

**Advanced Control Technologies Inc.**

Application  
For Class II Permissive Change  
**ZCU001 and ZCS000 Transmitter**

**FCC ID: QIE05X7-0X**

December 15, 2004



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### **EXHIBIT 1 - CONFIGURATION PHOTOGRAPHS**

## 1.0 JENERAL DESCRIPTION

### 1.1 Related Submittals Grants

This is a class II permissive change application of the *Advanced Control Technologies ZCU001 and ZCS0* for Certification under FCC Part 15, Subpart C.

The Receiver portion will be verified under Declaration of Conformity.

### 1.2 Product Description

*ZCU001* is a RF USB computer interface operating in 908.4MHz. The intended use of the *ZCU001* is to generate and transmit a RF signal upon receiving command from the computer. The *ZCU001* is powered at 5VDC from the AC/DC adapter.

*ZCS000* is a RS232F computer interface operating in 908.4MHz. The intended use of the *ZCS000* is to generate and transmit a RF signal upon receiving command from the computer. The *ZCS000* is powered at 5VDC from the AC/DC adapter.

#### Antenna Description:

Integrated antenna on the RF Board inside the unit.

Sample Submitted: December 10, 2004

Test Work Started: December 11, 2004

Test Work Completed: December 14, 2004

### 1.3 Test Methodology

Emission measurements were performed according to the procedures in ANSI C63.4-2000. 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**

N/A

### **2.2 EUT Exercising Software**

N/A

### **2.3 Special Accessories**

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

### **2.4 Equipment Modification**

No modifications were installed during the testing.

### **2.5 Support Equipment List and Description**

N/A

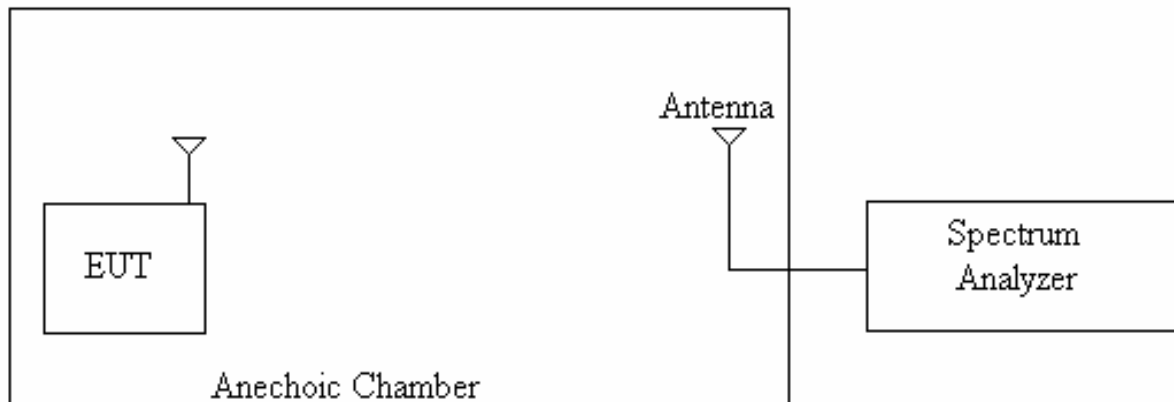
## 2.6 Test Configuration Block Diagrams

The EUT was setup as tabletop equipment.

The EUT was powered at 5VDC from the AC/DC adapter.

For simplicity of testing, the Unit was set to transmit continuously: the Pin 8 of the C01 connector (R9) was “grounded”.

### Field Strength 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 15.207	Line Conducted 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 908.4MHz. The Harmonics emissions were tested up to 10<sup>th</sup> harmonic.

The EUT complies with the Standard requirements for Fundamental and Harmonics Emissions with minimum margin 3dB for Fundamental Emissions and 10.8dB for Harmonic Emissions.

The Tables 3-1-1 and 3-1-2, and Graphs 3-1-1 and 3-1-2 show the Field Strength of Fundamental Radiation and Harmonics Emissions.

No emissions above ambient was found above 5<sup>th</sup> harmonics.

**Field Strength of Fundamental** **Date:** 12/11/2004  
**Company:** Advanced Control Technologies Inc.  
**Model:** ZCS000  
**Test Engineer:** Troy Ihle  
**Special Info:**  
**Standard:** FCC Part 15.249  
**Test Site:** 3 m Anechoic Chamber  
**Note:** Measurements were taking using a CISPR Quasi-Peak Detector with 100kHz Resolution Bandwidth

**Table # 3-1-1**

Frequency MHz	Antenna		Total Factor(dB/m)	Reading dBμV	Net at 3m. dBμV/m	Limit dBμV/m	Margin dB	Comments
	Polarity	Hts(m)						
908.361	V	100	25.08	55.50	80.58	93.98	-13.40	
908.361	H	100	25.08	63.40	88.48	93.98	-5.50	

**Field Strength of Fundamental** **Date:** 12/11/2004  
**Company:** Advanced Control Technologies Inc.  
**Model:** ZCU001  
**Test Engineer:** Troy Ihle  
**Special Info:**  
**Standard:** FCC Part 15.249  
**Test Site:** 3 m Anechoic Chamber  
**Note:** Measurements were taking using a CISPR Quasi-Peak Detector with 100kHz Resolution Bandwidth

**Table # 3-1-2**

Frequency MHz	Antenna		Total Factor(dB/m)	Reading dBμV	Net at 3m. dBμV/m	Limit dBμV/m	Margin dB	Comments
	Polarity	Hts(m)						
908.372	V	174	25.08	61.60	86.68	93.98	-7.30	
908.372	H	151	25.08	68.80	93.88	93.98	-0.10	

**Field Strength of Harmonics**
**Date: 12/11/2004**

**Company:** Advanced Control Technologies Inc.  
**Model:** ZCS000  
**Test Engineer:** Troy Ihle  
**Special Info:** Total Factor includes Antenna Factor, Cable Loss, Pre-amp Gain, RF Filter Factor  
**Standard:** FCC Part 15.249  
**Test Site:** 3 m Anechoic Chamber  
**Note:** Measurements were taking using a Peak Detector  
 with 1MHz Resolution Bandwidth  
 No emissions were detected above ambient above 5th harmonic.

