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Report On

Application for Grant of Equipment Authorization of the
CalAmp Wireless Networks Corp.
LMU5530 and Vanguard Cellular Broadband Routers

FCC Part 15 Subpart C §15.247
IC RSS-210 Issue 8 December 2010

Report No. SC1409448CD November 2014

REPORT ON	Radio Testing of the CalAmp Wireless Networks Corp. Cellular Broadband Routers
TEST REPORT NUMBER	SC1409448CD
PREPARED FOR	CalAmp Wireless Networks Corp. 1401 N Rice Ave. Oxnard, CA 93030
CONTACT PERSON	Imad Rizk Carrier & Product Certifications Manager (805) 987-9000 IRizk@CalAmp.com
PREPARED BY	Ferdinand S. Custodio **Name** Authorized Signatory Title: EMC/Wireless Test Engineer
APPROVED BY	Chip R. Fleury **Name** Authorized Signatory
DATED	October 13, 2014

TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

Revision History

SC1409448CD CalAmp Wireless Networks Corp. LMU5530 and Vanguard Cellular Broadband Routers					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
10/13/2014	Initial Release				Chip R. Fleury

CONTENTS

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SECTION 1

REPORT SUMMARY

Radio Testing of the
CalAmp Wireless Networks Corp.
Cellular Broadband Routers

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the CalAmp Wireless Networks Corp. LMU5530 and Vanguard Cellular Broadband Routers to the requirements of FCC Part 15 Subpart C §15.247 and IC RSS-210 Issue 8 December 2010.

Objective	To perform Radio Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	CalAmp Wireless Networks Corp.
Model Number(s)	VG3000, VG5530, LMU5530H and LMU5530L
FCC ID Number	APV-55BTW
IC Number	5843C-55BTW
Serial Number(s)	00013 and 00005
Number of Samples Tested	2
Test Specification/Issue/Date	• FCC Part 15 Subpart C §15.247 (October 1, 2013). • RSS-210 - Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment (Issue 8, December 2010). • RSS-Gen - General Requirements for Compliance of Radio Apparatus (Issue 4, November 2014). • 558074 D01 DTS Meas Guidance v03r01, (April 09, 2013) Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247. • KDB 412172 D01 Determining ERP and EIRP v01. Guidelines for Determining the Effective Radiated Power (ERP) and Equivalent Isotropically Radiated Power (EIRP) of a RF Transmitting System.
Start of Test	September 29, 2014
Finish of Test	October 07, 2014
Name of Engineer(s)	Ferdinand Custodio

Related Document(s)	• Supporting documents for EUT certification are separate exhibits. • Report Number: 13U14995-4 Revision B Certification Test Report for 2x2 802.11 a/b/g/n + BT Module (SiP) Model Number: QCA6234. Issued by UL Verification Services Inc. 47173 Benicia Street, Fremont, CA 94538, USA. • Report Number: 13U14995-1 Certification Test Report for 2x2 802.11 a/b/g/n + BT Module (SiP) Model Number: QCA6234. Issued by UL Verification Services Inc. 47173 Benicia Street, Fremont, CA 94538, USA.

1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC Part 15 Subpart C §15.247 with cross-reference to the corresponding IC RSS standard is shown below.

Section	§15.247 Spec Clause	RSS	Test Description	Result	Comments/ Base Standard
2.1	§15.247(b)(3)	RSS-210 A8.4 (4)	Peak Output Power	Compliant	
2.2	§15.207(a)	RSS-Gen 8.8	Conducted Emissions	N/A[1]	
2.3		RSS-Gen 6.6	99% Emission Bandwidth	N/A[2]	
2.4	§15.247(a)(2)	RSS-210 A8.2(a)	Minimum 6 dB RF Bandwidth	N/A[2]	
2.5	§15.247(d)	RSS-210 A8.5	Out-of-Band Emissions - Conducted	N/A[2]	
2.6	§15.247(d)	RSS-210 A8.5	Band-edge Compliance of RF Conducted Emissions	N/A[2]	
2.7	§15.247(d)	RSS-210 A8.5	Spurious Radiated Emissions	Compliant	
2.8	§15.247(d)	RSS-210 A8.5	Radiated Immediate Restricted bands	Compliant	
2.9	§15.247(e)	RSS-210 A8.2(b)	Power Spectral Density for Digitally Modulated Device	N/A[2]	
2.10		RSS-Gen 7.1	Receiver Spurious Emissions	Compliant	

N/A[1] Not applicable. EUT is battery operated only and designed for vehicular use.

N/A[2] Not performed. Bluetooth antenna conducted antenna port test results from Report Number: 13U14995-4 Revision B and 13U14995-1 Certification Test Report for 2x2 802.11 a/b/g/n + BT Module (SiP) Model Number: QCA6234 issued by UL Verification Services Inc. 47173 Benicia Street, Fremont, CA 94538, USA applies.

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) were CalAmp Wireless Networks Corp. LMU5530 and Vanguard Cellular Broadband Routers as shown in the subsequent table and photographs below. The EUT is a ready-to-deploy broadband router which enables wireless data connectivity using LAN and serial device over public cellular networks. The EUT incorporates a 16-channel GPS receiver, Bluetooth connectivity and a Wi-Fi access point that allows tethered devices to remain connected even when the user leave the vehicle. All models verified in this test report share the same board and architecture. The only difference between each model is the cellular modem and enclosure used. This test report covers verification of the WLAN (802.11g)/Bluetooth LE module common to all model variants.

EUT Photos	Model	FCC ID/IC number of the approved cellular modem used
	Vanguard 3000 (HSPA/GPRS)	FCC ID: QIPPXS8 IC: 7830A-PXS8 Using Cinterion PXS8
	Vanguard 5530 (LTE)	FCC ID: QIPALS3-US IC: 7830A-ALS3US Using Cinterion ALS3-US
	LMU5530H (HSPA)	FCC ID: XPYLISAU200 IC: 8595A-LISAU200 Using UBlox LISA U200
	LMU5530L (LTE)	FCC ID: QIPALS3-US IC: 7830A-ALS3US Using Cinterion ALS3-US
	LMU5530L/LMU5530H with WLAN/BT Integral Antenna	Can use both Cinterion ALS3-US and UBlox LISA U200

Equipment Under Test (Vanguard)

Equipment Under Test (LMU5530)

1.3.2 EUT General Description

EUT Description	Cellular Broadband Routers
Model Name	LMU5530 and Vanguard
Model Number(s)	VG3000, VG5530, LMU5530H and LMU5530L
Rated Voltage	7-32VDC Vehicle Systems with internal 3.7VDC Li-Ion Rechargeable pack battery 1000 mAh, 3.7Wh (Manu. Code BK643048A)
Mode Verified	Bluetooth Classic
Capability	UMTS/HSPA, EDGE/GPRS, EVDO Rev A, 1xEVDO Rev 0, 1xRTT and Bluetooth 4.0 Dual Mode
Primary Unit (EUT)	☐ Production
	☒ Pre-Production
	☐ Engineering
Antenna Type (External)	Miniature Magnetic Mount Antenna (PCTEL M/N BMMG24005ML195)
Antenna Gain	5 dBi
Antenna Type (Integral)	Embedded Bluetooth Antenna (Savvi™ Part No. M830310)
Antenna Gain	1.39 dBi

1.3.3 Maximum Peak Output Power (EIRP)

Mode	Frequency Range (MHz)	Output Power (dBm)	Output Power (mW)
802.11g	2412-2462	14.37	27.35
Bluetooth LE	2402-2480	-10.33	0.0927

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
Default	Radiated emissions test configuration. The EUT is transmitting through the external antenna or the integral antenna (model specific). EUT is placed on test mode using BtUART.exe and SSH Secure Shell (TM) Version 3.2.9 (Build 283) as applicable. For Bluetooth once in test mode, the EUT is connected to CMW500 for full test functionality. The firmware defaults the power setting to max setting and can't be modified during testing.

1.4.2 EUT Exercise Software

None. No special software was used to exercise the EUT. The EUT however was placed on a test mode using BtUART.exe and SSH Secure Shell (TM) Version 3.2.9 (Build 283) permitting connection with a call box (CMW500). The EUT Bluetooth functionality was configured using the CMW500. For 802.11g test, test commands are programmed using SSH Secure Shell only.

1.4.3 Support Equipment and I/O cables

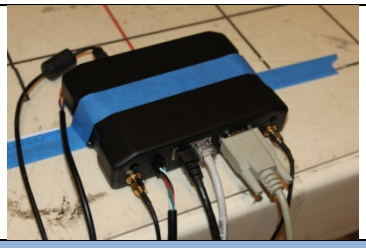
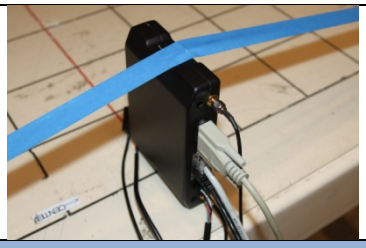
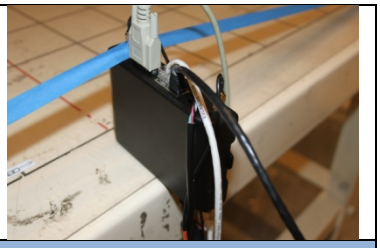
Manufacturer	Equipment/Cable	Description
Protek	Laboratory DC Power Supply	M/N 35010M S/N D102007S
Sony	Support Laptop	Model: PCG-31311L S/N:27545537 3001106
Rhode & Schwarz	Wideband Radio Communication Tester	M/N CMW 500 S/N 1201.0002k50/103829
Evercom Communication Technology Co. LTD	GPS/GSM Antenna	Model: GPM-11 2dBi 900/1800/1575.42 3meters (2X) coax cable with SMA connector
Black Box Corporation	Ethernet Cable (EUT LAN 2)	CAT 5E, 2 meters, unshielded crossover patch cable
Unicom	Ethernet Cable (EUT LAN 1)	CAT 5E, 1.5 meters, unshielded patch cable
Lin Shiung	USB cable (EUT)	1.5 meters, shielded, USB-Mini5B to USB-A
Herwell	Serial Cable (EUT 5-Pin)	1.0 meter, unshielded, 5-Pin Molex to DB-9 RS232 (switch power TTL levels)
-	Serial Cable (EUT DB-9 RS232)	3.0 meters, generic serial cable DB-9 female to male
Herwell	Power Cable (EUT 4-Pin)	2.2 meters, 4-pin Molex for power, ignition and I/O.

1.4.4 Worst Case Configuration

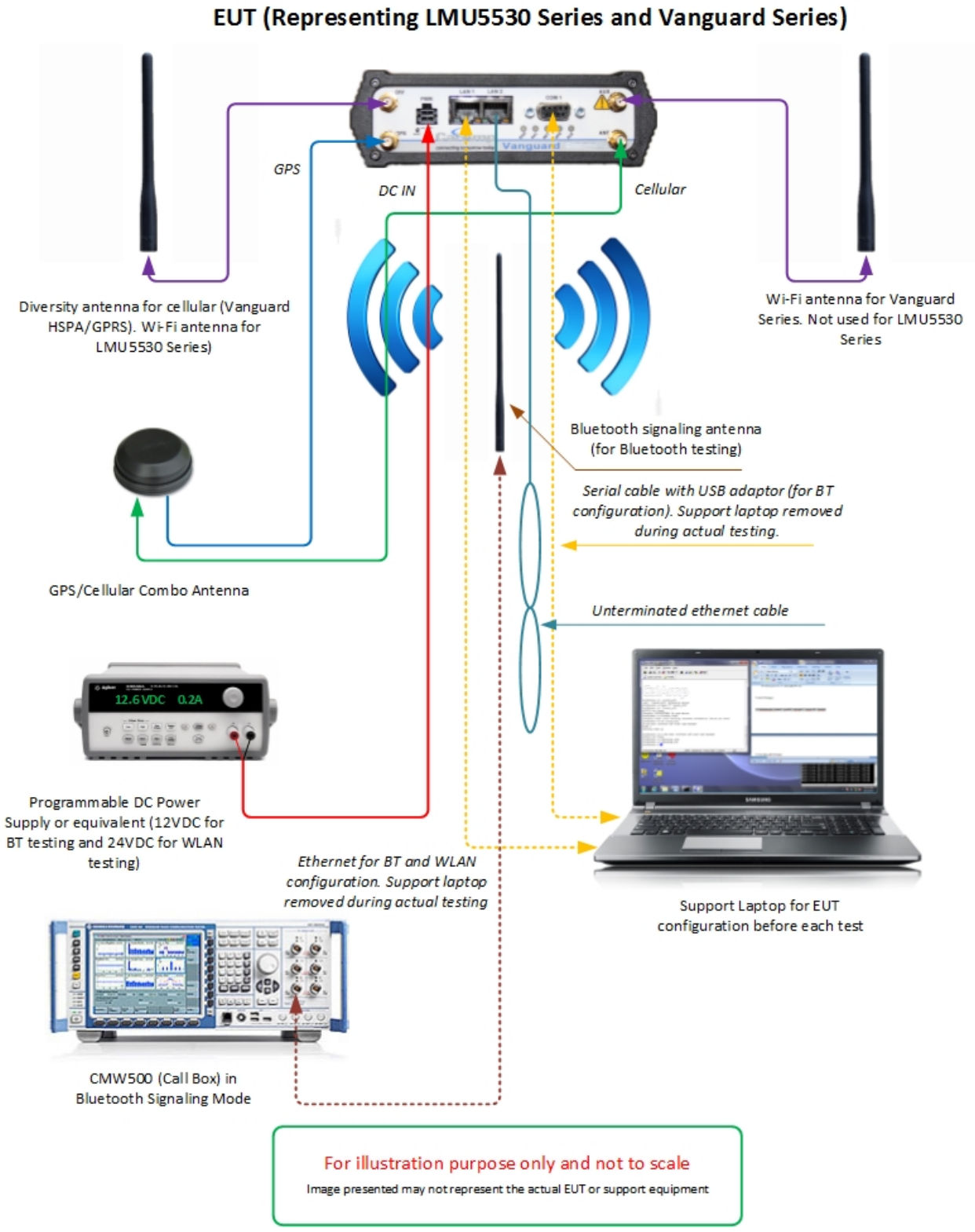
Worst-case configuration used in this test report as per maximum peak EIRP output power measurements:

Mode	Channel	Frequency
802.11g	1	2412 MHz
Bluetooth LE	37	2402 MHz

EUT is a mobile device. For radiated measurements X, Y and Z orientations were verified. Worst case position are "X" and "Z". Verification performed using "X" configuration.

		
"X" Configuration	***"Y" Configuration***	***"Z" Configuration***

1.4.5 Simplified Test Configuration Diagram



1.5 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standards or test plan were made during testing.

1.6 MODIFICATION RECORD

Description of Modification	Modification Fitted By	Date Modification Fitted
Serial Number 00013 and 00005		
N/A		

The table above details modifications made to the EUT during the test programme. The modifications incorporated during each test (if relevant) are recorded on the appropriate test pages.

1.7 TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.4-2009, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.
For conducted and radiated emissions the equipment under test (EUT) was configured to measure its highest possible emission level. This level was based on the maximized cable configuration from exploratory testing per ANSI C63.4-2009. The test modes were adapted according to the Operating Instructions provided by the manufacturer/client.

1.8 TEST FACILITY LOCATION

1.8.1 TÜV SÜD America Inc. (Mira Mesa)

10040 Mesa Rim Road, San Diego, CA 92121-2912 (32.901268,-117.177681). Phone: 858 678 1400 FAX: 858-546 0364

1.8.2 TÜV SÜD America Inc. (Rancho Bernardo)

Sony Electronics Inc., Building #8 16530 Via Esprillo, San Diego, CA 92127-1708 (33.018644,-117.092409). Phone: 858 942 5542 FAX: 858-546 0364

1.9 TEST FACILITY REGISTRATION

1.9.1 FCC – Registration No.: US1146

TUV SUD America Inc. (San Diego), is an accredited test facility with the site description report on file and has met all the requirements specified in §2.948 of the FCC rules. The acceptance letter from the FCC is maintained in our files and the Registration is US1146.

1.9.2 Industry Canada (IC) Registration No.: 3067A

The 10m Semi-anechoic chamber of TUV SUD America Inc. (San Diego) has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No. 3067A.

SECTION 2

TEST DETAILS

Radio Testing of the
CalAmp Wireless Networks Corp.
Cellular Broadband Routers

2.1 PEAK OUTPUT POWER

2.1.1 Specification Reference

Part 15 Subpart C §15.247(b)(3)

2.1.2 Standard Applicable

(3) For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

2.1.3 Equipment Under Test and Modification State

Serial No: 00013 and 00005 / Default Test Configuration

2.1.4 Date of Test/Initial of test personnel who performed the test

September 30, 2014 and October 07, 2014/FSC

2.1.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.6 Environmental Conditions

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	24.7°C
Relative Humidity	29.1%
ATM Pressure	98.8 kPa

2.1.7 Additional Observations

- This is a radiated test. The spectrum was searched from 2390MHz to 2500MHz to cover immediate restricted bands (masked by the notch filter during Radiated Spurious Emissions test), upper band edges and the fundamental frequency.
- All packet types' verified, only worst case presented.
- Fundamental measurements were used to calculate EIRP using Field Strength Approach – linear terms (Section 1.3.1 of KDB 412172 D01 Determining ERP and EIRP v01):

$$eirp = \frac{(\mathrm{E\ x\ d})^2}{30}$$

Where: E = electric field strength in V/m
d = measurement distance in meters.

- Field strength in dBµV/m was converted to V/m using the following formula::

$$V/m = 10^{\left(\frac{\left(db\mu\frac{V}{m}\right)-120}{20}\right)}$$

Computation Example:

$$V/m = 10^{\left(\frac{\left(84.9db\mu\frac{V}{m}\right)-120}{20}\right)}$$

$$V/m = 0.01757923$$

$$eirp = \frac{(0.01757923 \text{ x } 3)^2}{30}$$

$$eirp = \frac{(0.0527377)^2}{30}$$

$$eirp = 0.0000927 \text{ watt}$$

$$eirp\ (dBm) = 10\log(0.0000927) + 30$$

$$eirp\ (dBm) = -10.330$$

- Measurement was done using EMC32 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column on plots starting at Section 2.1.11 is for informational purposes only. See Section 2.1.8 for sample computation.

