FCC CFR47 PART 15 SUBPART C

CERTIFICATION TEST REPORT

FOR

KCF DTS TRANCEIVER

MODEL NUMBER: VSN-1

FCC ID: Z5IVSN1

REPORT NUMBER: 11CA62504

ISSUE DATE: MARCH 31, 2012

Prepared for
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NVLAP LAB CODE 200246

Revision History

Rev.	Issue Date	Revisions	Revised By
--	3/31/12	Initial Issue	Jim Marley

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	KCF TECHNOLOGIES 333 S. FRASER ST. STATE COLLEGE, PA 16801, U.S.A.
EUT DESCRIPTION:	15.247 Transceiver (2.4-2.4835 GHz)
MODEL:	VSN-1
SERIAL NUMBER:	Sample #S11LB153
DATE TESTED:	November 1-11, 2011

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Pass

Compliance Certification Services (UL CCS) tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL CCS based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL CCS will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For UL By:

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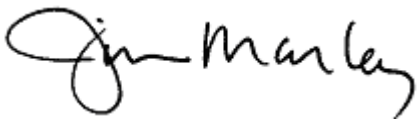
Tested By:



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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4:2003, FCC CFR 47 Part 2, FCC CFR 47 Part 15.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 12 Laboratory Drive, Research Triangle Park, NC USA.

UL is accredited by NVLAP, Laboratory Code 200246-0. The full scope of accreditation can be viewed at http://www.nist.gov/nvlap.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	± 2.5 dB
Radiated Disturbance, 30 to 1000 MHz	± 3.4 dB

Uncertainty figures are valid to a confidence level of 95%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a FCC Part 15.247 DTS device. Device utilizes a reverse SMA connector type to satisfy the unique antenna connector requirement. Device is DC powered and may be powered by batteries or DC voltage via laptop USB interface. Fresh batteries were installed prior to test.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

2400 to 2483.5 Authorized Band

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2422 - 2462	Normal	+15.85 dBm	38.46

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a monopole antenna with a maximum gain as table below;

Frequency Range (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)
2422 to 2462	2.0	1.58

5.4. SOFTWARE AND FIRMWARE

The EUT was tested with the firmware installed in the device as provided by the manufacturer. Test utility software for the laptop was provided to enable the operating channel to be changed as necessary during the test.

5.5. WORST-CASE CONFIGURATION AND MODE

The EUT was tested as an external module. EUT is attached to a laptop computer via USB port.

Only one data rate, modulation type is planned for this device.

For Radiated Spurious Emissions, the worst-case arrangement is determined by testing the EUT in each of three orthogonal axes (flat, side, upright). This arrangement is used for testing low and high channels.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

This product is tested connected to a laptop computer.

I/O CABLES

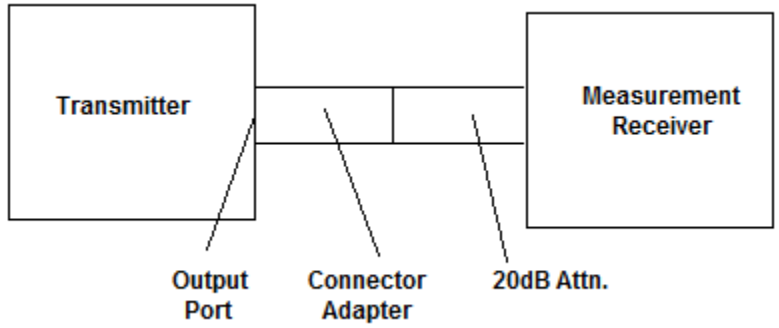
Mini-USB cable.

TEST SETUP

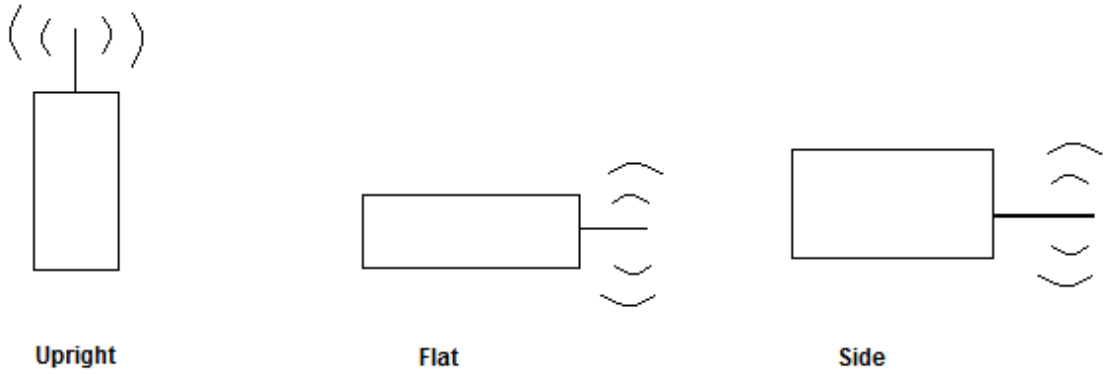
The EUT and support laptop are arranged as shown in the setup photos. For Antenna port tests, the antenna is removed and connected directly to the spectrum analyzer as shown in the setup diagram.

SETUP DIAGRAM FOR TESTS

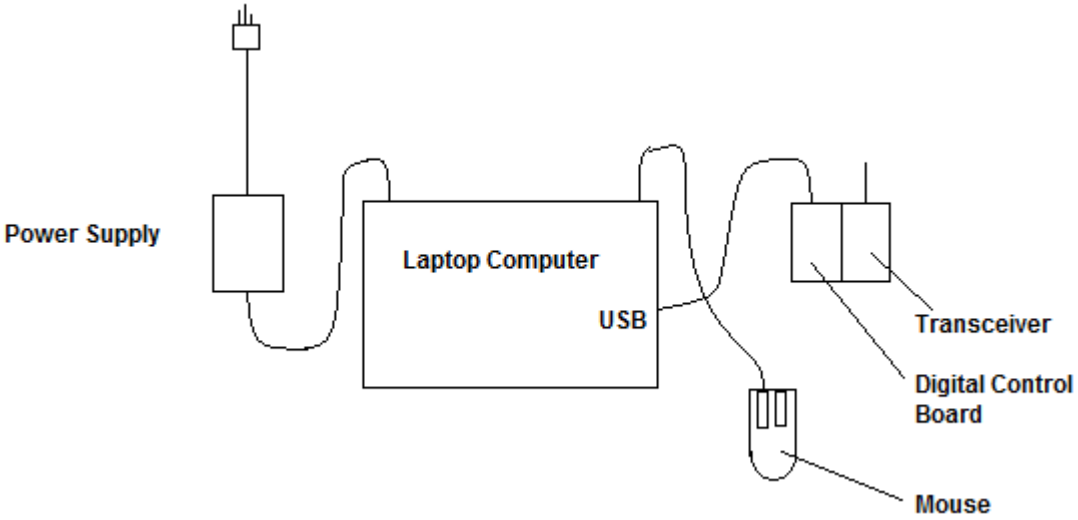
CONDUCTED PORT TESTS



RADIATED SPURIOUS ORIENTATIONS



UNINTENTIONAL RADIATED AND CONDUCTED EMISSIONS



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Radiated Emissions/Radiated Spurious

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	30-1000 MHz Range				
AT0021	Biconical Antenna, 30 to 300 MHz	Schaffner-Chase EMC Ltd.	VBA6106A	2011-05-31	2012-05-31
AT0030	Log-periodic Antenna, 200 MHz to 1000 MHz	Schaffner	UPA6109	2011-06-03	2012-06-30
	1-18 GHz				
AT0026	Horn Antenna 1 to 18 GHz	EMC Test Systems	3115	2011-02-03	2012-02-29
	18-25 GHz				
AT0053	Antenna	ARA	SWH-28 (S/N 1004)	2011-08-08	2012-08-31
	Amplifier (S/Ns 859993, 860112, 859864)	Miteq	JSD42-1800400-30-5A	2011-08-08	2012-08-31
	Cable (S/N 204158-001)	Micro-coax	UFA147A-0-1181-200200	2011-08-08	2012-08-31
	Cables and Pre-Amps				
SAC_C (Biconical 3m location)	(1) ATA084: Attenuator (2) ATA061: Amplifier (3) ATA167: Cable (4) ATA221: Cable (5) ATA229: DC Bias Tee (6) ATA199: Cable	(1) Pasternack (2) Miteq (3) Eupen (4) Micro-Coax (5) Miteq (6) Micro-Coax	(1) PE7002-6 (2) AM-3A-000110-N (3) CMS/RG 214 (4) UFA210A-0-6000-50U-50U (5) BT2000-C (6) UFB293C-0-0720-5GU50U)	2011-08-31	2012-08-31
SAC_D (Log-Periodic 3m location)	(1) ATA085: Attenuator (2) ATA110: Amplifier (3) ATA225: Cable (4) ATA189: Cable (5) ATA115: DC Bias Tee (6) ATA198: Cable	(1) Pasternack (2) Miteq (3) Eupen (4) UL (5) Miteq (6) Micro-Coax	(1) PE7002-6 (2) AM-3A-000110-N (3) CMS/RG 214 (4) RG-214 (5) AM-1523-7687 (6) UFB293C-0-0720-5GU50U	2011-08-31	2012-08-31
SAC_E_HORN (1-18 GHz)	(1) ATA144: Amplifier (2) CBL005: Cable (3) CBL002: Cable (4) ATA199: Cable	(1) Miteq (2) MegaPhase (3) MegaPhase (4) Micro-Coax	(1) AFS42-00101800-25-N-42MF (2) GC29-NKNK-264 (3) EM18-NKNK-600 (4) UFB293C-0-0720-5GU50U	2011-09-14	2012-09-30
	Receiver & Software				
SAR003	Spectrum Analyzer / Receiver	Rohde & Schwarz	1088.7490K40	2011-08-03	2012-08-31
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	Additional Equipment				
S/N-090	Band-Stop Filter	Micro-Tronics	BRM50702 S/N-090	2011-08-03	2012-08-31
-	10dB Attenuator (Qty 2)	-	N-male to N-female	*(Note 1)*	*(Note 1)*

Note 1: Attenuator loss confirmed prior to measurements.

Conducted Power / Conducted Spurious Emissions - Voltage

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	Conducted Power / Spurious				
SA0015	EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESCI 7	2011-02-14	2012-02-29
-	Attenuators, 50-ohm,10dB	Pasternack	N-Male to N-Female	2011-08-31	2012-08-31

Conducted Disturbance Emissions - Voltage

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	Equipment – Ground Plane E				
SA0015	EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESCI 7	2011-02-14	2012-02-29
ATA016	Coaxial cable, 20 ft., BNC -male to BNC-male	UL	RG-223	2011-08-31	2012-08-31
HI0069	Temp/Humid/Pressure Meter	Cole-Parmer	99760-00	2011-06-16	2012-06-30
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
	Transient Limiter		)		
ATA508	Transient Limiter, 0.009 to 100 MHz	Electro-Metrics	EM 7600	2011-08-31	2012-08-31
	LISNs				
ATA027	LISN, 50-ohm/50-uH, 25A	Solar Electronics	9629-50-TS-25-BNC	2011-08-31	2012-08-31
ATA028	LISN, 50-ohm/50-uH, 25A	Solar Electronics	9629-50-TS-25-BNC	2011-08-31	2012-08-31

7. ANTENNA PORT TEST RESULTS

7.1. DTS EMISSIONS IN THE 2.4 GHz BAND

7.1.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

The minimum 6 dB bandwidth shall be at least 500 kHz.

TEST PROCEDURE

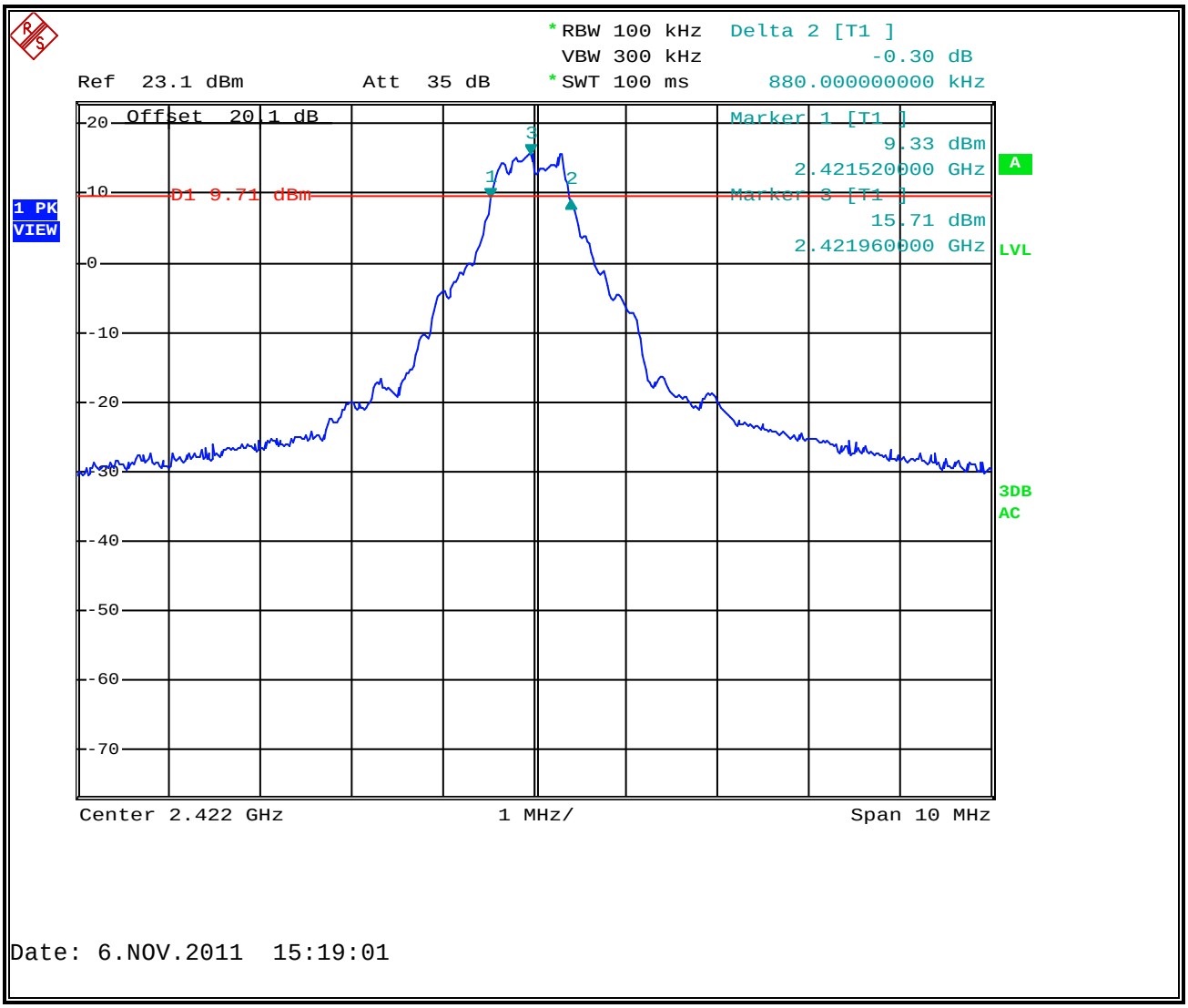
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

RESULTS

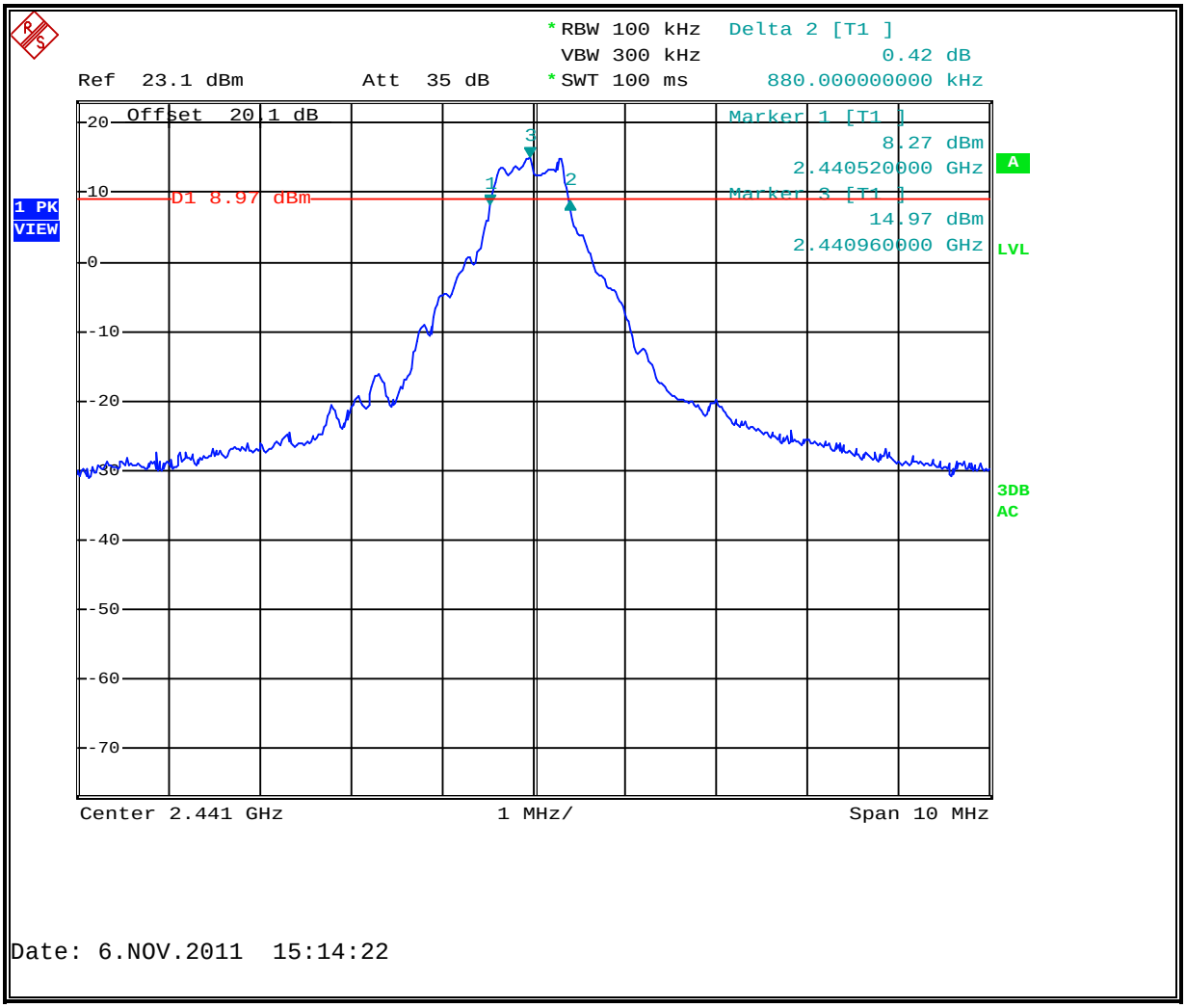
Channel	Frequency (MHz)	6 dB Bandwidth (kHz)	Minimum Limit (kHz)
Low	2422	880	500
Middle	2441	880	500
High	2462	880	500

