



Advanced Control Technologies Inc.

Application
For Certification
ZDP 100 Repeater

(FCC ID: QIE06X7-0X)

June 24, 2002



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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.

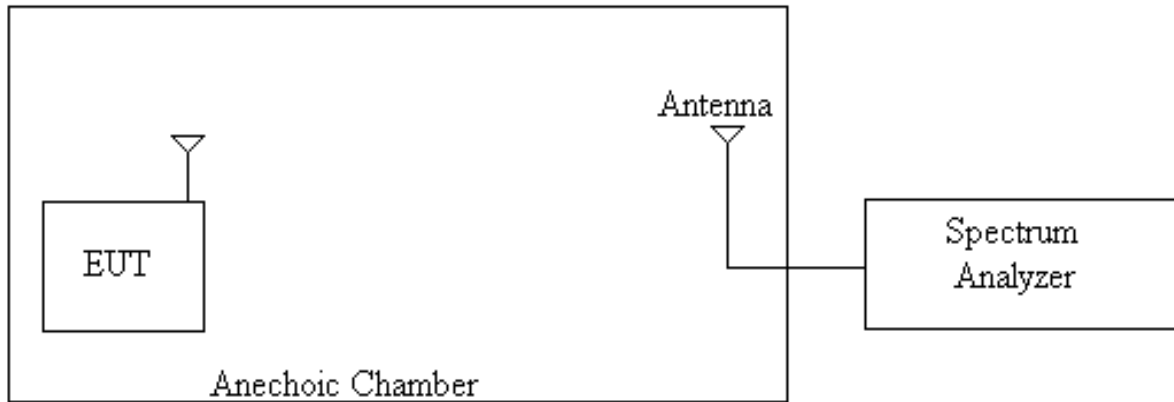
2.5 Support Equipment List and Description

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 10th 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 5th and higher harmonics.

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



Intertek Testing Services

Radiated Emissions
Company:
Model:
Test Engineer:
Special Config. Info:
Standard:
Test Site:
Note:
Date: 6/21/02

Advanced Control Technologies Inc.

ZDP100

Norman Shpilsher

Transitting mode of operation

FCC Part 15.249, 15.205

3 m Anechoic Chamber

Measurements were taking using a CISPR Quasi-Peak Detector for frequencies below 1GHz with 100kHz Resolution Bandwidth

