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EMC Test Report

Application for Grant of Equipment Authorization

FCC Part 15, Subpart E

Model: HR54-700

FCC ID:	PGRHR54-2
APPLICANT:	Pace Americas Inc. 310 Providence Mine Road Nevada City, CA 95959
TEST SITE(S):	National Technical Systems - Silicon Valley 41039 Boyce Road. Fremont, CA. 94538-2435
REPORT DATE:	May 16, 2016
REISSUE DATE:	June 29, 2016
FINAL TEST DATES:	June 19, 22, 25, 26, 28, July 1, 2, 8, 9, 10, 11, 14, 16, and August 5, 2015 and May 24, 2016
TOTAL NUMBER OF PAGES:	123

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Testing Cert #0214.26

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REVISION HISTORY

Rev#	Date	Comments	Modified By
-	May 16, 2016	First release	
1.0	May 17, 2016	Updated FCC ID	MEH
2.0	May 25, 2016	Removed reference to unused measurement procedure. Revised bandedge results for 40MHz operation. Removed reference to VBW settings for radiated measurements on the antenna conducted results section.	MEH
3.0	June 29, 2016	Removed reference to ferrite on HDMI cable	MEH

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SCOPE

An electromagnetic emissions test has been performed on the Pace Americas Inc. model HR54-700, pursuant to the following rules:

FCC Part 15, Subpart E requirements for UNII Devices

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

ANSI C63.10-2013
FCC General UNII Test Procedures KDB789033

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.

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 Pace Americas Inc. model HR54-700 complied with the requirements of the following regulations:

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 Pace Americas Inc. model HR54-700 and therefore apply only to the tested sample. The sample was selected and prepared by Mark Rieger of Pace Americas 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 (a) (1) (iv)	-	Output Power	a: 52.5mW (17.2dBm) n20: 145.5mW (21.6dBm) n40: 167.5mW (22.2dBm) (Max eirp: 0.430W)	24 dBm	Complies
15.407 (a) (1) (iv)	-	Power Spectral Density	a: 3.2 dBm/MHz n20: 9.5 dBm/MHz n40: 7.2 dBm/MHz	11 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	20.6MHz minimum	N/A – limits output power if < 20MHz	N/A
15.407(a) (2)	-	Output Power	a: 79.4mW (19.0dBm) n20: 143.3mW (21.6dBm) n40: 133.7mW (21.3dBm) (Max eirp: 0.368W)	24dBm (250mW)	Complies
15.407(a) (2)	-	Power Spectral Density	a: 6.9 dBm/MHz n20: 9.0 dBm/MHz n40: 6.2 dBm/MHz	11 dBm/MHz	Complies

Operation in the 5.47 – 5.725 GHz Band

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.407(a) (2)		26dB Bandwidth	20.5MHz minimum	N/A – limits output power if < 20MHz	N/A
15.407(a) (2)	-	Output Power	a: 85.1mW (19.3dBm) n20: 166.5mW (22.2dBm) n40: 157.1mW (22.0dBm) (Max eirp: 0.428 W)	24dBm (250mW)	Complies
15.407(a) (2))	-	Power Spectral Density	a: 6.6 dBm/MHz n20: 9.5 dBm/MHz n40: 6.7 dBm/MHz	11 dBm/MHz	Complies

Operation in the 5.725-5.850 GHz Band

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.407(e)		6dB Bandwidth	16.4MHz minimum	>500kHz	N/A
15.407(a) (3)	-	Output Power	a: 77.6mW (18.9dBm) n20: 158.9mW (22.0dBm) n40: 146.7mW (21.7dBm) (Max eirp: 0.408W)	30 dBm	Complies
15.407(a) (3)	-	Power Spectral Density	a: 6.3 dBm/MHz n20: 9.2 dBm/MHz n40: 6.6 dBm/MHz	30 dBm/500kHz	Complies

Requirements for all U-NII/LELAN bands

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result
15.407	-	Modulation	Digital Modulation is used	Digital modulation is required	Complies
15.407(b) (1), (3), and (4) / 15.209	-	Spurious Emissions	68.0 dBµV/m @ 5468.5 MHz (-0.3 dB)	Refer to page 20	Complies
15.407 (c)	-	Operation in the absence of information to transmit	Operation is discontinued in the absence of information	Device shall automatically discontinue operation in the absence of information to transmit	Complies
15.407 (g)	-	Frequency Stability	Frequency stability is better than 20ppm	Signal shall remain within the allocated band	Complies
15.407 (h1)	-	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)	-	Dynamic frequency Selection (device without radar detection)	Refer to separate test report, reference R98864	Channel move time < 10s Channel closing transmission time < 260ms	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	Antennas are internal to the device	Unique or integral antenna required	Complies
15.207	RSS GEN Table 3	AC Conducted Emissions	46.1 dBµV @ 0.443 MHz (-0.9 dB)	Refer to page 19	Complies
15.247 (b) (5) 15.407 (f)	RSS 102	RF Exposure Requirements	Refer to MPE calculations in separate exhibit	Refer to OET 65, FCC Part 1 and RSS 102	Complies

Note: Spurious emission results for 802.11 5GHz and RF4CE simultaneous operation is found in R101641.

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 Pace Americas Inc. model HR54-700 is a set-top-box DVR that incorporates 802.11abgn 2x2 and 2.4GHz RF4CE radios. Since the EUT would be placed on a tabletop during operation, the EUT was treated as tabletop equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 12 Volts DC, 4.0 Amps. The electrical rating of the EUT power adapter is 120 Volts, 60 Hz, 1.1 Amps.

The sample was received on June 19, 2015 and tested on June 19, 22, 25, 26, 28, July 1, 2, 8, 9, 10, 11, 14, 16, and August 5, 2015 and May 24, 2016. The EUT consisted of the following component(s):

Company	Model	Description	Serial Number	FCC ID
Pace Americas, Inc.	HR54-700	DVR	G54DA5DN000024	PGRHR54-2
DirecTV	EPS44R3-16	AC/DC Adapter	DD44B1425A0039	N/A

ANTENNA SYSTEM

The wifi and RF4CE radios use separate antennas.
The peak gain for the WiFi antennas: 3.3 dBi (2.4GHz), 4.1 dBi (5GHz)
The peak gain for the RF4CE antennas: 4.9 dBi (2.4GHz)

ENCLOSURE

The EUT enclosure is primarily constructed of plastic. It measures approximately 33 cm wide by 25 cm deep by 5.5 cm high.

MODIFICATIONS

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

SUPPORT EQUIPMENT

The following equipment was used as support equipment for testing:

Company	Model	Description	Serial Number	FCC ID
Dynex	DX-LCD19-09	Television	H8984JA055002	-
-	-	USB Memory Stick	None	-
Lacie	d2 Quadra	Sata Drive Enclosure	16551411120974GHB	

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

Company	Model	Description	Serial Number	FCC ID
Linksys	BEFSR41	Cable/DSL Router	687F749FC378	-

EUT INTERFACE PORTS

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

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
Power Input	AC Adpater	2 wire with ferrite	Shielded	0.7
SATA	Sata Drive	Multiwire	Shielded	1.2
USB	USB Memory Stick	4 wire	Shielded	1.2
Ethernet	Remote Switch	Cat 5	Unshielded	7
HDMI	Television	Multiwire	Shielded	1.2
Coaxial	Television	Coax	Shielded	1.2
Digital Audio Out	Not connected (optical)	-	-	-
A/V Out	Television	Multiwire	Shielded	1.0
Satellite In	Unterminated	Coax	Shielded	7
Temporary Serial Programming box	CN1510 connection on PCB	Multiwire	Unshielded	0.3
Temporary Serial Programming box	Laptop	Multiwire	Shielded	1.5

EUT OPERATION

During emissions testing the EUT was set to transmit continuously on the selected frequency, data rate, bandwidth, number of chains, power level and modulation as noted for each test using the serial port. The Ethernet port was in link state.

TEST SITE

GENERAL INFORMATION

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

Site	Designation / Registration Numbers FCC	Canada	Location
Chamber 3	US0027	2845B-3	41039 Boyce Road Fremont, CA 94538-2435
Chamber 4	US0027	2845B-4	
Chamber 5	US0027	2845B-5	
Chamber 7	US0027	2845B-7	

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

CONDUCTED EMISSIONS CONSIDERATIONS

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

RADIATED EMISSIONS CONSIDERATIONS

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

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

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

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

INSTRUMENT CONTROL COMPUTER

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

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

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

INSTRUMENT CALIBRATION

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

TEST PROCEDURES

EUT AND CABLE PLACEMENT

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

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.

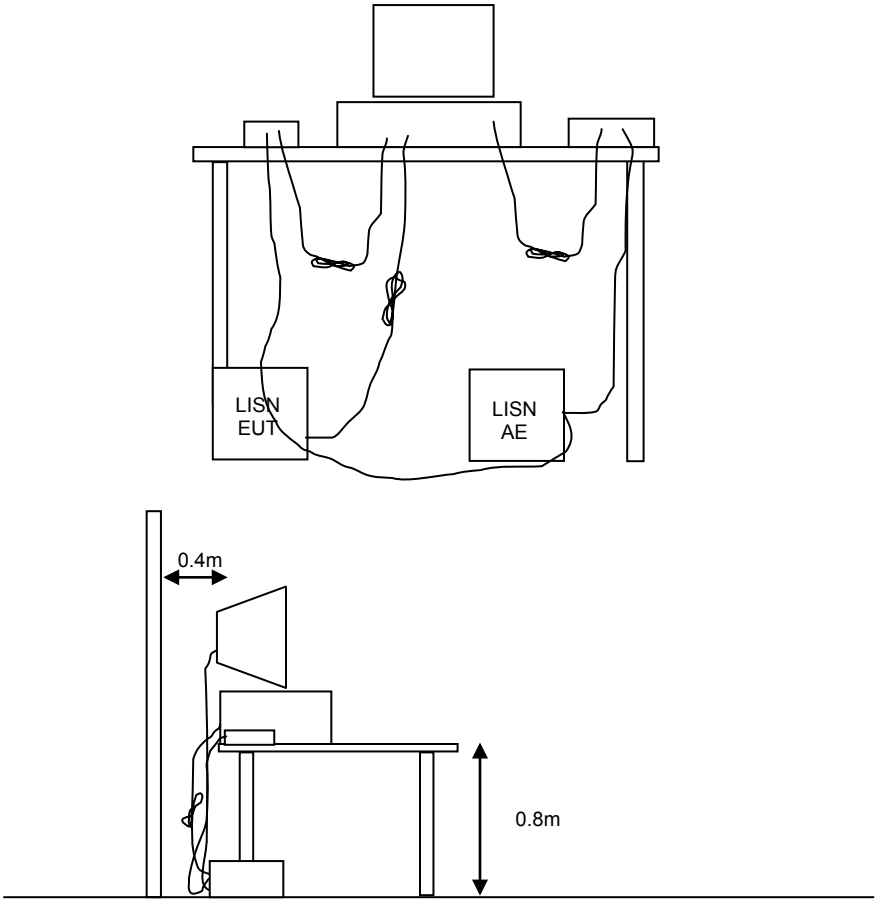


Figure 1 Typical Conducted Emissions Test Configuration

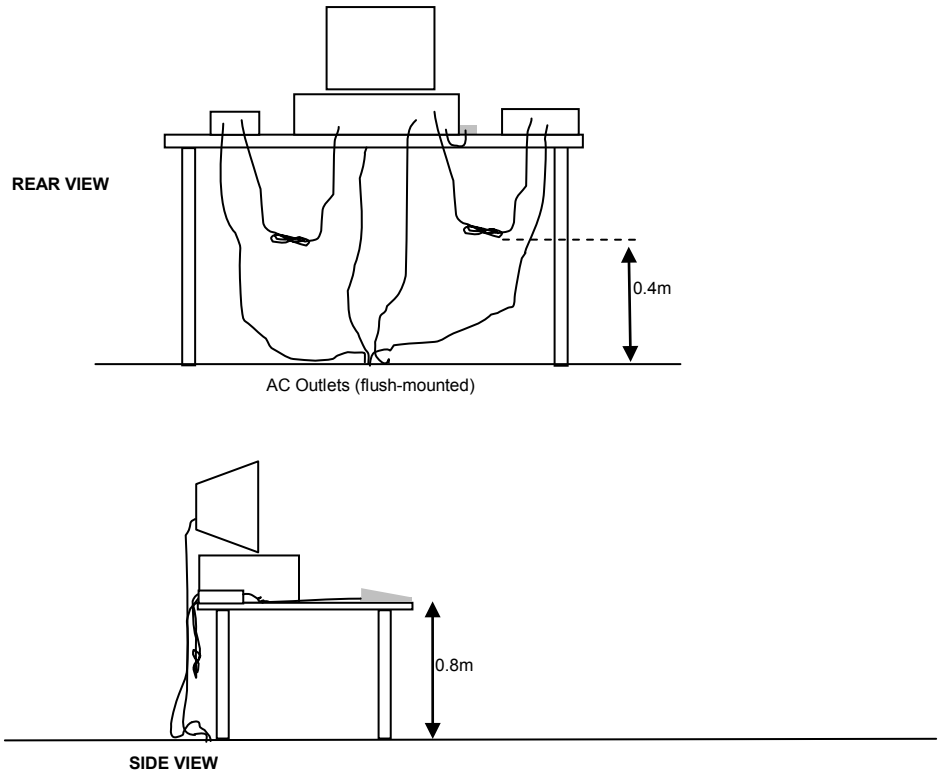
RADIATED EMISSIONS

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.

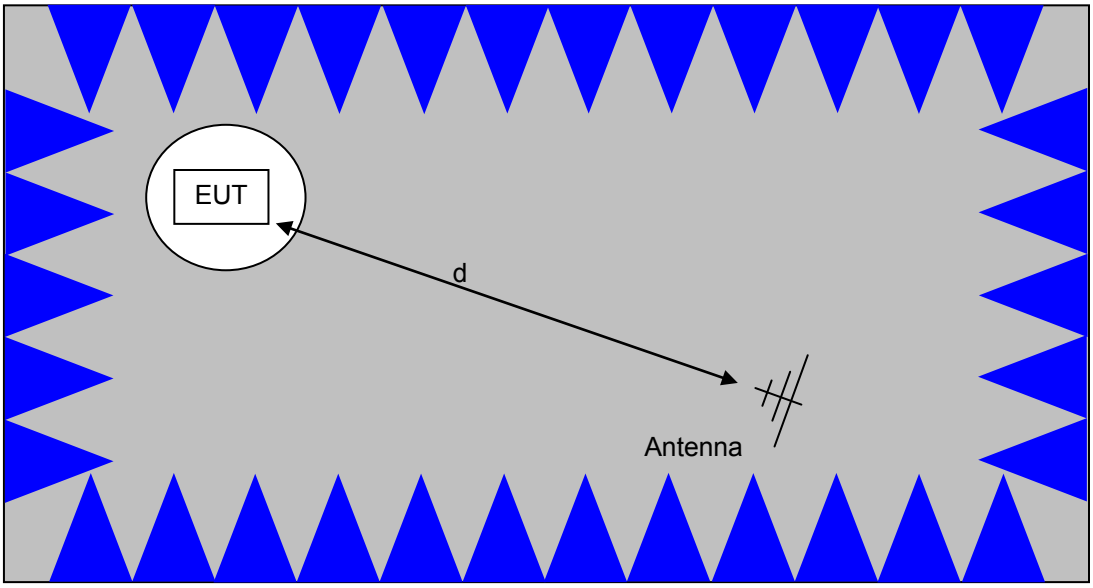
A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

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.

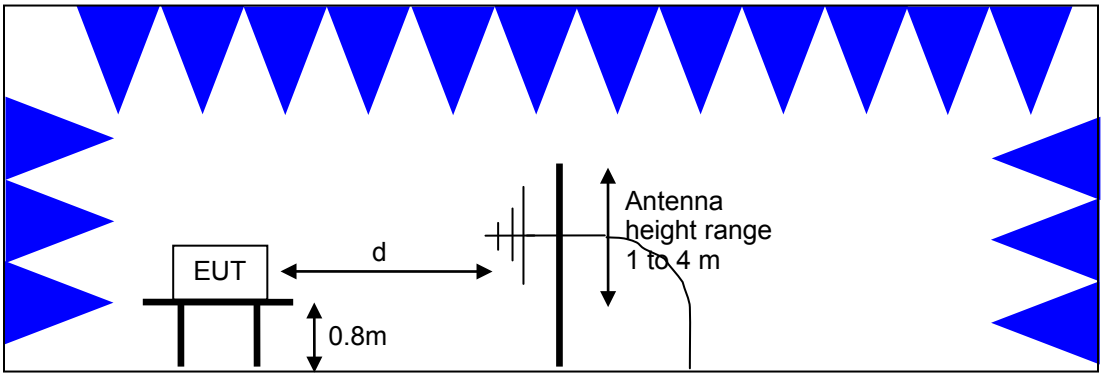


Typical Test Configuration for Radiated Field Strength Measurements



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.

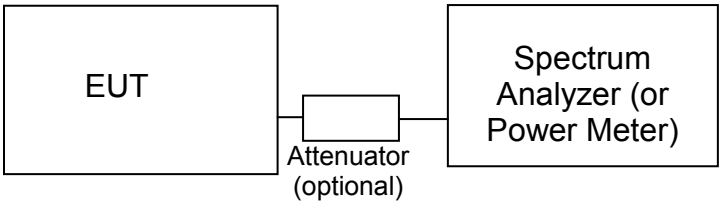
Floor-standing equipment is placed on the floor with insulating supports between the unit and the ground plane.



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

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

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

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

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

FCC 15.407 (a) OUTPUT POWER LIMITS

The table below shows the limits for output power and output power density.

Operating Frequency (MHz)	Output Power	Power Spectral Density
5150 – 5250	250 mW (24 dBm)	11 dBm/MHz
5250 – 5350	250 mW (24 dBm)	11 dBm/MHz
5470 - 5725	250 mW (24 dBm)	11 dBm/MHz
5725 – 5850	1 Watts (30 dBm)	30 dBm/500Hz

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.

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. 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.

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

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

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

$$R_r - S = M$$

where:

R_r = Receiver Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

SAMPLE CALCULATIONS - RADIATED EMISSIONS

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

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

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

where:

F_d = Distance Factor in dB

D_m = Measurement Distance in meters

D_s = Specification Distance in meters

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

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

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

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

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:

R_r = Receiver Reading in dBuV/m

F_d = Distance Factor in dB

R_C = Corrected Reading in dBuV/m

L_S = Specification Limit in dBuV/m

M = Margin in dB Relative to Spec

SAMPLE CALCULATIONS - FIELD STRENGTH TO EIRP CONVERSION

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

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

where P is the eirp (Watts)

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

Appendix A Test Equipment Calibration Data

Manufacturer	Description	Model	Asset #	Calibrated	Cal Due
Radiated Emissions, 1000 - 6,000 MHz, 19-Jun-15					
EMCO	Antenna, Horn, 1-18 GHz	3115	1561	6/27/2014	6/27/2016
Rohde & Schwarz	EMI Test Receiver, 20 Hz-40 GHz	ESIB40 (1088.7490.40)	2493	1/23/2015	1/23/2016
Radiated Emissions, 1000 - 6,000 MHz, 22-Jun-15					
EMCO	Antenna, Horn, 1-18 GHz	3115	1561	6/27/2014	6/27/2016
Rohde & Schwarz	EMI Test Receiver, 20 Hz-40 GHz	ESIB40 (1088.7490.40)	2493	1/23/2015	1/23/2016
Radiated Emissions, 1,000 - 6,500 MHz, 25-Jun-15					
EMCO	Antenna, Horn, 1-18 GHz	3115	1561	6/27/2014	6/27/2016
Rohde & Schwarz	EMI Test Receiver, 20 Hz-40 GHz	ESIB40 (1088.7490.40)	2493	1/23/2015	1/23/2016
Radiated Emissions, 1,000 - 18,000 MHz, 26-Jun-15					
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	10/31/2014	10/31/2015
Hewlett Packard	SpecAn 9 kHz - 40 GHz, FT (SA40) Blue	8564E (84125C)	1393	5/2/2015	5/2/2016
Micro-Tronics	Band Reject Filter, 5725-5875 MHz	BRC50705-02	1682	7/15/2014	7/15/2015
Micro-Tronics	Band Reject Filter, 5470-5725 MHz	BRC50704-02	2240	9/16/2014	9/16/2015
Micro-Tronics	Band Reject Filter, 5150-5350 MHz	BRC50703-02	2251	10/3/2014	10/3/2015
EMCO	Antenna, Horn, 1-18 GHz	3115	2870	8/20/2013	8/20/2015
Radiated Emissions, 1000 - 18,000 MHz, 28-Jun-15					
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	10/31/2014	10/31/2015
Hewlett Packard	SpecAn 9 kHz - 40 GHz, FT (SA40) Blue	8564E (84125C)	1393	5/2/2015	5/2/2016
Micro-Tronics	Band Reject Filter, 5725-5875 MHz	BRC50705-02	1682	7/15/2014	7/15/2015
Micro-Tronics	Band Reject Filter, 5470-5725 MHz	BRC50704-02	2240	9/16/2014	9/16/2015
Micro-Tronics	Band Reject Filter, 5150-5350 MHz	BRC50703-02	2251	10/3/2014	10/3/2015
EMCO	Antenna, Horn, 1-18 GHz	3115	2870	8/20/2013	8/20/2015
Radiated Emissions, 18 - 40 GHz, 01-Jul-15					
Hewlett Packard	Head (Inc W1-W4, 3136) Purple		1772	6/19/2015	6/19/2016
A. H. Systems	Purple System Horn, 18-40GHz	SAS-574, p/n: 2581	2160	8/11/2014	8/11/2015
Hewlett Packard	SpecAn 9 kHz - 40 GHz, (SA40) Purple	8564E (84125C)	2415	3/7/2015	3/7/2016
Radiated Emissions, 1000 - 6,000 MHz, 01-Jul-15					
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1538	12/20/2014	12/20/2015
EMCO	Antenna, Horn, 1-18 GHz	3115	1561	6/27/2014	6/27/2016

Manufacturer	Description	Model	Asset #	Calibrated	Cal Due
Bandedges, 1000 - 6,500 MHz, 02-Jul-15					
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	870	2/20/2015	2/20/2016
Hewlett Packard	SpecAn 30 Hz -40 GHz, SV (SA40) Red	8564E (84125C)	1148	9/20/2014	9/20/2015
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1538	12/20/2014	12/20/2015
EMCO	Antenna, Horn, 1-18 GHz	3115	1561	6/27/2014	6/27/2016
Micro-Tronics	Band Reject Filter, 5470-5725 MHz	BRC50704-02	2240	9/16/2014	9/16/2015
Radiated Emissions, 1000 - 40,000MHz, 02-Jul-15					
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	870	2/20/2015	2/20/2016
Hewlett Packard	Head (Inc flex cable, 1143, 2198) Red	84125C	1145	6/17/2014	7/17/2015
Hewlett Packard	SpecAn 30 Hz -40 GHz, SV (SA40) Red	8564E (84125C)	1148	9/20/2014	9/20/2015
EMCO	Antenna, Horn, 1-18 GHz	3115	1561	6/27/2014	6/27/2016
A. H. Systems	Blue System Horn, 18-40GHz	SAS-574, p/n: 2581	2159	9/2/2014	9/2/2015
Radiated Emissions, 1,000 - 26,000 MHz, 08-Jul-15					
EMCO	Antenna, Horn, 1-18 GHz	3115	487	7/29/2014	7/29/2016
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	1683	8/4/2014	8/4/2015
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	2199	2/20/2015	2/20/2016
Hewlett Packard	SpecAn 9 kHz - 40 GHz, (SA40) Purple	8564E (84125C)	2415	3/7/2015	3/7/2016
Radiated Emissions, 11000 - 25000 MHz, 09-Jul-15					
EMCO	Antenna, Horn, 1-18 GHz	3115	487	7/29/2014	7/29/2016
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	10/31/2014	10/31/2015
Hewlett Packard	Head (Inc flex cable, (1742,1743) Blue)	84125C	1620	6/5/2015	6/5/2016
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	1683	8/4/2014	8/4/2015
A. H. Systems	Spare System Horn, 18-40GHz	SAS-574, p/n: 2581	2162	7/24/2014	7/24/2015
Conducted Emissions - AC Power Ports, 09-Jul-15					
EMCO	LISN, 10 kHz-100 MHz	3825/2	1293	6/2/2015	6/2/2016
Rohde & Schwarz	Pulse Limiter	ESH3 Z2	1401	5/14/2015	5/14/2016
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1756	6/20/2015	6/20/2016
Radiated Emissions, 1000 - 25,000MHz, 10-Jul-15					
EMCO	Antenna, Horn, 1-18 GHz	3115	487	7/29/2014	7/29/2016
Micro-Tronics	Band Reject Filter, 5470-5725 MHz	BRC50704-02	1681	8/13/2014	8/13/2015
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	1683	8/4/2014	8/4/2015
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	2199	2/20/2015	2/20/2016
Hewlett Packard	SpecAn 9 kHz - 40 GHz, (SA40) Purple	8564E (84125C)	2415	3/7/2015	3/7/2016

Manufacturer	Description	Model	Asset #	Calibrated	Cal Due
Radio Antenna Port (Power and Spurious Emissions), 14-Jul-15					
EMCO	Antenna, Horn, 1-18 GHz	3115	487	7/29/2014	7/29/2016
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1538	12/20/2014	12/20/2015
Frequency Stability, 05-Aug-15					
Agilent Technologies	PSA, Spectrum Analyzer, (installed options, 111, 115, 123, 1DS, B7J, HYX,	E4446A	2139	22-Jun-15	6/22/16
Watlow	Temp Chamber (w/ F4 watlow Controller)	96A0	2171	14-Jul-15	7/14/16

Appendix B Test Data

T101679 Pages 27 – 122

Client:	Pace Americas, Inc.	Job Number:	J98591
Product	HR54-700	T-Log Number:	T101679
System Configuration:		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	
Emissions Standard(s):	FCC 15.247, 15.407	Class:	N/A
Immunity Standard(s):		Environment:	Radio

EMC Test Data

For The

Pace Americas, Inc.

Product

HR54-700

Date of Last Test: 5/24/2016

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	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, unless otherwise noted.

Ambient Conditions:

Temperature: 25 °C
Rel. Humidity: 35 %

Summary of Results

Run #	Mode	Channel	Target Setting	Passing Setting	Test Performed	Limit	Result / Margin
20MHz Bandwith Modes							
1	a	36 - 5180MHz	17	17	Restricted Band Edge at 5150 MHz	15.209	49.0 dBµV/m @ 5150.0 MHz (-5.0 dB)
2	a	64 - 5320MHz	18	18	Restricted Band Edge at 5350 MHz	15.209	47.7 dBµV/m @ 5350.0 MHz (-6.3 dB)
3	a	100 - 5500MHz	20	20	Restricted Band Edge at 5460 MHz	15.209	47.9 dBµV/m @ 5458.6 MHz (-6.3 dB)
	a	100 - 5500MHz	20	20	Band Edge 5460 - 5470 MHz	15E	65.8 dBµV/m @ 5468.3 MHz (-2.5 dB)
	a	140 - 5700MHz	20	19	Band Edge 5725MHz	15E	52.2 dBµV/m @ 5725.0 MHz (-1.8 dB)
4	a	149 - 5745MHz	16	16	Band Edge 5715MHz	15E	58.7 dBµV/m @ 5705.6 MHz (-9.6 dB)
	a	149 - 5745MHz	16	16	Band Edge 5725MHz	15E	70.2 dBµV/m @ 5724.2 MHz (-8.1 dB)
	a	165 - 5825MHz	19	19	Band Edge 5850MHz	15E	66.9 dBµV/m @ 5851.1 MHz (-11.4 dB)
	a	165 - 5825MHz	19	19	Band Edge 5860MHz	15E	60.9 dBµV/m @ 5861.0 MHz (-7.4 dB)

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #	Mode	Channel	Target Setting	Passing Setting	Test Performed	Limit	Result / Margin
5	n20	36 - 5180MHz	20	18	Restricted Band Edge at 5150 MHz	15.209	52.6 dBµV/m @ 5150.0 MHz (-1.4 dB)
6	n20	64 - 5320MHz	20	20	Restricted Band Edge at 5350 MHz	15.209	51.6 dBµV/m @ 5351.0 MHz (-2.4 dB)
7	n20	100 - 5500MHz	20	20	Restricted Band Edge at 5460 MHz	15.209	48.3 dBµV/m @ 5460.0 MHz (-5.7 dB)
	n20	100 - 5500MHz	20	20	Band Edge 5460 - 5470 MHz	15E	68.0 dBµV/m @ 5468.5 MHz (-0.3 dB)
	n20	140 - 5700MHz	20	19	Band Edge 5725MHz	15E	52.5 dBµV/m @ 5725.1 MHz (-1.5 dB)
8	n20	149 - 5745MHz	16	16	Band Edge 5715MHz	15E	58.1 dBµV/m @ 5705.9 MHz (-10.2 dB)
	n20	149 - 5745MHz	16	16	Band Edge 5725MHz	15E	49.9 dBµV/m @ 5725.0 MHz (-4.1 dB)
	n20	165 - 5825MHz	19	19	Band Edge 5850MHz	15E	67.4 dBµV/m @ 5850.2 MHz (-0.9 dB)
	n20	165 - 5825MHz	19	19	Band Edge 5860MHz	15E	60.4 dBµV/m @ 5860.6 MHz (-7.9 dB)
40MHz Bandwith Modes							
9	n40	38 - 5190MHz	17	16	Restricted Band Edge at 5150 MHz	15.209	52.4 dBµV/m @ 5150.0 MHz (-1.6 dB)
10	n40	62 - 5310MHz	19	18	Restricted Band Edge at 5350 MHz	15.209	72.5 dBµV/m @ 5350.3 MHz (-1.5 dB)
11	n40	102 - 5510MHz	19	17	Restricted Band Edge at 5460 MHz	15.209	46.9 dBµV/m @ 5460.0 MHz (-7.1 dB)
	n40	102 - 5510MHz	19	17	Band Edge 5460 - 5470 MHz	15E	65.2 dBµV/m @ 5470.0 MHz (-3.1 dB)
	n40	134 - 5670MHz	20	20	Band Edge 5725MHz	15E	61.6 dBµV/m @ 5726.9 MHz (-6.7 dB)
12	n40	151 - 5755MHz	15	15	Band Edge 5715MHz	15E	62.2 dBµV/m @ 5711.7 MHz (-6.1 dB)
	n40	151 - 5755MHz	15	15	Band Edge 5725MHz	15E	66.8 dBµV/m @ 5724.9 MHz (-11.5 dB)
	n40	159 - 5795MHz	20	20	Band Edge 5850MHz	15E	61.6 dBµV/m @ 5864.0 MHz (-6.7 dB)
	n40	159 - 5795MHz	20	20	Band Edge 5860MHz	15E	62.9 dBµV/m @ 5854.7 MHz (-15.4 dB)

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Procedure Comments:

Measurements performed in accordance with FCC KDB 789033
Peak measurements performed with: RBW=1MHz, VBW=3MHz, peak detector, max hold, auto sweep time
Unless otherwise stated/noted, emission has duty cycle ≥ 98% and was measured using RBW=1MHz, VBW=10Hz, peak detector, linear average mode, auto sweep time, max hold.

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
11a	6Mb/s	0.98	Yes	1.443	0	0	10
n20	MCS0	0.99	Yes	1.330	0	0	10
n40	MCS0	0.98	Yes	1.330	0	0	10

Sample Notes

Sample S/N: G54DA5DN000024
Driver: 5.99 RC 188.10
Antenna: Internal

Sample Notes (5/24/16)

Sample S/N: G54DA5DN000041
Driver: 5.99.188.21
Antenna: Internal

Measurement Specific Notes:

Note 3:	-
Note 6:	Plots of the average and peak bandedge do not account for any duty cycle correction. Refer to the tabular results for final measurements.

