Science and Economic Development Canada's Radio Standards Specification RSS-210 for the tests documented herein.



Applicant	Bogen Communications LLC
Manufacturer	Bogen Communications LLC
Applicant's Email Address	rpacer@bogen.com
Model Number(s)	Nyquist NQ-SERPAIR
Serial Number(s)	N/A
FCC ID	CD2-NQSERPAIR01
ISED Certification Number	1727A-NQSERPAIR
Hardware Version(s)	1.0
Software Version(s)	1.0
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, 2025 Innovation, Science and Economic Development Canada Radio Standards Specification: RSS-210 — Licence-Exempt Radio Apparatus: Category I Equipment, Issue 11, June 2024
Test Plan/Issue/Date	2025-March-25
Order Number	0721009645
Date	2025-March-28
Date of Receipt of EUT	2025-May-06
Start of Test	2025-May-06
Finish of Test	2025-May-15
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, 2025. Innovation, Science and Economic Development Canada Radio Standards Specification: RSS-GEN - General Requirements for Compliance of Radio Apparatus, Issue 5, Amendment 1, March 2019, Amendment 2, February 2021. FCC KDB Publication 174176 D01 Line Conducted FAQ v01r01: AC Power Line Conducted Emissions Frequently Asked Questions, June 2015.



1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC Part 15.225 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
20 dB Bandwidth	Yes	Pass	15.215(c)	-----	11
99% Bandwidth	Yes	Pass	-----	RSS-GEN 6.7	13
Field strength of Emissions within the Band 13.110-14.010 MHz	Yes	Pass	15.225(a),(b),(c)	RSS-210 Annex B.6(a)	15
Field Strength of Emissions outside of the Band 13.110-14.010 MHz	Yes	Pass	15.209, 15.225(d)	RSS-210 7.2, RSS-210 Annex B.6(a), RSS-GEN 8.9	19
Power Line Conducted Emissions	Yes	Pass	15.207	RSS-GEN 8.8	28
Frequency Tolerance of the Carrier Signal	Yes	Pass	15.225(e)	RSS-210 B.6(b)	34
Duty Cycle of the Test Mode of Operation	No	-----	-----	-----	37



1.4 Product Information

1.4.1 Technical Description

The EUT is a 5V CAN BUS powered NFC Antenna/ transceiver operating at 13.56 MHz. It will be used to pair a BT handheld microphone to a Bluetooth Receiver in a Classroom/Lecture hall.

Technical Details

Mode of Operation: 13.56 MHz NFC

Frequency Range: 13.56 MHz

Number of Channels: 1

Channel Separation: Not Applicable

Data Rate: 106 kbps

Modulations: ASK

Antenna Type/Gain: Differential Magnetic 3 coils/loops PCB / 4mm x 6.5mm

Input Power: 5 VDC

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

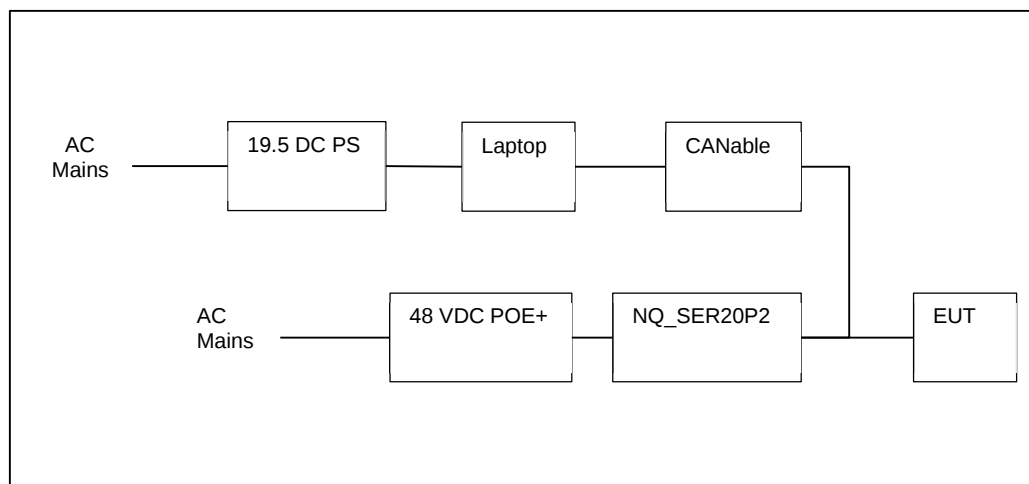


Figure 1.4.1-1 – Test Setup Block Diagram

**Table 1.4.1-1 – Cable Descriptions**

Cable/Port	Description
CAN	9.0 m, CAT 5E, EUT to NQ-SER20P2
CAN	0.7 m, NQ-SER20P2 to USB to CAN Adapter
POE	1.7 m, CAT 5E, POE Adapter to NQ-SER20P2
USB Micro to USB A	1.0 m, USB to CAN Adapter to Laptop
AC Power	0.9 m, POE Adapter to AC Mains
DC Power	1.8 m, Laptop Power Supply to Laptop
Power	0.9 m, Laptop Power Supply to AC Mains

For the radiated emissions evaluation, the support equipment was set outside of the test environment.

Table 1.4.1-2 – Support Equipment Descriptions

Make/Model	Description
Makerbase / MKS CANable V1.0	2.0 USB to CAN canbus adapter
Bogen /NQ-SER20P2	POE + NFC Supply
Ubiquity, Inc. / GP-H480-050G	48V POE Adapter, S/N: 2125-0005729
Dell / Latitude 3120	Laptop Computer, SN: 5TFLGY3
Dell / LA65NS2-01	19.5 VDC Laptop Power Supply, S/N: CN-506TM1C-LOC00-466-0C8F-A13



Declaration of Build Status

EQUIPMENT DESCRIPTION	
Model Name/Number	Nyquist NQ-SERPAIR
Part Number	N/A
Hardware Version	1.0
Software Version	1.0
FCC ID (if applicable)	FCC ID: CD2-NQSERPAIR01
ISED ID (if applicable)	IC: 1727A-NQSERPAIR
Technical Description (Please provide a brief description of the intended use of the equipment)	5V CAN Based NFC Antenna operating at 13.56 MHz It will be used to pair a BT handheld microphone to a Bluetooth Receiver in a Classroom/Lecture hall.

UN-INTENTIONAL RADIATOR	
Highest frequency generated or used in the device or on which the device operates or tunes	80 MHz
Lowest frequency generated or used in the device or on which the device operates or tunes	125 kHz
Class A Digital Device (Use in commercial, industrial or business environment) X	
Class B Digital Device (Use in residential environment only)	

Power Source			
AC	Single Phase	Three Phase	Nominal Voltage
		☐	
External DC	Nominal Voltage	Maximum Current	
	5.0 VDC	300 mA	
Battery	Nominal Voltage	Battery Operating End Point Voltage	

EXTREME CONDITIONS			
Maximum temperature	+40 °C	Minimum temperature	-5 °C

Ancillaries
Please list all ancillaries which will be used with the device.
NQ-SER20P2, NQ-SEHMIC, NQ-SEPMIC, NQ-SECSTAT,

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

Name: Ray Pace

Position held: Senior EE

Date: 05/15/2025



1.4.2 Modes of Operation

The EUT was evaluated for the 13.56 MHz NFC reader in continuous transmission mode. The reader was pre-configured to be on upon power up. The TX output power was not configurable during testing. The EUT was powered with 5 VDC through the NQ-SER20P2 device. The EUT was communicating to a laptop computer through a USB to CAN adapter. The laptop was running a Nyquist Can NFC Test v1.0.0 application which allowed to enable or disable the NFC device.

For the power line conducted emissions evaluation, a second sample was used with a matching dummy load at the antenna port for the measurement of the transmitter frequency range of operation.

1.4.3 Monitoring of Performance

The EUT was evaluated to the requirements of FCC Section 15.225 and ISSED Canada RSS-210 Annex B.6.

1.4.4 Performance Criteria

The EUT was evaluated for the following performance criteria.

Table 1.4.4-1 – Performance Criteria

Parameter	Requirement
Antenna Requirement	FCC: Section 15.203, 15.204
20 dB Bandwidth	FCC: Section 15.215(c)
99% Bandwidth	ISED Canada: RSS-GEN 6.7
Radiated Field Strength of Emissions within the 13.110-14.010 band	FCC: Section 15.225 (a),(b),(c); ISED Canada: RSS-210 Annex B.6 (a)
Radiated Field Strength of Emissions outside of the 13.110-14.010 band	FCC: Section 15.209, 15.225; ISED Canada: RSS-210 7.2, RSS-210 Annex B.6 (a), RSS-GEN 8.9
Power Line Conducted Emissions	FCC: Section 15.207; ISED Canada: RSS-GEN 8.8
Frequency Tolerance of the Carrier Signal	FCC: Section 15.225(e); ISED Canada: RSS-210 B.6 (b)
Duty Cycle of the Test Mode of Operation	N/A

1.5 Deviations from the Standard

The EUT uses an IC with a USB positive overvoltage protection controller with an overvoltage Lockout (OVLO) threshold ranging between 5.43 V to 5.9 V. The circuit turns off the transmitter once the voltage exceeds the OVLO threshold. The upper extreme voltage used for the frequency stability measurements was limited to the maximum input voltage permitted by the IC.



1.6 EUT Modification Record

The table below details modifications made to the EUT during the test programme. The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
None	N/A	N/A	N/A

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
20 dB Bandwidth	Thierry Jean-Charles	A2LA
99% Bandwidth	Thierry Jean-Charles	A2LA
Radiated Field Strength of Emissions within the 13.110-14.010 band	Thierry Jean-Charles	A2LA
Radiated Field Strength of Emissions outside of the 13.110-14.010 band	Thierry Jean-Charles	A2LA
Power Line Conducted Emissions	Thierry Jean-Charles	A2LA
Frequency Tolerance of Carrier Signal	Thierry Jean-Charles	A2LA
Duty Cycle of the Test Mode of Operation	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

SN: N/A

2.1.3 Date of Test

5/6/2025

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 printed loop antenna which is integral to the transceiver's PCB. The antenna is not replaceable 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 20 dB Bandwidth

2.2.1 Specification Reference

FCC: Section 15.215(c)

2.2.2 Equipment Under Test and Modification State

SN: N/A

2.2.3 Date of Test

5/8/2025

2.2.4 Test Method

The 20 dB bandwidth was measured in accordance with ANSI C63.10 Subclause 6.9.2. The spectrum analyzer span was set between two times and five times the OBW. The RBW of the spectrum analyzer was set to 1% to 5% of the OBW. The VBW was approximately three times RBW. A peak detector was used for the measurements.

