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Rocky Mountain Radiometry

RF ENERGY EMISSION TEST REPORT

OF THE

Hahn Tech Corporation.

Fish Bait Boat
Remote Control Transmitter Device

FCC ID: M24BAITBOAT

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NARTE CERTIFICATION: EMC 001676

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8/16/98
hantek4

FCC ID: M24BAITBOAT

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STATEMENT OF ACCURACY OF TEST DATA

All testing was performed by Markian Lapchak of Mark Lapchak & Associates using the prescribed procedures called out in ANSI Document C63.4-1992. The test site used is located at METRUM in Littleton, Colorado which is in compliance with Section 2.948 of the FCC Rules and complies with the radiated and AC line conducted criteria in ANSI C63.4-1992. The information with regard to the METRUM site may be found in FCC file 31040/SIT/1300F2. All equipment used was calibrated by the Bell Technology Services Division metrology laboratory whose standards are traceable to the National Institute of Standards and Technology. Certificates of calibration are available upon request.

Signed Markian Lapchak

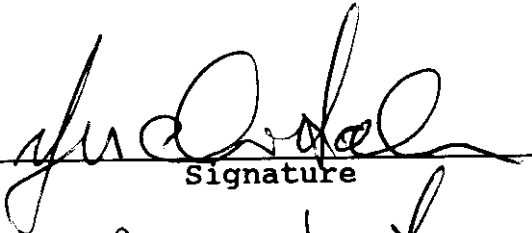
Markian Lapchak

NARTE Certification: EMC 001676-NE

Date August 16, 1998

RESPONSIBILITY OF THE GRANTEE

Hahn Tech Corporation does hereby warrant that each unit of equipment that is marketed and/or sold which bears the same equipment marking of this report (M24BAITBOAT), will conform to the unit that was measured and that the data (design and related operational characteristics) in this report, will continue to be representative of the equipment being produced within the variation which can be expected due to quantity of production and testing on a statistical basis.


Signature
president
Title

Aug 15, 98
Date

SUMMARY

The testing was performed under the provisions of ANSI C63.4/1992 and the OATS was calibrated in accordance with ANSI C63.4/1992.

The Hahn Tech Remote Control Transmitter, model Fish Bait Boat, hereafter referred to as the UUT. The UUT, with test setup as described in the block diagram of Appendix III, **PASSES** all the radiated requirements, the FCC Part 15, Subpart C, Class B regulations, pp 15.227 governing Low Power Intentional Radiators operating in the 26.96 - 27.28 MHz band.

The maximum field strength at the transmit frequency of 26.999 MHz was 2600 $\mu\text{V}/\text{M}$ versus a spec limit of 10,000 $\mu\text{V}/\text{M}$ when measured with an average detector at 120 KHz bandwidth. The maximum peak emissions at the transmit frequency of 26.999 MHz, when measured with 120 KHz bandwidth, was 6310 $\mu\text{V}/\text{M}$ without applying any correction factor for the 10% duty cycle. The maximum level of emissions at the edges of this band (26.96 MHz & 27.28 MHz) were 11 db under the 40 db limit.

The spurious radiated emissions which came closest to the limit are as follows, rounded to the nearest db:

FREQUENCY (MHz)	EMISSION LEVEL (db μV /meter)	Polarization	MARGIN(db)	TABLES Appendix I
297	39	Horizontal	-7	1
405	41	Horizontal	-5	1
36	37	Vertical	-3	2
404.97	40	Vertical	-6	2
431.97	34	Horizontal	-12	3
404.97	40	Vertical	-6	4

For more details, see Appendix I, Tables 1 - 8. A negative margin means that the emissions are under the specified limit. All other emissions from Tables 1 - 8, not listed above, were at least 8 db under the applicable limits.

Power Line Conducted emissions were not required since this product operates on a 9VDC battery. There is no provision to re-charge the battery while it is installed in the transmitter.

The antenna must be of the type supplied with the unit and does mount directly into the enclosure.

INFORMATION SUPPLIED TO THE USER

The manual contains a cautionary statement required by Section 15.21 of the FCC rules for an intentional radiator."

CAUTION: Changes or modifications not expressly approved or authorized by the manufacturer may violate the compliance of this equipment to the Class B limits for a digital device and could, thereby, void the users authority to operate the equipment.

The label on the outside of the equipment enclosure contains the FCC ID and the following text:

FCC ID: M24BAITBOAT

This device complies with Part 15 of the FCC Rules.
Operation is subject to the following two conditions:
(1) this device may not cause harmful interference,
and (2) This device must accept any interference
received, including interference that may cause
undesired operation.

Hahn Tech shall maintain the records listed in Section 2.938 of the FCC rules.

1.0 SCOPE AND OBJECTIVE OF TEST

To determine the degree of compliance of products to the Federal Communications Commission Part 15 Subpart C requirements for intentional radiators which limit emissions of Low Power Transmitter Devices pursuant to pp 15.227 through the certification process.

2.0 UNIT TESTED

The Fish Bait Boat Transmitter, manufactured by Hahn Tech Corporation, 1501 S Sunset Street, Longmont, CO 80501, hereafter referred to as the UUT, is intended to be used to control a fishing bobber receiver with a motorized propeller and rudder.

3.0 FACILITY REQUIREMENTS

3.1 Site Attenuation

The radiated testing described herein was accomplished on the METRUM OATS which is located at 4800 E. Dry Creek Road, Littleton, CO 80122. This site meets the requirements of FCC 47 CFR rules, Section 2.948. Refer to FCC File # 31040/SIT/1300F2 for a detailed description of the site. The test area is free of reflecting objects in an area as defined in Figure 1.

3.2 Instrumentation

Measurements/Radiated:

Polarad ESV Receiver, Asset # 230.150, calibrated 1/28/98, calibration due 1/28/99.

Ailtech 94455-1 Biconical Antenna, 30 -200 MHz, Cal'd 6/11/98.

Ailtech 96005 Log Periodic Antenna, 200 MHz - 1 GHz, Cal'd 6/11/98.

Avantek UTC 10-220-1 25 db Preamp, #211.093, Calibrated 3/7/98, calibration due 3/7/99.

4.0 SPURIOUS RADIATED TEST PROCEDURE AND RESULTS

4.1 Procedure

- 4.1.1 Setup of equipment on the test site, for detailed measurements, was according to Figure 2, Appendix I. **The ANSI C63.4/1992 measurement procedure was followed.**
- 4.1.2 The UUT was set to automatically transmit continuously. (The UUT transmits a short burst of data for about 100 milliseconds every second to turn on both propeller motors in the bobber boat which increases the average and peak level of the carrier.)
- Four conditions were tested:
- 4.1.2A UUT Transmit and Test Site Receive Antenna are horizontally polarized.
- 4.1.2B UUT Transmit and Test Site Receive Antenna are vertically polarized.
- 4.1.2C UUT Transmit Antenna Vertically Polarized, Test Site Receive Antenna Horizontally Polarized.
- 4.1.2D UUT Transmit Antenna Horizontally Polarized, Test Site Receive Antenna Vertically Polarized.
- 4.1.3 Perform all measurements at 3 meters at the METRUM OATS. Adjust the antenna height between 1 - 4 meters and the UUT rotated to maximize the emissions during the survey. Perform a preliminary survey with each antenna and polarization (4 setups as in 4.1.2) while tuning the ESV receiver in the CISPR mode from 27.28 MHz - 1 GHz in accordance with ANSI C63.4-1992, Appendix D procedure. There were no interface cables to adjust. Make measurements with the telescoping antenna fully extended.
- 4.1.4 At the conclusion of the preliminary survey for each antenna/polarization combination at all four combinations. The maximum field strength at each significant frequency found was recorded with the height of the antennas remotely and automatically varied between 1 and 4 meters off the ground plane. The orientation of the UUT which produced the maximum field strength was obtained by remotely rotating an automatic turntable and recording the angle as indicated in Tables 1 - 4. Only the frequencies which produced the highest emissions are reported.

