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Intertek Testing Services NA Inc.
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Emissions Testing
Performed on the:
ERS International, Inc.

Model: SN-ACATR-11
To FCC Part 15 Subpart C Intentional Radiators

Date of Test: June 20, 21 and 29, 2000

JOB #: J20015003

DOT: June 20, 21 & 29, 2000
Contact: Steve Flynn

Total No. of Pages Contained in this Report: 24

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INTERTEK TESTING SERVICES NA INC.

TO: Steve Flynn

FROM: Andy Bellezza

DATE: July 14, 2000

JOB #: J20015003

RE: Emissions Testing Performed On The Active Cell Antenna, Model: SN-ACATR-11

On June 20, 21 and 29, 2000 we tested the Active Cell Antenna, Model: SN-ACATR-11 to determine if it was in compliance with the FCC Part 15, Subpart C, and Sections §15.207, §15.209 and §15.247. A production version of the sample was received on June 20, 2000 in good condition. We found that the unit met the Part 15 requirements when tested as received.

Fundamental Field Strength and Harmonic Scan:

Fundamental output power is regulated under §15.247.

Harmonic emissions, which lie in the forbidden bands of §15.205, are required to meet the General Radiated Emission Limits of §15.209.

The maximum level of the fundamental signal at 2469.00 MHz was 109.1 dBµV/m, which is 23.9 dB below the FCC limit (see table 3). The worst case harmonic emission was 8.1 dB below the FCC Part 15 Subpart C limit.

Average Factor:

Please note that an average factor was applied to the level of the fundamental emission for comparison to the FCC limits. A duty cycle of 58% was measured, and the corresponding average factor of – 4.8 dB was determined and applied to the measured results.

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Occupied Bandwidth Measurement:

The maximum occupied bandwidth is determined in §15.247 (ii). For frequency hopping systems the maximum 20-dB bandwidth is equal to 1.0 MHz. The measured bandwidth of this signal was 143 KHz, which is significantly less than the FCC requirement. A bandwidth plot is shown in plot 1 at the end of this report.

Summary:

In summary, this report confirms that the Active Cell Antenna, Model: SN-ACATR-11 is compliant with the FCC Part 15, Subpart C requirements when production units conform with the initial sample. Please address all questions and comments concerning this report to, Candy Campbell, ITE Team Leader .

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LABORATORY MEASUREMENTS

Pursuant To Part 15 Subpart C For Intentional Radiators

**Manufacturer
(Name and Address):**

ERS International, Inc.
488 Main Avenue
Norwalk, CT 06851

Attention:

Mr. Steve Flynn

Model Number:

SN-ACATR-11

Serial Number:

#4

Certification

We attest to the accuracy of this report:



Signature

Andrew Bellezza

Testing Performed By

Senior Project Engineer

Title

Signature

Candy L. Campbell

Reviewer

ITE Engineering Team Leader

Title

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Introduction

The following is a description of the test procedure used by Intertek Testing Services in the measurements of transmitters operating under §15.209, General Requirements.

- A. **Test Set-Up:** The test set-up and procedures described below are designed to meet the requirements of ANSI C63.4 (1992).
1. The test site is a fiberglass structure with a ground-plane. The site has attenuation characteristics, which meet the requirements of ANSI C63.4 (1992). Information on the site has been filed with the FCC as required by Rule §2.948. The address of the site is 70 Codman Hill Road, Boxborough, MA 01719.
 2. Power to the site is nominal line voltage of 117 V_{AC} and 230 V_{AC}, 60 Hz.
 3. The equipment under test (EUT) is placed on a wooden turntable, which is 1.0 meter by 1.5 meters in diameter and 0.8 meters in height above the ground-plane. During the radiated emissions test, the turntable is rotated and any cables leaving the EUT are manipulated to find the configuration resulting in maximum emissions. The antenna height and polarization are also varied during the search for maximum signal levels. The height of the antenna is varied from one meter to four meters.
 4. Detector function for radiated emissions is in peak or quasi-peak mode. Average readings, when required, are taken by measuring the duty cycle of the equipment under test and subtracting the corresponding amount in dB from the measured peak readings according to the following formula:

$$\text{Averaging Factor in dB} = 20 \text{ LOG (duty cycle)}$$

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A. Test Set Up (cont'd)

The time period over which the duty cycle is measured is 100 msec. The worst-case (highest percentage on) duty cycle is used and described specifically in the data section. The duty cycle is measured by placing the EMI Receiver in zero span (receiver mode) and linear mode at maximum bandwidth (3 MHz at 3 dB down) and viewing the resulting time domain signal output from the receiver. The delta marker function is then used to determine the bit length, period and word length and period.

