

# RF Emissions Test Report To Determine Compliance With: FCC, Part 15 Rules and Regulations

**Model numbers:** HT130022 Rev. B.  
December 17, 2002

**Manufacturer:** HQ, Inc.  
210 9th Steet Drive  
Palmetto, FL 34221

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## Section 1

### General Information

|                                          |                                                                                                                           |
|------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| <b>Manufacturer:</b>                     | HQ, Inc.<br>210 9th Steet Drive<br>Palmetto, FL 34221                                                                     |
| <b>Manufacturer representative:</b>      | <b>Mr. Bill Hicks</b>                                                                                                     |
| <b>Equipment covered by this report:</b> | Model no. HT130022 RF Rev. B.                                                                                             |
| <b>Options covered by this report:</b>   | None                                                                                                                      |
| <b>Equipment serial no.</b>              | Prototype                                                                                                                 |
| <b>Test specifications:</b>              | To determine compliance with:<br>FCC, Part 15, Subpart C Rules<br>and Regulations, Class B                                |
| <b>Test report number:</b>               | 02-186A                                                                                                                   |
| <b>Test commenced:</b>                   | November 1, 2002                                                                                                          |
| <b>Test completed:</b>                   | November 25, 2002                                                                                                         |
| <b>Test engineer:</b>                    | <b>Kent Stewart</b>                                                                                                       |
| <b>Test Facility:</b>                    | The test facility used to perform these tests is on file with<br>the FCC under registration number 637500 and located at: |

**EMC Testing Laboratories, Inc.**  
2210 Justin Trail  
Alpharetta, GA 30004

## Section 2

### Test report summary sheet 1 of 3

**Summary:**

| Tests                                       | Results     |
|---------------------------------------------|-------------|
| FCC, Part 15, Class B, Radiated emissions:  | <b>Pass</b> |
| FCC, Part 15, Class B, Conducted emissions: | <b>Pass</b> |

- 1- The product(s) covered by this report was found to comply with the limits indicated in paragraph 15.109 Subpart B and 15.249, Part 15, Subpart C of the FCC Rules and Regulations.

**Product description:**

The product(s) covered by this report consisted of a RF Transceiver Module model HT130022 Rev. B., for use in HQ, Inc. equipment. The product is intended for use in transmitting body temperatures and heart rates received from a monitoring recorder via RS-232 cable. The EUT set to transmit at 914.5 MHz and utilizes a maximum 60% duty cycle.

The unit can be powered from an external DC power source, (battery) or from an external power supply.

The unit was tested with and may be provided with one of two different  $\frac{1}{4}$  wavelength antenna's. Antenna part number S331C, is a BNC style antenna that has been permanently mounted with the use of a metal epoxy which permanently bonds the male and female connector shells together. The antenna part number ANT-916-CW-QW, utilizes a unique reverse SMA type connector.

To determine a worst case configuration preliminary scans were performed on two configurations, 1) with the EUT powered by a 9V battery and 2) with the EUT powered by an external switching power supply. Final testing was performed with the EUT being powered by the external switching power supply and was also tested with both antenna types.

## Test report summary sheet 2 of 3

**Test configuration:**

The equipment under test was set-up and configured as specified by the manufacturer.

1- The EUT was connected to the following support peripherals to simulate a monitoring device and to make the EUT to continually transmit. During the test the receiver was disabled.

A) A laptop computer, manufactured by IBM, model no. 2611-410, serial no. AA-D2PFF 98/12, FCC marked.

B) A power supply, manufactured by CUI Stack, part number DTS120250U2/AC1-P5, serial number M04203917A1.

2- During the testing of the EUT utilized the following cables and were connected as indicated below.

A) A Shielded RS-232 cable provided with a power input adapter plug was connected from the EUT's communication/power port to the computer's RS-232 port. The power adapter plug was connected to an unshielded power cable integral to the power supply.

**Test operation:**

For all measurements, the equipment under test was and caused to function in a continuous mode of operation for maximum electrical activity as specified by the manufacturer. Specifically, the EUT was made to continually transmit data being provided from the computers software program.

**Modifications:**

The following modifications were required to comply with the indicated limits:

1- None

## Test report summary sheet 3 of 3

**Conclusion:**

With the above indicated modifications, the product(s) covered by this report has been tested and found to comply with the limits indicated in paragraph 15.249 of the FCC, Part 15, Subpart C Rules and Regulations and all subsequent limits indicated therein for a class B device.

