ENGINEERING TEST REPORT

BlackBerry World Band
Model No.: R6020GW

FCC ID: L6AR6020GW

Applicant: **Research In Motion Limited**
295 Phillip Street
Waterloo, Ontario
Canada, N2L 3W8

Tested in Accordance With

Federal Communications Commission (FCC)
PERSONAL COMMUNICATIONS SERVICES
CFR 47, PARTS 2 and 24 (Subpart E)

UltraTech's File No.: RIM-21-FTX

This Test report is Issued under the Authority of
Tri M. Luu, Professional Engineer,
Vice President of Engineering
UltraTech Group of Labs

Date: Dec. 05, 2001

Report Prepared by: Tri Luu, P.Eng.	Tested by: Mr. Hung Trinh, RFI/EMI Technician
Issued Date: Dec. 05, 2001	Test Dates: Nov. 29-30, 2001

The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.

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EXHIBIT 1. INTRODUCTION

1.1. SCOPE

Reference:	FCC Parts 2 and 24 (Subpart E): 1998
Title	Telecommunication - Code of Federal Regulations, CFR 47, Parts 2 & 24
Purpose of Test:	EIRP Measurements of the fundamental and spurious/harmonic emissions for a PCS radio transmitter operating in the frequency band 1850 - 1910 MHz (Broadband PCS).
Test Procedures	Radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4 - American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

1.2. NORMATIVE REFERENCES

Publication	Year	Title
FCC CFR Parts 2 and 24	1998	Code of Federal Regulations – Telecommunication
ANSI C63.4	1992	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
CISPR 22 & EN 55022	1997 1998	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
CISPR 16-1		Specification for Radio Disturbance and Immunity measuring apparatus and methods

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1. CLIENT INFORMATION

APPLICANT	
Name:	Research In Motion Limited
Address:	295 Phillip Street Waterloo, Ontario Canada, N2L 3W8
Contact Person:	Mr. Masud Attayi Phone #: (519) 888-7465 x2442 Fax #: (519) 888-6906 Email Address: mattayi@rim.net

MANUFACTURER	
Name:	Research In Motion Limited
Address:	295 Phillip Street Waterloo, Ontario Canada, N2L 3W8
Contact Person:	Mr. Masud Attayi Phone #: (519) 888-7465 x2442 Fax #: (519) 888-6906 Email Address: mattayi@rim.net

2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

Brand Name:	BlackBerry
Product Name:	BlackBerry World Band
Model Name or Number:	R6020GW
Serial Number:	Pre-production sample
Type of Equipment:	Personal Communications Services
External Power Supply:	AC charging adaptor and synchronization cradle supplied
Transmitting/Receiving Antenna Type:	Integral
Primary User Functions of EUT:	e-mail, personal digital assistant (PDA)
Associated Devices:	AC/DC power supply adapter, P/N: PWR-02908-003
Peripheral Devices	Charging Cradle, P/N: ASY-04056-001 Headset, P/N:-03458-002

2.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	Portable
Intended Operating Environment:	• Residential • Commercial, light industry & heavy industry
Power Supply Requirement:	rechargeable battery – required accessories supplied for charging
RF Output Power Rating:	32.04 dBm maximum EIRP
Antenna Connector Type:	Integral
Oscillator Frequencies:	IF Lo: 1048 MHz (Tx mode);1080 MHz (Rx mode) RF Lo: 1719 - 1779 Mhz (Tx mode); 1705 - 1765 MHz (Rx mode)
CPU Clock	32.5 MHz

2.4. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
1	DC input (AC/DC adapter)	1	Barrel jack	2 meters long, 2-wire, #24 AWG -non-shielded cable
2	Serial RS-232 (cradle)	1	DB9	1.5 meters long, 10-wire, #28 AWG - shielded cable
3	Audio	1	2.5mm barrel plug	1.25 meters long, PUR50% - non-shielded cable
4	Serial I/O & DC input (handheld)	1	JAE PCB-to-cable connector	N/A. The handheld is directly plugged to the cradle without cable.
5	Infrared	1	IrDA	N/A.

2.5. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None

2.6. EUT'S ACCESSORIES

The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests:

Accessory Equipment # 1	
Description:	Cradle
Brand name:	BlackBerry
Model Name or Number:	ASY-04056-001
Serial Number:	Pre-production sample
Cable Type:	Shielded RS-232 & non-shielded DC cables.
Connected to EUT's Port:	Serial I/O & DC

Accessory Equipment # 2	
Description:	AC/DC Power Adapter
Brand name:	BlackBerry
Model Name or Number:	PWR-02908-003
Serial Number:	Pre-production sample
Cable Length & Type:	Non-shielded power AC & DC cables
Connected to EUT's Port:	DC to the Cradle and AC to AC Mains

Accessory Equipment # 3	
Description:	Headset
Model Name or Number:	HDW-03458-002
Serial Number:	N/A
Cable Type:	Non-shielded cable
Connected to EUT's Port:	Audio

EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

3.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21^{o}C
Humidity:	51%
Pressure:	102 kPa
Power input source:	rechargeable battery

3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TEST SIGNALS

Operating Modes:	The transmitter was operated in a continuous transmission mode with the carrier modulated as specified in the Test Data.
Special Test Software:	N/A
Special Hardware Used:	R&S CMU 200

Transmitter Test Signals	
Frequency Band(s): ▪ 1850 – 1910 MHz	Near lowest, near middle & near highest frequencies each frequency bands that the transmitter covers: ▪ 1850.2 MHz, 1880.0 MHz and 1909.8 MHz
Transmitter Wanted Output Test Signals: ▪ RF Power Output (measured maximum output power): ▪ Normal Test Modulation ▪ Modulating signal source:	 ▪ 32.04 dBm max. (e.i.r.p.) ▪ GXW ▪ Internal

EXHIBIT 4. SUMMARY OF TEST RESULTS

4.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- Radiated Emissions were performed at the Ultratech's 3 Meter Open Field Test Site (OFTS) situated in the Town of Oakville, province of Ontario.

The above site have been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville Open Field Test Site has been filed with FCC office (FCC File No.: 31040/SIT 1300B3) and Industry Canada office (Industry Canada File No.: IC2049). Last Date of Site Calibration: Aug. 08, 2001.

4.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC PARAGRAPH.	TEST REQUIREMENTS	APPLICABILITY (YES/NO)
24.229	Frequencies	No request
24.232 & 2.1046	Equivalent Isotropically Radiated Power (e.i.r.p.) Limits	Yes
24.235 & 2.1055	Frequency Stability	No Request
24.238 & 2.1051	Emission Limits (Conducted)	Yes
24.236 & 24.238, 2.1057 & 2.1053	Emission Limits (Radiated)	Yes

EXHIBIT 5. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS

5.1. TEST PROCEDURES

This section contains test results only. Details of test methods and procedures can be found in Exhibit 7 of this report

5.2. MEASUREMENT UNCERTAINTIES

The measurement uncertainties stated were calculated in accordance with requirements of UKAS Document NIS 81 with a confidence level of 95%. Please refer to Exhibit 6 for Measurement Uncertainties.

5.3. MEASUREMENT EQUIPMENT USED:

The measurement equipment used complied with the requirements of the Standards referenced in the Methods & Procedures ANSI C63.4:1992 and CISPR 16-1.

5.4. ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUACTURER:

The essential function of the EUT is to correctly communicate data to and from radios over RF link.

5.5. EMISSION LIMITS (CONDUCTED) & OCCUPIED BANDWIDTH @ FCC §24.238 & §2.1049

5.5.1. Limits

On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least 43+10log(P) dB.

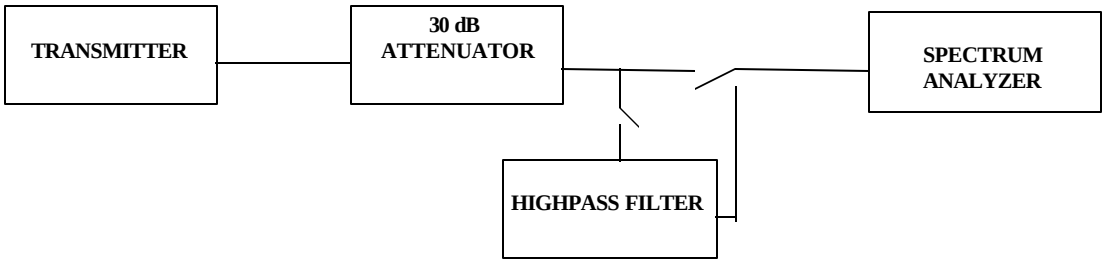
5.5.2. Method of Measurements

Please refer to FCC 24.238(b) - (d) and Exhibit 8, Section 8.4 for detailed test procedures.

Measuring Bandwidths:

- Outside the permitted band block: RBW = 1 MHz, VBW ≥ RBW
- Inside or on the permitted band block: RBW = 3 kHz (1% of -26dBc Bandwidth), VBW ≥ RBW

5.5.3. Test Arrangement



5.5.4. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Frequency Range
Spectrum Analyzer/ EMI Receiver	Hewlett Packard	HP 8593EM	3412A00103	9 kHz – 26.5 GHz	Jan. 30, 2001
Hihpass Filter, Microphase	Microphase	CR220HID	IITI11000AC	Cut-off Frequency at 4 GHz	In-house calibration at every test

5.5.5. Test Data

5.5.5.1. Conducted Spurious Emissions

Lowest Frequency (1850.2 MHz):

Frequency	RF Conducted Emissions (dBm)	FCC Limit (dBm)	Margin (dB)	PASS/FAIL
10 MHz - 1.85 GHz	Insignificant	-13.0	--	PASS
1.91 GHz - 20 GHz	Insignificant	-13.0	--	PASS

- The emissions were scanned from 10 MHz to 20 GHz and all emissions within 20 dB below the limits were recorded.
- Please refer to Plots # 1 to 4 for detailed measurements in Exhibit 8

Highest Frequency (1909.8 MHz):

Frequency	RF Conducted Emissions (dBm)	FCC Limit (dBm)	Margin (dB)	PASS/FAIL
10 MHz - 1.85 GHz	Insignificant	-13.0	--	PASS
1.91 GHz - 20 GHz	Insignificant	-13.0	--	PASS

- The emissions were scanned from 10 MHz to 20 GHz and all emissions within 20 dB below the limits were recorded.
- Please refer to Plots # 5 to 8 for detailed measurements in Exhibit 8

5.6. EMISSION LIMITS (RADIATED) @ FCC 2.1049, 24.236 & 24.238

5.6.1. Limits

- The predicted or measured field strength at any location on the border of the PCS Service area shall not exceed 47 dBμV/m unless the parties agree to a higher field strength.
- On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least 43+10log(P) dB.