5. The field strength measuring equipment used included:

EMI Receiver: Hewlett Packard 8542E

Preamplifier: None

LISN: Solar Electronics 9252-50-R-24-BNC

Additional equipment or comments (used for frequency measurements above 1GHz):

Other equipment used: Spectrum Analyzer: Hewlett-Packard 8593E
Preamplifier: Miteq NSP4000-NF

7. The frequency range to be scanned is from the lowest radio frequency signal generated in the device, which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency, or 40 GHz, whichever is lower. For line-conducted emissions, the range scanned is 450 kHz to 30 MHz.
8. Conducted measurements were made as described in ANSI C63.4 (1992). An IF bandwidth of 9 kHz is used, and peak or quasi-peak detection is employed.
9. The IF bandwidth used for measurement of radiated signal strength was 120 kHz or greater below 1000 MHz. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application No. 150-2. A discussion of whether pulse desensitivity is applicable to this unit is included in this report. Above 1000 MHz, a bandwidth of 1 MHz is generally used.
10. Transmitter measurements are normally conducted at a measurement distance of three meters. However, to assure low enough noise floor in the forbidden bands and above 1 GHz (where no preamplifier is used), signals may be acquired at a distance of one meter or less. All measurements are extrapolated to three meters using inverse scaling, but those measurements taken at a closer distance are so marked.

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Test Set Up (cont'd)

B. This transmitter was found to meet the requirements of §15.207, §15.209 and §15.247.

C. **Miscellaneous Information**

1. **Manufacturer:** ERS International, Inc
2. **Grantee:** ERS International, Inc.
3. **Model No.:** SN-ACATR-11
4. **Trade Name:** Active Cell Antenna
5. **Serial No.:** #4
6. **Date of Test:** June 20,21 and 29, 2000
7. **Frequencies to which device can be tuned:** 2400 MHz to 2483 MHz
8. **Can customer tune device?** No
9. **Detailed description of operation pursuant to 15.209:** Some harmonics in forbidden band.
10. **Applicable emissions limits:** §15.247, §15.209, §15.207 & §15.205
11. **Additional Comments:**

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Measurements of Bandwidth

The plot on the following page shows the fundamental emission when modulated with a worst-case bit sequence. From the plot, the bandwidth is observed to be 143 kHz at 20 dBc. The bandwidth limit is 1.0 MHz. The unit meets the FCC bandwidth requirements. Please note the following:

Frequency:	<u>2441.1 MHz</u>
Span:	<u>1.0 MHz</u>
RBW:	<u>30 kHz</u>
Bandwidth:	<u>143 kHz</u>

See Plot 1.

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Derivation of Averaging Factor

Determination of duty is determined in accordance with §15.35 [c]. For cases where the pulse train exceeds 100 msec, "...the measured field strength is determined from the average absolute voltage during a 100 msec interval...". In our instance, the maximum pulse train is in excess of 500 msec (see plot 3). As a result the Average Factor will be determined using 100 msec as the maximum allowable interval.

Using the average factor equation:

$$\text{Average Factor} = 20\text{Log}_{10}((T1 + T2) / 100 \text{ msec})$$

Period of T1 = 22.5 msec, period of T2 = 35.25 msec, as determined from plot 2.

$$\text{Average Factor} = 20 \text{ Log } ((T1+T2)/100) = 20\text{Log } (0.58) = -4.8$$

Average Factor for the ERS, Model: SN-ACATR-11 = 4.8 dB
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Derivation of Fundamental Field Strength

Using the FCC Alternate Test Procedure for measuring transmitter peak power. This method is explained in FCC 97-114.

For determining field strength from transmitter output power:

$$E = (\sqrt{30PG}) / d$$

Where: E is the measured maximum field strength in V/M utilizing the widest available RBW.

G is the numeric gain of the transmitting antenna over an isotropic radiator.

d is the distance in meters from which the field strength was measured.

P is the power in watts of the transmitter at the antenna terminals.

§15.247 allows for a 1 watt maximum at the antenna terminals, working with that power and with a known antenna gain of 6 dB over an isotropic we can then determine maximum field strength for the fundamental frequency at a measuring distance of 3 meters.

$$E = (\sqrt{30(1)(6)}) / 3 = 4.51 \text{ V/m} = 4.51 * 10^6 \text{ uV/m} = 133 \text{ dBuV/m}$$

Maximum Field Strength at 3 meters for the fundamental: 133 dBuV/m.

See tables 1, 2 & 3.

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Discussion of Pulse Desensitivity

The determination of pulse desensitivity was made in accordance with Hewlett Packard Application Note 150-2, *Spectrum Analysis ... Pulsed RF*.

Pulse desensitivity was not applicable for this device.

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Configuration Information

Equipment Under Test: Active Cell Antenna
Model: SN-ACATR-11
Serial No.: Not Available
FCC Identifier: Not Available
Support Equipment:

Make & Description	ERS / MCC	Make & Description	IBM / Keyboard
Model:	Not Available	Model:	KB-8923
Serial Number:	21D	Serial Number:	1807H06652107814
FCC ID:	Not Available	FCC ID:	E8HKB-5923
Make & Description	Gateway / PC	Make & Description	Gateway / Video Monitor
Model:	Baby AT	Model:	CPD-17F23
Serial Number:	3101744	Serial Number:	7029382
FCC ID:	HWY586P100	FCC ID:	AK8CPD17SF2
Make & Description	Microsoft / Mouse		
Model:	97599		
Serial Number:	00337536		
FCC ID:	C3KKMP5		

