

**TEST REPORT**

Report Number: 3076910.011

Project Number: 3076910

May 12, 2005

Evaluation of the  
ZIR000 Motion Sensor  
FCC ID: QIE0685-0X

to  
FCC Part 2  
FCC Part 15, Subpart C, Section 15.249

For  
Advanced Control Technologies Inc.

Test Performed by:  
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## 1.0 GENERAL DESCRIPTION

### 1.1 Related Submittals Grants

This is single application of the *Advanced Control Technologies Inc. ZIR000 Motion Sensor* Certification under FCC Part 15, Subpart C.

There are no other simultaneous applications.

### 1.2 Product Description

The *ZIR000 Motion Sensor* is a RF transmitter operating in 908.39MHz. The intended use of the *ZIR000 Motion Sensor* is to generate and transmit a RF signal to activate load receiver. *ZIR000 Motion Sensor* is powered at 6VDC AAA internal batteries.

#### Antenna Description:

Single isolated wire 9cm length soldered to the RF Board inside the unit

Sample Submitted: May 9, 2005  
Test Work Started: May 9, 2005  
Test Work Completed: May 12, 2005

### 1.3 Test Methodology

Emission measurements were performed according to the procedures in ANSI C63.4-2001. All field strength radiated emissions measurements were performed in the semi-anechoic chamber, and for each scan, the procedure for maximizing emissions in Appendices D and E were followed. All field strength radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application.

### 1.4 Test Facility

The test site facility used to collect the radiated and conducted measurement data is located at 7250 Hudson Blvd., Suite 100, Oakdale, Minnesota. This test facility has been fully described in a report dated on March 2003 submitted to FCC. Please reference the site registration number: 90706, dated April 18, 2003.

## **2.0 SYSTEM TEST CONFIGURATION**

### **2.1 Justification**

Line Conducted Emissions testing is inappropriate and therefore unnecessary as batteries power the equipment.

### **2.2 EUT Setup**

For simplicity of testing, the transmitter was setup to transmit continuously for spurious emissions testing.

### **2.3 EUT Exercising Software**

N/A

### **2.4 Special Accessories**

There are no special accessories necessary for compliance of these products.

#### **Cables**

N/A

### **2.5 Equipment Modification**

No modifications were installed during the testing.

### **2.6 Support Equipment List and Description**

N/A

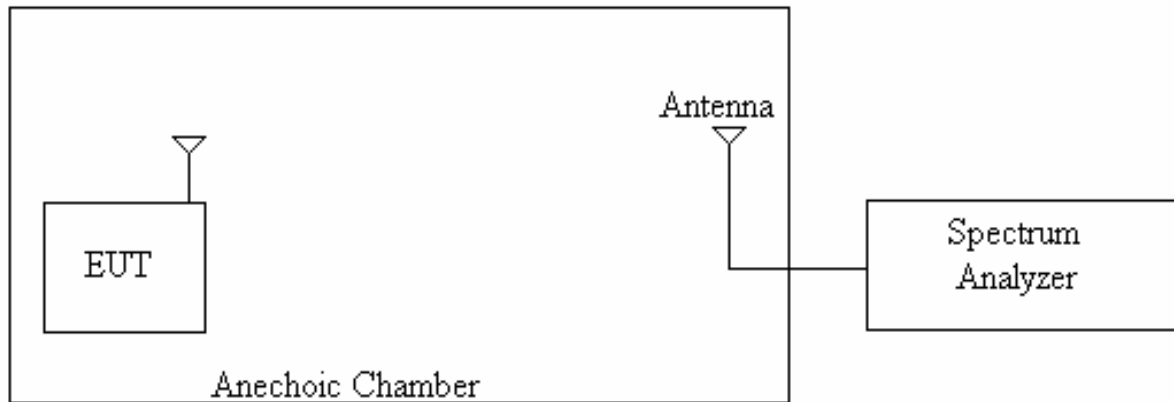
## 2.7 Test Configuration Block Diagrams

The EUT was setup as tabletop equipment.

The EUT was powered at 6VDC from new internal AAA batteries.