**Table # 3-1-3**

Frequency MHz	Antenna		Total Factor(dB/m)	Reading dBμV	Net at 3m. dBμV/m	Limit dBμV/m	Margin dB	Comments
	Polarity	Hts(m)						
1816.92	V	100	-2.40	38.20	35.80	N/A	N/A	2nd harm.
1816.92	H	100	-2.40	39.70	37.30	N/A	N/A	2nd harm.
2725.35	V	100	1.09	43.10	44.19	53.98	-9.79	3rd harm.
2725.35	H	100	1.09	42.60	43.69	53.98	-10.29	3rd harm.
3633.85	V	100	4.82	44.10	48.92	53.98	-5.06	4th harm.
3633.85	H	100	4.82	42.80	47.62	53.98	-6.36	4th harm.
4542.33	V	100	7.08	45.80	52.88	53.98	-1.10	5th harm.
4542.33	H	100	7.08	46.80	53.88	53.98	-0.10	5th harm.



**Field Strength of Harmonics**
**Date:** 12/11/2004

**Company:** Advanced Control Technologies Inc.

**Model:** ZCU001

**Test Engineer:** Troy Ihle

**Special Info:** Total Factor includes Antenna Factor, Cable Loss, Pre-amp Gain, RF Filter Factor

**Standard:** FCC Part 15.249

**Test Site:** 3 m Anechoic Chamber

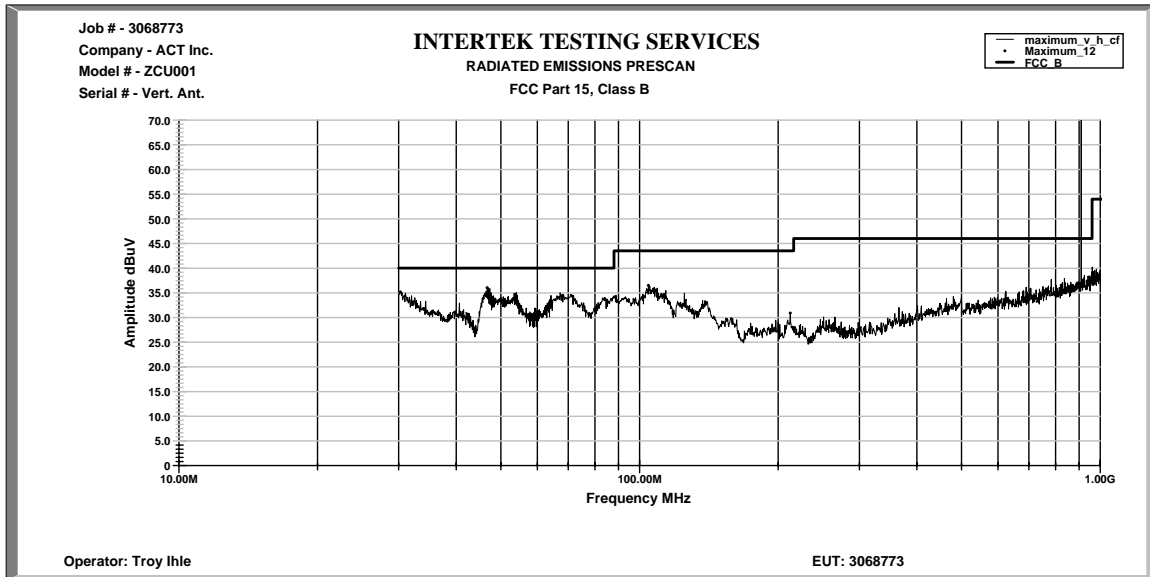
**Note:** Measurements were taking using a Peak Detector  
with 1MHz Resolution Bandwidth  
No emissions were detected above ambient above 5th harmonic.

