ELECTROMAGNETIC INTERFERENCE TEST REPORT

FOR

MAGNETEK/GENERAL ELECTRIC

ELECTRONIC FLUORESCENT DIMMING BALLAST WITH BULB

MODEL FEH552D/DV/120

FCC ID: NE455DVLC

TORCHIERE VERSION

April 14, 1998

Prepared for: General Electric Company
1975 Noble Road
East Cleveland, OH 44112

Measurements made
and report prepared by: James R. Pollock

SMITH ELECTRONICS, INC.
8200 SNOWVILLE RD.
CLEVELAND, OH 44141
440/526-4386

CERTIFICATE OF COMPLIANCE

| | | |
|---|---|---|
| 1. | Applicant: | MagneTek S.p.A<br>Settore Nord-Est, 81<br>Terranuova B.ni (Arezzo)<br>ITALY |
| 2. | Prepared for: | General Electric Company<br>1975 Noble Road<br>East Cleveland, OH 44112 |
| 3. | Regulation: | CFR47-Part 18 RF Lighting Devices 18.305 & 18.307 |
| 4. | Measurement Method: | FCC/OST MP-5 |
| 5. | FCC ID: | NE455DVLC |
| 6. | Model Number: | FEH552D/DV/120 |
| 7. | Trade Name: | Electronic Fluorescent Dimming Ballast with Bulb |
| 8. | Operating Frequency: | Low = 87.0 kHz, @ zero ohms<br>Med. = 49.0 kHz, @ 5 Kohms<br>High = 48.5 kHz, @ 10 Kohms |
| 9. | Input Power: | Low 120 VAC, 340 mA, 17 W<br>Med. 120 VAC, 820 mA, 52 W<br>High 120 VAC, 970 mA, 63.7 W |
| 10. | Date of Test: | April 2 & 13, 1998 |
| 10. | Place of Test: | Smith Electronics, Inc. Test Lab, 8200 Snowville Rd., Brecksville, OH. Open Field Site at 2730 Old Mill Rd., Hudson, OH |

11. Statement of Compliance:

I hereby certify that measurements of radio frequency emissions from the torchiere version the MagneTek/GE Electronic Fluorescent Dimming Ballast with Bulb, Model FEH552D/DV/120, were performed by me on April 2 & 13, 1998, and that the results of the measurements confirmed that the units tested were in compliance with the Rules and Regulations of the Federal Communications Commission for electromagnetic emissions according to Part 18.305 and 18.307 of the Rules.

4-14-98
Date

James K. Pollock Pres.
Signature, Title

# RADIO FREQUENCY EMISSION MEASUREMENTS

## OBJECTIVE

To perform radio frequency interference measurements to ascertain that the MagneTek/GE, Model FEH552D/DV/120, Electronic Fluorescent Dimming Ballast with Bulb, complies with the requirements of Part 18 of the FCC Rules and Regulations for consumer RF lighting devices.

## SUMMARY

The torchiere version of the MagneTek/GE FEH552D/DV/120, Electronic Fluorescent Dimming Adapter with Bulb was found to comply with the radio frequency emissions requirements for Industrial, Scientific, and Medical Equipment as found in paragraphs 18.305 and 18.307 of the FCC Rules for RF lighting devices used in a consumer environment.

The highest level of conducted emissions was observed at 471 kHz on the neutral side of the line and was a quasi-peak value of 46.8 dBuV, or 1.2 dB below the consumer limit.

The radiated emission closest to the limit was found at 80 MHz, and was 6.4 dB below the consumer limit.

A list of the highest conducted and radiated levels found is given in the following table.

## HIGHEST CONDUCTED LEVELS

| Freq. (MHz) | Level (dBuV) | Diff. from Limit (dB) | Line |
|---|---|---|---|
| 0.471 | 46.8 QP | - 1.2 | Neutral |
| 0.467 | 46.3 QP | - 1.7 | Hot |
| 0.635 | 46.0 QP | - 2.0 | Hot & Neutral |
| 0.785 | 44.3 QP | - 3.7 | Hot & Neutral |
| 0.940 | 41.4 QP | - 6.6 | Neutral |
| 0.940 | 40.4 QP | - 7.6 | Hot |

All other observed emissions are greater than 8 dB below the limit.

## HIGHEST RADIATED LEVELS

| Freq. (MHz) | Level (uV/m) | Diff. from Limit (dB) |
|---|---|---|
| 80.0 | 48.1 | - 6.4 |
| 76.0 | 45.9 | - 6.8 |
| 84.0 | 43.4 | - 7.2 |
| 86.0 | 43.2 | - 7.3 |
| 83.0 | 38.6 | - 8.3 |
| 72.0 | 33.1 | - 9.6 |

All other observed emissions are greater than 10 dB below the limit.

