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

For the

Nivis LLC, VN210 Module

FCC ID: SQB-NIVISMOD0003

UST Project: 09-0058
Issue Date: May 17, 2009

Total Pages: 48

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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: Stephen A. Sawyer

Name: 

Title: Chief Compliance Engineer

Date: May 13, 2009

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MEASUREMENT TECHNICAL REPORT

COMPANY NAME: Nivis, LLC

MODEL: VN210

FCC ID: SQB-NIVISMOD0003

DATE: May 13, 2009

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

Equipment type: VN210 Module

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:

US Tech
3505 Francis Circle
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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 April 30, 2009 in good operating condition.

1.3 Product Description

The Equipment under Test (EUT) is a Nivis, LLC, Model VN210, 2.4 GHz Direct Sequence Spread Spectrum transceiver (DSSS).

The EUT is plugged directly into an Applications board and soldered in place. The Application board provides regulated 3.3 VDC @ 150ma, thus the request for limited modularity according to CFR 15.212 (a) and the exception of subparagraph 15.212 (b) with this particular configuration. Full compliance of the module when installed into an end user device will take advantage of the shielding qualities of the end user hardware including satisfactory power line emissions performance. The EUT will be tested to provide graphic evidence that it does not degrade the end users satisfactory EMI profile.

The module provides general purpose analog and digital I/O for use by the Applications board (see module schematic). The module firmware implements the Nivis Mesh protocol.

A functional block diagram for the Nivis RF module is shown on Figure 1, herein. This module is a direct sequence spread spectrum transceiver operating in the 2400MHz 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. The system operates at a chip rate of 2 Mcps, a symbol rate of 62.5 kbps, and a bit rate of 250 kbps. O-QPSK modulation is used with 16-ary orthogonal symbols.

An input supply of 3.3 VDC is supplied to the RF module using buck-boost power supply. The module transmits with a maximum power of +10 dBm into the onboard MMCX connector. This module does not transmit for more than 42.35 ms over any 100 ms time period.

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 of the transmitter (with limited modular approval), Paragraphs 2.1 through 2.15 herein.
b) Verification as a class A digital device, Paragraphs 2.16 and 2.17 herein.

The manufacturer desires to seek a limited modular approval on this device.

Table 1 - EUT and Peripherals

PERIPHERAL MANUFACTURER.	MODEL NUMBER	SERIAL NUMBER	FCC ID:	CABLES P/D
(EUT) Nivis, LLC	VN210	None	Pending: SQB-NIVISMOD0003	6' U - P
Antenna, see Nearson ½ wave	S181-FL-5-RMM-2450S	None	None	30 cm Coax
Laptop Computer Hewlett Packard	None	None	None	6' U -P
Power Supply Hewlett Packard	HPP181a	00629710	None	6' U - P 120 VAC/ 60 Hz

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	8566B	HEWLETT-PACKARD	2332A10055	10/10/08
SPECTRUM ANALYZER	8593E	HEWLETT-PACKARD	3205A00124	9/9/08
RF PREAMP 100 kHz to 1.3 GHz	8447D	HEWLETT-PACKARD	2944A06291	9/12/08
BICONICAL ANTENNA 25 MHz to 200 MHz	3110B	EMCO	9307-1431	1/22/09
LOG PERIODIC 100 MHz to 1000 MHz	3146	EMCO	3110-3236	11/21/07 2 Year
LISN (x 2) 9247-50-TS-50-N	9247	Solar Electronics	955824 & 955826	1/29/09
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

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 1 near the bottom
Greater than 10 MHz	3	1 near top 1 near middle 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. 9kHz 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. Nivis, LLC will sell the VN210 RF Module with the following antenna in Table 4.

Table 4 - Allowed Antenna(s)

MANUFACTURER	TYPE OF ANTENNA	MODEL	REPORT REFERENCE	GAIN dB_i	TYPE OF CONNECTOR
Nearson, Inc.	External Monopole	S181FL-5-RMM-2450S	Antenna 1	2.0	MMCX

2 Test and Measurements (Cont'd)

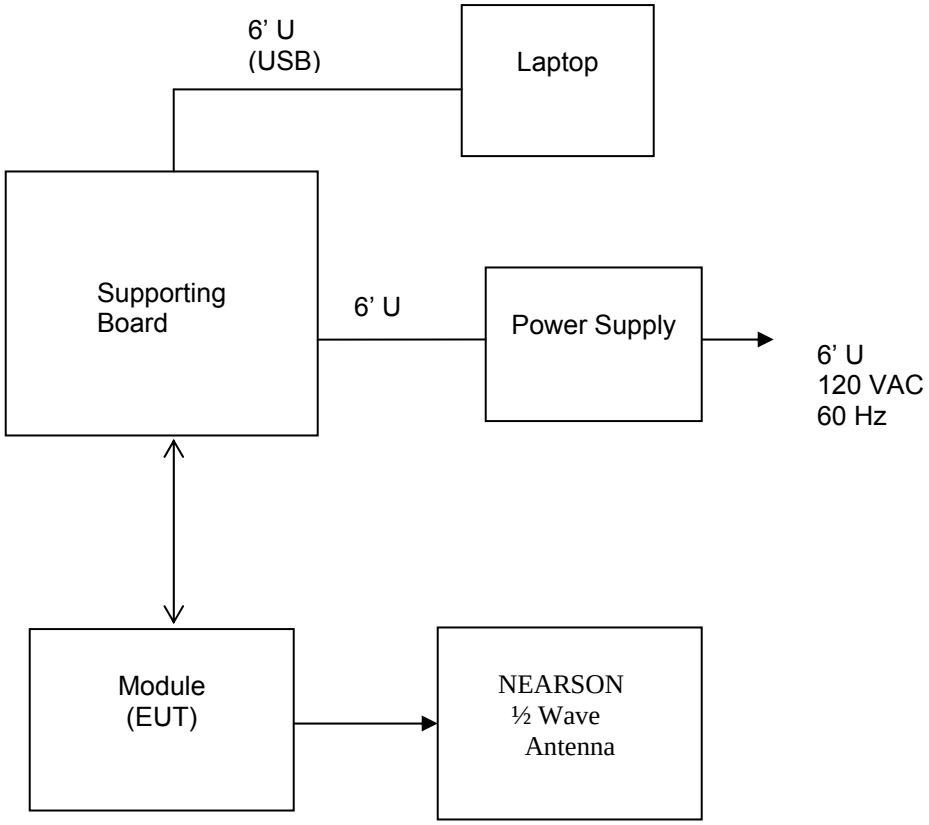


Figure 1- Test Configuration

2 Test and Measurements (Cont'd)

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 Transmitter Duty Cycle (CFR 35 (c))

The duty cycle de-rating factor used in the calculation of average radiated limits (per CFR 15.209 and 15.35(c)) is described below. This factor was calculated by first determining the worst case scenario for system operation.

With the worst case operating scenario the transmission duty cycle is calculated as:

Under worst case conditions, the maximum duration of each transmission is 4.352mS repeated at every 10mS (As shown in figure 3).

This adds up to 10 transmissions every 100mS, or a total of 43.52mS in a 100mS window (as shown in figures 2 and 3).

Total ON time: 43.52 milliseconds. Then (43.52 mS/100 mS)*100% = 43.5%
In terms of logarithmic voltage: dB = 20 log (0.4352) =