**Table # 3-1-4**

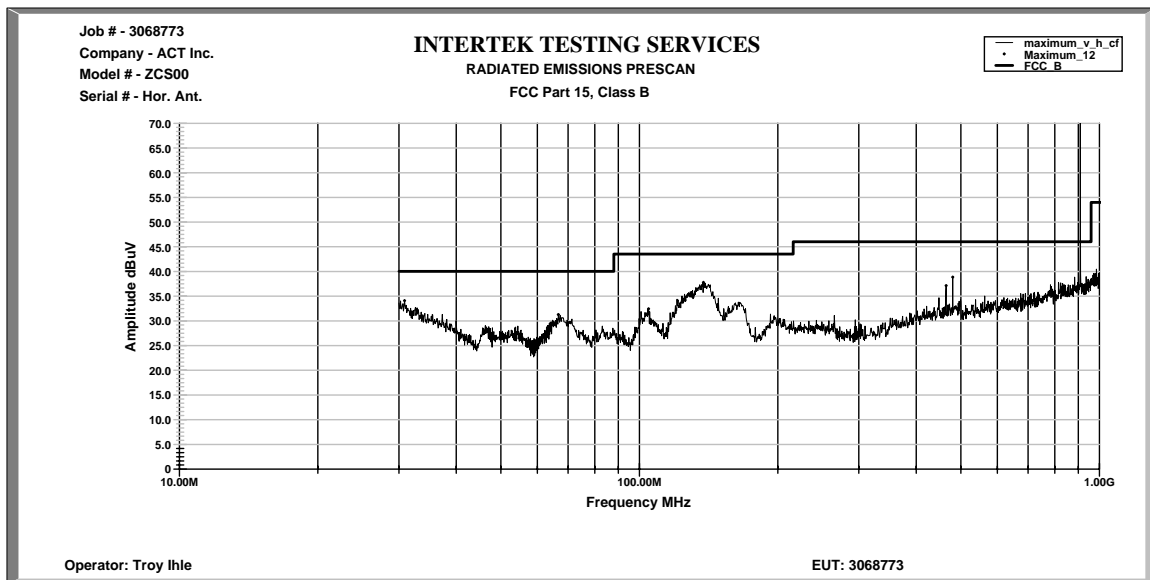
Frequency MHz	Antenna		Total Factor(dB/m)	Reading dB $\square$ V	Net at 3m. dB $\square$ V/m	Limit dB $\square$ V/m	Margin dB	Comments
	Polarity	Hts(m)						
1813.73	V	100	-2.40	43.58	41.18	N/A	N/A	2nd harm.
1813.73	H	100	-2.40	42.20	39.80	N/A	N/A	2nd harm.
2725.32	V	100	1.09	42.62	43.71	53.98	-10.27	3rd harm.
2725.32	H	100	1.09	42.25	43.34	53.98	-10.64	3rd harm.
3863.51	V	100	5.98	44.90	50.88	53.98	-3.10	4th harm.
3863.51	H	100	5.98	44.77	50.75	53.98	-3.23	4th harm.
4502.14	V	100	6.93	45.34	52.27	53.98	-1.71	5th harm.
4502.14	H	100	6.93	45.50	52.43	53.98	-1.55	5th harm.

