# EMI Test Report

Tested in accordance with
Federal Communications Commission (FCC)
Personal Communications Services
CFR 47, Part 15 Subpart C, RSS-210, RSS-GEN

# RIM Testing Services (RTS)

## A division of Research In Motion Limited

**REPORT NO.**: RTS-0665-0710-10

**PRODUCT MODEL NO.**: RBQ41GW
**TYPE NAME**: BlackBerry® smartphone
**FCC ID**: L6ARBQ40GW
**IC**: 2503A-RBQ40GW

**DATE**: 05 November 2007

## Statement of Performance:

The BlackBerry® smartphone, model RBQ41GW, part number CER-16647-001 Rev 2, and accessories when configured and operated per RIM's operation instructions, and performs within the requirements of the test standards.

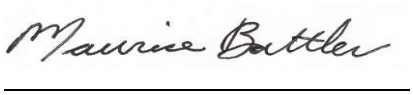
## Declaration:

We hereby certify that:
The test data reported herein is an accurate record of the performance of the sample(s) tested.
The test results are valid for the tested unit (s) only.
This device supports Bluetooth Frequency Hopping.
The test equipment used was suitable for the tests performed and within manufacturer's published specifications and operating parameters.
The test methods were consistent with the methods described in the relevant standards.

Documented and tested by:

Anas Hawari
Compliance Specialist
Date: 05 November 2007

Reviewed by:



Maurice Battler
Compliance Specialist
Date: 06 November 2007

Tested and reviewed by:

Masud S. Attayi, P.Eng.
Team Lead, Regulatory Compliance
Date: 06 Novemeber 2007

Approved by:

Paul G. Cardinal, Ph.D.
Director
Date: 06 November 2007

## Table of Contents

## A. Scope

This report details the results of compliance tests which were performed in accordance to the requirements of:

- FCC CFR 47 Part 15, Subpart C, May 04, 2007
- Industry Canada, RSS-210, Issue 7, June 2007, Low Power Licence-Exempt Radiocommunication Devices
- Industry Canada, RSS-GEN, Issue 2, June 2007 General Requirements and Information for the Certification of Radiocommunication Equipment

## B. Associated Documents

1. Document number CER-16647-REV2-Hardware-Change Notification.doc

## C. Product Identification

Manufactured by Research In Motion Limited located at:

295 Phillip Street
Waterloo, Ontario
Canada, N2L 3W8
Phone: 519 888 7465
Fax: 519 888 6906

The equipment under test (EUT) was tested at the RIM Testing Services (RTS) EMI test facility, located at:

305 Phillip Street
Waterloo, Ontario
Canada, N2L 3W8
Phone: 519 888 7465
Fax: 519 888 6906

The testing was performed October 09 to November 05, 2007.

The sample BlackBerry® smartphones tested were:

| SAMPLE | MODEL | CER NUMBER | PIN |
|---|---|---|---|
| 1 | RBQ41GW | CER-16647-001 Rev 1 | 20662E34 |
| 2 | RBQ41GW | CER-16647-001 Rev 1 | 20662E31 |
| 3 | RBQ41GW | CER-16647-001 Rev 2 | 2066F1C0 |

AC Conducted and Radiated Emission testing were performed on sample 1.
RF Conducted Emissions testing was performed on sample 2.

To view the differences between CER-16647-001 Rev 1 to CER-16647-001 Rev 2, see document number CER-16647-REV2-Hardware-Change Notification.doc

Only the characteristics that maybe impacted by the changes were re-measured.

BlackBerry® smartphone Accessories Tested

1) Alternative Captive Cable Charger, part number HDW-14917-001 with an output voltage of 5.0 volts dc, 0.75 amps and attached USB cable with a lead length of 1.80 metres.
2) Alternative Folding Blade Charger, part number ASY-12709-001 with an output voltage of 5.0 volts dc, 0.75 amps with an attached USB cable with a length of 1.80 metres.
3) TTY adapter, part number HDW-12420-001.
4) Stereo Headset, 2.5mm, part number HDW-13019-001, 1.3 metres long

## D. Support Equipment Used for the Testing of the EUT

1) Communication Tester, Rohde & Schwarz, model CMU 200, serial number 837493/073
2) Communication Tester, Rohde & Schwarz, model CMU 200, serial number 102204
3) DC Power Supply, H/P, model 6632B, serial number US37472178
4) Bluetooth Tester, Rohde & Schwarz, model CBT, serial number 100368

## E. Modification to EUT

No modifications were required on EUT.

## F. Summary of Results

| SPECIFICATION | | TEST TYPE | Meets Requirements | TEST DATA APPENDIX |
|---|---|---|---|---|
| FCC CFR 47 | IC | | | |
| Part 15.207 | RSS-GEN, 7.2.2 | Conducted AC Line Emission | Yes | 1 |
| Part 15.209<br>Part 15.247 | RSS-210, A8.5 | Radiated Spurious Emissions and Radiated Band Edge Compliance | Yes | 2 |
| Part 15.247(a) | RSS-210, A8.1 | Bluetooth 20 dB Bandwidth | Yes | 3 |
| Part 15.247(a) | RSS-210, A8.1 | Bluetooth Carrier Frequency Separation | Yes | 3 |
| Part 15.247(a) | RSS-210, A8.1d | Bluetooth Number of Hopping Frequencies | Yes | 3 |
| Part 15.247(a) | RSS-210, A8.1c | Bluetooth Time of Occupancy (Dwell Time) | Yes | 3 |
| Part 15.247(b) | RSS-210, A8.4 | Bluetooth Maximum Peak Conducted Output Power | Yes | 3 |
| Part 15.247(c) | RSS-210, A8.5 | Bluetooth Band-Edge Compliance of RF Conducted Emissions | Yes | 3 |
| Part 15.247(c) | RSS-210, A8.5 | Bluetooth Spurious RF Conducted Emissions | Yes | 3 |

1) AC LINE CONDUCTED EMISSIONS

The conducted emissions were measured using the test procedure outlined in CISPR Recommendation 22 through a 50 Ohm Line Impedance Stabilization Network (LISN), which was inserted in the power line to the equipment to provide the specified impedance for measurements. The EUT was placed on a nonconductive wooden table, 80 cm high that was positioned 40 cm from a vertical ground plane. The RF output of the network was connected to an EMI receiver system with characteristics that duplicate those of the receiver specified in CISPR Publication 16.

The following test configurations were measured. The ac input voltage was 120 volts, 60 Hz.

1. The BlackBerry® smartphone PIN 2066F1C0 in battery charging mode, was connected to the Alternative Captive Cable Charger and connected to a Stereo Headset through the TTY adapter.

2. The BlackBerry® smartphone PIN 20662E34 in battery charging mode, was connected to the Alternative Folding Blade Charger and connected to a Stereo Headset through the TTY adapter.

The sample EUT's conducted emissions were compared with respect to the FCC CFR 47 Part 15.207, Subpart C and IC RSS-Gen 7.2.2 limit. The sample EUT had a worse case test margin of 10.28 dB below the QP limit at 0.163 MHz using the Quasi-peak detector for the Alternative Captive Cable Charger, test configuration 1.

**Measurement Uncertainty ±2.0 dB**

See APPENDIX 1 for the test data

2) RADIATED EMISSIONS

a) Radiated Spurious and Harmonic Emissions

The EUT was placed on a nonconductive Styrofoam table, 80 cm high that was positioned on a remotely controlled turntable. The test distance used between the EUT and the receiving antenna was three metres. The turntable was rotated to determine the azimuth of the peak emissions. Then the emissions were maximized by elevating the antenna in the range of 1 to 4 metres. The maximum emission level was recorded. The frequency range measured was from 30 MHz to 25.0 GHz. Both the horizontal and vertical polarizations of the emissions were measured.

The measurements were performed in a semi-anechoic chamber. The semi-anechoic chamber's FCC registration number is **778487** and the Industry Canada file number is **IC4240**.

The EUT was configured and operated to produce the maximum radiated emissions while still keeping within RIM's specifications.

The BlackBerry® smartphone PIN 20662E34 was measured in standalone configuration with Bluetooth transmitting in single frequency mode at low channel (0), middle channel (39) and high channel (78) for packet type "DH5" and frequency hopping for packet type "DH5" and EDR mode at middle channel (39) for packet type "3-DH5". The system's radiated emission levels were compared with respect to the FCC CFR 47 Part 15, Subpart C, 15.247 and RSS-210.

The Bluetooth radiated spurious and harmonics were investigated up to the 10th harmonic. The sample EUT had a worse case test margin of 11.84 dB below the peak limit at 36.60 MHz using the peak detector.

See APPENDIX 2 for the test data

b) Co-location measurements.

The radiated emissions were measured up to 18 GHz for middle channels for simultaneous transmission in GSM 850/Bluetooth and PCS 1900/Bluetooth. Both horizontal and vertical polarizations were measured.

The emission due to different simultaneous transmission did not increase the amplitude of any emissions nor did it produce any new intermodulation products as a result of mixing.

c) Band-Edge Compliance of RF Radiated Emissions

The BlackBerry® smartphone PIN 20662E34 met the requirements for the Band-Edge Compliance of RF Radiated Emissions for Bluetooth as per 15.247, 15.209, and RSS-210.

See APPENDIX 2 for the test data.

**Measurement Uncertainty ±4.0 dB**

3) BLUETOOTH RF CONDUCTED EMISSIONS

a) 20 dB Bandwidth
The EUT met the requirements of the 20 dB bandwidth as per 47 CFR 15.247(a) and RSS-210. Low channel (0), middle channel (39) and high channel (78) were measured.
See APPENDIX 3 for the test data.

b) Carrier Frequency Separation
The EUT met the requirements of the carrier frequency separation as per 47 CFR 15.247(a) and RSS-210. Channel 38 to 39 was measured.
See APPENDIX 3 for the test data.

c) Number of Hopping Frequencies
The EUT met the requirements of the number of hopping frequencies as per 47 CFR 15.247(a) and RSS-210. The number of hopping channels measured was 79. See APPENDIX 3 for the test data.

d) Time of Occupancy (Dwell Time)
The EUT met the requirements of the dwell time as per 47 CFR 15.247(a) and RSS-210. Low channel (0), middle channel (39) and high channel (78) were measured. Bluetooth was operating in frequency hopping (Euro/US) mode during the measurements.
See APPENDIX 3 for the test data.

e) Maximum Peak Conducted Output Power
The EUT met the requirements of the maximum peak conducted output power as per 47 CFR 15.247(b) and RSS-210. Low channel (0), middle channel (39) and high channel (78) were measured.
See APPENDIX 3 for the test data.

f) Band-Edge Compliance of RF Conducted Emissions
The EUT met the requirements of the band-edge compliance of RF conducted emissions as per 47 CFR 15.247(c) and RSS-210. Channels 0 and 78 were measured in frequency hopping (Euro/US) mode and single frequency mode.
See APPENDIX 3 for the test data.

g) Spurious RF Conducted Emissions
The EUT met the requirements of the spurious RF conducted emissions as per 47 CFR 15.247(c) and RSS-210. The frequency range measured was 10 MHz to 26 GHz. Low channel (0), middle channel (39) and high channel (78) were measured in single frequency mode and frequency hopping (Euro/US) mode.
See APPENDIX 3 for the test data.

## G. Compliance Test Equipment Used

| UNIT | MANUFACTURER | MODEL | SERIAL NUMBER | CAL DUE DATE (YY MM DD) | USE |
|---|---|---|---|---|---|
| Preamplifier | Sonoma | 310N/11909A | 185831 | 07-11-23 | Radiated Emissions |
| Preamplifier system | TDK RF Solutions | PA-02 | 080010 | 07-11-22 | Radiated Emissions |
| Hybrid Log Antenna | TDK | HLP-3003C | 017401 | 08-08-04 | Radiated Emissions |
| Horn Antenna | TDK | HRN-0118 | 030101 | 08-07-26 | Radiated Emissions |
| Horn Antenna | Emco | 3116 | 2538 | 08-09-25 | Radiated Emissions |
| Preamplifier | TDK | 18-26 | 030002 | 07-11-23 | Radiated Emissions |
| Universal Radio Communication Tester | Rohde & Schwarz | CMU 200 | 837493/073 | 07-12-01 | Radiated Emissions |
| EMC Analyzer | Agilent | E7405A | US40240226 | 08-10-01 | Radiated Emissions |
| EMI Receiver | Rohde & Schwarz | ESIB-40 | 100255 | 08-09-18 | Radiated Emissions |
| Universal Radio Communication Tester | Rohde & Schwarz | CMU 200 | 102204 | 08-04-22 | Conducted Emissions |
| Spectrum Analyzer | HP | 8563E | 3745A08112 | 08-09-22 | RF Conducted Emissions |
| DC Power Supply | HP | 6632B | US37472178 | 08-09-24 | RF Conducted Emissions |
| Environment Monitor | Control Company | 1870 | 230355190 | 07-12-28 | Radiated Emissions |
| Environment Monitor | Control Company | 1870 | 230355189 | 07-12-28 | RF Conducted Emissions |
| Temperature Probe | Hart Scientific | 61161-302 | 21352860 | 08-08-14 | Frequency Stability |
| Environmental Chamber | ESPEC Corp. | SH-240S1 | 91005607 | N/R | Frequency Stability |
| Bluetooth Tester | Rohde & Schwarz | CBT | 100368 | 08-04-26 | Conducted/Radiated Emissions |
| Signal Generator | Agilent | 8648C | 4037U03155 | 09-09-20 | Frequency Stability |
| Digital Multimeter | Hewlett Packard | 34401A | US36042324 | 08-09-28 | Conducted/Radiated Emissions |
| L.I.S.N. | Emco | 3816/2 | 1120 | 08-08-28 | Conducted Emissions |
| Impulse Limiter | Rohde & Schwarz | ESHS-Z2 | 100786 | 08-09-11 | Conducted Emissions |

# APPENDIX 1 – AC CONDUCTED EMISSIONS TEST DATA/PLOTS

## AC Conducted Emissions Test Results

The measurements were performed by Vimal Olaganathan.

