

EMC Test Report**Application for Grant of Equipment Authorization****Industry Canada RSS-Gen Issue 3 / RSS 210 Issue 8
FCC Part 15 Subpart C****Model: B3000n Communication Badge**

IC CERTIFICATION #: 4362A-B3000N
FCC ID: QGZB3000N

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TEST SITE(S): National Technical Systems - Silicon Valley
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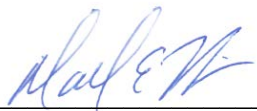
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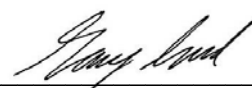
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REVISION HISTORY

Rev#	Date	Comments	Modified By
-	September 10, 2014	First release	

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SCOPE

An electromagnetic emissions test has been performed on the Vocera Communications, Inc. model B3000n Communication Badge, pursuant to the following rules:

Industry Canada RSS-Gen Issue 3
RSS 210 Issue 8 "Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment"
FCC Part 15 Subpart C

Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in the following reference standards and as outlined in National Technical Systems - Silicon Valley test procedures:

ANSI C63.10-2009
FCC DTS Measurement Guidance KDB558074

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant Industry Canada performance and procedural standards.

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

OBJECTIVE

The primary objective of the manufacturer is compliance with the regulations outlined in the previous section.

Prior to marketing in the USA, all unlicensed transmitters and transceivers require certification. Receive-only devices operating between 30 MHz and 960 MHz are subject to either certification or a manufacturer's declaration of conformity, with all other receive-only devices exempt from the technical requirements.

Prior to marketing in Canada, Class I transmitters, receivers and transceivers require certification. Class II devices are required to meet the appropriate technical requirements but are exempt from certification requirements.

Certification is a procedure where the manufacturer submits test data and technical information to a certification body and receives a certificate or grant of equipment authorization upon successful completion of the certification body's review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units, which are subsequently manufactured.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product which may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

STATEMENT OF COMPLIANCE

The tested sample of Vocera Communications, Inc. model B3000n Communication Badge complied with the requirements of the following regulations:

Industry Canada RSS-Gen Issue 3
RSS 210 Issue 8 “Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment”
FCC Part 15 Subpart C

Maintenance of compliance is the responsibility of the manufacturer. Any modifications to the product should be assessed to determine their potential impact on the compliance status of the device with respect to the standards detailed in this test report.

The test results recorded herein are based on a single type test of Vocera Communications, Inc. model B3000n Communication Badge and therefore apply only to the tested sample. The sample was selected and prepared by Rob Holt of Vocera Communications, Inc..

DEVIATIONS FROM THE STANDARDS

No deviations were made from the published requirements listed in the scope of this report.

TEST RESULTS SUMMARY**DIGITAL TRANSMISSION SYSTEMS (2400 – 2483.5MHz)**

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result
15.247(a)	RSS 210 A8.2	Digital Modulation	Systems uses OFDM / DSSS techniques	System must utilize a digital transmission technology	Complies
15.247 (a) (2)	RSS 210 A8.2 (1)	6dB Bandwidth	Minimum: 9.9 MHz	>500kHz	Complies
15.247 (b) (3)	RSS 210 A8.2 (4)	Output Power (multipoint systems)	11b:14.0dBm (25.1mW) 11g:15.2dBm (33.1mW) n20:15.1dBm (32.4mW) EIRP = 0.066 W ^{Note 1}	1Watt, EIRP limited to 4 Watts.	Complies
15.247(d)	RSS 210 A8.2 (2)	Power Spectral Density	11b: 5.5 dBm/100kHz 11g: 1.5dBm/100kHz n20: 1.8dBm/100kHz	8dBm/3kHz	Complies
15.247(c)	RSS 210 A8.5	Antenna Port Spurious Emissions 30MHz – 25 GHz	All emissions >30dBc	< -30dBc ^{Note 2}	Complies
15.247(c) / 15.209	RSS 210 A8.5	Radiated Spurious Emissions 30MHz – 25 GHz	53.9 dBμV/m @ 4874.0 MHz (-0.1 dB)	15.207 in restricted bands, all others <-30dBc ^{Note 2}	Complies
Note 1: EIRP calculated using antenna gain of 3 dBi for the highest EIRP system. Note 2: Limit of -30dBc used because the power was measured using the UNII test procedure (maximum power averaged over a transmission burst).					

DIGITAL TRANSMISSION SYSTEMS (5725 –5850 MHz)

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result
15.247(a)	RSS 210 A8.2	Digital Modulation	Systems uses OFDM techniques	System must utilize a digital transmission technology	Complies
15.247 (a) (2)	RSS 210 A8.2 (1)	6dB Bandwidth	Minimum: 16.5 MHz	>500kHz	Complies
15.247 (b)	RSS 210 A8.2 (4)	Output Power (multipoint systems)	a: 12.7dBm (18.7mW) n20: 12.8dBm (18.9mW) n40: 12.9dBm (19.6mW) EIRP = 0.039 W ^{Note 1}	1Watt, EIRP limited to 4 Watts.	Complies
15.247(d)	RSS 210 A8.2 (2)	Power Spectral Density	11a: -1.5dBm/100kHz n20: -0.8 dBm/100kHz n40: -3.0dBm/100kHz	Maximum permitted is 8dBm/3kHz	Complies
15.247(c)	RSS 210 A8.5	Antenna Port Spurious Emissions – 30MHz – 40 GHz	All emissions >30dBc	< -30dBc ^{Note 2}	Complies
15.247(c) / 15.209	RSS 210 A8.5 Table 2, 3	Radiated Spurious Emissions 30MHz – 40 GHz	51.3 dBμV/m @ 7713.3 MHz (-2.7 dB)	15.207 in restricted bands, all others <-30dBc ^{Note 2}	Complies
Note 1: EIRP calculated using antenna gain of 3 dBi for the highest EIRP system. Note 2: Limit of -30dBc used because the power was measured using the UNII test procedure (maximum power averaged over a transmission burst).					

GENERAL REQUIREMENTS APPLICABLE TO ALL BANDS

FCC Rule Part	RSS Rule part	Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.203	-	RF Connector	Antenna is integral to EUT	Unique or integral antenna required	Complies
15.207	RSS GEN Table 4	AC Conducted Emissions	N/A – EUT is battery powered.		
15.247 (b) (5) 15.407 (f)	RSS 102	RF Exposure Requirements	Refer to SAR report and RSS 102 declaration	Refer to OET 65, FCC Part 1 and RSS 102	Complies
-	RSP 100 RSS GEN 7.1.3	User Manual	Refer to manual	Statement required regarding non-interference	Complies
-	RSP 100 RSS GEN 4.6.1	99% Bandwidth	2.4GHz 11b: 13.6MHz 11g: 16.8MHz n20: 18.0MHz 5GHz 11a: 16.8MHz n20: 17.9MHz n40: 36.4 MHz	Information only	N/A

MEASUREMENT UNCERTAINTIES

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level and were calculated in accordance with UKAS document LAB 34.

Measurement Type	Measurement Unit	Frequency Range	Expanded Uncertainty
RF power, conducted (power meter)	dBm	25 to 7000 MHz	± 0.52 dB
RF power, conducted (Spectrum analyzer)	dBm	25 to 7000 MHz	± 0.7 dB
Conducted emission of transmitter	dBm	25 to 26500 MHz	± 0.7 dB
Conducted emission of receiver	dBm	25 to 26500 MHz	± 0.7 dB
Radiated emission (substitution method)	dBm	25 to 26500 MHz	± 2.5 dB
Radiated emission (field strength)	dBμV/m	25 to 1000 MHz	± 3.6 dB
		1000 to 40000 MHz	± 6.0 dB
Conducted Emissions (AC Power)	dBμV	0.15 to 30 MHz	± 2.4 dB

EQUIPMENT UNDER TEST (EUT) DETAILS**GENERAL**

The Vocera Communications, Inc. model B3000n Communication Badge is an 802.11abgn + BT 3.0 pendent that is designed to provide communication to mobile users. Since the EUT would be placed on a table top during operation, the EUT was treated as table-top equipment during testing to simulate the end-user environment. The EUT is battery powered and is unable to transmit while charging.

The sample was received on March 25, 2014 and tested on March 26, April 14, April 28-29, June 6, 12, and 16, 2014. The EUT consisted of the following component(s):

Company	Model	Description	Serial Number	FCC ID
Vocera Communications	B3000n (aka Northstar)	Communication Badge	3C, 3E, 4E	QGZB3000N

OTHER EUT DETAILS

802.11abgn, 1x1, no diversity
Bluetooth 3.0 (no LE)
No simultaneous transmission of BT/WiFi
Handheld
2.4GHz – 20MHz operation only
5GHz – 20/40MHz operation
DFS Client (see below)
Testing was performed with the Varta Standard Battery installed

ANTENNA SYSTEM

Internal antenna, 3dBi @ 2.4GHz and 5GHz

ENCLOSURE

The EUT enclosure is primarily constructed of Plastic. It measures approximately 9.8 cm wide by 3.6 cm deep by 1.8 cm high.

MODIFICATIONS

No modifications were made to the EUT during the time the product was at NTS Silicon Valley.

SUPPORT EQUIPMENT

No support equipment was used during testing.

EUT INTERFACE PORTS

The I/O cabling configuration during testing was as follows:

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
Headphones	Not connected	-	-	-

Preliminary testing showed no affect on radio related emissions with a headphone cable connected.

EUT OPERATION

The EUT was configured for continuous transmission on the channel noted, worse case data rate, and the maximum output power.

TEST SITE**GENERAL INFORMATION**

Final test measurements were taken at the test sites listed below. Pursuant to section 2.948 of the FCC's Rules and section 3.3 of RSP-100, construction, calibration, and equipment data has been filed with the Commission and with industry Canada.

Site	Designation / Registration Numbers		Location
	FCC	Canada	
Chamber 4	US0027	2845B-4	41039 Boyce Road Fremont, CA 94538-2435
Chamber 5	US0027	2845B-5	

ANSI C63.4 recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement. The test site(s) contain separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent requirements of ANSI C63.4.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing is performed in conformance with ANSI C63.10. Measurements are made with the EUT connected to the public power network through a nominal, standardized RF impedance, which is provided by a line impedance stabilization network, known as a LISN. A LISN is inserted in series with each current-carrying conductor in the EUT power cord.

RADIATED EMISSIONS CONSIDERATIONS

The FCC has determined that radiation measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an open field environment or in a semi-anechoic chamber. The test sites are maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4 guidelines and meet the Normalized Site Attenuation (NSA) requirements of ANSI C63.4.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

An EMI receiver as specified in CISPR 16-1-1 is used for emissions measurements. The receivers used can measure over the frequency range of 9 kHz up to 2000 MHz. These receivers allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The receiver automatically sets the required bandwidth for the CISPR detector used during measurements. If the repetition frequency of the signal being measured is below 20Hz, peak measurements are made in lieu of Quasi-Peak measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis. Average measurements above 1000MHz are performed on the spectrum analyzer using the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz, unless the signal is pulsed in which case the average (or video) bandwidth of the measuring instrument is reduced to onset of pulse desensitization and then increased.

INSTRUMENT CONTROL COMPUTER

The receivers utilize either a Rohde & Schwarz EZM Spectrum Monitor/Controller or contain an internal Spectrum Monitor/Controller to view and convert the receiver measurements to the field strength at an antenna or voltage developed at the LISN measurement port, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate. A personal computer is used to record all measurements made with the receivers.

The Spectrum Monitor provides a visual display of the signal being measured. In addition, the controller or a personal computer run automated data collection programs which control the receivers. This provides added accuracy since all site correction factors, such as cable loss and antenna factors are added automatically.

FILTERS/ATTENUATORS

External filters and precision attenuators are often connected between the receiving antenna or LISN and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

ANTENNAS

A loop antenna is used below 30 MHz. For the measurement range 30 MHz to 1000 MHz either a combination of a biconical antenna and a log periodic or a bi-log antenna is used. Above 1000 MHz, horn antennas are used. The antenna calibration factors to convert the received voltage to an electric field strength are included with appropriate cable loss and amplifier gain factors to determine an overall site factor, which is then programmed into the test receivers or incorporated into the test software.

ANTENNA MAST AND EQUIPMENT TURNTABLE

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height. Measurements below 30 MHz are made with the loop antenna at a fixed height of 1m above the ground plane.

ANSI C63.10 specifies that the test height above ground for table mounted devices shall be 80 centimeters. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor as specified in ANSI C63.4. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

INSTRUMENT CALIBRATION

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An exhibit of this report contains the list of test equipment used and calibration information.

TEST PROCEDURES

EUT AND CABLE PLACEMENT

The regulations require that interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.10, and the worst-case orientation is used for final measurements.

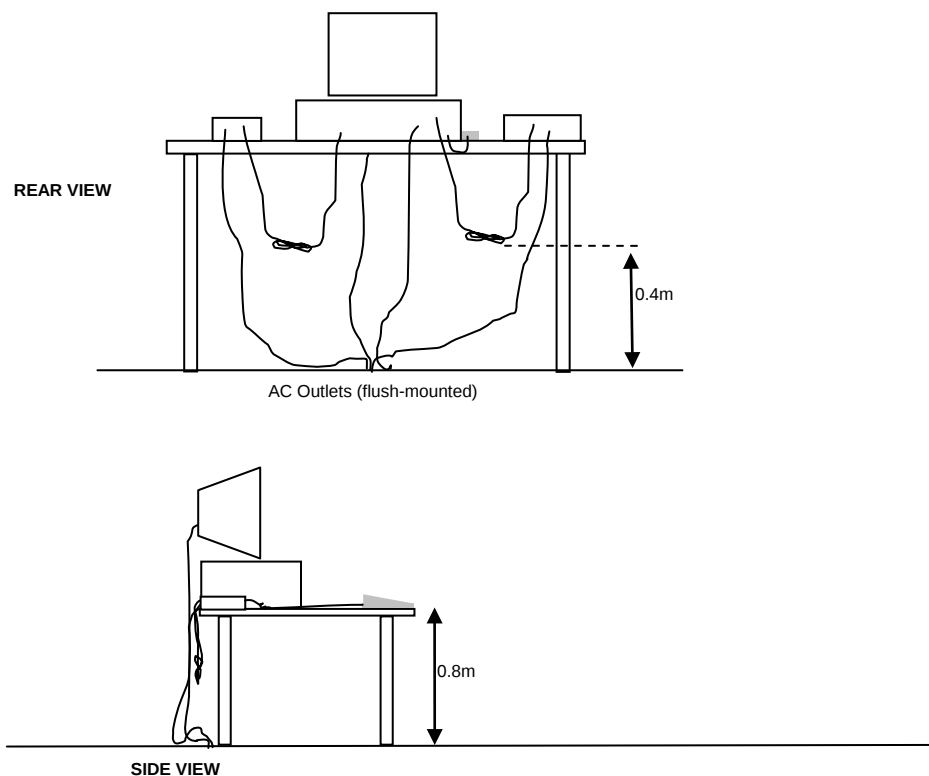
RADIATED EMISSIONS

A preliminary scan of the radiated emissions is performed in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed, one scan for each antenna polarization (horizontal and vertical; loop parallel and perpendicular to the EUT). During the preliminary scans, the EUT is rotated through 360°, the antenna height is varied (for measurements above 30 MHz) and cable positions are varied to determine the highest emission relative to the limit. Preliminary scans may be performed in a fully anechoic chamber for the purposes of identifying the frequencies of the highest emissions from the EUT.

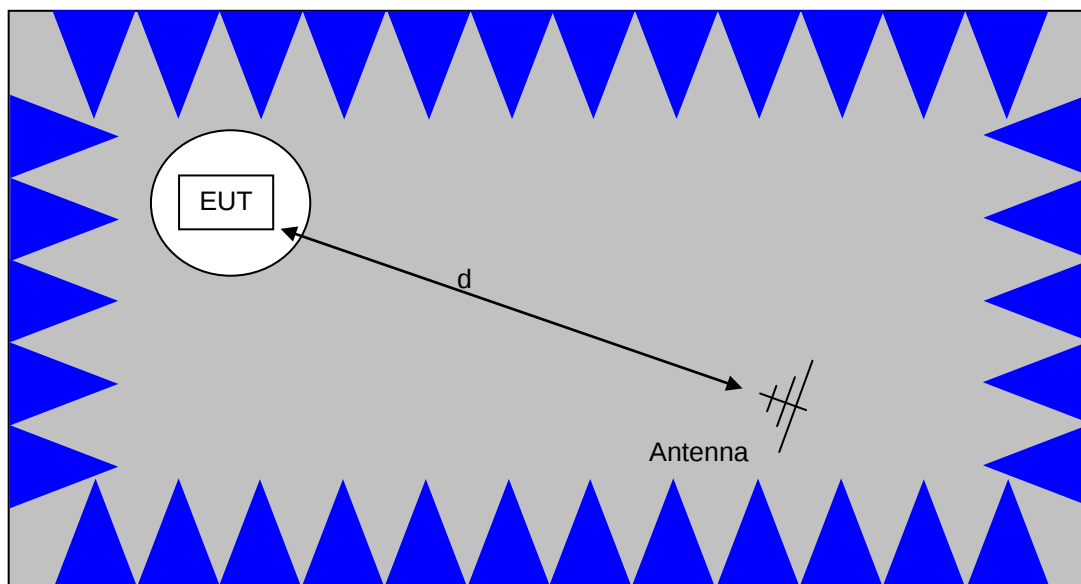
A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth, which results in the highest emission is then maintained while varying the antenna height from one to four meters (for measurements above 30 MHz, measurements below 30 MHz are made with the loop antenna at a fixed height of 1m). The result is the identification of the highest amplitude for each of the highest peaks. Each recorded level is corrected in the receiver using appropriate factors for cables, connectors, antennas, and preamplifier gain.

When testing above 18 GHz, the receive antenna is located at 1 meter from the EUT and the antenna height is restricted to a maximum of 2.5 meters.

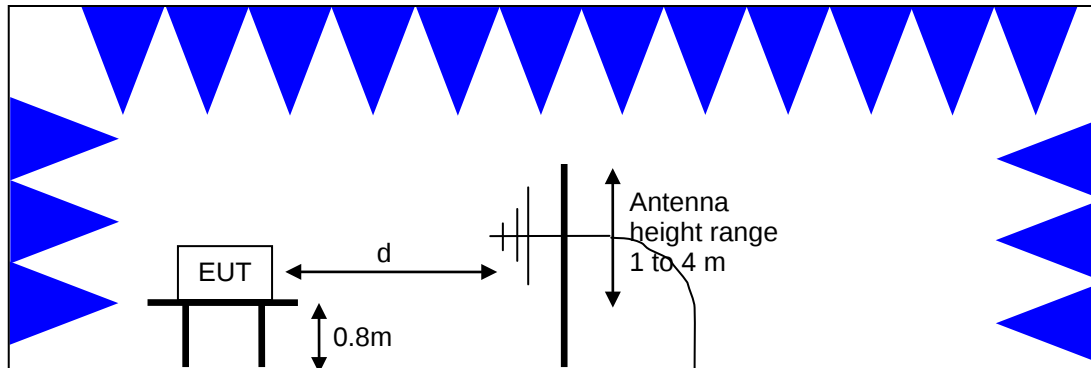


Typical Test Configuration for Radiated Field Strength Measurements



The anechoic materials on the walls and ceiling ensure compliance with the normalized site attenuation requirements of CISPR 16 / CISPR 22 / ANSI C63.4 for an alternate test site at the measurement distances used.

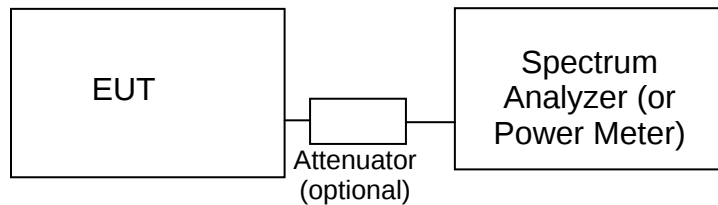
Floor-standing equipment is placed on the floor with insulating supports between the unit and the ground plane.



Test Configuration for Radiated Field Strength Measurements
Semi-Anechoic Chamber, Plan and Side Views

CONDUCTED EMISSIONS FROM ANTENNA PORT

Direct measurements of power, bandwidth and power spectral density are performed, where possible, with the antenna port of the EUT connected to either the power meter or spectrum analyzer via a suitable attenuator and/or filter. These are used to ensure that the front end of the measurement instrument is not overloaded by the fundamental transmission.

**Test Configuration for Antenna Port Measurements**

Measurement bandwidths (video and resolution) are set in accordance with the relevant standards and NTS Silicon Valley's test procedures for the type of radio being tested. When power measurements are made using a resolution bandwidth less than the signal bandwidth the power is calculated by summing the power across the signal bandwidth using either the analyzer channel power function or by capturing the trace data and calculating the power using software. In both cases the summed power is corrected to account for the equivalent noise bandwidth (ENBW) of the resolution bandwidth used.

If power averaging is used (typically for certain digital modulation techniques), the EUT is configured to transmit continuously. Power averaging is performed using either the built-in function of the analyzer or, if the analyzer does not feature power averaging, using external software. In both cases the average power is calculated over a number of sweeps (typically 100). When the EUT cannot be configured to continuously transmit then either the analyzer is configured to perform a gated sweep to ensure that the power is averaged over periods that the device is transmitting or power averaging is disabled and a max-hold feature is used.

If a power meter is used to make output power measurements the sensor head type (peak or average) is stated in the test data table.

BANDWIDTH MEASUREMENTS

The 6dB, 20dB, 26dB and/or 99% signal bandwidth are measured using the bandwidths recommended by ANSI C63.10 and RSS GEN.

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

The limits for conducted emissions are given in units of microvolts, and the limits for radiated emissions are given in units of microvolts per meter at a specified test distance. Data is measured in the logarithmic form of decibels relative to one microvolt, or dB microvolts (dBuV). For radiated emissions, the measured data is converted to the field strength at the antenna in dB microvolts per meter (dBuV/m). The results are then converted to the linear forms of uV and uV/m for comparison to published specifications.

For reference, converting the specification limits from linear to decibel form is accomplished by taking the base ten logarithm, then multiplying by 20. These limits in both linear and logarithmic form are as follows:

GENERAL TRANSMITTER RADIATED EMISSIONS SPECIFICATION LIMITS

The table below shows the limits for the spurious emissions from transmitters that fall in restricted bands¹ (with the exception of transmitters operating under FCC Part 15 Subpart D and RSS 210 Annex 9), the limits for all emissions from a low power device operating under the general rules of RSS 310 (tables 3 and 4), RSS 210 (table 2) and FCC Part 15 Subpart C section 15.209.

Frequency Range (MHz)	Limit (uV/m)	Limit (dBuV/m @ 3m)
0.009-0.490	$2400/F_{\text{KHz}} @ 300\text{m}$	$67.6-20*\log_{10}(F_{\text{KHz}}) @ 300\text{m}$
0.490-1.705	$24000/F_{\text{KHz}} @ 30\text{m}$	$87.6-20*\log_{10}(F_{\text{KHz}}) @ 30\text{m}$
1.705 to 30	30 @ 30m	29.5 @ 30m
30 to 88	100 @ 3m	40 @ 3m
88 to 216	150 @ 3m	43.5 @ 3m
216 to 960	200 @ 3m	46.0 @ 3m
Above 960	500 @ 3m	54.0 @ 3m

OUTPUT POWER LIMITS – DIGITAL TRANSMISSION SYSTEMS

The table below shows the limits for output power and output power density. Where the signal bandwidth is less than 20 MHz the maximum output power is reduced to the power spectral density limit plus 10 times the log of the bandwidth (in MHz).

Operating Frequency (MHz)	Output Power	Power Spectral Density
902 – 928	1 Watt (30 dBm)	8 dBm/3kHz
2400 – 2483.5	1 Watt (30 dBm)	8 dBm/3kHz
5725 – 5850	1 Watt (30 dBm)	8 dBm/3kHz

The maximum permitted output power is reduced by 1dB for every dB the antenna gain exceeds 6dBi. Fixed point-to-point applications using the 5725 – 5850 MHz band are not subject to this restriction.

¹ The restricted bands are detailed in FCC 15.203, RSS 210 Table 1 and RSS 310 Table 2

TRANSMIT MODE SPURIOUS RADIATED EMISSIONS LIMITS – FHSS and DTS SYSTEMS

The limits for unwanted (spurious) emissions from the transmitter falling in the restricted bands are those specified in the general limits sections of FCC Part 15 and RSS 210. All other unwanted (spurious) emissions shall be at least 20dB below the level of the highest in-band signal level (30dB if the power is measured using the sample detector/power averaging method).

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

Receiver readings are compared directly to the conducted emissions specification limit (decibel form) as follows:

$$R_T - S = M$$

where:

R_T = Receiver Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

SAMPLE CALCULATIONS - RADIATED EMISSIONS

Receiver readings are compared directly to the specification limit (decibel form). The receiver internally corrects for cable loss, preamplifier gain, and antenna factor. The calculations are in the reverse direction of the actual signal flow, thus cable loss is added and the amplifier gain is subtracted. The Antenna Factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

A distance factor, when used for electric field measurements above 30MHz, is calculated by using the following formula:

$$F_d = 20 * \log_{10} (D_m/D_s)$$

where:

F_d = Distance Factor in dB

D_m = Measurement Distance in meters

D_s = Specification Distance in meters

For electric field measurements below 30MHz the extrapolation factor is either determined by making measurements at multiple distances or a theoretical value is calculated using the formula:

$$F_d = 40 * \log_{10} (D_m/D_s)$$

Measurement Distance is the distance at which the measurements were taken and Specification Distance is the distance at which the specification limits are based. The antenna factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

The margin of a given emission peak relative to the limit is calculated as follows:

$$R_C = R_R + F_d$$

and

$$M = R_C - L_S$$

where:

R_R = Receiver Reading in dBuV/m

F_d = Distance Factor in dB

R_C = Corrected Reading in dBuV/m

L_S = Specification Limit in dBuV/m

M = Margin in dB Relative to Spec

SAMPLE CALCULATIONS - FIELD STRENGTH TO EIRP CONVERSION

Where the radiated electric field strength is expressed in terms of the equivalent isotropic radiated power (eirp), or where a field strength measurement of output power is made in lieu of a direct measurement, the following formula is used to convert between eirp and field strength at a distance of d (meters) from the equipment under test:

$$E = \frac{1000000 \sqrt{30 P}}{d} \quad \text{microvolts per meter}$$

where P is the eirp (Watts)

For a measurement at 3m the conversion from a logarithmic value for field strength (dBuV/m) to an eirp power (dBm) is -95.3dB.

Appendix A Test Equipment Calibration Data

Manufacturer	Description	Model	Asset#	Cal Due
Radio Antenna Port (Power and Spurious Emissions), 26-Mar-14				
Agilent Technologies	PSA, Spectrum Analyzer, (installed options, 111, 115, 123, 1DS, B7J, HYX,	E4446A	2139	3/27/2014
Agilent Technologies	USB Average Power Sensor	U2001A	2442	12/19/2014
Radio Antenna Port (Power and Spurious Emissions), 14-Apr-14				
Agilent Technologies	3Hz -44GHz PSA Spectrum Analyzer	E4446A	2796	2/6/2015
Radiated Emissions, 1,000 – 6,500 MHz, 28-Jun-14				
EMCO	Antenna, Horn, 1-18 GHz	3115	1561	7/12/2014
Rohde & Schwarz	EMI Test Receiver, 20 Hz-40 GHz	ESIB40 (1088.7490.40)	2493	1/11/2015
Radiated Emissions, 1,000 - 40,000 MHz, 09-Jun-14				
EMCO	Antenna, Horn, 1-18GHz	3115	868	6/19/2014
Hewlett Packard	High Pass filter, 8.2GHz (Purple System)	P/N 84300-80039	1767	11/26/2014
Hewlett Packard	Head (Inc W1-W4, 1946 , 1947) Purple	84125C	1772	4/25/2015
A. H. Systems	Blue System Horn, 18-40GHz	SAS-574, p/n: 2581	2159	8/8/2014
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	2199	2/20/2015
Micro-Tronics	Band Reject Filter, 5150-5350 MHz	BRC50703-02	2239	9/18/2014
Micro-Tronics	Band Reject Filter, 5470-5725 MHz	BRC50704-02	2240	9/18/2014
Micro-Tronics	Band Reject Filter, 5725-5875 MHz	BRC50705-02	2241	9/18/2014
Hewlett Packard	SpecAn 9 kHz - 40 GHz, (SA40) Purple	8564E (84125C)	2415	2/27/2015
Radiated Emissions, 1,000- 18,000 MHz, 12-Jun-14				
EMCO	Antenna, Horn, 1-18 GHz	3115	786	12/20/2015
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	2199	2/20/2015
Hewlett Packard	SpecAn 9 kHz - 40 GHz, (SA40) Purple	8564E (84125C)	2415	2/27/2015
Radiated Emissions, Band Edge, 16-Jun-14				
EMCO	Antenna, Horn, 1-18 GHz (SA40-Red)	3115	1142	8/23/2014
Rohde & Schwarz	EMI Test Receiver, 20 Hz-40 GHz	ESIB40 (1088.7490.40)	2493	1/11/2015
Radio Antenna Port, 16-Jun-14				
Rohde & Schwarz	Power Sensor, 1uW-100mW, DC-18GHz, 50ohms	NRV-Z51	1070	6/6/2015
Rohde & Schwarz	Power Meter, Single Channel	NRVS	1422	1/24/2015
Agilent Technologies	PSA, Spectrum Analyzer, (installed options, 111, 115, 123, 1DS, B7J, HYX,	E4446A	2139	4/8/2015

Appendix B Test Data

T94631 Pages 22 - 99



EMC Test Data

Client:	Vocera Communications	Job Number:	J94614
Product	Northstar (1x1 802.11abgn + BT)	T-Log Number:	T94631
		Project Manager:	Christine Krebill
Contact:	Rob Holt	Project Coordinator:	Irene Rademacher
Emissions Standard(s):	FCC 15.247/15.E/RSS-210	Class:	-
Immunity Standard(s):	-	Environment:	-

EMC Test Data

For The

Vocera Communications

Product

Northstar (1x1 802.11abgn + BT)

Date of Last Test: 7/23/2014

Client:	Vocera Communications	Job Number:	J94614
Model:	Northstar (1x1 802.11abgn + BT)	T-Log Number:	T94631
Contact:	Rob Holt	Project Manager:	Christine Krebill
Standard:	FCC 15.247/15.E/RSS-210	Project Coordinator:	Irene Rademacher
		Class:	N/A

Power vs. Data Rate

In normal operating modes the card uses power settings stored on EEPROM to set the output power. For a given nominal output power the actual transmit power normally is reduced as the data rate increases, therefore testing was performed at the data rate in the mode with highest power to determine compliance with the requirements.

