



PCTEST ENGINEERING LABORATORY, INC.

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MEASUREMENT REPORT FCC PART 15.247 / IC RSS-210 Bluetooth (Low Energy)

Applicant Name:

NEC Corporation of America
Radio Communications Systems Division
6535 N. State Highway 161
Irving, TX 75039-2402 USA

Date of Testing:

1/20/2012

Test Site/Location:

PCTEST Lab. Columbia, MD, USA

Test Report Serial No.:

0Y1201110058.A98

FCC ID: A98-CUL7580

APPLICANT: NEC Corporation of America

Application Type: Certification

Model(s): KMP7R4C1-1A

EUT Type: Portable Tablet Computer

Max. RF Output Power: 1.125 mW (0.51 dBm) Peak Conducted

Frequency Range: 2402 – 2480MHz (Bluetooth for US)

Type of Modulation: GFSK, $\pi/4$ -QPSK, 8DPSK

FCC Classification: Digital Transmission System (DTS)

FCC Rule Part(s): Part 15 Subpart C (15.247)

IC Specification(s): RSS-210 Issue 8

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4-2003. Test results reported herein relate only to the item(s) tested.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Grant Conditions: Power output listed is conducted.

PCTEST certifies that no party to this application has been subject to a denial of Federal benefits that includes FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. 862.



Randy Ortanez
President



FCC ID: A98-CUL7580		FCC Pt. 15.247 BLUETOOTH (LE) TEST REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0Y1201110058.A98	Test Dates: 1/20/2012	EUT Type: Portable Tablet Computer		Page 1 of 31

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MEASUREMENT REPORT

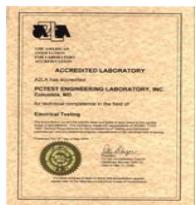
FCC Part 15.247

§ 2.1033 General Information

APPLICANT: NEC Corporation of America
APPLICANT ADDRESS: Radio Communications Systems Division
6535 N. State Highway 161, Irving, TX 75039-2402 USA
TEST SITE: PCTEST ENGINEERING LABORATORY, INC.
TEST SITE ADDRESS: 6660-B Dobbin Road, Columbia, MD 21045 USA
FCC RULE PART(S): Part 15 Subpart C (15.247)
IC SPECIFICATION(S): RSS-210 Issue 8
BASE MODEL: KMP7R4C1-1A
FCC ID: A98-CUL7580
Test Device Serial No.: IMEI# 004401200800270 Production Pre-Production Engineering
IMEI# 004401200800239
FCC CLASSIFICATION: Digital Transmission System (DTS)
Method/System: Frequency Hopping Spread Spectrum (FHSS)
DATE(S) OF TEST: 1/20/2012
TEST REPORT S/N: 0Y1201110058.A98

Test Facility / Accreditations

Measurements were performed at PCTEST Engineering Lab located in Columbia, MD 21045, U.S.A.



- PCTEST facility is an FCC registered (PCTEST Reg. No. 90864) test facility with the site description report on file and has met all the requirements specified in Section 2.948 of the FCC Rules and Industry Canada (2451A-1).
- PCTEST Lab is accredited to ISO 17025 by U.S. National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP Lab code: 100431-0) in EMC, FCC and Telecommunications.
- PCTEST Lab is accredited to ISO 17025-2005 by the American Association for Laboratory Accreditation (A2LA) in Specific Absorption Rate (SAR) testing, Hearing Aid Compatibility (HAC) testing, CTIA Test Plans, and wireless testing for FCC and Industry Canada Rules.
- PCTEST Lab is a recognized U.S. Conformity Assessment Body (CAB) in EMC and R&TTE (n.b. 0982) under the U.S.-EU Mutual Recognition Agreement (MRA).
- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC Guide 65 by the American National Standards Institute (ANSI) in all scopes of FCC Rules and Industry Canada Standards (RSS).
- PCTEST facility is an IC registered (2451A-1) test laboratory with the site description on file at Industry Canada.
- PCTEST is a CTIA Authorized Test Laboratory (CATL) for AMPS, CDMA, and EVDO wireless devices and for Over-the-Air (OTA) Antenna Performance testing for AMPS, CDMA, GSM, GPRS, EGPRS, UMTS (W-CDMA), CDMA 1xEVDO, and CDMA 1xRTT.



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1.0 INTRODUCTION

1.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Industry Canada Certification and Engineering Bureau.

1.2 PCTEST Test Location

The map below shows the location of the PCTEST LABORATORY, its proximity to the FCC Laboratory, the Columbia vicinity area, the Baltimore-Washington Int'l (BWI) airport, the city of Baltimore and the Washington, DC area. (see **Figure 1-1**).

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility in New Concept Business Park, Guilford Industrial Park, Columbia, Maryland. The site address is 6660-B Dobbin Road, Columbia, MD 21045. The test site is one of the highest points in the Columbia area with an elevation of 390 feet above mean sea level. The site coordinates are 39° 11'15" N latitude and 76° 49'38" W longitude. The facility is 1.5 miles North of the FCC laboratory, and the ambient signal and ambient signal strength are approximately equal to those of the FCC laboratory. There are no FM or TV transmitters within 15 miles of the site. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4-2003 on January 28, 2009.

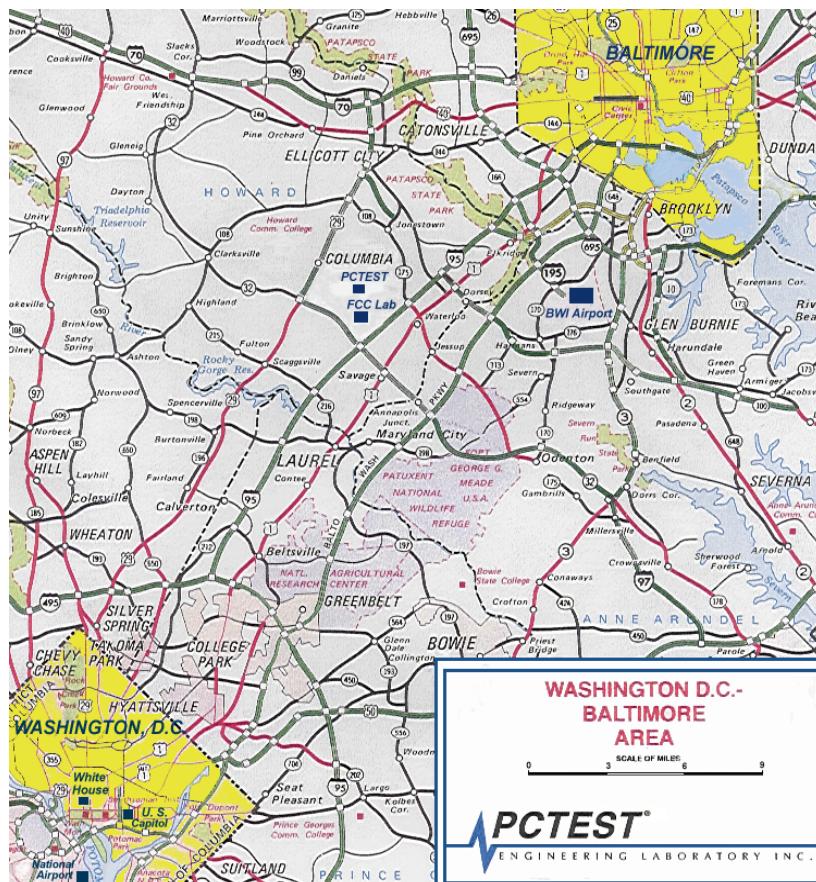


Figure 1-1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **NEC Portable Tablet Computer FCC ID: A98-CUL7580**. The test data contained in this report pertains only to the emissions due to the EUT's Bluetooth transmitter.

- This Bluetooth module has been tested by a Bluetooth Qualification Lab, and we confirm the following:
 - A) The hopping sequence is pseudorandom
 - B) All channels are used equally on average
 - C) The receiver input bandwidth equals the transmit bandwidth
 - D) The receiver hops in sequence with the transmit signal
- 15.247(g): In accordance with the Bluetooth Industry Standard, the system is designed to comply with all of the regulations in Section 15.247 when the transmitter is presented with a continuous data (or information) system.
- 15.247(h): In accordance with the Bluetooth Industry Standard, the system does not coordinate its channels selection/ hopping sequence with other frequency hopping systems for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters.
- The EUT consisted of the following component(s):

Manufacturer / Base Model	FCC ID	Description
NEC / Model: KMP7R4C1-1A	A98-CUL7580	Portable Tablet Computer

Table 2-1. EUT Equipment Description

2.2 Device Capabilities

This device contains the following capabilities:

850/1900 GSM/GPRS, 850 WCDMA, 802.11b/g/n WLAN, Bluetooth (LE), NFC

2.3 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and no modifications were made during testing.

2.4 Labeling Requirements

Per 15.19; Docket 95-19

The label shall be permanently affixed at a conspicuous location on the device; instruction manual or pamphlet supplied to the user and be readily visible to the purchaser at the time of purchase. However, when the device is so small wherein placement of the label with specified statement is not practical, only the trade name and FCC ID must be displayed on the device per Section 15.19(b)(2).

Please see attachment for FCC ID label and label location.

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3.0 DESCRIPTION OF TEST

3.1 Evaluation Procedure

The measurement procedure described in the American National Standard for Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz (ANSI C63.4-2003) and FCC Public Notice DA 00-705 dated March 30, 2000 entitled "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems" were used in the measurement of the **NEC Portable Tablet Computer FCC ID: A98-CUL7580**.