2.1.8 Sample Computation (Radiated Emission)

Measuring equipment raw measurement (dbµV) @ 2400 MHz			53.9
Correction Factor (dB)	Asset# 1153 (cable)	3.4	-0.4
	Asset# 8628(preamplifier)	-36.5	
	Asset#7575 (antenna)	32.7	
Reported Max Peak Final Measurement (dbµV/m) @ 2400 MHz			**53.5**

2.1.9 Test Results Bluetooth LE (EIRP Limit)

Models with external antenna						
Modulation	**Channel**	**Frequency (MHz)**	**Measured Field Strength (dBµV/m @ 3 meters)**	**Calculated Peak Output Power (dBm)**	**Calculated Peak Output Power (mW)**	**Limit (mW)**
GFSK @ 1Mbps	37	2402	84.9	-10.33	0.0927	1000.0
	17	2440	82.0	-13.23	0.0475	1000.0
	39	2480	84.5	-10.73	0.0845	1000.0

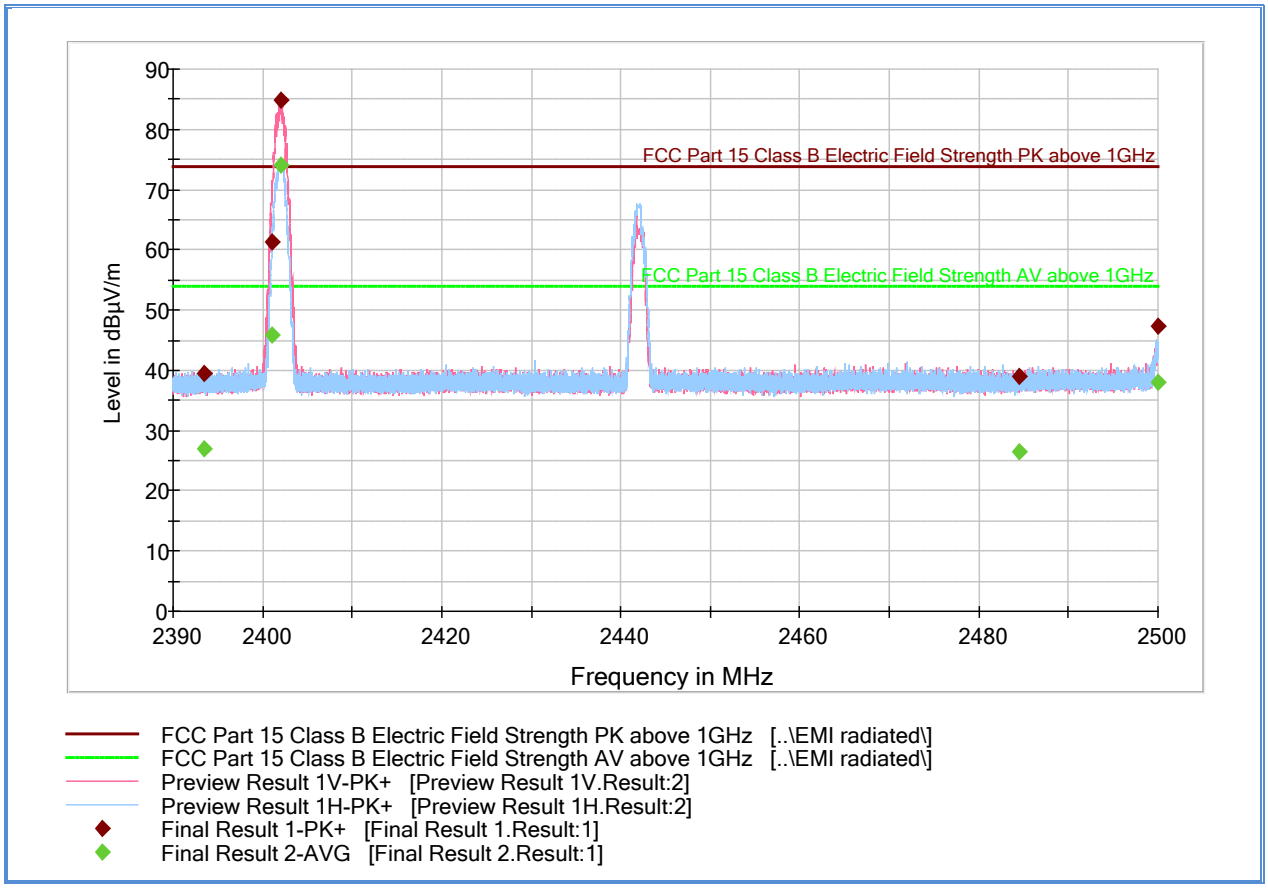
Models with internal antenna						
Modulation	**Channel**	**Frequency (MHz)**	**Measured Field Strength (dBµV/m @ 3 meters)**	**Calculated Peak Output Power (dBm)**	**Calculated Peak Output Power (mW)**	**Limit (mW)**
GFSK @ 1Mbps	37	2402	83.0	-12.23	0.060	1000.0
	17	2440	79.5	-15.73	0.027	1000.0
	39	2480	84.3	-10.93	0.081	1000.0

2.1.10 Test Results WLAN (EIRP Limit)

Models with internal antenna						
Mode	**Channel**	**Frequency (MHz)**	**Measured Field Strength (dBµV/m @ 3 meters)**	**Calculated Peak Output Power (dBm)**	**Calculated Peak Output Power (mW)**	**Limit (mW)**
802.11g (2.4GHz)	1	2412	75.3	-7.63	0.173	1000.0
	6	2437	82.6	-0.33	0.927	1000.0
	11	2462	79.4	-3.53	0.444	1000.0
Models with external antenna						
Mode	**Channel**	**Frequency (MHz)**	**Measured Field Strength (dBµV/m @ 3 meters)**	**Calculated Peak Output Power (dBm)**	**Calculated Peak Output Power (mW)**	**Limit (mW)**
802.11g (2.4GHz)	1	2412	97.3	14.37	27.35	1000.0
	6	2437	92.1	9.17	8.260	1000.0
	11	2462	96.5	13.57	22.75	1000.0

Additional Notes: For WLAN fundamental measurements, an additional bandwidth correction factor of 12.3dB is added to the calculated Peak Output Power. This is from 10log (17MHz/1MHz) where 17MHz is the required measurement bandwidth based from the signal occupied bandwidth and 1MHz is the actual measurement bandwidth.

2.1.11 Test Results Worst Case Configuration BT Low Channel with External antenna



Peak Data

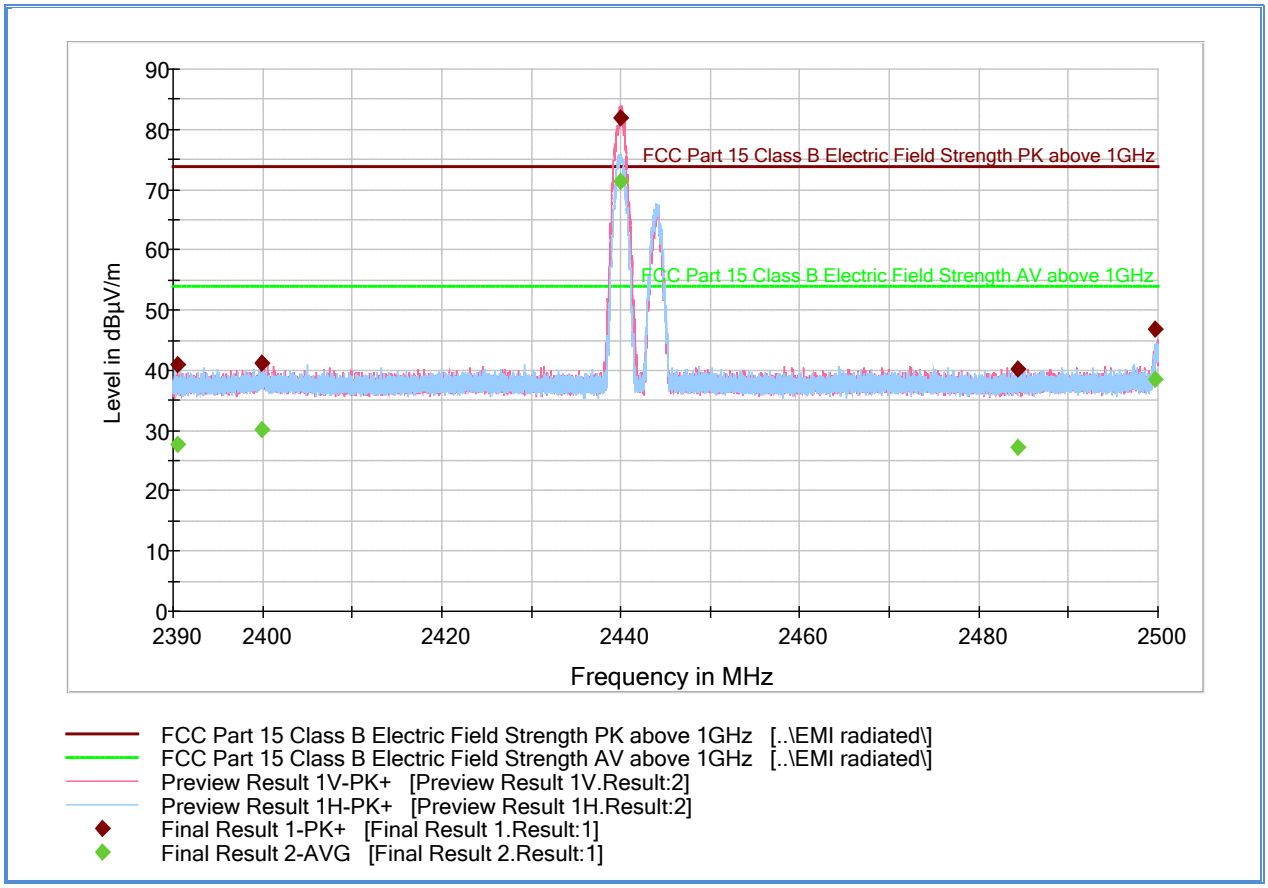
Frequency (MHz)	Max Peak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2393.386333	39.5	1000.0	1000.000	186.5	V	144.0	-0.2	34.4	73.9
2400.984333	61.2	1000.0	1000.000	155.6	H	296.0	-0.2	12.7	73.9
2402.083333	84.9	1000.0	1000.000	99.7	V	222.0	-0.2	Fundamental	
2484.540333	38.9	1000.0	1000.000	344.1	V	130.0	0.2	35.0	73.9
2500.000000	47.4	1000.0	1000.000	100.7	V	214.0	0.2	26.5	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2393.386333	26.9	1000.0	1000.000	186.5	V	144.0	-0.2	27.0	53.9
2400.984333	45.8	1000.0	1000.000	155.6	H	296.0	-0.2	8.1	53.9
2402.083333	74.0	1000.0	1000.000	99.7	V	222.0	-0.2	Fundamental	
2484.540333	26.4	1000.0	1000.000	344.1	V	130.0	0.2	27.5	53.9
2500.000000	37.9	1000.0	1000.000	100.7	V	214.0	0.2	16.0	53.9

Test Notes: Downlink from the call box is ignored.

2.1.12 Test Results Worst Case Configuration BT Mid Channel with External antenna



Peak Data

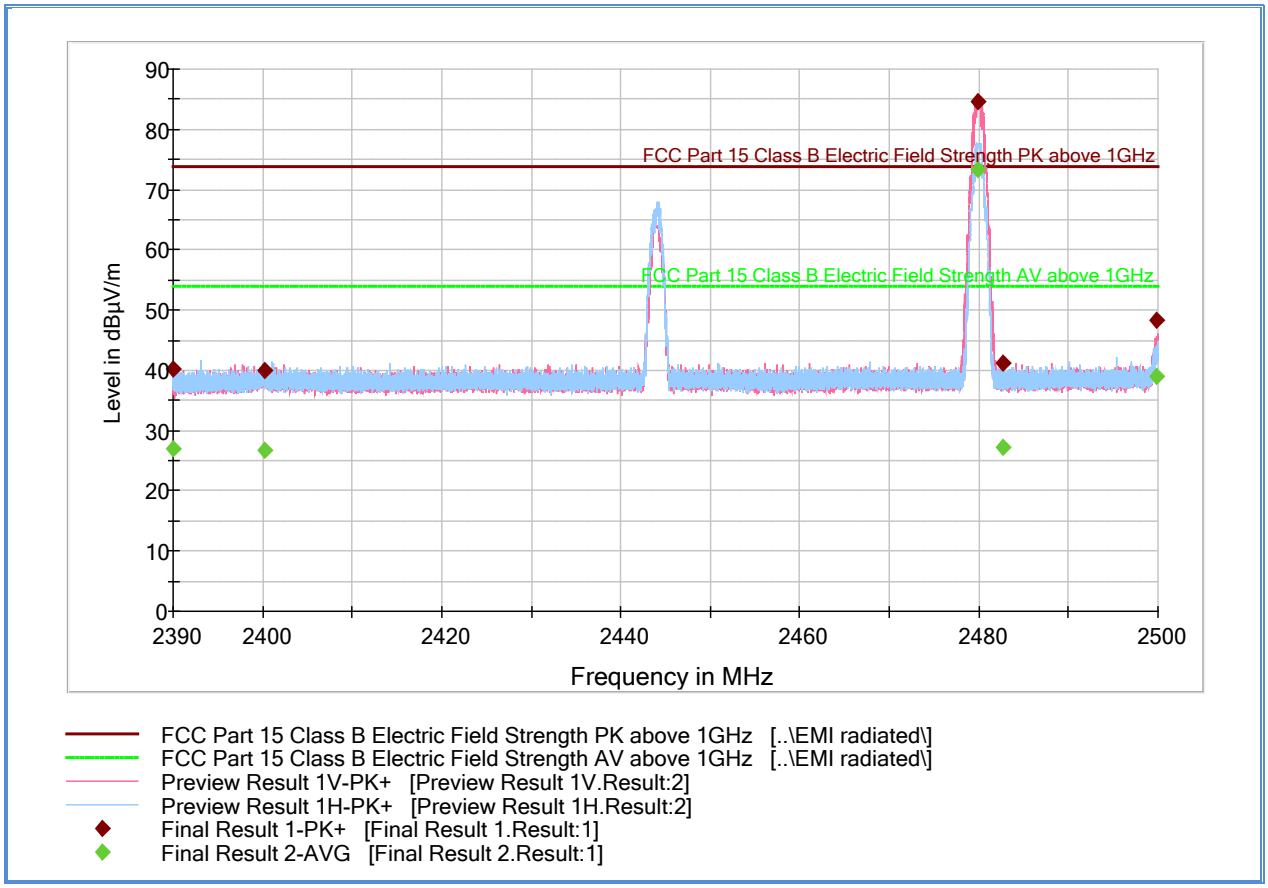
Frequency (MHz)	Max Peak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2390.500000	41.0	1000.0	1000.000	151.6	H	89.0	-0.2	32.9	73.9
2399.850333	41.3	1000.0	1000.000	186.5	V	310.0	-0.2	32.6	73.9
2439.897667	82.0	1000.0	1000.000	99.7	V	229.0	0.0	Fundamental	
2484.344000	40.2	1000.0	1000.000	219.4	H	331.0	0.2	33.7	73.9
2499.737667	46.9	1000.0	1000.000	103.7	V	199.0	0.2	27.0	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2390.500000	27.8	1000.0	1000.000	151.6	H	89.0	-0.2	26.1	53.9
2399.850333	30.3	1000.0	1000.000	186.5	V	310.0	-0.2	23.6	53.9
2439.897667	71.3	1000.0	1000.000	99.7	V	229.0	0.0	Fundamental	
2484.344000	27.3	1000.0	1000.000	219.4	H	331.0	0.2	26.6	53.9
2499.737667	38.5	1000.0	1000.000	103.7	V	199.0	0.2	15.4	53.9

Test Notes: Downlink from the call box is ignored.

