

EMI Test Report

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



Research In Motion Limited

REPORT NO.: RIM-0086-0406-01

PRODUCT MODEL NO: RAP40GW
TYPE NAME: BlackBerry Wireless Handheld
FCC ID: L6ARAP40GW
IC: 2503A-RAP40GW

Date: _____06 July 2004_____

Declaration**Statement of Performance:**

The BlackBerry Wireless Handheld, model RAP40GW ASY-07029-001 revision 1G, when configured and operated per RIM's operation instructions, 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 equipment used was suitable for the tests performed and within the manufacturers published specifications and operating parameters.

The test methods were consistent with the methods described in the relevant standards.

Tested by

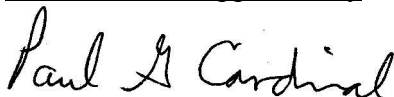
Maurice Battler
Compliance Specialist

Date: 06 July 2004



Masud S. Attayi, P.Eng.
Senior Compliance and Certification Engineer

Date: 07 July 2004

Reviewed and Approved by:

Paul G. Cardinal, Ph.D.
Manager, Compliance and Certification

Date: 08 July 2004

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A) Scope

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

- o FCC CFR 15 Subpart C, Dec. 8, 2003
- o Industry Canada, RSS-210, Issue 5, Nov./2001, Low Power Licence-Exempt Radiocommunication Devices

B) Product Identification

The equipment under test (EUT) was tested at the Research In Motion (RIM) EMI test facility, located at:

305 Phillip Street
Waterloo, Ontario
Canada, N2L 3W8
Phone: 519 888 7465
Fax: 519 888 6906
Web Site: www.rim.com

The testing began on May 05, 2004 and completed on June 25, 2004. The sample equipment under test (EUT) included:

- 1a) BlackBerry Wireless Handheld, model number RAP40GW, ASY-07029-001 revision 1G, RF PCB version 003, PIN 20130C360, FCC ID L6ARAP40GW, IC: 2503A-RAP40GW.
 - 1b) BlackBerry Wireless Handheld, model number RAP40GW, ASY-07029-001 revision 1G, RF PCB version 003, PIN 200FA58C, FCC ID L6ARAP40GW, IC: 2503A-RAP40GW.
 - 2a) Travel Charger, model number PSM05R-050CH, part number ASY-03746-003 with an output voltage of 5.0 volts dc and attached USB data cable with a lead length of 0.71 metres.
 - 2b) External Battery Charger model, number BCM6710A, part number ASY-06630-001.
 - 2c) North American Travel Charger, model number PSM04A-050RIM, part number ASY-07040-001 with an output voltage of 5.0 volts dc and attached USB data cable with a lead length of 0.73 metres.
 - 2d) Travel Charger, model number PSM05R-050Q, part number ASY-04078-001 with an output of 5.0 volts dc.
 - 2e) Rapid Battery Travel Charger, model number PSM08R-050RIM, part number ASY-07041-001 with an output voltage of 5.0 volts dc and attached USB data cable with a lead length of 0.85 metres.
 - 3) USB data cable, model number HDW-04162-001, 1.45 metres long.
 - 4) Headset, model number HDW-03458-001. The lead length was 1.25 metres long.
- C) The transmit frequency ranges for the BlackBerry Wireless Handheld model number RAP40GW are: GSM850 824 to 849 MHz, GSM 880 to 915 MHz, DCS 1710 to 1785 MHz, PCS 1850 to 1910 MHz, Bluetooth 2402 to 2480 MHz.

Support Equipment Used for the Testing of the EUT

- 1) Communication Tester, Rohde & Schwarz, model CMU 200, serial number 100251
- 2) Communication Tester, Rohde & Schwarz, model CMU 200, serial number 837493/073
- 3) DC Power Supply, H/P, model 6632B, serial number US37472178

D) Test Voltage

The ac input voltage was 120 volts, 60 Hz where applicable. This configuration was per RIM's specifications.

E) Test Results Chart

SPECIFICATION	Test Type	MEETS REQUIREMENTS	Performed By
FCC CFR 47 Part 15.207 IC RSS-210	AC Conducted Emissions	Yes	Masud Attayi
FCC CFR 47 Part 15.209	Radiated Emissions	Yes	Masud Attayi
FCC CFR 47 Part 15.247(a) IC RSS-210	20 dB Bandwidth, Carrier Freq. Separation Number of Hopping freq. Dwell Time	Yes	Maurice Battler
FCC CFR 47 Part 15.247(b) IC RSS-210	Max. Peak Output Power	Yes	Maurice Battler
FCC CFR 47 Part 15.247(c) IC RSS-210	Band Edge Compliance Spurious RF Conducted Emissions	Yes	Maurice Battler

F) Modifications to EUT

No modifications were required to the EUT.

G) Summary of Results

1) AC CONDUCTED EMISSIONS

The conducted emissions were measured while 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:

1. The Handheld in battery charging mode with Bluetooth transmitting was connected to the Travel Charger, model number PSM05R-050CH, part number ASY-03746-003. The ac input to the Travel Charger was 120 volts, 60 Hz.
2. The Handheld in battery charging mode with Bluetooth transmitting was connected to the External Battery Charger, part number ASY-06630-001. The ac input to the External Battery Charger was 120 volts, 60 Hz.
3. The Handheld in battery charging mode with Bluetooth transmitting was connected to the North American Travel Charger, part number ASY-07040-001. The ac input to the North American Travel Charger was 120 volts, 60 Hz.
4. The Handheld in battery charging mode with Bluetooth transmitting was connected to the Travel Charger, part number ASY-04078-001 via the USB data cable. The ac input to the Travel Charger was 120 volts, 60 Hz.
5. The Handheld in battery charging mode with Bluetooth transmitting was connected to the Rapid Battery Travel Charger, part number ASY-07041-001. The ac input to the Rapid Battery Travel Charger was 120 volts, 60 Hz.

The sample EUT's conducted emissions were compared with respect to the FCC CFR 47 Part 15, Subpart C (CISPR 22) and RSS-210, Class B limit. The sample EUT had a worse case test margin of 11.77 dB at 0.177 MHz in the North American Travel Charger test configuration.

Measurement Uncertainty ± 2.0 dB

To view the test data/plots, see APPENDIX 1.

2) RADIATED EMISSIONS

The radiated emissions from the EUT were measured as per FCC Part 15.247 and IC RSS-210. The EUT was placed on a nonconductive wooden table, 100 cm high that was positioned on a remotely rotatable 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. At this point 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 polarisations of the emissions were measured.

The measurements were done in a semi-anechoic chamber. The semi-anechoic chamber 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 Handheld was measured in standalone configuration with Bluetooth transmitting at low channel (0), middle channel (39) and high channel (78).

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 harmonics were investigated up to the 10th harmonic. Emissions were in the noise floor (NF).

Sample Calculation:

Field Strength (dB μ V/M) is calculated as follows:

FS = Measured Level (dB μ V) + A.F. (dB/m) + Cable Loss (dB) - Preamp (dB) + Filter Loss (dB)

Measurement Uncertainty ± 4.0 dB

To view the test data see APPENDIX 2.

3) BLUETOOTH RF CONDUCTED EMISSIONS

a) 20 dB Bandwidth

The EUT passed the 20 dB bandwidth requirement 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 passed 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 passed 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 passed 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 in DH1, DH3 and DH5 modes. 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 passed 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 passed 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 passed 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.

H) Compliance Test Equipment Used

<u>UNIT</u>	<u>MANUFACTURER</u>	<u>MODEL</u>	<u>SERIAL NUMBER</u>	<u>CAL DUE DATE</u> (YY MM DD)	<u>USE</u>
Preamplifier	Sonoma	310N/11909A	185831	04-11-06	Radiated Emissions
Preamplifier system	TDK RF Solutions	PA-02	080010	04-11-06	Radiated Emissions
EMC Analyzer	Agilent	E7405A	US40240226	04-07-31	Radiated Emissions
Hybrid Log Antenna	TDK	HLP-3003C	017401	04-07-14	Radiated Emissions
Horn Antenna	TDK	HRN-0118	130092	04-09-16	Radiated Emissions
Horn Antenna	TDK	HRN-0118	30101	04-07-18	Radiated Emissions
Horn Antenna	Emco	3116	2538	04-09-22	Radiated Emissions
Preamplifier	TDK	18-26	3002	04-11-27	Radiated Emissions
Dipole Antenna	Schwarzbeck	UHAP	974	04-09-25	Radiated Emissions
Dipole Antenna	Schwarzbeck	UHAP	973	04-12-01	Radiated Emissions
Universal Radio Communication Tester	Rohde & Schwarz	CMU 200	837493/073	05-05-29	Radiated Emissions
Universal Radio Communication Tester	Rohde & Schwarz	CMU 200	100251	05-04-21	Conducted Emissions
Spectrum Analyzer	HP	8563E	3745A08112	04-07-31	Radiated/Conducted Emissions
DC Power Supply	HP	6632B	US37472178	04-08-01	Conducted Emissions
Environment Monitor	Control Company	1870	230355190	06-01-11	Radiated/Conducted Emissions
Environment Monitor	Control Company	1870	230355189	06-01-11	RF Conducted Emissions

