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# *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 |
| APPLICANT: | Vocera Communications, Inc.<br>525 Race Street<br>San Jose, CA 95126 |
| TEST SITE(S): | National Technical Systems - Silicon Valley<br>41039 Boyce Road.<br>Fremont, CA. 94538-2435 |
| IC SITE REGISTRATION #: | 2845B-3; 2845B-4, 2845B-5, 2845B-7 |
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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)<br>11g:15.2dBm (33.1mW)<br>n20:15.1dBm (32.4mW)<br><br>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<br>11g: 1.5dBm/100kHz<br>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)<br>n20: 12.8dBm (18.9mW)<br>n40: 12.9dBm (19.6mW)<br><br>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<br>n20: -0.8 dBm/100kHz<br>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<br>11b: 13.6MHz<br>11g: 16.8MHz<br>n20: 18.0MHz<br><br>5GHz<br>11a: 16.8MHz<br>n20: 17.9MHz<br>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<br>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.

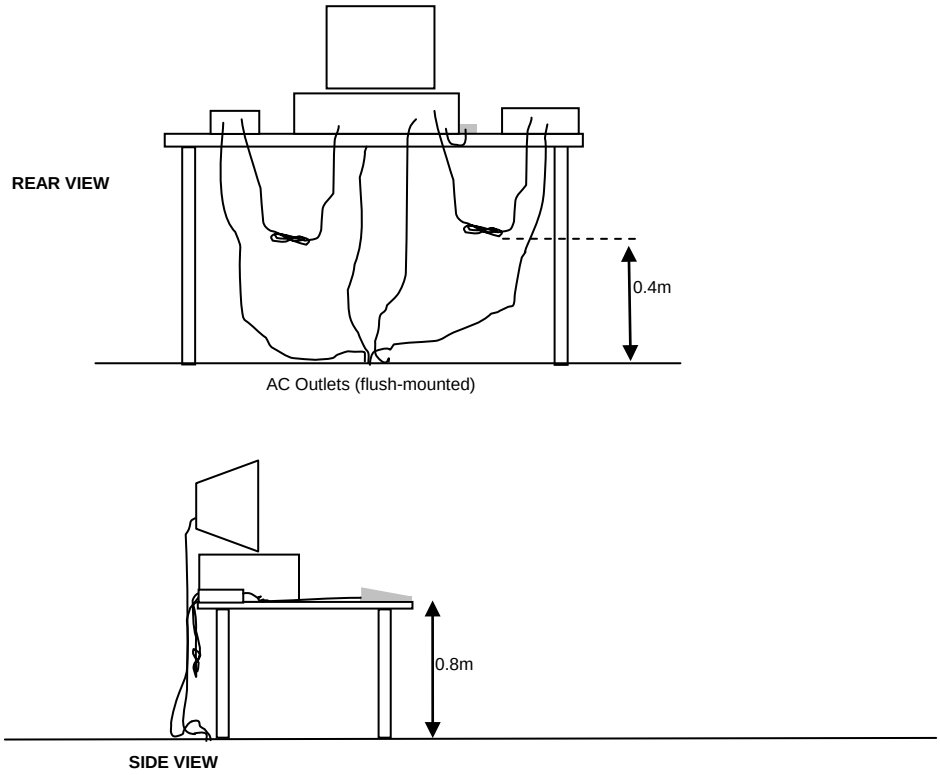
*RADIATED EMISSIONS*

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.

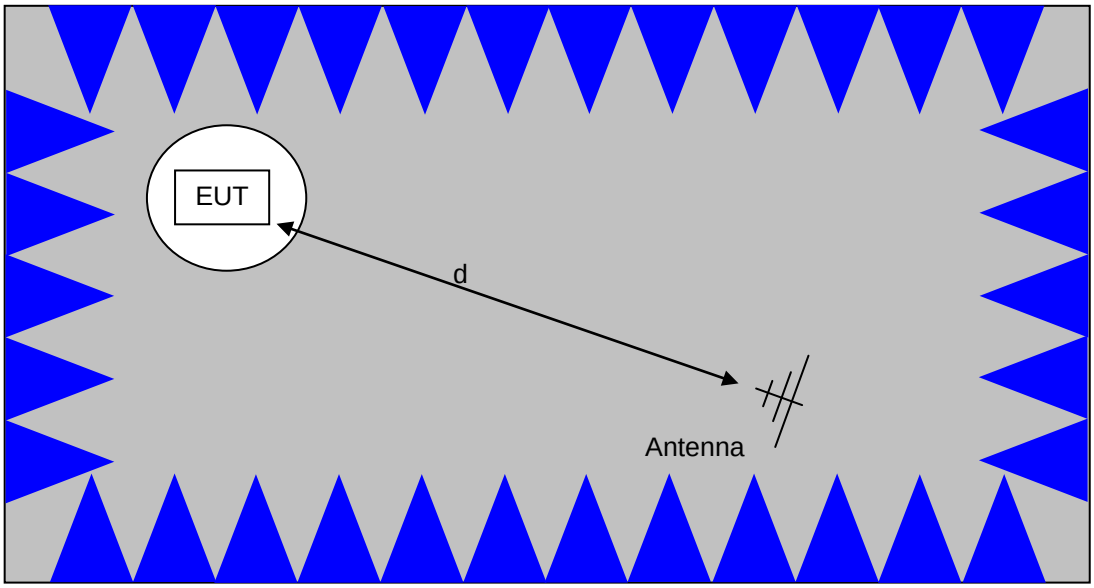
A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

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 1meter from the EUT and the antenna height is restricted to a maximum of 2.5 meters.

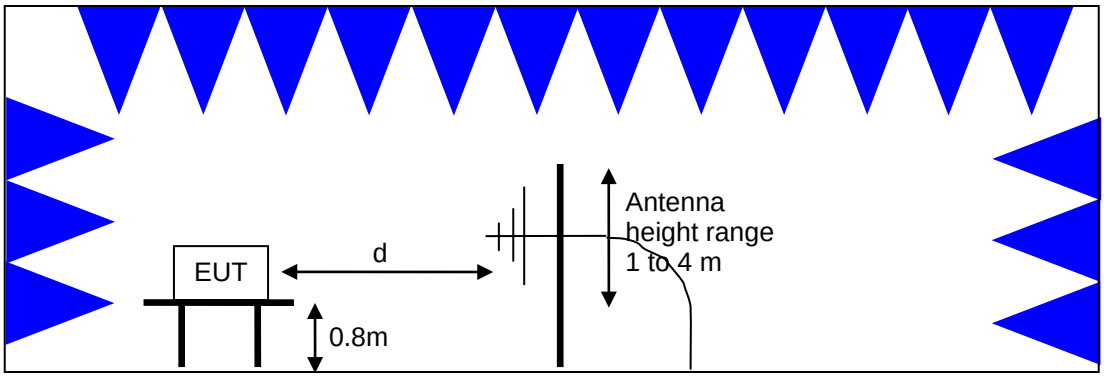



Typical Test Configuration for Radiated Field Strength Measurements




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.

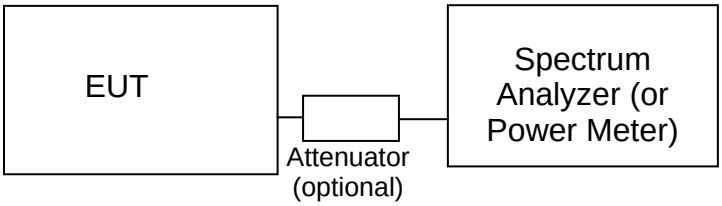
Floor-standing equipment is placed on the floor with insulating supports between the unit and the ground plane.




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 bands[1] (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 | $2400/F_{KHz}$ @ 300m | $67.6-20*\log_{10}(F_{KHz})$ @ 300m |
| 0.490-1.705 | $24000/F_{KHz}$ @ 30m | $87.6-20*\log_{10}(F_{KHz})$ @ 30m |
| 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:

$$R_r - S = M$$

where:

$R_r$ = 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

| | | | |
|---|---|---|---|
| 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 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210 | 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 redcued as the data rate increases, therefore testing was performed at the data rate in the mode wiht 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 | |

| | | | |
|---|---|---|---|
| Client: | Vocera Communications | Job Number: | J94614 |
| Model: | Northstar (1x1 802.11abgn + BT) | T-Log Number: | T94631 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210 | 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 | | <<-11ac mode only |
| 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 | | <<-11ac mode only |
| | 180 | Not supported | | <<-11ac mode only |
| 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 | | |

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 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210 | Class: | N/A |

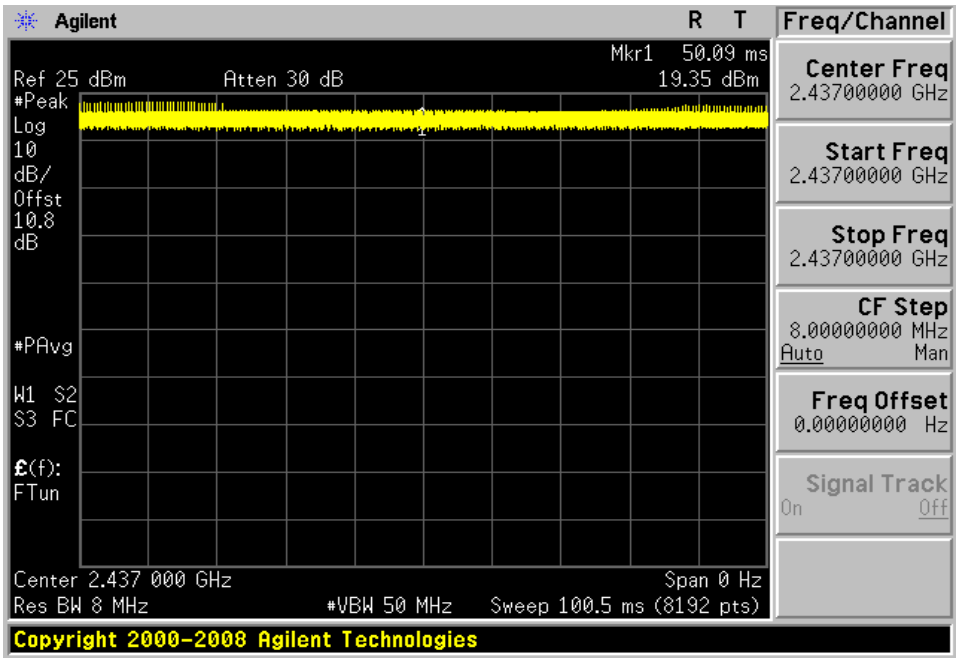
# Duty Cycle

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*log(1/x)
** Correction factor when using linear voltage average - 20*log(1/x)
T = Minimum transmission duration



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

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

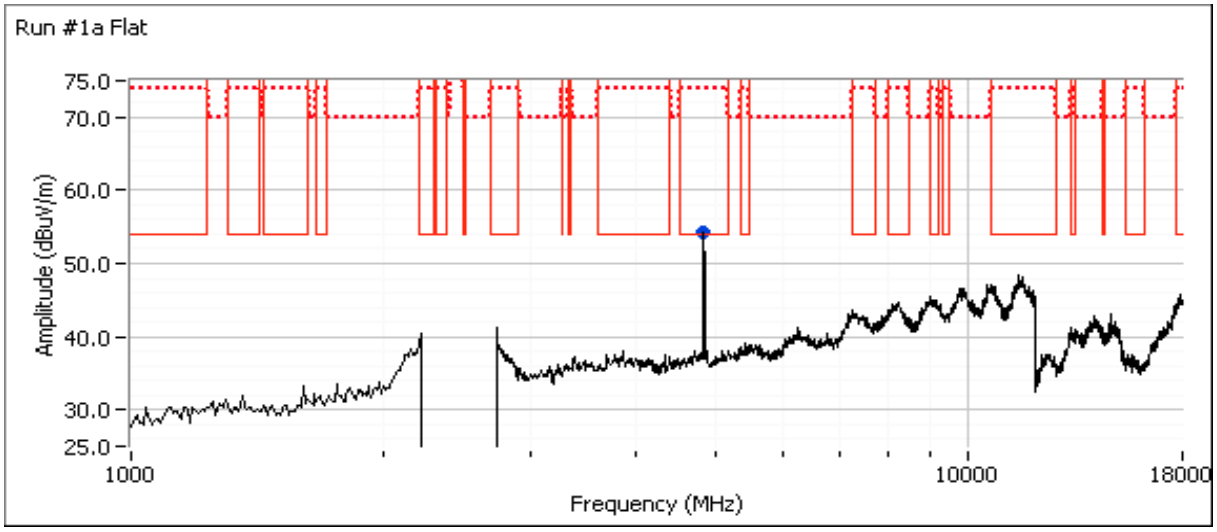
Date of Test: 6/12/2014 Config. Used: 1
Test Engineer: Deniz Demirci Config Change: None
Test Location: FT Chamber#4 EUT Voltage: Battery Operated

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 | dBµV/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* |

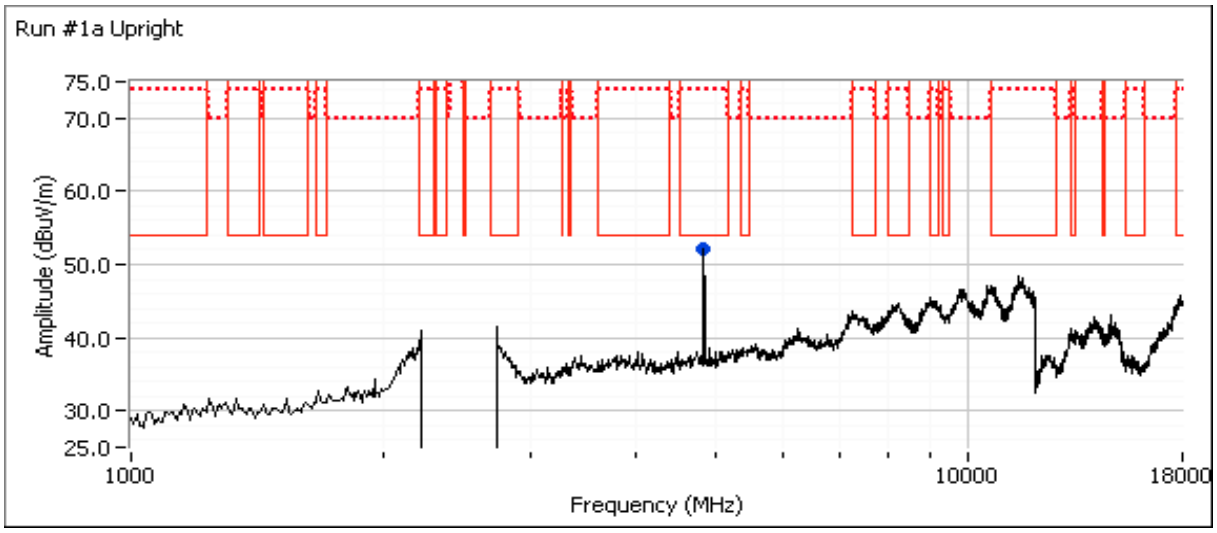


| | | | |
|---|---|---|---|
| Client: | Vocera Communications | Job Number: | J94614 |
| Model: | Northstar (1x1 802.11abgn + BT) | T-Log Number: | T94631 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210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

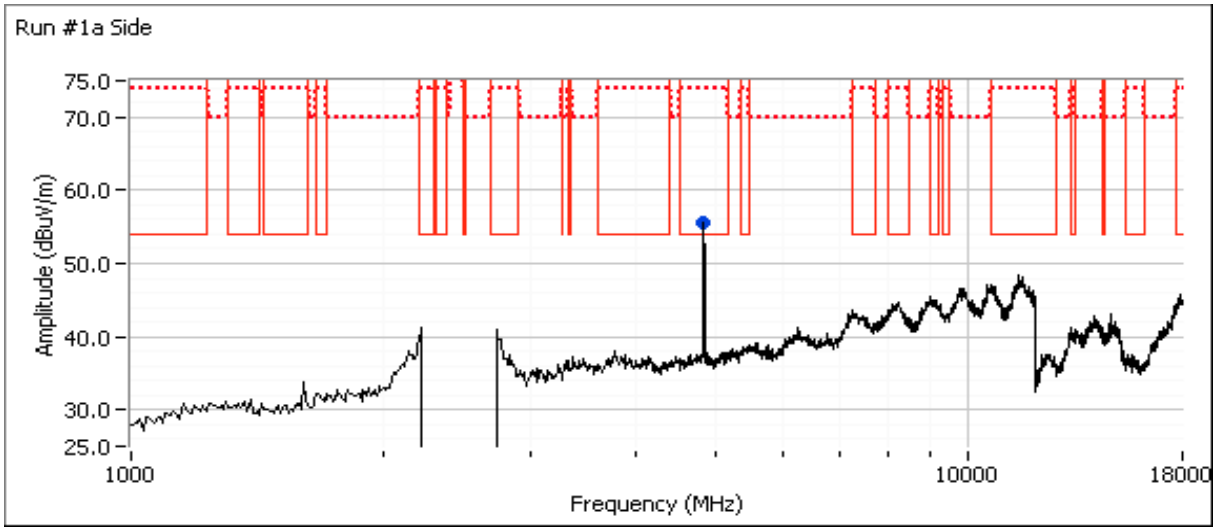


| | | | |
|---|---|---|---|
| Client: | Vocera Communications | Job Number: | J94614 |
| Model: | Northstar (1x1 802.11abgn + BT) | T-Log Number: | T94631 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210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



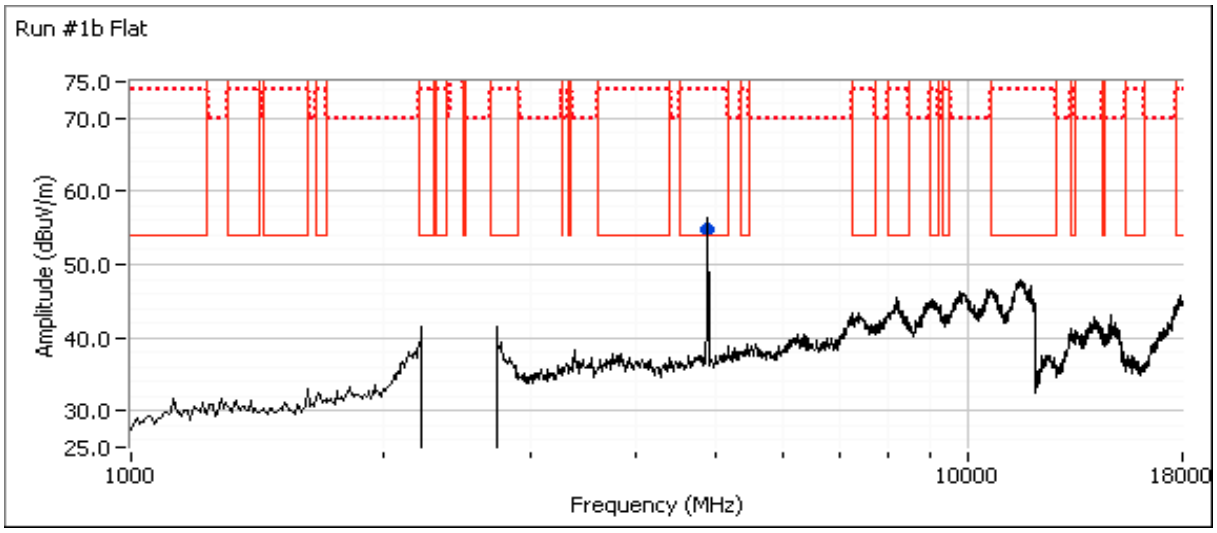
| | | | |
|---|---|---|---|
| Client: | Vocera Communications | Job Number: | J94614 |
| Model: | Northstar (1x1 802.11abgn + BT) | T-Log Number: | T94631 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210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



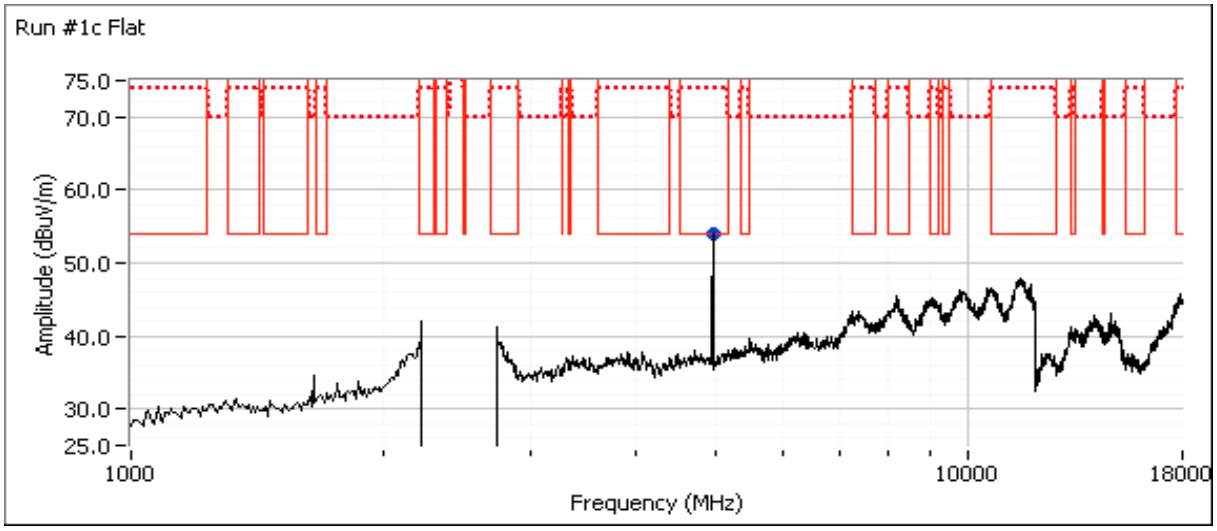
| | | | |
|---|---|---|---|
| Client: | Vocera Communications | Job Number: | J94614 |
| Model: | Northstar (1x1 802.11abgn + BT) | T-Log Number: | T94631 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210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

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

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

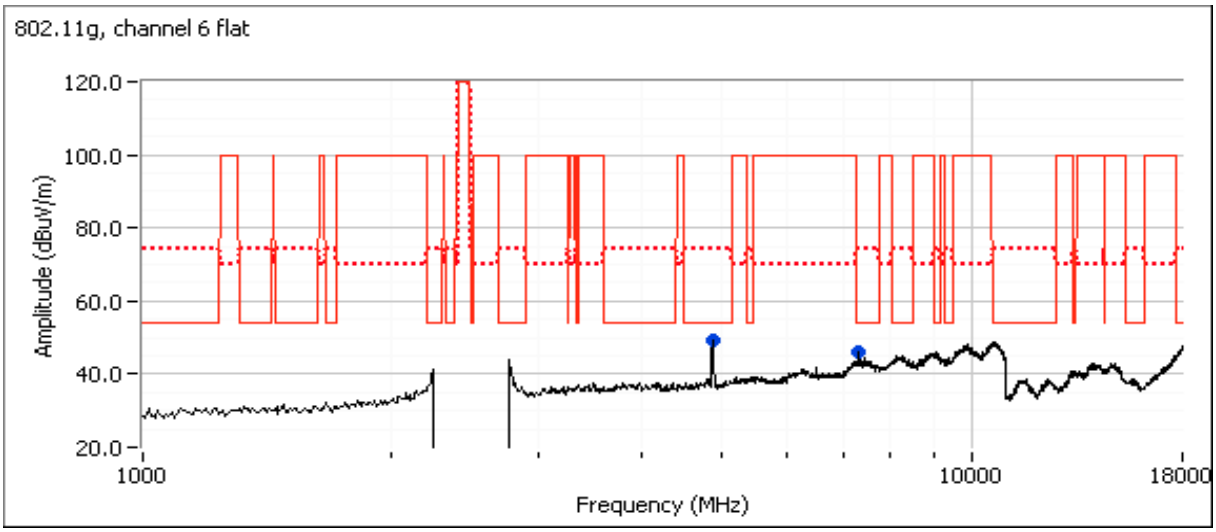
Date of Test: 4/29/2014 Config. Used: 1
Test Engineer: Joseph Cadigal Config Change: -
Test Location: Chamber #4 EUT Voltage: Battery

