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

Test Lab:		Applicant:	
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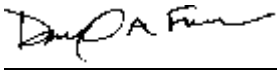
FCC ID/ IC	O6QPS60XW2 3892A-PS60XW2	**Test Report Date**	June 16, 2016
Platform	N/A	**RTL Work Order #**	2016058
Model	VEGAPULS 64	**RTL Quote #**	QRTL15-212A
FCC Classification	LPR – Level Probing Radar		
FCC Rule Part(s)/ Guidance	Part 15.256: Level Probing Radar FCC 14-2: ET Docket No. 10-23: Amendment 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 Meas 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)		
Industry Canada	RSS-211 Issue 1 Level Probing Radar Equipment RSS-Gen Issue 4 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**
76.0 – 80.0	0.072	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, Industry Canada RSS-211, RSS-Gen, and ANSI C63.10.

Signature:  Date: June 16, 2016

Typed/Printed Name: Desmond A. Fraser Position: President

These test(s) are accredited under Rhein Tech Laboratories, Inc. ISO/IEC 17025 accreditation issued by the ANSI-ASQ National Accreditation Board. Refer to certificate and scope of accreditation AT-1445.

Table of Contents

Table of Figures

Table of Plots

Table of Tables

Table of Appendixes

Table of Photographs

1 General Information

1.1 Scope

This measurement report is prepared on behalf of VEGA Grieshaber KG in accordance with the applicable Federal Communications Commission and Industry Canada rules and regulations.

The Equipment Under Test (EUT) was the Model VEGAPULS 64 Level Probing Radar, FCC ID: O6QPS60XW2, IC: 3892A-PS60XW2, tested with one antenna. The EUT is available with the PS64HW electronics unit.

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.

1.3 Modifications

None.

2 Tested System Details

The test sample was received on December 28, 2015. 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)

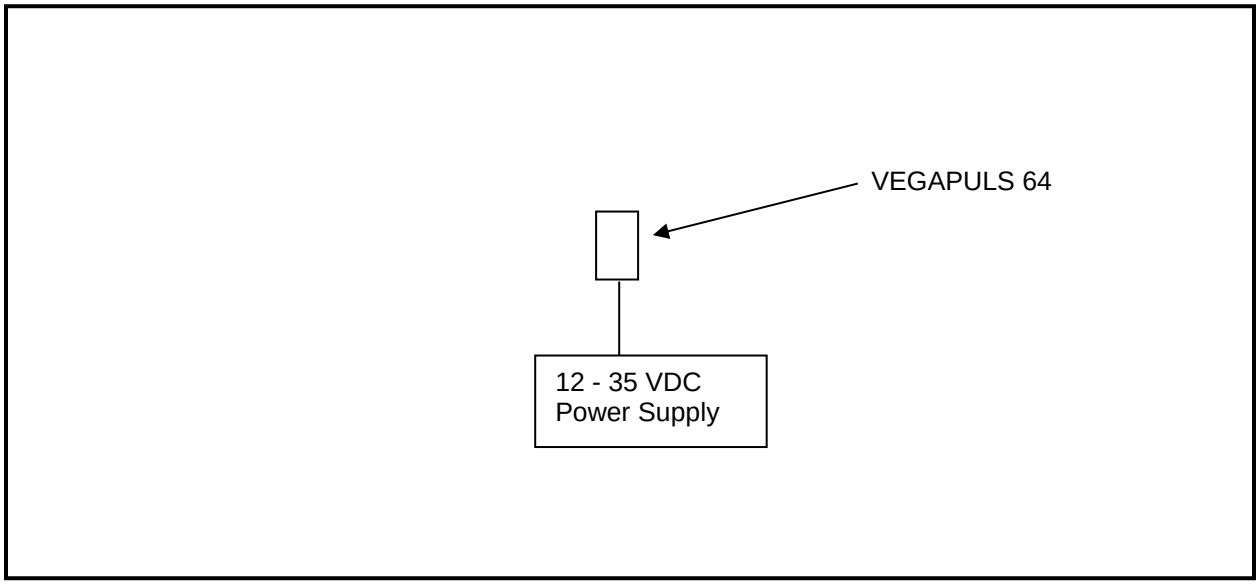
Part	Manufacturer	Model	Serial Number	FCC ID	Cable Type	RTL Bar Code
1-1/2" (36mm) Encapsulated Metal Horn Antenna (24.3 dBi)	VEGA Grieshaber KG	N/A	N/A	N/A	N/A	21967
VEGAPULS 64	VEGA Grieshaber KG	PS64 AXTTCAHXAMAXX	N/A	O6QPS60XW2	N/A	21970
Electronics	VEGA Grieshaber KG	PS64HW	N/A	N/A	N/A	21973

Table 2-2: Support Equipment

Part	Manufacturer	Model	Serial Number	FCC ID	Cable Type	RTL Bar Code
AC Adapter	Cincon Electronics	TR45A12 11A02	45120-0016390	N/A	1m unshielded	15932

Photograph 1: EUT Configuration

Figure 2-1: Configuration of Tested System



2.1 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), RSS-Gen 6.6; RSS-211 5.1; ETSI EN 302 729 8.1

3.1 Modulated Bandwidth Test Procedure - FCC §15.256(f), RSS-Gen 6.6

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 the actual image and a ghost image. The analyzer "Signal ID" and "Auto ID" were used to aid in discerning between the ghost images displayed by the mixer, the left and right markers can be calculated from twice the intermediate frequency of 404.4 MHz (808.8 MHz) from the ghost edge images to the actual bandwidth edges (distance between ghost images). The display markers could not be set to -10 dB from the peak since the spectral lines were completely vertical resulting in a noise floor placement. Max hold was used until the spectrum was adequately filled to portray the bandwidth and a plot was taken.

3.2 Limits

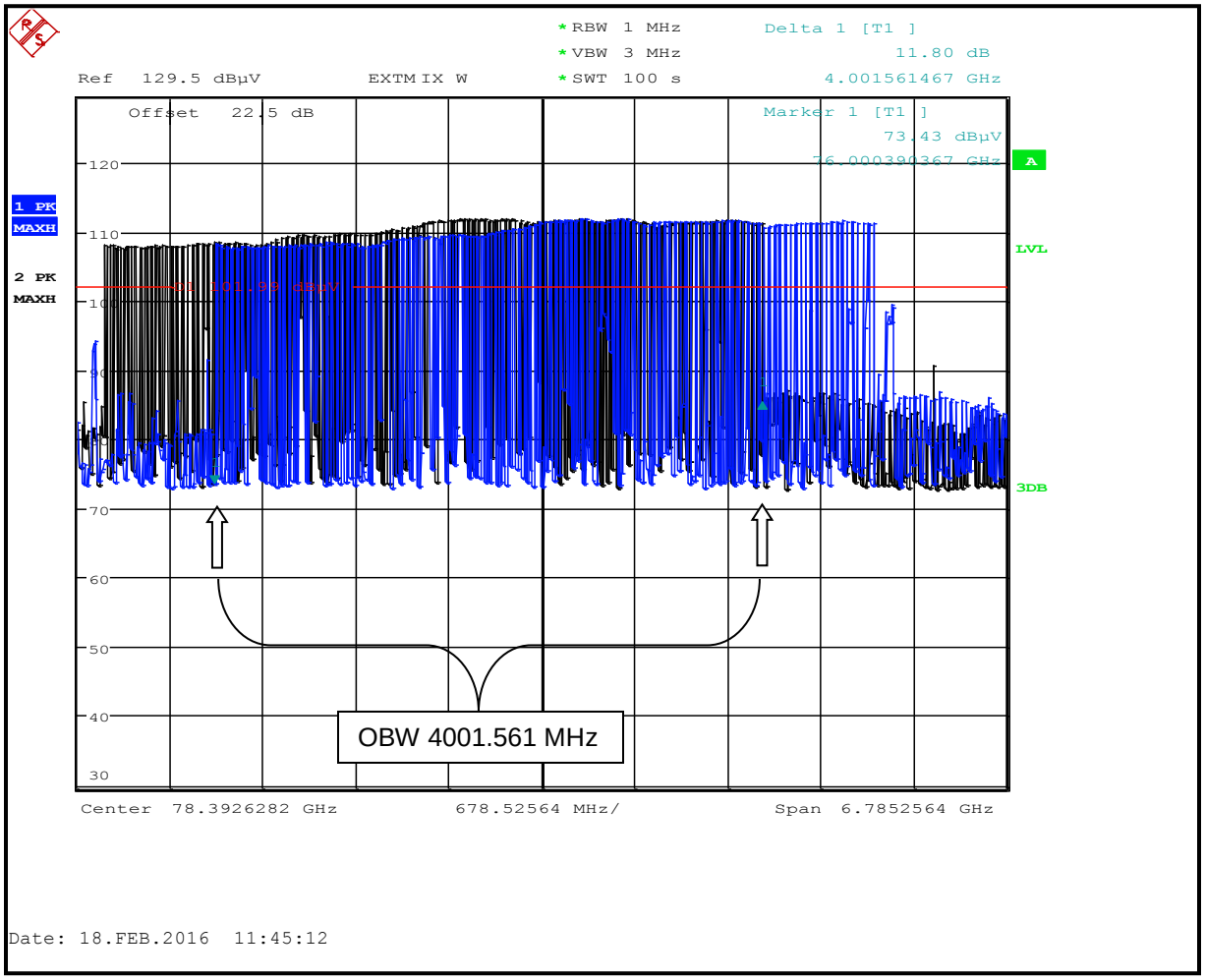
(f) The fundamental bandwidth of an LPR emission is defined as the width of the signal between two points, one below and one above the center frequency, outside of which all emissions are attenuated by at least 10 dB relative to the maximum transmitter output power when measured in an equivalent resolution 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)
Electronics PS64HW	4030	50	-3980

Plot 3-1: 10 dB Modulated Bandwidth



Marker 1: 76000.390 MHz; Marker Delta 1: 80001.951 MHz; OBW = 4001.561 MHz

Table 3-2: Modulated Bandwidth Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901581	Rohde & Schwarz	FSU	Spectrum Analyzer	1166.1660.50	11/13/16

Test Personnel:

Dan Baltzell		February 18, 2016
Test Engineer	Signature	Date of Test

4 Radiated Emissions – ANSI C63.10 6.3, FCC §15.256(g); 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 realizable antenna coupling. The EUT was also checked in all three orthogonal planes. Measurement was based on an average detector for -3 dBm/1 MHz power density limit and peak detector for 34 dBm/50 MHz limit. Limits are -3 dBm/MHz and 34 dBm/50 MHz bandwidth (20 MHz was used). Since these limits are power density, no pulse desensitization correction factor is required. Both were also measured finding the maximum amplitude at 1 meter and switching from 1 MHz to 20 MHz resolution bandwidths. One meter measuring distance was used since the antenna gain calibration was accomplished at one meter, a correction was used in the correction to dBm as 20 Log (1) = 0 dB.