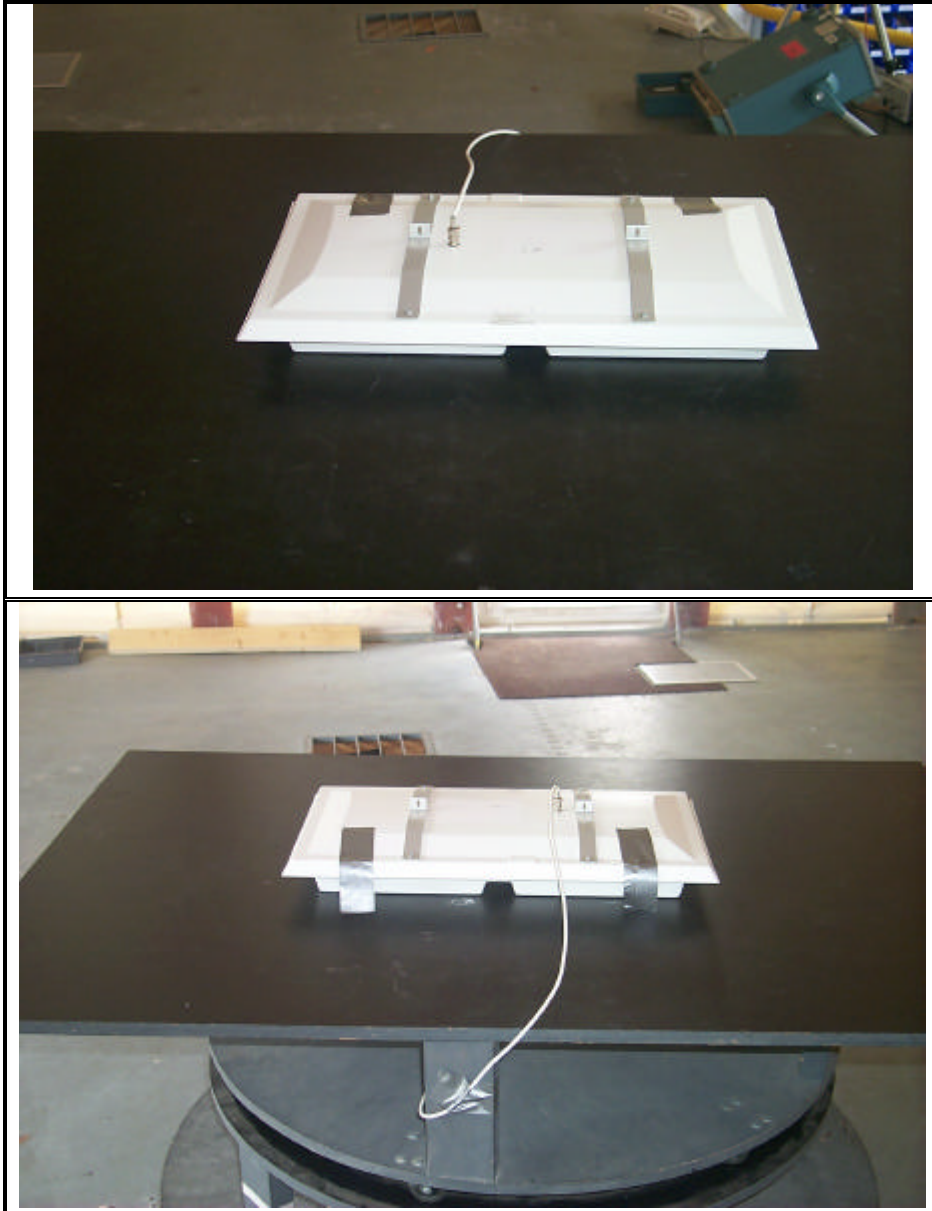
Cables:

Cable Description	Shield	Connector	Length (m)	Quantity
RG-58	Braid	Metal 360 degree	5.0	1

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Configuration Photographs

Worst-Case Radiated Emissions



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The following equipment was used to make measurements for emissions testing:

Description	Manufacturer	Model	Serial #	Cal Due
RECEIVER	HEWLETT PACKARD	8542E	3625A00188	01/19/2001
AMPLIFIER	MITEQ	NSP4000-NF	507145	10/11/2000
ANTENNA	EMCO	3142	9701-1116	07/02/2000
LISN	SOLAR ELECTRONICS	9252-50-R-24-BNC	941713	05/16/2001
HORN ANTENNA	EMCO	3115	9610-4980	08/12/2000
HORN ANTENNA	EMCO	3116	2090	03/15/2001
SPECTRUM ANALYZER	HEWLETT PACKARD	8593E	3829A03589	06/01/2001

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Test Data

Fundamental and Harmonics Radiated Scan

Radiated Emissions / Interference

Table: 1

Company: **ERS International Inc.**

Model: **ACA**

Job No.: **J20015003**

Date: 06/29/00

Standard: FCC Part 15 Subpart C

Class: None

Group: B

Notes: Fundamental and harmonic scan of low freq. (2409 MHz)

Tested by: Vathana Ven

Location: Site 2C

Detector: HP8593

Antenna: EMCO 3115, 3116

PreAmp: Miteq

Cable(s):

Distance: **3** meters

Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Average Factor (dB)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dBuV	Limit dBuVm	Margin dB
H	2409.500	104.7	4.8	28.8	1.7	22.3	0.0	108.1	133.0	-24.9
<i>H</i>	<i>4810.000</i>	<i>31.0</i>	<i>4.8</i>	<i>34.1</i>	<i>3.3</i>	<i>22.2</i>	<i>0.0</i>	<i>41.4</i>	<i>54.0</i>	<i>-12.6</i>
No other harmonics detected higher than 4810.00 MHz.										