2.2.5 Environmental Conditions

Ambient Temperature	23.8°C
Relative Humidity	42.2 %
Atmospheric Pressure	1015.7 mbar

2.2.6 Test Results

DC Powered Operating

Limit Clause FCC Part 15.215

The intentional radiator must be designed to ensure that the 20 dB bandwidth of the emission is contained within the frequency band designated in the rule section under which the equipment is operated.

Table 2.2.6-1 – 20 dB Bandwidth Test Results

Frequency (MHz)	20 dB Bandwidth (kHz)
13.56	426.16

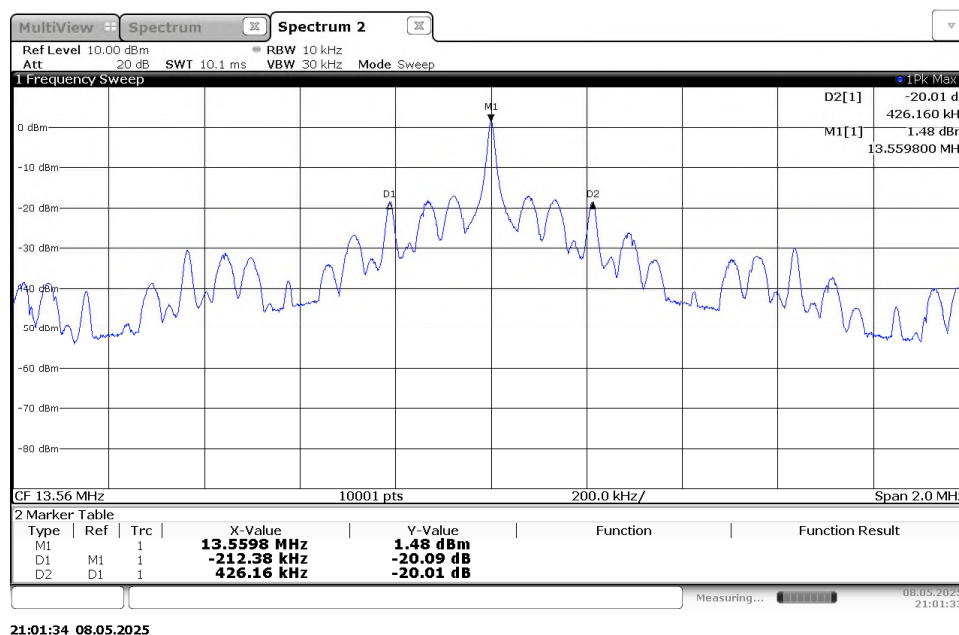


Figure 2.2.6-1 – 20 dB Bandwidth Test Results

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
Duratest 175 Cable 26.5GHz	Teledyne Storm Products	921-0101-036	BEMC02112	N/A	12	18-Oct-2025
PCB Loop Antenna	FAU EMI R&D Lab	EMI-LOOP	BEMC02141	N/A	N/A	NCR
Atten 10dB 2.9mm-M/F, DC-26.5GHz, 2W	Aeroflex Inmet	26AH-10	DEMC3046	N/A	12	25-Jun-2025
Signal & Spectrum Analyzer	Rohde & Schwarz	FSW43	DEMC3085	2.90 SP1	12	03-Jun-2025

TU - Traceability Unscheduled

O/P MON - Output Monitored with Calibrated Equipment

N/A - Not Applicable

NCR – No Calibration Required



2.3 99% Bandwidth

2.3.1 Specification Reference

ISED Canada: RSS-GEN 6.7

2.3.2 Equipment Under Test and Modification State

SN: N/A

2.3.3 Date of Test

5/8/2025

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 23.8°C
Relative Humidity 42.2 %
Atmospheric Pressure 1015.7 mbar

2.3.6 Test Results

DC Powered Operating

Limit Clause ISED RSS-GEN 6.6

Table 2.3.6-1 – 99% dB Bandwidth Test Results

Frequency (MHz)	99% Bandwidth (kHz)
13.56	598.0677

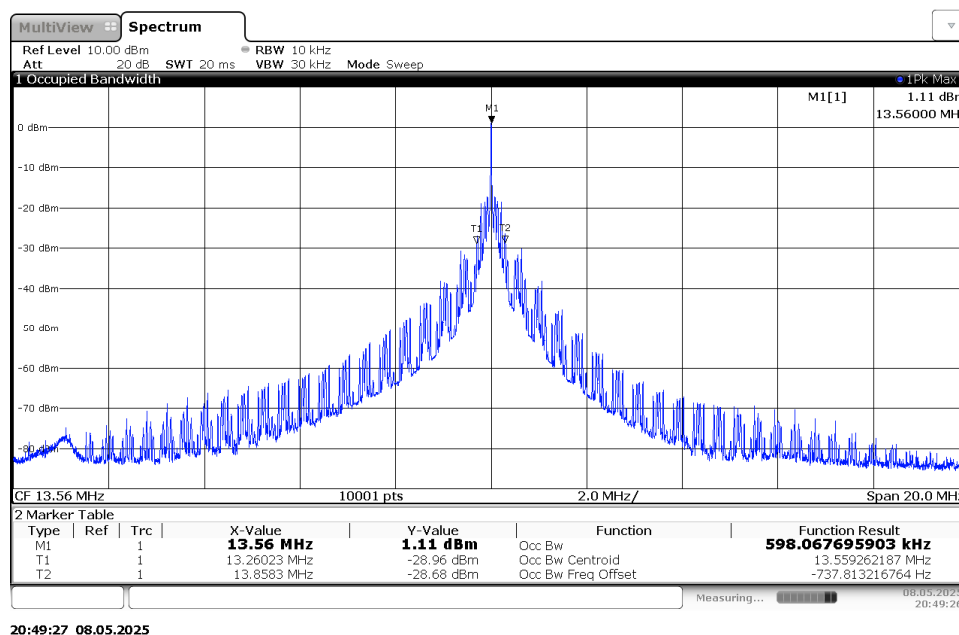


Figure 2.3.6-1 – 99% Bandwidth Test Results

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
Duratest 175 Cable 26.5GHz	Teledyne Storm Products	921-0101-036	BEMC02112	N/A	12	18-Oct-2025
PCB Loop Antenna	FAU EMI R&D Lab	EMI-LOOP	BEMC02141	N/A	N/A	NCR
Atten 10dB 2.9mm-M/F, DC-26.5GHz, 2W	Aeroflex Inmet	26AH-10	DEMC3046	N/A	12	25-Jun-2025
Signal & Spectrum Analyzer	Rohde & Schwarz	FSW43	DEMC3085	2.90 SP1	12	03-Jun-2025

TU - Traceability Unscheduled

O/P MON - Output Monitored with Calibrated Equipment

N/A - Not Applicable

NCR – No Calibration Required



2.4 Radiated Field Strength of Emissions within the 13.110-14.010 band

2.4.1 Specification Reference

FCC Sections: 15.225(a),(b),(c);
ISED Canada: RSS-210 Annex B.6(a)

2.4.2 Equipment Under Test and Modification State

SN: N/A

2.4.3 Date of Test

5/7/2025

2.4.4 Test Method

Radiated emissions tests were made over the frequency range of 13.110 to 14.010 MHz. The receive antenna height was set to 1 m and the EUT was rotated through 360 degrees. The resolution bandwidth was set to 9 kHz, and a Quasi-Peak detector was used. The emissions were assessed against the radiated emission limits as defined in FCC Sections: 15.225(a),(b),(c) and ISED Canada: RSS-210 Annex B.6(a).

2.4.5 Environmental Conditions

Ambient Temperature 25.2 °C
Relative Humidity 36.2 %
Atmospheric Pressure 1013.7 mbar

2.4.6 Test Results

DC Powered Operating

Limit Clause FCC Sections 15.225 (a),(b),(c), ISED Canada: RSS-210 Annex B.6 (a)

Frequency (MHz)	Field Strength (microvolts/meter)	Field Strength (dBuV/m)	Measurement Distance (meters)
13.110 – 13.410	106	40.5	30
13.410 – 13.553	334	50.5	30
13.553 – 13.567	15,848	84	30
13.567 – 13.710	334	50.5	30
13.710 – 14.010	106*	40.5	30

Radiated measurements were performed at a distance closer than 30m as required, according to Part 15.209. Therefore, a correction factor was applied to account for propagation loss at the specified distance. The propagation loss was determined by using the square of an inverse linear distance



extrapolation factor (40dB/decade) according to FCC Part 15.31 and ISED Canada's RSS-Gen 6.5. A sample calculation of the distance correction factor is shown below for limits expressed at a 30m measurement distance.

$$\begin{aligned}\text{Distance correction factor (30m Specified Test Distance)} &= 40 * \text{Log (Test Distance/30)} \\ &= 40 * \text{Log (3/30)} \\ &= - 40 \text{ dB}\end{aligned}$$

Table 2.4.6-1 – Radiated Field Strength of Emissions within the 13.110-14.010 band

Frequency (MHz)	Quasi-peak (dBμV)	Height (cm)	Polarity	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV)
12.994000	23.8	100.0	V	0.0	39.9	45.8	69.5
13.270000	24.0	100.0	V	0.0	39.2	56.5	80.5
13.350000	27.8	100.0	V	0.0	38.9	52.7	80.5
13.430000	27.7	100.0	V	0.0	38.7	62.8	90.5
13.480000	29.3	100.0	V	0.0	38.6	61.1	90.5
13.546000	34.7	100.0	V	0.0	38.4	55.8	90.5
13.553000	56.4	100.0	V	0.0	38.4	34.1	90.5
13.560000	71.4	100.0	V	0.0	38.4	52.6	124.0
13.567000	56.9	100.0	V	0.0	38.3	67.1	124.0
13.578000	33.9	100.0	V	0.0	38.3	56.5	90.5
13.641000	28.8	100.0	V	0.0	38.1	61.7	90.5
13.696000	27.3	100.0	V	0.0	38.0	63.2	90.5
13.771000	27.4	100.0	V	0.0	37.8	53.1	80.5
13.851000	22.6	100.0	V	0.0	37.6	57.9	80.5
14.062000	20.6	100.0	V	0.0	37.0	48.9	69.5

Notes:

- The measurements were performed at a test distance of 3m. The limits are corrected using a distance correction factor of 40 dB per decade as described above.
- The results are reported for the worst case receive loop antenna orientation.
- All other emissions were attenuated below the noise floor of the measurement equipment.

