CalComp

TEST REPORT TO FCC PART 15 SUBPART C:

CALCOMP DIGITIZER
MODEL NO. 11180, 11180A, 35180 AND 35180A

FCC ID: ECP11180

PREPARED FOR:

CalComp
Input Technologies Division
14555 North 82nd Street
Scottsdale, AZ 85260

PREPARED BY:

Kenneth B. Jacobson
Product Support Engineer
CalComp
Input Technologies Division
14555 North 82nd Street
Scottsdale, AZ 85260

DATE OF REPORT:

08/25/98

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I. OVERVIEW OF TEST REPORT

The procedures used for the conducted and radiated tests were derived from the American National Standard ANSI C63.4-1991 as stated in FCC CFR 47, Part 15, Paragraph 15.31. The test site attenuation and layout was done in accordance with ANSI C63.4-1991 and is on file with the FCC as required in FCC CFR 47, Part 2, Paragraph 2.948.

PRODUCT TESTED:	CalComp Digitizer Model No. 11180, 11180A, 35120 and 35120A
TRADE NAME:	Creation Station
APPLICANT:	CalComp Input Technologies Division 14555 North 82nd Street Scottsdale, AZ 85260
MANUFACTURER:	Same as Applicant
TEST FACILITY LOCATION:	Same as Applicant
TEST DATE:	07/21/98

The measurement data contained in this report reflects an accurate representation of the emission characteristics of the produce mentioned above.

REPORT PREPARED AND APPROVED BY: _____

Kenneth B. Jacobson
Product Support Engineer
CalComp Digitizer Division

II. STATEMENT OF COMPLIANCE

Under the test configuration as described in this test report, the product tested has shown that it complies to the requirements of:

FCC RULES, PART 15, SUBPART C

We, CalComp Digitizer Division, assume full responsibility to manufacture the product as shown in the enclosed photographs to uphold compliance to the FCC rules.

SIGNED: _____
Don Addiss

TITLE: Director of Engineering

DATE: 2/1/98

III. DESCRIPTION OF TEST SAMPLE

The " Digitizer Tested" is a microprocessor-based device that can convert graphic information into accurate digital information for entry into the host computer. The digitizer can be used for drawing, drafting, mapping, desktop publishing, animation, menuing, and presentation graphics.

The basic operation of the digitizer is as follows:

The transducer (cursor) electromagnetically induces voltages into precisely positioned grid conductors beneath the tablets surface. The digitizers electronics finds the grid conductors with the largest signals and converts the grid signals into digital position data. The digitizer then sends the information out the communication port to the host. The data generated indicates the distance vertically and horizontally from the origin on the digitizers surface.

The digitizer intentionally radiates a 1.8432 MHZ signal through the grid to the transducer. When the transducer receives this signal, it converts its energy into a DC voltage source via a tank circuit and this DC voltage powers the electronic components in the transducer such that it can radiate back to the digitizer (also at 1.8432 MHZ) for positioning and button information as outlined previously.

The digitizer also can be installed in a Macintosh environment without any change to the electronics or PWB. An ADB cable is installed at the manufactured stage in place of a RS-232 cable which tells the PIC 16C65 micro to transmit ADB data instead of RS-232 data by shorting out certain pins on the connector. The micro uses an inverter to drive a transistor for the ADB interface. These parts are always installed and has shown during testing that no new emissions are produced (no new clocks are generated). For test purposes, Model 11180 was used for testing.

Model 35180 is identical to Model 11180 as well as Model 35180A is identical to Model 11180A, the model number is the only difference. The reason for the different model numbers is for marketing the digitzer in different market, i.e., CAD desigh versus graphic artist use.

The digitizer is powered by +5VDC which is recieved from the host via the I/O cable.

IV. SUBASSEMBLIES OF TEST SAMPLE

The Model 11180, 11180A, 35180 and 35180A Digitizer has only one PWB. Any other subassemblies/accessories would be the cursor. All these are shown on the attached photographs.

V. TEST EQUIPMENT AND CALIBRATION

The following is a list of equipment and calibration dates that are used at CalComp's test site.

TEST EQUIPMENT	MODEL	CALIBRATION DATE	FREQUENCY
Com-Power Log Periodic Antenna	CPAL-100	06/08/98	1 Year
Com-Power Biconical Antenna	AB-100	05/28/98	1 Year
Com-Power Loop Antenna	AL-130	06/26/98	1 Year
EMCO LISN	3825/2	03/28/98	1.5 Year
EMCO LISN	3825/2	03/28/98	1.5 Year
HP Spectrum Analyzer with Quasi-Peak Adapter	8568B 85650A	11/24/98	1 Year
HP Signal Generator	HP8656B	03/21/98	1 Year
EMCO Turntable	1060	N/A	N/A
HP Plotter	HP7470	N/A	N/A
Cable	RG-59/U	05/13/98	1 Year

VI. CABLE LOSS AND ANTENNA FACTORS

Com-Power Corporation

(949) 587-9800

Antenna Calibration

Antenna Type:	Biconical
Model:	AB-100
Serial Number:	14069
Calibration Date:	5/28/98

Frequency MHz	Gain dBi	Factors dB/m
30	-14.6	14.4
40	-9.8	12.1
50	-8.0	12.2
60	-5.7	11.5
70	-3.3	10.4
80	0.8	7.5
90	3.0	6.3
100	4.1	6.1
125	-0.9	13.0
150	5.1	8.6
175	-1.8	16.9
200	-1.9	18.1
250	-2.0	20.2
300	-1.4	21.2

Trans. Antenna Height	2 meter
Receiving Antenna Height	1 to 4 meter
Calibration	3 meter
Spectrum Analyzer	
Resolution Bandwidth	100 kHz
Video Bandwidth	100 kHz
Signal Generator Output	120 dBuV