Bold Italicized entries represent frequencies that lay within the 15.205 restricted band of operation.

END

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Radiated Emissions / Interference

Table: 2

Company: **ERS International Inc.**

Model: **ACA**

Job No.: **J20015003**

Date: 06/29/00

Standard: FCC Part 15 Subpart C

Class: None

Group: B

Notes: Fundamental and harmonic scan of mid freq. (2442 MHz)

Tested by: Vathana Ven

Location: Site 2C

Detector: HP8593

Antenna: EMCO 3115 & 3116

PreAmp: Miteq

Cable(s):

Distance: **3** meters

Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Average Factor (dB)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dBuV/m	Limit dBuV/m	Margin dB
H	2442.000	104.2	4.8	28.9	1.7	22.3	0.0	107.7	133.0	-25.3
<i>H</i>	<i>4884.000</i>	<i>30.0</i>	<i>4.8</i>	<i>34.1</i>	<i>3.3</i>	<i>22.2</i>	<i>0.0</i>	<i>40.4</i>	<i>54.0</i>	<i>-13.6</i>
No other harmonics detected higher than 4884.00 MHz.										

Bold Italicized entries represent frequencies that lay within the 15.205 restricted band of operation.

END

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Radiated Emissions / Interference

Table: 3

Company: **ERS International Inc.**

Model: **ACA**

Job No.: **J20015003**

Date: 06/29/00

Standard: FCC Part 15 Subpart C

Class: None

Group: B

Notes: Fundamental and harmonic scan of high freq. (2469 MHz)

Tested by: Vathana Ven

Location: Site 2C

Detector: HP8593

Antenna: EMCO 3115 & 3116

PreAmp: Miteq

Cable(s):

Distance: **3** meters

Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Average Factor (dB)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dBuV/m	Limit dBuV/m	Margin dB
H	2469.000	105.2	4.8	28.8	2.2	22.3	0.0	109.1	133.0	-23.9
<i>H</i>	<i>4938.000</i>	<i>35.6</i>	<i>4.8</i>	<i>34.1</i>	<i>3.3</i>	<i>22.3</i>	<i>0.0</i>	<i>45.9</i>	<i>54.0</i>	<i>-8.1</i>
<i>H</i>	<i>7407.000</i>	<i>31.0</i>	<i>4.8</i>	<i>34.1</i>	<i>3.3</i>	<i>22.2</i>	<i>0.0</i>	<i>41.4</i>	<i>54.0</i>	<i>-12.6</i>

No other harmonics detected higher than 7407.00 MHz.

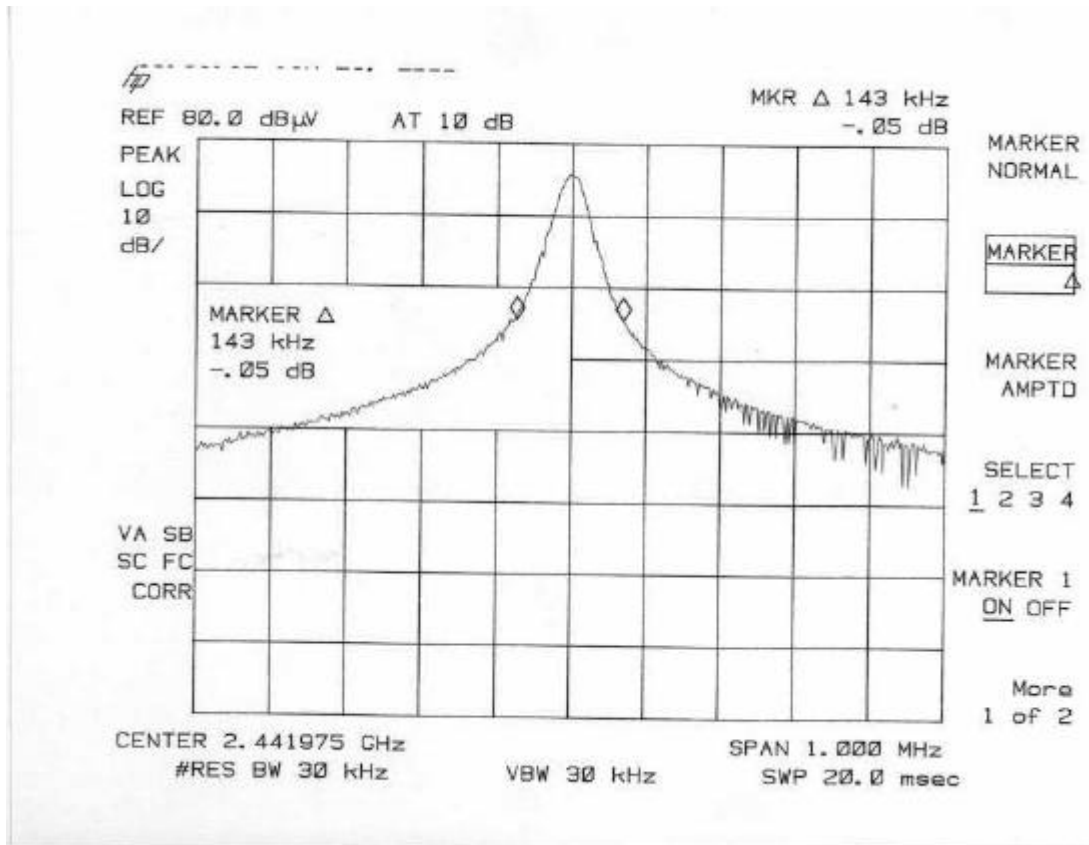
Bold Italicized entries represent frequencies that lay within the 15.205 restricted band of operation.