6 dB BANDWIDTH

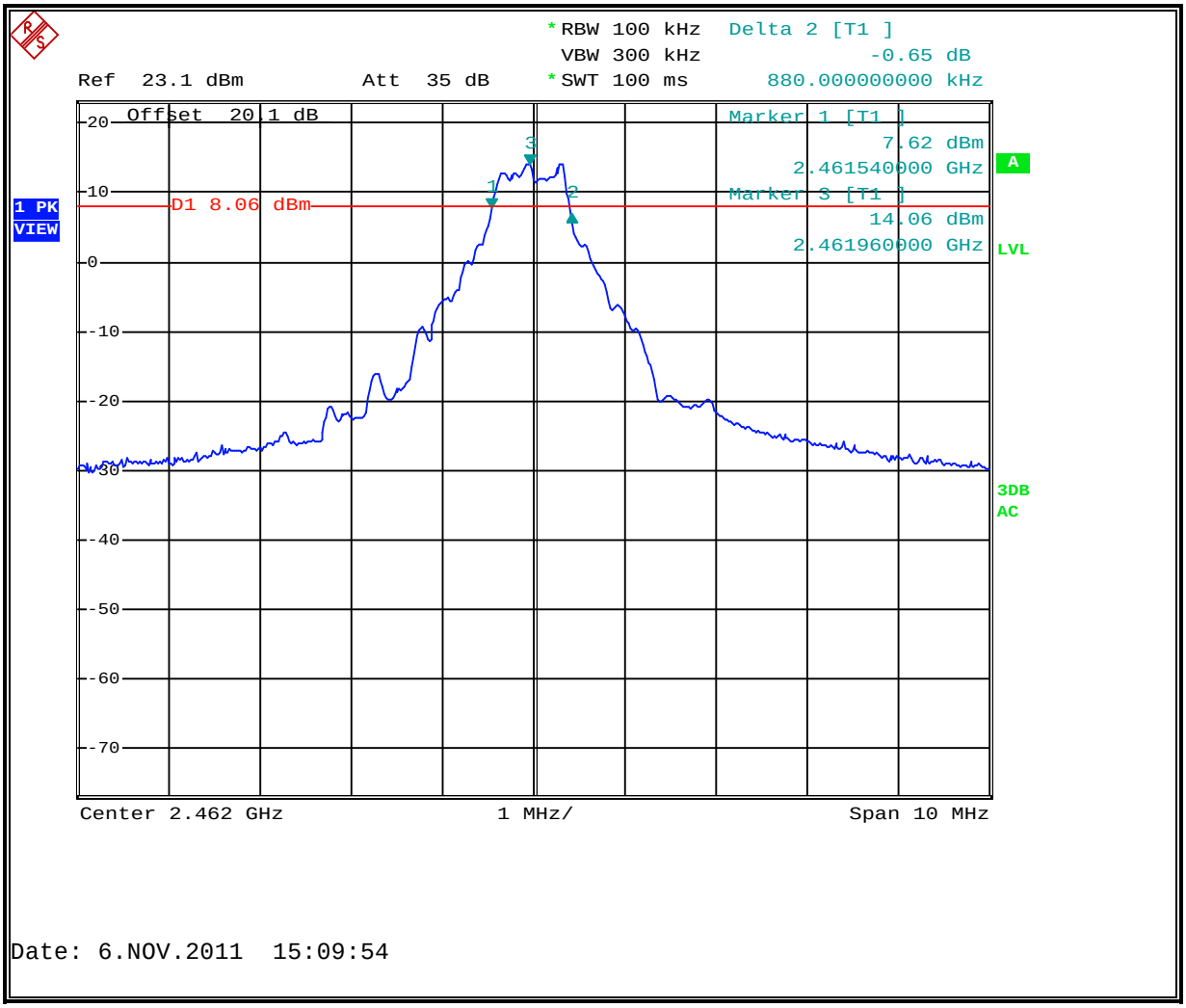
6 dB BANDWIDTH LOW



6 dB BANDWIDTH MID



6 dB BANDWIDTH HIGH



7.1.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99% bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

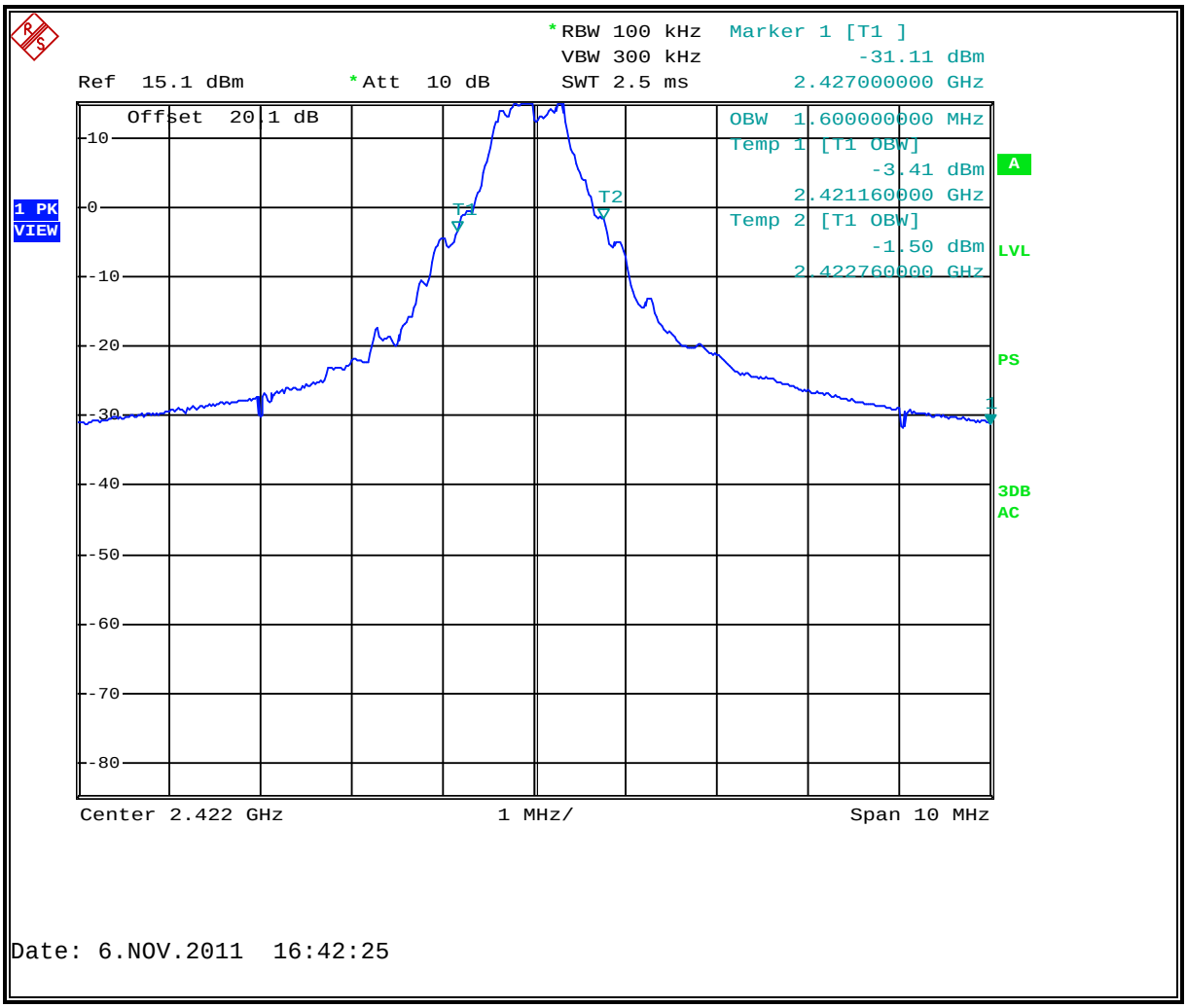
RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2422	1.60
Middle	2441	1.66
High	2462	1.66

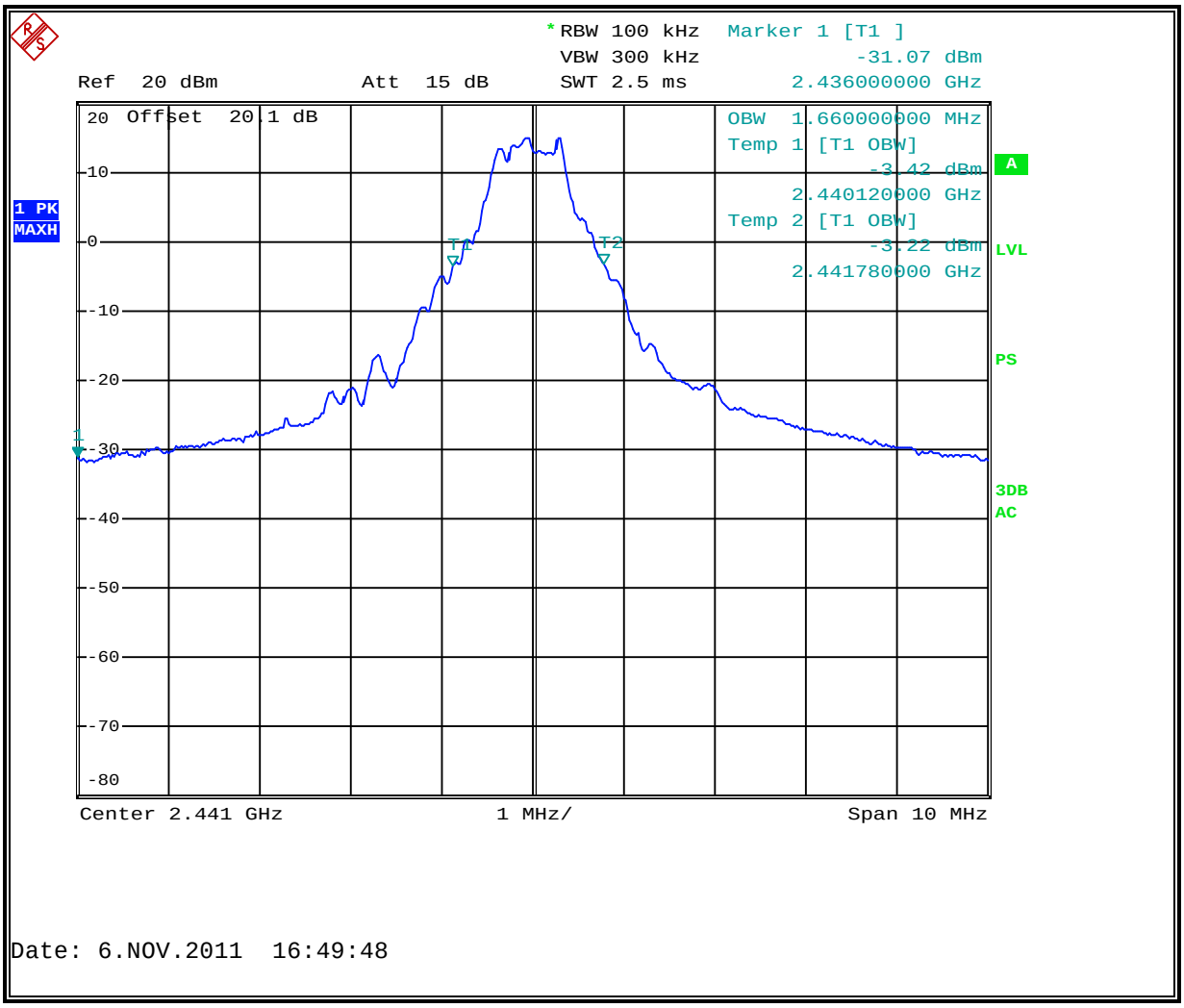
From above measurement Dmissions Designator is 1M66F1D.

99% BANDWIDTH

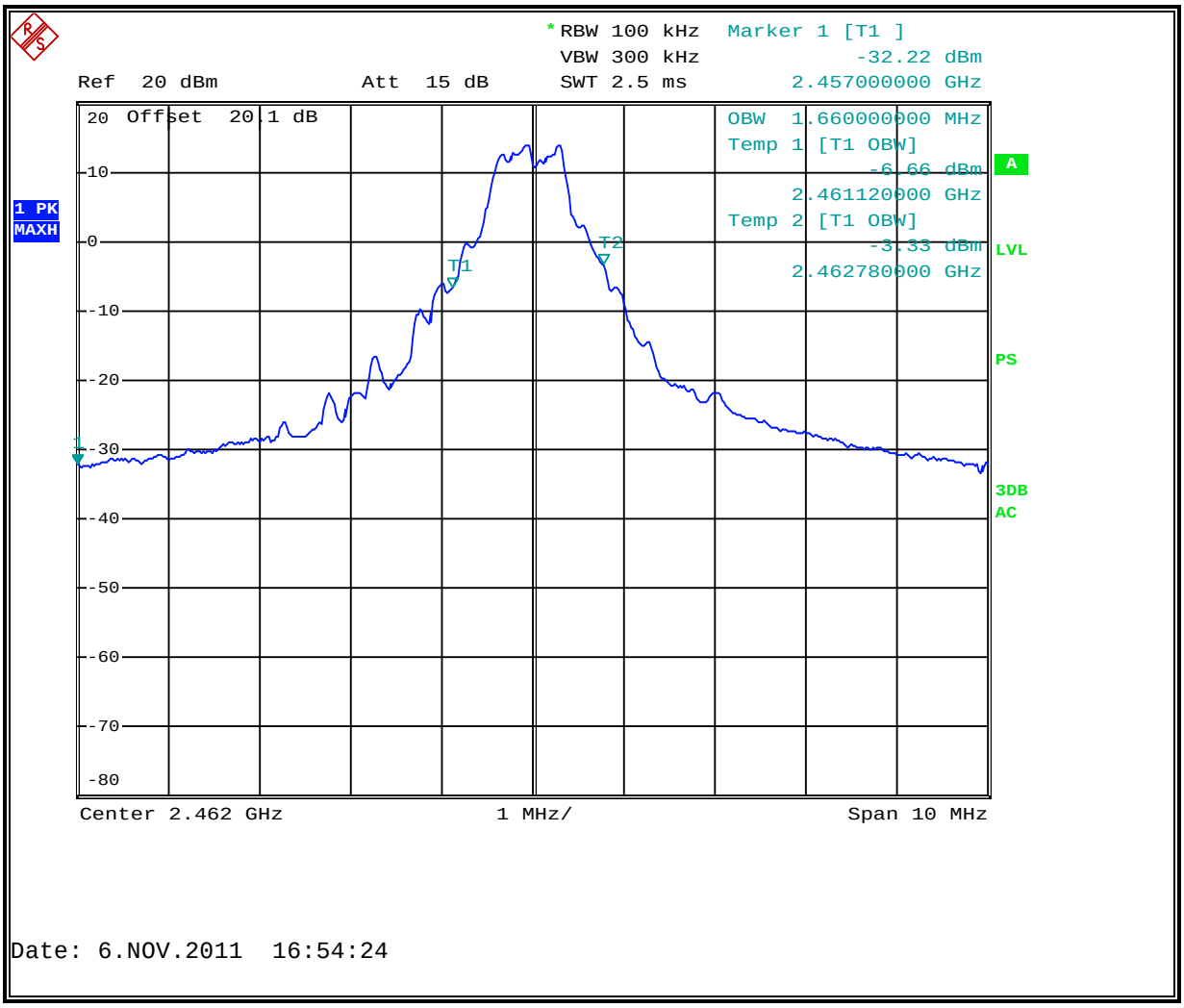
99% BANDWIDTH LOW CH



99% BANDWIDTH MID CH



99% BANDWIDTH HIGH CH



7.1.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

The maximum antenna gain is 2.0 dB (less than or equal to 6 dBi), therefore the limit is 30 dBm.

TEST PROCEDURE

Peak output power was measured using Power Output Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

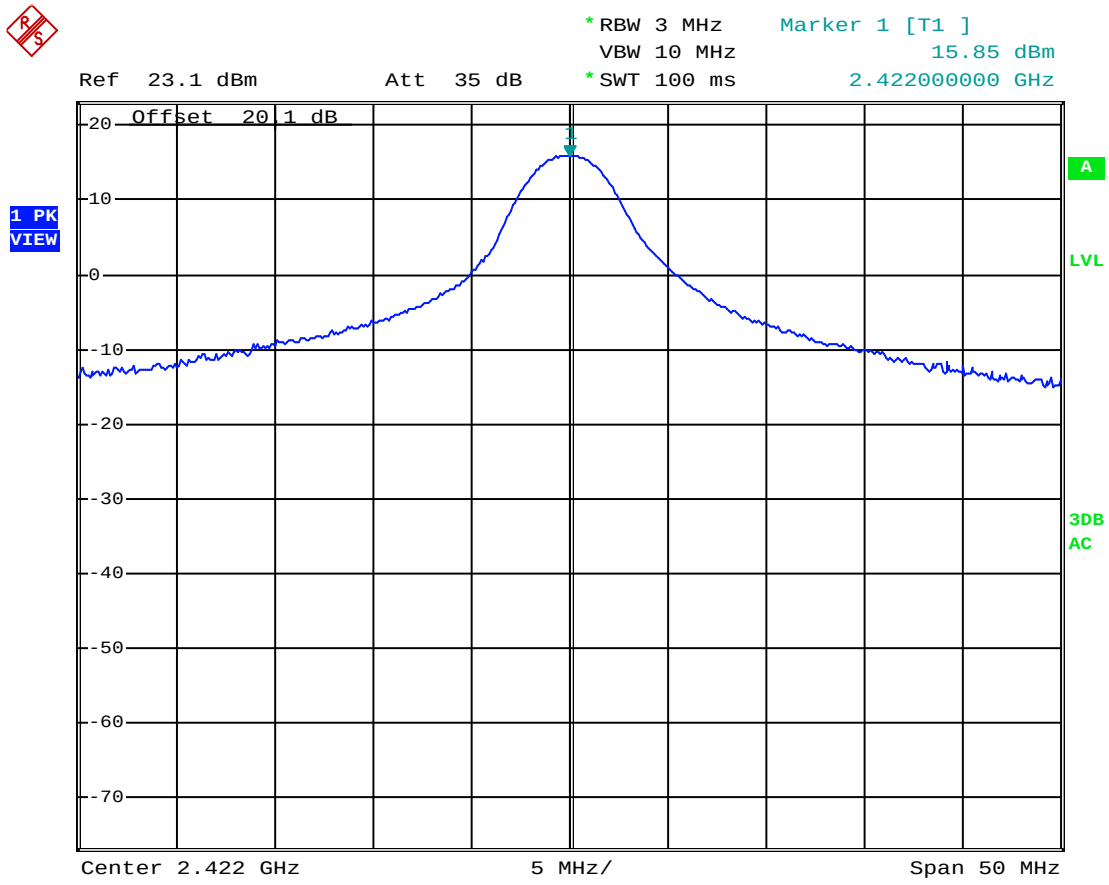
RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2422	15.85	30	14.15
Middle	2441	15.27	30	14.73
High	2462	14.33	30	15.67

Note: Above reading includes 20.1 dB offset for Attenuator and connectors.

