



Certification Test Report

FCC ID: 2ADX4-MDEV7

IC: 12677A-MDEV7

Radio Standard Specification: FCC 47 CFR Part 15.517
ISED Canada's Radio Standards Specification: RSS-220, Issue 1

TÜV SÜD Report Number: RD72162057.100

Manufacturer: Redpoint Positioning Corporation
Model: MDE-V7

Test Begin Date: September 24, 2020

Test End Date: October 23, 2020

Report Issue Date: October 30, 2020



FOR THE SCOPE OF ACCREDITATION UNDER LAB Code 2955.18

This report must not be used by the client to claim product certification, approval, or endorsement by A2LA, ANSI, or any agency of the Federal Government.

Prepared by:

A handwritten signature in black ink, likely belonging to Chris Gormley.

Chris Gormley
RF Wireless Engineer
TÜV SÜD America Inc.

Reviewed by:

A handwritten signature in black ink, likely belonging to Kirby Munroe.

Kirby Munroe
EMC Technical Manager, North America
TÜV SÜD America, Inc.

This test report shall not be reproduced except in full. This report may be reproduced in part with prior written consent of TÜV SÜD America Inc. The results contained in this report are representative of the sample(s) submitted for evaluation.

This report contains 36 pages

TABLE OF CONTENTS

1	GENERAL	3
1.1	PURPOSE.....	3
1.2	PRODUCT DESCRIPTION.....	3
1.3	TEST METHODOLOGY AND CONSIDERATIONS	4
2	TEST FACILITIES.....	4
2.1	LOCATION	4
2.2	LABORATORY ACCREDITATIONS/RECOGNITIONS/CERTIFICATIONS	4
2.3	RADIATED EMISSIONS TEST SITE DESCRIPTION	5
2.4	SEMI-ANECHOIC CHAMBER TEST SITE.....	5
3	APPLICABLE STANDARD REFERENCES.....	6
4	LIST OF TEST EQUIPMENT.....	6
5	SUPPORT EQUIPMENT	7
6	EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM	7
7	SUMMARY OF TESTS.....	8
7.1	ANTENNA REQUIREMENT – FCC: 15.203 AND RSS-220, ISSUE 1, SECTION 5.1 (B).....	8
7.2	POWER LINE CONDUCTED EMISSIONS – FCC: 15.207; ISED CANADA: RSS-GEN 8.8	8
7.2.1	Measurement Procedure.....	8
7.2.2	Measurement Results	8
7.3	10 dB BANDWIDTH – FCC 15.503(D) AND RSS-220 5.1(A)	10
7.3.1	Measurement Procedure.....	10
7.3.2	Measurement Results	10
7.4	FUNDAMENTAL EMISSION PEAK POWER – FCC 15.517(E) AND RSS-220, ISSUE 1, SECTION 5.2.1(G)	12
7.4.1	Measurement Procedure.....	12
7.4.2	Measurement Results	12
7.5	RADIATED EMISSIONS ABOVE 960 MHz – FCC 15.517(C) AND RSS-220, ISSUE 1, SECTION 5.2.1(D) 15	15
7.5.1	Measurement Procedure.....	15
7.5.2	Sample Calculation:	15
7.5.3	Measurement Results	16
7.6	RADIATED EMISSIONS AT OR BELOW 960 MHz, FCC 15.517(C) AND RSS-220, ISSUE 1, SECTION 5.3.1(C) / 3.4.....	28
7.6.1	Measurement Procedure.....	28
7.6.2	Measurement Results	28
7.7	RADIATED EMISSIONS IN THE GPS BANDS FCC 15.517(D) AND RSS-220, ISSUE 1, SECTION 5.2.1(E)	32
7.7.1	Measurement Procedure.....	32
7.7.2	Sample Calculation:	32
7.7.3	Measurement Results:.....	32
8	MEASUREMENT UNCERTAINTY.....	36
9	CONCLUSION	36

1 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with FCC 47 CFR 15.517 and RSS-220, Issue 1.

1.2 Product Description

The RTLS Module is a fully-functional real-time location system (RTLS) subsystem in a compact form factor. The self-contained module delivers all RTLS functions including high-accuracy positioning and data communication over the Redpoint UWB network.

Technical Information:

Detail	Description
Transmit Frequency / Carrier Wave	3774.0 MHz to 4243.2MHz (Channel 2) / 3993.6 MHz (FCC Only) 4243.2 MHz to 4742.4 MHz (Channel 3) / 4492.8 MHz (FCC Only) 6240.0 MHz to 6739.2 MHz (Channel 5) / 6489.6 MHz
Receiver Frequency / Carrier Wave	3774.0 MHz to 4243.2MHz (Channel 2) / 3993.6 MHz (FCC Only) 4243.2 MHz to 4742.4 MHz (Channel 3) / 4492.8 MHz (FCC Only) 6240.0 MHz to 6739.2 MHz (Channel 5) / 6489.6 MHz
Modulation Format	BPSK (850kbps)
Operating Voltage	3.3Vdc
Antenna Type / Gain:	UWB Flex Antenna / 7.1dBi (Channel 1-4), 4.8dBi (Channel 5)
Temperature Category	-40C to +85C
Type of equipment:	Mobile
Hardware version:	Rev. B
Software release:	5.10.13

Manufacturer Information:

Redpoint Positioning Corporation
100 North Washington Street
Boston, MA 02458

EUT Serial Numbers: E4956EA449FA

Test Sample Condition: The test samples were provided in good working order with no visible defects.

1.3 Test Methodology and Considerations

The device is physically small and can be used in many orientations. Therefore, the EUT was evaluated in the X, Y, and Z planes. The worst-case plane was X-Plane. The data in the report represents worst case.

The antenna being an external U.FL connection allows the antenna to be oriented in any of the 3 orthogonal axis. The X-Plane in relation to the module was deemed worst-case and is documented in this report.

The EUT was mounted to a carrier board which was powered via a USB cable connected to the configuration PC located outside of the chamber.

The EUT Power setting for was:

Channel 2: 0x64

Channel 3: 0xCB

Channel 5: 0xC0

Due to the Radiated Spurious Emission requirements set out in RSS-220, Section 5.2.1(d), channels 2 and 3 can not be certified at the current power levels.

For testing, the client provided software to control and configure the EUT.

2 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following address:

TÜV SÜD America Inc.
2320 Presidential Drive, Suite 101
Durham, NC 27703
Phone: (919) 381-4235

2.2 Laboratory Accreditations/Recognitions/Certifications

TÜV SÜD America Inc. (Durham) is accredited to ISO/IEC 17025 by A2LA accreditation program, and has been issued certificate number 2955.18 in recognition of this accreditation. Unless otherwise specified, all tests methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

The Semi-Anechoic Chamber Test Site and Conducted Emissions Site have been fully described, submitted to, and accepted by the FCC and Innovation, Science and Economic Development (ISED) Canada.

FCC Designation Number: US1245

FCC Test Firm Registration Number: 238628

ISED Canada Company Number: 20446

2.3 Radiated Emissions Test Site Description

2.4 Semi-Anechoic Chamber Test Site

The Semi-Anechoic Chamber Test Site consists of a 18' x 28' x 18' shielded enclosure. The chamber is lined with Samwha Electronics Co. LTD Ferrite Absorber, model number SFA300 (HSN-1). The ferrite tile is 10cm x 10 cm and weighs approximately 1.4lbs. These tiles are mounted on steel panels and installed directly on the inner walls of the chamber. On top of the ferrite tiles is DMAS HT-45 (Dutch Microwave Absorber Solutions) hybrid absorber on all walls except the wall behind the antenna mast which has a shorter DMAS HT-25 absorber.

The turntable is 1.50m in diameter and is located 150cm from the back wall of the chamber. The chamber is grounded via 1 - 8' copper ground rod, installed at the center of the back wall, it is bound to the ground plane using short #6 copper wire. The turntable is all steel, flush mounted table installed in an all steel frame. The table is remotely operated from inside the control room located 25' from the turntable. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane.

Behind the turntable is a 2' x 6' x 1.5' deep shielded pit used for support equipment if necessary. The pit is equipped with 2 - 4" PVC chase from the turntable to the pit that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit.

To comply with the requirements of the test methods given on page 4, RF absorbing foam was placed inside the chamber in a configuration that provided the best results. First, a 12ft X 12ft. patch of 10" tall absorber was placed on the floor between the turntable and the receiving antenna. This absorber meets the absorption requirements specified in ANSI C63.4:2009.

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3-1 below:

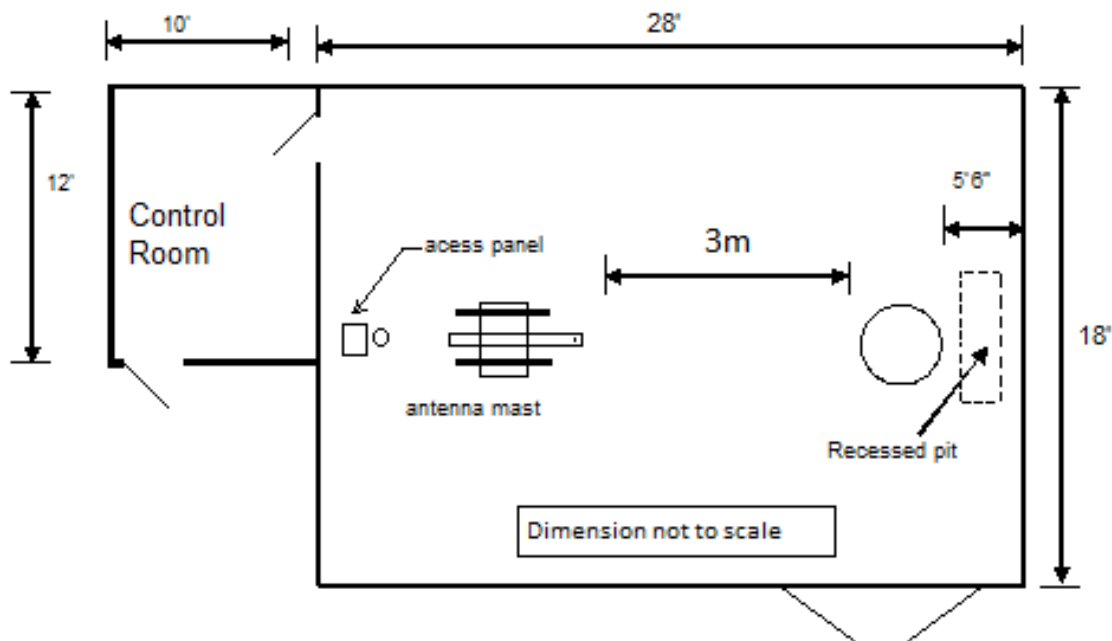


Figure 2.3-1: Semi-Anechoic Chamber Test Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ❖ ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
- ❖ RSS-220, Issue 1 (March 2009) Amendment 1 (July 2018) — Devices Using Ultra-Wideband (UWB) Technology

4 LIST OF TEST EQUIPMENT

The calibration interval of test equipment is annually or the manufacturer's recommendations. Where the calibration interval deviates from the annual cycle based on the instrument manufacturer's recommendations, it shall be stated below.

Table 4-1: Test Equipment

Asset ID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
DEMC0426	Thermotron	S-8 Mini Max	Environmental Chamber	25-2888-10	1/23/2020	1/23/2021
DEMC3002	Rohde & Schwarz	ESU40	Receiver	100346	1/22/2020	1/22/2021
DEMC3006	Rohde & Schwarz	TS-PR18	Amplifier	122006	1/23/2020	1/23/2021
DEMC3007	Rohde & Schwarz	TS-PR26	Amplifier	100051	1/23/2020	1/23/2021
DEMC3012	Rohde & Schwarz	EMC32-EB	Software	100731	NCR	NCR
DEMC3014	EMCO	3115	Antenna	9901-5653	4/12/2019	4/12/2021
DEMC3016	Fei Teng Wireless Technology	HA-07M18G-NF	Antenna	2013120203	4/8/2020	4/8/2021
DEMC3032	Hasco, Inc.	HLL142-S1-S1-192/WA	Cable	3075	1/23/2020	1/23/2021
DEMC3033	Hasco, Inc.	HLL142-S1-S1-36	Cable	1435	1/23/2020	1/23/2021
DEMC3038	Florida RF Labs	NMSE-290AW-60.0-NMSE	Cable Set	1448	1/27/2020	1/27/2021
DEMC3039	Florida RF Labs	NMSE-290AW-396.0-NMSE	Cable Set	1447	1/27/2020	1/27/2021
DEMC3055	Rohde & Schwarz	3005	Cable	3055	1/23/2020	1/23/2021
DEMC3085	Rohde & Schwarz	FSW43	Spectrum Analyzer	103997	1/22/2020	1/22/2021
DEMC3161	TESEQ	CBL-6112D	Antenna	51323	2/18/2020	2/18/2021
332	Rohde & Schwarz	TS-PR40	Amplifier	100021	6/12/2020	6/12/2022
333	Rohde & Schwarz	3160-10	Antenna	49404	NCR	NCR
335	Suhner	SF-102A	Cable	882/2A	6/23/2020	6/23/2021

NCR = No Calibration Required

DMAS MT-25 RF absorber material was used on the floor for all final measurements above 1 GHz.

Asset DEMC3002: Firmware Version: ESU40 is 4.73 SP4

Asset DEMC3012: Software Version: EMC32-B is 10.50.00

Asset DEMC3085: Instrument Firmware 2.90 SP1

All assets were only used within their current calibration cycle.

5 SUPPORT EQUIPMENT

Table 5-1: EUT and Support Equipment

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	EUT	Redpoint Positioning Corporation	MDE-V7	See Section 1.2
2	Development Carrier Board	Redpoint Positioning Corporation	9101-820	TUV#02
3	Antenna	Taoglas	FXUWB10	N/A
4	Laptop	Dell	Latitude E7440	4FJ5YZ1

Table 5-2: Cable Description

Cable #	Cable Type	Length	Shield	Termination
A	Antenna Cable	10cm	No	1 to 3
B	USB	6m	No	2 to 4

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

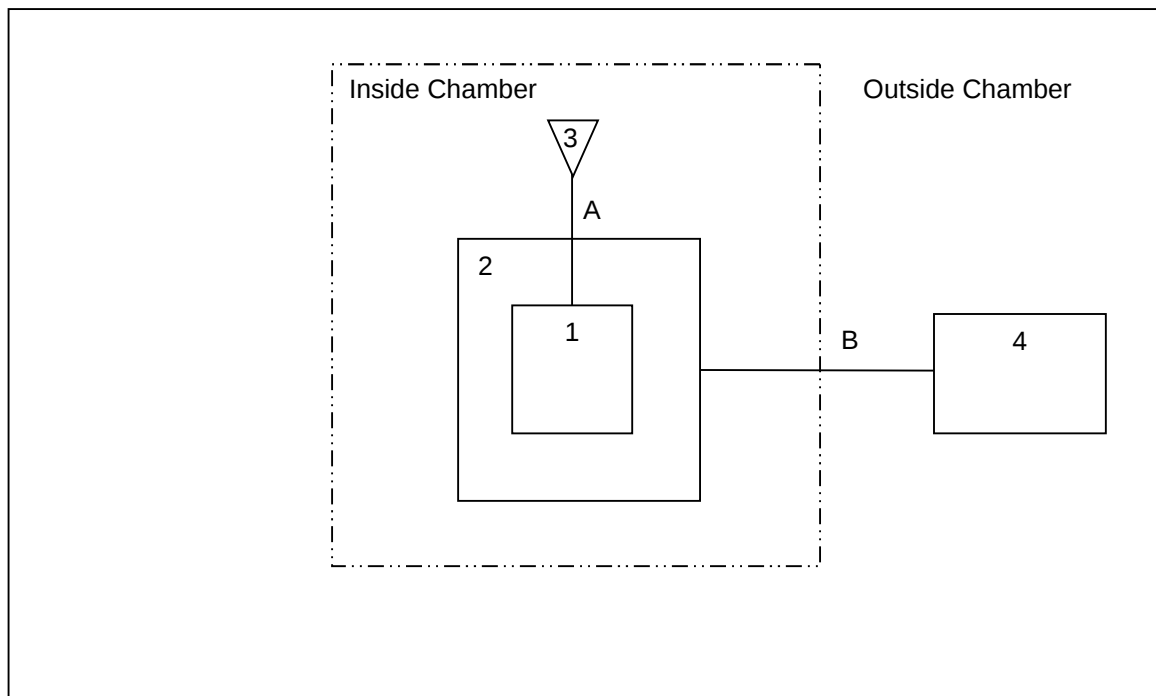


Figure 6-1: EUT Test Setup Block Diagram

7 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

7.1 Antenna Requirement – FCC: 15.203 and RSS-220, Issue 1, Section 5.1 (b)

The Taoglas FXUWB10 antenna is connected via a unique u.FL connector.

