RHEIN TECH LABORATORIES, INC.

Engineering Solutions & Electromagnetic Compatibility Services

AMETEK Magnetrol USA, LLC
705 Enterprise Street
Aurora, Illinois 60504 USA

MODEL: R80
FCC ID: LPN-R80
IC: 2331A-R80

November 2, 2021

Standards Referenced for this Report	
Part 2: 2020	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
Part 15: 2020	Radio Frequency Devices - §15.209: Radiated Emissions Limits
RSS-Gen: Issue 5	General Requirements for Compliance of Radio Apparatus
RSS-211: Issue 1	Level Probing Radar Equipment
ANSI C63.10-2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

Frequency Range	**Output Power (W) (Peak EIRP)**	**Frequency Tolerance (ppm)**	**Emission Designator**
77.0 – 81.0 GHz	1.66	N/A	N/A

We, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this attached test record. No modifications were made to the equipment during testing in order to achieve compliance with these standards. Furthermore, there was no deviation from, additions to, or exclusions from, the above standards for Certification methodology.

Signature: 

Date: November 2, 2021

Typed/Printed Name: Desmond Fraser

Position: President

Signature: 

Date: November 2, 2021

Typed/Printed Name: Daniel W. Baltzell

Position: Test Engineer

Document Number: 2021098

These tests are accredited and meet the requirements of ISO/IEC 17025 as verified by ANAB.
Refer to certificate and scope of accreditation AT-1445.

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1 General Information

1.1 Scope

The following Type Certification Report is prepared on behalf of AMETEK Magnetrol USA, LLC in accordance with the Federal Communications Commission and ISED Canada Rules and Regulations.

The Equipment Under Test (EUT) was the R80 Transmitter, FCC ID: LPN-R80, IC: 2331A-R80, configured with the 3" horn antenna, tested in concrete, metal, and reinforced fiberglass containers.

All measurements contained in this application were conducted in accordance with FCC Rules and Regulations CFR 47, and ANSI C63.10 American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices, 2013.

The instrumentation utilized for the measurements conforms to the ANSI C63.10 standard for EMI and Field Strength Instrumentation. Calibration checks are performed regularly on the instruments, and all accessories including high pass filter, coaxial attenuator, preamplifier and cables.

1.2 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located on the parking lot of Rhein Tech Laboratories, Inc., 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report submitted to and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing. CAB ID: US0079.

1.3 Related Submittal(s)/Grant(s)

This is an original FCC §15.209 and ISED RSS-211 application. The EUT can be configured with any of the 4 horn antennas listed in Table 1-1 below. Per Table 2-1, the EUT was tested with the highest gain antenna, 3" with 34 dBi gain, and proven compliant with the applicable rules and regulations in all tank configurations (concrete, metal and reinforced fiberglass). Based on the compliance of the highest gain antenna, the FCC grant and ISED TAC should include the ¾", 1½", 2", and 3" antennas.

Table 1-1: R80 Antenna Options

Antenna Model	Manufacturer	Model	Gain (dBi)
3" Horn Antenna	AMETEK Magnetrol USA, LLC	RC3-3"	34
2" Horn Antenna	AMETEK Magnetrol USA, LLC	RC2-2"	30.6
1 1/2" Horn Antenna	AMETEK Magnetrol USA, LLC	RC1-1 ½"	28
3/4" Horn Antenna	AMETEK Magnetrol USA, LLC	RC0-3/4"	23

1.4 Modifications

None.

2 Tested System Details

The test samples were received on August 23, 2021. Listed below are the identifiers and descriptions of all equipment, cables, and internal devices used with the EUT for this testing, as applicable.

Table 2-1: Equipment Under Test (EUT)

Part	Manufacturer	Model	Serial Number	FCC ID	Cable Type	RTL Bar Code
FMCW Radar	AMETEK Magnetrol USA, LLC	R80	N/A	LPN-R80	N/A	23838
3" Horn Antenna	AMETEK Magnetrol USA, LLC	RC3-3"	N/A	N/A	N/A	23838A

Table 2-2: Support Equipment

Part	Manufacturer	Model	Serial Number	FCC ID	Cable Type	RTL Bar Code
Programmable Power Supply	GW Instek	PSS-3203	B200344	N/A	1m unshielded	N/A

2.1 Test Configuration

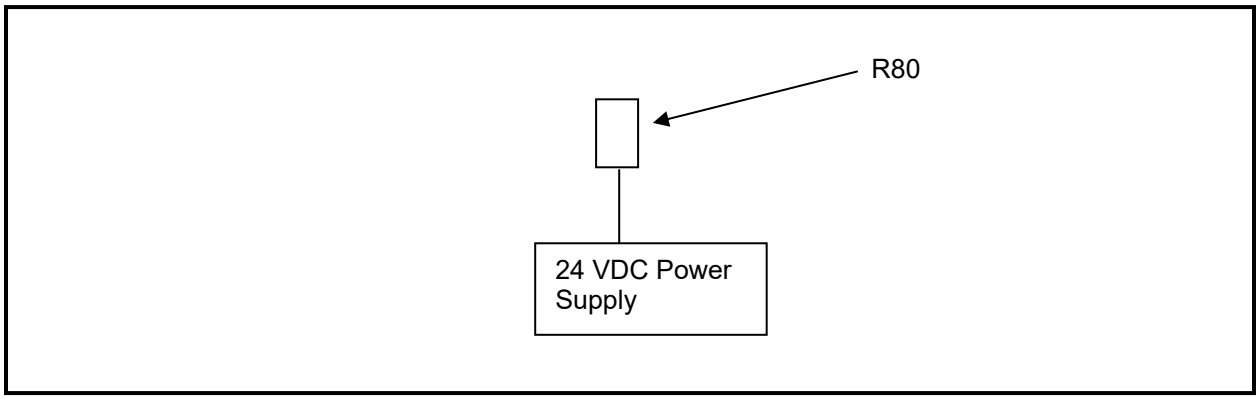


Figure 2-1: Configuration of Tested System

2.2 Test Distance and Exercising the EUT

The EUT's spurious emissions were investigated and tested in the restricted and non-restricted bands from 9 kHz to 220 GHz. Furthermore, test antenna handheld measurements were performed in and around the EUT to determine radiated emissions emanating from the EUT since it was mounted on metal, concrete, and reinforced fiberglass containers such that its main beam was enclosed and perpendicularly pointing downwards per RSS-211, ref. EN 302 372.

All measurements above 1 GHz were performed at an antenna–EUT test distance of 1.0 meter from 1-40 GHz, and with the test antenna polarized horizontally and vertically in order to determine the EUT's worst-case emissions. The measurement results were then corrected to the 3 meter limit.

Measurements below 1 GHz were performed at an antenna distance of 3 meters as a digital interface device. The EUT was tested with its main beam pointing vertically downward within metal, concrete, and reinforced fiberglass enclosed containers.

The plots were taken at 1 GHz to 220 GHz; to ensure no indication of detectable emissions, the emissions from the EUT were investigated at: 0.1m at 140-220 GHz for peak and 0.025m for average; and 0.1m from 40-140 GHz.

3 AC Conducted Emissions - ANSI C63.10 6.2, FCC §15.207, RSS-Gen 8.8

3.1 Test Methodology for Conducted Line Emissions Measurements

The power line conducted emission measurements were performed in a Series 81 type shielded enclosure manufactured by Rayproof. The EUT was placed on a wooden table. Power was fed to the EUT through a 50-ohm/50 μHenry Line Impedance Stabilization Network (LISN). The EUT LISN was fed power through an AC filter box on the outside of the shielded enclosure. The filter box and EUT LISN housing are bonded to the ground plane of the shielded enclosure. A second LISN, the peripheral LISN, provides isolation for the EUT's auxiliary equipment. This peripheral LISN was also fed AC power.

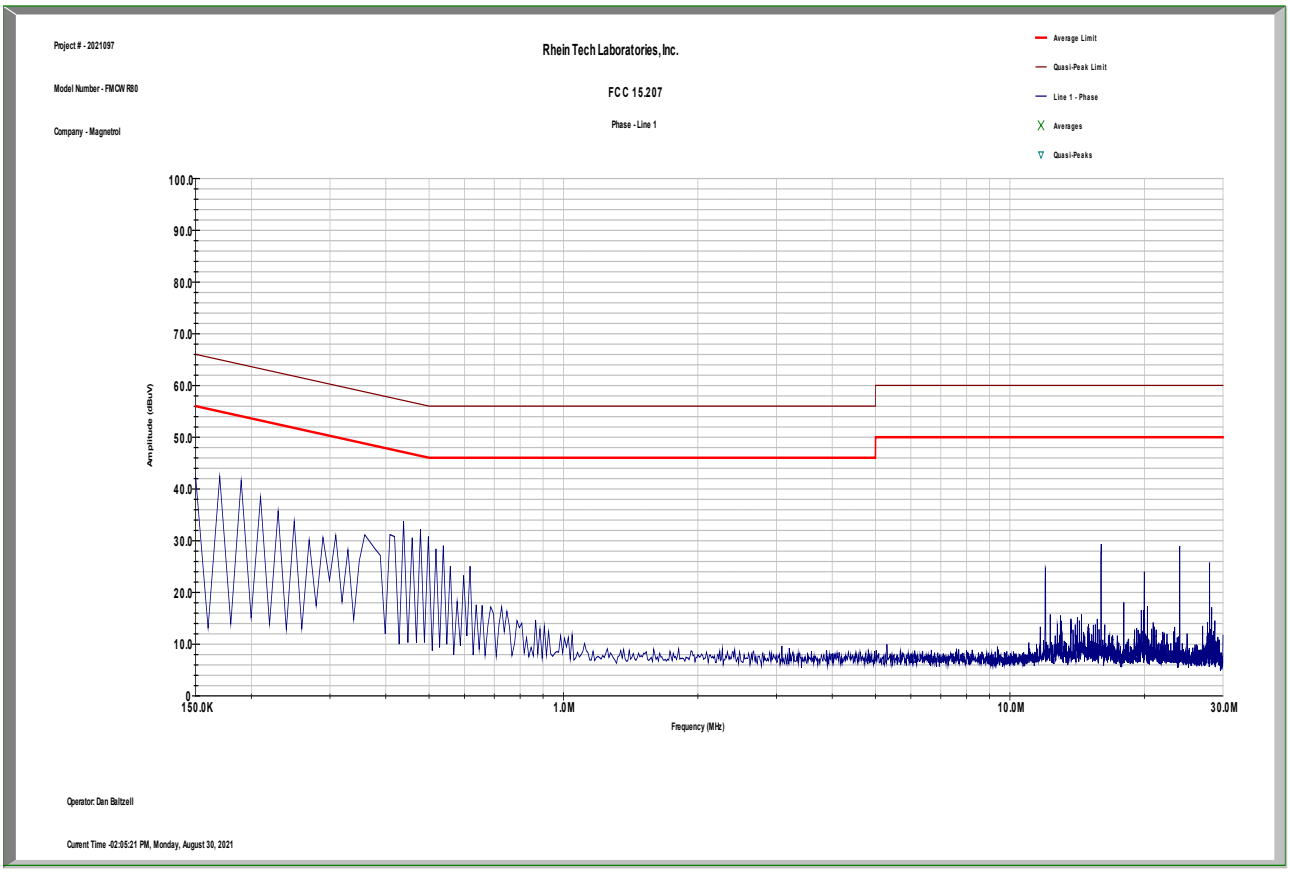
The spectrum analyzer was connected to the AC line through an isolation transformer. The 50-ohm output of the EUT LISN was connected to the spectrum analyzer input through a Solar 100 kHz high-pass filter. The filter is used to prevent overload of the spectrum analyzer from noise below 100 kHz. Conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or peak mode if applicable). The analyzer's 6 dB bandwidth was set to 9 kHz. Video filter less than 10 times the resolution bandwidth is not used. Average measurements are performed in linear mode using a 10 kHz resolution bandwidth, a 1 Hz video bandwidth, by increasing the sweep time in order to obtain a calibrated measurement. The emission spectrum was scanned from 150 kHz to 30 MHz. The highest emission amplitudes relative to the appropriate limits were measured and have been recorded.

3.2 Conducted Line Emissions Test Procedure

Conducted emissions were performed on the EUT using an off-the-shelf power supply. The general conducted limit under Part 15.207 was applied. The emissions were scanned between 150 kHz to 30 MHz on the neutral and phase conductors.