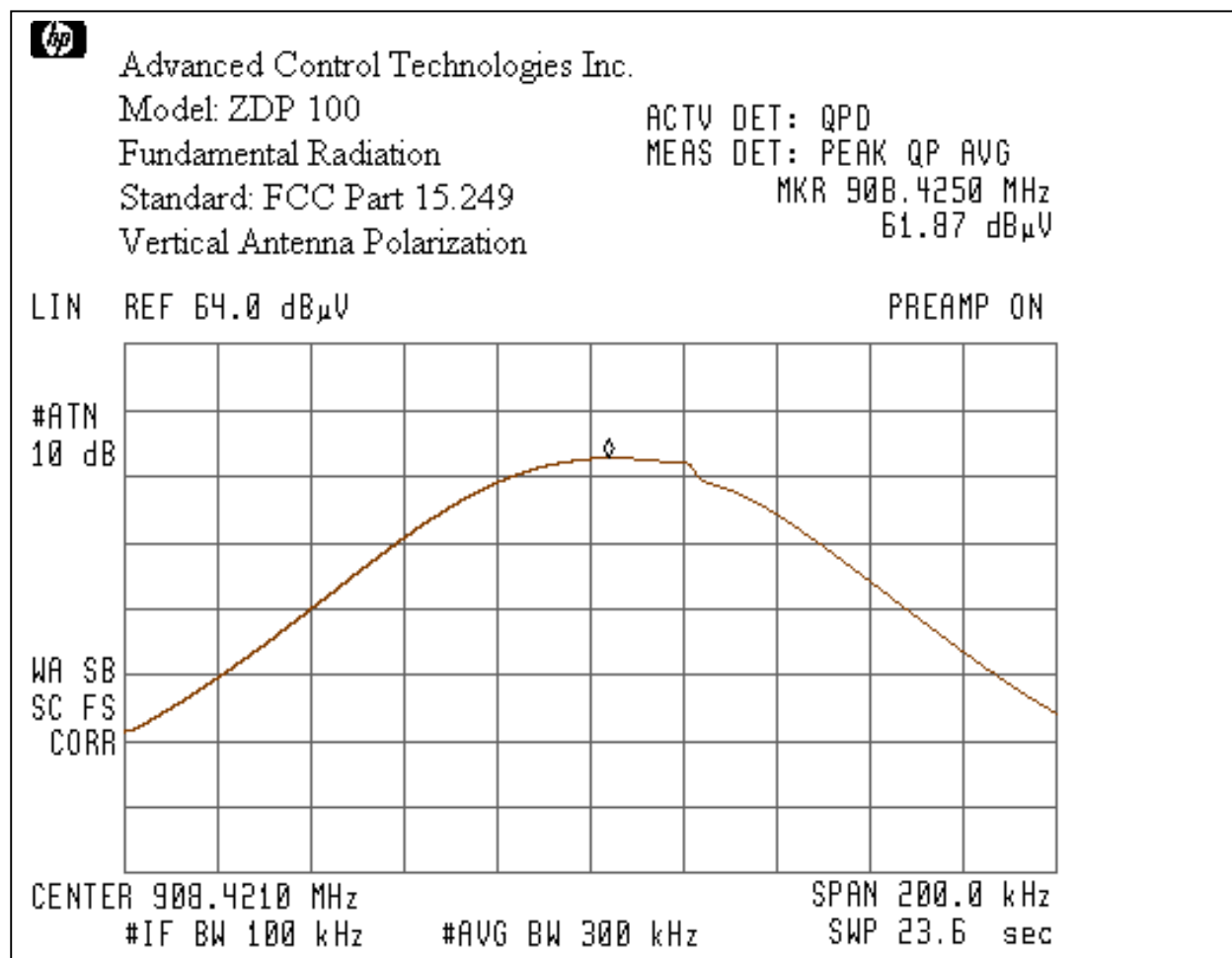
For frequencies above 1GHz measurements were taking using a Peak Detector with 1MHz Resolution Bandwidth

No emissions were found above ambient at 5th and higher harmonics.

