



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.
VersaNode 310
Model: VN310R**

FCC ID: SQB-VN3104034R5

**UST Project: 11-0207
Issue Date: October 6, 2011**

Total Pages: 55

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Testing Tomorrow's Technology

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: Compliance Engineer – President

Date October 6, 2011

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MEASUREMENT TECHNICAL REPORT

COMPANY NAME: Nivis, LLC.

MODEL: VN310R

FCC ID: SQB-VN3104034R5
IC ID: 6546A-VN3104034R5

DATE: October 6, 2011

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

Equipment type: 2.4 GHz Transmitter Module

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

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
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- Agency Agreement
- Application Forms
- Letter of Confidentiality
- Equipment Label
- Block Diagram(s)
- Schematic(s)
- Test Configuration Photographs
- Internal Photographs
- Theory of Operation
- RF Exposure
- User's Manual

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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 distribution 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 September 21, 2011 in good operating condition.

1.3 Product Description

The Equipment under Test (EUT) is the Nivis, LLC. VersaNode 310 model VN310R which is a 2.4 GHZ Transmitter Module. The VN310R consists of a baseband processor with integrated 2.4 GHz to 2.483 GHz ZigBee radio (SOC) plus peripheral components such as power amplifiers, switches, clocks, memory and linear regulators. There are no other variants to the VN310R. The EUT application is for indoor and outdoor environments and its main application is to serve as an industrial wireless network that supports isa100.11a and WirelessHART industry standards.

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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, KDB Publication No. 558074 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 modular approval), see test data presented herein.
- b) Verification as a class B digital device.

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

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Table 1 - EUT and Peripherals

PERIPHERAL MANUFACTURER.	MODEL NUMBER	SERIAL NUMBER	FCC ID:	CABLES P/D
2.4 GHz radio Cirronet Corp. (EUT)	VN310R	Engineering Sample	Pending: SQB-VN3104034R5	6' U - P
Antenna Nearson	S181FL-RMM-2405S	--	--	--
Laptop Computer IBM	Various	--	--	6' U -P
Power Supply IBM	Various	--	None	6' U - P 120 VAC/ 60 Hz

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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 herein.

Table 2 - Test Instruments

TEST INSTRUMENT	MODEL NUMBER	MANUFACTURER	SERIAL NUMBER	DATE OF LAST CALIBRATION
SPECTRUM ANALYZER	8593E	HEWLETT-PACKARD	3205A00124	10/18/2010
SPECTRUM ANALYZER	8566B	HEWLETT-PACKARD	2410A00109	10/29/10
RF PREAMP 100 kHz to 1.3 GHz	8447D	HEWLETT-PACKARD	2944A06291	9/7/10 Extended 90 days
LOOP ANTENNA	SAS-200/562	A. H. Systems	142	8/09/2011 2yrs
BICONICAL ANTENNA 25 MHz to 200 MHz	BIA-25	Electro-Metrics	2451	12/29/09 2 Year
LOG PERIODIC 100 MHz to 1000 MHz	3146	EMCO	3110-3236	1/22/10 2 Year
HORN ANTENNA 1 GHz to 18 GHz	SAS-571	A. H. Systems	605	2/9/2010 2 Year
PREAMP 1 GHz to 26.5 GHz	8449B	HEWLETT-PACKARD	3008A00480	9/21/10 Extended 90 days
CALCULATION PROGRAM	N/A	N/A	Ver. 6.0	N/A

Note: The calibration interval of the above test instruments are 12 months unless stated otherwise and all calibrations are traceable to NIST/USA.

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.

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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 10th 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.

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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. Please see section 2.8 herein for details.

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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. Only the antenna(s) listed in Table 4 will be used with this module.

Table 4 - Allowed Antenna(s)

MANUFACTURER	TYPE OF ANTENNA	MODEL	REPORT REFERENCE	GAIN dB _i	TYPE OF CONNECTOR
Nearson	Omni	S181FL-RMM-2405S	Omni	2.0	Reverse sex SMA to MMCX

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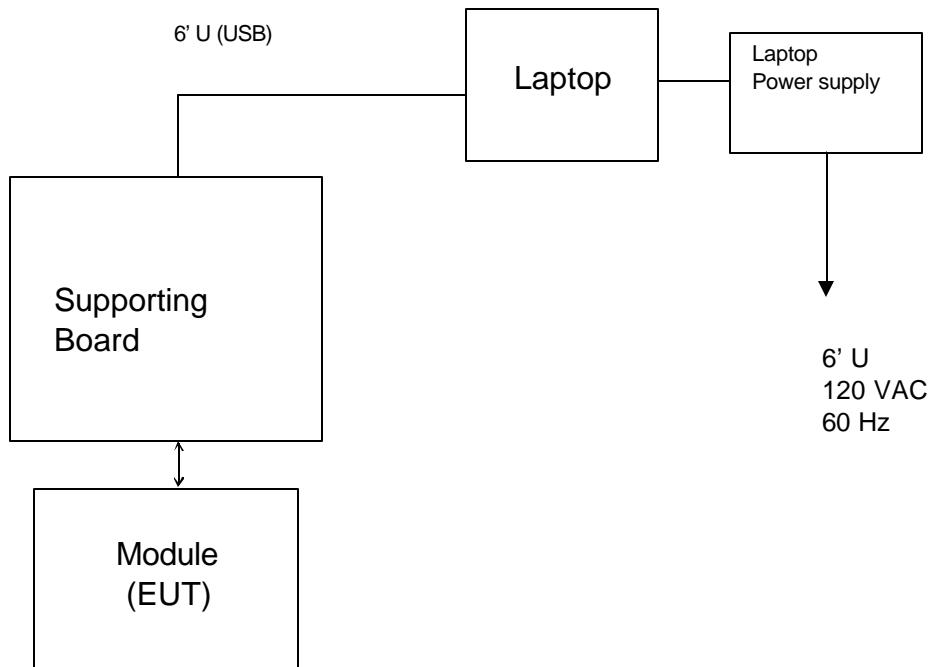


Figure 1- Test Configuration

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 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.

The worst-case scenario in any 100 ms timeslot, along with all transmission lengths, will be as follows:

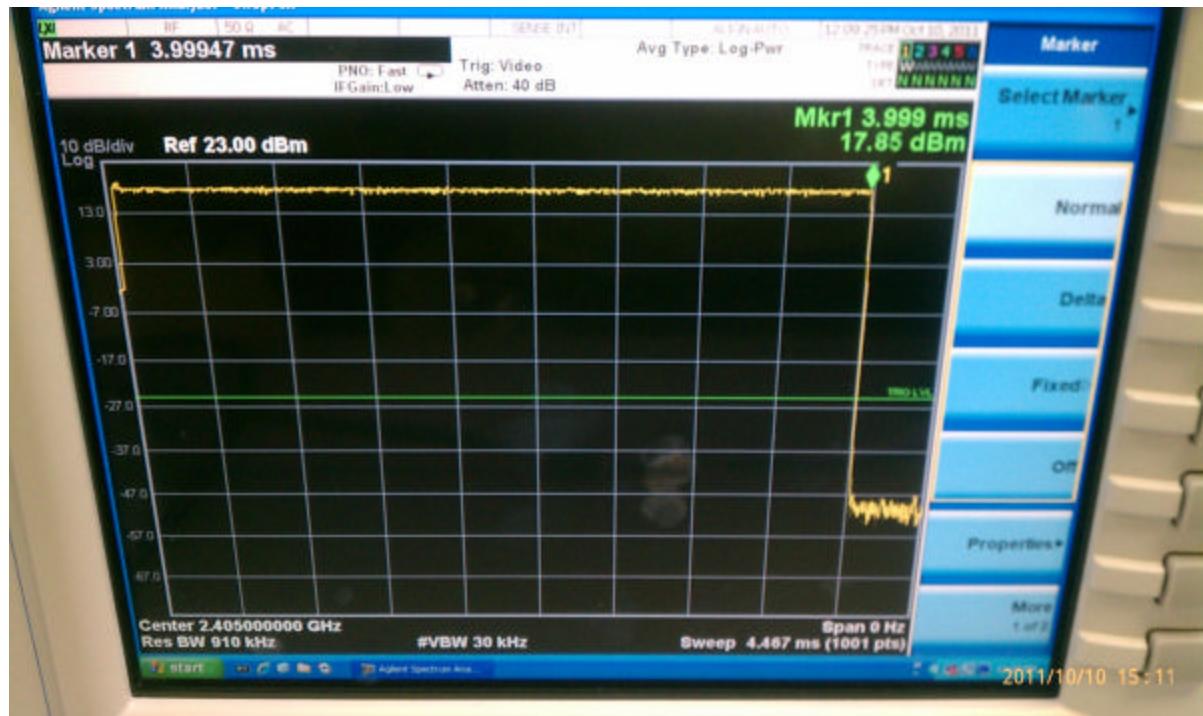


Figure 2 - Duty Cycle

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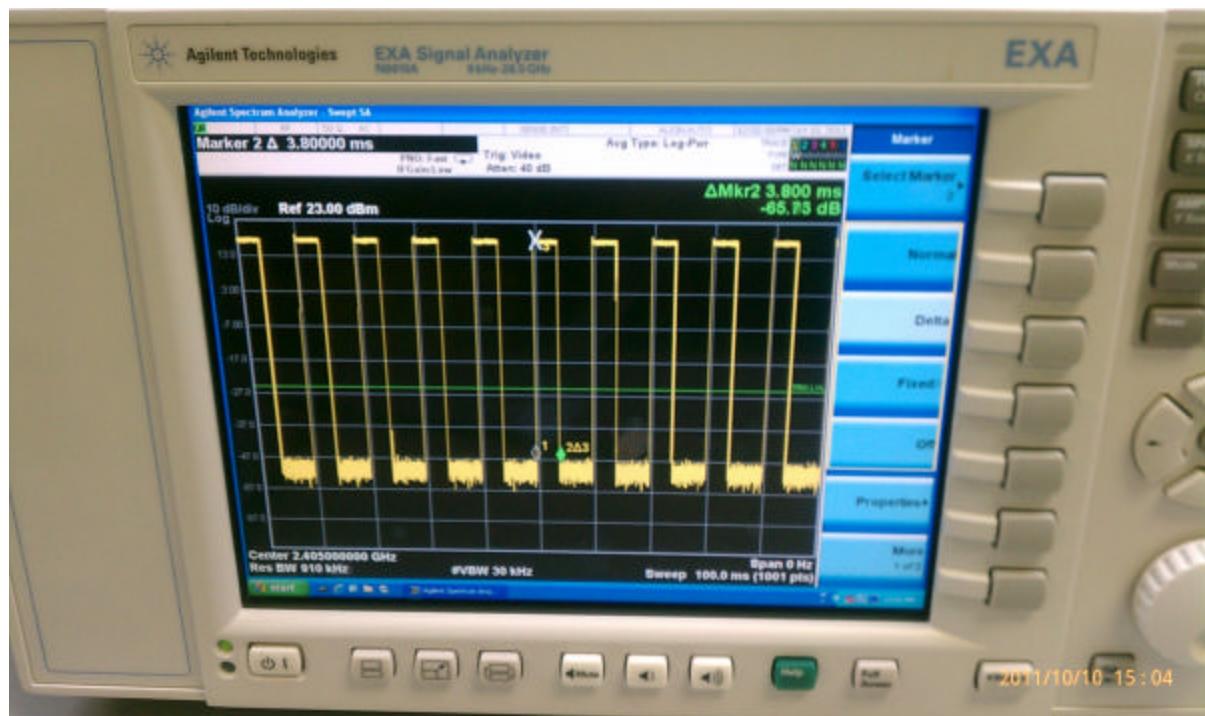


Figure 3 - Duty Cycle

The duty cycle is computed as follows (in any 100 ms period):

$$\text{Duty Cycle} = (40 \text{ msec}/100 \text{ msec}) = 0.40 = 40 \%$$

$$\text{Correction Factor} = 20\log_{10} (0.40) = -7.96 \text{ dB}$$

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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 5.0 dB of the Average limits. Those results are given in Table 5 below.

