EESI®
An Employee-Owned Company

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San Diego, California 92121
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FCC, PART 15, SUBPART C

CERTIFICATION REPORT

FOR THE

Water Computer Transmitter

MODEL: **LPX**

FCC ID: N6DLPX1 (PENDING)

PREPARED FOR:

HiTech Equipment Corporation
9672 Via Excelencia, Suite 101
San Diego, CA 92126

PREPARED ON:

NOVEMBER 23, 1998

REPORT NUMBER 98-292

This report has been prepared in accordance with all applicable requirements of ANSI C63.4-1992

DOCUMENT HISTORY

Revision	Date	Comments
A	11/23/98	Initial Release T. B. Ketterling

NOTE: EESI hereby makes the following statements so as to conform to Chapter 10 (Test Reports) Requirements of ANSI C63.4 (1992) "Methods and Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz":

- The units described in this report were received at EESI's facilities on June 23, 1998. Testing was performed on the units described in this report June 30 – July 1, 1998.
- The Test Results reported herein apply only to the Units actually tested, and to substantially identical Units.

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Form 731 with Filing Fee
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TEST CONFIGURATION AND EUT COMPONENT BREAKDOWN PHOTOGRAPHS

APPENDICES

CERTIFICATION

The Radio Frequency Interference (RFI) testing, data evaluation and this report have been prepared by Electromagnetic Engineering Services, Inc., an independent electromagnetic compatibility consulting and test laboratory.

The testing and data collection were accomplished in accordance with the requirements of the ANSI, C63.4-1992 standard and the applicable sections of FCC, Part 15, Subpart C for intentionally radiating equipment. Refer to the Administrative Summary for a description of the test sample.

I certify the data, data evaluation and equipment configuration herein to be a true and accurate representation of the sample's radio frequency interference emission characteristics, as of the test date(s), and for the design of the test sample utilized to compile this report.

T. Bruce Ketterling
V.P. for Technical Operations

1. ADMINISTRATIVE DATA AND TEST SUMMARY

1.1 Administrative Data

CLIENT: HiTech Equipment Corporation
9672 Via Excelencia, Suite 101
San Diego, CA 92126
(619) 566-1892
(619) 530-1458 - fax

CONTACT: Ken Arnold

DATE(S) OF TEST: June 30 – July 1, 1998

TEST SPECIFICATION: FCC, Part 15, Subpart C, for intentional radiators (for periodic, low-power transmitters)

EQUIPMENT UNDER TEST (EUT): Water Computer Transmitter
Model Number: LPX
Serial Number: N/A
FCC ID Number (pending): N6DLPX1

EUT transmitter fundamental frequency: 315.0 MHz

1.2 Tests Performed

Specification	*Frequency Range*	*Compliance Status*
FCC, CFR 47, §15.207, Class "B" Conducted Emissions for Intentional Radiators	0.45 MHz - 30.00 MHz	**PASS**
FCC, CFR 47, §15.209, Class "B" Radiated Emissions for Intentional Radiators	30.00 MHz - 1000 MHz	**PASS**
FCC, CFR 47, §15.231 Spurious Radiated Emissions	30.00 MHz - 1000 MHz	**PASS**
FCC, CFR 47, §15.231 Occupied Bandwidth – Fundamental + Harmonics	5.50 MHz – 3.50 GHz	**PASS**

T. Bruce Ketterling, EESI

Please refer to the Test Results section of this report for further details.

2. SYSTEM DESCRIPTION AND CONFIGURATION

2.1 Description of EUT

The Water Computer™ is a wireless utility submetering system that can be used for the collection of residential utility consumption data. The function of The Water Computer™ system is to collect and transfer residential utility consumption data from individual dwelling units to a centralized location for further processing. Data is acquired within each dwelling unit by a single board microcomputer system interfaced to the utility being measured. The sensor device to which the microcomputer is connected is purely passive, the electrical interface consisting of a dry contact closure. Utility consumption is measured by the frequency of switch closures over a fixed time interval. The microcomputer stores the consumption data in a non-volatile memory.

Once collected, the consumption data must be transferred to a central location for further processing. There are three primary subsystems of which The Water Computer™ is comprised. The LPX is a microcomputer controlled, low power, UHF radio transmitter. The UHF transmitter consists of a Colpitts oscillator operating at 315.0 MHz. The oscillator achieves frequency stabilization with a surface acoustic wave (SAW) resonator. The microcomputer monitors utility consumption and stores this as binary data. At appropriate times the microcomputer keys the transmitter with OOK (on-off keying) modulation. Operating from a 5-volt power supply and operating into an electrically short antenna (electrical wavelength approximately 0.1 wavelengths), the effective communications range of the LPX is approximately 100-150 feet. Each LPX unit is identified by a 32-bit serial number stored in the unit's non-volatile memory.

The second part of the system is the RT100RX Digital Data Receiver. This device consists of a 315 MHz receiver and a drive circuit for an optoisolated current loop. The RTX100RX utilizes its 315 MHz receiver to detect and demodulate the OOK transmissions from the numerous LPX units located within its reception range. The receiver is a single chip superheterodyne with the local oscillator generated by a low frequency PLL (phase locked loop). The receiver IF is centered at approximately 300 kHz, so the PLL frequency is chosen so that the 64^{th} harmonic is equal to the receive frequency offset by the IF. Additional out-of-band signal rejection is provided by a surface acoustic wave (SAW) filter located in the receiver front-end circuitry.

Once demodulated, the receiver output drives a comparator that is used as the driver for the optoisolated current loop. The optoisolator itself is located in the last subsystem of The Water Computer™, known as the Data Collection Unit (DCU). The DCU is a microcomputer-based device that is capable of decoding and processing the data provided to it by the RT100RX. The microcomputer is equipped with an asynchronous serial port to transfer the demodulated data to an appropriate central processing device. This device is generally some type of personal computer. The personal computer will, in general, contain a modem to allow a remote user to access the consumption data by telephone. Each DCU is identified by a 32-bit serial number contained in an on-board, non-volatile memory.

NOTE: This application covers the LPX unit only; the RT100RX and DCU units have been approved via the Declaration of Conformity and Verification self-declaration procedures respectively.

2.2 System Components and Power Cables

DEVICE	MANUFACTURER MODEL # SERIAL # FCC ID#	POWER CABLE
EUT: Water Computer Transmitter	HiTech Equipment Corporation LPX N/A N6DLPX1 (pending)	2m, unshielded, 22 AWG, 9vdc AC Adapter
Digital Data Receiver (Remote)	HiTech Equipment Corporation RT100RX N/A N/A	2m, unshielded, 22 AWG, 9vdc AC Adapter
Data Collection Unit (Remote)	HiTech Equipment Corporation DCU N/A N/A	2m, unshielded, 22 AWG, 9vdc AC Adapter
Laptop Computer (Remote)	Toshiba Satellite Model PA1176U 01512384 N/A	3m, unshielded, 18 AWG, 2-wire, 2-prong connector
Modem (Remote)	Zoom Technologies 2836 0767ZM4X0487 N/A	2m, unshielded, 22 AWG, 9vdc AC Adapter

2.3 Device Interconnection and I/O Cables

CONNECTION	I/O CABLE
Transmitter to Water Flow Sensors	1.5m, unshielded, 22 AWG, hardwired
Digital Data Receiver to Data Collection Unit	2m, shielded, 24 AWG, DB9 connectors
Data Collection Unit to Laptop Computer	2m, shielded, 24 AWG, DB9 connectors
Data Collection Unit to Modem	2m, shielded, 24 AWG, DB25 to DB25 connectors

3. DESIGN MODIFICATIONS FOR COMPLIANCE

Device: Water Computer Transmitter

Model: LPX

The following modification (listed below) was required to bring the equipment into compliance with Federal Communications Commission (FCC) rules and regulations.

