EMT **ELECTRO MAGNETIC TEST, INC.**
1547 Plymouth Street, Mountain View, CA 94043 Tel: (650) 965-4000 Fax: (650) 965-3000

FCC PART 15, SUBPART B CLASS A
and
FCC PART 15, SUBPART C
TEST REPORT

for

the

HANDREADER

MODEL: HKII

Prepared for

RECOGNITION SYSTEMS, INC.
1520 DELL AVENUE
CAMPBELL, CALIFORNIA 95008

Prepared by: _____
DOUG MOON

Approved by: _____
KEVIN BOTHMANN

ELECTRO MAGNETIC TEST, INC.
1547 PLYMOUTH STREET
MOUNTAIN VIEW, CALIFORNIA 94043
(650) 965-4000

DATE: APRIL 21, 2003

	REPORT BODY	APPENDICES				TOTAL
		A	***B***	***C***	***D***	
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GENERAL REPORT SUMMARY

This electromagnetic emission test report is generated by Electro Magnetic Test, Inc., which is an independent testing and consulting firm. The test report is based on testing performed Electro Magnetic Test, Inc. personnel according to the measurement procedure described in the test specification given below and in the "Test Procedures" section of this report.

The measurement data and conclusions appearing herein relate only to the sample tested and this report may not be reproduced in any form unless done so in full.

Associated with the data in this report is a ±2dB measurement uncertainty.

This report must not be used to claim product endorsement by NVLAP or any other agency of the U.S. Government.

Electro Magnetic Test, Inc. is approved to perform EMI/EMC testing by the following agencies:

COUNTRY	AGENCY	LAB APPROVAL #
USA	Federal Communications Commission (FCC)	*
USA	National Voluntary Lab Accreditation Program (NVLAP)	200147-0
Canada	Industry Canada	IC 2804
Japan	Voluntary Control Council For Interference (VCCI)	See Below
	Open Field Test Site Registration Number	R-589
	Conducted Emissions Test Site Registration Number	C-604
Taiwan	Bureau Of Standards, Metrology and Inspection (BSMI)	SL2-IN-E-1024
Australia / New Zealand	Australian Communications Authority (AUSTEL)	*
European Community	TUV Rheinland (EMC for the European Community)	*

*These agencies do not issue a lab approval number to test labs.

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GENERAL REPORT SUMMARY (CONTINUED)

Device Tested: Handreader
Model: HKII
S/N: N/A

Product Description: The EUT is a biometric device that operates using an automated method of verifying the identity of an individual using the physical size and shape of that individual's hand. The EUT can be used for access control as well as time and attendance. After an enrollment process, the user will enter an ID number prompting the EUT to turn on its camera. The user will then submit their hand for image capture. The hand images are then compared and the user will either have permissions granted or denied. The EUT is equipped with a battery backup and an iCLASS HID Reader. The EUT can be configured either with a modem installed, or an Ethernet card installed.

Modifications: The EUT was not modified during the testing.

Manufacturer: Recognition Systems, Inc.
1520 Dell Avenue
Campbell, California 95008

Test Date(s): January 30, 2003 and March 25, 2003

Test Specifications: EMI requirements
Limits: CISPR 22: 1997 Class A
FCC Title 47, Part 15 Subpart C
Test Procedure: ANSI C63.4: 1992

Test Deviations: The test procedure was not deviated from during the testing.

SUMMARY OF TEST RESULTS

TEST	DESCRIPTION	RESULTS
1	Conducted RF Emissions, 150 kHz - 30 MHz.	Complies with the **Class A** limits of CISPR 22: 1997
2	Radiated RF Emissions, 30 MHz - 1000 MHz.	Complies with the **Class A** limits of CISPR 22: 1997
3	Radiated RF Emissions, Field Strength Of Fundamental (13.56 MHz).	Complies with the limits of FCC Title 47, Part 15 Subpart C. (Section 15.225(a))
4	Radiated RF Emissions, Out Of Band Emissions.	Complies with the limits of FCC Title 47, Part 15 Subpart C. (Section 15.225(b), 15.209)
5	Frequency Tolerance Of The Carrier	Complies with the limits of FCC Title 47, Part 15 Subpart C. (Section 15.225(c))
6	Antenna Requirement (15.203)	Not Applicable. The antenna is permanently connected to the transmitter internally.

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1. PURPOSE

This document is a qualification test report based on the Electromagnetic Interference (EMI) tests performed on the Handreader Model: HKII. The EMI measurements were performed according to the measurement procedure described in ANSI C63.4: 1992. The tests were performed in order to determine whether the electromagnetic emissions from the equipment under test, referred to as EUT hereafter, are within the Class A specification limits defined by C.I.S.P.R. Publication 22 for Information Technology Equipment from 150 kHz to 1 GHz. Under paragraph G of section 15.109 of the Code of Federal Regulations Title 47, Part 15 of the FCC rules, FCC accepts the international standards set forth in C.I.S.P.R. Publication 22. The EUT was also tested to determine if the electromagnetic emissions were within the limits defined in FCC Title 47, Subpart C, Section 15.225.

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2. ADMINISTRATIVE DATA

2.1 Location of Testing

The EMI tests described herein were performed at the test facility of Electro Magnetic Test, Inc., 1547 Plymouth Street, Mountain View, California, 94043.

2.2 Traceability Statement

The calibration certificates of all test equipment used during the test are on file at the location of the test. The measurement results in this report and the calibration of the test equipment are traceable to the National Institute of Standards and Technology (NIST).

2.3 Cognizant Personnel

Recognition Systems, Inc.

Bonnie Hunter	Engineering Technician

Electro Magnetic Test, Inc.

Mario Garcia	Test Technician
Doug Moon	Test Technician
Kevin Bothmann	Lab Manager

2.4 Date Test Sample was Received

The test sample was received on January 29, 2003.

2.5 Disposition of the Test Sample

The test sample has not been returned at this time.

2.6 Abbreviations and Acronyms

The following abbreviations and acronyms may be used in this document.

RF	Radio Frequency
EMI	Electromagnetic Interference
EUT	Equipment Under Test
P/N	Part Number
S/N	Serial Number
HP	Hewlett Packard
ITE	Information Technology Equipment
CML	Corrected Meter Limit
LISN	Line Impedance Stabilization Network
CISPR	International Special Committee On Radio Interference
FCC	Federal Communications Commission

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3. APPLICABLE DOCUMENTS

The following documents are referenced or used in the preparation of this EMI Test Report.

SPEC	TITLE
FCC Title 47, Part 15, Subpart B	FCC Rules - Radio frequency devices (including digital devices).
FCC Title 47, Part 15, Subpart C	FCC Rules – Radio frequency devices (intentional radiators) (Section 15.225)
ANSI C63.4 1992	Methods of measurement of radio-noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz.
CISPR 22 1997	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement

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4. DESCRIPTION OF TEST CONFIGURATION

4.1 Description of Test Configuration - EMI

EUT #1 was connected to the relays and remote telephone line simulator via its clock output, bell or data output, and telephone line ports, respectively. EUT #2 was connected to the relays and remote laptop computer via its clock output, bell or data output, and Ethernet ports, respectively. Both EUT #1 and EUT #2 had unterminated cables connected to its switch input and output ports. The remote telephone line simulator was connected to the remote laptop computer via its telephone line port. The remote telephone line simulator and remote laptop computer were both located approximately 10 meters outside the test site. During the testing process, EUT #1 was being continuously polled per the modem with the Handnet For Windows software. EUT #2 was being continuously polled per the Ethernet card with the Handnet For Windows software. The Handnet for Windows software was running on the remote laptop computer. In both EUTs, the iCLASS HID Readers were continuously writing and reading to the cards. The clock outputs were holding the external relays shut to simulate a lock being held open, continuously. Also the cameras were operating in a continuously on condition.

EUT #1 was configured with a modem installed, and EUT #2 was configured with an Ethernet card installed. Both configurations were tested simultaneously.

For the intentional radiator tests, only the EUT with the modem installed was tested. The only difference between the EUT with the modem and the EUT with the Ethernet card is the card itself, which will not affect the intentional radiator tests.

It was determined that the emissions were at their highest level when the EUT was operating in the above configuration. The cables were moved to maximize the emissions. The final conducted as well as radiated data was taken in this mode of operation. All initial investigations were performed with the EMI receiver in manual mode scanning the frequency range continuously. The cables were bundled and routed as shown in the photographs in Appendix A.

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4.1.1 Cable Construction and Termination

Cable #1

This is a 50 foot unshielded cable connecting EUT #1 to the remote line simulator. It has a plastic RJ11 connector at both ends of the cable.

Cable #2

This is a 50 foot unshielded CAT5 cable connecting EUT #2 to the remote laptop computer. It has a plastic RJ45 connector at both ends of the cable.

Cables #3-4

These are 10 foot unshielded cables connected to EUT #1. They each have a plastic terminal at the EUT end, and is unterminated at the other end. These cables were bundled to a length of 1.5 feet.

Cables #5-6

These are 10 foot unshielded cables connected to EUT #2. They each have a plastic terminal at the EUT end, and is unterminated at the other end. These cables were bundled to a length of 1.5 feet.

Cables #7-8

These are two 1 foot single wire cables connecting EUT #1 to the relays. They each have a single wire at both ends of the cable.

Cables #9-10

These are two 1 foot single wire cables connecting EUT #2 to the relays. They each have a single wire at both ends of the cable.

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5. LISTS OF EUT, ACCESSORIES AND TEST EQUIPMENT

5.1 EUT and Accessory List

EQUIPMENT TYPE	MANUFACTURER	MODEL	SERIAL NUMBER	FCC ID
HANDREADER (EUT)	RECOGNITION SYSTEMS, INC.	HKII	N/A	Q33-RSI
POWER SUPPLY (EUT)	AULT, INC.	P48131000A010G	N/A	N/A
RELAYS	NAiS	N/A	N/A	N/A
RELAY POWER SUPPLY	AULT, INC.	P48131000A010G	N/A	N/A
RELAYS	OMRON	G5X-1C4	N/A	N/A
RELAY POWER SUPPLY	AULT, INC.	P48131000A010G	N/A	N/A
THE FOLLOWING WERE LOCATED OUTSIDE THE TEST SITE				
REMOTE TELEPHONE LINE SIMULATOR	TELTONE	TLS-3B-01	015863	N/A
REMOTE LAPTOP COMPUTER	IBM	THINK PAD 600E	78-CHFX3	DoC
REMOTE LAPTOP AC ADAPTER	IBM	02K6749	11S02K6749Z1Z 2UM25Y8JB	N/A
REMOTE MOUSE	MICRO INNOVATIONS	PS/2 MOUSE	010535257	IOWCM-PS2C

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5.2 EMI Test Equipment

EQUIPMENT TYPE	MANUFACT-URER	MODEL NUMBER	SERIAL NUMBER	CAL. DATE	CAL. CYCLE
Spectrum Analyzer	Hewlett Packard	8566B	3013A07296	August 7, 2002	1 Year
RF Preselector	Hewlett Packard	85685A	3010A01157	August 7, 2002	1 Year
Quasi-Peak Adapter	Hewlett Packard	85650A	2521A00584	August 7, 2002	1 Year
Preamplifier	Com Power	PA-102	1482	March 1, 2002	1 Year
RF Attenuator	Mini-Circuits	CAT-10	Asset #1000	December 6, 2002	1 Year
LISN	Com Power	LI-200	12012	April 20, 2002	1 Year
LISN	Com Power	LI-200	12214	April 20, 2002	1 Year
LISN	Com Power	LI-200	1767	April 20, 2002	1 Year
LISN	Com Power	LI-200	1768	April 20, 2002	1 Year
Biconical Antenna	Com Power	AB-100	01557	November 9, 2002	1 Year
Log Periodic Antenna	Com Power	AL-100	16037	November 9, 2002	1 Year
Horn Antenna	Com Power	AH-118	10062	N/A	N/A
Antenna Mast	Com Power	AM-400	N/A	N/A	N/A
Turntable	Com Power	TT-100	N/A	N/A	N/A
Computer	Compaq	Series 3284	X637BBS20212	N/A	N/A
Printer	Epson	P930A	3HR1398903	N/A	N/A
Plotter	Hewlett Packard	7470A	2308A96499	N/A	N/A

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6. TEST SITE DESCRIPTION

6.1 Test Facility Description

Please refer to section 7.1.1 and 7.1.2 of this report for EMI test location.