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #1: Radiated Bandedge Measurements, 5150-5250MHz

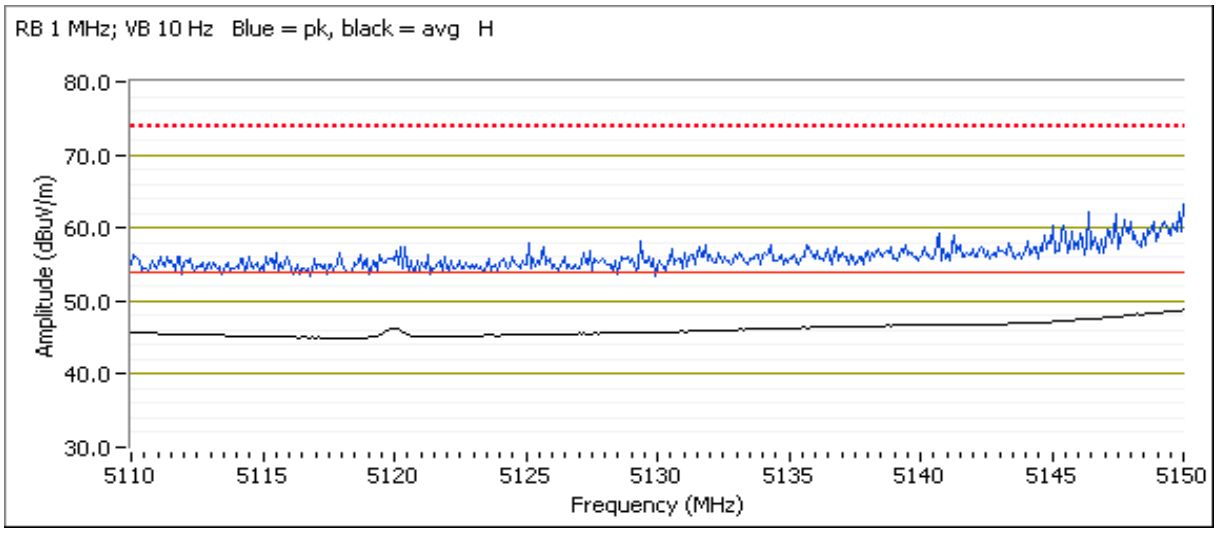
Date of Test: 6/22/2015 0:00
Test Engineer: John Caizzi
Test Location: Chamber 5

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

Channel: 36 - 5180 MHz
Tx Chain: 1 (0x01)
Mode: a
Data Rate: 6 Mbps

5150 MHz 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	
5150.000	49.0	H	54.0	-5.0	AVG	76	1.22	
5149.760	67.4	H	74.0	-6.6	PK	76	1.22	
5149.840	47.1	V	54.0	-6.9	AVG	233	1.59	
5149.520	62.5	V	74.0	-11.5	PK	233	1.59	



EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #2: Radiated Bandedge Measurements, 5250-5350MHz

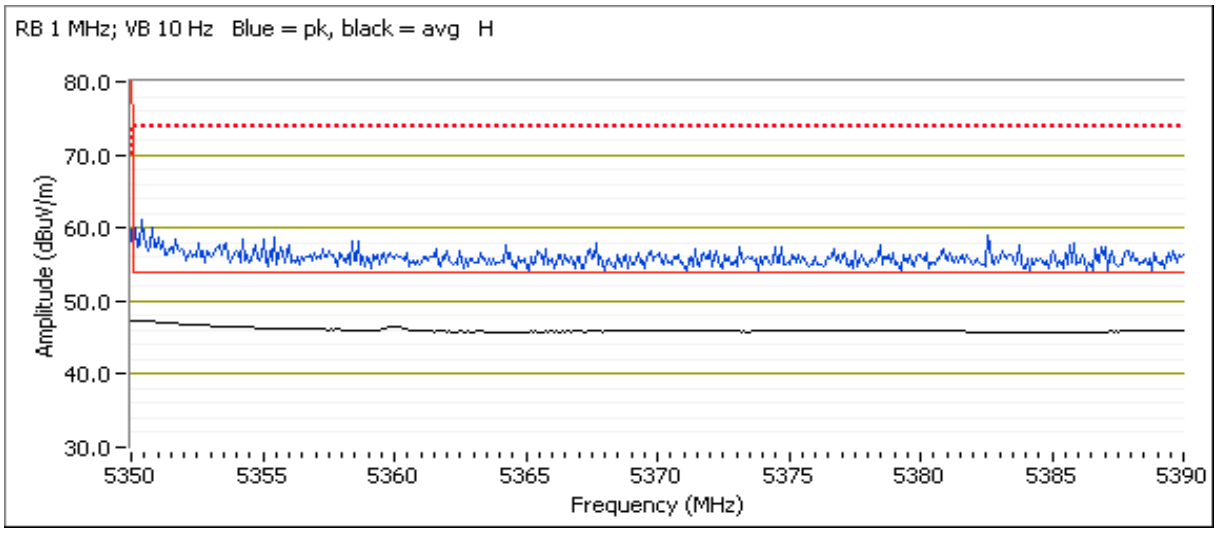
Date of Test: 6/22/2015 0:00
Test Engineer: John Caizzi
Test Location: Chamber 5

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

Channel: 64 - 5320MHz
Tx Chain: 1 (0x01)
Mode: a
Data Rate: 6 Mbps

5350 MHz 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	
5350.000	47.7	H	54.0	-6.3	AVG	70	1.0	POS; RB 1 MHz; VB: 10 Hz
5350.480	60.2	H	74.0	-13.8	PK	70	1.0	POS; RB 1 MHz; VB: 3 MHz
5350.000	46.1	V	54.0	-7.9	AVG	63	1.1	POS; RB 1 MHz; VB: 10 Hz
5357.700	59.6	V	74.0	-14.4	PK	63	1.1	POS; RB 1 MHz; VB: 3 MHz



EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #3: Radiated Bandedge Measurements, 5470-5725MHz

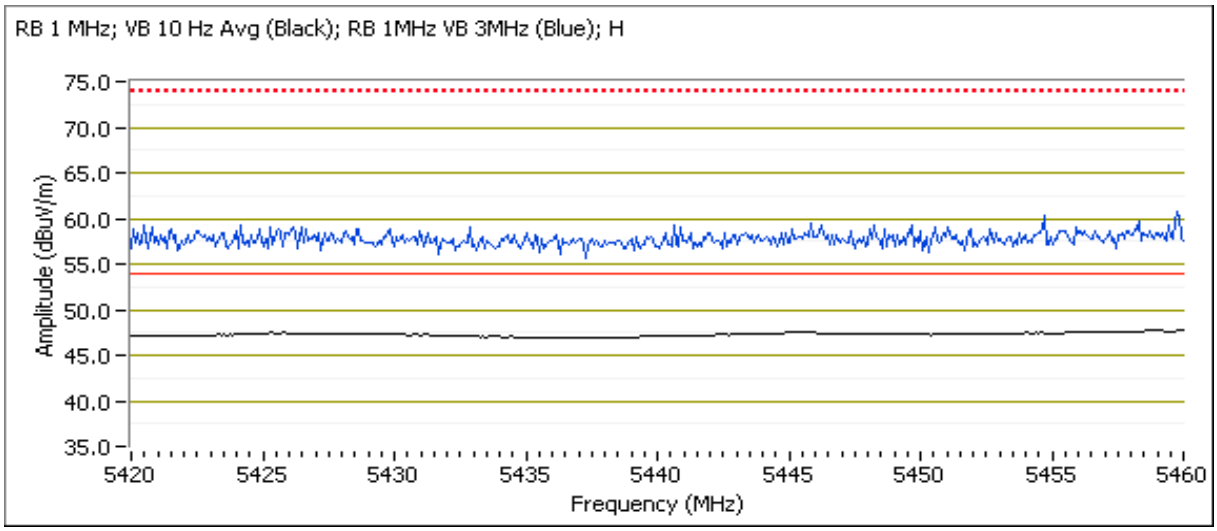
Date of Test: 6/22/2015 0:00
Test Engineer: Rafael Varelas
Test Location: FT Chamber #5

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

Channel: 100 - 5500MHz
Tx Chain: 1 (0x01)
Mode: a
Data Rate: 6 Mbps

5460 MHz Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	15.E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5458.560	47.9	H	54.0	-6.3	AVG	90	1.0	POS; RB 1 MHz; VB: 10 Hz
5454.550	60.4	H	74.0	-13.6	PK	90	1.0	POS; RB 1 MHz; VB: 3 MHz
5426.970	47.0	V	54.0	-7.0	AVG	66	1.0	POS; RB 1 MHz; VB: 10 Hz
5425.770	58.7	V	74.0	-15.3	PK	66	1.0	POS; RB 1 MHz; VB: 3 MHz

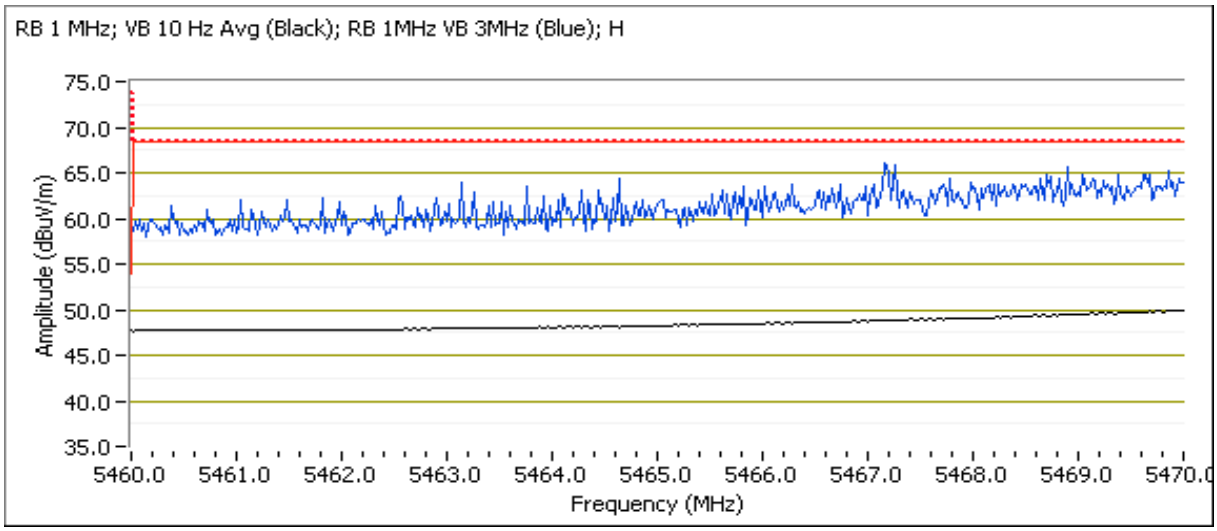


EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

5470 MHz Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	15.E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5468.320	65.8	H	68.3	-2.5	PK	90	1.0	POS; RB 1 MHz; VB: 3 MHz
5468.220	64.8	V	68.3	-3.5	PK	66	1.0	POS; RB 1 MHz; VB: 3 MHz



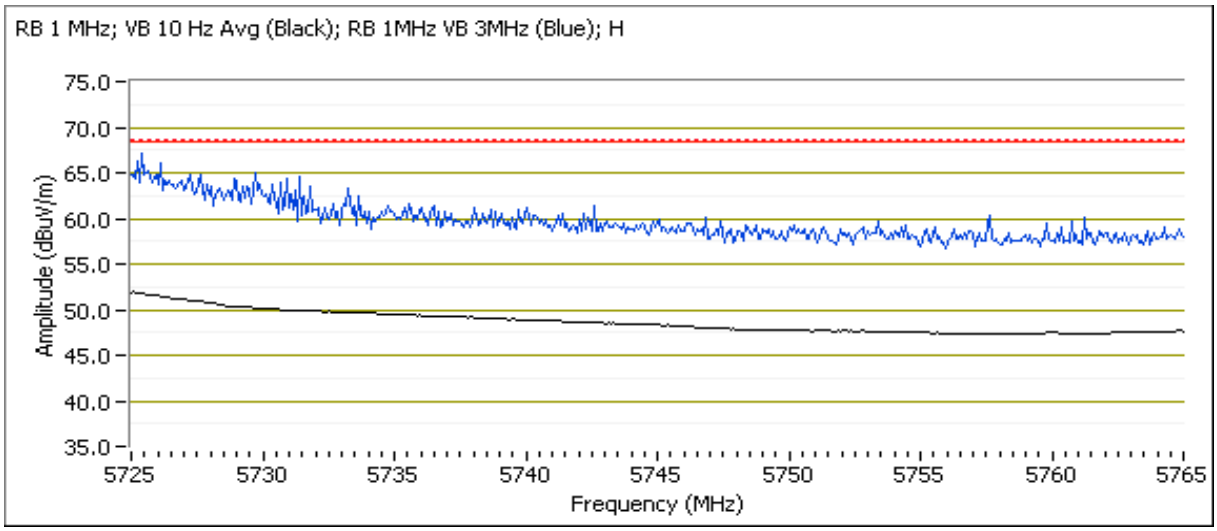
EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Channel: 140 - 5700MHz
Tx Chain: 1 (0x01)
Mode: a
Data Rate: 6 Mbps

5725 MHz Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	15.E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Pwr setting = 19								
5725.000	52.2	H	54.0	-1.8	AVG	91	1.0	POS; RB 1 MHz; VB: 10 Hz
5726.120	68.9	H	74.0	-5.1	PK	91	1.0	POS; RB 1 MHz; VB: 3 MHz
5725.000	48.3	V	54.0	-5.7	AVG	228	1.8	POS; RB 1 MHz; VB: 10 Hz
5727.080	63.2	V	74.0	-10.8	PK	228	1.8	POS; RB 1 MHz; VB: 3 MHz



EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #4: Radiated Bandedge Measurements, 5725-5850MHz

Date of Test: 6/22/2015 0:00
Test Engineer: Rafael Varelas
Test Location: FT Chamber #5

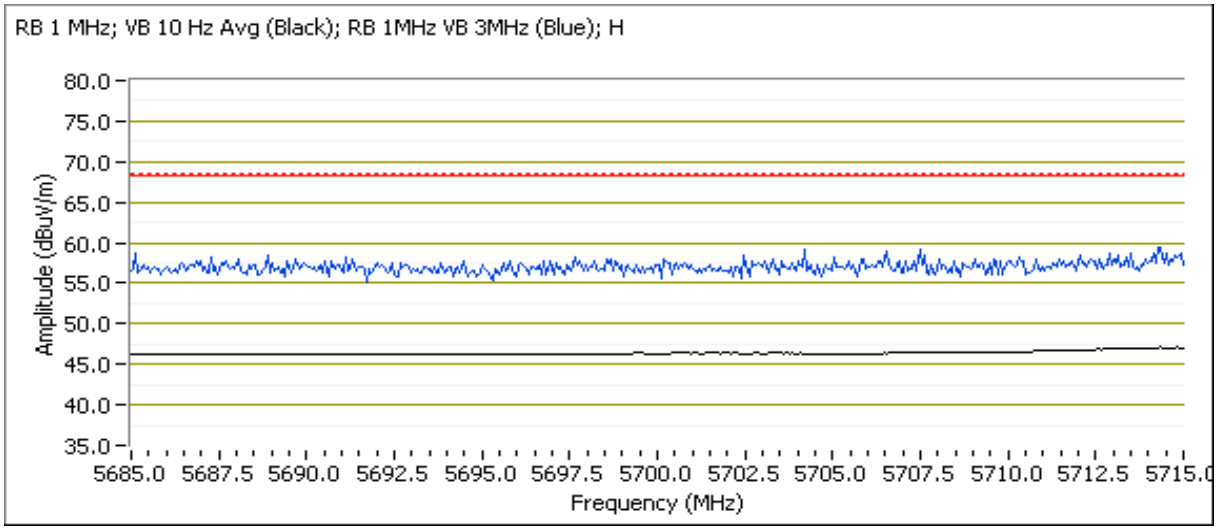
Config. Used: 1
Config Change: none
EUT Voltage: 120V / 60Hz

Channel: 149 - 5745MHz
Tx Chain: 1 (0x01)
Mode: a
Data Rate: 6 Mbps

78.3
68.3

5715 MHz 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	
5705.620	58.7	H	68.3	-9.6	PK	89	1.1	POS; RB 1 MHz; VB: 3 MHz
5712.720	57.2	V	68.3	-11.1	PK	233	1.6	POS; RB 1 MHz; VB: 3 MHz

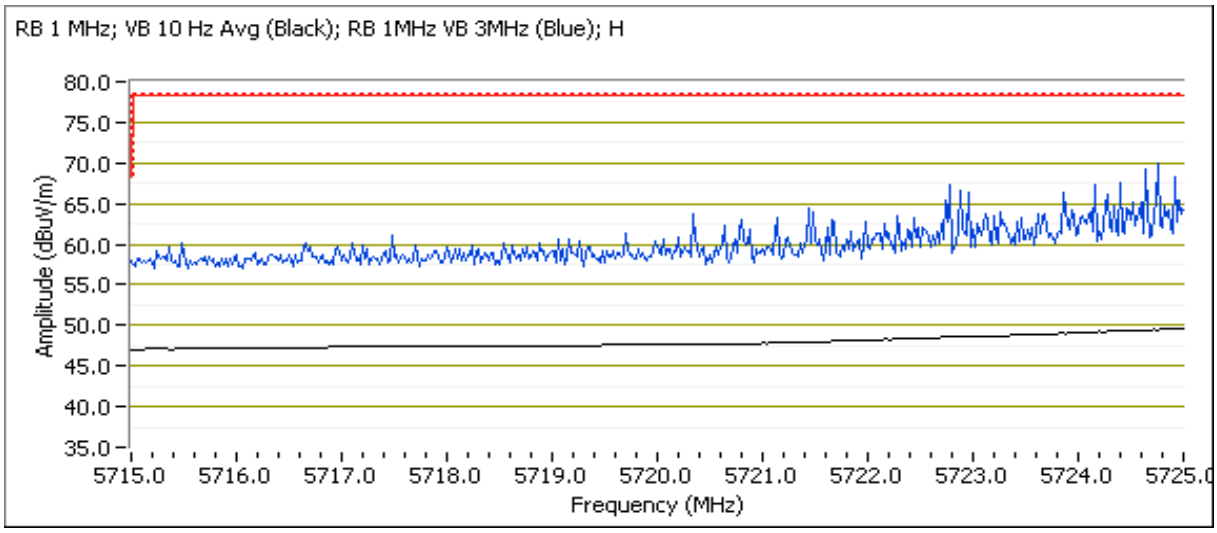


EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

5725 MHz Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	15.E		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5724.180	70.2	H	78.3	-8.1	PK	89	1.1	POS; RB 1 MHz; VB: 3 MHz
5724.280	64.4	V	78.3	-13.9	PK	233	1.6	POS; RB 1 MHz; VB: 3 MHz



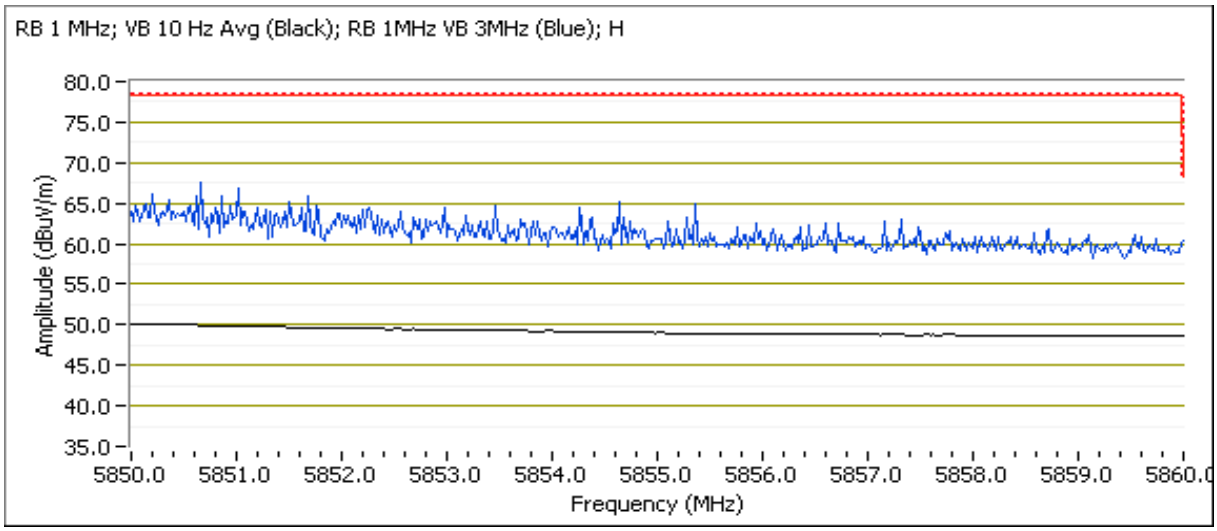
EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Channel: 165 - 5825MHz
Tx Chain: 1 (0x01)
Mode: a
Data Rate: 6 Mbps

5850 MHz Band Edge Signal Radiated Field Strength

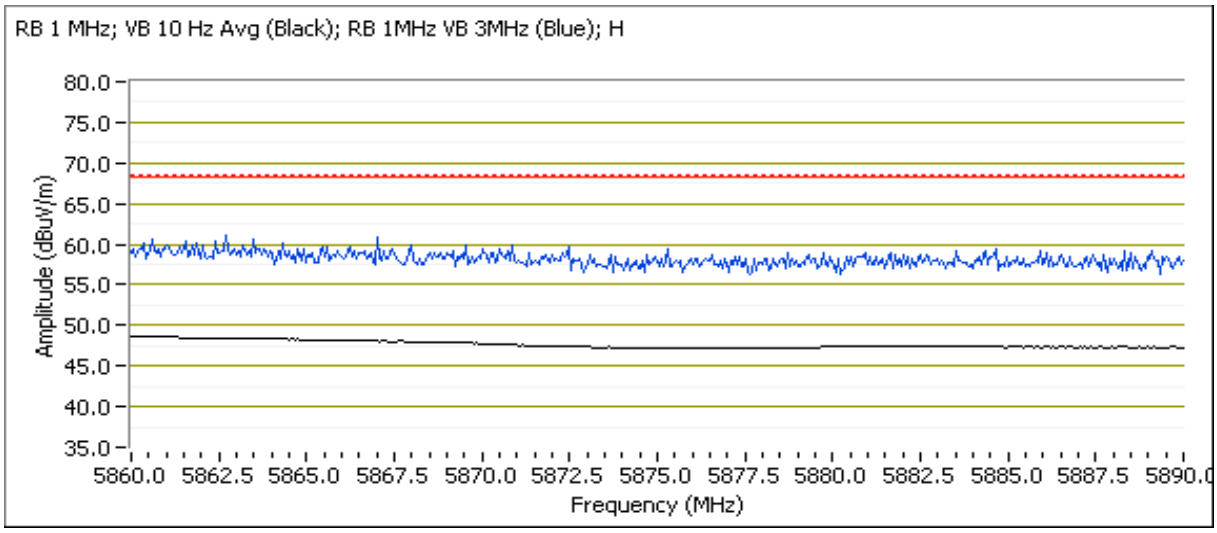
Frequency	Level	Pol	15.E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5851.120	66.9	H	78.3	-11.4	PK	89	1.0	POS; RB 1 MHz; VB: 3 MHz
5855.340	57.0	V	78.3	-21.3	PK	220	1.3	POS; RB 1 MHz; VB: 3 MHz



Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

5860 MHz Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	15.E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5860.960	60.9	H	68.3	-7.4	PK	89	1.0	POS; RB 1 MHz; VB: 3 MHz
5877.500	57.1	V	68.3	-11.2	PK	220	1.3	POS; RB 1 MHz; VB: 3 MHz



EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #5: Radiated Bandedge Measurements, 5150-5250MHz

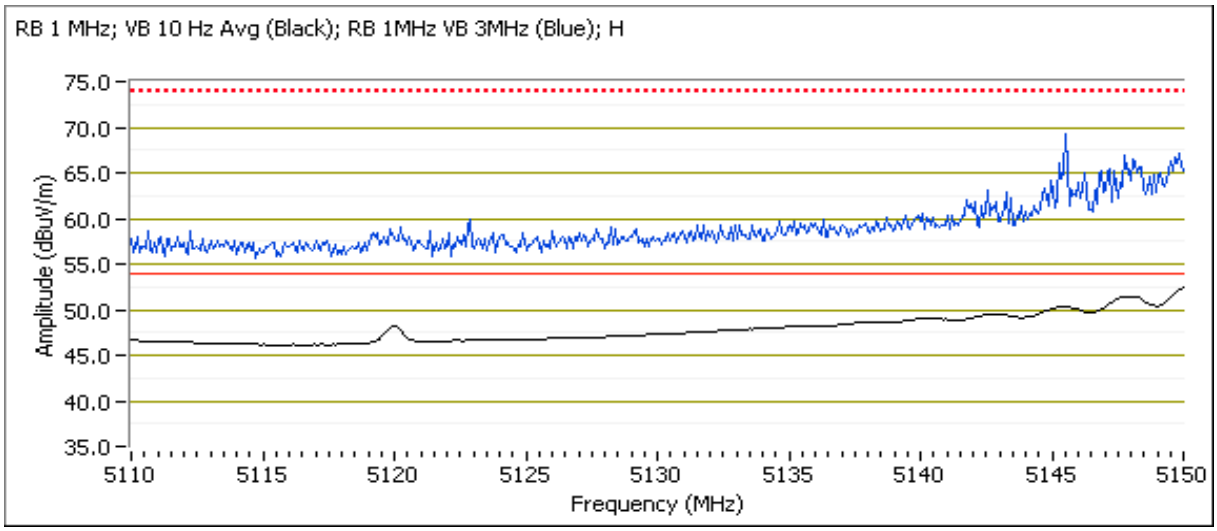
Date of Test: 6/22/2015 0:00
Test Engineer: Rafael Varelas
Test Location: FT Chamber #5

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

Channel: 36 - 5180 MHz
Tx Chain: 2x2
Mode: n20
Data Rate: MCS0

5150 MHz 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	
Pwr setting = 18								
5150.000	52.6	H	54.0	-1.4	AVG	88	1.0	POS; RB 1 MHz; VB: 10 Hz
5148.400	69.3	H	74.0	-4.7	PK	88	1.0	POS; RB 1 MHz; VB: 3 MHz
5149.360	49.3	V	54.0	-4.7	AVG	41	2.3	POS; RB 1 MHz; VB: 10 Hz
5149.440	65.9	V	74.0	-8.1	PK	41	2.3	POS; RB 1 MHz; VB: 3 MHz



EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #6: Radiated Bandedge Measurements, 5250-5350MHz

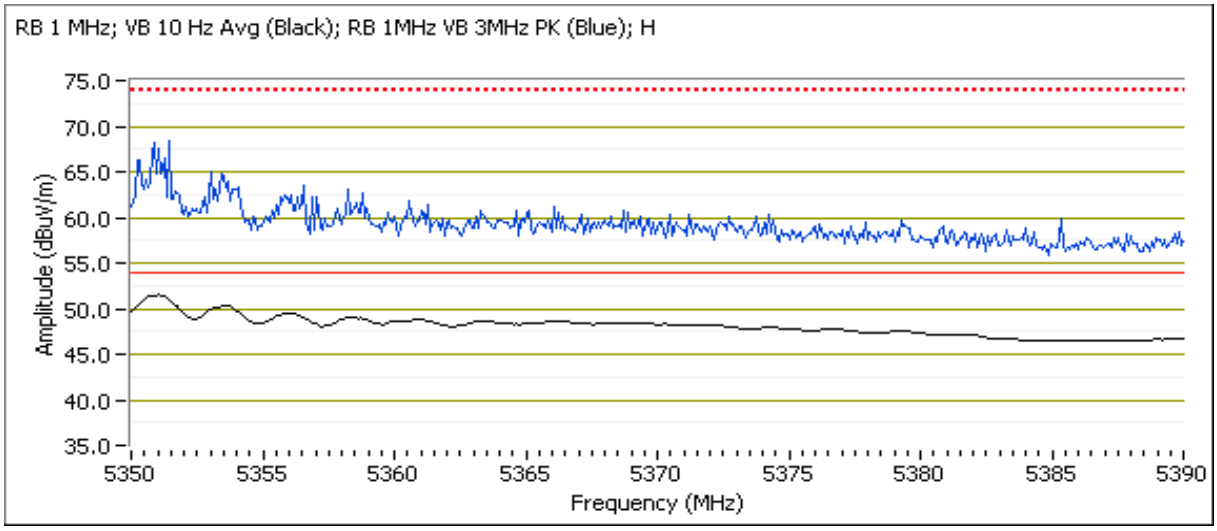
Date of Test: 6/22/2015 0:00
Test Engineer: Rafael Varelas
Test Location: FT Chamber #5

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

Channel: 64 - 5320MHz
Tx Chain: 2x2
Mode: n20
Data Rate: MCS0

5350 MHz 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	
5350.960	51.6	H	54.0	-2.4	AVG	79	2.6	POS; RB 1 MHz; VB: 10 Hz
5350.560	67.3	H	74.0	-6.7	PK	79	2.6	POS; RB 1 MHz; VB: 3 MHz
5350.400	49.1	V	54.0	-4.9	AVG	223	1.5	POS; RB 1 MHz; VB: 10 Hz
5351.120	60.7	V	74.0	-13.3	PK	223	1.5	POS; RB 1 MHz; VB: 3 MHz



EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #7: Radiated Bandedge Measurements, 5470-5725MHz

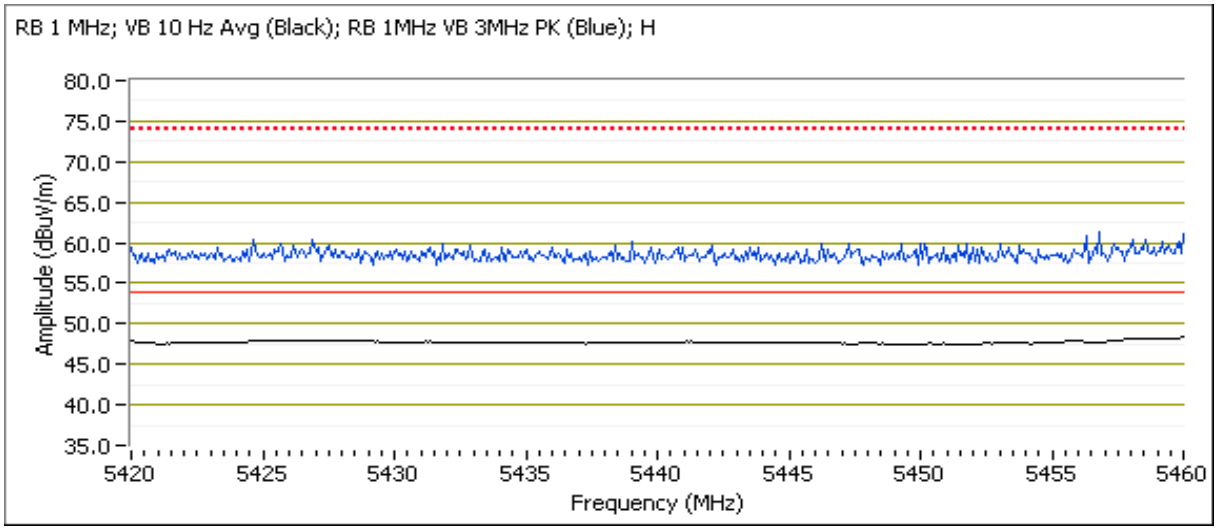
Date of Test: 6/22/2015 0:00
Test Engineer: Rafael Varelas
Test Location: FT Chamber #5

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

Channel: 100 - 5500MHz
Tx Chain: 2x2
Mode: n20
Data Rate: MCS0

5460 MHz 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	
5460.000	48.3	H	54.0	-5.7	AVG	270	1.2	POS; RB 1 MHz; VB: 10 Hz
5449.420	62.1	H	74.0	-11.9	PK	270	1.2	POS; RB 1 MHz; VB: 3 MHz
5427.210	46.9	V	54.0	-7.1	AVG	72	1.0	POS; RB 1 MHz; VB: 10 Hz
5459.280	58.4	V	74.0	-15.6	PK	72	1.0	POS; RB 1 MHz; VB: 3 MHz

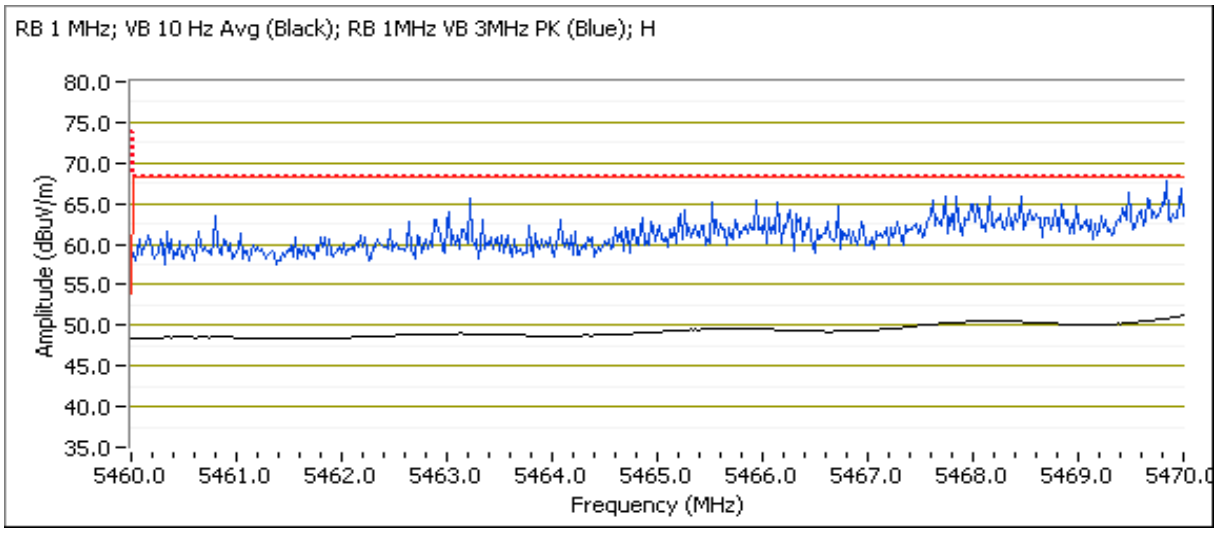


EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

5470 MHz Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	15.E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5468.520	68.0	H	68.3	-0.3	PK	270	1.2	POS; RB 1 MHz; VB: 3 MHz
5469.300	66.3	V	68.3	-2.0	PK	72	1.0	POS; RB 1 MHz; VB: 3 MHz



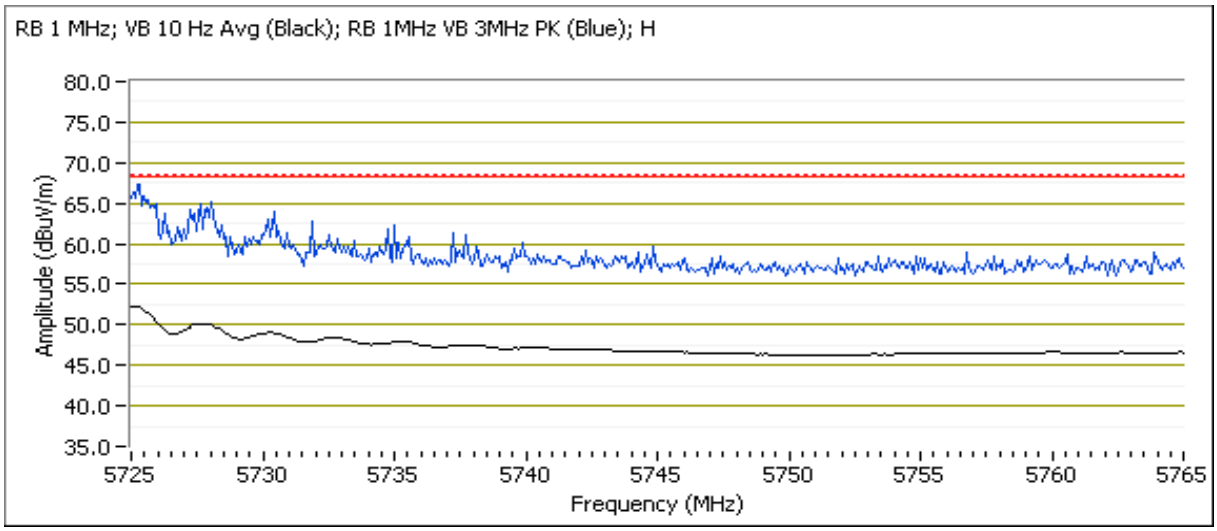
EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Channel: 140 - 5700MHz
Tx Chain: 2x2
Mode: n20
Data Rate: MCS0

