EMC Test Report

Application for Grant of Equipment Authorization
Class II Permissive Change/Reassessment

Industry Canada RSS-Gen Issue 3 / RSS 210 Issue 8
FCC Part 15 Subpart C

Model: XI-N450

IC CERTIFICATION #:	5428A-XIN450
FCC ID:	SK6XI-N450
APPLICANT:	Xirrus, Inc. 2101 Corporate Center Dr. Newbury Park, CA 91320
TEST SITE(S):	Elliott Laboratories 41039 Boyce Road. Fremont, CA. 94538-2435
IC SITE REGISTRATION #:	2845B-4, 2845B-7
REPORT DATE:	January 10, 2012
FINAL TEST DATES:	October 20, 21, 23 and 28, 2011
TOTAL NUMBER OF PAGES:	43

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A2LA ACCREDITED
Testing Cert #2016.01

REVISION HISTORY

Rev#	Date	Comments	Modified By
-	1-10-2012	First release	

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SCOPE

An electromagnetic emissions test has been performed on the Xirrus, Inc. model XI-N450, 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 Elliott Laboratories test procedures:

ANSI C63.4:2003
FCC DTS Measurement Procedure KDB558074, March 2005

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 Xirrus, Inc. model XI-N450 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 Xirrus, Inc. model XI-N450 and therefore apply only to the tested sample. The sample was selected and prepared by Steve Smith of Xirrus, 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	Testing not performed, no changes from the original filing. Output power of test sample confirmed to be with 0.5dB of the original filing.		
15.247 (a) (2)	RSS 210 A8.2 (1)	6dB Bandwidth			
15.247 (b) (3)	RSS 210 A8.2 (4)	Output Power (multipoint systems)			
15.247(d)	RSS 210 A8.2 (2)	Power Spectral Density			
15.247(c)	RSS 210 A8.5	Antenna Port Spurious Emissions 30MHz – 25 GHz			
15.247(c) / 15.209	RSS 210 A8.5	Radiated Spurious Emissions 30MHz – 25 GHz	51.8V/m @ 2390.0MHz (-2.2dB)	15.207 in restricted bands, all others <-30dBc Note 2	Complies
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	Testing not performed, no changes from the original filing. Output power of test sample confirmed to be with 0.5dB of the original filing.		
15.247 (a) (2)	RSS 210 A8.2 (1)	6dB Bandwidth			
15.247 (b)	RSS 210 A8.2 (4)	Output Power (multipoint systems)			
15.247(d)	RSS 210 A8.2 (2)	Power Spectral Density			
15.247(c)	RSS 210 A8.5	Antenna Port Spurious Emissions – 30MHz – 40 GHz			
15.247(c) / 15.209	RSS 210 A8.5 Table 2, 3	Radiated Spurious Emissions 30MHz – 40 GHz	53.4dBµV/m @ 5440.0MHz (-0.6dB)	15.207 in restricted bands, all others <-30dBc Note 2	Complies
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	Unchanged from original filing.		
15.207	RSS GEN Table 2	AC Conducted Emissions	50.6dBµV @ 0.212MHz (-12.5dB)	Refer to page 19	Complies
15.109	RSS GEN 7.2.3 Table 1	Receiver spurious emissions	53.2dBµV/m @ 3800.0MHz (-0.8dB)	Refer to page 20	Complies
15.247 (b) (5) 15.407 (f)	RSS 102	RF Exposure Requirements	Unchanged from original filing.		
-	RSP 100 RSS GEN 7.1.5	User Manual	Unchanged from original filing.		
-	RSP 100 RSS GEN 7.1.5	User Manual	Unchanged from original filing.		
-	RSP 100 RSS GEN 4.4.1	99% Bandwidth	Unchanged from original filing.		

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 Xirrus, Inc. model XI-N450 is an 802.11abgn 3x3 module intended to be installed in Xirrus Wireless Access Points. The module supports 802.11bgn 3x3 in the 2400-2483.5MHz, 5725-5850MHz, 5150-5250MHz, 5250-5350MHz and 5470-5725MHz bands. It additionally supports 802.11a SISO mode in the 5150-5250MHz, 5250-5350MHz and 5470-5725MHz bands at a higher per chain power. SISO modes in the other bands operate at the same output power per chain as the equivalent MIMO mode. It can operate in both 20- and 40-MHz channels in 802.11n mode.

The samples were received on October 17, 2011 and tested on October 20, 21, 23 and 28, 2011. For testing purposes 8 samples of the XI-N300 2x2 module, and 8 samples of a 3x3 version of the module (model number XI-N450) were installed into a Xirrus XR6000 host system capable of containing a maximum of 16 modules.

Normally, the XR6000 would be ceiling mounted during operation. The host system was tested as table-top equipment. The host system is powered via Power-Over-Ethernet (PoE). Compliance of the modules with the AC conducted emissions limits was evaluated by measuring the emissions at the AC input to a typical PoE injector used to power the host system.

The EUT consisted of the following component(s):

Company	Model	Description	Serial Number	FCC ID
Xirrus Inc.	XI-N450	802.11abgn 3x3 module	11000000239	SK6XI-N450

ANTENNA SYSTEM

The antenna system is integrated into the module with two antennas per module (one for each transmit-receive chain). The nominal antenna gains are 1dBi in the 2.4GHz band and 4dBi in the 5GHz bands.

ENCLOSURE

The EUT has no enclosure. It is designed to be installed within the enclosure of a host computer.

MODIFICATIONS

No modifications were made to the EUT during the time the product was at Elliott.

SUPPORT EQUIPMENT

The following equipment was used as support equipment for testing:

Company	Model	Description	Serial Number	FCC ID
Xirrus	XR6000	Access Point	-	-

The following equipment was used as remote support equipment for emissions testing:

Company	Model	Description	Serial Number	FCC ID
HP	Compaq 6910P	PC Laptop	n/a	DoC
Xirrus	XP2-MSI-95M	Dual Port POE Injector	P12400043B1	N/A

EUT INTERFACE PORTS

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

Port		Cable(s)		
From	To	Description	Shielded/Unshielded	Length(m)
POE1, POE2	Remote POE Injector	CAT5 (x2)	Unshielded	10
Gig3, Gig4	Not Connected	-	-	-
Console	Not Connected	-	-	-
Laptop Ethernet	PoE Injector	Cat 5	Unshielded	1

EUT OPERATION

The modules were installed into a host system for spurious emissions tests.

To evaluate the radiated spurious emissions related to the transmitter the module was evaluated in all operating modes (802.11b, 802.11g, 802.11a, 802.11n in both20- and 40-MHz channels) using ART software utility to place the module(s) under test in continuous transmit modes. Both transmit chains were active for the DTS tests, NII tests were repeated in 802.11a mode with a single chain active.

For measurements at the restricted band edges one module was operating on the channel closest to the band edge. The worse case operating mode from the original filing was tested for each band. For other spurious emissions measurements multiple radios were operating simultaneously such that all operating modes were active simultaneously on the high, center or low channel in each band. As the host system can also house a 3x3version of the module, during radiated spurious emissions tests there were up to sixteen radios active simultaneously on the same channel for these spurious measurements. When installed into host systems the host system firmware will not allow multiple radios to operate on the same or overlapping channels, so if signals were above the limit with multiple radios active, and those signals were related to harmonics of the transmitted signal, then the measurements were repeated with only one set of radios or one mode active because these harmonic emissions would only be present form one radio at any specific time.

During radiated emissions tests for receiver spurious emissions 10 radios (5 of each module type) were in receive mode with all chains active on the following channels: 2437 MHz, 5200 MHz, 5300 MHz, 5580 MHz, and 5785 MHz. This ensured that at least one module was on the center channel in each operating band as required by RSS 210 and RSS GEN.

Measurements on the host system for the frequency range 30 – 1000 MHz demonstrated that all significant emissions were from the host system. Digital device emissions from the host system above 1GHz (occurring at 2.5GHz, 5.0GHz and 7.5GHz) were excluded from the scope of this test report and will be evaluated as a part of the host system digital device tests.

AC conducted emissions measurements were made on the AC input to the Power-Over-Ethernet (PoE) injector used to power the host system. For these measurements all sixteen radios were in a transmit/receive mode with all chains active on the following channels: 2437 MHz, 5200 MHz, 5280 MHz, 5580 MHz, 5785 MHz, 2412 MHz, 2462 MHz, 5180 MHz, 5320 MHz, 5500 MHz, 5700 MHz, 5785 MHz, 2462 MHz, 5240MHz, 5260 MHz, 5540 MHz.

