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EMC Test Report

Application for Grant of Equipment Authorization

FCC Part 15 Subpart C

Model: C61-700

FCC ID:	PGRC61
APPLICANT:	Pace Americas Inc. 310 Providence Mine Road Nevada City, CA 95959
TEST SITE(S):	National Technical Systems - Silicon Valley 41039 Boyce Road. Fremont, CA. 94538-2435
IC SITE REGISTRATION #:	2845B-7
REPORT DATE:	December 11, 2015
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FINAL TEST DATES:	November 17, 18 and 30, 2015 and January 7, 2016
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A2LA ACCREDITED
Testing Cert #0214.26

REVISION HISTORY

Rev#	Date	Comments	Modified By
	December 11, 2015	First release	
1.0	December 17, 2015	Fixed 6dB BW summary results. Clarified the in-band measurements.	MEH
2.0	January 4, 2016	Updated Tx spurious emissions results	MEH
3.0	January 8, 2016	Added 2nd Harmonics data	DMG
4.0	January 18, 2016	Removed 2nd Harmonics data and clarified the signal at 4850 MHz	DMG

TABLE OF CONTENTS

SCOPE

An electromagnetic emissions test has been performed on the Pace Americas Inc. model C61-700, 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

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 C61-700 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 C61-700 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)	-	Digital Modulation	Systems uses DSSS techniques	System must utilize a digital transmission technology	Complies
15.247 (a) (2)	-	6dB Bandwidth	1.6 MHz	>500kHz	Complies
15.247 (b) (3)	-	Output Power (multipoint systems)	5.5 dBm (3.5mW) EIRP = 7.0mW Note 1	1Watt, EIRP limited to 4 Watts.	Complies
15.247(e)	-	Power Spectral Density	-12.6 dBm/3kHz	8dBm/3kHz	Complies
15.247(d) / 15.209	-	Spurious Emissions 30MHz – 25 GHz	39.2 dBµV/m @ 73.13 MHz (-0.8 dB)	15.207 in restricted bands, all others < -20dBc	Complies
Note 1: Conducted power calculated from EIRP measurement and antenna gain of 3.0dBi.					

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 integral to the internal PCB	Unique or integral antenna required	Complies
15.207	RSS GEN Table 3	AC Conducted Emissions	42.8dBµV @ 0.56MHz (-13.2 dB)	Refer to page 18	Complies
15.247 (b) (5) 15.407 (f)	RSS 102	RF Exposure Requirements	Refer to MPE calculations in separate exhibit	Refer to OET 65, FCC Part 1 and RSS 102	Complies

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 C61-700 is a high definition set top box, with MoCA and RF4CE. 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 100-240V, 50/60Hz, 0.5 Amps.

The sample was received on November 17, 2015 and tested on November 17, 18 and 30, 2015 and January 7, 2016. The EUT consisted of the following component(s):

Company	Model	Description	Serial Number	FCC ID
Pace Americas	C61-700	DirecTV Home Client	144582730000065	PGRC61
DirecTV	EPS10R3-15	AC/DC Adapter	CL10G1539K6004	-

ANTENNA SYSTEM

The EUT uses two pcb trace antennas, 3dBi gain, configured for transmit diversity.

ENCLOSURE

The EUT enclosure is primarily constructed of plastic. It measures approximately 15 cm wide by 9.5 cm deep by 3 cm high.

MODIFICATIONS

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

SUPPORT EQUIPMENT

The following equipment was used as support equipment for testing:

Company	Model	Description	Serial Number	FCC ID
JVC	EM39FT	TV	TA1SEI042503850	-

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

Company	Model	Description	Serial Number	FCC ID
Dell	Latitude D610	Laptop	-	-
DirecTV	Moca Bridge	Coax Home Adapter	GDD4A1206A0010	-
DirecTV	DCFR0-01	DC to Coax Adapter	XE02A114400018	-

EUT INTERFACE PORTS

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

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
Coax	Moca Bridge	Coax Adapter	Shielded	7
Component	TV input	RCA	Shielded	1
HDMI	TV Input	HDMI	Shielded	1
SPDIF	75 Ohm Terminated	RCA	Shielded	1
USB	USB Stick	USB	Shielded	1
DC power Input	AC/DC power Output	2Wire	Unshielded	1
AC/DC Adapter	AC Mains	2Wire	Unshielded	0.8

Additional on Support Equipment

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
Moca Bridge / Ethernet	Laptop	Cat-5	Unshielded	1
Moca Bridge / Coax input	DC to RF Adapter Output	Coax	Shielded	0.1
DC to RF Adapter Input	AC/DC Output	2Wire	Unshielded	1
Laptop DC Input	AC/DC Output	2Wire	Unshielded	1
AC/DC Adapter (x2)	AC Mains	2Wire	Unshielded	1
TV AC input	AC Mains	2Wire	Unshielded	1.5

EUT OPERATION

During testing, the EUT was configured to transmit a modulated signal on the noted channel at the maximum power setting.

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 7	US0027	2845B-7	41039 Boyce Road Fremont, CA 94538-2435

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

CONDUCTED EMISSIONS CONSIDERATIONS

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

RADIATED EMISSIONS CONSIDERATIONS

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

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

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

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

INSTRUMENT CONTROL COMPUTER

The receivers utilize either a Rohde & Schwarz EZM Spectrum Monitor/Controller or contain an internal Spectrum Monitor/Controller to view and convert the receiver measurements to the field strength at an antenna or voltage developed at the LISN measurement port, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate. A personal computer is used to record all measurements made with the receivers. The software used for radiated and conducted emissions measurements is NTS EMI Test Software (rev 2.10)

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

LINE IMPEDANCE STABILIZATION NETWORK (LISN)

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

FILTERS/ATTENUATORS

External filters and precision attenuators are often connected between the receiving antenna or LISN and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

ANTENNAS

A loop antenna is used below 30 MHz. For the measurement range 30 MHz to 1000 MHz either a combination of a biconical antenna and a log periodic or a bi-log antenna is used. Above 1000 MHz, horn antennas are used. The antenna calibration factors to convert the received voltage to an electric field strength are included with appropriate cable loss and amplifier gain factors to determine an overall site factor, which is then programmed into the test receivers or incorporated into the test software.

ANTENNA MAST AND EQUIPMENT TURNTABLE

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height. Measurements below 30 MHz are made with the loop antenna at a fixed height of 1m above the ground plane.

ANSI C63.10 specifies that the test height above ground for table mounted devices shall be 80 centimeters for measurements below 1GHz and 1.5m for measurements above 1GHz. 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.

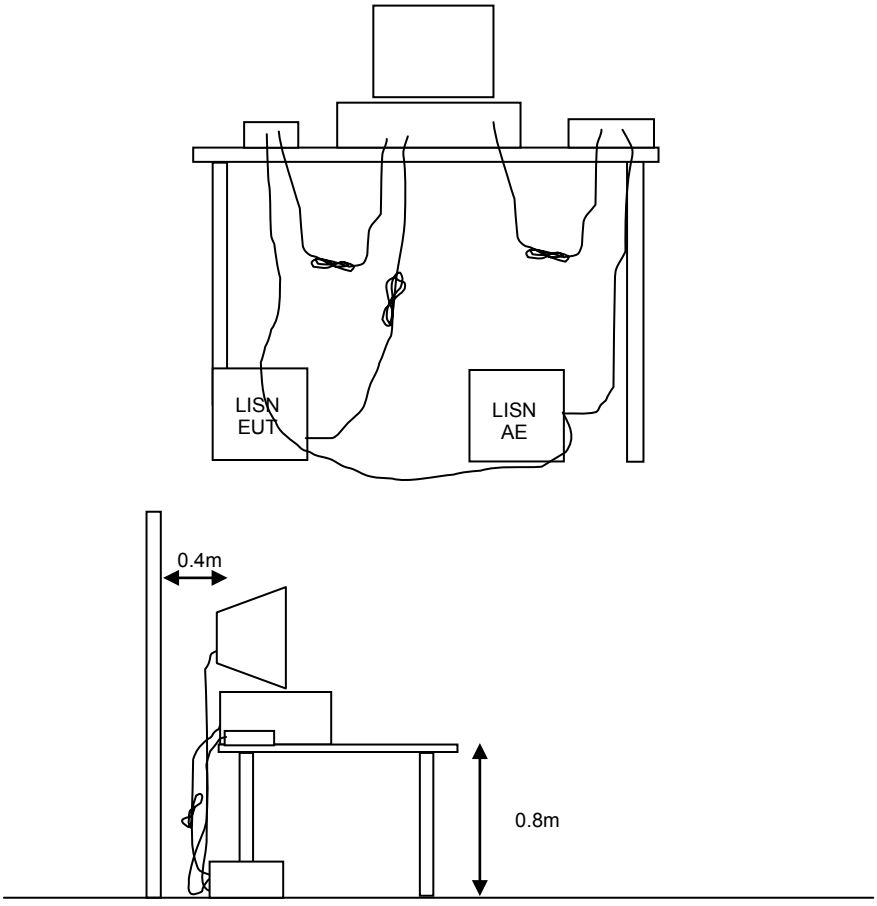


Figure 1 Typical Conducted Emissions Test Configuration

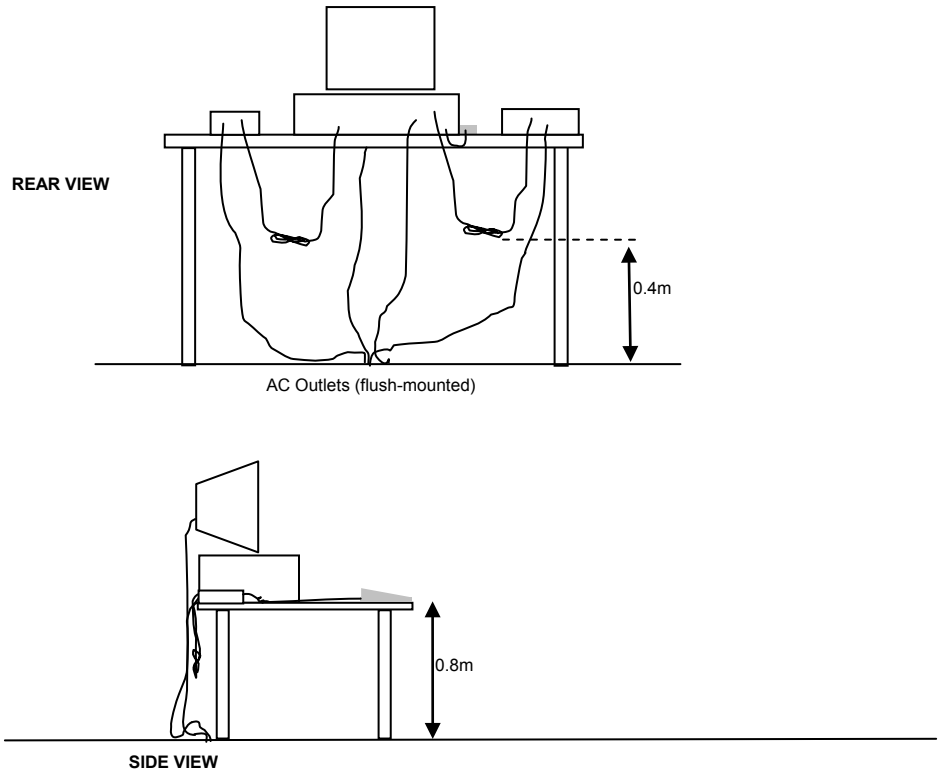
RADIATED EMISSIONS

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.