END

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Test Data

Bandwidth Plot



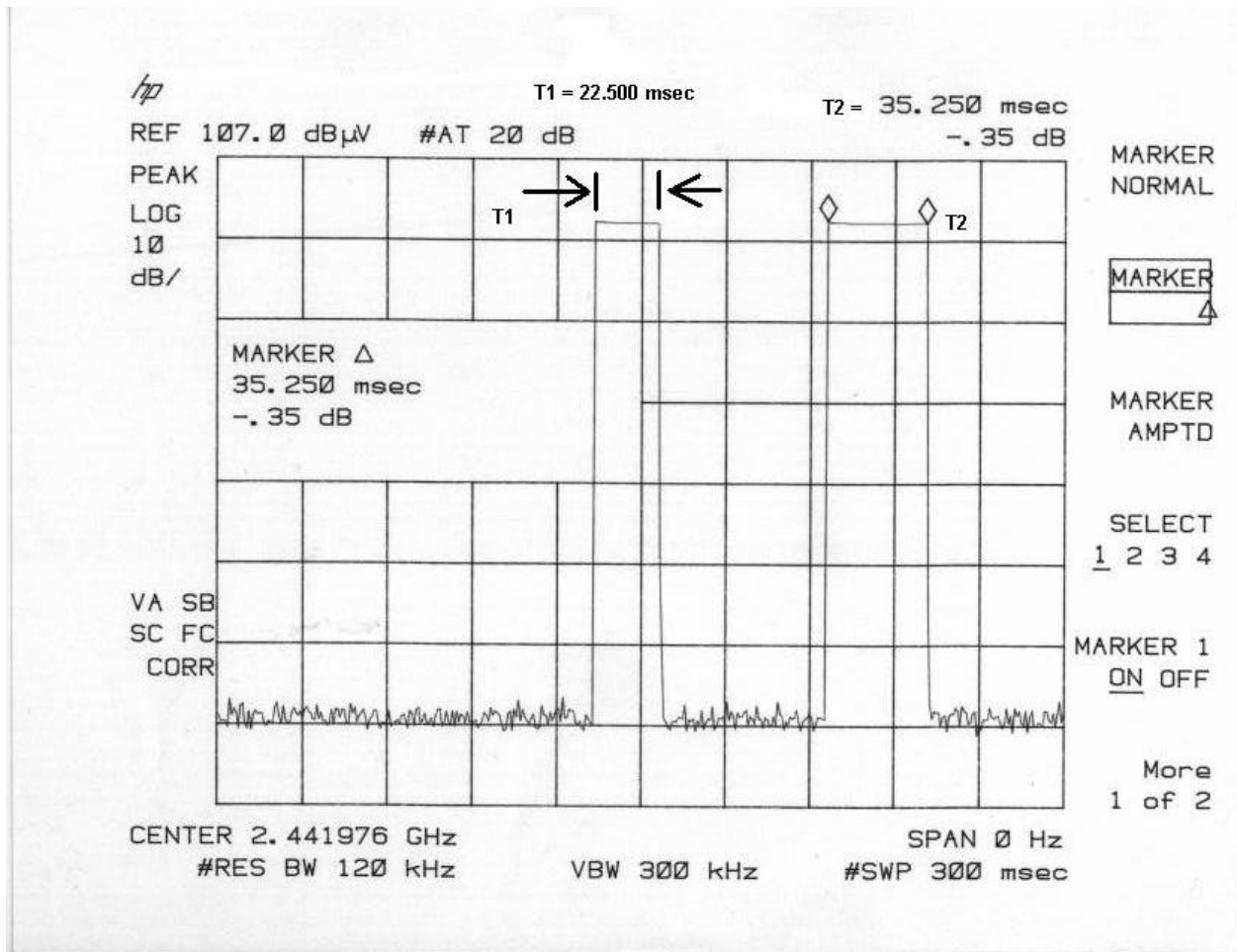
Note: Low, mid and high frequency channels exhibit similar bandwidth characteristics.

Plot 1

INTERTEK TESTING SERVICES

Test Data

Bit Length Plot



Note: Low, mid and high frequency channels exhibit similar pulse-width characteristics.