5.6.2. Method of Measurements

The spurious/harmonic ERP measurements are using substitution method specified in Exhibit 8, § 8.2 of this report and its value in dBc is calculated as follows:

(1) If the transmitter's antenna is an integral part of the EUT, the ERP is measured using substitution method.
(2) If the transmitter's antenna is non-integral and diverse, the lowest ERP of the carrier with 0 dBi antenna gain is used for calculation of the spurious/harmonic emissions in dBc:
Lowest ERP of the carrier = EIRP – 2.15 dB = Pc + G - 2.15 dB = xxx dBm (conducted) + 0 dBi – 2.15 dB
(3) Spurious /harmonic emissions levels expressed in dBc (dB below carrier) are as follows:

ERP of spurious/harmonic (dBc) = ERP of carrier (dBm) – ERP of spurious/harmonic emission (dBm)

Measuring Bandwidths:

- Outside the permitted band block: RBW = 1 MHz, VBW ≥ RBW
- Inside or on the permitted band block: RBW = 1% of -26dBc Bandwidth, VBW ≥ RBW

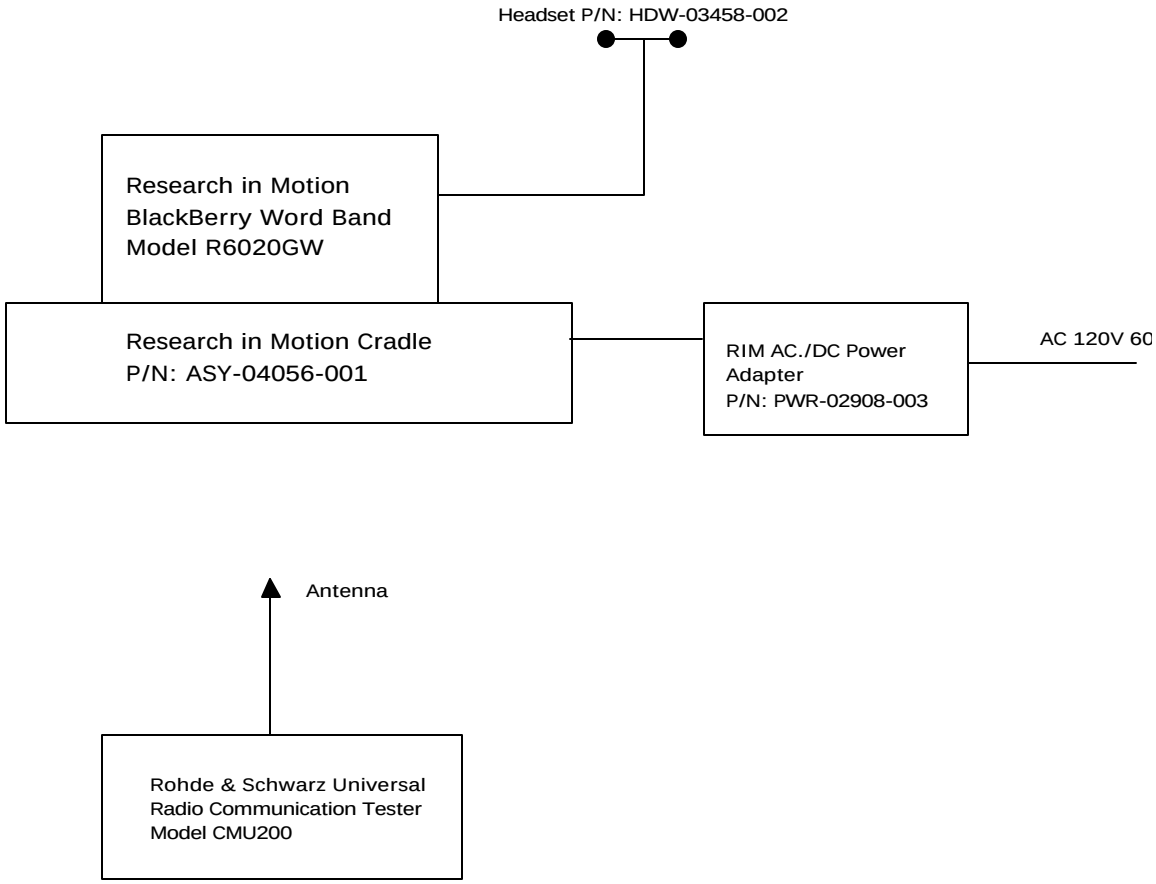
5.6.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Calibration Date
Spectrum Analyzer/ EMI Receiver	Hewlett Packard	HP 8546A	…	9 kHz to 5.6 GHz with built-in 30 dB Gain Pre-selector, QP, Average & Peak Detectors.	Oct. 05, 2001
Microwave Amplifier	Hewlett Packard	HP 83017A	3116A00661	1 GHz to 26.5 GHz	Nov. 13, 2001
Biconilog Antenna	EMCO	3142	9901-1347	30 MHz to 2 GHz	Nov. 01, 2001
Dipole Antenna	EMCO	3121C	8907-434	30 GHz – 1 GHz	Mar. 01, 2001
Dipole Antenna	EMCO	3121C	8907-440	30 GHz – 1 GHz	Mar. 01, 2001
Horn Antenna	EMCO	3155	9701-5061	1 GHz – 18 GHz	Apr. 27, 2001
Horn Antenna	EMCO	3155	9911-5955	1 GHz – 18 GHz	Apr. 27, 2001
Power Meter	Hewlett Packard	436A	1725A02249	10 kHz – 50 GHz, sensor dependent	Sep. 10, 2001
Power Sensor	Hewlett Packard	8481A	2702A68983	10 MHz – 18 GHz	Jan.04, 2001
Synthesize Sweeper	Hewlett Packard	83752B	3610A00457	0.01 – 20 GHz	Jan.30, 2001

5.6.4. Arrangement & Photographs of Test Setup

5.6.4.1. Test Configuration #1:- The EUT sit on the Cradle and Headset for fixed use

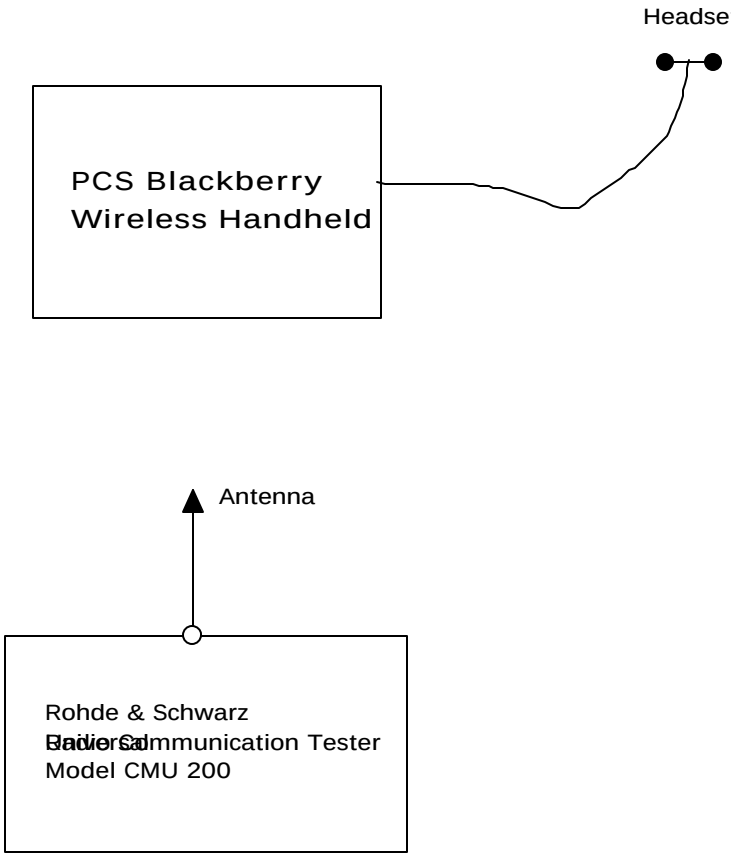
Please refer to Photos # 1 and 2 in Annex 1 for detailed of test setup.



5.6.4.2. Test Configuration #2:- The EUT with Headset only for portable use

The EUT was placed at 3 different orthogonal positions (vertical, horizontal and flat down) for searching the highest emission level:

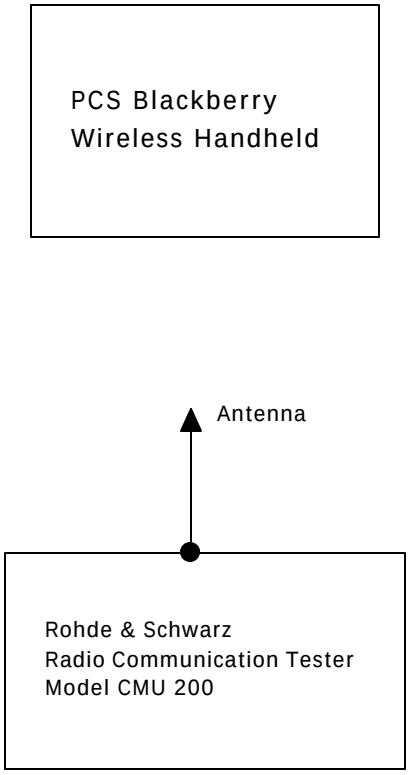
Please refer to Photos # 3 and 5 in Annex 1 for detailed of test setup.



5.6.4.3. Test configurations # 3: Handheld stand-alone for portable use

The EUT was placed at 3 different orthogonal positions (vertical, horizontal and flat down) for searching the highest emission level:

Please refer to Photos # 6 and 8 in Annex 1 for detailed of test setup.



5.6.5. Test Data

5.6.5.1. EIRP Measurements of the RF Output

Note 1: Only highest readings were chosen for EIRP measurements using substitution method.