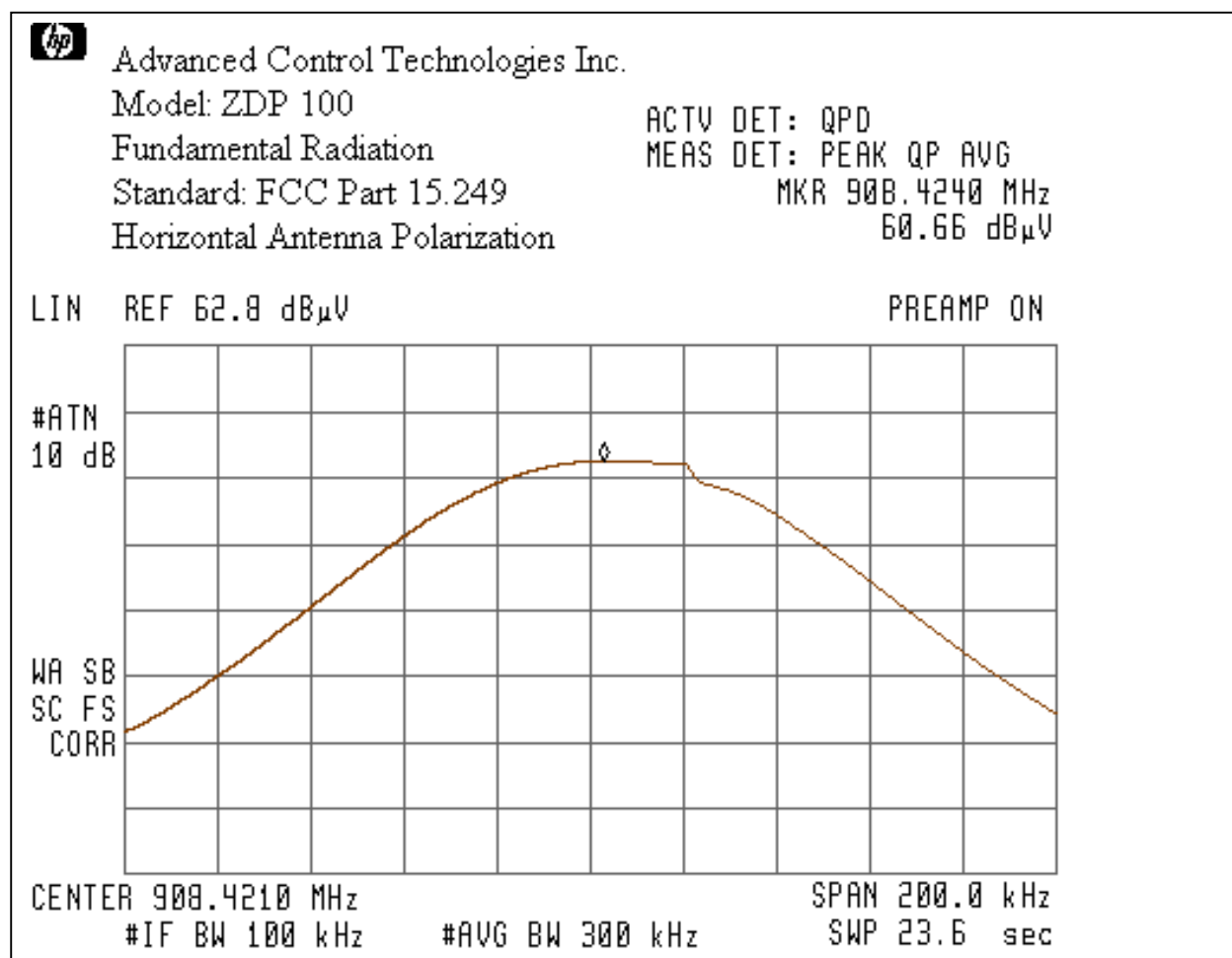
Table # 3-1-1

| Frequency MHz | Antenna | | | Total Factor(dB/m) | Reading dB μ V | Net at 3m. dB μ V/m | Limit dB μ 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. |