7.2 Power Line Conducted Emissions – FCC: 15.207; ISED Canada: RSS-Gen 8.8

7.2.1 Measurement Procedure

ANSI C63.10-2013 section 6 was the guiding document for this evaluation. Conducted emissions were performed from 150kHz to 30MHz with the spectrum analyzer's resolution bandwidth set to 9kHz and the video bandwidth set to 30kHz. The calculation for the conducted emissions is as follows:

Corrected Reading = Analyzer Reading + LISN Loss + Cable Loss

Margin = Applicable Limit - Corrected Reading

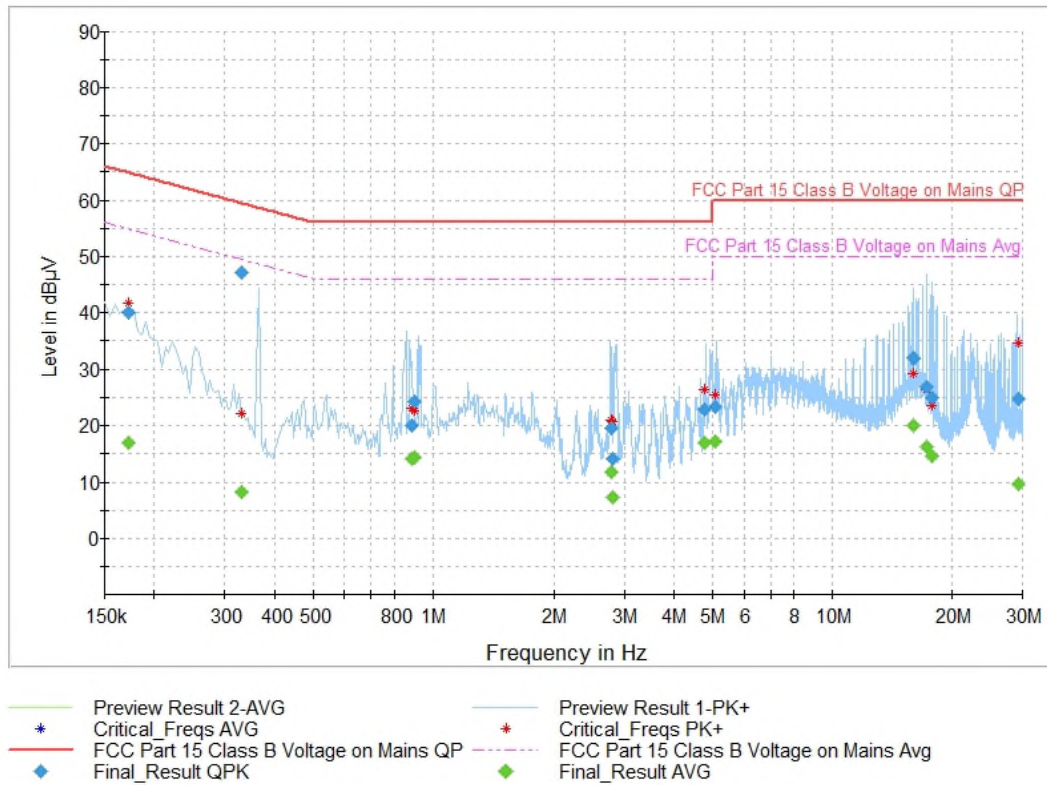
7.2.2 Measurement Results

Performed by: Chris Gormley

Table 7.2.2-1: Conducted EMI Results – Line and Neutral

Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Line	Filter	Corr. (dB)
0.172500	---	17.12	54.84	37.72	N	OFF	9.6
0.172500	40.03	---	64.84	24.80	N	OFF	9.6
0.330000	---	8.17	49.45	41.28	L1	OFF	9.7
0.330000	47.01	---	59.45	12.45	L1	OFF	9.7
0.883500	---	14.25	46.00	31.75	N	OFF	9.6
0.883500	20.02	---	56.00	35.98	N	OFF	9.6
0.897000	24.25	---	56.00	31.75	N	OFF	9.6
0.897000	---	14.34	46.00	31.66	N	OFF	9.6
2.791500	---	11.86	46.00	34.14	L1	OFF	9.8
2.791500	19.59	---	56.00	36.41	L1	OFF	9.8
2.818500	14.07	---	56.00	41.93	N	OFF	9.8
2.818500	---	7.31	46.00	38.69	N	OFF	9.8
4.785000	---	17.09	46.00	28.91	L1	OFF	9.8
4.785000	22.90	---	56.00	33.10	L1	OFF	9.8
5.059500	23.33	---	60.00	36.68	L1	OFF	9.8
5.059500	---	17.22	50.00	32.78	L1	OFF	9.8
15.945000	31.91	---	60.00	28.09	L1	OFF	10.1
15.945000	---	20.12	50.00	29.88	L1	OFF	10.1
17.268000	---	16.20	50.00	33.80	L1	OFF	10.1
17.268000	26.88	---	60.00	33.12	L1	OFF	10.1
17.808000	25.00	---	60.00	35.00	N	OFF	10.2
17.808000	---	14.65	50.00	35.35	N	OFF	10.2
29.215500	24.73	---	60.00	35.27	L1	OFF	10.3
29.215500	---	9.55	50.00	40.45	L1	OFF	10.3

Figure 7.2.2-1: Conducted Emissions Profile – Line and Neutral



7.3 10 dB Bandwidth – FCC 15.503(d) and RSS-220 5.1(a)

7.3.1 Measurement Procedure

The 10 dB bandwidth was measured in accordance with the ANSI C63.10: 2013 Section 10.1. The resolution bandwidth (RBW) of the spectrum analyzer was set to 1MHz. The video bandwidth (VBW) was set to 1MHz or greater. The trace was set to max hold with a Peak detector active.

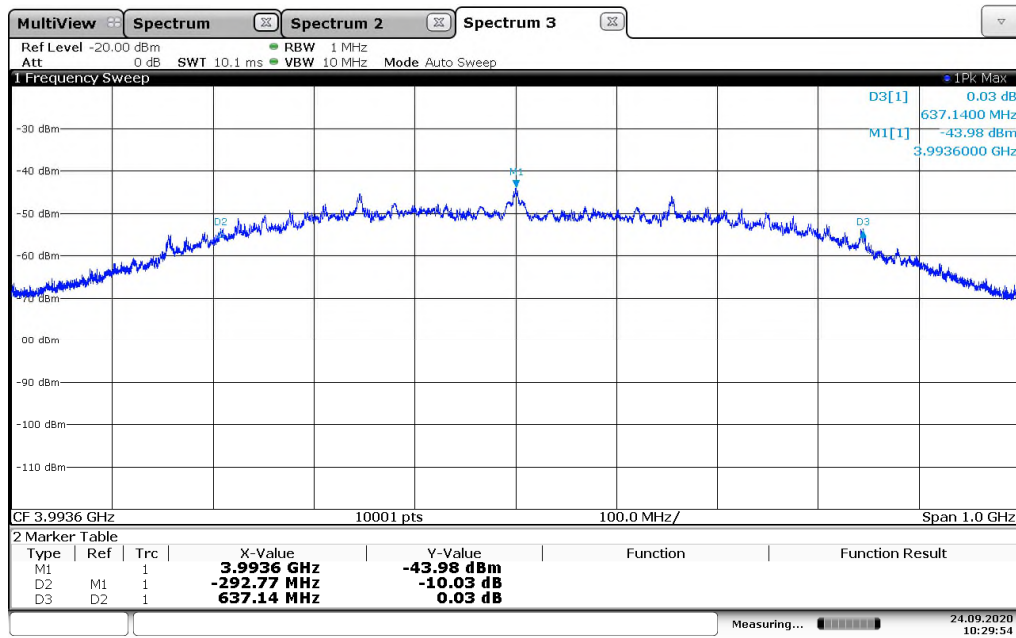
7.3.2 Measurement Results

Measurement Performed By: Chris Gormley

Table 7.3.2-1: 10 dB Bandwidth

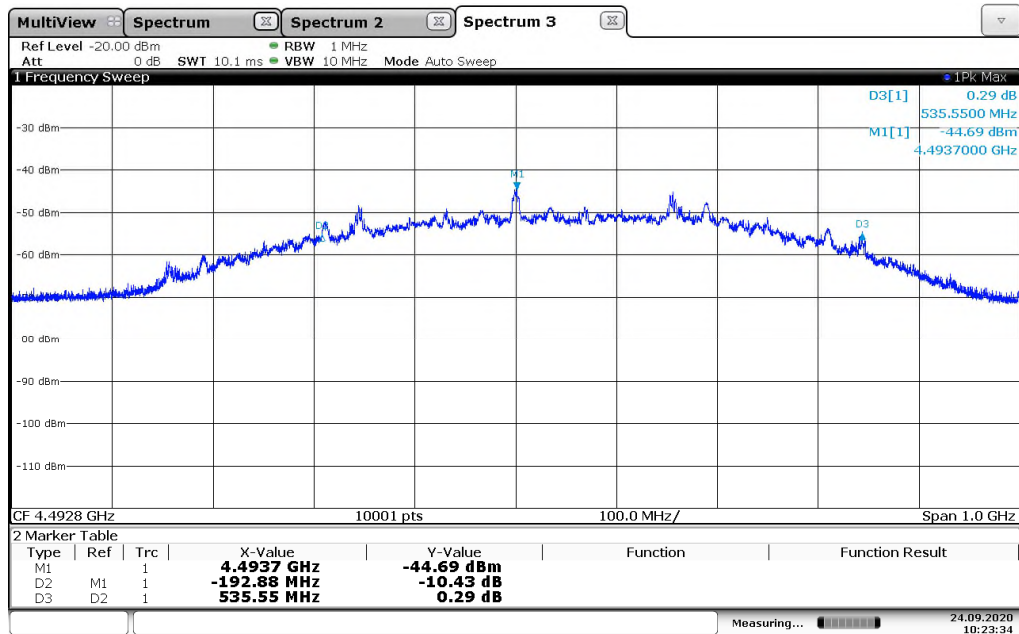
Channel	Frequency fc [MHz]	10 dB Bandwidth [MHz]
2	3993.6	637.14
3	4493.7	535.55
5	6489.4	570.04

*Note - RSS-220 limits: The -10 dB bandwidth of the device shall be totally contained in the band 3.1-10.6 GHz



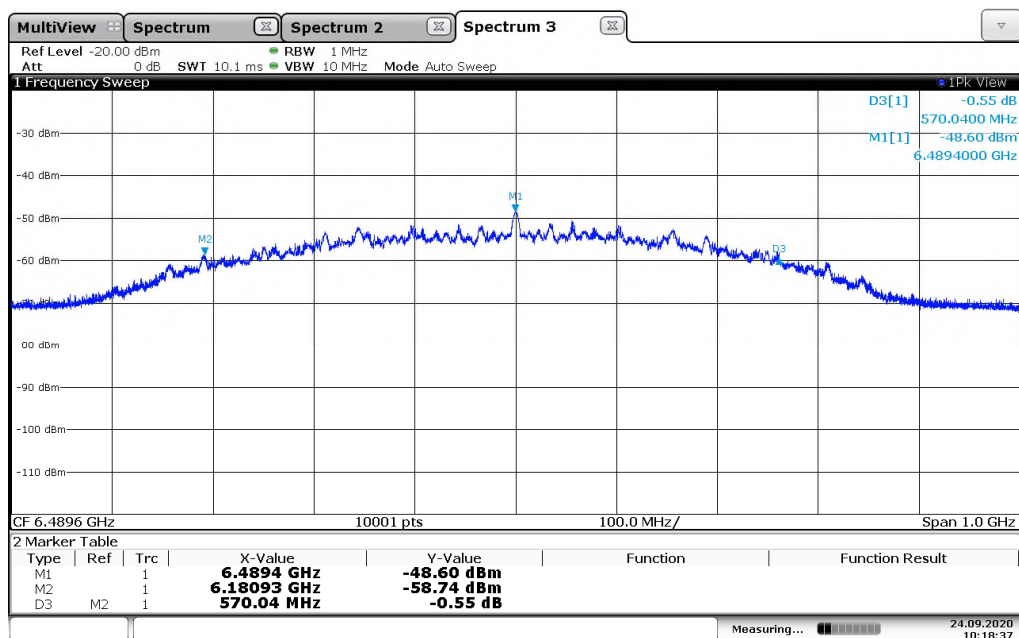
10:29:54 24.09.2020

Figure 7.3.2-1: 10 dB Bandwidth – Channel 2



10:23:34 24.09.2020

Figure 7.3.2-2: 10 dB Bandwidth – Channel 3



10:18:38 24.09.2020

Figure 7.3.2-3: 10 dB Bandwidth – Channel 5

7.4 Fundamental Emission Peak Power – FCC 15.517(e) and RSS-220, Issue 1, Section 5.2.1(g)

7.4.1 Measurement Procedure

The maximum peak radiated output power was measured in accordance with ANSI C63.10: 2013 Section 10.3.5. The Resolution Bandwidth (RBW) of the spectrum analyzer was set to 50MHz. The Video Bandwidth (VBW) was also set to 50MHz. The trace was set to max hold with a peak detector active.

The RMS power was measured with RBW of the spectrum analyzer set to 1MHz and the VBW set to 10MHz. A longer sweep time was utilized to ensure a 1ms integration period over each measurement bin.

7.4.2 Measurement Results

Measurement Performed By: Chris Gormley

Field Strength to EIRP (dBm): Corrected Field Strength – 95.3 = EIRP (dBm)

$$R_c = R_u + CF_T$$

Where:

CF_T	=	Total Correction Factor (AF+CA-PA)
R_u	=	Uncorrected Reading
R_c	=	Corrected Level
AF	=	Antenna Factor
CA	=	Cable Attenuation
PA	=	Preamplifier Gain

Example Calculation:

$$81.89\text{dBm} + 1.84\text{dB} = 83.73\text{dBuV}$$

$$83.73\text{dBuV} - 95.3 = -11.57\text{dBm EIRP}$$

Per FCC 15.517(e) and RSS-220, Section 5.2.1(g) the peak limit on the fundamental is 0 dBm EIRP.

