Testing Tomorrow's Technology

**Application**
**For**

**Title 47 USC, Part 2, Subpart J, Paragraph 2.902, Equipment Authorization of Verification for an Unintentional Radiator per Part 15, Subpart B, Paragraphs 15.107 and 15.109**

**and**

**Part 2, Subpart J, Paragraph 2.907 Equipment Authorization of Certification for an Intentional Radiator per Part 15, Subpart C, paragraph 15.247**

**and**

**IC Radio Standards Specification: RSS-210**

**For the**

**LabJack, SkyMote SM-TLB, SM-TLB-RH, SM-TLB-PRO**

# FCC ID: XJF-SMTLB

**UST Project: 09-0079**
**Issue Date: May 24, 2010**

Total Pages: 39

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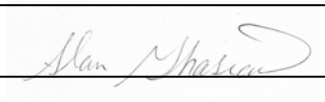
I certify that I am authorized to sign for the Test Agency and that all of the statements in this report and in the Exhibits attached hereto are true and correct to the best of my knowledge and belief:

US TECH (Agent Responsible For Test):

By: Alan Ghasiani

Name: 

Title: Consulting Engineer President

Date: May 24, 2010



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# MEASUREMENT TECHNICAL REPORT

**COMPANY NAME**: LabJack

**MODEL:** SkyMote SM-TLB, SM-TLB-RH, SM-TLB-PRO

**FCC ID:** XJF-SMTLB

**DATE:** May 24, 2010

This report concerns (check one): Original grant [X]
Class II change

Equipment type: Spread Spectrum Transceiver

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? yes_____ No X

If yes, defer until: _____N/A_____
date
agrees to notify the Commission by N/A
date
of the intended date of announcement of the product so that the grant can be issued on that date.

Report prepared by:

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# 1 General Information

## 1.1 Purpose of this Report

This Report is prepared as a means of conveying test results information concerning the suitability of this exact product for public dissemination according to the FCC Rules and Regulations Part 15, Section 247.

## 1.2 Characterization of Test Sample

The sample used for testing was received by US Tech on May 21, 2009 in good operating condition.

## 1.3 Product Description

The Equipment under Test (EUT) is a LabJack, Model SkyMote SMB-ETH, 2.4 GHz Direct Sequence Spread Spectrum transceiver (DSSS).

The EUT provides a link between LabJack motes and USB or Ethernet (see module schematic).

The EUT is a direct sequence spread spectrum transceiver operating in the 2400 MHz to 2483.5 MHz ISM band. The system is based on the IEEE 802.15.4 Wireless Personal Area Network (WPAN) standard, with channels spaced at 5 MHz intervals in the ISM band.

## 1.4 Configuration of Tested System

The Test Sample was tested per *ANSI C63.4, Methods of Measurement of Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (2003)* for FCC subpart B Digital equipment Verification requirements and per FCC KDB Publication number 558074 for Digital Transmission Systems Operating Under section 15.247. Also, FCC Public Notice DA 00-705 was used as a test procedure guide.

Digital RF conducted and radiated Verification emissions data (FCC 15.107 and 109) below 1 GHz were taken with the measuring receiver (or spectrum analyzer's) resolution bandwidth adjusted to 9 kHz and 120 kHz, respectively. All measurements performed above 1.0 GHz were made with a RBW of 1 MHz. All measurements are peak unless stated otherwise. The video filter associated with the spectrum analyzer was off throughout the evaluation process.

A list of EUT and Peripherals is found in Table 1 below. A block diagram of the tested system is shown in Figure 1. Test configuration photographs for spurious and fundamental emissions are provided in separate Appendices.

## 1.5 Test Facility

Testing was performed at US Tech's measurement facility at 3505 Francis Circle, Alpharetta, GA 30004. This site has been fully described and registered with the FCC. Its designation number is US5117. Additionally this site has also been fully described and submitted to Industry Canada (IC), and has been approved under file number 2982A-1.

## 1.6 Related Submittal(s)/Grant(s)

The EUT will be used to wirelessly send/receive data. The transceiver presented in this report will be used with other like transceivers:

The EUT is subject to the following FCC Equipment Authorizations:

a) Certification as a transceiver.
b) Verification as a digital device and receiver.

**Table 1 - EUT and Peripherals**

| PERIPHERAL MANUFACTURER. | MODEL NUMBER | SERIAL NUMBER | FCC ID: | CABLES P/D |
|---|---|---|---|---|
| (EUT) LabJack | SkyMote SM-TLB, -TLB-RH, -TLB-PRO | None | XJF-SMTLB | None |

# 2 Tests and Measurements

## 2.1 Test Equipment

Table 2 below lists test equipment used to evaluate this product. Model numbers, serial numbers and their calibration status are included herewith.

**Table 2- Test Instruments**

| TEST INSTRUMENT | MODEL NUMBER | MANUFACTURER | SERIAL NUMBER | DATE OF LAST CALIBRATION |
|---|---|---|---|---|
| SPECTRUM ANALYZER | 8593E | HEWLETT-PACKARD | 3205A00124 | 9/9/08 |
| LOG PERIODIC 100 MHz to 1000 MHz | 3146 | EMCO | 3110-3236 | 11/21/07 2 Year |
| BICONICAL ANTENNA 25 MHz to 200 MHz | 3110B | EMCO | 9307-1431 | 1/22/09 |
| HORN ANTENNA 1 GHz to 18 GHz | 3115 | EMCO | 9107-3723 | 11/4/08 2 Year |
| PREAMP 1 GHz to 26.5 GHz | 8449B | HEWLETT-PACKARD | 3008A00480 | 9/2/08 |
| CALCULATION PROGRAM | N/A | N/A | Ver. 6.0 | N/A |

**Note 1: The calibration interval of the above test instruments is 12 months unless stated above and all calibrations are traceable to NIST/USA.**
**Note 2: The product test Date is May, 2009.**

## 2.2 Modifications to EUT Hardware

No modifications were made by US Tech in order to bring the EUT into compliance with FCC Part 15, Subpart C Intentional Radiator Limits for the transmitter portion of the EUT or the Subpart B Unintentional Radiator Limits (Receiver and Digital Device) Requirements.

## 2.3 Number of Measurements for Intentional Radiators (15.31(m))

Measurements of intentional radiators or receivers shall be performed and reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in Table 3 as follows:

**Table 3 - Number of Test Frequencies for Intentional Radiators**

| Frequency Range over which the device operates | Number of Frequencies | Location in the Range of operation |
|---|---|---|
| 1 MHz or less | 1 | Middle |
| 1 to 10 MHz | 2 | 1 near the top<br>1 near the bottom |
| Greater than 10 MHz | 3 | 1 near top<br>1 near middle<br>1 near bottom |

Because the EUT operates over 2.4 GHz to 2.4835 GHz, 3 test frequencies will be used.

## 2.4 Frequency Range of Radiated Measurements (Part 15.33)

### 2.4.1 Intentional Radiator

The spectrum shall be investigated for the intentional radiator from the lowest RF signal generated in the EUT, without going below 9 kHz to the $10^{th}$ harmonic of the highest fundamental frequency generated or 40 GHz, whichever is the lowest.

### 2.4.2 Unintentional Radiator

For the digital device, an unintentional radiator, the frequency range shall be 30 MHz to 1000 MHz, or to the range specified in 2.4.1 above, whichever is the higher range of investigation.

## 2.5 Measurement Detector Function and Bandwidth (CFR 15.35)

The radiated and conducted emissions limits shown herein are based on the following:

### 2.5.1 Detector Function and Associated Bandwidth

On frequencies below 1000 MHz, the limits herein are based upon measurement equipment employing a CISPR Quasi-peak detector function and related measurement bandwidths (i.e. 9 kHz from 150 kHz to 30 MHz and 120 kHz from 30 MHz to 1000 MHz). Alternatively, measurements may be made with equipment employing a peak detector function as long as the same bandwidths specified for the Quasi-peak device are used.

### 2.5.2 Corresponding Peak and Average Requirements

Above 1000 MHz, radiated limits are based on measuring instrumentation employing an average detector function. When average radiated emissions are specified there is also a corresponding Peak requirement, as measured using a peak detector, of 20 dB greater than the average limit. For all measurements above 1000 MHz the Resolution Bandwidth shall be at least 1 MHz.

### 2.5.3 Pulsed Transmitter Averaging

When the radiated emissions limit is expressed as an average value, and the transmitter is pulsed, the measured field strength shall be determined by applying a Duty Cycle Correction Factor based upon dividing the total ON time during the first 100 ms period by 100 ms (or by the period if less than 100 ms). The duty cycle may also be expressed logarithmically in dB.

## 2.6 EUT Antenna Requirements (CFR 15.203)

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. LabJack will sell the F6-PRO RF Module with the following antenna in Table 4.

