Electromagnetic Compatibility Test Report

Tested to FCC Part 15C

On

Wireless Remote Monitoring Platform

Model: BRCD01

10 Maguire Road Building 3, 1st Floor
Lexington, MA 02421 USA

Prepared by:

TUV Rheinland of North America, Inc.

Manufacturer's statement - attestation

The manufacturer; MC10, as the responsible party for the equipment tested, hereby affirms:

a) That he has reviewed and concurs that the test shown in this report are reflective of the operational characteristics of the device for which certification is sought;

b) That the device in this test report will be representative of production units;

c) That all changes (in hardware and software/firmware) to the subject device will be reviewed.

d) That any changes impacting the attributes, functionality or operational characteristics documented in this report will be communicated to the body responsible for approving (certifying) the subject equipment.

Steven Fastert
Printed name of official

Signature of official

MC10
10 Maguire Road Building 3, 1st Floor
Lexington, MA 02421 USA
Address

MAR/30/2017
Date

857-214-5611
Telephone number

sfastert@mc10inc.com
Email address of official

Client:	MC10 10 Maguire Road Building 3, 1st Floor Lexington, MA 02421 USA	Steven Fastert Ph: 857-214-5611 Fax: - sfastert@mc10inc.com	
Identification:	Wireless Remote Monitoring Platform	***Serial No.:***	LP5LFPEZ
Test item:	Model: BRCD01	***Date tested:***	24 March 2017
Testing location:	TUV Rheinland of North America 762 Park Avenue Youngsville, NC 27596-9470 U.S.A.	Tel: (919) 554-3668 Fax: (919) 554-3542	
Test specification:	**Emissions:** FCC Part 15, Subpart C FCC Parts 15.207(a), FCC Parts 15.249(d), 15.209, 15.215(c) FCC Part 15.249, FCC Parts 15.249(a), 15.249(c),		
Test Result	**The above product was found to be Compliant to the above test standard(s)**		
tested by: Mark Ryan		***reviewed by:*** Randy Sorrenti	
 8 September 2017 ***Signature***		 8 September 2017 ***Signature***	
Other Aspects:	**None**		

Abbreviations: OK, Pass, Compliant, Complies = passed
Fail, Not Compliant, Does Not Comply = failed
N/A = not applicable

		Industry Canada
90552 and 100881	**Testing Cert #3331.05**	**2932H-1 and 2932H-2**

TABLE OF CONTENTS

1 General Information

1.1 Scope

This report is intended to document the status of conformance with the requirements of the standard(s), based on the results of testing performed on 24 March 2017 on the Wireless Remote Monitoring Platform, Model No. BRCD01, manufactured by MC10. This report only applies to the specific samples tested under the stated test conditions. It is the responsibility of the manufacturer to assure that additional production units of this model are manufactured with identical or EMI equivalent electrical and mechanical components. This report is further intended to document changes and modifications to the EUT throughout its life cycle. All documentation will be included as a supplement.

1.2 Purpose

Testing was performed to evaluate the EMC performance of the EUT (Equipment Under Test) in accordance with the applicable requirements, procedures, and criteria defined in the application of regulations and application of standards listed in this report.

1.3 Revision History

Revision	Date	Description of Revision
.001	6 April 2017	Initial Release
.002	13 April 2017	Corrected typo in model number.
.003	7 Sept. 2017	Updated Radiated Emissions and Measurement Uncertainty tables

1.1 *Summary of Test Results*

Applicant	MC10 10 Maguire Road Building 3, 1st Floor Lexington, MA 02421 USA	**Tel**	857-214-5611	**Contact**	Steven Fastert
		Fax	-	**e-mail**	sfastert@mc10inc.com

Description	Wireless Remote Monitoring Platform	**Model**	BRCD01
Serial Number	LP5LFPEZ	**Test Voltage/Freq.**	110VAC / 60Hz
Test Date Completed:	24 March 2017	**Test Engineer**	Mark Ryan

Standards	Description	Severity Level or Limit	Worst-case Values	Test Result
FCC Part 15, Subpart C Standard	Radio Frequency Devices-Subpart C: Intentional Radiators	See called out parts below	See Below	**Complies**
FCC Part 15.249	Operation within the band 2400 to 2483.5 MHz	See called out parts below	See Below	Complies
FCC Parts 15.249(a), 15.249(c)	Radiated Output Power for Fundamental and Harmonic Frequencies	Fund: Shall not exceed 50 mV/m at 3m Harmonics: Shall not exceed 500µV/m (0.5 mV/m) at 3m, (unresticted bands)	Below Limits	Complies
FCC Parts 15.249(d), 15.209, 15.215(c)	Out-of-Band Spurious Emissions and Band Edges (EUT in Transmit Mode)	Below the applicable limits	Below Limits	Complies
FCC Parts 15.207(a)	Conducted Emissions on AC Mains	FCC Part 15.207(a) limits	Below Limits	Complies

2 Laboratory Information

2.1 Accreditations

2.1.1 US Federal Communications Commission

TUV Rheinland of North America located at 762 Park Avenue, Youngsville, NC 27596-9470 is accredited by the commission for performing testing services for the general public on a fee basis. This laboratory test facilities have been fully described in reports submitted to and accepted by the FCC (Registration No 90552 and 100881). The laboratory scope of accreditation includes: Title 47 CFR Part 15, and 18. The accreditation is updated every 3 years.

2.1.2 ILAC / A2LA

The laboratory has been assessed and accredited by A2LA in accordance with ISO Standard 17025:2005 (Certificate Number: 3331.05, Master Code: 134288). The scope of laboratory accreditation includes emission and immunity testing. The accreditation is updated annually.

2.1.3 Industry Canada

Registration No.: 2932H-1 The OATS has been accepted by Industry Canada to perform testing to 3 and to 10 meters, based on the test procedures described in ANSI C63.4-2013 and ANSI C63.10-2014.

Registration No.: 2932H-2 The 5 meter chamber has been accepted by Industry Canada to perform testing to 3 meters, based on the test procedures described in ANSI C63.4-2013 and ANSI C63.10-2014.

2.1.4 Japan – VCCI

The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) is a group that consists of Information Technology Equipment (ITE) manufacturers and EMC test laboratories. The purpose of the Council is to take voluntary control measures against electromagnetic interference from Information Technology Equipment, and thereby contribute to the development of a socially beneficial and responsible state of affairs in the realm of Information Technology Equipment in Japan. TUV Rheinland at the 762 Park Ave. Youngsville, N.C 27596 address has been assessed and approved in accordance with the Regulations for Voluntary Control Measures. (Laboratory Registration No: A-0034).

2.1.5 Sample Calculation – radiated & conducted emissions

The field strength is calculated by subtracting the Amplifier Gain and adding the Cable Loss and Antenna Correction Factor to the measured reading. The basic equation is as follows:

Field Strength (dBμV/m) = RAW - AMP + CBL + ACF

Where: RAW = Measured level before correction (dBμV)

AMP = Amplifier Gain (dB)

CBL = Cable Loss (dB)

ACF = Antenna Correction Factor (dB/m)

$$\mu V/m = 10^{\frac{dB\mu V/m}{20}}$$

Sample radiated emissions calculation @ 30 MHz

Measurement +Antenna Factor–Amplifier Gain+Cable loss=Radiated Emissions (dBuV/m)

25 dBuV/m + 17.5 dB – 20 dB + 1.0 dB = 23.5 dBuV/m

2.2 Expanded Measurement Uncertainty

The accumulated measurement uncertainties of the test system in use for the parameters measured were expected not exceed the values given in the following tables.

Per CISPR 16-4-2:2011	U_{95}
Radiated Disturbance @ 3m, 10m	
30 MHz – 1,000 MHz (Horizontal Polarity)	3m = 4.52 dB,
1.0 GHz – 6.0 GHz	3m = 4.25 dB
> 6.0 GHz	3m = 4.93 dB

U_{95}= Expanded Uncertainty.

Note:

Expanded measurement uncertainty numbers are shown in the table above. Compliance criteria are not based on measurement uncertainty. The expanded uncertainty at a level of 95% confidence is obtained by multiplying the combined standard uncertainty by a coverage factor of 2 (U_{96}).

Per ETSI TR 100 028 and ETSI TR 100 273	U_{95}
Frequency Accuracy	
30 MHz – 1000 MHz (Band 1)	1.44 Hz
1.0 GHz – 6.0 GHz (Band 2)	1.78 Hz
> 6.0 GHz (Band 3)	3.13 Hz
Carrier Power Measurement	
Total	1.59 dB
Adjacent Channel Power Measurement	
Total	1.47 dB
Conducted Spurious Emissions Measurement	
Total	4.01 dB
Frequency Deviation Measurement	
Total	1.30 dB
Total Response Measurement	
Total	0.46 dB

$\mathbf{U_{95}}$= Expanded Uncertainty.

Notes:
Expanded measurement uncertainty numbers are shown in the table above. The given uncertainty figures are valid to a confidence level of 95 % (k=2), calculated according to the methods described in ETSI TR 100 028 and ETSI TR 100 273.

2.3 Calibration Traceability

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Measurement method complies with ANSI/NCSL Z540-1-1994 and ISO Standard 17025:2005. Equipment calibration records are kept on file at the test facility.

