Engineering and Testing for EMC and Safety Compliance

APPLICATION FOR FCC CLASS B CERTIFICATION
UNLICENSED TRANSMITTER

Model Name: TBOX
Model Number: TB101
FCC ID: QXP-TB101

EDH (South Africa) (Pty) Ltd.
1 Quantum Street
P.O. Box 747
Stellenbosch
South Africa
7599
Tel: 27 21 84 411 4111
Fax: 27 21 880 8301

April 16, 2003

STANDARDS REFERENCED FOR THIS REPORT	
PART 2: 1999	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS
PART 15: 1999	RADIO FREQUENCY DEVICES
ANSI C63.4-1992	STANDARD FORMAT MEASUREMENT/TECHNICAL REPORT PERSONAL COMPUTER AND PERIPHERALS
RSS-210	LOW POWER LICENSE-EXEMPT RADIO COMMUNICATION DEVICES (ALL FREQUENCY BANDS)

FCC Rules Parts	Frequency Range (MHz)	Output Power (W)	Frequency Tolerance	Emission Designator
15.245	10525	.949	N/A	N/A

REPORT PREPARED BY:

Test Engineer: Daniel Baltzell
Administrative Writer: Daniel Baltzell

Rhein Tech Laboratories, Inc.

Document Number: 2003022

TABLE OF CONTENTS

FIGURE INDEX

TABLE INDEX

PLOT INDEX

APPENDIX INDEX

PHOTOGRAPH INDEX

1 GENERAL INFORMATION

The following application for FCC Type Certification of a Transceiver is prepared on behalf of EDH (South Africa) (Pty) Ltd. in accordance with Part 2, and Part 15, Subparts A and B of the Federal Communications Commission rules and regulations and Industry Canada RSS-210. The Equipment Under Test (EUT) was the TBOX, Model Number: TB101, FCC ID: QXP-TB101. The test results reported in this document relate only to the item that was tested.

All measurements contained in this Application were conducted in accordance with ANSI C63.4 Methods of Measurement of Radio Noise Emissions, 1992. The instrumentation utilized for the measurements conforms to the ANSI C63.4 standard for EMI and Field Strength Instrumentation. Some accessories are used to increase sensitivity and prevent overloading of the measuring instrument. Calibration checks are performed regularly on the instruments, and all accessories including the high pass filter, preamplifier, and cables.

All radiated emissions measurements were performed manually at Rhein Tech Laboratories. The radiated emissions measurements required by the rules were performed on the three-meter, open field; test range maintained by Rhein Tech Laboratories, 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. A complete description and Site attenuation measurement data have been placed on file with the Federal Communications Commission. The power line conducted emissions measurements were performed in a shielded enclosure also located at the Herndon, Virginia facility. The FCC accepts Rhein Tech Laboratories, Inc. as a facility available to do measurement work for others on a contractual basis.

1.1 MODIFICATIONS

The following modifications were made to ensure passing digital radiated emissions:

1. 22 ohm resistors at ACLK and EXTAL on U18, and at EXTAL on U21 were added
2. 0.1uF, 0.01uF, and 22pF capacitors were added to C21
3. An internal ferrite on serial cable with one turn, close to internal connection and copper tape holding it to shield, and the ribbon cable to the front antenna were added. Fair Rite #0443166651
4. An external ferrite was added on power cord with 2 turns. Fair Rite #0431173551
5. Gasket around the base of the shield over DSP was added
6. Internal AC/DC power cables were twisted
7. The four DSP PCB standoffs were grounded to PCB grounds
8. Shields were added over the power supply and the DSP PCB

1.2 RELATED SUBMITTAL(S)/GRANT(S)

This is an original certification submission.

1.3 TEST METHODOLOGY

Radiated testing was performed according to the procedures in ANSI C63.4 1992. Radiated testing was performed at an antenna-to-EUT distance of 3 meters.