6.2 EUT Mounting, Bonding and Grounding

The EUT was mounted on a 1.0 by 1.5 meter non-conductive table 0.8 meters above the ground plane.

The EUT was not grounded.

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7. TEST PROCEDURES

The following sections describe the test methods and the specifications for the tests.

7.1 RF Emissions

7.1.1 Conducted Emissions Test

The HP 8566B spectrum analyzer was used as a measuring meter along with the HP 85650A quasi-peak adapter. The data was collected with the spectrum analyzer in the peak detect mode with the "Max Hold" feature activated. The quasi-peak detector was used only where indicated in the data sheets. A 10 dB attenuation pad was used for the protection of the spectrum analyzer input stage, and the spectrum analyzer offset was adjusted accordingly to read the actual data measured. The LISN output was read by the HP 8566B spectrum analyzer. The output of the second LISN was terminated by a 50 ohm termination. The effective measurement bandwidth used for the conducted emissions test was 9 kHz.

Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The EUT was powered through the LISN, which was bonded to the ground plane. The LISN power was filtered and the filter was bonded to the ground plane. The EUT was set up with the minimum distances from any conductive surfaces as specified in ANSI C63.4: 1992. The excess power cord was wrapped in a figure eight pattern to form a bundle not exceeding 0.4 meters in length.

The initial test data was taken in manual mode while scanning the frequency ranges of 0.150 MHz to 0.450 MHz, 0.450 MHz to 1.6 MHz, 1.6 MHz to 5 MHz and 5 MHz to 30 MHz. The conducted emissions from the EUT were maximized for operating mode as well as cable and peripheral placement. Once a predominant frequency (within 12 dB of the limit) was found, it was more closely examined with the spectrum analyzer span adjusted to 1 MHz.

The final data was collected under program control by the HP 85869PC software in several overlapping sweeps by running the spectrum analyzer at a minimum scan rate of 10 seconds per octave.

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7.1.2 Radiated Emissions Test

The HP 8566B spectrum analyzer was used as a measuring meter along with the HP 85650A quasi-peak adapter. The Com Power Preamplifier PA-102 was used to increase the sensitivity of the instrument. The spectrum analyzer was used in the peak detect mode with the "Max Hold" feature activated. In this mode, the spectrum analyzer records the highest measured reading over all the sweeps. The HP 85650A quasi-peak adapter was used only for those readings which are marked accordingly on the data sheets. The effective measurement bandwidth used for the radiated emissions test was 120 kHz.

Broadband biconical and log periodic antennas were used as transducers during the measurement. The biconical antenna was used from 30 MHz to 300 MHz, and the log periodic antenna was used from 300 MHz to 1 GHz. The frequency spans were wide (30 MHz to 88 MHz, 88 MHz to 216 MHz, 216 to 300 MHz and 300 MHz to 1 GHz) during preliminary investigations. The final data was taken with a frequency span of 1 MHz. Furthermore, the frequency span was reduced during the preliminary investigations as deemed necessary.

The open field test site of Electro Magnetic Test, Inc. was used for radiated emission testing. This test site is set up according to ANSI C63.4: 1992. Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The turntable supporting the EUT is remote controlled using a motor. The turntable permits EUT rotation of 360 degrees in order to maximize emissions. Also, the antenna mast allows height variation of the antenna from 1 meter to 4 meters. Data was collected in the worst case (highest emission) configuration of the EUT. At each reading, the EUT was rotated 360 degrees and the antenna height was varied from 1 to 4 meters (for E field radiated field strength).

The presence of ambient signals was verified by turning the EUT off. In case an ambient signal was detected, the measurement bandwidth was reduced temporarily and verification was made that an additional adjacent peak did not exist. This ensures that the ambient signal does not hide any emissions from the EUT. The EUT was tested at a 10 meter test distance to obtain final test data.

Calculation Of Radiated Emission Test Data:

Amplitude - Gain + Antenna Factor + Cable Loss = Corrected Amplitude

Corrected Amplitude - Limit = Margin

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8. CONCLUSIONS

The Handreader Model: HKII meets all of the Class A specification limits defined by C.I.S.P.R. Publication 22 for Information Technology Equipment from 150 kHz to 1 GHz. Under paragraph G of section 15.109 of the Code of Federal Regulations Title 47, Part 15 of the FCC rules, FCC accepts the international standards set forth in C.I.S.P.R. Publication 22. The EUT also meets the specification limits defined in FCC Title 47, Subpart C, Section 15.225.

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APPENDIX A

RADIATED AND CONDUCTED EMISSIONS DATA SHEETS

Electro Magnetic Test, Inc.
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Radiated Emissions Test Data

Purpose of Test: [X] QUALIFICATION [] ENGINEERING [] MANUFACTURING AUDIT
CISPR 22 Class A Test Date: 01-30-03
Company Name: RECOGNITION SYSTEMS, INC.
EUT Model Number: HKII
EUT Serial Number: N/A
EUT Description: HANDREADER

Test Setup Configuration

EUT Clock Speeds: 32.768 KHz, 4 MHz, 13.56 MHz, 18.432 MHz

EUT Power Cords: [] SHIELDED [X] NOT SHIELDED
EUT tested at: [] LOW SPEED [] HIGH SPEED
EUT is: [X] IN COMPLIANCE [] OUT OF COMPLIANCE with CISPR 22 Class A.

EUT Modifications during this test:
[] MODIFIED [X] NOT MODIFIED

Modifications: _____

_____

_____

NOTE: A formal report on passing data will be generated when required.
Design, debug and consultation services are available at all times.

Test Engineer: Mario Garcia (MARIO GARCIA)

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CISPR 22 Class A Test Date: 01-30-03
Company Name: RECOGNITION SYSTEMS, INC.
EUT Model Number: HKII
EUT Description: HANDREADER

RADIATED EMISSION TEST RESULTS

Freq MHz	Ampl dBuV	M	P	A	Ht m	Dist m	Ori deg	Gain dB	ACor dBuV/m	CCor dB	DCor dB	CorAmp dBuV/m	Limit dBuV/m	Margin dB	Flags FH---
VERTICAL POLARIZATION															
30.614	33.3	P	V	B	1.0	10.0	135	22.8	13.2	1.2	0.0	24.9	40.0	-15.1	-----
40.016	33.5	P	V	B	1.0	10.0	225	22.8	10.8	1.6	0.0	23.1	40.0	-16.9	-----
116.729	32.7	P	V	B	1.0	10.0	90	22.8	10.6	2.1	0.0	22.6	40.0	-17.4	-----
122.383	32.1	P	V	B	1.0	10.0	0	22.8	10.9	2.1	0.0	22.3	40.0	-17.7	-----
132.348	31.7	P	V	B	2.0	10.0	135	22.8	11.6	2.1	0.0	22.6	40.0	-17.4	-----
140.022	34.1	P	V	B	1.5	10.0	180	22.8	12.1	2.2	0.0	25.6	40.0	-14.4	-----
149.495	30.3	P	V	B	2.0	10.0	45	22.8	12.7	2.2	0.0	22.4	40.0	-17.6	-----
161.348	32.4	P	V	B	2.0	10.0	315	22.8	13.4	2.3	0.0	25.3	40.0	-14.7	-----
180.030	32.1	P	V	B	1.5	10.0	0	22.8	14.6	2.5	0.0	26.4	40.0	-13.6	-----
216.648	30.2	P	V	B	1.0	10.0	0	22.7	16.7	2.7	0.0	26.9	40.0	-13.1	-----
230.498	32.0	P	V	B	1.0	10.0	45	22.8	17.4	2.8	0.0	29.4	47.0	-17.6	-----
240.011	33.9	P	V	B	1.0	10.0	225	22.7	17.7	2.9	0.0	31.8	47.0	-15.2	-----
248.934	32.6	P	V	B	1.0	10.0	180	22.7	18.1	2.9	0.0	30.9	47.0	-16.1	-----
254.055	35.7	P	V	B	1.0	10.0	180	22.7	18.4	2.9	0.0	34.3	47.0	-12.7	-----
284.648	29.9	P	V	B	1.0	10.0	0	22.7	20.7	3.2	0.0	31.1	47.0	-15.9	-----
301.930	34.0	P	V	L	1.0	10.0	315	22.7	14.3	3.3	0.0	28.9	47.0	-18.1	-----
308.848	36.3	P	V	L	1.5	10.0	315	22.7	14.4	3.3	0.0	31.3	47.0	-15.7	-----
313.461	37.0	P	V	L	1.5	10.0	180	22.8	14.5	3.4	0.0	32.1	47.0	-14.9	-----
322.674	34.2	P	V	L	1.0	10.0	135	22.8	14.6	3.4	0.0	29.4	47.0	-17.6	-----
338.732	44.9	P	V	L	1.0	10.0	0	22.9	14.8	3.5	0.0	40.3	47.0	-6.7	-----
340.046	36.1	P	V	L	1.0	10.0	0	22.9	14.9	3.5	0.0	31.6	47.0	-15.4	-----
341.127	37.9	P	V	L	1.0	10.0	0	22.9	14.9	3.5	0.0	33.4	47.0	-13.6	-----
350.349	33.7	P	V	L	1.0	10.0	45	22.9	15.0	3.5	0.0	29.3	47.0	-17.7	-----
366.950	44.1	P	V	L	1.5	10.0	0	22.8	14.7	3.6	0.0	39.6	47.0	-7.4	-----
368.792	34.4	P	V	L	1.0	10.0	270	22.7	14.7	3.6	0.0	30.0	47.0	-17.0	-----
380.054	38.2	P	V	L	1.0	10.0	270	22.7	14.5	3.7	0.0	33.7	47.0	-13.3	-----
395.174	48.5	P	V	L	1.0	10.0	315	22.5	14.2	3.8	0.0	44.0	47.0	-3.0	-----
395.174	47.8	Q	V	L	1.0	10.0	315	22.5	14.2	3.8	0.0	43.3	47.0	-3.7	-----
423.398	42.5	P	V	L	1.0	10.0	315	22.5	15.4	3.9	0.0	39.3	47.0	-7.7	-----
479.867	41.3	P	V	L	1.0	10.0	315	22.5	16.6	4.2	0.0	39.6	47.0	-7.4	-----
536.310	38.3	P	V	L	1.0	10.0	315	22.4	17.3	4.5	0.0	37.7	47.0	-9.3	-----
592.750	35.4	P	V	L	1.0	10.0	225	22.2	18.9	4.9	0.0	37.0	47.0	-10.0	-----
649.215	31.8	P	V	L	1.0	10.0	315	22.0	19.9	5.2	0.0	34.9	47.0	-12.1	-----
705.661	28.9	P	V	L	1.0	10.0	225	22.0	20.5	5.2	0.0	32.6	47.0	-14.4	-----
789.247	26.4	P	V	L	1.0	10.0	270	21.3	21.4	5.7	0.0	32.2	47.0	-14.8	-----
894.959	23.7	P	V	L	1.0	10.0	0	21.5	23.1	6.2	0.0	31.5	47.0	-15.5	-----
HORIZONTAL POLARIZATION															
30.610	33.0	P	H	B	1.0	10.0	90	22.8	13.2	1.2	0.0	24.6	40.0	-15.4	-----
40.011	33.0	P	H	B	3.0	10.0	135	22.8	10.8	1.6	0.0	22.6	40.0	-17.4	-----
116.733	30.8	P	H	B	3.5	10.0	45	22.8	10.6	2.1	0.0	20.7	40.0	-19.3	-----
122.396	32.8	P	H	B	3.5	10.0	225	22.8	10.9	2.1	0.0	23.0	40.0	-17.0	-----
132.388	30.9	P	H	B	3.5	10.0	270	22.8	11.6	2.1	0.0	21.8	40.0	-18.2	-----
140.027	34.5	P	H	B	3.5	10.0	180	22.8	12.1	2.2	0.0	26.0	40.0	-14.0	-----
149.988	28.5	P	H	B	3.0	10.0	90	22.8	12.7	2.2	0.0	20.6	40.0	-19.4	-----
161.332	31.9	P	H	B	3.0	10.0	270	22.8	13.4	2.3	0.0	24.8	40.0	-15.2	-----
180.026	31.5	P	H	B	2.5	10.0	180	22.8	14.6	2.5	0.0	25.8	40.0	-14.2	-----
216.666	30.4	P	H	B	4.0	10.0	0	22.7	16.7	2.7	0.0	27.1	40.0	-12.9	-----
230.492	29.1	P	H	B	3.0	10.0	45	22.8	17.4	2.8	0.0	26.5	47.0	-20.5	-----
240.018	31.1	P	H	B	3.5	10.0	90	22.7	17.7	2.9	0.0	29.0	47.0	-18.0	-----
248.920	31.5	P	H	B	3.5	10.0	225	22.7	18.1	2.9	0.0	29.8	47.0	-17.2	-----
254.049	36.6	P	H	B	3.0	10.0	90	22.7	18.4	2.9	0.0	35.2	47.0	-11.8	-----