TEST INFORMATION

| | |
|---|---|
| MANUFACTURER | MagneTek S.p.A<br>Settore Nord-Est, 81<br>Terranuova B.ni (Arezzo)<br>ITALY |
| MARKETED BY: | General Electric Company<br>1975 Noble Rd.<br>East Cleveland, OH 44112 |
| TEST DATE | April 2 & 13, 1998 |
| EQUIPMENT UNDER TEST | MagneTek/GE FEH552D/DV/120<br>Electronic Fluorescent Dimming<br>Ballast with 55W 2D Bulb |
| MEASUREMENT EQUIPMENT | Hewlett-Packard Spectrum Analyzer<br>Type 8568B with 8560A RF Section<br>S/N 2216A02120<br>85662A Display Section<br>S/N 2152A03686<br>85650A Quasi-Peak Adapter<br>S/N 2043A00350<br>Calibrated 5/97<br><br>Singer Stoddart EMI Field Intensity Meter Model NM 37/57<br>S/N 0366-06168<br>Calibrated 5/97<br><br>Hewlett-Packard Preamplifier<br>Model 8447D S/N 1725A01282<br><br>50 uH LISN's<br><br>EMCO Biconical Antenna<br>Model 3104<br>Freq. Range 20 - 200 MHz<br><br>EMCO Log-Periodic Antenna<br>Model 3146<br>Freq. Range 200 - 1000 MHz<br><br>6.1 m RG-214/U coaxial cable |

Open field measurements were performed on the Smith Electronics open field test site located at 2730 Old Mill Rd., Hudson, OH. Information concerning this site is on file with the FCC.

INTRODUCTION

This torchiere style of the MagneTek/GE FEH552D/DV/120 Electronic Fluorescent Dimming Ballast with Bulb is intended for use in the torchiere type lamps which often use a halogen type bulb. This version of the adapter uses the threaded tube type mounting, and is provided with 2 wires for power input and 2 wires for a dimming resistor.

The sample lamp/ballast was tested to compare the values of emissions measured to the limits specified by the FCC. Measurements were made of both the conducted and radiated emissions with the results being compared to the applicable limits of 18.305 and 18.307 of the FCC Rules and Regulations.

MEASUREMENT PROCEDURES

The sample ballast was tested in a typical mounting position (lamp plane horizontal) using typical lamp hardware and non-conducting support materials. A short, three-wire electrical cord was used but the ground wire was not connected. Wire nuts were used to connect the cord to the ballast's input power leads, providing an overall length of about 1 meter.

Measurements made by General Electric prior to submission to this test laboratory indicated that maximum emissions were produced with the lamp at a low-medium power setting (2.5 Kohm dimming resistor) and all measurements were performed at that setting by connecting a fixed resistor to the dimming leads.

Conducted emissions were measured over the frequency range of 450 kHz - 30 MHz. Radiated tests were performed over the frequency range of 30 MHz to 1000 MHz, as covered by present FCC Rules and Regulations. Test procedures followed are those described in FCC/OST MP-5, "FCC METHODS OF MEASUREMENT OF RADIO NOISE EMISSIONS FROM INDUSTRIAL, SCIENTIFIC, AND MEDICAL EQUIPMENT".

CONDUCTED EMISSIONS MEASUREMENTS

All conducted emission measurements were made in the shielded room. The test set up is shown photographically in Pictorial 1. The test fixture was placed on a non-conducting support, 40 cm. from the shielded room wall. All other metallic surfaces were at least 80 cm. from the lamp. Filtered 120 VAC electric power was fed through the LISN's to the fixture.

With the lamp operating for at least 20 minutes, the output of the RF port of the LISN was connected to the spectrum analyzer. A given frequency range was scanned and the results compared to the appropriate FCC limit. Both sides of the line were examined for emissions with reference to ground. The results of these conducted emissions measurements are found in Figs. 1 - 3 of this report.

Figures 1 & 2 are plots of peak emission levels with Fig. 1 covering 450 kHz - 3 MHz and Fig. 2 covering 3 - 30 MHz. As some of the emissions are close to the limit, an expanded, quasi-peak scan was made covering 450 kHz - 1.4 MHz. This data is seen in Fig. 3.

RADIATED EMISSIONS MEASUREMENTS

Initial measurements of the radiated emissions emanating from the lamp were made in the shielded room. The absence of ambient RF noise in the shielded room allows easy measurement of the emissions produced by the lighting device. Measurements conducted in the shielded room have unwanted perturbations caused by reflections, resonances, and antenna loading. However, shielded room measurements are useful in identifying specific frequencies of interest for investigation on the open field site.

The same test setup was used for these measurements as for the conducted emissions except that the lamp was on a non-conducting table about 1 meter above the ground plane and positioned further away from the room walls.

All radiated emissions measured in the shielded room were measured at an antenna distance of 1 meter. All spectral plots made of the detected emissions have scaled FCC limits drawn in for reference. The spectrum analyzer detector was set to peak mode for all measurements. The FCC limits for consumer RF lighting devices radiated emissions are as follows:

| Frequency (MHz) | FCC Consumer Limit (1 m) (uV/m) | (dBuV/m) | FCC Consumer Limit (30 m) (uV/m) | (dBuV/m) |
|---|---|---|---|---|
| 30 - 88 | 300 | 49.5 | 10 | 20.0 |
| > 88 - 216 | 450 | 53.0 | 15 | 23.5 |
| > 216 - 1000 | 600 | 55.6 | 20 | 26.0 |

To transfer the scaled one meter FCC limits to the spectral plots taken in the shielded room, the following relationship was used:

$$L = FCC - AF - CP + P \qquad \text{(Eq. 1)}$$

Where: L = Corrected limit on plot in dBuV

FCC = Scaled FCC limit (1 m) at frequency of interest in dBuV/m

AF = Antenna factor in dB at frequency of interest

C = Coax loss in dB at frequency of interest

P = Gain of preamplifier (26 dB).