APPENDIX 1

AC CONDUCTED EMISSIONS TEST DATA/PLOTS

AC Conducted Emissions Test Results

June 03, 2004

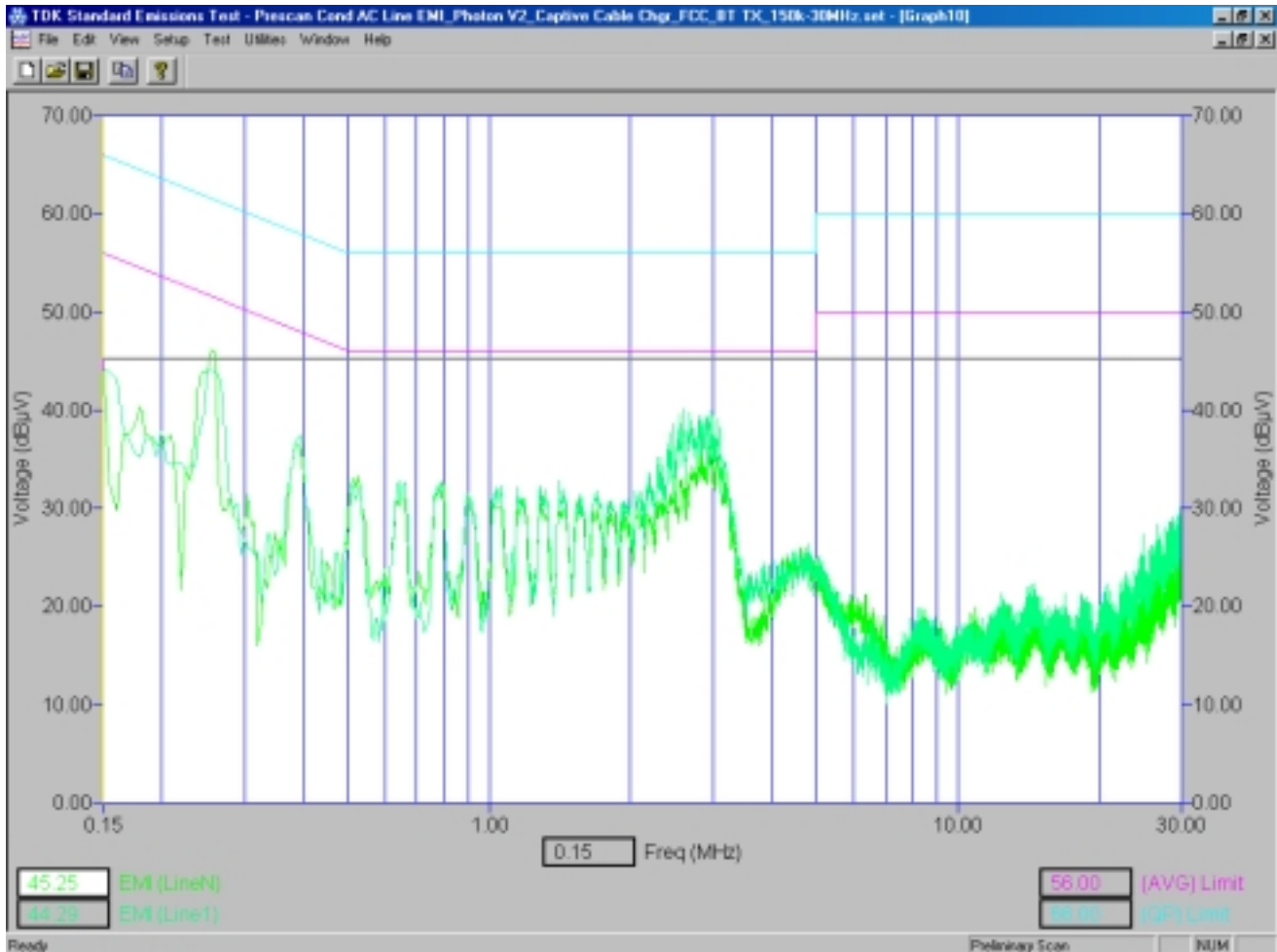
FCC CFR 47 Part 15, Subpart C (CISPR 22), Industry Canada, RSS-210, Class B

Operating Mode: The Handheld in battery charging mode with Bluetooth transmitting was connected to the Travel Charger part number ASY-03746-003. The ac input to the Travel Charger was 120 volts, 60 Hz

Frequency (MHz)	Line	Reading QP (dBµV)	Correction Factors for Impulse Limiter, LISN, Cable (dB)	QP Level (reading + Corr.Factor) (dB)	(QP) Limit (dBµV)	(AVG) Limit (dBµV)	Margin QP Limits (dB)	Margin Ave. Limits (dB)
0.155	N	26.87	9.77	36.69	66.0	56.0	-29.31	-19.31
0.252	N	32.81	9.72	42.65	61.6	51.6	-18.94	-8.94
0.388	N	24.42	9.73	34.25	58.1	48.1	-23.81	-13.81
0.518	N	21.96	9.72	31.80	56.0	46.0	-24.20	-14.20
2.462	N	21.00	9.74	30.90	56.0	46.0	-25.10	-15.10
2.569	L1	25.11	9.74	35.01	56.0	46.0	-20.99	-10.99
2.580	L1	25.14	9.76	35.05	56.0	46.0	-20.95	-10.95
2.689	L1	25.79	9.76	35.70	56.0	46.0	-20.30	-10.30
2.800	L1	25.23	9.76	35.14	56.0	46.0	-20.86	-10.86
2.935	L1	25.64	9.76	35.49	56.0	46.0	-20.51	-10.51
2.939	N	23.06	9.76	32.91	56.0	46.0	-23.09	-13.09
2.951	L1	25.34	9.79	35.18	56.0	46.0	-20.82	-10.82

All other emission levels had a test margin of greater than 25 dB.
See graph 1 for the measurement plot.

AC Conducted Emissions Test Graph 1



The Handheld in battery charging mode with Bluetooth transmitting was connected to the Travel Charger part number ASY-03746-003. The ac input to the Travel Charger was 120 volts, 60 Hz.

AC Conducted Emissions Test Results cont'd

May 28, 2004

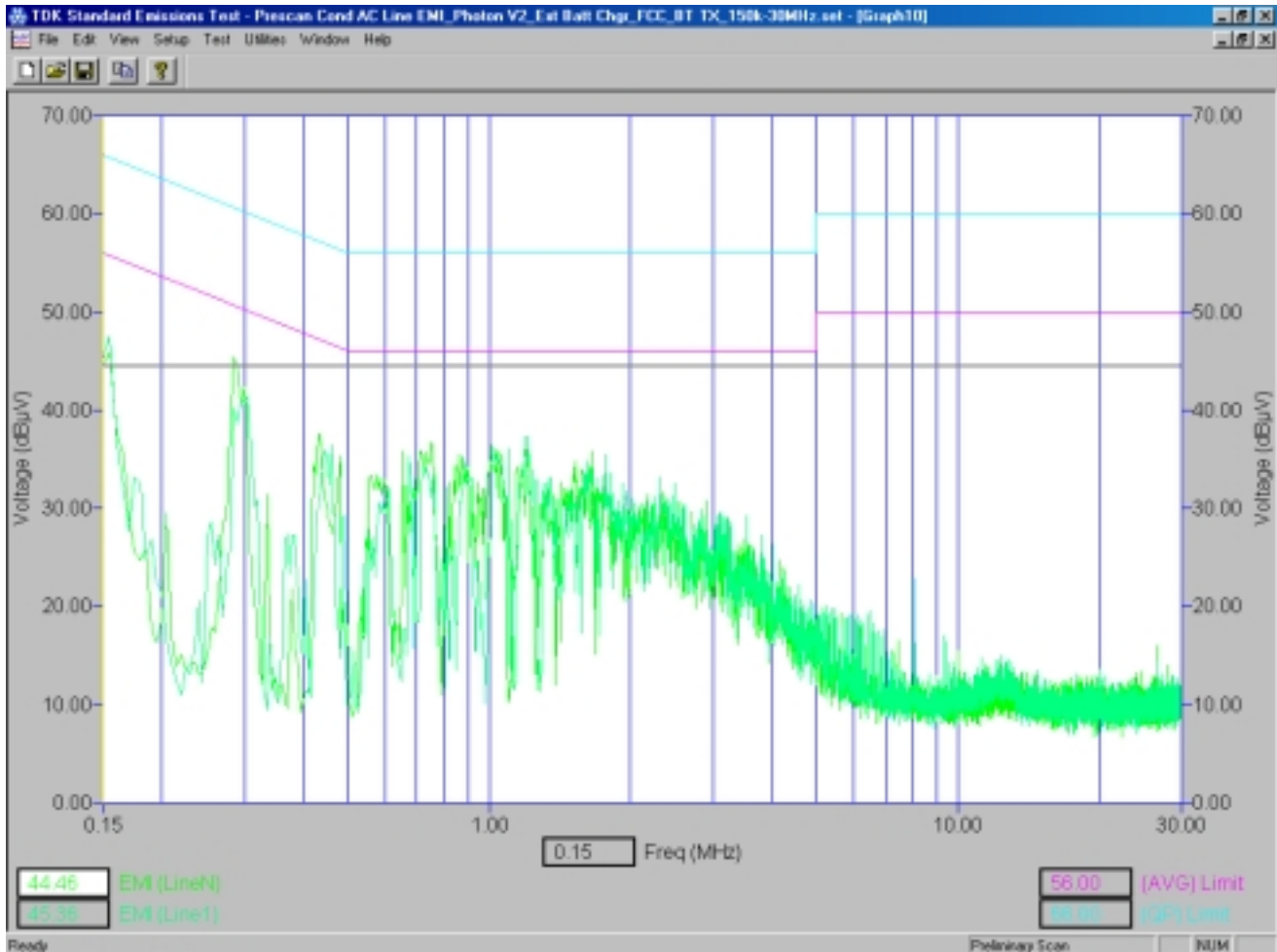
FCC CFR 47 Part 15, Subpart C (CISPR 22), Industry Canada, RSS-210, Class B

Operating Mode: The Handheld in battery charging mode with Bluetooth transmitting was connected to the External Battery Charger part number ASY-06630-001. The ac input to the External Battery Charger was 120 volts, 60 Hz

Frequency (MHz)	Line	Reading QP (dBµV)	Correction Factors for Impulse Limiter, LISN, Cable (dB)	QP Level (reading + Corr.Factor) (dB)	(QP) Limit (dBµV)	(AVG) Limit (dBµV)	Margin QP Limits (dB)	Margin Ave. Limits (dB)
0.150	L1	36.06	9.82	45.88	65.7	55.7	-19.85	-9.85
0.151	N	39.09	9.82	48.91	65.7	55.7	-16.82	-6.82
0.297	L1	24.89	9.85	34.74	60.1	50.1	-25.37	-15.37
0.298	N	29.07	9.85	38.92	60.7	50.7	-21.75	-11.75
0.751	N	22.74	9.86	32.60	56.0	46.0	-23.40	-13.40
1.031	N	14.38	9.90	24.28	56.0	46.0	-31.72	-21.72
1.035	L1	14.97	9.90	24.87	56.0	46.0	-31.13	-21.13
1.109	L1	20.24	9.90	30.14	56.0	46.0	-25.86	-15.86
1.187	N	14.03	9.90	23.93	56.0	46.0	-32.07	-22.07
1.188	L1	14.48	9.89	24.37	56.0	46.0	-31.63	-21.63
1.217	N	20.99	9.89	30.88	56.0	46.0	-25.12	-15.12
1.780	L1	15.28	9.88	25.16	56.0	46.0	-30.84	-20.84

All other emission levels had a test margin of greater than 25 dB.
See graph 2 for the measurement plot.

AC Conducted Emissions Test Graph 2



The Handheld in battery charging mode with Bluetooth transmitting was connected to the External Battery Charger part number ASY-06630-001. The ac input to the External Battery Charger was 120 volts, 60 Hz.