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. |



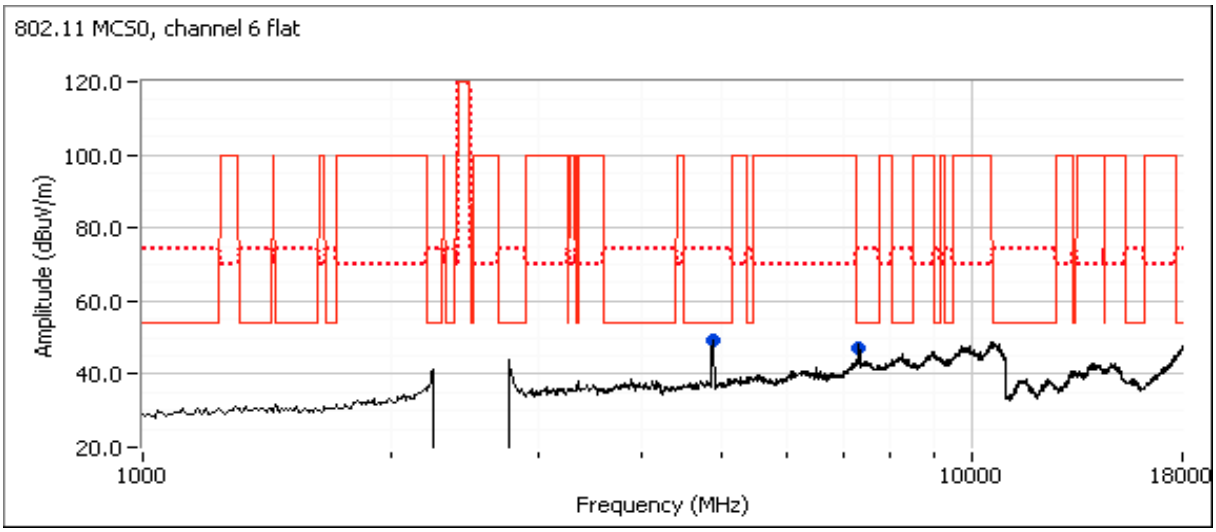
| | | | |
|---|---|---|---|
| Client: | Vocera Communications | Job Number: | J94614 |
| Model: | Northstar (1x1 802.11abgn + BT) | T-Log Number: | T94631 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210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

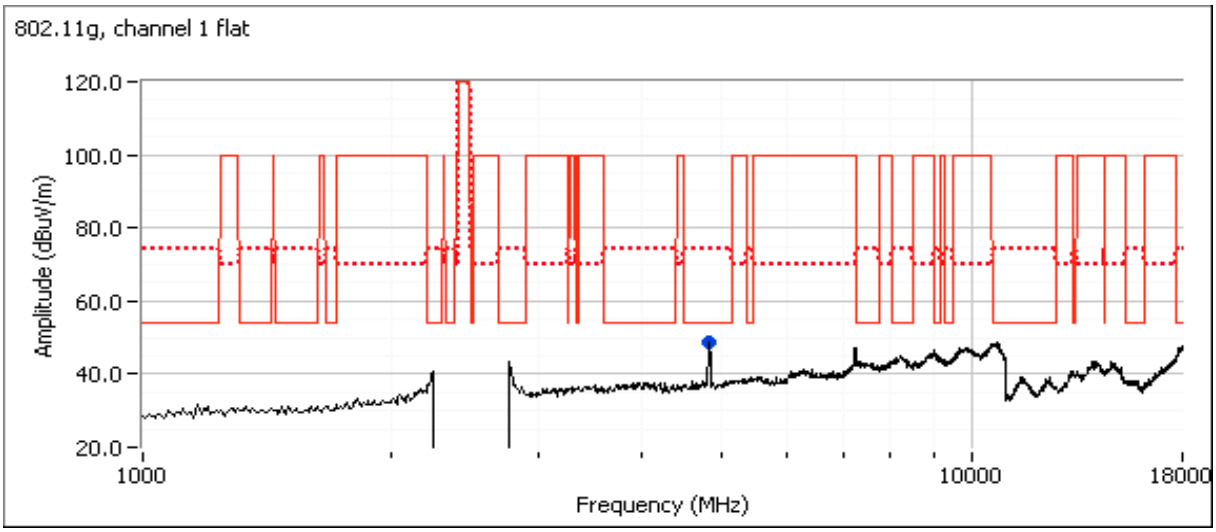
Run #3: Radiated Spurious Emissions, 1,000 - 25000 MHz. Operating Mode: Worse case from Run #2

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 |

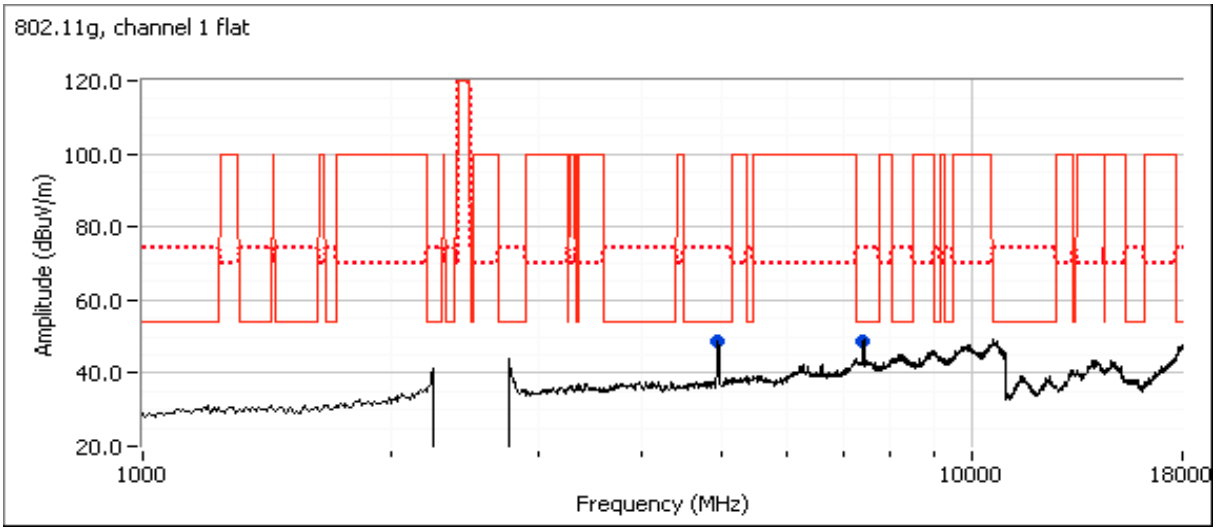


| | | | |
|---|---|---|---|
| Client: | Vocera Communications | Job Number: | J94614 |
| Model: | Northstar (1x1 802.11abgn + BT) | T-Log Number: | T94631 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210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

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

Run #0: Worse case orientation evaluation

Date of Test: 4/28/2014 0:00 Config. Used: 1
Test Engineer: John Caizzi Config Change: none
Test Location: Chamber 5 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 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210 | Class: | N/A |

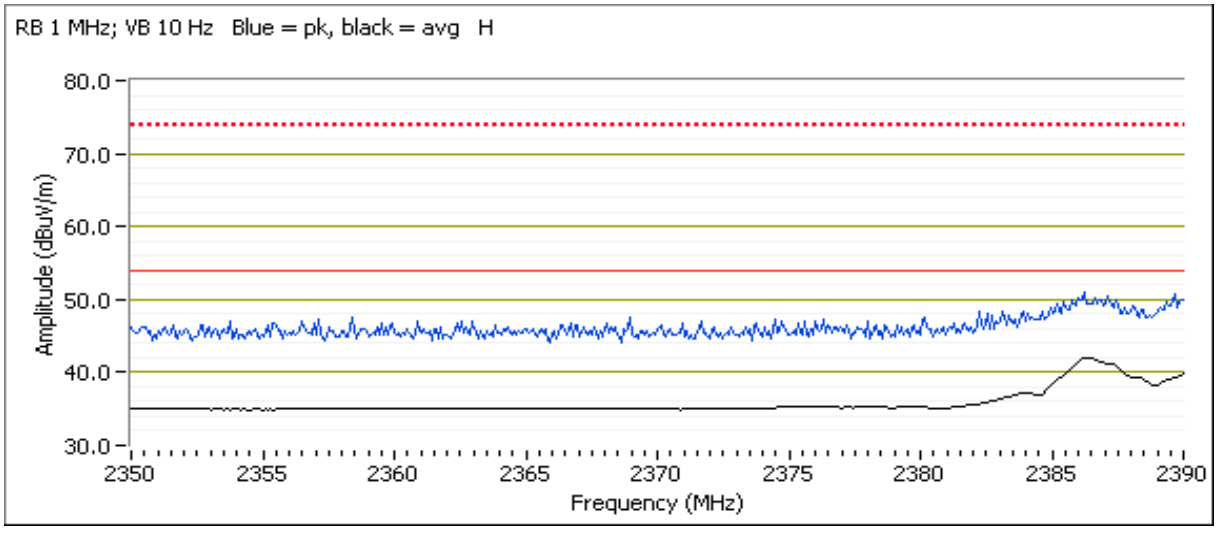
Run #1: Radiated Bandedge Measurements

Date of Test: 4/28/2014 Config. Used: 1
Test Engineer: John Caizzi Config Change: none
Test Location: Chamber 5 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 | dBµV/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 |

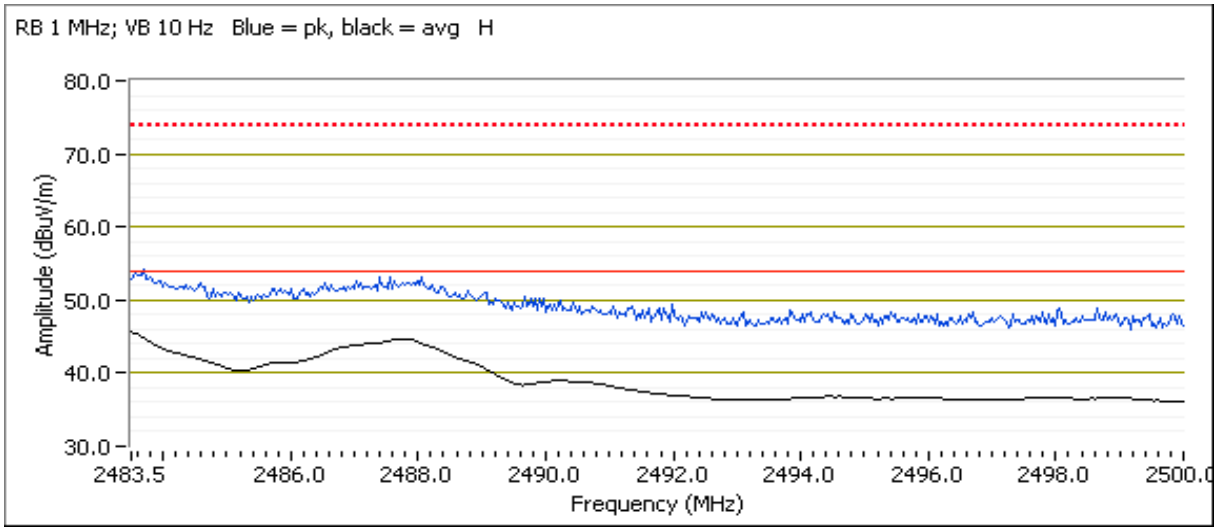


| | | | |
|---|---|---|---|
| Client: | Vocera Communications | Job Number: | J94614 |
| Model: | Northstar (1x1 802.11abgn + BT) | T-Log Number: | T94631 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210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

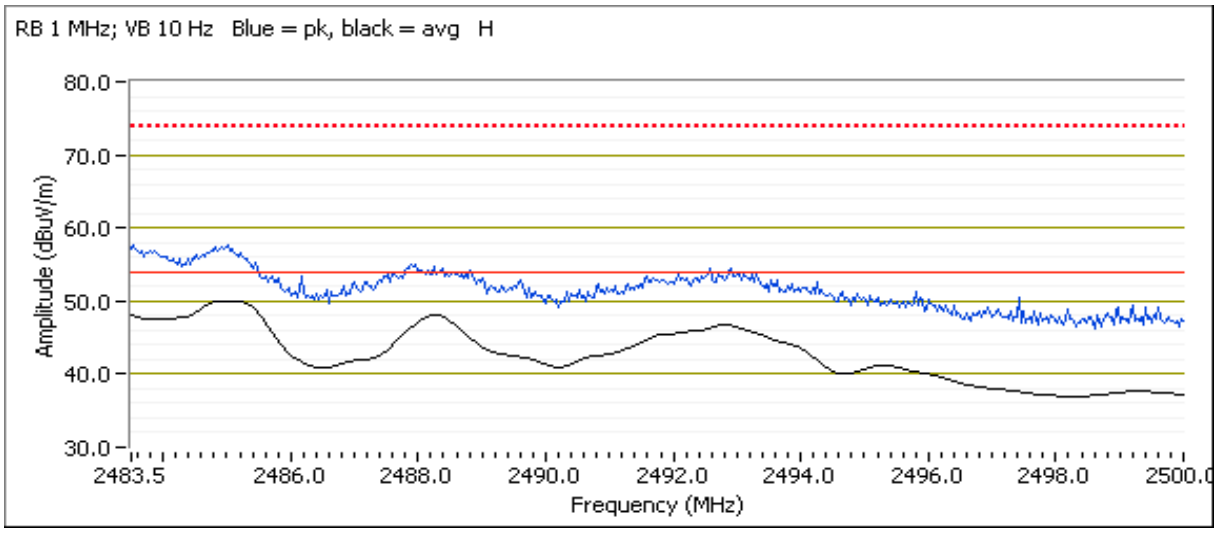


| | | | |
|---|---|---|---|
| Client: | Vocera Communications | Job Number: | J94614 |
| Model: | Northstar (1x1 802.11abgn + BT) | T-Log Number: | T94631 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210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

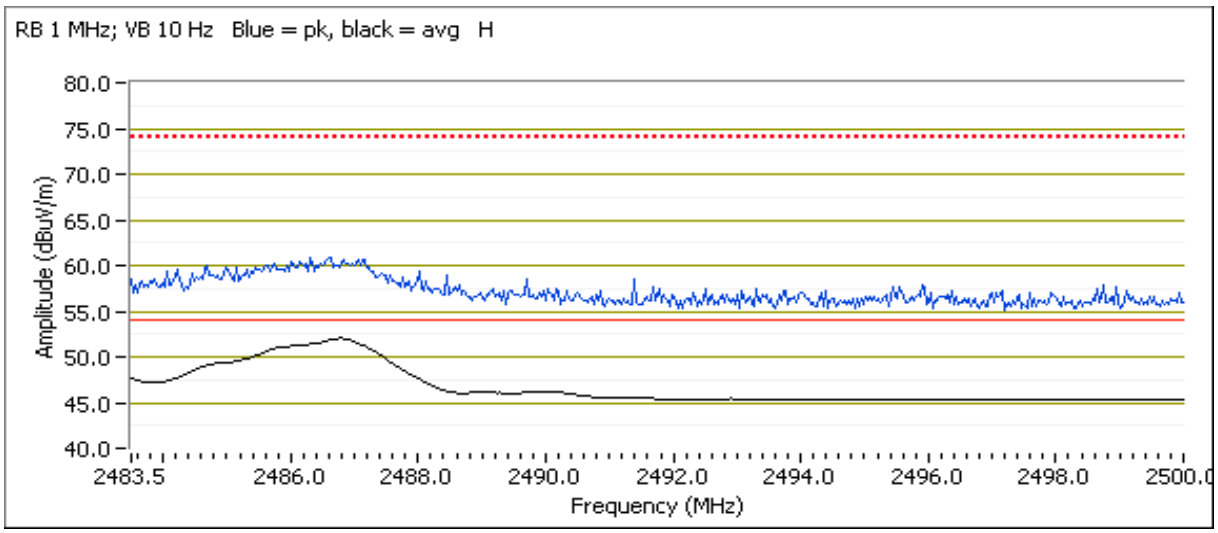


| | | | |
|---|---|---|---|
| Client: | Vocera Communications | Job Number: | J94614 |
| Model: | Northstar (1x1 802.11abgn + BT) | T-Log Number: | T94631 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210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

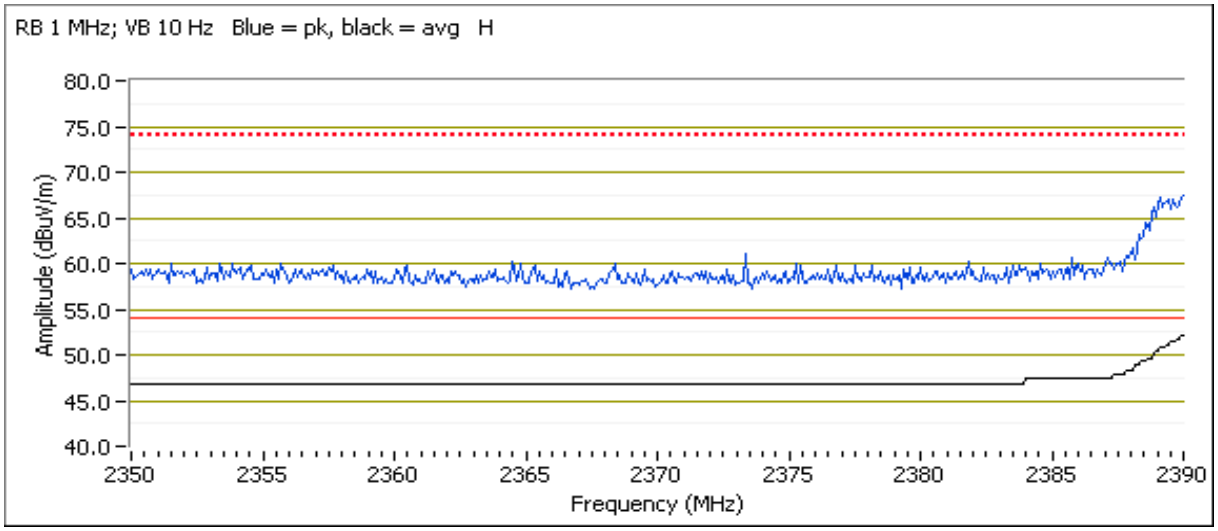
Run #2: Radiated Bandedge Measurements

Date of Test: 4/28/2014 Config. Used: 1
Test Engineer: M. Birgani Config Change: -
Test Location: Chamber #5 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 | dBµV/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 |

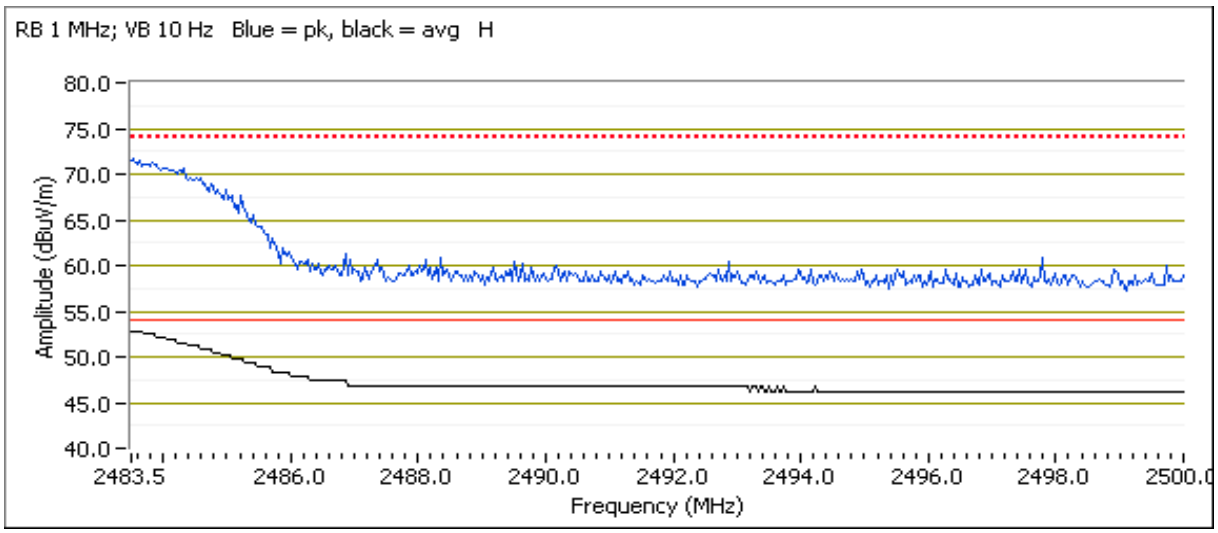


| | | | |
|---|---|---|---|
| Client: | Vocera Communications | Job Number: | J94614 |
| Model: | Northstar (1x1 802.11abgn + BT) | T-Log Number: | T94631 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210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

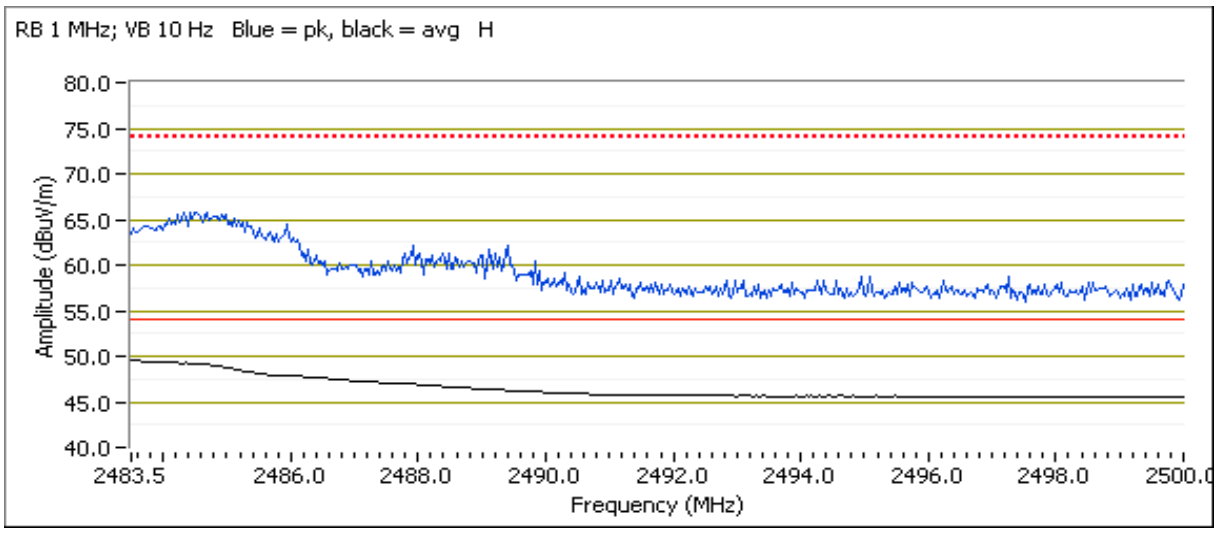


| | | | |
|---|---|---|---|
| Client: | Vocera Communications | Job Number: | J94614 |
| Model: | Northstar (1x1 802.11abgn + BT) | T-Log Number: | T94631 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210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

