FCC Part 15.256 & ISED Canada RSS-211/RSS-Gen
Certification Application Report

Test Lab:		Applicant:	
Rhein Tech Laboratories, Inc. Tel: 703-689-0368 360 Herndon Parkway, Ste 1400 www.rheintech.com Herndon, VA 20170 atcbinfo@rheintech.com		AMETEK Magnetrol USA, LLC 705 Enterprise Street Aurora, Illinois 60504 USA	
FCC ID / IC	LPN-R80 / 2331A-R80	**Test Report Date**	January 11, 2022
Platform	N/A	**RTL Work Order #**	2021097
Model	R80	**RTL Quote #**	QRTL21-097A
FCC Classification	LPR – Level Probing Radar		
FCC Rule Part(s)/ Guidance	Part 15.256: Level Probing Radar; FCC 14-2: ET Docket No. 10-23: Amendment of Part 15 of the Commission's Rules To Establish Regulations for Level Probing Radars and Tank Level Probing Radars in the Frequency Bands 5.925-7.250 GHz, 24.05-29.00 GHz and 75-85 GHz; KDB 890966-D01 Measure Level Probing Radars V01 (April 4, 2014); TR 14-1007 Measurement of Fundamental Emissions of FMCW Level Probing Radars (LPR) under Part 15, Section 15.256 (June 13, 2014)		
ISED Canada	RSS-211 Issue 1 - Level Probing Radar Equipment; RSS-Gen Issue 5 - General Requirements for Compliance of Radio Apparatus; ETSI EN 302 729 — Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SDR); Level Probing Radar (LPR) equipment operating in the frequency ranges 6 GHz to 8,5 GHz, 24,05 GHz to 26,5 GHz, 57 GHz to 64 GHz, 75 GHz to 85 GHz; Part 1: Technical characteristics and test methods		
Test Procedure	ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
Digital Interface Information	Digital Interface was found to be compliant		

Frequency Range (GHz)	**Output Power (W) (Peak EIRP)**	**Frequency Tolerance**	**Emission Designator**
77.0 – 81.0	1.54	N/A	N/A

I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this test report. 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 applicable parts of FCC Part 2, FCC Part 15, ISED Canada RSS-211, RSS-Gen, and ANSI C63.10.

Typed/Printed Name: Desmond A. Fraser — Date: January 11, 2022 — Position: President

Typed/Printed Name: Daniel W. Baltzell — Date: January 11, 2022 — Position: Test Engineer

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1 General Information

1.1 Scope

This measurement report is prepared on behalf of AMETEK Magnetrol USA, LLC in accordance with the applicable Federal Communications Commission and ISED Canada rules and regulations.

The Equipment Under Test (EUT) was the level probing radar Model R80, FCC ID: LPN-R80, IC: 2331A-R80, configured with the 3" horn antenna with a 34 dBi gain

All measurements contained in this application were conducted in accordance with FCC Rules and Regulations CFR 47, ANSI C63.10 American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices, 2013, and ETSI EN 302 729 Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SDR); Level Probing Radar (LPR) equipment operating in the frequency ranges 6 GHz to 8,5 GHz, 24,05 GHz to 26,5 GHz, 57 GHz to 64 GHz, 75 GHz to 85 GHz; Part 1: Technical characteristics and test methods.

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 §15.256 and ISED RSS-211 application. The EUT can be configured with either horn antenna 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 open-air measurements. Based on the compliance of the higher gain antenna, the FCC grant and ISED TAC should include both the 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

1.4 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

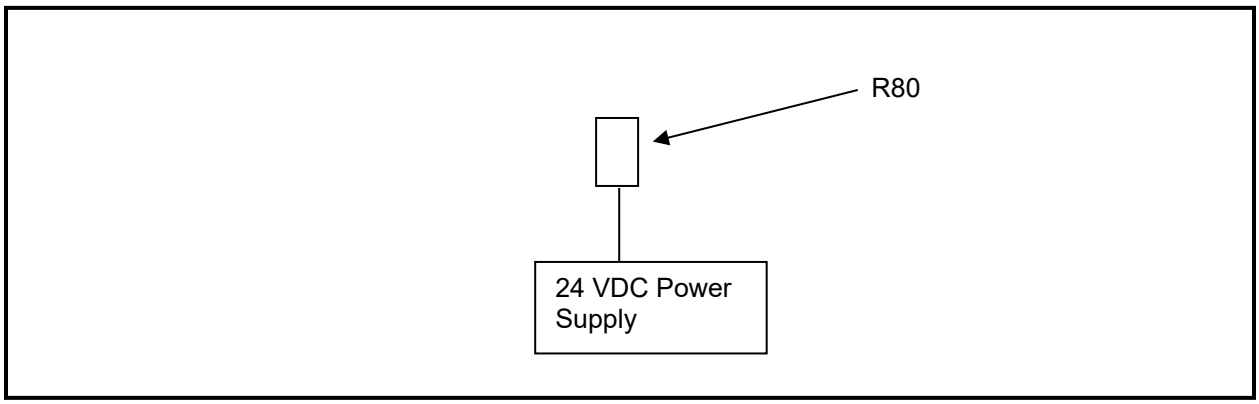
Table 2-2: Support Equipment

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 Configurations

The EUT was tested in the following configuration and the test data is included in this report.

Figure 2-1: Configuration of Tested System



2.2 Test Distance

The final radiated emissions tests were performed at a 3 meter horizontal distance from the edge of the radar to the test antenna. The EUT was also investigated at closer test distances in order to discern any emissions.

3 Modulated Bandwidth – ANSI C63.10 6.9, FCC §15.256(f); ISED RSS-Gen 6.7, RSS-211 5.1(a)

3.1 Modulated Bandwidth Test Procedure - FCC §15.256(f)

The minimum 10 dB bandwidth 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 an upper and lower image. The analyzer "Signal ID" was used to aid in discerning the actual image displayed by the mixer. Max hold was used until the spectrum was adequately filled to portray the bandwidth and a plot was taken.

3.2 Limits

(f) The fundamental bandwidth of an LPR emission is defined as the width of the signal between two points, one below and one above the center frequency, outside of which all emissions are attenuated by at least 10 dB relative to the maximum transmitter output power when measured in an equivalent resolution bandwidth.
(1) The minimum fundamental emission bandwidth shall be 50 MHz for LPR operation under the provisions of this section.

3.3 Modulated Bandwidth Test Data

Table 3-1: 10 dB Modulated Bandwidth - §15.256(f)(1)

Model	10 dB Bandwidth (MHz)	Minimum Limit (MHz)	Margin (MHz)
R80	3391.4	50	-3341.4

Plot 3-1: 10 dB Modulated Bandwidth

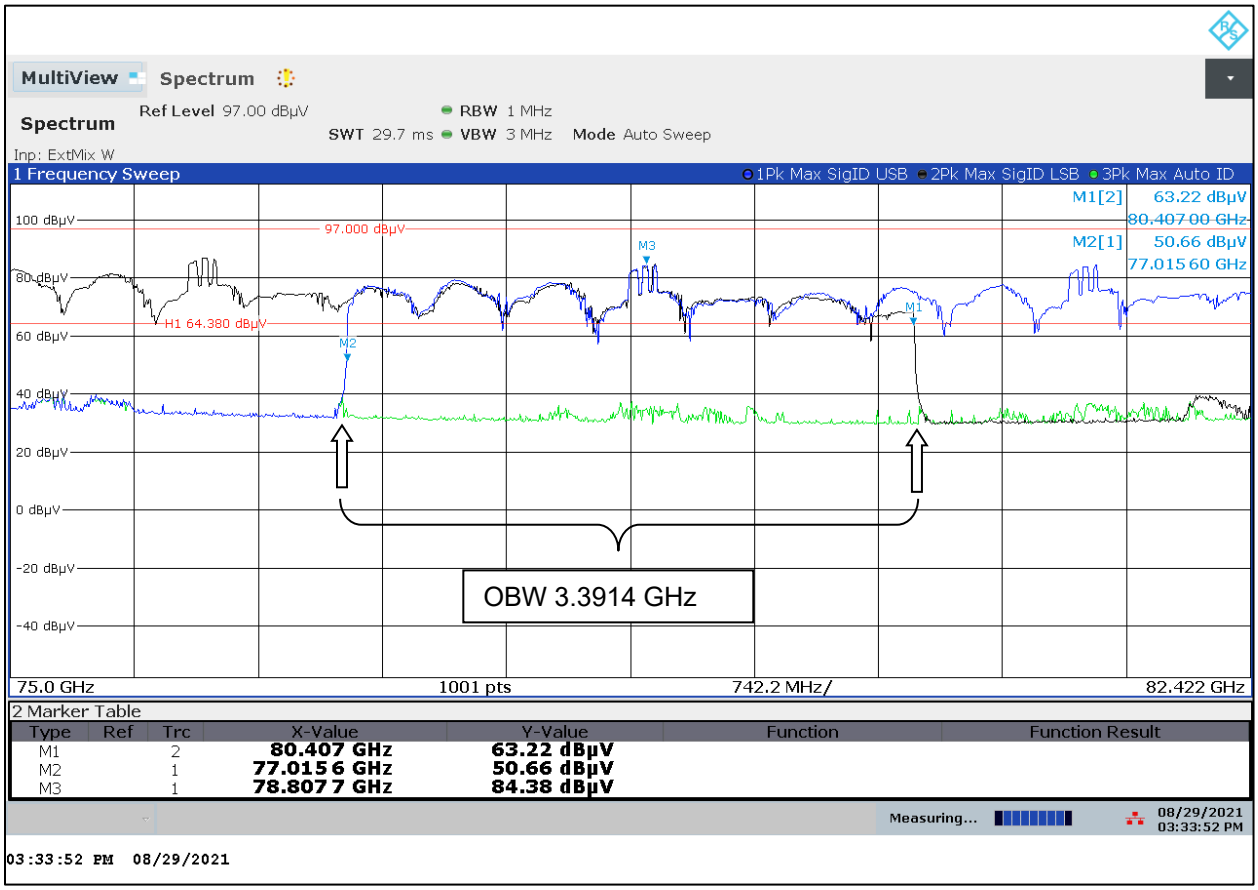


Table 3-2: Modulated Bandwidth Test Equipment

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

4 Radiated Emissions – ANSI C63.10 6.3, FCC §15.256(g); ISED RSS-Gen 6.12, RSS-211 5.2; ETSI EN 302 729 8.3

4.1 Radiated Fundamental Emissions Test Procedure – FCC §15.256(g); RSS-Gen 6.12

Radiated emissions of the fundamental were tested by "bore sighting" the main-beam emissions to produce the maximum antenna coupling. The EUT was also checked in all three orthogonal planes. Measurement was based on a peak detector and average calculated using an average factor. Limits are -3 dBm for average, and 34 dBm for peak. One meter measuring distance was used and corrected to 3 meter distance.

Limits: The EIRP limits for LPR operations in the bands authorized by this rule section are provided in the following table. These emission limits are based on bore sight measurements (i.e., measurements performed within the main beam of the LPR antenna).