**Graph 3-1-1**  
**Radiated Emissions from 30MHz to 1GHz**

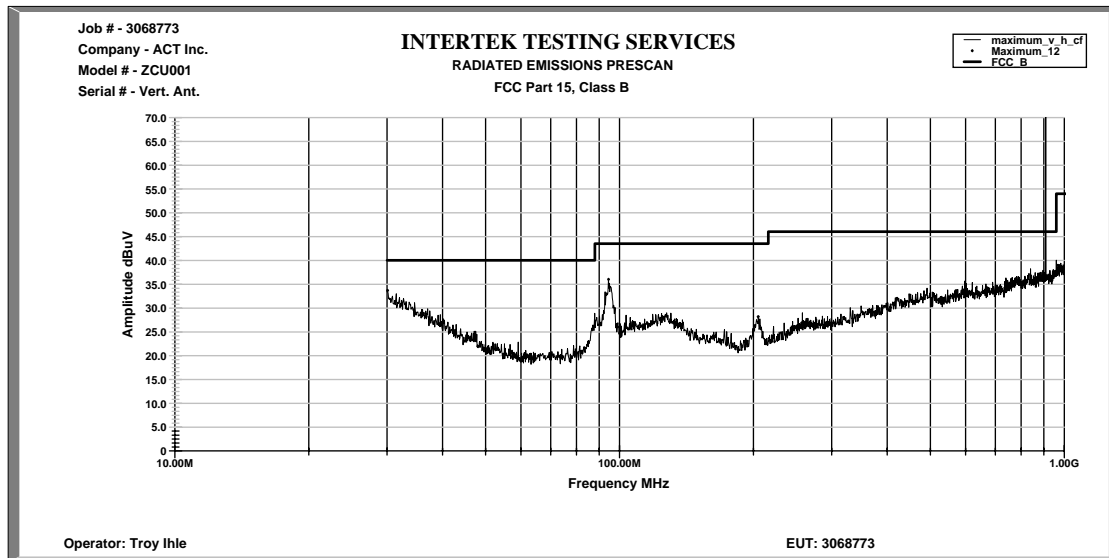
**Vertical Antenna Polarization**



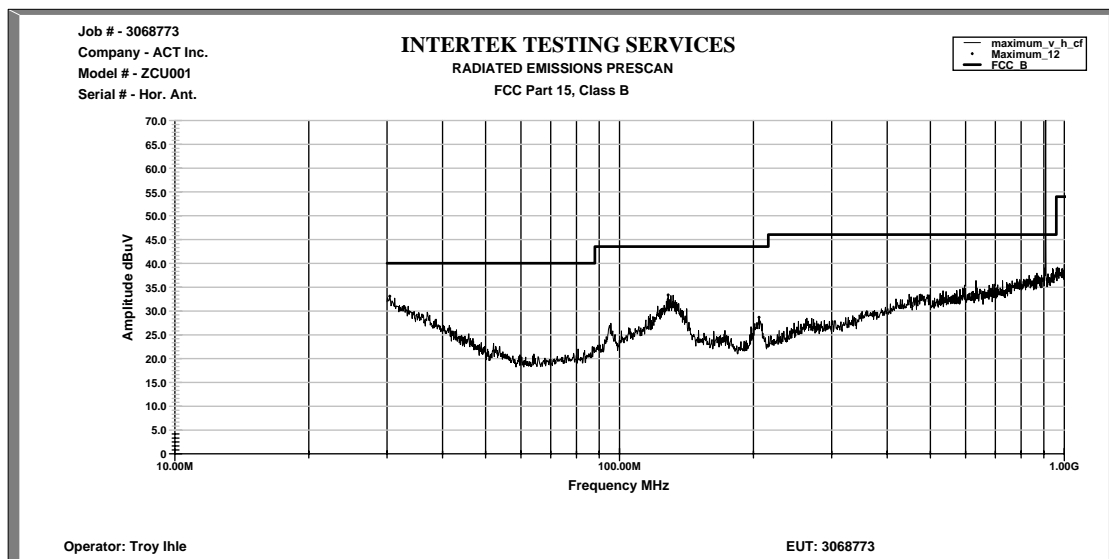
**Horizontal Antenna Polarization**



## Radiated Emissions from 30MHz to 1GHz Vertical Antenna Polarization

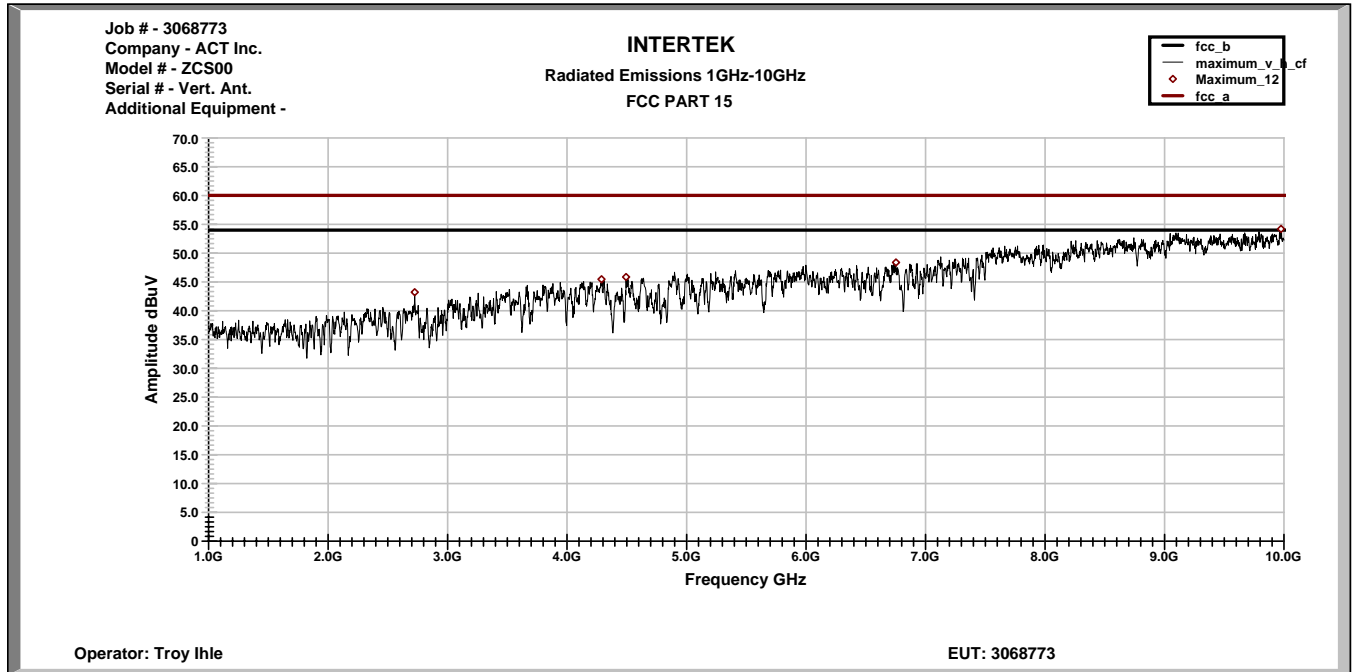


## Horizontal Antenna Polarization

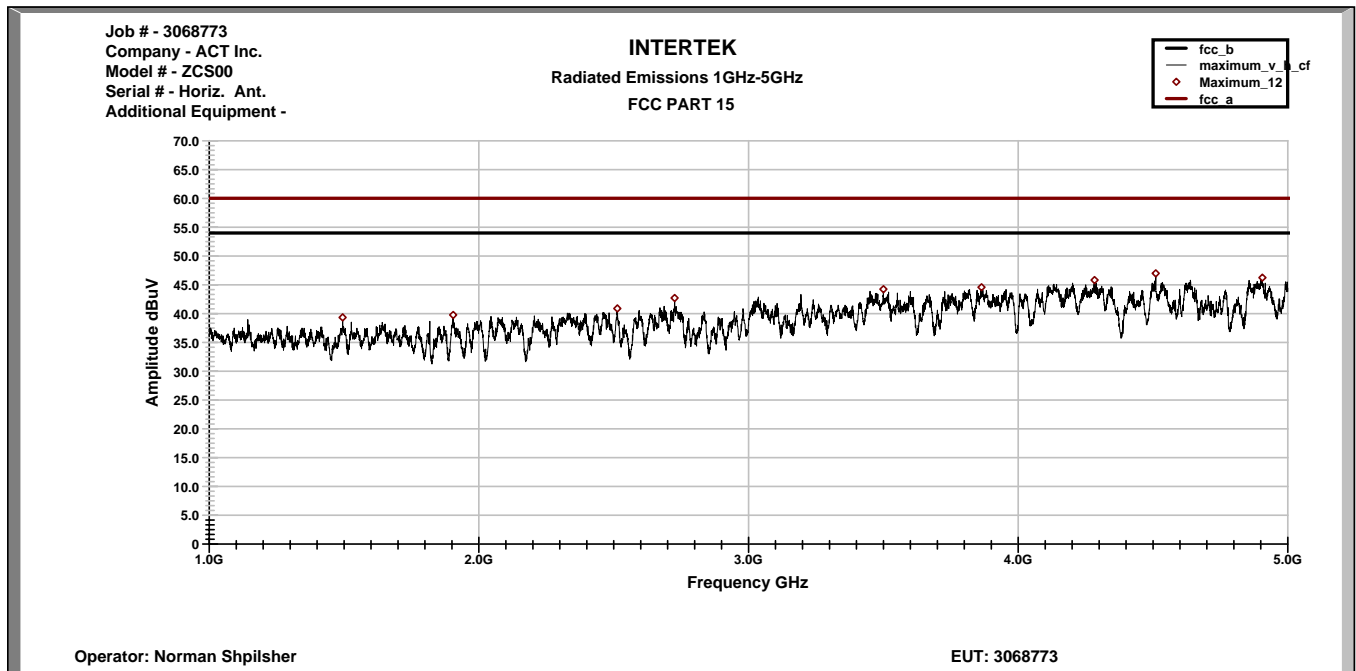


**Graph 3-1-2**  
**Radiated Emissions from 1GHz to 10GHz**

**Vertical Antenna Polarization**

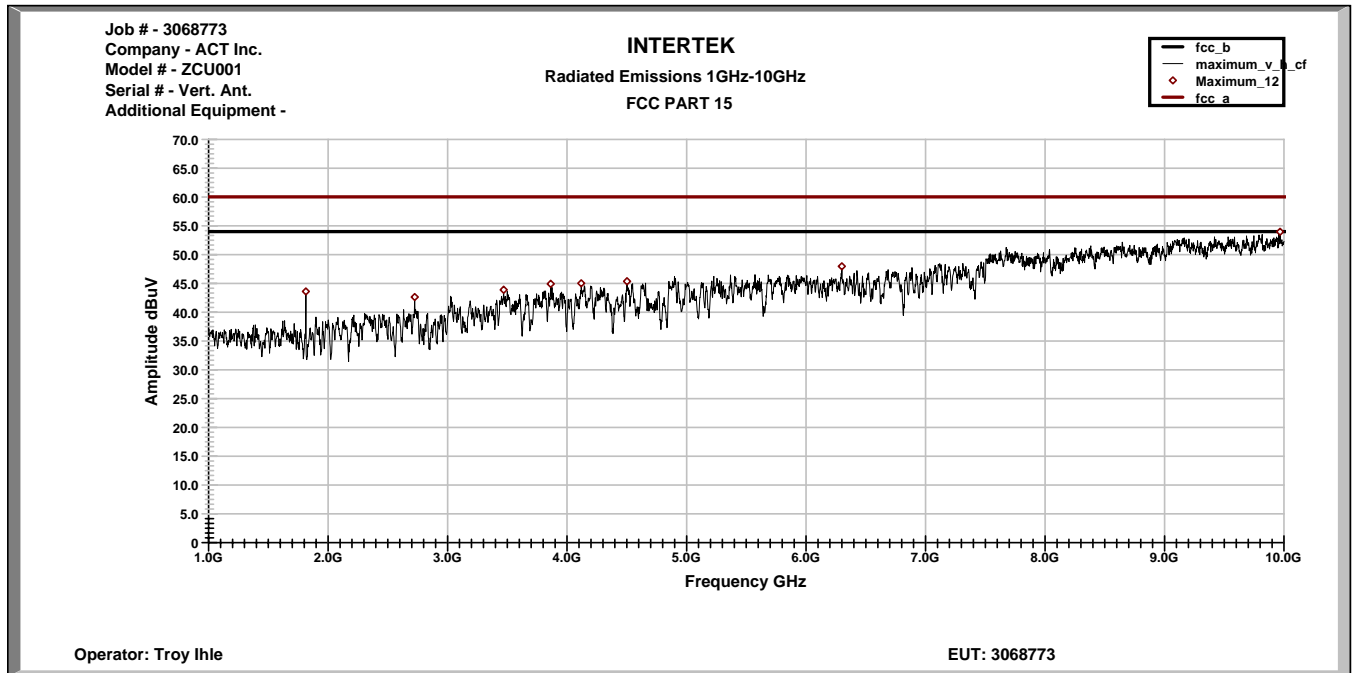


**Radiated Emissions from 1GHz to 5GHz,**  
**Horizontal Antenna Polarization**



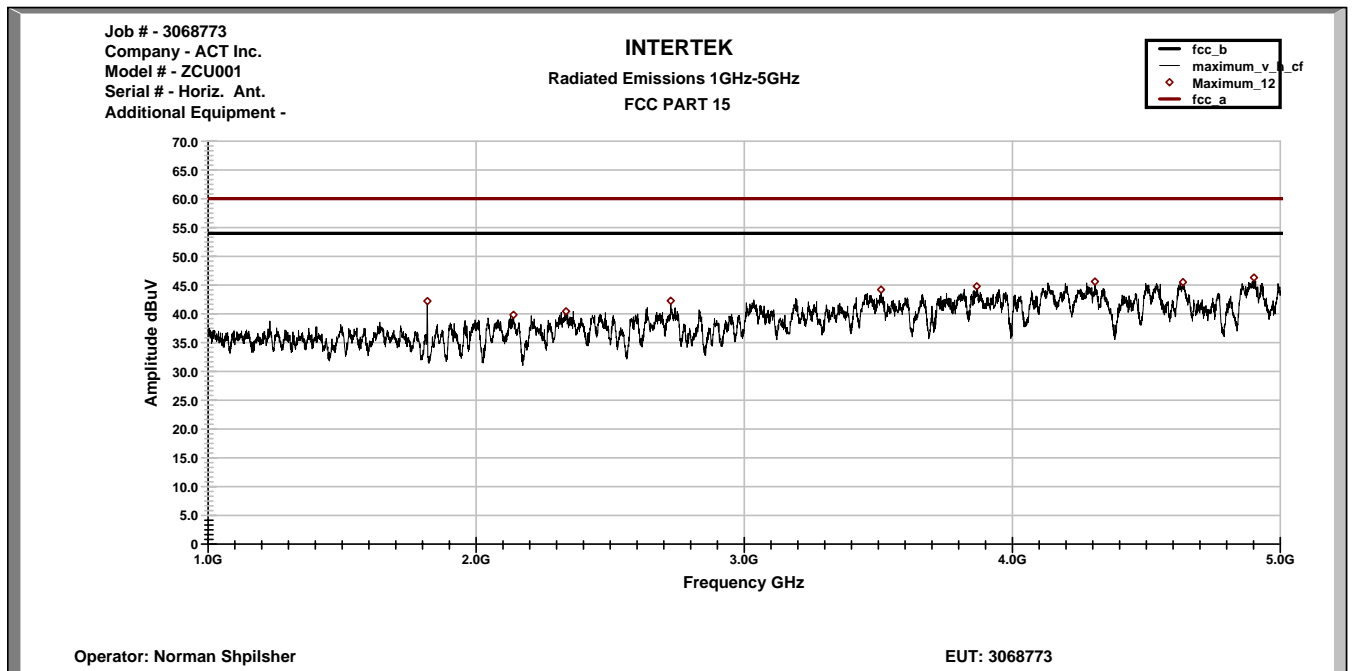
# Radiated Emissions from 1GHz to 10GHz

## Vertical Antenna Polarization



# Radiated Emissions from 1GHz to 5GHz,

## Horizontal