**Table 4 - Allowed Antenna(s)**

| MANUFACTURER | TYPE OF ANTENNA | MODEL | REPORT REFERENCE | GAIN $dB_i$ |
|---|---|---|---|---|
| Johanson Technology | Chip antenna | 2450AT18 | Antenna | 0.5 |

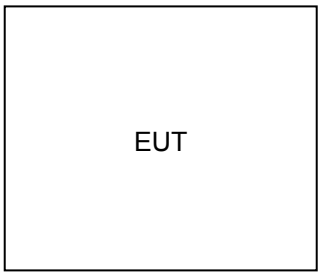



**Figure 1- Test Configuration**

## 2.7 Restricted Bands of Operation (Part 15.205)

Only spurious emissions can fall in the frequency bands of CFR 15.205. The field strength of these spurious cannot exceed the limits of 15.209. Radiated harmonics and other Spurious are examined for this requirement see paragraph 2.10.

## 2.8 Intentional Radiator, Power Lines Conducted Emissions (CFR 15.207)

The power line conducted voltage emission measurements have been carried out in accordance with CFR 15.207, per ANSI C63.4, Paragraph 7, with a spectrum analyzer connected to an LISN and the EUT placed into a continuous mode of transmission. Since the EUT is battery powered and there is no external input, this test was not applicable

## 2.9 Intentional Radiator, Radiated Emissions (Antenna Conducted) (CFR 15.209, 15.247(d)) (IC RSS 210, A2.9 (a))

The EUT was put into a continuous-transmit mode of operation and tested per FCC KDB Publication 558074 for conducted out of band emissions emanating from the antenna port over the frequency range of 30 MHz to 12.5 GHz. A conducted scan was performed on the EUT to identify and record spurious signals that were related to the transmitter. Antenna Conducted Emissions of a significant magnitude that fell within restricted bands were then measured as radiated emissions on the OATS. The conducted emissions graphs are found in figures 4 through 10 below. The limit for antenna conducted power is 1 Watt (30 dBm) per 15.247 (b)(3).

For radiated measurements, the EUT was set into a continuous transmission mode. Below 1 GHz, the RBW of the measuring instrument was set equal to 120 kHz. Peak measurements above 1 GHz were measured using a RBW = 1 MHz, with a VBW ≥ RBW. The results of peak radiated spurious emissions falling within restricted bands are given in Table 6 below.

For Average Voltage measurements above 1 GHz, the emissions were measured using RBW = 1 MHz and VBW = 10 Hz. For a pulse-modulated transmitter, the EUT's average emissions are further modified by adding to them the worst-case duty cycle, determined by adding the EUT's total pulse widths (on time) over a 100 ms period and dividing by 100 ms.

On the OATS, the EUT was mounted on top of a non-conductive table, 80 cm above the floor, by placing it in the X-Z plane along the Z axis with its bottom cover in parallel with the ground. The front of the EUT faced the measurement antenna located 3 meters away. Each signal measured was maximized by raising and lowering the receive antenna between 1 and 4 meters in height while monitoring the ever changing spectrum analyzer display (with channel A in the Clear-Write mode and channel B in the Max-Hold mode) for the largest signal visible. That exact antenna height where the signal was maximized was recorded for reproducibility purposes. Also, the EUT was rotated about its Y-axis while monitoring the Spectrum Analyzer display for maximum. The EUT azimuth was recorded for reproducibility purposes. The EUT was measured when both maxima were simultaneously satisfied.

For test data, see Tables 6 and 7. Radiated emissions above 10 GHz were measured at a distance of 1 meter. The measured value at 1 meter was then extrapolated to the resultant at 3 meters using an inverse distance extrapolation factor of -20 dB/decade. There were no test failures.

**Table 5 - Peak Radiated Harmonic & Spurious Emissions**

| Radiated Harmonic and Spurious Emissions, Tested from 30 MHz – 24 GHz | | | | | | | |
|---|---|---|---|---|---|---|---|
| Tested By: K.M. | Test: FCC Part 15, Para 15.247(d) | | | Client: LabJack | | | |
| | Project: 09-0079 | | | Model: F6-PRO | | | |
| **Frequency (MHz)** | **Test Data (dBuV)** | **AF+CL-PA (dB/m)** | **Corrected Results (dBuV/m)** | **Limits (dBuV/m)** | **Distance / Polarization** | **Pass Margin (dB)** | **Detector PK / AVG** |
| **LOW BAND - PEAK** | | | | | | | |
| 2405.5000 | 63.49 | 32.51 | 96.00 | --- | 3m./VERT | | **PK** |
| 4809.1300 | 52.55 | 2.34 | 54.89 | 74.0 | 3m./VERT | 19.1 | **PK** |
| 7216.3000 | 48.67 | 7.35 | 56.02 | 76.0 | 3m./VERT | 20.0 | **PK** |
| **MID BAND- PEAK** | | | | | | | |
| 2439.5300 | 64.53 | 32.65 | 97.18 | --- | 3m./VERT | | **PK** |
| 4879.1000 | 51.38 | 2.53 | 53.91 | 74.0 | 3m./VERT | 20.1 | **PK** |
| **HIGH BAND- PEAK** | | | | | | | |
| 2479.4000 | 63.50 | 32.81 | 96.31 | --- | 3m./VERT | | **PK** |
| 4959.0800 | 50.30 | 2.76 | 53.06 | 74.0 | 3m./VERT | 20.9 | **PK** |

- - Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 20 dB relaxation of CFR 15.35.
- ND = No other signals detected within 20 dB of specification limit.

SAMPLE CALCULATION:

RESULTS: At 4809.13 MHz: = 52.55 dBuV+ (1 dB high pass filter loss) + 2.34 dB/m = 54.89 dBuV/m @ 3m
Margin = (74.0 – 54.89) = 19.1 dB

Test Date: May 21, 2009

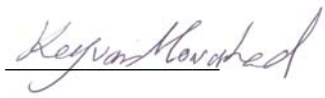
Tested By
Signature:  Name: **Keyvan Muvahhid**

**Table 6 - Average Radiated Spurious**

| Radiated Spurious Emissions, Tested from 30 MHz – 24 GHz | | | | | | | |
|---|---|---|---|---|---|---|---|
| Tested By: K.M. | Test: FCC Part 15, Para 15.247(d) | | | Client: LabJack | | | |
| | Project: 09-0079 | | | Model: F6-PRO | | | |
| **Frequency (MHz)** | **Test Data (dBuV)** | **AF+CL-PA+DC (dB/m)** | **Corrected Results (dBuV/m)** | **Limits (dBuV/m)** | **Distance / Polarization** | **Pass Margin (dB)** | **Detector PK / AVG** |
| **LOW BAND - PEAK** | | | | | | | |
| 2405.3800 | 54.64 | 32.51 | 87.15 | | 3m./VERT | | **PK** |
| 4809.1300 | 50.55 | 2.34 | 52.89 | 54.0 | 3m./VERT | 1.1 | **PK** |
| 7216.3000 | 38.15 | 8.35 | 46.50 | 54.0 | 1m./VERT | 7.5 | **PK** |
| **MID BAND- PEAK** | | | | | | | |
| 2439.5300 | 54.12 | 32.65 | 86.77 | | 3m./VERT | | **PK** |
| 4879.1000 | 48.71 | 2.53 | 51.24 | 54.0 | 3m./VERT | 2.8 | **PK** |
| 7321.4000 | 38.41 | 8.67 | 47.08 | 54.0 | 1m./VERT | 6.9 | **PK** |
| **HIGH BAND- PEAK** | | | | | | | |
| 2479.5300 | 52.69 | 32.81 | 85.50 | | 3m./VERT | | **PK** |
| 4959.0800 | 46.76 | 2.76 | 49.52 | 54.0 | 3m./VERT | 4.5 | **PK** |
| 7438.5000 | 37.73 | 9.02 | 46.75 | 54.0 | 1m./VERT | 7.2 | **PK** |

- - Falls within the restricted bands of CFR 15.205. ND = No other signals detected within 20 dB of specification limit.

No other emissions detected within 20 dB of the Part 15.209 limits for spurious emissions within Restricted Bands.

- - Test data values at frequencies > 5 GHz include a factor of -9.5 dB for distance extrapolation from a test distance of 1 meter to 3 meters.