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	Registration Numbers		Location
	FCC	Canada	
Chamber 4	211948	2845B-4	41039 Boyce Road Fremont, CA 94538-2435
Chamber 7	A2LA accreditation	2845B-7	

ANSI C63.4:2003 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 C63.4:2003.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing is performed in conformance with ANSI C63.4:2003. 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 C63.4:2003 guidelines and meet the Normalized Site Attenuation (NSA) requirements of ANSI C63.4:2003.

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.

LINE IMPEDANCE STABILIZATION NETWORK (LISN)

Line conducted measurements utilize a fifty microhenry Line Impedance Stabilization Network as the monitoring point. The LISN used also contains a 250 uH CISPR adapter. This network provides for calibrated radio frequency noise measurements by the design of the internal low pass and high pass filters on the EUT and measurement ports, respectively.

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 C63.4:2003 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. 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 C63.4:2003, and the worst-case orientation is used for final measurements.

CONDUCTED EMISSIONS

Conducted emissions are measured at the plug end of the power cord supplied with the EUT. Excess power cord length is wrapped in a bundle between 30 and 40 centimeters in length near the center of the cord. Preliminary measurements are made to determine the highest amplitude emission relative to the specification limit for all the modes of operation. Placement of system components and varying of cable positions are performed in each mode. A final peak mode scan is then performed in the position and mode for which the highest emission was noted on all current carrying conductors of the power cord.

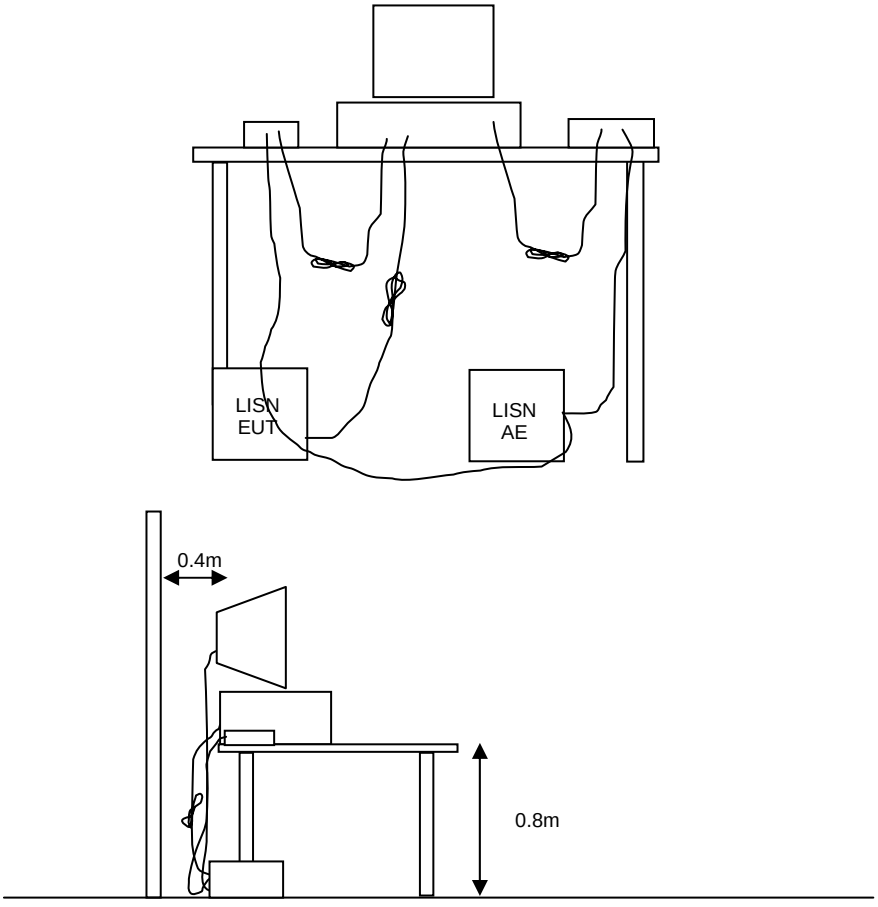


Figure 1 Typical Conducted Emissions Test Configuration

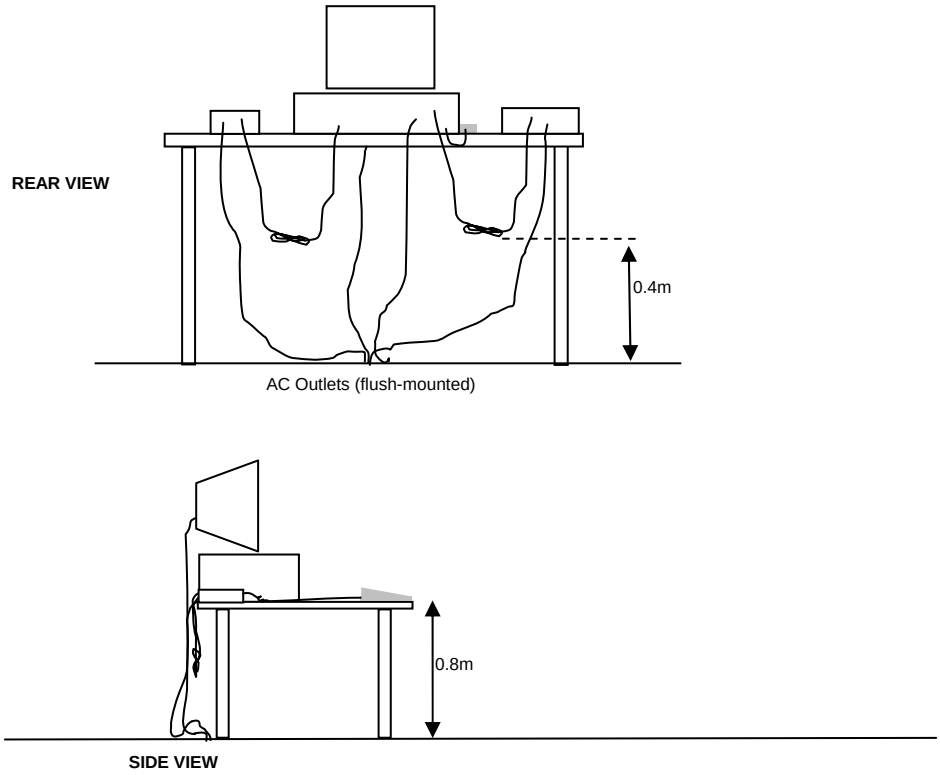
RADIATED EMISSIONS

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.

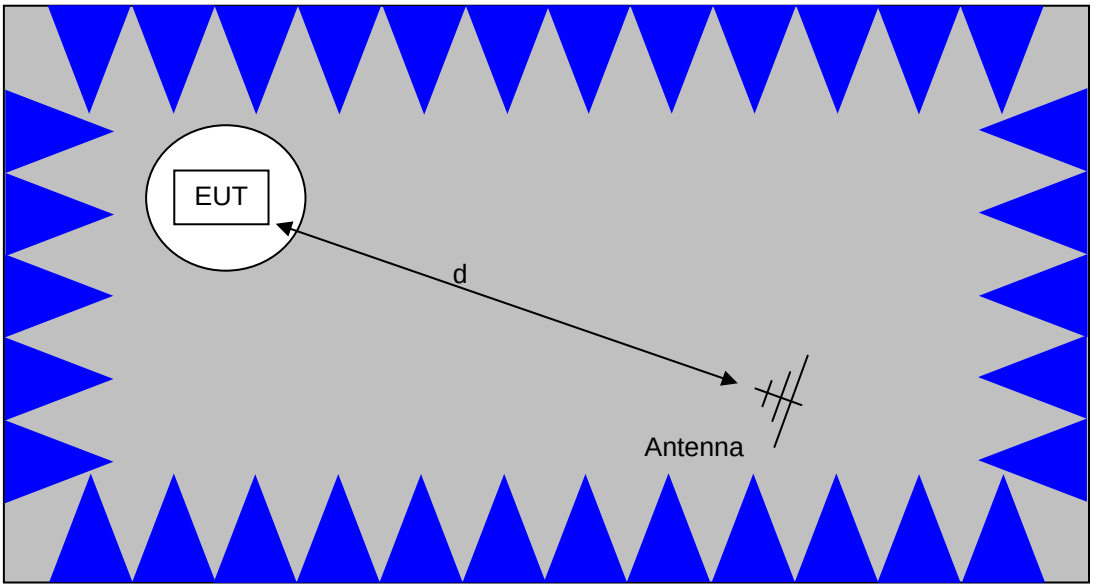
A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

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.