AC Conducted Emissions Test Results cont'd

June 04, 2004

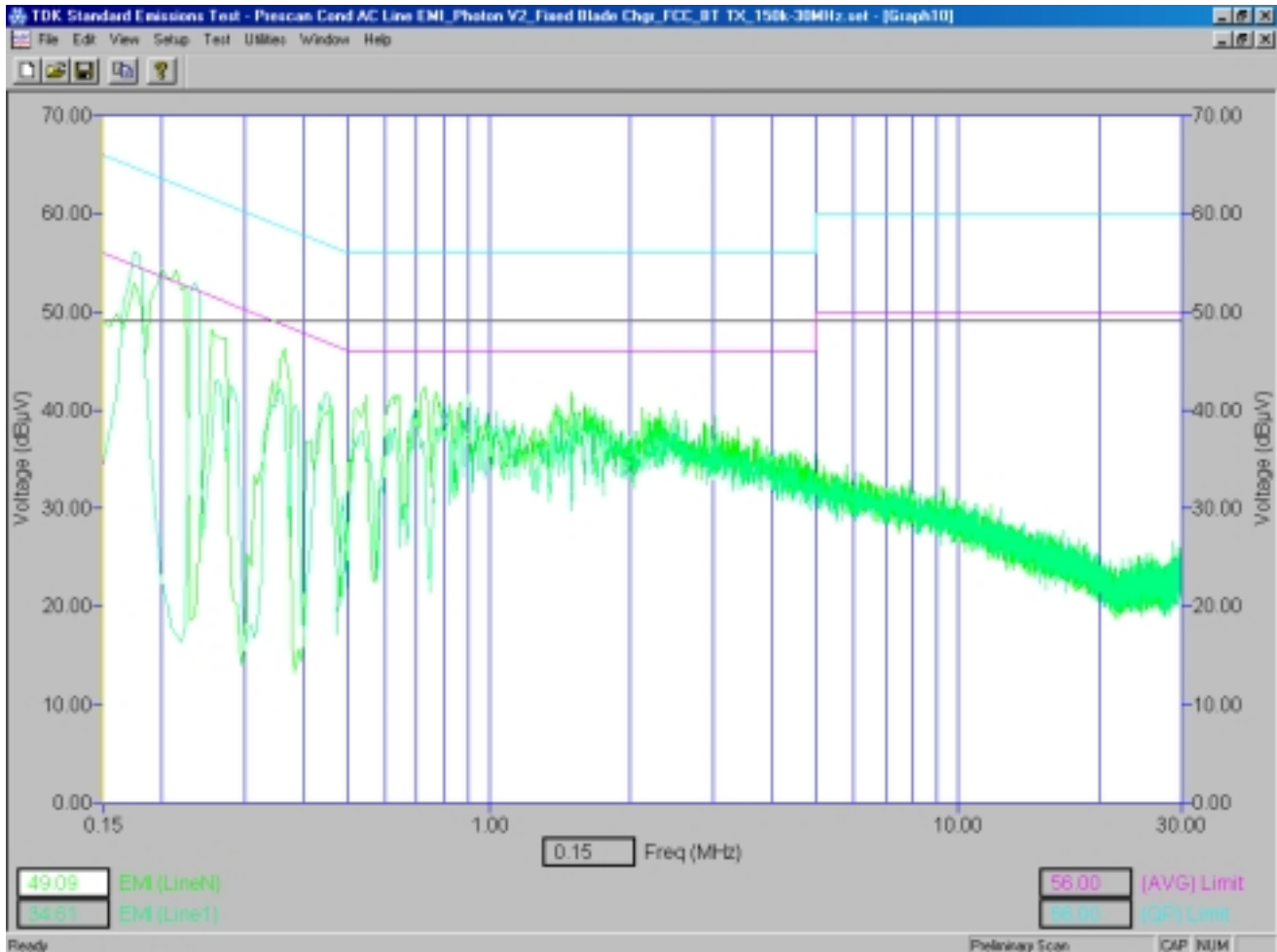
FCC CFR 47 Part 15, Subpart C (CISPR 22), Industry Canada, RSS-210, Class B

Operating Mode: The Handheld in battery charging mode with Bluetooth transmitting was connected to the North American Travel Charger part number ASY-07040-001. The ac input to the North American Travel Charger was 120 volts, 60 Hz

Freq. (MHz)	Line	Reading QP (dBµV)	Reading Ave. (dBµV)	Correction Factors for Impulse Limiter, LISN, Cable (dB)	QP Level (reading + Corr.Factor) (dB)	Ave. Level (reading + Corr.Factor) (dB)	(QP) Limit (dBµV)	(AVG) Limit (dBµV)	Margin QP Limits (dB)	Margin Ave. Limits (dB)
0.177	L1	42.94	33.10	9.83	52.77	42.93	64.7	54.7	-11.95	-11.77
0.177	N	42.81	33.10	9.83	52.64	42.93	64.7	54.7	-12.08	-11.77
0.205	N	37.81	7.81	9.83	47.64	17.64	63.6	53.6	-15.97	-35.96
0.223	L1	37.52	5.42	9.84	47.36	15.26	62.3	52.3	-14.91	-37.04
0.363	N	28.87	-	9.84	38.71	-	58.6	48.6	-19.91	-
0.447	L1	30.39	-	9.83	40.22	-	56.9	46.9	-16.66	-
0.718	N	29.65	-	9.85	39.50	-	56.0	46.0	-16.50	-
0.773	N	28.55	-	9.86	38.41	-	56.0	46.0	-17.59	-
0.807	L1	28.50	-	9.86	38.36	-	56.0	46.0	-17.64	-
0.895	L1	28.04	-	9.88	37.92	-	56.0	46.0	-18.08	-
1.503	N	26.15	-	9.89	36.04	-	56.0	46.0	-19.96	-
1.673	L1	24.78	-	9.89	34.67	-	56.0	46.0	-21.33	-
1.985	N	-	16.28	9.88	-	26.16	56.0	46.0	-	-19.84
1.992	L1	-	15.61	9.88	-	25.49	56.0	46.0	-	-20.41
2.086	N	-	16.15	9.88	-	26.03	56.0	46.0	-	-19.97
2.113	L1	-	15.51	9.88	-	25.40	56.0	46.0	-	20.60

The Average and Quasi-Peak detectors were used for the measurements.
 All other emission levels had a test margin of greater than 25 dB.
 See graph 3 for the measurement plot.

AC Conducted Emissions Test Graph 3



The Handheld in battery charging mode with Bluetooth transmitting was connected to the North American Travel Charger part number ASY-07040-001. The ac input to the North American Travel Charger was 120 volts, 60 Hz.

AC Conducted Emissions Test Results cont'd

May 28, 2004

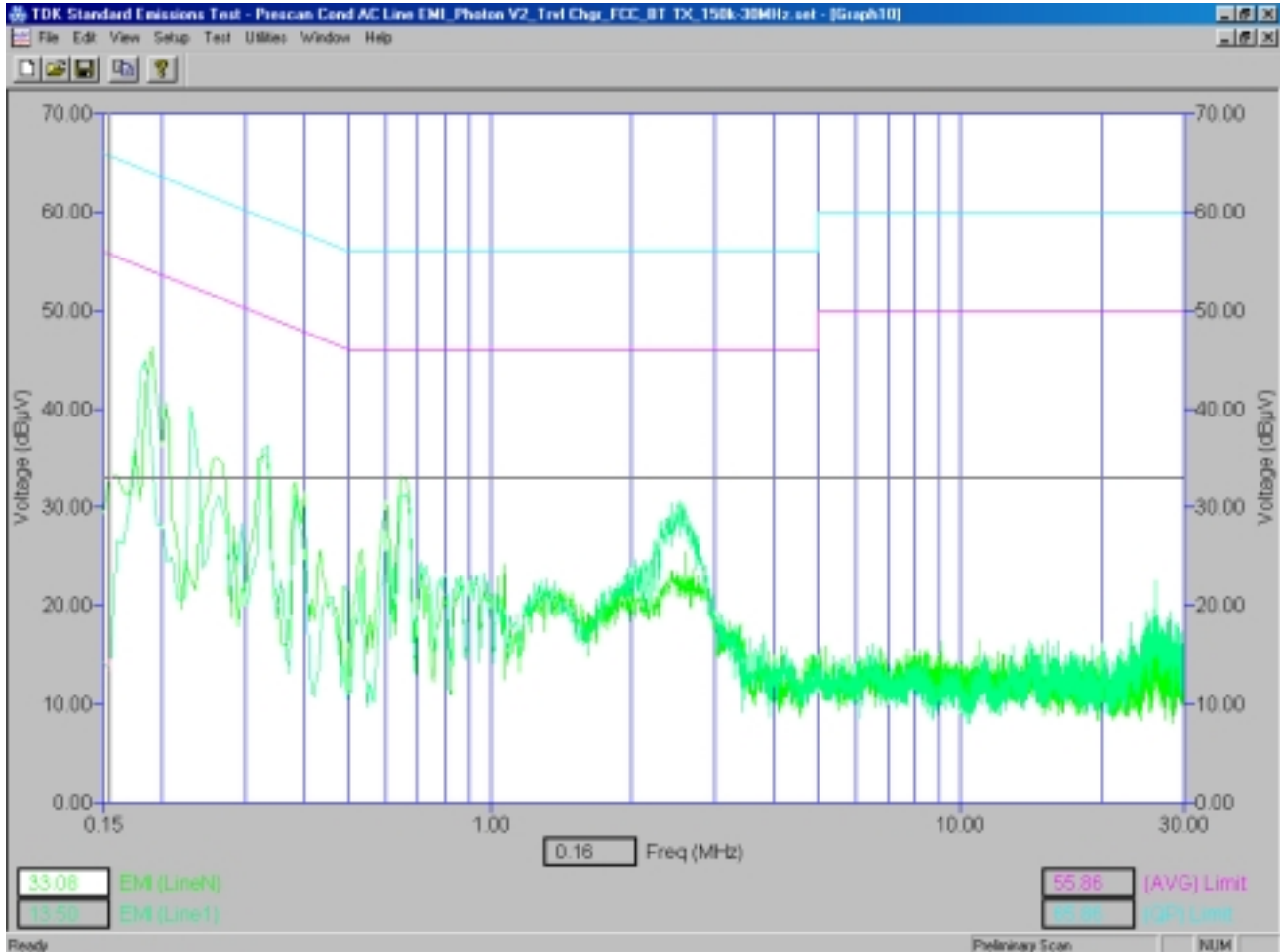
FCC CFR 47 Part 15, Subpart C (CISPR 22), Industry Canada, RSS-210, Class B

Operating Mode: The Handheld in battery charging mode with Bluetooth transmitting was connected to the Travel Charger part number ASY-04078-001 via the USB data cable, model number HDW-04162-001. The ac input to the Travel Charger was 120 volts, 60 Hz

Frequency (MHz)	Line	Reading QP (dBµV)	Correction Factors for Impulse Limiter, LISN, Cable (dB)	QP Level (reading + Corr.Factor) (dB)	(QP) Limit (dBµV)	(AVG) Limit (dBµV)	Margin QP Limits (dB)	Margin Ave. Limits (dB)
0.191	L1	29.92	9.83	39.75	64.3	54.3	-24.51	-14.51
0.194	N	32.94	9.83	42.77	64.0	54.0	-21.27	-11.27
0.195	N	32.85	9.83	42.68	63.4	53.4	-20.72	-10.72
0.210	L1	23.6	9.84	33.44	62.5	52.5	-29.01	-19.01
0.321	L1	21.16	9.84	31.00	59.3	49.3	-28.32	-18.32
0.326	N	23.01	9.84	32.85	59.5	49.5	-26.60	-16.60
0.387	L1	17.35	9.83	27.18	58.2	48.2	-30.99	-20.99
0.387	N	18.73	9.83	28.56	58.2	48.2	-29.61	-19.61
0.593	N	17.35	9.85	27.2	56.0	46.0	-28.80	-18.80
0.648	N	20.93	9.85	30.78	56.0	46.0	-25.22	-15.22
0.653	L1	18.81	9.85	28.66	56.0	46.0	-27.34	-17.34
2.520	L1	14.34	9.90	24.24	56.0	46.0	-31.76	-21.76

All other emission levels had a test margin of greater than 25 dB.
See graph 4 for the measurement plot.

