ITS Intertek Testing Services

FCC Part 24 (E) Test Report

for
Adicom Wireless
on the
Single Band PCS
Model: BRFM
FCC ID: PAJ-BRFM-PCS

Test Report: 200279941
Date of Report: October 28, 2000

NVLAP Laboratory Code 200201-0
Accredited for testing to FCC

Tested by:	Engineer	Ollie Moyrong
Reviewer:	EMC Manager	David Chernomordik

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1 JOB DESCRIPTION

1.1 Client Information

The EUT has been tested at the request of

Company: Adicom Wireless
5724 West Las Positas Blvd.
Plesanton, CA 94588

Name of contact: Brad Stribling
Telephone: (925) 201-4600
Fax: (925) 201-4610

1.2 Equipment under test (EUT)

Equipment type: Base Station Radio
Equipment class: Licensed Transmitter
Model number(s): BRFM
FCC ID: PAJ-BRFM-PCS
Manufacturer: SAME as above.
Use of Product : Data communications
Production is planned: [X] Yes, [ ] No

Technical Specifications:

Type of Emission	Complex CDMA
Modulation	Multiple QPSK
RF Output Power	Maximum Peak Envelope Power: +33 dBm Maximum Burst Average Power: +28 dBm Maximum Total Average Power: +21 dBm
Means for variation of operating power	Established from NMS Console at Base Station by specifying a Max Power parameter.
The dc voltage applied to and current into the several elements of the final RF amplifying device	6.3 V at 1.6 A
Frequency Range	1895 to 1910 MHz
Max. number of Channels	3
Antenna(s) (type, gain)	Vertically polarized sectorized antenna with carefully controlled backlobe and sidelobes, having 12 dBi gain
Detachable antenna ?	Yes
External input	Data
Frequency Tolerance	Normal operation: locked to GPS and maintains equivalent fractional ppm accuracy: prior to locking to GPS, frequency controlled by VCTCXO with 2 ppm accuracy

EUT receive date: 10/16/00

EUT received condition: Good condition prototype

Test start date: 10/16/00

Test end date: 10/26/00

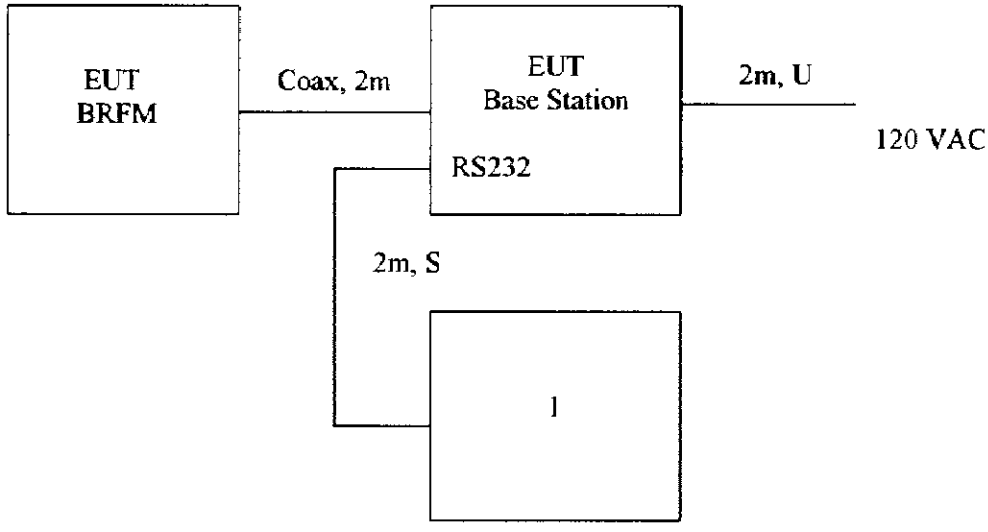
1.3 Test plan reference

FCC Part 2.1033, FCC Part 24 (E)

1.4 System test configuration

1.4.1 System block diagram & Support equipment

The diagram shown below details the placement of the equipment under test on the turntable.