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 6 b:

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)

All power averaging (RMS) emission levels are to be measured utilizing a 1 MHz resolution bandwidth with a one millisecond dwell time over each 1 MHz segment. The frequency span of the analyzer should equal the number of sampling bins times 1 MHz; the sweep rate of the analyzer should equal the number of sampling bins times one millisecond. The video bandwidth of the measurement instrument shall not be less than the resolution bandwidth and trace averaging shall not be employed. The RMS average emission measurement is to be repeated over multiple sweeps with the analyzer set for maximum hold until the amplitude stabilizes. The peak emission measurement is to be repeated over multiple sweeps with the analyzer set for maximum hold until the amplitude stabilizes.

NOTE: The number of sampling BINS used is 6001 corresponding to a span of 6 GHz, and there are two pulses/second from the DUT; therefore, two pulses will occur per MHz in each second for proper RMS averaging. If one millisecond dwell/MHz is used it will cause artificially high RMS averaging levels per FCC TR 14-1007.

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

Frequency (GHz)	Peak EIRP Measured (dBuV)	Antenna Correction Factor (dB/m)	Corrected Peak Measurement (dBuV/m)	Converted to dBm	Average Limit (dBm)	Margin (dB)
78.5	78.7	44.6	122.4	-20.8	-3.0	-23.8

Td=Ts/Df Ts=signal sweep = 0.5 s Df = frequency sweep = 4001.561 MHz Td=1.25E-4

Avg Factor=Td/cycle time Cycle time= 0.01054 s Avg Factor= 0.012

Avg Factor x Peak = $0.012 \times 10^{(122.4 \text{ dBuV/m}/20)} = 15819$ uV 20Log(15819)=84 dBuV/m

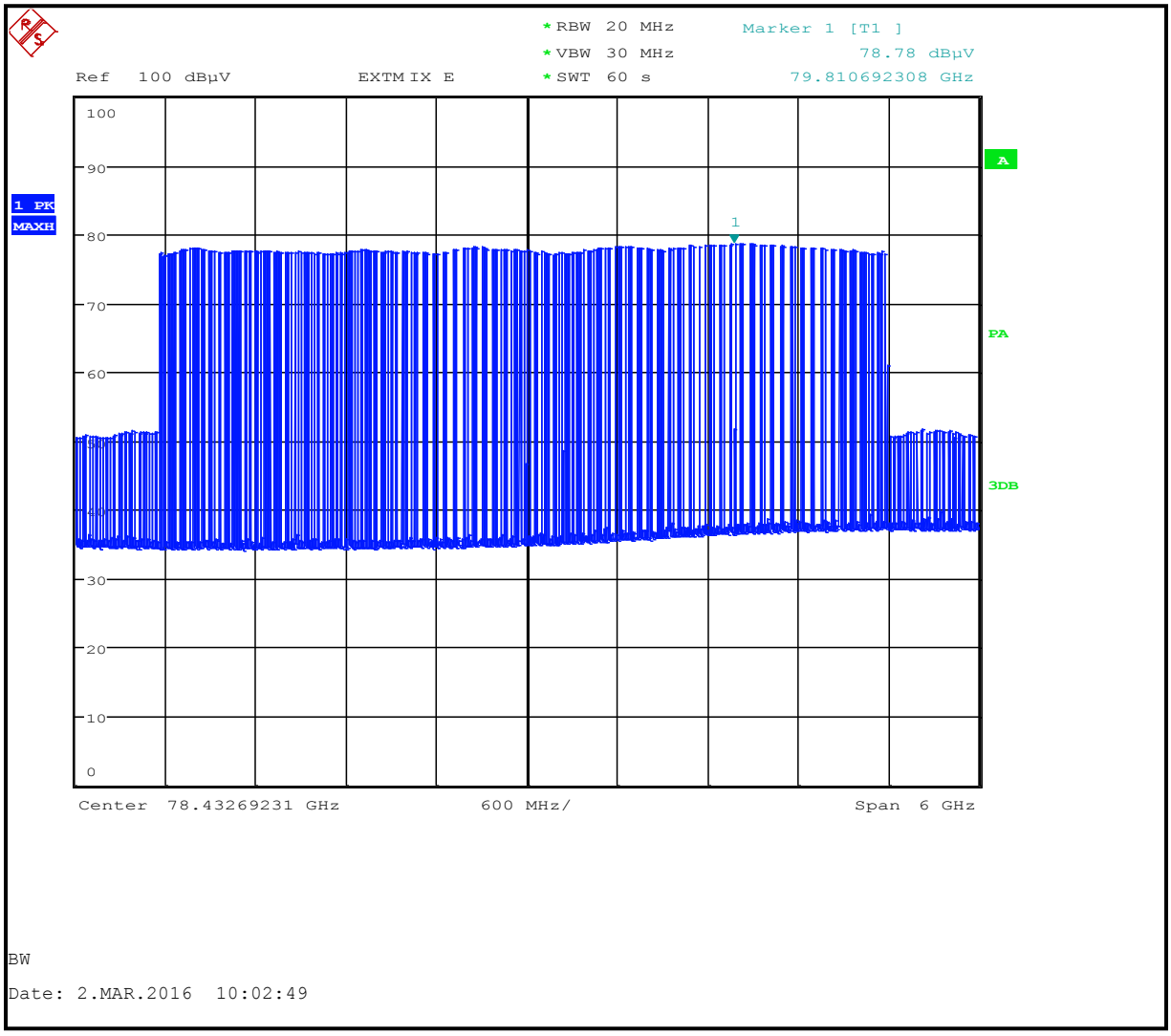
84 dBuV/m-104.8 = -20.8 dBm

Table 4-2: Radiated Fundamental Emissions (EIRP in 50 MHz, Peak Detector)

Frequency (GHz)	Peak EIRP Measured (dBuV)	Antenna Correction Factor (dB/m)	Corrected Peak Measurement (dBuV/m)	Converted to dBm	Peak Limit (dBm)	Margin (dB)
79.3	78.8	44.6	123.4	18.6	34.0	-15.4

Note: Per FCC 15.256(g)(2)(ii): The Rhode & Schwarz FSU 50 spectrum analyzer used a maximum video bandwidth resolution of 20 MHz, which is less than the required 50 MHz RBW; however, no bandwidth correction factor should be used for peak measurements, when the resolution is above 1 MHz, since the amplitude is a carrier wave and no amplitude change occurs after the resolution bandwidth is higher than 1 MHz. Reference Plots 4-1 and 4-2, which are 78.8 and 78.7 dBuV respectively, for 20 MHz resolution bandwidth and 1 MHz resolution bandwidth, which theoretically should be 20Log(20/1) or 26 dB difference, and is shown to be similar in amplitude.

Plot 4-1: Radiated Fundamental (EIRP in 20 MHz, Peak Detector)



Plot 4-2: Peak Radiated Fundamental (EIRP in 1 MHz, Peak Detector)

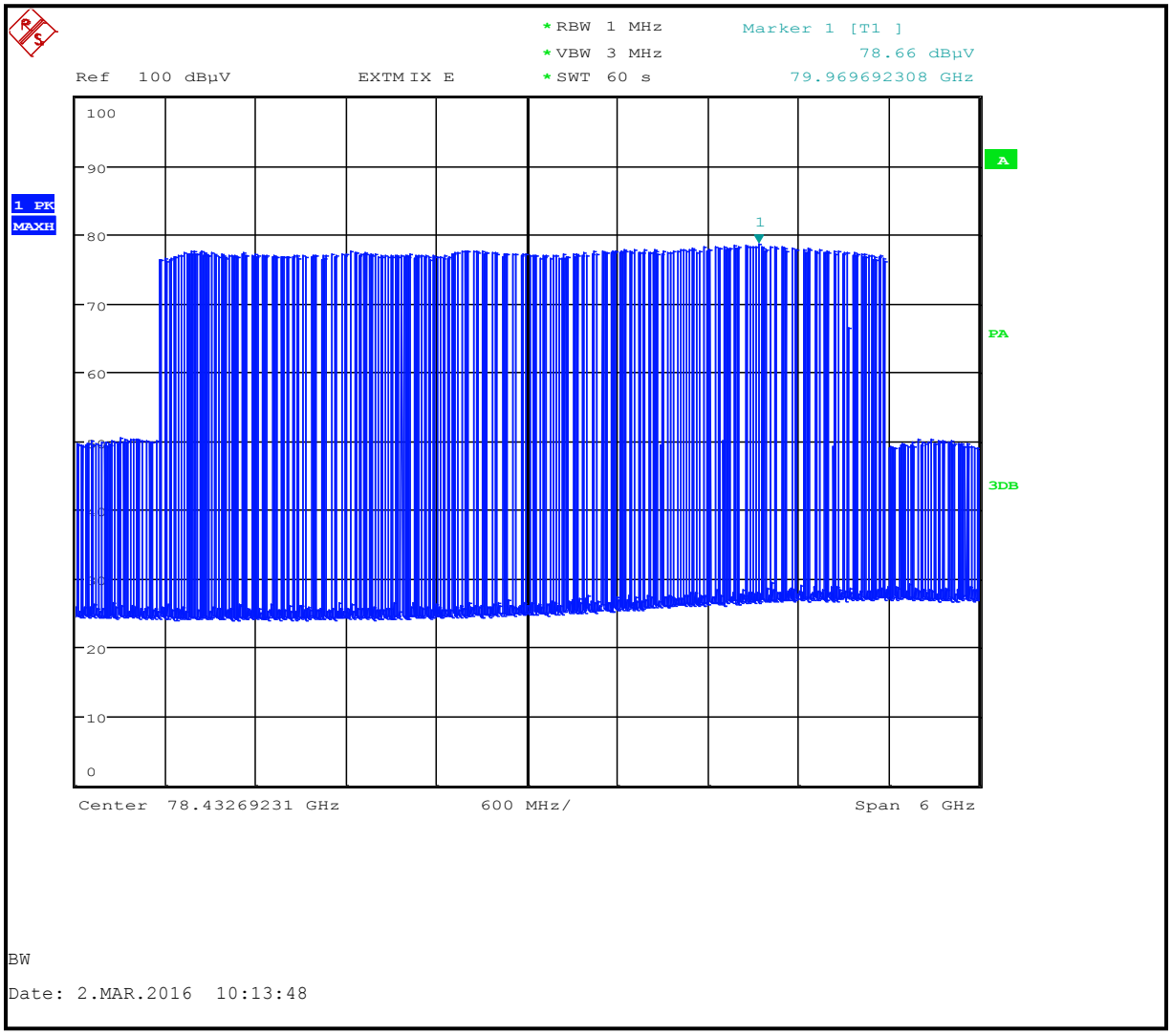


Table 4-3: Radiated Fundamental Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901581	Rohde & Schwarz	FSU	Spectrum Analyzer	1166.1660.50	11/13/16
901640	Rohde & Schwarz	FS-Z110	Mixer (75 – 110 GHz)	100010	4/2/17
900711	ATM	10-443-6R	Horn Antenna (75 - 110 GHz)	8051905-1	12/5/16

Test Personnel:

Dan Baltzell		March 2, 2016
Test Engineer	Signature	Date of Test

4.3 Radiated Emissions – ANSI C63.10 6.3, FCC §15.256(h), (k), RSS-Gen 6.13; RSS-211 5.1(d); ETSI EN 302 729 8.4

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

Noise floor and spurious emission data was taken and corrected to three meters. 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.