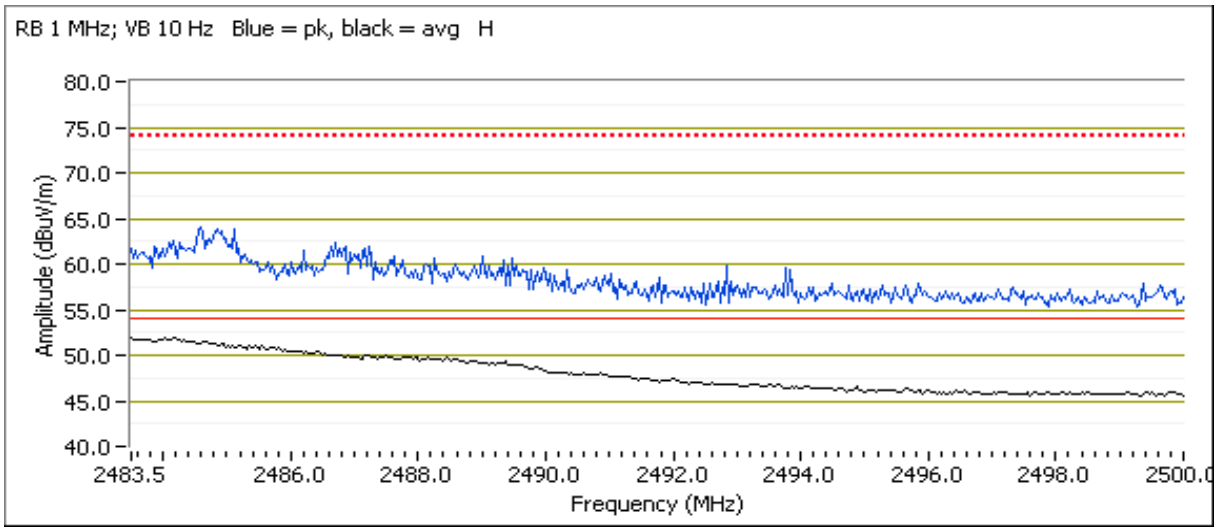


| | | | |
|---|---|---|---|
| Client: | Vocera Communications | Job Number: | J94614 |
| Model: | Northstar (1x1 802.11abgn + BT) | T-Log Number: | T94631 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210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

Run #3: Radiated Bandedge Measurements

Date of Test: 4/28/2014 Config. Used: 1

Test Engineer: John Caizzi Config Change: none

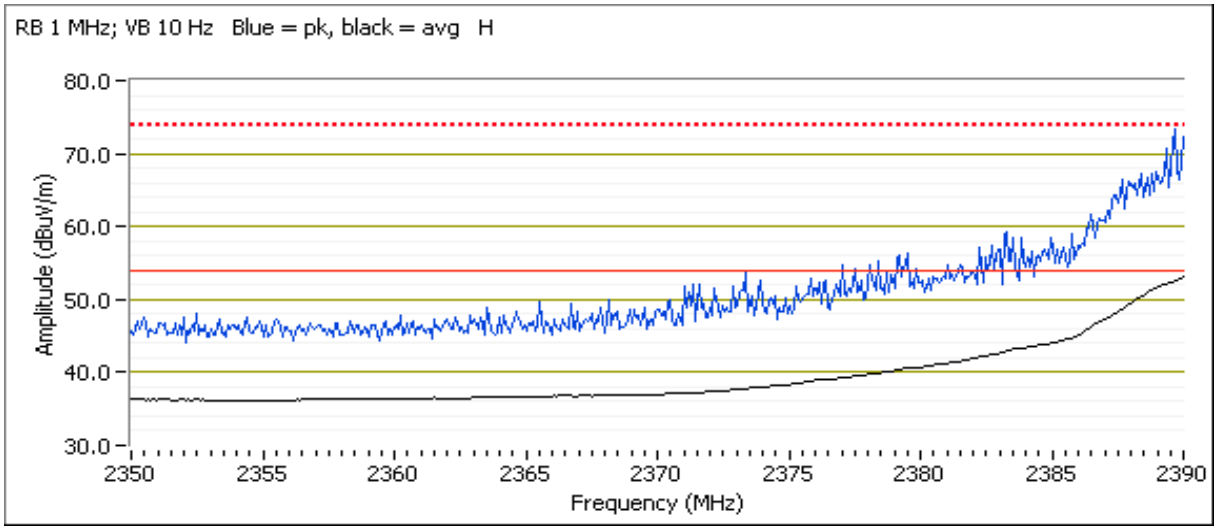
Test Location: Chamber 5 EUT Voltage: 3.3 VDC battery

Channel: 1 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 | |
| 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 |

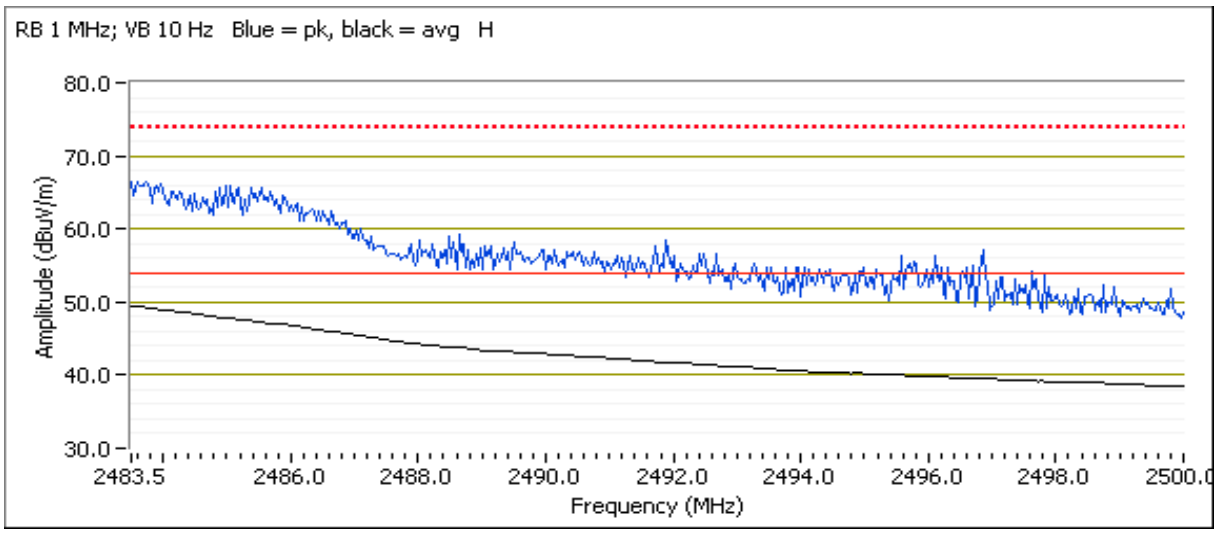


| | | | |
|---|---|---|---|
| Client: | Vocera Communications | Job Number: | J94614 |
| Model: | Northstar (1x1 802.11abgn + BT) | T-Log Number: | T94631 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210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

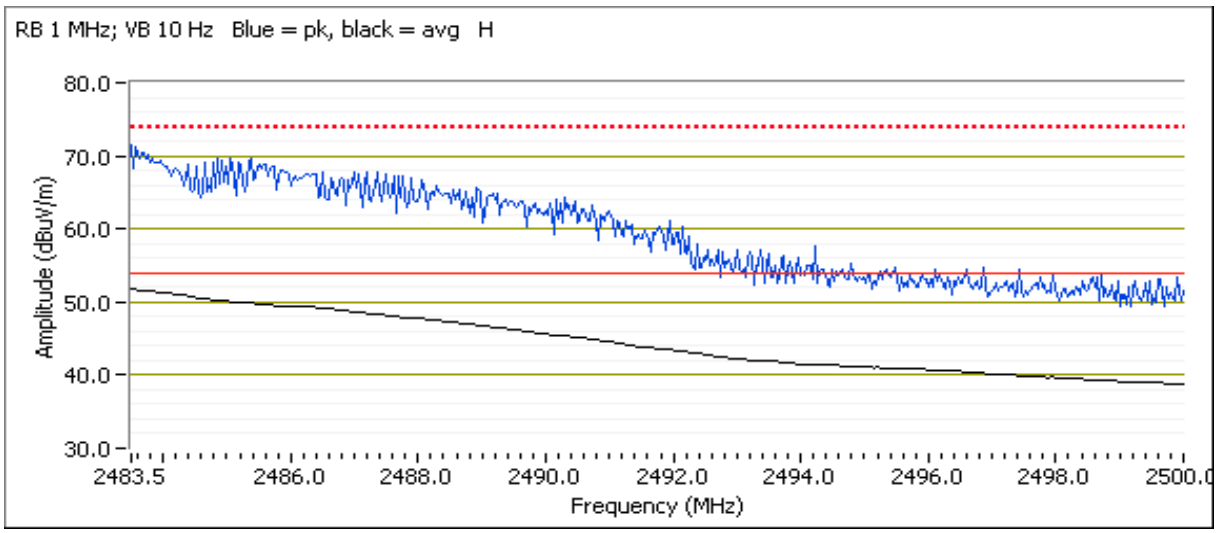


| | | | |
|---|---|---|---|
| Client: | Vocera Communications | Job Number: | J94614 |
| Model: | Northstar (1x1 802.11abgn + BT) | T-Log Number: | T94631 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210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

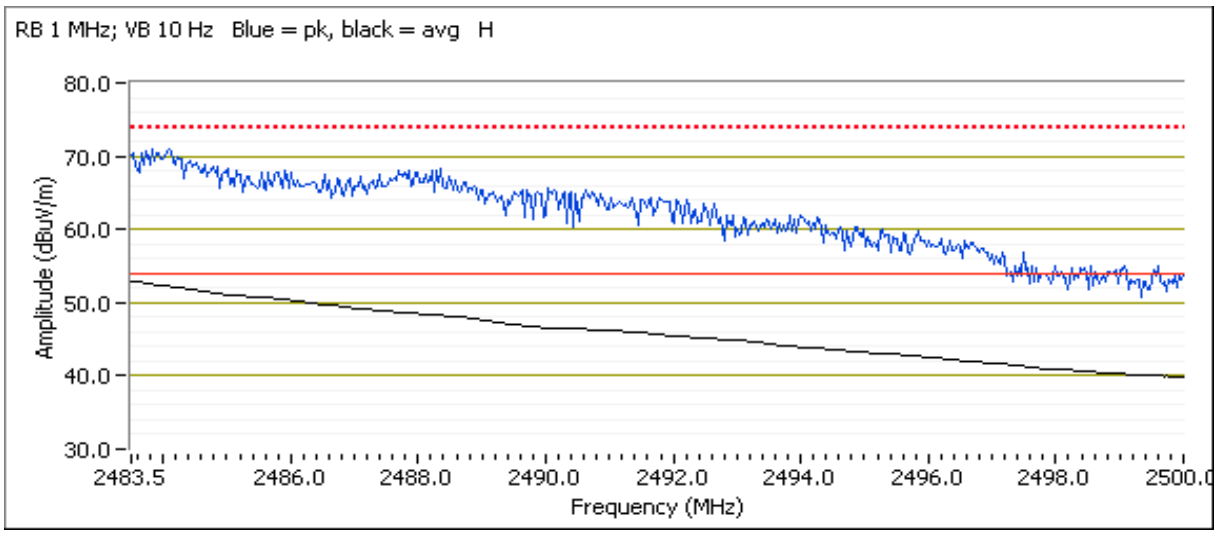


| | | | |
|---|---|---|---|
| Client: | Vocera Communications | Job Number: | J94614 |
| Model: | Northstar (1x1 802.11abgn + BT) | T-Log Number: | T94631 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210 | 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 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210 | 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)<br>11g:15.2dBm (33.1mW)<br>n20:15.1dBm (32.4mW) |
| 2 | - | - | Power spectral Density (PSD) | 15.247(d) | Pass | 11b: 5.5 dBm/100kHz<br>11g: 1.5dBm/100kHz<br>n20: 1.8dBm/100kHz |
| 3 | - | - | Minimum 6dB Bandwidth | 15.247(a) | Pass | 9.9 MHz |
| 3 | - | - | 99% Bandwidth | RSS GEN | - | 11b: 13.6MHz<br>11g: 16.8MHz<br>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 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210 | 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 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210 | Class: | N/A |

Run #1: Output Power

Mode: 11b

| Power Setting[2] | Frequency (MHz) | Output Power (dBm) [1] | Output Power mW | Antenna Gain (dBi) | Result | EIRP dBm | EIRP W | Power Meter (dBm) [3] | Power Meter 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 (dBm) [1] | Output Power mW | Antenna Gain (dBi) | Result | EIRP dBm | EIRP W | Power Meter (dBm) [3] | Power Meter 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 |

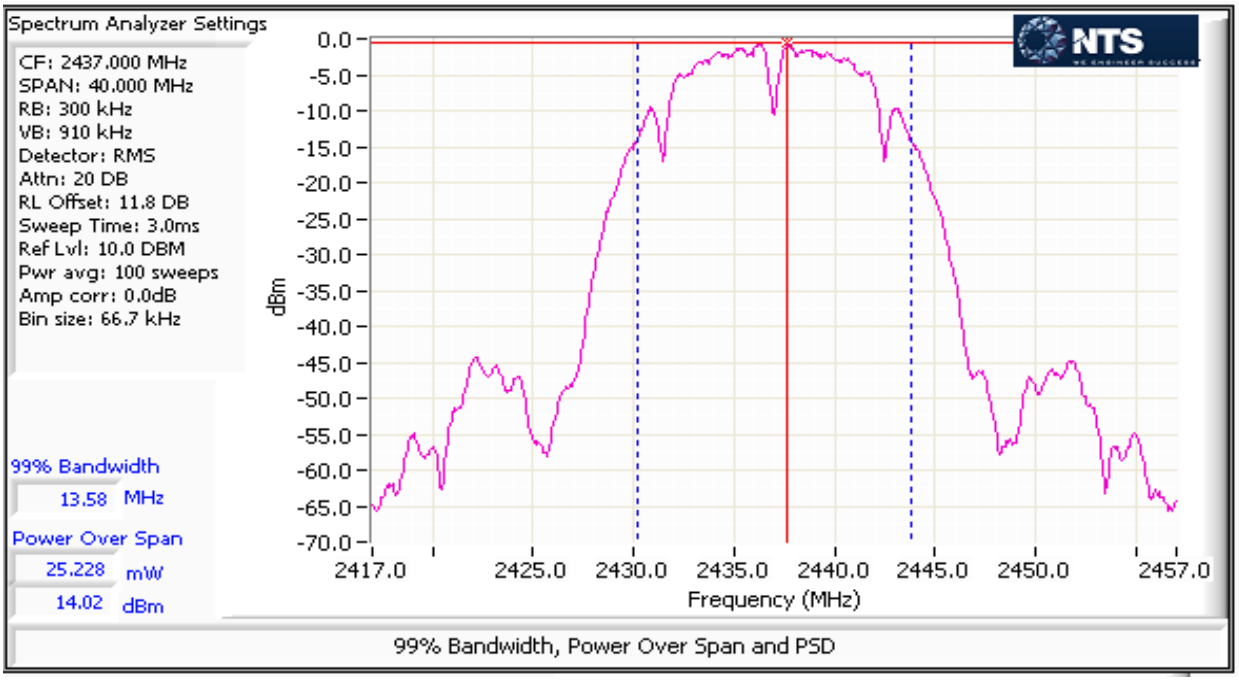
Mode: n20

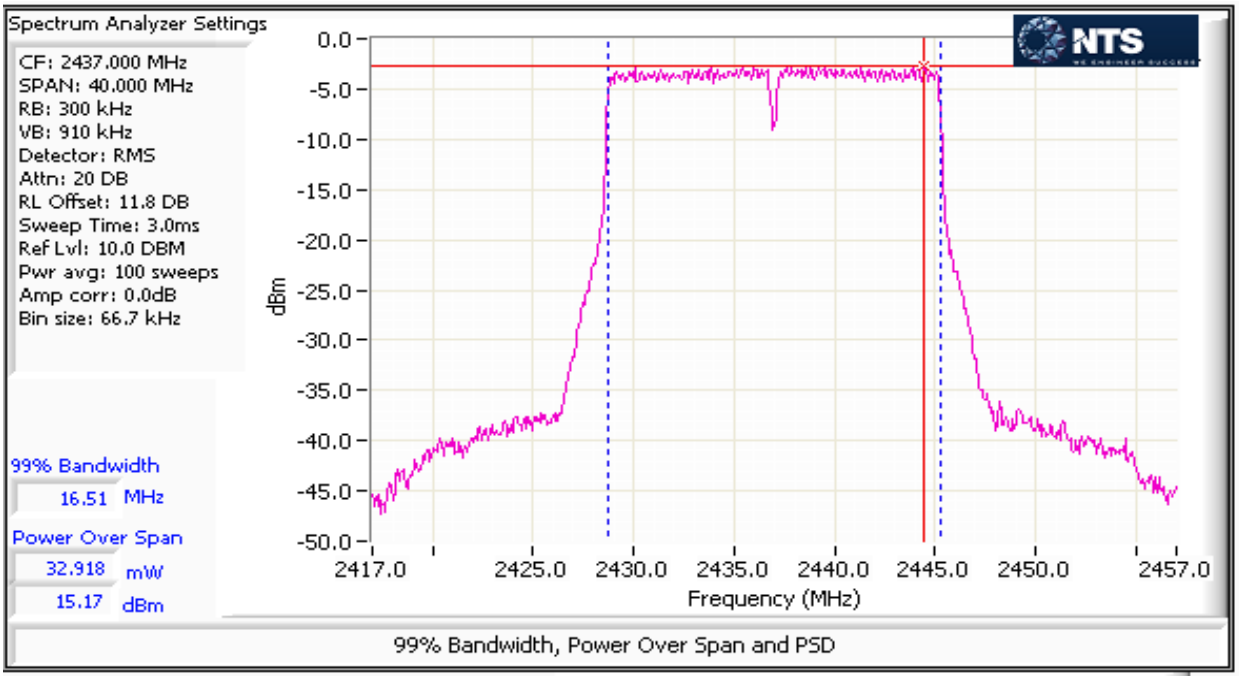
| Power Setting[2] | Frequency (MHz) | Output Power (dBm) [1] | Output Power mW | Antenna Gain (dBi) | Result | EIRP dBm | EIRP W | Power Meter (dBm) [3] | Power Meter mW |
|---|---|---|---|---|---|---|---|---|---|
| 16 | 2412 | 13.6 | 22.7 | 3.0 | Pass | 16.6 | 0.045 | 13.8 | 24.0 |
| 18 | 2437 | 15.1 | 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

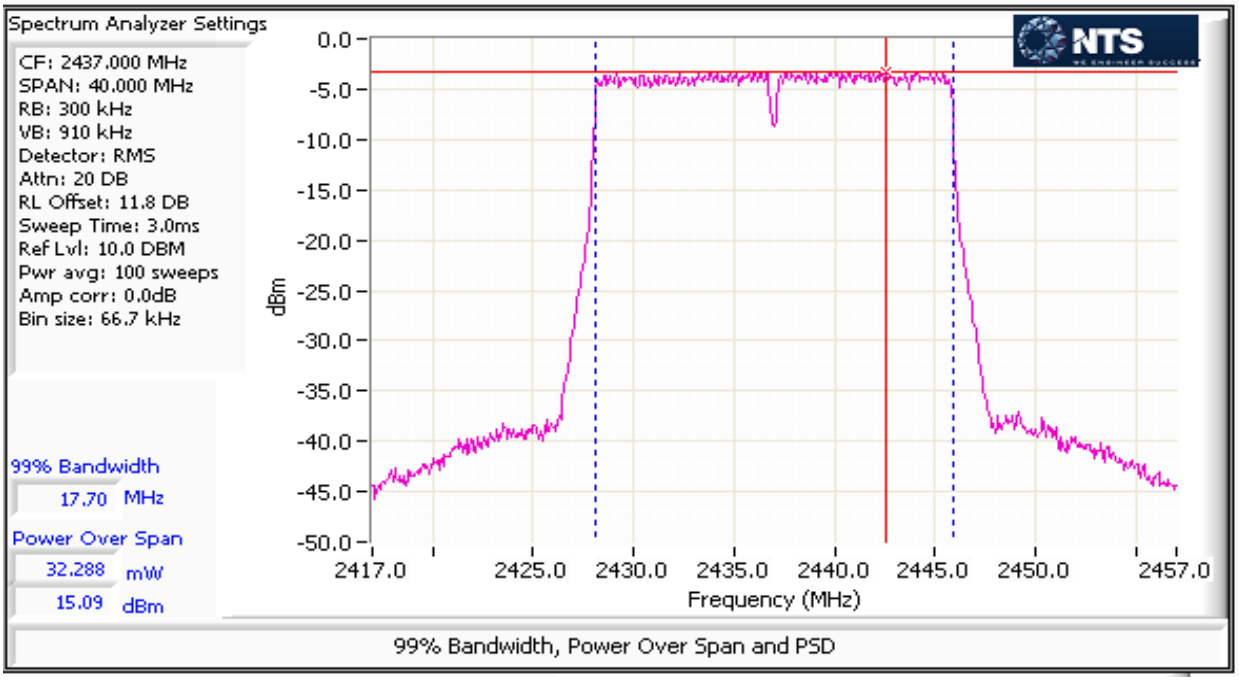
| | |
|---|---|
| Note 1: | Duty Cycle ≥ 98%. Output power measured using a spectrum analyzer (see plots below) with RBW= 1-5% of OBW, VB≥3* RBW, RMS detector, power averaging on, and power integration over the OBW, trace average 100 traces (option AVGSA-1, in KDB 558074). Spurious limit becomes -30dBc. |
| 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 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210 | Class: | N/A |



