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EMC Test Report

Application for FCC Grant of Equipment Authorization

FCC Part 15 Subpart C

Model: HR54-700

FCC ID:	PGRHR54-2
APPLICANT:	Pace Americas Inc. 310 Providence Mine Road Nevada City, CA 94959
TEST SITE(S):	National Technical Systems - Silicon Valley 41039 Boyce Road. Fremont, CA. 94538-2435
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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	Clarified Tx chain results. Corrected trace references in bandedge plots. Revised conducted spurious bandedge results.	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 C

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

ANSI C63.10-2013
FCC DTS Measurement Guidance KDB558074

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

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

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

OBJECTIVE

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

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

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 C

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

The test results recorded herein are based on a single type test of 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

DIGITAL TRANSMISSION SYSTEMS (2400 – 2483.5MHz)

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result
15.247(a)	RSS 247 5.2	Digital Modulation	Systems uses OFDM / DSSS techniques	System must utilize a digital transmission technology	Complies
15.247 (a) (2)	RSS 247 5.2 (1)	6dB Bandwidth	11b: 8.0 MHz 11g: 16.4 MHz n20: 17.6 MHz n40: 35.4 MHz	>500kHz	Complies
15.247 (b) (3)	RSS 247 5.4 (4)	Output Power (multipoint systems)	11b: 23.1 dBm (0.204W) 11g: 21.6 dBm (0.145W) n20: 23.0 dBm (0.200W) n40: 20.7 dBm (0.118W) EIRP = 0.436 W Note 1	1Watt, EIRP limited to 4 Watts.	Complies
15.247(e)	RSS 247 5.2 (2)	Power Spectral Density	11b: 4.6 dBm/3kHz 11g: -0.8 dBm/3kHz n20: 1.1 dBm/3kHz n40: -0.7 dBm/3kHz	8dBm/3kHz	Complies
15.247(d)	RSS 247 5.5	Antenna Port Spurious Emissions 30MHz – 25 GHz	All emissions below -30dBc limit	< -30dBc Note 2	Complies
15.247(d) / 15.209	RSS 247 5.5	Radiated Spurious Emissions 30MHz – 25 GHz	73.9 dBµV/m @ 2483.8 MHz (-0.1 dB)	Refer to the limits section (p21) for restricted bands, all others <-30dBc Note 2	Complies

Note 1: EIRP calculated using antenna gains of 3.3 dBi () for the highest EIRP system.
Note 2: Limit of -30dBc used because the power was measured using the UNII test procedure (maximum power averaged over a transmission burst).

DIGITAL TRANSMISSION SYSTEMS (2400 – 2483.5MHz) – RF4CE Operation

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result
15.247(a)	-	Digital Modulation	Systems uses DSSS techniques	System must utilize a digital transmission technology	Complies
15.247 (a) (2)	-	6dB Bandwidth	1.59MHz	>500kHz	Complies
15.247 (b) (3)	-	Output Power (multipoint systems)	-0.9 dBm (0.8mW) EIRP = 2.5mW Note 1	1Watt, EIRP limited to 4 Watts.	Complies
15.247(e)	-	Power Spectral Density	-0.6 dBm/100kHz	8dBm/3kHz	Complies
15.247(d)	-	Antenna Port Spurious Emissions 30MHz – 25 GHz	All signals below -30dBc	< -30dBc Note 2	Complies
15.247(d) / 15.209		Radiated Spurious Emissions 30MHz – 25 GHz	47.5 dBµV/m @ 4924.0 MHz (-6.5 dB)	15.207 in restricted bands, all others <-30dBc Note 2	Complies

Note 1: EIRP calculated using antenna gain of 4.9 dBi for the highest EIRP system.
Note 2: Limit of -30dBc used because the power was measured using the UNII test procedure (maximum power averaged over a transmission burst).

GENERAL REQUIREMENTS APPLICABLE TO ALL BANDS

FCC Rule Part	RSS Rule part	Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.203	-	RF Connector	Antennas are internal to the device	Unique or integral antenna required	Complies
15.407 (b) (6)	RSS-Gen Table 3	AC Conducted Emissions	46.1 dBµV @ 0.443 MHz (-0.9 dB)	Refer to page 20	Complies
15.247 (i) 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

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 that incorporates 802.11abgn 2x2 and 2.4GHz 802.15.4 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 120 Volts, 60 Hz, 1.3 Amps.

The sample was received on July 7, 2015 and April 20, 2016 and tested on July 8 and 14, 2015 and April 20, 21, 22, 25 and 26, and May 24, 2016. The EUT consisted of the following component(s):

RF4CE Testing from July 2015

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

Sample from April 2016

Company	Model	Description	Serial Number	FCC ID
Pace Americas	HR54-700	DVR	G54DA5DN000041	PGRHR54-2
DirecTV	EPS44R3-15	AC/DC Adapter	CL44E1452C2091	N/A

ANTENNA SYSTEM

The wifi and 802.15.4 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 802.15.4 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 (July 2015)

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	-

SUPPORT EQUIPMENT (April 2016)

The following equipment was used as support equipment for testing:

Company	Model	Description	Serial Number	FCC ID
Toshiba	24SL4150	TV	B46193106429C1	-
LACIE	16	SATA HD	16551411120837GHB	-
Kingston	DTSE9	USB	-	DTSE9H/32GB

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

Company	Model	Description	Serial Number	FCC ID
Pace America	C51-700	Setup Box	129445460000446	
Dell	D610	Laptop	CXWR91	-

EUT INTERFACE PORTS (July 2015)

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 INTERFACE PORTS (April 2016)

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

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
Sat In (SWM-5)	C51-700	Coax	Shielded	10
A/V Out	TV	Multiwire	Unshielded	1.5
Digital Audio Output	Terminated	Multiwire	Unshielded	1.5
HDMI	TV	HDMI	Shielded	1.5
Ethernet	Laptop	Cat 5	Unshielded	10
SATA	LACIE	Multiwire	Shielded	1
USB	Direct Connecti0on	-	-	-
Power Input	AC/DC aAdapter	2 Wire	Unshielded	1

EUT OPERATION

During emissions testing the EUT was transmitting in the mode, on the channel, & at the power called out in the individual tests. For 802.11b mode tests, 1Mb/s was used; MCS0 for n20 and n40. These represented the worse case modes.

A movie was continuously playing and there was communication between EUT and remote equipment.

TEST SITE

GENERAL INFORMATION

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

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

Software is used to view and convert 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 software used for radiated and conducted emissions measurements is NTS EMI Test Software (rev 2.10)

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.

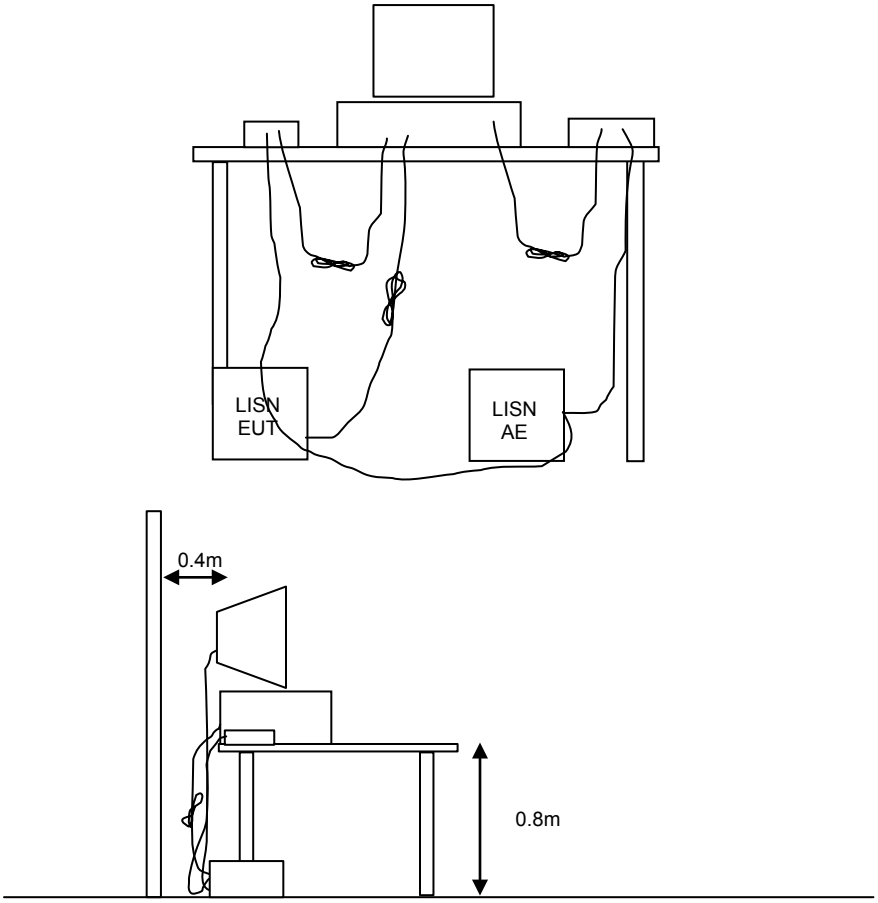


Figure 1 Typical Conducted Emissions Test Configuration

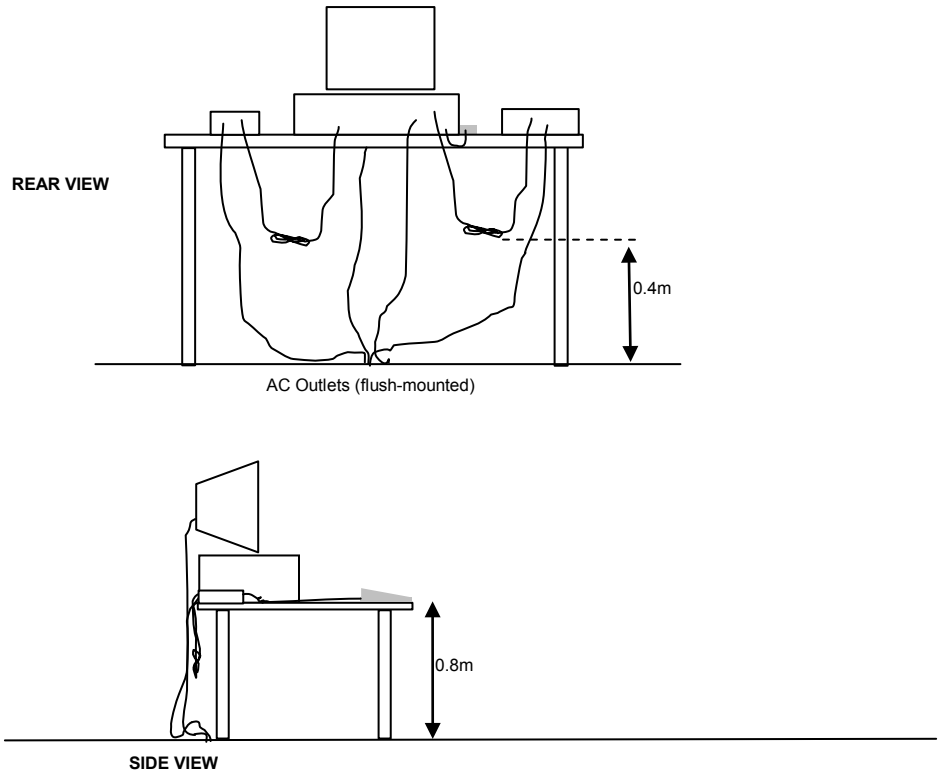
RADIATED EMISSIONS

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.

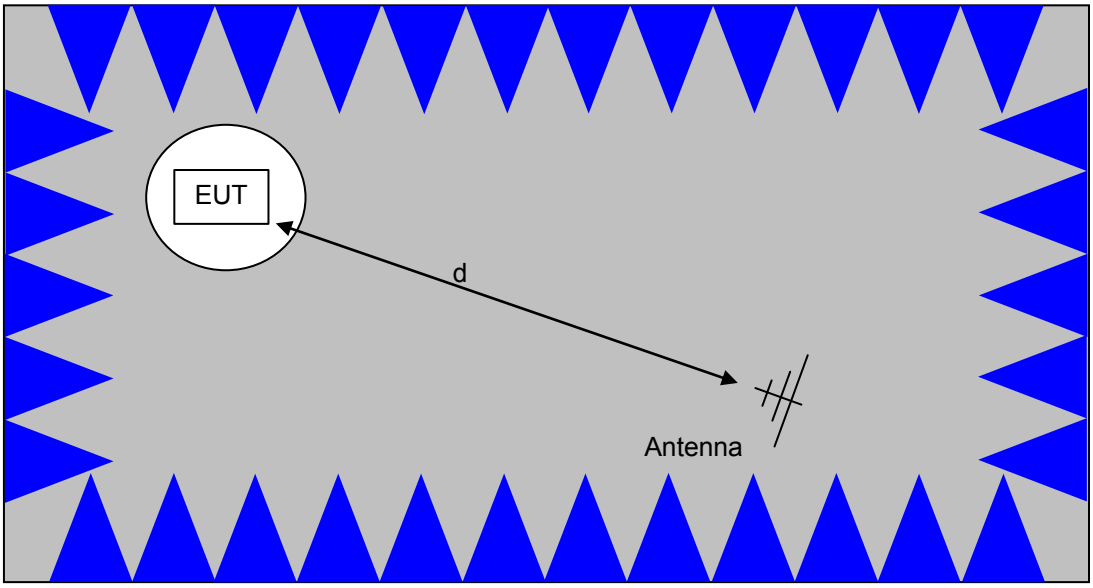
A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

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.

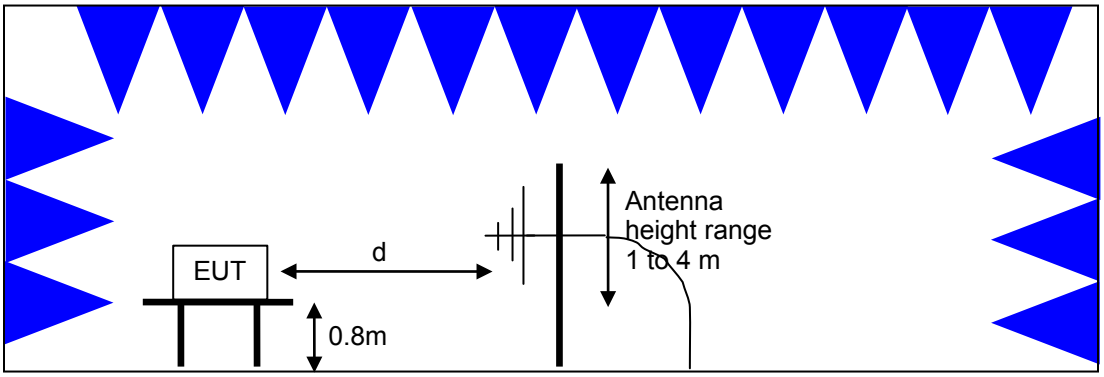


Typical Test Configuration for Radiated Field Strength Measurements



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.

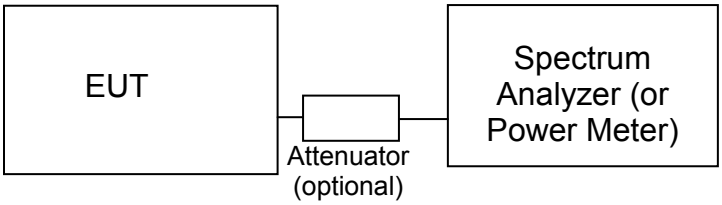
Floor-standing equipment is placed on the floor with insulating supports between the unit and the ground plane.



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].

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

[1] The restricted bands are detailed in FCC 15.205 and RSS-Gen Table 6

OUTPUT POWER LIMITS – DIGITAL TRANSMISSION SYSTEMS

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

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

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

TRANSMIT MODE SPURIOUS RADIATED EMISSIONS LIMITS – FHSS and DTS SYSTEMS

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

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

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

$$R_r - S = M$$

where:

R_r = Receiver Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

SAMPLE CALCULATIONS - RADIATED EMISSIONS

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

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

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

where:

F_d = Distance Factor in dB

D_m = Measurement Distance in meters

D_s = Specification Distance in meters

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

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

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

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

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:

R_r = Receiver Reading in dBuV/m

F_d = Distance Factor in dB

R_c = Corrected Reading in dBuV/m

L_s = Specification Limit in dBuV/m

M = Margin in dB Relative to Spec

SAMPLE CALCULATIONS - FIELD STRENGTH TO EIRP CONVERSION

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

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

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

T101679

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
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

T101528

Manufacturer	Description	Model	Asset #	Calibrated	Cal Due
Radiated Emissions, 1000 - 6,000 MHz, 20-Apr-16					
Rohde & Schwarz	EMI Test Receiver, 20 Hz-40 GHz	ESIB40 (1088.7490.40)	2493	2/20/2016	2/20/2017
EMCO	Antenna, Horn, 1-18 GHz	3115	2733	11/18/2014	11/18/2016
Radiated Emissions, 1000 - 6,000 MHz, 21-Apr-16					
Rohde & Schwarz	EMI Test Receiver, 20 Hz-40 GHz	ESIB40 (1088.7490.40)	2493	2/20/2016	2/20/2017
EMCO	Antenna, Horn, 1-18 GHz	3115	2733	11/18/2014	11/18/2016
Radiated Emissions, 1000 - 18,000 MHz, 21-Apr-16					
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	870	1/21/2016	1/21/2017
Hewlett Packard	Spectrum Analyzer (SA40) Red 30 Hz -40 GHz	8564E (84125C)	1148	10/17/2015	10/17/2016
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	1683	7/13/2015	7/13/2016
EMCO	Antenna, Horn, 1-18 GHz	3115	2733	11/18/2014	11/18/2016
Radiated Emissions, 1000 - 25,000 MHz, 22-Apr-16					

Manufacturer	Description	Model	Asset #	Calibrated	Cal Due
Hewlett Packard	EMC Spectrum Analyzer, 9 kHz - 6.5 GHz	8595EM	780	3/30/2016	3/30/2017
HP / Miteq	SA40 Head (Red)	TTA1840-45-5P-HG-S	1145	7/17/2015	7/17/2016
Hewlett Packard	Spectrum Analyzer (SA40) Red 30 Hz -40 GHz	8564E (84125C)	1148	10/17/2015	10/17/2016
Hewlett Packard	High Pass filter, 8.2 GHz	P/N 84300-80039	1152	7/10/2015	7/10/2016
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	1683	7/13/2015	7/13/2016
A. H. Systems	Purple System Horn, 18-40GHz	SAS-574, p/n: 2581	2160	8/28/2014	8/28/2017
EMCO	Antenna, Horn, 1-18 GHz	3115	2733	11/18/2014	11/18/2016
Radiated Emissions, 30 - 1,000 MHz, 26-Apr-16					
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	2197	9/9/2015	9/9/2018
Rohde & Schwarz	EMI Test Receiver, 20 Hz-40 GHz	ESIB40 (1088.7490.40)	2493	2/20/2016	2/20/2017
Com-Power	Preamplifier, 1-1000 MHz	PAM-103	2885	10/13/2015	10/13/2016
Radiated Emissions, 1000 - 25,000 MHz, 26-Apr-16					
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	870	1/21/2016	1/21/2017
HP / Miteq	SA40 Head (Red)	TTA1840-45-5P-HG-S	1145	7/17/2015	7/17/2016
Hewlett Packard	Spectrum Analyzer (SA40) Red 30 Hz -40 GHz	8564E (84125C)	1148	10/17/2015	10/17/2016
Hewlett Packard	High Pass filter, 8.2 GHz	P/N 84300-80039	1152	7/10/2015	7/10/2016
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	1683	7/13/2015	7/13/2016
A. H. Systems	Purple System Horn, 18-40GHz	SAS-574, p/n: 2581	2160	8/28/2014	8/28/2017
EMCO	Antenna, Horn, 1-18 GHz	3115	2733	11/18/2014	11/18/2016
Radio Antenna Port (Power and Spurious Emissions), 26-Apr-16					
Agilent Technologies	PSA, Spectrum Analyzer, (installed options, 111, 115, 123, 1DS, B7J, HYX,	E4446A	2139	6/22/2015	6/22/2016
Radio Antenna Port (Power and Spurious Emissions), 24-May-16					
Agilent Technologies	PSA, Spectrum Analyzer, (installed options, 111, 115, 123, 1DS, B7J, HYX,	E4446A	2139	6/22/2015	6/22/2016

Appendix B Test Data

T101679 Pages 28 – 48
T101528 Pages 49 – 124

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

FCC 15.247 (DTS) Radiated Spurious Emissions

Test Specific Details

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

General Test Configuration

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

Ambient Conditions:

Temperature: 25 °C
Rel. Humidity: 35 %

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

Run #	Mode	Channel	Power Setting		Test Performed	Limit	Result / Margin
1a	RF4CE + WiFi	15	w3		Restricted Band Edge (2390 MHz)	FCC Part 15.209 / 15.247(c)	31.3 dBµV/m @ 2376.9 MHz (-22.7 dB)
		11	w3 20		Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	47.5 dBµV/m @ 4924.0 MHz (-6.5 dB)
1b	RF4CE + WiFi	20 100	w3 20		Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	47.3 dBµV/m @ 5360.6 MHz (-6.7 dB)
1c	RF4CE + WiFi	25	w3		Restricted Band Edge (2483.5 MHz)	FCC Part 15.209 / 15.247(c)	42.4 dBµV/m @ 2484.0 MHz (-11.6 dB)
		1	w3 20		Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	46.1 dBµV/m @ 4949.0 MHz (-7.9 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.

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

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
RF4CE	Fixed	100%	-	-	0	0	-
11b	1Mb/s	0.98	Yes	2.737	0	0	10
11a	6Mb/s	0.98	Yes	1.443	0	0	10

Sample Notes

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

Measurement Specific Notes:

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

Test Notes

No emissions from the radio circuitry were observed below 1 GHz during preliminry tests.

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 - 25 GHz.

Date of Test: 7/8/2015 0:00
Test Engineer: Joseph Cadigal
Test Location: FT Chamber#3

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

Run #1a: Low Channel @ 2425 MHz

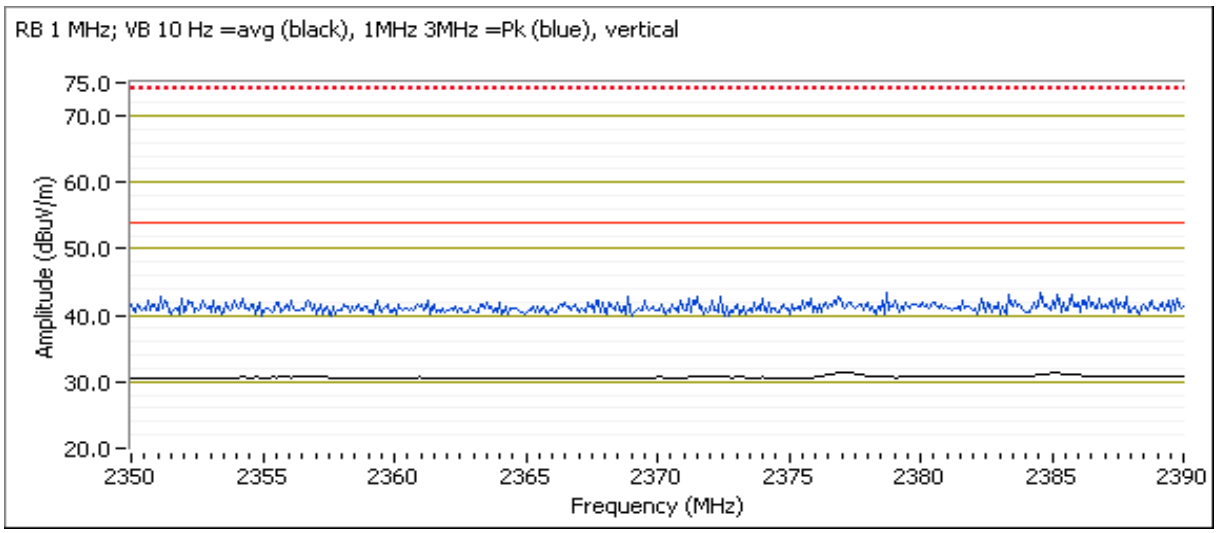
Fundamental Signal Field Strength: Peak value measured in 100kHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2424.760	92.4	V	-	-	Pk	281	1.7	POS; RB 100 kHz; VB: 100 kHz
2425.090	95.3	H	-	-	Pk	337	1.6	POS; RB 100 kHz; VB: 100 kHz

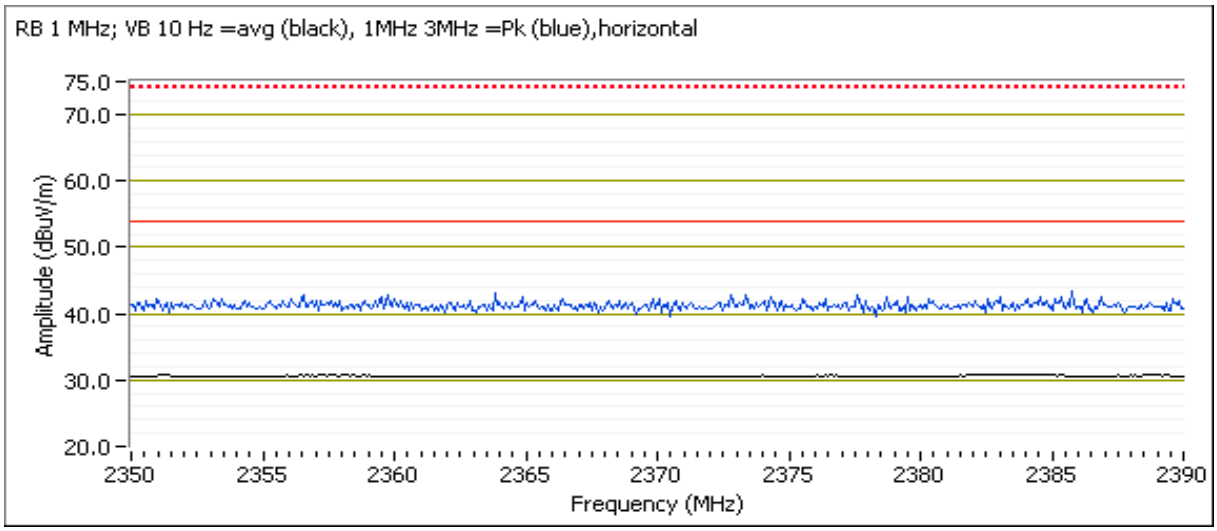
Fundamental emission level @ 3m in **100kHz RBW**:	95.3	dBμV/m	
Limit for emissions outside of restricted bands:	75.3	dBμV/m	Limit is -20dBc (Peak power measurement)
Limit for emissions outside of restricted bands:	65.3	dBμV/m	Limit is -30dBc (UNII power measurement)

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2376.930	**31.3**	H	54.0	**-22.7**	AVG	337	1.6	POS; RB 1 MHz; VB: 10 Hz
2366.510	42.9	H	74.0	-31.1	PK	337	1.6	POS; RB 1 MHz; VB: 3 MHz
2385.110	30.8	V	54.0	-23.2	AVG	279	1.7	POS; RB 1 MHz; VB: 10 Hz
2377.170	42.0	V	74.0	-32.0	PK	279	1.7	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

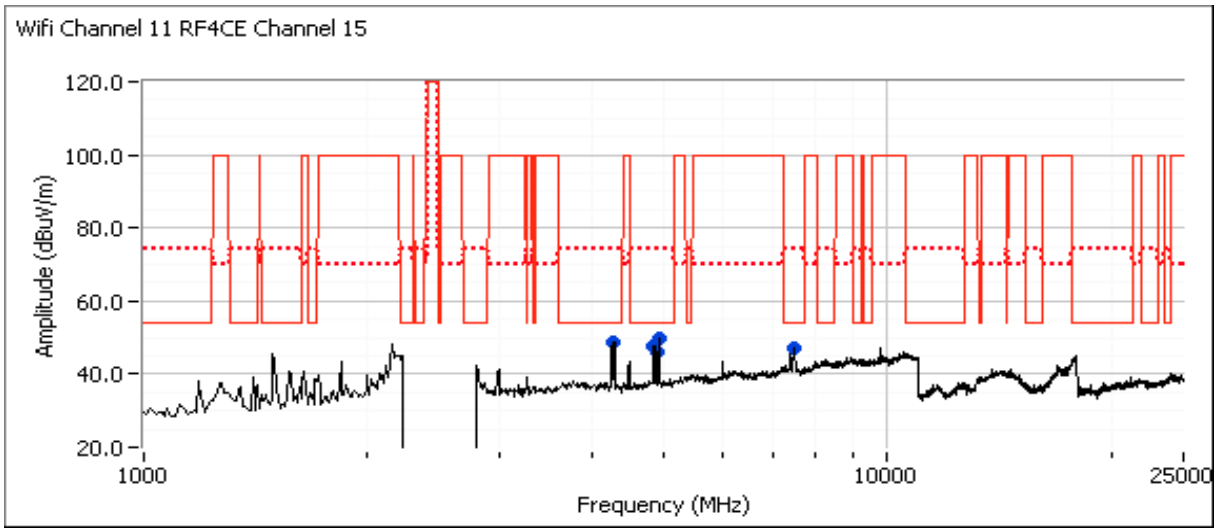


EMC Test Data

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

Other Spurious Emissions Low Channel @ 2425 MHz + Wifi Channel 11 802.11b

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4924.010	**47.5**	V	54.0	**-6.5**	AVG	358	1.0	RB 1 MHz;VB 10 Hz;Peak
4923.940	51.3	V	74.0	-22.7	PK	358	1.0	RB 1 MHz;VB 3 MHz;Peak
4268.820	36.3	V	54.0	-17.7	AVG	282	2.5	RB 1 MHz;VB 10 Hz;Peak
4269.200	45.7	V	74.0	-28.3	PK	282	2.5	RB 1 MHz;VB 3 MHz;Peak
4885.730	44.1	V	54.0	-9.9	AVG	340	1.3	RB 1 MHz;VB 10 Hz;Peak
4887.480	51.5	V	74.0	-22.5	PK	340	1.3	RB 1 MHz;VB 3 MHz;Peak
4850.960	43.8	V	54.0	-10.2	AVG	347	1.6	RB 1 MHz;VB 10 Hz;Peak
4851.100	51.1	V	74.0	-22.9	PK	347	1.6	RB 1 MHz;VB 3 MHz;Peak



Note:	Scans between 18 - 25 GHz performed with the measurement antenna moved around the card and its antennas 20-50cm from the device.
Note:	The emisisons at 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.

