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EMC Test Report

Company: Radiotronics, Inc
905 Messenger Lane
Moore, OK 73160

Contact: Tom Marks

Product: Wi.USB-DTS LP-mode
FCC ID: Q7V-3F090012X

Test Report No: R121405-05-02a

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Senior Test Engineer

DATE: 4 April 2006

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A handwritten signature in black ink, appearing to read "Doug Kramer", is written over a horizontal line.

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1.0 Summary of test results**1.1 Test Results**

Based on the data collected with the unit as configured:

Test	Test Specification	Results
CFR 47, FCC Part 15.203	Part 15.203	Complies
CFR 47, FCC Part 15.207	Part 15.207, Class B	N/A
CFR 47, FCC Part 15.209	Part 15.209, Class B	Complies
CFR 47, FCC Part 15.249	Part 15.249	Complies

1.2 Test Methods**1.2.1 Conducted Emissions**

The EUT contains no direct connection to the AC mains supply network. All power is supplied from a host machine via a USB connection. The EUT was found not to effect the host equipment with respect to conducted emissions.

1.2.2 Radiated Emissions

Compliance to CFR 47 Parts 15.209 and 15.249 was tested in accordance with the methods of ANSI/IEEE C63.4, 2003. Several configurations were examined and the results presented represent a worst-case scenario. The EUT was placed on a wooden table approximately 80cm high and centered on a 4m diameter turntable. The table was rotated to find the angles of maximum emissions and the receiving antenna was moved from 1m to 4m in both vertical and horizontal positions. All measurements were taken at a distance of 3m from the EUT for Part 15.209 intentional radiator measurements, and 3m for 15.249 measurements of the fundamental frequency in the 902MHz to 928MHz band and subsequent harmonics.

1.3 Reason for amendment

This report has been amended to clarify the data in regards to bandedge compliance.

2.0 Description**2.1 Equipment under test**

The Equipment under test (EUT) was a Radiotronix wireless USB device (Wi.USB-DTS, FCC ID: Q7V-3F090012X). The EUT connected to a host machine via a USB cable and was controlled by a PC using Radiotronix evaluation software. The EUT was operating in LP-mode with channel 1 through 83 representing frequencies between 902.571 MHz and 927.28 MHz.

2.1.1 Identification: Wi.USB-DTS

2.1.2 EUT received date: 1 December 2005

2.1.3 EUT tested dates: 7, 21, 31 Jan 06, 1 Feb 06

2.1.4 Manufacturer: Radiotronix

2.1.5 Serial number: NCEE Test 1

2.2 Laboratory description

All testing was performed at the NCEE Lincoln facility, which is a FCC registered lab. This site has been fully described in a report submitted to your office, and accepted in a letter dated May 4, 2001. Laboratory environmental conditions varied slightly throughout the tests:

Relative humidity of $46 \pm 4\%$

Temperature of $20 \pm 3^\circ$ Celsius

2.3 Special equipment or setup

The EUT was connected to a Dell PC with monitor, keyboard and mouse during testing. The EUT received power from the USB cable. The EUT was set to a BAUD rate of 19200 (rate at which the emissions were maximized), and the transmitter was set to operate in LP-mode at the greatest output setting "0dBm".

3.0 Test equipment used

<i>Serial #</i>	<i>Manufacturer</i>	<i>Model</i>	<i>Description</i>	<i>Last cal.</i>
1647	EMCO	3142B	Biconilog antenna	10-Mar-05
6416	EMCO	3115	DRG Horn	12-Oct-05
100037	Rohde & Schwarz	ESIB26	EMI Test Receiver	10-Aug-05
082001/003	Rohde & Schwarz	TS-PR18	Preamplifier	N/A
2575	Rohde & Schwarz	ES-K1	Software v1.60	N/A

4.0 Detailed Results

Radiated emissions measurements were made by first using a spectrum analyzer, then getting a rough signal spectrum. Any points of interest were then measured using a CISPR 16 compliant receiver with the following bandwidth setting:

30MHz - 1GHz: 120kHz IF bandwidth, 60kHz steps

1GHz - 10GHz: 1MHz IF bandwidth, 500kHz steps

4.1 FCC Part 15.203 unique connector for antenna

The antenna is not removable from the EUT; it is attached via a screw to the PCB. This is considered sufficient to comply with FCC Part 15.203.

4.2 FCC Part 15.207 Conducted Emissions

The EUT contains no direct connection to the AC mains supply network. All power is supplied from a host machine via a USB connection. The EUT was found not to effect the host equipment's conducted emissions as shown in Figures 9 and 10, and tables 4 through 7. Figures 3, 4 and 5 show the test setup.

4.3 FCC Part 15.209 Radiated Emissions

The EUT was found to comply with the published limits. The EUT was tested at 3m distance and compared to FCC Class B limits, results can be seen in Figures 6 through 8. No emissions were found to be in excess of the limits.

4.4 FCC Part 15.249 Operation within the 902-928 MHz Band

The EUT was tested at three different frequencies, one at the lowest possible transmitting frequency, one in the middle, and one at the highest. These corresponded to Channel 1, Channel 42 and Channel 83 respectively. The EUT was found to comply with the published regulations for the 902-928MHz band. All measurements were taken at a 3m distance. Appendix B, Figures 6 through 8 show the radiated emissions plots from 30 MHz to 1 GHz and tables 1 through 3 display the quasi-peak measurements. Tables 8, 9 and 10 of Appendix C show the harmonics measurements above 1 GHz up to the 6th harmonic. Appendix D, Figures 11 through 14 show the upper and lower bandedges of the 902-928 MHz operating band, at which measurements are to be at least 50 dB below that of the highest emission.