SAMPLE CALCULATION:
RESULTS: At 4809.1300 MHz: = (50.55+ (1 dB high pass filter loss)) + (2.34) = 52.89 dBuV/m @ 3m
Margin = (54.0 – 52.89) = 1.1 dB

Test Date: May 21, 2009

Tested By
Signature: Keyvan Muvahhid Name: Keyvan Muvahhid

## 2.10 Six (6) dB Bandwidth per CFR 15.247(a)(2), (IC RSS 210, A8.2(a))

The EUT antenna port was connected to a spectrum analyzer having a 50 Ω input impedance. Measurements were performed similar to the method of FCC DA 00-705 for a bandwidth of 6 dB. The RBW was set to approximately 1/100 of the manufacturers claimed RBW and with the VBW ≥ RBW. The results of this test are given in Table 8 and Figures 11 through 13.

**Table 7 – Six (6) dB Bandwidth**

| Frequency (MHz) | 6 dB Bandwidth (MHz) | Minimum FCC Bandwidth (MHz) |
|---|---|---|
| 2405 | 1.48 | 0.5 |
| 2440 | 1.45 | 0.5 |
| 2480 | 1.43 | 0.5 |

Test Date: May 22, 2009
Tested By
Signature: Keyvan Muvahhid Name: Keyvan Muvahhid

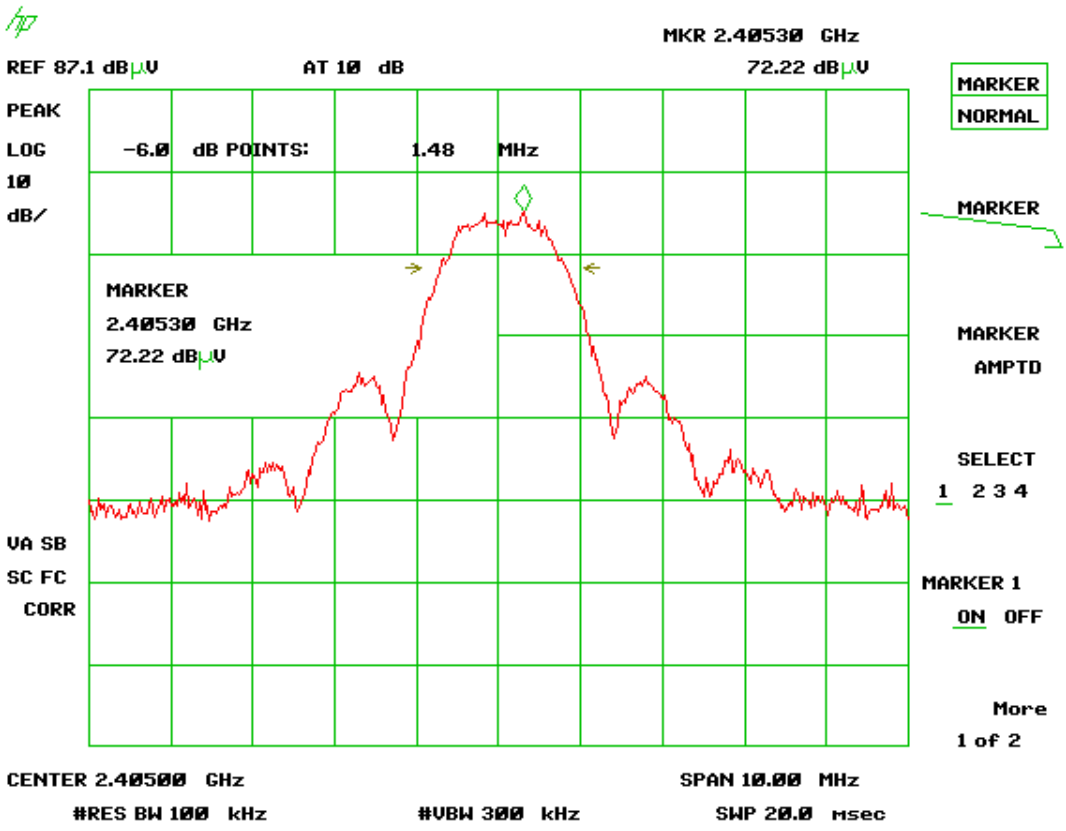



**Figure 2 - Six (6) dB Bandwidth - 15.247 (a) (2) - Low Channel**

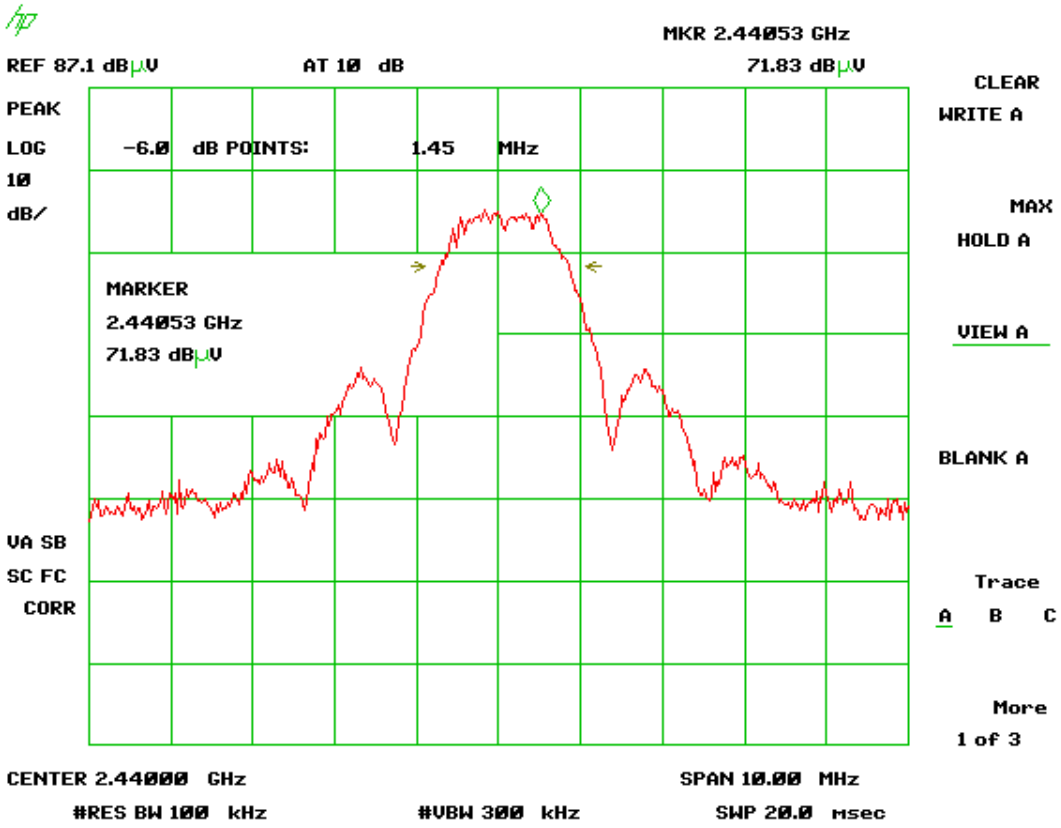



**Figure 3 – Six dB Bandwidth - 15.247 (a) (2) - Mid Channel**

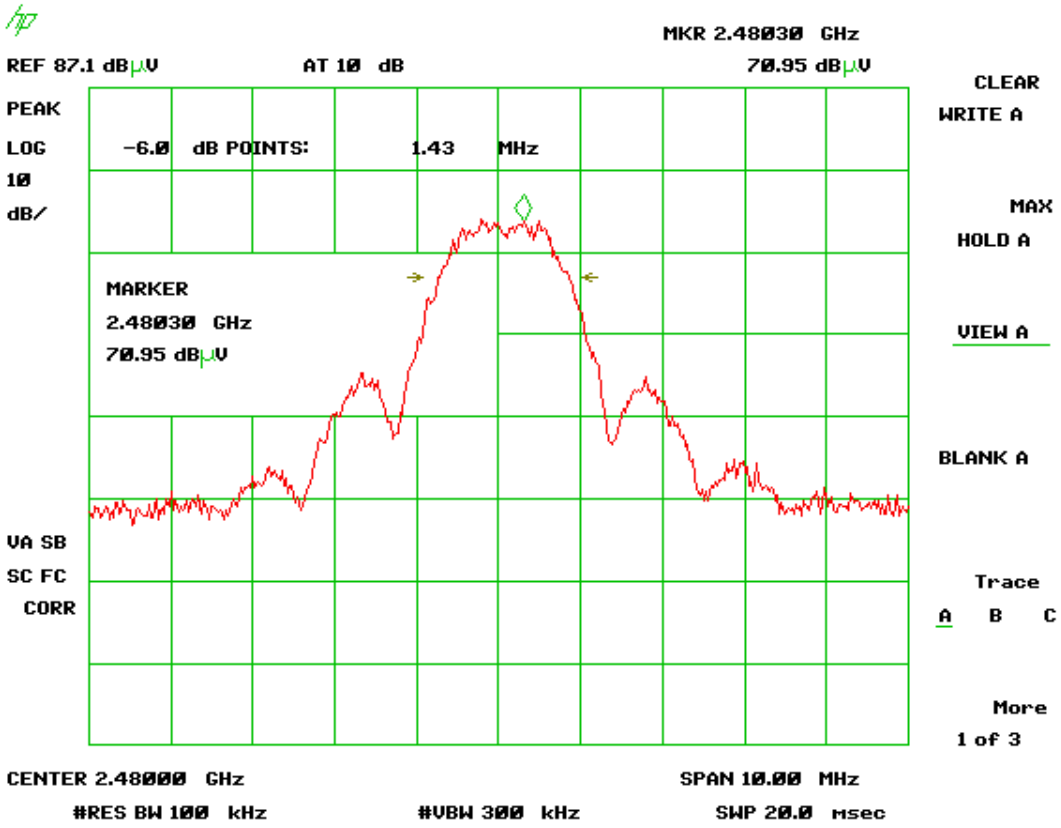



**Figure 4 - Six dB Bandwidth - 15.247 (a) (2) - High Channel**

## 2.11 Maximum Peak Conducted Output Power (CFR 15.247 (b) (3))

For the F6-PRO model, the transmitter was programmed to operate at a maximum of +12 dBm across the bandwidth.