Frequency Band of Operation (GHz)	Average Emission Limit (EIRP in dBm measured in 1 MHz)	Peak Emission Limit (EIRP in dBm measured in 50 MHz)
5.925-7.250	-33	7
24.05-29.00	-14	26
75-85	-3	34

4.2 Radiated Fundamental Emissions Test Data

Radiated measurements are converted from dBuV/m to dBm using the following equations from KDB 890966 6b:

For radiated emission measurements

EIRP (dBm) = F.S. (dBµV/m) – 104.8 + 20 Log D

where:

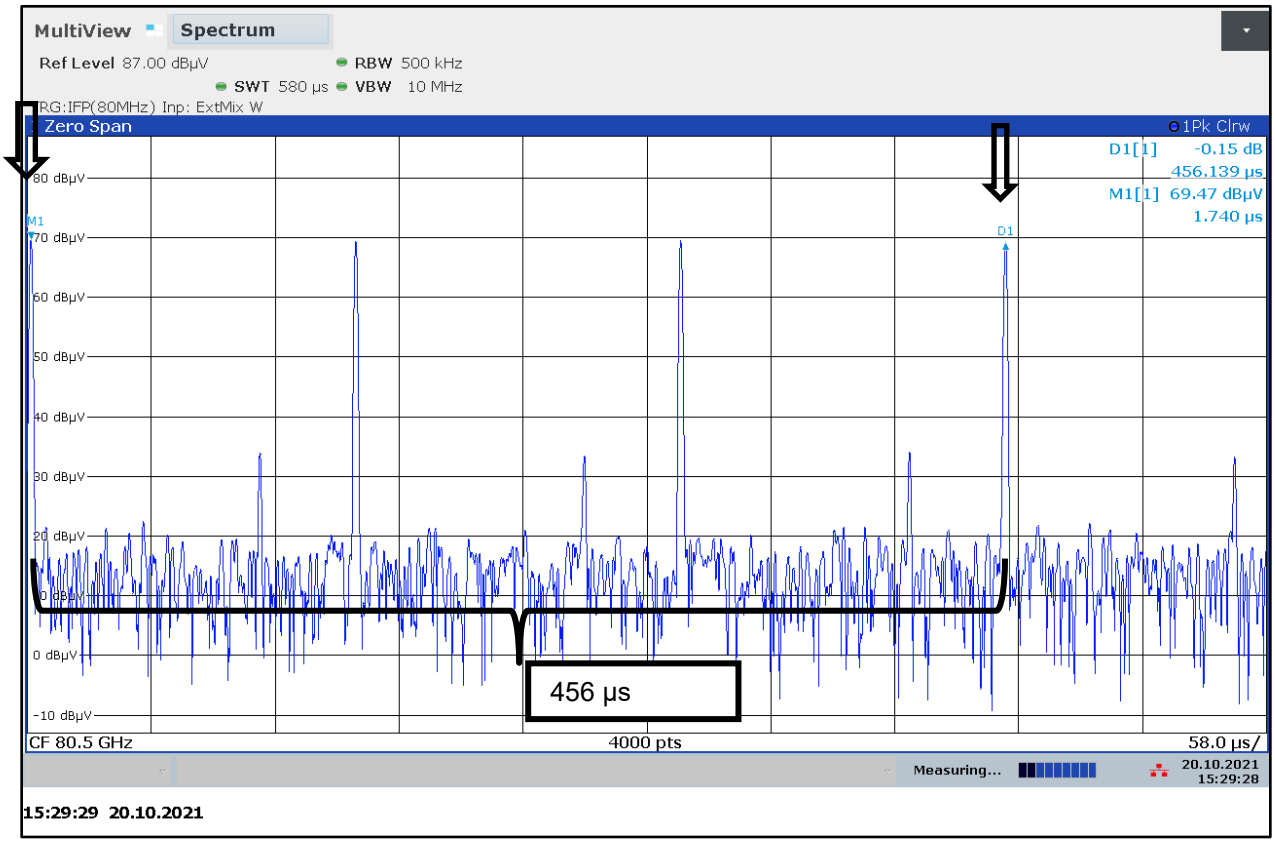
D is the measurement distance (one meter was used)

Average factor is calculated to determine an average value from the peak per section F of KDB 890966 D01.

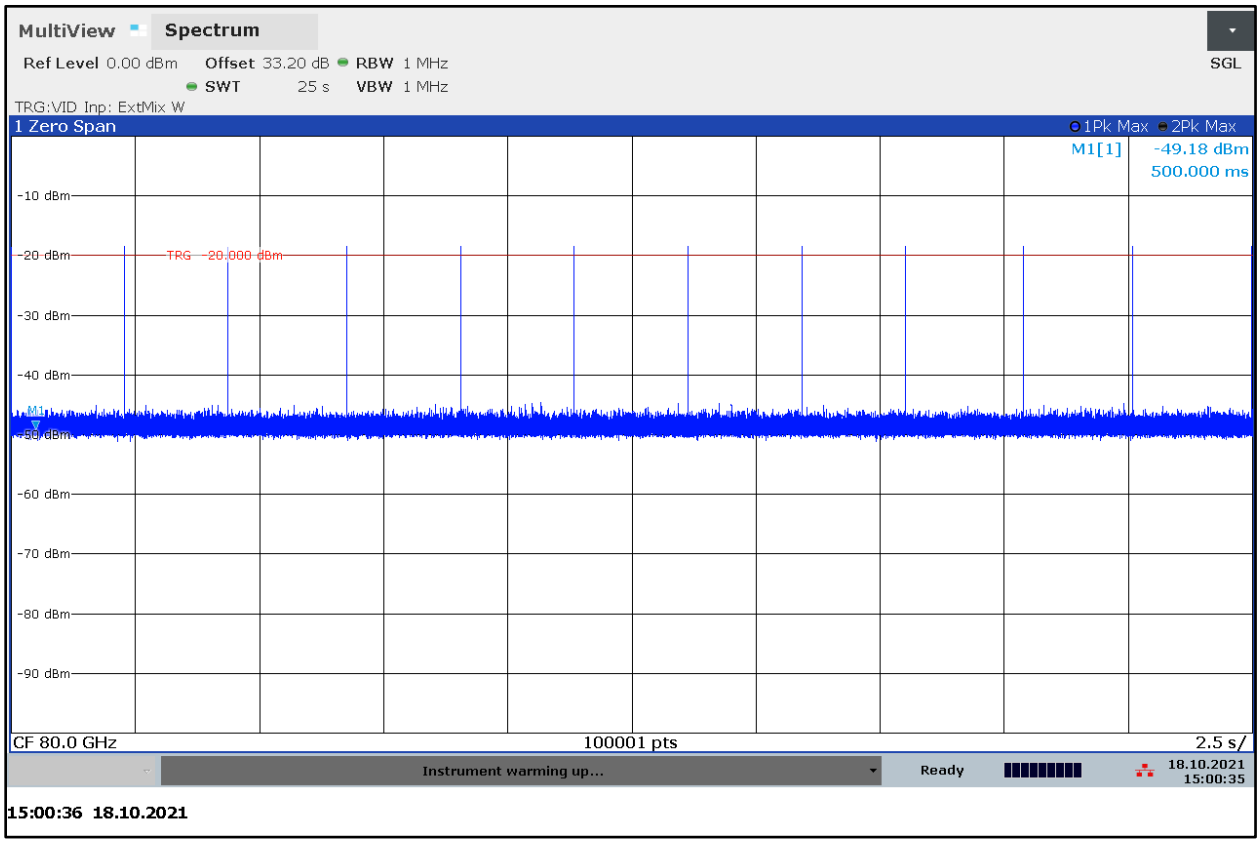
$T_D = T_S/\Delta F$; T_S=signal sweep=456 µs; ΔF=signal span=3391 MHz; T_D= 134 ns/MHz

Average factor= T_D/cycle time=(134 ns/MHz)/2.27 = 5.9E-8

Plot 4-1: 456 microsecond Signal Sweep



Plot 4-2: 2.27 second Cycle Time



11 cycle time groups in 25 second sweep = 2.27 second sweep frequency cycle time.

Table 4-1: Radiated Fundamental Emissions (EIRP in 1 MHz, Average Calculation)

Frequency (GHz)	Peak EIRP Measured (dBuV)	Antenna Correction Factor (dB/m)	Corrected Measurement (dBuV/m) @ 3m	Converted With Average Factor (dBm)	Average Limit (dBm)	Margin (dB)
79	81.6*	45.5	127.1	-40.4	-3.0	-37.4

* 1m measurement converted to 3m; 91.1+20log(1/3)=81.6

81.6 dBuV + Antenna Factor (45.5) = 127.1 dBuV/m @ 3m = 31.9 dBm

31.9 dBm = 1.54 W; 1.54 x Average Factor ($5.9E^{-08}$) = 90.1 nW = -40.4 dBm

Table 4-2: Radiated Fundamental Emissions (EIRP, Peak)

Frequency (GHz)	Peak EIRP Measured (dBuV)	Antenna Correction Factor (dB/m)	Corrected Measurement (dBuV/m) @ 3m	Converted to dBm	Peak Limit (dBm)	Margin (dB)
79	81.6*	45.5	127.1	31.9	34.0	-2.2

* 1m measurement converted to 3m; 91.1+20log(1/3)=81.6

Plot 4-3: Average Radiated Fundamental (EIRP in 1 MHz, Peak Detector)

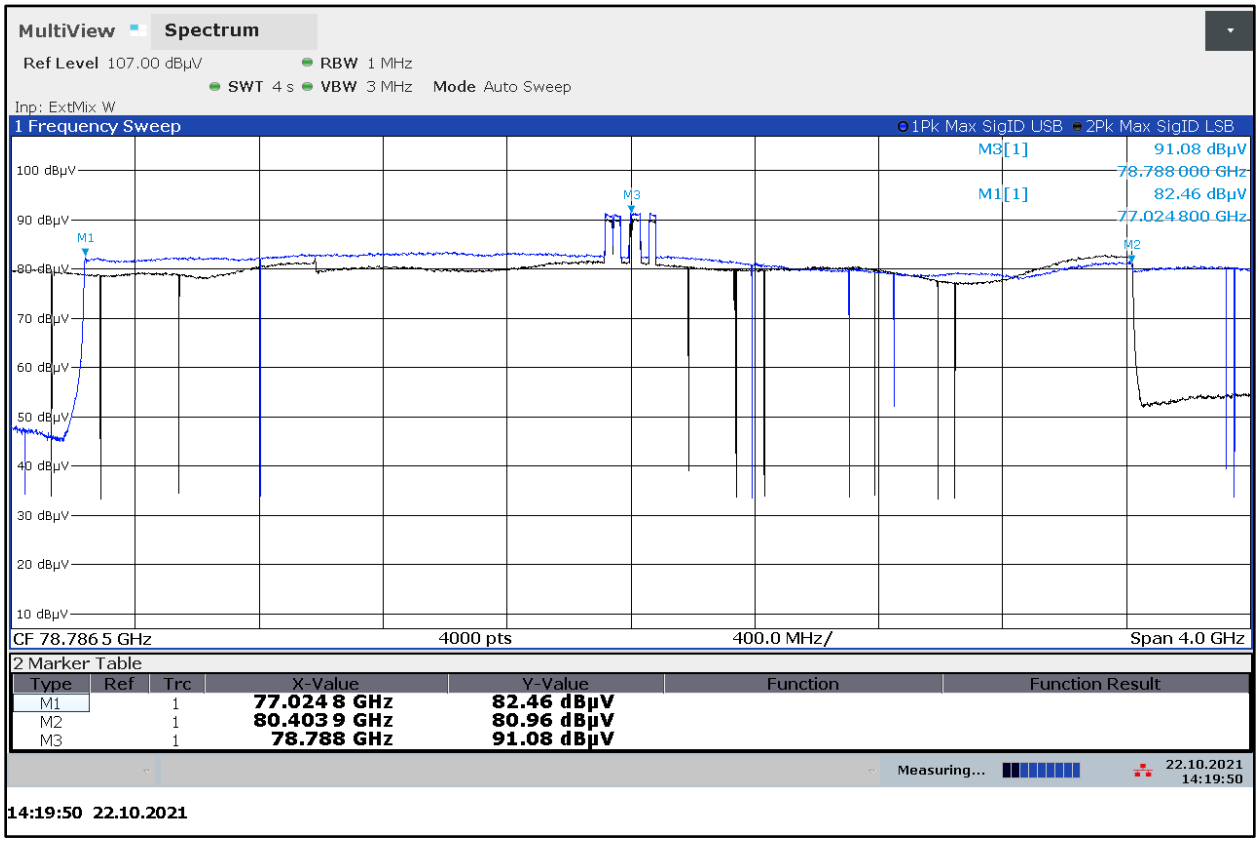


Table 4-3: Radiated Fundamental Emissions Test Equipment

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		October 18-22, 2021
Test Engineer	Signature	Dates of Test

5 Radiated Emissions – ANSI C63.10 6.3, FCC §15.256(h), (k); ISED RSS-Gen 6.13, RSS-211 5.1(d)

5.1 Radiated Emissions Harmonics/Spurious Test Procedure – FCC §15.256(h), (k), RSS-Gen 6.13

Noise floor and spurious emission data was taken at 1m or closer and corrected to 3m, 3m at less than 1 GHz. The EUT was checked in the three orthogonal planes with the receive antenna in both polarities. A resolution bandwidth of 100 kHz was used for frequencies less than 1000 MHz, and a resolution bandwidth of 1 MHz was used for frequencies greater than or equal to 1000 MHz.