2.4 Software Used

Manufacturer	Name	Version
Quantum Change/EMC Systems LLC.	Tile	3.2U
TUV	Alt "R"	1
TUV	Alt "C"	1
ETS-Lindgren	EMPower	1.0.2.11

2.5 Measurement Equipment Used

2.5.1 Original testing in March 2017

Equipment	Manufacturer	Model #	Serial/Inst #	Last Cal dd/mm/yy	Next Cal dd/mm/yy
Radiated and Conducted RF Emissions (5 Meter Chamber)					
Receiver, EMI	Rohde & Schwarz	ESIB40	100043	16-Aug-16	16-Aug-17
Spectrum Analyzer	Agilent Tec.	E7405A	US39440157	16-Aug-16	16-Aug-17
Amplifier, preamp	Agilent Technologies	8449B	3008A01480	20-Aug-15	20-Aug-17
Antenna Horn 1-18GHz	EMCO	3115	2236	18-Nov-15	18-Nov-17
18-40GHz Horn and Amp	COM-POWER	AHA-B40	105002	12-Sep-16	12-Sep-16
Cable, Coax	MicroCoax	MKR300C-0-0-1200-500500	002	17-Aug-16	17-Aug-17
Cable, Coax	MicroCoax	MKR300C-0-1968-500310	005	17-Aug-16	17-Aug-17
Cable, Coax	MicroCoax	UFB29C-1-5905-50U-50U	009	17-Aug-16	17-Aug-17
Notch Filter: 2.4-2.4835GHz	Micro-Tronics	BRM50702	049	18-Aug-16	18-Aug-17
USB RF Power Sensor	ETS-Lindgren	7002-006	14I000SNO054	18-Aug-16	18-Aug-17
USB RF Power Sensor	ETS-Lindgren	7002-006	14I000SNO055	18-Aug-16	18-Aug-17
General Laboratory Equipment					
Meter, Multi	Fluke	179	90580752	18-Aug-16	18-Aug-17
Meter, Temp/Humid/Barom	ExTech	SD700	Q677933	21-Dec-15	21-Dec-17
Meter, Temp/Humid/Barom	ExTech	SD700	Q677942	21-Dec-15	21-Dec-17

2.5.2 For September 2017 Testing:

Equipment	Manufacturer	Model #	Serial/Inst #	Last Cal dd/mm/yy	Next Cal dd/mm/yy
Radiated Emissions (5 Meter Chamber)					
Receiver, EMI	Rohde & Schwarz	ESIB40	100043	08-Aug-17	08-Aug-18
Amplifier, preamp	Agilent Technologies	8449B	3008A01480	17-Aug-16	17-Aug-18
Ant. BiconiLog	Chase	CBL6140A	1108	06-Oct-15	06-Oct-17
Antenna Horn 1-18GHz	EMCO	3115	5770	23-Mar-17	23-Mar-18
Cable, Coax	MicroCoax	MKR300C-0-0-1200-500500	002	17-Aug-16	17-Aug-18
Cable, Coax	MicroCoax	MKR300C-0-1968-500310	005	17-Aug-16	17-Aug-18
Cable, Coax	MicroCoax	UFB29C-1-5905-50U-50U	009	17-Aug-16	17-Aug-18
Cable, Coax	Andrew	FSJ1-50A	045	17-Aug-16	17-Aug-18
General Laboratory Equipment					
Meter, Multi	Fluke	179	12430137	15-Aug-16	15-Aug-17
Meter, Temp/Humid/Barom	ExTech	SD700	Q677933	21-Dec-15	21-Dec-17
Meter, Temp/Humid/Barom	ExTech	SD700	Q677942	21-Dec-15	21-Dec-17

3 Product Information

3.1 Product Description

See Appendix A of this report

3.2 Equipment Modifications

3.2.1 Radiated Emissions:

- Modified BSPS01 (medical power supply) to incorporate a ferrite core (P/N:2643480002, MFR FairRite) at the barrel connector end.
- Added a ferrite core to the flat flex cable FFC that interconnects the Main and Inductive Coil PCBAs within the BRCD01 assembly (P/N:SM28R0760, MFR Leader Tech)
- Modified the Inductive Coil PCBS with the BRCD01 assembly from 2 layers to 4 adding two power plane layers, one ground, one power plane.

3.3 Equivalent Models

No additional models covered by test report.

3.4 Test Plan

The EUT product information, test configuration, mode of operation, test types, test procedures, test levels, pass/failure criteria, in this report were carried out per the product test plan located in appendix A of this report

4 Radiated Emissions in Transmit mode

4.1 Radiated emissions - FCC Parts 15.249, RSS-210 A2.9(a)

The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following limits:
Fundamental Frequency: 2400 to 2483.5 MHz – 50 mV/m (94 dB µV/m) at 3m.
Harmonic Frequencies: 500 µV/m (54 dB µV/m) at 3m.
Spurious Emissions: To the limits of FCC Part 15.209 and RSS-GEN 7.2.1.

4.1.1 Over View of Test

Results	**Complies** (as tested per this report)				**Date**	24 March 2016 and 6 September 2017	
Standard	FCC Parts 15.205, 15.209, 15.215(c), 15.249(a), 15.249(c), 15.249(d) RSS-210 A2.9, and RSS-GEN						
Product Model	BRCD01			**Serial#**	LP5LFPEZ		
Test Set-up	Tested in a 5m Semi Anechoic chamber, placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane on a turn-table.						
EUT Powered By	120VAC / 60Hz	**Temp**	73º F	**Humidity**	35%	**Pressure**	998 mbar
Perf. Criteria	(Below Limit)		**Perf. Verification**		Readings Under Limit		
Mod. to EUT	None		**Test Performed By**		Mark Ryan		

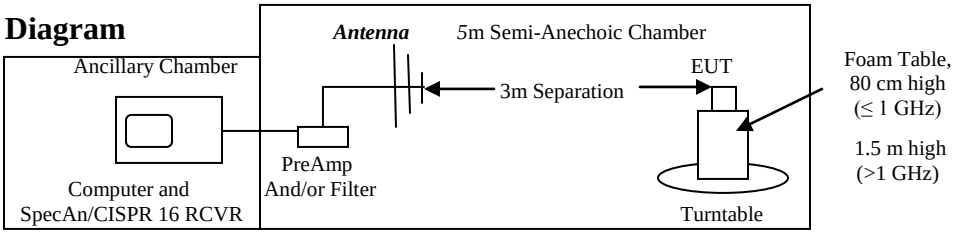
4.1.2 Test Procedure

Testing was performed in accordance with 47 CFR Part 15, ANSI C63.10:2013, RSS-GEN Issue 4. These test methods are listed under the laboratory's A2LA Scope of Accreditation. This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices.

4.1.3 Deviations

Since all emissions outside the band are within the limits of FCC Part 15.209 and RSS-GEN 7.2.1, the emissions shown below are also compliant with FCC Parts 15.205, 15.209, 15.215(c), 15.249(d), RSS-210 A8.5, and RSS-GEN 7.2.1.

4.1.4 Test Setup Block Diagram



4.1.5 Final Test

All final radiated spurious emissions measurements were below (in compliance) the limits.

The worst –case emissions are shown below. All other emissions are on file at TUV Rheinland.

4.1.5.1 Worst Case Emissions inside the Frequency Band

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Test to Part 15.249
Orientation A:									
2402.00	H	2.4	170	42.18	0.00	5.89	28.51	76.58	94.00
2402.00	H	2.4	170	53.04	0.00	5.89	28.51	87.44	114.00
2402.00	V	1.3	292	34.50	0.00	5.89	28.51	68.90	94.00
2402.00	V	1.3	292	48.37	0.00	5.89	28.51	82.77	114.00
2440.00	H	2.1	157	40.60	0.00	5.95	28.65	75.20	94.00
2440.00	H	2.1	157	51.52	0.00	5.95	28.65	86.12	114.00
2440.00	V	1.7	157	38.20	0.00	5.95	28.65	72.80	94.00
2440.00	V	1.7	157	49.19	0.00	5.95	28.65	83.79	114.00
2480.00	H	1	172	38.09	0.00	5.98	28.76	72.83	94.00
2480.00	H	1	172	52.09	0.00	5.98	28.76	86.83	114.00
2480.00	V	1.3	271	35.38	0.00	5.98	28.76	70.12	94.00
2480.00	V	1.3	271	49.30	0.00	5.98	28.76	84.04	114.00
Orientation B:									
2402.00	H	1.3	120	41.03	0.00	5.89	28.51	75.43	94.00
2402.00	H	1.3	120	51.91	0.00	5.89	28.51	86.31	114.00
2402.00	V	1.5	198	40.53	0.00	5.89	28.51	74.93	94.00
2402.00	V	1.5	198	51.39	0.00	5.89	28.51	85.79	114.00
Orientation C:									
2402.00	H	1.9	113	40.60	0.00	5.89	28.51	75.00	94.00
2402.00	H	1.9	113	51.52	0.00	5.89	28.51	85.92	114.00
2402.00	V	1.5	91	39.00	0.00	5.89	28.51	73.40	94.00
2402.00	V	1.5	91	49.89	0.00	5.89	28.51	84.29	114.00

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor

Notes: **GREEN = Average Detector, Blue = Peak Detector**
The Limit using the Peak Detector is 20dB higher than the Average Detector limit.
EUT in Orientation A is worst case as shown. All other data is on file at TUV Rheinland.
This highlighted frequency and orientation was Highest Emission (2402 MHz, Orientation A).