### Test Configuration 1

The environmental test conditions were:

| | |
|---|---|
| Temperature | 24ºC |
| Pressure | 997 mb |
| Relative Humidity | 24% |

Date of test: November 05, 2007

FCC CFR 47 Part 15, Subpart B, IC ICES-003

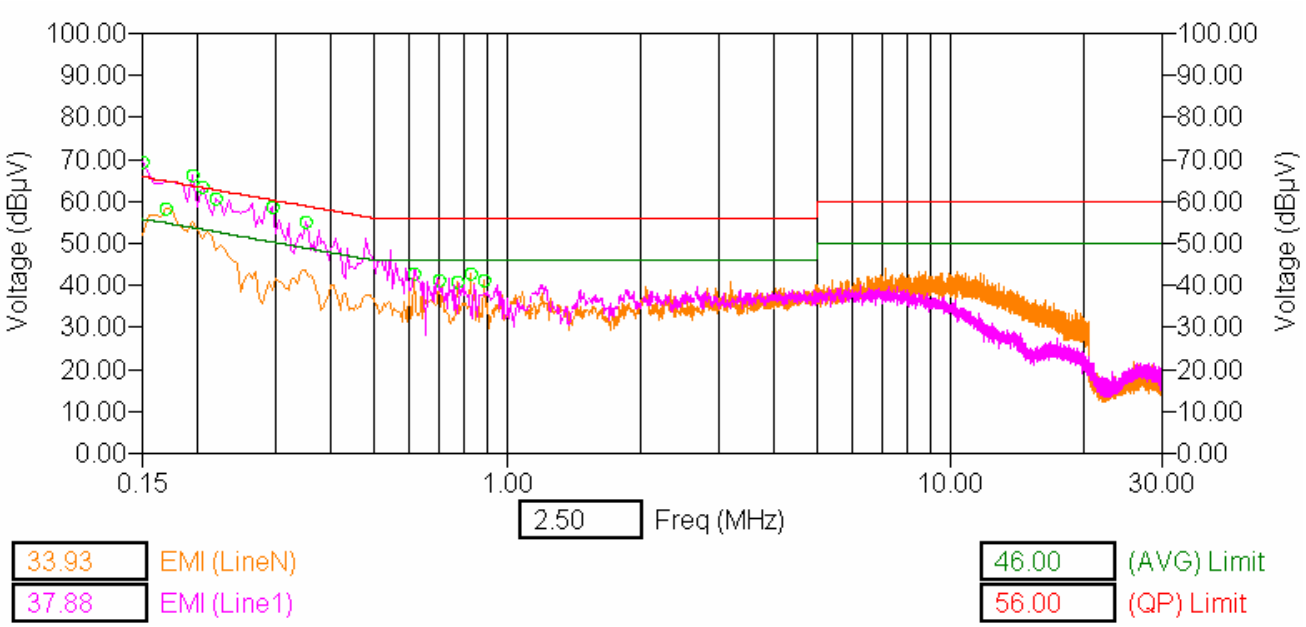
| Frequency (MHz) | Line | Reading (QP) (dBµV) | Correction Factor (dB) | Corrected Reading (QP) (dBµV) | Limit (QP) (dBµV) | Limit (AV) (dBµV) | Margin (QP) Limits (dB) | Margin (AV) Limits (dB) |
|---|---|---|---|---|---|---|---|---|
| 0.155 | L1 | 38.55 | 9.87 | 48.42 | 66.00 | 56.00 | -17.58 | -7.58 |
| 0.163 | N | 44.81 | 9.87 | 54.68 | 64.96 | 54.96 | **-10.28** | -0.28 |
| 0.191 | L1 | 42.31 | 9.87 | 52.18 | 63.82 | 53.82 | -11.64 | -1.64 |
| 0.213 | L1 | 41.10 | 9.87 | 50.97 | 63.41 | 53.41 | -12.44 | -2.44 |
| 0.216 | L1 | 39.66 | 9.87 | 49.53 | 62.82 | 52.82 | -13.29 | -3.29 |
| 0.289 | L1 | 32.91 | 9.90 | 42.81 | 60.38 | 50.38 | -17.58 | -7.58 |
| 0.343 | L1 | 30.16 | 9.89 | 40.05 | 58.96 | 48.96 | -18.92 | -8.92 |
| 0.819 | N | 23.77 | 9.93 | 33.70 | 56.00 | 46.00 | -22.30 | -12.30 |
| 0.890 | N | 23.86 | 9.95 | 33.81 | 56.00 | 46.00 | -22.19 | -12.19 |

All other emission levels had a test margin of greater than 25 dB.

Measurements were done with the quasi-peak detector.

See graph 1 for the measurement plot.

## AC Conducted Emissions Test Graph 1




## Test Configuration 1

AC Conducted Emissions Test Results cont'd

Test Configuration 2

The environmental test conditions were:

| | |
|---|---|
| Temperature | 24ºC |
| Pressure | 1006 mb |
| Relative Humidity | 31% |

Date of test: October 18, 2007

FCC CFR 47 Part 15, Subpart B, IC ICES-003

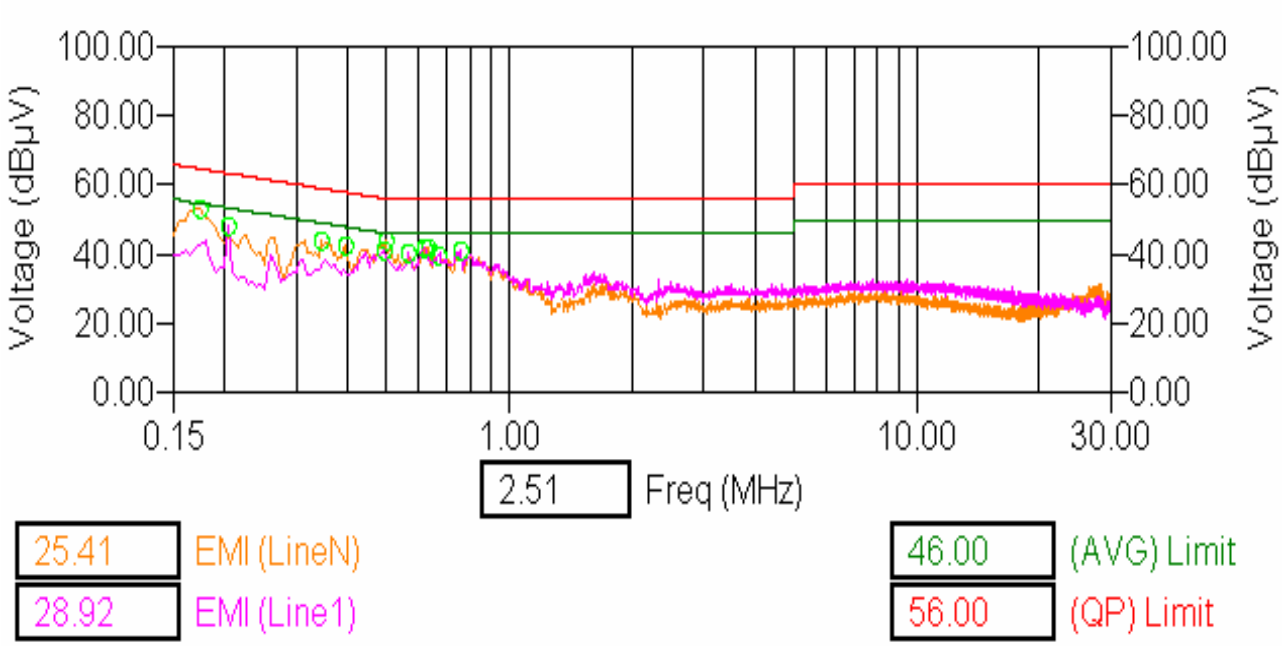
| Frequency (MHz) | Line | Reading (QP) (dBµV) | Correction Factor (dB) | Corrected Reading (QP) (dBµV) | Limit (QP) (dBµV) | Limit (AV) (dBµV) | Margin (QP) Limits (dB) | Margin (AV) Limits (dB) |
|---|---|---|---|---|---|---|---|---|
| 0.181 | N | 33.26 | 9.87 | 43.13 | 64.72 | 54.72 | -21.58 | -11.58 |
| 0.392 | N | 26.67 | 9.89 | 36.56 | 57.96 | 47.96 | -21.40 | -11.40 |
| 0.483 | L1 | 23.92 | 9.90 | 33.82 | 56.17 | 46.17 | -22.34 | -12.34 |
| 0.495 | N | 21.82 | 9.90 | 31.72 | 56.08 | 46.08 | -24.36 | -14.36 |
| 0.621 | L1 | 21.74 | 9.92 | 31.67 | 56.00 | 46.00 | -24.33 | -14.33 |
| 0.621 | N | 21.86 | 9.93 | 31.78 | 56.00 | 46.00 | -24.22 | -14.22 |
| 0.664 | N | 21.08 | 9.94 | 31.02 | 56.00 | 46.00 | -24.98 | -14.98 |

All other emission levels had a test margin of greater than 25 dB.

Measurements were done with the quasi-peak detector.

See graph 2 for the measurement plot.

AC Conducted Emissions Test Graph 2




Test Configuration 2

# APPENDIX 2 – RADIATED EMISSIONS TEST DATA

## Radiated Emissions Test Data Results

The measurements were performed by Caitlin O'Neill.

### Bluetooth Band

The environmental test conditions were:

| | |
|---|---|
| Temperature | 24ºC |
| Pressure | 1005 mb |
| Relative Humidity | 30% |

Date of Test: October 11, 2007

Test Distance was 3.0 metres with a EUT height of 0.8 metres, 30 MHz to 1000 MHz. The BlackBerry® smartphone PIN 20662E34 was in standalone, vertical position.

The frequency sweep measurements were performed in single frequency mode using packet type "DH5", channel 39.

| Frequency | Antenna | | Test Angle | Detector | Measured Level | Correction Factor for preamp/antenna/ cables/ filter | Field Strength Level (reading+corr) | Limit @ 3.0 m | Test Margin |
|---|---|---|---|---|---|---|---|---|---|
| | Pol. | Height | | | | (dB/m) | | | |
| (MHz) | (V/H) | (metres) | (Deg.) | (PK or AV) | (dBµV) | | (dBµV/m) | (dB) | (dB) |
| 36.55 | V | 1.59 | 151 | PK | 46.00 | -19.70 | 26.30 | 40.00 | -13.70 |
| 36.60 | H | 1.43 | 113 | PK | 47.88 | -19.72 | 28.16 | 40.00 | **-11.84** |
| 106.65 | H | 2.10 | 231 | PK | 37.99 | -18.55 | 19.44 | 43.50 | -24.06 |
| 106.70 | V | 4.00 | 283 | PK | 38.45 | -18.54 | 19.91 | 43.50 | -23.59 |
| 170.00 | V | 3.99 | 278 | PK | 39.81 | -16.98 | 22.83 | 43.50 | -20.67 |
| 170.05 | H | 1.00 | 211 | PK | 39.70 | -16.97 | 22.73 | 43.50 | -20.77 |
| 442.45 | H | 2.99 | 164 | PK | 41.13 | -7.73 | 33.40 | 46.00 | -12.60 |
| 442.45 | V | 2.17 | 207 | PK | 41.32 | -7.73 | 33.59 | 46.00 | -12.41 |

All other emissions had a test margin greater than 25.0 dB.

Radiated Emissions Test Data Results cont'd

The environmental test conditions were: Temperature 24ºC
Pressure 1016 mb
Humidity 35 %

Date of test: October 09, 2007

Test Distance was 1.0 metre, 1 GHz to 25 GHz. The harmonic measurements were performed in single frequency and hopping mode (channels 0 to 78) at maximum output power.

Using Pattern type "Static PBRS" and packet type "DH5" single channel mode during the measurements.

| Type | Channel | Frequency (MHz) | Antenna Type | Antenna Pol | Reading (Peak) (dBuV) | Corrected Reading (dBuV) | Detector (AVE/PK) | Peak Limit (dBuV/m) | Diff. To Limit (dB) |
|---|---|---|---|---|---|---|---|---|---|
| BlackBerry® smartphone Standalone, USB side down | | | | | | | | | |
| Single frequency mode Low Channel | | | | | | | | | |
| 2nd | 0 | 4804.0 | Horn | V | 48.79 | 45.68 | PK. | 74 | -28.32 |
| 2nd | 0 | 4804.0 | Horn | H | 52.76 | | | | |
| 2nd | 0 | 4804.0 | Horn | V | 38.93 | 36.37 | AVE. | 54 | -17.63 |
| 2nd | 0 | 4804.0 | Horn | H | 43.45 | | | | |
| The harmonics were investigated up to the 10th harmonic. | | | | | | | | | |
| Single frequency mode Middle Channel | | | | | | | | | |
| 2nd | 39 | 4882.0 | Horn | V | 46.13 | 45.30 | PK. | 74 | -28.70 |
| 2nd | 39 | 4882.0 | Horn | H | 51.89 | | | | |
| 2nd | 39 | 4882.0 | Horn | V | 33.92 | 34.92 | AVE. | 54 | -19.08 |
| 2nd | 39 | 4882.0 | Horn | H | 41.51 | | | | |
| The harmonics were investigated up to the 10th harmonic. | | | | | | | | | |
| Single frequency mode High Channel | | | | | | | | | |
| 2nd | 78 | 4960.0 | Horn | V | NF | 42.08 | PK. | 74 | -31.92 |
| 2nd | 78 | 4960.0 | Horn | H | 48.48 | | | | |
| 2nd | 78 | 4960.0 | Horn | V | NF | 25.19 | AVE. | 54 | -28.81 |
| 2nd | 78 | 4960.0 | Horn | H | 31.59 | | | | |
| The harmonics were investigated up to the 10th harmonic. | | | | | | | | | |

## Bluetooth Radiated Emissions Test Results cont'd

Using Pattern type "Static PBRS" and packet type "DH5" hopping mode during the measurements.

| Type | Channel | Frequency (MHz) | Antenna Type | Antenna Pol | Reading (Peak) (dBuV) | Corrected Reading (dBuV) | Detector (AVE/PK) | Peak Limit (dBuV/m) | Diff. To Limit (dB) |
|---|---|---|---|---|---|---|---|---|---|
| BlackBerry® smartphone Standalone, USB side down Hopping mode. | | | | | | | | | |
| 2nd | 0-78 | 4960.0 | Horn | V | NF | 41.92 | PK. | 74 | -32.08 |
| 2nd | 0-78 | 4960.0 | Horn | H | 48.32 | | | | |
| 2nd | 0-78 | 4960.0 | Horn | V | NF | 24.54 | AVE. | 54 | -29.46 |
| 2nd | 0-78 | 4960.0 | Horn | H | 30.94 | | | | |
| The harmonics were investigated up to the 10th harmonic. | | | | | | | | | |

Bluetooth Radiated Emissions Test Results cont'd

Using Pattern type "Static PBRS" and packet type "3-DH5", EDR single channel mode during the measurements.

| Type | Channel | Frequency (MHz) | Antenna Type | Antenna Pol | Reading (Peak) (dBuV) | Corrected Reading (dBuV) | Detector (AVE/PK) | Peak Limit (dBuV/m) | Diff. To Limit (dB) |
|---|---|---|---|---|---|---|---|---|---|
| BlackBerry® smartphone Standalone, USB side down, EDR mode. | | | | | | | | | |
| 2nd | 78 | 4960.0 | Horn | V | NF | 37.90 | PK. | 74 | -36.10 |
| 2nd | 78 | 4960.0 | Horn | H | 44.3 | | | | |
| 2nd | 78 | 4960.0 | Horn | V | NF | 24.09 | AVE. | 54 | -29.91 |
| 2nd | 78 | 4960.0 | Horn | H | 30.49 | | | | |
| The harmonics were investigated up to the 10th harmonic. | | | | | | | | | |

## Band-Edge Compliance of RF Radiated Emissions Test Results

The measurements were performed by Masud Attayi.