DC = - 7.23 dB

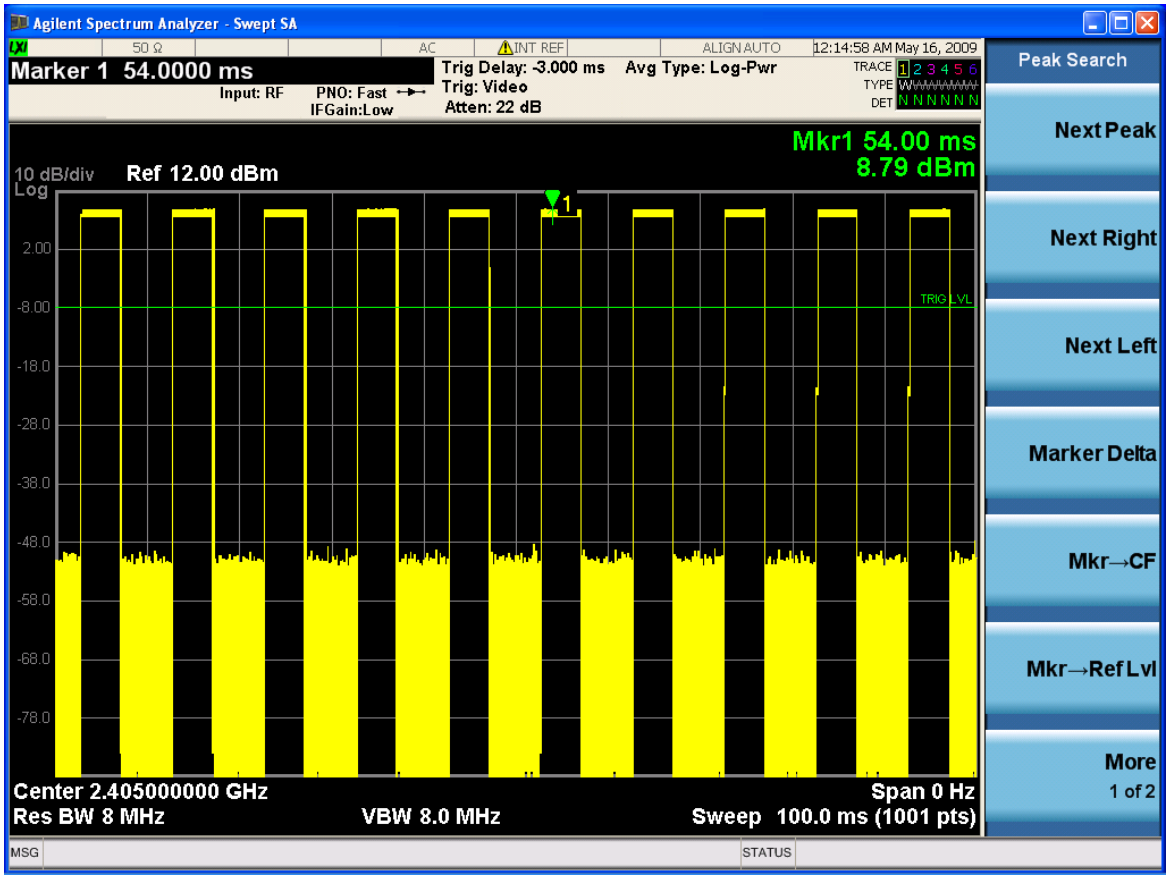


Figure 2- Transmitter Duty Cycle

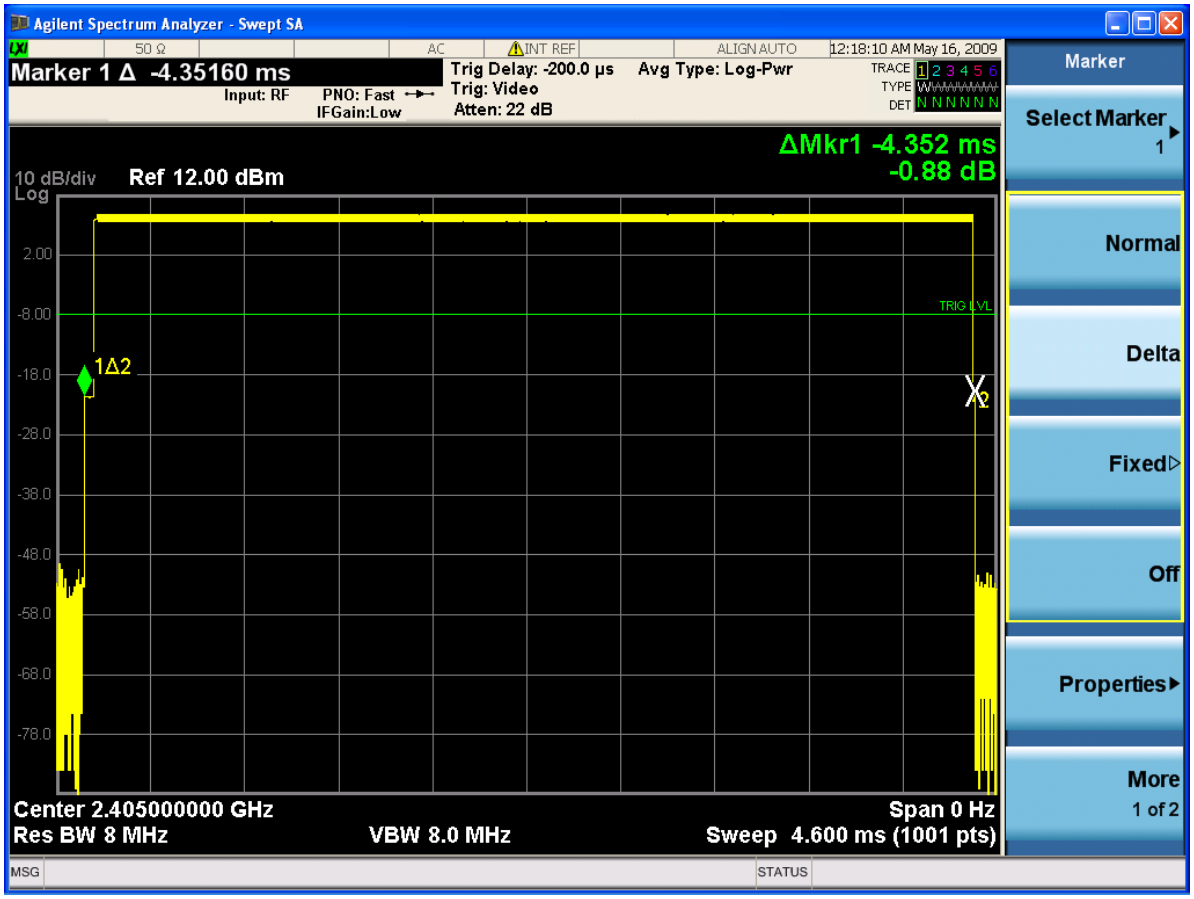


Figure 3- Pulse Width

2 Test and Measurements (Cont'd)

2.9 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.

The worst-case results for conducted emissions were determined to be produced when the EUT was operating under continuous transmission on the low channel. There were no signals within 8 dB of the Average limits. Those results are given in Table 5 below.

Table 5 – Transmitter Power Line Conducted Emissions Test Data, Part 15.207

CONDUCTED EMISSIONS						
Tested By: K.M	Specification Requirement: FCC Part 15.207 Class B		Project No.: 09-0058	Manufacturer/Model: Nivis, LLC model VN210		
Frequency (MHz)	Test Data (dBuV)	LISN+CL-PA (dB)	Corrected Results (dBuV)	Avg Limits (dBuV)	Margin (dB)	Detector
120 VAC, 60 Hz, Supply Line						
0.1550	47.80	-0.34	47.46	55.7	8.3	PK
0.5100	34.00	-0.06	33.94	46.0	12.1	PK
2.1360	28.00	0.16	28.16	46.0	17.8	PK
7.4000	25.40	0.31	25.71	50.0	24.3	PK
19.3900	26.10	0.51	26.61	50.0	23.4	PK
27.6000	27.60	0.49	28.09	50.0	21.9	PK
120 VAC, 60 Hz, Neutral Line						
0.1510	48.20	-0.34	47.86	55.9	8.1	PK
0.5870	25.90	-0.13	25.77	46.0	20.2	PK
2.0000	26.20	0.06	26.26	46.0	19.7	PK
7.2000	26.00	0.32	26.32	50.0	23.7	PK
19.3200	26.00	0.41	26.41	50.0	23.6	PK
21.3200	26.30	0.45	26.75	50.0	23.3	PK

Tested from 150 kHz to 30 MHz
SAMPLE CALCULATIONS: At 155 kHz, = 47.80 + (- 0.34) = 47.46 dBuV
Test Date: May 7, 2009
Tested By
Signature: Keyvan Muvahhid Name: Keyvan Muvahhid

2 Tests and Measurements (Cont'd)

2.10 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.

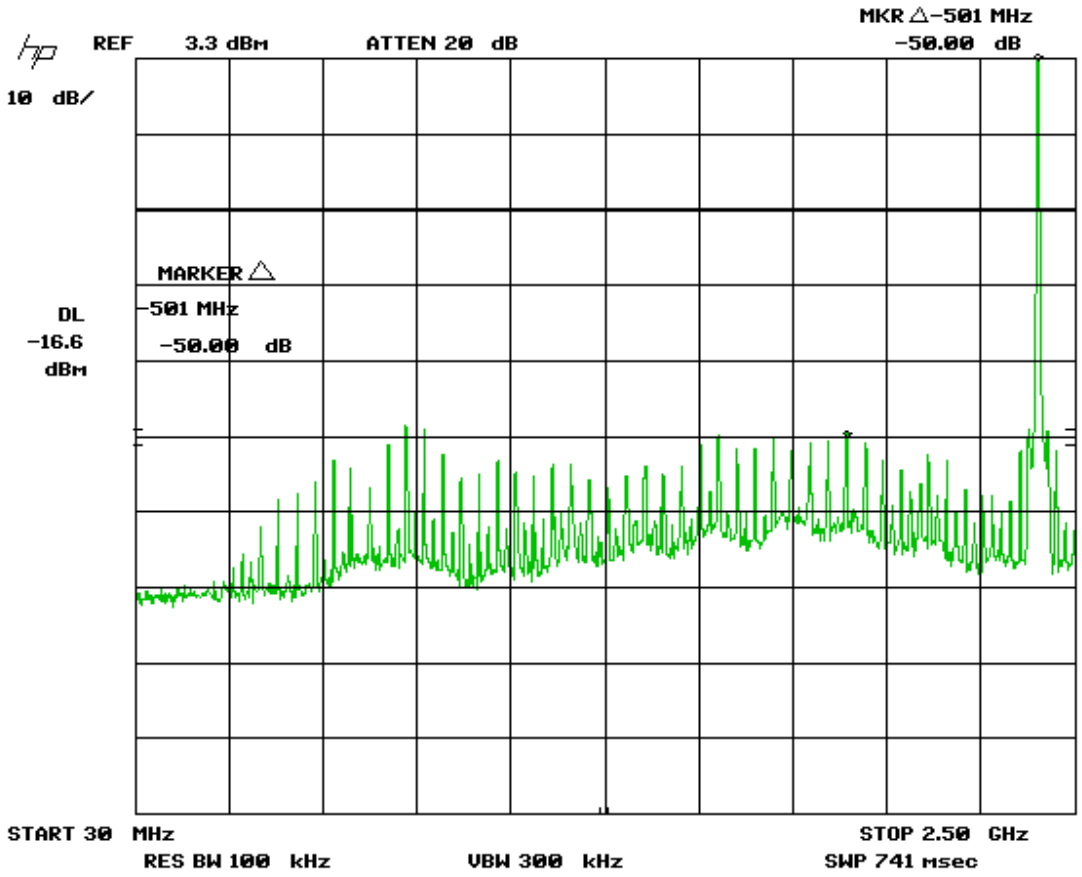
For Average Voltage measurements above 1 GHz, the emissions were measured using RBW = 1 MHz and VBW = 10 Hz. For a pulse-modulated transmitter, the EUT's average emissions are further modified by adding to them the worst-case duty cycle, determined by adding the EUT's total pulse widths (on time) over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

2 Test and Measurements (Cont'd)

2.10 Intentional Radiator, Radiated Emissions (CFR 15.209, 15.247(d)) (IC RSS 210, A2.9 (a)) (Cont'd).



Note: Signal shown represents Fundamental Frequency

Figure 4 - Antenna Conducted Spurious Emissions – CFR 15.247 (d) - Low Channel, Part 1

2 Test and Measurements (Cont'd)

2.10 Intentional Radiator, Radiated Emissions (CFR 15.209, 15.247(d)) (IC RSS 210, A2.9 (a)) (Cont'd).

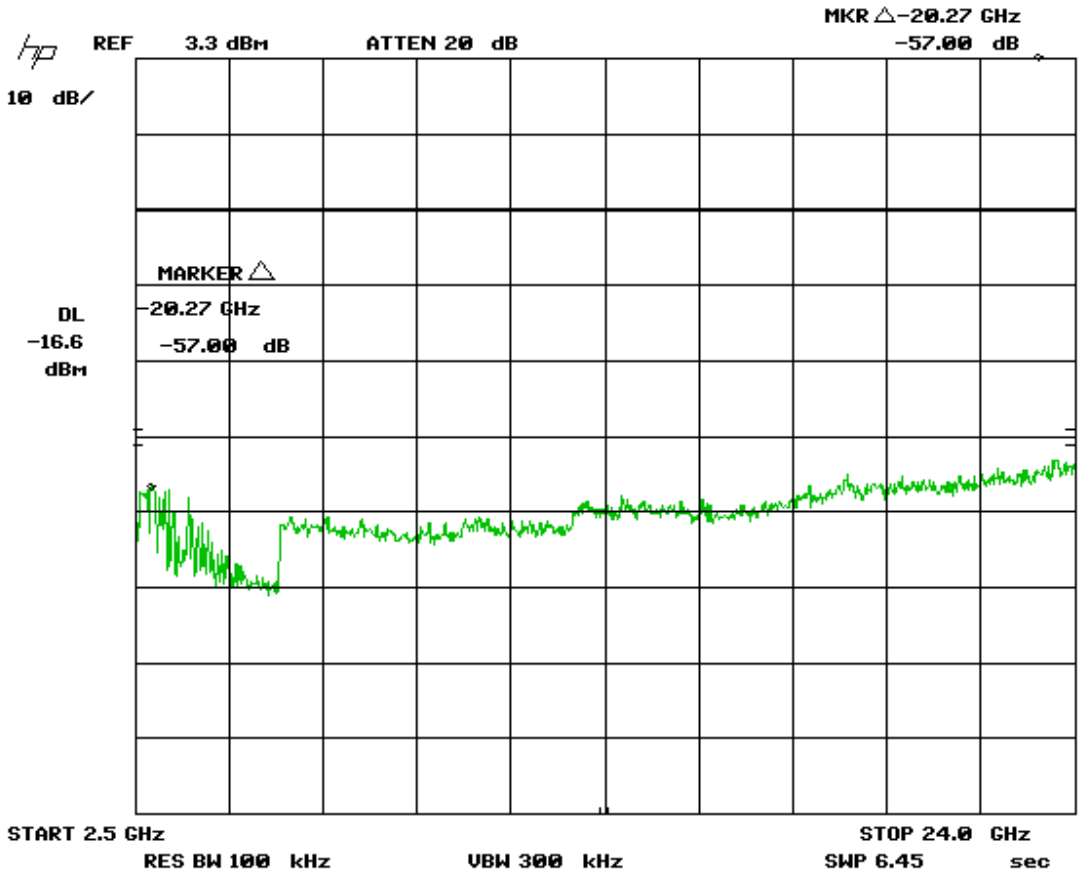


Figure 5 - Antenna Conducted Spurious Emissions – CFR 15.247 (d) - Low Channel, Part 2