Antenna Polarization



### 3.2 Line Conducted Emissions, FCC 15.207

Line Conducted Emissions testing was performed in frequency range from 150kHz to 30MHz.

The Table 3-2-1 and Graph 3-2-1 show the Line Conducted Emissions for model: ZCS000.

The Table 3-2-2 and Graph 3-2-2 show the Line Conducted Emissions for model: ZCU001.

**Conducted Emissions**      **Date:** 12/11/2004  
**Company:**                      Adadvanced Control Technology Inc.  
**Model:**                              ZCS000  
**Test Engineer:**                  Troy Ihle  
**Standard:**                          FCC Part 15.107, Class B  
**Note:**                                  The table shows the worst case conducted emissions  
     All measurements were taken using a CISPR Quasi-peak detector

**Table # 3-2-1**

**Line 1**

Frequency MHz	Peak dBμV	AVG dBμV	QP Limit dBμV	AVG Limit dBμV	QP Margin dB	AVG Margin dB
0.150	32.8	N/A	66.0	56.0	-33.2	N/A
0.230	30.1	N/A	62.4	52.4	-32.3	N/A
0.270	28.7	N/A	61.1	51.1	-32.4	N/A
0.320	26.6	N/A	59.7	49.7	-33.1	N/A
0.510	23.7	N/A	56.0	46.0	-32.3	N/A
15.680	19.3	N/A	60.0	50.0	-40.7	N/A
19.980	22.9	N/A	60.0	50.0	-37.1	N/A
30.000	29.9	N/A	60.0	50.0	-30.1	N/A

**Line 2**

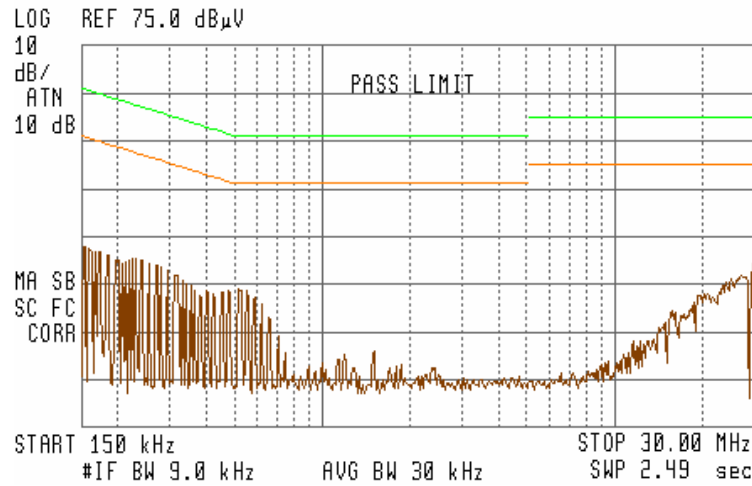
Frequency MHz	Peak dBμV	AVG dBμV	QP Limit dBμV	AVG Limit dBμV	QP Margin dB	AVG Margin dB
0.150	33.7	N/A	66.0	56.0	-32.3	N/A
0.250	31.3	N/A	61.7	51.7	-30.4	N/A
0.320	30.6	N/A	59.7	49.7	-29.1	N/A
0.380	29.5	N/A	58.3	48.3	-28.8	N/A
0.590	30.1	N/A	56.0	46.0	-25.9	N/A
15.680	16.9	N/A	60.0	50.0	-43.1	N/A
19.050	21.1	N/A	60.0	50.0	-38.9	N/A
30.000	24.1	N/A	60.0	50.0	-35.9	N/A