Com-Power Corporation

(949) 587-9800

Antenna Calibration

Antenna Type:	Log Periodic
Model:	AL-100
Serial Number:	1011
Calibration Date:	6/8/98

Frequency MHz	Gain dBi	Factors dB/m
300	5.2	14.6
400	6.9	15.4
500	5.2	19.0
600	3.2	22.6
700	5.4	21.7
800	5.6	22.7
900	7.6	21.7
1000	3.4	26.8

Trans. Antenna Height		2 meter
Receiving Antenna Height		1 to 4 meter
Spectrum Analyzer		
	Resolution Bandwidth	100 kHz
	Video Bandwidth	100 kHz
Signal Generator Output		114 dBuV

Com-Power Corporation

(714) 587-9800

Antenna Calibration

Antenna Type:	Loop Antenna
Model:	AL-130
Serial Number:	17000
Calibration Date:	6/26/98

Frequency MHz	Magnetic (dB/m)	Electric dB/m
0.01	-41.3	10.2
0.02	-42.3	9.2
0.03	-40.6	10.9
0.04	-40.6	10.9
0.05	-41.8	9.7
0.06	-41.4	10.1
0.07	-41.5	10.0
0.08	-41.8	9.7
0.09	-41.9	9.6
0.1	-41.9	9.6
0.2	-44.0	7.5
0.3	-41.6	9.9
0.4	-41.6	9.9
0.5	-41.5	10.0
0.6	-41.3	10.2
0.7	-41.2	10.3
0.8	-41.2	10.3
0.9	-41.1	10.4
1	-40.4	11.1
2	-39.7	11.8
3	-40.3	11.2
4	-40.6	10.9
5	-40.2	11.3
6	-40.3	11.2
7	-40.7	10.8
8	-41.1	10.4
9	-40.3	11.2
10	-40.5	11.0
12	-41.1	10.4
14	-41.5	10.0
15	-41.7	9.8
16	-42.0	9.5
18	-42.0	9.5
20	-42.0	9.5
25	-43.4	8.1
30	-46.7	4.8

Trans. Antenna Height	2 meter
Receiving Antenna Height	2 meter

CERTIFICATE OF CALIBRATION CONFORMANCE

COM-POWER CORPORATION
20621 Pascal Way
Lake Forest, CA 92630
TEL: (949) 587-9800
FAX: (949) 587-9960

This antenna has been individually calibrated using ANSI C63.5, American National Standard for Calibration of Antennas used for radiated emission measurement in EMI control.

Certificate Number	1001
Client	Calcomp
Manufacturer	Com-Power
Model Number	AB-100
Serial Number	14069
Date of Calibration	05/28/98

Calibration Accuracy: ± 1 dB

Calibration Traceability:

All measurement instrumentation is traceable to the United States National Institute of Standards and Technology (NIST). Supporting Documentation relative to traceability is on file and is available for examination upon request.

Measurement procedure per Military Handbook-52A as guidance for Military Standard 45662A, ANSI/NCSL Z540-1-1994 and ISO Guide 25.

Notes:

Re-Certification Date: 1 Year from Calibration Date.

COM-POWER CORPORATION

Calibration Engineer

CERTIFICATE OF CALIBRATION CONFORMANCE

COM-POWER CORPORATION
20621 Pascal Way
Lake Forest, CA 92630
TEL: (949) 587-9800
FAX: (949) 587-9960

This antenna has been individually calibrated using ANSI C63.5, American National Standard for Calibration of Antennas used for radiated emission measurement in EMI control.

Certificate Number	1000
Client	Calcomp
Manufacturer	Com-Power
Model Number	AL-100
Serial Number	1011
Date of Calibration	06/08/98

Calibration Accuracy: ± 1 dB

Calibration Traceability:

All measurement instrumentation is traceable to the United States National Institute of Standards and Technology (NIST). Supporting Documentation relative to traceability is on file and is available for examination upon request.

Measurement procedure per Military Handbook-52A as guidance for Military Standard 45662A, ANSI/NCSL Z540-1-1994 and ISO Guide 25.

Notes:

Re-Certification Date: 1 Year from Calibration Date.

COM-POWER CORPORATION

Calibration Engineer

RG-59/U 3 METER CABLE LOSS

MHZ	LOSS (db)	MHZ	LOSS (db)
		280	1.30
30	.47	290	1.37
35	.31	300	1.61
40	.64	310	1.28
45	.77	320	1.53
50	.70	330	1.71
55	.69	340	1.99
60	.76	350	1.84
65	.67	360	2.11
70	.48	370	2.06
75	.36	380	1.82
80	.23	390	2.29
85	.16	400	2.02
90	.12	410	2.18
95	.19	420	2.12
100	.24	430	2.31
105	.31	440	2.43
110	.48	450	2.57
115	.71	460	2.62
120	.45	470	3.03
125	.46	480	3.04
130	.50	490	3.18
135	.61	500	3.21
140	.61	525	2.95
145	.46	550	2.54
150	.58	575	2.85
155	.87	600	3.18
160	.95	625	3.15
165	.48	650	3.54
170	.48	675	3.71
175	.75	700	3.93
180	1.23	725	4.08
185	1.07	750	3.70
190	.43	775	3.65
195	.38	800	3.52
200	.58	825	4.41
210	.46	850	4.51
220	.58	875	4.33
230	.61	900	4.29
240	.90	925	4.78
250	.80	950	4.91
260	1.17	975	4.93
270	1.13	990	4.87

VII. DESCRIPTION OF EQUIPMENT/CABLES USED FOR TESTING

The test sample was connected and tested to the following equipment for conductive testing only.

