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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 E

Model: CELFI-RS224WU

FCC ID:	YETCELFI-RS224WU
IC CERTIFICATION #:	9298A-CRS224WU
APPLICANT:	Nextivity, Inc. 12230 World Trade Drive Suite 250 San Diego, CA 92128
TEST SITE(S):	NTS Silicon Valley 41039 Boyce Road. Fremont, CA. 94538-2435
IC SITE REGISTRATION #:	2845B-3; 2845B-4, 2845B-5, 2845B-7
REPORT DATE:	December 20, 2012
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ACCREDITED
Testing Cert #0214.26

REVISION HISTORY

Rev#	Date	Comments	Modified By
-		First release	

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SCOPE

An electromagnetic emissions test has been performed on the Nextivity, Inc. model CELFI-RS224WU, 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 E requirements for UNII Devices (using FCC KDB 789033)

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 NTS Silicon Valley test procedures:

ANSI C63.4:2003
FCC UNII test procedure KDB 789033

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 Nextivity, Inc. model CELFI-RS224WU complied with the requirements of the following regulations:

RSS 210 Issue 8 "Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment"
FCC Part 15, Subpart E requirements for UNII Devices

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 Nextivity, Inc. model CELFI-RS224WU and therefore apply only to the tested sample. The sample was selected and prepared by Michiel Lotter of Nextivity, Inc.

DEVIATIONS FROM THE STANDARDS

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

TEST RESULTS SUMMARY

UNII / LELAN DEVICES

Operation in the 5.15 – 5.25 GHz Band

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result
15.407(e)		Indoor operation only	Refer to user's manual	N/A	Complies
15.407(a) (2)		26dB Bandwidth	> 20MHz for all channels	N/A – limits output power if < 20MHz	N/A
	A9.2(1)	99% Bandwidth	> 20MHz for all channels	N/A – limits output power if < 20MHz	N/A
15.407 (a) (1)	A9.2(1)	Output Power	28 mW (0.099W eirp)	17dBm (50mW) 23dBm eirp	Complies
15.407 (a) (1)	-	Power Spectral Density	1.4 dBm/MHz	4 dBm/MHz	Complies
-	A9.2 (1)			4.5 dBm/MHz	Complies

Operation in the 5.25 – 5.35 GHz Band

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.407(a) (2)		26dB Bandwidth	> 20MHz for all channels	N/A – limits output power if < 20MHz	N/A
	A9.2(2)	99% Bandwidth	> 20MHz for all channels	N/A – limits output power if < 20MHz	N/A
15.407(a) (2)	A9.2(2)	Output Power	48 mW (0.169W eirp)	24dBm (250mW)	Complies
15.407(a) (2)	-	Power Spectral Density	3.7 dBm/MHz	11 dBm/MHz	Complies
-	A9.2(2)	Power Spectral Density		11 dBm / MHz[1]	Complies

Requirements for all U-NII/LELAN bands

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result
15.407	A9.4(1)	Modulation	OFDM Digital Modulation is used	Digital modulation is required	Complies
15.407(b) (5) / 15.209	A9.2	Spurious Emissions	51.7 dBµV/m @ 5130.4 MHz (-2.3 dB)	Refer to page 21	Complies
15.407(a)(6)	-	Peak Excursion Ratio	10.3 dB	< 13dB	Complies
-	A9.4(3)	Channel Selection	Spurious emissions tested at outermost channels in each band	Device was tested on the top, bottom and center channels in each band	N/A
15	-		Measurements on three channels in each band		N/A
15.407 (c)	A9.4(4)	Operation in the absence of information to transmit	Operation never stops as information from cell tower is always present	Device shall automatically discontinue operation in the absence of information to transmit	Complies

[1] May be reduced from 11dBm if highest value exceeded the average value by more than 3dB

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result
15.407 (g)	-	Frequency Stability	Frequency stability is better than 10ppm	Signal shall remain within the allocated band	Complies
15.407 (h1)	A9.3	Transmit Power Control	TPC is not required as the device operates at below 500mW eirp	The U-NII device shall have the capability to operate with a mean EIRP value lower than 24dBm (250mW)	Complies
15.407 (h2)	A9.3	Dynamic frequency Selection (device with radar detection)	Refer to separate test report, reference R	Threshold -62dBm (-64dBm if eirp > 200mW) Channel Availability Check > 60s Channel closing transmission time < 260ms Channel move time < 10s Non occupancy period > 30minutes	Complies
	A9.4(5)	User Manual information	Refer to User Manual Statements	Warning regarding interference from Satellite Systems	Complies
-	A9.4(6)	User Manual	Refer to User Manual statements	Indoor use and antenna gain	Complies
-	A9.4(7)	User Manual	Refer to User Manual statements	Advice about high power radar interference	Complies

GENERAL REQUIREMENTS APPLICABLE TO ALL BANDS

FCC Rule Part	RSS Rule part	Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.203	-	RF Connector	Integral antenna	Unique or integral antenna required	Complies
15.207	RSS GEN Table 2	AC Conducted Emissions	54.5 dBµV @ 0.159 MHz (-11.0 dB)	Refer to page 18	Complies
15.247 (b) (5) 15.407 (f)	RSS 102	RF Exposure Requirements	Refer to MPE calculations in Exhibit 11, RSS 102 declaration and User Manual statements.	Refer to OET 65, FCC Part 1 and RSS 102	Complies
-	RSP 100 RSS GEN 7.1.5	User Manual	Refer to User Manual statements	Statement required regarding non-interference	Complies
-	RSP 100 RSS GEN 7.1.5	User Manual	Device does not use detachable antennas	Statement for products with detachable antenna	Complies
-	RSP 100 RSS GEN 4.4.1	99% Bandwidth	26.9 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 Nextivity, Inc. CELFI-RS224CU and CELFI-RS224WU comprise a WCDMA Cellular Repeater for indoor residential use. The system is composed of two units, the Window Unit (WU) and the Coverage Unit (CU) that connect wirelessly over a full-duplex wireless link in the RLAN band using a mixed OFDM and muxed cellular signal (up to three 5MHz cellular channels) over a 30 MHz channel in each direction. The Cel-Fi WU transmits and receives Cellular signals from the base station and operates similar to a cellular handset. The Cel-Fi CU transmits and receives signals with the cellular handset and operates on frequencies similar to the cellular base station. The EUT was treated as table-top equipment during testing to most closely simulate the end-user environment. The electrical rating of the EUT is 12 Volts DC, 1.5A. The AC Adapter rating is 100-240V, 0.7A (Max), 47-63 Hz.

The sample was received on November 19, 2012 and tested on November19, 20 and 21, 2012. The EUT consisted of the following component(s):

Company	Model	Description	Serial Number	FCC ID
Nextivity, Inc.	CELFI-RS224WU	CelFi Window Unit	159246000005	YETCELFI-RS224WU

OTHER EUT DETAILS

The antennas are integral to the product.

ENCLOSURE

The EUT enclosure is primarily constructed of plastic. It measures approximately 157mm high x 145mm wide x 58mm deep.

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. A computer was connected via the USB port to configure the radio for testing and disconnected while performing the tests.

EUT INTERFACE PORTS

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

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
DC Power	External pwr supply out	2 wire	Unshielded	2.0
External pwr supply in	AC Mains	Direct plug-in	NA	NA

Note: The USB port was not connected during testing. Nextivity stated that this is for setup purposes and therefore would not normally be connected.

EUT OPERATION

During emissions testing the EUT was transmitting continuously at full power on the channels called out in the specific test.

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 3	769238	2845B-3	41039 Boyce Road Fremont, CA 94538-2435
Chamber 4	211948	2845B-4	
Chamber 5	211948	2845B-5	
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.