Deviation from measurement procedure.....**None**

3.2 Conducted Emissions

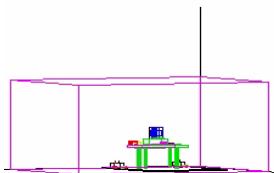


Figure 3-1. Shielded Enclosure Line-Conducted Test Facility

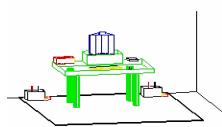


Figure 3-2. Line Conducted Emission Test Set-Up

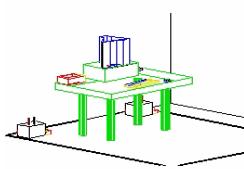


Figure 3-3. Wooden Table & Bonded LISNs

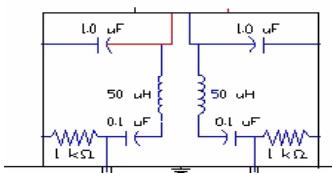


Figure 3-4. LISN Schematic Diagram

The line-conducted facility is located inside a 16'x20'x10' shielded enclosure, manufactured by Ray Proof Series 81 (see *Figure 3-1*). The shielding effectiveness of the shielded room is in accordance with MIL-Std-285 or NSA 65-5. A 1m x 1.5m wooden table 80cm high is placed 40cm away from the vertical wall and 1.5m away from the sidewall of the shielded room (see *Figure 3-2*). Solar Electronics and EMCO Model 3725/2 (10kHz-30MHz) 50Ω/50µH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room (see *Figure 3-3*). The EUT is powered from the Solar LISN and the support equipment is powered from the EMCO LISN. Power to the LISNs are filtered by a high-current high-insertion loss Ray Proof power line filter (100dB 14Hz-10GHz). The purpose of the filter is to attenuate ambient signal interference and this filter is also bonded to the shielded enclosure. All electrical cables are shielded by braided tinned copper zipper tubing with an inner diameter of 1/2". If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply line(s) will be connected to the Solar LISN. The LISN schematic diagram is shown (see *Figure 3-4*). All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion). Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the spectrum analyzer to determine the frequency producing the maximum EME from the EUT.

The spectrum was scanned from 150kHz to 30MHz with a spectrum analyzer. The detector function was set to CISPR quasi-peak and average mode. The bandwidth of the analyzer was set to 10kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each EME emission. Each emission was maximized by: switching power lines; varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and/or support equipment, and powering the monitor from the floor mounted outlet box and the computer aux AC outlet, if applicable; whichever determined the worst-case emission. Photographs of the worst-case emission can be seen in the test setup photographs. Each EME reported was calibrated using the Agilent E8257D (250kHz – 20GHz) PSG Signal Generator.

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3.3 Radiated Emissions

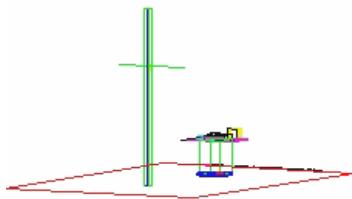


Figure 3-5. 3-Meter Test Site

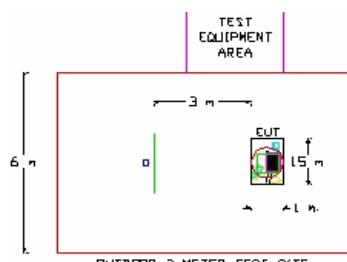


Figure 3-6. Dimensions of Outdoor Test Site

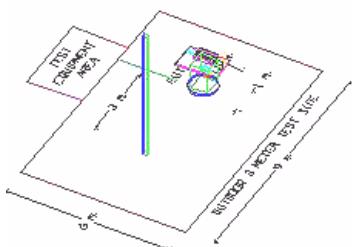


Figure 3-7. Turntable and System Setup

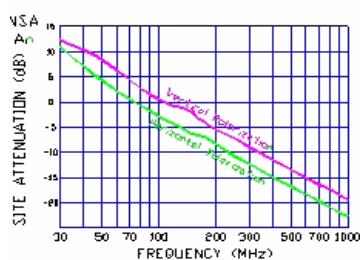


Figure 3-8. Normalized Site Attenuation Curves (H&V)

Preliminary measurements were made indoors at 1-meter using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequency producing the maximum EME. Appropriate precaution was taken to ensure that all EME from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, and turntable azimuth with respect to the antenna was noted for each frequency found. The spectrum was scanned from 30 to 200 MHz using a bi-conical antenna and from 200 to 1000 MHz using a log-spiral antenna. Above 1 GHz, linearly polarized double ridge horn antennas were used.

Final measurements were made outdoors at 3-meter test range using Roberts™ Dipole antennas or horn antennas (see Figure 3-5). The test equipment was placed on a wooden and plastic bench situated on a 1.5m x 2m area adjacent to the measurement area (see Figure 3-6). Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The detector function was set to CISPR quasi-peak mode and the bandwidth of the spectrum analyzer was set to 100kHz for frequencies below 1GHz or 1MHz for frequencies above 1GHz. Above 1GHz the detector function was set to average mode (RBW = 1MHz, VBW = 10Hz).

The half-wave dipole antenna was tuned to the frequency found during preliminary radiated measurements. The EUT, support equipment and interconnecting cables were re-configured to the set-up producing the maximum emission for the frequency and were placed on top of a 0.8-meter high non-metallic 1 x 1.5 meter table (see Figure 3-7). The EUT, support equipment, and interconnecting cables were re-arranged and manipulated to maximize each EME emission. The turntable containing the system was rotated and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by: varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and/or support equipment, and powering the monitor from the floor mounted outlet box and the computer aux AC outlet, if applicable; and changing the polarity of the antenna, whichever determined the worst-case emission. Photographs of the worst-case emission can be seen in the test setup photographs. Each EME reported was calibrated using the Agilent E8257D (250kHz – 20GHz) PSG Signal Generator. The Theoretical Normalized Site Attenuation Curves for both horizontal and vertical polarization are shown in Figure 3-8.

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4.0 ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:

"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section."

- The antennas of the NEC Portable Tablet Computer are **permanently attached**.
- There are no provisions for connection to an external antenna.

Conclusion:

The **NEC Portable Tablet Computer FCC ID: A98-CUL7580** unit complies with the requirement of §15.203.

Ch.	Frequency (MHz)
37	2402
:	:
17	2440
:	:
39	2480

Table 4-1. Frequency/ Channel Operations

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5.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST).

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	8447D	Broadband Amplifier	3/17/2011	Annual	3/17/2012	1937A03348
Agilent	8447D	Broadband Amplifier	3/17/2011	Annual	3/17/2012	2443A01900
Agilent	8449B	(1-26.5GHz) Pre-Amplifier	2/8/2011	Annual	2/8/2012	3008A00985
Agilent	85650A	Quasi-Peak Adapter	4/7/2011	Annual	4/7/2012	3303A01872
Agilent	85650A	Quasi-Peak Adapter	4/7/2011	Annual	4/7/2012	2043A00301
Agilent	8566B	(100Hz-22GHz) Spectrum Analyzer	4/7/2011	Annual	4/7/2012	2618A02866
Agilent	8566B	(100Hz-22GHz) Spectrum Analyzer	4/7/2011	Annual	4/7/2012	2542A11898
Agilent	8566B	(100Hz-22GHz) Spectrum Analyzer	4/7/2011	Annual	4/7/2012	3638A08713
Agilent	E4407B	ESA Spectrum Analyzer	4/5/2011	Annual	4/5/2012	US39210313
Agilent	E8257D	(250kHz-20GHz) Signal Generator	4/8/2011	Annual	4/8/2012	MY45470194
Agilent	N9038A	MXE EMI Receiver	8/5/2011	Annual	8/5/2012	MY51210133
Emco	3115	Horn Antenna (1-18GHz)	4/8/2010	Biennial	4/8/2012	9205-3874
Emco	3816/2	LISN	11/5/2010	Biennial	11/5/2012	9707-1077
Emco	3816/2	LISN	11/3/2010	Biennial	11/3/2012	9707-1079
MiniCircuits	VHF-3100+	High Pass Filter	6/10/2011	Annual	6/10/2012	30721
Pasternack	PE2209-10	Bidirectional Coupler	6/3/2011	Annual	6/3/2012	N/A
Rohde & Schwarz	CMU200	Base Station Simulator	6/1/2011	Annual	6/1/2012	833855/0010
Sunol	DRH-118	Horn Antenna (1 - 18GHz)	7/5/2011	Biennial	7/5/2013	A050307

Table 5-1. Annual Test Equipment Calibration Schedule

FCC ID: A98-CUL7580		FCC Pt. 15.247 BLUETOOTH (LE) TEST REPORT (CERTIFICATION)		Reviewed by: Quality Manager
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6.0 TEST RESULTS

6.1 Summary

Company Name: NEC Corporation of America
 FCC ID: A98-CUL7580
 Method/System: Frequency Hopping Spread Spectrum (FHSS)
 Number of Channels: 40

FCC Part Section(s)	RSS Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
TRANSMITTER MODE (Tx)						
15.247(a)(1)(iii)	RSS-210 [A8.1]	6dB Bandwidth	< 1 MHz only if using less than 15 non-overlapping channels	CONDUCTED	PASS	Section 6.2
15.247(b)(1)	RSS-210 [A8.4(2)]	Peak Transmitter Output Power	< 1 Watt if \geq 75 non-overlapping channels used		PASS	Section 6.3
15.247(e)	RSS-210 [A8.2]	Transmitter Power Spectral Density	< 8dBm / 3kHz Band		PASS	Section 6.4
15.247(d)	RSS-210 [A8.5]	Band Edge / Out-of-Band Emissions	Conducted < 20dBc		PASS	Section 6.5, Section 6.6
15.205 15.209	RSS-210 [A8.5]	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209 (RSS-210 table 3 limits)	RADIATED	PASS	Section 6.7, Section 6.8
15.207	RSS-Gen [7.2.2]	AC Conducted Emissions 150kHz – 30MHz	< FCC 15.207 limits or < RSS-Gen table 2 limits	LINE CONDUCTED	PASS	Section 6.9
RECEIVER MODE (Rx) / DIGITAL DEVICE						
15.107	RSS-Gen [7.2.2]	AC Conducted Emissions 150kHz – 30MHz	< FCC 15.107 limits or < RSS-Gen table 2 limits	LINE CONDUCTED	PASS	Part 15B Test Report
15.109	RSS-Gen [7.2.3.2]	General Field Strength Limits (Restricted Bands and Radiated Emissions Limits)	< FCC 15.109 limits or < RSS-Gen limits [Section 6; Table1]	RADIATED (30MHz-1GHz) (1-25 GHz)	PASS	Part 15B Test Report