Table 7.4.2-1: Maximum Radiated Output Power

Channel	Detector	Frequency (MHz)	Measured Power (dBuV)	Correction (dB/m)	Output Power (EIRP) (dBm)	Limit (dBm)
Channel 2	Peak	3994.6	81.89	1.84	-11.57	0
Channel 3	Peak	4485.8	80.18	3.27	-11.85	0
Channel 5	Peak	6489.6	77.00	5.64	-12.66	0

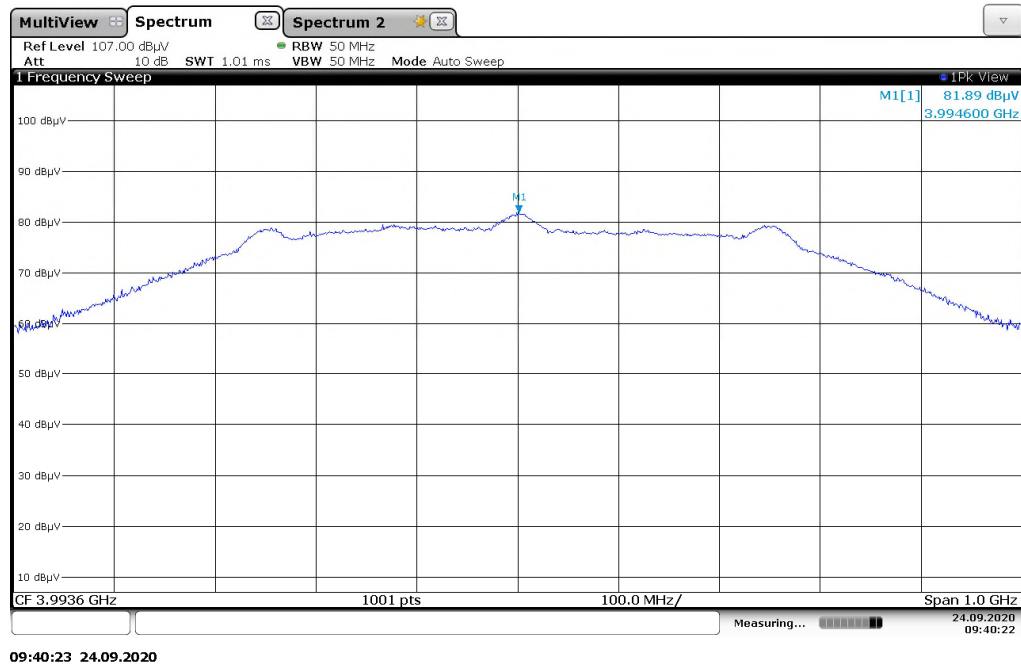


Figure 7.4.2-1: Peak Power Plot – Channel 2

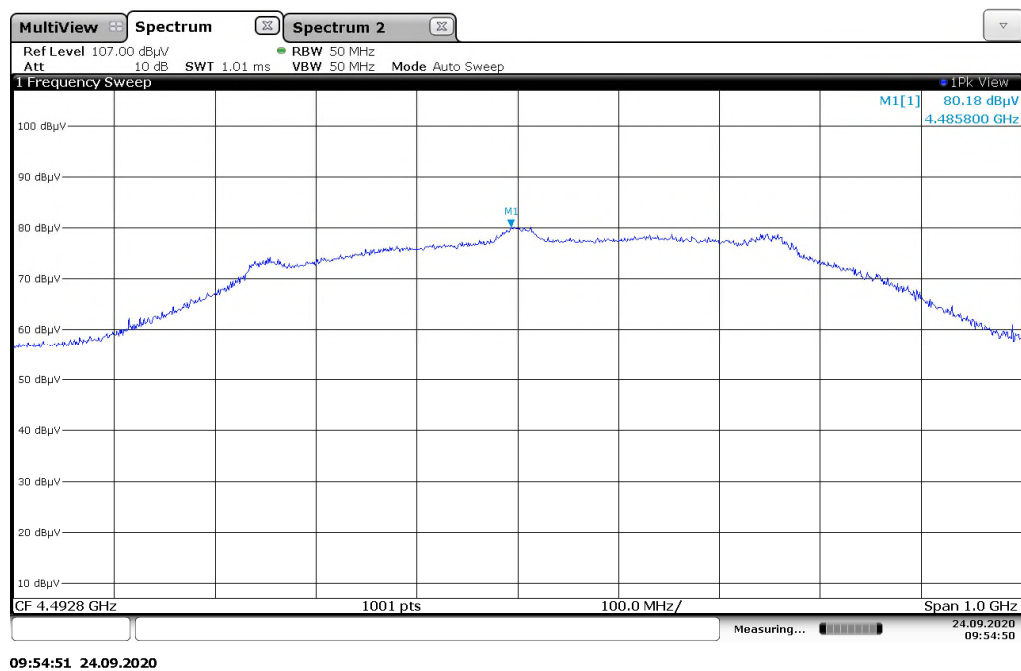
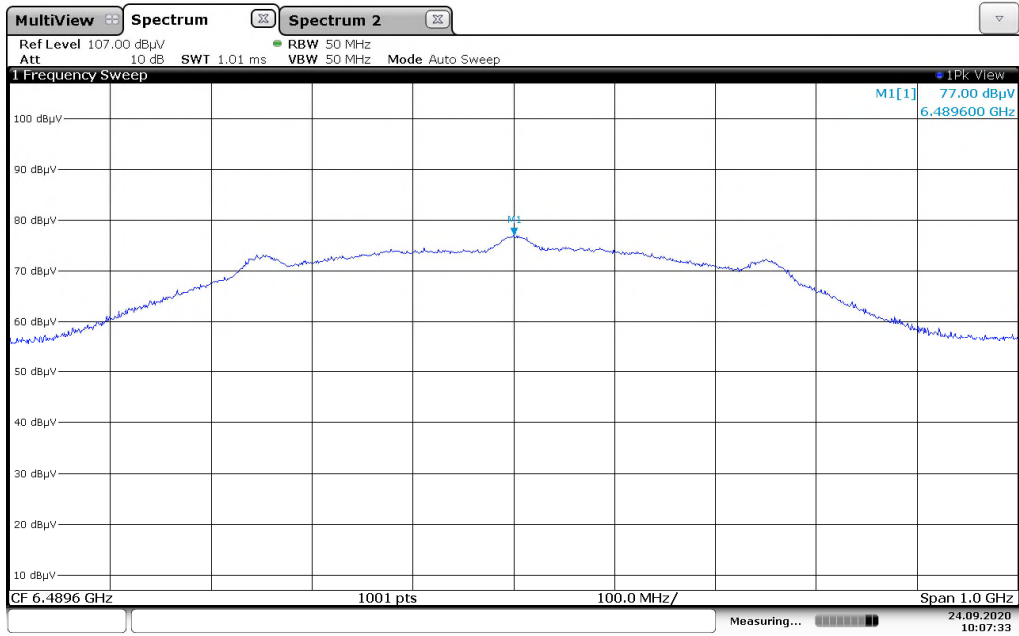


Figure 7.4.2-2: Peak Power Plot – Channel 3



10:07:33 24.09.2020

Figure 7.4.2-3: Peak Power Plot – Channel 5

7.5 Radiated emissions above 960 MHz – FCC 15.517(c) and RSS-220, Issue 1, Section 5.2.1(d)

7.5.1 Measurement Procedure

The rms-average power spectral density was measured in accordance with the ANSI C63.10 Section 10.3.7. The equipment under test was tested radiated. The resolution bandwidth (RBW) of the spectrum analyzer was set to 1 MHz. The video bandwidth (VBW) was set to ≥ 1 MHz. Span was set to a convenient frequency segment. The trace was set to max hold with an RMS detector active. The sweep time did not exceed 1ms per bin.

7.5.2 Sample Calculation:

Field Strength to EIRP (dBm): Field Strength – 95.3_{3m} (104.7_{1m}) = EIRP (dBm) (Applied using amplitude offset in plots)

$$R_C = R_U + CF_T$$

Where:

CF_T	=	Total Correction Factor (AF+CA-PA)
R_U	=	Uncorrected Reading
R_C	=	Corrected Level
AF	=	Antenna Factor
CA	=	Cable Attenuation
PA	=	Preamplifier Gain

Example Calculation: RMS

Corrected Level: 18.62 + -7.05 = 11.57dBuV/m

Convert from dBuV to dBm: 11.57 - 104.7 = -93.13dBm/MHz

Table 7.5.2-1: Limits from 15.517(c):

Frequency MHz	EIRP dBm
960 to 1610	-75.3
1610 to 1990	-53.3
1990 to 3100	-51.3
3100 to 10600	-41.3
Above 10600	-51.3

Table 7.5.2-2: Limits from RSS-220 Section 5.2.1(d):

Frequency MHz	EIRP dBm
960 to 1610	-75.3
1610 to 4750	-70.0
4750 to 10600	-41.3
Above 10600	-51.3

7.5.3 Measurement Results

Measurement Performed By: Chris Gormley

Table 7.5.3-1: Radiated Emissions above 960MHz – Channel 2

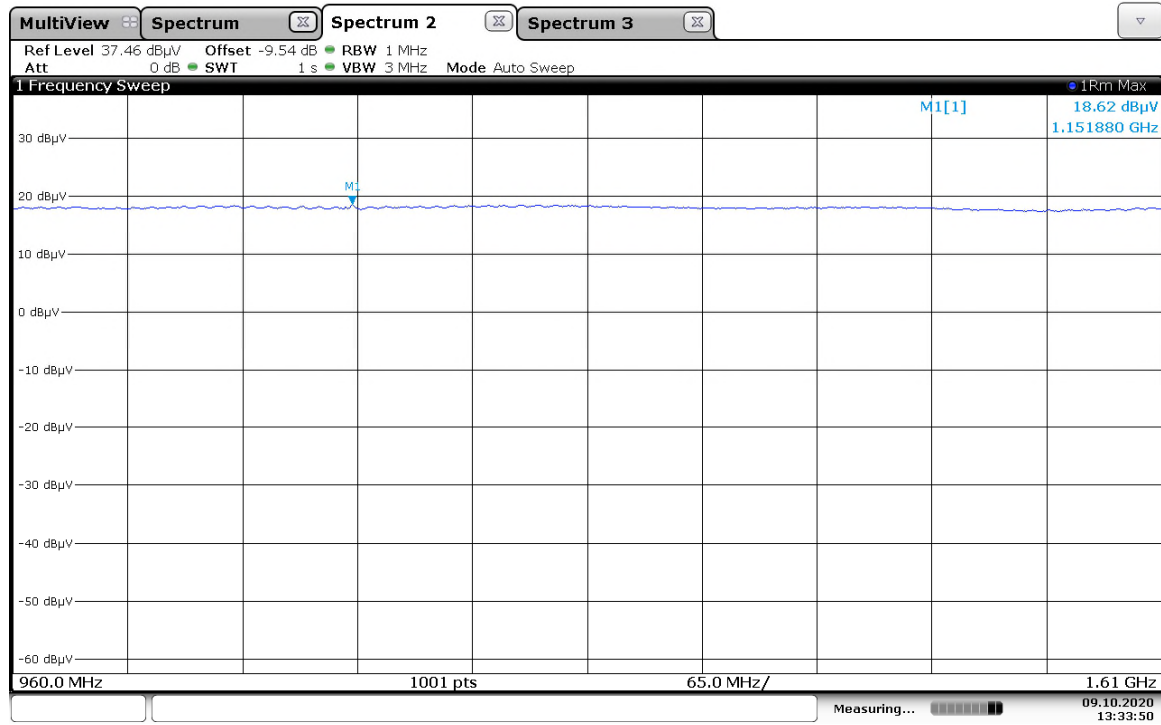
Emission Frequency MHz	Reading From plot dBμV	Antenna Polarity	Measurement Distance m	Correction Factors dB/m	Corrected EIRP dBm	FCC Limit dBm
1152.13	18.62	H	1	-7.05	-83.73	-75.3
1817.6	18.28	H	1	-4.01	-81.03	-53.3
3370.5	22.42	H	1	-0.27	-73.15	-41.3
3864	42.22	H	1	1.41	-51.67	-41.3
4617.5	21.64	H	1	3.37	-70.29	-41.3
4742.8	21.44	H	1	3.42	-70.44	-41.3
5117	21.25	H	1	3.60	-70.45	-41.3
7988.5	30.48	H	1	8.85	-55.97	-41.3
8747.2	16.67	H	1	10.85	-67.78	-41.3
15735	15.11	H	1	10.61	-69.58	-51.3

Table 7.5.3-2: Radiated Emissions above 960MHz – Channel 3

Emission Frequency MHz	Reading From plot dBμV	Antenna Polarity	Measurement Distance m	Correction Factors dB/m	Corrected EIRP dBm	FCC Limit dBm
1148.64	19.51	H	1	-7.06	-82.85	-75.3
2151.1	19.47	H	1	-2.63	-78.46	-51.3
3353.4	17.37	H	1	-0.33	-78.26	-41.3
4406.8	39.99	H	1	3.04	-52.27	-41.3
4651.7	43.54	H	1	3.38	-48.38	-41.3
5004.9	20.32	H	1	3.54	-71.44	-41.3
5117	19.65	H	1	3.60	-72.05	-41.3
5243.2	18.73	H	1	3.67	-72.90	-41.3
6148.9	17.22	H	1	4.69	-73.39	-41.3
8741.4	16.68	H	1	10.85	-67.77	-41.3
13816.4	15.75	H	1	12.73	-66.82	-51.3

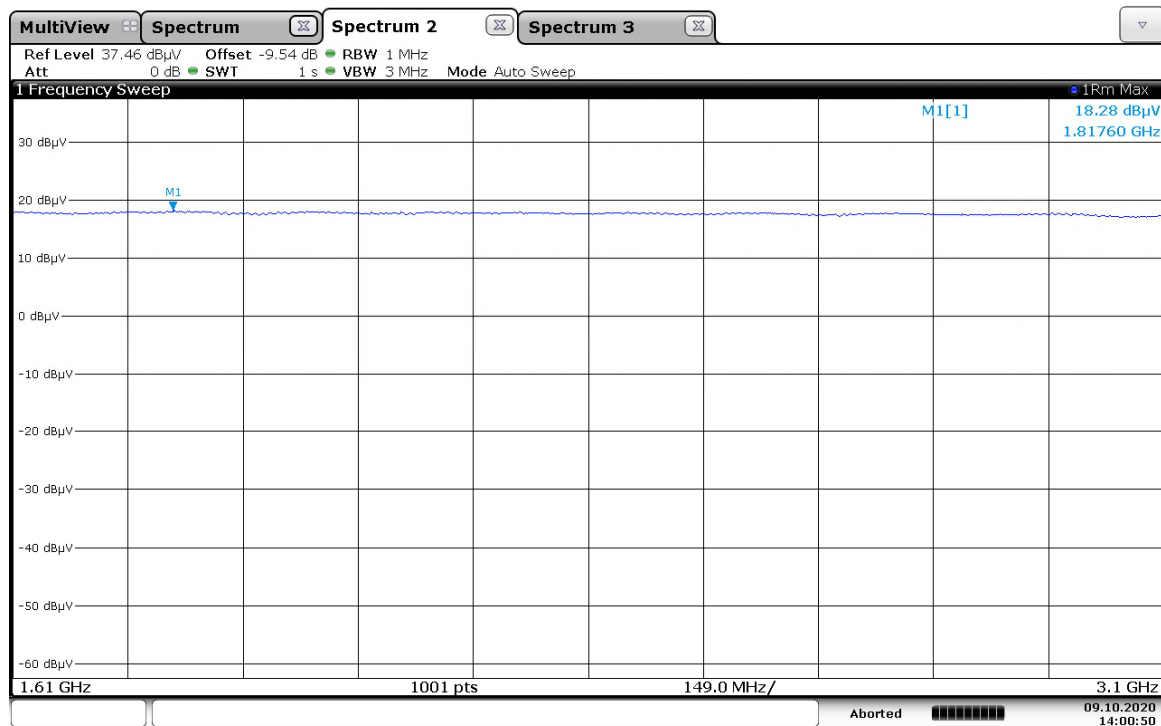
Table 7.5.3-3: Radiated Emissions above 960MHz – Channel 5