Plot 2

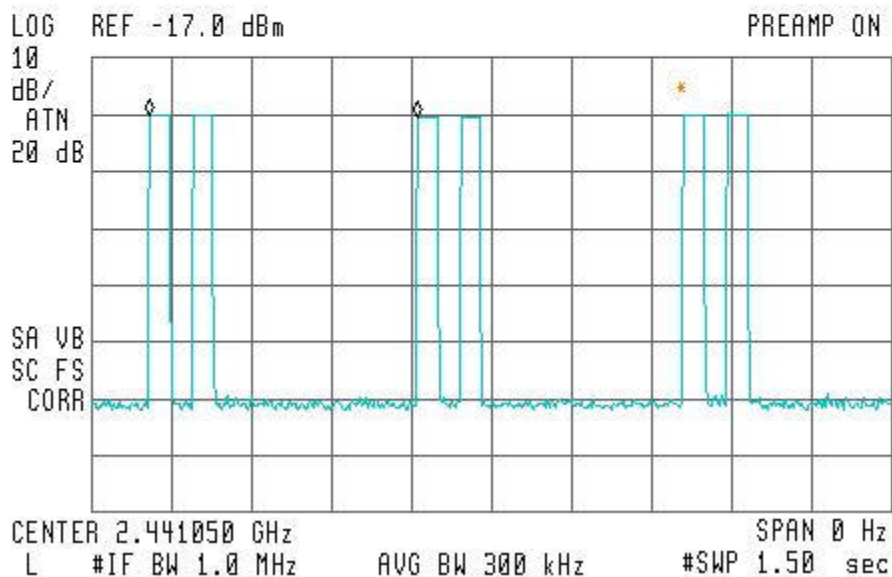
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Test Data

Word Period Plot

13:38:42 JUN 21, 2000
16:31:59 JUN 20, 2000

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 502.50 msec
-.11 dB

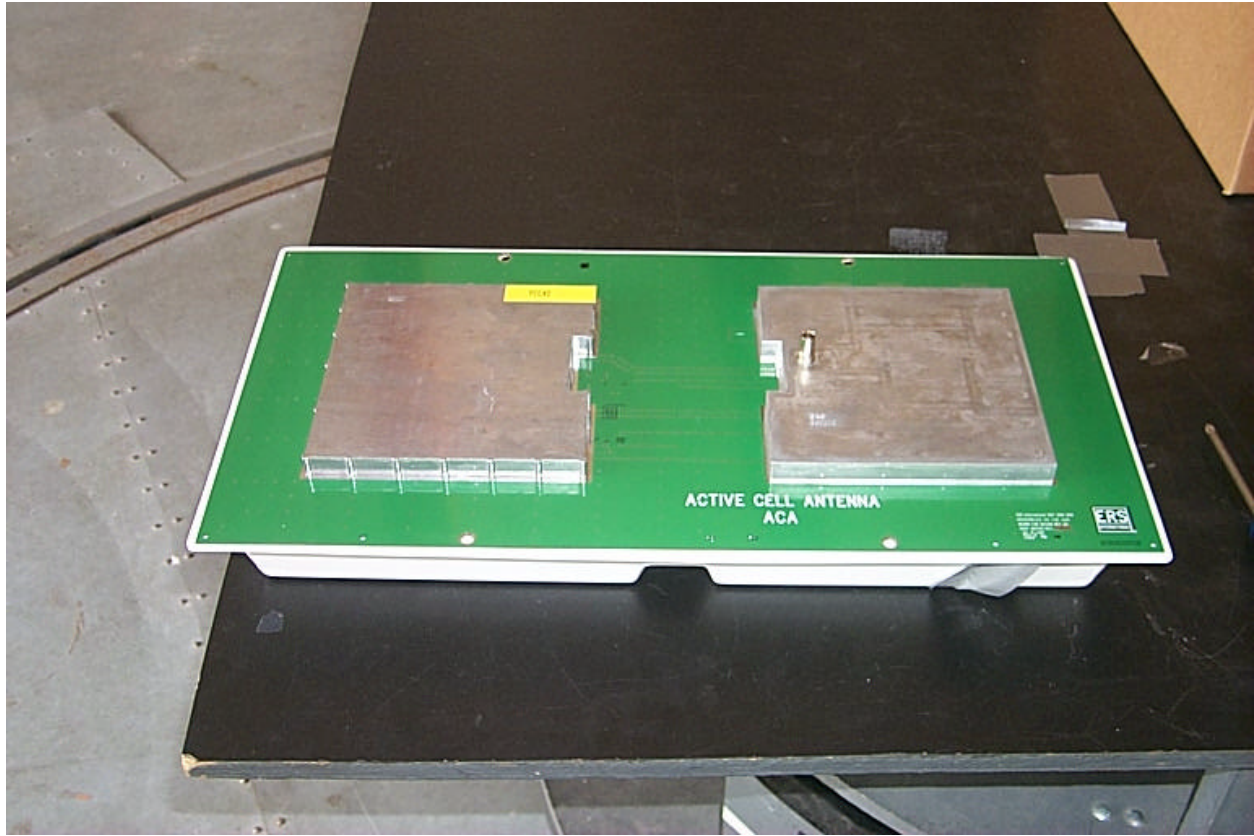


Note: Low, mid and high frequency channels exhibit similar word-length characteristics.