1.4 TEST FACILITY

The open area test site and conducted measurement facility used to collect the radiated data is located on the parking lot of Rhein Tech Laboratories, 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report, submitted to and approved by the Federal Communications Commission, to perform AC line conducted and radiated emissions testing (ANSI C63.4 1992).

2 CONFORMANCE STATEMENT

STANDARDS REFERENCED FOR THIS REPORT	
PART 2: 1999	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS
PART 15: 1999	RADIO FREQUENCY DEVICES
ANSI C63.4-1992	STANDARD FORMAT MEASUREMENT/TECHNICAL REPORT PERSONAL COMPUTER AND PERIPHERALS
RSS-210	LOW POWER LICENSE-EXEMPT RADIO COMMUNICATION DEVICES (ALL FREQUENCY BANDS)

FCC Rules Parts	Frequency Range (MHz)	Output Power (W)	Frequency Tolerance	Emission Designator
15.245	10525	.949	N/A	N/A

I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described above. Modifications made to the equipment during testing in order to achieve compliance for the digital radiated emissions have been listed in Section 1.1.

Furthermore, there was no deviation from, additions to or exclusions from the ANSI C63.4 test methodology.

Signature: 

Date: April 16, 2003

Typed/Printed Name: Desmond A. Fraser

Position: President
(NVLAP Signatory)

Accredited by the National Voluntary Accreditation Program for the specific scope of accreditation under Lab Code 20061-0.

Note: This report may not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.

3 SYSTEM TEST CONFIGURATION

3.1 JUSTIFICATION

To complete the test configuration required by the FCC, the transmitter was initiated by powering the unit with 120 VAC. Additionally, the serial port was terminated with a manufacturer-specified unshielded cable to a port replicator, to ensure matching impedance. The EUT's crystal oscillators and harmonics of each were investigated. The manufacturer provided software which was used to activate or deactivate transmission. Furthermore, the EUT was tested and investigated in three orthogonal planes.

3.2 EXERCISING THE EUT

The TBOX is a transmitter designed to function at 10525 MHz. Using proprietary software, the EUT was connected to an external laptop to activate the transmitter circuitry.

3.3 TEST SYSTEM DETAILS

The FCC Identifiers for all equipment, plus descriptions of all cables used in the tested system, are:

TABLE 3-1: EQUIPMENT UNDER TEST (EUT)

PART	MANUFACTURER	MODEL	SERIAL NUMBER	FCC ID	CABLE DESCRIPTION (SEE CONFIGURATION DIAGRAM BELOW FOR LOCATION)	RTL BAR CODE
TBOX (Golf Simulator)	EDH (South Africa)	TB101	TBOX-019	SAMPLE	a. Bundled 4 meter unshielded AC Power b. Bundled proprietary 15 meter male DB 9 to female DB 25 serial cable and DB25-DB9 adapter, terminated with the Port Replicator below	015097
Port Replicator	Targus	PA070	430-0019-001B	DoC	Unshielded I/O	None