2 Test and Measurements (Cont'd)

2.10 Intentional Radiator, Radiated Emissions (CFR 15.209, 15.247(d)) (IC RSS 210, A2.9 (a)) (Cont'd).

Note: Signal shown represents Fundamental Frequency

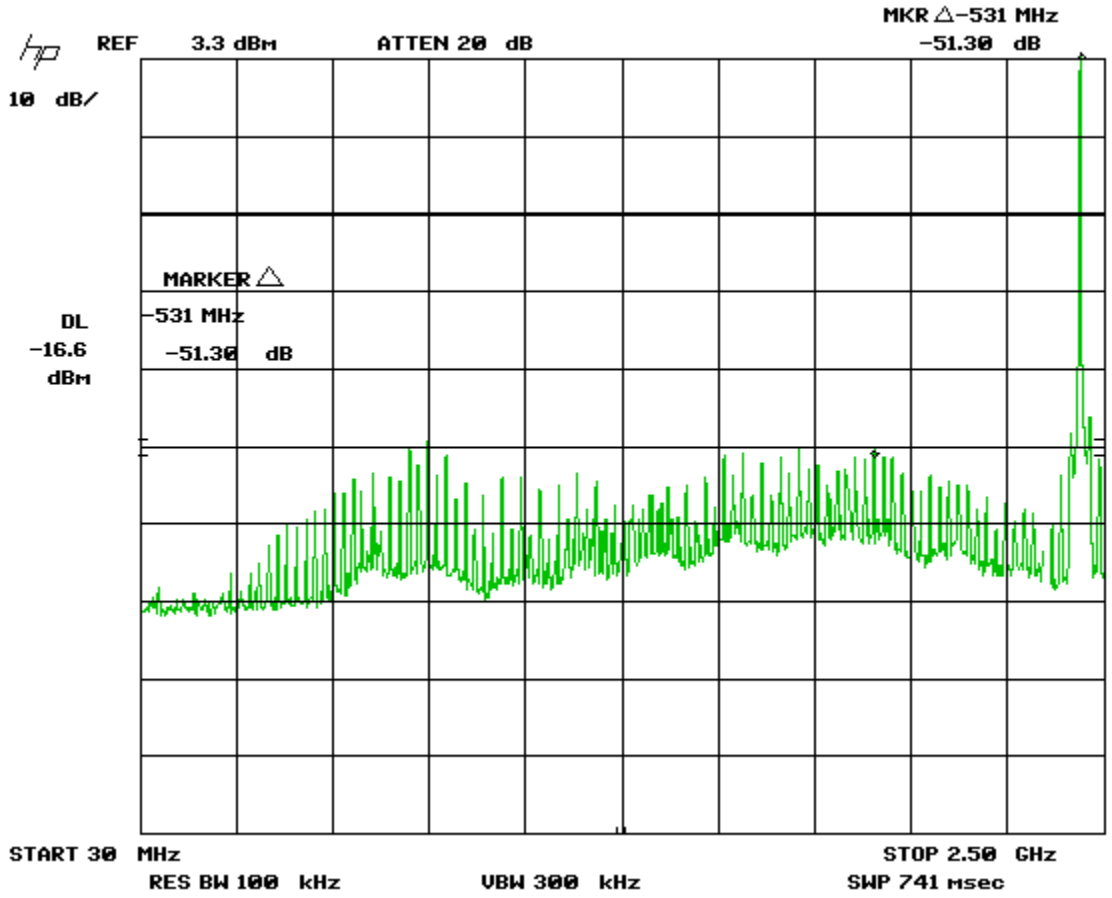


Figure 6 - Antenna Conducted Spurious Emissions – CFR 15.247 (d) - Mid Channel, Part 1

2 Test and Measurements (Cont'd)

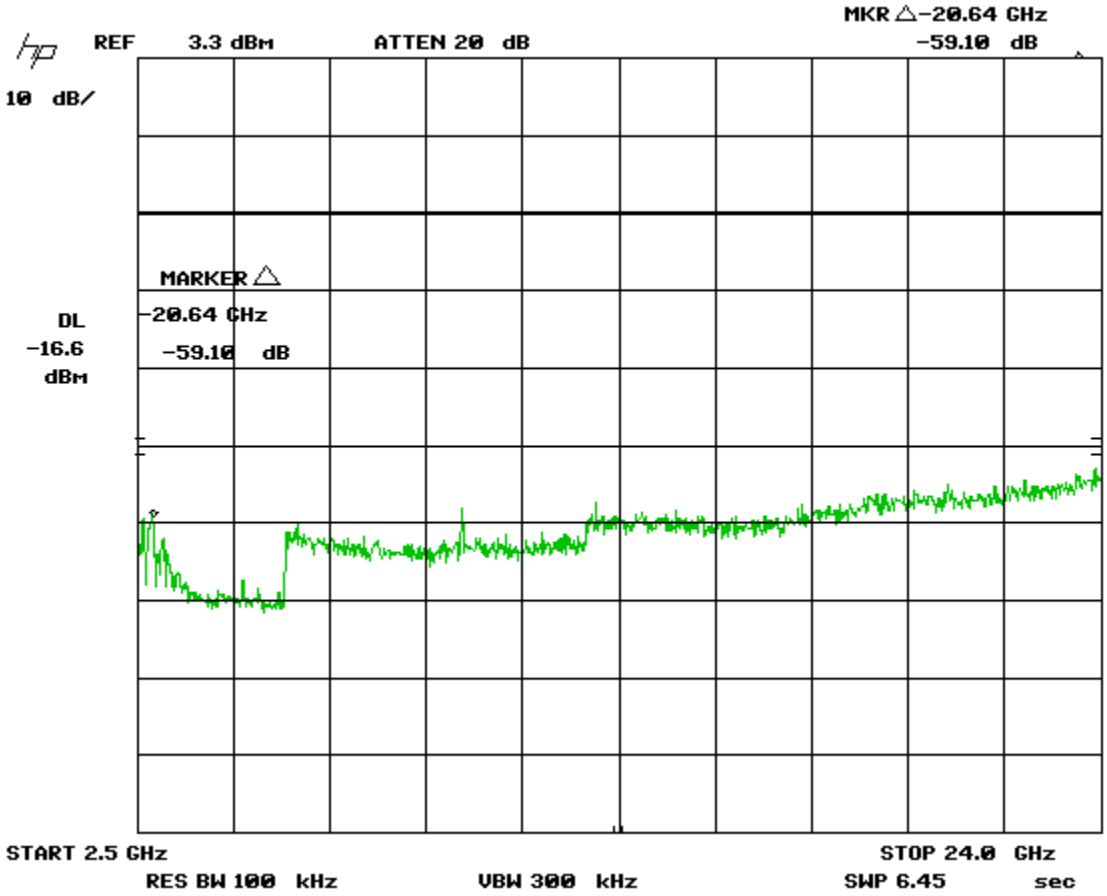


Figure 7 - Antenna Conducted Spurious Emissions – CFR 15.247 (d) - Mid Channel, Part 2

2 Test and Measurements (Cont'd)

2.10 Intentional Radiator, Radiated Emissions (CFR 15.209, 15.247(d)) (IC RSS 210, A2.9 (a)) (Cont'd)

Note: Large Signal shown is Fundamental Frequency

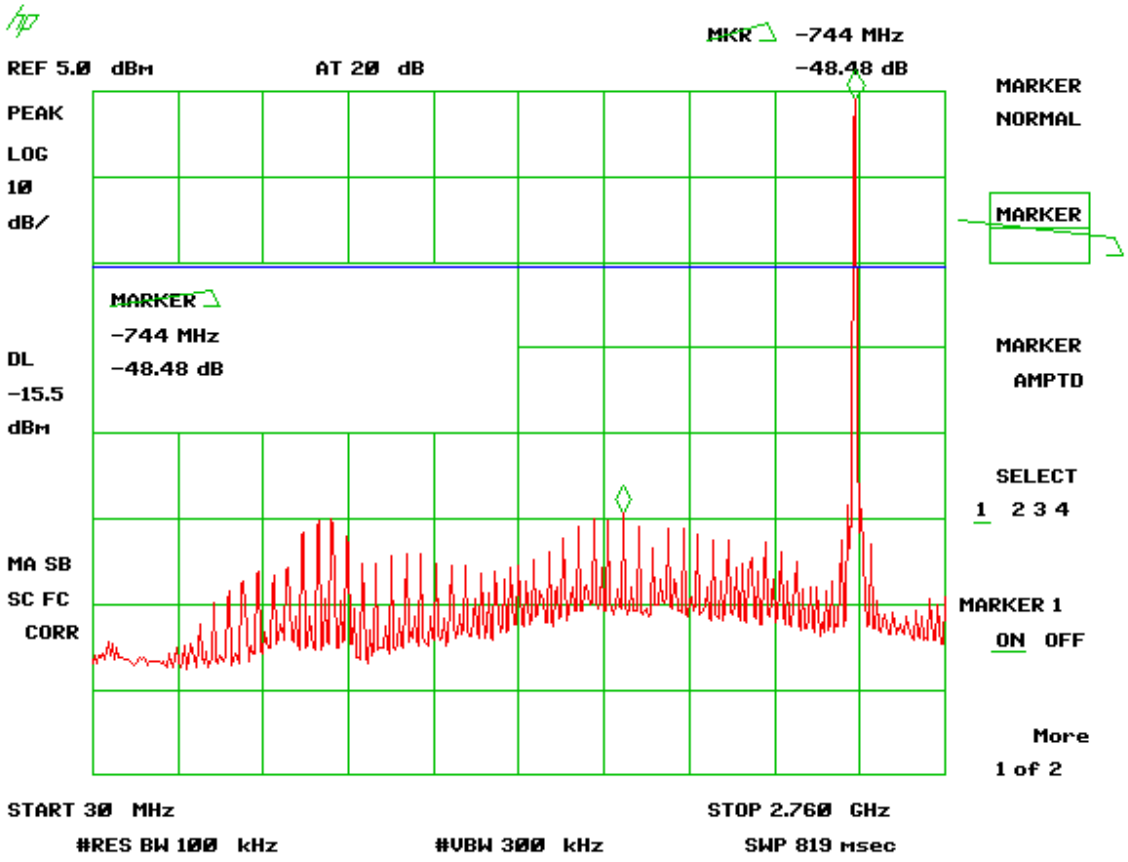


Figure 8 - Antenna Conducted Spurious Emissions – CFR 15.247 (b) - High Channel, Part 1

2 Test and Measurements (Cont'd)

2.10 Intentional Radiator, Radiated Emissions (CFR 15.209, 15.247(d)) (IC RSS 210, A2.9 (a)) (Cont'd)

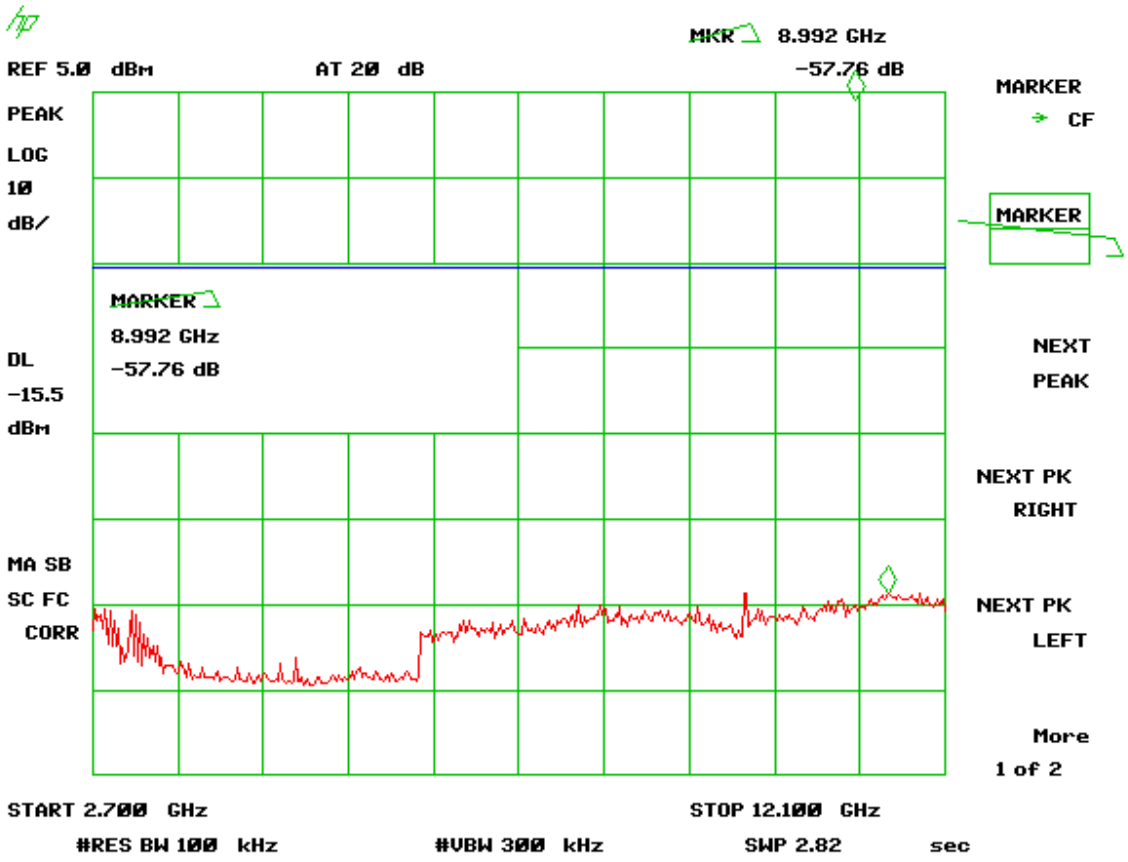


Figure 9 - Antenna Conducted Spurious Emissions - CFR 15.247 (d), High Channel, Part 2