3.3 Conducted Line Emissions Test Data

Plot 3-1: Conducted Emissions Transmit - Phase



Plot 3-2: Conducted Emissions Transmit – Neutral

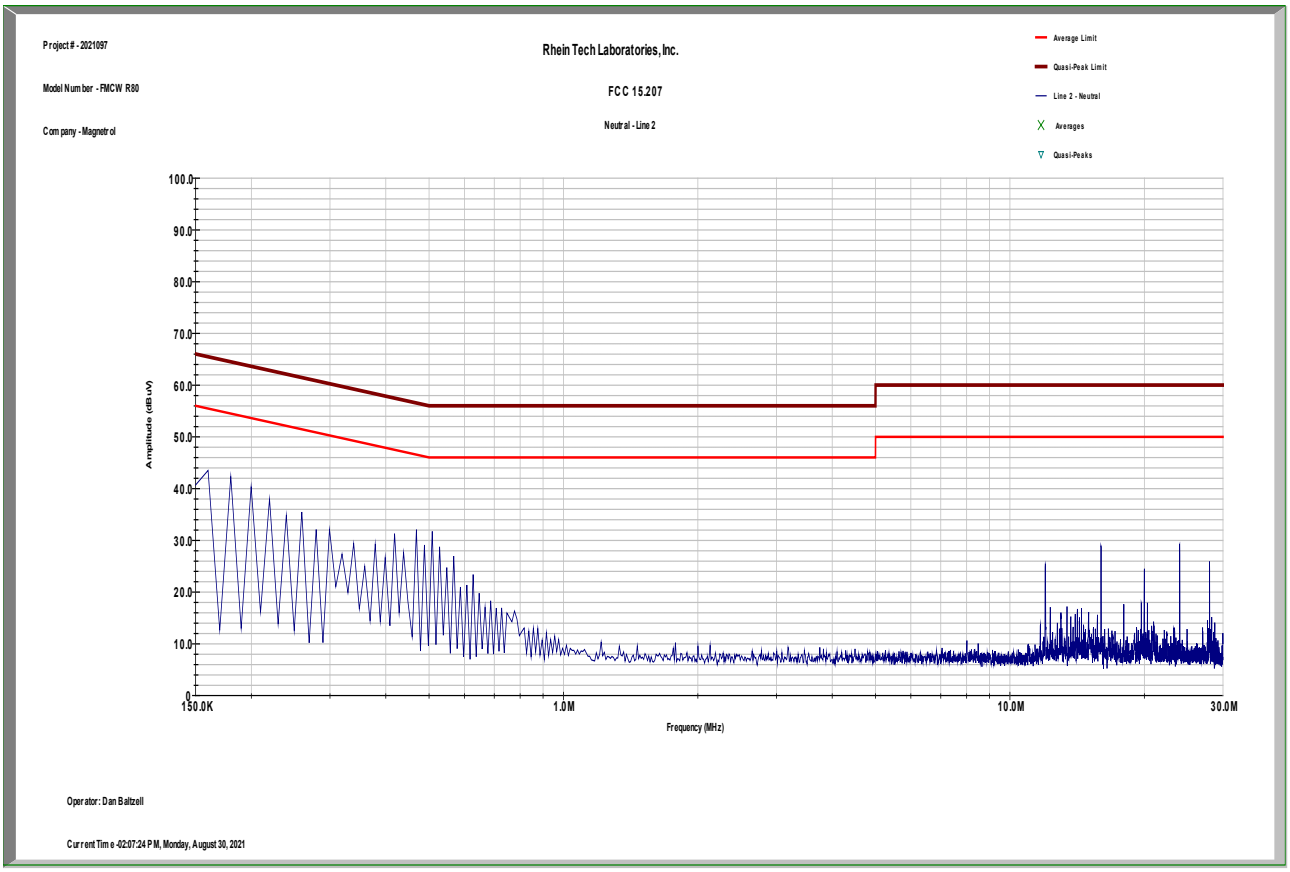


Table 3-1: Conducted Line Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771	02/26/23
900930	Hewlett Packard	85662A	Spectrum Analyzer Display Section	3144A20839	02/26/23
901083	AFJ International	LS16	16A LISN (110 V)	16010020080	02/16/23
N/A	ETS Lindgren	TILE!	Emissions Testing Software Rev. 7.1.3.20	N/A	N/A

Measurement uncertainty: ±3.6 dB. This measurement uncertainty is an expanded uncertainty for 95% confidence level received with a coverage factor k=2.

Result: PASS

Test Personnel:

Daniel W. Baltzell	Daniel W. Baltzell	August 30, 2021
Test Engineer	Signature	Date of Test

4 Modulated Bandwidth – ANSI C63.10 6.9; IC RSS-211 5.1(a)

4.1 Modulated Bandwidth Test Procedure

The minimum 99% bandwidths was measured using a 50 ohm spectrum analyzer with the resolution bandwidth set at 1 MHz and the video bandwidth set at 3 MHz. The spectrum analyzer's mixer mode resulted in an overlapping bandwidth image with the actual image and a ghost image. The analyzer "Signal ID" was used to aid in discerning between the ghost images displayed by the mixer. Max hold was used until the spectrum was adequately filled to portray the bandwidth and a plot was taken.

4.2 Modulated Bandwidth Test Data

Plot 4-1: 99% Modulated Bandwidth - RSS-Gen 6.7

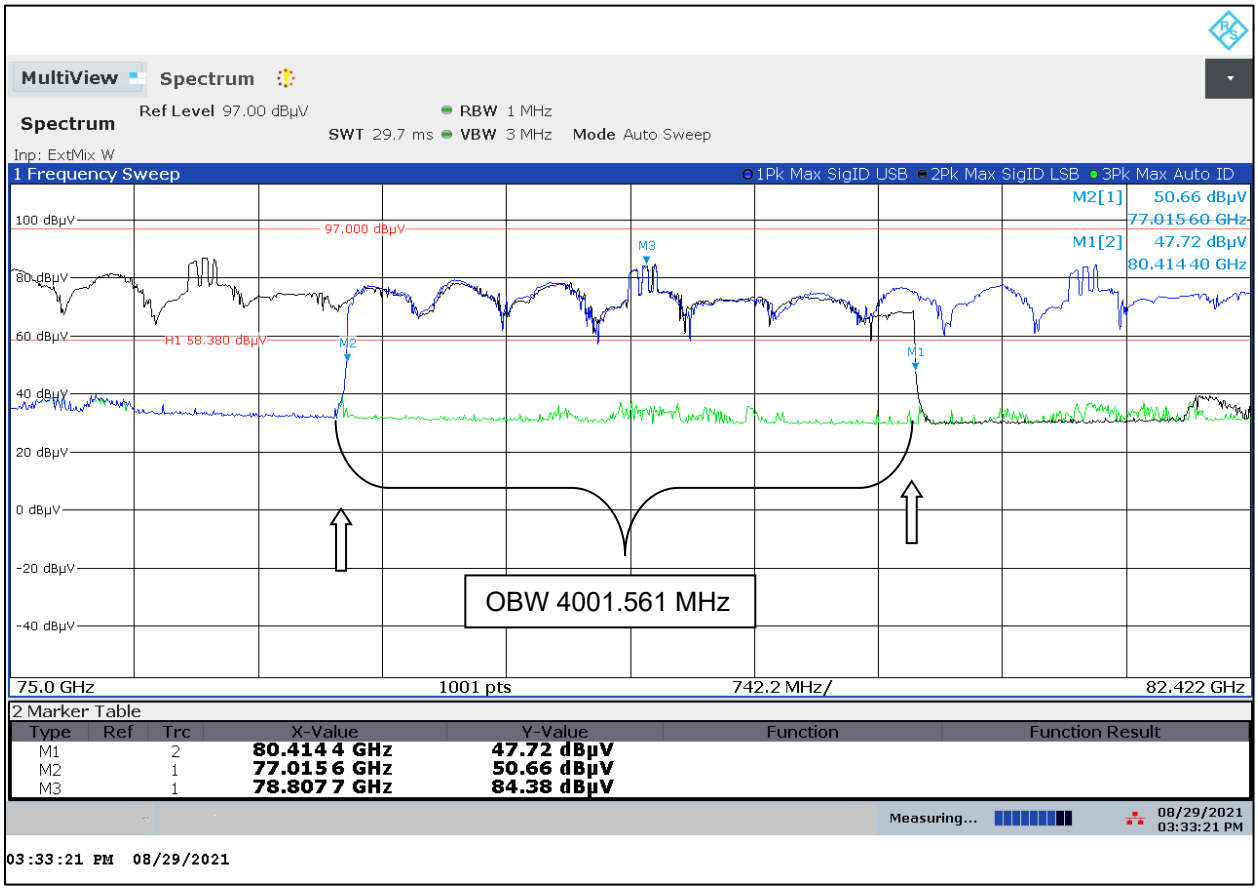


Table 4-1: Modulated Bandwidth Data

99% Bandwidth (MHz)
4001.56

Table 4-2: Modulated Bandwidth Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901773	Rohde & Schwarz	FSW50	Spectrum Analyzer	101021	08/16/22
901640	Rohde & Schwarz	FS-Z110	Mixer (75 – 110 GHz)	100010	05/03/23
900711	ATM	10-443-6R	Horn Antenna (75 - 110 GHz)	8051905-1	04/07/22

Measurement uncertainty: ±4.6 dB. This measurement uncertainty is an expanded uncertainty for 95% confidence level received with a coverage factor k=2.

Result: PASS

Test Personnel:

Daniel W. Baltzell		August 29, 2021
Test Engineer	Signature	Date of Test

5 Radiated Emission Limits - FCC §15.209; ISED RSS-Gen; RSS-211 5.3

5.1 Radiated Emission Limits Test Procedure

The EUT's radiated spurious emissions, comprised of harmonic and spurious emissions that fall in the restricted and non-restricted bands, were investigated and tested from 0.009 kHz to 220 GHz in accordance with C63.10 2013. The restricted bands are listed in Part 15.205. The maximum permitted average field strength for the restricted band is listed in Part 15.209. To determine worst-case emissions, the EUT was tested while installed perpendicularly downwards in metal and concrete containers, and the EUT was rotated along its axis.

The test antenna was horizontally and vertically polarized during testing. The general limit under Part 15.209 was applied for all frequencies from 0.009 kHz to 220 GHz, per FCC 15.209. Radiated spurious emissions were detected between 30 MHz and 1000 MHz and data provided in Tables 5.1 to 5.9; none were detected from 1 GHz to 220 GHz. Horizontal and vertical antenna polarization radiated spurious emissions plots are provided from 2 GHz to 26.5 GHz to demonstrate that the EUT has no discernable radiated spurious emissions to measure above 26.5 GHz. A handheld test-antenna measurement method was also used in, around, and close to the EUT, to investigate radiated spurious emissions; no radiated spurious emissions were found, except the carrier at 79 GHz.

The EUT was investigated and tested with the test configuration in enclosed metal, concrete, and reinforced fiberglass containers. No emissions from transmitting were found outside of the transmit band for any container.

5.2 Field Strength Calculation

The field strength is calculated by adding the antenna factor and the cable loss from the measured corrected conversion loss and spectrum analyzer reading.

Spectrum Analyzer Level Corrected (dBuV/m) =

Spectrum Analyzer Level (dBuV/m) + AF (dB/m) + CL (dB) – preamp gain;

AF = antenna factor and CL = cable loss

5.3 Radiated Emissions Test Data - FCC §15.209; ISED RSS-Gen

Table 5-1: Digital Radiated Emissions Test Data - Fiberglass Container, Below 1 GHz

Temperature: 79°F Humidity: 65%								
Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass/ Fail
313.339	Qp	V	30.8	-11.5	19.3	46.0	-26.7	Pass
320.713	Qp	V	32.3	-11.7	20.6	46.0	-25.4	Pass
328.085	Qp	H	38.2	-11.5	26.7	46.0	-19.3	Pass
335.457	Qp	H	33.0	-10.8	22.2	46.0	-23.8	Pass
342.832	Qp	H	31.5	-9.9	21.6	46.0	-24.4	Pass
350.205	Qp	V	30.5	-9.1	21.4	46.0	-24.6	Pass
357.575	Qp	H	31.2	-8.8	22.4	46.0	-23.6	Pass
364.948	Qp	H	31.0	-8.9	22.1	46.0	-23.9	Pass
372.324	Qp	H	31.2	-9.1	22.1	46.0	-23.9	Pass
379.697	Qp	V	31.6	-9.0	22.6	46.0	-23.4	Pass
387.070	Qp	H	30.8	-8.5	22.3	46.0	-23.7	Pass
394.442	Qp	V	31.1	-7.3	23.8	46.0	-22.2	Pass
401.812	Qp	V	30.7	-7.1	23.6	46.0	-22.4	Pass
409.185	Qp	V	31.0	-6.7	24.3	46.0	-21.7	Pass
416.557	Qp	V	30.7	-6.6	24.1	46.0	-21.9	Pass

Table 5-2: Digital Radiated Emissions Test Data – Metal Container, Below 1 GHz

Temperature: 79°F Humidity: 65%								
Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass/ Fail
313.339	Qp	H	31.7	-11.5	20.2	46.0	-25.8	Pass
320.713	Qp	V	31.6	-11.7	19.9	46.0	-26.1	Pass
328.085	Qp	V	33.5	-11.5	22.0	46.0	-24.0	Pass
335.457	Qp	V	33.2	-10.8	22.4	46.0	-23.6	Pass
342.832	Qp	V	31.5	-9.9	21.6	46.0	-24.4	Pass
350.205	Qp	V	30.4	-9.1	21.3	46.0	-24.7	Pass
357.575	Qp	V	31.3	-8.8	22.5	46.0	-23.5	Pass
364.948	Qp	H	30.8	-8.9	21.9	46.0	-24.1	Pass
372.324	Qp	H	31.5	-9.1	22.4	46.0	-23.6	Pass
379.697	Qp	V	30.8	-9.0	21.8	46.0	-24.2	Pass
387.070	Qp	H	30.6	-8.5	22.1	46.0	-23.9	Pass
394.442	Qp	H	31.1	-7.3	23.8	46.0	-22.2	Pass
401.812	Qp	V	30.8	-7.1	23.7	46.0	-22.3	Pass
409.185	Qp	V	31.7	-6.7	25.0	46.0	-21.0	Pass
416.557	Qp	H	30.9	-6.6	24.3	46.0	-21.7	Pass

Table 5-3: Digital Radiated Emissions Test Data – Concrete Container, Below 1 GHz

Temperature: 79°F Humidity: 65%								
Emission Frequency (MHz)	**Test Detector**	**Antenna Polarity (H/V)**	**Analyzer Reading (dBuV)**	**Site Correction Factor (dB/m)**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Pass/ Fail**
313.339	Qp	H	30.8	-11.5	19.3	46.0	-26.7	Pass
320.713	Qp	V	30.8	-11.7	19.1	46.0	-26.9	Pass
328.085	Qp	H	35.6	-11.5	24.1	46.0	-21.9	Pass
335.457	Qp	H	32.9	-10.8	22.1	46.0	-23.9	Pass
342.832	Qp	H	31.5	-9.9	21.6	46.0	-24.4	Pass
350.205	Qp	H	30.5	-9.1	21.4	46.0	-24.6	Pass
357.575	Qp	H	31.0	-8.8	22.2	46.0	-23.8	Pass
364.948	Qp	H	30.6	-8.9	21.7	46.0	-24.3	Pass
372.324	Qp	H	31.0	-9.1	21.9	46.0	-24.1	Pass
379.697	Qp	V	30.7	-9.0	21.7	46.0	-24.3	Pass
387.070	Qp	H	31.0	-8.5	22.5	46.0	-23.5	Pass
394.442	Qp	H	30.8	-7.3	23.5	46.0	-22.5	Pass
401.812	Qp	V	30.8	-7.1	23.7	46.0	-22.3	Pass
409.185	Qp	V	34.5	-6.7	27.8	46.0	-18.2	Pass
416.557	Qp	H	31.1	-6.6	24.5	46.0	-21.5	Pass

Table 5-4: Digital Radiated Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900905	Rhein Tech Laboratories, Inc.	PR-1040	OATS 1 Preamplifier 40dB (30 MHz – 2 GHz)	1006	09/15/21
901669	ETS-Lindgren	3142E	Biconilog Antenna (30 MHz – 6000 MHz)	00166065	04/24/22
900930	Hewlett Packard	85662A	Spectrum Analyzer Display Section	3144A20839	02/26/23
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771	02/26/23
900969	Hewlett Packard	85650A	Quasi-Peak Adapter	2412A00414	02/26/23

Measurement uncertainty: ±4.6 dB. This measurement uncertainty is an expanded uncertainty for 95% confidence level received with a coverage factor k=2.