Table 6-1. Summary of Test Results

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6.2 6 dB Bandwidth Measurement - Bluetooth (LE)

§15.247 (a)(1)(iii); RSS-210 (A8.1)

The bandwidth at 6dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the receive antenna while the EUT is operating in transmission mode at the appropriate frequencies. *The maximum permissible 6dB bandwidth is 500 kHz, unless more than 15 non-overlapping channels are employed.*

Frequency [MHz]	Channel No.	Bluetooth Mode	Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
2402	37	LE	0.693	0.500	Pass
2440	17	LE	0.697	0.500	Pass
2480	39	LE	0.697	0.500	Pass

Table 6-2. Conducted 6dB Bandwidth Measurements

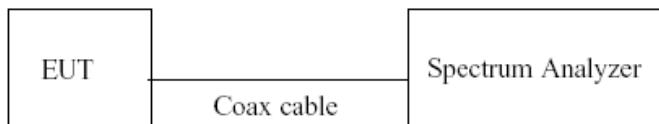
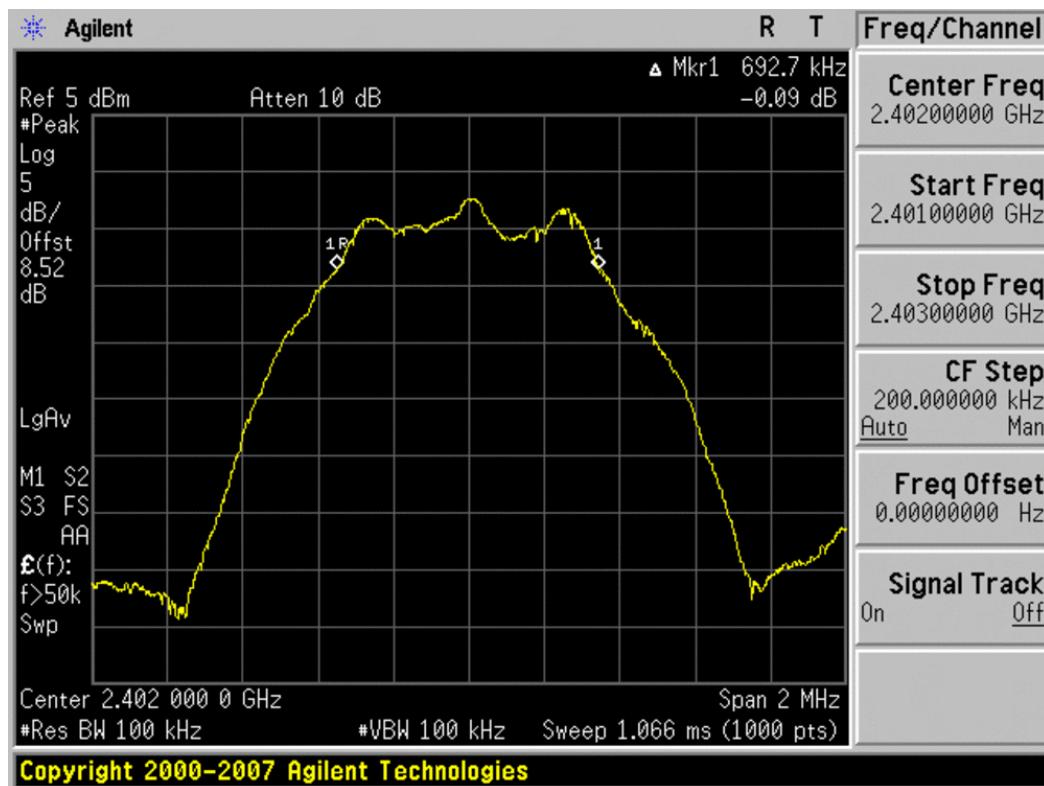
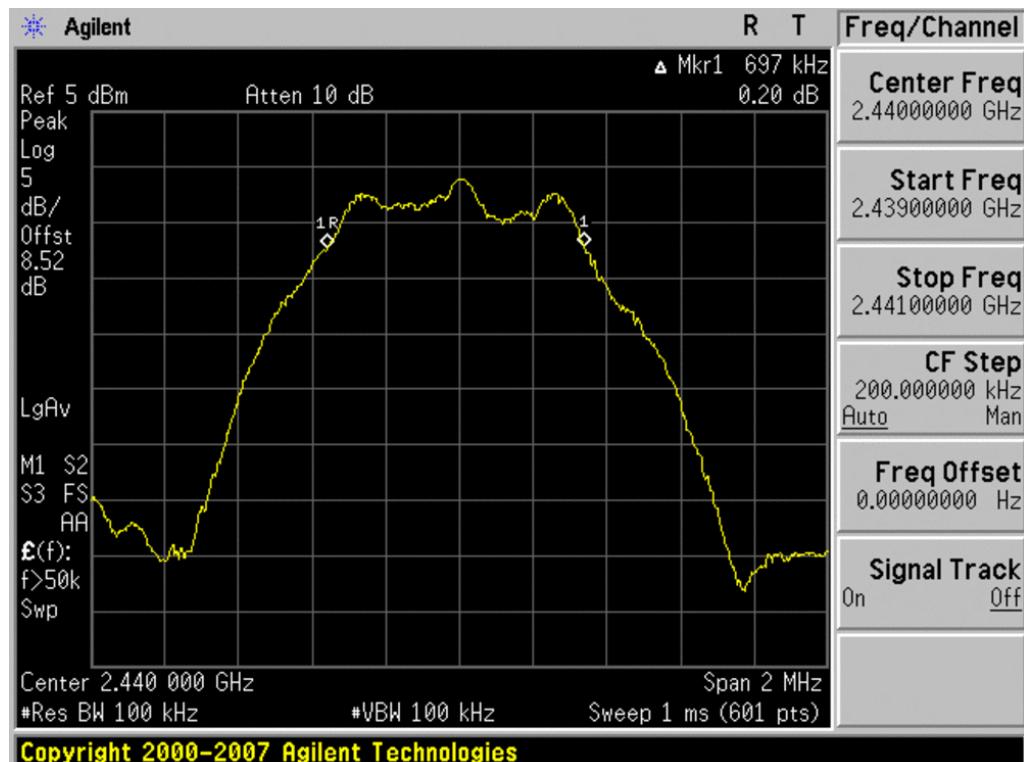


Figure 6-1. Test Instrument & Measurement Setup

FCC ID: A98-CUL7580		FCC Pt. 15.247 BLUETOOTH (LE) TEST REPORT (CERTIFICATION)		Reviewed by: Quality Manager
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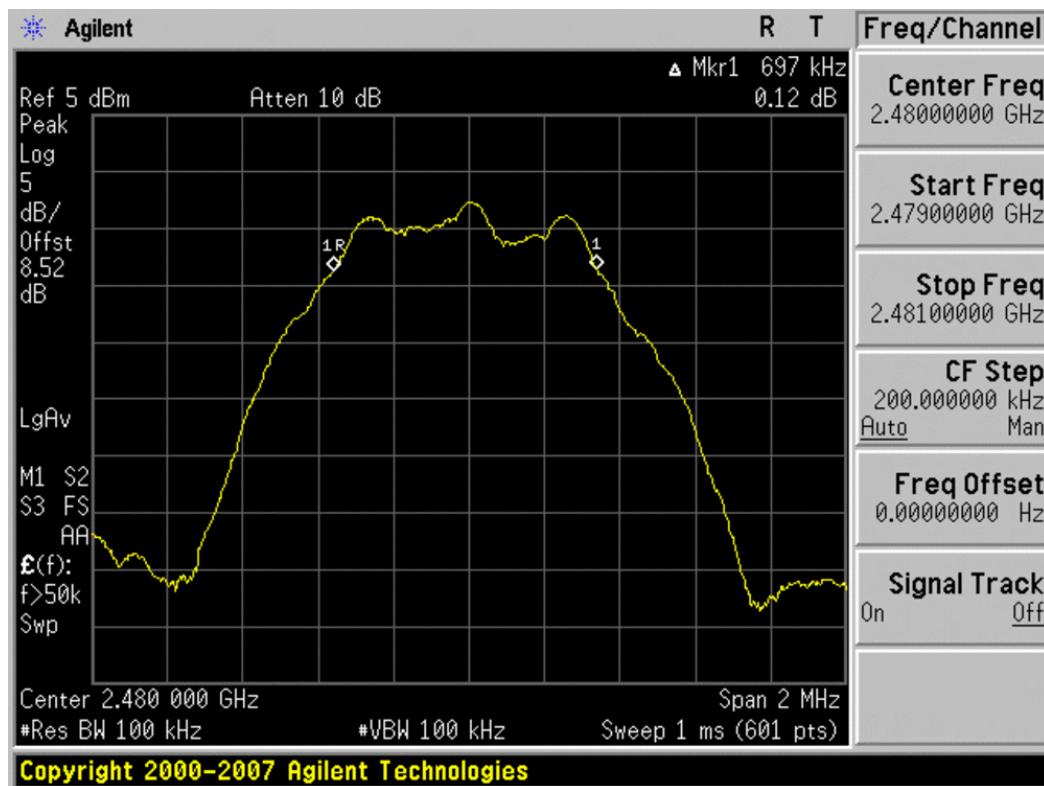


Plot 6-1. 6 dB Bandwidth Plot (Bluetooth (LE) – Ch. 37)



Plot 6-2. 6 dB Bandwidth Plot (Bluetooth (LE) – Ch. 17)

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Plot 6-3. 6 dB Bandwidth Plot (Bluetooth (LE) – Ch. 39)

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6.3 Output Power Measurement – Bluetooth (LE)

§15.247 (b)(1); RSS-210 (A8.4 (2))

Measurement is made while the EUT is operating in non-hopping transmission mode. The powers shown below are peak powers measured using a spectrum analyzer set to peak detector with RBW = VBW = 3MHz. **The maximum permissible output power is 1 Watt.**