284.649	29.6	P	H	B	3.0	10.0	270	22.7	20.7	3.2	0.0	30.8	47.0	-16.2	-----
301.949	32.8	P	H	L	3.5	10.0	315	22.7	14.3	3.3	0.0	27.7	47.0	-19.3	-----
308.852	36.0	P	H	L	3.0	10.0	45	22.7	14.4	3.3	0.0	31.0	47.0	-16.0	-----
313.477	32.0	P	H	L	4.0	10.0	45	22.8	14.5	3.4	0.0	27.1	47.0	-19.9	-----
322.687	38.7	P	H	L	3.5	10.0	0	22.8	14.6	3.4	0.0	33.9	47.0	-13.1	-----
338.721	42.2	P	H	L	3.0	10.0	45	22.9	14.8	3.5	0.0	37.6	47.0	-9.4	-----
340.028	34.9	P	H	L	3.0	10.0	45	22.9	14.9	3.5	0.0	30.4	47.0	-16.6	-----
341.143	35.8	P	H	L	3.5	10.0	90	22.9	14.9	3.5	0.0	31.3	47.0	-15.7	-----
350.338	35.6	P	H	L	3.0	10.0	315	22.9	15.0	3.5	0.0	31.2	47.0	-15.8	-----
366.931	39.7	P	H	L	4.0	10.0	225	22.8	14.7	3.6	0.0	35.2	47.0	-11.8	-----
368.778	33.6	P	H	L	3.0	10.0	225	22.7	14.7	3.6	0.0	29.2	47.0	-17.8	-----
380.058	33.9	P	H	L	4.0	10.0	225	22.7	14.5	3.7	0.0	29.4	47.0	-17.6	-----
395.157	41.7	P	H	L	3.5	10.0	90	22.5	14.2	3.8	0.0	37.2	47.0	-9.8	-----
423.389	41.2	P	H	L	2.5	10.0	0	22.5	15.4	3.9	0.0	38.0	47.0	-9.0	-----
479.842	39.8	P	H	L	2.5	10.0	0	22.5	16.6	4.2	0.0	38.1	47.0	-8.9	-----
536.287	40.7	P	H	L	2.0	10.0	0	22.4	17.3	4.5	0.0	40.1	47.0	-6.9	-----
592.750	37.4	P	H	L	2.0	10.0	45	22.2	18.9	4.9	0.0	39.0	47.0	-8.0	-----
649.204	33.3	P	H	L	2.0	10.0	45	22.0	19.9	5.2	0.0	36.4	47.0	-10.6	-----
705.671	31.1	P	H	L	1.0	10.0	315	22.0	20.5	5.2	0.0	34.8	47.0	-12.2	-----
789.234	28.9	P	H	L	2.5	10.0	270	21.3	21.4	5.7	0.0	34.7	47.0	-12.3	-----
894.977	23.5	P	H	L	1.0	10.0	0	21.5	23.1	6.2	0.0	31.3	47.0	-15.7	-----

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FRONT VIEW

RECOGNITION SYSTEMS, INC.
HANDREADER
MODEL: HKII
CISPR 22/FCC CLASS A - RADIATED EMISSIONS - 1-30-03

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

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REAR VIEW

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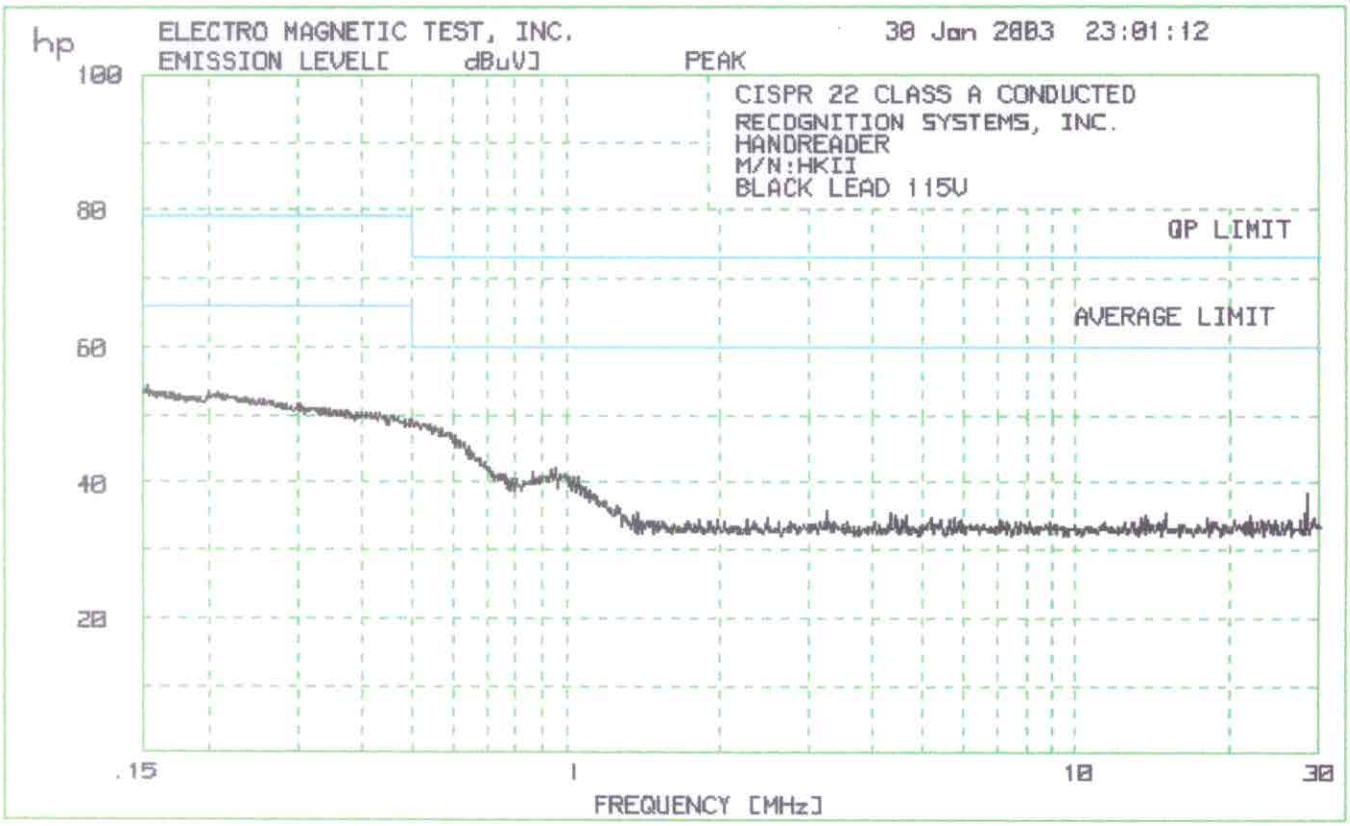
PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

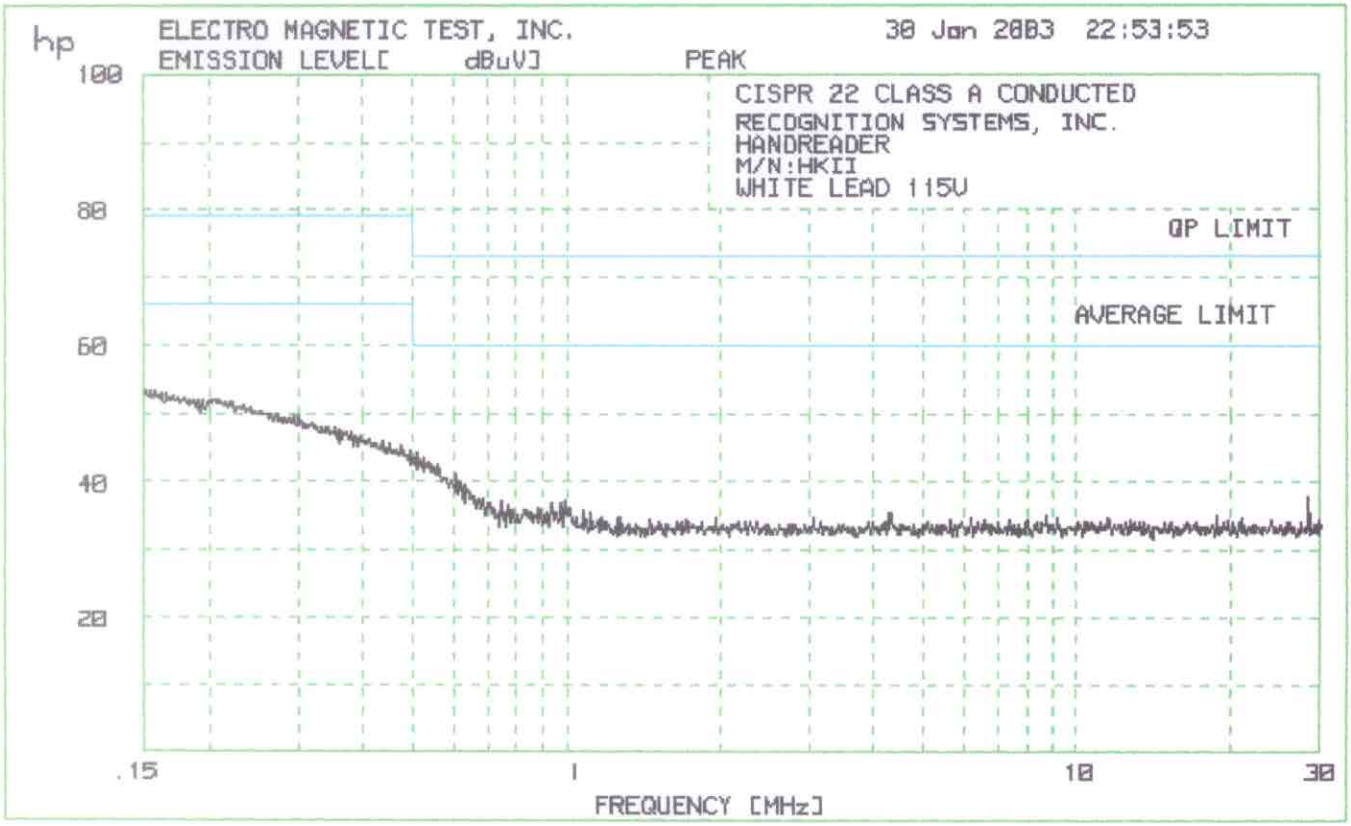

hp
ELECTRO MAGNETIC TEST, INC.
30 Jan 2003 23:01:12
EMISSION LEVEL[dBuV]
PEAK
CISPR 22 CLASS A CONDUCTED
RECOGNITION SYSTEMS, INC.
HANDREADER
M/N:HKII
BLACK LEAD 115V
QP LIMIT
AVERAGE LIMIT
100
80
60
40
20
.15
1
10
30
FREQUENCY [MHz]