AC Conducted Emissions Test Graph 4



The Handheld in battery charging mode with Bluetooth transmitting was connected to the Travel Charger part number ASY-04078-001 via the USB data cable, model number HDW-04162-001. The ac input to the Travel Charger was 120 volts, 60 Hz.

AC Conducted Emissions Test Results cont'd

June 23, 2004

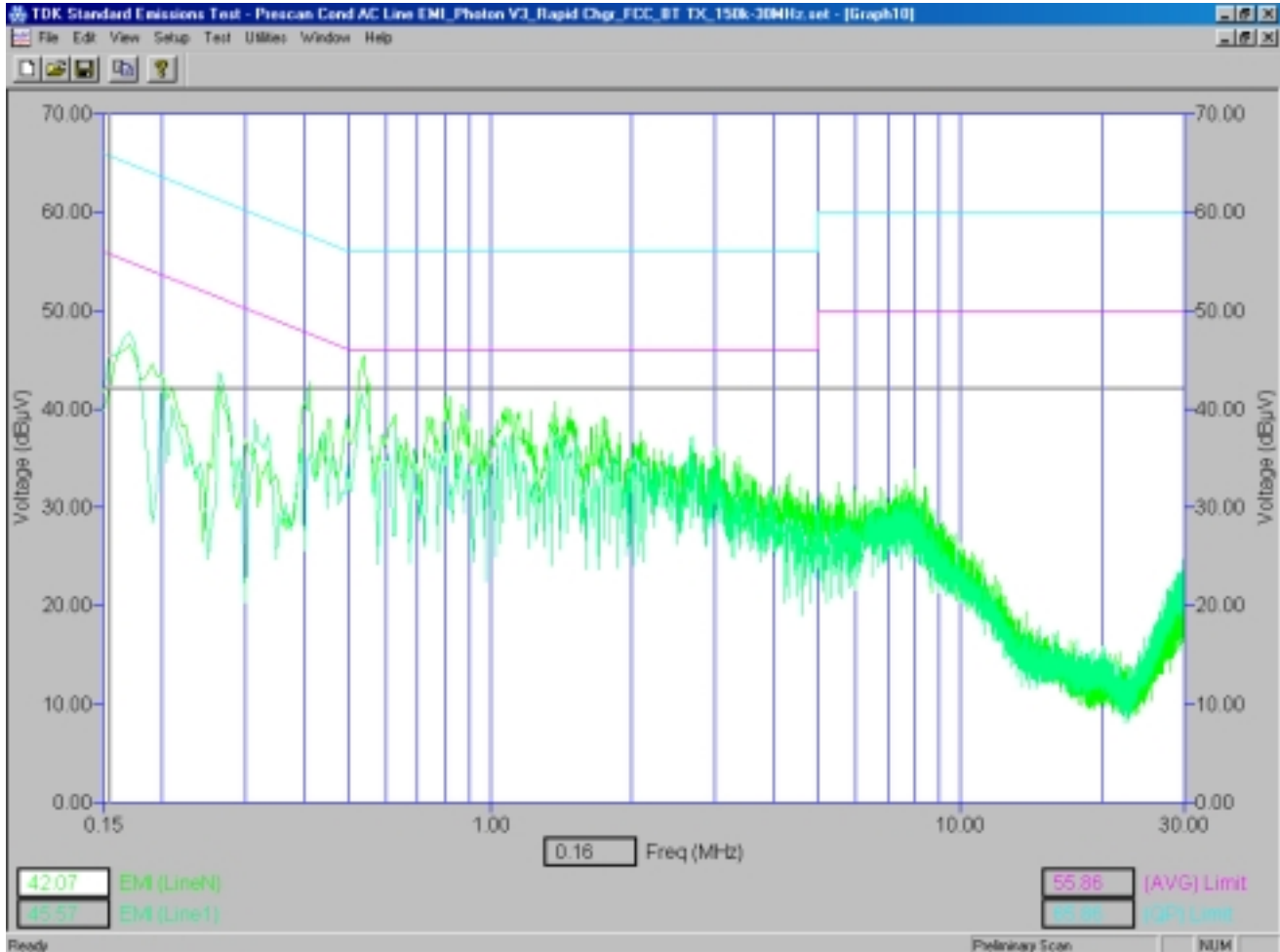
FCC CFR 47 Part 15, Subpart C (CISPR 22), Industry Canada, RSS-210, Class B

Operating Mode: The Handheld in battery charging mode with Bluetooth transmitting was connected to the Rapid Battery Travel Charger part number ASY-07041-001. The ac input to the Rapid Battery Travel Charger was 120 volts, 60 Hz

Frequency (MHz)	Line	Reading QP (dBµV)	Correction Factors for Impulse Limiter, LISN, Cable (dB)	QP Level (reading + Corr.Factor) (dB)	(QP) Limit (dBµV)	(AVG) Limit (dBµV)	Margin QP Limits (dB)	Margin Ave. Limits (dB)
0.163	L1	29.89	9.83	39.72	65.0	55.0	-25.25	-15.25
0.403	N	27.88	9.83	37.71	57.7	47.7	-19.94	-9.94
0.527	N	22.78	9.84	32.62	56.0	46.0	-23.38	-13.38
0.533	L1	27.45	9.84	37.29	56.0	46.0	-18.71	-8.71
0.626	L1	23.69	9.85	33.54	56.0	46.0	-22.46	-12.46
0.801	N	26.36	9.86	36.22	56.0	46.0	-19.78	-9.78
0.815	L1	22.03	9.86	31.89	56.0	46.0	-24.11	-14.11
0.874	N	23.51	9.87	33.38	56.0	46.0	-22.62	-12.62
1.091	N	26.68	9.9	36.58	56.0	46.0	-19.42	-9.42
1.354	N	25.21	9.89	35.10	56.0	46.0	-20.90	-10.90
1.36	L1	22.14	9.89	32.03	56.0	46.0	-23.97	-13.97
1.366	L1	21.79	9.89	31.68	56.0	46.0	-24.32	-14.32

All other emission levels had a test margin of greater than 25 dB.
See graph 5 for the measurement plot.

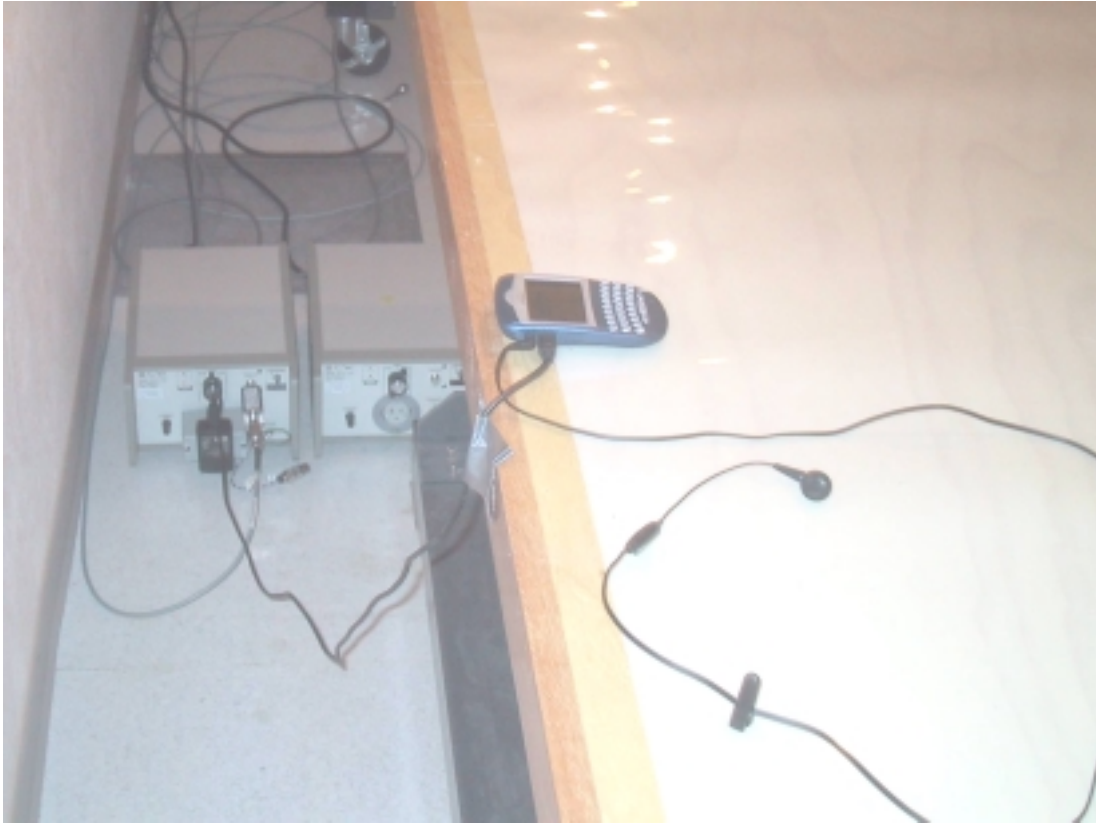
AC Conducted Emissions Test Graph 5



The Handheld in battery charging mode with Bluetooth transmitting was connected to the Rapid Battery Travel Charger part number ASY-07041-001. The ac input to the Rapid Battery Travel Charger was 120 volts, 60 Hz.

