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REPORT NO.: 43957-o 1

WYLE JOB NO.: 43957

CLIENT P.O. NO.: 00-0247

CONTRACT: N / A

TOTAL PAGES (INCLUDING COVER): 2 2

DATE: March 6, 2000

TEST REPORT

FCC CERTIFICATION TESTING ON MICRO SYSTEMS' RAPID SCORING SYSTEM

For
Micro Systems, Inc.
35 Hill Avenue
Fort Walton Beach, FL 32548
Attn: Adam Taylor

STATE OF ALABAMA }
COUNTY OF MADISON }

James R. Dearman, being duly sworn, deposes
and says: The information contained in this report is the result of complete and
carefully conducted testing and is to the best of his knowledge true and correct in all
respects.

SUBSCRIBED and sworn to before me this 7 day of March, 20 00

Deanna Paulsen
Notary Public in and for the State of Alabama at Large

My Commission expires April 6, 20 02

Wyle shall have no liability for damages of any kind to person or property, including
special or consequential damages, resulting from Wyle's providing the services
covered by this report.

TEST BY: Mike Moranha 3/7/00
Mike Moranha, Sr. Test Specialist Date

(dsc)



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CONTAINED HEREIN SHALL BE EQUIVALENT TO EXPRESS PRIOR PERMISSION.

1.0 INTRODUCTION

1.1 Scope

This report documents conformance with the FCC Rules, Part 15, Class A, as listed below, and details the results of the testing performed on Micro Systems' Rapid Scoring System (RSS) on February 28 and 29, 2000, at Wyle Laboratories' Huntsville, Alabama, Test Facility. The specimen was received in good condition on February 28, 2000.

1.2 Product Description

The Rapid Scoring System (RSS) provides schools with a simple system to conduct standardized testing. The student enters their multiple-choice answers into a small hand-held device rather than using a paper answer sheet. The RSS consists of 30 small hand-held devices (remote units), used by the students, and a base unit connected to a PC. The remote units use radio frequencies (RF) to communicate with the base unit. The base unit connects to the PC via an RS-232 connection and receives its power from a plug-in wall transformer. Each remote unit is powered by a rechargeable battery pack. The base unit polls each remote unit periodically to transfer information required for standardized testing.

1.3 Details for Tested System

The identifiers for the test specimen, support devices, and cables used in the tested system are:

- **Test Specimen**

Item	Part No.	Serial No.	Quantity
Base Unit	RSS	Wyle 001	1
Remote Unit	RSS	Wyle 001	1

- **Support Equipment**

There was no support equipment used during the FCC Part 15 testing.

1.4 Test Methodology

All emissions testing was performed according to the procedures in ANSI C63.4-1992. The EUT is subject to the radiated emission limits for a Class A Digital Device per Subpart B, Paragraphs 15.107(b), 15.109(b), 15.209 at an antenna-to-EUT distance of ten meters. Subpart C (Intentional Radiators), Paragraph 15.249 of the FCC Rules and Regulations testing was conducted at an antenna-to-EUT distance of three meters.

1.0 INTRODUCTION (Continued)

1.5 Test Facility

The Open-Area Test Site facility used to collect the data in this report is located on the grounds of Wyle Laboratories' Huntsville, Alabama Test Facility. This site has been fully described in reports provided to the FCC Reference 3 1040/SIDDS300B3. This test site was tested and meets the requirements of ANSI C63.4-1992.

1.6 References

- Micro Systems' purchase Order No. 00-0247
- Wyle Laboratories' Request for Quotation No. 545/002671-C1/DB
- ANSI C63.4-1992, "Methods of Measurement of Radio Noise From Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz"
- Code of Federal Regulations (CFR) Title 47, "Telecommunications," October 1, 1998
- Wyle Laboratories' Quality Assurance Program Manual, Revision 1
- ANSI/NCSL Z540-1, "Calibration Laboratories and Measuring and Test Equipment, General Requirements"
- ISO 10012-1, "Quality Assurance Requirements for Measuring Equipment"
- MIL-STD-45662A, *Calibration System Requirements"

1.7 Quality Assurance

1.7.1 Quality Assurance Program

All work performed on this test program was completed in accordance with Wyle Laboratories' Quality Assurance Program.

The Wyle Laboratories, Huntsville Facility, Quality Management System is registered in compliance with the ISO-9001 International Quality Standard. Registration has been completed by Quality Management Institute (QMI), a Division of Canadian Standards Association (CSA).

1.0 INTRODUCTION (Continued)

1.7 Quality Assurance (Continued)

1.7.2 Test Equipment and Instrumentation

All instrumentation, measuring, and test equipment used in the performance of this test program were calibrated in accordance with Wyle Laboratories' Quality Assurance Program, which complies with the requirements of ANSI/NCSL Z540-1, ISO 10012-1, and Military Specification MIL-STD-45662A. Standards used in performing all calibrations are traceable to the National Institute of Standards and Technology (NIST) by report number and date. When no national standards exist, the standards are traceable to international standards or the basis for calibration is otherwise documented.

Appendix C contains a list of the instrumentation, measuring, and test equipment that was used to perform the tests.

2.0 PRODUCT LABELING

FCC ID XXXXXXXX
THE DEVICE COMPLIES WITH PART 15 OF THE FCC RULES
OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS
(1) THE DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE AND
(2) THE DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED INCLUDING
INTERFERENCE THAT MAY CAUSE UNDESIRE OPERATION

Figure 2.1 – FCC ID Label

3.0 SYSTEM TEST CONFIGURATION

3.1 Justification

The equipment was configured for testing in a typical fashion (as a customer would normally use it).

3.0 SYSTEM TEST CONFIGURATION (Continued)

3.2 Test Specimen Configuration

The equipment was configured for testing in a typical fashion (as a customer would normally use it). Refer to Figure 2.1. Photographs of the equipment arrangement for the Radiated Emissions Test are presented in Attachment A.

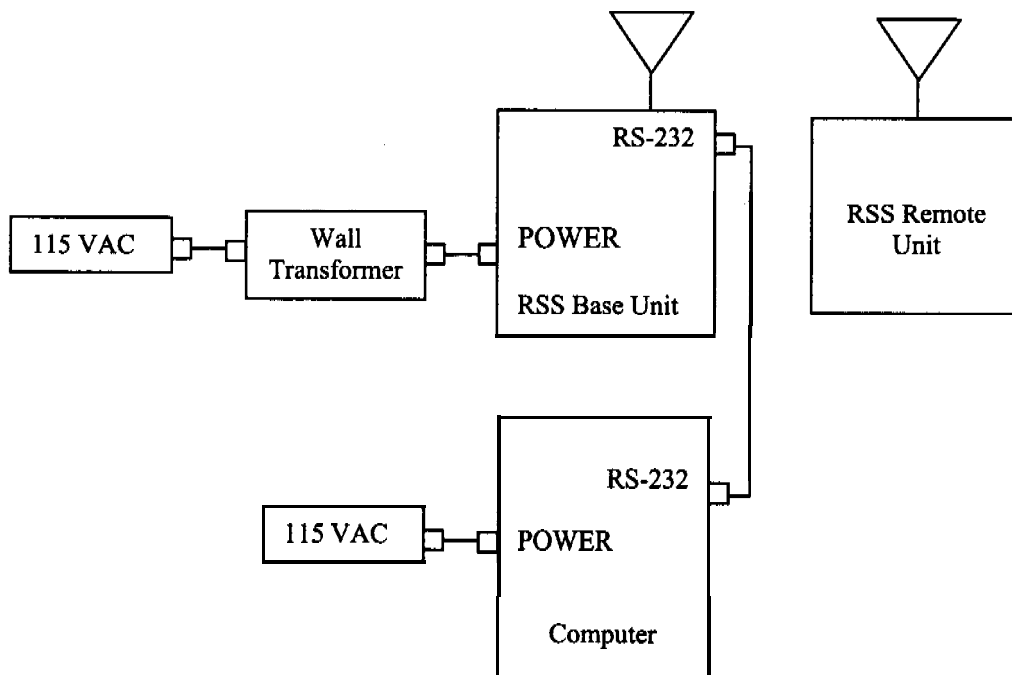


Figure 2.1 - Test Specimen Configuration

3.3 Special Accessories

There are no special accessories.

4.0 RADIATED EMISSIONS

4.1 Field Strength Calculations

The field strength emissions are calculated by adding the Antenna Factor and the Cable Factor and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows.

4.0 RADIATED EMISSIONS (Continued)

4.1 Field Strength Calculations (Continued)

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

where: FS = Field Strength
 RA = Received Amplitude
 AF = Antenna Factor
 CF = Cable Attenuation Factor
 AG = Amplifier Gain
 DC = Distance Correction

For example: assume a receiver input reading of 52.5 $\text{dB}\mu\text{V}$ is obtained. The Antenna Factor, 7.4 dB , and Cable Factor, 1.1 dB , are added and the amplifier gain, 29 dB , is subtracted.

$$FS = 52.5 + 7.4 + 1.1 - 29$$

$$FS = 32.0 \text{ dB}\mu\text{V}/m$$

Correction for measurement distance from 3 meters to 30 meters (if necessary) would add the distance correction factor of -20.0 dB to the value of FS .

$$FS (3 \text{ meters}) = 32.0 \text{ dB}\mu\text{V}/m - 20.0$$

$$FS (30 \text{ meters}) = 12.0 \text{ dB}\mu\text{V}/m$$

When the measured amplitude of the signal plus the ambient noise is less than 10 dB greater than the measured amplitude of the ambient noise, the actual signal level must be determined by applying a correction factor. The deviation of this correction factor is as follows:

$$10 \log (S+N)/N = 10 \log [(S+N)/N] - 10 \log [10^{\log (S+N)/N} - 1]$$

where the quantity $(S+N)/N$ is the measured amplitude of the signal plus the ambient noise divided by the measured amplitude of the ambient noise.