Appendix A: Test Photos



Figure 1 - Radiated Emissions Test Setup



Figure 2 - Radiated Emissions Test Setup

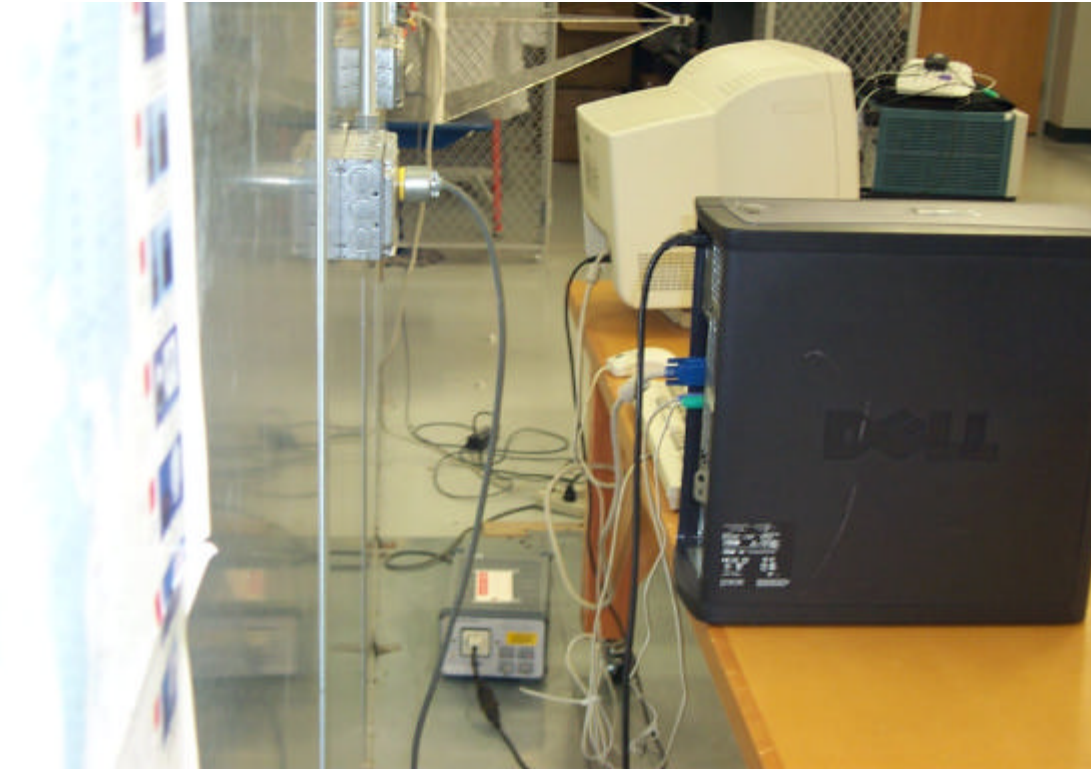


Figure 3 - Conducted Emissions Setup, EUT Not Present

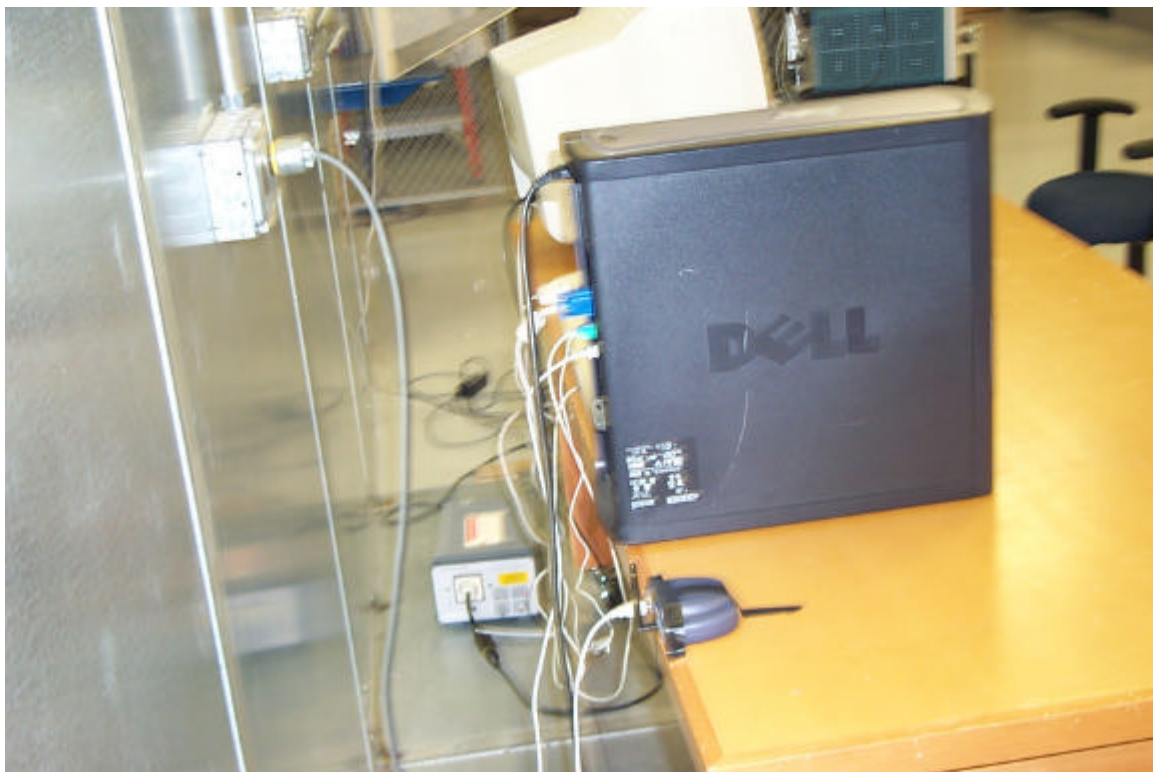


Figure 4 - Conducted Emissions Setup, EUT Present



Figure 5 - Conducted Emissions Test Setup

Appendix B: Emissions Plots