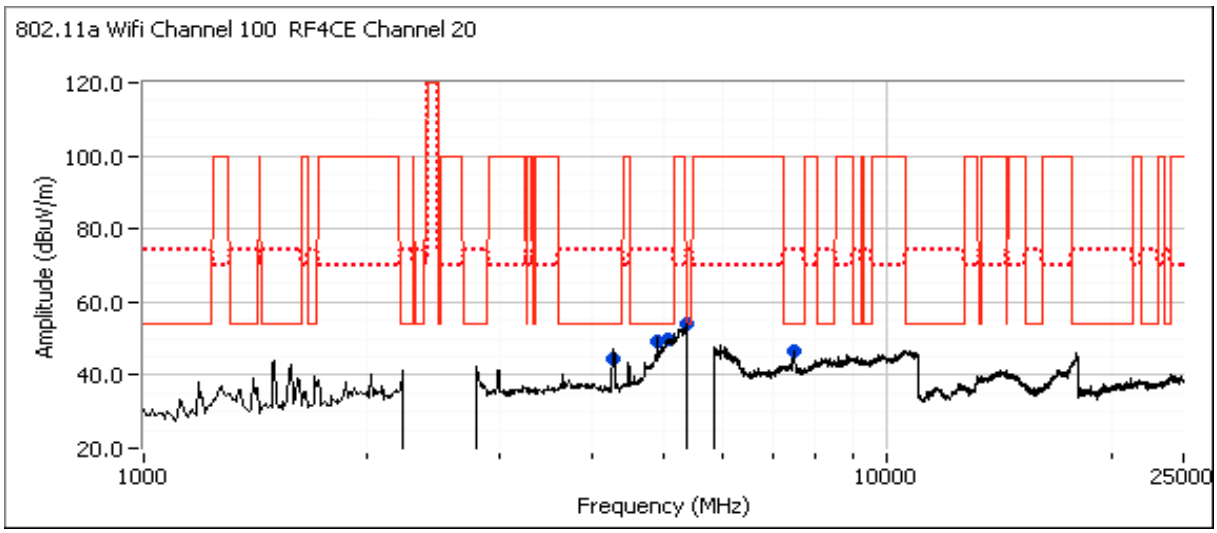
EMC Test Data

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 #1b: Center Channel @ 2450 MHz + WiFi Channel 100 802.11a

Fundamental emission level @ 3m in 100kHz RBW:	95.7	dBμV/m	
Limit for emissions outside of restricted bands:	75.7	dBμV/m	Limit is -20dBc (Peak power measurement)
Limit for emissions outside of restricted bands:	65.7	dBμV/m	Limit is -30dBc (UNII power measurement)

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5360.560	**47.3**	H	54.0	**-6.7**	AVG	267	1.3	RB 1 MHz;VB 10 Hz;Peak
5360.520	59.3	H	74.0	-14.7	PK	267	1.3	RB 1 MHz;VB 3 MHz;Peak
4269.470	34.8	V	54.0	-19.2	AVG	318	1.9	RB 1 MHz;VB 10 Hz;Peak
4269.890	54.7	V	74.0	-19.3	PK	318	1.9	RB 1 MHz;VB 3 MHz;Peak
4900.960	45.3	V	54.0	-8.7	AVG	9	1.3	RB 1 MHz;VB 10 Hz;Peak
4901.000	53.0	V	74.0	-21.0	PK	9	1.3	RB 1 MHz;VB 3 MHz;Peak
5065.210	44.7	H	54.0	-9.3	AVG	291	1.0	RB 1 MHz;VB 10 Hz;Peak
5064.440	56.4	H	74.0	-17.6	PK	291	1.0	RB 1 MHz;VB 3 MHz;Peak



Note:	Scans between 18 - 25 GHz performed with the measurement antenna moved around the card and its antennas 20-50cm from the device.
Note:	The emisisons at 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 #1c: High Channel @ 2475 MHz

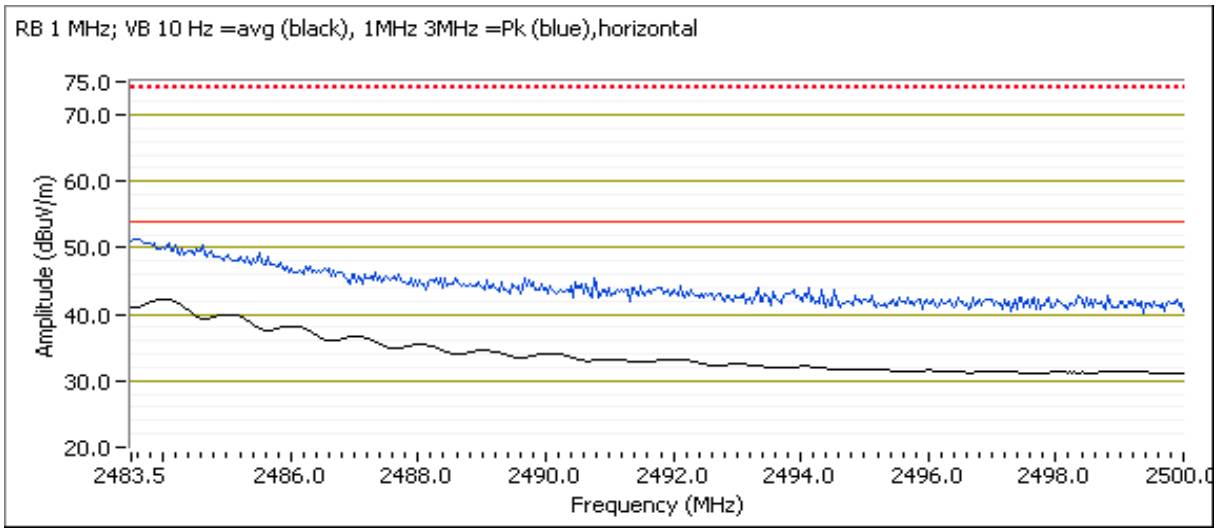
Fundamental Signal Field Strength: Peak value measured in 100kHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2474.910	92.2	V	-	-	Pk	293	1.3	POS; RB 100 kHz; VB: 100 kHz
2474.740	93.4	H	-	-	Pk	338	1.0	POS; RB 100 kHz; VB: 100 kHz

Fundamental emission level @ 3m in **100kHz RBW**:	93.4	dBμV/m	
Limit for emissions outside of restricted bands:	73.4	dBμV/m	Limit is -20dBc (Peak power measurement)
Limit for emissions outside of restricted bands:	63.4	dBμV/m	Limit is -30dBc (UNII power measurement)

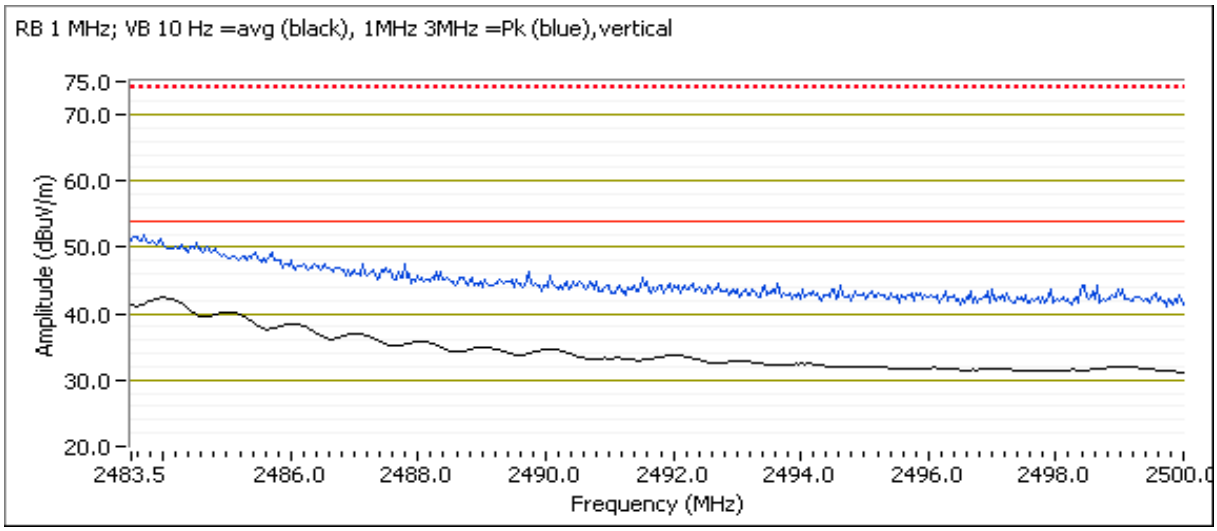
Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2484.000	**42.4**	V	54.0	**-11.6**	AVG	291	1.3	POS; RB 1 MHz; VB: 10 Hz
2483.700	51.1	V	74.0	-22.9	PK	291	1.3	POS; RB 1 MHz; VB: 3 MHz
2484.000	42.3	H	54.0	-11.7	AVG	338	1.0	POS; RB 1 MHz; VB: 10 Hz
2483.960	50.3	H	74.0	-23.7	PK	338	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

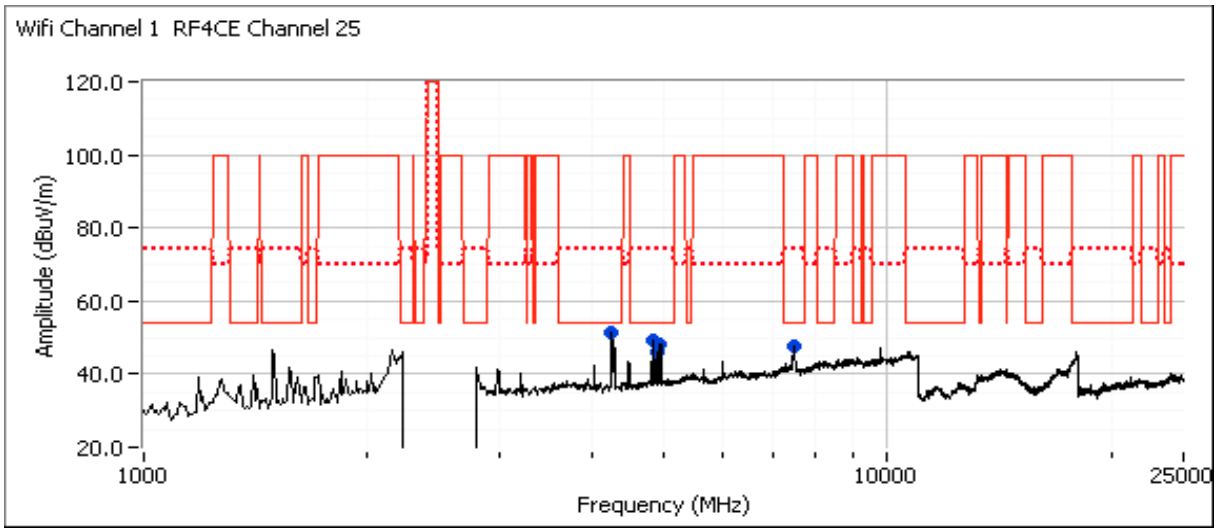


EMC Test Data

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

Other Spurious Emissions High Channel @ 2475 MHz + Wifi Channel 1 802.11b

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4949.000	**46.1**	V	54.0	**-7.9**	AVG	344	1.0	RB 1 MHz;VB 10 Hz;Peak
4948.850	54.1	V	74.0	-19.9	PK	344	1.0	RB 1 MHz;VB 3 MHz;Peak
4823.960	45.4	V	54.0	-8.6	AVG	22	1.3	RB 1 MHz;VB 10 Hz;Peak
4823.990	50.1	V	74.0	-23.9	PK	22	1.3	RB 1 MHz;VB 3 MHz;Peak
4264.750	36.1	V	54.0	-17.9	AVG	285	2.5	RB 1 MHz;VB 10 Hz;Peak
4264.900	44.8	V	74.0	-29.2	PK	285	2.5	RB 1 MHz;VB 3 MHz;Peak
4888.350	44.1	V	54.0	-9.9	AVG	357	1.0	RB 1 MHz;VB 10 Hz;Peak
4886.440	51.1	V	74.0	-22.9	PK	357	1.0	RB 1 MHz;VB 3 MHz;Peak



Note:	Scans between 18 - 25 GHz performed with the measurement antenna moved around the card and its antennas 20-50cm from the device.
Note:	The emisisons at 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

FCC 15.247 (DTS) Antenna Port Measurements

Power, PSD, Bandwidth and Spurious Emissions

Test Specific Details

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

Date of Test: 7/14/2015
Test Engineer: Mehran Birgani
Test Location: Chamber 7

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

General Test Configuration

All measurements were performed radiated at 3m distance from the measurement antenna.

All measurements have been corrected for the measurement system used.

Ambient Conditions:

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

Summary of Results

Run #	Pwr setting	Avg Pwr	Test Performed	Limit	Pass / Fail	Result / Margin
1	Max		Output Power	15.247(b)	Pass	-0.9 dBm (0.8mW)
2	Max		Power spectral Density (PSD)	15.247(d)	Pass	-0.6 dBm/100kHz
3	Max		Minimum 6dB Bandwidth	15.247(a)	Pass	1.59 MHz
3	Max		99% Bandwidth	RSS GEN	-	2.40 MHz
4	Max		Spurious emissions	15.247(b)	Pass	> -30dBc below limit

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Procedure Comments:

Measurements performed in accordance with FCC KDB 558074

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
RF4CE	Fixed	100%	-	-	0	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

Sample Notes

Sample S/N:
Driver: 5.99 RC 188.10
Antenna: Intergrated

Run #1: Output Power

Mode: RF4CE Chain 1

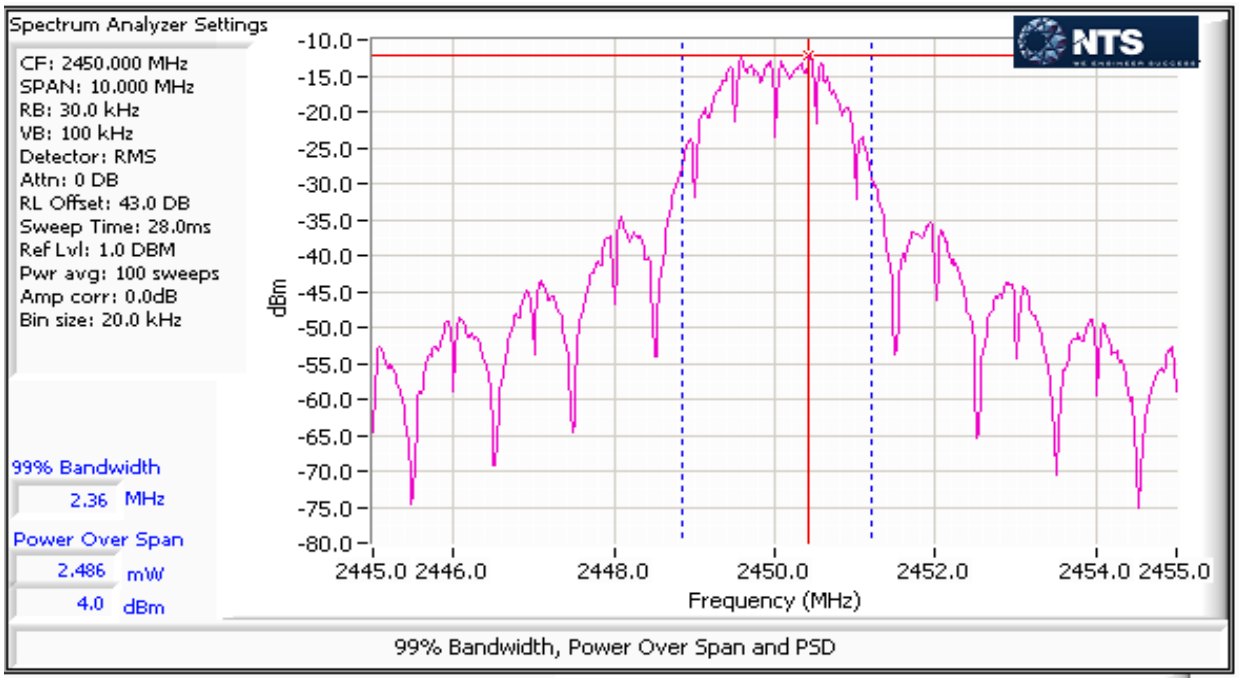
Power Setting[2]	Frequency (MHz)	Output Power (EIRP) (dBm) [1]	mW	Antenna Gain (dBi)	Result	Power dBm	W	Output Power (dBm)	mW
Vertical									
Max	2425	-1.4	0.7	4.9	Pass	-6.3	0.0002		
Max	2450	1.9	1.5	4.9	Pass	-3.0	0.0005		
Max	2475	1.9	1.5	4.9	Pass	-3.0	0.0005		
Horizontal									
Max	2425	2.8	1.9	4.9	Pass	-2.1	0.0006		
Max	2450	3.7	2.3	4.9	Pass	-1.2	0.0008		
Max	2475	1.7	1.5	4.9	Pass	-3.2	0.0005		

Mode: RF4CE Chain 2

Power Setting[2]	Frequency (MHz)	Output Power (EIRP) (dBm) [1]	mW	Antenna Gain (dBi)	Result	Power dBm	W	Output Power (dBm)	mW
Vertical									
Max	2425	1.0	1.3	4.9	Pass	-3.9	0.0004		
Max	2450	0.6	1.1	4.9	Pass	-4.3	0.0004		
Max	2475	-0.9	0.8	4.9	Pass	-5.8	0.0003		
Horizontal									
Max	2425	3.6	2.3	4.9	Pass	-1.3	0.0007		
Max	2450	4.0	2.5	4.9	Pass	-0.9	0.0008		
Max	2475	3.0	2.0	4.9	Pass	-1.9	0.0006		

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

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: Power spectral Density

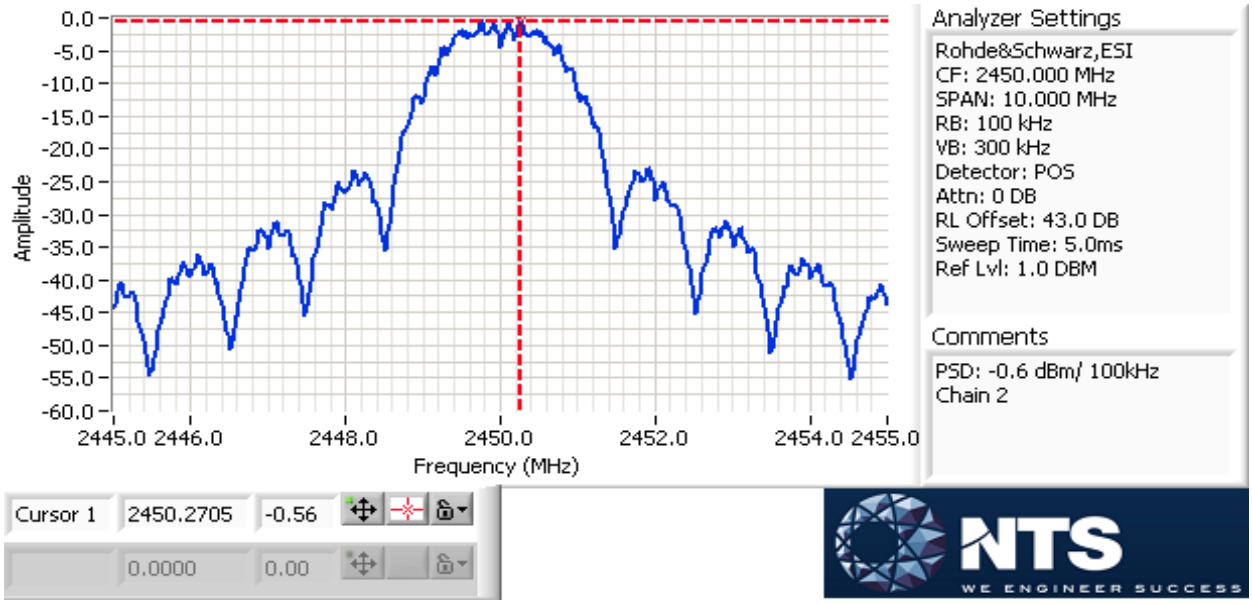
Mode: RF4CE Chain 1

Power Setting	Frequency (MHz)	PSD (eirp) (dBm/100kHz) Note 1	Ant Gain (dBi)	PSD (dBm/100kHz) Note 1	Limit dBm/3kHz	Result
Max	2425	-1.4	4.9	-6.3	8.0	Pass
Max	2450	-0.8	4.9	-5.7	8.0	Pass
Max	2475	-2.5	4.9	-7.4	8.0	Pass

Mode: RF4CE Chain 2

Power Setting	Frequency (MHz)	PSD (eirp) (dBm/100kHz) Note 1	Ant Gain (dBi)	PSD (dBm/100kHz) Note 1	Limit dBm/3kHz	Result
Max	2425	-0.7	4.9	-5.6	8.0	Pass
Max	2450	-0.6	4.9	-5.5	8.0	Pass
Max	2475	-1.5	4.9	-6.4	8.0	Pass

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



EMC Test Data

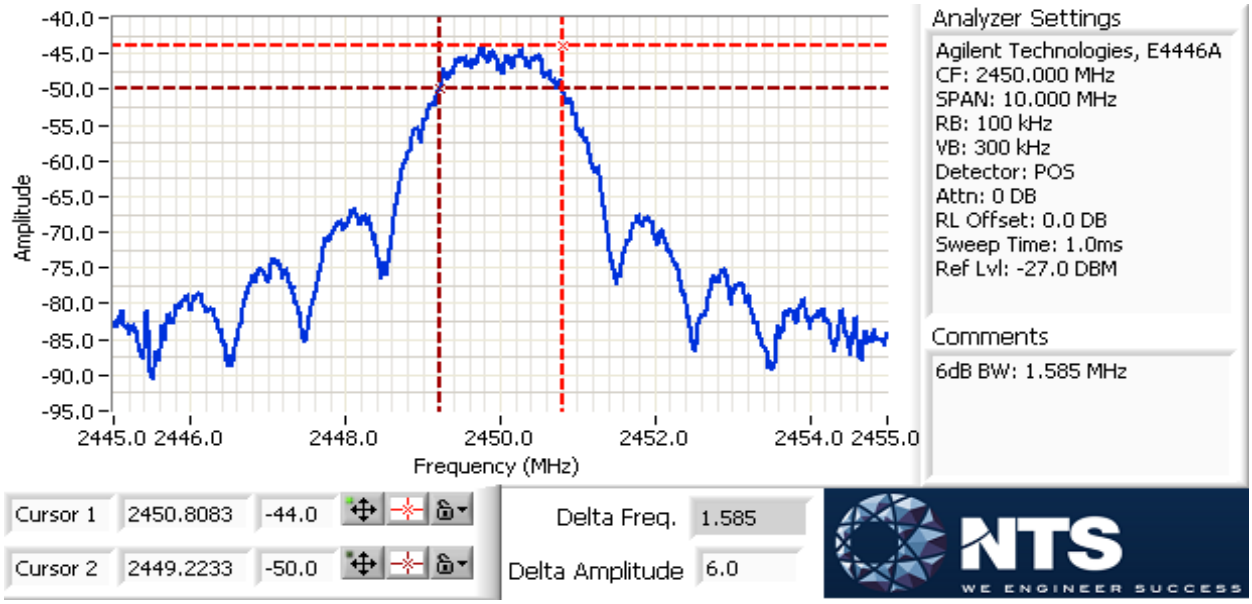
Client:	Pace Americas, Inc.	Job Number:	J98591
Model:	HR54-700	T-Log Number:	T101679
		Project Manager:	Irene Radamacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247, 15.407	Class:	N/A

Run #3: Signal Bandwidth

Mode: **RF4CE**

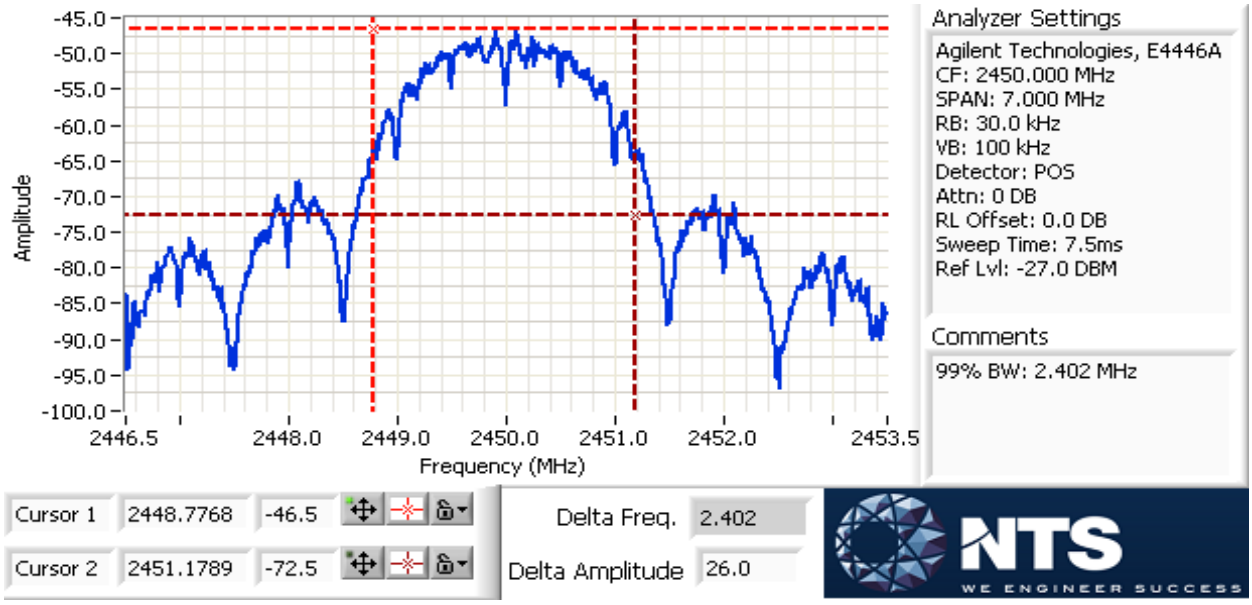
Power Setting	Frequency (MHz)	Bandwidth (MHz)		RBW Setting	
		6dB	99%	6dB	99%
w3	2450	1.59	2.40	100 kHz	30 kHz

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



Run #4a: Out of Band Spurious Emissions

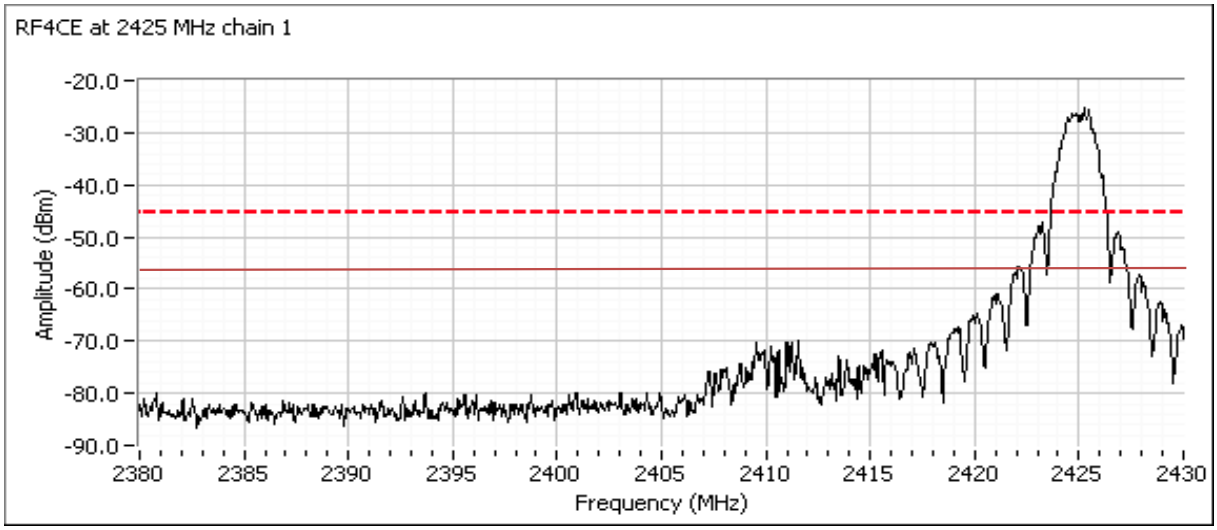
Power Setting Per Chain #1	#2	#3	#4	Mode	Frequency (MHz)	Limit	Result
w3	w3			RF4CE	2405	-30 dBc	Pass
w3	w3			RF4CE	2450	-30 dBc	Pass
w3	w3			RF4CE	2475	-30 dBc	Pass

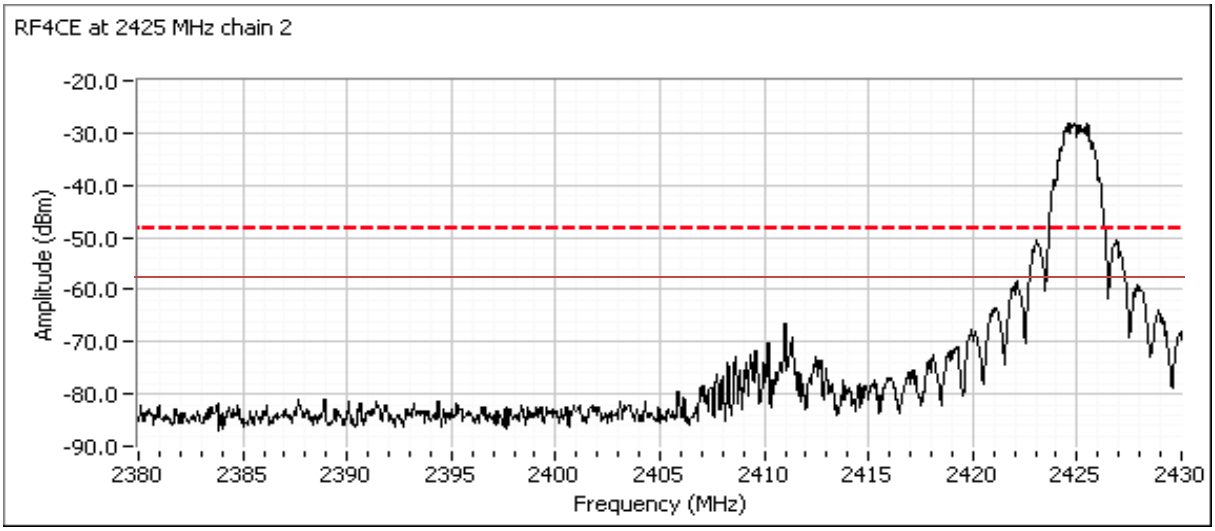
Note 1:	Measured on each chain individually and compared to the in-band level on that chain per FCC KDB 662911 D01 3)b)
Note:	Measured using a near field probe
Note:	Measured using RBW=100kHz, VBW=300kHz, peak detector, max hold

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

Plots for low channel, Chain 1

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





Note - solid line indicates -30dBc

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.

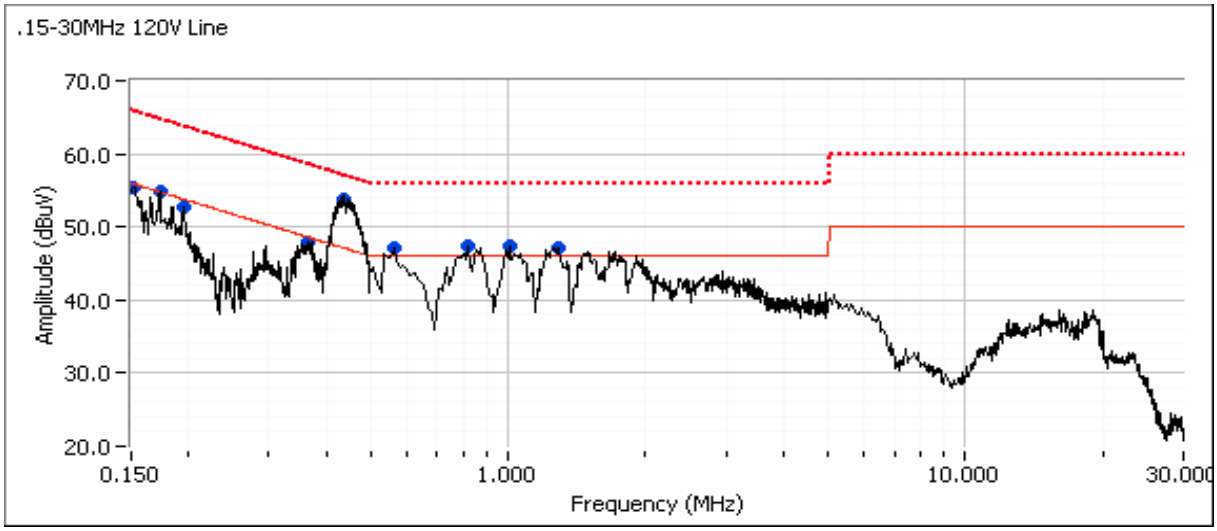
Sample Notes

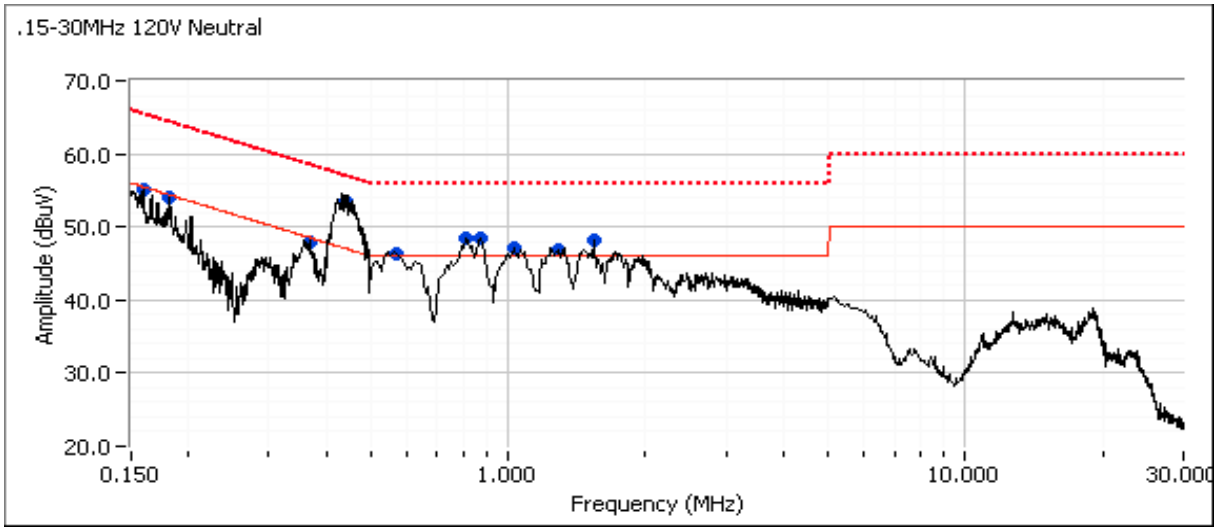
Sample S/N: G54DA5DN000024
Driver: 5.99 RC 188.10
Antenna: Internal

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)

Client:	Pace Americas, Inc.	Job Number:	JD100795
Product	HR54-700	T-Log Number:	T101528
System Configuration:	-	Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Emissions Standard(s):	FCC 15.247	Class:	B
Immunity Standard(s):	-	Environment:	-

EMC Test Data

For The

Pace Americas, Inc.

Product

HR54-700

Date of Last Test: 5/24/2016

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Power vs. Data Rate

In normal operating modes the card uses power settings stored on EEPROM to set the output power. For a given nominal output power the actual transmit power normally is reduced as the data rate increases, therefore testing was performed at the data rate in the mode with highest power to determine compliance with the requirements.
The following power measurements were made using a **GATED** average power meter and with the device configured in a continuous transmit mode on Chain 1 at the various data rates in each mode to verify the highest power mode:

Sample Notes

Sample S/N: G54DA5DN000041
Driver: 5.99.188.21

Date of Test: 4/20/2016
Test Engineer: Mehran Birgani
Test Location: Lab 4

Mode	Data Rate	Power (dBm)	Power setting
802.11b	1 (Chain 1)	**24.1**	q92
	2 (Chain 1)	24.1	
	5.5 (Chain 1)	24.1	
	11 (Chain 1)	24.0	
	11 (Chain 2)	26.1	
802.11g	6	**23.3**	q92
	9	23.3	
	12	23.3	
	18	23.2	
	24	23.1	
	36	23.2	
	48	23.1	
	54	23.2	

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Mode	Data Rate	Power (dBm)	Power setting	
802.11n 20MHz	6.5	**25.6**	q92	
	13	25.6		
	19.5	25.6		
	26	25.6		
	39	25.7		
	52	25.8		
	58.5	25.8		
	65	25.8		
	78	N/A		<<-11ac mode only
802.11n/ac 40MHz	13.5	**25.7**	q92	
	27	25.8		
	40.5	25.7		
	54	25.7		
	81	25.8		
	108	25.8		
	121.5	25.7		
	135	25.8		
	162	N/A		<<-11ac mode only
	180	N/A		<<-11ac mode only

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

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Duty Cycle

Date of Test: 4/20/2016
Test Engineer: Mehran Birgani
Test Location: Lab 4

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

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

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
11b	1 Mbps	99.9%	Yes	8.419	0	0	10
11g	6 Mbps	98.9%	Yes	1.398	0	0	10
n20	6.5 Mbps	98.8%	Yes	1.309	0	0	10
n40	13.5 Mbps	97.6%	Yes	0.651	0.11	0.21	1536

* Correction factor when using RMS/Power averaging - 10*log(1/x)
** Correction factor when using linear voltage average - 20*log(1/x)
T = Minimum transmission duration

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

RSS-247 and FCC 15.247 (DTS) Radiated Spurious Emissions

Test Specific Details

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

General Test Configuration

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

Ambient Conditions:

Temperature: 20-23 °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.

