
Project Number: 02454-10

Prepared for:

WIRELESS COMPUTING
14101 West Hwy 290 Bldg 700.
Ausrin, TX 78737

By

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CERTIFICATION
Electromagnetic Interference
Test Report

WIRELESS COMPUTING
RF-250 Wireless Keyboard
(Intentional Radiator Portion)

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Certificate of Compliance

Applicant: Wireless Computing
 Applicant's Address: 14101 West Hwy 290 Bldg 700
 Ausrin, TX 78737
 Model: RF-250 Wireless Keyboard
 Serial Number: B
 Project Number: 02454-10

I, Jeffrey A. Lenk, for Professional Testing (EMI), Inc., being familiar with the FCC rules and test procedures have reviewed the test setup, measured data and this report. I believe them to be true and accurate.

The **Wireless Computing RF-250 Wireless Keyboard** was tested to and found to be in compliance with FCC Part 15 Subpart C for an Intentional Radiator.

The highest emissions generated by the above equipment are listed below:

	<u>Frequency (MHz)</u>	<u>Level (dBμV/m)</u>	<u>Limit (dBμV/m)</u>	<u>Margin (dB)</u>
Fundamental	916.55	84.8	94	-9.2
Spurious	2749	46.9	54	-7.1
	<u>Frequency (kHz)</u>			
Occupied Bandwidth	620			

Jeffrey A. Lenk
 President

1.0 EUT Description

The Equipment Under Test (EUT) is the **Wireless Computing RF-250 Wireless Keyboard**. The **RF-250 Wireless Keyboard** is battery-powered wireless 900 MHz FM Keyboard. The EUT operates at 916.55 MHz and is designed for compliance with 47 CFR 15.249 of the FCC rules. Specific test requirements for this device include the following:

47 CFR 15.249	Fundamental Transmit Power
47 CFR 15.249 & 15.209	Spurious Radiated Power
47 CFR 15.249 & 2.1049	Occupied Bandwidth (2.989 used as Procedural Reference)
47 CFR 15.203	Antenna Requirement

The system tested consisted of the following:

<u>Manufacturer & Model</u>	<u>Serial #</u>	<u>FCC ID #</u>	<u>Description</u>
Wireless Computing, RF250KBD-A	B	None	KeyboardTransmitter
Sony VAB PCG-Z505HE	2830563232404		Laptop
	14		

1.1 EUT Operation

The **RF-250 Wireless Keyboard** was operated using two new AA batteries. The EUT was turned on and ran automatically. Setup and operational modes cover worst-case configuration and operational modes for the device. The frequency of the transmitting signal is 916.55 MHz.

2.0 Electromagnetic Emissions Testing

Professional Testing (EMI), Inc. (PTI), follows the guidelines of NIST for all uncertainty calculations, estimates and expressions thereof for EMC testing.

Radiated emission measurements were made of the Fundamental and Spurious Emission levels for the **RF-250 Wireless Keyboard**. Measurements of the occupied bandwidth were also made for the equipment.

Measurements of the maximum emission levels for the fundamental and the spurious/harmonic emissions of the **RF-250 Wireless Keyboard** were made at the Professional Testing "Open Field" Site 3, located in Round Rock, Texas to determine the radio noise radiated from the EUT. A "Description of Measurement Facilities" has been submitted to the FCC and approved pursuant to Section 2.948 of CFR 47 of the FCC rules.

Tests of the fundamental and spurious emissions for the device were performed to determine the worst-case polarization of the devices. The fundamental and spurious emissions of the device were measured with the antennas of the devices vertical and horizontal to the ground plane.

2.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a motorized turntable, which allows 360-degree rotation. For measurements of the fundamental signal, a measurement antenna was positioned at a distance of 3 meters as measured from the closest point of the EUT. For spurious/harmonic measurements above 1 GHz, the measurement antenna was placed 1 meter from the EUT. The radiated emissions were maximized by configuring the EUT, by rotating the EUT, and by raising and lowering the antenna from 1 to 4 meters.

A Spectrum Analyzer with peak detection was used to find the maximums of the radiated emissions during the variability testing. A drawing showing the test setup is given as Figure 1.

2.2 Test Criteria

The table below shows FCC Part 15.249 radiated limits for an intentional radiator operating at 916.55 MHz band. In addition to these requirements, the EUT must meet the restricted emission band requirements of §15.205. The limit of §15.209 was used for the spurious emission test. The spurious measurements of the harmonic were performed to the 10th harmonic of the fundamental. The reference distance for each limit is also shown in this table.