2.1.13 Test Results Worst Case Configuration BT High Channel with External antenna



Peak Data

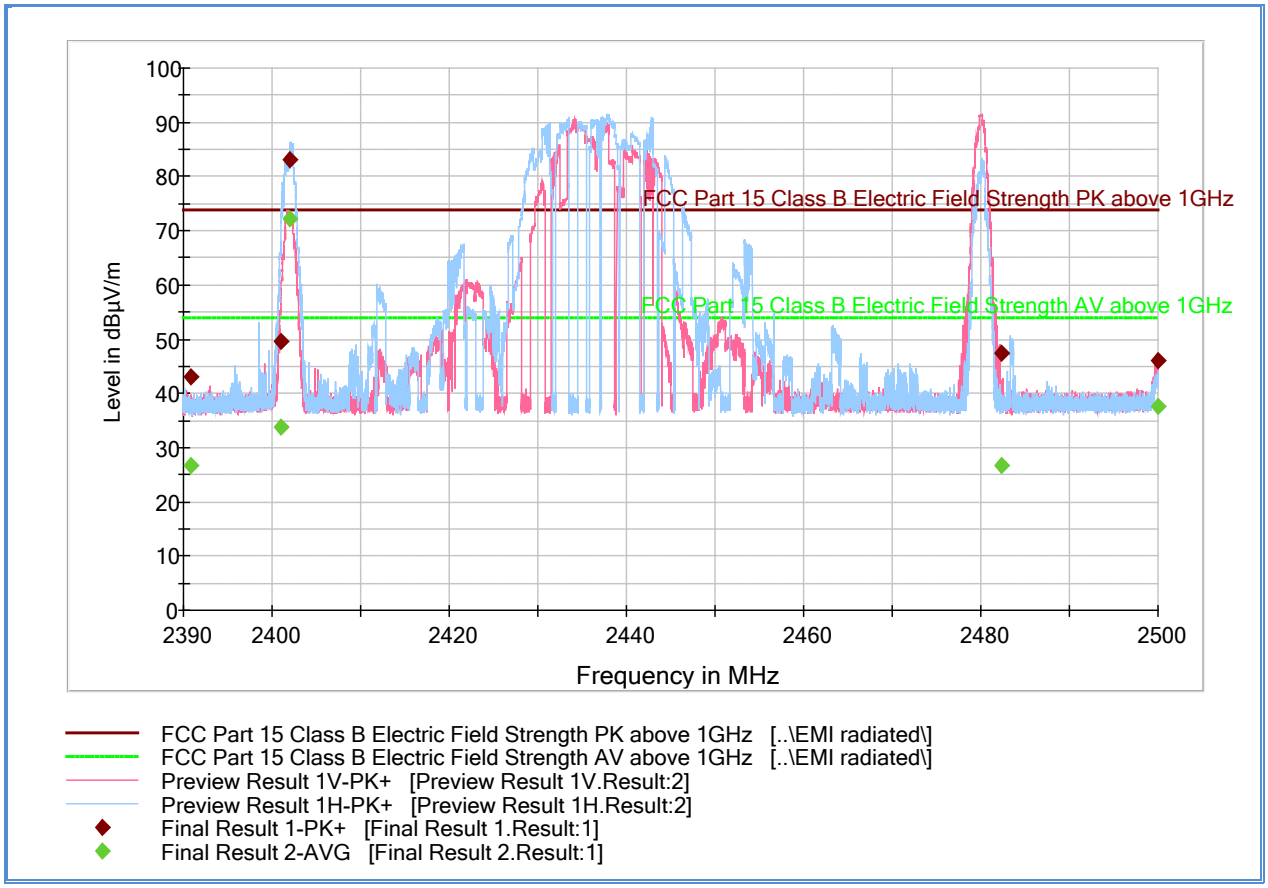
Frequency (MHz)	Max Peak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2390.000000	40.1	1000.0	1000.000	124.7	V	90.0	-0.2	33.8	73.9
2400.221000	40.0	1000.0	1000.000	209.4	H	293.0	-0.2	33.9	73.9
2479.809667	84.5	1000.0	1000.000	99.7	V	212.0	0.1	Fundamental	
2482.654000	41.3	1000.0	1000.000	124.7	V	173.0	0.1	32.6	73.9
2499.900000	48.4	1000.0	1000.000	103.7	V	213.0	0.2	25.5	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2390.000000	26.9	1000.0	1000.000	124.7	V	90.0	-0.2	27.0	53.9
2400.221000	26.7	1000.0	1000.000	209.4	H	293.0	-0.2	27.2	53.9
2479.809667	73.4	1000.0	1000.000	99.7	V	212.0	0.1	Fundamental	
2482.654000	27.2	1000.0	1000.000	124.7	V	173.0	0.1	26.7	53.9
2499.900000	38.9	1000.0	1000.000	103.7	V	213.0	0.2	15.0	53.9

Test Notes: Downlink from the call box is ignored.

2.1.14 Test Results Worst Case Configuration BT Low Channel with Integral antenna



Peak Data

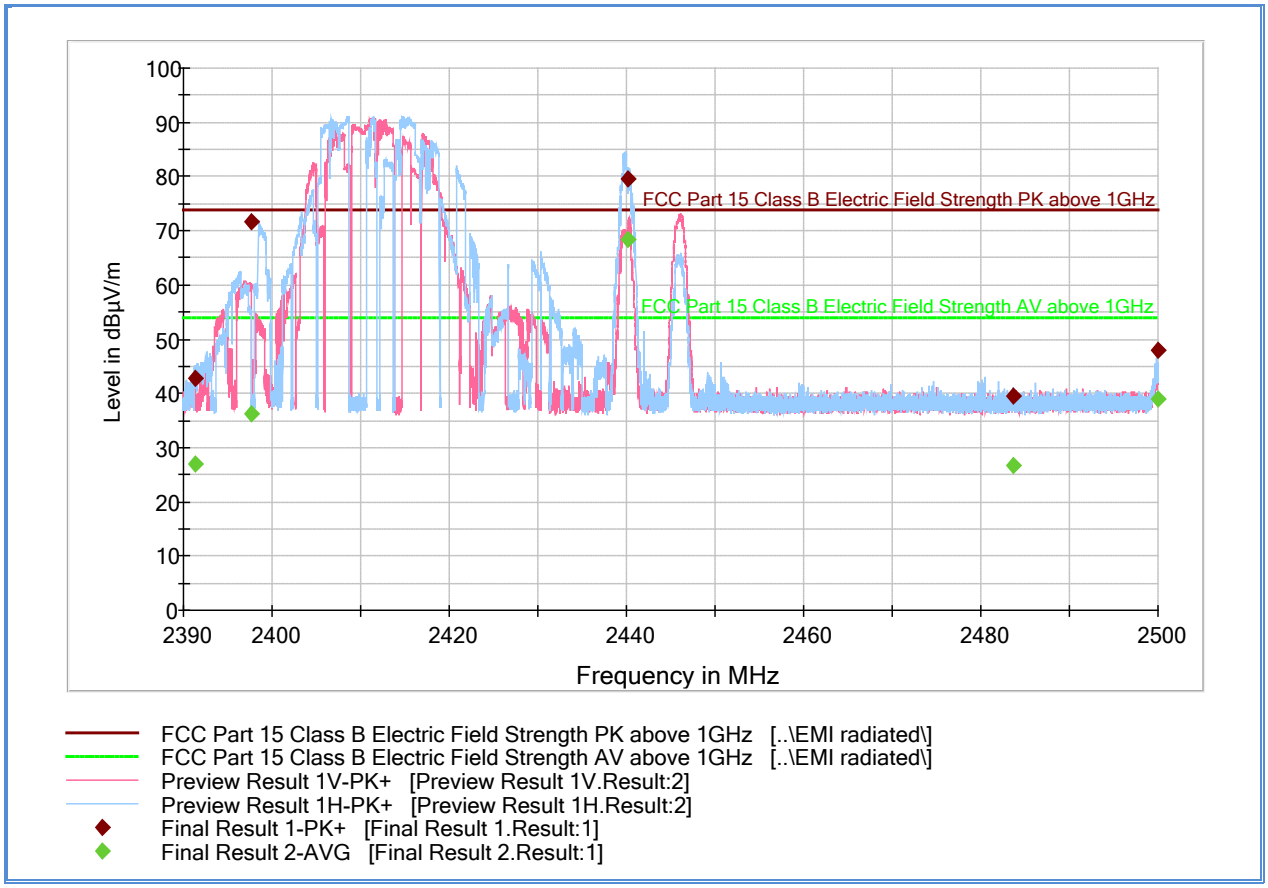
Frequency (MHz)	Max Peak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2390.900000	43.1	1000.0	1000.000	299.2	H	16.0	-0.2	30.8	73.9
2400.918333	49.7	1000.0	1000.000	173.6	V	163.0	-0.2	24.2	73.9
2401.991667	83.0	1000.0	1000.000	124.7	H	42.0	-0.2	BT Fundamental	
2482.375333	47.5	1000.0	1000.000	103.7	H	41.0	0.1	26.4	73.9
2500.000000	46.1	1000.0	1000.000	238.4	V	46.0	0.2	27.8	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2390.900000	26.8	1000.0	1000.000	299.2	H	16.0	-0.2	27.1	53.9
2400.918333	33.8	1000.0	1000.000	173.6	V	163.0	-0.2	20.1	53.9
2401.991667	72.3	1000.0	1000.000	124.7	H	42.0	-0.2	BT Fundamental	
2482.375333	26.8	1000.0	1000.000	103.7	H	41.0	0.1	27.1	53.9
2500.000000	37.7	1000.0	1000.000	238.4	V	46.0	0.2	16.2	53.9

Test Notes: Downlink from the call box is ignored. Scan performed with built-in WLAN active to determine worst case band edges measurements.

2.1.15 Test Results Worst Case Configuration BT Mid Channel with Integral antenna



Peak Data

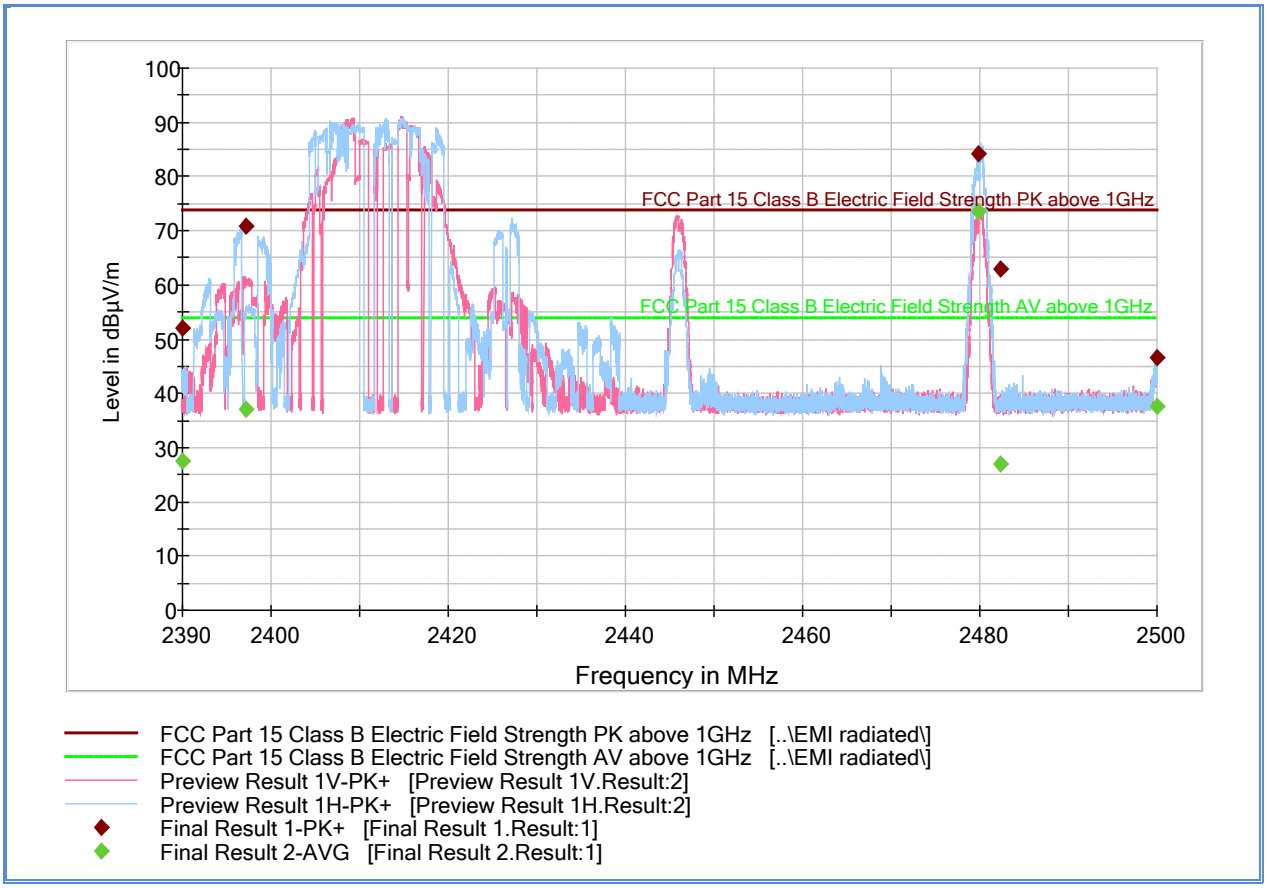
Frequency (MHz)	Max Peak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2391.300000	42.9	1000.0	1000.000	333.1	V	343.0	-0.2	31.0	73.9
2397.712000	71.5	1000.0	1000.000	103.7	H	311.0	-0.2	2.4	73.9
2440.110667	79.5	1000.0	1000.000	123.7	H	40.0	0.0	BT Fundamental	
2483.615667	39.4	1000.0	1000.000	344.1	V	101.0	0.1	34.5	73.9
2500.000000	48.0	1000.0	1000.000	102.7	H	93.0	0.2	25.9	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2391.300000	27.1	1000.0	1000.000	333.1	V	343.0	-0.2	26.8	53.9
2397.712000	36.1	1000.0	1000.000	103.7	H	311.0	-0.2	17.8	53.9
2440.110667	68.3	1000.0	1000.000	123.7	H	40.0	0.0	BT Fundamental	
2483.615667	26.8	1000.0	1000.000	344.1	V	101.0	0.1	27.1	53.9
2500.000000	39.1	1000.0	1000.000	102.7	H	93.0	0.2	14.8	53.9

Test Notes: Downlink from the call box is ignored. Scan performed with built-in WLAN active to determine worst case band edges measurements.

2.1.16 Test Results Worst Case Configuration BT High Channel with Integral antenna



Peak Data

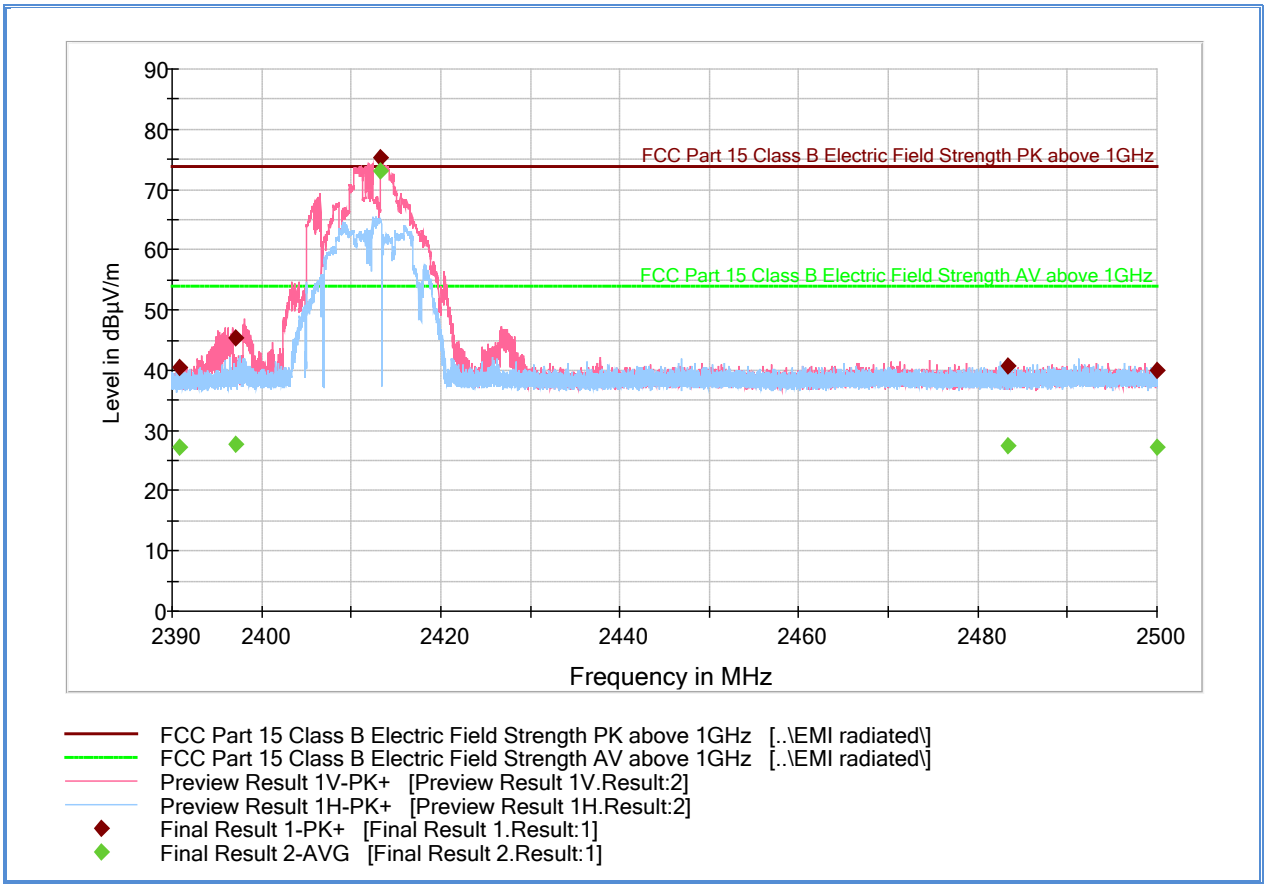
Frequency (MHz)	Max Peak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2390.000000	51.9	1000.0	1000.000	378.1	H	-6.0	-0.2	22.0	73.9
2397.238667	70.9	1000.0	1000.000	130.7	H	17.0	-0.2	3.0	73.9
2479.908333	84.3	1000.0	1000.000	99.7	H	39.0	0.1	BT Fundamental	
2482.397333	63.0	1000.0	1000.000	103.7	H	34.0	0.1	10.9	73.9
2500.000000	46.6	1000.0	1000.000	100.7	H	99.0	0.2	27.3	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2390.000000	27.4	1000.0	1000.000	378.1	H	-6.0	-0.2	26.5	53.9
2397.238667	37.1	1000.0	1000.000	130.7	H	17.0	-0.2	16.8	53.9
2479.908333	73.6	1000.0	1000.000	99.7	H	39.0	0.1	BT Fundamental	
2482.397333	27.0	1000.0	1000.000	103.7	H	34.0	0.1	26.9	53.9
2500.000000	37.7	1000.0	1000.000	100.7	H	99.0	0.2	16.2	53.9

Test Notes: Downlink from the call box is ignored. Scan performed with built-in WLAN active to determine worst case band edges measurements.