The environmental test conditions were: Temperature 24ºC
Pressure 1016 mb
Humidity 30 %

The test distance was 3.0 metres.
Date of test: October 16, 2007

BlackBerry® smartphone standalone, vertical, Pattern type "Static PBRS" and packet type "DH5" during the measurements.

| Channel | Freq. (MHz) | Rx Antenna Type | Rx Antenna POL. | Detector (PK, AVE.) | VBW (MHz) | Corrected Reading (dBuV/m) | Delta Marker (dB) | Corrected Band edge (dBuV/m) | Limit (dBuV/m) | Diff. To Limit (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel | | | | | | | | | | |
| 0 | 2402.0 | Horn | V | PK | 1 MHz | 95.60 | 39.60 | 56.00 | 74 | -18.00 |
| 0 | 2402.0 | Horn | H | PK | 1 MHz | 95.50 | 39.70 | 55.80 | 74 | -18.20 |
| 0 | 2402.0 | Horn | V | AVE. | 10 Hz | 88.60 | 39.60 | 49.00 | 54 | -5.00 |
| 0 | 2402.0 | Horn | H | AVE. | 10 Hz | 88.50 | 39.70 | 48.80 | 54 | -5.20 |

BlackBerry® smartphone in standalone, vertical, Pattern type "Static PBRS" and packet type "3-DH5" during the measurements.

| Channel | Freq. (MHz) | Rx Antenna Type | Rx Antenna POL. | Detector (PK, AVE.) | VBW (MHz) | Corrected Reading (dBuV/m) | Delta Marker (dB) | Corrected Band edge (dBuV/m) | Limit (dBuV/m) | Diff. To Limit (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel | | | | | | | | | | |
| 0 | 2402.0 | Horn | V | PK | 1 MHz | 95.30 | 40.10 | 55.20 | 74 | -18.80 |
| 0 | 2402.0 | Horn | H | PK | 1 MHz | 94.40 | 40.40 | 54.00 | 74 | -20.00 |
| 0 | 2402.0 | Horn | V | AVE. | 10 Hz | 85.60 | 40.10 | 45.50 | 54 | -8.50 |
| 0 | 2402.0 | Horn | H | AVE. | 10 Hz | 84.70 | 40.40 | 44.30 | 54 | -9.70 |
| High Channel | | | | | | | | | | |
| 78 | 2480.0 | Horn | V | PK | 1 MHz | 91.40 | 40.85 | 50.55 | 74 | -23.45 |
| 78 | 2480.0 | Horn | H | PK | 1 MHz | 92.50 | 41.20 | 51.30 | 74 | -22.70 |
| 78 | 2480.0 | Horn | V | AVE. | 10 Hz | 81.20 | 40.85 | 40.35 | 54 | -13.65 |
| 78 | 2480.0 | Horn | H | AVE. | 10 Hz | 82.70 | 41.20 | 41.50 | 54 | -12.50 |

See figures 2-1 to 2-6 for the plots of the Bluetooth band-edge compliance.

## Bluetooth Band-Edge Compliance of RF Radiated Emissions cont'd

**Figure 2-1: Band-Edge Compliance of RF Rad. Emi. Bluetooth, Single freq., Static PBRS, DH5, Channel 0, Pol: V, Detector: PK**

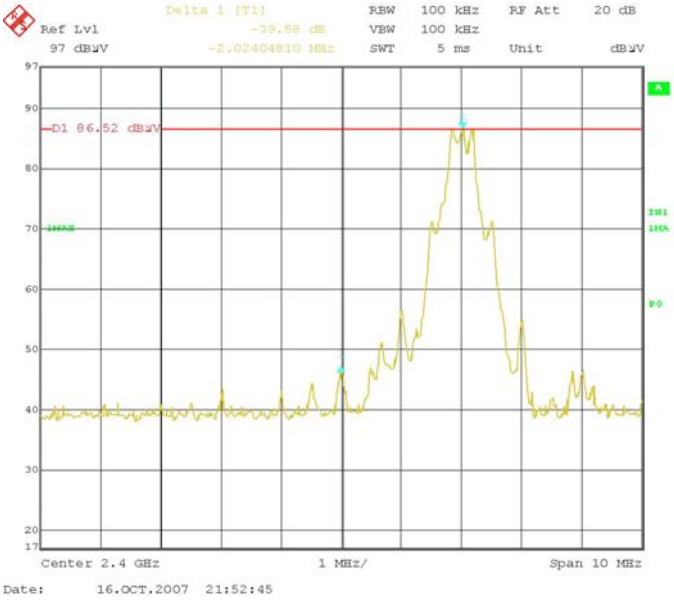



**Figure 2-2: Band-Edge Compliance of RF Rad. Emi. Bluetooth, Single freq., Static PBRS, DH5, Channel 0, Pol: H, Detector: PK**

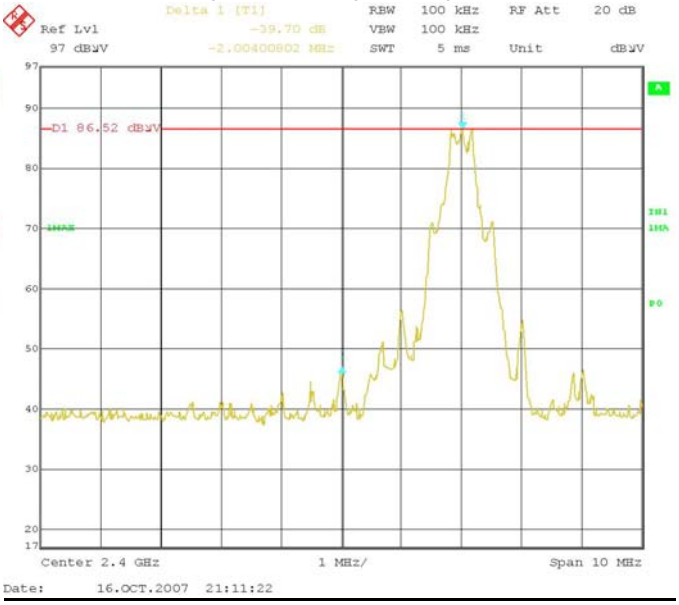



**Figure 2-3: Band-Edge Compliance of RF Rad. Emi. Bluetooth, Single freq., Static PBRS, 3-DH5, Channel 0, Pol: V, Detector: PK**

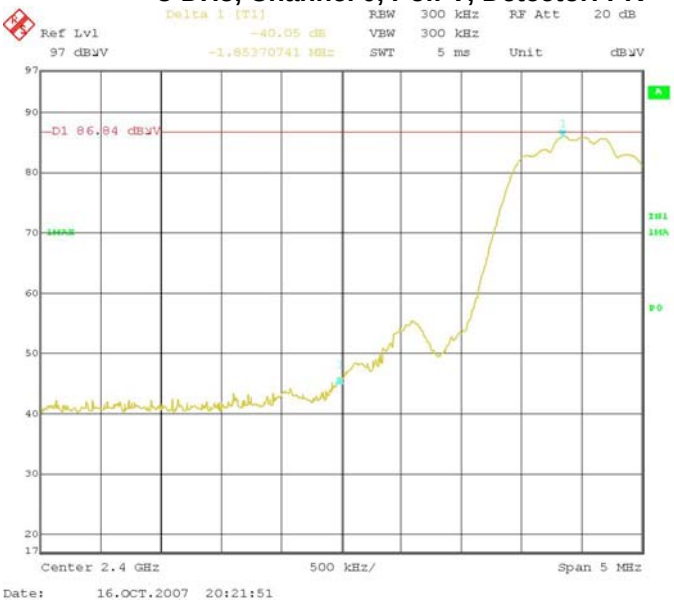



**Figure 2-4: Band-Edge Compliance of RF Rad. Emi. Bluetooth, Single freq., Static PBRS, 3-DH5, Channel 0, Pol: H, Detector: PK**

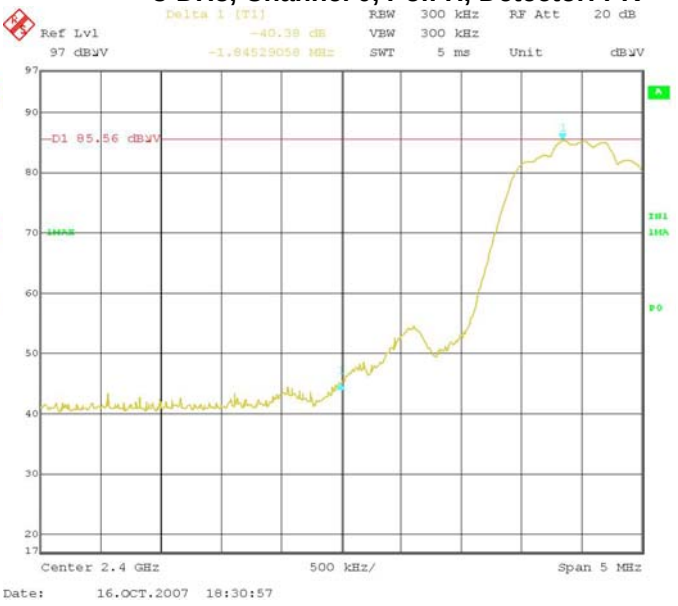


**Figure 2-5: Band-Edge Compliance of RF Rad. Emi. Bluetooth, Single freq., Static PBRS, 3-DH5, Channel 78, Pol: V, Detector: PK**

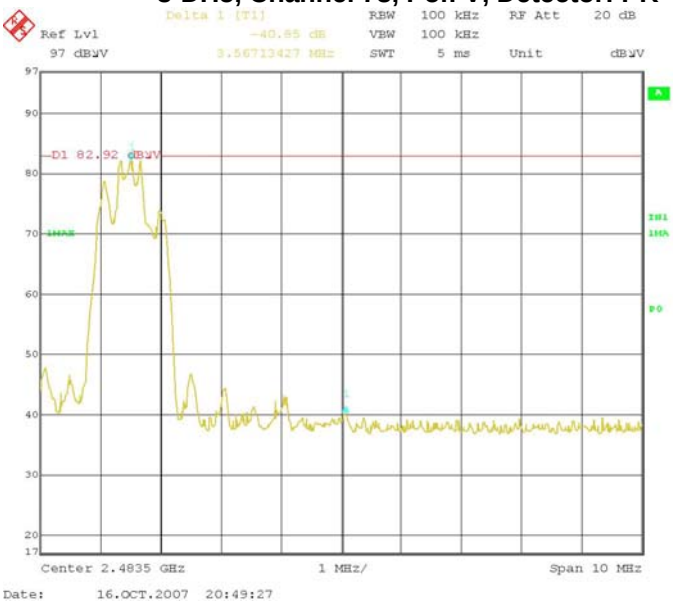
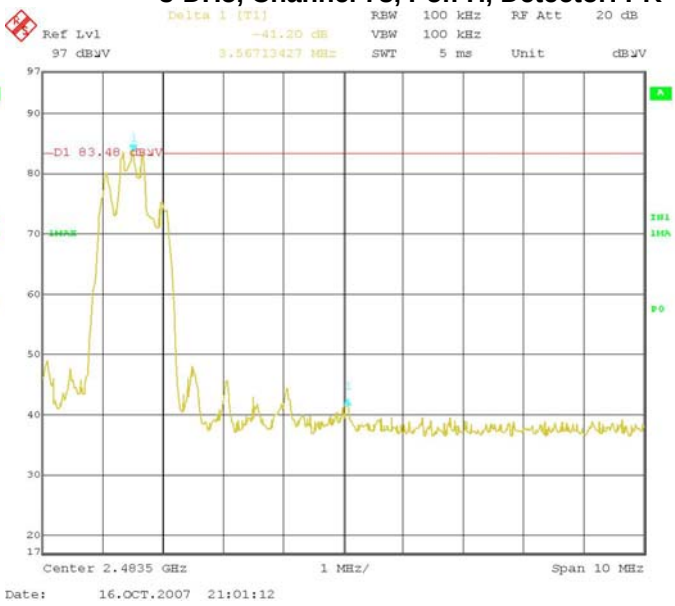



**Figure 2-6: Band-Edge Compliance of RF Rad. Emi. Bluetooth, Single freq., Static PBRS, 3-DH5, Channel 78, Pol: H, Detector: PK**



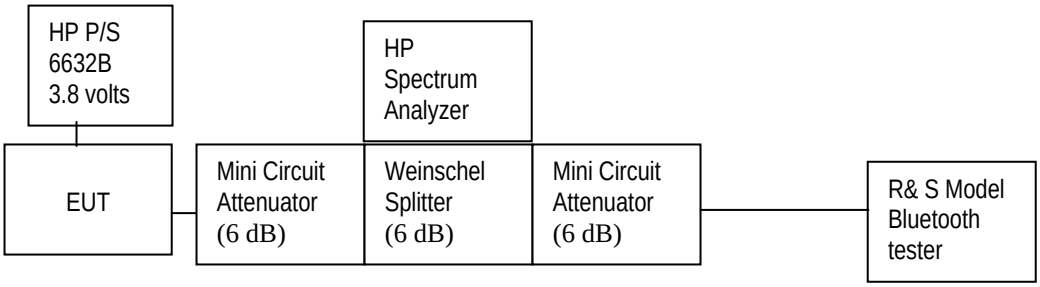
# APPENDIX 3 – BLUETOOTH CONDUCTED EMISSIONS TEST DATA/PLOTS

## Bluetooth RF Conducted Emission Test Results

The measurements were performed by Anas Hawari.

Bluetooth power output was at maximum for all the recorded measurements shown below on the BlackBerry® smartphone PIN 20662E31.

### Test Setup Diagram




A reference offset of 12.4 dB was applied to the spectrum analyzer reference level for the attenuators and coaxial cable loss in the test circuit.