ELECTRO MAGNETIC TEST, INC. 30 Jan 2003 23:01:12

1. CONDUCTED WITH PRESELECTOR
   1.3 CISPR 22 CLASS A CONDUCTED

45 highest Peaks above -50 dB of Limit Line #2
peak criteria = .1 dB

PEAK#	FREQ (MHz)	(dBuV)	DELTA
1	.5121	48.7	-11.3
2	.5287	48.6	-11.4
3	.5176	48.5	-11.5
4	.5457	48.5	-11.5
5	.54	48.3	-11.7
6	.5574	48.2	-11.8
7	.1516	54.1	-11.9
8	.5724	47.7	-12.3
9	.1557	53.3	-12.7
10	.1598	53.3	-12.7
11	.1659	53.3	-12.7
12	.1624	53.2	-12.8
13	.1703	53.2	-12.8
14	.2018	53.2	-12.8
15	.5846	47.2	-12.8
16	.1641	53.1	-12.9
17	.1685	53.1	-12.9
18	.2105	53.1	-12.9
19	.2061	53	-13.0
20	.2138	53	-13.0
21	.1767	52.9	-13.1
22	.6067	46.9	-13.1
23	.173	52.8	-13.2
24	.2184	52.8	-13.2
25	.1815	52.7	-13.3
26	.1996	52.7	-13.3
27	.1893	52.6	-13.4
28	.2255	52.6	-13.4
29	.2377	52.6	-13.4
30	.1844	52.4	-13.6
31	.1873	52.4	-13.6
32	.1924	52.4	-13.6
33	.2315	52.3	-13.7
34	.2352	52.3	-13.7
35	.2507	52.2	-13.8
36	.256	52.2	-13.8
37	.6197	46.2	-13.8
38	.2403	52.1	-13.9
39	.2441	52.1	-13.9
40	.2467	51.9	-14.1
41	.2629	51.9	-14.1
42	.2685	51.9	-14.1
43	.6363	45.7	-14.3
44	.6296	45.6	-14.4
45	.2728	51.5	-14.5


hp
ELECTRO MAGNETIC TEST, INC.
30 Jan 2003 22:53:53
EMISSION LEVEL[dBuV]
PEAK
CISPR 22 CLASS A CONDUCTED
RECOGNITION SYSTEMS, INC.
HANDREADER
M/N:HKII
WHITE LEAD 115V
QP LIMIT
AVERAGE LIMIT
100
80
60
40
20
.15
1
10
30
FREQUENCY [MHz]

ELECTRO MAGNETIC TEST, INC. 30 Jan 2003 22:53:53

1. CONDUCTED WITH PRESELECTOR
   1.3 CISPR 22 CLASS A CONDUCTED

45 highest Peaks above -50 dB of Limit Line #2
peak criteria = .1 dB

PEAK#	FREQ (MHz)	(dBuV)	DELTA
1	.1532	53.3	-12.7
2	.1573	53.1	-12.9
3	.1659	53	-13.0
4	.1615	52.9	-13.1
5	.1703	52.4	-13.6
6	.1749	52.2	-13.8
7	.1786	52.2	-13.8
8	.2028	52	-14.0
9	.2072	52	-14.0
10	.1903	51.9	-14.1
11	.1834	51.8	-14.2
12	.1873	51.7	-14.3
13	.1944	51.7	-14.3
14	.2105	51.7	-14.3
15	.2196	51.5	-14.5
16	.1986	51.4	-14.6
17	.215	51.4	-14.6
18	.2219	51.4	-14.6
19	.234	51.1	-14.9
20	.1965	50.9	-15.1
21	.2279	50.8	-15.2
22	.2415	50.7	-15.3
23	.2454	50.3	-15.7
24	.252	50.2	-15.8
25	.5094	44.2	-15.8
26	.2601	50	-16.0
27	.2643	49.9	-16.1
28	.2728	49.7	-16.3
29	.2938	49.6	-16.4
30	.3001	49.4	-16.6
31	.2757	49.3	-16.7
32	.2786	49.3	-16.7
33	.2816	49.3	-16.7
34	.2876	49.3	-16.7
35	.5287	43.3	-16.7
36	.5176	43	-17.0
37	.5231	42.9	-17.1
38	.5371	42.9	-17.1
39	.5429	42.6	-17.4
40	.5604	42.5	-17.5
41	.3197	48.4	-17.6
42	.3081	48.1	-17.9
43	.5486	42.1	-17.9
44	.3249	47.9	-18.1
45	.3336	47.9	-18.1

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FRONT VIEW

RECOGNITION SYSTEMS, INC.
HANDREADER
MODEL: HKII
CISPR 22 CLASS A - CONDUCTED EMISSIONS - 1-30-03

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

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REAR VIEW

RECOGNITION SYSTEMS, INC.
HANDREADER
MODEL: HKII
CISPR 22 CLASS A - CONDUCTED EMISSIONS - 1-30-03

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

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APPENDIX B

INTENTIONAL RADIATOR TEST DATA SHEETS (15.225)

EMT ELECTRO MAGNETIC TEST, INC.
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Transmitter Radiated & Conducted Emissions
FCC Rules 15.225, 15.209, 15.207

Requirements

The Field Strength of emissions at fundamental frequency shall not exceed 80 dB (µV/m) at 30m,
Emissions radiated outside of the specified frequency band shall not exceed the general radiated emission limits in 15.209.

The spurious emission data (30 MHz - 1000 MHz) for section 15.209 can be found in Appendix A of this report.

The conducted emission data (150 kHz - 30 MHz) for section 15.207 can be found in Appendix A of this report.

Procedure

During the test the EUT is rotated and the loop antenna is rotated around the vertical axis during the search for maximum signal level. The antenna height is fixed at 1 meter.

Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. All readings are extrapolated back to the equivalent three-meter reading using inverse scaling with distance.

Radiated emission measurements were performed from 10 MHz to 1 GHz.
Analyzer resolution is:

9 kHz or greater for frequencies 30 MHz and below
100 kHz or greater for frequencies 1000 MHz and below,
For those frequencies quasi-peak value was measured.

Data is included of the worst-case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

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 reading. The basic equation is as follows:
FS = RA + AF + CF - AG
Where FS = Field Strength in dB (µV/m)
RA = Receiver Amplitude (including preamplifier) in dB (µV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB (1/m)
AG = Amplifier Gain in dB

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Test Result

The data below shows the significant emission frequencies, the limit and the margin of compliance.

Radiated emissions at fundamental frequency

Frequency MHz	Antenna Polarization H/V	SA Reading at 10m dB(uV)	Antenna Factor dB (1/m)	Preamp Gain dB	Cable Loss dB	Distance Correct. Factor dB	FS at 30 m dB(uV/m)	FS Limit at 30m dB(uV/m)	Margin dB
13.562	H	39.5	17.5	-	0.5	-20.0	37.5	80.0	-42.5

FS – Field Strength
FS was measured with loop antenna

Spurious Radiated emissions below 30 MHz

Frequency MHz	Antenna Polarization H/V	SA Reading at 10m dB(uV)	Antenna Factor dB(1/m)	Preamp Gain dB	Cable loss dB	Distance Correct. Factor dB	FS at 30m dB(uV/m)	FS Limit at 30m dB(uV/m)	Margin dB
13.553	-	-	-	-	-	-	7.5 *	29.5	-22.0
13.567	-	-	-	-	-	-	7.5 *	29.5	-22.0
27.1	H	17.9	17.4	-	0.7	-20.0	16.0	29.5	-13.5

Note:
FS was measured with loop antenna
* The FS on the band-edge frequencies was obtained by subtracting “delta” (from out-of-band emission plots) from the FS on the fundamental frequency.
All other emissions not reported are noise floor, which is at least 20 dB below the limit.

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Occupied Bandwidth and Out-of-band Emission Plots

The EUT was setup to transmit in normal operating condition with 20% duty cycle.
A Spectrum Analyzer was connected to the output of the transmitter (antenna disconnected). The spectrum analyzer reading was plotted. The following plots show the in-band and out-of-band emissions.

Plot #	Description
1	In-band emission, RBW=100 Hz
2	In-band emission, RBW=100 Hz, MAX HOLD
3	In-band emission, RBW=300 Hz, MAX HOLD
4	Out-of-band emission, scan 10 MHz to 12 MHz
5	Out-of-band emission, scan 12 MHz to 13.553 MHz
6	Out-of-band emission, scan 13.567 MHz to 15 MHz
7	Out-of-band emission, scan 15 MHz to 30 MHz

The 20-dB bandwidth is about 140 Hz.
The emissions on the band-edge frequencies (see plots #2 and #3) are more than 30 dB below the level on fundamental frequency.

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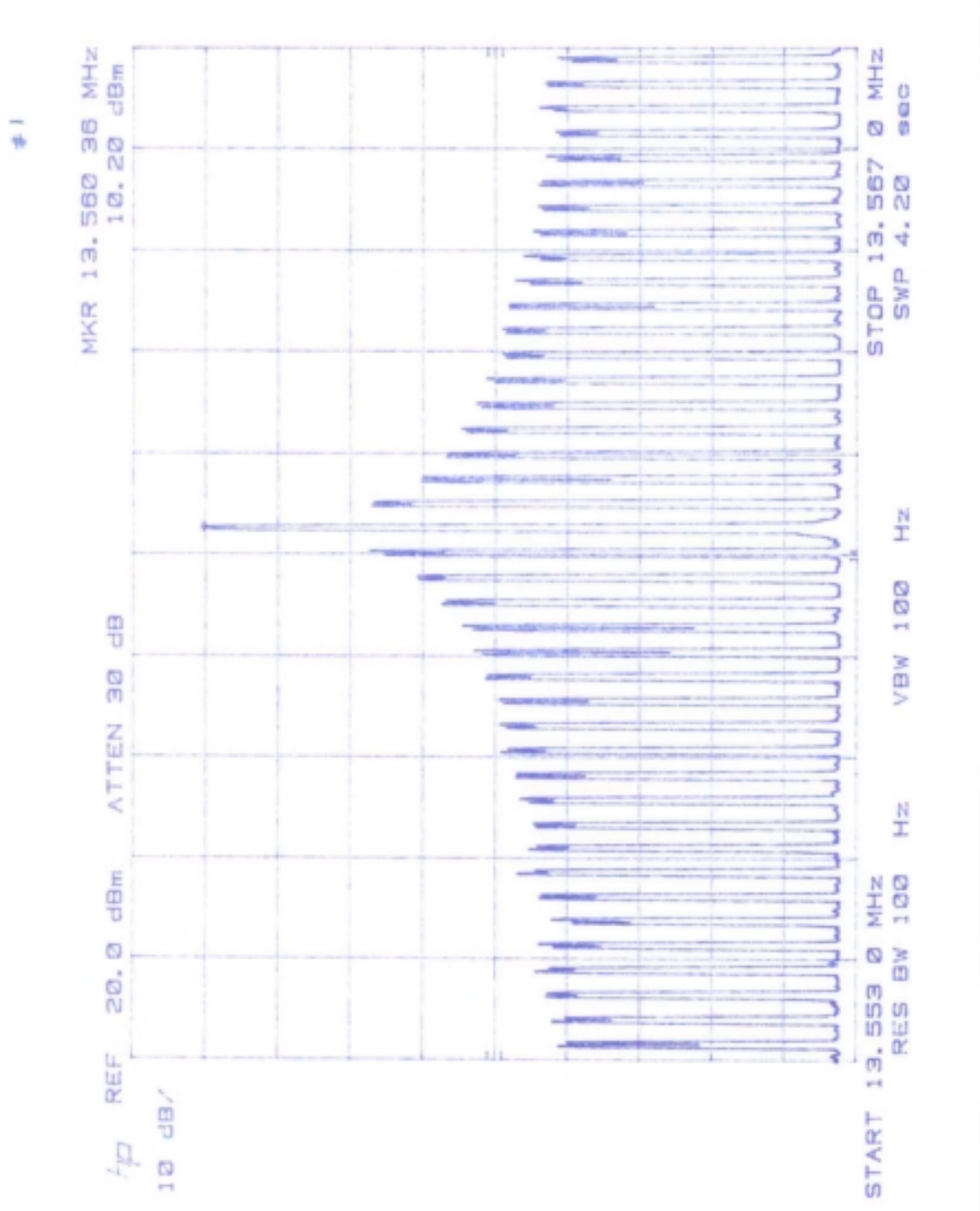