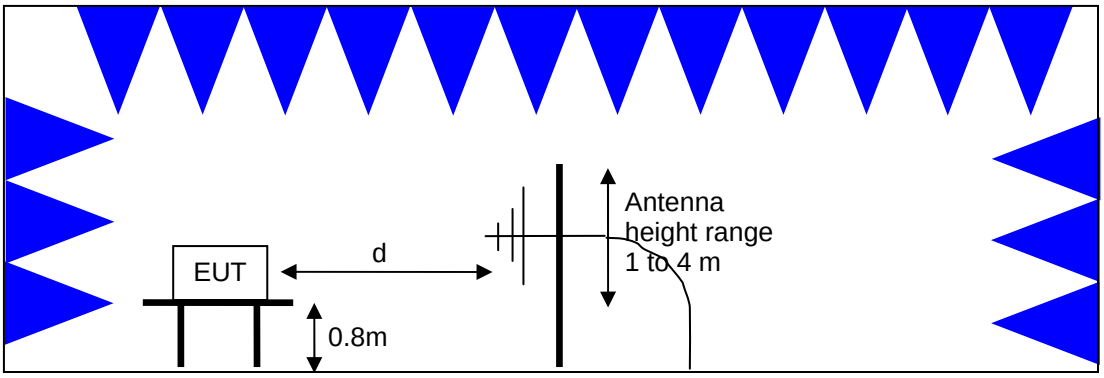


Typical Test Configuration for Radiated Field Strength Measurements



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.

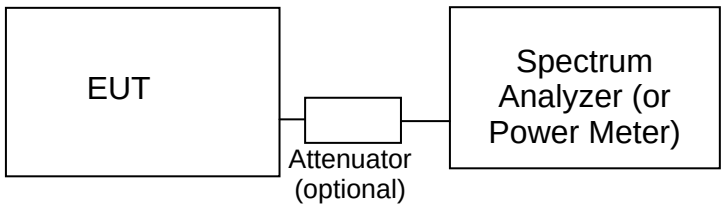
Floor-standing equipment is placed on the floor with insulating supports between the unit and the ground plane.



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 Elliott'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 and/or 26dB signal bandwidth is measured in using the bandwidths recommended by ANSI C63.4. When required, the 99% bandwidth is measured using the methods detailed in 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:

CONDUCTED EMISSIONS SPECIFICATION LIMITS: FCC 15.207; FCC 15.107(a), RSS GEN

The table below shows the limits for the emissions on the AC power line from an intentional radiator and a receiver.

Frequency (MHz)	Average Limit (dBuV)	Quasi Peak Limit (dBuV)
0.150 to 0.500	Linear decrease on logarithmic frequency axis between 56.0 and 46.0	Linear decrease on logarithmic frequency axis between 66.0 and 56.0
0.500 to 5.000	46.0	56.0
5.000 to 30.000	50.0	60.0

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

RECEIVER RADIATED SPURIOUS EMISSIONS SPECIFICATION LIMITS

The table below shows the limits for the spurious emissions from receivers as detailed in FCC Part 15.109, RSS 210 Table 2, RSS GEN Table 1 and RSS 310 Table 3. Note that receivers operating outside of the frequency range 30 MHz – 960 MHz are exempt from the requirements of 15.109.

Frequency Range (MHz)	Limit (uV/m @ 3m)	Limit (dBuV/m @ 3m)
30 to 88	100	40
88 to 216	150	43.5
216 to 960	200	46.0
Above 960	500	54.0

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

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.

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:

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

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

Radio (Spurious Emissions), 20-Oct-11

Manufacturer	Description	Model	Asset #	Cal Due
EMCO	Antenna, Horn, 1-18GHz	3115	868	6/8/2012
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	2199	2/23/2012
Hewlett Packard	SpecAn 9 kHz - 40 GHz, (SA40) Purple	8564E (84125C)	2415	7/28/2012

Radiated Emissions, 1000 - 18,000 MHz (BE), 21-Oct-11

Manufacturer	Description	Model	Asset #	Cal Due
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	263	12/8/2011
Hewlett Packard	SpecAn 30 Hz -40 GHz, SV (SA40) Red	8564E (84125C)	1148	8/15/2012
EMCO	Antenna, Horn, 1-18 GHz (SA40-Blu)	3115	1386	9/21/2012

Radiated Emissions, 30 - 10,000 MHz, 23-Oct-11

Manufacturer	Description	Model	Asset #	Cal Due
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	263	12/8/2011
Hewlett Packard	EMC Spectrum Analyzer, 9 kHz - 6.5 GHz	8595EM	787	7/29/2012
EMCO	Antenna, Horn, 1-18GHz	3115	868	6/8/2012
Hewlett Packard	SpecAn 30 Hz -40 GHz, SV (SA40) Red	8564E (84125C)	1148	8/15/2012
Rohde & Schwarz	Test Receiver, 9 kHz-2750 MHz	ESCS 30	1337	11/24/2011
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	1548	6/24/2012

Conducted Emissions - AC Power Ports, 23-Oct-11

Manufacturer	Description	Model	Asset #	Cal Due
Hewlett Packard	EMC Spectrum Analyzer, 9 kHz - 6.5 GHz	8595EM	787	7/29/2012
EMCO	LISN, 10 kHz-100 MHz, 25A	3825/2	1292	3/1/2012
Rohde & Schwarz	Test Receiver, 9 kHz-2750 MHz	ESCS 30	1337	11/24/2011
Rohde & Schwarz	Pulse Limiter	ESH3 Z2	1401	4/21/2012

Radiated Emissions Free Space, 1,000 - 6,500 MHz, 28-Oct-11

Manufacturer	Description	Model	Asset #	Cal Due
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	263	12/8/2011
EMCO	Antenna, Horn, 1-18 GHz	3115	786	12/11/2011
Hewlett Packard	SpecAn 30 Hz -40 GHz, SV (SA40) Red	8564E (84125C)	1148	8/15/2012

Appendix B Test Data

T85088 Pages 25 - 42

Client:	Xirrus, Inc.	Job Number:	J84865
Model:	XR6000 3x3	T-Log Number:	T85088
		Account Manager:	Susan Pelzl
Contact:	Steve Smith		-
Emissions Standard(s):	FCC 15.247, 15.E, 15.B, EN 55022	Class:	A
Immunity Standard(s):	-	Environment:	-

EMC Test Data

For The

Xirrus, Inc.

Model

XR6000 3x3

Date of Last Test: 11/16/2011

Client:	Xirrus, Inc.	Job Number:	J84865
Model:	XR6000 3x3	T-Log Number:	T85088
		Account Manager:	Susan Pelzl
Contact:	Steve Smith		
Standard:	FCC 15.247, 15.E, 15.B, EN 55022	Class:	N/A

RSS 210 and FCC 15.247 (DTS) Radiated Spurious Emissions
802.11bg, HT20 Band Edge and Spurious, HT40 Band Edge

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.

Ambient Conditions:

Temperature: 20-25 °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.

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

Run #	Mode	Channel	Power Setting		Test Performed	Limit	Result / Margin
1a Low Channel	HT20	2412 MHz	-		Restricted Band Edge (2390 MHz)	FCC Part 15.209 / 15.247(c)	51.8V/m @ 2390.0MHz (-2.2dB)
		2417 MHz	-		Restricted Band Edge (2390 MHz)	FCC Part 15.209 / 15.247(c)	48.8V/m @ 2389.5MHz (-5.2dB)
1b High Channel		2462 MHz	-		Restricted Band Edge (2483.5 MHz)	FCC Part 15.209 / 15.247(c)	48.4V/m @ 2500.0MHz (-5.6dB)
		2457 MHz	-		Restricted Band Edge (2483.5 MHz)	FCC Part 15.209 / 15.247(c)	50.1V/m @ 2483.6MHz (-3.9dB)

Testing was performed on the worse case mode from the original filing.
Power was set to be within 0.5dB of the original filing power.