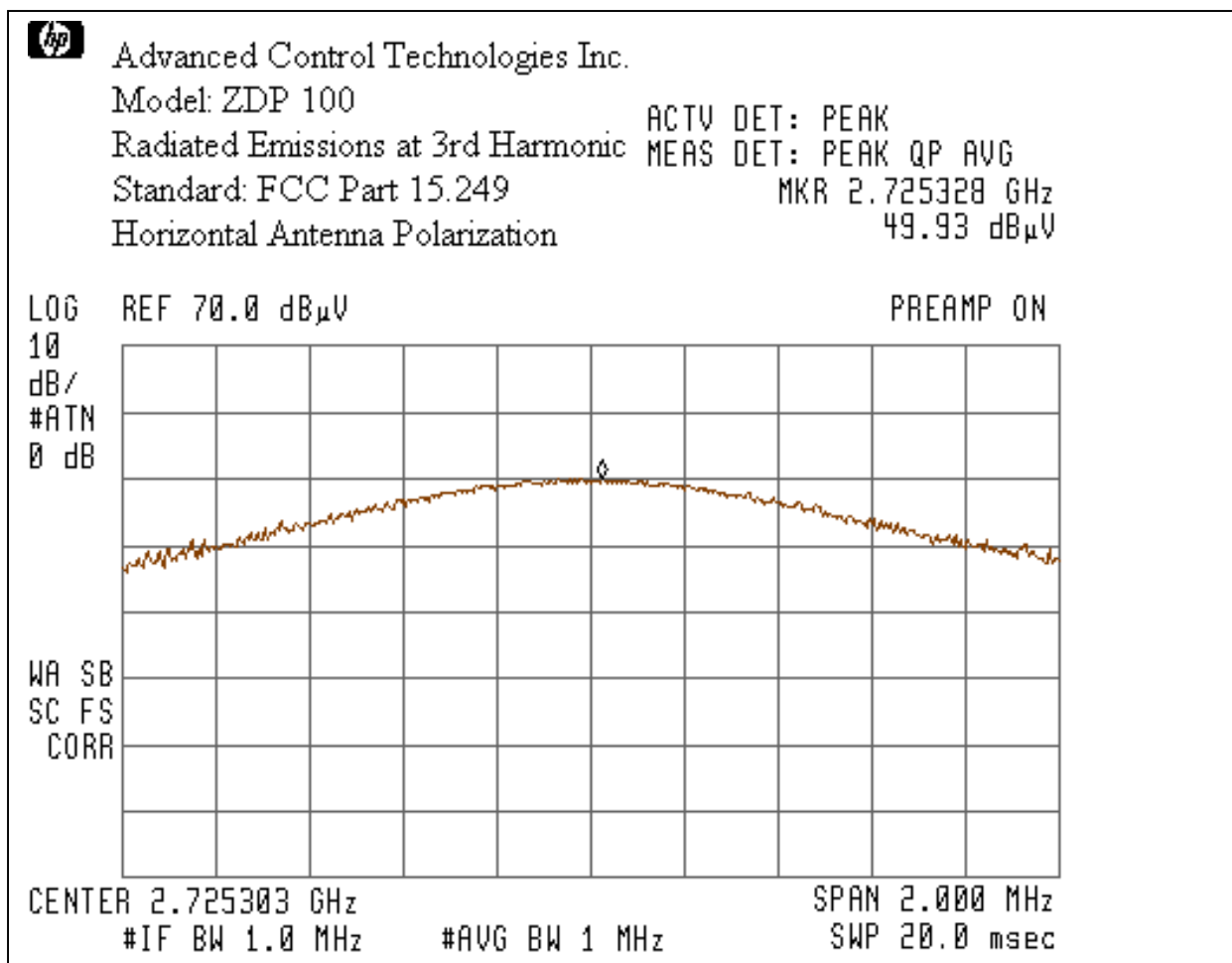
Graph # 3-1-1



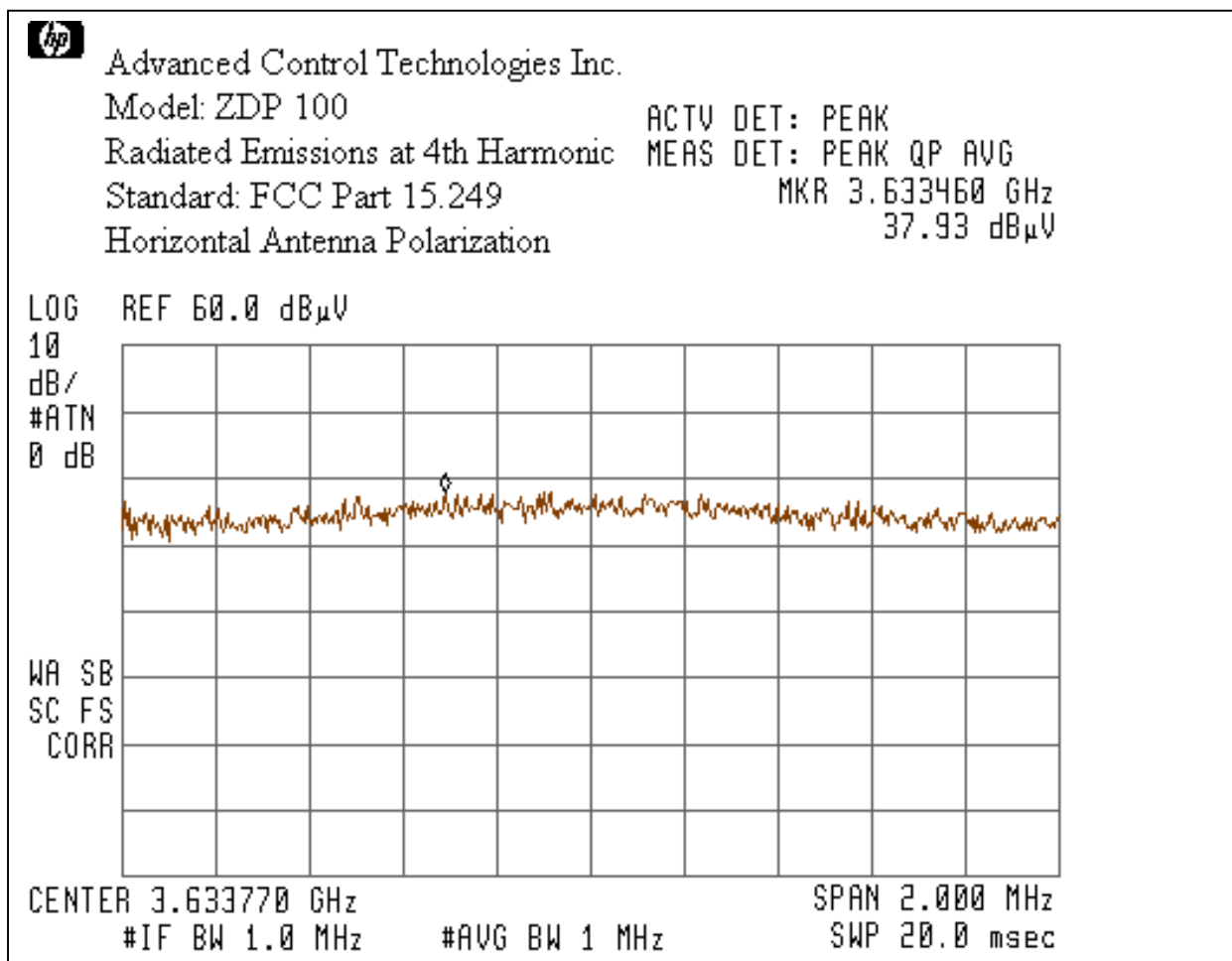
Graph # 3-1-2



Graph # 3-1-3



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 # 3-2-1 and 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.

**Radiated Emissions: Out of Band Emissions****Date:** 