PERIPHERAL	MAKE/MODEL	SERIAL NO.	FCC ID
PC	DELL 466/MX	34GL1	E2K486MX
Mouse	Logetech M-SR14	LC4293001363	DZLMSR14
Monitor	DELL VC5	33E2424	ARFKDM1466
Keyboard	DELL AT101R	M9310-021237	GYUR05SK
Printer	Epson FX-850	00C0042889	BKM9A8P82PA

DESCRIPTION OF CABLE

All cabling is shielded. See attached photograghs.

VIII. RADIATED TEST PROCEDURE

Testing in the field as specified in ANSI C63.4, Section 8, the EUT was evaluated from the range of 9 KHZ - 1000 MHZ. The EUT was placed on a wooden turntable .8 meters above the ground plane and at a distance of 3 meters from the search antenna.

Maximum emissions were obtained by rotating the turntable and raising and lowering the search antenna. Appendix D in ANSI C63.4 was used for a reference. Both horizontal and vertical polarizations of the antenna were scanned and the position is noted on the radiated data sheet. Worst case configuration is shown in photographs 1 and 2.

All emission levels were measured with a spectrum analyzer and represent peak readings at 100 KHZ bandwidth resolution. Converting the spectrum analyzer readings of dbm to dbμv/m proceeds as follows:

A. Convert dbm to dbμv by adding 107db to the reading in dbm. This is derived from the voltage for a power level into a 50 ohm load.

B. Finally, adding the antenna factor with any cable loss to the dbμv reading yields dbμv/m.
   By formula: dbμv/m = dbm (reading) + 107db + AF + CL
   Where: AF = Antenna Factor in db
   CL = Cable Loss in db

C. Since the Digitizer radiates a nominal frequency of 1.8432 MHZ, field strength limits were given for 30 meters. Measurement was done at 3 meters and extrapolated to 30 meters by using the square of an inverse linear distance extrapolation factor of 40db/decade as outlined in the FCC rules 15.31. Therefore, a total of 40db was subtracted from the measured readings at 3 meters.

   The field strength limit for an intentional radiator at 1.8432 MHZ is 30 μv/m per FCC rules in Paragraph 15.209. Therefore:

   Limit @ 30m = 30μv/m or 20 LOG 30μv/m = 29.54dbμv/m

   Since the intentional radiator (digitizer) is incorporated with a digital device, the frequency scanned was beyond the 10th harmonic up to 1000 MHZ as described in FCC rules Paragraph 15.33.