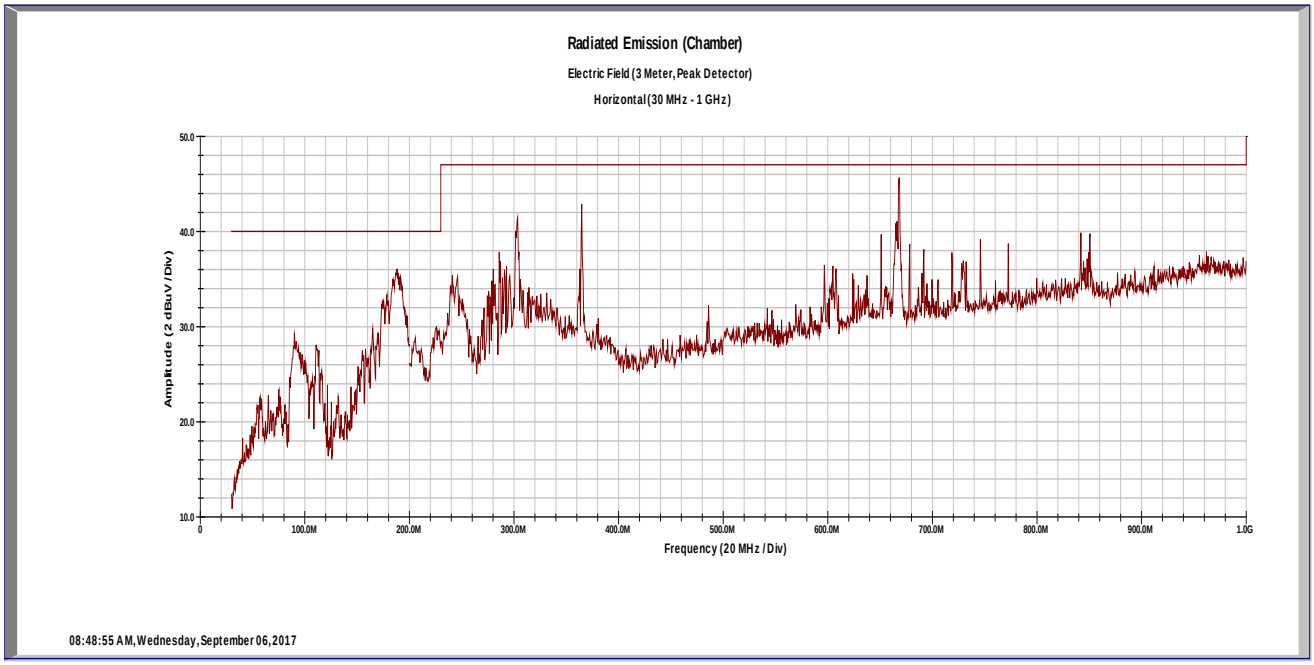
Note: the Maximum Field strength for using FCC Part 15.249 is 50mV/m or 94.0 dBµV/m (Avg) and 114 dBµV/m (peak).

The highest measured emission is 76.58 dBµV/m (Avg) and 87.44 dBµV/m (Peak).

FCC Part 15.249 is applicable for this intentional radiator.

4.1.5.2 Emissions Outside the Frequency Band:

Radiated Emissions – 30 MHz to 1000 MHz
Horizontal



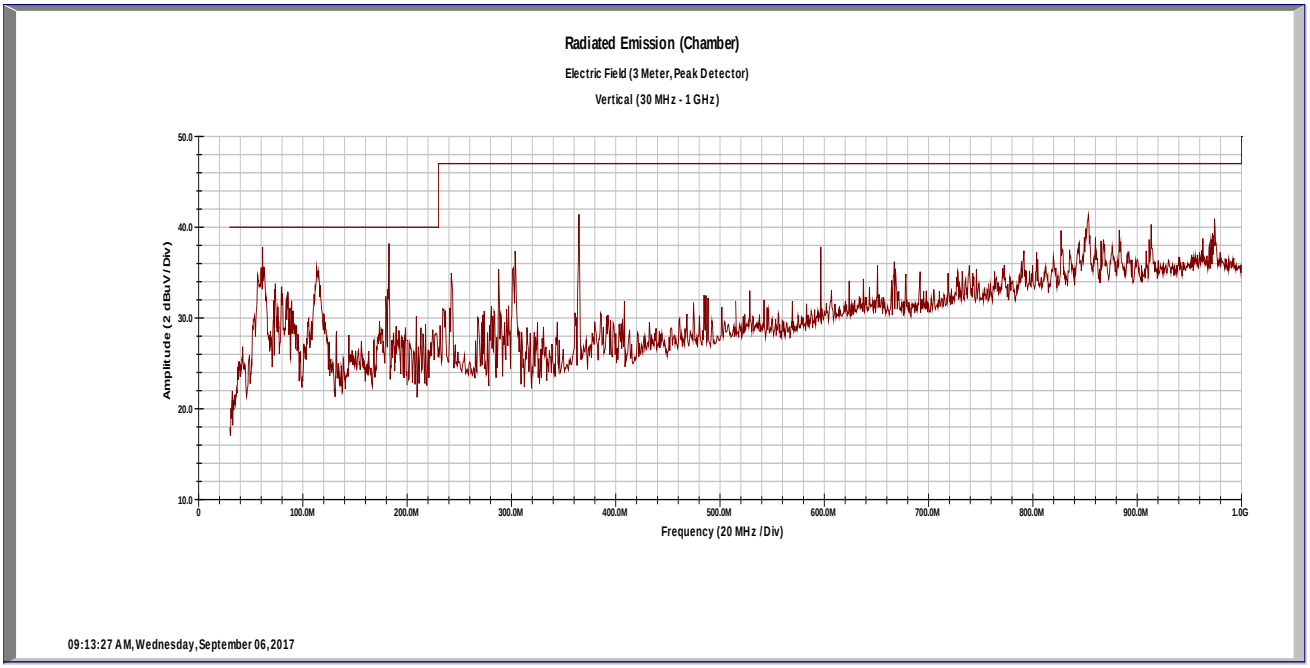
Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
162.52	H	1.5	297	9.34	0.00	1.61	12.20	23.15	40.00	-16.85
302.84	H	1	33	17.45	0.00	2.21	16.93	36.59	47.00	-10.41
364.36	H	1	207	12.10	0.00	2.43	18.81	33.34	47.00	-13.66
668.84	H	1.1	337	8.74	0.00	3.29	24.52	36.55	47.00	-10.45
162.52	H	1.5	297	9.34	0.00	1.61	12.20	23.15	40.00	-16.85
302.84	H	1	33	17.45	0.00	2.21	16.93	36.59	47.00	-10.41

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor

Notes: The remaining two channels gave very similar results.
A notch filter at the transmitter fundamental frequency was not used.

Radiated Emissions Ch 2 – 30 MHz to 1000 MHz

Vertical



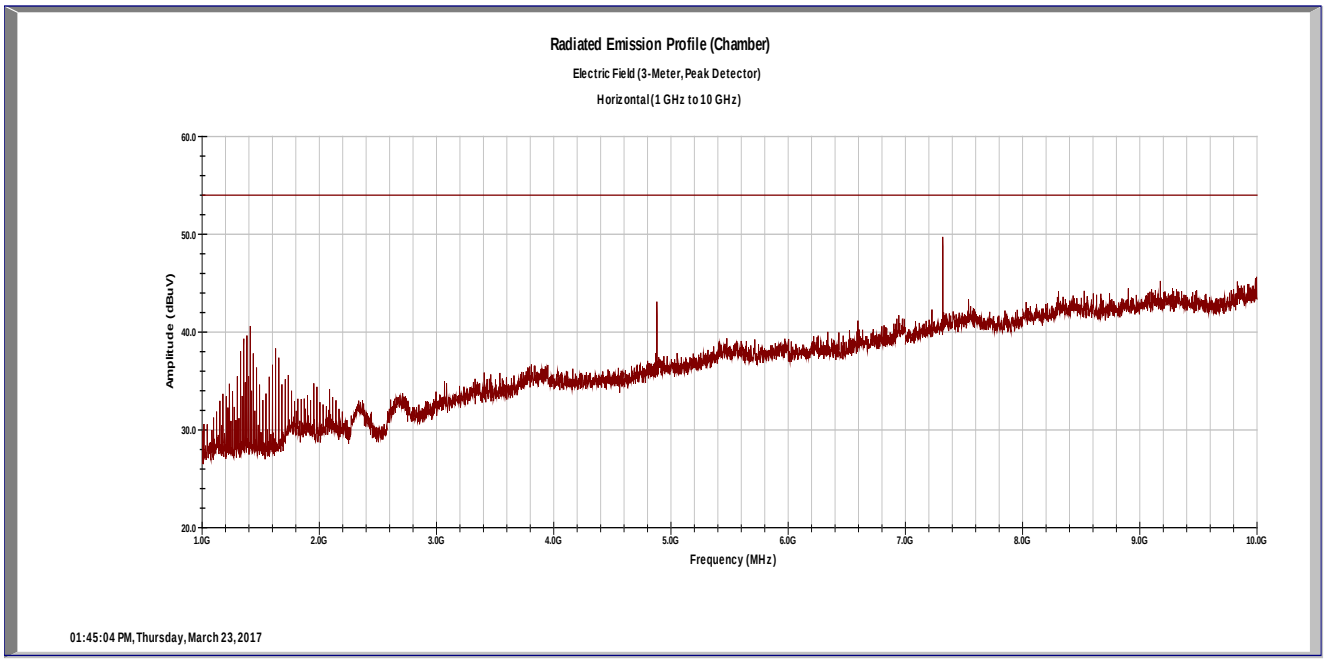
Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
60.72	V	1	250	19.82	0.00	0.99	14.16	34.96	40.00	-5.04
80.44	V	1	250	21.99	0.00	1.14	11.33	34.46	40.00	-5.54
113.28	V	1	53	20.75	0.00	1.34	11.10	33.19	40.00	-6.81
183.04	V	1	5	10.18	0.00	1.71	13.80	25.69	40.00	-14.31
364.64	V	1.2	145	14.55	0.00	2.43	18.81	35.79	47.00	-11.21
851.40	V	1.1	92	8.19	0.00	3.72	26.54	38.45	47.00	-8.55

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor

Notes: The remaining two channels gave very similar results.
A notch filter at the transmitter fundamental frequency was not used.