4.5 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 m to 140 GHz, and with the measuring antenna abutted to the transmit antenna, showing no indication or detectable frequencies above 140 GHz to determine if there were any valid measurements, this reduces signal to noise ratio as a distance of 1 mm corrected to 3 m is 20 log (0.001/3) = -69.5 dB. The emissions from the EUT were investigated at 1 m and 3 m to ensure no indication of detectable emissions. 1 cm distance was used to insure a worst case scenario and is equivalent to -49.5 dB.

Plot 4-3: Radiated Spurious Emissions (Second Harmonic) (140 GHz - 200 GHz)

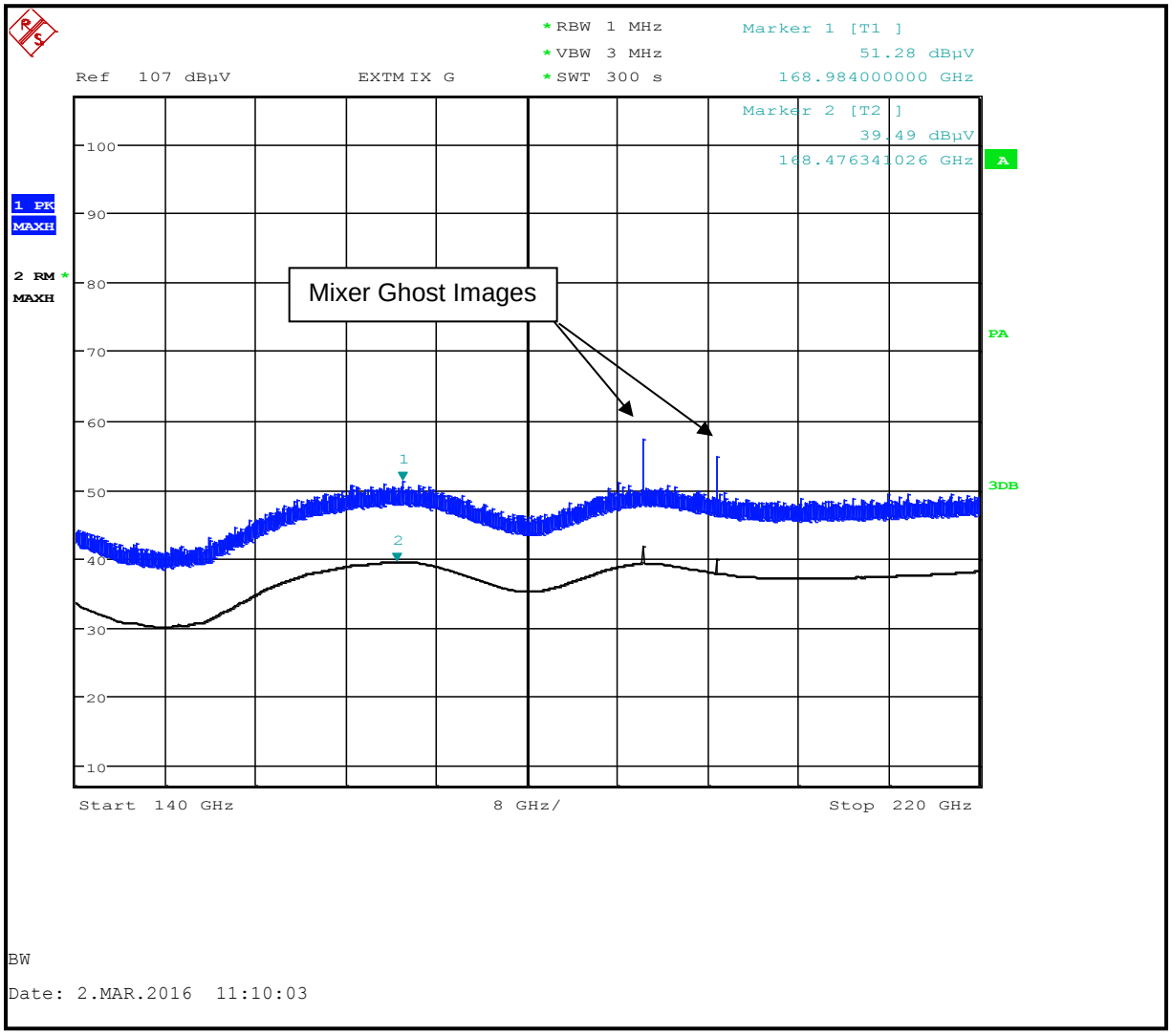


Table 4-4: Radiated Peak Noise Floor Calculation (140 GHz - 200 GHz)

Frequency (GHz)	Peak EIRP Measured (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from .01m to 3m (dB)	Corrected Measurement (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)
168.984	51.3	51.5	-49.5	53.3	74.0	-20.7

Table 4-5: Radiated Average Noise Floor Calculation (140 GHz - 200 GHz)

Frequency (GHz)	Average EIRP Measured (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from .01m to 3m (dB)	Corrected Measurement (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)
168.476	39.5	51.5	-49.5	41.5	54.0	-12.5

Plot 4-4: Radiated Spurious Emissions (90 GHz – 140 GHz)

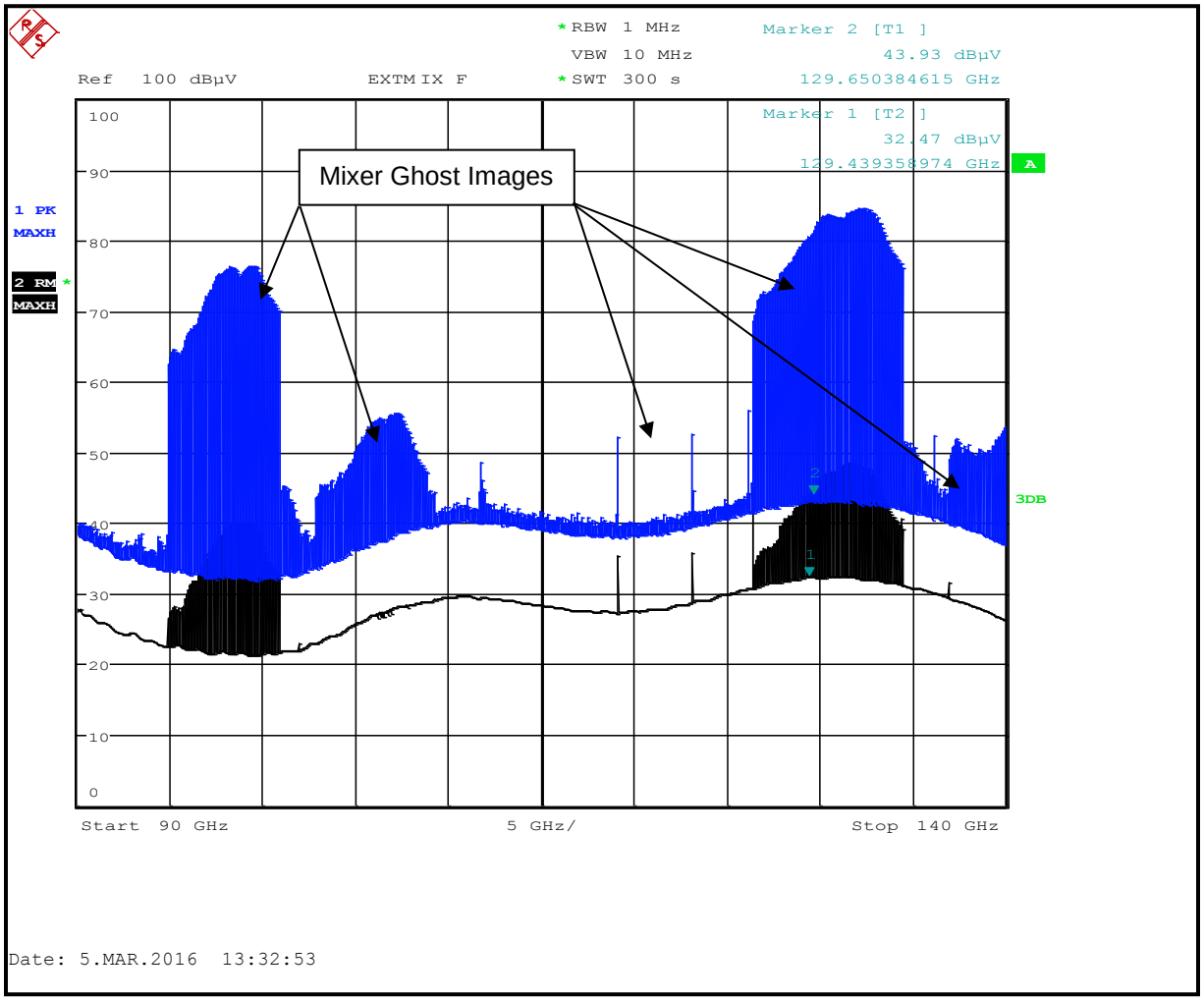


Table 4-6: Radiated Peak Noise Floor Calculation (90 GHz – 140 GHz)

Frequency (GHz)	Peak EIRP Measured (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 0.01m to 3m dB)	Corrected Measurement (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)
129.65	43.9	48.3	-49.5	42.7	74.0	-31.3

Table 4-7: Radiated Average Noise Floor Emission Calculation (90 GHz – 140 GHz)

Frequency (GHz)	Average EIRP Measured (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 0.01m to 3m (dB)	Corrected Measurement (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)
129.439	32.5	48.3	-49.5	31.3	54.0	-22.7

Plot 4-5: Radiated Spurious Emissions (60 GHz - 90 GHz)