OUTPUT POWER

OUTPUT POWER LOW CH



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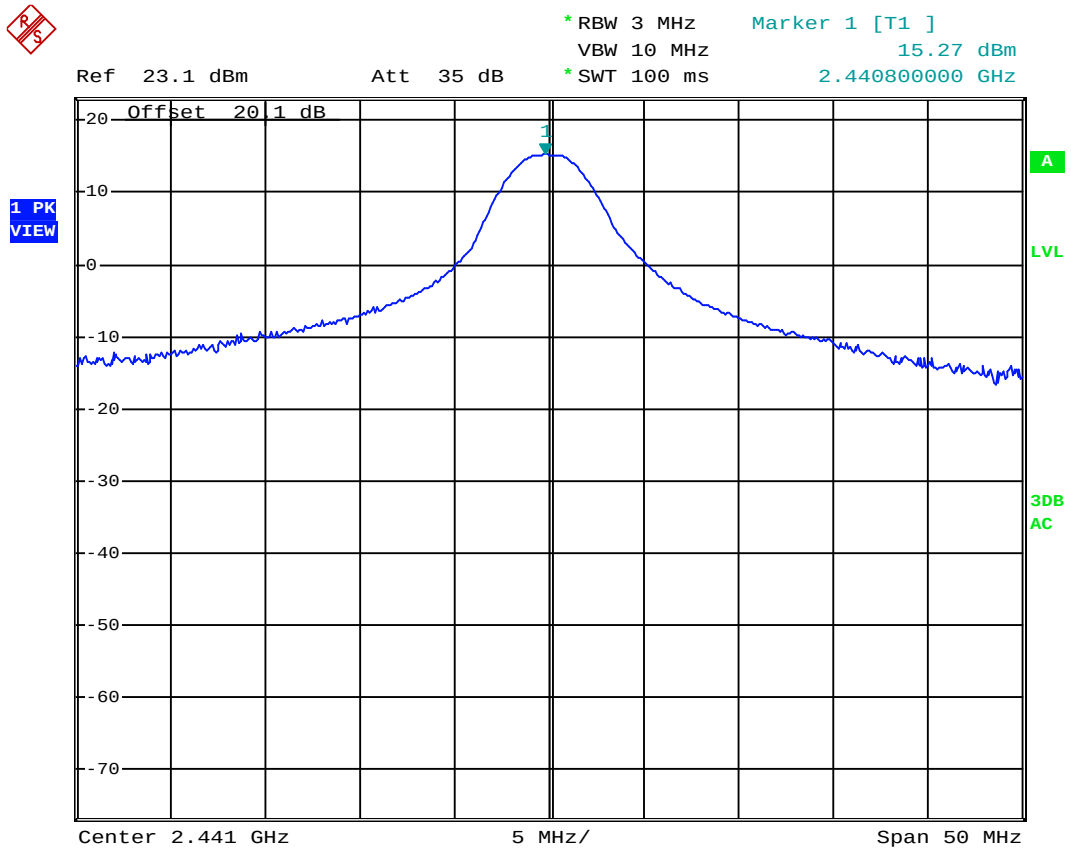
OUTPUT POWER MID CH



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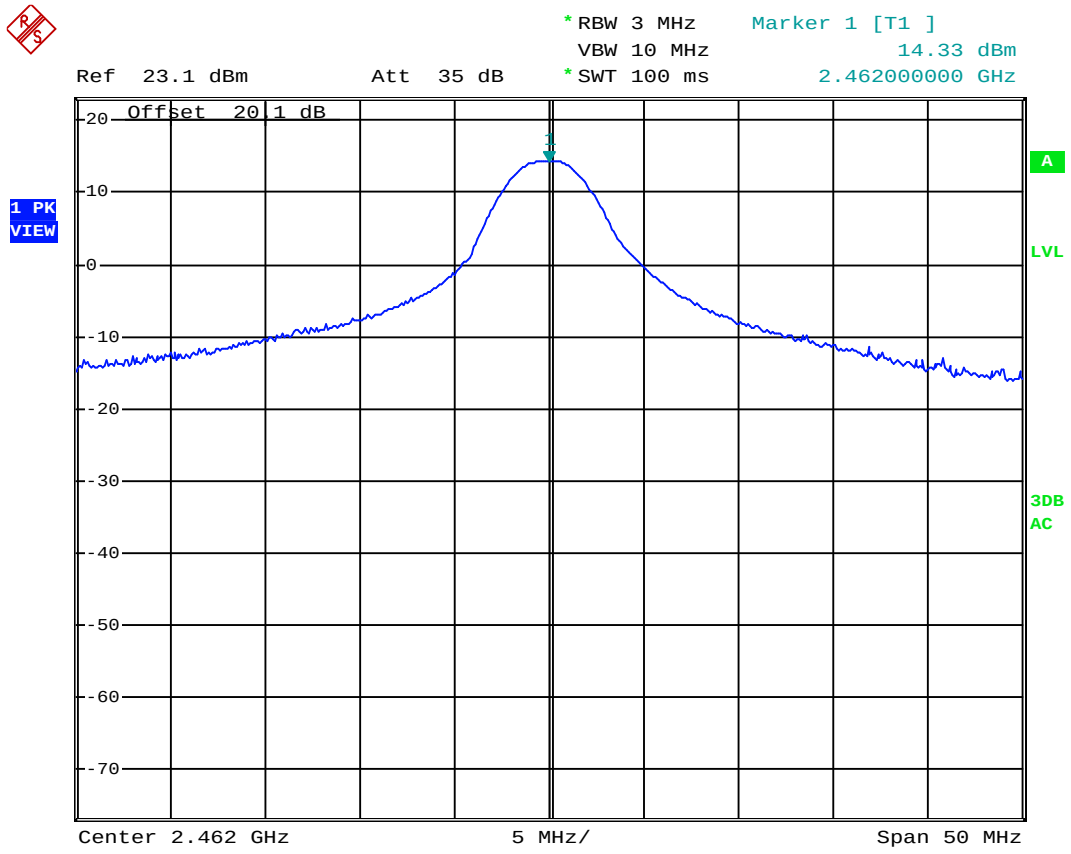
OUTPUT POWER HIGH CH



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7.1.4. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

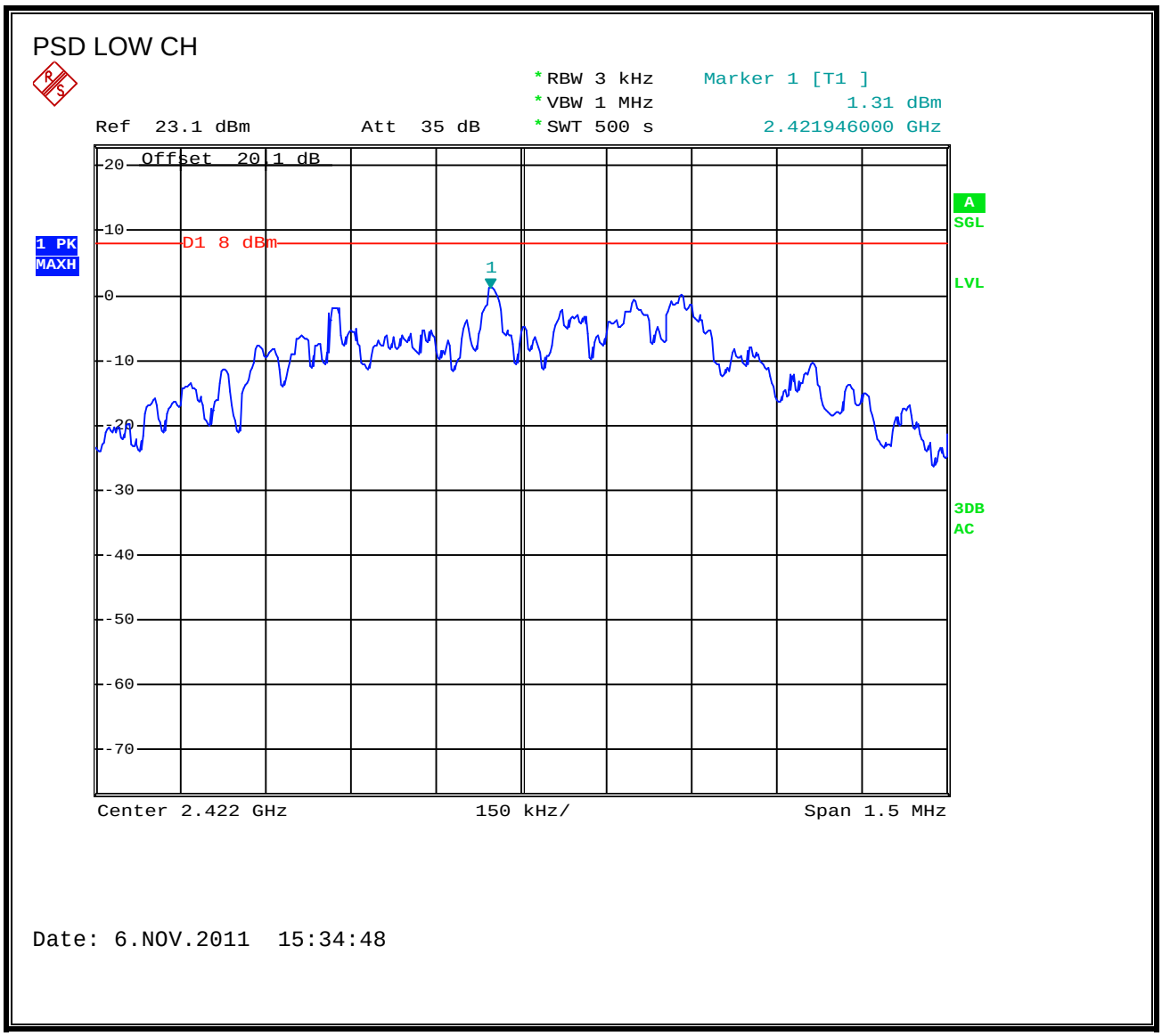
TEST PROCEDURE

Peak output power was measured, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document “Measurement of Digital Transmission Systems Operating under Section 15.247”, March 23, 2005.

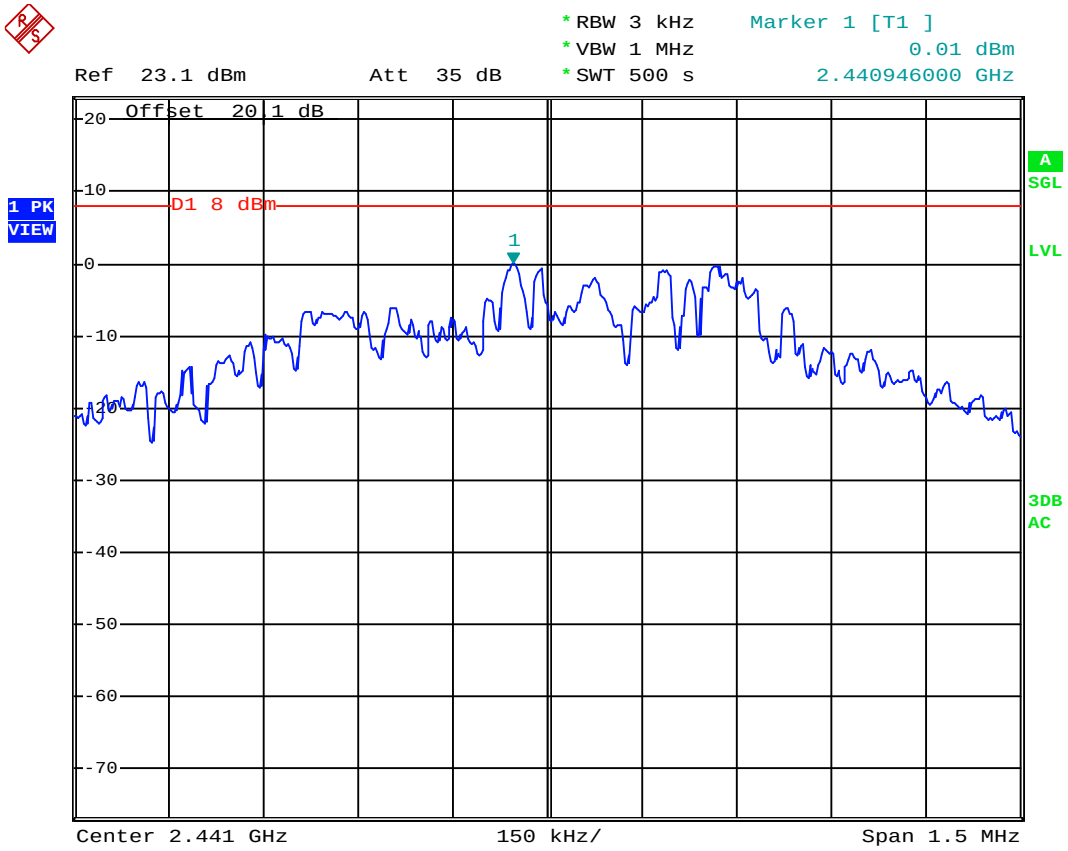
RESULTS

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2422	1.31	8	6.69
Middle	2441	0.01	8	7.99
High	2462	-0.12	8	8.12

POWER SPECTRAL DENSITY



PSD MID CH



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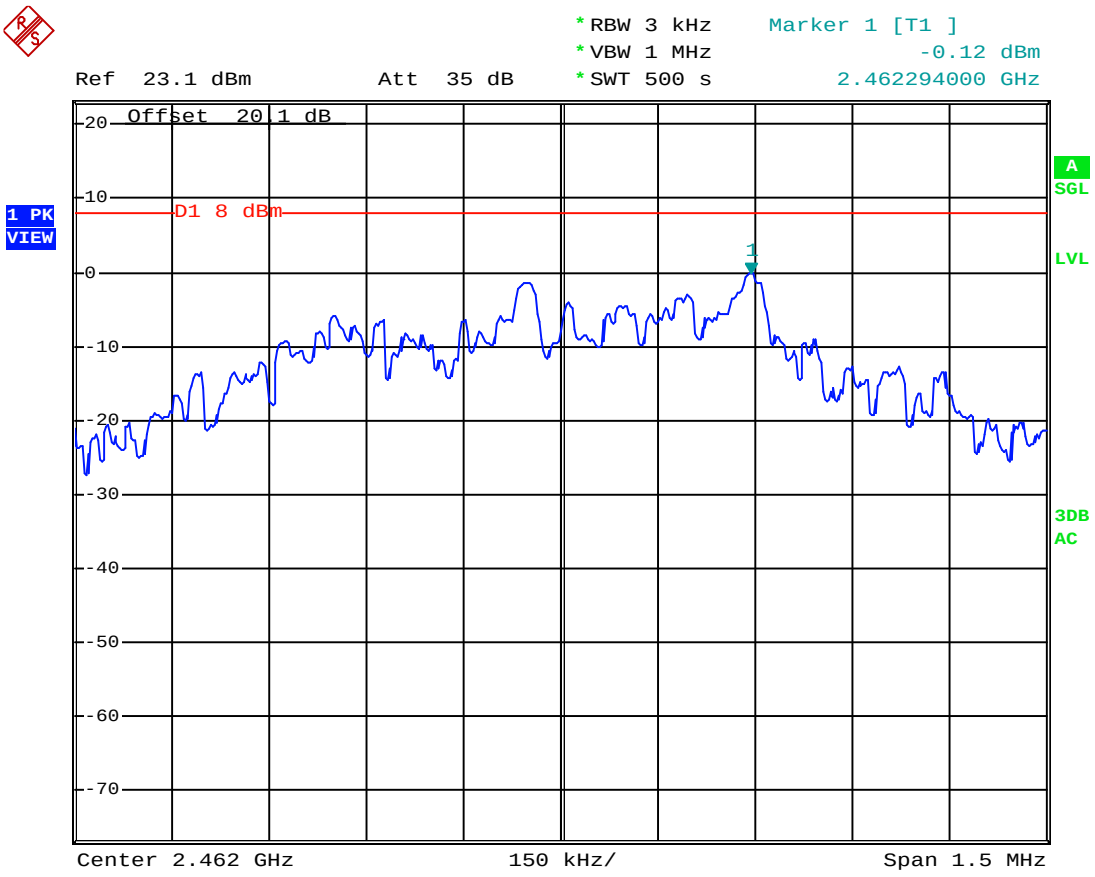
PSD HIGH CH



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7.1.5. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

TEST PROCEDURE

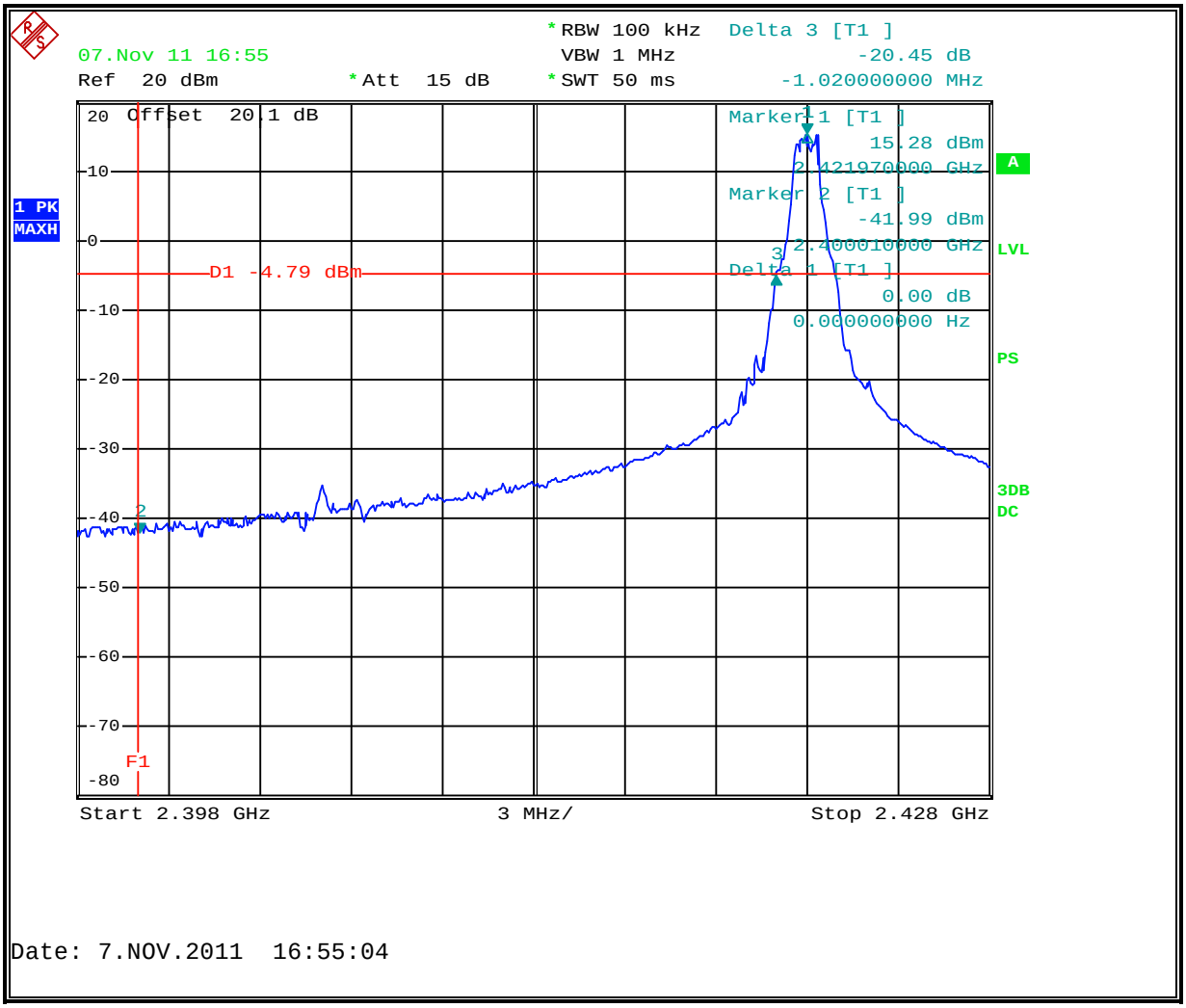
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 1 MHz.

