COMPLIANCE TESTING
OF
AUDIO INTELLIGENCE DEVICES

500 Milliwatt

SURVEILLANCE TRANSMITER

PST500

Test Report 90187

Tests performed on ---- July 6, 1999

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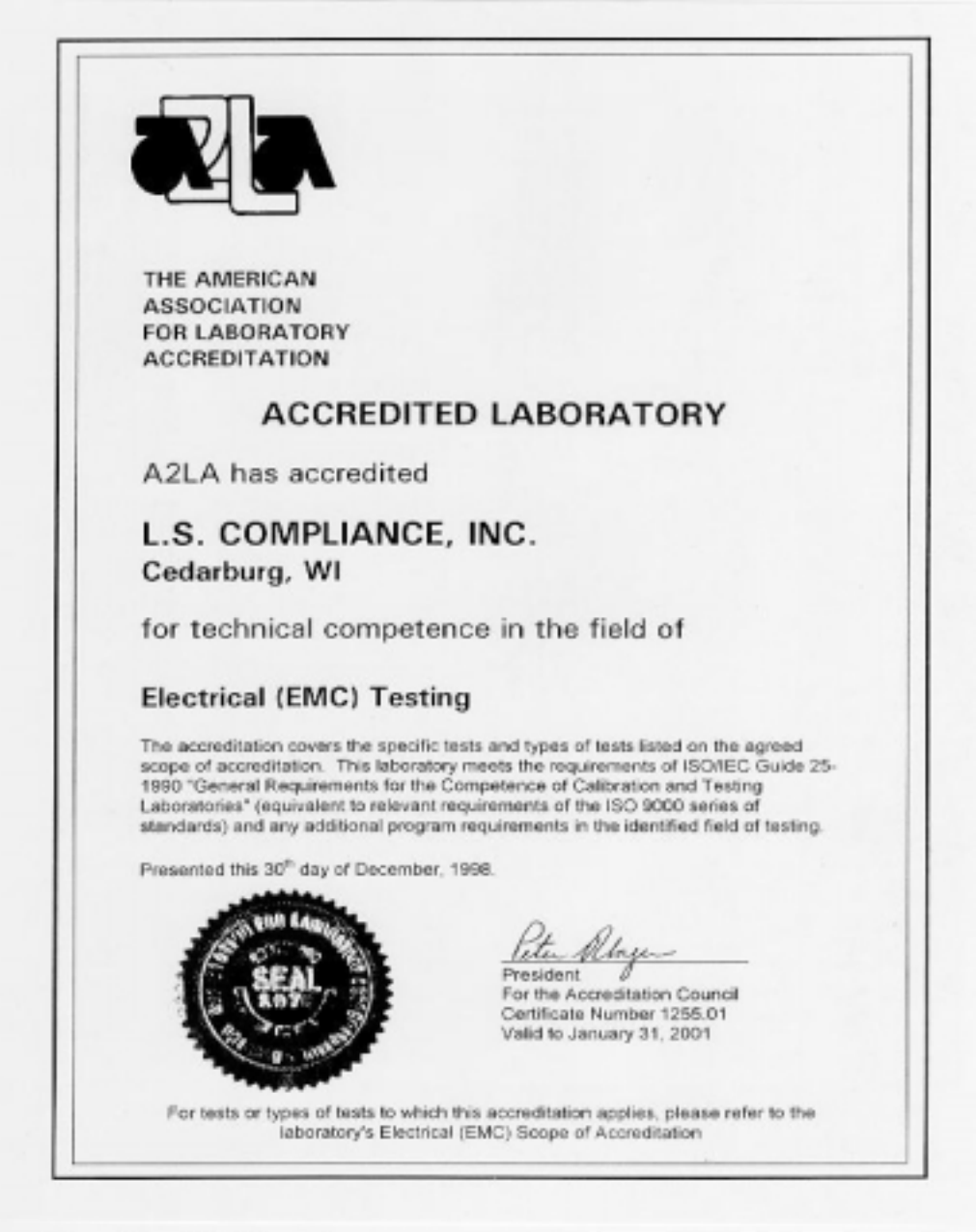
DESCRIPTION OF MEASUREMENT FACILITIES

Site on File With the FCC

ID Number: 31040/SIT

" The site referenced above has been found to comply with the test site criteria found in ANSI C63.4-1992 and 47CFR Section 2.948."



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ASSOCIATION
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ACCREDITED LABORATORY

A2LA has accredited

L.S. COMPLIANCE, INC.
Cedarburg, WI

for technical competence in the field of

Electrical (EMC) Testing

The accreditation covers the specific tests and types of tests listed on the agreed scope of accreditation. This laboratory meets the requirements of ISO/IEC Guide 25-1990 "General Requirements for the Competence of Calibration and Testing Laboratories" (equivalent to relevant requirements of the ISO 9000 series of standards) and any additional program requirements in the identified field of testing.

Presented this 30th day of December, 1998.

SEAL

President
For the Accreditation Council
Certificate Number 1255.01
Valid to January 31, 2001

For tests or types of tests to which this accreditation applies, please refer to the laboratory's Electrical (EMC) Scope of Accreditation

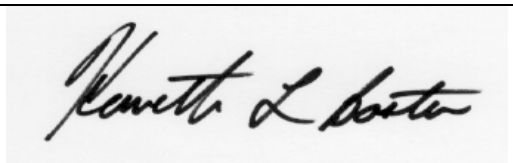
FCC ID: B348PRPST500

1.1 SUMMARY OF TEST REPORT

MANUFACTURER:	AUDIO INTELLIGENCE DEVICES, Inc
MODEL:	PST500
SERIAL:	preproduction
DESCRIPTION:	ELECTRONIC SURVEILLANCE DEVICE
FREQUENCY RANGE:	TRANSMITTER; 150 MHz TO 174 MHz: upon any assigned channel.