The following power measurements were made using a **GATED** average power meter and with the device configured in a continuous transmit mode on Chain 1 at the various data rates in each mode to verify the highest power mode:

Sample Notes

Sample S/N: 3C (NTS 2014-3721)

Driver: M3X14447

Date of Test: 3/26/2014

Test Engineer: Jack Liu

Test Location: FT Lab # 4B

b, g, n20 Test at 2437MHz

n40 Test at 5180MHz

Mode	Data Rate	Power (dBm)	Power setting
802.11b	1	15.3	18.0
	2	15.2	
	5.5	15.2	
	11	15.2	
802.11g	6	15.2	18.0
	9	15.1	
	12	15.1	
	18	15.1	
	24	15.1	
	36	15.1	
	48	15.1	
	54	15.1	

EMC Test Data

Client:	Vocera Communications	Job Number:	J94614
Model:	Northstar (1x1 802.11abgn + BT)	T-Log Number:	T94631
Contact:	Rob Holt	Project Manager:	Christine Krebill
Standard:	FCC 15.247/15.E/RSS-210	Project Coordinator:	Irene Rademacher
		Class:	N/A

Mode	Data Rate	Power (dBm)	Power setting
802.11n 20MHz	6.5	15.3	18.0
	13	15.2	
	19.5	15.2	
	26	15.1	
	39	15.2	
	52	15.2	
	58.5	15.2	
	65	15.2	
	78	Not supported	
802.11n/ac 40MHz	13.5	14.3	16.0
	27	14.3	
	40.5	14.2	
	54	14.2	
	81	14.2	
	108	14.2	
	121.5	14.2	
	135	14.2	
	162	Not supported	
	180	Not supported	
802.11ac 80MHz	29.3	Not supported	-
	58.5	Not supported	
	87.8	Not supported	
	117	Not supported	
	175.5	Not supported	
	234	Not supported	
	266.3	Not supported	
	292.5	Not supported	
	351	Not supported	
	390	Not supported	

<<-11ac mode only

<<-11ac mode only

<<-11ac mode only

Note : Power setting - the software power setting used during testing, included for reference only.

Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A

Duty Cycle

Date of Test: 3/26/2014
 Test Engineer: Jack Liu
 Test Location: FT Lab # 4B

Duty cycle measurements performed on the worse case data rate for power.

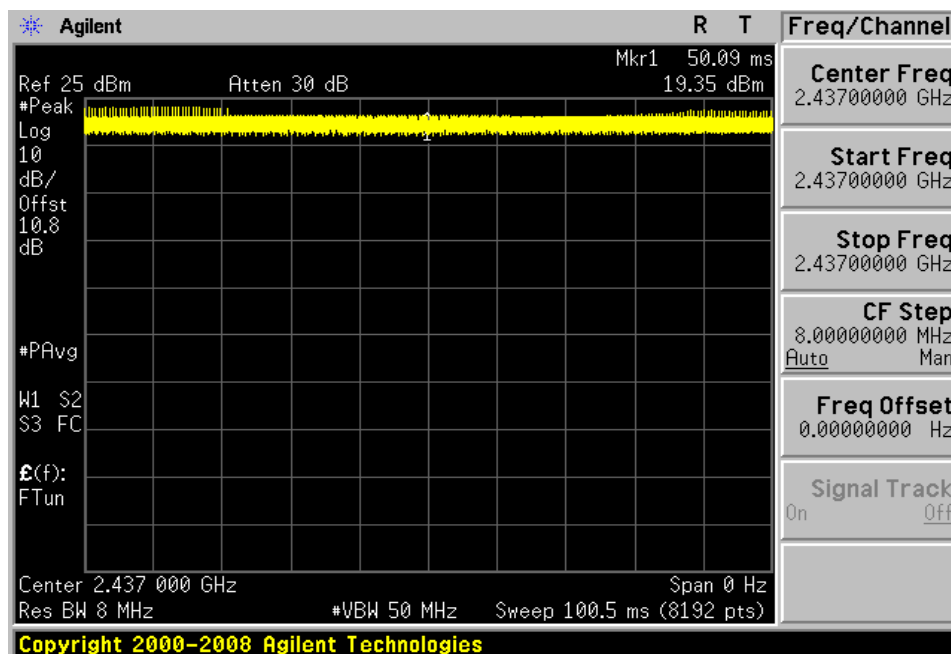
Notes: Measurements taken with maximum RBW/VBW settings allowed.

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
11b	1Mb/ss	100.00	-	-	0	0	-
11g	6Mb/s	100.00	-	-	0	0	-
11a	6Mb/s	100.00	-	-	0	0	-
n20	MCS0	100.00	-	-	0	0	-
n40	MCS0	100.00	-	-	0	0	-

* Correction factor when using RMS/Power averaging - $10 \cdot \log(1/x)$

** Correction factor when using linear voltage average - $20 \cdot \log(1/x)$

T = Minimum transmission duration





EMC Test Data

Client:	Vocera Communications	Job Number:	J94614
Model:	Northstar (1x1 802.11abgn + BT)	T-Log Number:	T94631
Contact:	Rob Holt	Project Manager:	Christine Krebill
Standard:	FCC 15.247/15.E/RSS-210	Project Coordinator:	Irene Rademacher
		Class:	N/A

RSS 210 and FCC 15.247 (DTS) Radiated Spurious Emissions

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT, unless otherwise noted.

Ambient Conditions:

Temperature: 20-24 °C
Rel. Humidity: 30-45 %

Summary of Results - Device Operating in the 2400-2483.5 MHz Band

Run #	Mode	Channel	Target Power	Final Power Setting	Test Performed	Limit	Result / Margin
1	b	1 - 2412MHz	18	16	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	53.4 dBμV/m @ 4824.0 MHz (-0.6 dB)
	b	6 - 2437MHz	18	16	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	53.9 dBμV/m @ 4874.0 MHz (-0.1 dB)
	b	13 - 2472MHz	18	16	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	53.7 dBμV/m @ 4944.0 MHz (-0.3 dB)

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Sample Notes

Sample S/N: 3E
Driver: M3X14447
Antenna: Internal/integrated

Client:	Vocera Communications	Job Number:	J94614
Model:	Northstar (1x1 802.11abgn + BT)	T-Log Number:	T94631
Contact:	Rob Holt	Project Manager:	Christine Krebill
Standard:	FCC 15.247/15.E/RSS-210	Project Coordinator:	Irene Rademacher
		Class:	N/A

Procedure Comments:

Measurements performed in accordance with FCC KDB 558074

Peak measurements performed with: RBW=1MHz, VBW=3MHz, peak detector, max hold, auto sweep time

Unless otherwise stated/noted, emission has duty cycle $\geq 98\%$ and was measured using RBW=1MHz, VBW=10Hz, peak detector, linear average mode, auto sweep time, max hold.

2.4GHz band reject filter used

Preliminary testing below 1GHz showed no radio related emissions

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
11b	1Mbps	100.00	-	-	0	0	-

Measurement Specific Notes:

Note 1:	Emission in non-restricted band, but limit of 15.209 used.
Note 2:	Emission in non-restricted band, the limit was set 30dB below the level of the fundamental and measured in 100kHz.
Note 2:	Emission has duty cycle $\geq 98\%$, average measurement performed: RBW=1MHz, VBW=3MHz, RMS, Power averaging, auto sweep, trace average 100 traces
Note 3:	Emission has duty cycle $< 98\%$, but constant, average measurement performed: RBW=1MHz, VBW=10Hz, peak detector, linear averaging, auto sweep, trace average 100 traces, measurement corrected by Linear Voltage correction factor
Note 4:	Emission has duty cycle $< 98\%$ and is NOT constant, average measurement performed: RBW=1MHz, VBW $> 1/T$, peak detector, linear average mode, sweep time auto, max hold. Max hold for $50 \cdot (1/DC)$ traces
Note 5:	Emission has duty cycle $< 98\%$, but constant, average measurement performed: RBW=1MHz, VBW=3MHz, RMS, Power averaging, auto sweep, trace average 100 traces, measurement corrected by Pwr correction factor
Note 6:	Plots of the average and peak bandedge do not account for any duty cycle correction. Refer to the tabular results for final measurements.

Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A

Run #1: Radiated Spurious Emissions, 1,000 - 25000 MHz. Operating Mode: 802.11b

Date of Test: 6/12/2014
 Test Engineer: Deniz Demirci
 Test Location: FT Chamber#4

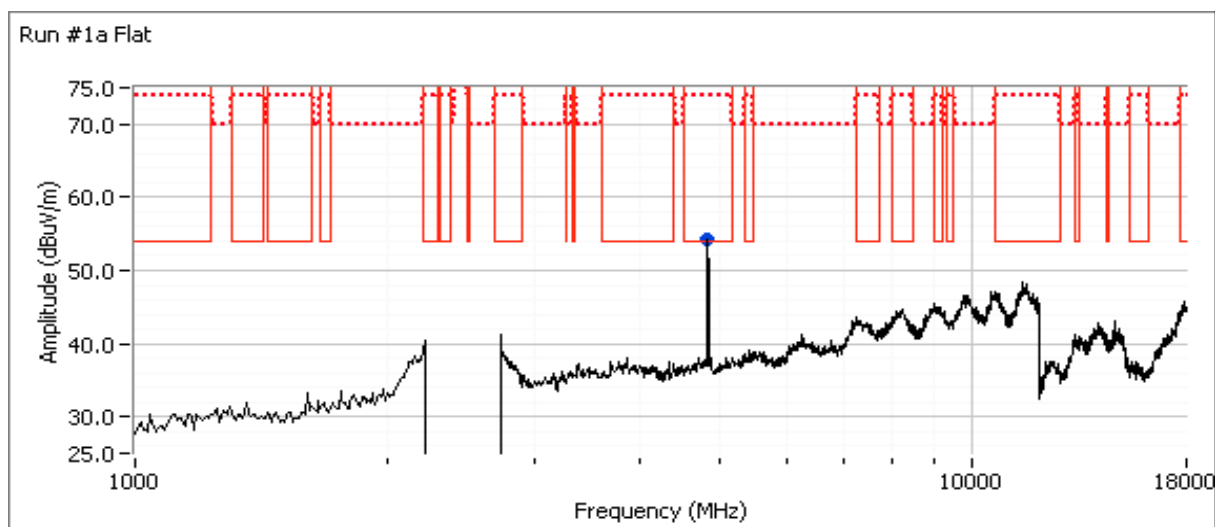
Config. Used: 1
 Config Change: None
 EUT Voltage: Battery Operated

Run #1a: Low Channel

Channel: 1 Mode: b Orientation: Flat
 Tx Chain: Main Data Rate: 1Mbps

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dB μ V/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4824.010	53.4	H	54.0	-0.6	AVG	60	1.1	Power: 16
4824.010	55.3	H	74.0	-18.7	PK	60	1.1	Power: 16

Note: Scans made between 18 - 25 GHz with the measurement antenna moved around the card and its antennas 20-50cm from the device indicated there were no significant emissions in this frequency range

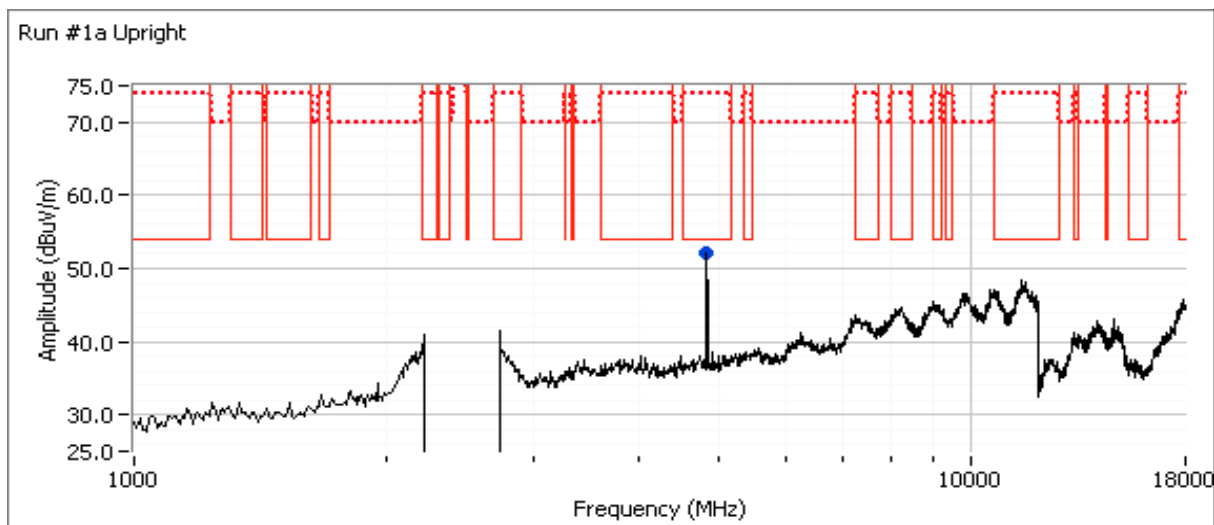


Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A

Channel: 1 Mode: b Orientation: Upright
Tx Chain: Main Data Rate: 1Mbps

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4823.980	52.0	H	54.0	-2.0	AVG	315	1.0	Power: 18
4823.980	54.7	H	74.0	-19.3	PK	315	1.0	Power: 18
4823.990	49.7	V	54.0	-4.3	AVG	134	1.2	Power: 18
4823.940	52.7	V	74.0	-21.3	PK	134	1.2	Power: 18

Note: Scans made between 18 - 25 GHz with the measurement antenna moved around the card and its antennas 20-50cm from the device indicated there were no significant emissions in this frequency range

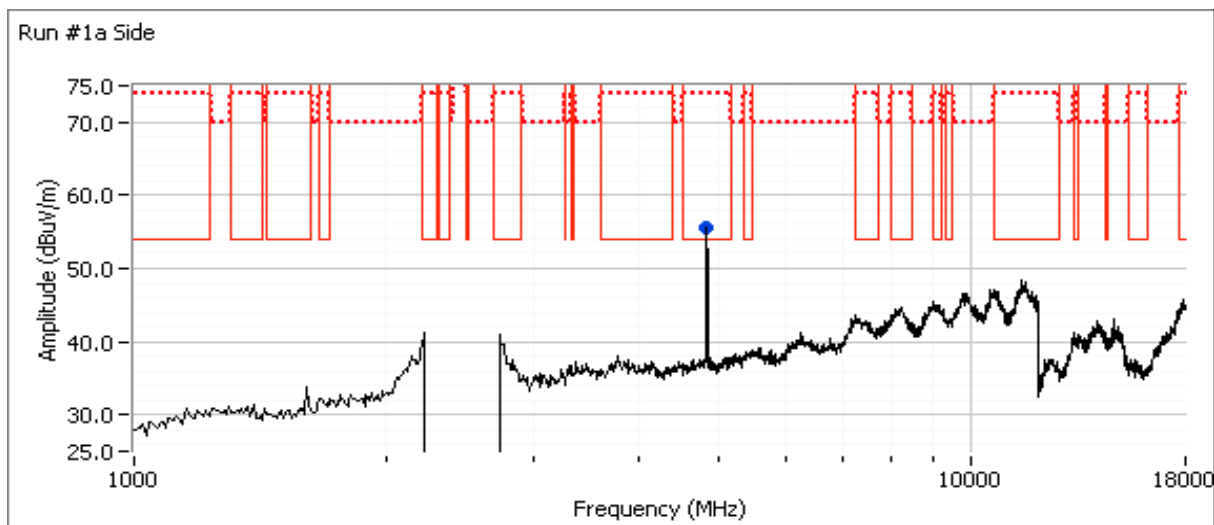


Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A

Channel: 1 Mode: b Orientation: Side
Tx Chain: Main Data Rate: 1Mbps

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4824.000	53.3	H	54.0	-0.7	AVG	200	1.4	Power: 16
4823.910	55.8	H	74.0	-18.2	PK	200	1.4	Power: 16
4823.990	51.7	V	54.0	-2.3	AVG	136	1.0	Power: 16
4823.980	54.2	V	74.0	-19.8	PK	136	1.0	Power: 16

Note: Scans made between 18 - 25 GHz with the measurement antenna moved around the card and its antennas 20-50cm from the device indicated there were no significant emissions in this frequency range



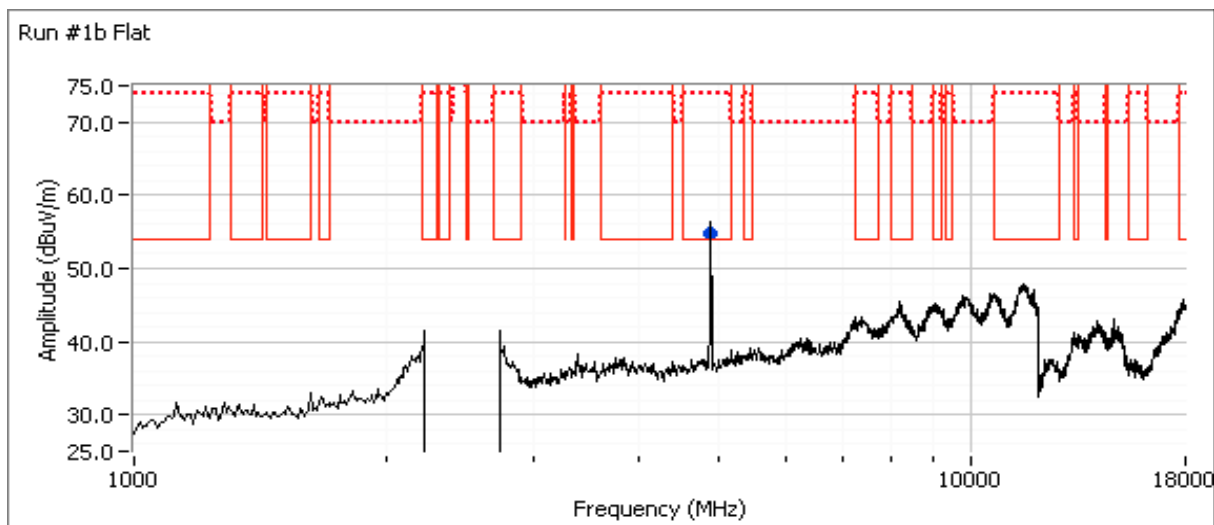
Client:	Vocera Communications	Job Number:	J94614
Model:	Northstar (1x1 802.11abgn + BT)	T-Log Number:	T94631
Contact:	Rob Holt	Project Manager:	Christine Krebill
Standard:	FCC 15.247/15.E/RSS-210	Project Coordinator:	Irene Rademacher
		Class:	N/A

Run #1b: Center Channel

Channel: 6 Mode: b
 Tx Chain: Main Data Rate: 1Mbps Orientation: Flat

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4874.000	53.9	H	54.0	-0.1	AVG	58	1.1	Power: 16
4873.980	55.7	H	74.0	-18.3	PK	58	1.1	Power: 16

Note: Scans made between 18 - 25 GHz with the measurement antenna moved around the card and its antennas 20-50cm from the device indicated there were no significant emissions in this frequency range



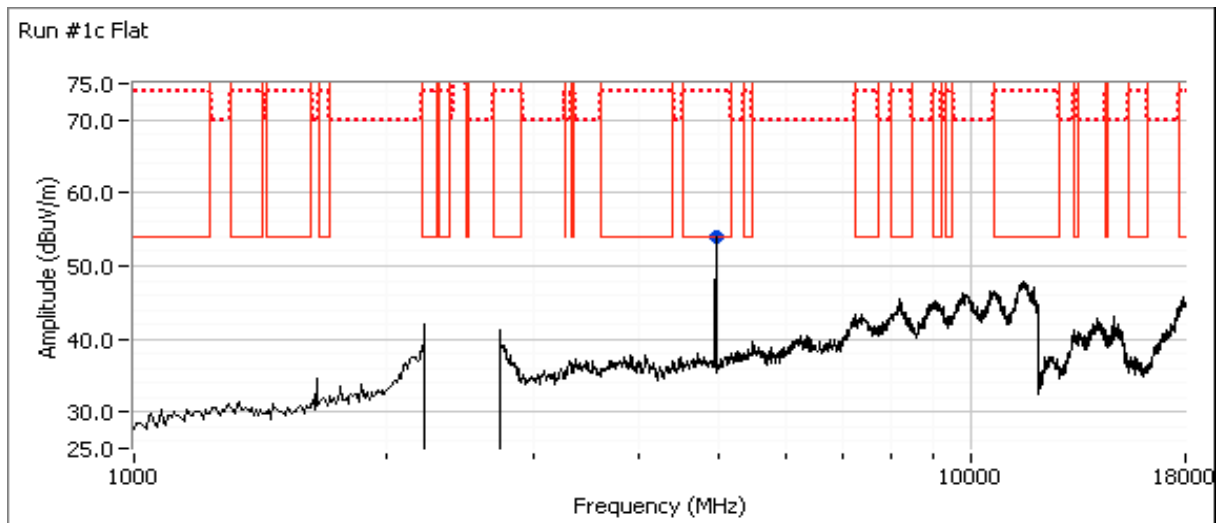
Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A

Run #1c: High Channel

Channel: 13 Mode: b Orientation: Flat
Tx Chain: Main Data Rate: 1Mbps

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4944.020	53.7	H	54.0	-0.3	AVG	62	1.4	Power: 16
4944.000	54.8	H	74.0	-19.2	PK	62	1.4	Power: 16

Note: Scans made between 18 - 25 GHz with the measurement antenna moved around the card and its antennas 20-50cm from the device indicated there were no significant emissions in this frequency range



Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A

RSS 210 and FCC 15.247 (DTS) Radiated Spurious Emissions

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing.
 For radiated emissions testing the measurement antenna was located 3 meters from the EUT, unless otherwise noted.

Ambient Conditions:

Temperature:	20-24 °C
Rel. Humidity:	30-45 %

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Sample Notes

Sample S/N: 3E
 Driver: M3X14447
 Antenna: Internal/integrated

Procedure Comments:

Measurements performed in accordance with FCC KDB 558074
 Peak measurements performed with: RBW=1MHz, VBW=3MHz, peak detector, max hold, auto sweep time
 Unless otherwise stated/noted, emission has duty cycle $\geq 98\%$ and was measured using RBW=1MHz, VBW=10Hz, peak detector, linear average mode, auto sweep time, max hold.
 2.4GHz band reject filter used
 Preliminary testing below 1GHz showed no radio related emissions

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
11b	1Mbps	100.00	-	-	0	0	-
11g	6Mbps	100.00	-	-	0	0	-
n20	MCS0	100.00	-	-	0	0	-



EMC Test Data

Client:	Vocera Communications	Job Number:	J94614
Model:	Northstar (1x1 802.11abgn + BT)	T-Log Number:	T94631
Contact:	Rob Holt	Project Manager:	Christine Krebill
Standard:	FCC 15.247/15.E/RSS-210	Project Coordinator:	Irene Rademacher
		Class:	N/A

Summary of Results - Device Operating in the 2400-2483.5 MHz Band

Run #	Mode	Channel	Target Power	Final Power Setting	Test Performed	Limit	Result / Margin
Scans on center channel in all three OFDM modes to determine the worst case mode.							
2	g	6 - 2437MHz	18	18	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	45.0 dBμV/m @ 7310.3 MHz (-9.0 dB)
	n20	6 - 2437MHz	18	18	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	43.2 dBμV/m @ 7317.2 MHz (-10.8 dB)
Measurements on low and high channels in worst-case OFDM mode.							
3	g	1 - 2412MHz	18	18	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	43.0 dBμV/m @ 4818.7 MHz (-11.0 dB)
	g	13 - 2472MHz	18	18	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	45.0 dBμV/m @ 7415.4 MHz (-9.0 dB)

Notes

Device is handheld. Preliminary measurements were done to determine worse case orientation. All spurious measurements were performed in this orientation.

Measurement Specific Notes:

Note 1:	Emission in non-restricted band, but limit of 15.209 used.
Note 2:	Emission in non-restricted band, the limit was set 30dB below the level of the fundamental and measured in 100kHz.
Note 2:	Emission has duty cycle $\geq 98\%$, average measurement performed: RBW=1MHz, VBW=3MHz, RMS, Power averaging, auto sweep, trace average 100 traces
Note 3:	Emission has duty cycle $< 98\%$, but constant, average measurement performed: RBW=1MHz, VBW=10Hz, peak detector, linear averaging, auto sweep, trace average 100 traces, measurement corrected by Linear Voltage correction factor
Note 4:	Emission has duty cycle $< 98\%$ and is NOT constant, average measurement performed: RBW=1MHz, VBW $> 1/T$, peak detector, linear average mode, sweep time auto, max hold. Max hold for $50 \cdot (1/DC)$ traces
Note 5:	Emission has duty cycle $< 98\%$, but constant, average measurement performed: RBW=1MHz, VBW=3MHz, RMS, Power averaging, auto sweep, trace average 100 traces, measurement corrected by Pwr correction factor
Note 6:	Plots of the average and peak bandedge do not account for any duty cycle correction. Refer to the tabular results for final measurements.

Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A

Run #2: Radiated Spurious Emissions, 1,000 - 25000 MHz. Operating Mode: OFDM

Date of Test: 4/29/2014

Config. Used: 1

Test Engineer: Joseph Cadigal

Config Change: -

Test Location: Chamber #4

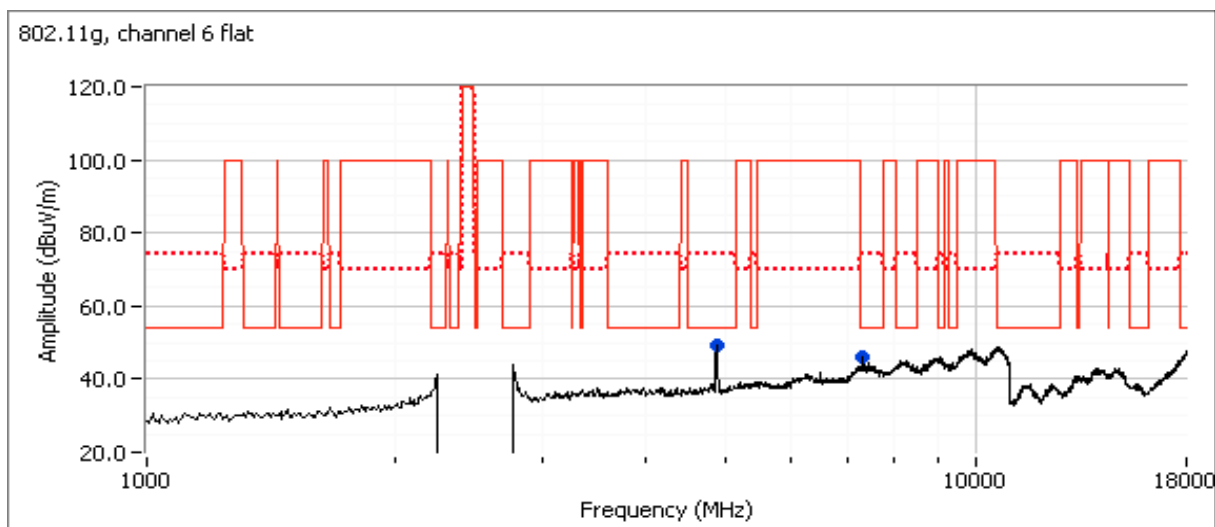
EUT Voltage: Battery

Run #2a: Center Channel

Channel: 6 Mode: g Orientation: Flat
 Tx Chain: Main Data Rate: 6Mbps

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
7310.270	45.0	V	54.0	-9.0	AVG	201	1.3	Power: 18
7310.420	57.6	V	74.0	-16.4	PK	201	1.3	Power: 18
4877.690	43.3	H	54.0	-10.7	AVG	338	1.2	Power: 18
4877.750	54.5	H	74.0	-19.5	PK	338	1.2	Power: 18

Note: Scans made between 18 - 25 GHz with the measurement antenna moved around the card and its antennas 20-50cm from the device indicated there were no significant emissions in this frequency range.



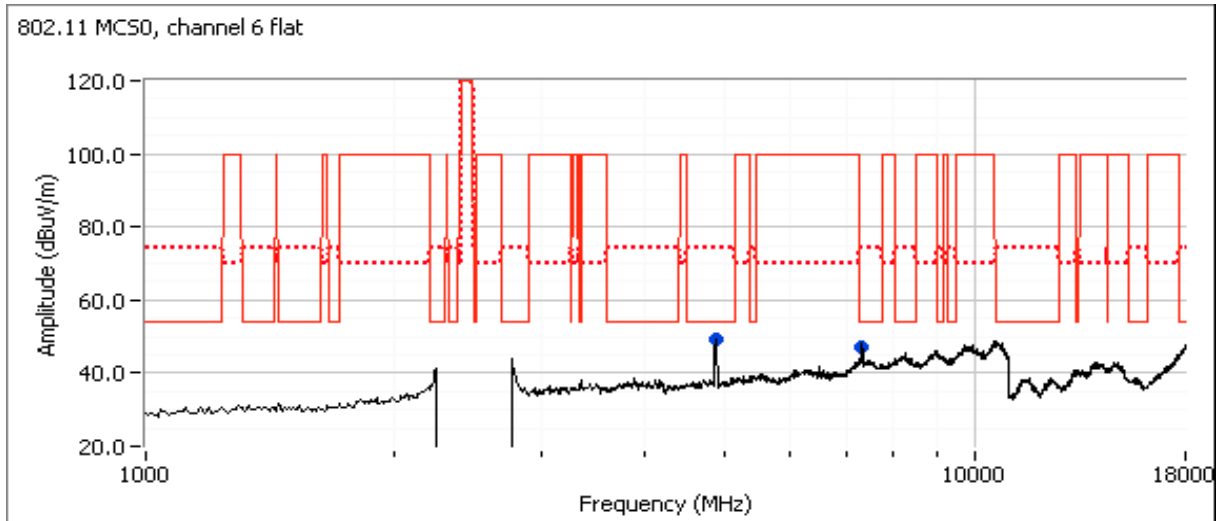
Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A

Run #2b: Center Channel

Channel: 6 Mode: n20 Orientation: Flat
Tx Chain: Main Data Rate: MCS0

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
7317.210	43.2	V	54.0	-10.8	AVG	183	1.5	Power: 18
7317.820	56.8	V	74.0	-17.2	PK	183	1.5	Power: 18
4876.530	42.0	H	54.0	-12.0	AVG	338	1.2	Power: 18
4876.900	55.4	H	74.0	-18.6	PK	338	1.2	Power: 18

Note: Scans made between 18 - 25 GHz with the measurement antenna moved around the card and its antennas 20-50cm from the device indicated there were no significant emissions in this frequency range.



Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A

Run #3: Radiated Spurious Emissions, 1,000 - 25000 MHz. Operating Mode: Worse case from Run #2

Date of Test: 4/29/2014

Config. Used: 1

Test Engineer: Joseph Cadigal

Config Change: -

Test Location: Chamber #4

EUT Voltage: Battery

Run #3a: Low Channel

Channel: 1

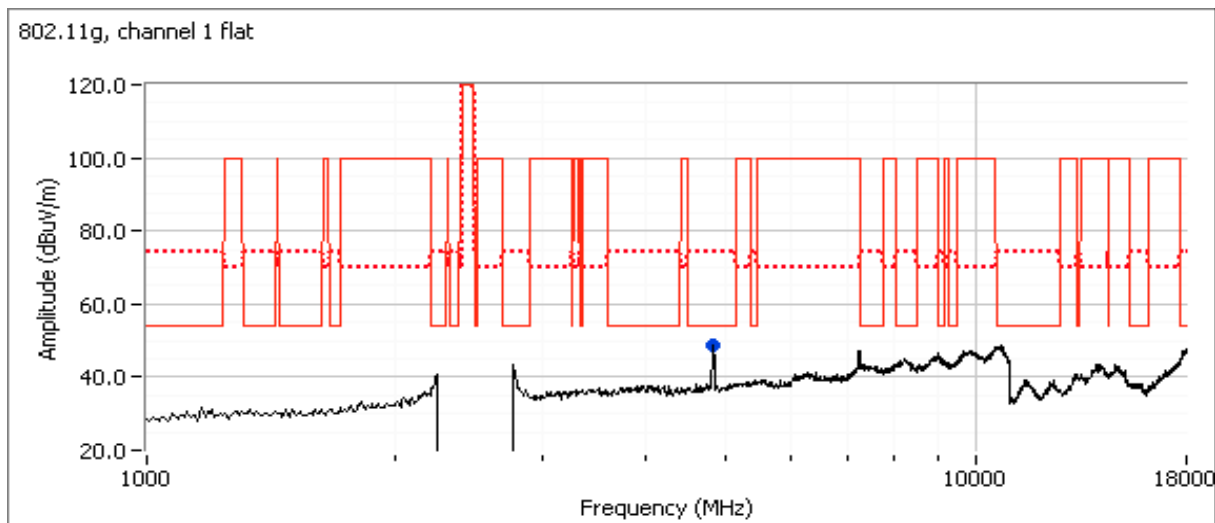
Mode: g

Orientation: Flat

Tx Chain: Main

Data Rate: 6Mbps

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4818.740	43.0	H	54.0	-11.0	AVG	349	1.5	Power: 18
4818.440	55.0	H	74.0	-19.0	PK	349	1.5	Power: 18

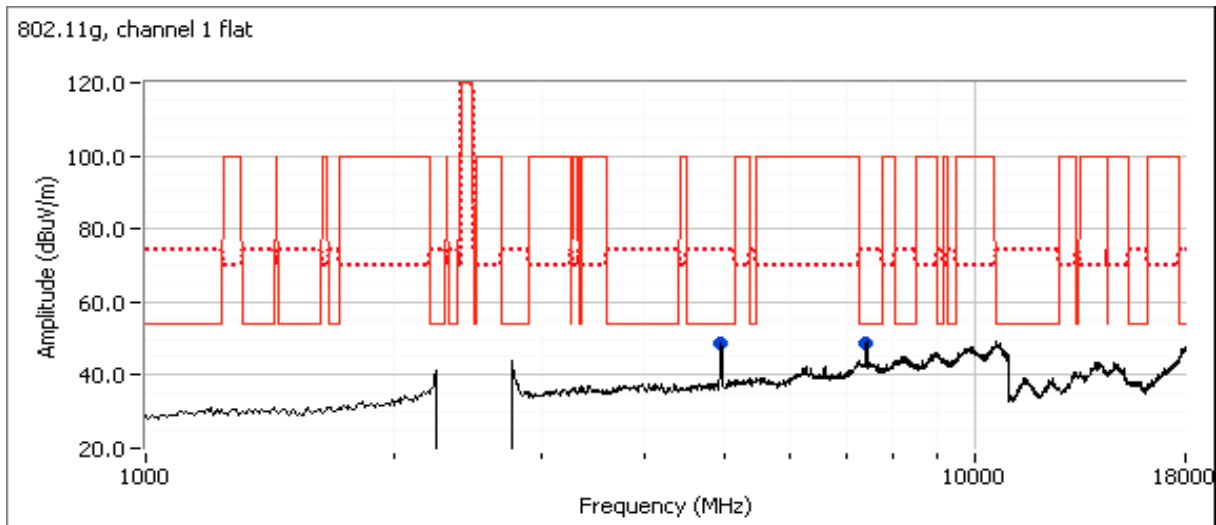


Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A

Run #3b: High Channel

Channel: 13 Mode: g Orientation: Flat
 Tx Chain: Main Data Rate: 6Mbps

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
7415.390	45.0	V	54.0	-9.0	AVG	198	1.3	Power: 18
7415.220	58.9	V	74.0	-15.1	PK	198	1.3	Power: 18
4943.880	44.6	H	54.0	-9.4	AVG	345	1.2	Power: 18
4944.600	55.8	H	74.0	-18.2	PK	345	1.2	Power: 18



Client:	Vocera Communications	Job Number:	J94614
Model:	Northstar (1x1 802.11abgn + BT)	T-Log Number:	T94631
Contact:	Rob Holt	Project Manager:	Christine Krebill
Standard:	FCC 15.247/15.E/RSS-210	Project Coordinator:	Irene Rademacher
		Class:	N/A

RSS 210 and FCC 15.247 (DTS) Radiated Spurious Emissions

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing.
 For radiated emissions testing the measurement antenna was located 3 meters from the EUT, unless otherwise noted.

Ambient Conditions:

Temperature: 18-20 °C
 Rel. Humidity: 30-40 %

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Sample Notes

Sample S/N: 3E
 Driver: M3X14447
 Antenna: Internal/integrated

Notes

Device is handheld. Evaluation of the fundamental field strength at CH6, 11b mode was performed thru three orientation to determine worse case orientation. All bandedge measurements were performed in this orientation.

Procedure Comments:

Measurements performed in accordance with FCC KDB 558074
 Peak measurements performed with: RBW=1MHz, VBW=3MHz, peak detector, max hold, auto sweep time
 Unless otherwise stated/noted, emission has duty cycle $\geq 98\%$ and was measured using RBW=1MHz, VBW=10Hz, peak detector, linear average mode, auto sweep time, max hold.

Client:	Vocera Communications	Job Number:	J94614
Model:	Northstar (1x1 802.11abgn + BT)	T-Log Number:	T94631
Contact:	Rob Holt	Project Manager:	Christine Krebill
Standard:	FCC 15.247/15.E/RSS-210	Project Coordinator:	Irene Rademacher
		Class:	N/A

Summary of Results - Device Operating in the 2400-2483.5 MHz Band

Run #	Mode	Channel	Target Power	Final Power Setting	Test Performed	Limit	Result / Margin
1	b	1 - 2412MHz	18	18	Restricted Band Edge (2390 MHz)	FCC Part 15.209 / 15.247(c)	42.1 dBµV/m @ 2386.3 MHz (-11.9 dB)
		11 - 2462MHz	18	18	Restricted Band Edge (2483.5 MHz)		45.6 dBµV/m @ 2483.5 MHz (-8.4 dB)
		12 - 2467MHz	Not defined	18	Restricted Band Edge (2483.5 MHz)		50.1 dBµV/m @ 2485.1 MHz (-3.9 dB)
		13 - 2472MHz	Not defined	13	Restricted Band Edge (2483.5 MHz)		52.0 dBµV/m @ 2486.8 MHz (-2.0 dB)
2	g	1 - 2412MHz	18	16	Restricted Band Edge (2390 MHz)		50.4 dBµV/m @ 2390.0 MHz (-3.6 dB)
		11 - 2462MHz	18	16	Restricted Band Edge (2483.5 MHz)		53.1 dBµV/m @ 2483.5 MHz (-0.9 dB)
		12 - 2467MHz	Not defined	12	Restricted Band Edge (2483.5 MHz)		49.7 dBµV/m @ 2483.6 MHz (-4.3 dB)
		13 - 2472MHz	Not defined	12	Restricted Band Edge (2483.5 MHz)		52.6 dBµV/m @ 2483.5 MHz (-1.4 dB)
3	n20	1 - 2412MHz	18	16	Restricted Band Edge (2390 MHz)		52.8 dBµV/m @ 2390.0 MHz (-1.2 dB)
		11 - 2462MHz	18	15	Restricted Band Edge (2483.5 MHz)		49.3 dBµV/m @ 2483.5 MHz (-4.7 dB)
		12 - 2467MHz	Not defined	14			52.0 dBµV/m @ 2483.5 MHz (-2.0 dB)
		13 - 2472MHz	Not defined	13			52.7 dBµV/m @ 2483.5 MHz (-1.3 dB)

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
11b	1Mbps	100.00	-	-	0	0	-
11g	6Mbps	100.00	-	-	0	0	-
n20	MCS0	100.00	-	-	0	0	-

Measurement Specific Notes:

Note 1:	Emission in non-restricted band, but limit of 15.209 used.
Note 2:	Emission in non-restricted band, the limit was set 30dB below the level of the fundamental and measured in 100kHz.

EMC Test Data

Client:	Vocera Communications	Job Number:	J94614
Model:	Northstar (1x1 802.11abgn + BT)	T-Log Number:	T94631
Contact:	Rob Holt	Project Manager:	Christine Krebill
Standard:	FCC 15.247/15.E/RSS-210	Project Coordinator:	Irene Rademacher
		Class:	N/A

Run #0: Worse case orientation evaluation

Date of Test: 4/28/2014 0:00

Test Engineer: John Caizzi

Test Location: Chamber 5

Config. Used: 1

Config Change: none

EUT Voltage: 3.3 VDC battery

Channel: 6 Mode: b
Tx Chain: Main Data Rate: 1Mbps

Fundamental Field Strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2436.000	106.5	V	-	-	PK	324	1.34	EUT vertical
2436.320	103.0	V	-	-	AVG	324	1.34	EUT vertical
2435.520	99.9	V	-	-	Pk	324	1.34	RB= 100 kHz= VB; EUT vertical
2436.080	101.3	H	-	-	PK	191	1.15	EUT vertical
2436.320	97.7	H	-	-	AVG	191	1.15	EUT vertical
2438.080	94.4	H	-	-	Pk	191	1.15	RB= 100 kHz= VB; EUT vertical
2436.080	103.2	V	-	-	PK	208	1.00	EUT side
2436.320	99.7	V	-	-	AVG	208	1.00	EUT side
2437.600	96.8	V	-	-	Pk	208	1.00	RB= 100 kHz= VB; EUT side
2438.000	111.2	H	-	-	PK	207	1.15	EUT side
2436.320	107.6	H	-	-	AVG	207	1.15	EUT side
2437.840	105.2	H	-	-	Pk	207	1.15	RB= 100 kHz= VB; EUT side
2436.000	101.8	V	-	-	PK	345	1.42	EUT flat
2435.280	98.4	V	-	-	AVG	345	1.42	EUT flat
2437.760	95.9	V	-	-	Pk	345	1.42	RB= 100 kHz= VB; EUT flat
2436.000	110.1	H	-	-	PK	64	1.13	EUT flat
2436.320	106.6	H	-	-	AVG	64	1.13	EUT flat
2436.320	106.5	H	-	-	Pk	64	1.13	RB= 100 kHz= VB; EUT flat

Worse Case Orientation: side

Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A

Run #1: Radiated Bandedge Measurements

Date of Test: 4/28/2014

Test Engineer: John Caizzi

Test Location: Chamber 5

Config. Used: 1

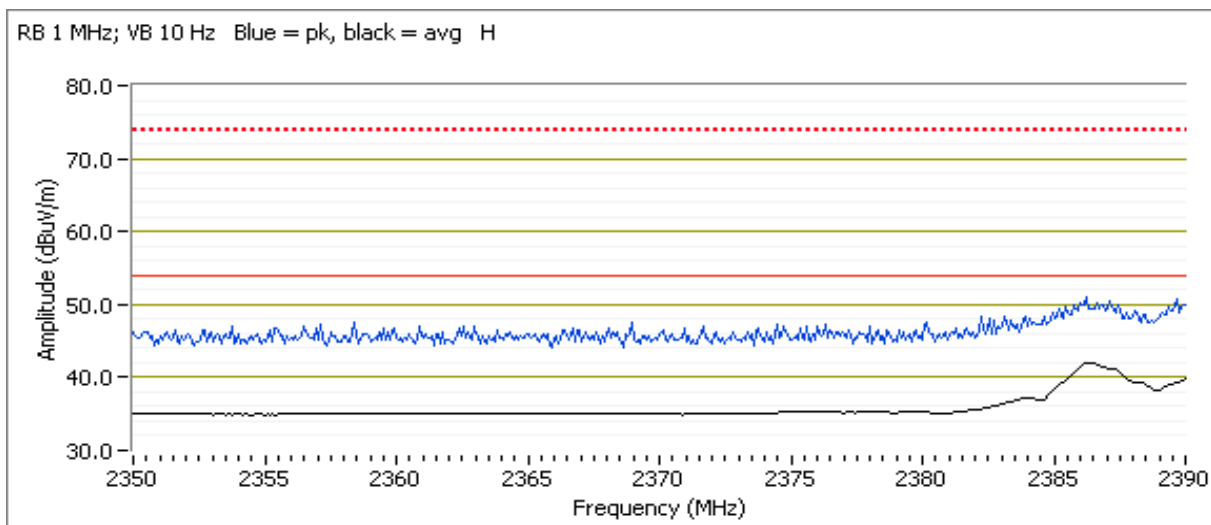
Config Change: none

EUT Voltage: 3.3 VDC battery

Channel: 1 Mode: b
 Tx Chain: Main Data Rate: 1Mbps

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dB μ V/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2386.310	42.1	H	54.0	-11.9	AVG	210	1.15	Power: 18
2386.310	38.5	V	54.0	-15.5	AVG	200	1.03	Power: 18
2386.150	50.9	H	74.0	-23.1	PK	210	1.15	Power: 18
2386.470	47.7	V	74.0	-26.3	PK	200	1.03	Power: 18

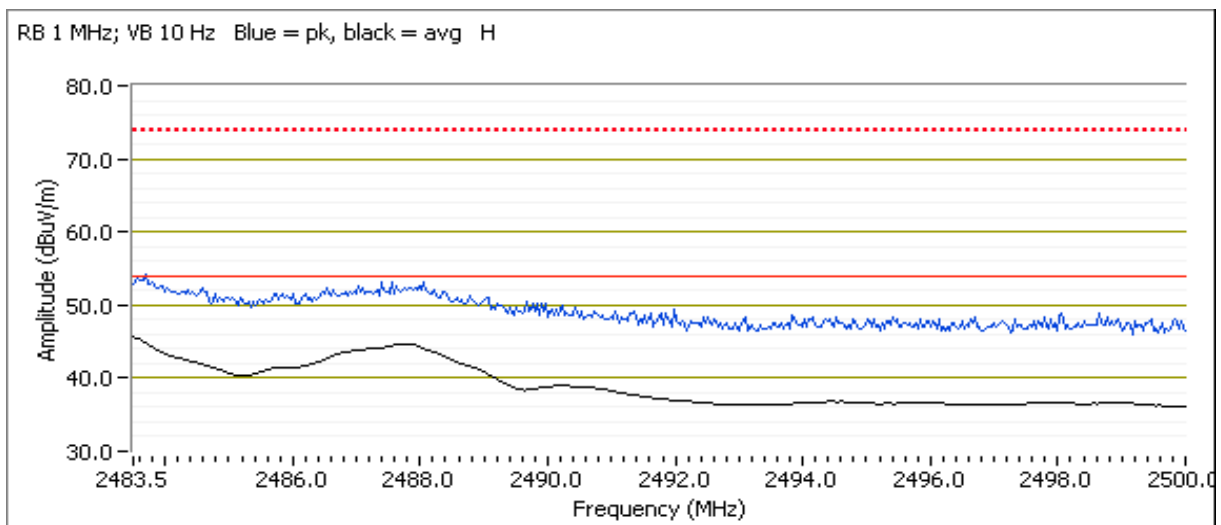


Client:	Vocera Communications	Job Number:	J94614
Model:	Northstar (1x1 802.11abgn + BT)	T-Log Number:	T94631
Contact:	Rob Holt	Project Manager:	Christine Krebill
Standard:	FCC 15.247/15.E/RSS-210	Project Coordinator:	Irene Rademacher
		Class:	N/A

Channel: 11 Mode: b
Tx Chain: Main Data Rate: 1Mbps

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2483.500	45.6	H	54.0	-8.4	AVG	206	1.42	Power: 18
2483.500	39.1	V	54.0	-14.9	AVG	218	1.00	Power: 18
2483.600	53.9	H	74.0	-20.1	PK	206	1.42	Power: 18
2487.530	48.5	V	74.0	-25.5	PK	218	1.00	Power: 18



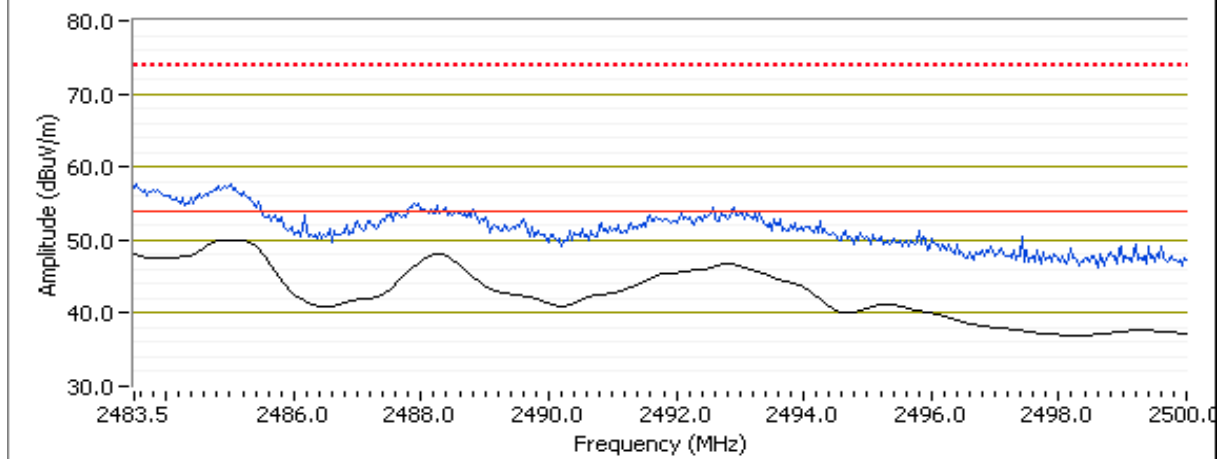
Client:	Vocera Communications	Job Number:	J94614
Model:	Northstar (1x1 802.11abgn + BT)	T-Log Number:	T94631
Contact:	Rob Holt	Project Manager:	Christine Krebill
Standard:	FCC 15.247/15.E/RSS-210	Project Coordinator:	Irene Rademacher
		Class:	N/A

Channel: 12 Mode: b
Tx Chain: Main Data Rate: 1Mbps

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2485.090	50.1	H	54.0	-3.9	AVG	216	1.12	Power: 18
2485.190	57.7	H	74.0	-16.3	PK	216	1.12	Power: 18

RB 1 MHz; VB 10 Hz Blue = pk, black = avg H

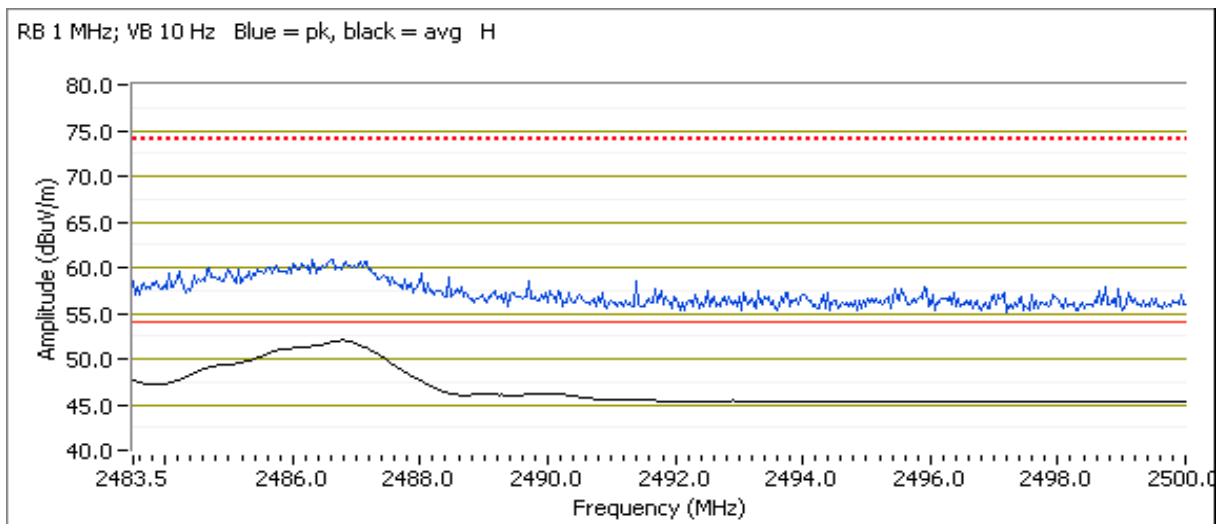


Client:	Vocera Communications	Job Number:	J94614
Model:	Northstar (1x1 802.11abgn + BT)	T-Log Number:	T94631
Contact:	Rob Holt	Project Manager:	Christine Krebill
Standard:	FCC 15.247/15.E/RSS-210	Project Coordinator:	Irene Rademacher
		Class:	N/A

Channel: 13 Mode: b
 Tx Chain: Main Data Rate: 1Mbps

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2486.810	52.0	H	54.0	-2.0	AVG	205	1.1	Power: 13dBm
2486.640	60.8	H	74.0	-13.2	PK	205	1.1	Power: 13dBm



Client:	Vocera Communications	Job Number:	J94614
Model:	Northstar (1x1 802.11abgn + BT)	T-Log Number:	T94631
Contact:	Rob Holt	Project Manager:	Christine Krebill
Standard:	FCC 15.247/15.E/RSS-210	Project Coordinator:	Irene Rademacher
		Class:	N/A

Run #2: Radiated Bandedge Measurements

Date of Test: 4/28/2014

Test Engineer: M. Birgani

Test Location: Chamber #5

Config. Used: 1

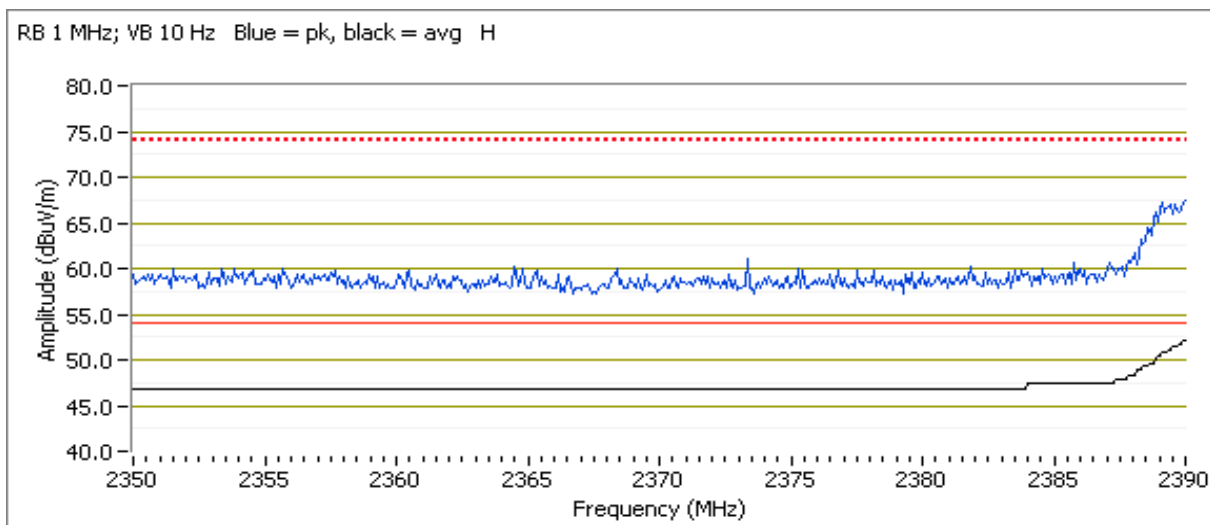
Config Change: -

EUT Voltage: Battery

Channel: 1 Mode: g
Tx Chain: Main Data Rate: 6Mbps

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dB μ V/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2390.000	50.4	H	54.0	-3.6	AVG	213	1.2	Power: 16dBm
2388.880	64.0	H	74.0	-10.0	PK	213	1.2	Power: 16dBm

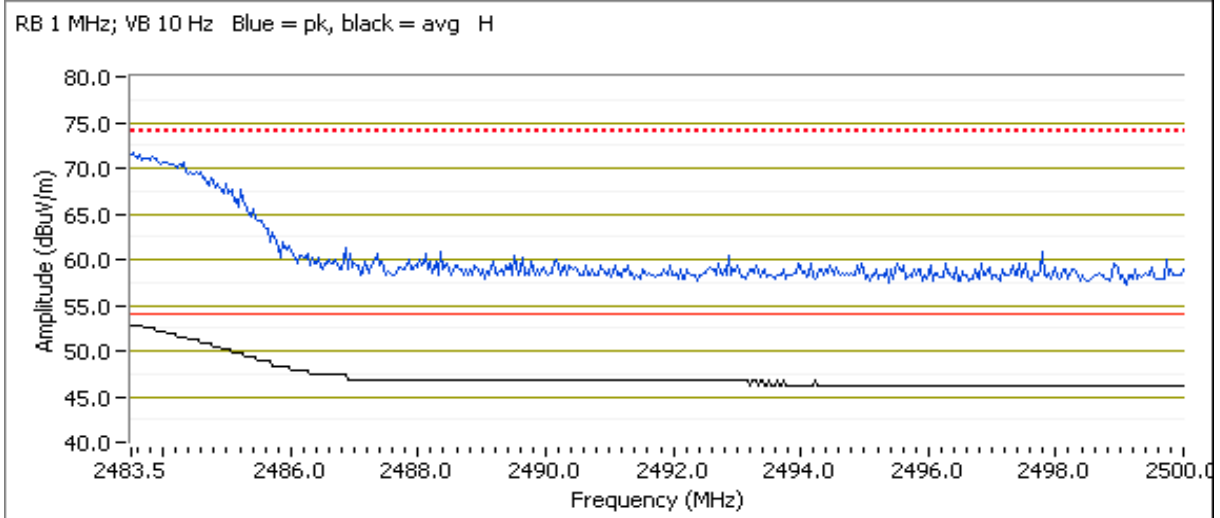


Client:	Vocera Communications	Job Number:	J94614
Model:	Northstar (1x1 802.11abgn + BT)	T-Log Number:	T94631
Contact:	Rob Holt	Project Manager:	Christine Krebill
Standard:	FCC 15.247/15.E/RSS-210	Project Coordinator:	Irene Rademacher
		Class:	N/A

Channel: 11 Mode: g
 Tx Chain: Main Data Rate: 6Mbps

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2483.500	53.1	H	54.0	-0.9	AVG	214	1.1	Power: 16dBm
2484.130	70.6	H	74.0	-3.4	PK	214	1.1	Power: 16dBm

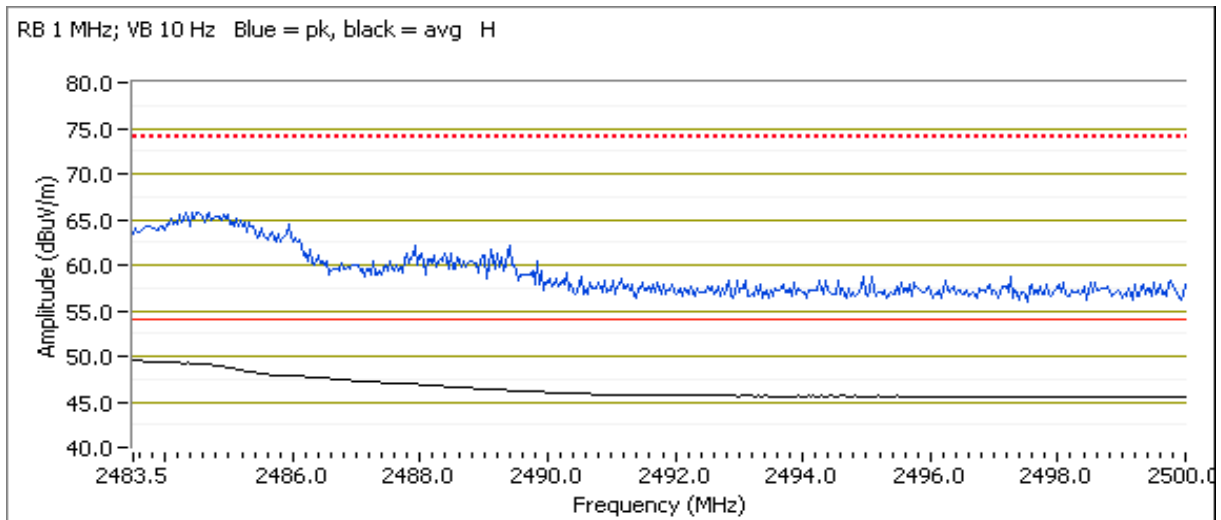


Client:	Vocera Communications	Job Number:	J94614
Model:	Northstar (1x1 802.11abgn + BT)	T-Log Number:	T94631
Contact:	Rob Holt	Project Manager:	Christine Krebill
Standard:	FCC 15.247/15.E/RSS-210	Project Coordinator:	Irene Rademacher
		Class:	N/A

Channel: 12 Mode: g
Tx Chain: Main Data Rate: 6Mbps

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2483.570	49.7	H	54.0	-4.3	AVG	218	1.1	Power: 12dBm
2484.490	65.1	H	74.0	-8.9	PK	218	1.1	Power: 12dBm