2.1.17 Test Results Worst Case Configuration WLAN Low Channel with Integral antenna



Peak Data

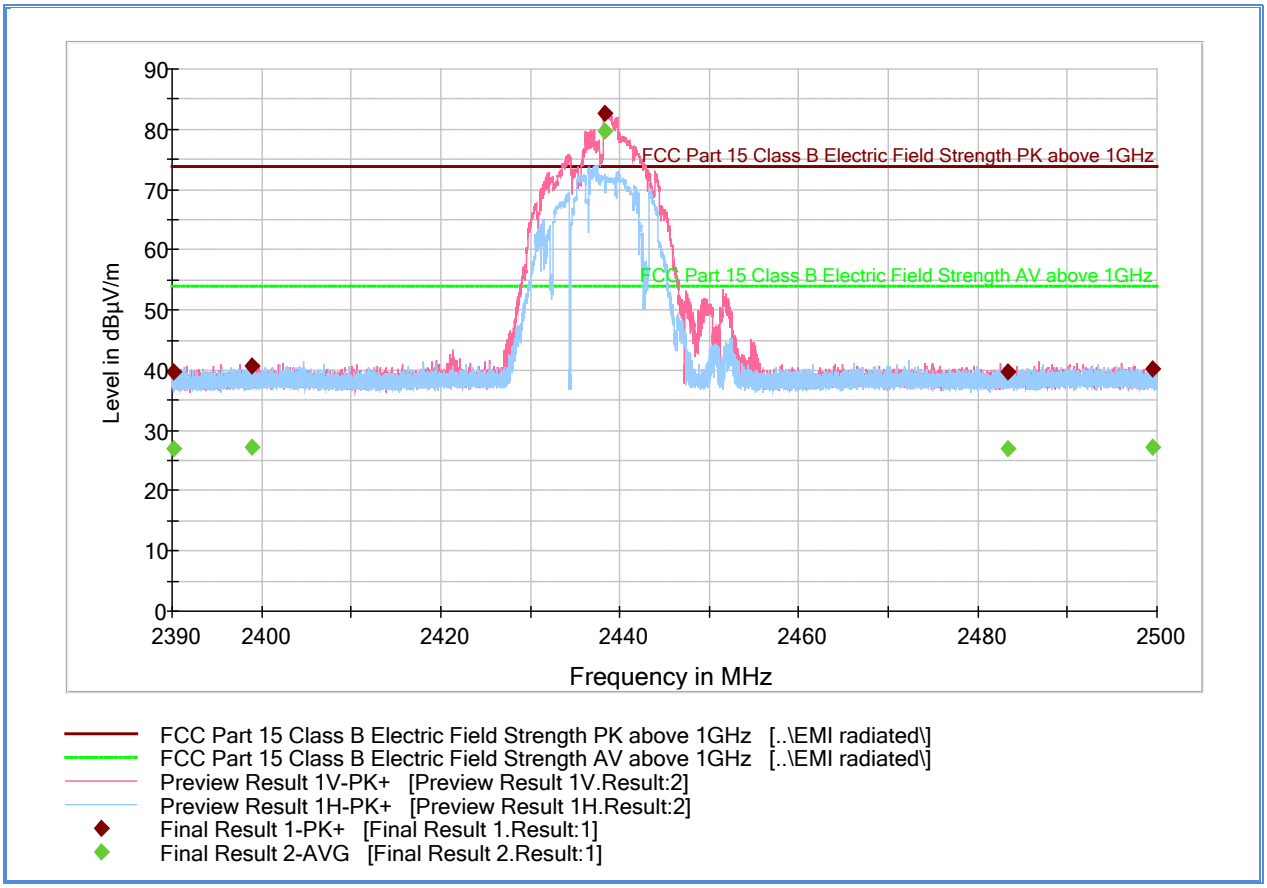
Frequency (MHz)	Max Peak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2390.900000	40.6	1000.0	1000.000	156.6	V	97.0	-0.2	33.3	73.9
2397.023667	45.4	1000.0	1000.000	169.6	V	336.0	-0.2	28.5	73.9
2413.310667	75.3	1000.0	1000.000	103.7	V	180.0	-0.1	-1.4	73.9
2483.336667	40.6	1000.0	1000.000	115.7	H	237.0	0.1	33.3	73.9
2500.000000	39.9	1000.0	1000.000	182.6	V	62.0	0.2	34.0	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2390.900000	27.2	1000.0	1000.000	156.6	V	97.0	-0.2	26.7	53.9
2397.023667	27.7	1000.0	1000.000	169.6	V	336.0	-0.2	26.2	53.9
2413.310667	73.0	1000.0	1000.000	103.7	V	180.0	-0.1	-19.1	53.9
2483.336667	27.5	1000.0	1000.000	115.7	H	237.0	0.1	26.4	53.9
2500.000000	27.3	1000.0	1000.000	182.6	V	62.0	0.2	26.6	53.9

Test Notes:

2.1.18 Test Results Worst Case Configuration WLAN Mid Channel with Integral antenna



Peak Data

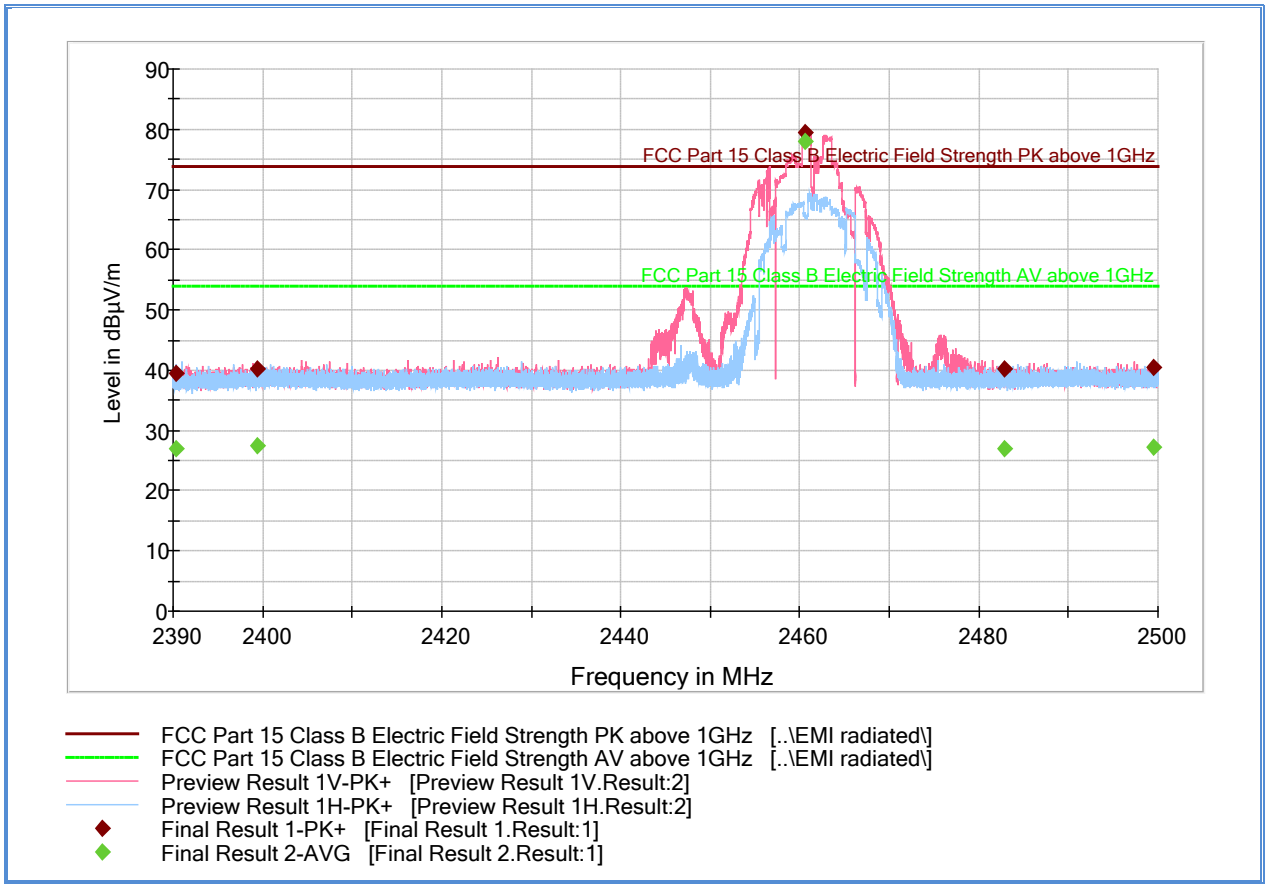
Frequency (MHz)	Max Peak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2390.124667	39.8	1000.0	1000.000	209.4	H	324.0	-0.2	34.1	73.9
2398.984333	40.6	1000.0	1000.000	182.6	V	235.0	-0.2	33.3	73.9
2438.295333	82.6	1000.0	1000.000	191.5	V	182.0	0.0	-8.7	73.9
2483.292667	39.7	1000.0	1000.000	165.6	V	92.0	0.1	34.2	73.9
2499.477333	40.2	1000.0	1000.000	238.4	H	85.0	0.2	33.7	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2390.124667	27.0	1000.0	1000.000	209.4	H	324.0	-0.2	26.9	53.9
2398.984333	27.3	1000.0	1000.000	182.6	V	235.0	-0.2	26.6	53.9
2438.295333	79.8	1000.0	1000.000	191.5	V	182.0	0.0	-25.9	53.9
2483.292667	27.1	1000.0	1000.000	165.6	V	92.0	0.1	26.8	53.9
2499.477333	27.2	1000.0	1000.000	238.4	H	85.0	0.2	26.7	53.9

Test Notes:

2.1.19 Test Results Worst Case Configuration WLAN High Channel with Integral antenna



Peak Data

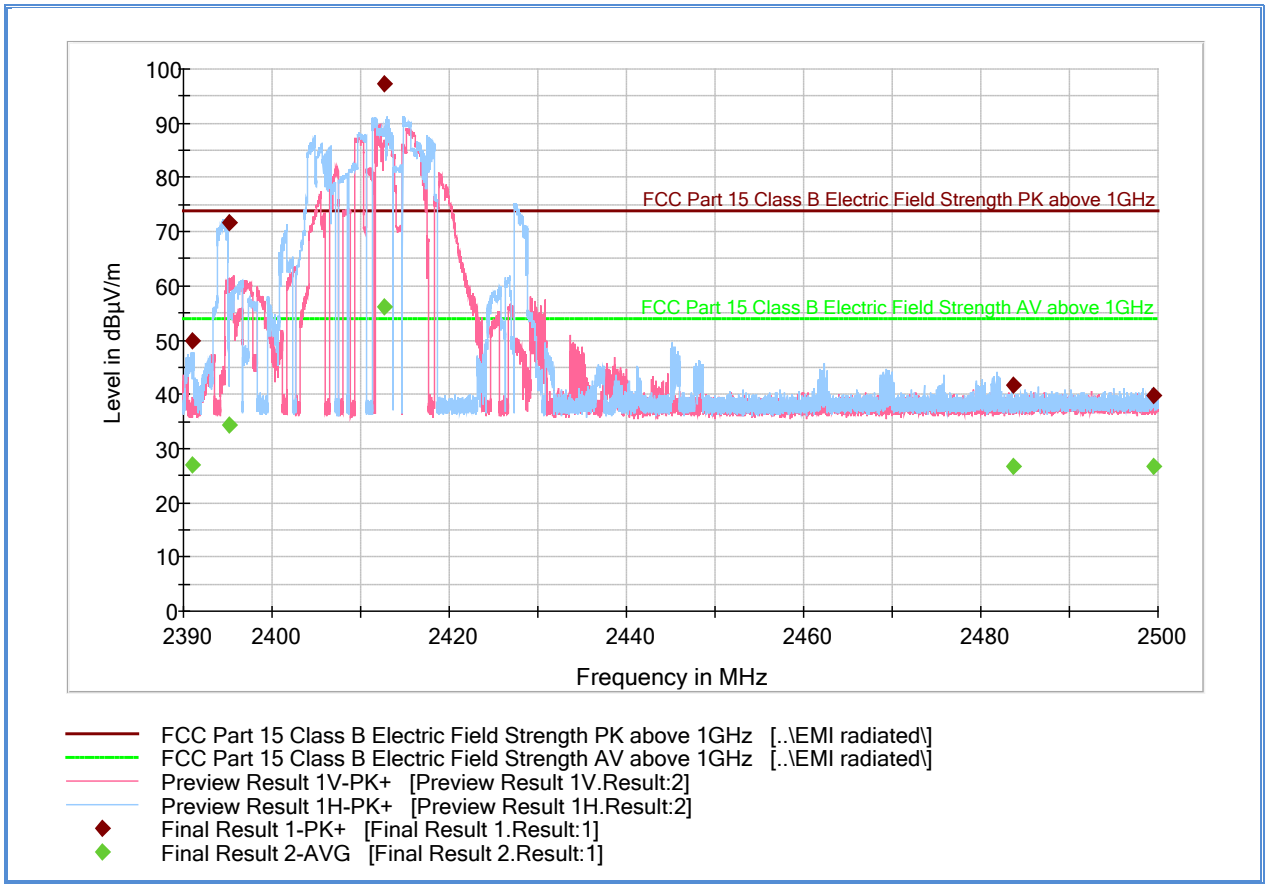
Frequency (MHz)	Max Peak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2390.300000	39.5	1000.0	1000.000	183.5	H	312.0	-0.2	34.4	73.9
2399.443000	40.1	1000.0	1000.000	332.1	V	76.0	-0.2	33.8	73.9
2460.629333	79.4	1000.0	1000.000	124.7	V	183.0	0.1	-5.5	73.9
2482.870667	40.3	1000.0	1000.000	182.6	V	170.0	0.1	33.6	73.9
2499.521333	40.4	1000.0	1000.000	209.4	V	152.0	0.2	33.5	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2390.300000	27.0	1000.0	1000.000	183.5	H	312.0	-0.2	26.9	53.9
2399.443000	27.4	1000.0	1000.000	332.1	V	76.0	-0.2	26.5	53.9
2460.629333	78.0	1000.0	1000.000	124.7	V	183.0	0.1	-24.1	53.9
2482.870667	27.0	1000.0	1000.000	182.6	V	170.0	0.1	26.9	53.9
2499.521333	27.2	1000.0	1000.000	209.4	V	152.0	0.2	26.7	53.9

Test Notes:

2.1.20 Test Results Worst Case Configuration WLAN Low Channel with External antenna



Peak Data

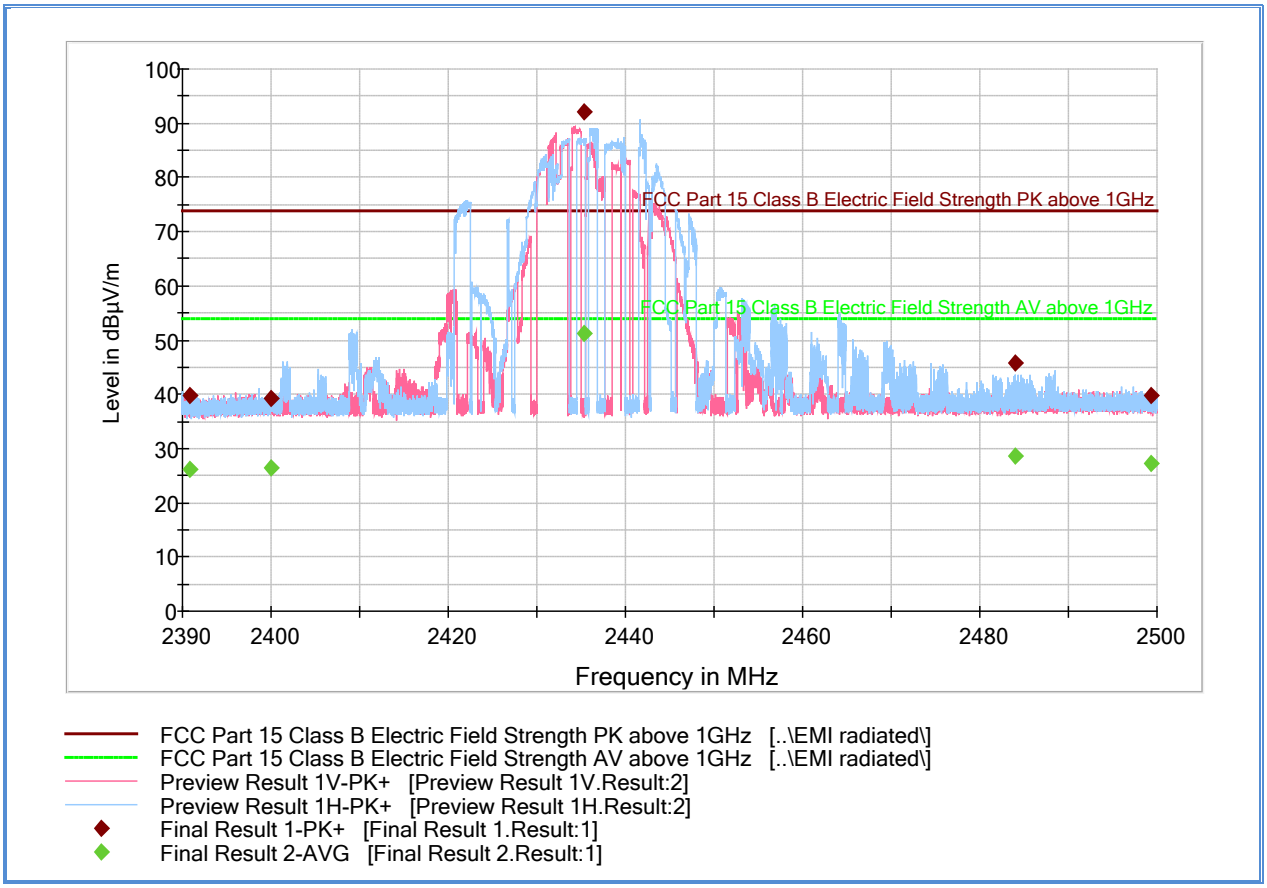
Frequency (MHz)	Max Peak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2391.078667	49.7	1000.0	1000.000	302.2	H	20.0	-0.2	24.2	73.9
2395.133667	71.8	1000.0	1000.000	103.7	H	11.0	-0.2	2.1	73.9
2412.678667	97.3	1000.0	1000.000	302.2	V	262.0	-0.1	-23.4	73.9
2483.681667	41.8	1000.0	1000.000	173.6	V	138.0	0.1	32.1	73.9
2499.500000	39.9	1000.0	1000.000	367.1	V	-20.0	0.2	34.0	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2391.078667	26.9	1000.0	1000.000	302.2	H	20.0	-0.2	27.0	53.9
2395.133667	34.4	1000.0	1000.000	103.7	H	11.0	-0.2	19.5	53.9
2412.678667	56.2	1000.0	1000.000	302.2	V	262.0	-0.1	-2.3	53.9
2483.681667	26.7	1000.0	1000.000	173.6	V	138.0	0.1	27.2	53.9
2499.500000	26.8	1000.0	1000.000	367.1	V	-20.0	0.2	27.1	53.9

