



## **Advanced Control Technologies Inc.**

Application  
For Certification  
ZDP 100 Repeater

**(FCC ID: QIE06X7-0X)**

June 24, 2002



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# ITS Intertek Testing Services

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## 1.0 GENERAL DESCRIPTION

### 1.1 Related Submittals Grants

This is single application of the *ZDP 100* Repeater for Certification under Part 15 Subpart C. There are no other simultaneous applications.

### 1.2 Product Description

The *ZDP 100* Repeater is a RF remote control operating in 908.44MHz. The intended use of the *ZDP 100* Repeater is to generate and transmit a RF signal upon receive the RF signal from other source. The *ZDP 100* Repeater powered at 120VAC/60Hz.

The *ZDP 100* Repeater antenna is an integrated antenna.

### 1.3 Test Methodology

Emission measurements were performed according to the procedures in ANSI C63.4-1992. 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 January 2000 submitted to your office. Please reference the site registration number: 90706, dated May 19, 2000.

## 2.0 SYSTEM TEST CONFIGURATION

### 2.1 Justification

Based on the interpretation of the rules provided by Advanced Control Technologies in reference to the FCC e-mail dated July 12, 2002 (uploaded with application), the Repeater Line Conducted Emissions testing per FCC Part 15.207 was performed with the dimmer function disabled.

### 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.

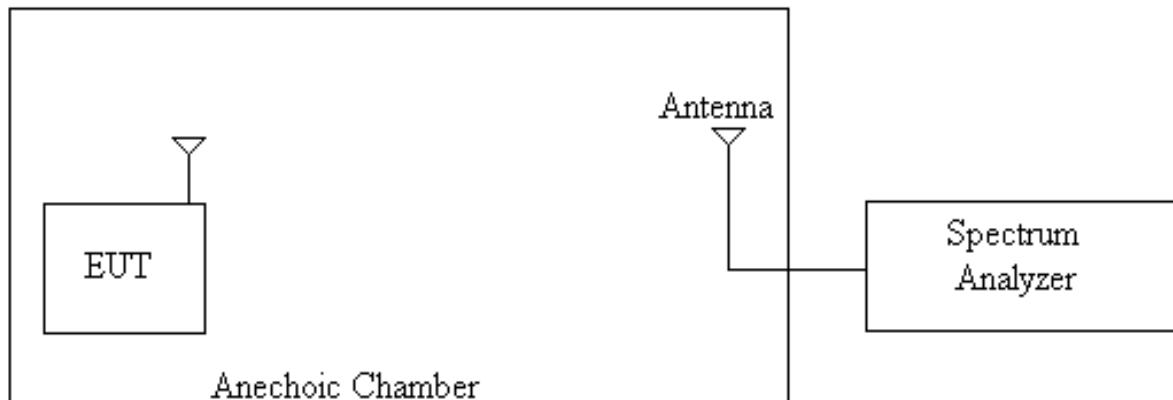
### 2.5 Support Equipment List and Description

N/A

## 2.6 Test Setup and Test Configuration Block Diagrams

The EUT was setup as tabletop equipment.  
The EUT was powered at 120VAC/60Hz.

### Field Strength Measurements



## 3.0 TEST RESULTS

Data is included of 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
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 908.44MHz. The Harmonics emissions were tested up to 10<sup>th</sup> harmonic.

The Table # 3-1-1 and Graphs ## 3-1-1 to 3-1-4 below show the Field Strength of Fundamental Radiation and Harmonics Emissions in the Restricted Bands of Operation according to FCC 15.205. No emissions above ambient was found at 5<sup>th</sup> and higher harmonics.

**Note:** Emission level shown on the Graphs does not include the Antenna and Cable correction factors and Pre-amplifier gain.