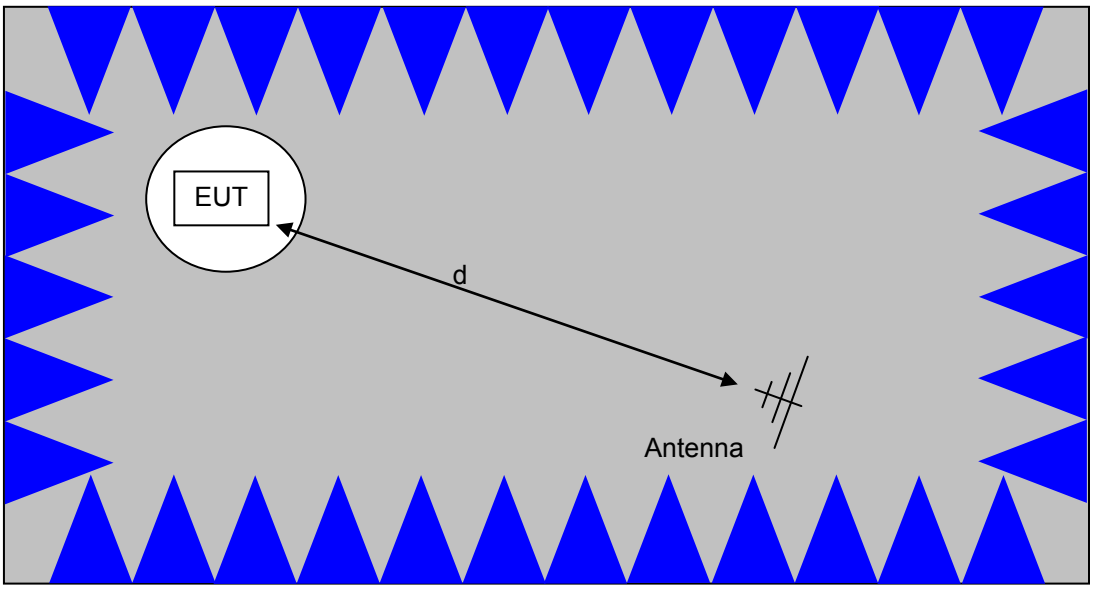
A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

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.

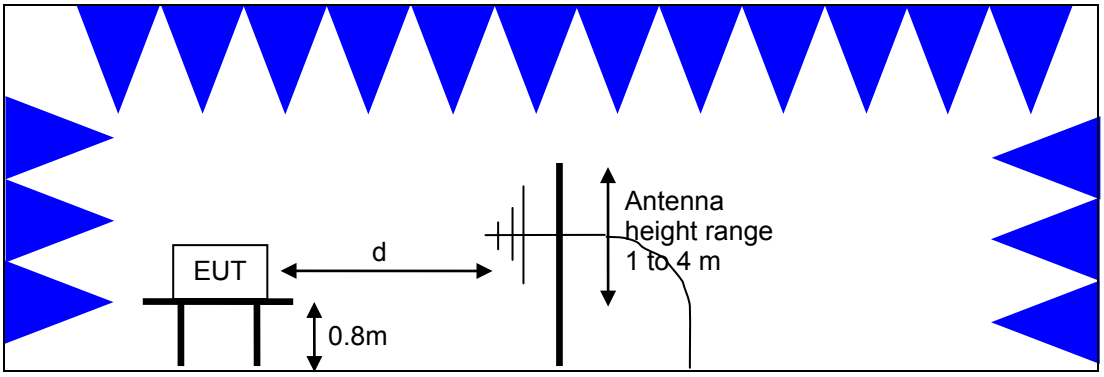


Typical Test Configuration for Radiated Field Strength Measurements



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.

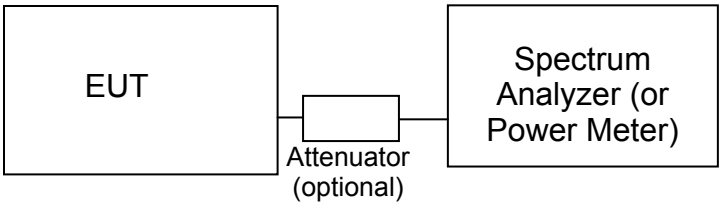
Floor-standing equipment is placed on the floor with insulating supports between the unit and the ground plane.



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

OUTPUT POWER LIMITS – DIGITAL TRANSMISSION SYSTEMS

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

Operating Frequency (MHz)	Output Power	Power Spectral Density
2400 – 2483.5	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 GEN. 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

[1] The restricted bands are detailed in FCC 15.205, RSS-GEN Table 3

SAMPLE CALCULATIONS - RADIATED EMISSIONS

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

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

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

where:

F_d = Distance Factor in dB

D_m = Measurement Distance in meters

D_s = Specification Distance in meters

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

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

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

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

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:

R_r = Receiver Reading in dBuV/m

F_d = Distance Factor in dB

R_c = Corrected Reading in dBuV/m

L_s = Specification Limit in dBuV/m

M = Margin in dB Relative to Spec

SAMPLE CALCULATIONS - FIELD STRENGTH TO EIRP CONVERSION

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

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

where P is the eirp (Watts)

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

Appendix A Test Equipment Calibration Data

Manufacturer	Description	Model	Asset #	Calibrated	Cal Due
Radiated Emissions, 1000 - 25,000 MHz, 17-Nov-15					
EMCO	Antenna, Horn, 1-18GHz	3115	868	6/26/2014	6/26/2016
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	870	2/20/2015	2/20/2016
Hewlett Packard	SA40 Head (Red)	Miteq	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
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1538	12/20/2014	12/20/2015
Hewlett Packard	High Pass filter, 8.2 GHz (Purple System)	P/N 84300-80039	1767	11/3/2015	11/3/2016
A. H. Systems	Purple System Horn, 18-40GHz	SAS-574, p/n: 2581	2160	8/28/2014	8/28/2017
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	2238	9/16/2015	9/16/2016
Radiated Emissions, 1000 - 25,000 MHz, 18-Nov-15					
EMCO	Antenna, Horn, 1-18 GHz	3115	786	12/20/2013	12/20/2015
Hewlett Packard	High Pass filter, 8.2 GHz (Purple System)	P/N 84300-80039	1767	11/3/2015	11/3/2016
Hewlett Packard	SA40 Head (Purple)	Miteq	1772	11/11/2015	11/11/2016
A. H. Systems	Spare System Horn, 18-40GHz	SAS-574, p/n: 2581	2162	7/29/2015	7/29/2017
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	2199	10/9/2015	10/9/2016
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	2238	9/16/2015	9/16/2016
Hewlett Packard	Spectrum Analyzer (SA40) Purple 9 kHz - 40 GHz,	8564E (84125C)	2415	3/7/2015	3/7/2016
Radiated Emissions, 30 - 1,000 MHz, 18-Nov-15					
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1538	12/20/2014	12/20/2015
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	1549	6/2/2015	6/2/2017
Hewlett Packard	9KHz-1300MHz pre-amp	8447F	2777	3/4/2015	3/5/2016
Conducted Emissions - AC Power Ports, 30-Nov-15					
EMCO	LISN, 10 kHz-100 MHz	3825/2	1292	7/24/2015	7/24/2016
EMCO	LISN, 10 kHz-100 MHz	3825/2	1293	6/2/2015	6/2/2016
Rohde & Schwarz	Pulse Limiter	ESH3 Z2	1398	3/16/2015	3/16/2016
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1538	12/20/2014	12/20/2015
Radiated Emissions, 1,000 - 6,500 MHz, 7-Jan-16					
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	2249	9/16/2015	9/16/2016
EMCO	Antenna, Horn, 1-18 GHz	3115	487	7/29/2014	7/29/2016
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	870	2/20/2015	2/20/2016
Hewlett Packard	Spectrum Analyzer (SA40) Red 30 Hz -40 GHz	8564E (84125C)	1148	10/17/2015	10/17/2016

Appendix B Test Data

T100054 Pages 24 – 54

Client:	Pace Americas Inc.	Job Number:	JD100016
Product	C61-700 (RF4CE STB)	T-Log Number:	T100054
System Configuration:	-	Project Manager:	Irene Rademacher
Contact:	Mark Rieger	Project Coordinator:	-
Emissions Standard(s):	FCC 15.B / 15.247	Class:	B
Immunity Standard(s):	-	Environment:	-

EMC Test Data

For The

Pace Americas Inc.

Product

C61-700 (RF4CE STB)

Date of Last Test: 1/15/2016

Client:	Pace Americas Inc.	Job Number:	JD100016
Model:	C61-700 (RF4CE STB)	T-Log Number:	T100054
		Project Manager:	Irene Rademacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.B / 15.247	Class:	N/A

Duty Cycle

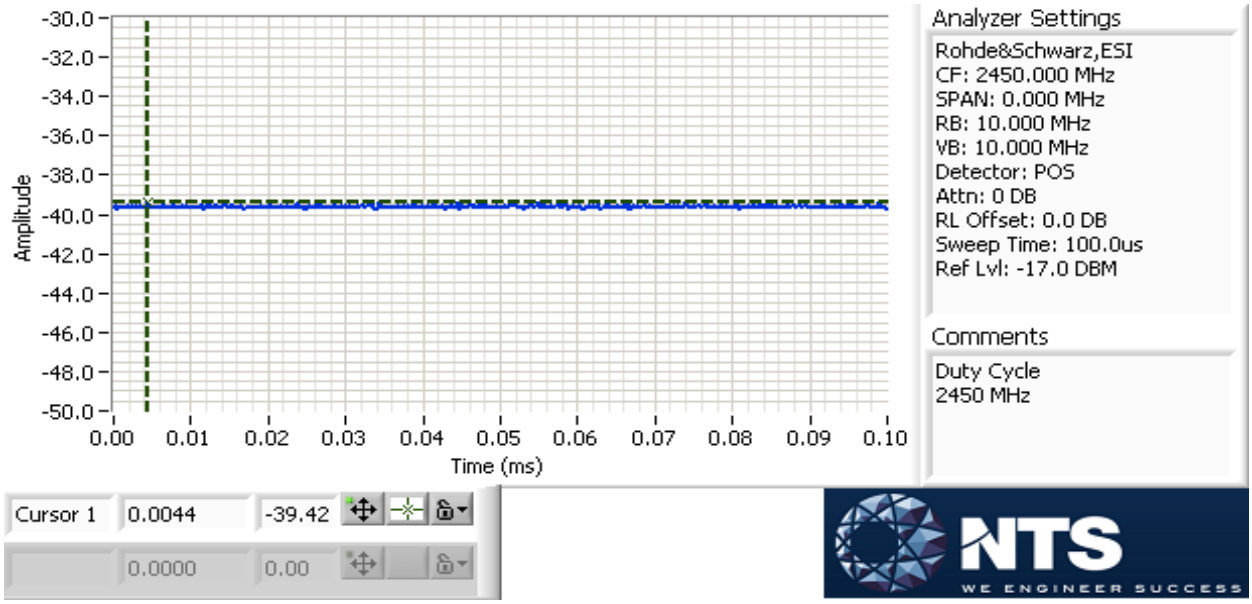
Date of Test: 11/17/2015 0:00
Test Engineer: Rafael Varelas
Test Location: FT Chamber #7