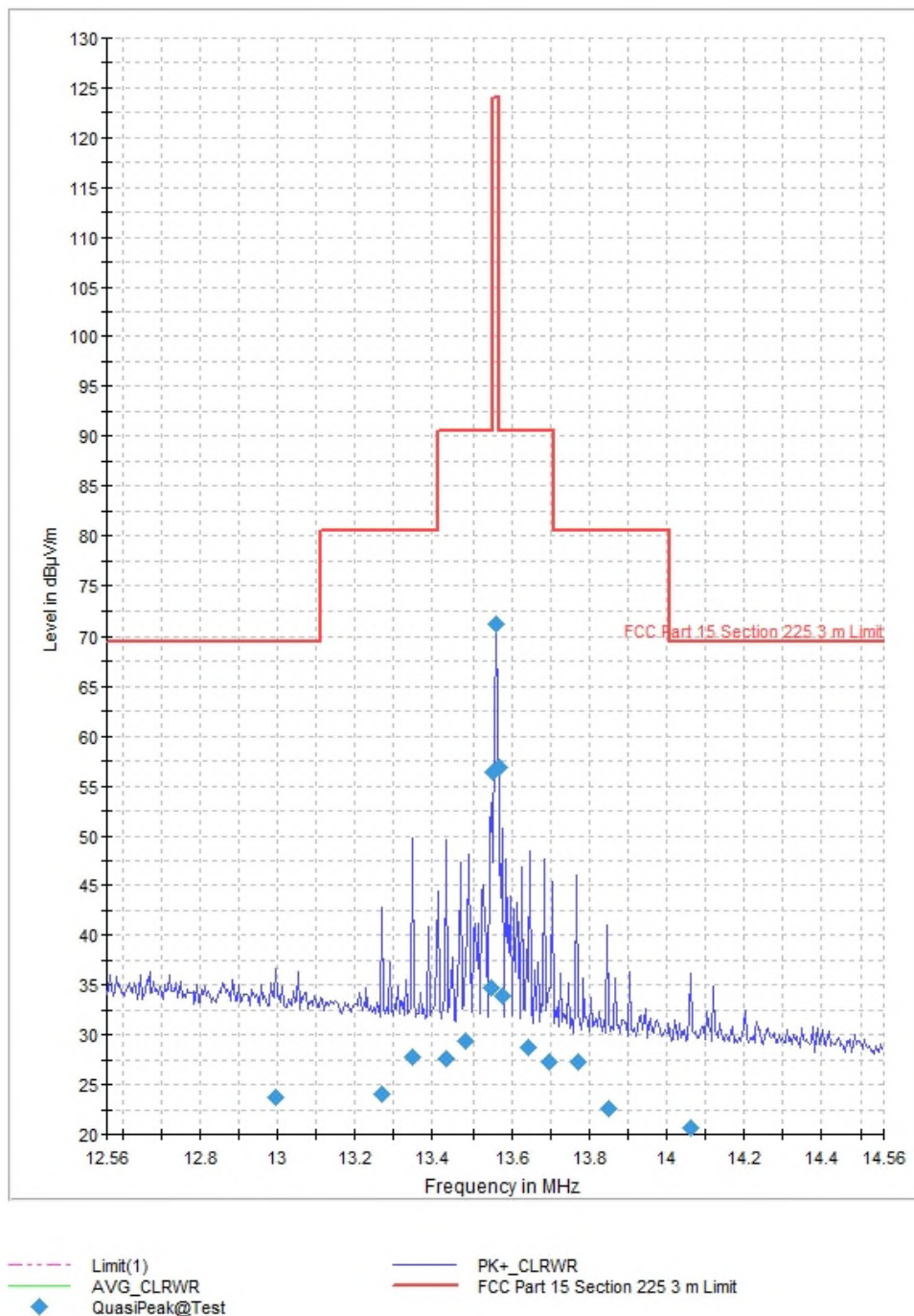


Figure 2.4.6-1 – Radiated Field Strength of Emissions within the 13.110-14.010 MHz band



2.4.7 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: Quasi-Peak

Corrected Level: $33 + 38.4 = 71.4 \text{ dB}\mu\text{V/m}$

Margin: $124 \text{ dB}\mu\text{V/m} - 71.4 \text{ dB}\mu\text{V/m} = 52.6 \text{ dB}$

2.4.8 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
Active Loop Antenna	EMCO	6502	BEMC00078	N/A	24	06-Sep-2025
EMC Chamber	Panashield	N/A	TEMC00031	N/A	24	19-Oct-2025
Loop Antenna	Electro-metrics	ALR 30M	TEMC00075	N/A	24	26-Jun-2025
Test Software	Rohde & Schwarz	EMC32	TEMC00184	11.50.00	N/A	NCR
R & S ESW EMI Test Receiver	Rohde & Schwarz	ESW	TEMC00232	2.00 SP1	12	04-Jun-2025
DC to 18 GHz Cable	SSI Technologies	2801-03-03-360/WN	TEMC00293	N/A	12	13-Dec-2025

TU - Traceability Unscheduled

O/P MON - Output Monitored with Calibrated Equipment

N/A - Not Applicable

NCR – No Calibration Required



2.5 Radiated Field Strength of Emissions outside of the 13.110-14.010 band

2.5.1 Specification Reference

FCC Sections: 15.225(d), 15.209;
ISED Canada: RSS-210 7.2, RSS-210 Annex B.6(a), RSS-GEN 8.9

2.5.2 Equipment Under Test and Modification State

SN: N/A

2.5.3 Date of Test

5/6/2025 to 5/7/2025

2.5.4 Test Method

Radiated emissions tests were made over the frequency range of 9 kHz to 1 GHz, 10 times the highest fundamental frequency. Each emission 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.

2.5.5 Duty Cycle Correction

The EUT was configured to transmit at 75.8% duty cycle during the evaluation. The measured transmission time was 192.6 ms which is greater than the 100 ms observation period for duty cycle correction calculation. Therefore, a Duty Cycle Correction of 100% corresponding to $20 \cdot \log(100/100) = 0$ dB was applied to the average measurements for the corrected average results.

2.5.6 Environmental Conditions

Ambient Temperature	23.7 °C
Relative Humidity	36.9 %
Atmospheric Pressure	1014.2 mbar



2.5.7 Test Results

DC Powered Operating

Limit Clause FCC Sections 15.209, 15.225(d), ISED Canada: RSS-210 7.2, RSS-GEN 8.9

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

Radiated measurements were performed at a distance closer than 300 meters and 30m as required, according to Part 15.209. Therefore, a correction factor was applied to account for propagation loss at the specified distance. The propagation loss was determined by using the square of an inverse linear distance extrapolation factor (40dB/decade) according to 15.31. A sample calculation of the distance correction factor is shown below for limits expressed at a 300m measurement distance and a 30m measurement distance.

Distance correction factor (300m Specified Test Distance) = $40 \cdot \log(\text{Test Distance}/300)$
 $= 40 \cdot \log(3/300)$
 $= -80 \text{ dB}$

Distance correction factor (30m Specified Test Distance) = $40 \cdot \log(\text{Test Distance}/30)$
 $= 40 \cdot \log(3/30)$
 $= -40 \text{ dB}$



Table 2.5.7-1 – Transmitter Radiated Spurious Emissions – Quasi-Peak Test Results below 30 MHz

Frequency (MHz)	Quasi-peak (dBμV)	Height (cm)	Polarity	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.506000	41.36	100.0	V	53.0	10.2	32.16	73.52
0.521000	41.18	100.0	V	312.0	10.2	32.09	73.27
0.637000	39.18	100.0	V	20.0	10.2	32.34	71.52
0.649000	38.98	100.0	V	0.0	10.2	32.38	71.36
0.741000	37.56	100.0	V	90.0	10.2	32.65	70.21
0.909000	35.42	100.0	V	81.0	10.2	33.02	68.43
0.977000	35.01	100.0	V	258.0	10.4	32.80	67.81
1.209000	32.57	100.0	V	236.0	10.5	33.39	65.96
1.241000	32.38	100.0	V	270.0	10.5	33.34	65.73
1.517000	30.54	100.0	V	90.0	10.5	33.44	63.99
1.557000	30.10	100.0	V	180.0	10.5	33.66	63.76
13.353000	21.51	100.0	V	19.0	11.0	58.99	80.51
27.120000	17.3	100.0	V	250.0	9.3	52.3	69.5

Notes:

- The measurements were performed at a test distance of 3m. The limits are corrected using a distance correction factor of 40 dB per decade as described above.
- The results are reported for the worst case receive loop antenna orientation.

**Table 2.5.7-2 – Transmitter Radiated Spurious Emissions – Average Test Results below 30 MHz**

Frequency (MHz)	Average (dBμV)	Height (cm)	Polarity	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.150000	29.83	100.0	V	46.0	10.2	74.25	104.08
0.158000	45.97	100.0	V	302.0	10.1	57.66	103.63
0.161000	46.16	100.0	V	306.0	10.1	57.30	103.47
0.162000	46.10	100.0	V	45.0	10.1	57.32	103.41
0.181000	44.96	100.0	V	26.0	10.1	57.49	102.45
0.189000	44.44	100.0	V	178.0	10.1	57.63	102.08
0.225000	42.64	100.0	V	220.0	10.1	57.92	100.56
0.253000	41.46	100.0	V	135.0	10.1	58.08	99.54
0.313000	39.64	100.0	V	211.0	10.0	58.05	97.69
0.337000	38.97	100.0	V	315.0	10.0	58.08	97.05
0.429000	36.90	100.0	V	45.0	10.0	58.06	94.96

Notes:

- The measurements were performed at a test distance of 3m. The limits are corrected using a distance correction factor of 40 dB per decade as described above.
- The results are reported for the worst case receive loop antenna orientation.