Tested by:

Reviewed by:

**Kent Stewart**  
**Laboratory Manager**  
**EMC Testing Laboratories, Inc.**  
December 17, 2002

**Gene J. Bailey**  
**Engineering Manager**  
**EMC Testing Laboratories, Inc.**  
December 17, 2002

Section 2 cont...

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## Section 3

### **STANDARD REFERENCE**

The following primary standards were used for this test:

- 1) **ANSI C63.4-1992:** Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9 Khz to 40 Ghz.
- 2) **US Code of Federal Regulations (CFR) 1998:** Title 47, Part 15, Radio Frequency Devices, Subpart C, Intentional Radiators.

## Section 4

# TEST METHOD

### INTRODUCTION:

The product(s) covered by this report were subjected to electromagnetic interference emissions measurements to determine compliance with the FCC, Part 15 requirements.

Radiated emissions were measured in accordance with Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 KHz to 40 Ghz, C63.4.

### MEASUREMENT CALCULATIONS:

#### Radiated Emissions:

For radiated emissions measurements, the signal attenuation due to impedance losses in the antenna and signal cable was significant and was added to the spectrum analyzer reading to give corrected signal strength reading. If a preamplifier was used, the signal gain was subtracted from the signal strength reading. Radiated emissions data was specified as microvolt per meter ( $\mu\text{V}/\text{m}$ ) of radiated field strength.

$$\text{Radiated emissions } (\mu\text{V}/\text{m}) = \text{Analyzer reading } (\mu\text{V}) \text{ plus} \\ \text{antenna factor (dB) plus cable factor (dB) minus Amplifier gain (dB)}$$

### RADIATED EMISSIONS MEASUREMENT:

Radiated emissions measurements were performed at an open field test site. The receiving antenna was positioned 3 meters from the equipment under test as indicated below, along the center axis of the test site. Measurements were made with broadband antennas and if necessary, detected emissions were verified with dipole antennas. The dipole antenna was manually tuned to the signal frequency by adjusting the length of the antenna elements. The radiated emissions were measured for both the horizontal and vertical signal planes by rotating the antennas. Additionally, the EUT was rotated by the turntable and the antenna height was raised and lowered 1 to 4 meters to locate the maximum emission strength at each frequency. In addition, the EUT was rotated through three orthogonal axis. The maximum emissions measured was with the EUT in the upright position (intended installation).

Section 4 continued

Radiated emission measurements were made from 30 Mhz to 9.2 GHz.

The following antennas were used to measure the radiated emissions within the specified frequency spans.

| <u>Antenna</u> | <u>Frequency Span</u> |
|----------------|-----------------------|
| Biconical      | 20 - 200 Mhz          |
| Log Periodic   | 200 - 1000 Mhz        |
| Dipoles        | 20 - 1000 Mhz         |
| Horn           | 1-18 Ghz              |

#### **INSTRUMENTATION:**

Radiated strength measurements were taken with a spectrum analyzer. Radiated emissions are measured with broadband and tuned dipole antennas. The test equipment consists of the following:

| <u>Test Equipment</u> | <u>Model No.</u> | <u>Serial No.</u> | <u>Cal. Due</u> |
|-----------------------|------------------|-------------------|-----------------|
| Spectrum Analyzer     | HP 8591A         | 3144A02506        | 02-06-03        |
| Spectrum Analyzer     | 8592L            | 3649A00744        | 02-06-03        |
| LISN                  | 94641-1          | 0145/0146         | 06-05-03        |
| LISN                  | 3825/2           | 9305-2088         | 08-21-03        |
| LISN                  | LI-210           | 25145             | 07-10-03        |
| Biconical Antenna     | 3110B            | 1708              | 10-01-03        |
| Biconical Antenna     | BIA-25           | 2451              | 09-18-03        |
| Log Periodic          | LPA25            | 1112              | 10-01-03        |
| Dipole Antenna        | DM-105A-T1       | 31402-110         | 06-05-03        |
| Dipole Antenna        | DM-105A-T2       | 31402-105         | 06-05-03        |
| Dipole Antenna        | DM-105A-T3       | 31402-109         | 06-05-03        |
| Horn Antenna          | 3115             | 9405-4264         | 10-01-03        |
| R.F. Amplifier        | QB-820           | 11602             | 02-07-03        |
| Preamplifier          | 8449B            | 3008A00914        | 02-07-03        |

Section 4 continued

#### **DETECTOR FUNCTION FOR OUT OF BAND EMISSIONS:**

The out of band emissions measurements were taken using a peak hold signal detector function. In this mode, the spectrum analyzer makes continuous scans across the frequency band and stores the highest emission value detected at each frequency for all scans. The peak hold integration will detect transient or low duty cycle emissions peak which might be missed on single scan measurement. The emission value at each frequency was a true value.