Peak power within the band 2400 MHz to 2483.5 MHz was measured per FCC KDB Publication 558074 as a radiated test with a spectrum analyzer by measuring radiated power at 3 meters. The spectrum analyzer was set for a 50 Ω impedance with the RBW set greater than the 6 dB bandwidth of the EUT, and the VBW ≥ RBW. The loss of the cable, gain of the preamp and antenna factor is added to the corrected measurement. Conducted output Power was determined by using formulas below. The raw data measured values are found in Figures 14, 15 & 16.

E= √(30PG)/d
P= (E*d)^2/(30G)
Where:
E is the measured maximum fundamental field strength in v/m
G is the numeric gain
d is the distance in meter from the EUT
P is the power in watts.

**Table 8 - Peak Antenna Conducted Output Power per Part 15.247 (b) (3)**

| Frequency (MHz) | Raw Test Data (dBuV) | AF+CA-AMP+DC (dB/m) | Corrected Measurement (dBuV/m) | Results (mW) | FCC Limit (mW Maximum) |
|---|---|---|---|---|---|
| 2405.00 | 92.11 | -5.64 | 86.47 | 0.119 | 1000 |
| 2444.00 | 91.38 | -5.47 | 85.91 | 0.104 | 1000 |
| 2480.00 | 90.13 | -5.31 | 84.82 | 0.081 | 1000 |

Test Date: May 1, 2009
Tested By
Signature: Keyvan Muvahhid Name: Keyvan Muvahhid