5.6.5.1.1. Test Configuration #1: Model R6020GW with Cradle and Headset

Frequency (MHz)	Peak E-Field @ 3m (dBµV/m)	Antenna Polarization (V/H)	Peak Power From Signal Generator (dBm)	Substitution Antenna Gain (dBi)	Measured Peak EIRP (dBm)	Peak EIRP LIMIT (dBm)
1850.2	123.91	V	Note 1	Note 1	Note 1	Note 1
	123.34	H	Note 1	Note 1	Note 1	Note 1
1880.0	123.69	V	Note 1	Note 1	Note 1	Note 1
	123.78	H	Note 1	Note 1	Note 1	Note 1
1909.8	125.50	V	Note 1	Note 1	Note 1	Note 1
	123.72	H	Note 1	Note 1	Note 1	Note 1

5.6.5.1.2. Test Configuration # 2: Model R6020GW Handheld stand-alone with headset (EUT was oriented in 3 different orthogonal positions (back down, stand up and side down)

Frequency (MHz)	Peak E-Field @ 3m (dBµV/m)	Antenna Polarization (V/H)	Peak Power From Signal Generator (dBm)	Substitution Antenna Gain (dBi)	Measured Peak EIRP (dBm)	Peak EIRP LIMIT (dBm)
1850.2	128.13	V	21.9	7.3	27.08	29.23
	127.81	H	Note 1	Note 1	Note 1	Note 1
1880.0	128.31	V	Note 1	Note 1	Note 1	Note 1
	129.19	H	Note 1	Note 1	Note 1	Note 1
1909.8	128.66	V	Note 1	Note 1	Note 1	Note 1
	130.16	H	Note 1	Note 1	Note 1	Note 1

5.6.5.1.3. Test Configuration # 3: Model R6020GW Handheld stand-alone (EUT was standing up)

Frequency (MHz)	Peak E-Field @ 3m (dBµV/m)	Antenna Polarization (V/H)	Peak Power From Signal Generator (dBm)	Substitution Antenna Gain (dBi)	Measured Peak EIRP (dBm)	Peak EIRP LIMIT (dBm)
1850.2	128.00	V	Note 1	Note 1	Note 1	Note 1
	120.13	H	Note 1	Note 1	Note 1	Note 1
1880.0	128.91	V	22.6	7.3	27.76	29.91
	121.91	H	Note 1	Note 1	Note 1	Note 1
1909.8	131.09	V	24.79	7.3	29.94	32.04
	121.91	H	Note 1	Note 1	Note 1	Note 1

5.6.5.2. Spurious/Harmonic Emissions

5.6.5.2.1. Test Configuration # 2: Model R6020GW Handheld stand-alone with headset (EUT was oriented in 3 different orthogonal positions (back down, stand up and side down)

5.6.5.2.1.1. Lowest Frequency (1850.2 MHz)

Fundamental Frequency:	1850.2 MHz							
EIRP:	29.2 dBm max.							
Modulation:	Internal data source							
FREQUENCY (MHz)	**E-FIELD @3m (dBuV/m)**	**EIRP measured by Substitution Method (dBm)**	**(dBc)**	**EMI DETECTOR (Peak/QP)**	**ANTENNA POLARIZATION (H/V)**	**MINIMUM LIMIT (dBc)**	**MARGIN (dB)**	**PASS/ FAIL**
3700.4	60.3	Note 2	> 70	PEAK	V	42.2	> 25	PASS
3700.4	56.8	Note 2	> 70	PEAK	H	42.2	> 25	PASS
5550.6	56.5	Note 2	> 70	PEAK	V	42.2	> 25	PASS
5550.6	56.0	Note 2	> 70	PEAK	H	42.2	> 25	PASS
(1) The emissions were scanned from 10 MHz to 20 GHz, (2) The EIRP measurements were only performed on emissions which were less than 20 dB below the limit (42.2 dBc).								

5.6.5.2.1.2. Middle Frequency (1880 MHz)

Fundamental Frequency:	1880.0 MHz							
EIRP:	29.9 dBm max.							
Modulation:	Internal data source							
FREQUENCY (MHz)	**E-FIELD @3m (dBuV/m)**	**EIRP measured by Substitution Method (dBm)**	**(dBc)**	**EMI DETECTOR (Peak/QP)**	**ANTENNA POLARIZATION (H/V)**	**MINIMUM LIMIT (dBc)**	**MARGIN (dB)**	**PASS/ FAIL**
3760	63.3	Note 2	> 70	PEAK	V	42.9	> 25	PASS
3760	61.7	Note 2	> 70	PEAK	H	42.9	> 25	PASS
5640	57.9	Note 2	> 70	PEAK	V	42.9	> 25	PASS
5640	59.7	Note 2	> 70	PEAK	H	42.9	> 25	PASS
7520	54.2	Note 2	> 70	PEAK	V	42.9	> 25	PASS
7520	60.9	Note 2	> 70	PEAK	H	42.9	> 25	PASS
(1) The emissions were scanned from 10 MHz to 20 GHz, (2) The EIRP measurements were only performed on emissions which were less than 20 dB below the limit (45 dBc).								

5.6.5.2.1.3. Highest Frequency (1909.8 MHz)

Fundamental Frequency:	1909.8 MHz							
EIRP:	32.0 dBm max.							
Modulation:	Internal data source							
FREQUENCY	**E-FIELD @3m**	**EIRP measured by Substitution Method**		**EMI DETECTOR**	**ANTENNA POLARIZATION**	**MINIMUM LIMIT**	**MARGIN**	**PASS/**
(MHz)	**(dBuV/m)**	**(dBm)**	**(dBc)**	**(Peak/QP)**	**(H/V)**	**(dBc)**	**(dB)**	**FAIL**
3819.6	71.2	-28.1	60.0	PEAK	V	45.0	15.0	PASS
3819.6	68.7	-31.2	63.2	PEAK	H	45.0	18.2	PASS
5729.4	55.3	Note 2	> 70	PEAK	V	45.0	> 25	PASS
5729.4	59.6	Note 2	> 70	PEAK	H	45.0	> 25	PASS
7639.2	65.0	-36.7	68.7	PEAK	V	45.0	23.7	PASS
7639.2	61.6	-39.8	> 70	PEAK	H	45.0	> 25	PASS
(3) The emissions were scanned from 10 MHz to 20 GHz,								
(4) The EIRP measurements were only performed on emissions which were less than 72 dB below the limit (45 dBc).								

EXHIBIT 6. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and NIS 81 (1994)

6.1. RADIATED EMISSION MEASUREMENT UNCERTAINTY

CONTRIBUTION (Radiated Emissions)	PROBABILITY DISTRIBUTION	UNCERTAINTY (± dB)	
		3 m	10 m
Antenna Factor Calibration	Normal (k=2)	±1.0	±1.0
Cable Loss Calibration	Normal (k=2)	±0.3	±0.5
EMI Receiver specification	Rectangular	±1.5	±1.5
Antenna Directivity	Rectangular	+0.5	+0.5
Antenna factor variation with height	Rectangular	±2.0	±0.5
Antenna phase center variation	Rectangular	0.0	±0.2
Antenna factor frequency interpolation	Rectangular	±0.25	±0.25
Measurement distance variation	Rectangular	±0.6	±0.4
Site imperfections	Rectangular	±2.0	±2.0
Mismatch: Receiver VRC Γ_1 = 0.2 Antenna VRC Γ_R = 0.67(Bi) 0.3 (Lp) Uncertainty limits 20Log(1±$\Gamma_1\Gamma_R$)	U-Shaped	+1.1 -1.25	±0.5
System repeatability	Std. Deviation	±0.5	±0.5
Repeatability of EUT		-	-
Combined standard uncertainty	Normal	+2.19 / -2.21	+1.74 / -1.72
Expanded uncertainty U	Normal (k=2)	+4.38 / -4.42	+3.48 / -3.44

Calculation for maximum uncertainty when 3m biconical antenna including a factor of k=2 is used:

$U = 2u_c(y) = 2x(+2.19) = +4.38$ dB And $U = 2u_c(y) = 2x(-2.21) = -4.42$ dB

EXHIBIT 7. MEASUREMENT METHODS

7.1. RADIATED POWER MEASUREMENTS (ERP & EIRP) USING SUBSTITUTION METHOD

7.1.1. Maximizing RF Emission Level (E-Field)

(a) The measurements was performed with full rf output power and modulation.
(b) Test was performed at listed 3m open area test site (listed with FCC, IC, ITI, NVLAP, ACA & VCCI).
(c) The transmitter under test was placed at the specified height on a non-conducting turntable (80 cm height)
(d) The BICONILOG antenna (20 MHz to 1 GHz) or HORN antenna (1 GHz to 18 GHz) was used for measuring.
(e) Load an appropriate correction factors file in EMI Receiver for correcting the field strength reading level

Total Correction Factor recorded in the EMI Receiver = Cable Loss + Antenna Factor
E (dBuV/m) = Reading (dBuV) + Total Correction Factor (dB/m)

(f) Set the EMI Receiver #1 and #2 as follows:

Center Frequency:	test frequency
Resolution BW:	100 kHz
Video BW:	same
Detector Mode:	positive
Average:	off
Span:	3 x the signal bandwidth

(g) The test antenna was lowered or raised from 1 to 4 meters until the maximum signal level was detected.
(h) The transmitter was rotated through 360^{o} about a vertical axis until a higher maximum signal was received.
(i) The test antenna was lowered or raised again from 1 to 4 meters until a maximum was obtained. This level was recorded.
(j) The recorded reading was corrected to the true field strength level by adding the antenna factor, cable loss and subtracting the pre-amplifier gain.
(k) The above steps were repeated with both transmitters' antenna and test receiving antenna placed in vertical and horizontal polarization. Both readings with the antennas placed in vertical and horizontal polarization shall be recorded.
(l) Repeat for all different test signal frequencies

7.1.2. Measuring the EIRP of Spurious/Harmonic Emissions using Substitution Method

(a) Set the EMI Receiver (for measuring E-Field) and Receiver #2 (for measuring EIRP) as follows:

Center Frequency:	equal to the signal source
Resolution BW:	10 kHz
Video BW:	same
Detector Mode:	positive
Average:	off
Span:	3 x the signal bandwidth

(b) Load an appropriate correction factors file in EMI Receiver for correcting the field strength reading level

Total Correction Factor recorded in the EMI Receiver = Cable Loss + Antenna Factor
E (dBuV/m) = Reading (dBuV) + Total Correction Factor (dB/m)

(c) Select the frequency and E-field levels obtained in the Section 8.2.1 for ERP/EIRP measurements.
(d) Substitute the EUT by a signal generator and one of the following transmitting antenna (substitution antenna):

- DIPOLE antenna for frequency from 30-1000 MHz or
- HORN antenna for frequency above 1 GHz }.