The spectrum from 30 MHz to 25 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

RESULTS

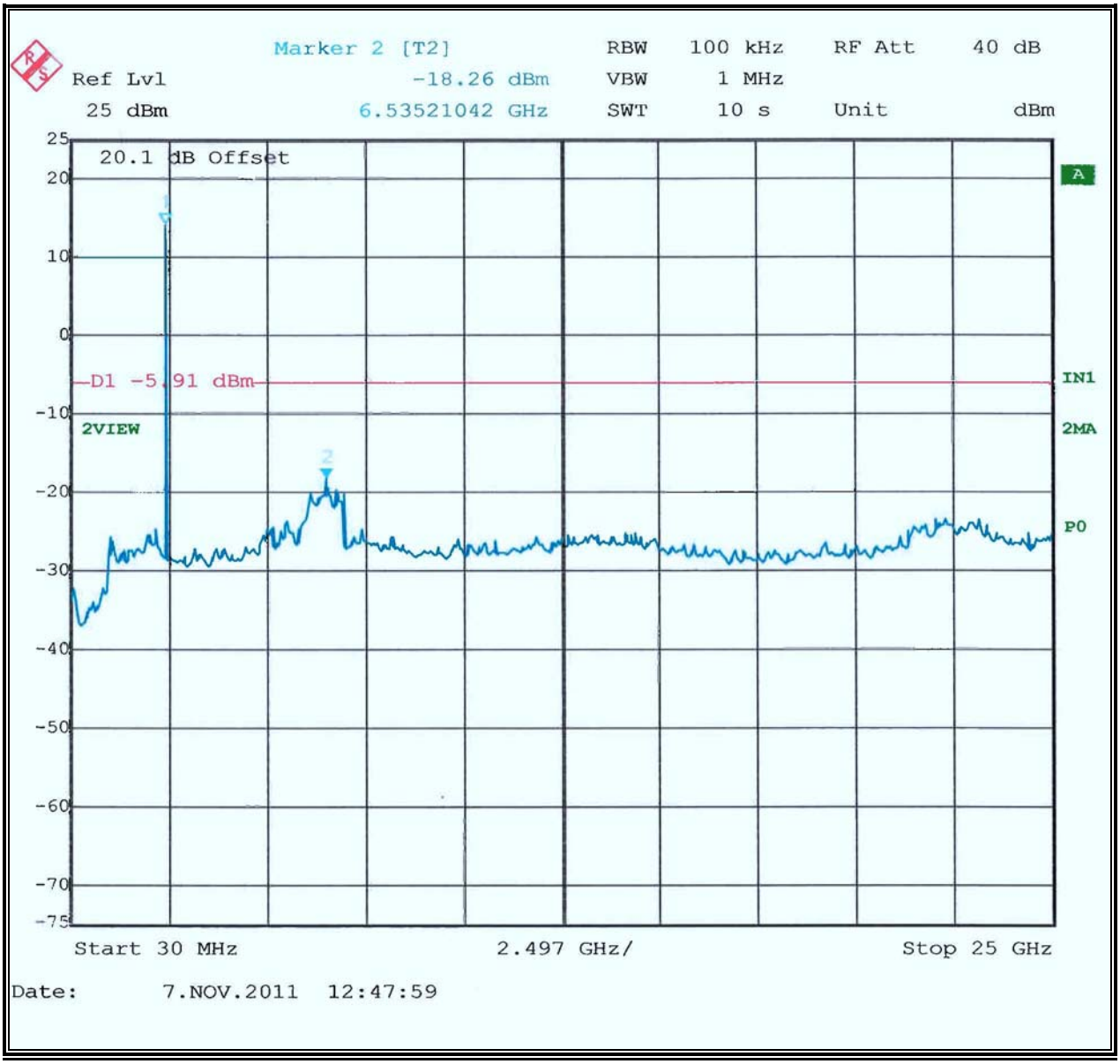
SPURIOUS EMISSIONS, LOW CHANNEL

LOW CH BANDEDGE



Frequency Line at 2400 MHz.

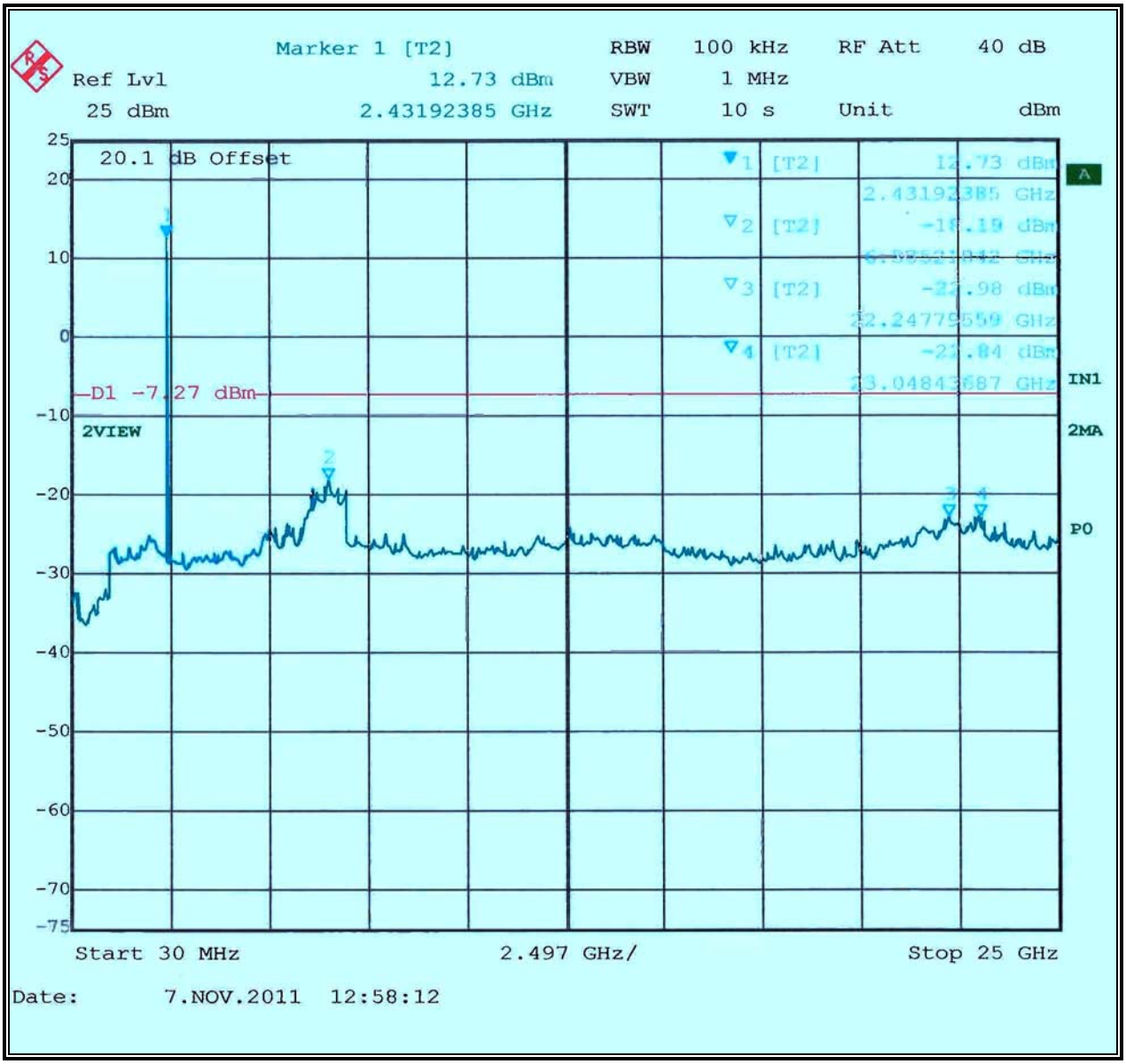
LOW CH SPURIOUS



Reference Line is placed 20dB below transmit signal level.

SPURIOUS EMISSIONS, MID CHANNEL

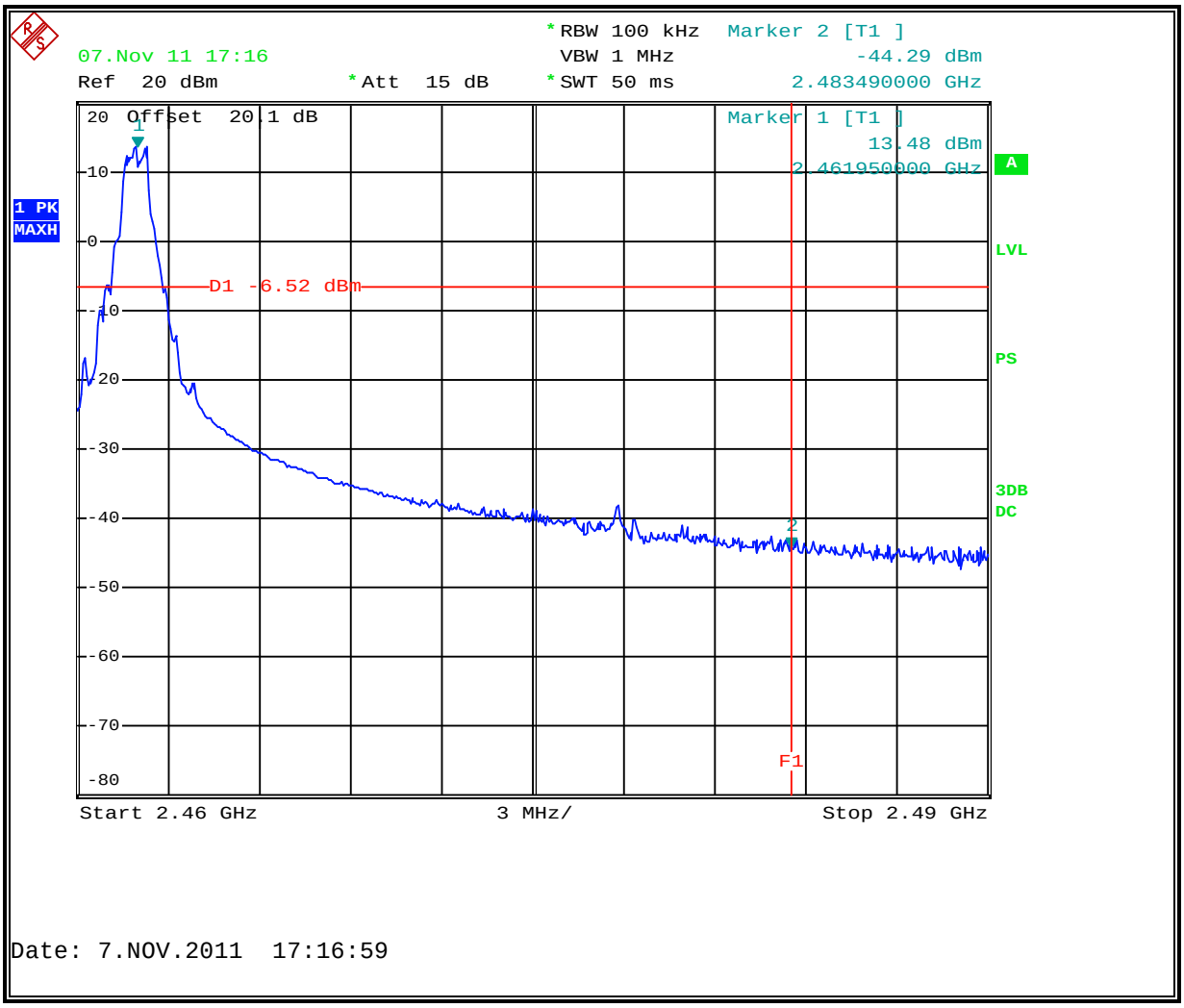
MID CH SPURIOUS



Reference Line is placed 20dB below transmit level.

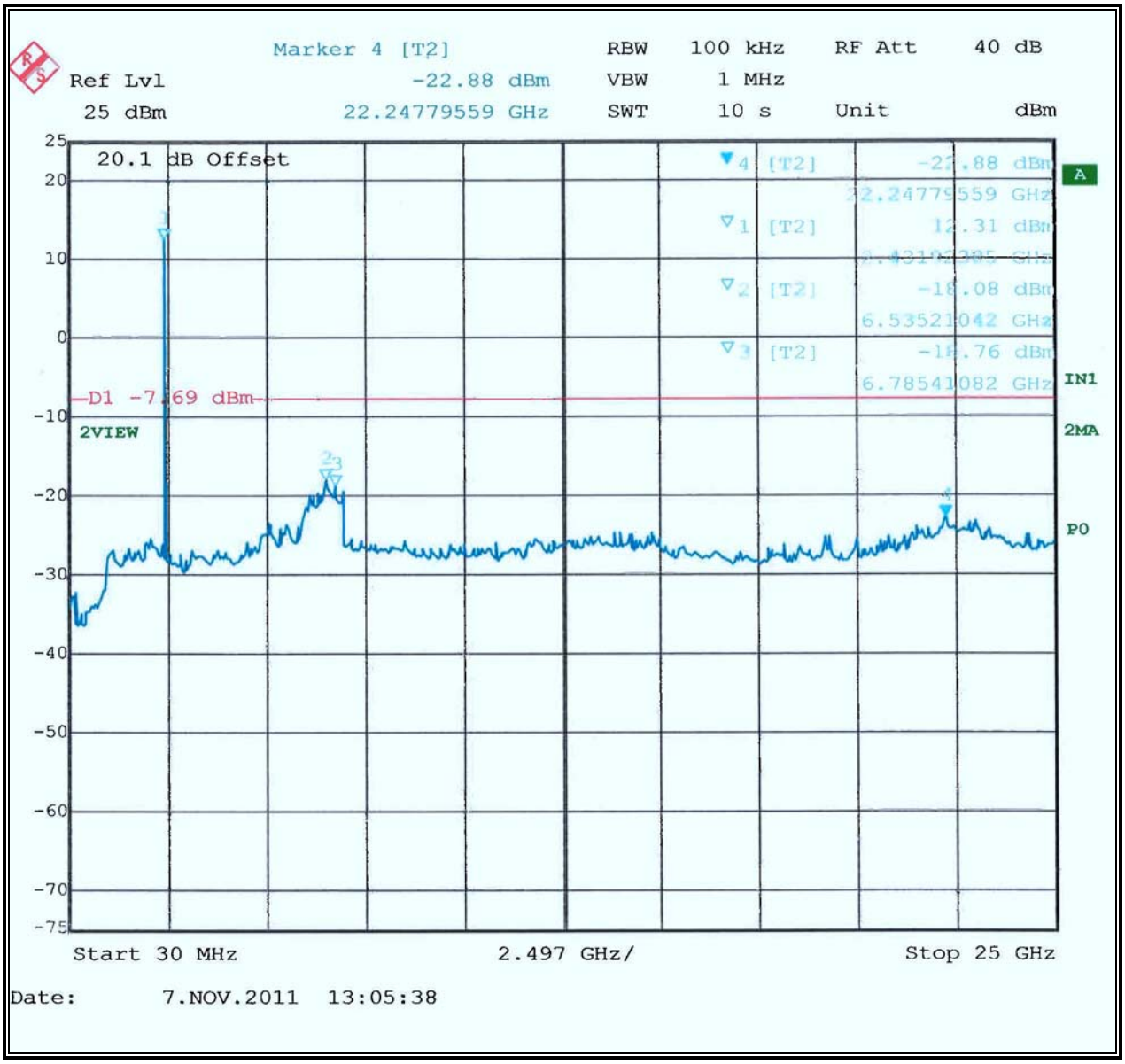
SPURIOUS EMISSIONS, HIGH CHANNEL

HIGH CH BANDEDGE



Line at 2483.5 MHz

HIGH CH SPURIOUS



Reference Line is placed 20dB below transmit level.

7.1.6. DUTY CYCLE FACTOR

LIMITS

Duty Cycle is measured to calculated average emissions. No direct limit applies.

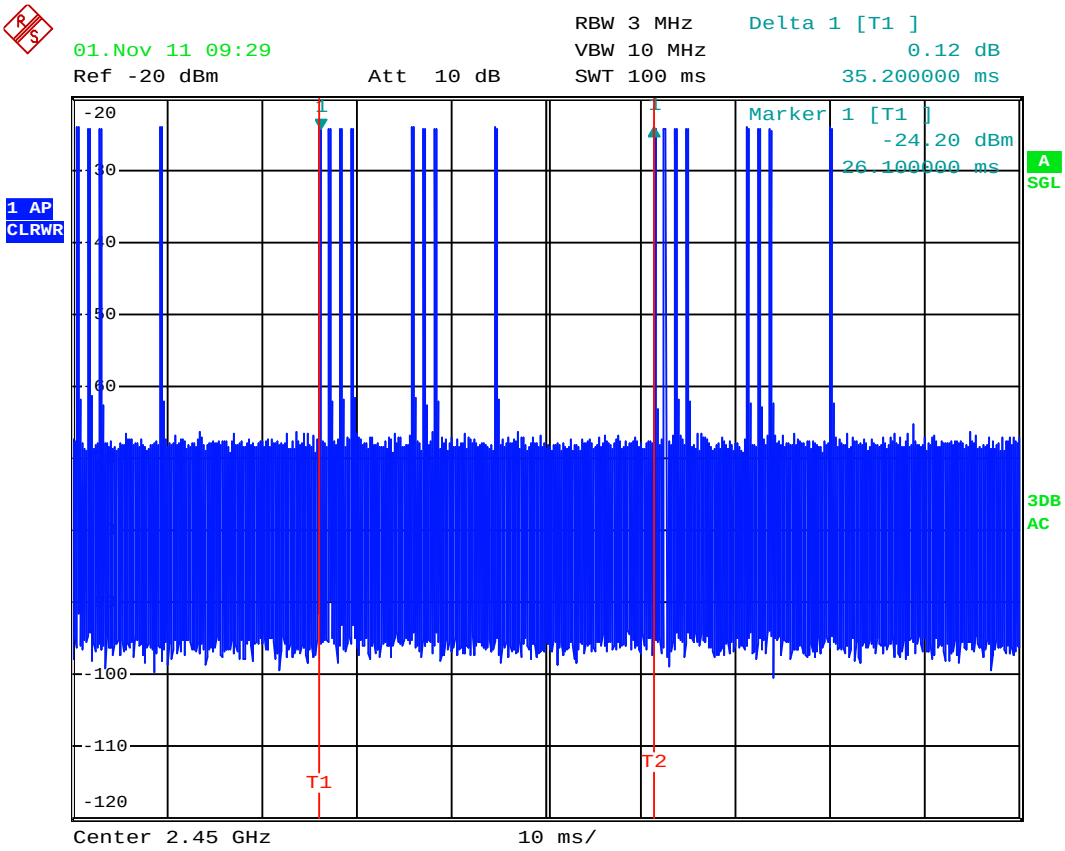
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer centered on the operating channel at zero span (time measurement). The resolution bandwidth is set to 1 MHz or larger. The video bandwidth is set larger than the resolution bandwidth.