#### **SPECTRUM ANALYZER SETTING FOR OUT OF BAND EMISSIONS:**

For all out of band emissions measurements, the spectrum analyzer was set for a 10 dB input attenuation, 10 dB/Division vertical scale and 90 or 100 dB $\mu$ V reference level. The resolution bandwidth is set at 9 KHz for the 0.15 - 30 Mhz span and at 120 KHz for 30 - 1000 Mhz span. The video bandwidth and sweep rates were automatically coupled by the analyzer.

## Section 5

# RADIATED OUT OF BAND EMISSIONS MEASUREMENTS

## Radiated Out of Band Emissions - Section 15.209 Limits

**Model number: HT130022 Rev. B.**

| <b>Frequency<br/>Mhz</b>                                                                                                                         | <b>Measurement<br/>Reading<br/>dB<math>\mu</math>V</b> | <b>Corrected<br/>Reading<br/>dB<math>\mu</math>V</b> | <b>FCC<br/>Limit<br/>dB<math>\mu</math>V</b> | <b>Minimum<br/>Margin<br/>dB<math>\mu</math>V</b> |
|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|------------------------------------------------------|----------------------------------------------|---------------------------------------------------|
| <b>Horizontal</b>                                                                                                                                |                                                        |                                                      |                                              |                                                   |
|                                                                                                                                                  |                                                        |                                                      |                                              |                                                   |
| Other than harmonic emissions originating from the fundamental frequency<br>there were no measurable emissions within 20dB $\mu$ V of the limits |                                                        |                                                      |                                              |                                                   |
|                                                                                                                                                  |                                                        |                                                      |                                              |                                                   |

## Section 6

### Fundamental Frequency Radiated Emissions Measurements

**EMISSION MEASUREMENTS FOR EQUIPMENT OPERATING WITHIN THE BAND 902 - 928:**

As per Section 15.249 of the 47 CFR and in accordance with the measurement provisions in Section 15.35, the peak and quasi-peak emissions field strength of the fundamental frequency were measured and recorded. For the harmonics emissions above 1000 MHz, peak and average measurements were recorded.

During the emissions measurement of the fundamental frequency, the antenna was positioned 3 meters from the EUT and with the spectrum analyzer in the Linear mode and the resolution bandwidth set to 100Khz minimum resolution bandwidth the fundamental frequency was measured. The measurements were performed with the antenna in the horizontal and vertical polarization. Peak and Quasi-peak measurements were taken as indicated in the plot.

During the emissions measurement of the harmonic emissions of the fundamental frequency, the antenna was positioned 3 meters from the EUT and with the spectrum analyzer in the Linear mode and the resolution bandwidth set to 1 MHz minimum the harmonic emissions were measured. The measurements were performed with the antenna in the horizontal and vertical polarization.

After measurement data was recorded the data was then corrected, as indicated in the Measurement Calculations section above.

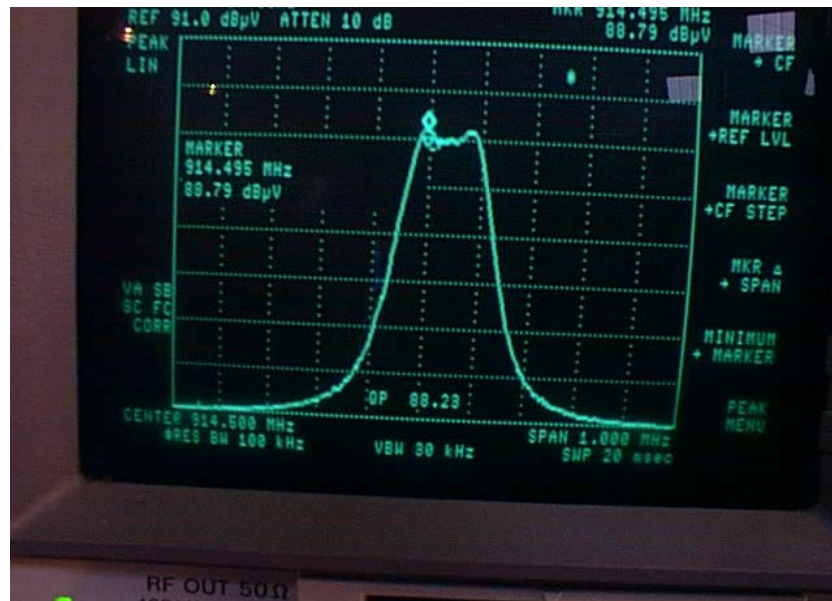
Additionally the following graphs show that the maximum field strength for the fundamental frequency was in compliance with the peak limits as indicated in Section 15.249.