The correction factor, $10 \log (S+N)/N$, is subtracted from the measured amplitude of the signal plus the ambient noise, to determine the true signal amplitude.

For example: assume the measured digital plus ambient noise is 19.5 $\text{dB}\mu\text{V}$ and the measured ambient noise amplitude is 18 $\text{dB}\mu\text{V}$. From the equation, the correction factor would be 5.3 dB .

4.0 RADIATED EMISSIONS (Continued)

4.1 Field Strength Calculations (Continued)

The true signal amplitude would be:

Measured value of signal plus ambient noise	19.5 dBμV
Correction factor, $10 \log (S+N)/N$	(-) 5.3 dB
True signal amplitude	14.2 dBμV

The correction subtracted from the signal plus the ambient noise amplitude gives a true signal amplitude of 14.2 **dB μ V**.

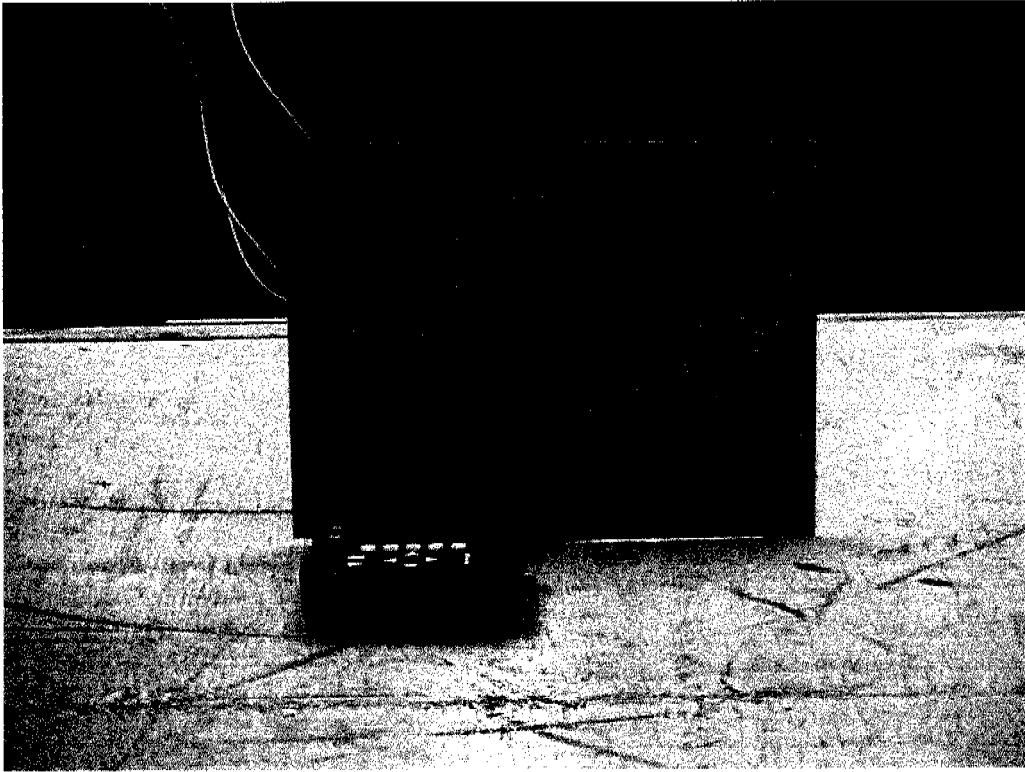
Correction for measurement distance from 3 meters to 10 meters (if necessary) would add the distance correction factor of -10.46 **dB** to the value of FS.

$$\text{FS (10 meters)} = 32.0 \text{ **dB}\mu\text{V/m} - 10.46**$$

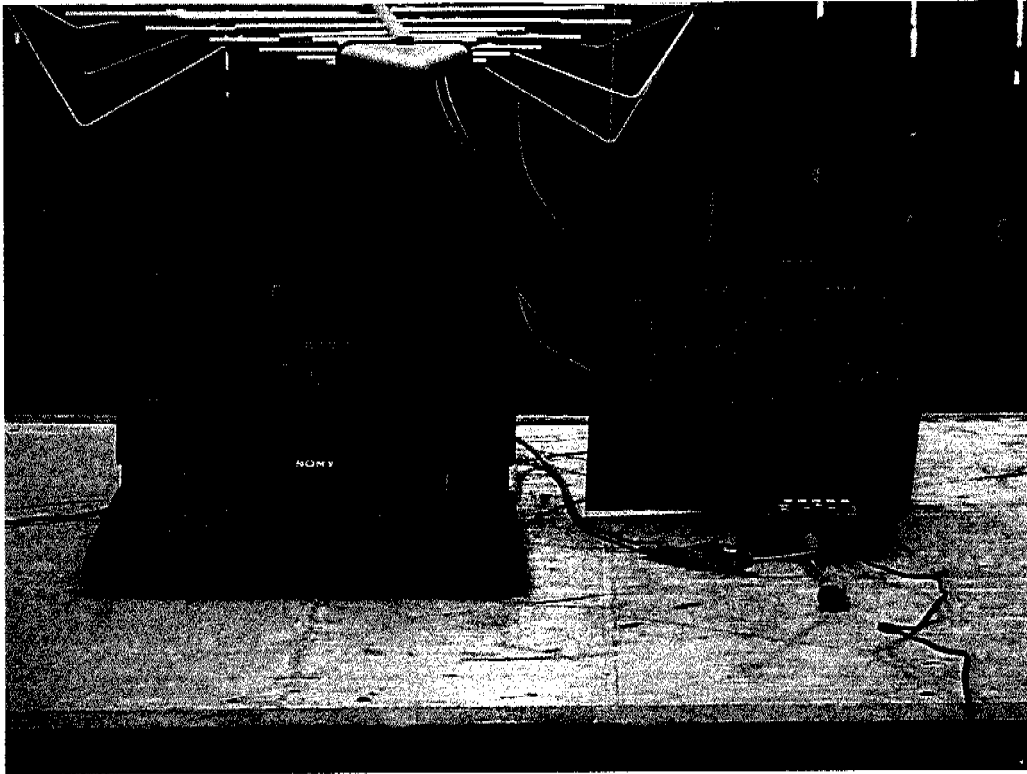
$$\text{FS (10 meters)} = 21.54 \text{ **dB}\mu\text{V/m}**$$

5.0 TEST RESULTS

The radiated emissions from the RSS complied with FCC Part 15, Class A, limits. No anomalies were noted. The test data is presented in Attachment B.



Photograph A-1
CFR 47, Part 15, Class A
Radiated Emissions Test Setup
for the RSS Remote Unit



Photograph A-2
CFR 47, Part 15, Class A
Radiated Emissions Test Setup
for the RSS Base Unit

wyle

EMISSIONS DATA SHEET

Customer: MICRO SYSTEM, INC

Date: 2/28/00

Model Number: RSS (BASE UNIT)

Job Number: 43957

Specimen Nomenclature: RAPID SEARCHING SYSTEM

Freq. Range of Test: 30-1000 MHz

Serial Number: PROTOTYPE #1

Mode of Operation: ACTIVE (TRANSMITTING)

Measurement Point: MAXIMUM

Measurement Technique:

Type of Measurement:

Standard:

Class:

Quasi-Peak ☒

Radiated ☒

FCC Part 15 ☒

A ☒

Peak ☐

Conducted ☐

EN55022/11 ☐

B ☐

Average ☐

GR-1089-Core ☐

Slideback ☐

ICES-005 ☐

Test Frequency (MHz)	ivleter Indication (dBu)	Correction Factors (dB)				Corrected Reading (dBu)	Limit (dBu)	Remarks
		A	B	C	D			
32.14	12.29	11.95	1.30			25.54	39.0	VERTICAL
75.82	19.78	6.99	1.60			28.37	39.0	VERTICAL
129.87	12.60	7.05	2.29			21.94	43.5	VERTICAL
199.23	23.33	10.18	2.70			36.21	43.5	HORIZONTAL
226.98	12.30	10.52	3.81			25.83	46.0	HORIZONTAL
324.23	12.31	13.61	3.74			29.66	46.0	HORIZONTAL
A = Antenna Factor B = Cable Loss C = _____ D = _____								

Tested By: [Signature]

Date: 2/28/00

Notice of Anomaly: None

Reviewed By: [Signature]

Date: 3/3/00

Sheet No. 1 of 2



EMISSIONS DATA SHEET

Customer: Micro Systems, Inc

Date: 2/28/00

Model Number: RSS (REMOTE UNIT)

Job Number: 43957

Specimen Nomenclature: RAPID SCORING SYSTEM

Freq. Range of Test: 30-1000 MHz

Serial Number: PROTOTYPE #2

Mode of Operation: ACTIVE (RECEIVE)

Measurement Point: MAXIMUM

Measurement Technique:

Type of Measurement:

Radiated ☒
Conducted ☐

Standard:

FCC Part 15 ☒
EN55022/11 ☐
GR-1089-Core ☐
ICES-005 ☐

Class:

A ☒
B ☐

Quasi-Peak ☒

Peak ☐

Average ☐

RMS ☐

Slideback ☐

Test Frequency (MHz)	Meter Indication <u>dBu</u>	Correction Factors (dB)				Corrected Reading <u>dBu</u>	Limit <u>dBu</u>	Remarks
		A	B	C	D			
32.14	11.43	11.95	1.30			24.68	39.0	VERTICAL
75.82	17.60	6.99	1.60			26.19	39.0	VERTICAL
129.87	11.92	7.05	2.29			21.26	43.5	VERTICAL
178.10	20.95	8.55	2.61			32.11	43.5	VERTICAL
221.20	11.26	10.46	2.95			24.67	46.0	HORIZONTAL
225.91	11.57	10.52	3.01			25.10	46.0	HORIZONTAL

A= Antenna Factor

B= Cable Loss

C= _____ D= _____

Tested By: Michael M...

