



FCC PART 22H, 24E

TEST AND MEASUREMENT REPORT

For

Mobile Communications, Inc.

230 Earl Steward Dr.
Aurora, Ontario L4G 6V8, Canada

FCC ID: S4RBRB8191

Report Type: Original Report	Product Type: Dual Band Wireless Booster
Test Engineer: <u>Quinn Jiang</u> 	
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Victor Zhang 	
Reviewed By: <u>EMC/RF Lead</u>	
Prepared By: <u>(91)</u> Bay Area Compliance Laboratories Corp. 1274 Anvilwood Avenue, Sunnyvale, CA 94089, USA Tel: (408) 732-9162 Fax: (408) 732 9164	

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* This report may contain data that are not covered by the NVLAP accreditation and are marked with an asterisk “*” (Rev. 2)

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1104043-2224	Original Report	2011-07-25

1 GENERAL INFORMATION

1.1 Product Description for Equipment under Test (EUT)

This test and measurement report has been complied on behalf of the company *Mobile Communications, Inc.* and their product model: BRB819-68, FCC ID: S4RBRB8191, which will be henceforth in this report referred to as the EUT (Equipment Under Test). The EUT is a Cellular/PCS Dual-band, bi-directional booster/amplifier.

EUT Description	Dual-Band, Bi-Directional Wireless Booster/Amplifier
FCC ID	S4RBRB8191
Operation Frequency	Cellular Band: 824-849 MHz, 869-894 MHz PCS Band: 1850-1910 MHz, 1930-1990 MHz
Modulation (s)	CDMA, WCDMA, LTE, HSPA, GSM, GPRS, EDGE
Type of Equipment	Mobile and Fixed

1.2 Mechanical Description

The EUT measures approximately 200mm (L) x 91mm (W) x 35mm (H), and weighs approximately 2.26 kg.

The test data gathered are from typical production sample, serial number: HJF048 provided by the Manufacturer.

1.3 Objective

This type approval report is prepared on behalf of *Mobile Communications, Inc.* in accordance with Part 2, Subpart J, Part 22 Subpart H, and Part 24 Subpart E of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC rules for RF output power, modulation characteristic, occupied bandwidth, spurious emissions at antenna terminal, field strength of spurious radiation, frequency stability, band edge, and conducted and radiated margin.

1.4 Related Submittal(s)/Grant(s)

N/A

1.5 Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of Federal Regulations Title 47 Part 2, Sub-part J as well as the following parts:

Part 22 Subpart H - Cellular Radiotelephone Service

Part 24 Subpart E - PCS

Applicable Standards: TIA/EIA603-C, ANSI C63.4-2003.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

1.6 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the values ranging from +2.0 dB for Conducted Emissions tests and +4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL Corp.

Detailed instrumentation measurement uncertainties can be found in BACL Corp. report QAP-018.

1.7 Test Facility

The test site used by BACL Corp. to collect radiated and conducted emissions measurement data is located at its facility in Sunnyvale, California, USA.

The test sites at BACL have been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission, Industry Canada, and Voluntary Control Council for Interference has the reports on file and is listed under FCC registration number: 90464, IC registration number: 3062A, and VCCI Registration Number: C-698 and R-2463. The test site has been approved by the FCC, IC, and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The current scope of accreditations can be found at <http://ts.nist.gov/ts/htdocs/210/214/scopes/2001670.htm>

2 SYSTEM TEST CONFIGURATION

2.1 Justification

The EUT was configured for testing according to TIA/EIA 603-C.

The final qualification test was performed with the EUT operating at normal mode.

2.2 EUT Exercise Software

N/A

2.3 Special Accessories

N/A

2.4 Equipment Modifications

N/A

2.5 Internal Configuration

Manufacturer	Description	Model	Serial Number
Mobile Communications, Inc.	PCB Main	-	-

2.6 Local Support Equipment

Manufacturer	Description	Model	Serial Number
Rohde & Schwarz	Signal Generator	SMIQ03	849192/0085

2.7 Power Supply and Line Filters

Manufacturers	Descriptions	Models	Serial Numbers
Smooth Talker	AC Power Adapter	BLC24063000WU	53XU5K

2.8 Interface Ports and Cabling

Cable Description	Length (m)	To	From
RF Cable	< 1	Signal Generator	EUT
RF Cable	< 1	Spectrum Analyzer	EUT

3 SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§2.1047	Modulation Characteristics	Note ¹
§2.1053 §22.917(a), §24.238(a)	Field Strength of Spurious Radiation	Compliant
§2.1093	RF Exposure Information	Compliant
§2.1046 §22.913, §24.232	RF Output Power	Note ²
§2.1049 §22.917, §24.238	Out of Band Emissions, Occupied Bandwidth	Note ²
§2.1051, §22.917, §24.238(a)	Spurious Emissions at Antenna Terminals	Compliant
§2.1055 §22.355, §24.235	Frequency stability vs. temperature Frequency stability vs. voltage	Note ¹
§22.917, §24.238	Band Edge	Note ²

Note¹: EUT is an amplifier.