Worst Case Radiated Emissions – 1 to 10 GHz

Horizontal



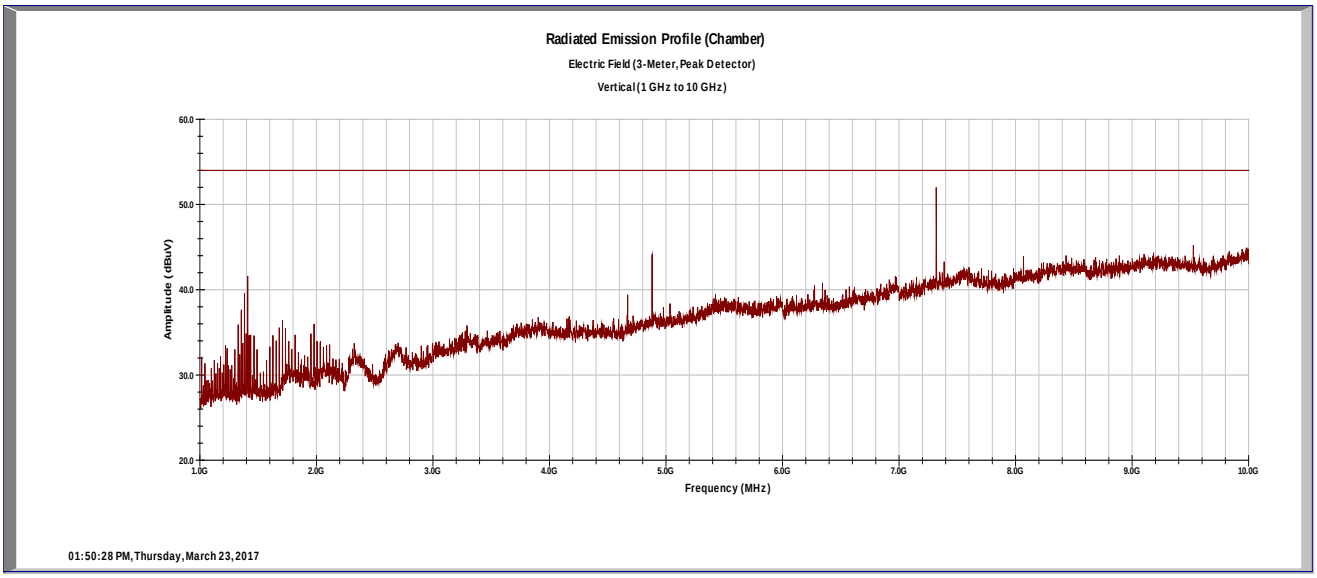
Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor

Notes: Worst-case spurs and harmonic on Vertical plot.

Worst Case Radiated Emissions - 1 to 10 GHz

Vertical



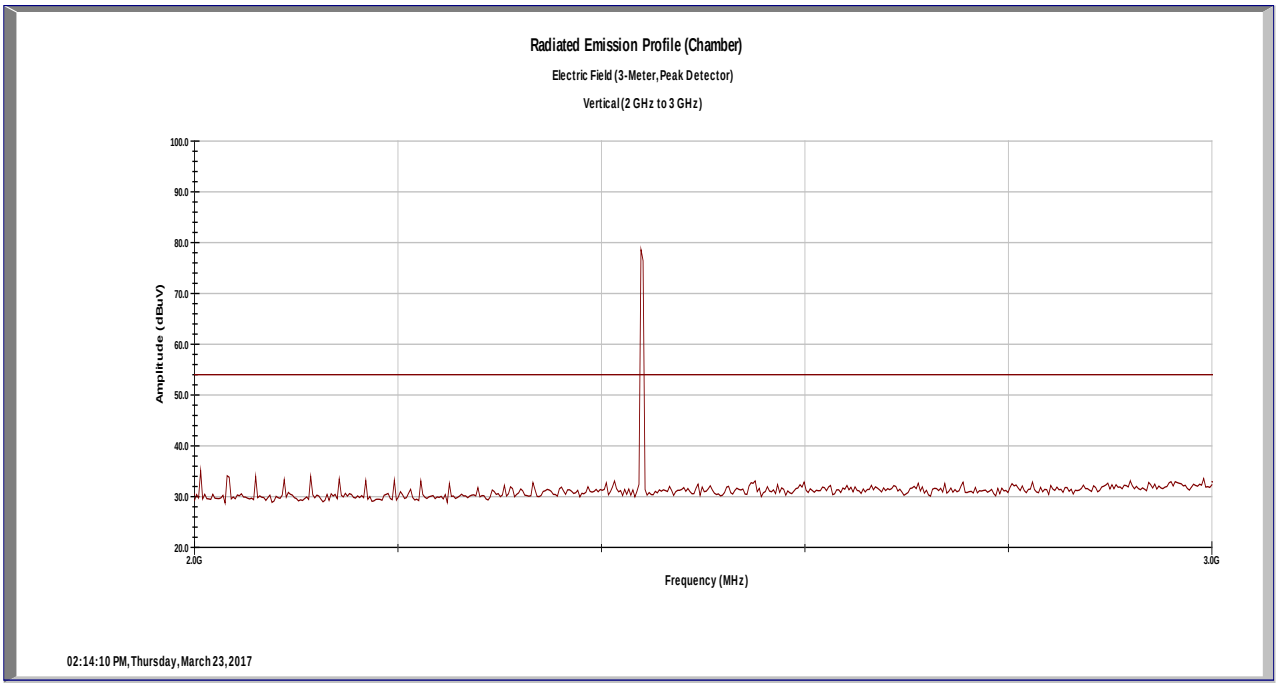
Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
1383.20	V	1.4	64	43.94	34.68	6.29	25.17	40.73	54.00	-13.27
1383.20	V	1.4	64	49.16	34.68	6.29	25.17	45.95	74.00	-28.05
4880.00	V	1.3	302	29.64	33.77	11.71	33.00	40.58	54.00	-13.42
4880.00	V	1.3	302	44.01	33.77	11.71	33.00	54.95	74.00	-19.10
7319.20	V	1.1	230	28.13	33.63	14.64	36.72	45.85	54.00	-8.15
7319.20	V	1.1	230	42.96	33.63	14.64	36.72	60.68	74.00	-13.32

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor

Notes: **GREEN = Average Detector, Blue = Peak Detector**

The Limit using the Peak Detector is 20dB higher than the Average Detector limit.

Band notch filter used for these values.

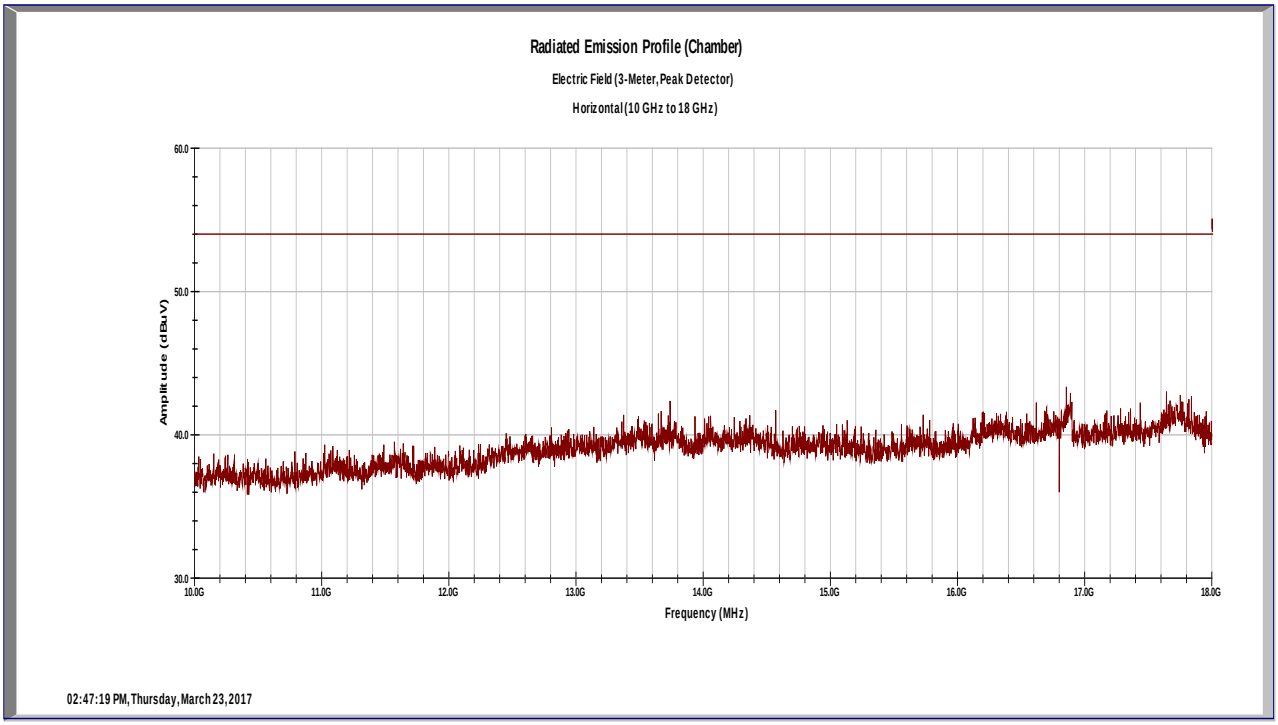


Plot of fundamental with the notch filter removed. This was to verify there are no large spurs appear that may have been covered up by the filter.

Vertical showed worst-case spurs. All peak values of the spurs were more than 20 dB below the average limts.