Result: PASS

Test Personnel:

Daniel W. Baltzell		September 13, 2021
Test Engineer	Signature	Date of Test

5.3.1 Radiated Emissions Test Data, EUT in Containers, FCC §15.209; ISED RSS-211 5.3(b)

Plot 5-1: Radiated Emissions – Fiberglass Container – Peak

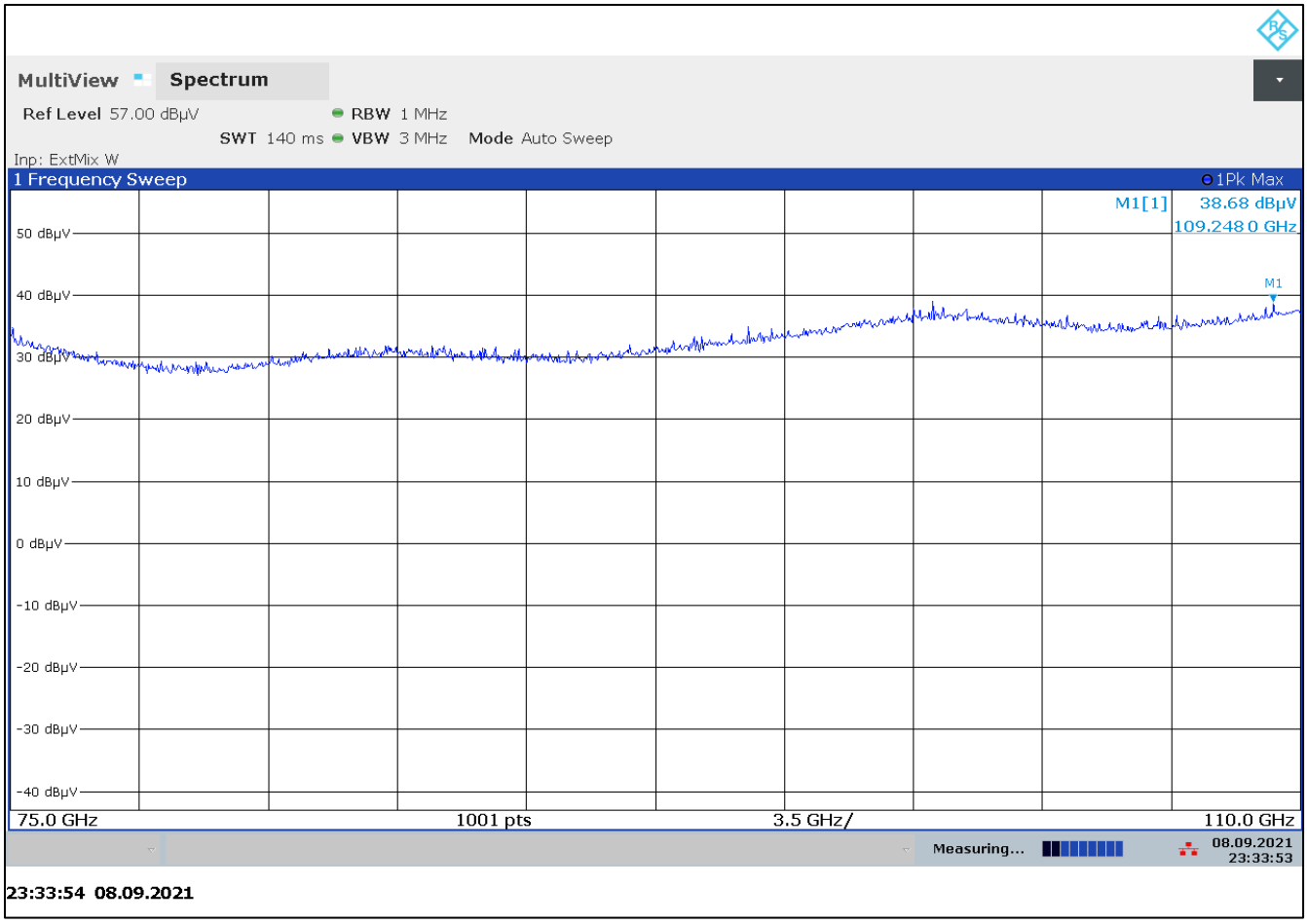


Table 5-5: Radiated Emissions – Fiberglass Container Peak

Frequency (GHz)	Detector	Test Antenna Pol	Measured Spectrum Analyzer Level (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 0.1m to 3m	Corrected Spectrum Analyzer Level (dBuV/m)	FCC Limit (dBuV)	Margin (dB)
109.248	PK	H	38.7	47.6	-29.5	56.8	74.0	-17.2

Plot 5-2: Radiated Emissions – Fiberglass Container - Average

Table 5-6: Radiated Emissions – Fiberglass Container Average

Frequency (GHz)	Detector	Test Antenna Pol	Measured Spectrum Analyzer Level (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 0.1m to 3m	Corrected Spectrum Analyzer Level (dBuV/m)	FCC Limit (dBuV)	Margin (dB)
109.913	AV	H	27.8	47.6	-29.5	45.9	54.0	-8.1

Plot 5-3: Radiated Emissions – Metal Container

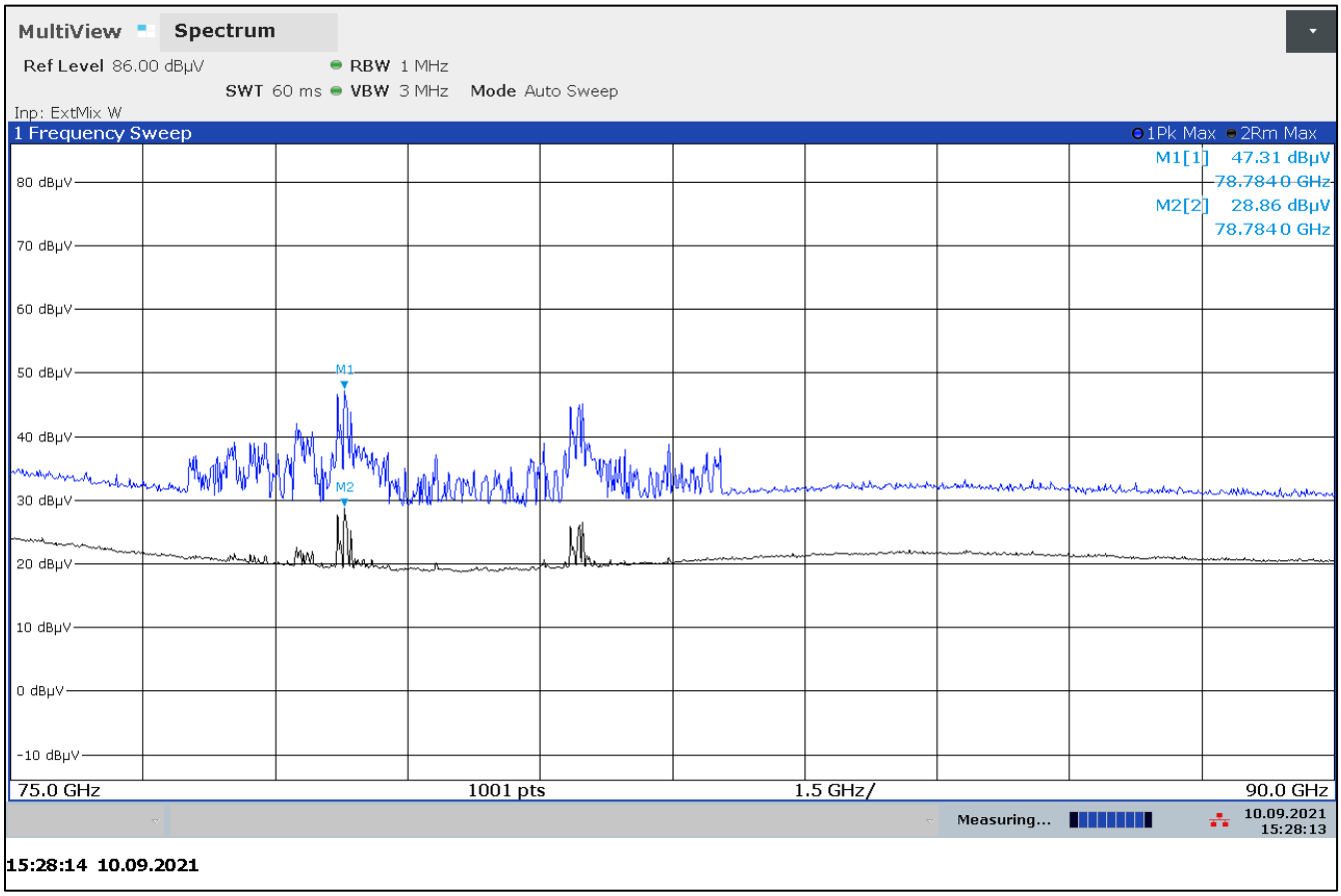


Table 5-7: Radiated Emissions – Metal Container

Frequency (GHz)	Detector	Test Antenna Pol	Measured Spectrum Analyzer Level (dBuV)	Test Antenna Correction Factor (dB/m)	Correction From 0.1m to 3m	Corrected Spectrum Analyzer Level (dBuV/m)	FCC Limit (dBuV)	Margin (dB)
78.784	PK	V	47.3	45.5	-29.5	63.3	74.0	-10.7
78.784	AV	V	28.9	45.5	-29.5	44.9	54.0	-9.1

Plot 5-4: Radiated Emissions - Concrete Container

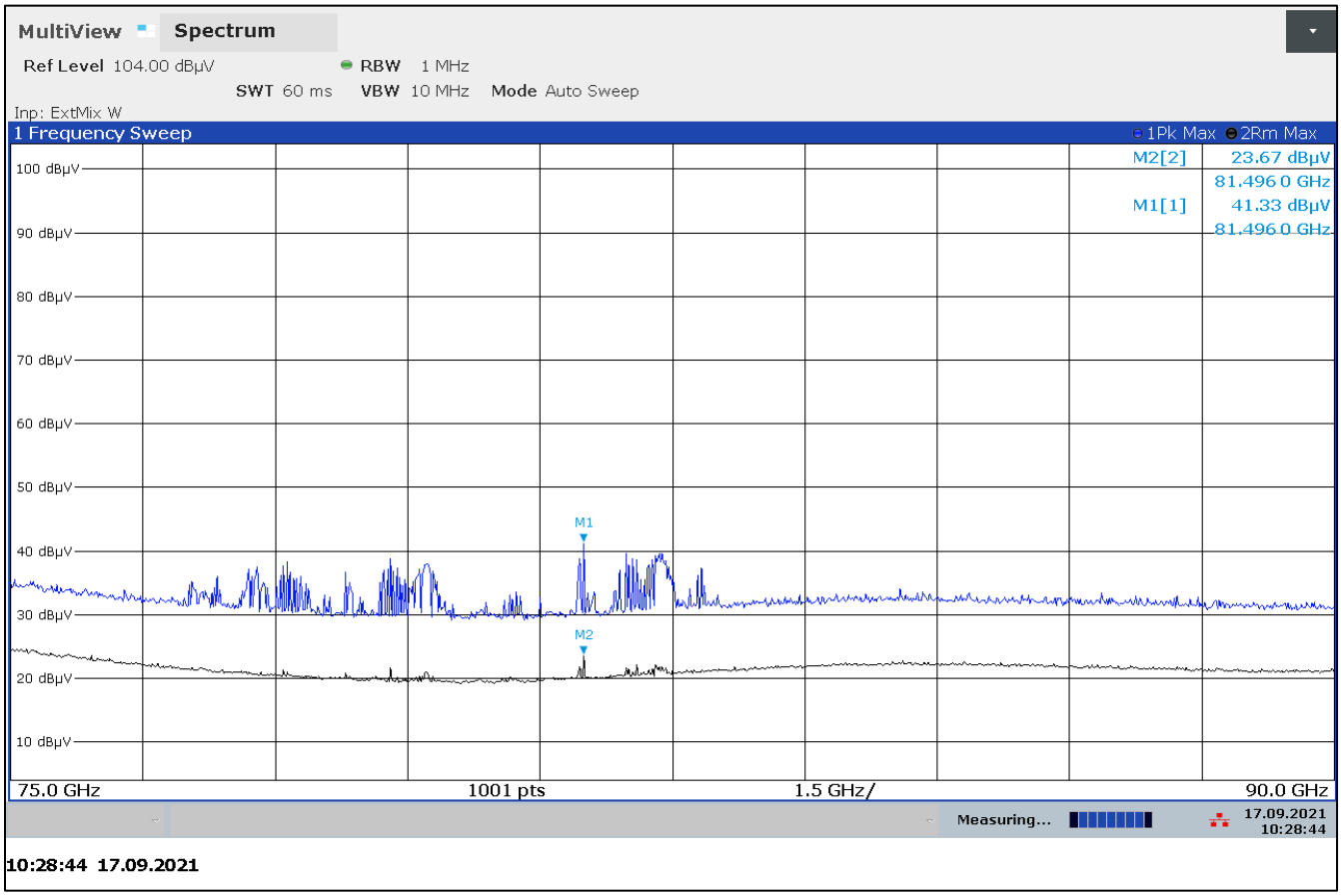


Table 5-8: Radiated Emissions – Concrete Container

Frequency (GHz)	Detector	Test Antenna Pol	Measured Spectrum Analyzer Level (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 0.1m to 3m	Corrected Spectrum Analyzer Level (dBuV/m)	FCC Limit (dBuV)	Margin (dB)
81.496	Peak	V	41.3	45.8	-29.5	57.6	74.0	-16.4
81.496	AV	V	23.7	45.8	-29.5	40.0	54.0	-14.0