UUT orientation in Tables 1 & 2 is defined as follows:

	FRONT	
	0	
LEFT	90	270 RIGHT
	180	
	BACK	

4.0 SPURIOUS RADIATED TEST PROCEDURE AND RESULTS (cont)

4.1.7 The specified limit is defined as follows:

Quasi peak detection

Separation (Meters) is 3.

30-88MHz	40 db μ V/m
88-216MHz	43.5 db μ V/m
216-960MHz	46 db μ V/m
above 960 MHz	54 db μ V/m

4.1.8 The radiated signal level, in db μ V vs. frequencies found, was determined from the correction factors found in Appendix II. The receiver reads directly in db μ V.

Emission level = ESV Receiver reading (db μ V) + antenna factor
+ cable loss - Preamp Gain.

4.1.9 Calculation

As an example in Table 1 of Appendix I, the 38 db μ V/m level at 297 MHz was calculated using the formula in paragraph 4.1.5. From Appendix II, the antenna factor is 15 db. From Appendix II, the cable loss is 3.8 db. The receiver reading was 42 db μ V. The preamp gain is 24.7 db.

Emission Level (297 MHz) = 42 + 15 + 3.8 - 24.7 = 36 db μ V/m.

There were no other factors involved such as external attenuators which would modify the calculations. The internal RF attenuation of the receiver was kept at 10 db minimum, but the receiver reading takes this into account so it does not enter into the calculation.

4.2 Results

Preliminary tests showed the 4.1.2A combination was the noisiest condition and the 4.1.2B condition was noisy. The emissions when testing per the 4.1.2C & D combinations were not considered nearly as noisy as the 4.1.2 A&B combinations. Only significant emissions are noted in the cross polarization measurement conditions.

See Appendix I, Tables 1 - 4 and GRAPHS 1 - 4.

Table 1/Graph 1: Transmit and Receive Antenna Horizontal (4.1.2A)

Table 2/Graph 2: Transmit and Receive Antenna Vertical (4.1.2B)

Table 3/Graph 3: Transmit Vertical/Receive Horizontal (4.1.2C)

Table 4/Graph 4: Transmit Horizontal/Receive Vertical (4.1.2D)

See Appendix III, Photos 1 - 7

The temperature at the time the final radiated measurements were taken was around 80 °F.

5.0 TRANSMIT FREQUENCY & BANDEDGE FIELD STRENGTH

5.1 PROCEDURE

- 5.1.1 Setup the transmitter on the OATS as in pp 4.0 of this procedure. The photographs of Appendix III are also applicable to these measurements. Perform measurements with each antenna polarization combination of pp 4.1.2. at a distance of 3 meters.
- 5.1.2 When measuring the maximum transmit field strength, set the ESV receiver detector function to "average" and the resolution bandwidth to 120 KHz. Repeat the measurement in "peak" mode with 120 KHz bandwidth.
- 5.1.3 When measuring the field strength at 26.96 and 27.28 MHz bandedges, set the ESV receiver detector function to "average" and the resolution bandwidth to 12 KHz. Slowly tune up and down from the main carrier and determine the emissions level at the bandedges and some points in between.
- 5.1.4 During the measurements of 5.1.2 and 5.1.3, the antenna is raised between 1 & 4 meters and the turntable is rotated 360° in order to maximize the emissions. The telescoping antenna on the UUT is fully extended.

5.2 RESULTS

All four polarization combinations listed in 4.1.2 are reported in Appendix I, Tables 5 - 8. The UUT easily met these requirements. When the center of the transmit frequency was measured in "peak" mode, the level increased no more than 8 db in all instances.

The sample calculations of pp 4.1.9 apply here as well.