Radiated Emissions Ch 2 – 10 to 18 GHz

Horizontal



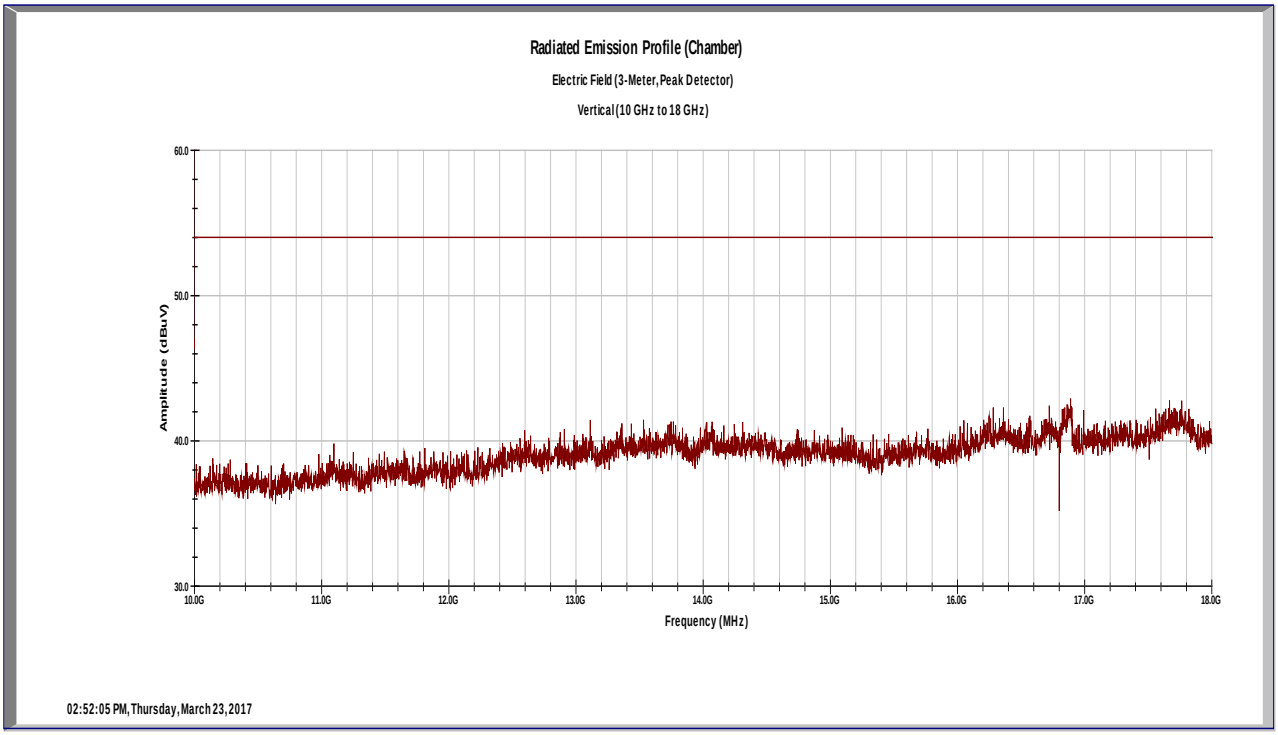
Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor

Notes: Band notch filter used for these values.
No measureable emissions noted

Radiated Emissions Ch 2 – 10 to 18 GHz

Vertical

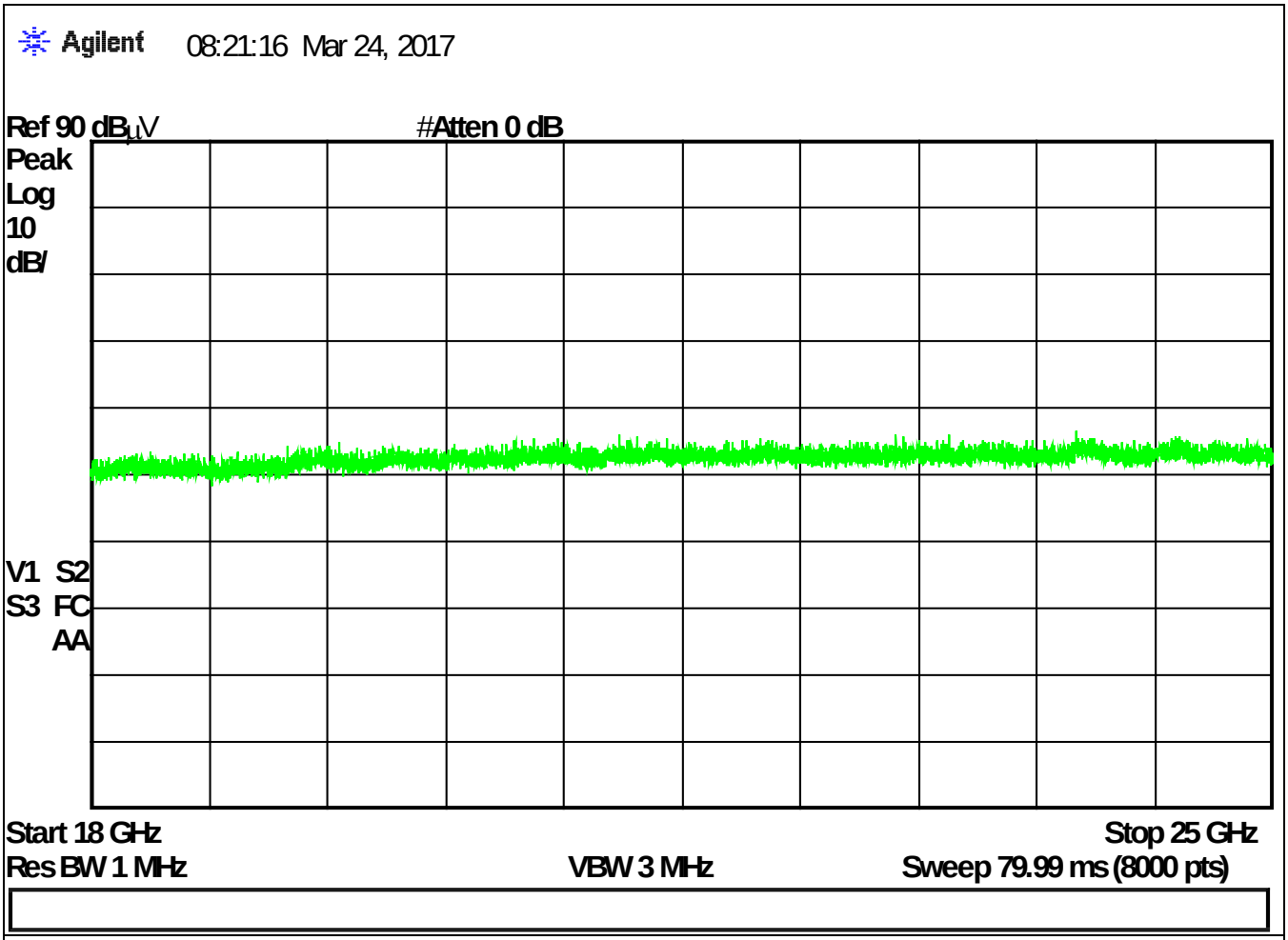


Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
16814.00	V	1	0	14.10	32.04	24.26	39.86	46.18	54.00	-7.82
16814.00	V	1	0	27.60	32.04	24.26	39.86	59.68	74.00	-14.32

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor

Notes: Band notch filter used for these values.
No measureable emissions noted

Radiated Emissions Ch 2 – 18 to 25 GHz
Horizontal

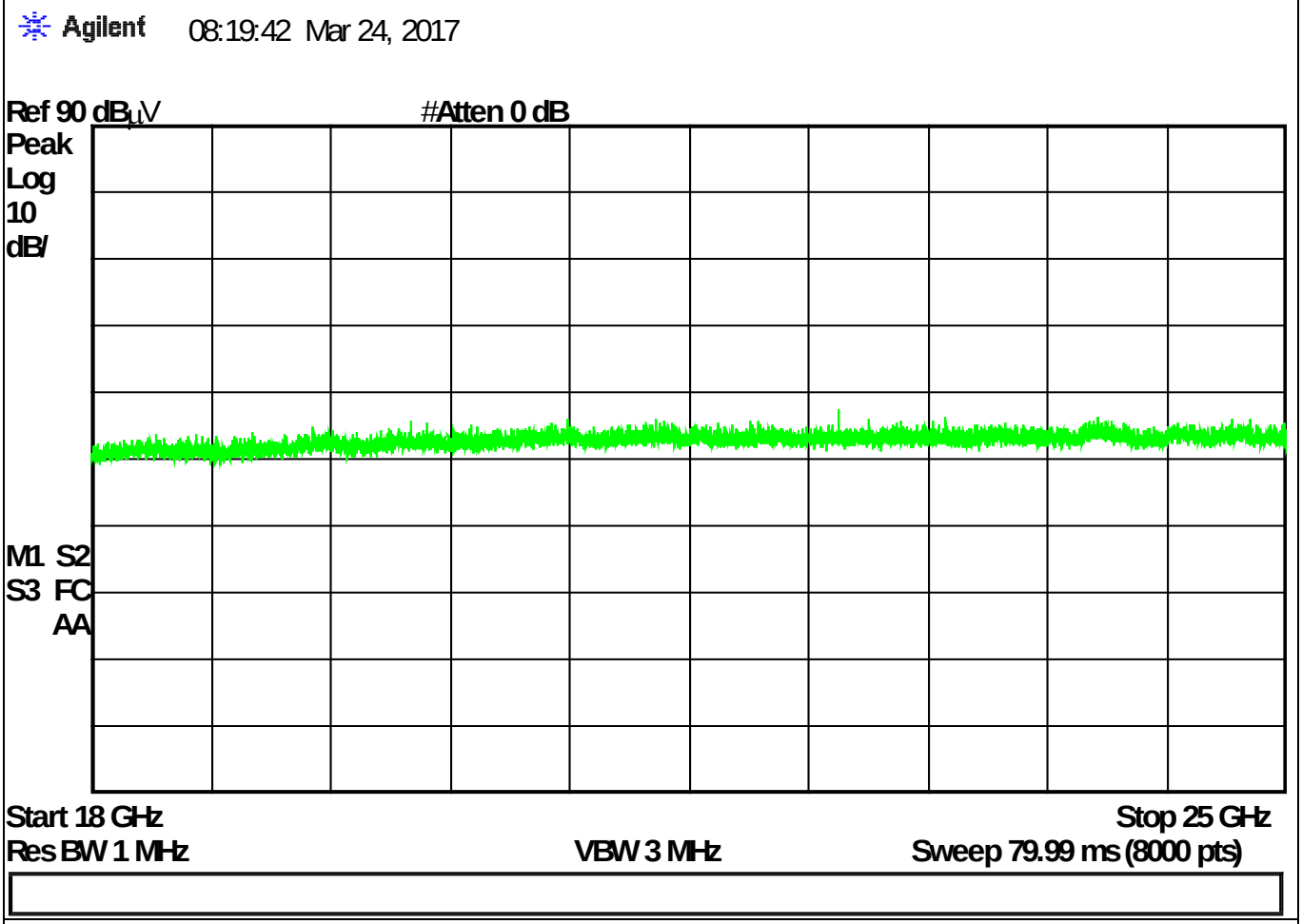


Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor

Notes: No measureable emissions were noted.
No correction factors were used for the above graph. The number of Sweep Points was increased to 8000.
The Measuring distance was decreased to 1 meter.
No notch filter was used for this frequency range.
The other two channels presented very similar results. Plots for other the channels are on file at TUV Rheinland.