IX. RADIATED TEST DATA/PHOTOGRAPHS

COMPANY NAME: CalComp DATE: 07/21/98

TEST SAMPLE: Digitizer Model 11180

SERIAL NUMBER: N/A

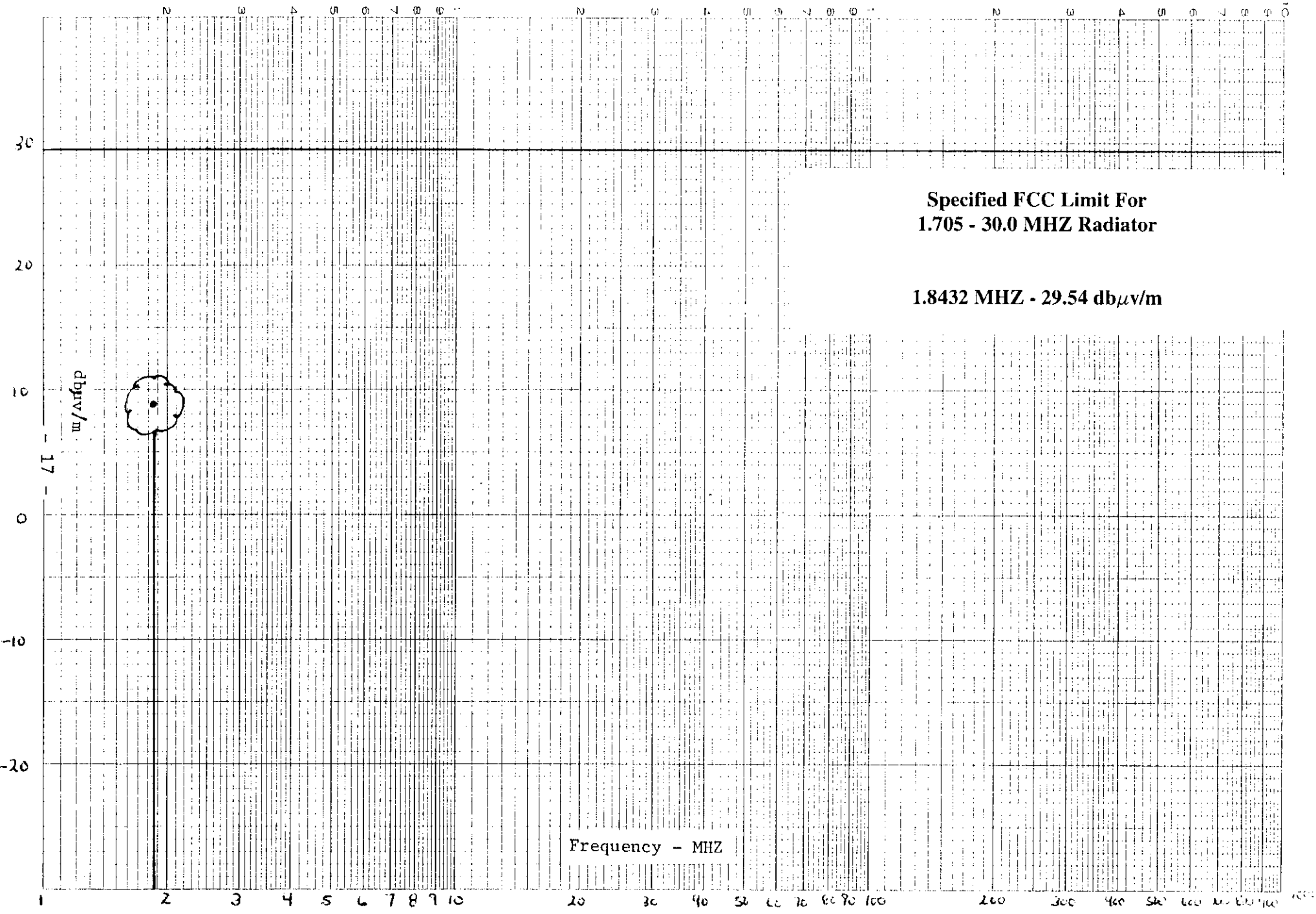
ANTENNA TYPE: DIPOLE _____ BICONICAL _____ LOG PER _____ LOOP X

TEST DISTANCE: 3M PEN _____ CURSOR _____

MHZ EMISSION FREQUENCY	ANT. POL.	ANT. HEIGHT (M)	*AZIMUTH DEGREES	METER READ dbµv	ANTENNA FACTOR & CABLE LOSS	**FINAL READING dbµv/m	FCC LIMIT dbµv/m	MARGIN
1.880	V	1.0	180	36.60	12.3	8.90	29.54	+20.64

* A 0-degree reading means the front of the EUT is facing the antenna. 180 degrees would mean the back of the EUT is facing the antenna. Rotation is clockwise from 0 degrees.

** Final reading is after a -40db extrapolation factor was taken for a 3-meter reading as outlined in FCC Rules 15.31.



X. CONDUCTED TEST PROCEDURE

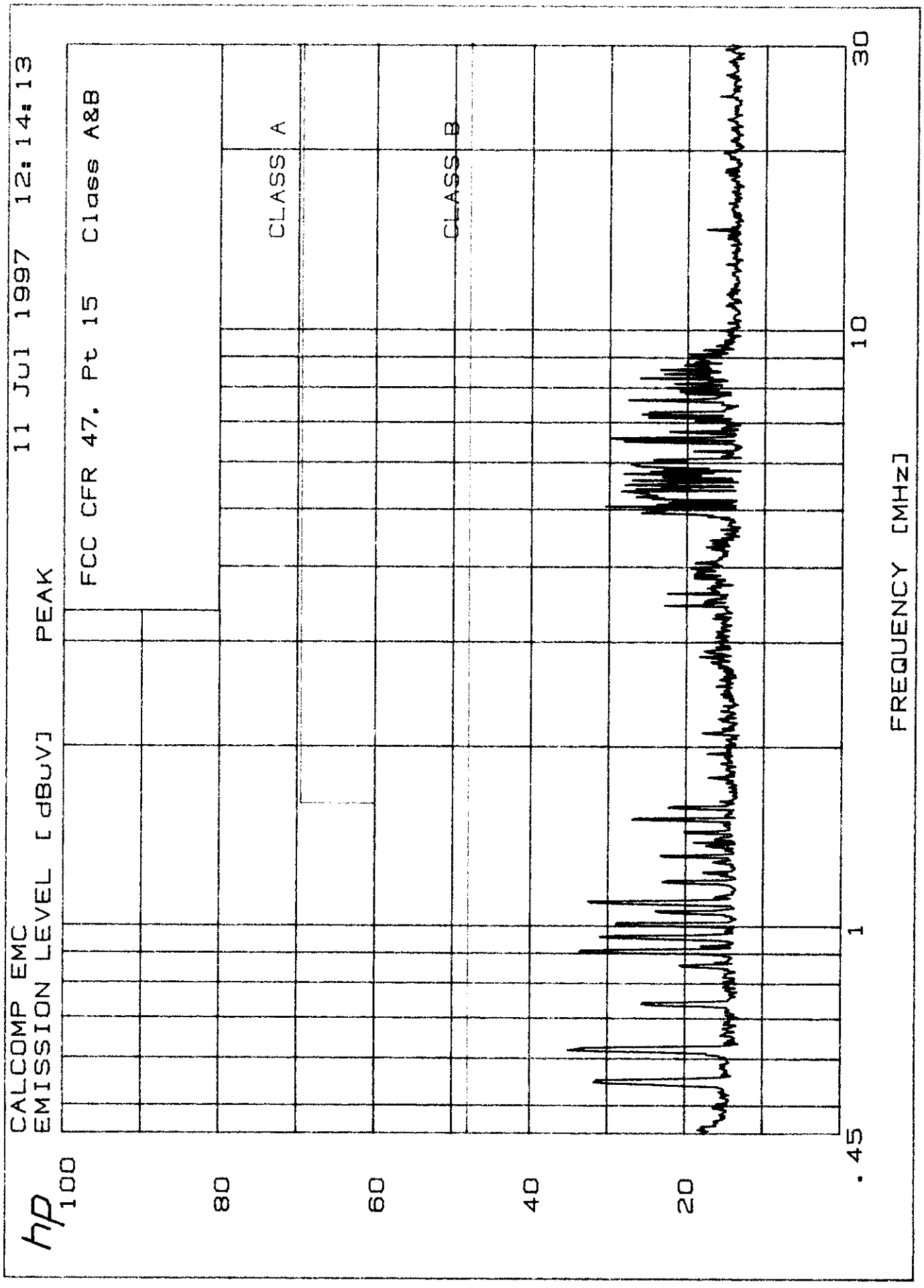
The EUT was connected to the public utility line through a separate line impedance stabilization network (LISN) and the support equipment was isolated from the utility line with a second LISN as outlined in Standard ANSI C63.4. The EUT was set up over a horizontal ground plane measuring approximately 2.5 x 3 meters and beside a vertical ground plane measuring about 2 x 2 meters as outlined in ANSI C63.4, Paragraphs 5.2.1 and 5.2.2. Any excess power cord between the LISN and EUT was folded back and forth to form a bundle not exceeding 40cm in length. All test procedures used ANSI C63.4, Paragraph 7.2.1 as a reference. Test configuration is shown in photographs 3 and 4.