Test Notes:

2.1.21 Test Results Worst Case Configuration WLAN Mid Channel with External antenna



Peak Data

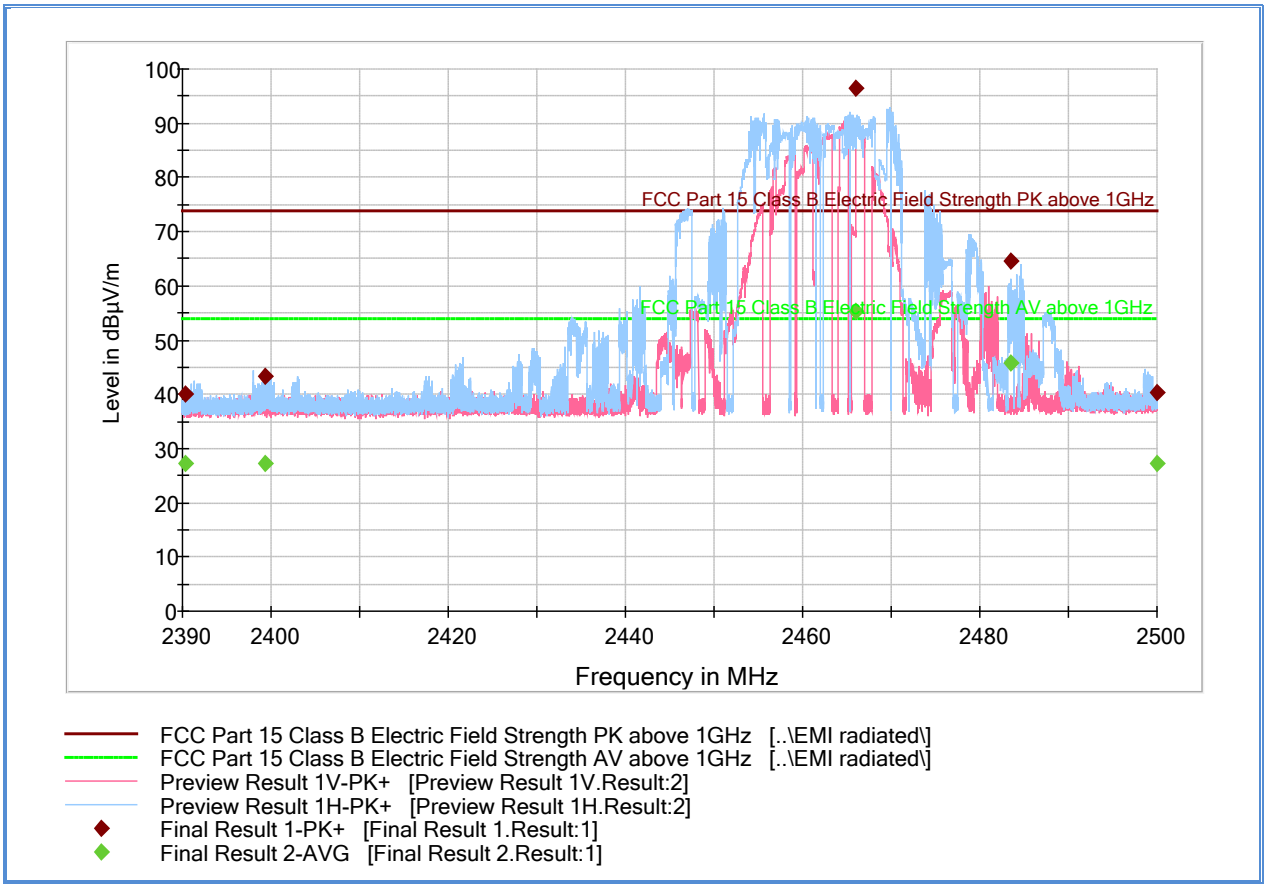
Frequency (MHz)	Max Peak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2390.900000	39.9	1000.0	1000.000	116.7	H	154.0	-0.2	34.0	73.9
2399.984333	39.1	1000.0	1000.000	406.7	V	10.0	-0.2	34.8	73.9
2435.297000	92.2	1000.0	1000.000	379.1	V	83.0	0.0	-18.3	73.9
2483.999000	45.7	1000.0	1000.000	102.7	H	7.0	0.1	28.2	73.9
2499.345000	39.8	1000.0	1000.000	322.2	H	267.0	0.2	34.1	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2390.900000	26.3	1000.0	1000.000	116.7	H	154.0	-0.2	27.6	53.9
2399.984333	26.4	1000.0	1000.000	406.7	V	10.0	-0.2	27.5	53.9
2435.297000	51.1	1000.0	1000.000	379.1	V	83.0	0.0	2.8	53.9
2483.999000	28.5	1000.0	1000.000	102.7	H	7.0	0.1	25.4	53.9
2499.345000	27.4	1000.0	1000.000	322.2	H	267.0	0.2	26.5	53.9

Test Notes:

2.1.22 Test Results Worst Case Configuration WLAN High Channel with External antenna



Peak Data

Frequency (MHz)	Max Peak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2390.400000	40.1	1000.0	1000.000	302.2	H	244.0	-0.2	33.8	73.9
2399.395333	43.4	1000.0	1000.000	102.7	H	51.0	-0.2	30.5	73.9
2465.919000	96.5	1000.0	1000.000	322.2	H	80.0	0.1	-22.6	73.9
2483.545000	64.5	1000.0	1000.000	344.1	H	63.0	0.1	9.4	73.9
2500.000000	40.4	1000.0	1000.000	280.2	V	95.0	0.2	33.5	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2390.400000	27.2	1000.0	1000.000	302.2	H	244.0	-0.2	26.7	53.9
2399.395333	27.1	1000.0	1000.000	102.7	H	51.0	-0.2	26.8	53.9
2465.919000	55.3	1000.0	1000.000	322.2	H	80.0	0.1	-1.4	53.9
2483.545000	45.7	1000.0	1000.000	344.1	H	63.0	0.1	8.2	53.9
2500.000000	27.1	1000.0	1000.000	280.2	V	95.0	0.2	26.8	53.9

Test Notes:

2.2 CONDUCTED EMISSIONS

2.2.1 Specification Reference

Part 15 Subpart C §15.207(a)

2.2.2 Standard Applicable

An intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN).

Frequency of emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

**Decreases with the logarithm of the frequency.*

2.2.3 Equipment Under Test and Modification State

Not performed. EUT is battery operated only and designed for vehicular use.

2.3 99% EMISSION BANDWIDTH

2.3.1 Specification Reference

RSS-Gen Clause 6.6

2.3.2 Standard Applicable

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured.
The transmitter shall be operated at its maximum carrier power measured under normal test conditions. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used given that a peak or peak hold may produce a wider bandwidth than actual.
The trace data points are recovered and directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded. The span between the two recorded frequencies is the occupied bandwidth.

2.3.3 Equipment Under Test and Modification State

Not performed. Bluetooth antenna conducted antenna port test results from Report Number: 13U14995-4 Revision B and 13U14995-1 Certification Test Report for 2x2 802.11 a/b/g/n + BT Module (SiP) Model Number: QCA6234 issued by UL Verification Services Inc. 47173 Benicia Street, Fremont, CA 94538, USA applies.

2.4 MINIMUM 6 dB RF BANDWIDTH

2.4.1 Specification Reference

Part 15 Subpart C §15.247(a)(2)

2.4.2 Standard Applicable

(2) Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

2.4.3 Equipment Under Test and Modification State

Not performed. Bluetooth antenna conducted antenna port test results from Report Number: 13U14995-4 Revision B and 13U14995-1 Certification Test Report for 2x2 802.11 a/b/g/n + BT Module (SiP) Model Number: QCA6234 issued by UL Verification Services Inc. 47173 Benicia Street, Fremont, CA 94538, USA applies.

2.5 OUT-OF-BAND EMISSIONS - CONDUCTED

2.5.1 Specification Reference

Part 15 Subpart C §15.247(d)

2.5.2 Standard Applicable

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

2.5.3 Equipment Under Test and Modification State

Not performed. Bluetooth antenna conducted antenna port test results from Report Number: 13U14995-4 Revision B and 13U14995-1 Certification Test Report for 2x2 802.11 a/b/g/n + BT Module (SiP) Model Number: QCA6234 issued by UL Verification Services Inc. 47173 Benicia Street, Fremont, CA 94538, USA applies.

2.6 BAND-EDGE COMPLIANCE OF RF CONDUCTED EMISSIONS

2.6.1 Specification Reference

Part 15 Subpart C §15.247(d)

2.6.2 Standard Applicable

See previous test.

2.6.3 Equipment Under Test and Modification State

Not performed. Bluetooth antenna conducted antenna port test results from Report Number: 13U14995-4 Revision B and 13U14995-1 Certification Test Report for 2x2 802.11 a/b/g/n + BT Module (SiP) Model Number: QCA6234 issued by UL Verification Services Inc. 47173 Benicia Street, Fremont, CA 94538, USA applies.

2.7 SPURIOUS RADIATED EMISSIONS

2.7.1 Specification Reference

Part 15 Subpart C §15.247(d)

2.7.2 Standard Applicable

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

2.7.3 Equipment Under Test and Modification State

Serial No: 00013 and 00005 / Default Test Configuration

2.7.4 Date of Test/Initial of test personnel who performed the test

September 30, 2014 and October 07, 2014/FSC

2.7.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.7.6 Environmental Conditions

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	24.7°C
Relative Humidity	29.1%
ATM Pressure	98.8 kPa

2.7.7 Additional Observations

- This is a radiated test. The spectrum was searched from 30MHz to the 10th harmonic (25GHz).
- There are no emissions found that do not comply to the restricted bands defined in FCC Part 15 Subpart C, 15.205 or Part 15.247(d).
- Only the considered worst case channel presented for radiated emissions below 1GHz. There are no significant differences in radiated emissions below 1GHz between Low, Mid and High channels.

- Measurement was done using EMC32 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only. See Section 2.7.8 for sample computation.

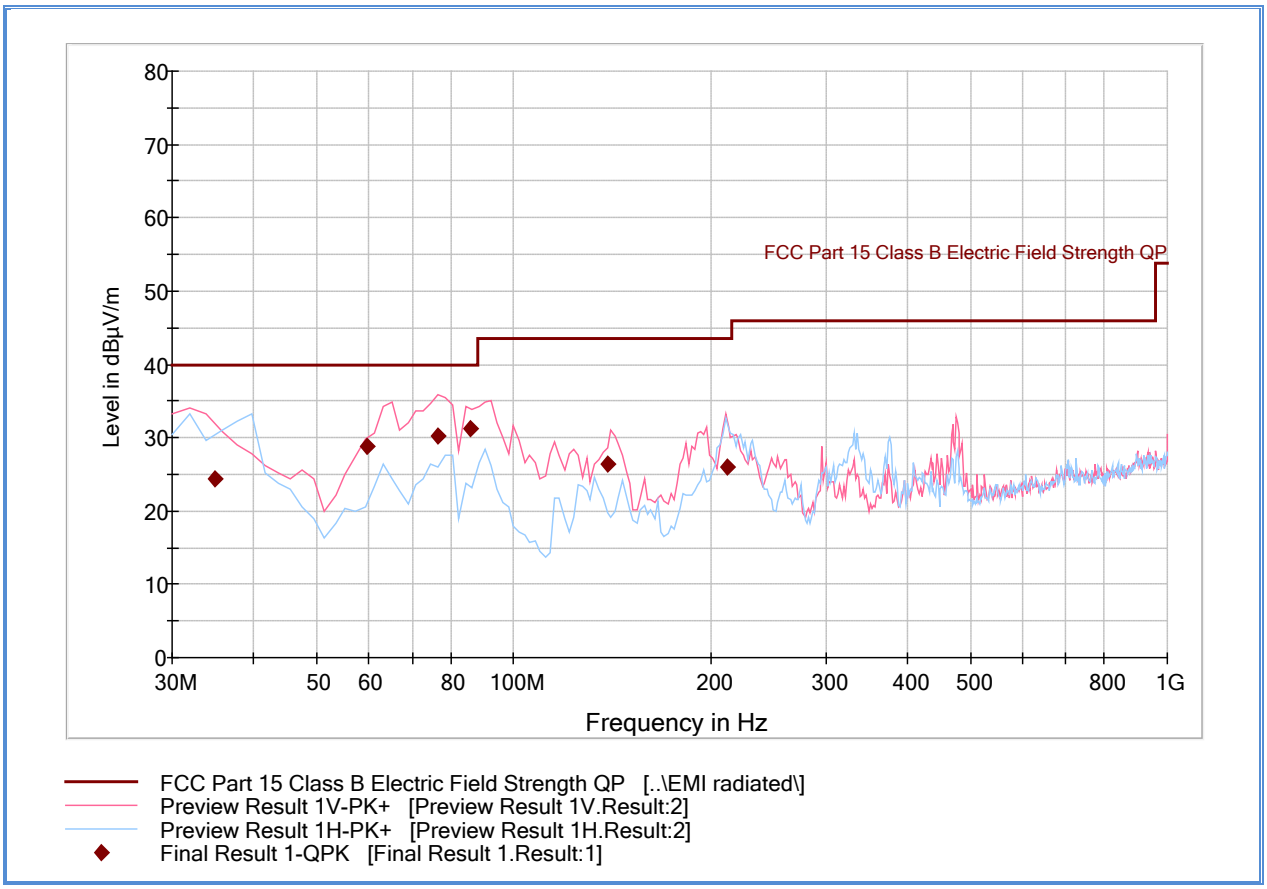
2.7.8 Sample Computation (Radiated Emission)

Measuring equipment raw measurement (dbµV) @ 30 MHz			24.4
Correction Factor (dB)	Asset# 1066 (cable)	0.3	-12.6
	Asset# 1172 (cable)	0.3	
	Asset# 1016 (preamplifier)	-30.7	
	Asset# 1175(cable)	0.3	
	Asset# 1002 (antenna)	17.2	
Reported QuasiPeak Final Measurement (dbµV/m) @ 30MHz			**11.8**

2.7.9 Test Results

See attached plots.

2.7.10 Test Results Below 1GHz (Receive Mode)

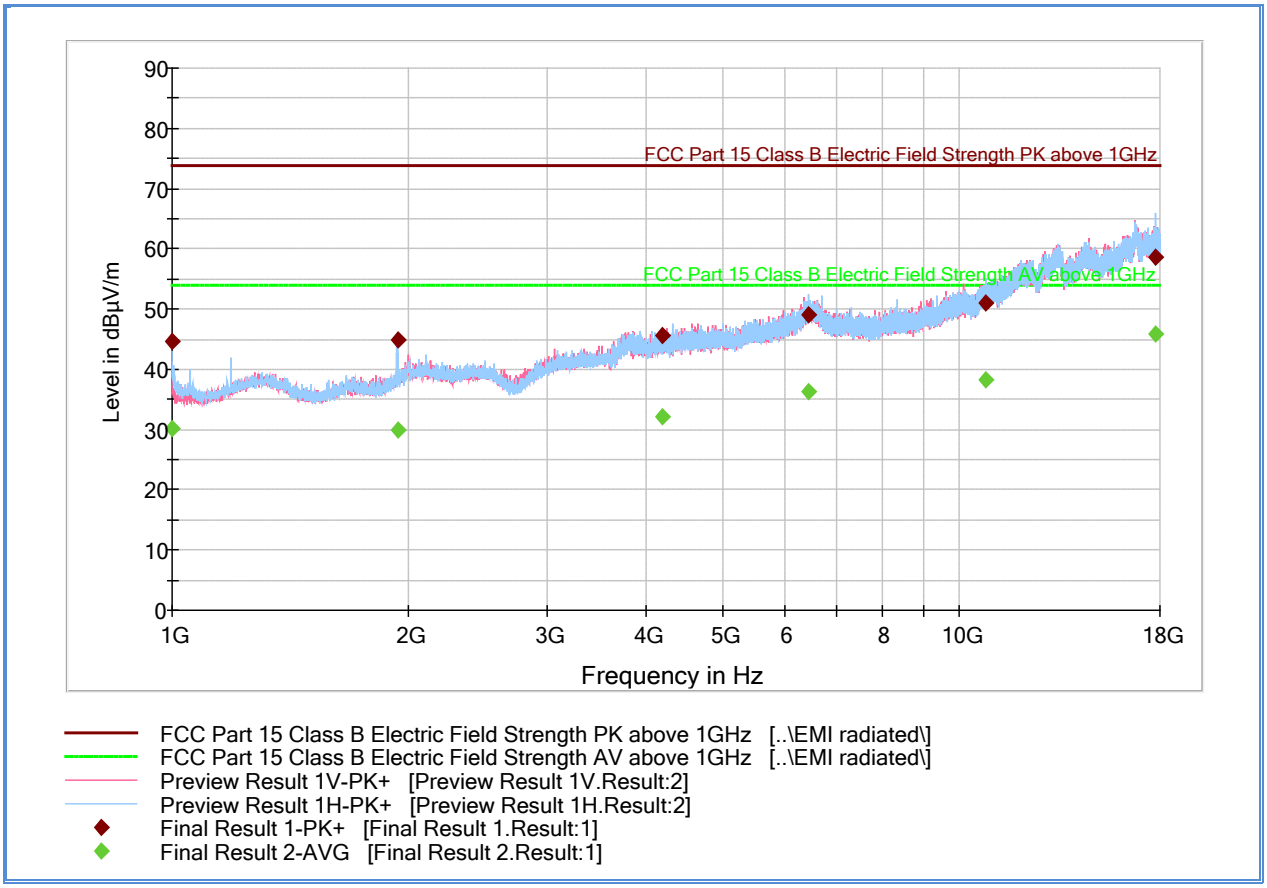


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
34.880000	24.3	1000.0	120.000	100.0	V	131.0	-13.2	15.7	40.0
59.558317	28.9	1000.0	120.000	109.0	V	56.0	-20.6	11.1	40.0
76.373307	30.3	1000.0	120.000	100.0	V	197.0	-21.2	9.7	40.0
85.692745	31.3	1000.0	120.000	100.0	V	349.0	-20.7	8.7	40.0
138.961603	26.4	1000.0	120.000	100.0	V	64.0	-19.1	17.1	43.5
212.221563	26.0	1000.0	120.000	100.0	V	321.0	-14.8	17.5	43.5

