

TEST REPORT

Report Number: 100016744ATL-001

April 19, 2011

Product Designation: VN210 2.4GHz

Standard: FCC 15.247 and RSS-210, Issue 7, 2007
Frequency Hopping and Digital Modulation Systems operatin within the
bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

Tested by:

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Client:

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Atlanta, GA 30339
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Tests performed by:



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EMC Department Engineer

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1.0 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 3.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested complies with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested.

2.0 Test Summary

Section	Test Full Name	Test Date	Result
4.0	System setup including cable interconnection details, support equipment and simplified block diagram. (System Setup)		
5.0	Transmitter Information for equipment operating under Parts 11, 15 and 18 of the rules (Transmitter Info - Unlicensed)		
6.0	6dB Bandwidth (6 dB Bandwidth)	02/05/2010	PASS
7.0	FCC Part 15.247(b)(3) / RSS-210 A8.4(4) (Peak Output Power)	02/05/2010	PASS
8.0	FCC Part 15.247(e) / RSS-210 A8.2(2) (Power Spectral Density)	02/05/2010	PASS
9.0	FCC Part 15.247(d) / RSS-210 A8.5 - Conducted (Conducted Spurious Emissions)	02/05/2010	PASS
10.0	FCC Part 15.205 / RSS-210 2.2 (Radiated Band Edge)	02/05/2010	PASS
11.0	Additional provisions to the general radiated emission limitations. (FCC 15C - 15.215)		
12.0	Revision History (Revision History)		

3.0 Description of Equipment Under Test

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
Wireless radio	Nivis	VN210	NA

EUT receive date:	02/03/2010
EUT receive condition:	Good

Description of EUT provided by Client:

The VN210 is an industrial wireless radio that enables users to wirelessly monitor industrial devices. It offers a full API for easy integration with an organization's devices. From temperature sensors to gas monitors, the VN210 helps an organization unlock valuable information about their operating environment.

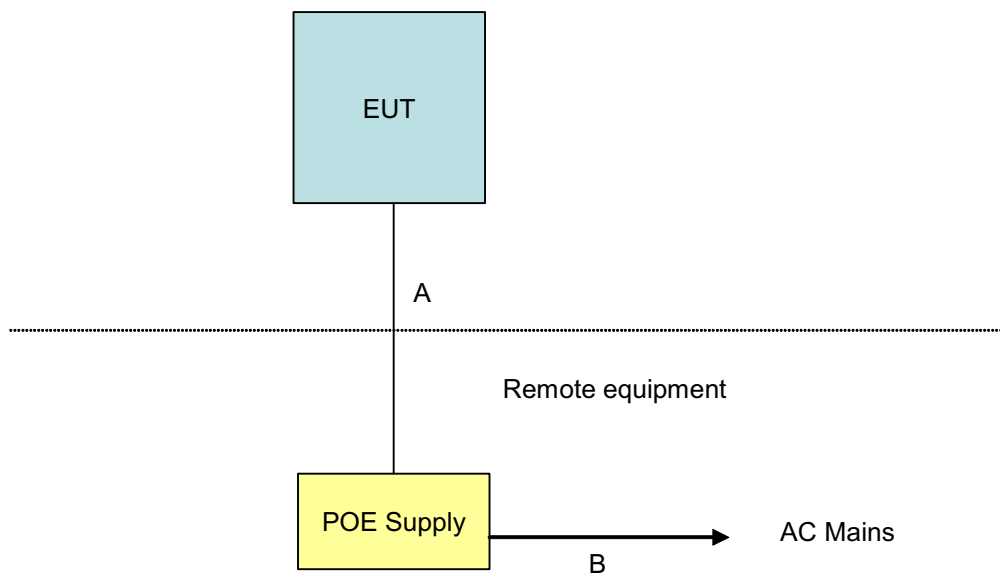
Description of EUT exercising:

The EUT was placed in a transmit state during testing. During radiated emissions testing, the antenna placed on the system was an ANT-N-5 Mini-Box (5.5 dBi).

4.0 System setup including cable interconnection details, support equipment and simplified block diagram. (System Setup)

Method:

Record the details of EUT cabling, document the support equipment, and show the interconnections in a block diagram.

Drawing:

Simplified block diagram

Data:

4.0 System setup including cable interconnection details, support equipment and simplified block diagram. (System Setup)

EUT Cabling						
ID	Description	Length	Shielding	Ferrites	Connection	
					From	To
A	RJ45	10m	No	No	EUT	POE Supply
B	Power cord	1.5m	No	No	POE Supply	AC Mains

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
POE Power Supply			

5.0 Transmitter Information for equipment operating under Parts 11, 15 and 18 of the rules (Transmitter Info - Unlicensed)

Method:

Data:

FCC Rule Part			
2.1033(b)(1)	Applicant	Company Name:	Nivis LLC
		Address:	1000 Circle 75 Parkway SE
		Phone:	678-202-6861
		Fax:	678-202-6820
		Contact Name:	Dean Carpenter
		Email:	dean.carpender@nivis.com
	Manufacturer	Company Name:	Nivis LLC
		Address:	1000 Circle 75 Parkway SE
		Phone:	678-202-6861
		Fax:	678-202-6820
		Contact Name:	Dean Carpenter
		Email:	dean.carpender@nivis.com
2.1033(b)(2)	Equipment	FCC ID:	TBD
		EUT Model Number:	VN210
		EUT Serial Number:	NA
2.1033(b)(3)	User Manual		Attach as separate exhibit.
2.1033(b)(4)	Brief description of circuit functions		Attach as separate exhibit.
2.1033(b)(5)	Block diagram showing frequency of oscillators		Attach as separate exhibit.
2.1033(b)(6)	Test report		Incorporated with this document
2.1033(b)(7)	Internal and external photographs		Attach as separate exhibit.

6.0 6dB Bandwidth (6 dB Bandwidth)

Method:

TEST PROCEDURE REFERENCE

FCC's KDB Publication 558074, "Measurement of Digital Transmission Systems Operating under Section 15.247" March 23, 2005

TEST LIMIT

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

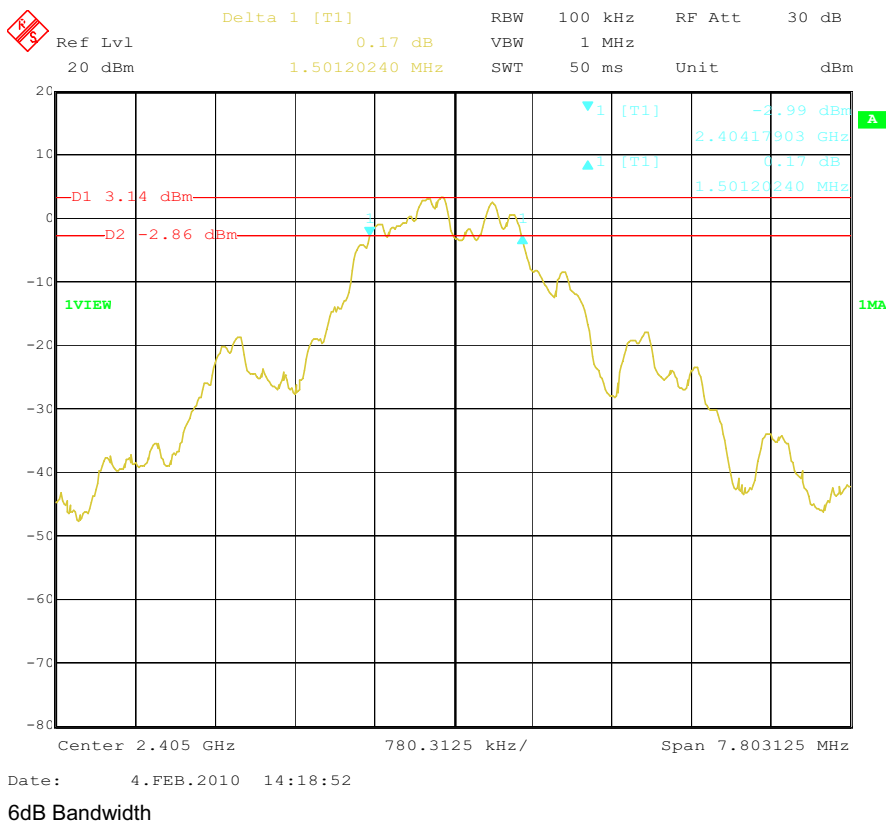
Connect the antenna port of the EUT to the input of a spectrum analyzer. Input a reference level offset into the spectrum analyzer to account for the associated cable loss. Set the analyzer resolution and video bandwidths to 100kHz and turn on the max hold function. Use the marker peak search on the resultant trace to find the peak amplitude. Positioned the markers on either side of the peak amplitude such that they were 6dB lower than the peak amplitude. The 6dB bandwidth is the frequency difference between the marker on the lower side and the marker on the higher side of the peak amplitude. The 6dB bandwidth shall be measured for the highest data rate for each possible modulation mode on the high, middle, and low channels.

Test Equipment Used:

Description:	Manufacturer:	Model:	Asset Number:	Cal Date:	Cal Due:
Attenuator, 10 dB, <18GHz, 50W	Weinschel	47-10-34	200061	08/13/2009	08/13/2010
Cable E20, <18GHz	United Microwave Pro	Micropore 190 577	E20	09/21/2009	09/21/2010
Spectrum Analyzer, 20Hz-40GHz	Rohde & Schwarz	FSEK30	200062	10/19/2009	10/19/2010

Results: The sample tested was found to Comply.

Plot:



6dB Bandwidth

Data:

6.0 6dB Bandwidth (6 dB Bandwidth)

Channel	6 dB Bandwidth	RWB kHz	VWB kHz
Low	1.501MHz	100	300

7.0 FCC Part 15.247(b)(3) / RSS-210 A8.4(4) (Peak Output Power)

Method:

TEST PROCEDURE REFERENCE

FCC's KDB Publication 558074, "Measurement of Digital Transmission Systems Operating under Section 15.247" March 23, 2005

TEST LIMIT

The maximum peak conducted output power of the intentional radiator shall not exceed the following: For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.