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



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

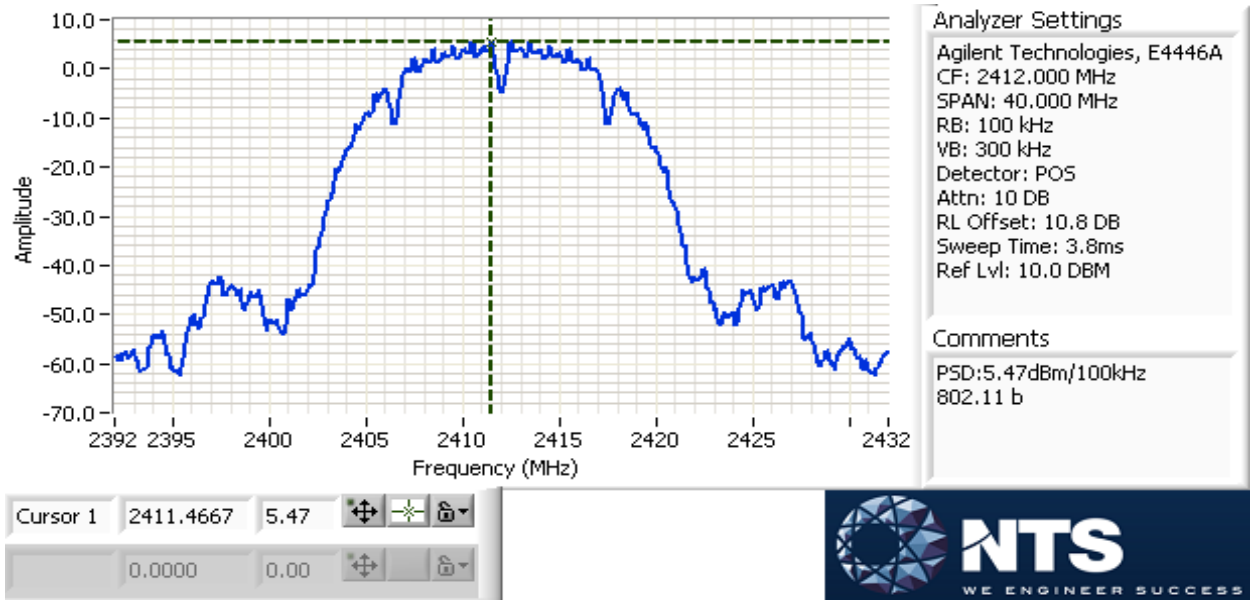
| Power Setting | Frequency (MHz) | PSD (dBm/100kHz) Note 1 | Limit dBm/3kHz | Result |
|---|---|---|---|---|
| 18 | 2412 | 1.5 | 8.0 | Pass |
| 18 | 2437 | 1.4 | 8.0 | Pass |
| 18 | 2472 | 1.1 | 8.0 | Pass |

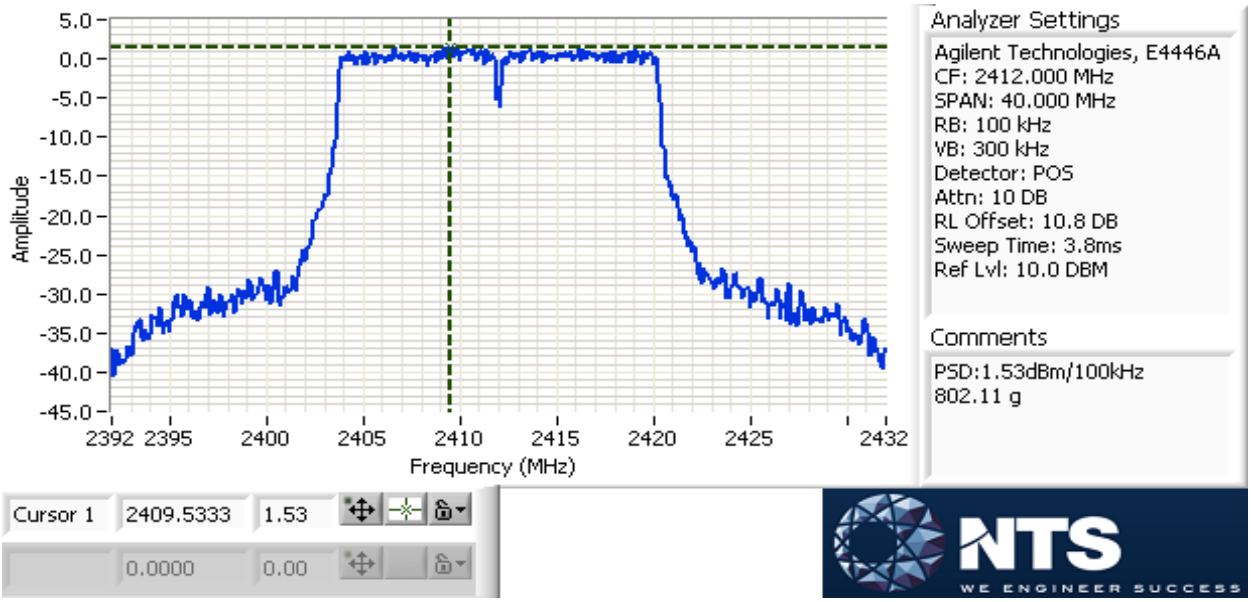
Mode: n20

| 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 |

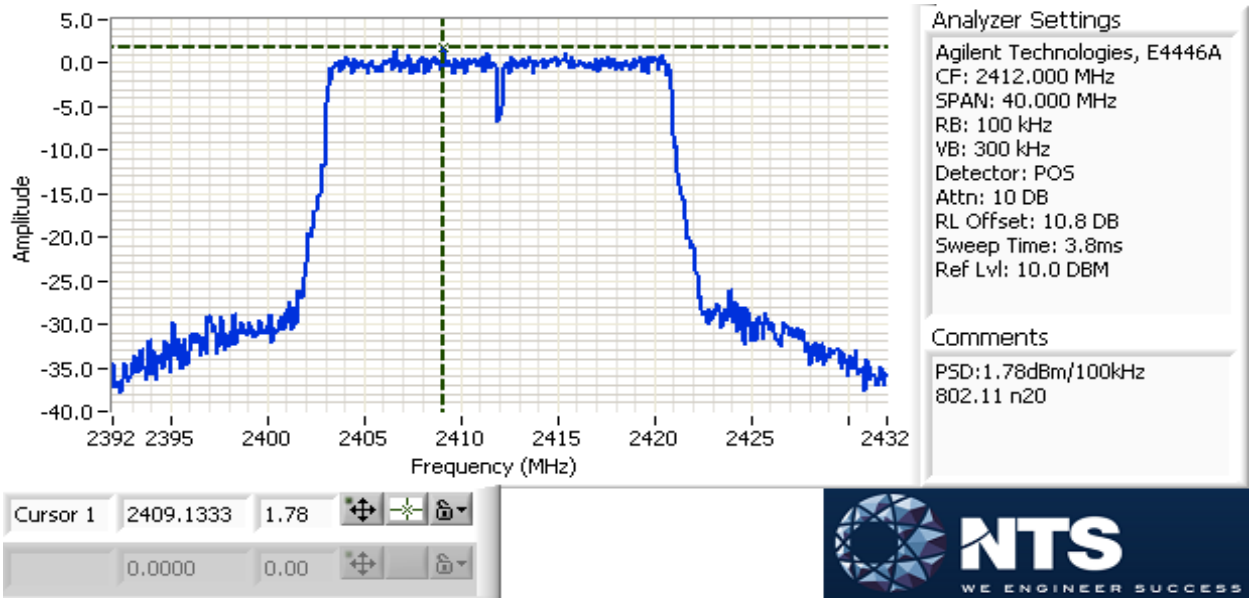
| | |
|---|---|
| Note 1: | Test performed per method PKSPD, in KDB 558074. Power spectral density measured using: 3kHz ≤ RBW ≤ 100kHz, VBW=3*RBW, peak detector, span = >1.5*DTS BW, auto sweep time, max hold. |

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



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



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

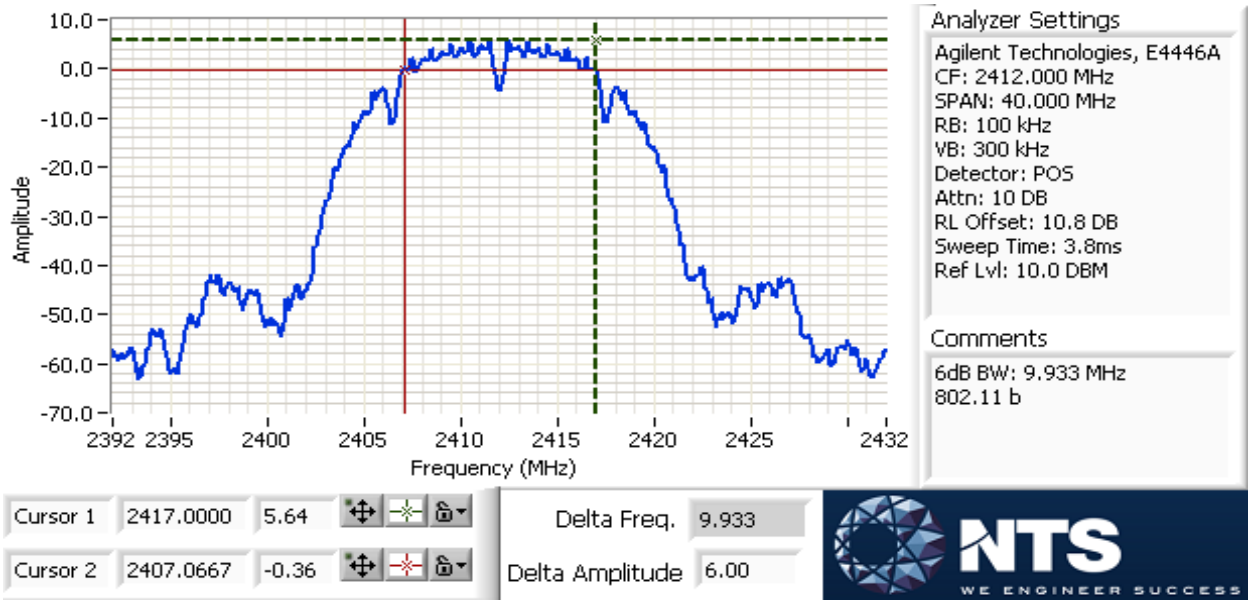
| Power Setting | Frequency (MHz) | Bandwidth (MHz) | | RBW Setting (kHz) | |
|---|---|---|---|---|---|
| | | 6dB | 99% | 6dB | 99% |
| 18 | 2412 | 16.5 | 16.8 | 100 | 300 |
| 18 | 2437 | 16.5 | 16.8 | 100 | 300 |
| 18 | 2472 | 16.5 | 16.8 | 100 | 300 |

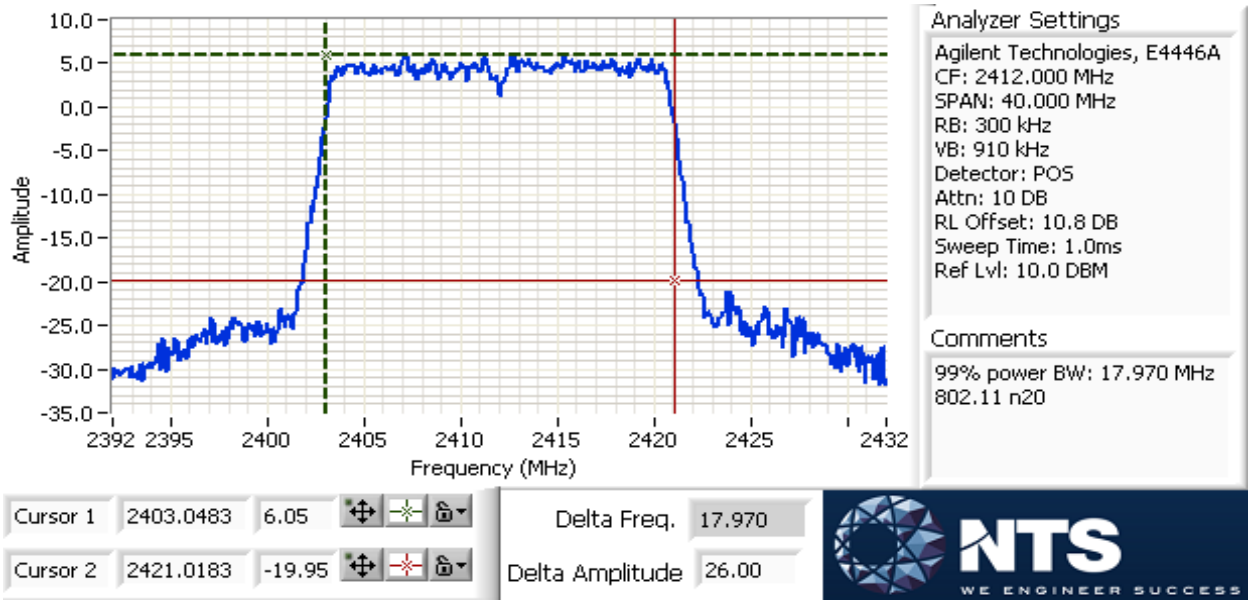
Mode: n20

| 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 ≥ 3*RBW, peak detector, max hold, auto sweep time.<br>99% BW: RBW=1-5% of of 99%BW, VBW ≥ 3*RBW, peak detector, max hold, auto sweep time. |

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



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

Run #4a: Out of Band Spurious Emissions

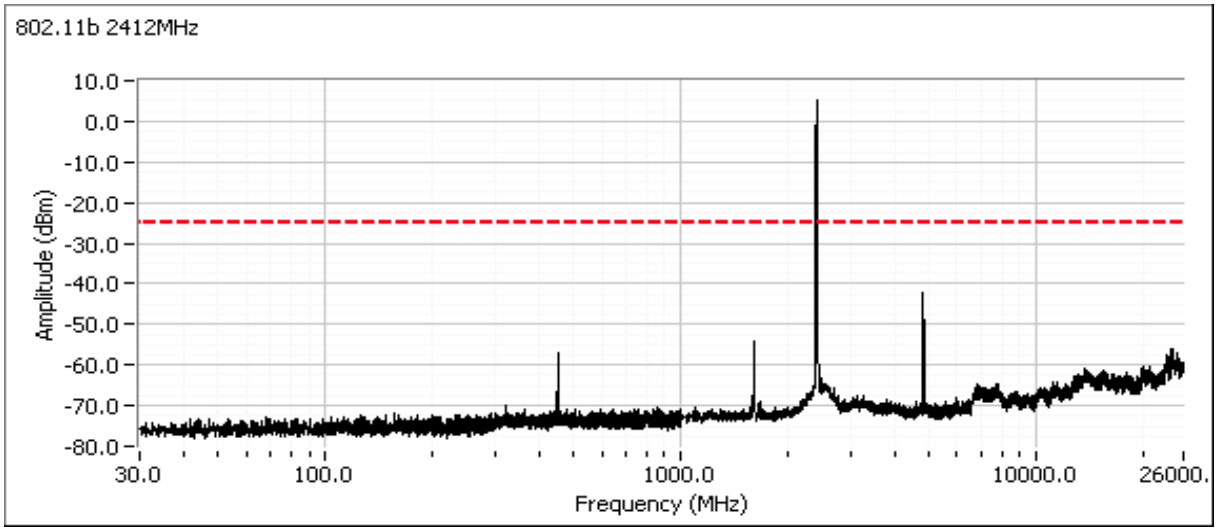
| Frequency (MHz) | Power Setting | Mode | Limit | Result |
|---|---|---|---|---|
| 2412 | 18 | b | -30dBc | Pass |
| 2437 | 18 | b | -30dBc | Pass |
| 2472 | 18 | b | -30dBc | Pass |

| 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 |

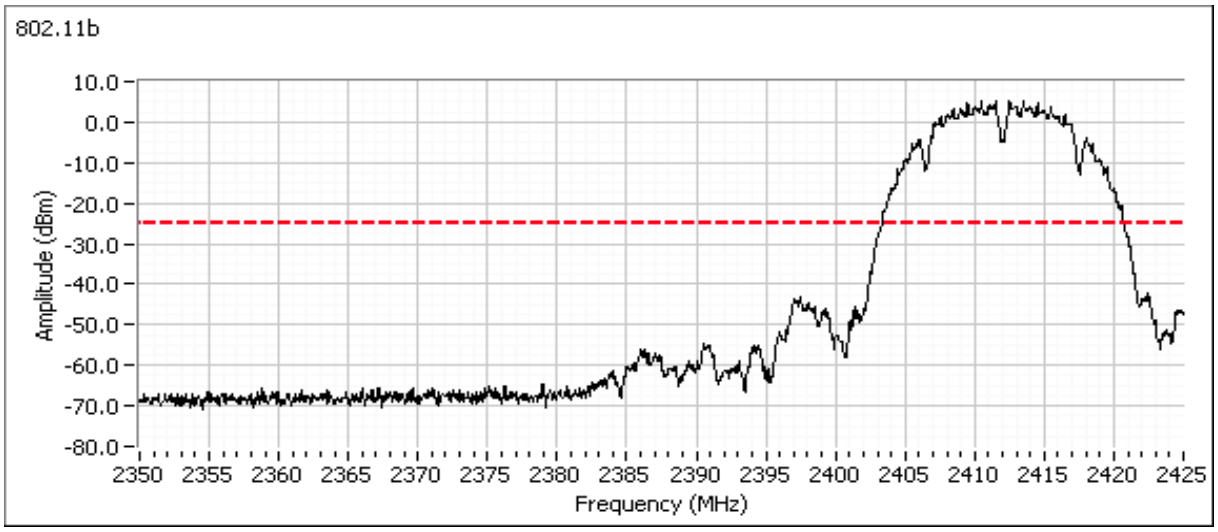
Mode: 11b

Plots for low channel

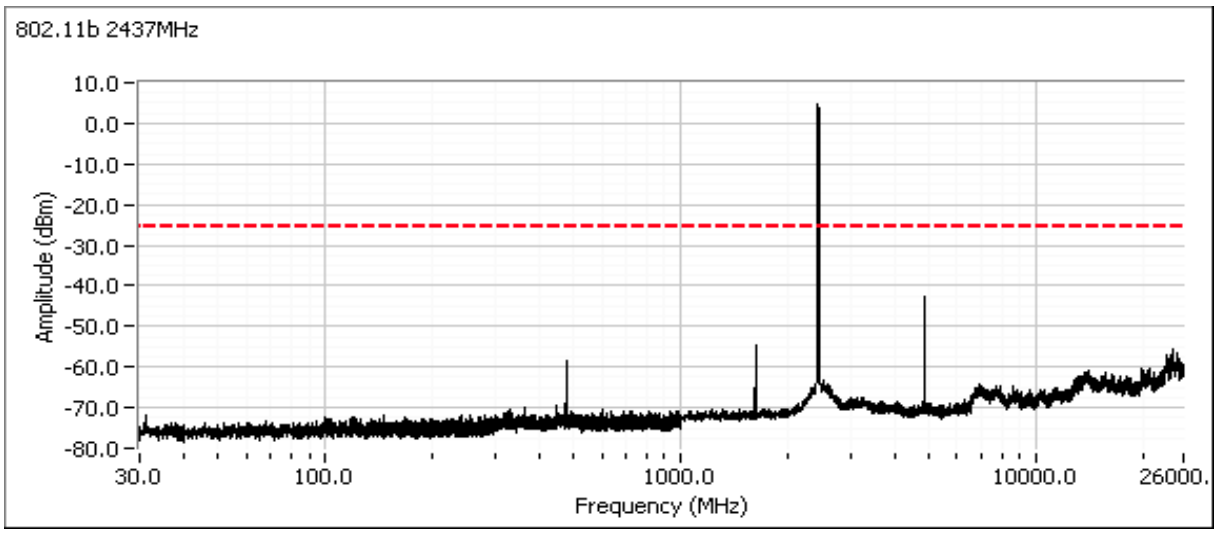


| | | | |
|---|---|---|---|
| Client: | Vocera Communications | Job Number: | J94614 |
| Model: | Northstar (1x1 802.11abgn + BT) | T-Log Number: | T94631 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210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

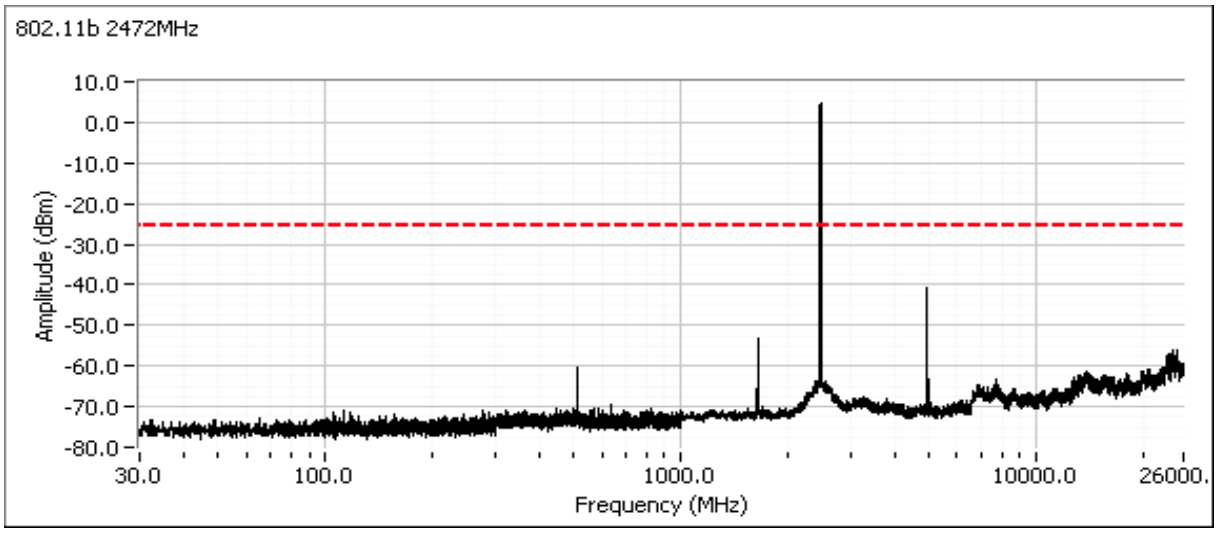



Plots for center channel



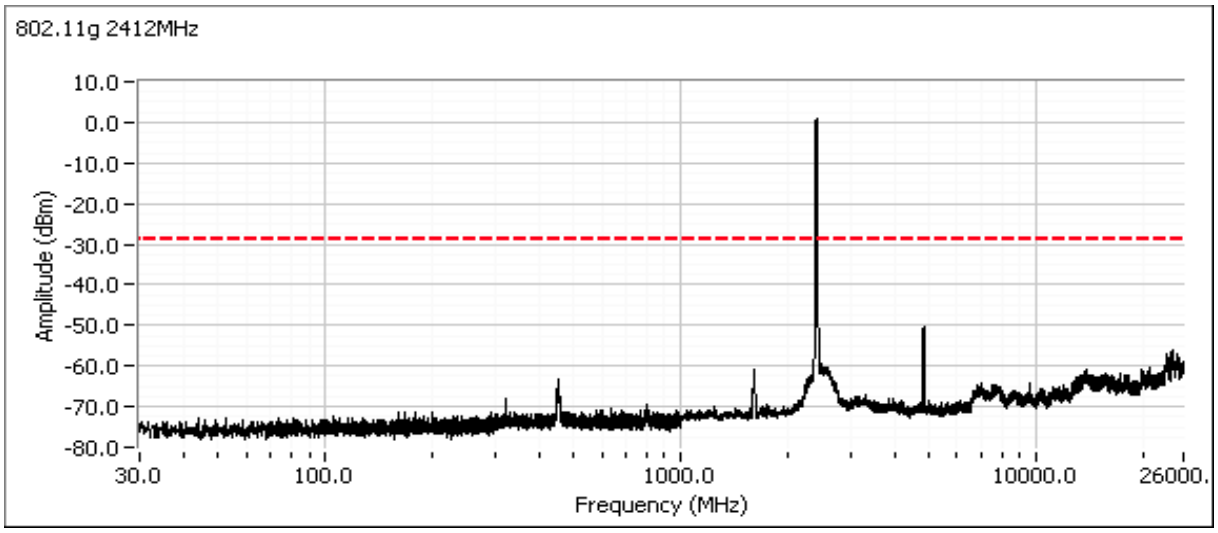
| | | | |
|---|---|---|---|
| Client: | Vocera Communications | Job Number: | J94614 |
| Model: | Northstar (1x1 802.11abgn + BT) | T-Log Number: | T94631 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210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