Test Notes:

2.7.11 Test Results Above 1GHz (Receive Mode)



Peak Data

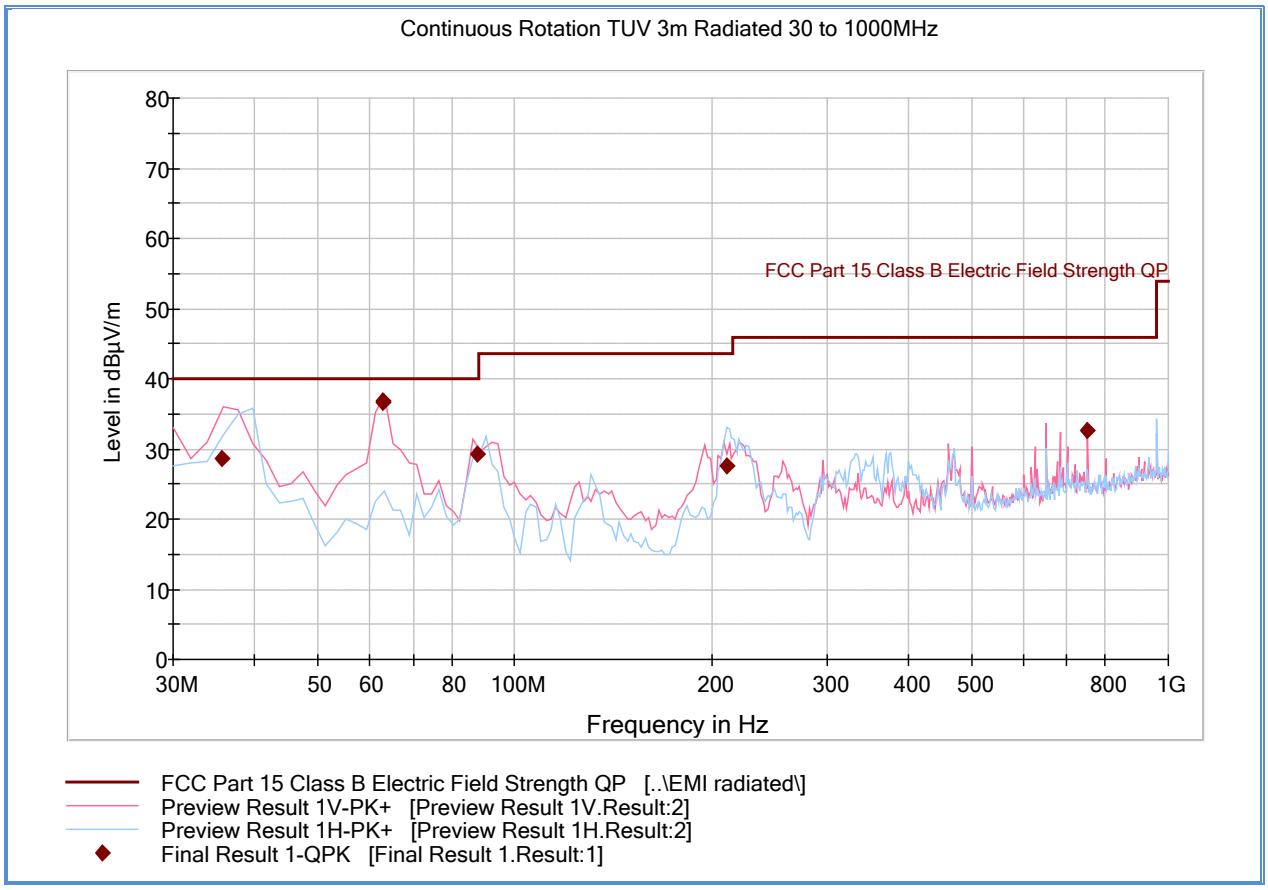
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.40000	44.7	1000.0	1000.000	250.3	H	168.0	-7.0	29.2	73.9
1932.96666	45.0	1000.0	1000.000	403.0	H	187.0	-1.4	28.9	73.9
4190.30000	45.5	1000.0	1000.000	201.5	H	50.0	6.1	28.4	73.9
6436.43333	49.1	1000.0	1000.000	117.7	H	290.0	12.7	24.8	73.9
10809.2333	51.0	1000.0	1000.000	379.0	H	-20.0	16.4	22.9	73.9
17738.7333	58.6	1000.0	1000.000	175.5	H	152.0	25.8	15.3	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.40000	30.1	1000.0	1000.000	250.3	H	168.0	-7.0	23.8	53.9
1932.96666	29.8	1000.0	1000.000	403.0	H	187.0	-1.4	24.1	53.9
4190.30000	32.2	1000.0	1000.000	201.5	H	50.0	6.1	21.7	53.9
6436.43333	36.2	1000.0	1000.000	117.7	H	290.0	12.7	17.7	53.9
10809.2333	38.2	1000.0	1000.000	379.0	H	-20.0	16.4	15.7	53.9
17738.7333	45.9	1000.0	1000.000	175.5	H	152.0	25.8	8.0	53.9

Test Notes:

2.7.12 Test Results Below 1GHz (Bluetooth TX Worst Case Channel)

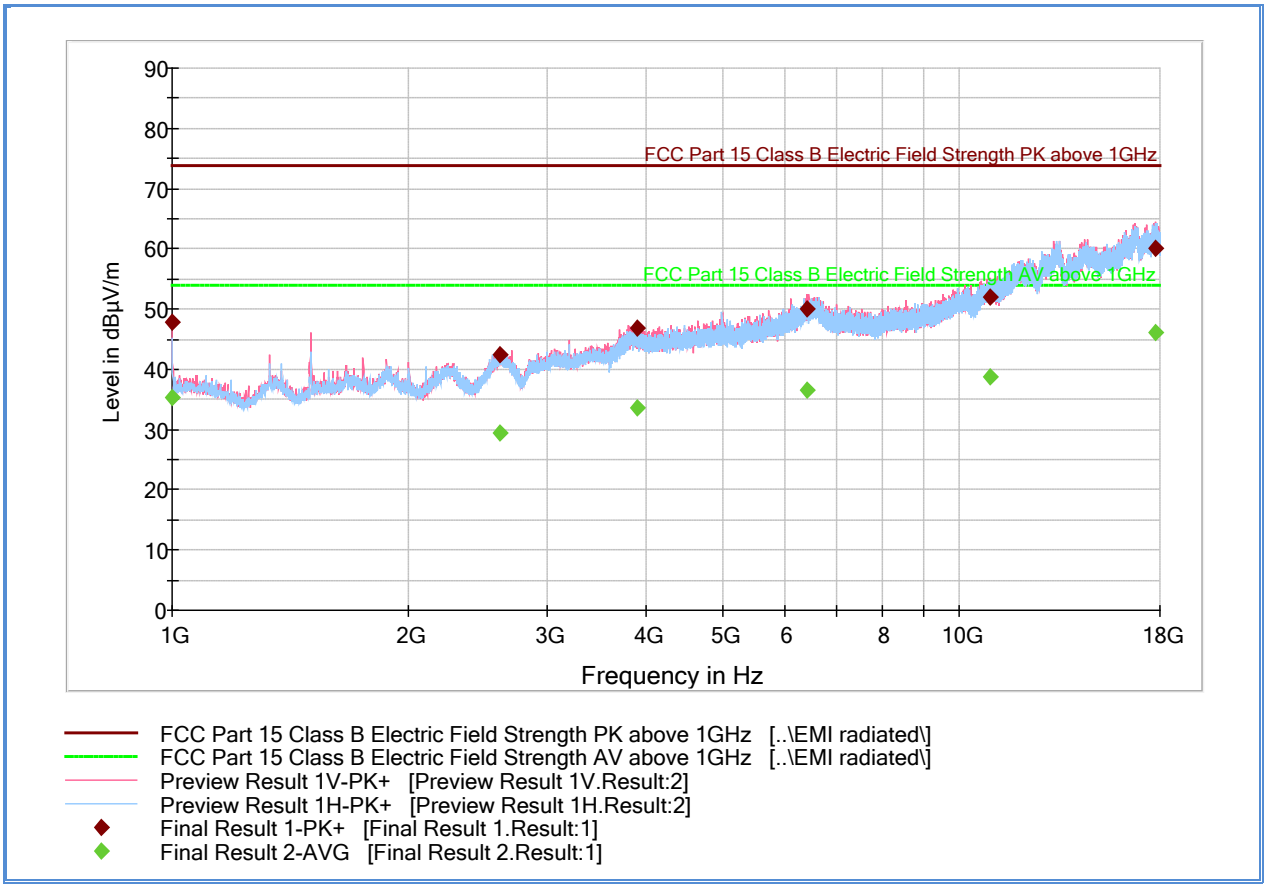


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
35.711663	28.7	1000.0	120.000	105.0	V	332.0	-13.7	11.3	40.0
62.646092	36.7	1000.0	120.000	109.0	V	110.0	-21.0	3.3	40.0
62.678317	36.8	1000.0	120.000	100.0	V	119.0	-21.0	3.2	40.0
87.732745	29.3	1000.0	120.000	100.0	V	262.0	-20.3	10.7	40.0
211.061563	27.6	1000.0	120.000	184.0	H	7.0	-14.9	15.9	43.5
750.022365	32.6	1000.0	120.000	100.0	V	136.0	-0.8	13.4	46.0

Test Notes: Only worst case channel presented for spurious emissions below 1GHz.

2.7.13 Test Results Above 1GHz Low Channel (Bluetooth TX Low Channel)



Peak Data

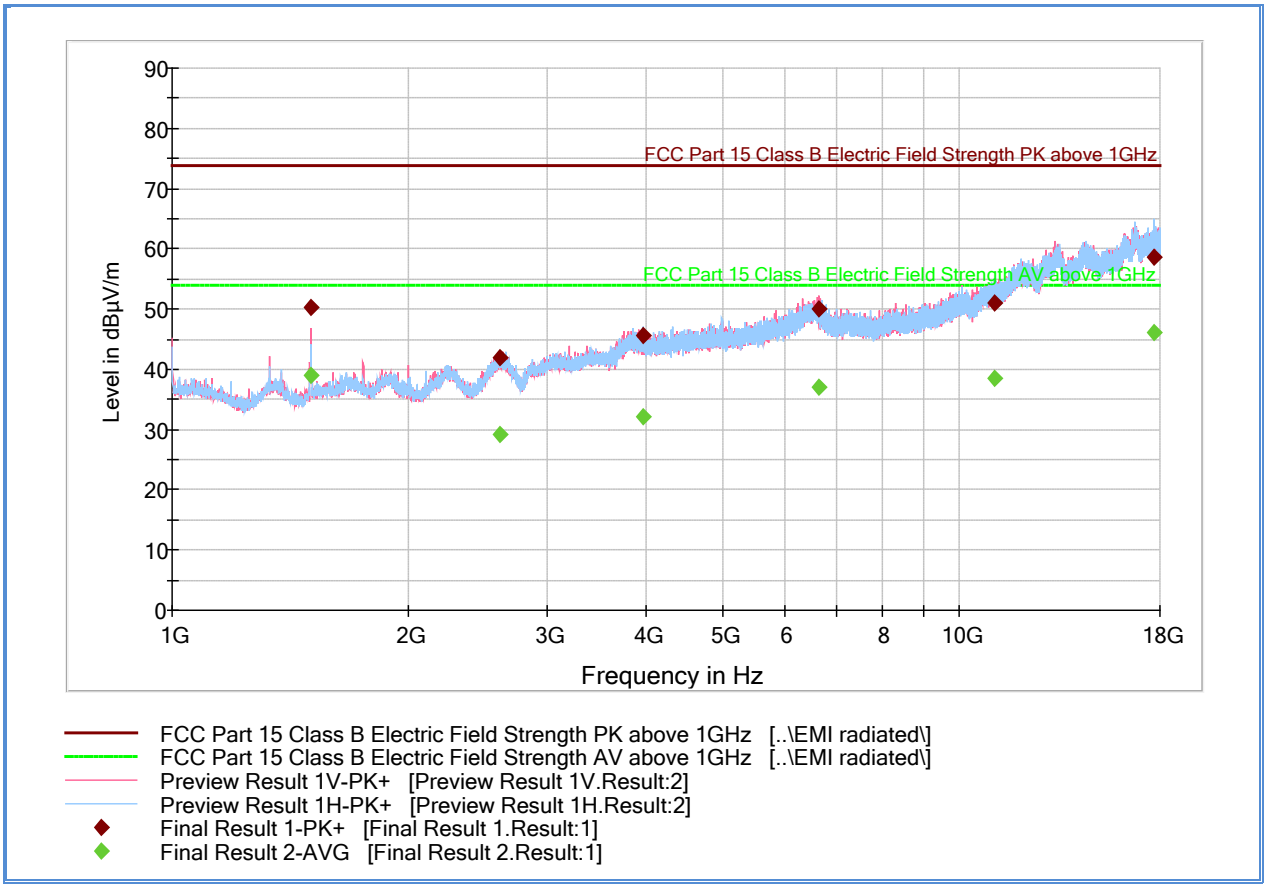
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	47.9	1000.0	1000.000	192.5	V	281.0	-7.0	26.0	73.9
2613.133333	42.4	1000.0	1000.000	152.6	V	221.0	-0.4	31.5	73.9
3895.866667	46.9	1000.0	1000.000	103.7	V	184.0	6.0	27.0	73.9
6415.466667	50.0	1000.0	1000.000	152.7	V	72.0	12.7	23.9	73.9
10937.433333	51.9	1000.0	1000.000	173.6	V	81.0	16.9	22.0	73.9
17769.600000	60.0	1000.0	1000.000	406.7	V	20.0	25.8	13.9	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	35.3	1000.0	1000.000	192.5	V	281.0	-7.0	18.6	53.9
2613.133333	29.3	1000.0	1000.000	152.6	V	221.0	-0.4	24.6	53.9
3895.866667	33.7	1000.0	1000.000	103.7	V	184.0	6.0	20.2	53.9
6415.466667	36.5	1000.0	1000.000	152.7	V	72.0	12.7	17.4	53.9
10937.433333	38.7	1000.0	1000.000	173.6	V	81.0	16.9	15.2	53.9
17769.600000	46.1	1000.0	1000.000	406.7	V	20.0	25.8	7.8	53.9

Test Notes: Measurement was performed with a 2.4GHz notch filter. No significant emissions observed above 10GHz. Measurements above 10GHz are noise floor figures.

2.7.14 Test Results Above 1GHz Mid Channel (Bluetooth TX Mid Channel)



Peak Data

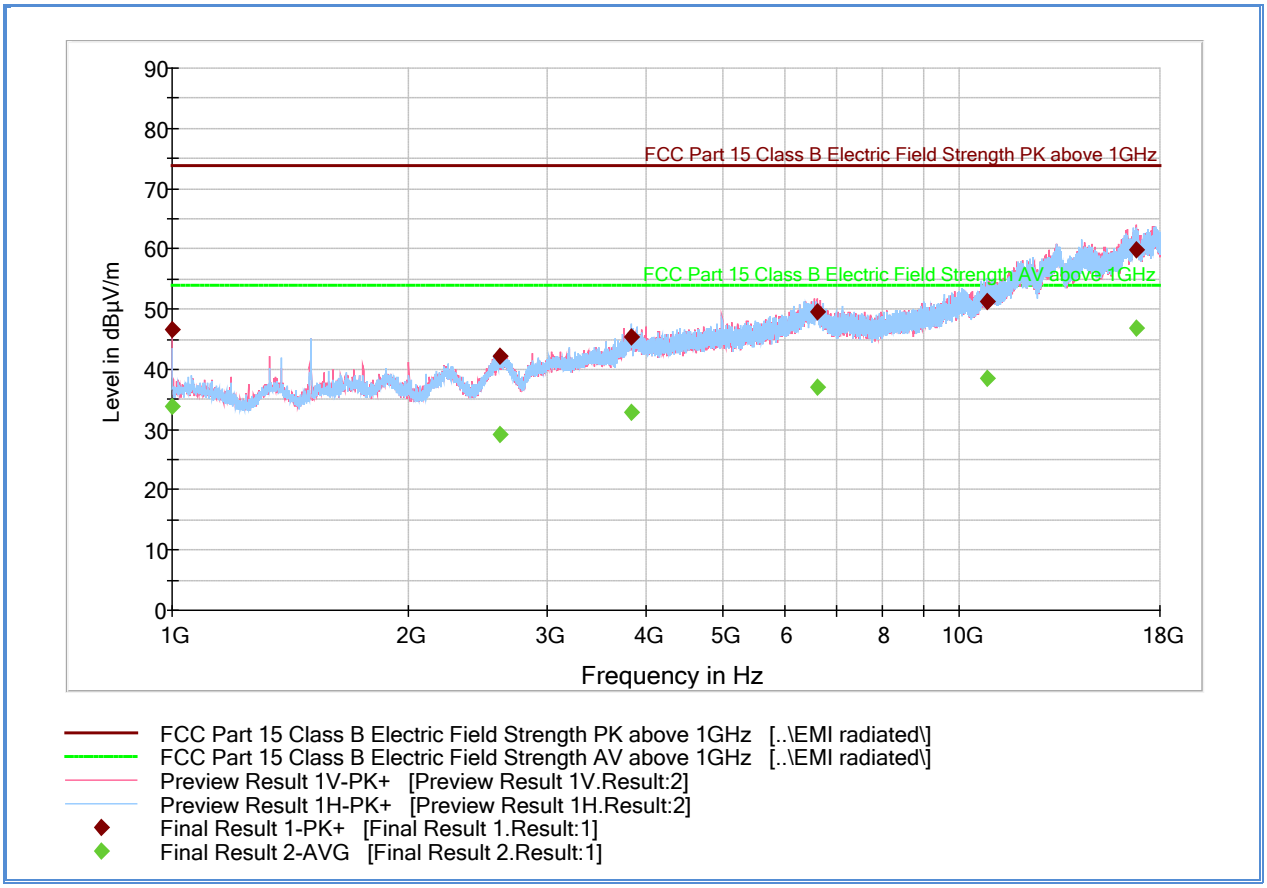
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1500.000000	50.3	1000.0	1000.000	103.7	V	342.0	-5.1	23.6	73.9
2605.333333	42.0	1000.0	1000.000	201.3	V	3.0	-0.3	31.9	73.9
3965.933333	45.6	1000.0	1000.000	164.6	H	267.0	5.9	28.3	73.9
6622.433333	50.1	1000.0	1000.000	406.7	V	272.0	12.7	23.8	73.9
11112.133333	51.1	1000.0	1000.000	131.7	H	195.0	16.5	22.8	73.9
17723.333333	58.6	1000.0	1000.000	123.7	H	-20.0	25.7	15.3	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1500.000000	39.0	1000.0	1000.000	103.7	V	342.0	-5.1	14.9	53.9
2605.333333	29.2	1000.0	1000.000	201.3	V	3.0	-0.3	24.7	53.9
3965.933333	32.1	1000.0	1000.000	164.6	H	267.0	5.9	21.8	53.9
6622.433333	36.9	1000.0	1000.000	406.7	V	272.0	12.7	17.0	53.9
11112.133333	38.4	1000.0	1000.000	131.7	H	195.0	16.5	15.5	53.9
17723.333333	46.1	1000.0	1000.000	123.7	H	-20.0	25.7	7.8	53.9

Test Notes: Measurement was performed with a 2.4GHz notch filter. No significant emissions observed above 10GHz. Measurements above 10GHz are noise floor figures.