The surveillance transmitter was found to **meet** the radiated spurious emission requirement of FCC part 2.993, to the levels required of FCC part 90.210D, emission mask "D".

tested by  Aug 11, 1999

Approved By:
Prepared By:  Aug 11, 1999

Kenneth L. Boston, EMC Lab Manager *Date*
PE #31926
Registered Professional Engineer
(State of Wisconsin)

1.2 INTRODUCTION

On July 6 of 1999, a series of Radiated Emissions tests were performed on a sample model of the A.I.D. PST500 Surveillance transmitter. These tests were performed using the test procedures outlined in ANSI/TIA/EIA 603-1-1998 for a low power transmitter in the Public Radio service; as called for in section 2.993 for a type accepted device, and in accordance with the limits set forth in FCC Part 90.210. Tests of conducted emissions were also performed in order to verify compliance with the limits set forth in part 90.210 and called out in section 2.991 for a type accepted device. The radiated emission tests were performed by Kenneth L. Boston PE, of L. S. Compliance, Inc.

1.3 PURPOSE

The above mentioned tests were performed in order to determine the compliance of the test sample with limits contained in various provisions of Title 47 CFR, including:

90.203
90.210
2.993

All radiated emissions tests were performed to measure the emissions in the frequency bands described by the above sections, and to determine whether said emissions are below the limits established by the above sections. These tests were performed in accordance with the procedure described in the Telecommunications Industry Association publication, TIA/EIA-603 , February 1993, and the addendum, March 1998. General radiated measurement techniques found in ANSI C63.4 were also utilized. Another document used as reference for the EMI receiver specification was the International Special Committee on Radio Interference (CISPR) number 16-1 (1993).

1.4 RADIATED EMISSIONS TEST SETUP

The test sample was operated within the 3 meter Semi-Anechoic, FCC listed chamber located at L.S. Compliance in Cedarburg, WI. The sample was placed on an 80cm high wooden table, which was centered on the flush-mounted 2m diameter metal turntable. The test sample was operated on its internal battery, and an appropriate passive antenna, 50 ohm dummy load, was connected to the antenna terminals. The transmitter occupies a small P.C board, and for the purposes of this test, was contained inside an integral metal case. The test sample was configured to run in a continuous transmit mode during the radiated measurements. The test sample was set to operate on one of three characteristic frequencies within the Private Land Mobile frequency assignment (Public safety radio pool). One at the low end of the band (150 MHz), one in the middle of the band (162 MHz) and one near the top of the band (174 MHz).

Please refer to Section 1.8 for pictures of the test setup.

1.5 RADIATED EMISSIONS TEST PROCEDURE

The fundamental and spurious (harmonic) emissions of the transmitter were tested for compliance to Title 47 CFR, FCC Part90.210 limits for transmitters in the Private Land Mobile services, and were also compared with the general limits laid out in Part 15.209. For the calculations used to determine the limits applicable for the test sample, refer to Appendix A. These limits are expressed in decibels below carrier level. (-dBc) The samples were tested from the lowest frequency generated by the transmitter (without going below 9 kHz) to the 10th harmonic of the fundamental frequency generated by the device. The limits described in part 15.209 were also consulted for observation and measurement of spurious signals. The samples were placed on a nonconductive (wooden) pedestal in the 3 Meter chamber and the antenna mast was placed such that the antenna was 3m from the test object. A biconical antenna was used to measure emissions from 30 to 200 MHz, a log periodic was used to measure emissions from 200 to 1000 MHz, and a double ridged waveguide horn was used to measure emissions above 1 GHz. The test object was set to operate in continuous transmit, and the resultant signals were maximized by rotating the turntable 360 degrees, and by raising and lowering the antenna between 1 and 4 meters. The test object was also given several different orientations to determine the maximum signal levels, using both horizontal and vertical antenna polarities. Signal levels found were compared to an equivalent signal level of a generated carrier radiated from a dipole located at the EUT position.

No significant emissions were found aside from the transmitter fundamental and the second through the fourth harmonic. Other emissions that were seen were lower than 20 dB below the 15.209 general limits. The unit was scanned for emissions while in continuous transmit, over the range 30 to 1800 MHz to establish compliance with Part 90 for the transmitter.

The required level for the transmitter harmonics and spurious signals where measured by means of a radiated measurement made in the FCC listed 3 meter semi-anechoic chamber, and is found by the substitution method, as described in EIA/TIA 603 section 2.2.12.2. i, j, k, and l. This method was used to confirm the calculated radiated signal level of a -20 dBm carrier, while transmitting into a reference dipole. By the mathematical method found in appendix A, a field strength of 75.23 dBuV/m is derived. Actual field measurements of this radiated field strength were performed using a set of reference dipoles, and a calibrated generator, on all of the harmonics from 300 mHz to 1 GHz. A comparison chart is given below. Because of the excellent correlation, the derived limit level was used for comparison of the signal levels for the harmonics above 1 GHz.

Frequency (MHz)	Reading(Vert) (dBuV/m)	Reading (Horiz) (dBuV/m)	Calculated level (dBuV/m)	Delta (Vert) (dB)	Delta (Horiz) (dB)
300	76.1	79.0	75.2	0.9	3.8
450	77.1	77.9	75.2	1.9	2.7
600	75.8	78.7	75.2	0.6	3.5
750	75.3	78.3	75.2	0.1	3.1
900	74.5	77.4	75.2	-0.7	2.2

1.6 TEST EQUIPMENT UTILIZED FOR THE RADIATED EMISSIONS TEST

A list of the test equipment and antennas used for the tests can be found in Section 1.9, which includes the calibration information as well as the equipment description. All equipment is calibrated and used according to the user manuals supplied by the manufacturer. All antenna calibrations were performed at a N.I.S.T traceable site, and the resultant correction factors were entered into the Hewlett Packard 8546A EMI receiver software database. The connecting cables used were also measured for loss using a calibrated signal generator and the HP 8546A EMI receiver. The resulting loss factors were entered into the HP 8546A database. This allowed for automatic changes in the antenna correction factor, as well as cable loss or other corrections, to be added to the EMI receiver display while taking measurements. Thus, the resulting data taken from the HP 8546A is an actual reading and can be entered into the database as a corrected meter reading.. The HP 8546A EMI receiver was operated with a bandwidth of at least 10 kHz when receiving signals below 1 GHz, and with a bandwidth of 1 MHz when receiving signals above 1 GHz, in accordance with TIA/EIA 603. Other IF and Video bandwidths, narrower than stated above, were used where appropriate and allowable.