Frequency [MHz]	Bluetooth Mode	Channel No.	Peak Conducted Power	
			[dBm]	[mW]
2402	LE	37	-0.53	0.885
2440	LE	17	0.51	1.125
2480	LE	39	-1.12	0.774

Table 6-3. Conducted Output Power Measurements (Bluetooth LE)

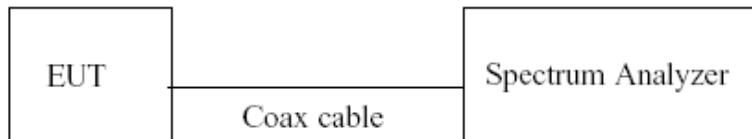


Figure 6-2. Test Instrument & Measurement Setup

Note: Final results were obtained using calibrated couplers, attenuators and cables. The following formula was used:

$$\text{Output Power (dBm)} = \text{Raw Analyzer Level (dBm)} + \text{Cable Loss (dB)}$$

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6.4 Power Spectral Density – Bluetooth (LE)

§15.247(e); RSS-210 [A8.2]

The peak power density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies. ***The maximum permissible power spectral density is 8 dBm in any 3 kHz band.***

Frequency [MHz]	Channel No.	Bluetooth Mode	Measured Power Spectral Density [dBm]	Maximum Permissible Power Density [dBm / 3kHz]	Margin [dB]
2402	37	LE	-21.23	8.0	-29.23
2440	17	LE	-18.19	8.0	-26.19
2480	39	LE	-19.66	8.0	-27.66

Table 6-4. Conducted Power Density Measurements

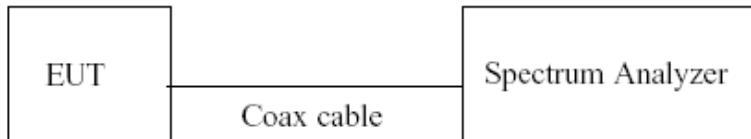
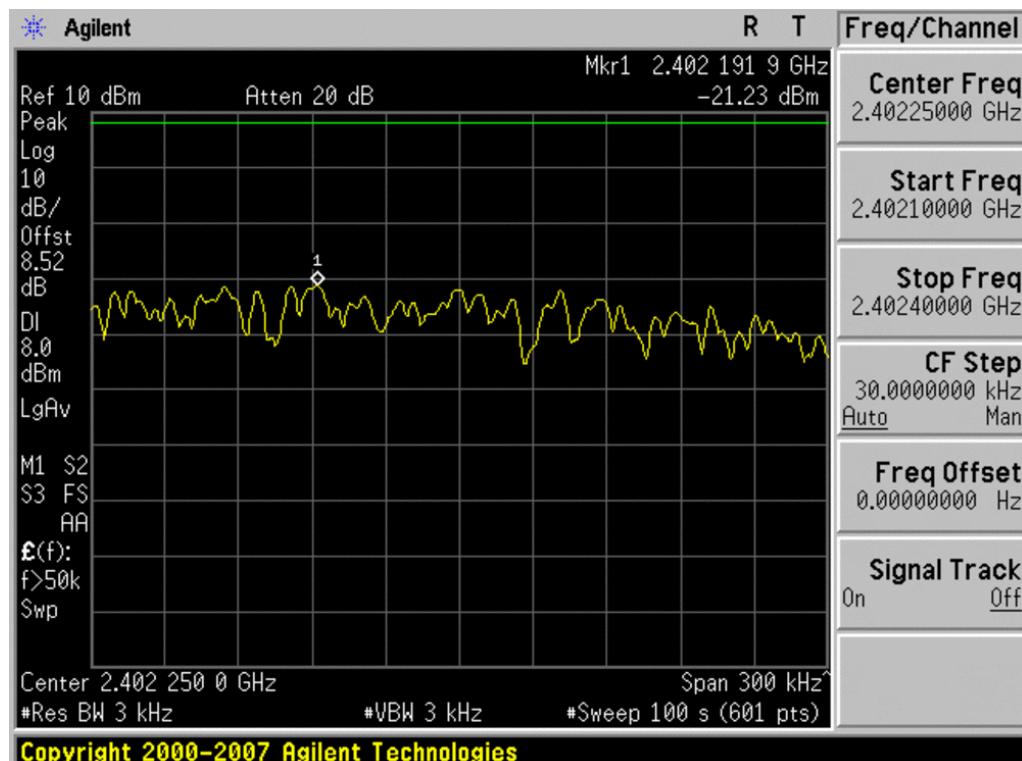
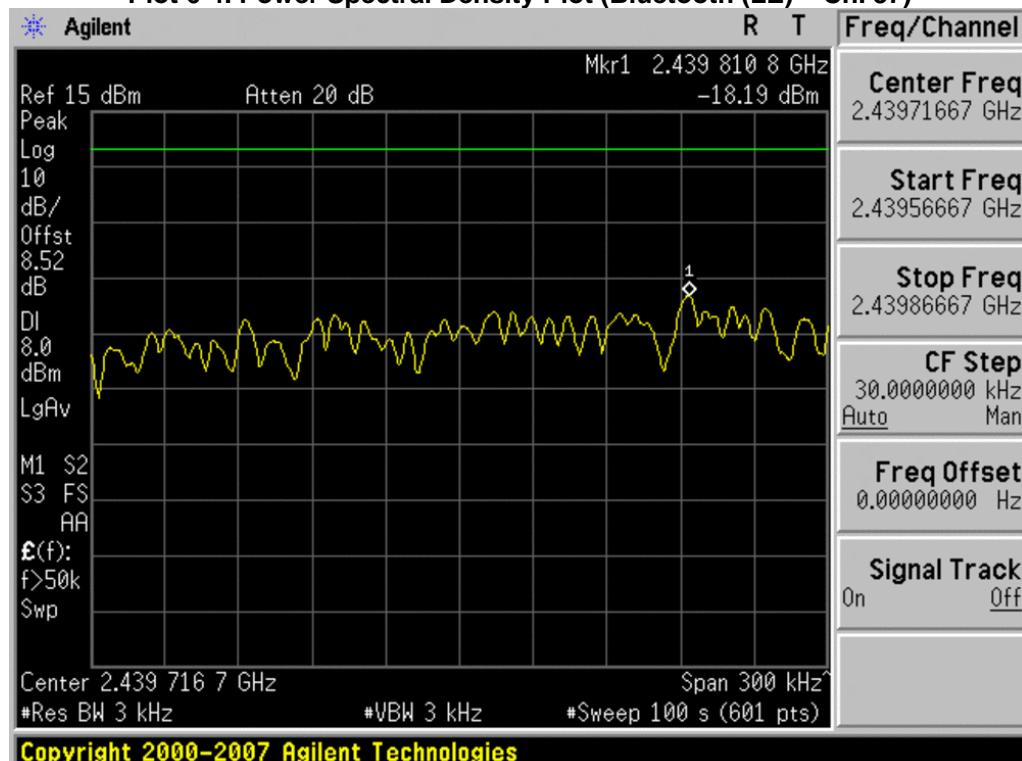


Figure 6-3. Test Instrument & Measurement Setup

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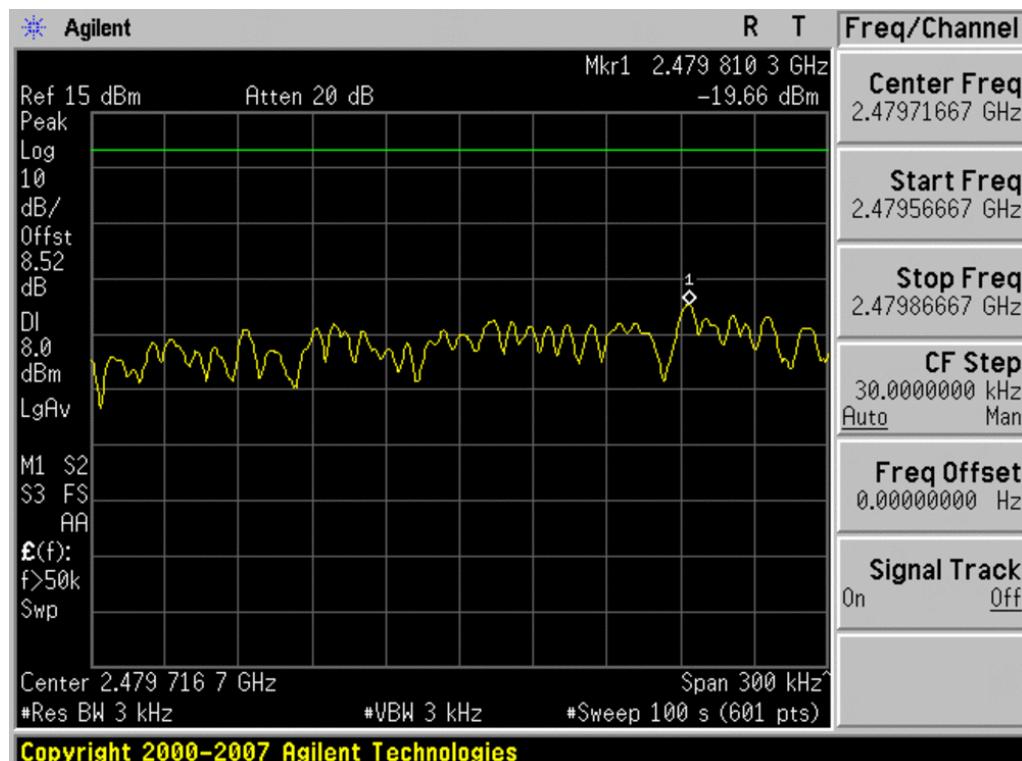


Plot 6-4. Power Spectral Density Plot (Bluetooth (LE) – Ch. 37)



Plot 6-5. Power Spectral Density Plot (Bluetooth (LE) – Ch. 17)