5.3.2 Radiated Emissions Test Data – Reinforced Fiberglass Container

Plot 5-5: Radiated Emissions 1 GHz – 2 GHz; Fiberglass Container

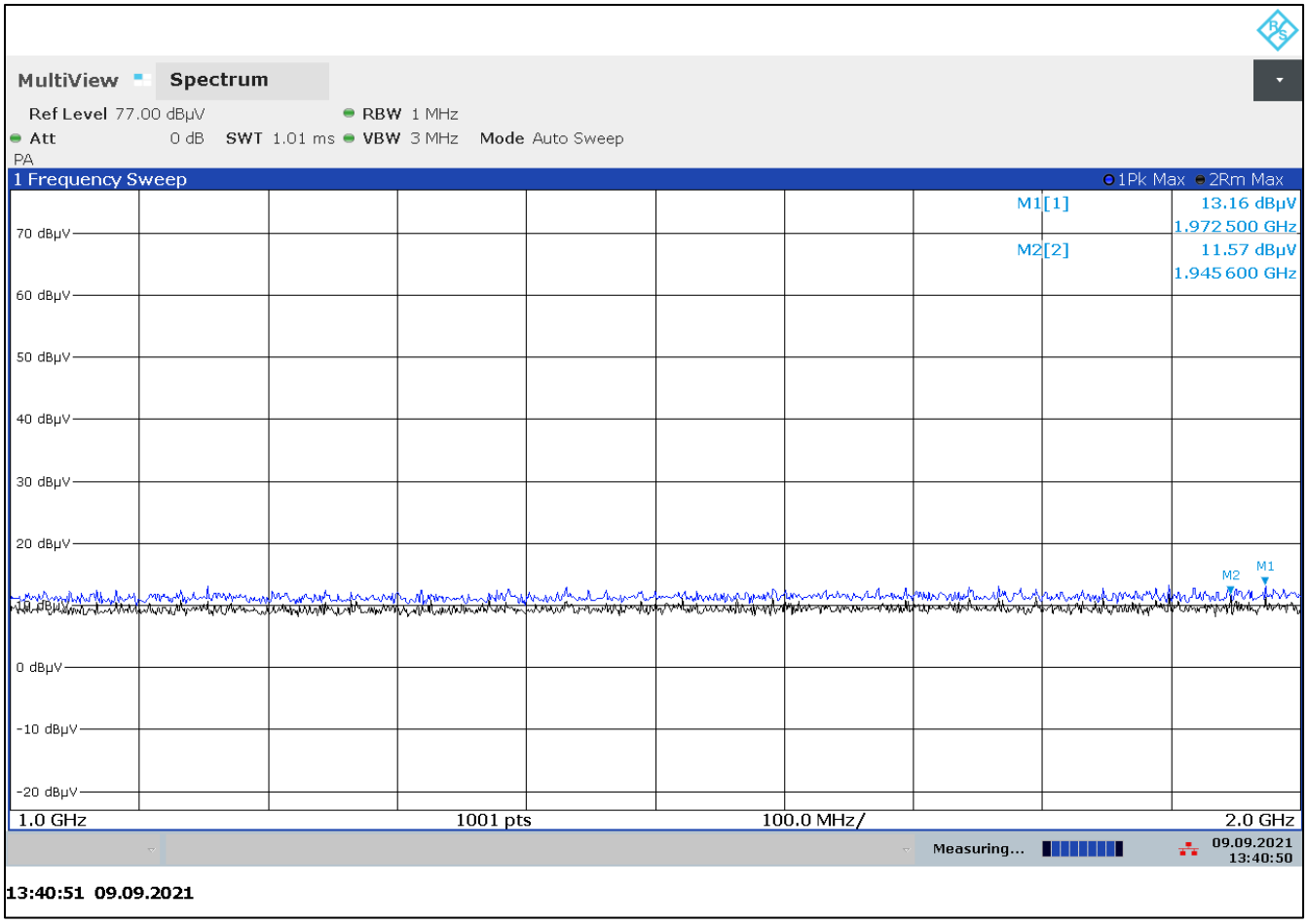


Table 5-9: Radiated Emissions – Fiberglass Container (1 GHz – 2 GHz)

Frequency (GHz)	Detector	Test Antenna Pol	Measured Spectrum Analyzer Level (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 1m to 3m	Corrected Spectrum Analyzer Level (dBuV/m)	FCC Limit (dBuV)	Margin (dB)
1.9725	PK	H	13.2	33.1	-9.5	36.8	74.0	-37.2
1.9456	AV	H	11.6	33.9	-9.5	36.0	54.0	-18.0

Plot 5-6: Radiated Emissions 2 GHz – 4 GHz; Fiberglass Container

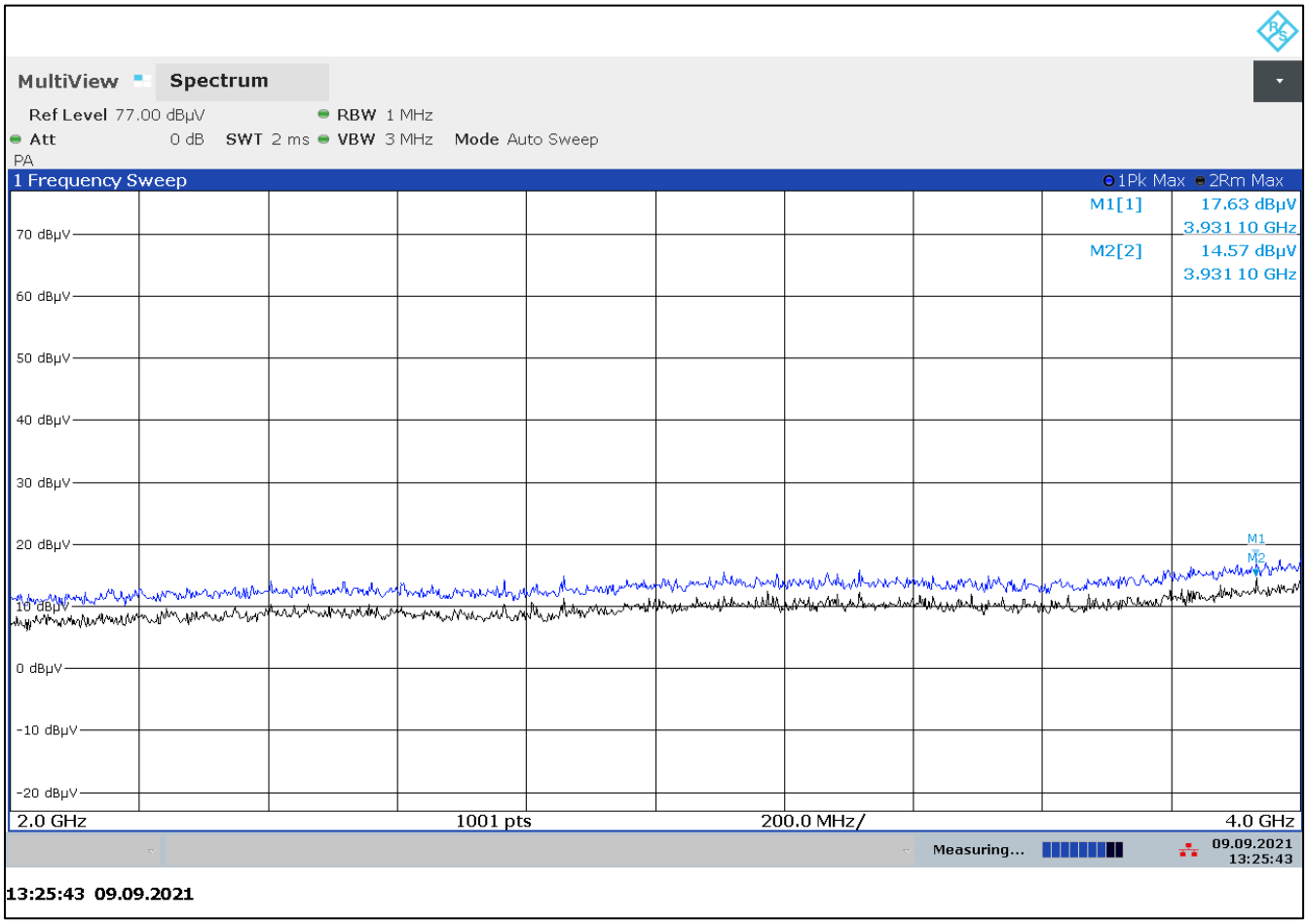


Table 5-10: Radiated Emissions – Fiberglass Container (2 GHz – 4 GHz)

Frequency (GHz)	Detector	Test Antenna Pol	Measured Spectrum Analyzer Level (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 1m to 3m	Corrected Spectrum Analyzer Level (dBuV/m)	FCC Limit (dBuV)	Margin (dB)
3.9311	PK	V	17.6	23.1	-9.5	31.2	74.0	-42.8
3.9311	AV	V	14.6	23.1	-9.5	28.2	54.0	-25.8

Plot 5-7: Radiated Emissions 4 GHz – 8 GHz; Fiberglass Container

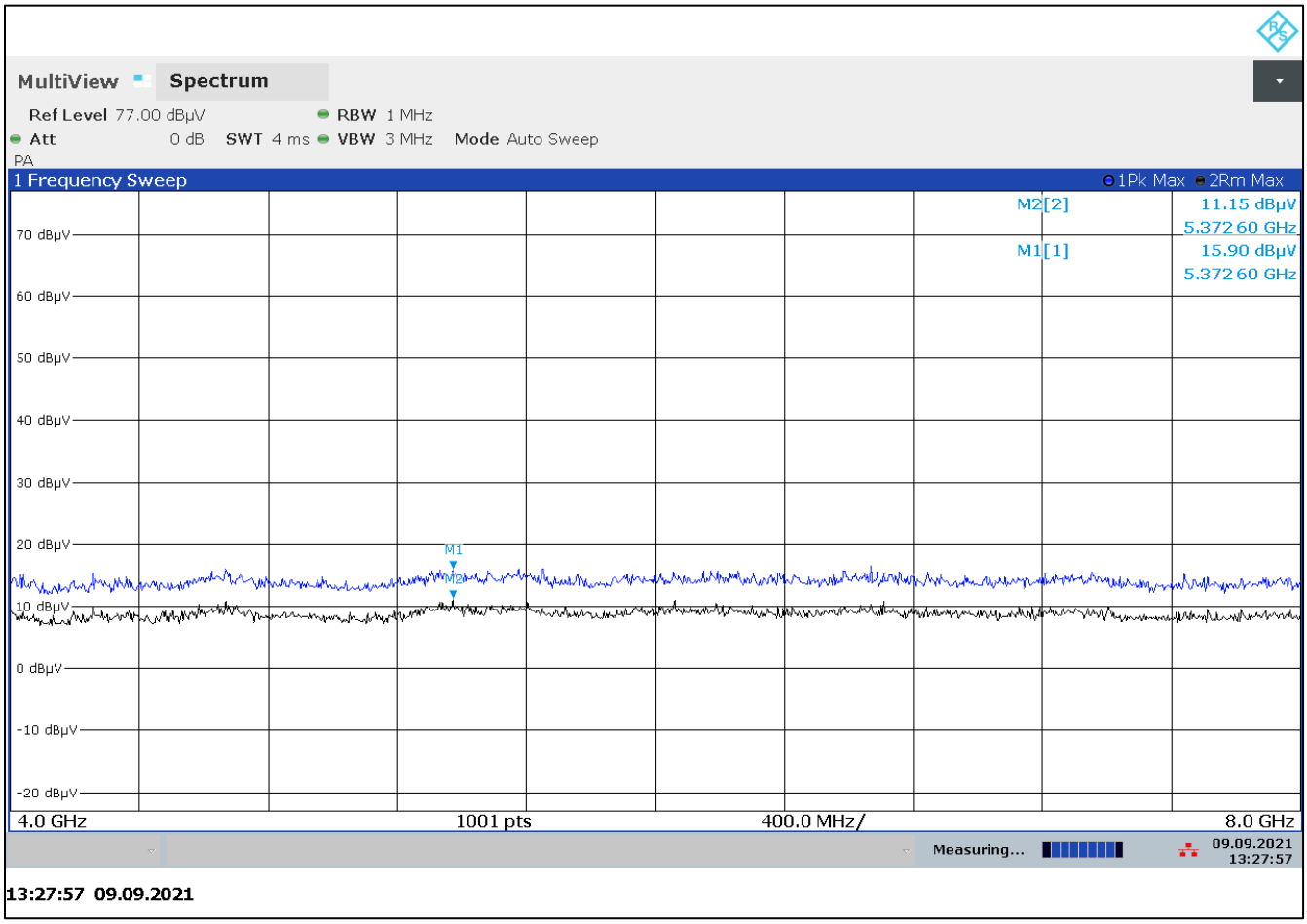


Table 5-11: Radiated Emissions – Fiberglass Container (4 GHz –8 GHz)

Frequency (GHz)	Detector	Test Antenna Pol	Measured Spectrum Analyzer Level (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 1m to 3m	Corrected Spectrum Analyzer Level (dBuV/m)	FCC Limit (dBuV)	Margin (dB)
5.3726	PK	V	15.9	27.4	-9.5	33.8	74.0	-40.2
5.3726	AV	V	14.6	27.4	-9.5	32.5	54.0	-21.5