As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level.

If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

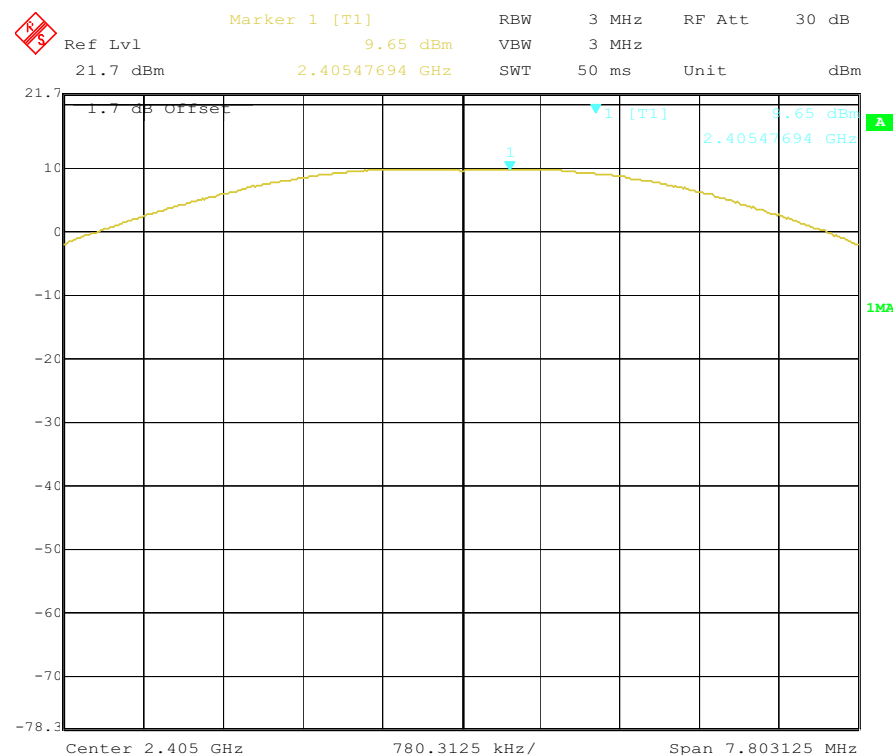
Connect the antenna port of the EUT to the input of a peak power meter (or spectrum analyzer with resolution bandwidth set greater than the emission bandwidth). Read the power directly from the power meter (or equivalent) that is corrected for cable loss to obtain the power at the antenna terminals. Measure the conducted power on the high, middle and low channels for all data rates and modulation modes.

Test Equipment Used:

Description:	Manufacturer:	Model:	Asset Number:	Cal Date:	Cal Due:
Attenuator, 10 dB, <18GHz, 50W	Weinschel	47-10-34	200061	08/13/2009	08/13/2010
Cable E20, <18GHz	United Microwave Pro	Micropore 190 577	E20	09/21/2009	09/21/2010
Spectrum Analyzer, 20Hz-40GHz	Rohde & Schwarz	FSEK30	200062	10/19/2009	10/19/2010

Results: The sample tested was found to Comply.

Plot:

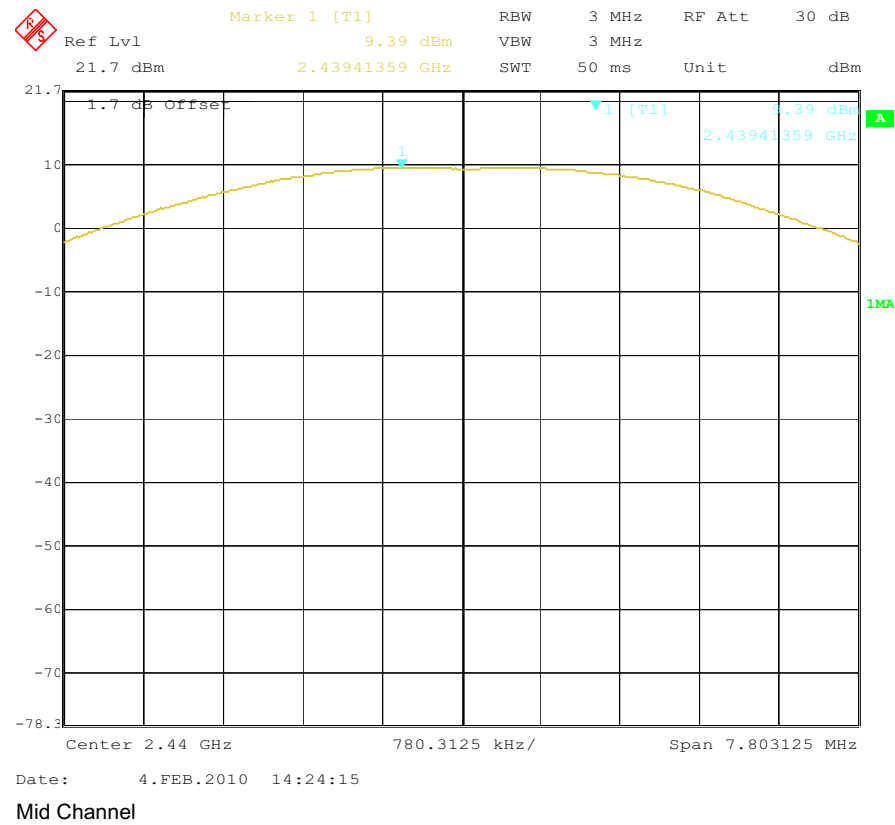


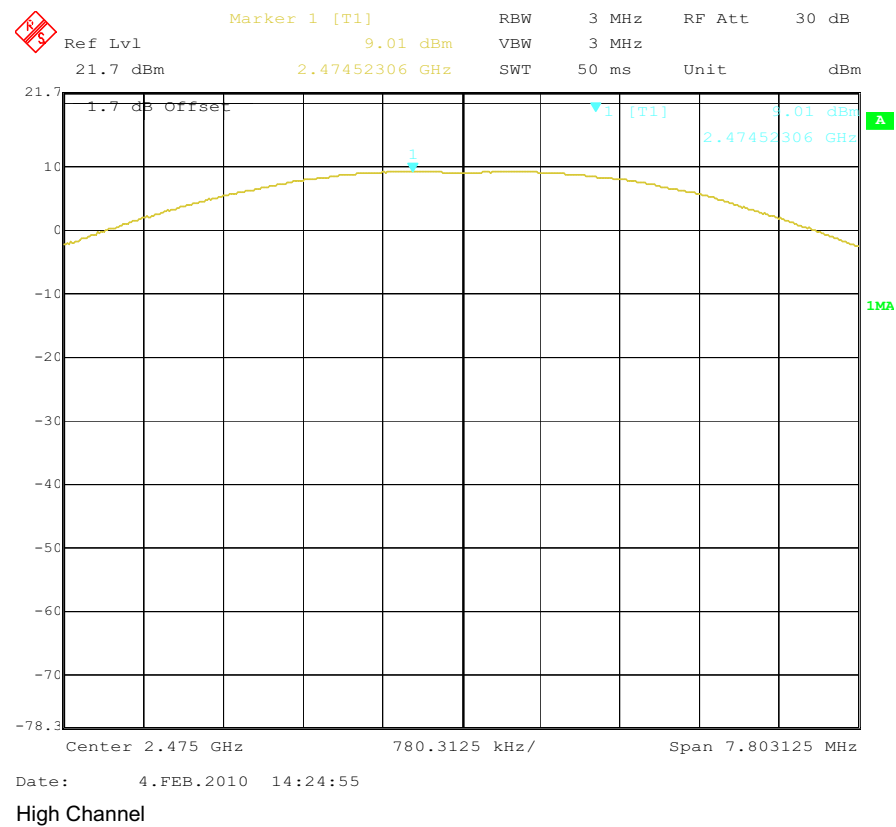
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Low Channel

7.0 FCC Part 15.247(b)(3) / RSS-210 A8.4(4) (Peak Output Power)

Plot:



7.0 FCC Part 15.247(b)(3) / RSS-210 A8.4(4) (Peak Output Power)**Plot:****Data:**

7.0 FCC Part 15.247(b)(3) / RSS-210 A8.4(4) (Peak Output Power)

Channel	Peak Power	RWB MHz	VWB MHz
Low	9.65	3	3
Mid	9.39	3	3
High	9.01	3	3

8.0 FCC Part 15.247(e) / RSS-210 A8.2(2) (Power Spectral Density)

Method:

TEST PROCEDURE REFERENCE

FCC's KDB Publication 558074, "Measurement of Digital Transmission Systems Operating under Section 15.247" March 23, 2005

TEST LIMIT

The peak level measured must be no greater than +8 dBm.

Connect the antenna port of the EUT to the input of a spectrum analyzer. Input an offset into the analyzer amplitude to account for the associated cable loss.

Set the span to cover the entire emission bandwidth. With a bandwidth of 100kHz or greater, set the marker to the peak emission and move that frequency to the center of the display. Set the analyzer resolution and video bandwidths to 3kHz and turn on the max hold function. Set the frequency span was set to 300kHz around the highest amplitude occurring in the peak emission envelope. The total sweep time was calculated as follows:

Sweep time (Sec.) = (Fstop - Fstart)/Resolution Bandwidth

Example:

Sweep time (Sec) = 300kHz / 3kHz

Sweep time (Sec) = 100 Seconds

Perform a peak search on the resultant trace. Record the amplitude of that peak as the maximum power density in dBm. Measure the power density for all data rates and modulation modes on the middle channel.

For the high and low channels, measure the power density at the data rate and modulation mode that resulted in the highest and lowest conducted power for that channel.