3.4 CONFIGURATION DIAGRAM OF TESTED SYSTEM

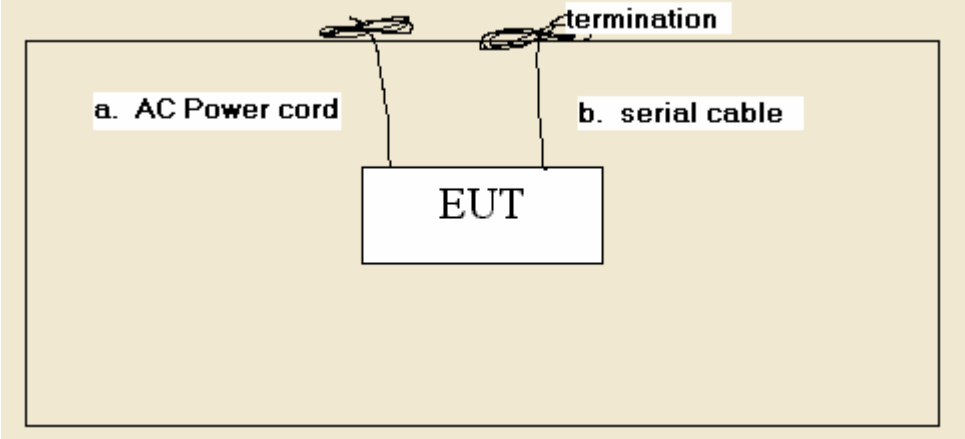


FIGURE 1: TEST SYSTEM CONFIGURATION DIAGRAM

4 CONDUCTED LIMITS - §15.207

4.1 TEST METHODOLOGY FOR CONDUCTED EMISSIONS MEASUREMENTS

The power line conducted emission measurements were performed in a Series 81 type shielded enclosure manufactured by Rayproof. The EUT was assembled on a wooden table 80 centimeters high. Power was fed to the EUT through a 50 ohm / 50 microhenry Line Impedance Stabilization Network (EUT LISN). The EUT LISN was fed power through an A.C. filter box on the outside of the shielded enclosure. The filter box and EUT LISN housing are bonded to the ground plane of the shielded enclosure. A second LISN, the peripheral LISN, provides isolation for the EUT test peripherals. This peripheral LISN was also fed A.C. power. A metal power outlet box, which is bonded to the ground plane and electrically connected to the peripheral LISN, powers the EUT host peripherals.

The spectrum analyzer was connected to the A.C. line through an isolation transformer. The 50-ohm output of the EUT LISN was connected to the spectrum analyzer input through a Solar 400 kHz high-pass filter. The filter is used to prevent overload of the spectrum analyzer from noise below 400 kHz. Conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or peak mode if applicable). The analyzer's 6 dB bandwidth was set to 9 kHz. No video filter less than 10 times the resolution bandwidth was used. Average measurements are performed in linear mode using a 10 kHz resolution bandwidth, a 1 Hz video bandwidth, and by increasing the sweep time in order to obtain a calibrated measurement. The emission spectrum was scanned from 150 kHz to 30 MHz. The highest emission amplitudes relative to the appropriate limit were measured and have been recorded in this report.

Note: Rhein Tech Laboratories, Inc. has implemented procedures to minimize errors that occur from test instruments, calibration, procedures, and test setups. Test instrument and calibration errors are documented from the manufacturer or calibration lab. Other errors have been defined and calculated within the Rhein Tech Quality Manual, section 6.1. Rhein Tech implements the following procedures to minimize errors that may occur: yearly as well as daily calibration methods, technician training, and emphasis to employees on avoiding error.

4.2 CONDUCTED EMISSION TEST

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. If the conducted emissions exceed the limit with the instrument set to the quasi-peak mode, then measurements are made in the average mode. If the quasi-peak measurement is at least 6 dB higher than the amplitude in the average mode, the level measured in the quasi-peak mode may be reduced by 13dB before comparing it to the limit.

The conducted test was performed with the EUT exercise program loaded, and the emissions were scanned between 150 kHz to 30 MHz on the NEUTRAL SIDE and the PHASE SIDE.

TABLE 4-1: CONDUCTED SPURIOUS EMISSIONS TEST EQUIPMENT

RTL ASSET #	MANUFACTURER	MODEL	PART TYPE	SERIAL NUMBER	CALIBARATION DUE DATE
900339	Hewlett Packard	85650A	Quasi-Peak Adapter (30 Hz - 1 GHz)	2521A00743	4/10/03
901084	AFJ international	LS16	16A LISN	16010020082	11/4/03
900968	Hewlett Packard	8567A	Spectrum Analyzer (10 kHz - 1.5 GHz)	2602A00160	4/10/03
900970	Hewlett Packard	85662A	Spectrum Analyzer Display	2542A11239	4/10/03

4.3 CONDUCTED EMISSIONS TEST DATA

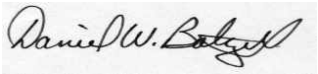
TABLE 4-2: CONDUCTED EMISSIONS (NEUTRAL SIDE)