FCC ID: A98-CUL7580		FCC Pt. 15.247 BLUETOOTH (LE) TEST REPORT (CERTIFICATION)		Reviewed by: Quality Manager
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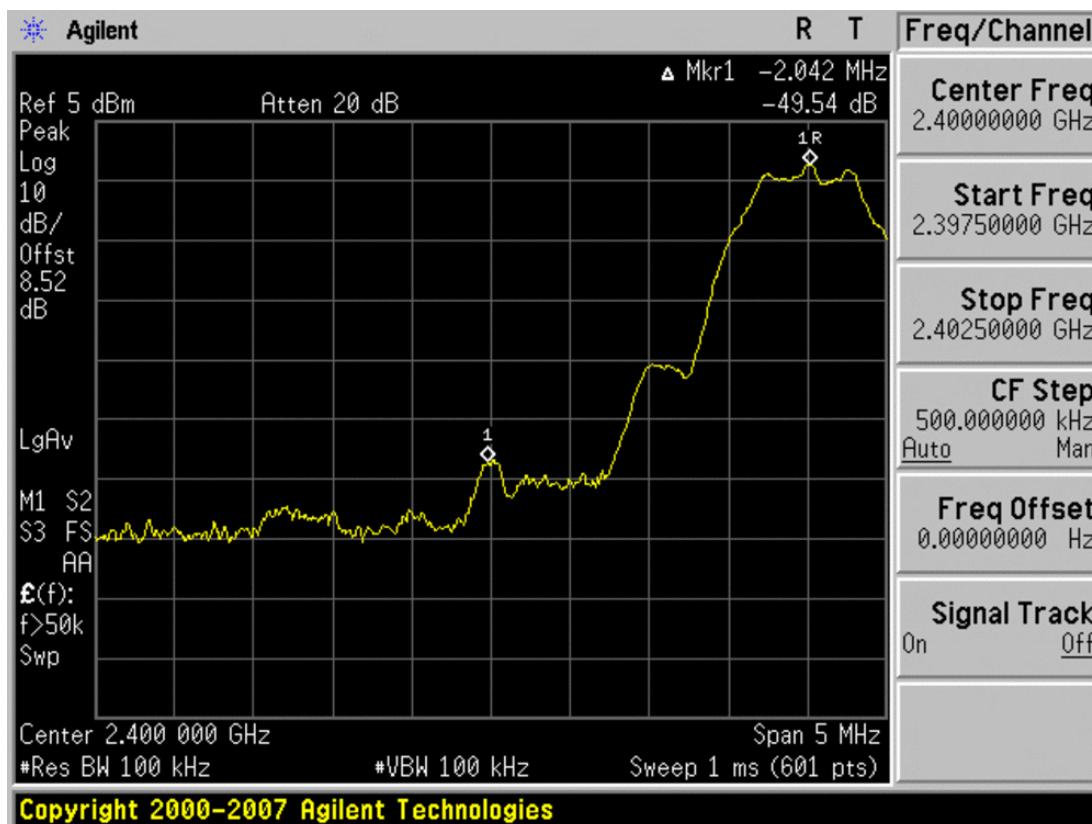
Plot 6-6. Power Spectral Density Plot (Bluetooth (LE) – Ch. 39)

FCC ID: A98-CUL7580		FCC Pt. 15.247 BLUETOOTH (LE) TEST REPORT (CERTIFICATION)		Reviewed by: Quality Manager
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6.5 Band Edge Compliance

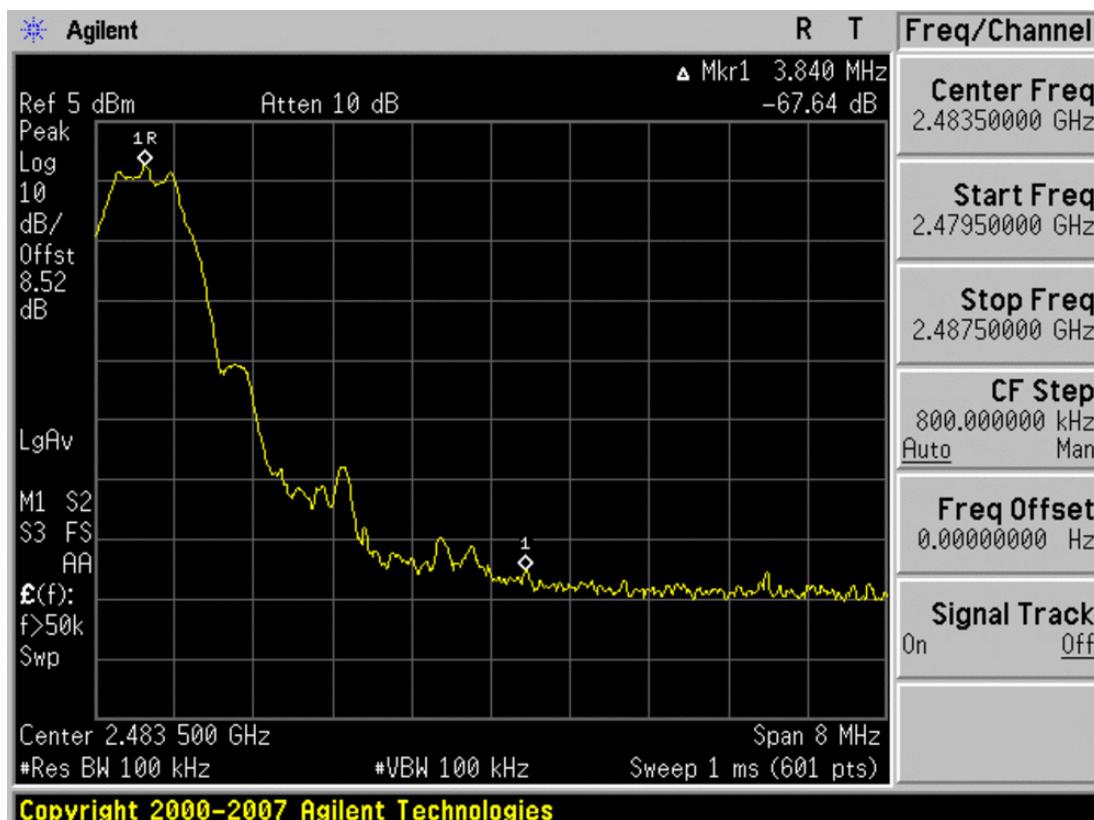
§15.247 (d); RSS-210 (A8.5)

For the following out of band conducted spurious emissions plots at the band edge, the EUT was set to transmit at maximum power with the largest packet size available. These settings produced the worst-case emissions.



Plot 6-7. Band Edge Plot (Bluetooth LE – Ch. 37)

FCC ID: A98-CUL7580		FCC Pt. 15.247 BLUETOOTH (LE) TEST REPORT (CERTIFICATION)		Reviewed by: Quality Manager
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Plot 6-8. Band Edge Plot (Bluetooth LE – Ch. 39)

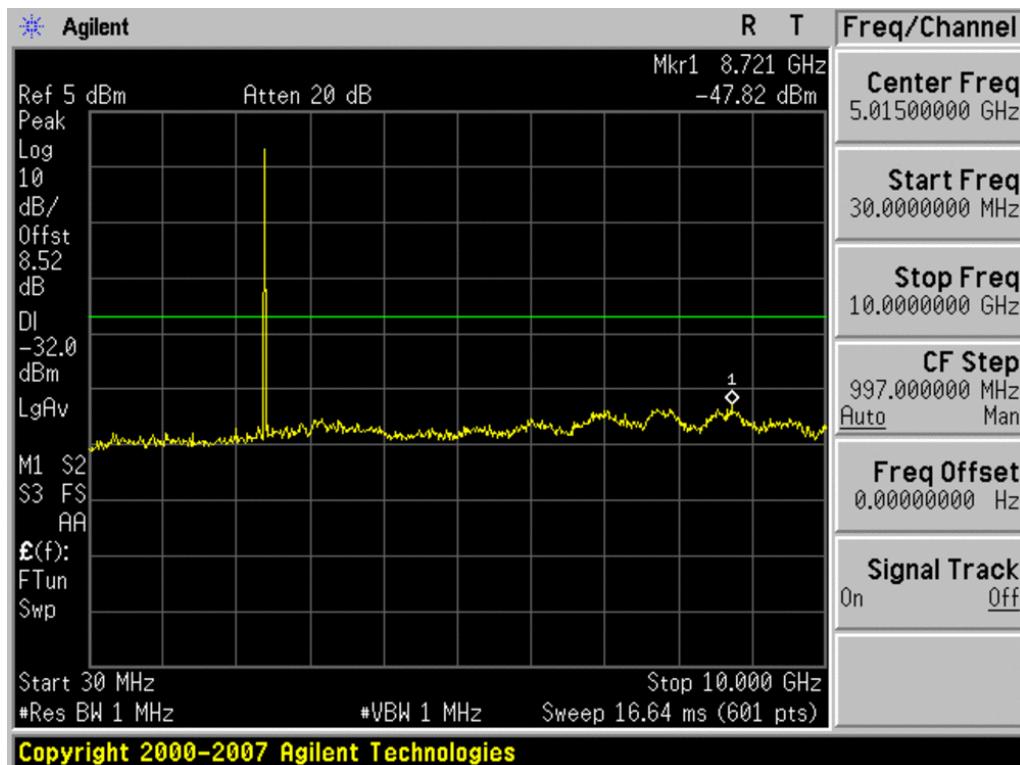
FCC ID: A98-CUL7580	PCTEST ENGINEERING LABORATORY, INC.	FCC Pt. 15.247 BLUETOOTH (LE) TEST REPORT (CERTIFICATION)	NEC	Reviewed by: Quality Manager
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6.6 Conducted Spurious Emissions

§15.247 (d)