Radiated Emissions Ch 2 – 18 to 25 GHz
Vertical



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor

Notes: No measureable emissions were noted.
No correction factors were used for the above graph. The number of Sweep Points was increased to 8000.
The Measuring distance was decreased to 1 meter.
No notch filter was used for this frequency range.
The other two channels presented very similar results. Plots for other the channels are on file at TUV Rheinland.

4.2 Band Edge requirements - FCC Part 15.249(d), RSS-210 2.2

4.2.1 Test Over View

Results	**Complies** (as tested per this report)				**Date**	23 March 2017	
Standard	FCC Part 15.249(d), RSS 210 2.2						
Product Model	BRCD01		**Serial#**	LP5LFPEZ			
Test Set-up	Direct Measurement from antenna port						
EUT Powered By	120VAC / 60Hz	**Temp**	73º F	**Humidity**	35%	**Pressure**	998 mbar
Perf. Criteria	(Below Limit)		**Perf. Verification**		Readings Under Limit		
Mod. to EUT	None		**Test Performed By**		Mark Ryan		

4.2.2 Test Procedure

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Sec. 15.209, whichever is the lesser attenuation.

4.2.3 Deviations

There were no deviations from the test methodology listed in the test plan.

RBW of 100 kHz was chosen as it is within 1% to 5% of the total span. (4.8%)

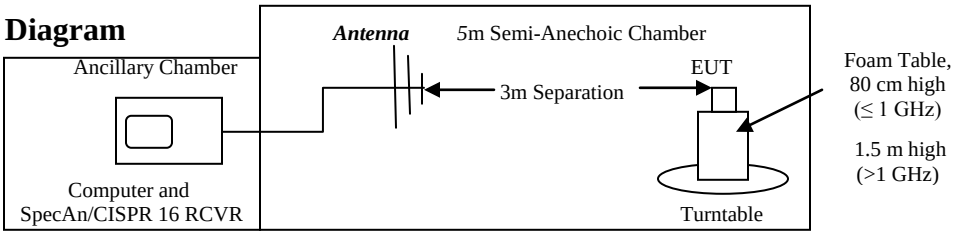
The VBW of 300 kHz was chosen as it is 3 times the 100 kHz RBW.

The Sweep time was set to Auto.

4.2.4 Final Test

The EUT met the performance criteria requirement as specified in the standards.

4.2.5 Test Setup Block Diagram



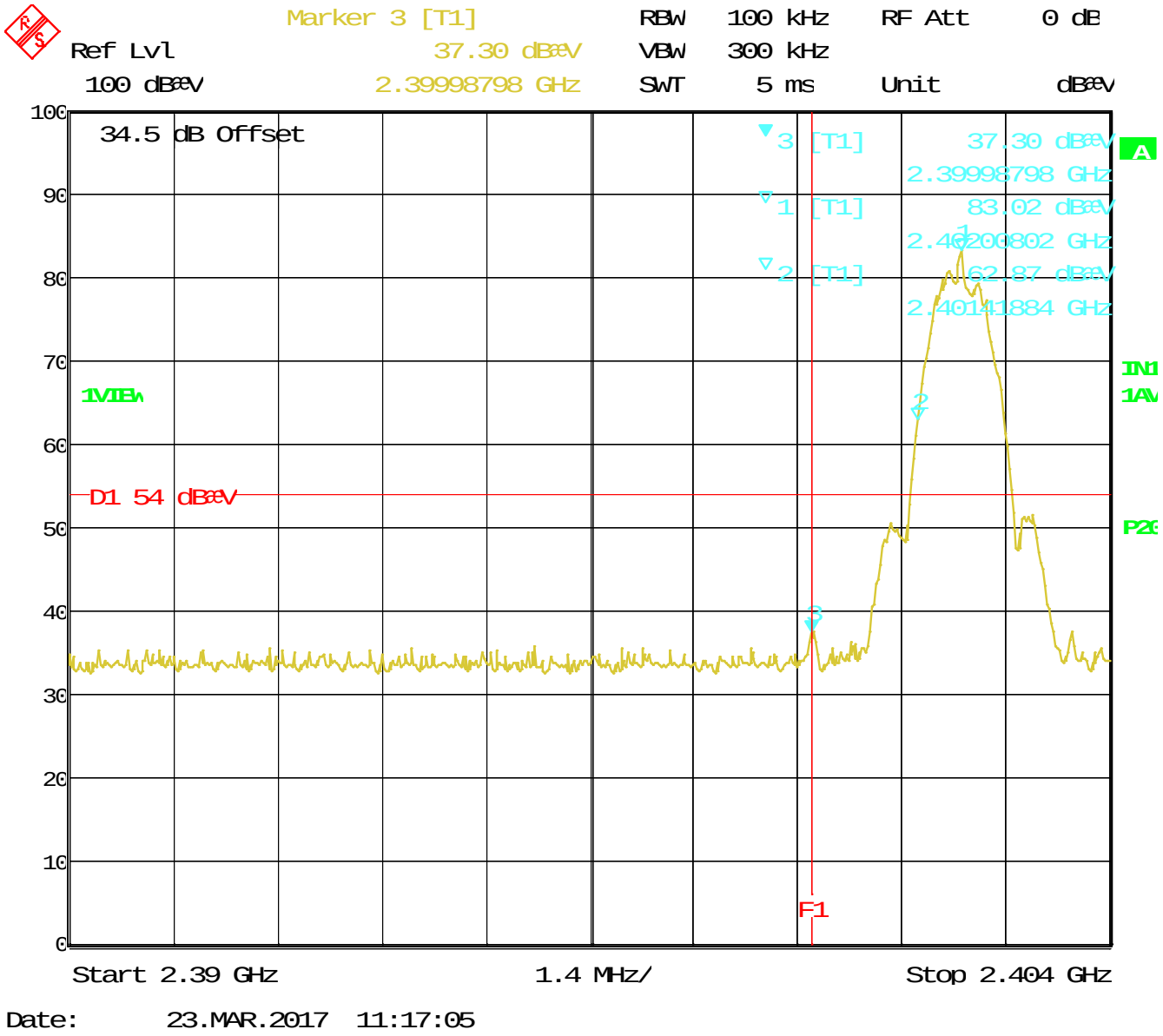


Figure 1: Lower Band Edge Average Measurement (Radiated Emission)

Note: Band Edge is at 2.4 GHz, and the nearest restricted band (2390MHz) is 10 MHz below the band-edge. At the lowest channel, the 20dB down point is at 2401.42 MHz. The EUT is compliant with the rules.

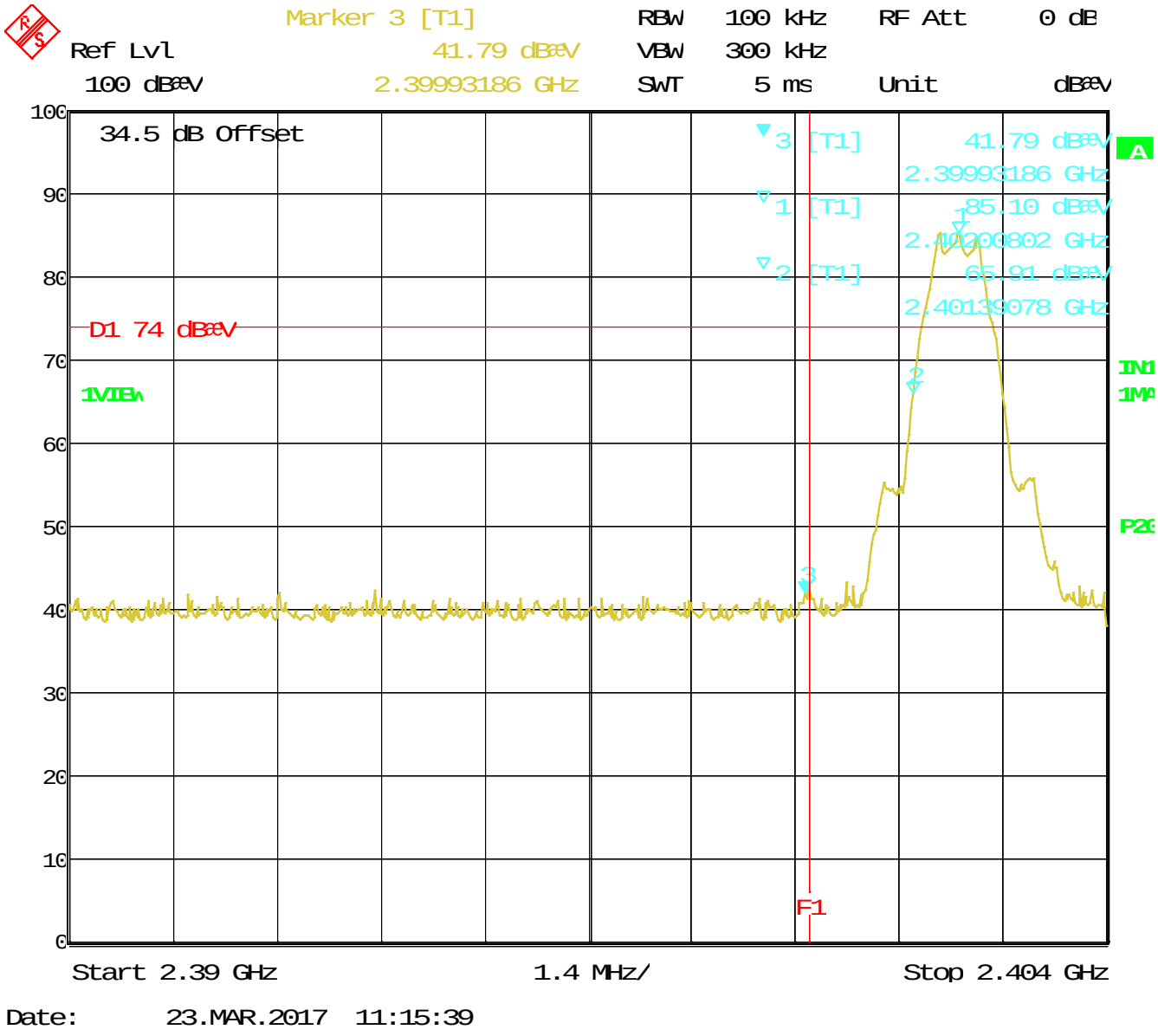


Figure 2: Lower Band Edge Peak Measurement (Radiated Emission)

Note: Band Edge is at 2.4 GHz, and the nearest restricted band (2390MHz) is 10 MHz below the band-edge. At the lowest channel, the 20dB down point is at 2401.39 MHz. The EUT is compliant with the rules.