- Added Steward P/N 25A-2024-0A0 ferrite bead around all 5 sensor leads at LPX base with 2 turns (1.5m cables). See photograph on page 23 of this test report.

4. DESCRIPTION OF TEST SITE AND EQUIPMENT

4.1 Description of Open Area Test Site

The test site is located at:

11696 Sorrento Valley Road, Suite F
San Diego, CA 92121

This 11 x 17 meter open area test site is located behind the office/lab building. It conforms to the normalized site attenuation limits and construction specifications as set in the EN 55022 (1987), CISPR 16 and 22 (1985) and ANSI C63.4-1992 documents. The site attenuation characteristics are verified for compliance every three years and was last registered with the Federal Communications Commission on October 21, 1996, FCC Document Number 31040/SIT (1300B3). The test site is physically located 18 miles Northwest of downtown San Diego. The general area is a valley 1.5 miles east of the Pacific Ocean. This particular part of the valley tends to minimize ambient levels, i.e. radio and TV broadcast stations and land mobile communications.

4.2 Test Equipment

The following test equipment was used to collect data for this report. All devices used were of current calibration and of the type required in the applicable documents section of this report.

DEVICE	MANUFACTURER	MODEL # SERIAL #
Spectrum Analyzer	Hewlett Packard	8568A 2216A02160
Quasi-peak adapter (CISPR)	Hewlett Packard	85650A 2043A00211
Power line filter	Lindgren	C-150-30-2
Power mains network, Line Impedance Stabilization Network (LISN)	EMCO	3825/2
High pass filter	Solar	7801-5.0 838132
Amplifier	Mini-Circuits	ZHL-2 (SMA) 091887-21
Antenna, Conical Log Spiral	Electro Mechanics	3101
Antenna, Biconical	Electro-Metrics	3104 3020

5. DESCRIPTION OF TESTING METHODS

5.1 Introduction

As required in 47 CFR, Parts 2 and 15, the methods employed to test the radiated and conducted emissions (as applicable) of the EUT are those contained within the American National Standards Institute (ANSI) document C63.4-1992, titled "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz." All applicable FCC Rule Sections that provide further guidance for performance of such testing are also observed.

For General Test Configuration please refer to Figure 1 on page 9.

5.2 Configuration and Methods of Measurements for Conducted Emissions

Section 7 of ANSI C63.4 determines the general configuration of the EUT and associated equipment, as well as the test platform for conducted emissions testing. Tabletop devices are placed on a non-conducting surface 80 centimeters above the ground plane floor and 40 centimeters from the ground plane wall. The EUT and associated system are configured to operate continuously, representing a "normally operating" mode. Power is supplied via a Line Impedance Stabilization Network (LISN). The emissions are recorded using the required bandwidth of 9 kHz in the quasi-peak mode. The average amplitude is also observed employing a 10 kHz bandwidth to determine the presence of broadband RFI. When such interference is caused by broadband sources (as defined by the FCC and ANSI Rules), the deviation guidelines contained in Section 11.3.1 of ANSI C63.4 are employed, which allows a correction factor of 13 dB to be subtracted from the quasi-peak reading. The emission levels are then compared to the applicable FCC limits to determine compliance.

For Conducted Emissions Test Configuration please refer to Figure 2 on page 10.

5.3 Configuration and Methods of Measurements for Maximum Radiated Emissions

Section 8 of ANSI C63.4 determines the general configuration and procedures for measuring the radiated emissions of equipment under test. Initially, the primary emission frequencies are identified inside the test lab by positioning a broadband receive antenna one meter from the EUT to locate frequencies of significant radiation. Normally this is done inside a shielded anechoic chamber to eliminate ambients. Next, the EUT and associated system are placed on a turntable on an 10 meter open area test site (registered with the FCC in accord with its Rules and ANSI C63.4) and the receive antenna is located at a distance of ten or three meters from the EUT.

The EUT and associated system are configured to operate with a series of periodic transmissions, representing a "normally operating" mode. To ensure that the maximum emission at each discrete frequency of interest is observed, the receive antenna is varied in height from one to four meters and rotated to produce horizontal and vertical polarities, and the turntable is also rotated to determine the worst emitting configuration.

For Frequency ID and Radiated Emissions test configurations please refer to Figures 3 and 4 on pages 11-12.

5.4 Radiated Emission Field Strength

47 CFR sections §15.201, §15.203, §15.205, §15.209 and §15.231 specify the general emission specification limits and several specific parameter measures for low power periodic transmitters operating in the frequency range from 260 MHz to 470 MHz. Compliance to the specific sections are listed on the following page.

§15.203: The device under test has a hardwired external antenna. The user has no practical means to attach an additional external antenna or attach a different external antenna to the transmitter. This complies with the requirements of this section.

§15.231 (a): The device under test operates at 315.0 MHz frequency and emits data signals for a residential utility consumption data acquisition system. No continuous transmission is possible with this device. Thus the provisions of this section are met.

§15.231 (a) (1): The device is not manually operated.

§15.231 (a) (2): EUT operates automatically. A single transmission occurs once or twice a day at randomly spaced intervals. The message is less than 1 second in duration.

§15.231 (a) (3): Periodic transmissions do not occur at predetermined intervals. A single transmission occurs at randomly spaced intervals once or twice a day. This interval is much greater than 30 times the message length, and also greater than 10 seconds.

§15.231 (a) (4): Not used for radio control purposes.

§15.205, §15.209 and §15.231 (b): These sections specify the radiated emissions limits and restricted bands of operation. Please refer to the data sheets attached to this report for a tabulated list of the emission frequencies and their compliance status.

In order to obtain the true field strength reading, the spectrum analyzer reading is corrected for amplifier gain, antenna factor and cable loss. In addition, for periodic transmitters an **averaging factor** is also allowed for the transmitter duty cycle. From the test plots of the fundamental harmonic (seen at zero span on a spectrum analyzer), the averaging factor is calculated as follows:

Total duration of each transmission (pulse repetition period):	.950 sec	(>.1 sec)
Duration of digital pulses in the transmission sequence:	.250 msec	
Duration of each bit period:	3.0 msec	

The LPX unit utilizes OOK (On-Off Keying) of an otherwise unmodulated carrier signal. The data is transmitted utilizing a PPM (Pulse Position Modulation) scheme with a fundamental bit period of 3 msec. Ignoring the occasional short dead spaces between parts of the message, a worst-case 100 msec of message On-time would be constructed of consecutive data bits. The On-time percentage would be:

Duty cycle = (total 'ON' time)/(pulse repetition period) = (0.250 /3.0) = 0.0833 = 8.33%

Averaging factor = 20*log(duty cycle) = 20*log(0.0833) = **-21.6 dB**, which exceeds the maximum allowable duty cycle correction of -20 dB.