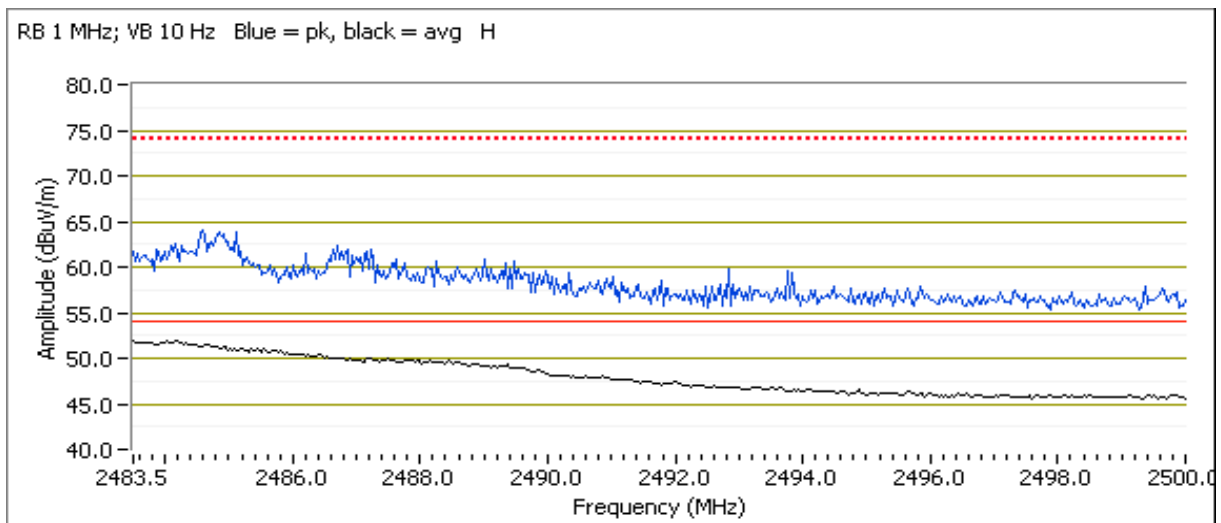


Client:	Vocera Communications	Job Number:	J94614
Model:	Northstar (1x1 802.11abgn + BT)	T-Log Number:	T94631
Contact:	Rob Holt	Project Manager:	Christine Krebill
Standard:	FCC 15.247/15.E/RSS-210	Project Coordinator:	Irene Rademacher
		Class:	N/A

Channel: 13 Mode: g
 Tx Chain: Main Data Rate: 6Mbps

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2483.500	52.6	H	54.0	-1.4	AVG	216	1.1	Power: 12dBm
2484.130	69.9	H	74.0	-4.1	PK	216	1.1	Power: 12dBm



Client:	Vocera Communications	Job Number:	J94614
Model:	Northstar (1x1 802.11abgn + BT)	T-Log Number:	T94631
Contact:	Rob Holt	Project Manager:	Christine Krebill
Standard:	FCC 15.247/15.E/RSS-210	Project Coordinator:	Irene Rademacher
		Class:	N/A

Run #3: Radiated Bandedge Measurements

Date of Test: 4/28/2014

Test Engineer: John Caizzi

Test Location: Chamber 5

Config. Used: 1

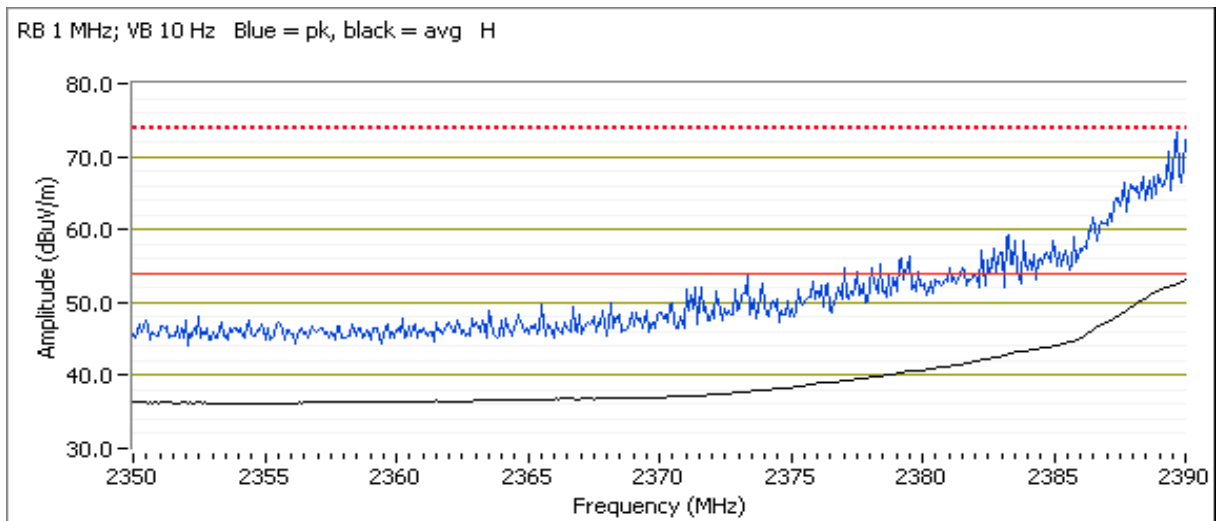
Config Change: none

EUT Voltage: 3.3 VDC battery

Channel: 1
 Tx Chain: Main
 Mode: n20
 Data Rate: MCS0

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2390.000	52.8	H	54.0	-1.2	AVG	204	1.16	Power: 16dBm
2389.600	72.7	H	74.0	-1.3	PK	204	1.16	Power: 16dBm

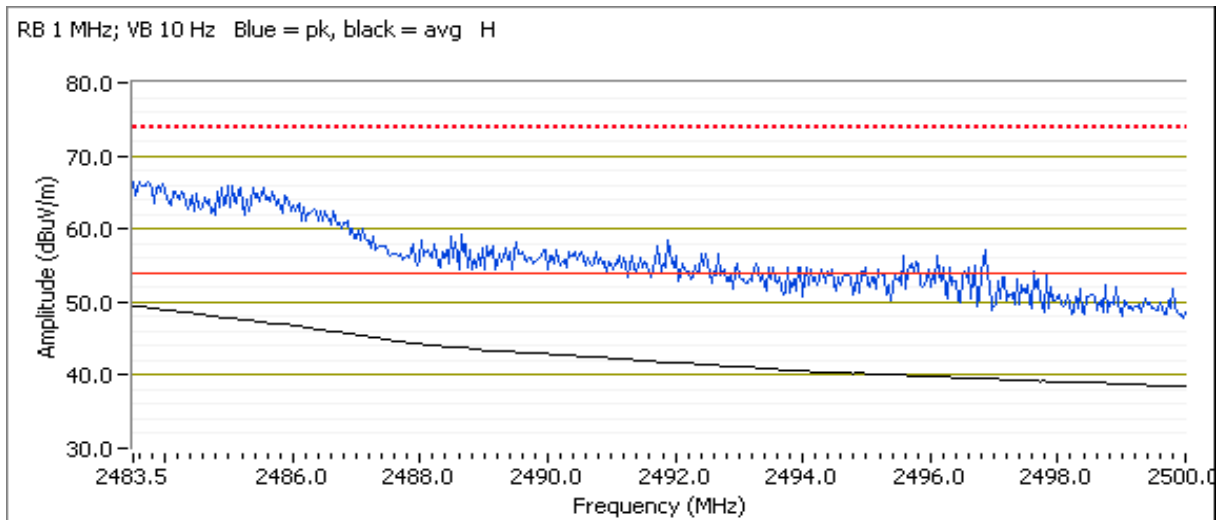


Client:	Vocera Communications	Job Number:	J94614
Model:	Northstar (1x1 802.11abgn + BT)	T-Log Number:	T94631
Contact:	Rob Holt	Project Manager:	Christine Krebill
Standard:	FCC 15.247/15.E/RSS-210	Project Coordinator:	Irene Rademacher
		Class:	N/A

Channel: 11 Mode: n20
 Tx Chain: Main Data Rate: MCS0

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2483.500	49.3	H	54.0	-4.7	AVG	331	1.11	Power: 15dBm
2483.670	66.2	H	74.0	-7.8	PK	331	1.11	Power: 15dBm

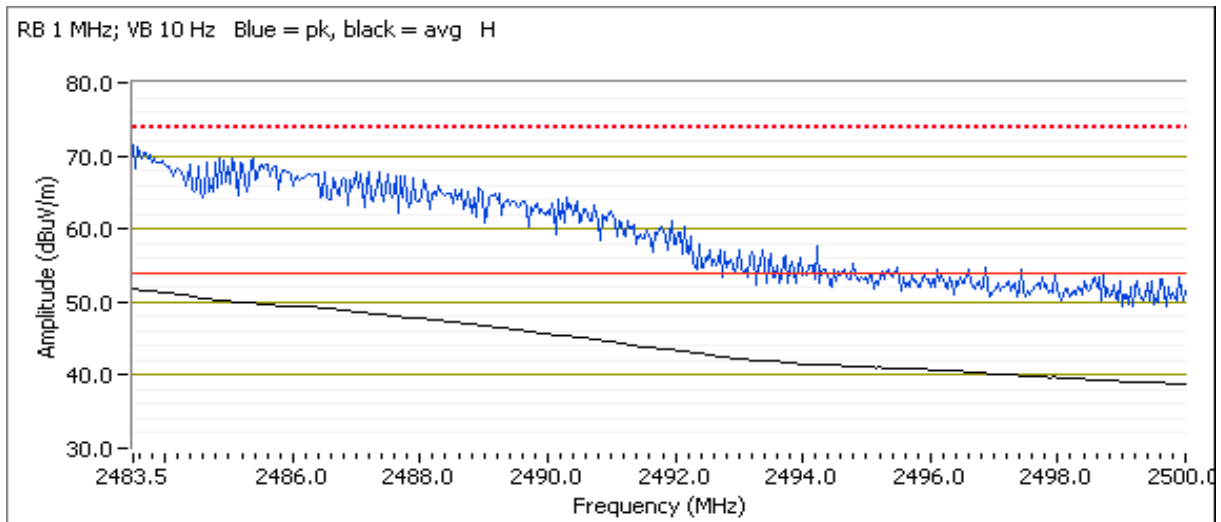


Client:	Vocera Communications	Job Number:	J94614
Model:	Northstar (1x1 802.11abgn + BT)	T-Log Number:	T94631
Contact:	Rob Holt	Project Manager:	Christine Krebill
Standard:	FCC 15.247/15.E/RSS-210	Project Coordinator:	Irene Rademacher
		Class:	N/A

Channel: 12 Mode: n20
Tx Chain: Main Data Rate: MCS0

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2483.530	52.0	H	54.0	-2.0	AVG	335	1.13	Power: 14dBm
2483.830	71.0	H	74.0	-3.0	PK	335	1.13	Power: 14dBm

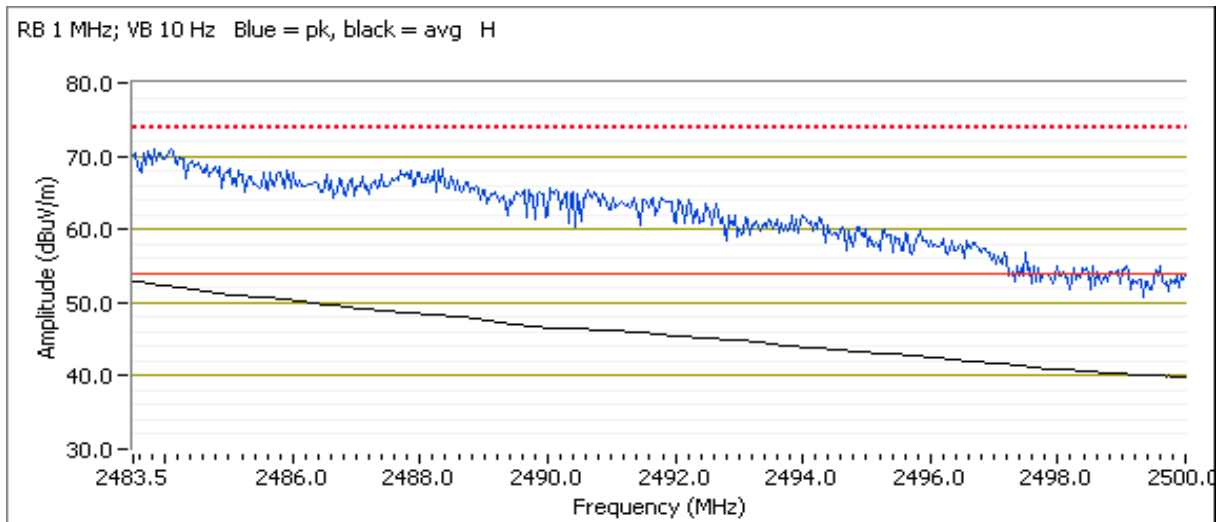


Client:	Vocera Communications	Job Number:	J94614
Model:	Northstar (1x1 802.11abgn + BT)	T-Log Number:	T94631
Contact:	Rob Holt	Project Manager:	Christine Krebill
Standard:	FCC 15.247/15.E/RSS-210	Project Coordinator:	Irene Rademacher
		Class:	N/A

Channel: 13 Mode: n20
Tx Chain: Main Data Rate: MCS0

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2483.500	52.7	H	54.0	-1.3	AVG	326	1.14	Power: 13dBm
2483.930	70.4	H	74.0	-3.6	PK	326	1.14	Power: 13dBm



Client:	Vocera Communications	Job Number:	J94614
Model:	Northstar (1x1 802.11abgn + BT)	T-Log Number:	T94631
Contact:	Rob Holt	Project Manager:	Christine Krebill
Standard:	FCC 15.247/15.E/RSS-210	Project Coordinator:	Irene Rademacher
		Class:	N/A

RSS 210 and FCC 15.247 (DTS) Antenna Port Measurements Power, PSD, Bandwidth and Spurious Emissions

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 3/26/2014, 6/16/2014
 Test Engineer: Jack Liu, Deniz Demirci
 Test Location: FT Lab # 4B

Config. Used: 1
 Config Change: None
 EUT Voltage: 4.2VDC

General Test Configuration

The EUT was connected to the spectrum analyzer or power meter via a suitable attenuator. All measurements were made on a single chain.

All measurements have been corrected to allow for the external attenuators used.

Ambient Conditions:

Temperature: 21-24 °C
 Rel. Humidity: 30-45 %

Summary of Results

Run #	Pwr setting	Avg Pwr	Test Performed	Limit	Pass / Fail	Result / Margin
1	-	-	Output Power	15.247(b)	Pass	11b:14.0dBm (25.1mW) 11g:15.2dBm (33.1mW) n20:15.1dBm (32.4mW)
2	-	-	Power spectral Density (PSD)	15.247(d)	Pass	11b: 5.5 dBm/100kHz 11g: 1.5dBm/100kHz n20: 1.8dBm/100kHz
3	-	-	Minimum 6dB Bandwidth	15.247(a)	Pass	9.9 MHz
3	-	-	99% Bandwidth	RSS GEN	-	11b: 13.6MHz 11g: 16.8MHz n20: 18.0MHz
4	-	-	Spurious emissions	15.247(b)	Pass	All emissions >30dBc

Client:	Vocera Communications	Job Number:	J94614
Model:	Northstar (1x1 802.11abgn + BT)	T-Log Number:	T94631
Contact:	Rob Holt	Project Manager:	Christine Krebill
Standard:	FCC 15.247/15.E/RSS-210	Project Coordinator:	Irene Rademacher
		Class:	N/A

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Procedure Comments:

Measurements performed in accordance with FCC KDB 558074

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
11b	1Mb/ss	100.00	-	-	0	0	-
11g	6Mb/s	100.00	-	-	0	0	-
n20	MCS0	100.00	-	-	0	0	-

Sample Notes

Sample S/N: 3C (NTS 2014-3721) and 3E (Final power)

Driver: M3X14447

Client:	Vocera Communications	Job Number:	J94614
Model:	Northstar (1x1 802.11abgn + BT)	T-Log Number:	T94631
Contact:	Rob Holt	Project Manager:	Christine Krebill
Standard:	FCC 15.247/15.E/RSS-210	Project Coordinator:	Irene Rademacher
		Class:	N/A

Run #1: Output Power

Mode: 11b

Power Setting ²	Frequency (MHz)	Output Power		Antenna Gain (dBi)	Result	EIRP		Power Meter	
		(dBm) ¹	mW			dBm	W	(dBm) ³	mW
16	2412	13.8	23.7	3.0	Pass	16.8	0.047	13.9	24.5
16	2437	14.0	25.1	3.0	Pass	17.0	0.050	14.0	25.1
13	2472	10.3	10.7	3.0	Pass	13.3	0.021	10.4	11.0

Mode: 11g

Power Setting ²	Frequency (MHz)	Output Power		Antenna Gain (dBi)	Result	EIRP		Power Meter	
		(dBm) ¹	mW			dBm	W	(dBm) ³	mW
16	2412	13.4	22.0	3.0	Pass	16.4	0.044	13.7	23.4
18	2437	15.2	33.1	3.0	Pass	18.2	0.066	15.2	33.1
12	2472	9.1	8.2	3.0	Pass	12.1	0.016	9.0	7.9

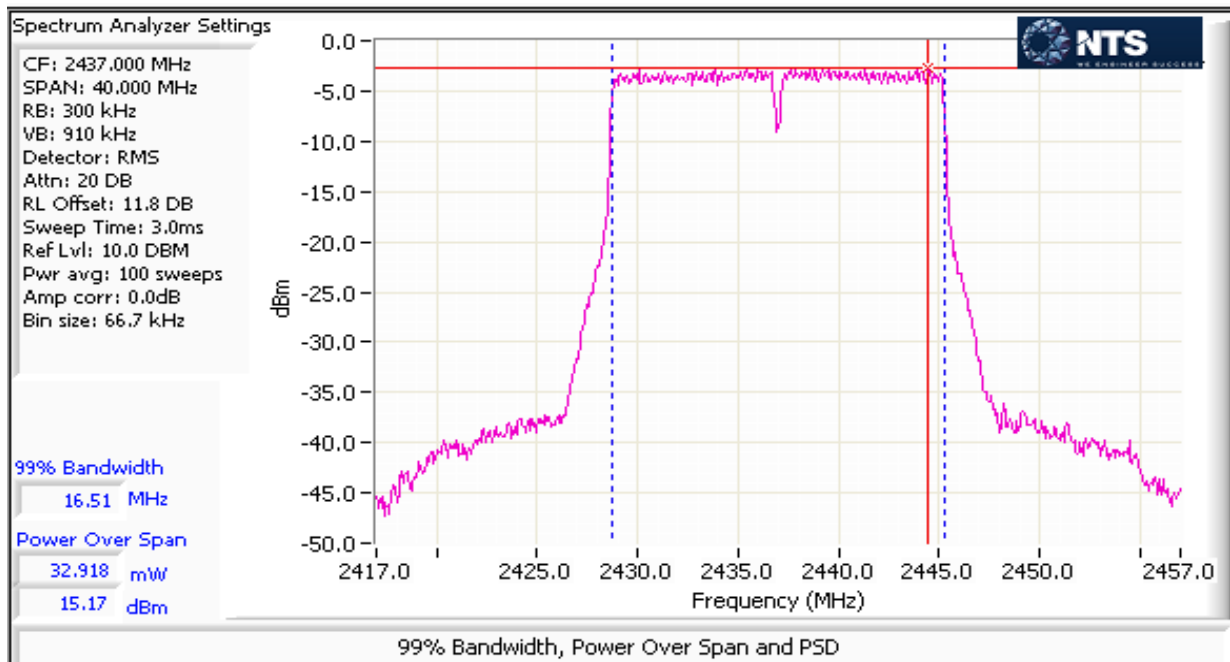
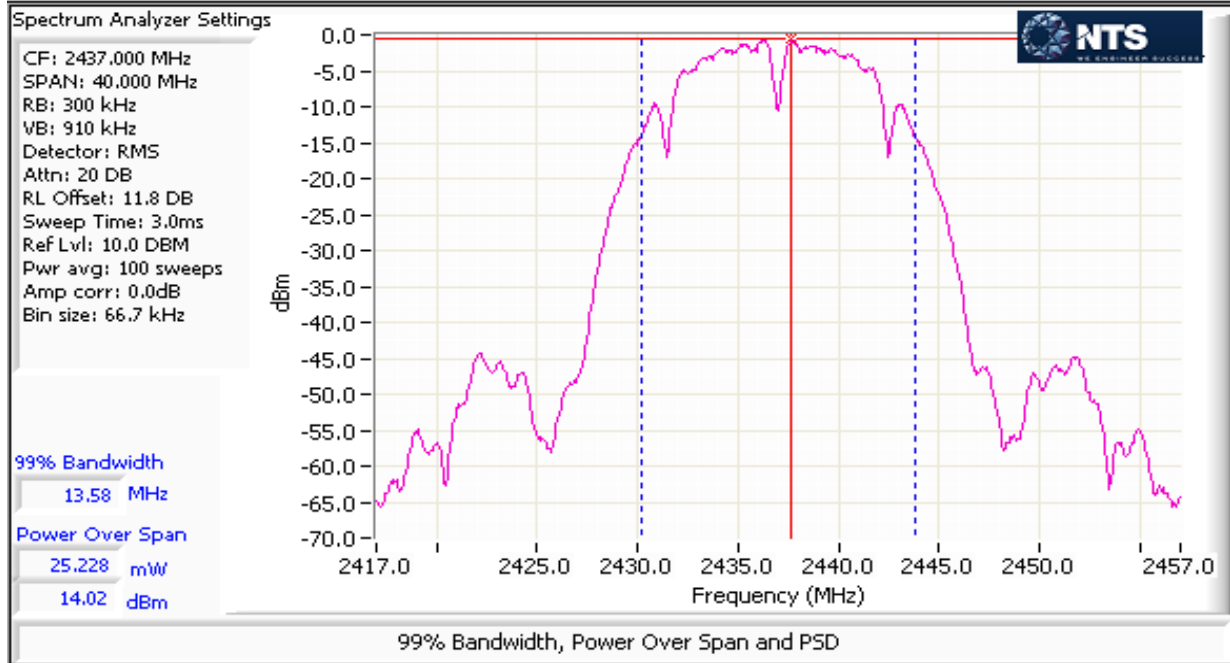
Mode: n20

Power Setting ²	Frequency (MHz)	Output Power		Antenna Gain (dBi)	Result	EIRP		Power Meter	
		(dBm) ¹	mW			dBm	W	(dBm) ³	mW
16	2412	13.6	22.7	3.0	Pass	16.6	0.045	13.8	24.0
18	2437	15.1	32.4	3.0	Pass	18.1	0.065	15.1	32.4
13	2472	10.4	10.9	3.0	Pass	13.4	0.022	10.3	10.7

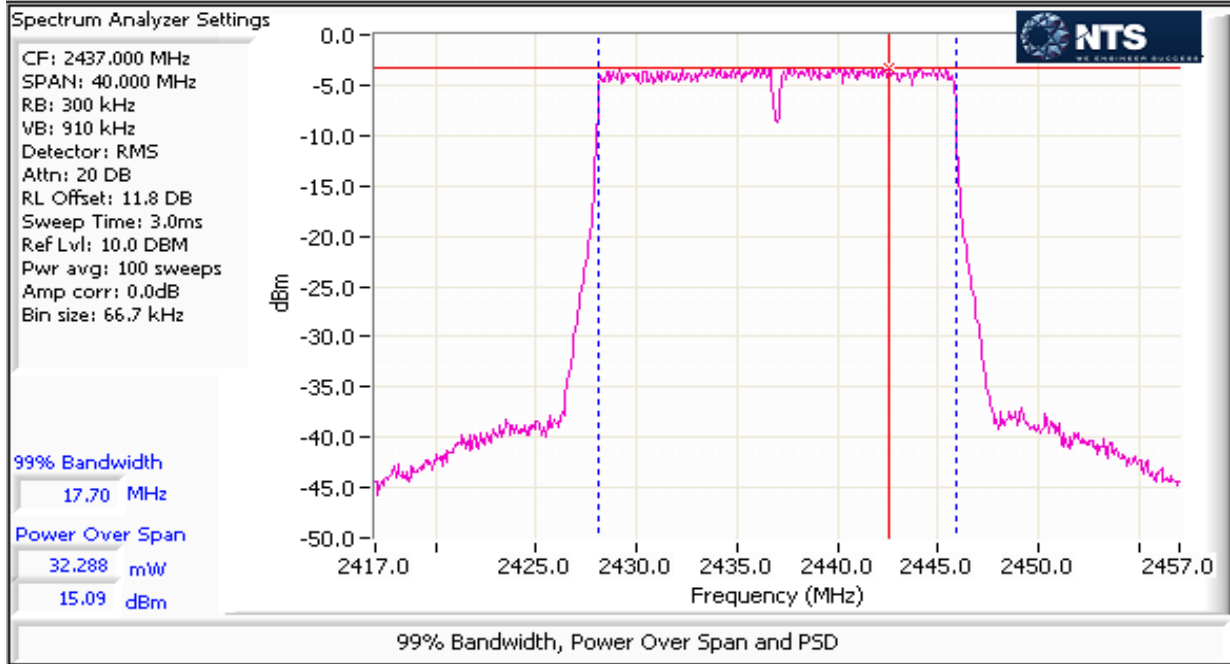
Sample S/N: 3E

- Note 1: Duty Cycle $\geq$ 98%. Output power measured using a spectrum analyzer (see plots below) with RBW= 1-5% of OBW, VB $\geq$ 3* RBW, RMS detector, power averaging on, and power integration over the OBW, trace average 100 traces (option AVGSA-1, in KDB 558074). Spurious limit becomes -30dBc.
- Note 2: Power setting - the software power setting used during testing, included for reference only.
- Note 3: Power measured using average power meter (non-gated) and is included for reference only.

Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A



Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A



Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A

Run #2: Power spectral Density

Mode: 11b

Power Setting	Frequency (MHz)	PSD (dBm/100kHz) Note 1	Limit dBm/3kHz	Result
18	2412	5.5	8.0	Pass
18	2437	5.2	8.0	Pass
18	2472	5.0	8.0	Pass

Mode: 11g

Power Setting	Frequency (MHz)	PSD (dBm/100kHz) Note 1	Limit dBm/3kHz	Result
18	2412	1.5	8.0	Pass
18	2437	1.4	8.0	Pass
18	2472	1.1	8.0	Pass

Mode: n20

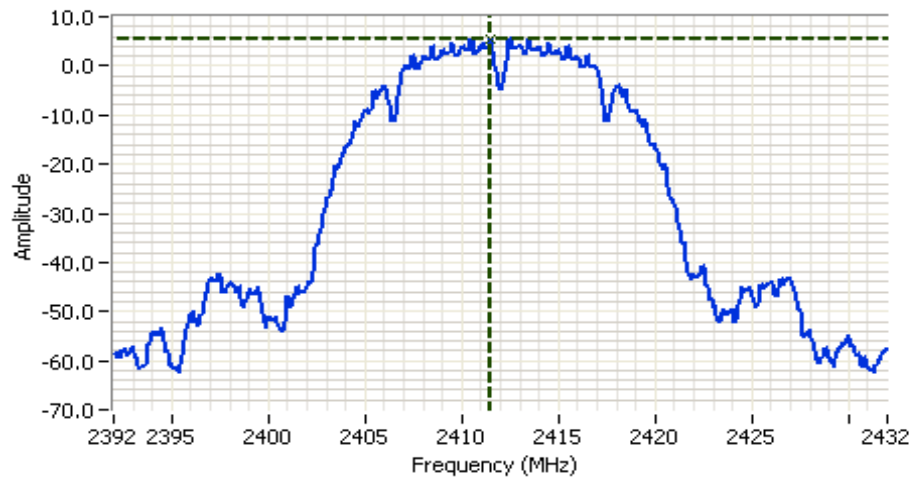
Power Setting	Frequency (MHz)	PSD (dBm/100kHz) Note 1	Limit dBm/3kHz	Result
18	2412	1.8	8.0	Pass
18	2437	1.7	8.0	Pass
18	2472	1.7	8.0	Pass

Note 1: Test performed per method PKSPD, in KDB 558074. Power spectral density measured using: $3\text{kHz} \leq \text{RBW} \leq 100\text{kHz}$, $\text{VBW}=3*\text{RBW}$, peak detector, span = $>1.5*\text{DTS BW}$, auto sweep time, max hold.