Emission Frequency MHz	Reading From plot dBμV	Antenna Polarity	Measurement Distance m	Correction Factors dB/m	Corrected EIRP dBm	FCC Limit dBm	ISED Limit dBm
1152.08	20.00	H	1	-7.05	-82.35	-75.3	-75.3
1996.7	18.32	H	1	-2.42	-79.40	-51.3	-70.0
3355.6	17.48	H	1	-0.32	-78.14	-41.3	-70.0
6490	40.38	H	1	5.64	-49.28	-41.3	-41.3
8741.3	16.41	H	1	10.85	-68.04	-41.3	-41.3
15735	15.09	H	1	10.61	-69.60	-51.3	-51.3



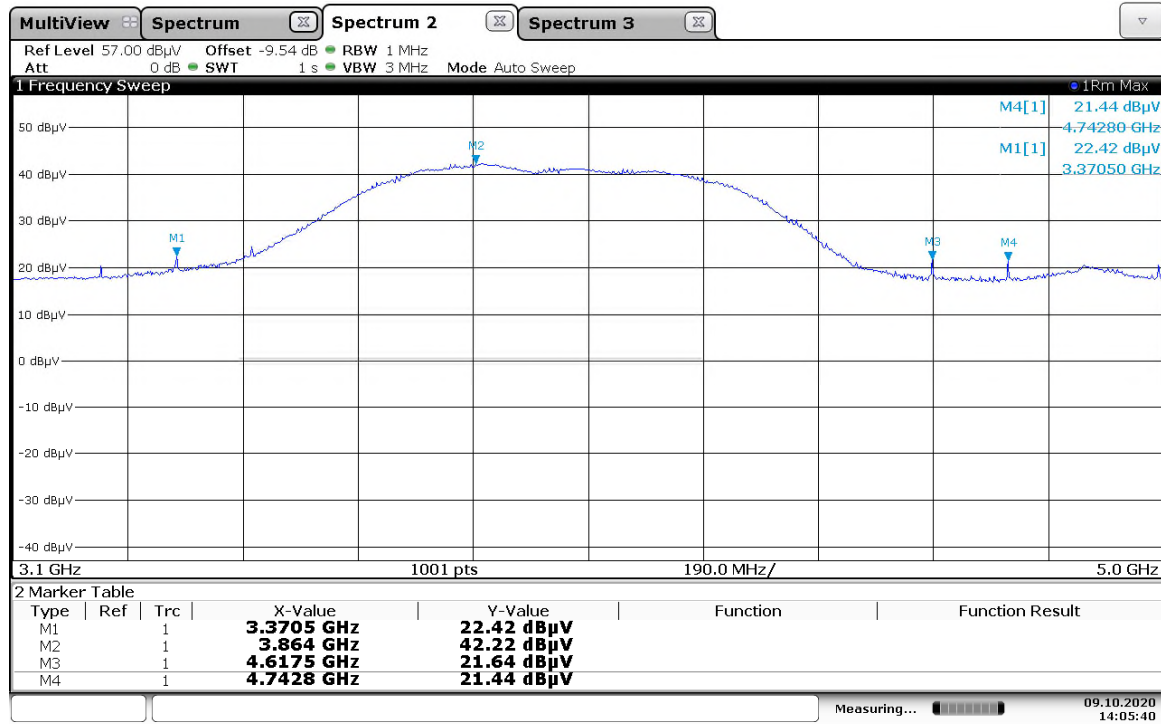
13:33:50 09.10.2020

Figure 7.5.3-1: 960 MHz – 1.61 GHz – Channel 2 – 1m



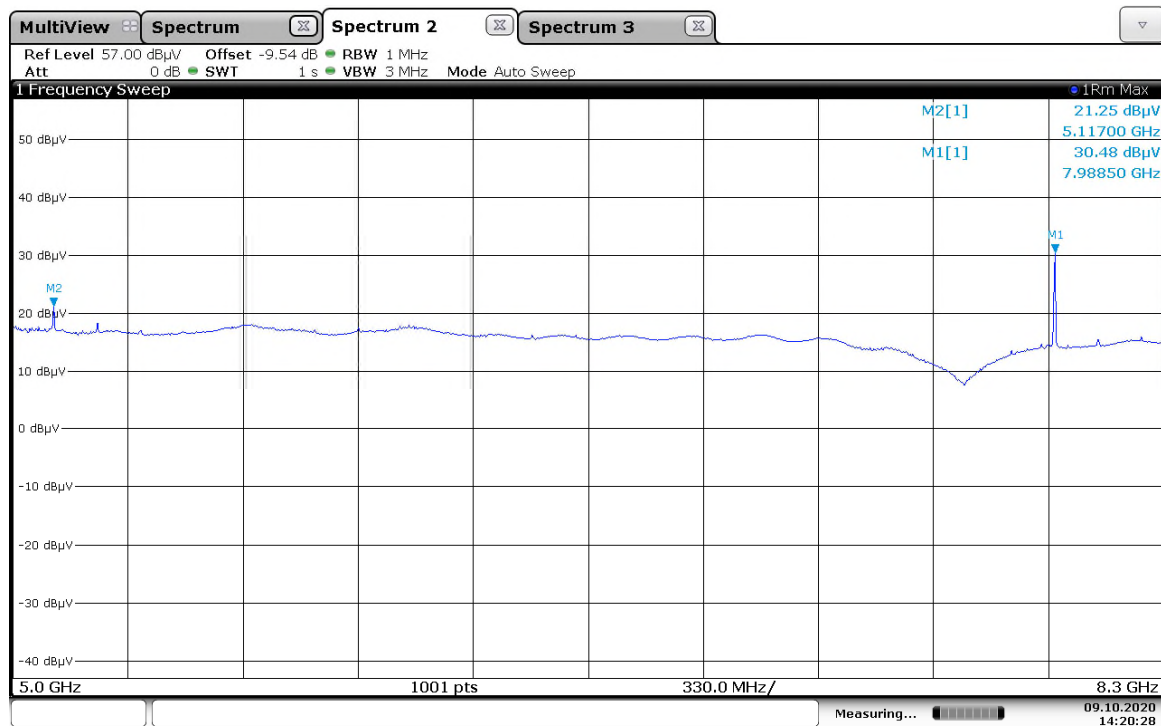
14:00:51 09.10.2020

Figure 7.5.3-2: 1.61 GHz – 3.1 GHz – Channel 2 – 1m



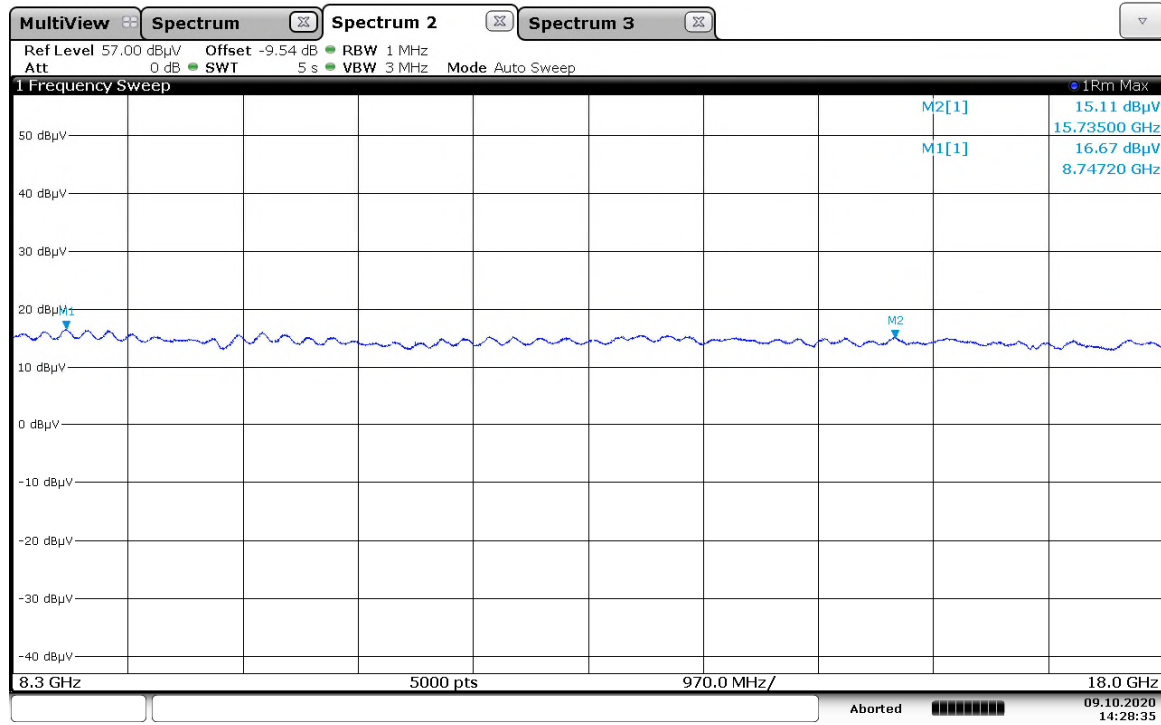
14:05:40 09.10.2020

Figure 7.5.3-3: 3.1 GHz – 5.0 GHz – Channel 2 – 1m



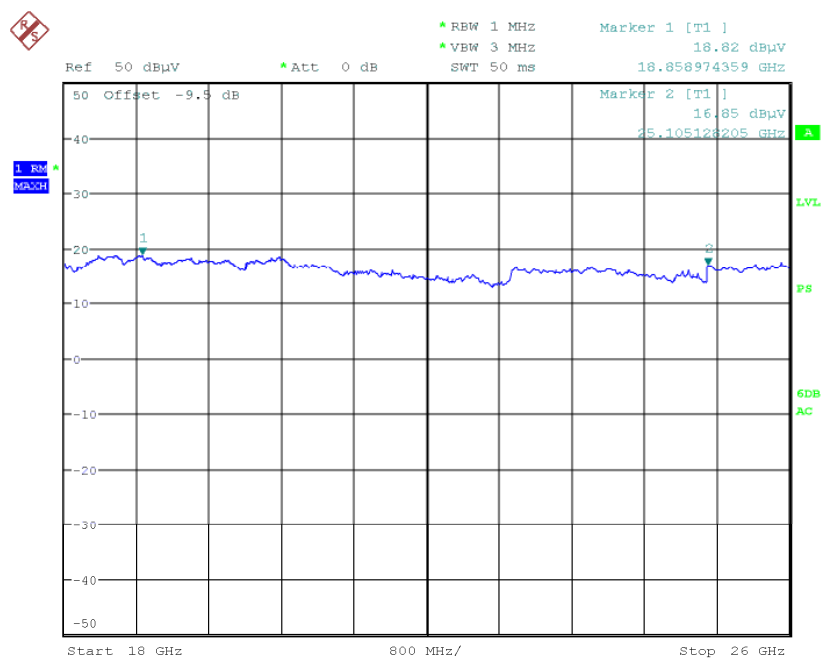
14:20:29 09.10.2020

Figure 7.5.3-4: 5.0 GHz – 8.3 GHz – Channel 2 – 1m



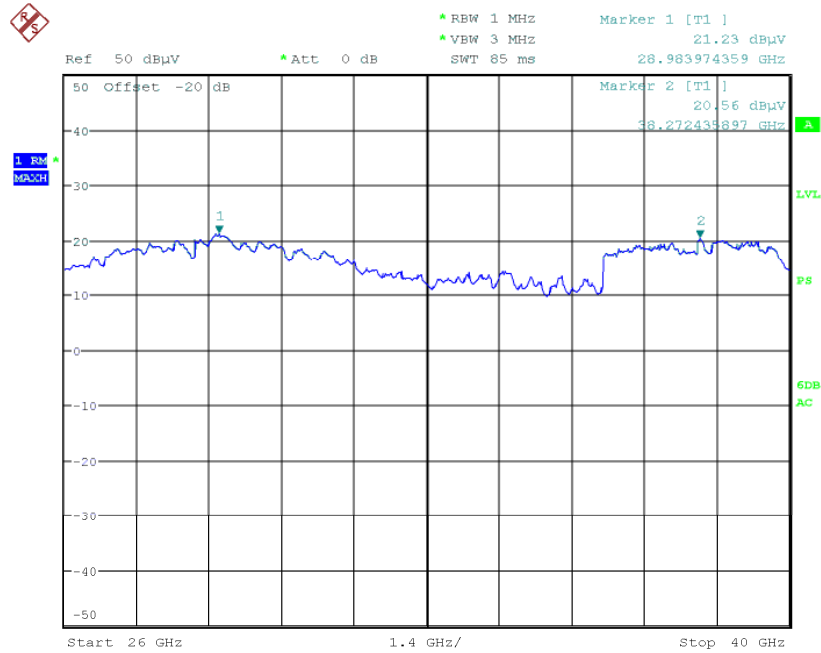
14:28:36 09.10.2020

Figure 7.5.3-5: 8.3 GHz – 18.0 GHz – Channel 2 – 1m



Date: 23.OCT.2020 12:15:04

Figure 7.5.3-6: 18-26 GHz – Channel 2 – 1m



Date: 23.OCT.2020 13:08:57