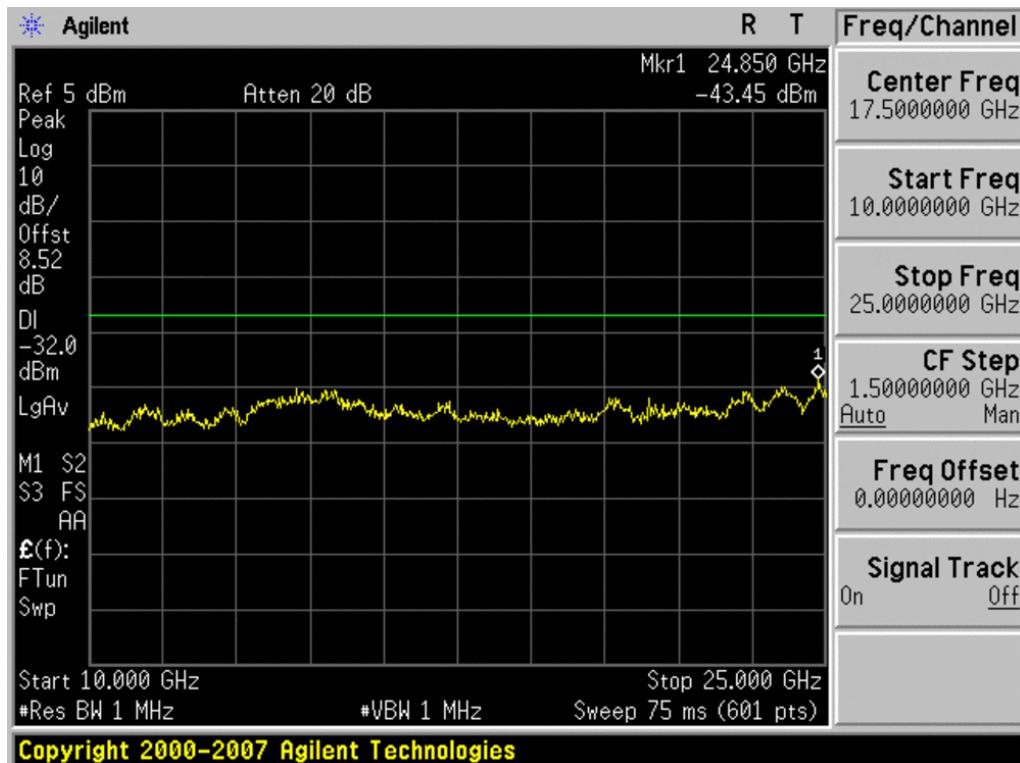
For the following out of band conducted spurious emissions plots, the EUT was set to transmit at maximum power with the largest packet size available. The worst case spurious emissions were found in this configuration.

The display line shown in the following plots denotes the limit at NEC Corporation of AmericadB below the fundamental emission level measured in a 100kHz bandwidth. However, since the traces in the following plots are measured with a 1MHz RBW, the display line may not necessarily appear to be NEC Corporation of AmericadB below the level of the fundamental in a 1MHz bandwidth.

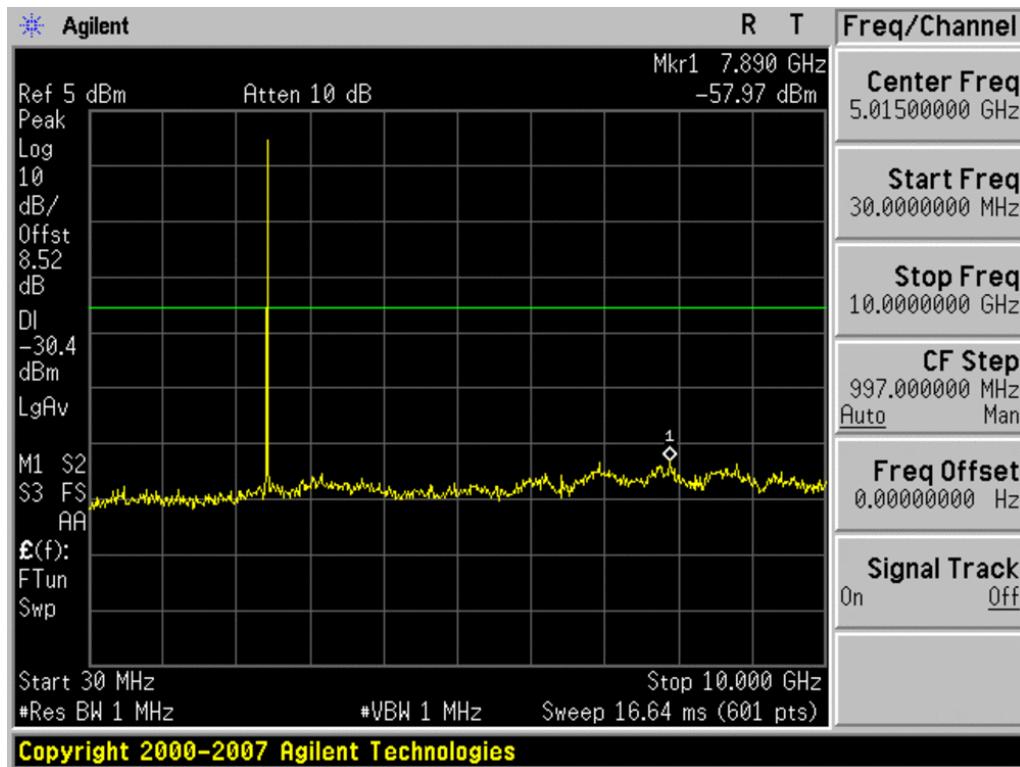


Plot 6-9. Conducted Spurious Plot (Bluetooth LE – Ch. 37)

FCC ID: A98-CUL7580		FCC Pt. 15.247 BLUETOOTH (LE) TEST REPORT (CERTIFICATION)		Reviewed by: Quality Manager
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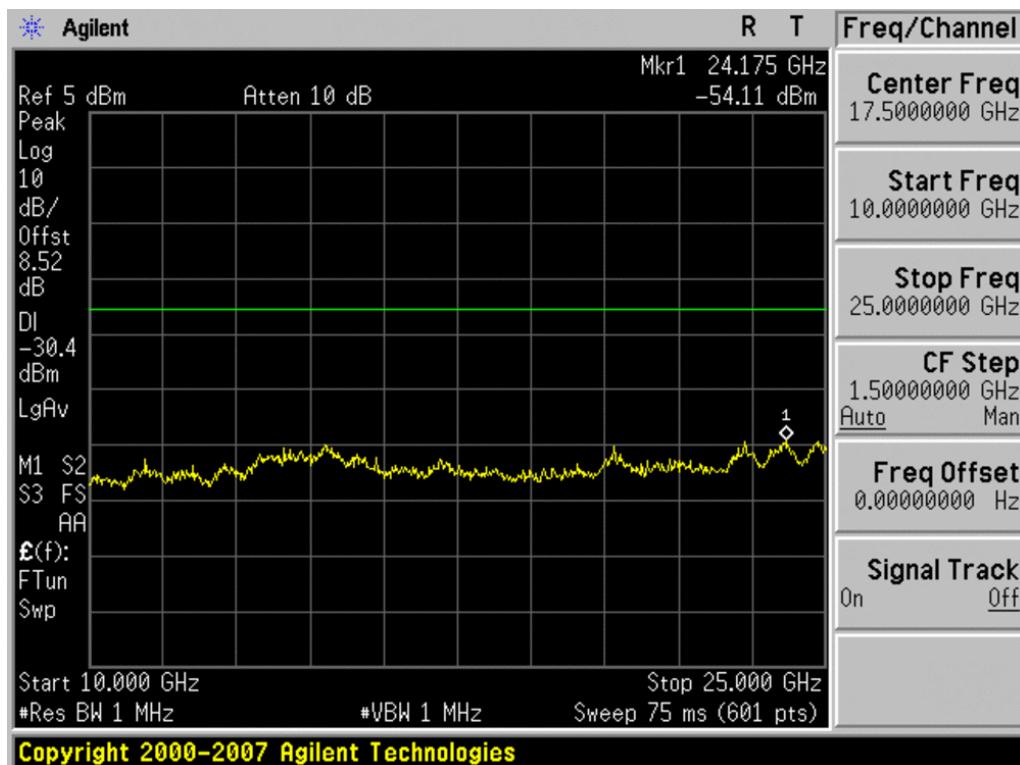


Plot 6-10. Conducted Spurious Plot (Bluetooth LE – Ch. 37)

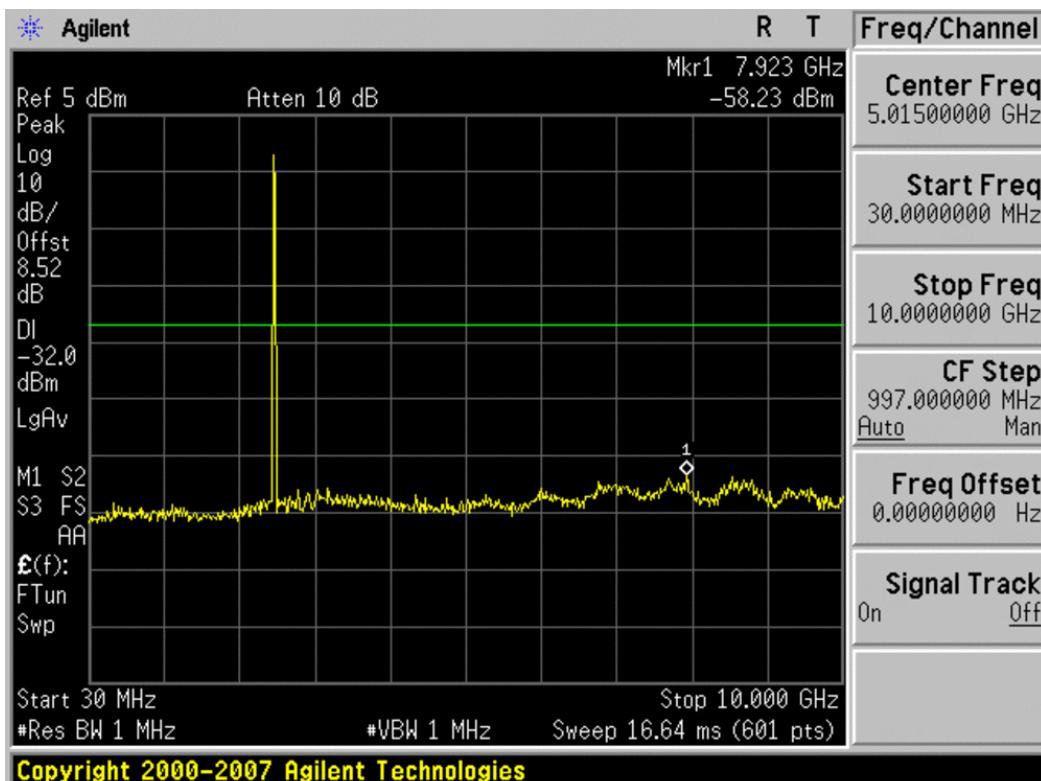


Plot 6-11. Conducted Spurious Plot (Bluetooth LE – Ch. 17)