AC Conducted Emission Test-Setup Photo

FCC CFR 47 Part 15, Subpart C (CISPR 22), Industry Canada, RSS-210, Class B



APPENDIX 2

RADIATED EMISSIONS TEST DATA

Radiated Emissions Test Results

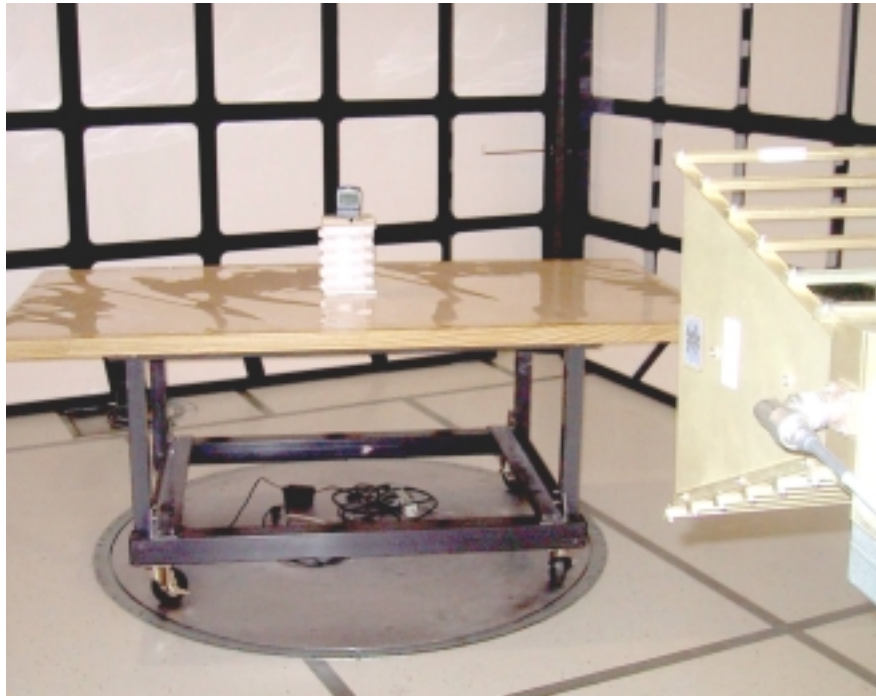
Test Distance was 3.0 metres.

Bluetooth Band

June 25, 2004

The measurements were performed in frequency hopping mode (channels 0 to 78) at maximum output power.

EUT			Rx Antenna		Spectrum Analyzer			Substitution Method				
Type	Ch	Frequency (MHz)	Type	Pol.	Reading (dBuV)	Corrected Reading (dBuV)	Max (V,H) (dBuV)	Reading (dBm)	Corrected Reading (relative to dipole) (dBm)	Pol. Tx-Rx	Limit (Peak) (dBμ)	Diff to Limit (dB)
Handheld Standalone, Vertical position												
2 nd	0 - 78	4804-4960	Horn	V	NF	NF				V-V	74	
2 nd	0 - 78	4804-4960	Horn	H	NF					H-H		
The harmonics were investigated up to the 10th harmonic. Emissions were in the NF.												
Handheld Standalone, horizontal position												
2 nd	0 - 78	4804-4960	Horn	V	NF	NF				V-V	74	
2 nd	0 - 78	4804-4960	Horn	H	NF					H-H		
Emissions were in the NF.												
Handheld Standalone, on it's side												
2 nd	0 - 78	4804-4960	Horn	V	NF	NF				V-V	74	
2 nd	0 - 78	4804-4960	Horn	H	NF					H-H		
Emissions were in the NF.												

Radiated Emissions Test Photo

APPENDIX 3

BLUETOOTH RF CONDUCTED EMISSIONS TEST DATA/PLOTS

Bluetooth RF Conducted Emission Test Results

Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer	HP	8563E	374A08112	30 Hz – 26.5 GHz
Splitter	Weinschel	1515	ME092	DC – 18 GHz
Attenuator	Mini Circuit	MCL BW-S20W2	-	DC – 18 GHz
Attenuator	Mini Circuit	MCL BW-S6W2	-	DC – 18 GHz
Attenuator	Mini Circuit	MCL BW-S6W2	-	DC – 18 GHz
Universal Radio Communication Tester	Rohde & Schwarz	CMU200	100251	-
DC Power Supply	HP	6632B	US37472178	-

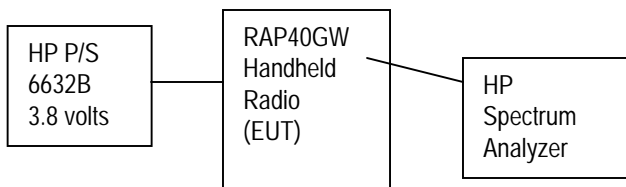
Bluetooth power output was at maximum for all the recorded measurements shown below.

20 dB Bandwidth

The EUT passed the 20 dB bandwidth requirement 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 PRBS and packet type DH5 during the measurements.

Bluetooth Channel	Limit (MHz)	Measured Value (MHz)
0	≤1.0	0.603
39	≤1.0	0.603
78	≤1.0	0.660

Test Setup Diagram



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

The environmental test conditions were: Temperature 24° C
 Pressure 980 mb
 Relative Humidity 22 %

RF Conducted Emission Test Results cont'd

Figure 1: 20 dB Bandwidth, channel 0

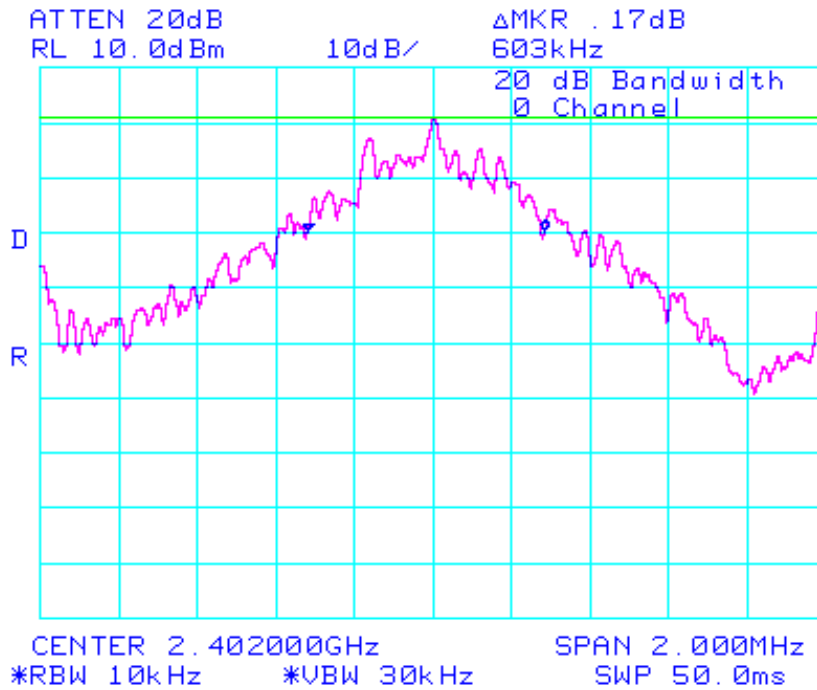
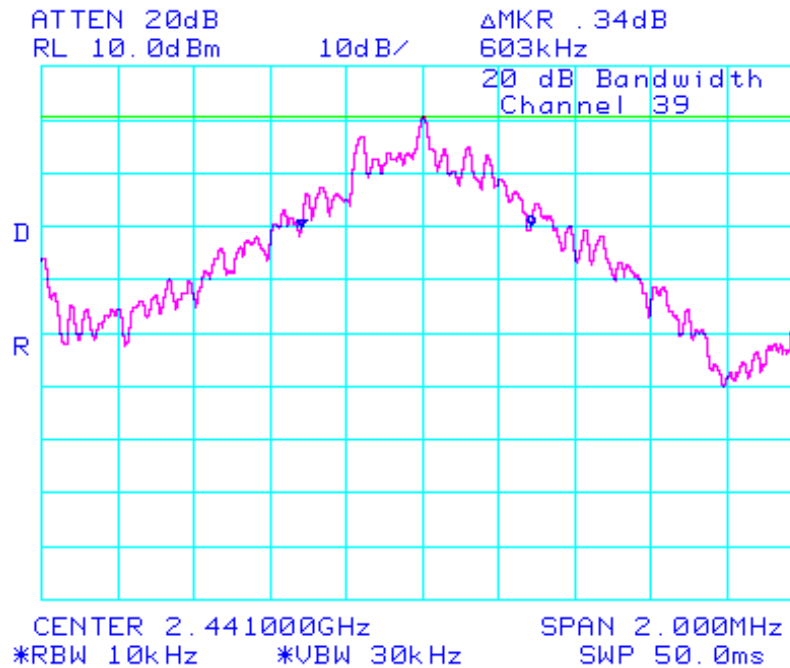
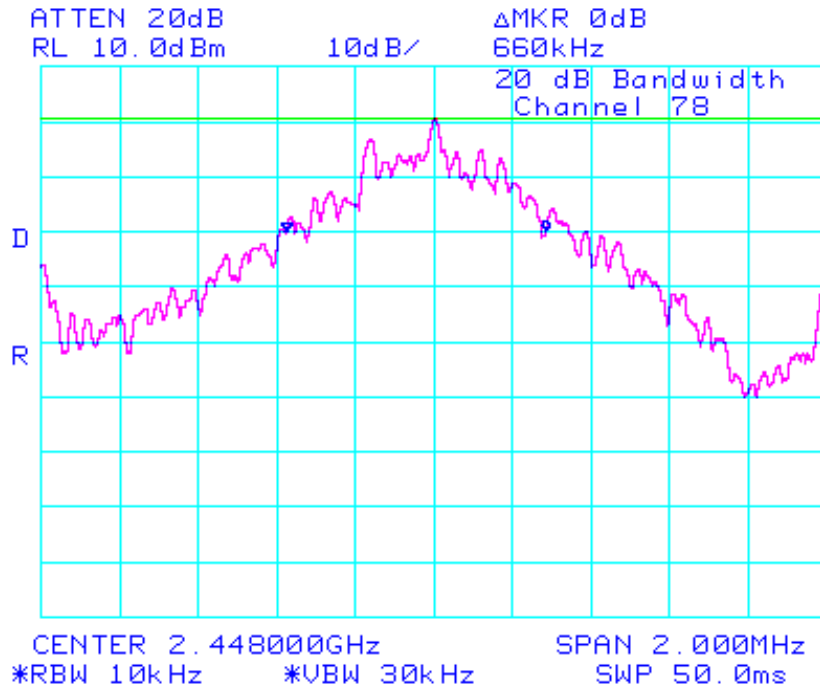


Figure 2: 20 dB Bandwidth, channel 39



RF Conducted Emission Test Results cont'd

Figure 3: 20 dB Bandwidth, channel 78



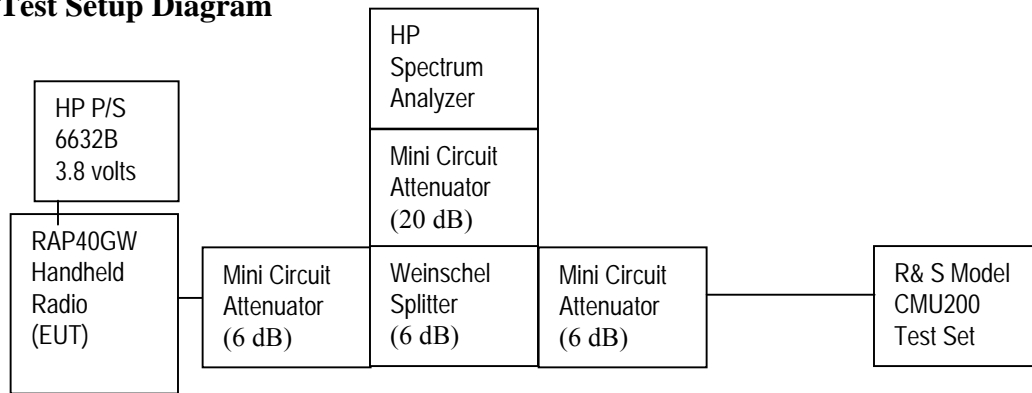
Carrier Frequency Separation

The EUT passed the Carrier Frequency Separation requirement 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 PRBS and packet type DH5 during the measurements.