To determine compliance with FCC limits on the open field site, the following equation was used:

$$Q = S + AF + C - FCC \qquad \text{(Eq. 2)}$$

Where: Q = Magnitude in dB above/below the FCC limit

S = Measured signal strength of interference in dBuV

AF = Antenna factor in dB at frequency of interest

C = Coax loss in dB at frequency of interest

FCC = FCC Consumer RF lighting device limit (3 m) in dBuV/m at frequency of interest.

Note: The antenna and coax factors used are found in the appendix.

The shielded room measurements, as well as those on the open field, were made using broadband linearly polarized antennas. A biconical antenna was used for measurements between 30 - 200 MHz and a log periodic antenna was used between 200 - 1000 MHz.

Measurements were made with both vertical and horizontal antenna polarizations with the detected emissions recorded on a spectral plot. Data obtained in the shielded room is shown in Figs. 4 & 5.

Radiated emissions measurements were also made on a 3 m open field site with the lamp set up as shown photographically in Pictorial 2. The 120 VAC was provided in the same manner as for the conducted emissions tests except that the LISN's were not used. With the appropriate antenna in place, the frequency range was scanned using the EMI receiver. Quasi-Peak detection was used for these measurements.

When an emission was detected, the lamp was rotated until the maximum level was observed. The measurement antenna was then raised and lowered between 1 & 4 meters to again find the maximum value. This maximum value was then recorded. Measurements were made using both horizontal and vertical polarizations and the maximum results of these open field radiated measurements are found in Table 1.

The measured values of the radiated emissions were recorded in dBuV. To these values are added the antenna factors and a coax loss factor.

As the limits for radiated emissions are specified at 30 meters and the measurements were made at 3 meters a factor of 10 is also included to account for the difference using linear extrapolation.

All measured values recorded in Table 1 are below the FCC limits for radiated emissions for consumer lighting devices.

