MPE EVALUATION REPORT

FOR THE

DUAL BAND BI-DIRECTIONAL AMPLIFIER, 811201

FCC OET BULLETIN 65, EDITION 97-01, ANSI / IEEE C95.1-1992, AND ANSI / IEEE C95.3-1992

RF EXPOSURE COMPLIANCE

DATE OF ISSUE: JULY 14, 2004

PREPARED FOR:

Wilson Electronics
3301 East Deseret Drive
St. George, UT 84790

W.O. No.: 81935

PREPARED BY:

Randy Clark
CKC Laboratories, Inc.
5473A Clouds Rest
Mariposa, CA 95338

Date of test: June 1 – July 7, 2004

Report No.: FC04-021-RC

TABLE OF CONTENTS

ADMINISTRATIVE INFORMATION

PURPOSE OF TEST:
To demonstrate the compliance of the Dual Band Bi-Directional Amplifier, 811201 with the RF Exposure Requirements for mobile devices.

REPRESENTATIVE:
Patrick Cook

SUMMARY OF RESULTS

VEHICLE MOUNTED ANTENNA

For General Population / Uncontrolled Exposure, the Maximum Permissible Exposure (MPE) limit for the operating frequency range 1 (824-849 MHz) is 0.55 mW/cm^2 and for operating frequency range 2 (1850-1910 MHz) is 1.0 mW/cm^2. The data in this report demonstrates that this device complies with the Maximum Permissible Exposure (MPE) requirements set forth in 47 CFR §2.1091, §1.1310, and OET Bulletin 65, Edition 97-01 for General Population / Uncontrolled Exposure environment at a minimum distance of 10 cm through a ground plane from the vehicle mounted antenna (operator requirement), and for General Population / Uncontrolled Exposure environment at a minimum distance of 40 cm laterally from the vehicle mounted antenna (bystander requirement).

GLASS MOUNTED ANTENNA

For General Population / Uncontrolled Exposure, the Maximum Permissible Exposure (MPE) limit for the operating frequency range 1 (824-849 MHz) is 0.55 mW/cm^2 and for operating frequency range 2 (1850-1910 MHz) is 1.0 mW/cm^2. The data in this report demonstrates that this device complies with the Maximum Permissible Exposure (MPE) requirements set forth in 47 CFR §2.1091, §1.1310, and OET Bulletin 65, Edition 97-01 for General Population / Uncontrolled Exposure environment at a minimum distance of 10 cm below the vehicle glass mounted antenna base (operator requirement), and for General Population / Uncontrolled Exposure environment at a minimum distance of 20 cm laterally from the vehicle mounted antenna (bystander requirement).

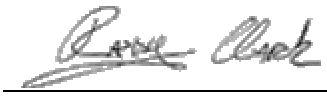
APPROVALS

Steve Behm, Director of Engineering Services

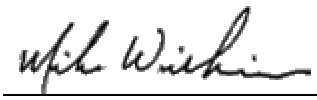
QUALITY ASSURANCE:

Joyce Walker, Quality Assurance Administrative Manager

TEST PERSONNEL:



Randy Clark, EMC Engineer



Mike Wilkinson, Lab Manager

EQUIPMENT UNDER TEST

Dual Band Bi-Directional Amplifier

Manuf:	Wilson Electronics
Model:	811201
Serial:	5218
FCC ID:	pending

12VDC Power Adapter

Manuf:	Wilson Electronics
Model:	NA
Serial:	NA
FCC ID:	NA

Vehicle Mounted Antenna

Manuf:	Wilson Electronics
Model:	301103
Serial:	NA
FCC ID:	NA

Glass Mounted Antenna

Manuf:	Wilson Electronics
Model:	301102
Serial:	NA
FCC ID:	NA

PERIPHERAL DEVICES

The EUT was tested with the following peripheral device(s):

Signal Generator (CDMA Adapter)

Manuf:	HP
Model:	83205A
Serial:	US37461985
FCC ID:	DoC

Signal Generator

Manuf:	HP
Model:	8921A
Serial:	3519A01796
FCC ID:	DoC

Preamp

Manuf:	Mini-Circuits
Model:	ZHL-42-SMA
Serial:	D030204-#19
FCC ID:	DoC

Signal Generator

Manuf:	HP
Model:	E4437B
Serial:	MY41310476
FCC ID:	DoC

SPECIFICATIONS AND REQUIREMENTS

The following summarizes the specifications and requirements for Maximum Permissible Exposure for mobile devices applied during RF exposure evaluation.