### Field Strength Measurements

For simplicity of testing, the Unit was set to transmit continuously for spurious emissions measurements.



### 3.0 TEST RESULTS

Data is included for the worst-case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs, data tables and graphical representations of the emissions are included.

The EUT is intended for operation under the requirements of Part 15 Subpart C. Specific test requirements include the following:

|                             |                                  |
|-----------------------------|----------------------------------|
| 47 CFR 15.249(a)(b)         | Field Strength of Fundamental    |
| 47 CFR 15.249(a)(b), 15.205 | Field Strength of Harmonics      |
| 47 CFR 15.249(c), 15.209    | Out of Band Spurious Emissions   |
|                             | Bandwidth of Emissions           |
| 47 CFR 15.109               | Unintentional Radiated Emissions |

### 3.1 Field Strength of Fundamental and Harmonics Emissions, FCC 15.249(a)(b), 15.205

Field Strength of Fundamental and Harmonics Emissions measurements were made with Fundamental frequency at 908.39MHz. The Harmonics emissions were tested up to 10<sup>th</sup> harmonic.

The Tables 3-1-1 and 3-1-2 show the Field Strength of Fundamental Radiation and Restricted Band Harmonics Emissions. No emissions above the floor noise were found above 5<sup>th</sup> harmonics.

**Field Strength of Fundamental** **Date:** 5/9/2005  
**Company:** ACT, Inc.  
**Model:** ZIR000  
**Test Engineer:** Uri Spector  
**Standard:** FCC Part 15.249  
**Test Site:** 3 m Anechoic Chamber  
**Note:** Measurements were taking using peak detector  
with 100kHz Resolution Bandwidth  
Antenna Factors include Antenna Correction Factors and Cable Loss

**Table # 3-1-1**

| Frequency<br>MHz | Antenna  |        | Antenna Factor<br>dB(1/m) | Peak Reading<br>dB $\mu$ V | Net at 3m.<br>dB $\mu$ V/m | Limit<br>dB $\mu$ V/m | Margin<br>dB |
|------------------|----------|--------|---------------------------|----------------------------|----------------------------|-----------------------|--------------|
|                  | Polarity | Hts(m) |                           |                            |                            |                       |              |
| 908.39           | V        | 175    | 25.1                      | 52.0                       | 77.1                       | 94.0                  | -16.9        |
| 908.39           | H        | 152    | 25.1                      | 57.8                       | 82.9                       | 94.0                  | -11.1        |

**Radiated Emissions of Spurious Emissions  
in restricted band**

**Date:** 5/9/2005

**Company:** ACT, Inc.  
**Model:** ZIR000  
**Test Engineer:** Uri Spector  
**Standard:** FCC Part 15.249, 15.205  
**Test Site:** 3m Anechoic Chamber, 3m measurement distance  
**Note:** The table shows the worst case radiated emissions  
 All measurements were taken using a Peak detector  
 Total Antenna Factors include Antenna Correction Factors, Cable Loss and Filter Loss  
 Measurements above 1GHz were taken with RBW1MHz

**Table # 3-1-2**

| Frequency<br>MHz | Antenna<br>Polarity | Ant. Factor<br>dB1/m | Pre-Amp<br>Gain (dB) | Peak Reading<br>dBμV | Total Emissions<br>dBμV/m | Limit<br>dBμV/m | Margin<br>dB |
|------------------|---------------------|----------------------|----------------------|----------------------|---------------------------|-----------------|--------------|
| 2725.14          | V                   | 32.6                 | 35.1                 | 43.0                 | 40.6                      | 54.0            | -13.4        |
| 3633.52          | V                   | 35.4                 | 34.5                 | 42.9                 | 43.8                      | 54.0            | -10.2        |
| 4541.90          | V                   | 37.1                 | 34.0                 | 38.5                 | 41.6                      | 54.0            | -12.3        |
|                  |                     |                      |                      |                      |                           |                 |              |
| 2725.14          | H                   | 32.6                 | 35.1                 | 48.0                 | 45.6                      | 54.0            | -8.4         |
| 3633.52          | H                   | 35.4                 | 34.5                 | 43.2                 | 44.1                      | 54.0            | -9.9         |
| 4541.90          | H                   | 37.1                 | 34.0                 | 40.0                 | 43.1                      | 54.0            | -10.8        |

**Comments:** No emissions above floor noise were found above the 5th harmonic.

### 3.2 Out of Band Spurious Emissions, FCC 15.249(c), 15.209

Out-of-band measurements were made for frequencies:

- 902MHz
- 928MHz.