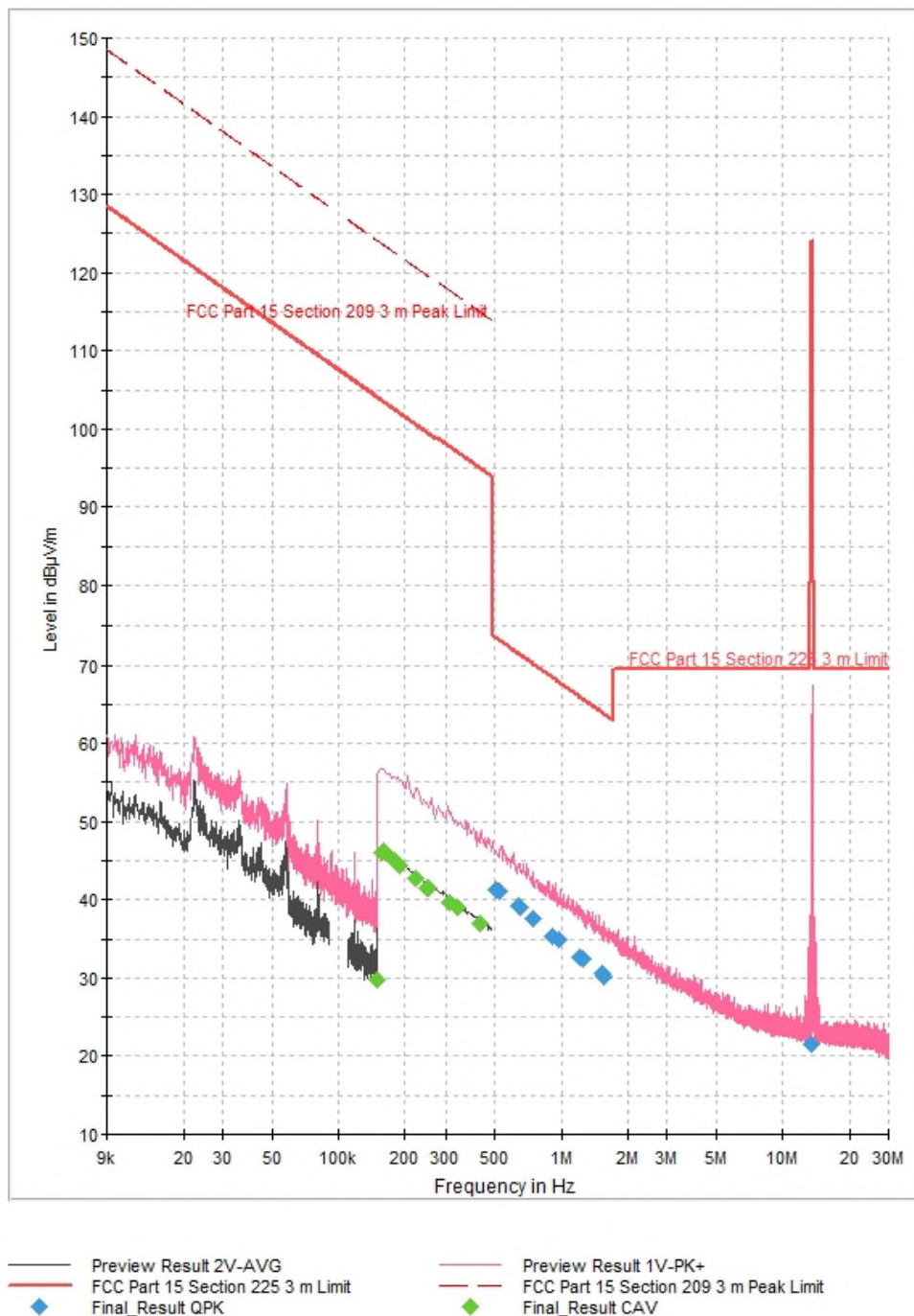


Figure 2.5.7-1 – Transmitter Radiated Spurious Emissions below 30 MHz

**Table 2.5.7-3 – Transmitter Radiated Spurious Emissions – Average Test Results above 30 MHz**

Frequency (MHz)	Quasi-peak (dBμV)	Height (cm)	Polarity	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV)
30.510000	19.08	338.0	V	270.0	25.7	20.92	40.00
30.780000	18.67	295.0	V	24.0	25.5	21.33	40.00
71.970000	21.39	180.0	V	0.0	13.2	18.61	40.00
76.290000	23.41	191.0	H	154.0	13.4	16.59	40.00
97.830000	16.29	174.0	V	173.0	17.1	27.21	43.50
127.140000	20.78	231.0	V	34.0	19.1	22.72	43.50
139.860000	21.79	221.0	V	77.0	18.3	21.71	43.50
480.990000	17.55	203.0	V	45.0	25.1	28.45	46.00
492.000000	17.73	150.0	V	222.0	25.1	28.27	46.00
622.260000	19.37	174.0	V	28.0	27.0	26.63	46.00
673.170000	19.04	175.0	V	90.0	26.9	26.96	46.00
764.790000	21.32	143.0	V	267.0	28.1	24.68	46.00

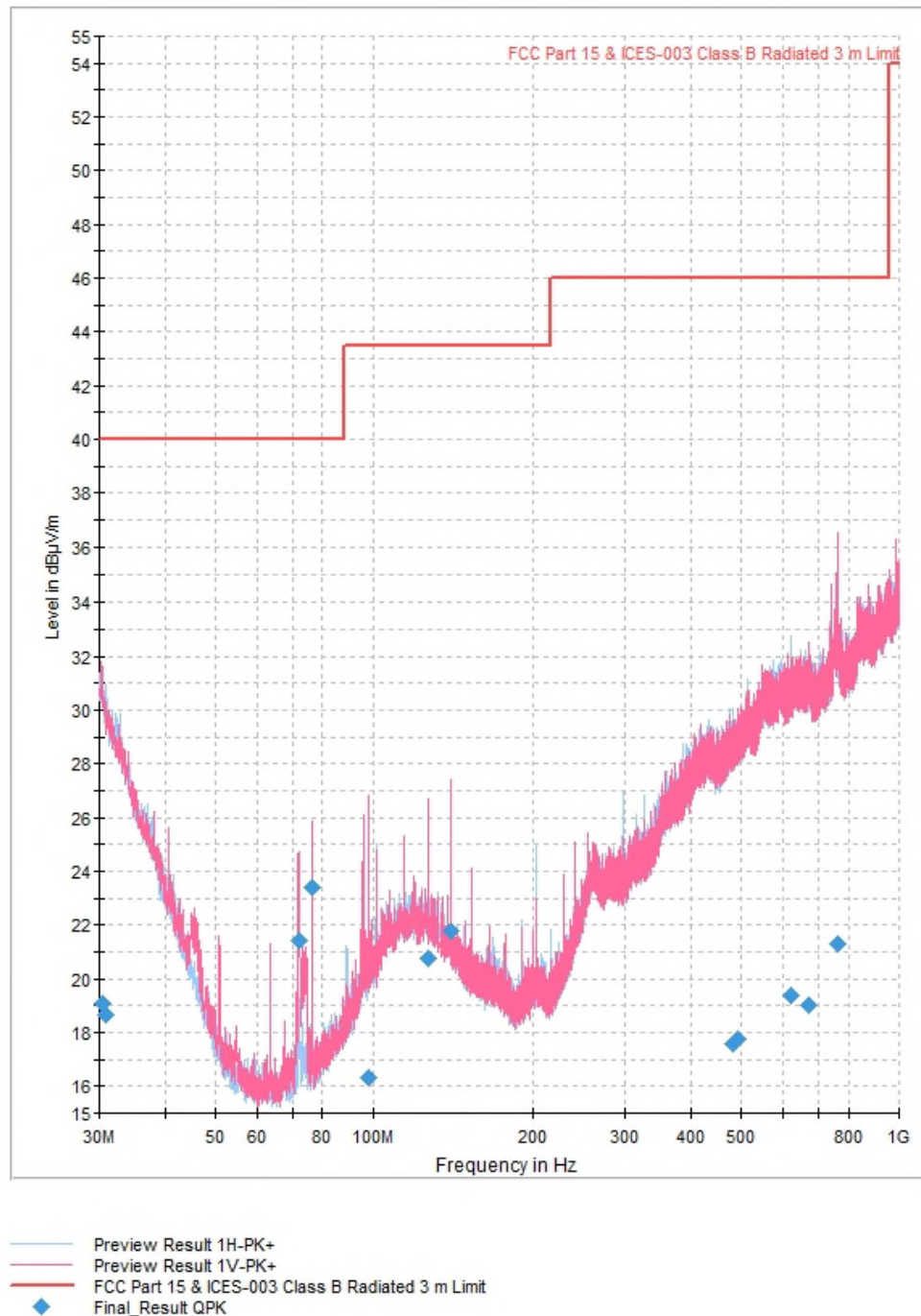


Figure 2.5.7-2 – Transmitter Radiated Spurious Emissions above 30 MHz



2.5.8 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: Quasi-Peak

Corrected Level: $31.16 + 10.2 = 41.36$ dB μ V/m

Margin: 73.52 dB μ V/m – 41.36 dB μ V/m = 32.16 dB

Example Calculation: Average

Corrected Level: $36 + 10.1 - 0 = 46.10$ dB μ V/m

Margin: 103.41 dB μ V/m – 46.10 dB μ V/m = 57.31 dB



2.5.9 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
Active Loop Antenna	EMCO	6502	BEMC00078	N/A	24	06-Sep-2025
100Hz-26.5GHz EMC analyzer/HYZ	Hewlett Packard	E7405A	BEMC00523	A.14.06	12	25-Jun-2025
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	07-Nov-2025
EMC Chamber	Panashield	N/A	TEMC00031	N/A	24	19-Oct-2025
Loop Antenna	Electro-metrics	ALR 30M	TEMC00075	N/A	24	26-Jun-2025
Test Software	Rohde & Schwarz	EMC32	TEMC00184	11.50.00	N/A	NCR
R & S ESW EMI Test Receiver	Rohde & Schwarz	ESW	TEMC00232	2.00 SP1	12	04-Jun-2025
DC to 18 GHz Cable	SSI Technologies	2801-03-03-360/WN	TEMC00293	N/A	12	13-Dec-2025