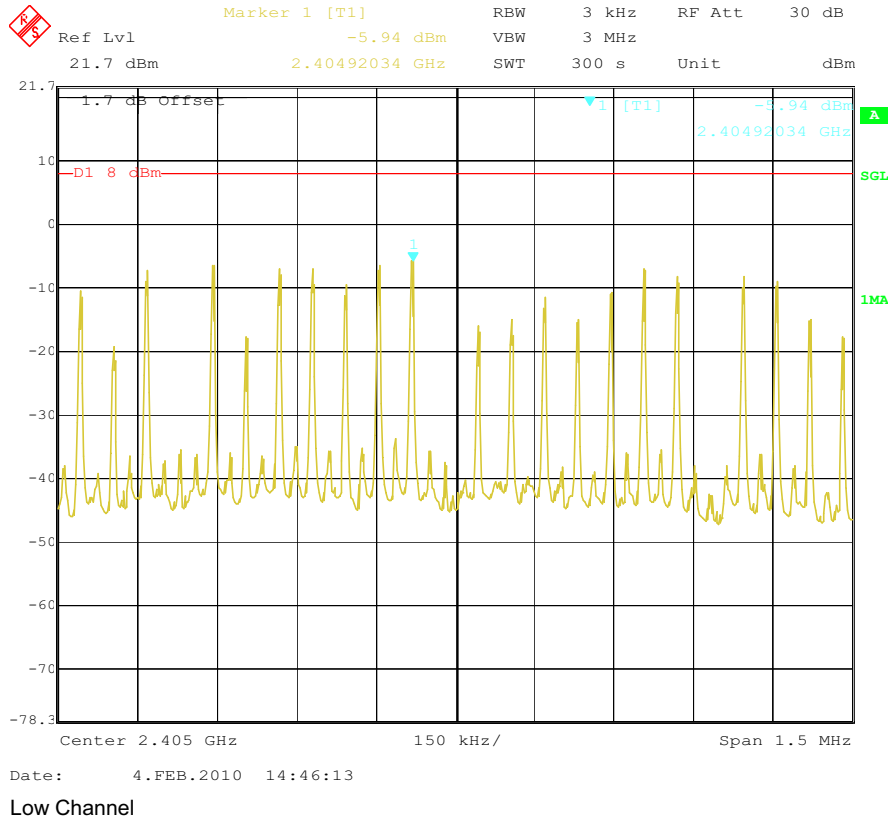
Test Equipment Used:

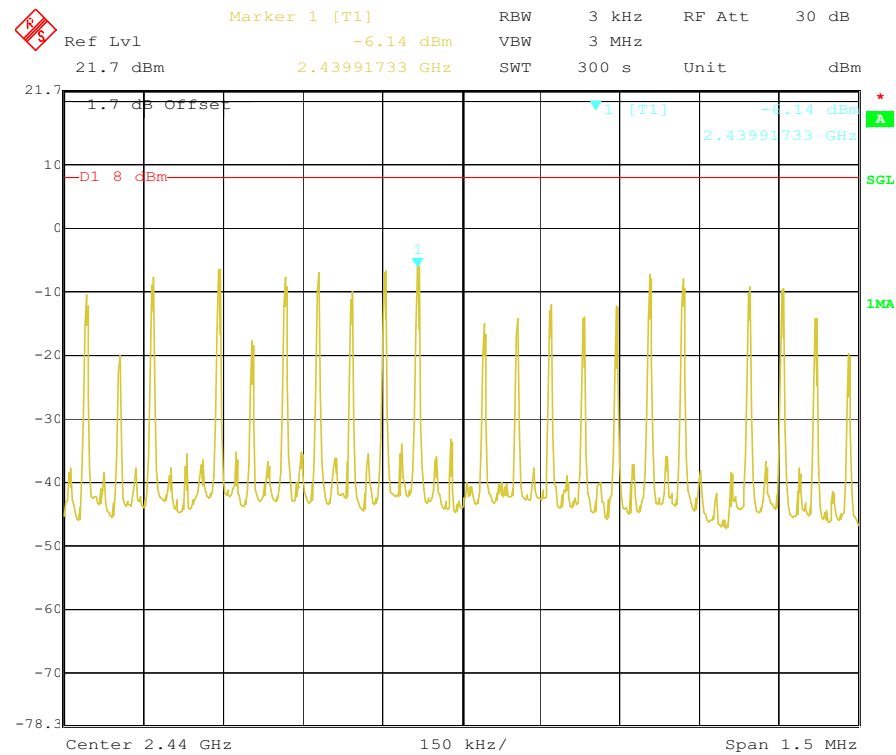
Description:	Manufacturer:	Model:	Asset Number:	Cal Date:	Cal Due:
Attenuator, 10 dB, <18GHz, 50W	Weinschel	47-10-34	200061	08/13/2009	08/13/2010
Cable E20, <18GHz	United Microwave Pro	Micropore 190 577	E20	09/21/2009	09/21/2010
Spectrum Analyzer, 20Hz-40GHz	Rohde & Schwarz	FSEK30	200062	10/19/2009	10/19/2010

Results: The sample tested was found to Comply.