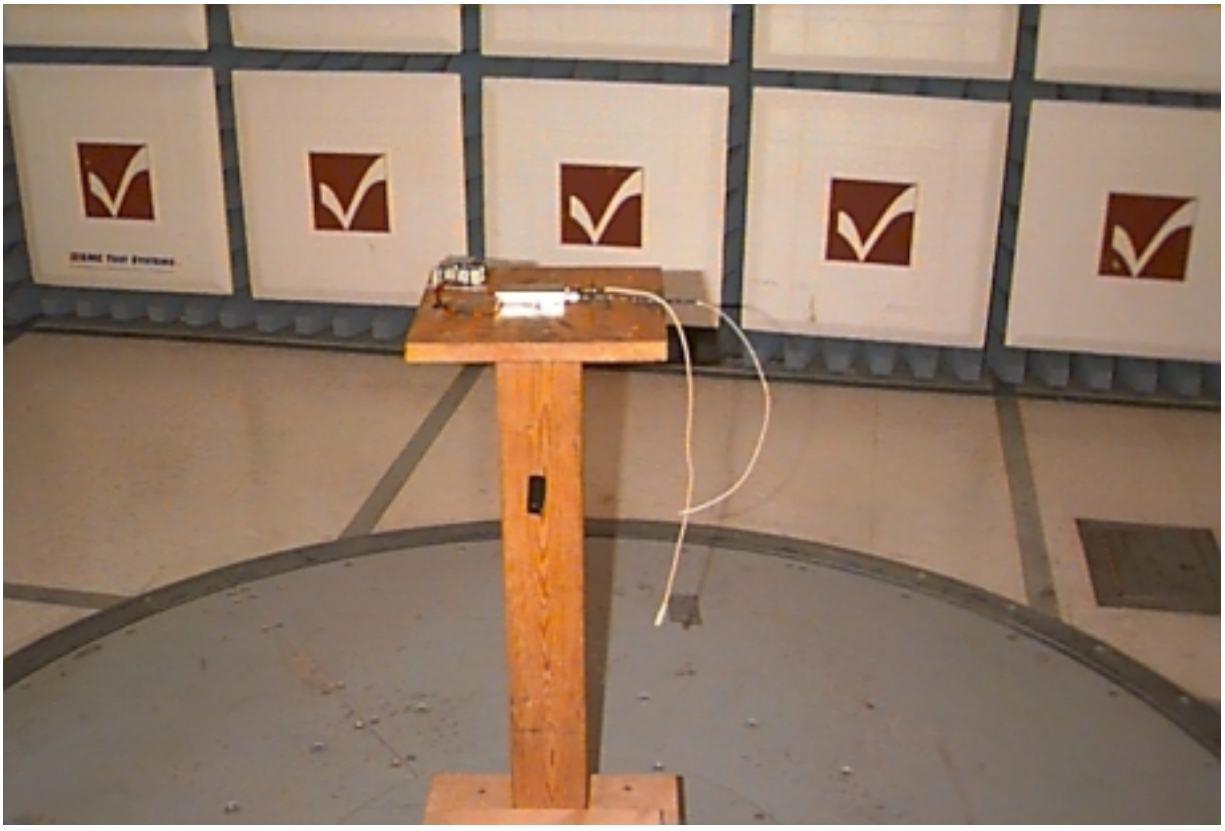
1.7 Conducted Emission Test

The remaining Part 90 conducted tests, including spurious signals and modulation mask measurements were made via the antenna port of the surveillance transmitter. The results of this investigation can be found in the accompanying report.

SECTION 1.8

PHOTOS TAKEN DURING TESTING

View of the AID surveillance transmitter while performing Radiated Emission Testing



view shows 270 degree position with unit flat, microphone connected, antenna physically attached, but dummy load internally connected to transmitter output

1.9 - Test Equipment

Asset #	Manufacturer	Model #	Serial #	Description	Due Date
AA960004	EMCO	3146	9512-4276	Log Periodic Antenna	9/12/99
AA960005	EMCO	3110B	9601/2280	Biconical Antenna	9/12/99
AA960007	EMCO	3115	99111-4198	Double Ridged Guide/Horn Antenna	7/20/99
EE960004	EMCO	2090	9607-1164	Mast/Ttable Controller	I.O
EE960013	HP	8546A	3617A00320	Receiver RF Section W/Display and RF filter section	8/12/99
CC000130	HP	8596E	3205A00103	Spectrum Analyzer	8/12/99

APPENDIX A:

SAMPLE CALCULATIONS

FIELD STRENGTH OF FUNDAMENTAL FREQUENCIES:

Conducted: Measured at 27.0 dBm for the 500 milliwatt power level.