5725 MHz Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	15.E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Pwr setting = 19								
5725.080	52.5	H	54.0	-1.5	AVG	292	1.0	POS; RB 1 MHz; VB: 10 Hz
5727.480	68.9	H	74.0	-5.1	PK	292	1.0	POS; RB 1 MHz; VB: 3 MHz
5725.000	50.7	V	54.0	-3.3	AVG	62	2.2	POS; RB 1 MHz; VB: 10 Hz
5725.000	65.6	V	74.0	-8.4	PK	62	2.2	POS; RB 1 MHz; VB: 3 MHz



EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #8: Radiated Bandedge Measurements, 5725-5850MHz

Date of Test: 6/24/2015 Test Engineer: Mehran Birgani

Test Location: Chamber #5 EUT Voltage: 120V/ 60Hz

Channel: 149 - 5745MHz

Tx Chain: 2x2 Data Rate: MCS0

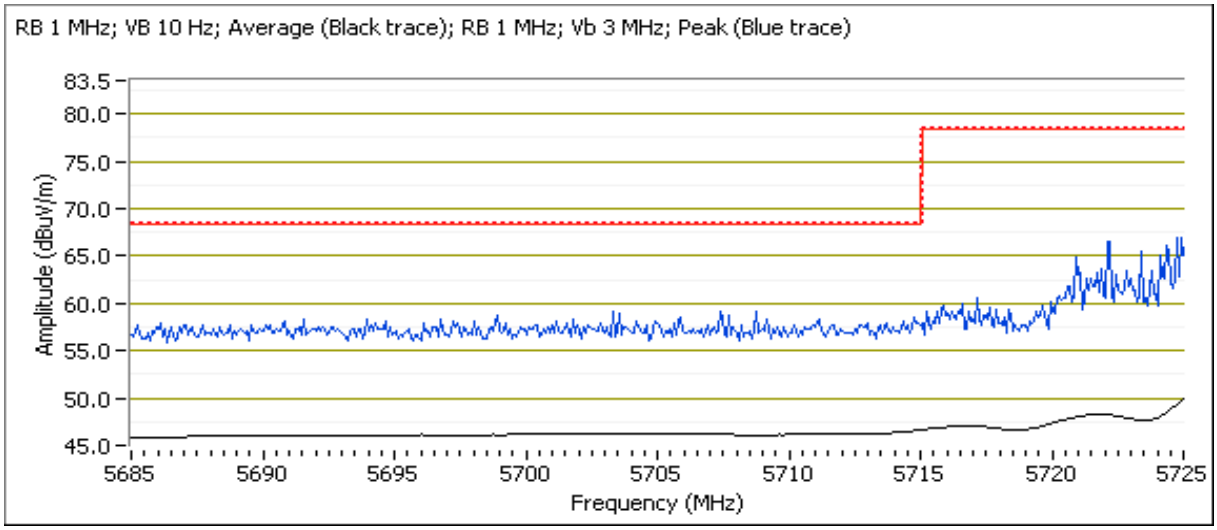
Mode: n20 Setting: 16

5715 MHz 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	
5705.860	58.1	H	68.3	-10.2	PK	280	1.0	POS; RB 1 MHz; VB: 3 MHz
5695.220	56.7	V	68.3	-11.6	PK	135	1.0	POS; RB 1 MHz; VB: 3 MHz

5725 MHz Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	15.E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5725.000	49.9	H	54.0	-4.1	AVG	278	1.0	POS; RB 1 MHz; VB: 10 Hz
5724.840	48.1	V	54.0	-5.9	AVG	137	1.0	POS; RB 1 MHz; VB: 10 Hz
5724.520	66.4	H	74.0	-7.6	PK	278	1.0	POS; RB 1 MHz; VB: 3 MHz
5723.880	61.2	V	74.0	-12.8	PK	137	1.0	POS; RB 1 MHz; VB: 3 MHz



EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Date of Test: 6/24/2015
Test Location: Chamber #5

Test Engineer: Mehran Birgani
EUT Voltage: 120V/ 60Hz

Channel: 165 - 5825MHz
Tx Chain: 2x2
Mode: n20

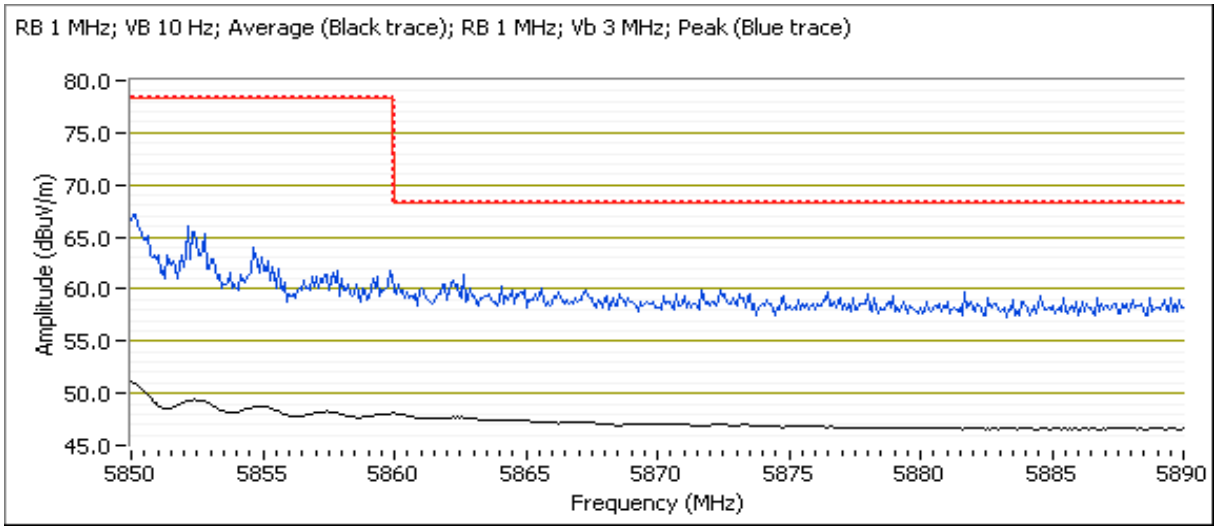
Data Rate: MCS0
Setting: 19

5850 MHz Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	15.E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5850.240	67.4	H	68.3	-0.9	PK	291	1.0	POS; RB 1 MHz; VB: 3 MHz
5850.200	62.8	V	68.3	-5.5	PK	134	1.1	POS; RB 1 MHz; VB: 3 MHz

5860 MHz Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	15.E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5860.600	60.4	H	68.3	-7.9	PK	291	1.0	POS; RB 1 MHz; VB: 3 MHz
5861.680	58.5	V	68.3	-9.8	PK	134	1.1	POS; RB 1 MHz; VB: 3 MHz



EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #9: Radiated Bandedge Measurements, 5150-5250MHz

Date of Test: 6/24/2015 Test Engineer: Mehran Birgani

Test Location: Chamber #5 EUT Voltage: 120V/ 60Hz

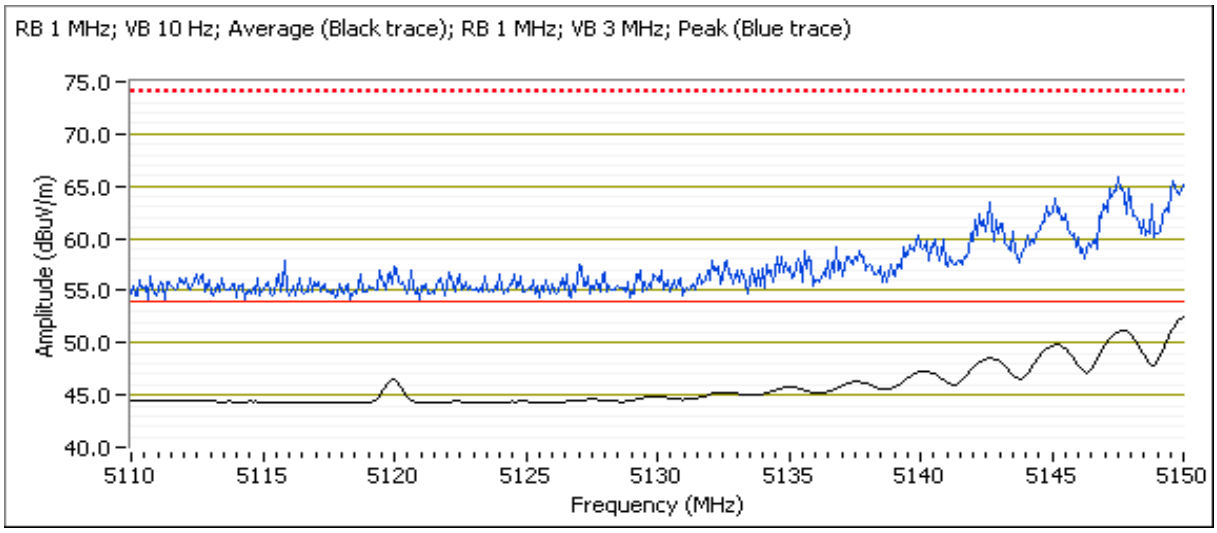
Channel: 38 - 5190 MHz

Tx Chain: 2x2 Data Rate: MCS0

Mode: n40 Setting: 16

5150 MHz 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	
5150.000	52.4	H	54.0	-1.6	AVG	293	1.0	POS; RB 1 MHz; VB: 10 Hz
5147.350	65.6	H	74.0	-8.4	PK	293	1.0	POS; RB 1 MHz; VB: 3 MHz
5149.920	50.0	V	54.0	-4.0	AVG	96	1.0	POS; RB 1 MHz; VB: 10 Hz
5149.680	64.6	V	74.0	-9.4	PK	96	1.0	POS; RB 1 MHz; VB: 3 MHz



EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #10: Radiated Bandedge Measurements, 5250-5350MHz

Date of Test: 5/24/2016 Test Engineer: Mehran Birgani

Test Location: Chamber #4 EUT Voltage: 120V/ 60Hz

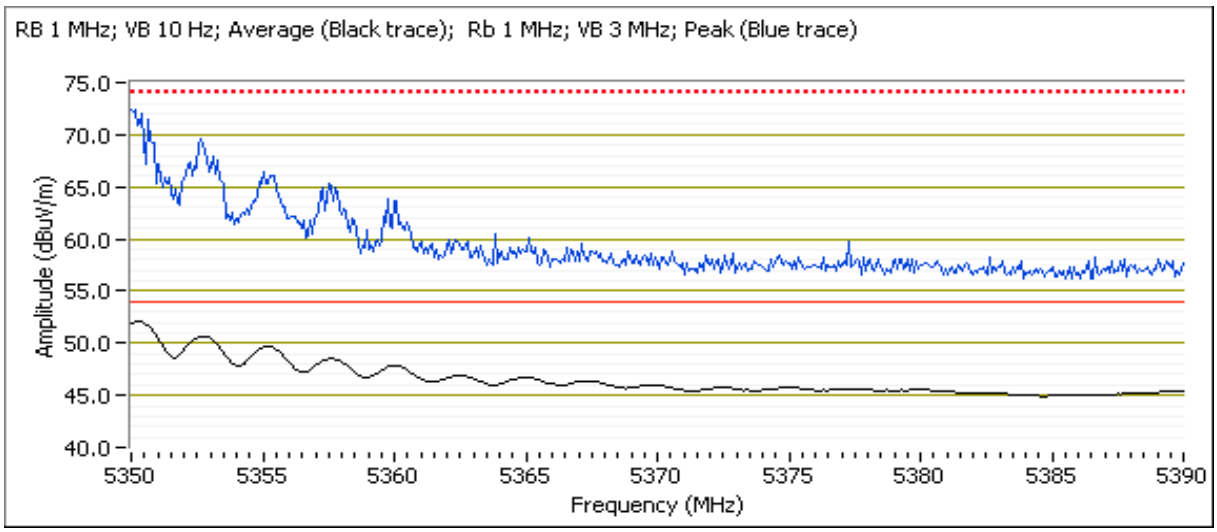
Channel: 62 - 5310MHz

Tx Chain: 2x2 Data Rate: MCS0

Mode: n40 Setting: 18

5350 MHz 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	
5350.260	72.5	H	74.0	-1.5	PK	60	1.3	POS; RB 1 MHz; VB: 3 MHz
5350.320	52.0	H	54.0	-2.0	AVG	60	1.3	POS; RB 1 MHz; VB: 10 Hz



EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

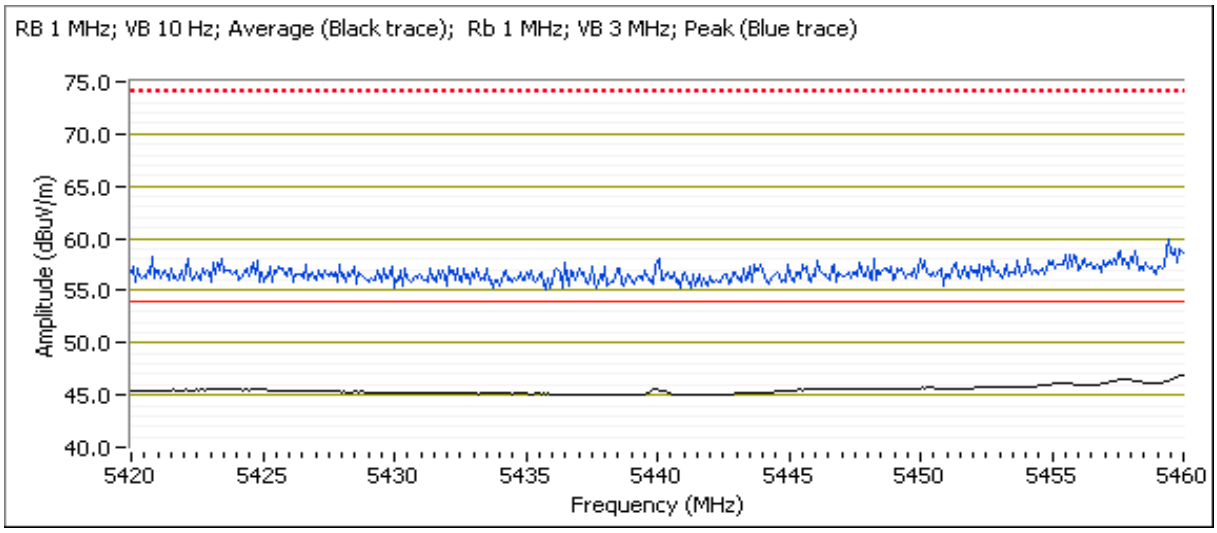
Run #11: Radiated Bandedge Measurements, 5470-5725MHz

Date of Test: 5/24/2016 Test Engineer: Mehran Birgani

Test Location: Chamber #4 EUT Voltage: 120V/ 60Hz

5460 MHz 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	
5459.980	46.9	H	54.0	-7.1	AVG	58	1.2	POS; RB 1 MHz; VB: 10 Hz
5458.980	62.0	H	74.0	-12.0	PK	58	1.2	POS; RB 1 MHz; VB: 3 MHz

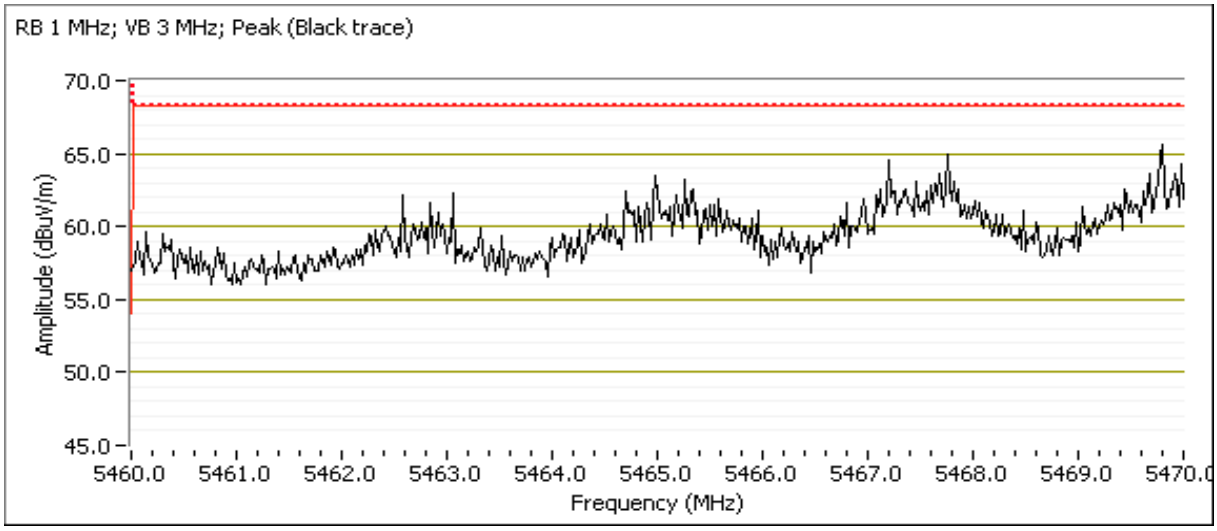


EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

5470 MHz Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	15.E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5469.980	65.2	H	68.3	-3.1	PK	58	1.2	POS; RB 1 MHz; VB: 3 MHz



EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Date of Test: 5/24/2016
Test Location: Chamber #4

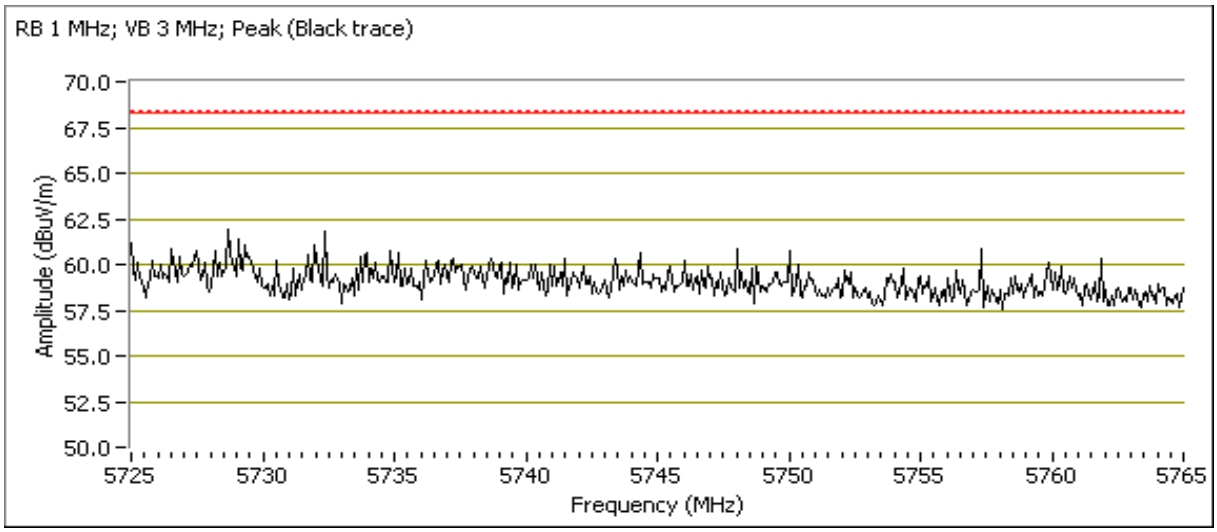
Test Engineer: Mehran Birgani
EUT Voltage: 120V/ 60Hz

Channel: 134 - 5670MHz
Tx Chain: 2x2
Mode: n40

Data Rate: MCS0
Setting: 20

5725 MHz Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	15.E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5726.880	61.6	H	68.3	-6.7	PK	61	1.2	POS; RB 1 MHz; VB: 3 MHz



EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #12: Radiated Bandedge Measurements, 5725-5850MHz

Date of Test: 5/24/2016 Test Engineer: Mehran Birgani

Test Location: Chamber #4 EUT Voltage: 120V/ 60Hz

Channel: 151 - 5755MHz

Tx Chain: 2x2 Data Rate: MCS0

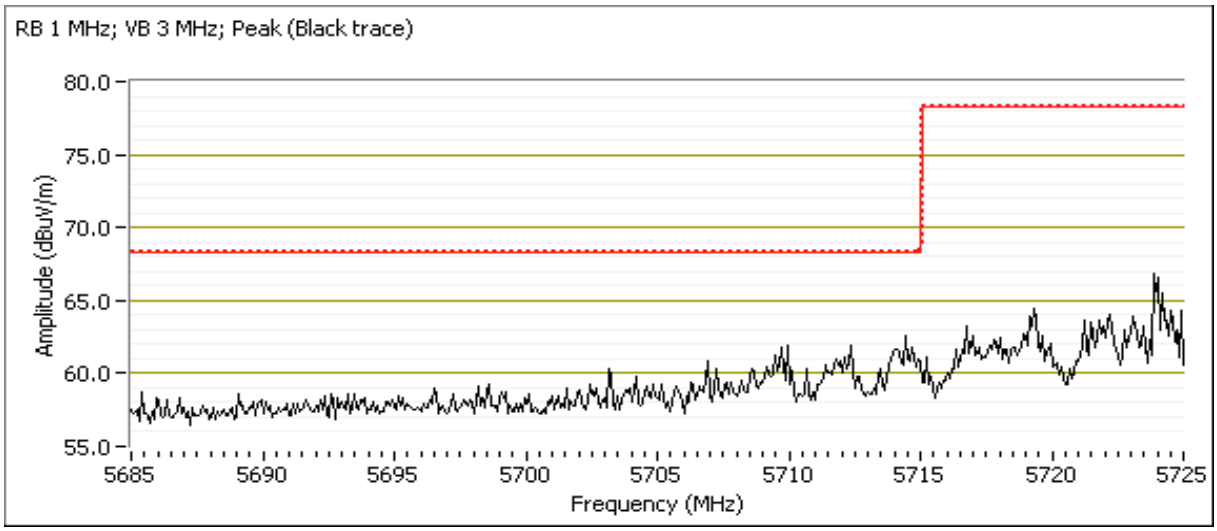
Mode: n40 Setting: 15

5715 MHz 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	
5711.690	62.2	H	68.3	-6.1	PK	61	1.2	POS; RB 1 MHz; VB: 3 MHz

5725 MHz Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	15.E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5724.940	66.8	H	78.3	-11.5	PK	61	1.2	POS; RB 1 MHz; VB: 3 MHz



EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Date of Test: 5/24/2016
Test Location: Chamber #4

Test Engineer: Mehran Birgani
EUT Voltage: 120V/ 60Hz

Channel: 159 - 5795MHz
Tx Chain: 2x2
Mode: n40

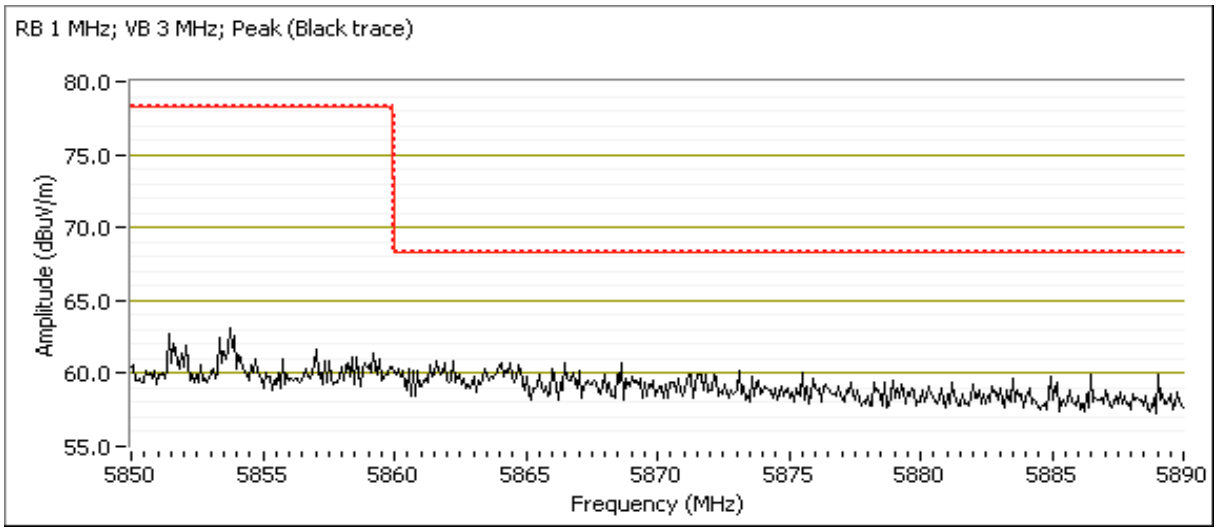
Data Rate: MCS0
Setting: 20

5850 MHz Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	15.E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5864.030	61.6	H	68.3	-6.7	PK	61	1.2	POS; RB 1 MHz; VB: 3 MHz

5860 MHz Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	15.E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5854.650	62.9	H	78.3	-15.4	PK	61	1.2	POS; RB 1 MHz; VB: 3 MHz



Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	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, unless otherwise noted.

Ambient Conditions:

Temperature: 20-27 °C
Rel. Humidity: 32-38 %

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.

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Summary of Results

Run #	Mode	Channel	Power Setting		Test Performed	Limit	Result / Margin
Scans on "center" channel in all three OFDM modes to determine the worst case mode.							
1	a	40 - 5200MHz	20	20	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	52.7 dBµV/m @ 5040.0 MHz (-1.3 dB)
	n20	40 - 5200MHz	20	20	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	45.3 dBµV/m @ 4965.6 MHz (-8.7 dB)
	n40	38 - 5190MHz	20	20	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	43.9 dBµV/m @ 4968.2 MHz (-10.1 dB)
Measurements on low and high channels in worst-case OFDM mode.							
2	a	36 - 5180MHz	20	20	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	49.4 dBµV/m @ 5040.0 MHz (-4.6 dB)
	a	48 - 5240MHz	20	20	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	42.7 dBµV/m @ 5034.5 MHz (-11.3 dB)
40MHz - use if worse case from 1 and also do lowest n20 channel							
2	n20	36 - 5180MHz	20	20	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	48.7 dBµV/m @ 5040.0 MHz (-5.3 dB)
	n40	46 - 5230MHz	20	20	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	48.2 dBµV/m @ 4959.9 MHz (-5.8 dB)
Scans on "center" channel in all three OFDM modes to determine the worst case mode.							
3	a	60 - 5300MHz	20	20	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	42.2 dBµV/m @ 4959.9 MHz (-11.8 dB)
	n20	60 - 5300MHz	20	20	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	44.4 dBµV/m @ 4880.0 MHz (-9.6 dB)
	n40	54 - 5270MHz	20	20	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	43.5 dBµV/m @ 4756.0 MHz (-10.5 dB)
Measurements on low and high channels in worst-case OFDM mode.							
4	a	52 - 5260MHz	20	20	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	42.2 dBµV/m @ 5046.2 MHz (-11.8 dB)
	a	64 - 5320MHz	20	20	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	43.0 dBµV/m @ 5045.2 MHz (-11.0 dB)
40MHz - use if worse case from 1 and also do lowest a or n20 channel							
4	n20	52 - 5260MHz	20	20	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	47.3 dBµV/m @ 5040.0 MHz (-6.7 dB)
	n20	64 - 5320MHz	20	20	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	43.0 dBµV/m @ 5045.2 MHz (-11.0 dB)

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Summary of Results

Run #	Mode	Channel	Power Setting		Test Performed	Limit	Result / Margin
Scans on "center" channel in all three OFDM modes to determine the worst case mode.							
5	a	116 - 5580MHz	20	20	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	46.9 dBµV/m @ 5355.4 MHz (-7.1 dB)
	n20	116 - 5580MHz	20	20	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	45.8 dBµV/m @ 5356.9 MHz (-8.2 dB)
	n40	110 - 5550MHz	20	20	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	45.7 dBµV/m @ 4960.0 MHz (-8.3 dB)
Measurements on low and high channels in worst-case OFDM mode.							
6	a	100 - 5500MHz	20	20	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	44.5 dBµV/m @ 5138.6 MHz (-9.5 dB)
	a	140- 5700MHz	20	20	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	47.7 dBµV/m @ 5354.8 MHz (-6.3 dB)
	a	144- 5720MHz	20	20	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	47.7 dBµV/m @ 5354.8 MHz (-6.3 dB)
Scans on "center" channel in all three OFDM modes to determine the worst case mode.							
7	a	157 - 5785MHz	20	20	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	47.9 dBµV/m @ 5377.8 MHz (-6.1 dB)
	n20	157 - 5785MHz	20	20	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	49.1 dBµV/m @ 5378.8 MHz (-4.9 dB)
	n40	159 - 5795MHz	20	20	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	45.3 dBµV/m @ 5428.9 MHz (-8.7 dB)
Measurements on low and high channels in worst-case OFDM mode.							
8	n20	149 - 5745MHz	20	20	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	45.5 dBµV/m @ 5127.3 MHz (-8.5 dB)
	n20	165- 5825MHz	20	20	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	50.9 dBµV/m @ 5400.2 MHz (-3.1 dB)

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Procedure Comments:

Measurements performed in accordance with FCC KDB 789033
Peak measurements performed with: RBW=1MHz, VBW=3MHz, peak detector, max hold, auto sweep time
Unless otherwise stated/noted, emission has duty cycle ≥ 98% and was measured using RBW=1MHz, VBW=10Hz, peak detector, linear average mode, auto sweep time, max hold.

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
11a	6MB/s	0.98	Yes	1.417	0	0	10
11n20	MCS 0	0.98	Yes	1.302	0	0	10
11n40	MCS 0	0.98	Yes	1.309	0.0	0.0	10

Sample Notes

Sample S/N: G54DA5DN000024
Driver: 5.99 RC 188.10
Antenna: Internal

Measurement Specific Notes:

Note 1:	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). Per KDB 789033 2) c) (i), compliance can be demonstrated by meeting the average and peak limits of 15.209, as an alternative.
Note 2:	For emissions in restricted bands, the limit of 15.209 was used which requires average and peak measurements.
Note 3:	Emission has duty cycle ≥ 98% for a nd n20 modes, average measurement performed using: RBW=1MHz, VBW=10Hz, Peak Detector, Linear mode, auto sweep, trace max hold, 50 sweeps
Note 4:	Emission has duty cycle < 98% for n40 mode, average measurement performed using: RBW=1MHz, VBW=3kHz, Peak Detector, Linear mode, auto sweep, trace max hold, 54 sweeps

Test Notes

No emissions from the radio circuitry were observed below 1 GHz during preliminry tests.
Emissions results of 802.11 5GHz + RF4CE are found in R98955

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #1, Radiated Spurious Emissions, 1,000 - 40,000 MHz. Operation in the 5150-5250 MHz Band

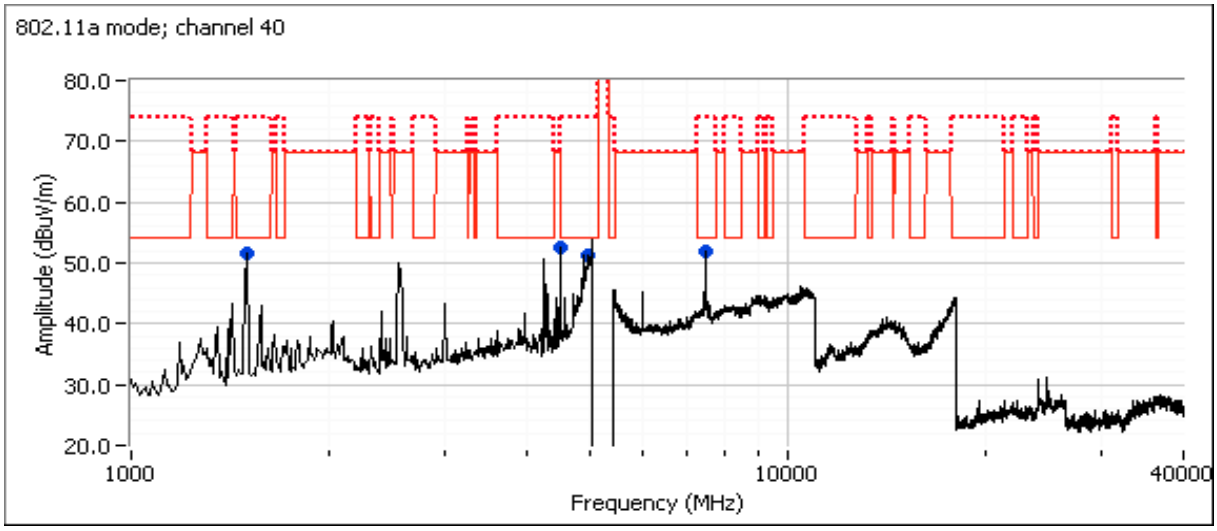
Date of Test: 6/25/2015 & 7/1/2015 Config. Used: 1

Test Location: Fremont Chambers #4 and 7 Test Engineer: M. Birgani & David Bare

Run #1a: Center Channel

Channel: 40 Mode: a Setting: 20

Tx Chain: 1 Data Rate: 6MB/s



Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5039.960	52.7	H	54.0	-1.3	AVG	71	1.1	RB 1 MHz;VB 10 Hz;Pk
5040.160	61.0	H	74.0	-13.0	PK	71	1.1	RB 1 MHz;VB 3 MHz;Pk
4500.000	53.6	H	68.3	-14.7	AVG	164	1.6	RB 1 MHz;VB 10 Hz;Pk
4500.000	55.4	H	74.0	-18.6	PK	164	1.6	RB 1 MHz;VB 3 MHz;Pk
1500.020	51.5	V	54.0	-2.5	AVG	120	2.5	RB 1 MHz;VB 10 Hz;Pk
1499.960	56.3	V	74.0	-17.7	PK	120	2.5	RB 1 MHz;VB 3 MHz;Pk
7499.980	51.2	V	54.0	-2.8	AVG	27	1.0	RB 1 MHz;VB 10 Hz;Pk
7499.790	56.8	V	74.0	-17.2	PK	27	1.0	RB 1 MHz;VB 3 MHz;Pk

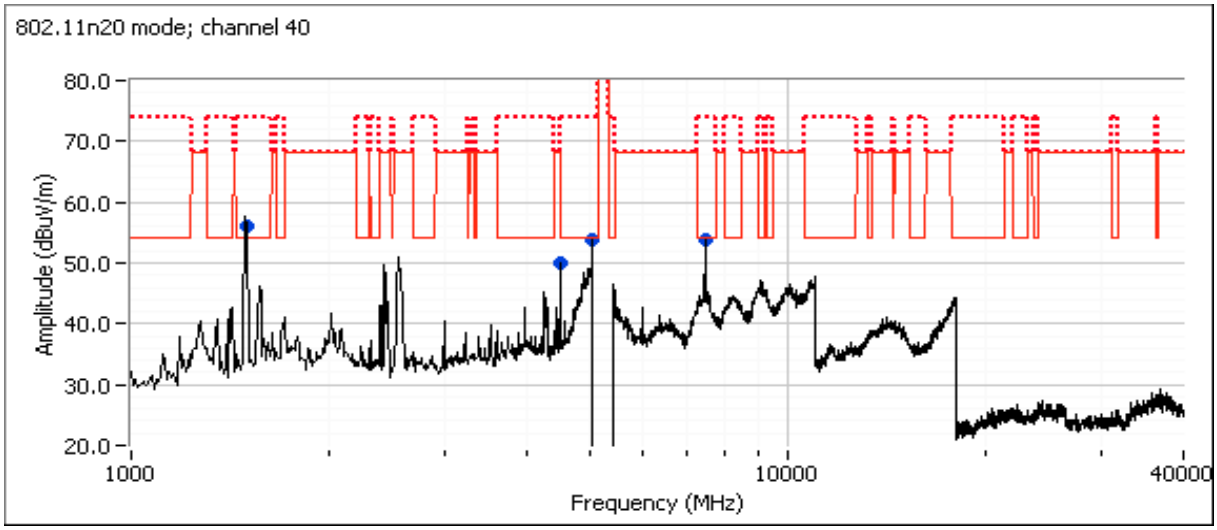
Note:	Scans between 11 - 40 GHz performed with the measurement antenna moved around the EUT at 20-50cm from the device. No significant emissions were observed.
Note:	The emisisons at 1.5, 4.5 and 7.5 GHz are not related to radio. After maximizing the signals; stopped the transmission and the signal level did not change.