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

CONDUCTED EMISSIONS 150 kHz to 30 MHz						
Tested By: JW	Specification Requirement: FCC Part 15.207 Class B		Project No.: 11-0207	Manufacturer/Model: Nivis, LLC. Model VN310R		
Frequency (MHz)	Test Data (dBuV)	LISN+CL-PA (dB)	Corrected Results (dBuV)	Avg Limits (dBuV)	Margin (dB)	Detector
120 VAC, 60 Hz, Phase Line						
0.1560	50.20	0.46	50.66	55.7	5.0	PK
0.5092	35.50	0.14	35.64	46.0	10.4	PK
1.6840	35.20	0.26	35.46	46.0	10.5	PK
5.0400	41.50	0.33	41.83	50.0	8.2	PK
10.0800	40.60	0.55	41.15	50.0	8.9	PK
29.0400	39.60	1.06	40.66	50.0	9.3	PK
120 VAC, 60 Hz, Neutral Line						
0.1515	56.30	0.46	56.76	65.9	9.2*	PK
0.1515	44.30	0.46	44.76	55.9	11.2	AVG
0.5007	33.10	0.24	33.34	46.0	12.7	PK
4.1600	29.80	0.42	30.22	46.0	15.8	PK
9.7700	28.50	0.61	29.11	50.0	20.9	PK
14.6400	29.70	0.70	30.40	50.0	19.6	PK
27.7000	29.20	1.04	30.24	50.0	19.8	PK

(*)= Quasi-Peak limit used

SAMPLE CALCULATIONS: At 0.1560 MHz, = 50.20 + (0.46) = 50.66 dBuV

Test Date: September 22, 2011

Tested By

Signature: 

Name: John Wynn

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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 3 through 8 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.

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

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.

The test data is detailed below in for this section. Several radiated emissions above 1 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.

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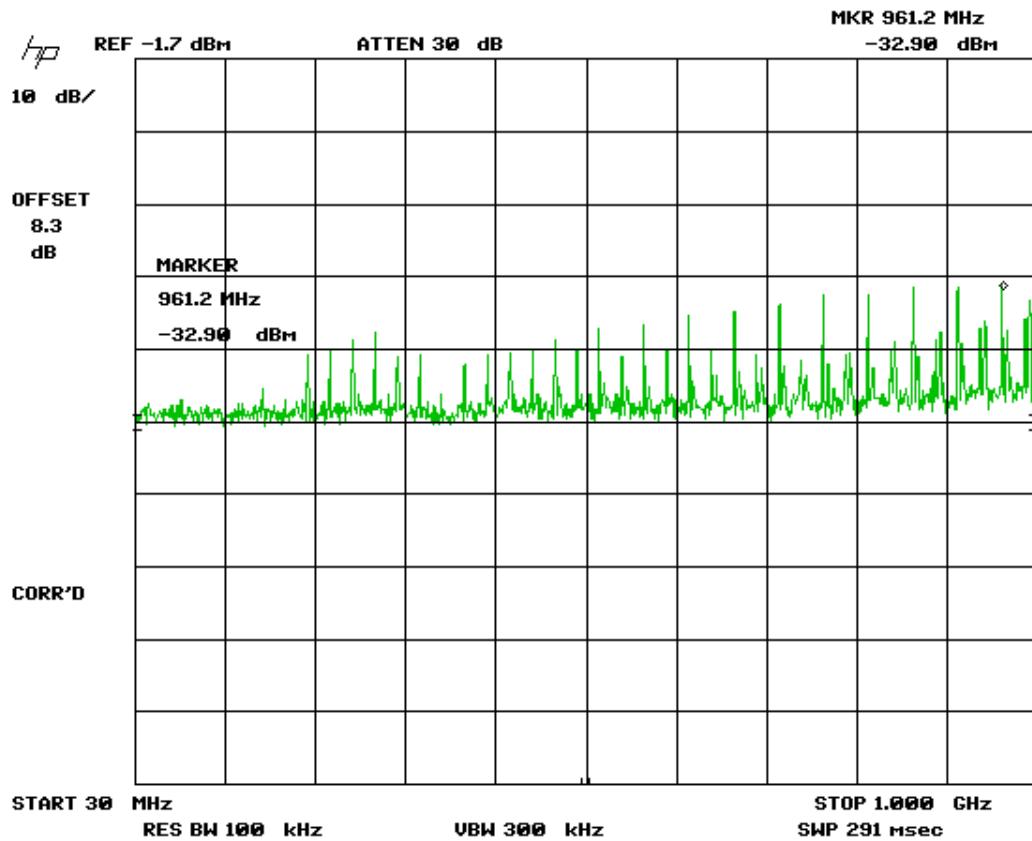
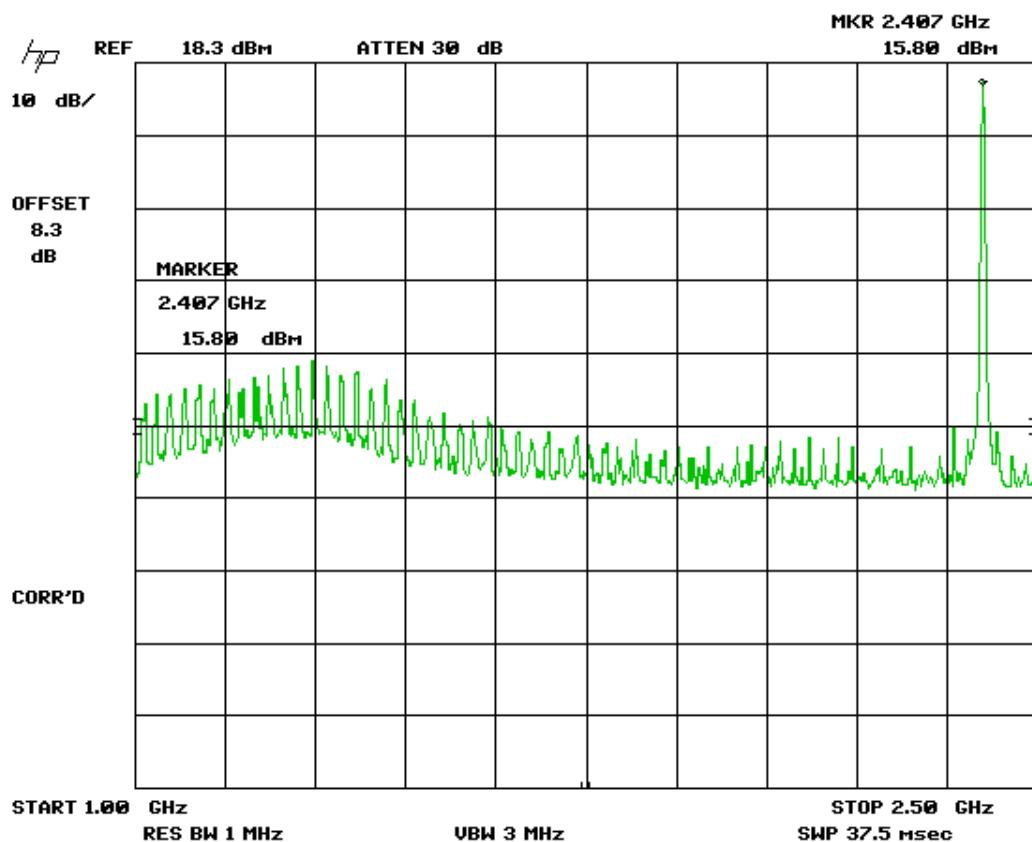


Figure 4 - Antenna Conducted Spurious Emissions – CFR 15.247 (d) - Low Channel, Part 1

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

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

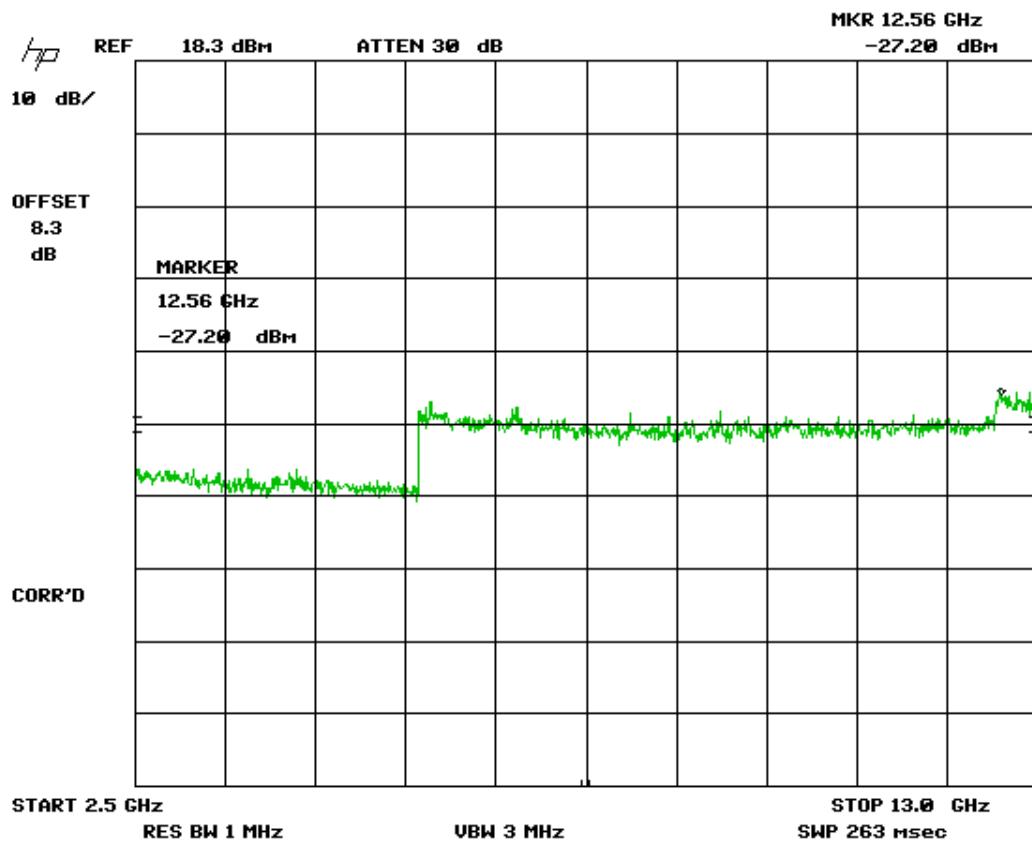


Figure 6 - Antenna Conducted Spurious Emissions – CFR 15.247 (d) - Low Channel, Part 3

US Tech Test Report,

FCC ID:

Test Report Number:

Issue Date:

Customer:

Model:

FCC Part 15 Certification

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

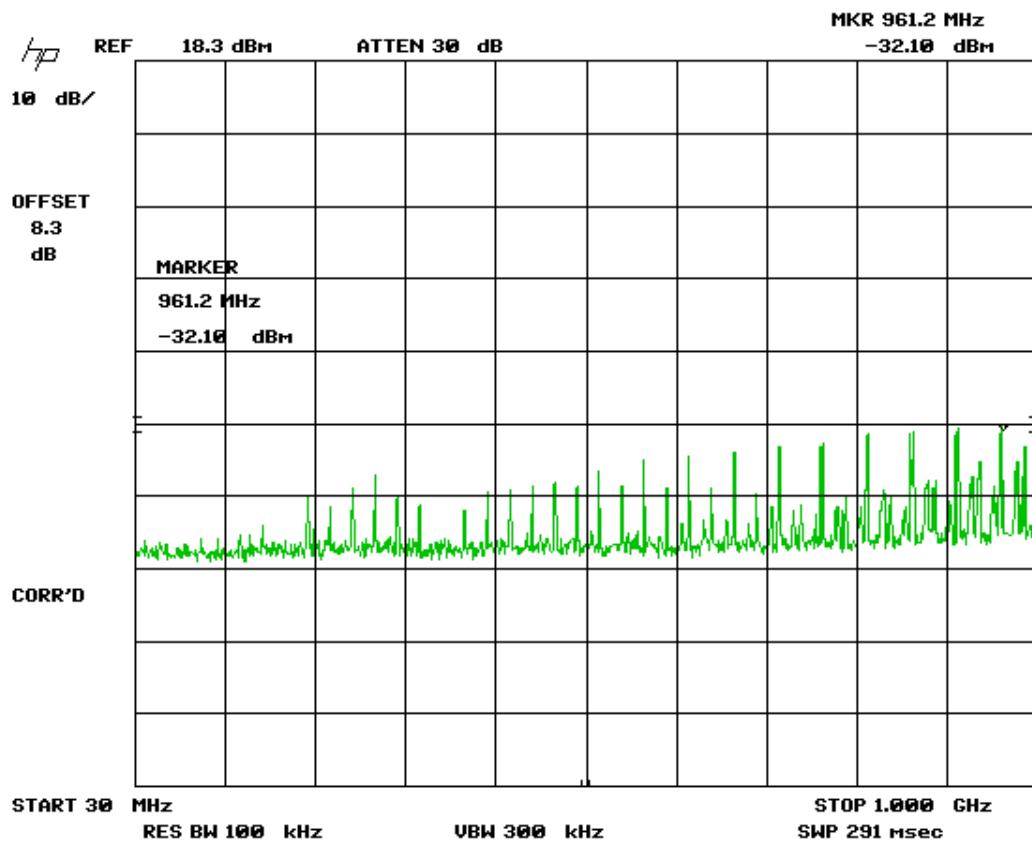


Figure 7 - Antenna Conducted Spurious Emissions – CFR 15.247 (d) - Mid Channel, Part 1

US Tech Test Report,

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Test Report Number:

Issue Date:

Customer:

Model:

FCC Part 15 Certification

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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

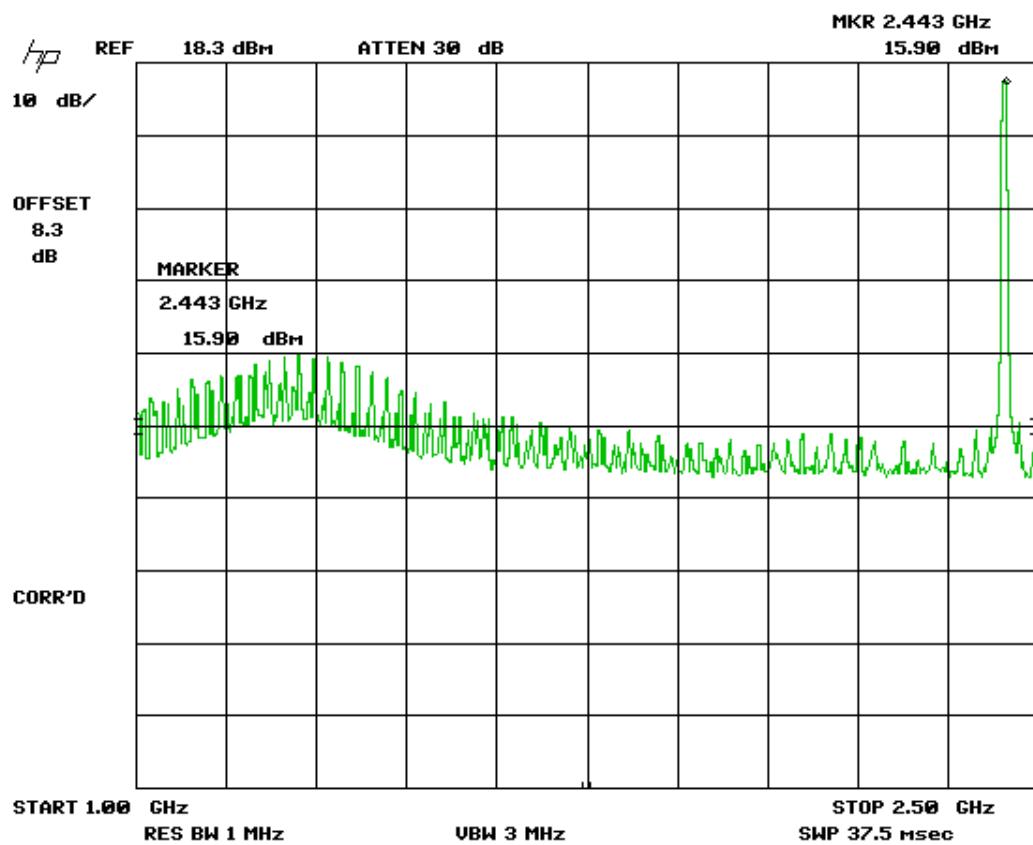


Figure 8 - Antenna Conducted Spurious Emissions – CFR 15.247 (d) - Mid Channel, Part 2

US Tech Test Report,
FCC ID:
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Customer:
Model:

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

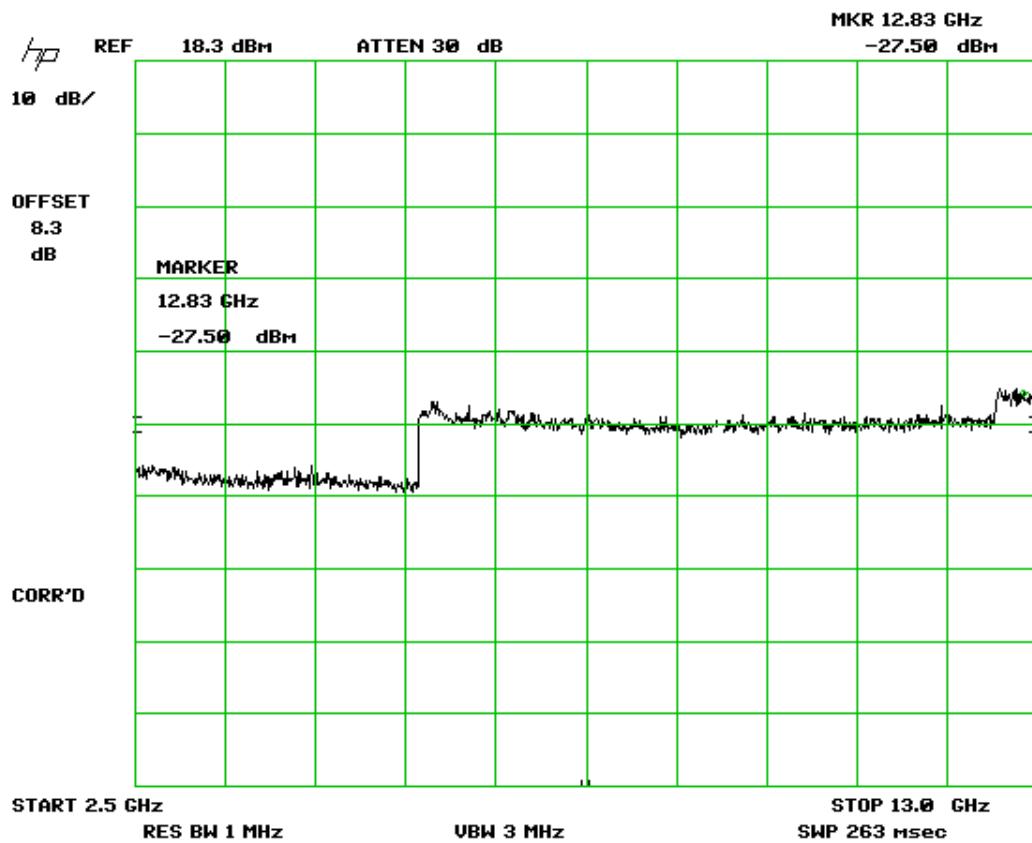


Figure 9 - Antenna Conducted Spurious Emissions – CFR 15.247 (d) - Mid Channel, Part 3

US Tech Test Report,

FCC ID:

Test Report Number:

Issue Date:

Customer:

Model:

FCC Part 15 Certification

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

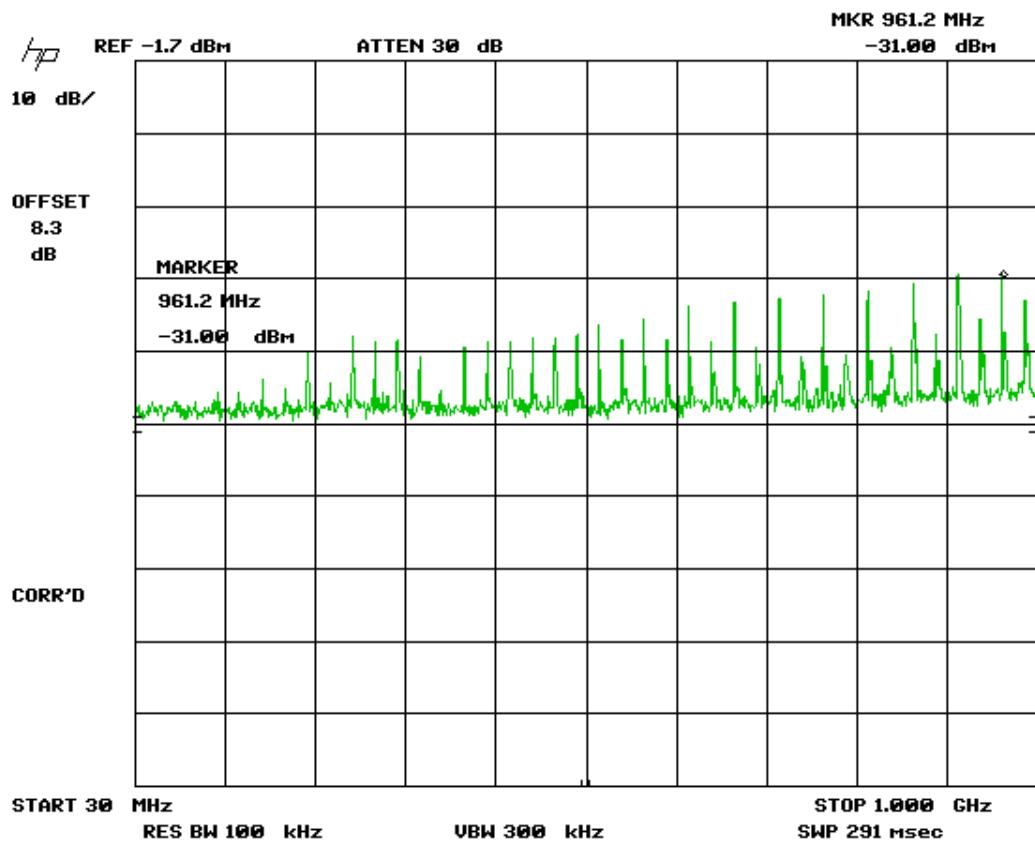


Figure 10 - Antenna Conducted Spurious Emissions – CFR 15.247 (b) - High Channel, Part 1

US Tech Test Report,

FCC ID:

Test Report Number:

Issue Date:

Customer:

Model:

FCC Part 15 Certification

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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