Plot 3

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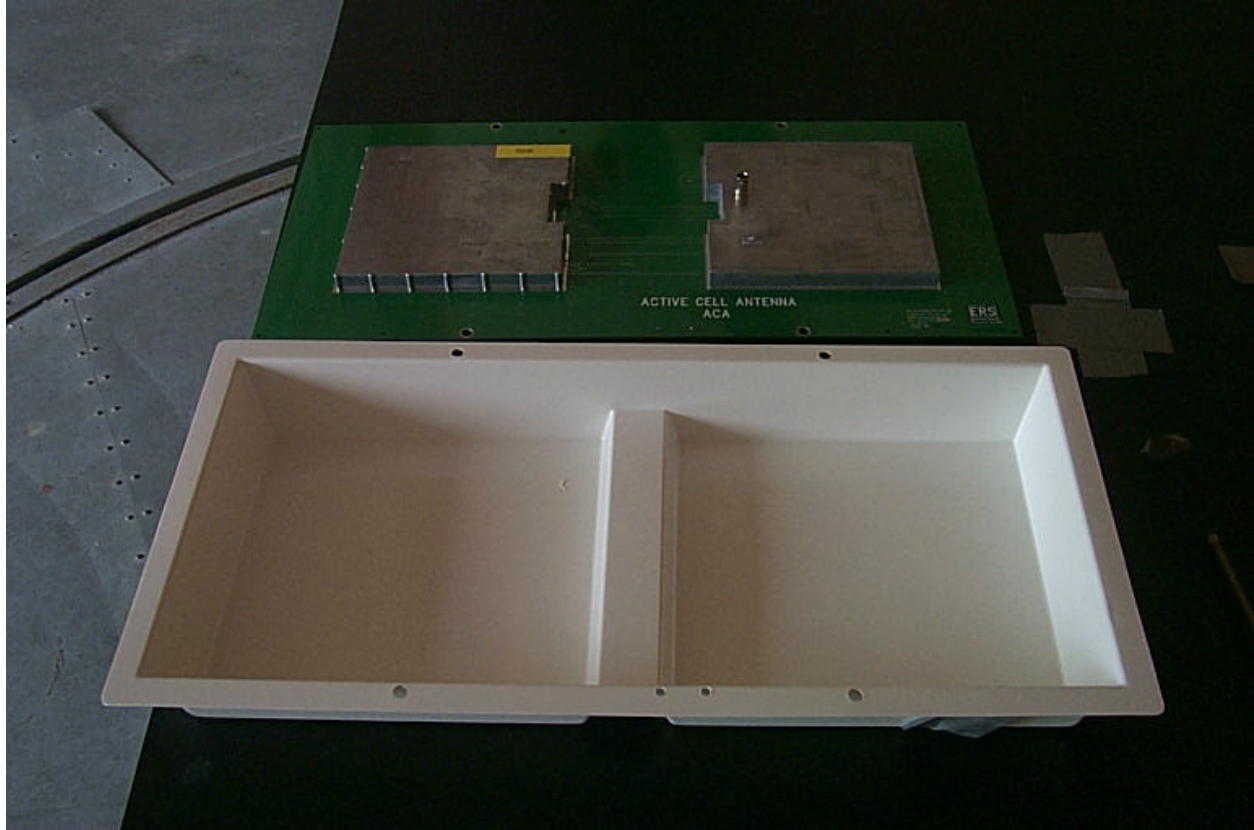
Certification Photographs



Photograph 1: Model SN-ACATR-11 with top cover removed.

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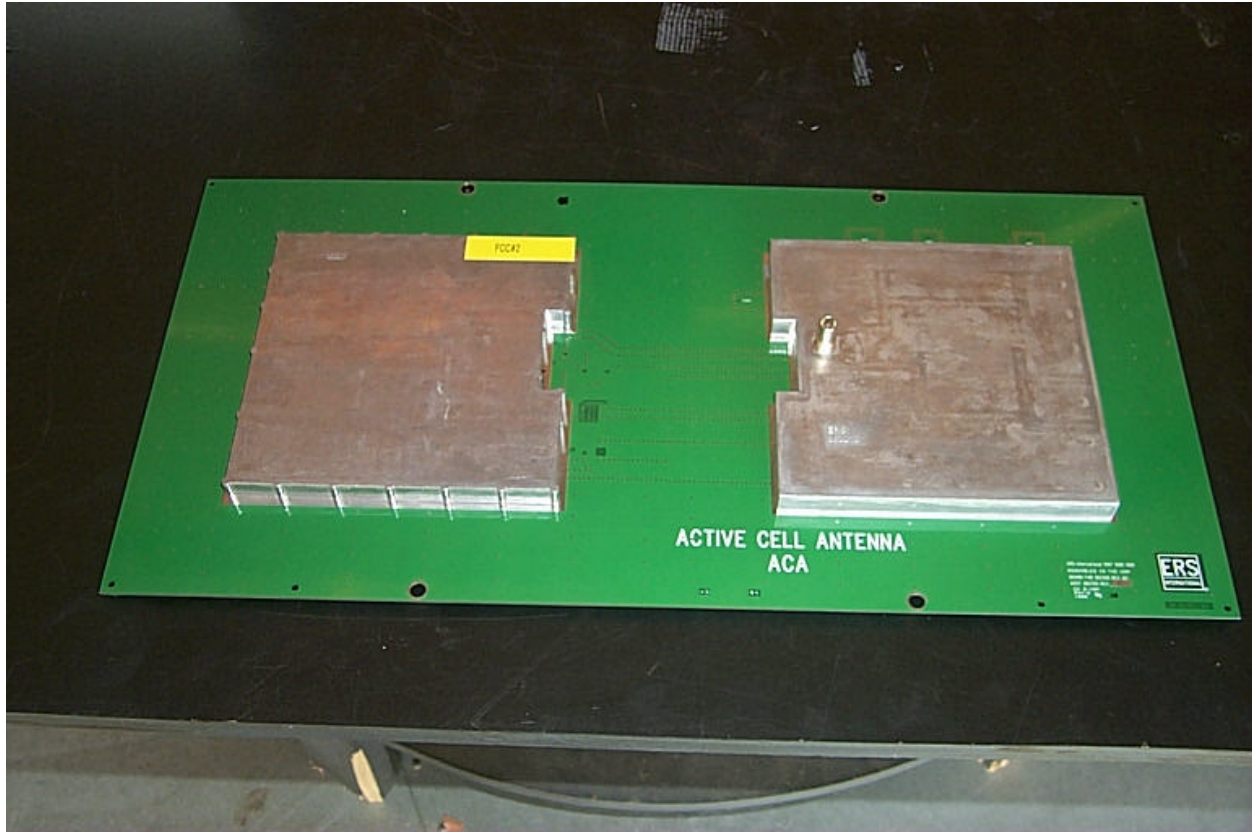
Certification Photographs