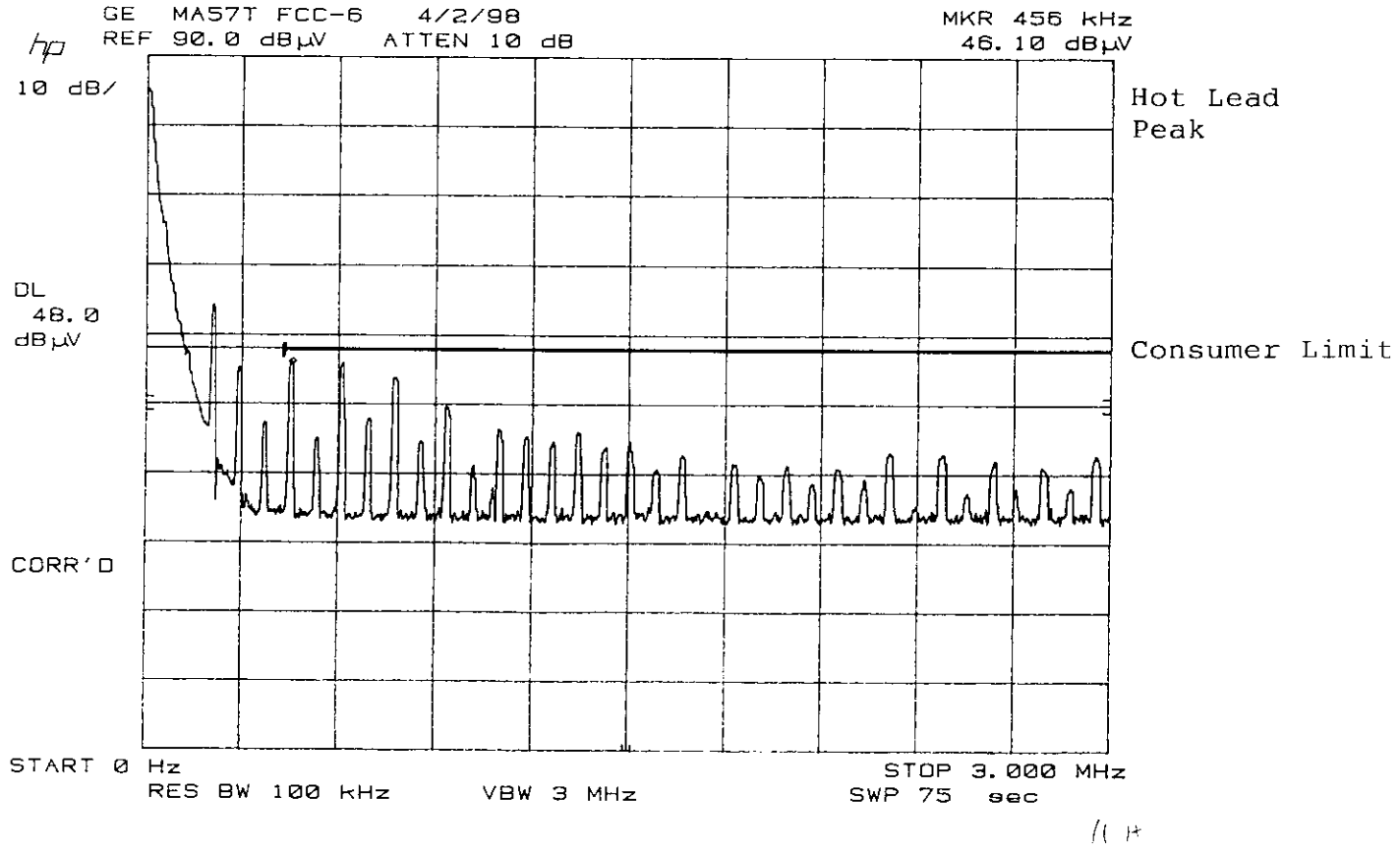
RESULTS

The plots of the conducted emissions are found in Figs. 1 - 3, along with the appropriate consumer limit per 18.307. All emissions are below the required limit.

The results of the radiated emissions measurements taken on the open field site and tabulated in Table 1 indicate that the lamps tested comply with the limits for consumer RF lighting devices given in paragraph 18.305 of the FCC rules. This is found in the column labeled "DB VS. FCC B" in the tables. At 80 MHz in Table 1, a quasi-peak value of 48.1 uV/m was obtained which is 6.4 dB below the 100 uV/m limit at 3 meters. The "DB VS. FCC A" column would compare the reading to the limit for non-consumer RF lighting devices.

CONCLUSION:

The FEH552D/DV/120, FCC ID NO. NE455DVLC, in the torchiere version tested and mounted as described, does comply with the requirements for radiated and conducted radio frequency emissions for consumer RF lighting devices as provided for in paragraphs 18.305 and 18.307 of the Federal Communications Commission's Rules and Regulations.