Plots for high channel



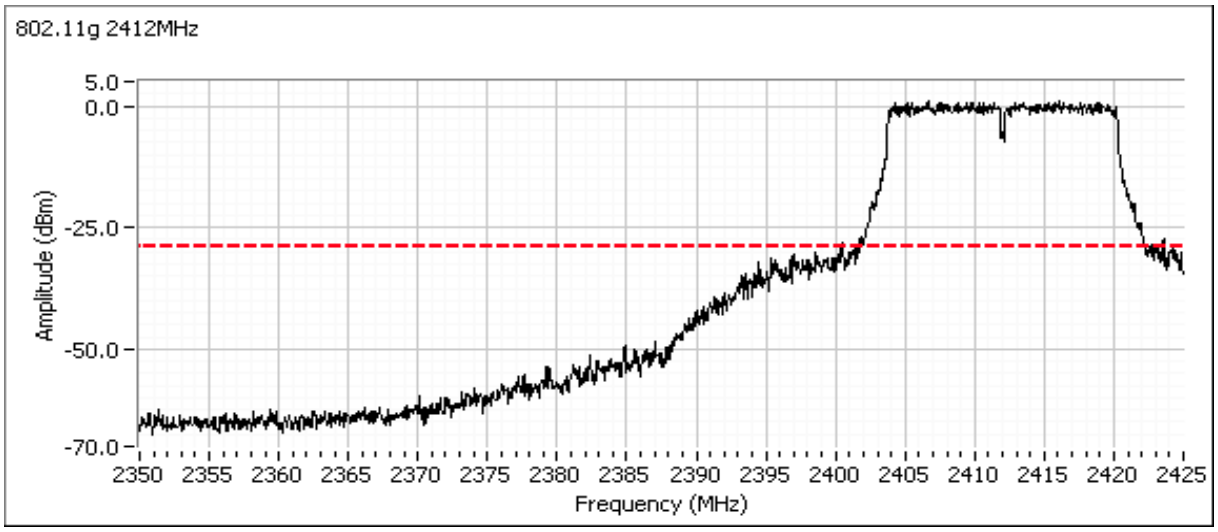

Mode: 11g

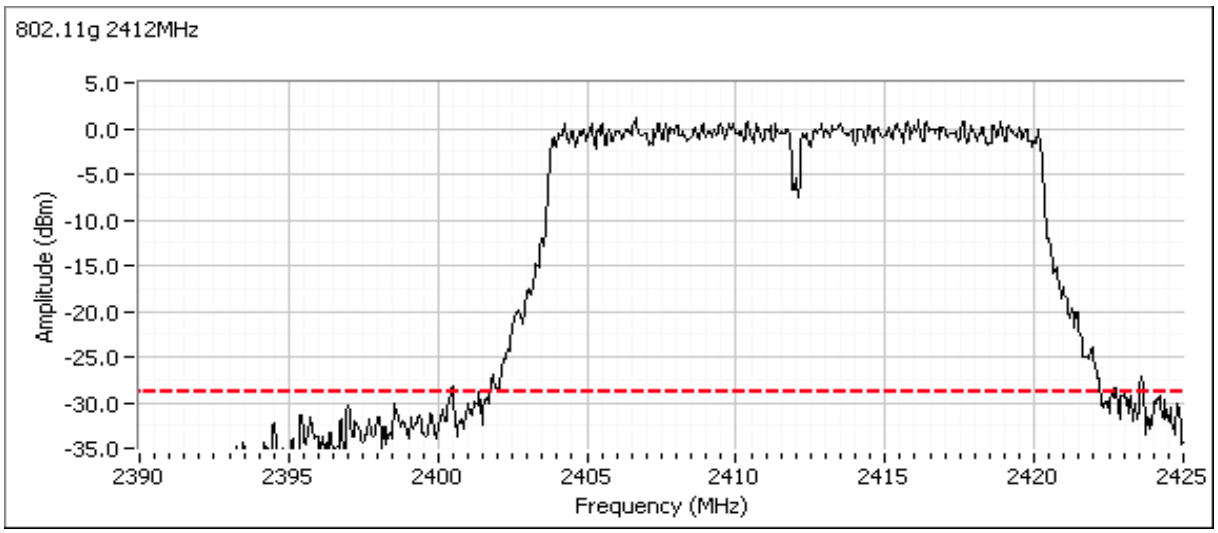
Plots for low channel



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

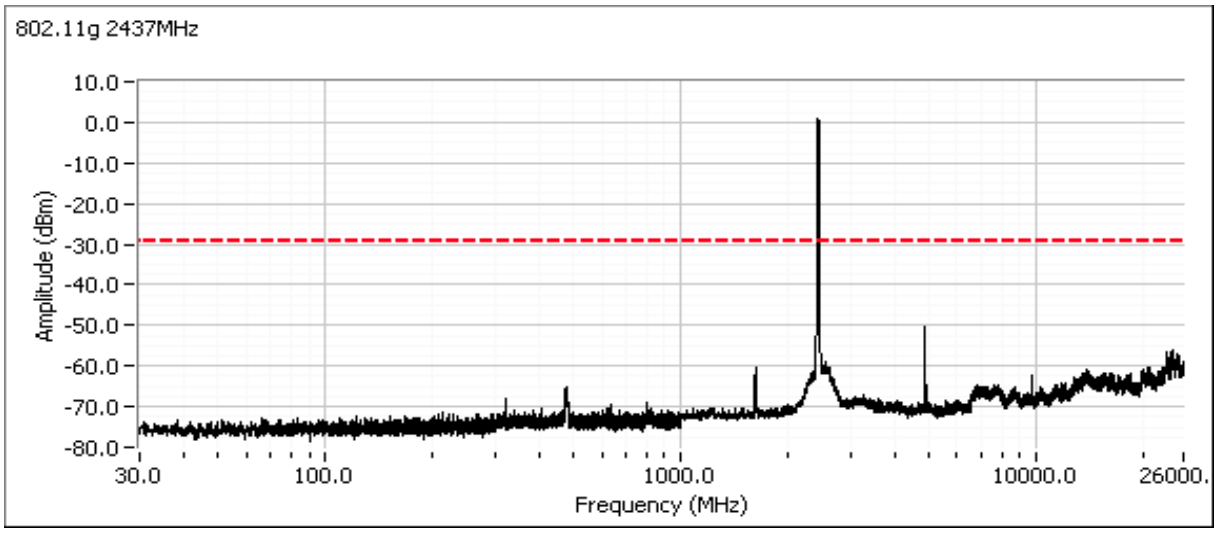
Additional plot showing compliance with -30dBc limit from 2390 MHz to 2400 MHz. Radiated measurements used to show compliance with the limits in the restricted band below 2390 MHz.



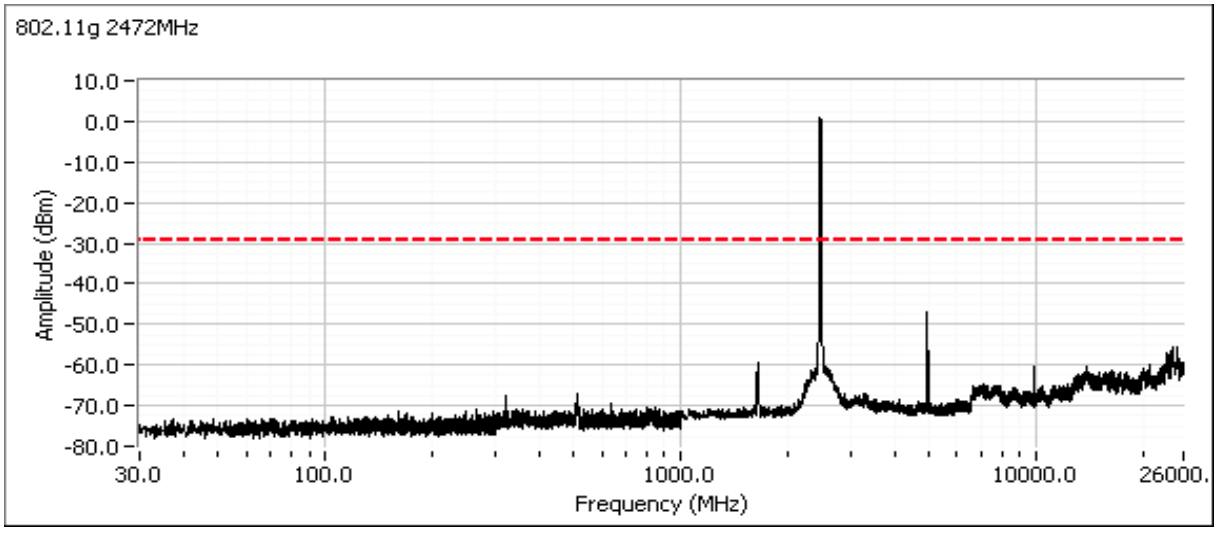



| | | | |
|---|---|---|---|
| Client: | Vocera Communications | Job Number: | J94614 |
| Model: | Northstar (1x1 802.11abgn + BT) | T-Log Number: | T94631 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210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

Plots for center channel



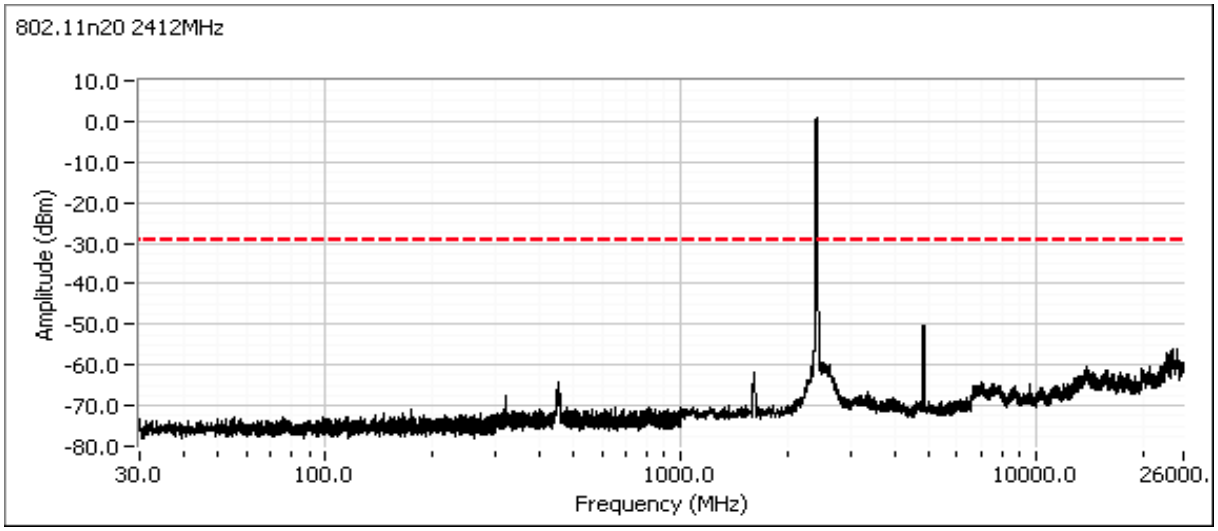

Plots for high channel



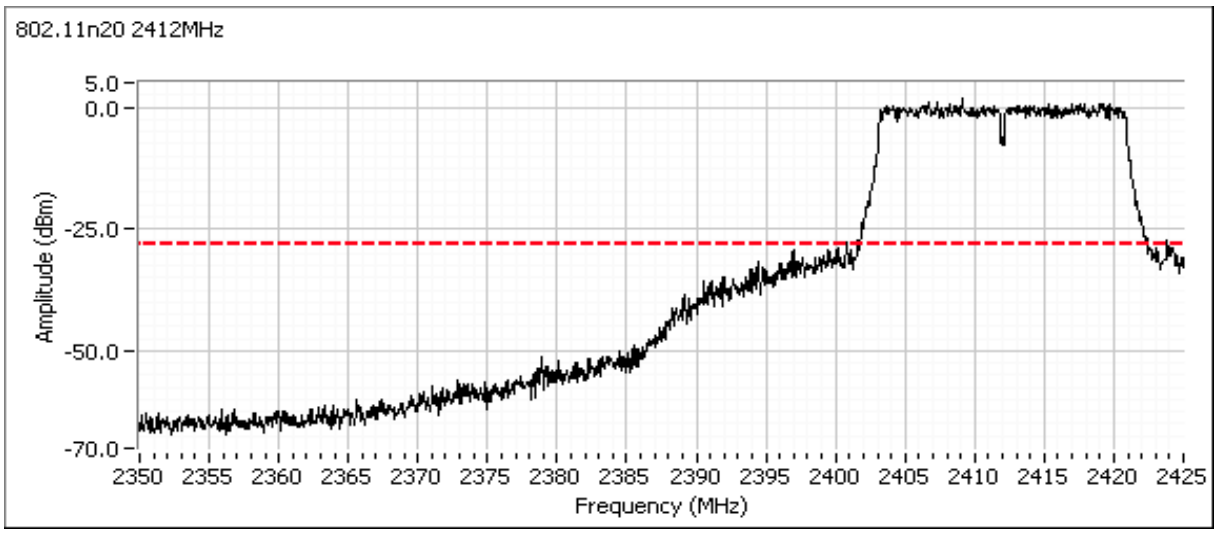
| | | | |
|---|---|---|---|
| Client: | Vocera Communications | Job Number: | J94614 |
| Model: | Northstar (1x1 802.11abgn + BT) | T-Log Number: | T94631 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210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

Mode: 11n20

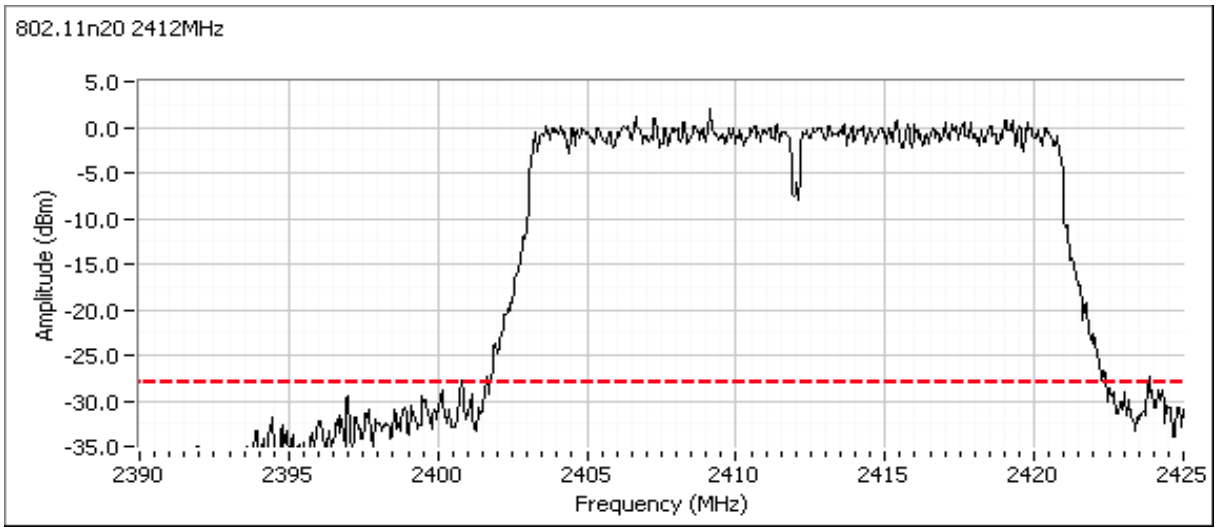
Plots for low channel



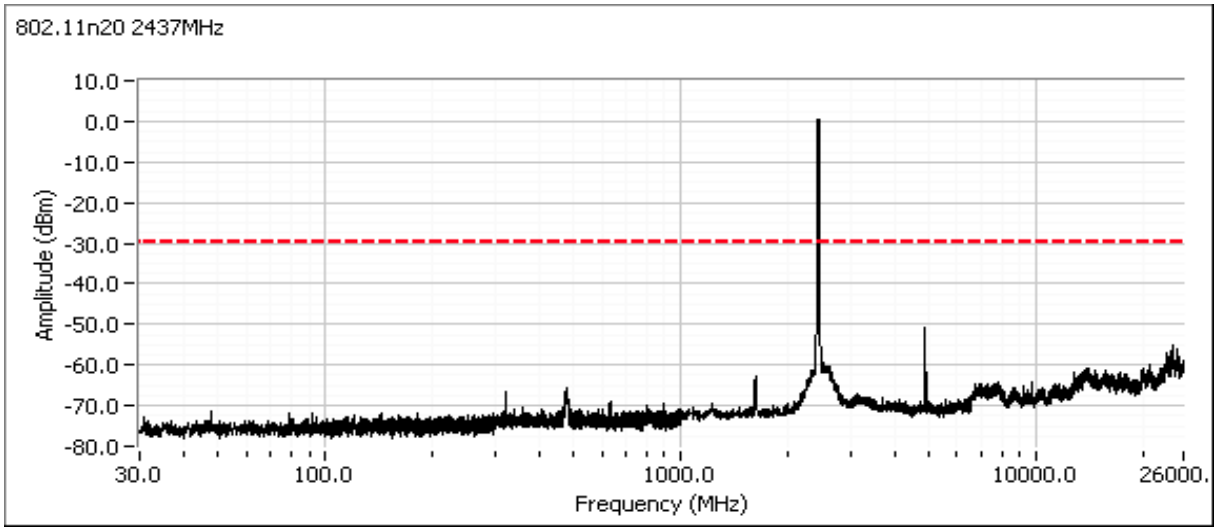

Additional plot showing compliance with -30dBc limit from 2390 MHz to 2400 MHz. Radiated measurements used to show compliance with the limits in the restricted band below 2390 MHz.



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

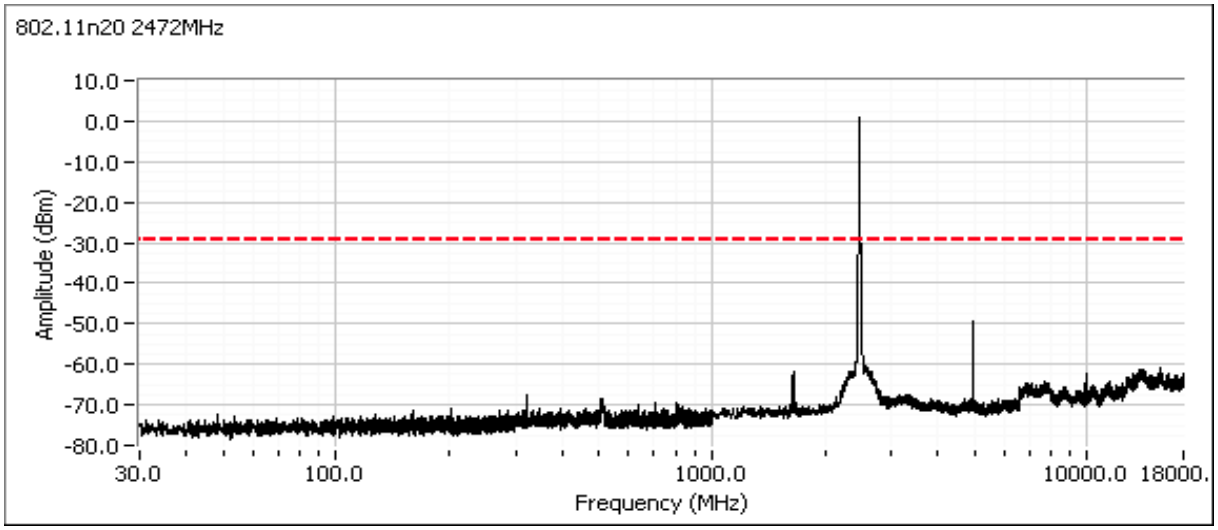



Plots for center channel



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

Plots for high channel



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

## Sample Notes

Sample S/N: 3E
Driver: M3X14447

## Notes

Device is handheld. Evaluation of the fundamental field strenght at CH157, 11a mode was performed thru three orientation to determine worse 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 ≥ 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 ≥ 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*(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 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210 | Class: | N/A |

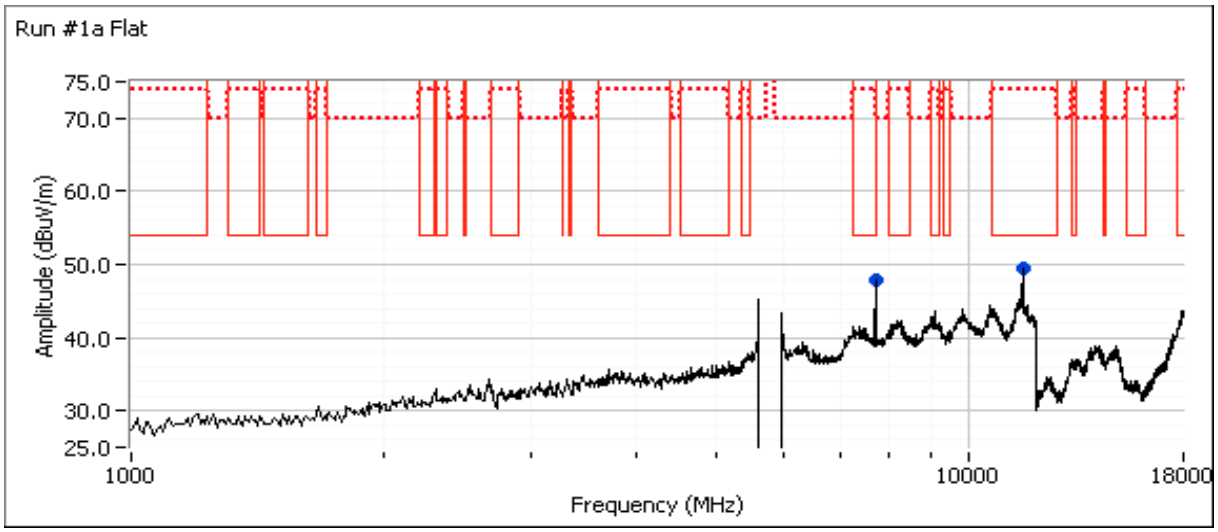
Run #1: Radiated Spurious Emissions, 1,000 - 40000 MHz. Operating Mode: Determination of worse case OFDM mode