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

RF Conducted Emission Test Results cont'd

Test Setup Diagram

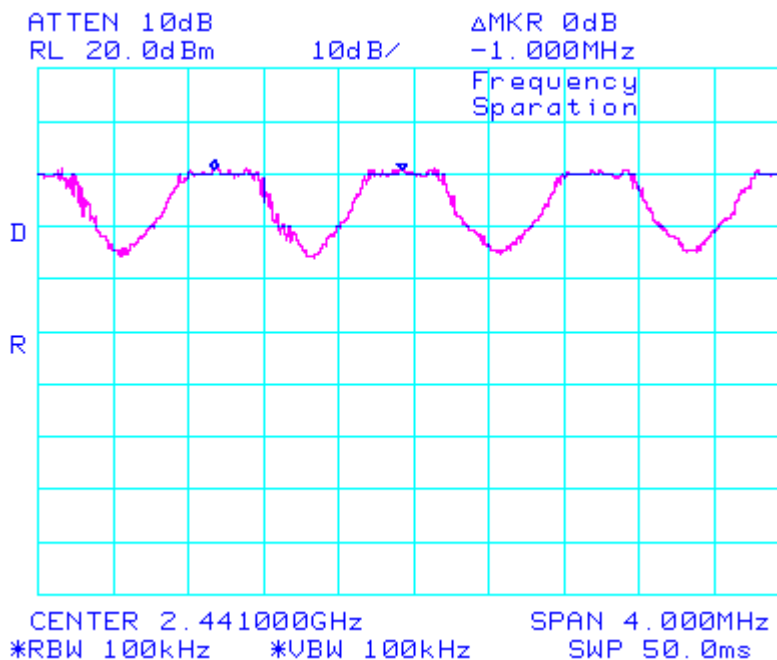


A reference offset of 32.9 dB was applied to the spectrum analyzer reference level for the attenuators and coaxial cable loss in the test circuit.

The environmental test conditions were: Temperature 24° C
 Pressure 980 mb
 Relative Humidity 34 %

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

Figure 4: Carrier Frequency Separation, channel 38 to 39



RF Conducted Emission Test Results cont'd

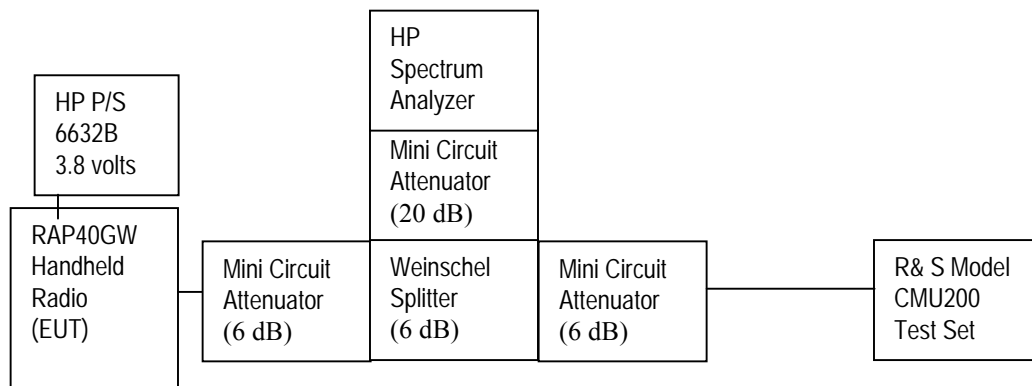
Number of Hopping Frequencies

The EUT passed the number of hopping frequencies requirement as per 47 CFR 15.247(a) and RSS-210.

Bluetooth was operating in frequency hopping (Euro/US) mode using pattern type Static PRBS and packet type DH5 during the measurements.

Limit (MHz)	Number of Hopping Frequencies
≥ 75	79

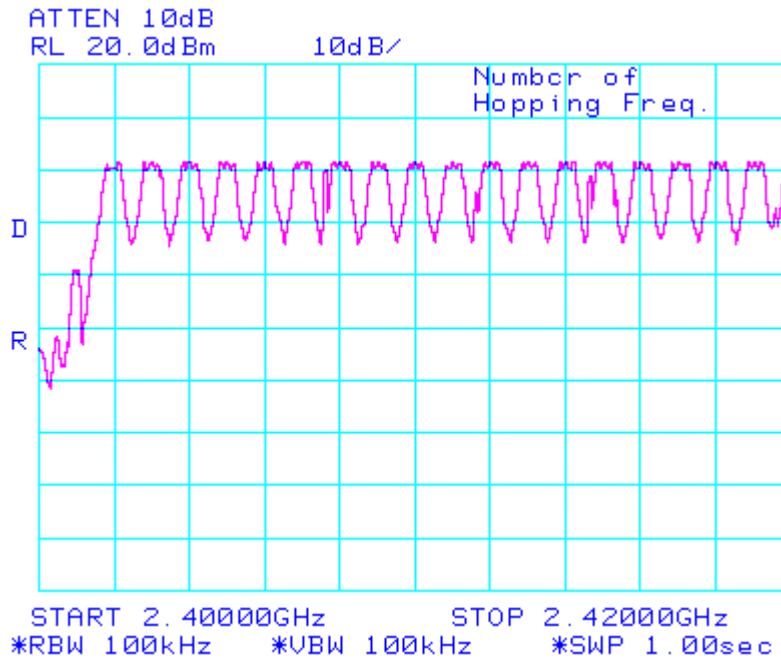
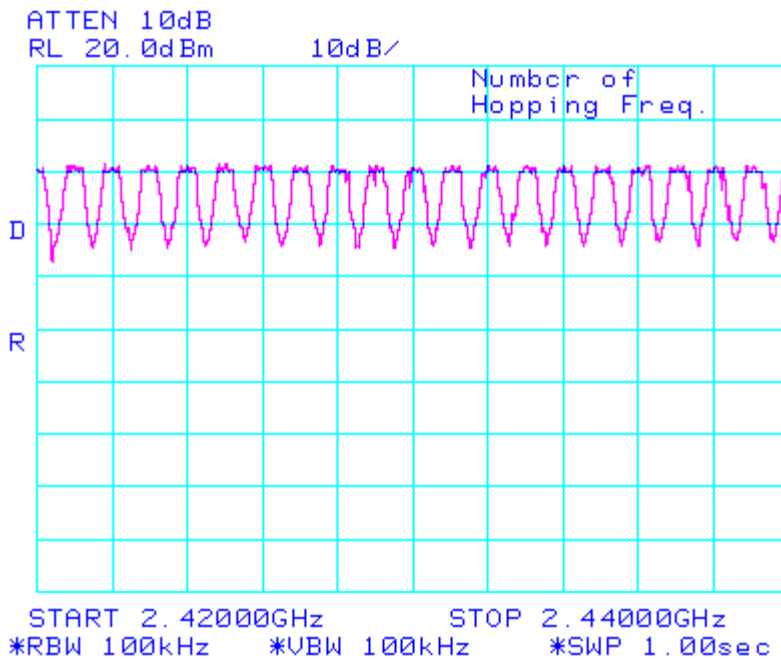
Test Setup Diagram

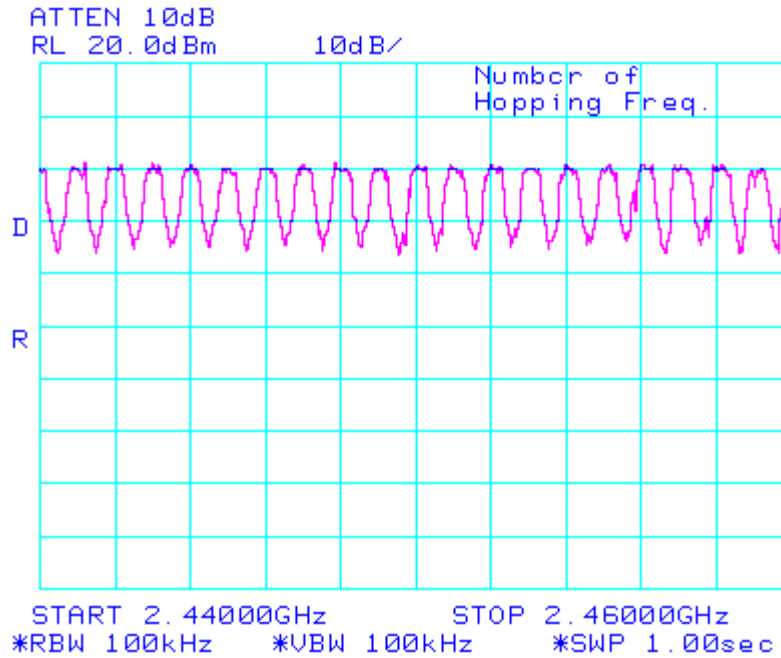
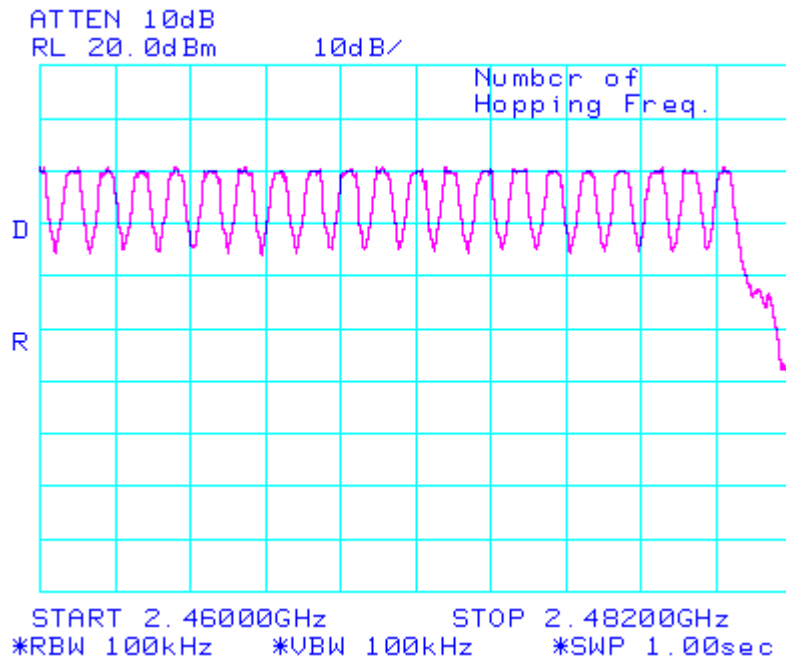


A reference offset of 32.9 dB was applied to the spectrum analyzer reference level for the attenuators and coaxial cable loss in the test circuit.