Plot 5-8: Radiated Emissions 8 GHz – 12.4 GHz; Fiberglass Container

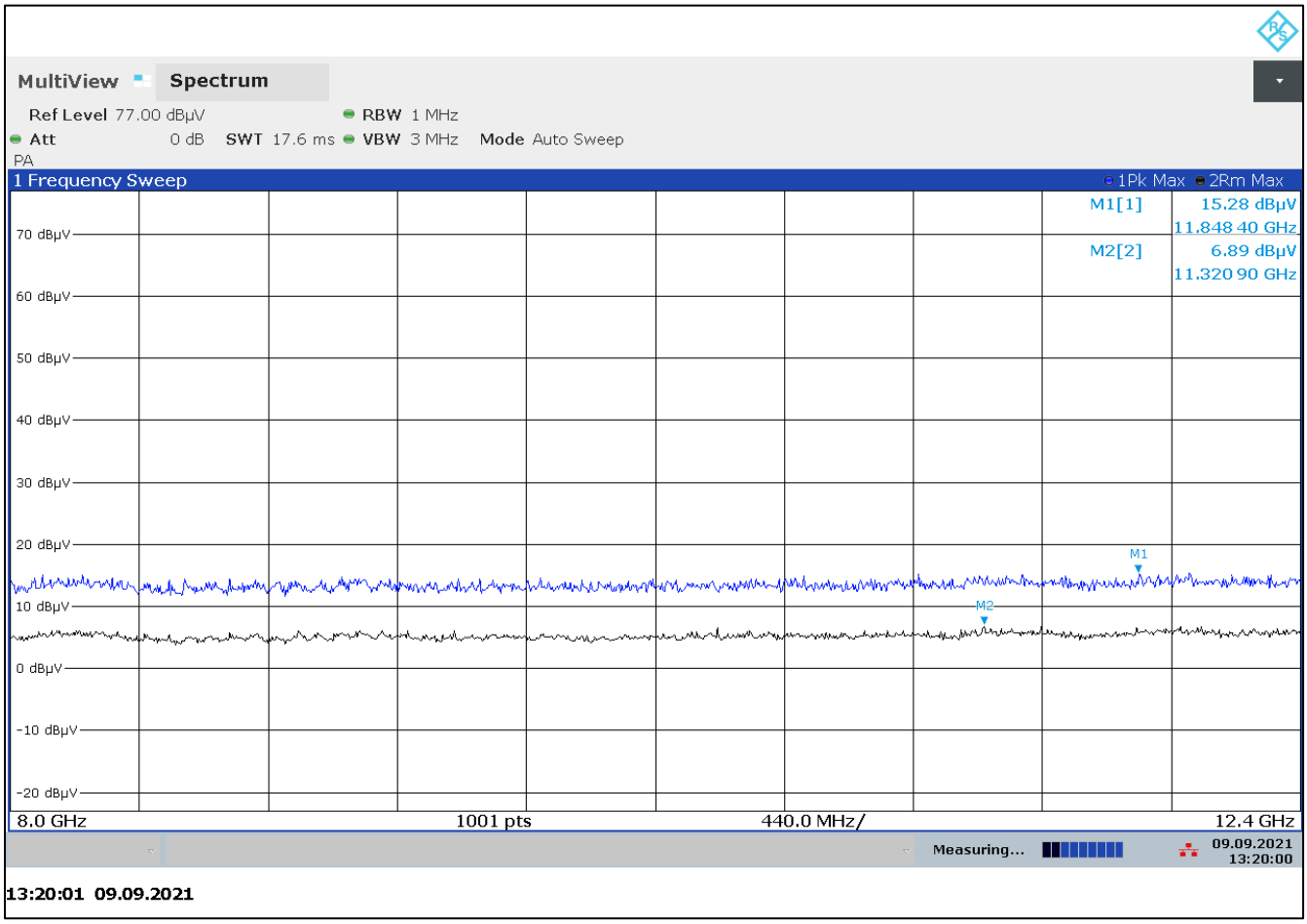


Table 5-12: Radiated Emissions – Fiberglass Container (8 GHz –12.4 GHz)

Frequency (GHz)	Detector	Test Antenna Pol	Measured Spectrum Analyzer Level (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 1m to 3m	Corrected Spectrum Analyzer Level (dBuV/m)	FCC Limit (dBuV)	Margin (dB)
11.8484	PK	V	15.3	34.1	-9.5	39.9	74.0	-34.1
11.3209	AV	V	6.9	33.7	-9.5	31.1	54.0	-22.9

Plot 5-9: Radiated Emissions 12.4 GHz – 18 GHz; Fiberglass Container

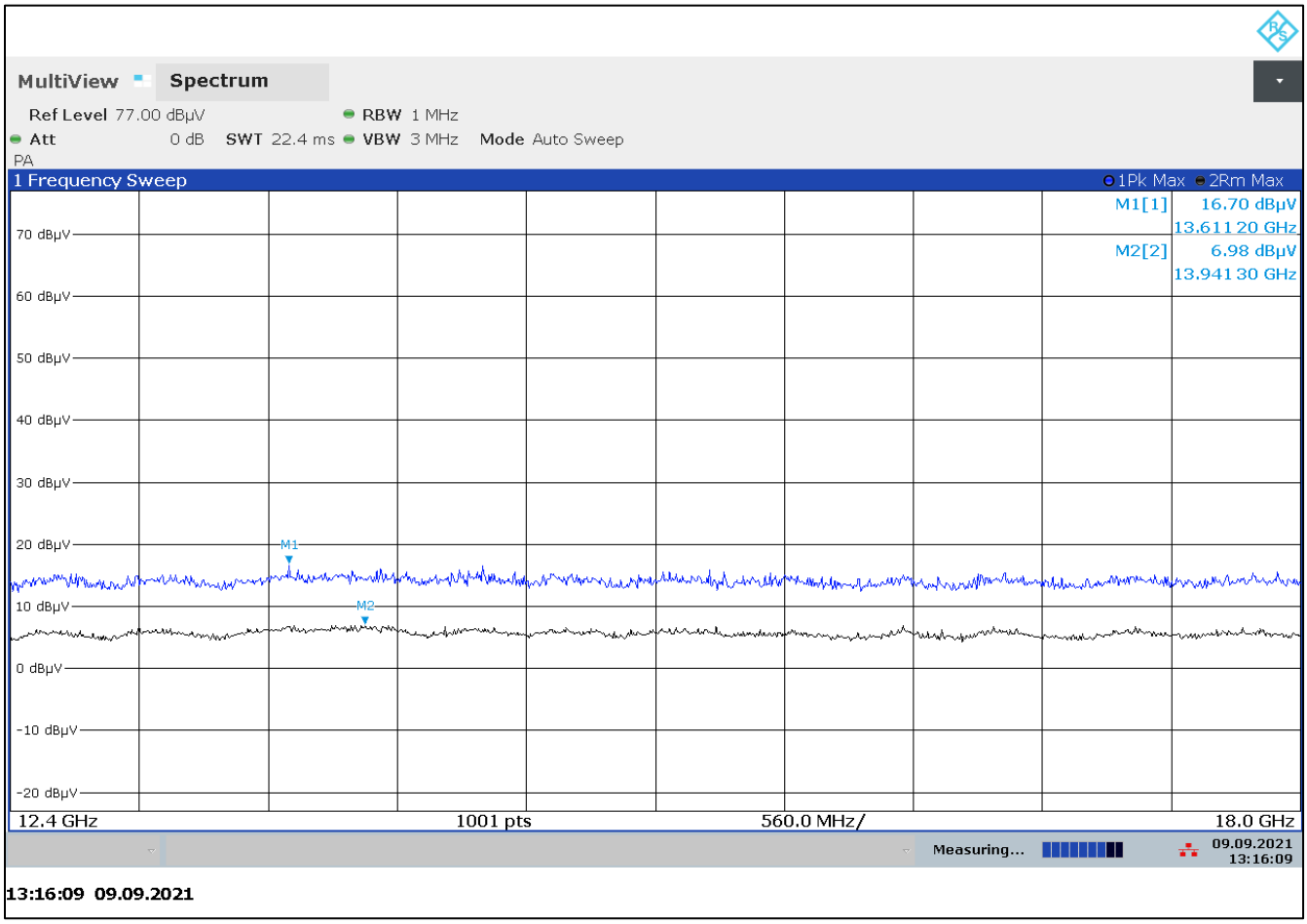


Table 5-13: Radiated Emissions – Fiberglass Container (12.4 GHz –18 GHz)

Frequency (GHz)	Detector	Test Antenna Pol	Measured Spectrum Analyzer Level (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 1m to 3m	Corrected Spectrum Analyzer Level (dBuV/m)	FCC Limit (dBuV)	Margin (dB)
13.6112	PK	V	16.7	37.3	-9.5	44.5	74.0	-29.5
13.9413	AV	V	7.0	37.3	-9.5	34.8	54.0	-19.2

Plot 5-10: Radiated Emissions 18 GHz – 26.5 GHz; Fiberglass Container

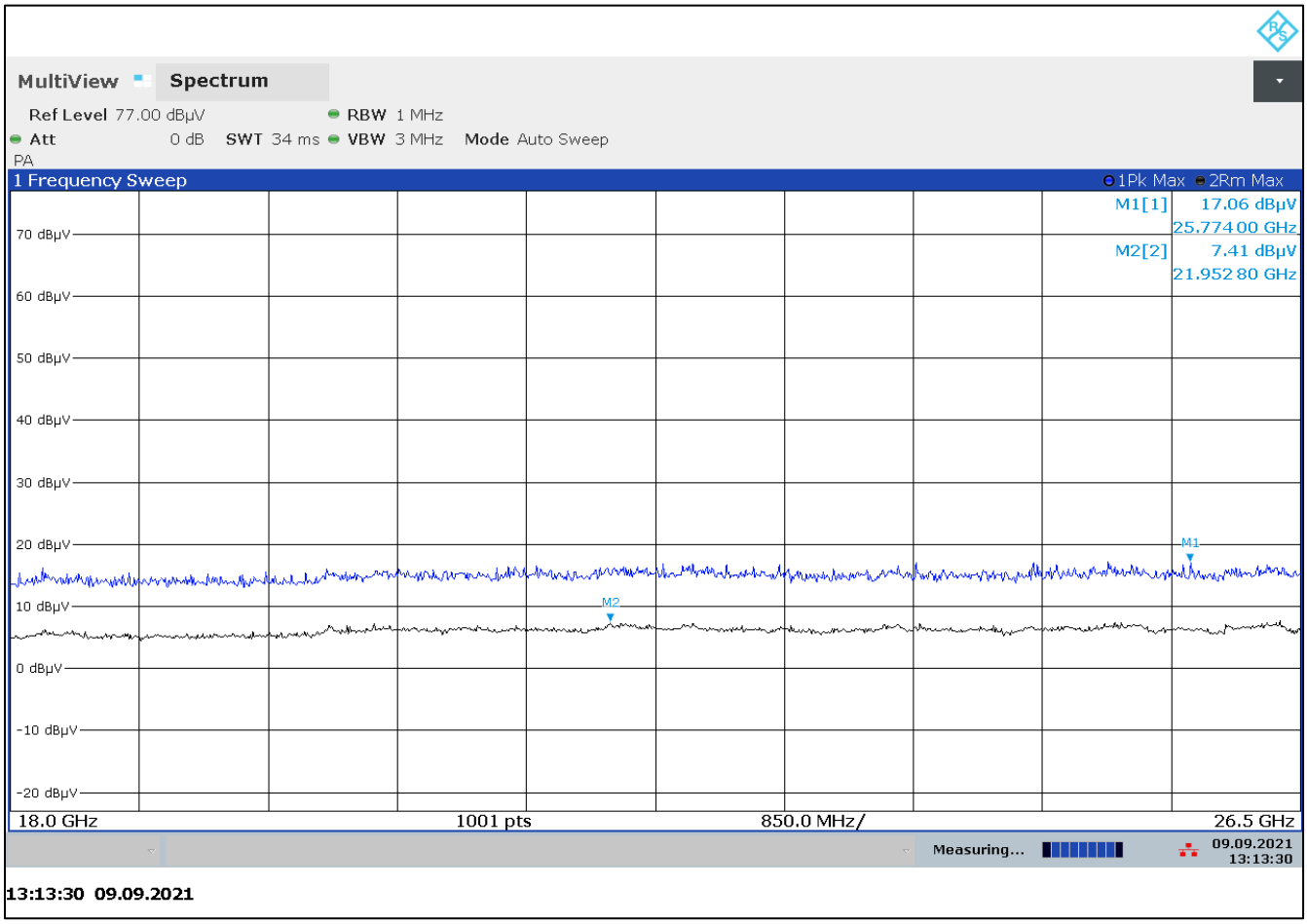


Table 5-14: Radiated Emissions – Fiberglass Container (18 GHz –26.5 GHz)

Frequency (GHz)	Detector	Test Antenna Pol	Measured Spectrum Analyzer Level (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 1m to 3m	Corrected Spectrum Analyzer Level (dBuV/m)	FCC Limit (dBuV)	Margin (dB)
25.7740	PK	V	17.1	40.6	-9.5	48.2	74.0	-25.8
21.9528	AV	V	7.4	40.4	-9.5	38.3	54.0	-15.7

Plot 5-11: Radiated Emissions 26.5 GHz – 40 GHz; Fiberglass Container

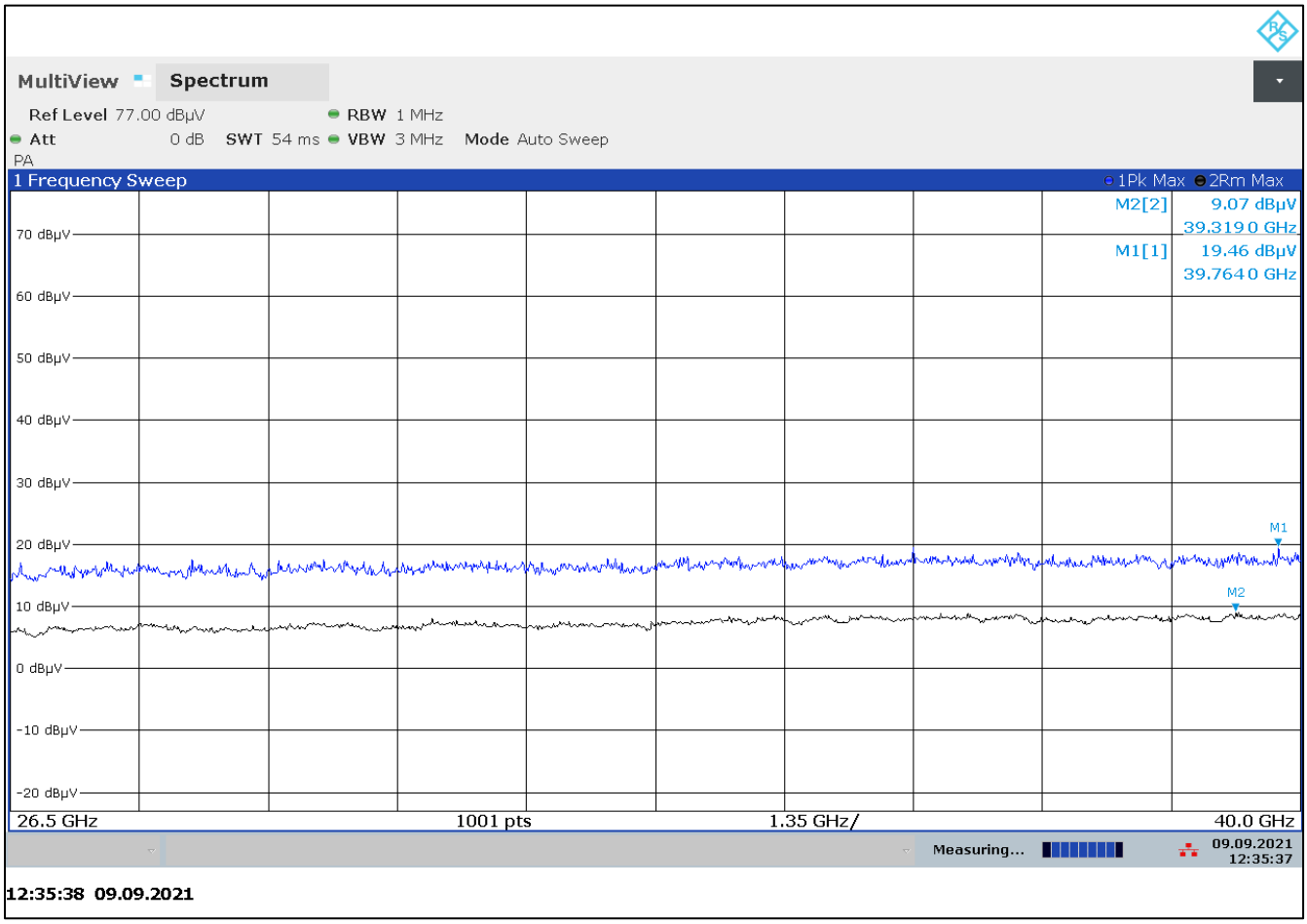


Table 5-15: Radiated Emissions – Fiberglass Container (26.5 GHz –40 GHz)