Temperature: 74°F Humidity: 30%								
Emission Frequency (MHz)	**Test Detector**	**Analyzer Reading (dBuV)**	**Site Correction Factor (dB)**	**Emission Level (dBuV)**	**QP Limit (dBuV)**	**QP Margin (dBuV)**	**AV Limit (dBuV)**	**AV Margin (dBuV)**
0.160	Pk	46.8	1.9	48.7	65.5	-16.8	55.5	-6.8
0.242	Pk	47.8	1.4	49.2	62.0	-12.8	52.0	-2.8
3.480	Pk	32.3	1.4	33.7	56.0	-22.3	46.0	-12.3
8.610	Pk	23.1	2.1	25.2	60.0	-34.8	50.0	-24.8
9.910	Pk	24.1	2.1	26.2	60.0	-33.8	50.0	-23.8
15.900	Pk	22.2	2.8	25.0	60.0	-35.0	50.0	-25.0

TABLE 4-3: CONDUCTED EMISSIONS (PHASE SIDE)

Temperature: 74°F Humidity: 30%								
Emission Frequency (MHz)	**Test Detector**	**Analyzer Reading (dBuV)**	**Site Correction Factor (dB)**	**Emission Level (dBuV)**	**QP Limit (dBuV)**	**QP Margin (dBuV)**	**AV Limit (dBuV)**	**AV Margin (dBuV)**
0.202	Pk	44.0	1.6	45.6	63.5	-17.9	53.5	-7.9
0.241	Pk	45.2	1.4	46.6	62.1	-15.5	52.1	-5.5
3.480	Pk	34.2	1.4	35.6	56.0	-20.4	46.0	-10.4
9.880	Pk	24.0	1.4	25.4	60.0	-34.6	50.0	-24.6
15.930	Pk	23.3	2.8	26.1	60.0	-33.9	50.0	-23.9
29.710	Pk	27.7	3.6	31.3	60.0	-28.7	50.0	-18.7

TEST PERSONNEL:

Daniel W. Baltzell		April 4, 2003
Test Engineer	Signature	Date Of Test

5 RADIATED EMISSIONS

5.1 TEST METHODOLOGY FOR RADIATED EMISSIONS MEASUREMENTS

Before final measurements of radiated emissions were made on the open-field three/ten meter range, the EUT was scanned indoors at one meter and three meter distances, in order to determine its emissions spectrum signature. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emissions measurements on the open-field range, at each frequency, in order to ensure that maximum emission amplitudes were attained.

Final radiated emissions measurements were made on the three-meter, open-field test site. The EUT was placed on a nonconductive turntable approximately 0.8 meters above the ground plane. The spectrum was examined from 30 MHz to 1000 MHz using a spectrum analyzer, a quasi-peak adapter, and EMCO log periodic and biconical antenna. In order to gain sensitivity, a preamplifier was connected in series between the antenna and the input of the spectrum analyzer.

At each frequency, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters in order to determine the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarizations. The spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. No video filter less than 10 times the resolution bandwidth was used. The second harmonic of the highest LO was tested. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

5.2 RADIATED EMISSIONS DATA

TABLE 5-1: FUNDAMENTAL RADIATED EMISSIONS: FCC PART 15.245; 15.35

Temperature: 25°F Humidity: 32%									
Emission Frequency (MHz)	**Test Detector**	**Antenna Polarity (H/V)**	**Turntable Azimuth (deg)**	**Antenna Height (m)**	**Analyzer Reading (dBuV)**	**Site Correction Factor (dB/m)**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**
10522.31	Av	V	0	1.0	78.0	47.0	125.0	128	-3.0
10522.31	Pk	V	0	1.0	78.2	47.0	125.2	138	-12.8