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)
RF4CE	-	100.00	Yes	N/A	0	0	10

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



Client:	Pace Americas Inc.	Job Number:	JD100016
Model:	C61-700 (RF4CE STB)	T-Log Number:	T100054
		Project Manager:	Irene Rademacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.B / 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: 22.4 °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	RF4CE	2425MHz	3	3	Restricted Band Edge (2390 MHz)	FCC Part 15.209 / 15.247(c)	30.7 dBµV/m @ 2377.0 MHz (-23.3 dB)
	RF4CE	2475MHz	3	3	Restricted Band Edge (2483.5 MHz)	FCC Part 15.209 / 15.247(c)	43.9 dBµV/m @ 2484.0 MHz (-10.1 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.

Sample Notes

Sample S/N: 144582730000065
Driver:
Antenna: Internal

Client:	Pace Americas Inc.	Job Number:	JD100016
Model:	C61-700 (RF4CE STB)	T-Log Number:	T100054
		Project Manager:	Irene Rademacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.B / 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)
RF4CE	-	100.00	Yes	N/A	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.

Client:	Pace Americas Inc.	Job Number:	JD100016
Model:	C61-700 (RF4CE STB)	T-Log Number:	T100054
		Project Manager:	Irene Rademacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.B / 15.247	Class:	N/A

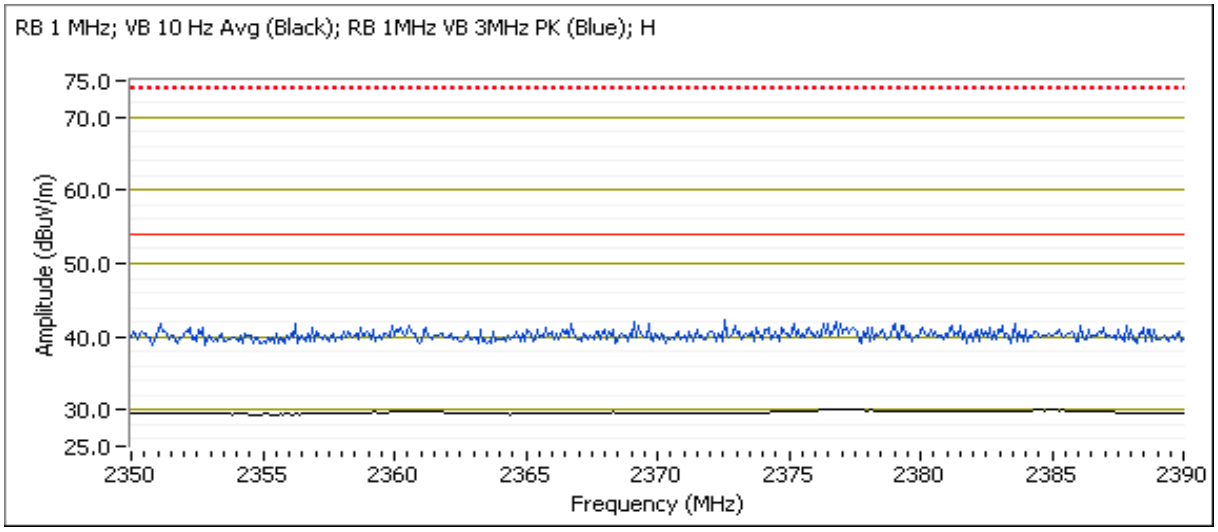
Run #1: Radiated Bandedge Measurements

Date of Test: 11/17/2015 0:00 Config. Used: 1
Test Engineer: Rafael Varelas Config Change: None
Test Location: FT Chamber #7 EUT Voltage: 120V/60Hz

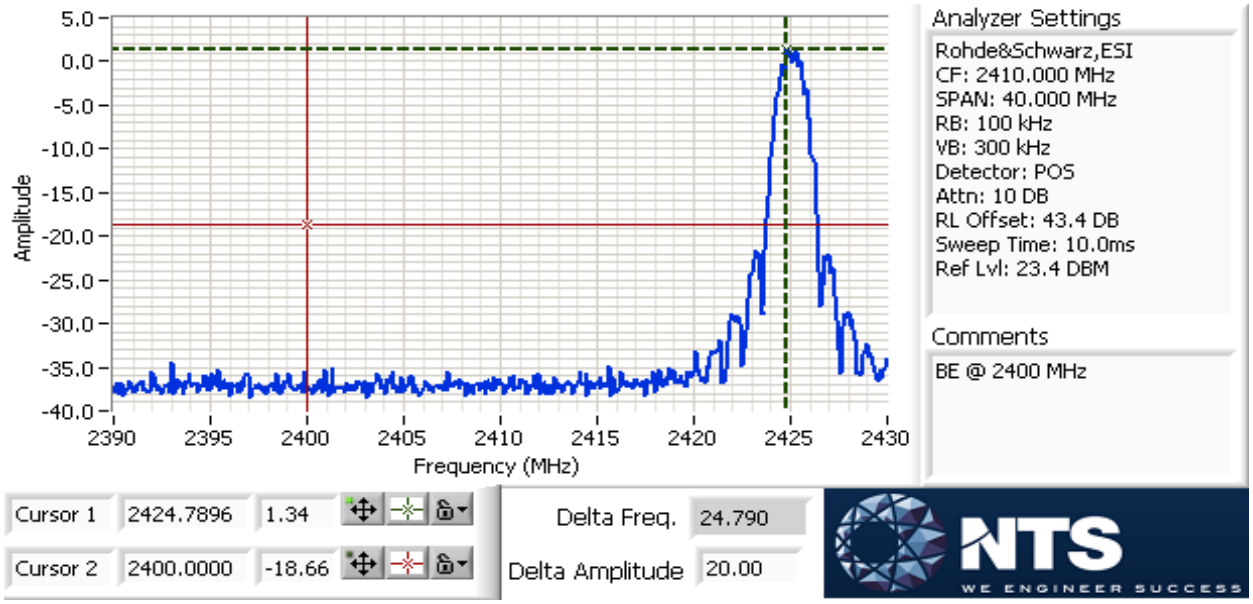
Channel: 2425MHz Mode: RF4CE
Tx Chain: Ant 0 Data Rate: -

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	
2377.090	30.1	H	54.0	-23.9	AVG	138	1.0	POS; RB 1 MHz; VB: 10 Hz
2368.120	42.8	H	74.0	-31.2	PK	138	1.0	POS; RB 1 MHz; VB: 3 MHz
2377.170	30.1	V	54.0	-23.9	AVG	214	1.0	POS; RB 1 MHz; VB: 10 Hz
2366.990	41.9	V	74.0	-32.1	PK	214	1.0	POS; RB 1 MHz; VB: 3 MHz



Client:	Pace Americas Inc.	Job Number:	JD100016
Model:	C61-700 (RF4CE STB)	T-Log Number:	T100054
		Project Manager:	Irene Rademacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.B / 15.247	Class:	N/A

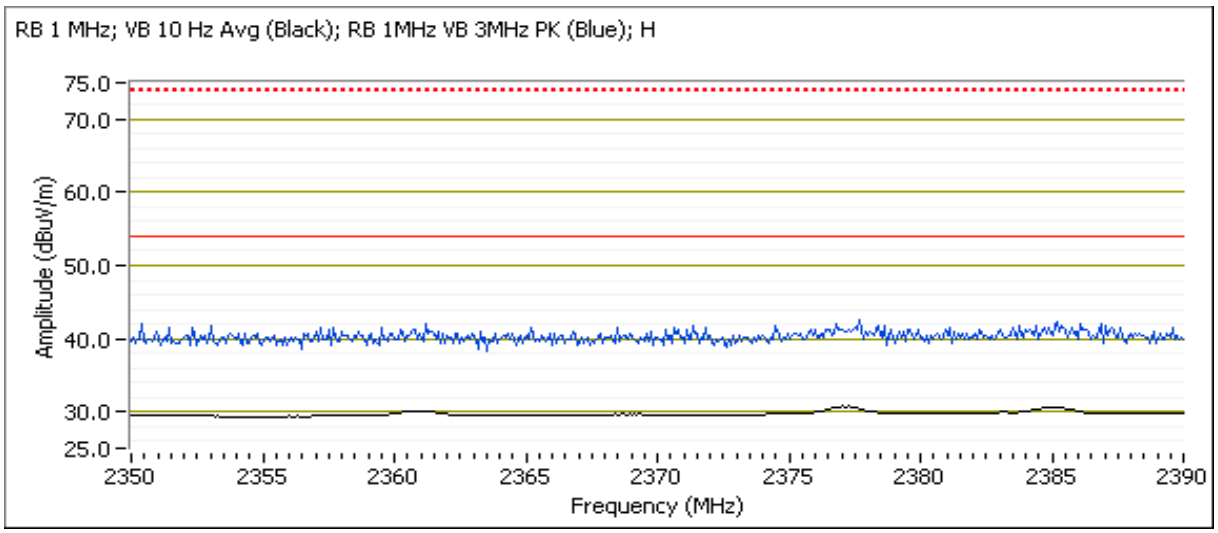


Channel: 2425MHz Mode: RF4CE
Tx Chain: Ant 1 Data Rate: -

Client:	Pace Americas Inc.	Job Number:	JD100016
Model:	C61-700 (RF4CE STB)	T-Log Number:	T100054
		Project Manager:	Irene Rademacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.B / 15.247	Class:	N/A

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	
2377.010	30.7	H	54.0	-23.3	AVG	360	1.0	POS; RB 1 MHz; VB: 10 Hz
2376.210	30.1	V	54.0	-23.9	AVG	146	1.0	POS; RB 1 MHz; VB: 10 Hz
2351.760	42.9	H	74.0	-31.1	PK	360	1.0	POS; RB 1 MHz; VB: 3 MHz
2374.450	41.0	V	74.0	-33.0	PK	146	1.0	POS; RB 1 MHz; VB: 3 MHz