Limit: Unwanted Emissions from LPR devices shall not exceed the general emission limit in §15.209 of this chapter.

5.2 Radiated Emissions Harmonics/Spurious Test Data

The following plots are provided as reference; tabular data of pertinent frequencies follow.

The plots were taken at 1 GHz to 220 GHz, the emissions from the EUT were investigated at:

0.02m at 140-220 GHz;
0.1m from 75-140 GHz;
1m for peak and 0.31m for average emission from 50-75 GHz;
1m from 1 GHz to 50 GHz;
3m below 1 GHz

to ensure no indication of detectable emissions.

Plot 5-1: Radiated Spurious Emissions (140 GHz - 220 GHz)

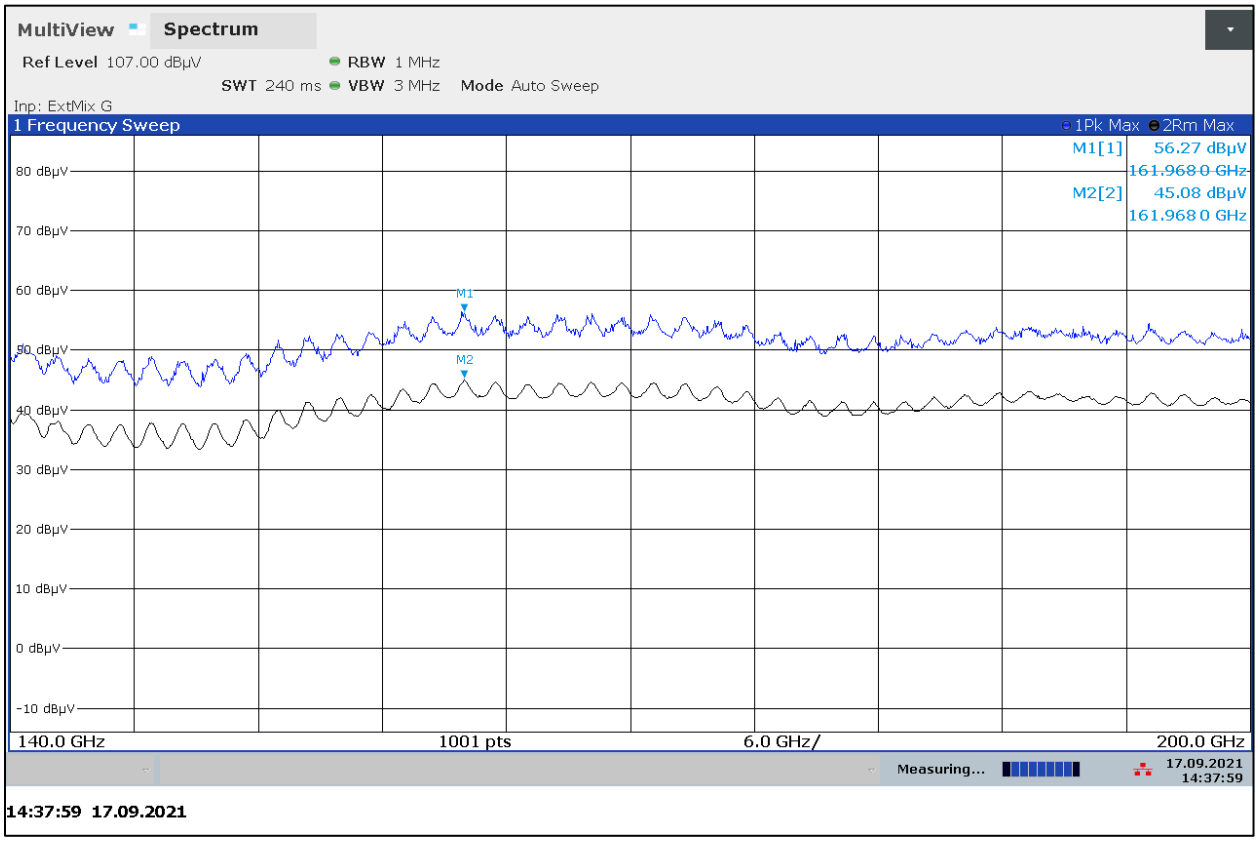


Table 5-1: Radiated Spurious Emissions (140 GHz - 220 GHz)

Frequency (GHz)	Detector Type	EIRP Measured (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 0.02m to 3m (dB)	Corrected Measurement (dBuV/m)	Limits (dBuV/m)	Margin (dB)
161.968	Peak	56.3	51.4	-43.5	64.2	74.0	-9.8
161.968	RMS	45.1	51.4	-43.5	53.0	54.0	-1.0

Plot 5-2: Radiated Spurious Emissions (90 GHz – 140 GHz)

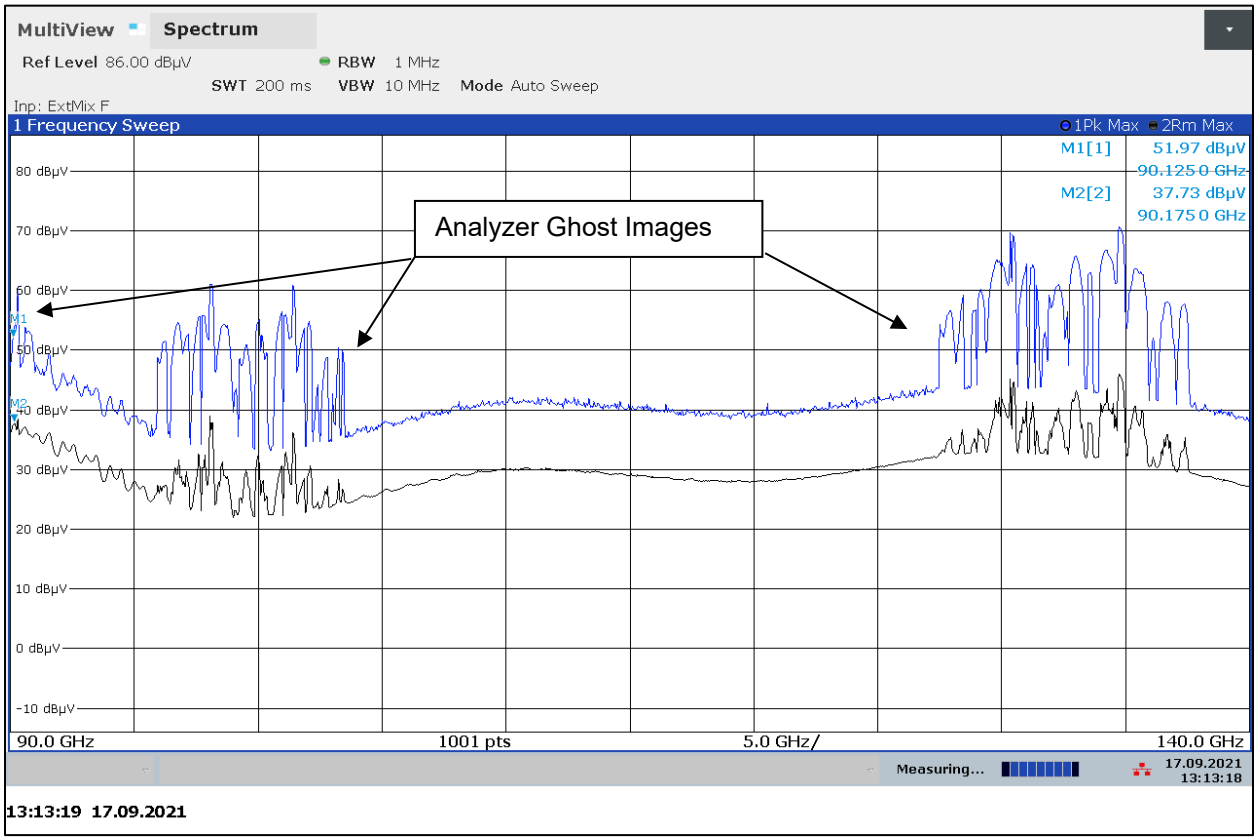


Table 5-2: Radiated Spurious Emissions (90 GHz – 140 GHz)

Frequency (GHz)	Detector Type	EIRP Measured (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 0.1m to 3m (dB)	Corrected Measurement (dBuV/m)	Limits (dBuV/m)	Margin (dB)
90.125	Peak	52.0	45.3	-29.5	67.8	74.0	-6.2
90.175	RMS	37.7	45.3	-29.5	53.5	54.0	-0.5

Plot 5-3: Radiated Spurious Emissions (75 GHz - 110 GHz)