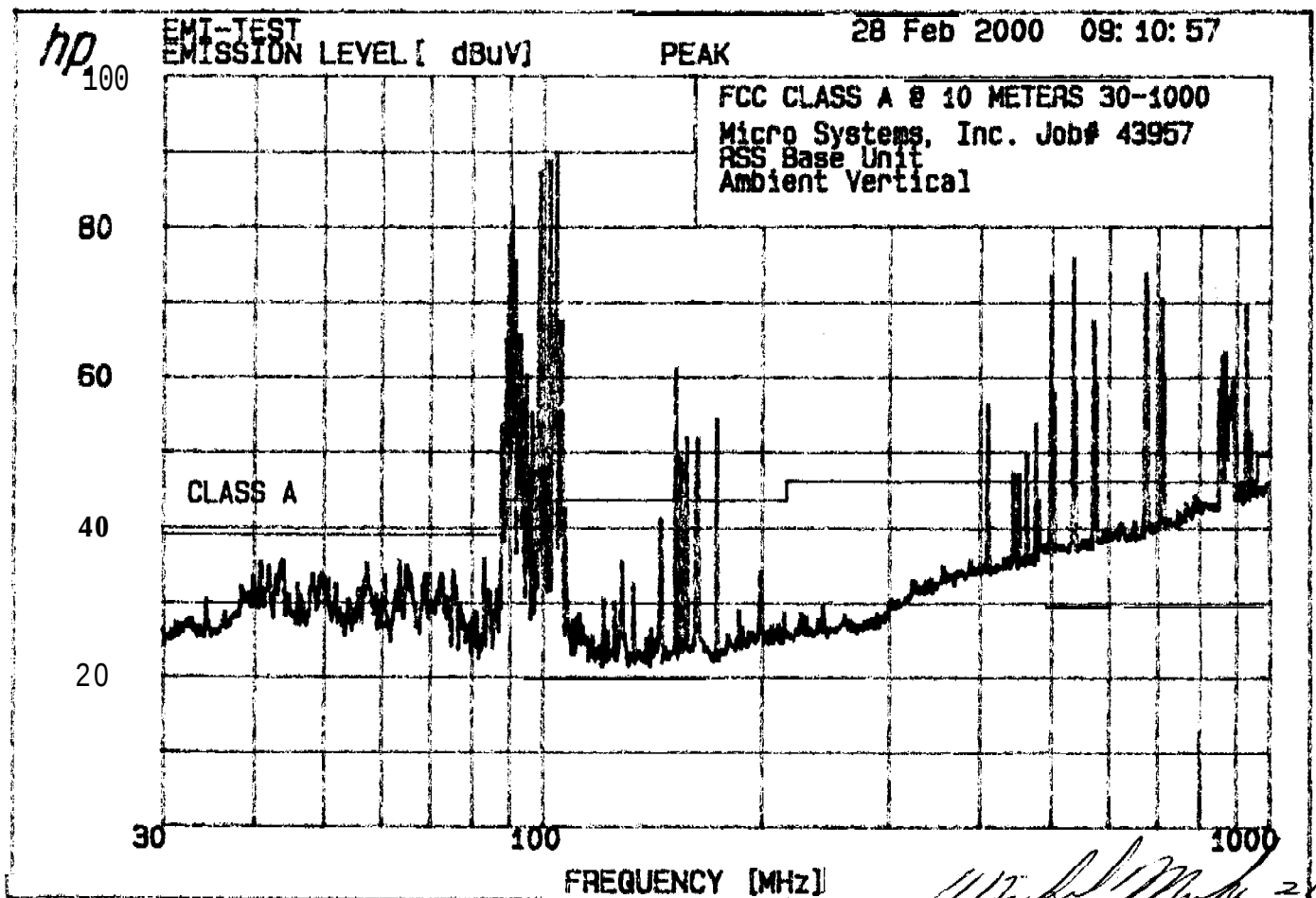
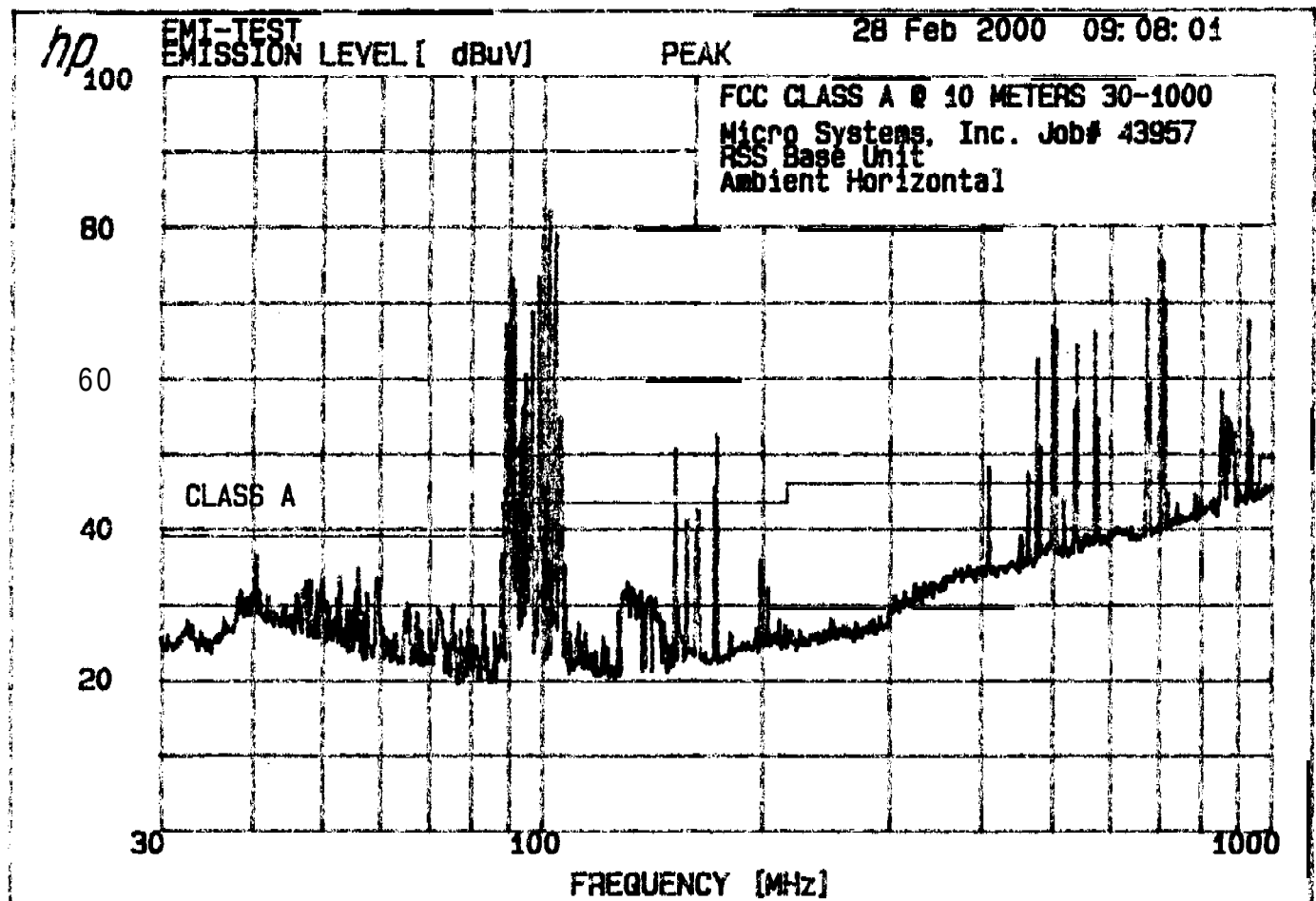
Date: 2/28/00