The environmental test conditions were: Temperature 24° C
 Pressure 977 mb
 Relative Humidity 33 %

See figures 5 to 8 for the plots of the number of hopping frequencies.

RF Conducted Emission Test Results cont'd**Figure 5: Number of Hopping Frequencies****Figure 6: Number of Hopping Frequencies**

RF Conducted Emission Test Results cont'd**Figure 7: Number of Hopping Frequencies****Figure 8: Number of Hopping Frequencies**

RF Conducted Emission Test Results cont'd

Time of Occupancy (Dwell Time)

The EUT passed the time of occupancy (dwell time) requirement 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 μ sec. for 79 channels.

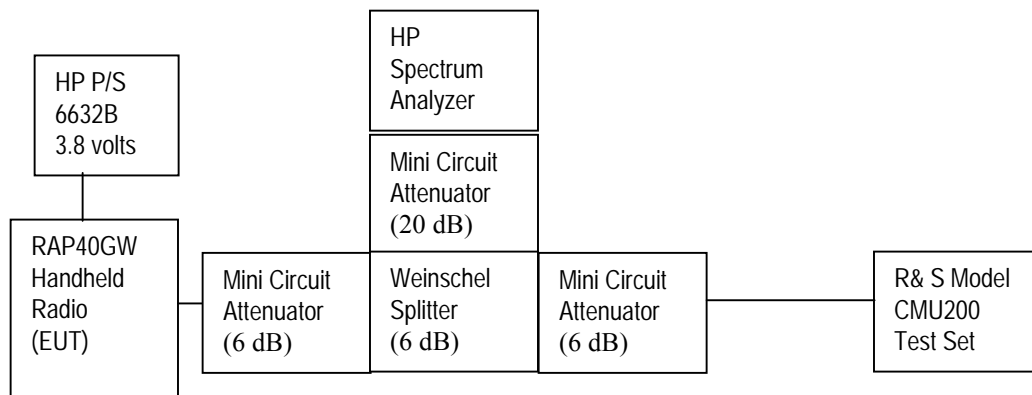
A DH1 packet needs one time slot for transmitting and one time slot for receiving. The frequency hopping is 800 hops per second with 79 channels which is 10.127 times per second. Therefore for 30 seconds there are 303.81 times of appearance.

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 30 seconds there are 151.8 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 30 seconds there are 101.4 times of appearance.

Bluetooth Channel	Mode	Tx Time (ms)	Dwell Time/30 sec. (msec.)	Limit (msec.)	Margin (msec.)
0	DH1	0.3900	.39 x 303.81 = 118. 5	400	281.5
39	DH1	0.4073	.4073 x 303.81 = 123. 7	400	276.3
78	DH1	0.4073	.4073 x 303.81 = 123. 7	400	276.3
0	DH3	1.6900	1.69 x 151.8 = 256. 5	400	143.5
39	DH3	1.6900	1.69 x 151.8 = 256. 5	400	143.5
78	DH3	1.6987	1.6987 x 151.8 = 257. 9	400	142.1
0	DH5	2.9500	2.95 x 101.4 = 299. 1	400	100.9
39	DH5	2.9500	2.95 x 101.4 = 299. 1	400	100.9
78	DH5	2.9400	2.94 x 101.4 = 298. 1	400	101.9

Test Setup Diagram

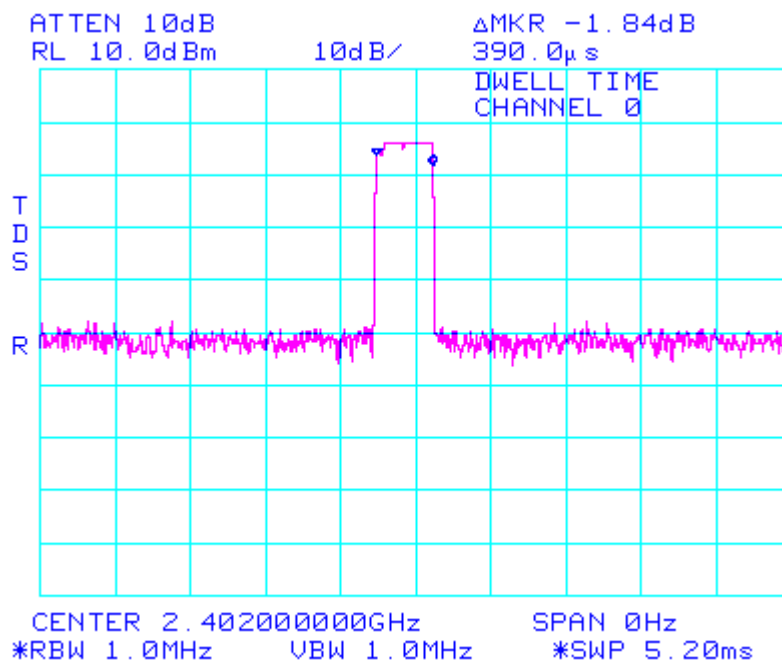


RF Conducted Emission Test Results cont'd

The environmental test conditions were: Temperature 24° C
Pressure 980 mb
Relative Humidity 34 %

See figures 9 to 17 for the plots of the dwell time.

Figure 9: Dwell Time, Low Channel, Packet Type DH1



RF Conducted Emission Test Results cont'd

Figure 12: Dwell Time, Low Channel, Packet Type DH3

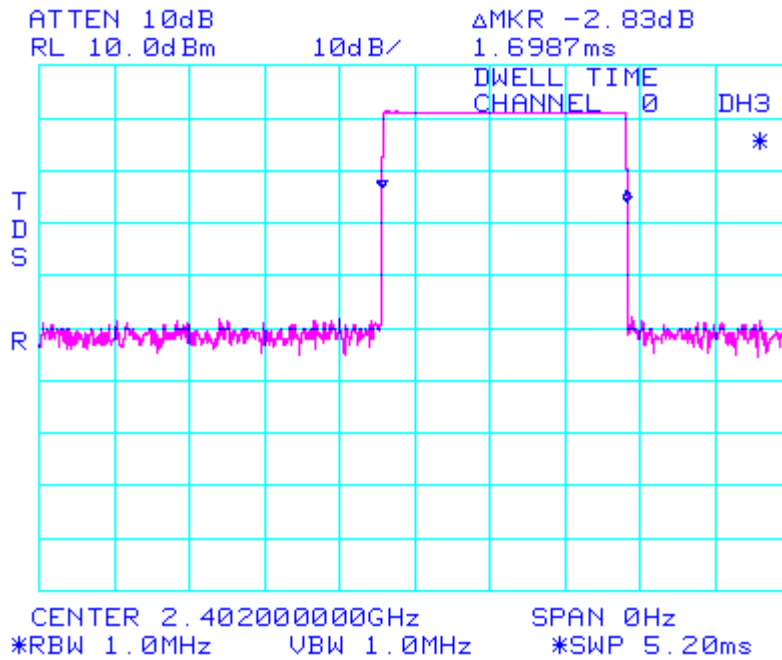
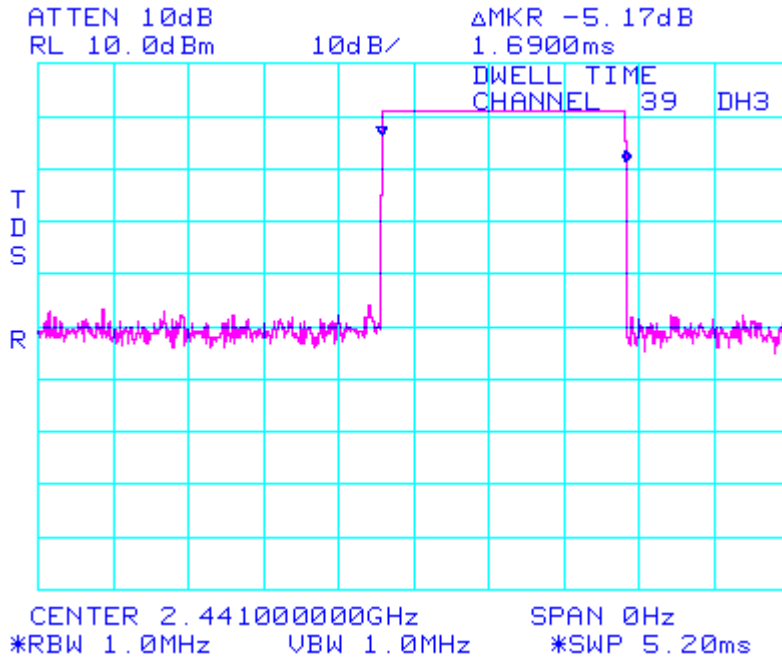