The limits indicated in the tables below have been calculated for the measurement distance as indicated above.

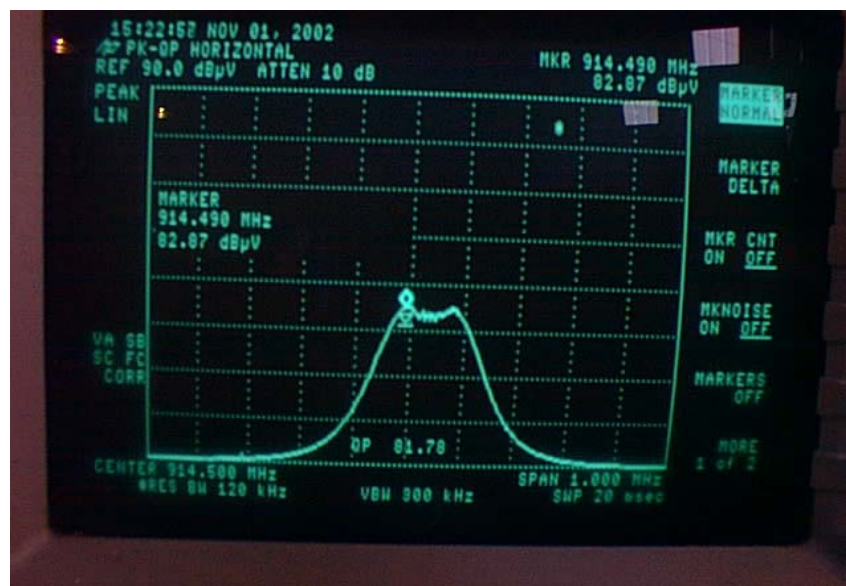
**Model: HT130022 Rev. B., with BNC antenna**

| <b>Frequency<br/>Mhz</b> | <b>Detection<br/>method</b> | <b>Total Level<br/>dB<math>\mu</math>V/m</b> | <b>FCC Limit<br/>dB<math>\mu</math>V/m</b> | <b>Margin<br/>dB<math>\mu</math>V</b> |
|--------------------------|-----------------------------|----------------------------------------------|--------------------------------------------|---------------------------------------|
| <b>Vertical</b>          |                             |                                              |                                            |                                       |
| 914.5                    | Quasi-peak                  | 93.4                                         | 94.0                                       | -0.6                                  |
| 1829                     | Average                     | 43.8                                         | 54.0                                       | -10.2                                 |
| 2743                     | Average                     | 41.0                                         | 54.0                                       | -13.0                                 |
| <b>Horizontal</b>        |                             |                                              |                                            |                                       |
| 914.5                    | Quasi-peak                  | 87.1                                         | 94.0                                       | -6.9                                  |
| 1829                     | Average                     | 53.5                                         | 54.0                                       | -0.5                                  |
| 2743.5                   | Average                     | 47.2                                         | 54.0                                       | -6.8                                  |
| <b>Horizontal</b>        |                             |                                              |                                            |                                       |
| 914.5                    | Peak                        | 88.2                                         | 114.0                                      | -25.8                                 |
| 1829                     | Peak                        | 58.0                                         | 74.0                                       | -16.0                                 |
| 2743.5                   | Peak                        | 51.6                                         | 74.0                                       | -22.4                                 |
| <b>Vertical</b>          |                             |                                              |                                            |                                       |
| 914.5                    | Peak                        | 94.0                                         | 114.0                                      | -20.0                                 |
| 1829                     | Peak                        | 48.2                                         | 74.0                                       | -25.8                                 |
| 2743.5                   | Peak                        | 45.4                                         | 74.0                                       | -28.6                                 |