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

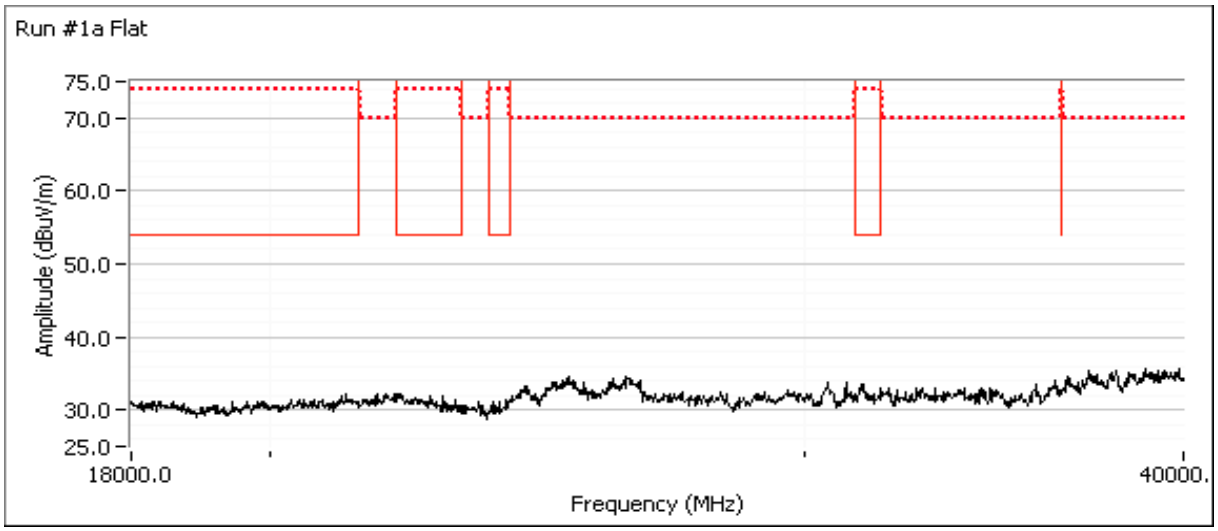
Run #1a: Center Channel

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 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210 | Class: | N/A |

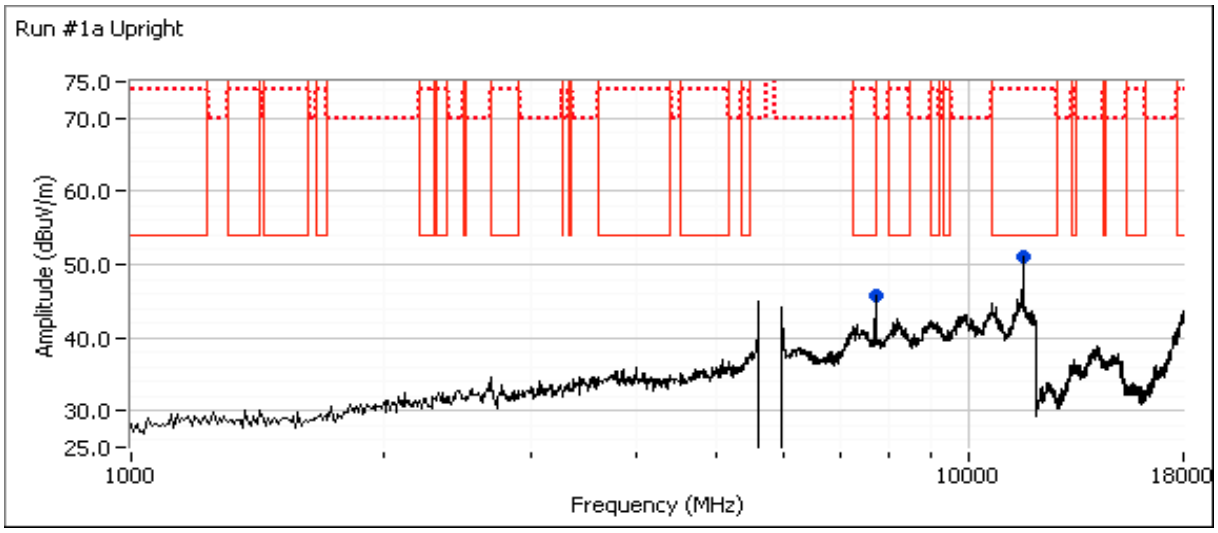


| | | | |
|---|---|---|---|
| Client: | Vocera Communications | Job Number: | J94614 |
| Model: | Northstar (1x1 802.11abgn + BT) | T-Log Number: | T94631 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210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

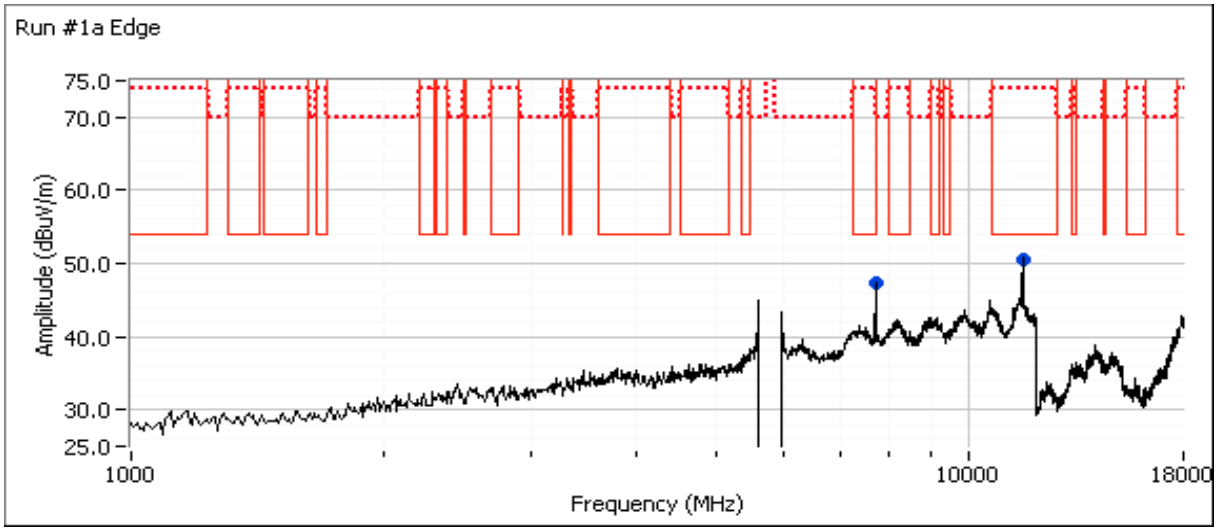


| | | | |
|---|---|---|---|
| Client: | Vocera Communications | Job Number: | J94614 |
| Model: | Northstar (1x1 802.11abgn + BT) | T-Log Number: | T94631 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210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



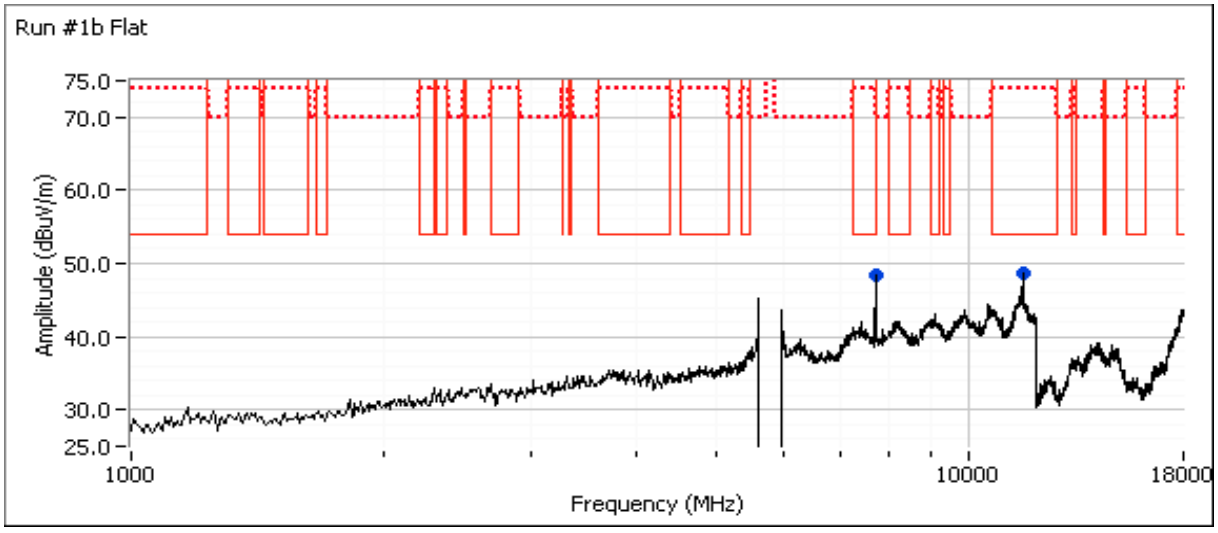
| | | | |
|---|---|---|---|
| Client: | Vocera Communications | Job Number: | J94614 |
| Model: | Northstar (1x1 802.11abgn + BT) | T-Log Number: | T94631 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210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



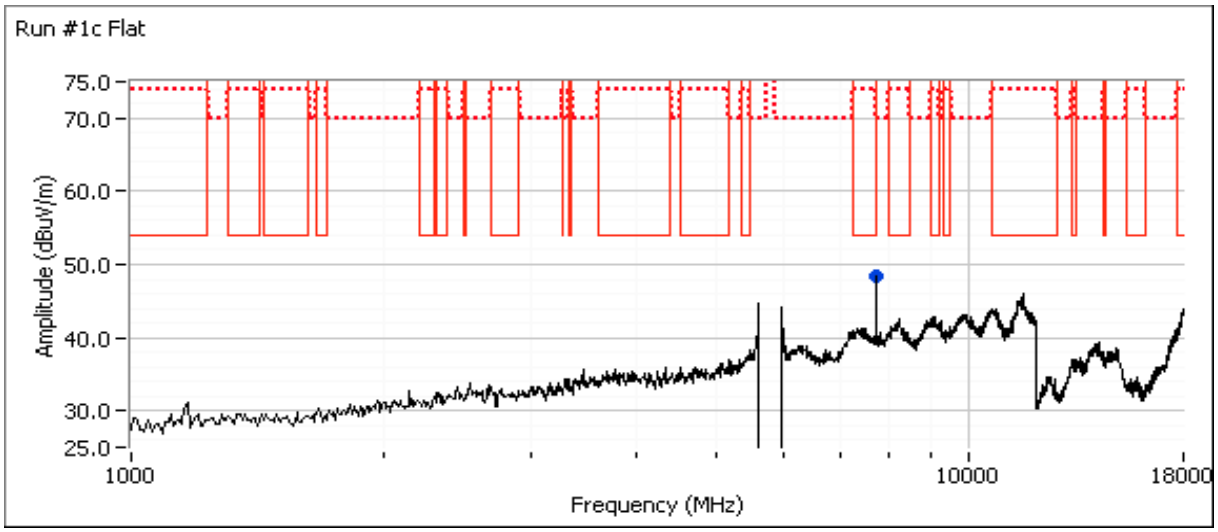
| | | | |
|---|---|---|---|
| Client: | Vocera Communications | Job Number: | J94614 |
| Model: | Northstar (1x1 802.11abgn + BT) | T-Log Number: | T94631 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210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

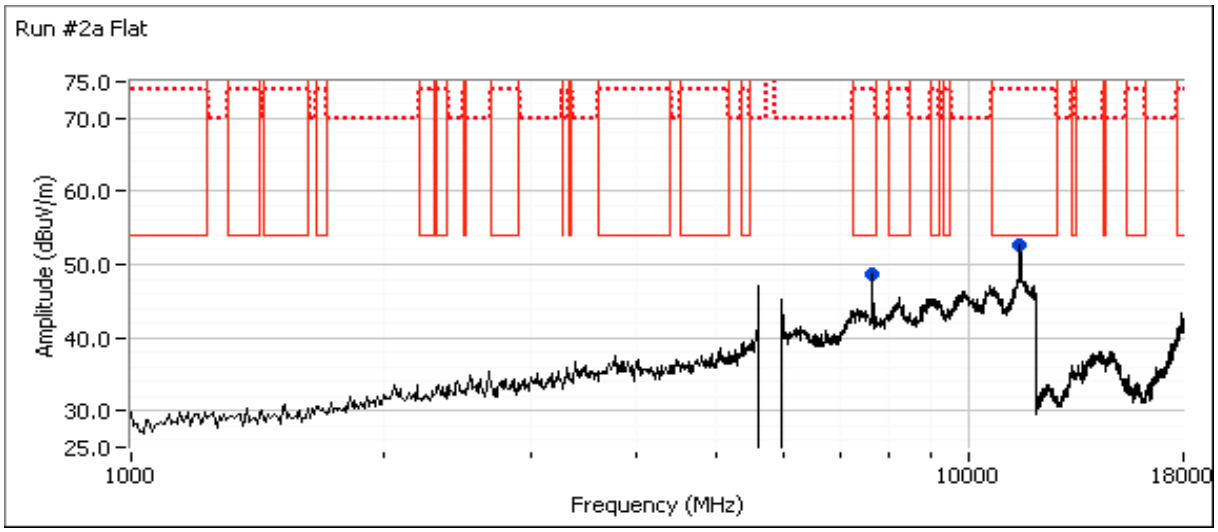
Run #2: Radiated Spurious Emissions, 1,000 - 40000 MHz. Operating Mode: Worse case from Run #1

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* |



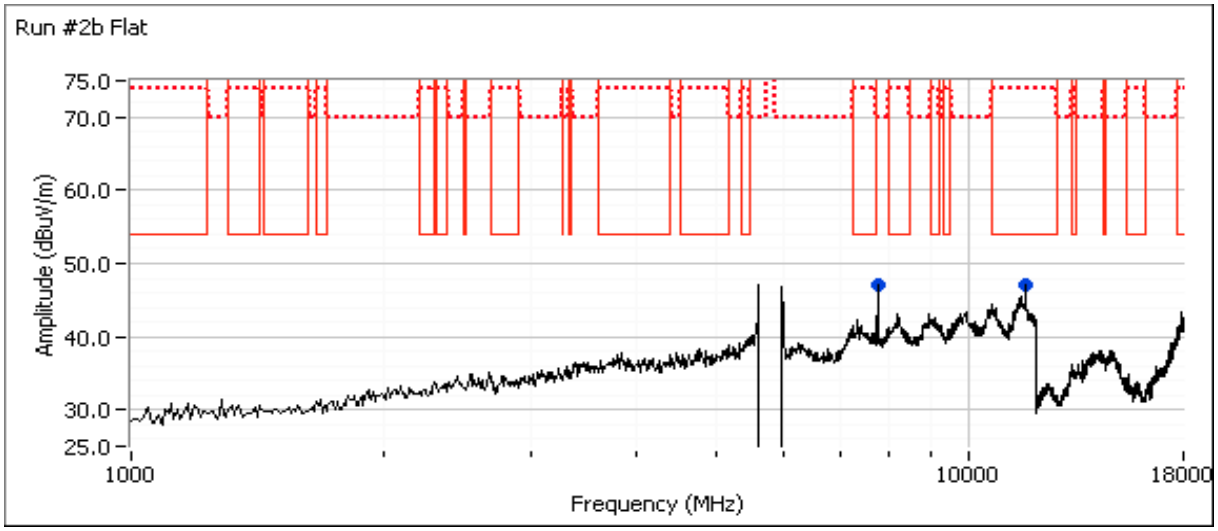
| | | | |
|---|---|---|---|
| Client: | Vocera Communications | Job Number: | J94614 |
| Model: | Northstar (1x1 802.11abgn + BT) | T-Log Number: | T94631 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210 | 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 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210 | 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)<br>n20: 12.8dBm (18.9mW)<br>n40: 12.9dBm (19.6mW) |
| 2 | - | - | Power spectral Density (PSD) | 15.247(d) | Pass | 11a: -1.5dBm/100kHz<br>n20: -0.8 dBm/100kHz<br>n40: -3.0dBm/100kHz |
| 3 | - | - | Minimum 6dB Bandwidth | 15.247(a) | Pass | 16.5 MHz |
| 3 | - | - | 99% Bandwidth | RSS GEN | - | 11a: 16.8MHz<br>n20: 17.9MHz<br>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 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210 | 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 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210 | Class: | N/A |

Run #1: Output Power

Mode: 11a

| Power Setting[2] | Frequency (MHz) | Output Power (dBm) [1] | Output Power mW | Antenna Gain (dBi) | Result | EIRP dBm | EIRP W | Output Power (dBm) [3] | Output Power 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 (dBm) [1] | Output Power mW | Antenna Gain (dBi) | Result | EIRP dBm | EIRP W | Output Power (dBm) [3] | Output Power 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 (dBm) [1] | Output Power mW | Antenna Gain (dBi) | Result | EIRP dBm | EIRP W | Output Power (dBm) [3] | Output Power 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 ≥ 98%. Output power measured using a spectrum analyzer (see plots below) with RBW= 1-5% of OBW, VB≥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 |
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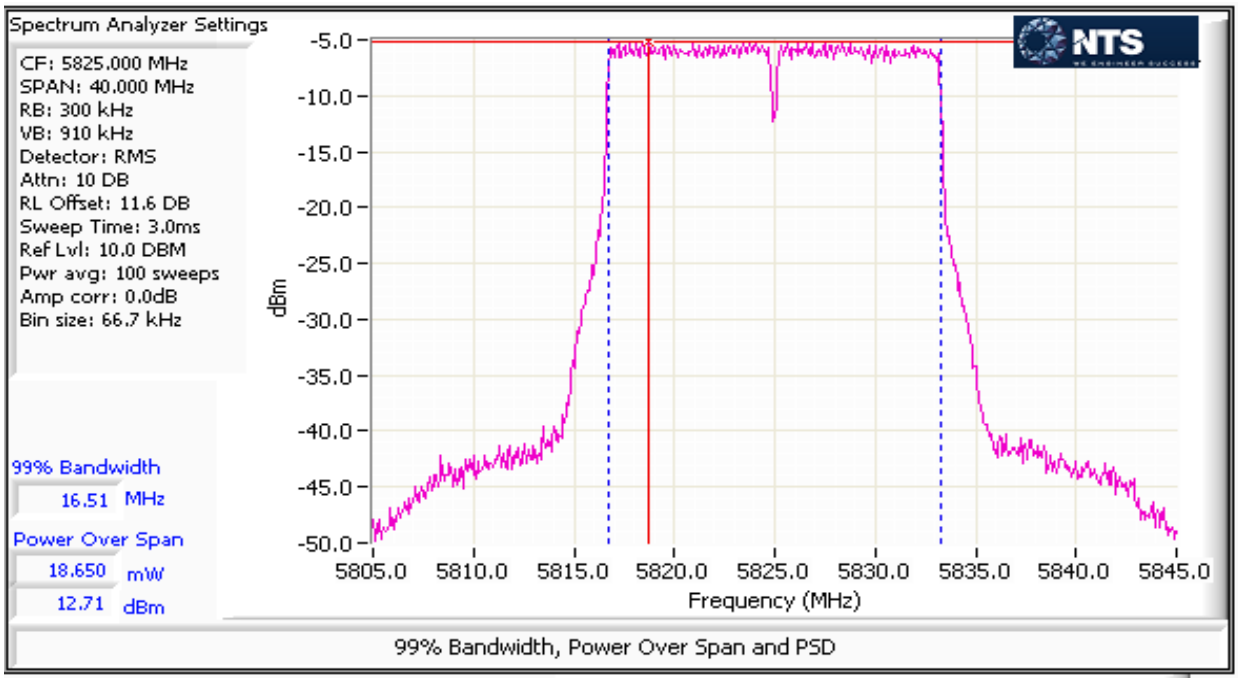
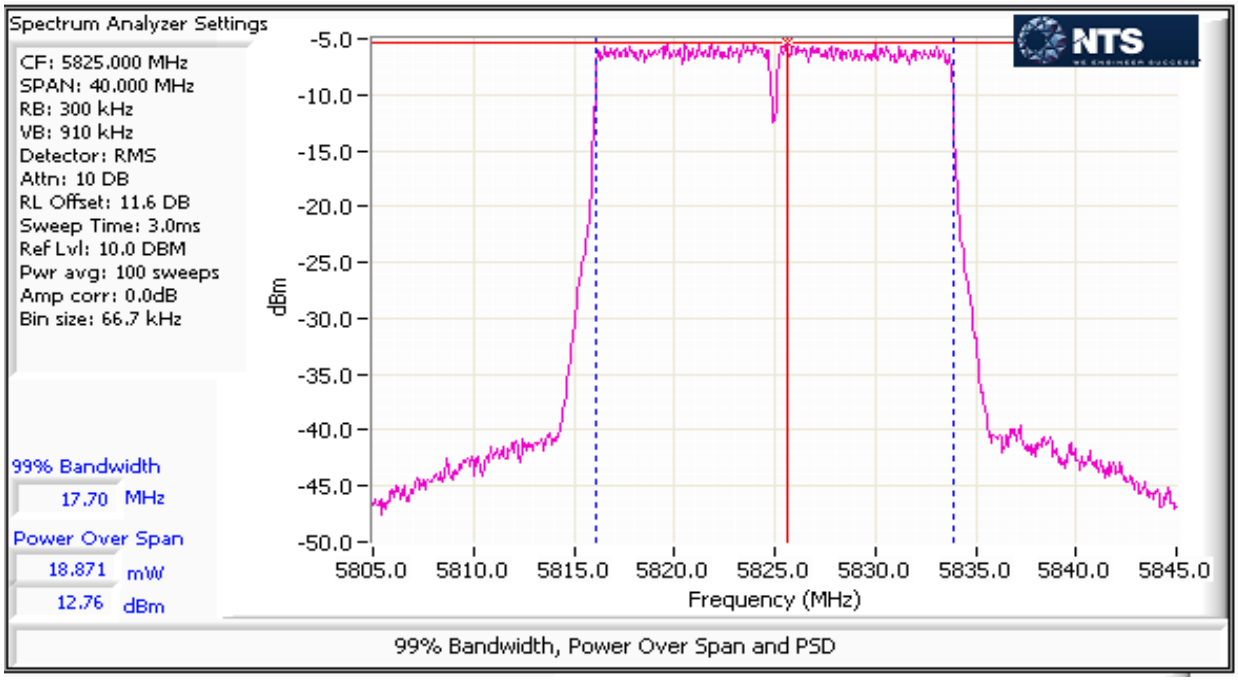
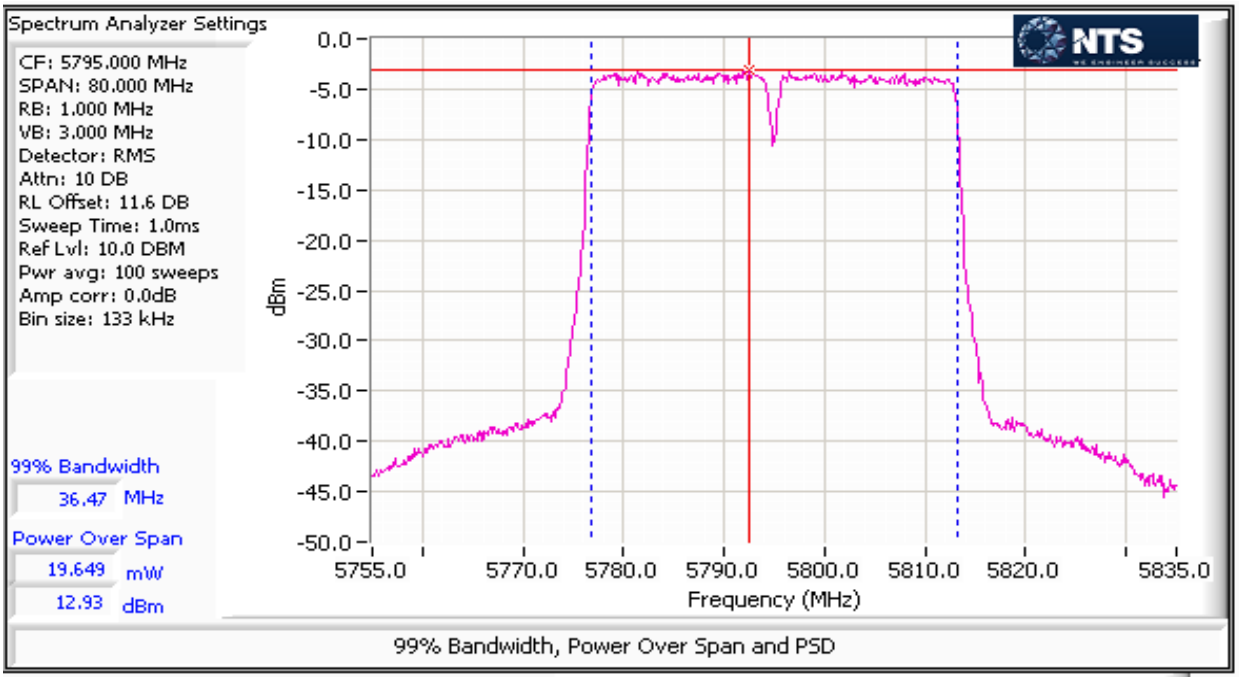
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210 | Class: | N/A |