(e) Mount the transmitting antenna at 1.5 meter high from the ground plane.
(f) Use one of the following antenna as a receiving antenna:

- DIPOLE antenna for frequency from 30-1000 MHz or
- HORN antenna for frequency above 1 GHz }.

(g) If the DIPOLE antenna is used, tune it's elements to the frequency as specified in the calibration manual.
(h) Adjust both transmitting and receiving antenna in a VERTICAL polarization.
(i) Tune the EMI Receivers to the test frequency.
(j) Lower or raise the test antenna from 1 to 4 meters until the maximum signal level was detected.
(k) The transmitter was rotated through 360^{o} about a vertical axis until a higher maximum signal was received.
(l) Lower or raise the test antenna from 1 to 4 meters until the maximum signal level was detected.
(m) Adjust input signal to the substitution antenna until an equal or a known related level to that detected from the transmitter was obtained in the test receiver.
(n) Record the power level read from the Average Power Meter and calculate the ERP/EIRP as follows:

P = P1 - L1 = (P2 + L2) – L1 = P3 + A + L2 - L1
EIRP = P + G1 = P3 + L2 - L1 + A + G1
ERP = EIRP – 2.15 dB
Total Correction factor in EMI Receiver # 2 = L2 – L1 + G1

Where: P: Actual RF Power fed into the substitution antenna port after corrected.
P1: Power output from the signal generator
P2: Power measured at attenuator A input
P3: Power reading on the Average Power Meter
EIRP: EIRP after correction
ERP: ERP after correction

(o) Adjust both transmitting and receiving antenna in a HORIZONTAL polarization, then repeat step (k) to (o)
(p) Repeat step (d) to (o) for different test frequency
(q) Repeat steps (c) to (j) with the substitution antenna oriented in horizontal polarization.
(r) Actual gain of the EUT's antenna is the difference of the measured EIRP and measured RF power at the RF port. Correct the antenna gain if necessary.:

Figure 2

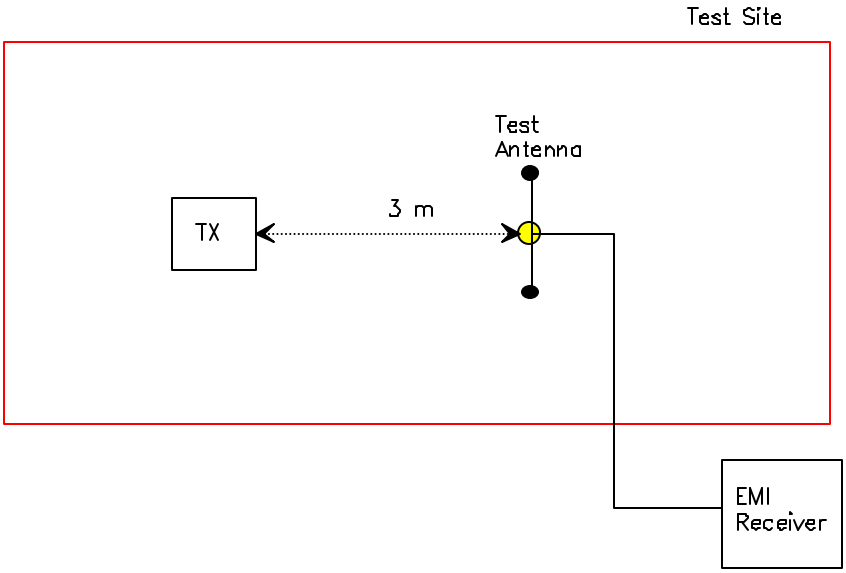


Figure 3

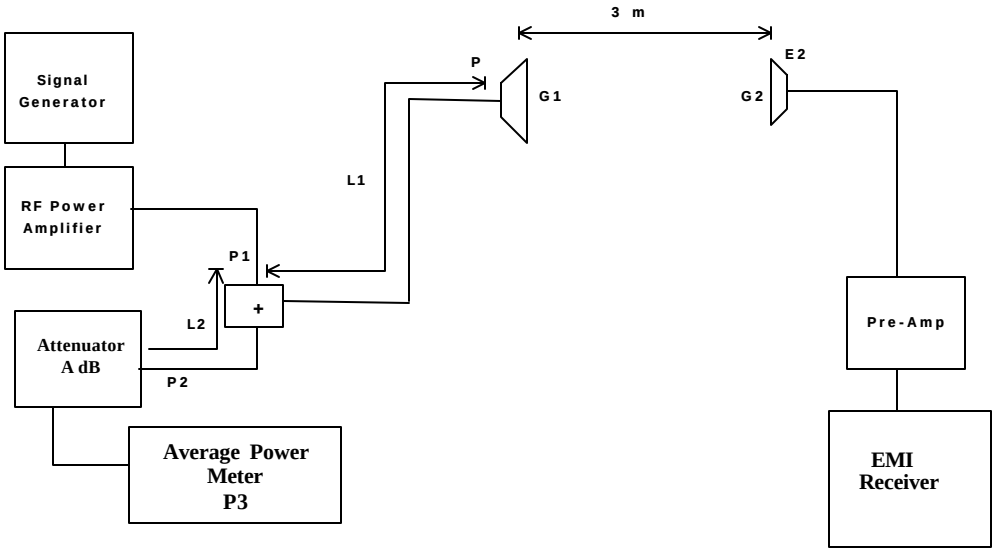
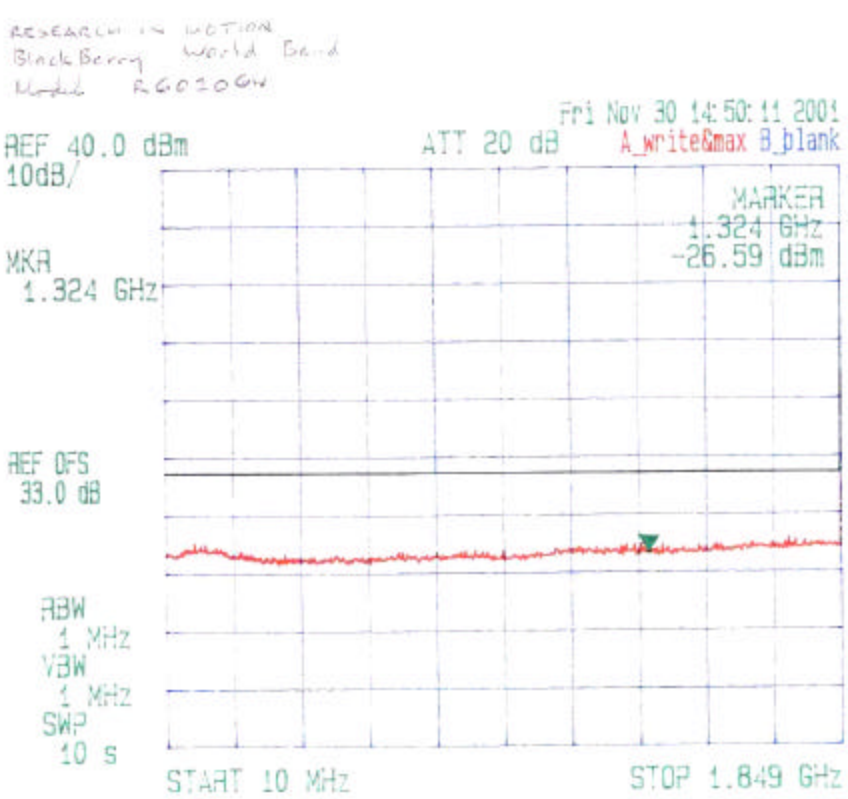