TU - Traceability Unscheduled

O/P MON - Output Monitored with Calibrated Equipment

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: N/A

2.6.3 Date of Test

5/8/2025 to 5/13/2025

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 23.7 - 23.9 °C
Relative Humidity 36.8 - 46.9 %
Atmospheric Pressure 1013.0 - 1015.7 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)
0.150000	52.36	N	20.2	13.64	66.00
0.217500	43.07	L1	20.2	19.84	62.91
0.582000	51.93	L1	20.2	4.07	56.00
1.279500	35.30	L1	20.3	20.70	56.00
3.502500	39.64	N	20.4	16.36	56.00
3.610500	39.91	N	20.4	16.09	56.00
13.560000	53.17	N	20.8	6.83	60.00
15.405000	37.83	N	20.9	22.17	60.00
18.559500	35.08	N	21.0	24.92	60.00

Table 2.6.6-2 – Power Line Conducted Emissions – Average Detector Results

Frequency (MHz)	Average (dBμV)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.150000	34.91	L1	20.2	21.09	56.00
0.213000	30.95	L1	20.2	22.13	53.09
0.586500	44.72	L1	20.2	1.28	46.00
1.248000	28.45	L1	20.3	17.55	46.00
3.529500	30.89	N	20.4	15.11	46.00
3.561000	30.96	N	20.4	15.04	46.00
13.560000	50.81	N	20.8	-0.81	50.00
15.265500	31.47	N	20.9	18.53	50.00
27.838500	33.04	L1	21.0	16.96	50.00

Note: The Measurements at 13.56 MHz were repeated with a matching load at the antenna port in accordance with the FCC KDB 174176 D01 Line Conducted FAQ v01r01.

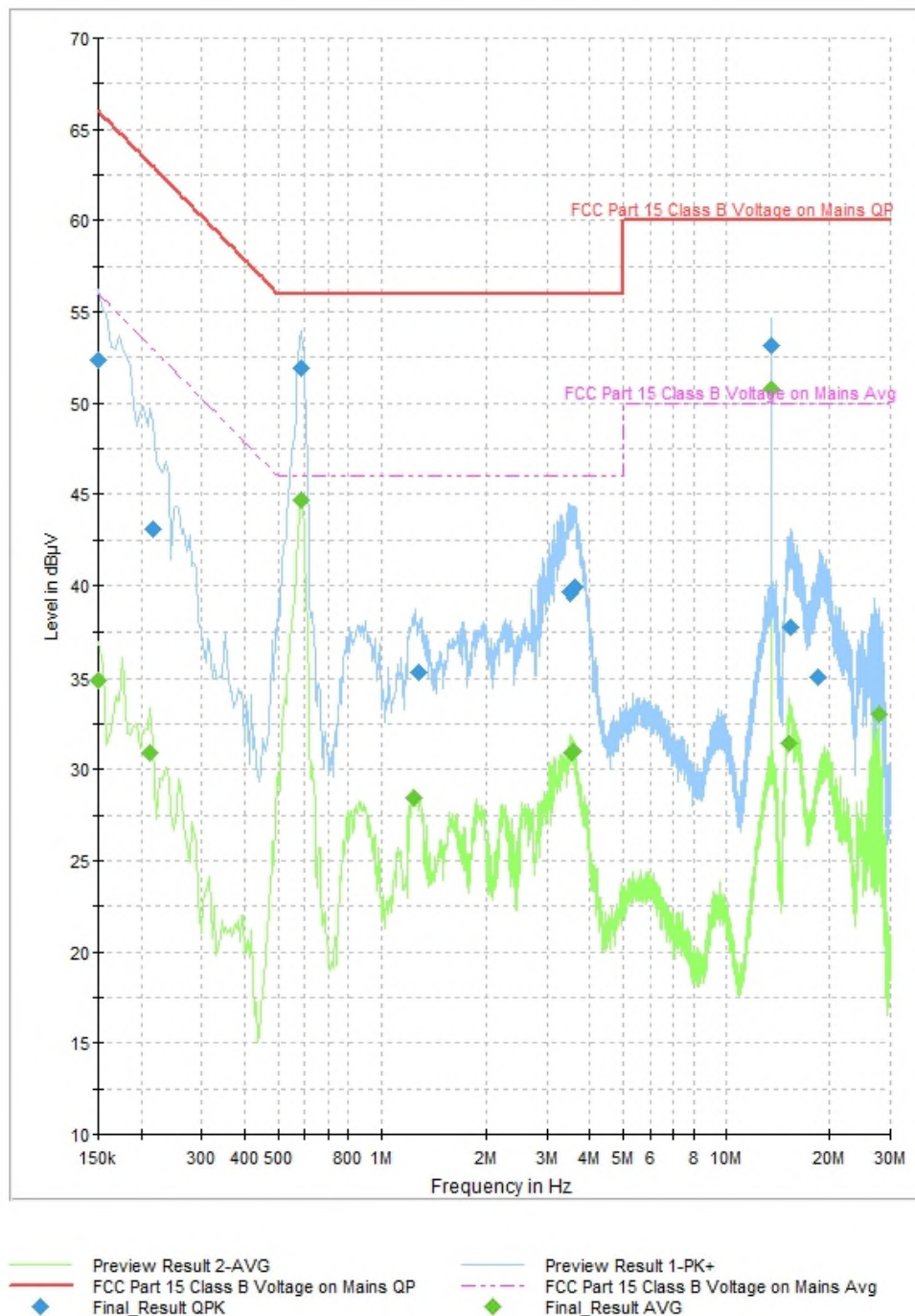


Figure 2.6.6-1 – Composite Power Line Conducted Emissions Plot



Table 2.6.6-3 – Power Line Conducted Emissions – Quasi-Peak Detector Results – Matching Load at the antenna port

Frequency (MHz)	Quasi-peak (dBμV)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
13.560000	47.9	N	20.8	12.1	60.0
13.560000	47.1	L1	20.8	12.9	60.0

Table 2.6.6-4 – Power Line Conducted Emissions – Average Detector Results – Matching Load at the antenna port

Frequency (MHz)	Average (dBμV)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
13.560000	25.6	N	20.8	24.4	50.0
13.560000	24.9	L1	20.8	25.1	50.0

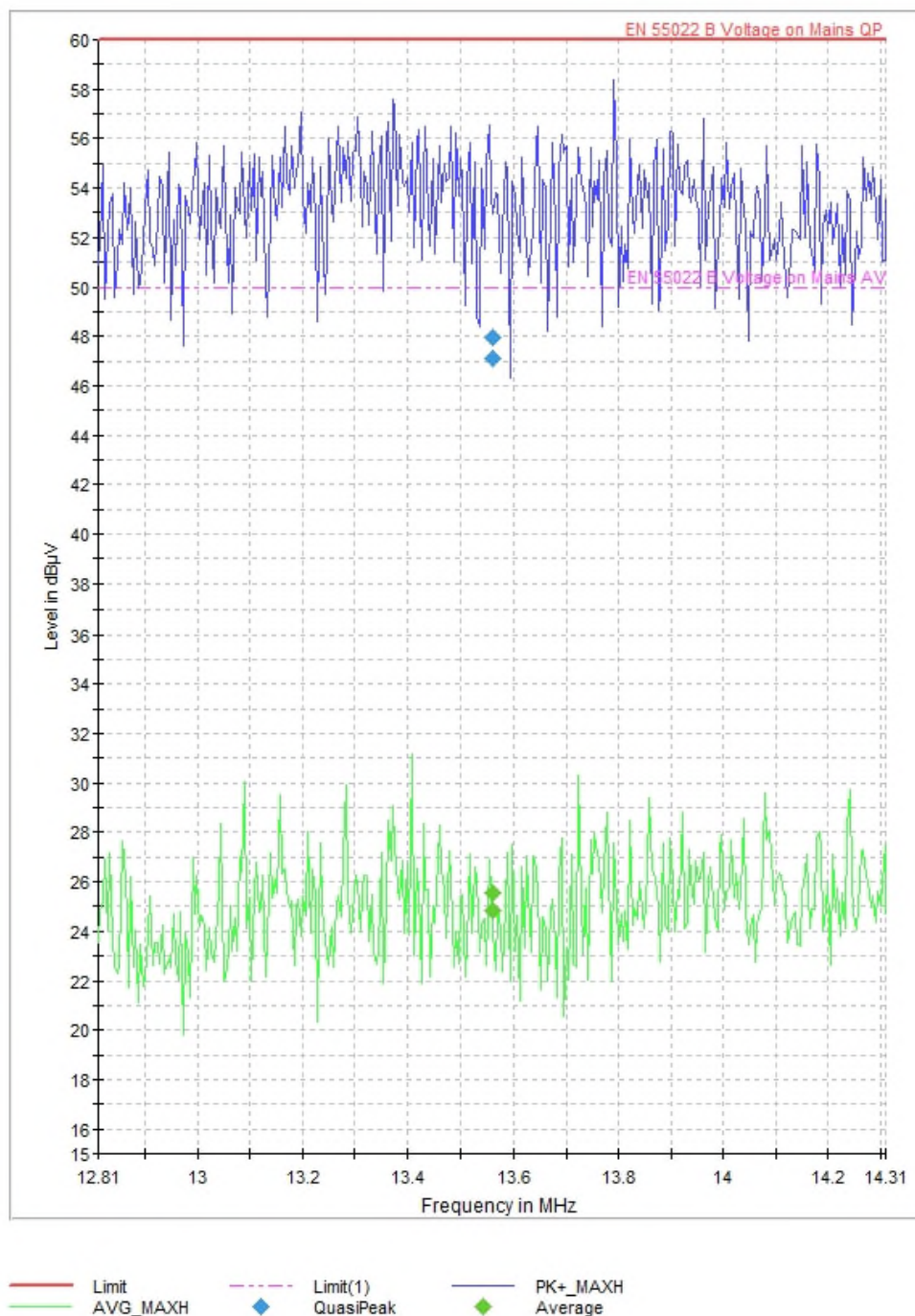


Figure 2.6.6-2 – Composite Power Line Conducted Emissions Plot – Matching Load



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
EMI Test Receiver	Rohde & Schwarz	ESCS30	TEMC00011	2.3003.0203.36	12	14-Jan-2026
RFI/EMI Shielded Enclosure	UNIVERSAL SHIELDING CORP.	N/A	TEMC00100	N/A	N/A	NCR
Test Software	Rohde & Schwarz	EMC32	TEMC00184	10.50.00	N/A	NCR
Two Line V Network	Rohde & Schwarz	ENV 216	TEMC00244	N/A	12	06-Jun-2025
2-Line V-Network	Rohde & Schwarz GmbH & Co. KG	ENV216	TEMC00290	N/A	12	06-Jun-2025
Conducted cable with UNAT-10+ attenuator	L-com	RG58C/U	TEMC00291	N/A	12	18-Oct-2025