Note²: Please refer to RBR819-68 Conducted Test Report.

4 FCC §2.1047 - MODULATION CHARACTERISTIC

4.1 Applicable Standard

According to FCC §2.1047(d), Part 22H & 24E there is no specific requirement for digital modulation, therefore modulation characteristic is not presented.

4.2 Test Result

N/A, EUT is an amplifier

5 FCC §1.1307(b) (1) & §2.1091 - RF EXPOSURE INFORMATION

5.1 Applicable Standard

According to §1.1310 and §2.1091 (Mobile Devices) RF exposure is calculated.

Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minute)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

Note: f = frequency in MHz

* = Plane-wave equivalent power density

5.2 MPE Prediction

Predication of MPE limit at a given distance, Equation from OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = power density

P = power input to antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

Cellular Band

Downlink:

Maximum peak output power at antenna input terminal (dBm): 10.49

Maximum peak output power at antenna input terminal (mW): 11.19

Prediction distance (cm): 40

Prediction frequency (MHz): 881.5

Antenna Gain, typical (dBi): 10

Maximum Antenna Gain (numeric): 10

Power density at predication frequency and distance (mW/cm²): 0.0056

MPE limit for uncontrolled exposure at predication frequency (mW/cm²): 0.5877

Uplink:

Maximum peak output power at antenna input terminal (dBm): 29.33

Maximum peak output power at antenna input terminal (mW): 857.04

Prediction distance (cm): 40

Prediction frequency (MHz): 836.5

Antenna Gain, typical (dBi): 10

Maximum Antenna Gain (numeric): 10

Power density at predication frequency and distance (mW/cm²): 0.4263

MPE limit for uncontrolled exposure at predication frequency (mW/cm²): 0.5577

PCS Band**Downlink:**

Maximum peak output power at antenna input terminal (dBm):	<u>8.98</u>
Maximum peak output power at antenna input terminal (mW):	<u>7.91</u>
Prediction distance (cm):	<u>40</u>
Prediction frequency (MHz):	<u>1960</u>
Antenna Gain, typical (dBi):	<u>12</u>
Maximum Antenna Gain (numeric):	<u>15.85</u>
Power density at predication frequency and distance (mW/cm ²):	<u>0.00624</u>
MPE limit for uncontrolled exposure at predication frequency (mW/cm ²):	<u>1.0</u>

Uplink:

Maximum peak output power at antenna input terminal (dBm):	<u>28.10</u>
Maximum peak output power at antenna input terminal (mW):	<u>645.65</u>
Prediction distance (cm):	<u>40</u>
Prediction frequency (MHz):	<u>1880</u>
Antenna Gain, typical (dBi):	<u>12</u>
Maximum Antenna Gain (numeric):	<u>15.85</u>
Power density at predication frequency and distance (mW/cm ²):	<u>0.509</u>
MPE limit for uncontrolled exposure at predication frequency (mW/cm ²):	<u>1.0</u>

Test Result

The device complies with the MPE requirements by providing a safe separation distance of 40 cm between the antenna, including any radiating structure, and any persons when normally operated based on a 12 dBi antenna. The proposed RF exposure safety information has been included in the User's Manual.

6 FCC §2.1053, §22.917 & §24.2383 - RADIATED SPURIOUS EMISSIONS

6.1 Applicable Standard

Requirements: FCC §2.1053, §22.917, §24.238.