TABLE 5-2: HARMONIC RADIATED EMISSIONS: FCC PART 15.245; 15.35

Temperature: 25°F Humidity: 32%									
Emission Frequency (MHz)	**Test Detector**	**Antenna Polarity (H/V)**	**Turntable Azimuth (deg)**	**Antenna Height (m)**	**Analyzer Reading (dBuV)**	**Mixer Conversion Loss (dB)**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**
21045.24	Av	H	30	1.2	32.6	22.8	55.4	88.0	-32.6
21045.24	Pk	H	30	1.2	33.0	22.8	55.8	108.0	-52.2
31568.07	Av	V	30	1.3	32.0	22.5	54.5	88.0	-33.5
31568.07	Pk	V	30	1.3	33.0	22.5	55.5	108.0	-52.5
42091.62	Av	H	30	1.4	24.5	23.8	48.3	88.0	-39.7
42091.62	Pk	H	30	1.4	30.9	23.8	54.7	108.0	-53.3

TABLE 5-3: SPURIOUS RADIATED EMISSIONS: FCC PART 15.245; 15.35

Temperature: 25°F Humidity: 32%									
Emission Frequency (MHz)	**Test Detector**	**Antenna Polarity (H/V)**	**Turntable Azimuth (deg)**	**Antenna Height (m)**	**Analyzer Reading (dBuV)**	**Site Correction Factor (dB/m) or Mixer Conversion Loss (dB)**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**
9432.266	Av	H	0	1.0	52.0	18.2	70.2	75.0	-4.8
9432.266	Pk	H	0	1.0	61.5	18.2	79.7	95.0	-15.3
9494.425	Av	H	0	1.0	52.0	17.3	69.3	75.0	-5.7
9494.425	Pk	H	0	1.0	62.5	17.3	79.8	95.0	-15.2
9812.625	Av	H	0	1.0	54.2	16.7	70.9	75.0	-4.1
9812.625	Pk	H	0	1.0	65.3	16.7	82.0	95.0	-13.0
10046.810	Av	H	0	1.0	55.0	17.2	72.2	75.0	-2.8
10046.810	Pk	H	0	1.0	63.8	17.2	81.0	95.0	-14.0
19958.770	Av	H	30	1.2	31.6	22.6	54.2	75.0	-20.8
19958.770	Pk	H	30	1.2	32.9	22.6	55.5	95.0	-39.5
20020.150	Av	V	30	1.2	39.7	22.6	62.3	75.0	-12.7
20020.150	Pk	V	30	1.2	39.7	22.6	62.3	95.0	-32.7
20340.890	Av	V	30	1.2	34.1	22.6	56.7	75.0	-18.3
20340.890	Pk	V	30	1.2	34.7	22.6	57.3	95.0	-37.7
20582.440	Av	V	30	1.2	36.4	22.9	59.3	75.0	-15.7
20582.440	Pk	V	30	1.2	37.1	22.9	60.0	95.0	-35.0
40673.810	Av	V	30	1.2	19.8	24.6	44.4	75.0	-30.6
40673.810	Pk	V	30	1.2	24.4	24.6	49.0	95.0	-46.0