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



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

Run #2: Power spectral Density

Mode: 11a

| Power Setting | Frequency (MHz) | PSD (dBm100kHz) Note 1 | Limit dBm/3kHz | Result |
|---|---|---|---|---|
| 16 | 5745 | -1.6 | 8.0 | Pass |
| 16 | 5785 | -1.6 | 8.0 | Pass |
| 16 | 5825 | -1.5 | 8.0 | Pass |

Mode: n20

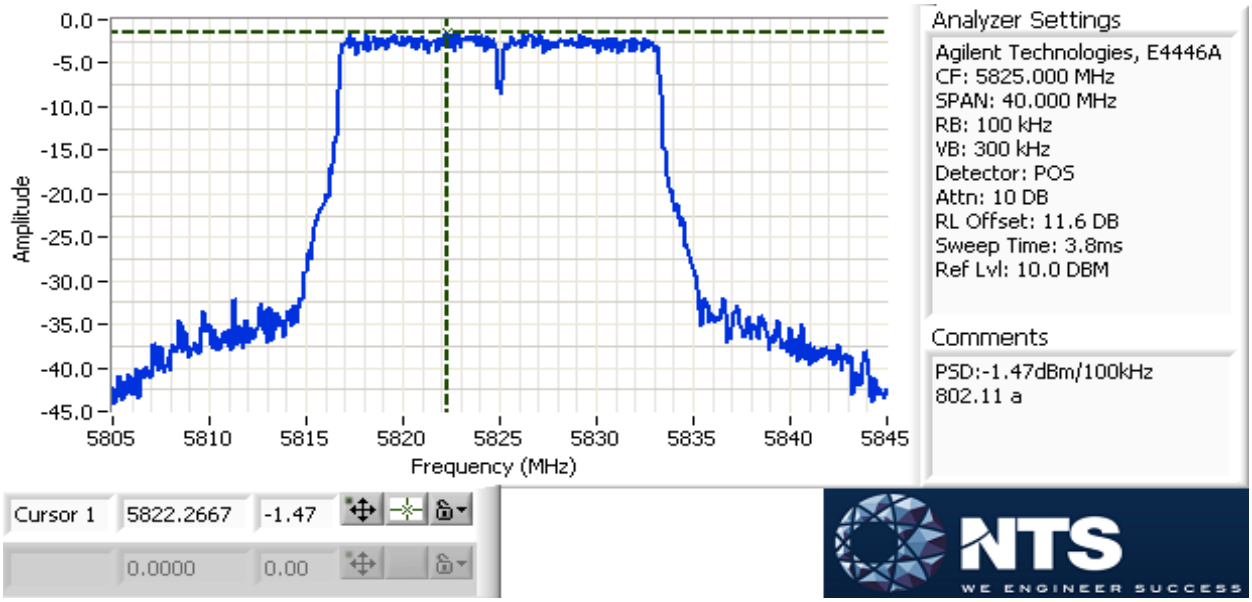
| Power Setting | Frequency (MHz) | PSD (dBm100kHz) Note 1 | Limit dBm/3kHz | Result |
|---|---|---|---|---|
| 16 | 5745 | -0.8 | 8.0 | Pass |
| 16 | 5785 | -0.9 | 8.0 | Pass |
| 16 | 5825 | -0.8 | 8.0 | Pass |

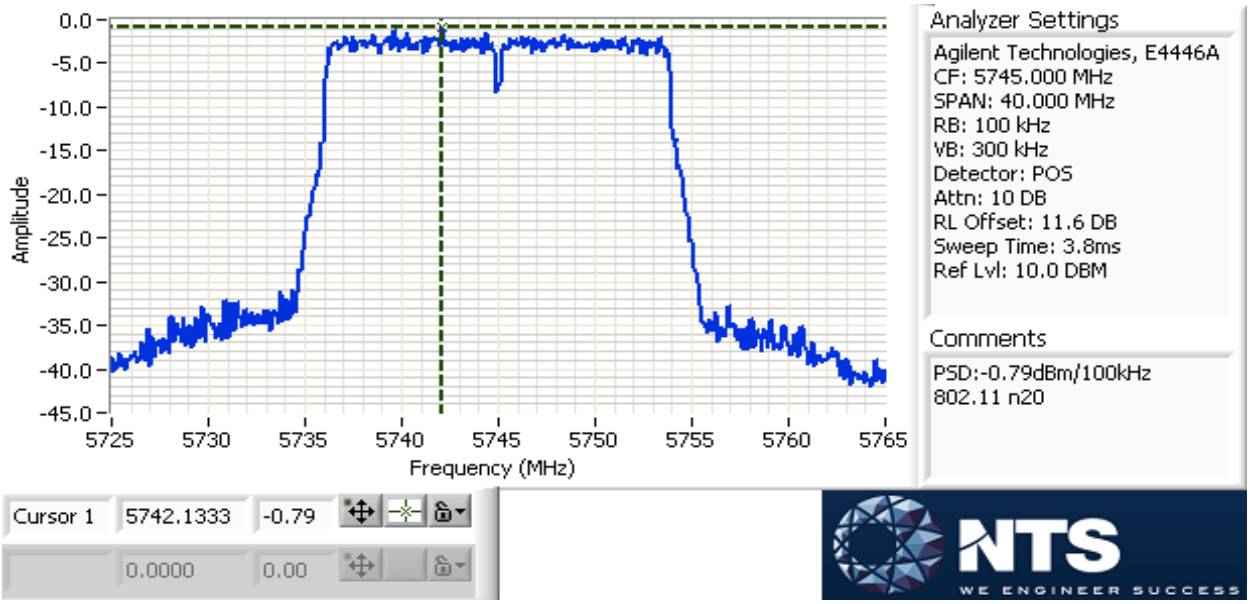
Mode: n40

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

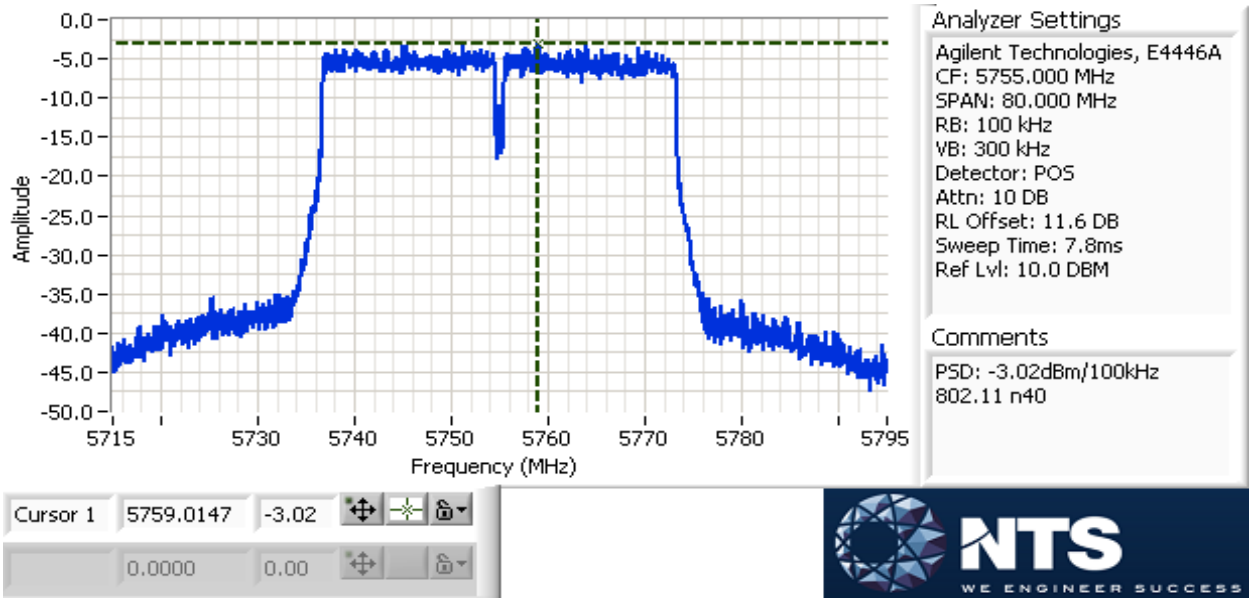
| | |
|---|---|
| Note 1: | Test performed per method PKSPD, in KDB 558074. Power spectral density measured using: 3kHz ≤ RBW ≤ 100kHz, VBW=3*RBW, peak detector, span => 1.5*DTS BW, auto sweep time, max hold. |

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



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



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

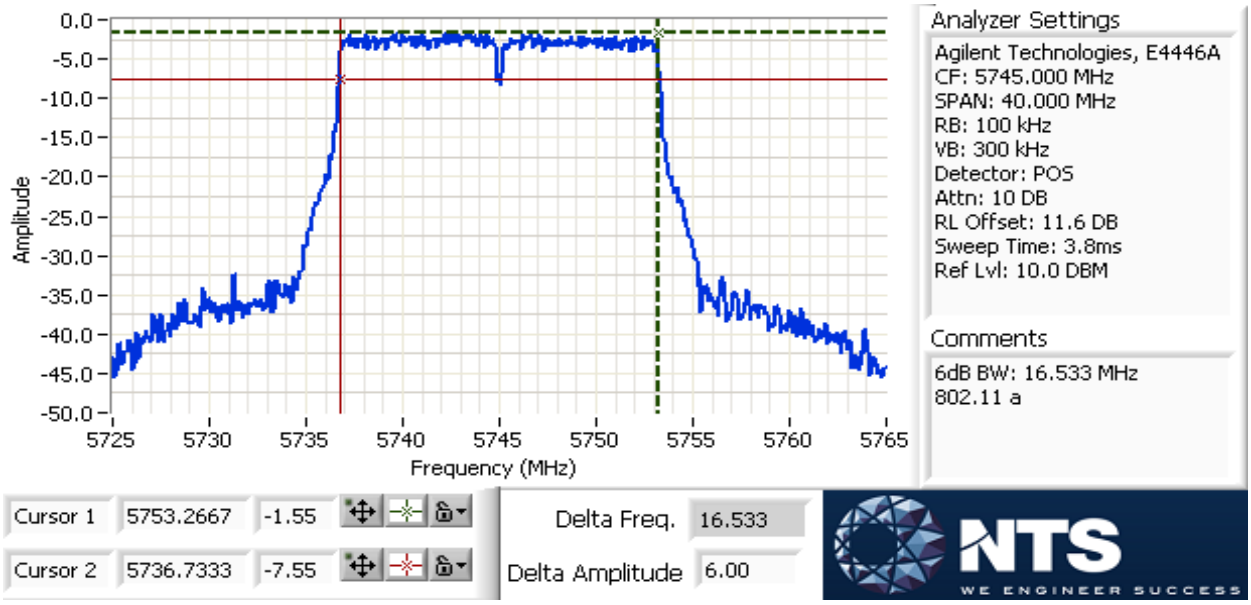
| Power Setting | Frequency (MHz) | Bandwidth (MHz) | | RBW Setting (kHz) | |
|---|---|---|---|---|---|
| | | 6dB | 99% | 6dB | 99% |
| 16 | 5745 | 17.7 | 17.9 | 100 | 300 |
| 16 | 5785 | 17.8 | 17.9 | 100 | 300 |
| 16 | 5825 | 17.8 | 17.9 | 100 | 300 |

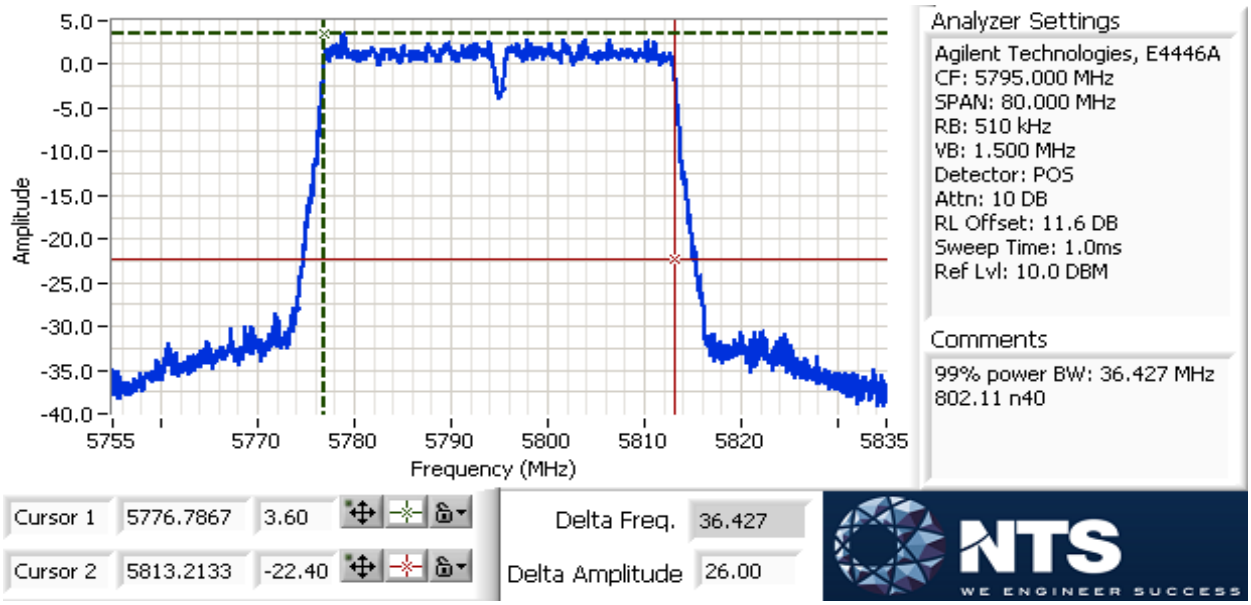
Mode: n40

| 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 ≥ 3*RBW, peak detector, max hold, auto sweep time.<br>99% BW: RBW=1-5% of of 99%BW, VBW ≥ 3*RBW, peak detector, max hold, auto sweep time. |

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



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

Run #4a: Out of Band Spurious Emissions

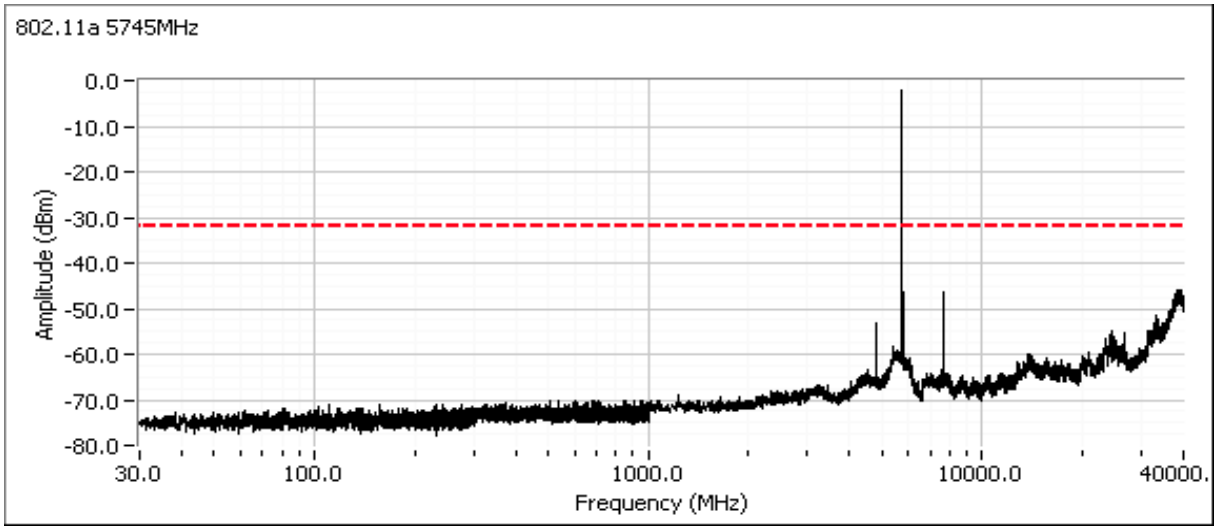
| Frequency (MHz) | Power Setting | Mode | Limit | Result |
|---|---|---|---|---|
| 5745 | 16 | a | -30dBc | Pass |
| 5785 | 16 | a | -30dBc | Pass |
| 5825 | 16 | a | -30dBc | Pass |

| 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 |

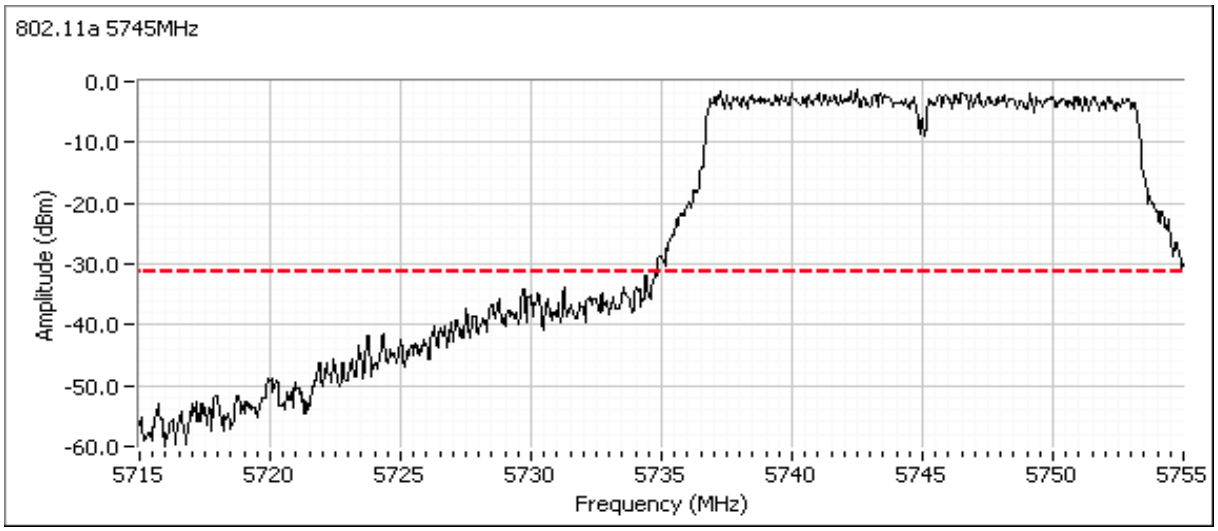
802.11 a

Plots for low channel

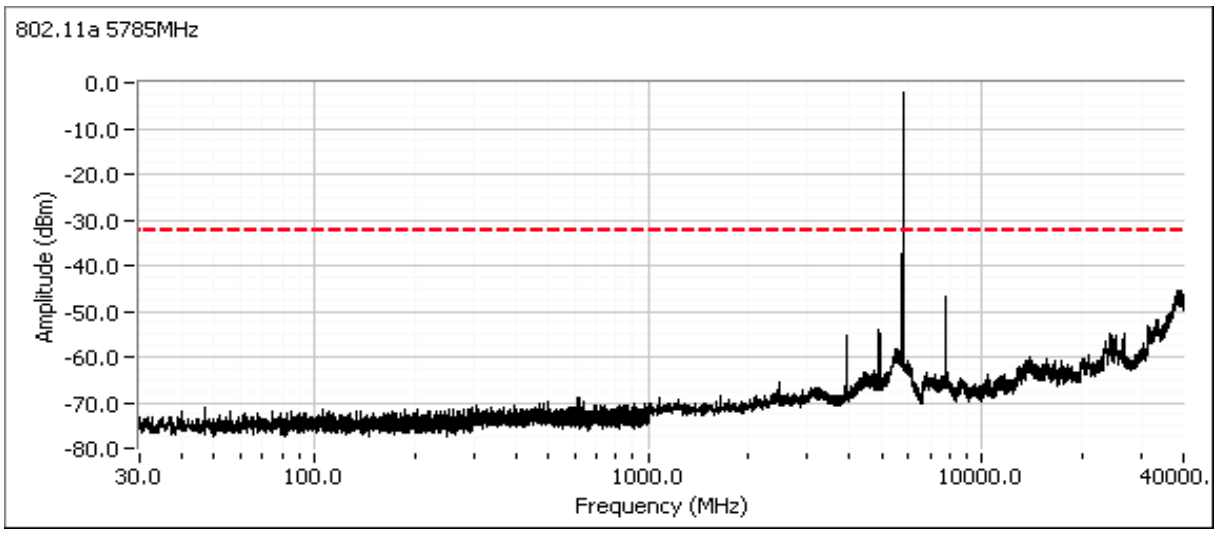


| | | | |
|---|---|---|---|
| Client: | Vocera Communications | Job Number: | J94614 |
| Model: | Northstar (1x1 802.11abgn + BT) | T-Log Number: | T94631 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210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