### 2.11.1 Peak Power Output (CFR 15.247 (b)(3))-low channel

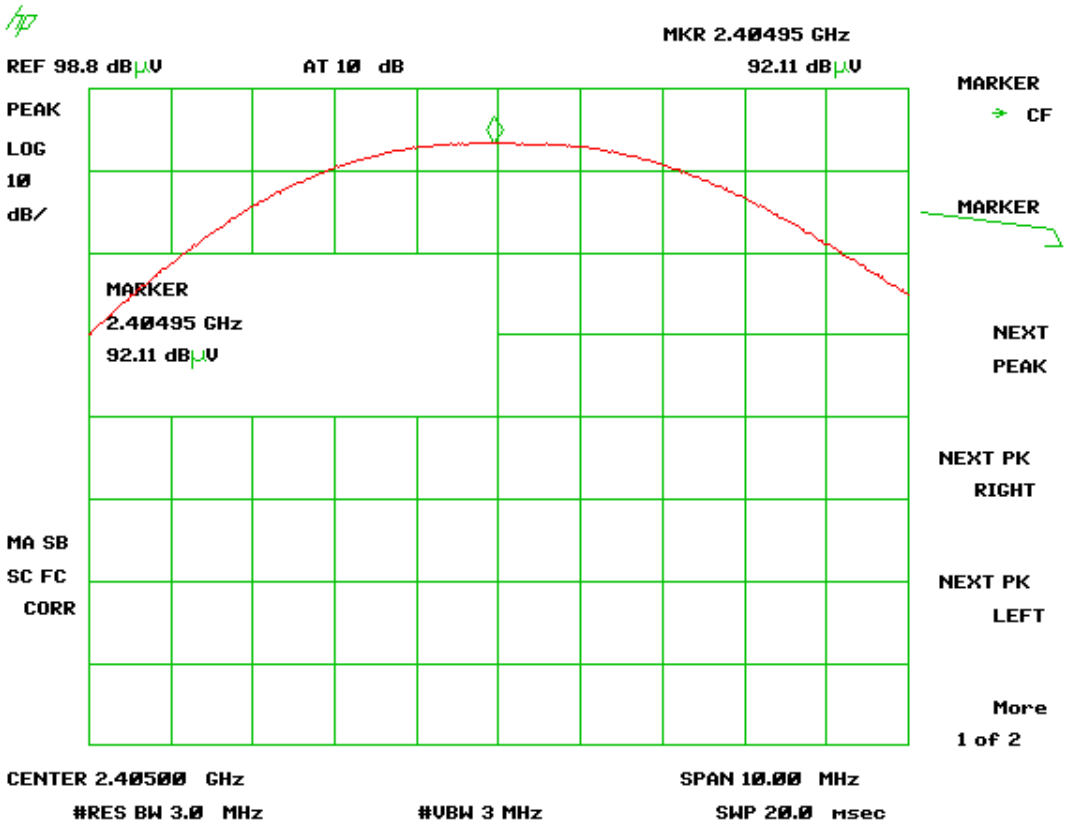



**Figure 5 - Peak Antenna Conducted Output Power, Low Channel**

## 2.11.2 Peak Power Output (CFR 15.247 (b)(3))-Mid Channel

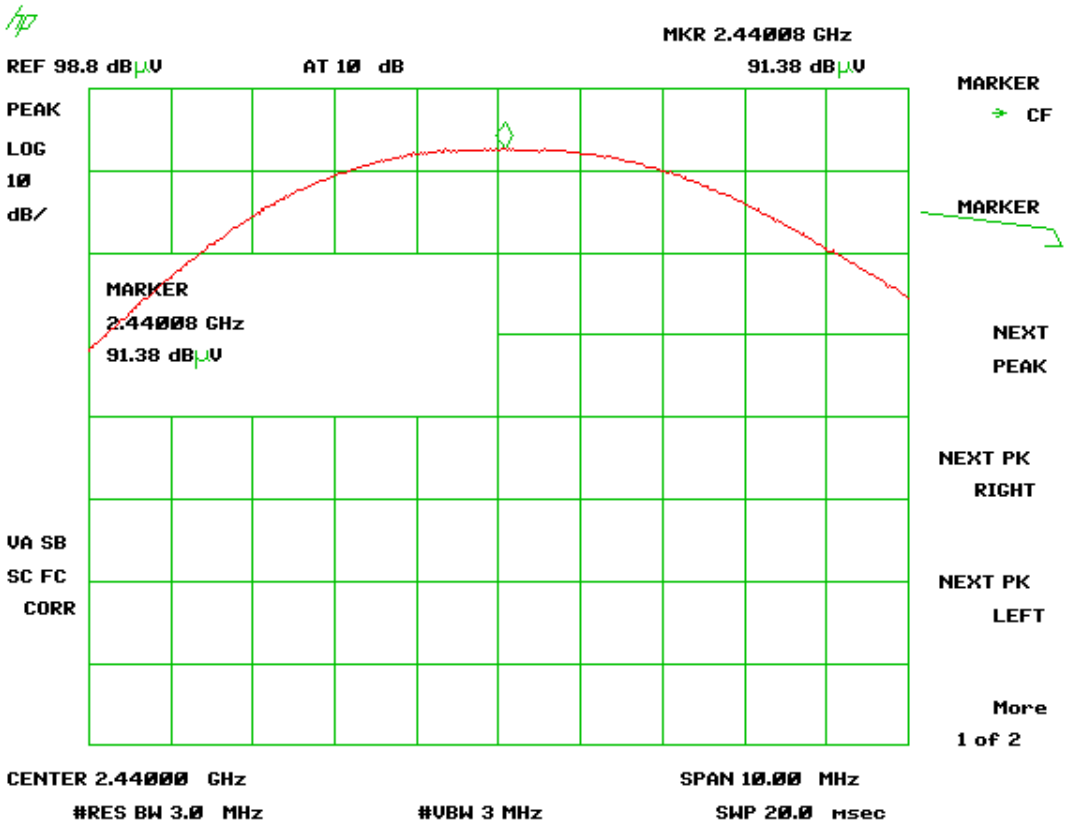



**Figure 6 - Peak Antenna Conducted Output Power, Mid Channel**

## 2.11.3 Peak Power Output (CFR 15.247 (b)(3))-high Channel

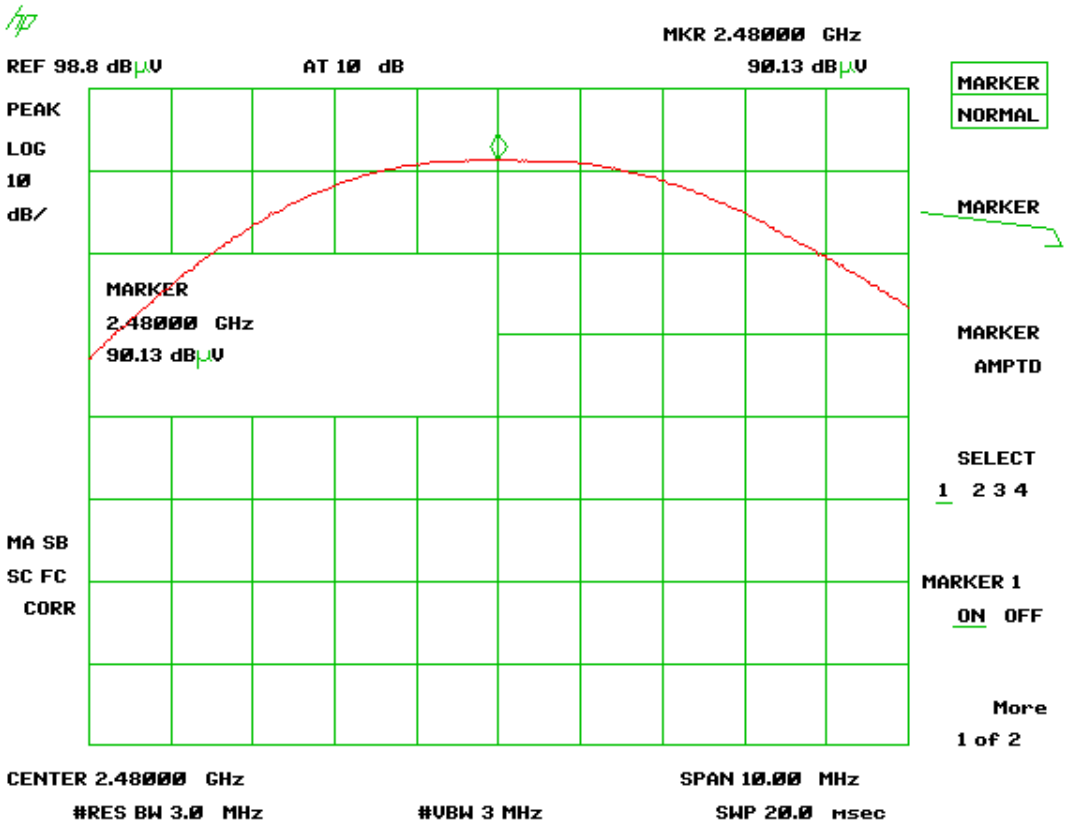



**Figure 7 - Peak Antenna Conducted Output Power, High Channel**

## 2.12 Power Spectral Density (CFR 15.247(e)) (IC RSS 210 A8.5)

The transmitter was placed into a continuous mode of operation at all applicable frequencies. The measurements were performed per the procedures of FCC KDB Procedure 558074. The RBW was set to 3 kHz and the Video Bandwidth was set to ≥ RBW. The trace capture time was set to (Span/3 kHz).

In accordance with 15.247 (e), the power spectral density shall be no greater than +8 dBm per any 3 kHz band.

Results are shown in table 10 and figures 17 through 19 below. Results are corrected by adding the preamp gain, cable loss and antenna factor. All are less than +8 dBm per 3 kHz band.

**Table 9 - Power Spectral Density for Low, Mid and High Bands**

| Frequency (MHz) | Row Test Data (dBuv/3 KHz) | Corrected Test Data (dBuv/m)/3 KHz | Results (dBm/3 kHz) | FCC Limit (dBm/3 kHz) |
|---|---|---|---|---|
| Low-2405 | 80.82 | 75.18 | -20.4 | +8.0 |
| Mid-2440 | 80.29 | 74.82 | -20.96 | +8.0 |
| High- 2475 | 78.93 | 74.11 | -21.54 | +8.0 |

Test Date: May 1, 2009
Tested By
Signature: Keyvan Muvahhid Name: Keyvan Muvahhid