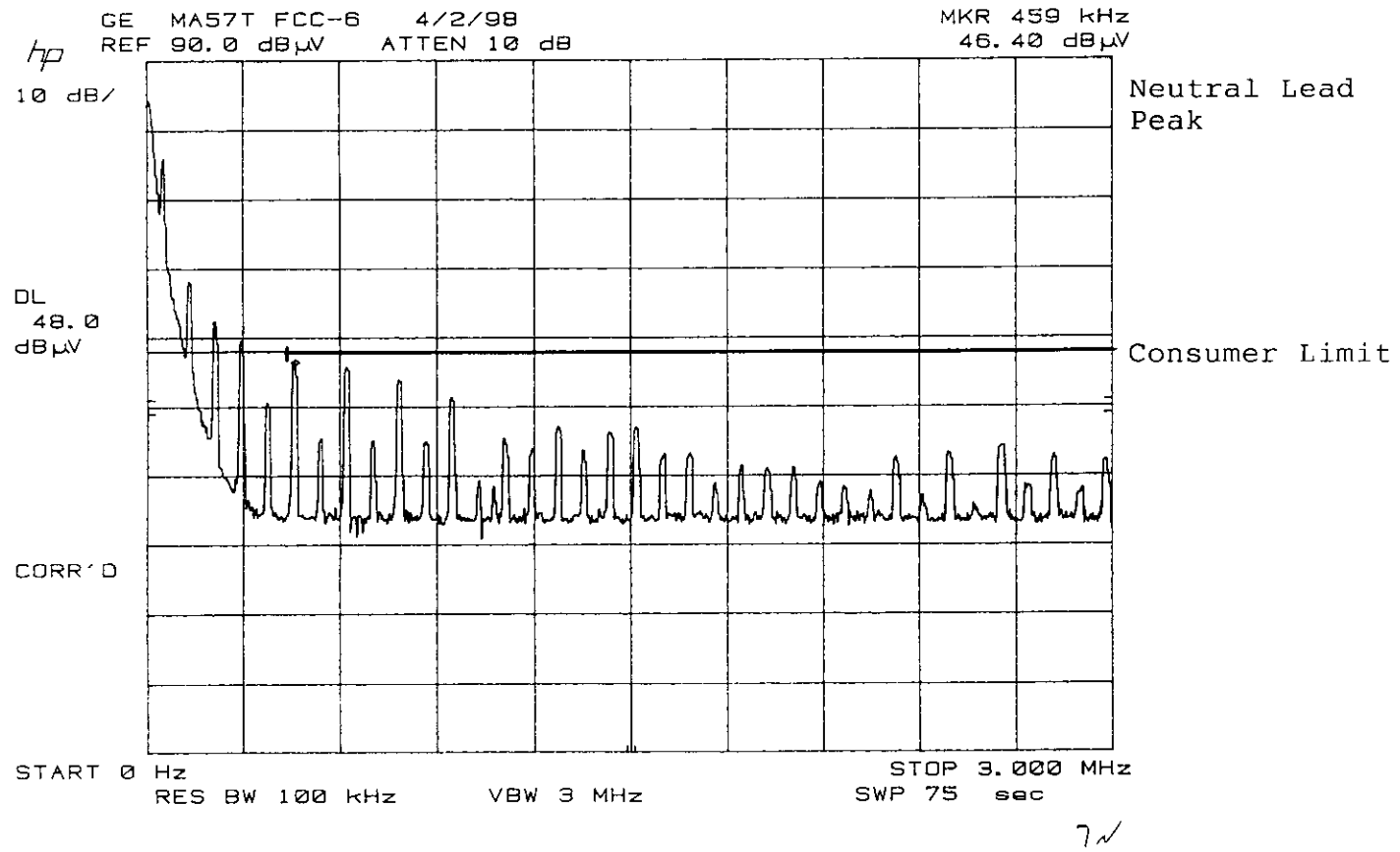
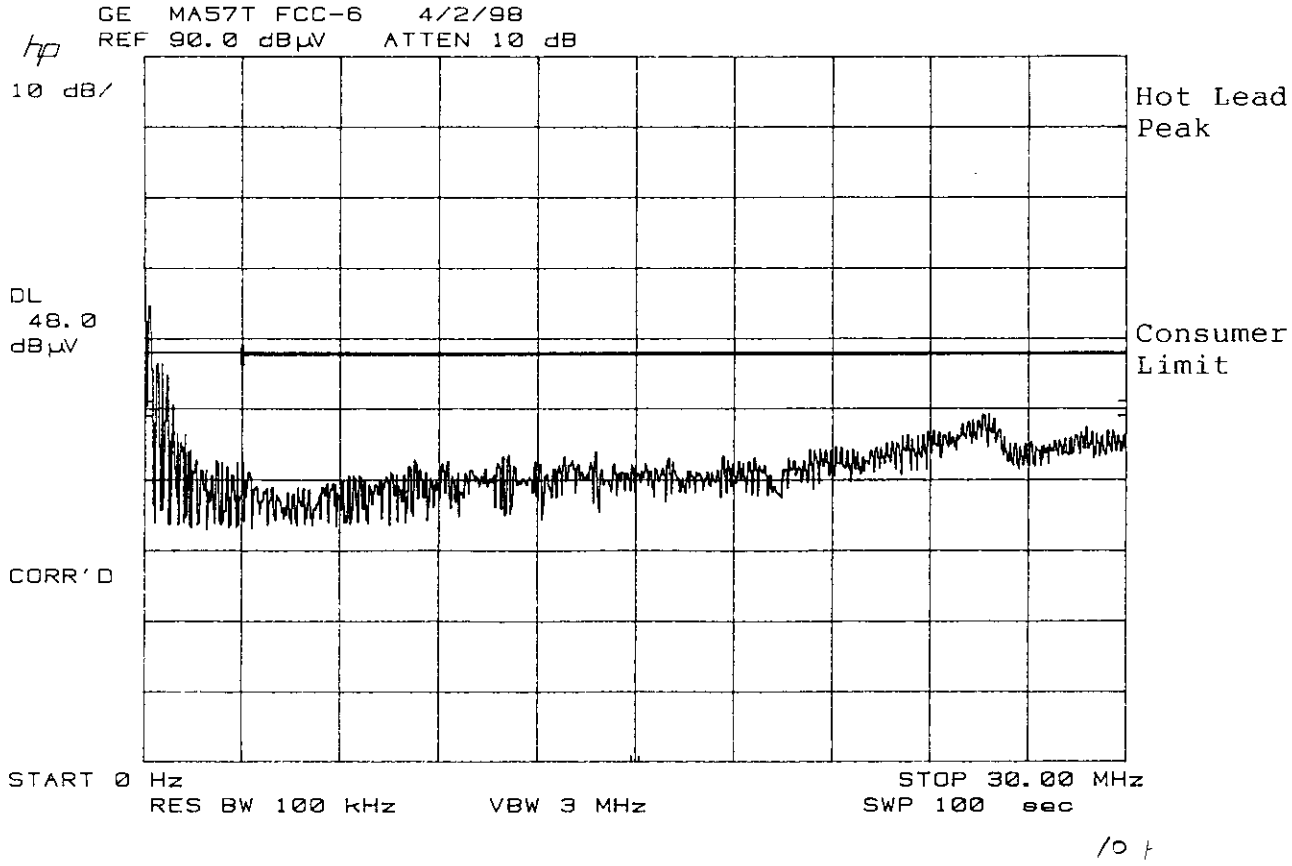