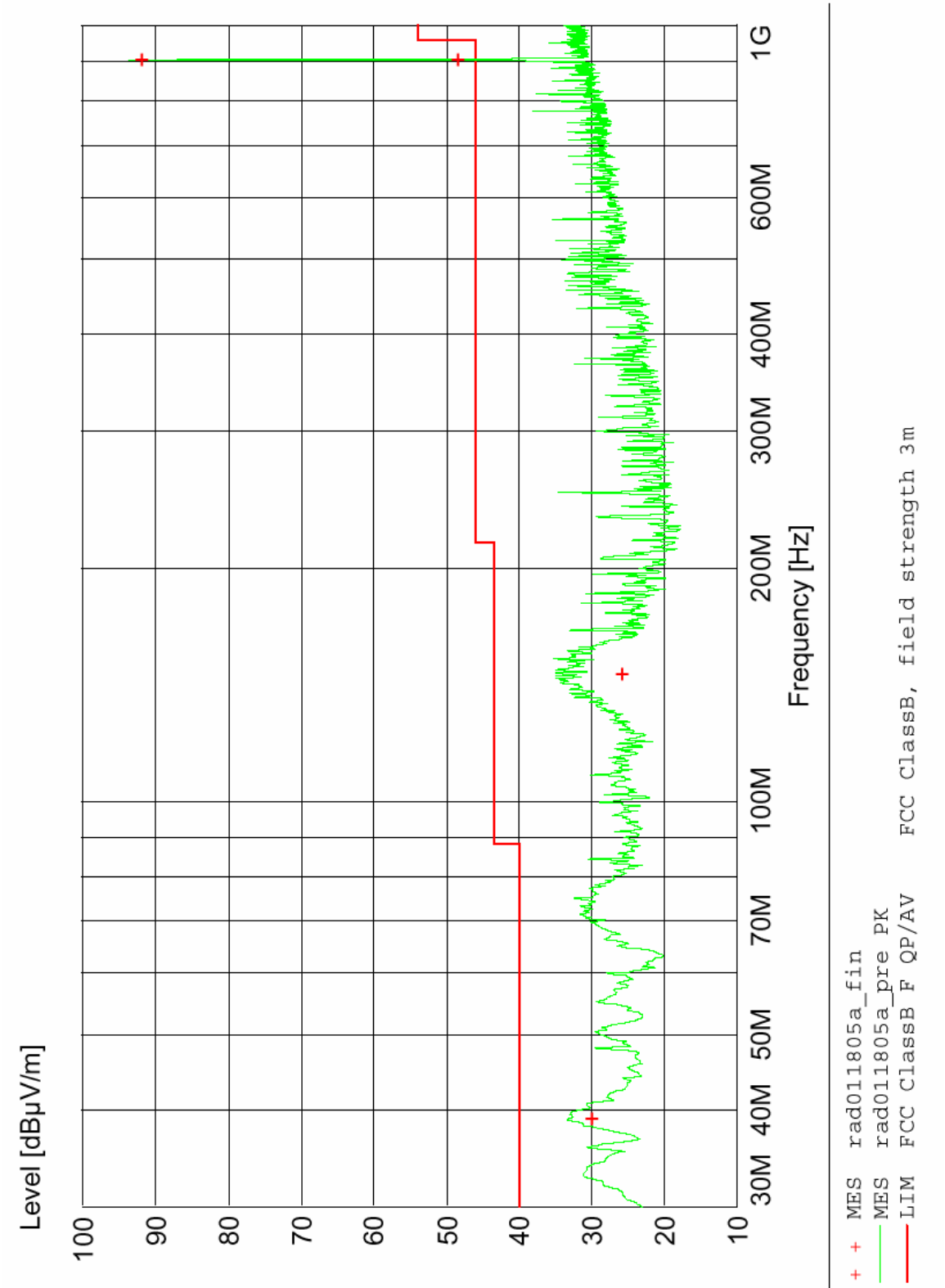


Figure 6 - Radiated Emissions Plot, Channel 1

Table 1 - Channel 1, Quasi- Peak Measurements

Frequency	Level	Limit	Margin	Height	Angle	Pol.
MHz	dBμV/m	dBμV/m	dB	cm	deg	
39.060000	30.03	40.0	10.0	114.0	266	VERT
145.920000	25.90	43.5	17.6	187.0	318	HORI
902.640000	91.96	93.98	2.02	187.0	13	VERT
904.080000	48.43	93.98	45.55	150.0	12	VERT