Figure 7.5.3-7: 26-40 GHz – Channel 2 – 30cm



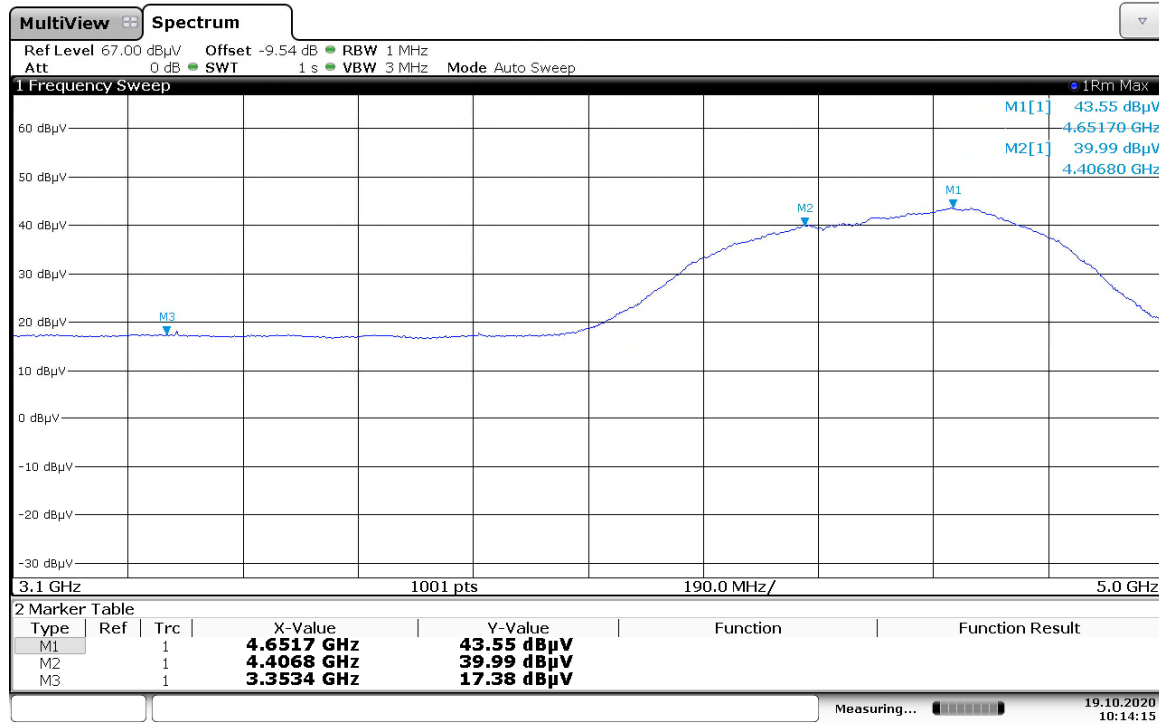
09:48:47 19.10.2020

Figure 7.5.3-8: 960 MHz – 1.61 GHz – Channel 3 – 1m



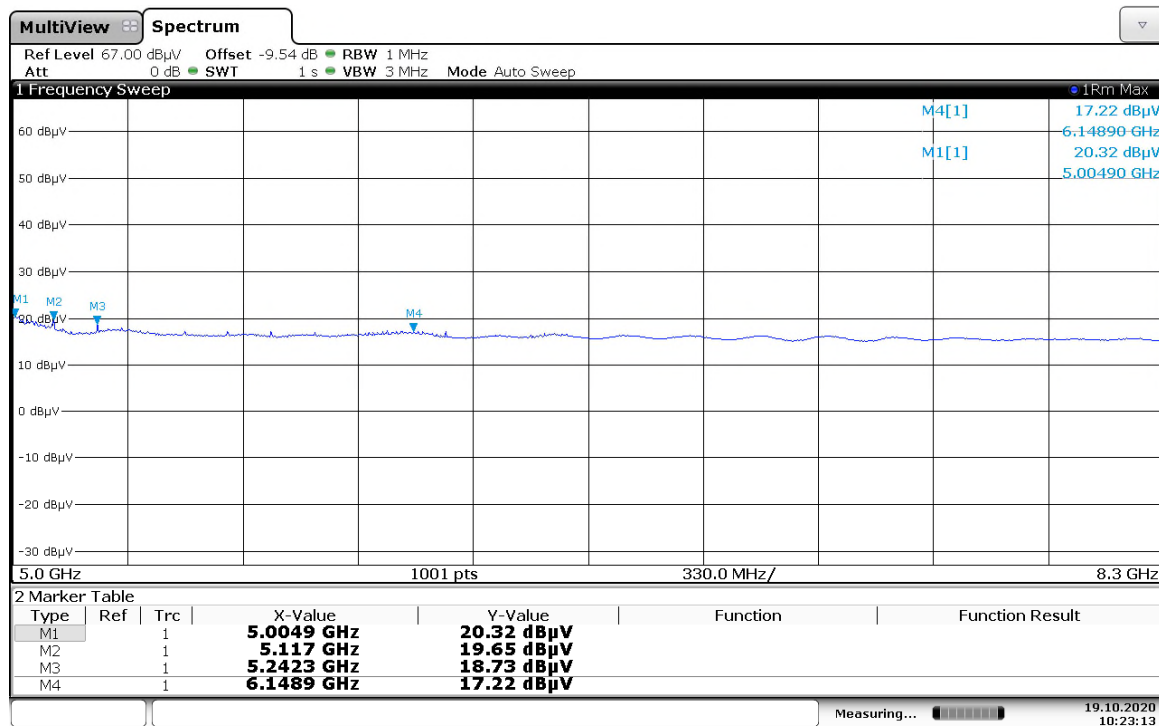
09:50:54 19.10.2020

Figure 7.5.3-9: 1.61 GHz – 3.1 GHz – Channel 3 – 1m



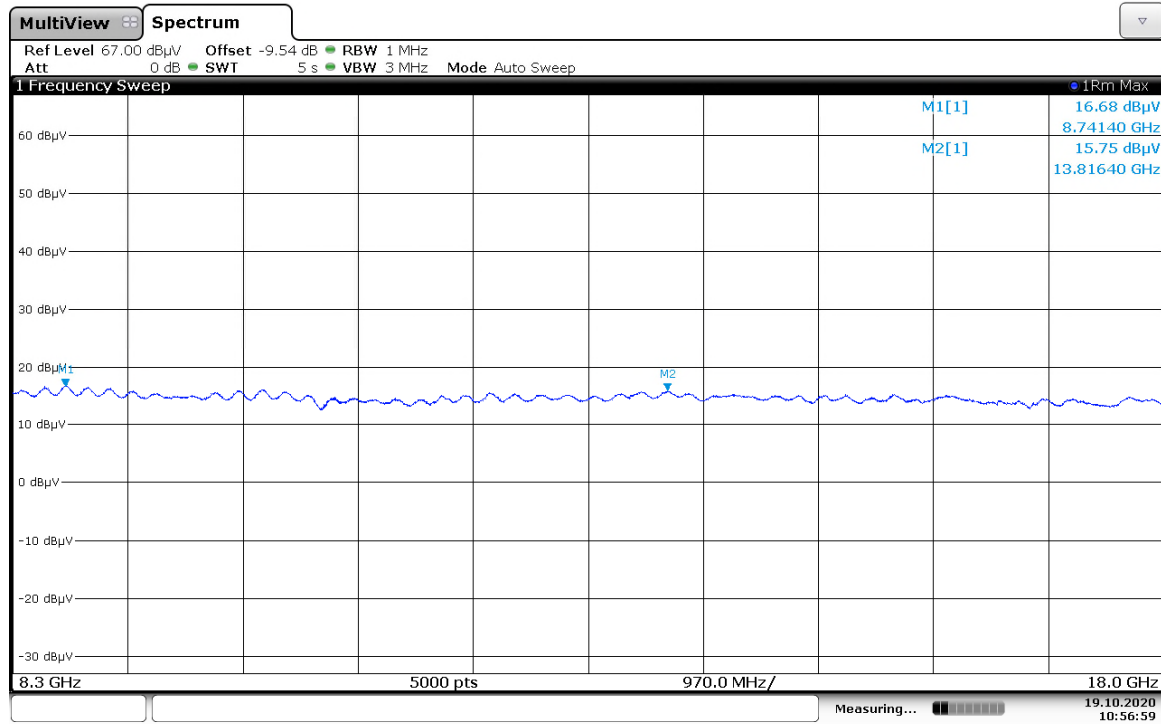
10:14:15 19.10.2020

Figure 7.5.3-10: 3.1 GHz – 5.0 GHz – Channel 3 – 1m



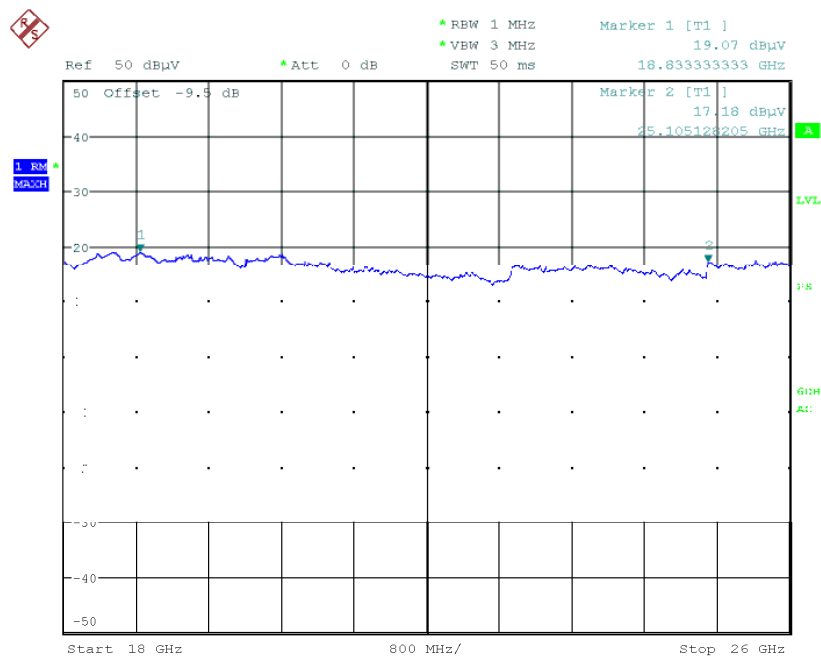
10:23:14 19.10.2020

Figure 7.5.3-11: 5.0 GHz – 8.3 GHz – Channel 3 – 1m



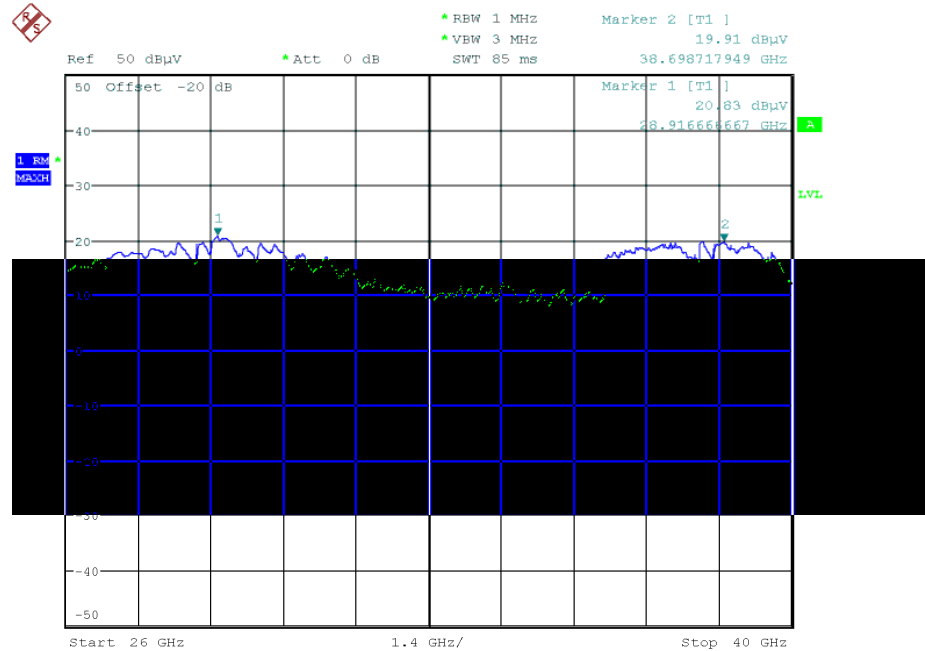
10:57:00 19.10.2020

Figure 7.5.3-12: 8.3 GHz – 18.0 GHz – Channel 3 – 1m



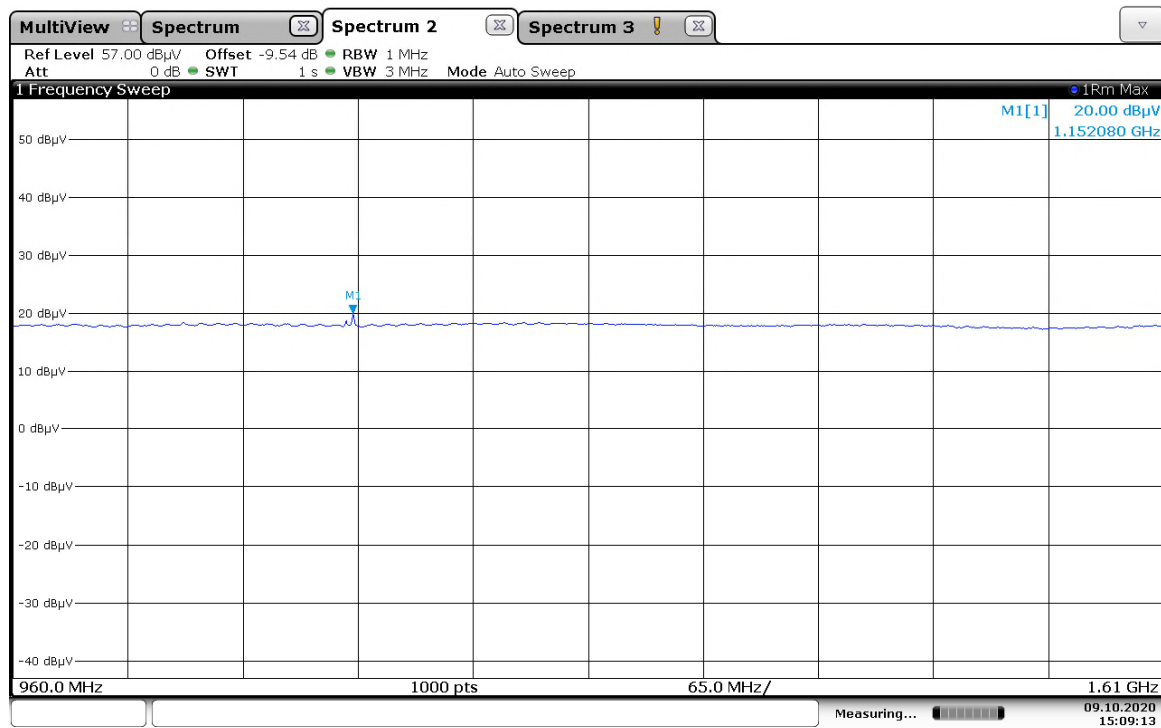
Date: 23.OCT.2020 12:18:26

Figure 7.5.3-13: 18-26 GHz – Channel 3 – 1m



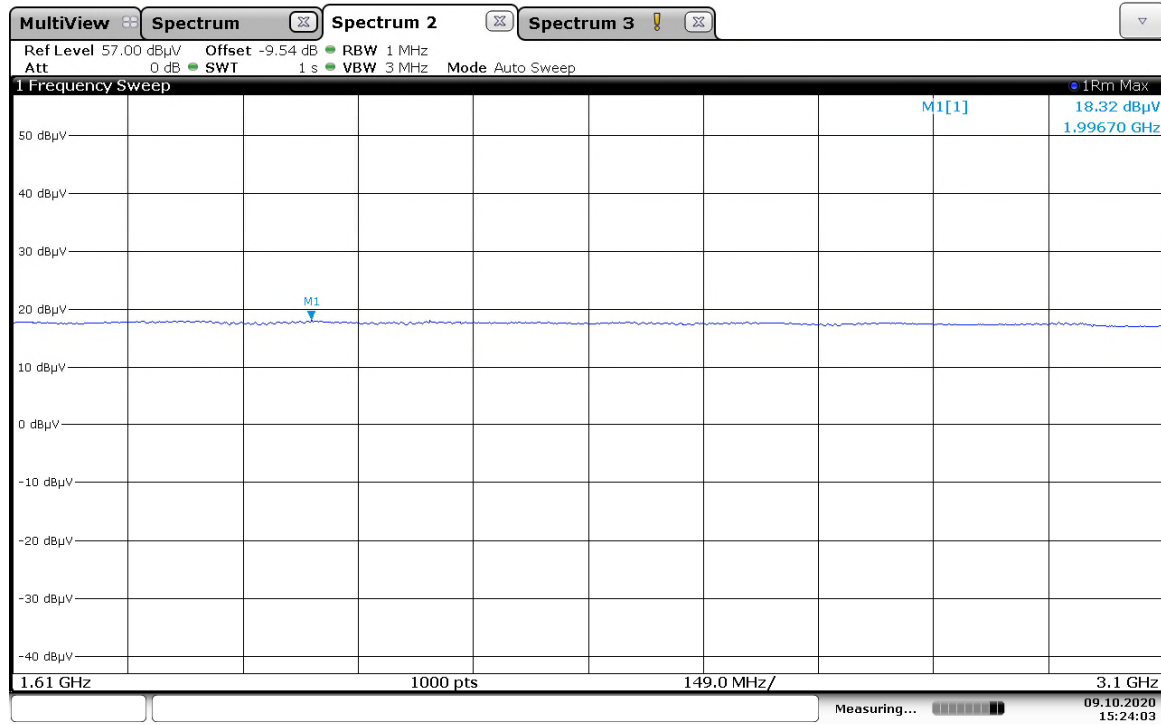
Date: 23.OCT.2020 13:12:54

Figure 7.5.3-14: 26-40 GHz – Channel 3 – 30cm



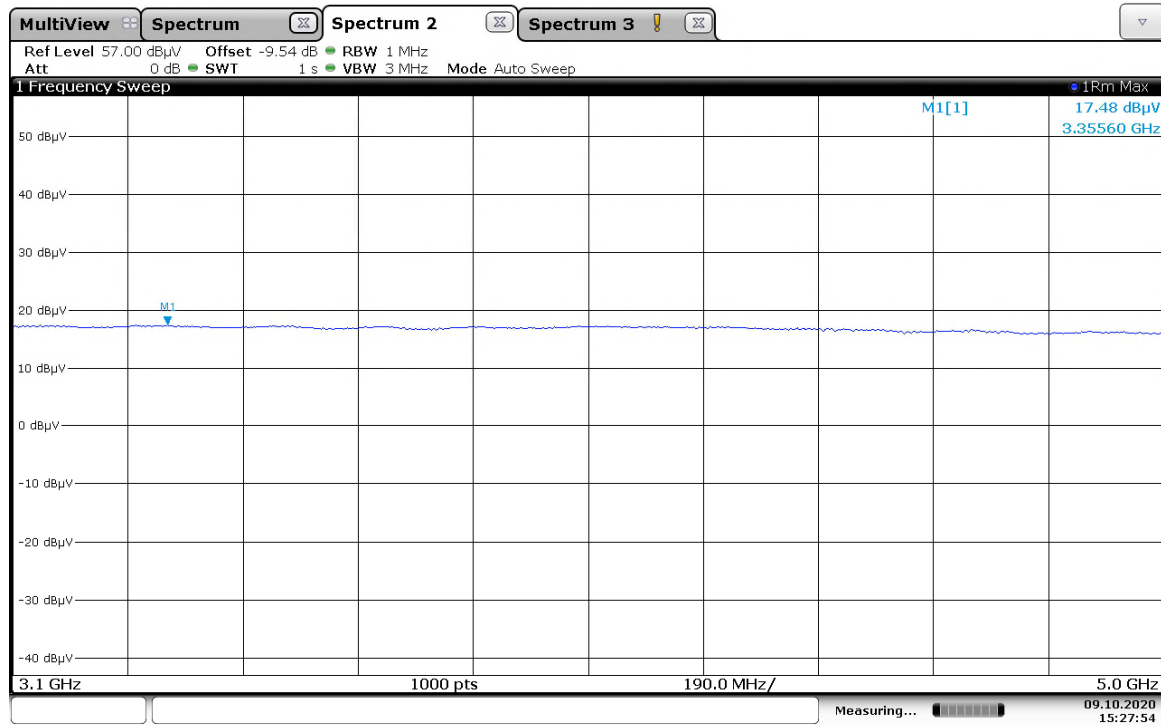
15:09:14 09.10.2020

Figure 7.5.3-15: 960 MHz – 1.61 GHz – Channel 5 – 1m



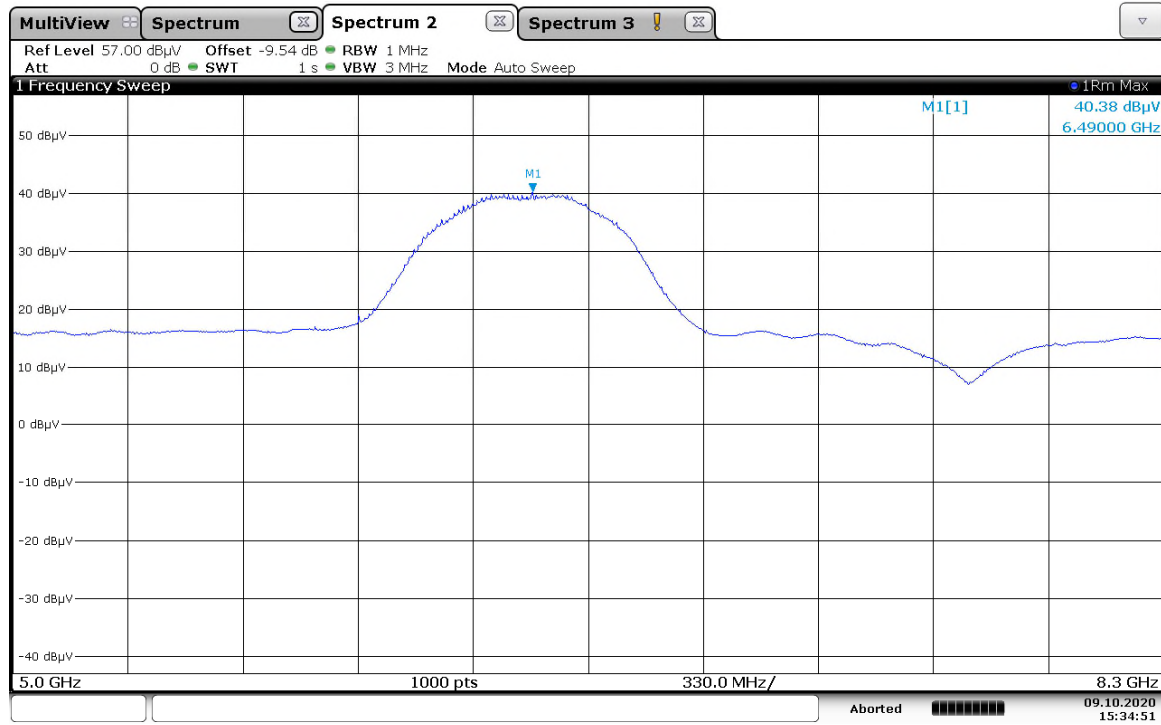
15:24:04 09.10.2020

Figure 7.5.3-16: 1.61 GHz – 3.1 GHz – Channel 5 – 1m