Fig. 1
CONDUCTED EMISSIONS
MAGNETEK/GE FEH552D/DV/120
FCC ID: NE455DVLC
450 kHz - 3 MHz Peak

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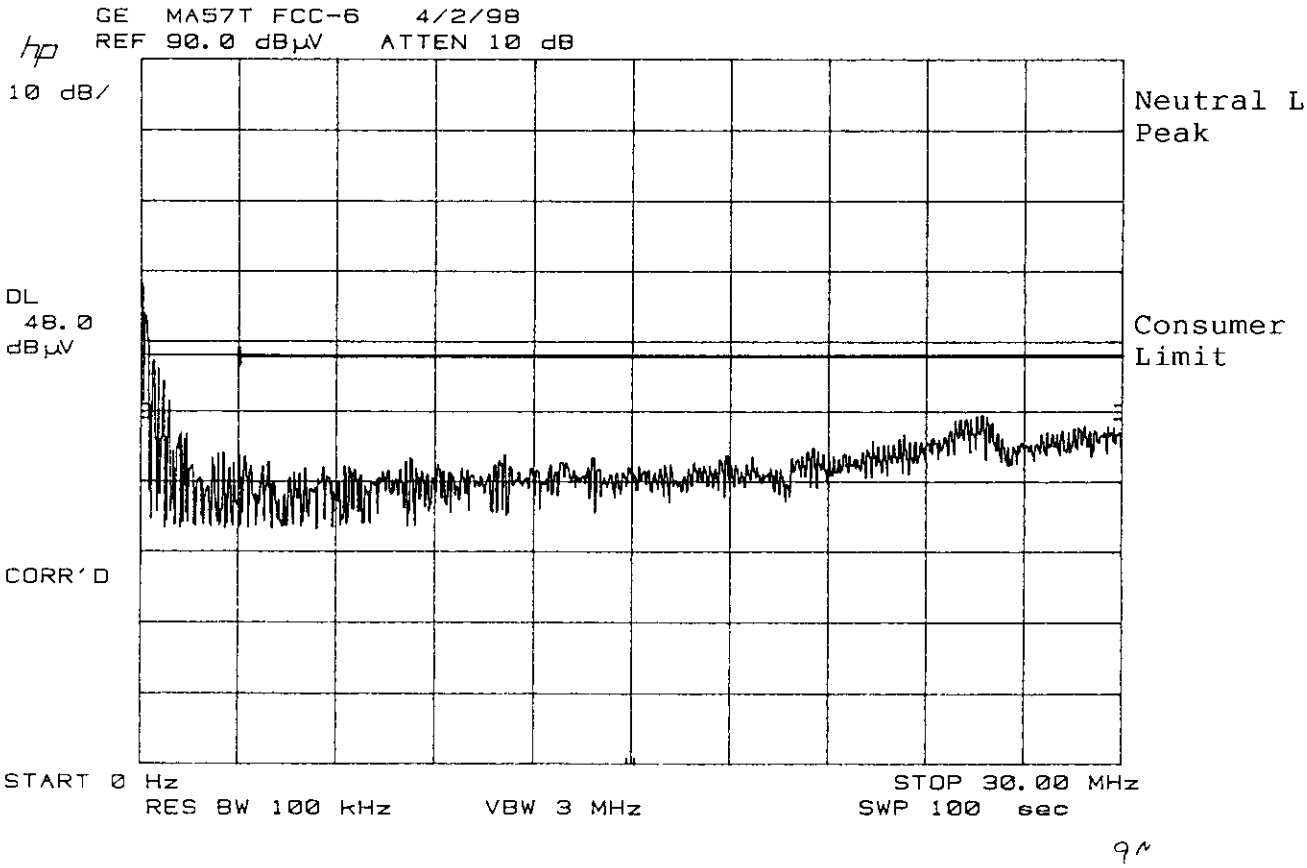