S: Shielded	U: Unshielded	F: With Ferrite Core

Support equipment					
Equp. #	**Equipment**	**Manufacturer**	**Model #**	**S/N #**	**FCC ID**
1	Laptop	Toshiba	PA1224UTV	10624101-1	CJGUK435

1.4.2 Justification

The system was configured for testing in a typical manner in accordance with ANSI C63.4 standard.

1.4.3 Mode(s) of operation

The EUT was powered from 120 VAC. During tests, EUT was operating in transmitting/receiving mode at 3 channels: 1900.8625 MHz, 1904.1125 MHz, 1908.9875 MHz.

1.5 Modifications required for compliance

No modifications were implemented by Intertek Testing Services.

2 TEST SUMMARY

FCC RULE	DESCRIPTION OF TEST	RESULT	PAGE
	Transmitter Section		
2.1046 24.232(b)	RF Power Output Equivalent Isotropic Radiated Power (EIRP)	2 W (Peak) 32.4 W (Peak)	7
2.1047	Modulation Characteristics	Not Applicable	N/A
24.238	Out-of-band emissions at antenna terminal	Pass	9
2.1051 24.238	Spurious Emissions at antenna terminal	Pass	10
2.1053 24.238	Radiated Spurious Emission Attenuation	Pass	12
2.1055 24.235	Frequency Stability	Pass	18
2.1091	Radiated Exposure	Pass	20
15.107	Line Conducted Emissions	Not performed. See separate report provided by client	N/A
	Digital Section		
15.109	Radiated Emissions	Not performed. See separate report provided by client	N/A

3 RADIATED POWER

3.1 Test Description

Parameter:	FCC § 2.1046
Requirement:	FCC § 24.232(a)
(EIRP):	< 1640 Watts peak

3.2 Test Procedure

The Average output power at the antenna terminal of the EUT was set to 22 dBm measured by HP EPM-441A Power Meter. The Peak output power then was measured with a peak power meter and with a spectrum analyzer. The resolution bandwidth of a spectrum analyzer was set to 10 MHz and the video bandwidth was set to 7 MHz. The spectrum analyzer was connected to the EUT through a 6-dB attenuator and a cable having 1.5 dB insertion loss.

The Equivalent Isotropic Radiated Power (EIRP in dBm) was calculated using equation:

$$EIRP = P + G$$

Where P is the Output Power (in dBm), G is an antenna Gain (in dBi)

3.3 Test Results

Frequency, MHz	Peak Output Power, dBm	Antenna Gain, dBi	Peak EIRP, dBm	Peak EIRP, Watt
1900.8625	32.8	12	44.8	30.2
1904.1125	32.9	12	44.9	30.9
1908.9875	33.1	12	45.1	32.4

See Exhibit 1 for the peak output power plots (plots # 3.1, 3.2, 3.3)

3.4 Modifications made during testing

None

3.5 Test Instrumentation

Tektronix 2784 Spectrum Analyzer
HP EPM-441A Power Meter
HP Peak Power Meter
HP 6-dB Attenuator
HP 7470A Plotter

4 MODULATION CHARACTERISTICS

4.1 Test Description

Parameter:	FCC § 2.1047
Requirement:	Not Applicable

5 OUT -OF-BAND EMISSIONS AT ANTENNA TERMINAL

5.1 Test description

Parameter:	FCC §2.1049
Requirement:	FCC § 24.238
Emission Attenuation:	At least 43 + 10Log (P in Watts) dB below the transmitter Power on any frequency outside a licensee's frequency block

5.2 Test Procedure

The RF output was connected to the input of the spectrum analyzer through sufficient attenuation. The resolution bandwidth of the spectrum analyzer was set to 30 kHz, which is higher than 1% of 26-dB emission bandwidth (1.4 MHz approximately). At each fundamental frequency, the output power was measured and plotted. Then measurements were performed at the band-edge frequencies (1895 MHz for the lowest channel and 1910 MHz for the highest channel).

5.3 Test Results

See Exhibit 1 for the out-of-band emission plots:

Plot Number	Description
5.1	Low Channel, in band
5.2	Low Channel, on the band-edge frequency
5.3	Middle Channel, in band
5.4	Middle Channel, on the band-edge frequency
5.5	High Channel, in band
5.6	High Channel, on the band-edge frequency

The EUT passed the test by 6 dB.