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #1b: Center Channel

Channel: 40 Mode: 11n20 Setting: 20

Tx Chain: 2x2 Data Rate: MCS 0



Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4965.600	45.3	H	54.0	-8.7	AVG	76	1.3	RB 1 MHz;VB 10 Hz;Peak
4968.970	57.5	H	74.0	-16.5	PK	76	1.3	RB 1 MHz;VB 3 MHz;Peak

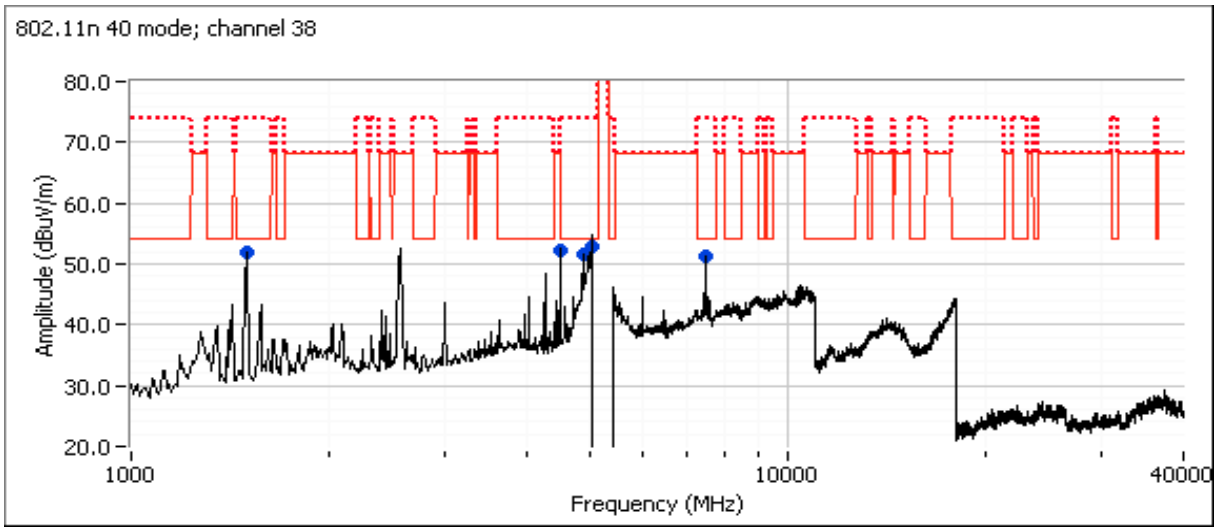
Note:	Scans between 11 - 40 GHz performed with the measurement antenna moved around the EUT at 20-50cm from the device. No significant emissions were observed.
Note:	The emisisons at 1.5, 4.5 and 7.5 GHz are not related to radio. After maximizing the signals; stopped the transmission and the signal level did not change.

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #1c: Center Channel

Channel: 38 Mode: 11n40 Setting: 20

Tx Chain: 2x2 Data Rate: MCS 0



Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4968.200	43.9	H	54.0	-10.1	AVG	78	1.3	RB 1 MHz;VB 10 Hz;Peak
4967.320	54.9	H	74.0	-19.1	PK	78	1.3	RB 1 MHz;VB 3 MHz;Peak

Note:	Scans between 11 - 40 GHz performed with the measurement antenna moved around the EUT at 20-50cm from the device. No significant emissions were observed.
Note:	The emisisons at 1.5, 4.5 and 7.5 GHz are not related to radio. After maximizing the signals; stopped the transmission and the signal level did not change.

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

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

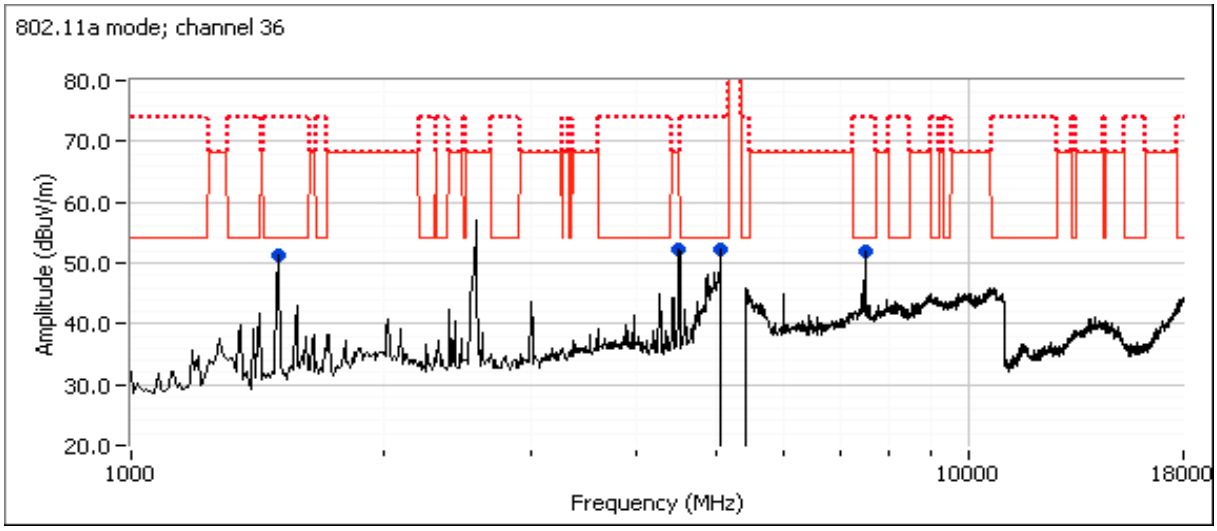
Date of Test: 6/25/2015 Config. Used: 1

Test Location: Chamber 4 Test Engineer: Joseph Cadigal

Run #2a: Low Channel

Channel: 36 Mode: a Setting: 20

Tx Chain: 1 Data Rate: 6MB/s



Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5039.980	49.4	H	54.0	-4.6	AVG	71	2.5	RB 1 MHz;VB 10 Hz;Peak
5040.050	58.3	H	74.0	-15.7	PK	71	2.5	RB 1 MHz;VB 3 MHz;Peak

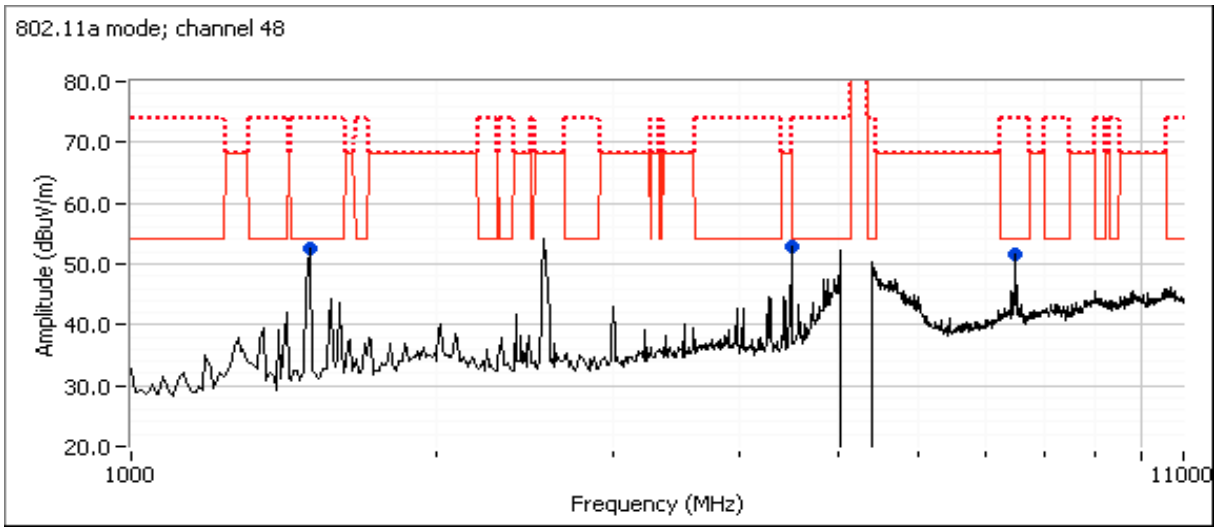
Note: The emisisons at 1.5, 4.5 and 7.5 GHz are not related to radio. After maximizing the signals; stopped the transmission and the signal level did not change.

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #2b: High Channel

Channel: 48 Mode: a Setting: 20

Tx Chain: 1 Data Rate: 6MB/s



Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5034.450	42.7	H	54.0	-11.3	AVG	89	2.2	RB 1 MHz;VB 10 Hz;Peak
5031.870	54.2	H	74.0	-19.8	PK	89	2.2	RB 1 MHz;VB 3 MHz;Peak

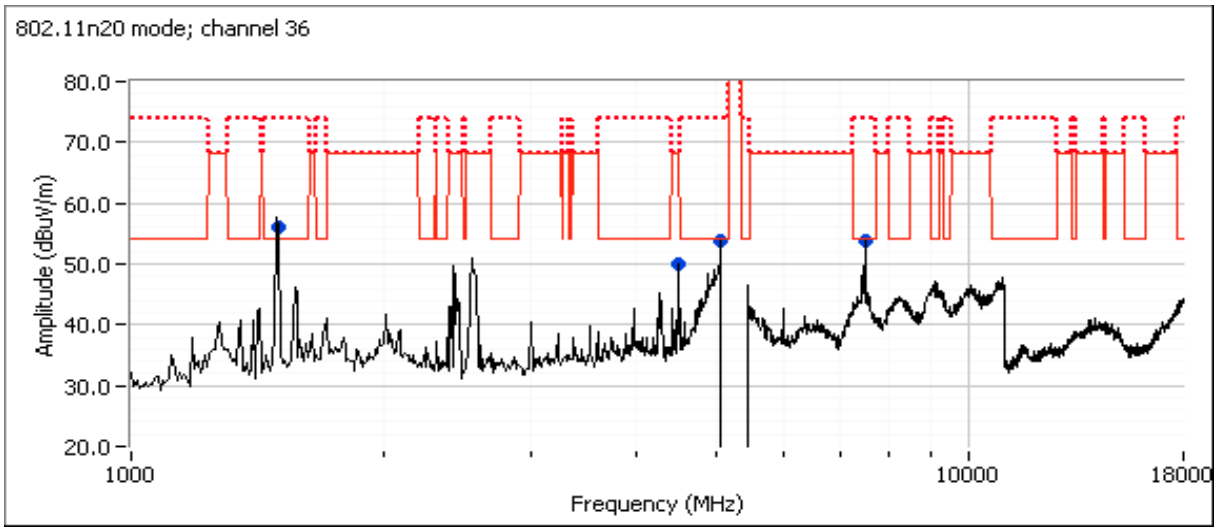
Note: The emisisons at 1.5, 4.5 and 7.5 GHz are not related to radio. After maximizing the signals; stopped the transmission and the signal level did not change.

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #2c: Low Channel (n20 mode selected as there are only 2 n40 channels in the band)

Channel: 36 Mode: n20 Setting: 20

Tx Chain: 2x2 Data Rate: MCS0



Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5039.990	48.7	H	54.0	-5.3	AVG	87	2.2	RB 1 MHz;VB 10 Hz;Peak
5040.050	57.6	H	74.0	-16.4	PK	87	2.2	RB 1 MHz;VB 3 MHz;Peak

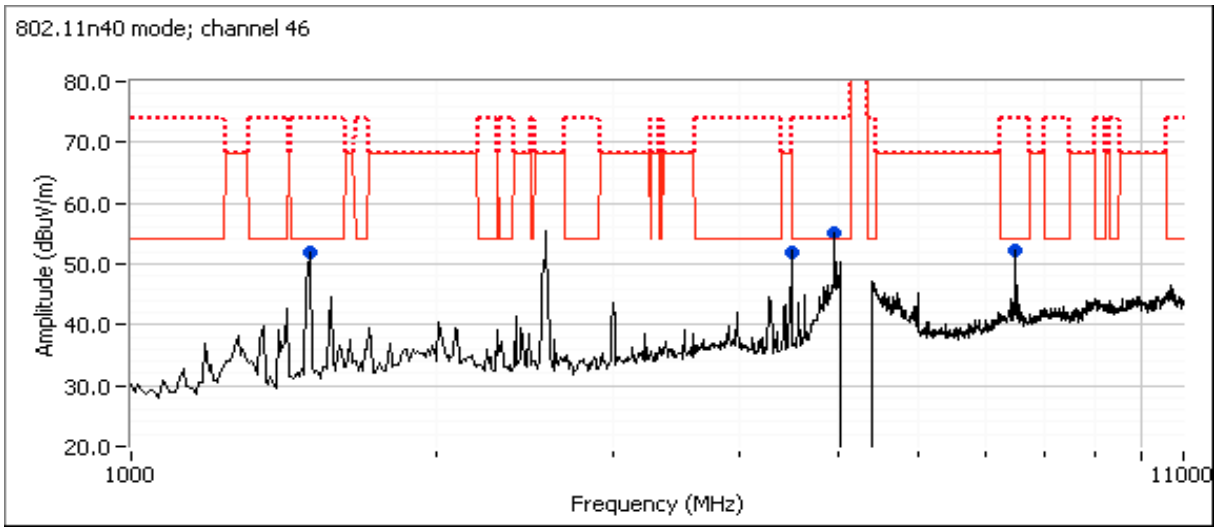
Note: The emisisons at 1.5, 4.5 and 7.5 GHz are not related to radio. After maximizing the signals; stopped the transmission and the signal level did not change.

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #2d: Low Channel

Channel: 46 Mode: n40 Setting: 20

Tx Chain: 2x2 Data Rate: MCS0



Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4959.940	48.2	H	54.0	-5.8	AVG	77	2.5	RB 1 MHz;VB 10 Hz;Peak
4960.010	53.6	H	74.0	-20.4	PK	77	2.5	RB 1 MHz;VB 3 MHz;Peak

Note: The emisisons at 1.5, 4.5 and 7.5 GHz are not related to radio. After maximizing the signals; stopped the transmission and the signal level did not change.

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #3, Radiated Spurious Emissions, 1,000 - 40,000 MHz. Operation in the 5250-5350 MHz Band

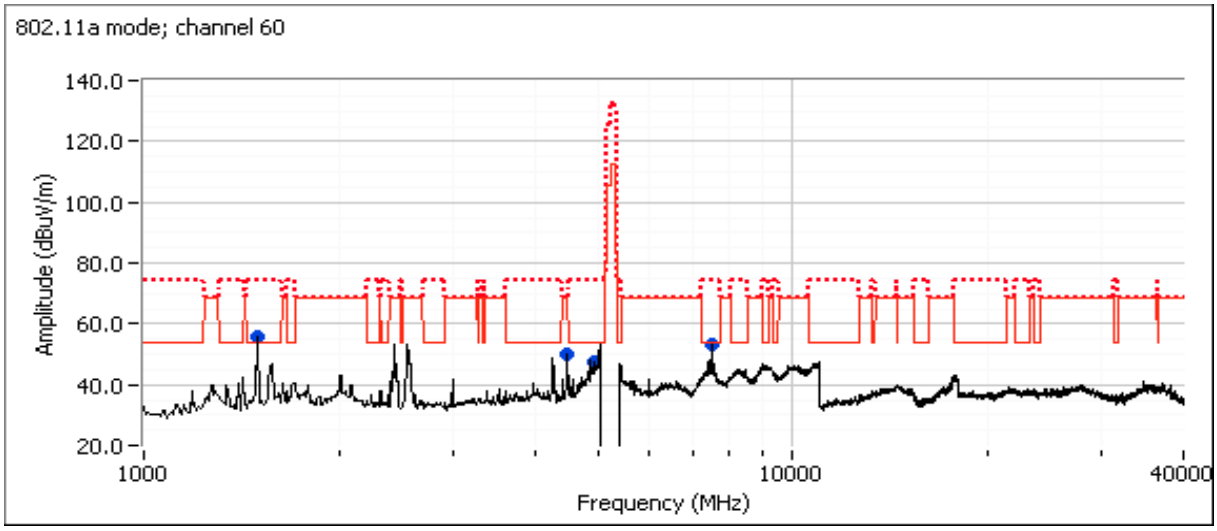
Date of Test: 6/26/2015 Config. Used: 1

Test Location: Chamber 4 Test Engineer: M. Birgani

Run #3a: Center Channel

Channel: 60 Mode: a Setting: 20

Tx Chain: 1 Data Rate: 6MB/s



Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4959.930	42.2	H	54.0	-11.8	AVG	77	2.5	RB 1 MHz;VB 10 Hz;Peak
4959.680	52.0	H	74.0	-22.0	PK	77	2.5	RB 1 MHz;VB 3 MHz;Peak

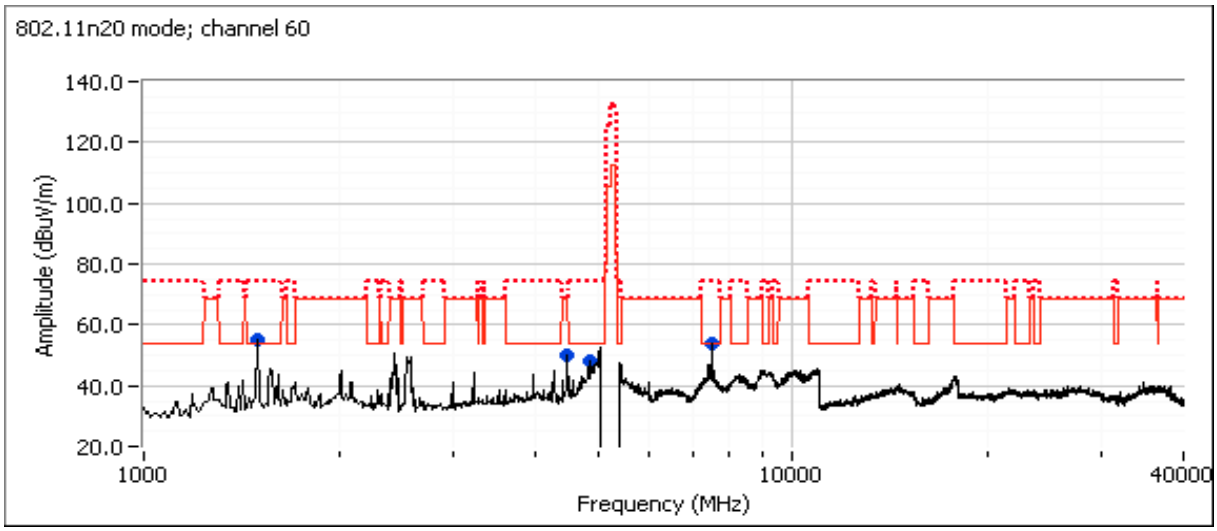
Note:	Scans between 18 - 40 GHz performed with the measurement antenna moved around the EUT at 20-50cm from the device. No significant emissions were observed.
Note:	The emisisons at 1.5, 4.5 and 7.5 GHz are not related to radio. After maximizing the signals; stopped the transmission and the signal level did not change.

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #3b: Center Channel

Channel: 60 Mode: 11n20 Setting: 20

Tx Chain: 2x2 Data Rate: MCS 0



Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4879.970	44.4	H	54.0	-9.6	AVG	74	2.3	RB 1 MHz;VB 10 Hz;Peak
4880.350	51.4	H	74.0	-22.6	PK	74	2.3	RB 1 MHz;VB 3 MHz;Peak

Note:	Scans between 18 - 40 GHz performed with the measurement antenna moved around the EUT at 20-50cm from the device. No significant emissions were observed.
Note:	The emisisons at 1.5, 4.5 and 7.5 GHz are not related to radio. After maximizing the signals; stopped the transmission and the signal level did not change.

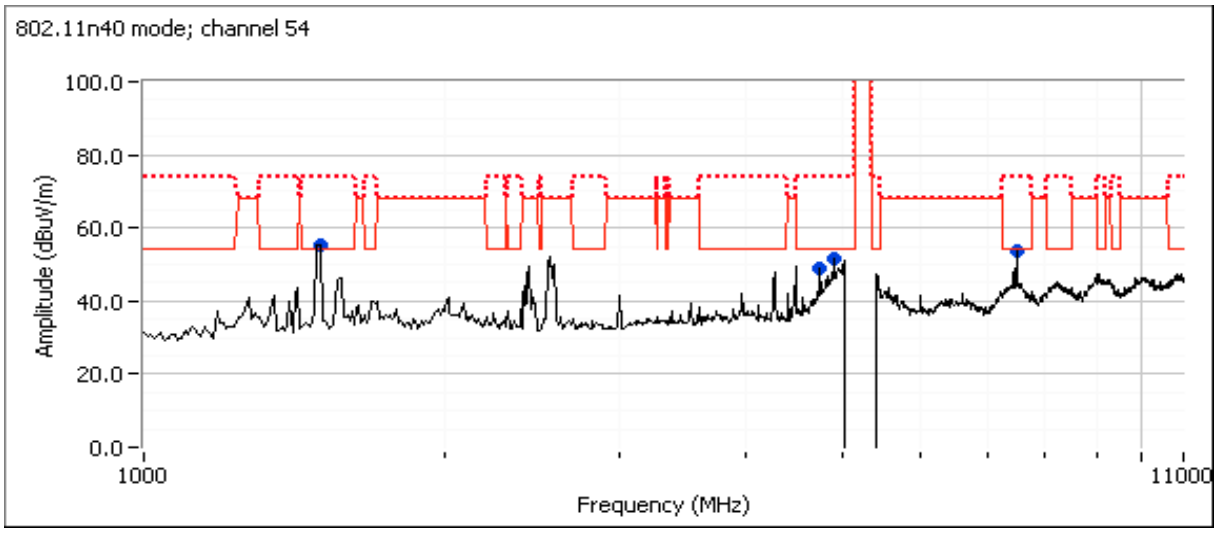
EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Date of Test: 6/26/2015 Config. Used: 1
Test Location: Chamber 4 Test Engineer: Joseph Cadigal

Run #3c: Center Channel

Channel: 54 Mode: 11n40 Setting: 20
Tx Chain: 2x2 Data Rate: MCS 0



Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4755.980	43.5	H	54.0	-10.5	AVG	84	2.2	RB 1 MHz;VB 10 Hz;Peak
4919.940	40.7	H	54.0	-13.3	AVG	78	2.5	RB 1 MHz;VB 10 Hz;Peak
4919.990	50.2	H	74.0	-23.8	PK	78	2.5	RB 1 MHz;VB 3 MHz;Peak
4755.510	50.0	H	74.0	-24.0	PK	84	2.2	RB 1 MHz;VB 3 MHz;Peak

Note:	Scans between 11 - 40 GHz performed with the measurement antenna moved around the EUT at 20-50cm from the device. No significant emissions were observed.
Note:	The emisisons at 1.5, 4.5 and 7.5 GHz are not related to radio. After maximizing the signals; stopped the transmission and the signal level did not change.

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #4: Radiated Spurious Emissions, 1,000 - 40000 MHz. Operating Mode: Worse case from Run #3

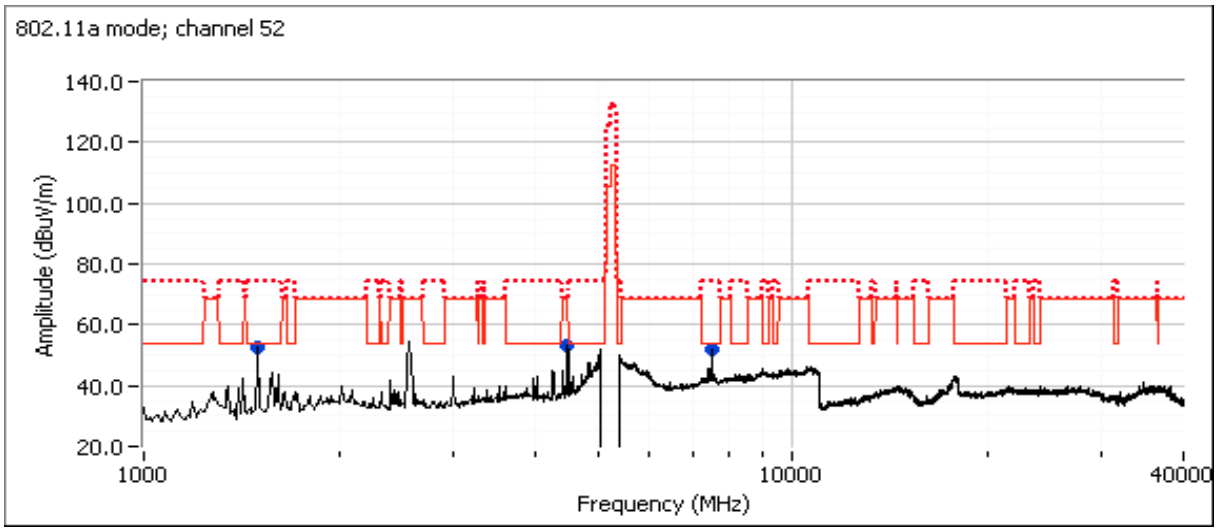
Date of Test: 6/26/2015 Config. Used: 1

Test Location: Chamber #4 Test Engineer: Joseph Cadigal

Run #4a: Low Channel

Channel: 52 Mode: 11a Setting: 20

Tx Chain: 1 Data Rate: 6MB/s



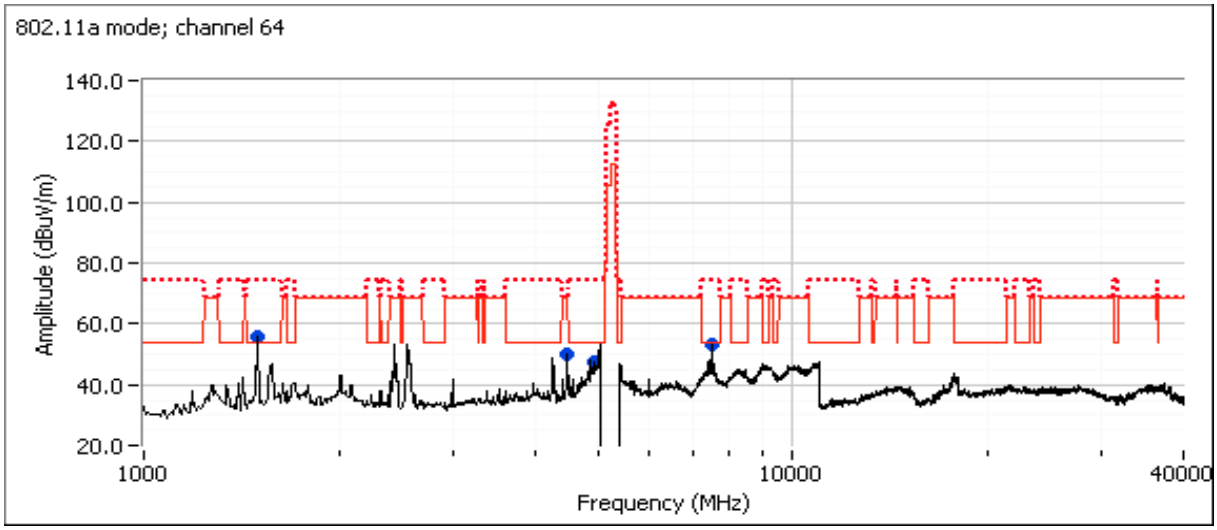
Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5046.170	42.2	H	54.0	-11.8	AVG	75	2.5	RB 1 MHz;VB 10 Hz;Peak
5048.330	54.5	H	74.0	-19.5	PK	75	2.5	RB 1 MHz;VB 3 MHz;Peak

Note:	Scans between 18 - 40 GHz performed with the measurement antenna moved around the EUT at 20-50cm from the device. No significant emissions were observed.
Note:	The emisisons at 1.5, 4.5 and 7.5 GHz are not related to radio. After maximizing the signals; stopped the transmission and the signal level did not change.

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #4b: High Channel

Channel: 64 Mode: 11a Setting: 20
Tx Chain: 1 Data Rate: 6MB/s



Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5045.160	43.0	H	54.0	-11.0	AVG	58	2.2	RB 1 MHz;VB 10 Hz;Peak
5046.050	56.3	H	74.0	-17.7	PK	58	2.2	RB 1 MHz;VB 3 MHz;Peak

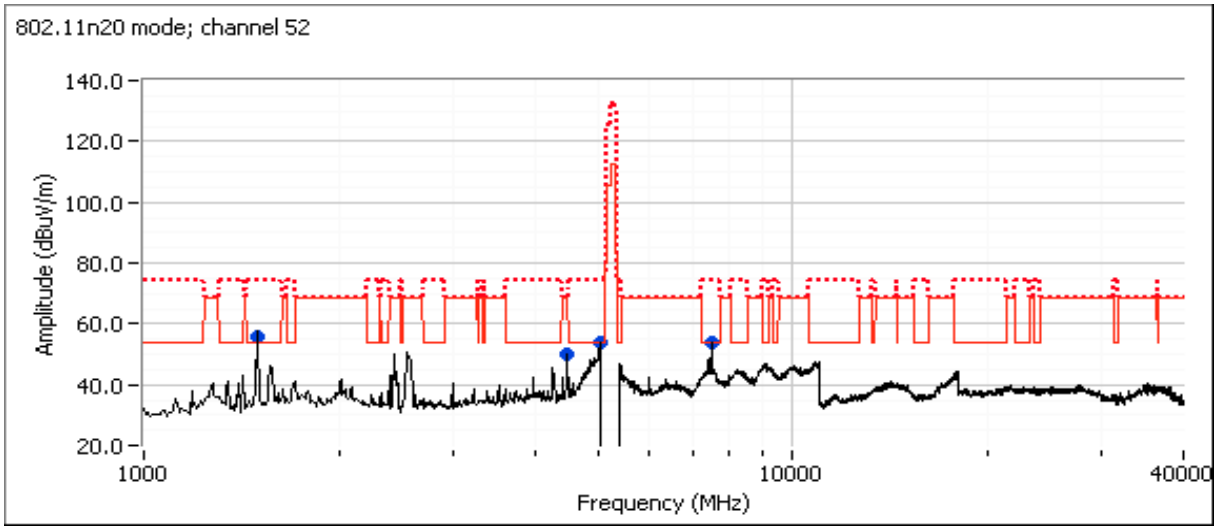
Note:	Scans between 18 - 40 GHz performed with the measurement antenna moved around the EUT at 20-50cm from the device. No significant emissions were observed.
Note:	The emisisons at 1.5, 4.5 and 7.5 GHz are not related to radio. After maximizing the signals; stopped the transmission and the signal level did not change.

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #4c: Low Channel

Channel: 52 Mode: 11n20 Setting: 20

Tx Chain: 2x2 Data Rate: MCS0



Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5039.960	47.3	H	54.0	-6.7	AVG	71	2.2	RB 1 MHz;VB 10 Hz;Peak
5040.000	57.9	H	74.0	-16.1	PK	71	2.2	RB 1 MHz;VB 3 MHz;Peak

Note:	Scans between 18 - 40 GHz performed with the measurement antenna moved around the EUT at 20-50cm from the device. No significant emissions were observed.
Note:	The emisisons at 1.5, 4.5 and 7.5 GHz are not related to radio. After maximizing the signals; stopped the transmission and the signal level did not change.

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #4d: Low Channel

Date of Test: 6/28/2015 Config. Used: #1
Test Location: Chamber #5 Test Engineer: Rafael Varelas

Channel: 64 Mode: 11n20 Setting: 20
Tx Chain: 2x2 Data Rate: MCS0

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4879.950	44.0	H	54.0	-10.0	AVG	63	2.2	RB 1 MHz;VB 10 Hz;Peak
4880.140	51.4	H	74.0	-22.6	PK	63	2.2	RB 1 MHz;VB 3 MHz;Peak
5039.940	46.8	H	54.0	-7.2	AVG	80	1.0	RB 1 MHz;VB 10 Hz;Peak
5039.840	55.3	H	74.0	-18.7	PK	80	1.0	RB 1 MHz;VB 3 MHz;Peak

Note:	Scans between 18 - 40 GHz performed with the measurement antenna moved around the EUT at 20-50cm from the device. No significant emissions were observed.
Note:	The emisisons at 1.5, 4.5 and 7.5 GHz are not related to radio. After maximizing the signals; stopped the transmission and the signal level did not change.

Note: No plot provided. Tabular data represents the worse case emissions observed during a preliminary scan.