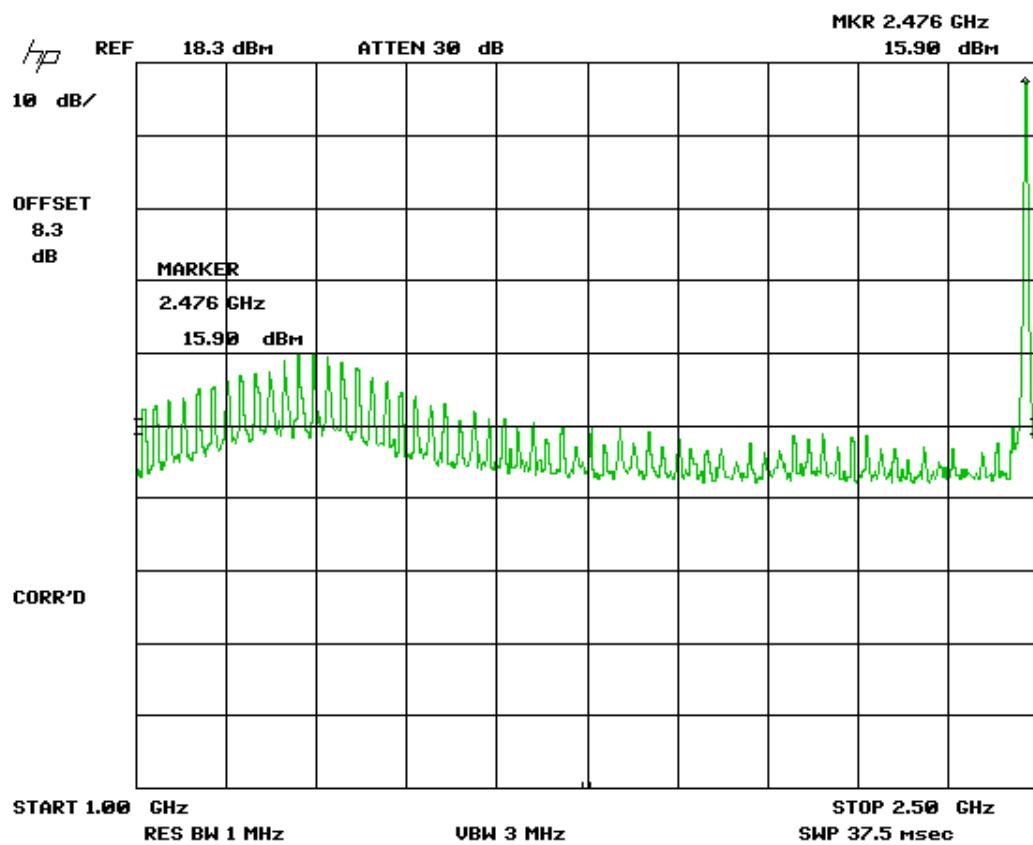


Figure 11 - Antenna Conducted Spurious Emissions - CFR 15.247 (d), High Channel, Part 2

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

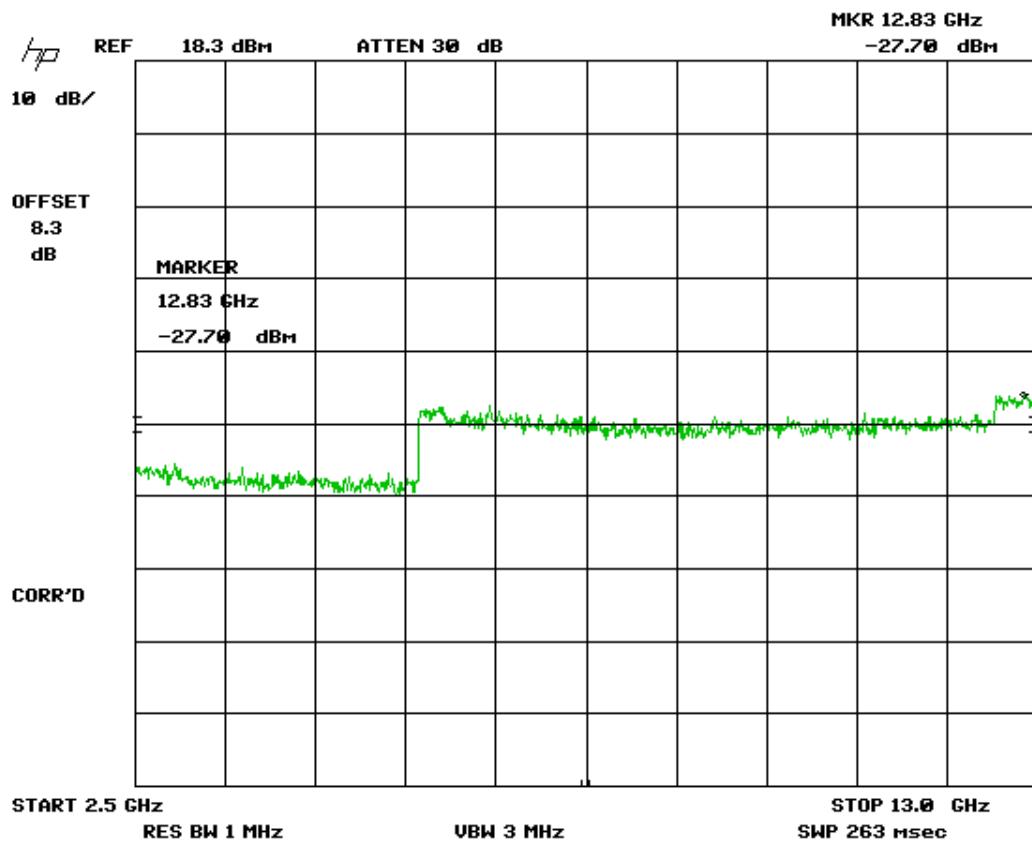


Figure 12 - Antenna Conducted Spurious Emissions - CFR 15.247 (d), High Channel, Part 3

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

Table 6 – Omni Antenna- Peak Radiated Harmonic & Spurious Emissions

Radiated Harmonic and Spurious Emissions, Tested from 30 MHz – 24 GHz							
Tested By: JW	Test: FCC Part 15, Para 15.247(d) Project: 11-0207		Client: Nivis, LLC. Model: VN310R				
Frequency (MHz)	Test Data (dBuV)	AF+CL-PA (dB/m)	Corrected Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Pass Margin	Detector PK / AVG
LOW BAND - PEAK							
2405.75	82.39	31.95	114.34		3.0m./		PK
4811.78*	51.73	3.96	56.69	74.0	3.0m./	17.3	PK
7217.53	60.98	8.76	70.74	94.3	3.0m./	23.6	PK
9623.25	50.90	11.81	63.71	74.0	1.0m./	10.3	PK
MID BAND- PEAK							
2440.83	82.04	31.95	113.99		3.0m./		PK
4881.73*	47.99	3.82	52.81	74.0	3.0m./	21.2	PK
7322.48*	57.30	9.39	67.69	74.0	3.0m./	6.3	PK
9763.60	50.62	11.01	62.63	74.0	3.0m./	11.4	PK
HIGH BAND- PEAK							
2475.83	81.24	32.21	113.45		3.0m./		PK
4949.70*	47.38	3.95	52.33	74.0	3.0m./	21.7	PK
7427.50*	58.16	9.21	68.37	74.0	3.0m./	5.6	PK
9903.52	49.45	11.69	62.14	74.0	1.0m./	11.9	PK

1. (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 20 dB relaxation of CFR 15.35.

2. ND = No other signals detected within 20 dB of specification limit.

SAMPLE CALCULATION:

3. Measurements taken at 1 meter distance were extrapolated to 3 meter using a factor of (-9.5 dB).

4. 1 dB loss factor is added for all measurement using the high pass filter.

RESULTS: At 4811.78 MHz: = 51.73 dBuV+ (1 dB high pass filter loss) +3.96 dB/m = 56.69 dBuV/m
 @ 3m

Margin = (74.0 – 56.69) = 17.3 dB

Test Date: September 21, 2011

Tested By

Signature: 

Name: John Wynn

US Tech Test Report,
 FCC ID:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

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 Nivis, LLC.
 VN310R

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

Table 7 – Omni Antenna- Average Radiated Spurious

Radiated Spurious Emissions, Tested from 30 MHz – 24 GHz							
Tested By: JW	Test: FCC Part 15, Para 15.247(d) Project: 11-0207		Client: Nivis, LLC. Model: VN310R				
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							
2405.75	82.39	31.95	106.80		3.0m./		PK
4811.78*	44.17	3.96	41.59	54.0	3.0m./	12.4	AVG
7217.53	53.16	8.76	55.38	86.8	3.0m./	31.4	AVG
9623.25	42.51	11.81	47.78	54.0	1.0m./	6.2	AVG
MID BAND- PEAK							
2440.83	80.46	31.95	104.87		3.0m./		AVG
4881.73*	40.34	3.82	37.62	54.0	3.0m./	16.4	AVG
7322.48*	49.33	9.39	52.18	54.0	3.0m./	1.8	AVG
9763.60	42.56	11.01	46.92	54.0	3.0m./	7.1	AVG
HIGH BAND- PEAK							
2475.83	79.66	32.21	105.33		3.0m./		AVG
4949.70*	38.05	3.95	35.46	54.0	3.0m./	18.5	AVG
7427.50*	49.45	9.21	52.12	54.0	3.0m./	1.9	AVG
9903.52	49.45	11.69	45.88	54.0	1.0m./	8.1	AVG

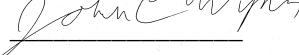
1. (*) Falls within the restricted bands of CFR 15.205.
2. ND = No other emissions detected within 20 dB of the Part 15.209 limits for spurious emissions within Restricted Bands.
3. Test data values measured at 1 meter include a factor of -9.54 dB for distance extrapolation from a test distance of 1 meter to 3 meters.
4. Additional factors include a Duty Cycle, DC = -7.96 dB and filter factor of +1.0 dB.

SAMPLE CALCULATION:

RESULTS: At 4811.78 MHz: $= (44.17 + (1 \text{ dB high pass filter loss})) + (3.96) = 41.59 \text{ dBuV/m} @ 3m$
 Margin = $(54.0 - 41.59) = 12.4 \text{ dB}$

Test Date: September 21, 2011

Tested By

Signature: 

Name: John Wynn

US Tech Test Report,
FCC ID:
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Model:

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2.11Six (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 ? input impedance. Measurements were performed similar to the method of FCC, KDB Publication No. 558074 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 12 through 14.

Table 8 – Six (6) dB Bandwidth

Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum FCC Bandwidth (MHz)
2405	1.63	0.5
2440	1.54	0.5
2475	1.56	0.5

Test Date: September 22, 2011

Tested By

Signature:



Name: John Wynn

US Tech Test Report,
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Issue Date:
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2.11 Six dB Bandwidth per CFR 15.247(a)(2), (IC RSS 210, A8.2(a))