PLOT #1 - IN-BAND EMISSION, RBW=100 Hz

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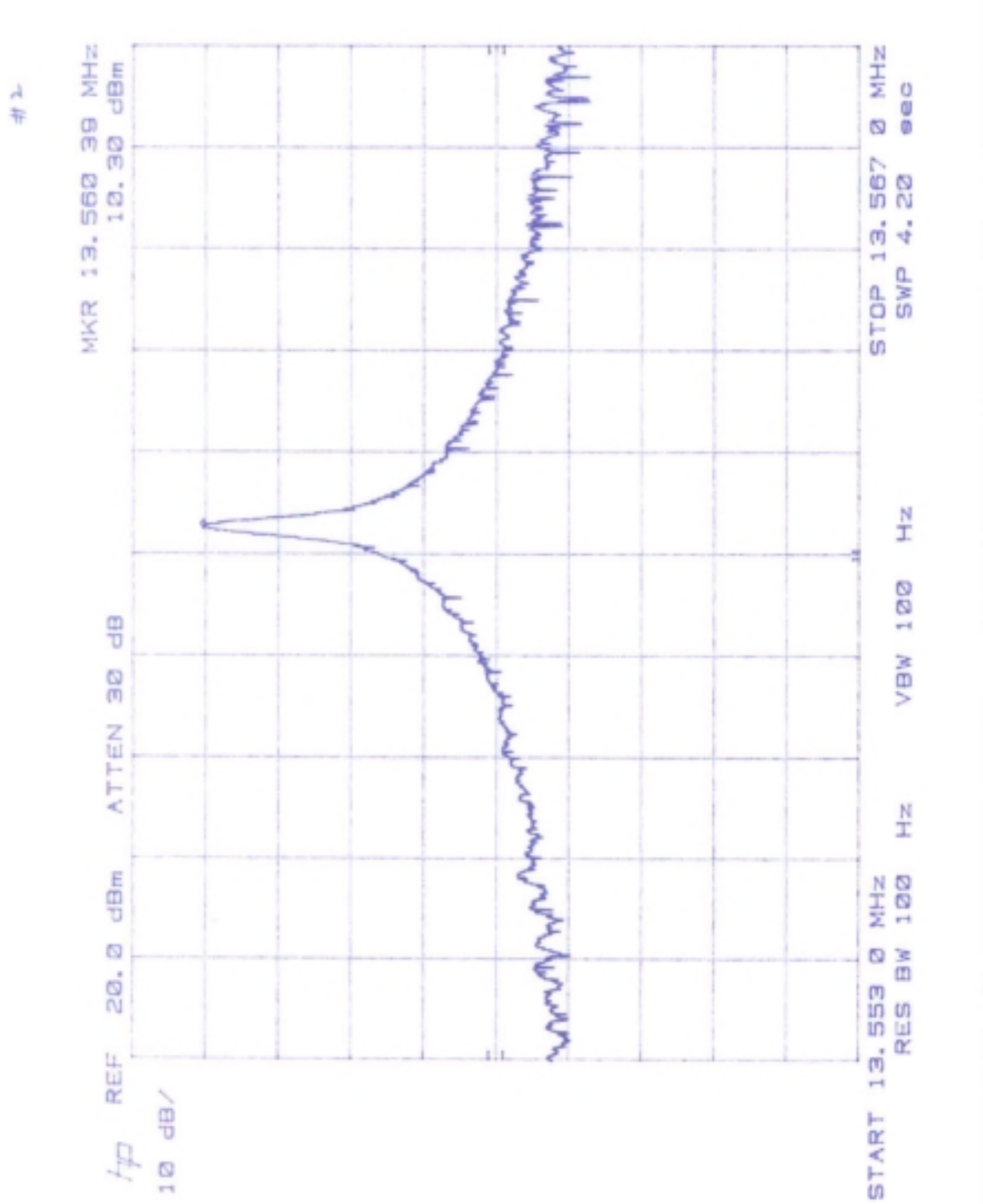

PLOT #2 - IN-BAND EMISSION, RBW=100 Hz, MAX HOLD

EMT
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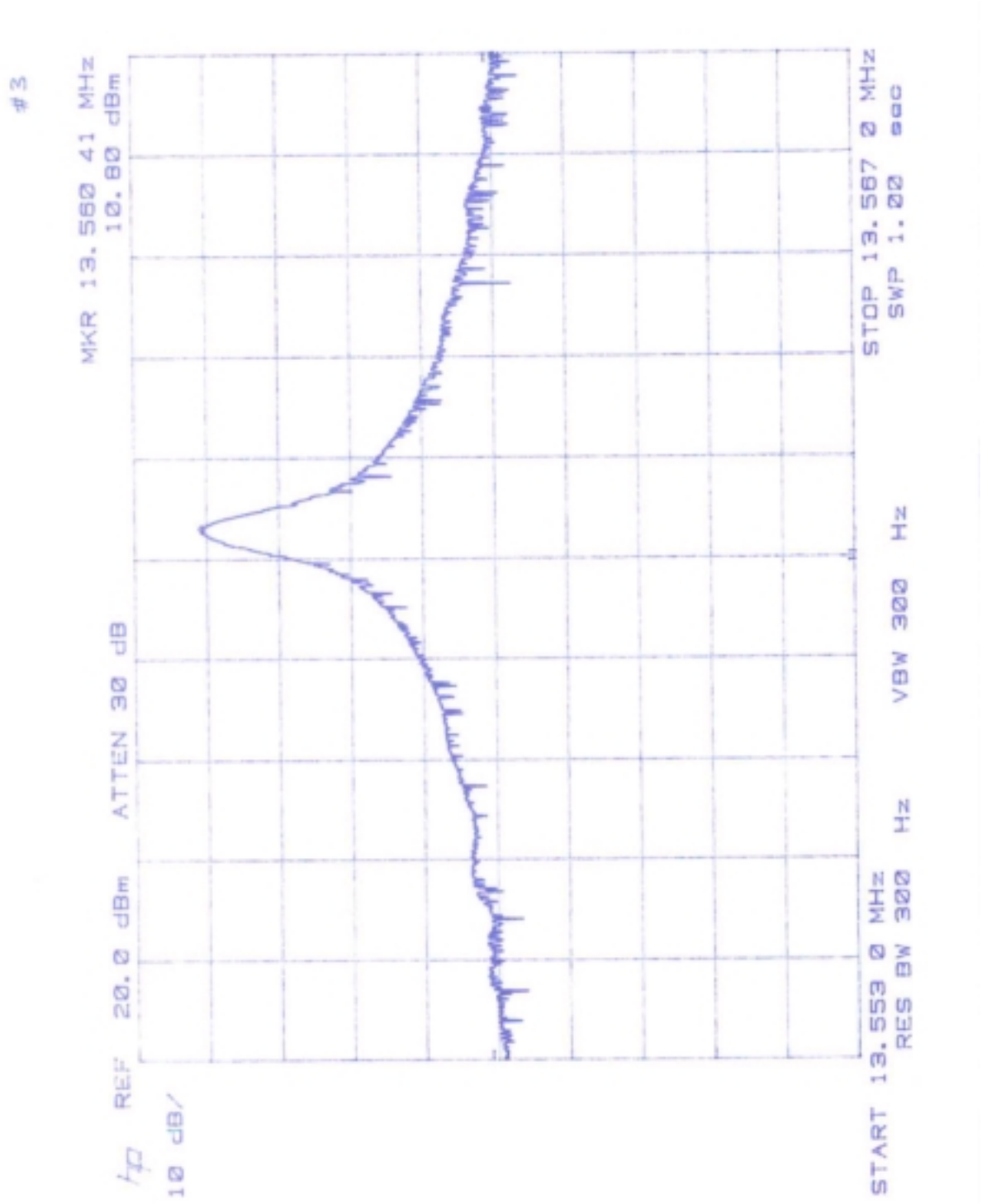

PLOT #3 - IN-BAND EMISSION, RBW=300 Hz, MAX HOLD

EMT
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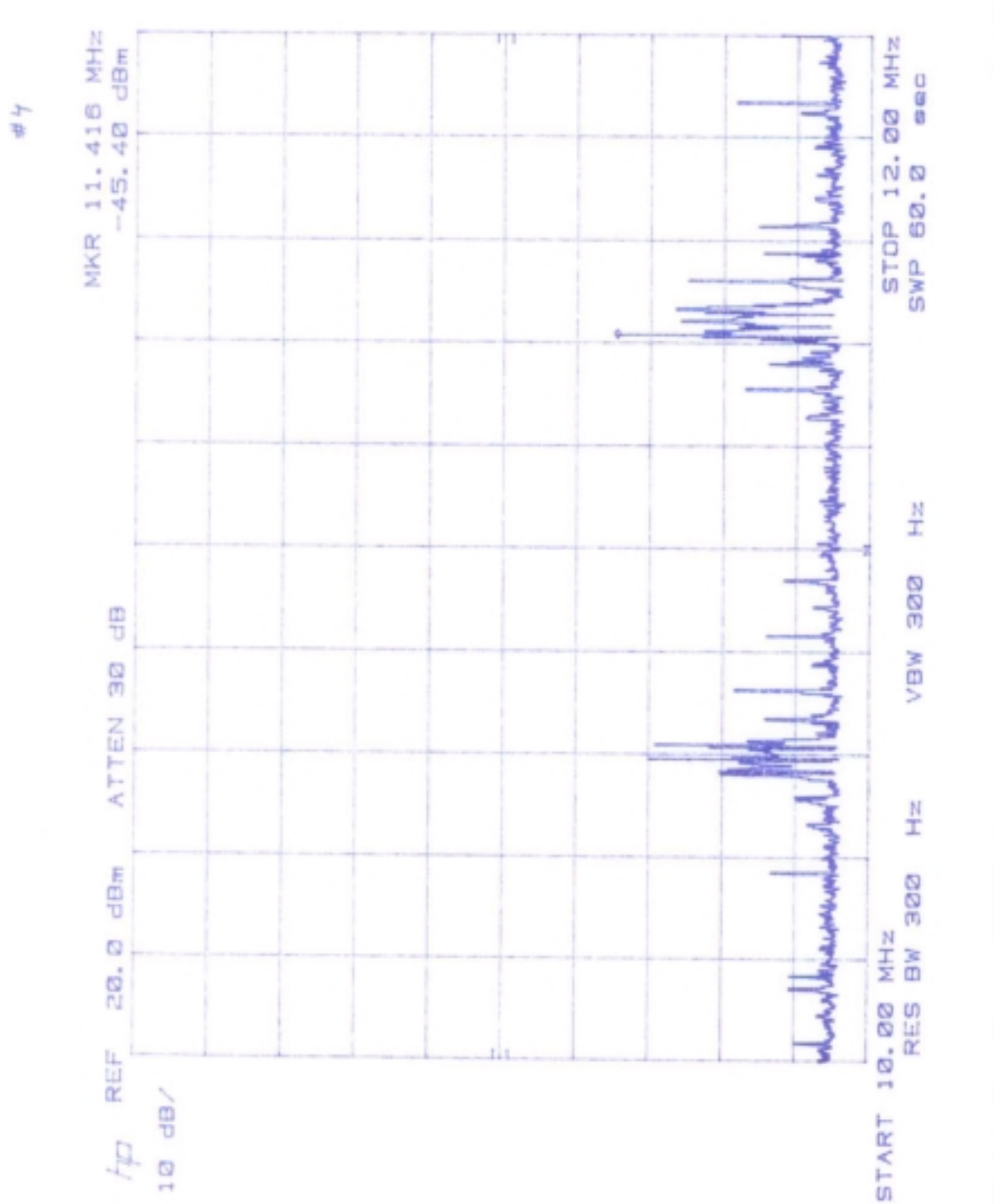