Frequency (GHz)	Detector	Test Antenna Pol	Measured Spectrum Analyzer Level (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 1m to 3m	Corrected Spectrum Analyzer Level (dBuV/m)	FCC Limit (dBuV)	Margin (dB)
39.764	PK	V	19.5	45.6	-9.5	55.6	74.0	-18.4
39.319	AV	V	9.1	45.0	-9.5	44.6	54.0	-9.4

Plot 5-12: Radiated Emissions 40 GHz – 50 GHz; Fiberglass Container

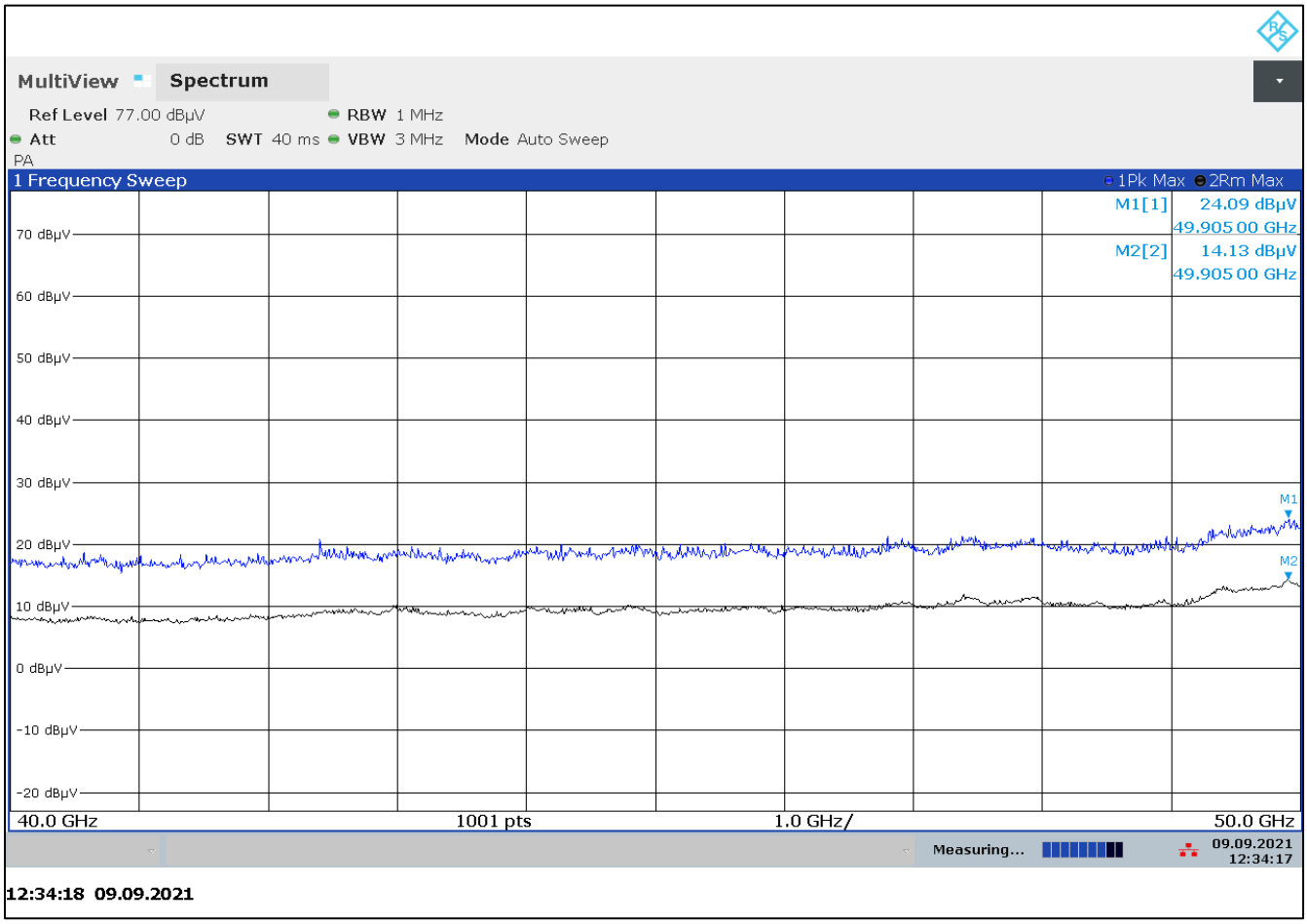


Table 5-16: Radiated Emissions – Fiberglass Container (40 GHz – 50 GHz)

Frequency (GHz)	Detector	Test Antenna Pol	Measured Spectrum Analyzer Level (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 0.1m to 3m	Corrected Spectrum Analyzer Level (dBuV/m)	FCC Limit (dBuV)	Margin (dB)
49.905	PK	V	24.1	64.2	-29.5	58.8	74.0	-15.2
49.905	AV	V	14.1	64.2	-29.5	48.8	54.0	-5.2

Plot 5-13: Radiated Emissions 50 GHz – 75 GHz; Fiberglass Container - Peak

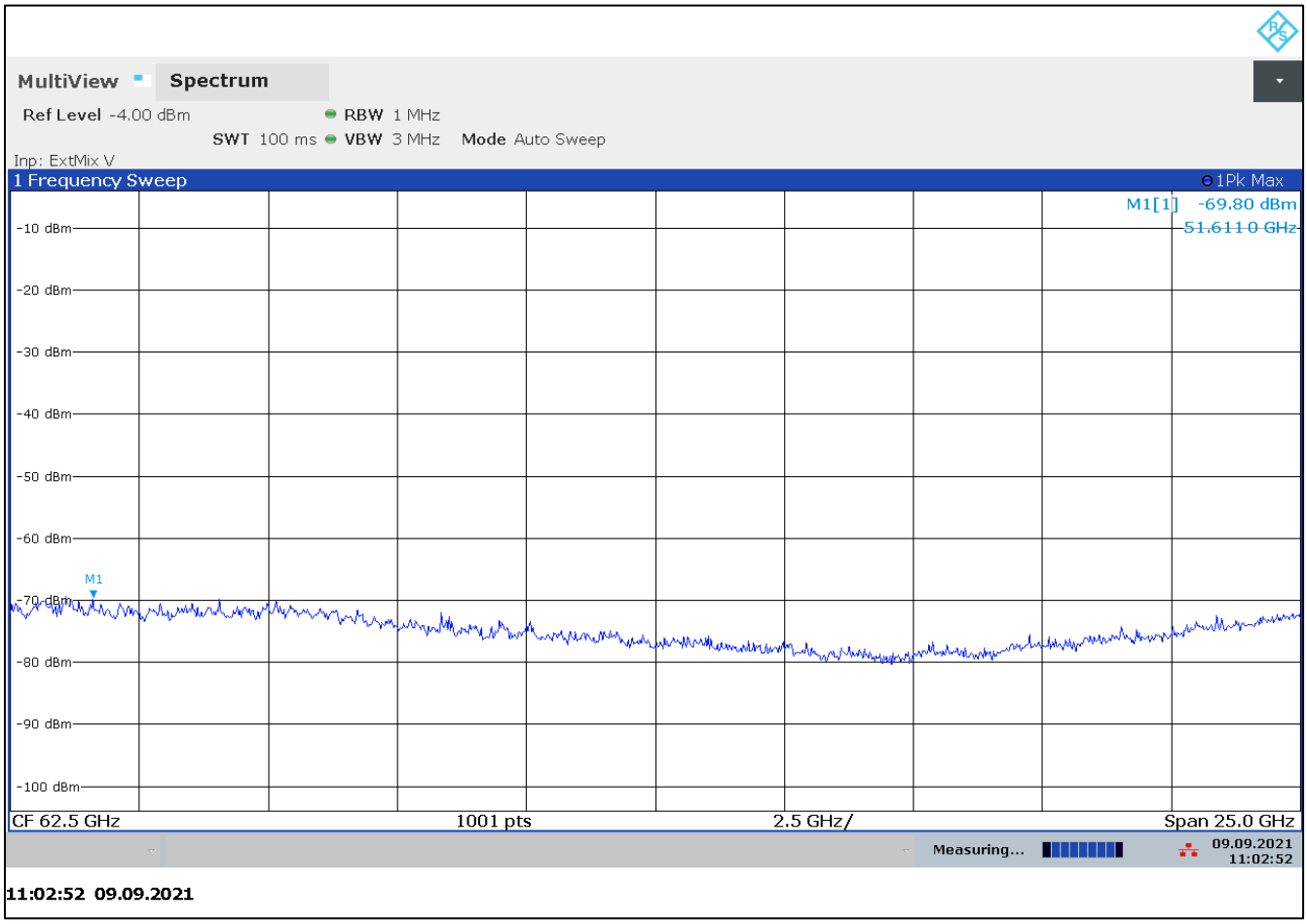


Table 5-17: Radiated Emissions – Fiberglass Container (50 GHz – 75 GHz) Peak

Frequency (GHz)	Detector	Test Antenna Pol	Measured Spectrum Analyzer Level (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 0.1m to 3m	Corrected Spectrum Analyzer Level (dBuV/m)	FCC Limit (dBuV)	Margin (dB)
51.611	PK	V	37.2	41.9	-29.5	49.6	74.0	-24.4

Plot 5-14: Radiated Emissions 50 GHz – 75 GHz; Fiberglass Container – Average

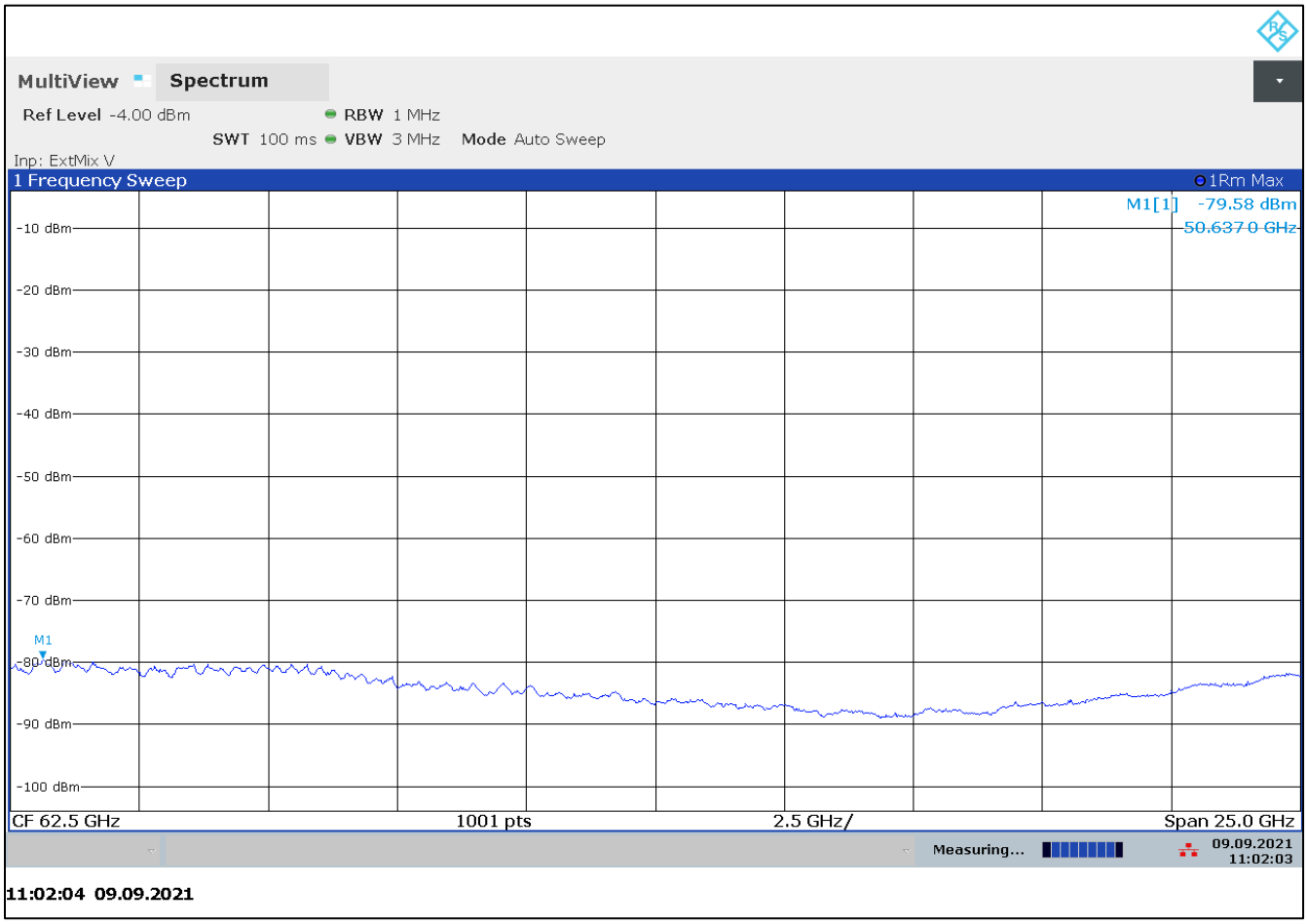


Table 5-18: Radiated Emissions – Fiberglass Container (50 GHz – 75 GHz) Average

Frequency (GHz)	Detector	Test Antenna Pol	Measured Spectrum Analyzer Level (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 0.1m to 3m	Corrected Spectrum Analyzer Level (dBuV/m)	FCC Limit (dBuV)	Margin (dB)
50.6370	AV	V	27.4	41.9	-29.5	39.8	54.0	-14.2