Date of Tests: October 9 - 10, 2007

Bluetooth RF Conducted Emission Test Results cont'd

## 20 dB Bandwidth

The EUT met the requirements of the 20 dB bandwidth as per 47 CFR 15.247(a) and RSS-210. Low channel (0), middle channel (39) and high channel (78) were measured. Bluetooth was operating in single frequency mode using pattern type Static PBRS and packet type DH5 during the measurements.

| Bluetooth Channel | Limit (MHz) | Measured Level (MHz) |
|---|---|---|
| 0 | ≤1.0 | 0.933 |
| 39 | ≤1.0 | 0.937 |
| 78 | ≤1.0 | 0.937 |

See figures 3-1 to 3-3 for the plots of the 20 dB bandwidth measurements.

The environmental test conditions were:

| | |
|---|---|
| Temperature | 22ºC |
| Pressure | 1007 mb |
| Relative Humidity | 33% |

## Bluetooth RF Conducted Emission Test Results cont'd

**Figure 3-1: 20 dB Bandwidth**
**Single freq., Static PBRS, DH5**


**Figure 3-2: 20 dB Bandwidth**
**Single freq., Static PBRS, DH5**

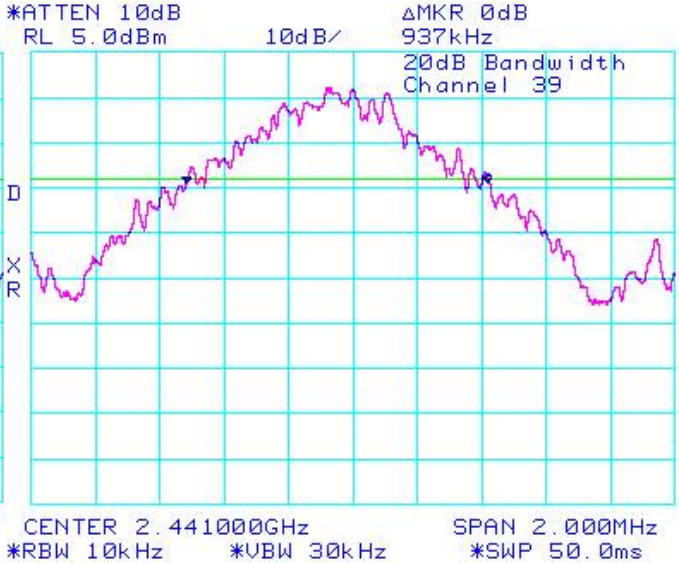



**Figure 3-3: 20 dB Bandwidth**
**Single freq., Static PBRS, DH5**

Bluetooth RF Conducted Emission Test Results cont'd

## Carrier Frequency Separation

The EUT met the requirements of the Carrier Frequency Separation as per 47 CFR 15.247(a) and RSS-210. Channel 38 to 39 was measured. Bluetooth was operating in frequency hopping (Euro/US) mode.

Using pattern type "Static PBRS" and packet type "DH5" during the measurements.

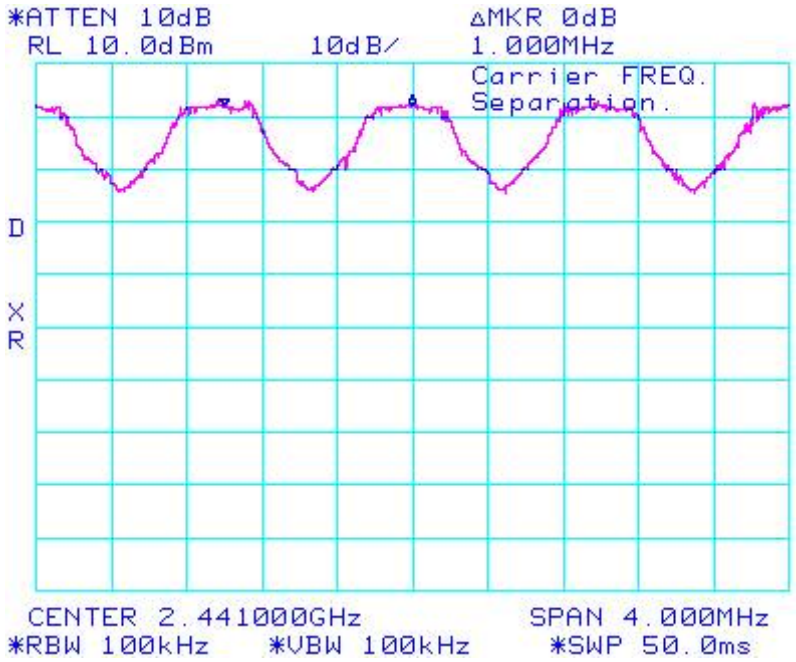
| Bluetooth Channels | Limit (MHz) | Measured Level (MHz) |
|---|---|---|
| 38 to 39 | ≥ 0.025 or 20 dB bandwidth | 1.000 |

The environmental test conditions were:

| | |
|---|---|
| Temperature | 22ºC |
| Pressure | 1007 mb |
| Relative Humidity | 33% |

See figure 3-4 for the plot of the Carrier Frequency Separation measurement.

**Figure 3-4: Carrier Frequency Separation, Freq. Hopping, Static PBRS, DH5, Channels 38 to 39**



Bluetooth RF Conducted Emission Test Results cont'd

Using Pattern type "Static PBRS" and packet type "3-DH5" during the measurements.

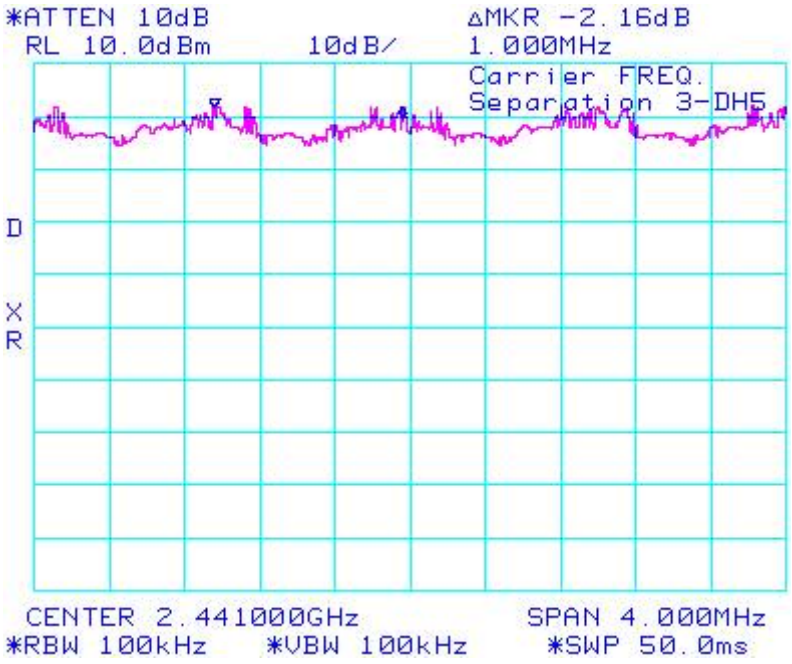
| Bluetooth Channels | Limit (MHz) | Measured Level (MHz) |
|---|---|---|
| 38 to 39 | ≥ 0.025 or 20 dB bandwidth | 1.000 |

The environmental test conditions were:

| | |
|---|---|
| Temperature | 22ºC |
| Pressure | 1007 mb |
| Relative Humidity | 33% |

See figure 3-5 for the plot of the Carrier Frequency Separation measurement.

**Figure 3-5: Carrier Frequency Separation, Freq. Hopping, Static PBRS, 3-DH5, Channels 38 to 39**



Bluetooth RF Conducted Emission Test Results cont'd

## Number of Hopping Frequencies

The EUT met the requirements of the number of hopping frequencies as per 47 CFR 15.247(a) and RSS-210. Bluetooth was operating in frequency hopping (Euro/US) mode.

Using pattern type "Static PBRS" and packet type "DH5" during the measurements.

| Limit (CH) | Number of Hopping Frequencies (CH) |
|---|---|
| ≥ 75 | 79 |

The environmental test conditions were:

| | |
|---|---|
| Temperature | 22ºC |
| Pressure | 1007 mb |
| Relative Humidity | 33% |

See figures 3-6 to 3-9 for the plots of the number of hopping frequencies.

## Bluetooth RF Conducted Emission Test Results cont'd

**Figure 3-6: Number of Hopping Frequencies Static PBRS, DH5**

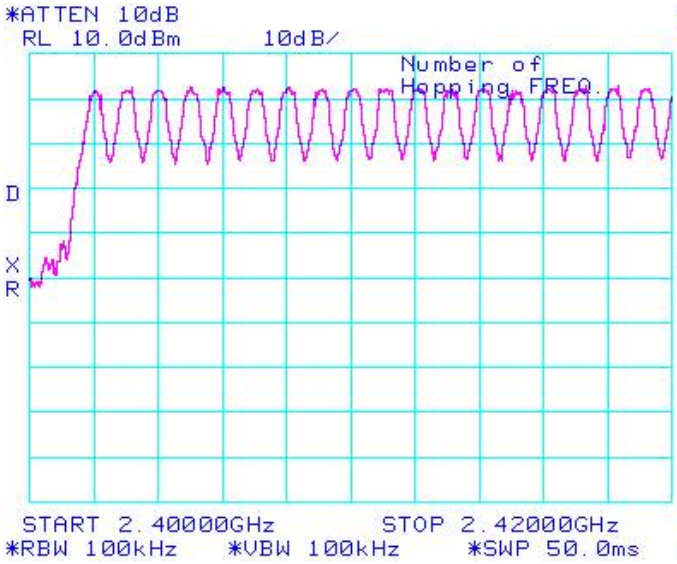



**Figure 3-7: Number of Hopping Frequencies Static PBRS, DH5**

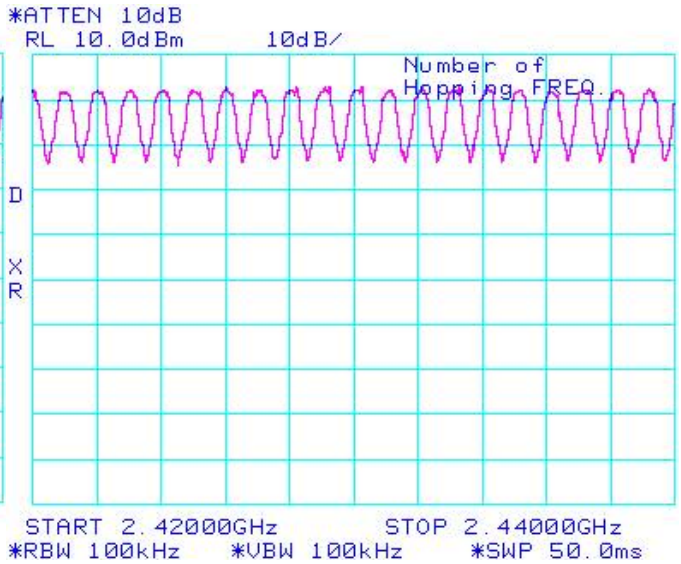



**Figure 3-8: Number of Hopping Frequencies Static PBRS, DH5**

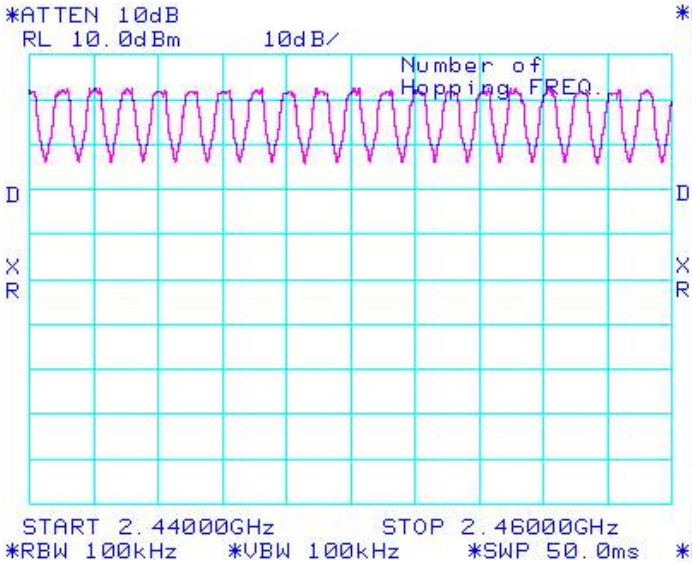
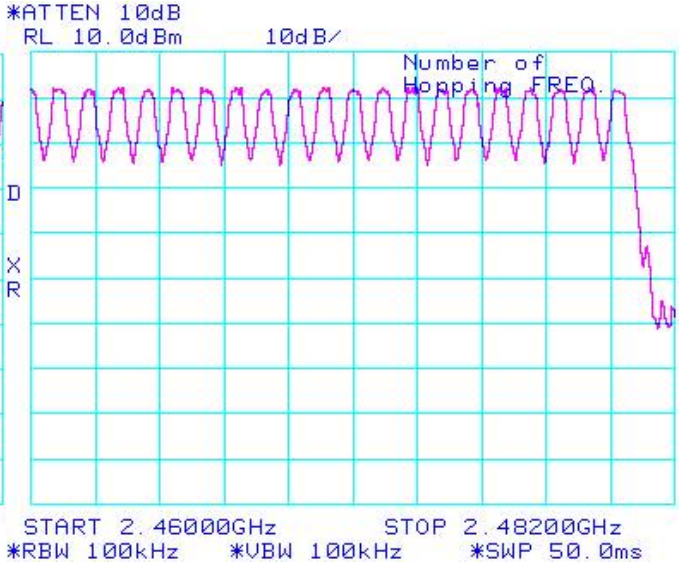



**Figure 3-9: Number of Hopping Frequencies Static PBRS, DH5**



Bluetooth RF Conducted Emission Test Results cont'd

**Time of Occupancy (Dwell Time)**

The EUT met the requirements of the time of occupancy (dwell time) as per 47 CFR 15.247(a) and RSS-210. Low channel (0), middle channel (39) and high channel (78) were measured in packet types DH1, DH3 and DH5. Bluetooth was operating in frequency hopping (Euro/US) mode during the measurements.
The frequency hopping is 1600 hops per second for a dwell time of 625 µsec. for 79 channels.
A DH1 packet needs one time slot for transmitting and one time slot for receiving. The frequency hopping is 800 hops per second with 79 channels which is 10.127 times per second. As per 15.247(a) (iii) "The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed". Therefore for 31.6 seconds (79x0.4) there are 320.0 times of appearance.

A DH3 packet needs one time slot for transmitting and one time slot for receiving. The frequency hopping is 400 hops per second with 79 channels which is 5.06 times per second. Therefore for 31.6 seconds there are 159.9 times of appearance.