Excerpt from 47 CFR §1.1310 Radio Frequency radiation exposure limits

Table 1. - Limits for Maximum Permissible Exposure (MPE)

(A) Limits for Occupational/Controlled Exposures

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (V/m)	Power Density (mW/cm^2)	Averaging Time (Minutes)
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*(900/f2)	6
30-300	61.4	0.163	1	6
300-1500	---	---	f/300	6
1500-100,000	---	---	5	6

(B) Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (V/m)	Power Density (mW/cm^2)	Averaging Time (Minutes)
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f2)	30
30-300	27.5	0.073	0.2	30
300-1500	---	---	f/1500	30
1500-100,000	---	---	1	30

f = frequency in MHz
* = Plane-wave equivalent power density

NOTE 1 to Table 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 to Table 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

SUMMARY OF RF EXPOSURE CONDITIONS

Range 1

Operating Frequency Range (MHz)	824-849 (uplink)
Rated Power Output (Watts)	3 (conducted)

MPE Limit =	f/1500 (mW/cm^2)
=	0.549 (mW/cm^2)

Range 2

Operating Frequency Range (MHz)	1850-1910 (uplink)
Rated Power Output (Watts)	3 (conducted)

MPE Limit =	1 (mW/cm^2)

All Frequency Ranges

Operator Exposure Condition

	Occupational / Controlled Exposure
X	General Population / Uncontrolled Exposure

Bystander Exposure Condition

	Occupational / Controlled Exposure
X	General Population / Uncontrolled Exposure

Device and Antenna Operating Configuration

Vehicle Mounted Antenna

Antenna used for test is a magnetically mounted vehicle antenna with gain of 5.12dBi in the frequency range of 824-849 MHz and 6.12dBi in the frequency range of 1850-1910 MHz. Input CDMA signal (representative of worst case) is provided via support signal generator. Signal generator output is fed to the input of the EUT through a preamplifier when necessary to obtain the maximum output.

Glass Mounted Antenna

Antenna used for test is a glass mounted vehicle antenna with gain of 4.5dBi in the frequency range of 824-849 MHz and 5.9dBi in the frequency range of 1850-1910 MHz. Input CDMA signal (representative of worst case) is provided via support signal generator. Signal generator output is fed to the input of the EUT through a preamplifier when necessary to obtain the maximum output.

REPORT OF MEASUREMENTS

VEHICLE MOUNTED ANTENNA

The following tables show the measurements performed to determine conformity with the applicable limits for RF exposure. Measurements are performed at the center of the equipment's operating band; this allows the maximum power output through the device.

Range 1
Frequency investigated: 836.5MHz

Operator Exposure Measurements

Measurement of the operator made directly under the ground plane at a separation of 10cm beneath and 10cm forward of the base of the transmitting antenna

d (m)	mW/cm^2	Limit	Result
0.1	**0.00435**	0.55	Pass

Bystander Exposure Measurements

Measurements on point grid in mW/cm^2.

	A	*B*	*C*	*Height*
1	0.009	0.004	0.008	1.75
2	0.085	0.138	0.078	1.00
3	0.002	0.002	0.003	0.50

The spatially averaged power density is

X (m)	mW/cm^2	Limit	Result
0.5	**0.03667**	0.55	Pass

Evaluation was performed at the following measurement distances: 0.40m, 0.50m and 0.70m. The maximum power density measurements were obtained at 0.50m representing the edge of the conductive plane simulating vehicular installation.

Range 2
Frequency investigated: 1880MHz

Operator Exposure Measurements

Measurement of the operator made directly under the ground plane at a separation of 10cm beneath and 10cm forward of the base of the transmitting antenna

d (m)	mW/cm^2	Limit	Result
0.1	**0.00713**	1.0	Pass

Bystander Exposure Measurements

Measurements on point grid in mW/cm^2.

	A	*B*	*C*	*Height*
1	0.009	0.012	0.016	1.75
2	0.091	0.240	0.155	1.00
3	0.005	0.006	0.006	0.50

The spatially averaged power density is

X (m)	mW/cm^2	Limit	Result
0.4	**0.06004**	0.55	Pass

Evaluation was performed at the following measurement distances: 0.40m, 0.50m and 0.70m. The maximum power density measurements were obtained at 0.40m.

GLASS MOUNTED ANTENNA

The following tables show the measurements performed to determine conformity with the applicable limits for RF exposure. Measurements are performed at the center of the equipment's operating band; this allows the maximum power output through the device.

Range 1
Frequency investigated: 836.5MHz

Operator Exposure Measurements

Measurement of the operator made directly under the ground plane at a separation of 10cm beneath and 10cm forward of the base of the transmitting antenna

d (m)	mW/cm^2	Limit	Result
0.1	**0.11554**	0.55	Pass

Bystander Exposure Measurements

Measurements on point grid in mW/cm^2.