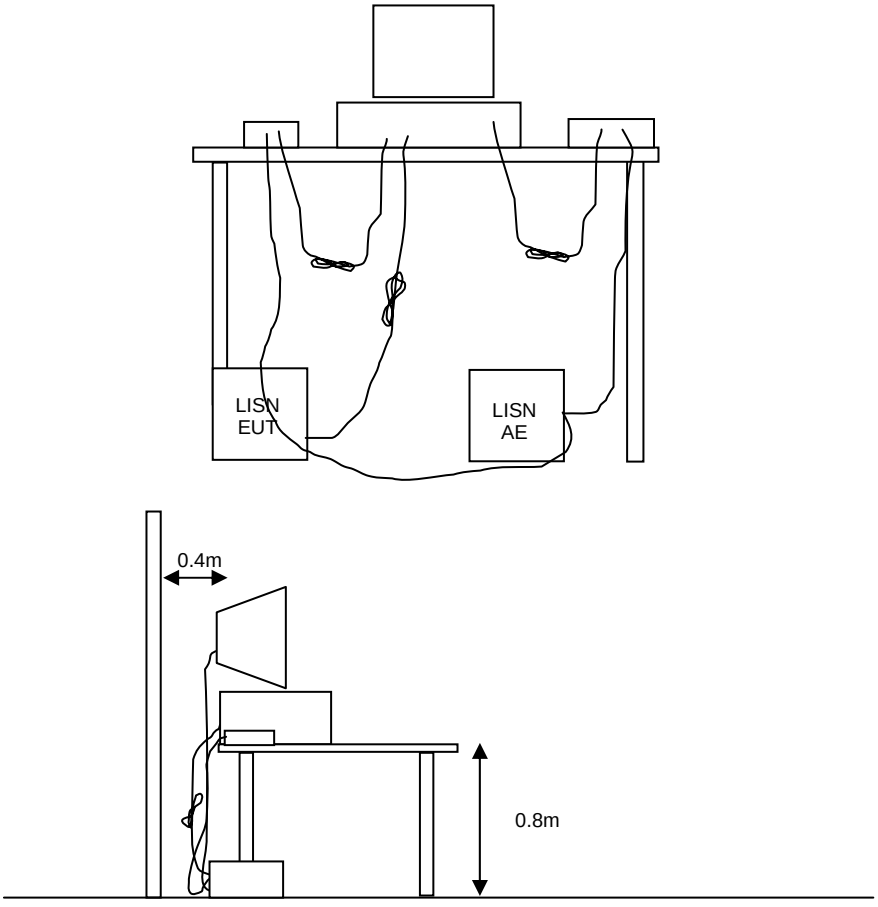


Figure 1 Typical Conducted Emissions Test Configuration

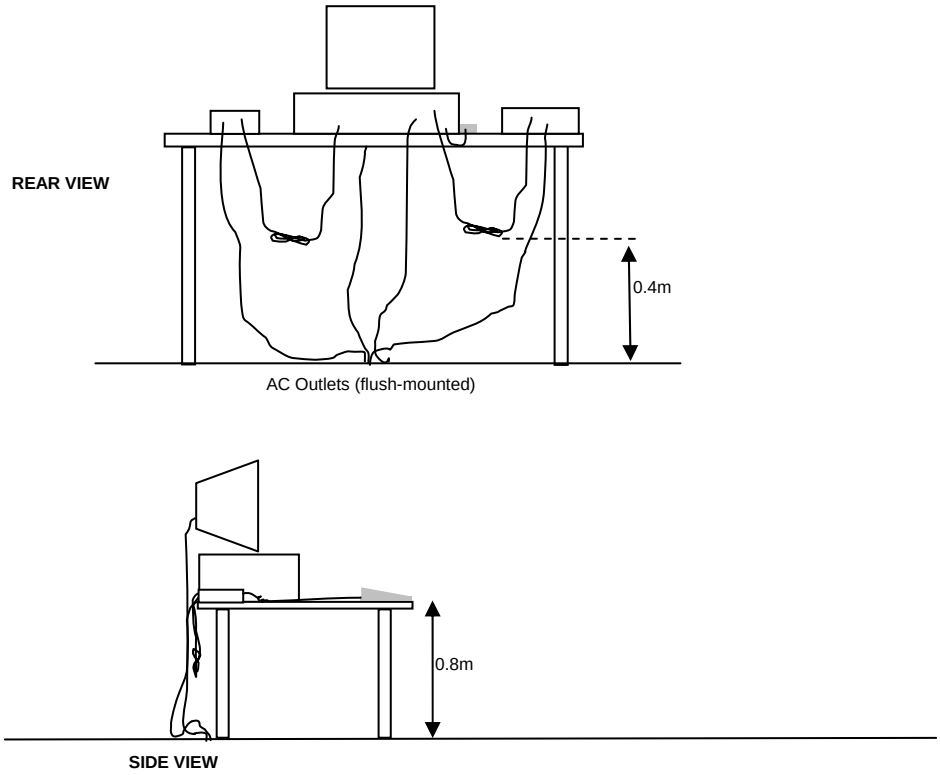
RADIATED EMISSIONS

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.

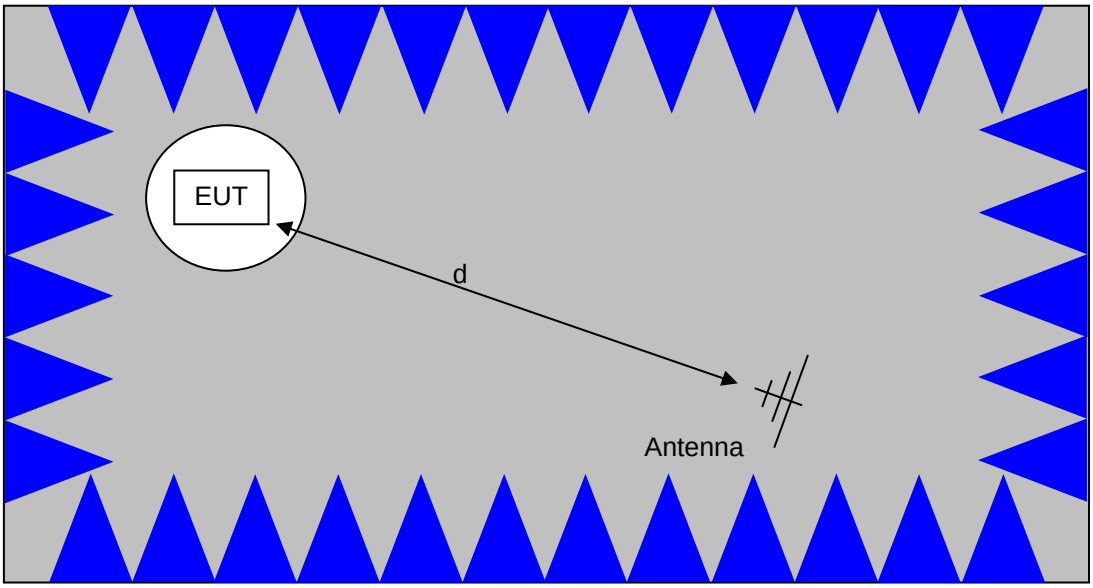
A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

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.

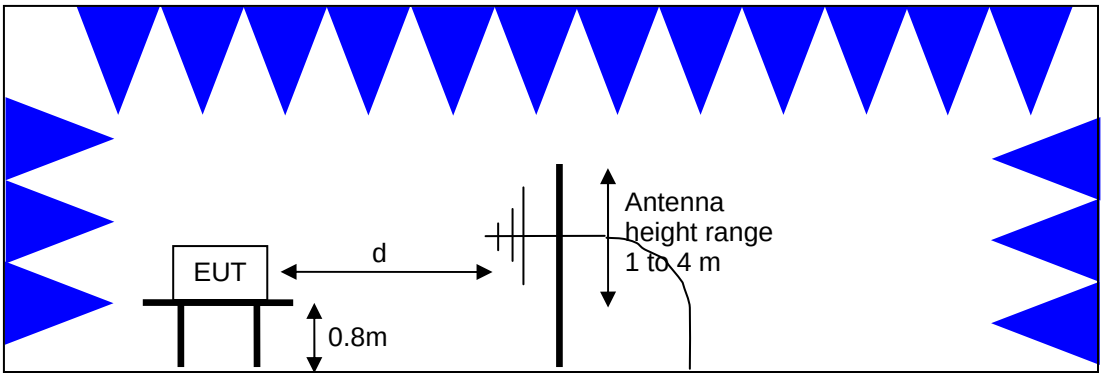


Typical Test Configuration for Radiated Field Strength Measurements



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.

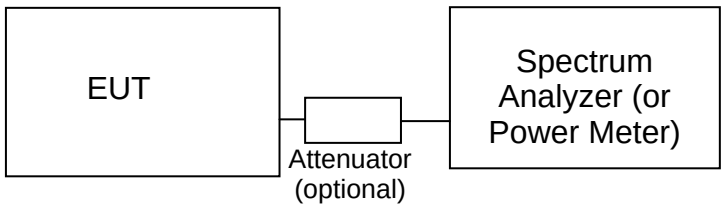
Floor-standing equipment is placed on the floor with insulating supports between the unit and the ground plane.



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 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 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[2] (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

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

FCC 15.407 (a) OUTPUT POWER LIMITS

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
5150 – 5250	50mW (17 dBm)	4 dBm/MHz
5250 – 5350	250 mW (24 dBm)	11 dBm/MHz
5725 – 5825	1 Watts (30 dBm)	17 dBm/MHz

For system using antennas with gains exceeding 6dBi, the output power and power spectral density limits are reduced by 1dB for every dB the antenna gain exceeds 6dBi. Fixed point-to-point applications using the 5725 – 5825 MHz band may use antennas with gains of up to 23dBi without this limitation. If the gain exceeds 23dBi then the output power limit of 1 Watt is reduced by 1dB for every dB the gain exceeds 23dBi.

The peak excursion envelope is limited to 13dB.

OUTPUT POWER LIMITS –LELAN DEVICES

The table below shows the limits for output power and output power density defined by RSS 210. 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
5150 – 5250	200mW (23 dBm) eirp	10 dBm/MHz eirp
5250 – 5350	250 mW (24 dBm)[3] 1W (30dBm) eirp	11 dBm/MHz
5470 – 5725	250 mW (24 dBm)[4] 1W (30dBm) eirp	11 dBm/MHz
5725 – 5825	1 Watts (30 dBm) 4W eirp	17 dBm/MHz

In addition, the power spectral density limit shall be reduced by 1dB for every dB the highest power spectral density exceeds the "average" power spectral density) by more than 3dB. The "average" power spectral density is determined by dividing the output power by 10log(EBW) where EBW is the 99% power bandwidth.

Fixed point-to-point applications using the 5725 – 5825 MHz band may use antennas with gains of up to 23dBi without this limitation. If the gain exceeds 23dBi then the output power limit of 1 Watt is reduced by 1dB for every dB the gain exceeds 23dBi.

[3] If EIRP exceeds 500mW the device must employ TPC
[4] If EIRP exceeds 500mW the device must employ TPC

SPURIOUS EMISSIONS LIMITS –UNII and LELAN DEVICES

The spurious emissions limits for signals below 1GHz are the FCC/RSS-GEN general limits. For emissions above 1GHz, signals in restricted bands are subject to the FCC/RSS GEN general limits. All other signals have a limit of –27dBm/MHz, which is a field strength of 68.3dBuV/m/MHz at a distance of 3m. This is an average limit so the peak value of the emission may not exceed –7dBm/MHz (88.3dBuV/m/MHz at a distance of 3m). For devices operating in the 5725-5850Mhz bands under the LELAN/UNII rules, the limit within 10Mhz of the allocated band is increased to –17dBm/MHz.

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

Radiated Emissions, 1000 - 40,000 MHz, 20-Nov-12

Manufacturer	Description	Model	Asset #	Cal Due
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	263	3/29/2013
Hewlett Packard	High Pass filter, 8.2 GHz (Blu System)	P/N 84300-80039 (84125C)	1392	5/18/2013
Hewlett Packard	SpecAn 9 kHz - 40 GHz, FT (SA40) Blue	8564E (84125C)	1393	5/1/2013
EMCO	Antenna, Horn, 1-18 GHz	3115	1561	7/12/2014
Hewlett Packard	Head (Inc flex cable, (1742,1743) Blue)	84125C	1620	5/17/2013
Micro-Tronics	Band Reject Filter, 5470-5725 MHz	BRC50704-02	1730	8/2/2013
A.H. Systems	Spare System Horn, 18-40GHz	SAS-574, p/n: 2581	2162	5/8/2013
Hewlett Packard	High Pass filter, 8.2 GHz (Blu System)	P/N 84300-80039 (84125C)	1392	5/18/2013
Micro-Tronics	Band Reject Filter, 5150-5350 MHz	BRC50703-02	2251	10/11/2013
Micro-Tronics	High Pass Filter 2700 MHz	HPM50111	2326	3/22/2013

Radiated Emissions, 30 - 1,000 MHz, 20-Nov-12

Manufacturer	Description	Model	Asset #	Cal Due
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	1657	6/4/2014
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1756	5/21/2013
Com-Power Corp.	Preamplifier, 30-1000 MHz	PAM-103	2380	7/6/2013

Conducted Emissions - AC Power Ports, 21-Nov-12

Manufacturer	Description	Model	Asset #	Cal Due
EMCO	LISN, 10 kHz-100 MHz, 25A	3825/2	1292	2/16/2013
Rohde & Schwarz	Pulse Limiter	ESH3 Z2	1594	5/22/2013
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1756	5/21/2013

Appendix B Test Data

T89741 Pages 25 - 47

Client:	Nextivity, Inc.	Job Number:	J89693
Product	CELFI-RS224WU	T-Log Number:	T89741
		Account Manager:	Christine Krebill
Contact:	Michiel Lotter		
Emissions Standard(s):	FCC parts 15, 24 and 27	Class:	-
Immunity Standard(s):	-	Environment:	Radio

EMC Test Data

For The

Nextivity, Inc.