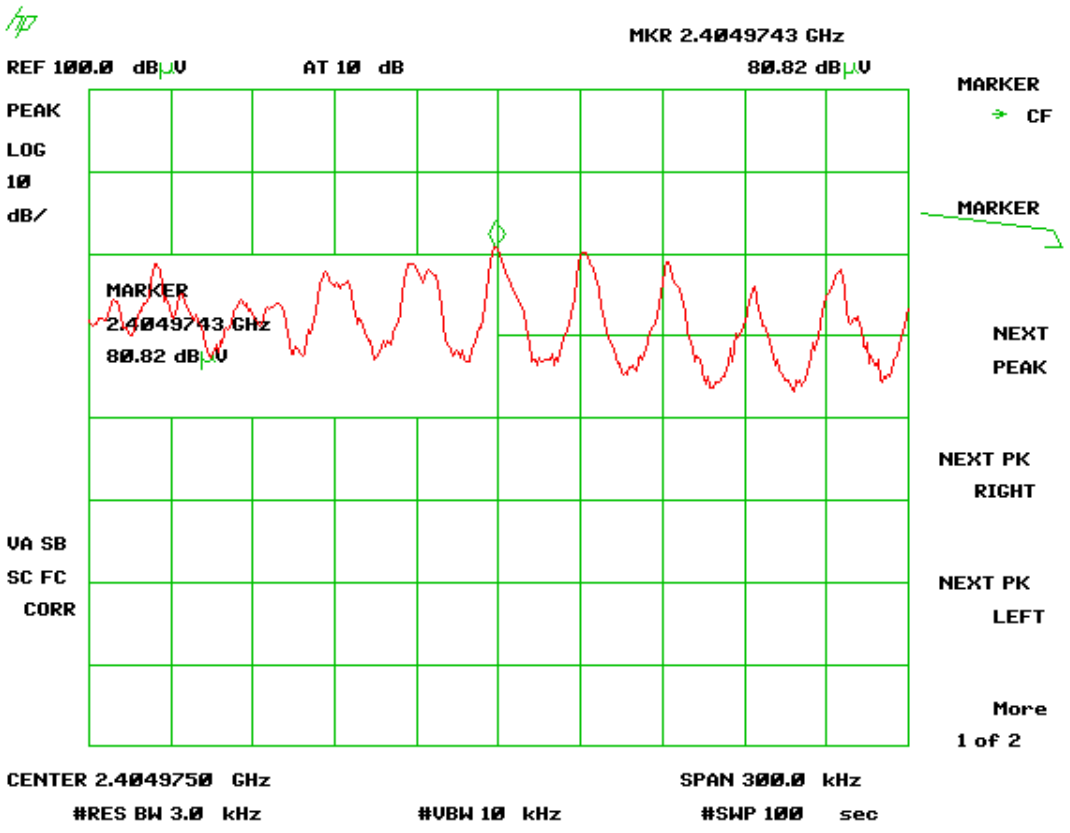



**Figure 8 - Peak Power Spectral Density - Part 15.247 (e) - Low Channel**

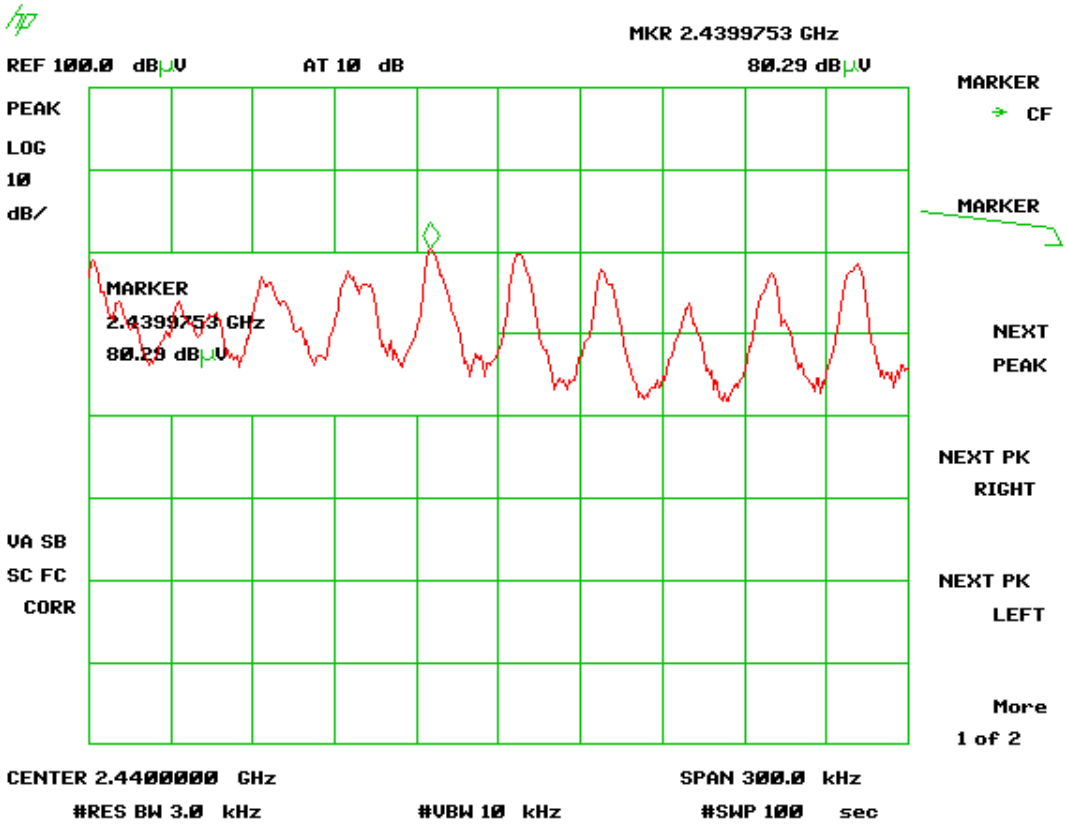



**Figure 9 - Power Spectral Density - Part 15.247 (e) - Mid Channel**

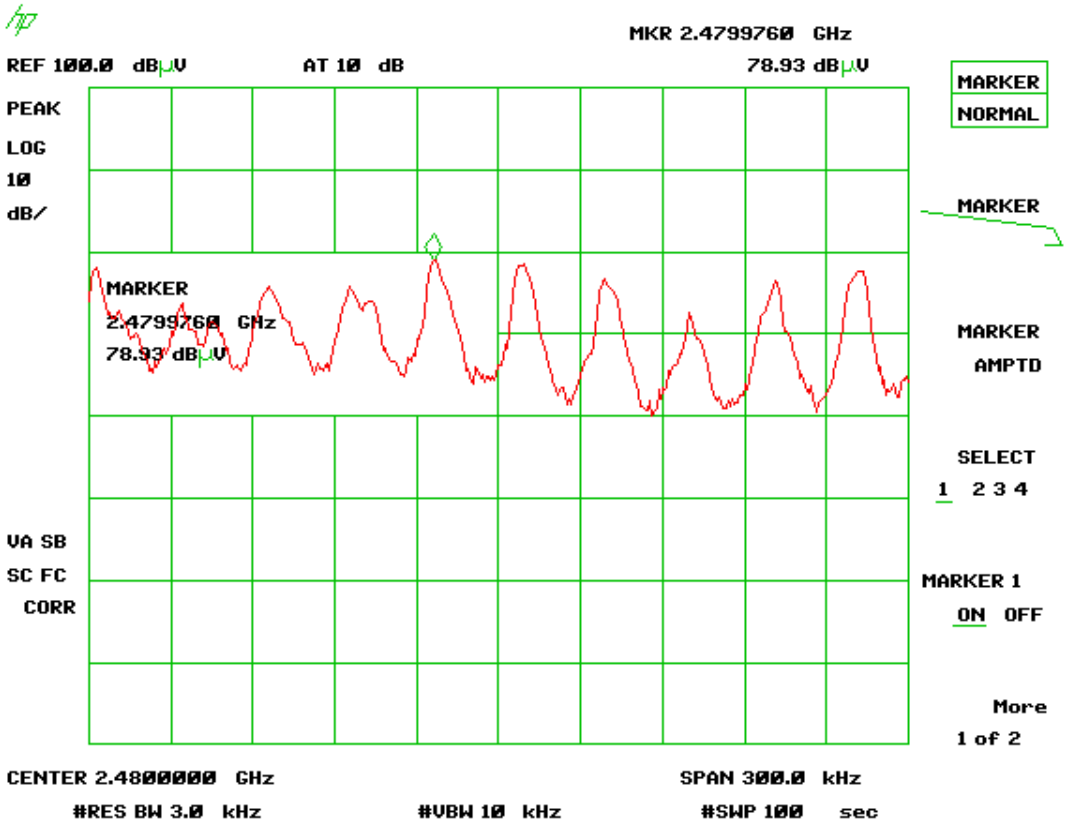



**Figure 10 - Peak Power Spectral Density - Part 15.247 (e) - High Channel**

## 2.13 Band Edge Measurements – (CFR 15.247 (d))

Band Edge measurements are made with the EUT initially operating on the Lowest Channel and then operating on the Highest Channel within its band of operation. Antenna port conducted measurements are performed to demonstrate compliance with the requirement of 15.247(d) that all emissions outside of the band edges be attenuated by at least 20 dB when compared to its highest in-band value (contained in a 100 kHz band). Because these frequencies occur above 1000 MHz they have both a peak and average requirement.

Set the Spectrum Analyzer frequency span large enough (usually around 10 MHz) to capture the peak level of the emission operating on the channel closest to the band edge as well as any modulation products falling outside of the authorized band of operation. Conducted measurements are performed with RBW ≥1% of the frequency span. In all cases, the VBW is set ≥ RBW.

Additionally, because a restricted band per 15.205, begins at the upper band edge (2483.5 MHz), radiated emissions measurements are performed at the upper band edge to demonstrate compliance with the radiated emission limits of 15.209 (54 dBuV/m for average signals and 74 dBuV/m for peak signals) that fall within the restricted bands.

Using the “Marker-Delta” method for radiated band edge, the emission of greatest magnitude up to two standard bandwidths (~2 MHz) outside of the operating band is marked and then a delta level measurement between that emission peak and the peak of the fundamental emission is taken. That delta value is to be subtracted from the value of the fundamental signal of the highest operating channel to compute the field strength of the signal outside of the operating band.

### 2.13.1 Lower Band Edge

Refer to Figure 11, with the transmitter set to its highest operating channel (around 2405 MHz), the signal level at 2.400 GHz, the lower band edge, is more than 20 dB down from the peak per the requirements of 15.247(d). The actual level of attenuation is measured by the delta marker as 45.07 dB. The EUT passes the requirement.

### 2.13.2 Upper Band Edge

Refer to Table 6. The peak electric field strength at 2480 MHz is 96.31 dBuV/m. Because the signal at 2483.5 MHz is 39.5 dB down from the signal field strength, its peak field Strength is 56.81 dBuV/m. This is less than the peak limit of 74 dBuV/m at that frequency. Therefore the EUT passes this requirement.

The limit for the average value of radiated emissions in a Restricted Band is 54 dBuV/m. The EUT passes the average limit requirements for both Low and High Channels

As shown in Figure 13 Below, the raw, measured field strength using a video-averaging technique at 2480.0 MHz (RBW = 1 MHz, VBW = 10 Hz) is 52.69 dBuV. After correcting for cable loss, preamp gain, and the duty cycle, the result is as follows:

Result = $V_{SA}$(dBuV) + [Cable Loss(db) + Antenna Factor (dB/m) ] + Duty Cycle(dB)
= 52.69 + [32.81] = 85.50 dBuV/m.

As shown in Figure 13 Below, the delta measured is 39.28 dB.
= 85.50 dBuV/m – 39.28 dBuV/m = 46.22 dB

The limit is 54 dBuV/m. The unit passes the requirement.