FIELD STRENGTH OF SPURIOUS/HARMONIC FREQUENCIES:

All out of band spurious emissions must be below the mean power of the carrier by at least:

50 + 10 log(carrier power)

which for the 0.25 watt rating on the test sample is:

50+ 10 log(0.5)
50 – 3 = -47 dBc,
which is the level below the mean carrier for spurs/harmonics

-47 dBc from 27.0 dBm = -20.0 dBm

FIELD STRENGTH OF PART 90 LIMIT: AT R = 3 METERS DSTANCE

FROM THE STANDARD REFERENCE FORMULA FOR POWER TRANSMITTED VERSUS ELECTRIC FIELD:

$$Pt = (R^{**}) \times |E|^{**} / 30$$

Then to convert to dB:

$$Pt = 20\log|E| + 20\log(R) - 10\log(30)$$

Insert additional terms to convert watts to milli-watts (in dB) and volts to micro-volts (in dBuV):

$$Pt = 20\log|Euv| - 20\log(1{,}000{,}000) + 10\log(1000) + 20\log(3) - 10\log(30)$$

$$Pt = 20\log|Euv| - 120 + 30 + 9.54 - 14.77$$

$$Pt = 20\log|Euv| - 95.23$$

OR; $20\log|Euv| = Pt \text{ (in dBm)} + 95.23$

$|E|$ (in dBuV) = -20 dBm + 95.23 = 75.23 dBuV/m , at 3 meters

APPENDIX B:

DATA CHARTS

RADIATED EMISSIONS IN THE 3 METER FCC LISTED CHAMBER

Date of Test:	6 July, 1999	Manufacturer:	Audio Intelligence Devices
Location:	L. S. Compliance, Inc. W66 N220 Commerce Court Cedarburg, WI 53012	Model No.:	PST500
Specifications:	90.210	Serial No.:	preproduction
Equipment:	HP 8546A EMI Receiver EMCO 3110B biconical EMCO 3146A Log Periodic EMCO 3115 Waveguide Horn	Configuration:	Continuous transmit at 1 of 3 frequencies; 150, 162, 174 MHz
		Detector(s) Used:	Peak (with 10 kHz RBW) below 1 GHz Average (with1 MHz RBW) above 1 GHz

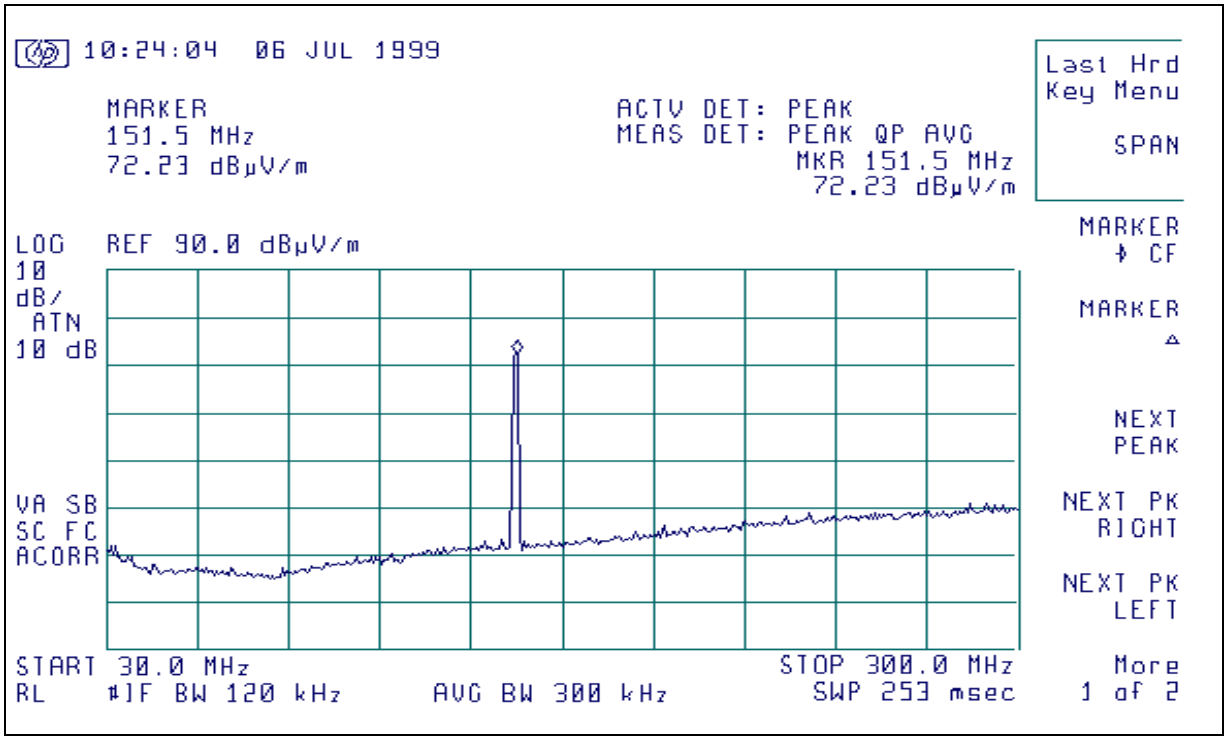
FREQ (MHz)	Transmit Freq(MHz)	ELEV. (meters)	AZIMU (degrees)	POL. (H/V)	DETECT.	METER (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)
300	150	1.0	260	H	Q-peak	55.7	75.2	19.5
450	150	1.0	190	H	Q-peak	52.4	75.2	22.8
600	150	1.4	290	H	Q-peak	54.3	75.2	20.9
324	162	1.1	250	H	Q-peak	49.8	75.2	25.4
486	162	2.0	60	H	Q-peak	56.5	75.2	18.7
648	162	1.4	30	H	Q-peak	47.6	75.2	27.6
348	174	1.0	275	H	Q-peak	52.8	75.2	22.4
522	174	1.7	200	H	Q-peak	51.0	75.2	24.2
696	174	1.0	340	H	Q-peak	43.0	75.2	32.2