Product

CELFI-RS224WU

Date of Last Test: 12/11/2012

Client:	Nextivity, Inc.	Job Number:	J89693
Model:	CELFI-RS224WU	T-Log Number:	T89741
		Account Manager:	Christine Krebill
Contact:	Michiel Lotter		
Standard:	FCC parts 15, 24 and 27	Class:	-

Conducted 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: 11/21/2012
Test Engineer: M. Birgani
Test Location: Fremont Chamber #7

Config. Used: 1
Config Change: -
EUT Voltage: 120V/60Hz

General Test Configuration

The EUT was located on a wooden table inside the semi-anechoic chamber, 40 cm from a vertical coupling plane and 80cm from the LISN.

Ambient Conditions:

Temperature: 15-20 °C
Rel. Humidity: 40-50 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, AC Power,120V/60Hz	Class A	PASS	54.5 dBµV @ 0.159 MHz (Margin: -11.0 dB)
2	CE, AC Power,120V/60Hz	Class A	PASS	53.0 dBµV @ 0.190 MHz (Margin: -11.0 dB)

Modifications Made During Testing

No modifications were made to the EUT during testing

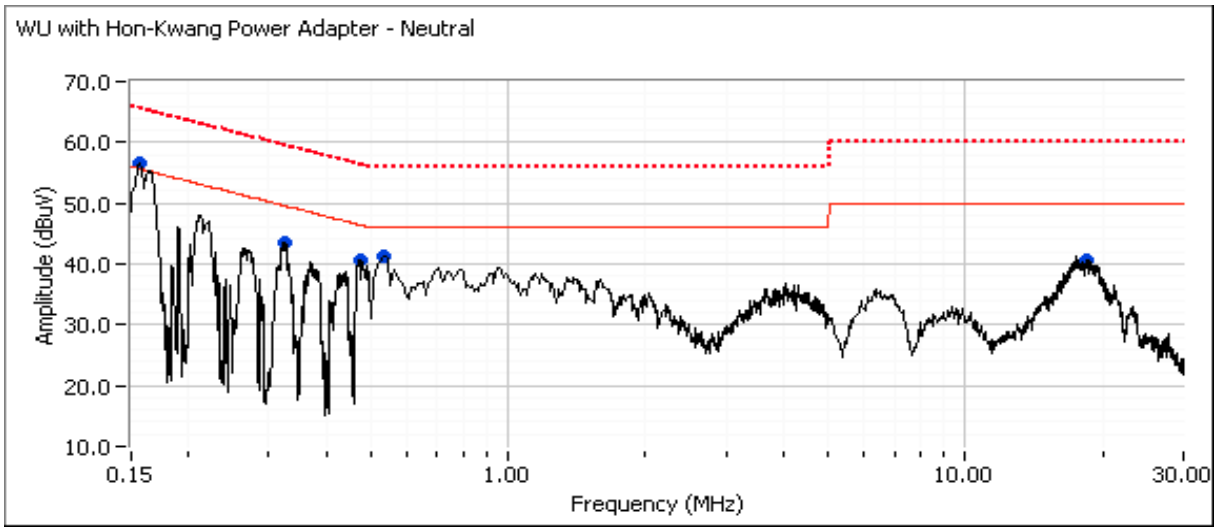
Deviations From The Standard

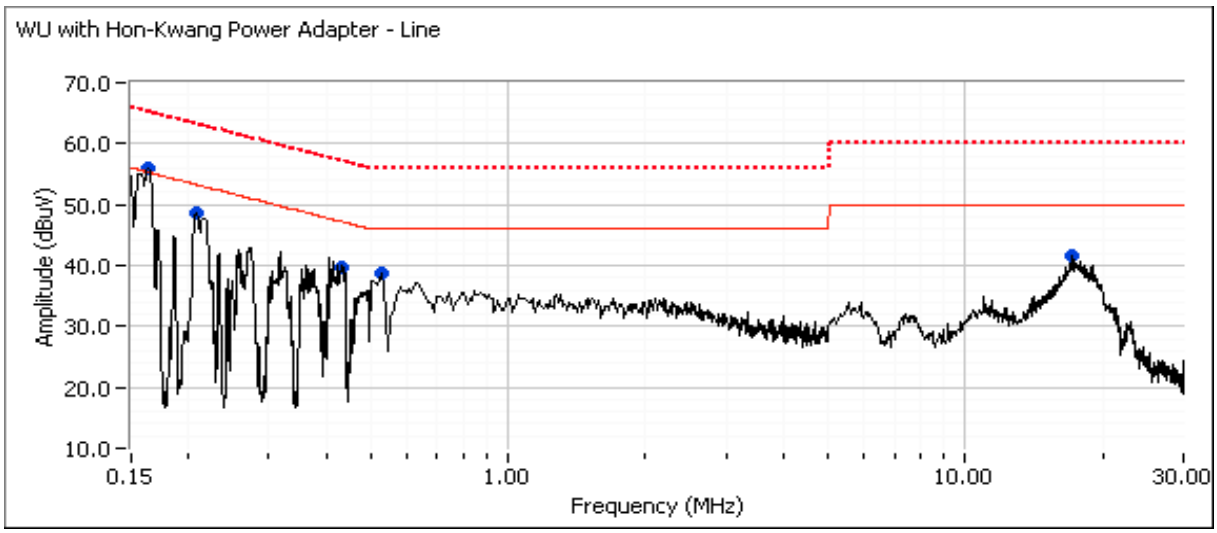
No deviations were made from the requirements of the standard.

Client:	Nextivity, Inc.	Job Number:	J89693
Model:	CELFI-RS224WU	T-Log Number:	T89741
		Account Manager:	Christine Krebill
Contact:	Michiel Lotter		
Standard:	FCC parts 15, 24 and 27	Class:	-

Run #1: AC Power Port Conducted Emissions, 0.15 - 30MHz, 120V/60Hz

The EUT (RS224 WU with Hon-Kwang Power Supply) was transmitting at 1732.4 MHz and 5199.0 MHz





Client:	Nextivity, Inc.	Job Number:	J89693
Model:	CELFI-RS224WU	T-Log Number:	T89741
		Account Manager:	Christine Krebill
Contact:	Michiel Lotter		
Standard:	FCC parts 15, 24 and 27	Class:	-

Run #1: AC Power Port Conducted Emissions, 0.15 - 30MHz, 120V/60Hz

The EUT (RS224 WU with Hon-Kwang Power Supply) was transmitting at 1732.4 MHz and 5199.0 MHz

Preliminary peak readings captured during pre-scan (peak readings vs. average limit)

Frequency MHz	Level dBµV	AC Line	Class A Limit	Class A Margin	Detector QP/Ave	Comments
0.159	56.5	Neutral	55.6	0.9	Peak	
0.162	55.8	Line	55.3	0.5	Peak	
0.207	48.5	Line	53.2	-4.7	Peak	
0.538	41.3	Neutral	46.0	-4.7	Peak	
0.478	40.5	Neutral	46.4	-5.9	Peak	
0.327	43.6	Neutral	49.6	-6.0	Peak	
0.500	38.6	Line	46.0	-7.4	Peak	
0.433	39.8	Line	47.2	-7.4	Peak	
17.205	41.6	Line	50.0	-8.4	Peak	
18.277	40.7	Neutral	50.0	-9.3	Peak	