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

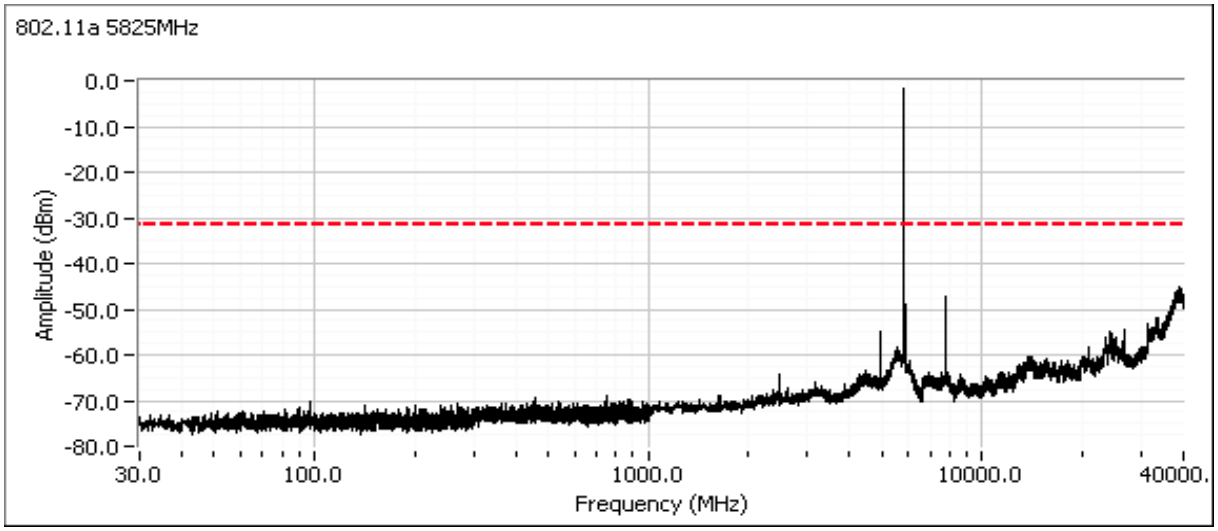



Plots for center channel

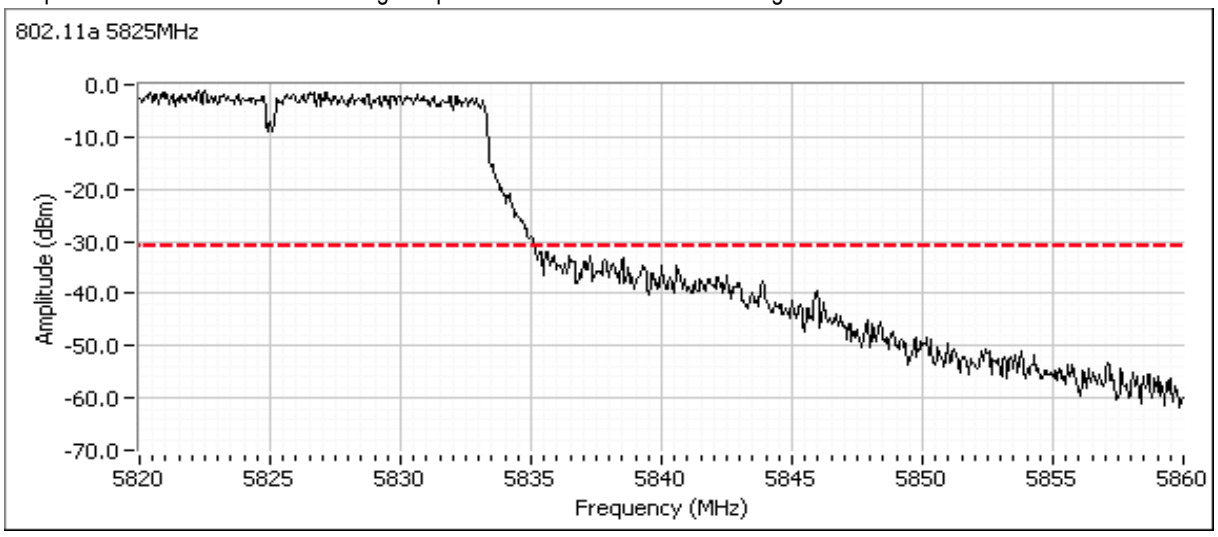


| | | | |
|---|---|---|---|
| Client: | Vocera Communications | Job Number: | J94614 |
| Model: | Northstar (1x1 802.11abgn + BT) | T-Log Number: | T94631 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210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

Plots for high channel



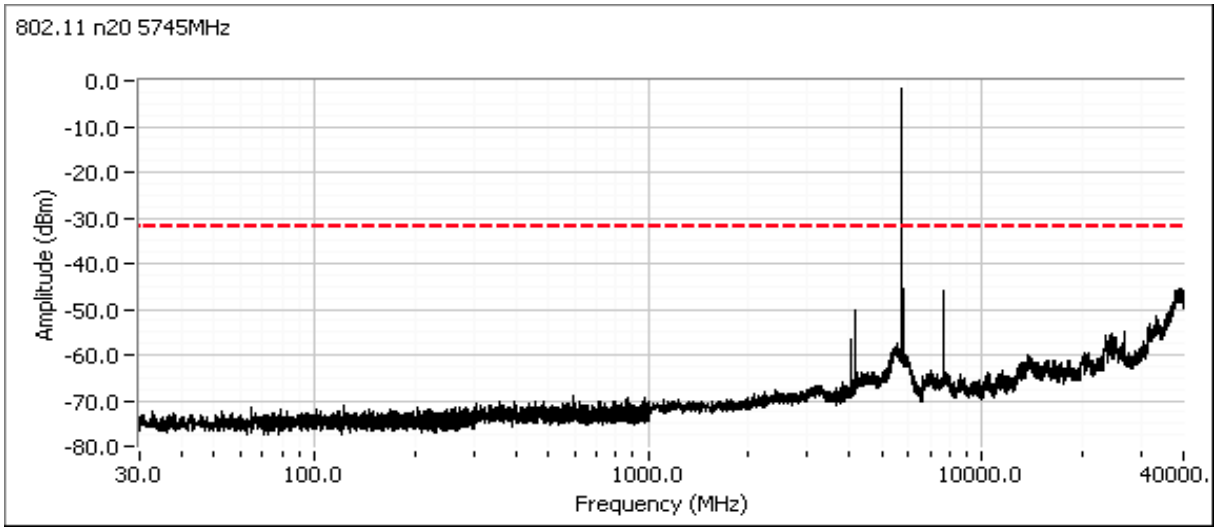

Additional plot from 5820 - 5860 MHz showing compliance with -30dBc at the band edge.



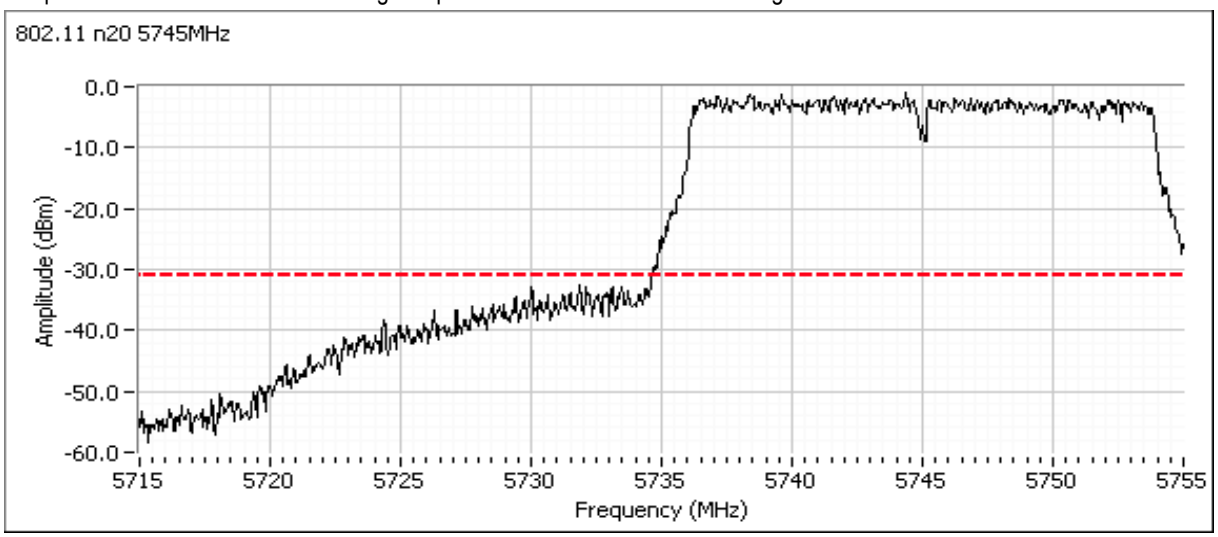
| | | | |
|---|---|---|---|
| Client: | Vocera Communications | Job Number: | J94614 |
| Model: | Northstar (1x1 802.11abgn + BT) | T-Log Number: | T94631 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210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

802.11 n20

Plots for low channel

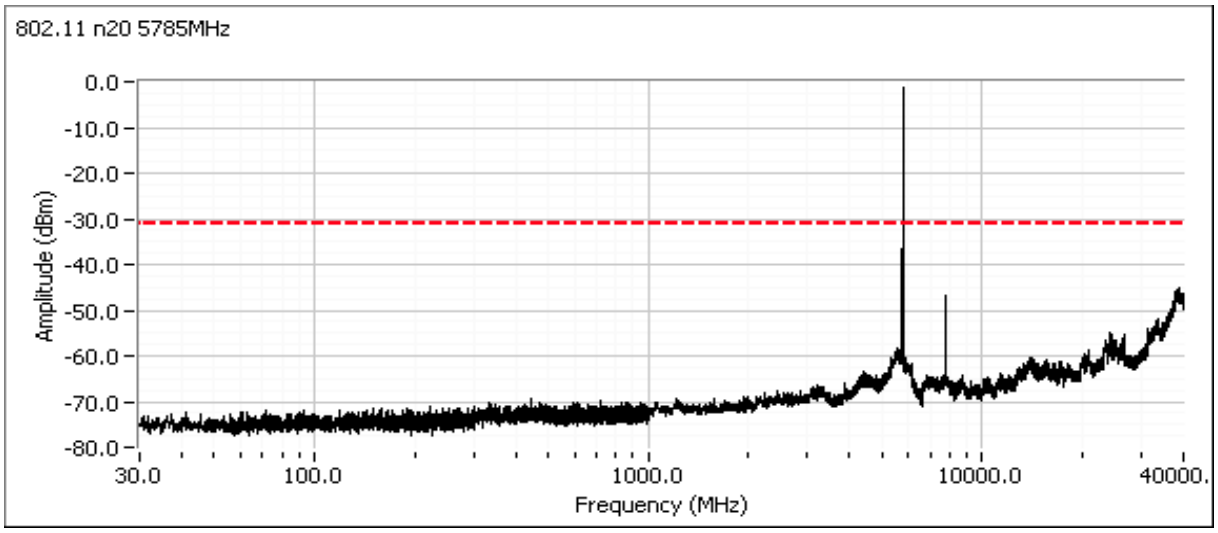



Additional plot from 5715 - 5755 MHz showing compliance with -30dBc at the band edge.

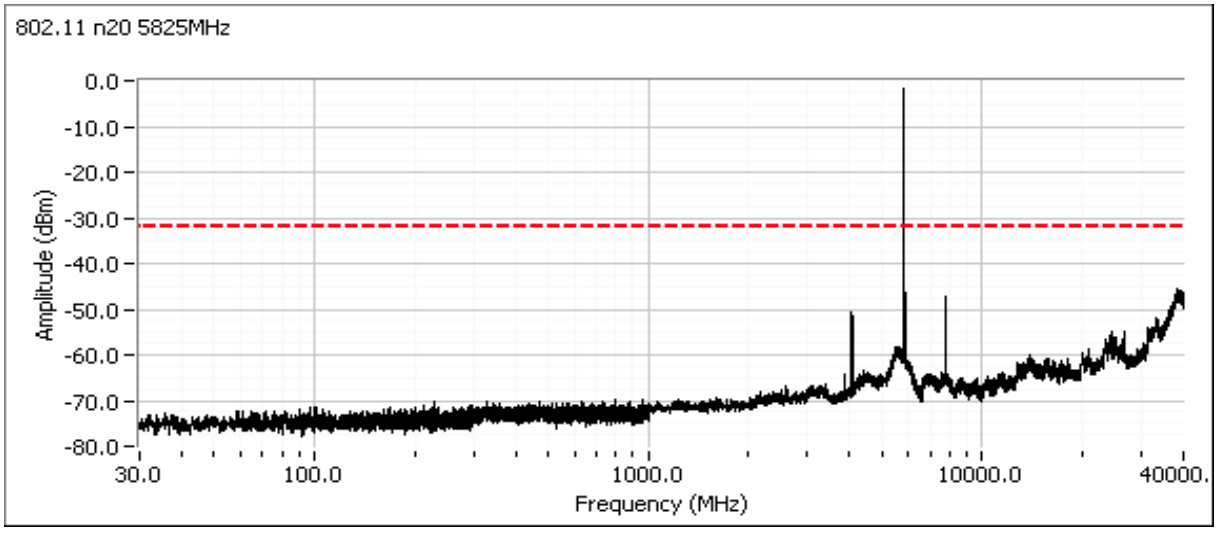


| | | | |
|---|---|---|---|
| Client: | Vocera Communications | Job Number: | J94614 |
| Model: | Northstar (1x1 802.11abgn + BT) | T-Log Number: | T94631 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210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

Plots for center channel

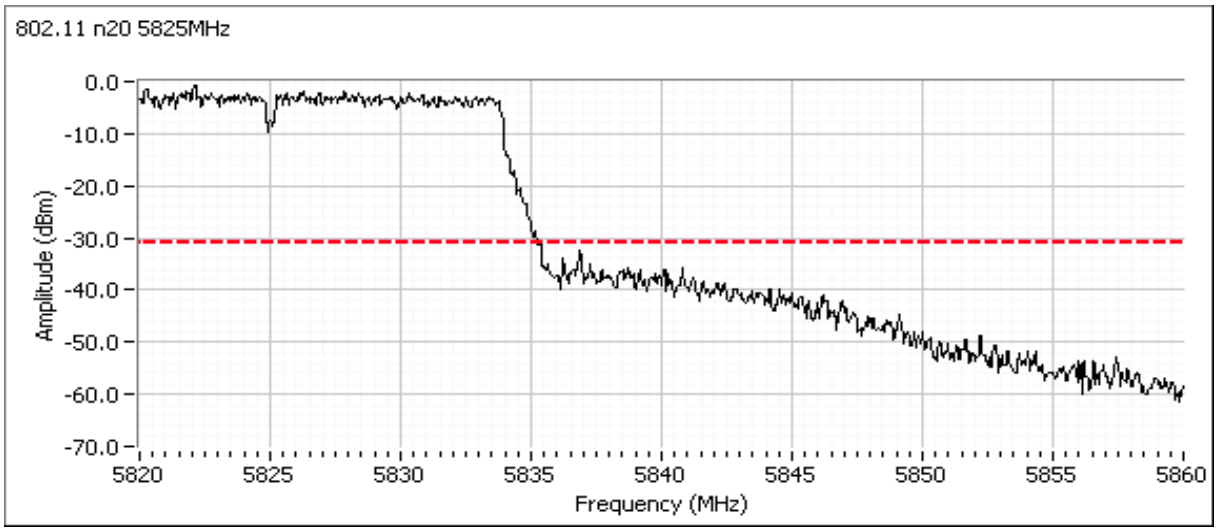



Plots for high channel



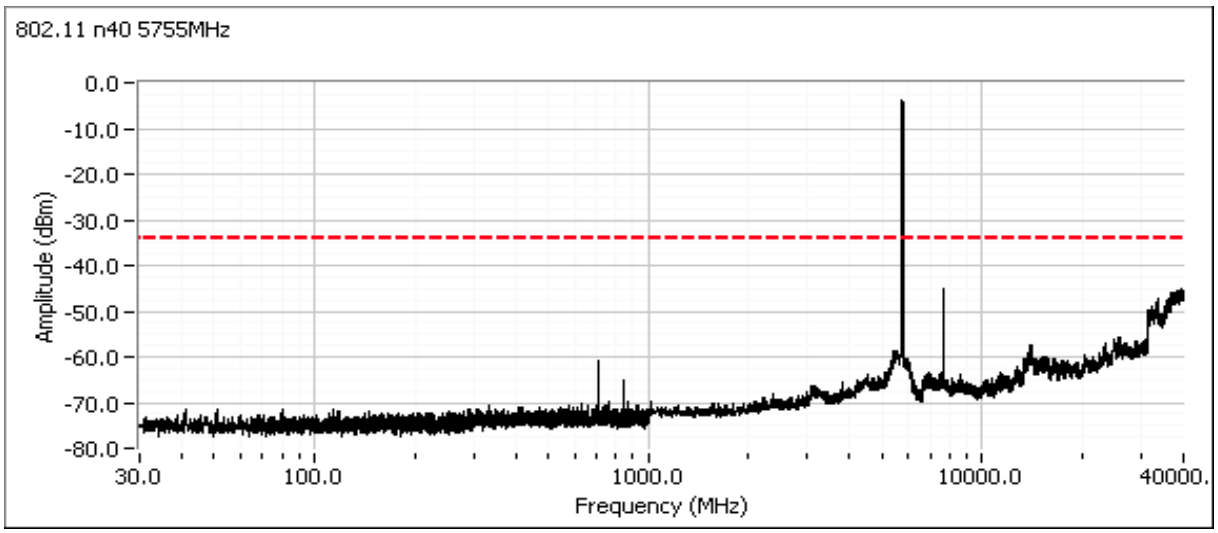
| | | | |
|---|---|---|---|
| Client: | Vocera Communications | Job Number: | J94614 |
| Model: | Northstar (1x1 802.11abgn + BT) | T-Log Number: | T94631 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210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

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



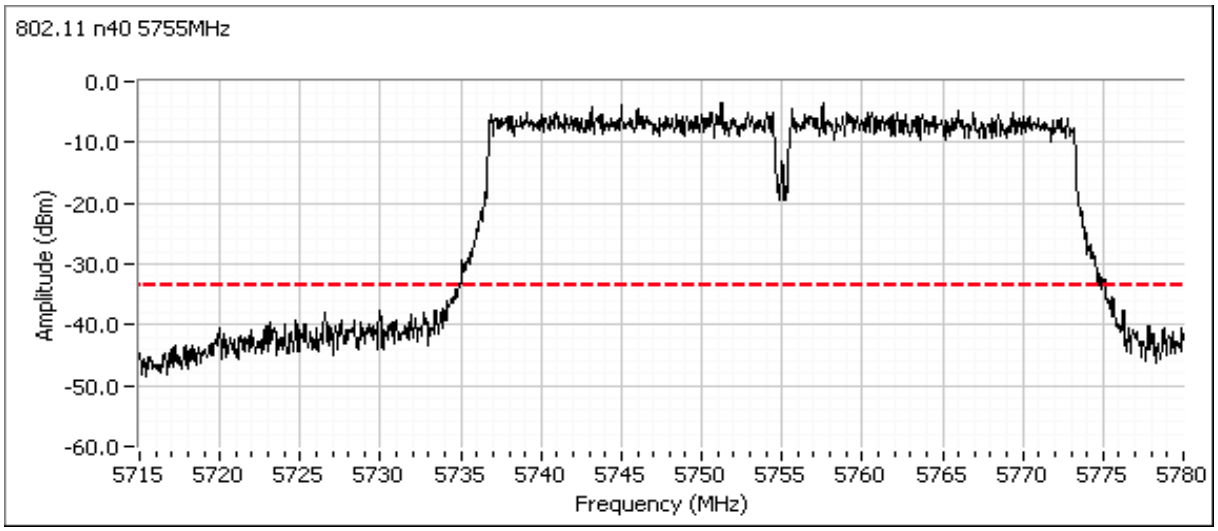

802.11 n40

Plots for low channel

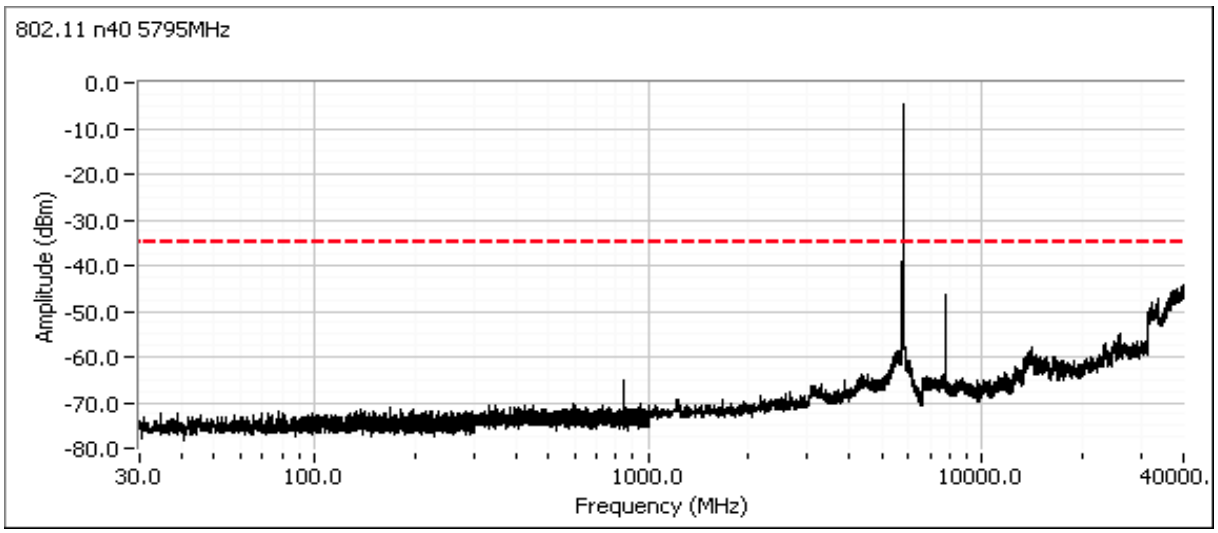


| | | | |
|---|---|---|---|
| Client: | Vocera Communications | Job Number: | J94614 |
| Model: | Northstar (1x1 802.11abgn + BT) | T-Log Number: | T94631 |
| | | Project Manager: | Christine Krebill |
| Contact: | Rob Holt | Project Coordinator: | Irene Rademacher |
| Standard: | FCC 15.247/15.E/RSS-210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

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

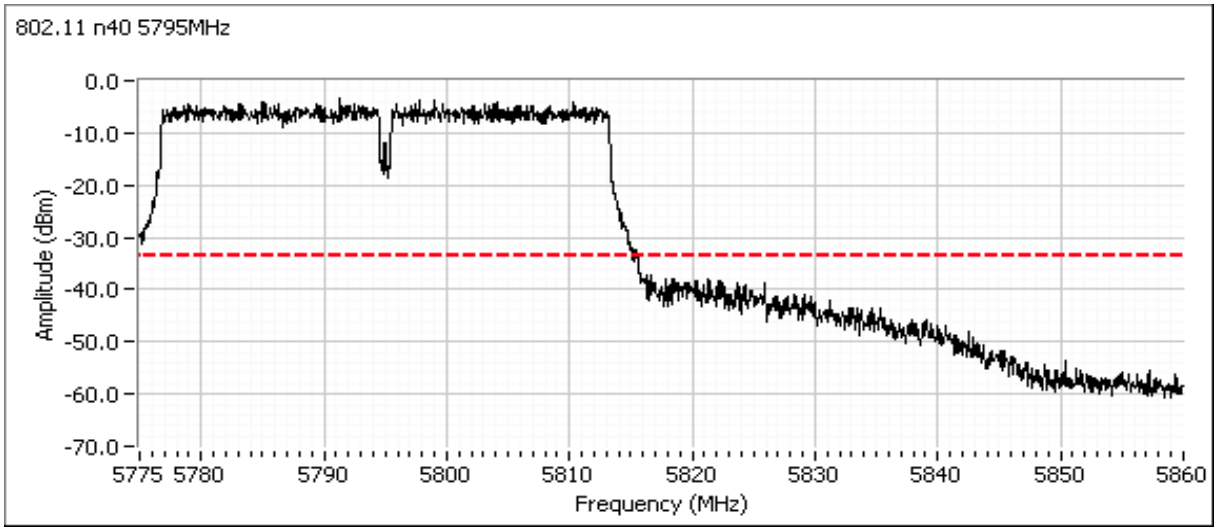



Plots for high channel



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

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



*End of Report*

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