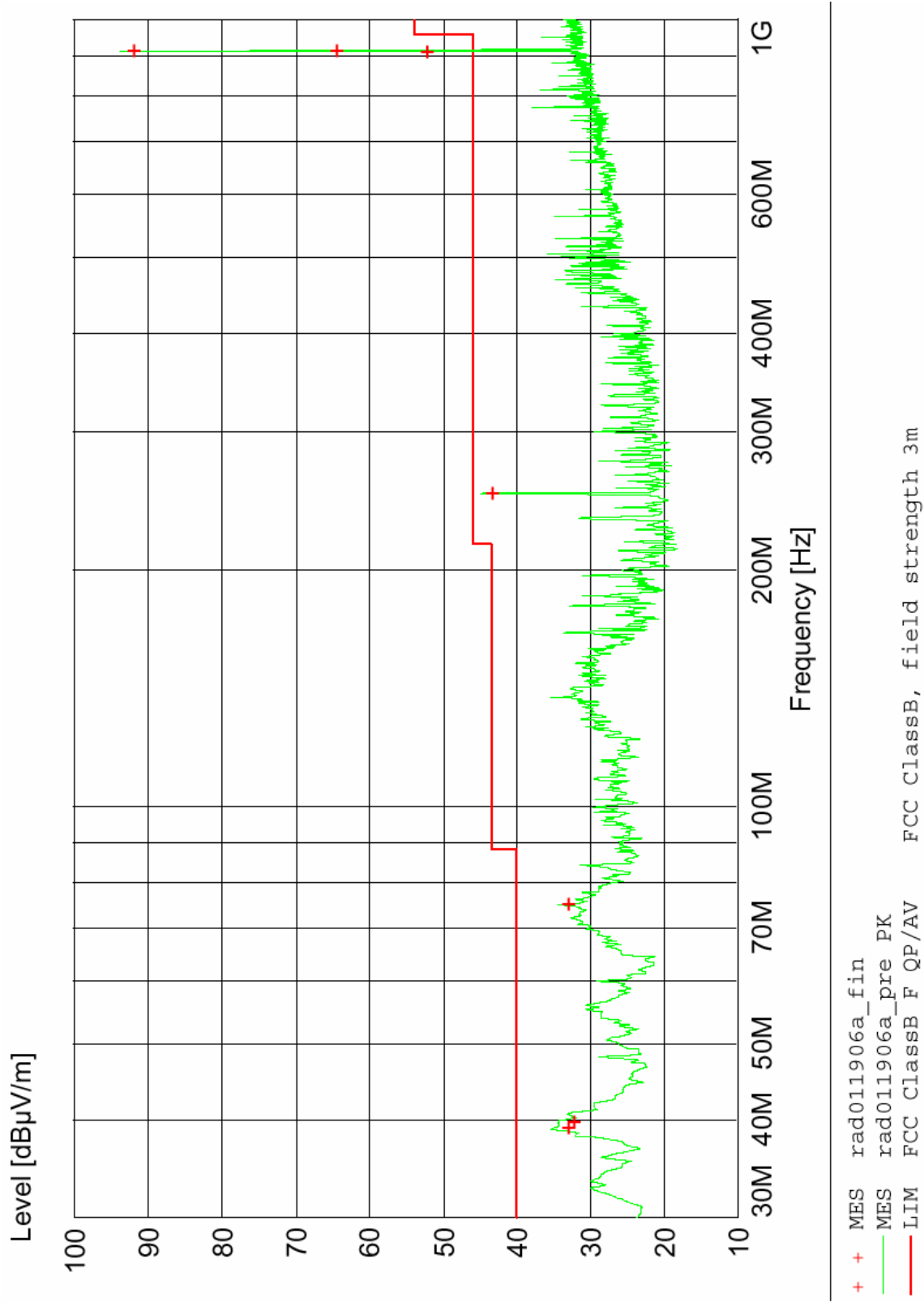


Figure 7 - Radiated Emissions Plot, Channel 42

Table 2 – Channel 42, Quasi- Peak Measurements

Frequency	Level	Limit	Margin	Height	Angle	Pol.
MHz	dBμV/m	dBμV/m	dB	cm	deg	
38.940000	33.03	40.0	7.0	112.0	290	VERT
39.780000	32.18	40.0	7.8	115.0	290	VERT
75.000000	33.02	40.0	7.0	262.0	298	HORI
250.020000	43.37	46.0	2.6	149.0	78	HORI
913.200000	52.24	93.98	41.4	172.0	13	VERT
914.820000	91.98	93.98	2.0	112.0	139	HORI
915.180000	64.35	93.98	29.3	249.0	30	VERT