PLOT #4 - OUT-OF-BAND EMISSION, SCAN 10 MHz TO 12 MHz

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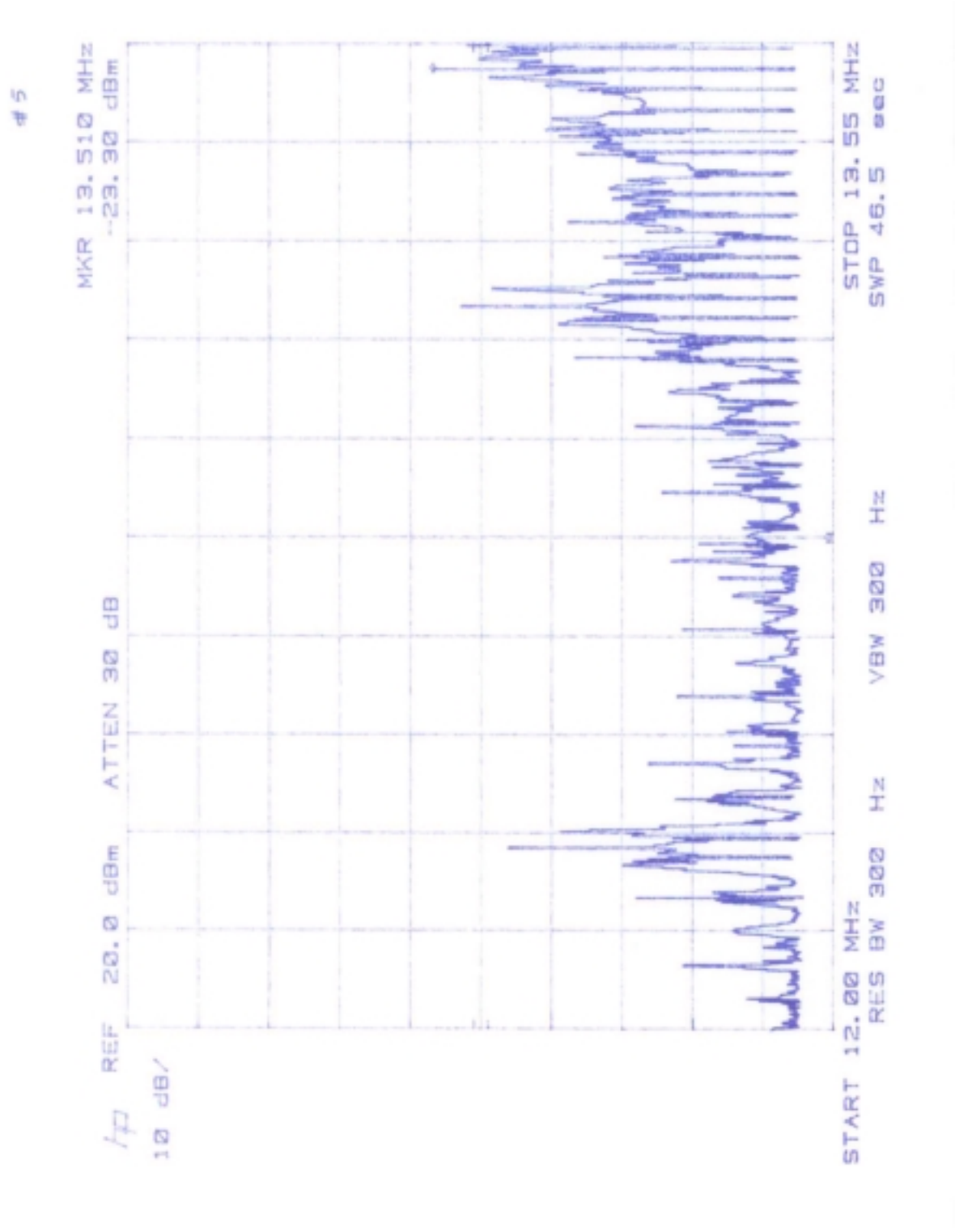

PLOT #5 - OUT-OF-BAND EMISSION, SCAN 12 MHz TO 13.553 MHz

EMT
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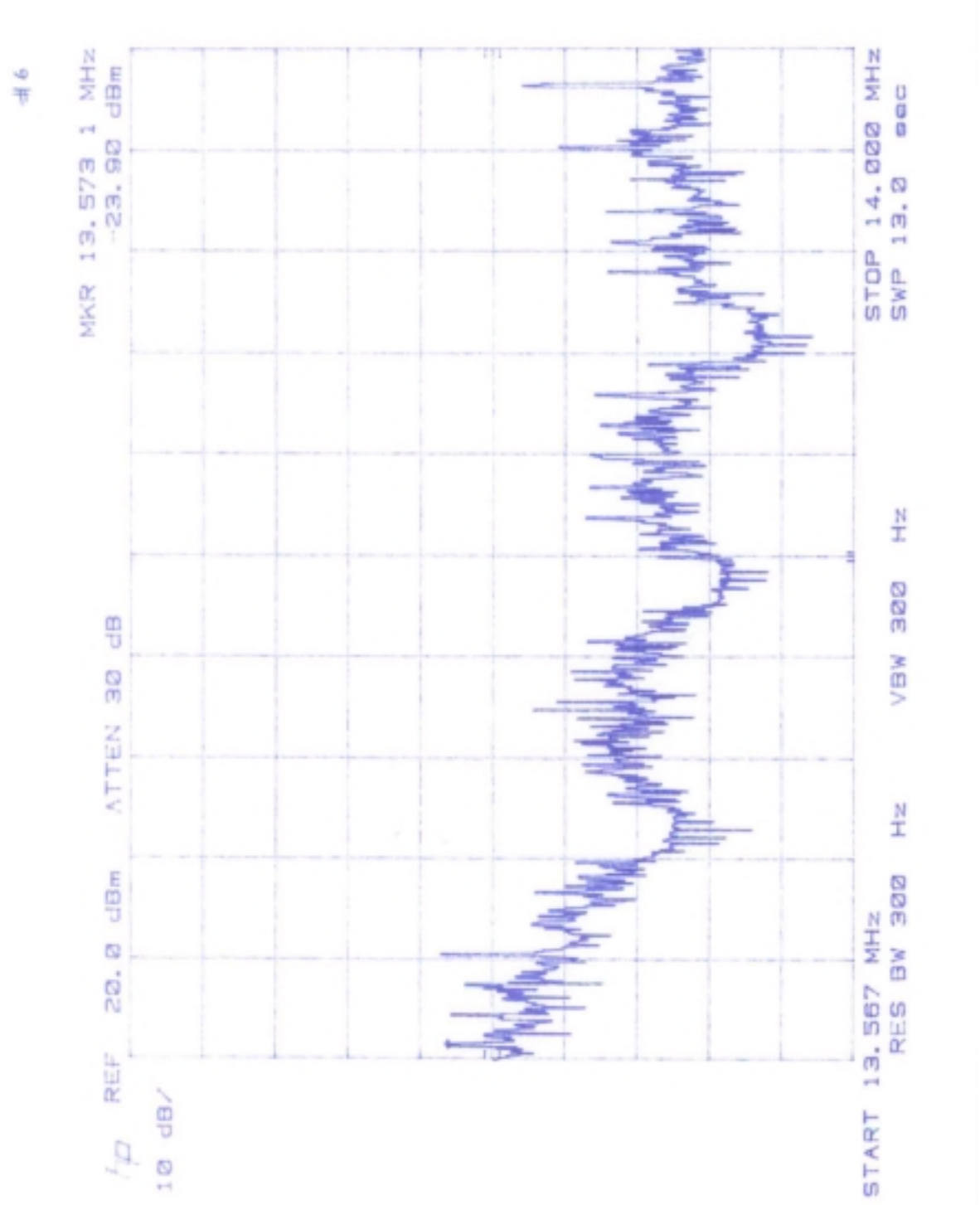