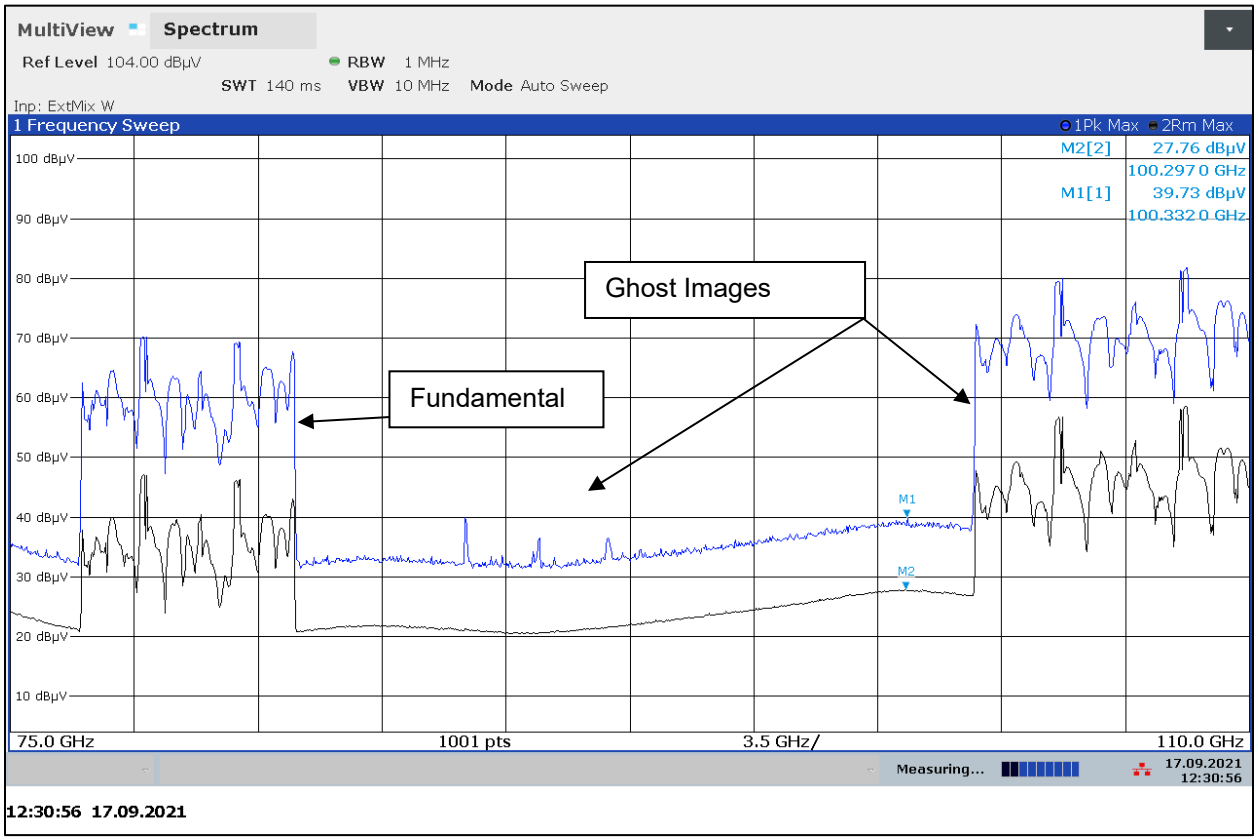


Table 5-3: Radiated Spurious Emissions (75 GHz – 110 GHz)

Frequency (GHz)	Detector Type	EIRP Measured (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 0.1m to 3m (dB)	Corrected Measurement (dBuV/m)	Limits (dBuV/m)	Margin (dB)
100.332	Peak	39.7	47.0	-29.5	57.2	74.0	-16.8
100.297	RMS	27.8	47.0	-29.5	45.3	54.0	-8.7

Plot 5-4: Radiated Spurious Emissions (50 GHz – 75 GHz), Peak

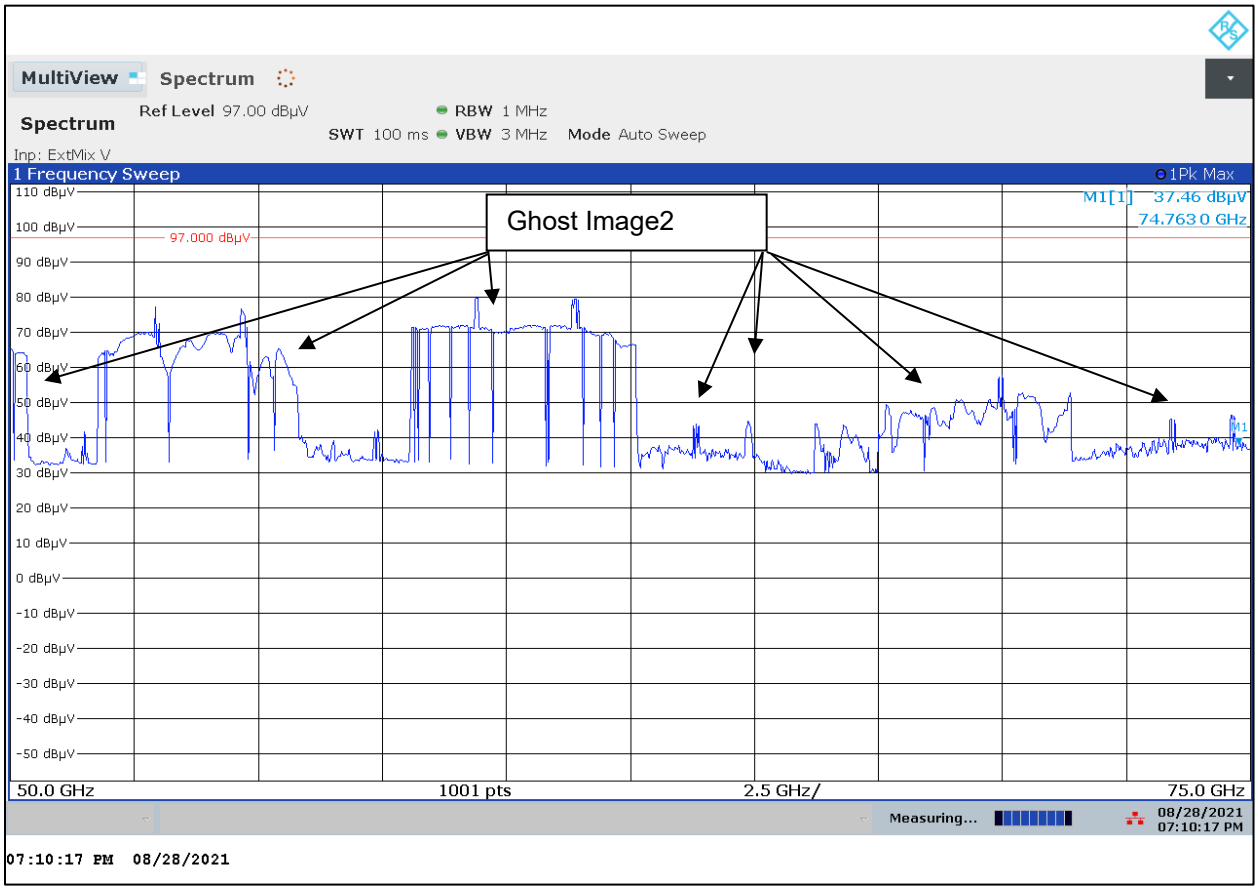


Table 5-4: Radiated Peak Emission (50 GHz – 75 GHz)

Frequency (GHz)	Peak EIRP Measured (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 1m to 3m (dB)	Corrected Measurement (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)
74.763	37.5	44.3	-9.5	72.2	74.0	-1.8

Plot 5-5: Radiated Spurious Emissions (50 GHz – 75 GHz), Average

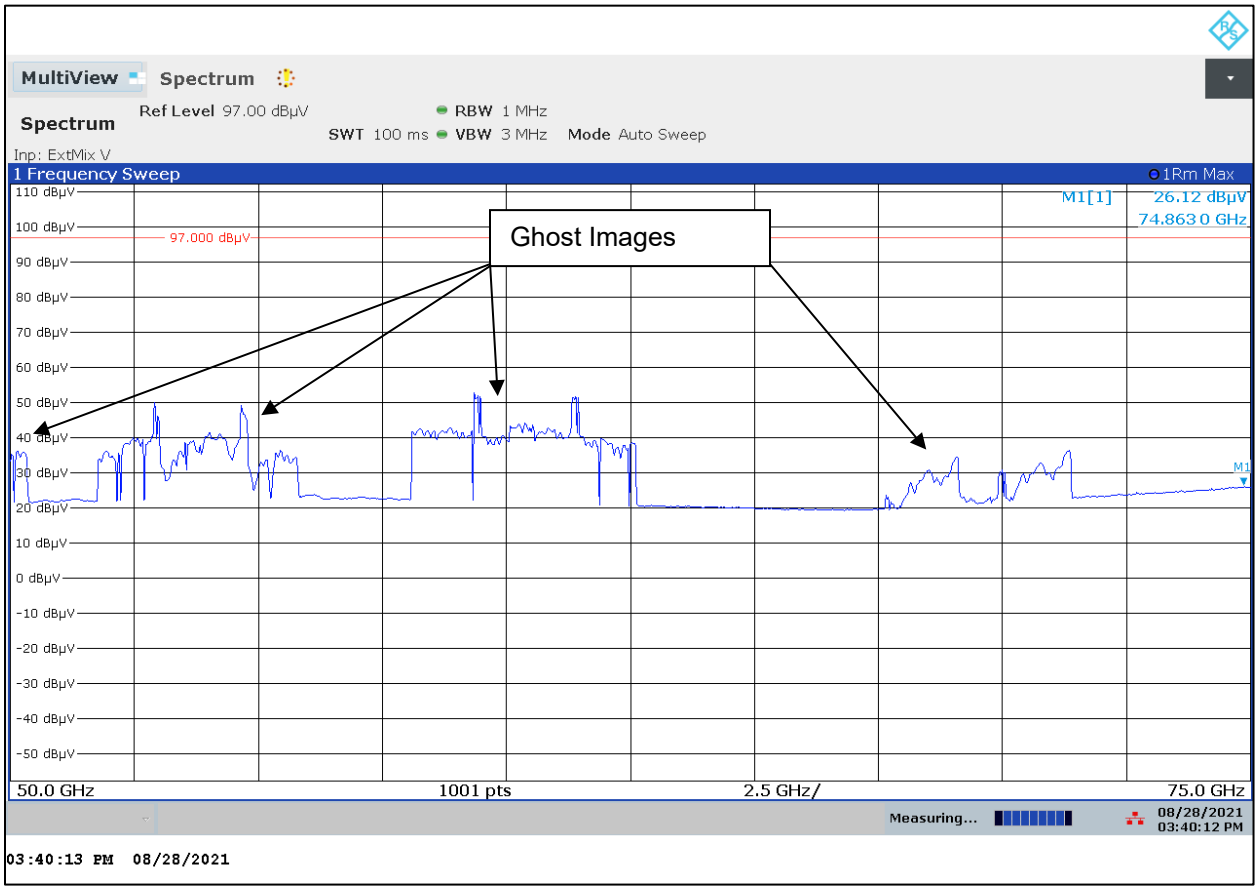


Table 5-5: Radiated Average Emission (50 GHz – 75 GHz)

Frequency (GHz)	Average EIRP Measured (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 0.31m to 3m (dB)	Corrected Measurement (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)
74.863	26.1	44.3	-19.7	50.7	54.0	-3.3

Plot 5-6: Radiated Spurious Emissions (40 GHz – 50 GHz)