EMC Test Data

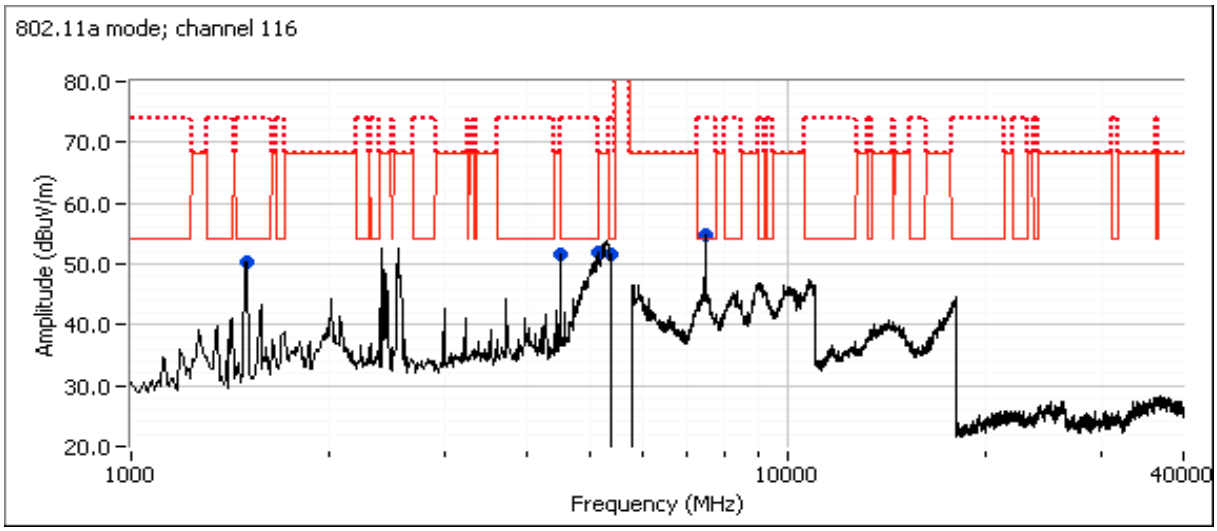
Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #5, Radiated Spurious Emissions, 1,000 - 40,000 MHz. Operation in the 5470-5725 MHz Band

Date of Test: 6/28/2015 Config. Used: #1
Test Location: Fremont Chambers #5 & 7 Test Engineer: Rafael Varelas & David Bare

Run #5a: Center Channel

Channel: 116 Mode: a
Tx Chain: 1 Data Rate: 6MB/s



Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5355.420	46.9	H	54.0	-7.1	AVG	290	2.0	RB 1 MHz;VB 10 Hz;Peak
5354.720	57.5	H	74.0	-16.5	PK	290	2.0	RB 1 MHz;VB 3 MHz;Peak
5133.890	44.6	H	54.0	-9.4	AVG	276	1.1	RB 1 MHz;VB 10 Hz;Peak
5129.310	56.0	H	74.0	-18.0	PK	276	1.1	RB 1 MHz;VB 3 MHz;Peak

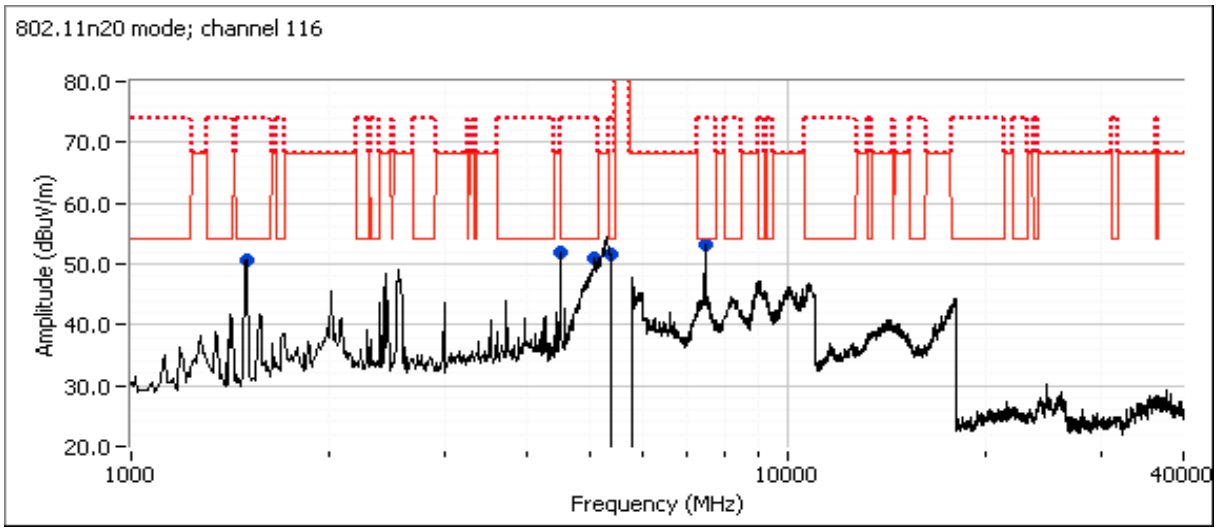
Note:	Scans between 18 - 40 GHz performed with the measurement antenna moved around the card and its antennas 20-50cm from the device.
Note:	The emisisons at 1.5, 4.5 and 7.5 GHz are not related to radio. After maximizing the signals; stopped the transmission and the signal level did not change.

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #5b: Center Channel

Channel: 116 Mode: 11n20

Tx Chain: 2x2 Data Rate: MCS 0



Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5356.850	45.8	H	54.0	-8.2	AVG	286	1.0	RB 1 MHz;VB 10 Hz;Peak
5356.460	56.8	H	74.0	-17.2	PK	286	1.0	RB 1 MHz;VB 3 MHz;Peak
5080.350	44.5	H	54.0	-9.5	AVG	292	1.1	RB 1 MHz;VB 10 Hz;Peak
5079.150	57.0	H	74.0	-17.0	PK	292	1.1	RB 1 MHz;VB 3 MHz;Peak

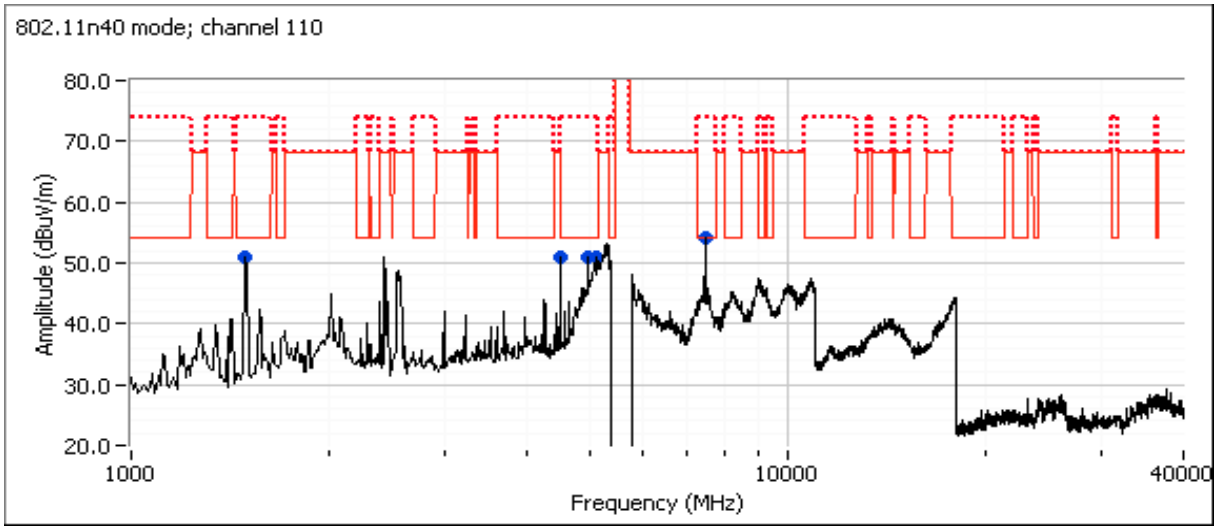
Note:	Scans between 18 - 40 GHz performed with the measurement antenna moved around the card and its antennas 20-50cm from the device.
Note:	The emisisons at 1.5, 4.5 and 7.5 GHz are not related to radio. After maximizing the signals; stopped the transmission and the signal level did not change.

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #5c: Center Channel

Channel: 110 Mode: 11n40
Tx Chain: 2x2 Data Rate: MCS 0



Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4959.950	45.7	H	54.0	-8.3	AVG	69	1.0	RB 1 MHz;VB 10 Hz;Peak
4960.040	52.2	H	74.0	-21.8	PK	69	1.0	RB 1 MHz;VB 3 MHz;Peak
5120.010	43.8	H	54.0	-10.2	AVG	66	2.3	RB 1 MHz;VB 10 Hz;Peak
5119.730	53.2	H	74.0	-20.8	PK	66	2.3	RB 1 MHz;VB 3 MHz;Peak

Note:	Scans between 18 - 40 GHz performed with the measurement antenna moved around the card and its antennas 20-50cm from the device.
Note:	The emisisons at 1.5, 4.5 and 7.5 GHz are not related to radio. After maximizing the signals; stopped the transmission and the signal level did not change.

EMC Test Data

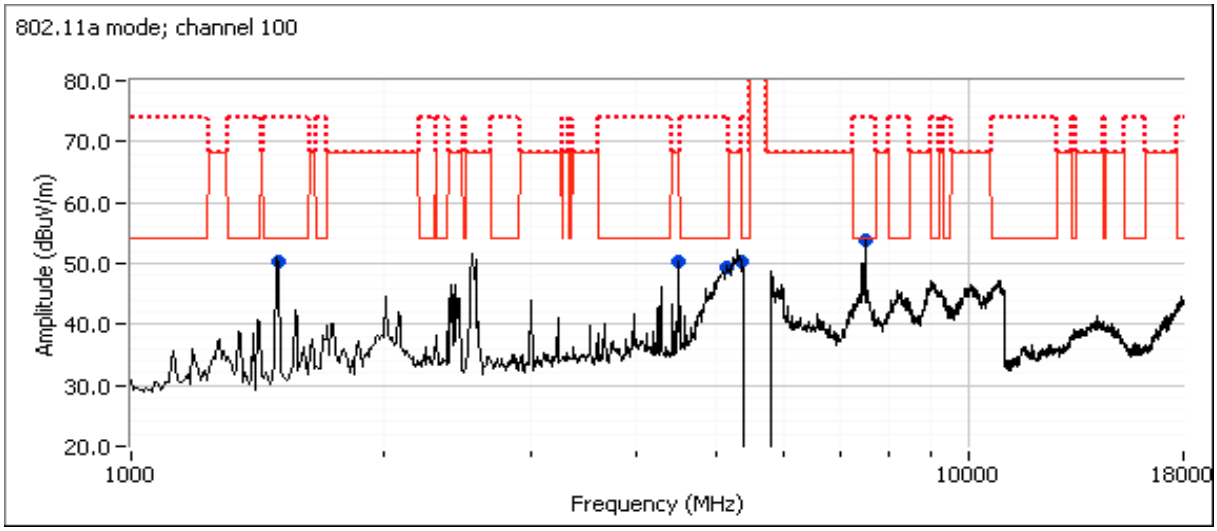
Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #6: Radiated Spurious Emissions, 1,000 - 40000 MHz. Operating Mode: Worse case from Run #5

Date of Test: 6/28/2015 Config. Used: #1
Test Location: Fremont Chamber #5 Test Engineer: Rafael Varelas

Run #6a: Low Channel

Channel: 100 Mode: a
Tx Chain: 2x2 Data Rate: 6MB/s



Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5138.560	44.5	V	54.0	-9.5	AVG	52	2.3	RB 1 MHz;VB 10 Hz;Peak
5136.260	55.9	V	74.0	-18.1	PK	52	2.3	RB 1 MHz;VB 3 MHz;Peak
5356.690	43.2	H	54.0	-10.8	AVG	290	1.0	RB 1 MHz;VB 10 Hz;Peak
5353.990	54.7	H	74.0	-19.3	PK	290	1.0	RB 1 MHz;VB 3 MHz;Peak

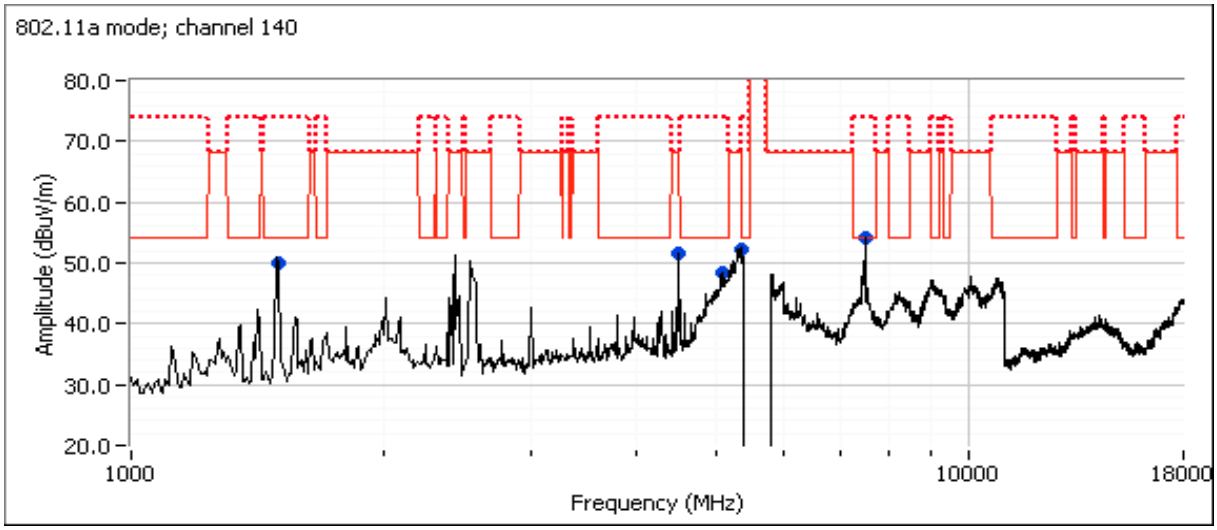
Note:	Scans between 18 - 40 GHz performed with the measurement antenna moved around the card and its antennas 20-50cm from the device.
Note:	The emisisons at 1.5, 4.5 and 7.5 GHz are not related to radio. After maximizing the signals; stopped the transmission and the signal level did not change.

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #6b: High Channel

Channel: 140 Mode: a
Tx Chain: 2x2 Data Rate: 6MB/s



Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5354.820	47.7	H	54.0	-6.3	AVG	274	1.1	RB 1 MHz;VB 10 Hz;Peak
5355.050	58.4	H	74.0	-15.6	PK	274	1.1	RB 1 MHz;VB 3 MHz;Peak
5069.780	41.4	H	54.0	-12.6	AVG	285	1.0	RB 1 MHz;VB 10 Hz;Peak
5068.800	52.7	H	74.0	-21.3	PK	285	1.0	RB 1 MHz;VB 3 MHz;Peak

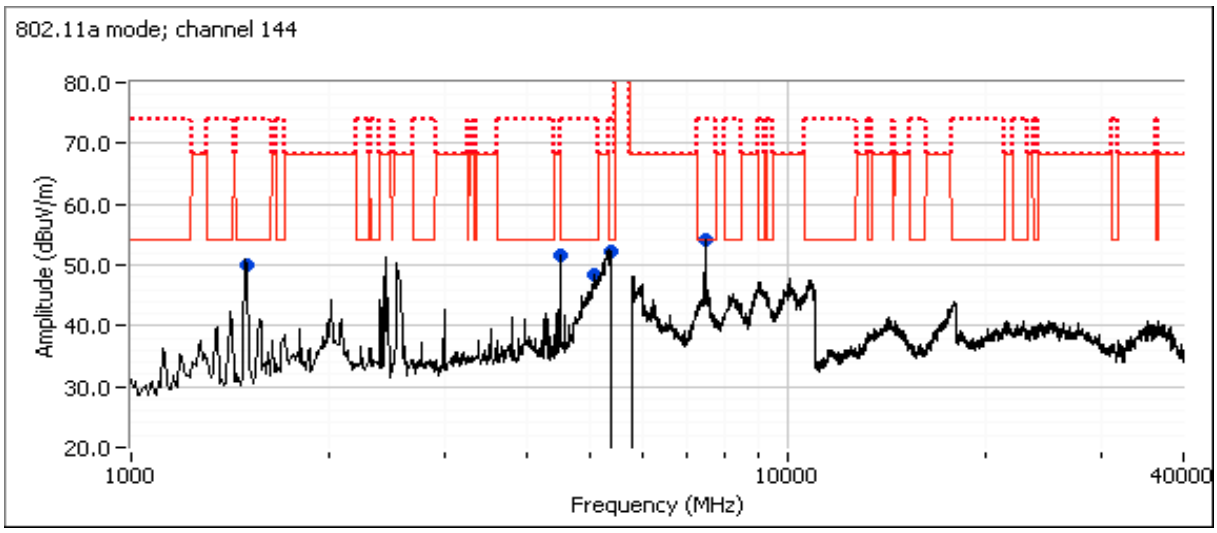
Note:	Scans between 18 - 40 GHz performed with the measurement antenna moved around the card and its antennas 20-50cm from the device.
Note:	The emisisons at 1.5, 4.5 and 7.5 GHz are not related to radio. After maximizing the signals; stopped the transmission and the signal level did not change.

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #6c: High Channel

Channel: 144 Mode: a
Tx Chain: 2x2 Data Rate: 6MB/s



Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5354.820	47.7	H	54.0	-6.3	AVG	274	1.1	RB 1 MHz;VB 10 Hz;Peak
5069.780	41.4	H	54.0	-12.6	AVG	285	1.0	RB 1 MHz;VB 10 Hz;Peak
5355.050	58.4	H	74.0	-15.6	PK	274	1.1	RB 1 MHz;VB 3 MHz;Peak
5068.800	52.7	H	74.0	-21.3	PK	285	1.0	RB 1 MHz;VB 3 MHz;Peak

Note:	Scans between 18 - 40 GHz performed with the measurement antenna moved around the card and its antennas 20-50cm from the device.
Note:	The emisisons at 1.5, 4.5 and 7.5 GHz are not related to radio. After maximizing the signals; stopped the transmission and the signal level did not change.

EMC Test Data

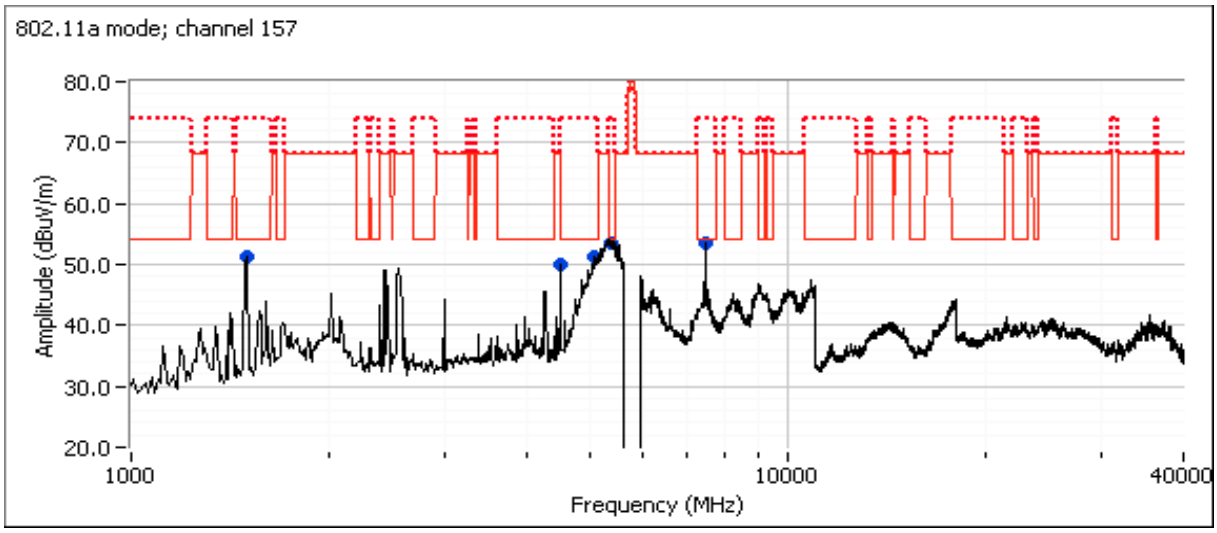
Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #7, Radiated Spurious Emissions, 1,000 - 40,000 MHz. Operation in the 5725-5850 MHz Band

Date of Test: 6/28/2015 Config. Used: #1
Test Location: Chamber #5 Test Engineer: Rafael Varelas

Run #7a: Center Channel

Channel: 157 Mode: a
Tx Chain: 2x2 Data Rate: 6MB/s



Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5377.760	47.9	H	54.0	-6.1	AVG	271	1.5	RB 1 MHz;VB 10 Hz;Peak
5079.390	44.4	H	54.0	-9.6	AVG	290	1.0	RB 1 MHz;VB 10 Hz;Peak
5371.360	58.4	H	74.0	-15.6	PK	271	1.5	RB 1 MHz;VB 3 MHz;Peak
5075.910	55.3	H	74.0	-18.7	PK	290	1.0	RB 1 MHz;VB 3 MHz;Peak

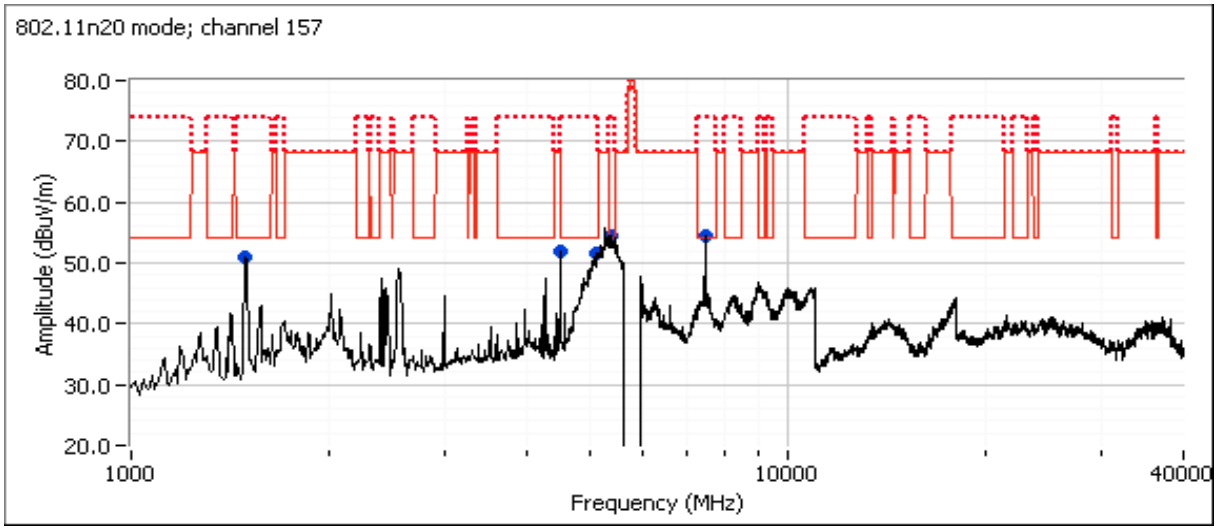
Note:	Scans between 18 - 40 GHz performed with the measurement antenna moved around the card and its antennas 20-50cm from the device.
Note:	The emisisons at 1.5, 4.5 and 7.5 GHz are not related to radio. After maximizing the signals; stopped the transmission and the signal level did not change.

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #7b: Center Channel

Channel: 157 Mode: 11n20
Tx Chain: 2x2 Data Rate: MCS 0



Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5378.830	49.1	H	54.0	-4.9	AVG	267	1.1	RB 1 MHz;VB 10 Hz;Peak
5109.670	45.4	H	54.0	-8.6	AVG	285	1.1	RB 1 MHz;VB 10 Hz;Peak
5374.800	59.7	H	74.0	-14.3	PK	267	1.1	RB 1 MHz;VB 3 MHz;Peak
5109.330	57.2	H	74.0	-16.8	PK	285	1.1	RB 1 MHz;VB 3 MHz;Peak

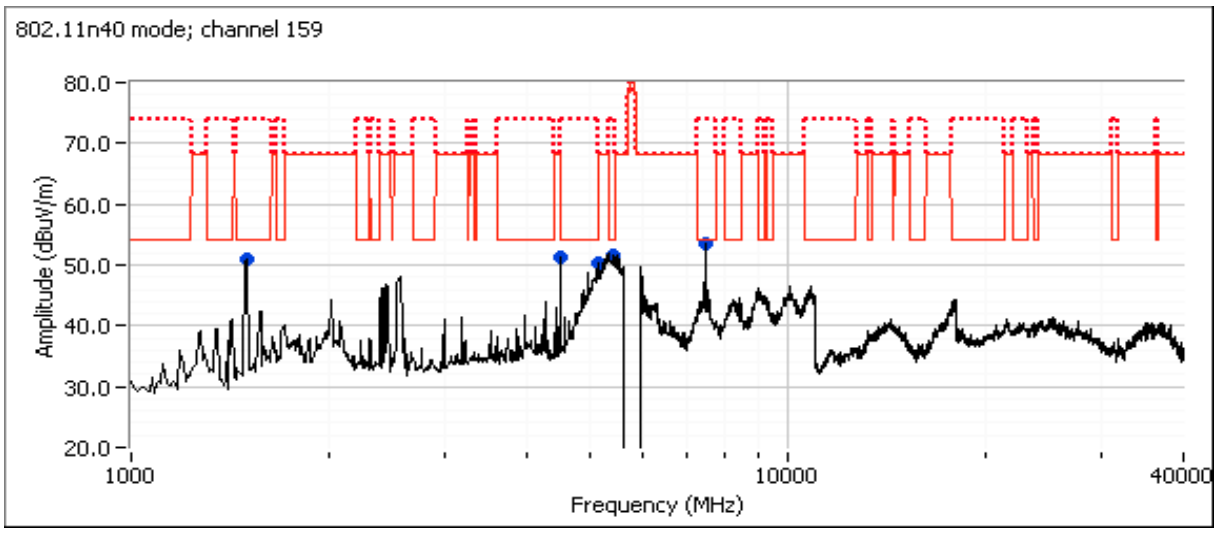
Note:	Scans between 18 - 40 GHz performed with the measurement antenna moved around the card and its antennas 20-50cm from the device.
Note:	The emisisons at 1.5, 4.5 and 7.5 GHz are not related to radio. After maximizing the signals; stopped the transmission and the signal level did not change.

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #7c: Center Channel

Channel: 159 Mode: 11n40
Tx Chain: 2x2 Data Rate: MCS 0



Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5428.910	45.3	H	54.0	-8.7	AVG	265	1.1	RB 1 MHz;VB 10 Hz;Peak
5130.970	42.7	H	54.0	-11.3	AVG	272	1.0	RB 1 MHz;VB 10 Hz;Peak
5427.670	55.9	H	74.0	-18.1	PK	265	1.1	RB 1 MHz;VB 3 MHz;Peak
5128.820	55.6	H	74.0	-18.4	PK	272	1.0	RB 1 MHz;VB 3 MHz;Peak

Note:	Scans between 18 - 40 GHz performed with the measurement antenna moved around the card and its antennas 20-50cm from the device.
Note:	The emisisons at 1.5, 4.5 and 7.5 GHz are not related to radio. After maximizing the signals; stopped the transmission and the signal level did not change.

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #8: Radiated Spurious Emissions, 1,000 - 40000 MHz. Operating Mode: Worse case from Run #7

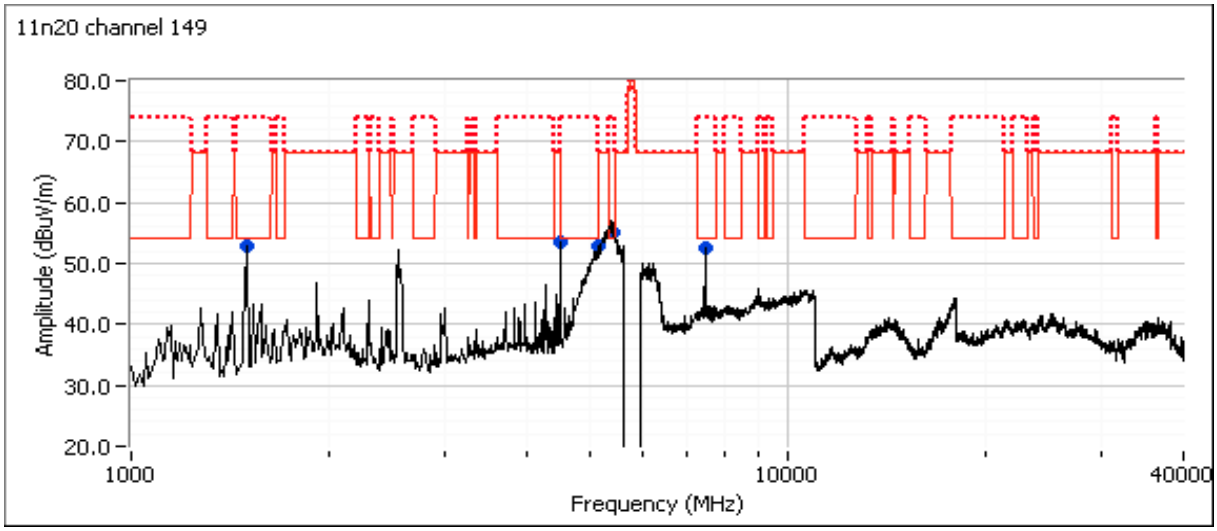
Date of Test: 6/28/2015 Config. Used: #1

Test Location: Chamber #5 Test Engineer: Joseph Cadigal

Run #8a: Low Channel

Channel: 149 Mode: 11n20

Tx Chain: 2x2 Data Rate: MCS 0



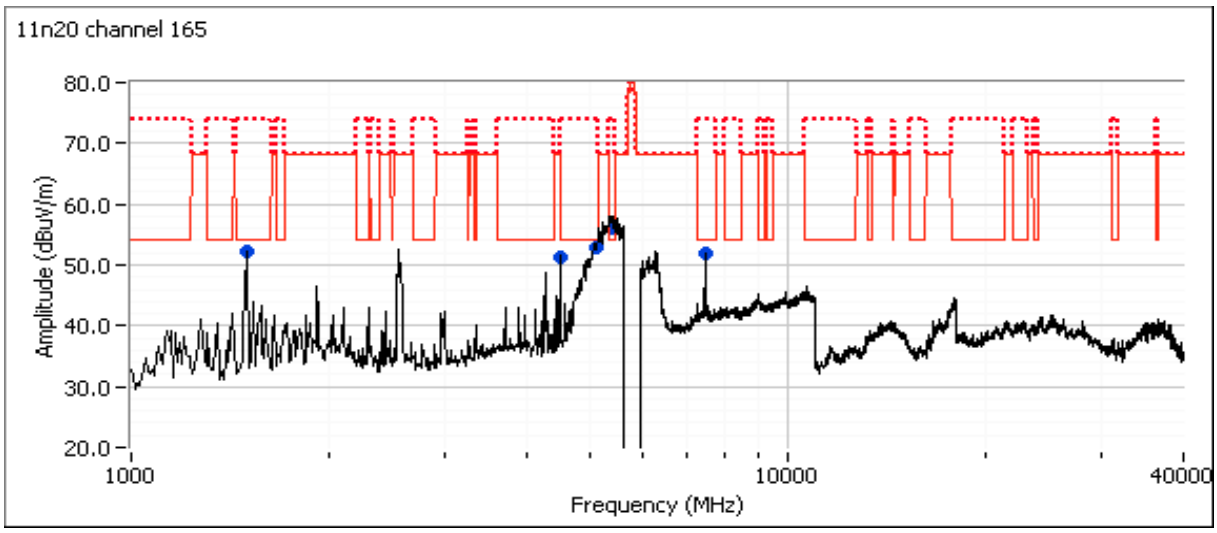
Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5127.270	45.5	H	54.0	-8.5	AVG	285	2.2	RB 1 MHz;VB 10 Hz;Peak
5423.460	42.0	H	54.0	-12.0	AVG	287	2.5	RB 1 MHz;VB 10 Hz;Peak
5126.940	57.5	H	74.0	-16.5	PK	285	2.2	RB 1 MHz;VB 3 MHz;Peak
5417.260	53.5	H	74.0	-20.5	PK	287	2.5	RB 1 MHz;VB 3 MHz;Peak

Note:	Scans between 18 - 40 GHz performed with the measurement antenna moved around the card and its antennas 20-50cm from the device.
Note:	The emisisons at 1.5, 4.5 and 7.5 GHz are not related to radio. After maximizing the signals; stopped the transmission and the signal level did not change.

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #8b: High Channel

Channel: 165 Mode: 11n20
Tx Chain: 2x2 Data Rate: MCS 0



Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5400.150	50.9	H	54.0	-3.1	AVG	288	2.5	RB 1 MHz;VB 10 Hz;Peak
5400.210	64.9	H	74.0	-9.1	PK	288	2.5	RB 1 MHz;VB 3 MHz;Peak
5118.310	42.4	H	54.0	-11.6	AVG	295	2.5	RB 1 MHz;VB 10 Hz;Peak
5117.610	56.1	H	74.0	-17.9	PK	295	2.5	RB 1 MHz;VB 3 MHz;Peak

Note:	Scans between 18 - 40 GHz performed with the measurement antenna moved around the card and its antennas 20-50cm from the device.
Note:	The emisisons at 1.5, 4.5 and 7.5 GHz are not related to radio. After maximizing the signals; stopped the transmission and the signal level did not change.

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

FCC 15.407(UNII)
Antenna Port Measurements
Power, PSD, Bandwidth and Spurious Emissions

Test Specific Details

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

General Test Configuration

When measuring the conducted emissions from the EUT's antenna port, the antenna port of the EUT was connected to the spectrum analyzer or power meter via a suitable attenuator to prevent overloading the measurement system. All measurements are corrected to allow for the external attenuators and cables used.

Ambient Conditions:

Temperature: 20-22 °C
Rel. Humidity: 30-35 %

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.