2.7.15 Test Results Above 1GHz High Channel (Bluetooth TX High Channel)



Peak Data

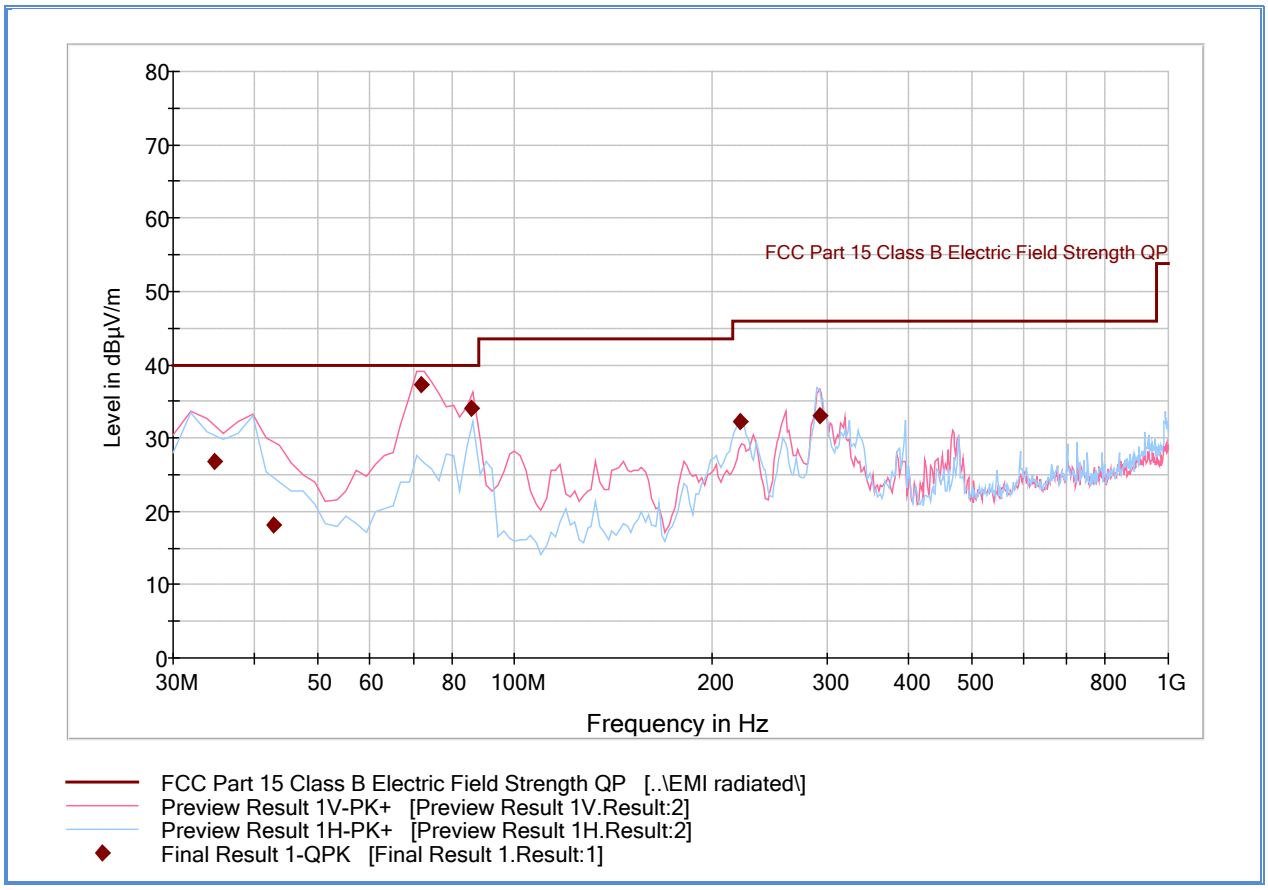
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	46.7	1000.0	1000.000	219.4	V	171.0	-7.0	27.2	73.9
2608.200000	42.1	1000.0	1000.000	302.2	H	311.0	-0.4	31.8	73.9
3827.666667	45.3	1000.0	1000.000	355.1	H	10.0	6.1	28.6	73.9
6593.433333	49.6	1000.0	1000.000	200.5	V	10.0	12.8	24.3	73.9
10851.900000	51.4	1000.0	1000.000	103.7	H	218.0	16.6	22.5	73.9
16782.933333	59.9	1000.0	1000.000	99.7	V	255.0	25.9	14.0	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	33.7	1000.0	1000.000	219.4	V	171.0	-7.0	20.2	53.9
2608.200000	29.2	1000.0	1000.000	302.2	H	311.0	-0.4	24.7	53.9
3827.666667	32.9	1000.0	1000.000	355.1	H	10.0	6.1	21.0	53.9
6593.433333	37.0	1000.0	1000.000	200.5	V	10.0	12.8	16.9	53.9
10851.900000	38.6	1000.0	1000.000	103.7	H	218.0	16.6	15.3	53.9
16782.933333	46.8	1000.0	1000.000	99.7	V	255.0	25.9	7.1	53.9

Test Notes: Measurement was performed with a 2.4GHz notch filter. No significant emissions observed above 10GHz. Measurements above 10GHz are noise floor figures.

2.7.16 Test Results Below 1GHz (802.11g TX Worst Case Channel)

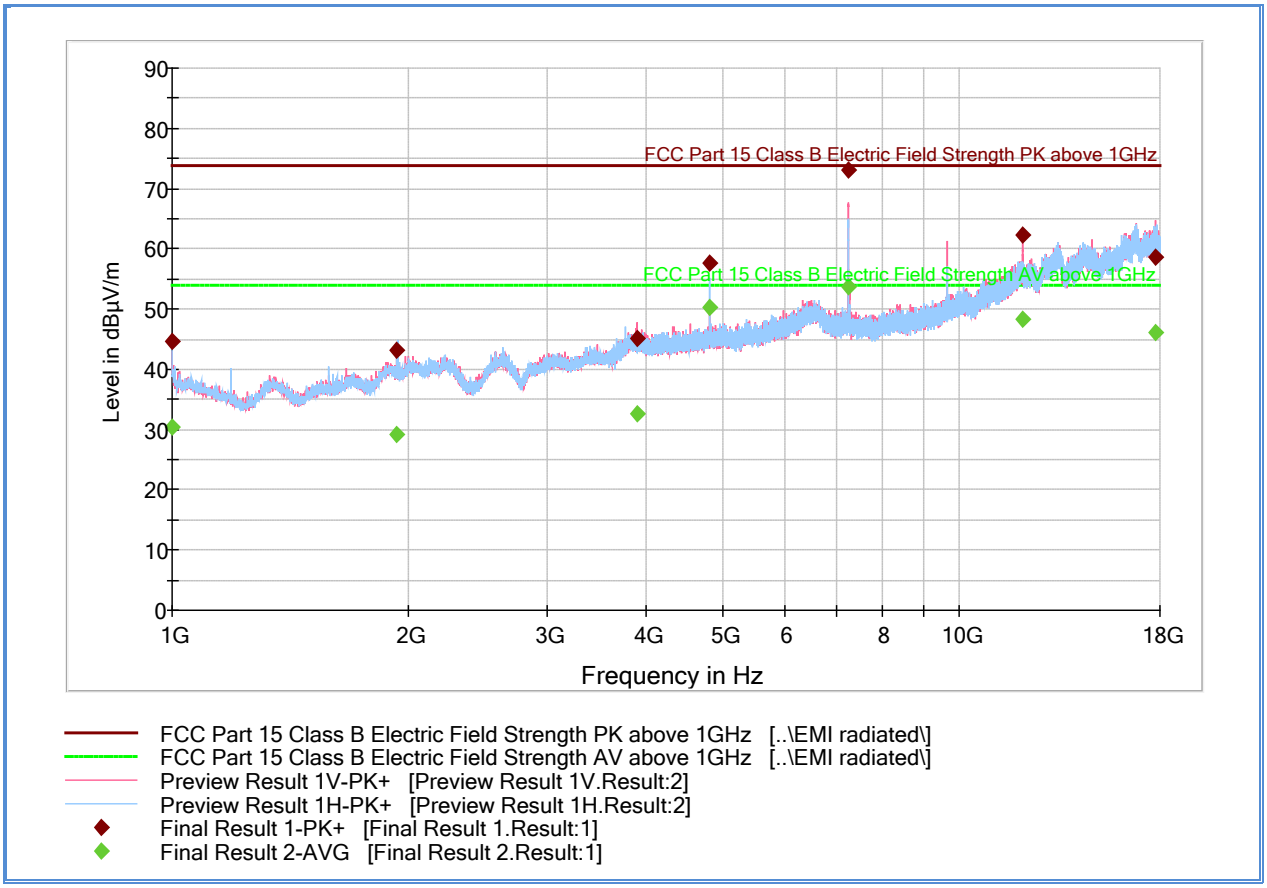


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
34.760000	26.7	1000.0	120.000	100.0	V	35.0	-13.2	13.3	40.0
42.807214	18.0	1000.0	120.000	105.0	V	15.0	-16.8	22.0	40.0
72.021643	37.3	1000.0	120.000	150.0	V	95.0	-21.4	2.7	40.0
85.612745	34.0	1000.0	120.000	100.0	V	312.0	-20.7	6.0	40.0
221.324890	32.2	1000.0	120.000	170.0	H	134.0	-14.6	13.8	46.0
292.480962	33.0	1000.0	120.000	100.0	H	92.0	-11.9	13.0	46.0

Test Notes: Only worst case channel presented for spurious emissions below 1GHz.

2.7.17 Test Results Above 1GHz Low Channel (802.11g TX Low Channel)



Peak Data

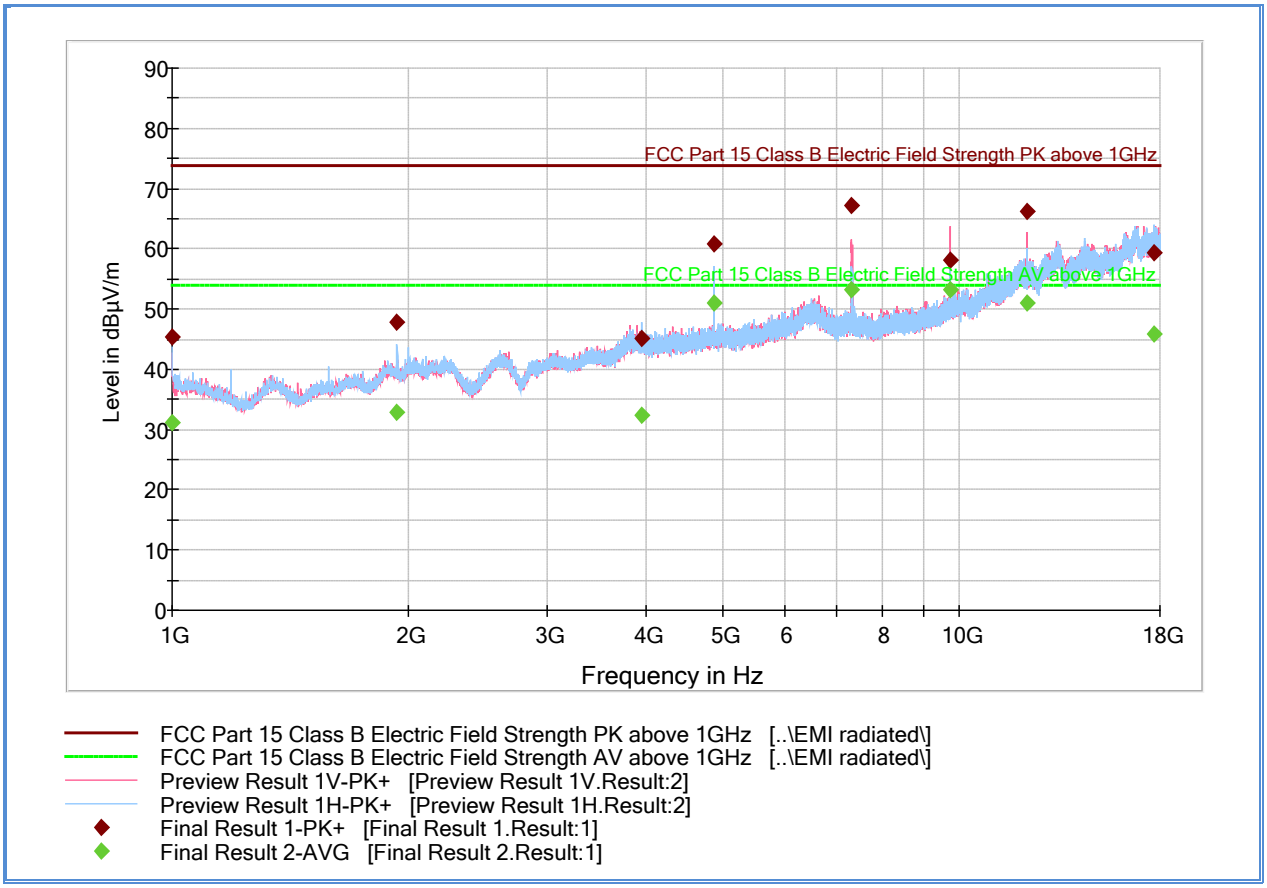
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.400000	44.7	1000.0	1000.000	310.2	H	154.0	-7.0	29.2	73.9
1932.533333	43.2	1000.0	1000.000	124.7	H	10.0	-1.4	30.7	73.9
3892.633333	45.1	1000.0	1000.000	310.2	V	89.0	6.0	28.8	73.9
4823.666667	57.6	1000.0	1000.000	258.3	H	162.0	6.9	16.3	73.9
7237.266667	73.0	1000.0	1000.000	355.1	V	46.0	11.3	0.9	73.9
12061.000000	62.2	1000.0	1000.000	332.1	V	190.0	20.1	11.7	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.400000	30.5	1000.0	1000.000	310.2	H	154.0	-7.0	23.4	53.9
1932.533333	29.1	1000.0	1000.000	124.7	H	10.0	-1.4	24.8	53.9
3892.633333	32.7	1000.0	1000.000	310.2	V	89.0	6.0	21.2	53.9
4823.666667	50.4	1000.0	1000.000	258.3	H	162.0	6.9	3.5	53.9
7237.266667	53.8	1000.0	1000.000	355.1	V	46.0	11.3	0.1	53.9
12061.000000	48.3	1000.0	1000.000	332.1	V	190.0	20.1	5.6	53.9

Test Notes: Measurement was performed with a 2.4GHz notch filter. No significant emissions observed above 18GHz. Measurements above 18GHz are noise floor figures.