6.2 Test Procedure

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

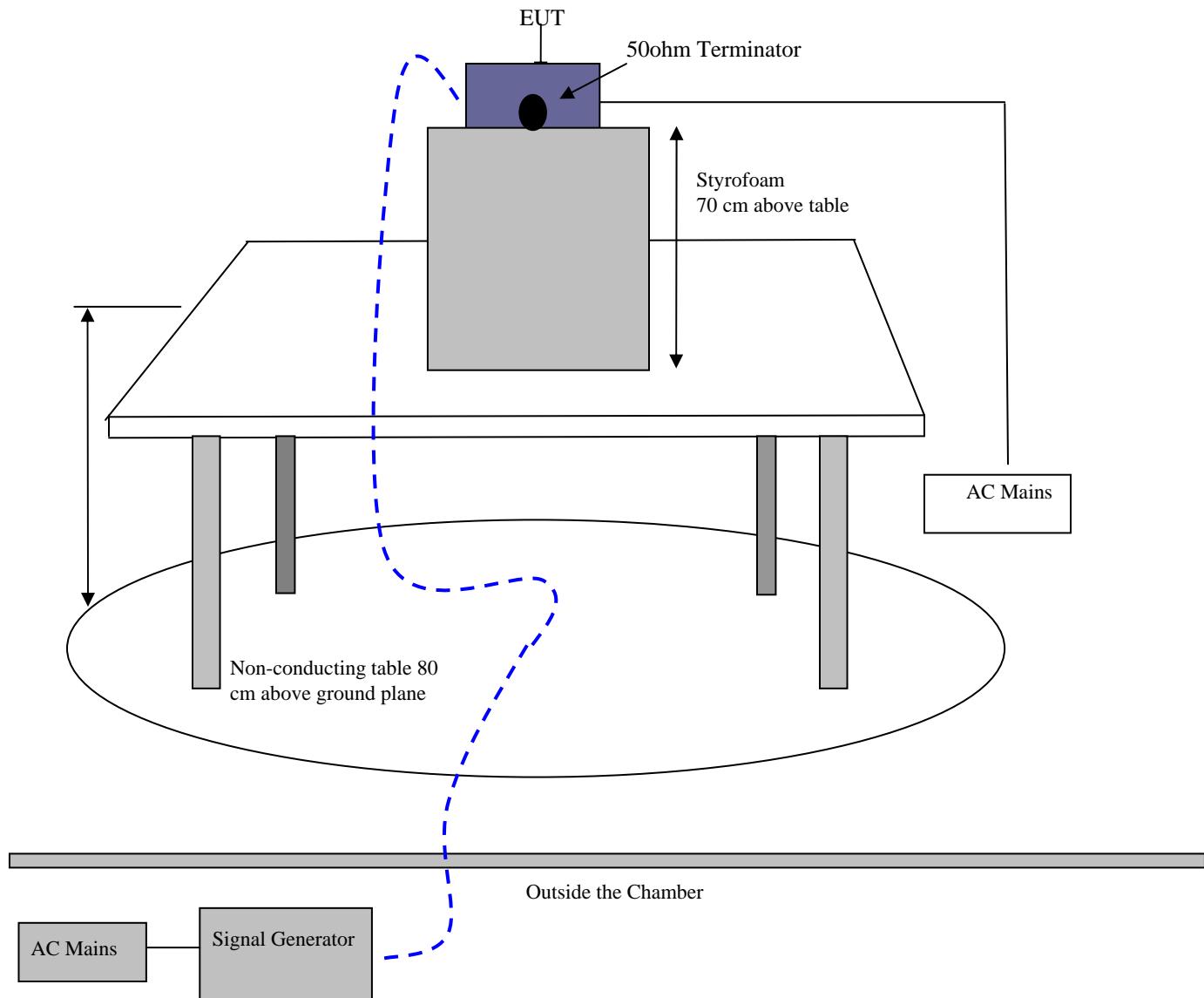
The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB = $10 \lg (\text{TXpwr in Watts}/0.001)$ – the absolute level

Spurious attenuation limit in dB = $43 + 10 \log_{10} (\text{power out in Watts})$

6.3 Test Setup Block Diagram



6.4 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Hewlett Packard	Pre-amplifier	8447D	2944A06639	2010-06-18
Sunol Science Corp	Combination Antenna	JB3	A0020106-3	2010-06-16
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2011-03-21
Sunol Science Corp	System Controller	SC99V	122303-1	N/R
A.R.A Inc	Horn antenna	DRG-1181A	1132	2010-11-29
Agilent	PSA Series Spectrum Analyzer	E4440A	MY44303352	2010-05-09
HP	Pre-amplifier	8449B	3147A00400	2011-02-03

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

6.5 Test Environmental Conditions

Temperature:	25°C
Relative Humidity:	55%
ATM Pressure:	101.2 kPa

Testing was performed by Quinin Jiang from 2011-04-06 to 2011-04-07 in 5 meter chamber 3.