**All other harmonics and spurs were greater than 30 dB below the limit

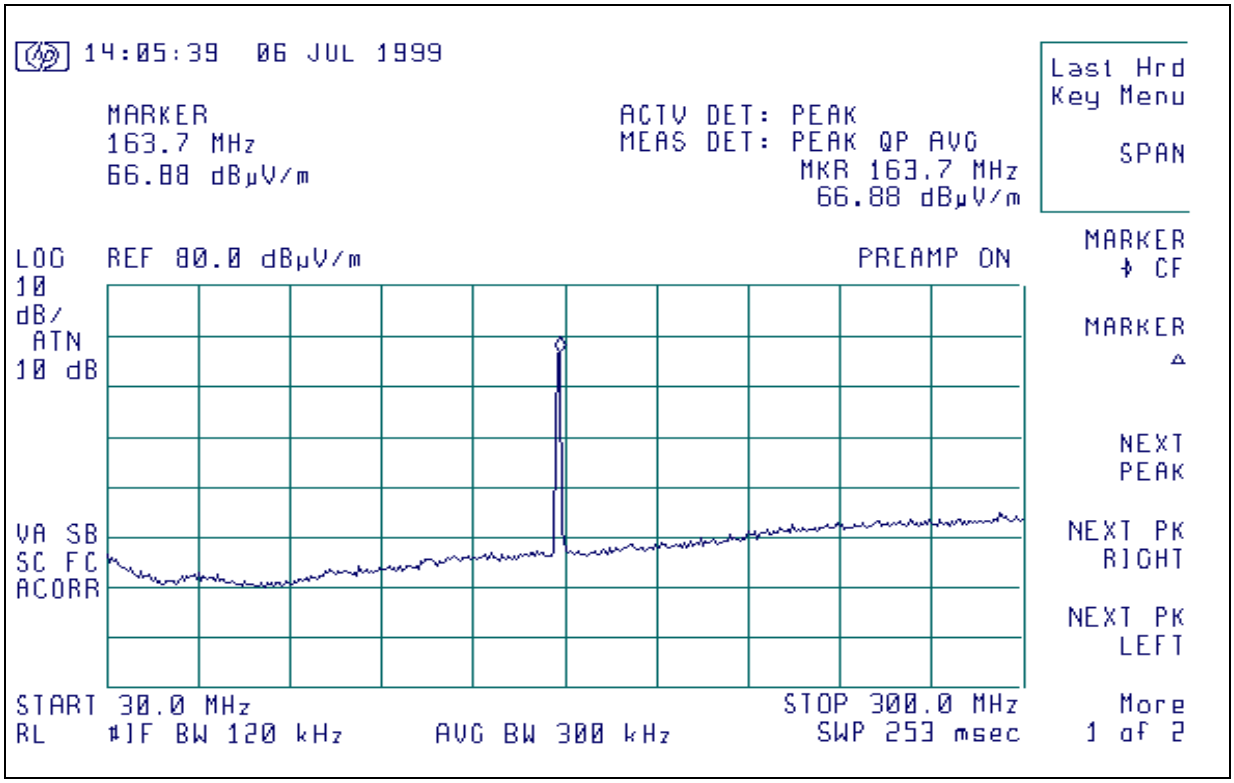
APPENDIX C:

GRAPHS; Signature Scan

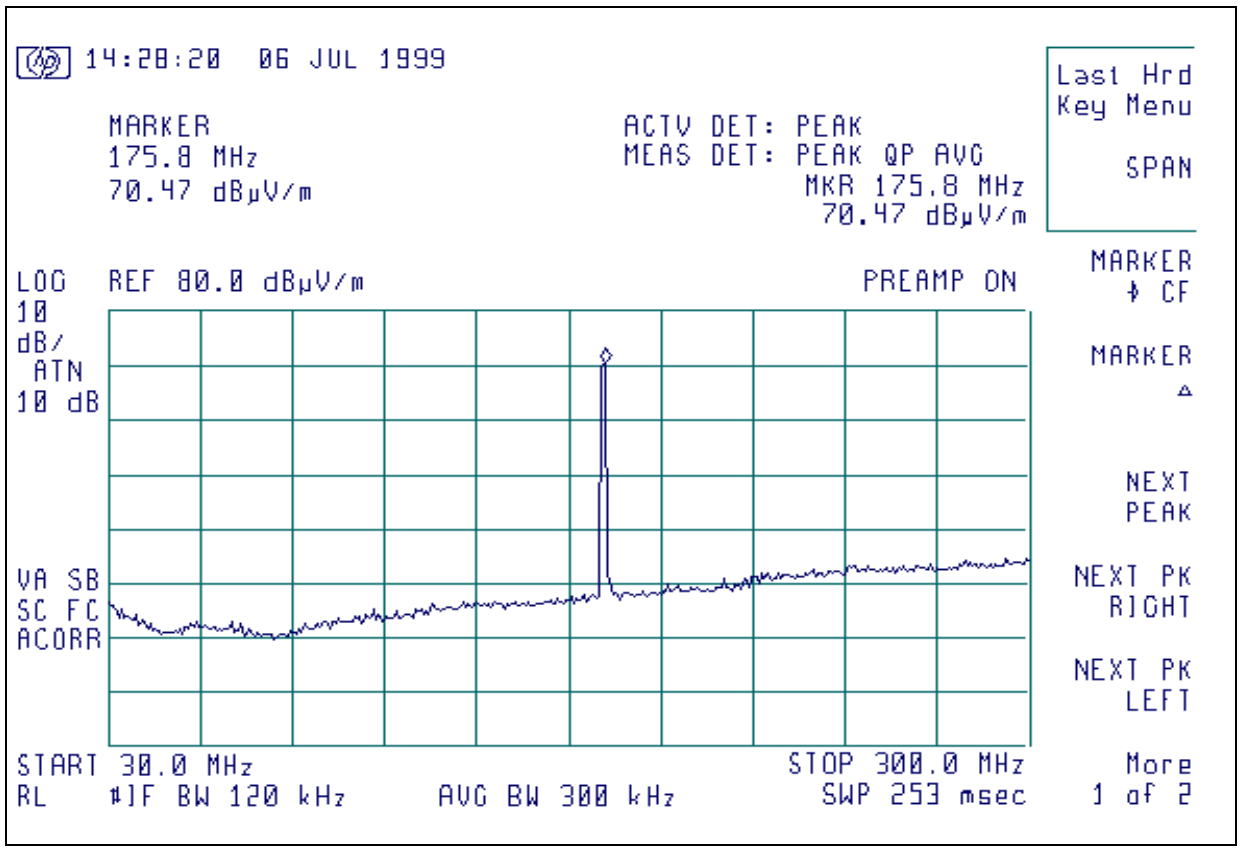
Radiated Emissions signature scan, 150 MHZ, vertical polarity, 500 milliwatt level, 30-300 MHz