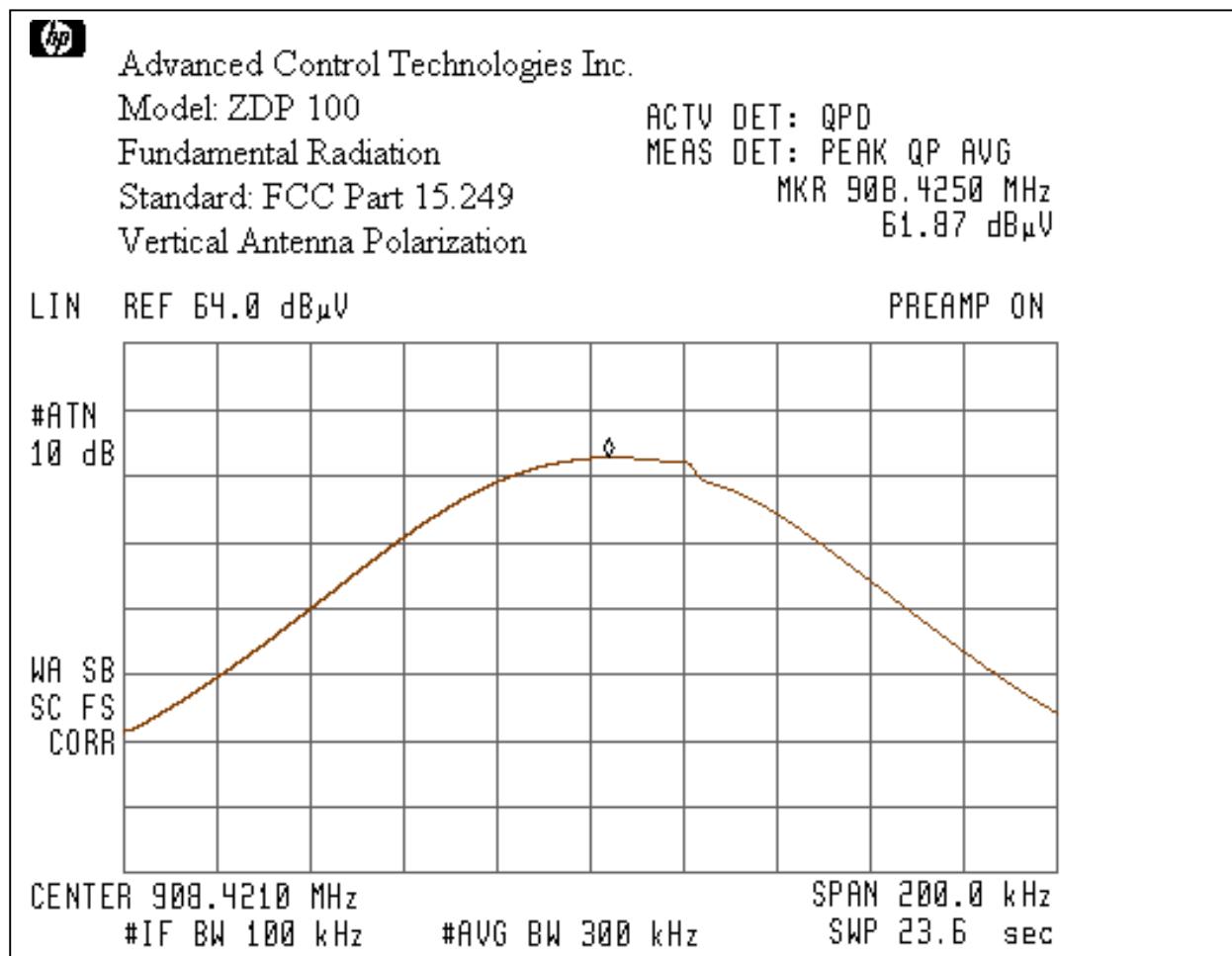
# ITS Intertek Testing Services

**Radiated Emissions** **Date:** 6/21/02  
**Company:** Advanced Control Technologies Inc.  
**Model:** ZDP100  
**Test Engineer:** Norman Shpilsher  
**Special Config. Info:** Transitting mode of operation  
**Standard:** FCC Part 15.249, 15.205  
**Test Site:** 3 m Anechoic Chamber  
**Note:** Measurements were taking using a CISPR Quasi-Peak Detector for frequencies below 1GHz with 100kHz Resolution Bandwidth  
 For frequencies above 1GHz measurements were taking using a Peak Detector with 1MHz Resolution Bandwidth  
 No emissions were found above ambient at 5th and higher harmonics.