As per §15.231 (e), the emission specification limit for transmitters operating in the 260-470 MHz frequency range is 1.5 to 5.0mV/m (linearly interpolated) at 3 meters for the fundamental harmonic and 0.15-0.50mV/m (linearly interpolated) at 3 meters for the spurious emissions, unless a spurious emission falls within a the restricted bands as defined in §15.205, in which case the general limits given in §15.209 applies. The limit is calculated as follows:

((315 - 260) / (470 - 260)) x (5000 - 1500) + 1500 = 2416.7 μV/m

The Corrected Analyzer Reading is then given by the following formula:

Corrected Analyzer Reading = (Spectrum Analyzer Reading) - AG + AF + CL + AV

where AG = Amplifier Gain
AF = Antenna Factor
CL = Cable Loss
AV = Duty Cycle Averaging Factor

The corrected analyzer reading is then compared with the above determined emission specification limits. The following is a sample calculation using this procedure:

Data Sheet:	page <15>	
Frequency:	315.000	MHz
Spectrum Analyzer Reading (at 3 m):	45.200	dBμV
Combined Amp. Gain, Cable & Antenna Factor:	+19.500	dB/m
Duty Cycle Averaging Factor:	- 20.000	dB
Corrected Analyzer Reading (at 3 m):	44.700	dBμV/m
Corrected Analyzer Reading (at 3 m):	**171.800**	**μV/m**
Emission Spec. Limit (at 3 m):	**2416.700**	**μV/m (= 67.6 dBμV/m)**

§15.231 (c): The bandwidth of the fundamental harmonic (defined at the points 20 dB below the peak) was measured to be 33 kHz. This meets the requirement of this section that the bandwidth shall not be greater than 0.25% of the center frequency (which is 788 kHz for a center frequency of 315 MHz). For details please refer to the following section.

§15.231 (e): The EUT's data message does not exceed 1 second in length. The EUT's data message does not repeat more frequently than 30 times the duration of the data message. The device is only intended to gather data once or twice per day.

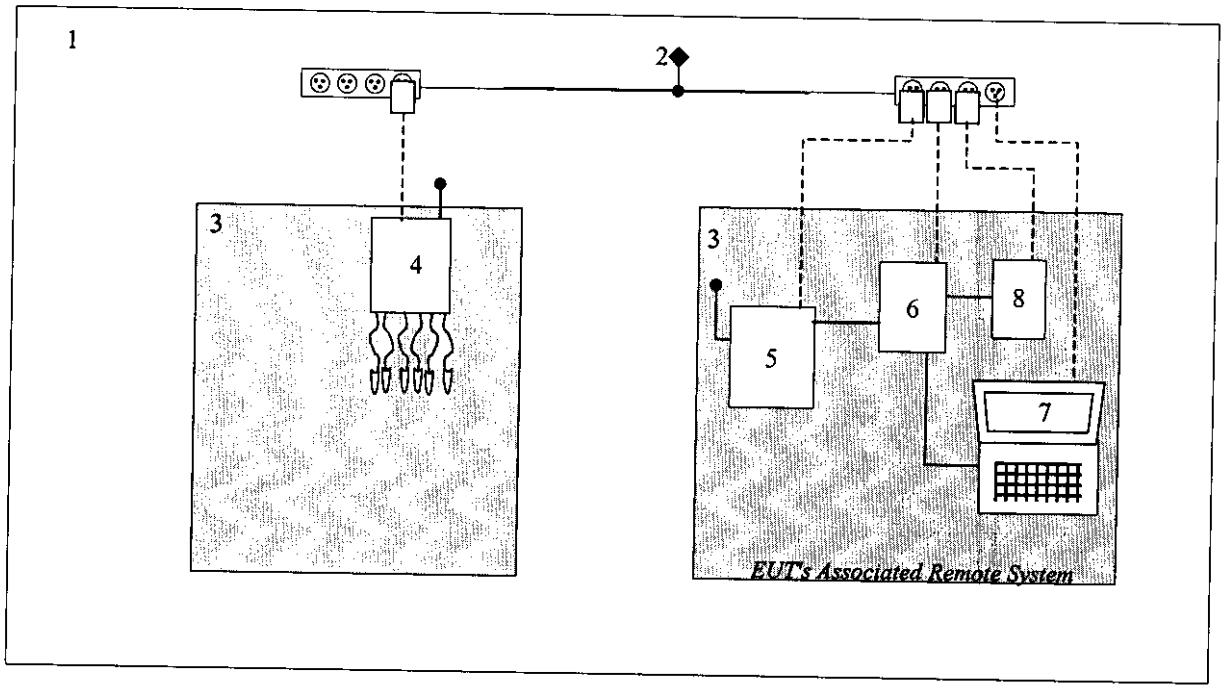
5.5 Configuration and Methods of Measurements for Occupied Bandwidth

The EUT's peak emissions at the fundamental frequency are measured and plotted, and the bandwidth is measured at 20dB below the peak. Data plots of measured emissions are plotted and included in this test report to illustrate compliance.

5.6 Information Relevant to Transition Provisions in 47 CFR, §15.37

Equipment authorization of the device under test is NOT being requested under the transition rules in 47 CFR, §15.37.