Output frequency of the EUT is 908.39MHz

The EUT complies with the Standard requirements Out of Band Spurious Emissions for Section 15.249(c). Table 3-2-1 shows the Out of Band Spurious Emissions.

#### Out of Band Spurious Emissions

Date: 5/9/2005

Company: ACT, Inc.

Model: ZIR000

Test Engineer: Uri Spector

Standard: FCC Part 15.249(c), 15.209

Test Site: 3m Anechoic Chamber, 3m measurement distance

Note: The table shows the worst case radiated emissions  
All measurements were taken using a peak detector

Table # 3-2-1

| Frequency<br>MHz | Antenna  |         |                | Peak reading<br>dBμV | Total Peak<br>dBμV/m | QP Limit<br>dBμV/m | Margin<br>dB | Comments |
|------------------|----------|---------|----------------|----------------------|----------------------|--------------------|--------------|----------|
|                  | Polarity | Hts(cm) | Factor (dB1/m) |                      |                      |                    |              |          |
| 902.00           | V        | 100     | 25.0           | 10.9                 | 35.9                 | 46.0               | -10.1        |          |
| 902.00           | H        | 100     | 25.0           | 11.3                 | 36.3                 | 46.0               | -9.7         |          |
| 928.00           | V        | 100     | 25.3           | 10.4                 | 35.7                 | 46.0               | -10.3        |          |
| 928.00           | H        | 100     | 25.3           | 11.8                 | 37.1                 | 46.0               | -8.9         |          |

### 3.3 Bandwidth of Emissions

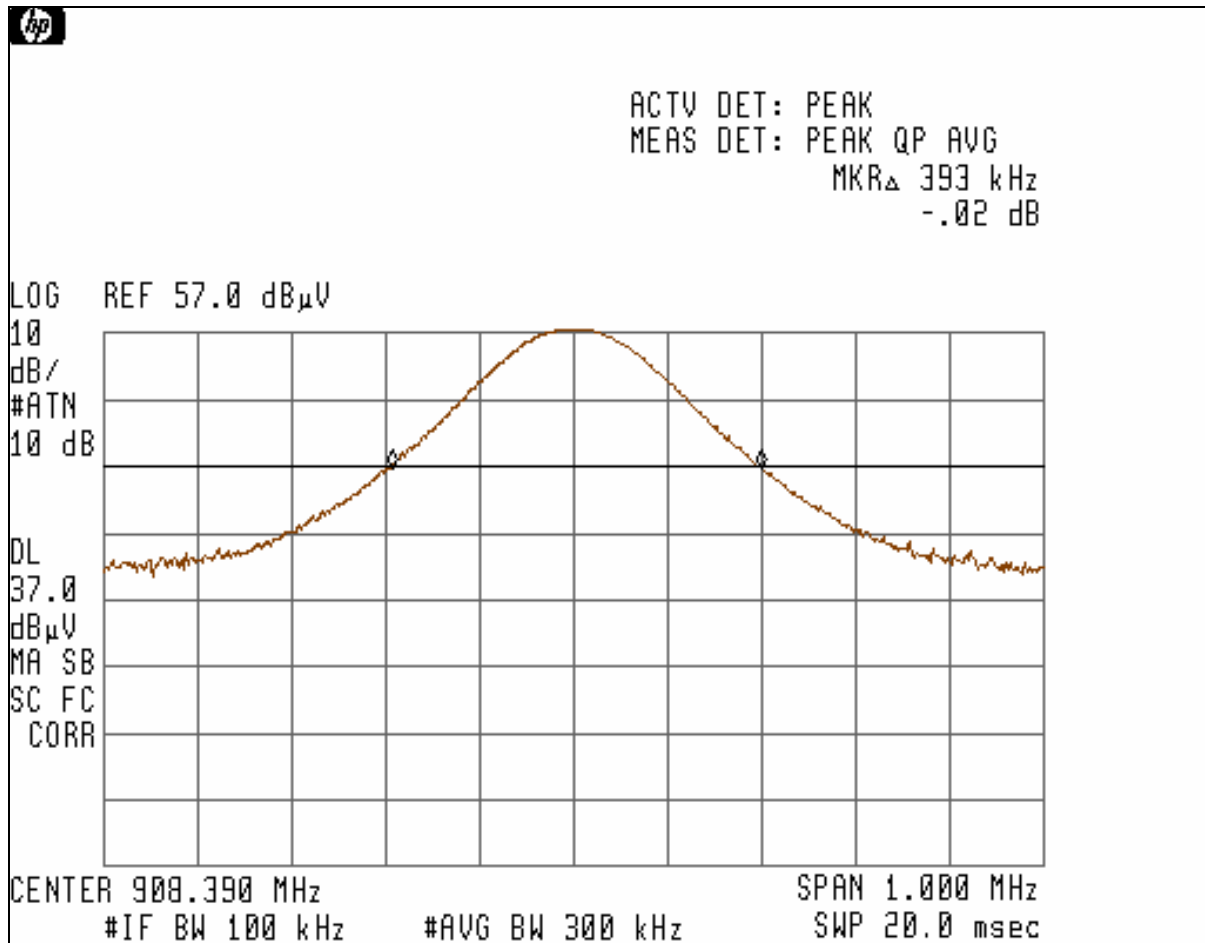
Bandwidth of Emissions measurements was made for frequency of 908.39MHz.