6/21/02

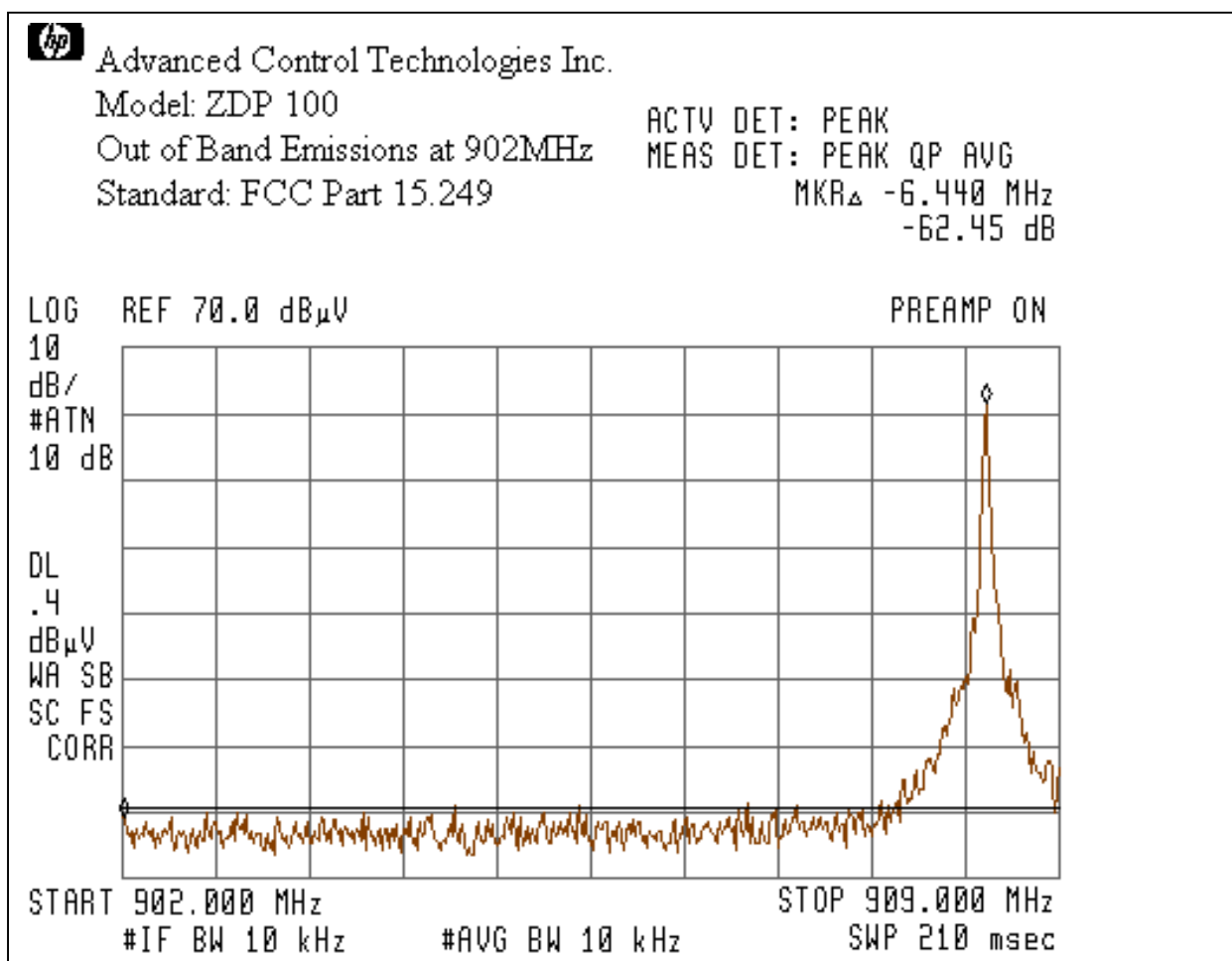
Company: Advanced Control Technologies Inc.
Model: ZDP100
Test Engineer: Norman Shpilsher
Special Config. Info: Frequency range 902 to 928MHz
Standard: FCC Part 15.249, 15.209
Test Site: 3 m Anechoic Chamber
Note: Measurements were taken using a Peak detector