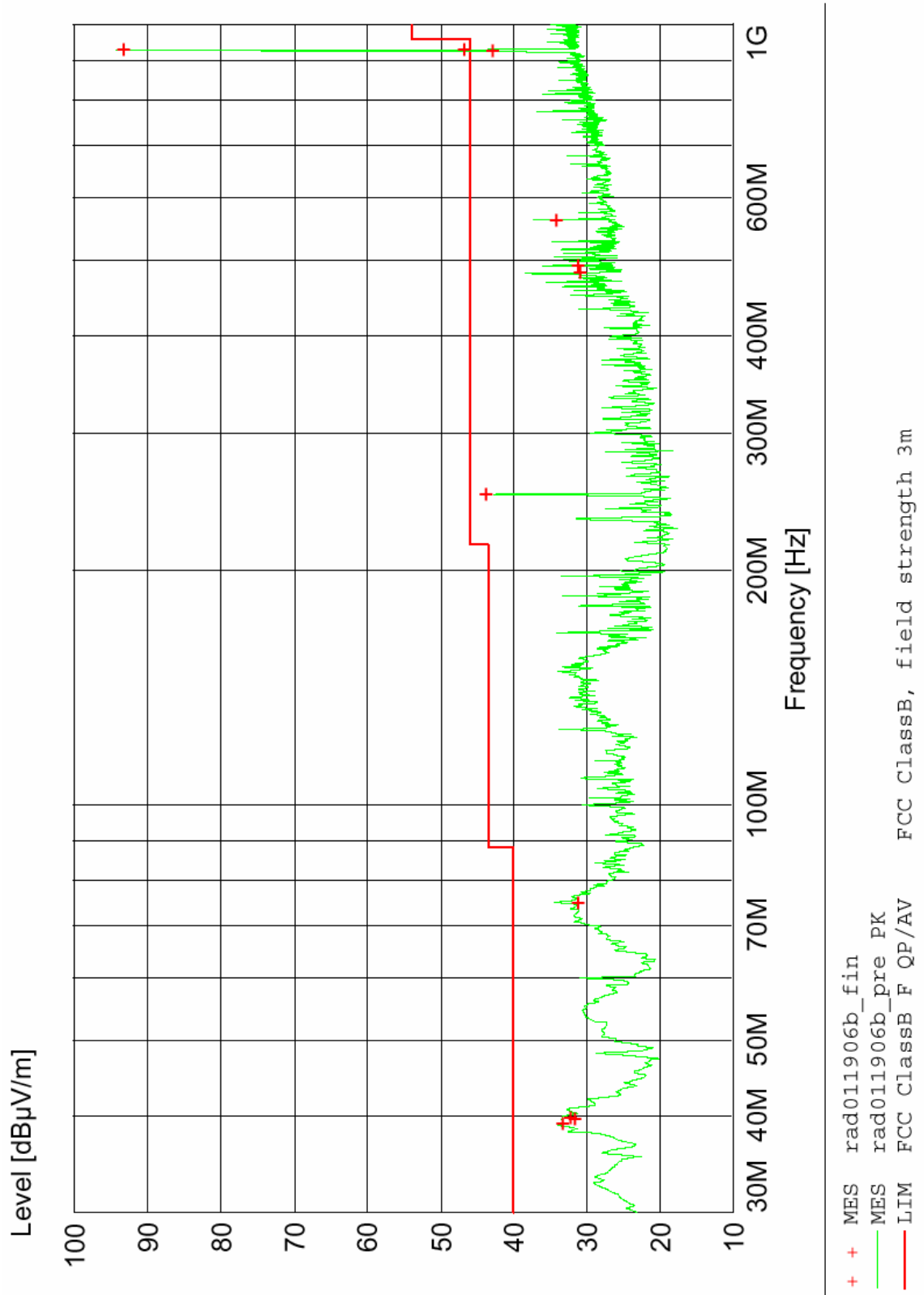


Figure 8 - Radiated Emissions Plot, Channel 83

Table 3 – Channel 83, Quasi- Peak Measurements

Frequency	Level	Limit	Margin	Height	Angle	Pol.
MHz	dBμV/m	dBμV/m	dB	cm	deg	
38.940000	33.26	40.0	6.7	112.0	265	VERT
39.480000	31.78	40.0	8.2	112.0	311	VERT
39.780000	32.26	40.0	7.7	112.0	265	VERT
74.880000	31.26	40.0	8.7	266.0	306	HORI
250.020000	43.78	46.0	2.2	262.0	77	HORI
479.940000	30.91	46.0	15.1	220.0	106	HORI
492.060000	31.33	46.0	14.7	321.0	170	VERT
562.500000	34.25	46.0	11.8	150.0	183	VERT
926.700000	42.85	46.0	3.2	112.0	140	HORI
927.300000	93.38	93.98	0.6	250.0	0	VERT
928.800000	46.80	93.98	47.18	227.0	17	VERT

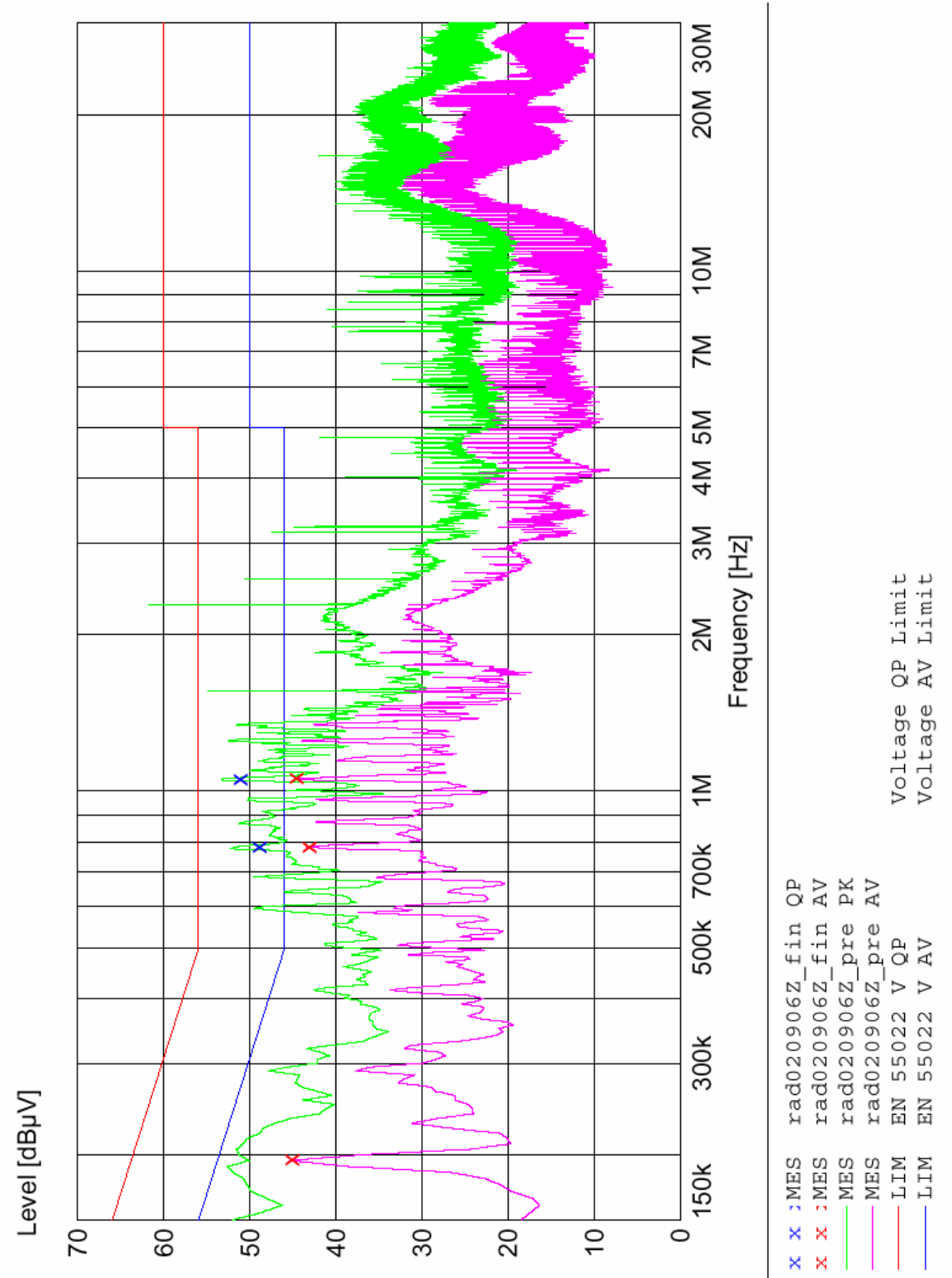


Figure 9 - Conducted Emissions plot, EUT Not Present

**Table 4- Conducted Emissions Measurements
Quasi-Peak Measurements, EUT Not Present**

Frequency	Level	Limit	Margin	Line	PE
MHz	dBμV	dBμV	dB		
0.780000	49.10	56	6.9	N	FLO
1.050000	51.30	56	4.7	L1	GND

**Table 5- Conducted Emissions Measurements
Average Measurements, EUT Not Present**

Frequency	Level	Limit	Margin	Line	PE
MHz	dBμV	dBμV	dB		
0.195000	45.30	54	8.5	L1	FLO
0.780000	43.30	46	2.7	N	GND
1.055000	44.80	46	1.2	N	GND