2 Test and Measurements (Cont'd)

2.10 Intentional Radiator, Radiated Emissions (CFR 15.209, 15.247(d)) (IC RSS 210, A2.9 (a)) (Cont'd)

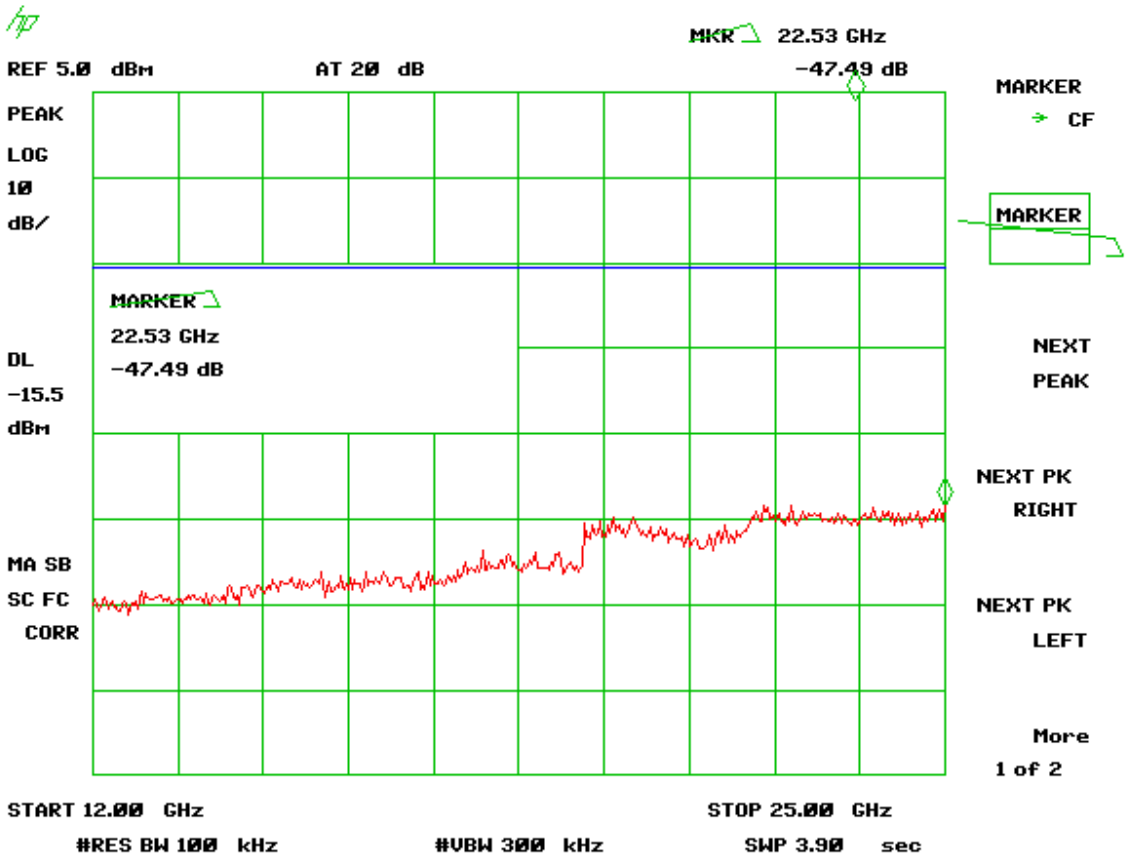


Figure 10 - Antenna Conducted Spurious Emissions - CFR 15.247 (d), High Channel, Part 3

2.10 Intentional Radiator, Radiated Emissions (CFR 15.209, 15.247(d)) (IC RSS 210, A2.9 (a)) (Cont'd)

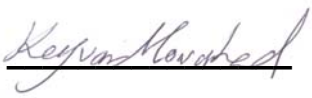
Table 6 - Peak Radiated Harmonic & Spurious Emissions

Radiated Harmonic and Spurious Emissions, Tested from 30 MHz – 24 GHz							
Tested By: K.M.	Test: FCC Part 15, Para 15.247(d)			Client: Nivis, LLC			
	Project: 09-0058			Model: VN210			
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							
2405.43	78.52	31.89	110.41	--	3m./VERT	--	**PK**
4811.06*	59.25	2.34	61.59	74.0	3m./VERT	12.4	**PK**
12027.70*	43.92	14.75	58.67	74.0	1m./VERT	15.3	**PK**
MID BAND- PEAK							
2440.03	77.90	31.94	109.84	--	3m./VERT	--	**PK**
4880.98*	60.90	2.54	63.44	74.0	3m./VERT	10.6	**PK**
12202.73*	45.70	15.34	61.04	74.0	1m./VERT	13.0	**PK**
HIGH BAND- PEAK							
2475.80	76.80	32.00	108.80	--	3m./VERT	--	**PK**
4951.95*	60.29	2.74	63.03	74.0	3m./VERT	11.0	**PK**
7426.53*	52.05	7.99	60.04	74.0	3m./VERT	14.0	**PK**
12377.58*	41.97	15.93	57.90	74.0	1m./VERT	16.1	**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 4811.06 MHz: = 58.25 dBuV+ (1 dB high pass filter loss) + 2.34 dB/m = 61.59 dBuV/m @ 3m
Margin = (74.0 – 61.59) = 12.4 dB

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

2.10 Intentional Radiator, Radiated Emissions (CFR 15.209, 15.247(d)) (IC RSS 210, A2.9 (a)) (Cont'd).

Table 7 - Average Radiated Spurious

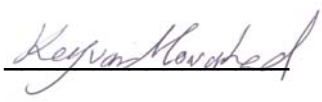
Radiated Spurious Emissions, Tested from 30 MHz – 24 GHz							
Tested By: K.M.	Test: FCC Part 15, Para 15.247(d)			Client: Nivis, LLC			
	Project: 09-0058			Model: VN210			
Frequency (MHz)	**Test Data (dBuV)**	**AF+CL-PA+DC (dB/m)**	**Corrected Results (dBuV/m)**	**Limits (dBuV/m)**	**Distance / Polarization**	**Pass Margin (dB)**	**Detector PK / AVG**
LOW BAND - PEAK							
2405.43	74.30	24.47	98.77	--	3m./VERT	- -	**PK**
4811.06*	52.10	-4.89	47.21	54.0	3m./VERT	7	**AVG**
12027.7*	35.09	7.52	42.61	54.0	1m./VERT	11.4	**AVG**
MID BAND- PEAK							
2440.03	74.14	24.52	98.66	--	3m./VERT	- -	**PK**
4880.98*	53.86	-4.69	49.17	54.0	3m./VERT	4.8	**AVG**
7318.70*	43.58	0.43	44.01	54.0	3m./VERT	10.0	**AVG**
12202.73*	36.36	8.11	44.47	54.0	1m./VERT	9.5	**AVG**
HIGH BAND- PEAK							
2475.80	73.80	24.58	98.38	--	3m./VERT	- -	**PK**
4950.95*	53.43	-4.50	48.93	54.0	3m./VERT	5.1	**AVG**
7426.53*	43.62	0.76	44.38	54.0	3m./VERT	9.6	**AVG**
12377.58*	32.38	8.70	41.08	54.0	1m./VERT	12.9	**AVG**

- - 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 > 10 GHz include a factor of -9.5 dB for distance extrapolation from a test distance of 1 meter to 3 meters.
- Duty Cycle, DC = -7.23 dB

SAMPLE CALCULATION:
RESULTS: At 4811.06 MHz: = (51.10+ (1 dB high pass filter loss)) + (-4.89) = 47.21 dBuV/m @ 3m
Margin = (54.0 – 47.02) = 6.98 dB

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

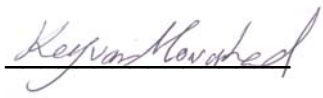
2 Test and Measurements (Cont'd)

2.11 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 8 – Six (6) dB Bandwidth

Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum FCC Bandwidth (MHz)
2405	1.5	0.5
2440	1.5	0.5
2475	1.5	0.5