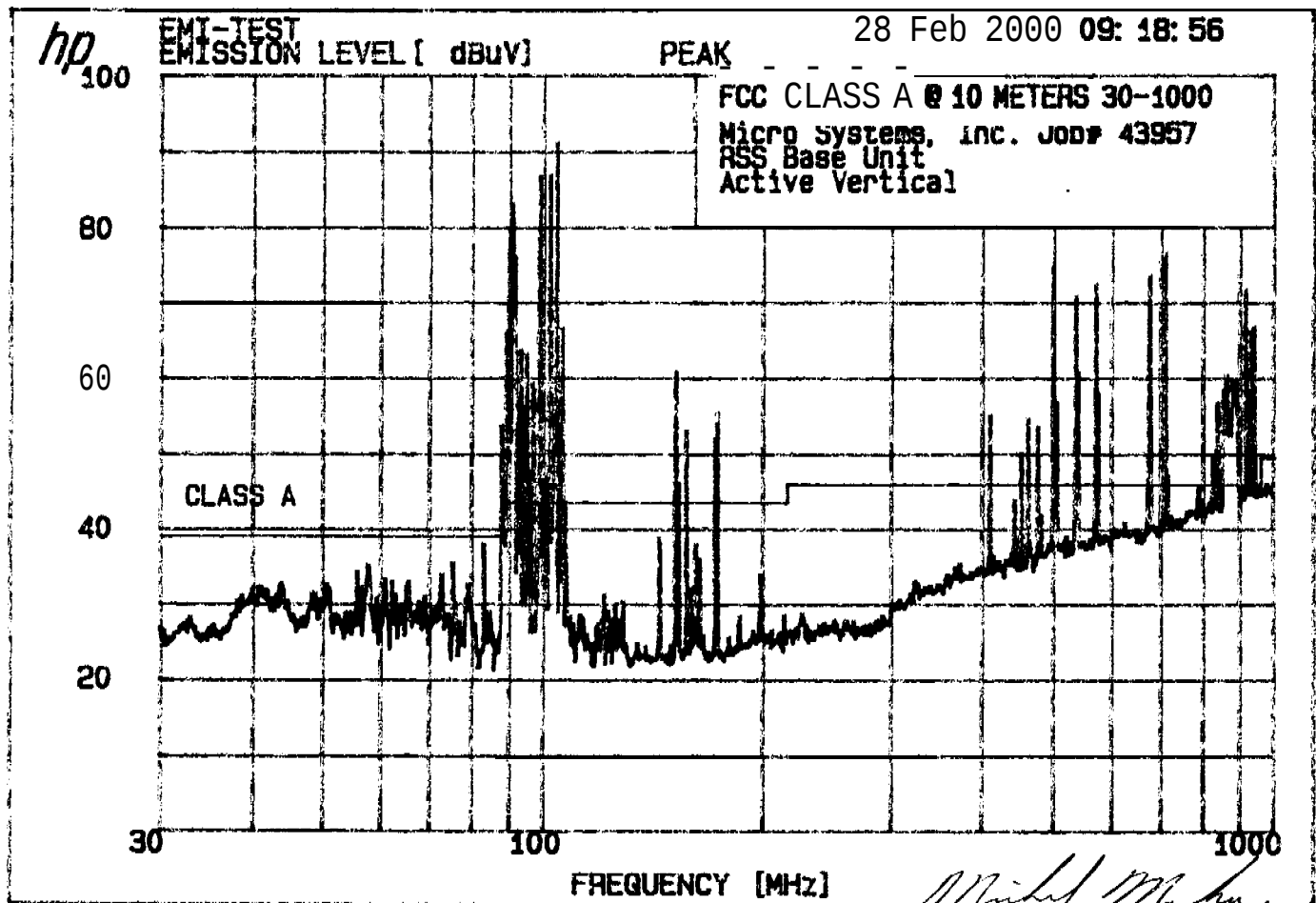
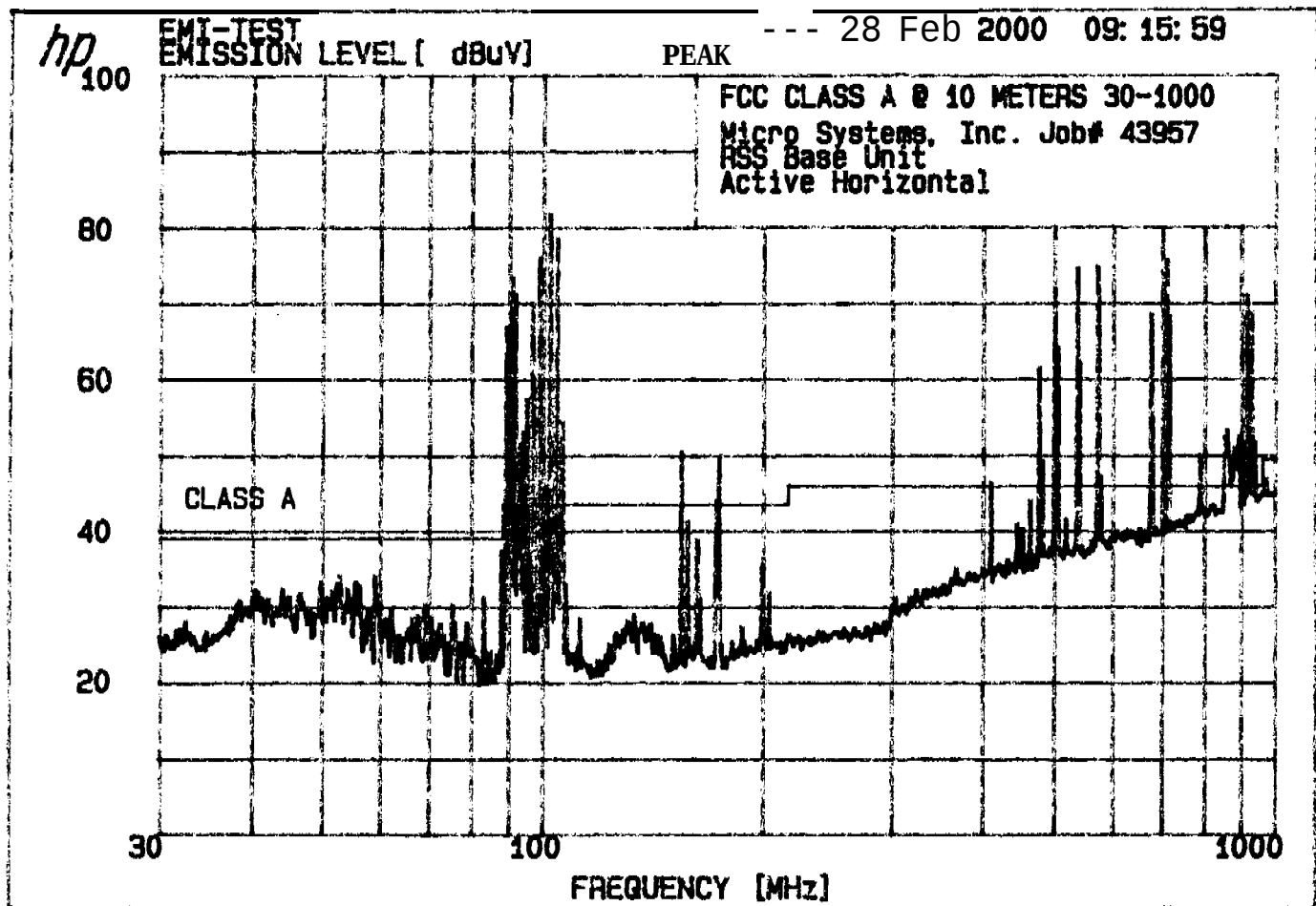
Notice of Anomaly: NONE

Reviewed By: ...

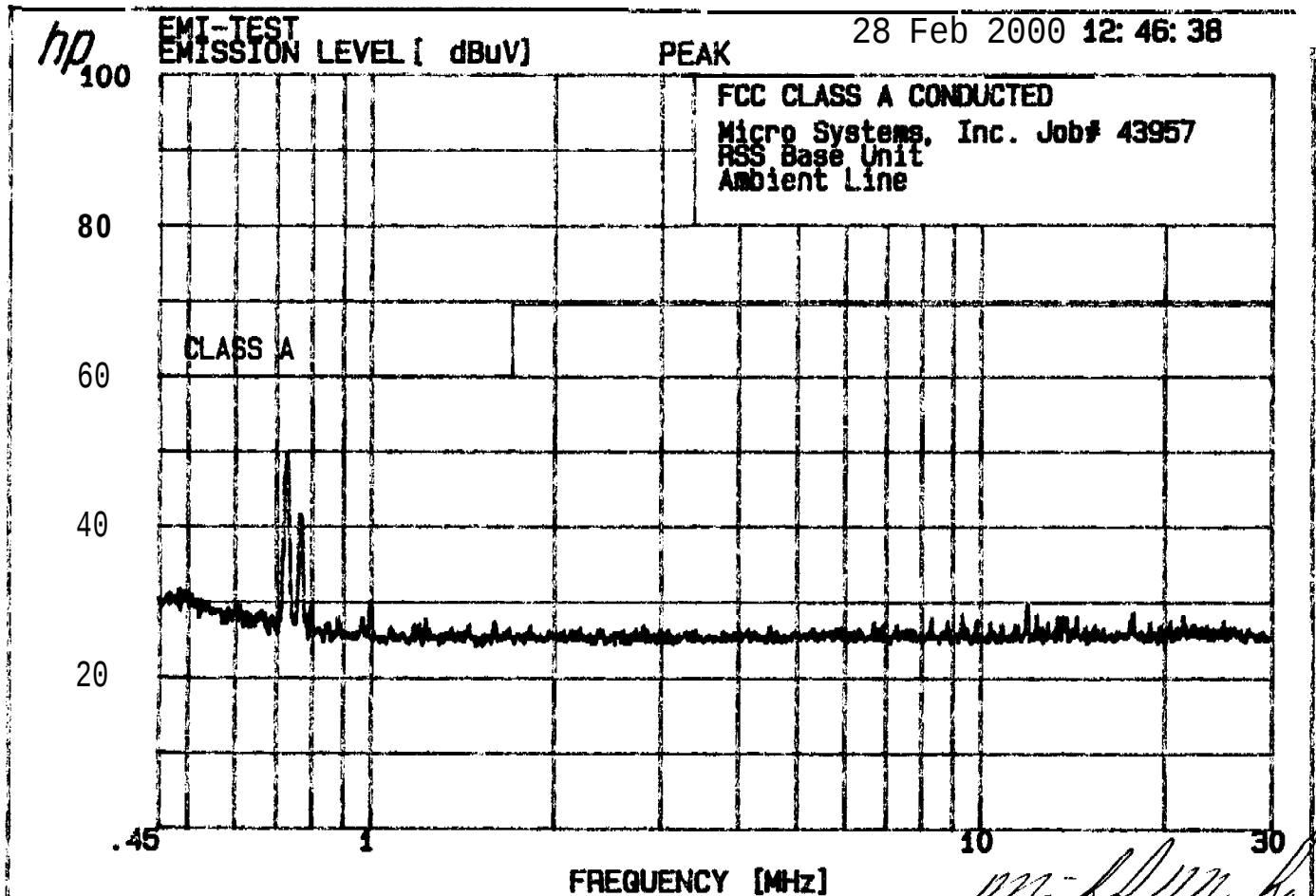
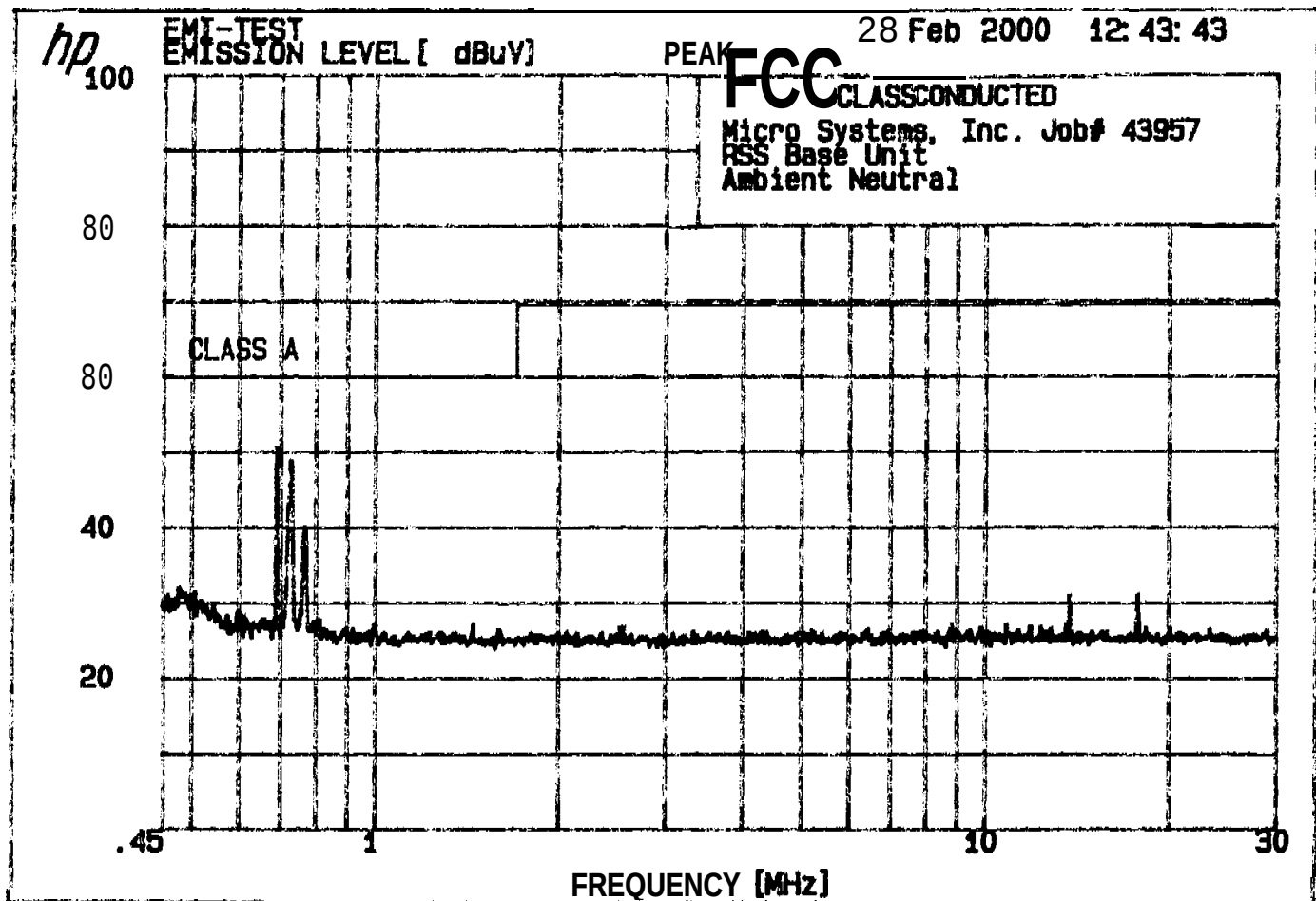
Date: 2/3/00