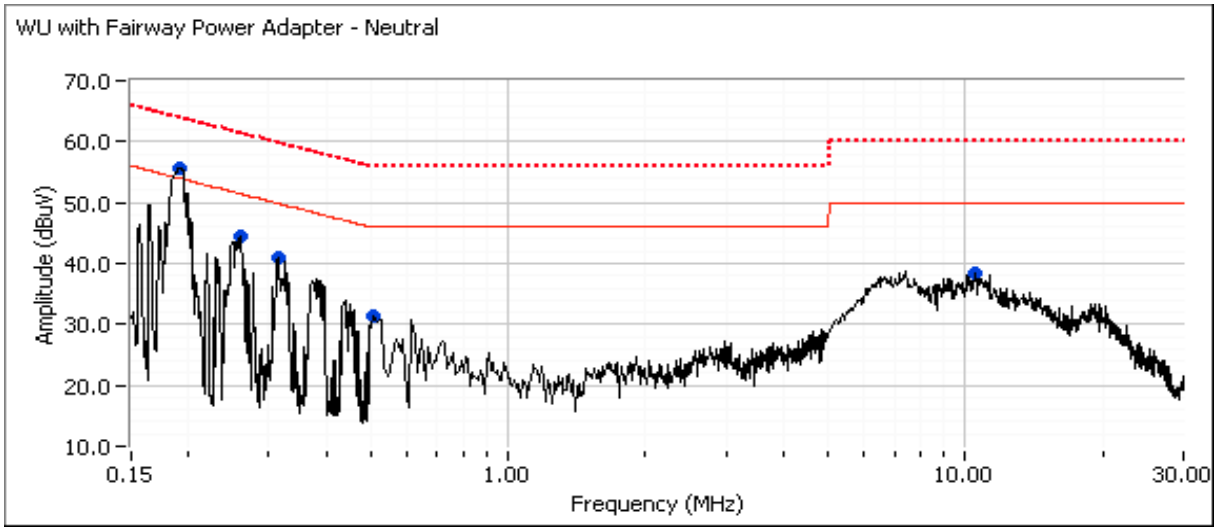
Final quasi-peak and average readings

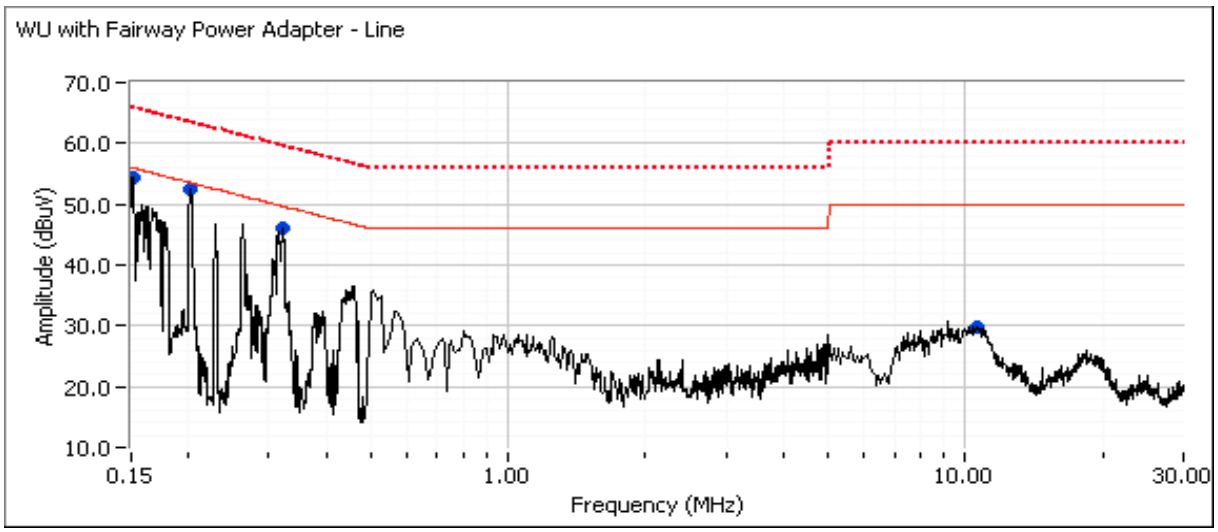
Frequency MHz	Level dBµV	AC Line	Class A Limit	Class A Margin	Detector QP/Ave	Comments
0.159	**54.5**	Neutral	65.5	**-11.0**	QP	QP (1.00s)
0.162	53.8	Line	65.4	-11.6	QP	QP (1.00s)
0.159	42.3	Neutral	55.5	-13.2	AVG	AVG (0.10s)
0.478	32.7	Neutral	46.4	-13.7	AVG	AVG (0.10s)
0.538	32.2	Neutral	46.0	-13.8	AVG	AVG (0.10s)
0.538	39.9	Neutral	56.0	-16.1	QP	QP (1.00s)
0.207	46.6	Line	63.3	-16.7	QP	QP (1.00s)
0.207	36.5	Line	53.3	-16.8	AVG	AVG (0.10s)
0.478	39.2	Neutral	56.4	-17.2	QP	QP (1.00s)
0.162	37.0	Line	55.4	-18.4	AVG	AVG (0.10s)
0.327	40.3	Neutral	59.5	-19.2	QP	QP (1.00s)
0.327	30.0	Neutral	49.5	-19.5	AVG	AVG (0.10s)
17.205	30.3	Line	50.0	-19.7	AVG	AVG (0.10s)
0.433	37.2	Line	57.2	-20.0	QP	QP (1.00s)
18.277	29.6	Neutral	50.0	-20.4	AVG	AVG (0.10s)
0.433	26.5	Line	47.2	-20.7	AVG	AVG (0.10s)
17.205	36.5	Line	60.0	-23.5	QP	QP (1.00s)
18.277	35.9	Neutral	60.0	-24.1	QP	QP (1.00s)
0.500	31.9	Line	56.0	-24.1	QP	QP (1.00s)
0.500	11.6	Line	46.0	-34.4	AVG	AVG (0.10s)

Client:	Nextivity, Inc.	Job Number:	J89693
Model:	CELFI-RS224WU	T-Log Number:	T89741
		Account Manager:	Christine Krebill
Contact:	Michiel Lotter		
Standard:	FCC parts 15, 24 and 27	Class:	-

Run #2: AC Power Port Conducted Emissions, 0.15 - 30MHz, 120V/60Hz

The EUT (RS224 WU with Fairway Power Supply) was transmitting at 1732.4 MHz and 5199.0 MHz





Client:	Nextivity, Inc.	Job Number:	J89693
Model:	CELFI-RS224WU	T-Log Number:	T89741
		Account Manager:	Christine Krebill
Contact:	Michiel Lotter		
Standard:	FCC parts 15, 24 and 27	Class:	-

Run #2: AC Power Port Conducted Emissions, 0.15 - 30MHz, 120V/60Hz

The EUT (RS224 WU with Fairway Power Supply) was transmitting at 1732.4 MHz and 5199.0 MHz

Preliminary peak readings captured during pre-scan (peak readings vs. average limit)

Frequency	Level	AC	Class A		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
0.190	55.6	Neutral	53.9	1.7	Peak	
0.200	52.4	Line	53.5	-1.1	Peak	
0.151	54.3	Line	55.9	-1.6	Peak	
0.322	46.0	Line	49.6	-3.6	Peak	
0.261	44.4	Neutral	51.4	-7.0	Peak	
0.312	41.1	Neutral	49.9	-8.8	Peak	
10.357	38.3	Neutral	50.0	-11.7	Peak	
0.527	31.5	Neutral	46.0	-14.5	Peak	
10.499	29.8	Line	50.0	-20.2	Peak	

Final quasi-peak and average readings

Frequency	Level	AC	Class A		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
0.190	**53.0**	Neutral	64.0	**-11.0**	QP	QP (1.00s)
0.199	52.1	Line	63.7	-11.6	QP	QP (1.00s)
0.190	40.1	Neutral	54.0	-13.9	AVG	AVG (0.10s)
0.322	41.0	Line	59.7	-18.7	QP	QP (1.00s)
0.261	42.6	Neutral	61.4	-18.8	QP	QP (1.00s)
0.199	34.6	Line	53.7	-19.1	AVG	AVG (0.10s)
0.322	28.8	Line	49.7	-20.9	AVG	AVG (0.10s)
0.312	38.7	Neutral	59.9	-21.2	QP	QP (1.00s)
0.151	43.7	Line	65.9	-22.2	QP	QP (1.00s)
0.261	28.0	Neutral	51.4	-23.4	AVG	AVG (0.10s)
0.312	24.9	Neutral	49.9	-25.0	AVG	AVG (0.10s)
10.357	33.6	Neutral	60.0	-26.4	QP	QP (1.00s)
10.357	22.8	Neutral	50.0	-27.2	AVG	AVG (0.10s)
0.527	27.6	Neutral	56.0	-28.4	QP	QP (1.00s)
10.499	16.9	Line	50.0	-33.1	AVG	AVG (0.10s)
0.527	12.7	Neutral	46.0	-33.3	AVG	AVG (0.10s)
10.499	26.4	Line	60.0	-33.6	QP	QP (1.00s)
0.151	19.8	Line	55.9	-36.1	AVG	AVG (0.10s)

Client:	Nextivity, Inc.	Job Number:	J89693
Model:	CELFI-RS224WU	T-Log Number:	T89741
		Account Manager:	Christine Krebill
Contact:	Michiel Lotter		
Standard:	FCC parts 15, 24 and 27	Class:	-

RSS-210 (LELAN) and FCC 15.407(UNII)
Radiated Measurements
Power, PSD, Peak Excursion and Bandwidth

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: 11/19/2012
Test Engineer: Deniz Demirci
Test Location: FT Ch#7

Config. Used: 1
Config Change: None
EUT Voltage: 120V/60Hz

Summary of Results

Run #	Test Performed	Limit	Pass / Fail	Result / Margin
1	Power, 5150 - 5250MHz	15.407(a) (1), (2)	Pass	28 mW
1	PSD, 5150 - 5250MHz	15.407(a) (1), (2)	Pass	1.4 dBm/MHz
1	Power, 5250 - 5350MHz	15.407(a) (1), (2)	Pass	48 mW
1	PSD, 5250 - 5350MHz	15.407(a) (1), (2)	Pass	3.7 dBm/MHz
1	26dB Bandwidth	15.407	-	> 20MHz for all modes
1	99% Bandwidth	RSS 210	N/A	26.9 MHz
2	Peak Excursion Envelope	15.407(a) (6) - 13dB	Pass	10.3 dB

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing.
The EUT was radiating through its internal antenna. The emission was maximized, & EIRP was measured as described in the notes below.
For radiated emissions testing the measurement antenna was located 3 meters from the EUT.

Ambient Conditions:

Temperature: 23 °C
Rel. Humidity: 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.

Client:	Nextivity, Inc.	Job Number:	J89693
Model:	CELFI-RS224WU	T-Log Number:	T89741
		Account Manager:	Christine Krebill
Contact:	Michiel Lotter		
Standard:	FCC parts 15, 24 and 27	Class:	-

Run #1: Bandwidth, Output Power and Power Spectral Density - MIMO Systems

Note 1:	Output power measured using a spectrum analyzer (see plots below). RBW=1MHz, VB=3 MHz, # of points in sweep ≥ 2*span/RBW, **sample** detector, power averaging on (transmitted signal was continuous) and power integration over 50 MHz (method SA-1 of KDB 789033).
Note 2:	Measured using the same analyzer settings used for output power.
Note 3:	For RSS-210 the limit for the 5150 - 5250 MHz band accounts for the antenna gain as the maximum eirp allowed is 10dBm/MHz. The limits are also corrected for instances where the highest measured value of the PSD exceeds the average PSD (calculated from the measured power divided by the measured 99% bandwidth) by more than 3dB by the amount that the measured value exceeds the average by more than 3dB.
Note 4:	99% Bandwidth measured in accordance with RSS GEN - RB > 1% of span and VB >=3xRB

Single Chain Operation, 5150-5250MHz Band

Antenna Gain (dBi): 5.5 EIRP: 99.3 mW 20.0 dBm

Frequency (MHz)	Software Setting	Bandwidth 26dB	Output Power[1] dBm		Power (Watts)	PSD[2] dBm/MHz			Result
			Measured	Limit		Measured	FCC Limit	RSS Limit[3]	
5198.4	Max	28.5	11.8	17.0	0.015	-1.0	4.0	4.5	Pass
5215.2	Max	29.1	13.2	17.0	0.021	-0.2	4.0	4.5	Pass
5248.8	Max	37.7	14.5	17.0	0.028	1.4	4.0	4.5	Pass

Output Power (Industry Canada limit based on 99% BW))

Frequency (MHz)	Software Setting	Bandwidth 99%[4]	Output Power[1] dBm		Power (Watts)	PSD[2] dBm/MHz			Result
			Measured	Limit		Measured	FCC Limit	RSS Limit[3]	
5198.4	Max	26.7	11.8	17.0	0.015	-1.0	4.0	4.5	Pass
5215.2	Max	26.7	13.2	17.0	0.021	-0.2	4.0	4.5	Pass
5248.8	Max	26.8	14.5	17.0	0.028	1.4	4.0	4.5	Pass

Client:	Nextivity, Inc.	Job Number:	J89693
Model:	CELFI-RS224WU	T-Log Number:	T89741
		Account Manager:	Christine Krebill
Contact:	Michiel Lotter		
Standard:	FCC parts 15, 24 and 27	Class:	-