Client:	Xirrus, Inc.	Job Number:	J84865
Model:	XR6000 3x3	T-Log Number:	T85088
		Account Manager:	Susan Pelzl
Contact:	Steve Smith		
Standard:	FCC 15.247, 15.E, 15.B, EN 55022	Class:	N/A

Run #1: Radiated Spurious Emissions, 30 - 26500 MHz. Operating Mode: 802.11n 20 MHz, 3x3

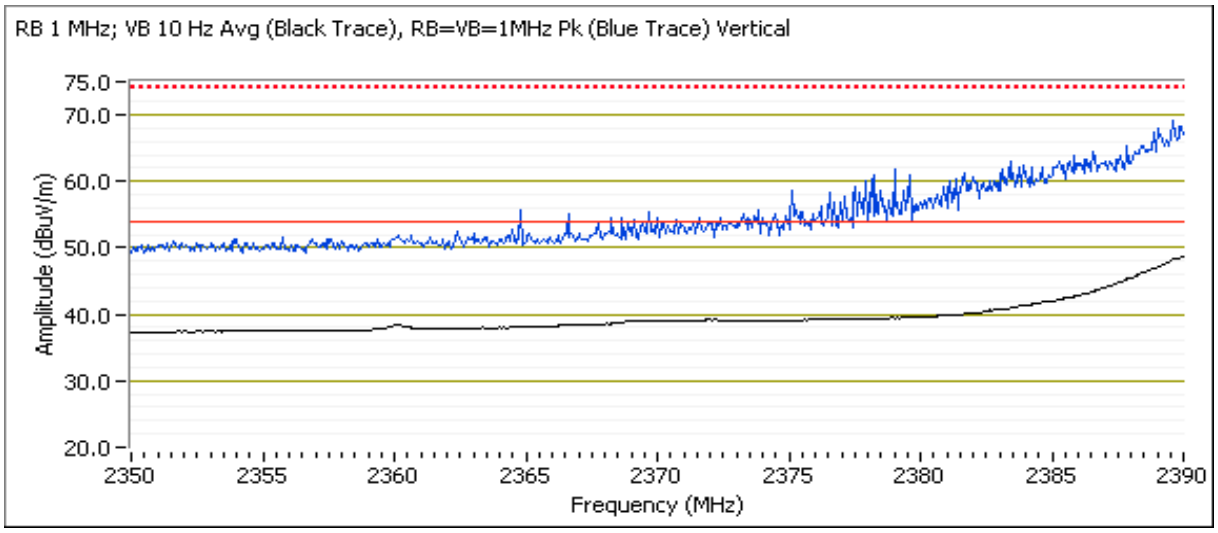
Date of Test: 10/20/2011 Test Location: FT Chamber #4

Test Engineer: Rafael Varelas

Run #1a: Channel 1@ 2412 MHz, Radio #0

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	V/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2389.960	51.8	V	54.0	-2.2	AVG	270	1.0	RB 1 MHz;VB 10 Hz;Pk
2389.790	67.2	V	74.0	-6.8	PK	270	1.0	RB 1 MHz;VB 3 MHz;Pk
2389.970	50.1	H	54.0	-3.9	AVG	354	1.0	RB 1 MHz;VB 10 Hz;Pk
2389.710	70.3	H	74.0	-3.7	PK	354	1.0	RB 1 MHz;VB 3 MHz;Pk

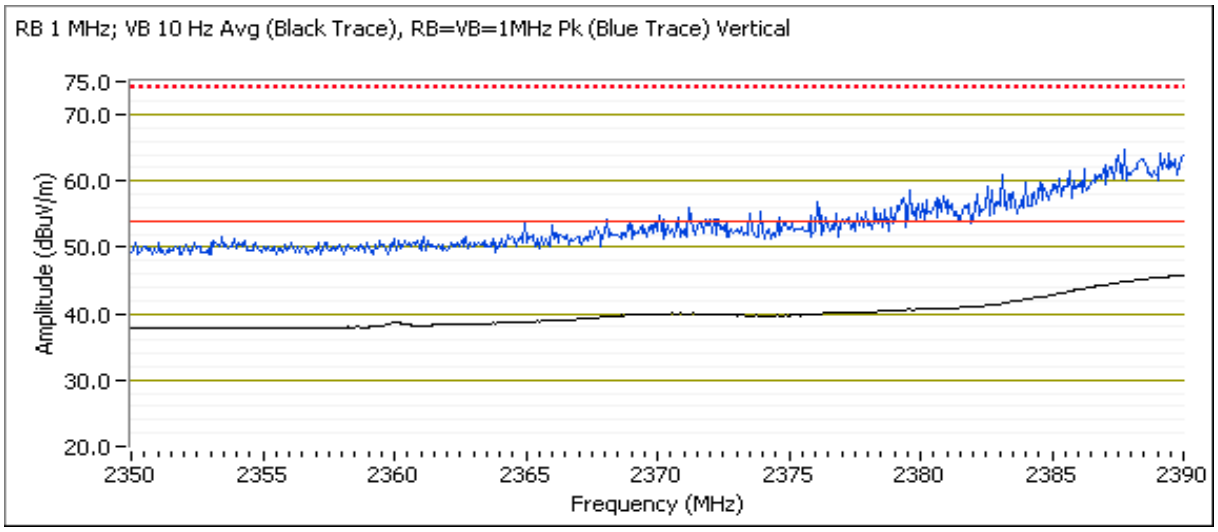


Client:	Xirrus, Inc.	Job Number:	J84865
Model:	XR6000 3x3	T-Log Number:	T85088
		Account Manager:	Susan Pelzl
Contact:	Steve Smith		
Standard:	FCC 15.247, 15.E, 15.B, EN 55022	Class:	N/A

Channel 2 @ 2417 MHz, Radio #0

Band Edge Signal Field Strength - Direct measurement of field strength

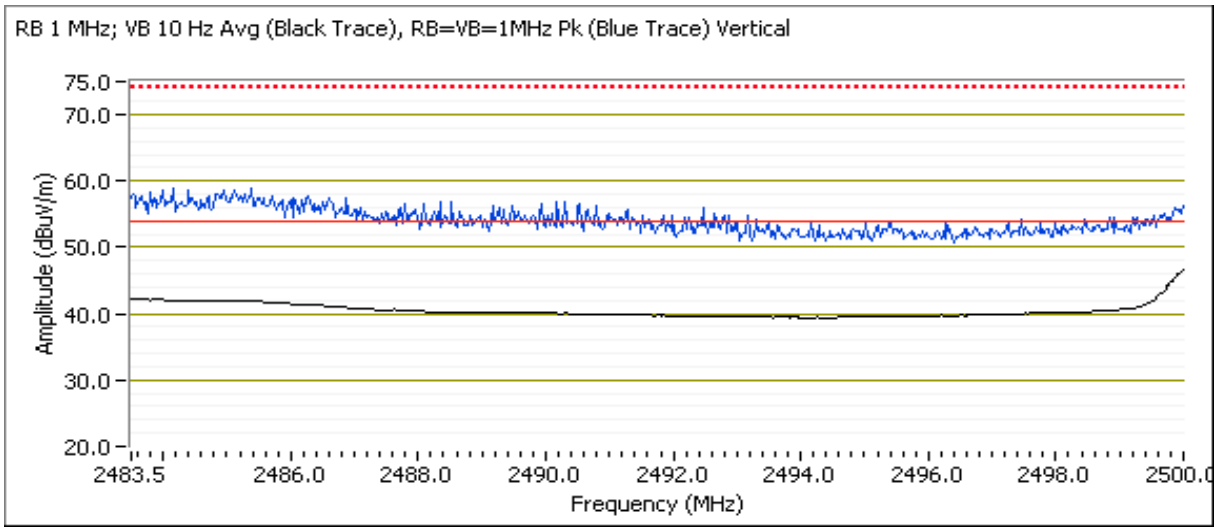
Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	V/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2389.470	48.8	V	54.0	-5.2	AVG	273	1.0	RB 1 MHz;VB 10 Hz;Pk
2387.960	64.3	V	74.0	-9.7	PK	273	1.0	RB 1 MHz;VB 3 MHz;Pk
2389.470	42.9	H	54.0	-11.1	AVG	18	1.0	RB 1 MHz;VB 10 Hz;Pk
2389.930	57.0	H	74.0	-17.0	PK	18	1.0	RB 1 MHz;VB 3 MHz;Pk



Client:	Xirrus, Inc.	Job Number:	J84865
Model:	XR6000 3x3	T-Log Number:	T85088
		Account Manager:	Susan Pelzl
Contact:	Steve Smith		
Standard:	FCC 15.247, 15.E, 15.B, EN 55022	Class:	N/A

Run #1b: High Channel @ 2462 MHz, Radio #0
Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	V/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2499.970	48.4	V	54.0	-5.6	AVG	326	1.0	RB 1 MHz;VB 10 Hz;Pk
2485.480	58.3	V	74.0	-15.7	PK	326	1.0	RB 1 MHz;VB 3 MHz;Pk
2499.970	48.3	H	54.0	-5.7	AVG	357	1.0	RB 1 MHz;VB 10 Hz;Pk
2483.530	63.5	H	74.0	-10.5	PK	357	1.0	RB 1 MHz;VB 3 MHz;Pk