EXHIBIT 8. PLOTS OF MEASUREMENTS

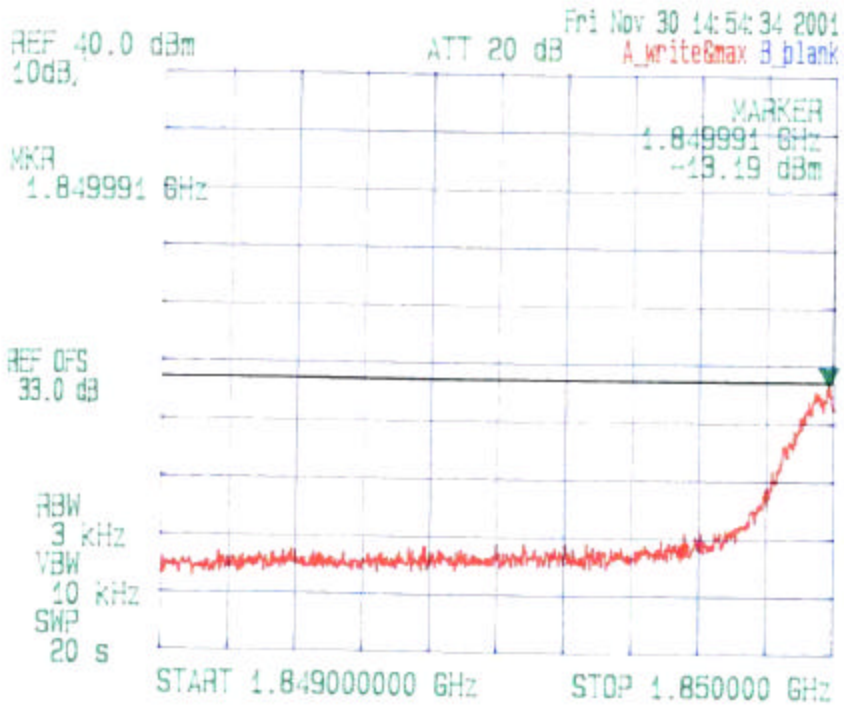
PLOT #1

Channel Frequency: 1850.2 MHz



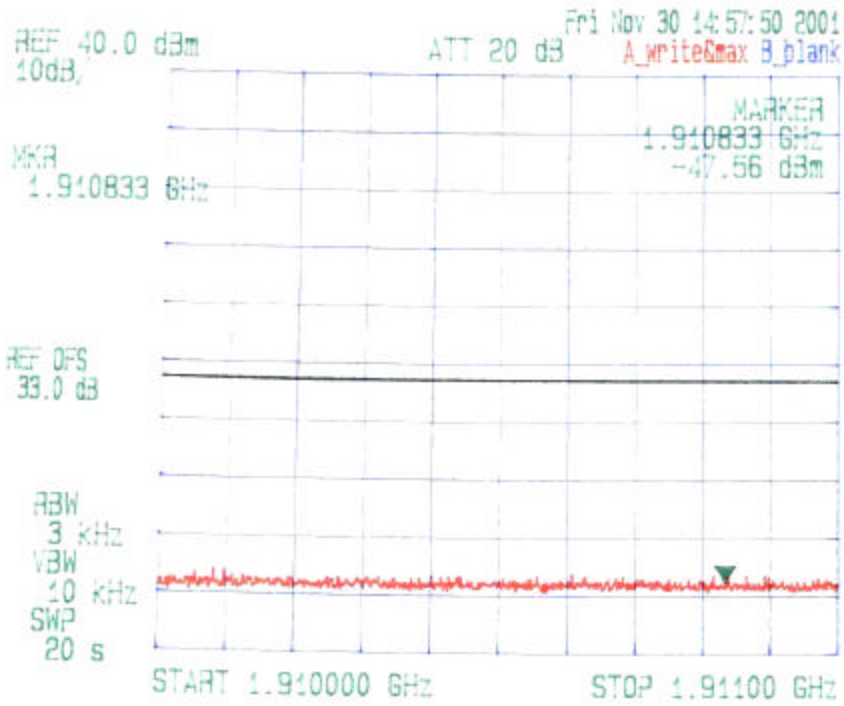
PLOT #2

Channel Frequency: 1850.2 MHz



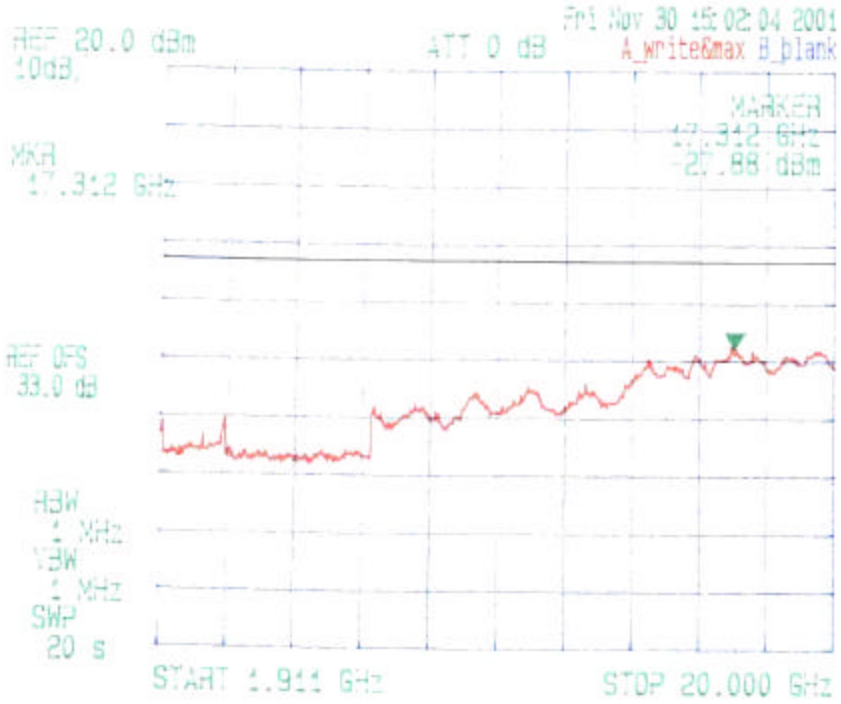
PLOT #3

Channel Frequency: 1850.2 MHz



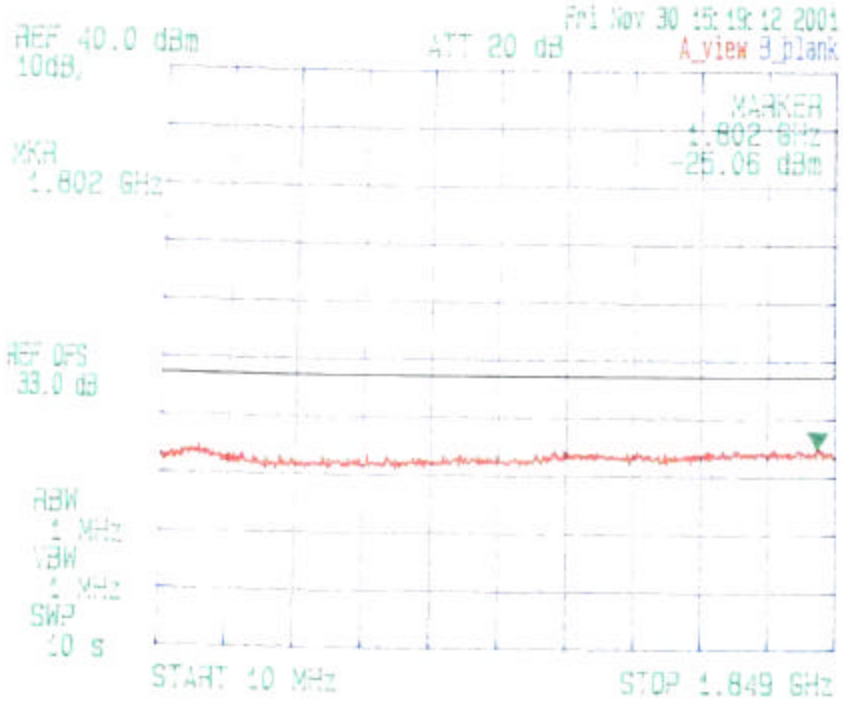
PLOT #4

Channel Frequency: 1850.2 MHz



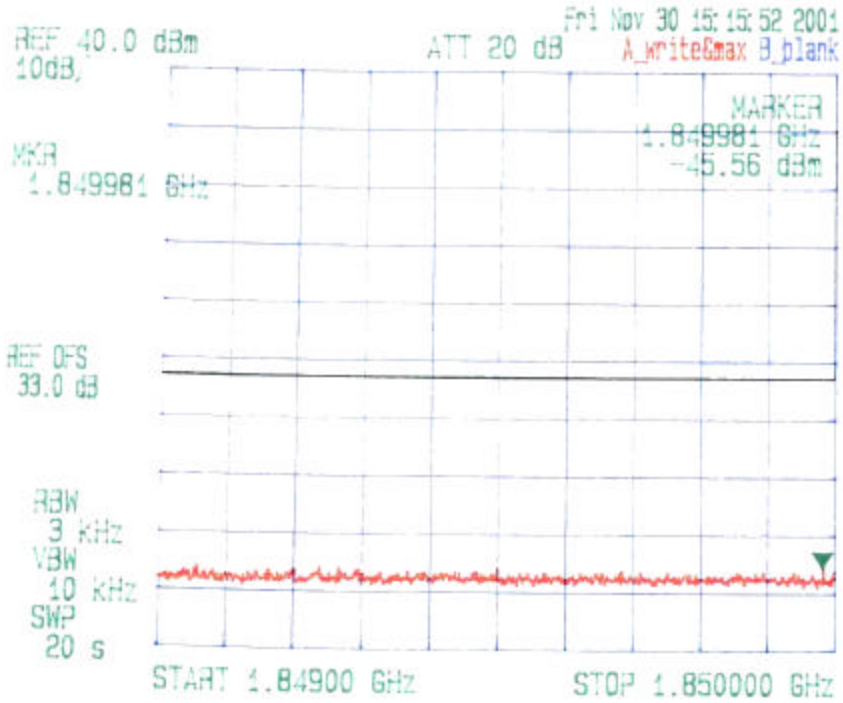
PLOT #5

Channel Frequency: 1909.8 MHz



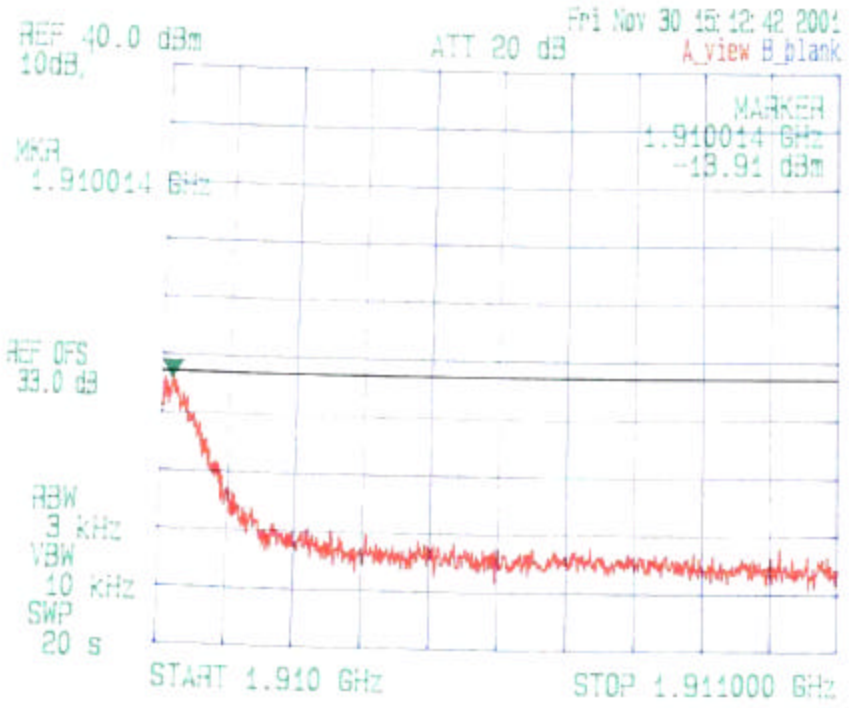
PLOT #6

Channel Frequency: 1909.8 MHz



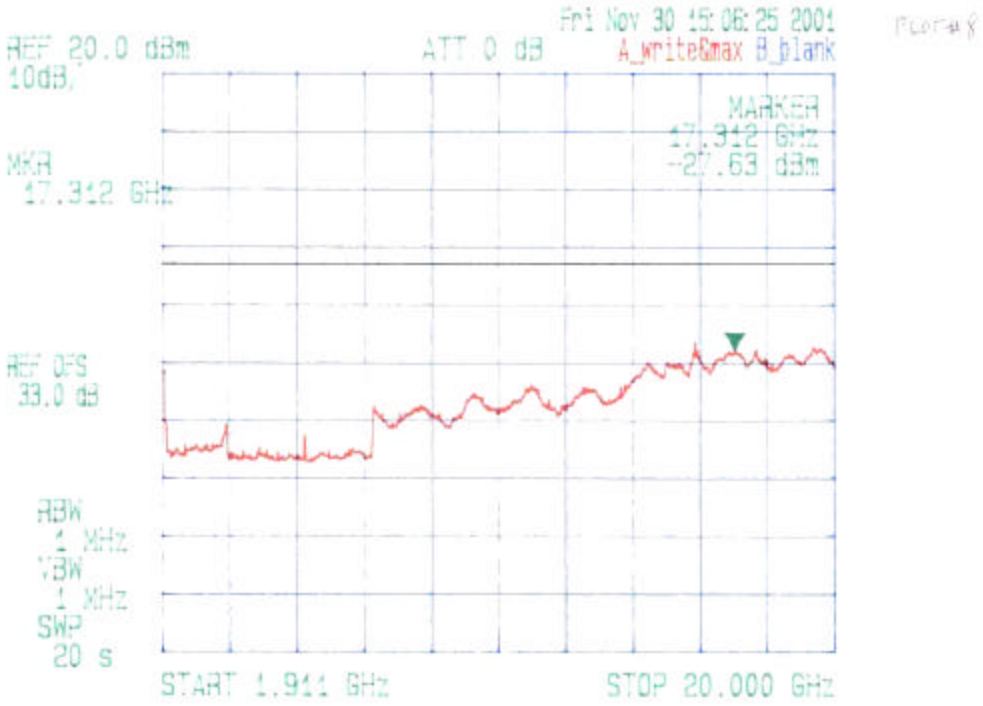
PLOT #7

Channel Frequency: 1909.8 MHz



PLOT #8

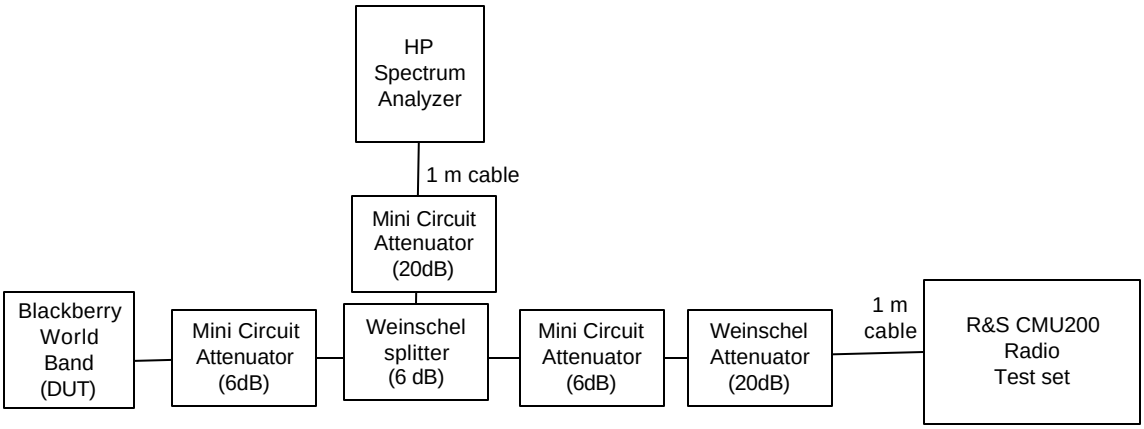
Channel Frequency: 1909.8 MHz



Author Data	Date	Document No.
Masud S. Attayi	January 03, 2002	04063-CERT-OPER-010
Approved	Rev	File / Reference
		Power&Bandwidth.doc

This document contains measurement data pertaining to conducted RF power, 99% power bandwidth, and –26 dBc bandwidth.

Test Setup Diagram



Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer	HP	8563E	374A08112	30 Hz – 26.5 GHz
Combination Network	Weinschel	1515	--	DC – 18 GHz
Attenuator	Weinschel	1R-20	--	DC – 18 GHz
Attenuator	Mini Circuit	MCL BW-S6W2	--	DC – 18 GHz
Attenuator	Mini Circuit	MCL BW-S20W2	--	DC – 18 GHz
Universal Radio Communication Tester	Rohde & Schwarz	CMU200	100250	--

Power Output

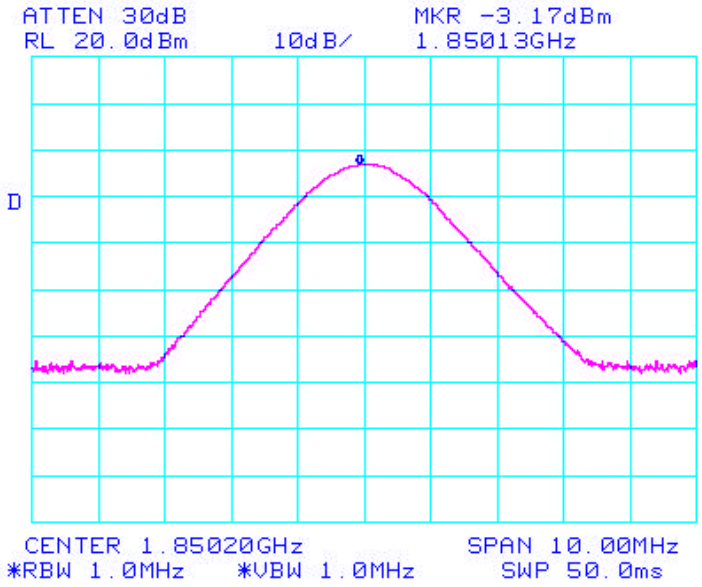