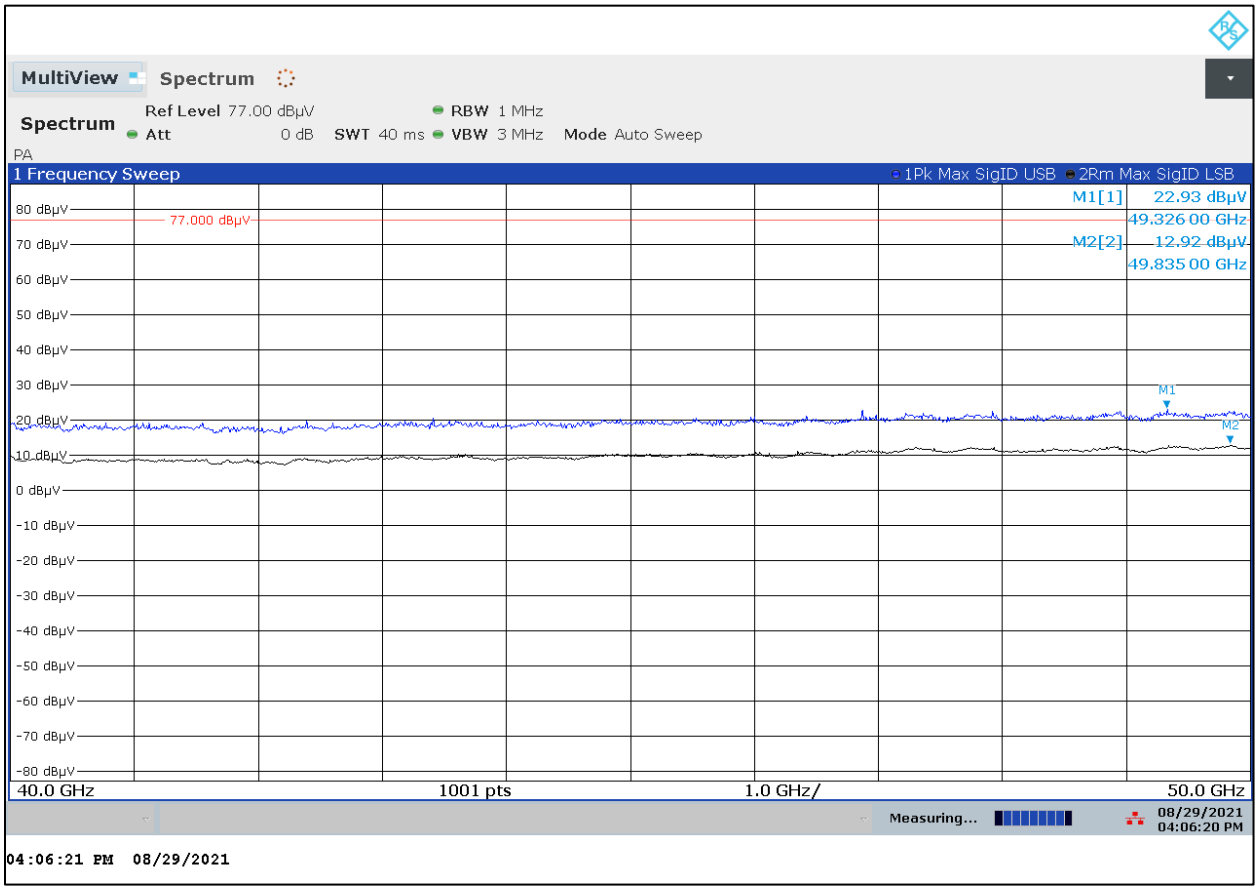


Table 5-6: Radiated Spurious Emissions (40 GHz – 50 GHz)

Frequency (GHz)	Detector Type	EIRP Measured (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 1m to 3m (dB)	Corrected Measurement (dBuV/m)	Limits (dBuV/m)	Margin (dB)
49.326	Peak	22.9	40.0	-9.5	53.4	74.0	-20.6
49.835	RMS	12.9	40.0	-9.5	43.4	54.0	-10.6

Plot 5-7: Radiated Spurious Emissions (26.5 GHz – 40 GHz)

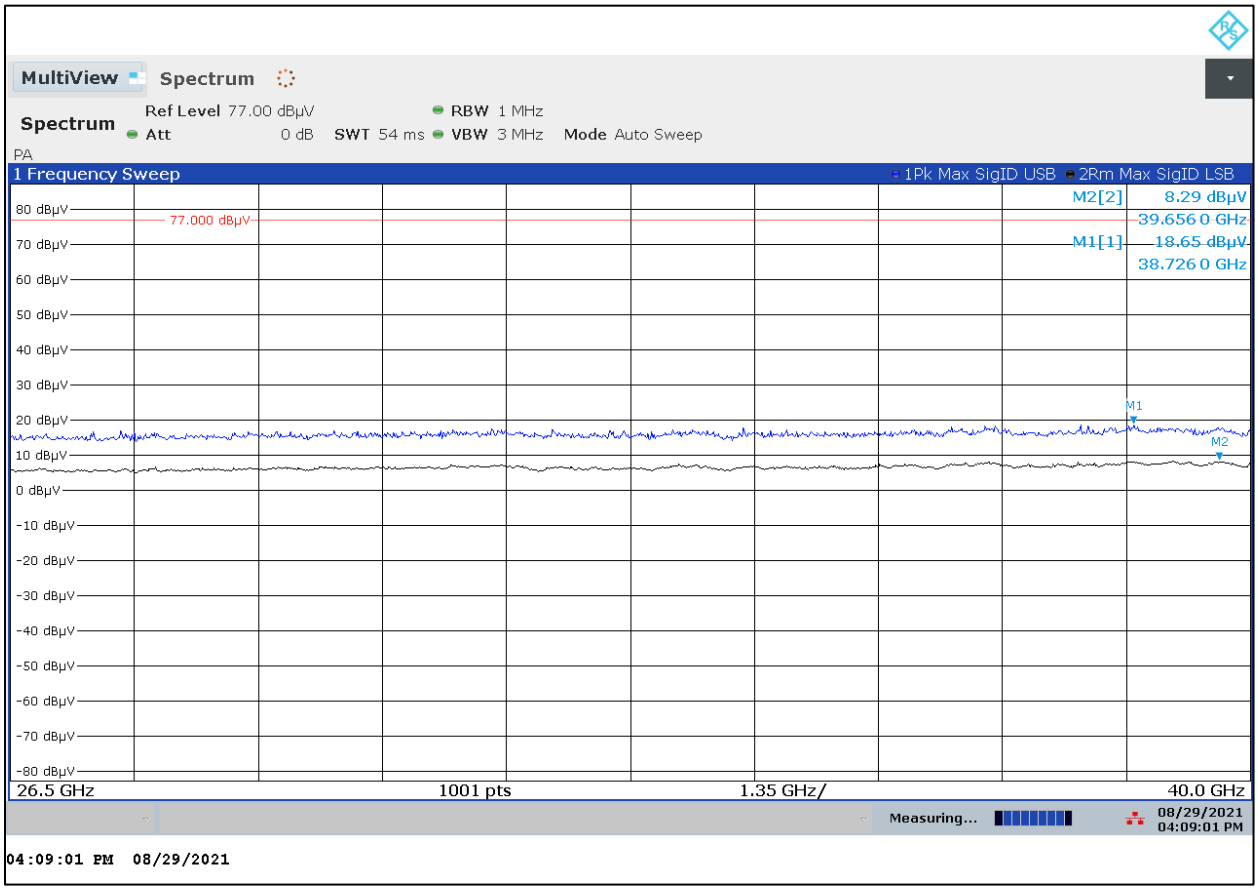


Table 5-7: Radiated Spurious Emissions (26.5 GHz – 40 GHz)

Frequency (GHz)	Detector Type	EIRP Measured (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 1m to 3m (dB)	Corrected Measurement (dBuV/m)	Limits (dBuV/m)	Margin (dB)
38.726	Peak	18.7	45.0	-9.5	54.2	74.0	-19.8
39.656	RMS	8.3	45.2	-9.5	41.5	54.0	-12.5

Plot 5-8: Radiated Spurious Emissions (18 GHz – 26.5 GHz)

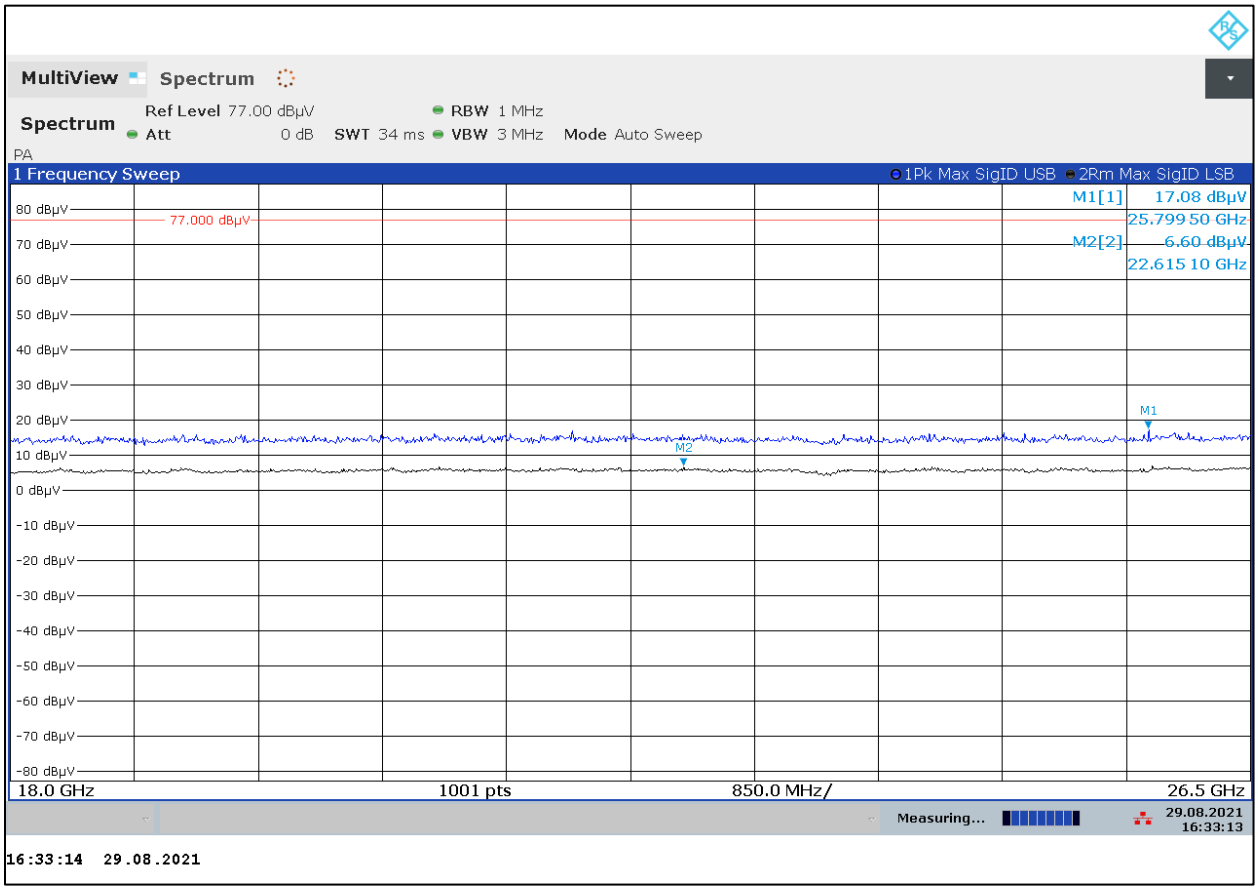


Table 5-8: Radiated Spurious Emissions (18 GHz – 26.5 GHz)

Frequency (GHz)	Detector Type	EIRP Measured (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 1m to 3m (dB)	Corrected Measurement (dBuV/m)	Limits (dBuV/m)	Margin (dB)
25.7995	Peak	17.1	40.6	-9.5	48.2	74.0	-25.8
22.6151	RMS	6.6	41.4	-9.5	38.5	54.0	-15.5

Plot 5-9: Radiated Spurious Emissions (12.4 GHz – 18 GHz)