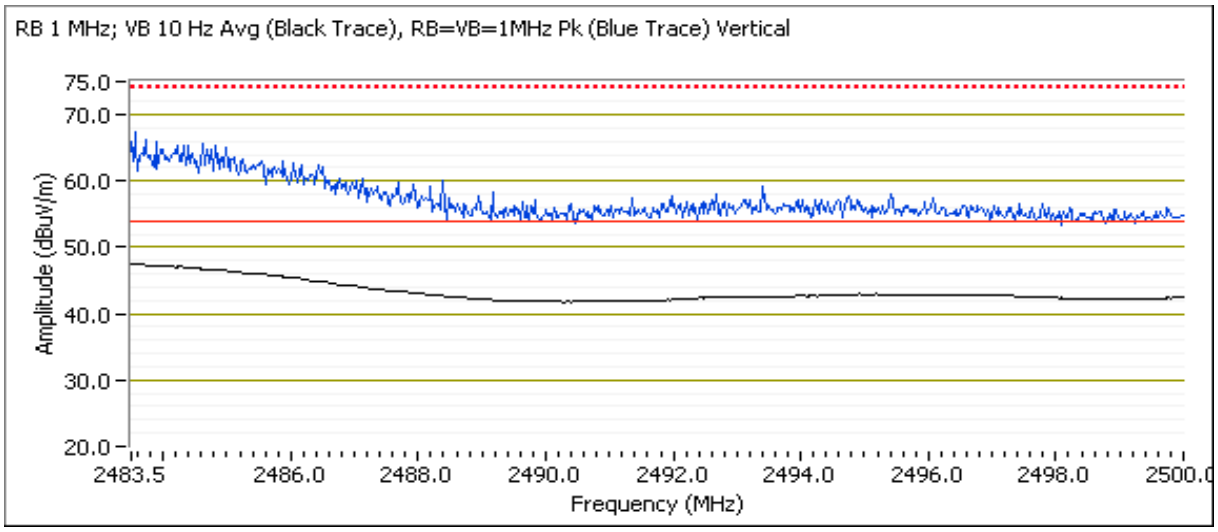


Client:	Xirrus, Inc.	Job Number:	J84865
Model:	XR6000 3x3	T-Log Number:	T85088
		Account Manager:	Susan Pelzl
Contact:	Steve Smith		
Standard:	FCC 15.247, 15.E, 15.B, EN 55022	Class:	N/A

Channel 10 @ 2457 MHz, Radio #0

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	V/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2483.550	50.1	V	54.0	-3.9	AVG	301	1.1	RB 1 MHz;VB 10 Hz;Pk
2483.800	63.1	V	74.0	-10.9	PK	301	1.1	RB 1 MHz;VB 3 MHz;Pk
2484.080	49.2	H	54.0	-4.8	AVG	347	1.2	RB 1 MHz;VB 10 Hz;Pk
2485.750	63.3	H	74.0	-10.7	PK	347	1.2	RB 1 MHz;VB 3 MHz;Pk



Client:	Xirrus, Inc.	Job Number:	J84865
Model:	XR6000 3x3	T-Log Number:	T85088
		Account Manager:	Susan Pelzl
Contact:	Steve Smith		
Standard:	FCC 15.247, 15.E, 15.B, EN 55022	Class:	N/A

RSS 210 and FCC 15.247 (DTS) Radiated Spurious Emissions
2x2 and 3x3 Modules - 802.11b, 802.11g, HT20 Modes

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.

Ambient Conditions:

Temperature: 20-25 °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.

Client:	Xirrus, Inc.	Job Number:	J84865
Model:	XR6000 3x3	T-Log Number:	T85088
		Account Manager:	Susan Pelzl
Contact:	Steve Smith		
Standard:	FCC 15.247, 15.E, 15.B, EN 55022	Class:	N/A

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

Run #	Mode	Channel	Power Setting	Measured Power	Test Performed	Limit	Result / Margin
1a (Outer)	HT20 802.11b 802.11g	2412 MHz 2462 MHz	-		Radiated Emissions, 1 - 26 GHz	FCC Part 15.209 / 15.247(c)	40.8dBµV/m @ 5000.0MHz (-13.2dB)
1b (Center)		2437 MHz	-		Radiated Emissions, 1 - 26 GHz	FCC Part 15.209 / 15.247(c)	43.7dBµV/m @ 5000.0MHz (-10.3dB)

System Configuration: Operating at low and high channels

Radio #	Frequency	Module	Mode	Radio #	Frequency	Module	Mode
1	2412	2x2	802.11b	9	2462	2x2	802.11b
0	2412	3x3	802.11b	8	2462	3x3	802.11b
3	2412	2x2	802.11g	11	2462	2x2	802.11g
2	2412	3x3	802.11g	10	2462	3x3	802.11g
5	2412	2x2	802.11HT20	13	2462	2x2	802.11HT20
4	2412	3x3	802.11HT20	12	2462	3x3	802.11HT20

System Configuration: Operating at center channel

Radio #	Frequency	Module	Mode	Radio #	Frequency	Module	Mode
1	2437	2x2	802.11b	3	2437	2x2	802.11g
0	2437	3x3	802.11b	2	2437	3x3	802.11g
5	2437	2x2	802.11HT20	4	2437	3x3	802.11HT20

Notes - Multiple radios operating at the same time as shown above. In all cases, power set to the maximum worse case single channel power, transmitting on all chains.

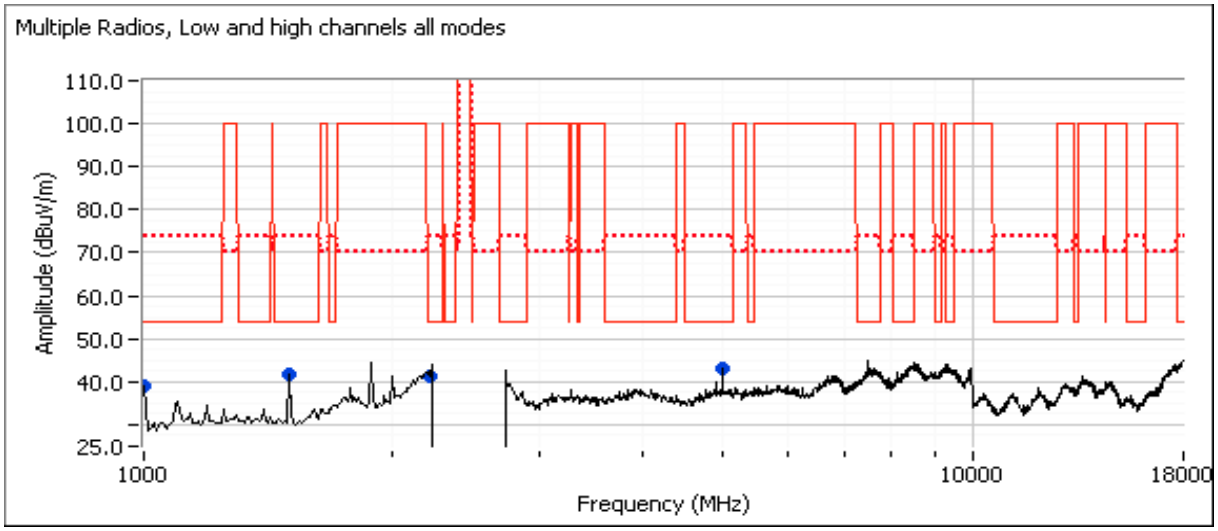
Client:	Xirrus, Inc.	Job Number:	J84865
Model:	XR6000 3x3	T-Log Number:	T85088
		Account Manager:	Susan Pelzl
Contact:	Steve Smith		
Standard:	FCC 15.247, 15.E, 15.B, EN 55022	Class:	N/A

Run #1: Radiated Spurious Emissions, 1-26.5GHz. HT20, 802.11g and 802.11b - 2x2 and 3x3 modules.
Date of Test: 10/17/2011 Test Location: FT Chamber #7
Test Engineer: M. Birgani, J. Liu

Run #1a: Operating at low and high channels: Channel 1@ 2412 MHz and Channel 11@ 2462 MHz
Other Spurious Emissions

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5000.000	40.8	V	54.0	-13.2	AVG	191	2.3	RB 1 MHz;VB 10 Hz;Pk
1500.100	40.0	V	54.0	-14.0	AVG	174	1.9	RB 1 MHz;VB 10 Hz;Pk
2200.030	38.5	V	54.0	-15.5	AVG	80	1.0	RB 1 MHz;VB 10 Hz;Pk
1000.030	32.9	V	54.0	-21.1	AVG	225	1.0	RB 1 MHz;VB 10 Hz;Pk
2210.770	49.1	V	74.0	-24.9	PK	80	1.0	RB 1 MHz;VB 3 MHz;Pk
5000.070	46.4	V	74.0	-27.6	PK	191	2.3	RB 1 MHz;VB 3 MHz;Pk
1500.030	45.1	V	74.0	-28.9	PK	174	1.9	RB 1 MHz;VB 3 MHz;Pk
1000.130	39.9	V	74.0	-34.1	PK	225	1.0	RB 1 MHz;VB 3 MHz;Pk