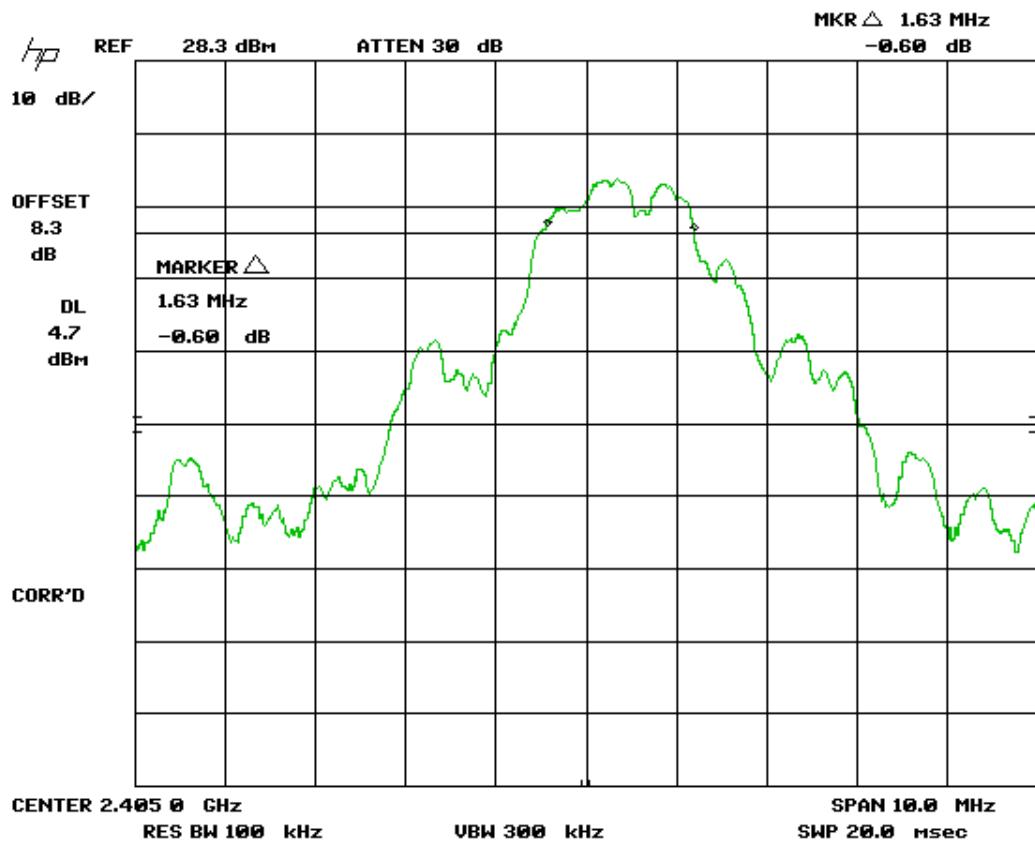


Figure 13 - Six (6) dB Bandwidth - 15.247 (a) (2) - Low Channel

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

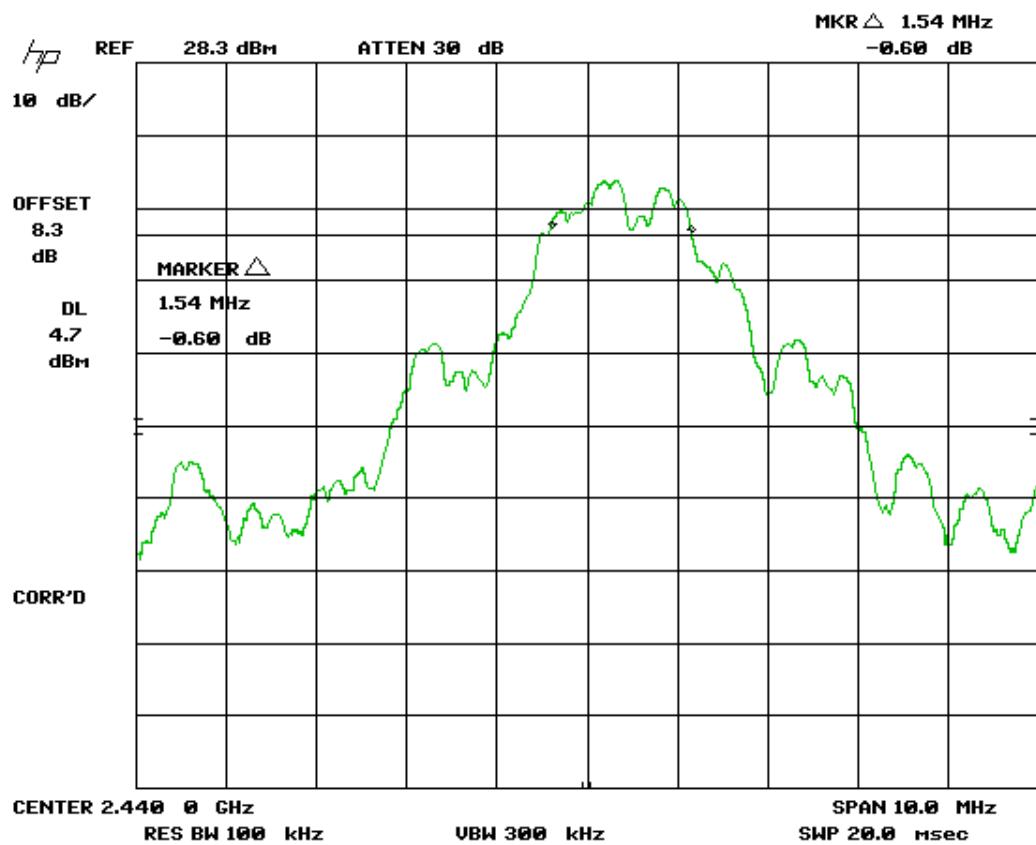


Figure 14 – Six dB Bandwidth - 15.247 (a) (2) - Mid Channel

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Model:

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VN310R

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

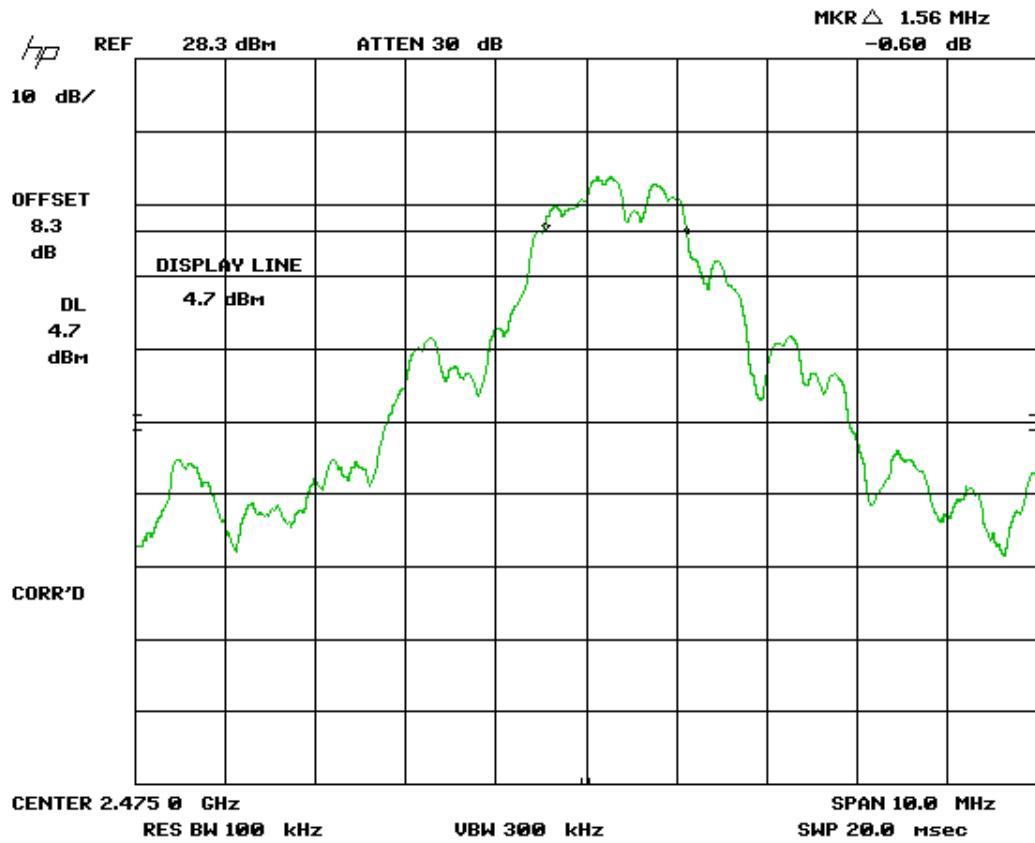


Figure 15 - Six dB Bandwidth - 15.247 (a) (2) - High Channel

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Model:

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

For the VN310R module, 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 0.3 dB, and addition of an attenuator, 8.0 dB and the final corrected measurements were determined by adding 8.3 dB to the raw data measured values of Figures 15 to 17. 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 15 to 17 above. The 0.3 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 2405	17.5	17.5	56.23	1000
Mid Band 2442	17.4	17.4	54.95	1000
High Band 2475	17.3	17.3	53.70	1000

Note: reference adjusted for correction factor, 8.3 dB for attenuator and cable loss.

Test Date: September 22, 2011

Tested By

Signature: 

Name: John Wynn

US Tech Test Report,

FCC ID:

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Model:

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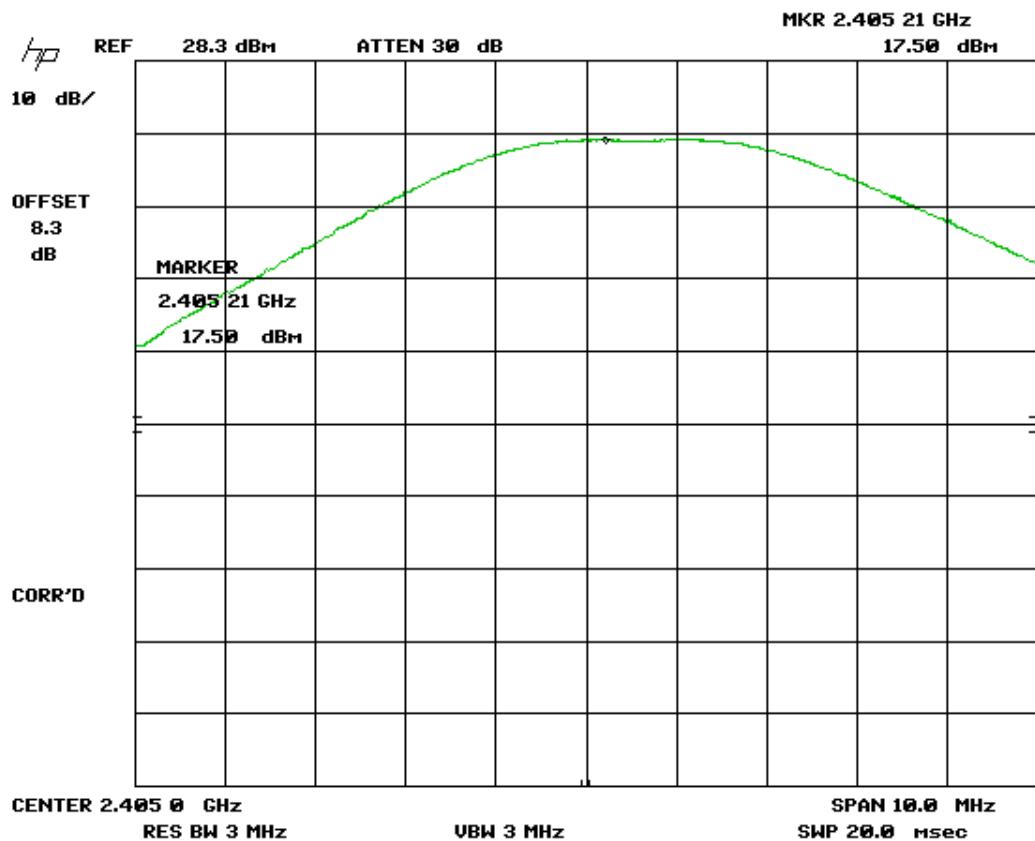
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VN310R

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



Note: reference adjusted for correction factor.

Figure 16 - Peak Antenna Conducted Output Power, Low Channel

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Customer:

Model:

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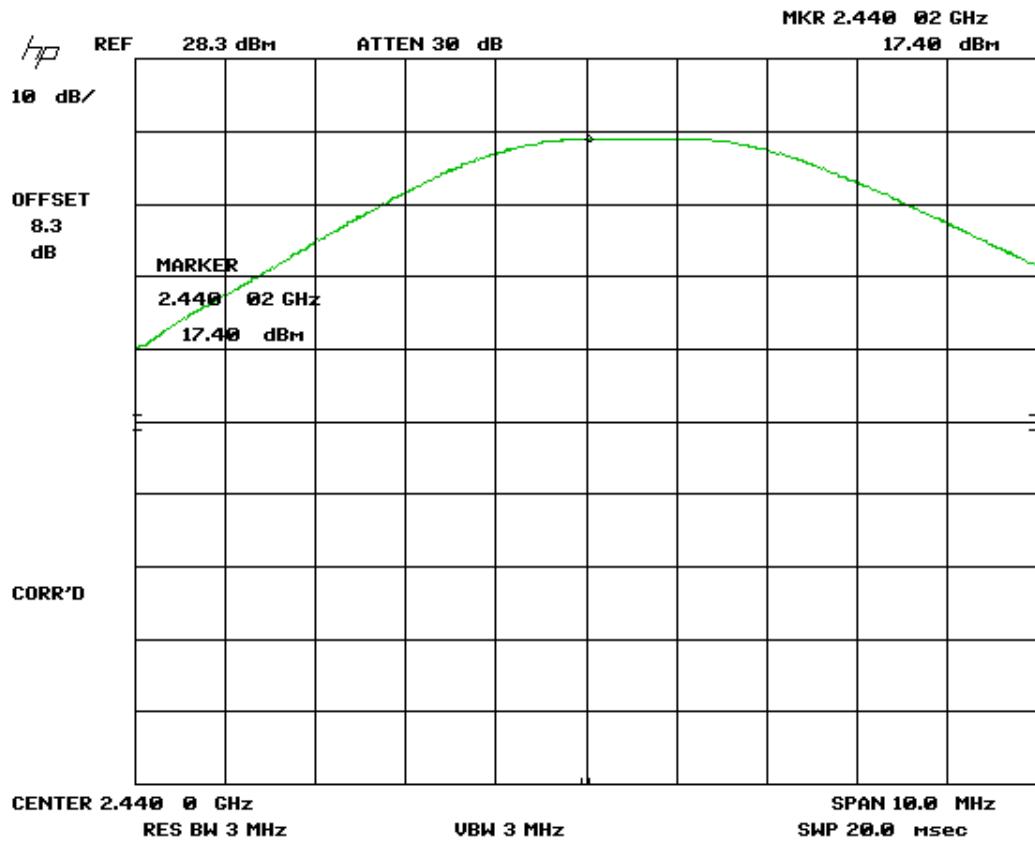
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2.12 Peak Power Output (CFR 15.247 (b)(3))



Note: reference adjusted for correction factor.