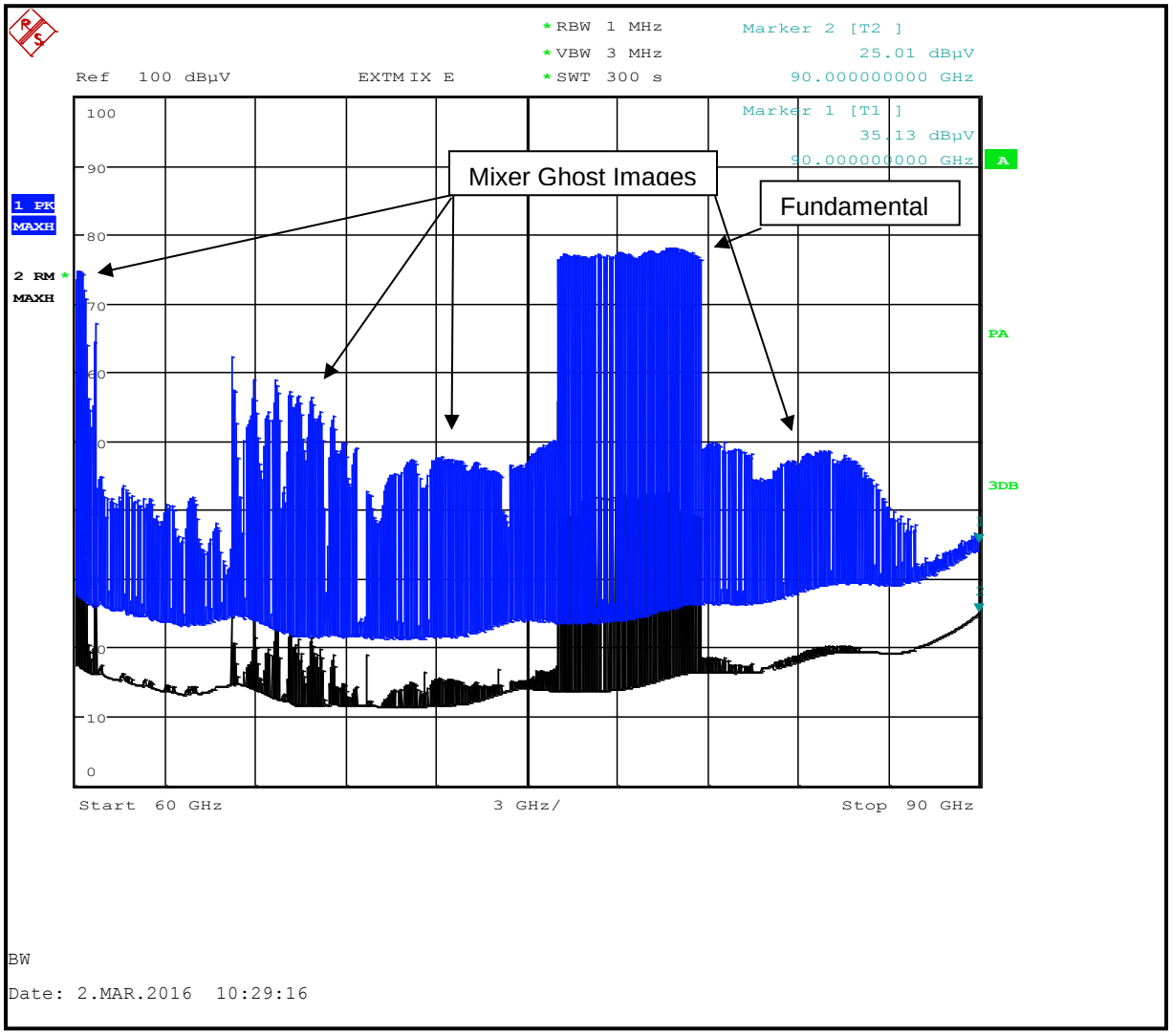


Table 4-8: Radiated Peak Emission Calculation (60 GHz - 90 GHz)

Frequency (GHz)	Peak EIRP Measured (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 0.01m to 3m (dB)	Corrected Measurement (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)
90.0	35.1	46.4	-49.5	32.0	74.0	-42.0

Table 4-9: Radiated Average Emission Calculation (60 GHz - 90 GHz)

Frequency (GHz)	Average EIRP Measured (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 0.01m to 3m (dB)	Corrected Measurement (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)
90.0	25.0	46.4	-49.5	21.9	54.0	-32.1

Plot 4-6: Radiated Spurious Emissions (50 GHz – 60 GHz)

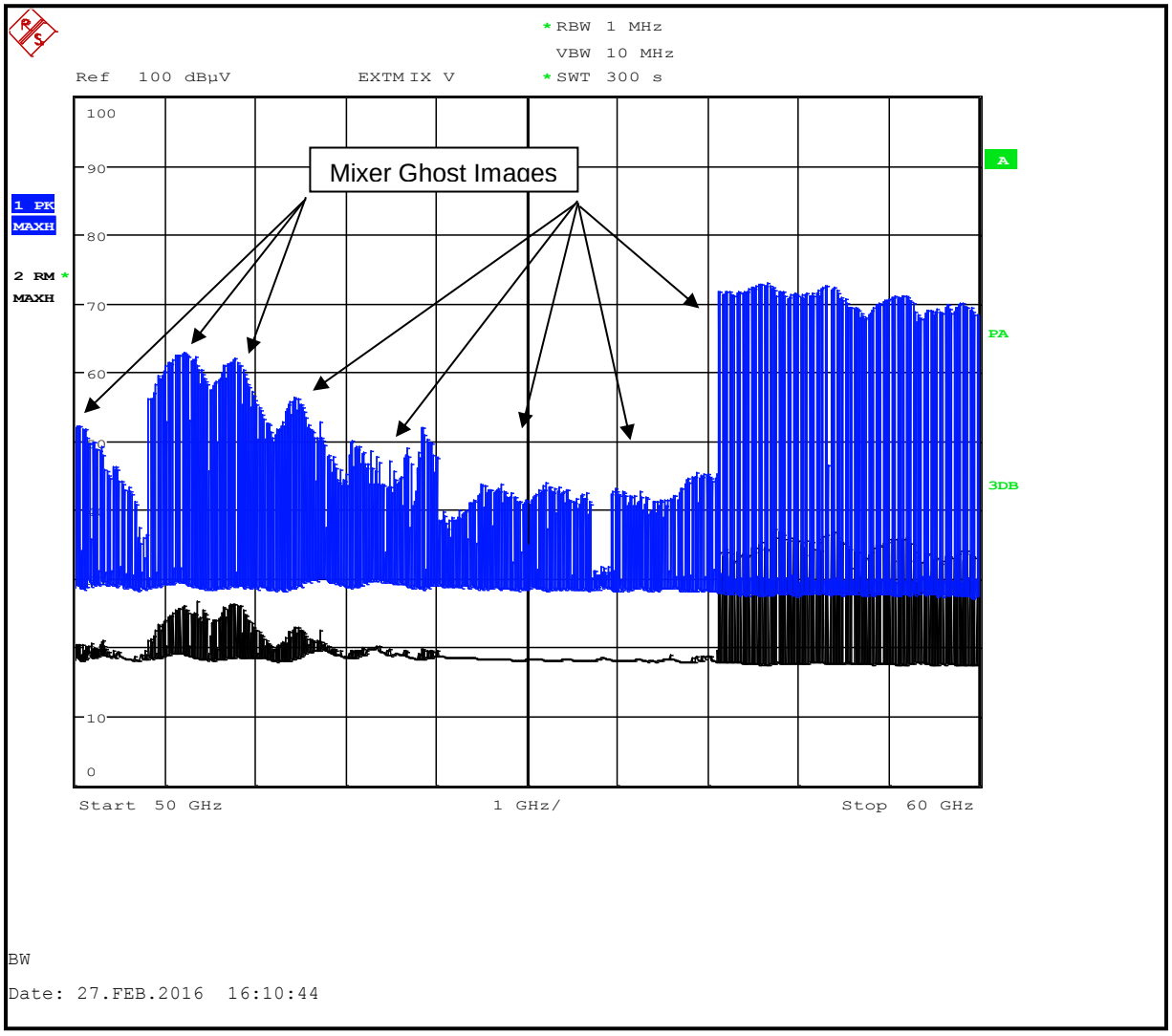


Table 4-10: Radiated Peak Noise Floor Calculation (50 GHz – 60 GHz)

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)
52.692	29.8	42.0	-9.5	62.3	74.0	-11.7

Table 4-11: Radiated Average Noise Emission (50 GHz – 60 GHz)

Frequency (GHz)	Average EIRP Measured (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 1m to 3m (dB)	Corrected Measurement (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)
52.692	18.1	42.0	-9.5	50.6	54.0	-3.4

Plot 4-7: Radiated Spurious Emissions (40 GHz – 50 GHz)