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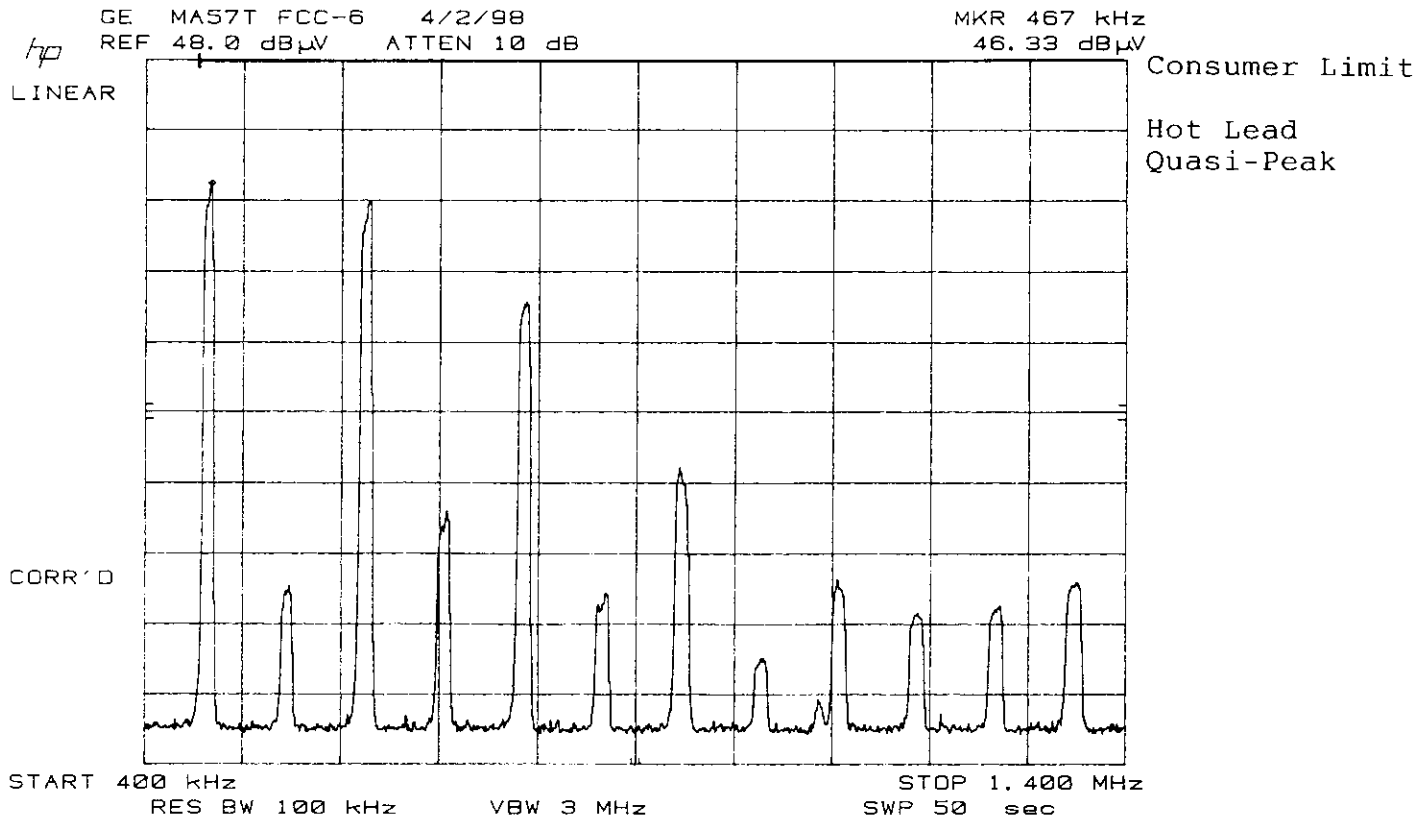
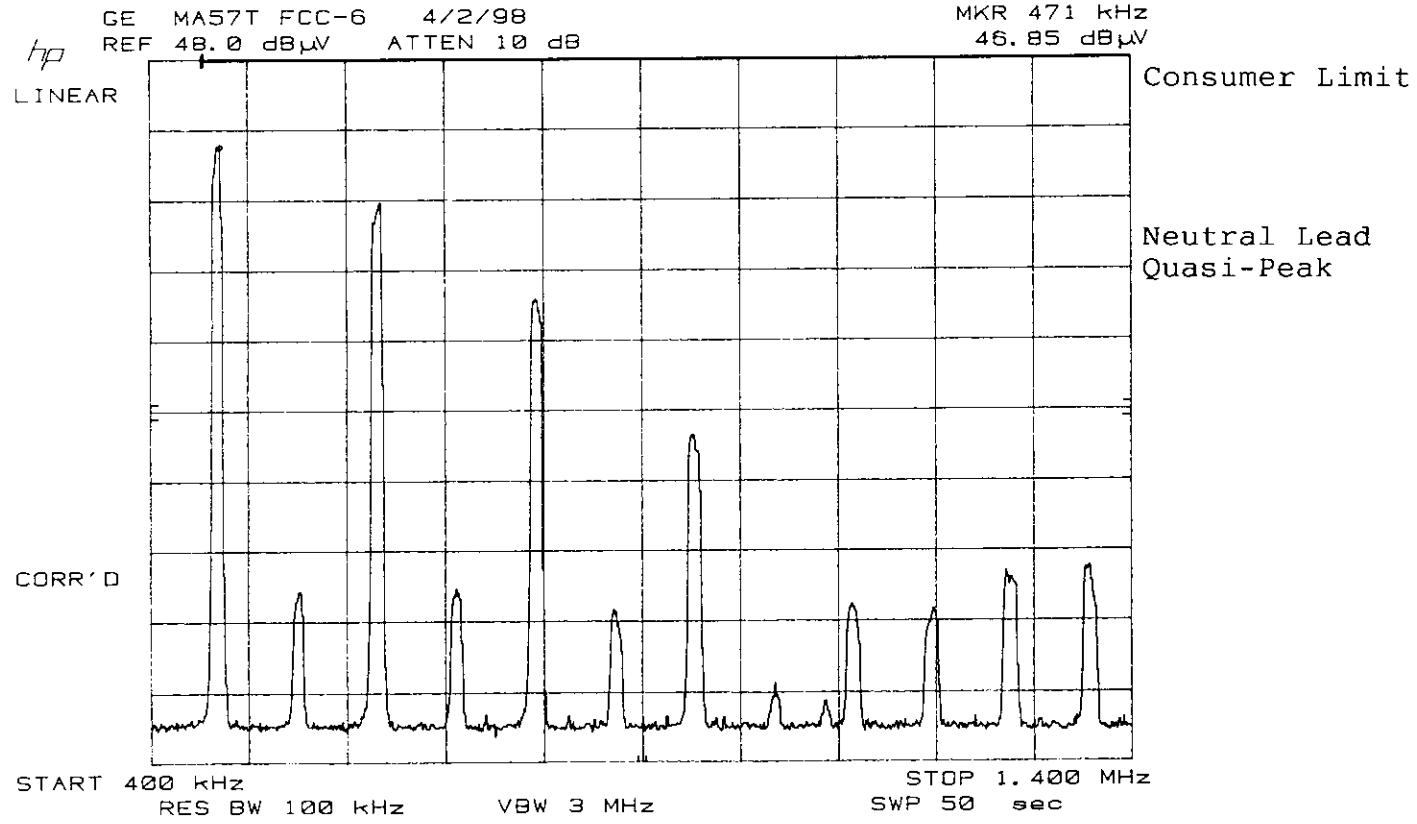
Fig. 2
CONDUCTED EMISSIONS
MAGNETEK/GE FEH552D/DV/120
FCC ID: NE455DVLC
3 MHz - 30 MHz Peak