Plot:

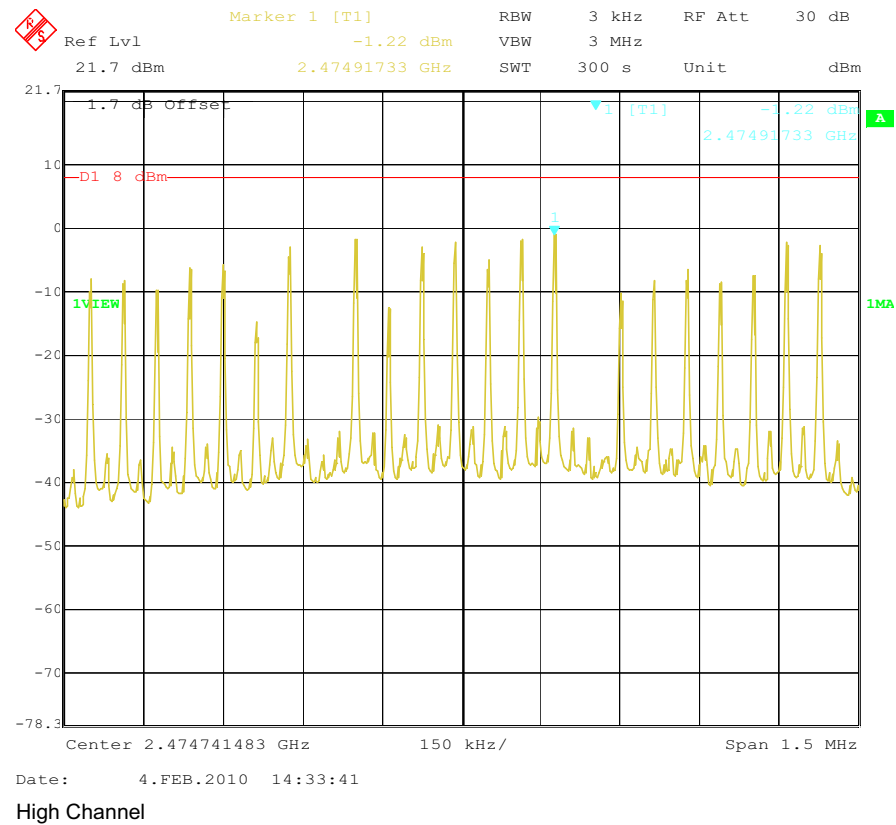
8.0 FCC Part 15.247(e) / RSS-210 A8.2(2) (Power Spectral Density)



8.0 FCC Part 15.247(e) / RSS-210 A8.2(2) (Power Spectral Density)**Plot:**

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Mid Channel

8.0 FCC Part 15.247(e) / RSS-210 A8.2(2) (Power Spectral Density)**Plot:****Data:**

8.0 FCC Part 15.247(e) / RSS-210 A8.2(2) (Power Spectral Density)

Channel	PSD dBm	Limit dBm	RWB kHz	Span kHz	Sweep Time seconds
Low	-5.94	8	3	1500	300
Mid	-6.14	8	3	1500	300
High	-1.22	8	3	1500	300

9.0 FCC Part 15.247(d) / RSS-210 A8.5 - Conducted (Conducted Spurious Emissions)

Method:

TEST PROCEDURE REFERENCE

FCC's KDB Publication 558074, "Measurement of Digital Transmission Systems Operating under Section 15.247" March 23, 2005

TEST LIMIT

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

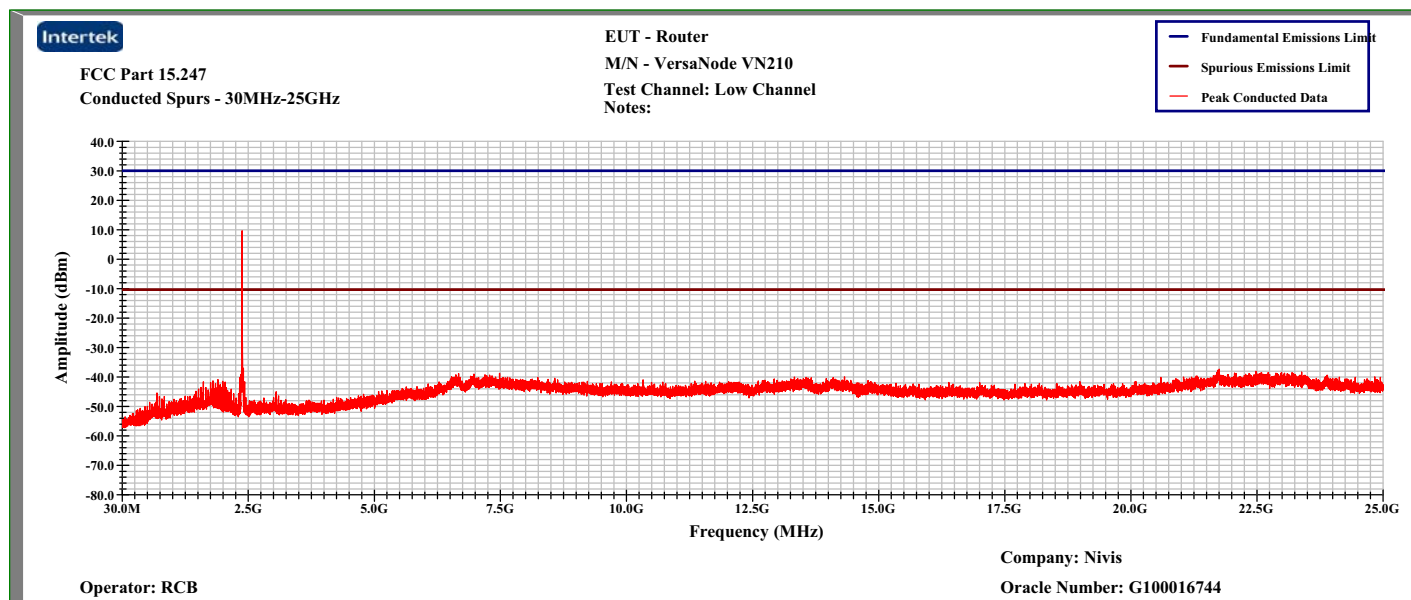
If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB.