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Summary of Results

Run #	Test Performed	Limit	Pass / Fail	Result / Margin
1	Power, 5150 - 5250MHz	15.407(a) (1), (2), (3)	Pass	a: 52.5 mW (17.2 dBm) n20: 145.5 mW (21.6 dBm) n40: 167.5 mW (22.2 dBm)
1	PSD, 5150 - 5250MHz	15.407(a) (1), (2), (3)	Pass	a: 3.2 dBm/MHz n20: 9.5 dBm/MHz n40: 7.2 dBm/MHz
1	Power, 5250 - 5350MHz	15.407(a) (1), (2), (3)	Pass	a: 79.4 mW (19.0 dBm) n20: 143.3 mW (21.6 dBm) n40: 133.7 mW (21.3 dBm)
1	PSD, 5250 - 5350MHz	15.407(a) (1), (2), (3)	Pass	a: 6.9 dBm/MHz n20: 9.0 dBm/MHz n40: 6.2 dBm/MHz
1	Max EIRP 5250 - 5350MHz	TPC required if EIRP≥ 500mW (27dBm). EIRP ≥ 200mW (23dBm) DFS threshold = -64dBm.	Pass	EIRP = 25.7 dBm (368.4 mW)
1	Power, 5470 - 5725MHz	15.407(a) (1), (2), (3)	Pass	a: 85.1 mW (19.3 dBm) n20: 166.5 mW (22.2 dBm) n40: 157.1 mW (22.0 dBm)
1	PSD, 5470 - 5725MHz	15.407(a) (1), (2), (3)	Pass	a: 6.6 dBm/MHz n20: 9.5 dBm/MHz n40: 6.7 dBm/MHz
1	Max EIRP 5470 - 5725MHz	TPC required if EIRP≥ 500mW (27dBm). EIRP ≥ 200mW (23dBm) DFS threshold	Pass	EIRP = 26.3 dBm (428.0 mW)
1	Power, 5725 - 5850MHz	15.407(a) (1), (2), (3)	Pass	a: 77.6 mW (18.9 dBm) n20: 158.9 mW (22.0 dBm) n40: 146.7 mW (21.7 dBm)
1	PSD, 5725 - 5850MHz	15.407(a) (1), (2), (3)	Pass	a: 6.3 dBm/MHz n20: 9.2 dBm/MHz n40: 6.6 dBm/MHz
1	99% Bandwidth	-	N/A	a: 17.0 MHz n20: 18.0 MHz n40: 36.2 MHz

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Summary of Results

Run #	Test Performed	Limit	Pass / Fail	Result / Margin
1	26dB Bandwidth (5250-5350 and 5470-5725 MHz Bands)	15.407 (Information only)	-	> 20MHz for all modes
2	6dB Bandwidth (5725-5850 MHz band only)	15.407	-	> 500 kHz all modes
3	Antenna Conducted - Out of Band Spurious	15.407(b) -27dBm/MHz	-	All measurements performed radiated

General Test Configuration

When measuring the conducted emissions from the EUT's antenna port, the antenna port of the EUT was connected to the spectrum analyzer or power meter via a suitable attenuator to prevent overloading the measurement system. All measurements are corrected to allow for the external attenuators and cables used.

Ambient Conditions:

Temperature: 20-22 °C
Rel. Humidity: 30-35 %

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Procedure Comments:

Measurements performed in accordance with FCC KDB 789033 D02 v01

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
11a	6 Mb/s	98.4%	yes	1.41	0	0	-
n20	MCS 0	99.2%	yes	1.33	0	0	-
n40	MCS 0	98.4%	yes	1.33	0	0	-

Sample Notes

Sample S/N: G54DA5DN000024
Driver: 5.99 RC 188.10
Antenna: Internal

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Antenna Gain Information

Freq	Antenna Gain (dBi) / Chain				BF	MultiChain Legacy	CDD	Sectorized / Xpol	Dir G (PWR)	Dir G (PSD)
	1	2	3	4						
5150-5250	4.1	4.1			No	No	Yes	No	4.1	7.1
5250-5350	4.1	4.1			No	No	Yes	No	4.1	7.1
5470-5725	4.1	4.1			No	No	Yes	No	4.1	7.1
5725-5825	4.1	4.1			No	No	Yes	No	4.1	7.1

For devices that support CDD modes

Min # of spatial streams: 1

Max # of spatial streams: 2

Notes:	BF = beamforming mode supported, Multichain Legacy = 802.11 legacy data rates supported for multichain transmissions, CDD = Cyclic Delay Diversity (or Cyclic Shift Diversity) modes supported, Sectorized / Xpol = antennas are sectorized or cross polarized.
Notes:	Dir G (PWR) = total gain (Gant + Array Gain) for power calculations; GA (PSD) = total gain for PSD calculations based on FCC KDB 662911. Depending on the modes supported, the Array Gain value for power could be different from the PSD value.
Notes:	Array gain for power/psd calculated per DKB 662911 D01, v01r02. Spatial Multiplexing with Nant=4, Nss=2, for worse case condition. Array gain = 10*log(4/2) = 3dB.
Notes:	For systems with Beamforming and CDD, choose one the following options: Option 1: Delays are optimized for beamforming, rather than being selected from cyclic delay table of 802.11; Array gains calculated based on beamforming criteria. Option 2: Antennas are paired for beamforming, and the pairs are configured to use the cyclic delay diversity of 802.11; the array gain associated with beamforming with 2 antennas (3dB), and the array gain associated with CDD with two antennas (3dB for PSD and 0 dB for power)

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

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

Date of Test: 7/13 and 14/2015 Test Location: Lab 4A

Test Engineer: Mehran Birgani EUT Voltage: 120V/60Hz

Note 1:	Output power measured using a spectrum analyzer (see plots below). RBW=1MHz, VB=3 MHz, # of points in sweep ≥ 2*span/RBW, RMS detector, power averaging on (transmitted signal was continuous) and power integration over 50 MHz for 802.11a and n20 modes over 70 MHz for 802.11n40 mode (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
Note 5:	For MIMO systems the total output power and total PSD are calculated form the sum of the powers of the individual chains (in linear terms). The antenna gain used to determine the EIRP and limits for PSD/Output power depends on the operating mode of the MIMO device. If the signals on the non-coherent between the transmit chains then the gain used to determine the limits is the highest gain of the individual chains and the EIRP is the sum of the products of gain and power on each chain. If the signals are coherent then the effective antenna gain is the sum (in linear terms) of the gains for each chain and the EIRP is the product of the effective gain and total power.
Note 6:	PL8200 Grey: Port 1; PL8100 Black: Port 2

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

MIMO Device - 5150-5250 MHz Band - FCC

Mode: 11a

Max EIRP (mW): 134.9

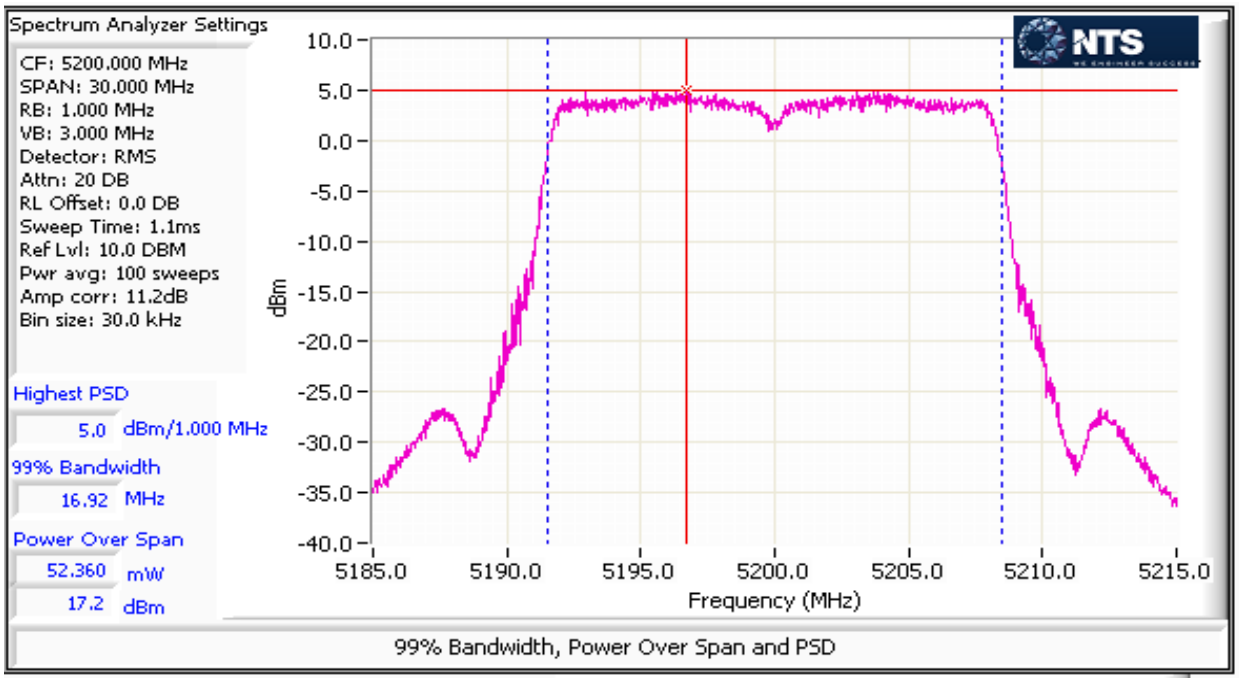
Frequency (MHz)	Chain	Software Setting		Duty Cycle %	Power[1] dBm	Total Power mW	Total Power dBm	FCC Limit dBm	Max Power (W)	Result
5180	1	17		98.4	16.3	42.7	16.3	24.0	0.052	Pass
	3									
	4									
	2									
5200	1	18		98.4	17.2	52.5	17.2	24.0		Pass
	3									
	4									
	2									
5240	1	18		98.4	16.8	47.9	16.8	24.0		Pass
	3									
	4									
	2									

5150-5250 PSD

Mode: 11a

Frequency (MHz)	Chain	Software Setting	99% BW (MHz)	Duty Cycle %	PSD dBm/MHz	Total PSD[1] mW/MHz	Total PSD[1] dBm/MHz	FCC Limit dBm/MHz		Result
5180	1	17	16.9	98.4	4.2	2.6	4.2	11.0		Pass
	3									
	4									
	2									
5200	1	18	16.9	98.4	5.0	3.2	5.0	11.0		Pass
	3									
	4									
	2									
5240	1	18	16.9	98.4	4.6	2.9	4.6	11.0		Pass
	3									
	4									
	2									

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A



EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

MIMO Device - 5150-5250 MHz Band - FCC

Mode: n20 Max EIRP (mW): 374.0

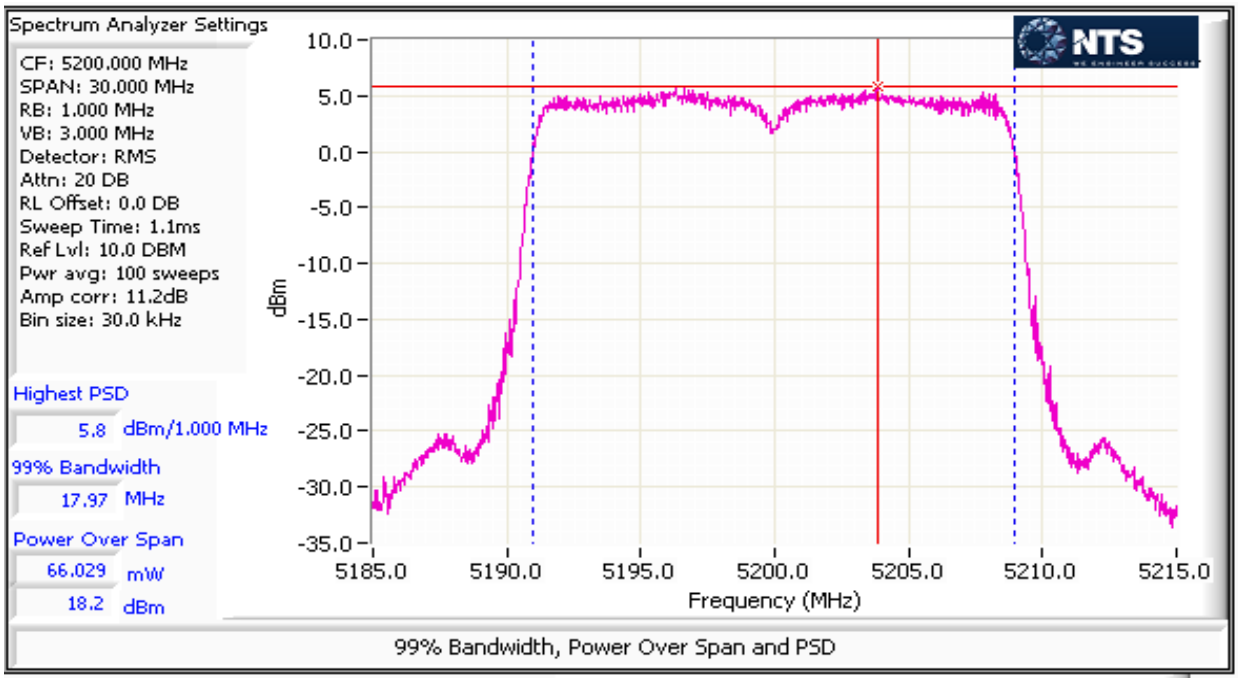
Frequency (MHz)	Chain	Software Setting		Duty Cycle %	Power[1] dBm	Total Power mW	Total Power dBm	FCC Limit dBm	Max Power (W)	Result
5180	1	18		99.2	17.3	121.3	20.8	24.0	0.146	Pass
	3									
	4									
	2				18.3					
5200	1	19		99.2	18.2	145.5	21.6	24.0		Pass
	3									
	4									
	2				19.0					
5240	1	19		99.2	17.7	128.1	21.1	24.0		Pass
	3									
	4									
	2				18.4					

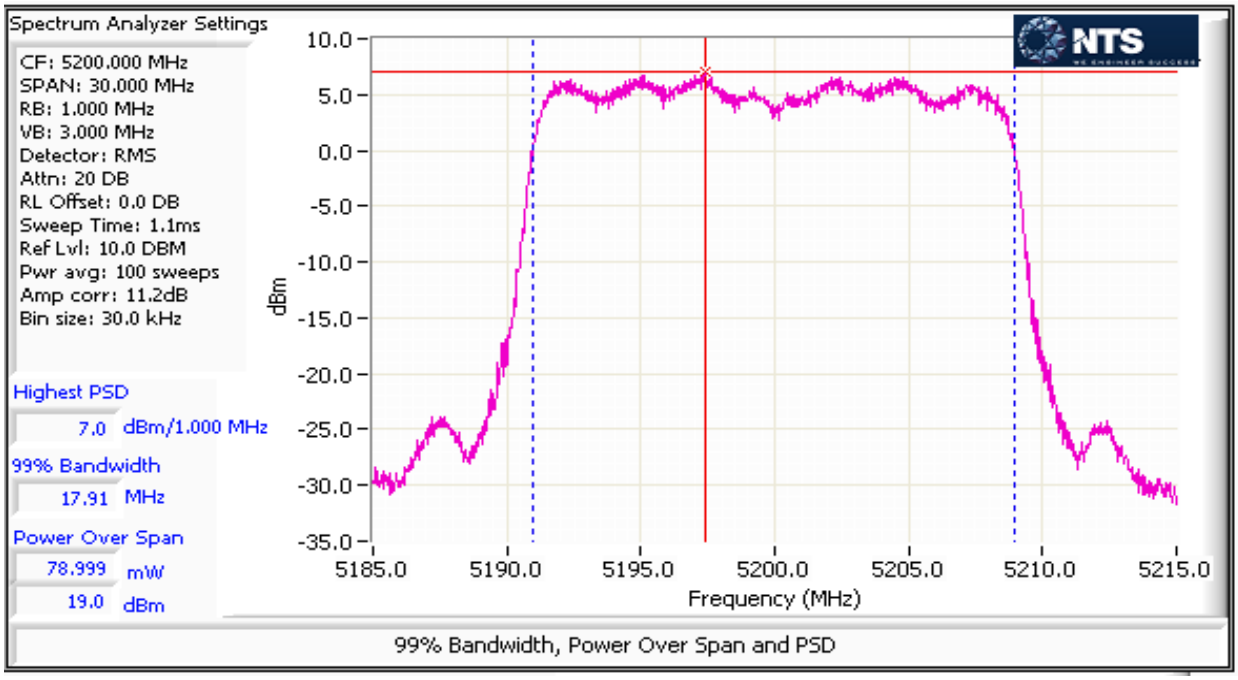
5150-5250 PSD

Mode: n20

Frequency (MHz)	Chain	Software Setting	99% BW (MHz)	Duty Cycle %	PSD dBm/MHz	Total PSD[1] mW/MHz	Total PSD[1] dBm/MHz	FCC Limit dBm/MHz		Result
5180	1	18	18.0	99.2	4.7	7.2	8.6	9.9		Pass
	3									
	4									
	2				6.3					
5200	1	19	18.0	99.2	5.8	8.8	9.5	9.9		Pass
	3									
	4									
	2				7.0					
5240	1	19	18.0	99.2	5.2	7.6	8.8	9.9		Pass
	3									
	4									
	2				6.3					

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A





EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

MIMO Device - 5150-5250 MHz Band - FCC

Mode: n40 Max EIRP (mW): 430.4

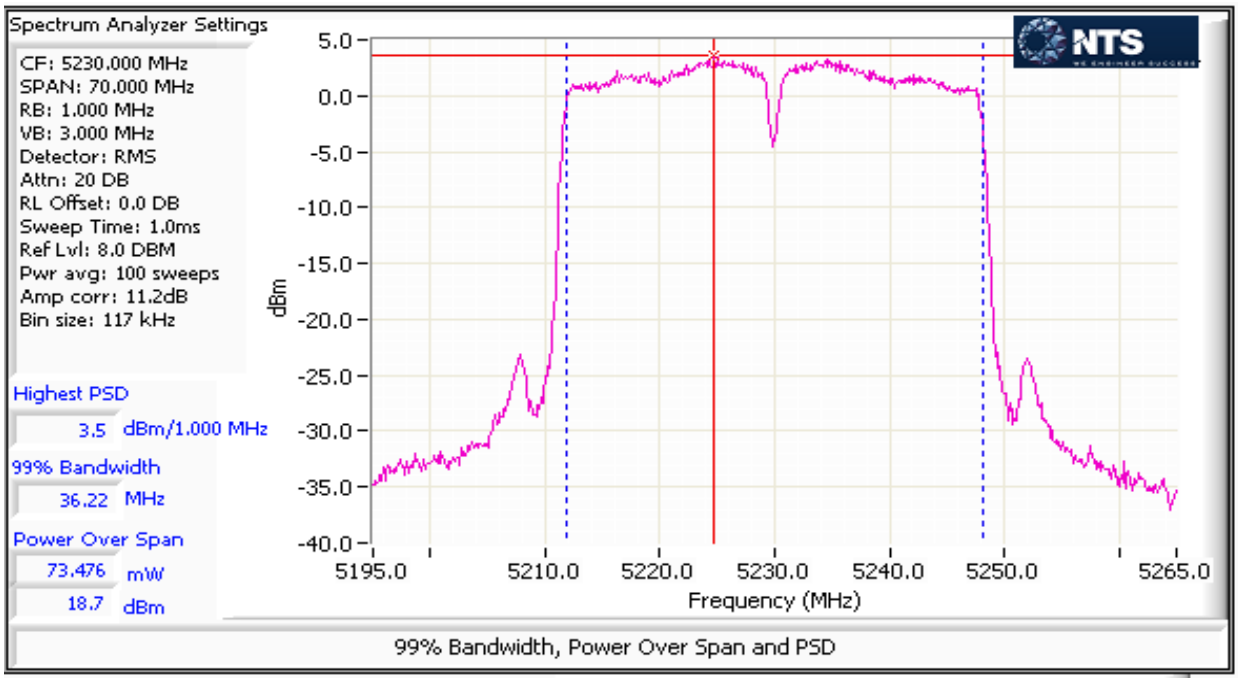
Frequency (MHz)	Chain	Software Setting		Duty Cycle %	Power dBm	Total Power[1] mW	Total Power[1] dBm	FCC Limit dBm	Max Power (W)	Result
5190	1	16		98.4	15.1	77.0	18.9	24.0	0.167	Pass
	3									
	4									
	2				16.5					
5230	1	20		98.4	18.7	167.5	22.2	24.0		Pass
	3									
	4									
	2				19.7					

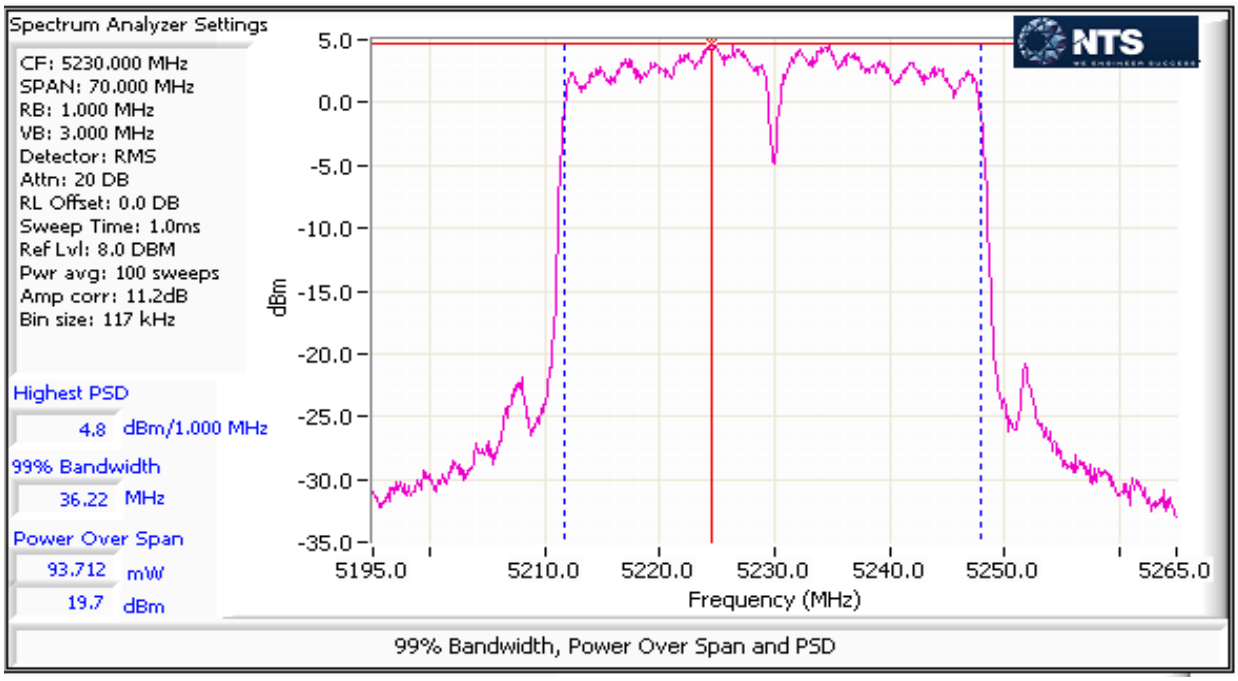
5150-5250 PSD

Mode: n40

Frequency (MHz)	Chain	Software Setting	99% BW (MHz)	Duty Cycle %	PSD dBm/MHz	Total PSD[1] mW/MHz	Total PSD[1] dBm/MHz	FCC Limit dBm/MHz		Result
5190	1	16	36.2	98.4	-0.2	2.4	3.9	9.9		Pass
	3									
	4									
	2				1.7					
5230	1	20	36.2	98.4	3.5	5.3	7.2	9.9		Pass
	3									
	4									
	2				4.8					

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A





EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

MIMO Device - 5250-5350 MHz Band - FCC

Mode: 11a

Max EIRP (mW): 204.2

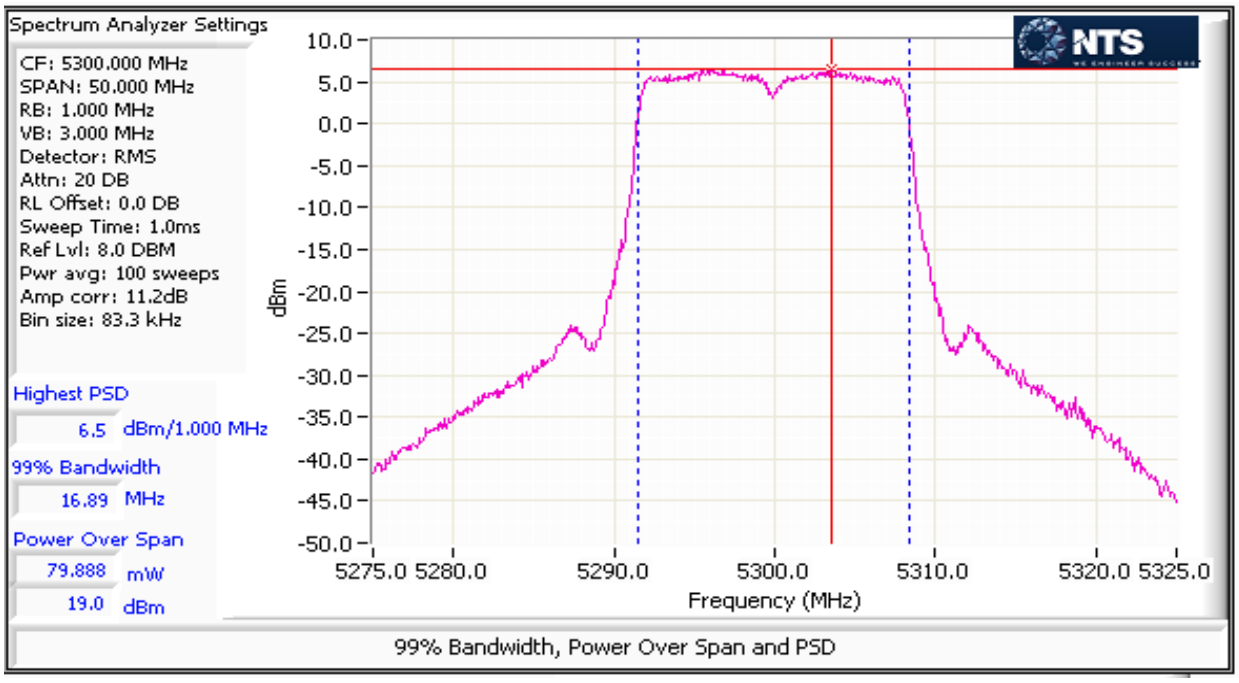
Frequency (MHz)	Chain	Software Setting	26dB BW (MHz)	Duty Cycle %	Power dBm	Total Power[1] mW	Total Power[1] dBm	FCC Limit dBm	Max Power (W)	Result
5260	1	20	21.5	98.4	18.7	74.1	18.7	24.0	0.079	Pass
	3									
	4									
	2									
5300	1	20	21.2	98.4	19.0	79.4	19.0	24.0		Pass
	3									
	4									
	2									
5320	1	18	20.6	98.4	17.3	53.7	17.3	24.0		Pass
	3									
	4									
	2									

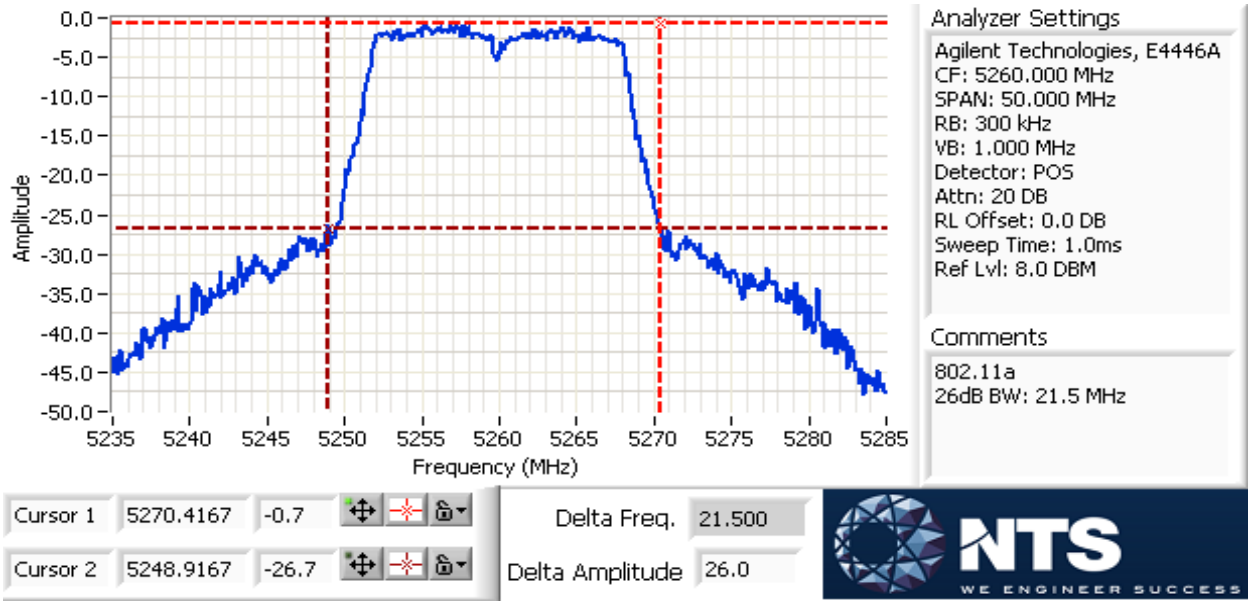
5250-5350 PSD

Mode: 11a

Frequency (MHz)	Chain	Software Setting	99% BW (MHz)	Duty Cycle %	PSD dBm/MHz	Total PSD[1] mW/MHz	Total PSD[1] dBm/MHz	FCC Limit dBm/MHz		Result
5260	1	20	16.9	98.4	6.9	4.9	6.9	9.9		Pass
	3									
	4									
	2									
5300	1	20	16.9	98.4	6.5	4.5	6.5	9.9		Pass
	3									
	4									
	2									
5320	1	18	16.9	98.4	4.8	3.0	4.8	9.9		Pass
	3									
	4									
	2									

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A





EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

MIMO Device - 5250-5350 MHz Band - FCC

Mode: n20 Max EIRP (mW): 368.4

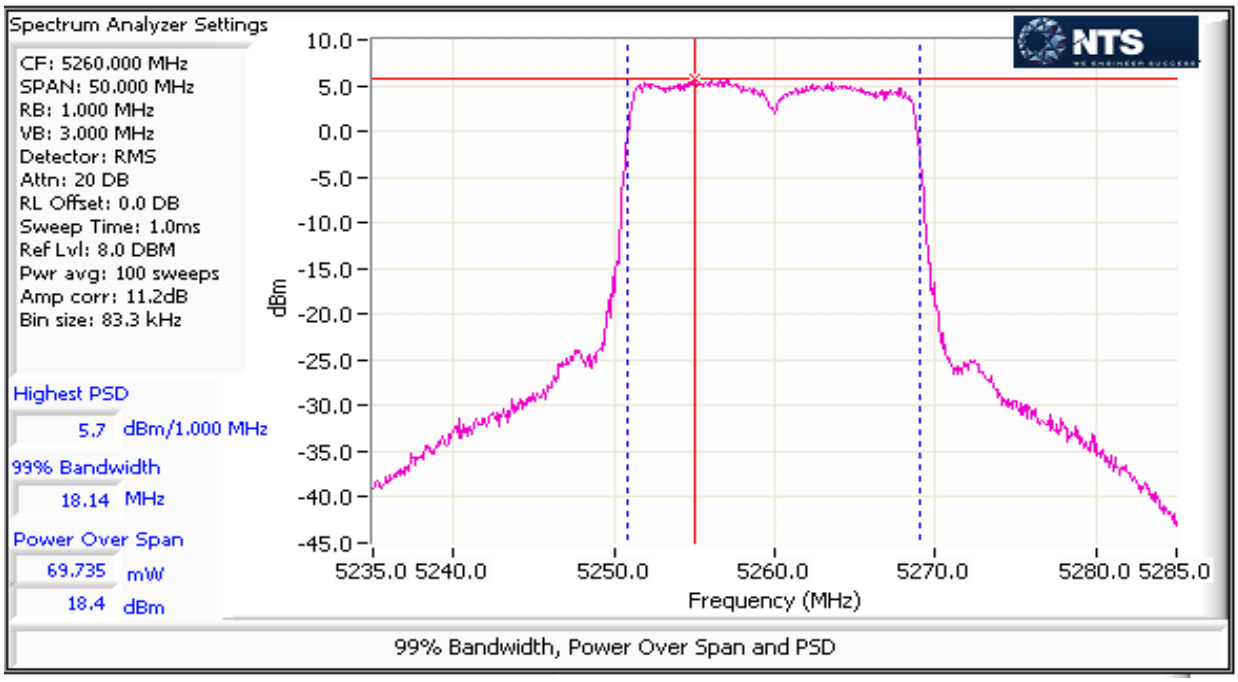
Frequency (MHz)	Chain	Software Setting	26dB BW (MHz)	Duty Cycle %	Power dBm	Total Power[1] mW	Total Power[1] dBm	FCC Limit dBm	Max Power (W)	Result
5260	1	20	24.0	99.2	18.4	143.3	21.6	24.0	0.143	Pass
	3									
	4									
	2				18.7					
5300	1	20	21.9	99.2	18.6	132.7	21.2	24.0		Pass
	3									
	4									
	2				17.8					
5320	1	20	22.5	99.2	17.9	123.3	20.9	24.0		Pass
	3									
	4									
	2				17.9					