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

2 Test and Measurements (Cont'd)

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

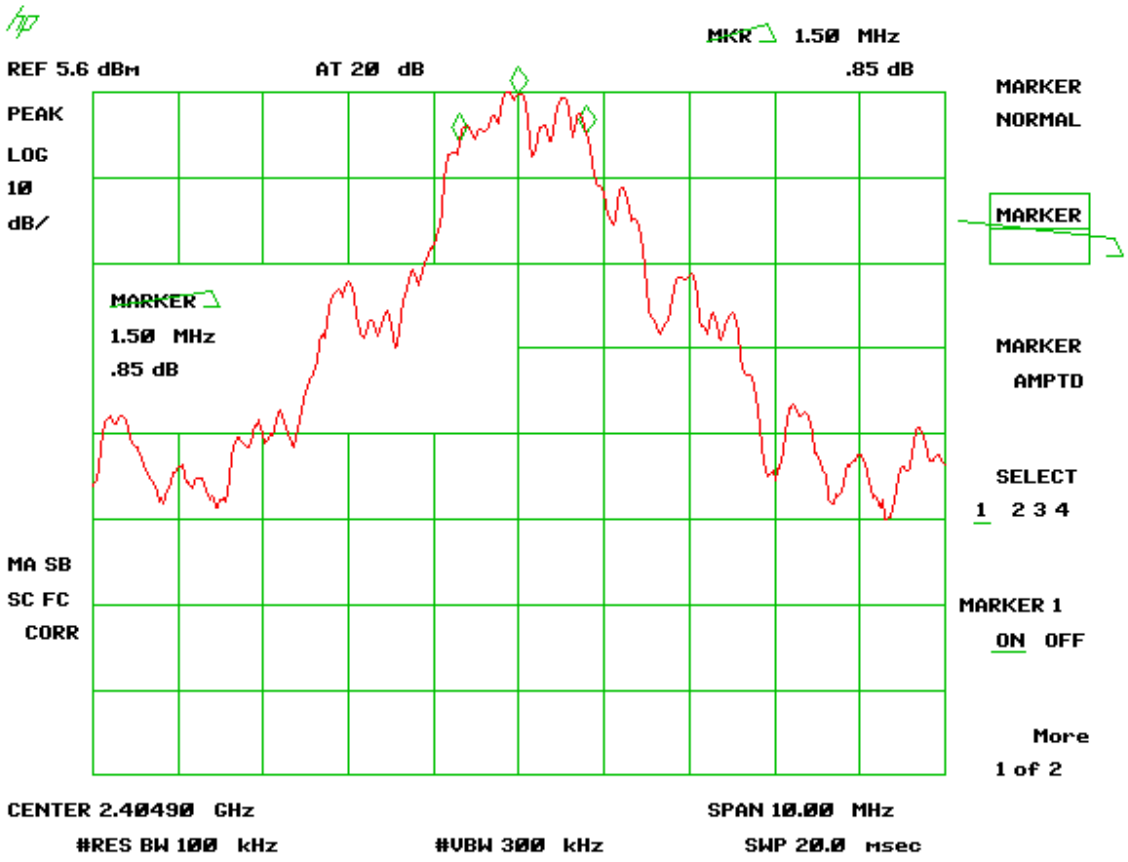


Figure 11 - Six (6) dB Bandwidth - 15.247 (a) (2) - Low Channel

2 Test and Measurements (Cont'd)

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

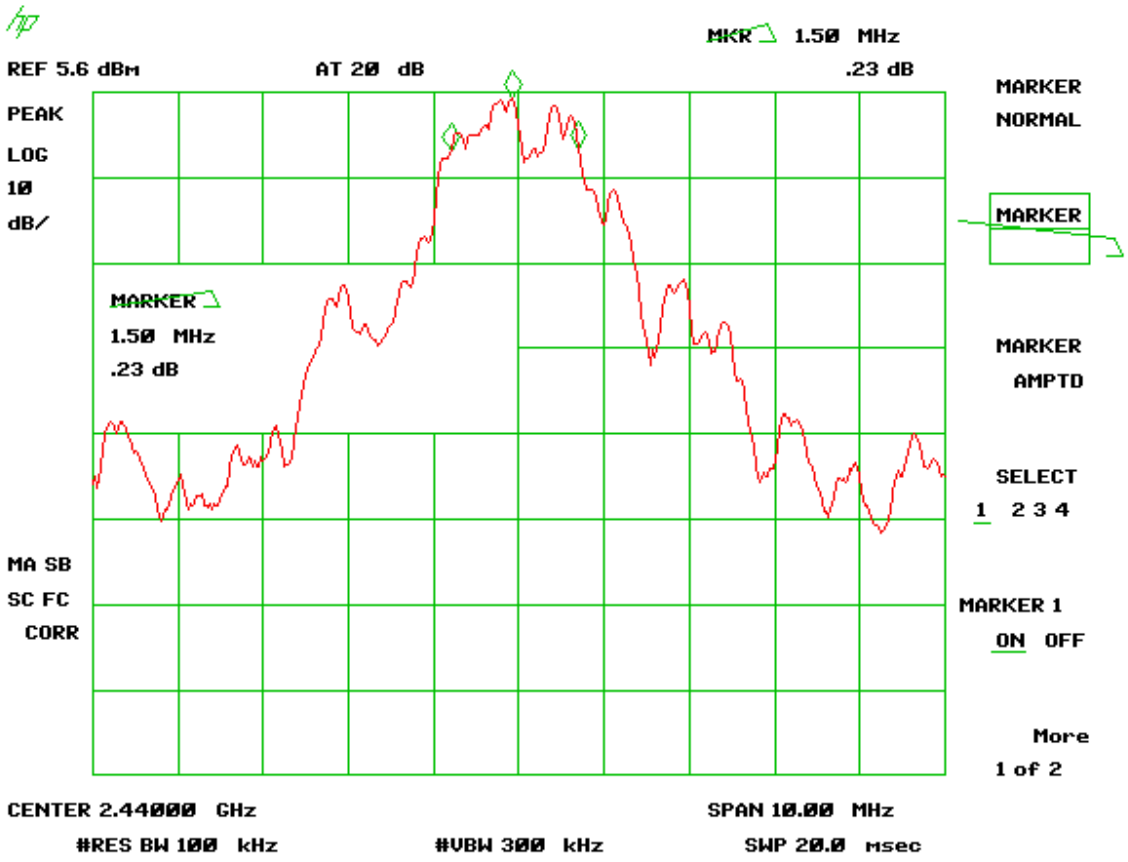


Figure 12 – Six dB Bandwidth - 15.247 (a) (2) - Mid Channel

2 Test and Measurements (Cont'd)

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

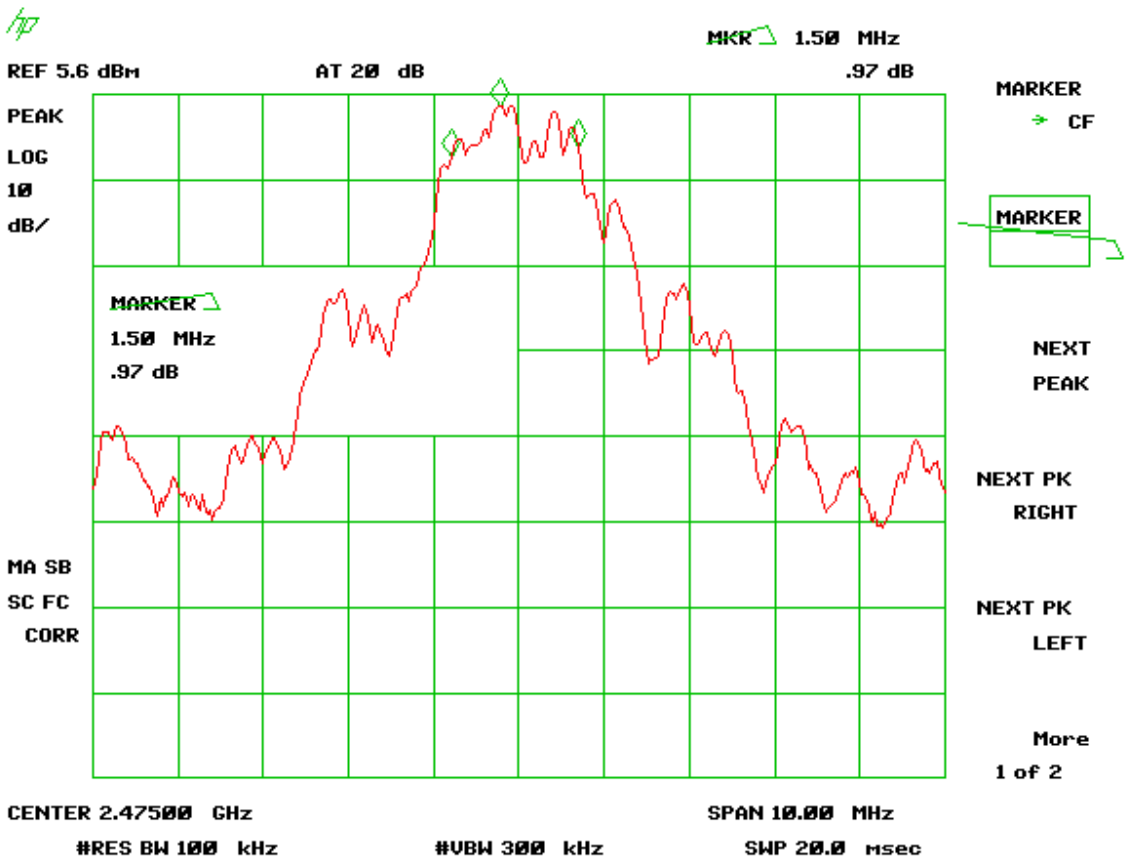


Figure 13 - Six dB Bandwidth - 15.247 (a) (2) - High Channel, Ch. 14

2 Test and Measurements (Cont'd)

2.12 Maximum Peak Conducted Output Power (CFR 15.247 (b) (3))

For the VN210 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 an Antenna Conducted test with a spectrum analyzer by connecting the spectrum analyzer directly, via a short RF cable, to the antenna output terminals on the EUT. The spectrum analyzer was set for an impedance of 50 Ω with the RBW set greater than the 6 dB bandwidth of the EUT, and the VBW ≥ RBW. The loss of the short cable is 0.2 dB, and the final corrected measurements were determined by adding 0.2 dB to the raw data measured values of Figures 14, 15 & 16. Peak antenna conducted output power is tabulated in Table 9 below.

Antenna Conducted Output Power was measured at Low Channel, Mid Channel and High Channel frequencies. See Figures 14 through 16 below. The 0.2 dB loss for the RF wire is taken into consideration here (Corrected Measurement column).

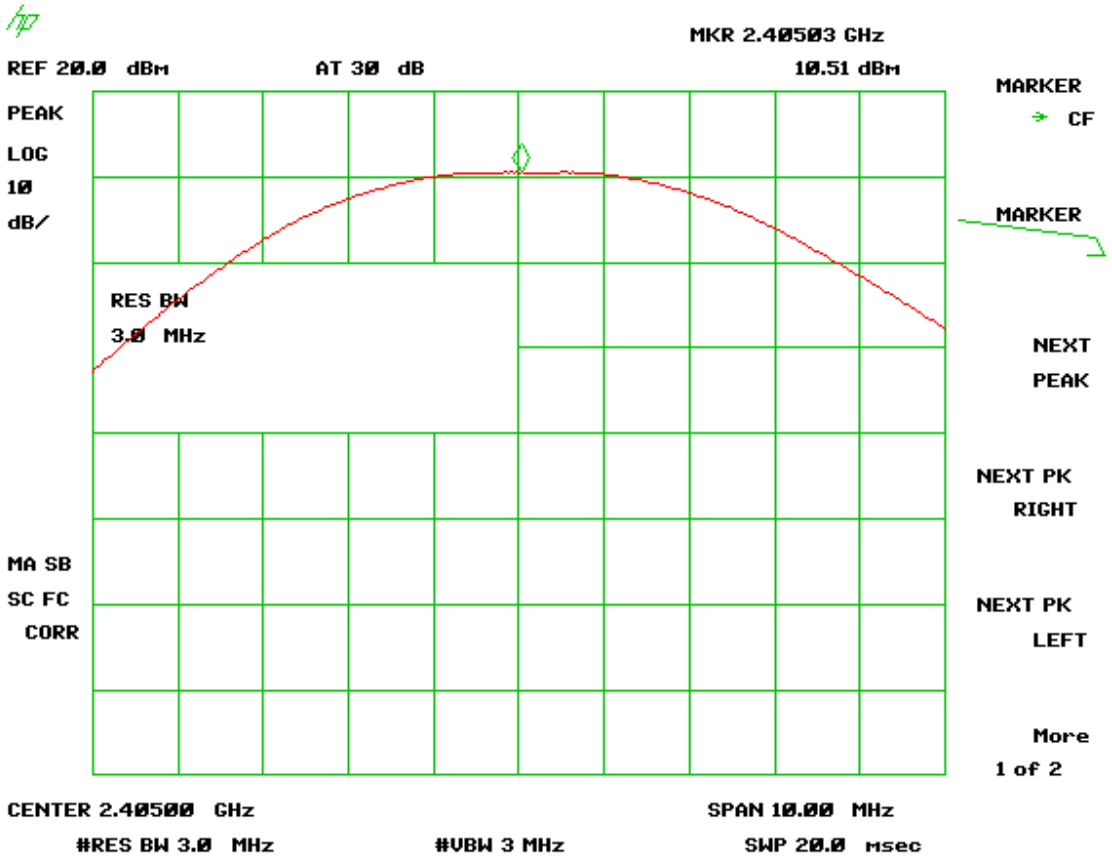
Table 9 - Peak Antenna Conducted Output Power per Part 15.247 (b) (3) (Same as EIRP)

Frequency of Fundamental (MHz)	Raw Test Data dBm	Corrected Measurement (dBm)	(mW)	FCC Limit (mW Maximum)
Low Band (ch00) 2405.03	10.51	10.71	11.77	1000
Mid Band (ch07) 2440.43	9.76	9.96	9.91	1000
High Band (ch14) 2474.45	9.02	9.22	8.35	1000