Photograph 2: Model SN-ACATR-11 removed from bottom cover.

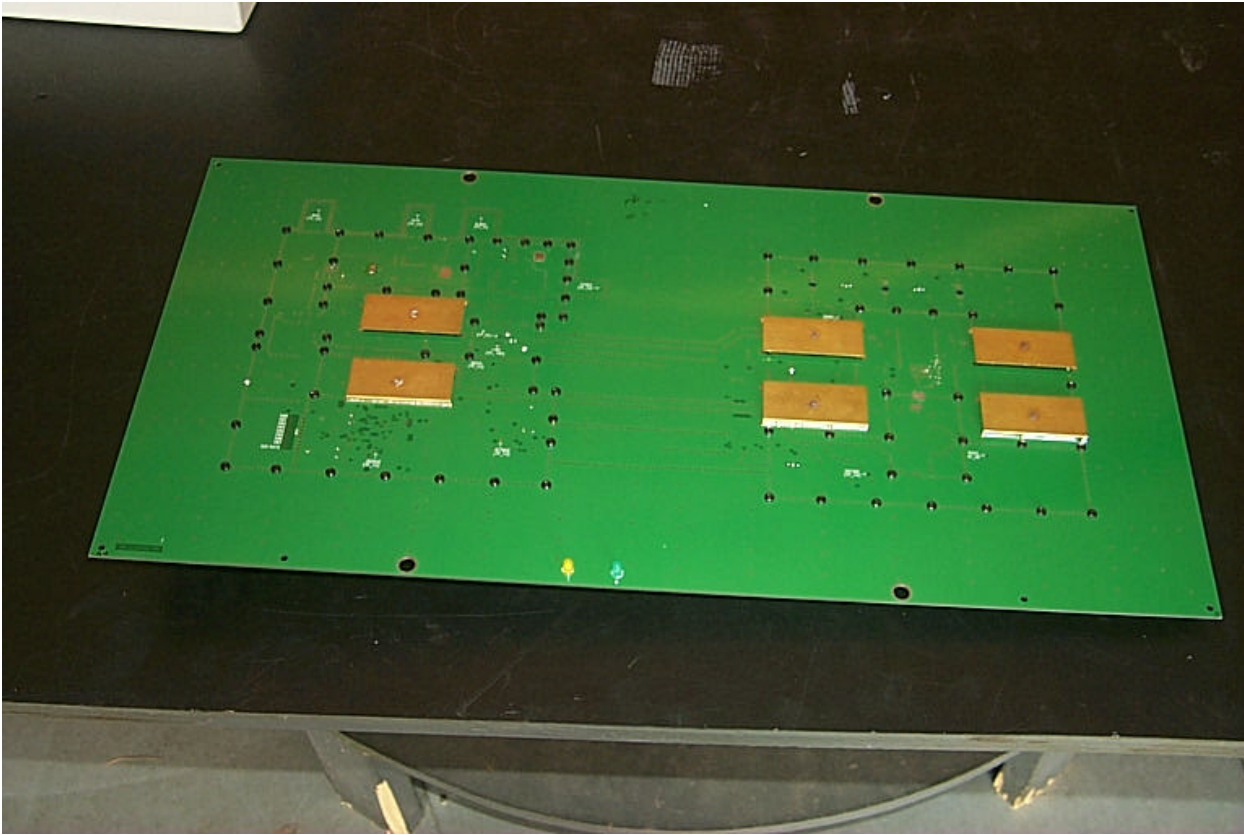
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Certification Photographs



Photograph 3: Model SN-ACATR-11 with no covers, picture is of upper portion of device.

Certification Photographs



Photograph 4: Model SN-ACATR-11 with covers removed, picture is of the bottom of the device