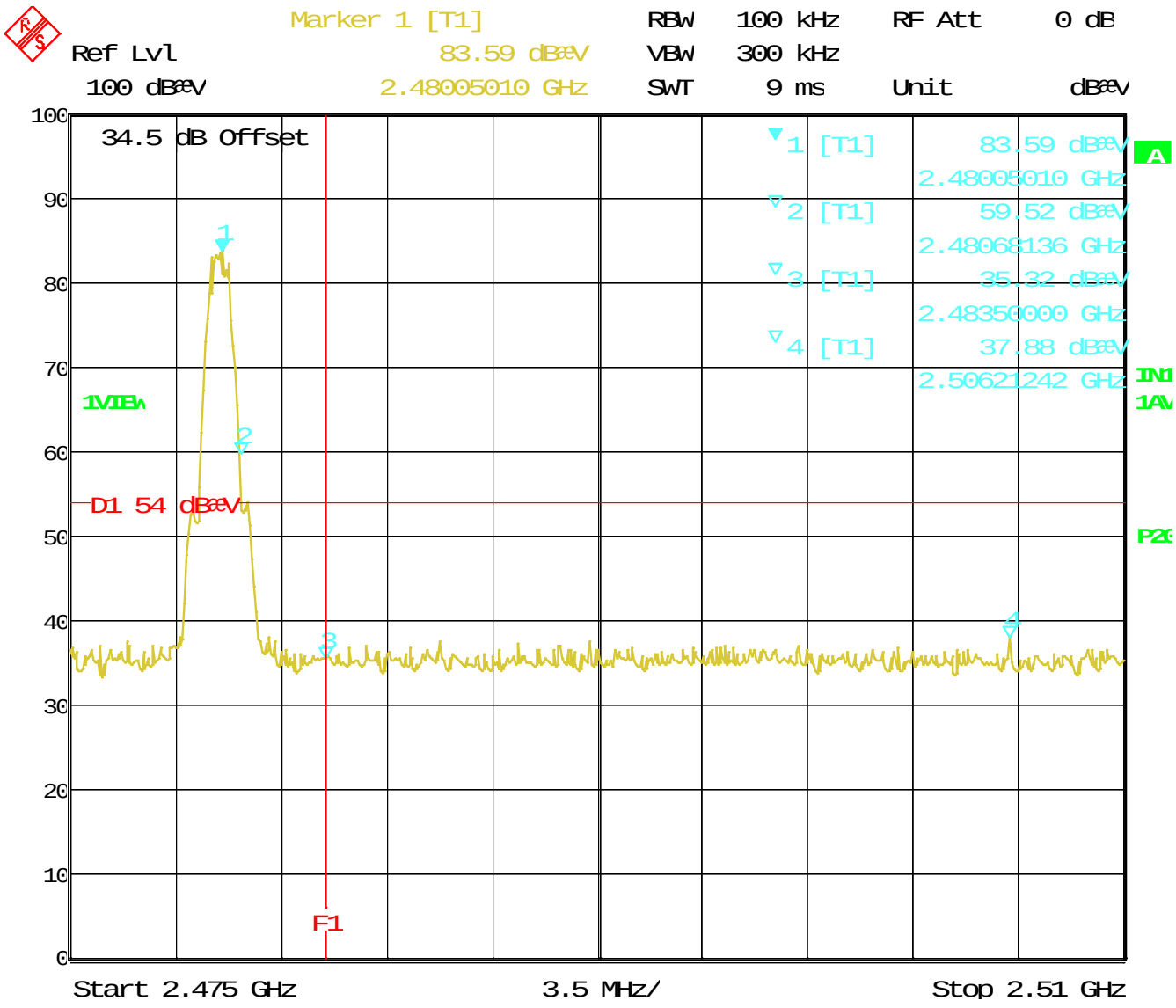


Figure 3: Upper Band Edge Average Measurement (Radiated Emission)

Note: Band edge (F1) at 2483.5 MHz is also the start of a restricted band, so the rules for restricted bands apply.

The highest channel frequency outside the band-edge (2506.21 MHz) is 37.88 dBµV/m (average), which is 16.12dB below the 54 dB restrict-band average limit.

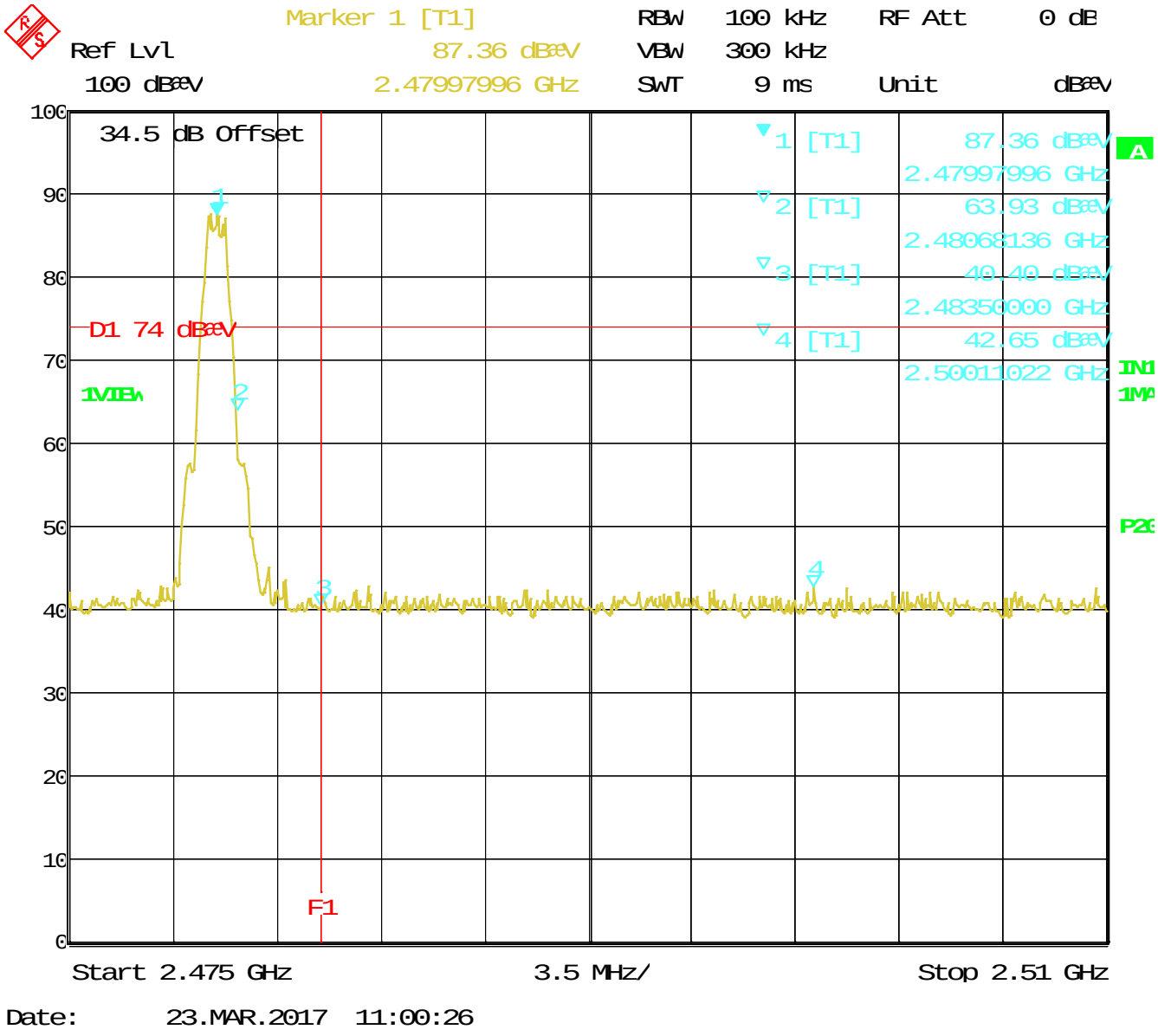


Figure 4: Upper Band Edge Peak Measurement (Radiated Emission)

Note: Band edge (F1) at 2483.5 MHz is also the start of a restricted band, so the rules for restricted bands apply.

The highest channel frequency outside the band-edge (2500.11 MHz) is 42.65 dBµV/m (peak) which is 31.35 dB below the 74 dB restrict-band peak limit.

The EUT is compliant with the rules.

5 Conducted Emissions on AC MAINS in Transmit mode

5.1 Conducted Emissions on AC Mains – FCC 15.207(a) and RSS-GEN 7.2.4

This test measures the electromagnet levels of spurious signals generated by the EUT on the AC power line that may affect the performance of other nearby electronic equipment.