**Table # 3-1-1**

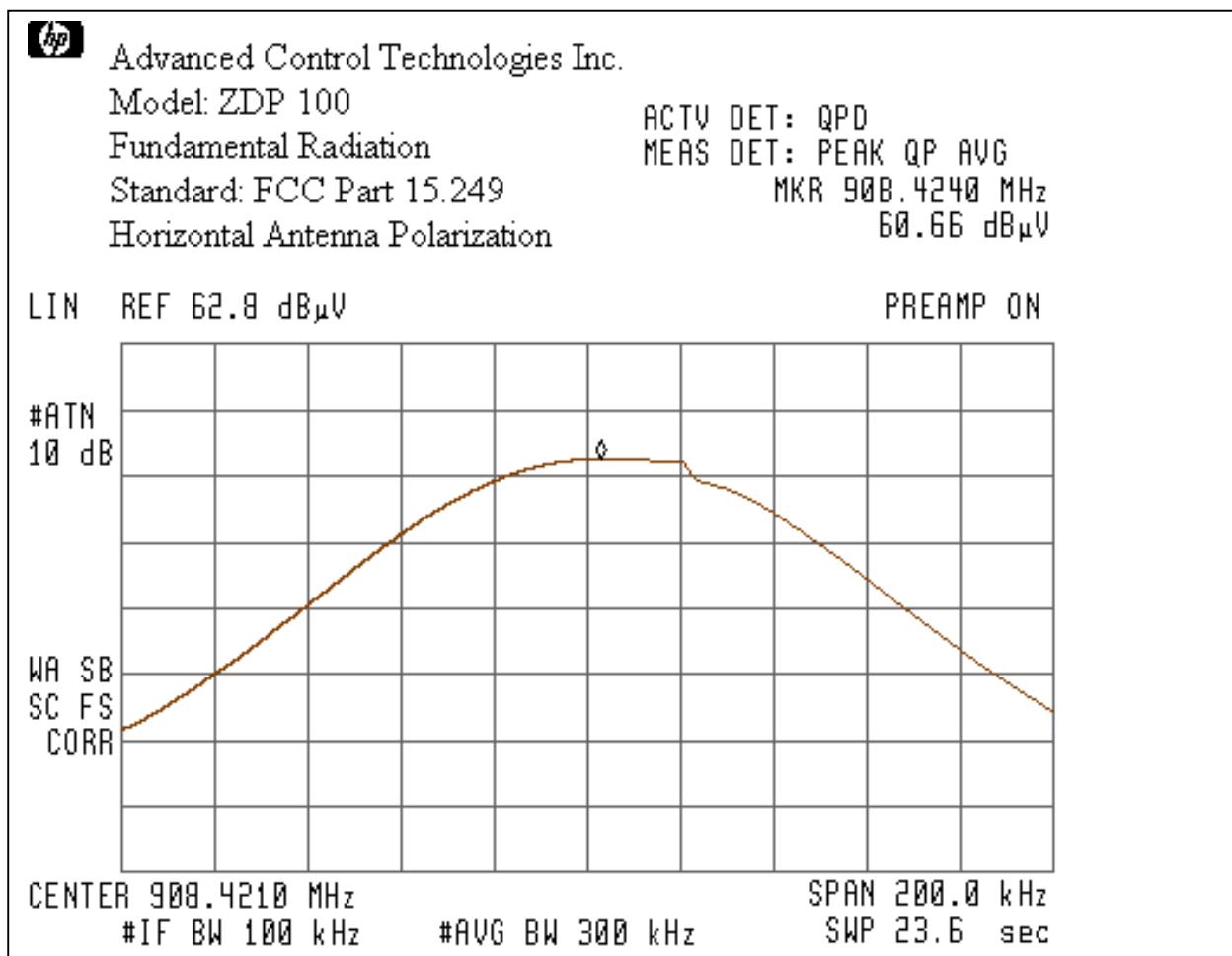
Frequency MHz	Antenna			Total Factor(dB/m)	Reading dB <sub>1</sub> V	Net at 3m dB <sub>1</sub> V/m	Limit dB <sub>1</sub> V/m	Margin dB	Comments
	Polarity	Hts(m)	Dir (°)						
908.42	V	148	196	25.08	61.87	86.95	93.98	-7.03	Fund.
908.42	H	153	293	25.08	60.66	85.74	93.98	-8.24	Fund.
1816.87	V	122	55	-2.90	42.89	39.99	N/A	N/A	2nd harm.
1816.87	H	223	130	-2.90	43.09	40.19	N/A	N/A	2nd harm.
2725.35	V	153	115	0.78	44.41	45.19	53.98	-8.79	3rd harm.
2725.35	H	196	170	0.78	49.93	50.71	53.98	-3.27	3rd harm.
3633.85	V	165	24	4.93	37.55	42.48	53.98	-11.50	4th harm.
3633.85	H	204	73	4.93	37.93	42.86	53.98	-11.12	4th harm.
4542.28	V	104	102	6.98	32.10	39.08	53.98	-14.90	5th harm.
4542.28	H	160	132	6.98	32.05	39.03	53.98	-14.95	5th harm.