	A	*B*	*C*	*Height*
1	0.009	0.010	0.010	1.75
2	0.161	0.202	0.150	1.12
3	0.045	0.054	0.069	0.50

The spatially averaged power density is

X (m)	mW/cm^2	Limit	Result
0.1	**0.11554**	0.55	Pass

Evaluation was performed at the following measurement distances: 0.20m and 0.50m. The maximum power density measurements were obtained at 0.20m.

Range 2
Frequency investigated: 1880 MHz

Operator Exposure Measurements

Measurement of the operator made directly under the ground plane at a separation of 10cm beneath and 10cm forward of the base of the transmitting antenna

d (m)	mW/cm^2	Limit	Result
0.1	**0.10196**	1.0	Pass

Bystander Exposure Measurements

Measurements on point grid in mW/cm^2.

	A	*B*	*C*	*Height*
1	0.009	0.010	0.010	1.75
2	0.161	0.202	0.150	1.12
3	0.045	0.054	0.069	0.50

The spatially averaged power density is

X (m)	mW/cm^2	Limit	Result
0.2	**0.04704**	1	Pass

Evaluation was performed at the following measurement distances: 0.20m and 0.50m. The maximum power density measurements were obtained at 0.20m.

TEST CONFIGURATION

The EUT antenna is placed in a configuration typical of normal installation. Where antenna mounting is required, non-conductive materials are used for support structures. Where vehicle mounted antennas are used, a reference ground plane is used to simulate actual installation. Where vehicle glass mounted antennas are used, no antenna reference ground plane is used. In order to limit external interference effects, the test is performed in a semi-anechoic chamber. The EUT equipment is setup in a configuration representative of normal use. Support equipment for the measurement instruments are located outside of the chamber.

TEST PROCEDURE

To determine the spatially averaged value, local values including the maximum value are measured over a surface area of 0.35 m (width) x 1.25 m (height) perpendicular to the ground beginning at 0.50m from the ground reference plane. Preliminary investigation is performed in order to determine the orientation and height which yields the highest power density or field strength measurements. The height of the center row of local points is determined during preliminary investigation and correspondes to a location at which a local maximum exists. Where the field is reasonably uniform (within +20%), e.g., in the far-field, measurements will suffice in one location, representative of the space that is occupied by a person. Where the field is not uniform, measurements are made at a series of locations. The measurement points are uniformly spaced within the sampling area. Local values are measured at nine points within the sampling grid. The spatially averaged electric field strength along a grid of *n* points is calculated using:

$$E = \left[\frac{1}{n} \sum_{i=1}^{n} E_i^2 \right]^{\frac{1}{2}}$$

And the spatially averaged power density along a grid of n points is calculated using:

$$W = \frac{1}{n} \sum_{i=1}^{n} W_i$$

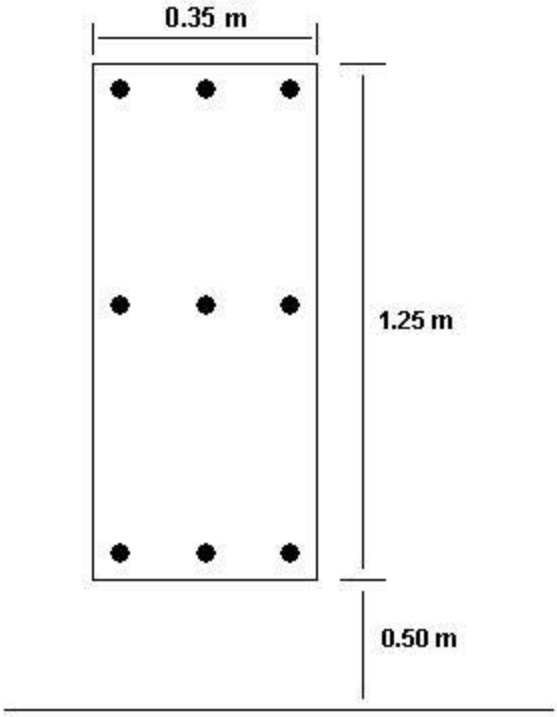
Assuming measurements are made in the far field, where the E and H vectors are mutually orthogonal, power density is calculated using:

$$S = \frac{E^2}{377}$$

The following diagram is an example of the grid used to perform local measurements for RF exposure evaluation over a whole-body spatial average.