## Vertical Antenna Polarization



## Horizontal Antenna Polarization



**Model: HT130022 Rev. B., with SMA antenna**

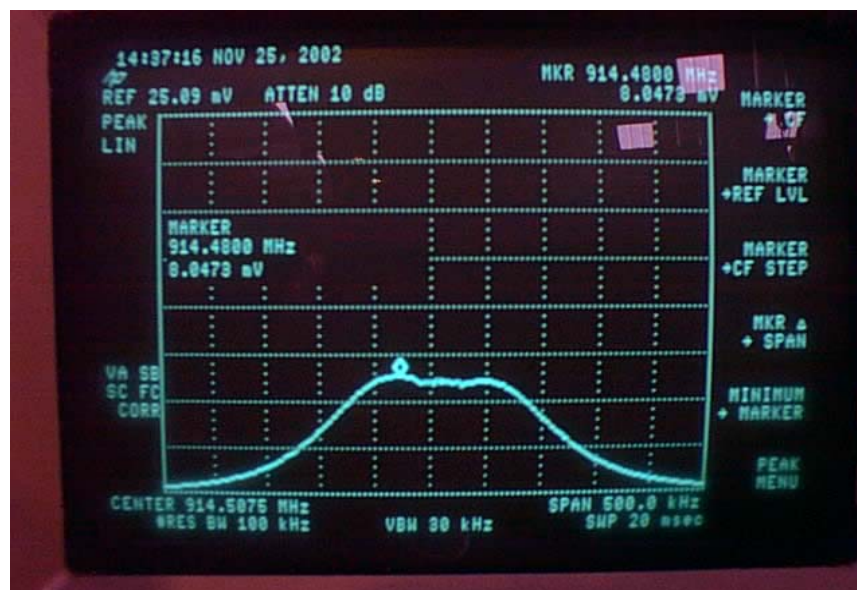
| <b>Frequency<br/>Mhz</b> | <b>Detection<br/>method</b> | <b>Total Level<br/>dB<math>\mu</math>V/m</b> | <b>FCC Limit<br/>dB<math>\mu</math>V/m</b> | <b>Margin<br/>dB<math>\mu</math>V</b> |
|--------------------------|-----------------------------|----------------------------------------------|--------------------------------------------|---------------------------------------|
| <b>Vertical</b>          |                             |                                              |                                            |                                       |
| 914.6                    | Quasi-peak                  | 92.9*                                        | 94.0                                       | -1.1                                  |
| 1829                     | Average                     | 53.2                                         | 54.0                                       | -0.8                                  |
| 2743                     | Average                     | 39.1                                         | 54.0                                       | -14.9                                 |
| <b>Horizontal</b>        |                             |                                              |                                            |                                       |
| 914.5                    | Quasi-peak                  | 84.4*                                        | 94.0                                       | -9.6                                  |
| 1829                     | Average                     | 49.4                                         | 54.0                                       | -4.6                                  |
| 2743.5                   | Average                     | 39.8                                         | 54.0                                       | -9.8                                  |
| <b>Horizontal</b>        |                             |                                              |                                            |                                       |
| 914.5                    | Peak                        | 84.4                                         | 114.0                                      | -29.6                                 |
| 1829                     | Peak                        | 53.8                                         | 74.0                                       | -20.2                                 |
| 2743.5                   | Peak                        | 51.6                                         | 74.0                                       | -29.8                                 |
| <b>Vertical</b>          |                             |                                              |                                            |                                       |
| 914.5                    | Peak                        | 92.9                                         | 114.0                                      | -21.1                                 |
| 1829                     | Peak                        | 57.6                                         | 74.0                                       | -16.4                                 |
| 2743.5                   | Peak                        | 43.5                                         | 74.0                                       | -30.5                                 |

\* - Indicates peak reading meeting quasi-peak limits

## Vertical Antenna Polarization



## Horizontal Antenna Polarization



## Section 6

### CONDUCTED EMISSIONS MEASUREMENTS

## CONDUCTED EMISSIONS MEASUREMENTS

**Model number:** HT130022 Rev. B. with the EUT in transmit mode**Test voltage:** 120V 60Hz

| Frequency<br>Mhz | Reading *<br>dBuV, L1 | Frequency<br>Mhz | Reading *<br>dBuV, L2 | CISPR Limit,<br>dBuV** | Margin<br>dBuV |
|------------------|-----------------------|------------------|-----------------------|------------------------|----------------|
| 0.71             | 26.2                  | 0.71             | 26.3                  | 46.0                   | -19.7          |
| 9.4              | 30.4                  | 9.3              | 29.3                  | 50.0                   | -19.6          |
| 12.1             | 31.6                  | 12.1             | 31.7                  | 50.0                   | -18.3          |
| 14.1             | 31.5                  | 14.5             | 28.3                  | 50.0                   | -18.5          |
| 19.2             | 31.3                  | 19.8             | 31.0                  | 50.0                   | -18.7          |
| 24.1             | 29.6                  | 24.1             | 29.3                  | 50.0                   | -20.4          |

\* - Measurement in the QP detection mode

\*\* - Limit for the average detection mode

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