Table # 3-2-1

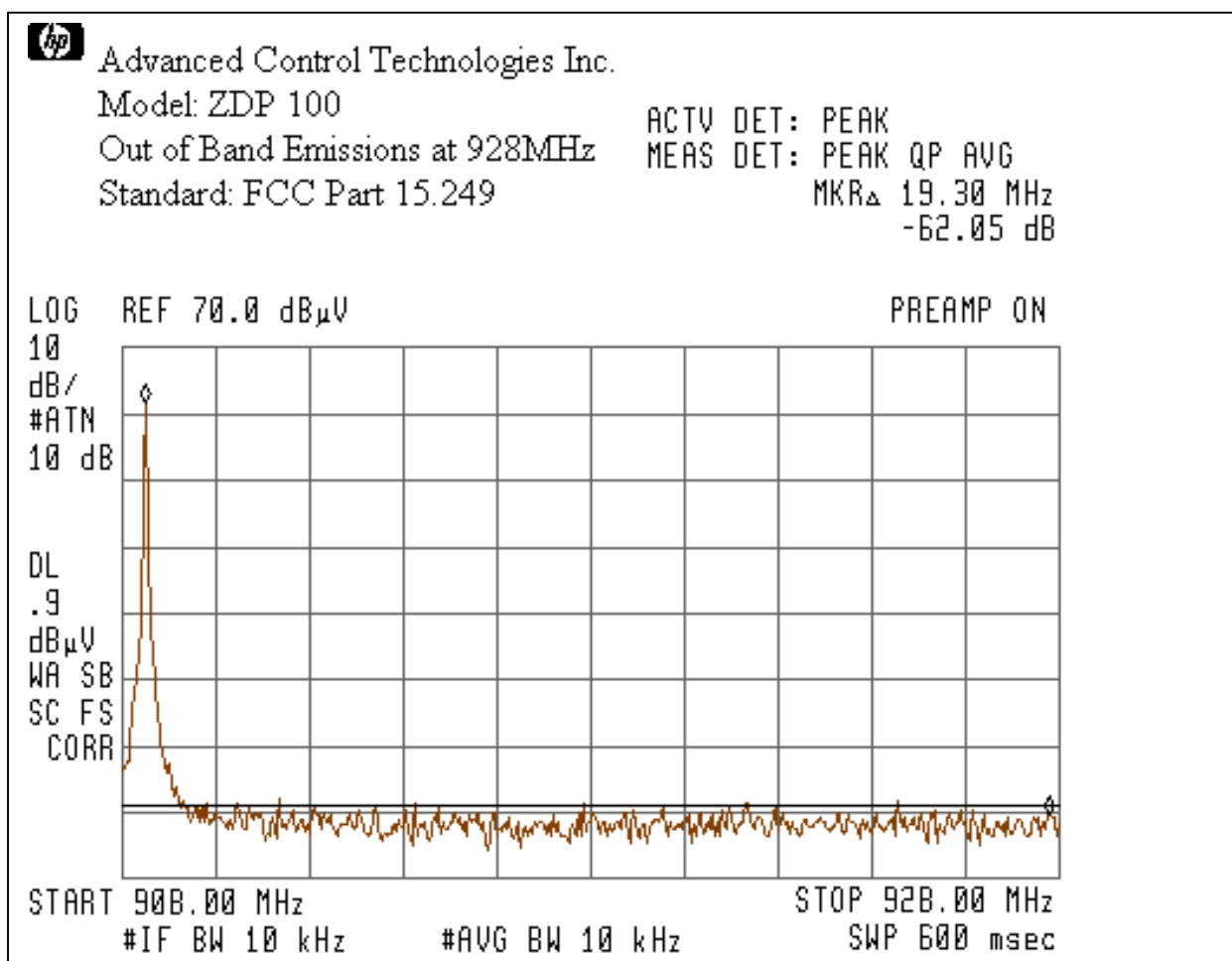
| Frequency MHz | Reading dB _μ V | Total Factor dB/m | Net at 3m dB _μ V/m | 15.249 Attenuation dB | 15.249 Limit dB _μ V/m | 15.249 Margin dB | 15.209 Limit dB _μ V/m | 15.209 Margin dB |
|------------------|------------------------------|-------------------------|----------------------------------|-----------------------------|--|------------------------|--|------------------------|
| 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:

Graph # 3-2-1



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.

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

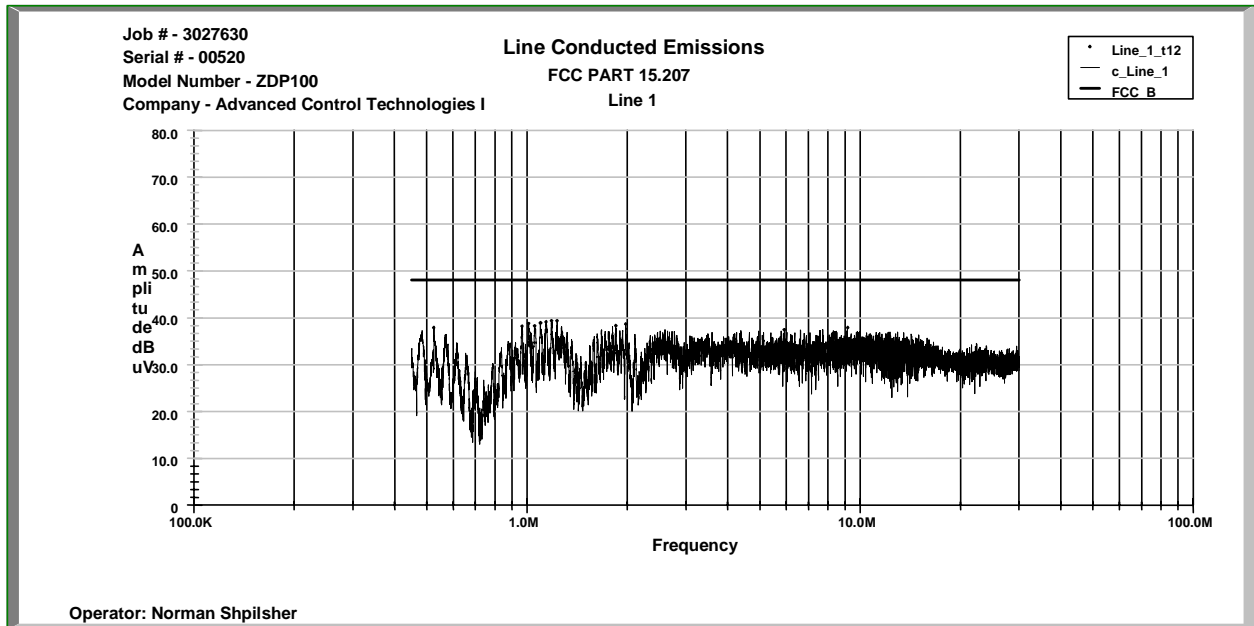
| Frequency MHz | QP dB _μ V | AVG dB _μ V | QP Limit dB _μ V | Margin dB |
|------------------|-------------------------|--------------------------|-------------------------------|--------------|
| 530.62 KHz | 35.2 | 31.46 | 48.0 | -12.8 |
| 971.89 KHz | 36.27 | 32.13 | 48.0 | -11.7 |
| 1.0158 MHz | 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