Figure 17 - Peak Antenna Conducted Output Power, Mid Channel

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Test Report Number:

Issue Date:

Customer:

Model:

FCC Part 15 Certification

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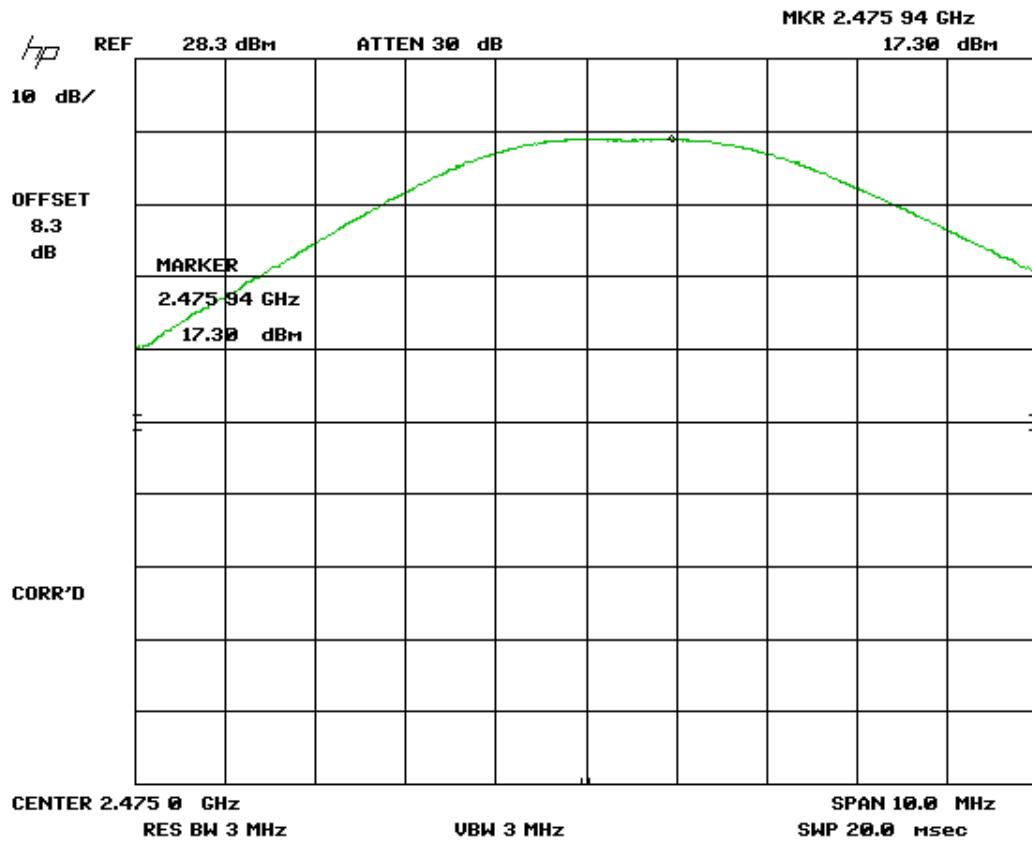
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2.12 Peak Power Output (CFR 15.247 (b)(3))



Note: reference adjusted for correction factor.

Figure 18 - Peak Antenna Conducted Output Power, High Channel

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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 18 through 20 below. Results are corrected by adding 0.5 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	7.10	7.10	+8.0
Mid-2440	6.50	6.50	+8.0
High-2475	6.60	6.60	+8.0

Note: reference adjusted for correction factor, 8.3 dB for attenuator and cable loss.

Test Date: September 22, 2011

Tested By

Signature: John C Wynn

Name: John Wynn

US Tech Test Report,

FCC ID:

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Customer:

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

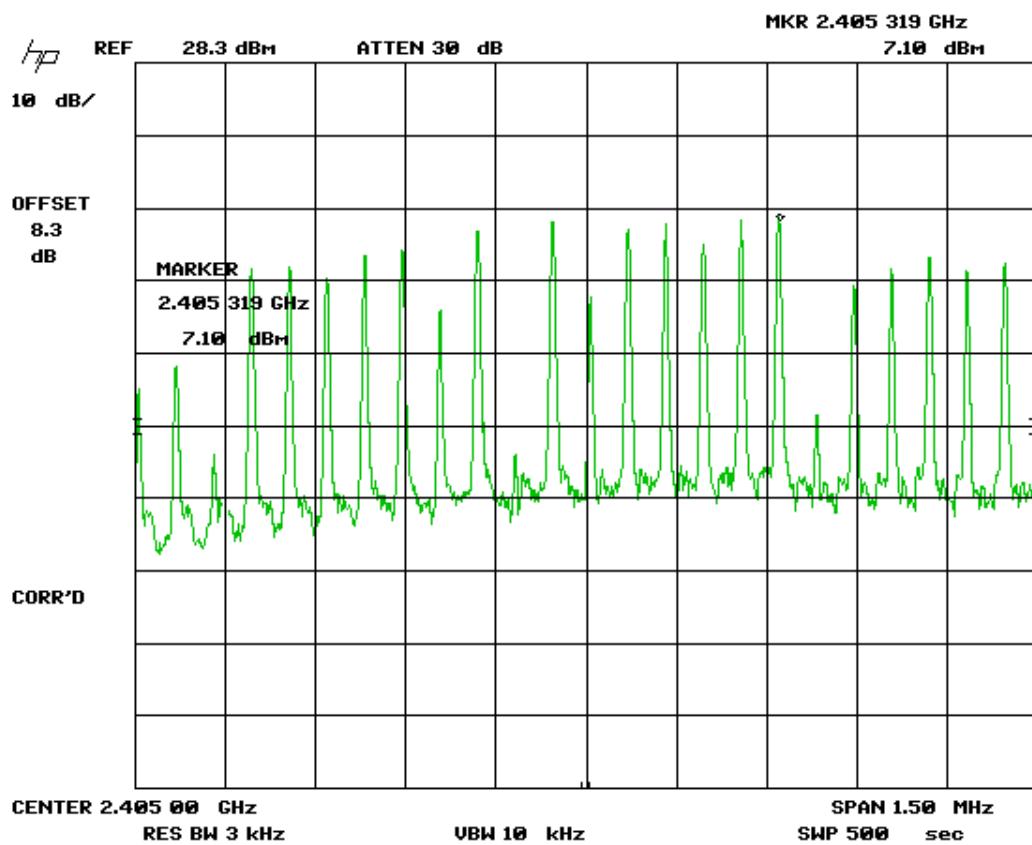


Figure 19. Peak Power Spectral Density - Part 15.247 (e) - Low Channel

Note: reference adjusted for correction factor, 8.3 dB for attenuator and cable loss.

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

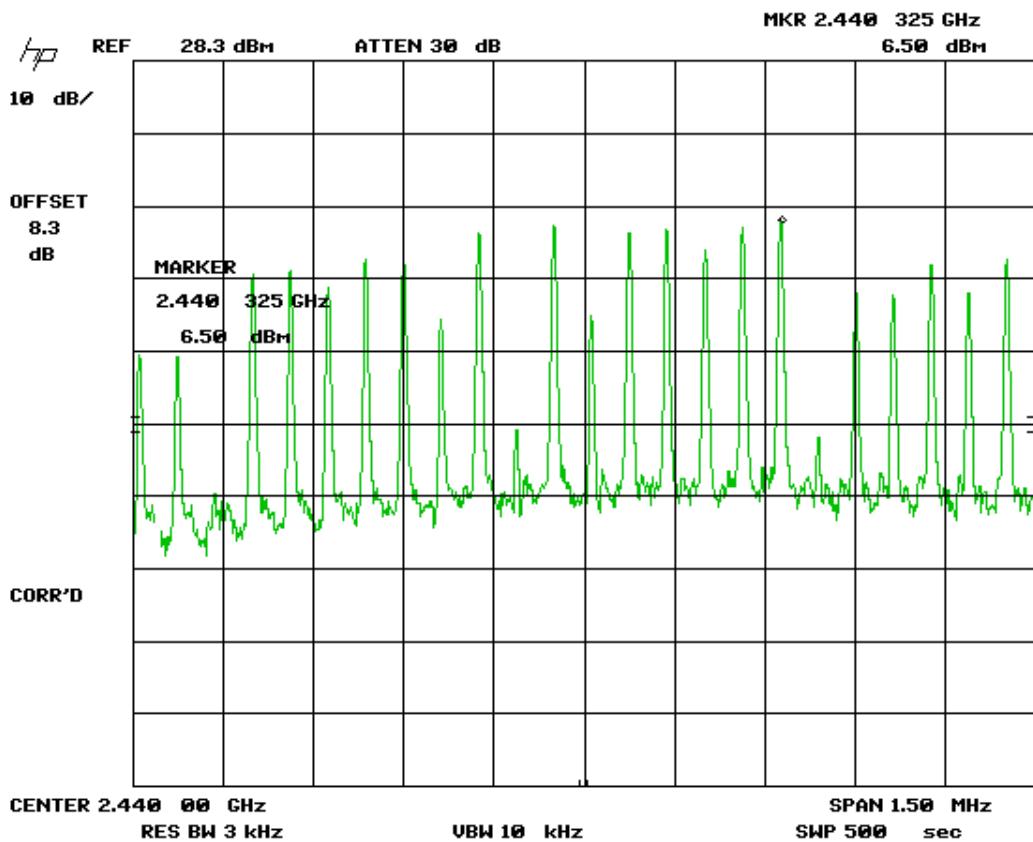


Figure 20. Power Spectral Density - Part 15.247 (e) - Mid Channel

Note: reference adjusted for correction factor, 8.3 dB for attenuator and cable loss.