Figure 1. General EUT Test Setup Diagram

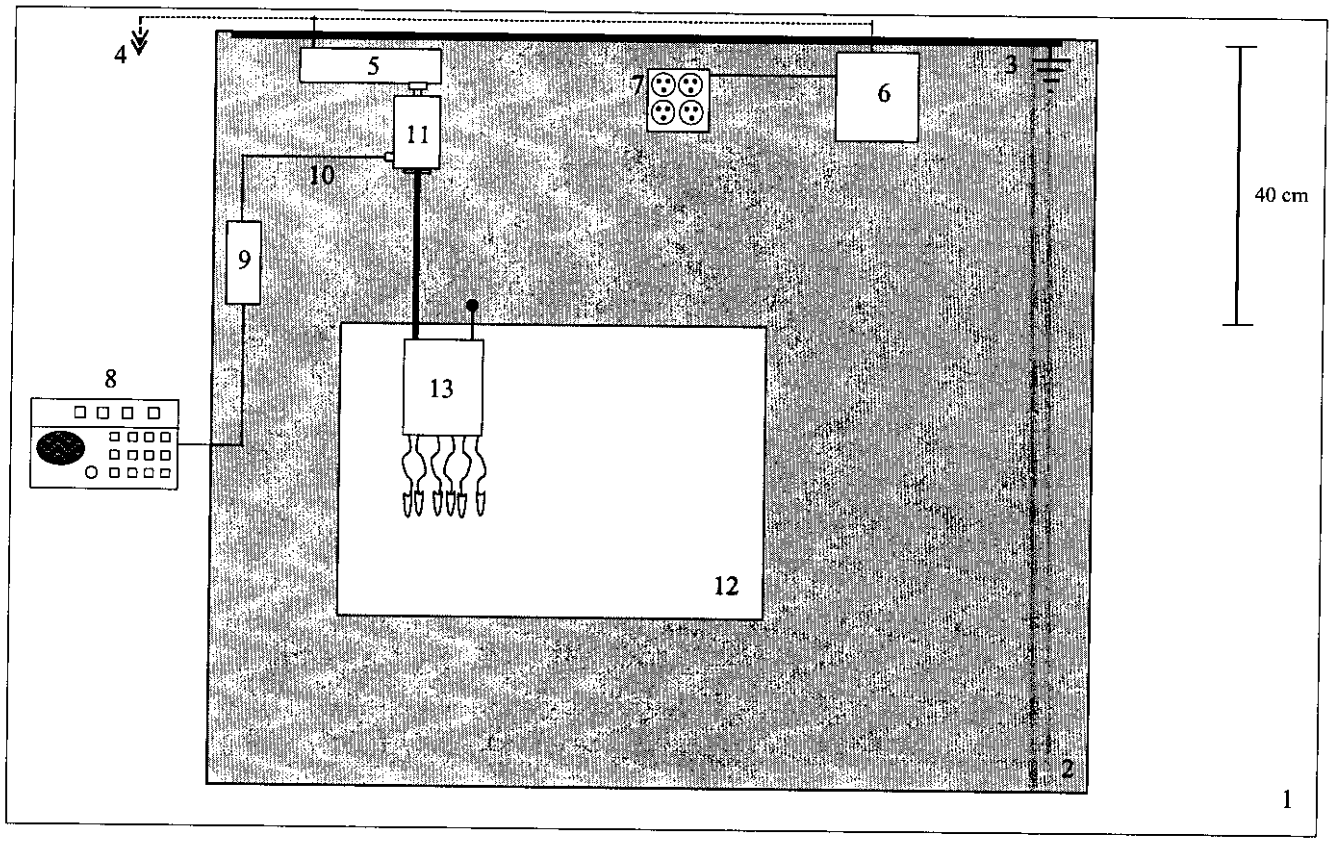


NOT TO SCALE

CONFIGURATION LEGEND

1. Test Laboratory
2. AC Power for Devices
3. Non-Conducting tables 80 cm above ground plane
4. EUT: Water Computer Transmitter
5. Digital Data Receiver (part of EUT system)
6. Data Collection Unit (part of EUT system)
7. Laptop Computer
8. Modem

Figure 2. Conducted Emissions Test Setup Diagram

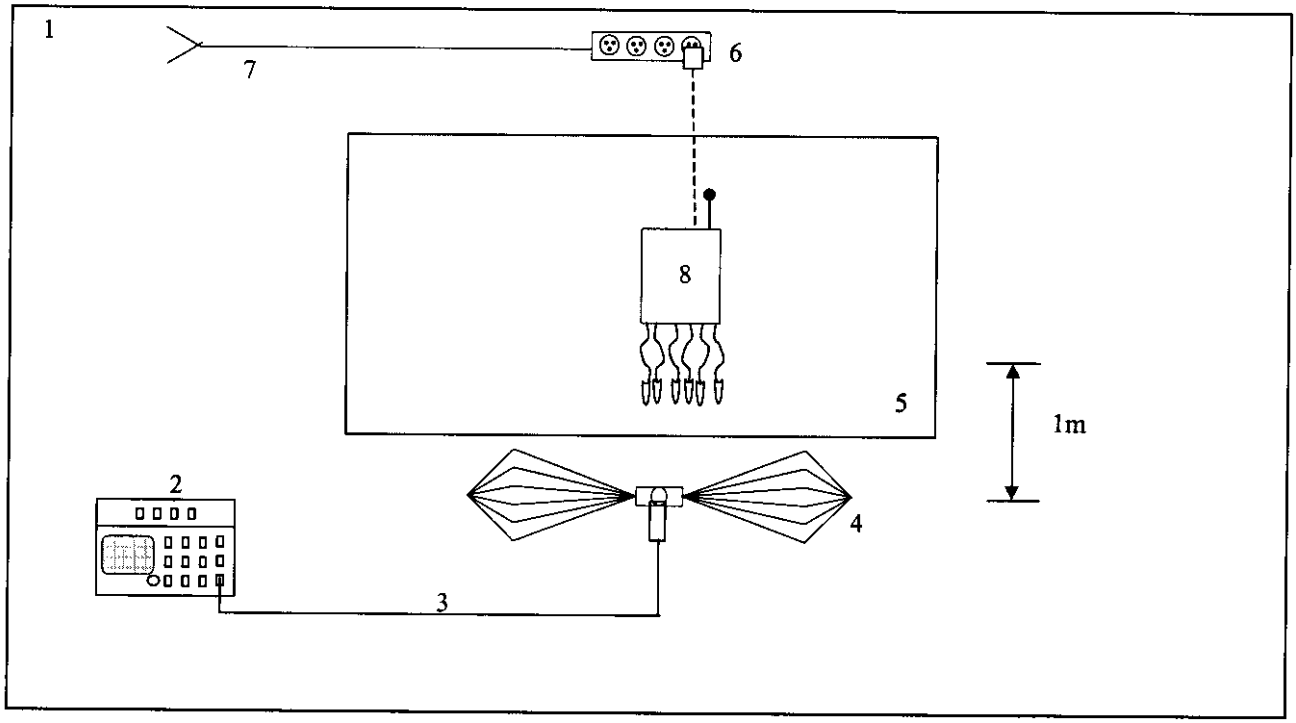


NOT TO SCALE

CONFIGURATION LEGEND

1. Test Laboratory (6 X 6 meters)
2. Ground Plane (15 square meters)
3. Vertical Conducting Wall (Grounded through Ground Plane via 10' ground rod)
4. AC Power for Devices (120V, 60 cycles, single phase)
5. Power Line Filter, Lindgren, 120 dB, 30 amp
6. Line Impedance Stabilization Network (LISN) for peripheral devices
7. Power Distribution Box for peripheral devices
8. Spectrum Analyzer with Quasi-Peak Adapter
9. High Pass Filter
10. Coax input from EUT LISN to Spectrum Analyzer
11. LISN for EUT
12. Non-Conducting table 80 cm above ground plane
13. EUT: Water Computer Transmitter