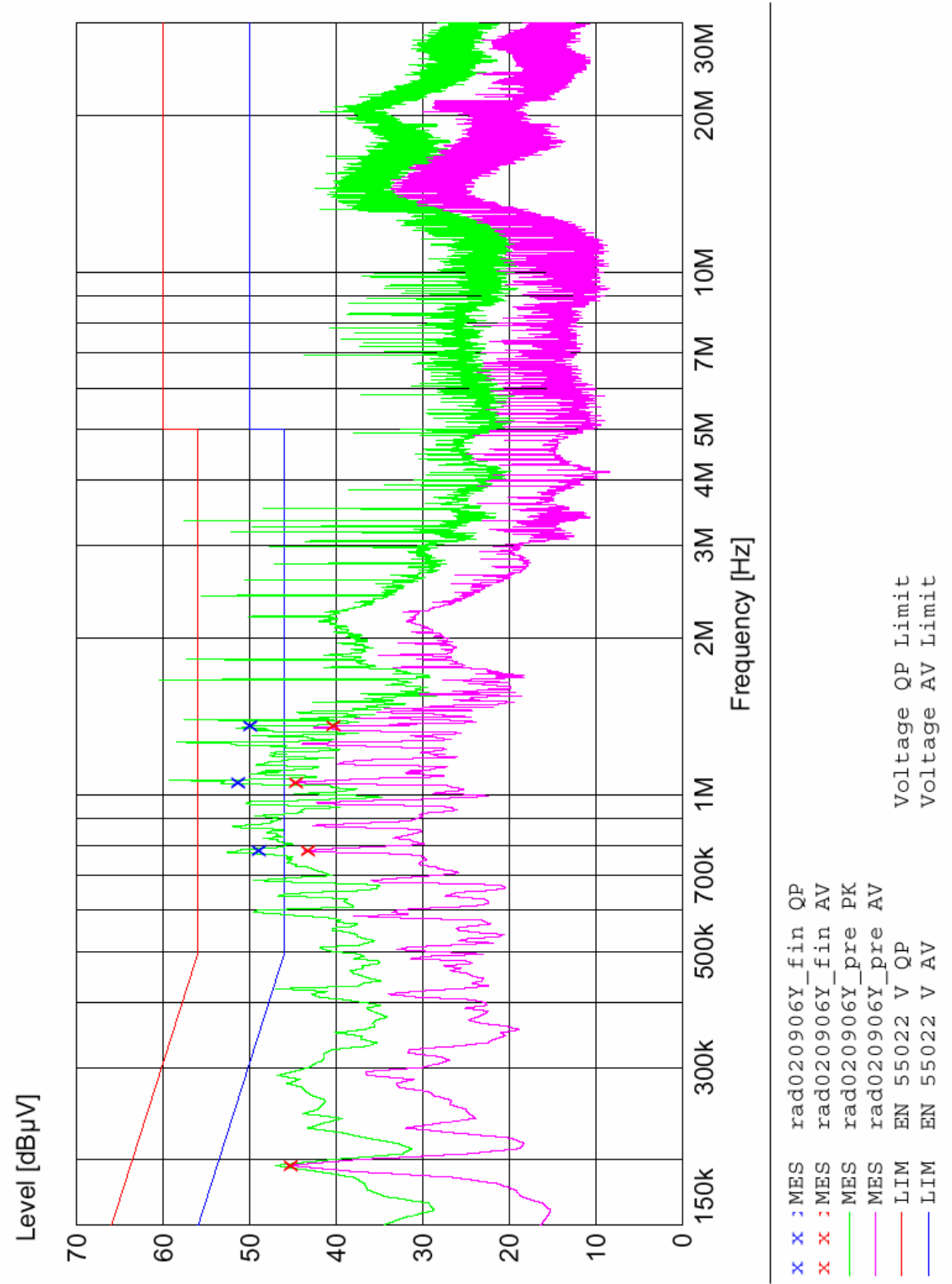


Figure 10 - Conducted Emissions plot, EUT Present

**Table 6- Conducted Emissions Measurements
Quasi-Peak Measurements, EUT Present**

Frequency	Level	Limit	Margin	Line	PE
MHz	dBμV	dBμV	dB		
0.780000	49.20	56	6.8	L1	GND
1.050000	51.60	56	4.4	L1	FLO
1.350000	50.20	56	5.8	N	GND

**Table 7- Conducted Emissions Measurements
Average Measurements, EUT Present**

Frequency	Level	Limit	Margin	Line	PE
MHz	dBμV	dBμV	dB		
0.195000	45.50	54	8.3	L1	GND
0.780000	43.50	46	2.5	N	FLO
1.055000	44.90	46	1.1	L1	FLO
1.350000	40.60	46	5.4	L1	FLO

Appendix C: Harmonics Measurements

Table 8- Radiated Emissions Measurements
Channel 1, LP-mode, 0dBm setting, 1 MHz RBW, 5 Sec. Measurement Time

Frequency	Level	Limit	Margin	Height	Angle	Pol.	Detector
MHz	dBμV/m	dBμV/m	dB	cm	deg		
1804.5	41.66	53.9	12.2	117	139	HORI	Average
2707	44.97	53.9	8.9	128	339	HORI	Average
2791	45.29	53.9	8.6	99	204	VERT	Average
2796	38.19	53.9	15.7	104	0	HORI	Average
2797.5	30.58	53.9	23.3	101	352	HORI	Average
2846	38.97	53.9	14.9	158	9	VERT	Average
1804.5	49.35	73.9	24.6	117	139	HORI	Peak
2707	54.78	73.9	19.1	128	339	HORI	Peak
2791	49.94	73.9	24	99	204	VERT	Peak
2796	57.45	73.9	16.5	104	0	HORI	Peak
2797.5	56.25	73.9	17.7	101	352	HORI	Peak
2846	41.9	73.9	32	158	9	VERT	Peak