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 30dB below the level of the fundamental and measured in 100kHz.
Note 2:	Signal is not in a restricted band but the more stringent restricted band limit was used.
Note 3:	No significant emissions were observed for 18-26GHz

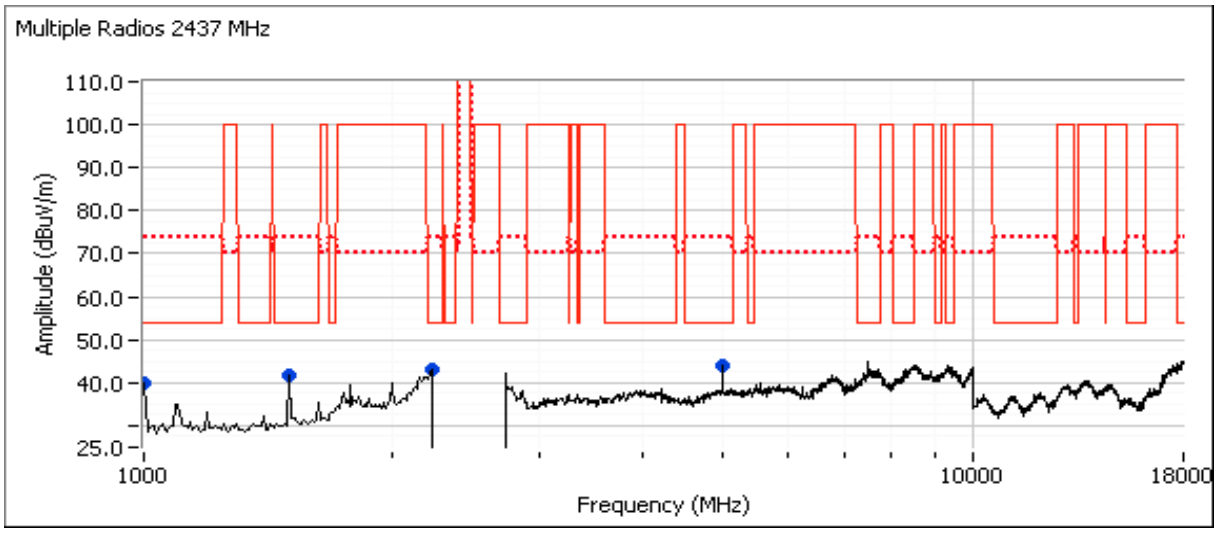


Client:	Xirrus, Inc.	Job Number:	J84865
Model:	XR6000 3x3	T-Log Number:	T85088
		Account Manager:	Susan Pelzl
Contact:	Steve Smith		
Standard:	FCC 15.247, 15.E, 15.B, EN 55022	Class:	N/A

Run #1b: Center Channel @ 2437 MHz
Other Spurious Emissions

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5000.000	43.7	V	54.0	-10.3	AVG	253	1.3	RB 1 MHz;VB 10 Hz;Pk
1500.100	40.3	V	54.0	-13.7	AVG	178	1.9	RB 1 MHz;VB 10 Hz;Pk
2226.830	39.7	V	54.0	-14.3	AVG	97	1.0	RB 1 MHz;VB 10 Hz;Pk
1000.070	35.0	V	54.0	-19.0	AVG	220	1.0	RB 1 MHz;VB 10 Hz;Pk
2226.890	51.3	V	74.0	-22.7	PK	97	1.0	RB 1 MHz;VB 3 MHz;Pk
5000.200	47.9	V	74.0	-26.1	PK	253	1.3	RB 1 MHz;VB 3 MHz;Pk
1500.100	45.3	V	74.0	-28.7	PK	178	1.9	RB 1 MHz;VB 3 MHz;Pk
1000.010	41.7	V	74.0	-32.3	PK	220	1.0	RB 1 MHz;VB 3 MHz;Pk

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 30dB below the level of the fundamental and measured in 100kHz.
Note 2:	Signal is not in a restricted band but the more stringent restricted band limit was used.
Note 3:	No significant emissions were observed for 18-26GHz



Client:	Xirrus, Inc.	Job Number:	J84865
Model:	XR6000 3x3	T-Log Number:	T85088
		Account Manager:	Susan Pelzl
Contact:	Steve Smith		
Standard:	FCC 15.247, 15.E, 15.B, EN 55022	Class:	N/A

RSS 210 and FCC 15.247 (DTS) Radiated Spurious Emissions
2x2 and 3x3 Modules - HT40 2.4GHz

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.

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.

Ambient Conditions:

Temperature: 20-25 °C
Rel. Humidity: 30-40 %

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

Radiated spurious emissions for HT40 mode. The radiated spurious emissions for other modes are covered separately

Run #	Mode	Channel	Power Setting	Measured Power	Test Performed	Limit	Result / Margin
4a (outer)	n40	2422 MHz 2452 MHz	-		Radiated Emissions, 1 - 26 GHz	FCC Part 15.209 / 15.247(c)	40.8dBµV/m @ 5000.0MHz (-13.2dB)
4b (center)	n40	center 2437 MHz	-		Radiated Emissions, 1 - 26 GHz	FCC Part 15.209 / 15.247(c)	43.7dBµV/m @ 5000.0MHz (-10.3dB)

System Configuration: Operating at low and high channels

Radio #	Frequency	Module	Mode	Radio #	Frequency	Module	Mode
7	2412	2x2	802.11HT40	15	2462	2x2	802.11HT40
6	2412	3x3	802.11HT40	14	2462	3x3	802.11HT40

System Configuration: Operating at center channel

Radio #	Frequency	Module	Mode	Radio #	Frequency	Module	Mode
7	2437	2x2	802.11HT40	6	2437	3x3	802.11HT40

Notes - Multiple radios operating at the same time as shown above. In all cases, power set to the maximum worse case single channel power, transmitting on all chains. Performed at the same time as the 20MHz spurious.

Client:	Xirrus, Inc.	Job Number:	J84865
Model:	XR6000 3x3	T-Log Number:	T85088
		Account Manager:	Susan Pelzl
Contact:	Steve Smith		
Standard:	FCC 15.247, 15.E, 15.B, EN 55022	Class:	N/A

Run #4: Radiated Spurious Emissions, 30 - 26500 MHz. Operating Mode: 802.11n 40MHz

Date of Test: 10/17/2011 Test Location: FT Chamber #7

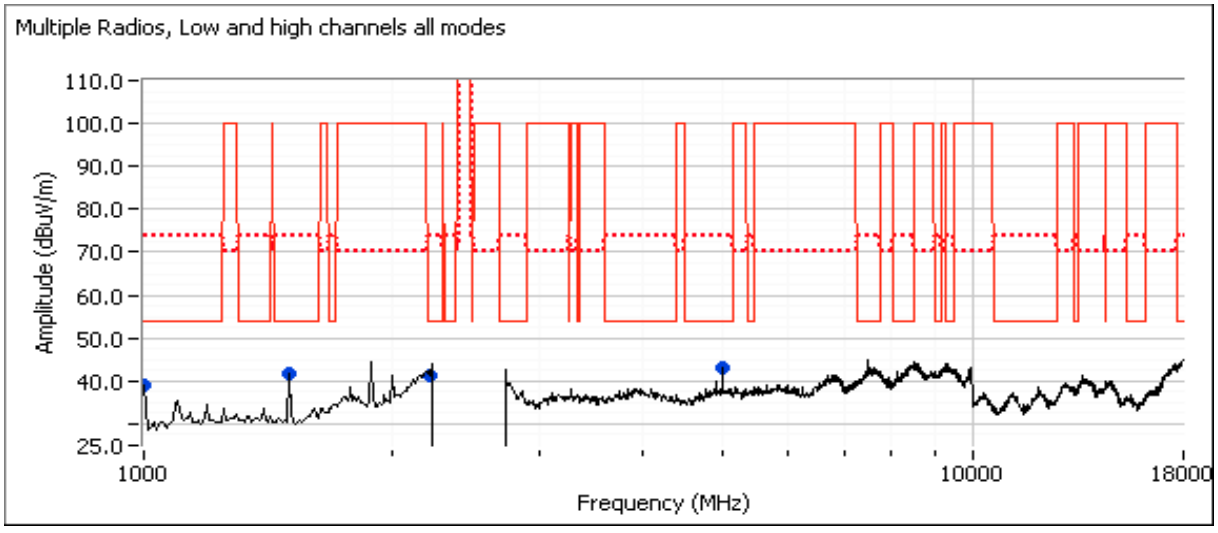
Test Engineer: M. Birgani, J. Liu

Run #4a: Operating on outer channels: Channel 3 @ 2422 MHz and Channel 9 @ 2452 MHz