High Channel Passing Margin = 54.0 dBuV/m – 46.22 dBuV/m = 7.88 dB

Test Date: May 1, 2009
Tested By
Signature: Keyvan Muvahhid Name: Keyvan Muvahhid

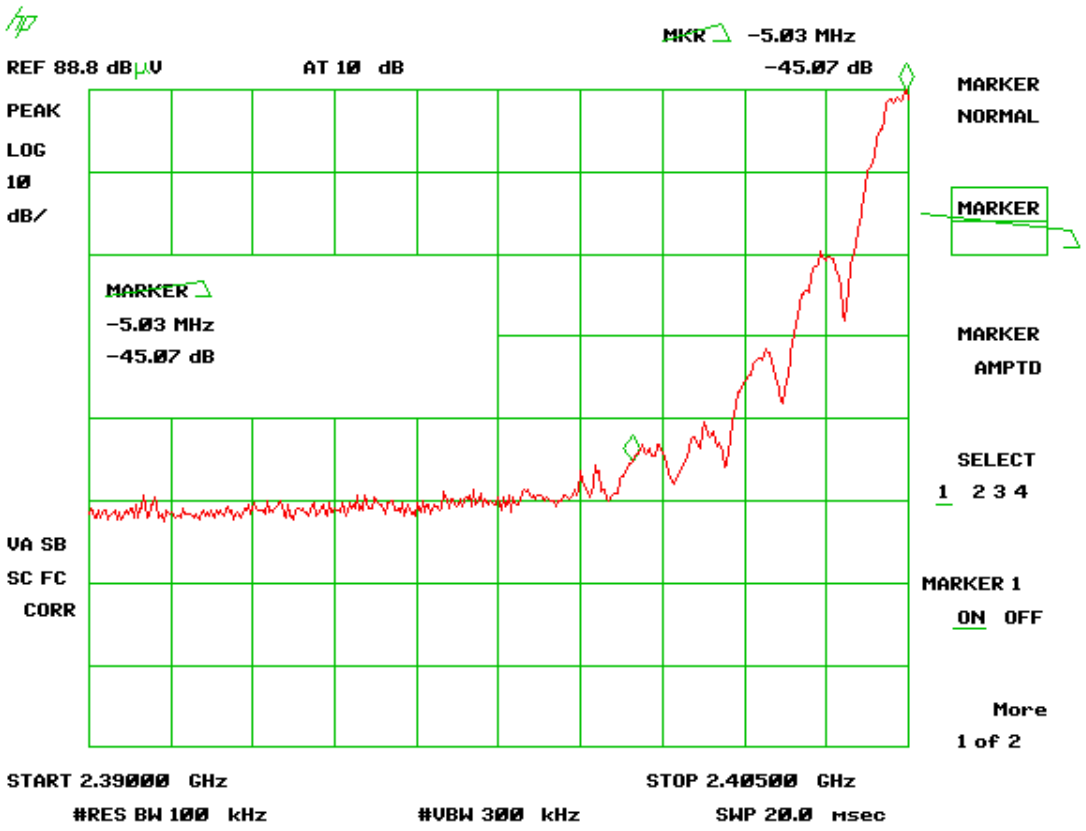



**Figure 11 - Conducted Band Edge Compliance – Low Channel-Peak**

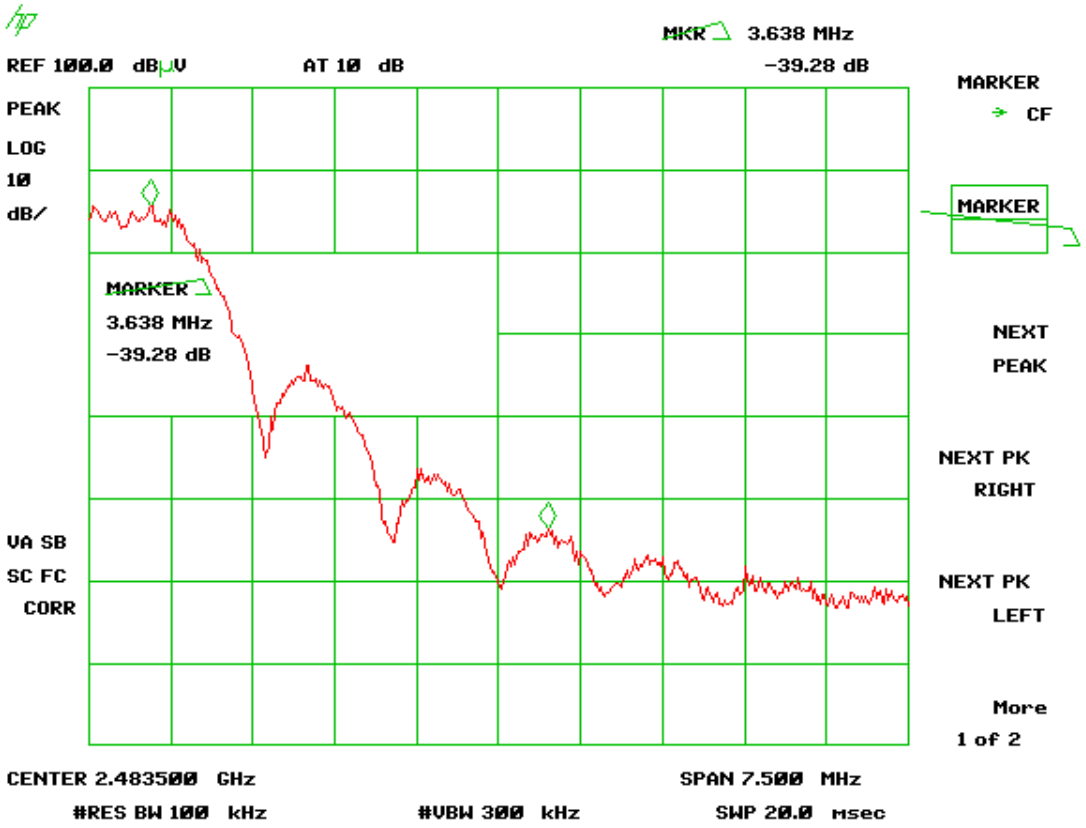



**Figure 12 – Radiated Band Edge Compliance – High Channel-Delta**

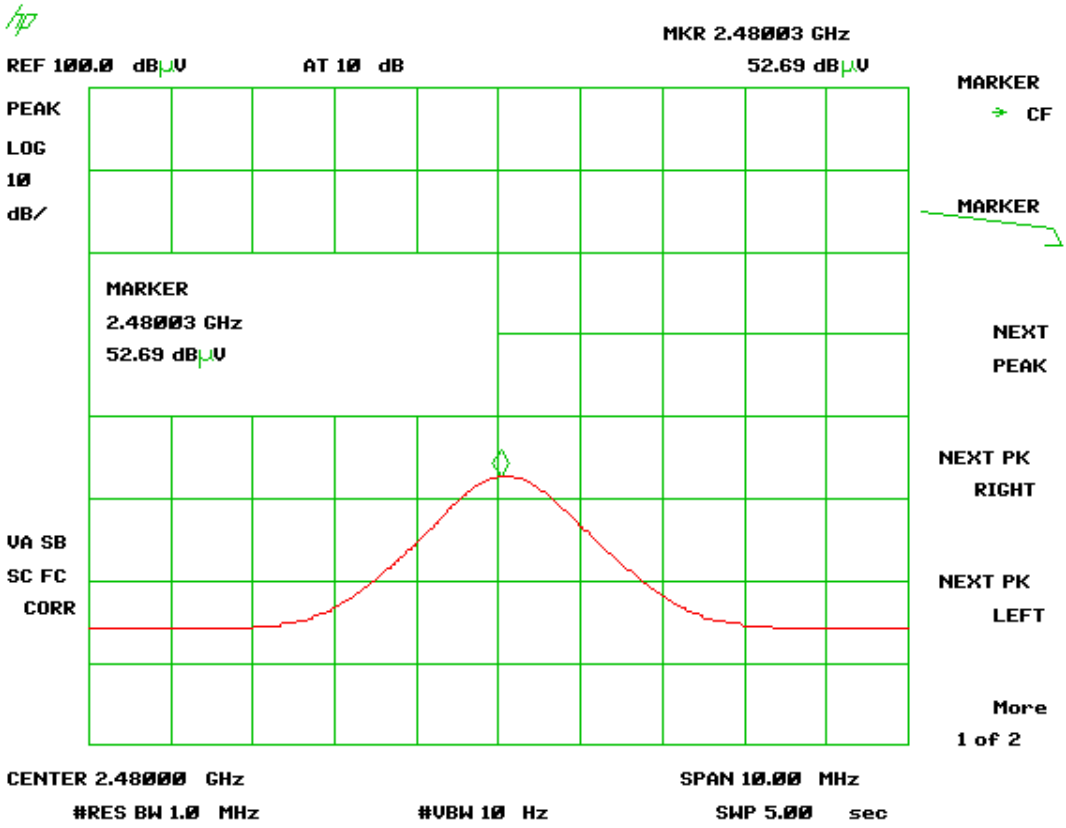



**Figure 13 - Radiated Band Edge Compliance – High Channel**

## 2.14 Maximum Public Exposure to RF (MPE) CFR 15.247 (i)

The maximum exposure level to the public from the RF power of the EUT shall not exceed a power density, **S**, of 1 mW/cm$^2$ at a distance, d, of 20 cm from the EUT.