A full cycle is captured and measured. Each transmission within the cycle is also captured and measured by placing markers on the start and stop edges of each transmission. From these measurements, the duty cycle factor is calculated.

RESULTS

CYCLE DURATION



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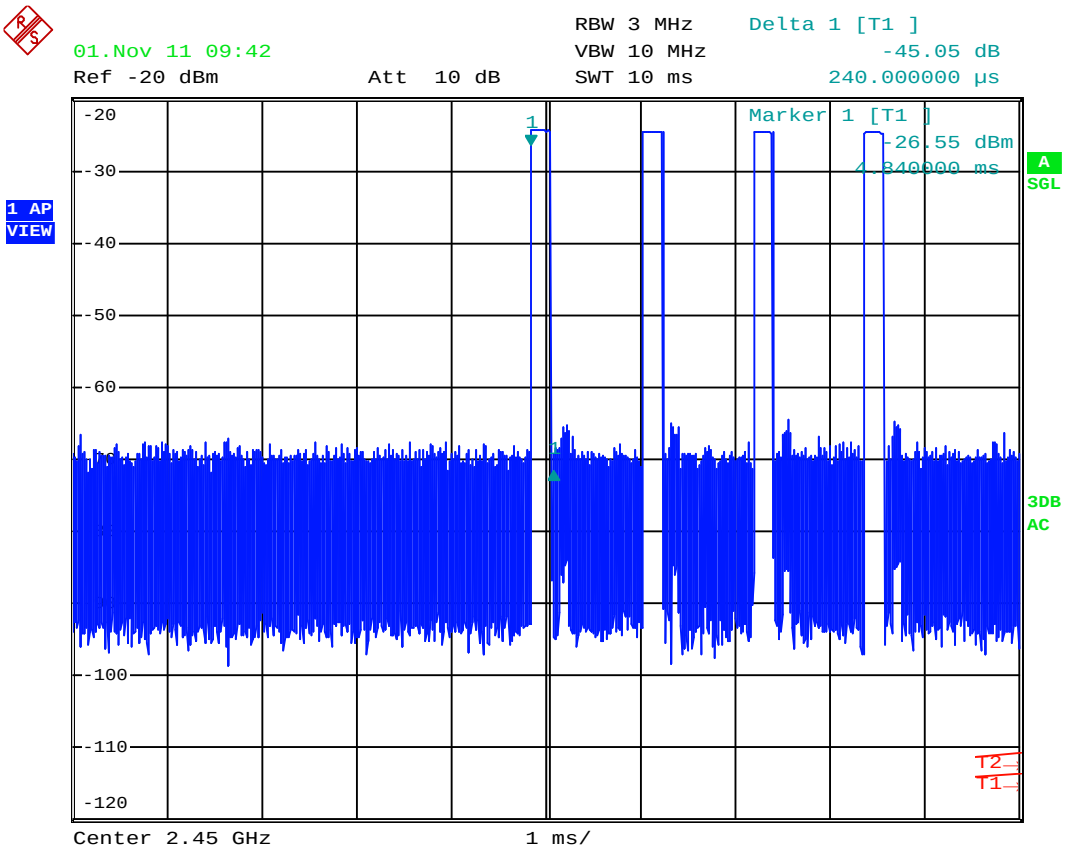
COMPLETE CYCLE IS 35.2 mS. EIGHT TRANSMISSIONS ARE OBSERVED PER CYCLE.

TRANSMISSION DURATIONS



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TRANSMISSION 1 IS SHOWN TO BE 240uS. ALL TRANSMISSIONS WERE FOUND TO BE EITHER 220uS or 240uS IN LENGTH AND ARE SHOWN IN THE TABLE ON THE FOLLOWING PAGE.

DUTY CYCLE CALCULATION

Transmission	Duration (ms)
1	.24
2	.22
3	.22
4	.22
5	.24
6	.22
7	.22
8	.22
Total	1.80

DUTY CYCLE IS TOTAL TRANSMISSIONS TIME WITHIN ONE CYCLE, OR 100 mS, WHICHEVER IS LESS.

DUTY CYCLE FACTOR (linear) = 1.8mS / 35.2mS = 0.051136 or **5.1136%**

DUTY CYCLE FACTOR (dB) = 20 * LOG_{10}(0.051136) = **– 25.8 dB**

THE ABOVE FACTOR IS APPLIED TO PEAK MEASUREMENTS FOR RADIATED SPURIOUS EMISSIONS AND RF EXPOSURE CALCULATIONS TO CALCULATE AVERAGE VALUES.

8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz for peak measurements. The Duty Cycle factor of -25.8dB is applied to the peak measurement and recorded as the average measurement.

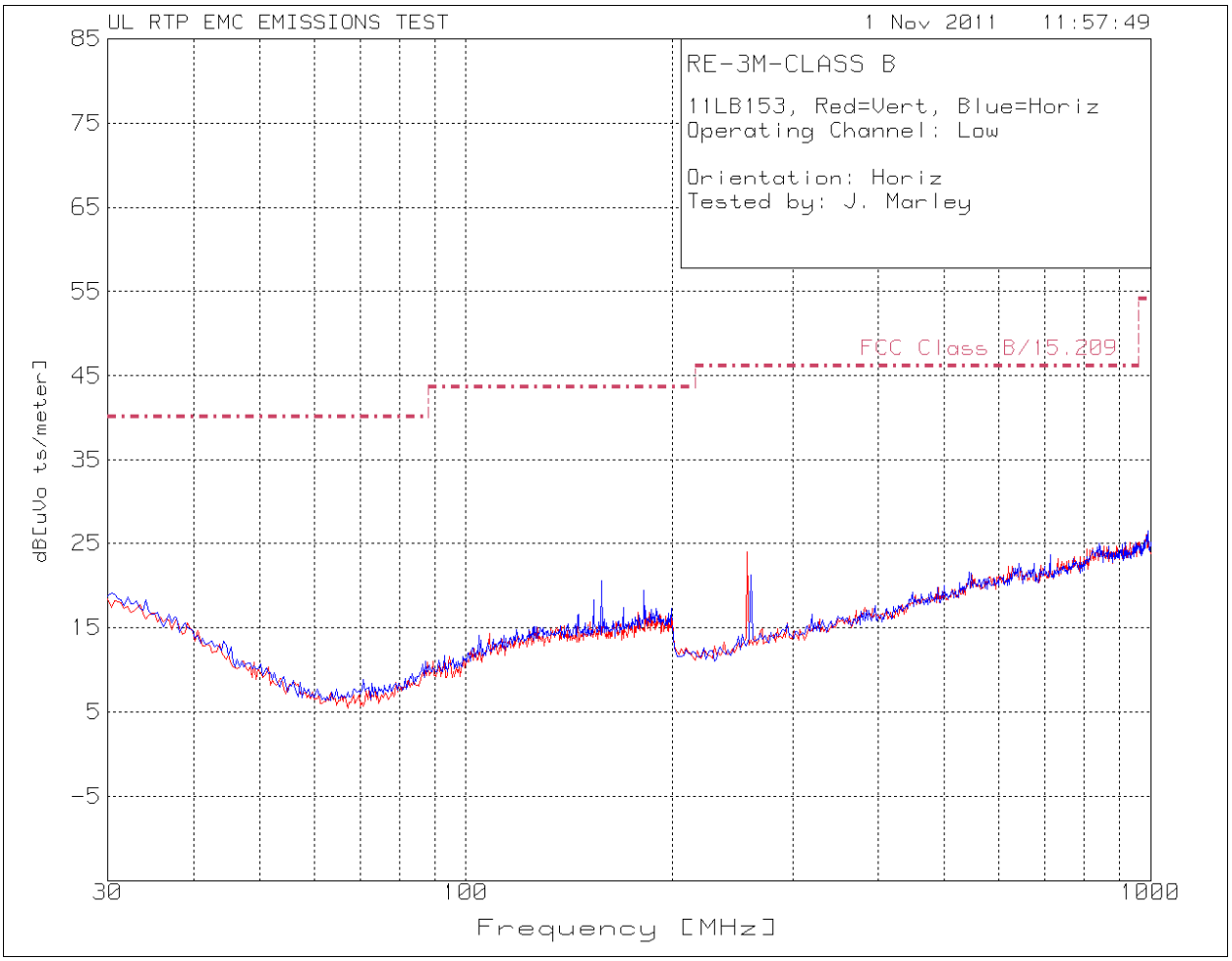
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

8.2. TRANSMITTER 30-1000 MHz

8.2.1. RADIATED SPURIOUS EMISSIONS

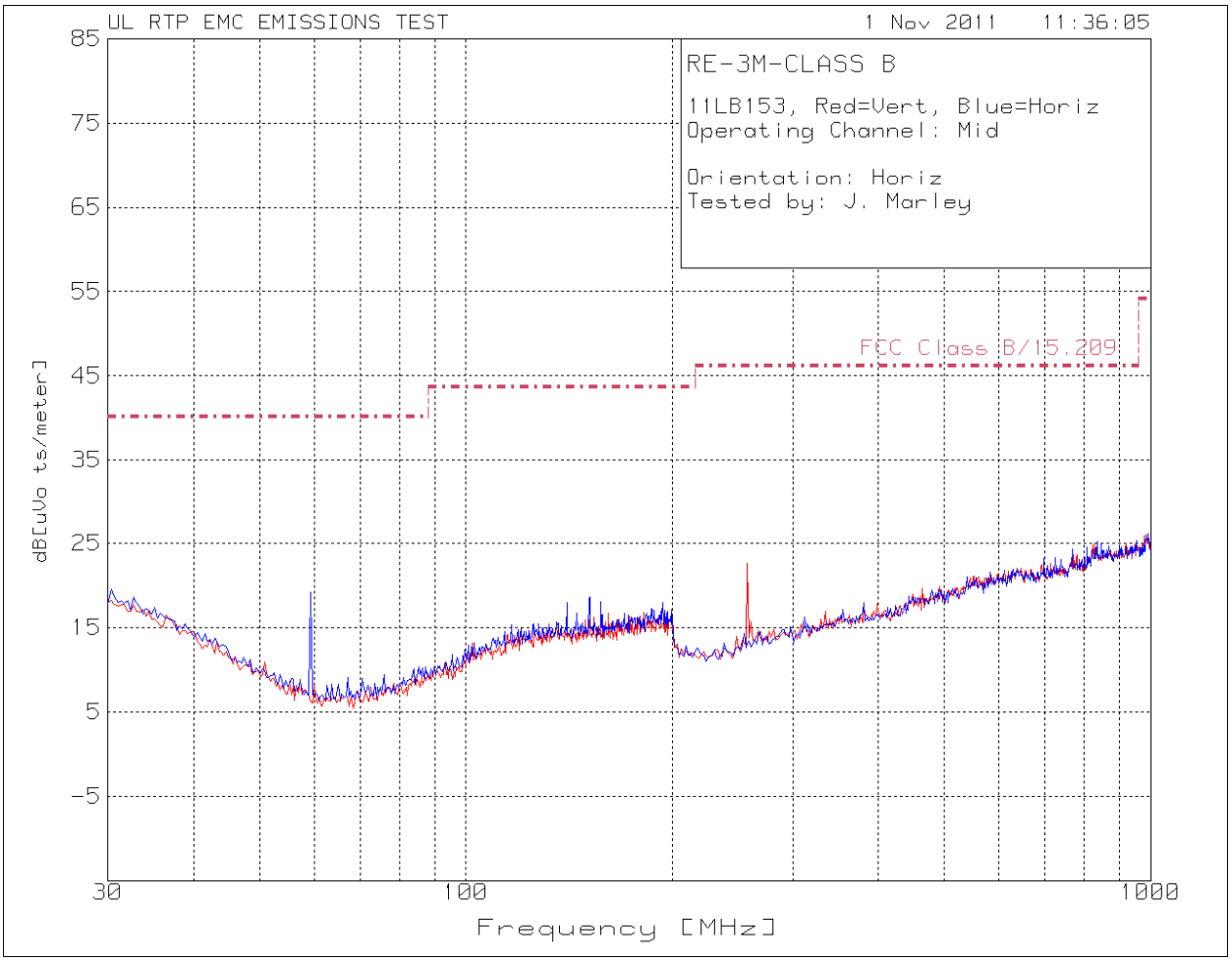
(LOW CHANNEL, HORIZONTAL AND VERTICAL)



Frequency Measured [MHz]	Meter Reading {dBuV}	Det. Type	Anten. Factor [dB/m]	Amp/Cbl Factor [dB]	Field Strngth [dBuV/m]	15.209 Limit [dBuV/m]	Margin	Anten. Height [cm]	Anten. Polar. [V/H]
153.6673	31.85	PK	14.6	-28.2	18.25	43.5	-25.25	249	Horz
157.7555	33.93	PK	14.7	-28.1	20.53	43.5	-22.97	100	Horz
169.6794	30.53	PK	14.8	-28	17.33	43.5	-26.17	249	Horz
181.9439	31.95	PK	15.4	-27.9	19.45	43.5	-24.05	249	Horz
257.7154	39.93	PK	12.1	-28.1	23.93	46	-22.07	199	Vert
260.9218	37.02	PK	12.2	-28	21.22	46	-24.78	299	Horz

PK – Peak Detection

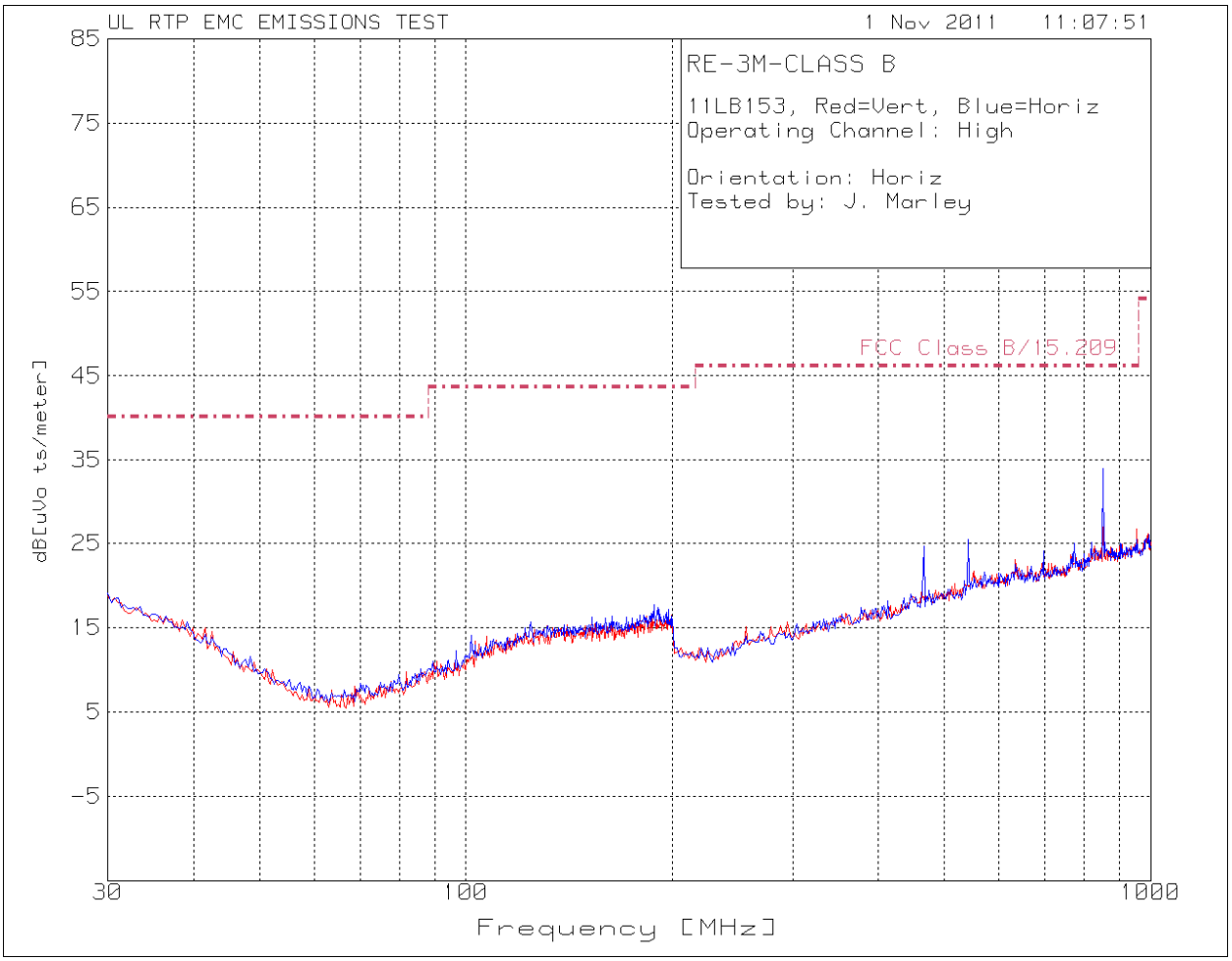
(MID CHANNEL, HORIZONTAL AND VERTICAL)



Frequency Measured [MHz]	Meter Reading {dBuV}	Det. Type	Anten. Factor [dB/m]	Amp/Cbl Factor [dB]	Field Strngth [dBuV/m]	15.209 Limit [dBuV/m]	Margin	Anten. Height [cm]	Anten. Polar. [V/H]
59.7271	41.24	PK	6.4	-28.2	19.44	46	-26.56	249	Horz
257.7154	38.63	PK	12.1	-28.1	22.63	46	-23.37	100	Vert