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

2 Test and Measurements (Cont'd)

2.12 Peak Power Output (CFR 15.247 (b)(3))

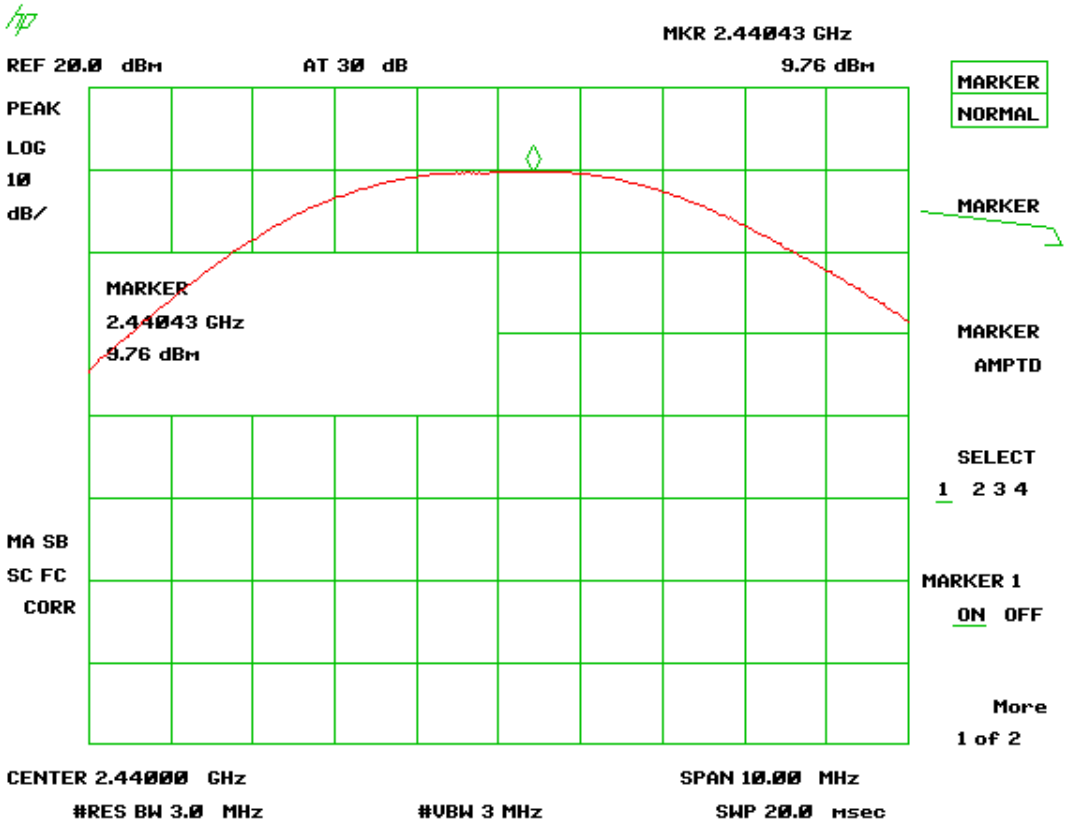


must Add 0.2 dB loss for cable attenuation

Figure 14 - Peak Antenna Conducted Output Power, Low Channel

2 Test and Measurements (Cont'd)

2.12 Peak Power Output (CFR 15.247 (b)(3))

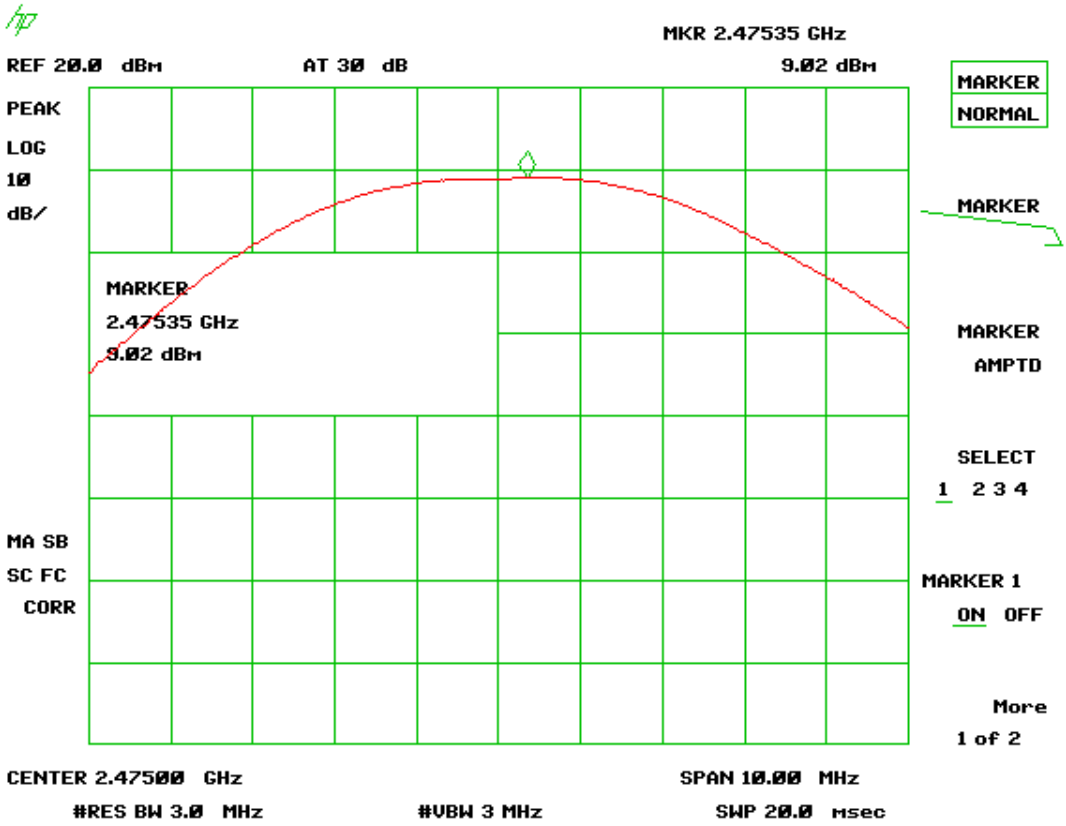


Must Add 0.2 dB loss for cable assembly

Figure 15 - Peak Antenna Conducted Output Power, Mid Channel

2 Test and Measurements (Cont'd)

2.12 Peak Power Output (CFR 15.247 (b)(3))



Must Add 0.2 dB loss for cable assembly.

Figure 16 - Peak Antenna Conducted Output Power, High Channel

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

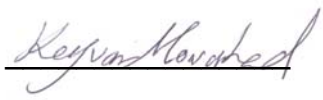
The transmitter was placed into a continuous mode of operation at all applicable frequencies. The measurements were performed per the procedures of FCC KDB Procedure 558074. The RBW was set to 3 kHz and the Video Bandwidth was set to ≥ RBW. The trace capture time was set to (Span/3 kHz).

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 0.2 dB to the measured value to account for the cable loss. All are less than +8 dBm per 3 kHz band.

Table 10 - Power Spectral Density for Low, Mid and High Bands

Frequency (MHz)	Test Data (dBm/3 KHz)	Results (dBm/3 kHz)	FCC Limit (dBm/3 kHz)
Low-2405	-3.10	-2.90	+8.0
Mid-2440	-3.60	-3.40	+8.0
High- 2475	-4.40	-4.20	+8.0