A DH5 packet needs one time slot for transmitting and one time slot for receiving. The frequency hopping is 266.7 hops per second with 79 channels which is 3.38 times per second. Therefore for 31.6 seconds there are 106.8 times of appearance.

| Bluetooth Channel | Mode | Tx Time (ms) | Dwell Time/31.6 sec. (ms) | Limit (ms) | Margin (ms) |
|---|---|---|---|---|---|
| 0 | DH1 | 0.5160 | 0.5160 x 320.0 = 165.12 | 400 | 234.88 |
| 39 | DH1 | 0.5160 | 0.5160 x 320.0 = 165.12 | 400 | 234.88 |
| 78 | DH1 | 0.5120 | 0.5120 x 320.0 = 163.84 | 400 | 236.16 |
| 0 | DH3 | 1.7680 | 1.7680 x 159.9 = 282.70 | 400 | 117.30 |
| 39 | DH3 | 1.7767 | 1.7767 x 159.9 = 284.09 | 400 | 115.91 |
| 78 | DH3 | 1.7680 | 1.7680 x 159.9 = 282.70 | 400 | 117.30 |
| 0 | DH5 | 3.0333 | 3.0333 x 106.8 = 323.96 | 400 | 76.04 |
| 39 | DH5 | 3.0247 | 3.0247 x 106.8 = 323.04 | 400 | 76.96 |
| 78 | DH5 | 3.0247 | 3.0247x 106.8 = 323.04 | 400 | 76.96 |

The environmental test conditions were:

| | |
|---|---|
| Temperature | 23ºC |
| Pressure | 1006 mb |
| Relative Humidity | 32% |

See figures 3-10 to 3-18 for the plots of the dwell time.

## Bluetooth RF Conducted Emission Test Results cont'd

**Figure 3-10: Time of Occupancy (Dwell Time)**
**Freq. Hopping, Static PBRS, DH1**

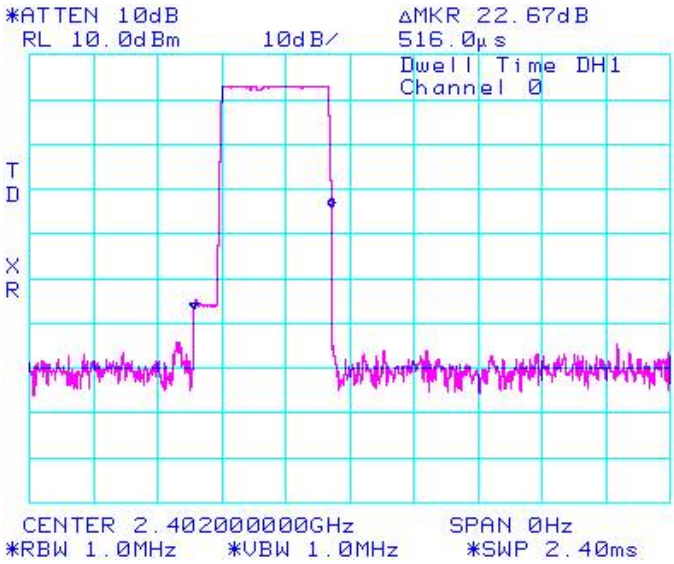



**Figure 3-11: Time of Occupancy (Dwell Time)**
**Freq. Hopping, Static PBRS, DH1**

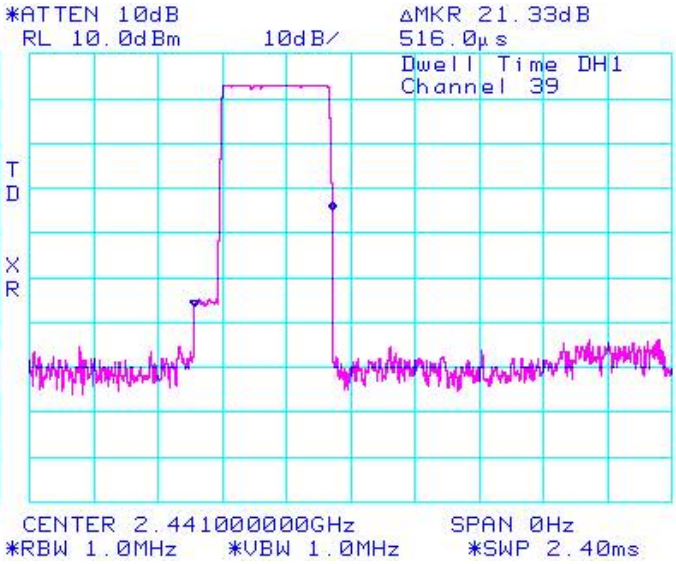



**Figure 3-12: Time of Occupancy (Dwell Time)**
**Freq. Hopping, Static PBRS, DH1**

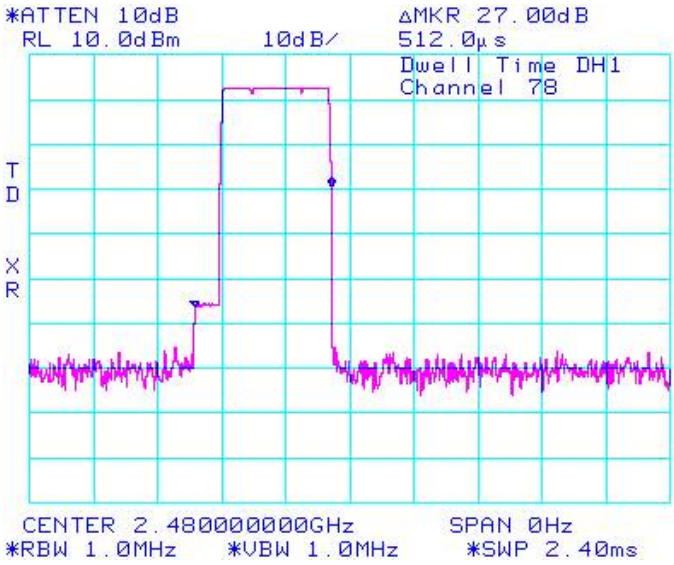
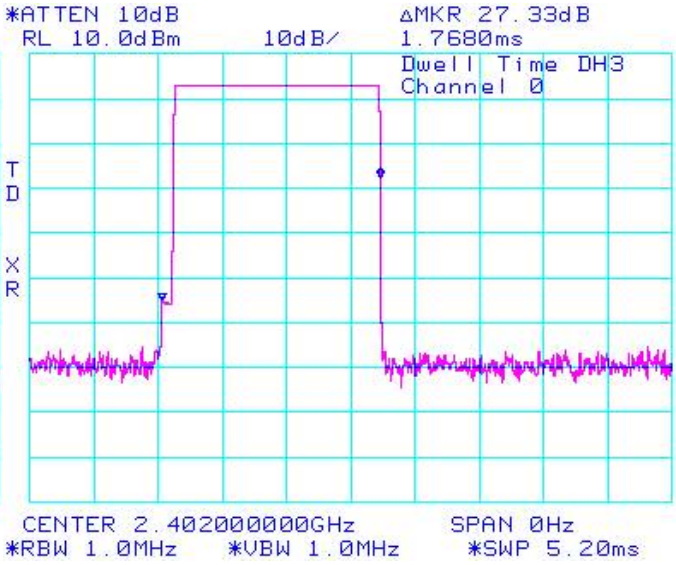



**Figure 3-13: Time of Occupancy (Dwell Time)**
**Freq. Hopping, Static PBRS, DH3**



## Bluetooth RF Conducted Emission Test Results cont'd

**Figure 3-14: Time of Occupancy (Dwell Time)**
**Freq. Hopping, Static PBRS, DH3**

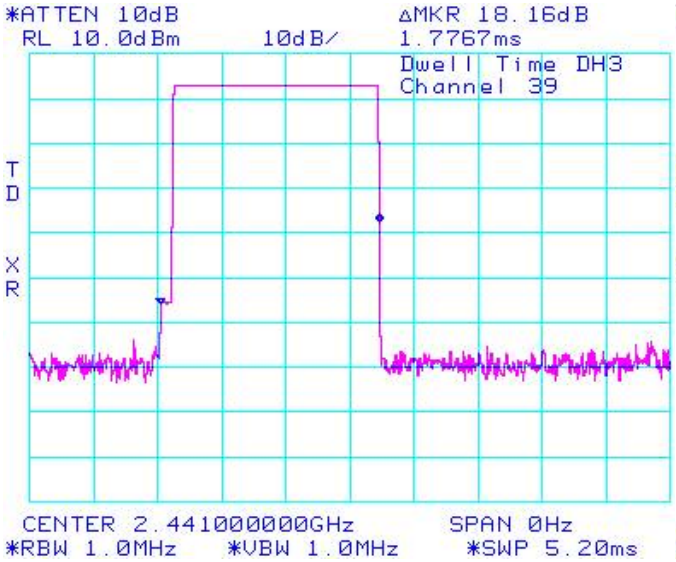



**Figure 3-5 : Time of Occupancy (Dwell Time)**
**Freq. Hopping, Static PBRS, DH3**

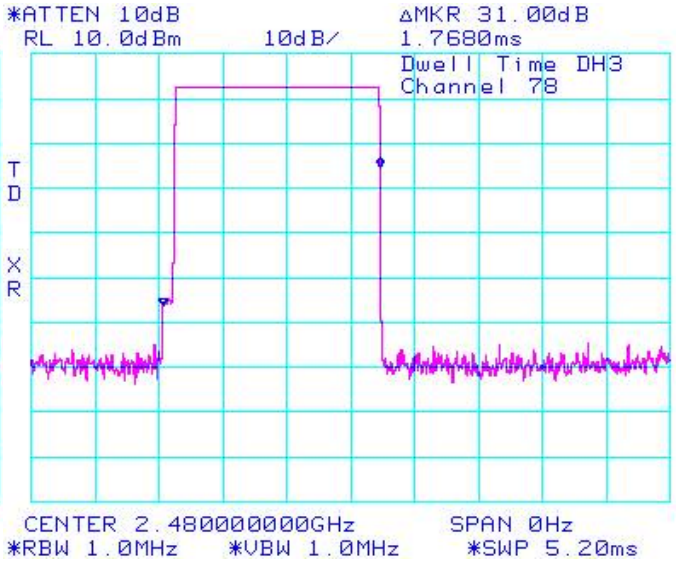



**Figure 3-16: Time of Occupancy (Dwell Time)**
**Freq. Hopping, Static PBRS, DH5**

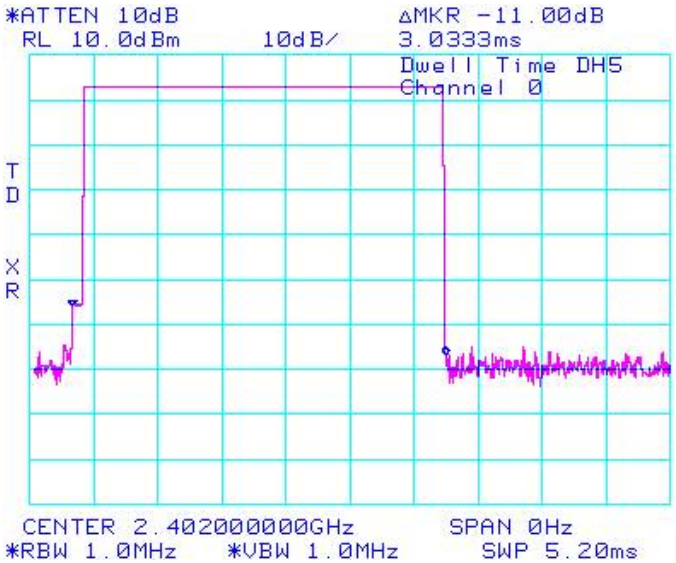
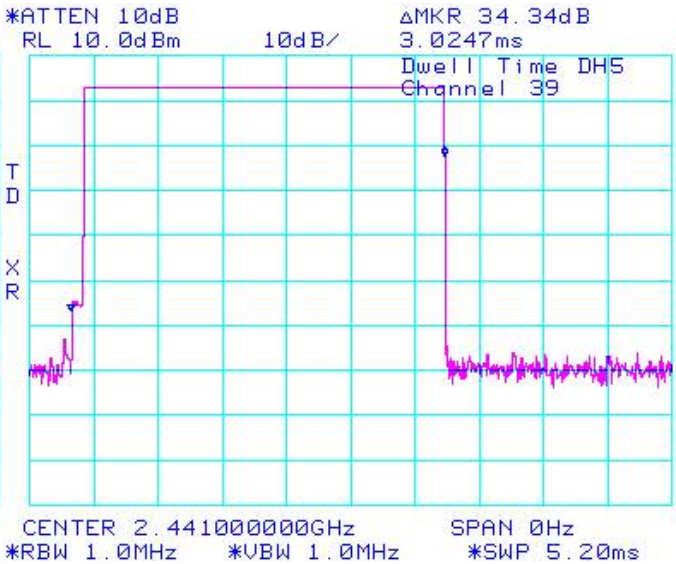
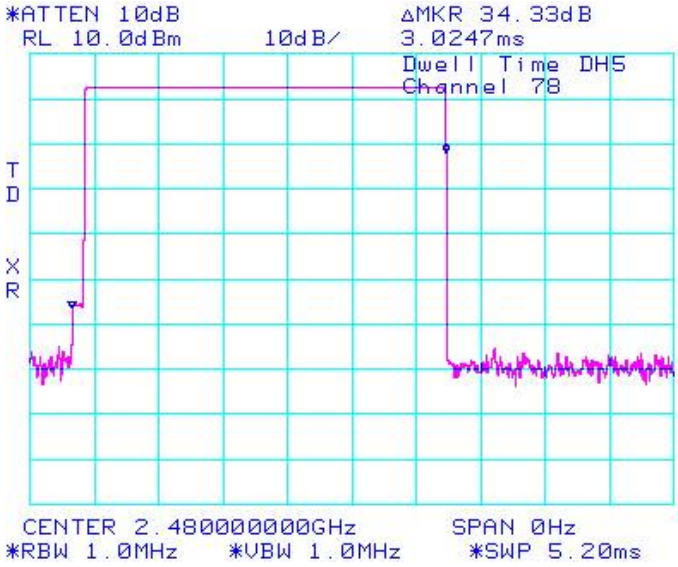



**Figure 3-17: Time of Occupancy (Dwell Time)**
**Freq. Hopping, Static PBRS, DH5**



Bluetooth RF Conducted Emission Test Results cont'd

**Figure 3-18: Time of Occupancy (Dwell Time)**
**Freq. Hopping, Static PBRS, DH5**



Bluetooth RF Conducted Emission Test Results cont'd

## Maximum Peak Conducted Output Power

The EUT met the requirements of the maximum peak conducted output power of class 2 as per 47 CFR 15.247(b) and RSS-210. Low channel (0), middle channel (39) and high channel (78) were measured. Bluetooth was operating in single frequency mode during the measurements. A reference offset of 12.4 dB was applied to the spectrum analyzer reference level for the coaxial cable loss and attenuators in the test circuit.