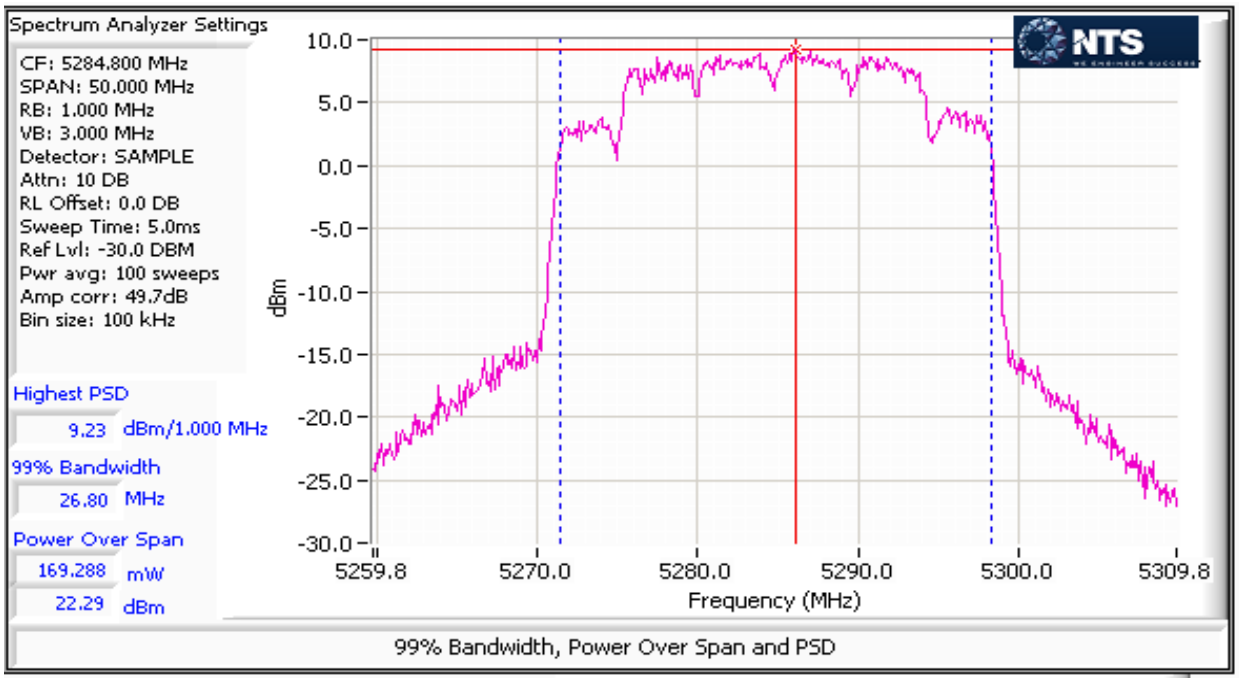
Single Chain Operation, 5250-5350 MHz Band

Antenna Gain (dBi): 5.5 EIRP: 169.4 mW 22.3 dBm

Frequency (MHz)	Software Setting	Bandwidth 26dB	Output Power[1] dBm		Power (Watts)	PSD[2] dBm/MHz			Result
			Measured	Limit		Measured	FCC Limit	RSS Limit[3]	
5268.0	Max	39.3	15.3	24.0	0.034	2.0	11.0	11.0	Pass
5284.8	Max	40.9	16.8	24.0	0.048	3.7	11.0	10.9	Pass
5301.6	Max	35.7	15.7	24.0	0.037	2.9	11.0	11.0	Pass

Output Power (Industry Canada limit based on 99% BW))

Frequency (MHz)	Software Setting	Bandwidth 99%[4]	Output Power[1] dBm		Power (Watts)	PSD[2] dBm/MHz			Result
			Measured	Limit		Measured	FCC Limit	RSS Limit[3]	
5268.0	Max	26.9	15.3	24.0	0.034	2.0	11.0	11.0	Pass
5284.8	Max	26.8	16.8	24.0	0.048	3.7	11.0	11.0	Pass
5301.6	Max	26.8	15.7	24.0	0.037	2.9	11.0	11.0	Pass



Note: EIRP values in plot

Output Power at Low Power Setting - 5250-5350 MHz Band

EIRP does not exceed 500mW, therefore TPC is not required and measurements at a low power setting are not required.

Client:	Nextivity, Inc.	Job Number:	J89693
Model:	CELFI-RS224WU	T-Log Number:	T89741
		Account Manager:	Christine Krebill
Contact:	Michiel Lotter		
Standard:	FCC parts 15, 24 and 27	Class:	-

Run #2: Peak Excursion Measurement

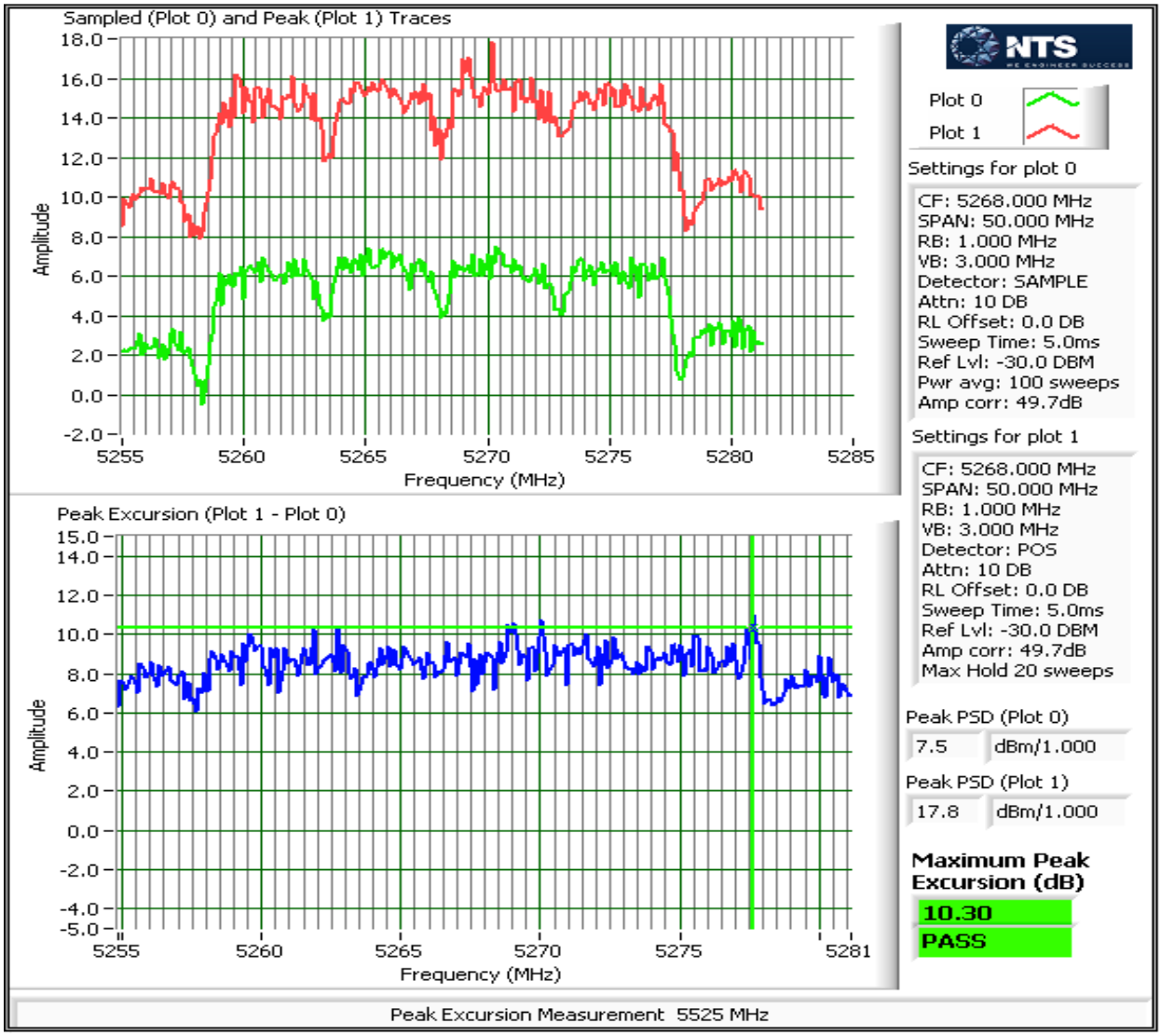
Device meets the requirement for the peak excursion

Freq	Peak Excursion(dB)		Freq	Peak Excursion(dB)		Freq	Peak Excursion(dB)	
(MHz)	Value	Limit	(MHz)	Value	Limit	(MHz)	Value	Limit
5198.4	9.7	13.0	5215.2	9.4	13.0	5248.8	9.7	13.0
5268.0	10.3	13.0	5284.8	9.2	13.0	5301.6	8.7	13.0

Plots Showing Peak Excursion

Trace A: RBW = 1MHz, VBW = 3MHz, Peak hold

Trace B: Same settings as used for power/PSD measurements (RBW = 1 MHz, VBW = 3MHz, Integrated **average** power)



Client:	Nextivity, Inc.	Job Number:	J89693
Model:	CELFI-RS224WU	T-Log Number:	T89741
		Account Manager:	Christine Krebill
Contact:	Michiel Lotter		
Standard:	FCC parts 15, 24 and 27	Class:	N/A

RSS 210 and FCC 15.407 (UNII) 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.

Ambient Conditions:

Temperature:	23 °C
Rel. Humidity:	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.

Test Procedure Comments:

Unless otherwise noted, average measurements above 1GHz were performed as documented in FCC KDB 789033 G) 6) d) Method VB

Antenna: antenna connected (internal)
Duty Cycle: 100%

Client:	Nextivity, Inc.	Job Number:	J89693
Model:	CELFI-RS224WU	T-Log Number:	T89741
		Account Manager:	Christine Krebill
Contact:	Michiel Lotter		
Standard:	FCC parts 15, 24 and 27	Class:	N/A

Summary of Results

Run #	Mode	Channel	Power Setting	Measured Power	Test Performed	Limit	Result / Margin
1	Proprietary	5150-5250 Low	Max	-	Restricted Band Edge at 5150 MHz	15.209	51.7 dBµV/m @ 5130.4 MHz (-2.3 dB)
		5150-5250 Low	Max	-	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	Pass
		5150-5250 Center	Max	-	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	Pass
		5150-5250 High	Max	-	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	Pass
2	Proprietary	5250-5350 Low	Max	-	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	Pass
		5250-5350 Center	Max	-	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	Pass
		5250-5350 High	Max	-	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	Pass
		5250-5350 High	Max	-	Restricted Band Edge at 5350 MHz	15.209	48.3 dBµV/m @ 5350.2 MHz (-5.7 dB)

Client:	Nextivity, Inc.	Job Number:	J89693
Model:	CELFI-RS224WU	T-Log Number:	T89741
		Account Manager:	Christine Krebill
Contact:	Michiel Lotter		
Standard:	FCC parts 15, 24 and 27	Class:	N/A

Run #1, Radiated Spurious Emissions, 1-40 GHz. Operation in the 5150-5250 MHz Band