FCC ID: A98-CUL7580		FCC Pt. 15.247 BLUETOOTH (LE) TEST REPORT (CERTIFICATION)		Reviewed by: Quality Manager
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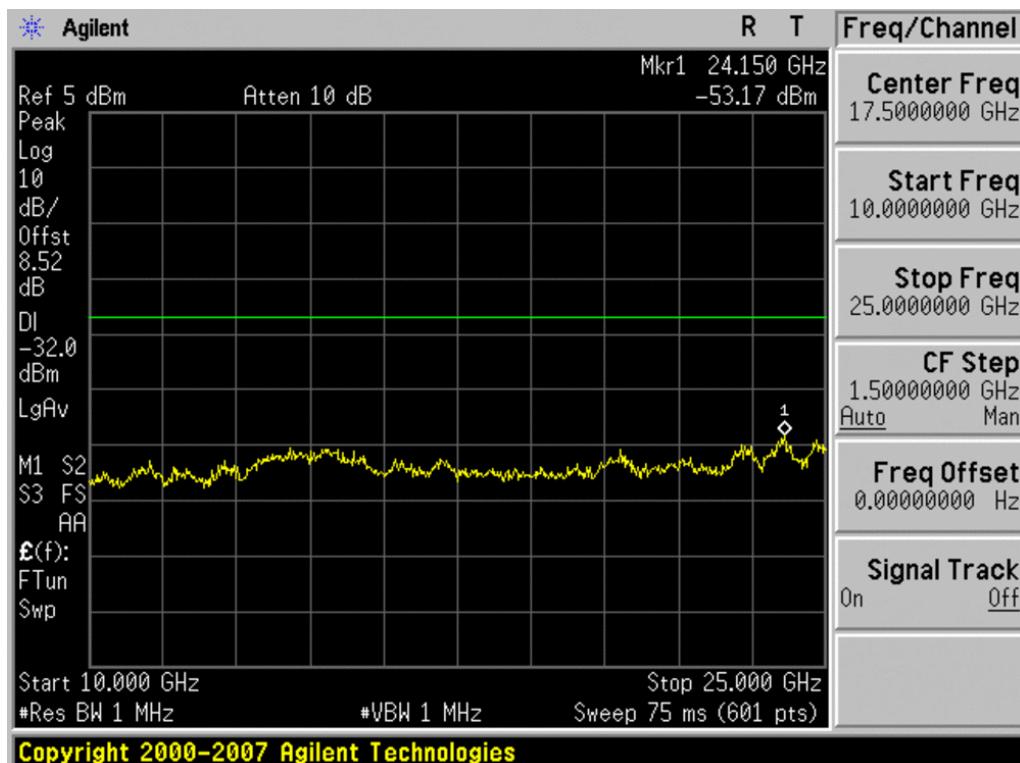


Plot 6-12. Conducted Spurious Plot (Bluetooth LE – Ch. 17)



Plot 6-13. Conducted Spurious Plot (Bluetooth LE – Ch. 39)

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Plot 6-14. Conducted Spurious Plot (Bluetooth LE – Ch. 39)

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6.7 Radiated Spurious Emission Measurements

§15.205 & §15.209, §15.247 (d); RSS-210 (A8.5)

The EUT was tested from 9kHz and up to the 10th harmonic of the fundamental frequency of the transmitter using CISPR quasi peak detector below 1GHz. Above 1 GHz, average measurement was used, using RBW = 1MHz, VBW = 1kHz $\geq 1/\tau$ Hz, where τ is the Bluetooth pulse width in seconds, and linearly polarized horn antennas. All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Table 6-5 per Section 15.209. This unit was tested with all possible data rates and the highest power is reported with the unit transmitting at 3Mbps. No significant radiated emissions were found in the 2310 - 2390MHz restricted band.

Frequency	Field Strength [μ V/m]	Measured Distance [Meters]
0.009 – 0.490 MHz	2400/F (kHz)	300
0.490 – 1.705 MHz	24000/F (kHz)	30
1.705 – 30.00 MHz	30	30
30.00 – 88.00 MHz	100	3
88.00 – 216.0 MHz	150	3
216.0 – 960.0 MHz	200	3
Above 960.0 MHz	500	3

Table 6-5. Radiated Limits

Sample Calculation

- Field Strength Level [$\text{dB}_{\mu\text{V/m}}$] = Analyzer Level [dBm] + 107 + AFCL [dB] + Duty Cycle Correction [dB]

Notes:

- AFCL = Antenna Factor [dB] + Cable Loss [dB]
- Duty Cycle Correction Factor Calculation:
 - Time to cycle through all channels = $\Delta t = \tau$ [ms] \times 79 channels, where τ = pulse width
 - $100\text{ms} / \Delta t$ [ms] = $H \rightarrow$ Round up to next highest integer, to account for worst case, H'
 - Worst Case Dwell Time = τ [ms] \times H'
 - Duty Cycle Correction = $20\log(\text{Worst Case Dwell Time}/100\text{ms})$ [dB]

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Radiated Spurious Emission Measurements (Cont'd)

§15.205 & §15.209, §15.247 (d); RSS-210 (A8.5)

Mode: Bluetooth
Measurement Distance: 1 Meters
Operating Frequency: 2402MHz
Channel: 37

Frequency [MHz]	Analyzer Level [dBm]	Detector	Pol [H/V]	AFCL [dB]	Dist. Corr. Factor [dB]	Field Strength [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]
4804.00	-105.58	Avg	H	42.59	-9.54	34.47	53.98	-19.51
4804.00	-95.55	Peak	H	42.59	-9.54	44.49	73.98	-29.49
12010.00	-135.00	Avg	H	62.23	0.00	34.23	53.98	-19.75
12010.00	-125.00	Peak	H	62.23	0.00	44.23	73.98	-29.75

Table 6-6. Radiated Measurements

NOTES:

1. All emissions shown lie in the restricted bands specified in §15.205 and are below the limit shown in Table 6-5.
2. Average measurements > 1GHz using RBW = 1MHz and VBW = 1kHz $\geq 1/\tau$ Hz, where τ = pulse width in seconds. Peak measurements > 1GHz using RBW = VBW = 1MHz.
3. The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.
4. The EUT is supplied with nominal AC voltage and/or a new/fully-recharged battery.
5. The spectrum is measured from 9kHz to the 10th harmonic and the worst-case emissions are reported. No significant emissions were found beyond the fifth harmonic for this device.
6. Levels at - 135 dBm represent the analyzer noise floor and signify that no emission was detected.
7. Above 960MHz the limit is 500 μ V/m (54dB μ /m) at 3 meters radiated.

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Radiated Spurious Emission Measurements (Cont'd)

§15.205 & §15.209, §15.247 (d); RSS-210 (A8.5)

Mode: Bluetooth
Measurement Distance: 1 Meters
Operating Frequency: 2440MHz
Channel: 17

Frequency [MHz]	Analyzer Level [dBm]	Detector	Pol [H/V]	AFCL [dB]	Dist. Corr. Factor [dB]	Field Strength [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]
4880.00	-105.97	Avg	H	42.81	-9.54	34.30	53.98	-19.68
4880.00	-96.47	Peak	H	42.81	-9.54	43.80	73.98	-30.18
7320.00	-135.00	Avg	H	49.54	0.00	21.54	53.98	-32.44
7320.00	-125.00	Peak	H	49.54	0.00	31.54	73.98	-42.44
12200.00	-135.00	Avg	H	63.35	0.00	35.35	53.98	-18.63
12200.00	-125.00	Peak	H	63.35	0.00	45.35	73.98	-28.63

Table 6-7. Radiated Measurements

NOTES:

1. All emissions shown lie in the restricted bands specified in §15.205 and are below the limit shown in Table 6-5.
2. Average measurements > 1GHz using RBW = 1MHz and VBW = 1kHz $\geq 1/\tau$ Hz, where τ = pulse width in seconds. Peak measurements > 1GHz using RBW = VBW = 1MHz.
3. The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.
4. The EUT is supplied with nominal AC voltage and/or a new/fully-recharged battery.
5. The spectrum is measured from 9kHz to the 10th harmonic and the worst-case emissions are reported. No significant emissions were found beyond the fifth harmonic for this device.
6. Levels at - 135 dBm represent the analyzer noise floor and signify that no emission was detected.
7. Above 960MHz the limit is 500 μ V/m (54dB μ /m) at 3 meters radiated.