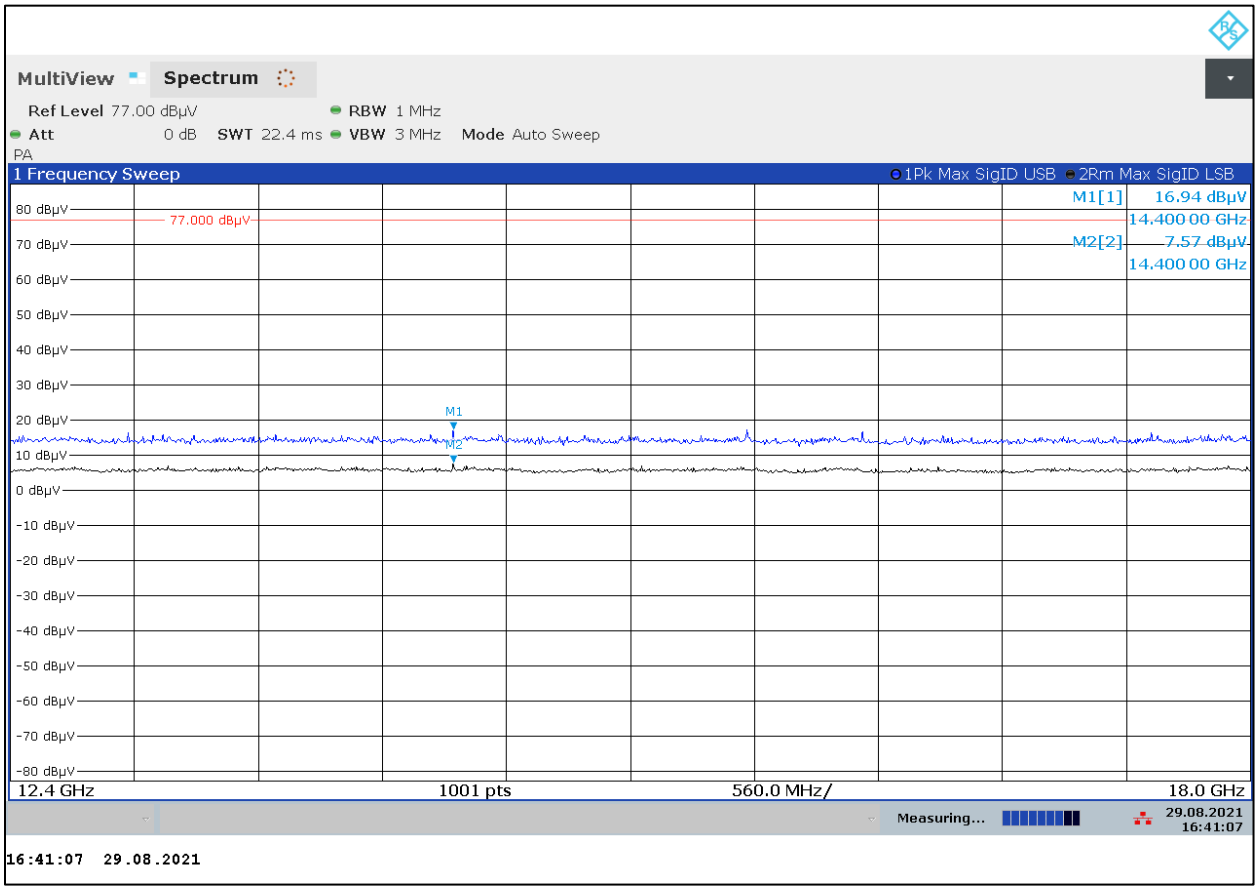


Table 5-9: Radiated Spurious Emissions (12.4 GHz – 18 GHz)

Frequency (GHz)	Detector Type	EIRP Measured (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 1m to 3m (dB)	Corrected Measurement (dBuV/m)	Limits (dBuV/m)	Margin (dB)
14.4000	Peak	16.9	37.1	-9.5	44.5	74.0	-29.5
14.4000	RMS	7.6	37.1	-9.5	35.2	54.0	-18.8

Plot 5-10: Radiated Spurious Emissions (8.0 GHz – 12.4 GHz)

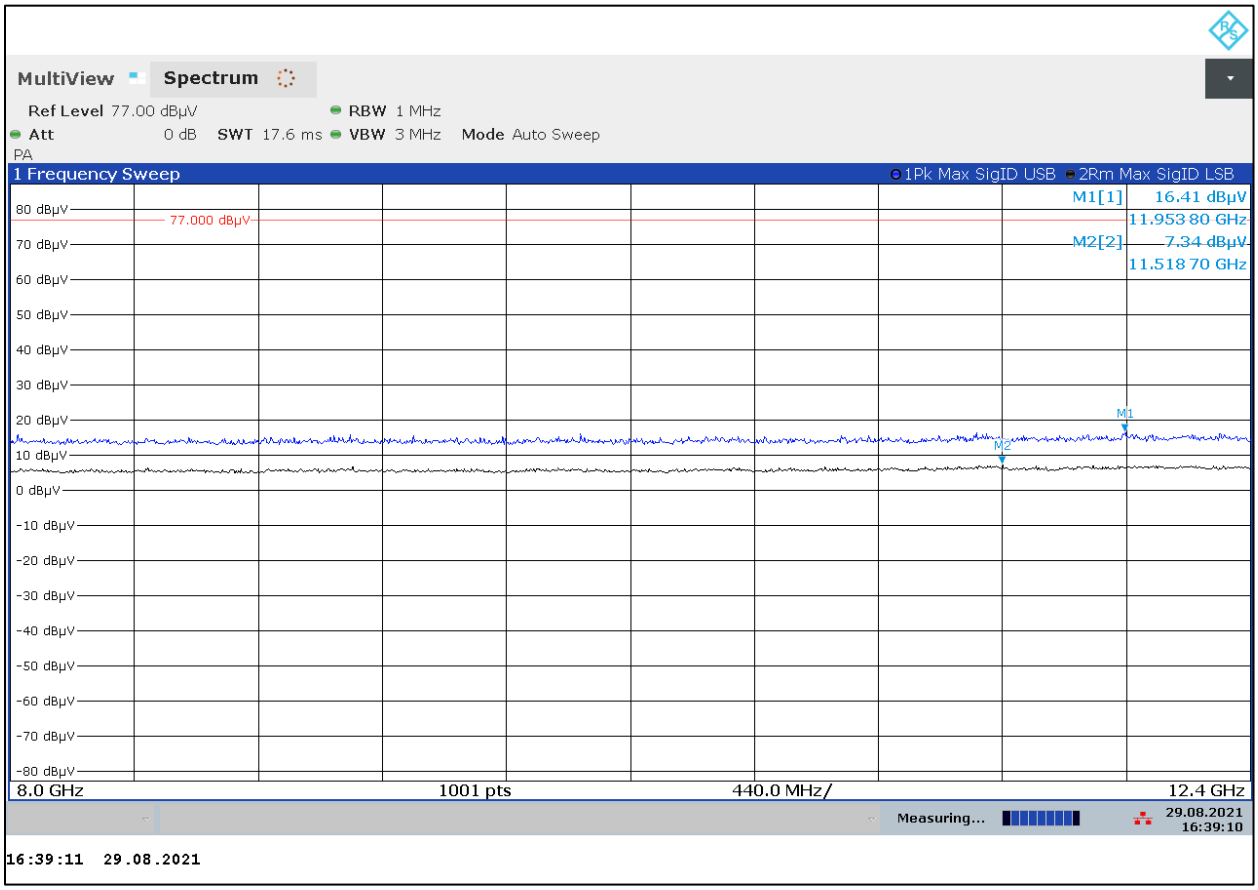


Table 5-10: Radiated Spurious Emissions (8.0 GHz – 12.4 GHz)

Frequency (GHz)	Detector Type	EIRP Measured (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 1m to 3m (dB)	Corrected Measurement (dBuV/m)	Limits (dBuV/m)	Margin (dB)
11.9538	Peak	16.4	34.1	-9.5	41.0	74.0	-33.0
11.5187	RMS	7.3	33.7	-9.5	31.5	54.0	-22.5

Plot 5-11: Radiated Spurious Emissions (4 GHz – 8.0 GHz)

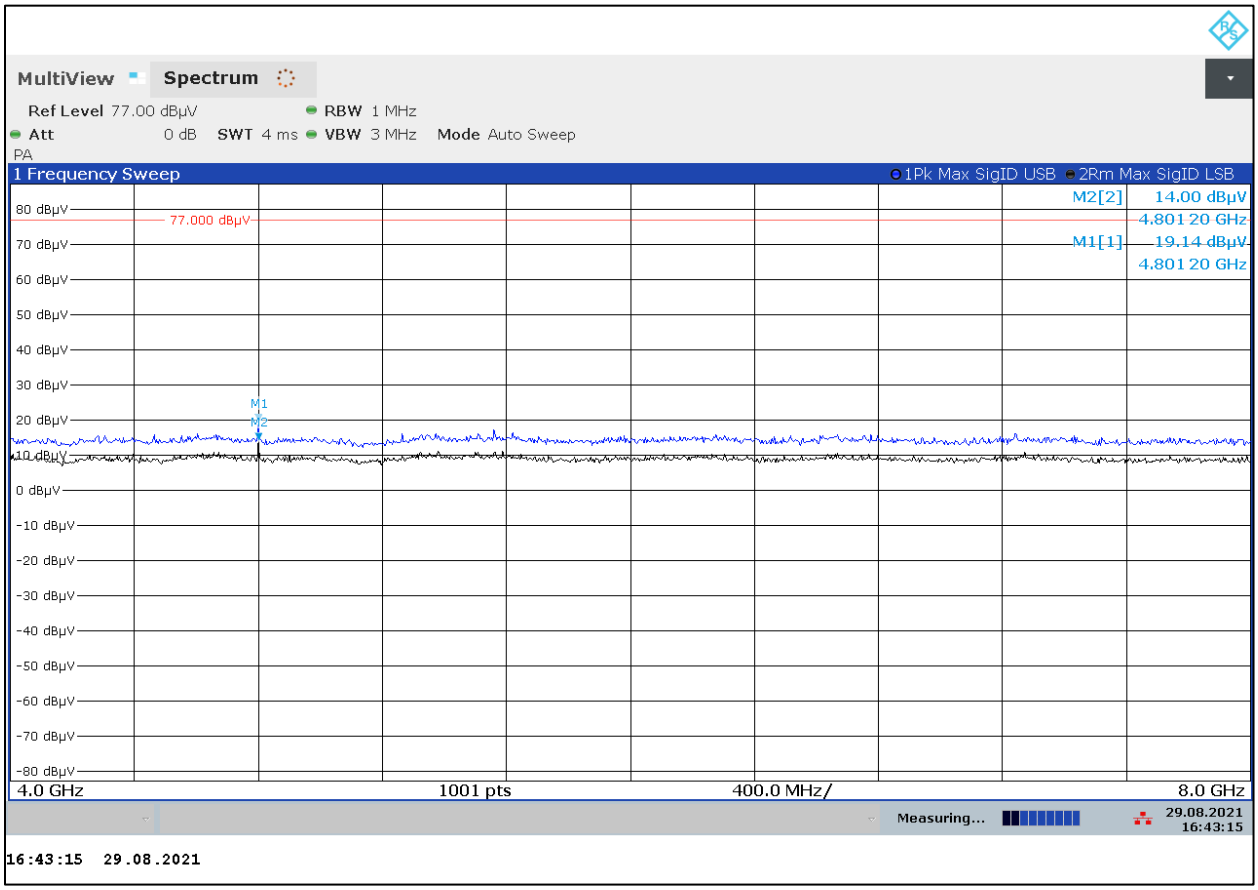


Table 5-11: Radiated Spurious Emissions (4 GHz – 8.0 GHz)

Frequency (GHz)	Detector Type	EIRP Measured (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 1m to 3m (dB)	Corrected Measurement (dBuV/m)	Limits (dBuV/m)	Margin (dB)
4.8012	Peak	19.1	27.3	-9.5	36.9	74.0	-37.1
4.8012	RMS	14.0	27.3	-9.5	31.8	54.0	-22.2

Plot 5-12: Radiated Spurious Emissions (2 GHz – 4 GHz)