Figure 3. Radiated Emissions Frequency ID Test Setup Diagram

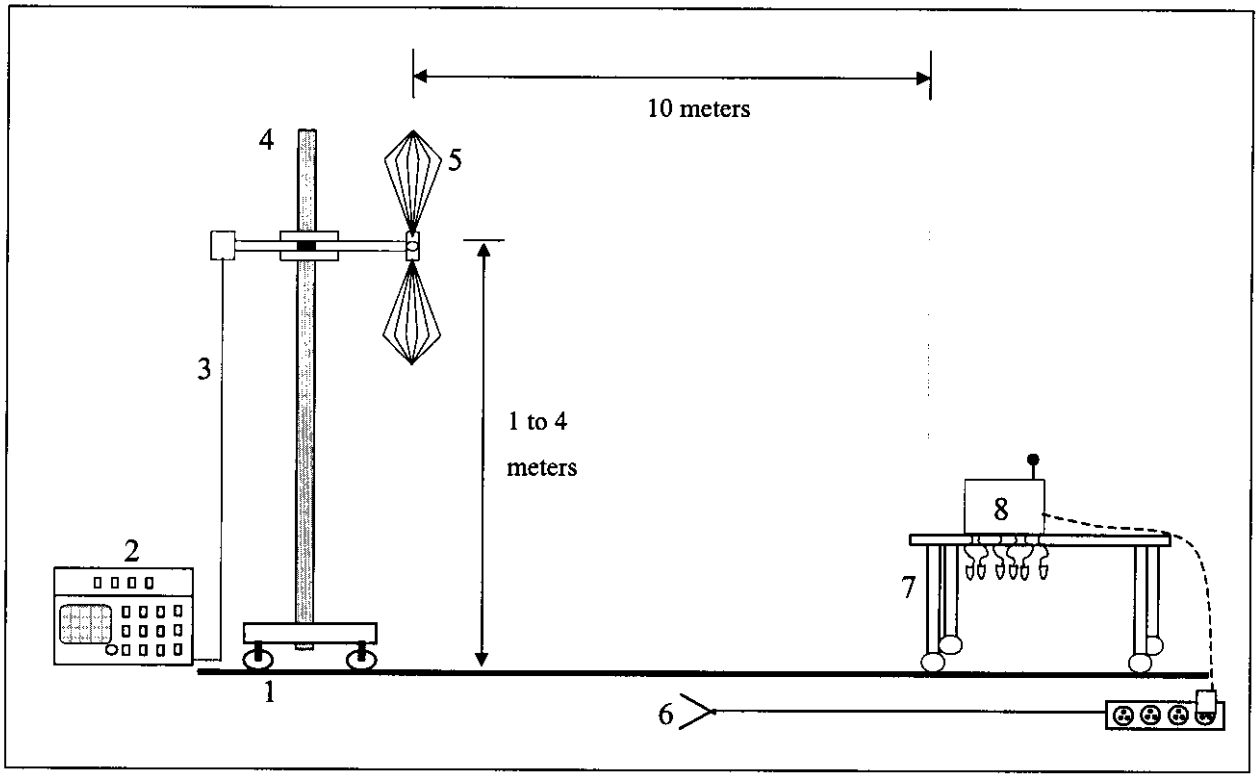


NOT TO SCALE

CONFIGURATION LEGEND

1. Test Laboratory
2. Spectrum Analyzer with Quasi-Peak Adapter
3. Coax interconnect from Antenna to Spectrum Analyzer
4. Receive Antenna (basic relative position)
5. Non-Conducting table 80 cm above ground plane
6. Power strip for EUT and peripherals
7. AC power for devices (120 VAC, 60 cycles, single phase)
8. EUT: Water Computer Transmitter