Sample Notes

Sample S/N: G54DA5DN000041
Driver: 5.99.188.21
Antenna: Internal
Chain 1: Gray cable PL8200
Chain 2: Black cable PL800

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

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

Run #	Mode	Channel	Target Power	Power Setting	Test Performed	Limit	Result / Margin
1	b	1 - 2412MHz	23	q92	Restricted Band Edge (2390 MHz)	FCC Part 15.209 / 15.247(c)	53.8 dBµV/m @ 2386.9 MHz (-0.2 dB)
	b	11 - 2462MHz	23	q88	Restricted Band Edge (2483.5 MHz)	FCC Part 15.209 / 15.247(c)	52.7 dBµV/m @ 2486.7 MHz (-1.3 dB)
2	g	1 - 2412MHz	23	q80	Restricted Band Edge (2390 MHz)	FCC Part 15.209 / 15.247(c)	72.9 dBµV/m @ 2387.5 MHz (-1.1 dB)
	g	2 - 2417MHz	23	q89	Restricted Band Edge (2390 MHz)	FCC Part 15.209 / 15.247(c)	53.8 dBµV/m @ 2390.0 MHz (-0.2 dB)
	g	11 - 2462MHz	23	q69	Restricted Band Edge (2483.5 MHz)	FCC Part 15.209 / 15.247(c)	73.8 dBµV/m @ 2485.2 MHz (-0.2 dB)
	g	10 - 2457MHz	23	q80	Restricted Band Edge (2483.5 MHz)	FCC Part 15.209 / 15.247(c)	72.9 dBµV/m @ 2483.5 MHz (-1.1 dB)
	g	9 - 2452MHz	23	q85	Restricted Band Edge (2483.5 MHz)	FCC Part 15.209 / 15.247(c)	73.9 dBµV/m @ 2483.8 MHz (-0.1 dB)
3	n20	1 - 2412MHz	23	q76	Restricted Band Edge (2390 MHz)	FCC Part 15.209 / 15.247(c)	73.5 dBµV/m @ 2386.7 MHz (-0.5 dB)
	n20	2 - 2417MHz	23	q83	Restricted Band Edge (2390 MHz)	FCC Part 15.209 / 15.247(c)	53.4 dBµV/m @ 2389.0 MHz (-0.6 dB)
	n20	11 - 2462MHz	23	q61	Restricted Band Edge (2483.5 MHz)	FCC Part 15.209 / 15.247(c)	73.4 dBµV/m @ 2484.7 MHz (-0.6 dB)
	n20	10 - 2457MHz	23	q77	Restricted Band Edge (2483.5 MHz)	FCC Part 15.209 / 15.247(c)	52.7 dBµV/m @ 2484.1 MHz (-1.3 dB)
	n20	9 - 2452MHz	23	q79	Restricted Band Edge (2483.5 MHz)	FCC Part 15.209 / 15.247(c)	73.8 dBµV/m @ 2484.1 MHz (-0.2 dB)
	n20	8 - 2447MHz	23	q80	Restricted Band Edge (2483.5 MHz)	FCC Part 15.209 / 15.247(c)	73.1 dBµV/m @ 2483.9 MHz (-0.9 dB)
	n20	7 - 2442MHz	23	q86	Restricted Band Edge (2483.5 MHz)	FCC Part 15.209 / 15.247(c)	52.6 dBµV/m @ 2483.7 MHz (-1.4 dB)
	n20	6 - 2437MHz	23	q88	Restricted Band Edge (2483.5 MHz)	FCC Part 15.209 / 15.247(c)	73.8 dBµV/m @ 2483.6 MHz (-0.2 dB)

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

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

Run #	Mode	Channel	Target Power	Power Setting	Test Performed	Limit	Result / Margin
4	n40	3 - 2422MHz	23	q68	Restricted Band Edge (2390 MHz)	FCC Part 15.209 / 15.247(c)	53.2 dBµV/m @ 2387.0 MHz (-0.8 dB)
	n40	4 - 2427MHz	23	q71	Restricted Band Edge (2390 MHz)	FCC Part 15.209 / 15.247(c)	53.5 dBµV/m @ 2389.7 MHz (-0.5 dB)
	n40	5 - 2432MHz	23	q77	Restricted Band Edge (2390 MHz)	FCC Part 15.209 / 15.247(c)	53.8 dBµV/m @ 2389.3 MHz (-0.2 dB)
	n40	6 - 2437MHz	23	q78	Restricted Band Edge (2390 MHz)	FCC Part 15.209 / 15.247(c)	53.9 dBµV/m @ 2389.5 MHz (-0.1 dB)
	n40	9 - 2452MHz	23	q62	Restricted Band Edge (2483.5 MHz)	FCC Part 15.209 / 15.247(c)	53.5 dBµV/m @ 2483.5 MHz (-0.5 dB)
	n40	8 - 2447MHz	23	q63	Restricted Band Edge (2483.5 MHz)	FCC Part 15.209 / 15.247(c)	73.2 dBµV/m @ 2484.4 MHz (-0.8 dB)
	n40	7 - 2442MHz	23	q68	Restricted Band Edge (2483.5 MHz)	FCC Part 15.209 / 15.247(c)	73.8 dBµV/m @ 2486.0 MHz (-0.2 dB)
	n40	6 - 2437MHz	23	q72	Restricted Band Edge (2483.5 MHz)	FCC Part 15.209 / 15.247(c)	73.4 dBµV/m @ 2484.4 MHz (-0.6 dB)

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Procedure Comments:

Measurements performed in accordance with FCC KDB 558074
Peak measurements performed with: RBW=1MHz, VBW=3MHz, peak detector, max hold, auto sweep time
Unless otherwise stated/noted, emission has a 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)
11b	1 Mbps	99.9%	Yes	8.419	0	0	10
11g	6 Mbps	98.9%	Yes	1.398	0	0	10
n20	6.5 Mbps	98.8%	Yes	1.309	0	0	10
n40	13.5 Mbps	97.6%	Yes	0.651	0.11	0.21	1536

Measurement Specific Notes:

Note 1:	Emission in non-restricted band, but limit of 15.209 used.
Note 2:	Emission in non-restricted band, the limit was set 30dB below the level of the fundamental and measured in 100kHz.
Note 4:	Emission has constant duty cycle < 98%, average measurement performed: RBW=1MHz, VBW>1/T but not less than 10Hz, peak detector, linear averaging, auto sweep, trace average 100 traces, measurement corrected by Linear voltage correction factor
Note 6:	Emission has non constant duty cycle < 98%, average measurement performed: RBW=1MHz, VBW> 1/T, peak detector, linear average mode, sweep time auto, max hold. Max hold for 50*(1/DC) traces
Note 8:	Plots of the average and peak bandedge do not account for any duty cycle correction. Refer to the tabular results for final measurements.

Notes

Worse case antenna chain for 11b/g taken from original filing

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Run #1: Radiated Bandedge Measurements

Date of Test: 04/20/16
Test Engineer: Rafael Varelas
Test Location: FT Chamber #4

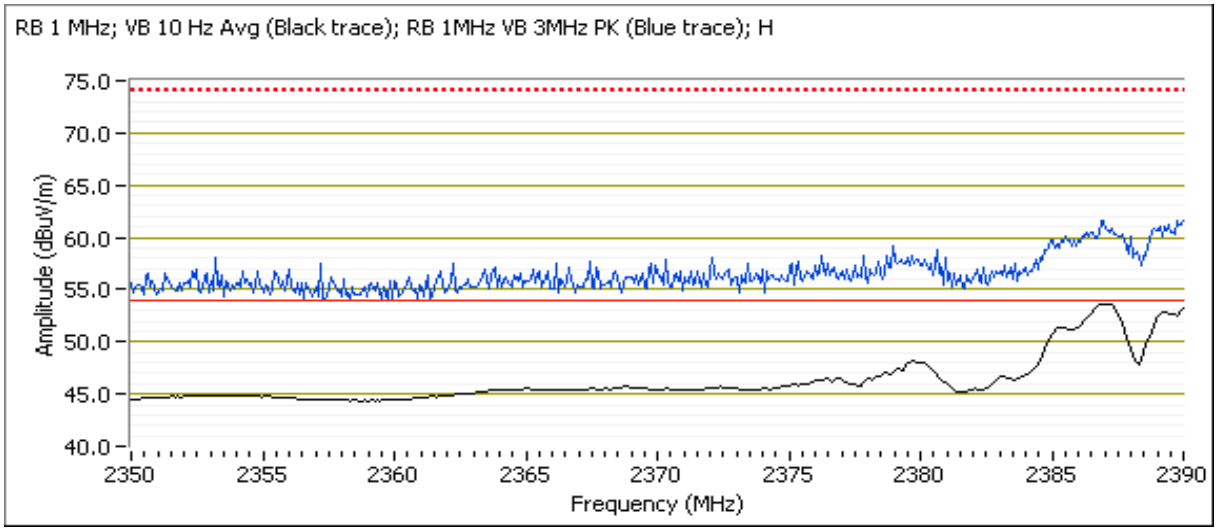
Config. Used: 1
Config Change: None
EUT Voltage: 120V/60Hz

Channel: 1
Tx Chain: 2

Mode: b
Data Rate: 1 Mbps

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2386.870	53.8	H	54.0	-0.2	AVG	44	2.5	POS; RB 1 MHz; VB: 10 Hz
2389.980	61.9	H	74.0	-12.1	PK	44	2.5	POS; RB 1 MHz; VB: 3 MHz
2386.950	47.5	V	54.0	-6.5	AVG	207	1.0	POS; RB 1 MHz; VB: 10 Hz
2389.920	55.3	V	74.0	-18.7	PK	207	1.0	POS; RB 1 MHz; VB: 3 MHz



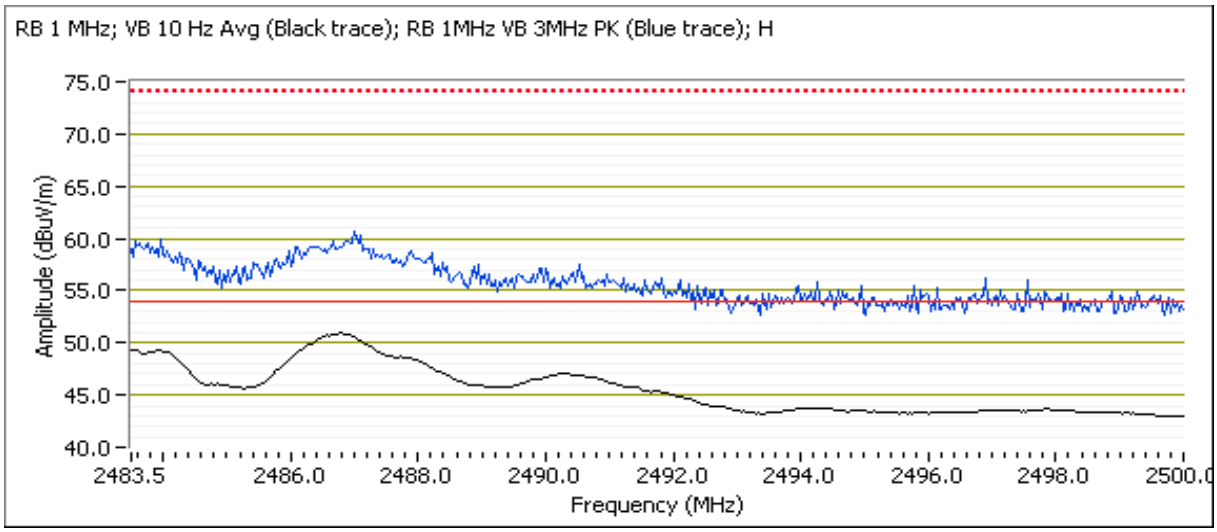
EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Channel: 11 Mode: b
Tx Chain: 2 Data Rate: 1 Mbps

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Power setting = q88								
2486.710	52.7	H	54.0	-1.3	AVG	49	1.0	POS; RB 1 MHz; VB: 10 Hz
2486.610	61.1	H	74.0	-12.9	PK	49	1.0	POS; RB 1 MHz; VB: 3 MHz
2486.770	46.5	V	54.0	-7.5	AVG	9	1.0	POS; RB 1 MHz; VB: 10 Hz
2486.810	56.8	V	74.0	-17.2	PK	9	1.0	POS; RB 1 MHz; VB: 3 MHz



EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Run #2: Radiated Bandedge Measurements

Date of Test: 04/20/16
Test Engineer: Rafael Varelas
Test Location: FT Chamber #4

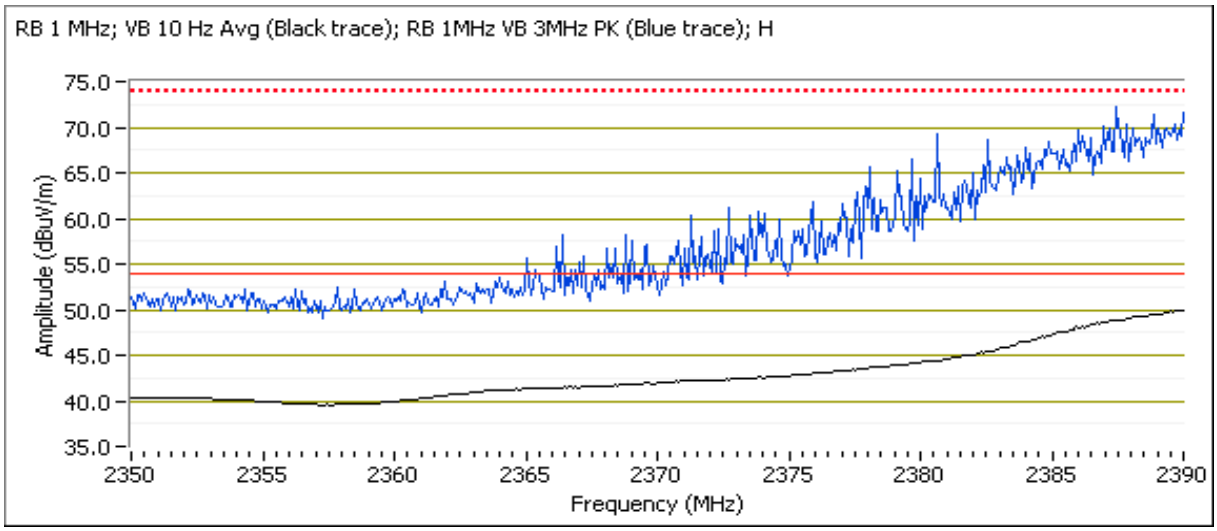
Config. Used: 1
Config Change: None
EUT Voltage: 120V/60Hz

Channel: 1
Tx Chain: 2

Mode: g
Data Rate: 6 Mbps

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Power setting = q80								
2390.000	49.9	H	54.0	-4.1	AVG	46	1.4	POS; RB 1 MHz; VB: 10 Hz
2387.520	72.9	H	74.0	-1.1	PK	46	1.4	POS; RB 1 MHz; VB: 3 MHz
2390.000	43.2	V	54.0	-10.8	AVG	209	1.0	POS; RB 1 MHz; VB: 10 Hz
2385.670	64.4	V	74.0	-9.6	PK	209	1.0	POS; RB 1 MHz; VB: 3 MHz



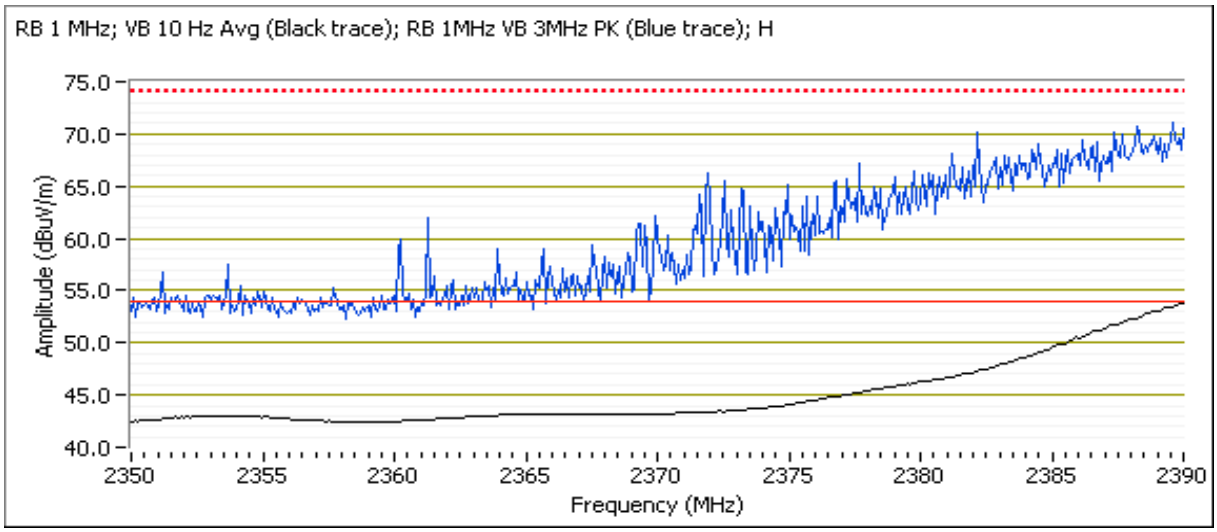
EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Channel: 2 Mode: g
Tx Chain: 2 Data Rate: 6 Mbps

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Power setting = q89								
2390.000	53.8	H	54.0	-0.2	AVG	45	1.2	POS; RB 1 MHz; VB: 10 Hz
2389.840	70.3	H	74.0	-3.7	PK	45	1.2	POS; RB 1 MHz; VB: 3 MHz
2390.000	47.4	V	54.0	-6.6	AVG	206	1.0	POS; RB 1 MHz; VB: 10 Hz
2388.000	64.7	V	74.0	-9.3	PK	206	1.0	POS; RB 1 MHz; VB: 3 MHz



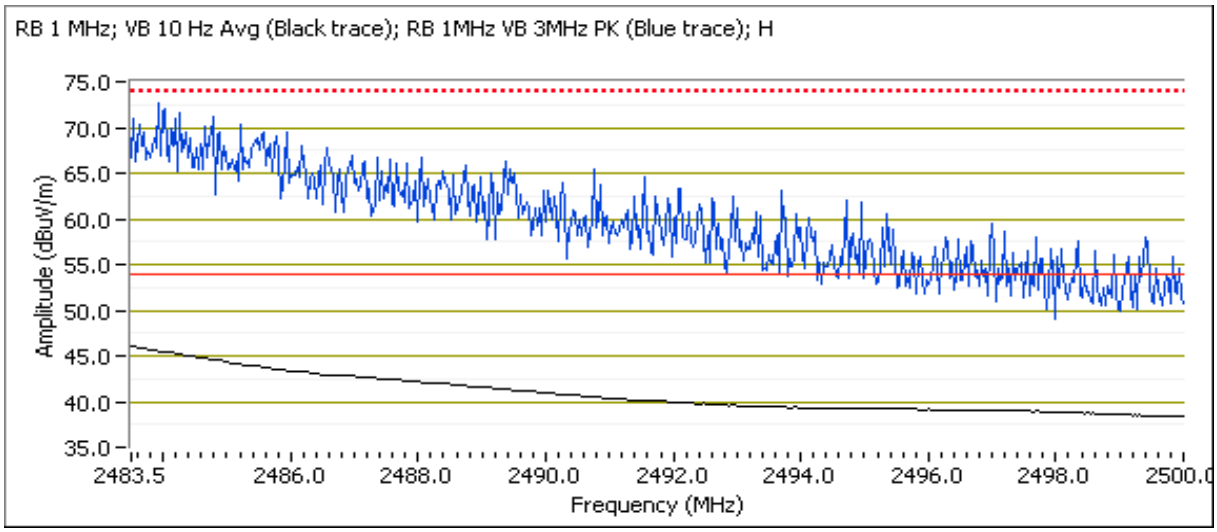
EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Channel: 11 Mode: g
Tx Chain: 2 Data Rate: 6 Mbps

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Power setting = q69								
2483.600	46.1	H	54.0	-7.9	AVG	42	1.0	POS; RB 1 MHz; VB: 10 Hz
2485.220	73.8	H	74.0	-0.2	PK	42	1.0	POS; RB 1 MHz; VB: 3 MHz
2483.530	41.4	V	54.0	-12.6	AVG	4	1.0	POS; RB 1 MHz; VB: 10 Hz
2484.130	68.5	V	74.0	-5.5	PK	4	1.0	POS; RB 1 MHz; VB: 3 MHz



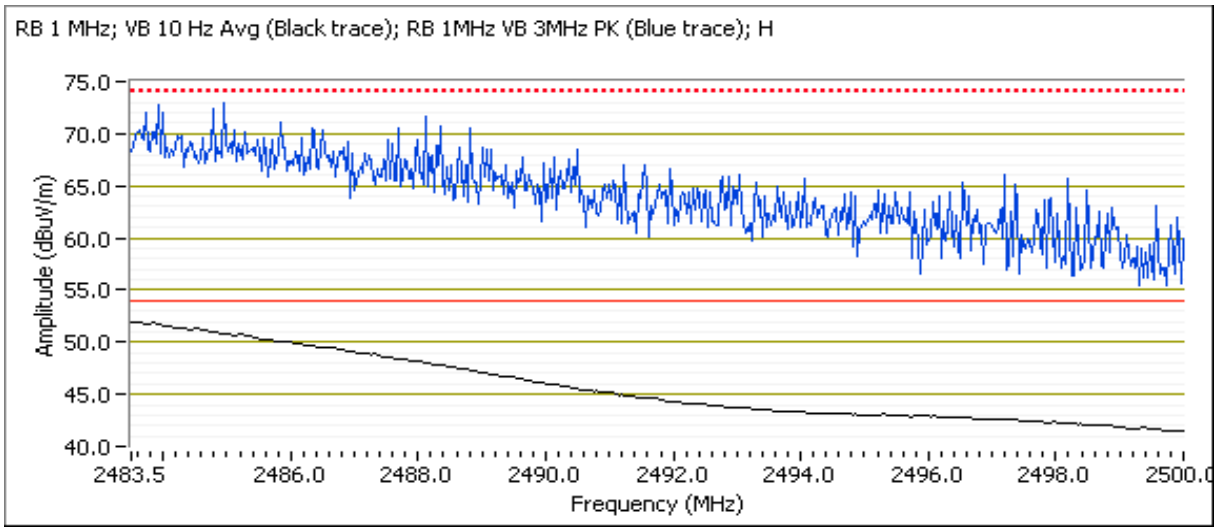
EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Channel: 10 Mode: g
Tx Chain: 2 Data Rate: 6 Mbps

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Power setting = q80								
2483.500	51.9	H	54.0	-2.1	AVG	45	1.0	POS; RB 1 MHz; VB: 10 Hz
2483.530	72.9	H	74.0	-1.1	PK	45	1.0	POS; RB 1 MHz; VB: 3 MHz
2483.570	46.4	V	54.0	-7.6	AVG	360	1.0	POS; RB 1 MHz; VB: 10 Hz
2490.340	65.6	V	74.0	-8.4	PK	360	1.0	POS; RB 1 MHz; VB: 3 MHz



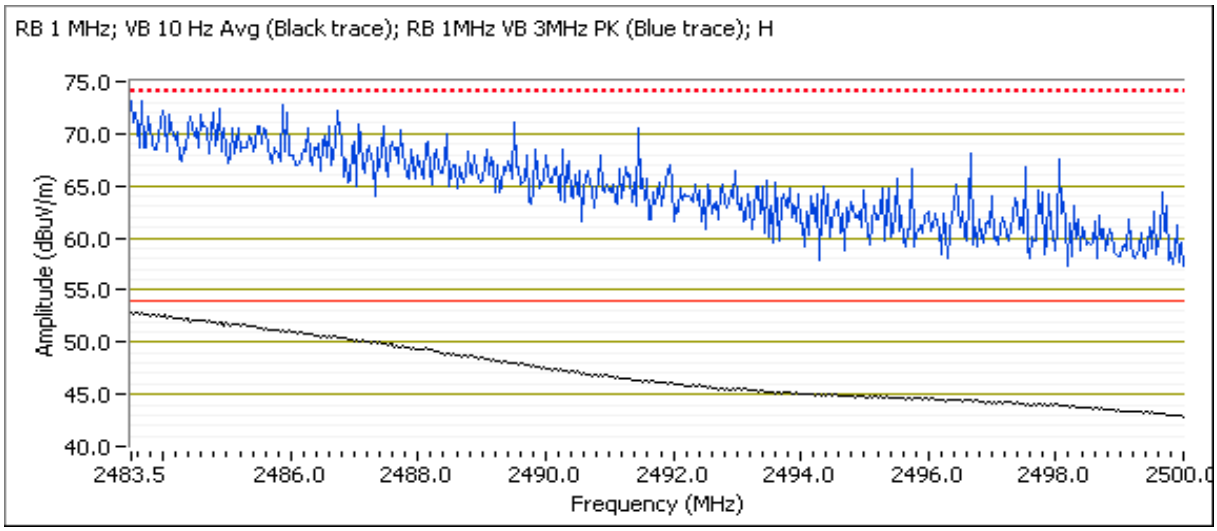
EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Channel: 9 Mode: g
Tx Chain: 2 Data Rate: 6 Mbps

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Power setting = q85								
2483.570	52.9	H	54.0	-1.1	AVG	44	1.0	POS; RB 1 MHz; VB: 10 Hz
2483.830	73.9	H	74.0	-0.1	PK	44	1.0	POS; RB 1 MHz; VB: 3 MHz
2483.530	47.4	V	54.0	-6.6	AVG	9	1.0	POS; RB 1 MHz; VB: 10 Hz
2485.750	66.0	V	74.0	-8.0	PK	9	1.0	POS; RB 1 MHz; VB: 3 MHz



EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Run #3: Radiated Bandedge Measurements

Date of Test: 04/20/16
Test Engineer: Rafael Varelas
Test Location: FT Chamber #4

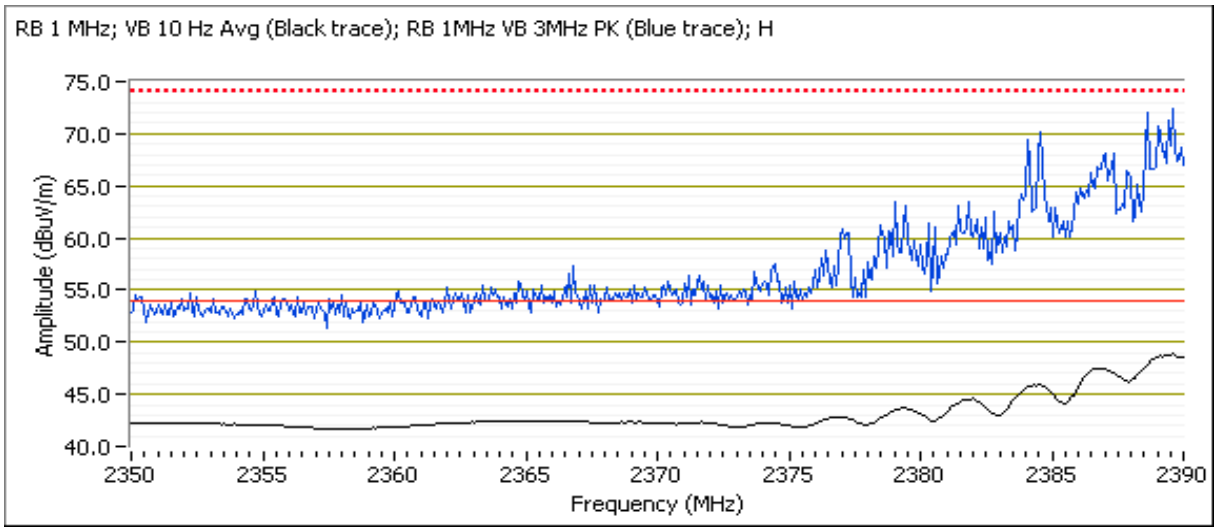
Config. Used: 1
Config Change: None
EUT Voltage: 120V/60Hz

Channel: 1
Tx Chain: 2Tx

Mode: n20
Data Rate: 6.5 Mbps

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Power setting = q76								
2389.200	50.2	H	54.0	-3.8	AVG	277	1.2	POS; RB 1 MHz; VB: 10 Hz
2386.710	73.5	H	74.0	-0.5	PK	277	1.2	POS; RB 1 MHz; VB: 3 MHz
2389.920	44.9	V	54.0	-9.1	AVG	208	1.0	POS; RB 1 MHz; VB: 10 Hz
2389.440	64.5	V	74.0	-9.5	PK	208	1.0	POS; RB 1 MHz; VB: 3 MHz



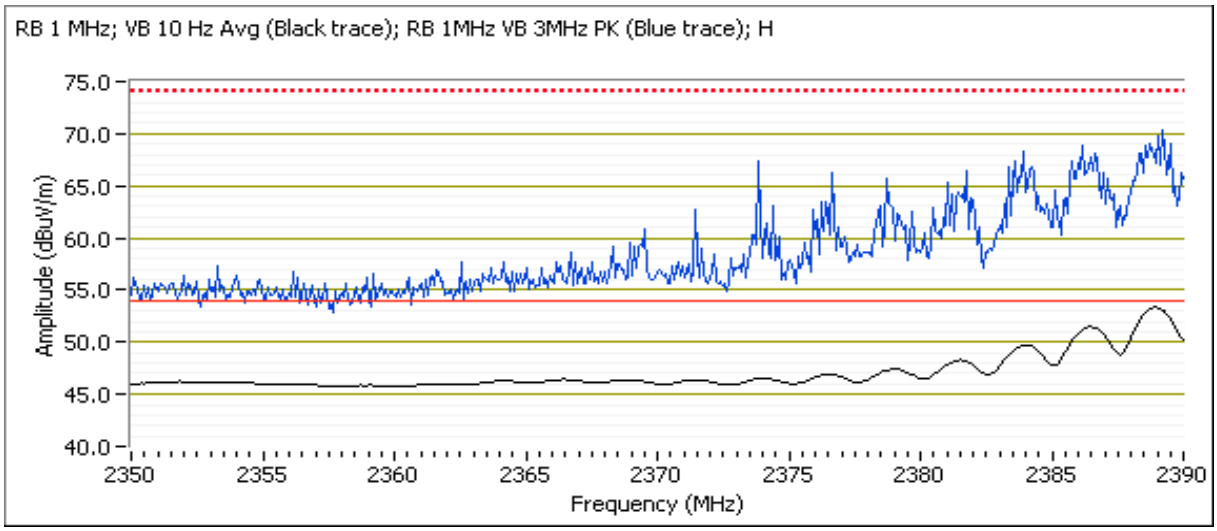
EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Channel: 2 Mode: n20
Tx Chain: 2Tx Data Rate: 6.5 Mbps

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Power setting = q83								
2388.960	53.4	H	54.0	-0.6	AVG	279	1.1	POS; RB 1 MHz; VB: 10 Hz
2389.680	72.8	H	74.0	-1.2	PK	279	1.1	POS; RB 1 MHz; VB: 3 MHz
2389.760	46.3	V	54.0	-7.7	AVG	323	1.0	POS; RB 1 MHz; VB: 10 Hz
2386.710	64.3	V	74.0	-9.7	PK	323	1.0	POS; RB 1 MHz; VB: 3 MHz



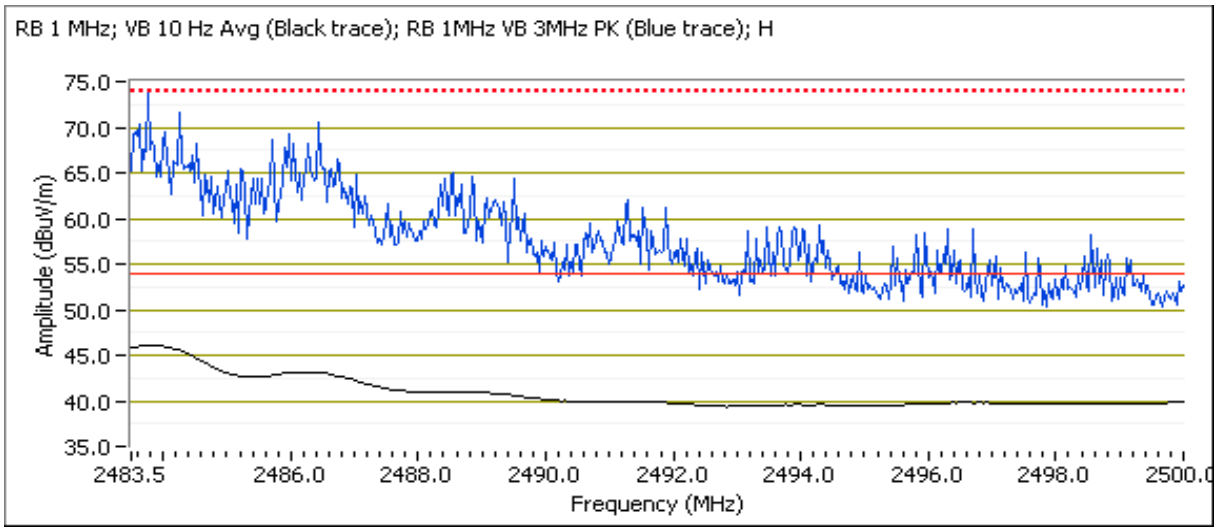
EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Channel: 11 Mode: n20
Tx Chain: 2Tx Data Rate: 6.5 Mbps

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Power setting = q61								
2483.800	46.0	H	54.0	-8.0	AVG	279	1.0	POS; RB 1 MHz; VB: 10 Hz
2484.720	73.4	H	74.0	-0.6	PK	279	1.0	POS; RB 1 MHz; VB: 3 MHz
2483.500	40.4	V	54.0	-13.6	AVG	183	1.0	POS; RB 1 MHz; VB: 10 Hz
2484.890	59.2	V	74.0	-14.8	PK	183	1.0	POS; RB 1 MHz; VB: 3 MHz