Test Equipment Used:

Description:	Manufacturer:	Model:	Asset Number:	Cal Date:	Cal Due:
Attenuator, 10 dB, <18GHz, 50W	Weinschel	47-10-34	200061	08/13/2009	08/13/2010
Cable E20, <18GHz	United Microwave Pro	Micropore 190 577	E20	09/21/2009	09/21/2010
Spectrum Analyzer, 20Hz-40GHz	Rohde & Schwarz	FSEK30	200062	10/19/2009	10/19/2010

Results: The sample tested was found to Comply.

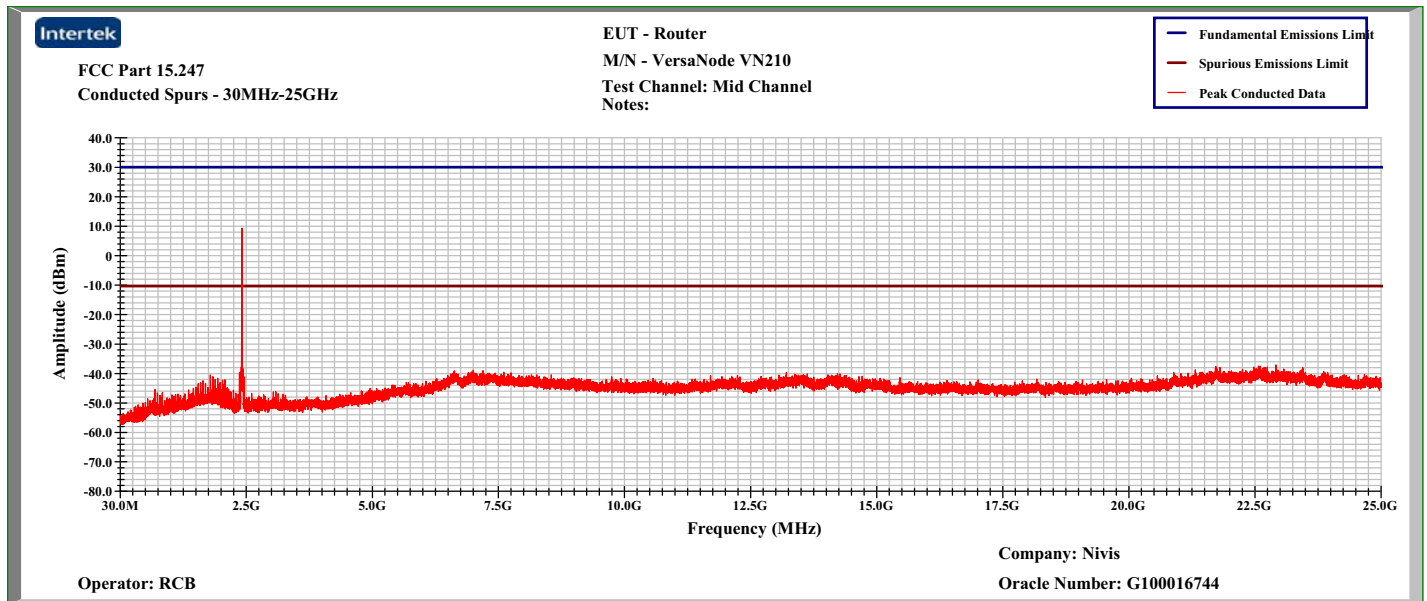
Plot:



Low Channel

9.0 FCC Part 15.247(d) / RSS-210 A8.5 - Conducted (Conducted Spurious Emissions)

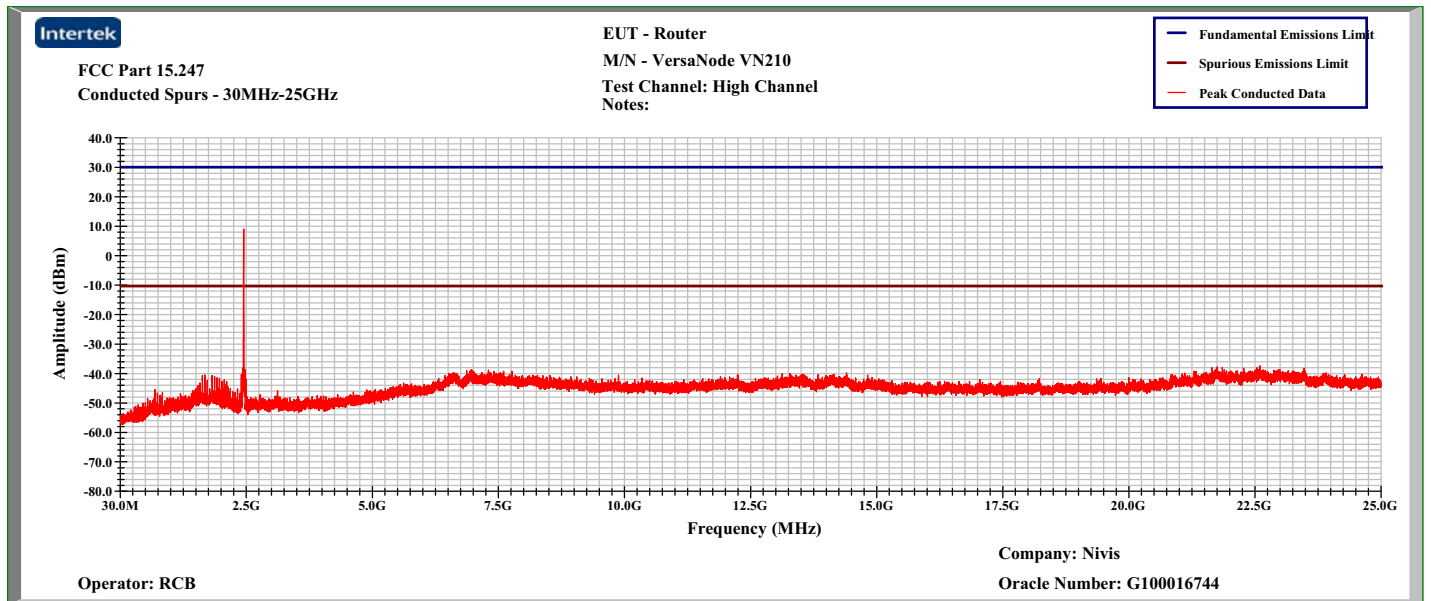
Plot:



Mid Channel

9.0 FCC Part 15.247(d) / RSS-210 A8.5 - Conducted (Conducted Spurious Emissions)

Plot:



High Channel

10.0 FCC Part 15.205 / RSS-210 2.2 (Radiated Band Edge)**Method:**

TEST PROCEDURE REFERENCE
ANSI C63.4: 2003

TEST LIMIT

Unwanted emissions falling into restricted bands shall meet the general field strength limits. It should also be noted that unwanted emissions falling in non-restricted bands do not need to be suppressed to a level lower than the general field strength limits (FCC 15.209).

Specifically, at the restricted band frequency nearest the lowest and highest channel of each available band, the field strength shall meet the general field strength limits.

Test Equipment Used:

Description:	Manufacturer:	Model:	Asset Number:	Cal Date:	Cal Due:
Antenna, Horn, <18 GHz	EMCO	3115	213061	04/30/2009	04/30/2010
Cable E20, <18GHz	United Microwave Pro	Micropore 190 577	E20	09/21/2009	09/21/2010
Preamplifier, 20 MHz to 18 GHz, 40 dB	A.H. Systems	PAM-0118	200108	04/07/2009	04/07/2010
Spectrum Analyzer, 20Hz-40GHz	Rohde & Schwarz	FSEK30	200062	10/19/2009	10/19/2010

Results: The sample tested was found to Comply.

Data:

10.0 FCC Part 15.205 / RSS-210 2.2 (Radiated Band Edge)

Observing peak data in the frequency range 30MHz to 25GHz, there are no unwanted emissions within 20dB of the limit.

11.0 Additional provisions to the general radiated emission limitations. (FCC 15C - 15.215)**Method:**

§ 15.215 Additional provisions to the general radiated emission limitations.

(a) The regulations in §§15.217 through 15.257 provide alternatives to the general radiated emission limits for intentional radiators operating in specified frequency bands. Unless otherwise stated, there are no restrictions as to the types of operation permitted under these sections.

(b) In most cases, unwanted emissions outside of the frequency bands shown in these alternative provisions must be attenuated to the emission limits shown in §15.209. In no case shall the level of the unwanted emissions from an intentional radiator operating under these additional provisions exceed the field strength of the fundamental emission.

(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

12.0 Revision History (Revision History)

Method:

Document the history of the report.

Data:

Revision Level	Date	Report Number	Notes
Original issue	February 28, 2010	100016744ATL-001	--
1	April 19, 2011	100016744ATL-001	Corrected typographical errors in sections 8 and 9 and added frequency range clarification in section 10.