Table 9 - Radiated Emissions Measurements
Channel 42, LP-mode, 0dBm setting, 1 MHz RBW, 5 Sec. Measurement Time

Frequency	Level	Limit	Margin	Height	Angle	Pol.	Detector
MHz	dBμV/m	dBμV/m	dB	cm	deg		
1830	53.68	53.9	0.2	99	141	HORI	Average
2743.5	49.69	53.9	4.2	101	132	HORI	Average
2796.5	25.29	53.9	28.6	150	0	VERT	Average
1830	57.14	73.9	16.8	99	141	HORI	Peak
2743.5	61.31	73.9	12.6	101	132	HORI	Peak
2796.5	56.68	73.9	17.2	150	0	VERT	Peak

Table 10 - Radiated Emissions Measurements
Channel 83, LP-mode, 0dBm setting, 1 MHz RBW, 5 Sec. Measurement Time

Frequency	Level	Limit	Margin	Height	Angle	Pol.	Detector
MHz	dBμV/m	dBμV/m	dB	cm	deg		
1854.5	43.89	53.9	10	99	139	HORI	Average
1856.5	35.67	53.9	18.2	101	133	HORI	Average
2779	35.31	53.9	18.6	98	139	HORI	Average
2780.5	50.85	53.9	3	199	0	VERT	Average
2781.5	49.31	53.9	4.6	101	139	HORI	Average
2797.5	42.07	53.9	11.8	159	53	VERT	Average
2827	42.27	53.9	11.6	117	348	HORI	Average
2851	39.82	53.9	14.1	106	355	HORI	Average
1854.5	59.52	73.9	14.4	99	139	HORI	Peak
1856.5	50.86	73.9	23	101	133	HORI	Peak
2779	51.16	73.9	22.7	98	139	HORI	Peak
2780.5	60.07	73.9	13.8	199	0	VERT	Peak
2781.5	53.24	73.9	20.7	101	139	HORI	Peak
2797.5	50.18	73.9	23.7	159	53	VERT	Peak
2827	39.93	73.9	34	117	348	HORI	Peak
2851	46.81	73.9	27.1	106	355	HORI	Peak

Appendix D: Bandedge data

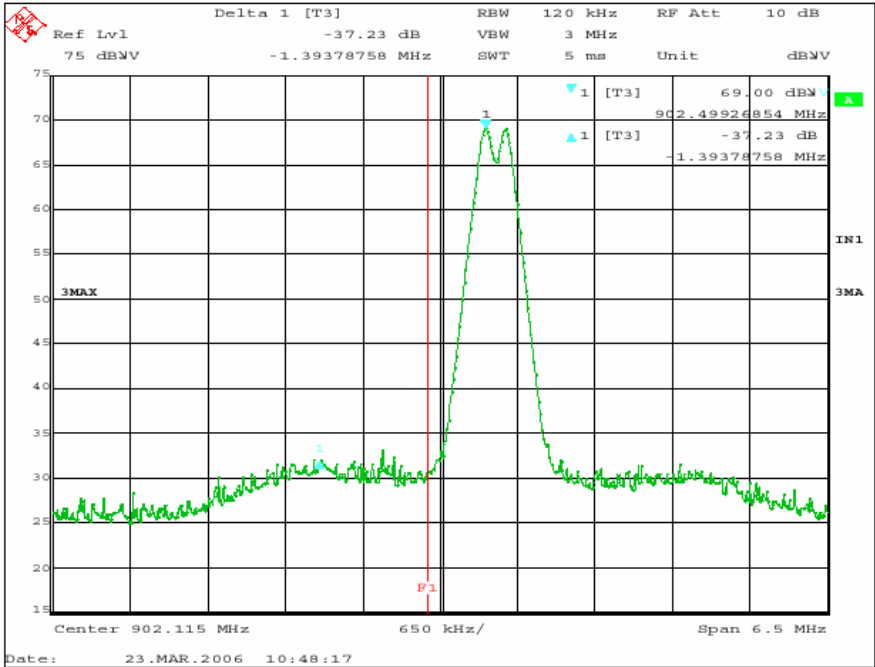


Figure 11 - 902MHz Bandedge, Peak Measurement, 120kHz RBW

Vertical red line is 902MHz bandedge, fundamental is 37.23dB above the highest emission outside of the band (54.73dBuV/m, corrected from Table1).

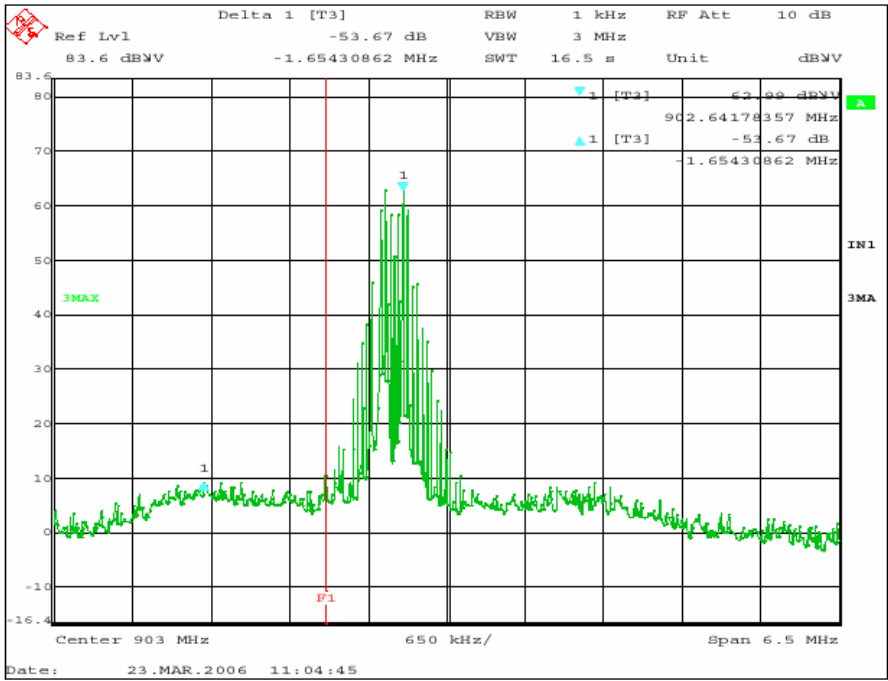


Figure 12 - 902MHz Bandedge, Peak Measurement, 1kHz RBW

Vertical red line is 902MHz bandedge, fundamental is 53.67 dB above the highest emission outside of the band (38.29dBuV/m, corrected from Table 1). Correcting for BW would add 6dB thus the highest out of band emission would be 44.29dBuV/m, corrected.