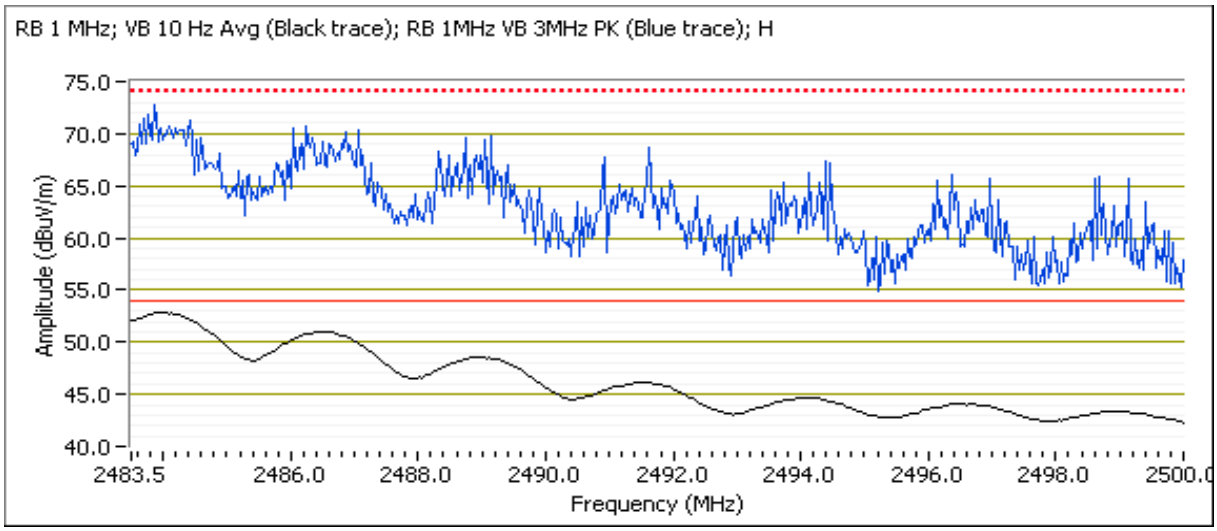
EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Channel: 10 Mode: n20
Tx Chain: 2Tx Data Rate: 6.5 Mbps

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Power setting = q77								
2484.060	52.7	H	54.0	-1.3	AVG	279	1.0	POS; RB 1 MHz; VB: 10 Hz
2484.290	72.5	H	74.0	-1.5	PK	279	1.0	POS; RB 1 MHz; VB: 3 MHz
2483.900	46.5	V	54.0	-7.5	AVG	110	1.0	POS; RB 1 MHz; VB: 10 Hz
2484.490	65.3	V	74.0	-8.7	PK	110	1.0	POS; RB 1 MHz; VB: 3 MHz



EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Date of Test: 04/21/16
Test Engineer: M. Birgani
Test Location: FT Chamber #4

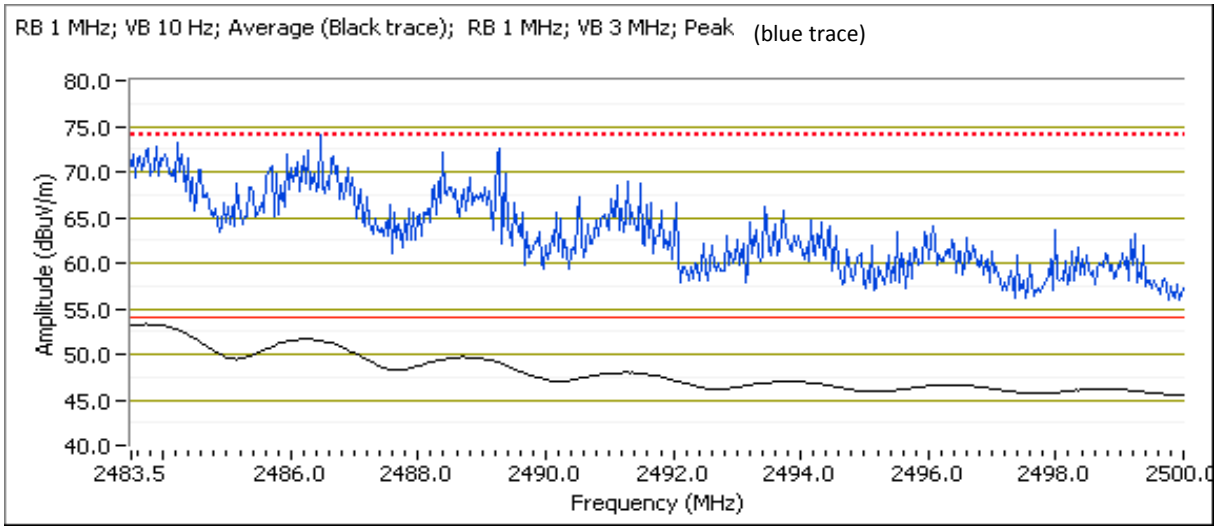
Config. Used: 1
Config Change: None
EUT Voltage: 120V/60Hz

Channel: 9
Tx Chain: 2Tx

Mode: n20
Data Rate: 6.5 Mbps

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Power setting = q79								
2484.130	73.8	H	74.0	**-0.2**	PK	290	1.0	POS; RB 1 MHz; VB: 3 MHz
2483.900	53.1	H	54.0	-0.9	AVG	290	1.0	POS; RB 1 MHz; VB: 10 Hz
2483.600	43.4	V	54.0	-10.6	AVG	111	1.0	POS; RB 1 MHz; VB: 10 Hz
2483.530	61.0	V	74.0	-13.0	PK	111	1.0	POS; RB 1 MHz; VB: 3 MHz



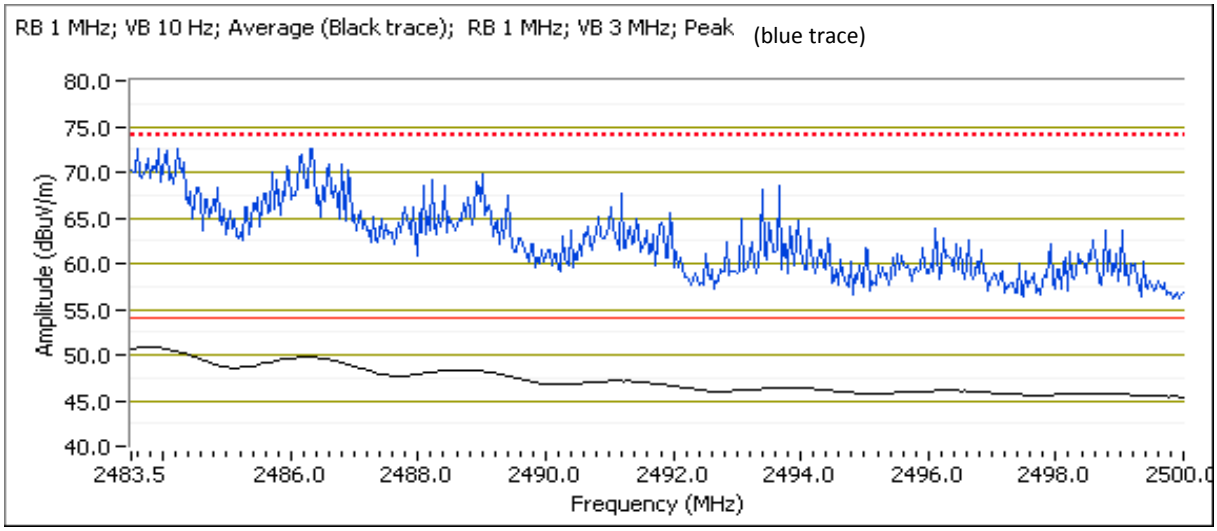
EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Channel: 8 Mode: n20
Tx Chain: 2Tx Data Rate: 6.5 Mbps

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Power setting = q80								
2483.930	73.1	H	74.0	**-0.9**	PK	290	1.0	POS; RB 1 MHz; VB: 3 MHz
2483.800	50.7	H	54.0	-3.3	AVG	290	1.0	POS; RB 1 MHz; VB: 10 Hz



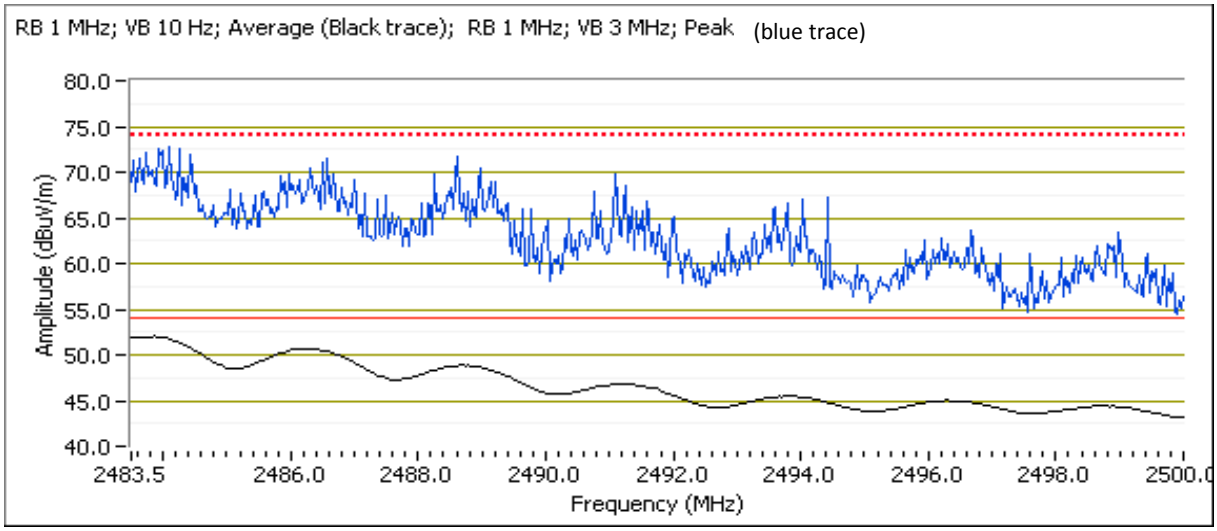
EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Channel: 7 Mode: n20
Tx Chain: 2Tx Data Rate: 6.5 Mbps

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Power setting = q86								
2483.700	52.6	H	54.0	**-1.4**	AVG	290	1.0	POS; RB 1 MHz; VB: 10 Hz
2484.030	72.6	H	74.0	-1.4	PK	290	1.0	POS; RB 1 MHz; VB: 3 MHz



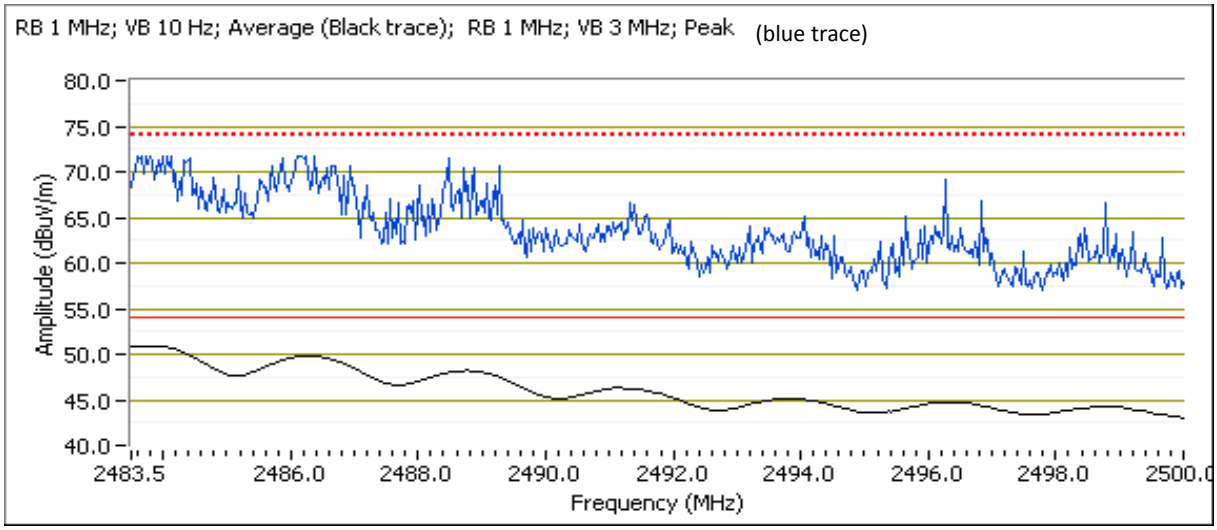
EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Channel: 6 Mode: n20
Tx Chain: 2Tx Data Rate: 6.5 Mbps

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Power setting = q88								
2483.570	73.8	H	74.0	**-0.2**	PK	290	1.0	POS; RB 1 MHz; VB: 3 MHz
2483.760	51.8	H	54.0	-2.2	AVG	290	1.0	POS; RB 1 MHz; VB: 10 Hz



EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Run #4: Radiated Bandedge Measurements

Date of Test: 04/21/16
Test Engineer: Rafael Varelas
Test Location: FT Chamber #4

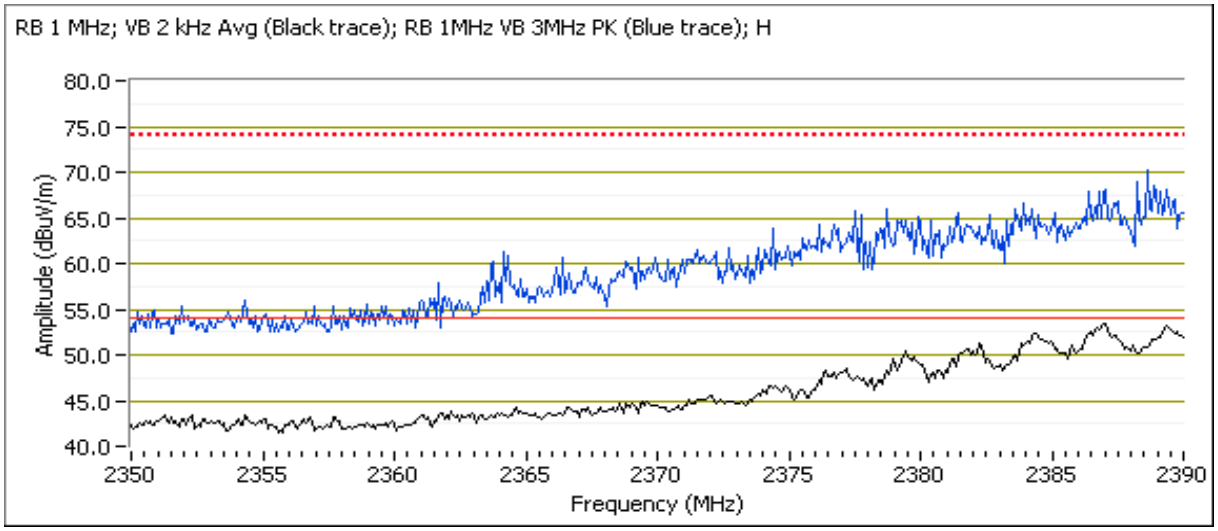
Config. Used: 1
Config Change: None
EUT Voltage: 120V/60Hz

Channel: 3
Tx Chain: 2Tx

Mode: n40
Data Rate: 13.5 Mbps

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Power setting = q68								
2386.950	53.2	H	54.0	-0.8	Avg	73	2.1	Note 4,POS Vavg:100; RB 1 MHz; VB: 2 kHz
2386.950	69.2	H	74.0	-4.8	PK	73	2.1	POS; RB 1 MHz; VB: 3 MHz
2388.160	46.6	V	54.0	-7.4	AVG	262	2.3	Note 4,POS Vavg:100; RB 1 MHz; VB: 2 kHz
2389.120	62.7	V	74.0	-11.3	PK	262	2.3	POS; RB 1 MHz; VB: 3 MHz



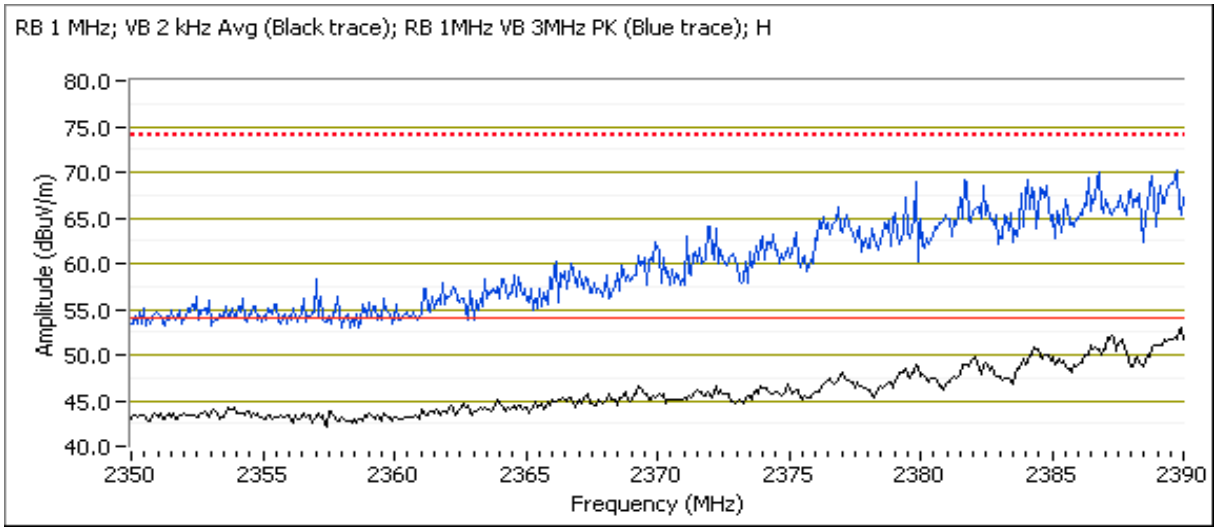
EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Channel: 4 Mode: n40
Tx Chain: 2Tx Data Rate: 13.5 Mbps

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Power setting = q71								
2389.680	53.5	H	54.0	-0.5	Avg	70	2.3	Note 4,POS Vavg:100; RB 1 MHz; VB: 2 kHz
2382.300	71.0	H	74.0	-3.0	PK	70	2.3	POS; RB 1 MHz; VB: 3 MHz



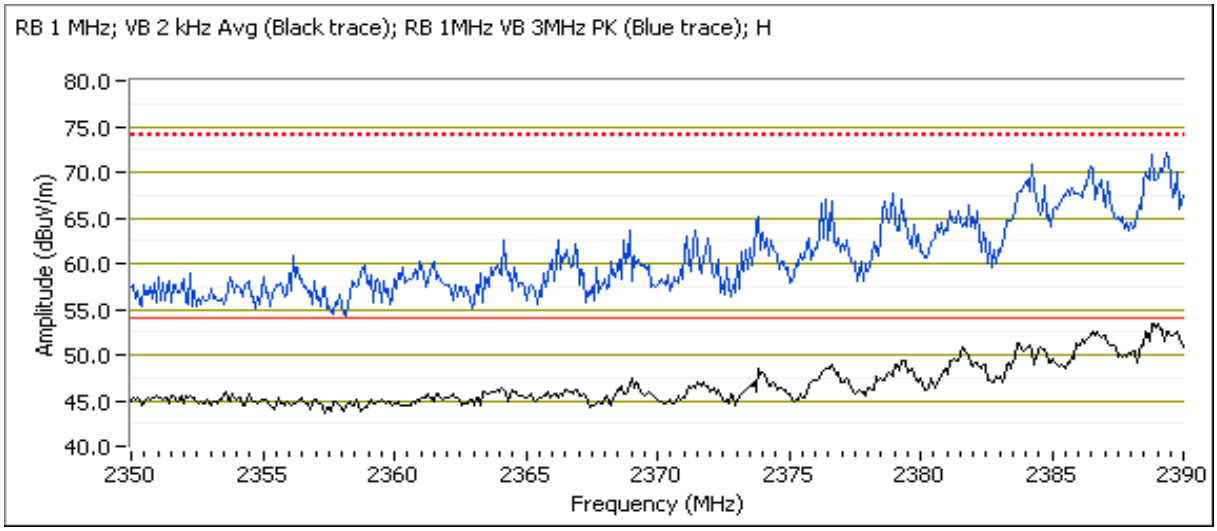
EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Channel: 5 Mode: n40
Tx Chain: 2Tx Data Rate: 13.5 Mbps

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Power setting = q77								
2389.280	53.8	H	54.0	-0.2	Avg	278	1.5	Note 4,POS Vavg:100; RB 1 MHz; VB: 2 kHz
2389.200	71.7	H	74.0	-2.3	PK	278	1.5	POS; RB 1 MHz; VB: 3 MHz



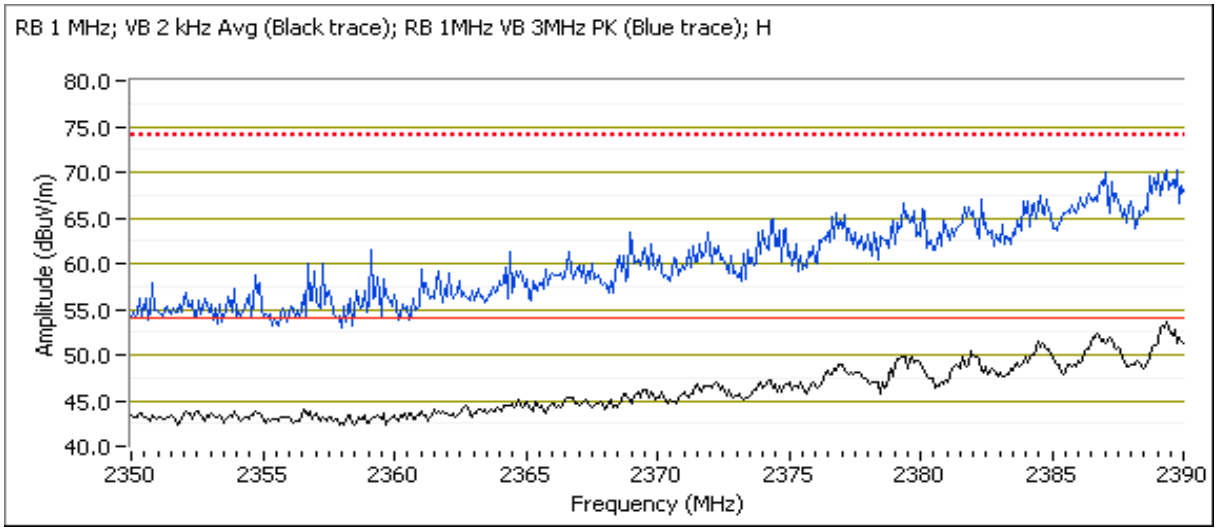
EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Channel: 6 Mode: n40
Tx Chain: 2Tx Data Rate: 13.5 Mbps

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Power setting = q78								
2389.520	53.9	H	54.0	-0.1	Avg	75	2.3	Note 4,POS Vavg:100; RB 1 MHz; VB: 2 kHz
2389.520	70.7	H	74.0	-3.3	PK	75	2.3	POS; RB 1 MHz; VB: 3 MHz



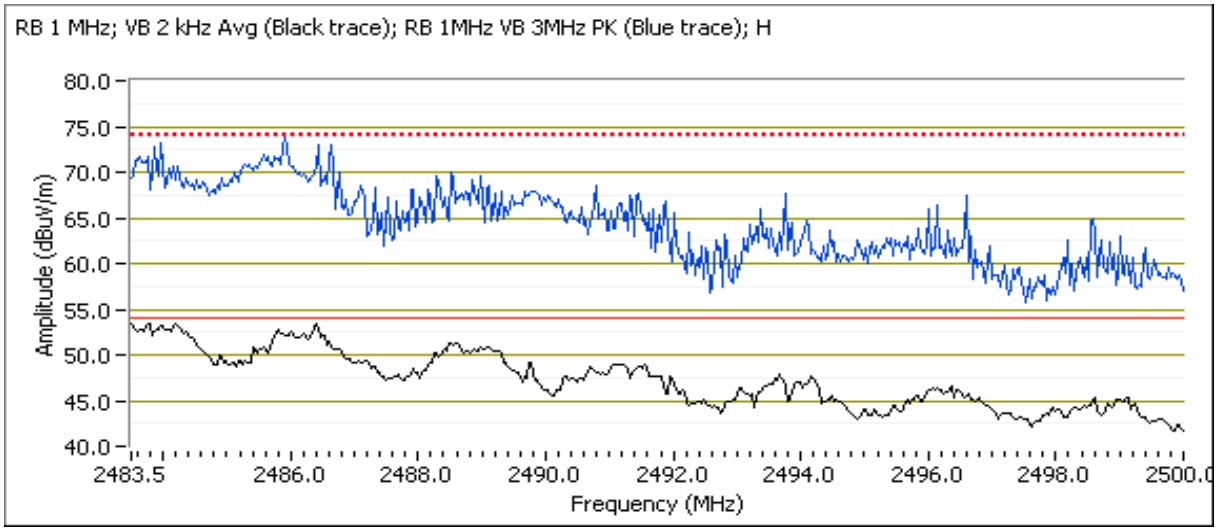
EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Channel: 9 Mode: n40
Tx Chain: 2Tx Data Rate: 13.5 Mbps

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Power setting = q62								
2483.530	53.5	H	54.0	-0.5	Avg	294	1.0	Note 4,POS Vavg:100; RB 1 MHz; VB: 2 kHz
2485.910	73.1	H	74.0	-0.9	PK	294	1.0	POS; RB 1 MHz; VB: 3 MHz



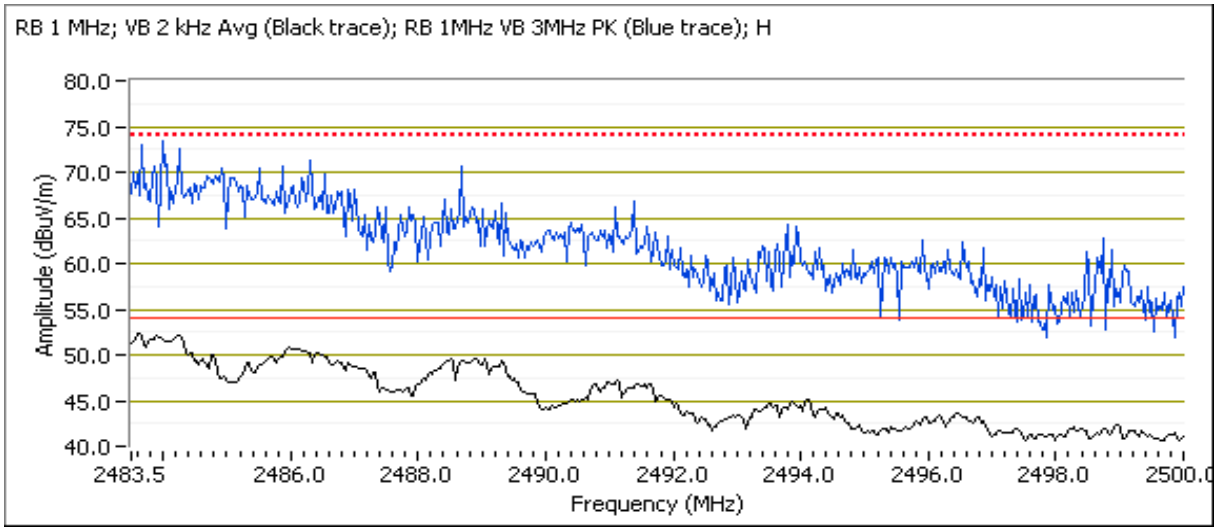
EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Channel: 8 Mode: n40
Tx Chain: 2Tx Data Rate: 13.5 Mbps

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Power setting = q63								
2483.900	52.1	H	54.0	-1.9	Avg	290	1.0	Note 4,POS Vavg:100; RB 1 MHz; VB: 2 kHz
2484.360	73.2	H	74.0	-0.8	PK	290	1.0	POS; RB 1 MHz; VB: 3 MHz



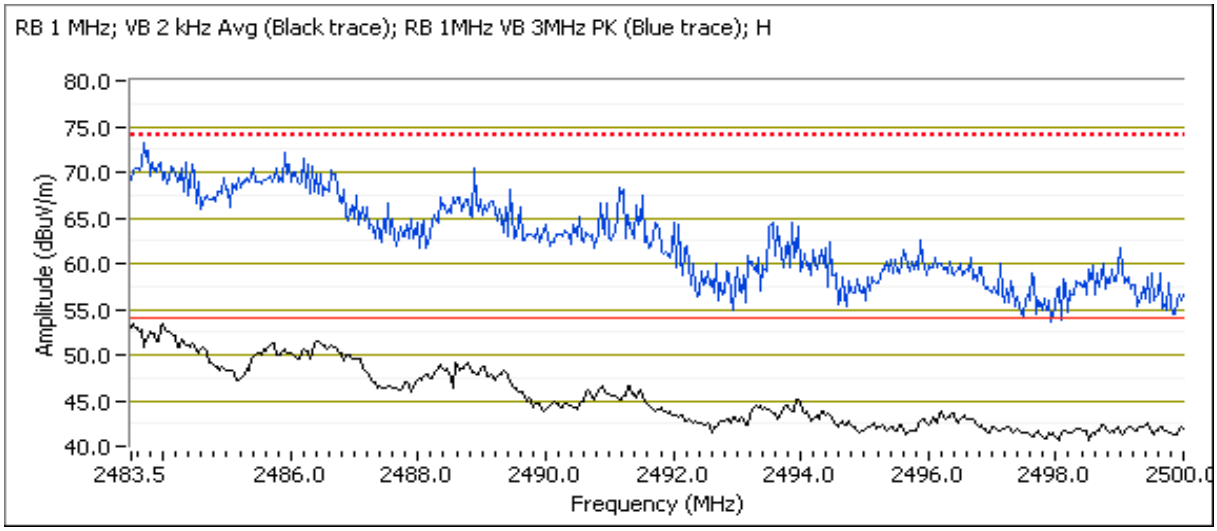
EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Channel: 7 Mode: n40
Tx Chain: 2Tx Data Rate: 13.5 Mbps

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Power setting = q68								
2483.860	53.3	H	54.0	-0.7	Avg	291	1.0	Note 4,POS Vavg:100; RB 1 MHz; VB: 2 kHz
2485.980	73.8	H	74.0	-0.2	PK	291	1.0	POS; RB 1 MHz; VB: 3 MHz



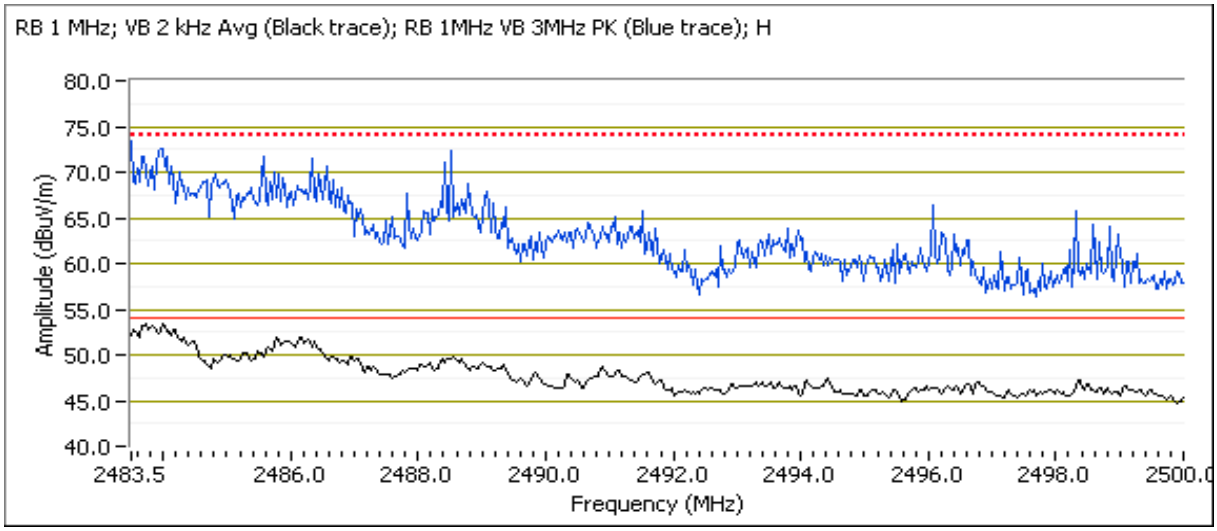
EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Channel: 6 Mode: n40
Tx Chain: 2Tx Data Rate: 13.5 Mbps

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Power setting = q72								
2483.730	53.2	H	54.0	-0.8	Avg	293	1.0	Note 4,POS Vavg:100; RB 1 MHz; VB: 2 kHz
2484.390	73.4	H	74.0	-0.6	PK	293	1.0	POS; RB 1 MHz; VB: 3 MHz



EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

RSS-247 and FCC 15.247 (DTS) Radiated Spurious Emissions

Test Specific Details

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

General Test Configuration

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

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

Ambient Conditions:

Temperature: 21.8 °C
Rel. Humidity: 36 %

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

Run #	Mode	Channel	Target Power	Power Setting	Test Performed	Limit	Result / Margin
1	b	1 - 2412MHz	23	23	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	50.1 dBµV/m @ 14472.0 MHz (-3.9 dB)
	b	6 - 2437MHz	23	23	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	48.9 dBµV/m @ 14622.0 MHz (-5.1 dB)
	b	11 - 2462MHz	23	23	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	49.5 dBµV/m @ 4924.0 MHz (-4.5 dB)
Scans on center channel in all three OFDM modes to determine the worst case mode.							
2	g	6 - 2437MHz	23	23	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	45.5 dBµV/m @ 2219.9 MHz (-8.5 dB)
	n20	6 - 2437MHz	23	23	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	47.7 dBµV/m @ 2219.8 MHz (-6.3 dB)
	n40	6 - 2437MHz	23	23	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	52.0 dBµV/m @ 2240.2 MHz (-2.0 dB)
40MHz - use if worse case from 2							
3	n40	3 - 2422MHz	23	23	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	51.5 dBµV/m @ 2240.0 MHz (-2.5 dB)
	n40	9 - 2452MHz	23	23	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	52.0 dBµV/m @ 2239.9 MHz (-2.0 dB)

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	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.