Appendix I

Figure 1

C 13

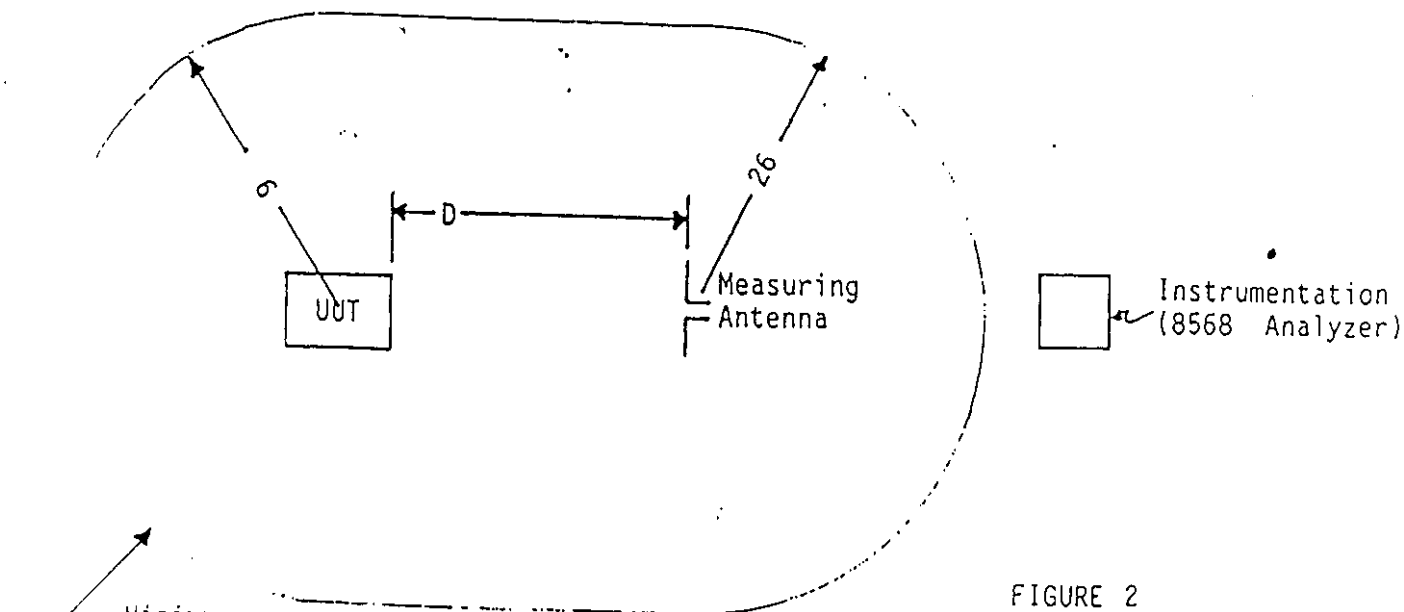
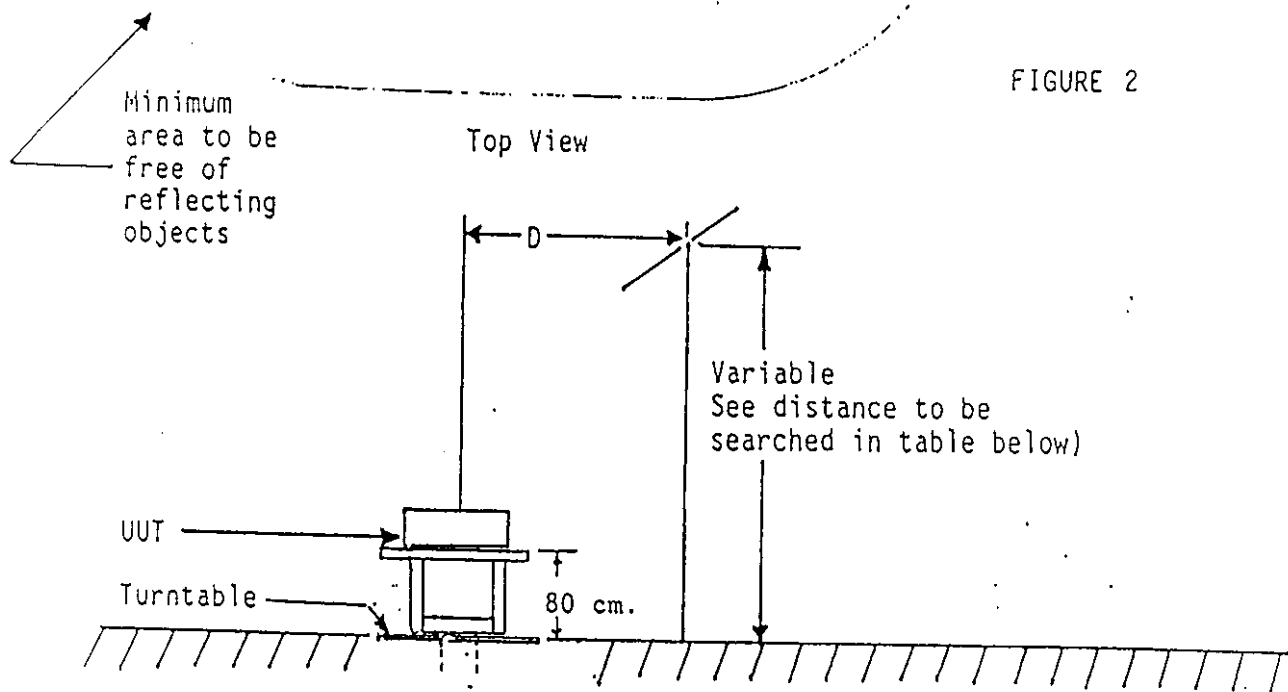


FIGURE 2



NOTE: Dimensions in meters.

Measuring Antenna Height		"D" Spacing
Fixed Low	Preliminary Scan	1 - 3 meters
1m - 4m*	Detailed Measurement	3 meters
1m - 4m	Detailed Measurement	10 meters FCC Part 15

*Height is varied to find peak emission level.

TABLE 1

Polarization: Horizontal

Antennas: AilTech

Test Distance: 3 Meters

Product: Hahn Tech BaitBoat Transmitter

Mode: Transmitting Continuously with data and carrier bursts.

Date: 8/10/98; spurious radiated

		degrees	dbuv	dbuv/m	FCC Class B
Freq(MHz)	Uncorrected	Azimuth	Correction Factor(db)	Corrected Level(db)	Margin (db)
27.28	27	0	-11	16	-24
27.88	25	0	-11	14	-26
28	25	0	-11	14	-26
29.53	26	0	-11	15	-25
36	38	167	-11	27	-13
54	33	0	-15	18	-22
63	24	0	-17	7	-33
81	30	0	-14	16	-24
117	25	0	-12	13	-31
135	31	0	-8	23	-21
162	25	208	-6	19	-25
243	45	218	-9	36	-10
270	46	360	-8	38	-8
297	45	0	-6	39	-7
324	38	226	-7	31	-15
387	40	236	-5	35	-11
405	45	243	-4	41	-5
414	36	243	-4	32	-14
423	33	236	-4	29	-17
432	34	240	-4	30	-16
441	29	330	-3	26	-20
459	23	330	-3	20	-26

TABLE 2

Polarization: Vertical
 Antennas: AilTech
 Test Distance: 3 Meters
 Product: Hahn Tech BaitBoat Transmitter
 Mode: Transmitting Repeatedly with Data and Carrier Bursts
 Date: 8/10/98; spurious radiated

		degrees	dbuv	dbuv/m	FCC Class B
Freq(MHz)	Uncorrected	Azimuth	Correction Factor(db)	Corrected Level(db)	Margin (db)
27.28	40	0	-11	29	-11
36	48	0	-11	37	-3
54	39	0	-15	24	-16
63	27	330	-17	10	-30
71.51	32	0	-17	15	-25
81	40	0	-14	26	-14
135	25	0	-8	17	-27
161.92	25	0	-6	19	-25
188.97	36	0	-8	28	-16
216	36	0	-11	25	-19
243	36	0	-9	27	-19
270	41	0	-8	33	-13
279	32	0	-7	25	-21
297	42	0	-6	36	-10
306	31	0	-7	24	-22
324	36	0	-7	29	-17
333	29	0	-7	22	-24
351	39	0	-6	33	-13
377.93	43	294	-5	38	-8
387	36	311	-5	31	-15
396	39	310,110	-5	34	-12
404.97	44	137	-4	40	-6
431.97	40	300	-4	36	-10
440.99	32	0	-3	29	-17
458.95	37	0	-3	34	-12

TABLE 3

Polarization: Horizontal Receive, Vertical Transmit

Antennas: AilTech

Test Distance: 3 Meters

Product: Hahn Tech BaitBoat Transmitter

Mode: Transmitting Continuously with data and carrier bursts.