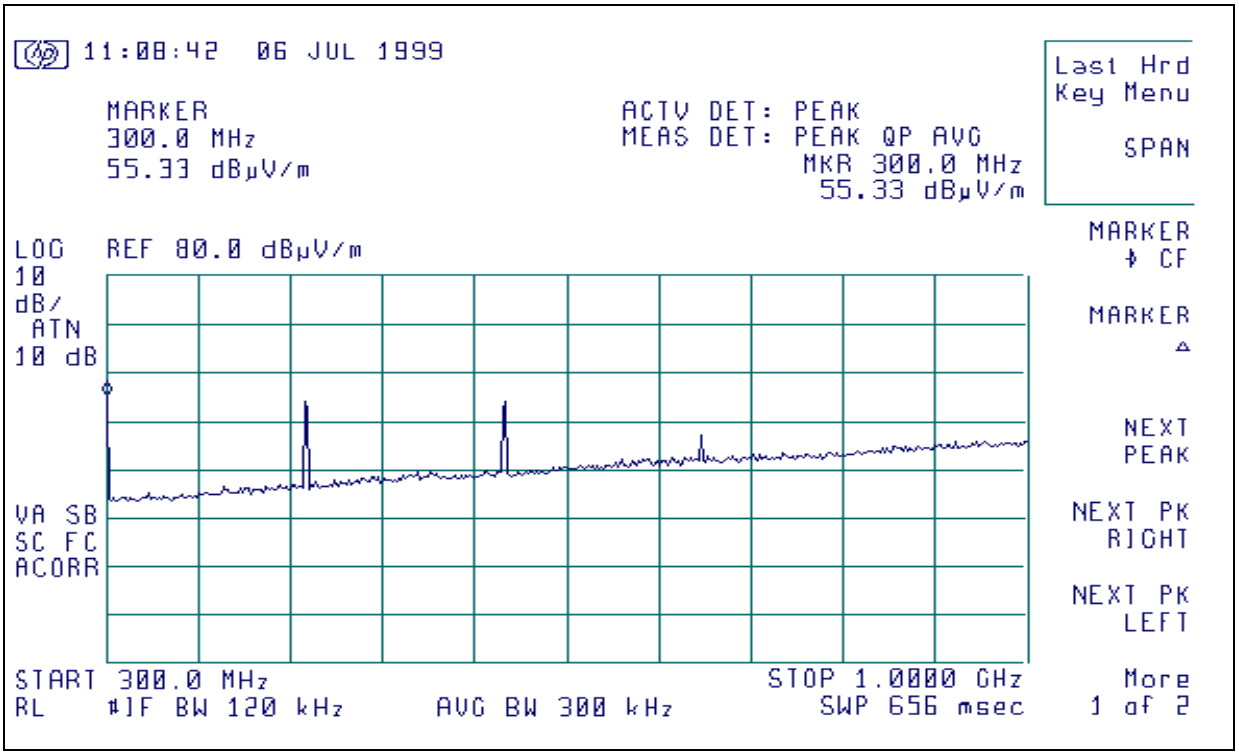
Radiated Emissions signature scan, 162 MHz, vertical polarity, 500 milliwatt level, 30-300 MHz



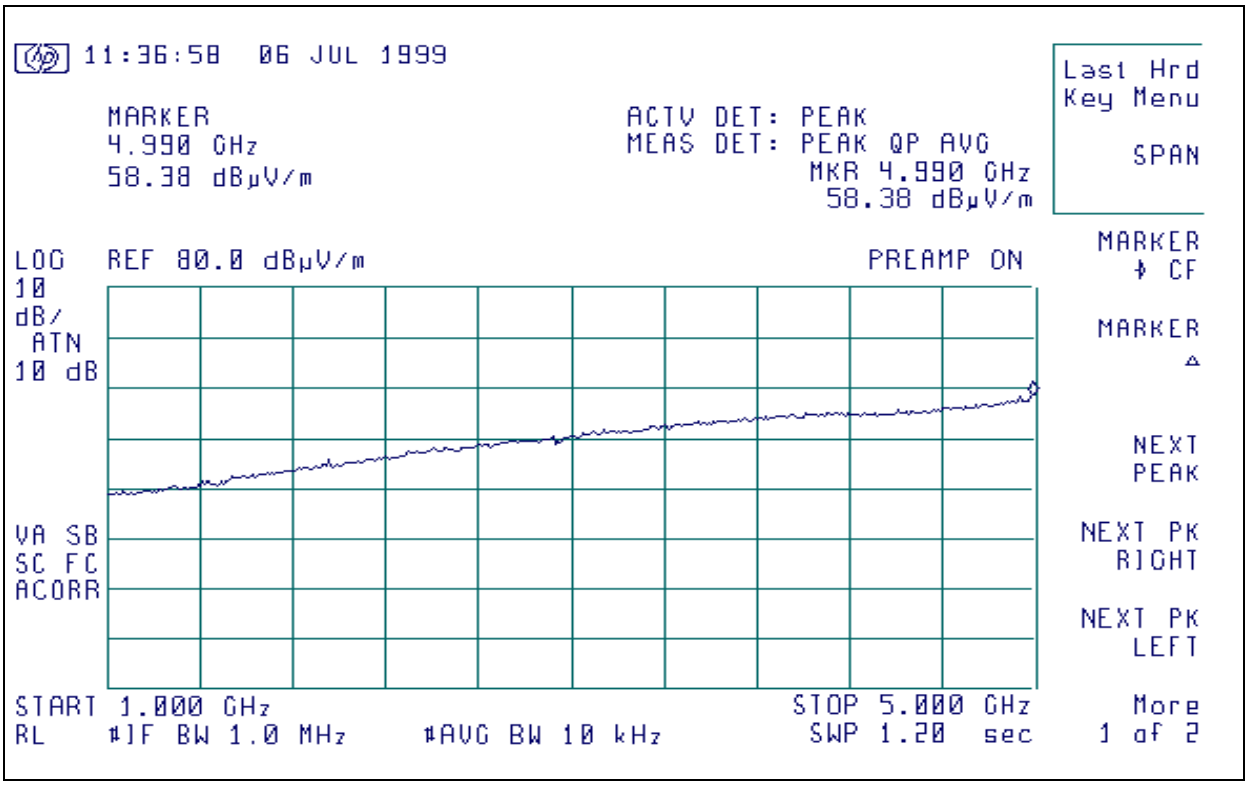
Radiated Emission signature scan, 174 MHz, vertical polarity, 500 MW level, 30-300 MHz