Other Spurious Emissions

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5000.000	40.8	V	54.0	-13.2	AVG	191	2.3	RB 1 MHz;VB 10 Hz;Pk
1500.100	40.0	V	54.0	-14.0	AVG	174	1.9	RB 1 MHz;VB 10 Hz;Pk
2200.030	38.5	V	54.0	-15.5	AVG	80	1.0	RB 1 MHz;VB 10 Hz;Pk
1000.030	32.9	V	54.0	-21.1	AVG	225	1.0	RB 1 MHz;VB 10 Hz;Pk
2210.770	49.1	V	74.0	-24.9	PK	80	1.0	RB 1 MHz;VB 3 MHz;Pk
5000.070	46.4	V	74.0	-27.6	PK	191	2.3	RB 1 MHz;VB 3 MHz;Pk
1500.030	45.1	V	74.0	-28.9	PK	174	1.9	RB 1 MHz;VB 3 MHz;Pk
1000.130	39.9	V	74.0	-34.1	PK	225	1.0	RB 1 MHz;VB 3 MHz;Pk

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 30dB below the level of the fundamental and measured in 100kHz.
Note 2:	Signal is not in a restricted band but the more stringent restricted band limit was used.
Note 3:	No significant emissions were observed for 18-26GHz

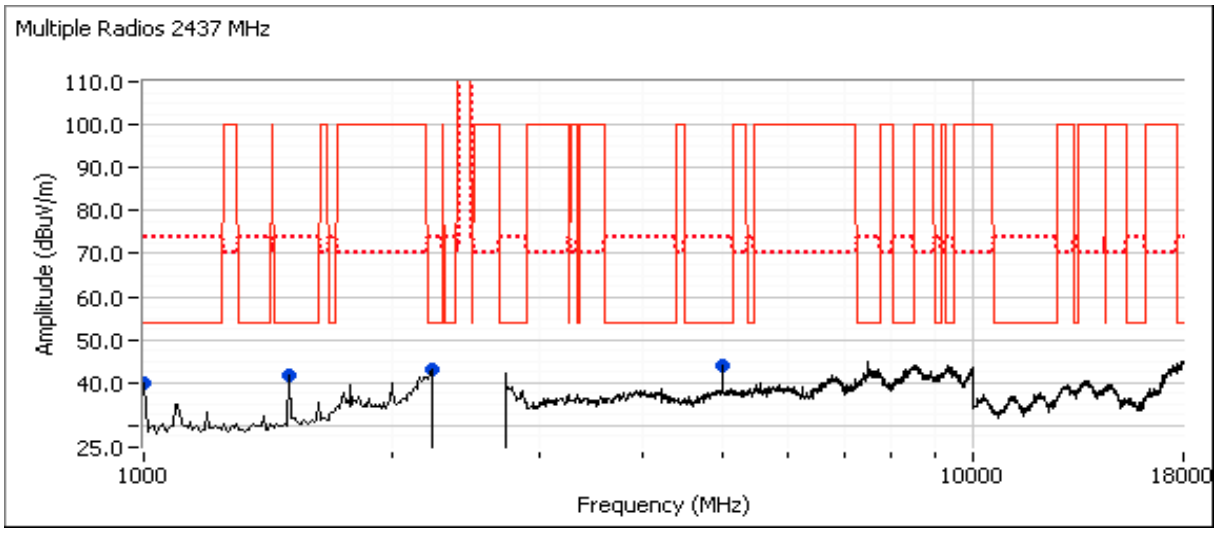


Client:	Xirrus, Inc.	Job Number:	J84865
Model:	XR6000 3x3	T-Log Number:	T85088
		Account Manager:	Susan Pelzl
Contact:	Steve Smith		
Standard:	FCC 15.247, 15.E, 15.B, EN 55022	Class:	N/A

Run #4b: Center Channel @ 2437 MHz
Other Spurious Emissions

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5000.000	43.7	V	54.0	-10.3	AVG	253	1.3	RB 1 MHz;VB 10 Hz;Pk
1500.100	40.3	V	54.0	-13.7	AVG	178	1.9	RB 1 MHz;VB 10 Hz;Pk
2226.830	39.7	V	54.0	-14.3	AVG	97	1.0	RB 1 MHz;VB 10 Hz;Pk
1000.070	35.0	V	54.0	-19.0	AVG	220	1.0	RB 1 MHz;VB 10 Hz;Pk
2226.890	51.3	V	74.0	-22.7	PK	97	1.0	RB 1 MHz;VB 3 MHz;Pk
5000.200	47.9	V	74.0	-26.1	PK	253	1.3	RB 1 MHz;VB 3 MHz;Pk
1500.100	45.3	V	74.0	-28.7	PK	178	1.9	RB 1 MHz;VB 3 MHz;Pk
1000.010	41.7	V	74.0	-32.3	PK	220	1.0	RB 1 MHz;VB 3 MHz;Pk

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 30dB below the level of the fundamental and measured in 100kHz.
Note 2:	Signal is not in a restricted band but the more stringent restricted band limit was used.
Note 3:	No significant emissions were observed for 18-26GHz



Client:	Xirrus, Inc.	Job Number:	J84865
Model:	XR6000 3x3	T-Log Number:	T85088
		Account Manager:	Susan Pelzl
Contact:	Steve Smith		
Standard:	FCC 15.247, 15.E, 15.B, EN 55022	Class:	N/A

RSS 210 and FCC 15.247 (DTS) Radiated Spurious Emissions
2x2 and 3x3 Modules - HT40 2.4GHz, 802.11a, HT20 and HT40 5GHz

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.

Ambient Conditions:

Temperature:	20-25 °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.

Client:	Xirrus, Inc.	Job Number:	J84865
Model:	XR6000 3x3	T-Log Number:	T85088
		Account Manager:	Susan Pelzl
Contact:	Steve Smith		
Standard:	FCC 15.247, 15.E, 15.B, EN 55022	Class:	N/A

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

Spurious Radiated Emissions: 2x2 and 3x3 Modules for 802.11a; HT20; and HT40 modes

Run #	Mode	Channel	Power Setting	Measured Power	Test Performed	Limit	Result / Margin
5a Low, Center, High Channel	802.11a Chain 012	20MHz: 5745 MHz, 5785 MHz, 5825 MHz 40MHz: 5755 MHz, 5795 MHz	-		Radiated Emissions, 1 - 40GHz	FCC Part 15.209 / 15.247(c)	53.4dBµV/m @ 5440.0MHz (-0.6dB)
	802.11n20 Chain 012		-		Radiated Emissions, 1 - 40GHz	FCC Part 15.209 / 15.247(c)	
	802.11n40 Chain 012		-		Radiated Emissions, 1 - 40GHz	FCC Part 15.209 / 15.247(c)	

System Configuration: Operating within 5745-5850 MHz

Radio #	Frequency	Module	Mode	Radio #	Frequency	Module	Mode
1	5745	2x2	802.11a	9	5825	2x2	802.11a
0	5745	3x3	802.11a	8	5825	3x3	802.11a
3	5745	2x2	802.11HT20	11	5825	2x2	802.11HT20
2	5745	3x3	802.11HT20	10	5825	3x3	802.11HT20
5	5755	2x2	802.11HT40	13	5795	2x2	802.11HT40
4	5755	3x3	802.11HT40	12	5795	3x3	802.11HT40
7	5785	2x2	802.11a	15	5785	2x2	802.11HT20
6	5785	3x3	802.11a	14	5785	3x3	802.11HT20

Notes - Multiple radios operating at the same time as shown above. In all cases, power set to the maximum worse case single channel power, transmitting on all chains.