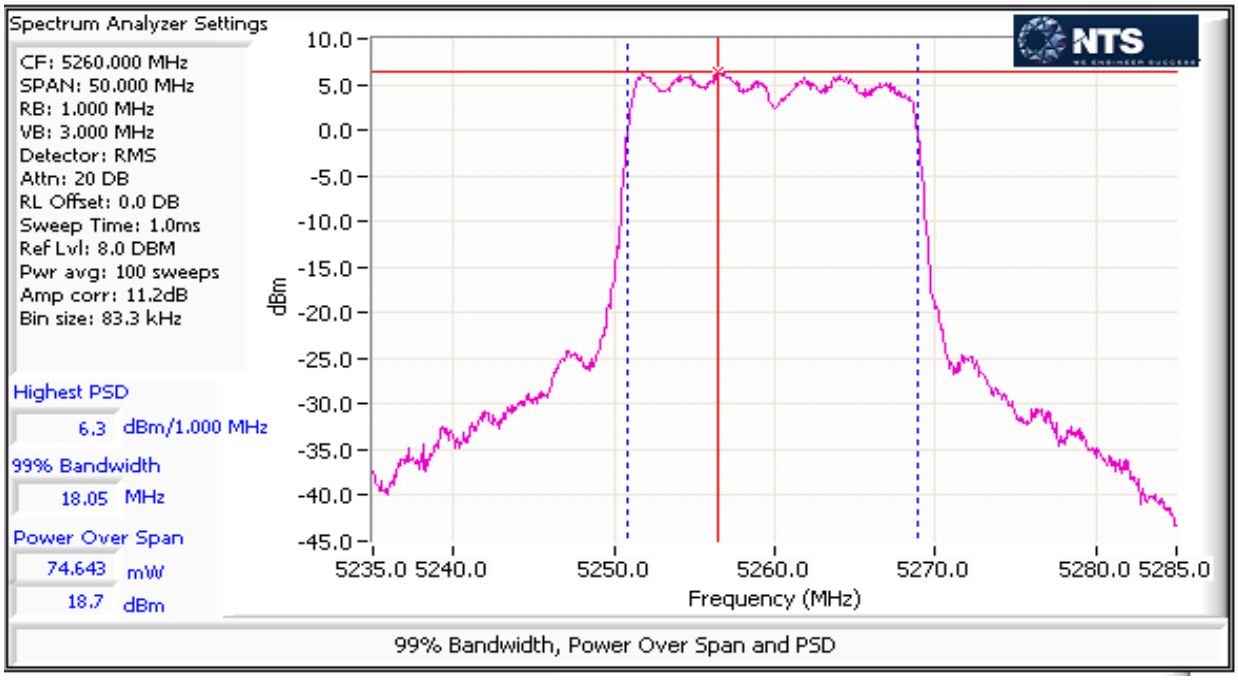
5250-5350 PSD

Mode: n20

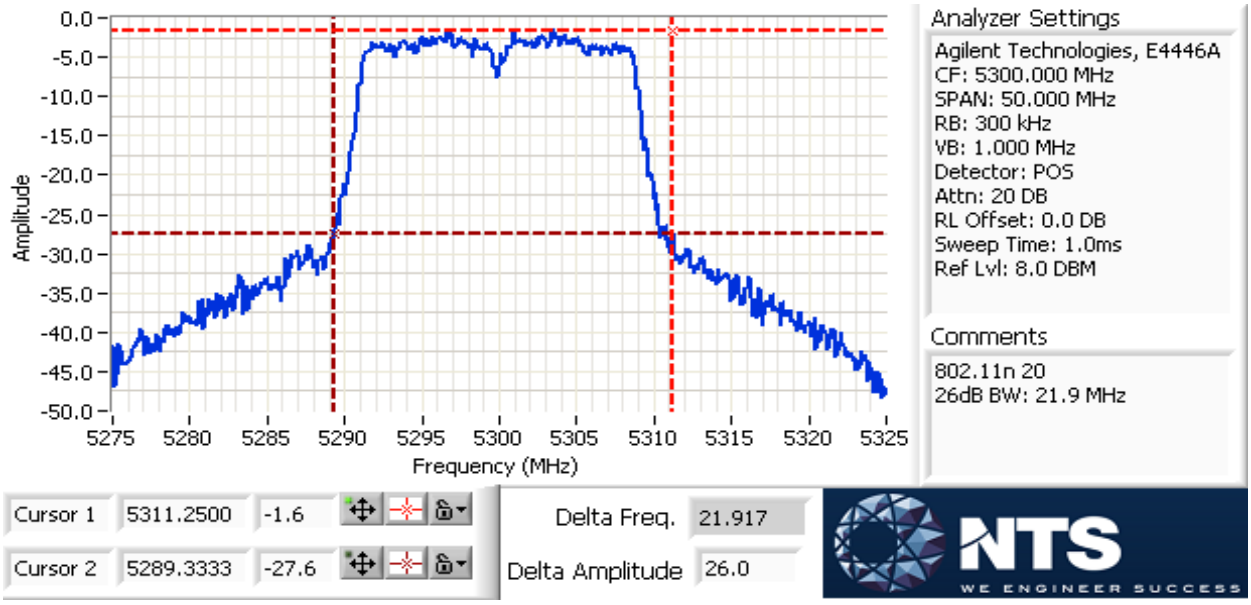
Frequency (MHz)	Chain	Software Setting	99% BW (MHz)	Duty Cycle %	PSD dBm/MHz	Total PSD[1] mW/MHz	Total PSD[1] dBm/MHz	FCC Limit dBm/MHz		Result
5260	1	20	18.1	99.2	5.7	8.0	9.0	9.9		Pass
	3									
	4									
	2				6.3					
5300	1	20	18.0	99.2	5.7	7.0	8.5	9.9		Pass
	3									
	4									
	2				5.2					
5320	1	20	18.1	99.2	5.0	6.6	8.2	9.9		Pass
	3									
	4									
	2				5.4					

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A





Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A



EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

MIMO Device - 5250-5350 MHz Band - FCC

Mode: n40 Max EIRP (mW): 343.8

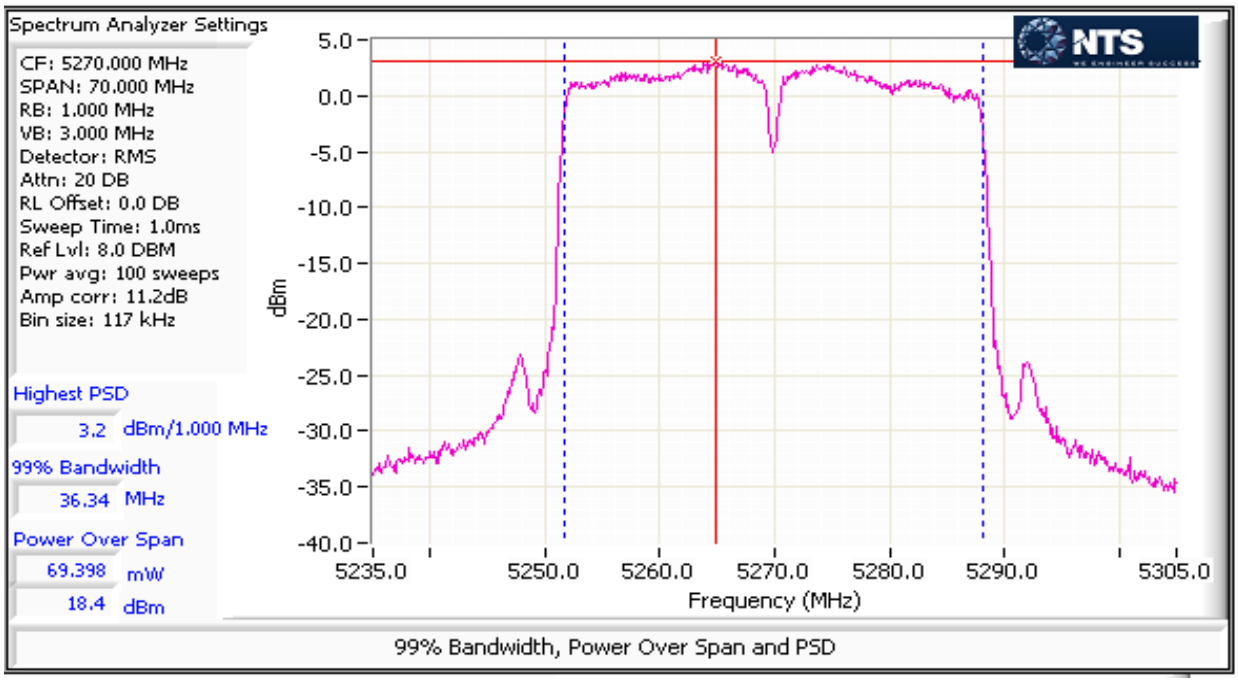
Frequency (MHz)	Chain	Software Setting	26dB BW (MHz)	Duty Cycle %	Power dBm	Total Power[1] mW	Total Power[1] dBm	FCC Limit dBm	Max Power (W)	Result
5270	1	20	46.4	98.4	18.4	133.7	21.3	24.0	0.134	Pass
	3									
	4									
	2				18.1					
5310	1	18	43.3	98.4	16.9	96.8	19.9	24.0		Pass
	3									
	4									
	2				16.8					

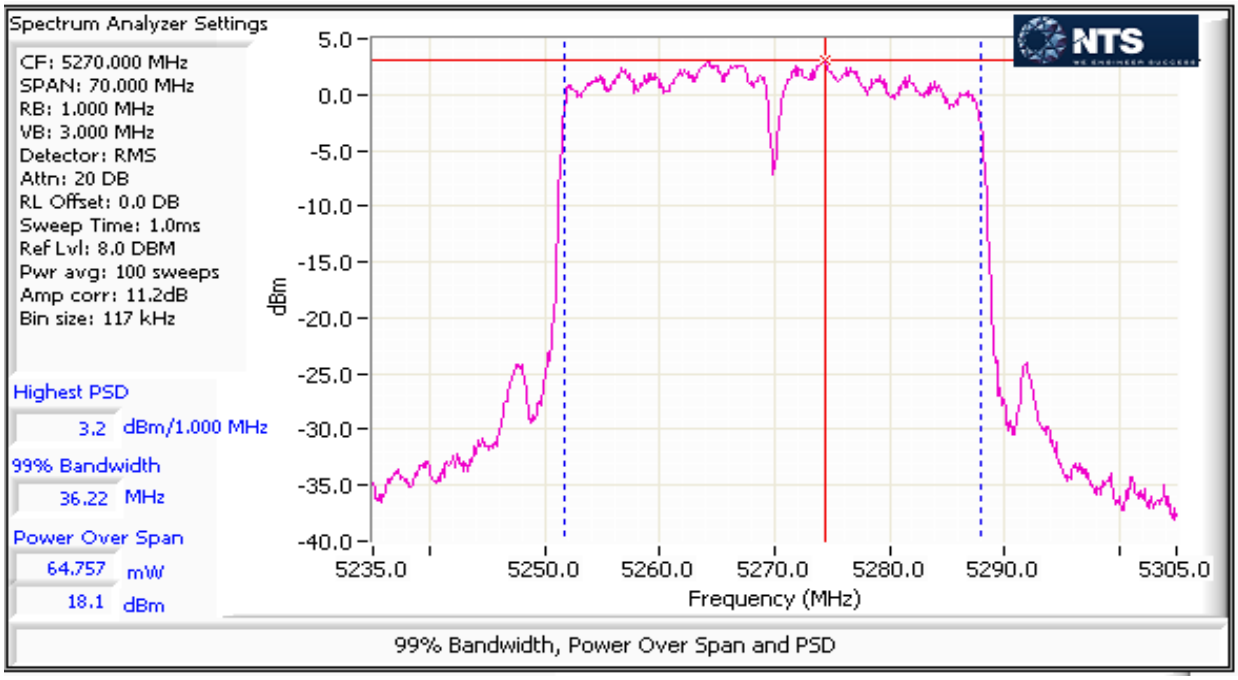
MIMO Device 5250-5350 PSD

Mode: n40

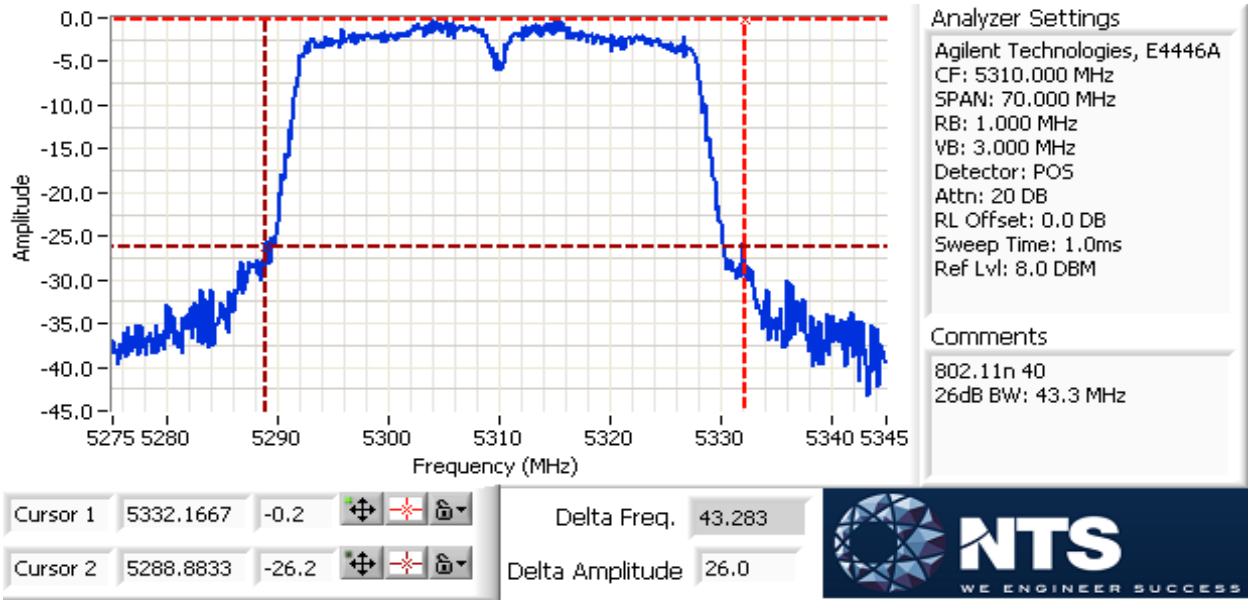
Frequency (MHz)	Chain	Software Setting	99% BW (MHz)	Duty Cycle %	PSD dBm/MHz	Total PSD[1] mW/MHz	Total PSD[1] dBm/MHz	FCC Limit dBm/MHz		Result
5270	1	20	36.3	98.4	3.2	4.2	6.2	9.9		Pass
	3									
	4									
	2				3.2					
5310	1	18	36.2	98.4	1.6	3.0	4.8	9.9		Pass
	3									
	4									
	2				1.9					

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A





Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A



EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

MIMO Device - 5470-5725 MHz Band - FCC

Mode: 11a

Max EIRP (mW): 218.8

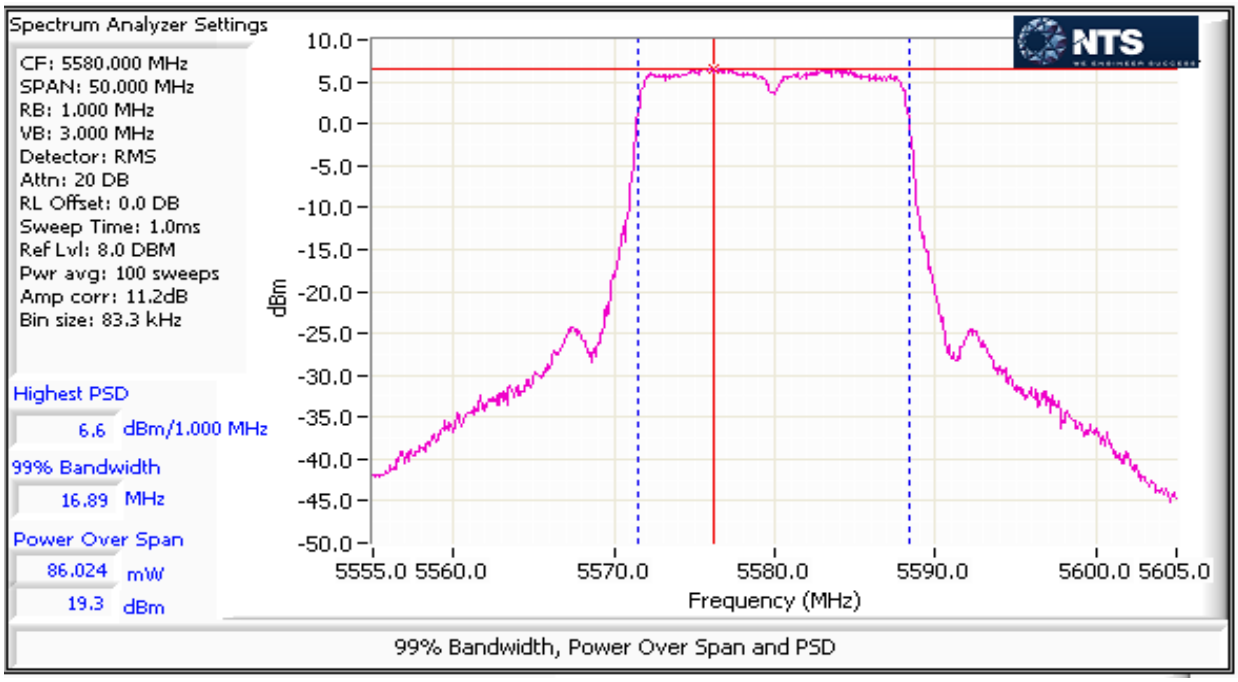
Frequency (MHz)	Chain	Software Setting	26dB BW (MHz)	Duty Cycle %	Power dBm	Total Power[1] mW	Total Power[1] dBm	FCC Limit dBm	Max Power (W)	Result
5500	1	20	20.5	98.4	19.0	79.4	19.0	24.0	0.085	Pass
	3									
	4									
	2									
5580	1	20	20.7	98.4	19.3	85.1	19.3	24.0		Pass
	3									
	4									
	2									
5700	1	19	20.5	98.4	18.5	70.8	18.5	24.0		Pass
	3									
	4									
	2									

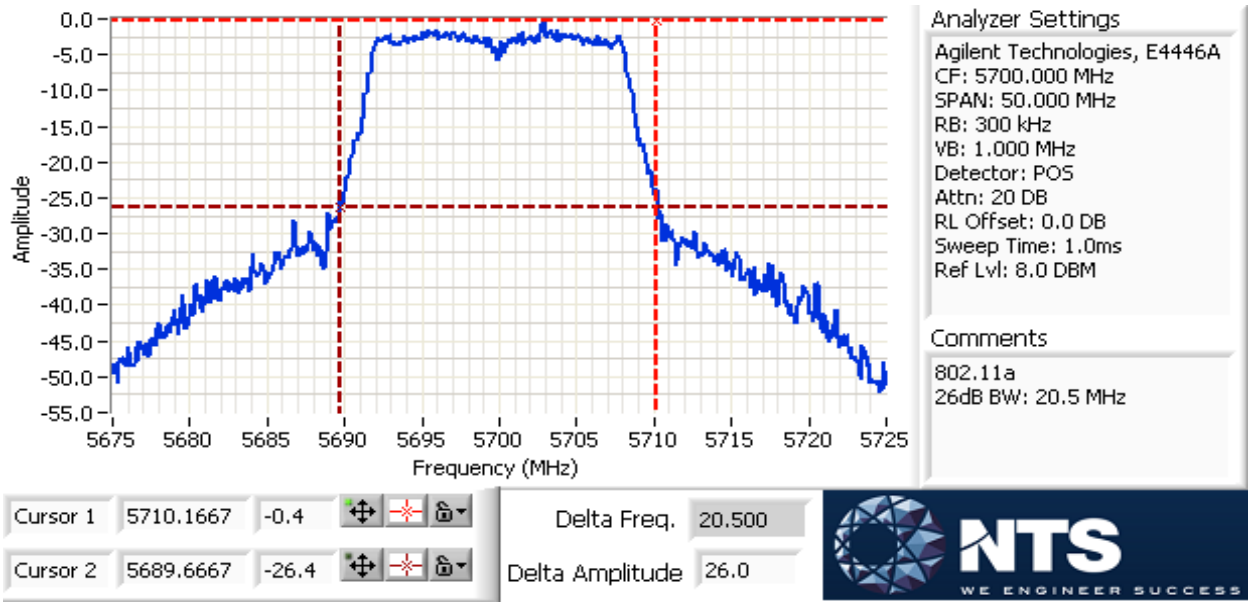
5470-5700 PSD

Mode: 11a

Frequency (MHz)	Chain	Software Setting	99% BW (MHz)	Duty Cycle %	PSD dBm/MHz	Total PSD[1] mW/MHz	Total PSD[1] dBm/MHz	FCC Limit dBm/MHz		Result
5500	1	20	16.9	98.4	6.5	4.5	6.5	9.9		Pass
	3									
	4									
	2									
5580	1	20	16.9	98.4	6.6	4.6	6.6	9.9		Pass
	3									
	4									
	2									
5700	1	19	16.9	98.4	5.9	3.9	5.9	9.9		Pass
	3									
	4									
	2									

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A





EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

MIMO Device - 5470-5725 MHz Band - FCC

Mode: n20 Max EIRP (mW): 428.0

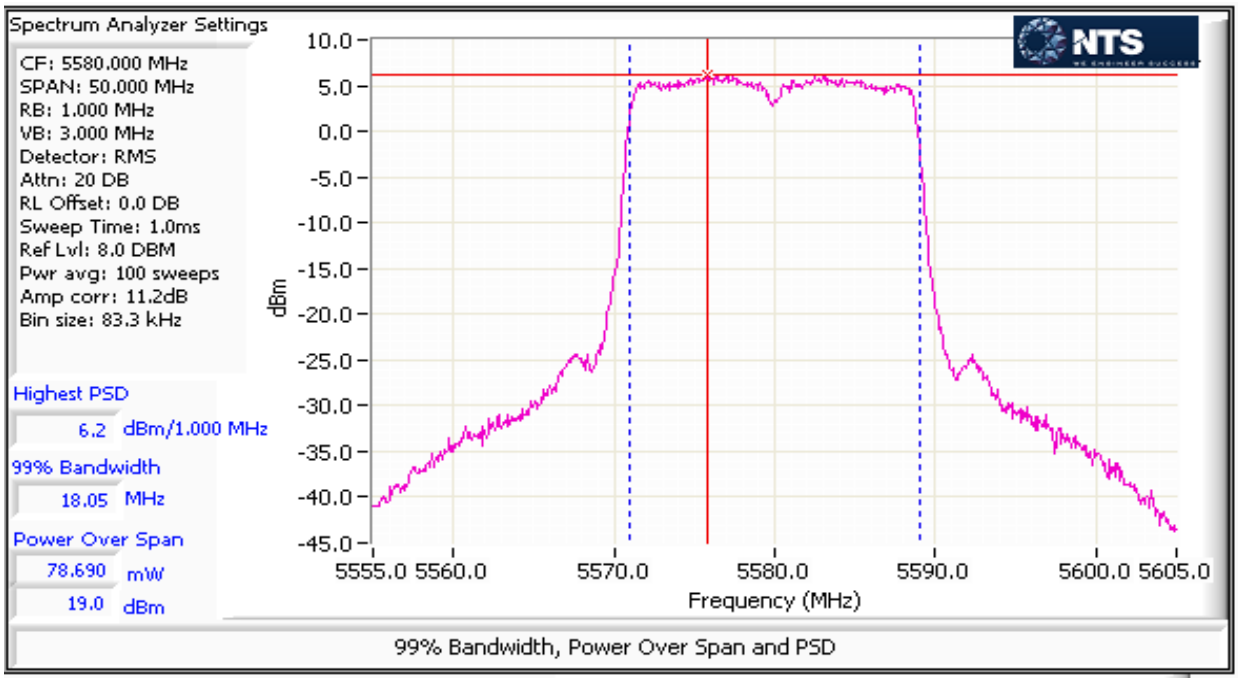
Frequency (MHz)	Chain	Software Setting	26dB BW (MHz)	Duty Cycle %	Power dBm	Total Power[1] mW	Total Power[1] dBm	FCC Limit dBm	Max Power (W)	Result
5500	1	20	20.7	99.2	17.2	128.3	21.1	24.0	0.167	Pass
	3									
	4									
	2				18.8					
5580	1	20	20.7	99.2	19.0	166.5	22.2	24.0		Pass
	3									
	4									
	2				19.4					
5700	1	19	20.7	99.2	18.4	138.4	21.4	24.0		Pass
	3									
	4									
	2				18.4					

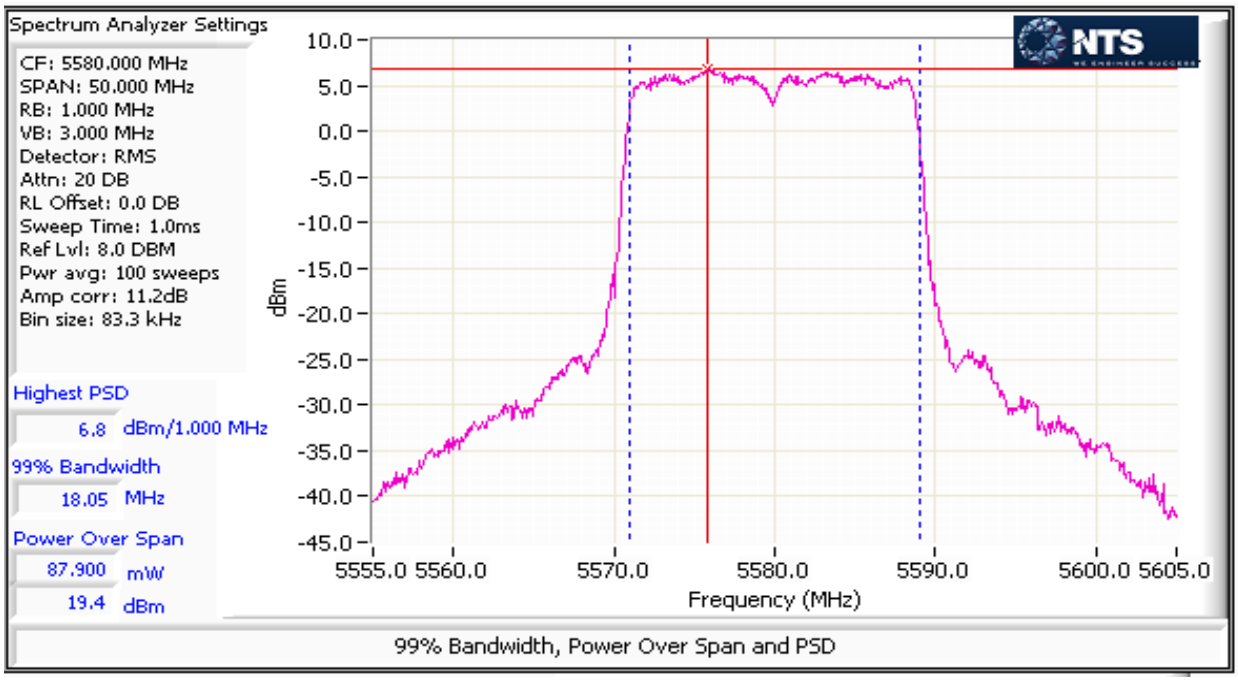
5470-5725 PSD

Mode: n20

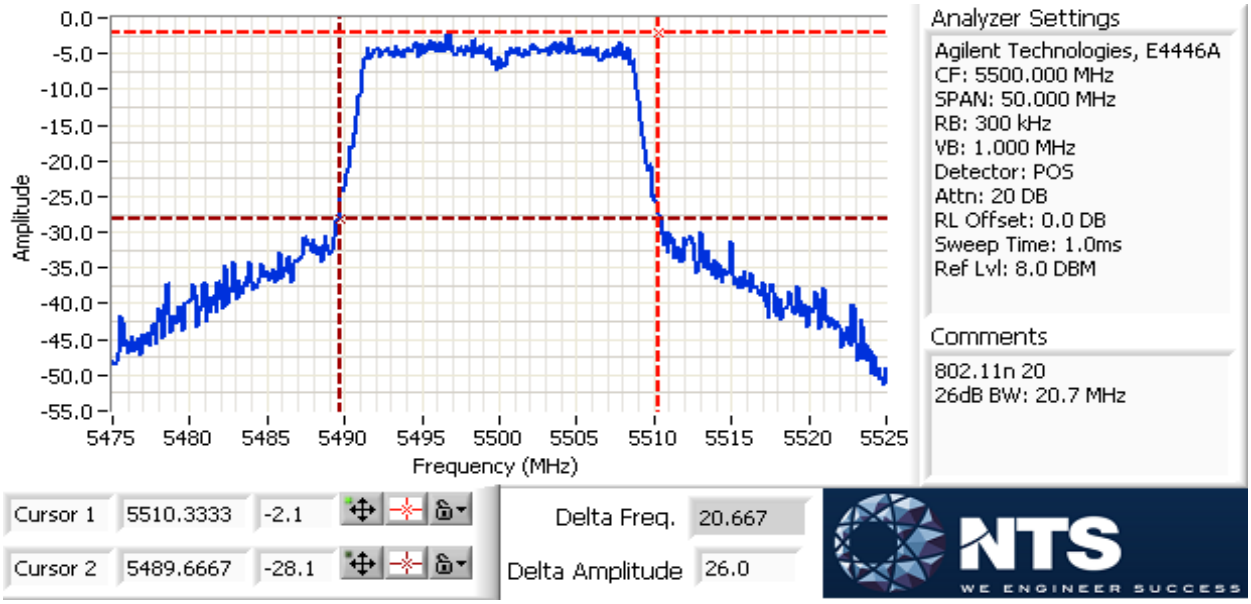
Frequency (MHz)	Chain	Software Setting	99% BW (MHz)	Duty Cycle %	PSD dBm/MHz	Total PSD[1] mW/MHz	Total PSD[1] dBm/MHz	FCC Limit dBm/MHz		Result
5500	1	20	18.1	99.2	4.3	6.9	8.4	9.9		Pass
	3									
	4									
	2				6.2					
5580	1	20	18.1	99.2	6.2	9.0	9.5	9.9		Pass
	3									
	4									
	2				6.8					
5700	1	19	18.1	99.2	5.6	7.3	8.7	9.9		Pass
	3									
	4									
	2				5.7					

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A





Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A



EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

MIMO Device - 5470-5725 MHz Band - FCC

Mode: n40 Max EIRP (mW): 403.9

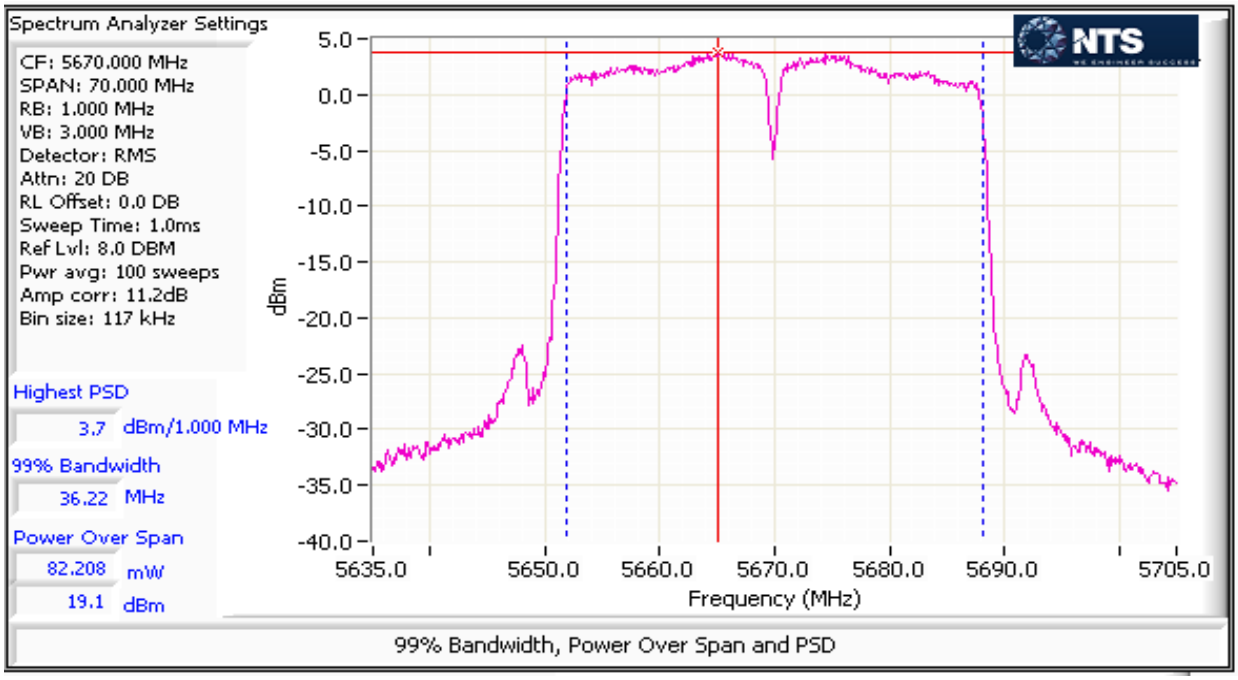
Frequency (MHz)	Chain	Software Setting	26dB BW (MHz)	Duty Cycle %	Power dBm	Total Power[1] mW	Total Power[1] dBm	FCC Limit dBm	Max Power (W)	Result
5510	1	17	41.3	98.4	15.8	69.6	18.4	24.0	0.157	Pass
	3									
	4									
	2				15.0					
5550	1	20	42.7	98.4	19.0	144.0	21.6	24.0		Pass
	3									
	4									
	2				18.1					
5670	1	20	44.6	98.4	19.1	157.1	22.0	24.0		Pass
	3									
	4									
	2				18.8					

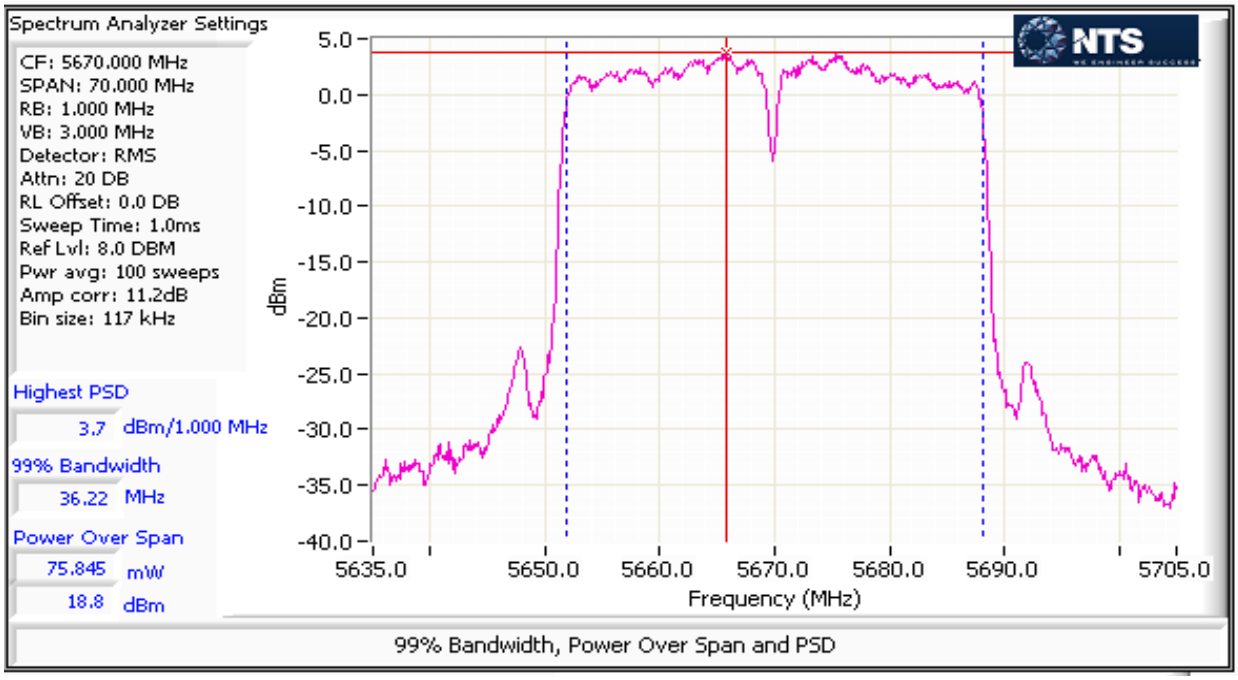
MIMO Device 5470-5725 PSD

Mode: n40

Frequency (MHz)	Chain	Software Setting	99% BW (MHz)	Duty Cycle %	PSD dBm/MHz	Total PSD[1] mW/MHz	Total PSD[1] dBm/MHz	FCC Limit dBm/MHz		Result
5510	1	17	36.2	98.4	0.4	2.1	3.1	9.9		Pass
	3									
	4									
	2				-0.2					
5550	1	20	36.2	98.4	3.6	4.2	6.2	9.9		Pass
	3									
	4									
	2				2.8					
5670	1	20	36.2	98.4	3.7	4.7	6.7	9.9		Pass
	3									
	4									
	2				3.7					