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

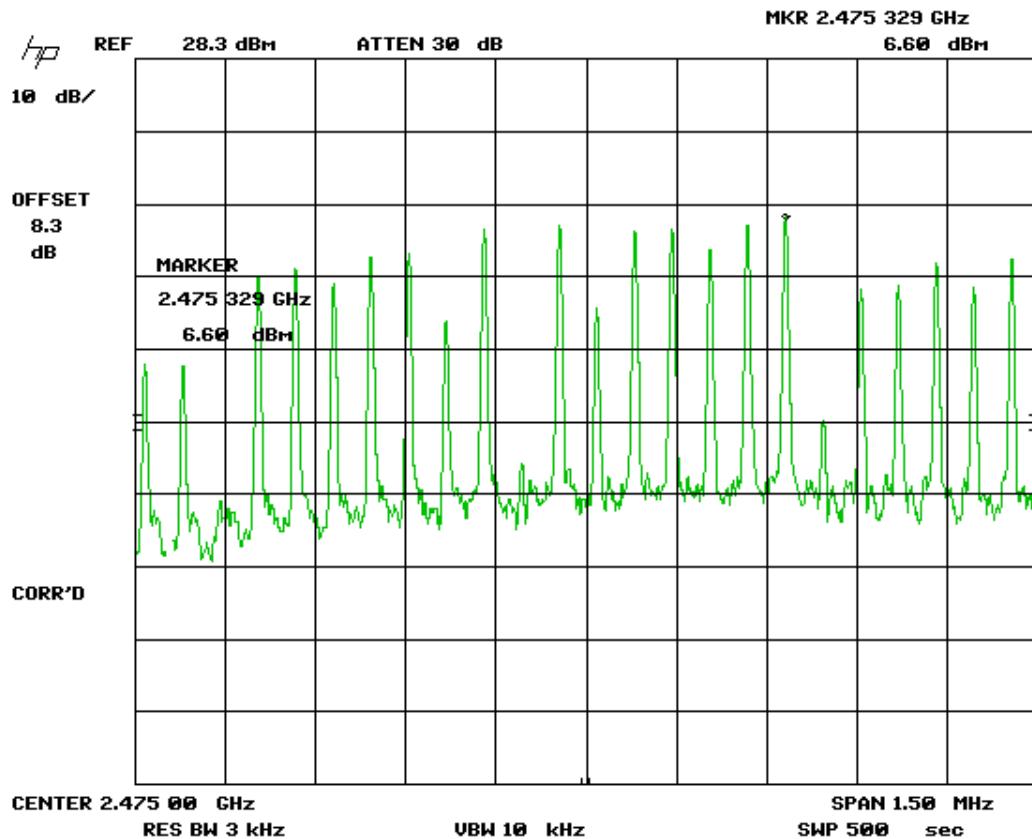


Figure 21. Peak Power Spectral Density - Part 15.247 (e) - High Channel

Note: reference adjusted for correction factor, 8.3 dB for attenuator and cable loss.

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

Band Edge measurements are made following the guidelines in FCC KDB Publication No. 558074 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.

To capture the band edge 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. See figure 24 and 25 below.

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 Customer:
 Model:

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2.14 Band Edge (Cont'd)

Table 11. Upper Band Edge - Radiated Emissions

Peak Radiated Higher Band Edge Measurements								
Test By: GY	Test: FCC Part 15.247			Client: Nivis, LLC.				
	Project: 11-0207	Class:	Model: VN310R					
Frequency (MHz)	AF table	Test data	AF+CA- AMP+DC dB/m	Corrected Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarity	Margin (dB)	Detector PK / AVG
Internal Antenna								
Fund. 2475.83	1HN3mV	79.66	32.21	105.33		3.0m./		AVG
Band Edge 2483.5	--	(105.33- 48.69)	--	56.64	54.0	3m./	See calculation below	PK

The limit for the average value of radiated emissions in a Restricted Band is 54 dBuV/m. To compute the average values of the band edge emissions, the duty cycle correction factor of -20.0 dB is applied to the values in the Corrected Results column. After this correction the EUT is found to have met the restrictions placed on average radiated emissions in Restricted Bands. The worst-case measurement is computed below.

CALCULATION OF WORST-CASE AVERAGE UPPER BAND EDGE MEASUREMENT:

Results = Peak Corrected Results + Duty Cycle Correction Factor

Results = 56.64 + (-7.96) = 48.68 dBuV/m

Margin = Limit – Results = 54 – 48.68 = 5.32 dB

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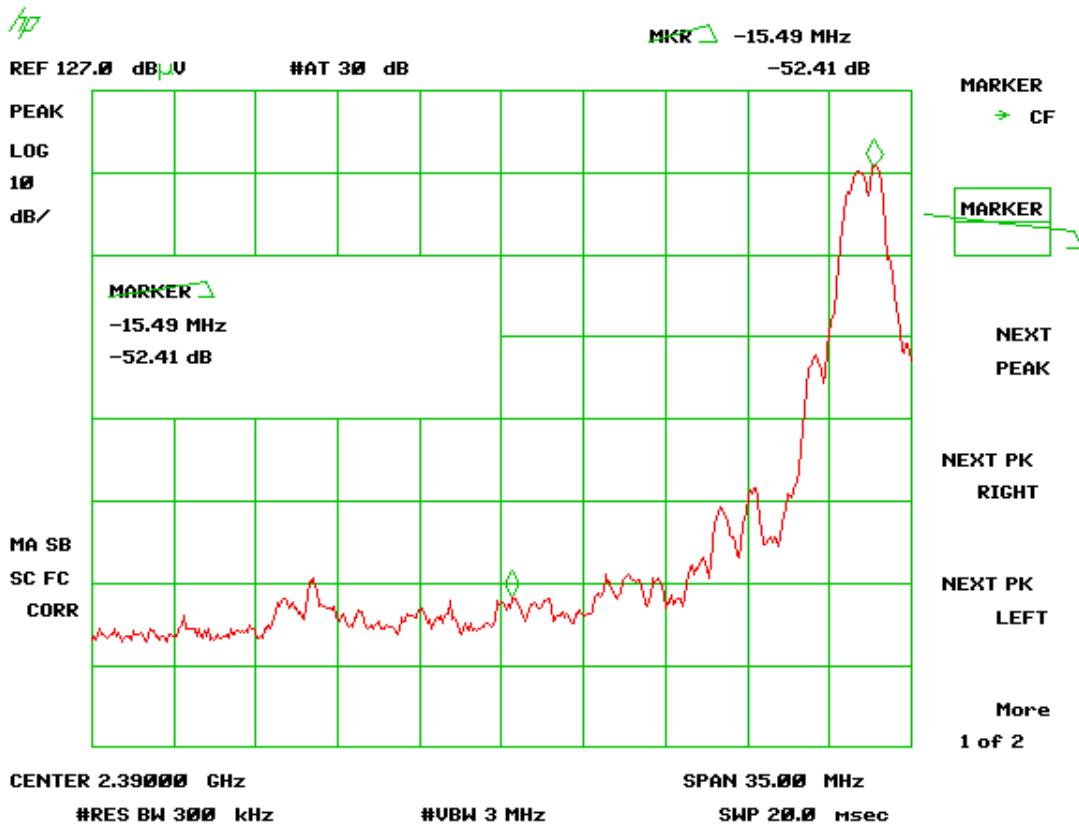


Figure 22. Band Edge Compliance – Low Channel Delta - Peak
Note: Radiated emission shown here as this is the worst case.

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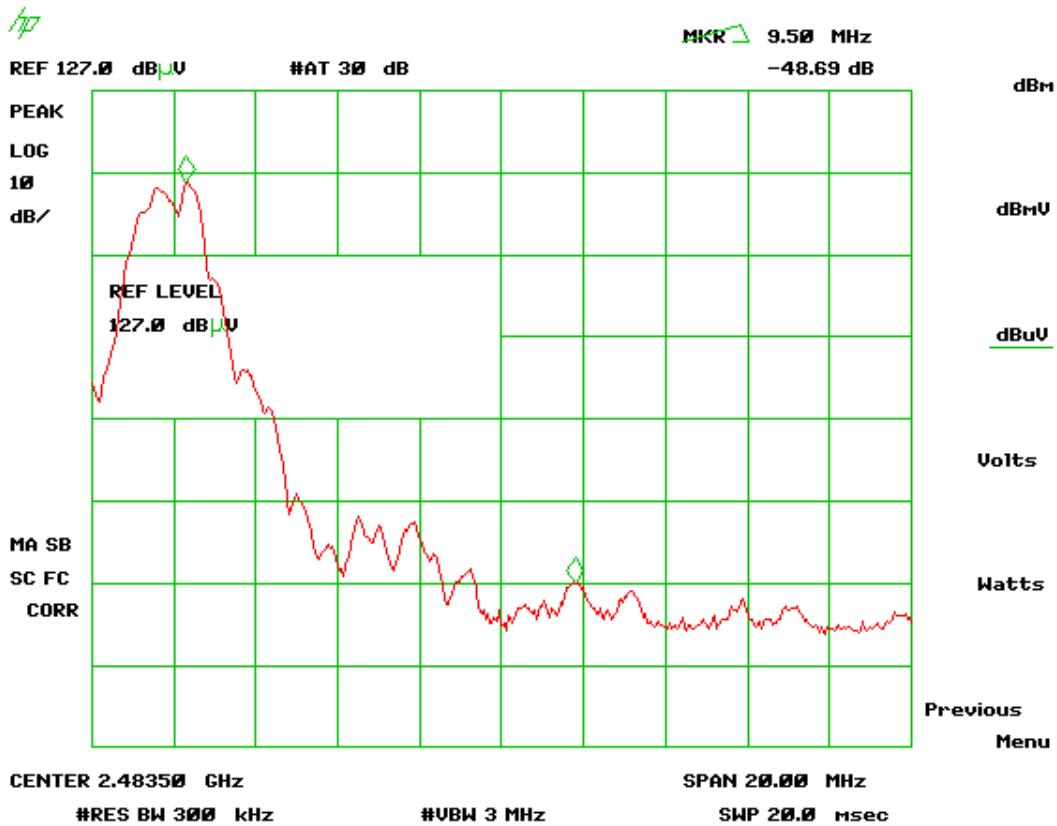


Figure 23. Band Edge Compliance – High Channel Delta - Peak

Note: Radiated emission shown here as this is the worst case.

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2.15 20 dB Bandwidth Measurement per CFR 15.247, 99% Occupied Bandwidth (IC RSS 210, A8.1)

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, KDB Publication No. 558074 for a bandwidth of 20 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 12 and Figures 23 through 25.

Table 12 – 20 dB Bandwidth and 99% Occupied Bandwidth

Frequency (MHz)	20 dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
2405.0	2.90	2.90
2440.0	2.90	2.90
2475.0	2.90	2.90

Test Date: September 22, 2011

Tested By

Signature: 

Name: John Wynn

US Tech Test Report,

FCC ID:

Test Report Number:

Issue Date:

Customer:

Model:

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Nivis, LLC.

VN310R

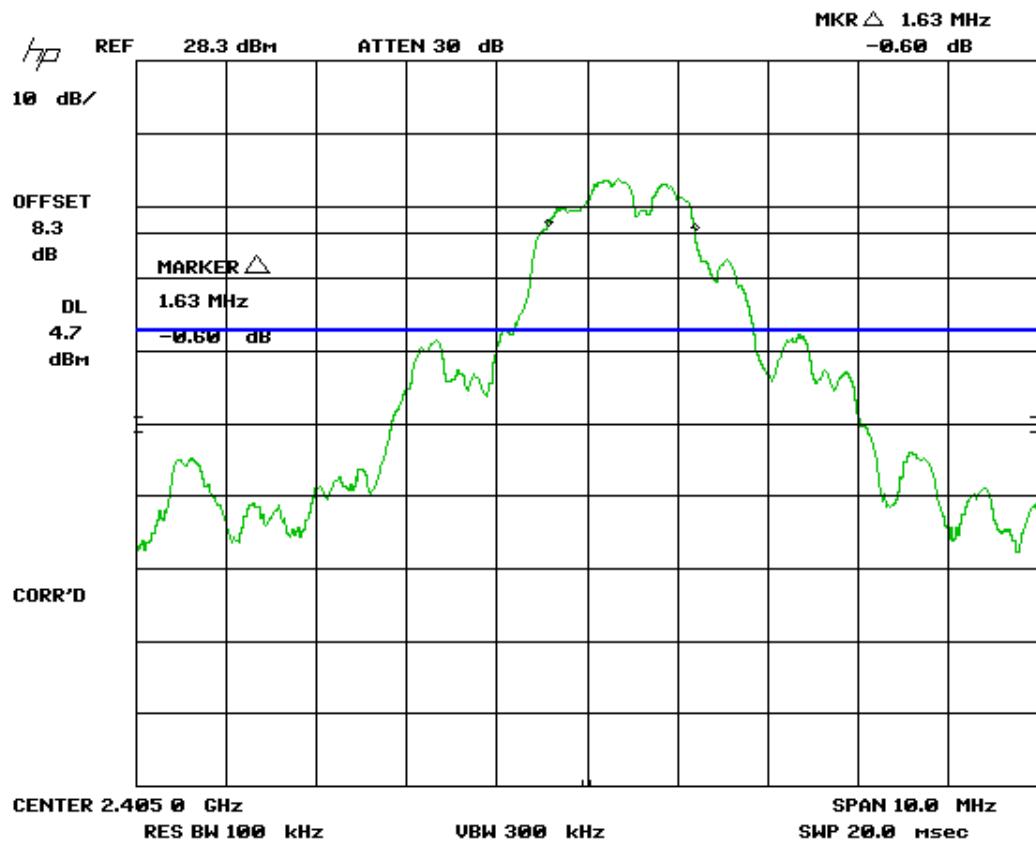


Figure 24. Low Channel 99% Bandwidth

Note: Blue line indicates the 20 dB bandwidth.