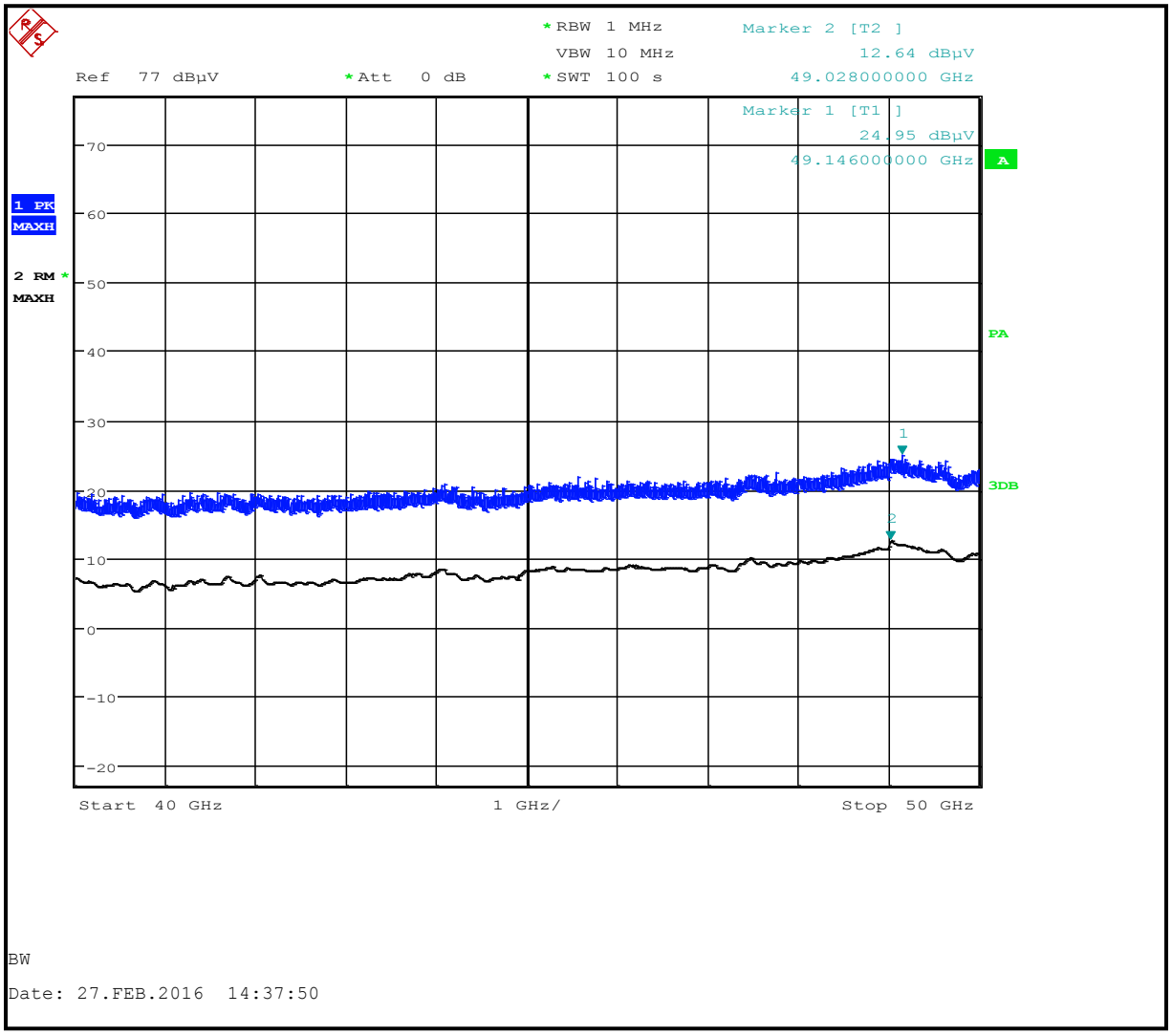


Table 4-12: Radiated Peak Noise Floor Calculation (40 GHz – 50 GHz)

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)
49.146	25.0	40.0	-9.5	55.5	74.0	-18.5

Table 4-13: Radiated Average Noise Floor Calculation (40 GHz – 50 GHz)

Frequency (GHz)	Average EIRP Measured (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 1m to 3m (dB)	Corrected Measurement (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)
49.028	12.6	40.0	-9.5	43.1	54.0	-10.9

Plot 4-8: Radiated Spurious Emissions (26.5 GHz – 40 GHz)

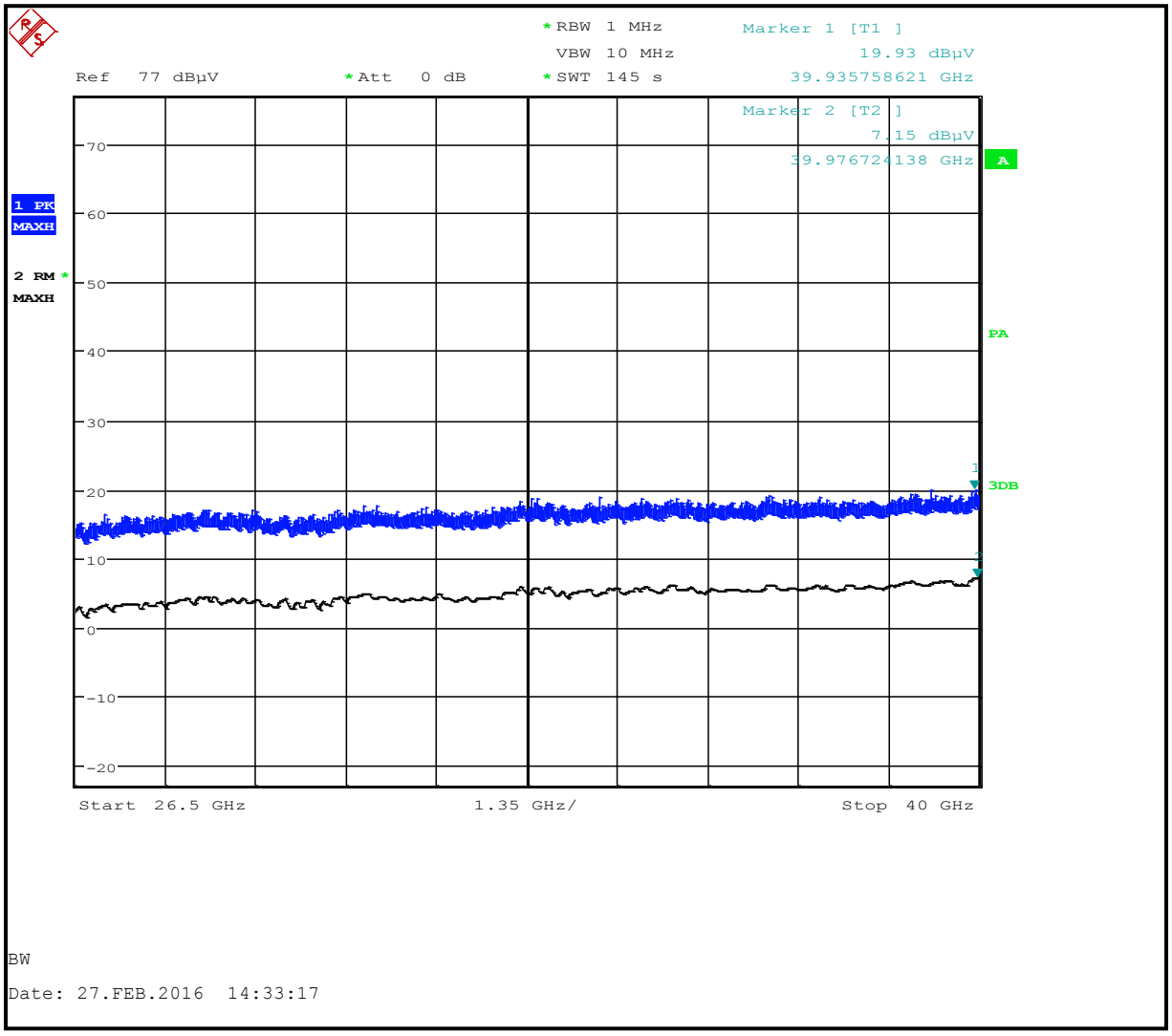


Table 4-14: Radiated Peak Noise Floor Calculation (26.5 GHz – 40 GHz)

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)
39.936	19.9	45.8	-9.5	56.2	74.0	-17.8

Table 4-15: Radiated Average Noise Floor Calculation (26.5 GHz – 40 GHz)

Frequency (GHz)	Average EIRP Measured (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 1m to 3m (dB)	Corrected Measurement (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)
39.977	7.2	45.8	-9.5	43.5	54	-10.5

Plot 4-9: Radiated Spurious Emissions (18 GHz – 26.5 GHz)

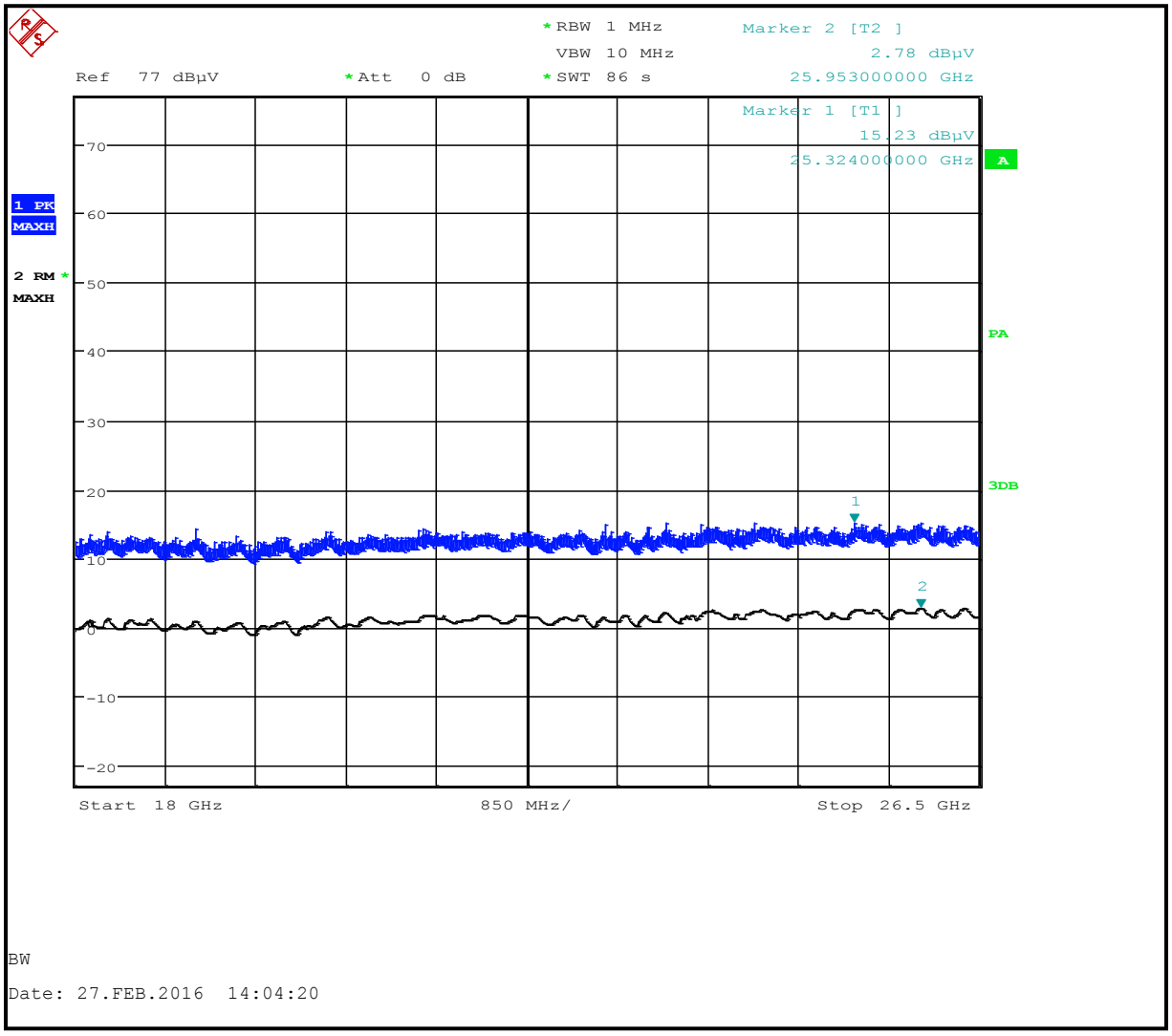


Table 4-16: Radiated Peak Noise Floor Calculation (18 GHz – 26.5 GHz)

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)
25.324	15.2	40.6	-9.5	46.3	74.0	-27.7