Sheet No. 2 of 2

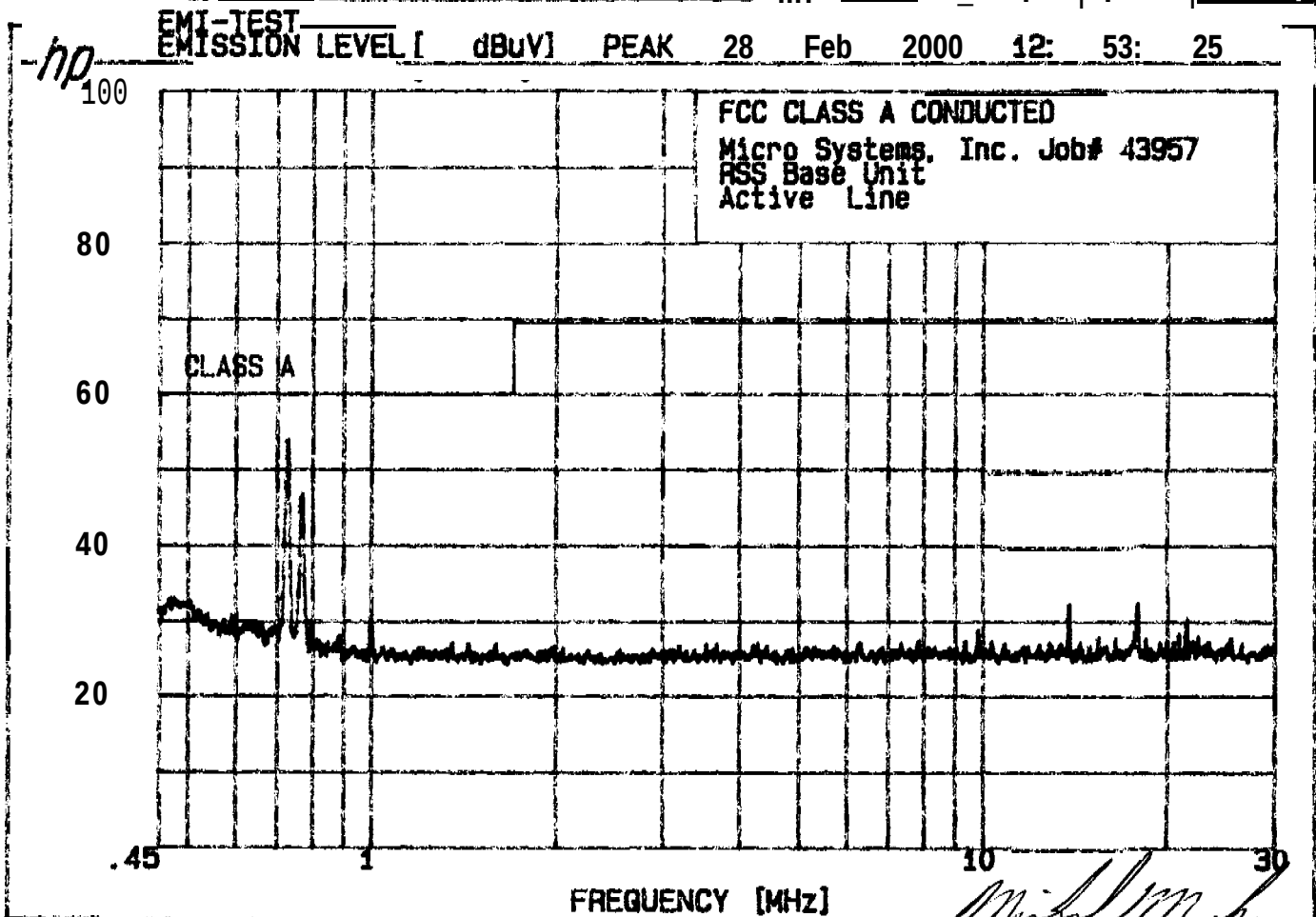
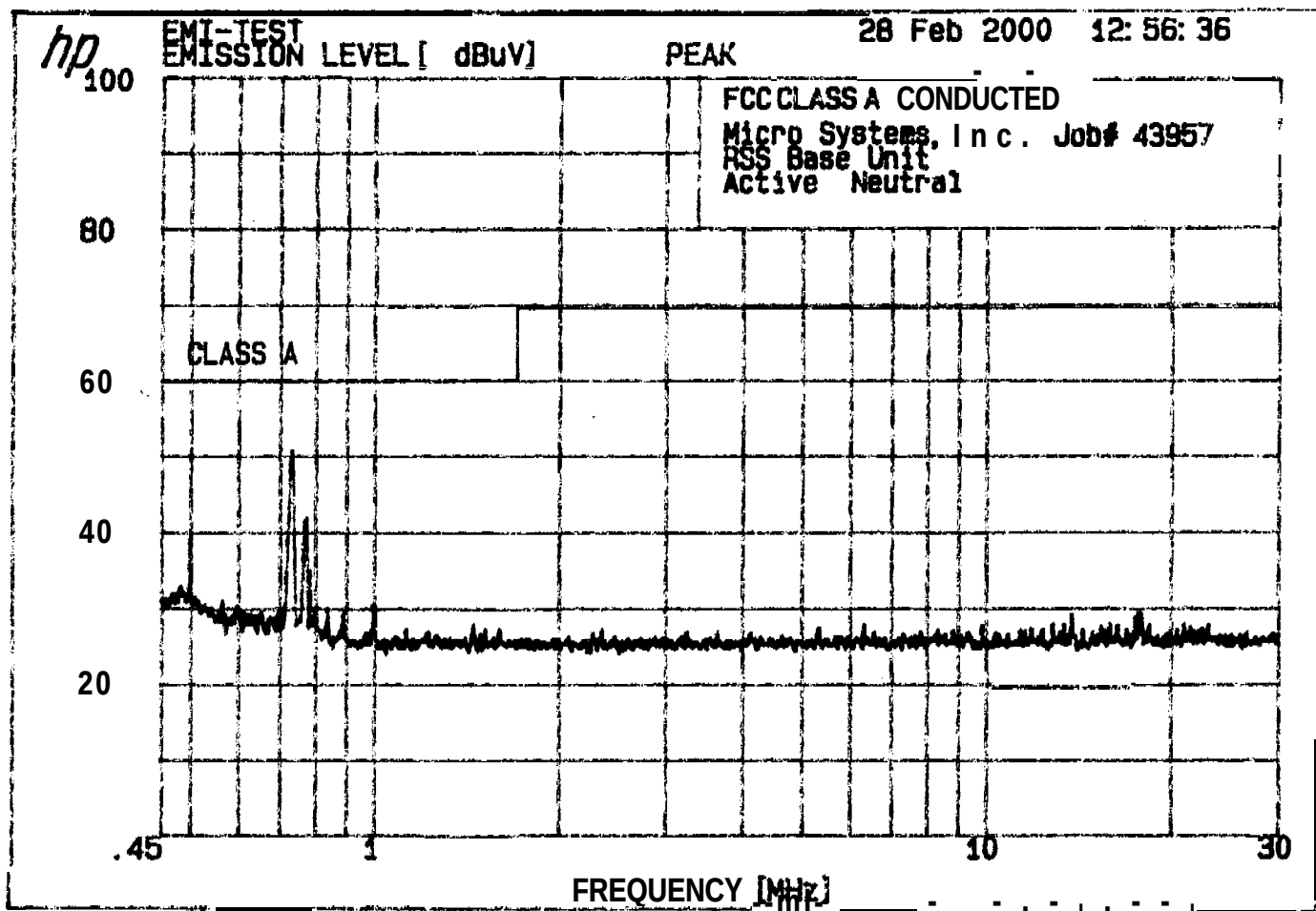