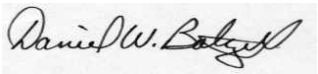
TABLE 5-4: DIGITAL RADIATED EMISSIONS; FCC PART 15.209

Temperature: 60°F Humidity: 50%									
Emission Frequency (MHz)	**Test Detector**	**Antenna Polarity (H/V)**	**Turntable Azimuth (deg)**	**Antenna Height (m)**	**Analyzer Reading (dBuV)**	**Site Correction Factor (dB/m)**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**
309.656	Qp	H	110	1.0	54.6	-14.6	40.0	46.0	-6.0
324.402	Qp	H	170	1.0	54.4	-14.0	40.4	46.0	-5.6
339.148	Qp	H	5	1.0	56.0	-13.6	42.4	46.0	-3.6
353.890	Qp	H	80	1.0	53.2	-12.9	40.3	46.0	-5.7
368.637	Qp	H	235	1.0	56.8	-12.7	44.1	46.0	-1.9
383.384	Qp	V	170	1.0	56.9	-12.6	44.3	46.0	-1.7
383.384	Qp	V	180	1.4	56.9	-12.6	44.3	46.0	-1.7
398.130	Qp	V	180	1.0	52.4	-12.3	40.1	46.0	-5.9
398.130	Qp	V	180	1.0	55.0	-12.3	42.7	46.0	-3.3
412.875	Qp	V	180	1.0	51.4	-11.5	39.9	46.0	-6.1
412.875	Qp	V	185	1.1	48.7	-11.5	37.2	46.0	-8.8
427.621	Qp	V	180	1.0	47.7	-11.2	36.5	46.0	-9.5
501.352	Qp	V	185	1.0	54.3	-9.8	44.5	46.0	-1.5
516.092	Qp	V	180	1.0	53.1	-9.5	43.6	46.0	-2.4
530.838	Qp	V	180	1.0	52.4	-9.3	43.1	46.0	-2.9

**All readings are quasi-peak, unless stated otherwise.*

* Note: The preamplifier's gain is included in the site correction factor.

TEST PERSONNEL:



Daniel W. Baltzell		February 18, 2003
Test Engineer	Signature	Date Of Test

TABLE 5-5: EQUIPMENT USED FOR TESTING RADIATED EMISSIONS

Radiated Emissions					
RTL Asset #	**Manufacturer**	**Model**	**Part Type**	**Serial Number**	**Calibration Due Date**
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771	5/10/03
900930	Hewlett Packard	85662A	Spectrum Analyzer Display Section	3144A20839	5/10/03
901053	Schaffner &Chase	CBL6112B	Bilog Antenna (20 MHz - 2 GHz)	2648	5/24/03
900905	Rhein Tech Laboratories, Inc.	PR-1040	Pre Amplifier 40dB (10 MHz – 2 GHz)	1006	7/10/03
900969	Hewlett Packard	85650A	Quasi-Peak Adapter	2412A00414	5/10/03
901215	Hewlett Packard	8596EM (9kHz - 12.8GHz)	EMC Analyzer	3826A00144	8/23/03
900932	Hewlett Packard	8449B OPT H02	Preamplifier 1-26.5 GHz	3008A00505	7/15/03
900772	EMCO	3161-02	Horn Antenna 2 - 4 GHz	9804-1044	3/15/04
900323	EMCO	3160-07	Horn Antenna 8.2-12.4 GHz	9605-1054	6/10/04
900356	EMCO	3160-08	Horn Antenna 12.4-18 GHz	9607-1044	6/10/04
900321	EMCO	3161-03	Horn Antenna 4.0-8.2 GHz	9508-1020	4/10/04
901218	EMCO	3301B	Horn Antenna 18-26 GHz	960281-003	7/30/04
900717	Hewlett Packard	11970U	Harmonic Mixer 40 - 60 GHz	2332A01110	7/30/04
900716	Hewlett Packard	11970W	Harmonic Mixer 75 - 110 GHz	2521A00710	7/30/04
900715	Hewlett Packard	11970V	Harmonic Mixer 50 - 75 GHz	2521A00512	7/30/04
900712	ATM	15-443-6R	Horn Antenna 50-75 GHz, waveguide size WR-15	8051805-1	7/30/04
900711	ATM	10-443-6R	Horn Antenna 75-110 GHz, waveguard size WR-10	8051905-1	7/30/04
900392	Hewlett Packard	1197OK	Harmonic Mixer 18 - 26 GHz	3525A00159	7/30/04
900126	Hewlett Packard	11970A	Harmonic Mixer 26 - 40 GHz	2332A01199	7/30/04

6 CONCLUSION

The data in this measurement report shows that the EDH (South Africa) (Pty) Ltd. Model TBOX, Model # TB101, FCC ID: QXP-TB101, complies with all the requirements of Parts 2 and 15.245 of the FCC Rules and Industry Canada RSS-210.