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

2 Test and Measurements (Cont'd)

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

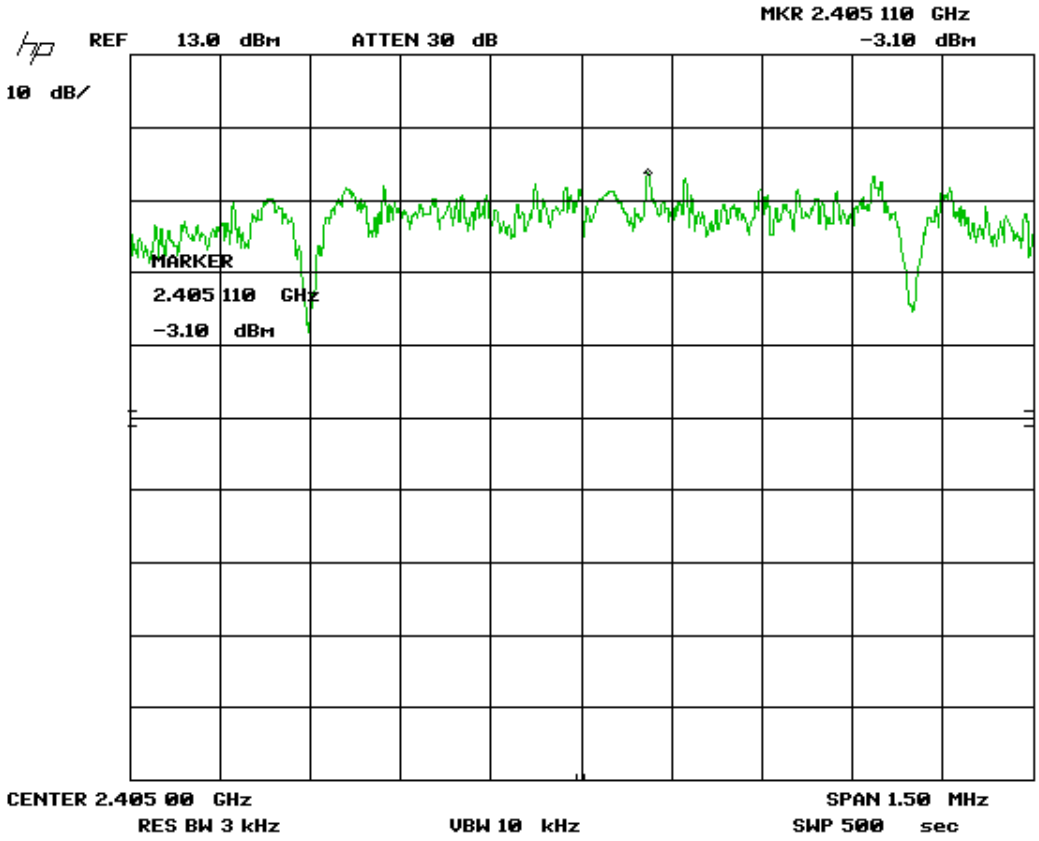


Figure 17 - Peak Power Spectral Density - Part 15.247 (e) - Low Channel

2 Test and Measurements (Cont'd)

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

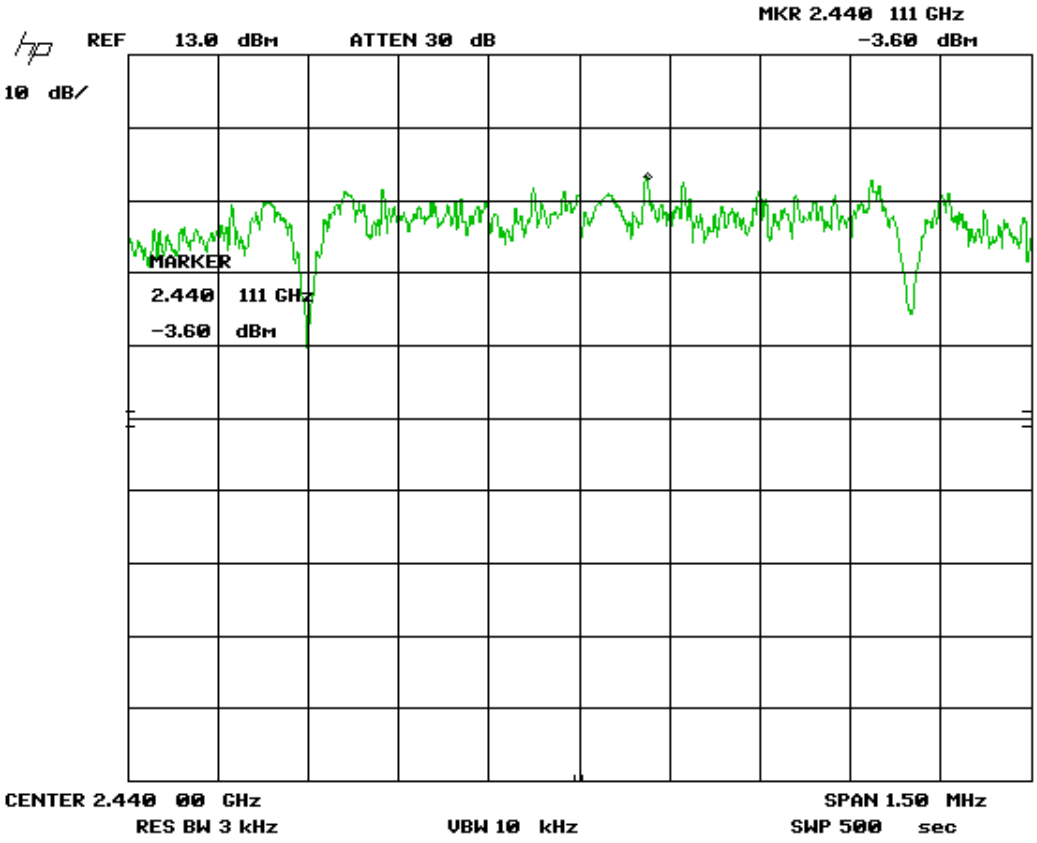


Figure 18 - Power Spectral Density - Part 15.247 (e) - Mid Channel

2 Test and Measurements (Cont'd)

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

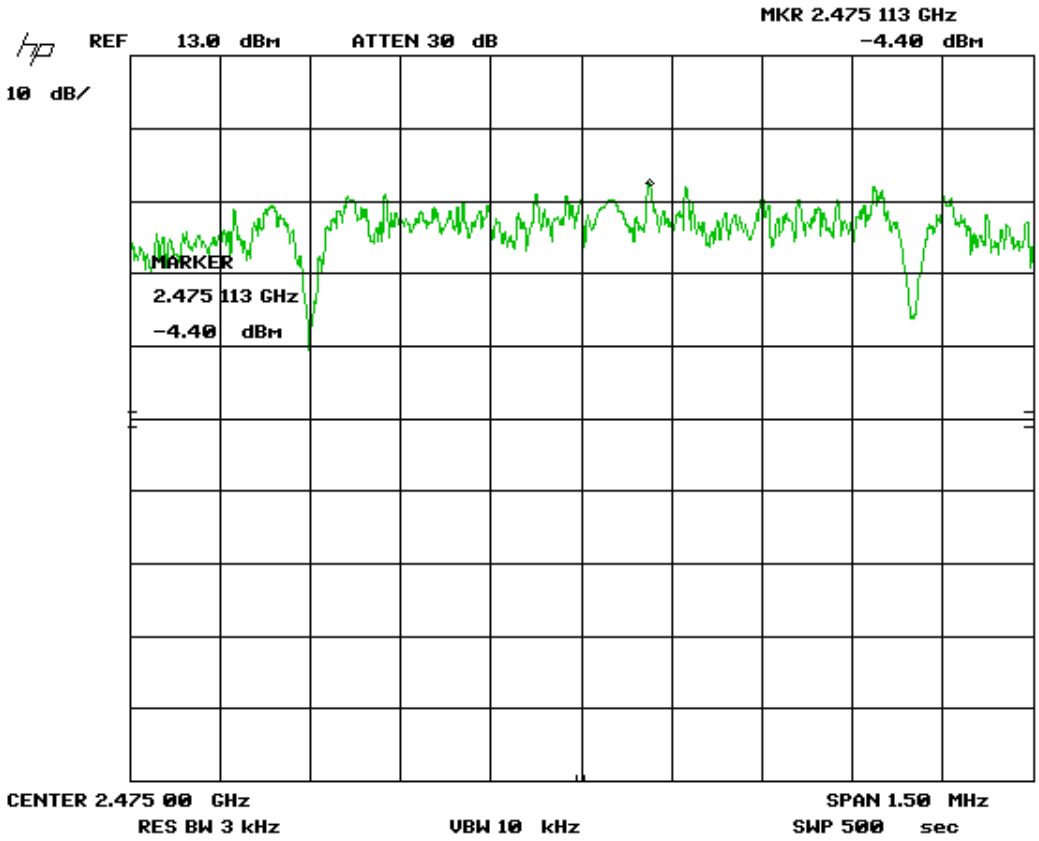


Figure 19 - Peak Power Spectral Density - Part 15.247 (e) - High Channel

2 Test and Measurements (Cont'd)

2.14 Band Edge Measurements – (CFR 15.247 (d))

2.14.1 Band Edge and Restricted Bands

For Band-Edge measurements we consider the frequency span of 2310 MHz to 2500 MHz. This span is further decomposed into 4 sub-bands according to whether they contain restricted bands or band edge data:

1) Sub Band 2310 to 2390 MHz: This span includes a restricted band per section 15.205. The restricted band limits are from 15.209 for Peak (74 dBuV/m) and Average (54 dBuV/m). These values are measured in a conventional manner with the spectrum analyzer. See Figures 22 and 23.

2) Sub Band 2390 to 2400 MHz. The 15.247 (d) limit is Delta ≥ 20 dB. See Figure 20.

3) Sub Band 2400 to 2483.5 MHz. This covers the operating band.

4) Sub Band 2483.5 MHz to 2500 MHz. This is the upper restricted band. It is measured in a conventional radiated manner. Its peak and average limits are from section 15.209 (74 dBuV/m and 54 dBuV/m) and 15.247 (d) Delta ≥ 20 dB. See Figure 21.

2.14.2 Discussion of Test Results

2.14.2.1 Lower Restricted Band, Peak Radiated Measurement

The lower restricted band covers 2310 MHz to 2390 MHz. As shown in Figure 22 below, the raw measured field strength using Peak detector is 64.78. After correcting for cable loss and preamp gain, the result is as follows:

Result = VSA(dBuV) + [Cable Loss(db) + Antenna Factor (dB/m)]– Amp Gain

= 64.78 + [-5.71] = 59.07 dBuV/m Peak

Lower Restricted Band Passing Margin, Peak = 74 – 59.07 = 14.9

2.14.2.2 Lower Restricted Band, Average Radiated Measurement

The lower restricted band covers 2310 MHz to 2390 MHz. As shown in Figure 23 below, the raw measured field strength using a video-averaging technique

at 2483.5 MHz (RBW = 1 MHz, VBW = 10 Hz) is 57.87. After correcting for cable loss and preamp gain, the result is as follows:

Result = VSA(dBuV) + [Cable Loss(db) + Antenna Factor (dB/m)]– Amp Gain – Duty cycle(dB)

= 54 – 51.8 = 2.2 dB
= 57.87 + [-5.71] + (-7.23) = 44.93 dBuV/m AVG

Lower Restricted Band Passing Margin, Average = 54 – 44.93 = 9.1

2.14.2.3 Upper Restricted Band, Peak Radiated Measurement

Refer to Table 6, page 26. The peak electric field strength at 2475 MHz is 108.8 dBuV/m. Because the signal at 2485 MHz is 47.97 dB down(Figure 21), its peak Field Strength is 60.83 dBuV/m. This is less than the peak limit of 74 dBuV/m at that frequency. Therefore the EUT passes this requirement.

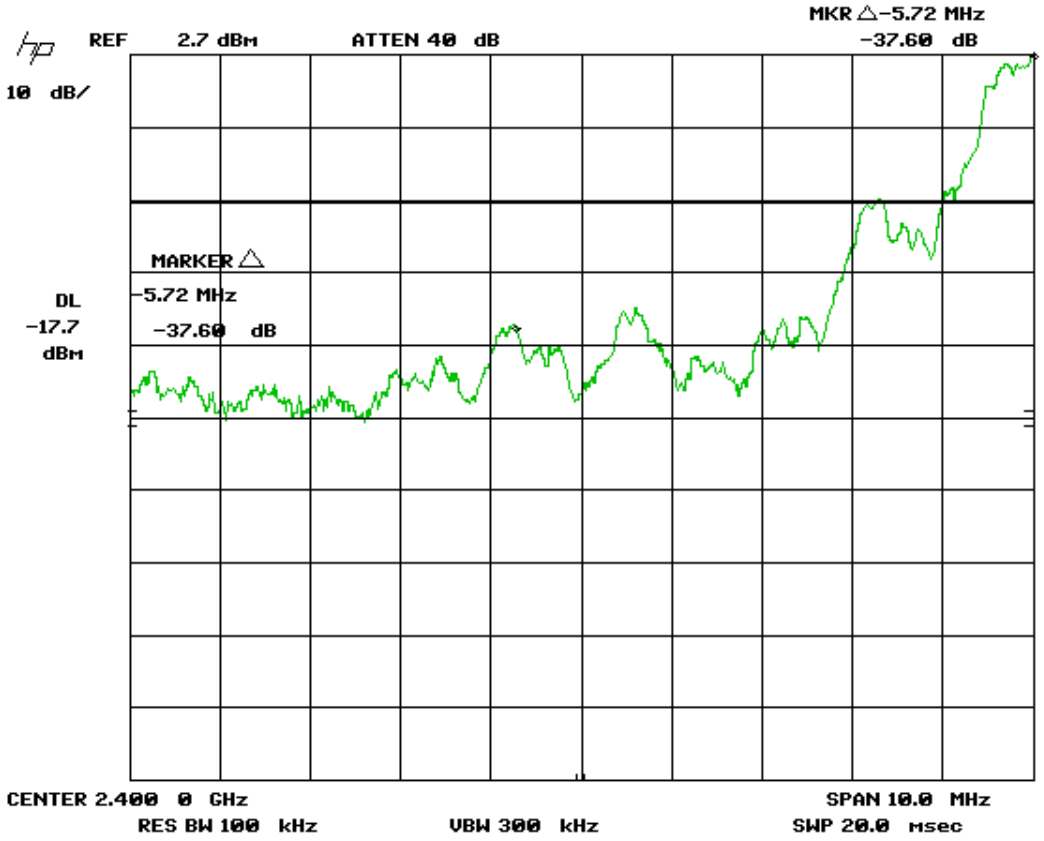
Upper Restricted Band Passing Margin, Peak = 74 – 60.83 = 13.17 dB

2.14.2.4 Upper Restricted Band, Average Radiated Measurement

Refer to Table 7, page 27. The Average electric field strength at 2475 MHz is 98.4 dBuV/m. Because the signal at 2485 MHz is 47.97 dB down(Figure 21), its average Field Strength is 50.93 dBuV/m. This is less than the peak limit of 54 dBuV/m at that frequency, therefore the EUT passes this requirement.

Upper Restricted Band Passing Margin, Average = 54 – 50.93=3.07 dB

2 Test and Measurements (Cont'd)



Δ Signal at 2400 MHz is 37.60 dB down from signal at 2405 MHz.