Figure 4. Radiated Emissions (OATS) Test Setup Diagram



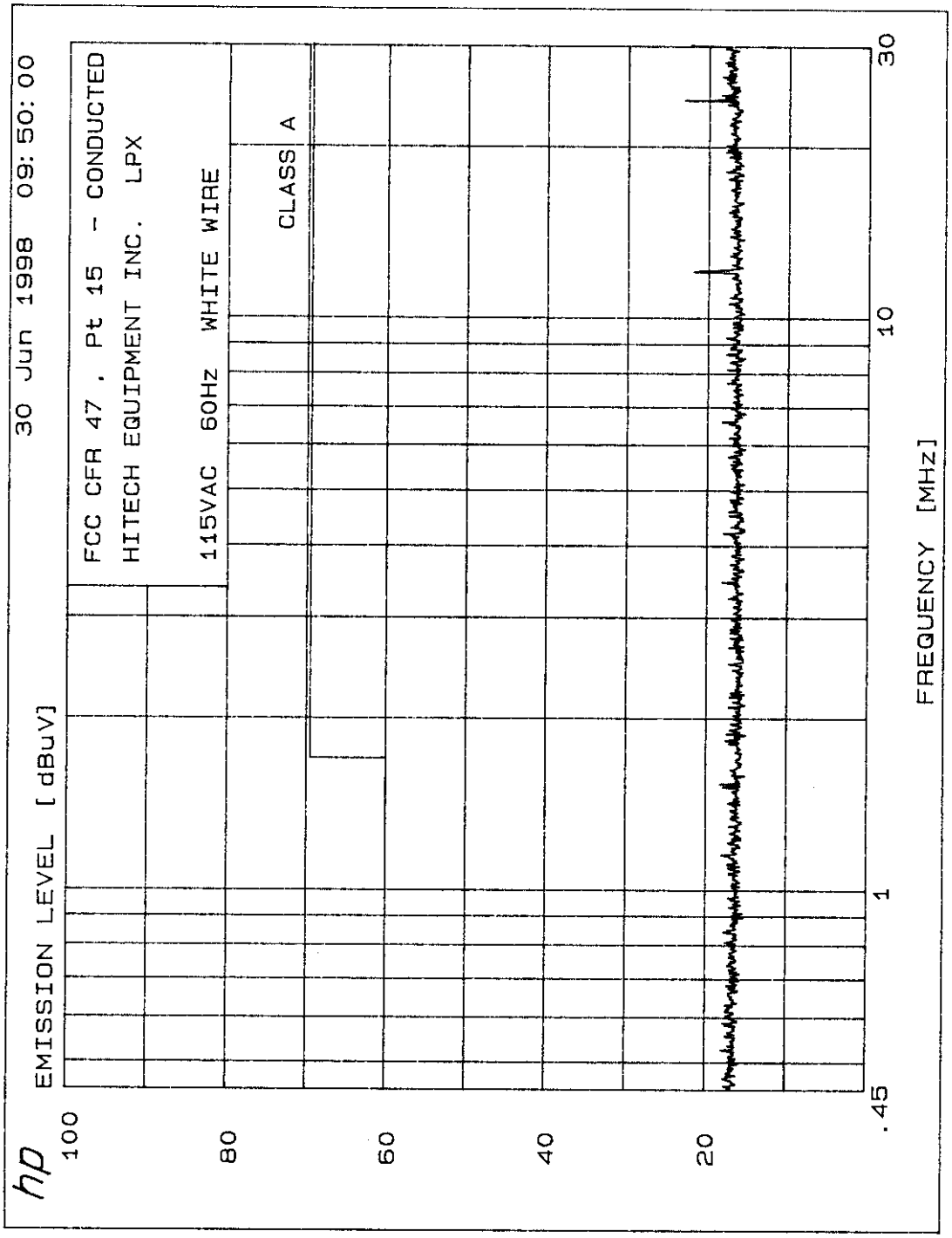
NOT TO SCALE

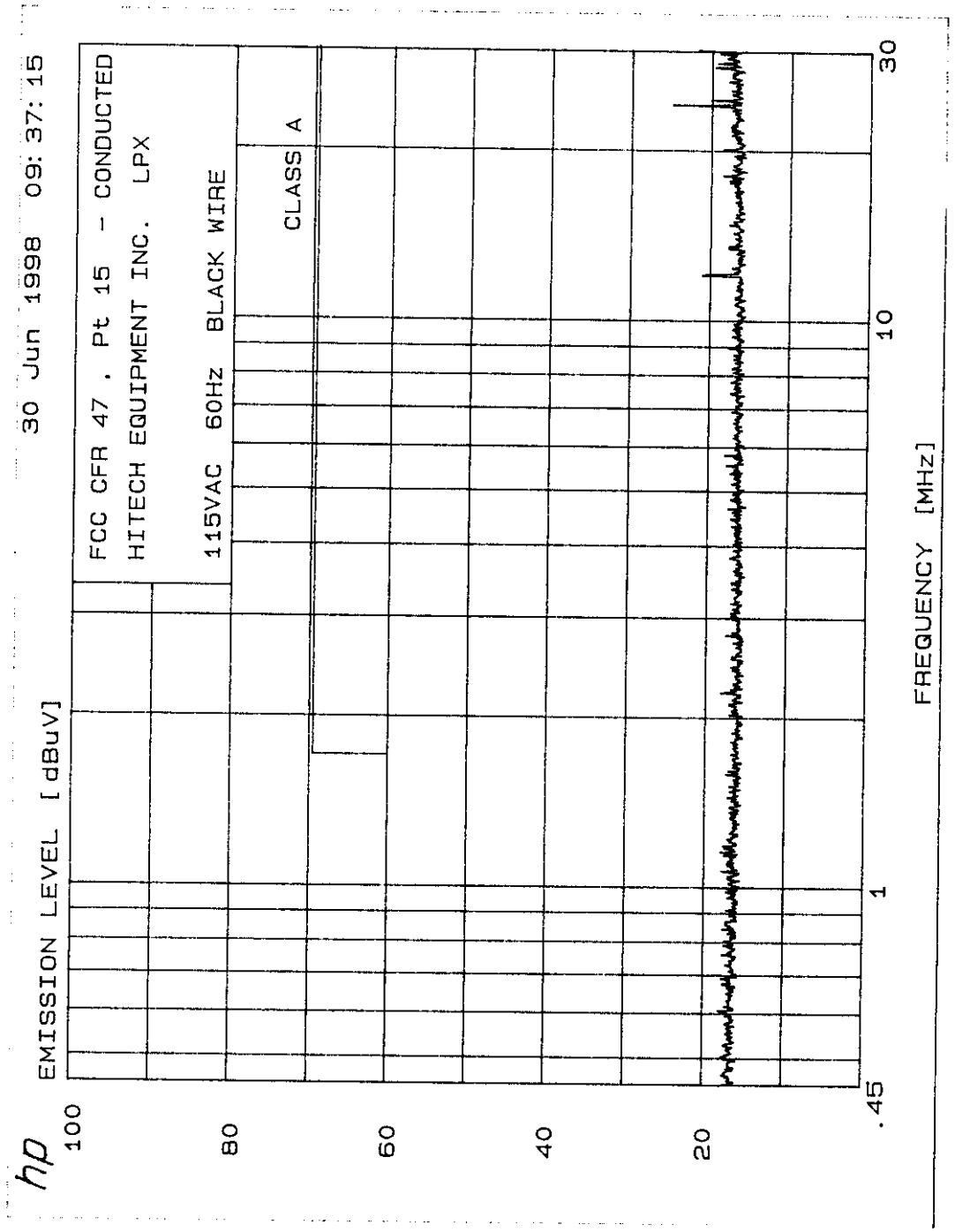
CONFIGURATION LEGEND

1. Ground plane (11 X 17 meters)
2. Spectrum Analyzer with Quasi-Peak Adapter
3. Coax interconnect from Receive Antenna to Spectrum Analyzer
4. Antenna Mast with motorized mounting assembly
5. Receive Antenna (basic relative position)
6. AC power for devices
7. Non-Conducting table 80 cm above ground plane
8. EUT: Water Computer Transmitter

6. TEST RESULTS

6.1 Conducted Emissions Test Data




30 Jun 1998 09:37:15
FCC CFR 47 . Pt 15 - CONDUCTED
HITECH EQUIPMENT INC. LPX
115VAC 60Hz BLACK WIRE
CLASS A
EMISSION LEVEL [dBuV]
100
80
60
40
20
.45
1
10
30
FREQUENCY [MHz]

6.2 Radiated Emissions Test Data

Electromagnetic Engineering Services, Incorporated
FCC, Part 15.231(e) Radiated Emissions Data Sheet
(3m Open Area Test Site)

Client: HiTech Equipment
EUT: Transmitter
Model #: LPX (long wires w/ferrite, 2 turns)

Conducted by: BBottorff
Date of Test: 07-01-98
Test Distance, Amp. gain: 3 m, 0 dB

Frequency (MHz)	Spectrum Analyzer Reading at 3m (dBµV)	Antenna Polari-zation (vertical or horizontal)	Amp. Gain & Cable Loss, Distance & Antenna Factor Correction for 3 m (dBuV/m)	Total Interference Level at 3 m (dBµV/m)	Emission Spec. Limit at 3 m (dBµV/m)	Difference Margin (dB)
315.000	45.2	v	19.5	64.7	67.6	-2.9
630.000	3.1	v	26.8	29.9	47.6	-17.7
945.000	9.8	v	33.1	42.9	47.6	-4.7

Test Conditions: Standard radiated emissions test set up on FCC registered open field site. The highest emissions for all antenna heights, polarities, and table orientations are the only emissions recorded.

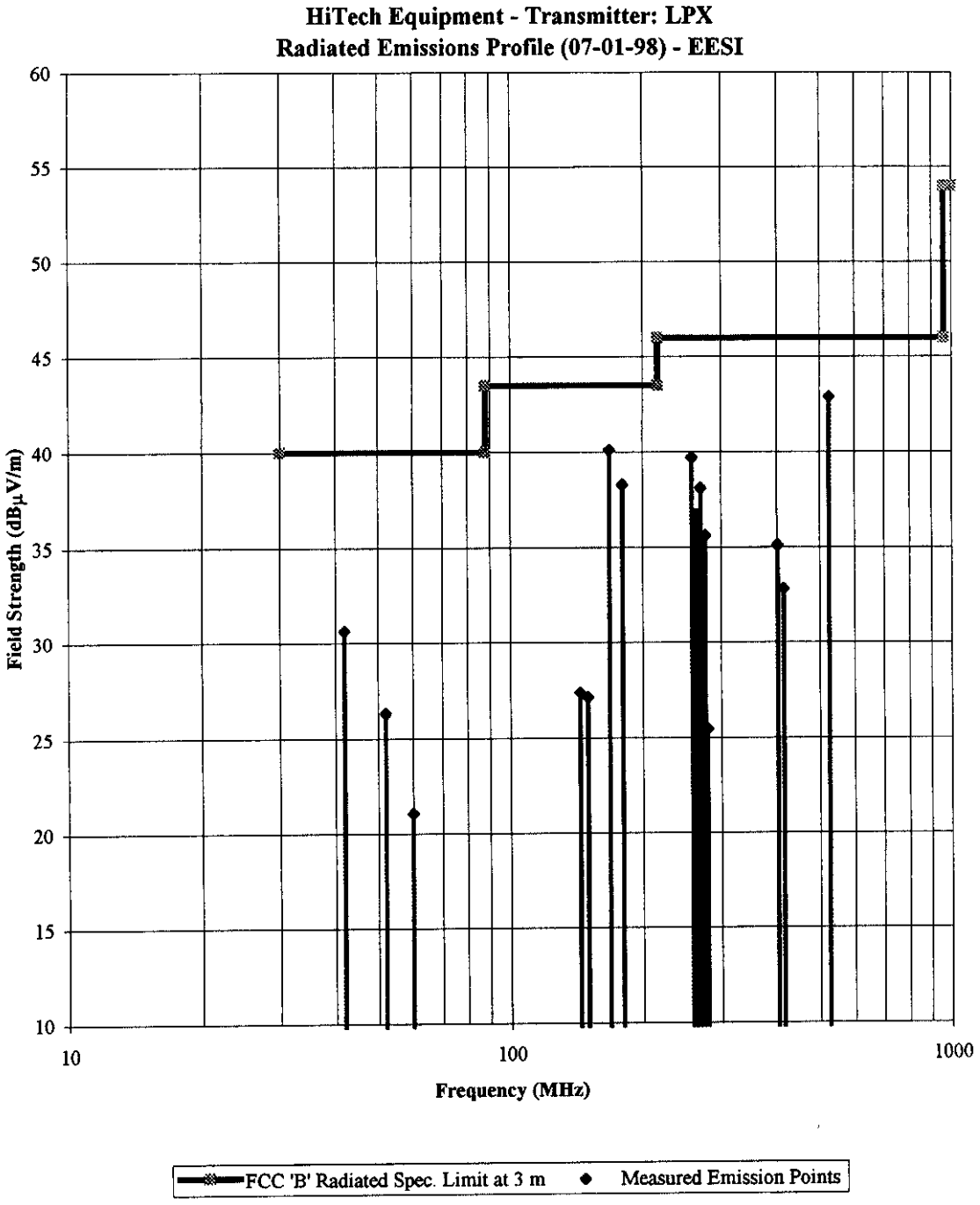
6.3 Spurious Radiated Emissions Test Data