Figure 13: Dwell Time, Middle Channel, Packet Type DH3



RF Conducted Emission Test Results cont'd

Figure 18: Maximum Peak Conducted Output Power

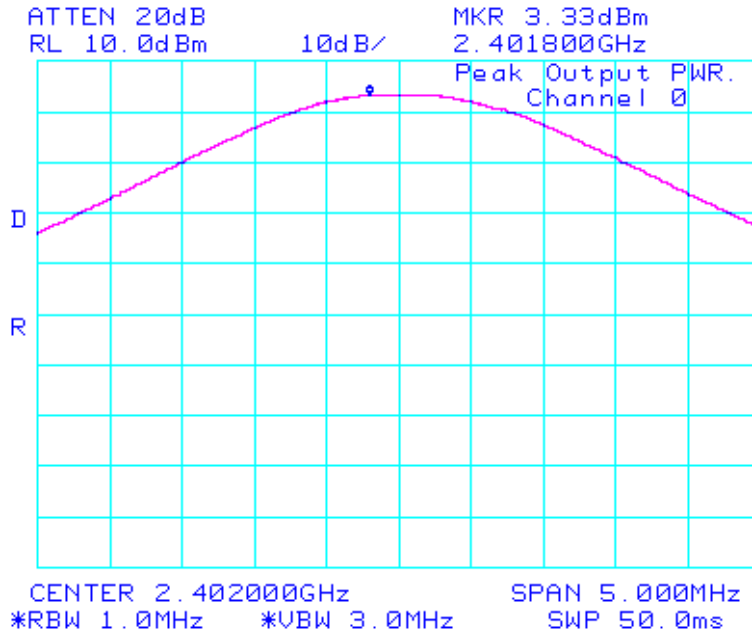
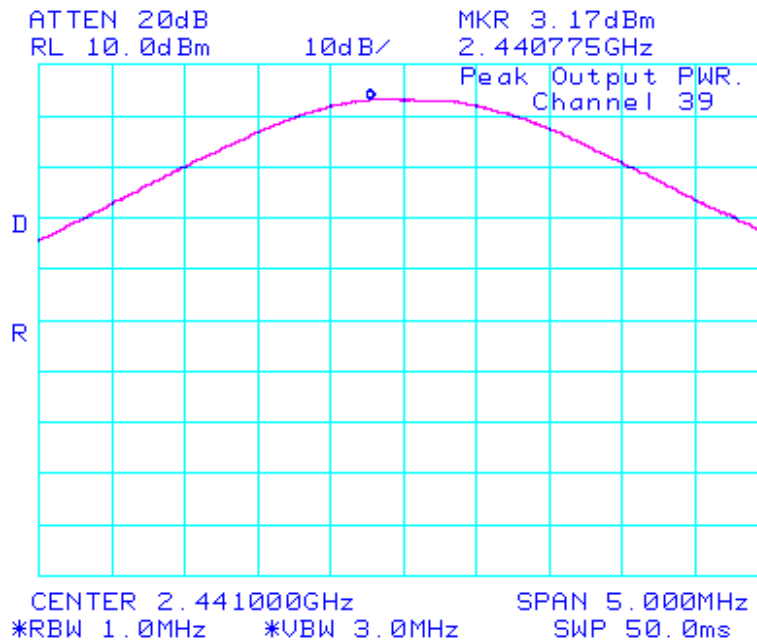
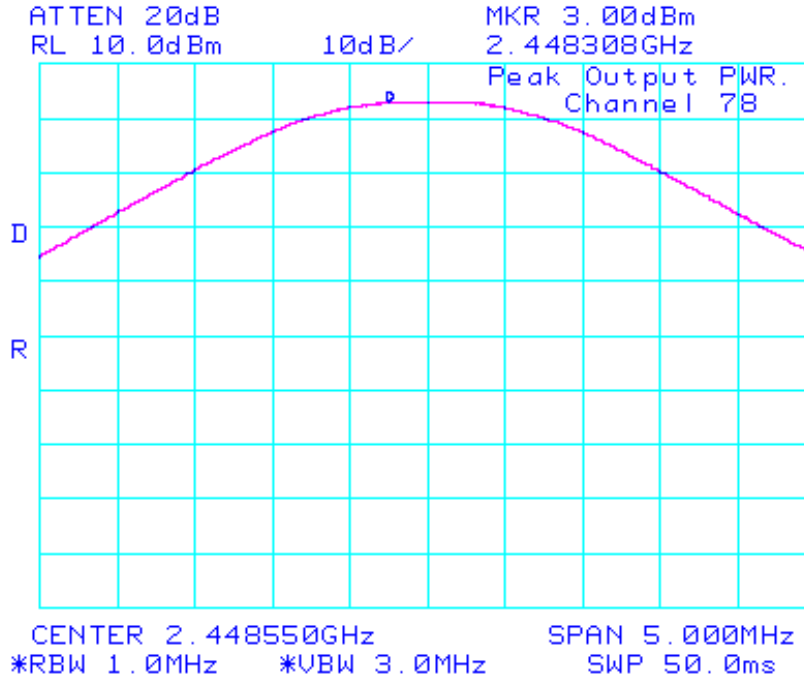


Figure 19: Maximum Peak Conducted Output Power



RF Conducted Emission Test Results cont'd

Figure 20: Maximum Peak Conducted Output Power



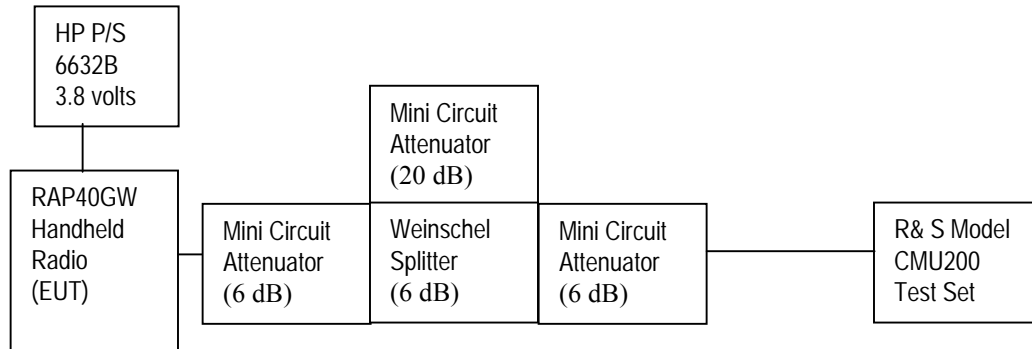
Band Edge Compliance

The EUT passed the band edge compliance requirement 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 PRBS and packet type DH5 during the measurements.

Bluetooth Channel	Operating Mode	Measured Value (dBc)	Limit (dBc)	Margin (dB)
0	Single Frequency	-20.33	20	0.33
0	Hopping	-20.67	20	0.67
78	Single Frequency	-21.50	20	1.50
78	Hopping	-22.33	20	2.33

RF Conducted Emission Test Results cont'd

Test Setup Diagram



The environmental test conditions were: Temperature 24° C
 Pressure 980 mb
 Relative Humidity 34 %

See figures 21 to 24 for the plots of the band edge compliance measurements.

RF Conducted Emission Test Results cont'd

Figure 23: Band Edge Compliance, Single Frequency Mode, Channel 78

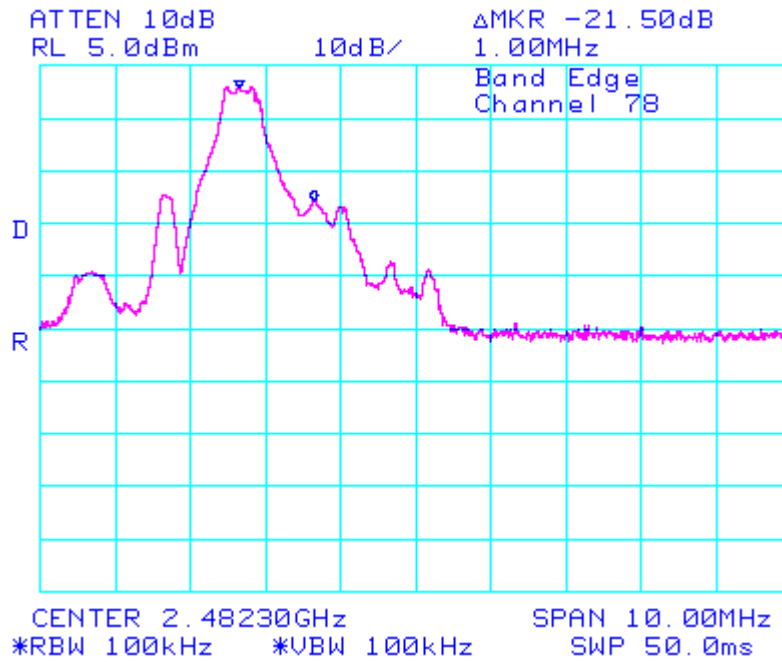
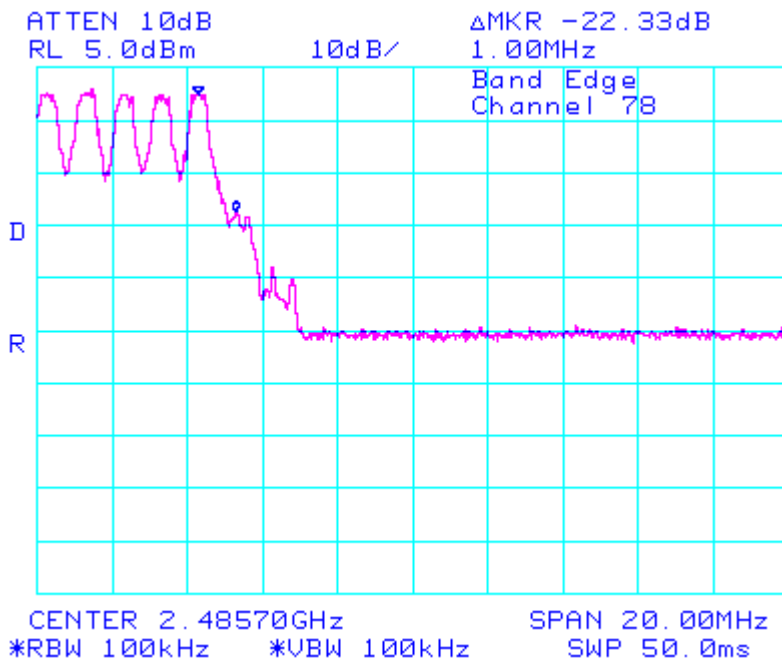


Figure 24: Band Edge Compliance, Hopping Frequency Mode, Channel 78



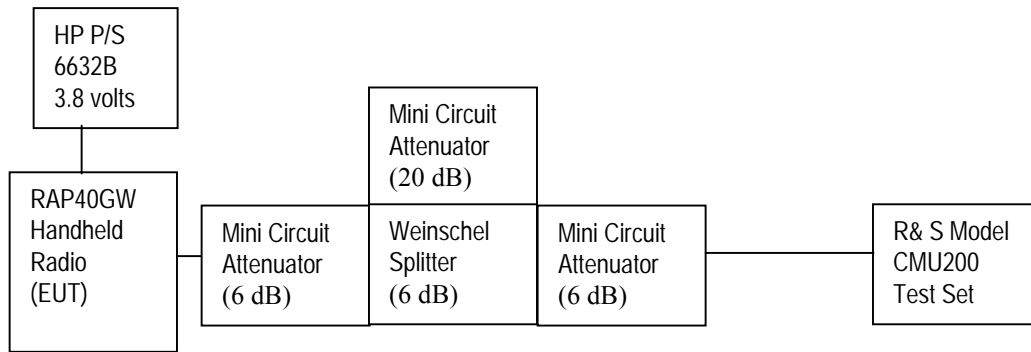
RF Conducted Emission Test Results cont'd

Spurious RF Conducted Emissions

The EUT passed the spurious RF conducted emissions requirement 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 mode using pattern type Static PRBS and packet type DH5 during the measurements. A reference offset of 32.9 dB was applied to the spectrum analyzer reference level for the attenuators and coaxial cable loss in the test circuit. No emissions could be seen above the noise floor (NF) of the spectrum analyzer.

Bluetooth Channel	Max. Measured Value from dBc	Limit (dBc)
0	-40.40 (NF)	-20
39	-44.67 (NF)	-20
78	-45.50 (NF)	-20
Hopping mode	-46.50 (NF)	-20

Test Setup Diagram



The environmental test conditions were: Temperature 24° C
 Pressure 980 mb
 Relative Humidity 34 %

See figures 25 to 33 for the plots of the Spurious RF Conducted Emissions.