5.4 Modifications made during testing

None

5.5 Test instrumentation

Tektronix 2784 Spectrum Analyzer
HP 6-dB Attenuator
HP 7470A Plotter

6 SPURIOUS EMISSION AT ANTENNA TERMINAL

6.1 Test description

Parameter:	FCC §2.1051
Requirement:	FCC § 238
Emission Attenuation:	At least 43 + 10Log (P in Watts) dB below the transmitter Power on any frequency outside a licensee's frequency block.

6.2 Test Procedure

The RF output was connected to the input of the spectrum analyzer through sufficient attenuation. The resolution bandwidth of the spectrum analyzer was set to 100 kHz. At each fundamental frequency, the output power was measured and plotted. Then measurements were performed from 30 MHz up to 25 GHz.

6.3 Test Results

See Exhibit 1 for the antenna conducted spurious emission plots:

Plot Number	Description
6.1.a	Low Channel, 1-30 MHz
6.2.a	Low Channel, 30 - 1000 MHz
6.3.a	Low Channel, 1-1895 MHz
6.4.a	Low Channel, 1895 – 1910 MHz, 100 kHz resolution
6.5.a	Low Channel, 1910 – 2100 MHz
6.6.a	Low Channel, 2.1– 10 GHz
6.7.a	Low Channel, 10 –20 GHz

Plot Number	Description
6.1.b	Middle Channel, 1-30 MHz
6.2.b	Middle Channel, 30 - 1000 MHz
6.3.b	Middle Channel, 1-1895 MHz
6.4.b	Middle Channel, 1907 – 2100 MHz
6.5.b	Middle Channel, 2.1– 10 GHz
6.6.b	Middle Channel, 10 –20 GHz

Plot Number	Description
6.1.c	High Channel, 1-30 MHz
6.2.c	High Channel, 30 - 1000 MHz
6.3.c	High Channel, 1-1895 MHz
6.4.c	High Channel, 1895 – 1910 MHz, 100 kHz resolution
6.5.c	High Channel, 1910 – 2100 MHz
6.6.c	High Channel, 2.1– 10 GHz
6.7.c	High Channel, 10 –20 GHz

The EUT passed the test by 5.3 dB.

6.4 Modifications made during testing

None

6.5 Test instrumentation

Tektronix 2784 Spectrum Analyzer
HP 6-dB Attenuator
HP 7470A Plotter

7 Radiated Spurious emissions

7.1 Test Description

Parameter:	FCC §2.1053
Requirement:	FCC § 24.238
Emission Attenuation:	At least 43 + 10Log (P in Watts) dB below the transmitter Power on any frequency outside a licensee's frequency block.

7.2 Test Procedure

The dummy load was connected to the transmitter output. The transmitter was placed on a wooden 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 frequency range up to tenth harmonic of the fundamental frequency was investigated, with measurement equipment RBW setting at 1 MHz.

The spurious harmonic attenuation was calculated as the difference between field strength E in dB(uV/m) at the fundamental frequency and at the spurious emission frequency.

Field Strength at the fundamental frequency was calculated using equation

$$E = \frac{\sqrt{30 \cdot (EIRP)}}{D}$$

Where E is in V/m, and EIRP is in Watts.

Note 1: For this calculation, the antenna gain was not taking into account.
Note 2: FCC Part 15.109 radiated emission measurements (frequency range from 30 MHz to 1 GHz) were not performed. Test data can be found in separate FCC Part 15 report provided by the customer.

7.3 Test Results

Please see the following pages for spurious harmonic attenuation. The EUT passed the test by 13.5 dB.

7.4 Modifications made during testing

None

7.5 Test instrumentation

EMCO 3115 Horn antenna
EMCO 3160-9 Horn antenna
HP 8566B Spectrum Analyzer
Preamplifiers: CDI P1000, AFT18855, ACO/400

Radiated Emissions Test Data

Compan	Adicom Wireless	Model #:	Base	Req	FCC	24.238
EUT:	Transceiver	FCC ID: PAJ-BRFM-PCS		Test	3	meters
Project	J20027994	Test Date:	Oct 23, 2000	TP	1.91	Watt
Test	Low channel, 1900.86 MHz	Engineer:	Barry S.	Min	45.81	dBc