TU - Traceability Unscheduled

O/P MON - Output Monitored with Calibrated Equipment

N/A - Not Applicable

NCR – No Calibration Required



2.7 Frequency Tolerance of Carrier Signal

2.7.1 Specification Reference

FCC Section 15.225(e);
ISED Canada RSS-210 Annex B.6(b)

2.7.2 Equipment Under Test and Modification State

Model: Nyquist NQ-SERPAIR, Serial Number: N/A

2.7.3 Date of Test

2025-May-09

2.7.4 Test Method

Frequency stability measurements with respect to ambient temperature and when varying voltage were performed in accordance with ANSI C63.10 section 6.8 and ISED Canada RSS-GEN 6.11. The measurements were performed using a spectrum analyzer. Sufficient stabilization period was used at each temperature prior to each measurement.

2.7.5 Environmental Conditions

Ambient Temperature 23.8 °C
Relative Humidity 42.2 %
Atmospheric Pressure 1015.7 mbar

2.7.6 Test Results

Limit Clause FCC Sections 15.225(e), ISED Canada: RSS-210 B.6 (b)

	Carrier Frequency Tolerance Limits	
Temperature Range	FCC 15.225 (e)	RSS-210 B6 (b)
-20 C to +50C	0.01%	100 ppm



Frequency Stability

Frequency (MHz): 13.560121
 Deviation Limit (%): 0.01
 Deviation Limit (PPM): 100.00
 Nominal Voltage (VDC): 5

Temperature C	Frequency MHz	Frequency Error		Voltage (%)	Voltage (VDC)
		(%)	PPM		
-20 C	13.560238	0.00087	8.67986	100%	5.00
-10 C	13.560250	0.00096	9.57219	100%	5.00
0 C	13.560238	0.00087	8.67249	100%	5.00
10 C	13.560191	0.00052	5.17695	100%	5.00
20 C	13.560121	0.00000	0.00000	100%	5.00
30 C	13.560058	-0.00046	-4.64598	100%	5.00
40 C	13.560004	-0.00086	-8.56187	100%	5.00
50 C	13.559965	-0.00115	-11.48220	100%	5.00
20 C	13.560130	0.00007	0.70796	85%	4.25
20 C	13.560136	0.00012	1.16518	112%	5.60

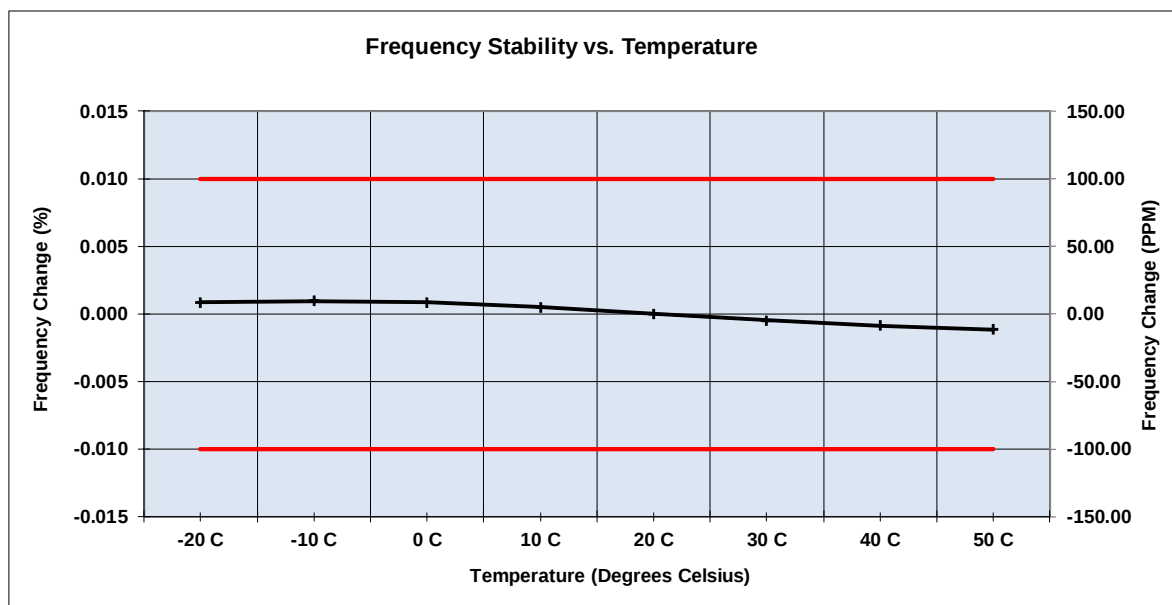


Figure 2.7.6-1 – Frequency Tolerance of Carrier Signal Result

Note: The EUT uses an IC with a USB positive overvoltage protection controller with an overvoltage Lockout (OVLO) threshold ranging between 5.43 V to 5.9 V. The circuit turns off the transmitter once the voltage exceeds the OVLO threshold. The measurements were performed using the maximum input voltage permitted by the IC, 5.6 VDC, which is 112% of the nominal voltage.



2.7.7 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
Digital Thermometer	US-Omega Engineering	MDSS41-TC	BEMC00002	N/A	24	19-Sep-2025
Digital MultiMeter	Fluke	115	BEMC02108	N/A	12	15-Jan-2026
PCB Loop Antenna	FAU EMI R&D Lab	EMI-LOOP	BEMC02141	N/A	N/A	NCR
Signal & Spectrum Analyzer	Rohde & Schwarz	FSW43	DEMC3085	2.90 SP1	12	03-Jun-2025
DC Power Supply	Xantrex	HPD-60-5	TAME01064	N/A	N/A	NCR
Temperature Test Chamber	Sun Electronic Systems, Inc.	EC127	TEMC00242	5.10	N/A	NCR
Flexible Test Cable	Mini-Circuits	ULC-8FT-SMSM+	TEMC00267	N/A	12	20-Feb-2026
SMA Fixed Attenuator Kit	Mini Circuits	K2-BW2+	TEMC00272	N/A	12	05-Mar-2026

TU - Traceability Unscheduled

O/P MON - Output Monitored with Calibrated Equipment

N/A - Not Applicable

NCR – No Calibration Required



2.8 Duty Cycle of the Test Mode of Operation

2.8.1 Specification Reference

FCC: Section: N/A
ISED Canada: N/A

2.8.2 Equipment Under Test and Modification State

S/N: N/A

2.8.3 Date of Test

5/15/2025

2.8.4 Test Method

The spectrum analyzer's RBW was set to $\geq$ OBW or the largest value. The measurements were performed using a Peak detector.

2.8.5 Environmental Conditions

Ambient Temperature 23.7 °C
Relative Humidity 38.5 %
Atmospheric Pressure 1013.4 mbar

2.8.6 Test Results

DC Powered, Operating

Table 2.8.6-1: Duty Cycle Results

Frequency (MHz)	Tx On (ms)	Period (ms)	Duty Cycle (%)
13.56	192.6	254.2	75.8%

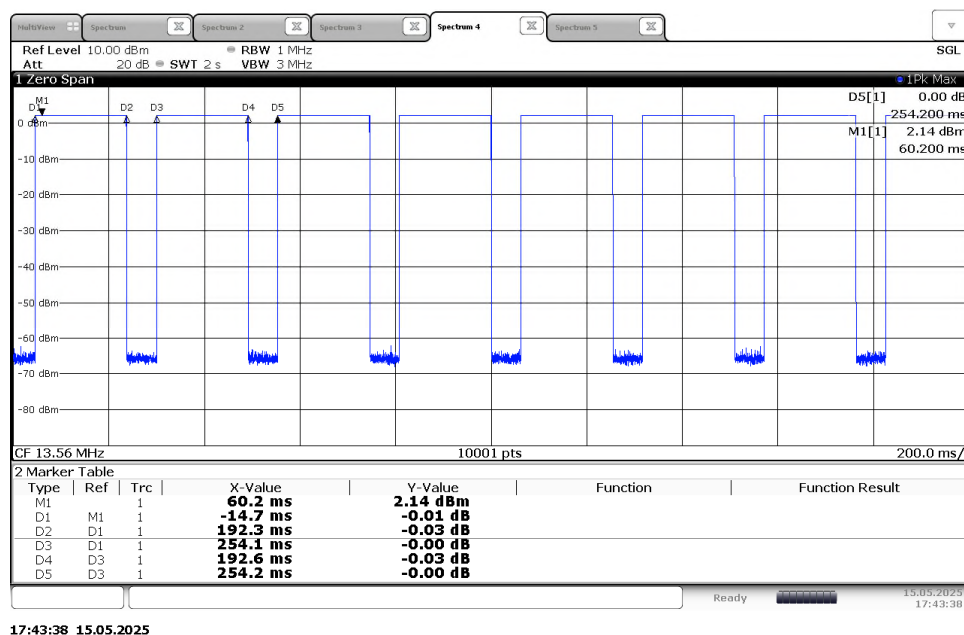


Figure 2.8.6-1: Duty Cycle Results

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
Duratest 175 Cable 26.5GHz	Teledyne Storm Products	921-0101-036	BEMC02112	N/A	12	18-Oct-2025
PCB Loop Antenna	FAU EMI R&D Lab	EMI-LOOP	BEMC02141	N/A	N/A	NCR
Atten 10dB 2.9mm-M/F, DC-26.5GHz, 2W	Aeroflex Inmet	26AH-10	DEMC3046	N/A	12	25-Jun-2025
Signal & Spectrum Analyzer	Rohde & Schwarz	FSW43	DEMC3085	2.90 SP1	12	03-Jun-2025