Bandwidth of Emissions for the EUT at level -20dB was measured at 393kHz

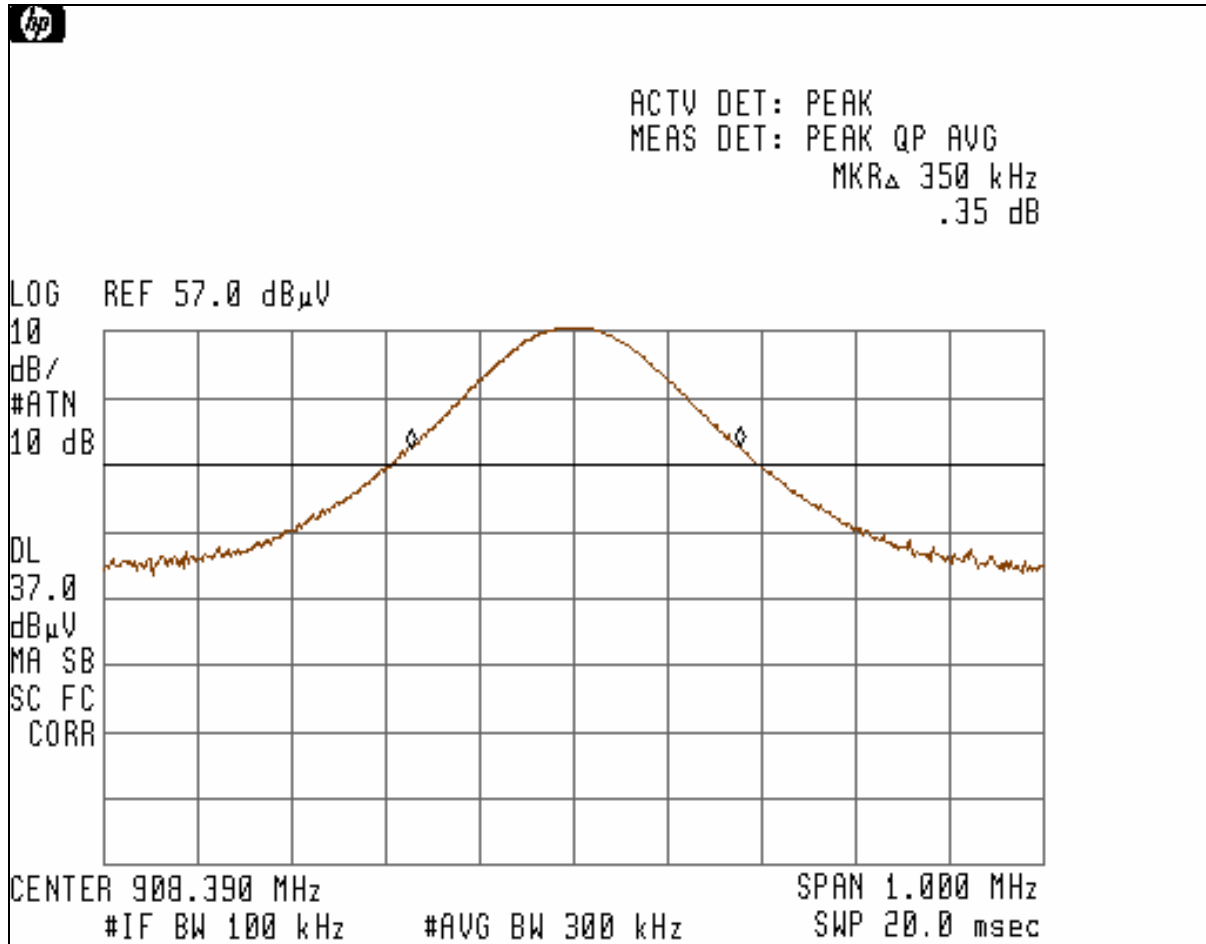
Bandwidth of Emissions for the EUT at 99% power was measured at 350kHz