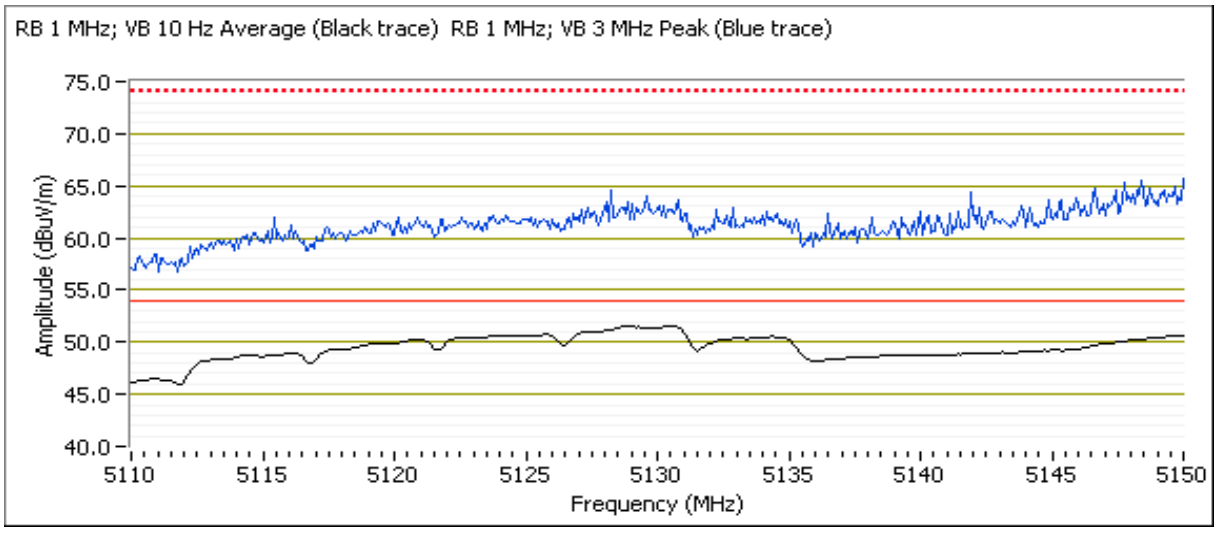
Date of Test: 11/20/2012 Config. Used: 1
Test Engineer: Deniz Demirci, M. Birgani Config Change: None
Test Location: FT Ch#7 EUT Voltage: 120V/60Hz

Run #1a: Low Channel - 5198.4 MHz

With PCS Low channel 3 carriers max power

5150 MHz Restricted Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	FCC 15.209		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5130.440	**51.7**	V	54.0	**-2.3**	AVG	189	1.1	POS; RB 1 MHz; VB: 10 Hz
5130.600	46.2	H	54.0	-7.8	AVG	192	1.1	POS; RB 1 MHz; VB: 10 Hz
5149.920	63.8	V	74.0	-10.2	PK	189	1.1	POS; RB 1 MHz; VB: 3 MHz
5147.760	58.6	H	74.0	-15.4	PK	192	1.1	POS; RB 1 MHz; VB: 3 MHz

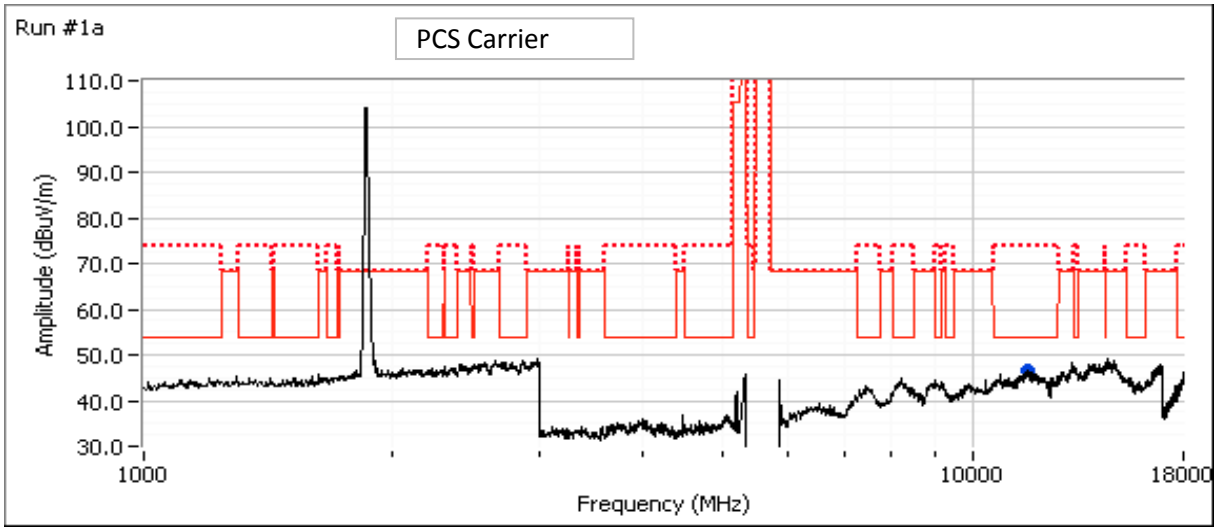


Client:	Nextivity, Inc.	Job Number:	J89693
Model:	CELFI-RS224WU	T-Log Number:	T89741
		Account Manager:	Christine Krebill
Contact:	Michiel Lotter		
Standard:	FCC parts 15, 24 and 27	Class:	N/A

Spurious Radiated Emissions:

Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
11670.000	*46.5*	*V*	*54.0*	*-7.5*	*Peak*	*57*	*1.0*	*Noise floor reading*
15483.330	*44.9*	*V*	*54.0*	*-9.1*	*Peak*	*276*	*1.0*	*Noise floor reading*

Note 1:	For emissions in restricted bands, the limit of 15.209 was used which requires average and peak measurements.
Note 2:	For emissions outside of the restricted bands the limit is -27dBm/MHz eirp (68.3dBuV/m). The measurement method required is a peak measurement (RB=1MHz, VB≥3MHz, peak detector).



Run #1b: Center Channel - 5215.2 MHz

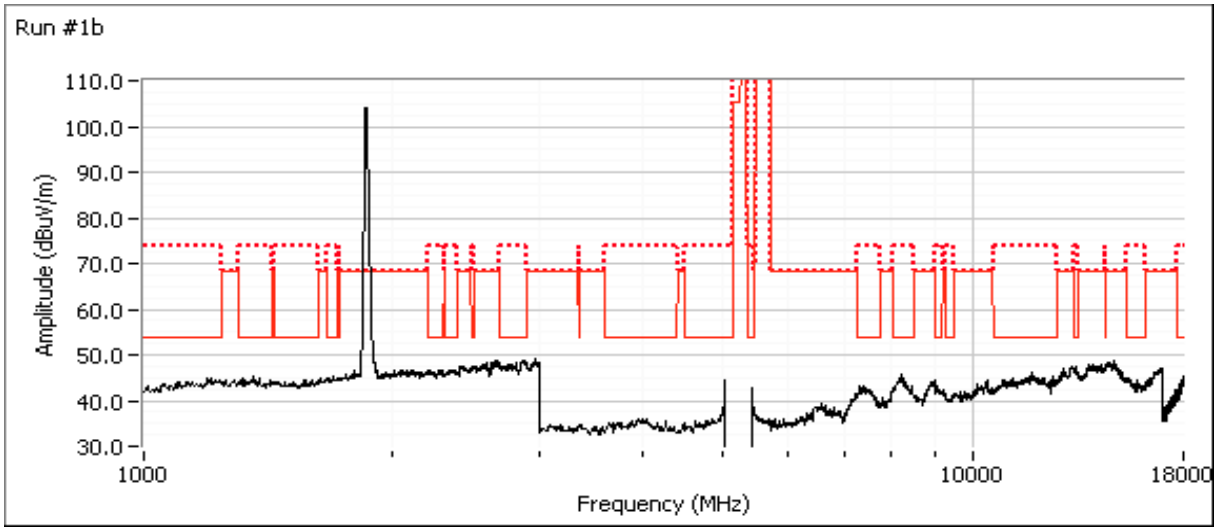
With PCS Low channel 3 carriers max power

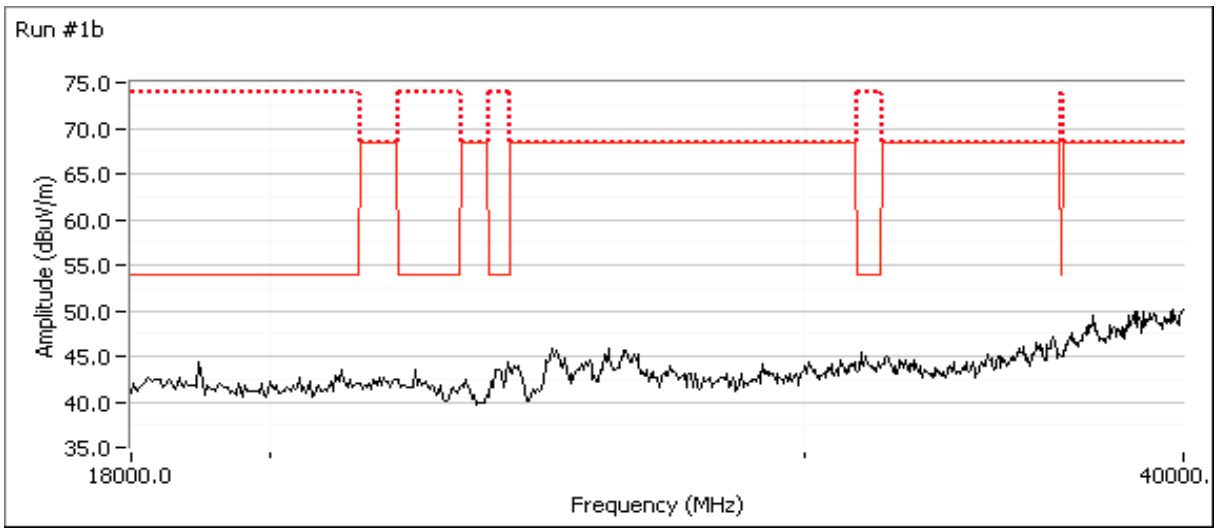
Spurious Radiated Emissions:

Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
13333.330	*47.3*	*H*	*54.0*	*-6.7*	*Peak*	*331*	*1.3*	*Noise floor reading*
8240.000	*45.8*	*V*	*54.0*	*-8.2*	*Peak*	*246*	*1.3*	*Noise floor reading*

Note 1:	For emissions in restricted bands, the limit of 15.209 was used which requires average and peak measurements.
Note 2:	For emissions outside of the restricted bands the limit is -27dBm/MHz eirp (68.3dBuV/m). The measurement method required is a peak measurement (RB=1MHz, VB≥3MHz, peak detector).