	Antenna Used			Pre-Amp Used			Cable			Transducer Used
Number:	14	21	12	8	10	13	21			0
Model:	EMCO 3115	EMCO 3160-9	EMCO 3104	CDI _P1000	AFT18855	ACO/400	Grn_M+L	None	None	None

Frequen	Reading	Detector	Ant	Ant	Ant. Pol.	Ant. Factor	Pre-Amp	Insert.loss	Net	EIRP	Attn.	Margin
MHz	dB(µV)	P/A/Q	#	#	H/V	dB(1/m)	dB	dB	dB(µV/m)	mW	dBc	dB
1900.86									128.1		-	-
3801.72	25.9	Peak	14	8	H	32.1	27.8	2.7	32.9		95.2	-49.4
5702.58	25.9	Peak	14	8	H	36.2	28.3	3.7	37.5		90.6	-44.8
7604.33	32.3	Peak	14	8	H	38.5	27.8	4.6	47.6		80.5	-34.7
9504.30	31.8	Peak	14	8	H	39.0	27.3	5.0	48.5		79.6	-33.8
11405.20	34.2 *	Peak	14	10	H	40.7	39.9	5.6	40.6		87.5	-41.7
13306.00	38.5 *	Peak	14	10	H	40.0	39.2	6.1	45.4		82.7	-36.9
15206.90	38.9 *	Peak	14	10	H	41.7	38.3	6.8	49.1		79.0	-33.2
17107.70	39.8 *	Peak	14	10	H	43.0	38.8	7.5	51.5		76.6	-30.8
19008.60	43.7 *	Peak	21	13	H	40.2	23.3	7.7	68.3		59.8	-14.0

Notes:
a) O.C.F.:Other Correction Factor
b) Insert. Loss = Cable A + Cable B + Cable C + Transducer.
c) Net = Reading + Antenna Factor - Pre-Amp + Insert. Loss.
d) Attn. = Field Strength (Fundamental) - Field Strength (Harmonics).
e) Negative signs (-) in Margin column signify levels below the limits.
f) * indicates a noise floor

Radiated Emissions Test Data

Compan	Adicom Wireless	**Model #:**	Base	**Req**	FCC	24.238
EUT:	Transceiver	**FCC ID: PAJ-BRFM-PCS**		**Test**	3	meters
Project	J20027994	**Test Date:**	Oct 23, 2000	**TP**	1.95	Watt
Test	Middle channel, 1904.11 MHz	**Engineer:**	Barry S.	**Min.**	45.90	dBc

	Antenna Used			Pre-Amp Used			Cable			Transducer Used
Number:	14	21	12	8	10	13	21			0
Model:	EMCO 3115	EMCO 3160-9	EMCO 3104	CDI _P1000	AFT18855	ACO/400	Grn_M+L	None	None	None

Frequen	Reading	Detector	Ant	Amp	Ant. Pol.	Ant.	Pre-Amp	Insert.loss	Net	EIRP	Attn.	Margin
MHz	dB(μV)	P/A/Q	#	#	H/V	dB(1/m)	dB	dB	dB(μV/m)	mW	dBc	dB
1904.11									128.2		-	-
3808.22	26.4	Peak	14	8	H	32.1	27.8	2.7	33.4		94.8	-48.9
5712.33	26.6	Peak	14	8	H	36.2	28.3	3.7	38.2		90.0	-44.1
7616.44	25.9	Peak	14	8	H	38.5	27.8	4.6	41.2		87.0	-41.1
9520.55	23.5	Peak	14	10	H	39.0	38.3	5.0	29.2		99.0	-53.1
11424.70	33.7 *	Peak	14	10	H	40.7	39.9	5.6	40.1		88.1	-42.2
13328.80	38.5 *	Peak	14	10	H	40.0	39.2	6.1	45.4		82.8	-36.9
15232.90	39.5 *	Peak	14	10	H	41.7	38.3	6.8	49.7		78.5	-32.6
17137.00	39.9 *	Peak	14	10	H	43.0	38.8	7.5	51.6		76.6	-30.7
19041.10	44.2 *	Peak	21	13	H	40.2	23.3	7.7	68.8		59.4	-13.5