PK – Peak Detection

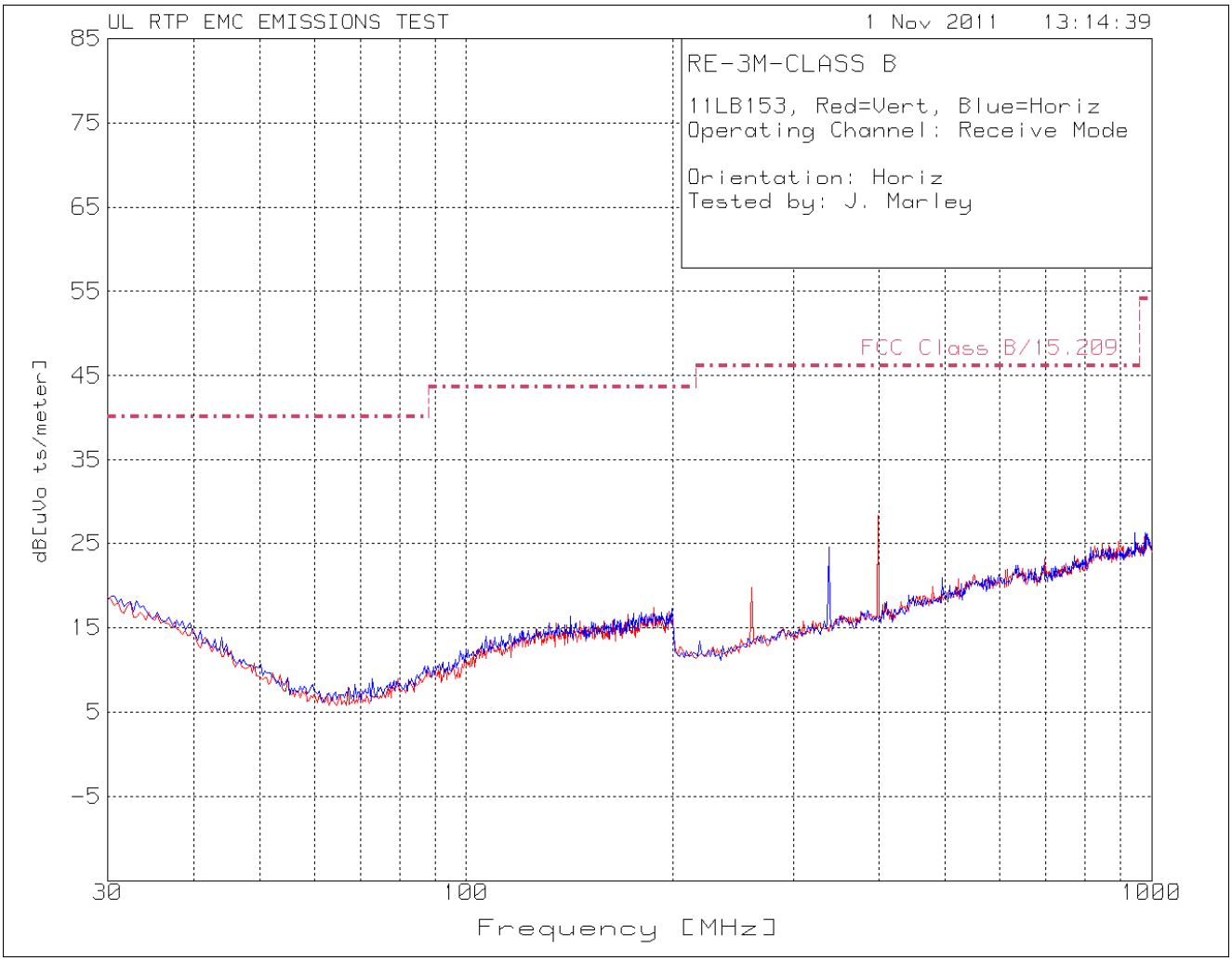
(HIGH CHANNEL, HORIZONTAL AND VERTICAL)



Frequency Measured [MHz]	Meter Reading {dBuV}	Det. Type	Anten. Factor [dB/m]	Amp/Cbl Factor [dB]	Field Strngth [dBuV/m]	15.209 Limit [dBuV/m]	Margin	Anten. Height [cm]	Anten. Polar. [V/H]
466.1323	34.13	PK	16.7	-26.2	24.63	46	-21.37	299	Horz
541.483	32.81	PK	18.6	-25.9	25.51	46	-20.49	199	Horz
850.9018	36.54	PK	22.3	-24.9	33.94	46	-12.06	100	Horz

PK – Peak Detection

(RECEIVE MODE / UNINTENTIONAL, HORIZONTAL AND VERTICAL)



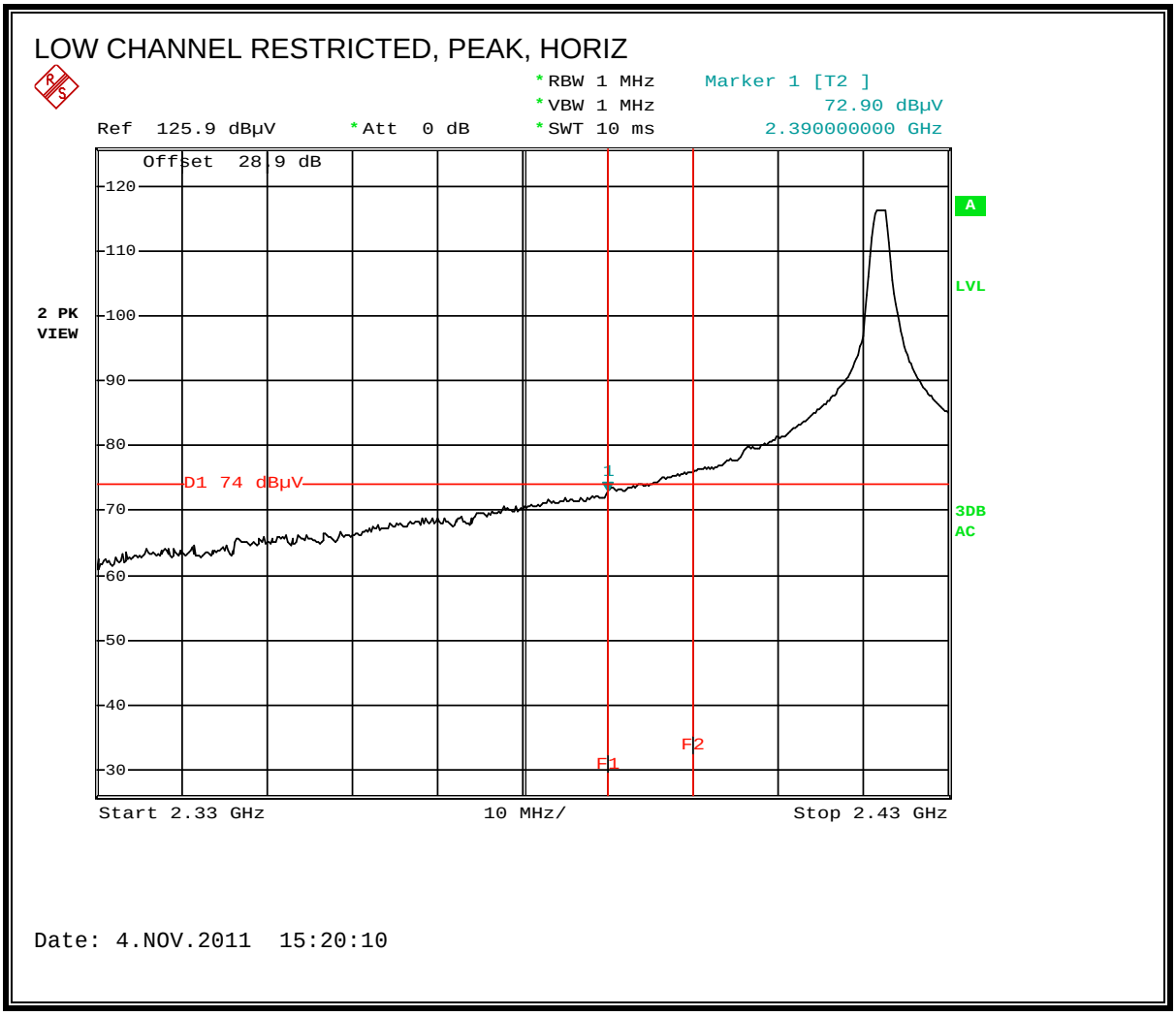
Frequency Measured [MHz]	Meter Reading {dBuV}	Det. Type	Anten. Factor [dB/m]	Amp/Cbl Factor [dB]	Field Strngth [dBuV/m]	15.209 Limit [dBuV/m]	Margin	Anten. Height [cm]	Anten. Polar. [V/H]
257.7154	36.06	PK	12.1	-28.1	20.03	46	-25.97	199	Horz
334.5057	38.16	PK	14.3	-27.8	24.66	46	-21.34	100	Vert
400.4143	39.22	PK	15.8	-26.9	28.12	46	-17.88	299	Horz

PK – Peak Detection

8.3. TRANSMITTER ABOVE 1 GHz

8.3.1. TRANSMITTER ABOVE 1 GHz – BAND EDGE

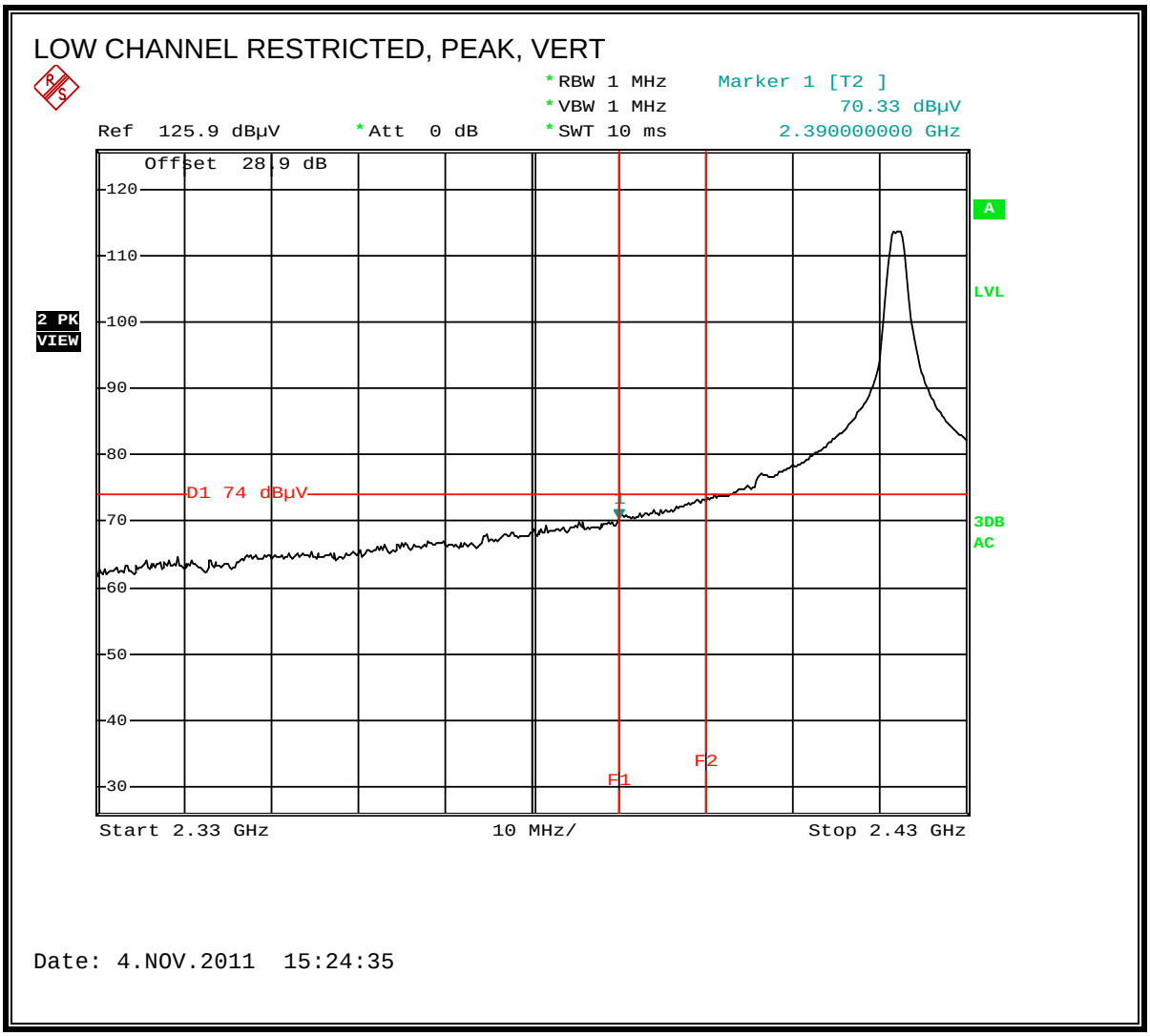
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



Cable Factor and Antenna Factor Offset of 28.9 dB is included the above measurement.

Operating Channel (MHz)	Frequency Measured (MHz)	Peak Field Strength (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Duty Cycle Factor (dB)	Average Field Strength (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2422	2390	72.90	74	-1.1	-25.8	47.1	54	-6.9

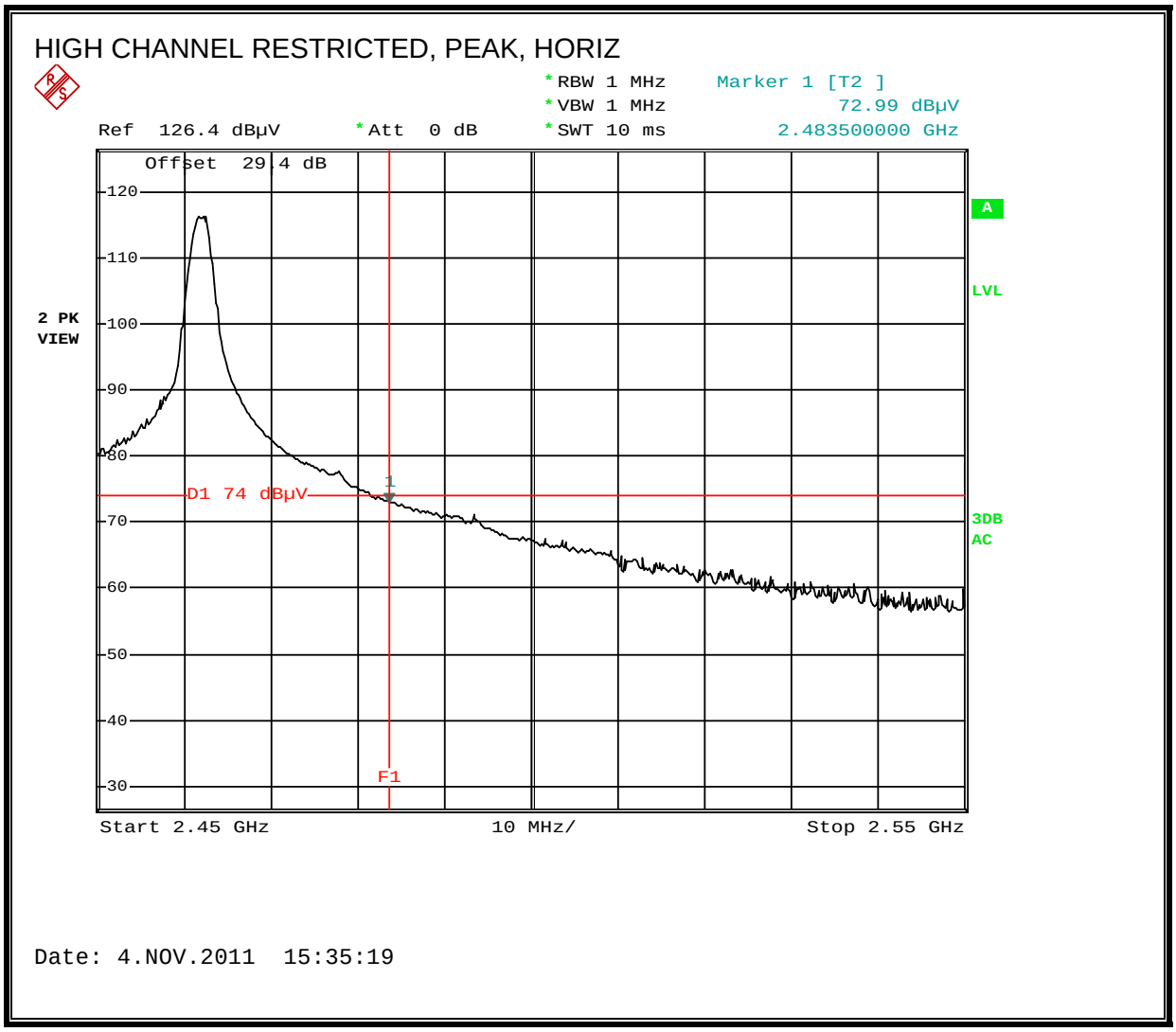
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



Note: Peak Data is shown to comply with Peak Limit. Average Limit is shown to be met by applying Duty Cycle Factor of (-25.8dB) to Peak Measurement.

Operating Channel (MHz)	Frequency Measured (MHz)	Peak Field Strength (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Duty Cycle Factor (dB)	Average Field Strength (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2422	2390	70.33	74	-3.67	-25.8	44.53	54	-10.47

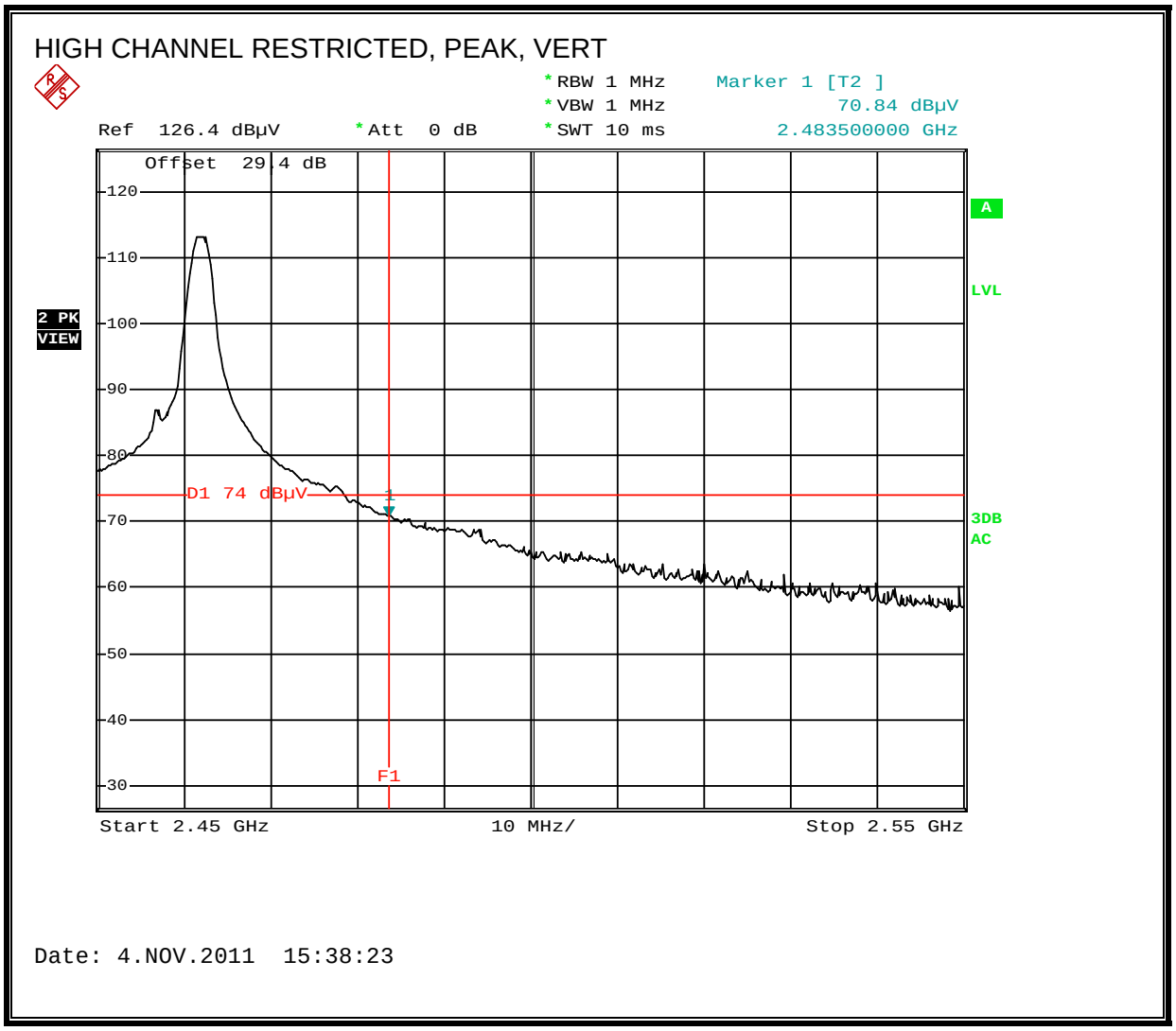
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



Cable Factor and Antenna Factor Offset of 29.4 dB is included the above measurement.