### Graph # 3-1-1



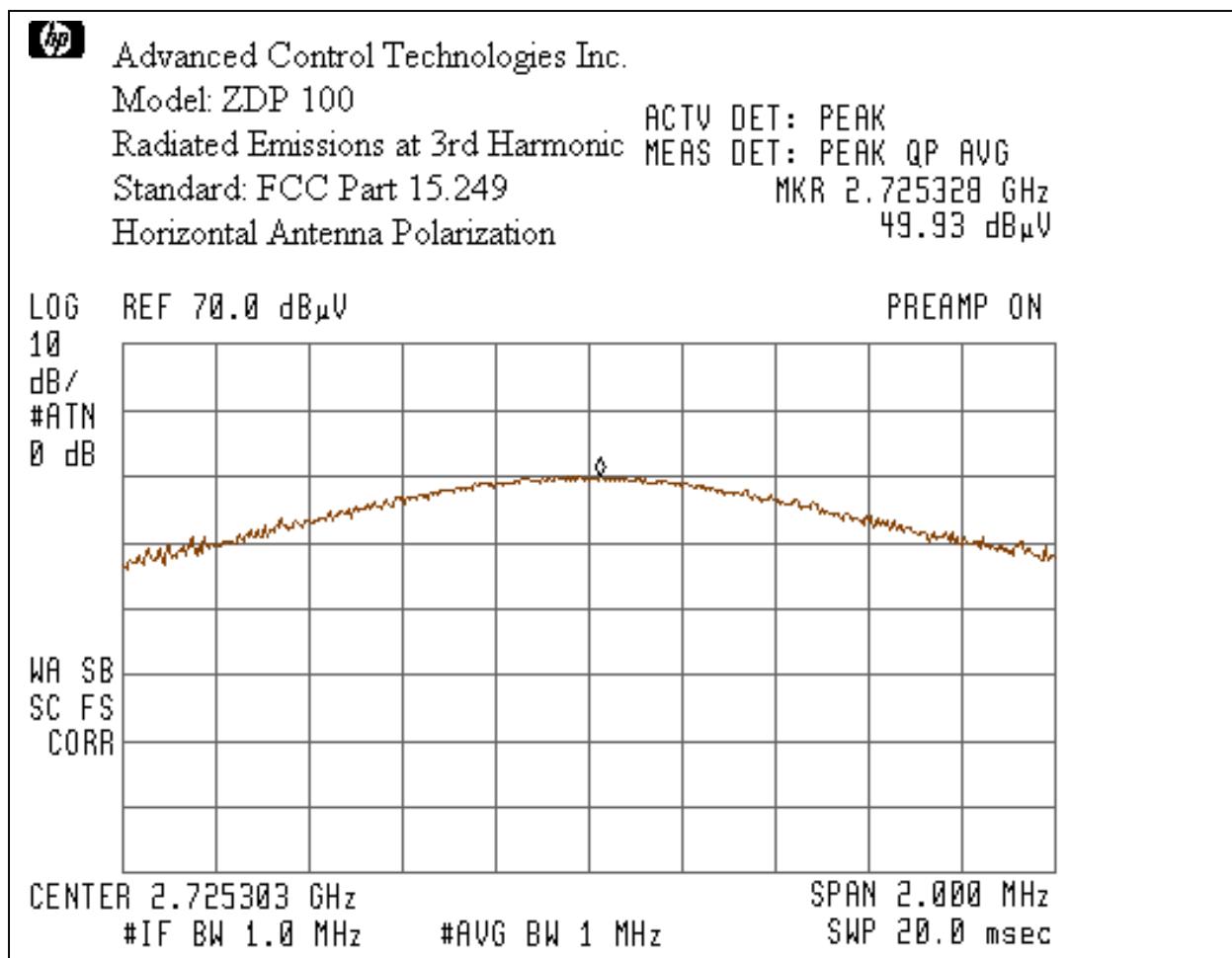
# ITS Intertek Testing Services

Graph # 3-1-2



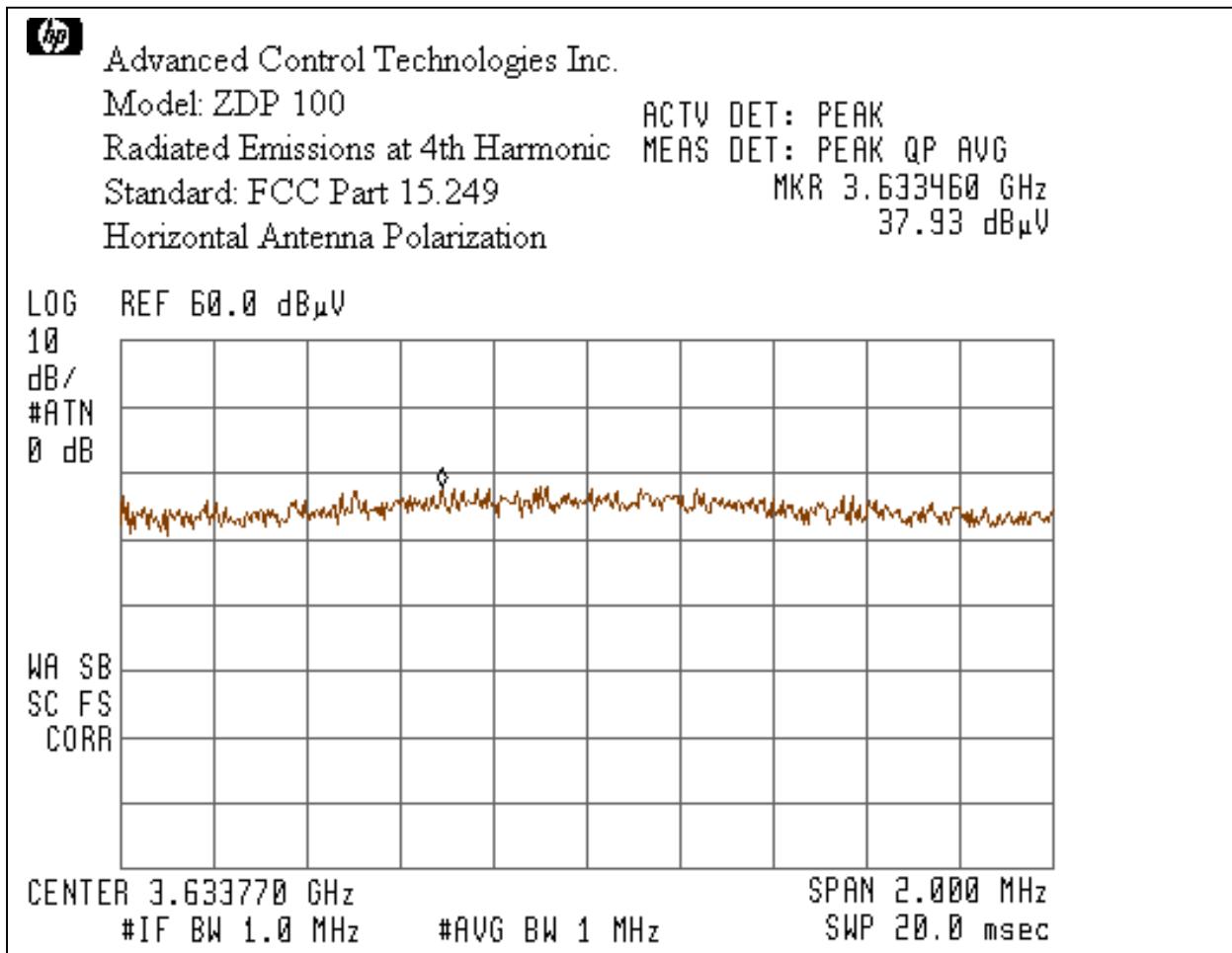
# ITS Intertek Testing Services

Graph # 3-1-3



# ITS Intertek Testing Services

## Graph # 3-1-4



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

Out-of-band measurements were made for frequencies:

- 902MHz
- 928MHz.

Output frequencies of the EUT was 908.44MHz

The Table # 3-2-1and Graphs ## 3-2-1 and 3-2-2 show the Out of Band Spurious Emissions.

**Note:** Emission level shown in the Graphs does not include the Antenna, Cable and Pre-amplifier correction factors.

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## Radiated Emissions: Out of Band Emissions

Date: 6/21/02

**Company:** Advanced Control Technologies Inc.  
**Model:** ZDP100  
**Test Engineer:** Norman Shpilsher  
**Special Config. Info:** Frequency range 902 to 928MHz  
**Standard:** FCC Part 15.249, 15.209  
**Test Site:** 3 m Anechoic Chamber  
**Note:** Measurements were taken using a Peak detector