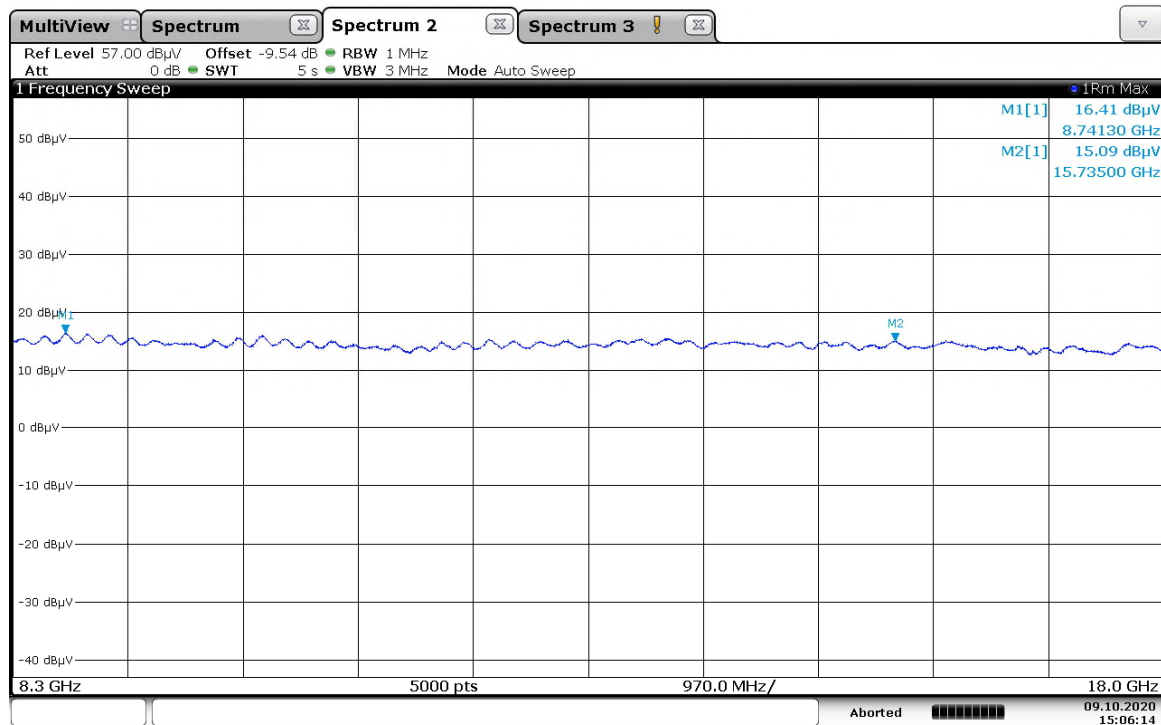
15:27:54 09.10.2020

Figure 7.5.3-17: 3.1 GHz – 5.0 GHz – Channel 5 – 1m



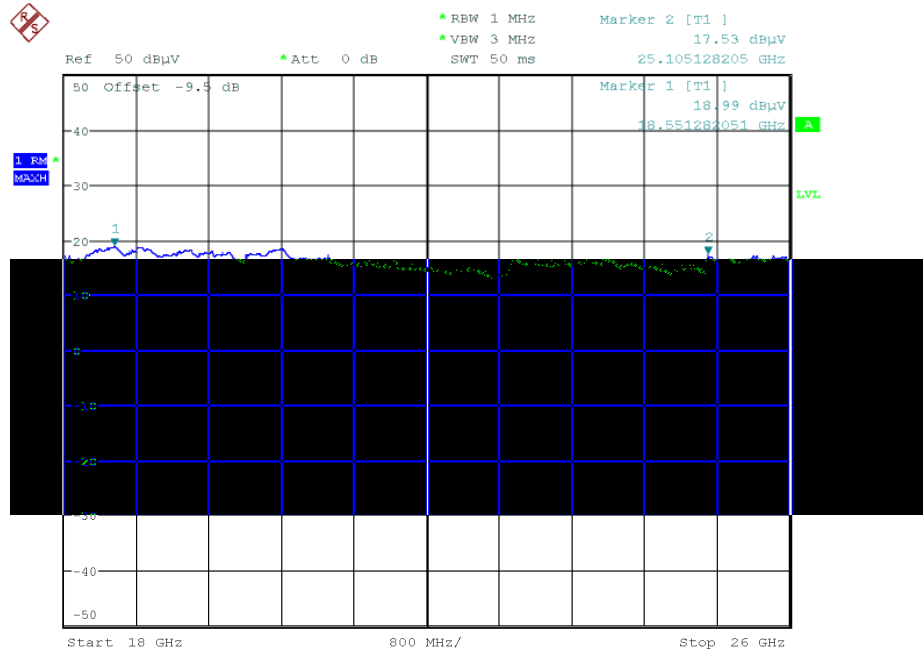
15:34:52 09.10.2020

Figure 7.5.3-18: 5.0 GHz – 8.3 GHz – Channel 5 – 1m



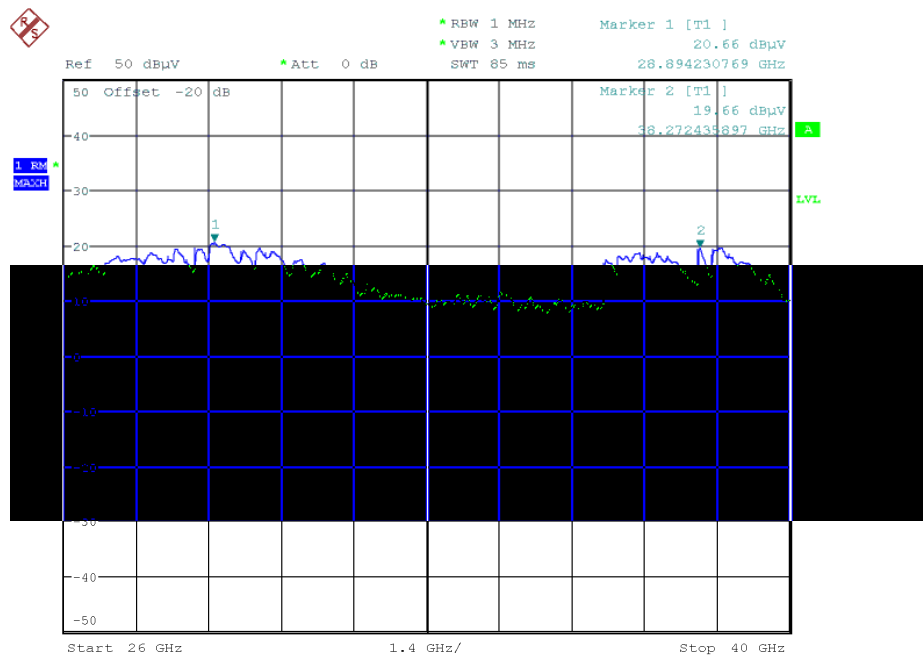
15:06:14 09.10.2020

Figure 7.5.3-19: 8.3 GHz – 18.0 GHz – Channel 5 – 1m



Date: 23.OCT.2020 12:12:53

Figure 7.5.3-20: 18-26 GHz – Channel 5 – 1m



Date: 23.OCT.2020 13:18:19

Figure 7.5.3-21: 26-40 GHz – Channel 5 – 30cm

7.6 Radiated emissions at or below 960 MHz, FCC 15.517(c) and RSS-220, Issue 1, Section 5.3.1(c) / 3.4

7.6.1 Measurement Procedure

The unwanted emissions from the lowest frequency generated or 9 kHz to 960 MHz in accordance with ANSI 63.10: 2013 Section 10.2. For peak prescans of the frequency range 30MHz to 960MHz, the Resolution Bandwidth (RBW) of the spectrum analyzer was set to 100 kHz, and the Video Bandwidth (VBW) was set to 300 kHz. For final measurements, the receiver function of the analyzer was employed, and the resolution bandwidth was 120kHz.