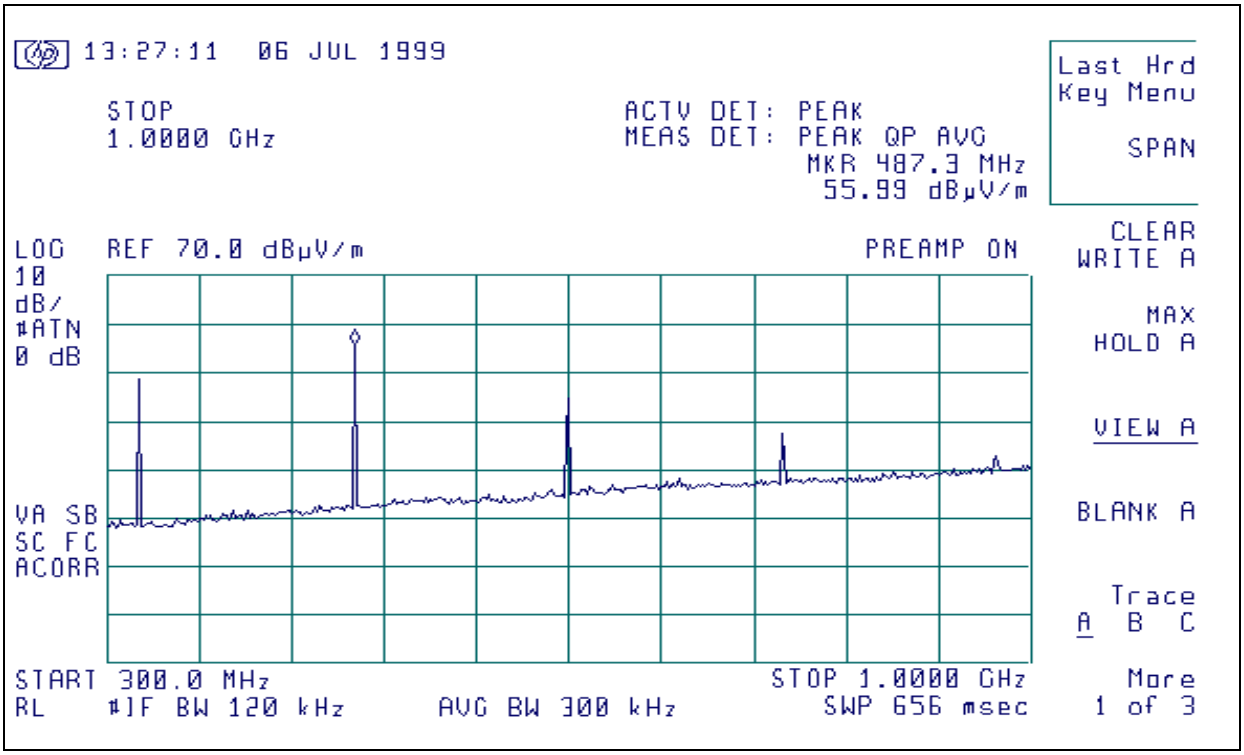
Radiated Emission signature scan, 150 MHz, horizontal polarity, 500 MW level, 300-1000MHz