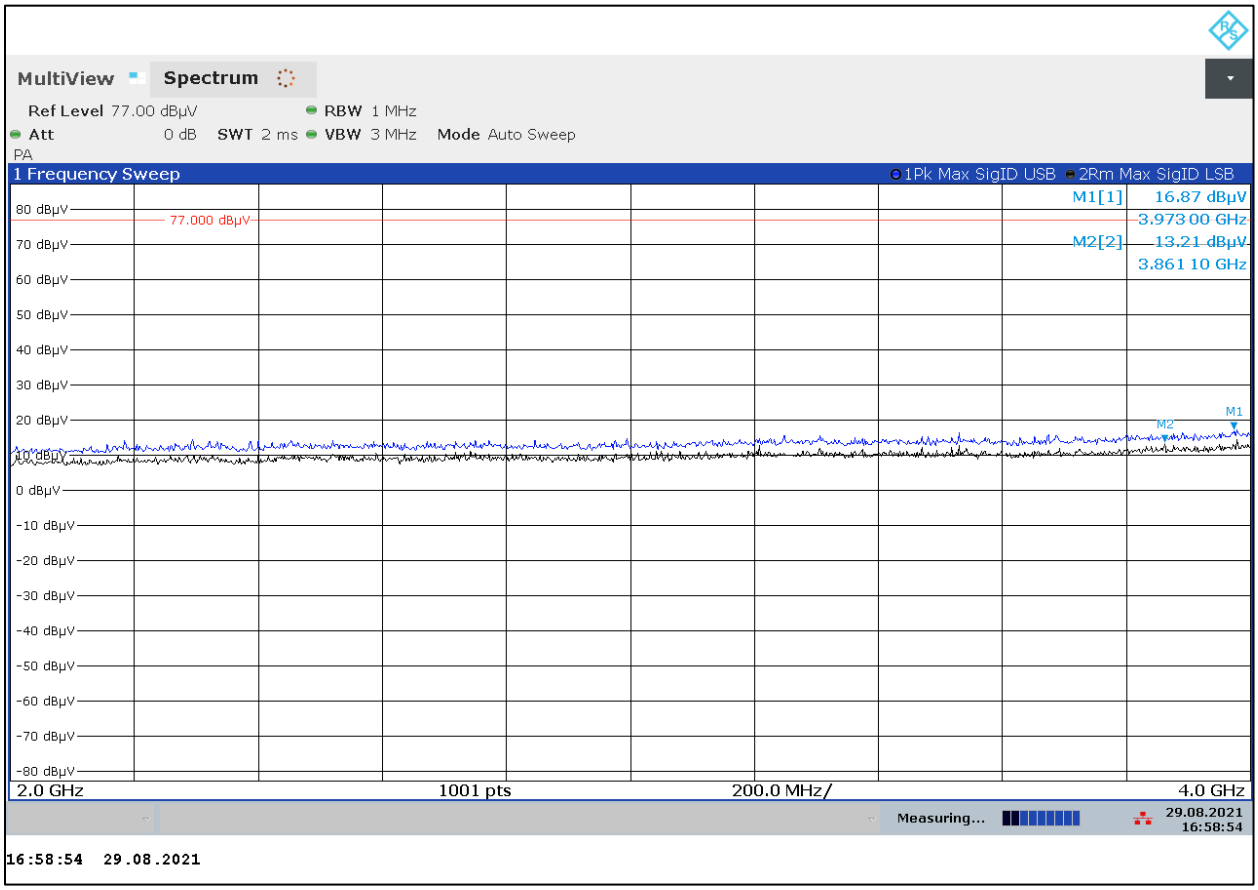


Table 5-12: Radiated Spurious Emissions (2 GHz – 4 GHz)

Frequency (GHz)	Detector Type	EIRP Measured (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 1m to 3m (dB)	Corrected Measurement (dBuV/m)	Limits (dBuV/m)	Margin (dB)
3.973	Peak	16.9	22.4	-9.5	29.8	74.0	-44.2
3.861	RMS	13.2	22.4	-9.5	26.1	54.0	-27.9

Plot 5-13: Radiated Spurious Emissions (1 GHz – 2 GHz)

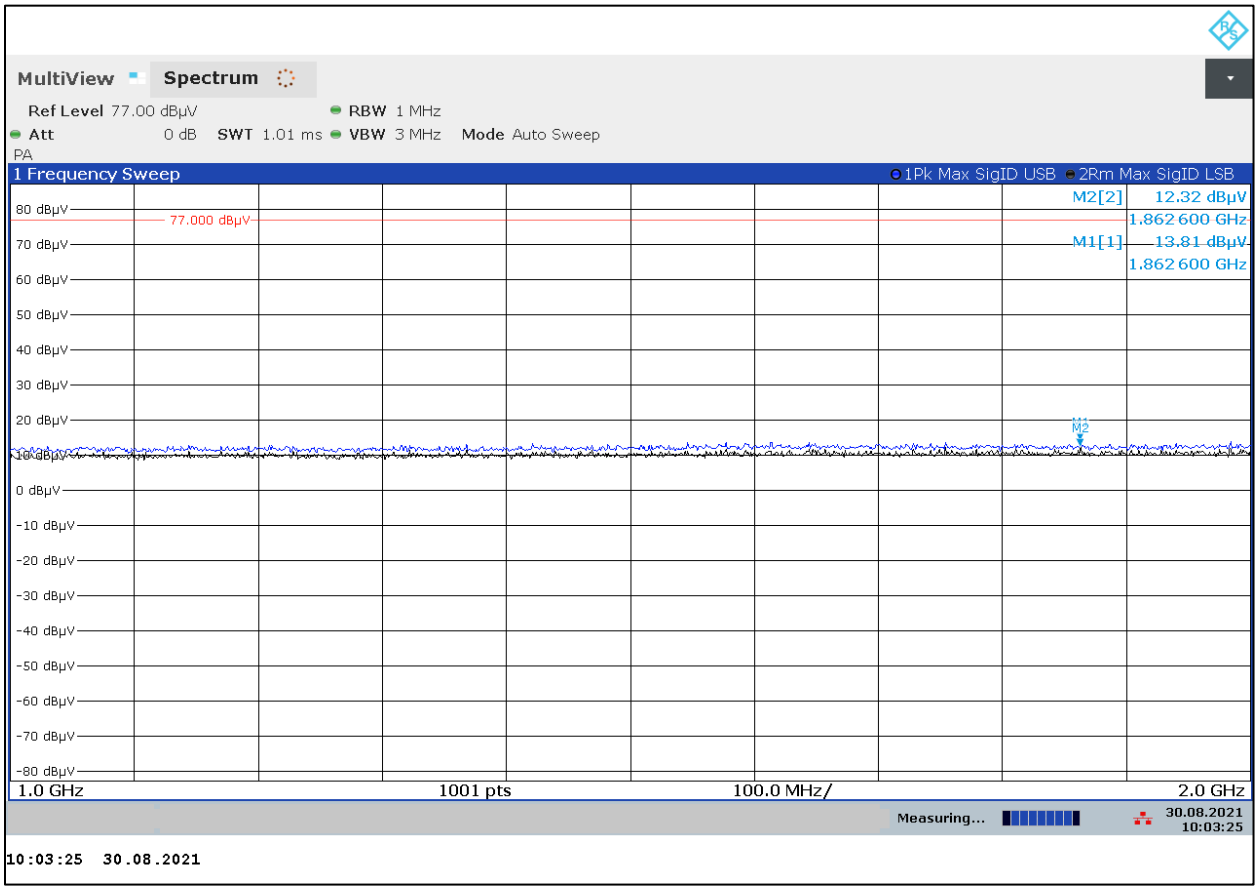


Table 5-13: Radiated Spurious Emissions (1 GHz – 2 GHz)

Frequency (GHz)	Detector Type	EIRP Measured (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 1m to 3m (dB)	Corrected Measurement (dBuV/m)	Limits (dBuV/m)	Margin (dB)
1.8626	Peak	13.8	33.0	-9.5	37.3	74.0	-36.7
1.8626	RMS	12.3	33.0	-9.5	35.8	54.0	-18.2

5.3 Radiated Emissions Unintentional/Digital Test Data

Table 5-14: Radiated Emissions Test Data below 1 GHz

Temperature: 73°F Humidity: 97%										
Emission Frequency (MHz)	**Test Detector**	**Antenna Polarity (H/V)**	**Turntable Azimuth (deg)**	**Antenna Height (m)**	**Analyzer Reading (dBuV)**	**Site Correction Factor (dB/m)**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Pass/ Fail**
313.339	Qp	V	350	1.9	30.7	-12.9	17.8	46.0	-28.2	Pass
320.7126	Qp	V	10	1.6	30.1	-12.9	17.2	46.0	-28.8	Pass
328.0845	Qp	V	360	1.9	30.8	-12.8	18.0	46.0	-28.0	Pass
335.4575	Qp	V	280	1.8	29.7	-12.6	17.1	46.0	-28.9	Pass
342.8316	Qp	V	95	2.5	29.6	-12.0	17.6	46.0	-28.4	Pass
350.2046	Qp	V	215	2.3	29.6	-11.4	18.2	46.0	-27.8	Pass
357.575	Qp	V	95	2.0	29.6	-11.0	18.6	46.0	-27.4	Pass
364.948	Qp	V	45	1.2	30.1	-11.0	19.1	46.0	-26.9	Pass
372.3236	Qp	H	245	1.6	30.9	-10.9	20.0	46.0	-26.0	Pass
379.6966	Qp	H	240	2.6	30.1	-10.8	19.3	46.0	-26.7	Pass
387.0695	Qp	H	310	2.7	30.7	-10.6	20.1	46.0	-25.9	Pass
394.4425	Qp	V	95	2.2	30.3	-10.0	20.3	46.0	-25.7	Pass
401.8116	Qp	V	95	1.9	30.1	-09.5	20.6	46.0	-25.4	Pass
409.1845	Qp	V	335	2.0	29.9	-09.1	20.8	46.0	-25.2	Pass
416.5575	Qp	V	300	2.7	30.4	-09.1	21.3	46.0	-24.7	Pass

Notes: Unwanted emissions were investigated (other than harmonics) as required by 15.33(a)(3).

"If the intentional radiator operates at or above 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 200 GHz, whichever is lower, unless specified otherwise elsewhere in the rules."

Table 5-15: Radiated Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901639	Wiltron	35WR19F	Waveguide (40 – 50 GHz)	N/A	Not required
901640	Rohde & Schwarz	FS-Z110	Mixer (75 – 110 GHz)	100010	050/3/23
901773	Rohde & Schwarz	FSW50	Spectrum Analyzer	101021	08/16/22
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
901586	Rohde & Schwarz	FS-Z75	Harmonic Mixer (50 – 75 GHz)	100098	01/23/22
901256	ATM	19-443-6R	Horn Antenna WR-19 (40 - 60 GHz)	8041704-01	05/03/23
901303	EMCO	3160-10	Horn Antenna WR-28 (26.5 - 40.0 GHz)	960452-007	08/05/24
901161	ATM	28-25K-6	Waveguide (26.5 – 40 GHz)	B082304	Not required
900711	ATM	10-443-6R	Horn Antenna (75 - 110 GHz)	8051905-1	04/07/22
900712	ATM	15-443-6R	Horn Antenna (50 - 75 GHz)	8051805-1	04/07/22
901669	ETS-Lindgren	3142E	BiLog Antenna (26 - 6000 MHz)	00166065	04/24/22
900772	EMCO	3161-02	Horn Antenna (2 - 4 GHz)	9804-1044	08/05/24
900321	EMCO	3161-03	Horn Antenna (4.0 - 8.2 GHz)	9508-1020	08/05/24
901587	Radiometer Physics Gmbh	SAM-220	140 - 220 GHz Mixer	20005	04/15/22
900713	ATM	05-443-6R	Horn Antenna (140 – 220)	S0685	05/03/23
900323	EMCO	3160-07	Horn Antenna (8.2 - 12.4 GHz)	9605-1054	08/05/24
900356	EMCO	3160-08	Horn Antenna (12.4 - 18 GHz)	9607-1044	08/05/24
901218	EMCO	3160-09	Horn Antenna (18 - 26.5 GHz)	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		Aug. 25 – Sept. 17, 2021
Test Engineer	Signature	Dates of Test

6 Frequency Stability - ANSI C63.10 6.8, FCC §15.256(f)(2); ISED RSS-Gen 8.11, RSS-211 5.1(b)

6.1 Frequency Stability Test Procedure - FCC §15.256(f)(2), RSS-Gen 8.11

The carrier frequency stability is the ability of the transmitter to maintain an assigned carrier frequency.