The following graphs show the resulting conducted tests and each graph shows the following:

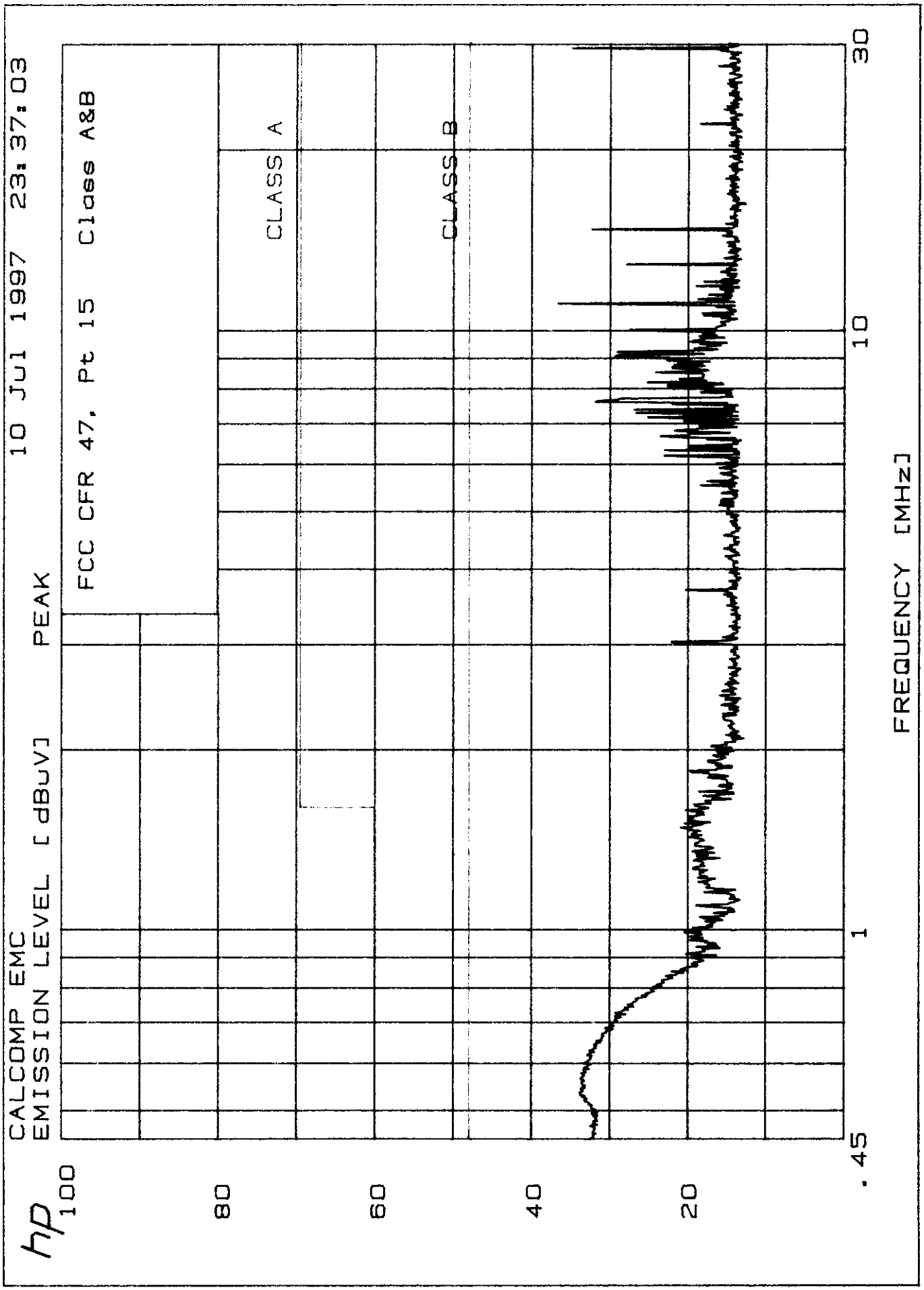
GRAPH NUMBER	FREQUENCY RANGE, MHZ	POWER LINE SIDE	GROUNDING
1	.45-30	Neutral	Ungrounded
2	.45-30	Line	Ungrounded
3	.45-1	Neutral	Ungrounded
4	.45-1	Line	Ungrounded
5	.15-30	Neutral	Ungrounded
6	.15-30	Line	Ungrounded

On all graphs, the red horizontal line is the maximum FCC Class B Reference Level or EN55022 Class B Level.