Frequency MHz	Test Distance (Meters)	Field Strength Fundamental		Field Strength Harmonics	
		(mV/ m)	(dBμV/ m)	(μV/m)	(dBμV/m)
902-928	3	50	94	500	54

2.3 Test Results

The radiated test data for the fundamental is included in Appendix A. A Quasi-Peak detector was used during the test. The radiated emission test data for the harmonics is included in Appendix B. The emissions were maximized at each frequency and the highest emissions identified were measured using peak detection. The radiated emissions generated by the **RF-250 Wireless Keyboard** are below the FCC Part 15.249 and FCC Part 15.209 maximum emission criteria.

3.0 Occupied Bandwidth Measurements

Measurements of the occupied bandwidth for the fundamental signals of the of the FCC Part 15.249 were made at the Professional Testing's Round Rock, Texas laboratory. All measurements were made in a controlled indoor environment in a configuration, which did not present measurement distortion or ambient interference.

3.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the floor. The table was rotated to an angle, which presented the highest signal level. The occupied bandwidth was also measured on the device. Peak detection was used for this test. The occupied bandwidth

was based on a 26 dB criteria (26 dB down either side of the emission from the nominal center of the emission). A drawing showing the test setup is given as Figure 1.

3.2 Test Criteria

The Bandwidth of Emission for intentional radiators operating under FCC part 15.249 is not specified, but must be within the specified band.

Measurement of the occupied bandwidth was performed to verify that the emission bandwidth from the EUT did not exceed 26 MHz. The typical occupied bandwidth for the module is 600 kHz.

3.3 Test Results

The 99% bandwidth of the fundamental emission was measured and determined to be 620 kHz, which is approximately centered in the 902 to 928 MHz band. The figure is typical for the **RF-250 Wireless Keyboard**.

The intended center frequency for the EUT was centered at 916.55 MHz. The center frequency is within the allowed band. The fundamental signal generated by the **RF-250 Wireless Keyboard** is within the band allowed under FCC Part 15.249 emission band criteria.

4.0 Antenna Requirement

An analysis of the **RF-250 Wireless Keyboard** was performed to determine compliance with Section 15.203 of the Rules. This section requires specific handling and control of antennas used for devices subject to regulations under the Intentional Radiator portions of Part 15.

4.1 Evaluation Procedure

The structure and application of the **RF-250 Wireless Keyboard** were analyzed with respect to the rules. The antenna for this unit is an external antenna, which is soldered onto the main board and is not accessible by the user. An auxiliary antenna port is not present.

4.2 Evaluation Criteria

Section 15.203 of the rules states that the subject device must meet at least one of the following criteria:

- (a) Antenna be permanently attached to the unit.
- (b) Antenna must use a unique type of connector to attach to the EUT.
- (c) Unit must be professionally installed. Installer shall be responsible for verifying that the correct antenna is employed with the unit.

4.3 Evaluation Results

The **RF-250 Wireless Keyboard** meets the criteria of this rule by virtue of having an external antenna permanently attached to the unit. The EUT is therefore compliant with §15.203.

5.0 Modifications to Equipment

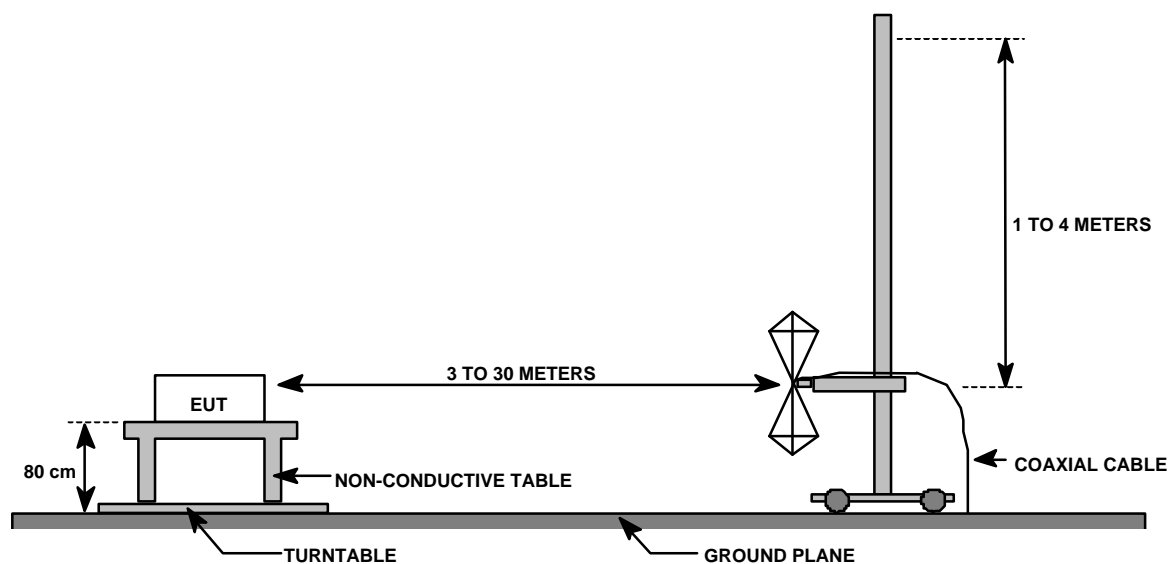
There were no modifications made on the **RF-250 Wireless Keyboard** during the performance of the test program in order to meet the FCC criteria.