Sample Notes

Sample S/N: G54DA5DN000041
Driver: 5.99.188.21
Antenna: Internal
Chain 1: Gray cable PL8200
Chain 2: Black cable PL800

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Procedure Comments:

Measurements performed in accordance with FCC KDB 558074
Peak measurements performed with: RBW=1MHz, VBW=3MHz, peak detector, max hold, auto sweep time
Unless otherwise stated/noted, emission has duty cycle ≥ 98% and was measured using RBW=1MHz, VBW=10Hz, peak detector, linear average mode, auto sweep time, max hold.
2.4GHz band reject filter used

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
11b	1 Mbps	99.9%	Yes	8.419	0	0	10
11g	6 Mbps	98.9%	Yes	1.398	0	0	10
n20	6.5 Mbps	98.8%	Yes	1.309	0	0	10
n40	13.5 Mbps	97.6%	Yes	0.651	0.1055018	0.2110036	1536

Measurement Specific Notes:

Note 1:	Emission in non-restricted band, but limit of 15.209 used.
Note 2:	Emission in non-restricted band, the limit was set 30dB below the level of the fundamental and measured in 100kHz.
Note 4:	Emission has constant duty cycle < 98%, average measurement performed: RBW=1MHz, VBW>1/T but not less than 10Hz, peak detector, linear averaging, auto sweep, trace average 100 traces, measurement corrected by Linear voltage correction factor
Note 6:	Emission has non constant duty cycle < 98%, average measurement performed: RBW=1MHz, VBW> 1/T, peak detector, linear average mode, sweep time auto, max hold. Max hold for 50*(1/DC) traces

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

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

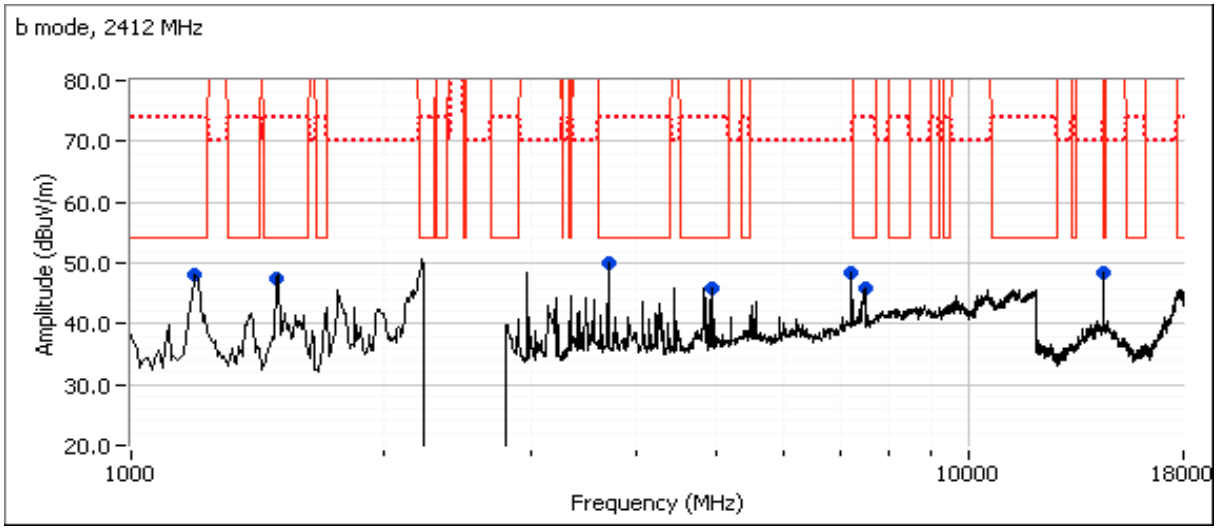
Date of Test: 04/21/16 Config. Used: 1
Test Engineer: Rafael Varelas Config Change: None
Test Location: FT Chamber #4 EUT Voltage: 120V/60Hz

Run #1a: Low Channel

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

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
14472.030	50.1	V	54.0	-3.9	AVG	326	1.0	RB 1 MHz;VB 10 Hz;Peak
14471.830	60.3	V	74.0	-13.7	PK	326	1.0	RB 1 MHz;VB 3 MHz;Peak
7236.830	47.4	V	54.0	-6.6	AVG	203	1.6	RB 1 MHz;VB 10 Hz;Peak
7236.940	54.9	V	74.0	-19.1	PK	203	1.6	RB 1 MHz;VB 3 MHz;Peak
4945.730	32.8	H	54.0	-21.2	AVG	318	1.0	RB 1 MHz;VB 10 Hz;Peak
4946.650	43.9	H	74.0	-30.1	PK	318	1.0	RB 1 MHz;VB 3 MHz;Peak
1495.800	53.5	V	74.0	-20.5	PK	178	1.2	Note 8
1197.790	62.3	H	74.0	-11.7	PK	190	1.6	Note 8
3708.700	52.5	V	74.0	-21.5	PK	138	1.3	Note 8
7498.830	37.8	V	54.0	-16.2	AVG	113	1.2	RB 1 MHz;VB 10 Hz;Peak
7499.670	53.7	V	74.0	-20.3	PK	113	1.2	RB 1 MHz;VB 3 MHz;Peak

Note 8: These frequencies are not related to the radio since they are not present when radio is turned off



EMC Test Data

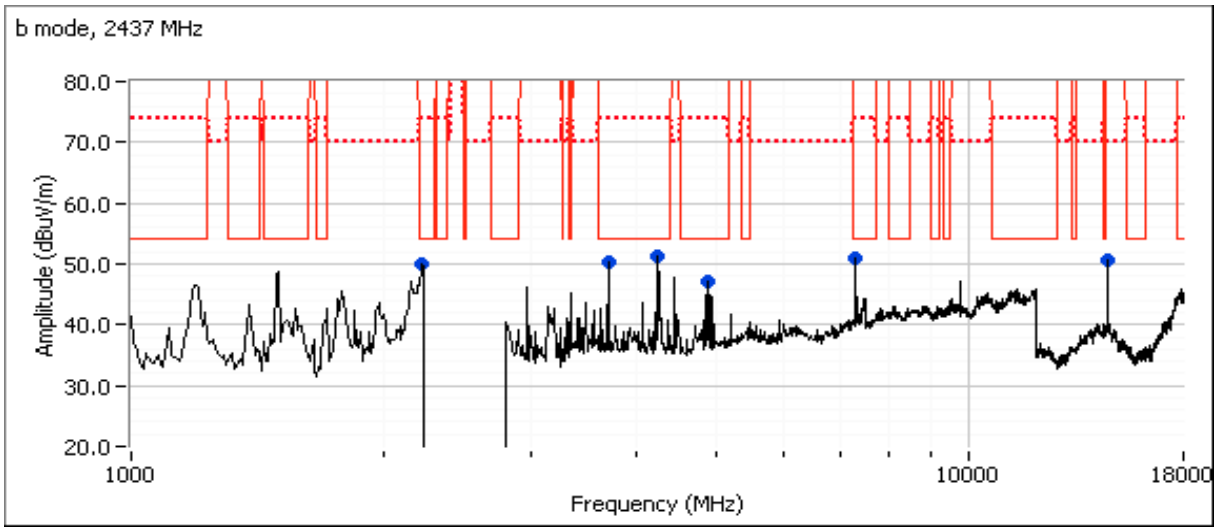
Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Run #1b: Center Channel

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

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
14622.040	48.9	V	54.0	-5.1	AVG	53	1.8	Note 1,RB 1 MHz;VB 10 Hz;Peak
14624.810	59.8	V	74.0	-14.2	PK	53	1.8	Note 1,RB 1 MHz;VB 3 MHz;Peak
4874.000	46.3	H	54.0	-7.7	AVG	294	1.3	RB 1 MHz;VB 10 Hz;Peak
4874.100	51.9	H	74.0	-22.1	PK	294	1.3	RB 1 MHz;VB 3 MHz;Peak
2220.220	46.3	H	54.0	-7.7	AVG	67	2.1	RB 1 MHz;VB 10 Hz;Peak
2215.220	58.4	H	74.0	-15.6	PK	67	2.1	RB 1 MHz;VB 3 MHz;Peak
3708.770	53.5	V	74.0	-20.5	PK	137	1.0	Note 8
7310.270	44.9	V	54.0	-9.1	AVG	215	1.0	RB 1 MHz;VB 10 Hz;Peak
7312.570	53.3	V	74.0	-20.7	PK	215	1.0	RB 1 MHz;VB 3 MHz;Peak
4262.010	37.9	V	54.0	-16.1	AVG	262	2.2	RB 1 MHz;VB 10 Hz;Peak
4265.410	58.5	V	74.0	-15.5	PK	262	2.2	RB 1 MHz;VB 3 MHz;Peak

Note:	Scans made between 18 - 25 GHz with the measurement antenna moved around the card and its antennas 20-50cm from the device indicated there were no significant emissions in this frequency range
Note 8:	These frequencies are not related to the radio since they are not present when radio is turned off



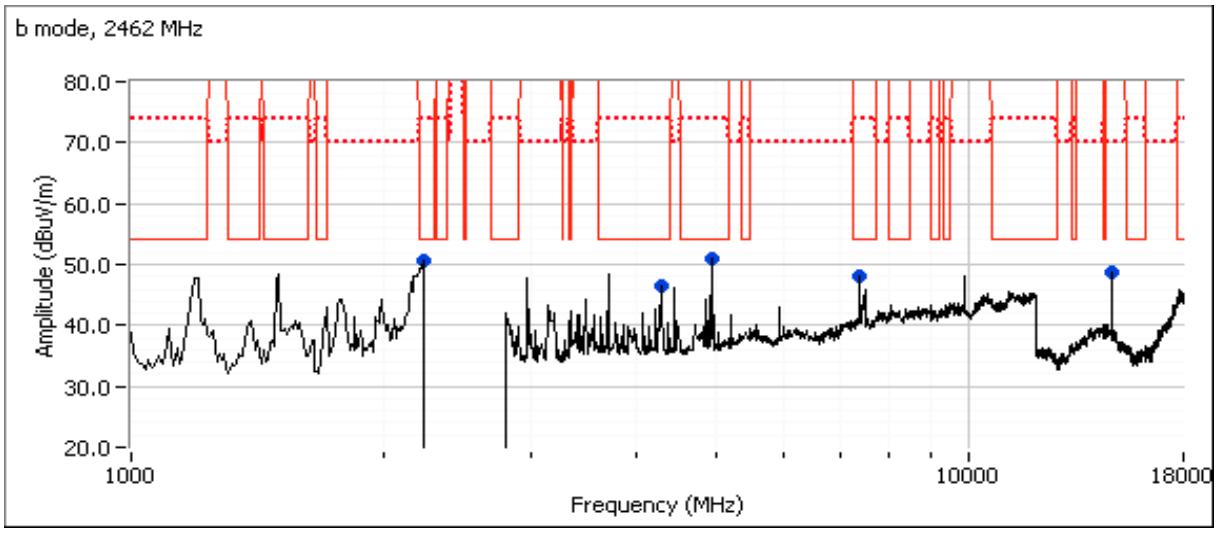
EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Run #1c: High Channel

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

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4923.980	49.5	H	54.0	-4.5	AVG	53	1.6	RB 1 MHz;VB 10 Hz;Peak
4923.810	53.6	H	74.0	-20.4	PK	53	1.6	RB 1 MHz;VB 3 MHz;Peak
4281.530	36.0	V	54.0	-18.0	AVG	294	2.1	RB 1 MHz;VB 10 Hz;Peak
4298.470	54.6	V	74.0	-19.4	PK	294	2.1	RB 1 MHz;VB 3 MHz;Peak
7386.770	47.0	V	54.0	-7.0	AVG	235	1.0	RB 1 MHz;VB 10 Hz;Peak
7387.620	54.9	V	74.0	-19.1	PK	235	1.0	RB 1 MHz;VB 3 MHz;Peak
2225.880	48.8	H	54.0	-5.2	AVG	33	1.4	RB 1 MHz;VB 10 Hz;Peak
2225.990	61.0	H	74.0	-13.0	PK	33	1.4	RB 1 MHz;VB 3 MHz;Peak
14771.940	49.3	V	54.0	-4.7	AVG	57	1.0	Note 1,RB 1 MHz;VB 10 Hz;Peak
14768.880	58.5	V	74.0	-15.5	PK	57	1.0	Note 1,RB 1 MHz;VB 3 MHz;Peak



EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

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

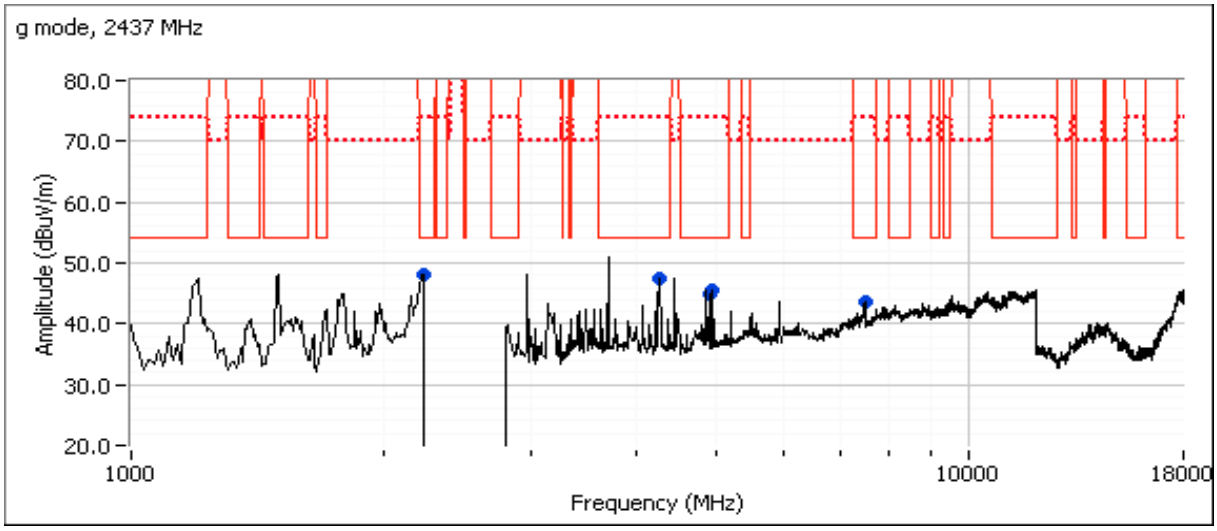
Date of Test: 04/21/16 Config. Used: 1
Test Engineer: Rafael Varelas Config Change: None
Test Location: FT Chamber #4 EUT Voltage: 120V/60Hz

Run #2a: Center Channel

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

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2219.850	45.5	H	54.0	-8.5	AVG	278	1.2	RB 1 MHz;VB 10 Hz;Peak
2218.620	57.6	H	74.0	-16.4	PK	278	1.2	RB 1 MHz;VB 3 MHz;Peak
4895.510	44.4	H	54.0	-9.6	AVG	32	0.9	RB 1 MHz;VB 10 Hz;Peak
4891.280	44.5	H	74.0	-29.5	PK	32	0.9	RB 1 MHz;VB 3 MHz;Peak
7490.170	37.0	H	54.0	-17.0	AVG	81	1.5	RB 1 MHz;VB 10 Hz;Peak
7491.270	48.5	H	74.0	-25.5	PK	81	1.5	RB 1 MHz;VB 3 MHz;Peak
4260.430	38.3	V	54.0	-15.7	AVG	259	2.4	RB 1 MHz;VB 10 Hz;Peak
4258.500	45.6	V	74.0	-28.4	PK	259	2.4	RB 1 MHz;VB 3 MHz;Peak
4951.970	32.7	H	54.0	-21.3	AVG	360	1.5	RB 1 MHz;VB 10 Hz;Peak
4947.630	44.9	H	74.0	-29.1	PK	360	1.5	RB 1 MHz;VB 3 MHz;Peak

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



EMC Test Data

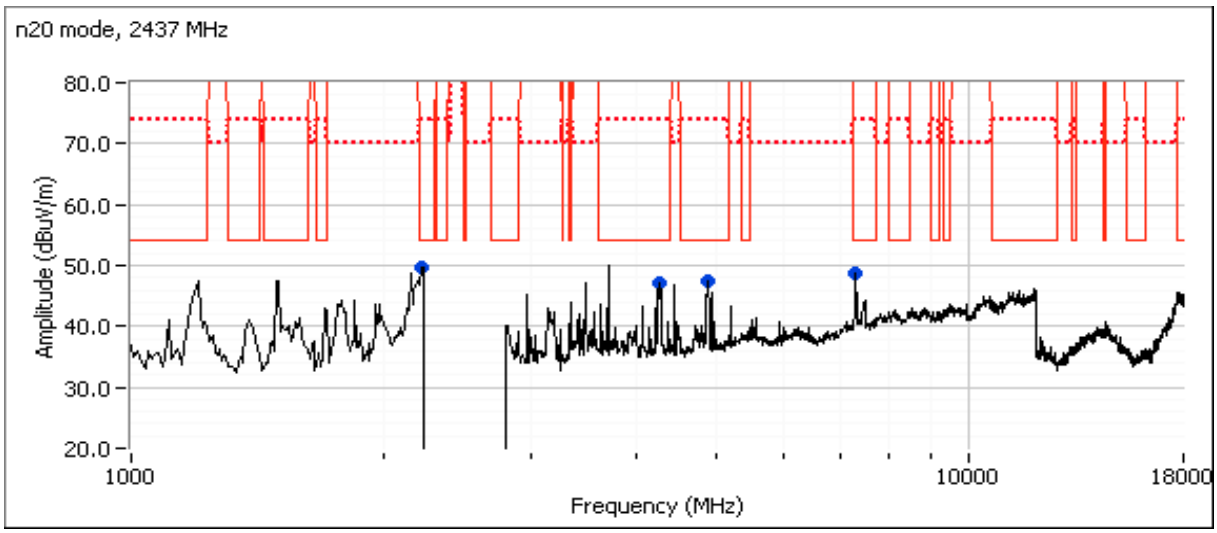
Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Run #2b: Center Channel

Channel: 6 Mode: n20
Tx Chain: 2Tx Data Rate: 6.5 Mbps

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2219.820	47.7	H	54.0	-6.3	AVG	268	1.4	RB 1 MHz;VB 10 Hz;Peak
2219.890	59.1	H	74.0	-14.9	PK	268	1.4	RB 1 MHz;VB 3 MHz;Peak
4872.650	41.2	V	54.0	-12.8	AVG	329	1.2	RB 1 MHz;VB 10 Hz;Peak
4867.480	54.5	V	74.0	-19.5	PK	329	1.2	RB 1 MHz;VB 3 MHz;Peak
4259.870	36.7	V	54.0	-17.3	AVG	306	1.9	RB 1 MHz;VB 10 Hz;Peak
4258.740	52.6	V	74.0	-21.4	PK	306	1.9	RB 1 MHz;VB 3 MHz;Peak
7311.720	46.3	V	54.0	-7.7	AVG	136	2.5	RB 1 MHz;VB 10 Hz;Peak
7311.090	59.8	V	74.0	-14.2	PK	136	2.5	RB 1 MHz;VB 3 MHz;Peak

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



EMC Test Data

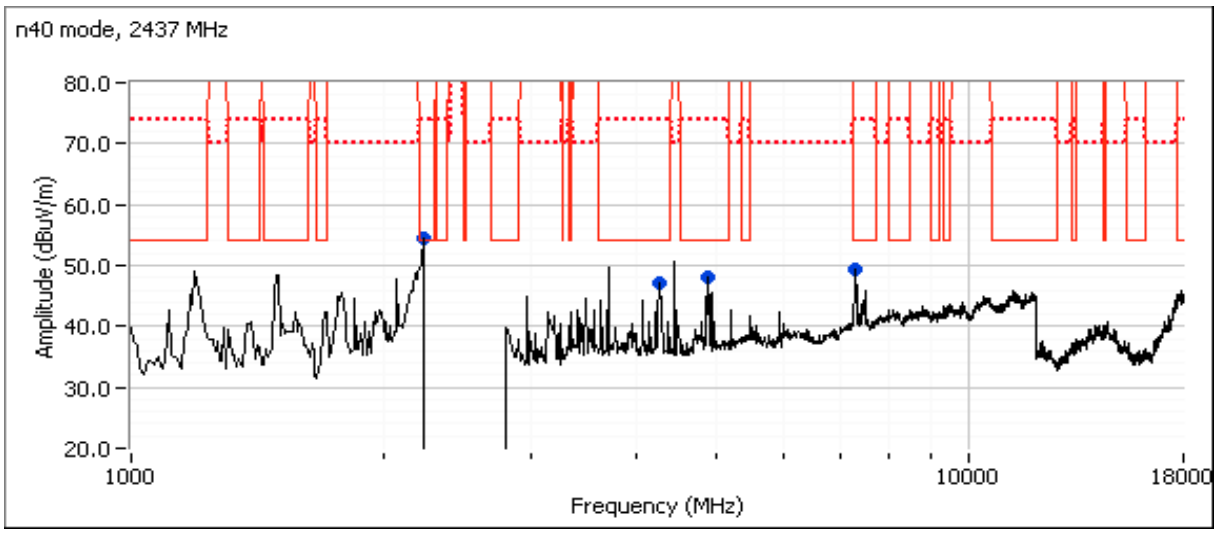
Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Run #2c: Center Channel

Channel: 6 Mode: n40
Tx Chain: 2Tx Data Rate: 13.5 Mbps

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2240.190	52.0	H	54.0	-2.0	AVG	271	1.0	RB 1 MHz;VB 3 kHz;Peak VAVG 50
2219.210	61.6	H	74.0	-12.4	PK	271	1.0	RB 1 MHz;VB 3 MHz;Peak
4872.880	42.2	V	54.0	-11.8	AVG	6	1.3	RB 1 MHz;VB 3 kHz;Peak VAVG 50
4872.880	54.6	V	74.0	-19.4	PK	6	1.3	RB 1 MHz;VB 3 MHz;Peak
7311.800	45.1	V	54.0	-8.9	AVG	136	2.5	RB 1 MHz;VB 3 kHz;Peak VAVG 50
7303.870	59.0	V	74.0	-15.0	PK	136	2.5	RB 1 MHz;VB 3 MHz;Peak
4265.790	38.4	V	54.0	-15.6	AVG	248	1.6	RB 1 MHz;VB 3 kHz;Peak VAVG 50
4263.490	55.9	V	74.0	-18.1	PK	248	1.6	RB 1 MHz;VB 3 MHz;Peak

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



EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

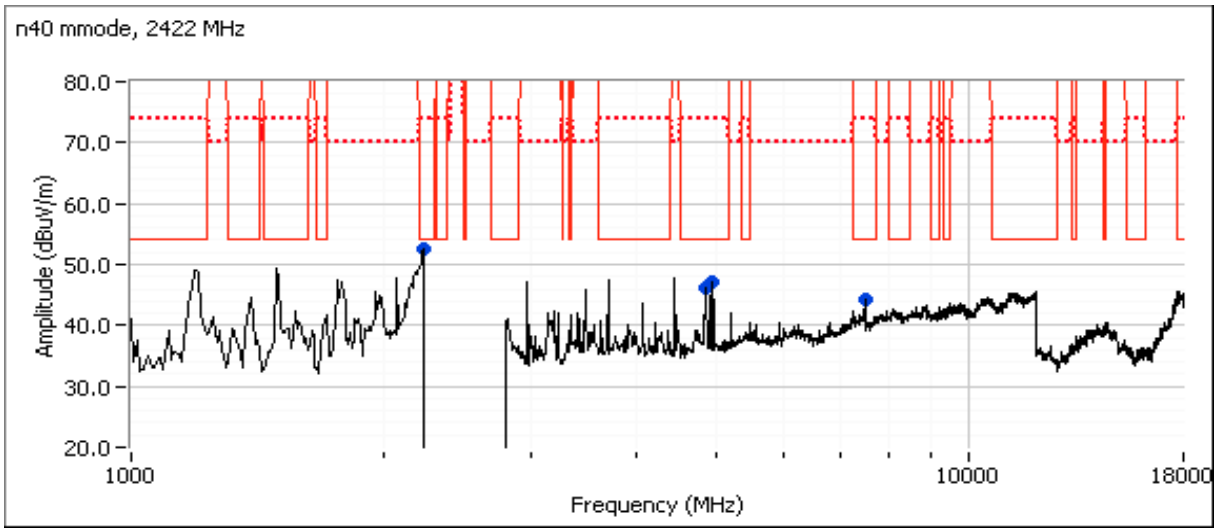
Run #3: Radiated Spurious Emissions, 1,000 - 25000 MHz. Operating Mode: Worse case from Run #2

Date of Test: 04/22/16 Config. Used: 1
Test Engineer: Rafael Varelas Config Change: None
Test Location: FT Chamber #4 EUT Voltage: 120V/60Hz

Run #3a: Low Channel

Channel: 3 Mode: n40
Tx Chain: 2Tx Data Rate: 13.5 Mbps

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2240.010	51.5	H	54.0	-2.5	Avg	261	1.0	Note 4,RB 1 MHz;VB 3 kHz;Peak VA
2231.560	62.8	H	74.0	-11.2	PK	261	1.0	RB 1 MHz;VB 3 MHz;Peak
4845.250	40.9	V	54.0	-13.1	Avg	6	1.5	Note 4,RB 1 MHz;VB 3 kHz;Peak VA
4842.990	54.7	V	74.0	-19.3	PK	6	1.5	RB 1 MHz;VB 3 MHz;Peak
7498.240	37.6	V	54.0	-16.4	Avg	300	2.0	Note 4,RB 1 MHz;VB 3 kHz;Peak VA
7497.760	51.7	V	74.0	-22.3	PK	300	2.0	RB 1 MHz;VB 3 MHz;Peak
4954.930	33.0	H	54.0	-21.0	Avg	289	1.0	Note 4,RB 1 MHz;VB 3 kHz;Peak VA
4964.200	44.9	H	74.0	-29.1	PK	289	1.0	RB 1 MHz;VB 3 MHz;Peak



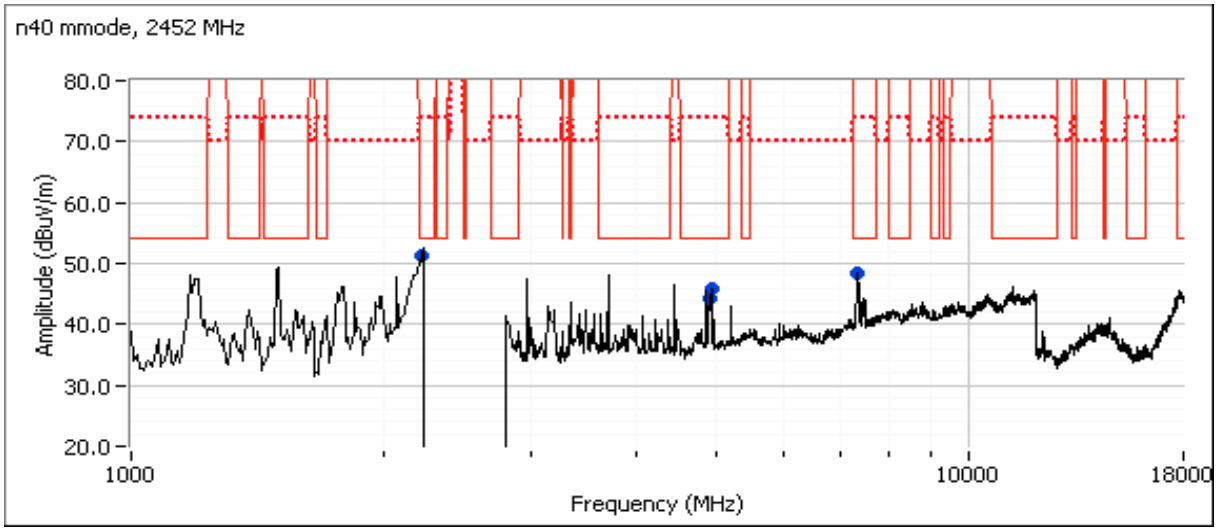
EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Run #3b: High Channel

Channel: 9 Mode: n40
Tx Chain: 2Tx Data Rate: 13.5 Mbps

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2239.900	52.0	H	54.0	-2.0	Avg	272	1.2	RB 1 MHz;VB 3 kHz;Peak VAVG 50
2230.000	64.2	H	74.0	-9.8	PK	272	1.2	RB 1 MHz;VB 3 MHz;Peak
4892.830	36.3	H	54.0	-17.7	Avg	334	1.0	RB 1 MHz;VB 3 kHz;Peak VAVG 50
4884.750	48.9	H	74.0	-25.1	PK	334	1.0	RB 1 MHz;VB 3 MHz;Peak
4929.220	33.7	H	54.0	-20.3	Avg	330	1.0	RB 1 MHz;VB 3 kHz;Peak VAVG 50
4946.220	47.9	H	74.0	-26.1	PK	330	1.0	RB 1 MHz;VB 3 MHz;Peak
7349.770	41.2	V	54.0	-12.8	Avg	124	1.1	RB 1 MHz;VB 3 kHz;Peak VAVG 50
7349.920	54.0	V	74.0	-20.0	PK	124	1.1	RB 1 MHz;VB 3 MHz;Peak



EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

RSS-247 and FCC 15.247 (DTS) Antenna Port Measurements
MIMO and Smart Antenna Systems
Power, PSD, Bandwidth and Spurious Emissions

Test Specific Details

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

Date of Test: 4/25/2016 and 5/24/16
Test Engineer: M. Birgani / R. Varelas
Test Location: Lab 4

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

General Test Configuration

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

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

Ambient Conditions:

Temperature: 18-20 °C
Rel. Humidity: 30-32 %

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: **G54DA5DN000041** Driver: **5.99.188.21** Antenna: **Internal**
Chain 1: **Gray cable PL8200** Chain 2: **Black cable PL800**

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Summary of Results

Run #	Pwr setting	Avg Pwr	Test Performed	Limit	Pass / Fail	Result / Margin
1Tx Modes						
1			Output Power	15.247(b)	PASS	11b: 23.1 dBm 11g: 21.6 dBm
2			Power spectral Density (PSD)	15.247(e)	PASS	11b: 4.6 dBm/3kHz 11g: -0.8 dBm/3kHz
2Tx Modes						
1			Output Power	15.247(b)	PASS	n20: 23.0 dBm n40: 20.7 dBm
2			Power spectral Density (PSD)	15.247(e)	PASS	n20: 1.1 dBm/3kHz n40: -0.7 dBm/3kHz
Applicable to all modes						
3			Minimum 6dB Bandwidth	15.247(a)	PASS	11b: 8.0 MHz 11g: 16.4 MHz n20: 17.6 MHz n40: 35.4 MHz
3			99% Bandwidth	RSS GEN	-	11b: 13.0 MHz 11g: 16.6 MHz n20: 17.7 MHz n40: 36.1 MHz
4			Spurious emissions	15.247(d)	PASS	All emissions below -30dBc limit

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Procedure Comments:

Measurements performed in accordance with FCC KDB 558074

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
11b	1 Mbps	99.9%	Yes	8.419	0	0	10
11g	6 Mbps	98.9%	Yes	1.398	0	0	10
n20	6.5 Mbps	98.8%	Yes	1.309	0	0	10
n40	13.5 Mbps	97.6%	Yes	0.651	0.11	0.21	1536

Antenna Gain Information

Freq	Antenna Gain (dBi) / Chain				BF	MultiChain Legacy	CDD	Sectorized / Xpol	Dir G (PWR)	Dir G (PSD)
	1	2	3	4						
2.4-2.4835 GHz	3.3	3.3			No	No	Yes	No	3.3	6.3

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; Dir G (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 KDB 662911 D01, v01r02.
Note 1:	Duty Cycle ≥ 98%. Output power measured using a spectrum analyzer (see plots below) with RBW= 1-5% of OBW and ≤ 1 MHz, VB≥3* RBW, Span ≥ 1.5 of OBW, auto sweep time, RMS detector, power averaging on, and power integration over the OBW, trace average 100 traces (option AVGSA-1 in ANSI C63.10). Spurious limit becomes -30dBc.
Note 1:	Duty Cycle < 98%. Output power measured using a spectrum analyzer (see plots below) with RBW= 1-5% of OBW and ≤ 1 MHz, VB≥3* RBW, Span ≥ 1.5 of OBW, auto sweep time, RMS detector, power averaging on, GATING enabled, and power integration over the OBW, trace average 100 traces (option AVGSA-1 in C63.10). Spurious limit becomes -30dBc.