TU - Traceability Unscheduled

O/P MON – Output Monitored with Calibrated Equipment

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
Duratest 175 Cable 26.5GHz	Teledyne Storm Products	921-0101-036	BEMC02112	N/A	12	18-Oct-2025
PCB Loop Antenna	FAU EMI R&D Lab	EMI-LOOP	BEMC02141	N/A	N/A	NCR
Atten 10dB 2.9mm-M/F, DC-26.5GHz, 2W	Aeroflex Inmet	26AH-10	DEMC3046	N/A	12	25-Jun-2025
Signal & Spectrum Analyzer	Rohde & Schwarz	FSW43	DEMC3085	2.90 SP1	12	03-Jun-2025
Active Loop Antenna	EMCO	6502	BEMC00078	N/A	24	06-Sep-2025
100Hz-26.5GHz EMC analyzer/HYZ	Hewlett Packard	E7405A	BEMC00523	A.14.06	12	25-Jun-2025
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	07-Nov-2025
EMC Chamber	Panashield	N/A	TEMC00031	N/A	24	19-Oct-2025
Loop Antenna	Electro-metrics	ALR 30M	TEMC00075	N/A	24	26-Jun-2025
Test Software	Rohde & Schwarz	EMC32	TEMC00184	10.50.00 / 11.50.00	N/A	NCR
R & S ESW EMI Test Receiver	Rohde & Schwarz	ESW	TEMC00232	2.00 SP1	12	04-Jun-2025
DC to 18 GHz Cable	SSI Technologies	2801-03-03-360/WN	TEMC00293	N/A	12	13-Dec-2025
EMI Test Receiver	Rohde & Schwarz	ESCS30	TEMC00011	2.3003.0203.36	12	14-Jan-2026
RFI/EMI Shielded Enclosure	UNIVERSAL SHIELDING CORP.	N/A	TEMC00100	N/A	N/A	NCR
Two Line V Network	Rohde & Schwarz	ENV 216	TEMC00244	N/A	12	06-Jun-2025
2-Line V-Network	Rohde & Schwarz GmbH & Co. KG	ENV216	TEMC00290	N/A	12	06-Jun-2025
Conducted cable with UNAT-10+ attenuator	L-com	RG58C/U	TEMC00291	N/A	12	18-Oct-2025
Digital Thermometer	US-Omega Engineering	MDSS41-TC	BEMC00002	N/A	24	19-Sep-2025
Digital MultiMeter	Fluke	115	BEMC02108	N/A	12	15-Jan-2026
PCB Loop Antenna	FAU EMI R&D Lab	EMI-LOOP	BEMC02141	N/A	N/A	NCR
Temperature Test Chamber	Sun Electronic Systems, Inc.	EC127	TEMC00242	5.10	N/A	NCR
Flexible Test Cable	Mini-Circuits	ULC-8FT-SMSM+	TEMC00267	N/A	12	20-Feb-2026
SMA Fixed Attenuator Kit	Mini Circuits	K2-BW2+	TEMC00272	N/A	12	05-Mar-2026



TU - Traceability Unscheduled
O/P MON - Output Monitored with Calibrated Equipment
N/A - Not Applicable
NCR – No Calibration Required