6.6 Test Results

Worst case reading as follows:

Mode: Transmitting		
Margin (dB)	Frequency (MHz)	Antenna Polarization (Horizontal/Vertical)
-18.22	9400	Vertical

Cellular 850 MHz band Downlink (Input frequency = 881.6 MHz)

Indicated		Turtable Azimuth (degree)	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Frequency (MHz)	S.A. Amp. (dBuV)		Height (m)	Polarity (H/V)	Frequency (MHz)	Level (dBm)	Ant. Cord. (dB)	Cable Loss (dB)	Absolute Level (dBm)		
44.26	55.25	35	1.0	V	44.26	-46	0	1.0	-47	-13	-34.00
1763	43.29	201	1.72	H	1763	-62.31	8.1	1.0	-55.21	-13	-42.21
1763	41.72	127	1.0	V	1763	-63.88	8.1	1.0	-56.78	-13	-43.78
44.26	37.92	89	3.0	H	44.26	-63.33	0	1.0	-64.33	-13	-51.33

Cellular 850 MHz band Uplink (Input frequency = 836.6 MHz)

Indicated		Turtable Azimuth (degree)	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Frequency (MHz)	S.A. Amp. (dBuV)		Height (m)	Polarity (H/V)	Frequency	Level (dBm)	Ant. Cord. (dB)	Cable Loss (dB)	Absolute Level (dBm)		
1673	50.17	148	1.5	H	1673	-55.9	8.5	1.0	-48.4	-13	-35.40
48.47	57.79	360	1.0	V	48.47	-48.28	0	1.0	-49.28	-13	-36.28
1673	47.17	216	1.0	V	1673	-58.9	8.5	1.0	-51.4	-13	-38.40
48.47	42.41	290	3.0	H	48.47	-63.66	0	1.0	-64.66	-13	-51.66

PCS 1900 MHz band Downlink (Input frequency = 1960 MHz)

Indicated		Turtable Azimuth (degree)	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Frequency (MHz)	S.A. Amp. (dBuV)		Height (m)	Polarity (H/V)	Frequency	Level (dBm)	Ant. Cord. (dB)	Cable Loss (dB)	Absolute Level (dBm)		
49.76	41.93	262	3.0	H	49.76	-66.25	0	1.0	-67.25	-13	-54.25
49.76	57.25	354	1.0	V	49.76	-50.93	0	1.0	-51.93	-13	-38.93

PCS 1900 MHz band Uplink (Input frequency = 1880 MHz)

Indicated		Turtable Azimuth (degree)	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Frequency (MHz)	S.A. Amp. (dBuV)		Height (m)	Polarity (H/V)	Frequency	Level (dBm)	Ant. Cord. (dB)	Cable Loss (dB)	Absolute Level (dBm)		
9400	46.97	170	1.16	V	9400	-41.92	12.7	2.0	-31.22	-13	-18.22
9400	42.77	169	1.25	H	9400	-46.12	12.7	2.0	-35.42	-13	-22.42
49.23	58.77	342	1.0	V	49.23	-48.47	0	1.0	-49.47	-13	-36.47
49.23	43.9	293	3.0	H	49.23	-63.34	0	1.0	-64.34	-13	-51.34

7 FCC §2.1046, §22.913(a) & §24.232 - RF OUTPUT POWER

7.1 Applicable Standard

According to FCC §2.1046 and §22.913 (a), the ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts.

According to FCC §2.1046 and §24.232 (a), in no case may the peak output power of a base station transmitter exceed 2 watt.

7.2 Test Result

Please refer to RBR819-68 Conducted Test Report.

8 FCC §2.1049, §22.917 & §24.238 - OCCUPIED BANDWIDTH

8.1 Applicable Standard

Requirements: FCC §2.1049, §22.917 and §24.238.

8.2 Test Result

Please refer to RBR819-68 Conducted Test Report.

9 FCC §2.1051, §22.917 & §24.238(a) - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

9.1 Applicable Standard

Requirements: FCC §2.1051. §22.917 & §24.238(a).

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in §2.1057.

9.2 Test Result

Please refer to RBR819-68 Conducted Test Report.

10 FCC §2.1055, §22.355 & §24.235 - FREQUENCY STABILITY

10.1 Applicable Standard

Requirements: FCC §2.1055 (a), § 2.1055 (d) & following:

According to FCC §22.355, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in the table below:

Frequency Tolerance for Transmitters in the Public Mobile Services

Frequency Range (MHz)	Base, fixed (ppm)	Mobile \leq 3 watts (ppm)	Mobile \leq 3 watts (ppm)
25 to 50	20.0	20.0	50.0
50 to 450	5.0	5.0	50.0
450 to 512	2.5	5.0	5.0
821 to 896	1.5	2.5	2.5
928 to 929.	5.0	N/A	N/A
929 to 960.	1.5	N/A	N/A
2110 to 2220	10.0	N/A	N/A

According to §24.235, the frequency stability shall be sufficient to ensure that the fundamental emissions stays within the authorized frequency block.

10.2 Test Result

This EUT is an amplifier, therefore there is no frequency stability measurement required.

11 FCC §22.917 & §24.238 - BAND EDGE

11.1 Applicable Standard

According to §22.917, the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

According to §24.238, the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

11.2 Test Result

Please refer to RBR819-68 Conducted Test Report.