**Graph 3-2-1  
Conducted Emissions**

**Line 1**

**15:00:06 DEC 11, 2004**

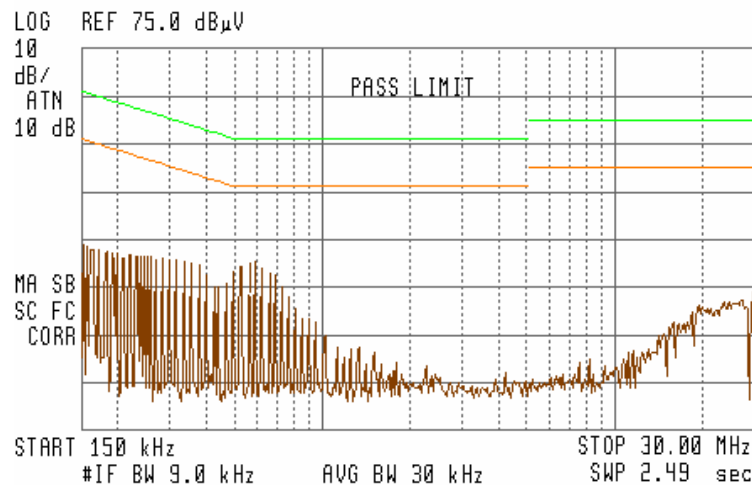
Company: Advanced Control Technologies    ACTV DET: PEAK  
Model: ZCS000    MEAS DET: PEAK QP AVG  
Test Engineer: Troy Ihle  
Standard: FCC Part 15.207



**Line 2**

**15:34:15 DEC 11, 2004**

Company: Advanced Control Technologies    ACTV DET: PEAK  
Model: ZCS000    MEAS DET: PEAK QP AVG  
Test Engineer: Troy Ihle  
Standard: FCC Part 15.207



**Conducted Emissions**  
**Company:** Adadvanced Control Technology Inc.  
**Model:** ZCU001  
**Test Engineer:** Troy Ihle  
**Standard:** FCC Part 15.107, Class B  
**Note:** The table shows the worst case conducted emissions  
 All measurements were taken using a CISPR Quasi-peak detector

**Table # 3-2-2**

**Line 1**

Frequency MHz	Peak dBμV	AVG dBμV	QP Limit dBμV	AVG Limit dBμV	QP Margin dB	AVG Margin dB
0.150	32.6	N/A	66.0	56.0	-33.4	N/A
0.190	30.4	N/A	64.0	54.0	-33.6	N/A
0.210	29.1	N/A	63.2	53.2	-34.1	N/A
0.240	30.2	N/A	62.1	52.1	-31.9	N/A
0.300	27.7	N/A	60.2	50.2	-32.5	N/A
0.430	22.6	N/A	57.2	47.2	-34.6	N/A
0.500	23.6	N/A	56.0	46.0	-32.4	N/A
0.590	22.5	N/A	56.0	46.0	-33.5	N/A

**Line 2**

Frequency MHz	Peak dBμV	AVG dBμV	QP Limit dBμV	AVG Limit dBμV	QP Margin dB	AVG Margin dB
0.150	33.5	N/A	66.0	56.0	-32.5	N/A
0.180	31.9	N/A	64.5	54.5	-32.6	N/A
0.230	31.2	N/A	62.4	52.4	-31.2	N/A
0.270	30.8	N/A	61.1	51.1	-30.3	N/A
0.320	30.4	N/A	59.7	49.7	-29.3	N/A
0.520	28.2	N/A	56.0	46.0	-27.8	N/A
0.570	29.6	N/A	56.0	46.0	-26.4	N/A
0.650	28.5	N/A	56.0	46.0	-27.5	N/A



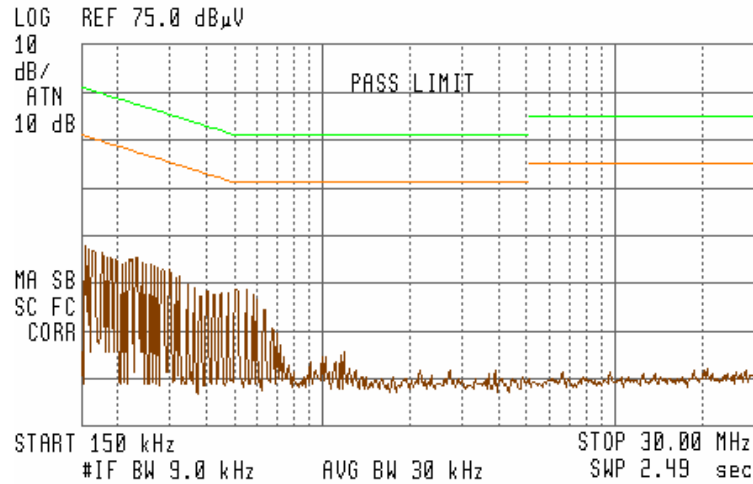
**Graph 3-2-2  
Conducted Emissions**

**Line 1**

14:41:05 DEC 11, 2004

Company: Advanced Control Technologies  
Model: ZCU001  
Test Engineer: Troy Ihle  
Standard: FCC Part 15.207