The Graphs 3-3-1 & 3-3-2 show the Bandwidth of Emissions.

**Graph # 3-3-1**



Graph # 3-3-2



### 3.4 Radiated Emissions, FCC 15.109, Class B

The EUT was tested as a digital device according to FCC Part 15.109, Class B in frequency range from 30MHz to 5GHz. Radiated Emissions testing was performed in Anechoic Chamber with 3m-measurement distance. Signal generator was used in close proximity to activate the EUT in receiving mode.

**Note:** No Radiated Emissions above the floor noise were detected during testing above 1GHz.

The Tables 3-4-1 shows the worst-case Radiated Emissions.

#### *TILE Instrument Control System EMI Measurement Software*

**Radiated Emissions**                      **Date:**                      05-9-2005  
**Company:**                      ACT, Inc.  
**Model:**                      ZIR000  
**Test Engineer:**                      Uri Spector  
**Standard:**                      FCC Part 15.109, Class B  
**Test Site:**                      3m Anechoic Chamber, 3m measurement distance  
**Note:**                      The table shows the worst case radiated emissions  
                                          All measurements were taken using a Peak detector

**Table # 3-4-1**

| Frequency   | Ant. Polarity | Peak Reading dB $\mu$ V | Total CF dB1/m | Total at 3m dB $\mu$ V/m | QP Limit dB $\mu$ V/m | Margin dB |
|-------------|---------------|-------------------------|----------------|--------------------------|-----------------------|-----------|
| 30.316 MHz  | V             | 12.80                   | 20.41          | 33.21                    | 40.00                 | -6.79     |
| 125.712 MHz | V             | 13.90                   | 13.62          | 27.52                    | 43.53                 | -16.00    |
| 175.93 MHz  | V             | 12.40                   | 10.86          | 23.26                    | 43.52                 | -20.26    |
| 190.00 MHz  | V             | 11.20                   | 10.90          | 22.10                    | 43.52                 | -21.42    |
| 222.30 MHz  | V             | 13.93                   | 12.70          | 26.63                    | 46.02                 | -19.39    |
| 410.60 MHz  | V             | 12.52                   | 18.70          | 31.22                    | 46.02                 | -14.80    |

### 3.5 Test Procedure

#### Field Strength Measurements

The EUT was placed on a non-conductive table 0.8m above the ground plane inside the Anechoic Chamber. The table was centered on a motorized turntable, which allows 360-degree rotation. The measurement antenna was positioned at 3m distance. The Bicono-Log antenna was used in frequency range from 30MHz to 1GHz, and the Horn antenna was used in frequency range above 1GHz. The radiated emissions were maximized by configuring the EUT through its placement in three orthogonal axes, by rotating the EUT, by changing antenna polarization, and by changing antenna height from 1 to 4m. Method of the direct Field Strength Calculation is shown in Section 3.6.