The EUT was evaluated over the temperature range -30°C to +55°C.

The temperature was initially set to -30°C and a 1-hour period was observed for stabilization of the EUT. The frequency stability was measured within one minute after application of primary power to the transmitter. The temperature was raised at intervals of 10 degrees centigrade through the range. A ½-hour period was observed to stabilize the EUT at each measurement step and the frequency stability was measured within one minute after application of primary power to the transmitter. Additionally, the power supply voltage of the EUT was varied +/-15% nominal input voltage, +15% of minimum voltage and -15% of maximum voltage.

6.2 FCC §15.256(f)(2) Limit

LPR devices operating under this section must confine their fundamental emission bandwidth within the 5.925-7.250 GHz, 24.05-29.00 GHz, and 75-85 GHz bands under all conditions of operation.

6.3 Temperature-Voltage Frequency Stability Test Data

Table 6-1: Temperature Frequency Stability

Temp. (°C)	Lower Edge (MHz)	Measured Frequency (MHz)	Upper Edge (MHz)
-30	77016.13	78711.83	80407.53
-20	77016.43	78712.13	80407.83
-10	77016.45	78712.15	80407.85
0	77016.45	78712.15	80407.85
10	77015.60	78711.30	80407.00
20	77015.60	78711.30	80407.00
30	77014.77	78710.47	80406.17
40	77013.45	78709.15	80404.85
50	77013.24	78708.94	80404.64
55	77011.03	78706.73	80402.43

Table 6-2: Voltage Frequency Stability

Voltage (VDC)	Lower Edge (MHz)	Measured Frequency (MHz)	Upper Edge (MHz)
12.0 (Min.)	77016.62	78712.32	80408.02
13.8 (Min. + 15%)	77017.53	78713.23	80408.93
20.4 (Nominal -15%)	77018.92	78714.62	80410.32
24.0 (Nominal)	77015.60	78711.30	80407.00
27.6 (Nominal + 15%)	77016.08	78711.78	80407.48
31.5 (Max. -15%)	77018.18	78713.88	80409.58
35.0 (Max.)	77018.50	78714.20	80409.90

Result: The EUT is within band and compliant.

Table 6-3: Frequency Stability Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900946	Tenney Engineering, Inc.	TH65	Temperature Chamber with Humidity	11380	04/07/22
901762	Hewlett Packard	8566B	Spectrum Analyzer	2504A01428	02/01/22
901763	Hewlett Packard	85662A	Spectrum Analyzer Display Section	2542A10724	02/01/22
901626	Amprobe	34XR-A	Multimeter	13041390A	09/19/21

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 31, 2021
Test Engineer	Signature	Date of Test

7 AC Conducted Emissions - FCC Rules and Regulations ANSI C63.10 6.2, FCC §15.207; ISED RSS-Gen 8.8

7.1 Test Methodology for Conducted Line Emissions Measurements – FCC §15.207, RSS-Gen 8.8

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.

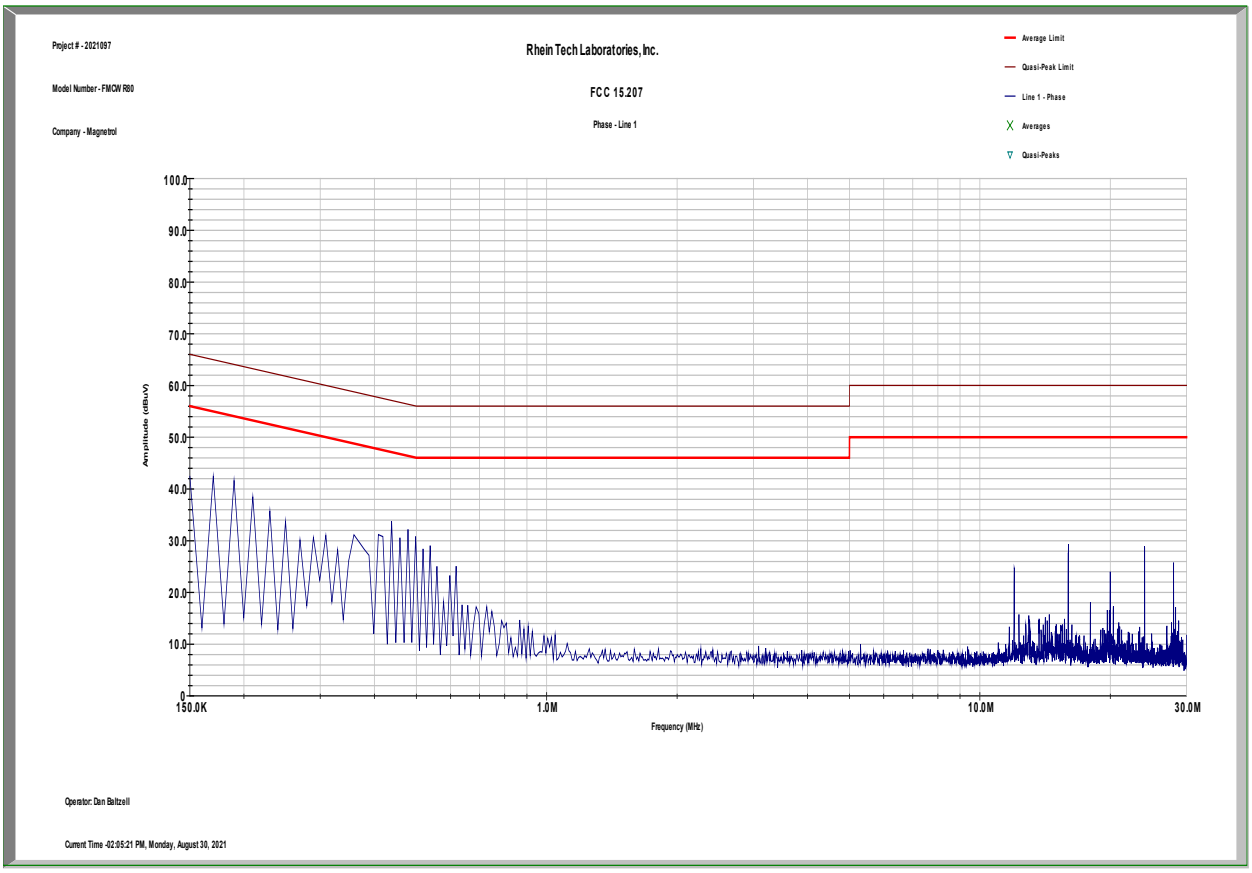
The spectrum analyzer was connected to the AC line through an isolation transformer. The 50-ohm output of the EUT LISN was connected to the spectrum analyzer input through a Solar 100 kHz high-pass filter. The filter is used to prevent overload of the spectrum analyzer from noise below 100 kHz. Conducted 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.

7.2 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.

7.3 Conducted Line Emissions Test Data

Plot 7-1: Conducted Emissions Transmit - Phase



Plot 7-2: Conducted Emissions Transmit – Neutral

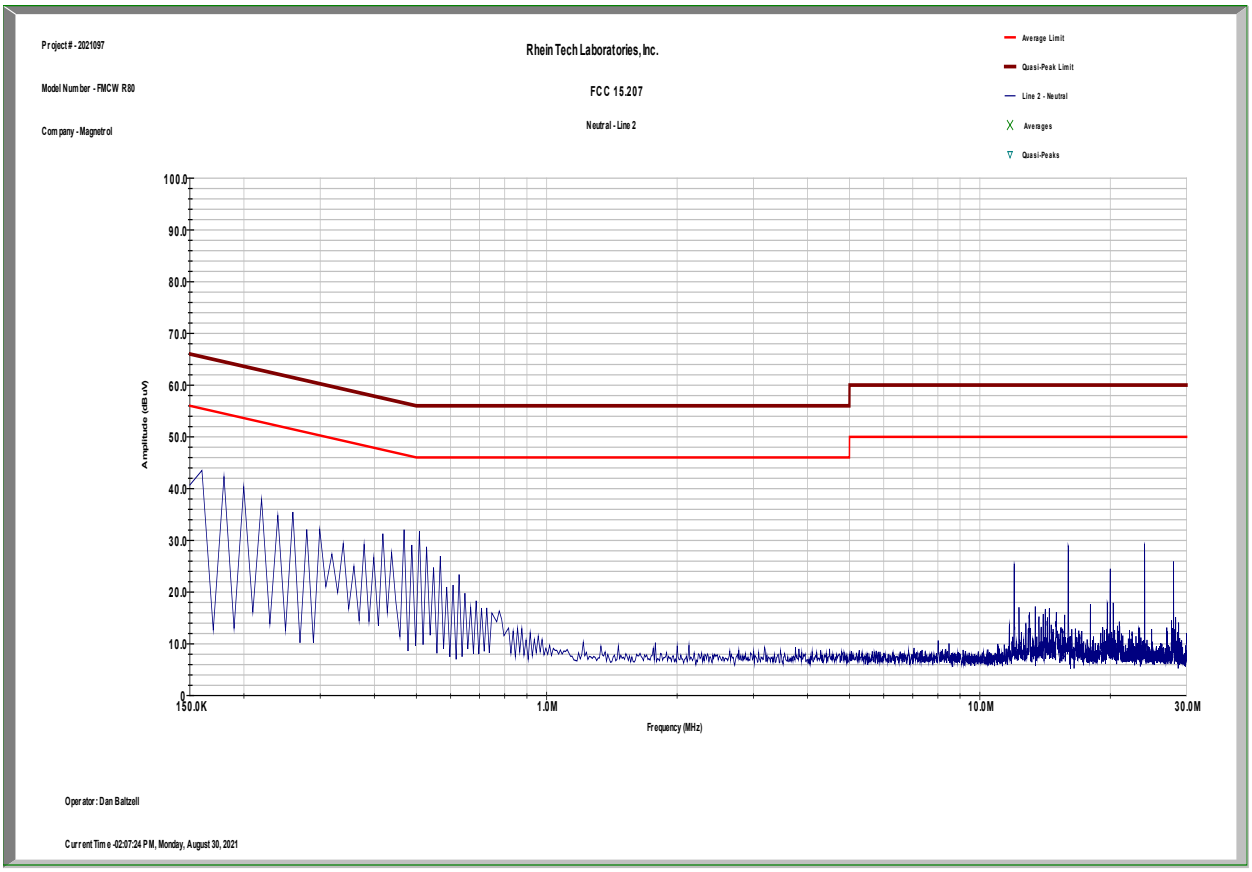


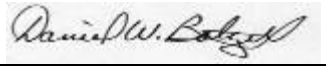
Table 7-1: Conducted Line Emissions Test Equipment

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		August 30, 2021
Test Engineer	Signature	Date of Test

8 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 FCC Parts 2 and 15 of the FCC rules and regulations, and those of ISED Canada RSS-211 and RSS-Gen.