Notes:

a) O.C.F.:Other Correction Factor

b) Insert. Loss = Cable A + Cable B + Cable C + Transducer.

c) Net = Reading + Antenna Factor - Pre-Amp + Insert. Loss.

d) Attn. = Field Strength (Fundamental) - Field Strength (Harmonics).

e) Negative signs (-) in Margin column signify levels below the limits.

f) * indicates a noise floor

Radiated Emissions Test Data

Compan	Adicom Wireless	**Model #:**	Base		**Req**	**FCC**	**24.238**
EUT:	Transceiver	**FCC ID: PAJ-BRFM-PCS**			**Test**	3	meters
Project	J20027994	**Test Date:**	Oct 23, 2000		**TP**	2.04	Watt
Test	High channel, 1908.9875 MHz	**Engineer:**	Barry S.		**Min.**	**46.10**	dBc

	Antenna Used			Pre-Amp Used			Cable			Transducer Used
Number:	14	21	12	8	10	13	21			0
Model:	EMCO 3115	EMCO 3160-9	EMCO 3104	CDI P1000	AFT18655	ACO/400	Gra_M+L	None	None	None

Frequen	Reading	Detector	Ant	Ant	Ant. Pol.	Ant.	Pre-Amp	Insert.loss	Net	EIRP	Attn.	Margin
MHz	dB(μV)	P/A/Q	#	#	H/V	dB(1/m)	dB	dB	dB(μV/m)	mW	dBc	dB
1908.99									128.4		-	-
3817.97	29.3	Peak	14	8	H	32.1	27.8	2.7	36.3		92.1	-46.0
5726.95	26.2	Peak	14	8	H	36.2	28.3	3.7	37.8		90.6	-44.5
7635.94	23.3	Peak	14	8	H	38.5	27.8	4.6	38.6		89.8	-43.7
9544.92	23.4	Peak	14	10	H	39.0	38.3	5.0	29.1		99.3	-53.2
11453.90	33.5 *	Peak	14	10	H	40.7	39.9	5.6	39.9		88.5	-42.4
13362.90	37.9 *	Peak	14	10	H	40.0	39.2	6.1	44.8		83.6	-37.5
15271.90	38.9 *	Peak	14	10	H	41.7	38.3	6.8	49.1		79.3	-33.2
17180.90	39.2 *	Peak	14	10	H	43.0	38.8	7.5	50.9		77.5	-31.4
19089.90	42.9 *	Peak	21	13	H	40.2	23.3	7.7	67.5		60.9	-14.8

Notes:

a) O.C.F.:Other Correction Factor

b) Insert. Loss = Cable A + Cable B + Cable C + Transducer.

c) Net = Reading + Antenna Factor - Pre-Amp + Insert. Loss.

d) Attn. = Field Strength (Fundamental) - Field Strength (Harmonics).

e) Negative signs (-) in Margin column signify levels below the limits.

f) * indicates a noise floor

8 FREQUENCY STABILITY

8.1 Test description

Parameter:	FCC §2.1055
Requirement:	FCC § 24.235
Frequency Tolerance:	Sufficient to ensure that the fundamental emission stays within the authorized frequency block

8.2 Test Procedure

The ppm frequency error of the transmitter was calculated by:

$$ppm\ error = \left(\frac{MCF}{ACF} - 1\right) \cdot 10^6$$

Where MCF is the Measured Carrier Frequency in MHz
ACF is the Assigned Carrier Frequency in MHz

8.2.1 Frequency Stability vs. Temperature

The equipment under test was connected to a power supply and the RF output was connected to a frequency counter via feedthrough attenuators. The EUT was placed inside the temperature chamber. After the temperature stabilized for approximately 20 minutes, the frequency of the output signal was recorded from the counter.

8.2.2 Frequency Stability vs. Voltage

At room temperature (25 ±5 °C), a power supply was connected to the EUT. The frequency of the transmitter was measured for 115%, 100% and 85% of the nominal operating input voltage.