#### Conducted Emissions

For conducted emissions testing, the equipment is moved to an insulating platform over the ground plane, and the EUT is powered from a LISN. Both sides of the AC line are measured and the results are compared to the applicable limits. Measurements are taken using CISPR quasi-peak and average detectors when the peak readings approach or exceed the average limit. Only quasi-peak readings are taken when the emissions from the EUT meet the average limit as measured with the quasi-peak detector.

### 3.7 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured emissions reading on the EMI Receiver.

The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where: FS = Field Strength in dB( $\mu$ V/m)

RA = Receiver Amplitude in dB( $\mu$ V)

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB( $m^{-1}$ )

AG = Amplifier Gain in dB

Assume a receiver reading of 48.1 dB( $\mu$ V) is obtained. The antenna factor of 7.4 dB( $m^{-1}$ ) and cable factor of 1.6 dB is added and amplifier gain of 16.0 dB is subtracted giving field strength of 41.1 dB( $\mu$ V/m).

$$RA = 48.1 \text{ dB}(\mu\text{V})$$

$$AF = 7.4 \text{ dB}(m^{-1})$$

$$CF = 1.6 \text{ dB}$$

$$AG = 16.0 \text{ dB}$$

$$FS = RA + AF + CF - AG$$

$$FS = 48.1 + 7.4 + 1.6 - 16.0$$

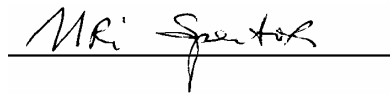
$$FS = 41.1 \text{ dB}(\mu\text{V}/m)$$

In the tables the Cable correction factors are included to the Antenna Factors.

Tested by:

Uri Spector  
EMC Project Engineer  
Intertek ETL SEMKO

Signature

A handwritten signature in black ink, appearing to read "Uri Spector", written over a horizontal line.

Date: May 12, 2005

#### 4.0 TEST EQUIPMENT

##### Receivers/Spectrum Analyzers and Test Software

| DESCRIPTION                        | SERIAL NO.   | LAST CAL | CAL DUE | USED |
|------------------------------------|--------------|----------|---------|------|
| HP85462A Receiver RF Section       | 3325A00106   | 08/04    | 08/05   | X    |
| HP85460A RF Filter Section         | 3330A00109   | 08/04    | 08/05   | X    |
| Advantest Spectrum Analyzer R3271A | 55050084     | 06/04    | 06/05   | X    |
| TILE! Instrument Control System    | ver. 3.4.G.1 | N/A      | N/A     | X    |

##### Antennas

| DESCRIPTION                        | SERIAL NO. | LAST CAL | CAL DUE | USED |
|------------------------------------|------------|----------|---------|------|
| Schaffner-Chase Bicono-Log Antenna | 2468       | 01/05    | 01/06   | X    |
| EMCO Horn Antenna 3115             | 9507-4513  | 12/04    | 12/05   | X    |

##### Pre-Amplifiers/Filters

| DESCRIPTION               | SERIAL NO. | LAST CAL | CAL DUE | USED |
|---------------------------|------------|----------|---------|------|
| HP 83017A Pre-Amplifier   | 3123A00475 | 04/05    | 04/06   | X    |
| Reactel 7HS-1G-S12 Filter | 0223       | 01//05   | 01/06   | X    |

**EXHIBIT 1**  
**CONFIGURATION PHOTOS**



**Radiated Emissions Test Configuration**



**Radiated Emissions Test Configuration**