Therefore, for:

Peak Power (Watts) = 0.119 (from Table 8, herein)
Gain of Transmit Antenna = 0.5 $dB_i$ = 1.12, numeric (from Table 4, herein)
d = Distance = 20 cm = 0.2 m

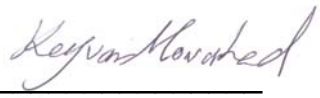
**S** = (PG/ $4\pi d^2$) = EIRP/4A = 0.119 (1.12)/4*$\pi$*0.2*0.2
=0.1332/0.502 = 0.265 w/m$^2$
= (W/m$^2$) (1m$^2$/W) (0.1 mW/cm$^2$)
= 0.0265 mW/cm$^2$

which is << less than 1 mW/cm$^2$

## 2.15 Unintentional Radiator Power Lines Conducted Emissions (CFR 15.107)

The test data provided herein is to support the Verification requirement for the digital apparatus. The power line conducted voltage measurements for Receiver and Digital Devices have been carried out in accordance with CFR 15.107 and ANSI C63.4, Paragraph 7, with a spectrum analyzer connected to an LISN and the EUT placed into an idle condition or a continuous mode of receive (non-transmitting). There were no signals within 19 dB of the limit. Please refer to the results as shown in Table 11 below.

Test Date: May 7, 2009
Tested By

Signature:  Name: Keyvan Muvahhid

## 2.16 Unintentional Radiator, Radiated Emissions (CFR 15.109 (a))

These test data are provided herein to support the Verification requirement for digital devices. Radiated emissions coming from the EUT in a non-transmit state were evaluated from 30 MHz to 12.5 GHz per ANSI C63.4, Paragraph 8.

Measurements were made with the analyzer's resolution bandwidth set to 120 kHz for measurements made below 1 GHz and 1 MHz for measurements made above 1 GHz. The video bandwidth was set to three times the resolution bandwidth. The test data were maximized for magnitude by rotating the turn-table through 360 degrees and raising and lowering the receiving antenna between 1 to 4 meters in height as a part of the measurement procedure. All measured signals were at least 6 db below the specification limit. The results are shown in Table 12 below.

No emissions were detected within 20 dB of the FCC Part 15.109 limits.

Tested By Signature: Keyvan Muvahhid Name: Keyvan Muvahhid

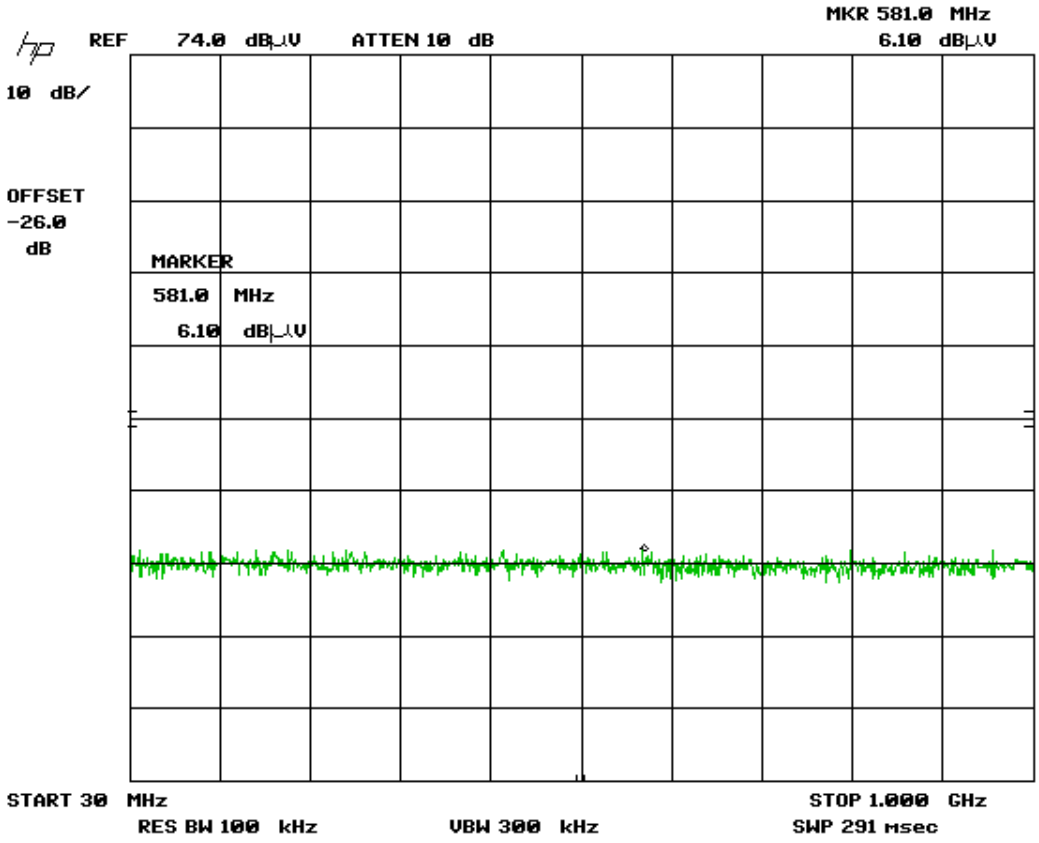



**Figure 14-Radiated Emissions Horizontal Polarity**

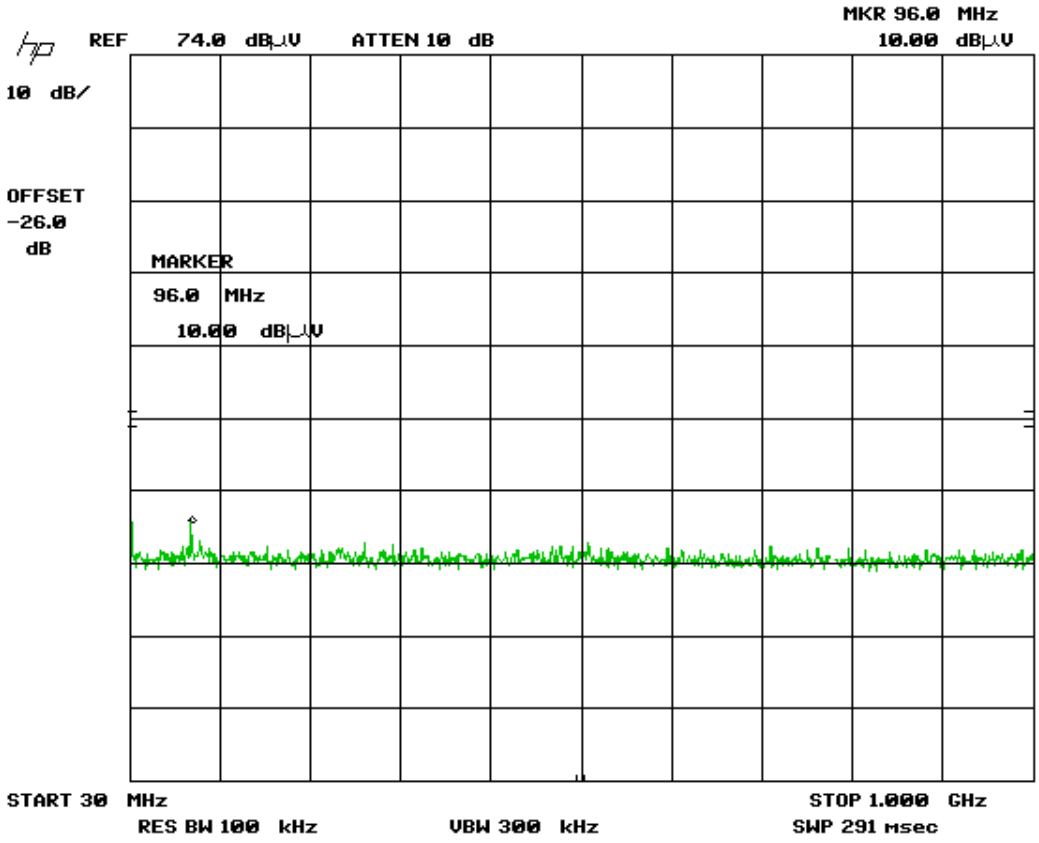



**Figure 15-Radiated Emissions Vertical Polarity**

## 2.17 Measurement Uncertainty

### 2.17.1 Conducted Emissions Measurement Uncertainty:

Measurement Uncertainty (within a 95% confidence level) for this test is ±2.8 dB.

The data listed in this test report has sufficient margin to negate the effects of uncertainty. This measurement unconditionally passes.

### 2.17.2 Radiated Emissions Measurement Uncertainty:

For a measurement distance of 3 m the measurement uncertainty (with a 95% confidence level) for this test using a Biconical Antenna (30 MHz to 200 MHz) is ±5.3 dB. This value includes all elements of measurement.

The measurement uncertainty (with a 95% confidence level) for this test using a Log Periodic Antenna (200 MHz to 1000 MHz) is ±5.1 dB.

The measurement uncertainty (with a 95% confidence level) for this test using a Horn Antenna is ±5.1 dB.