Plot 5-15: Radiated Emissions 75 GHz – 110 GHz; Fiberglass Container – Peak

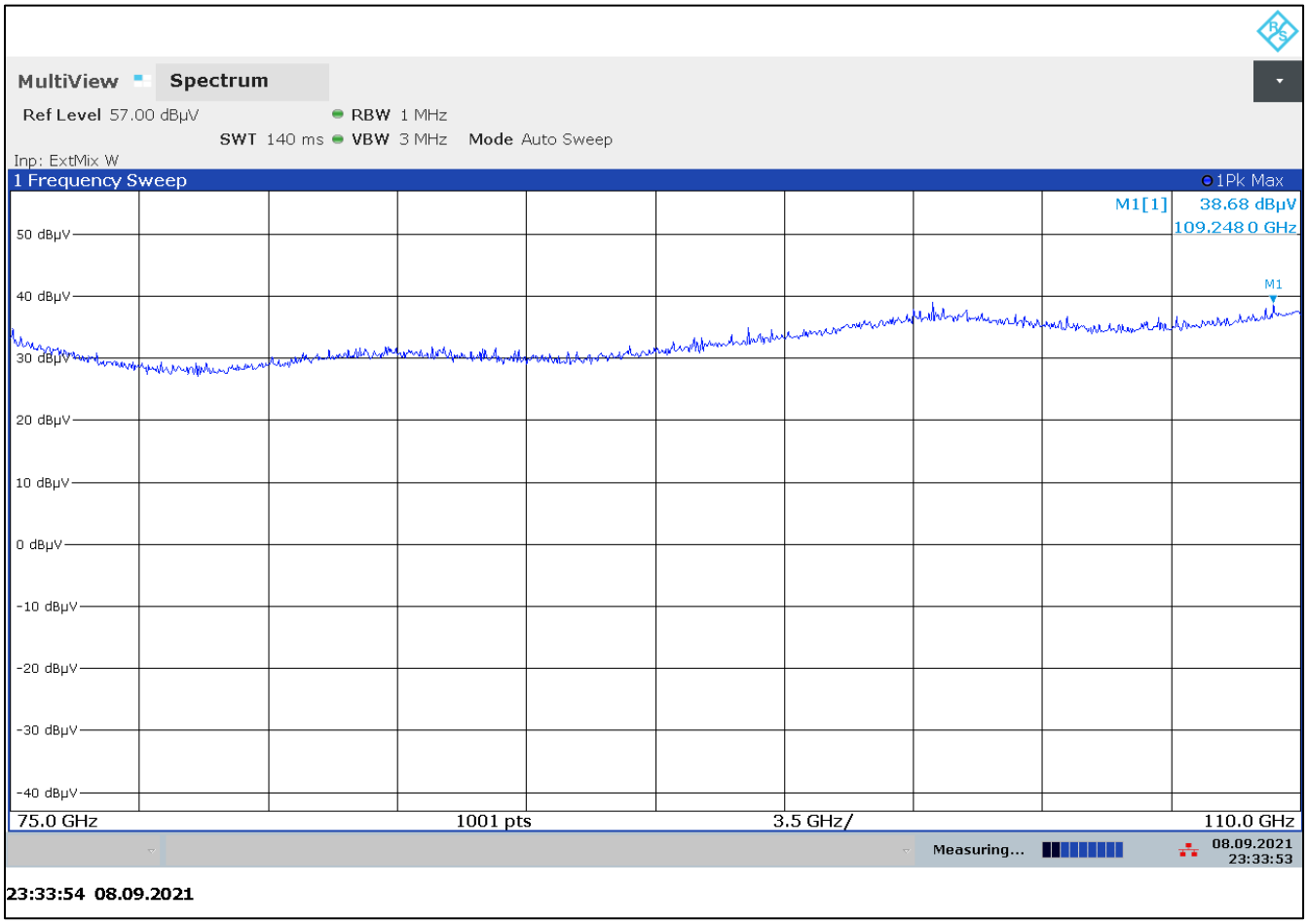


Table 5-19: Radiated Emissions – Fiberglass Container (75 GHz – 110 GHz) Peak

Frequency (GHz)	Detector	Test Antenna Pol	Measured Spectrum Analyzer Level (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 0.1m to 3m	Corrected Spectrum Analyzer Level (dBuV/m)	FCC Limit (dBuV)	Margin (dB)
109.248	PK	V	38.7	47.6	-29.5	56.8	74.0	-17.2

Plot 5-16: Radiated Emissions 75 GHz – 110 GHz; Fiberglass Container – Average

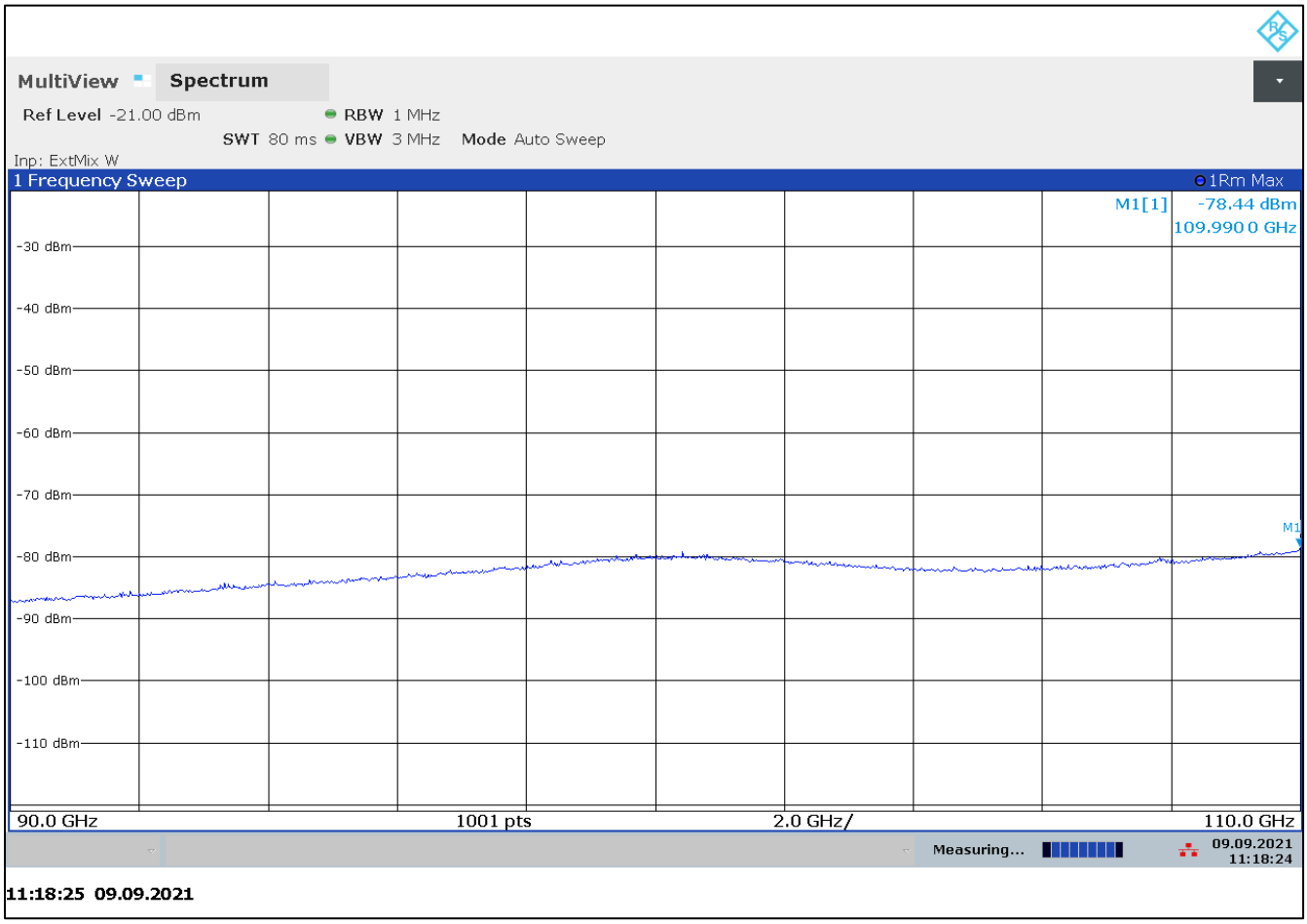


Table 5-20: Radiated Emissions – Fiberglass Container (75 GHz – 110 GHz) Average

Frequency (GHz)	Detector	Test Antenna Pol	Measured Spectrum Analyzer Level (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 0.1m to 3m	Corrected Spectrum Analyzer Level (dBuV/m)	FCC Limit (dBuV)	Margin (dB)
109.99	AV	V	28.6	47.6	-29.5	46.7	54.0	-7.3

Plot 5-17: Radiated Emissions 110 GHz – 140 GHz; Fiberglass Container – Peak

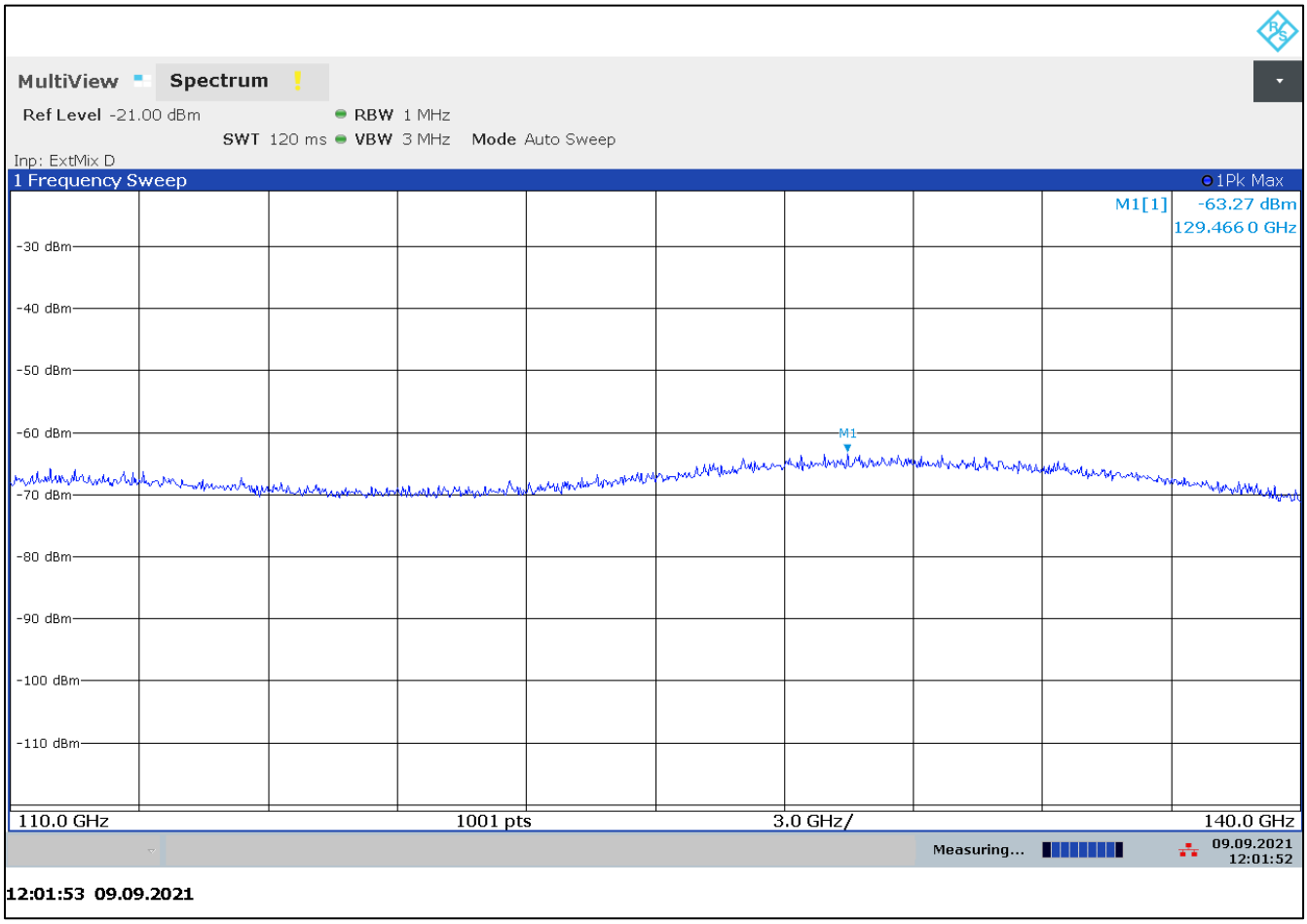


Table 5-21: Radiated Emissions – Fiberglass Container (110 GHz – 140 GHz) Peak

Frequency (GHz)	Detector	Test Antenna Pol	Measured Spectrum Analyzer Level (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 0.1m to 3m	Corrected Spectrum Analyzer Level (dBuV/m)	FCC Limit (dBuV)	Margin (dB)
129.466	PK	V	43.7	47.0	-29.5	61.2	74.0	-12.8