EMC Test Data

Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A



Analyzer Settings

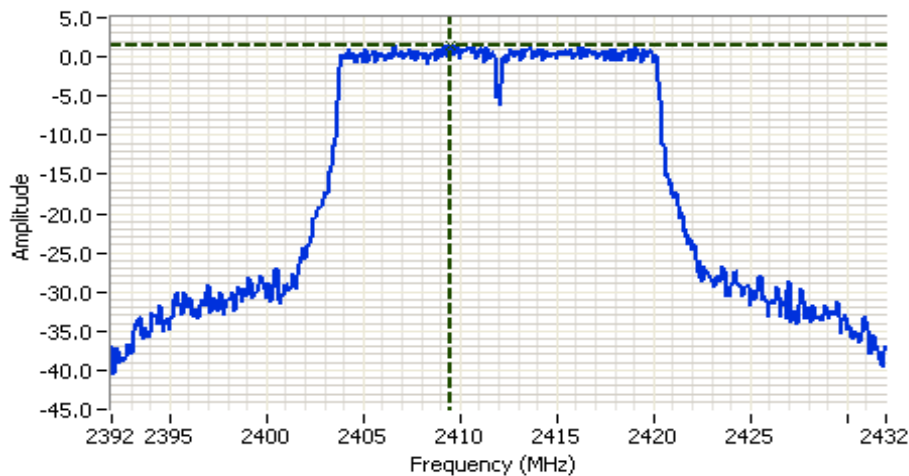
Agilent Technologies, E4446A
CF: 2412.000 MHz
SPAN: 40.000 MHz
RB: 100 kHz
VB: 300 kHz
Detector: POS
Attn: 10 DB
RL Offset: 10.8 DB
Sweep Time: 3.8ms
Ref Lvl: 10.0 DBM

Comments

PSD: 5.47 dBm/100kHz
802.11 b

Cursor 1 2411.4667 5.47

0.0000 0.00



Analyzer Settings

Agilent Technologies, E4446A
CF: 2412.000 MHz
SPAN: 40.000 MHz
RB: 100 kHz
VB: 300 kHz
Detector: POS
Attn: 10 DB
RL Offset: 10.8 DB
Sweep Time: 3.8ms
Ref Lvl: 10.0 DBM

Comments

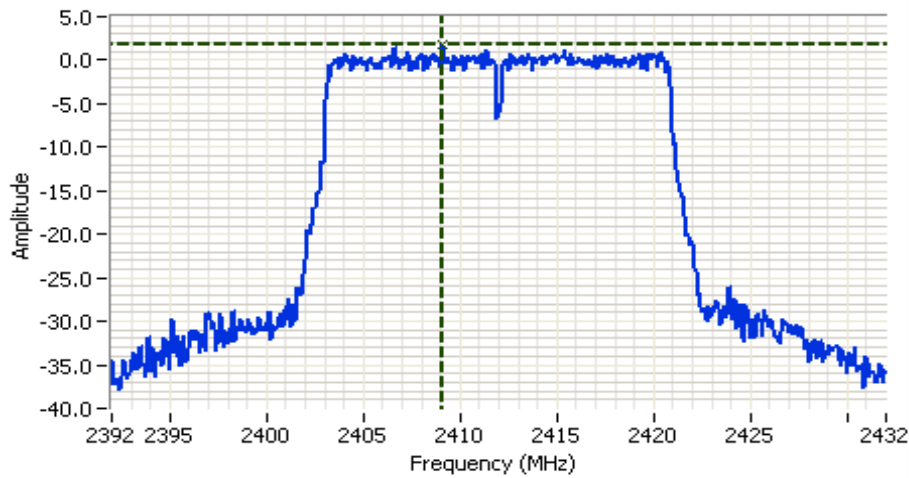
PSD: 1.53 dBm/100kHz
802.11 g

Cursor 1 2409.5333 1.53

0.0000 0.00



Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A



Analyzer Settings

Agilent Technologies, E4446A
 CF: 2412.000 MHz
 SPAN: 40.000 MHz
 RB: 100 kHz
 VB: 300 kHz
 Detector: POS
 Attn: 10 DB
 RL Offset: 10.8 DB
 Sweep Time: 3.8ms
 Ref Lvl: 10.0 DBM

Comments

PSD: 1.78dBm/100kHz
 802.11 n20

Cursor 1 2409.1333 1.78

0.0000 0.00

Client:	Vocera Communications	Job Number:	J94614
Model:	Northstar (1x1 802.11abgn + BT)	T-Log Number:	T94631
Contact:	Rob Holt	Project Manager:	Christine Krebill
Standard:	FCC 15.247/15.E/RSS-210	Project Coordinator:	Irene Rademacher
		Class:	N/A

Run #3: Signal Bandwidth

Mode: 11b

Power Setting	Frequency (MHz)	Bandwidth (MHz)		RBW Setting (kHz)	
		6dB	99%	6dB	99%
18	2412	9.9	13.6	100	300
18	2437	9.9	13.6	100	300
18	2472	9.9	13.6	100	300

Mode: 11g

Power Setting	Frequency (MHz)	Bandwidth (MHz)		RBW Setting (kHz)	
		6dB	99%	6dB	99%
18	2412	16.5	16.8	100	300
18	2437	16.5	16.8	100	300
18	2472	16.5	16.8	100	300

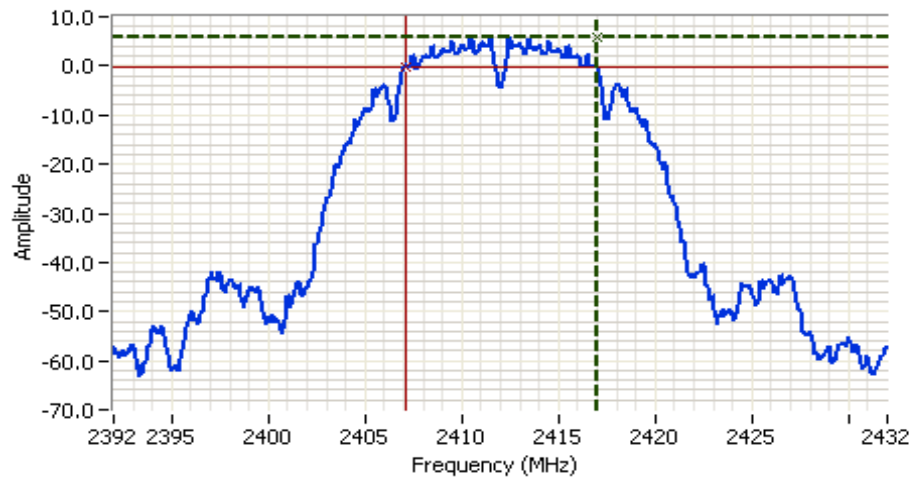
Mode: n20

Power Setting	Frequency (MHz)	Bandwidth (MHz)		RBW Setting (kHz)	
		6dB	99%	6dB	99%
18	2412	17.8	18.0	100	300
18	2437	17.8	18.0	100	300
18	2472	17.8	18.0	100	300

Note 1:

DTS BW: RBW=100kHz, VBW $\geq 3 \times$ RBW, peak detector, max hold, auto sweep time.
 99% BW: RBW=1-5% of 99%BW, VBW $\geq 3 \times$ RBW, peak detector, max hold, auto sweep time.

Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A



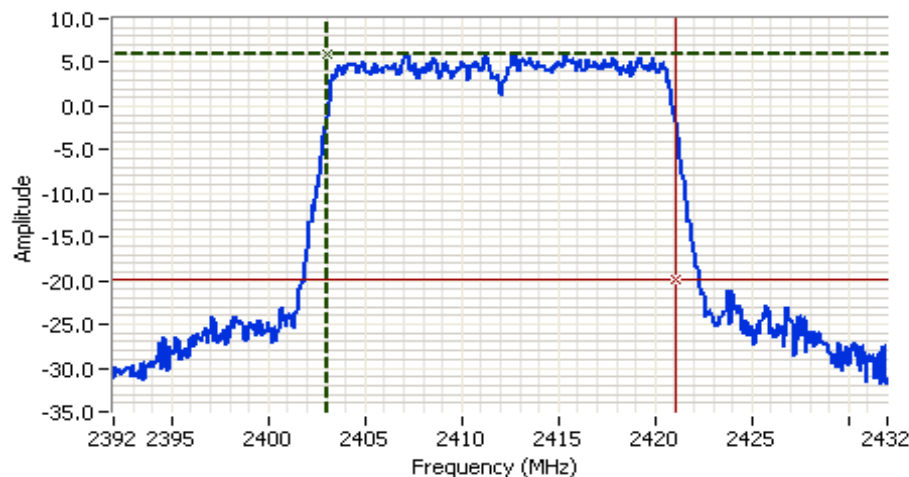
Analyzer Settings

Agilent Technologies, E4446A
 CF: 2412.000 MHz
 SPAN: 40.000 MHz
 RB: 100 kHz
 VB: 300 kHz
 Detector: POS
 Attn: 10 DB
 RL Offset: 10.8 DB
 Sweep Time: 3.8ms
 Ref Lvl: 10.0 DBM

Comments

6dB BW: 9.933 MHz
 802.11 b

Cursor 1 2417.0000 5.64
 Cursor 2 2407.0667 -0.36
 Delta Freq. 9.933
 Delta Amplitude 6.00



Analyzer Settings

Agilent Technologies, E4446A
 CF: 2412.000 MHz
 SPAN: 40.000 MHz
 RB: 300 kHz
 VB: 910 kHz
 Detector: POS
 Attn: 10 DB
 RL Offset: 10.8 DB
 Sweep Time: 1.0ms
 Ref Lvl: 10.0 DBM

Comments

99% power BW: 17.970 MHz
 802.11 n20

Cursor 1 2403.0483 6.05
 Cursor 2 2421.0183 -19.95
 Delta Freq. 17.970
 Delta Amplitude 26.00



Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A

Run #4a: Out of Band Spurious Emissions

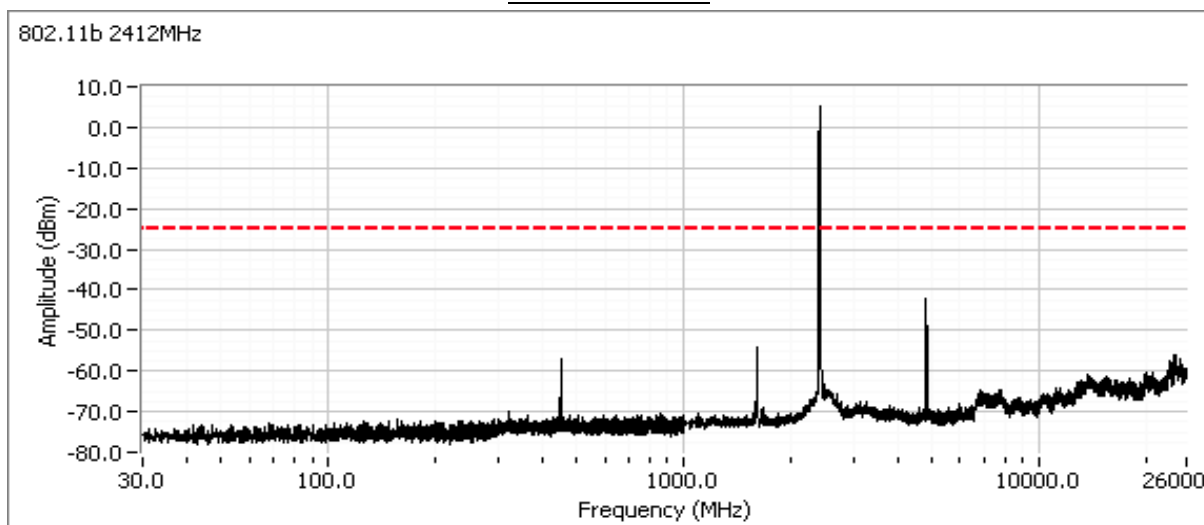
Frequency (MHz)	Power Setting	Mode	Limit	Result
2412	18	b	-30dBc	Pass
2437	18	b	-30dBc	Pass
2472	18	b	-30dBc	Pass

Frequency (MHz)	Power Setting	Mode	Limit	Result
2412	18	g	-30dBc	Pass
2437	18	g	-30dBc	Pass
2472	18	g	-30dBc	Pass

Frequency (MHz)	Power Setting	Mode	Limit	Result
2412	18	n20	-30dBc	Pass
2437	18	n20	-30dBc	Pass
2472	18	n20	-30dBc	Pass

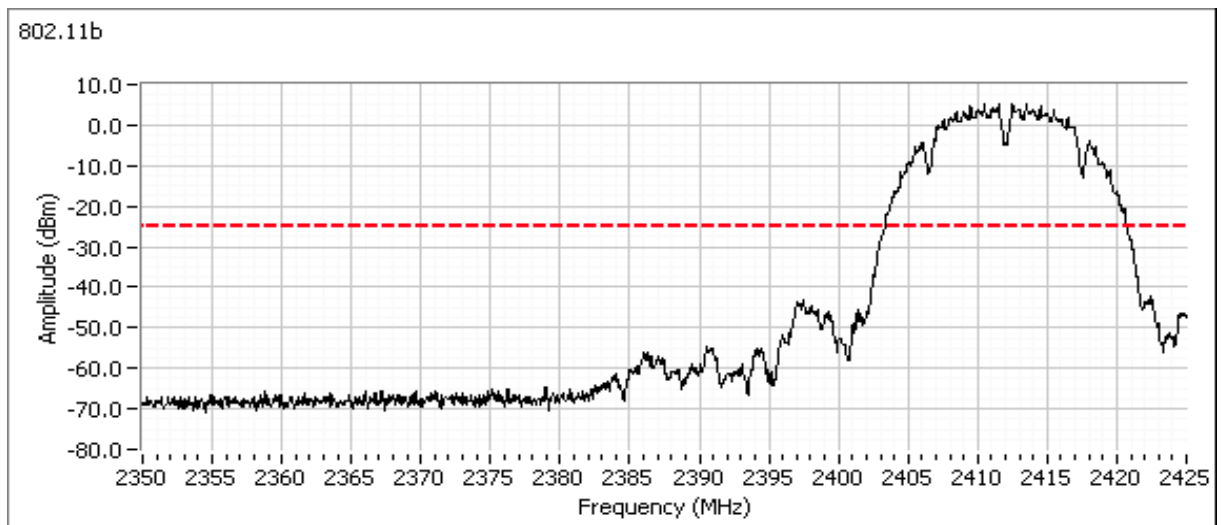
Mode: 11b

Plots for low channel

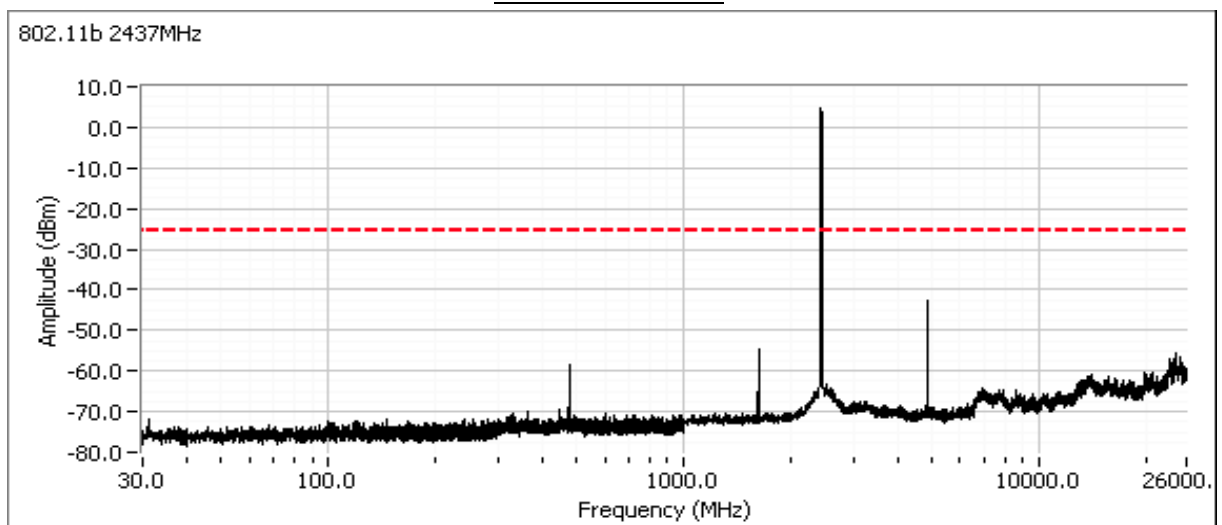


Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A

Additional plot showing compliance with -30dBc limit from 2390 MHz to 2400 MHz. Radiated measurements used to show compliance with the limits in the restricted band below 2390 MHz.

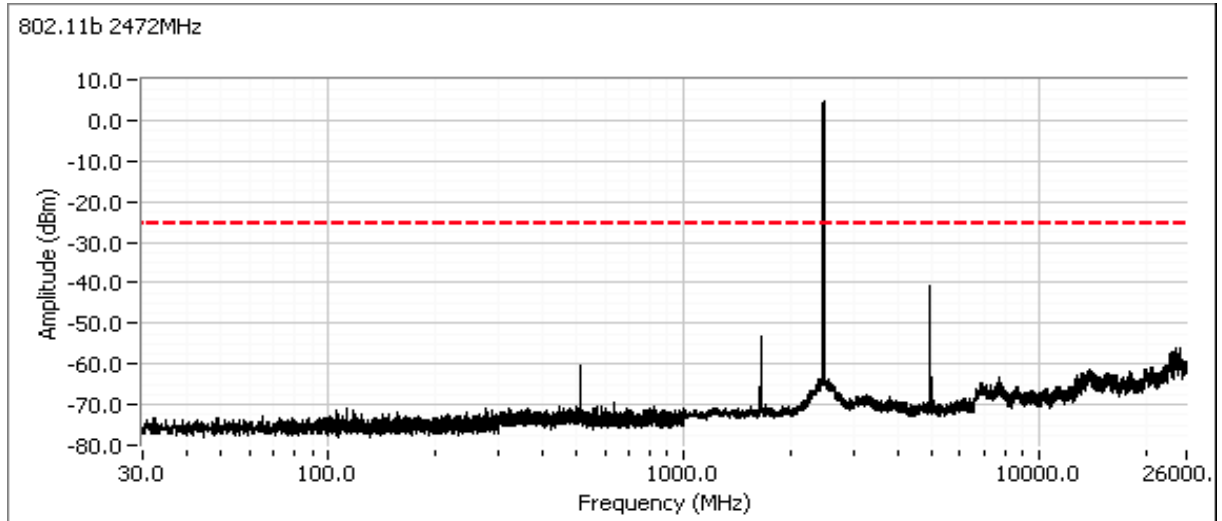


Plots for center channel



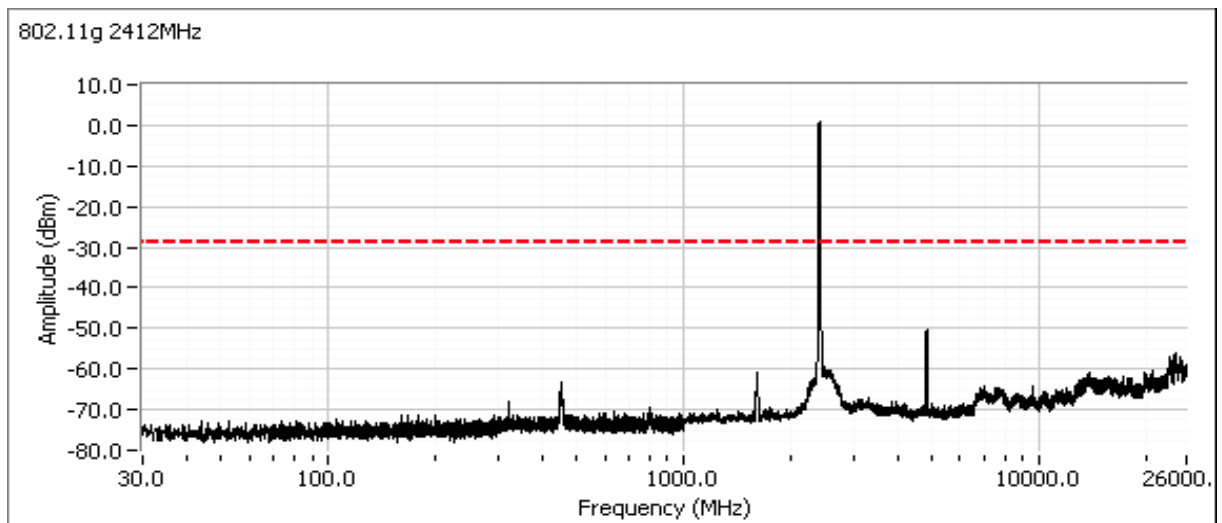
Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A

Plots for high channel



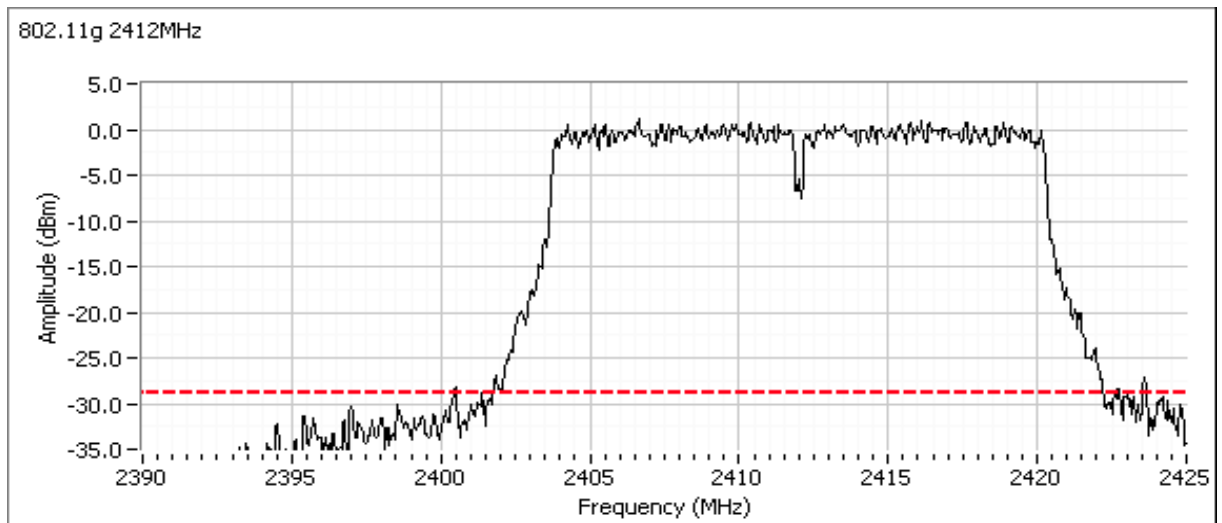
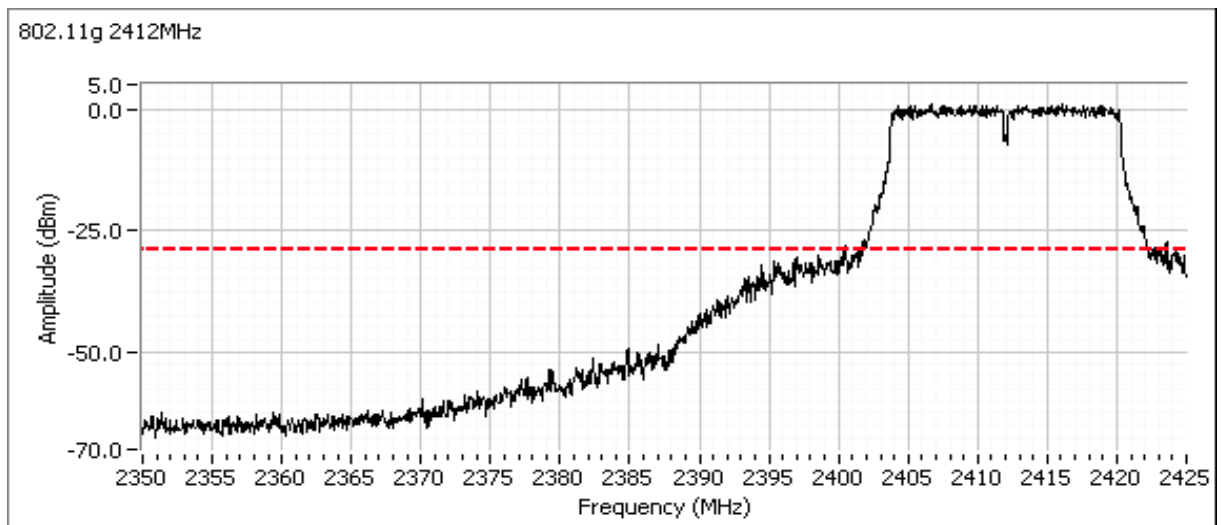
Mode: 11g

Plots for low channel



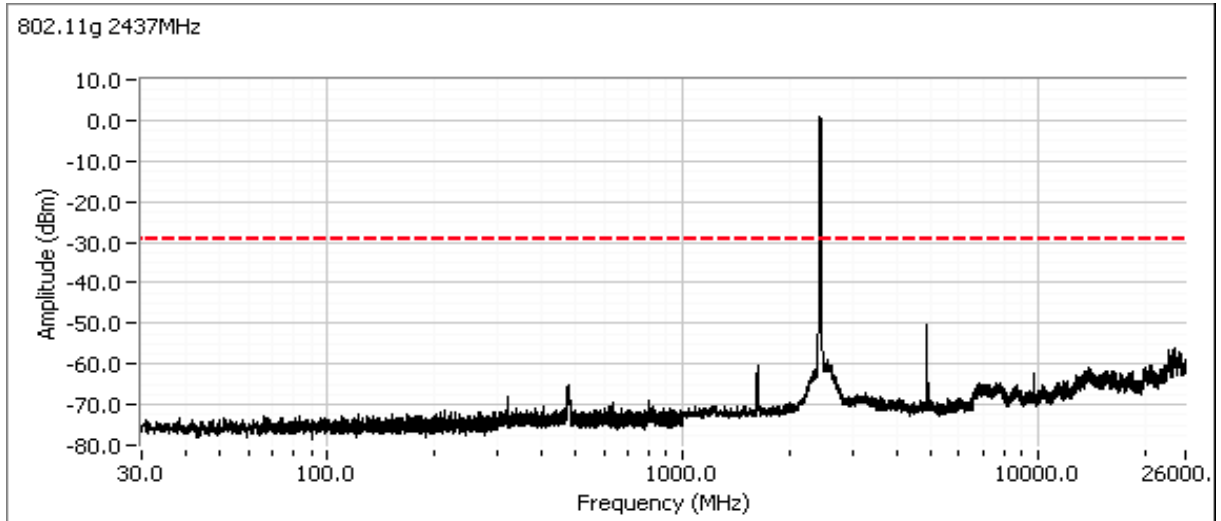
Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A

Additional plot showing compliance with -30dBc limit from 2390 MHz to 2400 MHz. Radiated measurements used to show compliance with the limits in the restricted band below 2390 MHz.

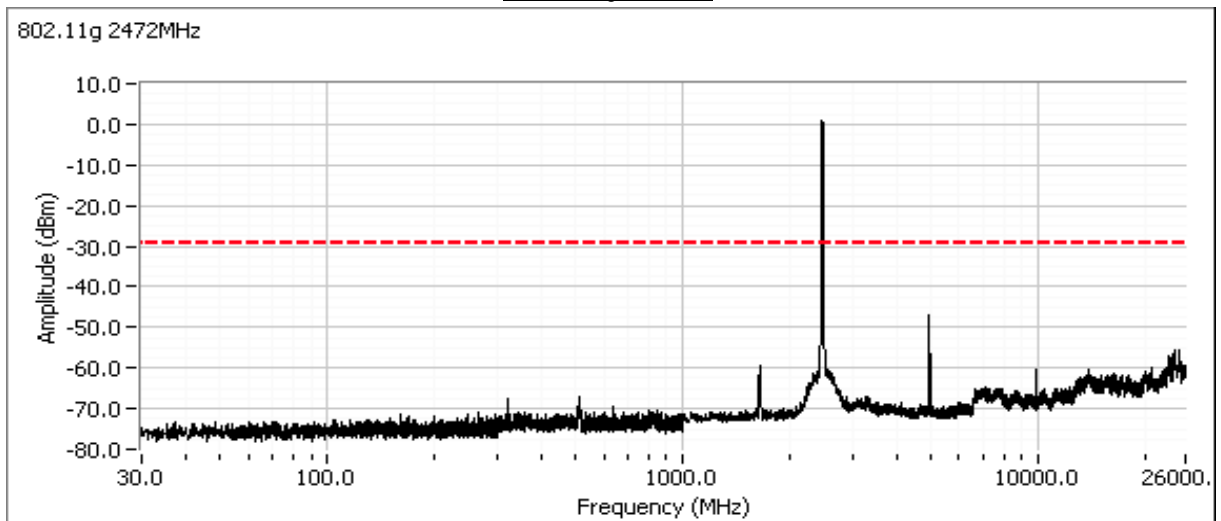


Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A

Plots for center channel



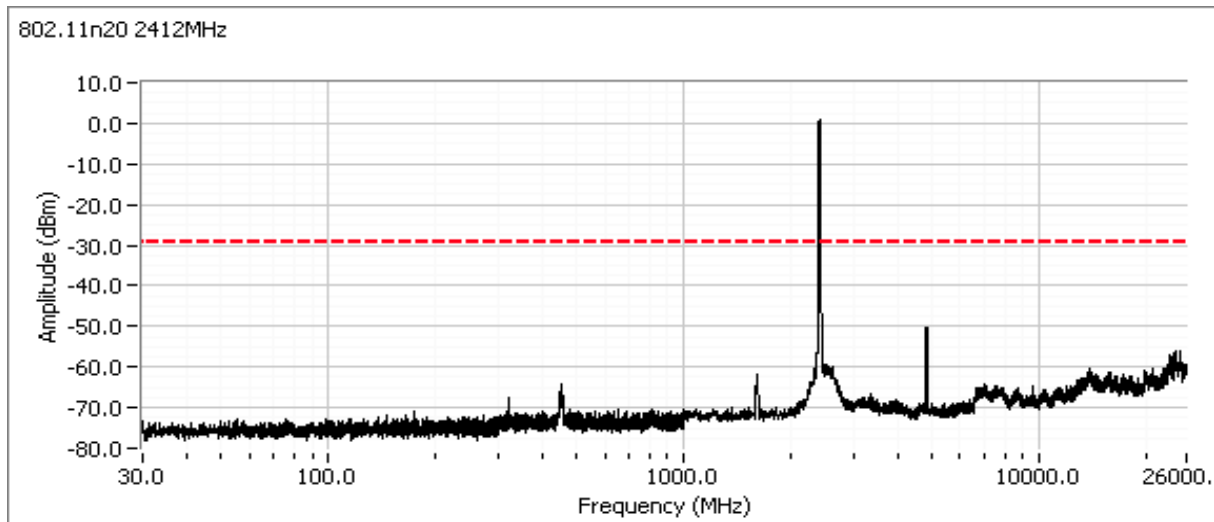
Plots for high channel



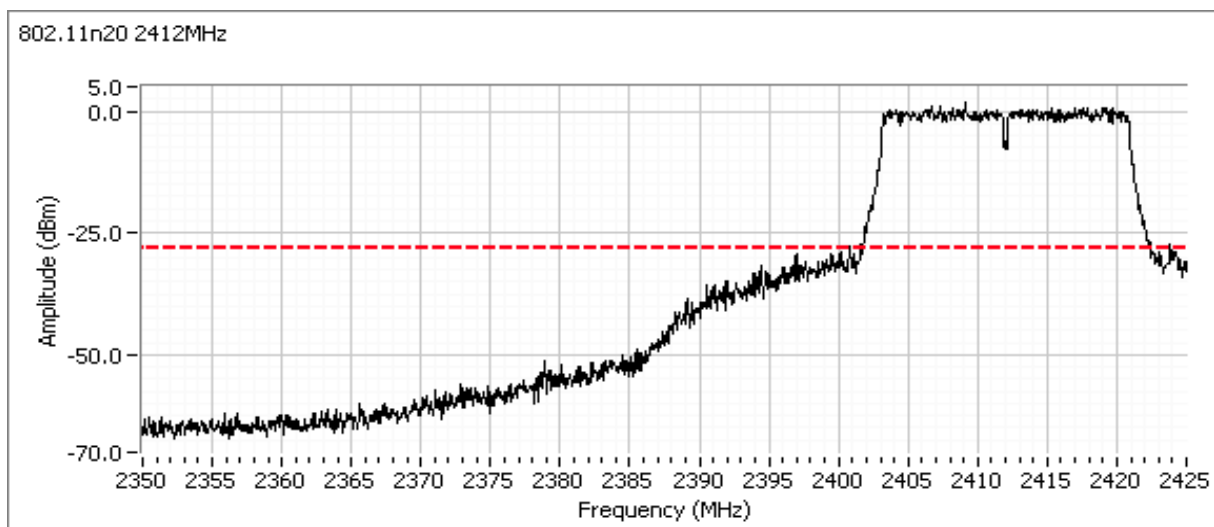
Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A