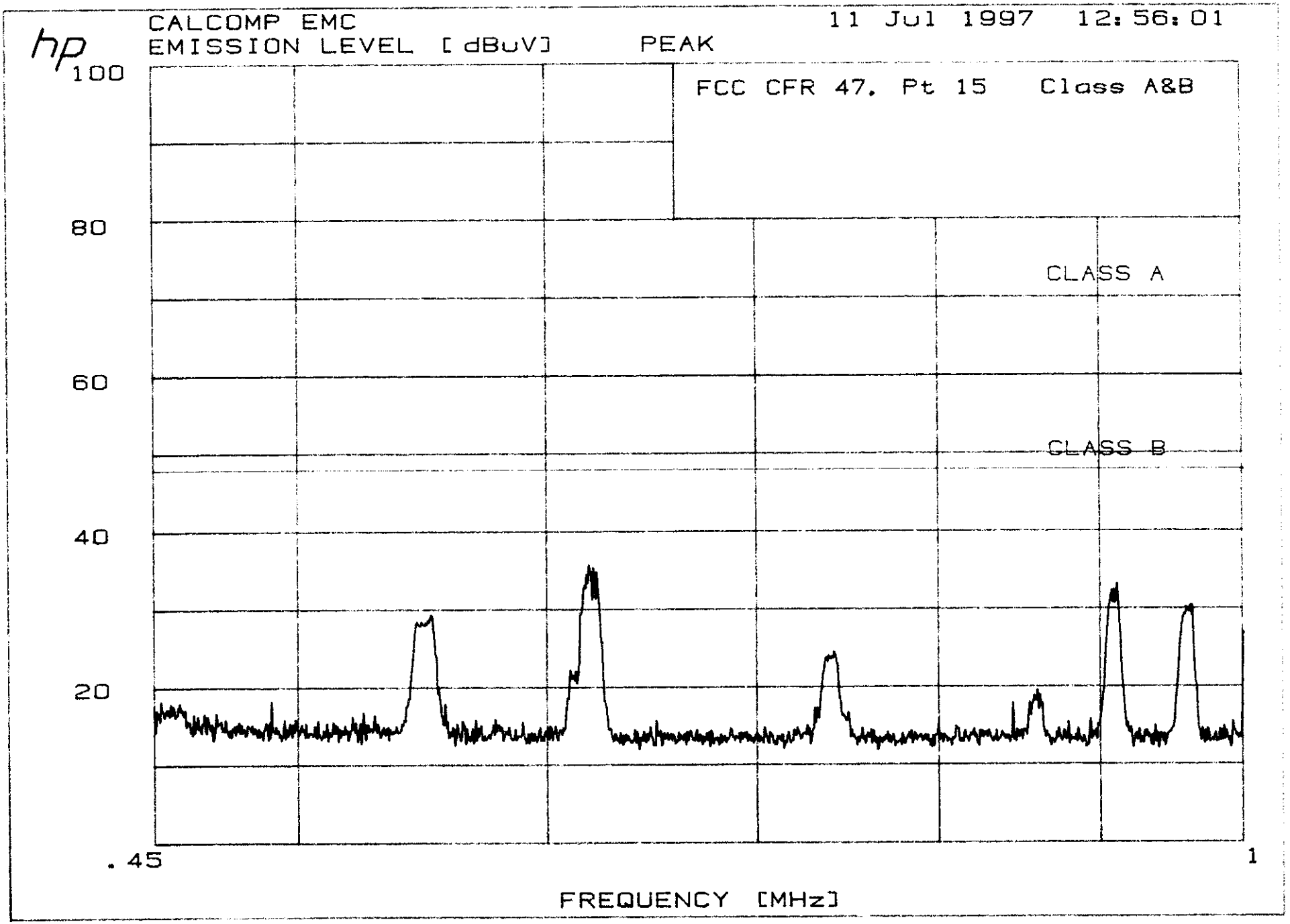
XI. CONDUCTED TEST DATA/PHOTOGRAPHS


CALCOMP EMC
EMISSION LEVEL [dBuV]
11 Jul 1997 12:14:13
PEAK
FCC CFR 47, Pt 15 Class A&B
CLASS A
CLASS B
100
80
60
40
20
.45
1
10
30
FREQUENCY [MHz]