Table 4-17: Radiated Average Noise Floor Calculation (18 GHz – 26.5 GHz)

Frequency (GHz)	Average EIRP Measured (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 1m to 3m (dB)	Corrected Measurement (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)
25.953	2.8	40.6	-9.5	33.9	54	-20.1

Plot 4-10: Radiated Spurious Emissions (12.4 GHz – 18 GHz)

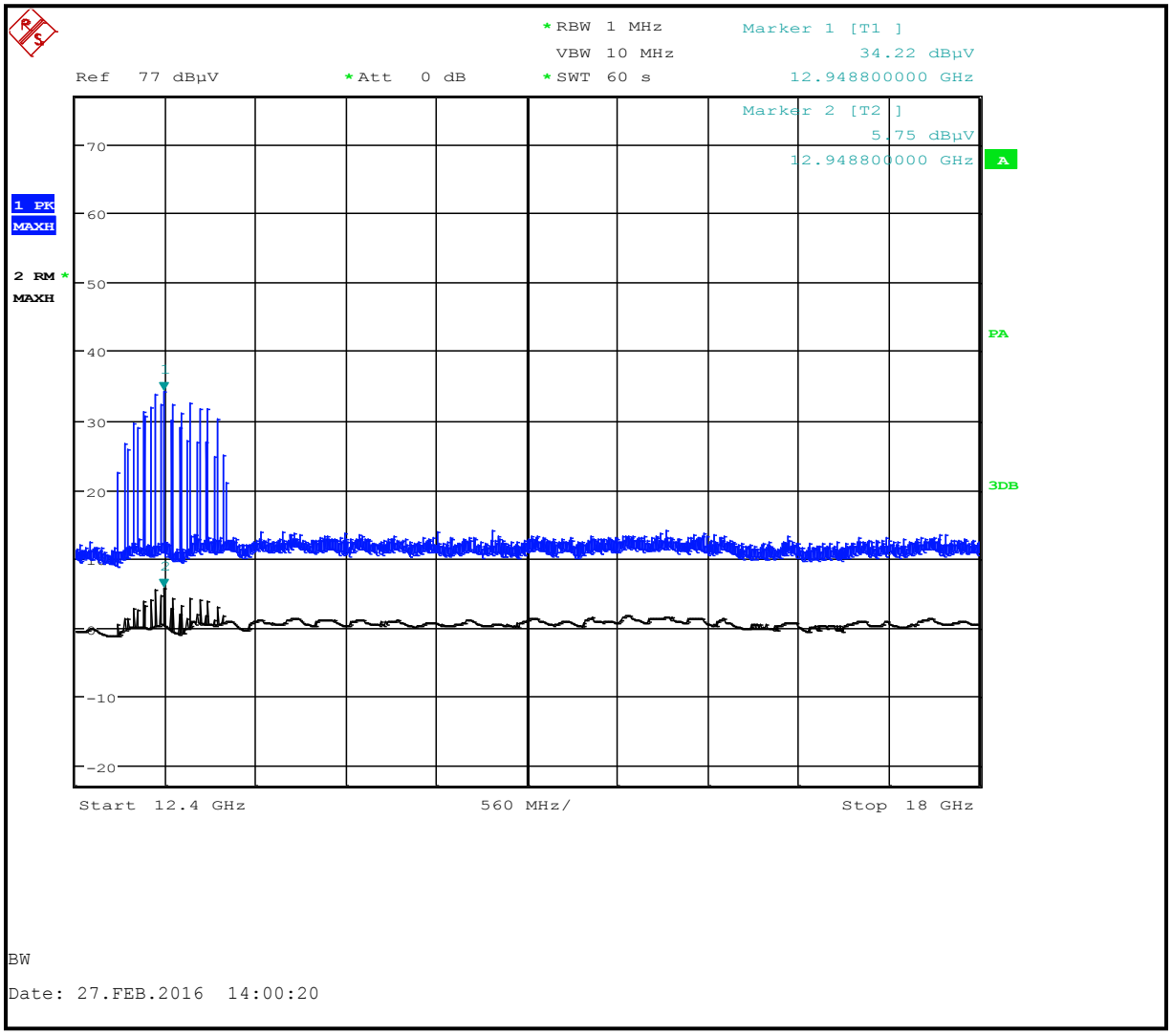


Table 4-18: Radiated Peak Calculation (12.4 GHz – 18 GHz)

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)
12.949	34.2	37.2	-9.5	61.9	74.0	-12.1

Table 4-19: Radiated Average Calculation (12.4 GHz – 18 GHz)

Frequency (GHz)	Average EIRP Measured (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 1m to 3m (dB)	Corrected Measurement (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)
12.949	5.8	37.2	-9.5	33.5	54	-20.5

Plot 4-11: Radiated Spurious Emissions (8.2 GHz – 12.4 GHz)

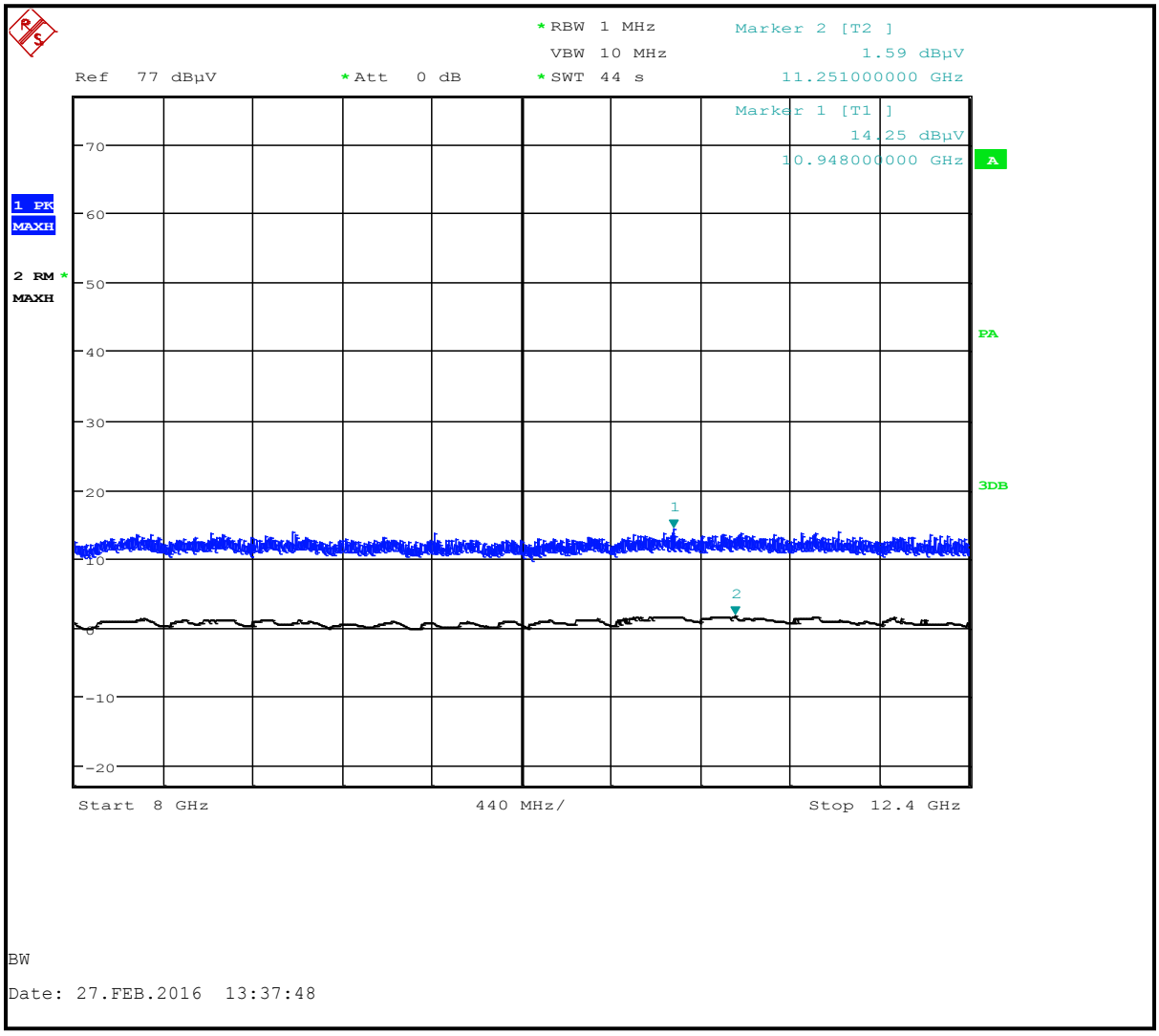


Table 4-20: Radiated Peak Noise Floor Calculation (8.2 GHz – 12.4 GHz)

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)
10.948	14.3	33.7	-9.5	38.5	74	-35.5

Table 4-21: Radiated Average Noise Floor Calculation (8.2 GHz – 12.4 GHz)

Frequency (GHz)	Average EIRP Measured (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 1m to 3m (dB)	Corrected Measurement (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)
11.251	1.6	33.7	-9.5	25.8	54	-28.2

Plot 4-12: Radiated Spurious Emissions (4 GHz – 8.2 GHz)