At three transmit frequencies the maximum radio output power level was measured using the Spectrum Analyzer. The calibrated insertion loss measured for the attenuator and cable assembly was added to the power measurements which produced the following results.

Test Data

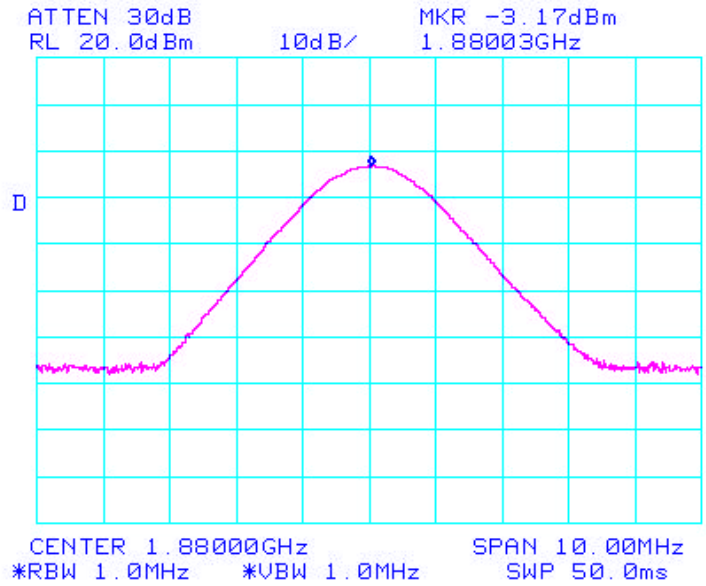
Peak nominal output power is 30 dBm

Frequency (MHz)	Meausred Peak Conducted Power (dBm)	Total correction Factor (dB)	Corrected Peak Conducted Power (dBm)
1850.2	-3.17	33	29.83
1880.0	-3.17	33	29.83
1909.8	-3.33	33	29.67

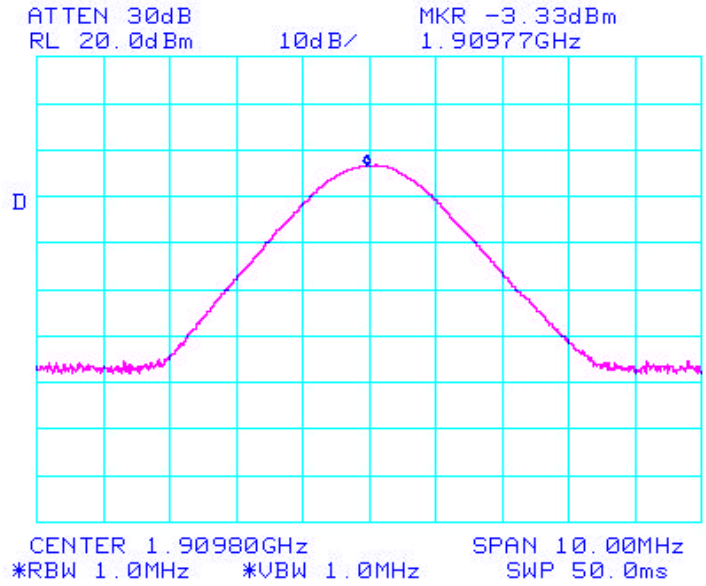
Low Channel peak power



Middle Channel peak power



High Channel peak power



Occupied Bandwidth (99%) and –26 dBc Bandwidth

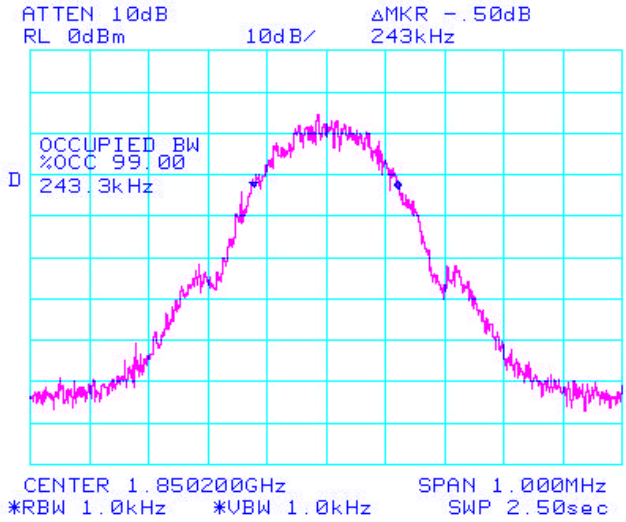
For each carrier frequency of low, middle and high, the modulation spectrum were measured by both methods of 99% power bandwidth and –26 dBc bandwidth.
The resolution bandwidth required for out-of-band emissions in the 1 MHz bands immediately outside and adjacent to the frequency block, was determined to be at least 1% of the emission bandwidth.
The worst case emission bandwidth for the three channels was measured to be 270 KHz as shown below, which results in 3.0 KHz resolution bandwidth.
On any frequency outside the frequency block and outside the adjacent 1 MHz bands, a resolution bandwidth of at least 1 MHz was employed.