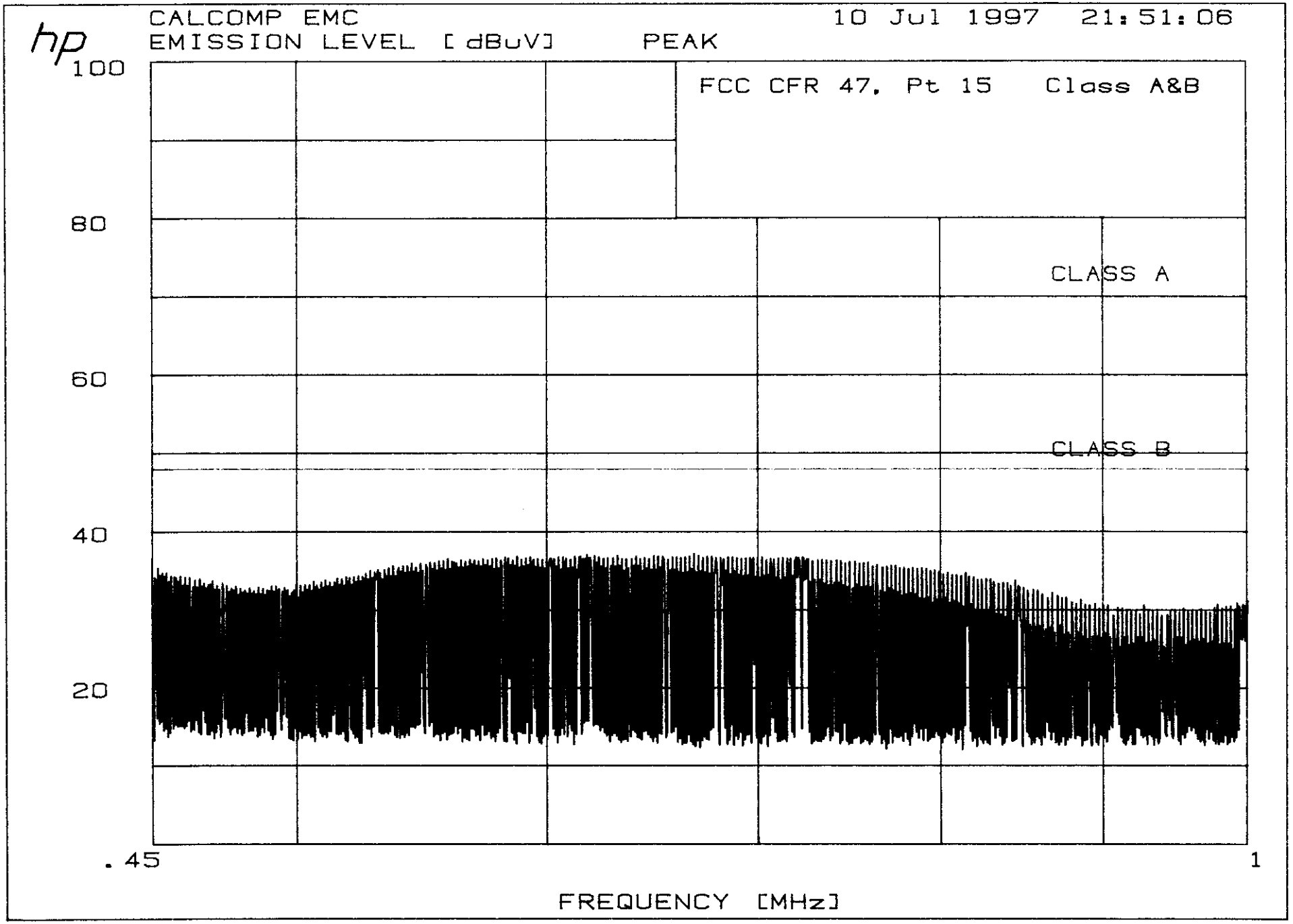
Graph 1


CALCOMP EMC
EMISSION LEVEL [dBuV]
PEAK
10 Jul 1997 23:37:03
FCC CFR 47, Pt 15 Class A&B
CLASS A
CLASS B
100
80
60
40
20
.45
1
10
30
FREQUENCY [MHz]

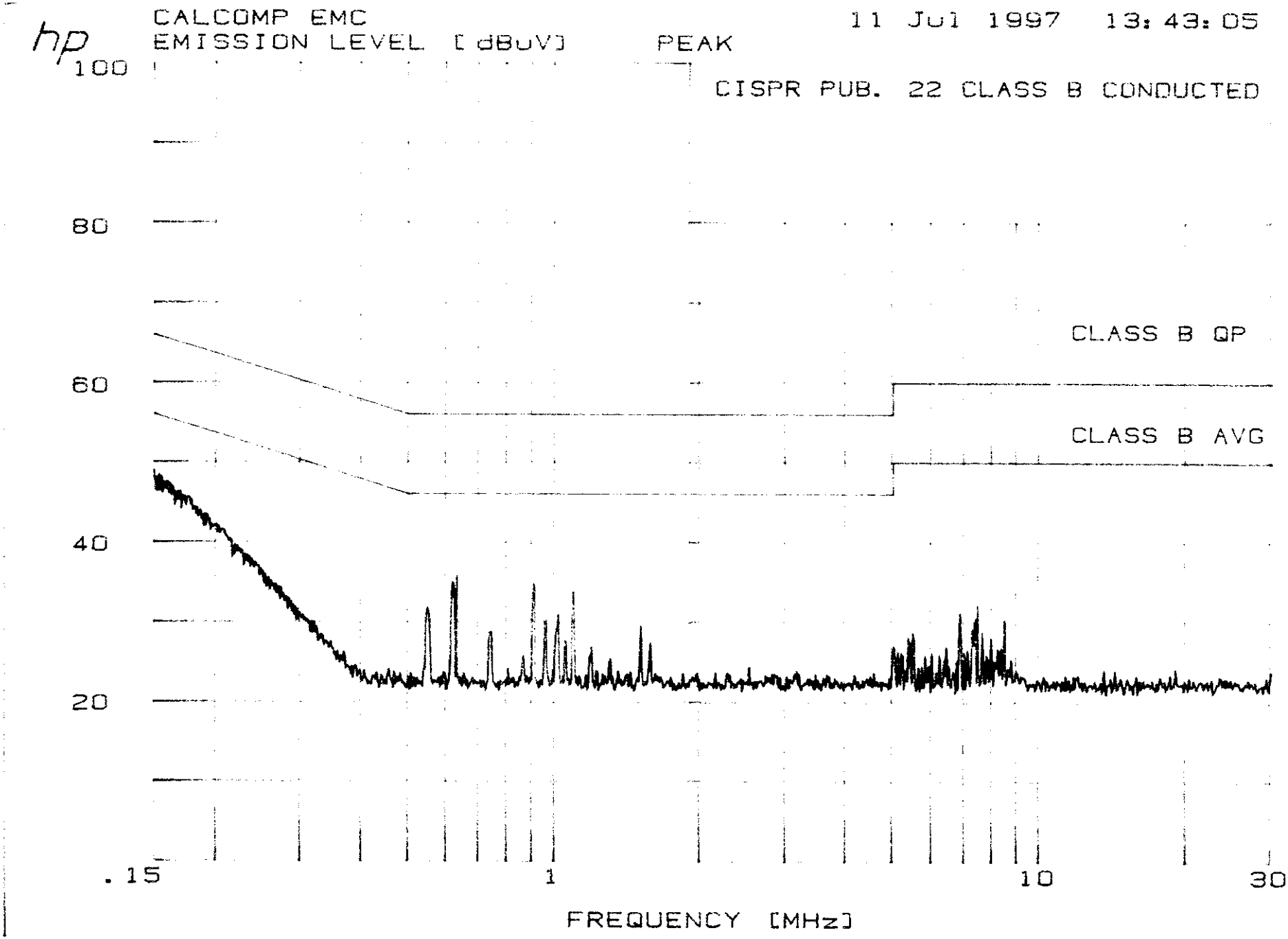
Graph 2


CALCOMP EMC
11 Jul 1997 12:56:01
EMISSION LEVEL [dBuV]
PEAK
100
FCC CFR 47. Pt 15 Class A&B
80
CLASS A
60
CLASS B
40
20
.45
1
FREQUENCY [MHz]