Date: 8/10/98; spurious radiated

		degrees	dbuv	dbuv/m	FCC Class B
Freq(MHz)	Uncorrected	Azimuth	Correction Factor(db)	Corrected Level(db)	Margin (db)
27.28	31	0	-11	20	-20
81	29	0	-14	15	-25
216	25	0	-11	14	-30
351.98	25	0	-6	19	-27
404.97	26	0	-4	22	-24
431.97	38	167	-4	34	-12

TABLE 4

Polarization: Vertical Receive, Horizontal Transmit

Antennas: AilTech

Test Distance: 3 Meters

Product: Hahn Tech BaitBoat Transmitter

Mode: Transmitting Repeatedly with Data and Carrier Bursts

Date: 8/10/98; spurious radiated

degrees dbuv dbuv/m FCC Class B

Freq(MHz)	Uncorrected	Azimuth	Correction Factor(db)	Corrected Level(db)	Margin (db)
27.28	40	263	-11	29	-11
36	30	182	-11	19	-21
81	29	0	-14	15	-25
243	36	0	-9	27	-19
270	41	0	-8	33	-13
279	32	0	-7	25	-21
297	42	0	-6	36	-10
324	36	0	-7	29	-17
351	39	0	-6	33	-13
377.93	43	294	-5	38	-8
387	36	311	-5	31	-15
404.97	44	137	-4	40	-6

TABLE 5

Polarization: Horizontal
 Antennas: AilTech
 Test Distance: 3 Meters
 Product: Hahn Tech BAITBOAT Transmitter
 Mode: Horizontal Transmit/Horizontal Receive per 4.1.2A
 Transmit Level and Occupied Bandwidth
 Date: 8/10/98

		degrees	dbuv	dbuv/m	FCC Class B
Freq(MHz)	Uncorrected	Azimuth	Correction Factor(db)	Corrected Level(db)	Margin (db)
26.96	19	0	-11	8	-32
26.984	50	0,180	-11	39	-41
26.999*	66	0	-11	55	-25
27.012	47	0,180	-11	36	-44
27.2	10	0	-11	-1	-81
27.28	20	0	-11	9	-31

* Center of Intentional Transmit Peak

TABLE 6

Polarization: Vertical
 Antennas: AilTech
 Test Distance: 3 Meters
 Product: Hahn Tech BAITBOAT Transmitter
 Mode: Vertical Transmit/Vertical Receive per 4.1.2B
 Transmit Level and Occupied Bandwidth
 Date: 8/10/98

		degrees	dbuv	dbuv/m	FCC Class B
Freq(MHz)	Uncorrected	Azimuth	Correction Factor(db)	Corrected Level(db)	Margin (db)
26.96	28	0	-11	17	-23
26.981	37	0	-11	26	-54
26.988	51	0	-11	40	-40
26.999*	79	0	-11	68	-12
27.013	48	0	-11	37	-43
27.025	39	0	-11	28	-52
27.2	23	0	-11	12	-68
27.28	20	0	-11	9	-31

* Center of Intentional Transmit Peak

TABLE 7

Polarization: Horizontal
 Antennas: AilTech
 Test Distance: 3 Meters
 Product: Hahn Tech BAITBOAT Transmitter
 Mode: Vertical Transmit/Horizontal Receive per 4.1.2C
 Transmit Level and Occupied Bandwidth
 Date: 8/10/98

		degrees	dbuv	dbuv/m	FCC Class B
Freq(MHz)	Uncorrected	Azimuth	Correction Factor(db)	Corrected Level(db)	Margin (db)
26.96	13	0	-11	2	-38
26.999*	59	152	-11	48	-32
27.004	50	150	-11	39	-41
27.28	8	0	-11	-3	-43

* Center of Intentional Transmit Peak

TABLE 8

Polarization: Vertical
 Antennas: AilTech
 Test Distance: 3 Meters
 Product: Hahn Tech BAITBOAT Transmitter
 Mode: Horizontal Transmit/Vertical Receive per 4.1.2D
 Transmit Level and Occupied Bandwidth
 Date: 8/10/98

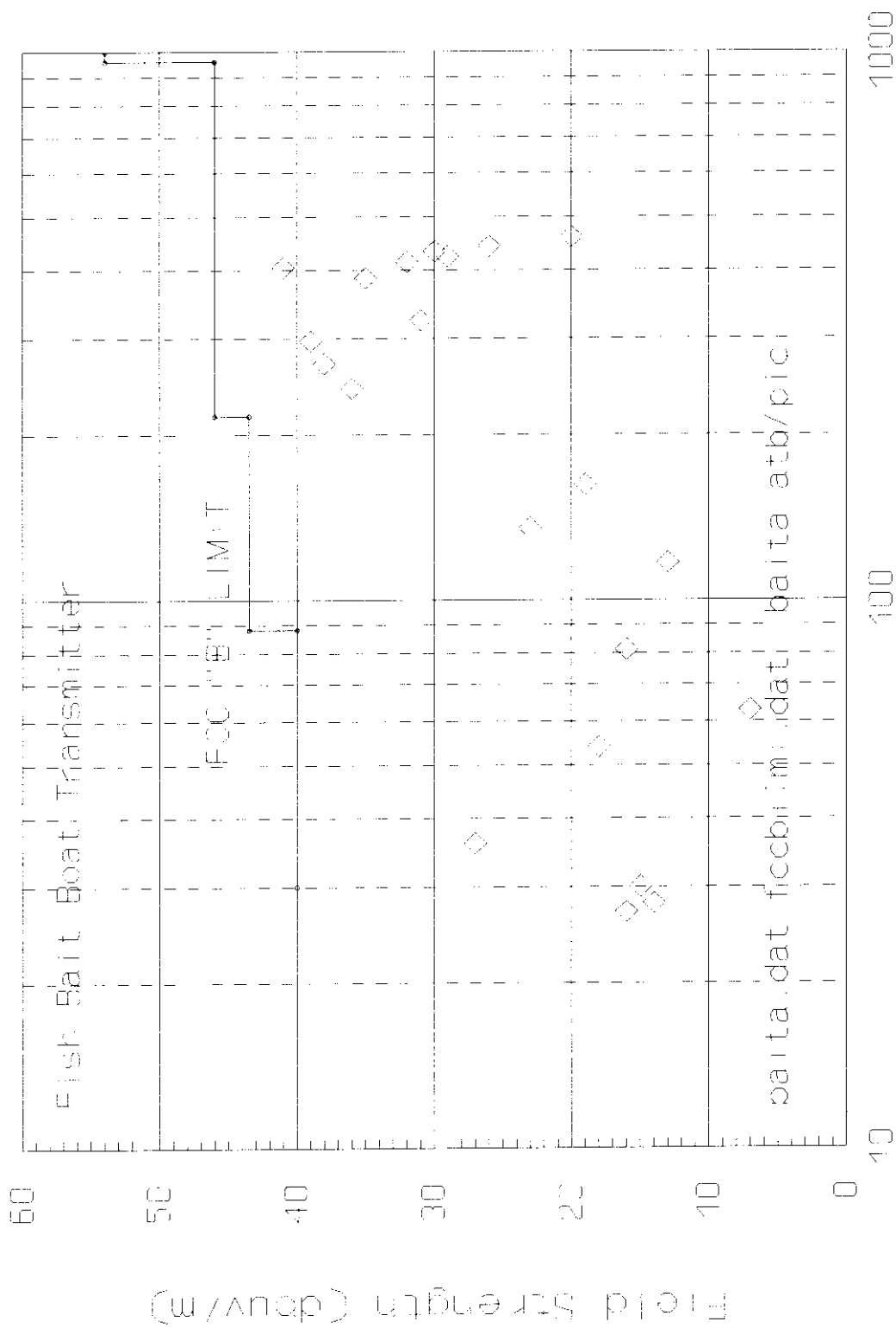
		degrees	dbuv	dbuv/m	FCC Class B
Freq(MHz)	Uncorrected	Azimuth	Correction Factor(db)	Corrected Level(db)	Margin (db)
26.96	29	279	-11	18	-22
26.989	50	250	-11	39	-41
26.999*	72	268	-11	61	-19
27.012	50	250	-11	39	-41
27.28	17	0	-11	6	-34