Test Data

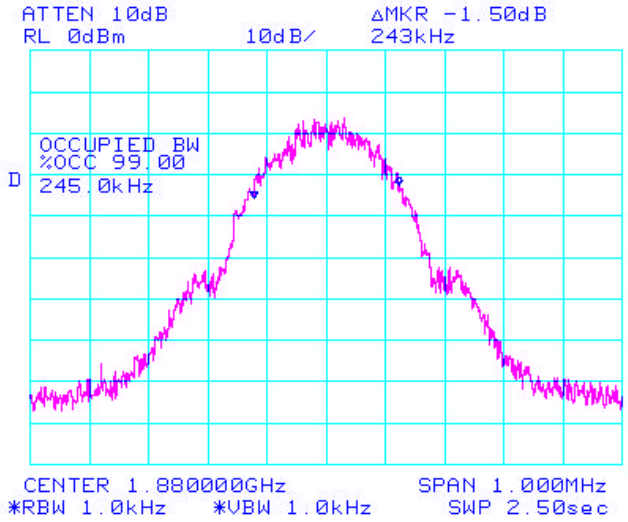
Frequency (MHz)	99% Occupied Bandwidth (kHz)	-26dBc Bandwidth (kHz)
1850.2	243	270
1880.0	243	265
1909.8	245	267

Measurement Plots
Refer to the following measurement plots for more detail.

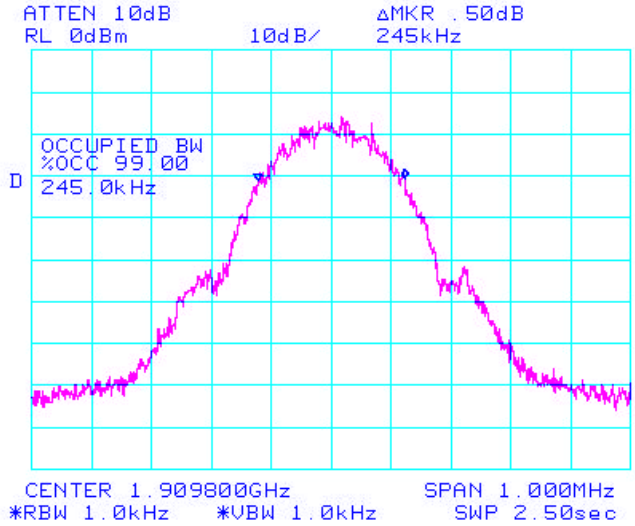
Low Channel Occupied Bandwidth (99%)



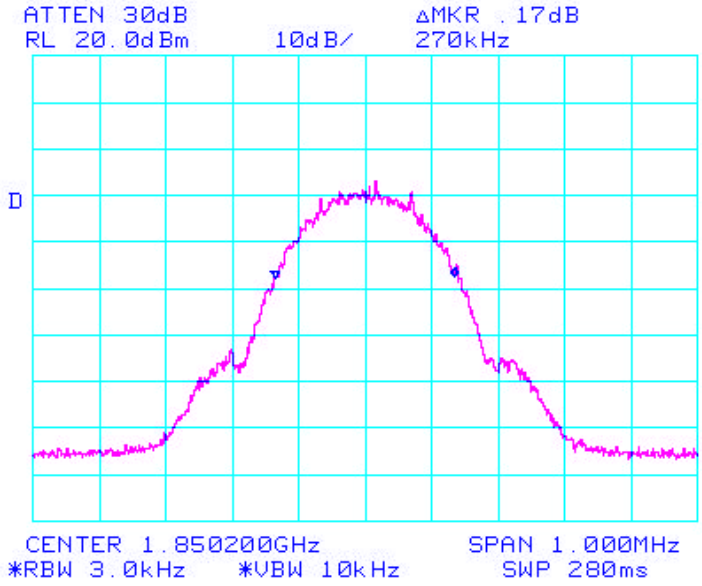
Middle Channel Occupied Bandwidth (99%)



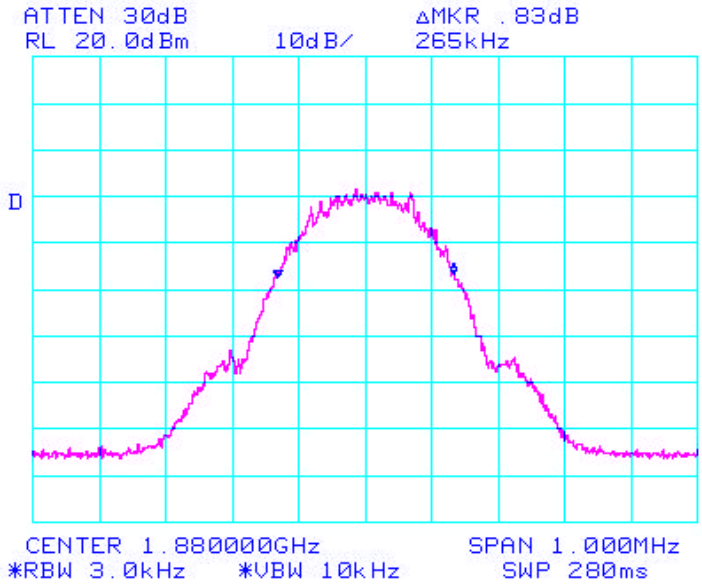
High Channel Occupied Bandwidth (99%)



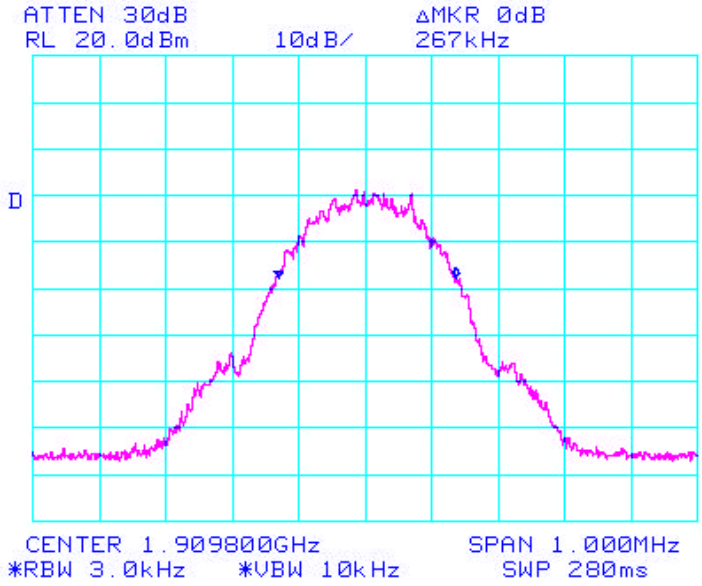
Low Channel –26 dBc Bandwidth



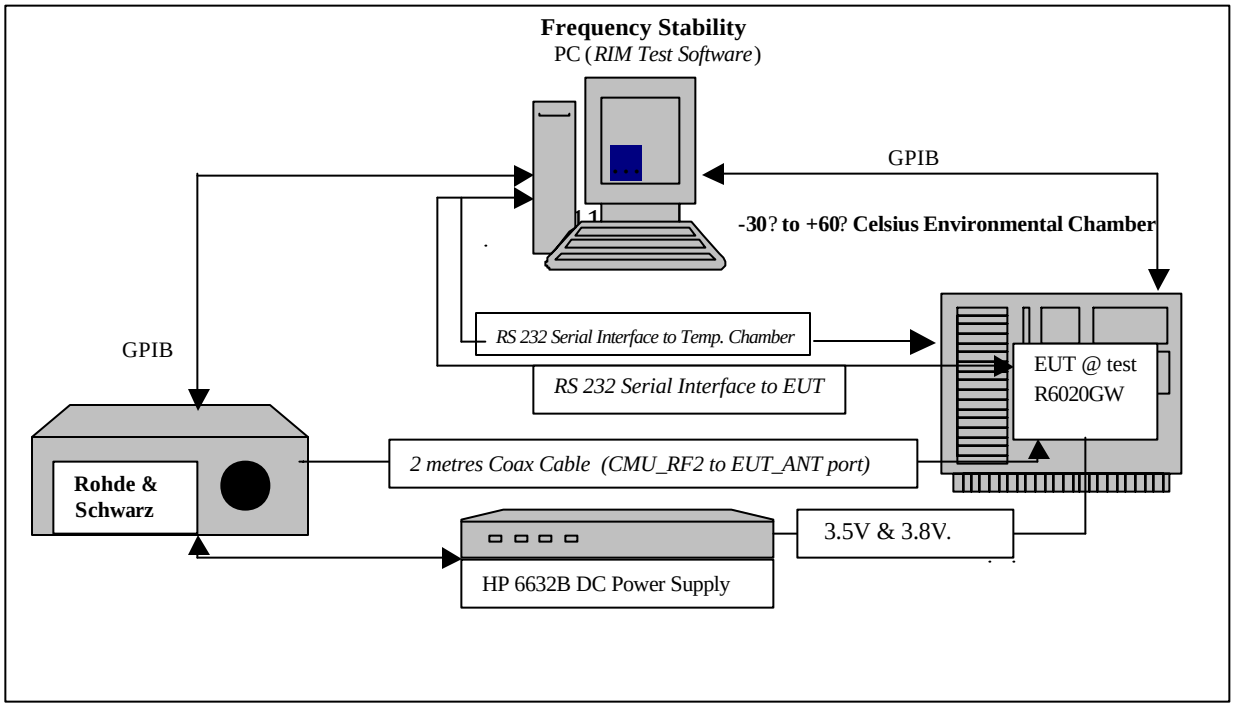
Middle Channel –26 dBc Bandwidth



High Channel –26 dBc Bandwidth



The following document contains measurement data pertaining to Frequency Stability.