6.0 List of Test Equipment

A list of the test equipment utilized to perform the testing is given below. The date of calibration is given for each.

Electromagnetic Emissions Test Equipment

<u>Device</u>	<u>Description</u>	<u>Calibration Due</u>
SOLAR 8012-50-R24-BNC	LISN	August 2002
HP 85662A	Display Unit	November 2002
HP 8566B	Spectrum Analyzer	November 2002
HP 85650A	Quasi Peak Adapter	November 2002
HP 8447D	Preamplifier	October 2002
Compliance Design B-100	Biconical Antenna	November 2002
Cond. EMI 3146	RG-223	November 2002
EMCO 3146	Log Antenna	November 2002
EMCO 3115	Microwave Antenna	July 2002
MITEQ	Preamplifier	January 2003
Tektronix 2706	RF Preselector	October 2002

FIGURE 1: Radiated Emissions Test Setup

Appendix A

Radiated Emissions Data Sheets

Fundamental Radiated Data Sheet**Wireless Computing
RF-250 Wireless Keyboard**

SERIAL #: B
 DATE: May 29, 2002
 PROJECT #: 02454-10

MEASUREMENT DISTANCE (m): 3
 DETECTOR FUNCTION: Quasi-Peak

$$\text{Corrected Level} = \text{Recorded Level} - \text{Amplifier Gain} + \text{Antenna Factor} + \text{Cable Loss}$$

Antenna Horizontal

Freq. (MHz)	EUT Dir (Deg.)	Antenna Elevation (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
916.55	185	1.2	73.2	26.5	23.8	14.2	84.8	94	-9.2

Antenna Vertical

Freq. (MHz)	EUT Dir (Deg.)	Antenna Elevation (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
916.55	180	1.4	63.3	26.5	23.8	14.2	74.9	94	-19.1

TEST ENGINEER: Bob Ripley

Appendix B

Spurious Radiated Emissions Data Sheets

Spurious Radiated Data Sheet**Wireless Computing
RF-250 Wireless Keyboard**

SERIAL #: B

DATE: May 29, 2002

PROJECT #: 02454-10

MEASUREMENT DISTANCE (m): 1

ANTENNA POLARIZATION:
Horizontal

DETECTOR FUNCTION: Average

Corrected Level = Recorded Level – Amplifier Gain + Antenna Factor + Cable Loss

Freq.	EUT	Antenna	Recorded	Amplifier	Antenna	Cable	Corrected	Limit	Margin
(MHz)	Dir (Deg.)	Elevation (Meters)	Level (dBuV)	Gain (dB)	Factor (dB/m)	Loss (dB)	Level (dBuV/m)	(dBuV/m)	(dB)
1833	180	1	37.3	22.0	26.7	2.4	44.4	63.5	-19.1
2749	180	1	35.0	21.8	27.2	3.0	43.5	63.5	-20.0
3665	45	1	31.3	22.7	29.4	3.6	41.7	63.5	-21.8

TEST ENGINEER: Bob Ripley

Spurious Radiated Data Sheet**Wireless Computing
RF-250 Wireless Keyboard**

SERIAL #: B
 DATE: May 29, 2002
 PROJECT #: 02454-10

MEASUREMENT DISTANCE (m): 1
 ANTENNA POLARIZATION: Vertical
 DETECTOR FUNCTION: Average

$$\text{Corrected Level} = \text{Recorded Level} - \text{Amplifier Gain} + \text{Antenna Factor} + \text{Cable Loss}$$