US Tech Test Report,

FCC ID:

Test Report Number:

Issue Date:

Customer:

Model:

FCC Part 15 Certification

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11-0207

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Nivis, LLC.

VN310R

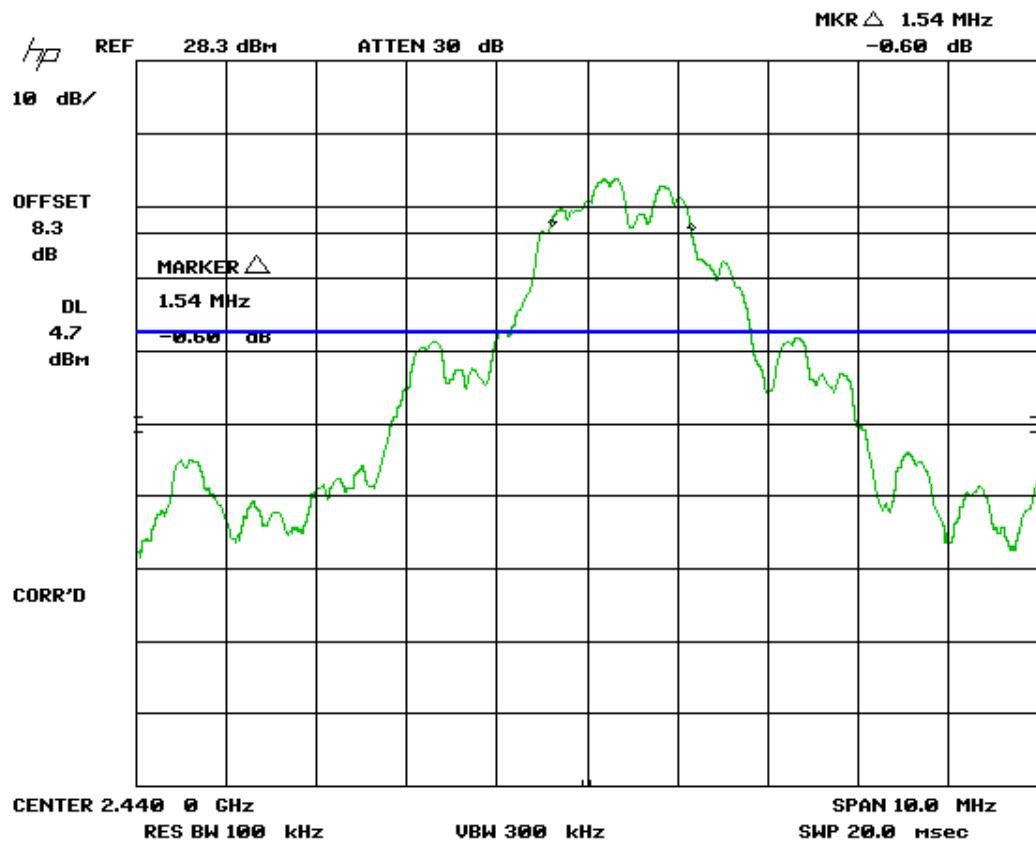


Figure 25. Mid Channel 99% Bandwidth
Note: Blue line indicates the 20 dB bandwidth.

US Tech Test Report,

FCC ID:

Test Report Number:

Issue Date:

Customer:

Model:

FCC Part 15 Certification

SQB-VN3104034R5

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Nivis, LLC.

VN310R

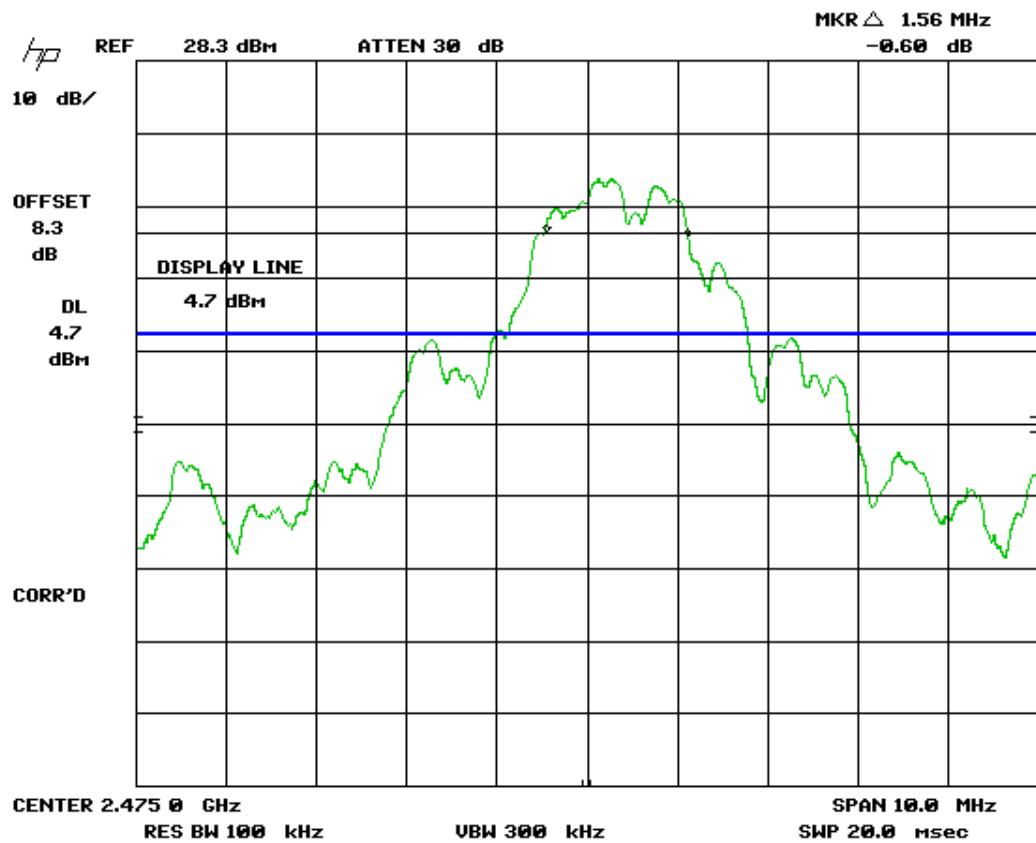


Figure 26. High Channel 99% Bandwidth

Note: Blue line indicates the 20 dB bandwidth.

US Tech Test Report,
FCC ID:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification
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Nivis, LLC.
VN310R

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). Please refer to the results as shown in Table 13 below.

US Tech Test Report,
FCC ID:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification
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2.16 Unintentional Radiator Power Lines Conducted Emissions (Cont'd)

Table 13. Power Line Conducted Emissions Data, Class B Part 15.107, Peak Measurement vs. Avg. Limits

CONDUCTED EMISSIONS						
Tested By: JW	Specification Requirement: FCC Part 15, Para 15.107 Class A		Project No.: 11-0207	Manufacturer/Model: Nivis, LLC. model VN310R		
Frequency (MHz)	Test Data (dBuV)	LISN+CL-PA (dB)	Corrected Results (dBuV)	Avg Limits (dBuV)	Margin (dB)	Detector
120 VAC, 60 Hz, Supply Line						
0.1560	50.20	0.46	50.66	55.7	5.0	PK
0.5092	35.50	0.14	35.64	46.0	10.4	PK
1.6840	35.20	0.26	35.46	46.0	10.5	PK
5.0400	41.50	0.33	41.83	50.0	8.2	PK
10.0800	40.60	0.55	41.15	50.0	8.9	PK
29.0400	39.60	1.06	40.66	50.0	9.3	PK
120 VAC, 60 Hz, Neutral Line						
0.1515	56.30	0.46	56.76	65.9	9.2*	PK
0.1515	44.30	0.46	44.76	55.9	11.2	AVG
0.5007	33.10	0.24	33.34	46.0	12.7	PK
4.1600	29.80	0.42	30.22	46.0	15.8	PK
9.7700	28.50	0.61	29.11	50.0	20.9	PK
14.6400	29.70	0.70	30.40	50.0	19.6	PK

Tested from 150 kHz to 30 MHz

SAMPLE CALCULATIONS: At 0.1560 MHz, = 50.20 + (0.46) = 50.66 dBuV

Test Date: September 22, 2011

Tested By

Signature: 

Name: John Wynn

US Tech Test Report,
FCC ID:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification
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October 6, 2011
Nivis, LLC.
VN310R

2.17 Unintentional Radiator, Radiated Emissions (CFR 15.109, 15.209)

The test data provided herein is to support the verification requirement for digital devices. Radiated emissions coming from the EUT in a non-transmit state per 15.109 were evaluated from 30 MHz to 12.5 GHz as well as radiated emission coming for the EUT in a transmitting state per 15.209 and were investigated from 9kHz or the lowest operating clock frequency to 12.5 GHz and tested as detailed in ANSI C63.4, Paragraph 8. The worst case is presented herein.

Radiated emissions within the band of 9 kHz to 30 MHz were investigated using a calibrated Loop Antenna and per the requirements of ANSI C63.4:2006.

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; 1 MHz RBW and 3 MHz VBW. 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 0.5 dB below the specification limit. The results are shown in Table 14 below.

US Tech Test Report,
 FCC ID:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

FCC Part 15 Certification
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 Nivis, LLC.
 VN310R

Table 14. Unintentional Radiator, Radiated Emissions.

Unintentional Radiator, Radiated Emissions							
Test By: JW	Test: FCC Part 15.109, 15.209		Client: Nivis, LLC.				
	Project: 11-0207 Class: A		Model: VN310R				
Frequency (MHz)	Test Data (dBuV)	AF+CL-PA (dB)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	DETECTOR PK / QP
Tested from 9 kHz to 12.5 GHz							
24.0000	20.30	10.66	30.96	41.0	3 meter/LOOP	10.0	QP
240.0000	50.27	-11.25	39.03	46.0	3 meter/H	7.0	PK
264.0000	53.62	-9.90	43.72	46.0	3 meter/H	2.3	PK
288.0150	48.76	-9.06	39.70	46.0	3 meter/H	6.3	QP
336.1200	51.06	-8.73	42.33	46.0	3 meter/H	3.7	PK
480.0570	42.35	-5.87	36.48	46.0	3 meter/H	9.5	PK
528.0570	41.44	-4.79	36.65	46.0	3 meter/H	9.4	PK
576.0450	40.98	-4.41	36.57	46.0	3 meter/H	9.4	PK
720.0850	42.72	-1.52	41.20	46.0	3 meter/H	4.8	PK
768.0850	40.93	-0.72	40.21	46.0	3 meter/H	5.8	QP
816.0960	45.73	-0.28	45.45	46.0	3 meter/V	0.5	QP
960.1000	48.82	3.03	51.85	54.0	3 meter/V	2.1	QP
984.1320	44.56	3.59	48.15	54.0	3 meter/V	5.8	QP

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: At 240.00 MHz: = 50.27 + (-11.25) = 39.09 dBuV/m @ 3m
 Margin = (46.0-39.03) = 7.0 dB

Test Date: September 21, 2011

Tested By Signature: John C Wynn Name: John Wynn