4 Diagram of Test Set-ups

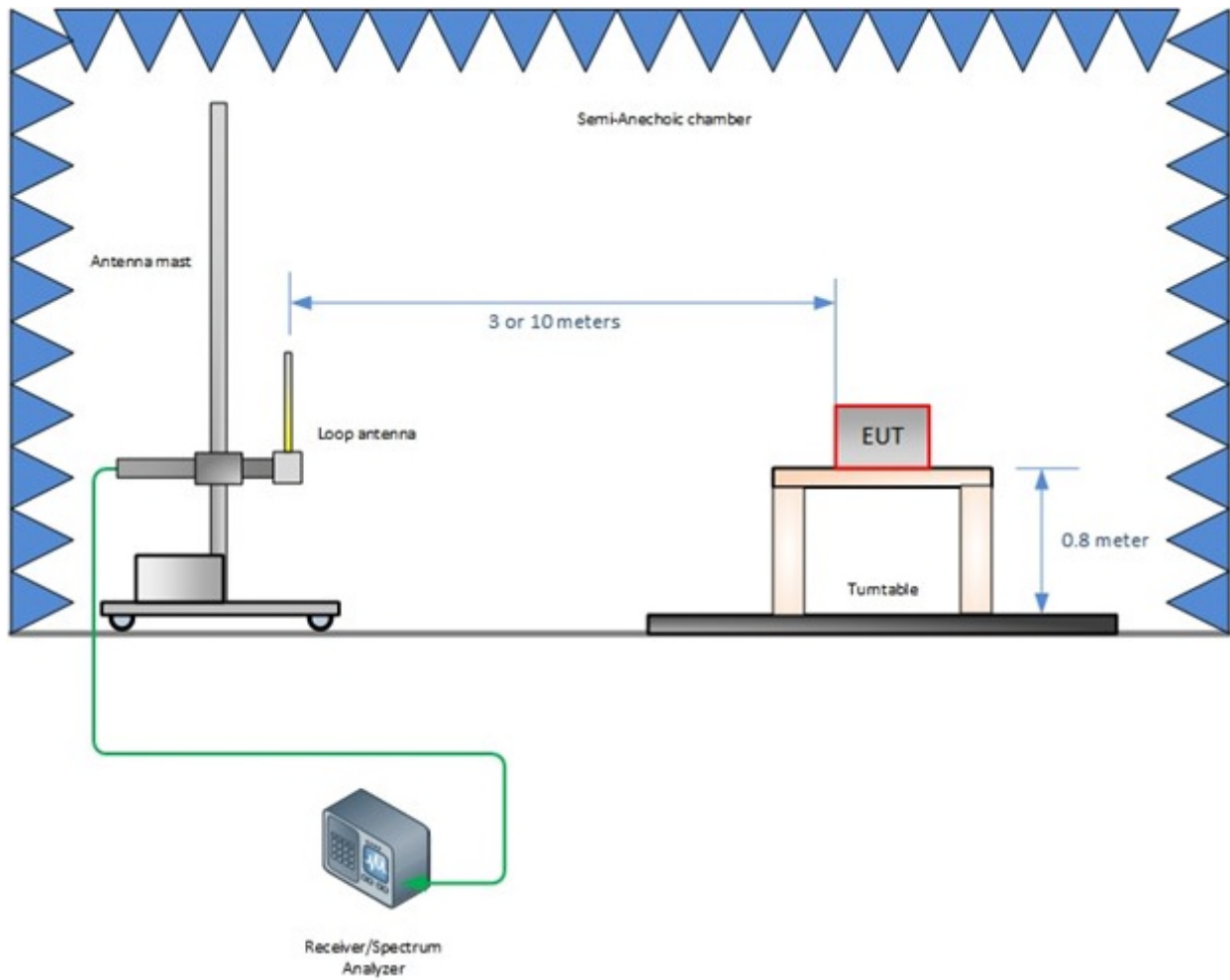


Figure 2.8.7-1 - Radiated Emissions Test Setup up to 30 MHz

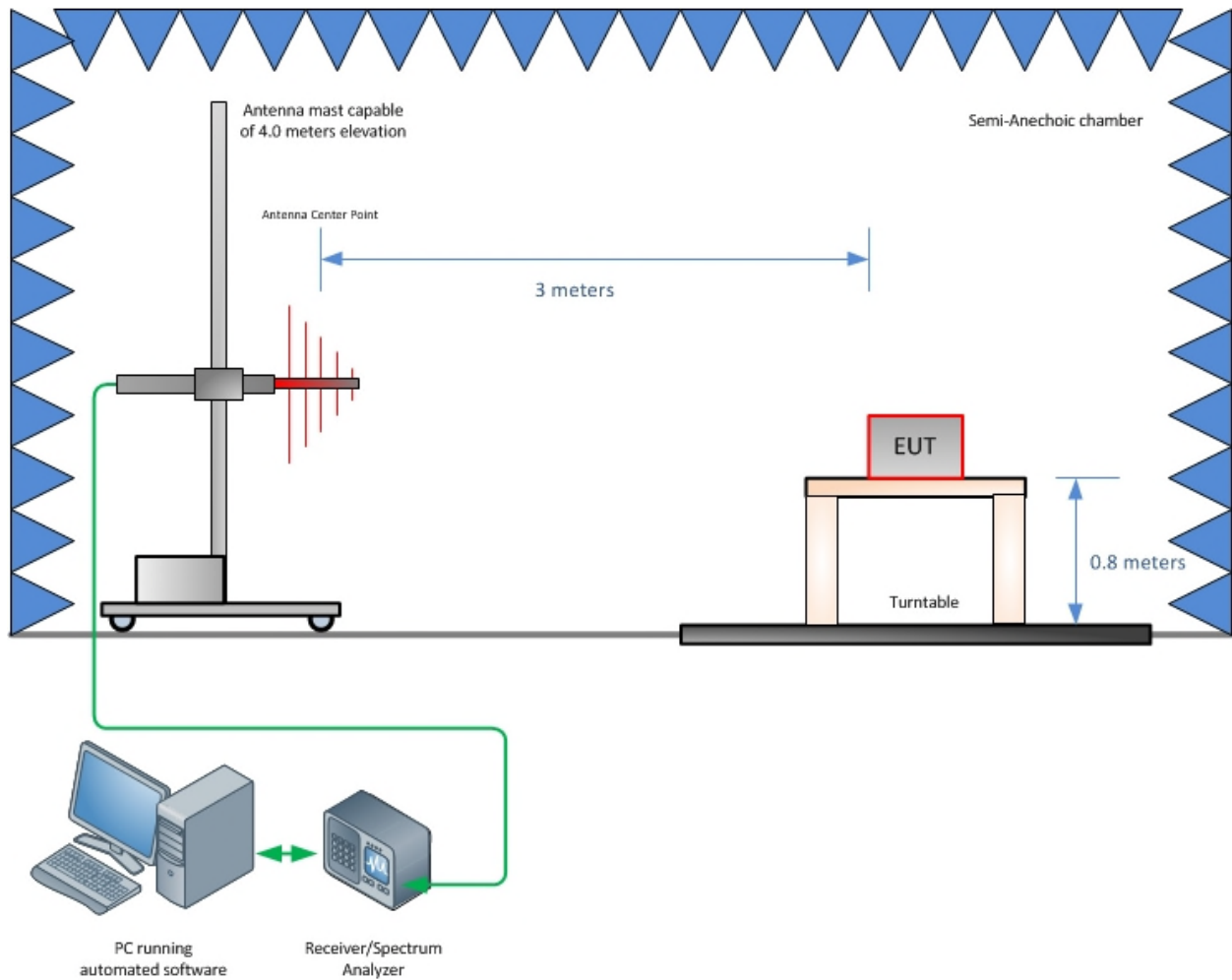


Figure 2.8.7-2 - Radiated Emissions Test Setup up to 1 GHz

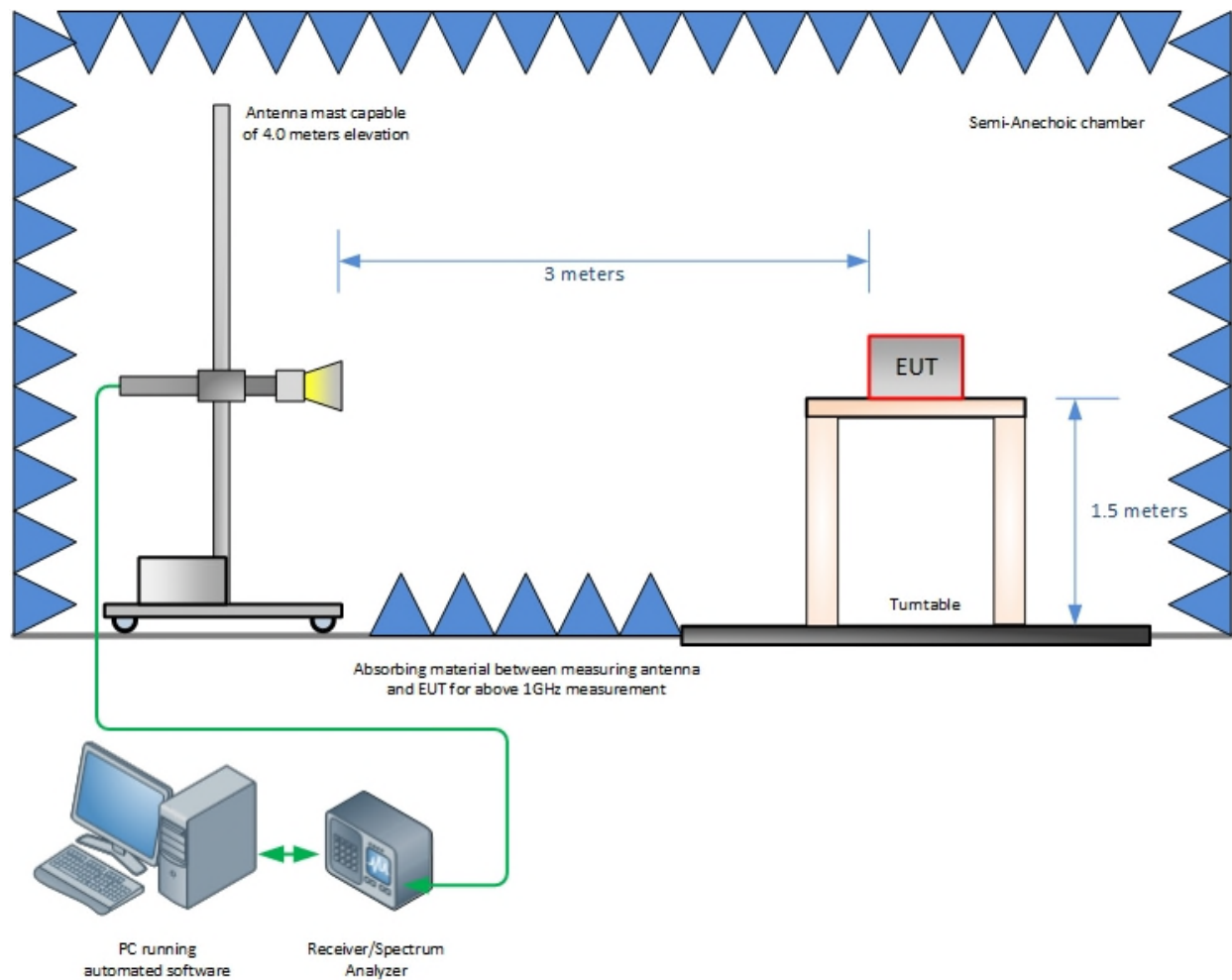


Figure 2.8.7-3 - Radiated Emissions Test Setup above 1 GHz

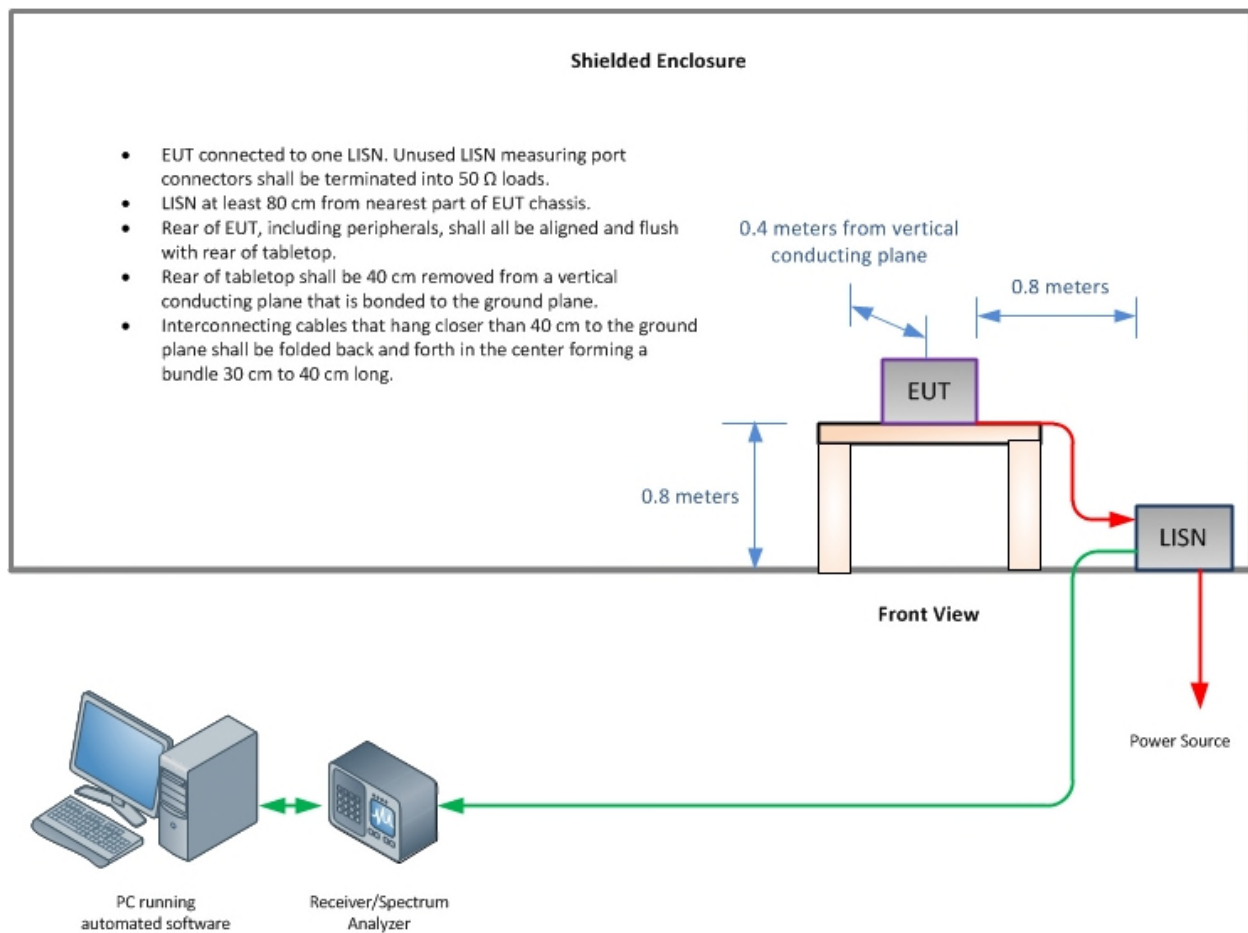


Figure 2.8.7-4 - Conducted Emissions Test Setup

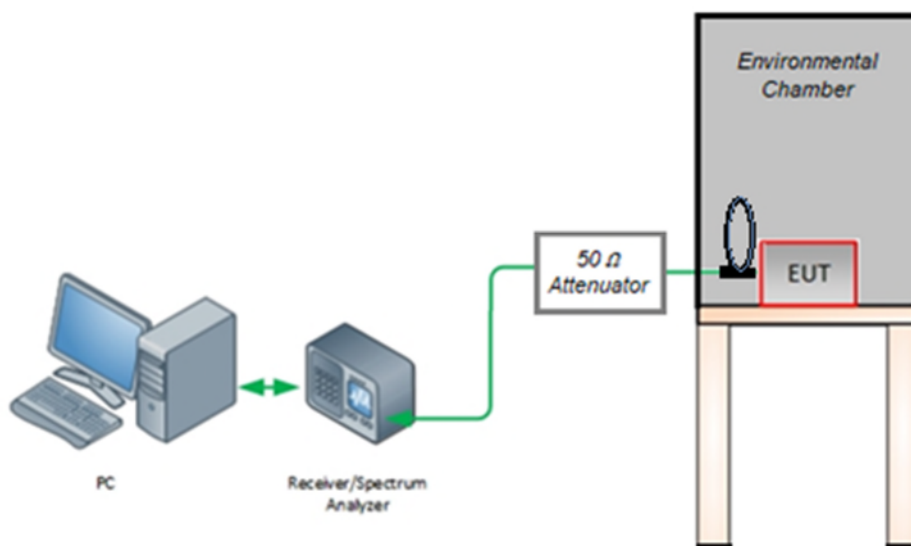


Figure 2.8.7-5 – Frequency Stability Test Setup



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.



6 Accreditation, Disclaimers and Copyright

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