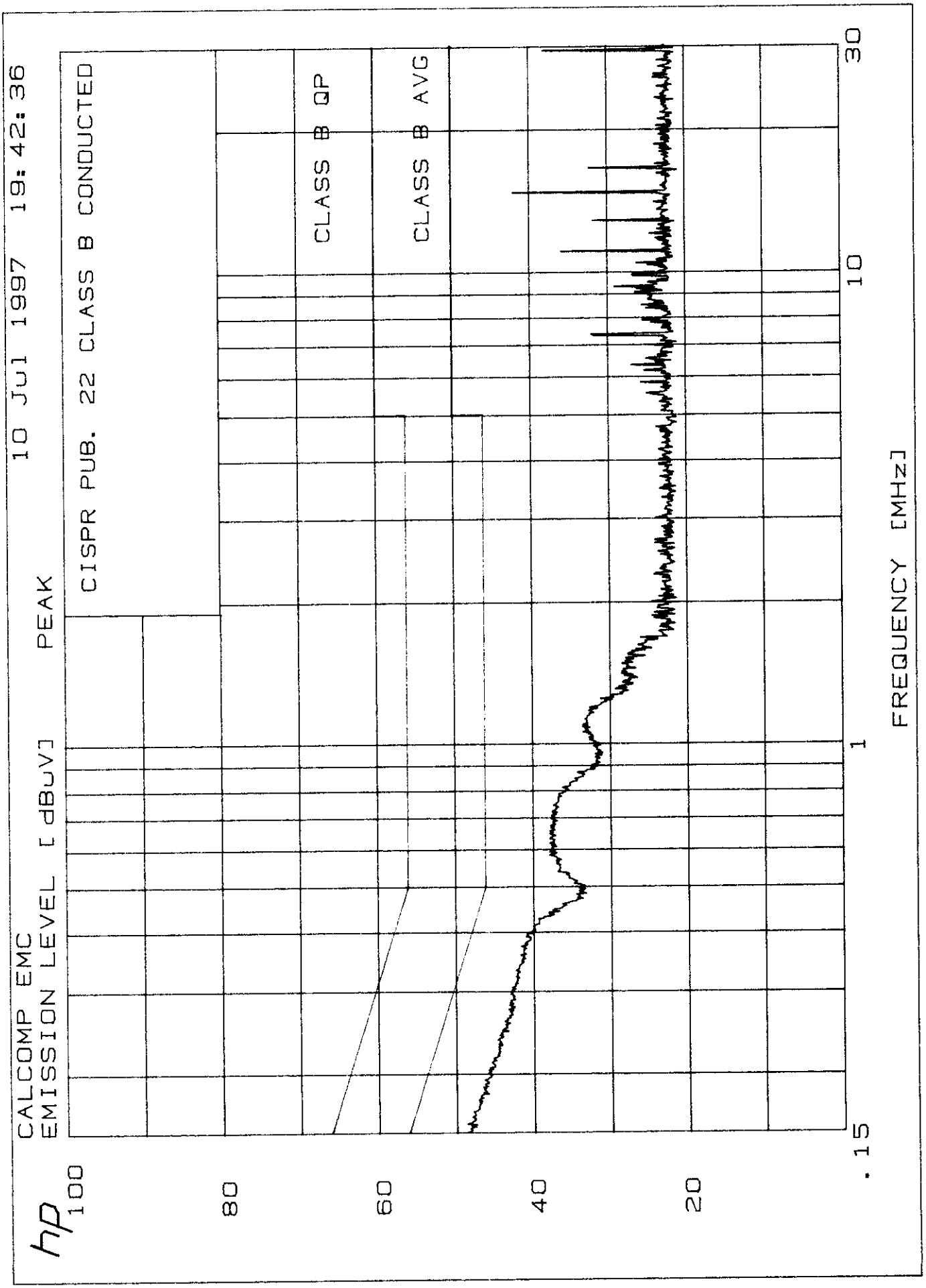
Graph 3
-23-


CALCOMP EMC
10 Jul 1997 21:51:06
EMISSION LEVEL [dBuV]
PEAK
100
80
60
40
20
FCC CFR 47, Pt 15 Class A&B
CLASS A
CLASS B
.45
1
FREQUENCY [MHz]

Graph 4
-24-


hp
CALCOMP EMC
EMISSION LEVEL [dBuV]
PEAK
11 Jul 1997 13:43:05
CISPR PUB. 22 CLASS B CONDUCTED
100
80
60
40
20
CLASS B QP
CLASS B AVG
.15
1
10
30
FREQUENCY [MHz]

Graph 5
-25-


CALCOMP EMC
EMISSION LEVEL [dBuV]
PEAK
10 Jul 1997 19:42:36
CISPR PUB. 22 CLASS B CONDUCTED
CLASS B QP
CLASS B AVG
100
80
60
40
20
.15
1
10
30
FREQUENCY [MHz]

Graph 6

XII. SUMMARY OF RESULTS

The Digitizer Model 11180, 11180A, 35180 and 35180A has shown that it passes the radiated test limits in FCC's CFR 47, Part 15, Subpart C, Paragraphs 15.207 and 15.209. The worst case margin was noted to be the fundamental frequency of 1.880 MHZ with a margin of +20.64. Only the fundamental frequency was recieved at 3 meters.

The product tested had no specific modifications done to it to pass the above limits.