5.1.1 Over View of Test

Results	**Complies** (as tested per this report)				**Date**	16 Mar 2017	
Standard	FCC Parts 15.207(a)						
Product Model	BRCD01			**Serial#**	NA		
Test Set-up	Tested in shielded room. EUT placed on table, see test plans for details						
EUT Powered By	120VAC / 60Hz	**Temp**	72º F	**Humidity**	10%	**Pressure**	1001 mbar
Frequency Range	150 kHz – 30 MHz						
Perf. Criteria	(Below Limit)	**Perf. Verification**	Readings Under Limit for L1 & Neutral				
Mod. to EUT	None	**Test Performed By**	Robert Richards				

5.1.2 Test Procedure

Conducted and FCC emissions tests were performed using the procedures of ANSI C63.4:2014 including methods for signal maximizations and EUT configuration.

The frequency range from 150 kHz – 30 MHz was investigated for conducted emissions.

EUT was placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane, 40cm from a vertical ground plane, using procedures specified in the test plan and standard.

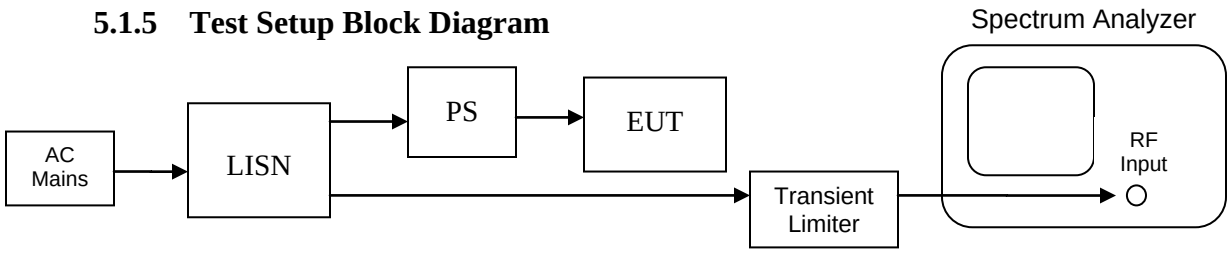
5.1.3 Deviations

There were no deviations from the test methodology listed in the test plan for the conducted emission test.

5.1.4 Final Test

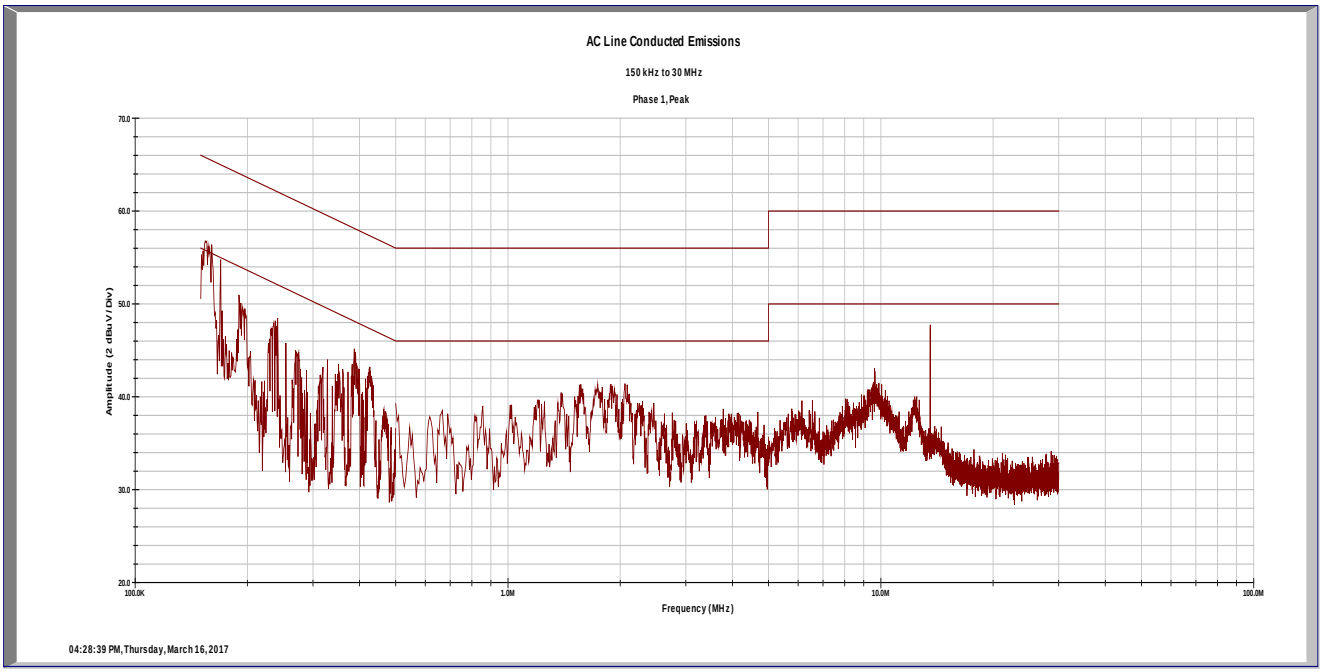
All final conducted emissions measurements were below (in compliance) the limits.

5.1.5 Test Setup Block Diagram



5.1.6 Final data and Graphs

Conducted Emissions @ 120V/60Hz
Line 1



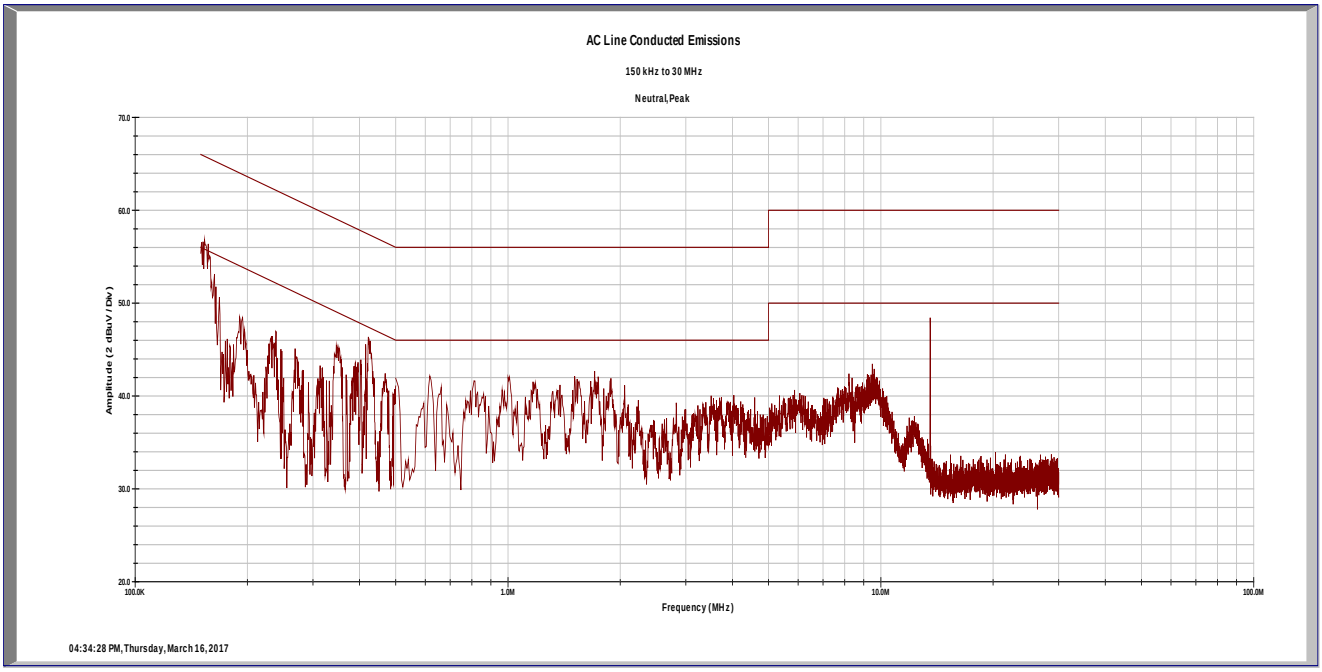
Freq (MHz)	ID (1,2,3,N)	Quasi FIM (dBµV)	Ave FIM (dBµV)	Cable Loss (dB)	TL/LISN (dB)	Limit QP (dBµV)	Limit AVE (dBµV)	Margin QP (dB)	Margin AVE (dB)
0.16	1	44.05	31.38	0.03	9.94	65.46	55.46	-11.45	-14.12
0.27	1	32.55	18.93	0.03	9.93	61.12	51.12	-18.61	-22.23
0.39	1	32.09	24.70	0.04	9.94	58.06	48.06	-16.00	-13.39
13.56	1	36.74	35.66	0.24	10.33	60.00	50.00	-12.68	-3.76

Quasi Spec Margin = Quasi FIM + Cable Loss + TL/LISN - QP Limit
Ave Spec Margin = Ave FIM + Cable Loss + TL/LISN CF - Ave Limit

Notes: Inductive charger and phone charger are activated
The Spike at 13.56 MHz is the inductive charger.

Conducted Emissions @ 120V/60Hz

Neutral



Freq (MHz)	ID (1,2,3,N)	Quasi FIM (dBµV)	Ave FIM (dBµV)	Cable Loss (dB)	TL/LISN (dB)	Limit QP (dBµV)	Limit AVE (dBµV)	Margin QP (dB)	Margin AVE (dB)
0.15	N	44.54	34.12	0.02	9.94	66.00	56.00	-11.49	-11.91
0.42	N	33.01	24.64	0.04	9.95	57.45	47.45	-14.45	-12.82
13.56	N	36.52	35.62	0.24	10.65	60.00	50.00	-12.59	-3.49

Quasi Spec Margin = Quasi FIM + Cable Loss + TL/LISN - QP Limit
Ave Spec Margin = Ave FIM + Cable Loss + TL/LISN CF - Ave Limit

Notes: Inductive charger and phone charger are activated
The Spike at 13.56 MHz is the inductive charger.