* Center of Intentional Transmit Peak

RADIATED EMISSIONS

8/10/98

GRAPH Hahn Tech Corporation

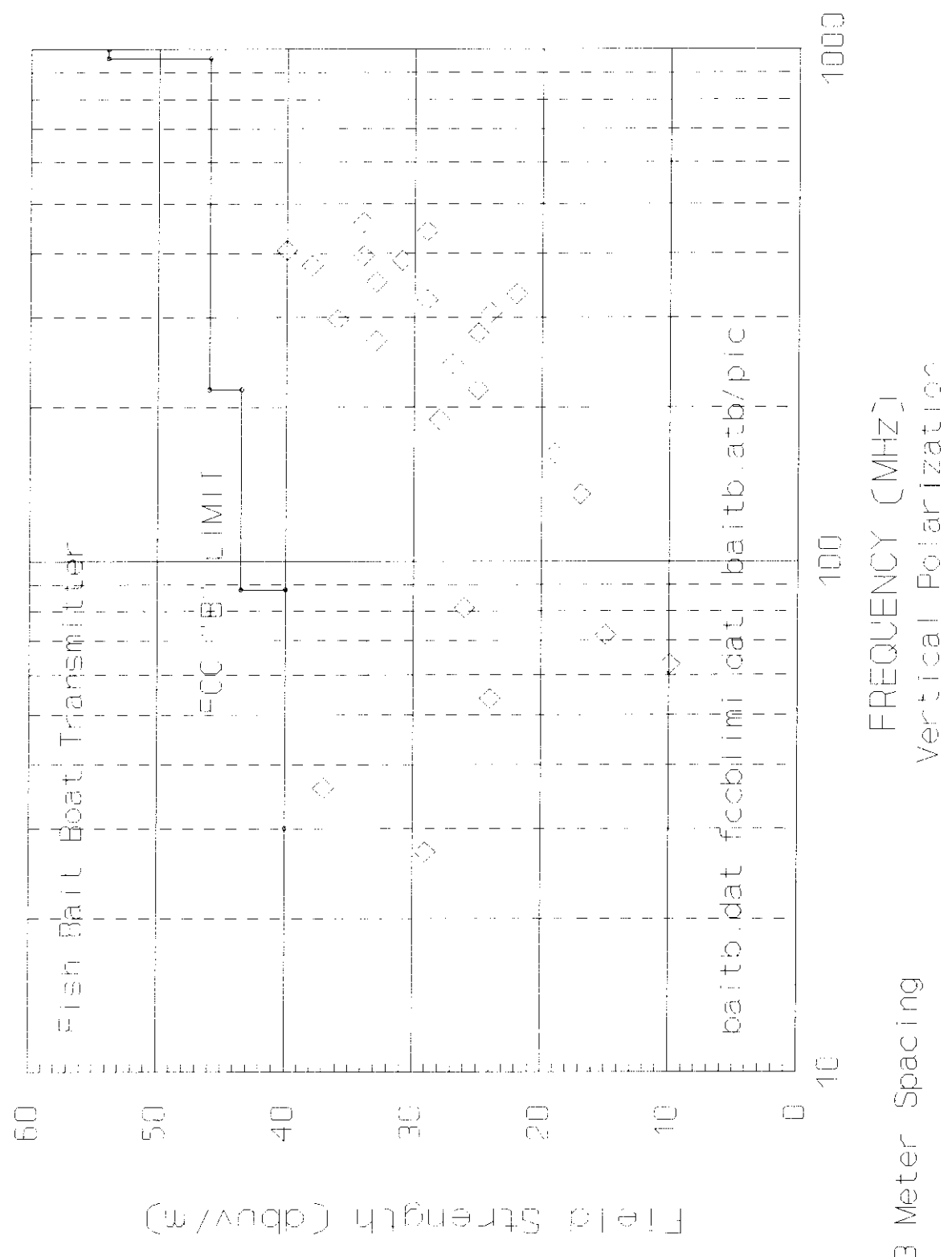


3 Meter Spacing

FREQUENCY (MHz)
Horizontal Polarization

RADIATED EMISSIONS

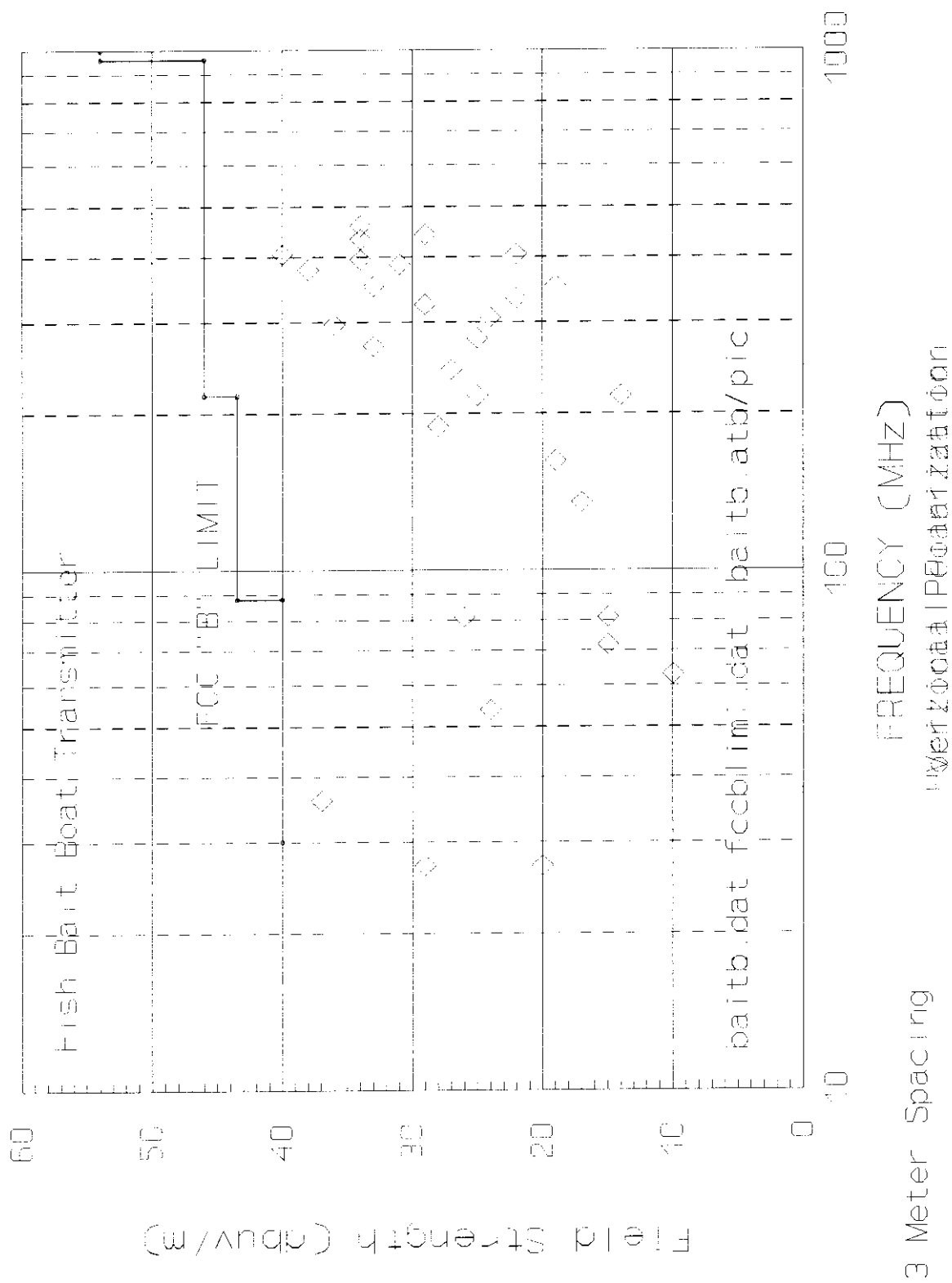