ACTV DET: PEAK  
MEAS DET: PEAK QP AVG

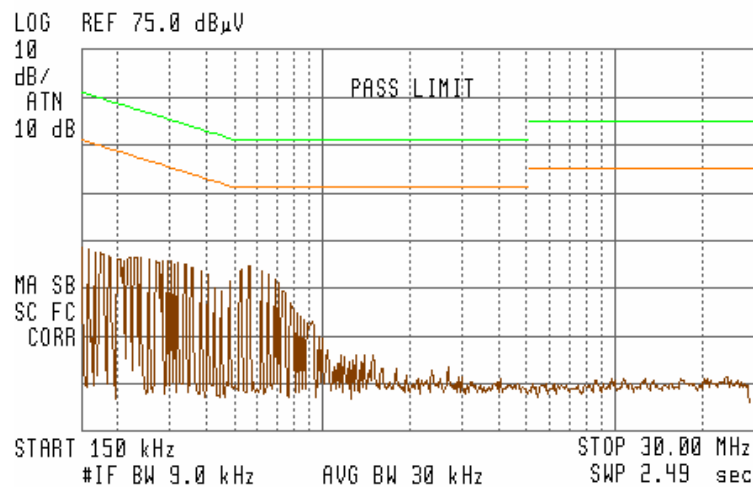


**Line 2**

14:49:45 DEC 11, 2004

Company: Advanced Control Technologies  
Model: ZCU001  
Test Engineer: Troy Ihle  
Standard: FCC Part 15.207

ACTV DET: PEAK  
MEAS DET: PEAK QP AVG



### 3.3 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.

### 3.4 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 dBi

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 dBi is subtracted giving field strength of 41.1 dB( $\mu$ V/m).

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

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

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

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

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

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

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

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

Tested by:

Troy Ihle  
Sr. Associate Engineer  
Intertek

Signature

Date: December 15, 2004

#### 4.0 TEST EQUIPMENT

##### Receivers/Spectrum Analyzers

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

##### Antennas/Pre-Amplifiers

DESCRIPTION	SERIAL NO.	LAST CAL	CAL DUE	USED
Schaffner-Chase Bicono-Log Antenna	2468	01/04	01/05	X
EMCO Horn Antenna 3115	9507-4513	12/03	12/04	X

##### Artificial Mains Networks/Absorbing Clamps

DESCRIPTION	SERIAL NO.	LAST CAL	CAL DUE	USED
FCC LISN-2	316	05/04	05/05	X

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



**Radiated Emissions Test Configuration**



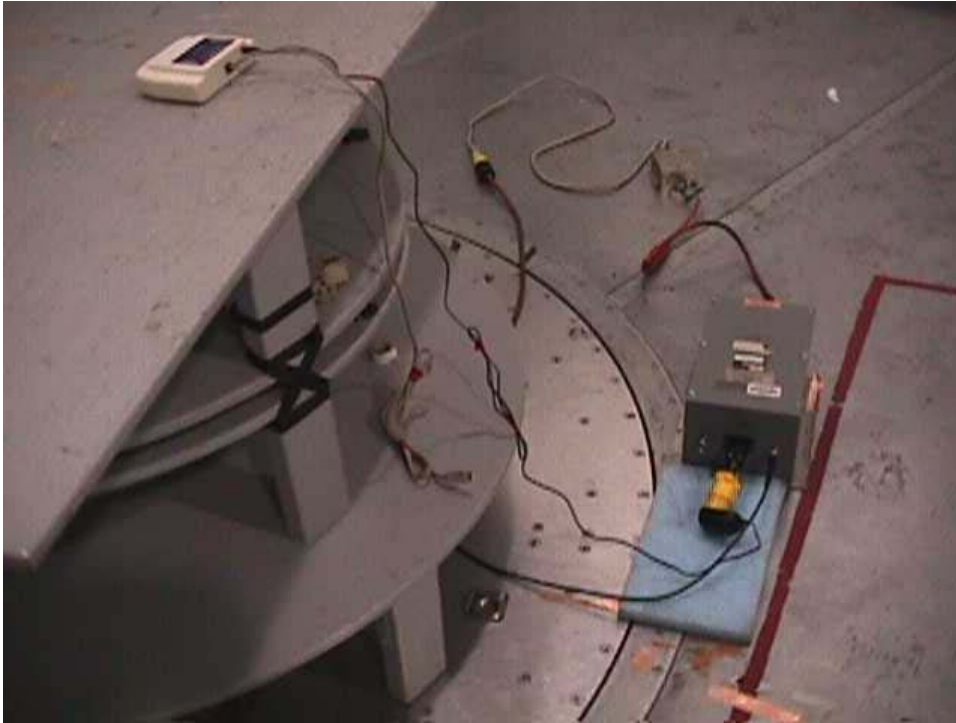
**Radiated Emissions Test Configuration**



**Radiated Emissions Test Configuration**



**Radiated Emissions Test Configuration**



**Conducted Emissions Test Configuration**



**Conducted Emissions Test Configuration**