Electromagnetic Engineering Services, Incorporated
FCC, Part 15.231(e) Spurious Radiated Emissions Data Sheet
(3m Open Area Test Site)

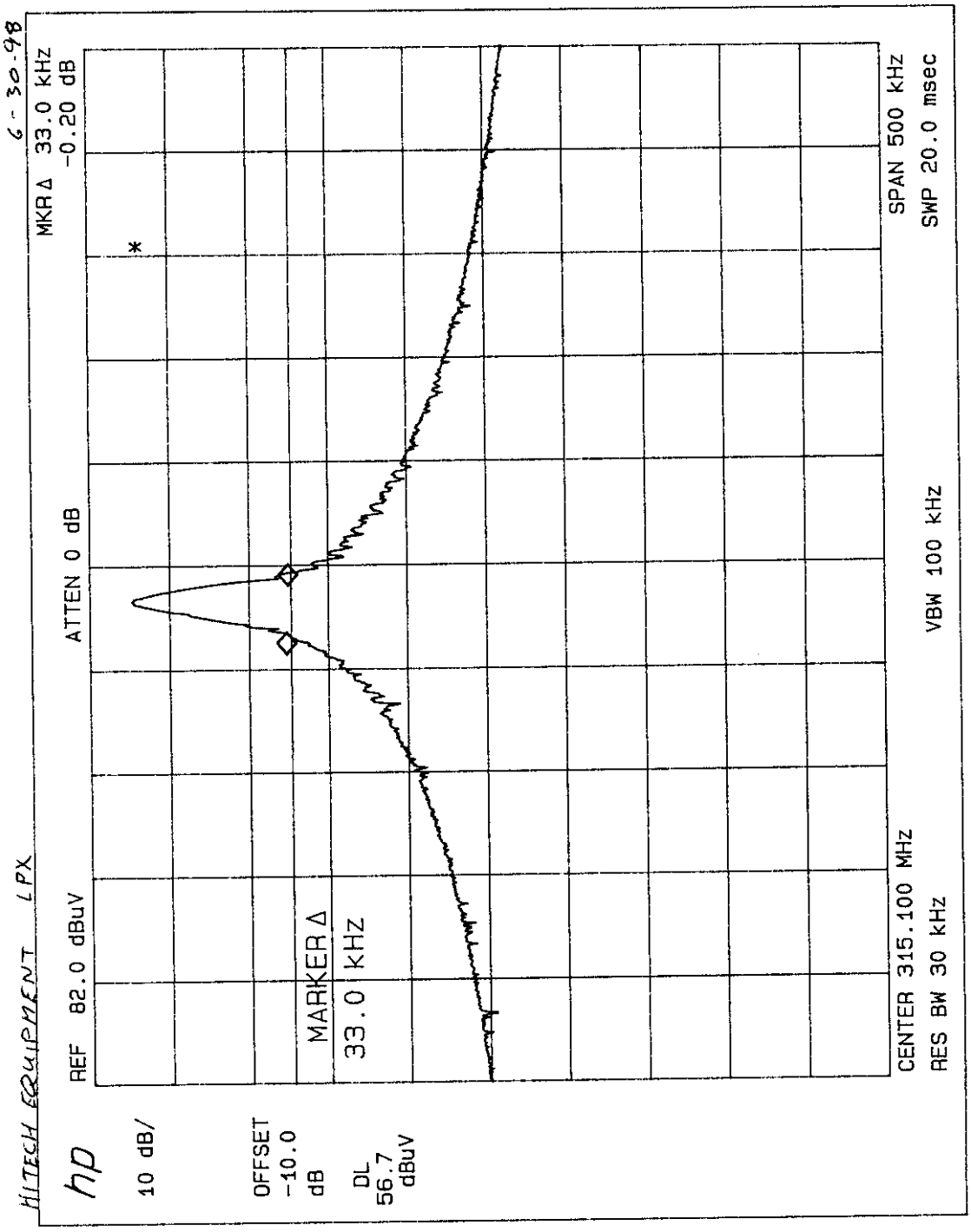
Client: **HiTech Equipment** *Conducted by:* T Battenberg
EUT: **Transmitter** *Date of Test:* **07-01-98**
Model #: **LPX** *Test Distance, Amp. gain:* **3 m, 0 dB**

Frequency (MHz)	Spectrum Analyzer Reading at 3m (dBµV)	Antenna Polori-zation (vertical or horizontal)	Amp. Gain & Cable Loss, Distance & Antenna Factor Correction for 3 m (dBuV/m)	Total Interference Level at 3 m (dBµV/m)	Emission Spec. Limit at 3 m (dBµV/m)	Difference Margin (dB)
42.000	16.7	v	14.0	30.7	40.0	-9.3
52.040	12.0	v	14.3	26.3	40.0	-13.7
60.000	7.3	v	13.8	21.1	40.0	-19.0
144.040	11.2	h	16.2	27.4	43.5	-16.2
150.040	10.1	v	17.0	27.1	43.5	-16.4
168.060	20.5	h	19.6	40.1	43.5	-3.4
180.070	17.3	h	21.0	38.3	43.5	-5.2
258.100	21.2	h	18.5	39.7	46.0	-6.3
264.070	18.2	h	18.6	36.8	46.0	-9.3
270.100	19.5	h	18.6	38.1	46.0	-7.9
276.100	16.9	h	18.7	35.6	46.0	-10.4
279.100	6.7	h	18.8	25.5	46.0	-20.6
402.110	12.1	h	23.0	35.1	46.0	-10.9
414.130	9.2	h	23.6	32.8	46.0	-13.2

Test Conditions: Standard radiated emissions test set up on FCC registered open field site. The highest emissions for all antenna heights, polarities, and table orientations are the only emissions recorded.