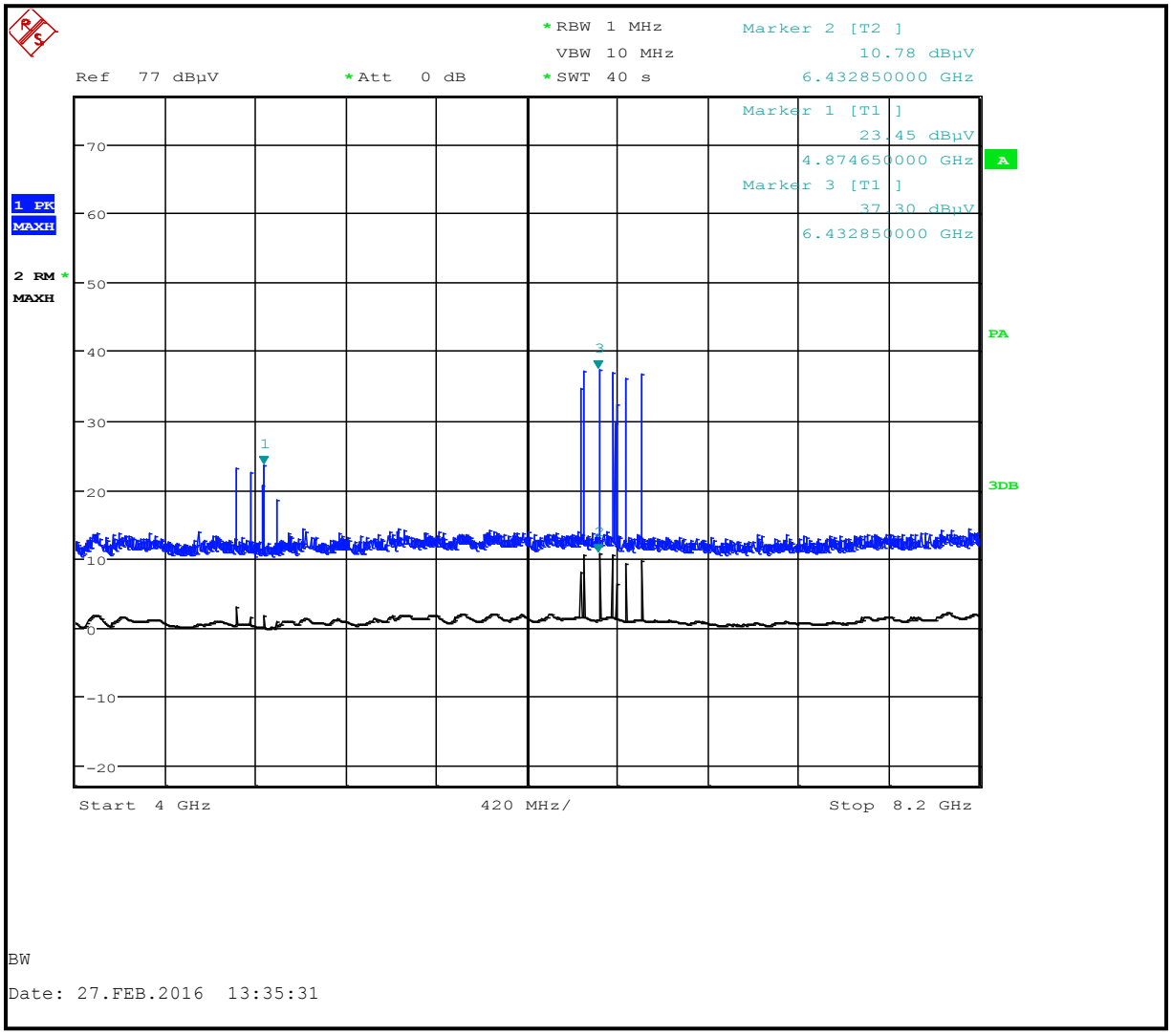


Table 4-22: Radiated Peak Emission Calculation (4 GHz – 8.2 GHz)

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)
4.875	23.5	26.0	-9.5	40.0	74.0	-34.0
6.43	37.3	28.4	-9.5	56.2	74.0	-17.8

Table 4-23: Radiated Average Emission Calculation (4 GHz – 8.2 GHz)

Frequency (GHz)	Average EIRP Measured (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 1m to 3m (dB)	Corrected Measurement (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)
6.433	10.8	28.4	-9.5	29.7	54.0	-24.3

Plot 4-13: Radiated Spurious Emissions (2 GHz – 4 GHz)

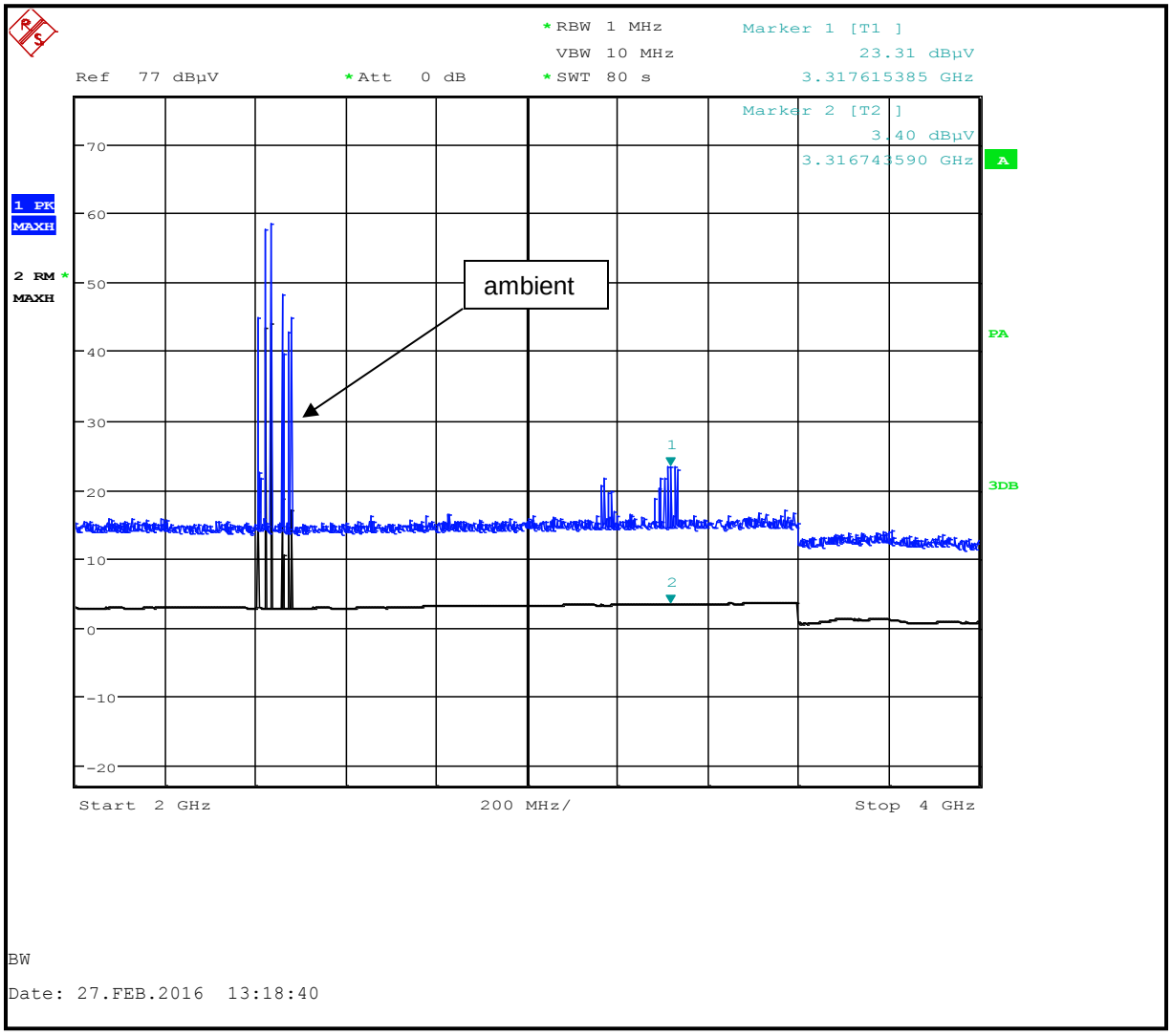


Table 4-24: Radiated Peak Emission Calculation (2 GHz – 4 GHz)

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)
3.317	23.3	22.7	-9.5	36.4	74.0	-37.6

Table 4-25: Radiated Average Emission Calculation (2 GHz – 4 GHz)

Frequency (GHz)	Average EIRP Measured (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from 1m to 3m (dB)	Corrected Measurement (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)
3.317	3.4	22.7	-9.5	16.5	54.0	-37.5

4.6 Radiated Emissions Unintentional/Digital Test Data

Table 4-26: Radiated Emissions Test Data below 2 GHz

Temperature: 60.6°F Humidity: 35%										
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**
126.266	Qp	H	0	1.0	39.1	-20.1	19.0	43.5	-24.5	Pass
132.235	Qp	V	0	1.0	37.4	-20.4	17.0	43.5	-26.5	Pass
133.008	Qp	V	90	1.0	37.8	-20.4	17.4	43.5	-26.1	Pass
136.348	Qp	V	90	1.0	38.5	-20.5	18.0	43.5	-25.5	Pass
324.935	Qp	H	90	1.0	35.4	-16.6	18.8	46.0	-27.2	Pass
344.898	Qp	H	90	1.0	38.1	-15.8	22.3	46.0	-23.7	Pass
405.049	Qp	V	0	1.0	36.1	-13.8	22.3	46.0	-23.7	Pass
415.034	Qp	V	0	1.0	39.3	-13.5	25.8	46.0	-20.2	Pass
440.000	Qp	H	100	1.0	36.8	-12.8	24.0	46.0	-22.0	Pass
445.074	Qp	V	0	1.0	45.0	-12.8	32.2	46.0	-13.8	Pass
455.030	Qp	H	0	1.0	34.3	-12.6	21.7	46.0	-24.3	Pass
474.979	Qp	H	0	1.0	35.1	-12.0	23.1	46.0	-22.9	Pass
485.071	Qp	H	0	1.0	34.5	-11.9	22.6	46.0	-23.4	Pass
1590.375	Av	V	0	1.0	35.5	3.0	38.5	54.0	-15.5	Pass

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 4-27: Radiated Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901592	Insulated Wire Inc.	KPS-1503-3600-KPR	SMK RF Cables 20'	NA	9/3/16
900717	Hewlett Packard	11970U	Harmonic Mixer (40 – 60 GHz)	2332A01110	4/20/16
901639	Wiltron	35WR19F	Waveguide (40 – 50 GHz)	N/A	6/18/16
901640	Rohde & Schwarz	FS-Z110	Mixer (75 – 110 GHz)	100010	4/02/17
901581	Rohde & Schwarz	FSU	Spectrum Analyzer	1166.1660.50	11/13/16
901586	Rohde & Schwarz	FS-Z75	Harmonic Mixer (50 – 75 GHz)	100098	1/23/17
901256	ATM	19-443-6R	Horn Antenna WR-19 (40 - 60 GHz)	8041704-01	4/4/17
901303	EMCO	3160-10	Horn Antenna WR-28 (26.5 - 40.0 GHz)	960452-007	6/19/16
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	12/5/16
900712	ATM	15-443-6R	Horn Antenna (50 - 75 GHz)	8051805-1	3/16/16
900724	Antenna Research Associates, Inc.	LPB-2520	BiLog Antenna (25 - 2000 MHz)	1037	4/19/16
900772	EMCO	3161-02	Horn Antenna (2 - 4 GHz)	9804-1044	4/20/16
900321	EMCO	3161-03	Horn Antenna (4.0 - 8.2 GHz)	9508-1020	4/20/16
901587	Radiometer Physics Gmbh	SAM-220	140 - 220 GHz Mixer	20005	2/13/17
900713	ATM	05-443-6R	Horn Antenna (140 – 220)	S0685	5/20/16
900323	EMCO	3160-07	Horn Antenna (8.2 - 12.4 GHz)	9605-1054	4/20/16
900356	EMCO	3160-08	Horn Antenna (12.4 - 18 GHz)	9607-1044	4/20/16
901218	EMCO	3160-09	Horn Antenna (18 - 26.5 GHz)	960281-003	4/19/16

Test Personnel:

Daniel W. Baltzell		February 27-March 5, 2016
Test Engineer	Signature	Dates of Test

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

5.1 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.