Operating Channel (MHz)	Frequency Measured (MHz)	Peak Field Strength (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Duty Cycle Factor (dB)	Average Field Strength (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2462	2483.5	72.99	74	-1.01	-25.8	47.19	54	-6.81

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

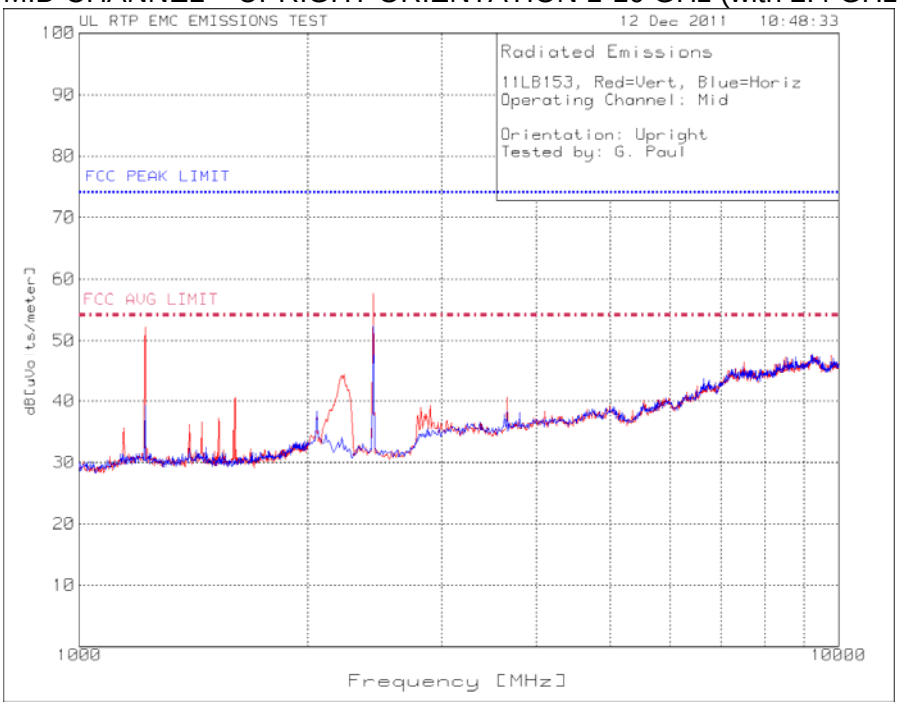


Operating Channel (MHz)	Frequency Measured (MHz)	Peak Field Strength (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Duty Cycle Factor (dB)	Average Field Strength (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2462	2483.5	70.84	74	-3.16	-25.8	45.04	54	-8.96

8.3.1. TRANSMITTER ABOVE 1 GHz – HARMONICS AND SPURIOUS EMISSIONS

PLOTS FOR MID CHANNEL, UPRIGHT ORIENTATION ARE SHOWN. THIS WAS FOUND TO BE THE WORST-CASE ORIENTATION FOR RADIATED SPURIOUS. TABLES SHOW ALL CHANNELS MEASURED.

MID CHANNEL – UPRIGHT ORIENTATION 1-10 GHz (with 2.4 GHz band reject filter)

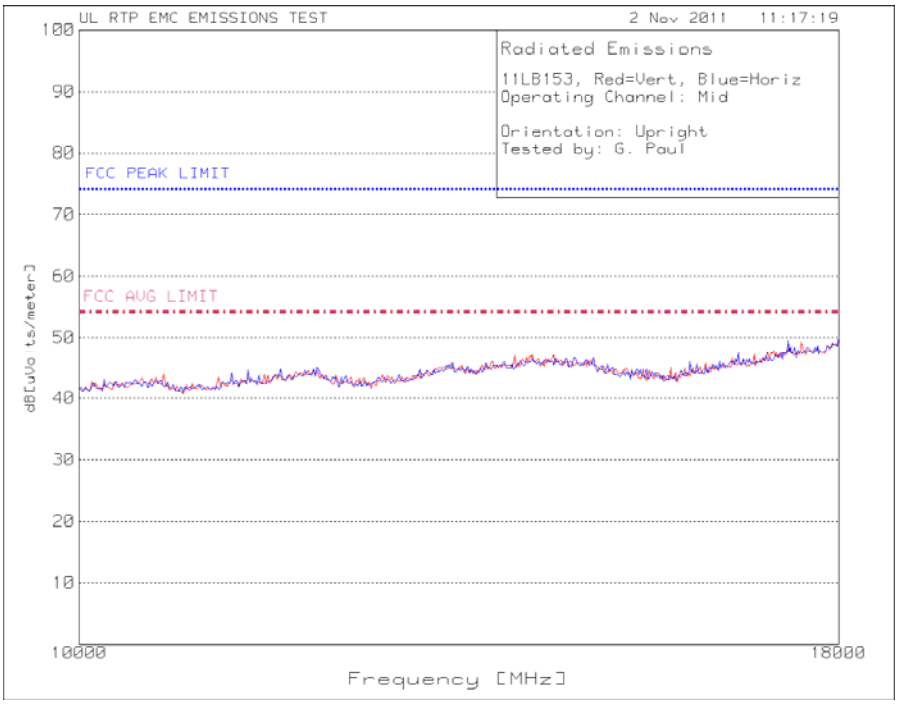


Frequency Measured [MHz]	Meter Reading [dBuV]	Det. Type	Anten. Factor [dB/m]	Amp/Cbl Factor [dB]	Field Strength [dBuV/m]	15.209 Limit [dBuV/m]	Margin [dB]	Anten. Height [cm]	Anten. Polar. [V/H]	
1220.441	60.96	PK	25.1	-33.9	52.16	74	-21.84	100	Vert	
1220.441	35.16	AV	25.1	-33.9	26.36	54	-27.64	100	Vert	Note 2
1603.206	49.14	PK	25.0	-33.5	40.64	54	-13.36	100	Vert	
2232.232	50.18	PK	27.3	-33.2	44.28	54	-9.72	100	Vert	
2440.44	62.74	PK	27.6	-32.7	57.64	-	-	100	Vert	Note 1
9207.207	31.5	PK	38.1	-22	47.6	54	-6.4	100	Vert	
2440.44	57.47	PK	27.6	-32.7	52.37	-	-	200	Horz	Note 1

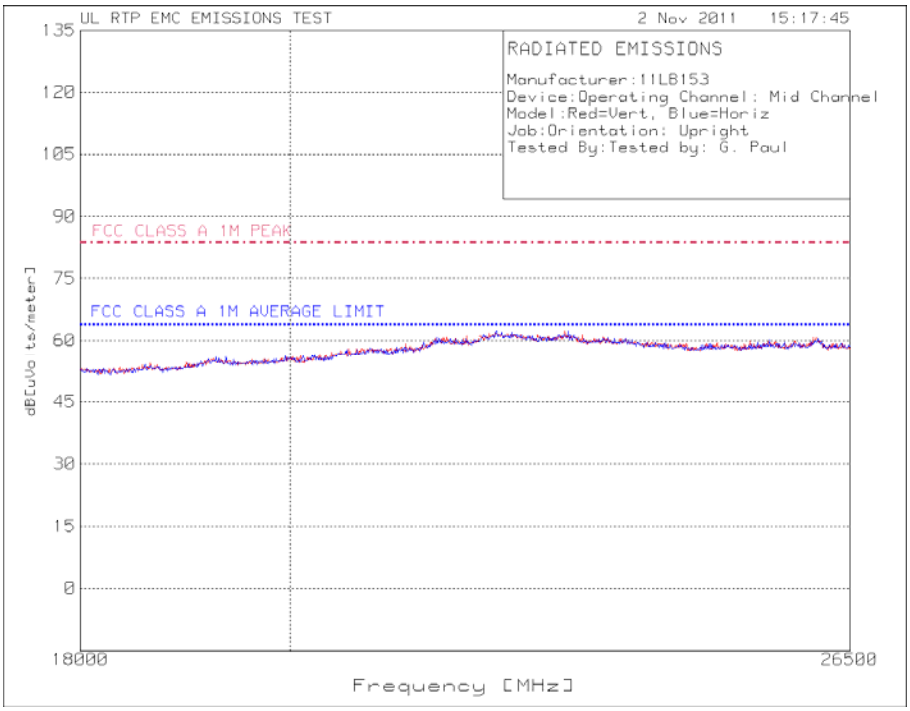
Note 1: Transmit signal
Note 2: Spurious signal was observed to pulse on/off with duty cycle of transmit signal. Therefore, peak-to-average ratio of -25.8 dB was applied as average.

PK = Peak
AV = Average (Duty Cycle Method)

MID CHANNEL – UPRIGHT ORIENTATION 10-18 GHz

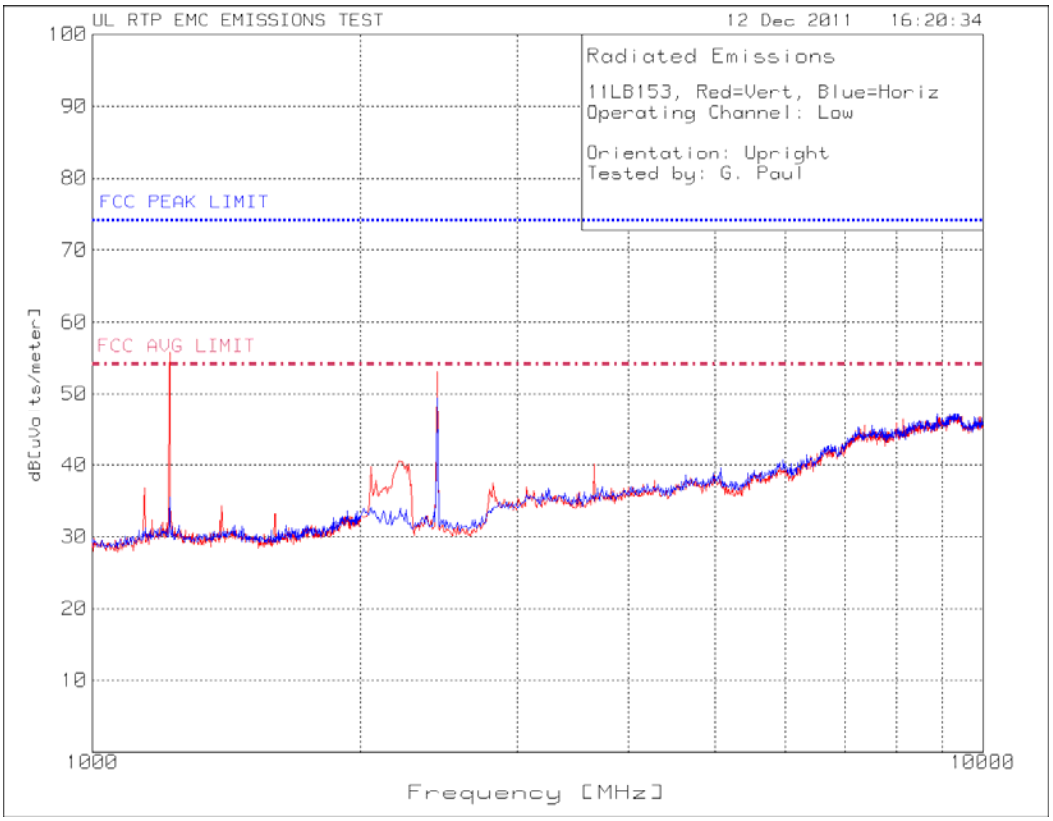


MID CHANNEL – UPRIGHT ORIENTATION 18-26 GHz



No significant emission was observed above 10 GHz.

LOW CHANNEL



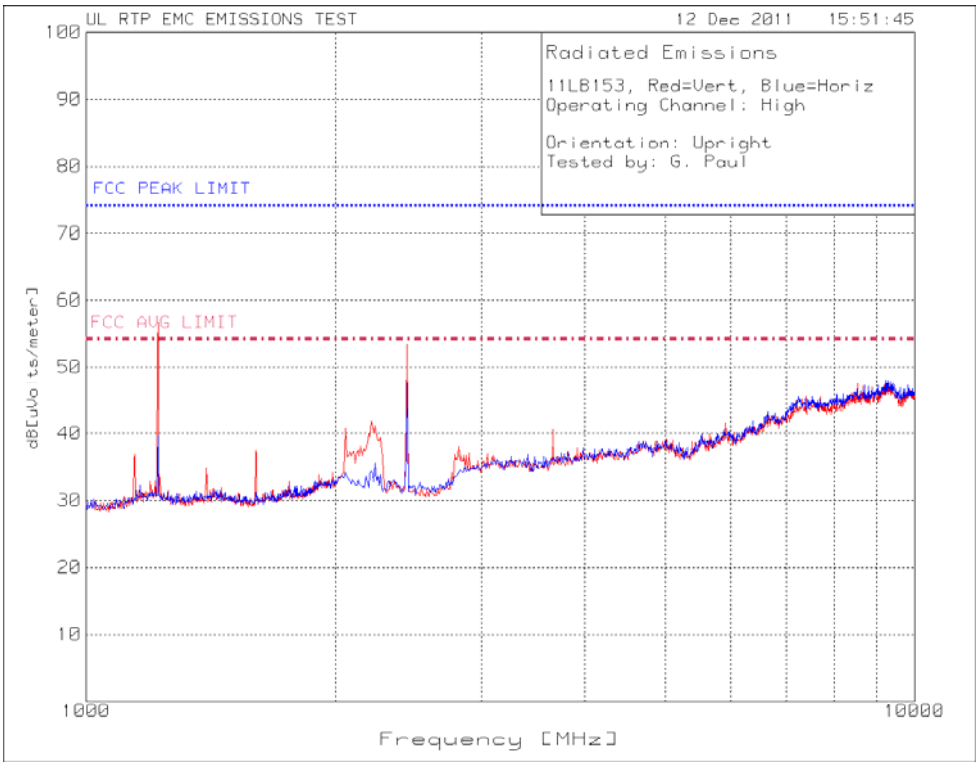
Frequency Measured [MHz]	Meter Reading [dBuV]	Det. Type	Anten. Factor [dB/m]	Amp/Cbl Factor [dB]	Field Strength [dBuV/m]	15.209 Limit [dBuV/m]	Margin [dB]	Anten. Height [cm]	Anten. Polar. [V/H]	
Low Channel										
1211.632	64.64	PK	25.1	-33.9	55.84	74	-18.16	100	Vert	
1211.632	38.84	AV	25.1	-33.9	30.04	54	-23.96	100	Vert	Note 2
2421.878	58.2	PK	27.6	-32.7	53.1	-	-	100	Vert	Note 1
3634.016	41.84	PK	30.6	-32.3	40.14	54	-13.86	100	Vert	

Note 1: Transmit signal
Note 2: Spurious signal was observed to pulse on/off with duty cycle of transmit signal. Therefore, peak-to-average ratio of -25.8 dB was applied as average.

PK = Peak
AV = Average (Duty Cycle Method)

No significant emission was observed above 10 GHz.

HIGH CHANNEL



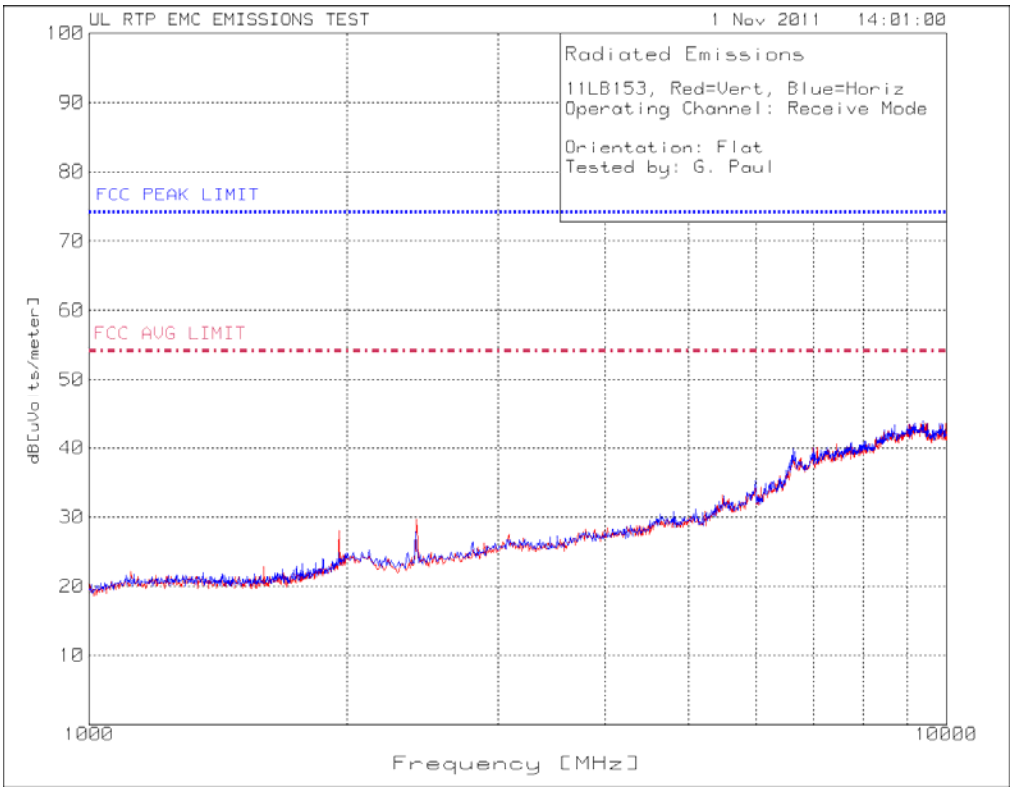
Frequency Measured [MHz]	Meter Reading [dBuV]	Det. Type	Anten. Factor [dB/m]	Amp/Cbl Factor [dB]	Field Strength [dBuV/m]	15.209 Limit [dBuV/m]	Margin [dB]	Anten. Height [cm]	Anten. Polar. [V/H]	
High Channel										
1232.268	65.5	PK	25.1	-33.9	56.7	74	-17.3	100	Vert	
1232.268	39.7	AV	25.1	-33.9	30.9	54	-23.1	100	Vert	Note 2
2462.484	58.49	PK	27.6	-32.7	53.39	-	-	100	Vert	Note 1
3692.658	42.32	PK	30.6	-32.3	40.62	54	-13.38	100	Vert	

Note 1: Transmit signal
Note 2: Spurious signal was observed to pulse on/off with duty cycle of transmit signal. Therefore, peak-to-average ratio of -25.8 dB was applied as average.

PK = Peak
AV = Average (Duty Cycle Method)

No significant emission was observed above 10 GHz.