EMC Test Data

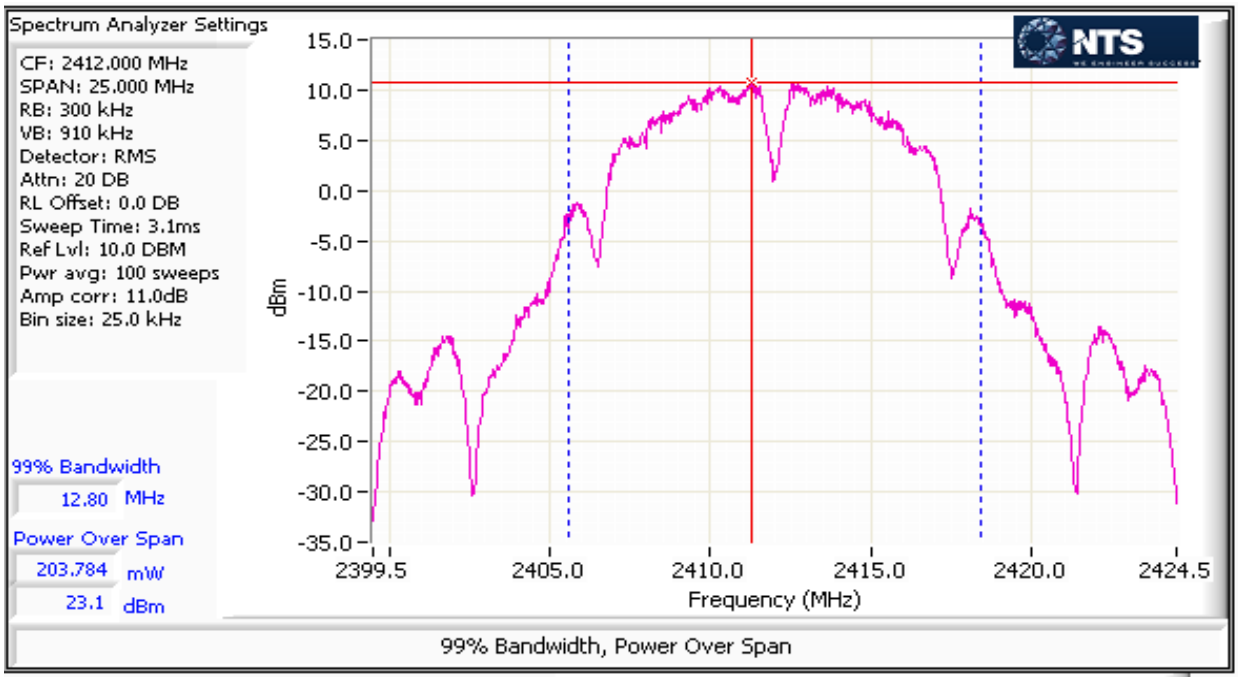
Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Run #1: Output Power

Operating Mode: 11b
Directional Gain (dBi): 3.3

Max EIRP (mW): 436.51583

Frequency (MHz)	Chain	Software Setting	Power[1] dBm	Power[1] mW	Total mW	Total dBm	Max Power (W)	Limit dBm	Result	Power (dBm)[3]
2412	3	q92		0.0	204.2	23.1	0.204	30.0	Pass	
	3			0.0						
	4			0.0						
	2		23.1	204.2						
2437	1	q92		0.0	204.2	23.1		30.0	Pass	
	3			0.0						
	4			0.0						
	2		23.1	204.2						
2462	1	q88		0.0	117.5	20.7		30.0	Pass	
	3			0.0						
	4			0.0						
	2		20.7	117.5						



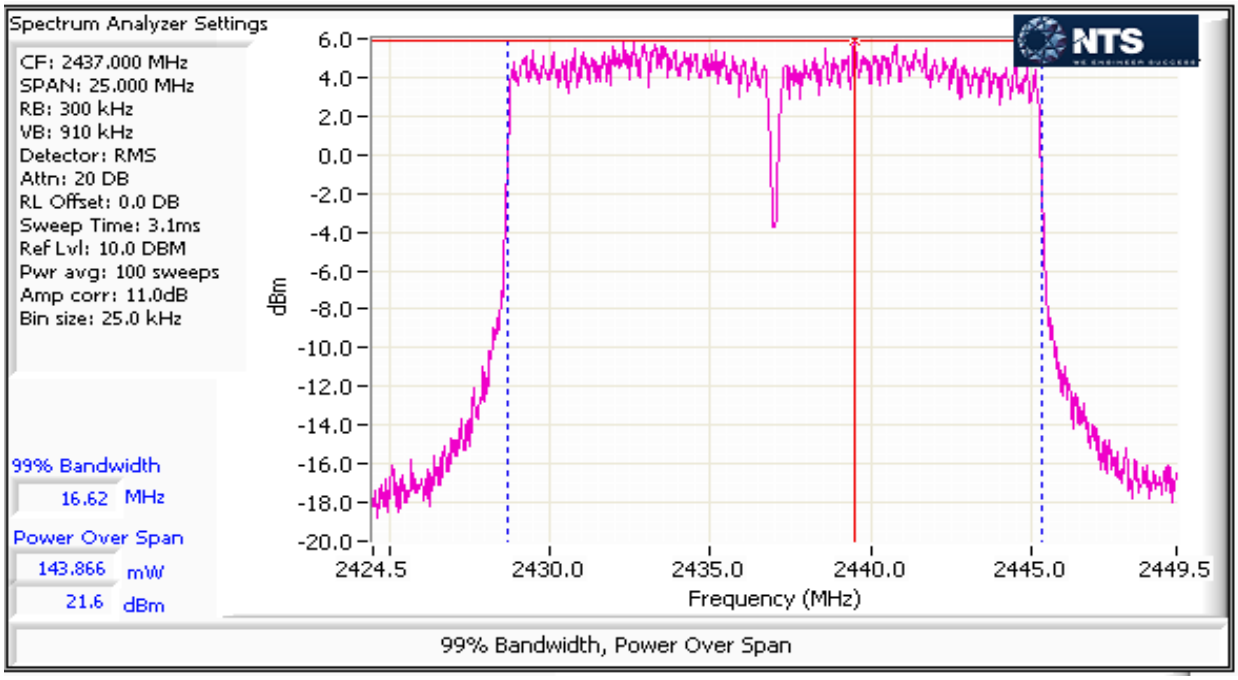
EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Operating Mode: 11g
Directional Gain (dBi): 3.3

Max EIRP (mW): 309.02954

Frequency (MHz)	Chain	Software Setting	Power[1] dBm	Power[1] mW	Total mW	Total dBm	Max Power (W)	Limit dBm	Result	Power (dBm)[3]
2412	3	q80		0.0	66.1	18.2	0.145	30.0	Pass	
	3			0.0						
	4			0.0						
	2		18.2	66.1						
2437	1	q92		0.0	144.5	21.6		30.0	Pass	
	3			0.0						
	4			0.0						
	2		21.6	144.5						
2462	1	q69		0.0	33.1	15.2		30.0	Pass	
	3			0.0						
	4			0.0						
	2		15.2	33.1						



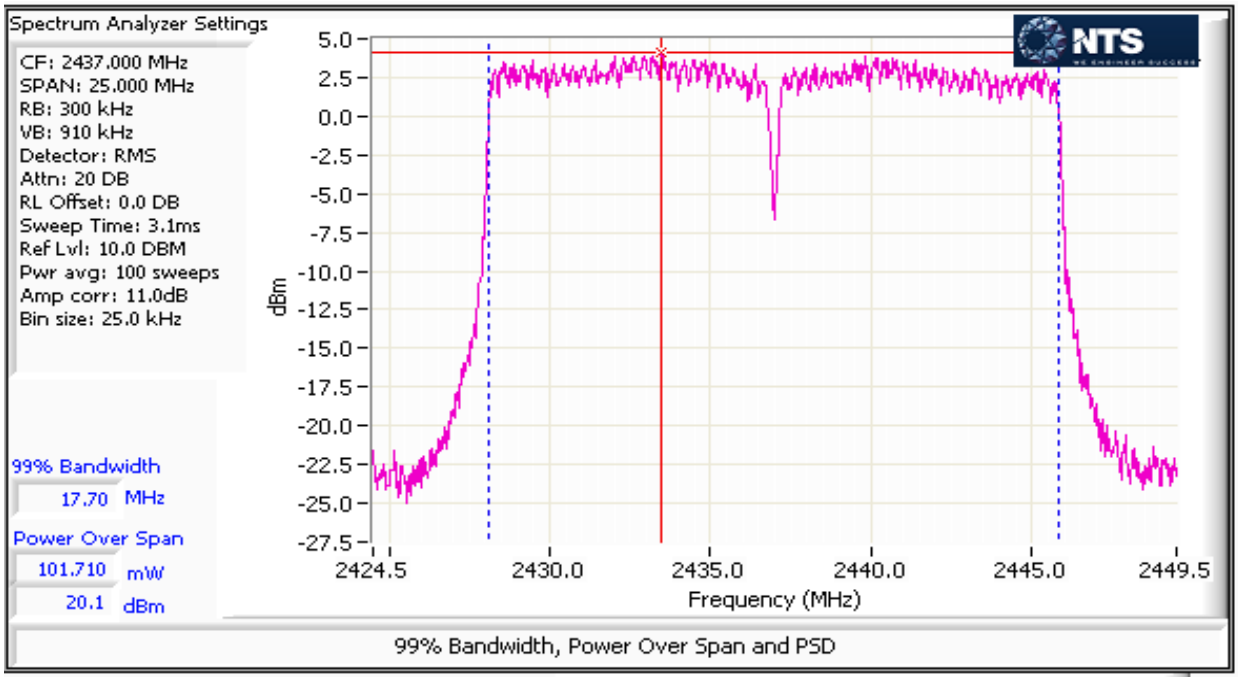
EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Operating Mode: n20
Directional Gain (dBi): 3.3

Max EIRP (mW): 427.70578

Frequency (MHz)	Chain	Software Setting	Power[1] dBm	Power[1] mW	Total mW	Total dBm	Max Power (W)	Limit dBm	Result	Power (dBm)[3]
2412	1	q76	17.3	53.7	102.7	20.1	0.200	30.0	Pass	
	3			0.0						
	4			0.0						
	2		16.9	49.0						
2437	1	q88	20.1	102.3	200.1	23.0		30.0	Pass	
	3			0.0						
	4			0.0						
	2		19.9	97.7						
2462	1	q61	13.5	22.4	42.8	16.3		30.0	Pass	
	3			0.0						
	4			0.0						
	2		13.1	20.4						



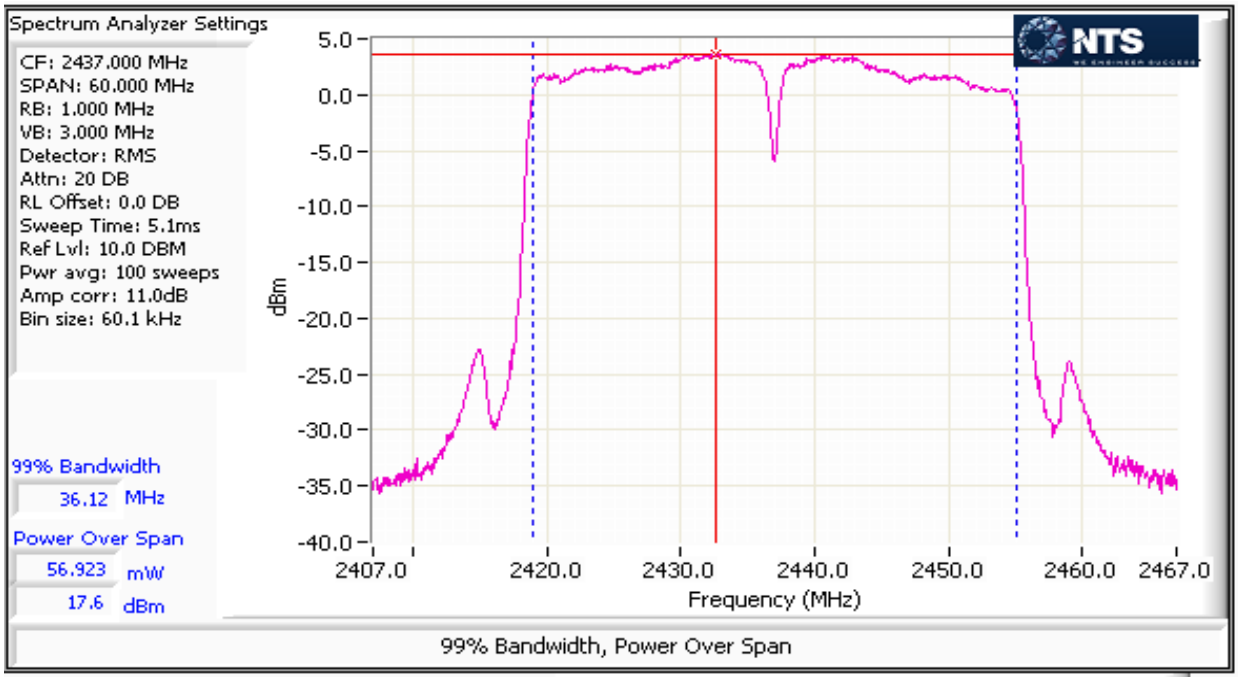
EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Operating Mode: n40
Directional Gain (dBi): 3.3

Max EIRP (mW): 251.85183

Frequency (MHz)	Chain	Software Setting	Power[1] dBm	Power[1] mW	Total mW	Total dBm	Max Power (W)	Limit dBm	Result	Power (dBm)[3]
2422	1	q68	15.1	32.4	68.7	18.4	0.118	30.0	Pass	
	3			0.0						
	4			0.0						
	2		15.6	36.3						
2437	1	q78	17.6	57.5	117.8	20.7		30.0	Pass	
	3			0.0						
	4			0.0						
	2		17.8	60.3						
2452	1	q62	13.6	22.9	47.5	16.8		30.0	Pass	
	3			0.0						
	4			0.0						
	2		13.9	24.5						



Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Run #2: Power spectral Density

Mode: 11b

Power Setting	Frequency (MHz)	PSD (dBm/3kHz) Note 1					Limit dBm/3kHz	Result
		Chain 1	Chain 2	Chain 3	Chain 4	Total		
q92	2412		3.0			3.0	8.0	Pass
q92	2437		4.6			4.6	8.0	Pass
q92	2462		2.4			2.4	8.0	Pass

Mode: 11g

Power Setting	Frequency (MHz)	PSD (dBm/3kHz) Note 1					Limit dBm/3kHz	Result
		Chain 1	Chain 2	Chain 3	Chain 4	Total		
q92	2412		-0.8			-0.8	8.0	Pass
q92	2437		-1.0			-1.0	8.0	Pass
q92	2462		-1.2			-1.2	8.0	Pass

Mode: n20

Power Setting	Frequency (MHz)	PSD (dBm/3kHz) Note 1					Limit dBm/3kHz	Result
		Chain 1	Chain 2	Chain 3	Chain 4	Total		
q92	2412	-2.3	-1.8			1.0	8.0	Pass
q92	2437	-2.3	-1.5			1.1	8.0	Pass
q92	2462	-2.5	-2.1			0.7	8.0	Pass

Mode: n40

Power Setting	Frequency (MHz)	PSD (dBm/3kHz) Note 1					Limit dBm/3kHz	Result
		Chain 1	Chain 2	Chain 3	Chain 4	Total		
q92	2422	-4.8	-2.8			-0.7	8.0	Pass
q92	2437	-4.8	-3.6			-1.1	8.0	Pass
q92	2452	-5.4	-3.5			-1.3	8.0	Pass

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

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Run #3: Signal Bandwidth

Mode: 11b

Power Setting	Frequency (MHz)	Bandwidth (MHz)		RBW Setting (MHz)	
		6dB	99%	6dB	99%
q92	2412	9.1	12.8	0.1	0.3
q92	2437	9.0	13.0	0.1	0.3
q88	2462	8.0	10.2	0.1	0.3

Mode: 11g

Power Setting	Frequency (MHz)	Bandwidth (MHz)		RBW Setting (MHz)	
		6dB	99%	6dB	99%
q80	2412	16.5	16.5	0.1	0.3
q92	2437	16.4	16.6	0.1	0.3
q69	2462	16.4	16.5	0.1	0.3

Mode: n20

Power Setting	Frequency (MHz)	Bandwidth (MHz)		RBW Setting (MHz)	
		6dB	99%	6dB	99%
q76	2412	17.6	17.7	0.1	0.3
q88	2437	17.6	17.7	0.1	0.3
q61	2462	17.6	17.7	0.1	0.3

Mode: n40

Power Setting	Frequency (MHz)	Bandwidth (MHz)		RBW Setting (MHz)	
		6dB	99%	6dB	99%
q68	2422	35.7	36.1	0.1	0.3
q78	2437	35.7	36.1	0.1	0.3
q62	2452	35.4	36.1	0.1	0.3

Note 1:	DTS BW: RBW=100kHz, VBW ≥ 3*RBW, peak detector, max hold, auto sweep time, Span 2-5 times measured BW. 99% BW: RBW=1-5% of 99%BW, VBW ≥ 3*RBW, peak detector, max hold, auto sweep time. Span 1.5-5 times OBW.
Note 2:	Measurements performed on chain 2

EMC Test Data

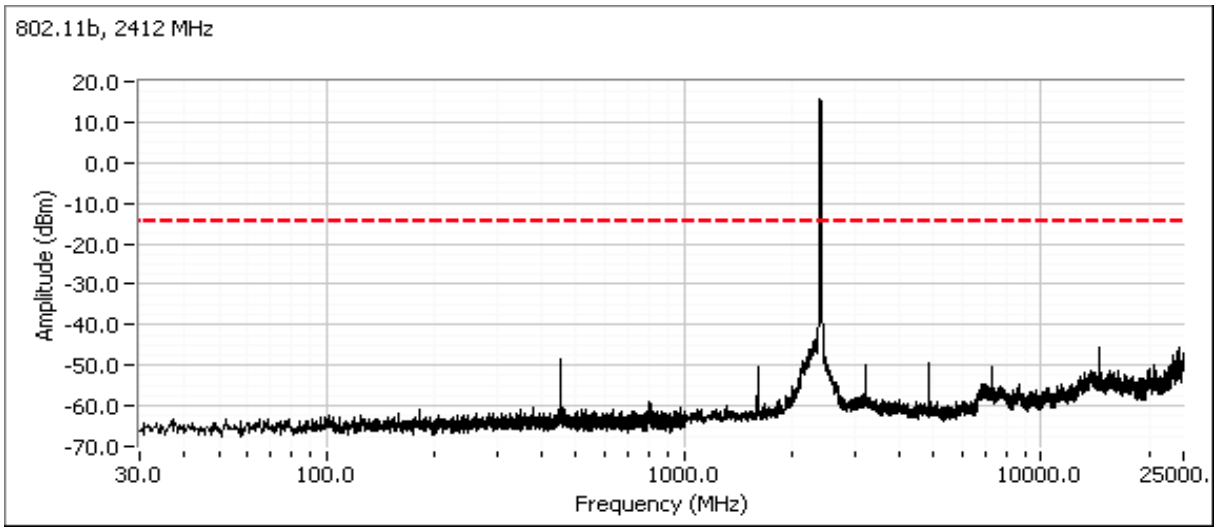
Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Run #4a: Out of Band Spurious Emissions

Power Setting Per Chain				Mode	Frequency (MHz)	Limit	Result
#1	#2	#3	#4				
	92			b	2412	-30 dBc	Pass
	92			b	2437	-30 dBc	Pass
	92			b	2462	-30 dBc	Pass
	80			g	2412	-30 dBc	Pass
	92			g	2437	-30 dBc	Pass
	92			g	2462	-30 dBc	Pass
q76	q76			n20	2412	-30 dBc	Pass
q92	q92			n20	2437	-30 dBc	Pass
q92	q92			n20	2462	-30 dBc	Pass
q68	q68			n40	2422	-30 dBc	Pass
q92	q92			n40	2437	-30 dBc	Pass
q92	q92			n40	2452	-30 dBc	Pass

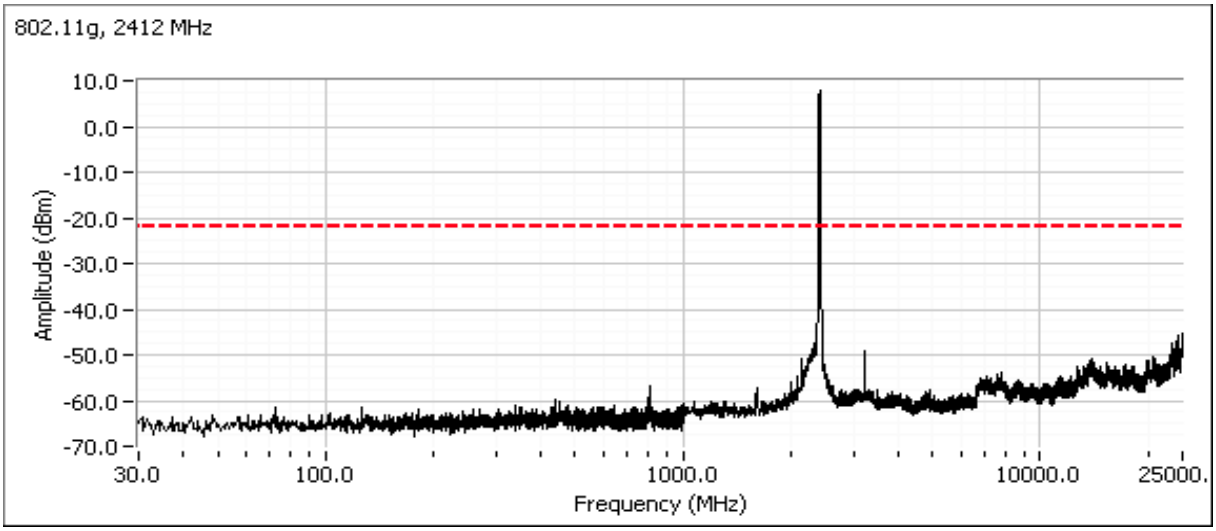
Note 1:	Measured on each chain individually

Plots for low channel



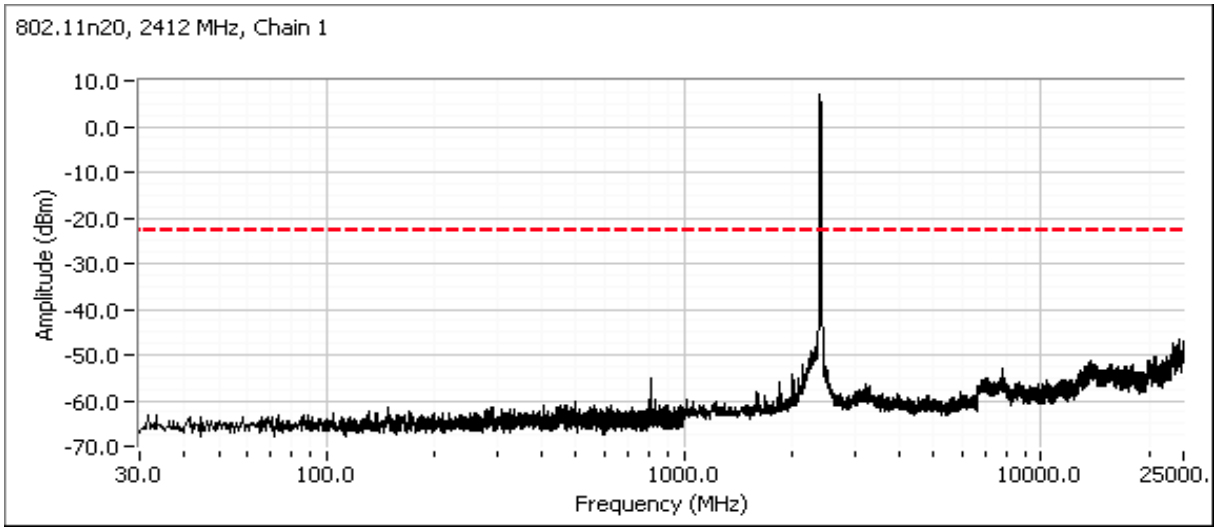
EMC Test Data

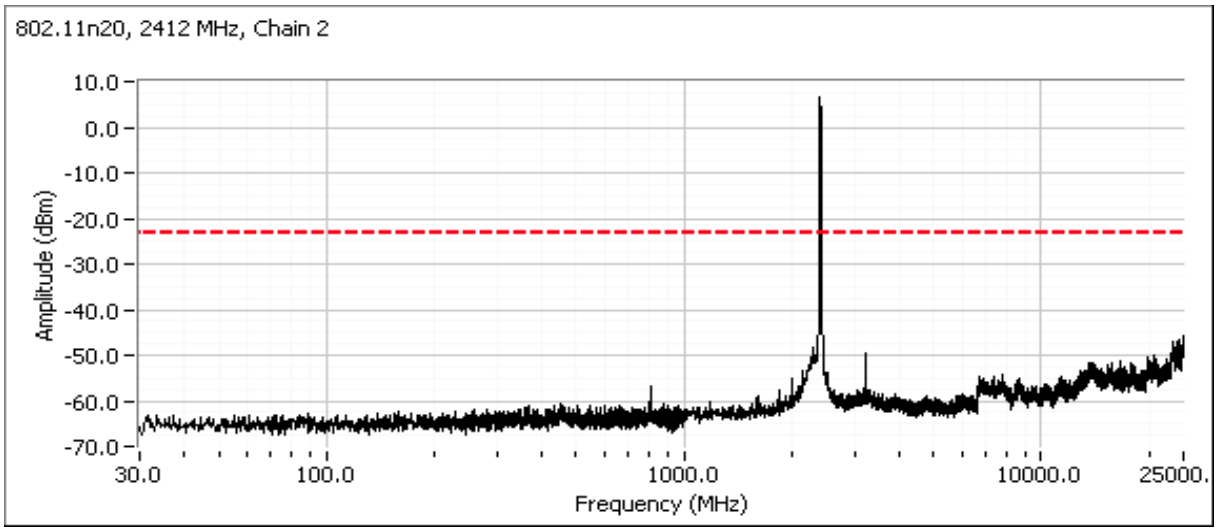
Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A



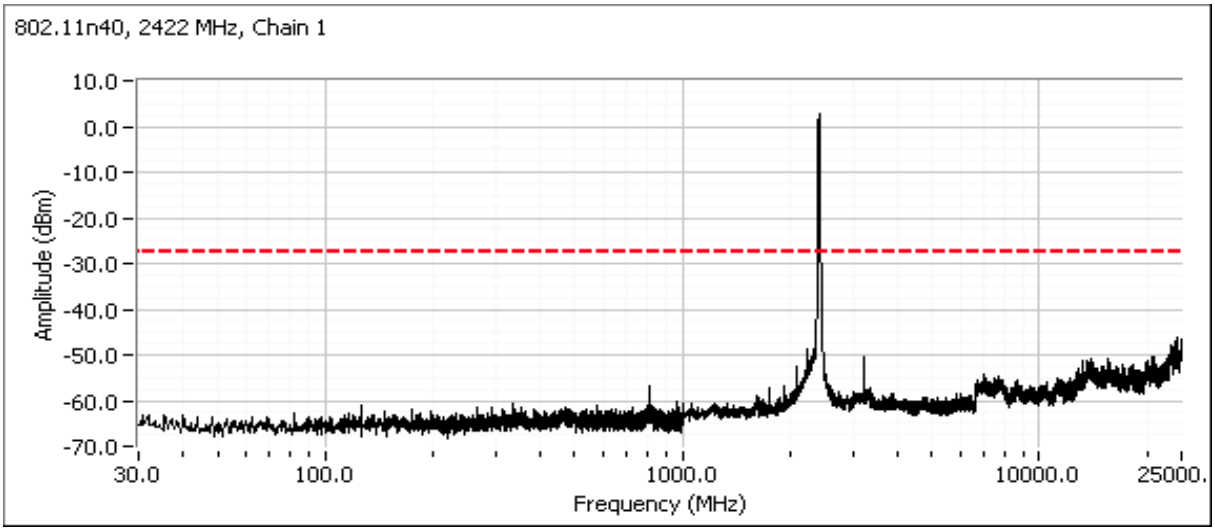
EMC Test Data

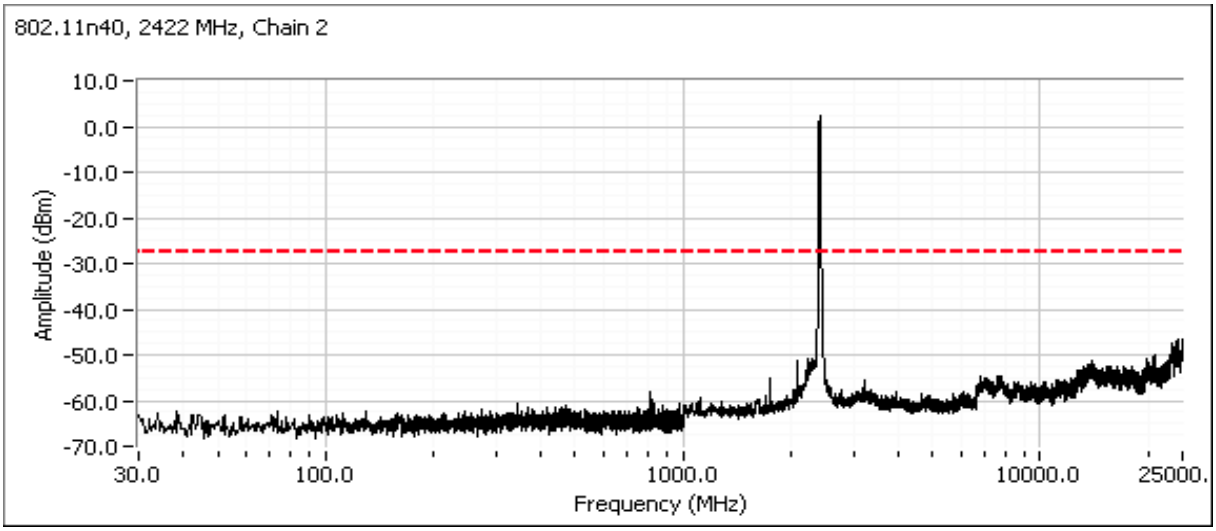
Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A





Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

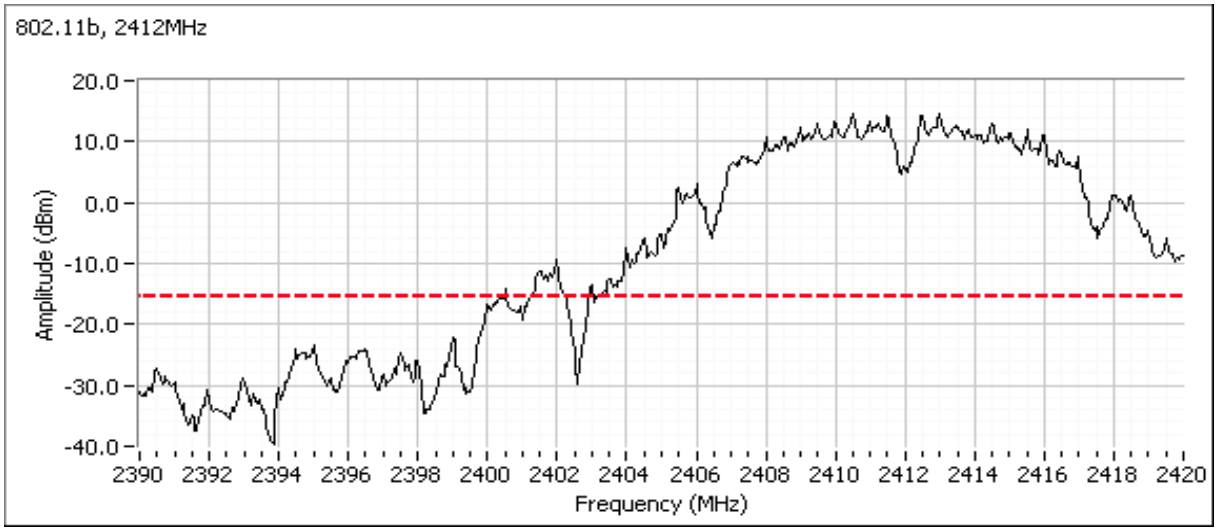


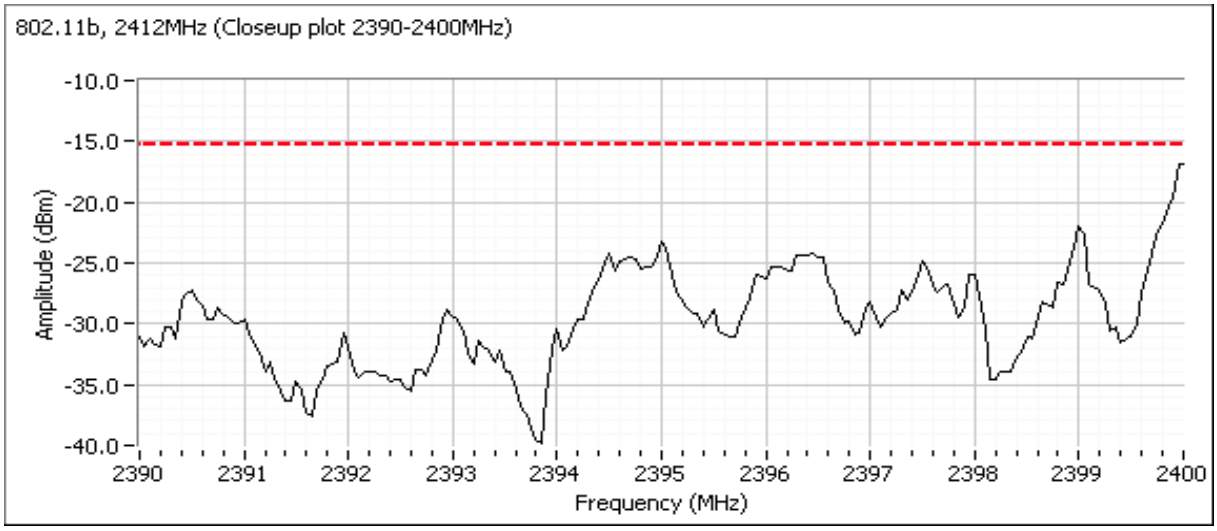


EMC Test Data

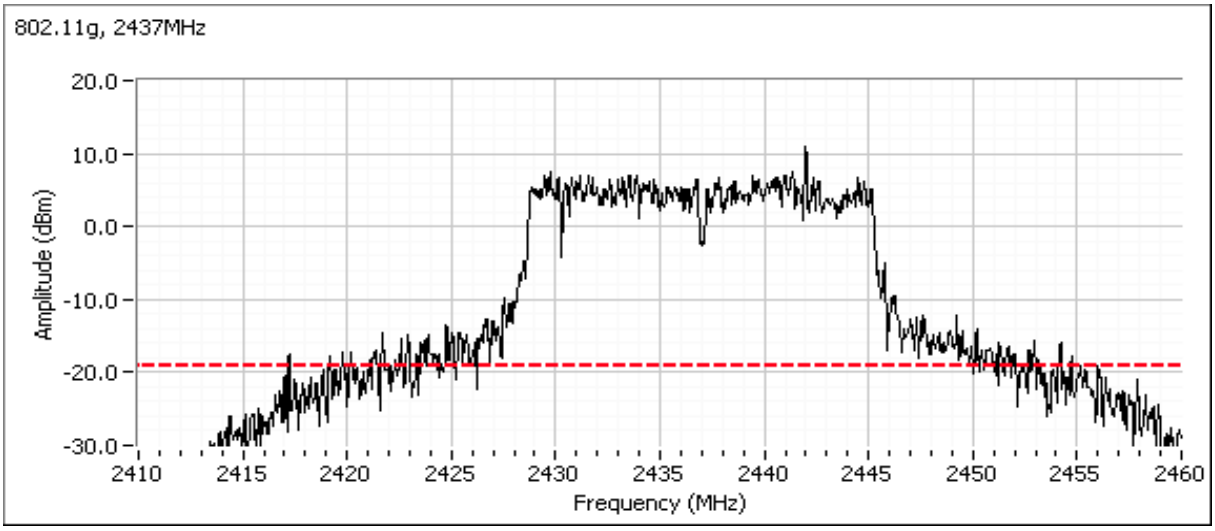
Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