8.3 Test Results

Frequency Stability vs Temperature		
ACF (MHz): 1904.1125		
Temperature, C	MCF (MHz)	ppm Error
50	1903.968	-75.9
40	1903.955	-82.7
30	1903.955	-82.7
20	1903.969	-75.4
10	1903.960	-80.1
0	1903.960	-80.1
-10	1903.960	-80.1
-20	1903.948	-86.4
-30	1903.948	-86.4

Frequency Stability vs Voltage			
ACF (MHz): 1904.1125			
%	Voltage, V	MCF (MHz)	ppm Error
85	102	1904.133	10.8
100	120	1904.133	10.8
115	138	1904.133	10.8

The EUT passed the test.

8.4 Modifications made during testing

None

8.5 Test instrumentation

[X] Data provided by applicant
[ ] Temperature Chamber, -50C to +100C
[ ] Hewlett Packard 5383A Frequency Counter
[ ] Tektronix 2784 Spectrum Analyzer

9 AC LINE CONDUCTED EMISSIONS

9.1 Test description

Parameter:	ANSI C63.4
Requirement:	FCC § 15.107

9.2 Test Procedure

The EUT was connected to the AC line through the LISNs.

Both HOT and NEUTRAL leads were tested.

9.3 Test Results

Test was not performed. Test data can be found in the separate FCC Part 15 report provided by client.

9.4 Modifications made during testing

None

9.5 Test instrumentation

[ ] HP 8568B Spectrum Analyzer
[ ] LISN

10 RADIATION EXPOSURE

The BRFM Radio is the up-mast transceiver intended to service multiple subscribers on a point-to-multipoint basis. Antenna is fix-mounted, generally quite high, so it is impossible to use the product in any portable application. Therefore, to comply with RF Exposure Requirement, the MPE is calculated.

The maximum Peak EIRP measured and calculated is 45.1 dBm or 32.4 W. The Power Density can be calculated using the formula

$$S = EIRP/ 4\pi D^2$$

Where: S is Power Density in W/m^2
D is the distance from the antenna.

The transmitter operates with the Duty Cycle of 0.47 (3.8 ms – ON, 4.25 ms – OFF, see plots 11.1 and 11.2 in Exhibit 1).

In the table below, the calculated Power Density at different distances and MPE Limit are presented.

Distance, m	Power Density, W/m^2 (with no Duty Cycle)	Power Density, W/m^2 (with 47% Duty Cycle)	MPE, W/m^2
0.2	64.5	30.3	10.0
0.3	28.6	13.4	10.0
0.4	16.1	7.6	10.0
0.5	10.3	4.8	10.0
0.6	7.2	3.4	10.0
0.7	5.3	2.5	10.0
0.8	4.0	1.9	10.0
0.9	3.2	1.5	10.0
1.0	2.6	1.2	10.0

As can be seen from the Table, Power Density at 0.5 m distance from the antenna is well below the limit. A Warning Statement is written in the User Manual.

11 LIST OF TEST EQUIPMENT

Equipment	Manufacturer	Model	Serial #	Cal. Int.	Cal. Due	Used
Double-ridged Horn Antenna	EMCO	3115	9107-3712	12	6/25/01	X
Horn Antenna	EMCO	3160-9	N/A	#	#	X
Pre-amplifier	CDI	P1000	N/A	12	11/14/00	X
Pre-amplifier	Avantek	AFT18855	8723H705	12	11/14/00	X
Pre-amplifier	CTT	ACO/400	47526	12	11/14/00	X
Spectrum Analyzer w/8650 QP Adapter	Hewlett Packard	HP 8566B	2416A00317 2521A01021	6	2/03/01	X
Spectrum Analyzer	Tektronix	2784	B3020108	12	8/4/01	X
Peak Power Meter	Hewlett Packard	8900D	3607U00673	12	7/31/01	X
Peak Power Sensor	Hewlett Packard	84811A	3318A05091	12	12/7/99	X
Power Meter	Hewlett Packard	EPM-441A	US37481023	12	5/17/01	X

CALIBRATION IS NOT REQUIRED

12 EXHIBIT 1

Plot No	Description
3.1 – 3.3	Output Power
5.1 – 5.6	Out-of-band conducted emission at antenna terminal
6.1a – 6.7a	Spurious conducted emissions at antenna terminal, low channel
6.1b – 6.6b	Spurious conducted emissions at antenna terminal, middle channel
6.1c – 6.7c	Spurious conducted emissions at antenna terminal, high channel