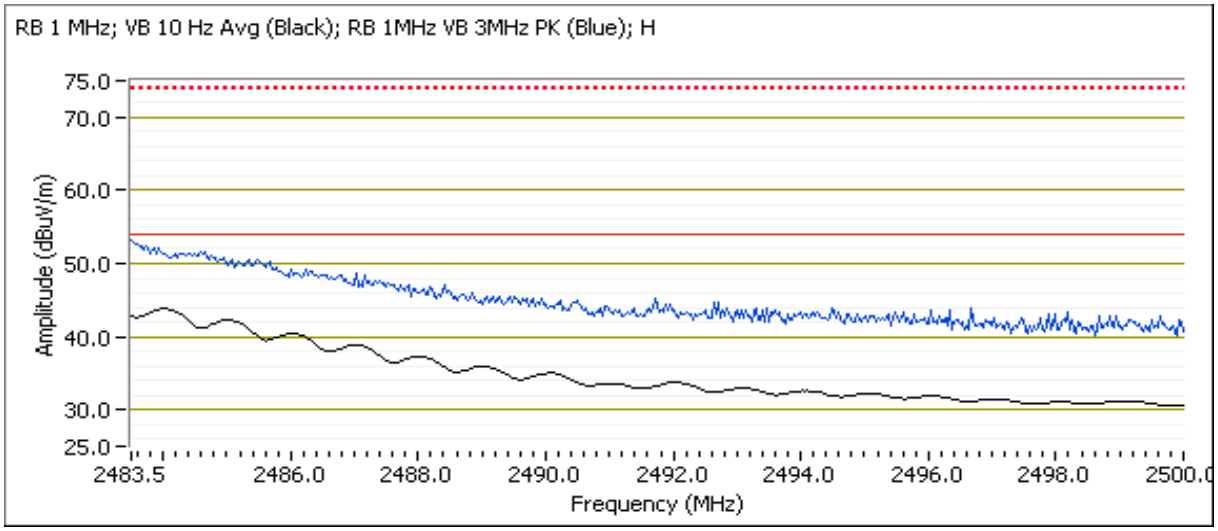


Client:	Pace Americas Inc.	Job Number:	JD100016
Model:	C61-700 (RF4CE STB)	T-Log Number:	T100054
		Project Manager:	Irene Rademacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.B / 15.247	Class:	N/A

Channel: 2475MHz Mode: RF4CE
Tx Chain: Ant 0 Data Rate: -

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	43.8	H	54.0	-10.2	AVG	360	1.0	POS; RB 1 MHz; VB: 10 Hz
2483.570	52.8	H	74.0	-21.2	PK	360	1.0	POS; RB 1 MHz; VB: 3 MHz
2484.030	38.8	V	54.0	-15.2	AVG	190	1.9	POS; RB 1 MHz; VB: 10 Hz
2483.630	48.1	V	74.0	-25.9	PK	190	1.9	POS; RB 1 MHz; VB: 3 MHz

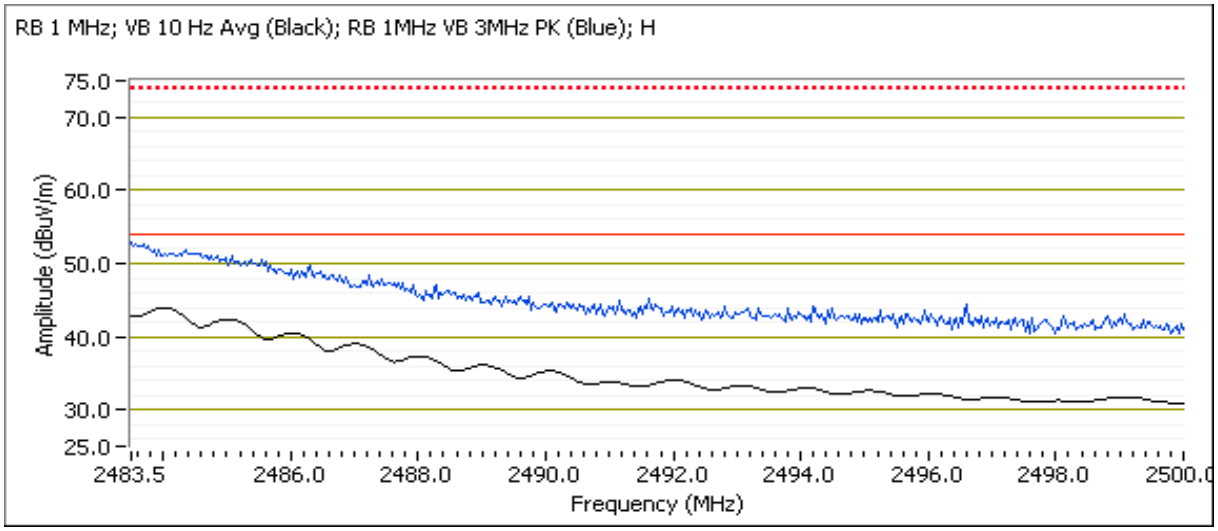


Client:	Pace Americas Inc.	Job Number:	JD100016
Model:	C61-700 (RF4CE STB)	T-Log Number:	T100054
		Project Manager:	Irene Rademacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.B / 15.247	Class:	N/A

Channel: 2475MHz Mode: RF4CE
Tx Chain: Ant 1 Data Rate: -

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	43.9	H	54.0	-10.1	AVG	27	1.1	POS; RB 1 MHz; VB: 10 Hz
2484.000	36.1	V	54.0	-17.9	AVG	144	1.0	POS; RB 1 MHz; VB: 10 Hz
2483.570	52.2	H	74.0	-21.8	PK	27	1.1	POS; RB 1 MHz; VB: 3 MHz
2483.730	45.9	V	74.0	-28.1	PK	144	1.0	POS; RB 1 MHz; VB: 3 MHz



Client:	Pace Americas Inc.	Job Number:	JD100016
Model:	C61-700 (RF4CE STB)	T-Log Number:	T100054
		Project Manager:	Irene Rademacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.B / 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: 22.4 °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	RF4CE	2425MHz	3	3	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	40.2 dBµV/m @ 4851.1 MHz (-13.8 dB)
	RF4CE	2450MHz	3	3	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	39.1 dBµV/m @ 4899.2 MHz (-14.9 dB)
	RF4CE	2475MHz	3	3	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	36.4 dBµV/m @ 4949.0 MHz (-17.6 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: 144582730000065
Driver: -
Antenna: Internal

Client:	Pace Americas Inc.	Job Number:	JD100016
Model:	C61-700 (RF4CE STB)	T-Log Number:	T100054
		Project Manager:	Irene Rademacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.B / 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)
RF4CE	-	100.00	Yes	N/A	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:	Average value calculated from peak measurement and duty cycle correction for actual operation (0.5ms per every 100ms, 20log(0.5/100) = -46dB (FCC maximum value of 20dB used). Refer to operational description for more details.

Client:	Pace Americas Inc.	Job Number:	JD100016
Model:	C61-700 (RF4CE STB)	T-Log Number:	T100054
		Project Manager:	Irene Rademacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.B / 15.247	Class:	N/A

Run #1: Radiated Spurious Emissions, 1,000 - 25000 MHz.

Date of Test: 11/17/2015 0:00 Config. Used: 1
Test Engineer: Rafael Varelas Config Change: None
Test Location: FT Chamber #7 EUT Voltage: 120V/60Hz

Run #1a: Low Channel

Channel: 2425MHz Mode: RF4CE
Tx Chain: Ant 0 Data Rate: -

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	
2425.070	91.3	V	-	-	AVG	216	1.0	POS; RB 1 MHz; VB: 10 Hz
2425.500	95.1	V	-	-	PK	216	1.0	POS; RB 1 MHz; VB: 3 MHz
2425.080	90.0	V	-	-	PK	216	1.0	POS; RB 100 kHz; VB: 300 kHz
2425.070	96.6	H	-	-	AVG	2	1.2	POS; RB 1 MHz; VB: 10 Hz
2425.480	100.5	H	-	-	PK	2	1.2	POS; RB 1 MHz; VB: 3 MHz
2425.230	95.9	H	-	-	PK	2	1.2	POS; RB 100 kHz; VB: 300 kHz

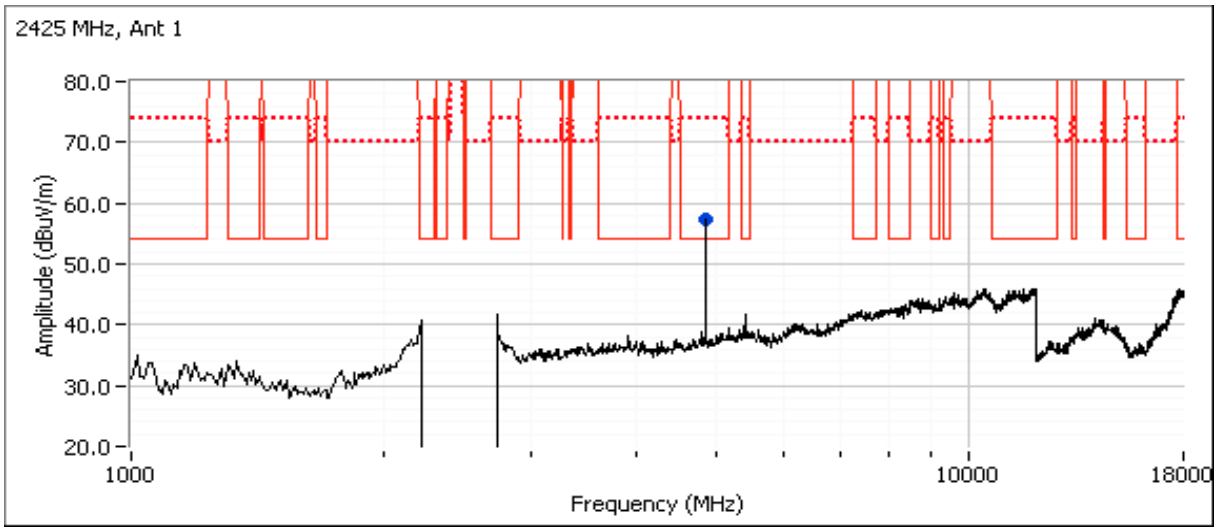
Fundamental emission level @ 3m in 100kHz RBW:	95.9 dBµV/m	
Limit for emissions outside of restricted bands:	75.9 dBµV/m	Limit is -20dBc (Peak power measurement)
Limit for emissions outside of restricted bands:	65.9 dBµV/m	Limit is -30dBc (UNII power measurement)

Spurious Emissions - Ant 1

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4851.050	40.2	H	54.0	-13.8	AVG	16	1.6	Note 3
4849.100	60.2	H	74.0	-13.8	PK	16	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

Client:	Pace Americas Inc.	Job Number:	JD100016
Model:	C61-700 (RF4CE STB)	T-Log Number:	T100054
		Project Manager:	Irene Rademacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.B / 15.247	Class:	N/A