Using pattern type "Static PBRS" and packet type "DH5" during the measurements.

| Bluetooth Channel | Measured Level (dBm) | Measured Level (mW) | Limit (W) |
|---|---|---|---|
| 0 | 2.83 | 1.92 | 1.0 |
| 39 | 2.83 | 1.92 | 1.0 |
| 78 | 2.33 | 1.71 | 1.0 |

The environmental test conditions were:

| | |
|---|---|
| Temperature | 23ºC |
| Pressure | 1006 mb |
| Relative Humidity | 32% |

See figures 3-19 to 3-21 for the plots of the maximum peak conducted output power.

## Bluetooth RF Conducted Emission Test Results cont'd

**Figure 3-19: Max. Peak Conducted Output Power**
**Single Freq., Static PBRS, DH5**

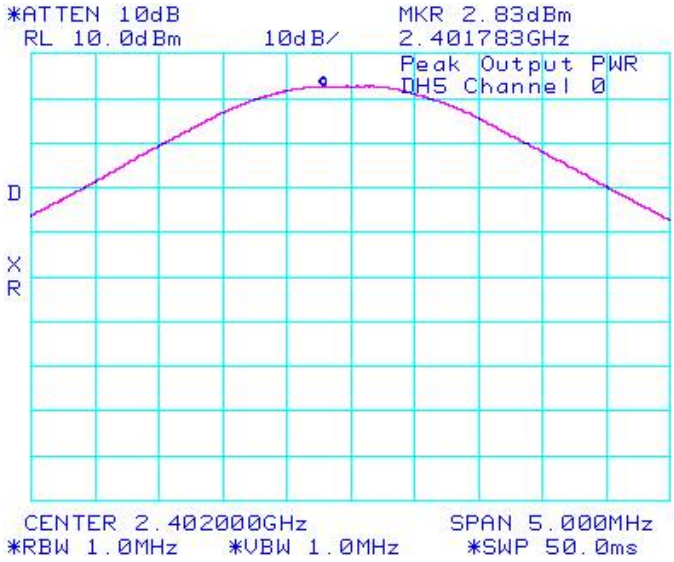



**Figure 3-20: Max. Peak Conducted Output Power**
**Single Freq., Static PBRS, DH5**

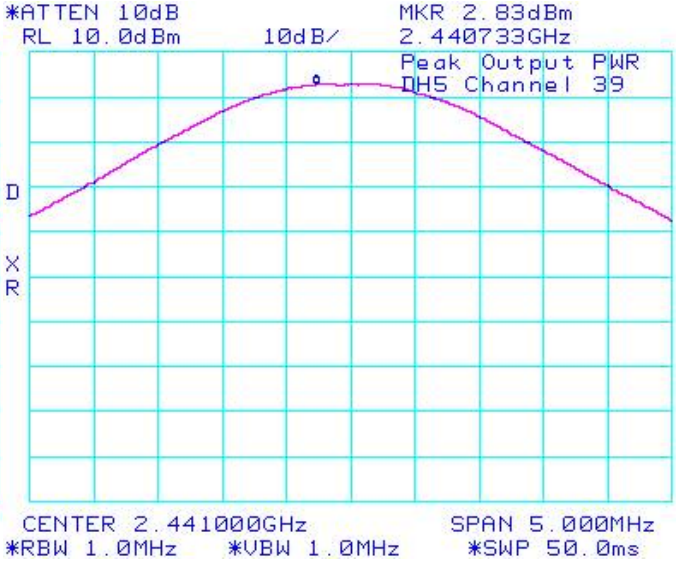
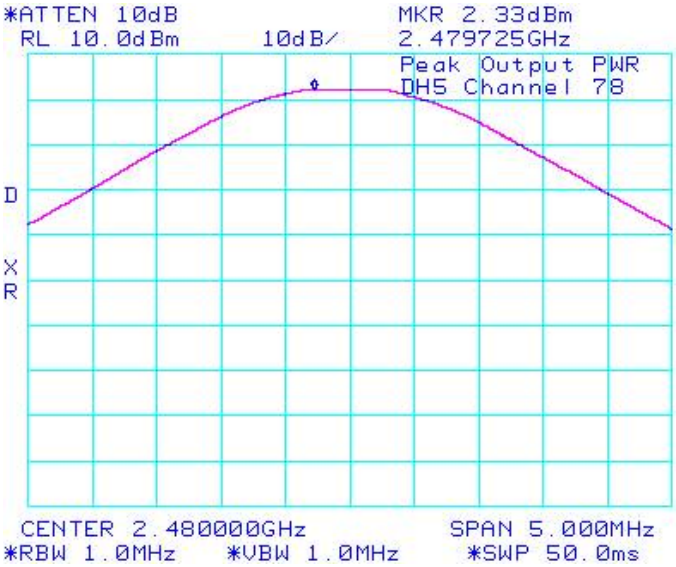



**Figure 3-21: Max. Peak Conducted Output Power**
**Single Freq., Static PBRS, DH5**



Bluetooth RF Conducted Emission Test Results cont'd

Using Pattern type "Static PBRS" and packet type "3-DH5" during the measurements.

| Bluetooth Channel | Measured Level (dBm) | Measured Level (mW) | Limit (W) |
|---|---|---|---|
| 0 | 2.33 | 1.71 | 1.0 |
| 39 | 2.17 | 1.65 | 1.0 |
| 78 | 1.50 | 1.41 | 1.0 |

The environmental test conditions were:

| | |
|---|---|
| Temperature | 23ºC |
| Pressure | 1006 mb |
| Relative Humidity | 32% |

See figures 3-22 to 3-24 for the plots of the maximum peak conducted output power.

## Bluetooth RF Conducted Emission Test Results cont'd

**Figure 3-22: Max. Peak Conducted Output Power**
**Single Freq., Static PBRS, 3-DH5**

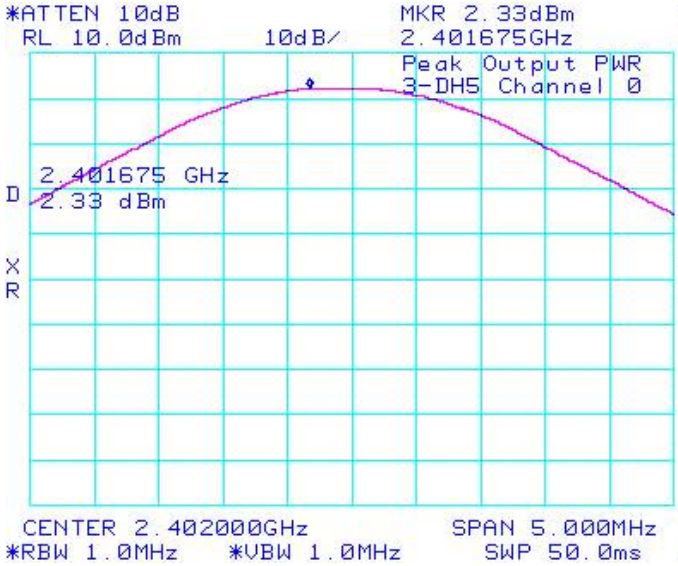



**Figure 3-23: Max. Peak Conducted Output Power**
**Single Freq., Static PBRS, 3-DH5**

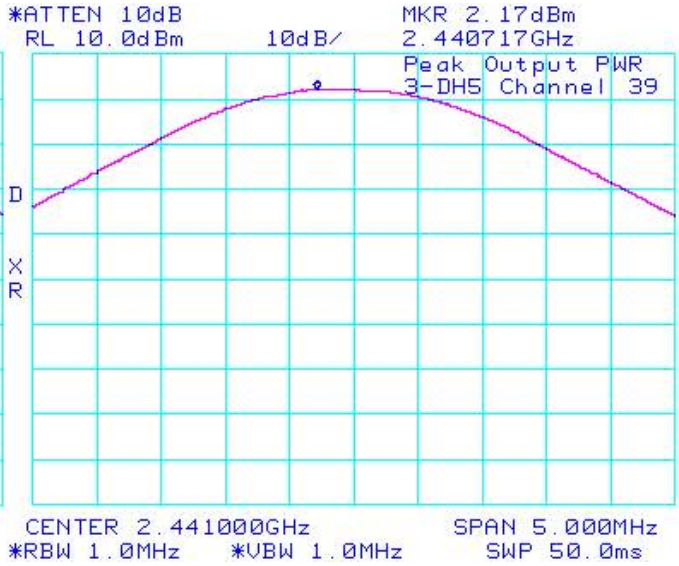
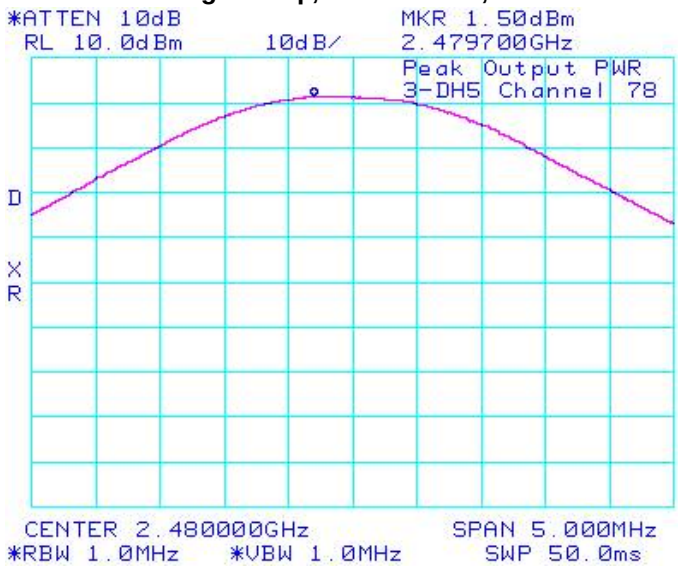



**Figure 3-24: Max. Peak Conducted Output Power**
**Single Freq., Static PBRS, 3-DH5**



Bluetooth RF Conducted Emission Test Results cont'd

**Band Edge Compliance**

The EUT met the requirements of the band edge compliance as per 47 CFR 15.247(c) and RSS-210. Low channel (0) and high channel (78) were measured. Bluetooth was operating in single frequency and hopping mode.

Using pattern type "Static PBRS" and packet type "DH5" during the measurements.

| Bluetooth Channel | Operating Mode | Measured Level (dBc) | Limit (dBc) | Margin (dB) |
|---|---|---|---|---|
| 0 | Single Frequency | -32.50 | -20 | -12.50 |
| 78 | Single Frequency | -34.66 | -20 | -14.66 |
| 0 | Hopping | -32.34 | -20 | -12.34 |
| 78 | Hopping | -35.00 | -20 | -15.00 |

The environmental test conditions were:

| | |
|---|---|
| Temperature | 23ºC |
| Pressure | 1006 mb |
| Relative Humidity | 32% |

See figures 3-25 to 3-28 for the plots of the band edge compliance measurements.

## Bluetooth RF Conducted Emission Test Results cont'd

**Figure 3-25: Band Edge Compliance**
**Single Freq., Static PBRS, DH5**

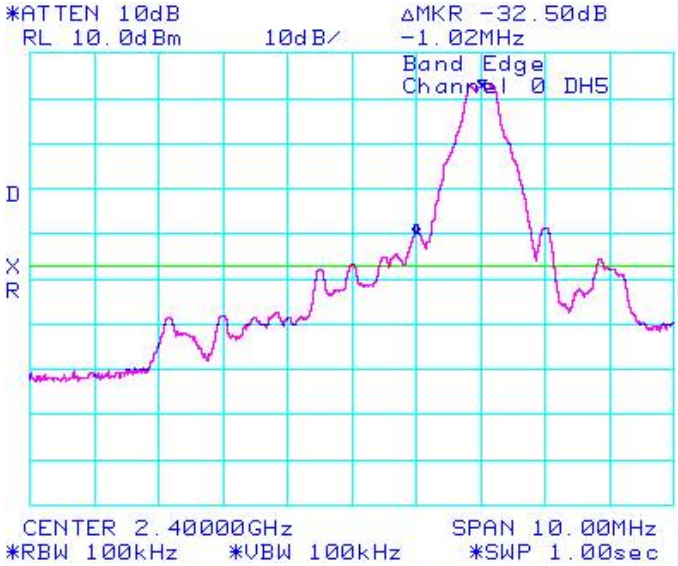



**Figure 3-26: Band Edge Compliance**
**Single Freq., Static PBRS, DH5**

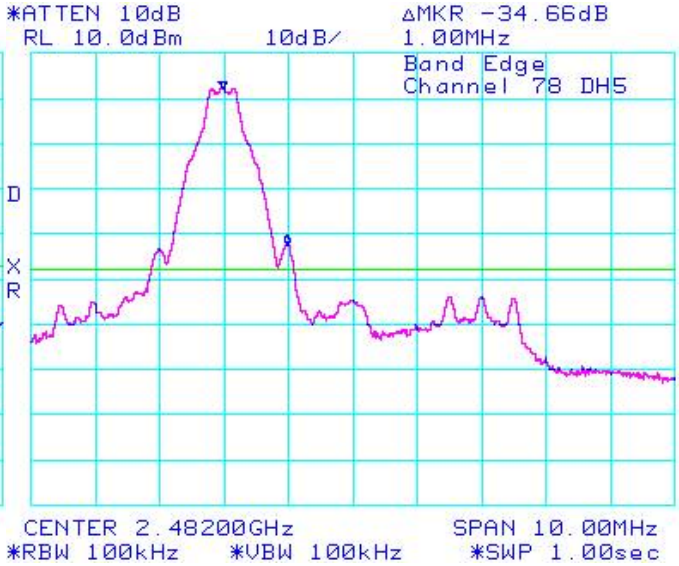



**Figure 3-27: Band Edge Compliance**
**Freq. Hopping, Static PBRS, DH5**

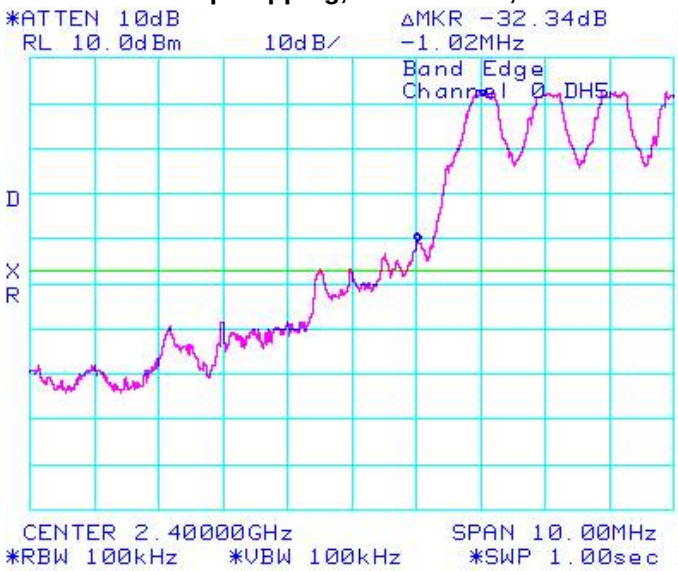
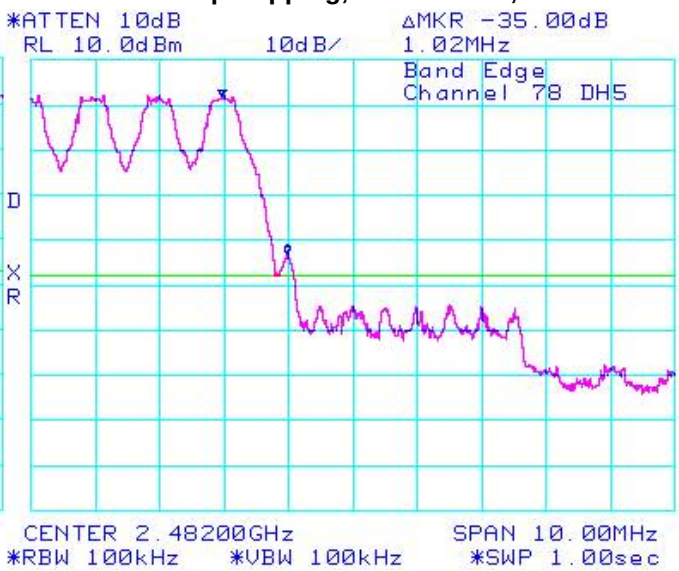