Client:	Nextivity, Inc.	Job Number:	J89693
Model:	CELFI-RS224WU	T-Log Number:	T89741
		Account Manager:	Christine Krebill
Contact:	Michiel Lotter		
Standard:	FCC parts 15, 24 and 27	Class:	N/A



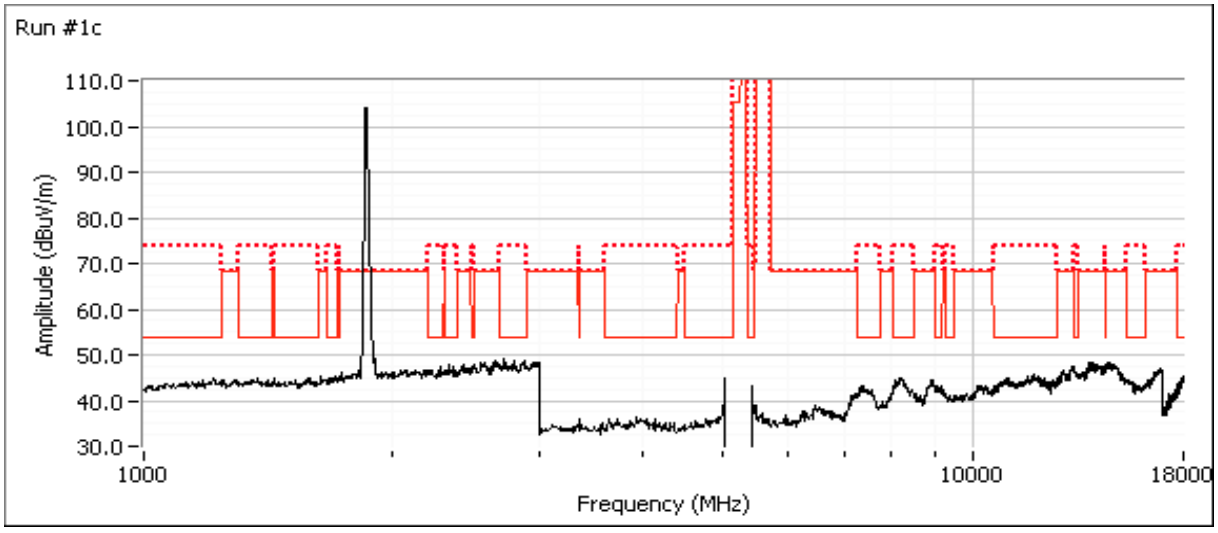


Client:	Nextivity, Inc.	Job Number:	J89693
Model:	CELFI-RS224WU	T-Log Number:	T89741
		Account Manager:	Christine Krebill
Contact:	Michiel Lotter		
Standard:	FCC parts 15, 24 and 27	Class:	N/A

Run #1c: High Channel 5248.8 MHz
With PCS Low channel 3 carriers max power
Spurious Radiated Emissions:

Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
8200.000	*44.7*	*H*	*54.0*	*-9.3*	*Peak*	*353*	*2.5*	*Noise floor reading*

Note 1:	For emissions in restricted bands, the limit of 15.209 was used which requires average and peak measurements.
Note 2:	For emissions outside of the restricted bands the limit is -27dBm/MHz eirp (68.3dBuV/m). The measurement method required is a peak measurement (RB=1MHz, VB≥3MHz, peak detector).



Client:	Nextivity, Inc.	Job Number:	J89693
Model:	CELFI-RS224WU	T-Log Number:	T89741
		Account Manager:	Christine Krebill
Contact:	Michiel Lotter		
Standard:	FCC parts 15, 24 and 27	Class:	N/A

Run #2, Radiated Spurious Emissions, 1-40 GHz. Operation in the 5250-5350 MHz Band

Date of Test: 11/20/2012 Config. Used: 1
Test Engineer: Jack Liu, M. Birgani Config Change: None
Test Location: FT Ch#7 EUT Voltage: 120V/60Hz

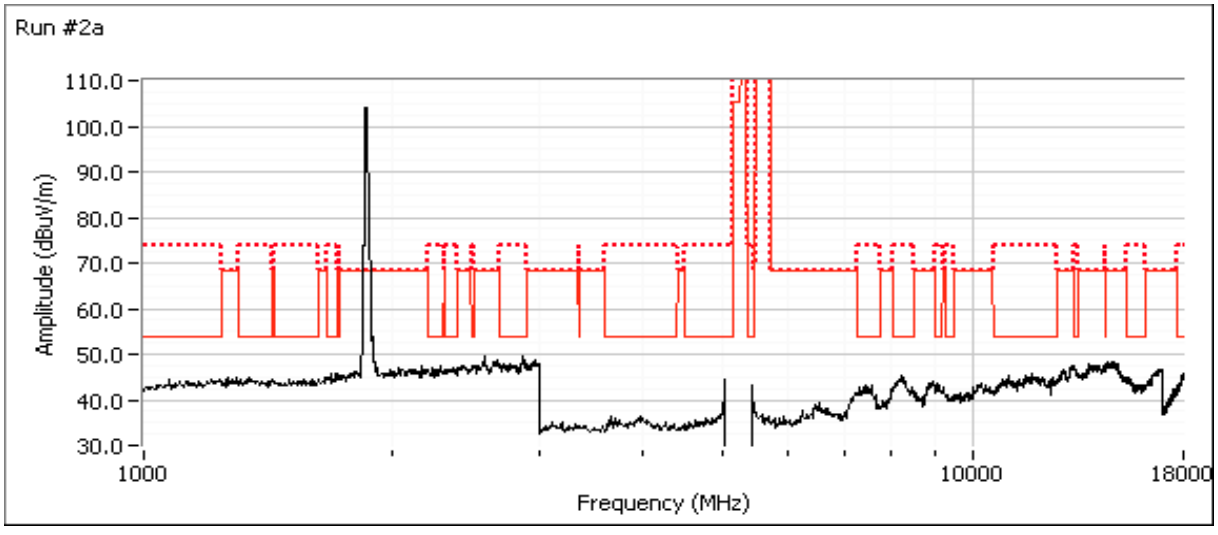
Run #2a: Low Channel - 5268 MHz

With PCS Low channel 3 carriers max power

Spurious Radiated Emissions:

Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
8200.000	44.7	V	54.0	-9.3	Peak	214	2.5	Noise floor reading

Note 1:	For emissions in restricted bands, the limit of 15.209 was used which requires average and peak measurements.
Note 2:	For emissions outside of the restricted bands the limit is -27dBm/MHz eirp (68.3dBuV/m). The measurement method required is a peak measurement (RB=1MHz, VB≥3MHz, peak detector).

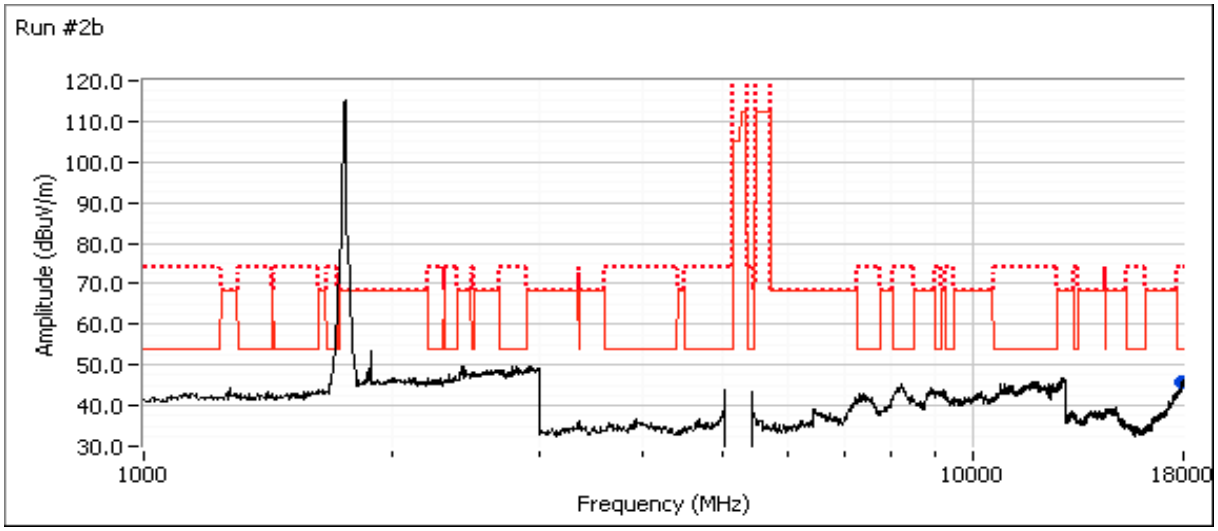


Client:	Nextivity, Inc.	Job Number:	J89693
Model:	CELFI-RS224WU	T-Log Number:	T89741
		Account Manager:	Christine Krebill
Contact:	Michiel Lotter		
Standard:	FCC parts 15, 24 and 27	Class:	N/A

Run #2b: Center Channel - 5284.8 MHz
With AWS Low channel 3 carriers max power
Spurious Radiated Emissions:

Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
17941.670	**45.6**	H	54.0	**-8.4**	Peak	290	2.2	Noise Floor Reading

Note 1:	For emissions in restricted bands, the limit of 15.209 was used which requires average and peak measurements.
Note 2:	For emissions outside of the restricted bands the limit is -27dBm/MHz eirp (68.3dBuV/m). The measurement method required is a peak measurement (RB=1MHz, VB≥3MHz, peak detector).
Note 3:	Near field scan showed no emission from 18-40GHz.