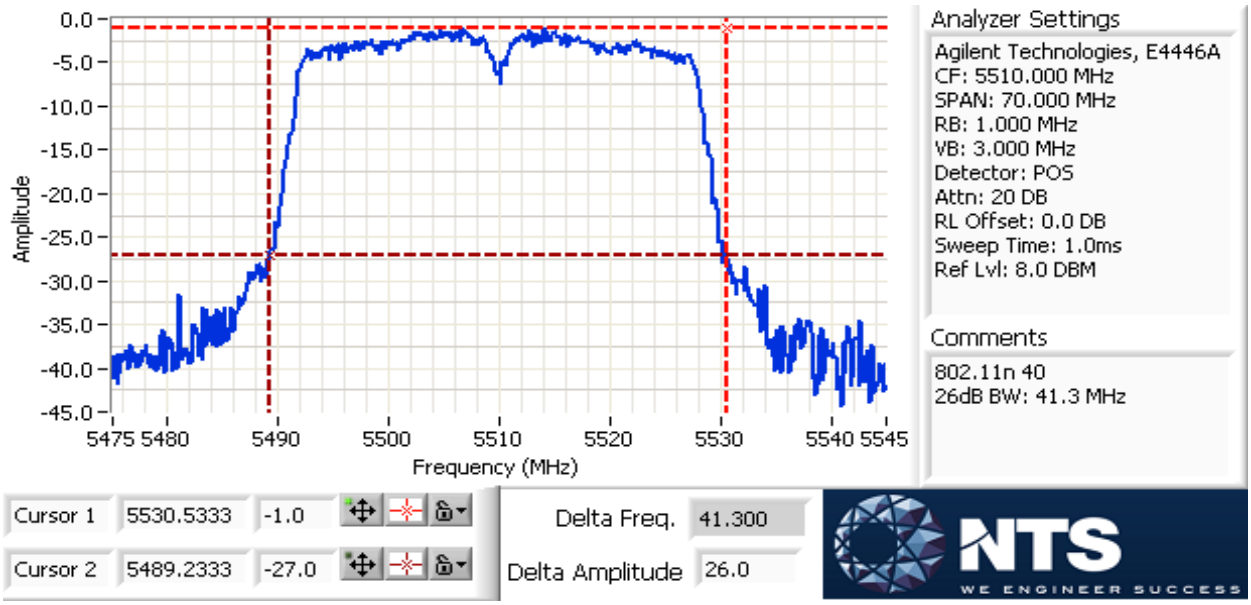
Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A





EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A



EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

MIMO Device - 5725-5850 MHz Band - FCC

Mode: 11a

Max EIRP (mW): 199.5

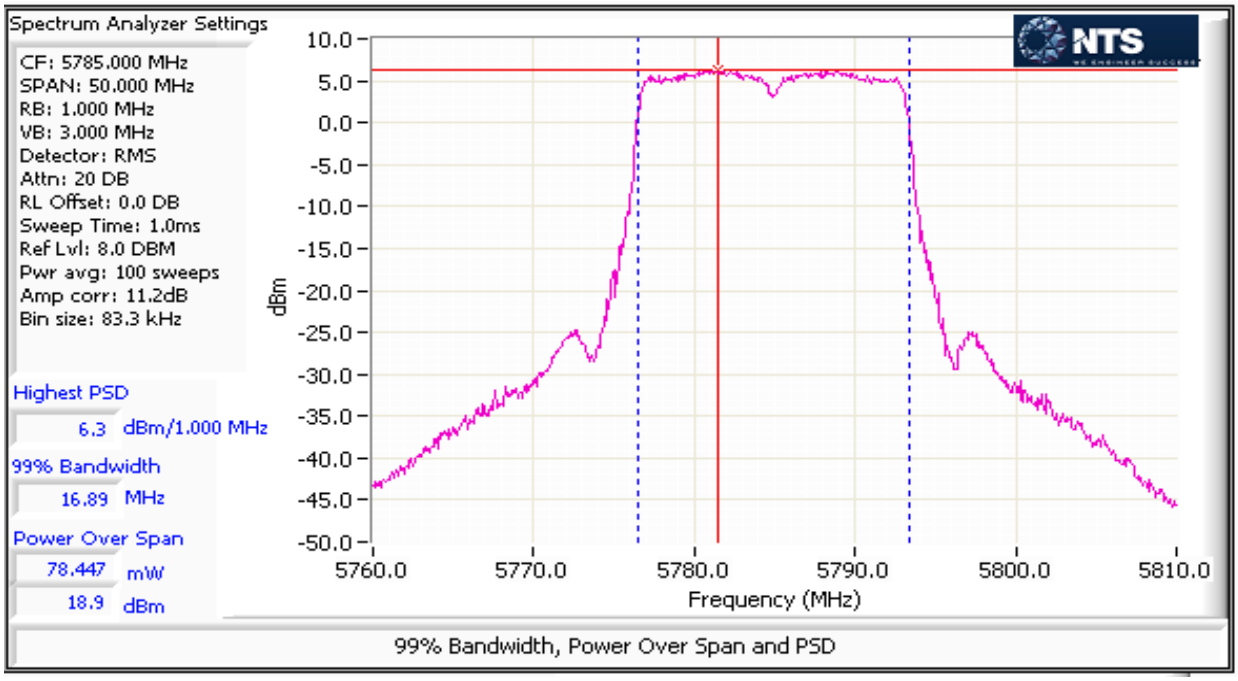
Frequency (MHz)	Chain	Software Setting		Duty Cycle %	Power dBm	Total Power[1] mW	Total Power[1] dBm	FCC Limit dBm	Max Power (W)	Result
5745	1 3 4 2	16		98.4	14.7	29.5	14.7	30.0	0.078	Pass
5785	1 3 4 2	20		98.4	18.9	77.6	18.9	30.0		Pass
5825	1 3 4 2	19		98.4	17.6	57.5	17.6	30.0		Pass

5725-5850 PSD

Mode: 11a

Frequency (MHz)	Chain	Software Setting	99% BW (MHz)	Duty Cycle %	PSD dBm/MHz	Total PSD[1] mW/MHz	Total PSD[1] dBm/MHz	FCC Limit dBm/500kHz		Result
5745	1 3 4 2	16	16.9	98.4	2.1	1.6	2.1	30.0		Pass
5785	1 3 4 2	20	16.9	98.4	6.3	4.3	6.3	30.0		Pass
5825	1 3 4 2	19	17.0	98.4	5.0	3.2	5.0	30.0		Pass

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A



EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

MIMO Device - 5725-5850 MHz Band - FCC

Mode: n20 Max EIRP (mW): 408.3

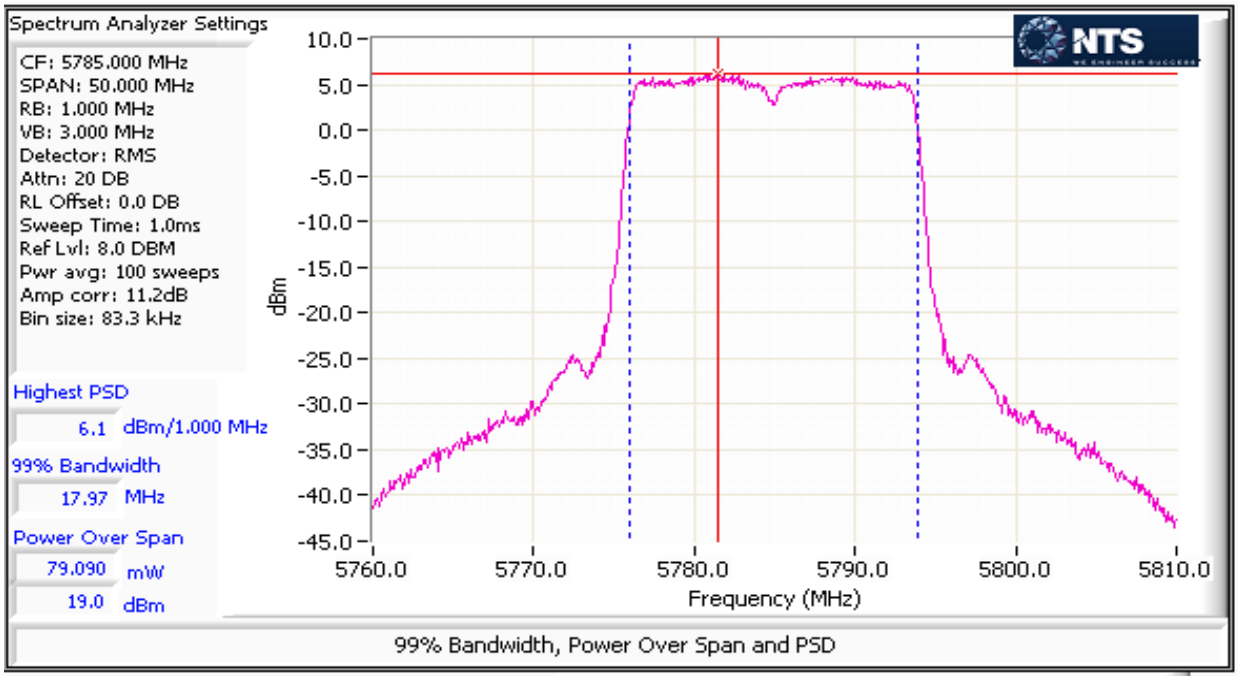
Frequency (MHz)	Chain	Software Setting		Duty Cycle %	Power dBm	Total Power[1] mW	Total Power[1] dBm	FCC Limit dBm	Max Power (W)	Result
5745	1	16		99.2	14.7	57.7	17.6	30.0	0.159	Pass
	3									
	4									
	2				14.5					
5785	1	20		99.2	19.0	158.9	22.0	30.0		Pass
	3									
	4									
	2				19.0					
5825	1	19		99.2	17.6	115.1	20.6	30.0		Pass
	3									
	4									
	2				17.6					

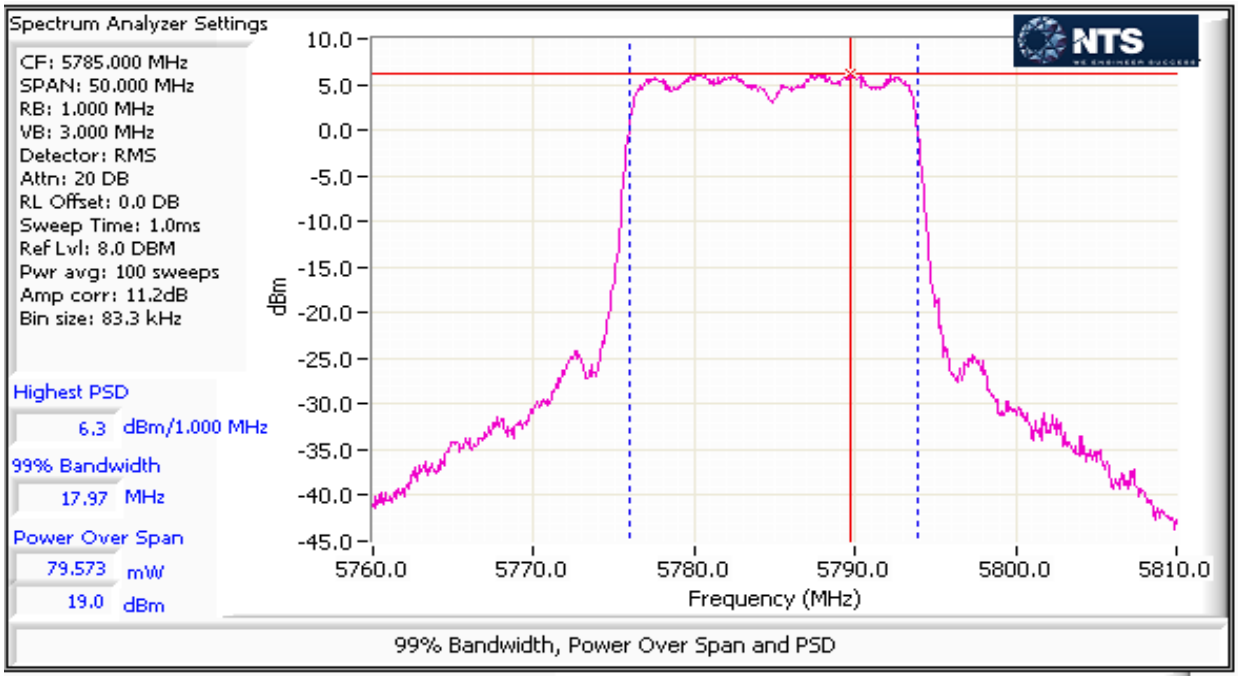
5725-5850 PSD

Mode: n20

Frequency (MHz)	Chain	Software Setting	99% BW (MHz)	Duty Cycle %	PSD dBm/MHz	Total PSD[1] mW/MHz	Total PSD[1] dBm/MHz	FCC Limit dBm/500kHz		Result
5745	1	16	18.0	99.2	1.9	3.0	4.8	28.9		Pass
	3									
	4									
	2				1.7					
5785	1	20	18.0	99.2	6.1	8.3	9.2	28.9		Pass
	3									
	4									
	2				6.3					
5825	1	19	18.0	99.2	4.8	6.3	8.0	28.9		Pass
	3									
	4									
	2				5.1					

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A





EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

MIMO Device - 5725-5850 MHz Band - FCC

Mode: n40 Max EIRP (mW): 377.0

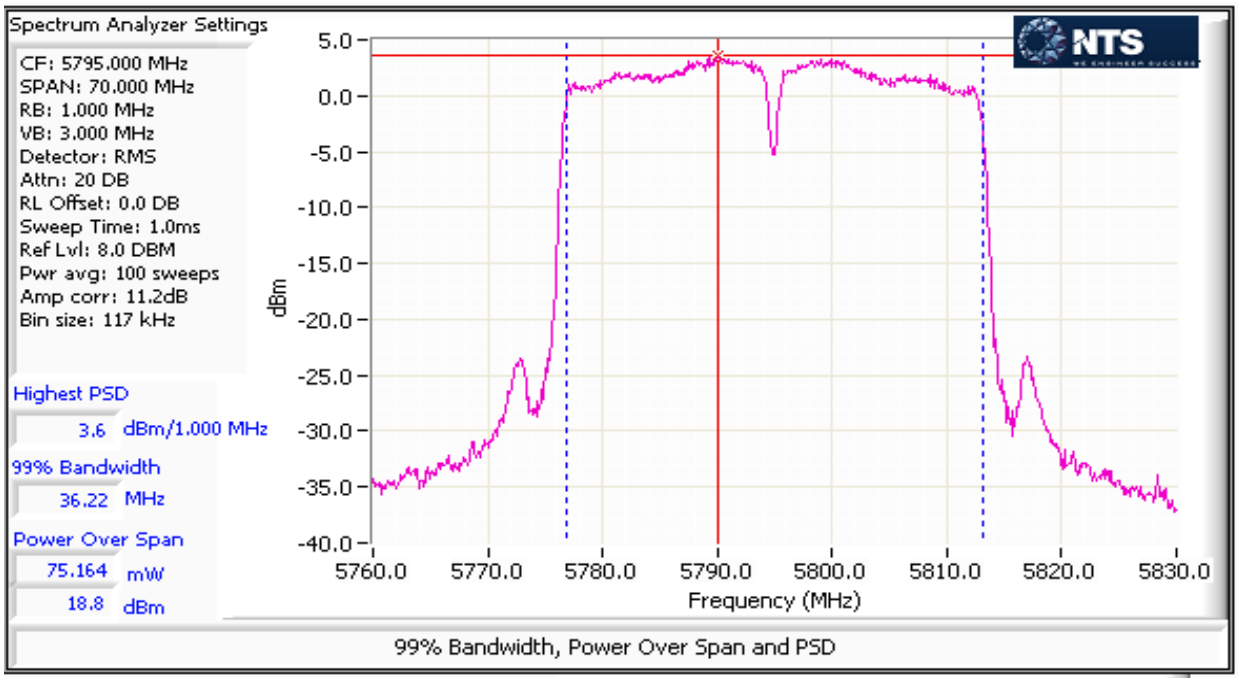
Frequency (MHz)	Chain	Software Setting		Duty Cycle %	Power dBm	Total Power[1] mW	Total Power[1] dBm	FCC Limit dBm	Max Power (W)	Result
5755	1	15		98.4	13.7	45.3	16.6	30.0	0.147	Pass
	3									
	4									
	2				13.4					
5795	1	20		98.4	18.8	146.7	21.7	30.0		Pass
	3									
	4									
	2				18.5					

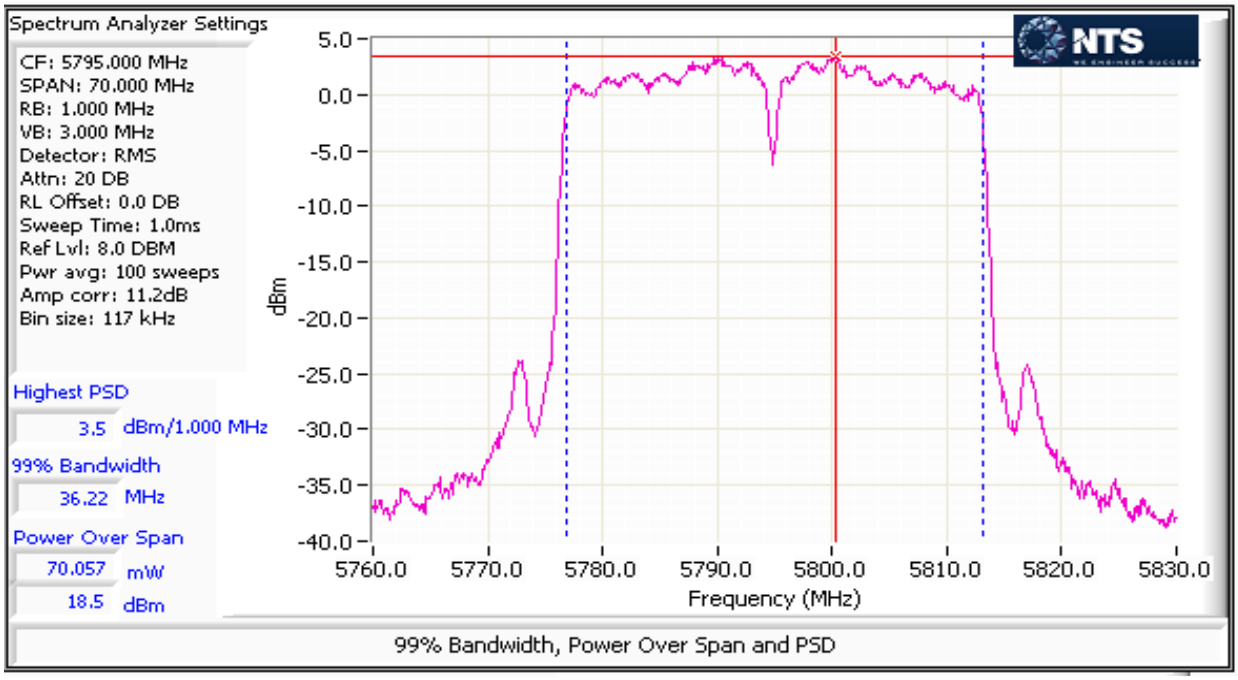
5725-5850 PSD

Mode: n40

Frequency (MHz)	Chain	Software Setting	99% BW (MHz)	Duty Cycle %	PSD dBm/MHz	Total PSD[1] mW/MHz	Total PSD[1] dBm/MHz	FCC Limit dBm/500kHz		Result
5755	1	15	36.2	98.4	-1.7	1.4	1.4	28.9		Pass
	3									
	4									
	2				-1.6					
5795	1	20	36.2	98.4	3.6	4.5	6.6	28.9		Pass
	3									
	4									
	2				3.5					

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A





EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #2: - Signal Bandwidth (5725-5850 MHz)

Mode: 11a

Power Setting	Frequency (MHz)	Bandwidth (MHz) 6dB		RBW Setting 6dB	
20	5785	16.4		100 kHz	

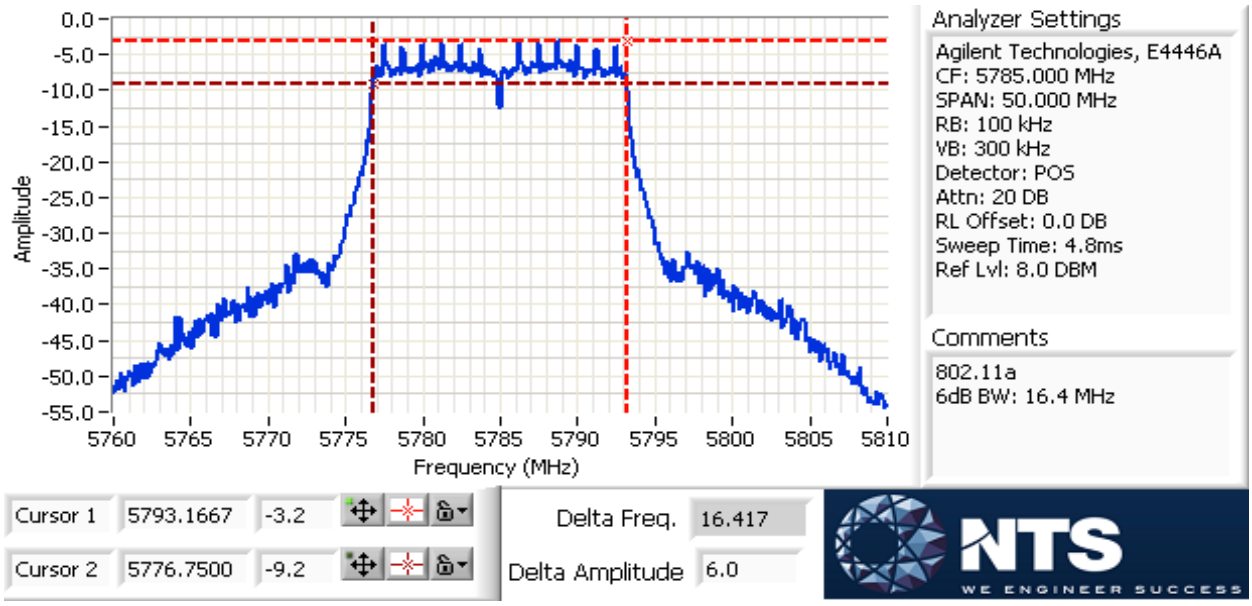
Mode: n20

Power Setting	Frequency (MHz)	Bandwidth (MHz) 6dB		RBW Setting 6dB	
20	5785	17.6		100 kHz	

Mode: n40

Power Setting	Frequency (MHz)	Bandwidth (MHz) 6dB		RBW Setting 6dB	
20	5795	35.1		100 kHz	

Note 1:	DTS BW: RBW=100kHz, VBW ≥ 3*RBW, peak detector, max hold, auto sweep time.
Note 2:	Measurements performed on chain 0



EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Conducted Emissions

(NTS Silicon Valley, 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: 7/8/2015
Test Engineer: Joseph Cadigal
Test Location: FT Chamber#3

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

General Test Configuration

For tabletop equipment, 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. A second LISN was used for all local support equipment. Remote support equipment was located outside of the semi-anechoic chamber. Any cables running to remote support equipment where routed through metal conduit and when possible passed through a ferrite clamp upon exiting the chamber.

Ambient Conditions:

Temperature: 25 °C
Rel. Humidity: 31 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, AC Power,120V/60Hz	FCC 15.209	Pass	46.1 dBµV @ 0.443 MHz (-0.9 dB)

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

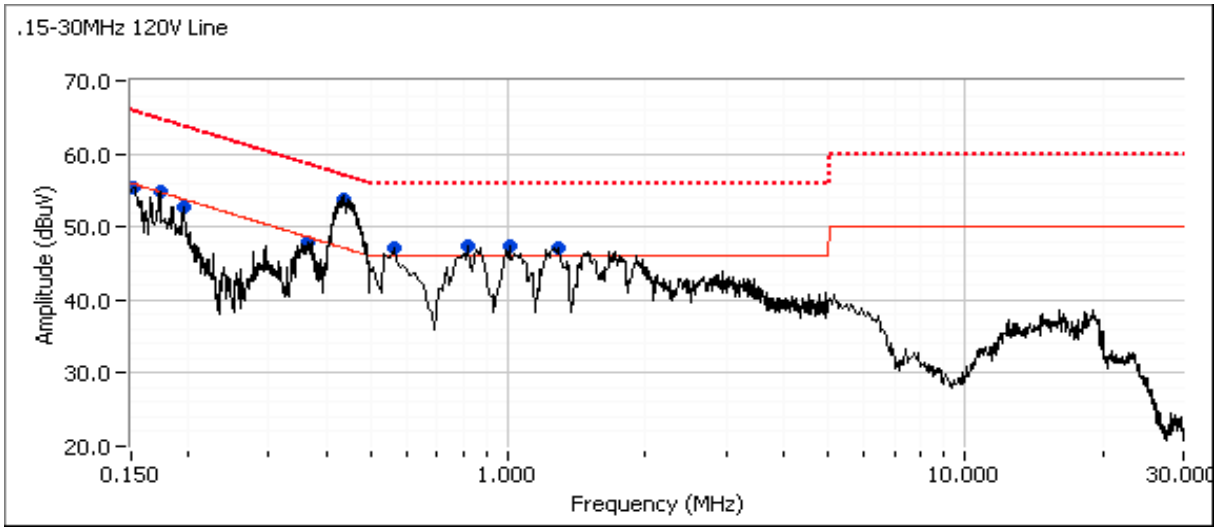
Sample Notes

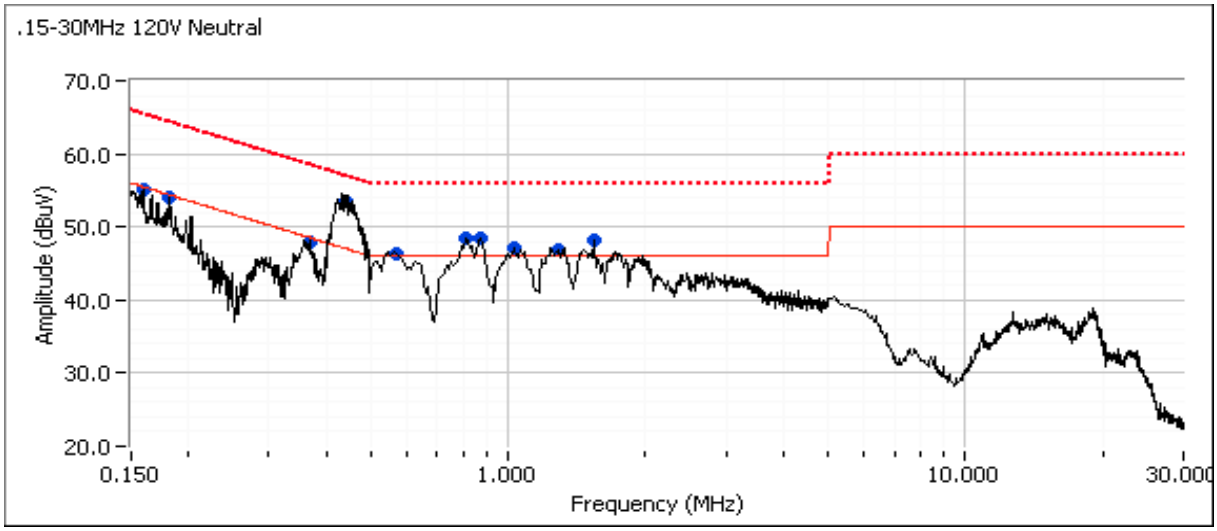
Sample S/N: G54DA5DN000024
Driver: 5.99 RC 188.10
Antenna: Internal

EUT configured to transmit on 802.11b, 1Mbps on channel 6 at maximum power and RF4CE on channel 15 at maximum power

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

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





EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

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

Frequency MHz	Level dBμV	AC Line	FCC 15.209 Limit	Margin	Detector QP/Ave	Comments
0.152	55.4	Line 1	55.9	-0.5	Peak	
0.173	54.8	Line 1	54.8	0.0	Peak	
0.196	52.7	Line 1	53.8	-1.1	Peak	
0.436	53.7	Line 1	47.1	6.6	Peak	
0.364	47.9	Line 1	48.6	-0.7	Peak	
1.277	47.0	Line 1	46.0	1.0	Peak	
1.010	47.4	Line 1	46.0	1.4	Peak	
0.814	47.4	Line 1	46.0	1.4	Peak	
0.566	47.0	Line 1	46.0	1.0	Peak	
0.160	55.1	Neutral	55.5	-0.4	Peak	
0.182	54.1	Neutral	54.4	-0.3	Peak	
0.368	48.0	Neutral	48.6	-0.6	Peak	
0.443	53.4	Neutral	47.0	6.4	Peak	
1.536	48.3	Neutral	46.0	2.3	Peak	
1.291	46.9	Neutral	46.0	0.9	Peak	
1.028	47.0	Neutral	46.0	1.0	Peak	
0.873	48.4	Neutral	46.0	2.4	Peak	
0.566	46.3	Neutral	46.0	0.3	Peak	
0.566	46.3	Neutral	46.0	0.3	Peak	
0.798	48.4	Neutral	46.0	2.4	Peak	

Final quasi-peak and average readings

Frequency MHz	Level dBμV	AC Line	FCC 15.209 Limit	Margin	Detector QP/Ave	Comments
0.443	46.1	Neutral	47.0	-0.9	AVG	AVG (0.10s)
0.436	46.1	Line 1	47.1	-1.0	AVG	AVG (0.10s)
0.436	52.1	Line 1	57.1	-5.0	QP	QP (1.00s)
0.443	51.7	Neutral	57.0	-5.3	QP	QP (1.00s)
0.566	39.2	Neutral	46.0	-6.8	AVG	AVG (0.10s)
1.277	38.9	Line 1	46.0	-7.1	AVG	AVG (0.10s)
1.028	38.9	Neutral	46.0	-7.1	AVG	AVG (0.10s)
0.566	38.8	Line 1	46.0	-7.2	AVG	AVG (0.10s)
0.814	38.7	Line 1	46.0	-7.3	AVG	AVG (0.10s)
1.010	38.6	Line 1	46.0	-7.4	AVG	AVG (0.10s)
1.291	38.5	Neutral	46.0	-7.5	AVG	AVG (0.10s)
1.536	37.8	Neutral	46.0	-8.2	AVG	AVG (0.10s)
0.364	40.1	Line 1	48.6	-8.5	AVG	AVG (0.10s)
0.368	39.3	Neutral	48.5	-9.2	AVG	AVG (0.10s)

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

0.873	36.3	Neutral	46.0	-9.7	AVG	AVG (0.10s)
0.814	45.1	Line 1	56.0	-10.9	QP	QP (1.00s)
0.873	44.9	Neutral	56.0	-11.1	QP	QP (1.00s)
0.566	44.9	Neutral	56.0	-11.1	QP	QP (1.00s)
1.277	44.8	Line 1	56.0	-11.2	QP	QP (1.00s)
0.566	44.8	Line 1	56.0	-11.2	QP	QP (1.00s)
1.291	44.5	Neutral	56.0	-11.5	QP	QP (1.00s)
1.028	44.4	Neutral	56.0	-11.6	QP	QP (1.00s)
1.010	44.2	Line 1	56.0	-11.8	QP	QP (1.00s)
1.536	43.8	Neutral	56.0	-12.2	QP	QP (1.00s)
0.364	45.9	Line 1	58.6	-12.7	QP	QP (1.00s)
0.173	41.9	Line 1	54.8	-12.9	AVG	AVG (0.10s)
0.368	45.2	Neutral	58.5	-13.3	QP	QP (1.00s)
0.182	40.4	Neutral	54.4	-14.0	AVG	AVG (0.10s)
0.152	51.9	Line 1	65.9	-14.0	QP	QP (1.00s)
0.152	41.6	Line 1	55.9	-14.3	AVG	AVG (0.10s)
0.196	39.4	Line 1	53.8	-14.4	AVG	AVG (0.10s)
0.160	40.6	Neutral	55.5	-14.9	AVG	AVG (0.10s)
0.182	48.6	Neutral	64.4	-15.8	QP	QP (1.00s)
0.173	48.8	Line 1	64.8	-16.0	QP	QP (1.00s)
0.160	49.5	Neutral	65.5	-16.0	QP	QP (1.00s)
0.196	47.2	Line 1	63.8	-16.6	QP	QP (1.00s)

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

FCC Part 15
Frequency Stability

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

All measurements are made with the EUT's rf port connected to the measurement instrument via an attenuator. All amplitude measurements are adjusted to account for the attenuation between EUT and measuring instrument. For frequency stability measurements the EUT was placed inside an environmental chamber.

Ambient Conditions:

Temperature: 24 °C
Rel. Humidity: 38 %

Run #			Test Performed	Limit	Pass / Fail	
1			Frequency Stability	Stays in band	Pass	

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.

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #1: Frequency Stability

Date of Test: 8/5/2015
Test Engineer: J Caizzi and E Mariscal
Test Location: Fremont EMC Lab #4

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

Nominal Frequency: 5180 MHz

Frequency Stability Over Temperature

The EUT was soaked at each temperature for a minimum of 30 minutes prior to starting the transmitter and making the measurements to ensure the EUT and chamber had stabilized at that temperature.

Temperature	Frequency Measured	Drift	
(Celsius)	(MHz)	(Hz)	(ppm)
0	5179.9850	-15000	-2.9
10	5179.9850	-15000	-2.9
20	5179.9700	-30000	-5.8
30	5179.9600	-40000	-7.7
40	5179.9450	-55000	-10.6
50	5179.9400	-60000	-11.6
	Worst case:	-55000	-11.6

Frequency Stability Over Input Voltage

Nominal Voltage is 120Vac.

Voltage	Frequency Measured	Drift	
(DC)	(MHz)	(Hz)	(ppm)
102.00	5179.970000	-30000	-5.8
138.00	5179.965000	-35000	-6.8
	Worst case:	-35000	-6.8

End of Report

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