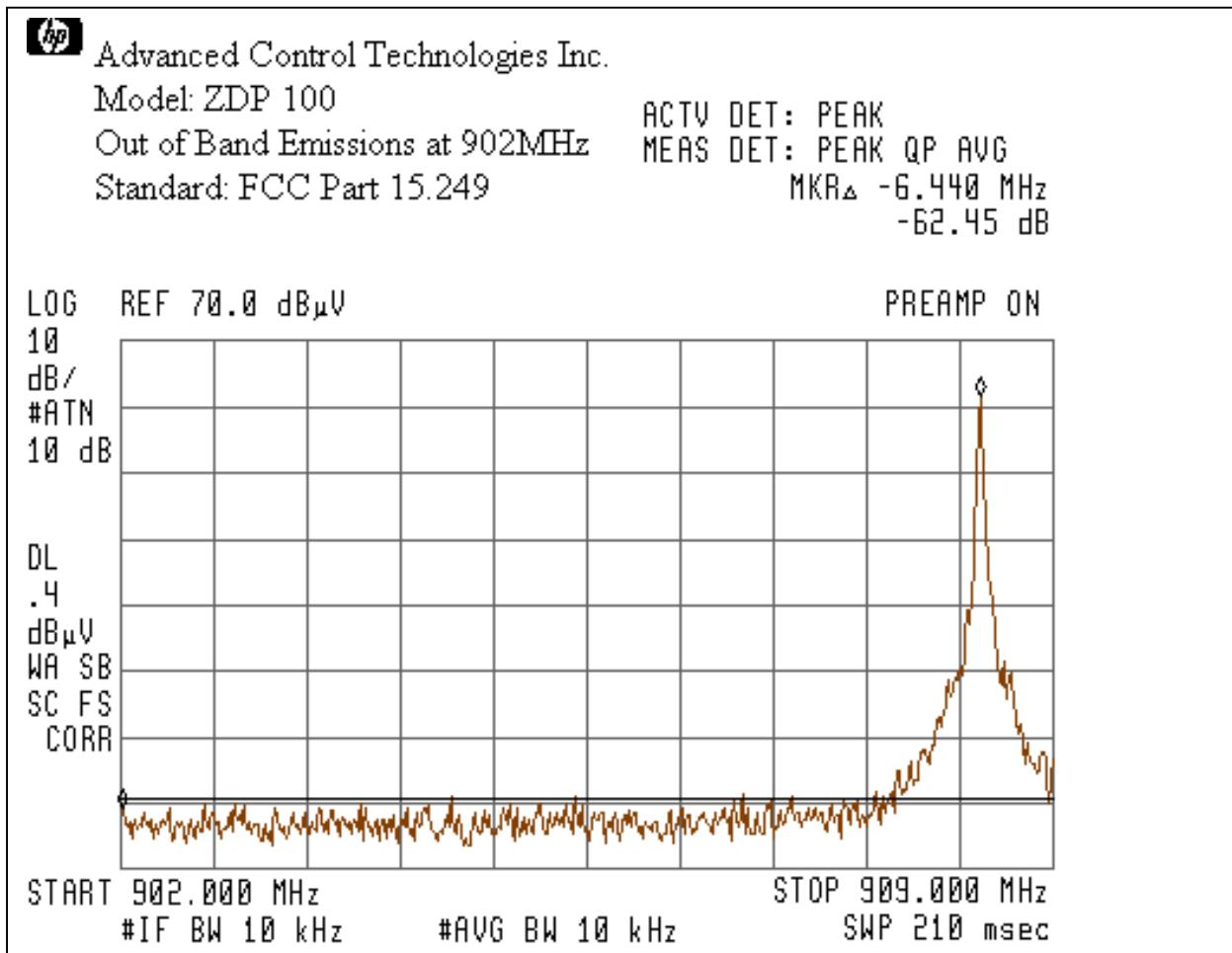
**Table # 3-2-1**

Frequency MHz	Reading dB <sub>1</sub> V	Total Factor dB/m	Net at 3m dB <sub>1</sub> V/m	15.249 Attenuation dB	15.249 Limit dB <sub>1</sub> V/m	15.249 Margin dB	15.209 Limit dB <sub>1</sub> V/m	15.209 Margin dB
908.44								
902.00	0.4	25.0	25.4	62.5	50.0	-12.5	46	-20.6
908.44								
928.00	0.9	25.3	26.2	62.1	50.0	-12.1	46	-19.8

## Comments:

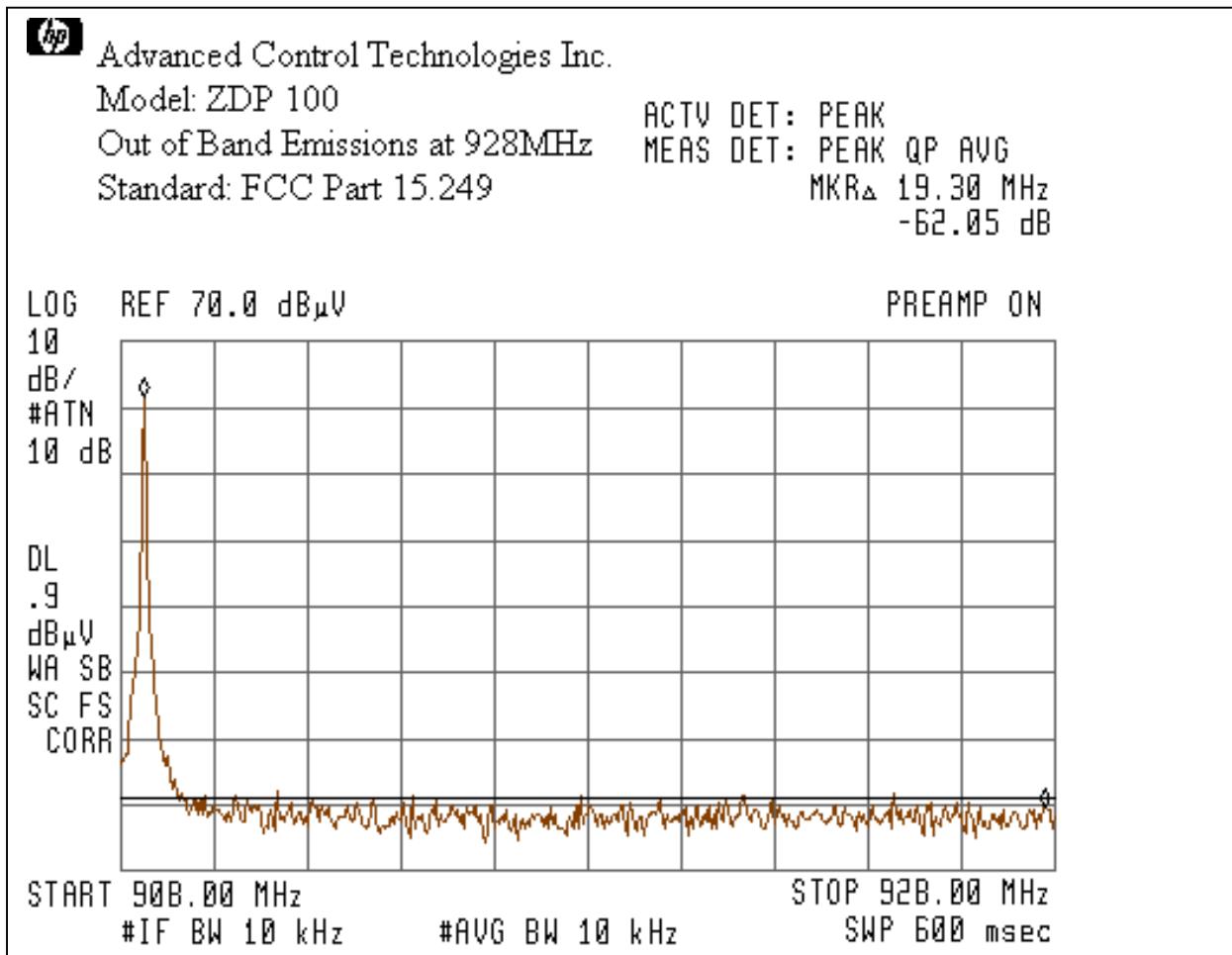
# ITS Intertek Testing Services

Graph # 3-2-1



# ITS Intertek Testing Services

Graph # 3-2-2



### **3.3 Line Conducted Emissions, FCC 15.207**

Line Conducted Emissions testing was performed in frequency range from 450kHz to 30MHz. The dimmer function of the Repeater was disabled during testing (See Section 2.1)

The Table # 3-3-1 and Graphs ## 3-3-1 and 3-3-2 show the Line Conducted Emissions.