**Figure 3-28: Band Edge Compliance**
**Freq. Hopping, Static PBRS, DH5**



Bluetooth RF Conducted Emission Test Results cont'd

Using pattern type "Static PBRS" and packet type "3-DH5" during the measurements.

| Bluetooth Channel | Operating Mode | Measured Level (dBc) | Limit (dBc) | Margin (dB) |
|---|---|---|---|---|
| 0 | Single Frequency | -32.50 | -20 | -12.50 |
| 78 | Single Frequency | -33.00 | -20 | -13.00 |
| 0 | Hopping | -32.00 | -20 | -12.00 |
| 78 | Hopping | -33.00 | -20 | -13.00 |

The environmental test conditions were: Temperature 23ºC
Pressure 1006 mb
Relative Humidity 32%

See figures 3-29 to 3-32 for the plots of the band edge compliance measurements.

## Bluetooth RF Conducted Emission Test Results cont'd

**Figure 3-29: Band Edge Compliance**
**Single Freq., Static PBRS, 3-DH5**

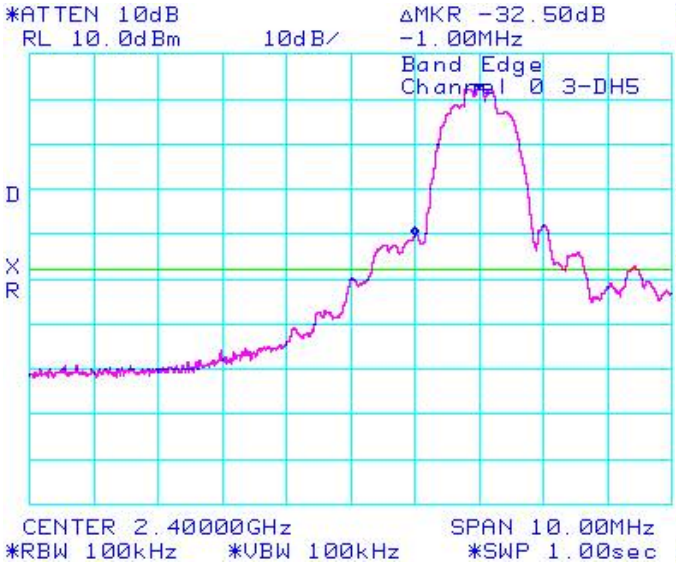



**Figure 3-30: Band Edge Compliance**
**Single Freq., Static PBRS, 3-DH5**

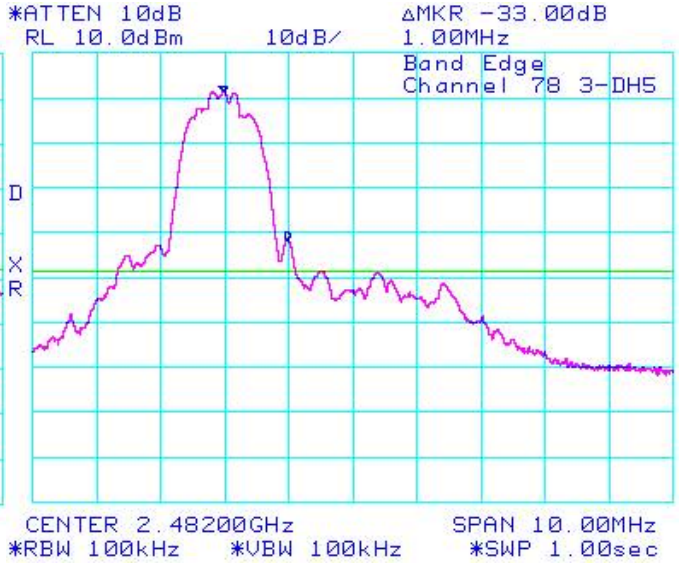



**Figure 3-31: Band Edge Compliance**
**Freq. Hopping, Static PBRS, 3-DH5**

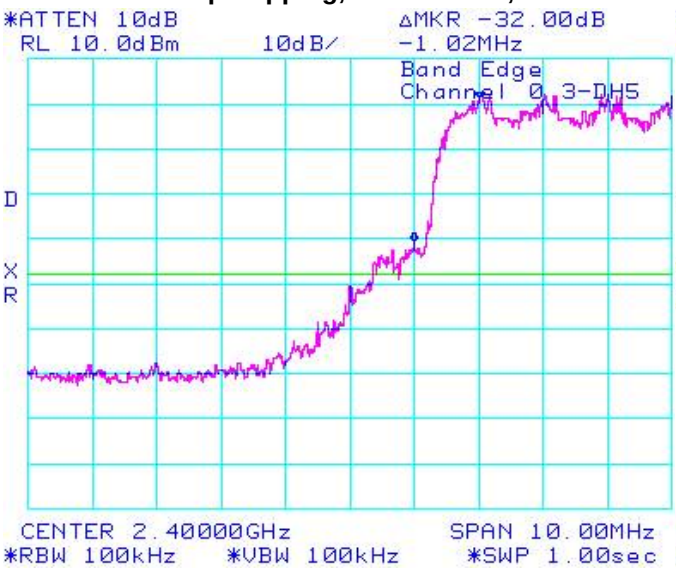
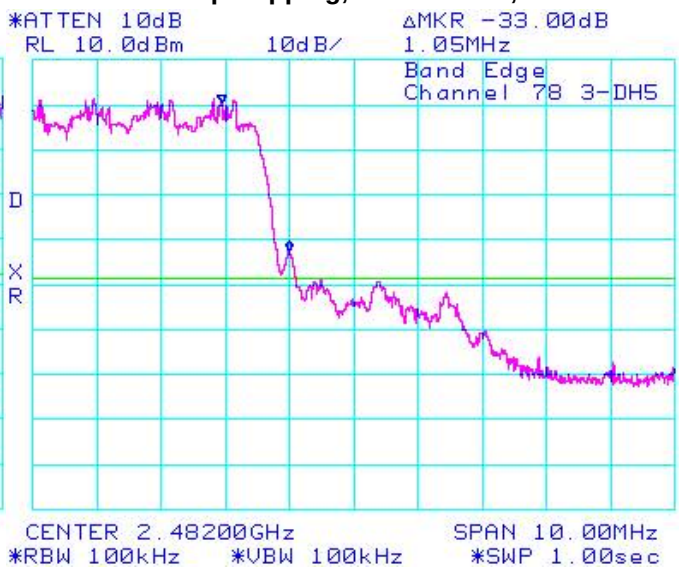



**Figure 3-32: Band Edge Compliance**
**Freq. Hopping, Static PBRS, 3-DH5**



Bluetooth RF Conducted Emission Test Results cont'd

## Spurious RF Conducted Emissions

The EUT met the requirements of the spurious RF conducted emissions as per 47 CFR 15.247(c) and RSS-210. Low channel (0), mid channel (39) and high channel (78) were measured. Bluetooth was operating in single frequency and hopping mode. A reference offset of 12.4 dB was applied to the spectrum analyzer reference level for the attenuators and coaxial cable loss in the test circuit.

Using pattern type "Static PBRS" and packet type "DH5" during the measurements.

| Bluetooth Channel | Channel Power (dBm) | Max. Measured Level (dBm) | Max. Measured Level from carrier (dBc) | Limit (dBc) |
|---|---|---|---|---|
| 0 | 2.83 | -51.33 | -54.16 | -20 |
| 39 | 2.83 | -56.67 | -59.50 | -20 |
| 78 | 2.33 | -58.17 | -60.50 | -20 |
| Hopping mode | 2.33 | -55.33 | -57.66 | -20 |

The environmental test conditions were:

| | |
|---|---|
| Temperature | 22ºC |
| Pressure | 1002 mb |
| Relative Humidity | 33% |

See figures 3-33 to 3-36 for the plots of the spurious RF conducted emissions.

## Bluetooth RF Conducted Emission Test Results cont'd

**Figure 3-33: Spurious RF Conducted Emissions**
**Single Freq., Static PBRS, DH5,**

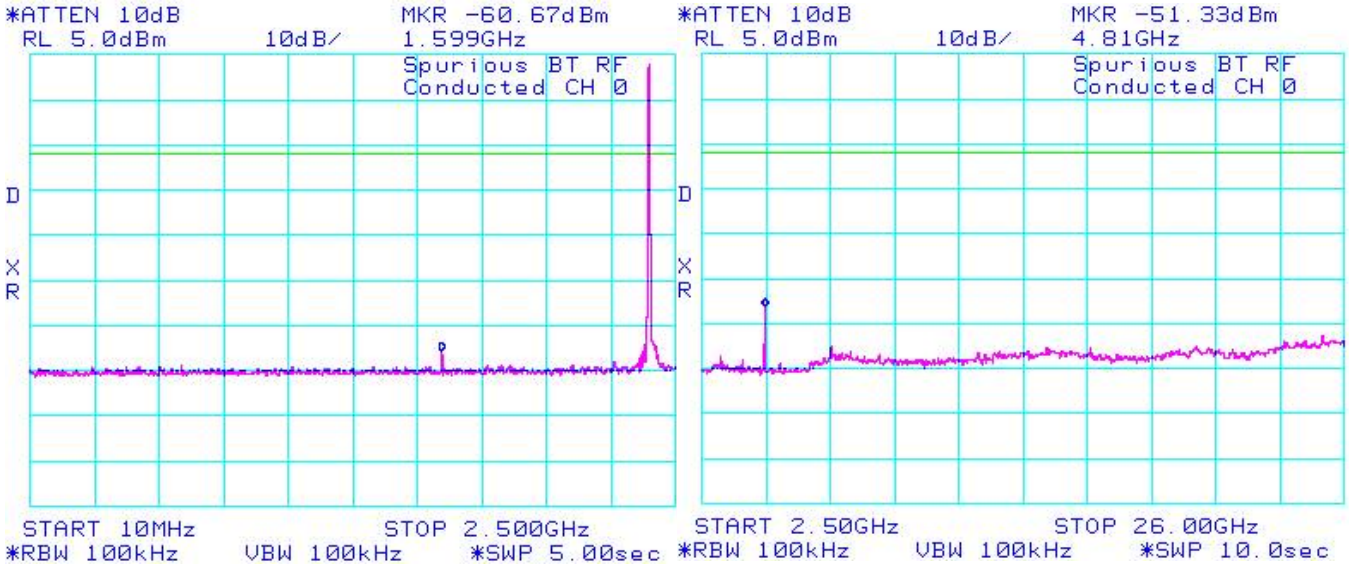
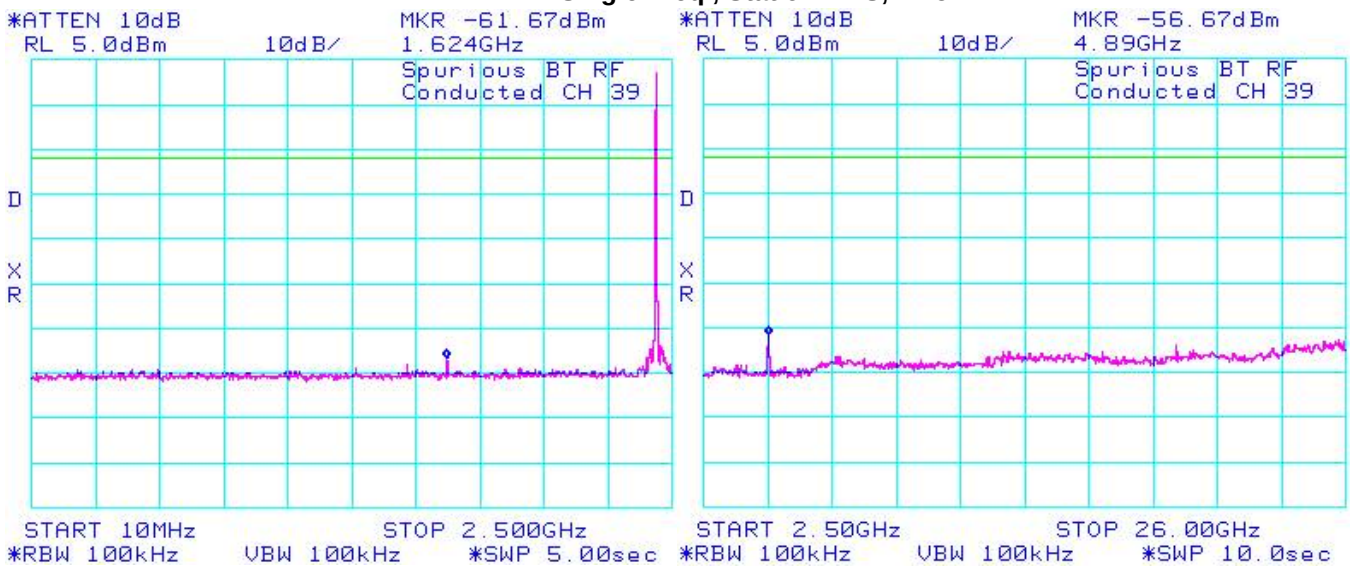