Client:	Pace Americas Inc.	Job Number:	JD100016
Model:	C61-700 (RF4CE STB)	T-Log Number:	T100054
		Project Manager:	Irene Rademacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.B / 15.247	Class:	N/A

Run #1b: Center Channel

Channel: 2450MHz Mode: RF4CE
Tx Chain: Ant 0 Data Rate: -

Fundamental Signal 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	
Ant #0								
2450.050	90.9	V	-	-	AVG	234	1.0	POS; RB 1 MHz; VB: 10 Hz
2450.490	94.8	V	-	-	PK	234	1.0	POS; RB 1 MHz; VB: 3 MHz
2449.960	89.2	V	-	-	PK	234	1.0	POS; RB 100 kHz; VB: 300 kHz
2450.050	97.9	H	-	-	AVG	4	1.1	POS; RB 1 MHz; VB: 10 Hz
2450.530	101.9	H	-	-	PK	4	1.1	POS; RB 1 MHz; VB: 3 MHz
2450.490	96.7	H	-	-	PK	4	1.1	POS; RB 100 kHz; VB: 300 kHz
Ant #1								
2450.060	86.9	V	-	-	AVG	148	1.2	POS; RB 1 MHz; VB: 10 Hz
2450.510	91.0	V	-	-	PK	148	1.2	POS; RB 1 MHz; VB: 3 MHz
2449.890	86.2	V	-	-	PK	148	1.2	POS; RB 100 kHz; VB: 300 kHz
2450.080	97.0	H	-	-	AVG	0	1.5	POS; RB 1 MHz; VB: 10 Hz
2450.530	101.2	H	-	-	PK	0	1.5	POS; RB 1 MHz; VB: 3 MHz
2450.080	96.5	H	-	-	PK	0	1.5	POS; RB 100 kHz; VB: 300 kHz

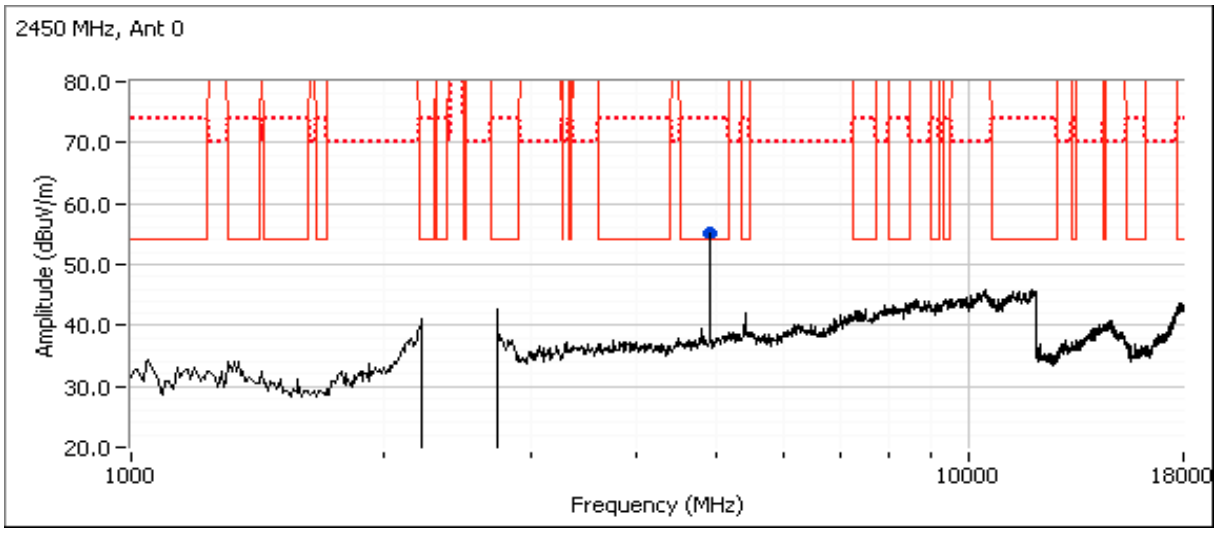
Fundamental emission level @ 3m in 100kHz RBW:	96.7 dBµV/m	
Limit for emissions outside of restricted bands:	76.7 dBµV/m	Limit is -20dBc (Peak power measurement)
Limit for emissions outside of restricted bands:	66.7 dBµV/m	Limit is -30dBc (UNII power measurement)

Client:	Pace Americas Inc.	Job Number:	JD100016
Model:	C61-700 (RF4CE STB)	T-Log Number:	T100054
		Project Manager:	Irene Rademacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.B / 15.247	Class:	N/A

Spurious Emissions - Ant 0

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4899.130	38.5	V	54.0	-15.5	AVG	52	1.0	Note 3
4899.020	58.5	V	74.0	-15.5	PK	52	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

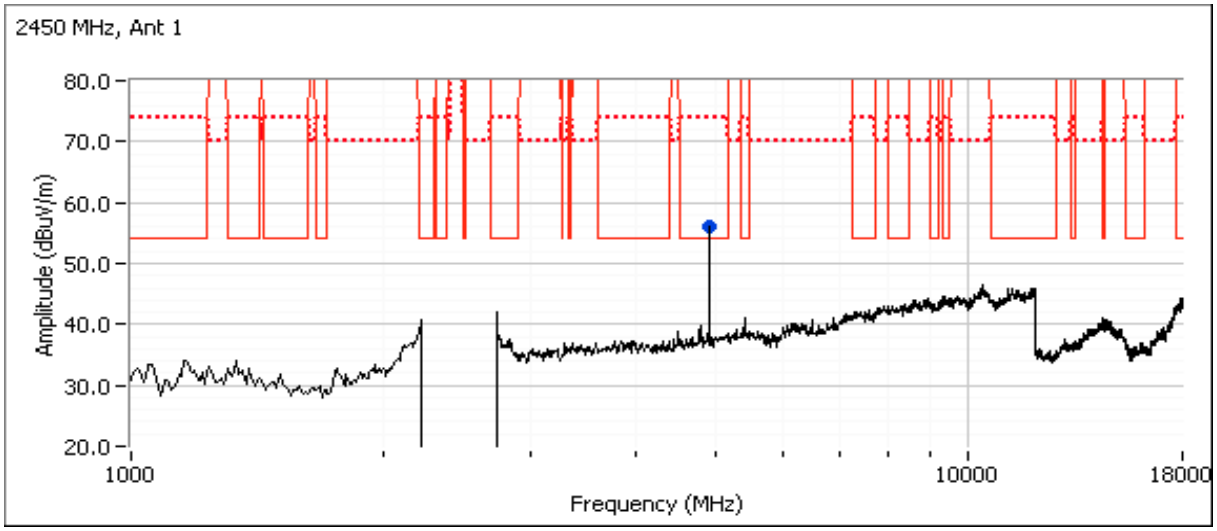


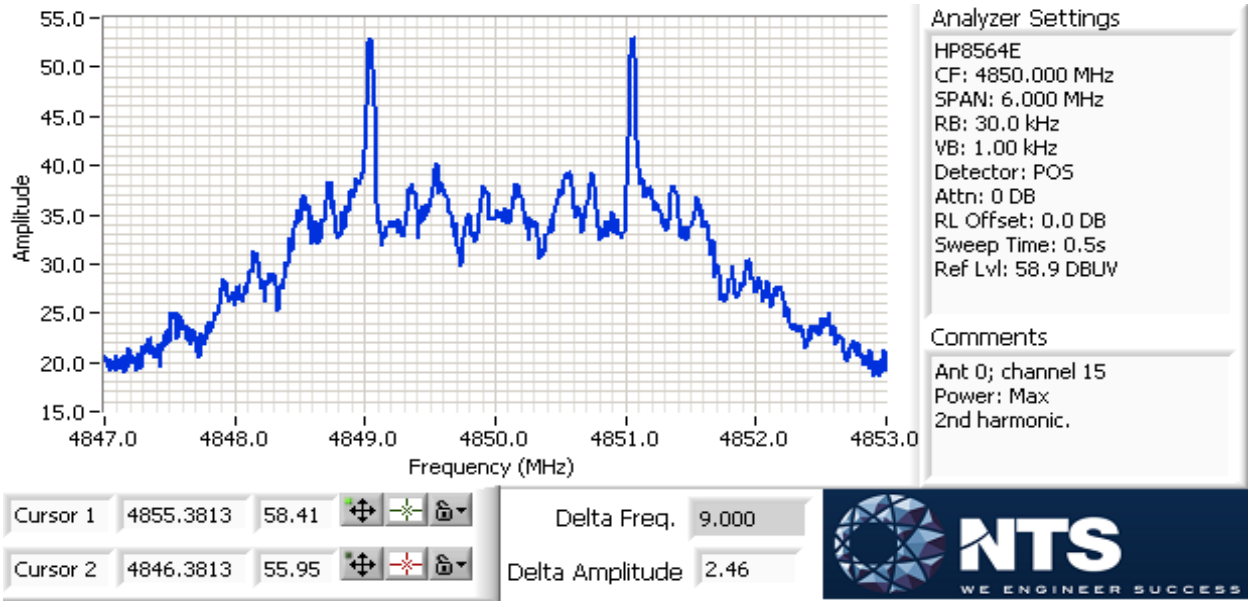
Spurious Emissions - Ant 1

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4899.180	39.1	H	54.0	-14.9	AVG	22	1.4	note 3
4899.110	59.1	H	74.0	-14.9	PK	22	1.4	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

Client:	Pace Americas Inc.	Job Number:	JD100016
Model:	C61-700 (RF4CE STB)	T-Log Number:	T100054
		Project Manager:	Irene Rademacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.B / 15.247	Class:	N/A





Note:	The purpose of this plot is only to show the characteristic of signal at 4850MHz.