Freq. (MHz)	EUT Dir (Deg.)	Antenna Elevation (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1833	170	1	34.9	22.0	26.7	2.4	42.0	63.5	-21.5
2749	180	1	38.4	21.8	27.2	3.0	46.9	63.5	-16.6
3665	120	1	31.3	22.7	29.4	3.6	41.7	63.5	-21.8

TEST ENGINEER: Bob Ripley

Appendix C

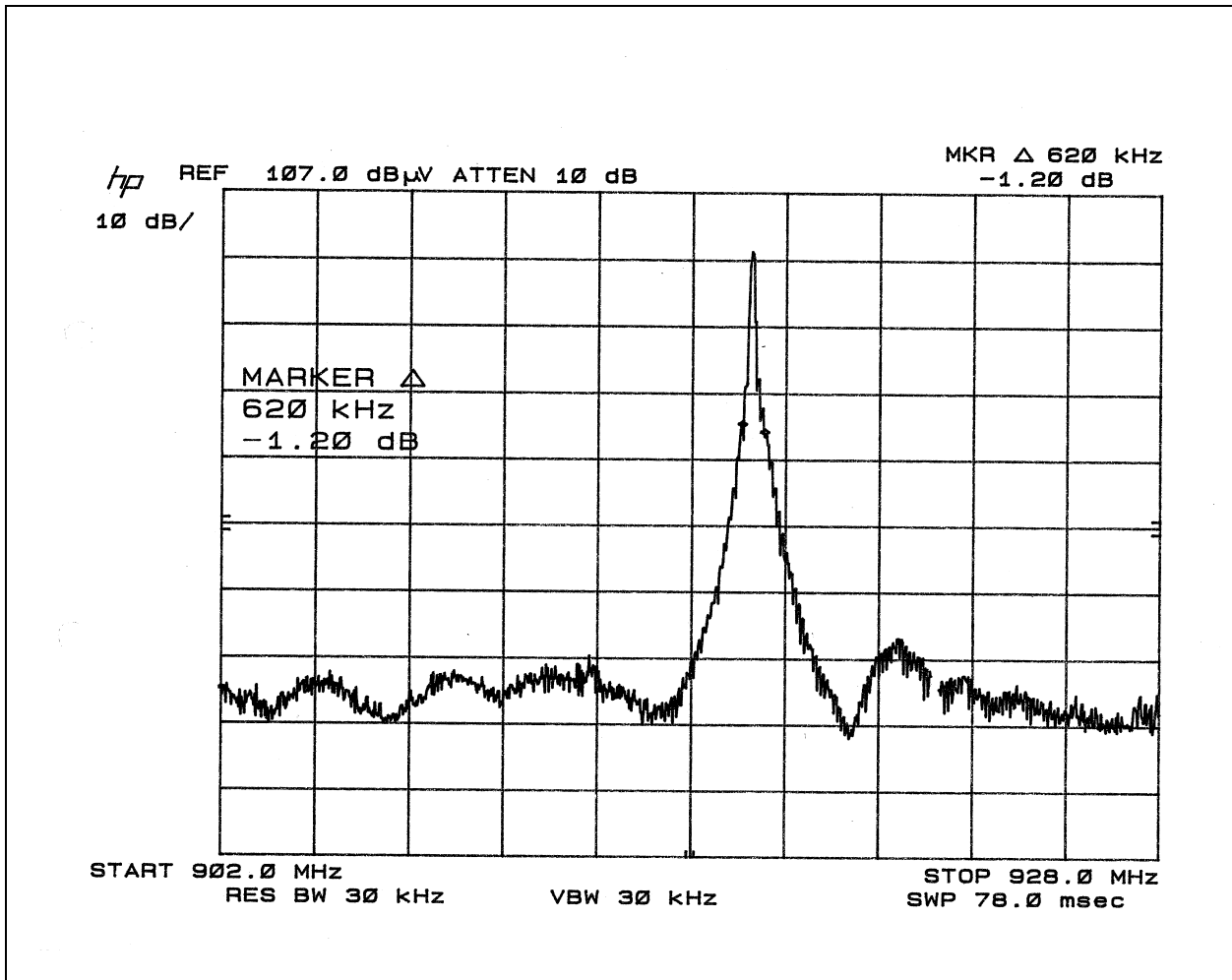
Occupied Bandwidth Data Sheets

Occupied Bandwidth Datasheet

Wireless Computing
RF-250 Wireless Keyboard

SERIAL #: B
DATE: May 29, 2002
PROJECT #: 02454-10

MEASUREMENT DISTANCE (m): 1.0
ANTENNA POLARIZATION: Horizontal
DETECTOR FUNCTION: Peak



TEST ENGINEER: Bob Ripley