**Figure 3-34: Spurious RF Conducted Emissions**
**Single Freq., Static PBRS, DH5**



## Bluetooth RF Conducted Emission Test Results cont'd

**Figure 3-35: Spurious RF Conducted Emissions**
**Single Freq., Static PBRS, DH5**

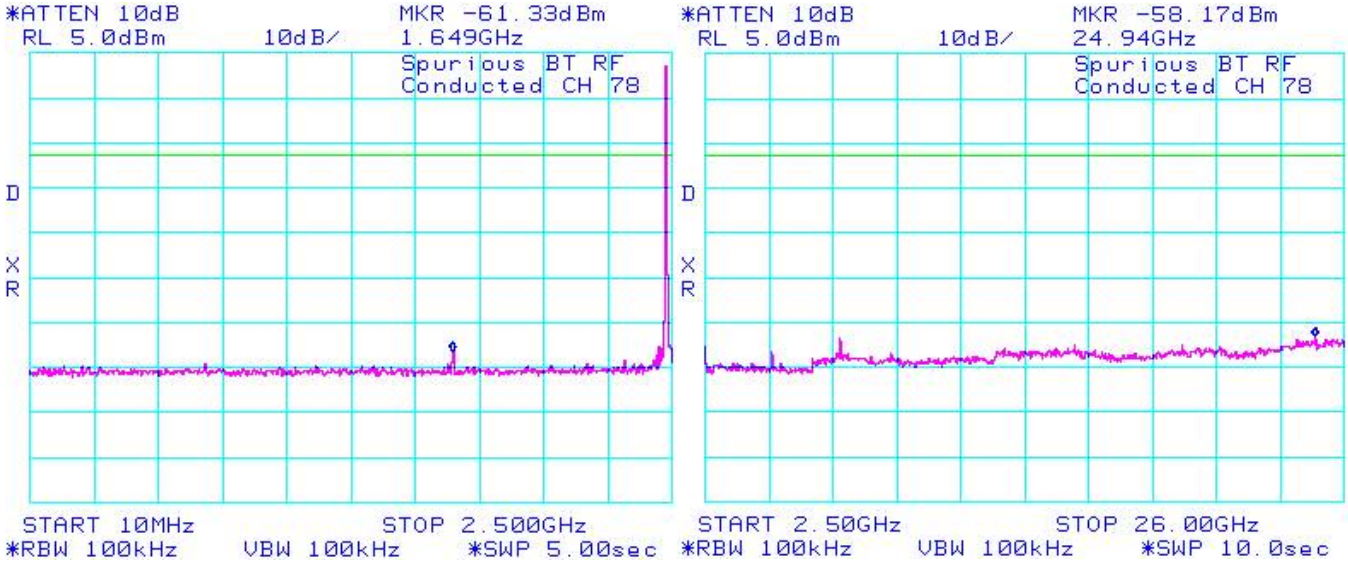
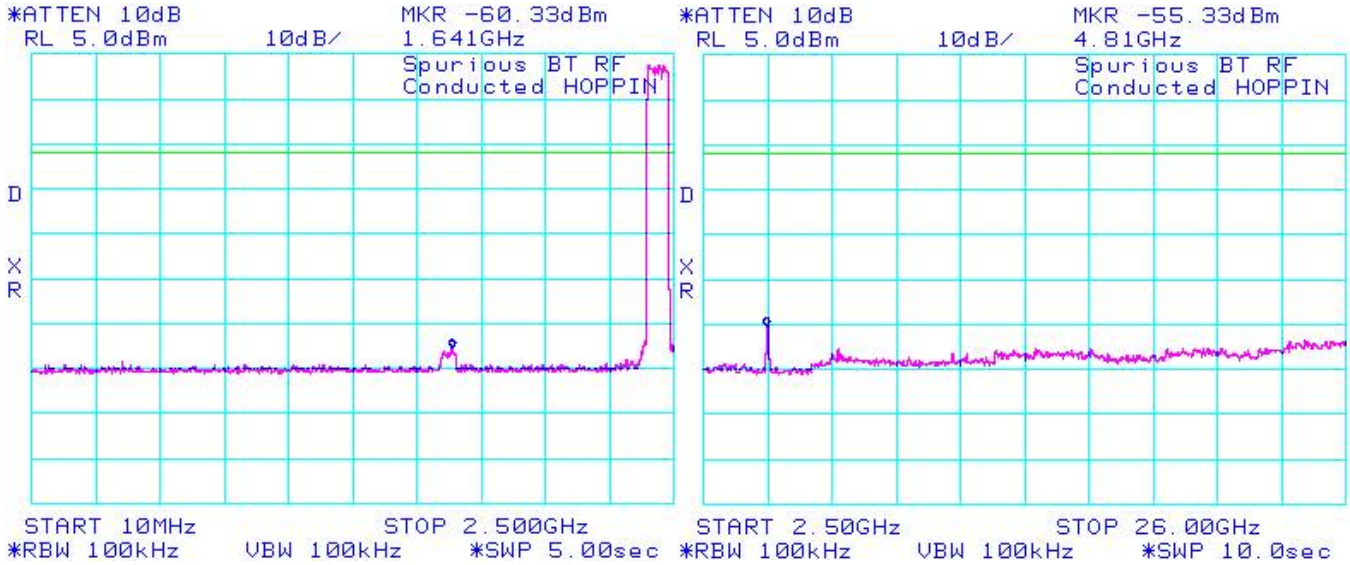



**Figure 3-36: Spurious RF Conducted Emissions**
**Freq. Hopping, Static PBRS, DH5**



Bluetooth RF Conducted Emission Test Results cont'd

Using pattern type "Static PBRS" and packet type "3-DH5" during the measurements.

| Bluetooth Channel | Channel Power (dBm) | Max. Measured Level (dBm) | Max. Measured Level from carrier (dBc) | Limit (dBc) |
|---|---|---|---|---|
| 0 | 2.33 | -57.83 | -60.16 | -20 |
| 39 | 2.17 | -58.83 | -61.00 | -20 |
| 78 | 1.50 | -58.67 | -60.17 | -20 |
| Hopping mode | 1.50 | -58.67 | -60.17 | -20 |

The environmental test conditions were:

| | |
|---|---|
| Temperature | 22ºC |
| Pressure | 1002 mb |
| Relative Humidity | 33% |

See figures 3-37 to 3-40 for the plots of the spurious RF conducted emissions.

## Bluetooth RF Conducted Emission Test Results cont'd

**Figure 3-37 : Spurious RF Conducted Emissions**
**Single Freq., Static PBRS, 3-DH5**

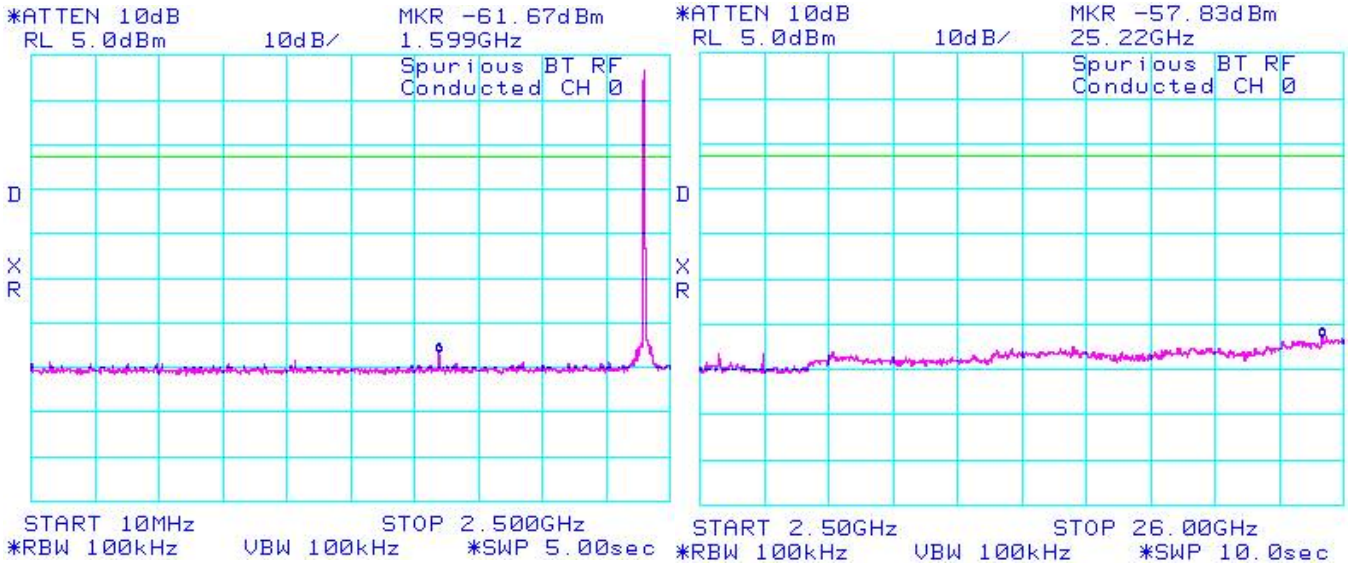
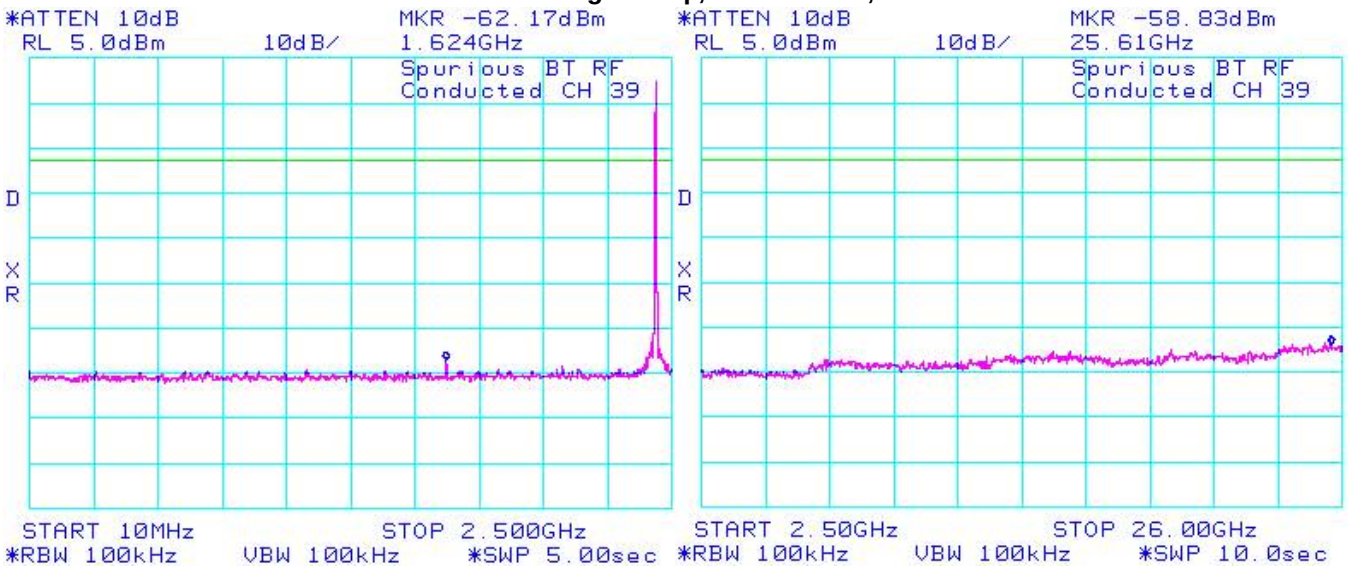



**Figure 3-38: Spurious RF Conducted Emissions**
**Single Freq., Static PBRS, 3-DH5**



## Bluetooth RF Conducted Emission Test Results cont'd

**Figure 3-39: Spurious RF Conducted Emissions**
**Single Freq., Static PBRS, 3-DH5**

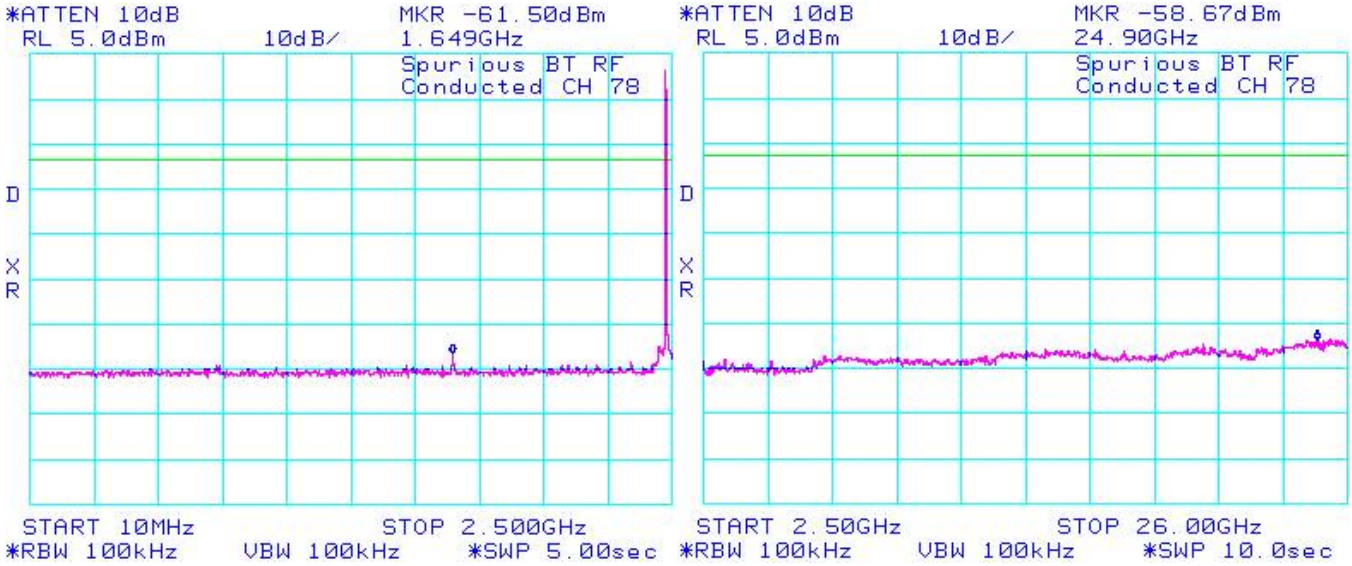



**Figure 3-40 : Spurious RF Conducted Emissions**
**Freq. Hopping, Static PBRS, 3-DH5**