Plot 5-18: Radiated Emissions 110 GHz – 140 GHz; Fiberglass Container – Average

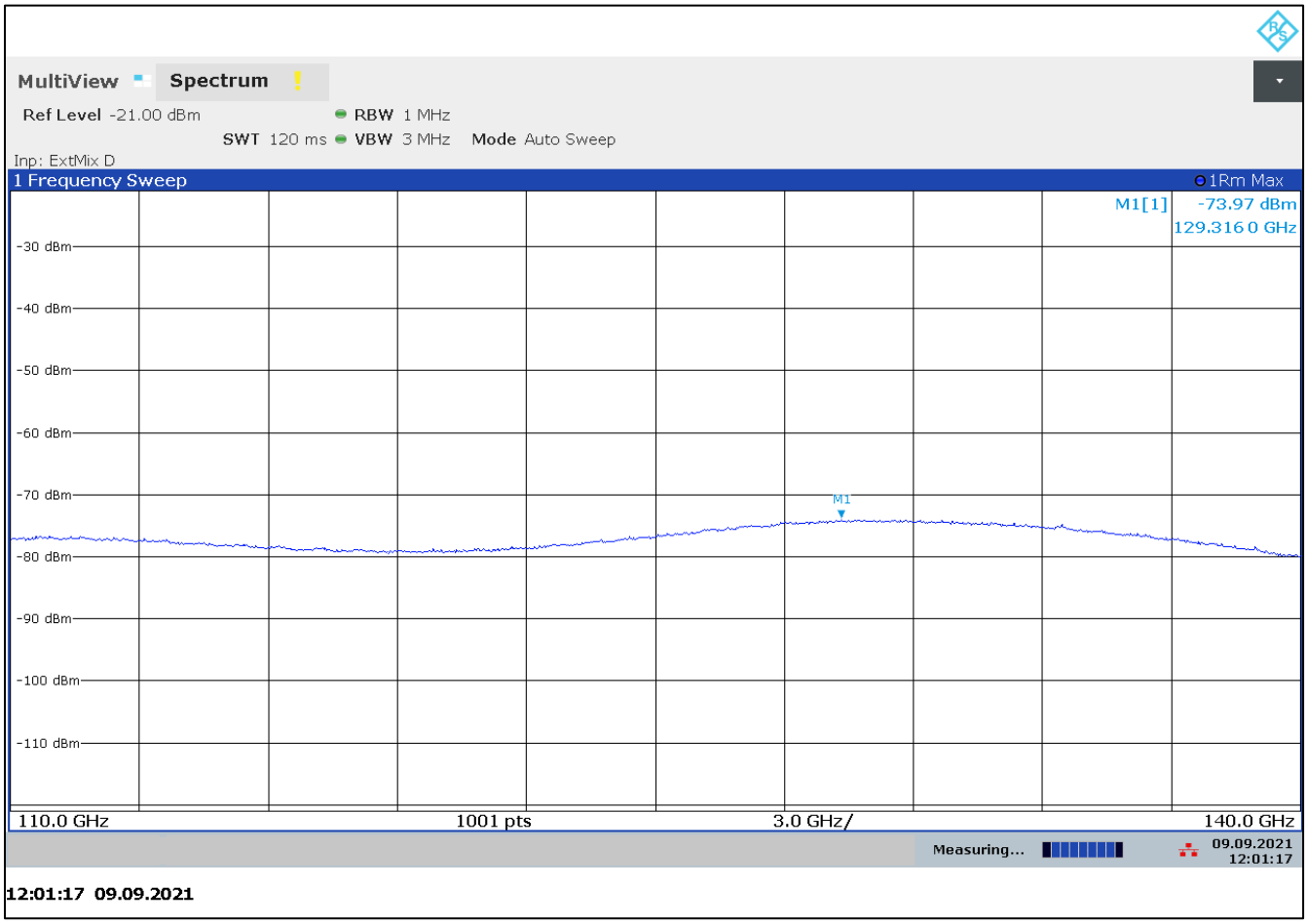


Table 5-22: Radiated Emissions – Fiberglass Container (110 GHz – 140 GHz) Average

Frequency (GHz)	Detector	Test Antenna Pol	Measured Spectrum Analyzer Level (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 0.1m to 3m	Corrected Spectrum Analyzer Level (dBuV/m)	FCC Limit (dBuV)	Margin (dB)
129.316	AV	V	33.0	47.0	-29.5	50.5	54.0	-3.5

Plot 5-19: Radiated Emissions 140 GHz – 220 GHz; Fiberglass Container– Peak

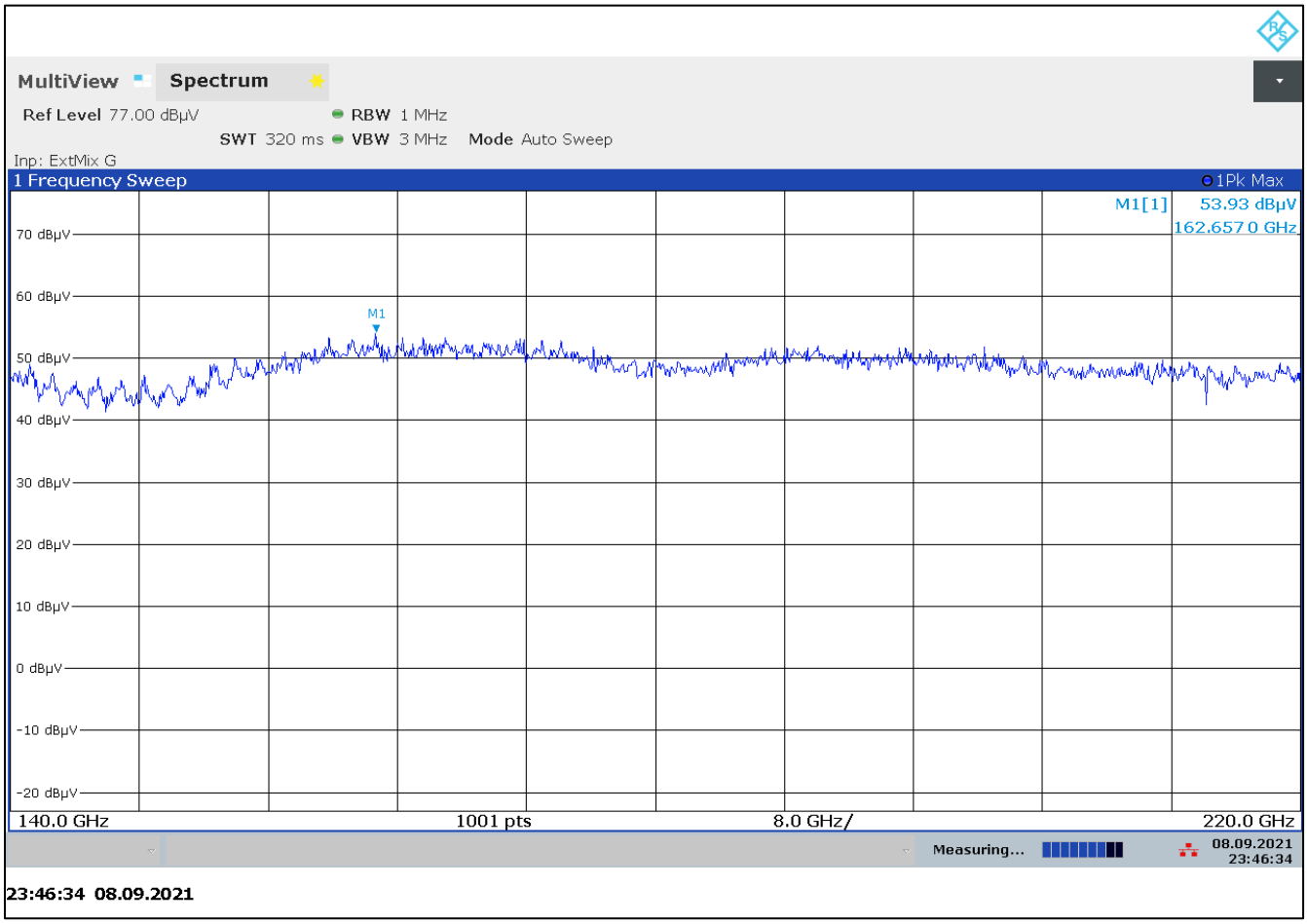


Table 5-23: Radiated Emissions – Fiberglass Container (140 GHz – 220 GHz) Peak

Frequency (GHz)	Detector	Test Antenna Pol	Measured Spectrum Analyzer Level (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 0.1m to 3m	Corrected Spectrum Analyzer Level (dBuV/m)	FCC Limit (dBuV)	Margin (dB)
162.657	PK	V	53.9	48.0	-29.5	72.4	74.0	-1.6

Plot 5-20: Radiated Emissions 140 GHz – 220 GHz; Fiberglass Container– Average

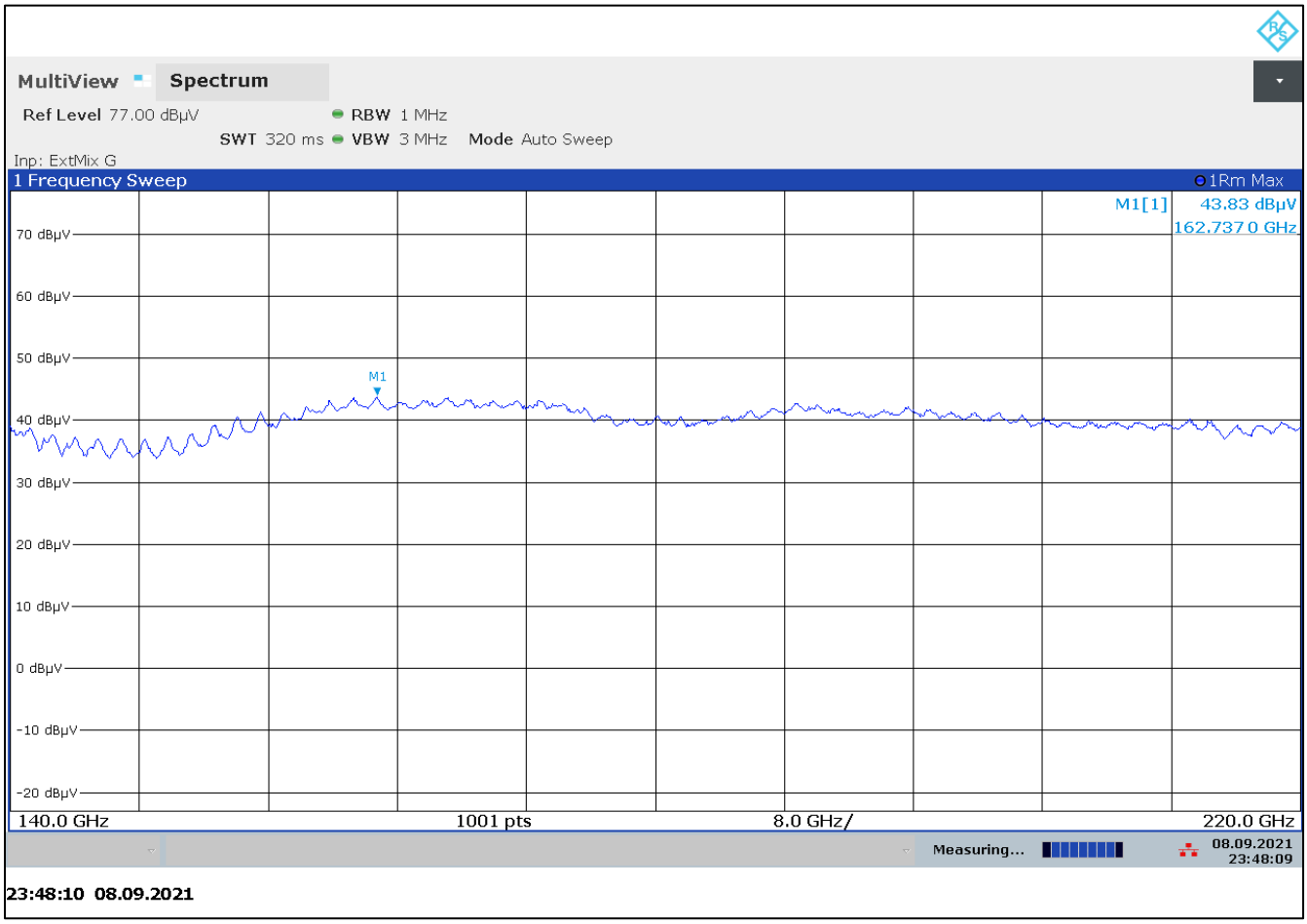


Table 5-24: Radiated Emissions – Fiberglass Container (140 GHz – 220 GHz) Average

Frequency (GHz)	Detector	Test Antenna Pol	Measured Spectrum Analyzer Level (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 0.025m to 3m	Corrected Spectrum Analyzer Level (dBuV/m)	FCC Limit (dBuV)	Margin (dB)
162.737	AV	V	43.8	48.0	-41.6	50.2	54.0	-3.8

Table 5-25: Radiated Emissions Test Equipment for Enclosure Plots

RTL Bar Code	Manufacturer	Part	Model	Serial Number	Calibration Due Date
901639	Wiltron	Waveguide (40 – 50 GHz)	35WR19F	N/A	Not required
901640	Rohde & Schwarz	Mixer (75 – 110 GHz)	FS-Z110	100010	05/03/23
901773	Rohde & Schwarz	Spectrum Analyzer	FSW50	101021	08/16/22
900930	Hewlett Packard	Spectrum Analyzer Display Section	85662A	3144A20839	02/26/23
900931	Hewlett Packard	Spectrum Analyzer (100 Hz - 22 GHz)	8566B	3138A07771	02/26/23
901586	Rohde & Schwarz	Harmonic Mixer (50 – 75 GHz)	FS-Z75	100098	01/23/22
901256	ATM	Horn Antenna WR-19 (40 - 60 GHz)	19-443-6R	8041704-01	05/03/23
901303	EMCO	Horn Antenna WR-28 (26.5 - 40.0 GHz)	3160-10	960452-007	08/05/24
901161	ATM	Waveguide (26.5 – 40 GHz)	28-25K-6	B082304	Not required
900711	ATM	Horn Antenna (75 - 110 GHz)	10-443-6R	8051905-1	04/07/22
900712	ATM	Horn Antenna (50 - 75 GHz)	15-443-6R	8051805-1	04/07/22
901669	ETS-Lindgren	BiLog Antenna (26 - 6000 MHz)	3142E	00166065	04/24/22
900772	EMCO	Horn Antenna (2 - 4 GHz)	3161-02	9804-1044	08/05/24
900321	EMCO	Horn Antenna (4.0 - 8.2 GHz)	3161-03	9508-1020	08/05/24
901587	Radiometer Physics Gmbh	140 - 220 GHz Mixer	SAM-220	20005	04/15/22
900713	ATM	Horn Antenna (140 – 220)	05-443-6R	S0685	05/03/23
900323	EMCO	Horn Antenna (8.2 - 12.4 GHz)	3160-07	9605-1054	08/05/24
900356	EMCO	Horn Antenna (12.4 - 18 GHz)	3160-08	9607-1044	08/05/24
901218	EMCO	Horn Antenna (18 - 26.5 GHz)	3160-09	960281-003	08/05/24

Measurement uncertainty: ±4.6 dB. This measurement uncertainty is an expanded uncertainty for 95% confidence level received with a coverage factor k=2.

Result: PASS

Test Personnel:

Daniel W. Baltzell		September 17, 2021
Test Engineer	Signature	Date of Test

6 Conclusion

The data in this measurement report shows that the AMETEK Magnetrol USA, LLC Model R80, FCC ID: LPN-R80, IC: 2331A-R80, complies with the applicable requirements of Parts 2 and 15 of the FCC rules and regulations, and those of ISED Canada RSS-211 and RSS-Gen.