Figure 20 - Conducted Band Edge Compliance – Low Channel Delta - Peak

2 Test and Measurements (Cont'd)

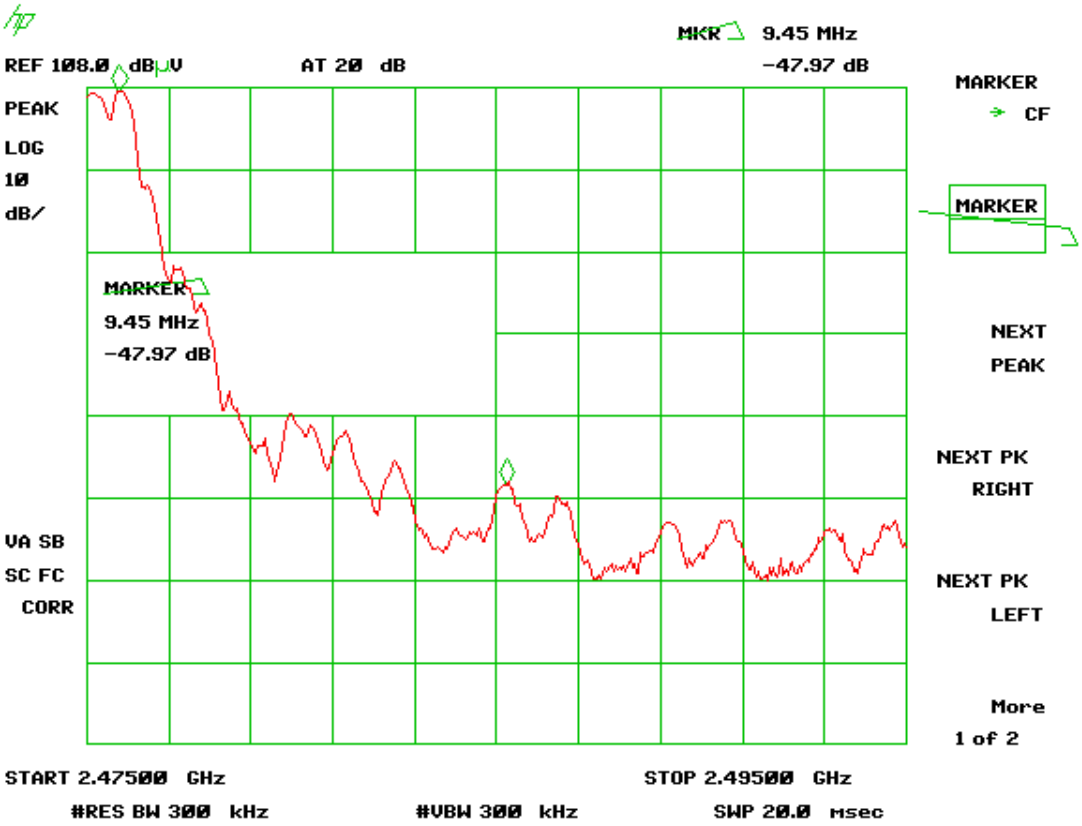


Figure 21 - Radiated Band Edge Compliance – High Channel

2 Test and Measurements (Cont'd)

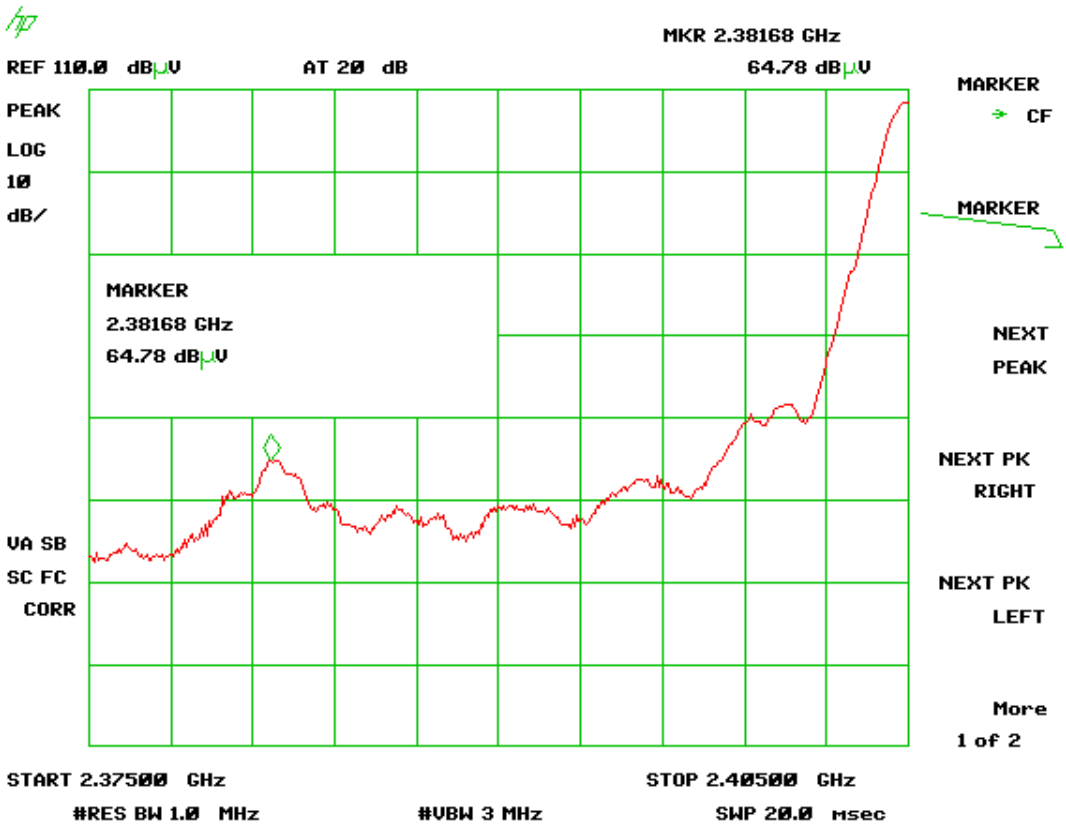


Figure 22 - Radiated Band Edge Compliance – Low Channel-Peak

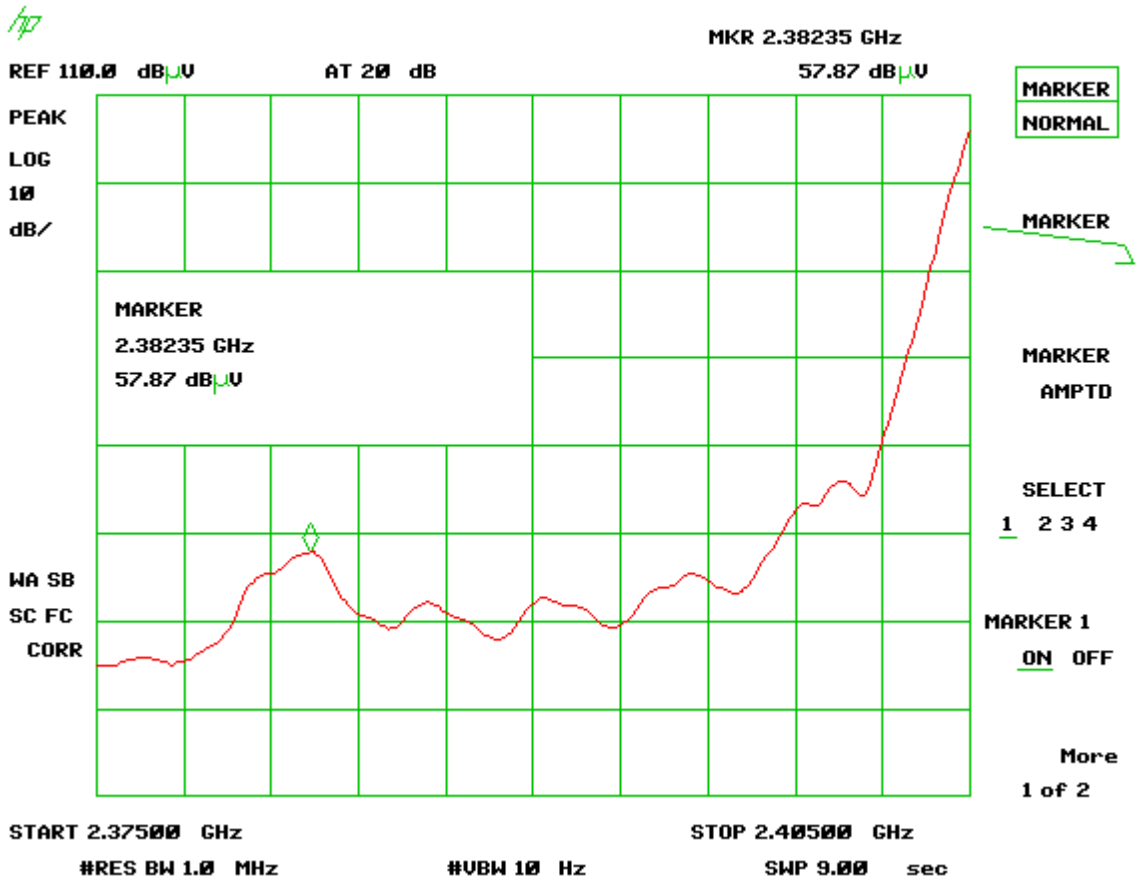


Figure 23 - Radiated Band Edge Compliance – Low Channel-Average

2 Test and Measurements (Cont'd)

2.15 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) = .01124 (from Table 11, herein)
Gain of Transmit Antenna = 2.0 dB_i = 1.58, numeric (from Table 4, herein)
d = Distance = 20 cm = 0.2 m

S = (PG/ $4\pi d^2$) = EIRP/4A = 0.01177 (1.58)/4*π*0.2*0.2
=0.018608/0.502 = 0.0371 w/m^2
= (W/m^2) (1m^2/W) (0.1 mW/cm^2)
= 0.00371 mW/cm^2

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

2.16 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.

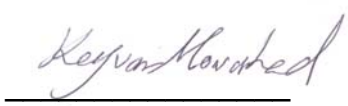
2.16 Unintentional Radiator Power Lines Conducted Emissions (Cont'd)

Table 11 - Power Line Conducted Emissions Data, Class B Part 15.107, Peak Measurement vs. Avg. Limits

CONDUCTED EMISSIONS						
Tested By: K.M	Specification Requirement: FCC Part 15, Para 15.107 Class B		Project No.: 09-0058	Manufacturer/Model: Nivis, LLC model VN210		
Frequency (MHz)	Test Data (dBuV)	LISN+CL-PA (dB)	Corrected Results (dBuV)	Avg Limits (dBuV)	Margin (dB)	Detector
120 VAC, 60 Hz, Supply Line						
0.1550	47.80	-0.34	47.46	66.0	18.5	PK
0.5100	34.00	-0.06	33.94	60.0	26.1	PK
2.1360	28.00	0.16	28.16	60.0	31.8	PK
7.4000	25.40	0.31	25.71	60.0	34.3	PK
19.3900	26.10	0.51	26.61	60.0	33.4	PK
27.6000	27.60	0.49	28.09	60.0	31.9	PK
120 VAC, 60 Hz, Neutral Line						
0.1510	48.20	-0.34	47.86	66.0	18.1	PK
0.5870	25.90	-0.13	25.77	60.0	34.2	PK
2.0000	26.20	0.06	26.26	60.0	33.7	PK
7.2000	26.00	0.32	26.32	60.0	33.7	PK
19.3200	26.00	0.41	26.41	60.0	33.6	PK
21.3200	26.30	0.45	26.75	60.0	33.3	PK

Tested from 150 kHz to 30 MHz
SAMPLE CALCULATIONS: At 155 kHz, = 47.80 + (- 0.34) = 47.46 dBuV

Test Date: May 7, 2009
Tested By

Signature:  Name: Keyvan Muvahhid

2.17 Unintentional Radiator, Radiated Emissions (CFR 15.109 (a))

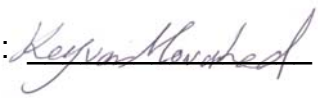
These test data are provided herein to support the Verification requirement for digital devices. Radiated emissions coming from the EUT in a non-transmit state were evaluated from 30 MHz to 12.5 GHz per ANSI C63.4, Paragraph 8.

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.

Table 12 – Unintentional Radiator, Radiated Emissions.

Unintentional Radiator, Radiated Emissions							
Test By: K.M	Test: FCC Part 15.109			Client: Nivis, LLC			
	Project: 09-0058 Class: A			Model: VN210			
Frequency (MHz)	Test Data (dBuV)	AF+CL-PA (dB)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	DETECTOR PK / QP
Tested from 30 MHz to 12.5 GHz							
33.08	3.20	13.27	16.47	39	3m./VERT	22.5	PK
288.00	8.74	18.55	27.29	46.4	3m./VERT	19.1	PK
311.00	2.62	17.45	20.07	46.4	3m./VERT	26.3	PK
335.00	1.30	18.55	19.85	46.4	3m./VERT	26.5	PK
744.00	3.01	17.82	20.83	46.4	3m./VERT	25.6	PK
791.00	13.75	26.24	39.99	46.4	3m./VERT	6.4	QP
839.00	11.76	26.71	38.47	46.4	3m./VERT	7.9	PK
887.00	7.65	27.51	35.16	46.4	3m./VERT	11.2	PK
1684.00	42.27	-8.98	33.29	49.5	3m./VERT	16.2	AVG
1997.00	40.18	-6.65	33.53	49.5	3m./VERT	16	AVG
2453.00	41.08	-5.43	35.65	49.5	3m./VERT	13.9	AVG
3124.00	39.41	-2.92	36.49	49.5	3m./VERT	13.0	AVG

No other emissions detected within 20 dB of the FCC Part 15.109 limits
AF is antenna factor. CL is cable loss. PA is preamplifier gain
SAMPLE CALCULATION:
RESULTS: At 33.08 MHz: = ((13.74-10.54(extrapolation Factor to 10 m) + 13.27)) = 16.47 dBuV/m @ 3m
Margin = (46.4 – 27.29) = 19.1 dB
Test Date: May 7, 2009

Tested By Signature:  Name: Keyvan Muvahhid