Mode: 11n20

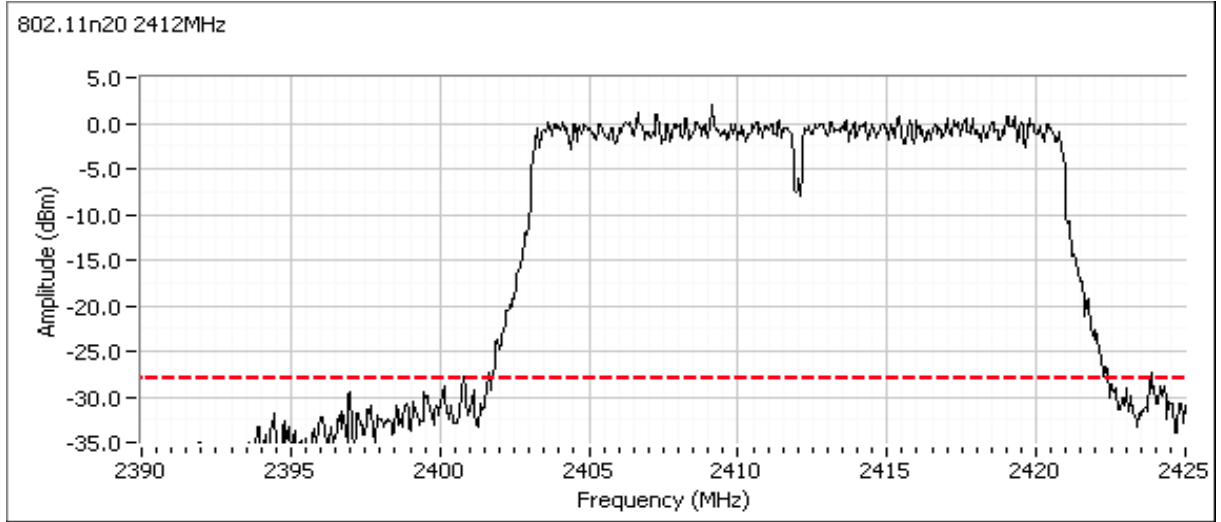
Plots for low channel



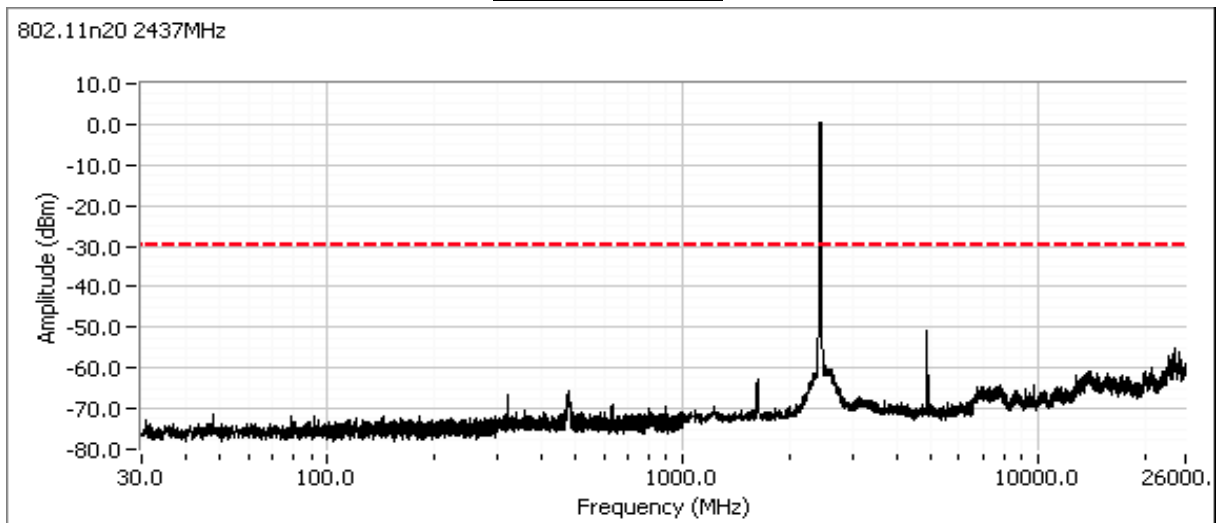
Additional plot showing compliance with -30dBc limit from 2390 MHz to 2400 MHz. Radiated measurements used to show compliance with the limits in the restricted band below 2390 MHz.



Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A

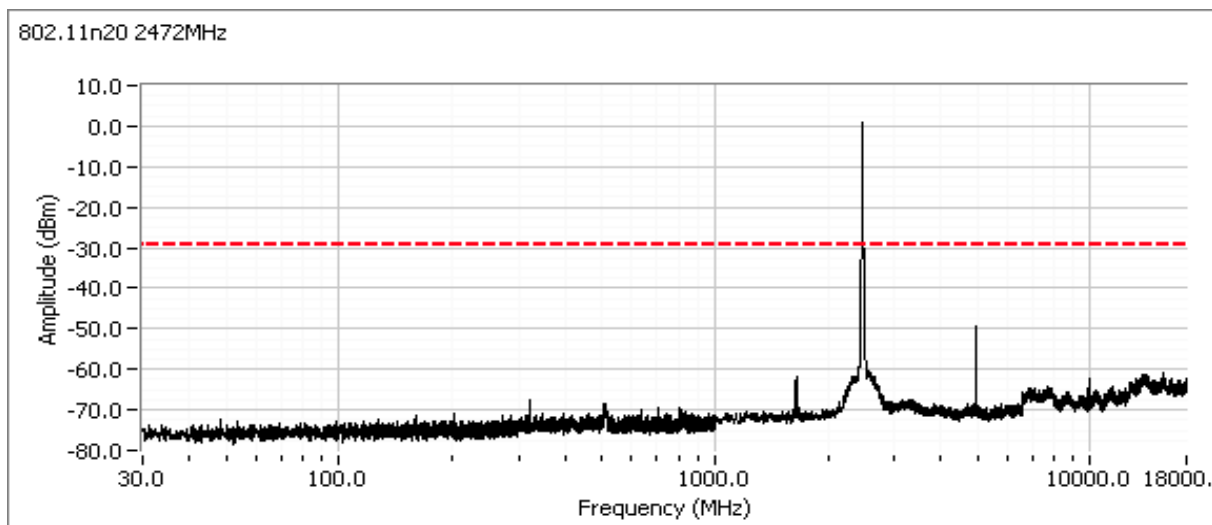


Plots for center channel



Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A

Plots for high channel



Client:	Vocera Communications	Job Number:	J94614
Model:	Northstar (1x1 802.11abgn + BT)	T-Log Number:	T94631
Contact:	Rob Holt	Project Manager:	Christine Krebill
Standard:	FCC 15.247/15.E/RSS-210	Project Coordinator:	Irene Rademacher
		Class:	N/A

RSS 210 and FCC 15.247 (DTS) Radiated Spurious Emissions

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT, unless otherwise noted.

Ambient Conditions:

Temperature: 20-24 °C
 Rel. Humidity: 30-45 %

Summary of Results - Device Operating in the 5725-5850 MHz Band

Run #	Mode	Channel	Target Power	Final Power Setting	Test Performed	Limit	Result / Margin
Scans on center channel in all three OFDM modes to determine the worst case mode.							
1	a	157 - 5785MHz	16	16	Radiated Emissions, 1 - 40 GHz	FCC Part 15.209 / 15.247(c)	50.1 dBμV/m @ 7713.3 MHz (-3.9 dB)
	n20	157 - 5785MHz	16	16	Radiated Emissions, 1 - 40 GHz	FCC Part 15.209 / 15.247(c)	51.3 dBμV/m @ 7713.3 MHz (-2.7 dB)
	n40	159 - 5795MHz	16	16	Radiated Emissions, 1 - 40 GHz	FCC Part 15.209 / 15.247(c)	51.1 dBμV/m @ 7726.7 MHz (-2.9 dB)
Measurements on low and high channels in worst-case OFDM mode.							
2	n20	149 - 5745MHz	16	16	Radiated Emissions, 1 - 40 GHz	FCC Part 15.209 / 15.247(c)	50.8 dBμV/m @ 7660.0 MHz (-3.2 dB)
	n20	165 - 5825MHz	16	16	Radiated Emissions, 1 - 40 GHz	FCC Part 15.209 / 15.247(c)	49.5 dBμV/m @ 11649.8 MHz (-4.5 dB)

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	Vocera Communications	Job Number:	J94614
Model:	Northstar (1x1 802.11abgn + BT)	T-Log Number:	T94631
Contact:	Rob Holt	Project Manager:	Christine Krebill
Standard:	FCC 15.247/15.E/RSS-210	Project Coordinator:	Irene Rademacher
		Class:	N/A

Sample Notes

Sample S/N: 3E
Driver: M3X14447

Notes

Device is handheld. Evaluation of the fundamental field strength at CH157, 11a mode was performed thru three orientation to determine worst case orientation. All spurious measurements were performed in this orientation.

Procedure Comments:

Measurements performed in accordance with FCC KDB 558074

Peak measurements performed with: RBW=1MHz, VBW=3MHz, peak detector, max hold, auto sweep time

Unless otherwise stated/noted, emission has duty cycle $\geq 98\%$ and was measured using RBW=1MHz, VBW=10Hz, peak detector, linear average mode, auto sweep time, max hold.

5.8 GHz band reject filter used

Preliminary testing below 1GHz showed no radio related emissions

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
11a	6Mb/s	100.00	-	-	0	0	-
n20	MCS0	100.00	-	-	0	0	-
n40	MCS0	100.00	-	-	0	0	-

Measurement Specific Notes:

Note 1:	Emission in non-restricted band, but limit of 15.209 used.
Note 2:	Emission in non-restricted band, the limit was set 30dB below the level of the fundamental and measured in 100kHz.
Note 2:	Emission has duty cycle $\geq 98\%$, average measurement performed: RBW=1MHz, VBW=3MHz, RMS, Power averaging, auto sweep, trace average 100 traces
Note 3:	Emission has duty cycle $< 98\%$, but constant, average measurement performed: RBW=1MHz, VBW=10Hz, peak detector, linear averaging, auto sweep, trace average 100 traces, measurement corrected by Linear Voltage correction factor
Note 4:	Emission has duty cycle $< 98\%$ and is NOT constant, average measurement performed: RBW=1MHz, VBW $> 1/T$, peak detector, linear average mode, sweep time auto, max hold. Max hold for $50 \cdot (1/DC)$ traces
Note 5:	Emission has duty cycle $< 98\%$, but constant, average measurement performed: RBW=1MHz, VBW=3MHz, RMS, Power averaging, auto sweep, trace average 100 traces, measurement corrected by Pwr correction factor
Note 6:	Plots of the average and peak bandedge do not account for any duty cycle correction. Refer to the tabular results for final measurements.

Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A

Run #1: Radiated Spurious Emissions, 1,000 - 40000 MHz. Operating Mode: Determination of worse case OFDM mode

Date of Test: 6/6/2014 0:00

Config. Used: 1

Test Engineer: Deniz Demirci

Config Change: none

Test Location: FT Ch#4

EUT Voltage: Battery Operated

Run #1a: Center Channel

Channel: 157

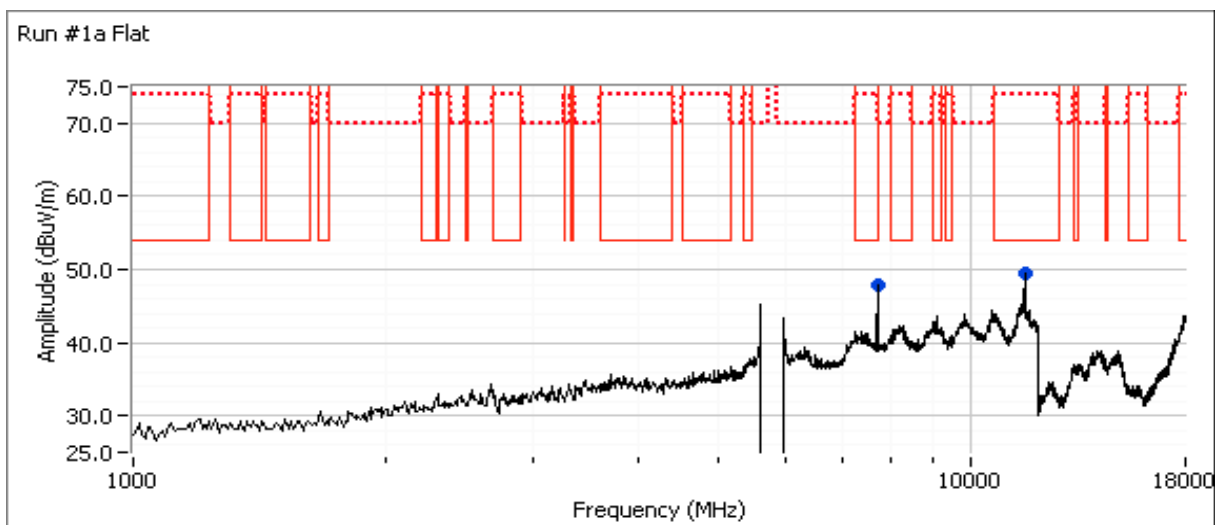
Mode: a

Orientation: Flat

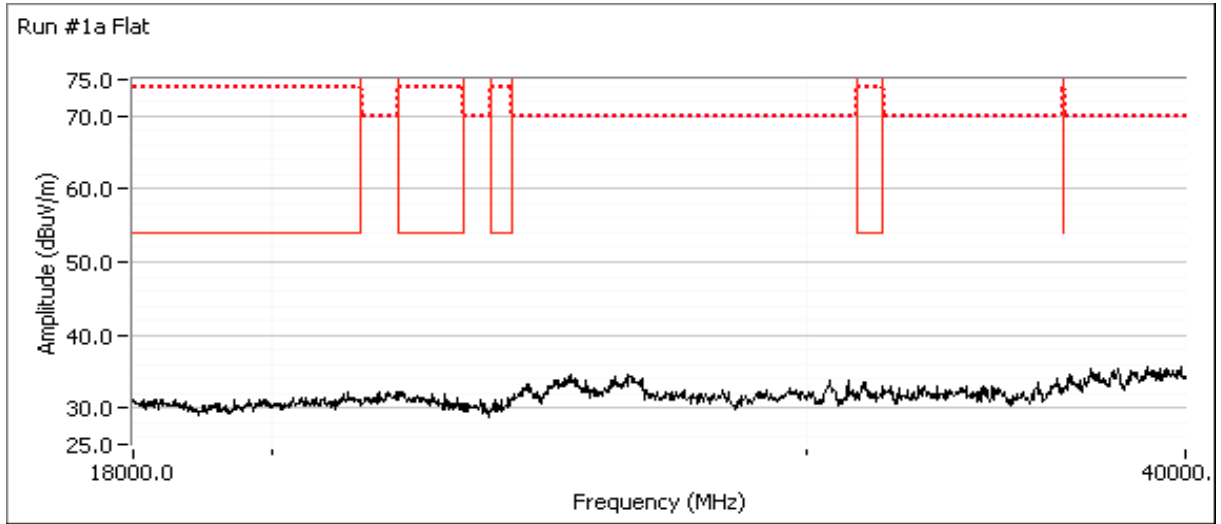
Tx Chain: Main

Data Rate: 6Mb/s

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
7713.350	49.2	H	54.0	-4.8	AVG	41	1.0	RB 1 MHz;VB 10 Hz;Peak
7713.490	55.5	H	74.0	-18.5	PK	41	1.0	RB 1 MHz;VB 3 MHz;Peak
11570.060	47.7	H	54.0	-6.3	AVG	289	1.4	RB 1 MHz;VB 10 Hz;Peak
11568.040	59.9	H	74.0	-14.1	PK	289	1.4	RB 1 MHz;VB 3 MHz;Peak
7713.340	50.1	V	54.0	-3.9	AVG	78	1.8	RB 1 MHz;VB 10 Hz;Peak
7713.390	56.2	V	74.0	-17.8	PK	78	1.8	RB 1 MHz;VB 3 MHz;Peak
11569.060	42.1	V	54.0	-11.9	AVG	274	1.6	RB 1 MHz;VB 10 Hz;Peak
11572.640	55.0	V	74.0	-19.0	PK	274	1.6	RB 1 MHz;VB 3 MHz;Peak



Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A

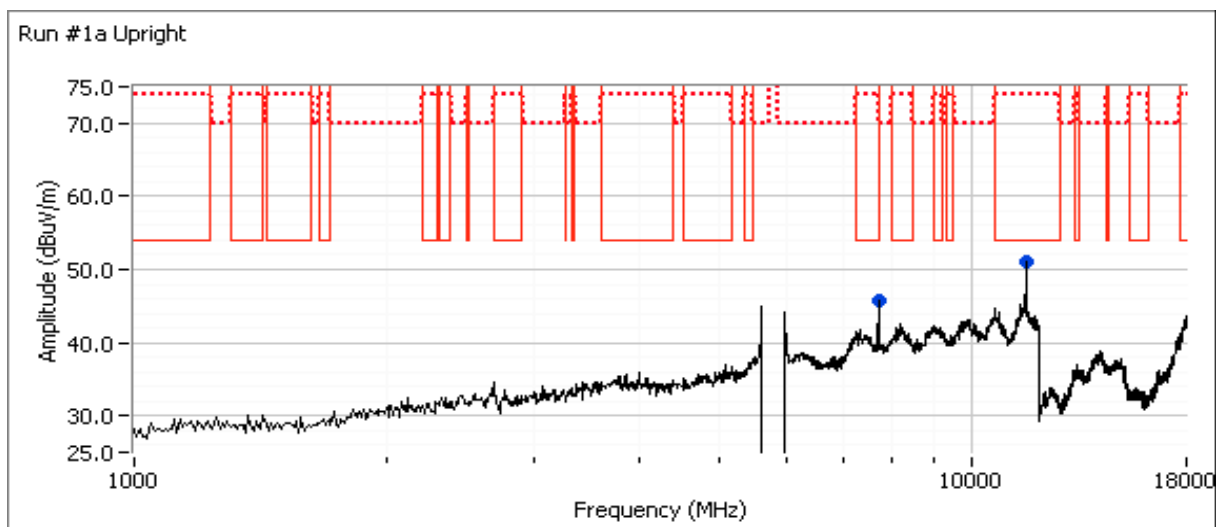


Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A

Channel: 157 Mode: a Orientation: Upright
Tx Chain: Main Data Rate: 6Mb/s

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
7713.320	47.2	V	54.0	-6.8	AVG	180	1.1	RB 1 MHz;VB 10 Hz;Peak
7713.500	54.5	V	74.0	-19.5	PK	180	1.1	RB 1 MHz;VB 3 MHz;Peak
7713.350	46.1	H	54.0	-7.9	AVG	127	1.5	RB 1 MHz;VB 10 Hz;Peak
7713.560	54.4	H	74.0	-19.6	PK	127	1.5	RB 1 MHz;VB 3 MHz;Peak
11570.200	46.5	V	54.0	-7.5	AVG	360	1.0	RB 1 MHz;VB 10 Hz;Peak
11568.470	57.9	V	74.0	-16.1	PK	360	1.0	RB 1 MHz;VB 3 MHz;Peak

Note: Scans made between 18 - 40 GHz with the measurement antenna moved around the card and its antennas 20-50cm from the device indicated there were no significant emissions in this frequency range

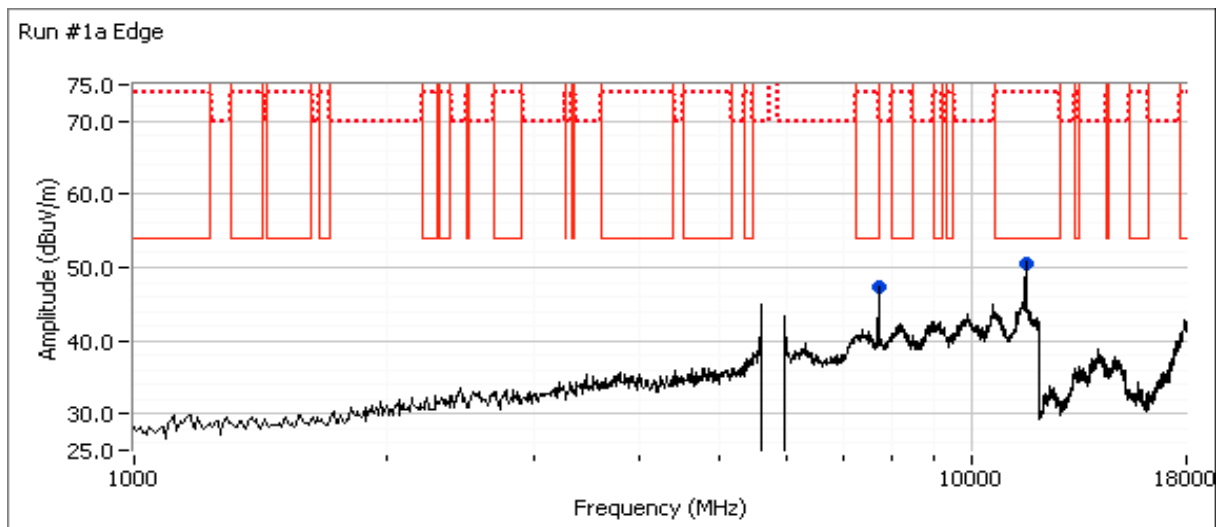


Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A

Channel: 157 Mode: a Orientation: Edge
 Tx Chain: Main Data Rate: 6Mb/s

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
7713.340	49.4	H	54.0	-4.6	AVG	146	1.0	RB 1 MHz;VB 10 Hz;Peak
7713.500	55.3	H	74.0	-18.7	PK	146	1.0	RB 1 MHz;VB 3 MHz;Peak
7713.370	49.9	V	54.0	-4.1	AVG	53	1.7	RB 1 MHz;VB 10 Hz;Peak
7713.250	55.9	V	74.0	-18.1	PK	53	1.7	RB 1 MHz;VB 3 MHz;Peak
11570.070	47.2	H	54.0	-6.8	AVG	23	1.3	RB 1 MHz;VB 10 Hz;Peak
11569.940	59.4	H	74.0	-14.6	PK	23	1.3	RB 1 MHz;VB 3 MHz;Peak
11570.230	44.9	V	54.0	-9.1	AVG	52	1.6	RB 1 MHz;VB 10 Hz;Peak
11570.150	57.2	V	74.0	-16.8	PK	52	1.6	RB 1 MHz;VB 3 MHz;Peak

Note: Scans made between 18 - 40 GHz with the measurement antenna moved around the card and its antennas 20-50cm from the device indicated there were no significant emissions in this frequency range



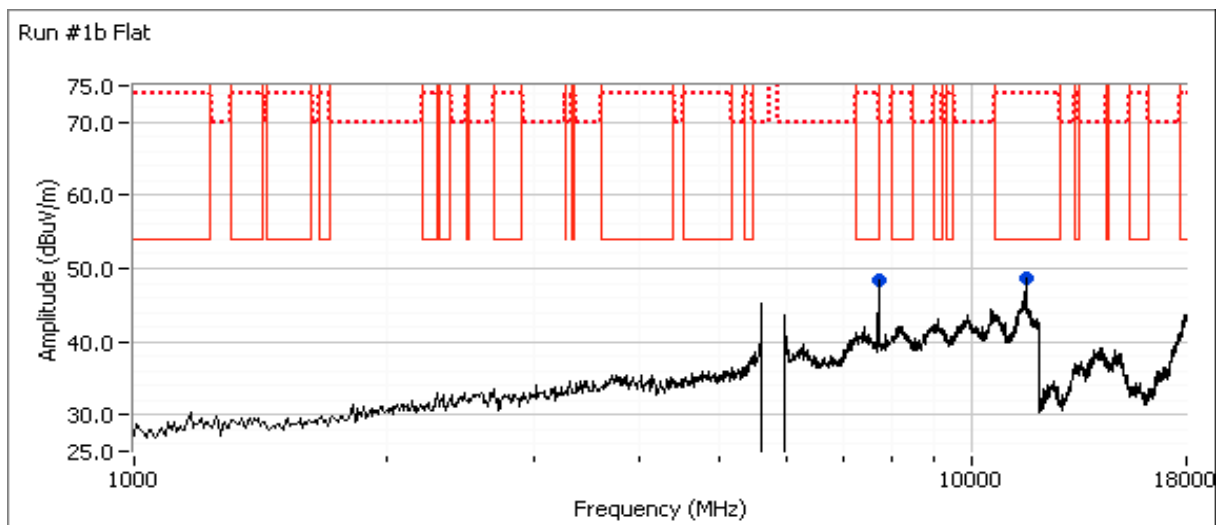
Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A

Run #1b: Center Channel

Channel: 157 Mode: n20 Orientation: Flat
 Tx Chain: Main Data Rate: MCS0

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
7713.330	51.3	V	54.0	-2.7	AVG	74	1.7	RB 1 MHz;VB 10 Hz;Peak
7713.190	56.7	V	74.0	-17.3	PK	74	1.7	RB 1 MHz;VB 3 MHz;Peak
7713.340	51.2	H	54.0	-2.8	AVG	33	0.9	RB 1 MHz;VB 10 Hz;Peak
7713.490	57.2	H	74.0	-16.8	PK	33	0.9	RB 1 MHz;VB 3 MHz;Peak
11570.030	45.8	V	54.0	-8.2	AVG	20	1.4	RB 1 MHz;VB 10 Hz;Peak
11569.150	58.8	V	74.0	-15.2	PK	20	1.4	RB 1 MHz;VB 3 MHz;Peak
11569.910	43.2	H	54.0	-10.8	AVG	54	1.7	RB 1 MHz;VB 10 Hz;Peak
11569.180	55.4	H	74.0	-18.6	PK	54	1.7	RB 1 MHz;VB 3 MHz;Peak

Note: Scans made between 18 - 40 GHz with the measurement antenna moved around the card and its antennas 20-50cm from the device indicated there were no significant emissions in this frequency range



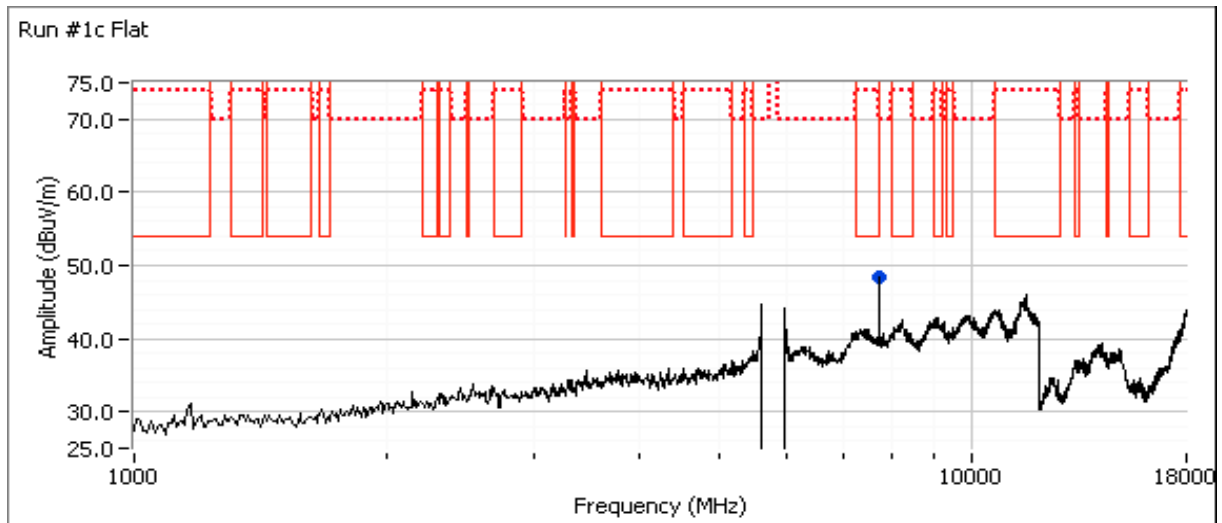
Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A

Run #1c: Center Channel

Channel: 159 Mode: n40 Orientation: Flat
 Tx Chain: Main Data Rate: MCS0

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
7726.660	51.1	V	54.0	-2.9	AVG	252	2.0	RB 1 MHz;VB 10 Hz;Peak
7726.690	57.7	V	74.0	-16.3	PK	252	2.0	RB 1 MHz;VB 3 MHz;Peak
7726.660	50.5	H	54.0	-3.5	AVG	218	1.4	RB 1 MHz;VB 10 Hz;Peak
7726.690	56.7	H	74.0	-17.3	PK	218	1.4	RB 1 MHz;VB 3 MHz;Peak

Note: Scans made between 18 - 40 GHz with the measurement antenna moved around the card and its antennas 20-50cm from the device indicated there were no significant emissions in this frequency range



Client:	Vocera Communications	Job Number:	J94614
Model:	Northstar (1x1 802.11abgn + BT)	T-Log Number:	T94631
Contact:	Rob Holt	Project Manager:	Christine Krebill
Standard:	FCC 15.247/15.E/RSS-210	Project Coordinator:	Irene Rademacher
		Class:	N/A