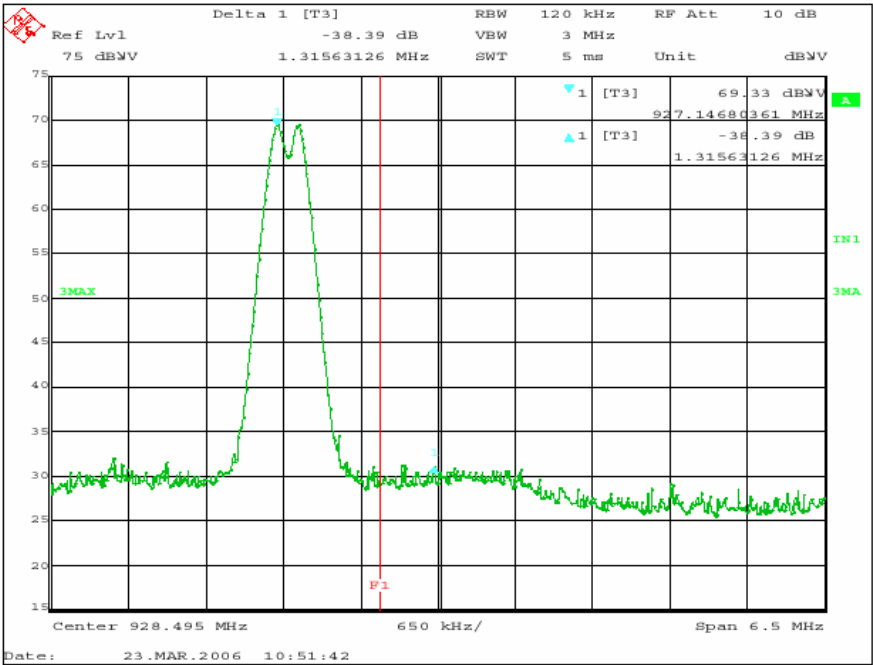


Figure 13 - 928MHz Bandedge, Peak Measurement, 120kHz RBW

Vertical red line is 928MHz bandedge, fundamental is 38.39dB above the highest emission outside of the band (54.99, corrected from Table 3).

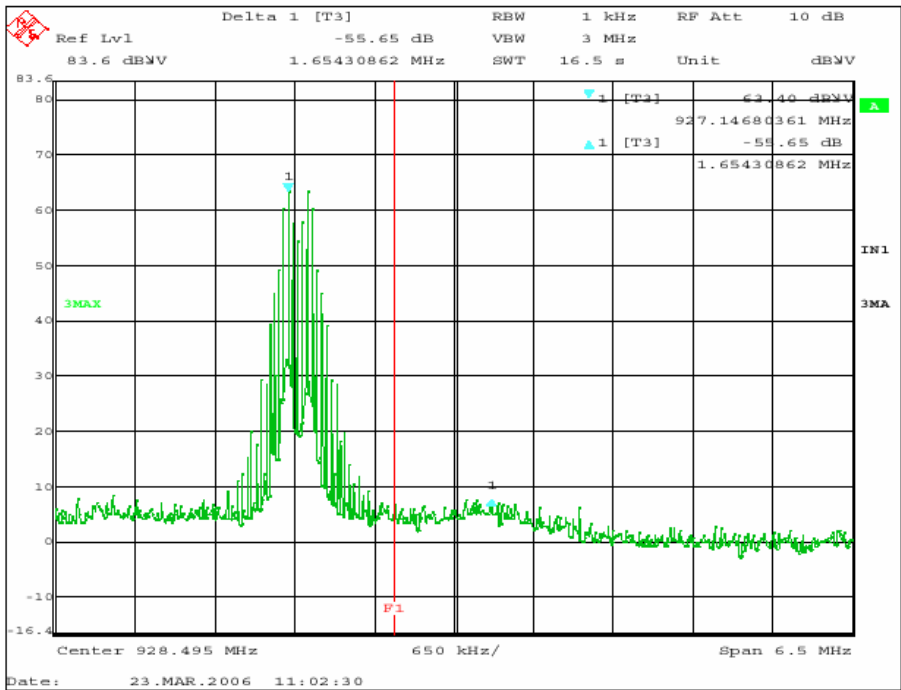


Figure 14 - 928MHz Bandedge, Peak Measurement, 1kHz RBW

Vertical red line is 928MHz bandedge, fundamental is 55.65dB above the highest emission outside of the band (37.73dBuV/m, corrected from Table 3). Correcting for BW would add 6dB thus the highest out of band emission would be 43.73dBuV/m, corrected

Appendix E: Sample Calculation

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF - (-CF + AG) + AV$$

where FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

AG = Amplifier Gain

AV = Averaging Factor (if applicable)

Assume a receiver reading of 55 dB μ V is obtained. The Antenna Factor of 12 and a Cable Factor of 1.1 is added. The Amplifier Gain of 20 dB is subtracted, giving a field strength of 48.1 dB μ V/m.

$$FS = 55 + 12 - (-1.1 + 20) + 0 = 48.1 \text{ dB}\mu\text{V/m}$$

The 48.1 dB μ V/m value can be mathematically converted to its corresponding level in μ V/m.

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm} [(48.1 \text{ dB}\mu\text{V/m})/20] = 254.1 \mu\text{V/m}$$

AV is calculated by the taking the $20 \cdot \log(T_{\text{on}}/100)$ where T_{on} is the maximum transmission time in any 100ms window.

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