5.2 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.

5.3 Temperature-Voltage Frequency Stability Test Data

Table 5-1: Temperature Frequency Stability

Temp. (°C)	Lower Edge of Measured Frequency (GHz)	Upper Edge of Measured Frequency (GHz)	Margin (GHz)
-30	75.995908397	80.812893974	+0.99591/-4.18711
-20	75.996351731	80.812974808	+0.99635/-4.18703
-10	75.996542564	80.812922308	+0.99654/-4.18708
0	75.996490064	80.812963974	+0.99649/-4.18704
10	75.996310897	80.812882308	+0.99631/-4.18712
20	75.996517564	80.812901474	+0.99652/-4.18710
30	75.996703397	80.812228141	+0.99670/-4.18777
40	75.996633397	80.812153141	+0.99663/-4.18785
50	75.996580897	80.812068974	+0.99658/-4.18793
55	75.996695897	80.811968974	+0.99670/-4.18803

Table 5-2: Voltage Frequency Stability

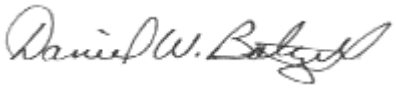
Limit (GHz)	(GHz)	+/-15% VDC						
		12 (Min.)	13.8 (Min. + 15%	19.975 (-15%)	23.5 (Mid.)	27.025 (+ 15%)	29.75 (Max. -15%	35 (Max.)
75	Lower Edge	75.996326	75.996547	75.996560	75.996551	75.996590	75.996670	75.996618
85	Upper Edge	80.812898	80.812857	80.812891	80.812906	80.812843	80.812955	80.813001

Results: The EUT is within band and compliant.

Table 5-3: 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	3/28/16
901581	Rohde & Schwarz	FSU	Spectrum Analyzer	1166.1660.50	11/13/16
901350	Meterman	33XR	Multimeter	040402802	4/14/17

Test Personnel:



Daniel Baltzell		February 28, 2016
Test Engineer	Signature	Date of Test

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

6.1 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.

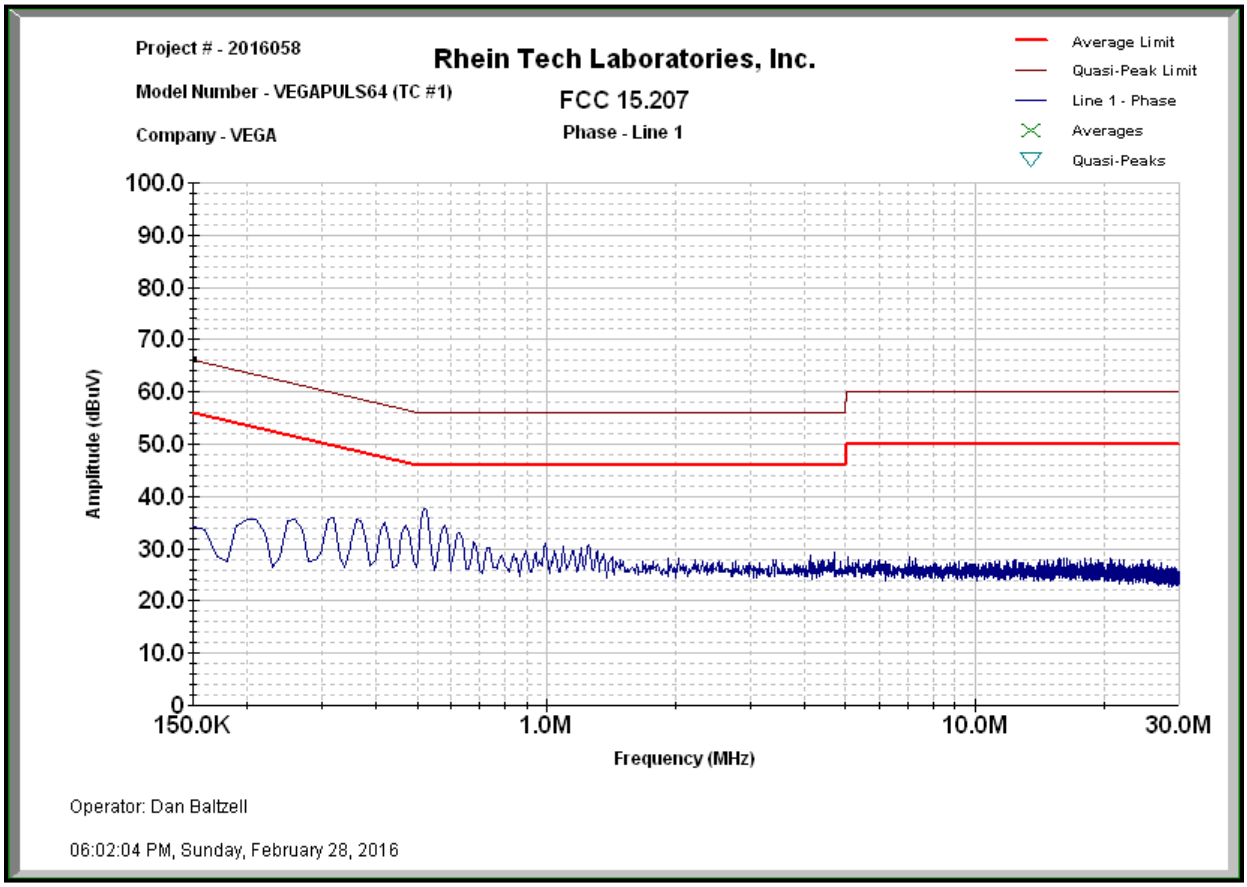
The spectrum analyzer was connected to the AC line through an isolation transformer. The 50-ohm output of the EUT LISN was connected to the spectrum analyzer input through a Solar 100 kHz high-pass filter. The filter is used to prevent overload of the spectrum analyzer from noise below 100 kHz. Conducted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

6.2 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.

6.3 Conducted Line Emissions Test Data

Plot 6-1: Conducted Emissions Transmit - Phase



Plot 6-2: Conducted Emissions Transmit – Neutral

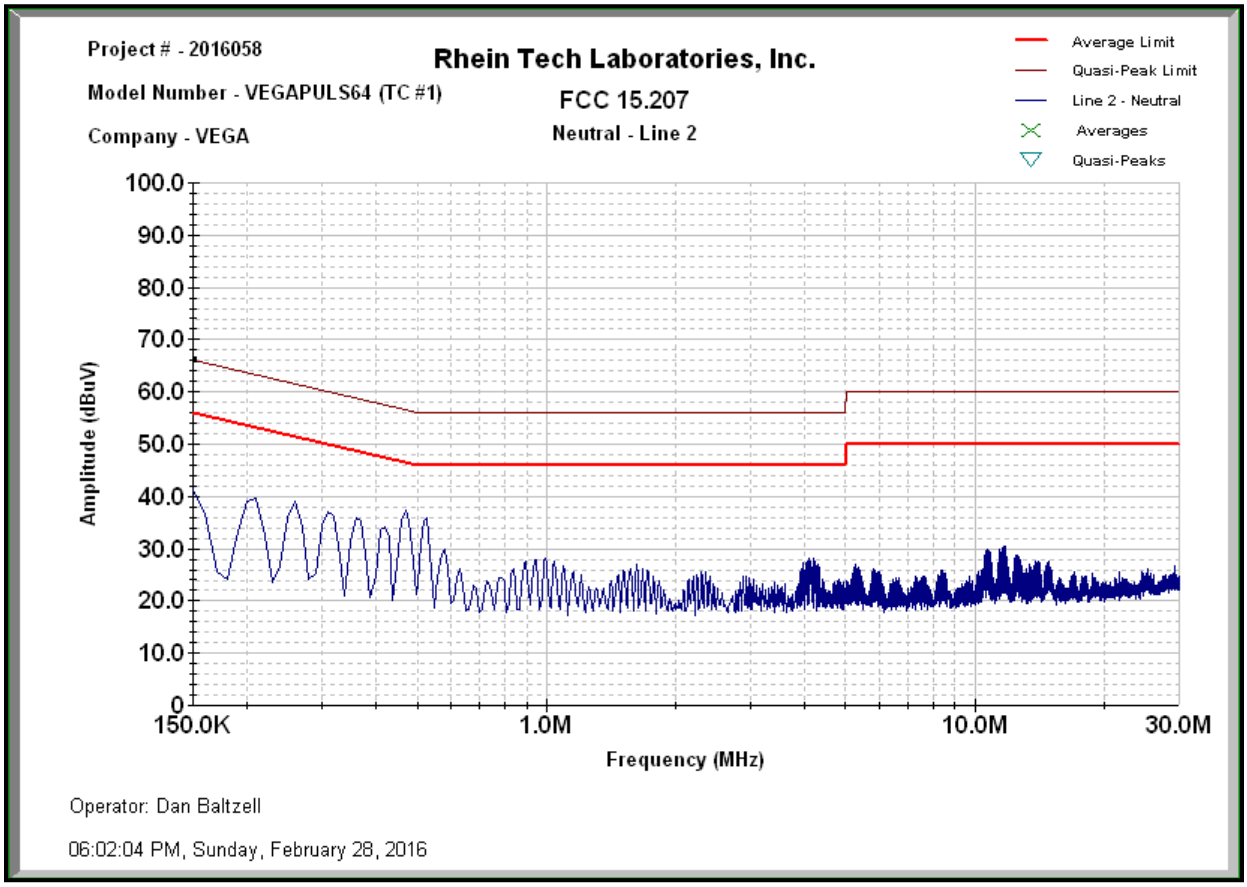


Table 6-1: Conducted Line Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771	4/21/16
900969	Hewlett Packard	85650A	Quasi-Peak Adapter	2412A00414	7/8/16
900930	Hewlett Packard	85662A	Spectrum Analyzer Display Section	3144A20839	4/21/16
901083	AFJ International	LS16	16A LISN (110 V)	16010020080	3/11/16
N/A	Rhein Tech Laboratories, Inc.	Automated Emissions Tester	Emissions Testing Software Rev. 14.0.2	N/A	N/A

Test Personnel:

Daniel W. Baltzell		February 28, 2016
Test Engineer	Signature	Date of Test

7 Conclusion

The data in this measurement report shows that the Vega Grieshaber KG Model VEGAPULS64, FCC ID: O6QPS60XW2, IC: 3892A-PS60XW2, complies with the applicable requirements of FCC Parts 2 and 15 of the FCC rules and regulations and Industry Canada RSS-211 and RSS-Gen.