SYSTEM	*Model*	*Serial Number*	*Calibration Date.*
R & S Universal Radio Communication Test Set	**CMU200**	100250	21-March-01
HP System DC Power Supply	**6632B**	US37472258	30-July-2001
Network Analyzer	**HP 8753D**	3410A05905	07-Aug-2001
Calibration Kit	**HP85033D**	20A80439405	01-Nov-2001
Espec Environmental Chamber	**SH240**	91005607	N/A

CFR 47 Chapter 1 - Federal Communications Commission Rules

Part 2 Required Measurements
2.995 Frequency Stability - Procedures
(a,b) Frequency Stability - Temperature Variation
(d) Frequency Stability - Voltage Variation

24.235 ***Frequency Stability***.
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

The BlackBerry World Band Handheld's (referred to as EUT from hereinafter) transmitted frequency stability is less than 0.1 ppm of the received frequency measured by the Rhode & Schwarz CMU 200 Universal Radio Communication Test Set.
The BlackBerry World Band Handheld meets the requirements as stated in CFR 47 chapter 1, Section 24.235, Frequency Stability.

Frequency Stability measurement devices were configured as presented in the block diagram recording frequency, power, temperatures, and stepped voltages which were controlled via GPIB interfaces linked to the Environmental chamber, a DC power supply, and the Communications Test Set. A two-meter coax cable was

calibrated to characterize the insertion loss for the transmitted frequencies between the RF input/output of the CMU 200 and the EUT antenna port; located inside the environmental chamber.

Calibration for the cable loss was performed in the RF Laboratory on December 4th, 2001.

Procedure:
Full two-port calibration of 8753D using the 85033D was completed.

The cable assembly from the RF input to the RF output was measured at the following frequencies:
1850.2 MHz = 3.0 dB.
1877.2.0 MHz = 3.05 dB.
1904.2 MHz = 3.15 dB.

Procedure:

The EUT was placed in the temperature chamber and connected to the CMU 200. Dry air was pumped inside the temperature chamber to maintain a backpressure during the test. The EUT was kept in the off condition at all times except when the measurements were to be made.

The chamber was switched on, and the temperature was set to -30?C.

After the chamber stabilized at -30 ?C there was a soak period of one hour to alleviate moisture in the chamber.

After the initial one-hour soak at -30?C a period of thirty minutes soak was maintained between each ascending temperature step prior to the start of the next measurement test cycle.

A computer system controlled the automated software. This application was given the command of activating all the test equipment intrinsic to the temperature and voltage tests controlling the CMU 200 via the GPIB Bus. The Environmental Chamber was instructed through an RS-232 serial line. The EUT dialogue was passed through a serial connection.

The EUT repetitively transmitted 100 bursts for each set of programmed parameters recording temperature, voltage settings, and systematically selected frequencies of 1850.2, 1877.2.0, and 1904.2 MHz.
The power supply was cycled from minimum voltage of 3.5 volts to 3.8 volts nominal and maximum operating voltage under load. The frequency error was measured at a maximum output power of 30 dBm and recorded by the automated system test software. The frequency was recorded in MHz and deviation from nominal, in Parts Per Million.

Procedure:

The test system software for commencing the Frequency Stability Tests carried through the following cycle.

1. Switch on the HP 6632B power supply; CMU 200 Communications test Set, and Environmental Chamber.
2. Start system test program
3. Set the Temperature to –30 degrees Celsius and maintain a period of one- hour soak time, with the EUT supply voltage disabled.
4. Set power supply voltage to 3.5 volts
5. Set up CMU 200 Radio Communication Tester
6. Command the CMU 200 to switch to 1850.2 MHz
7. Enable the voltage to the EUT, and connect a link to the CMU 200 test set
8. EUT is commanded to Transmit 100 Bursts
9. Software logs the following data from the CMU 200, power supply and temperature chamber: Traffic Channel Number, Traffic Channel Frequency, Power Level, Chamber Temperature, Supply Voltage, Power, Frequency Error.
10. The CMU 200 commands the EUT to change frequency to 1877.2 and 1904.2 MHz and repeats steps 7, to 9.
11. Repeat steps 5, to 10 changing the supply voltage to 3.8 volts
12. Increase temperature by 10?C and soak for 1/2 hour.
13. Repeat steps 4 - 12 for temperatures –20 degrees to 60 degrees Celsius.

Procedure 5 to 10 was repeated at room temperature (20?C) with the power supply voltage set to 3.5volts and 3.8 volts.

Channel results: 512, 647, & 782 @ 20?C and maximum transmitted power

Traffic Channel Number	***Frequency (MHz)***	***Tx Power (dBm)***	***Voltage (Volts)***	***Temperature (Celsius)***	***Frequency Error (Hz)***	***PPM***
512	1850.2	30	3.5	20	-23.57	-0.0013
647	1877.2	30	3.5	20	-21.57	-0.0011
782	1904.2	30	3.5	20	-22.92	-0.0012

Traffic Channel Number	***Frequency (MHz)***	***Tx Power (dBm)***	***Voltage (Volts)***	***Temperature (Celsius)***	***Frequency Error (Hz)***	***PPM***
512	1850.2	30	3.8	20	-29.90	-0.0016
647	1877.2	30	3.8	20	27.18	0.0014
782	1904.2	30	3.8	20	27.89	0.0015

Channel Results: 512 @ maximum transmitted power

Traffic Channel Number	*Frequency (MHz)*	*Tx Power (dBm)*	*Voltage (Volts)*	*Temperature (Celsius)*	*Frequency Error (Hz)*	*PPM*
512	1850.2	30	3.5	-30	52.63	0.0028
512	1850.2	30	3.5	-20	-32.80	-0.0018
512	1850.2	30	3.5	-10	-28.28	-0.0015
512	1850.2	30	3.5	0	-19.76	-0.0011
512	1850.2	30	3.5	10	-24.73	-0.0013
512	1850.2	30	3.5	20	-23.57	-0.0013
512	1850.2	30	3.5	30	-45.65	-0.0025
512	1850.2	30	3.5	40	-29.96	-0.0016
512	1850.2	30	3.5	50	-40.42	-0.0022
512	1850.2	30	3.5	60	-32.35	-0.0017

Traffic Channel Number	*Frequency (MHz)*	*Tx Power (dBm)*	*Voltage (Volts)*	*Temperature (Celsius)*	*Frequency Error (Hz)*	*PPM*
512	1850.2	30	3.8	-30	-55.79	-0.0030
512	1850.2	30	3.8	-20	-46.43	-0.0025
512	1850.2	30	3.8	-10	-21.24	-0.0011
512	1850.2	30	3.8	0	37.45	0.0020
512	1850.2	30	3.8	10	-24.67	-0.0013
512	1850.2	30	3.8	20	-29.90	-0.0016
512	1850.2	30	3.8	30	-32.61	-0.0018
512	1850.2	30	3.8	40	39.20	0.0021
512	1850.2	30	3.8	50	-37.45	-0.0020
512	1850.2	30	3.8	60	-27.70	-0.0015

Channel Results: 647 @ maximum transmitted power

Traffic Channel Number	*Frequency (MHz)*	*Tx Power (dBm)*	*Voltage (Volts)*	*Temperature (Celsius)*	*Frequency Error (Hz)*	*PPM*
647	1877.2	30	3.5	-30	49.91	0.0027
647	1877.2	30	3.5	-20	47.59	0.0025
647	1877.2	30	3.5	-10	28.54	0.0015
647	1877.2	30	3.5	0	37.45	0.0020
647	1877.2	30	3.5	10	35.00	0.0019
647	1877.2	30	3.5	20	-21.57	-0.0011
647	1877.2	30	3.5	30	28.15	0.0015
647	1877.2	30	3.5	40	34.29	0.0018
647	1877.2	30	3.5	50	-39.00	-0.0021
647	1877.2	30	3.5	60	31.38	0.0017

Traffic Channel Number	*Frequency (MHz)*	*Tx Power (dBm)*	*Voltage (Volts)*	*Temperature (Celsius)*	*Frequency Error (Hz)*	*PPM*
647	1877.2	30	3.8	-30	-55.21	-0.0029
647	1877.2	30	3.8	-20	51.33	0.0027
647	1877.2	30	3.8	-10	30.03	0.0016
647	1877.2	30	3.8	0	35.9	0.0019
647	1877.2	30	3.8	10	26.86	0.0014
647	1877.2	30	3.8	20	27.18	0.0014
647	1877.2	30	3.8	30	28.28	0.0015
647	1877.2	30	3.8	40	51.08	0.0027
647	1877.2	30	3.8	50	-34.48	-0.0018
647	1877.2	30	3.8	60	30.54	0.0016

Channel Results: 782 @ maximum transmitted power

Traffic Channel Number	*Frequency (MHz)*	*Tx Power (dBm)*	*Voltage (Volts)*	*Temperature (Celsius)*	*Frequency Error (Hz)*	*PPM*
782	1904.2	30	3.5	-30	54.5	0.0029
782	1904.2	30	3.5	-20	60.7	0.0032
782	1904.2	30	3.5	-10	30.41	0.0016
782	1904.2	30	3.5	0	43.07	0.0023
782	1904.2	30	3.5	10	43.91	0.0023
782	1904.2	30	3.5	20	-22.92	-0.0012
782	1904.2	30	3.5	30	37.45	0.0020
782	1904.2	30	3.5	40	36.68	0.0019
782	1904.2	30	3.5	50	-34.55	-0.0018
782	1904.2	30	3.5	60	38.68	0.0020

Traffic Channel Number	*Frequency (MHz)*	*Tx Power (dBm)*	*Voltage (Volts)*	*Temperature (Celsius)*	*Frequency Error (Hz)*	*PPM*
782	1904.2	30	3.8	-30	-53.66	-0.0028
782	1904.2	30	3.8	-20	37.71	0.0020
782	1904.2	30	3.8	-10	34.55	0.0018
782	1904.2	30	3.8	0	39.45	0.0021
782	1904.2	30	3.8	10	30.87	0.0016
782	1904.2	30	3.8	20	27.89	0.0015
782	1904.2	30	3.8	30	34.80	0.0018
782	1904.2	30	3.8	40	61.41	0.0032
782	1904.2	30	3.8	50	27.18	0.0014
782	1904.2	30	3.8	60	38.16	0.0020