HiTech Equipment - Transmitter: LPX
Radiated Emissions Profile (07-01-98) - EESI
Field Strength (dBμV/m)
60
55
50
45
40
35
30
25
20
15
10
10
100
1000
Frequency (MHz)
FCC 'B' Radiated Spec. Limit at 3 m
Measured Emission Points

6.4 Occupied Bandwidth Test Data



APPENDIX A
EESI'S TEST EQUIPMENT & TEST FACILITIES CALIBRATION PROGRAM

EESI operates a comprehensive equipment calibration program in order to ensure the validity of all test data. EESI's calibration program is fully compliant to the requirements of ANSI/NCSL Z540-1 (1994) and of ISO 10012-1 (1993-05-01). EESI's calibration program therefore meets or exceeds the US national commercial and military requirements (N.B. ANSI/NCSL Z540-1 (1994) replaces MIL-STD-45662A) and meets the requirements of ISO-9000. Specifically, all of EESI's primary reference standard devices (e.g., resistor and capacitor decade boxes, vector voltmeters, multimeters, attenuators and terminations, RF power meters (and their detector heads), oscilloscope mainframes and plug-ins, spectrum analyzers, RF preselectors, quasi-peak adapters, interference analyzers, impulse generators, signal generators and pulse/function generators, etc.) and certain secondary standard devices (e.g., RF preamplifiers used in CISPR 11/22 and FCC Part 15/18 tests) are calibrated by EESI-approved independent (third party) metrology laboratories, using NIST-traceable standards. In all cases, the metrology laboratory furnishes EESI with Certificates Of Calibration on each item of equipment that has been successfully recalibrated.

Calibration intervals are normally one year, except when the manufacturer advises a shorter interval (e.g., the HP 8568B Spectrum Analyzer is recalibrated every 6 months) or if US Government directives demand a shorter interval (e.g., the Eaton 533X-11 Impulse Generator is required to be recalibrated every six months for use in TEMPEST testing). Items of equipment which fail during routine use, or which suffer visible mechanical damage (during use or while in transit), are sidelined pending repair and recalibration. (Repairs are carried out either by the EESI-approved independent (third party) metrology laboratories, or by the manufacturer of the equipment.

EESI typically determines the Antenna Factors in its test antennas using qualified vendors. Antennas used for CISPR 11, CISPR 22, and FCC Part 15 and Part 18 Radiated Emissions testing (and for testing to the European Norms) are calibrated against NIST-traceable, FCC-approved Roberts™ Dipoles, using the methods specified in both Annex G.5 of CISPR 16-1 (1993) and ANSI C63.5 (1991), including the "Three-Antenna Method." Certain other antennas (e.g., log-conic spirals) are calibrated using the procedures specified in SAE ARP-958A. In accordance with FCC regulations, EESI recalibrates its suite of antennas used for FCC tests on an annual basis. These calibrations are performed as a precursor to the FCC-required annual revalidation of the Normalized Site Attenuation properties of EESI's Open Area Test Site1. In those instances where antennas are acquired directly from the manufacturer, EESI will purchase an Antenna Factor Calibration Data Package. Finally, EESI may send antennas out to NIST-traceable/military-approved independent antenna range laboratories, or to the original equipment manufacturer.

[1] EESI uses the procedures contained in both Subclause 16.6 and Annex G.2 of CISPR 16-1 (1993), and ANSI C63.4 (1992) when performing Normalized Site Attenuation measurement for calibration of EESI's Open Area Test Site.

FEDERAL COMMUNICATIONS COMMISSION

7435 Oakland Mills Road
Columbia, MD 21046
Telephone: 301-725-1585 (ext-218)
Facsimile: 301-344-2050

October 21, 1996

IN REPLY REFER TO
31040/SIT
1300F2

Electromagnetic Engineering Services, Inc.
11696 Sorrento Valley Road, Suite F
San Diego, CA 92121

Attention: Harry H. Hodes

Re: Measurement facility located at above address
(3 and 10 meter site)

Gentlemen:

Your submission of the description of the subject measurement facility has been reviewed and found to be in compliance with the requirements of Section 2.948 of the FCC Rules. The description has, therefore, been placed on file and the name of your organization added to the Commission's list of facilities whose measurement data will be accepted in conjunction with applications for certification or notification under Parts 15 or 18 of the Commission's Rules. Our list will also indicate that the facility complies with the radiated and AC line conducted test site criteria in ANSI C63.4-1992. Please note that this filing must be updated for any changes made to the facility, and at least every three years the data on file must be certified as current.

Per your request, the above mentioned facility has been also added to our list of those who perform these measurement services for the public on a fee basis. This list is published periodically and is also available on the Laboratory's Public Access Link as described in the enclosed Public Notice.

Sincerely,

Thomas W. Phillips
Electronics Engineer
Customer Service Branch

Enclosure:
PAL PN

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

ISO/IEC GUIDE 25:1990
ISO 9002:1987

Certificate of Accreditation

DEPARTMENT OF COMMERCE * UNITED STATES OF AMERICA *

ELECTROMAGNETIC ENGINEERING SERVICES, INC. "EESI"
SAN DIEGO, CA

is recognized under the National Voluntary Laboratory Accreditation Program for satisfactory compliance with criteria established in Title 15, Part 285 Code of Federal Regulations. These criteria encompass the requirements of ISO/IEC Guide 25 and the relevant requirements of ISO 9002 (ANSI/ASQC Q92-1987) as suppliers of calibration or test results. Accreditation is awarded for specific services, listed on the Scope of Accreditation for:

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS
FCC

December 31, 1998
Effective through

For the National Institute of Standards and Technology

NVLAP Lab Code: 200116-0

NVLAP-01C (11-95)

National Institute of Standards and Technology

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National Voluntary Laboratory Accreditation Program

ISO/IEC GUIDE 25:1990
ISO 9002:1987

Scope of Accreditation

Page: 1 of 1

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS

NVLAP LAB CODE 200116-0

ELECTROMAGNETIC ENGINEERING SERVICES, INC. "EESI"
11696 Sorrento Valley Road, Suite F
San Diego, CA 92121
Mr. Harry H. Hodes
Phone: 619-259-4952 Fax: 619-259-7170

NVLAP Code	*Designation / Description*
International Special Committee on Radio Interference (CISPR) Methods	
12/CIS22	IEC/CISPR 22:1993: Limits and methods of measurement of radio disturbance characteristics of information technology equipment
Federal Communications Commission (FCC) Methods	
12/F01	FCC Method - 47 CFR Part 15 - Digital Devices
12/F01a	Conducted Emissions, Power Lines, 450 KHz to 30 MHz
12/F01b	Radiated Emissions
Australian Standards referred to by clauses in AUSTEL Technical Standards	
12/T51	AS/NZS 3548: Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment

December 31, 1998

Effective through

For the National Institute of Standards and Technology

NVLAP-01S (11-95)