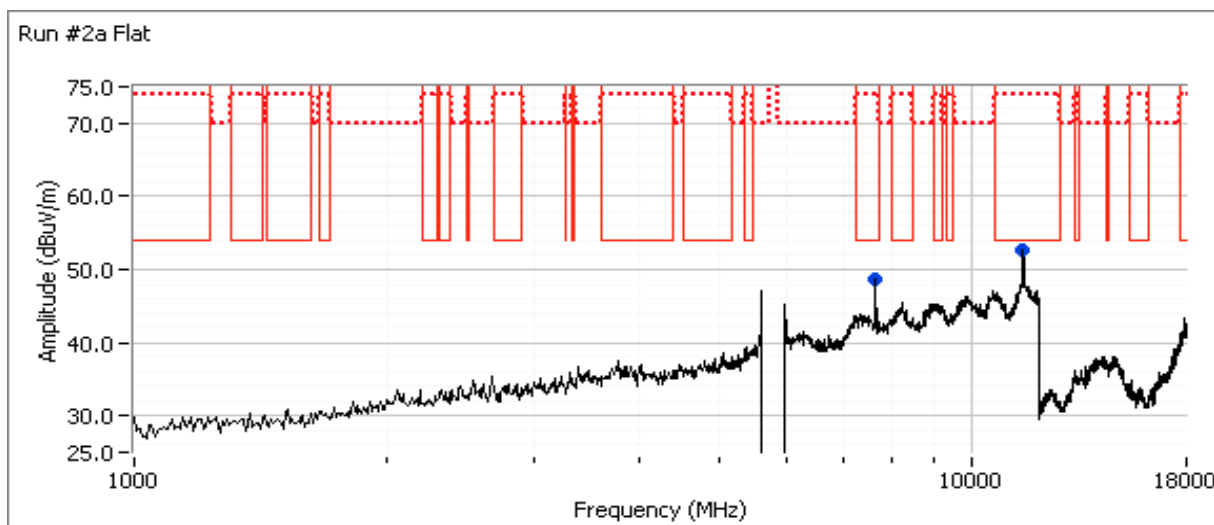
Run #2: Radiated Spurious Emissions, 1,000 - 40000 MHz. Operating Mode: Worse case from Run #1

Run #2a: Low Channel

Channel: 149 Mode: n20 Orientation: Flat
 Tx Chain: Main Data Rate: MCS0

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
7659.980	50.8	V	54.0	-3.2	AVG	74	1.7	RB 1 MHz;VB 10 Hz;Peak
7660.110	55.8	V	74.0	-18.2	PK	74	1.7	RB 1 MHz;VB 3 MHz;Peak
7660.000	48.7	H	54.0	-5.3	AVG	37	1.0	RB 1 MHz;VB 10 Hz;Peak
7660.170	54.8	H	74.0	-19.2	PK	37	1.0	RB 1 MHz;VB 3 MHz;Peak
11489.800	48.8	V	54.0	-5.2	AVG	73	1.1	RB 1 MHz;VB 10 Hz;Peak
11488.670	61.1	V	74.0	-12.9	PK	73	1.1	RB 1 MHz;VB 3 MHz;Peak
11489.870	47.3	H	54.0	-6.7	AVG	350	1.7	RB 1 MHz;VB 10 Hz;Peak
11494.530	59.6	H	74.0	-14.4	PK	350	1.7	RB 1 MHz;VB 3 MHz;Peak

Note: Scans made between 18 - 40 GHz with the measurement antenna moved around the card and its antennas 20-50cm from the device indicated there were no significant emissions in this frequency range



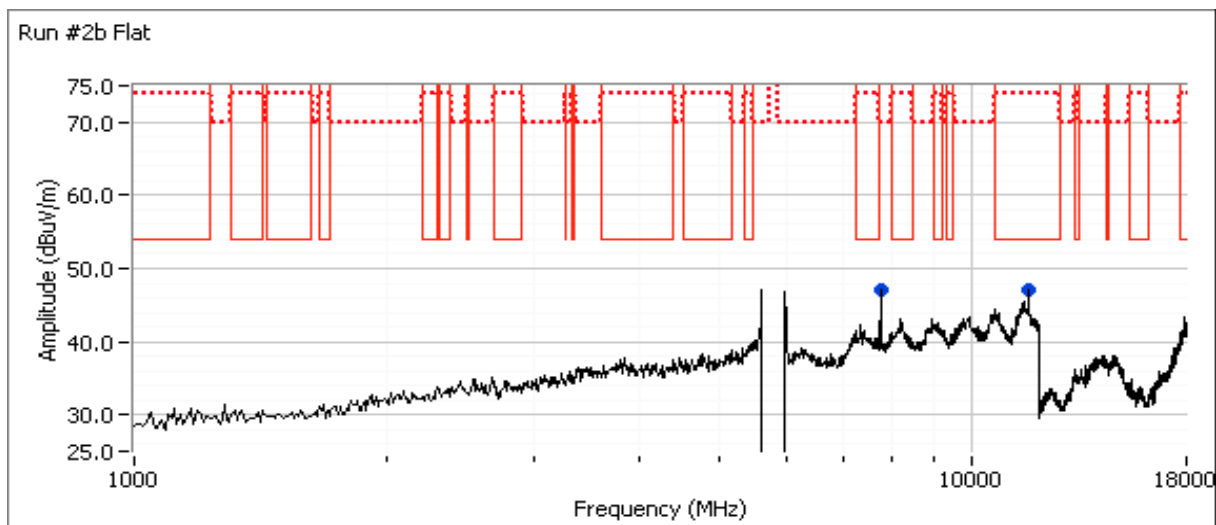
Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A

Run #2b: High Channel

Channel: 165 Mode: n20 Orientation: Flat
Tx Chain: Main Data Rate: MCS0

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
11649.800	49.5	V	54.0	-4.5	AVG	75	1.4	RB 1 MHz;VB 10 Hz;Peak
11649.470	61.9	V	74.0	-12.1	PK	75	1.4	RB 1 MHz;VB 3 MHz;Peak
11649.920	48.1	H	54.0	-5.9	AVG	351	1.6	RB 1 MHz;VB 10 Hz;Peak
11648.080	60.7	H	74.0	-13.3	PK	351	1.6	RB 1 MHz;VB 3 MHz;Peak
7766.690	48.8	H	54.0	-5.2	AVG	39	1.0	Note 1
7766.750	54.6	H	74.0	-19.4	PK	39	1.0	Note 1
7766.690	49.4	V	54.0	-4.6	AVG	85	1.8	Note 1
7766.580	55.9	V	74.0	-18.1	PK	85	1.8	Note 1

Note: Scans made between 18 - 40 GHz with the measurement antenna moved around the card and its antennas 20-50cm from the device indicated there were no significant emissions in this frequency range



Client:	Vocera Communications	Job Number:	J94614
Model:	Northstar (1x1 802.11abgn + BT)	T-Log Number:	T94631
Contact:	Rob Holt	Project Manager:	Christine Krebill
Standard:	FCC 15.247/15.E/RSS-210	Project Coordinator:	Irene Rademacher
		Class:	N/A

RSS 210 and FCC 15.247 (DTS) Antenna Port Measurements

Power, PSD, Bandwidth and Spurious Emissions

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 3/26/14, 4/14/14
 Test Engineer: Jack Liu
 Test Location: FT Lab # 4B / 6

Config. Used: 1
 Config Change: None
 EUT Voltage: 4.2VDC

General Test Configuration

The EUT was connected to the spectrum analyzer or power meter via a suitable attenuator. All measurements were made on a single chain.

All measurements have been corrected to allow for the external attenuators used.

Ambient Conditions:

Temperature: 24 - 25 °C
 Rel. Humidity: 39 - 40 %

Summary of Results

Run #	Pwr setting	Avg Pwr	Test Performed	Limit	Pass / Fail	Result / Margin
1	-	-	Output Power	15.247(b)	Pass	a: 12.7dBm (18.7mW) n20: 12.8dBm (18.9mW) n40: 12.9dBm (19.6mW)
2	-	-	Power spectral Density (PSD)	15.247(d)	Pass	11a: -1.5dBm/100kHz n20: -0.8 dBm/100kHz n40: -3.0dBm/100kHz
3	-	-	Minimum 6dB Bandwidth	15.247(a)	Pass	16.5 MHz
3	-	-	99% Bandwidth	RSS GEN	-	11a: 16.8MHz n20: 17.9MHz n40: 36.4 MHz
4	-	-	Spurious emissions	15.247(b)	Pass	All emissions >30dBc

Client:	Vocera Communications	Job Number:	J94614
Model:	Northstar (1x1 802.11abgn + BT)	T-Log Number:	T94631
Contact:	Rob Holt	Project Manager:	Christine Krebill
Standard:	FCC 15.247/15.E/RSS-210	Project Coordinator:	Irene Rademacher
		Class:	N/A

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Procedure Comments:

Measurements performed in accordance with FCC KDB 558074

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
11a	6Mb/s	100.00	-	-	0	0	-
n20	MCS0	100.00	-	-	0	0	-
n40	MCS0	100.00	-	-	0	0	-

Sample Notes

Sample S/N: 3C (NTS 2014-3721)

Driver: M3X14447 (a and n20)

Driver: M3X144473 FW:14.66.35.P46 (n40)

Client:	Vocera Communications	Job Number:	J94614
Model:	Northstar (1x1 802.11abgn + BT)	T-Log Number:	T94631
Contact:	Rob Holt	Project Manager:	Christine Krebill
Standard:	FCC 15.247/15.E/RSS-210	Project Coordinator:	Irene Rademacher
		Class:	N/A

Run #1: Output Power

Mode: 11a

Power Setting ²	Frequency (MHz)	Output Power		Antenna Gain (dBi)	Result	EIRP		Output Power	
		(dBm) ¹	mW			dBm	W	(dBm) ³	mW
16	5745	12.6	18.1	3.0	Pass	15.6	0.036	13.3	21.1
16	5785	12.5	17.6	3.0	Pass	15.5	0.035	13.3	21.4
16	5825	12.7	18.7	3.0	Pass	15.7	0.037	13.3	21.4

Mode: n20

Power Setting ²	Frequency (MHz)	Output Power		Antenna Gain (dBi)	Result	EIRP		Output Power	
		(dBm) ¹	mW			dBm	W	(dBm) ³	mW
16	5745	12.7	18.4	3.0	Pass	15.7	0.037	13.3	21.2
16	5785	12.6	18.2	3.0	Pass	15.6	0.036	13.3	21.4
16	5825	12.8	18.9	3.0	Pass	15.8	0.038	13.3	21.4

Mode: n40

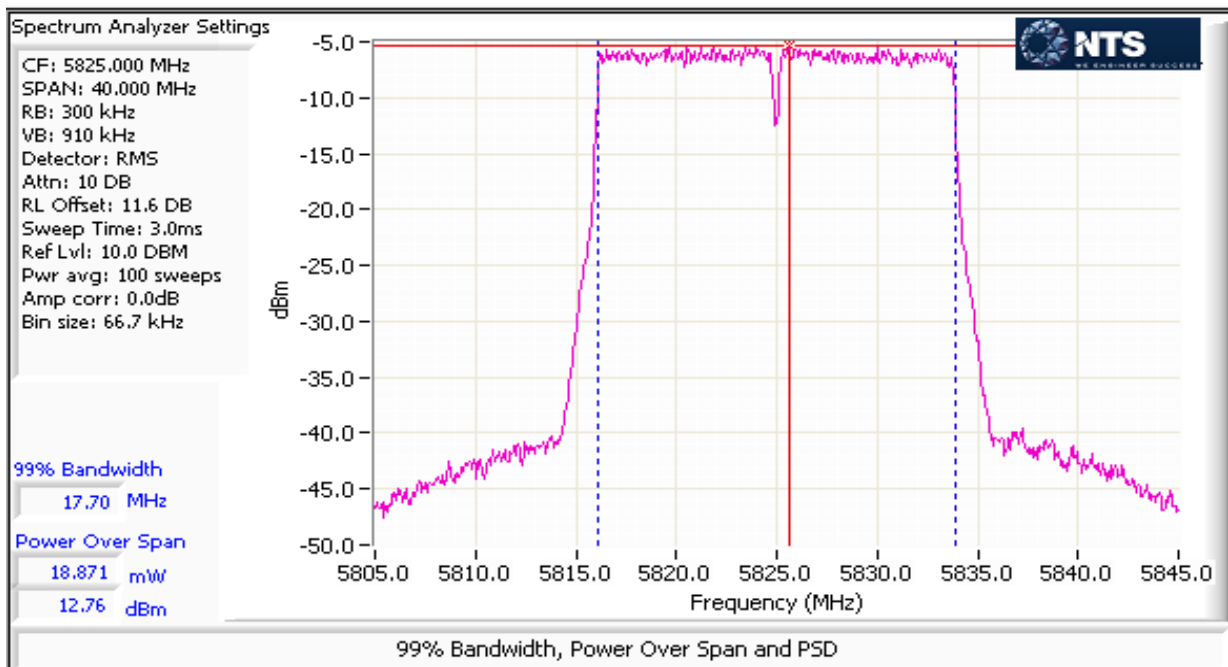
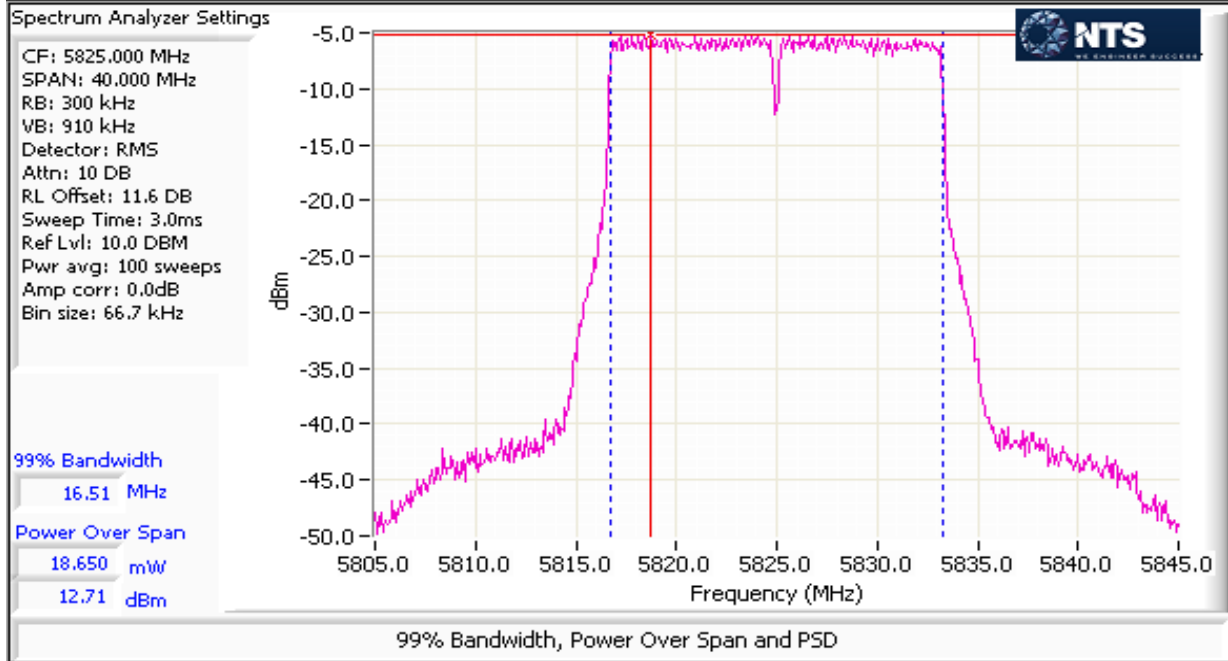
Power Setting ²	Frequency (MHz)	Output Power		Antenna Gain (dBi)	Result	EIRP		Output Power	
		(dBm) ¹	mW			dBm	W	(dBm) ³	mW
16	5755	12.5	17.8	3.0	Pass	15.5	0.036	13.1	20.4
16	5795	12.9	19.6	3.0	Pass	15.9	0.039	13.2	20.9

Note 1: Duty Cycle $\geq 98\%$. Output power measured using a spectrum analyzer (see plots below) with RBW= 1-5% of OBW, VB $\geq 3^*$ RBW, RMS detector, power averaging on, and power integration over the OBW, trace average 100 traces (option AVGSA-1, in KDB 558074). Spurious limit becomes -30dBc.

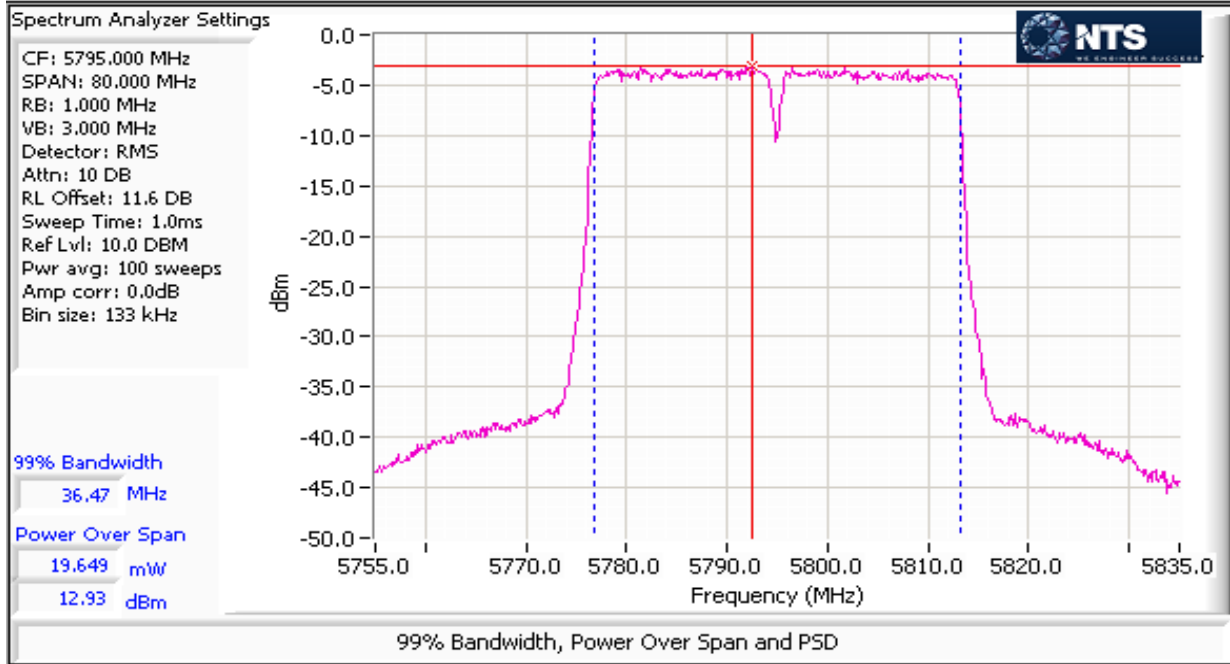
Note 2: Power setting - the software power setting used during testing, included for reference only.

Note 3: Power measured using average power meter (non-gated) and is included for reference only.

Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A



Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A



Client:	Vocera Communications	Job Number:	J94614
Model:	Northstar (1x1 802.11abgn + BT)	T-Log Number:	T94631
Contact:	Rob Holt	Project Manager:	Christine Krebill
Standard:	FCC 15.247/15.E/RSS-210	Project Coordinator:	Irene Rademacher
		Class:	N/A

Run #2: Power spectral Density

Mode: 11a

Power Setting	Frequency (MHz)	PSD	Limit dBm/3kHz	Result
		(dBm/100kHz) Note 1		
16	5745	-1.6	8.0	Pass
16	5785	-1.6	8.0	Pass
16	5825	-1.5	8.0	Pass

Mode: n20

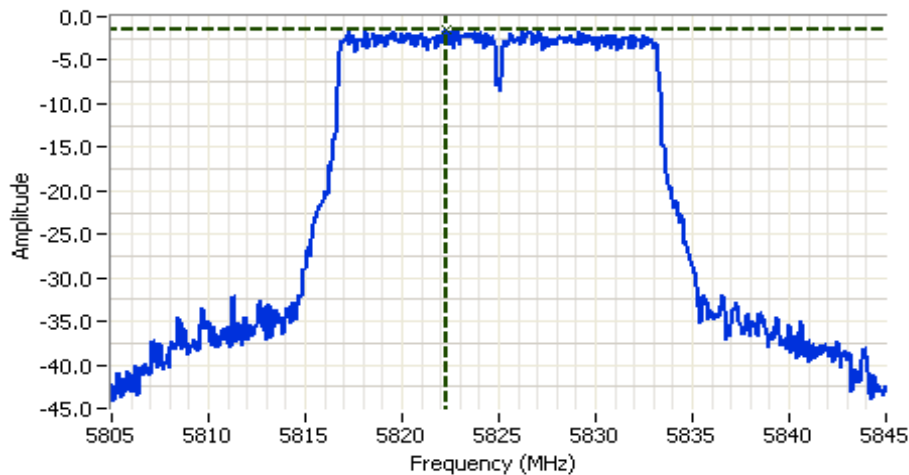
Power Setting	Frequency (MHz)	PSD	Limit dBm/3kHz	Result
		(dBm/100kHz) Note 1		
16	5745	-0.8	8.0	Pass
16	5785	-0.9	8.0	Pass
16	5825	-0.8	8.0	Pass

Mode: n40

Power Setting	Frequency (MHz)	PSD	Limit dBm/3kHz	Result
		(dBm/100kHz) Note 1		
16	5755	-3.0	8.0	Pass
16	5795	-3.8	8.0	Pass

Note 1: Test performed per method PKSPD, in KDB 558074. Power spectral density measured using: $3\text{kHz} \leq \text{RBW} \leq 100\text{kHz}$, $\text{VBW}=3*\text{RBW}$, peak detector, span => $1.5*\text{DTS BW}$, auto sweep time, max hold.

Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A



Analyzer Settings

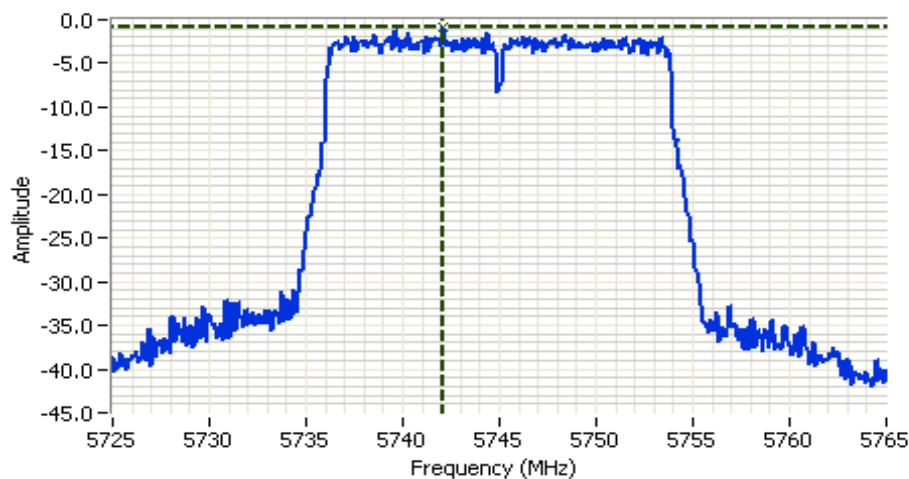
Agilent Technologies, E4446A
 CF: 5825.000 MHz
 SPAN: 40.000 MHz
 RB: 100 kHz
 VB: 300 kHz
 Detector: POS
 Attn: 10 DB
 RL Offset: 11.6 DB
 Sweep Time: 3.8ms
 Ref Lvl: 10.0 DBM

Comments

PSD: -1.47dBm/100kHz
 802.11 a

Cursor 1 5822.2667 -1.47

0.0000 0.00



Analyzer Settings

Agilent Technologies, E4446A
 CF: 5745.000 MHz
 SPAN: 40.000 MHz
 RB: 100 kHz
 VB: 300 kHz
 Detector: POS
 Attn: 10 DB
 RL Offset: 11.6 DB
 Sweep Time: 3.8ms
 Ref Lvl: 10.0 DBM

Comments

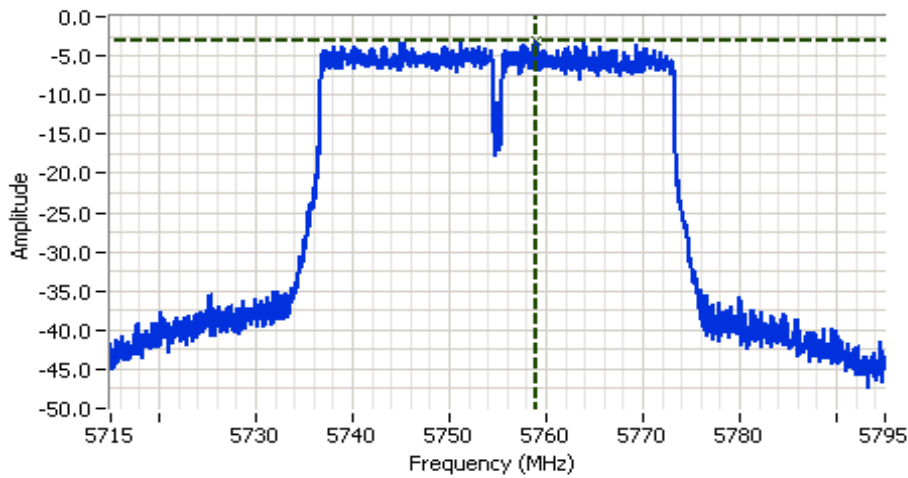
PSD: -0.79dBm/100kHz
 802.11 n20

Cursor 1 5742.1333 -0.79

0.0000 0.00



Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A



Analyzer Settings

Agilent Technologies, E4446A
 CF: 5755.000 MHz
 SPAN: 80.000 MHz
 RB: 100 kHz
 VB: 300 kHz
 Detector: POS
 Attn: 10 DB
 RL Offset: 11.6 DB
 Sweep Time: 7.8ms
 Ref Lvl: 10.0 DBM

Comments

PSD: -3.02dBm/100kHz
 802.11 n40

Cursor 1 5759.0147 -3.02

0.0000 0.00

Client:	Vocera Communications	Job Number:	J94614
Model:	Northstar (1x1 802.11abgn + BT)	T-Log Number:	T94631
Contact:	Rob Holt	Project Manager:	Christine Krebill
Standard:	FCC 15.247/15.E/RSS-210	Project Coordinator:	Irene Rademacher
		Class:	N/A

Run #3: Signal Bandwidth

Mode: 11a

Power Setting	Frequency (MHz)	Bandwidth (MHz)		RBW Setting (kHz)	
		6dB	99%	6dB	99%
16	5745	16.5	16.7	100	300
16	5785	16.5	16.8	100	300
16	5825	16.5	16.8	100	300

Mode: n20

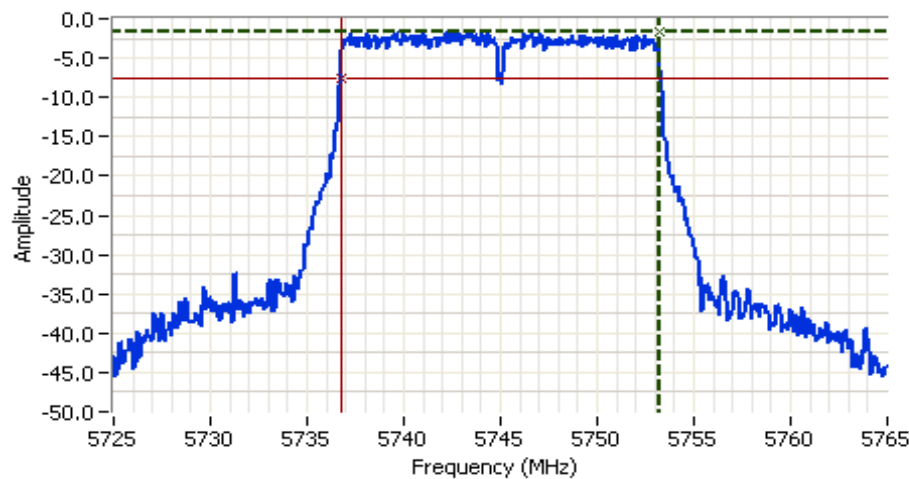
Power Setting	Frequency (MHz)	Bandwidth (MHz)		RBW Setting (kHz)	
		6dB	99%	6dB	99%
16	5745	17.7	17.9	100	300
16	5785	17.8	17.9	100	300
16	5825	17.8	17.9	100	300

Mode: n40

Power Setting	Frequency (MHz)	Bandwidth (MHz)		RBW Setting (kHz)	
		6dB	99%	6dB	99%
16	5755	36.5	36.4	100	510
16	5795	36.5	36.4	100	510

Note 1: DTS BW: RBW=100kHz, VBW $\geq 3 \times$ RBW, peak detector, max hold, auto sweep time.
 99% BW: RBW=1-5% of 99%BW, VBW $\geq 3 \times$ RBW, peak detector, max hold, auto sweep time.

Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A



Analyzer Settings

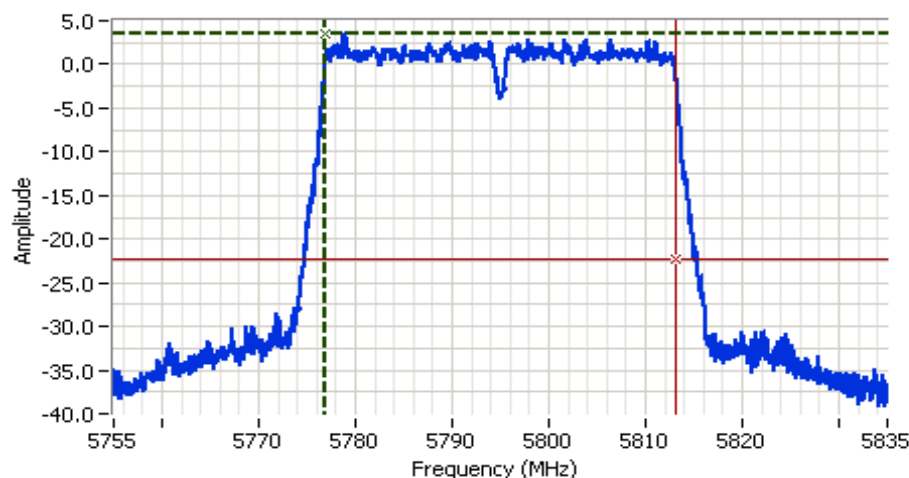
Agilent Technologies, E4446A
 CF: 5745.000 MHz
 SPAN: 40.000 MHz
 RB: 100 kHz
 VB: 300 kHz
 Detector: POS
 Attn: 10 DB
 RL Offset: 11.6 DB
 Sweep Time: 3.8ms
 Ref Lvl: 10.0 DBM

Comments

6dB BW: 16.533 MHz
 802.11 a

Cursor 1 5753.2667 -1.55
 Cursor 2 5736.7333 -7.55

Delta Freq. 16.533
 Delta Amplitude 6.00



Analyzer Settings

Agilent Technologies, E4446A
 CF: 5795.000 MHz
 SPAN: 80.000 MHz
 RB: 510 kHz
 VB: 1.500 MHz
 Detector: POS
 Attn: 10 DB
 RL Offset: 11.6 DB
 Sweep Time: 1.0ms
 Ref Lvl: 10.0 DBM

Comments

99% power BW: 36.427 MHz
 802.11 n40

Cursor 1 5776.7867 3.60
 Cursor 2 5813.2133 -22.40

Delta Freq. 36.427
 Delta Amplitude 26.00



Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A

Run #4a: Out of Band Spurious Emissions

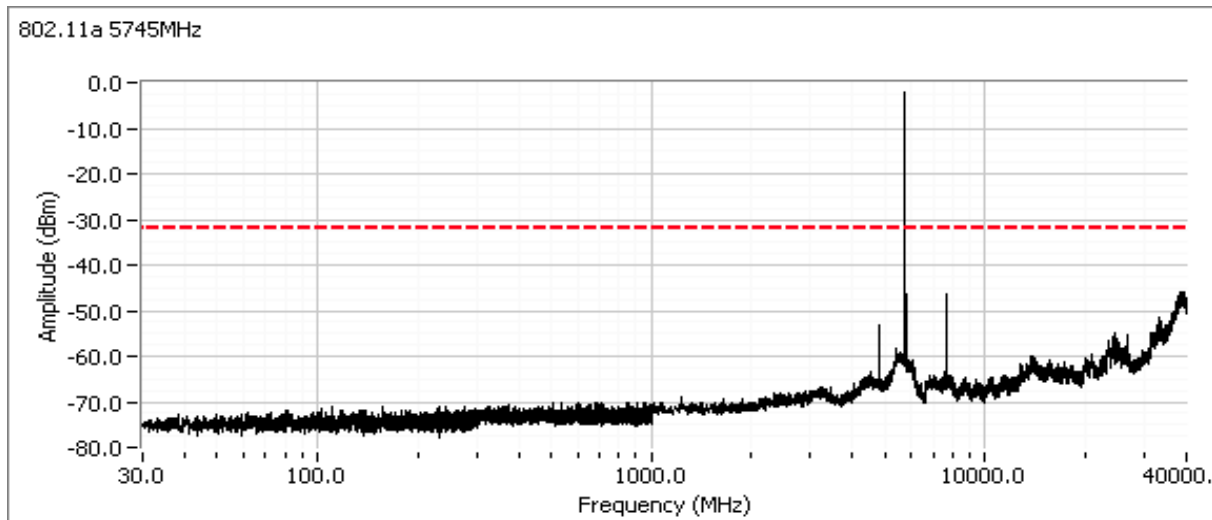
Frequency (MHz)	Power Setting	Mode	Limit	Result
5745	16	a	-30dBc	Pass
5785	16	a	-30dBc	Pass
5825	16	a	-30dBc	Pass

Frequency (MHz)	Power Setting	Mode	Limit	Result
5745	16	n20	-30dBc	Pass
5785	16	n20	-30dBc	Pass
5825	16	n20	-30dBc	Pass

Frequency (MHz)	Power Setting	Mode	Limit	Result
5755	16	n40	-30dBc	Pass
5795	16	n40	-30dBc	Pass

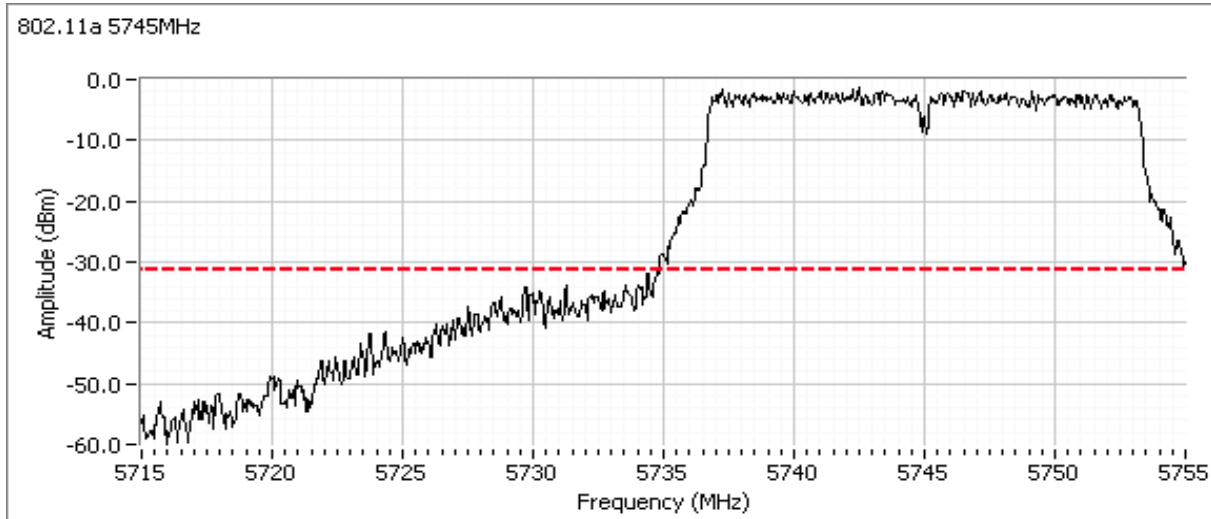
802.11 a

Plots for low channel

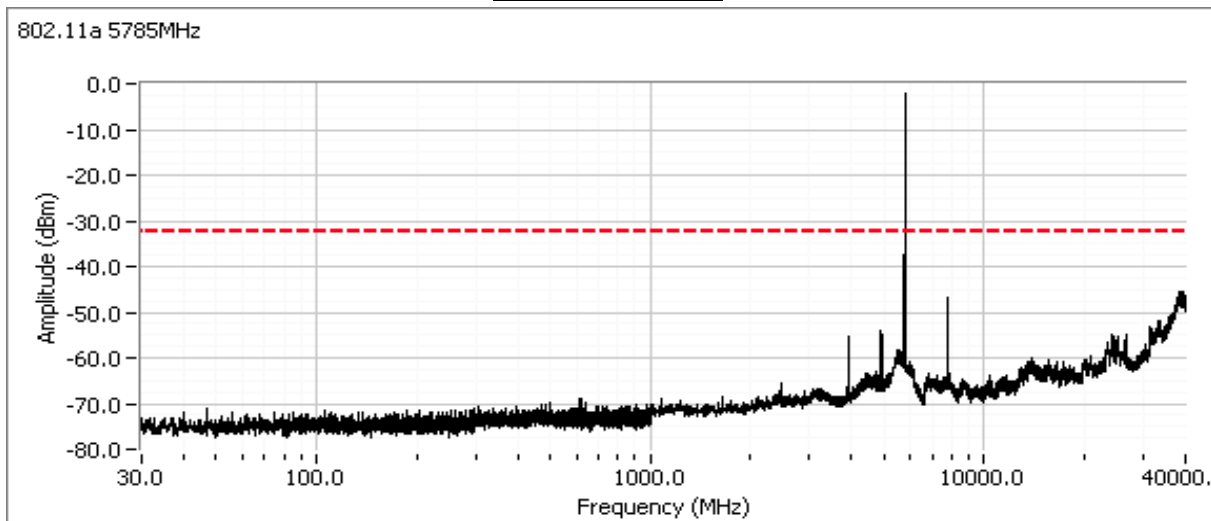


Client: Vocera Communications	Job Number: J94614
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Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A

Additional plot from 5715 - 5755 MHz showing compliance with -30dBc at the band edge.

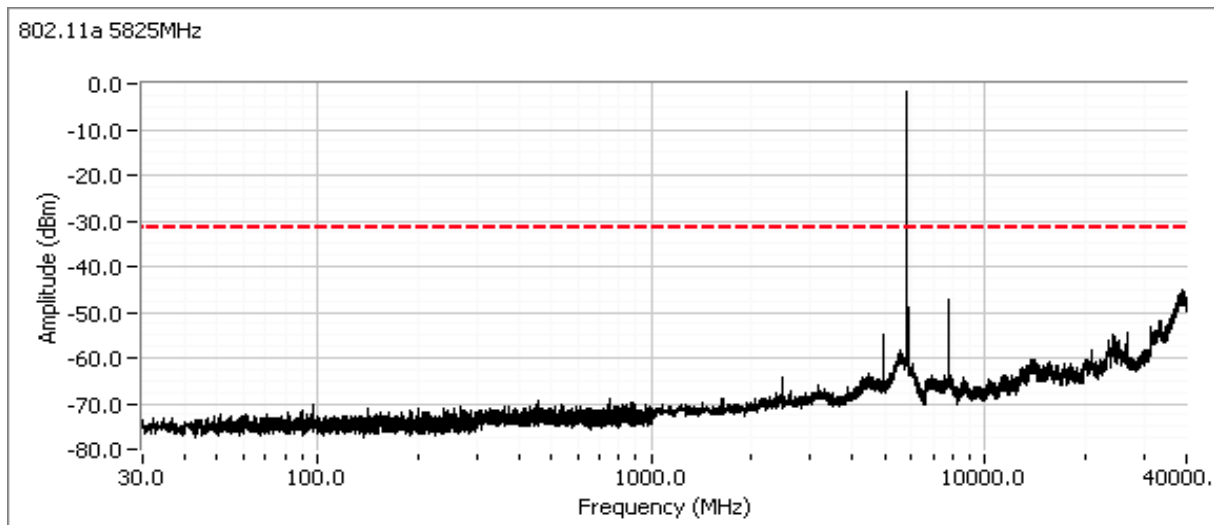


Plots for center channel

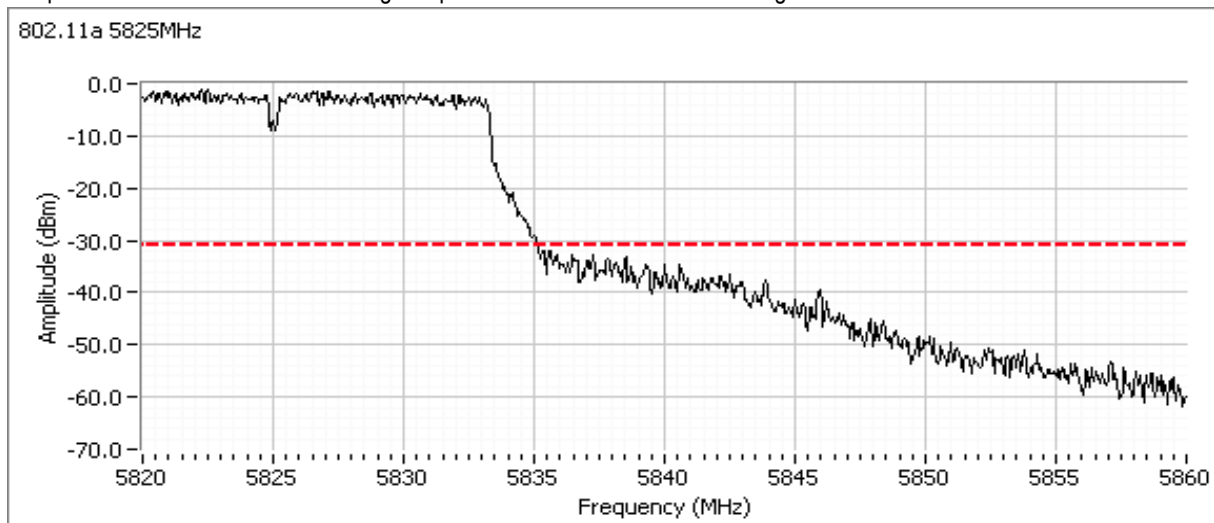


Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A

Plots for high channel



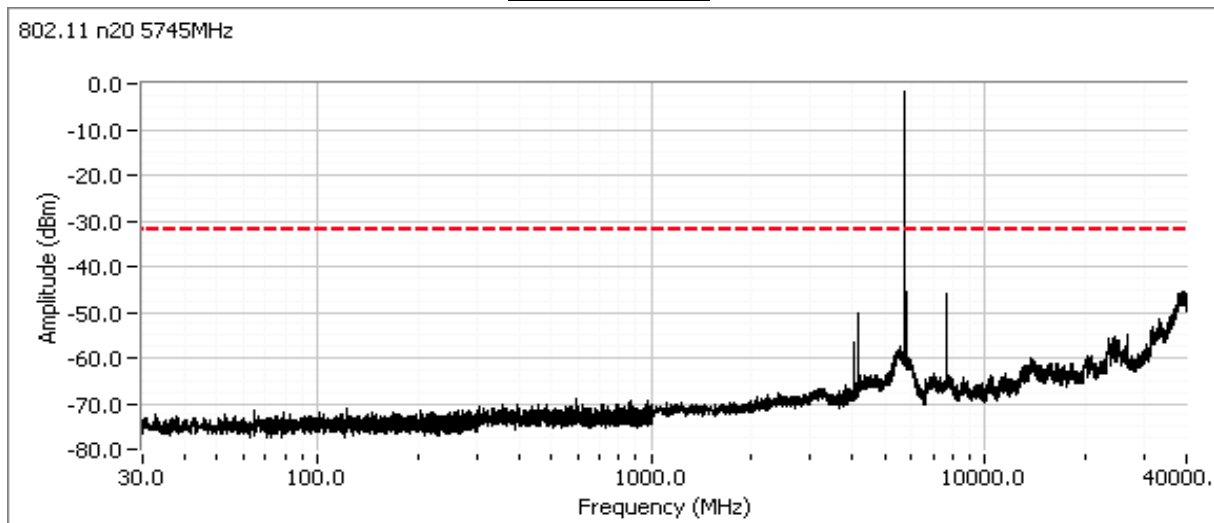
Additional plot from 5820 - 5860 MHz showing compliance with -30dBc at the band edge.



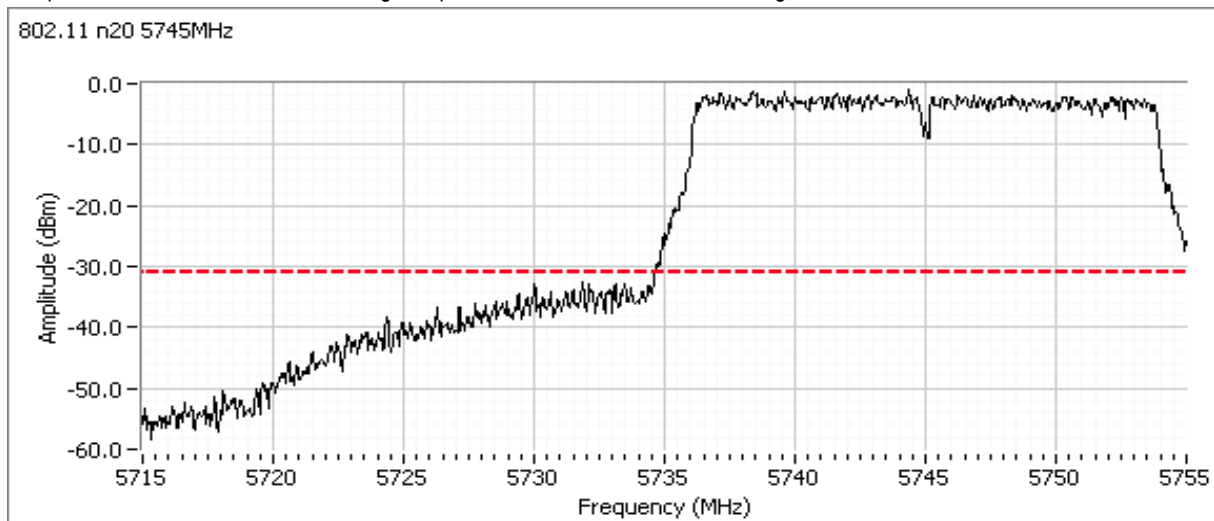
Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A

802.11 n20

Plots for low channel

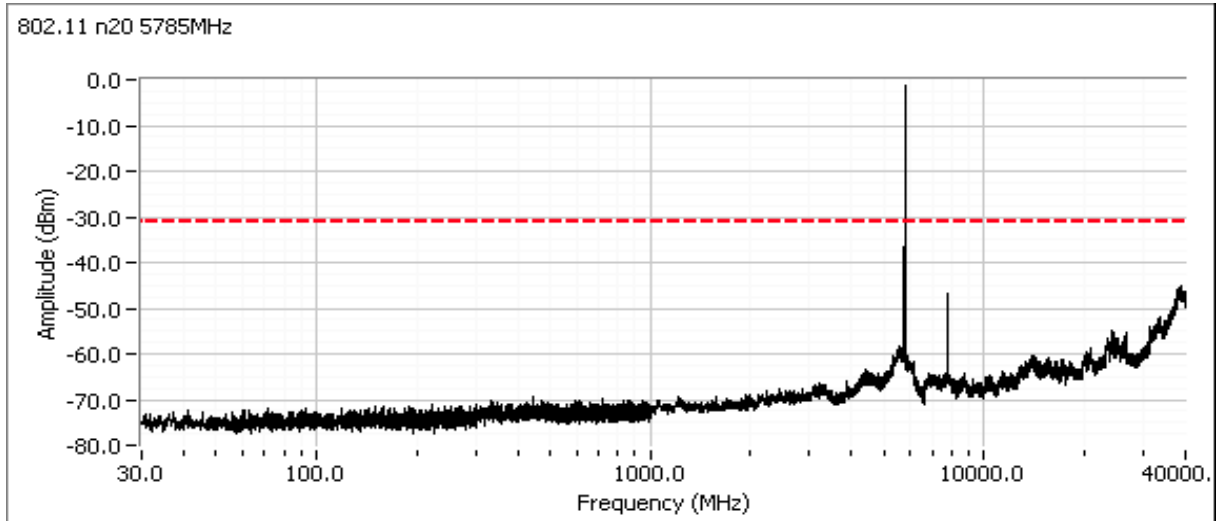


Additional plot from 5715 - 5755 MHz showing compliance with -30dBc at the band edge.

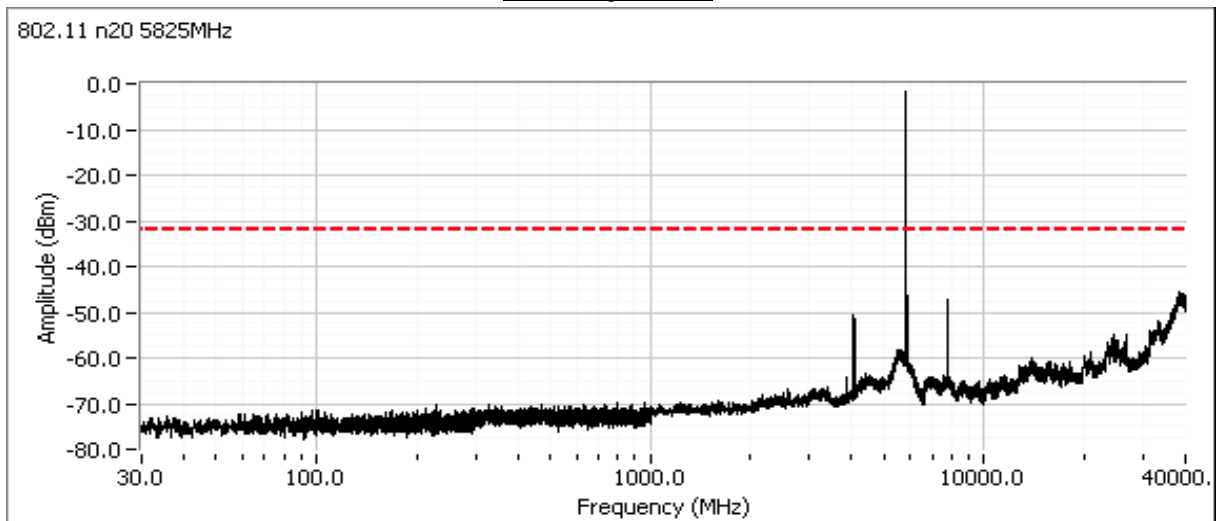


Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A

Plots for center channel

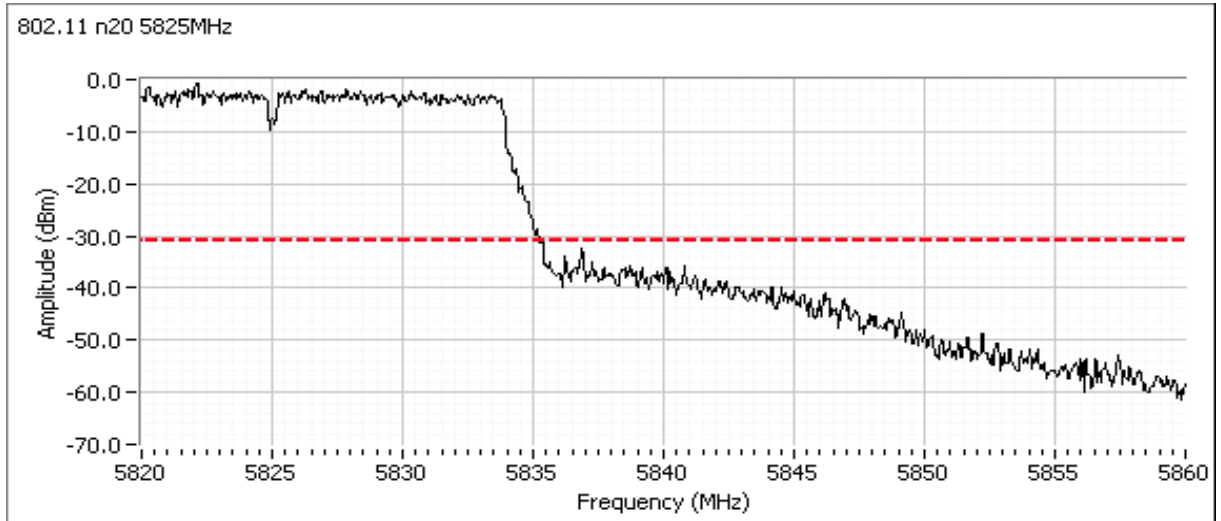


Plots for high channel



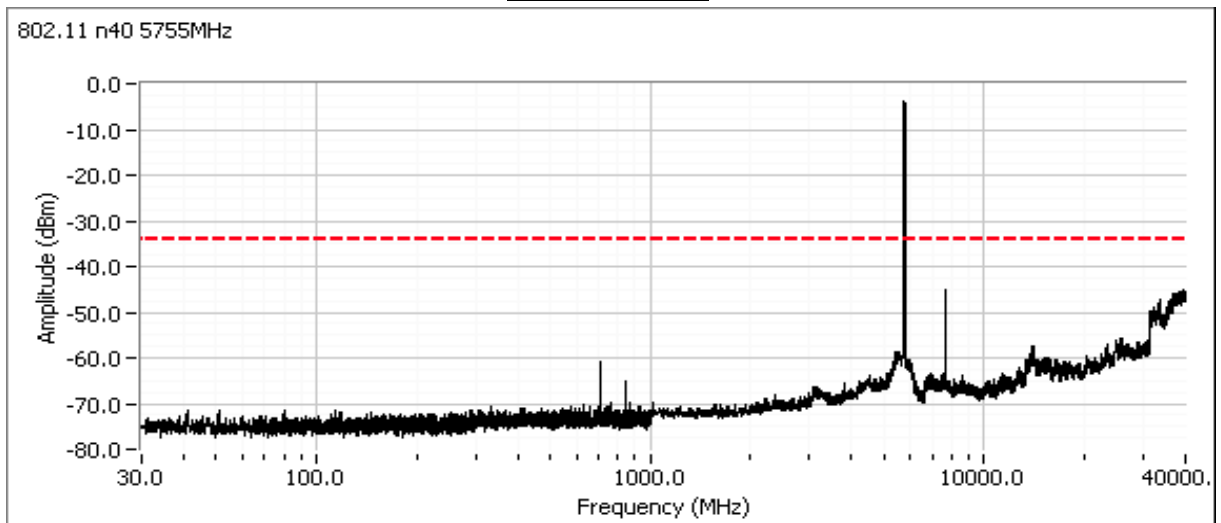
Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A

Additional plot from 5820 - 5860 MHz showing compliance with -30dBc at the band edge.



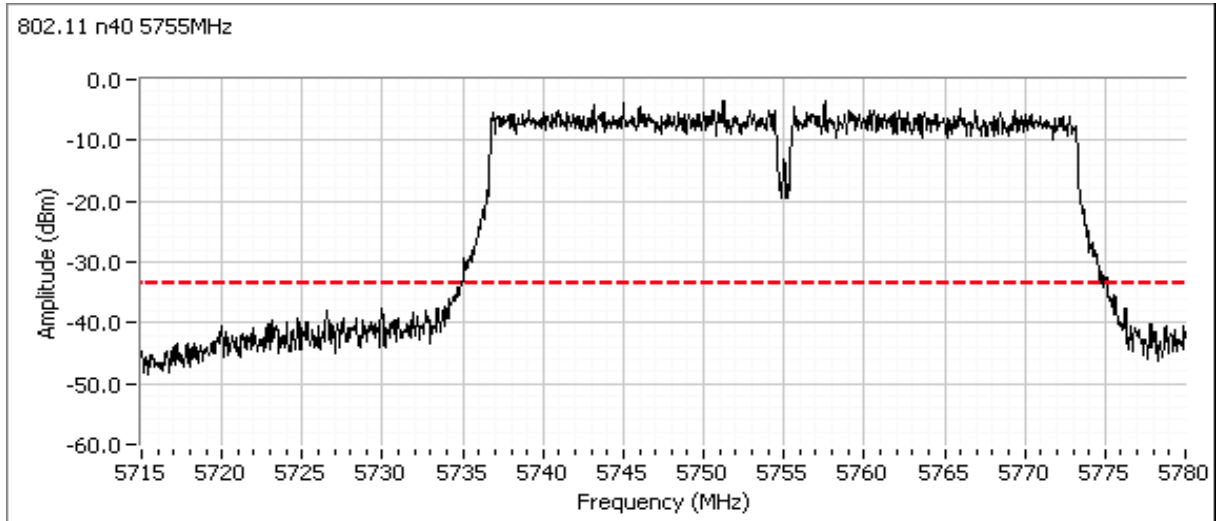
802.11 n40

Plots for low channel

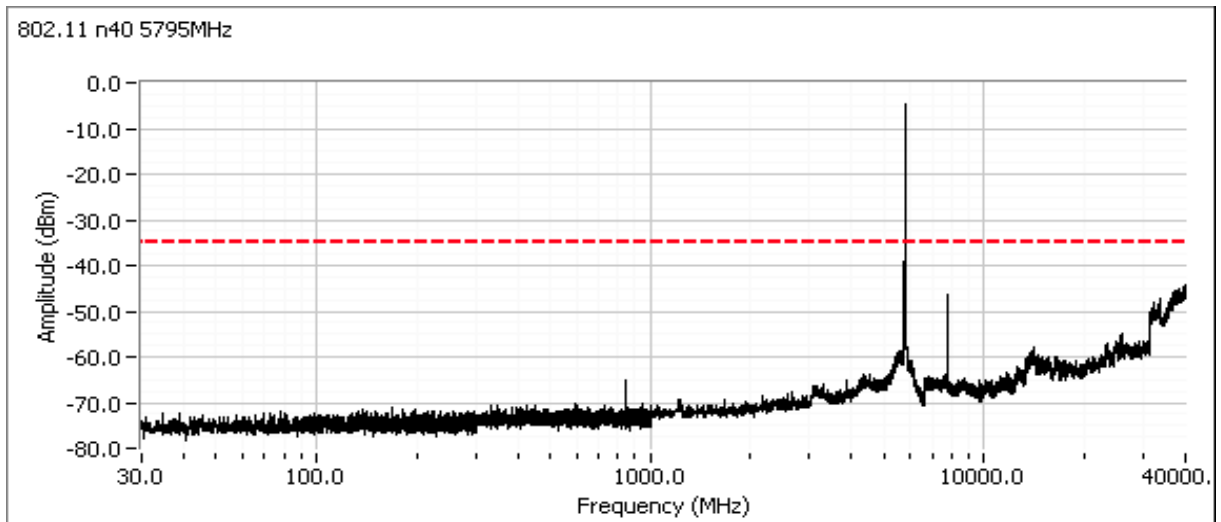


Client: Vocera Communications	Job Number: J94614
Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
Contact: Rob Holt	Project Manager: Christine Krebill
Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A

Additional plot from 5715 - 5755 MHz showing compliance with **-30dBc** at the band edge.

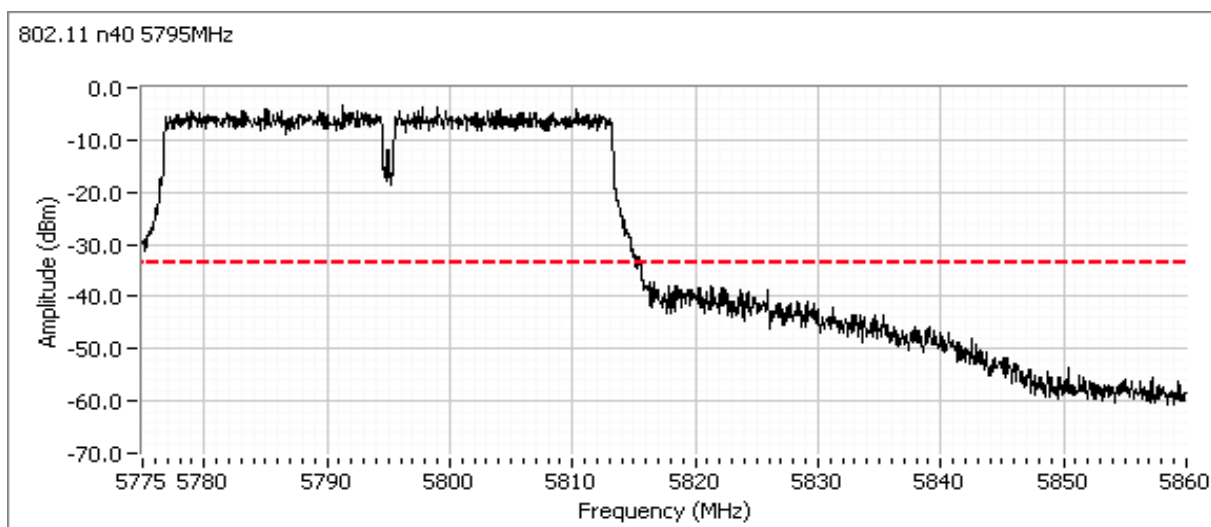


Plots for high channel



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Model: Northstar (1x1 802.11abgn + BT)	T-Log Number: T94631
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Standard: FCC 15.247/15.E/RSS-210	Project Coordinator: Irene Rademacher
	Class: N/A

Additional plot from 5820 - 5860 MHz showing compliance with **-30dBcdBc** at the band edge.



End of Report

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