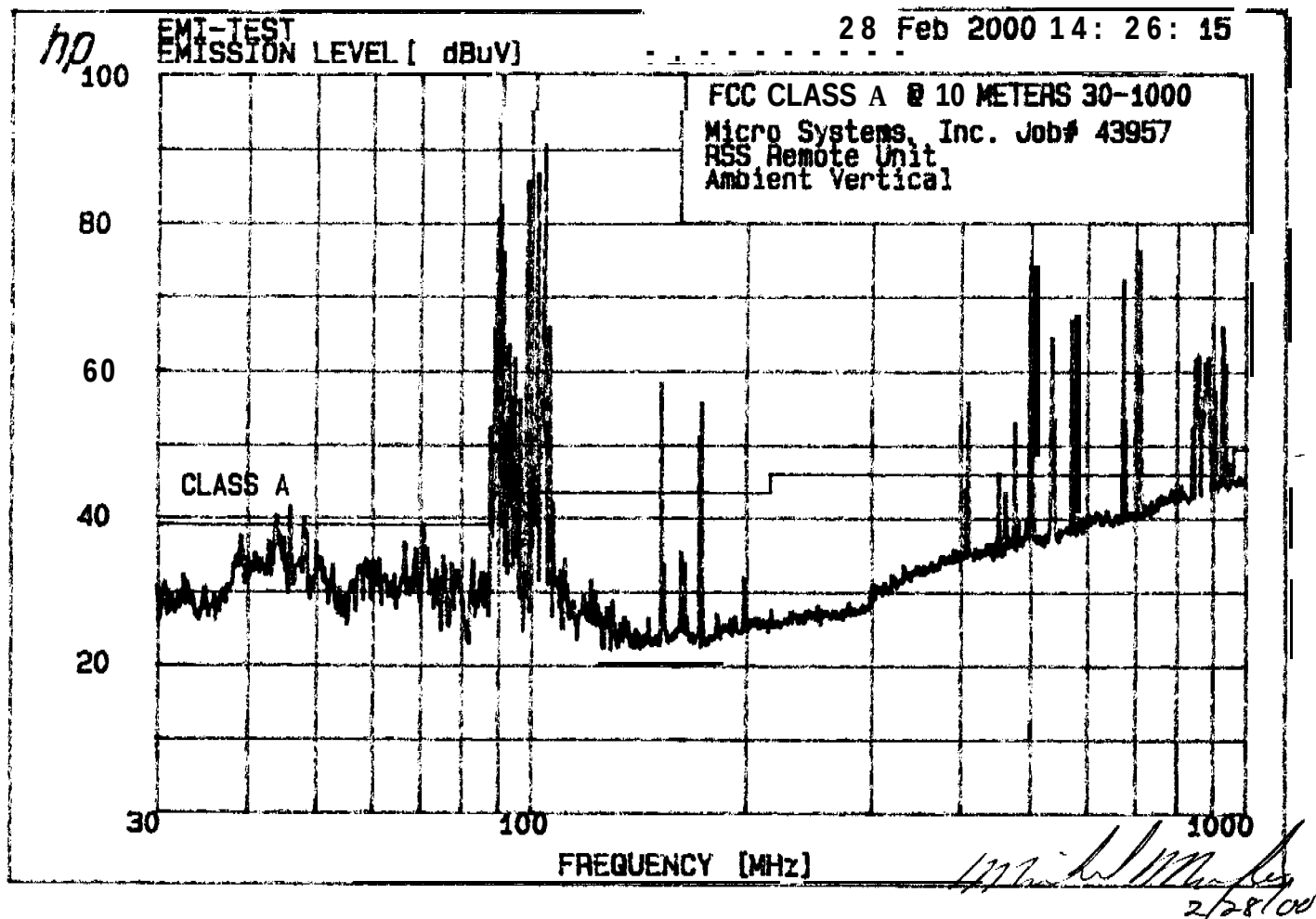
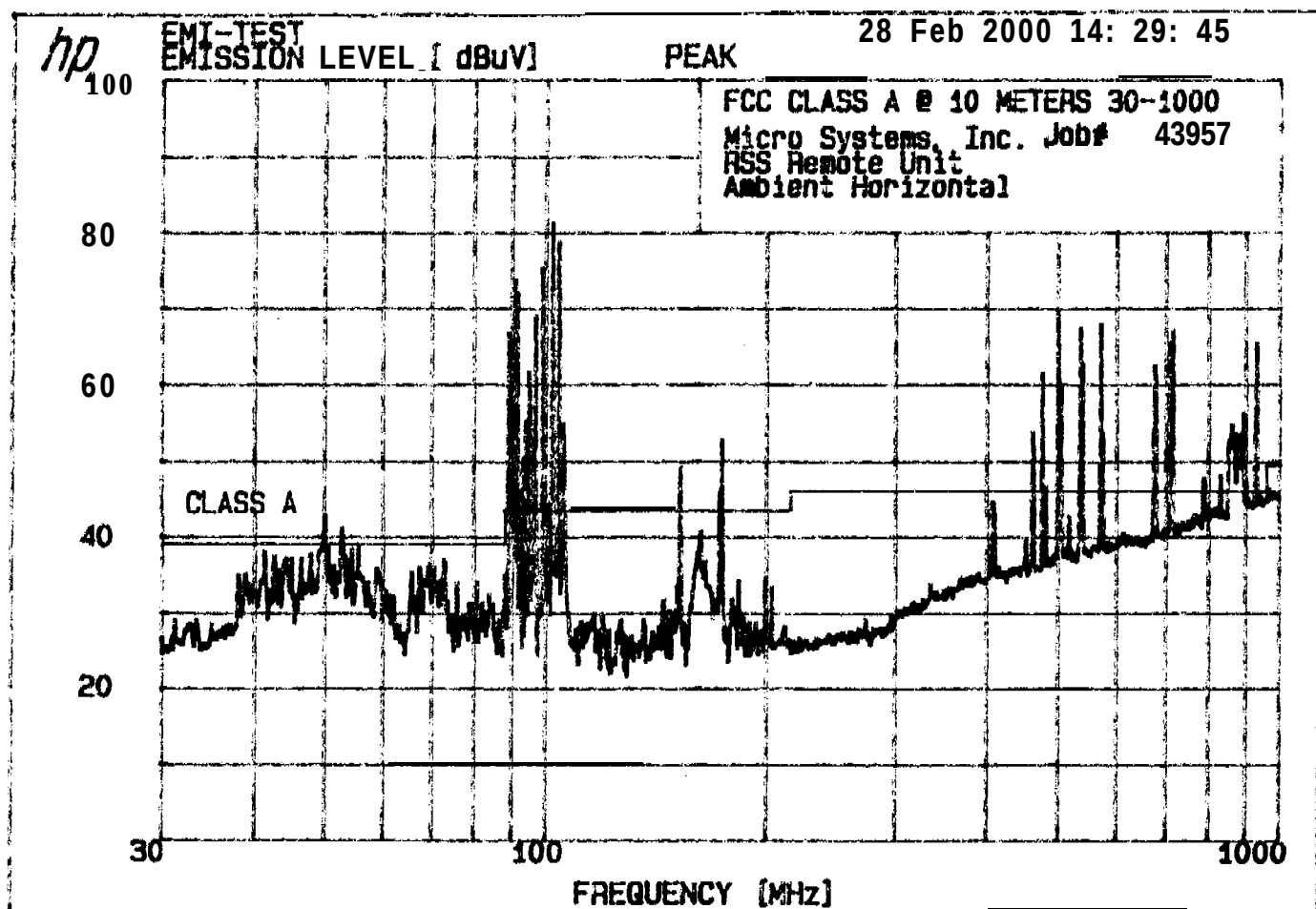
mill m
2/28/00