GRAPH 2 Hahn Tech Corporation 8/10/98



RADIATED EMISSIONS

8/10/98

GRAPH 2 Hahn Tech Corporation

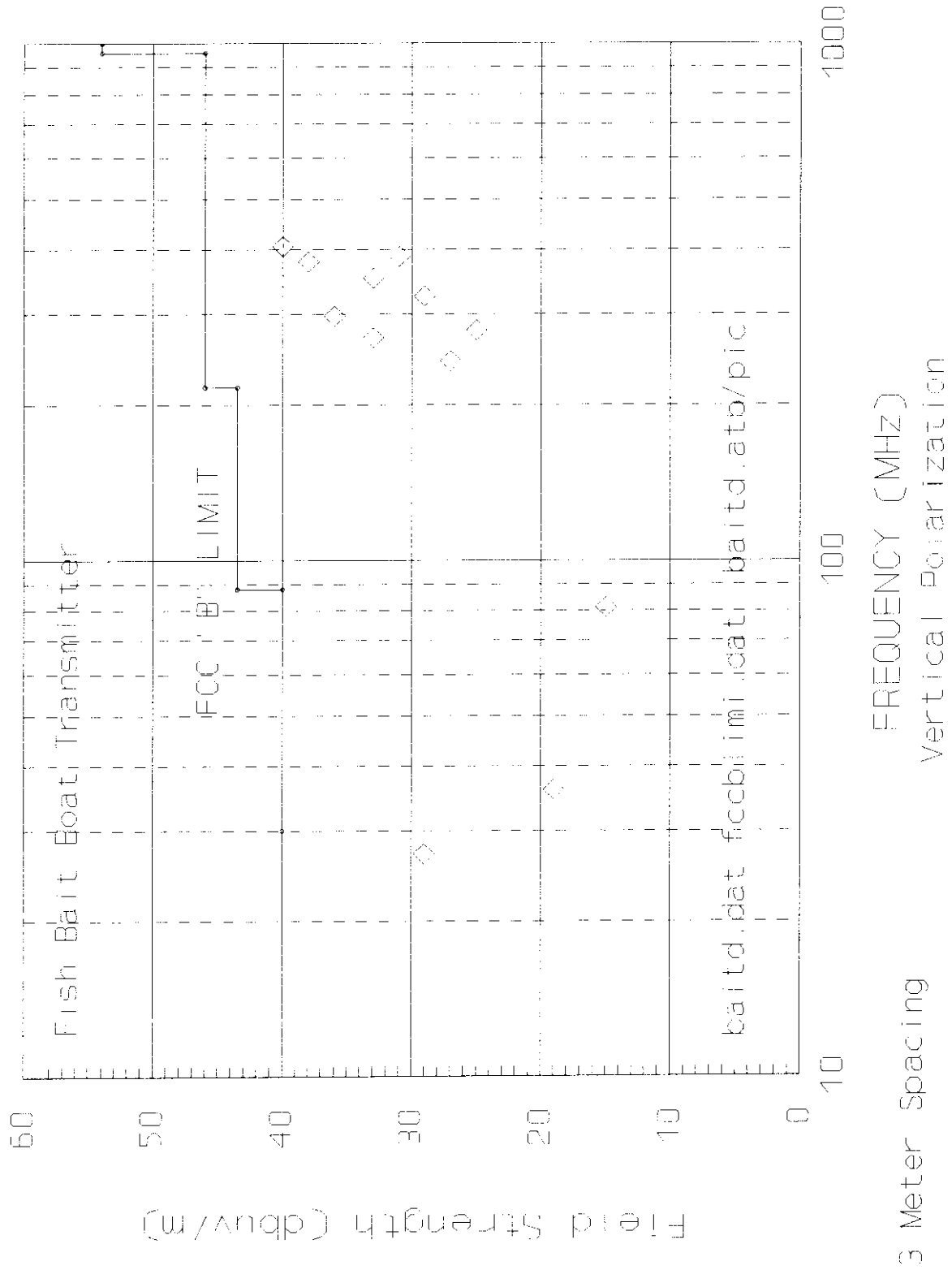


3 Meter Spacing

RADIATED EMISSIONS

GRAPH 4 Hahn Tech Corporation

8/10/98