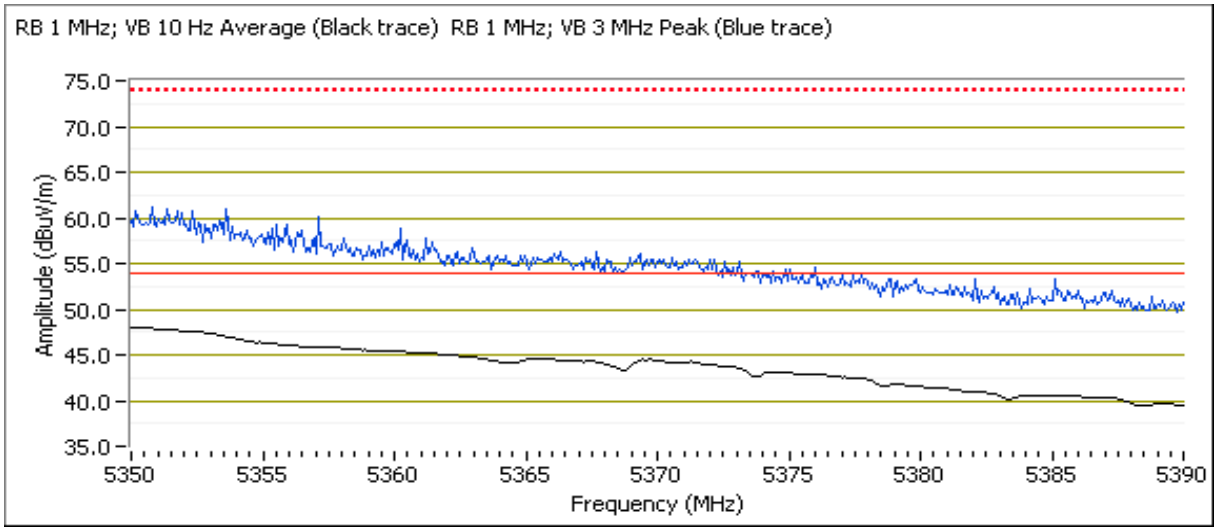


Client:	Nextivity, Inc.	Job Number:	J89693
Model:	CELFI-RS224WU	T-Log Number:	T89741
		Account Manager:	Christine Krebill
Contact:	Michiel Lotter		
Standard:	FCC parts 15, 24 and 27	Class:	N/A

Run #2c: High Channel - 5301.6 MHz
With PCS Low channel 3 carriers max power

5350 MHz Restricted Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	FCC 15.209		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5350.160	**48.3**	V	54.0	**-5.7**	AVG	196	1.3	POS; RB 1 MHz; VB: 10 Hz
5350.000	44.0	H	54.0	-10.0	AVG	314	1.0	POS; RB 1 MHz; VB: 10 Hz
5350.800	61.0	V	74.0	-13.0	PK	196	1.3	POS; RB 1 MHz; VB: 3 MHz
5351.040	56.3	H	74.0	-17.7	PK	314	1.0	POS; RB 1 MHz; VB: 3 MHz

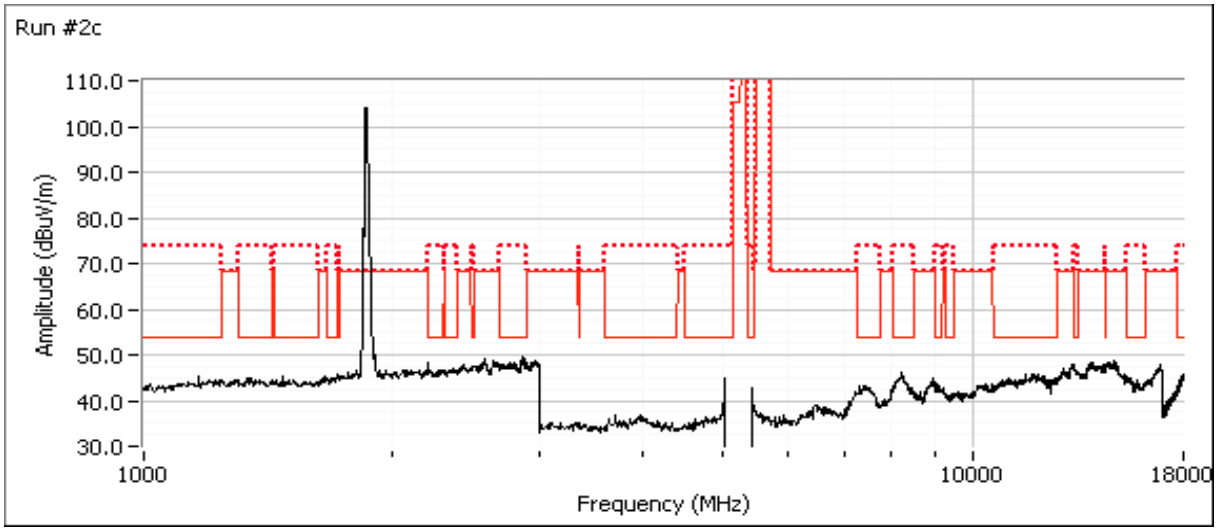


Client:	Nextivity, Inc.	Job Number:	J89693
Model:	CELFI-RS224WU	T-Log Number:	T89741
		Account Manager:	Christine Krebill
Contact:	Michiel Lotter		
Standard:	FCC parts 15, 24 and 27	Class:	N/A

Spurious Radiated Emissions:

Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
8200.000	45.0	H	54.0	-9.0	Peak	108	2.3	Noise floor reading

Note 1:	For emissions in restricted bands, the limit of 15.209 was used which requires average and peak measurements.
Note 2:	For emissions outside of the restricted bands the limit is -27dBm/MHz eirp (68.3dBuV/m). The measurement method required is a peak measurement (RB=1MHz, VB≥3MHz, peak detector).



Client:	Nextivity, Inc.	Job Number:	J89693
Model:	CELFI-RS224WU	T-Log Number:	T89741
		Account Manager:	Christine Krebill
Contact:	Michiel Lotter		
Standard:	FCC parts 15, 24 and 27	Class:	N/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: 11/20/2012
Test Engineer: M. Birgani
Test Location: FT Chamber #7

Config. Used: 1
Config Change: WU # 159246000012
EUT Voltage: 120V/60Hz

General Test Configuration

The EUT was located on the turntable for radiated emissions testing.
The test distance and extrapolation factor (if applicable) are detailed under each run description.

Note, preliminary testing indicates that the emissions were maximized by orientation of the EUT and elevation of the measurement antenna. Maximized testing indicated that the emissions were maximized by orientation of the EUT, elevation of the measurement antenna, and manipulation of the EUT's interface cables.

Ambient Conditions:

Temperature: 15-20 °C
Rel. Humidity: 35-45 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	Radiated Emissions 30 - 1000 MHz, Preliminary	FCC 15.209 / 15 E	-	38.4 dBµV/m @ 30.00 MHz (Margin: -1.6 dB)
2	Radiated Emissions 30 - 1000 MHz, Maximized	FCC 15.209 / 15 E	PASS	38.8 dBµV/m @ 30.00 MHz (Margin: -1.2 dB)

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

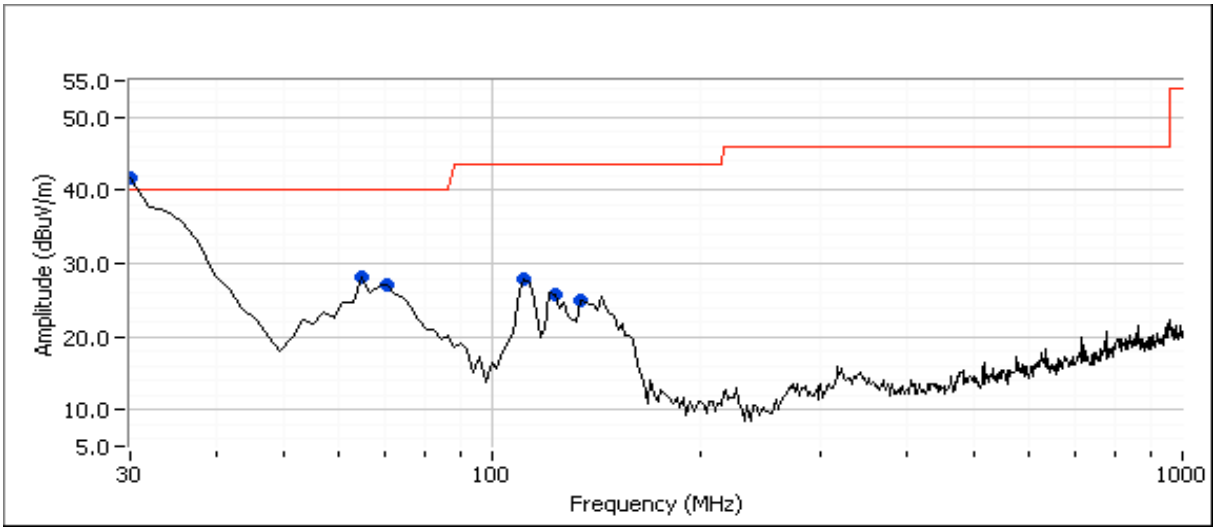
No deviations were made from the requirements of the standard.

Test Parameters for Preliminary Scan(s)			
Frequency Range	Prescan Distance	Limit Distance	Extrapolation Factor
30 - 1000 MHz	3	3	0.0

Client:	Nextivity, Inc.	Job Number:	J89693
Model:	CELFI-RS224WU	T-Log Number:	T89741
		Account Manager:	Christine Krebill
Contact:	Michiel Lotter		
Standard:	FCC parts 15, 24 and 27	Class:	N/A

Run #1: Preliminary Radiated Emissions, 30 - 1000 MHz

EUT Configuration Details: *The unit was transmitting at 5301.6 MHz and Cell frequency of 1740 MHz with HON-KWANG PS, 120 VAC 60 Hz.*



Preliminary peak readings captured during pre-scan

Frequency	Level	Pol	FCC 15.209 / 15 E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
30.000	41.7	V	40.0	1.7	Peak	268	1.0	
64.990	28.1	V	40.0	-11.9	Peak	213	1.0	
111.643	27.8	V	43.5	-15.7	Peak	338	1.0	
123.307	25.8	V	43.5	-17.7	Peak	328	1.0	
134.970	25.0	V	43.5	-18.5	Peak	288	1.0	
70.822	27.1	V	40.0	-12.9	Peak	183	1.0	

Preliminary quasi-peak readings (no manipulation of EUT interface cables)

Frequency	Level	Pol	FCC 15.209 / 15 E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
30.000	**38.4**	V	40.0	**-1.6**	QP	273	1.0	QP (1.00s)
64.990	26.4	V	40.0	-13.6	QP	201	1.0	QP (1.00s)
70.822	25.1	V	40.0	-14.9	QP	204	1.0	QP (1.00s)
111.643	26.4	V	43.5	-17.1	QP	332	1.0	QP (1.00s)
123.307	26.0	V	43.5	-17.5	QP	338	1.0	QP (1.00s)
134.970	22.9	V	43.5	-20.6	QP	285	1.0	QP (1.00s)

Client:	Nextivity, Inc.	Job Number:	J89693
Model:	CELFI-RS224WU	T-Log Number:	T89741
		Account Manager:	Christine Krebill
Contact:	Michiel Lotter		
Standard:	FCC parts 15, 24 and 27	Class:	N/A

Run #2: Maximized Readings From Run #1

Maximized quasi-peak readings (includes manipulation of EUT interface cables)

Frequency	Level	Pol	FCC 15.209 / 15 E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
30.000	**38.8**	V	40.0	**-1.2**	QP	273	1.0	QP (1.00s)
64.990	26.4	V	40.0	-13.6	QP	201	1.0	QP (1.00s)
70.822	25.1	V	40.0	-14.9	QP	204	1.0	QP (1.00s)
111.643	26.4	V	43.5	-17.1	QP	332	1.0	QP (1.00s)
123.307	26.0	V	43.5	-17.5	QP	338	1.0	QP (1.00s)
134.970	22.9	V	43.5	-20.6	QP	285	1.0	QP (1.00s)

End of Report

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