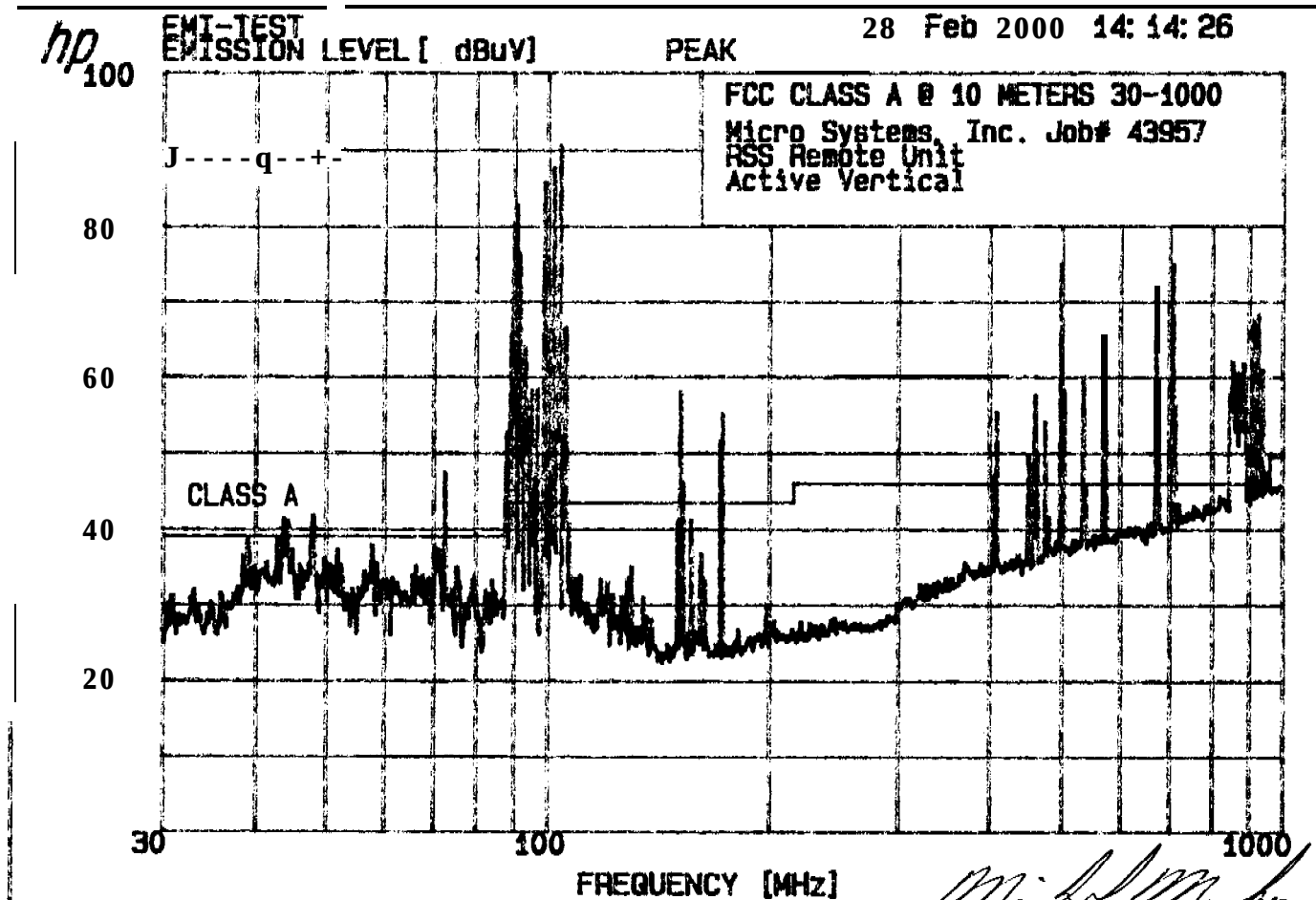
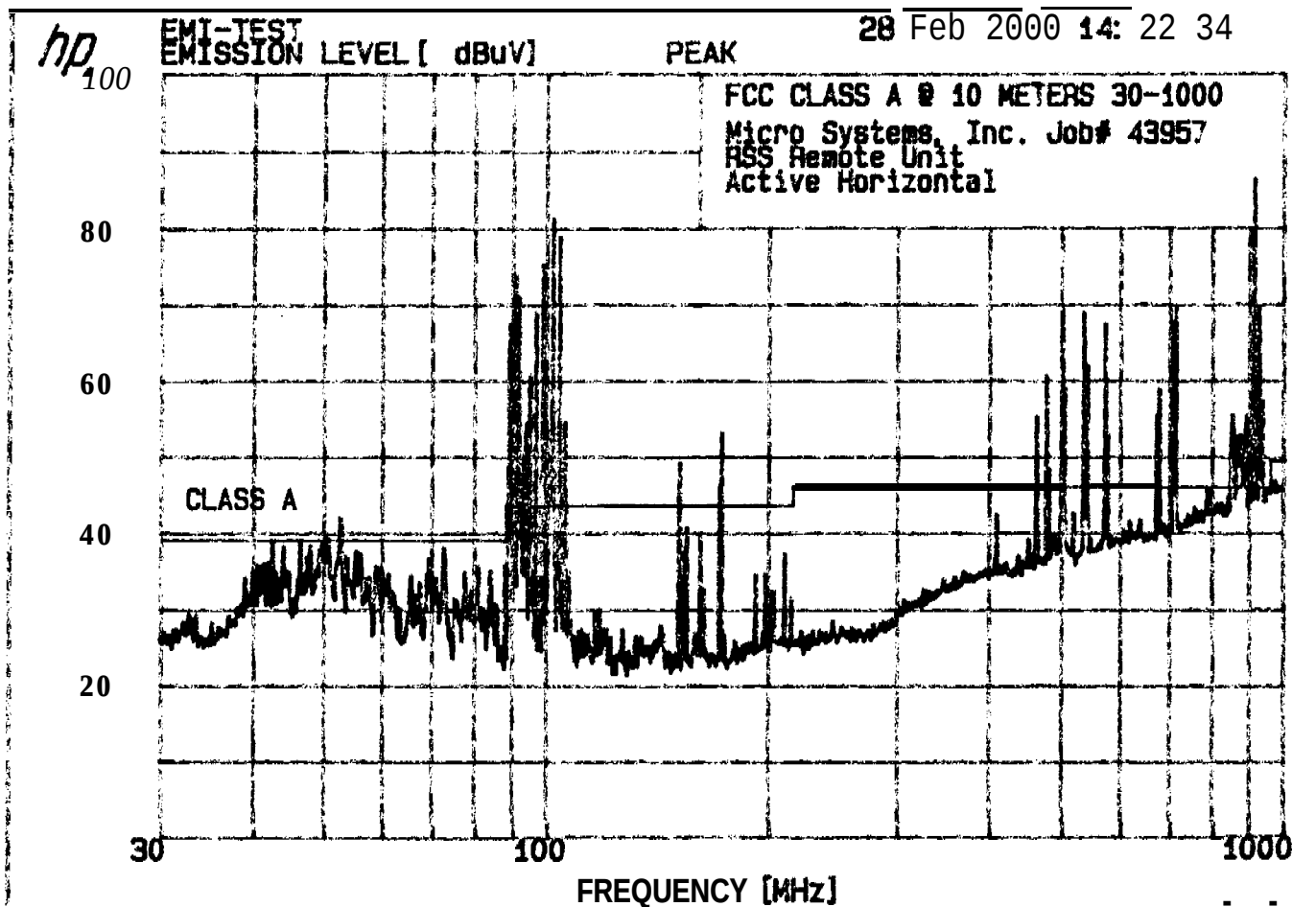


mm-llm
2/28/00



Michael J. Smith
2/28/00





Michael M. [Signature]
2/28/00



EMISSIONS DATA SHEET

Customer: MICRO SYSTEM, INC

Date: 2-29-00

Model Number: RSS (BASE UNIT)

Job Number: 43957

Specimen Nomenclature: RAPID SCORING SYSTEM Freq. Range of Test: 30-10000 MHz

Serial Number: PROTO TYPE #1

Mode of Operation: ACTIVE (TX)

Measurement Point: MAXIMUM EMISSION

Technique:

Type of Measurement: ☐ Radiated ☐ Conducted
Standard: INTENTIONAL CLASS
FCC Part 15C ☒ RADIATOR A ☐
EN55022/11 ☐ B ☐
GR-1089-Core ☐
ICES-005 ☐

Quasi-Peak ☒
Peak ☒
Average ☒
 ☒
Slideback ☐

Test Frequency (MHz)	Meter Indication (dBu)	Correction Factors (dB)				Corrected Reading (dBu)	Limit (dBu)	Remarks
		A	B	C	D			
916.53	41	21.83	5.94			68.77	94	QUASI PEAK HORIZONTAL AVERAGE
1833.06	50.22	26.5	-28			48.72	54	HORIZONTAL
2749.59	45.75	29.25	-27.8			47.20	54	PEAK HORIZONTAL
1833.06	68.93	26.5	-28			67.43	54 ⁽¹⁾	PEAK HORIZONTAL
Note: (1) Cannot exceed the Limit by more than 20 dBu.								
A= Antenna Factor		B= Cable Loss		C= _____		D= _____		

Tested By: Michael M. M. M.

Date: 2/29/00

Notice of Anomaly: NONE

Reviewed By: Ken L.

Date: 3/3/00

Sheet No. 1 of 2



EMISSIONS DATA SHEET

Customer: MITRO SYSTEM, INC

Date: 2-29-00

Model Number: RSS (REMOTE UNIT)

Job Number: 43957

Specimen Nomenclature: RAPID SCORING SYSTEM

Freq. Range of Test: 30-10000 MHz

Serial Number: PROTOTYPE #2

Mode of Operation: ACTIVE (TX)

Measurement Point: MAXIMUM EMISSION

Measurement Technique:

Type of Measurement:

Standard: INTENTIONAL Class:

Radiated ☒

FCC Part 15 C ☐

RADIATOR A ☐

Quasi-Peak ☒

Conducted ☐

EN55022/11 ☐

B ☐

Peak ☒

GR-1 089-Core ☐

Average ☒

ICES-005 ☐

RMS ☐

Slideback ☐

Test Frequency (MHz)	Meter Indication (dBu)	Correction Factors (dB)				Corrected Reading (dBu)	Limit (dBu)	Remarks
		A	B	C	D			
916.53	37.12	21.83	5.94			64.89	94	QUASI-PEAK HORIZONTAL
1833.06	47.61	26.50	-28			46.11	54	AVERAGE HORIZONTAL
2749.59	45.24	29.25	-27.8			46.69	54	PEAK HORIZONTAL
1833.06	63.79	26.50	-28			62.29	54 (1)	PEAK HORIZONTAL
Note (1) cannot exceed the limit by more than 20 dbuv.								
A= Antenna Factor		B= Cable Loss _{AMP}		C= _____		D= _____		