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## TILE Instrument Control System EMI Measurement Software

**Conducted Emissions**    **Date:** 6/21/02  
**Company:** Advanced Control Technologies Inc.  
**Model:** ZDP100  
**Test Engineer:** Norman Shpilsher  
**Special Info:** The dimmer function of the EUT was not active during testing  
**Standard:** FCC Part 15.207  
**Note:** The table shows the worst case conducted emissions  
 All measurements were taken using a CISPR Quasi-peak detector

**Table # 3-3-1**

**Line 1**

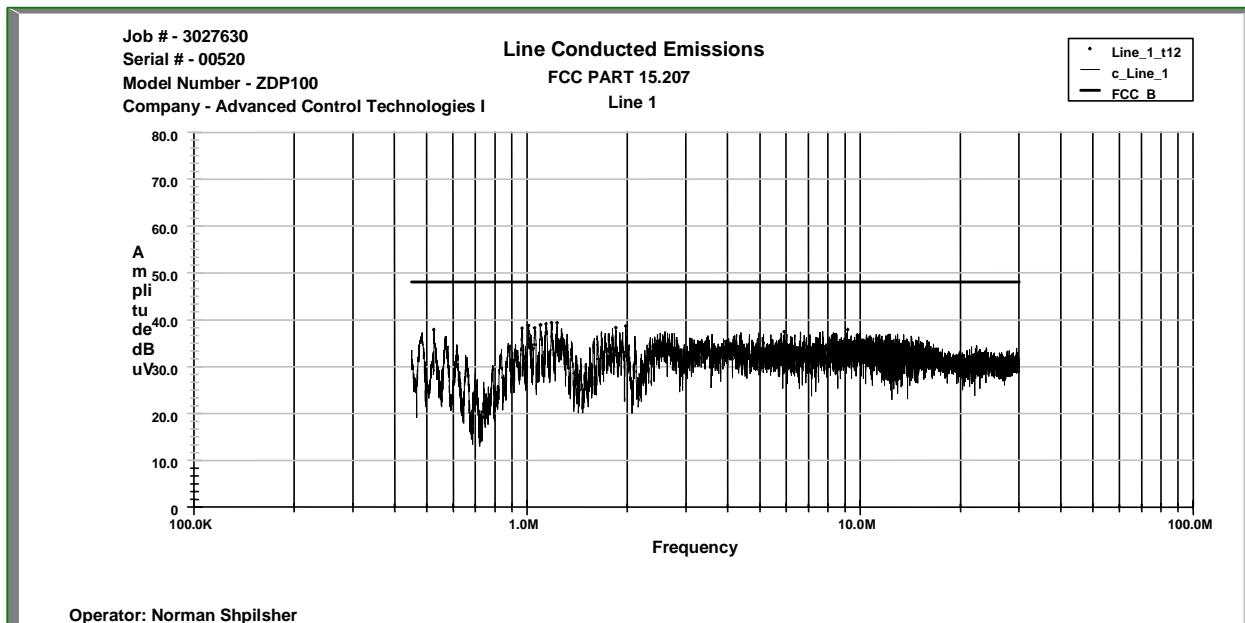
Frequency MHz	QP dB <sub>u</sub> V	AVG dB <sub>u</sub> V	QP Limit dB <sub>u</sub> V	Margin dB
530.62 KHz	35.2	31.46	48.0	-12.8
971.89 KHz	36.27	32.13	48.0	-11.7
1.0158 MHz	37.38	35.69	48.0	-10.6
1.0606 MHz	37.44	33.51	48.0	-10.5
1.1027 MHz	38.03	36.38	48.0	-9.9
1.1486 MHz	37.6	34.03	48.0	-10.4
1.1926 MHz	36.41	33.05	48.0	-11.6
1.2386 MHz	36.45	31.61	48.0	-11.5
1.8595 MHz	36.14	33.31	48.0	-11.8
1.9871 MHz	35.42	29.64	48.0	-12.5
5.8553 MHz	33.99	27.82	48.0	-14.0
9.1316 MHz	33.06	25.55	48.0	-14.9