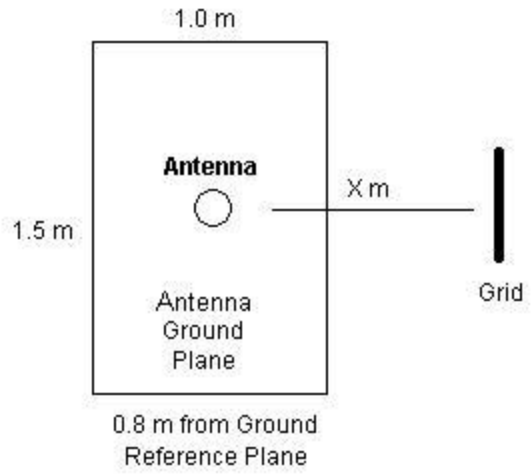
Example Grid used for RF Exposure Measurements

● Represents local points used for whole-body spatial averaging



The following diagram is an example of the setup used for vehicle-mounted antennas. The letter X represents the test distance used for RF exposure measurements. The distance X is measured from the phase center of the transmitting antenna to the volumetric center of the measurement instrument. In order to more accurately simulate normal installation, the antenna ground plane is not bonded to the ground reference plane. The transmitting antenna is placed in the center of the antenna ground plane.

Setup Used for Vehicle-Mounted Antennas



Top View

REFERENCE DOCUMENTS

ANSI IEEE C95.1-1991. IEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz to 300GHz.

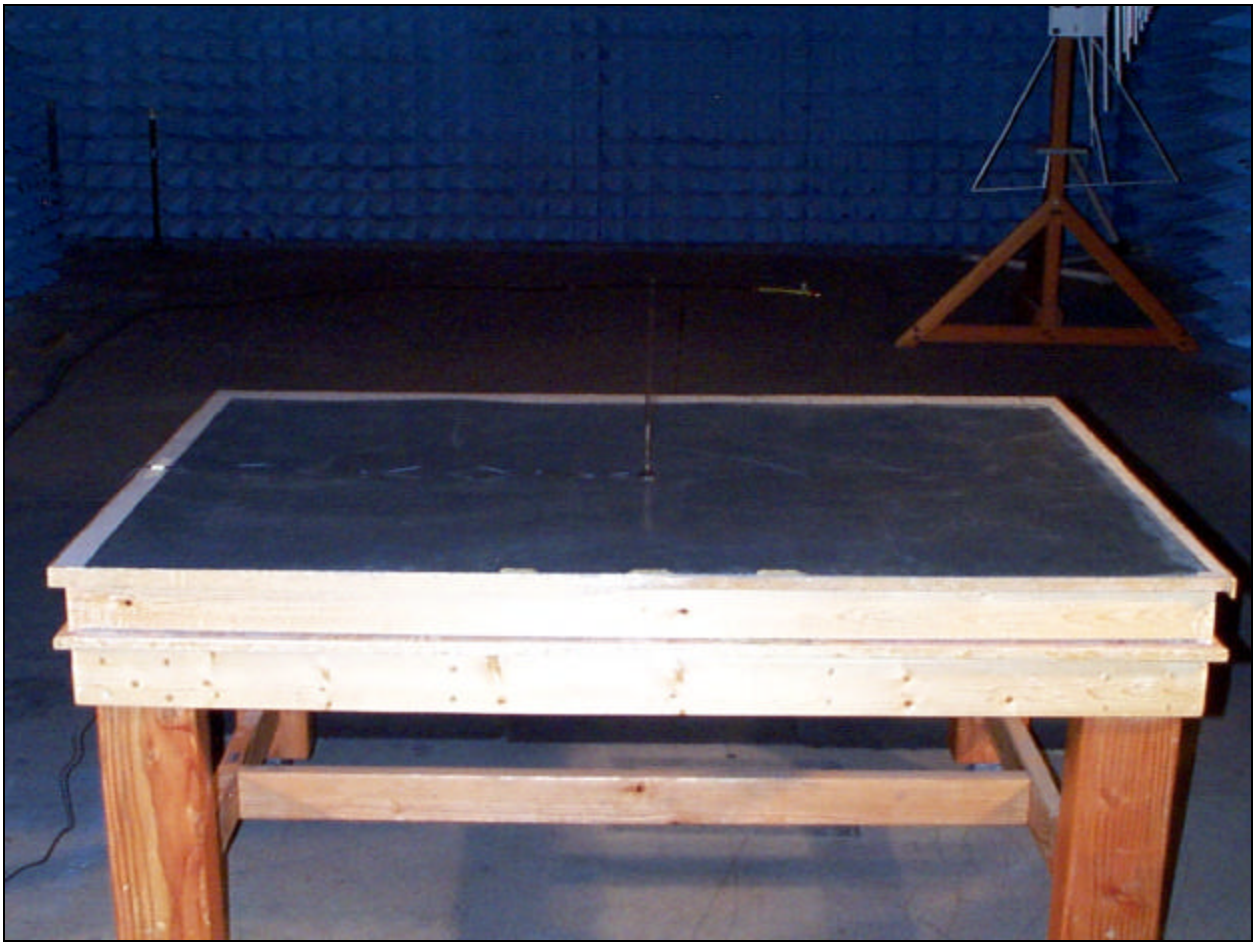
ANSI IEEE C95.3-1991. IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave

FCC OET Bulletin 65 Supplement C. Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields

Health Canada Safety Code 6. Limits of Human Exposure to Radio Frequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz.

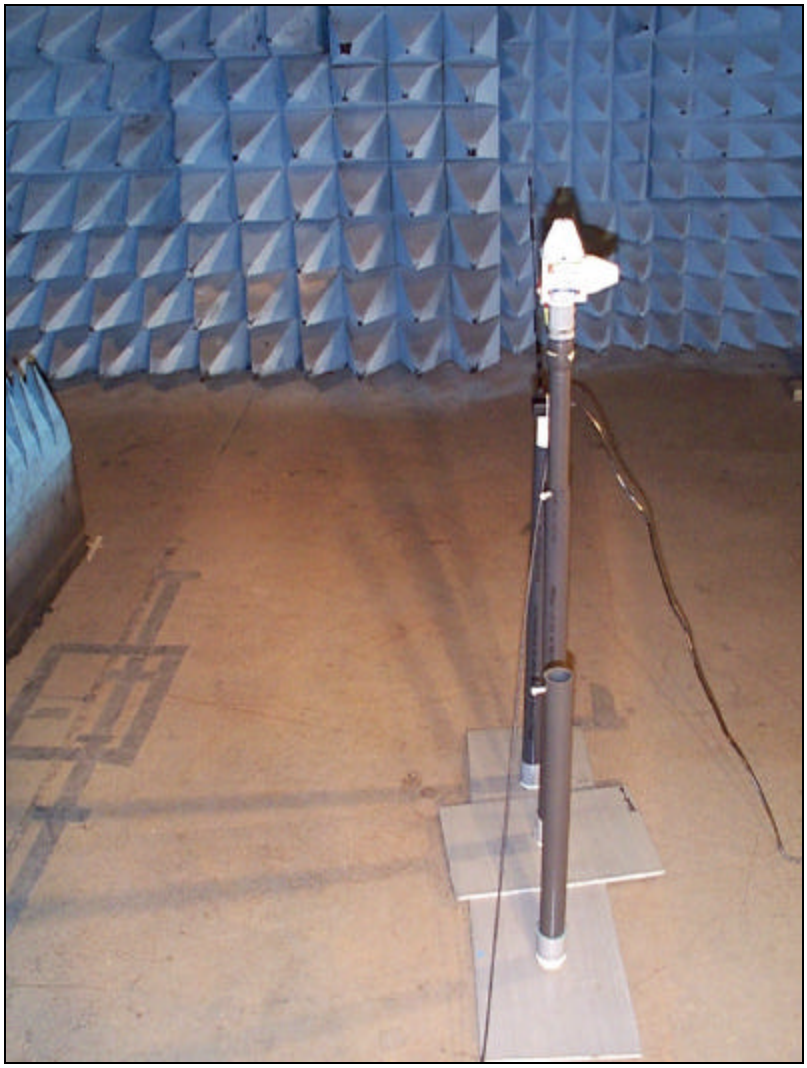
APPENDIX A

PHOTOGRAPH OF THE TEST SETUP USED



Vehicle Mounted Antenna

PHOTOGRAPH OF THE TEST SETUP USED



Glass Mounted Antenna

APPENDIX B

TEST EQUIPMENT LIST

Description	*Asset #*	*Manufacturer*	*Model #*	*Serial #*	*Cal Date*	*Cal Due*
Field Probe	2043	AR	FP2080	16770	12/12/02	12/11/04
Field Monitor	02007	AR	FM1000	11757	9/26/02	9/25/04
Field Probe	02024	AR	FP1000	11836	9/26/02	9/25/04
Power Sensor	00774	HP	8481A	2349A41124	8/12/02	8/11/04
Power Meter	00613	HP	435B	2702A16632	8/12/02	8/11/04
Spectrum Analyzer, 9kHz to 26.5 GHz	02111	HP	8593EM	3624A00159	5/12/03	5/11/05
Antenna, Horn	00656	EMCO	3115	4085	4/25/03	4/24/05