Client:	Pace Americas Inc.	Job Number:	JD100016
Model:	C61-700 (RF4CE STB)	T-Log Number:	T100054
		Project Manager:	Irene Rademacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.B / 15.247	Class:	N/A

Run #1c: High Channel

Channel: 2475MHz Mode: RF4CE
Tx Chain: Ant 0 Data Rate: -

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	
2475.080	90.0	V	-	-	AVG	192	1.8	POS; RB 1 MHz; VB: 10 Hz
2475.520	94.1	V	-	-	PK	192	1.8	POS; RB 1 MHz; VB: 3 MHz
2475.210	89.2	V	-	-	PK	192	1.8	POS; RB 100 kHz; VB: 300 kHz
2475.080	96.7	H	-	-	AVG	5	1.0	POS; RB 1 MHz; VB: 10 Hz
2475.520	100.7	H	-	-	PK	5	1.0	POS; RB 1 MHz; VB: 3 MHz
2474.880	96.0	H	-	-	PK	5	1.0	POS; RB 100 kHz; VB: 300 kHz

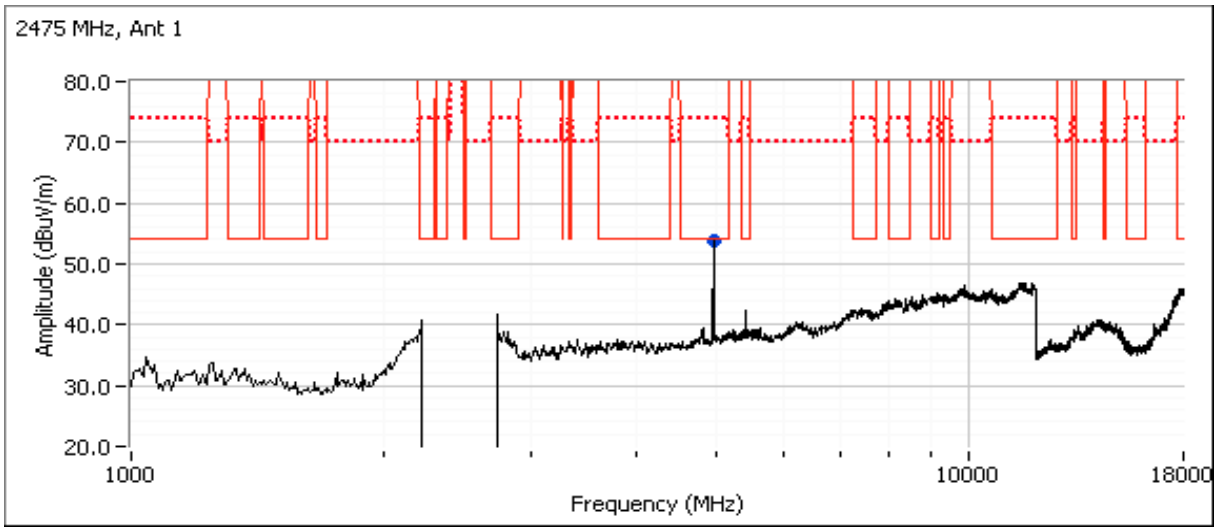
Fundamental emission level @ 3m in 100kHz RBW:	96.0 dBµV/m	
Limit for emissions outside of restricted bands:	76.0 dBµV/m	Limit is -20dBc (Peak power measurement)
Limit for emissions outside of restricted bands:	66.0 dBµV/m	Limit is -30dBc (UNII power measurement)

Spurious Emissions - Ant 1

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4949.030	36.4	H	54.0	-17.6	AVG	6	1.3	note 3
4948.960	56.4	H	74.0	-17.6	PK	6	1.3	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

Client:	Pace Americas Inc.	Job Number:	JD100016
Model:	C61-700 (RF4CE STB)	T-Log Number:	T100054
		Project Manager:	Irene Rademacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.B / 15.247	Class:	N/A



Client:	Pace Americas Inc.	Job Number:	JD100016
Model:	C61-700 (RF4CE STB)	T-Log Number:	T100054
		Project Manager:	Irene Rademacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.B / 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: 20-25 °C

Rel. Humidity: 35-40 %

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	RF4CE	2450MHz	3	3	Radiated Emissions, 30 -1000 MHz	FCC Part 15.209 / 15.247(c)	39.2 dBµV/m @ 73.13 MHz (-0.8 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: 144582730000065

Driver:

Antenna: Internal

Client:	Pace Americas Inc.	Job Number:	JD100016
Model:	C61-700 (RF4CE STB)	T-Log Number:	T100054
		Project Manager:	Irene Rademacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.B / 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)
RF4CE	-	100.00	Yes	N/A	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
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 7:	Emission has non constant duty cycle < 98%, average measurement performed: RBW=1MHz, VBW> 1/T, RMS detector, sweep time auto, max hold. Max hold for 50*(1/DC) traces

Client:	Pace Americas Inc.	Job Number:	JD100016
Model:	C61-700 (RF4CE STB)	T-Log Number:	T100054
		Project Manager:	Irene Rademacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.B / 15.247	Class:	N/A

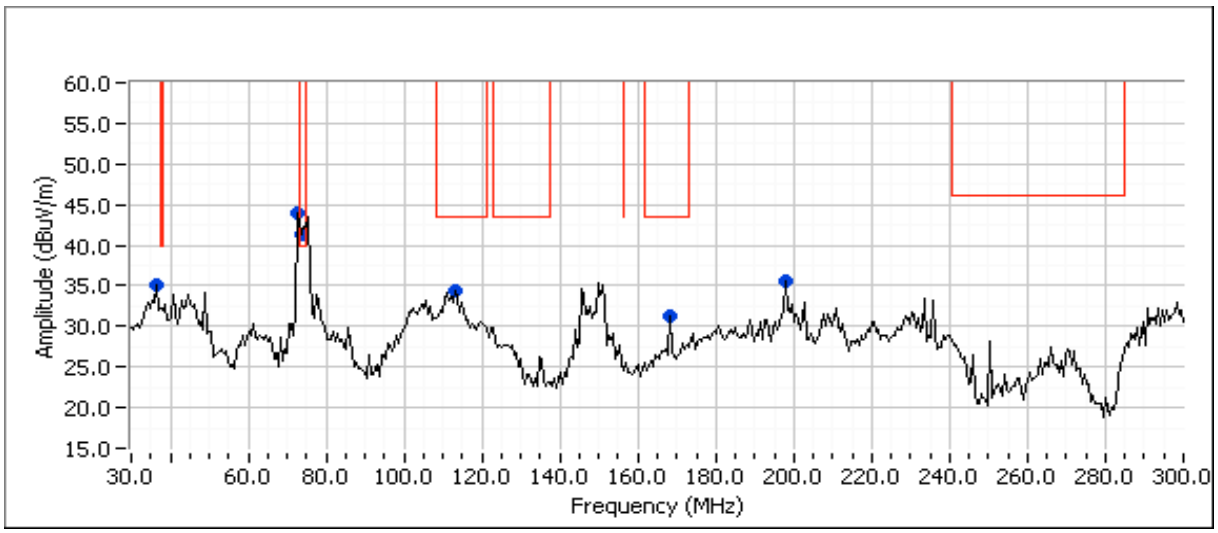
Run #1: Radiated Spurious Emissions, 30 - 1000 MHz. Operating Mode: RF4CE

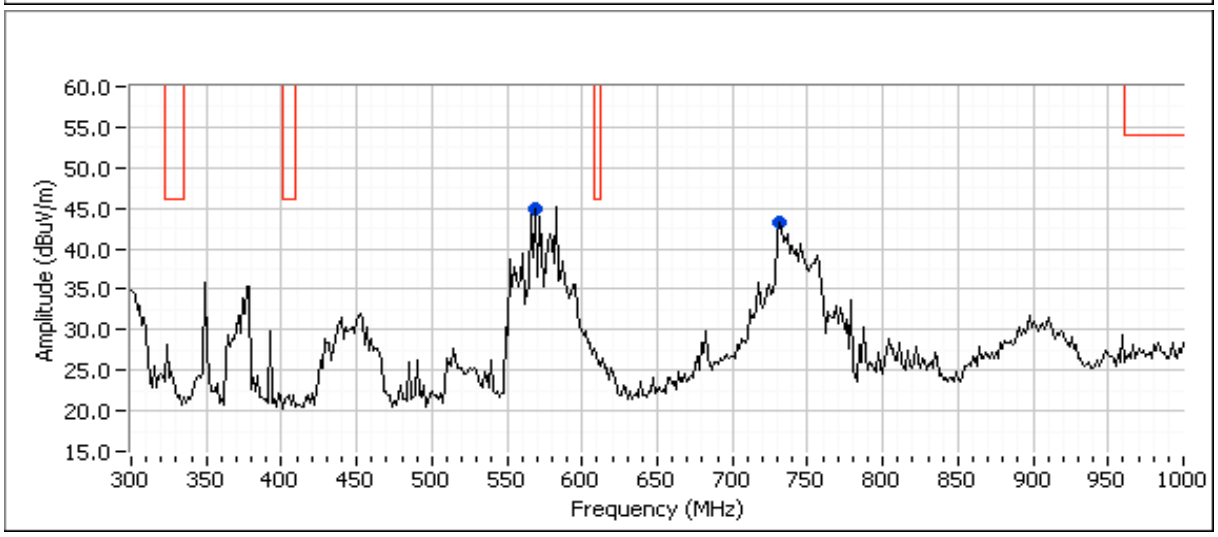
Date of Test: 11/18/2015 0:00
Test Engineer: Rafael Varelas
Test Location: FT Chamber #7

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

Channel: 2450MHz
Tx Chain: Ant 1

Mode: RF4CE
Data Rate: -





Client:	Pace Americas Inc.	Job Number:	JD100016
Model:	C61-700 (RF4CE STB)	T-Log Number:	T100054
		Project Manager:	Irene Rademacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.B / 15.247	Class:	N/A

Preliminary peak readings captured during pre-scan

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
36.876	35.2	V	100.0	-64.8	Peak	16	1.5	
73.127	41.3	H	40.0	1.3	Peak	162	2.0	
113.899	34.3	V	43.5	-9.2	Peak	334	1.0	
168.389	31.2	H	43.5	-12.3	Peak	166	2.0	
196.618	35.7	H	100.0	-64.3	Peak	172	1.0	
570.036	45.0	V	100.0	-55.0	Peak	164	1.0	
729.021	43.2	H	100.0	-56.8	Peak	156	1.0	

Final quasi-peak readings

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
73.127	39.2	H	40.0	-0.8	QP	162	2.0	QP (1.00s)
113.899	30.6	V	43.5	-12.9	QP	334	1.0	QP (1.00s)
168.389	24.7	H	43.5	-18.8	QP	166	2.0	QP (1.00s)
570.036	41.1	V	76.7	-35.6	QP	181	1.1	QP (1.00s)
729.021	39.7	H	76.7	-37.0	QP	156	1.0	QP (1.00s)
36.876	32.8	V	76.7	-43.9	QP	16	1.0	QP (1.00s)
196.618	31.7	H	76.7	-45.0	QP	172	1.7	QP (1.00s)

Client:	Pace Americas Inc.	Job Number:	JD100016
Model:	C61-700 (RF4CE STB)	T-Log Number:	T100054
		Project Manager:	Irene Rademacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.B / 15.247	Class:	N/A

RSS-247 and FCC 15.247 (DTS) Antenna Port Measurements

Power, PSD, Bandwidth and Spurious Emissions

Test Specific Details

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

Date of Test: 11/17/2015 0:00
Test Engineer: Rafael Varelas
Test Location: FT Chamber #7

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

General Test Configuration

The EUT does not provide an RF connector. All measurements performed radiated. For power and PSD measurements, the field strength was maximized at a distance of 3m.