PLOT #6 - OUT-OF-BAND EMISSION, SCAN 13.567 MHz TO 14 MHz

EMT
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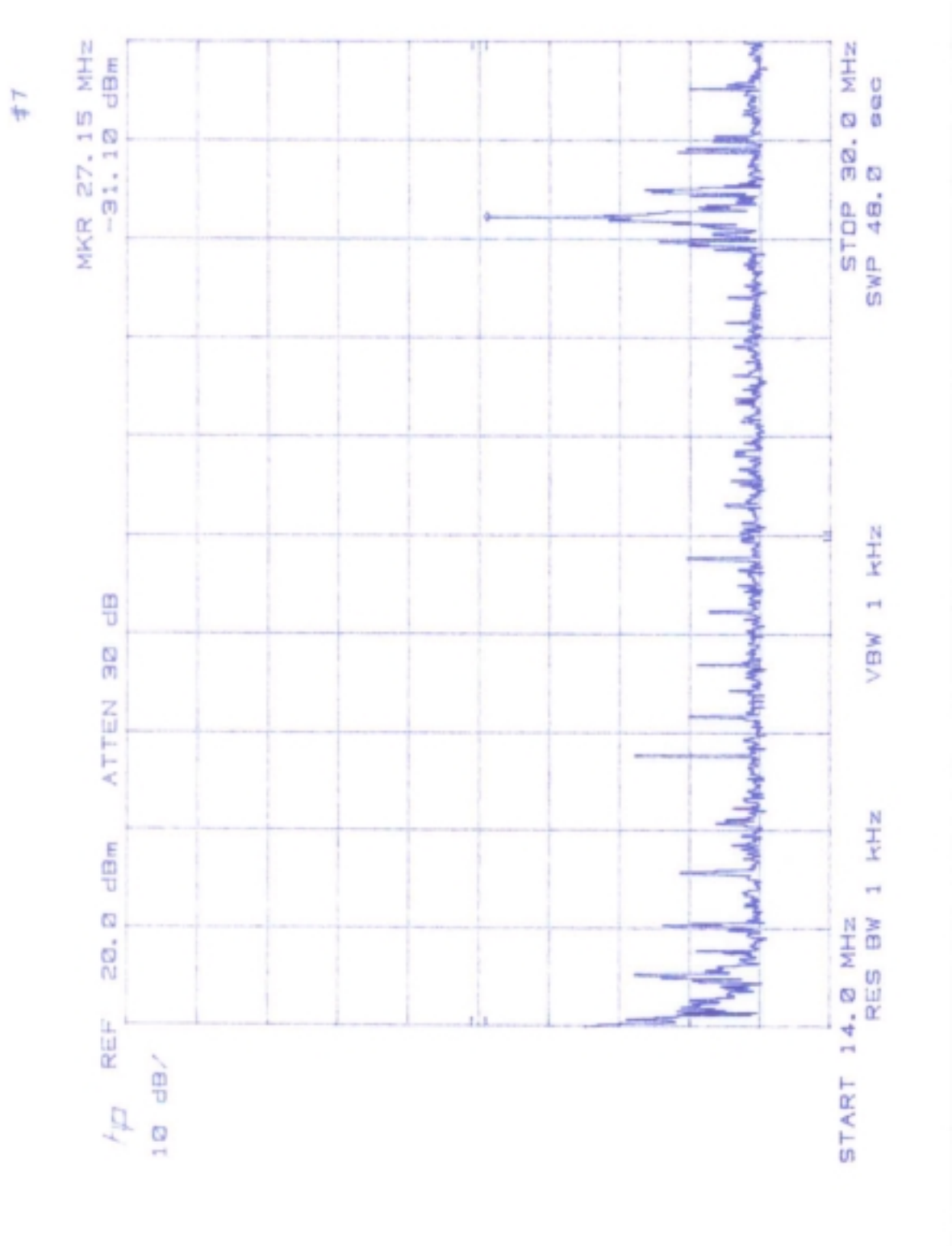
1547 Plymouth Street, Mountain View, CA 94043 Tel: (650) 965-4000 Fax: (650) 965-3000



PLOT #7 - OUT-OF-BAND EMISSION, SCAN 14 MHz TO 30 MHz

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Frequency Tolerance

Requirement

The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency over a temperature variation of –20^{0}C to +50^{0}C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of +20^{0}C.

Procedure

The EUT was placed in the temperature chamber and set to transmit unmodulated carrier. The transmitter was powered from a DC power supply (12 VDC). The frequency counter was connected to the transmitter output. For each temperature, the carrier frequency was recorded. In addition, the carrier frequency was recorded when the power was set to 16.1 VDC (115% of the maximum specified voltage – 14 VDC) and to 5.1 VDC (85% of the minimum specified voltage – 6VDC).

Result

Nominal Frequency: 13.560000 Hz

Temperature, ^{0}C	**Measured Frequency, Hz**	**Measured Frequency, Hz**	**Measured Frequency, Hz**	**Maximum difference, Hz**
	12.0 VDC	**16.1VDC**	**5.1VDC**	
+50	13.560792			
+40	13.560745			
+30	13.560678			
+20	13.560402	13.560428	13.560485	
+10	13.560390			
0	13559945			
-10	13.559840			
-20	13.559800			

The frequency tolerance is within –0.001% to 0.005%.

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List of test equipment

Measurement equipment used for emission compliance testing utilized the equipment on the following list:

Equipment	Manufacturer	Model/Type	Serial #	Cal Int	Cal Due
Loop Antenna	EMCO	6507	9012-1259	12	5/12/03
RF Filter Section	Hewlett Packard	85460A	3448A00267	12	7/16/03
EMI Receiver	Hewlett Packard	8546A	3710A00373	12	7/16/03
Spectrum Analyzer w/85650 QP Adapter	Hewlett Packard	8566B	2416A00317 2043A00251	12	4/06/03

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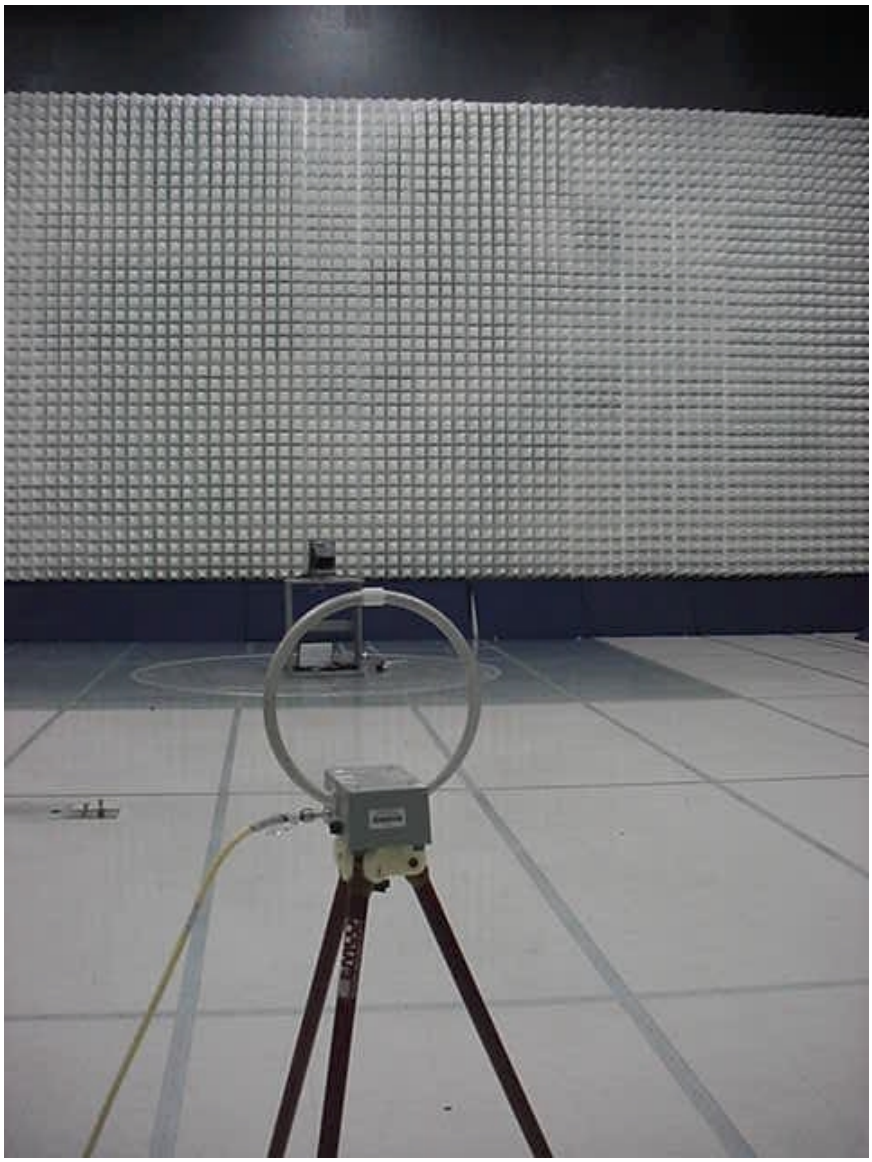
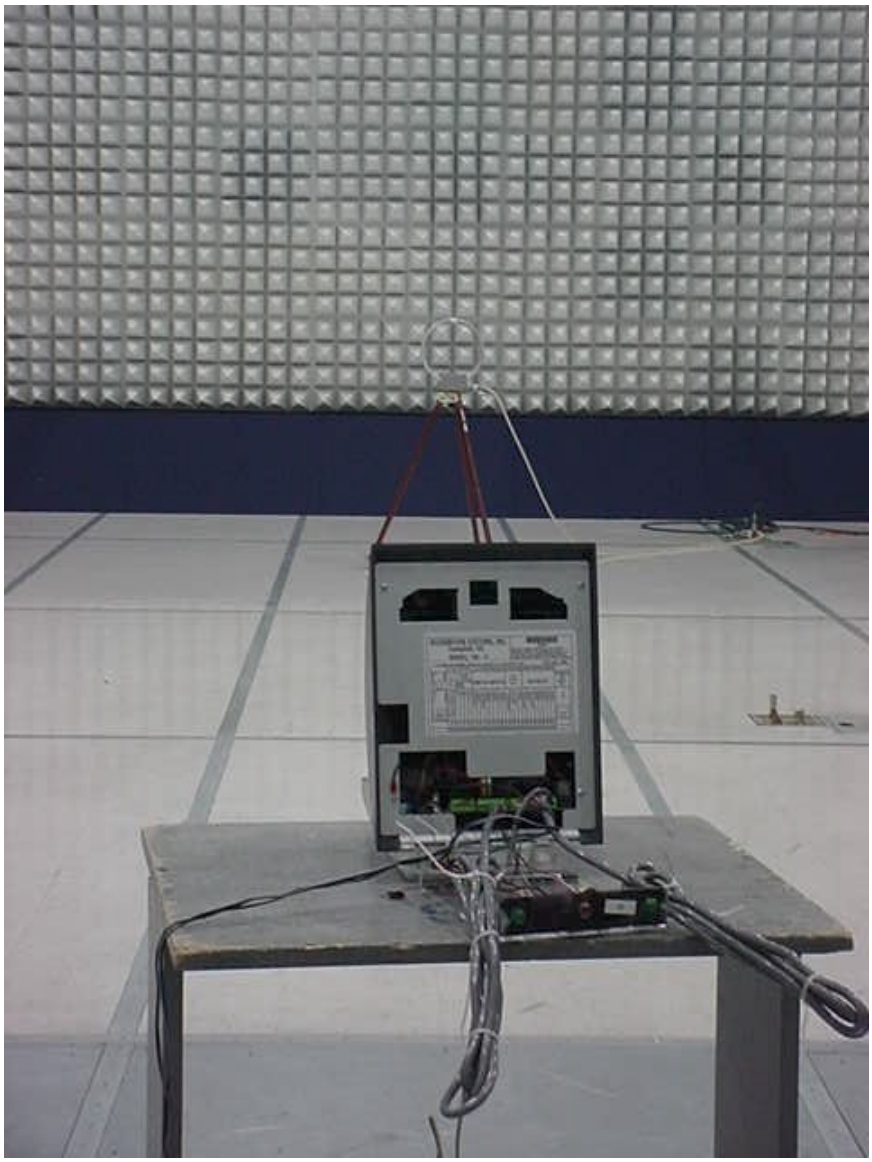


FRONT VIEW

RECOGNITION SYSTEMS, INC.
HANDREADER
MODEL: HKII
FCC PART 15, SUBPART C - RADIATED EMISSIONS - 3-25-03

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

EMT *ELECTRO MAGNETIC TEST, INC.*
1547 Plymouth Street, Mountain View, CA 94043 Tel: (650) 965-4000 Fax: (650) 965-3000