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Radiated Spurious Emission Measurements (Cont'd)

§15.205 & §15.209, §15.247 (d); RSS-210 (A8.5)

Mode: Bluetooth
Measurement Distance: 1 Meters
Operating Frequency: 2480MHz
Channel: 39

Frequency [MHz]	Analyzer Level [dBm]	Detector	Pol [H/V]	AFCL [dB]	Dist. Corr. Factor [dB]	Field Strength [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]
4960.00	-103.80	Avg	H	43.11	-9.54	36.76	53.98	-17.22
4960.00	-96.63	Peak	H	43.11	-9.54	43.93	73.98	-30.05
7440.00	-135.00	Avg	H	49.68	0.00	21.68	53.98	-32.30
7440.00	-125.00	Peak	H	49.68	0.00	31.68	73.98	-42.30
12400.00	-135.00	Avg	H	63.59	0.00	35.59	53.98	-18.39
12400.00	-125.00	Peak	H	63.59	0.00	45.59	73.98	-28.39

Table 6-8. Radiated Measurements

NOTES:

1. All emissions shown lie in the restricted bands specified in §15.205 and are below the limit shown in Table 6-5.
2. Average measurements > 1GHz using RBW = 1MHz and VBW = 1kHz $\geq 1/\tau$ Hz, where τ = pulse width in seconds. Peak measurements > 1GHz using RBW = VBW = 1MHz.
3. The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.
4. The EUT is supplied with nominal AC voltage and/or a new/fully-recharged battery.
5. The spectrum is measured from 9kHz to the 10th harmonic and the worst-case emissions are reported. No significant emissions were found beyond the fifth harmonic for this device.
6. Levels at - 135 dBm represent the analyzer noise floor and signify that no emission was detected.
7. Above 960MHz the limit is 500 μ V/m (54dB μ /m) at 3 meters radiated.

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6.8 Radiated Restricted Band Edge Measurements

§15.205 & §15.209, §15.247 (d); RSS-210 (A8.5)

Mode: Bluetooth
Measurement Distance: 1 Meters
Operating Frequency: 2480MHz
Channel: 39

Frequency [MHz]	Analyzer Level [dBm]	Detector	Pol [H/V]	AFCL [dB]	Dist. Corr. Factor [dB]	Field Strength [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]
2483.54	-104.50	Avg	H	36.41	-9.54	29.37	53.98	-24.61
2483.54	-95.92	Peak	H	36.41	-9.54	37.95	73.98	-36.03
2484.92	-104.88	Avg	H	36.42	-9.54	29.00	53.98	-24.98
2484.92	-95.98	Peak	H	36.42	-9.54	37.90	73.98	-36.08
2499.03	-105.36	Avg	H	36.45	-9.54	28.55	53.98	-25.43
2499.03	-96.10	Peak	H	36.45	-9.54	37.80	73.98	-36.18

Table 6-9. Radiated Restricted Band Edge Measurements at 3-meters

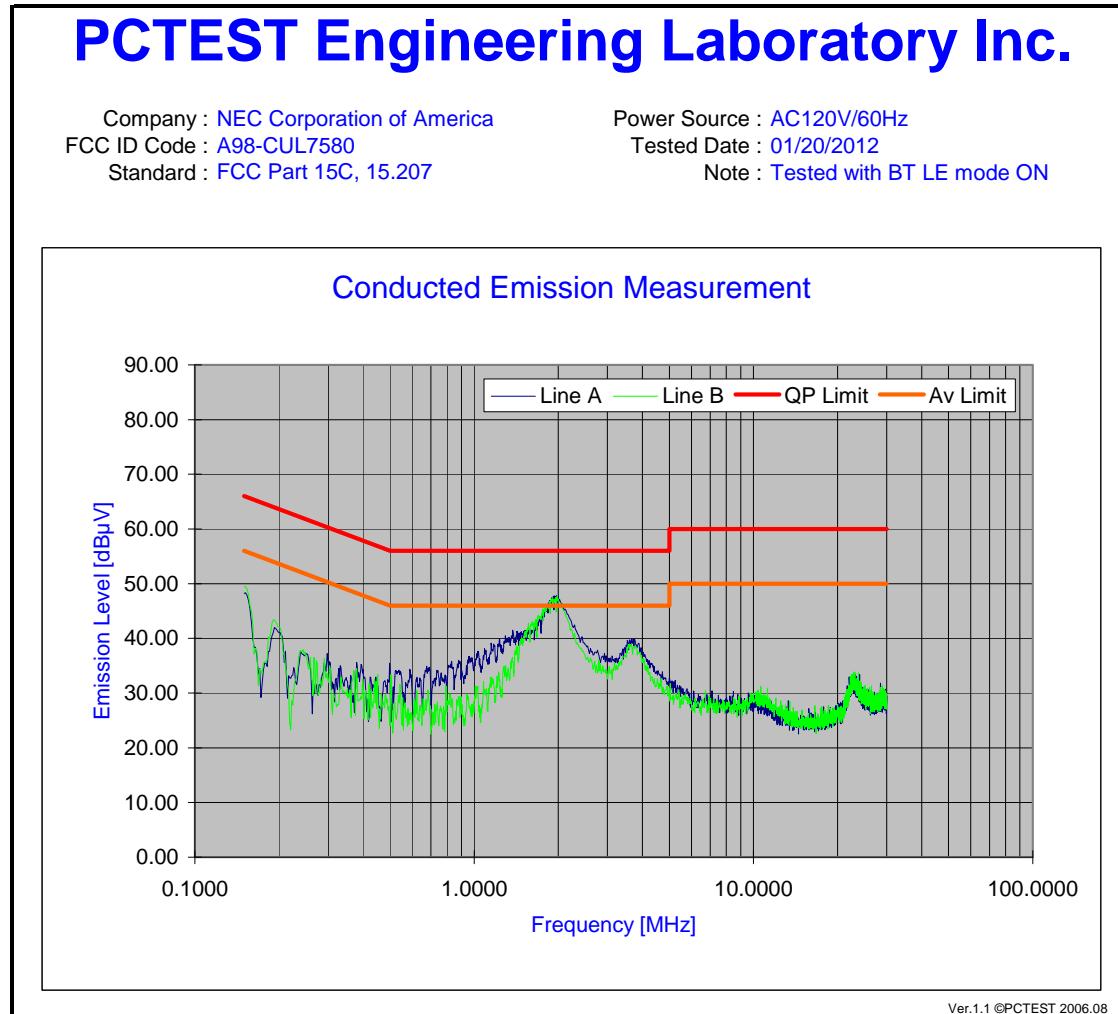
NOTES:

1. All emissions shown lie in the restricted bands specified in §15.205 and are below the limit shown in Table 6-5.
2. Average measurements > 1GHz using RBW = 1MHz and VBW = 1kHz $\geq 1/\tau$ Hz, where τ = pulse width in seconds. Peak measurements > 1GHz using RBW = VBW = 1MHz.
3. The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.
4. The EUT is supplied with nominal AC voltage and/or a new/fully-recharged battery.
5. The spectrum is measured from 9kHz to the 10th harmonic and the worst-case emissions are reported. No significant emissions were found beyond the fifth harmonic for this device.
6. Levels at - 135 dBm represent the analyzer noise floor and signify that no emission was detected.
7. Above 960MHz the limit is 500 μ V/m (54dB μ /m) at 3 meters radiated.

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6.9 Line-Conducted Test Data

§15.207; RSS-Gen (7.2.2)



Plot 6-15. Line Conducted Plot with Bluetooth

Notes:

1. All modes of operation were investigated and the worst-case emissions are reported. The Low, Mid, and High channels were also investigated for the AC line conducted, and all channels showed the same level of emissions. Therefore, the mid channel was selected for final measurements as shown in the data tables.
2. The limit for Class B device(s) from 150kHz to 30MHz are specified in Section 15.207 of the Title 47 CFR.
3. Line A = Phase; Line B = Neutral
4. Traces shown in plot are made using a peak detector.
5. Deviations to the Specifications: None.

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Line-Conducted Test Data (Cont'd)

§15.207; RSS-Gen (7.2.2)

No.	Line	Frequency [MHz]	Factor [dB]	QP [dB μ V]	Limit [dB μ V]	Margin [dB]	Average [dB μ V]	Limit [dB μ V]	Margin [dB]
1	A	0.150	6.85	52.29	66.00	-13.71	36.83	56.00	-19.17
2	A	1.171	7.07	35.65	56.00	-20.35	23.76	46.00	-22.24
3	A	1.235	7.07	37.68	56.00	-18.32	28.83	46.00	-17.17
4	A	1.286	7.08	37.62	56.00	-18.38	27.53	46.00	-18.47
5	A	1.335	7.09	38.02	56.00	-17.98	27.38	46.00	-18.62
6	A	1.384	7.09	39.16	56.00	-16.84	29.72	46.00	-16.28
7	A	1.385	7.09	39.00	56.00	-17.00	25.33	46.00	-20.67
8	A	1.433	7.10	39.42	56.00	-16.58	29.41	46.00	-16.59
9	A	1.949	7.15	45.41	56.00	-10.59	32.09	46.00	-13.91
10	A	3.696	7.32	37.94	56.00	-18.06	27.74	46.00	-18.26
11	B	0.150	6.84	53.95	66.00	-12.05	38.70	56.00	-17.30
12	B	0.179	6.86	47.16	64.53	-17.37	29.59	54.53	-24.94
13	B	1.279	7.08	32.12	56.00	-23.88	23.19	46.00	-22.81
14	B	1.280	7.08	32.24	56.00	-23.76	24.14	46.00	-21.86
15	B	1.426	7.10	36.91	56.00	-19.09	27.46	46.00	-18.54
16	B	1.427	7.10	36.87	56.00	-19.13	27.77	46.00	-18.23
17	B	1.571	7.11	41.62	56.00	-14.38	30.01	46.00	-15.99
18	B	1.702	7.12	42.27	56.00	-13.73	30.91	46.00	-15.09
19	B	1.704	7.12	42.81	56.00	-13.19	29.55	46.00	-16.45
20	B	1.980	7.15	45.72	56.00	-10.28	30.25	46.00	-15.75

Table 6-10. Line Conducted Data with Bluetooth

Notes:

1. All modes of operation were investigated and the worst-case emissions are reported. The Low, Mid, and High channels were also investigated for the AC line conducted, and all channels showed the same level of emissions. Therefore, the mid channel was selected for final measurements as shown in the data tables.
2. The limit for Class B device(s) from 150kHz to 30MHz are specified in Section 15.207 of the Title 47 CFR.
3. Line A = Phase; Line B = Neutral
4. Traces shown in plot are made using a peak detector.
5. Deviations to the Specifications: None.

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7.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **NEC Portable Tablet Computer** **FCC ID: A98-CUL7580** is in compliance with Part 15 Subpart C (15.247) of the FCC Rules and RSS-210 of the Industry Canada Rules.

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