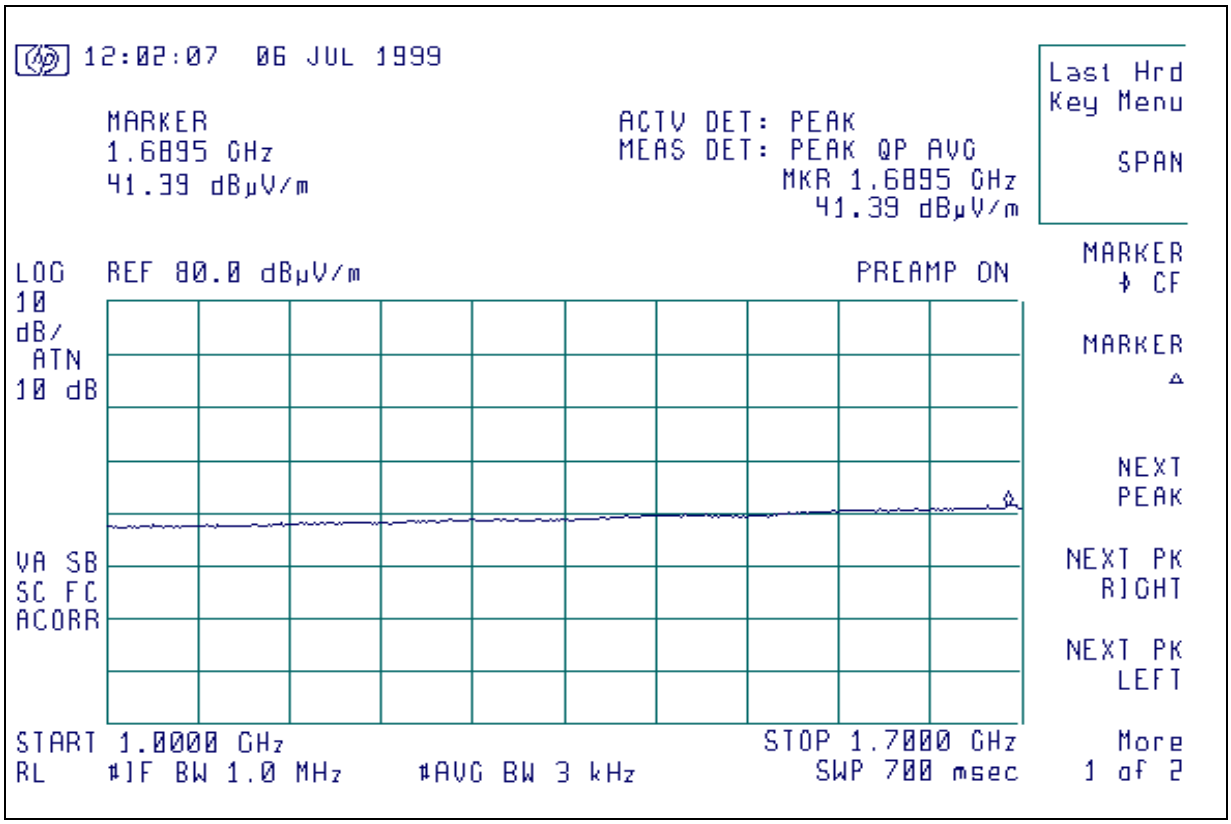
Radiated Emission signature scan, 150 MHz, horizontal polarity, 500 MW level, 1-5 GHz



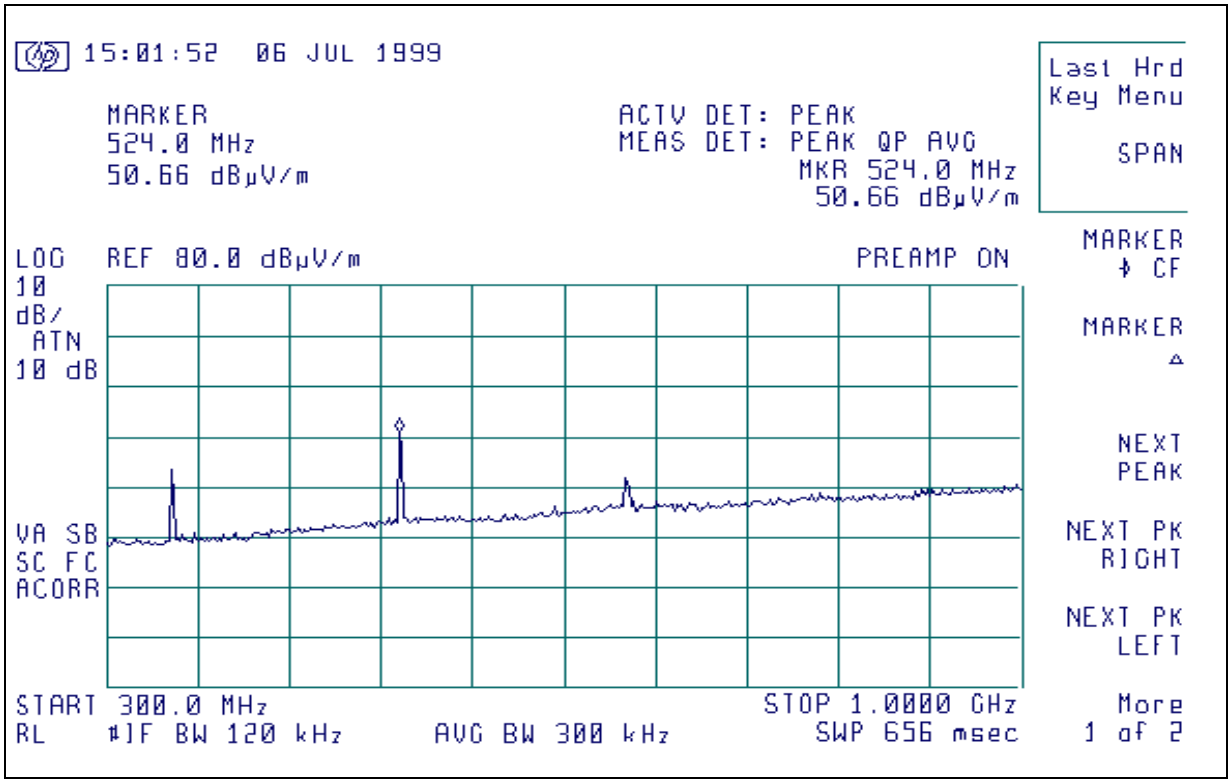
Radiated Emission signature scan, 162 MHz, horizontal polarity, 500 MW level, 300-1000MHz



Radiated Emission signature scan, 162 MHz, horizontal polarity, 500 MW level, 1-1.7 GHz


12:02:07 06 JUL 1999
MARKER
1.6895 GHz
41.39 dBµV/m
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 1.6895 GHz
41.39 dBµV/m
Last Hrd Key Menu
SPAN
LOG
10
dB/
ATN
10 dB
REF 80.0 dBµV/m
PREAMP ON
MARKER → CF
MARKER Δ
NEXT PEAK
NEXT PK RIGHT
NEXT PK LEFT
More 1 of 2
VA SB
SC FC
ACORR
START 1.0000 GHz
RL
#IF BW 1.0 MHz
#AVG BW 3 kHz
STOP 1.7000 GHz
SWP 700 msec

Radiated Emission signature scan, 174 MHz, vertical polarity, 500 MW level, 300-1000 MHz



Radiated Emission signature scan, 174 MHz, horizontal polarity, 500 MW level, 1-1.8 GHz