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

Ambient Conditions:

Temperature: 22.4 °C
Rel. Humidity: 36 %

Summary of Results

Run #	Pwr setting	Avg Pwr	Test Performed	Limit	Pass / Fail	Result / Margin
1	-	-	Output Power	15.247(b)	Pass	5.5dBm (3.5mW)
2	-	-	Power spectral Density (PSD)	15.247(d)	Pass	-12.6 dBm/3kHz
3	-	-	Minimum 6dB Bandwidth	15.247(a)	Pass	1.6 MHz
3	-	-	99% Bandwidth	RSS GEN	-	2.4 MHz

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	Pace Americas Inc.	Job Number:	JD100016
Model:	C61-700 (RF4CE STB)	T-Log Number:	T100054
		Project Manager:	Irene Rademacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.B / 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)
RF4CE	-	100.00	Yes	N/A	0	0	10

Sample Notes

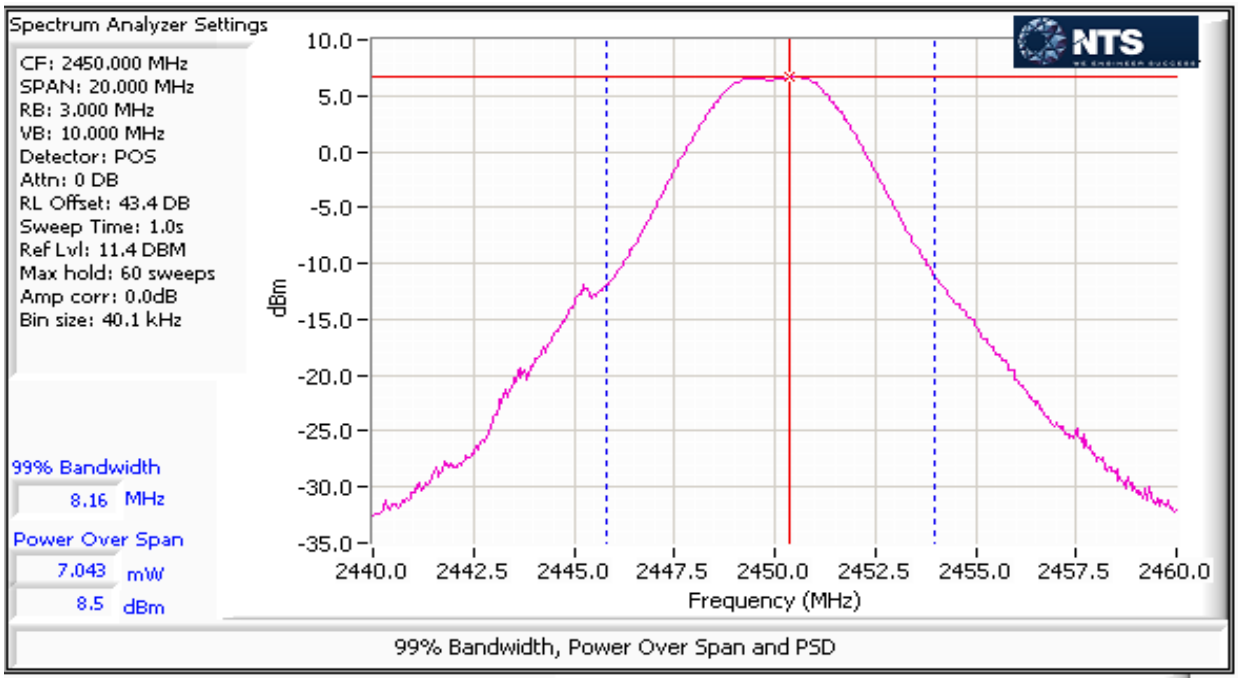
Sample S/N: 144582730000065
Driver:

Client:	Pace Americas Inc.	Job Number:	JD100016
Model:	C61-700 (RF4CE STB)	T-Log Number:	T100054
		Project Manager:	Irene Rademacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.B / 15.247	Class:	N/A

Run #1: Output Power

Power Setting[2]	Frequency (MHz)	EIRP [1] dBm	EIRP [1] W	Antenna Gain (dBi)	Output Power (dBm) [1]	Output Power mW	Result	
3	2425	7.3	0.005	3.0	4.3	2.7	Pass	Ant 0
3	2450	8.5	0.007	3.0	5.5	3.5	Pass	Ant 0
3	2450	7.7	0.006	3.0	4.7	3.0	Pass	Ant 1
3	2475	7.1	0.005	3.0	4.1	2.6	Pass	Ant 0

Note 1:	Output power measured using RBW > OBW, VBW=3xRBW, peak detector, max hold
Note 2:	Power setting - the software power setting used during testing, included for reference only.
Note 3:	Power measurement performed at the worse case orientation and measurement antenna polarity (horizontal). Refer to the fundamental field strength measurements in the spurious emissions results.
Note 4:	As the device operates using Tx diversity, the power for each output was measured at the center channel. Measurements on the low and high channels were performed on the port with the highest EIRP.

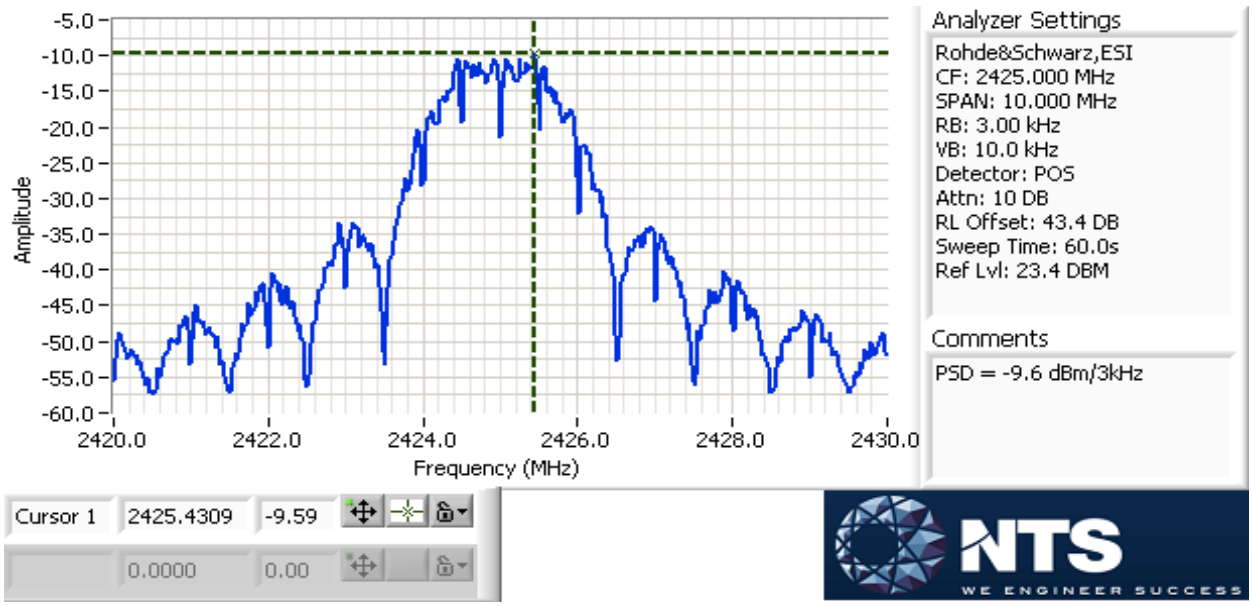


Client:	Pace Americas Inc.	Job Number:	JD100016
Model:	C61-700 (RF4CE STB)	T-Log Number:	T100054
		Project Manager:	Irene Rademacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.B / 15.247	Class:	N/A

Run #2: Power spectral Density

Power Setting	Frequency (MHz)	PSD (eirp) (dBm/3kHz) Note 1	Antenna Gain (dBi)	PSD (dBm/3kHz) Note 1	Limit dBm/3kHz	Result
3	2425	-9.6	3.0	-12.6	8.0	Pass
3	2450	-9.7	3.0	-12.7	8.0	Pass
3	2475	-10.5	3.0	-13.5	8.0	Pass

Note 1:	Power spectral density measured radiated. 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.
Note 2:	PSD performed radiated using Ant 0 (highest output power). Measurement performed at the worse case orientation and measurement antenna polarity (horizontal).



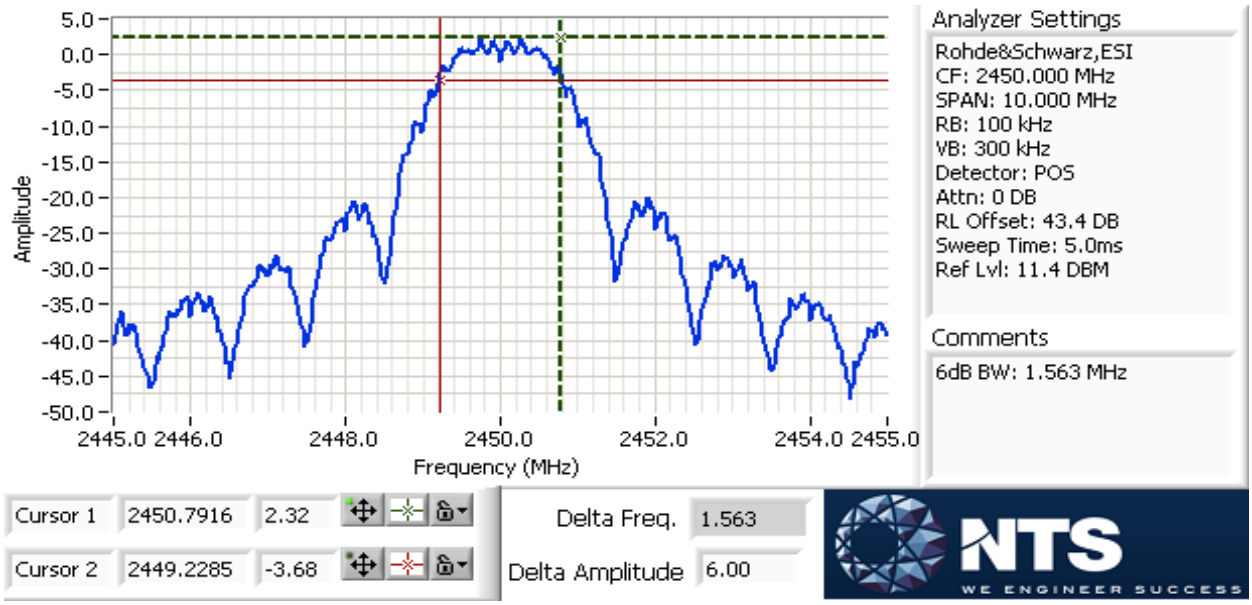
Client:	Pace Americas Inc.	Job Number:	JD100016
Model:	C61-700 (RF4CE STB)	T-Log Number:	T100054
		Project Manager:	Irene Rademacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.B / 15.247	Class:	N/A