The correction factor is a combination of measurement cable(s) loss, preamplifier gain, antenna factor, and a distance correction factor (if needed).

Table 7.6.1.1-1 Limits from FCC 15.209 and RSS-220, Section 3.4:

Frequency (MHz)	Field Strength ($\mu\text{V/m}$)	Measurement Distance (m)
0.009-0.490	2,400/F (F in kHz)	300
0.490-1.705	24,000/F (F in kHz)	30
1.705-30	30	30
30.0 to 88.0	100	3
88.0 to 216.0	150	3
216.0 to 960.0	200	3

7.6.2 Measurement Results

Measurement Performed By: Chris Gormley

Table 7.6.2-1: Radiated Emissions below 960MHz – Channel 2

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Turntable Position (o)	Antenna Height (cm)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg					pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
35.929	21.50	12.60	V	101	100	19.96	-----	32.56	-----	40.0	-----	7.44
47.95	24.50	17.30	V	86	100	13.58	-----	30.88	-----	40.0	-----	9.12
54.18	32.00	18.80	V	49	100	11.26	-----	30.06	-----	40.0	-----	9.94
59.97	25.60	16.80	V	112	100	10.50	-----	27.30	-----	40.0	-----	12.70
65.79	28.40	15.90	V	18	235	10.65	-----	26.55	-----	40.0	-----	13.45
107.05	21.10	18.40	H	104	285	16.16	-----	34.56	-----	43.5	-----	8.94
125.48	19.60	9.50	V	328	100	16.68	-----	26.18	-----	43.5	-----	17.32

Table 7.6.2-2: Radiated Emissions below 960MHz – Channel 3

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Turntable Position (o)	Antenna Height (cm)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg					pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
35.69	18.80	12.80	V	108	100	20.10	-----	32.90	10.0	40.0	-----	7.10
47.85	23.20	16.10	V	57	100	13.63	-----	29.73	10.0	40.0	-----	10.27
54.1	29.3	17.8	V	17	100	11.29	-----	29.09	-----	40.0	-----	10.91
60	26.9	17.9	V	135	100	10.50	-----	28.40	10.0	40.0	-----	11.60
66.15	27.8	16.4	V	317	242	10.67	-----	27.07	10.0	40.0	-----	12.93
107.05	21.6	19.1	H	105	287	16.16	-----	35.26	10.0	43.5	-----	8.24
113.62	23	8.2	V	296	100	16.62	-----	24.82	10.0	43.5	-----	18.68
137.5	22.6	8.7	V	0	100	16.00	-----	24.70	-----	43.5	-----	18.80
185.42	18.6	7.1	V	0	100	13.71	-----	20.81	10.0	43.5	-----	22.69

Table 7.6.2-3: Radiated Emissions below 960MHz – Channel 5

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Turntable Position (o)	Antenna Height (cm)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg					pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
36.04	22.00	9.80	V	74	100	19.90	-----	29.70	-----	40.0	-----	10.30
48.01	24.60	16.10	V	3	100	13.56	-----	29.66	-----	40.0	-----	10.34
54.18	31.50	18.80	V	0	175	11.26	-----	30.06	-----	40.0	-----	9.94
66.15	27.90	16.40	V	345	215	10.67	-----	27.07	-----	40.0	-----	12.93
77.92	25.30	9.40	V	326	157	11.49	-----	20.89	-----	40.0	-----	19.11
107.08	21.30	19.20	H	104	290	16.17	-----	35.37	-----	43.5	-----	8.13
113.75	21.80	8.60	V	0	100	16.63	-----	25.23	-----	43.5	-----	18.28
149.79	20.7	9.7	V	0	100	15.31	-----	25.01	-----	43.5	-----	18.49

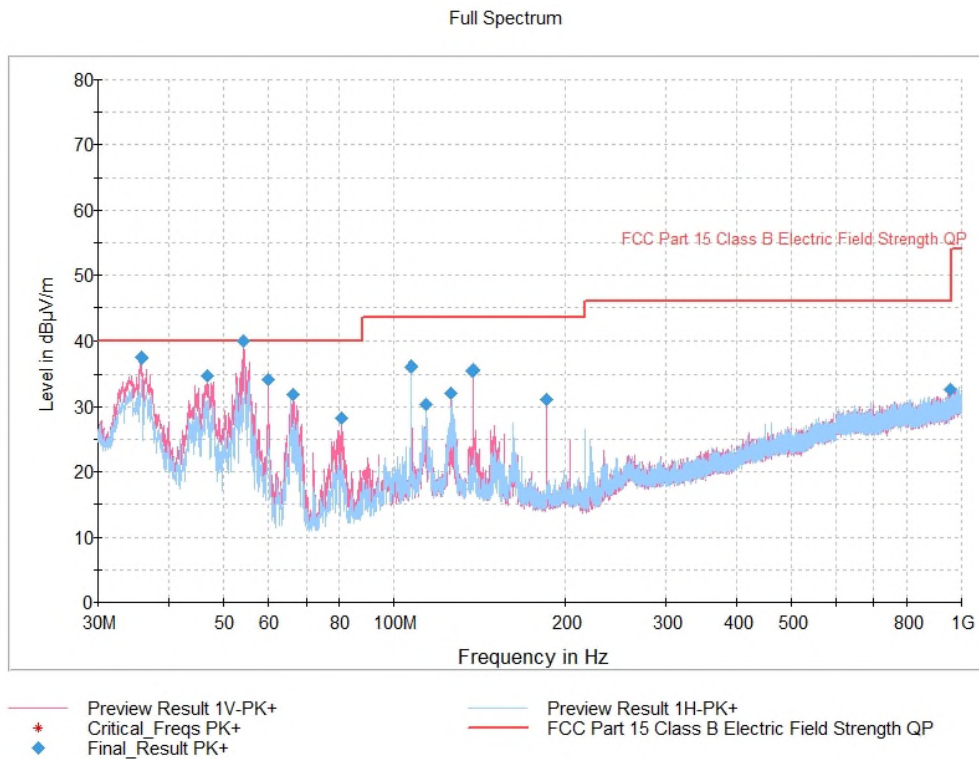


Figure 7.6.2-1: Emission Profile 30MHz-1GHz – Channel 2

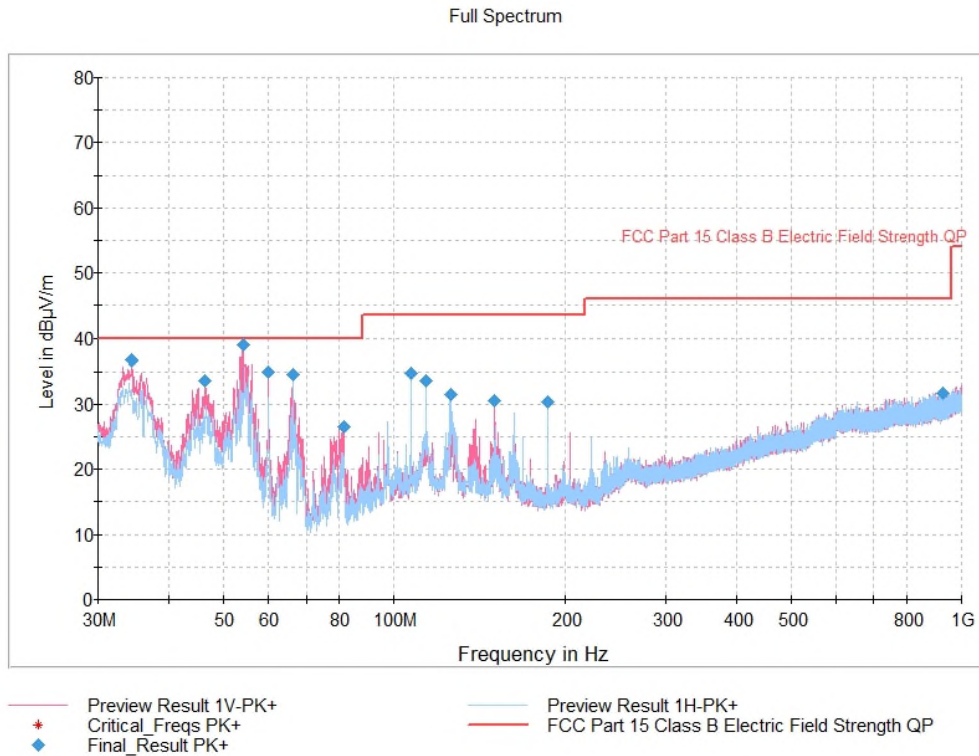


Figure 7.6.2-2: Emission Profile 30MHz-1GHz – Channel 3

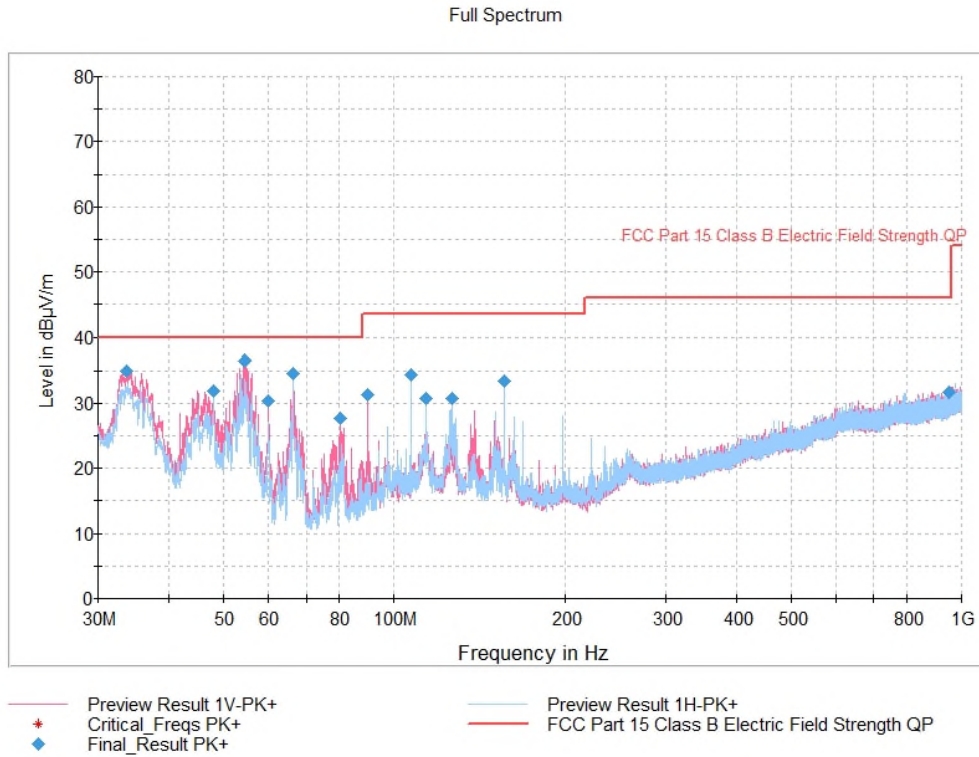


Figure 7.6.2-3: Emission Profile 30MHz-1GHz – Channel 5

7.7 Radiated Emissions in the GPS bands FCC 15.517(d) and RSS-220, Issue 1, Section 5.2.1(e)**7.7.1 Measurement Procedure**

Unwanted emissions in the above bands were measured radiated in accordance with ANSI 63.10: 2013 Section 10.3.10. The resolution bandwidth (RBW) of the spectrum analyzer was set to 1 kHz. The ratio of the RBW to Video Bandwidth (VBW) was set to ≥ 3 where possible. The trace was set to max hold with the RMS detector active. The sweep time did not exceed 1ms per bin.

7.7.2 Sample Calculation:

Field Strength to EIRP (dBm): Field Strength – 95.3 = EIRP (dBm)

$$R_C = R_U + CF_T$$

Where:

CF_T	=	Total Correction Factor (AF+CA-PA)
R_U	=	Uncorrected Reading
R_C	=	Corrected Level
AF	=	Antenna Factor
CA	=	Cable Attenuation
PA	=	Preamplifier Gain

$$\begin{aligned} 5.59\text{dBuV} + -7.01\text{dB} &= -1.42\text{dBuV} \\ -1.42\text{dBuV} - 95.3 &= -96.72\text{dBm EIRP} \end{aligned}$$

The frequency bands to be investigated and the associated limits are:

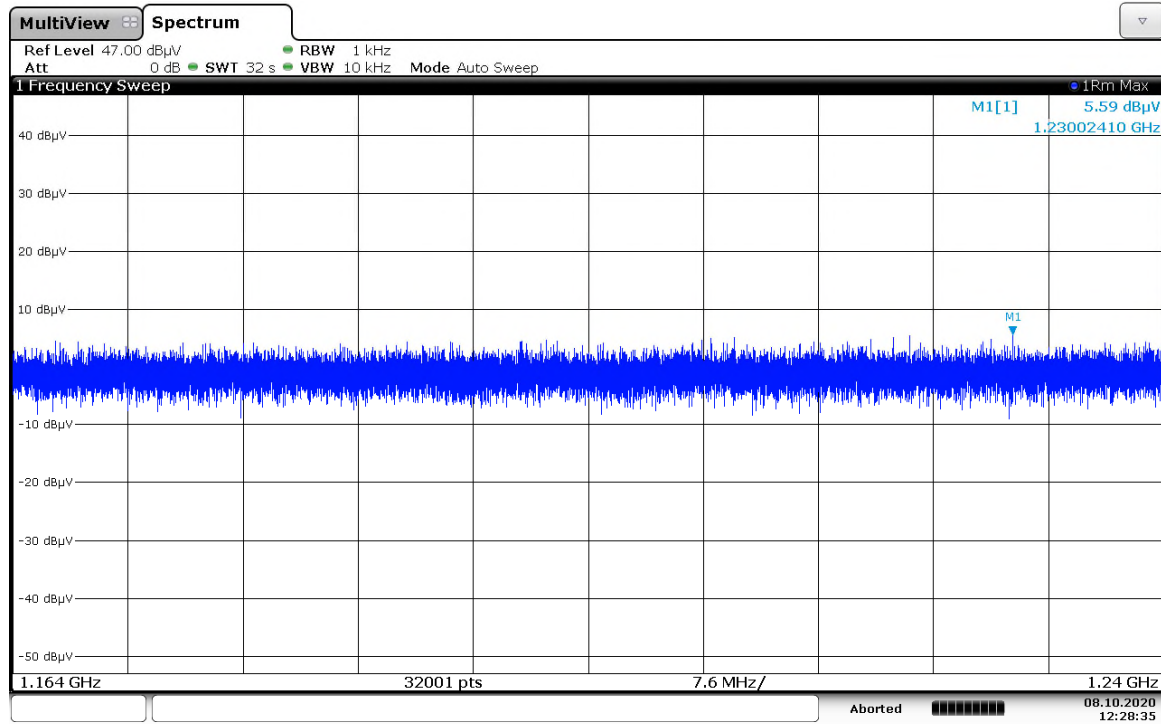
Table 7.7.2-1 Frequency Bands

Frequency MHz	EIRP dBm
1164 to 1240	-85.3
1559 to 1610	-85.3

7.7.3 Measurement Results:

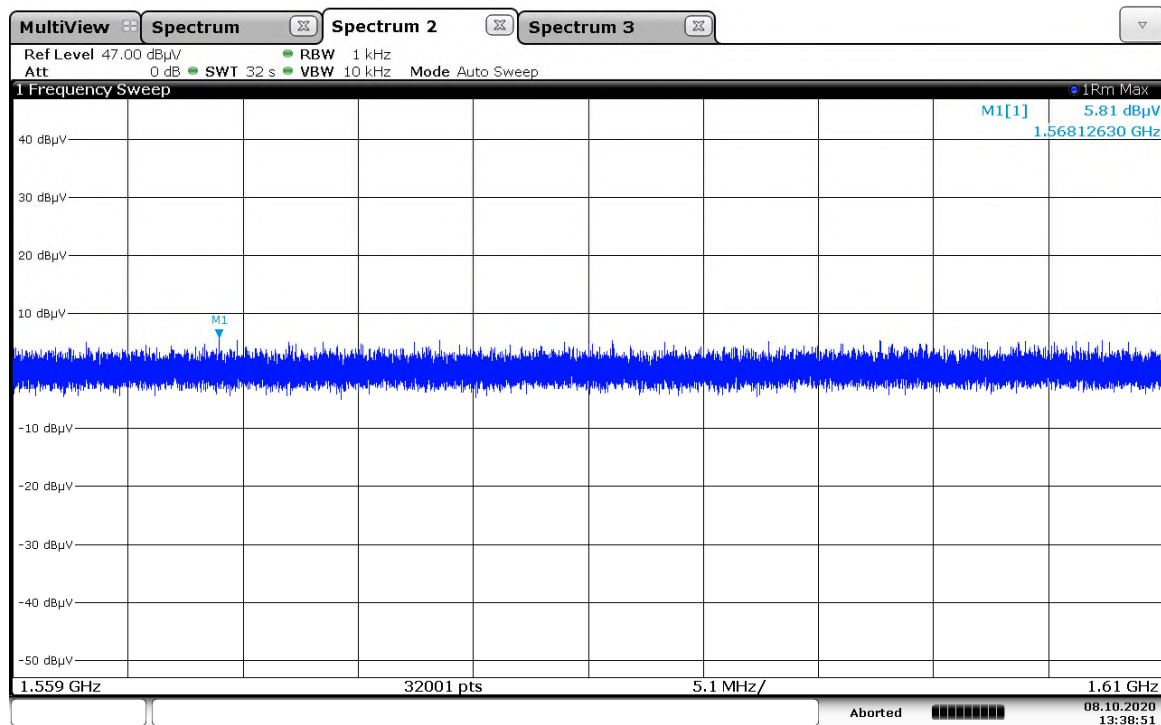
Measurement Performed By: Chris Gormley

There were no emissions above the noise floor of the analyzer for either any of the channels. See plots on the following pages.



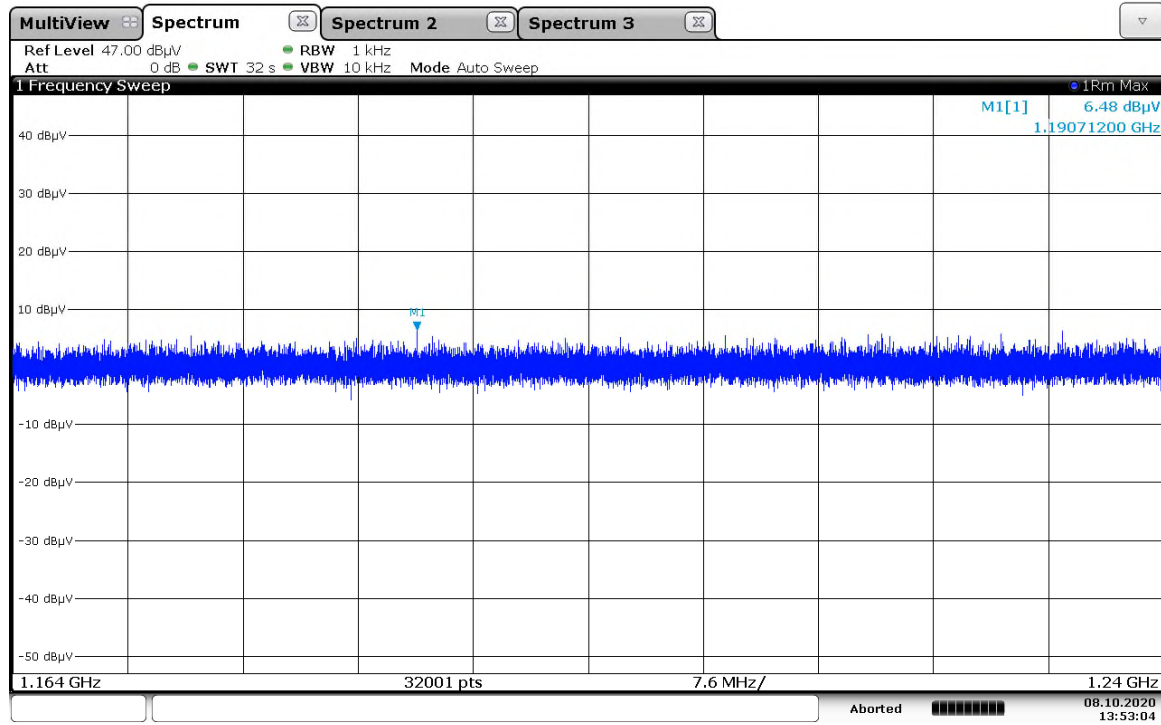
12:28:35 08.10.2020

Figure 7.7.3-1: 1.164 GHz – 1.24 GHz – Channel 2 – 3m



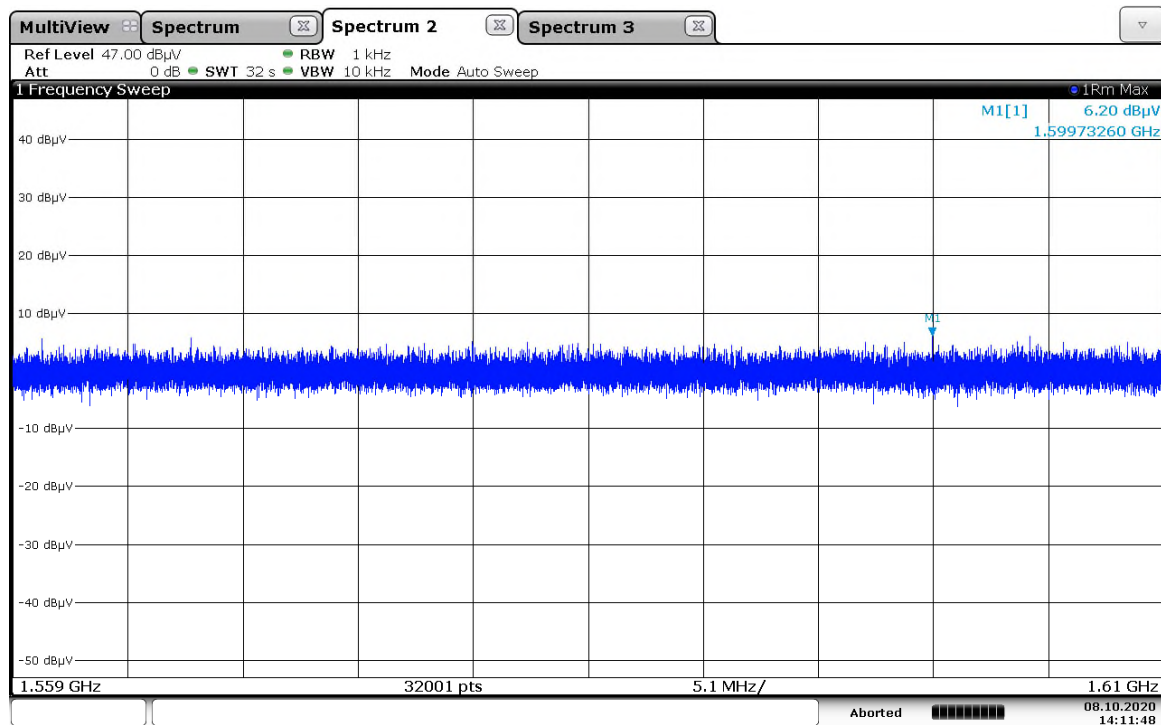
13:38:52 08.10.2020

Figure 7.7.3-2: 1.559 GHz – 1.610 GHz – Channel 2 – 3m



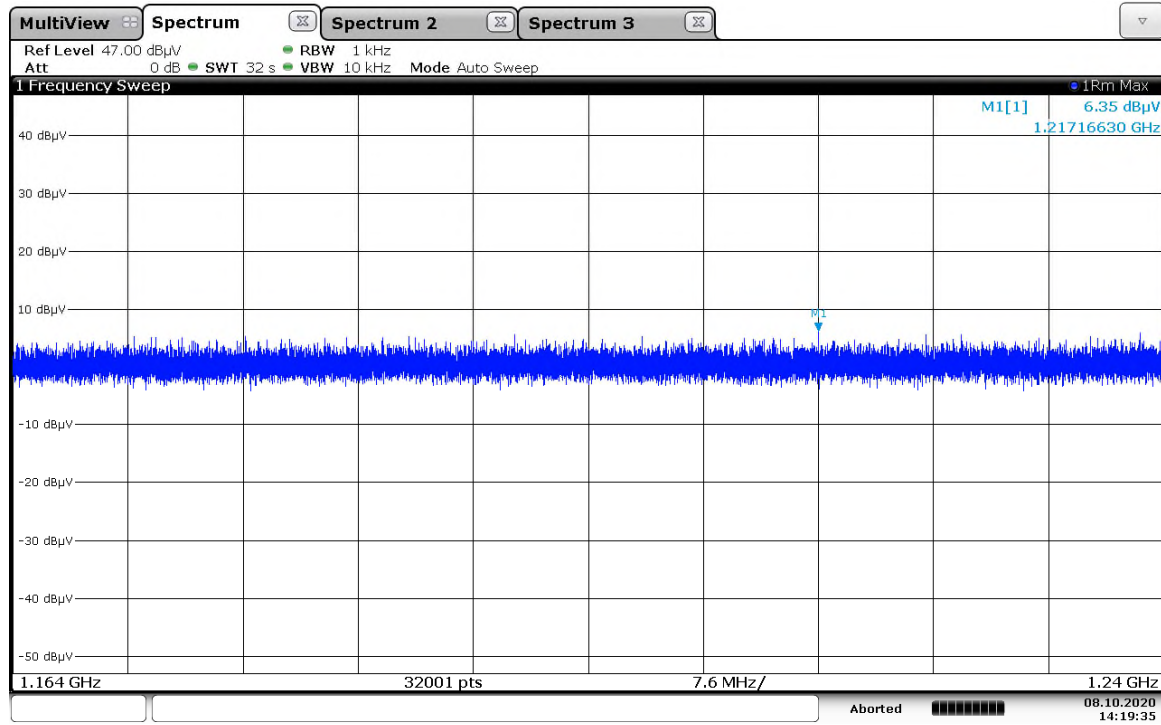
13:53:05 08.10.2020

Figure 7.7.3-3: 1.164 GHz – 1.24 GHz – Channel 3 – 3m



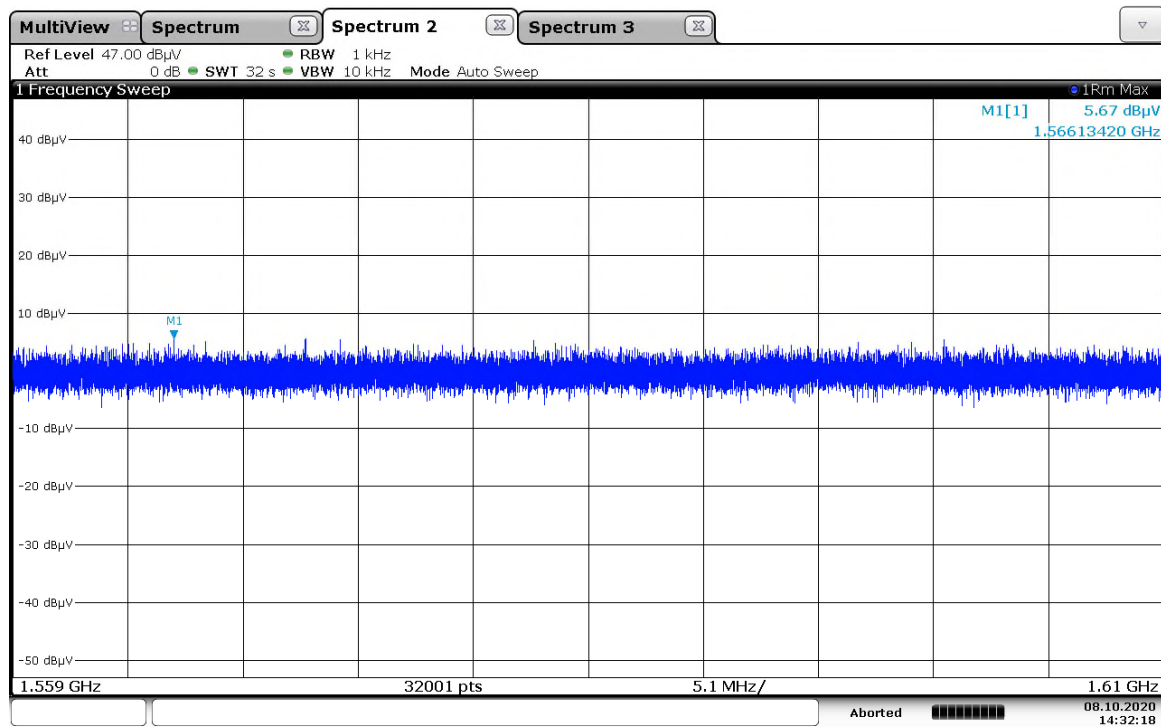
14:11:48 08.10.2020

Figure 7.7.3-4: 1.559 GHz – 1.610 GHz – Channel 3 – 3m



14:19:36 08.10.2020

Figure 7.7.3-5: 1.164 GHz – 1.24 GHz – Channel 5 – 3m



14:32:18 08.10.2020

Figure 7.7.3-6: 1.559 GHz – 1.610 GHz – Channel 5 – 3m

8 MEASUREMENT UNCERTAINTY

The expanded laboratory measurement uncertainty figures (U_{Lab}) provided below correspond to an expansion factor (coverage factor) $k = 1.96$ which provide confidence levels of 95%.

Parameter	U_{Lab}
Occupied Channel Bandwidth	$\pm 0.004\%$
RF Conducted Output Power	$\pm 0.689 \text{ dB}$
Power Spectral Density	$\pm 0.5 \text{ dB}$
Antenna Port Conducted Emissions	$\pm 2.717 \text{ dB}$
Radiated Emissions	$\pm 5.877 \text{ dB}$
Temperature	$\pm 0.860 \text{ }^{\circ}\text{C}$
Radio Frequency	$\pm 2.832 \times 10^{-8}$
AC Power Line Conducted Emissions	$\pm 2.85 \text{ dB}$

9 CONCLUSION

In the opinion of TÜV SÜD America Inc. the MDE-V7 manufactured by Redpoint Positioning Corporation meets the requirements of FCC 15.517 for all channels and RSS-220, Issue 1 for channel 5 only.

END REPORT