Tested By: Michael Munka

Date: 2/29/00

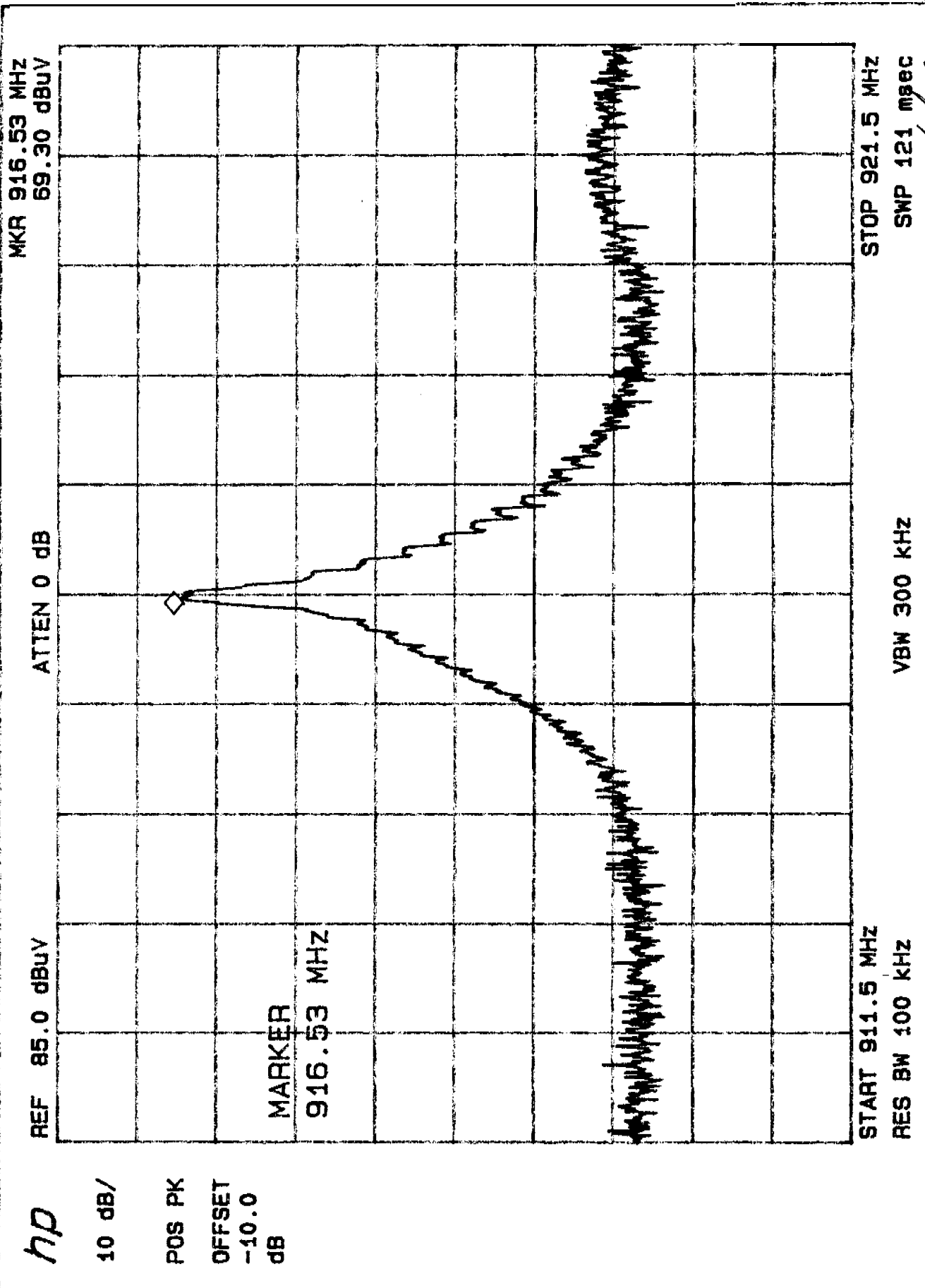
Notice of Anomaly: NONE

Reviewed By: Ram Tu

Date: 3/3/00

Sheet No. 2 of 2

BASE UNIT (Tx)



M. J. M. J.

REMOTE UNIT (TX)

hp

10 dB/

POS PK

OFFSET
-10.0
dB

REF 85.0 dBuV

ATTEN 0 dB

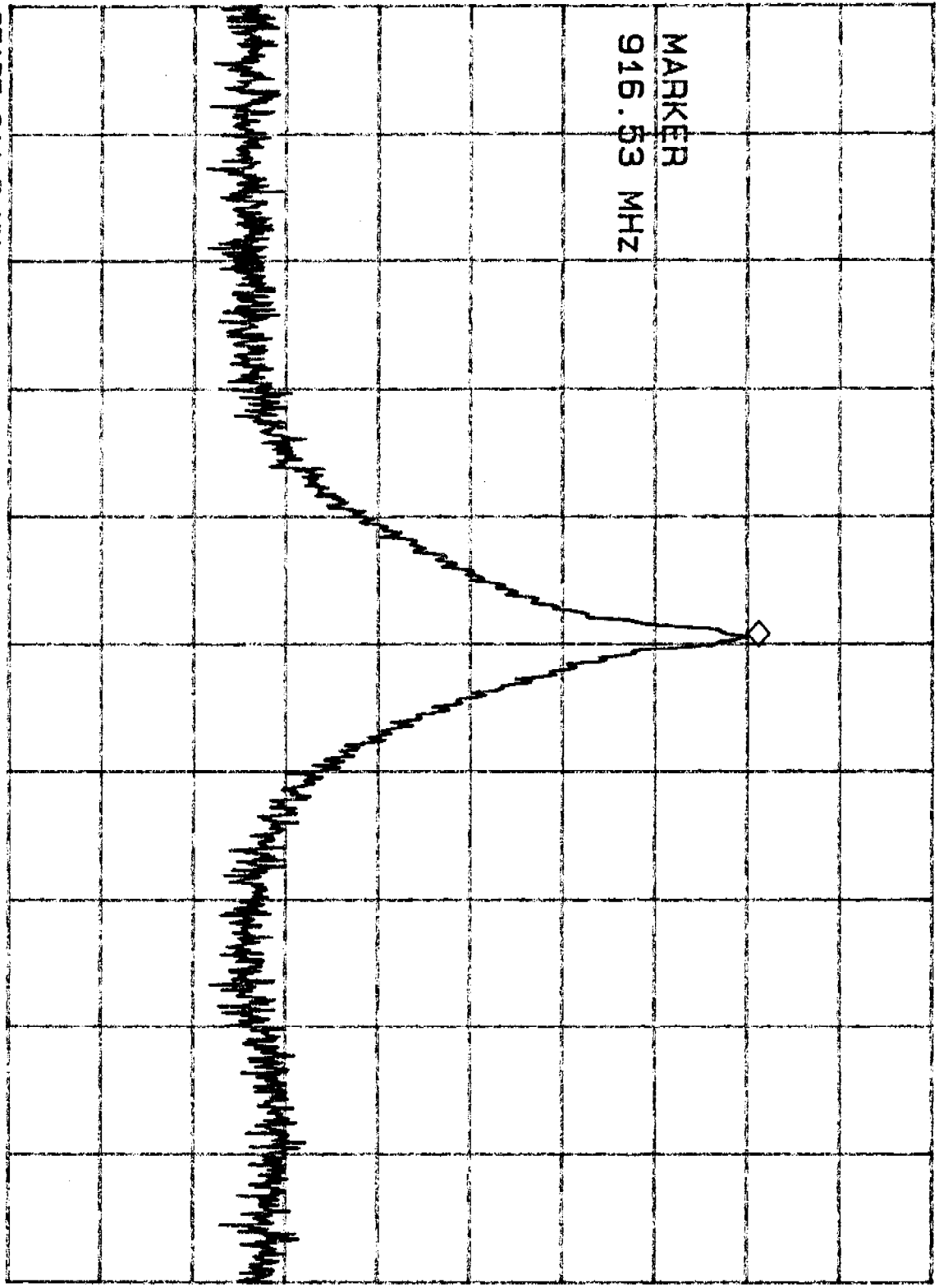
MKR 916.53 MHz
65.10 dBuV

MARKER
916.53 MHz

START 911.5 MHz
RES BW 100 KHz

VBW 300 KHz

STOP 921.5 MHz
SWP 75.0 msec



W. J. Miller
2/20/00



INSTRUMENTATION EQUIPMENT SHEET

DATE 2/28/00
TECHNICIAN: M. MORANHA

JOB NUMBER: 43957
CUSTOMER: MICRO SYSTEMS INC

TEST AREA: FCC (OATS)
TYPE TEST: FCC

1

NO.	INSTRUMENT	MANUFACTURER	MODEL #	SERIAL #	WYLE #	RANGE	ACCURACY	CAL DATE	CAL DUE
	Q-PEAK ADAPTER	HP	85650A	2811A01189	112109	PASS M O D	.3db	5/24/99	5/23/00
2	DISPLAY SECTION	HP	85662A	2648A13534	108392	MFG	CERT	4/15/99	4/14/00
3	SPEC ANAL	HP	85660	2637A03696	108391	10MHZ	CERT	4/15/99	4/14/00
4	RF PRESELECTOR	HP	85685A	3107A01286	109934	20 - 2GHZ	2db	9/15/99	9/14/00
5	ANTENNA	EMCO	EM-6917A	124116	114415	30MHZ - 3GHZ	CERT	3/ 4/99	3/ 4/00
6	LISN	SOLAR	8028-50-TS-24-B	974622	113973	10K-100MHZ	CERT	9/15/99	9/14/00
	LISN	SOLAR	8028-50-TS-24-B	974623	113974	10K-100MHZ	CERT	9/15/99	9/14/00
8	ANTENNA	EMCO	3115	3289	10971 1	1-18GHZ	CERT	5/11/99	5/11/00
9	PRE-AMP	HP	84498	3008A00159	112595	2-22GHZ	3.8db	5/ 5/99	5/ 4/00

This is to certify that the above instruments were calibrated using state-of-the-art techniques with standards whose calibration is traceable to the National Institute of Standards and Technology.

INSTRUMENTATION

Minda M. M. 2/29/00

CHECKED & RECEIVED BY

Steven G. Luthin 2/29/00

Q.A.

Brenda M. 2/28/00