Run #3: Signal Bandwidth

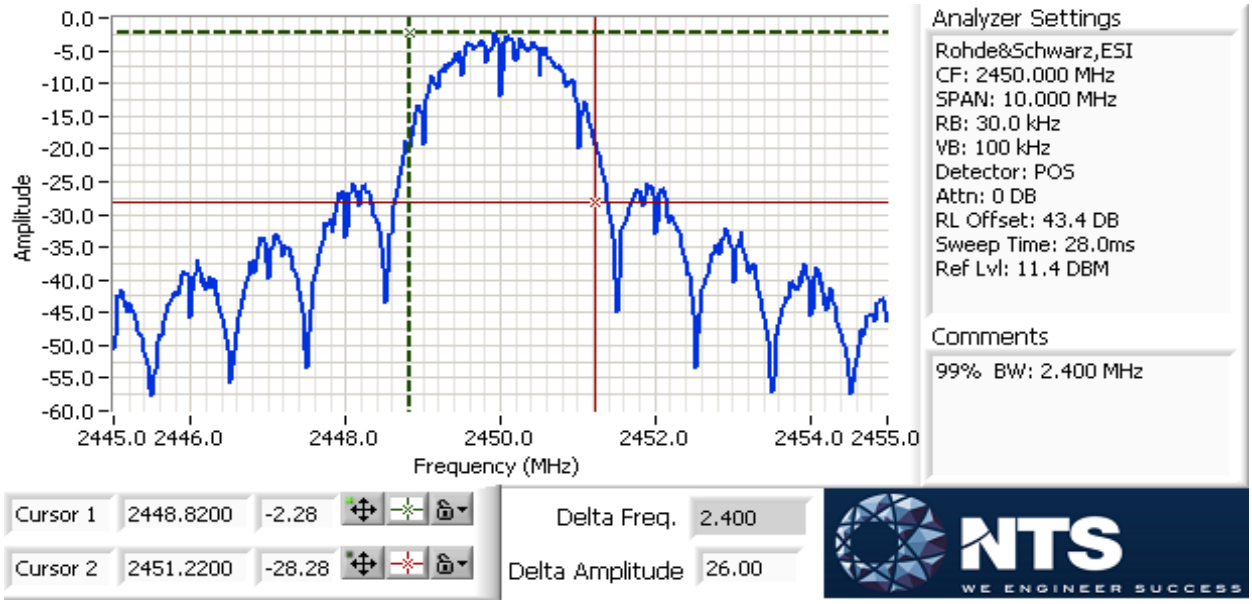
Mode: RF4CE

Power Setting	Frequency (MHz)	Bandwidth (MHz)		RBW Setting (kHz)	
		6dB	99%	6dB	99%
3	2425	1.6	2.4	100	30
3	2450	1.6	2.4	100	30
3	2475	1.6	2.4	100	30

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:	Bandwidth measurements performed radiated using Ant 0 (highest output power). Measurement performed at the worse case orientation and measurement antenna polarity (horizontal).



Client:	Pace Americas Inc.	Job Number:	JD100016
Model:	C61-700 (RF4CE STB)	T-Log Number:	T100054
		Project Manager:	Irene Rademacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.B / 15.247	Class:	N/A



Client:	Pace Americas Inc.	Job Number:	JD100016
Model:	C61-700 (RF4CE STB)	T-Log Number:	T100054
		Project Manager:	Irene Rademacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.B / 15.247	Class:	B

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: 11/30/2015
Test Engineer: M. Birgani
Test Location: Chamber #7

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

General Test Configuration

The EUT was located on a wooden table inside the semi-anechoic chamber, 40 cm from a vertical coupling plane and 80cm from the LISN. 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 were routed through metal conduit and passed through a ferrite clamp upon exiting the chamber.

Ambient Conditions:

Temperature: 18-20 °C
Rel. Humidity: 35-40 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, AC Power,120V/60Hz	FCC 15.207	PASS	42.8dBµV @ 0.56MHz (-13.2 dB)

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

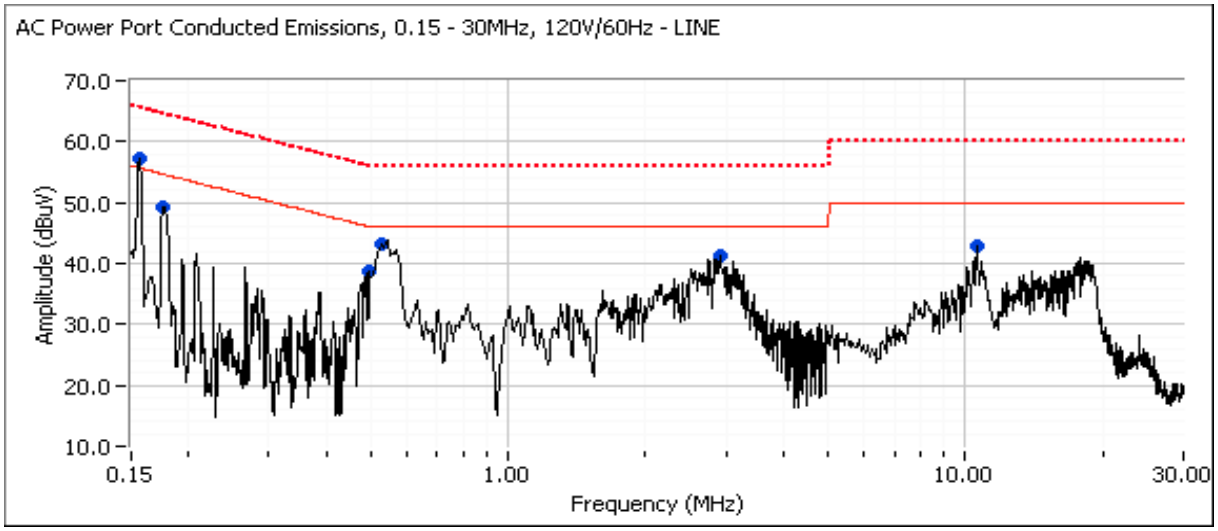
No deviations were made from the requirements of the standard.

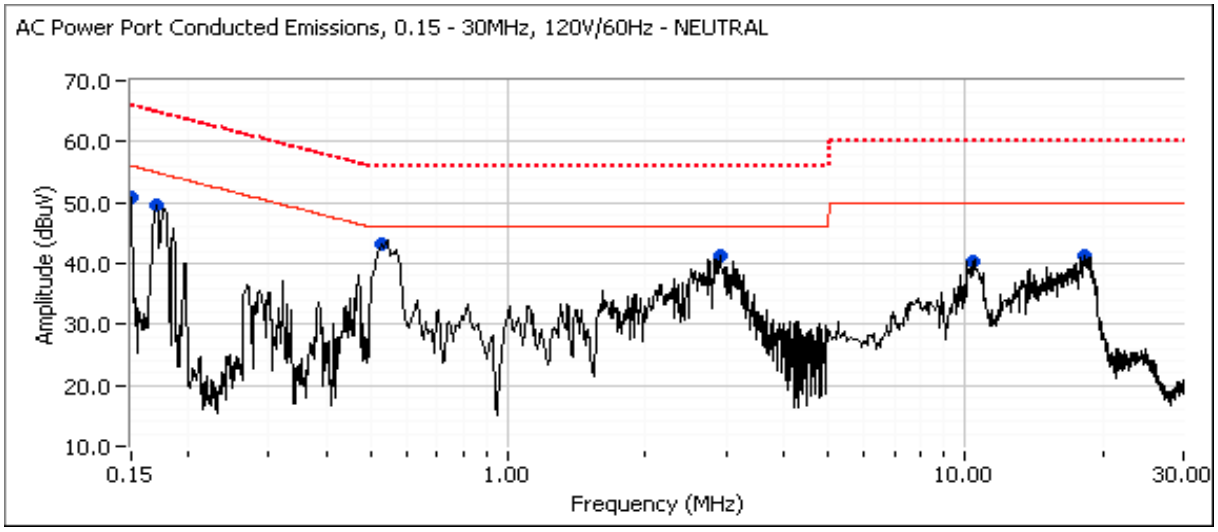
Note

Radio configured for continuous transmit on center channel (2450MHz) at maximum power

Client:	Pace Americas Inc.	Job Number:	JD100016
Model:	C61-700 (RF4CE STB)	T-Log Number:	T100054
		Project Manager:	Irene Rademacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.B / 15.247	Class:	B

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





Client:	Pace Americas Inc.	Job Number:	JD100016
Model:	C61-700 (RF4CE STB)	T-Log Number:	T100054
		Project Manager:	Irene Rademacher
Contact:	Mark Rieger	Project Coordinator:	-
Standard:	FCC 15.B / 15.247	Class:	B

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

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

Frequency	Level	AC	15.207		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
0.158	57.3	Line	55.7	1.6	Peak	
0.557	43.3	Neutral	46.0	-2.7	Peak	
0.547	43.3	Line	46.0	-2.7	Peak	
2.810	41.6	Neutral	46.0	-4.4	Peak	
2.912	41.2	Line	46.0	-4.8	Peak	
0.151	50.8	Neutral	56.0	-5.2	Peak	
0.170	49.6	Neutral	54.9	-5.3	Peak	
0.175	49.3	Line	54.6	-5.3	Peak	
10.724	42.8	Line	50.0	-7.2	Peak	
0.493	38.7	Line	46.1	-7.4	Peak	
18.187	41.2	Neutral	50.0	-8.8	Peak	
10.386	40.3	Neutral	50.0	-9.7	Peak	

Final quasi-peak and average readings

Frequency	Level	AC	15.207		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
0.557	42.8	Neutral	56.0	-13.2	QP	QP (1.00s)
0.547	42.2	Line	56.0	-13.8	QP	QP (1.00s)
0.557	31.7	Neutral	46.0	-14.3	AVG	AVG (0.10s)
0.150	50.9	Neutral	66.0	-15.1	QP	QP (1.00s)
0.175	48.9	Line	64.7	-15.8	QP	QP (1.00s)
0.158	48.7	Line	65.6	-16.9	QP	QP (1.00s)
0.547	28.8	Line	46.0	-17.2	AVG	AVG (0.10s)
0.169	47.6	Neutral	65.0	-17.4	QP	QP (1.00s)
2.912	38.0	Line	56.0	-18.0	QP	QP (1.00s)
2.912	26.2	Line	46.0	-19.8	AVG	AVG (0.10s)
2.810	35.5	Neutral	56.0	-20.5	QP	QP (1.00s)
10.724	28.3	Line	50.0	-21.7	AVG	AVG (0.10s)
2.810	22.8	Neutral	46.0	-23.2	AVG	AVG (0.10s)
18.187	26.4	Neutral	50.0	-23.6	AVG	AVG (0.10s)
10.724	36.1	Line	60.0	-23.9	QP	QP (1.00s)
18.187	36.1	Neutral	60.0	-23.9	QP	QP (1.00s)
0.175	30.0	Line	54.7	-24.7	AVG	AVG (0.10s)
0.169	26.3	Neutral	55.0	-28.7	AVG	AVG (0.10s)
0.150	23.2	Neutral	56.0	-32.8	AVG	AVG (0.10s)
0.158	19.9	Line	55.6	-35.7	AVG	AVG (0.10s)

End of Report

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