Client:	Xirrus, Inc.	Job Number:	J84865
Model:	XR6000 3x3	T-Log Number:	T85088
		Account Manager:	Susan Pelzl
Contact:	Steve Smith		
Standard:	FCC 15.247, 15.E, 15.B, EN 55022	Class:	N/A

Run #5: Radiated Spurious Emissions, 30 - 40,000 MHz. Operating Mode: 802.11a, 802.11n20, and 802.11n40

Date of Test: 10/17/2011 Test Location: FT Chamber #7

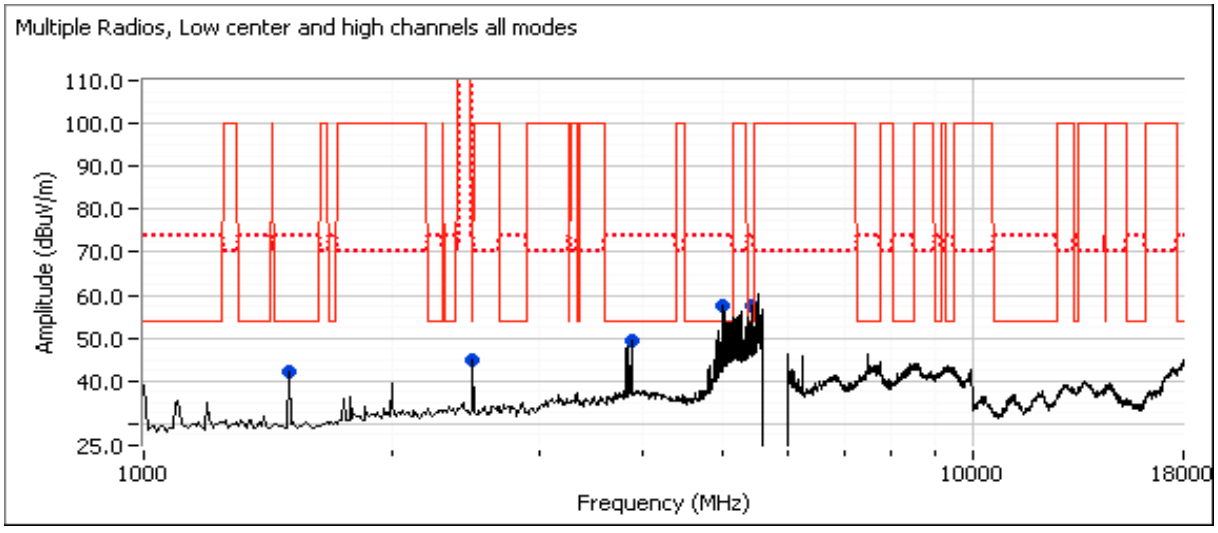
Test Engineer: M. Birgani

Run #5a: Low, Middle and High Channels for both 20 and 40 MHz

Other Spurious Emissions

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5440.010	53.4	V	54.0	-0.6	AVG	30	1.0	RB 1 MHz;VB 10 Hz;Pk
4999.900	62.0	V	74.0	-12.0	PK	30	1.0	RB 1 MHz;VB 3 MHz;Pk
3856.690	41.4	H	54.0	-12.6	AVG	106	1.1	RB 1 MHz;VB 10 Hz;Pk
1500.030	41.4	V	54.0	-12.6	AVG	310	1.1	RB 1 MHz;VB 10 Hz;Pk
5439.980	60.6	V	74.0	-13.4	PK	30	1.0	RB 1 MHz;VB 3 MHz;Pk
3856.850	51.6	H	74.0	-22.4	PK	106	1.1	RB 1 MHz;VB 3 MHz;Pk
1500.090	45.7	V	74.0	-28.3	PK	310	1.1	RB 1 MHz;VB 3 MHz;Pk
4999.990	57.7	V	54.0	3.7	AVG	30	1.0	RB 1 MHz;VB 10 Hz;Pk, note 2

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 30dB below the level of the fundamental and measured in 100kHz.
Note 2:	Emission from the digital circuitry of the host system. Refer to FCC 15.B test resutls.
Note 3:	No significant emissions were observed for 18-40GHz



Client:	Xirrus, Inc.	Job Number:	J84865
Model:	XR6000 3x3	T-Log Number:	T85088
		Account Manager:	Susan Pelzl
Contact:	Steve Smith		
Standard:	FCC 15.247, 15.E, 15.B, EN 55022	Class:	A

Radiated Emissions

(Elliott Laboratories Fremont Facility, Semi-Anechoic Chamber)

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: 10/20/2011 0:00
Test Engineer: Jack Liu
Test Location: FT Chamber #4
Config. Used: 1
Config Change: None
EUT Voltage: POE

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing. All remote support equipment was located approximately 30 meters from the EUT .

For radiated emissions testing the measurement antenna was located 3 meters from the EUT.

Ambient Conditions:

Temperature: 20-25 °C
Rel. Humidity: 30-40 %

Summary of Results

Run #	Mode	Channel	Power Setting	Measured Power	Test Performed	Limit	Result / Margin
1	Rx	ALL	-	-	Radiated Emissions, 1 - 18GHz	RSS-GEN	53.2dBµV/m @ 3800.0MHz (-0.8dB)

Test performed with one of each module type (2x2 or 3x3) tuned to the center frequency of each operating band.

System Configuration:

Radio #	Module	Channel/Freq			
1	2x2	2437	6	3x3	5300
0	3x3	2437	9	2x2	5580
5	2x2	5200	8	3x3	5580
4	3x3	5200	3	2x2	5785
7	2x2	5300	2	3x3	5785

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

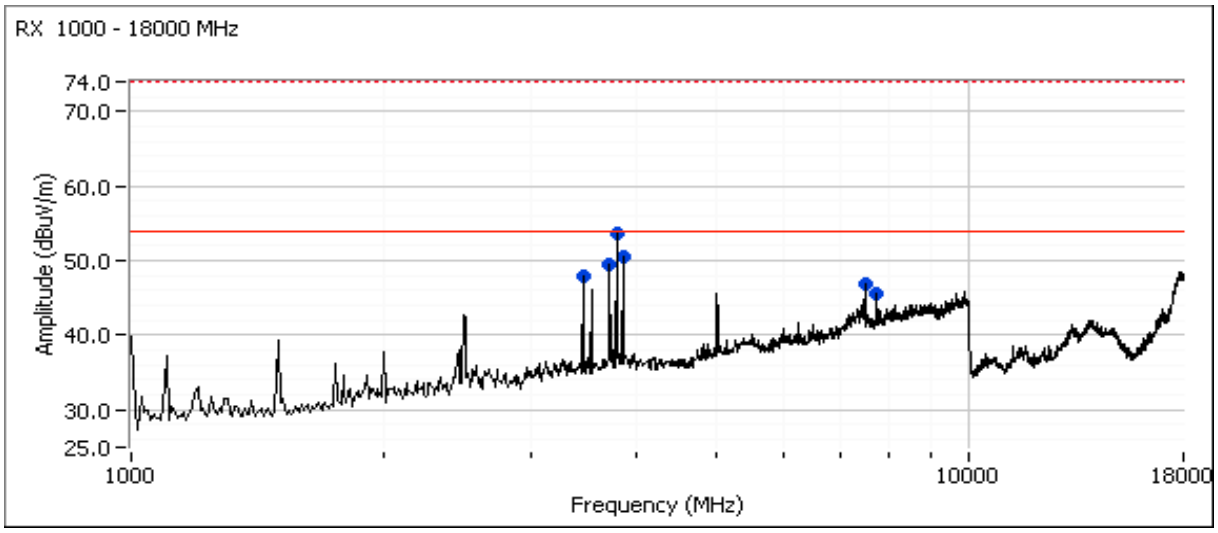
No deviations were made from the requirements of the standard.

Client:	Xirrus, Inc.	Job Number:	J84865
Model:	XR6000 3x3	T-Log Number:	T85088
		Account Manager:	Susan Pelzl
Contact:	Steve Smith		
Standard:	FCC 15.247, 15.E, 15.B, EN 55022	Class:	A

Run #1, Radiated Spurious Emissions, 1000 - 18,000 MHz.

Date of Test: 10/20/2011
Test Engineer: Jack Liu
Test Location: FT4

Frequency	Level	Pol	RSS-GEN		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
3799.980	53.2	H	54.0	-0.8	AVG	273	1.1	RB 1 MHz;VB 10 Hz;Pk
3726.650	51.5	H	54.0	-2.5	AVG	153	1.0	RB 1 MHz;VB 10 Hz;Pk
3863.380	47.5	V	54.0	-6.5	AVG	335	1.5	RB 1 MHz;VB 10 Hz;Pk
3459.990	47.0	H	54.0	-7.0	AVG	81	1.0	RB 1 MHz;VB 10 Hz;Pk
7499.950	45.9	V	54.0	-8.1	AVG	106	1.5	RB 1 MHz;VB 10 Hz;Pk
7726.700	40.5	V	54.0	-13.5	AVG	58	1.3	RB 1 MHz;VB 10 Hz;Pk
3800.010	55.6	H	74.0	-18.4	PK	273	1.1	RB 1 MHz;VB 3 MHz;Pk
3726.680	53.8	H	74.0	-20.2	PK	153	1.0	RB 1 MHz;VB 3 MHz;Pk
7499.660	51.4	V	74.0	-22.6	PK	106	1.5	RB 1 MHz;VB 3 MHz;Pk
3863.420	51.1	V	74.0	-22.9	PK	335	1.5	RB 1 MHz;VB 3 MHz;Pk
3460.040	50.4	H	74.0	-23.6	PK	81	1.0	RB 1 MHz;VB 3 MHz;Pk
7726.980	49.0	V	74.0	-25.0	PK	58	1.3	RB 1 MHz;VB 3 MHz;Pk



End of Report

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