**Line 2**

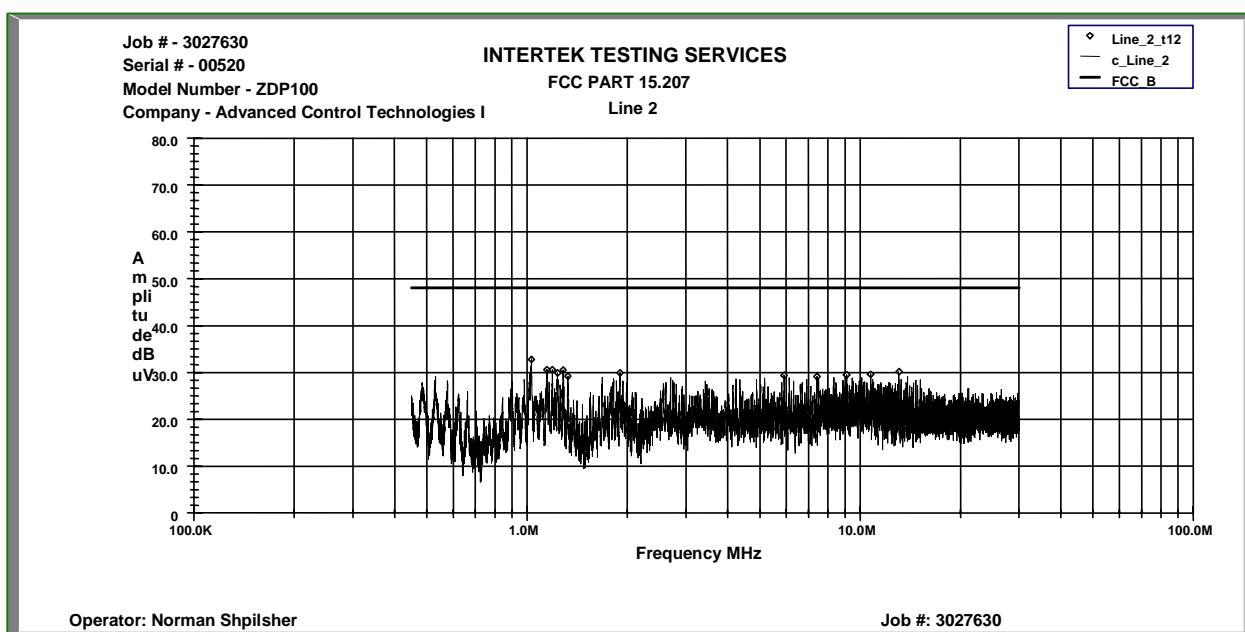
Frequency MHz	QP dB <sub>u</sub> V	AVG dB <sub>u</sub> V	QP Limit dB <sub>u</sub> V	Margin dB
1.0295 MHz	33	29.36	48.0	-15.0
1.1485 MHz	27.96	20.73	48.0	-20.0
1.1944 MHz	26.38	19.23	48.0	-21.6
1.2413 MHz	27.88	19.67	48.0	-20.1
1.2843 MHz	26.84	17.92	48.0	-21.1
1.326 MHz	25.68	16.89	48.0	-22.3
1.9026 MHz	27.09	18.93	48.0	-20.9
5.9548 MHz	24.06	15.34	48.0	-23.9
7.3259 MHz	22.33	14.69	48.0	-25.6
9.1772 MHz	23.35	14.13	48.0	-24.6
10.775 MHz	21.53	11.68	48.0	-26.4
13.173 MHz	19.41	11.58	48.0	-28.6

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## Graph #3-3-1



## Graph #3-3-2



## 3.4 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. The Horn antenna with the pre-amplifier was used in frequency range above 1GHz. The radiated emissions were maximized by configuring the EUT, 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 3.5.

## 3.5 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).

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

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

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

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

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

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

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

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

Tested by:

Norman Shpilsher  
EMC Project Engineer  
Intertek Testing Services NA, Inc.

Signature

Norman Shpilsher

Signature

Date: June 24, 2002

# ITS Intertek Testing Services

## 4.0 TEST EQUIPMENT

### Receivers/Spectrum Analyzers

DESCRIPTION	SERIAL NO.	LAST CAL DATE	CAL DUE	TICK IF USED
HP85462A Receiver RF Section	3325A00106	07/01	07/02	X
HP85460A RF Filter Section	3330A00109	07/01	07/02	X
Advantest Spectrum Analyzer R3271A	55050084	06/02	06/03	X
HP 83017A Microwave Amplifier	3123A00475	09/01	09/02	X

### Antennas

DESCRIPTION	SERIAL NO.	LAST CAL DATE	CAL DUE	TICK IF USED
Schaffner-Chase Bicono-Log Antenna	2468	11/01	11/02	X
A.H. Systems SAS-200/562B Loop antenna	215	11/01	11/02	
EMCO Horn antenna 3115	9507-4513	09/01	09/02	X
EMCO Horn antenna 3115	6579	12/01	12/02	
EMCO Horn antenna 3116	9904-2423	10/01	10/02	

### Artificial Mains Networks/Absorbing Clamps

DESCRIPTION	SERIAL NO.	LAST CAL DATE	CAL DUE	TICK IF USED
FCC LISN-2	316	01/02	01/03	
FCC-LISN-50-25-2	2014	04/02	04/03	

**EXHIBIT I**

**TEST SET UP PHOTOS**

**EXHIBIT II**

**FCC ID LABEL LOCATION**

**(See ID Label/Location Info. Attachments)**

**EXHIBIT III**

**EXTERNAL PHOTOS**

**EXHIBIT IV**

**INTERNAL PHOTOS**

**EXHIBIT V**

**ELECTRICAL SCHEMATICS AND BLOCK DIAGRAM**

**(See Block Diagram and Schematic Attachments)**

**EXHIBIT VI**

**USER MANUAL AND OPERATIONAL DESCRIPTION**

**(See User Manual and Operational Description Attachments)**