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

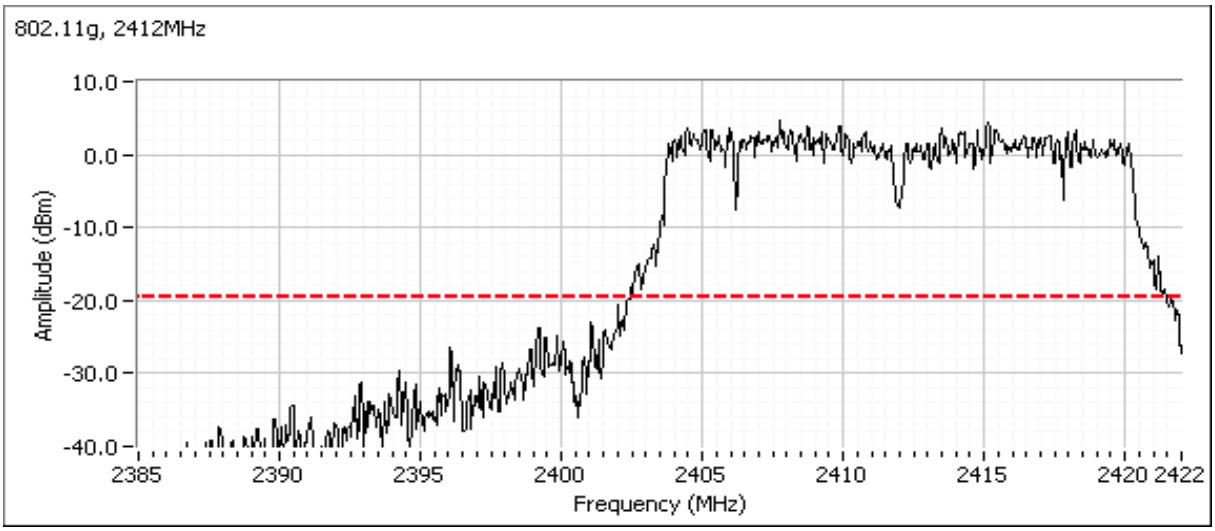




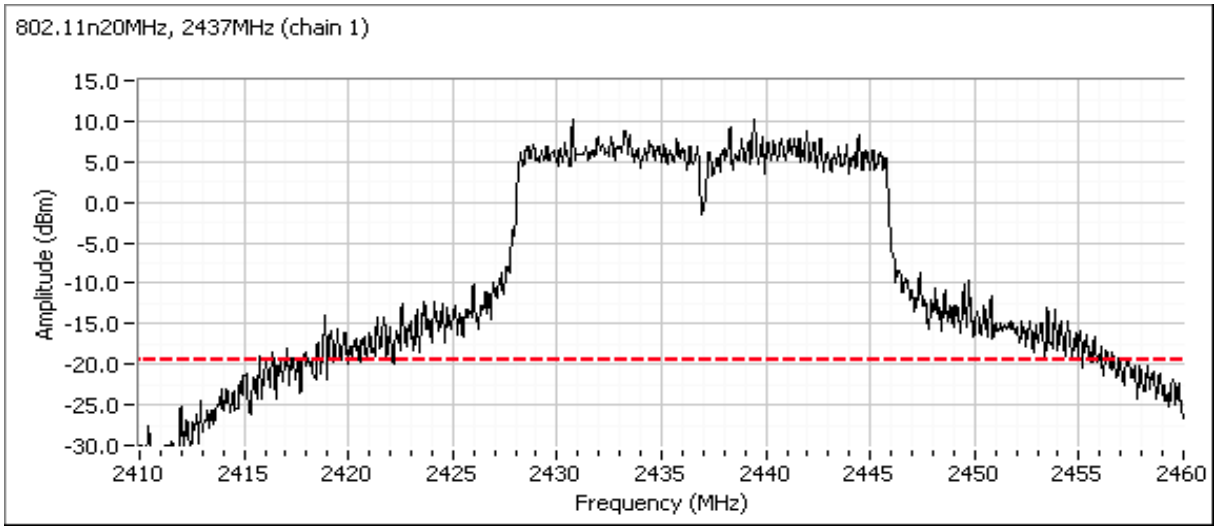
Establishment of reference level using center channel, @ final power setting: q88



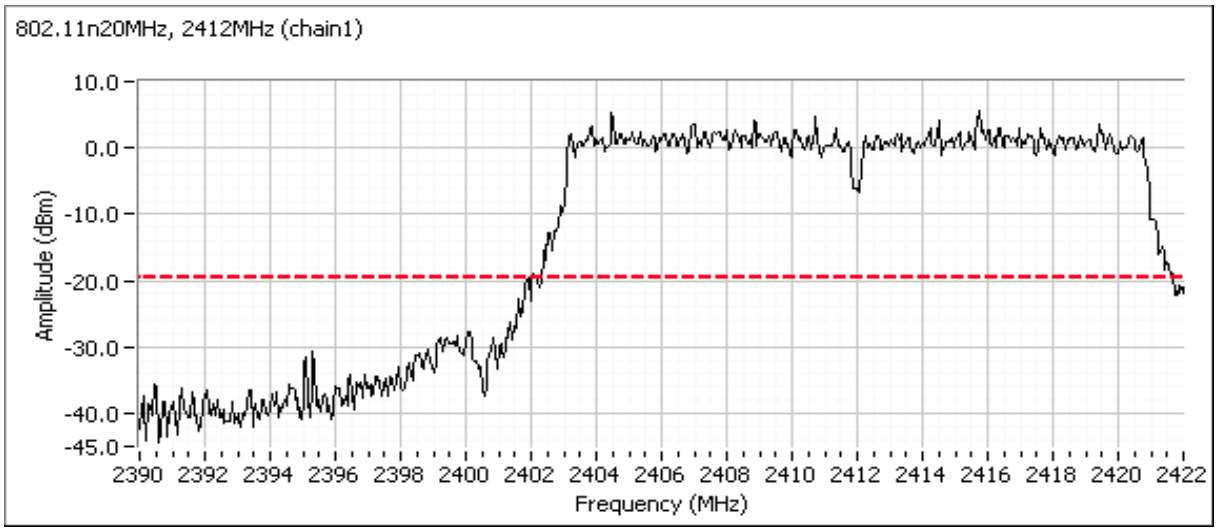
Low channel @ final power setting: q80



Establishment of reference level using center channel, @ final power setting: q88

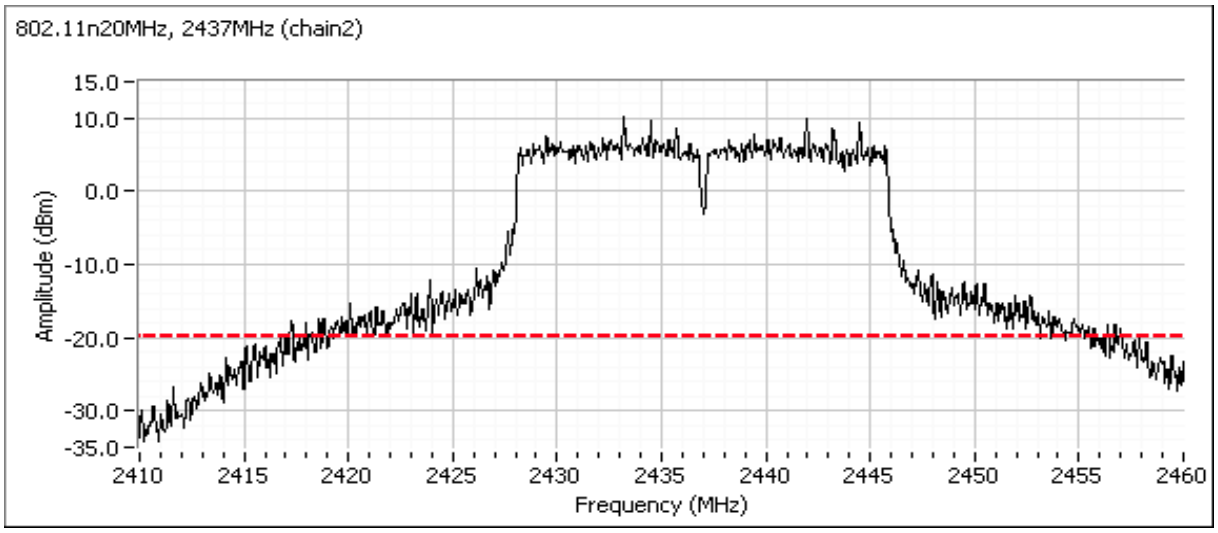


Low channel @ final power setting: q76

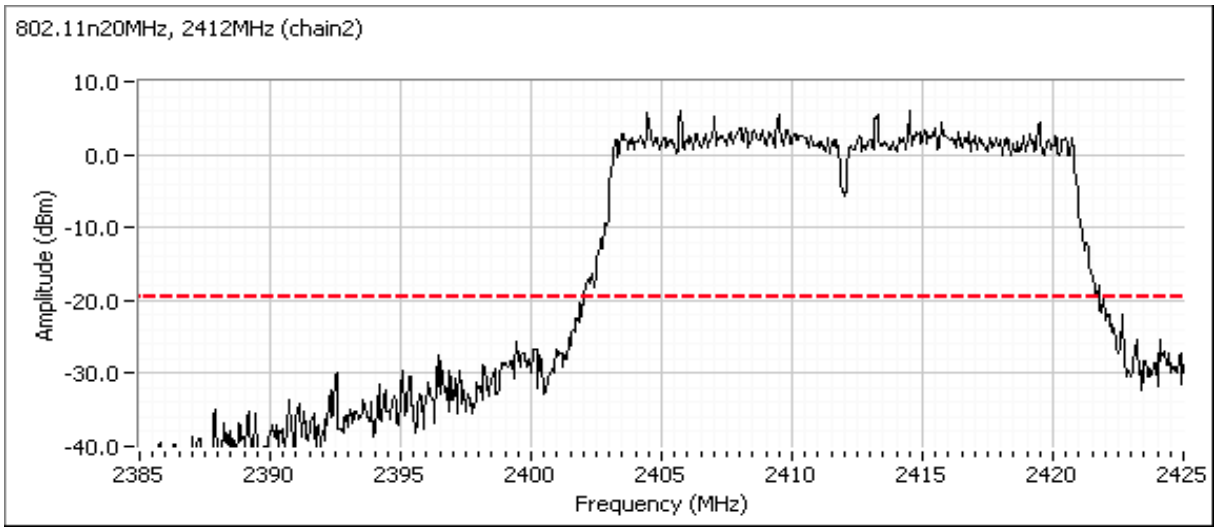


Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

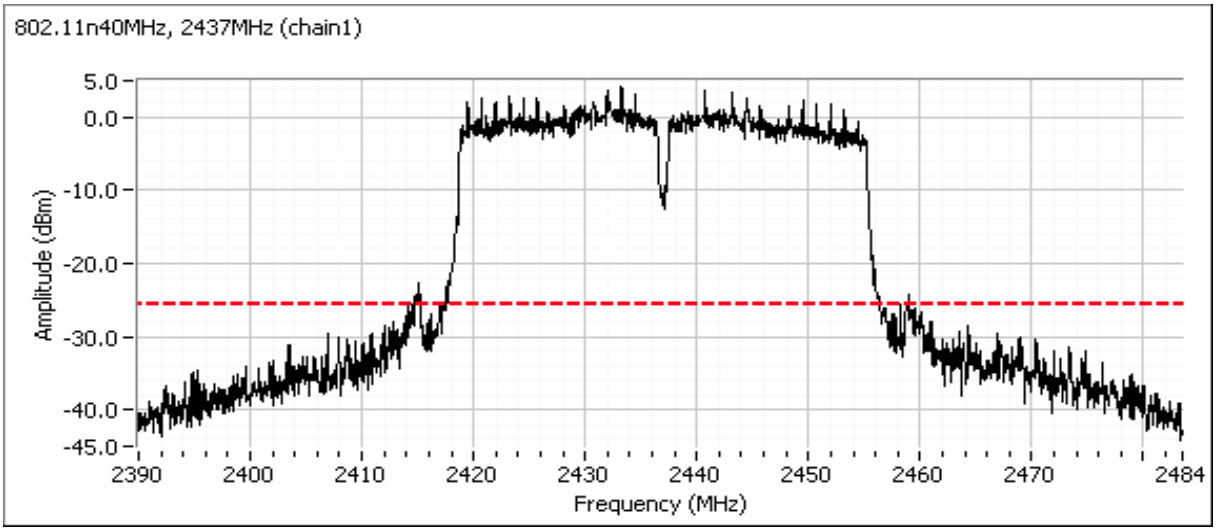
Establishment of reference level using center channel, @ final power setting: q88



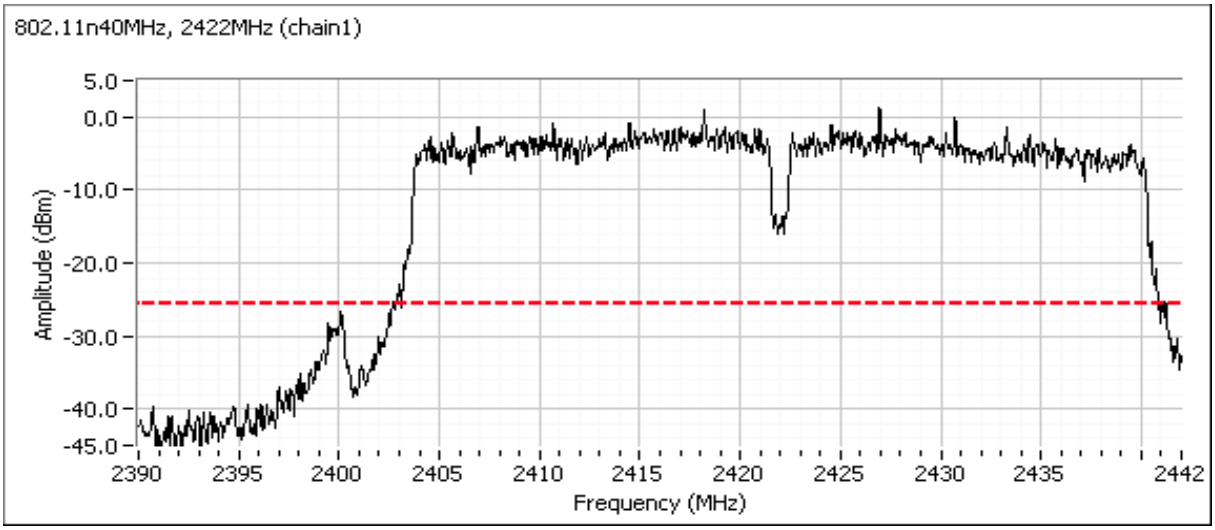
Low channel @ final power setting: q76



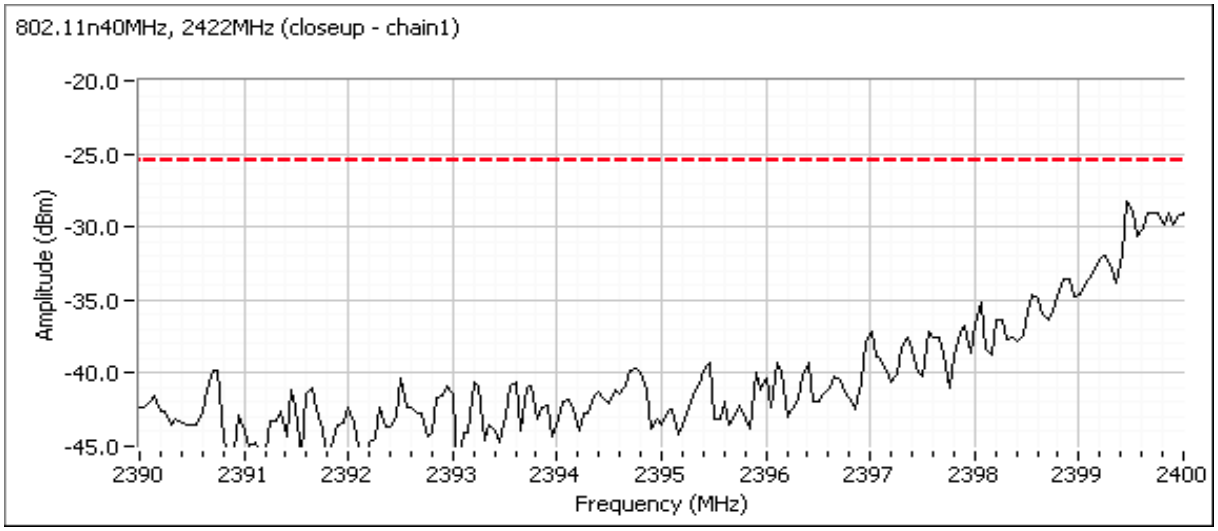
Establishment of reference level using center channel, @ final power setting: q78



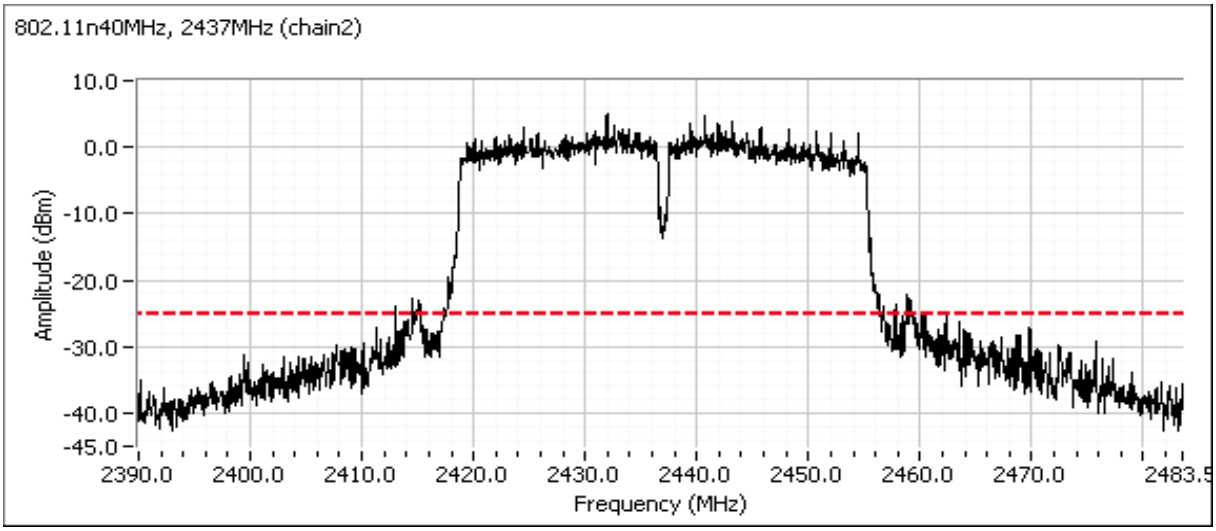
Low channel @ final power setting: q68



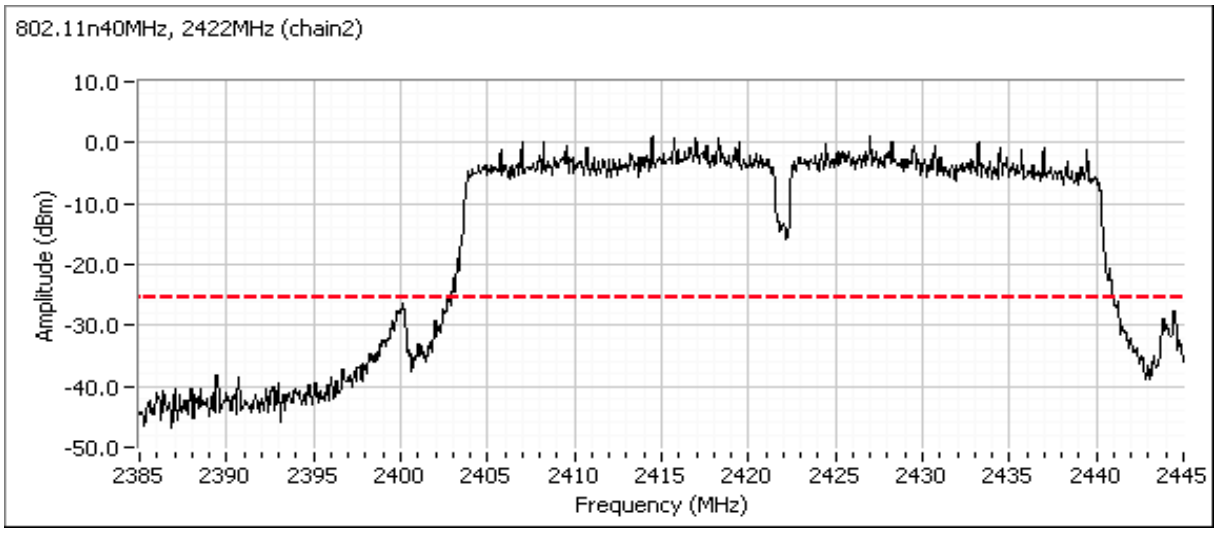
Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

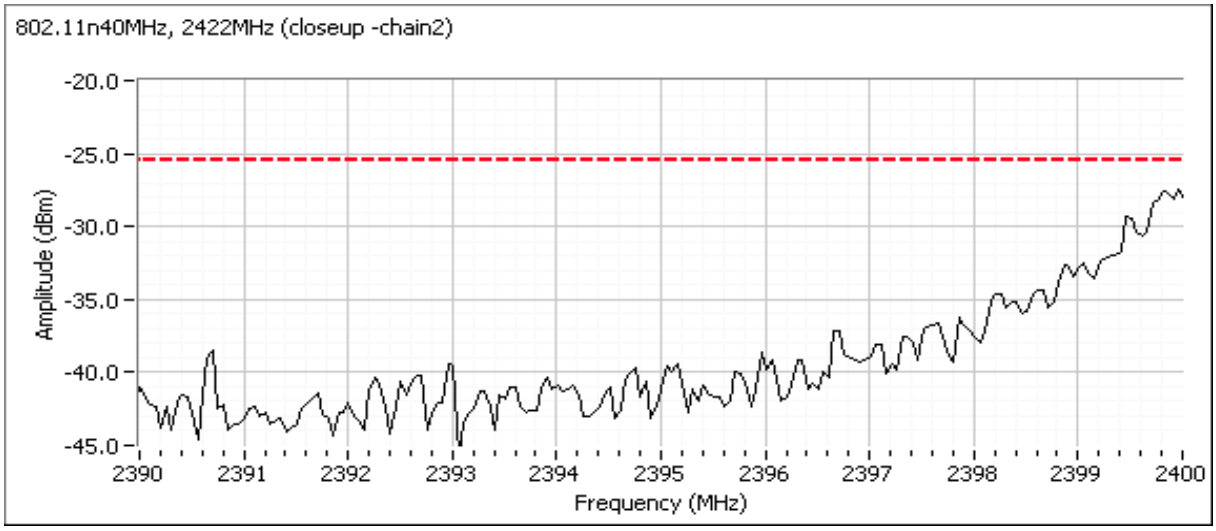


Establishment of reference level using center channel, @ final power setting: q78

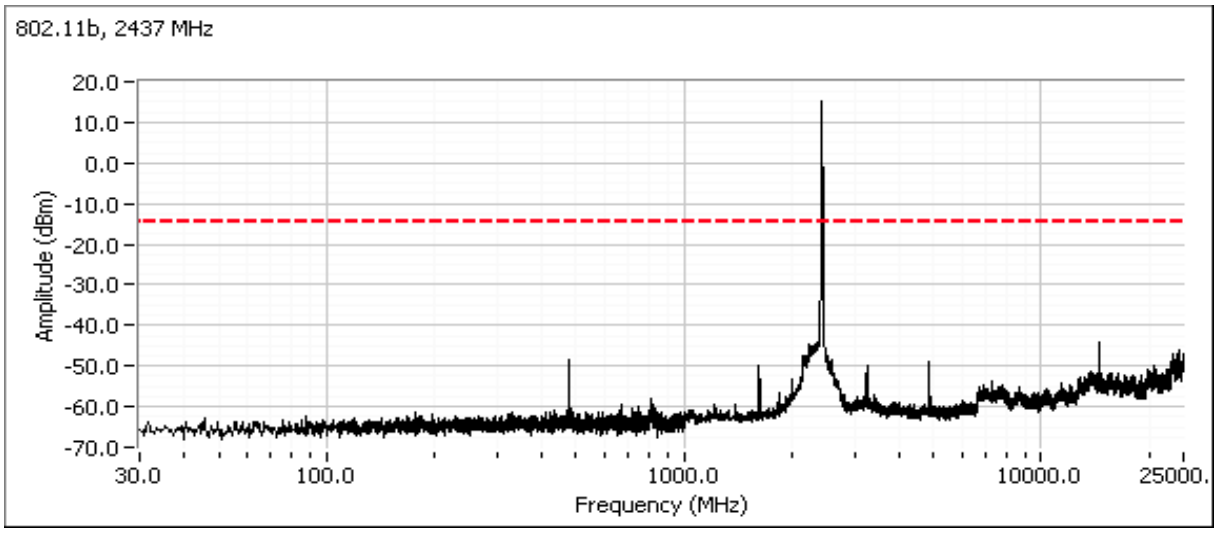


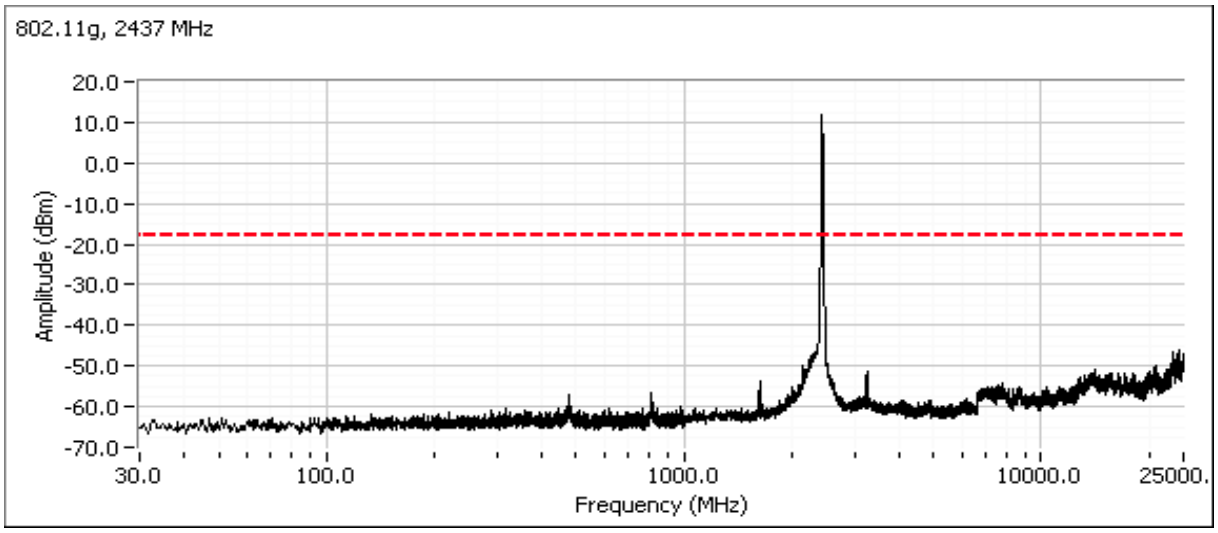
Low channel @ final power setting: q68





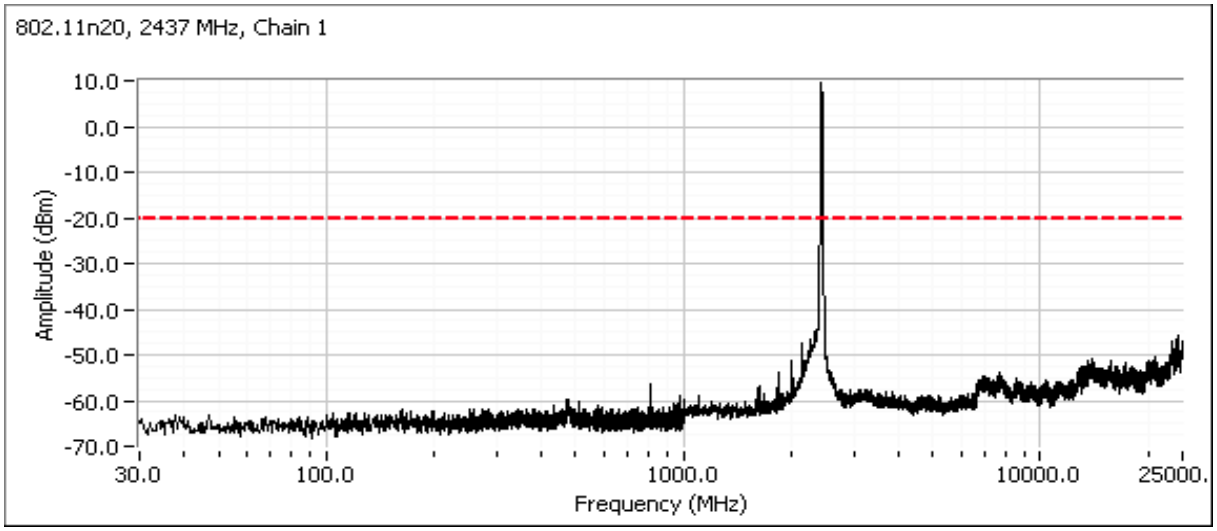
Plots for center channel

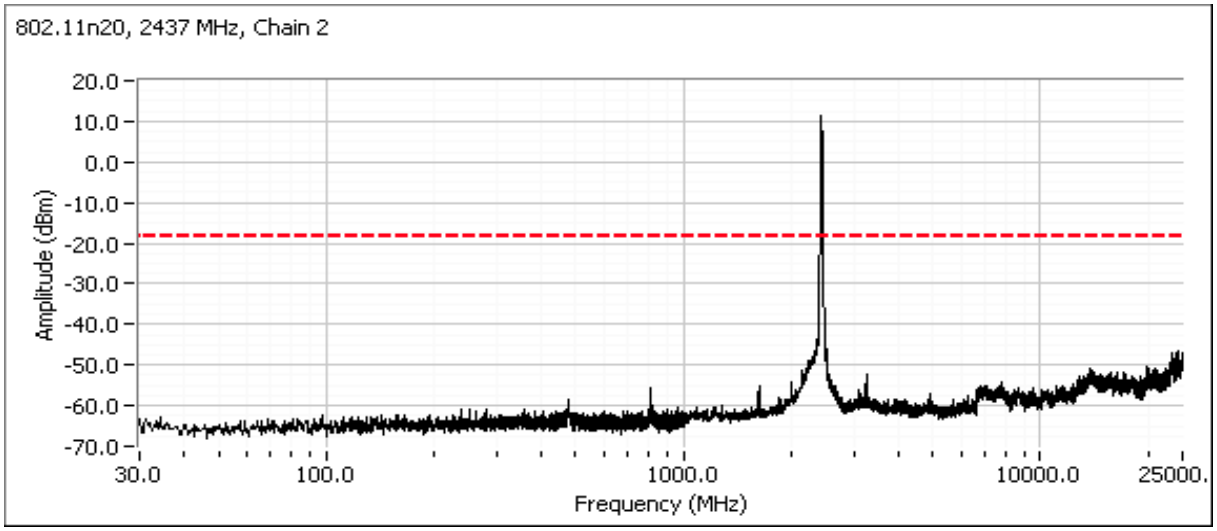




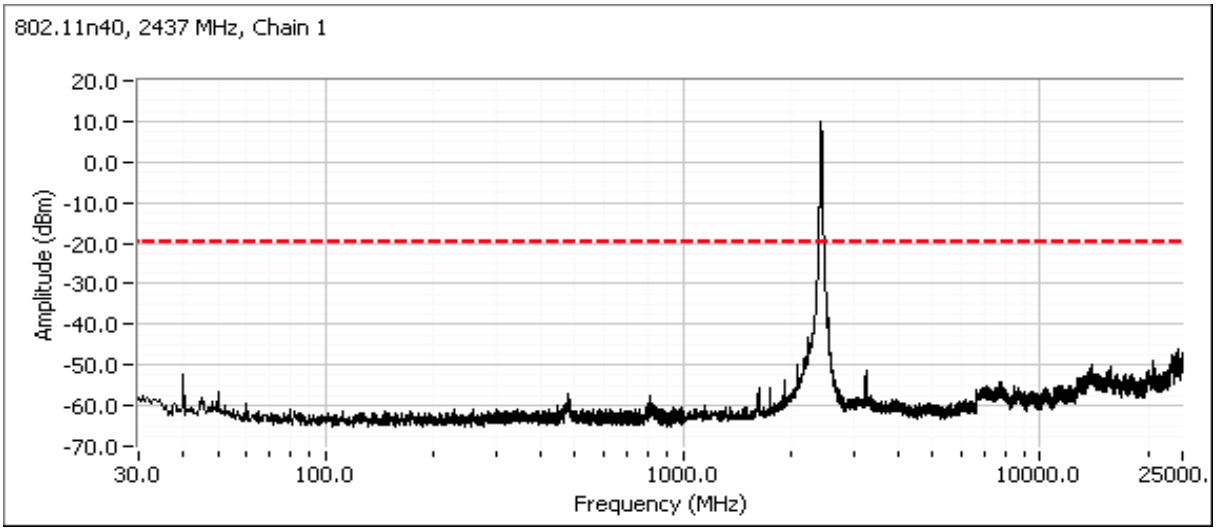
EMC Test Data

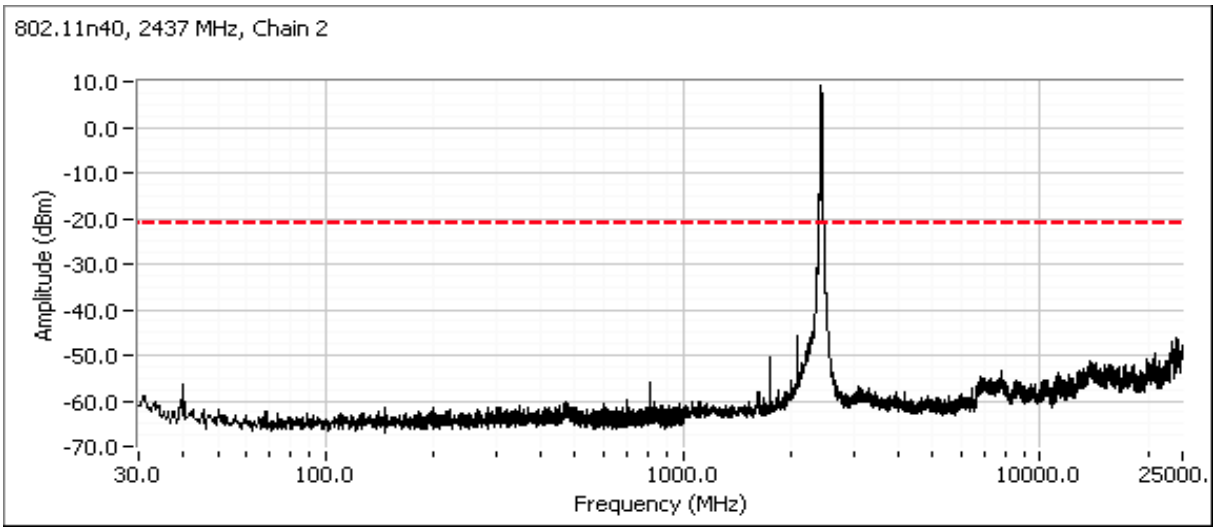
Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A