2.7.18 Test Results Above 1GHz Mid Channel (802.11g TX Mid Channel)



Peak Data

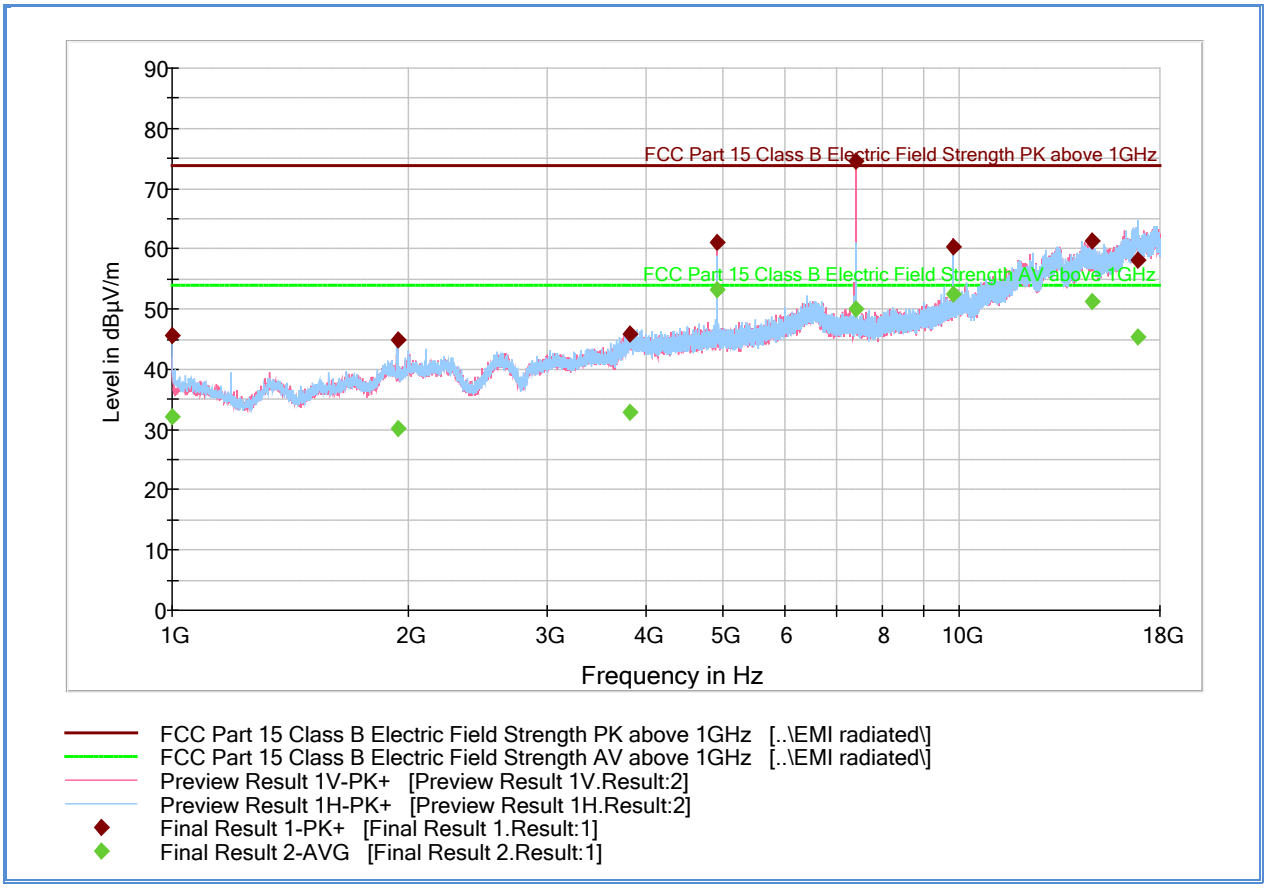
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.400000	45.4	1000.0	1000.000	310.2	H	16.0	-7.0	28.5	73.9
1932.366667	47.9	1000.0	1000.000	102.7	H	73.0	-1.4	26.0	73.9
3951.066667	45.1	1000.0	1000.000	238.4	H	153.0	6.0	28.8	73.9
4873.933333	60.9	1000.0	1000.000	290.2	H	163.0	7.1	13.0	73.9
7309.700000	67.2	1000.0	1000.000	165.6	V	334.0	11.1	6.7	73.9
9747.833333	58.1	1000.0	1000.000	239.4	V	42.0	13.7	15.8	73.9
12183.533333	66.3	1000.0	1000.000	239.4	V	44.0	19.4	7.6	73.9
17714.066667	59.2	1000.0	1000.000	103.7	H	71.0	25.6	14.7	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.400000	31.3	1000.0	1000.000	310.2	H	16.0	-7.0	22.6	53.9
1932.366667	32.8	1000.0	1000.000	102.7	H	73.0	-1.4	21.1	53.9
3951.066667	32.3	1000.0	1000.000	238.4	H	153.0	6.0	21.6	53.9
4873.933333	51.0	1000.0	1000.000	290.2	H	163.0	7.1	2.9	53.9
7309.700000	53.2	1000.0	1000.000	165.6	V	334.0	11.1	0.7	53.9
9747.833333	53.3	1000.0	1000.000	239.4	V	42.0	13.7	0.6	53.9
12183.533333	51.0	1000.0	1000.000	239.4	V	44.0	19.4	2.9	53.9
17714.066667	46.0	1000.0	1000.000	103.7	H	71.0	25.6	7.9	53.9

Test Notes: Measurement was performed with a 2.4GHz notch filter. No significant emissions observed above 18GHz. Measurements above 18GHz are noise floor figures.

2.7.19 Test Results Above 1GHz High Channel (802.11g TX High Channel)



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	45.7	1000.0	1000.000	311.2	H	180.0	-7.0	28.2	73.9
1932.766667	45.0	1000.0	1000.000	103.7	H	330.0	-1.4	28.9	73.9
3808.366667	45.8	1000.0	1000.000	259.3	H	117.0	6.0	28.1	73.9
4923.800000	61.1	1000.0	1000.000	406.7	V	49.0	7.3	12.8	73.9
7387.266667	73.9	1000.0	1000.000	345.1	V	87.0	10.9	0.0	73.9
9847.733333	60.4	1000.0	1000.000	313.2	V	180.0	13.9	13.5	73.9
14771.666667	61.2	1000.0	1000.000	250.3	V	119.0	22.3	12.7	73.9
16850.466667	58.1	1000.0	1000.000	250.3	H	201.0	25.1	15.8	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	32.2	1000.0	1000.000	311.2	H	180.0	-7.0	21.7	53.9
1932.766667	30.2	1000.0	1000.000	103.7	H	330.0	-1.4	23.7	53.9
3808.366667	32.9	1000.0	1000.000	259.3	H	117.0	6.0	21.0	53.9
4923.800000	53.2	1000.0	1000.000	406.7	V	49.0	7.3	0.7	53.9
7387.266667	49.9	1000.0	1000.000	345.1	V	87.0	10.9	4.0	53.9
9847.733333	52.4	1000.0	1000.000	313.2	V	180.0	13.9	1.5	53.9
14771.666667	51.2	1000.0	1000.000	250.3	V	119.0	22.3	2.7	53.9
16850.466667	45.4	1000.0	1000.000	250.3	H	201.0	25.1	8.5	53.9

Test Notes: Measurement was performed with a 2.4GHz notch filter. No significant emissions observed above 10GHz. Measurements above 10GHz are noise floor figures.

2.8 RADIATED IMMEDIATE RESTRICTED BANDS

2.8.1 Specification Reference

Part 15 Subpart C §15.247(d)

2.8.2 Standard Applicable

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

2.8.3 Equipment Under Test and Modification State

Test results from Section 2.1.11 to 2.1.22 of this test report applies. The scan performed under Section 2.1 of this report covers the upper immediate restricted band. Section 2.7 on the other hand covers the lower immediate restricted band (2310 MHz to 2390 MHz).

2.9 POWER SPECTRAL DENSITY

2.9.1 Specification Reference

Part 15 Subpart C §15.247(e)

2.9.2 Standard Applicable

(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

2.9.3 Equipment Under Test and Modification State

Not performed. Bluetooth antenna conducted antenna port test results from Report Number: 13U14995-4 Revision B and 13U14995-1 Certification Test Report for 2x2 802.11 a/b/g/n + BT Module (SiP) Model Number: QCA6234 issued by UL Verification Services Inc. 47173 Benicia Street, Fremont, CA 94538, USA applies.

2.10 RECEIVER SPURIOUS EMISSIONS

2.10.1 Specification Reference

RSS-Gen 7.1

2.10.2 Standard Applicable

Receivers shall comply with the limits of spurious emissions set out in this section, measured over the frequency range determined in accordance with Section 4.10 of RSS-Gen.

Table 2: Radiated Limits of Receiver Spurious Emissions

Frequency (MHz)	Field Strength (microvolts/m at 3 metres)*
30-88	100
88-216	150
216-960	200
Above 960	500

*Measurements for compliance with limits in the above table may be performed at distances other than 3 metres, in accordance with Section 7.2.7 of RSS-Gen.

2.10.3 Equipment Under Test and Modification State

Serial No: 00013 / Default Test Configuration

2.10.4 Date of Test/Initial of test personnel who performed the test

July 03 and 09, 2014/FSC

2.10.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.10.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	20.9-25.3°C
Relative Humidity	44.3-56.4%
ATM Pressure	99.1-99.3 kPa

2.10.7 Additional Observations

- This is a radiated test. The spectrum was searched from 30MHz to the 3rd harmonic (up to 10th performed).
- Result identical to Section 2.7.10 and 2.7.11 of this test report.
- EUT in RX (Receive) mode configuration.

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SECTION 3

TEST EQUIPMENT USED

3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

ID Number (SDGE/SDRB)	Test Equipment	Type	Serial Number	Manufacturer	Cal Date	Cal Due Date
Radiated Test Setup						
1184	Spectrum Analyzer	FSEM	849718/025	Rhode & Schwarz	06/27/14	06/27/15
1002	Bilog Antenna	3142C	00058717	ETS-Lindgren	01/30/14	01/30/16
7575	Double-ridged waveguide horn antenna	3117	00155511	EMCO	04/08/14	04/08/15
8628	Pre-amplifier	QLJ 01182835-JO	8986002	QuinStar Technologies Inc.	04/03/14	04/03/15
1150	Horn antenna	3160-09	012054-004	ETS	04/26/13	04/26/15
1151	Pre-amplifier	TS-PR26	100026	Rhode & Schwarz	05/02/13	05/02/15
8760	Pre-amplifier	ZKL-2	1001	Mini-Circuits	09/04/14	09/04/15
1153	High-frequency cable	SucoFlex 100 SX	N/A	Suhner	04/03/14	04/03/15
8543	High-frequency cable	Micropore 19057793	N/A	United Microwave Products	09/04/14	09/04/15
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	08/29/14	08/29/15
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	03/17/14	03/17/15
6815	2.4GHz Band Notch Filter	BRM50702	008	Micro-Tronics	Verified by 1003and 1049	
1016	Pre-amplifier	PAM-0202	187	PAM	05/05/14	05/05/15
1003	Signal Generator	SMR-40	1104.0002.40	Rhode & Schwarz	01/20/14	01/20/15
Miscellaneous						
6792	Multimeter	3478A	2911A70964	Hewlett Packard	08/12/14	08/12/15
7554	Barometer/Temperature /Humidity Transmitter	iBTHX-W	0400706	Omega	01/30/14	01/30/15
1123	DC Power Supply	E3631A	N/A	Hewlett Packard	Verified by 6792	
	Test Software	EMC32	V8.53	Rhode & Schwarz	N/A	

3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:

3.2.1 Radiated Emission Measurements (Below 1GHz)

	Contribution	Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.45	0.26	0.07
2	Cables	Rectangular	0.50	0.29	0.08
3	Preamp	Rectangular	0.50	0.29	0.08
4	Antenna	Rectangular	0.75	0.43	0.19
5	Site	Rectangular	3.89	2.25	5.04
6	EUT Setup	Rectangular	1.00	0.58	0.33
				Combined Uncertainty (u_c):	2.41
				Coverage Factor (k):	2
				Expanded Uncertainty:	4.82

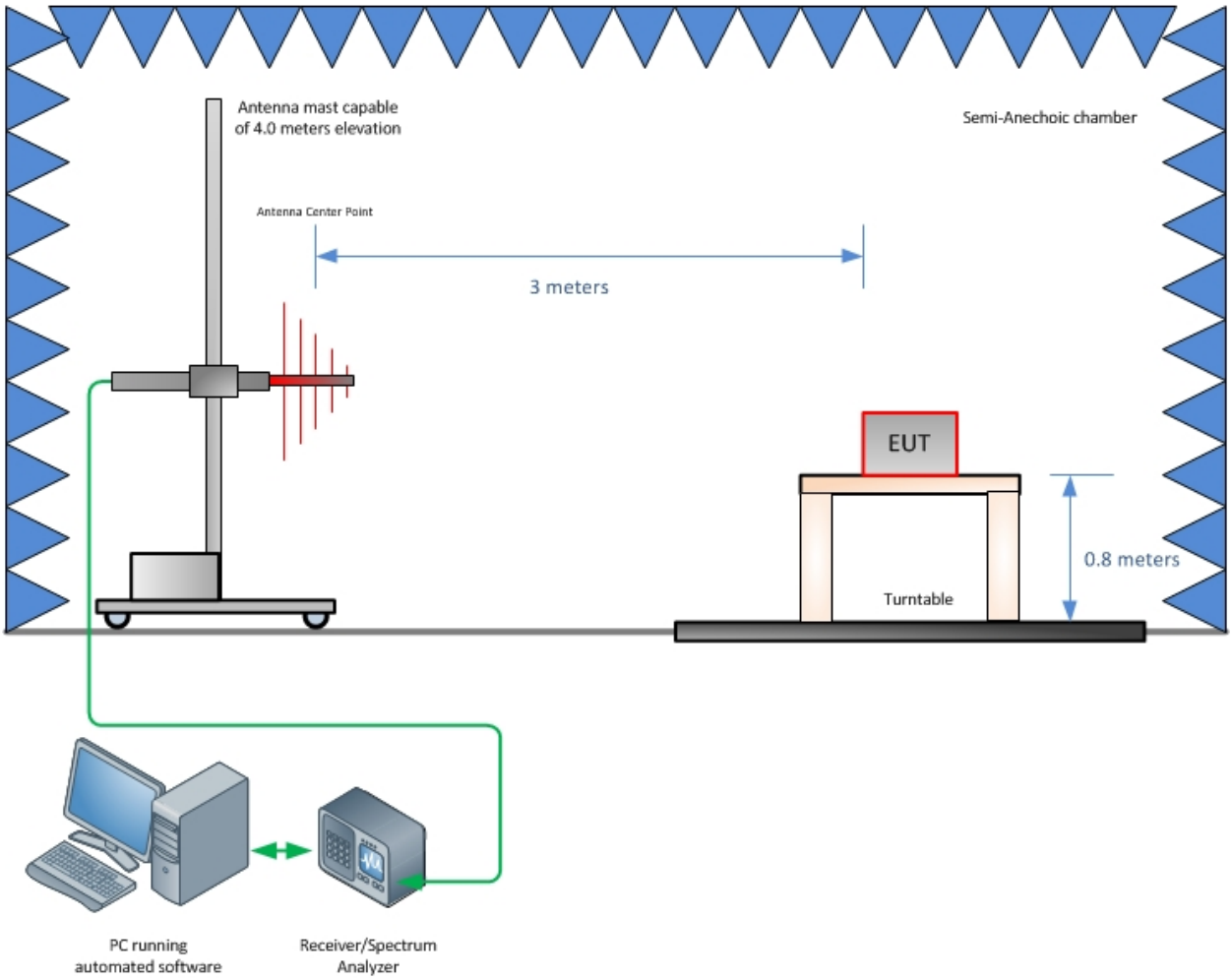
3.2.2 Radiated Emission Measurements (Above 1GHz)

	Contribution	Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.57	0.33	0.11
2	Cables	Rectangular	0.70	0.40	0.16
3	Preamp	Rectangular	0.50	0.29	0.08
4	Antenna	Rectangular	0.37	0.21	0.05
5	Site	Rectangular	3.89	2.25	5.04
6	EUT Setup	Rectangular	1.00	0.58	0.33
				Combined Uncertainty (u_c):	2.40
				Coverage Factor (k):	2
				Expanded Uncertainty:	4.81

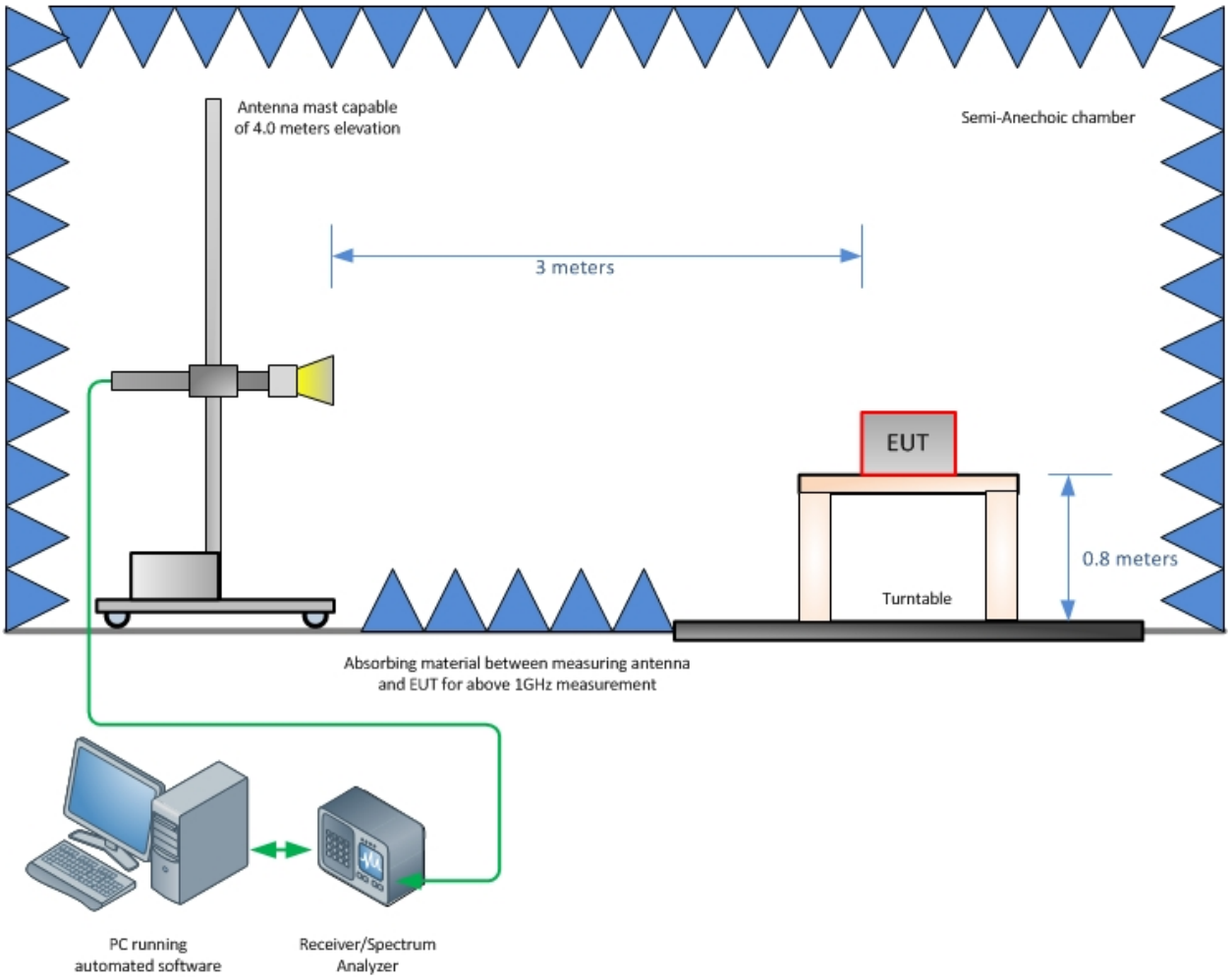
SECTION 4

DIAGRAM OF TEST SETUP

4.1 TEST SETUP DIAGRAM



Radiated Emission Test Setup (Below 1GHz)



Radiated Emission Test Setup (Above 1GHz)

SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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