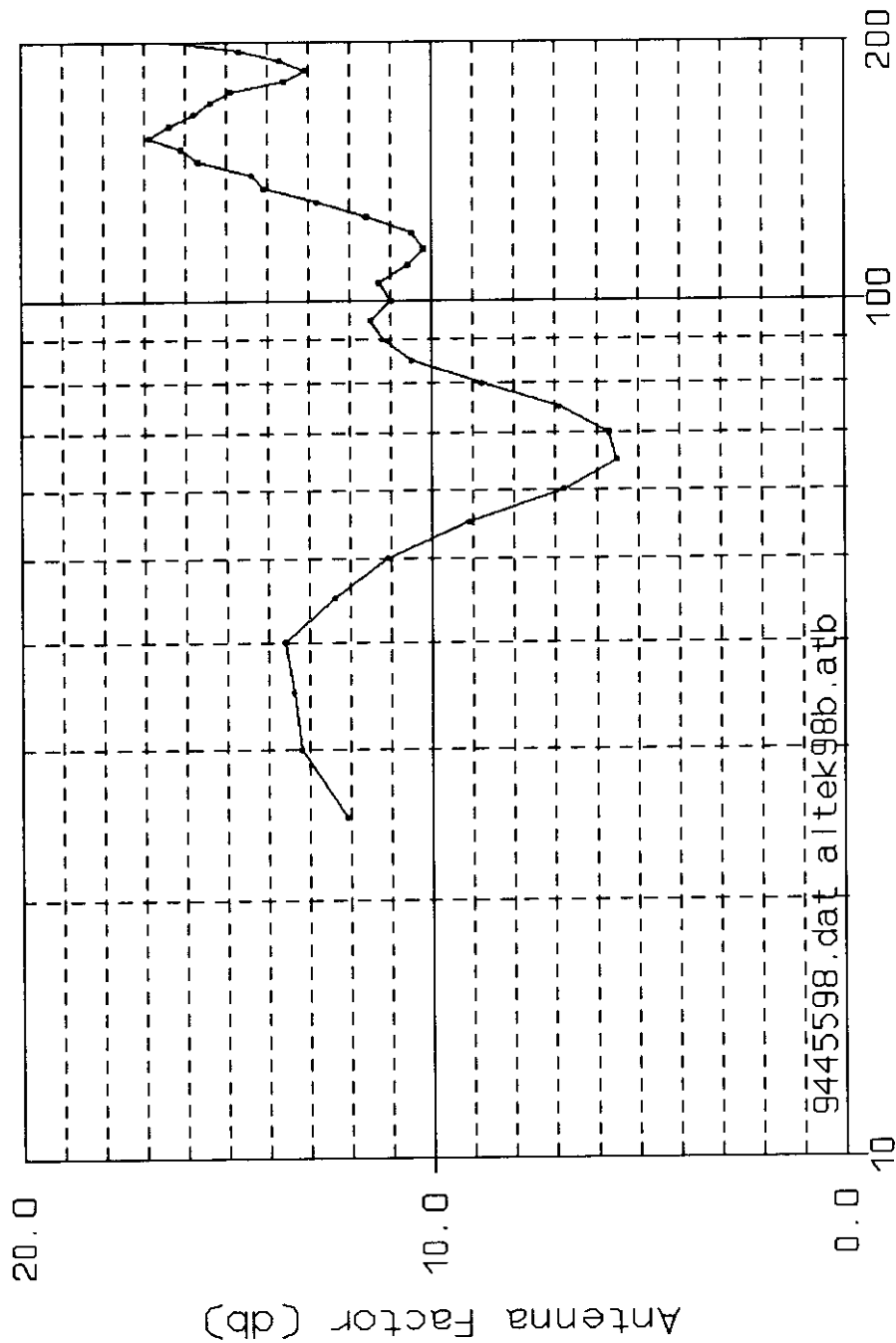


Appendix II

AILTECH MODEL 94455-1 BICONICAL ANTENNA

Serial No: 918

Calibrated 6/11/98

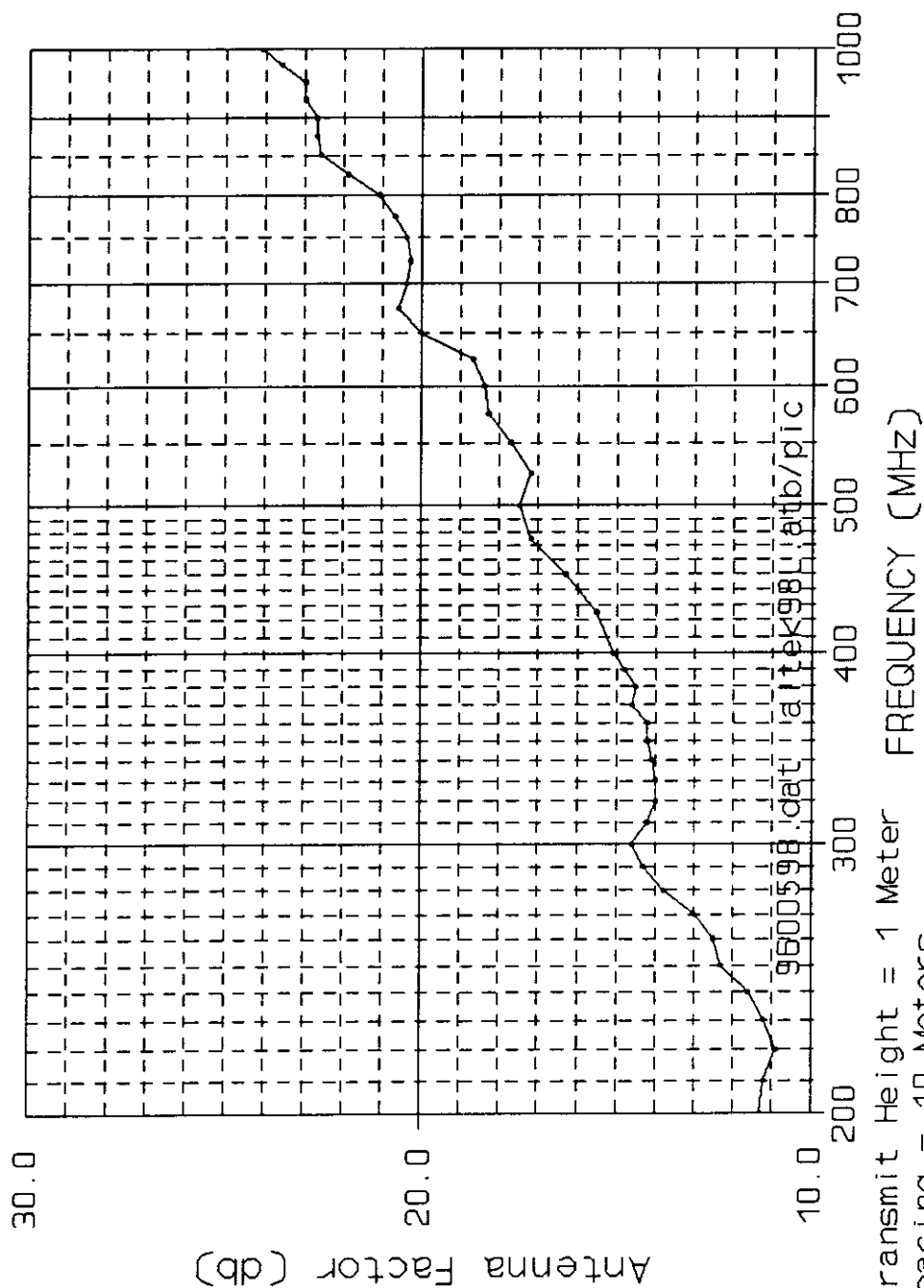


Transmit Height = 1 Meter
10 Meter Spacing

AILTECH 96005 LOG PERIODIC ANTENNA