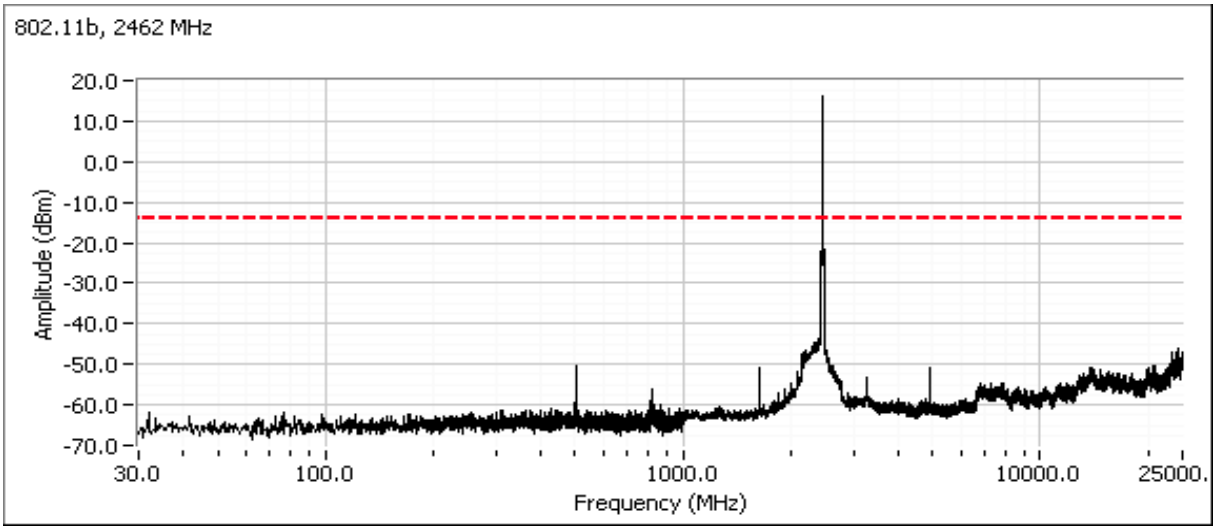


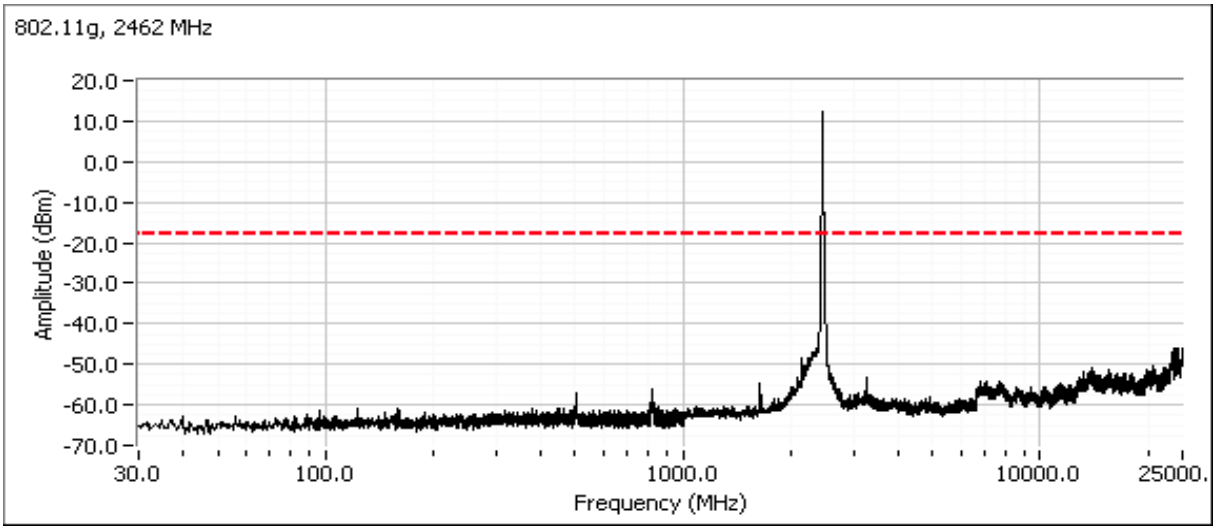
Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A





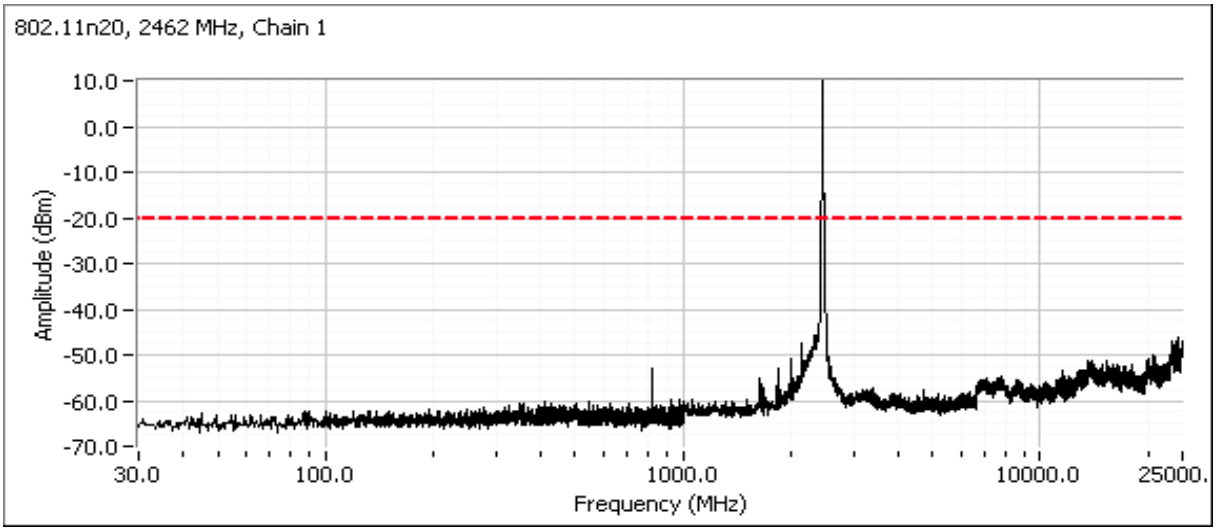
Plots for high channel

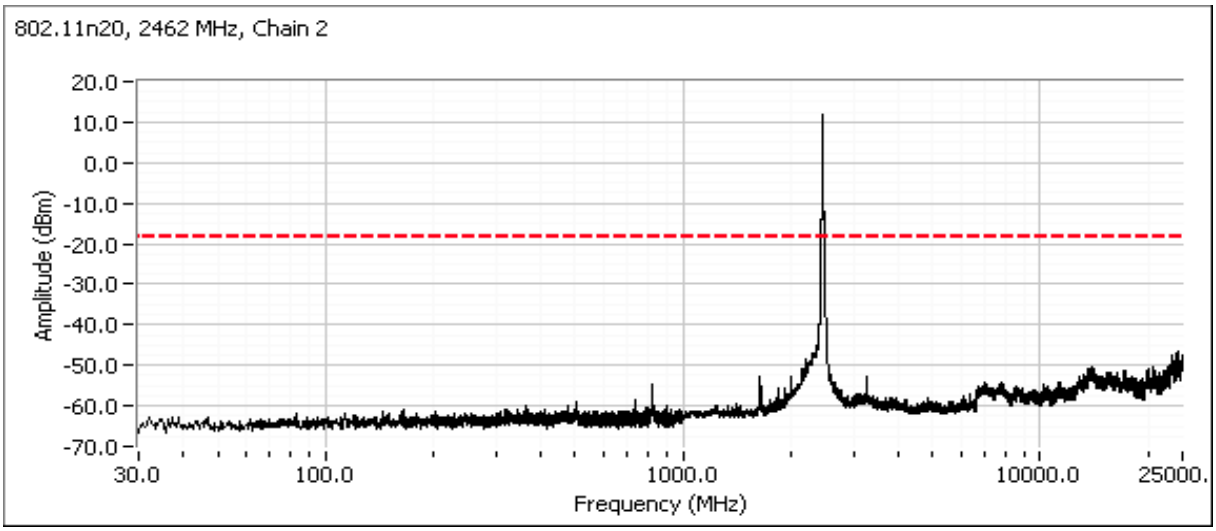




EMC Test Data

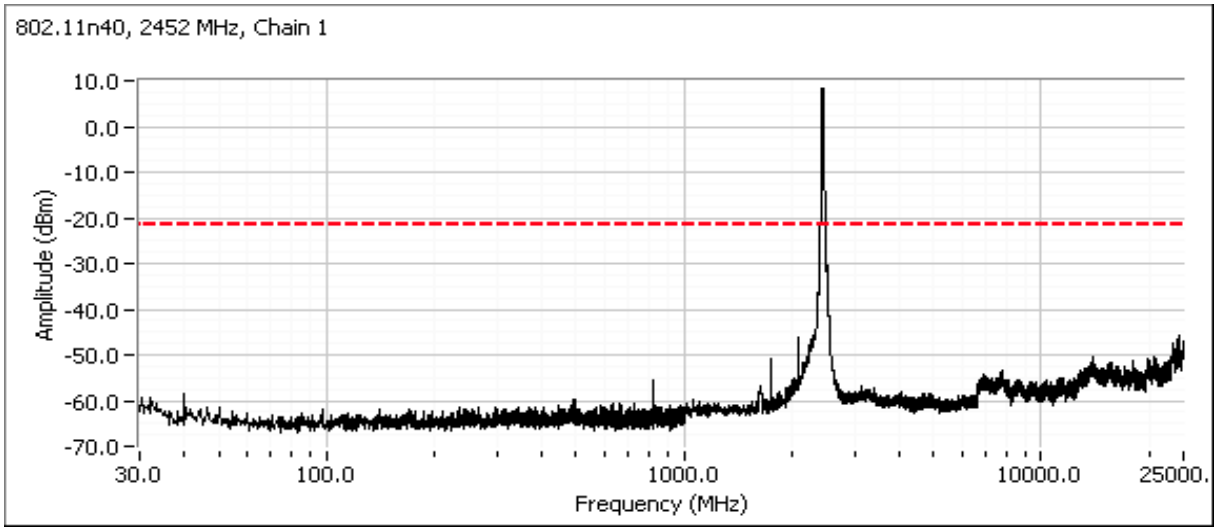
Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

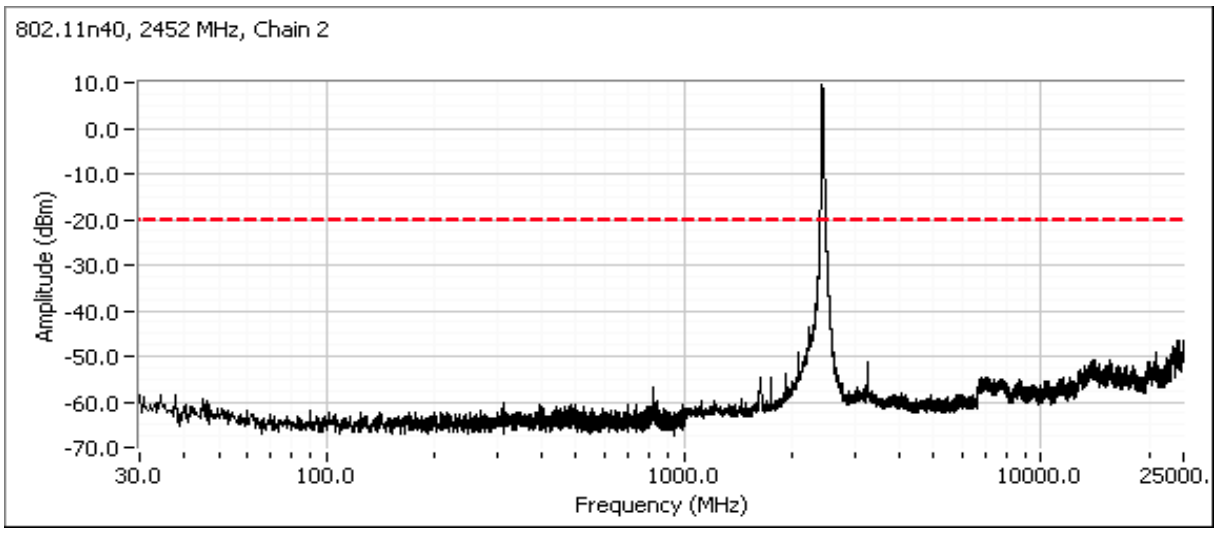




EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A





Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

RSS-247 and FCC 15.247 (DTS) Radiated Spurious Emissions

Test Specific Details

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

General Test Configuration

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

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

Ambient Conditions:

Temperature: 22.6 °C
Rel. Humidity: 35 %

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

Run #	Mode	Channel	Target Power	Power Setting	Test Performed	Limit	Result / Margin
Simultaneous Tx - RF4CE + Wifi - using the worse case 2.4GHz wifi channel and the worse case for RF4CE channel							
1	RF4CE + Worse case Wifi	b (Chain1) 2462MHz & Zigbee CH15	-	23 / 3	Radiated Emissions 30MHz - 1000MHz	FCC 15.209 / 15.247	37.8 dBµV/m @ 37.64 MHz (-2.2 dB)
			-		Radiated Emissions 1 - 25 GHz	FCC 15.209 / 15.247	50.5 dBµV/m @ 4924.0 MHz (-3.5 dB)
2	RF4CE + Worse case Wifi	n20 (2x2) 2462MHz & Zigbee CH15	-	23 / 3	Radiated Emissions 30MHz - 1000MHz	FCC 15.209 / 15.247	37.4 dBµV/m @ 37.73 MHz (-2.6 dB)
			-		Radiated Emissions 1 - 25 GHz	FCC 15.209 / 15.247	44.9 dBµV/m @ 7382.1 MHz (-9.1 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.

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Sample Notes

Sample S/N: G54DA5DN000041
Driver: 5.99.188.21
Antenna: Internal
Chain 1: Gray cable PL8200
Chain 2: Black cable PL800

Procedure Comments:

Measurements performed in accordance with FCC KDB 558074
Peak measurements performed with: RBW=1MHz, VBW=3MHz, peak detector, max hold, auto sweep time
Unless otherwise stated/noted, emission has duty cycle ≥ 98% and was measured using RBW=1MHz, VBW=10Hz, peak detector, linear average mode, auto sweep time, max hold.
2.4GHz band reject filter used

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
RF4CE	Fixed	100.0%	-	-			10
11b	1 Mbps	99.9%	Yes	8.419	0	0	10
n20	6.5 Mbps	98.8%	Yes	1.309	0	0	10

Measurement Specific Notes:

Note 1:	Emission in non-restricted band, but limit of 15.209 used.
Note 2:	Emission in non-restricted band, the limit was set 30dB below the level of the fundamental and measured in 100kHz.
Note 3:	Emission has a duty cycle ≥ 98%, average measurement performed: RBW=1MHz, VBW=3MHz, RMS, Power averaging, auto sweep, trace average 100 traces
Note 4:	Emission has constant duty cycle < 98%, average measurement performed: RBW=1MHz, VBW>1/T but not less than 10Hz, peak detector, linear averaging, auto sweep, trace average 100 traces, measurement corrected by Linear voltage correction factor
Note 5:	Emission has constatnt duty cycle < 98%, average measurement performed: RBW=1MHz, VBW=3MHz, RMS, Power averaging, auto sweep, trace average 100 traces, measurement corrected by Pwr correction factor

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Run #1: Radiated Spurious Emissions, 30 - 40,000 MHz.

Date of Test: 04/26/16
Test Engineer: Rafael Varelas
Test Location: FT Chamber #4

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

Channel: 11 Mode: b Power Setting: 23
Tx Chain: 1 Data Rate: 1 Mbps

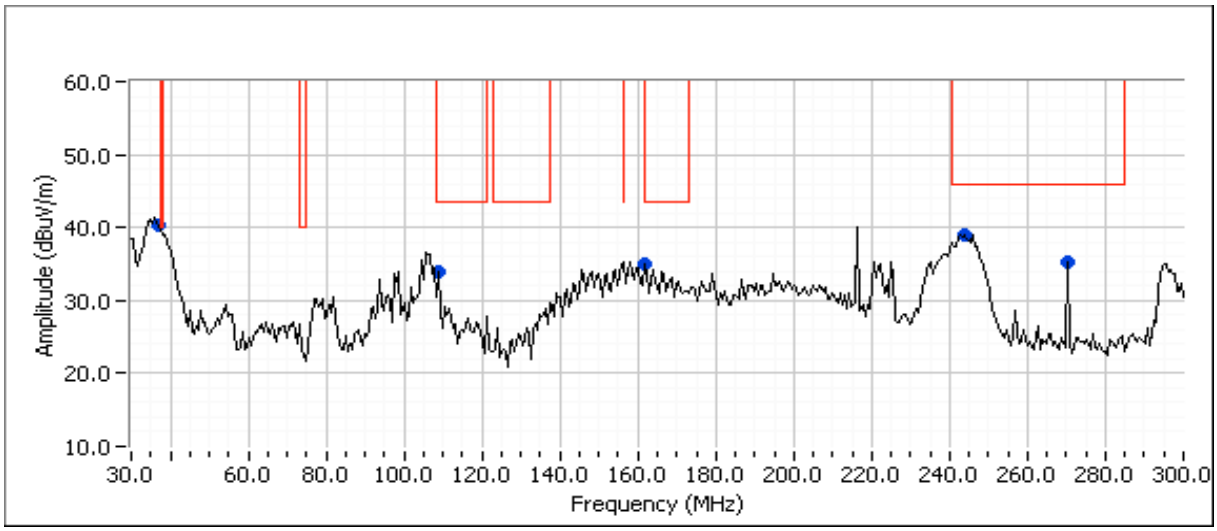
RF4CE: 2425 MHz Power Setting: 3
Tx Chain: -

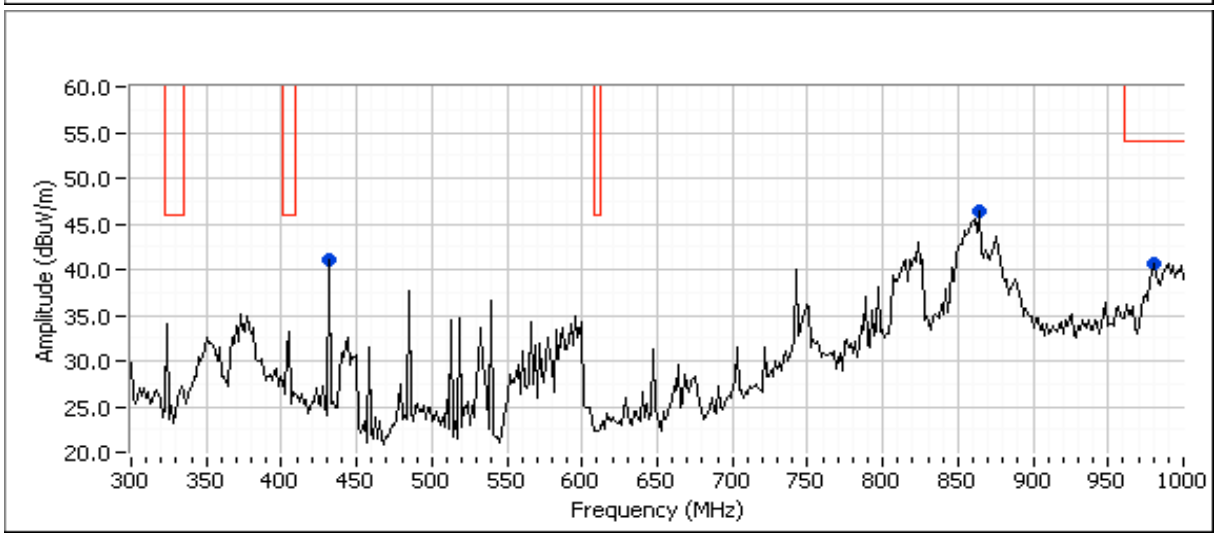
30-1000MHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
37.641	**37.8**	V	40.0	**-2.2**	QP	79	0.9	QP (1.00s)
432.007	40.4	H	46.0	-5.6	QP	267	1.0	QP (1.00s)
864.021	40.1	H	46.0	-5.9	QP	156	1.0	QP (1.00s)
242.763	39.3	H	46.0	-6.7	QP	8	1.2	QP (1.00s)
270.003	36.2	H	46.0	-9.8	QP	213	1.0	QP (1.00s)
108.774	30.3	V	43.5	-13.2	QP	112	1.0	QP (1.00s)
162.170	29.4	H	43.5	-14.1	QP	156	1.4	QP (1.00s)
980.218	36.8	H	54.0	-17.2	QP	161	1.5	QP (1.00s)

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A





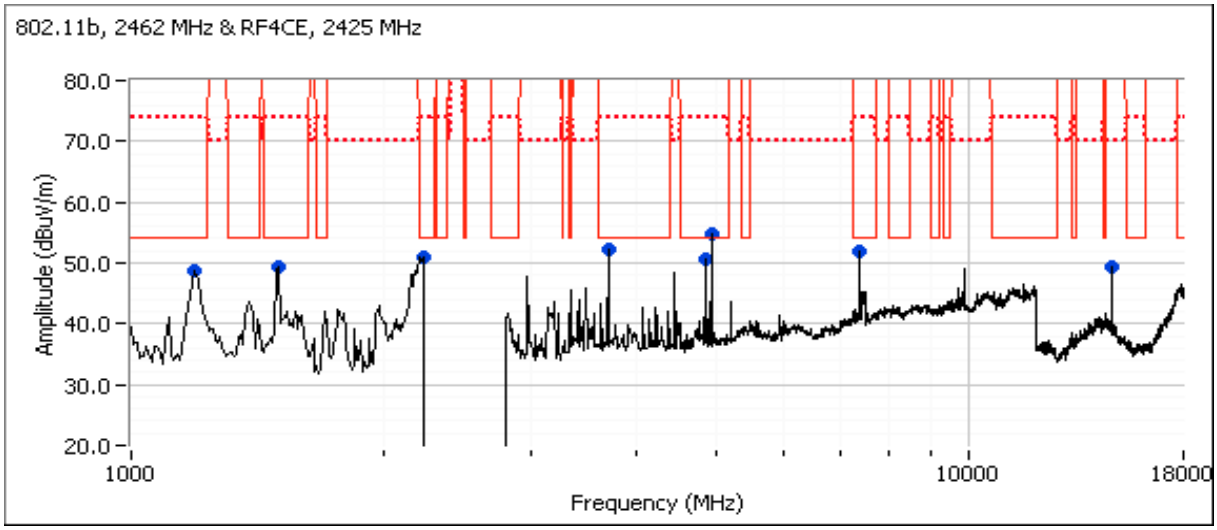
EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

1000-25000MHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4924.020	50.5	H	54.0	-3.5	AVG	62	1.0	RB 1 MHz;VB 10 Hz;Peak
4924.120	54.3	H	74.0	-19.7	PK	62	1.0	RB 1 MHz;VB 3 MHz;Peak
1184.670	32.4	H	54.0	-21.6	AVG	66	2.0	RB 1 MHz;VB 10 Hz;Peak
1185.290	48.2	H	74.0	-25.8	PK	66	2.0	RB 1 MHz;VB 3 MHz;Peak
7386.830	47.7	V	54.0	-6.3	AVG	121	1.0	RB 1 MHz;VB 10 Hz;Peak
7387.060	54.3	V	74.0	-19.7	PK	121	1.0	RB 1 MHz;VB 3 MHz;Peak
3708.880	49.8	V	54.0	-4.2	AVG	152	1.9	RB 1 MHz;VB 10 Hz;Peak
3708.480	53.9	V	74.0	-20.1	PK	152	1.9	RB 1 MHz;VB 3 MHz;Peak
1498.670	39.5	V	54.0	-14.5	AVG	163	1.4	RB 1 MHz;VB 10 Hz;Peak
1499.820	53.8	V	74.0	-20.2	PK	163	1.4	RB 1 MHz;VB 3 MHz;Peak
2223.190	49.6	H	54.0	-4.4	AVG	271	1.0	RB 1 MHz;VB 10 Hz;Peak
2226.530	61.3	H	74.0	-12.7	PK	271	1.0	RB 1 MHz;VB 3 MHz;Peak
4850.950	47.6	V	54.0	-6.4	AVG	333	1.3	RB 1 MHz;VB 10 Hz;Peak
4851.000	54.6	V	74.0	-19.4	PK	333	1.3	RB 1 MHz;VB 3 MHz;Peak
14772.000	48.5	V	54.0	-5.5	AVG	122	1.0	RB 1 MHz;VB 10 Hz;Peak
14771.550	59.0	V	74.0	-15.0	PK	122	1.0	RB 1 MHz;VB 3 MHz;Peak

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



EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

Channel: 11 Mode: n20 Power Setting: 23
Tx Chain: 2x2 Data Rate: 6.5 Mbps

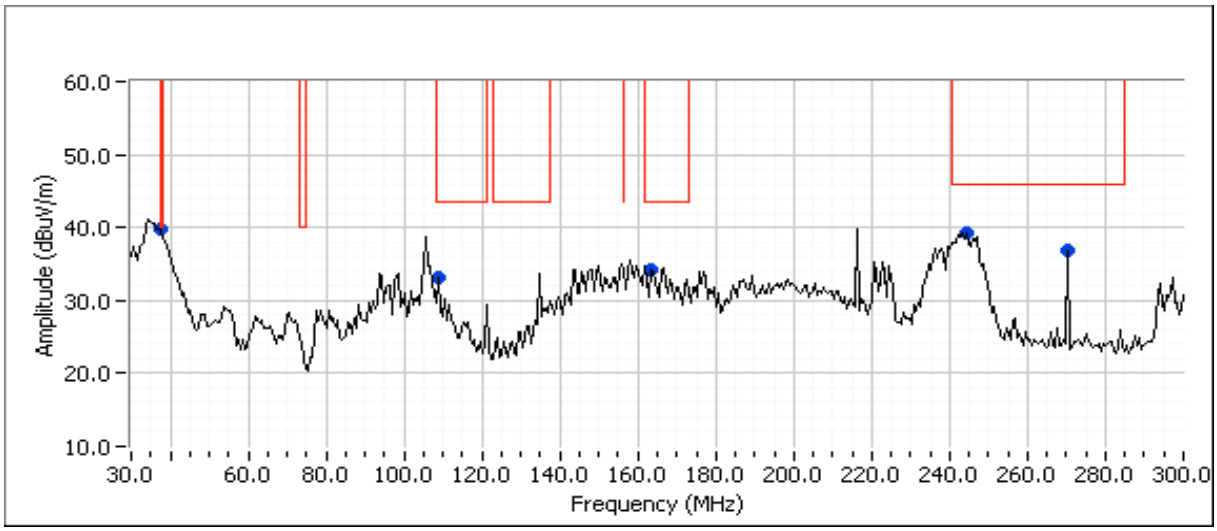
RF4CE: 2425 MHz Power Setting: 3
Tx Chain: -

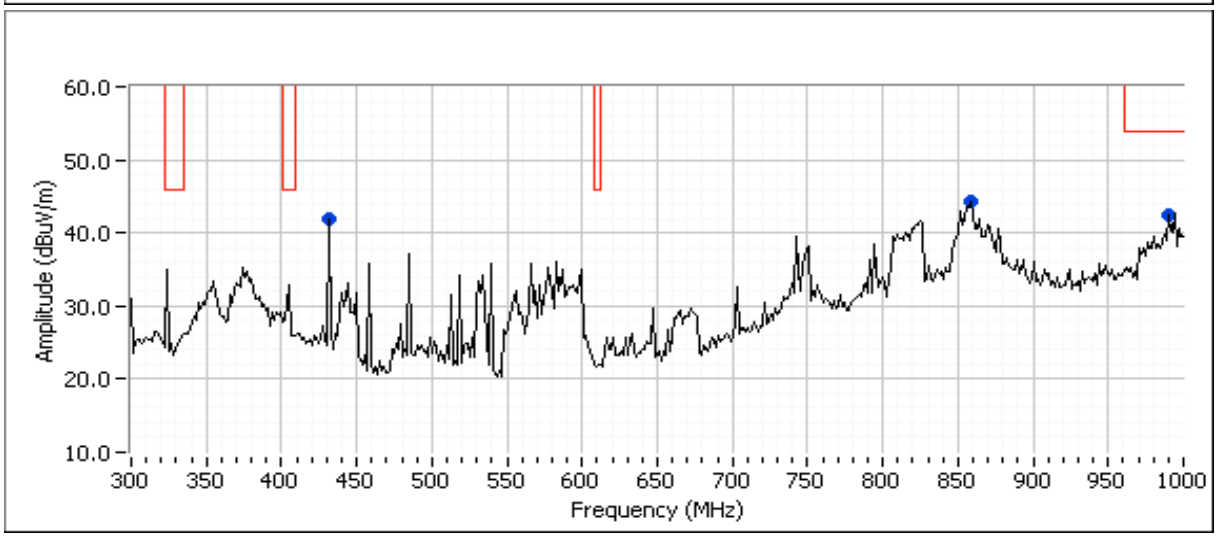
30-1000MHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
37.728	**37.4**	V	40.0	**-2.6**	QP	85	1.0	QP (1.00s)
432.007	40.9	H	46.0	-5.1	QP	271	1.0	QP (1.00s)
243.681	39.1	H	46.0	-6.9	QP	12	1.2	QP (1.00s)
857.686	38.6	H	46.0	-7.4	QP	143	1.0	QP (1.00s)
270.003	36.7	H	46.0	-9.3	QP	217	1.0	QP (1.00s)
164.124	31.9	H	43.5	-11.6	QP	19	1.6	QP (1.00s)
108.839	31.7	V	43.5	-11.8	QP	80	1.0	QP (1.00s)
988.724	37.1	H	54.0	-16.9	QP	141	1.5	QP (1.00s)

EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A





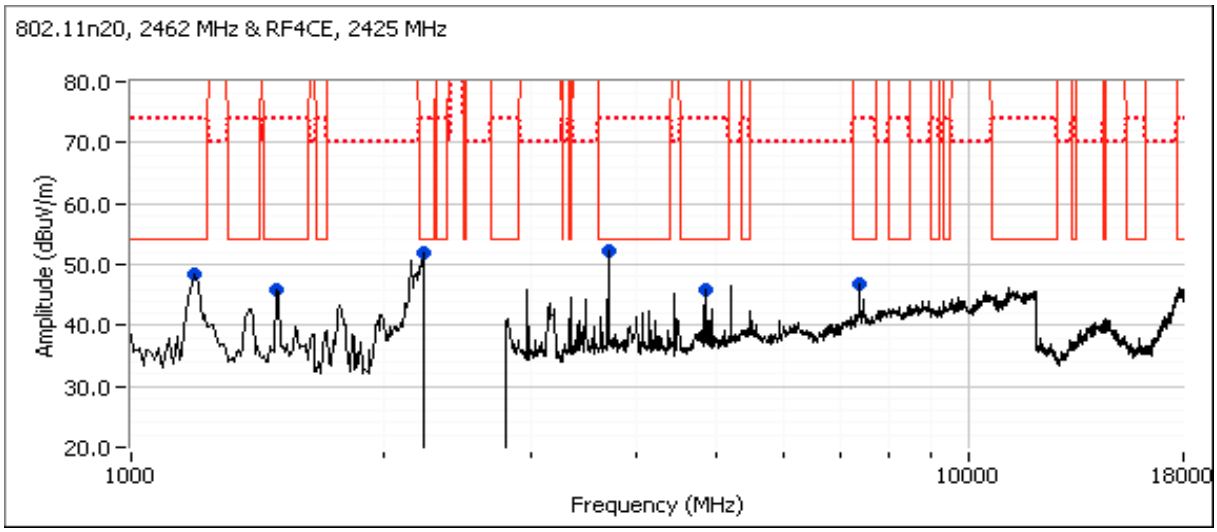
EMC Test Data

Client:	Pace Americas, Inc.	Job Number:	JD100795
Model:	HR54-700	T-Log Number:	T101528
		Project Manager:	Irene Rademacker
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.247	Class:	N/A

1000-25000MHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
7382.060	44.9	V	54.0	-9.1	AVG	146	2.4	RB 1 MHz;VB 10 Hz;Peak
7384.940	57.1	V	74.0	-16.9	PK	146	2.4	RB 1 MHz;VB 3 MHz;Peak
4849.120	43.0	H	54.0	-11.0	AVG	0	1.3	RB 1 MHz;VB 10 Hz;Peak
4848.970	50.7	H	74.0	-23.3	PK	0	1.3	RB 1 MHz;VB 3 MHz;Peak
3708.760	44.4	V	54.0	-9.6	AVG	110	1.7	RB 1 MHz;VB 10 Hz;Peak
3708.420	49.6	V	74.0	-24.4	PK	110	1.7	RB 1 MHz;VB 3 MHz;Peak
1188.120	35.6	V	54.0	-18.4	AVG	126	1.9	RB 1 MHz;VB 10 Hz;Peak
1187.460	50.1	V	74.0	-23.9	PK	126	1.9	RB 1 MHz;VB 3 MHz;Peak
2219.910	41.3	V	54.0	-12.7	AVG	284	2.3	RB 1 MHz;VB 10 Hz;Peak
2222.650	52.3	V	74.0	-21.7	PK	284	2.3	RB 1 MHz;VB 3 MHz;Peak
1494.330	39.3	V	54.0	-14.7	AVG	307	2.4	RB 1 MHz;VB 10 Hz;Peak
1492.500	53.2	V	74.0	-20.8	PK	307	2.4	RB 1 MHz;VB 3 MHz;Peak

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



End of Report

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