REAR VIEW

RECOGNITION SYSTEMS, INC.
HANDREADER
MODEL: HKII
FCC PART 15, SUBPART C - RADIATED EMISSIONS - 3-25-03

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

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APPENDIX C

TEST SETUP DIAGRAMS

EMT
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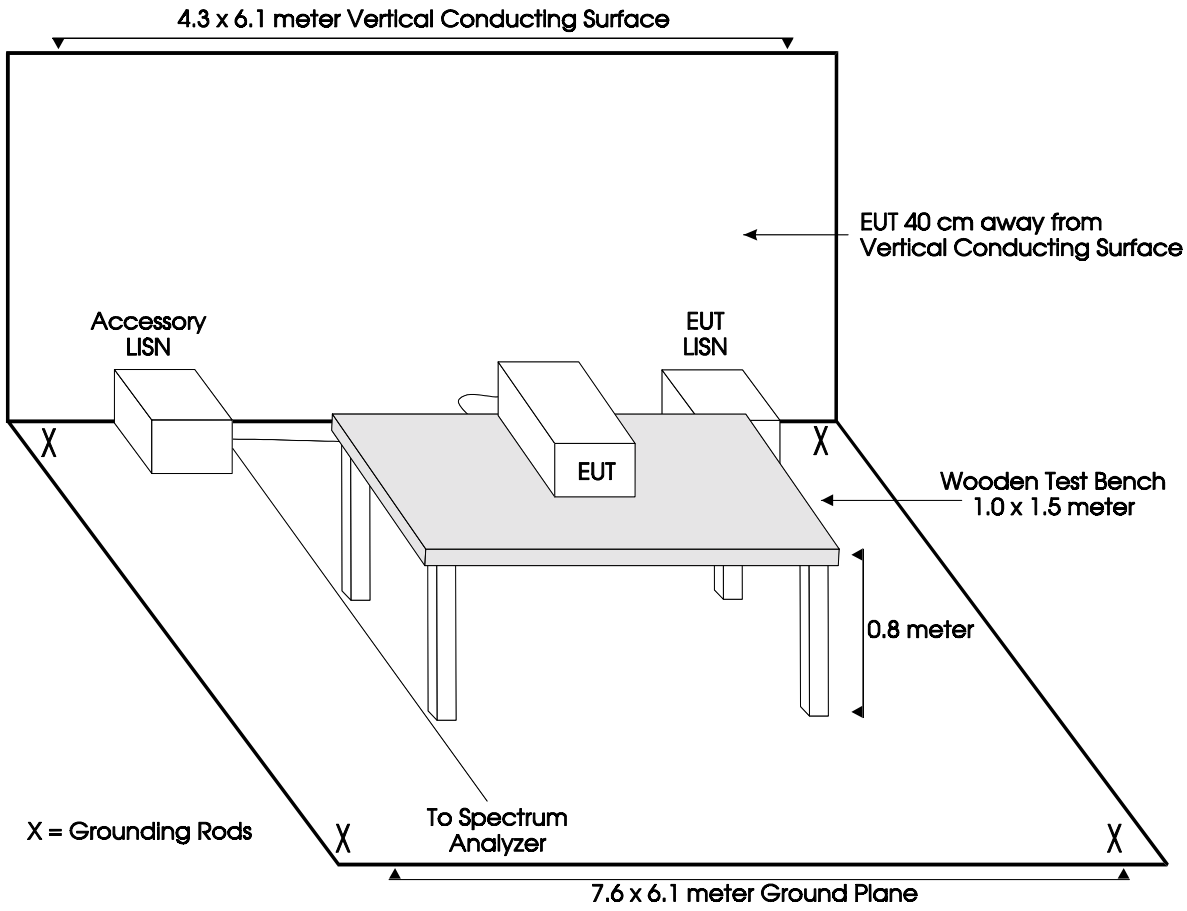

FIGURE 1

CONDUCTED EMISSIONS TEST SETUP – SITE "A"

EMT
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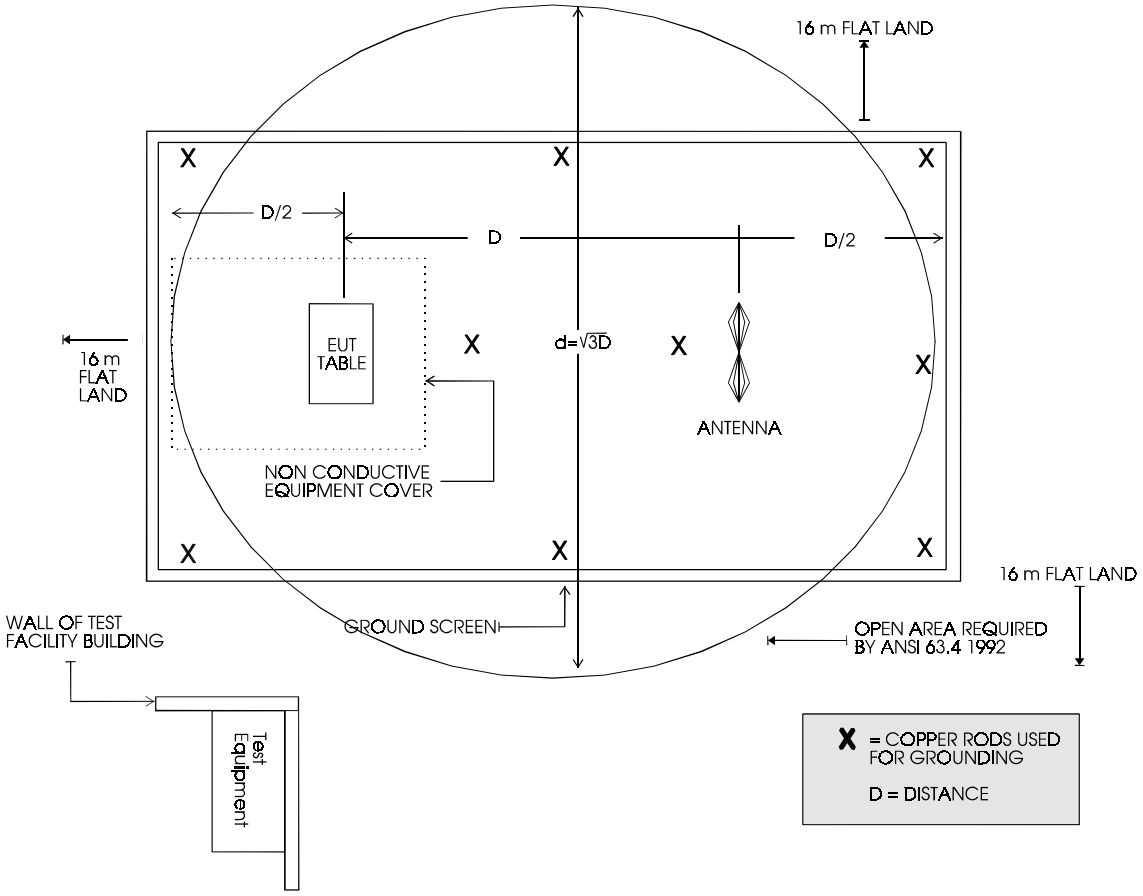

FIGURE 2

PLOT MAP AND LAYOUT OF TEST SITE "A"

EMT
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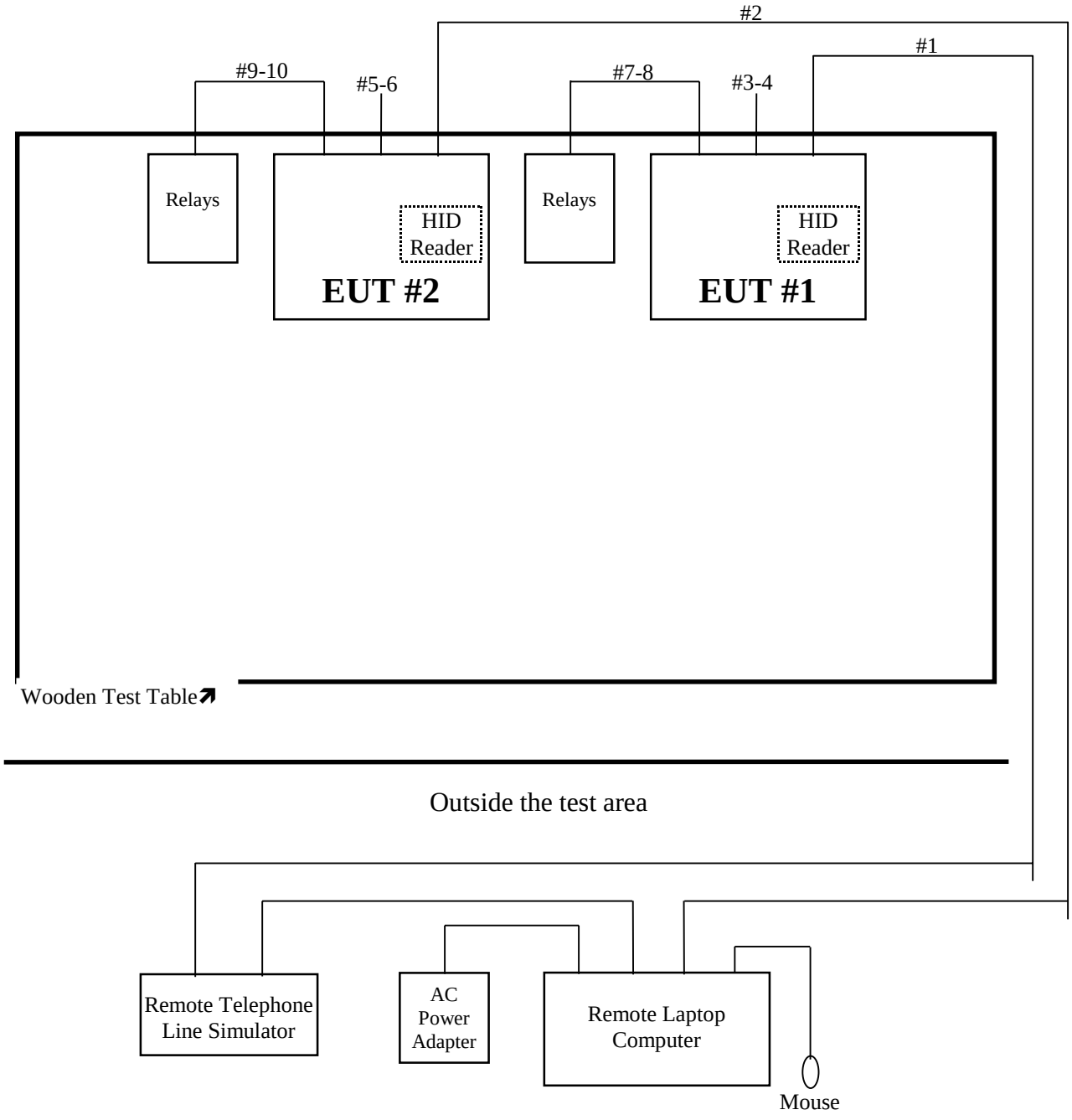

FIGURE 3: EQUIPMENT CONFIGURATION BLOCK DIAGRAM

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APPENDIX D

ADDITIONAL MODELS COVERED UNDER THIS REPORT

EMT *ELECTRO MAGNETIC TEST, INC.*
1547 Plymouth Street, Mountain View, CA 94043 Tel: (650) 965-4000 Fax: (650) 965-3000

ADDITIONAL MODELS COVERED UNDER THIS REPORT

USED FOR THE PRIMARY TEST HANDREADER
MODEL: HKII
S/N: N/A

MODELS ALSO APPROVED UNDER THIS REPORT:

MODEL: HKCM

The same PCB as HKII with the second terminal strip removed, two banana jacks are in front of the reader for 485 communications to an eye button, it has a different top panel overlay, and its own back model label.

MODEL: HKCR

The same as HKII, with the second terminal strip removed, it has a different top panel overlay, and its own back model label.

MODEL: HP1000

The same as HP2000, except the memory is stepped differently, it has a different top panel overlay, and its own back model label.

MODEL: HP2000

The same PCB as HKII with the main PCB terminal strips 1, 2, & 3 removed, the Lock/Auxiliary circuit is removed, it has a different top panel overlay, and its own back model label.

MODEL: HP3000

The same PCB as HKII, with a fully populated main PCB with an RJ11 port instead of the first terminal strip for communications, it has a different top panel overlay, and its own back model label.

MODEL: HP4000

The same as HP3000 except with 8 extra function keys that are programmable through the End User's software and it has an internal barcode reader.