Serial No: 1058

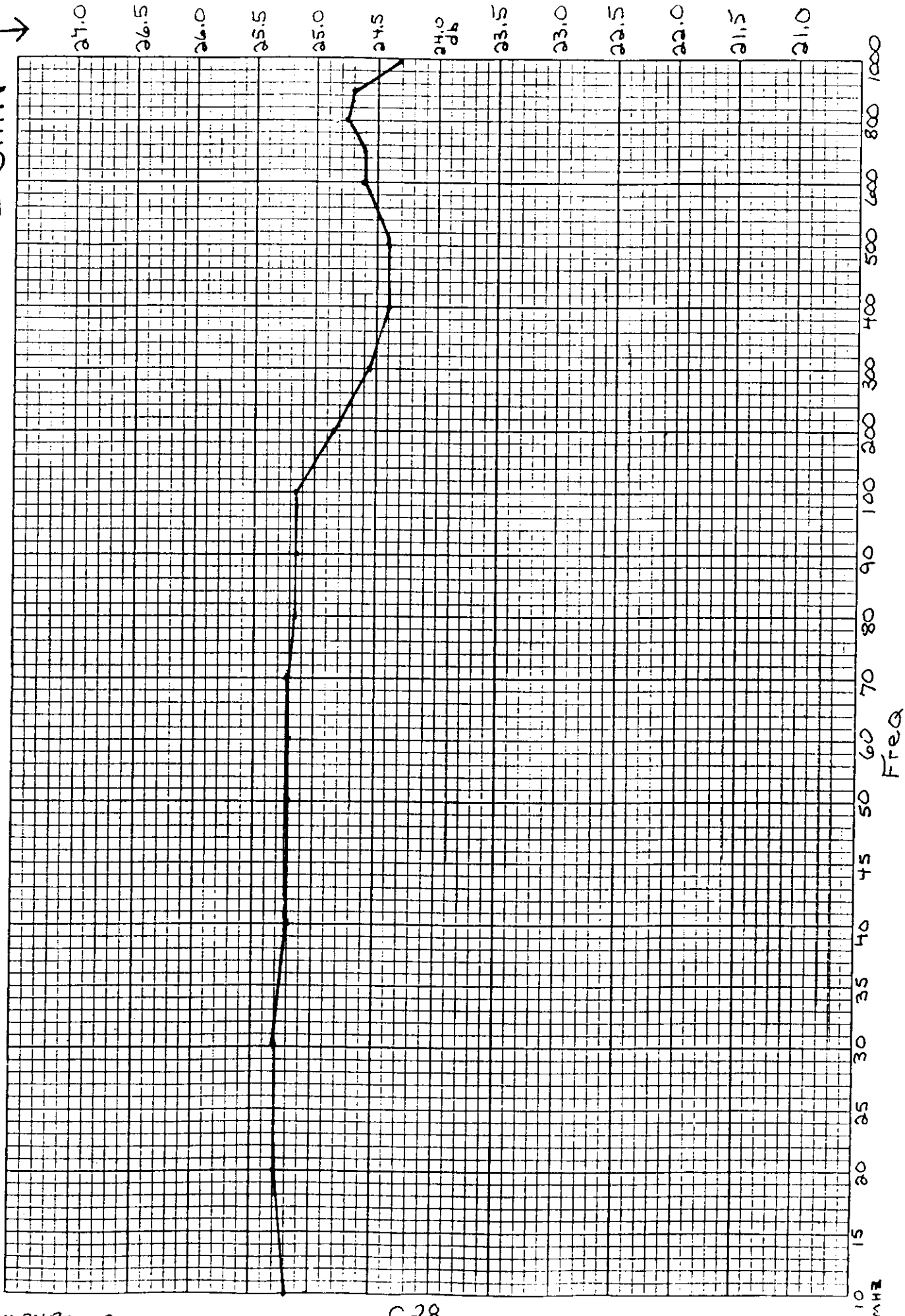
Calibrated 6/11/98



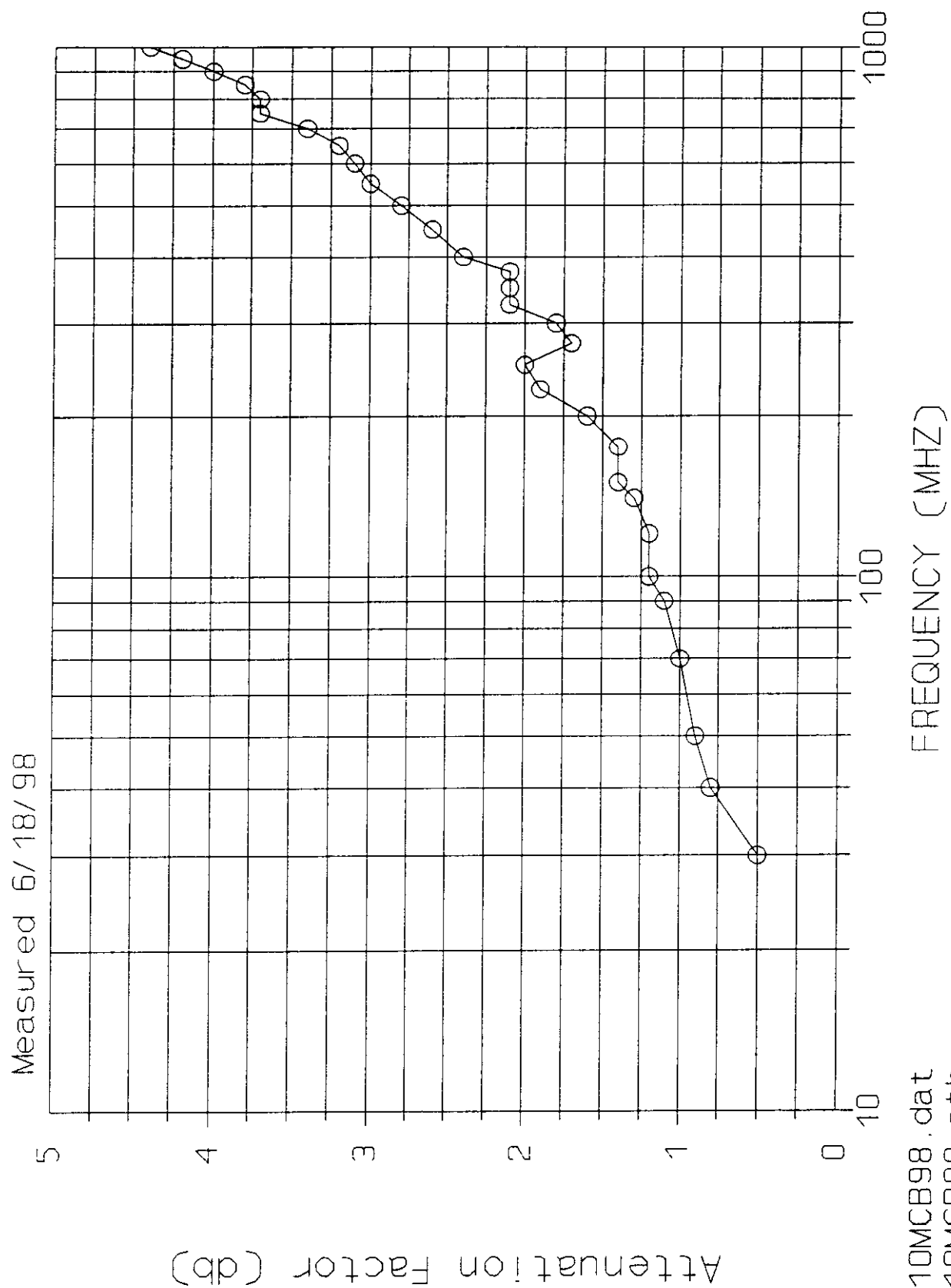
MODEL UTC10-220-1 SN 211.093 DATE CAL 7 MAR 98



dB GAIN →



3 METER CABLE ATTENUATION



Appendix III

UUT BLOCK DIAGRAM