(RECEIVE MODE / UNINTENTIONAL, HORIZONTAL AND VERTICAL)



Frequency Measured [MHz]	Meter Reading [dBuV]	Det. Type	Anten. Factor [dB/m]	Amp/Cbl Factor [dB]	Field Strength [dBuV/m]	15.209 Limit [dBuV/m]	Margin [dB]	Anten. Height [cm]	Anten. Polar. [V/H]
1955.912	33.97	PK	27.2	-33.1	28.07	54	-25.93	100	Vert
2408.408	35.14	PK	27.4	-32.9	29.64	54	-24.36	100	Vert
9511.512	27.71	PK	38	-22.2	43.51	54	-10.49	100	Vert
2400.4	33.44	PK	27.4	-32.9	27.94	54	-26.06	100	Horz
9191.191	27.66	PK	38.1	-22.1	43.66	54	-10.34	199	Horz
6620.621	31.77	PK	35.5	-27.4	39.87	54	-14.13	100	Horz

PK = Peak

9. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

TEST PROCEDURE

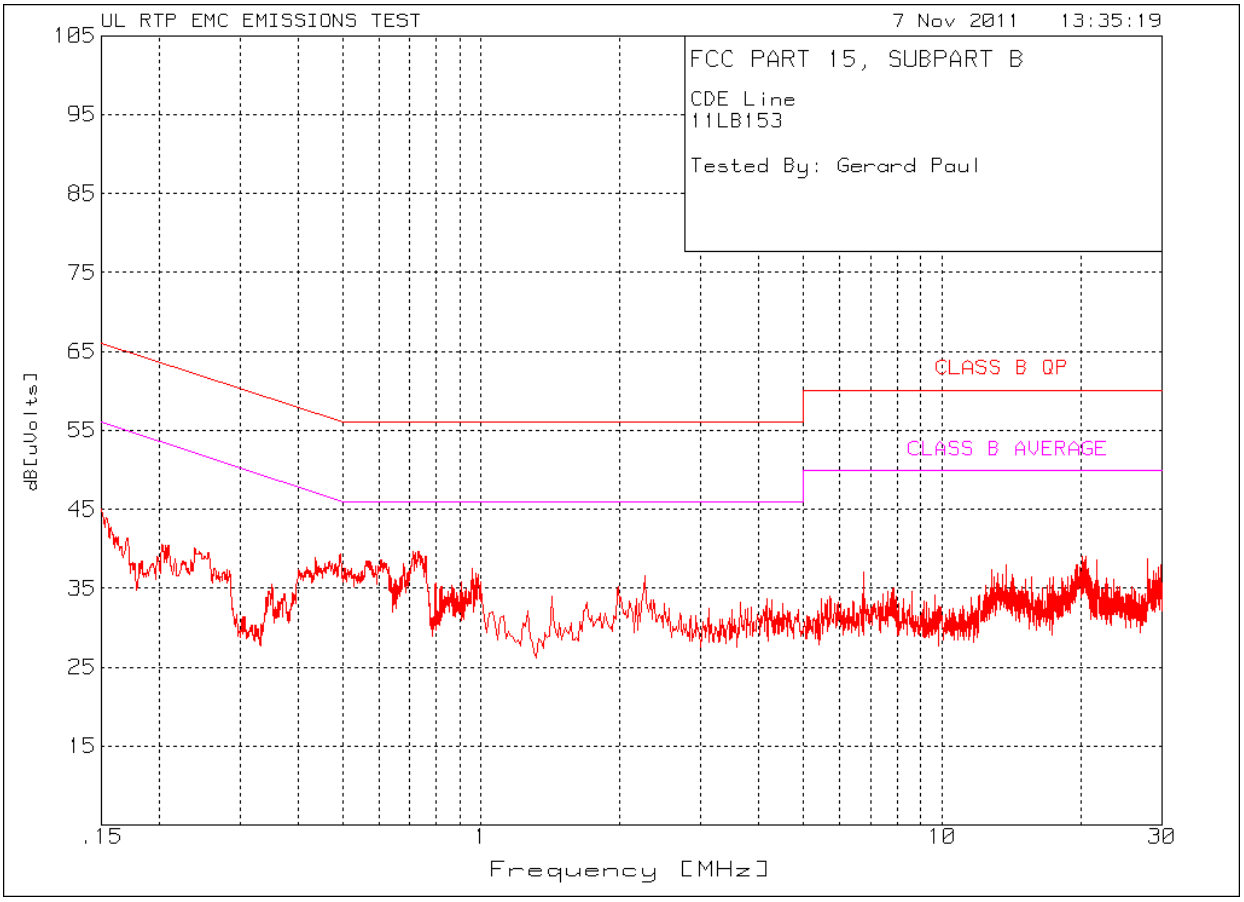
The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4.

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

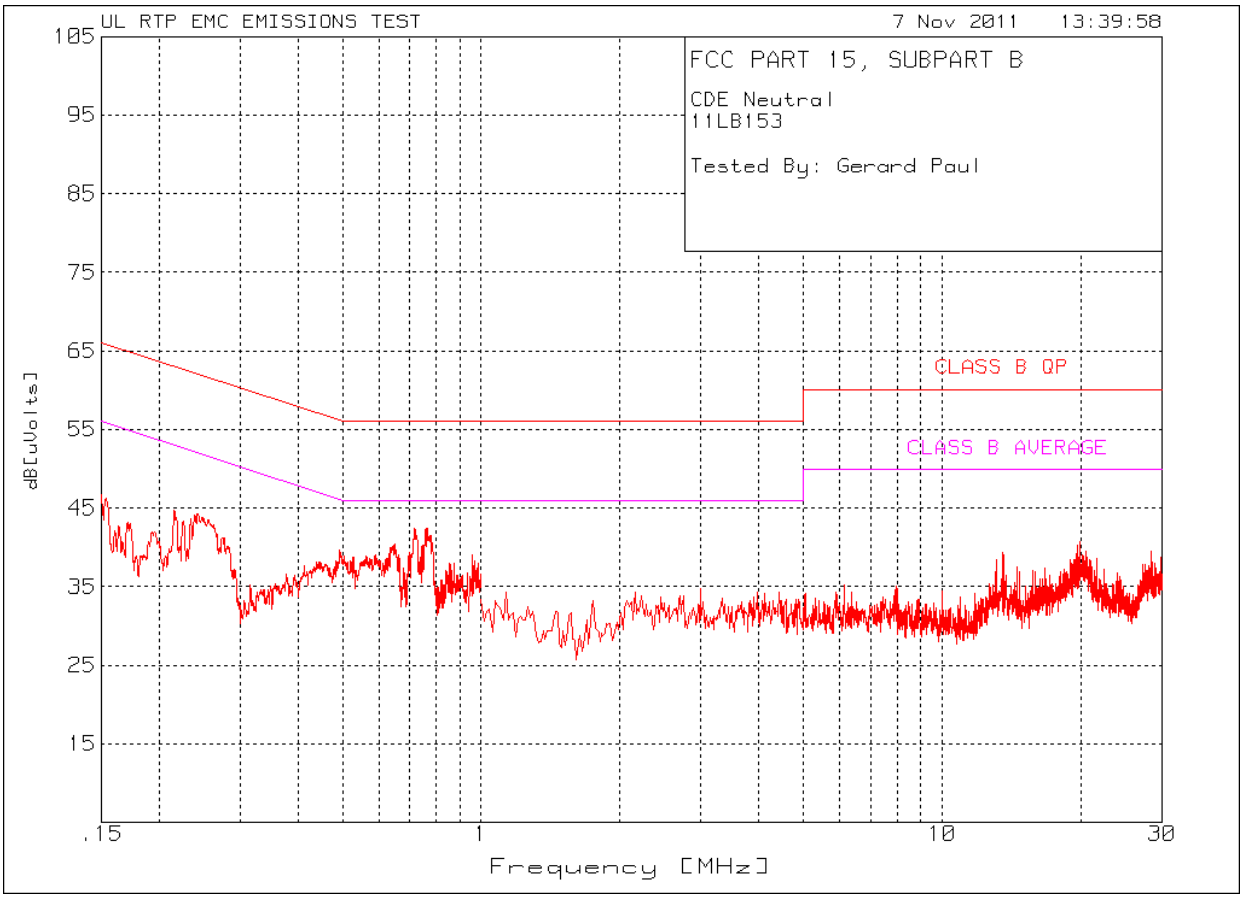
CONDUCTED EMISSIONS – LINE CONDUCTOR



Test Freq. [MHz]	Meter Reading [dBuV]	Detector Type [type]	Cable Factor [dB]	LISN Factor [dB]	Limiter Factor [dB]	Noise Voltage [dBuV]	QP Limit [dBuV]	QP Margin [dB]	AV Limit [dBuV]	AV Margin [dB]
.15000	35.28	PK	.1	0	9.6	44.98	66	-21.02	56	-11.02
.25577	29.78	PK	.1	0	9.6	39.48	61.6	-22.12	51.6	-12.12
.71263	30.01	PK	0	0	9.6	39.61	56	-16.39	46	-6.39
2.26087	26.9	PK	0	.1	9.6	36.6	56	-19.4	46	-9.4
13.75362	28.24	PK	.1	.2	9.5	38.04	60	-21.96	50	-11.96
20.18841	29.14	PK	.1	.3	9.5	39.04	60	-20.96	50	-10.96

PK - Peak detector

CONDUCTED EMISSIONS – NEUTRAL CONDUCTOR



Test Freq. [MHz]	Meter Reading [dBuV]	Detector Type [type]	Cable Factor [dB]	LISN Factor [dB]	Limiter Factor [dB]	Noise Voltage [dBuV]	QP Limit [dBuV]	QP Margin [dB]	AV Limit [dBuV]	AV Margin [dB]
.15000	35.28	PK	.1	0	9.6	44.98	66	-21.02	56	-11.02
.25577	29.78	PK	.1	0	9.6	39.48	61.6	-22.12	51.6	-12.12
.71263	30.01	PK	0	0	9.6	39.61	56	-16.39	46	-6.39
2.26087	26.9	PK	0	.1	9.6	36.6	56	-19.4	46	-9.4
13.75362	28.24	PK	.1	.2	9.5	38.04	60	-21.96	50	-11.96
20.18841	29.14	PK	.1	.3	9.5	39.04	60	-20.96	50	-10.96

PK - Peak detector

Text File: CDE Line.TXT

MAXIMUM PERMISSIBLE EXPOSURE

FCC RULES

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*($900/f^2$)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

EQUATIONS

Power density is given by:

S = EIRP / (4 * Pi * D^2)

where

S = Power density in W/m^2
EIRP = Equivalent Isotropic Radiated Power in W
D = Separation distance in m

Power density in units of W/m^2 is converted to units of mWc/m^2 by dividing by 10.

Distance is given by:

D = SQRT (EIRP / (4 * Pi * S))

where

D = Separation distance in m
EIRP = Equivalent Isotropic Radiated Power in W
S = Power density in W/m^2

For multiple colocated transmitters operating simultaneously in frequency bands where the limit is identical, the total power density is calculated using the total EIRP obtained by summing the Power * Gain product (in linear units) of each transmitter.

Total EIRP = (P1 * G1) + (P2 * G2) + ... + (Pn * Pn)

where

Px = Power of transmitter x
Gx = Numeric gain of antenna x

In the table(s) below, Power and Gain are entered in units of dBm and dBi respectively and conversions to linear forms are used for the calculations.

LIMITS

From FCC §1.1310 Table 1 (B), the maximum value of S = 1.0 mW/cm^2

RESULTS

Band	Separation Distance (cm)	Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Duty Cycle (%)	FCC Power Density (mW/cm^2)
2400-2483.5	20	15.85	+2.0	17.85	5.11%	0.00062

SETUP PHOTOS

RADIATED RF MEASUREMENT SETUP

RADIATED FRONT PHOTO

RADIATED BACK PHOTO

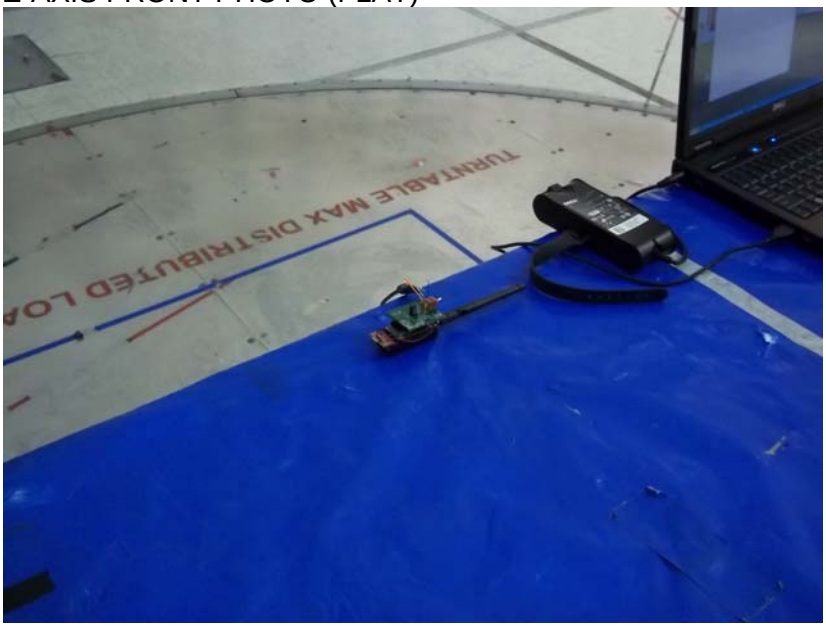
RADIATED RF MEASUREMENT SETUP FOR PORTABLE CONFIGURATION

X-AXIS IS WORST CONFIGURATION

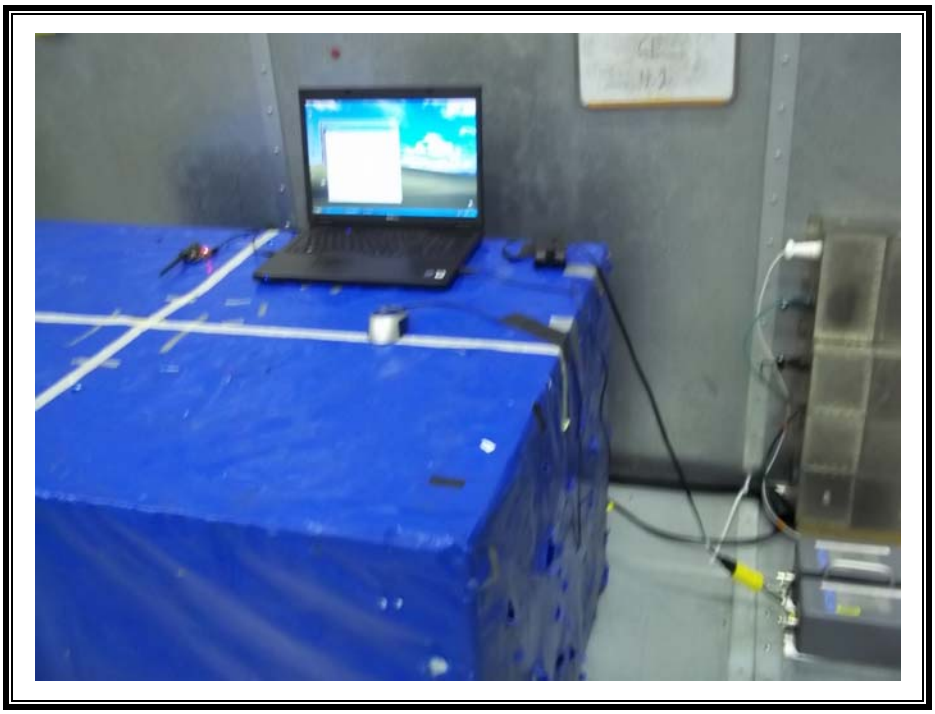
X-AXIS FRONT PHOTO (UPRIGHT)

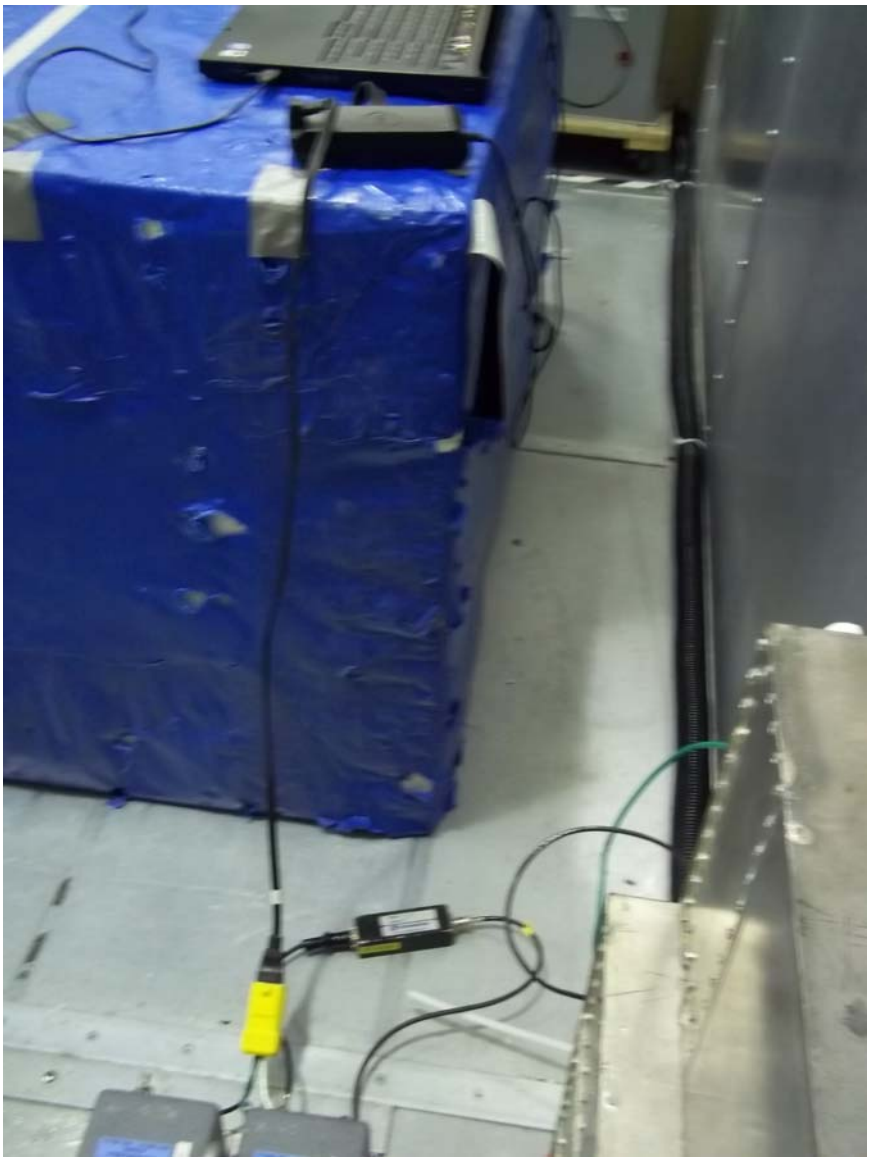
Y-AXIS FRONT PHOTO (SIDE)

Z-AXIS FRONT PHOTO (FLAT)



POWERLINE CONDUCTED EMISSIONS MEASUREMENT SETUP





END OF REPORT