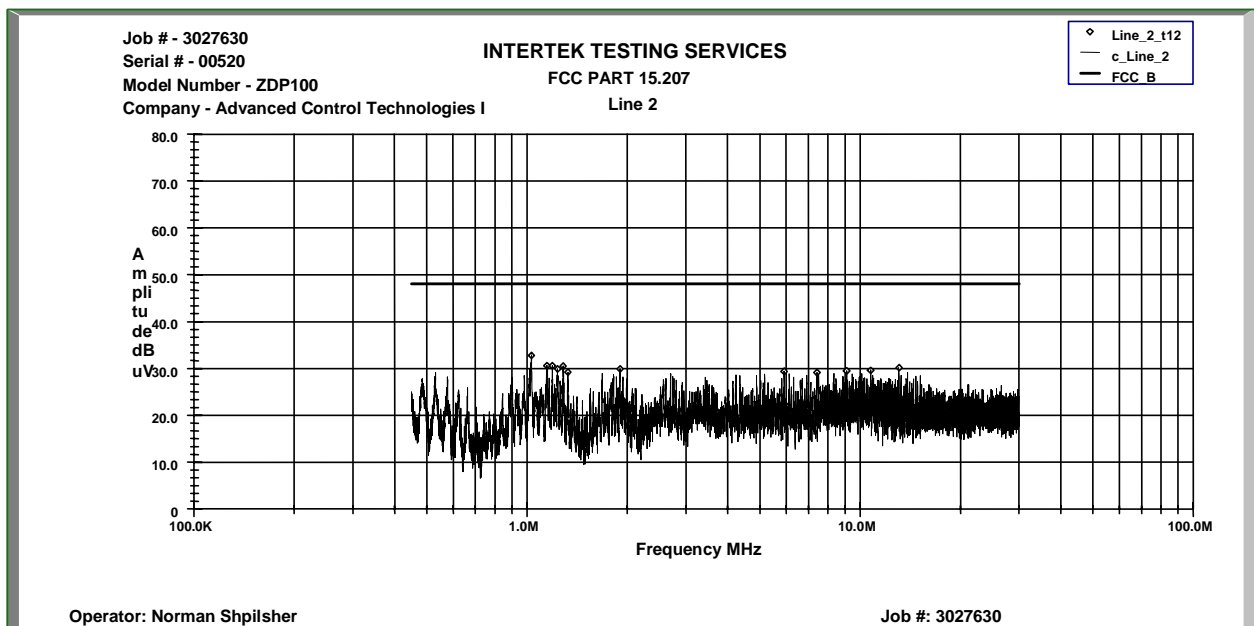
| Frequency MHz | QP dB _μ V | AVG dB _μ V | QP Limit dB _μ V | Margin dB |
|------------------|-------------------------|--------------------------|-------------------------------|--------------|
| 1.0295 MHz | 33 | 29.36 | 48.0 | -15.0 |
| 1.1485 MHz | 27.96 | 20.73 | 48.0 | -20.0 |
| 1.1944 MHz | 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 |



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(μ V/m)

RA = Receiver Amplitude in dB(μ 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(μ 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(μ V/m).

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

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

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

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

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

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

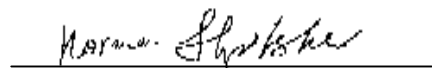
$$FS = 41.1 \text{ dB}(\mu\text{V}/\text{m})$$

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



Signature

Date: June 24, 2002

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)