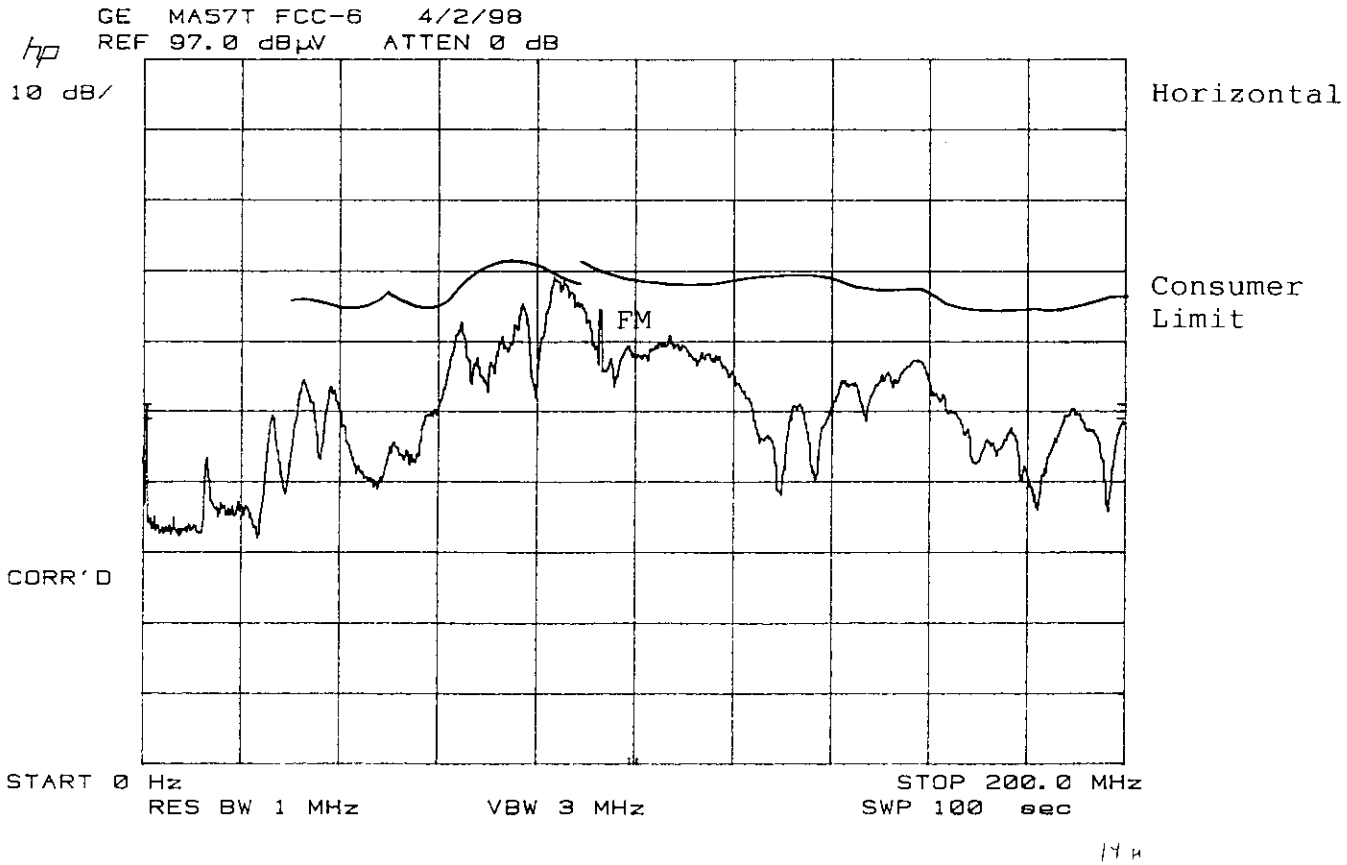



12"




8"

Fig. 3
CONDUCTED EMISSIONS
MAGNETEK/GE FEH552D/DV/120
FCC ID: NE455DVLC
450 kHz - 1.4 MHz Quasi-Peak



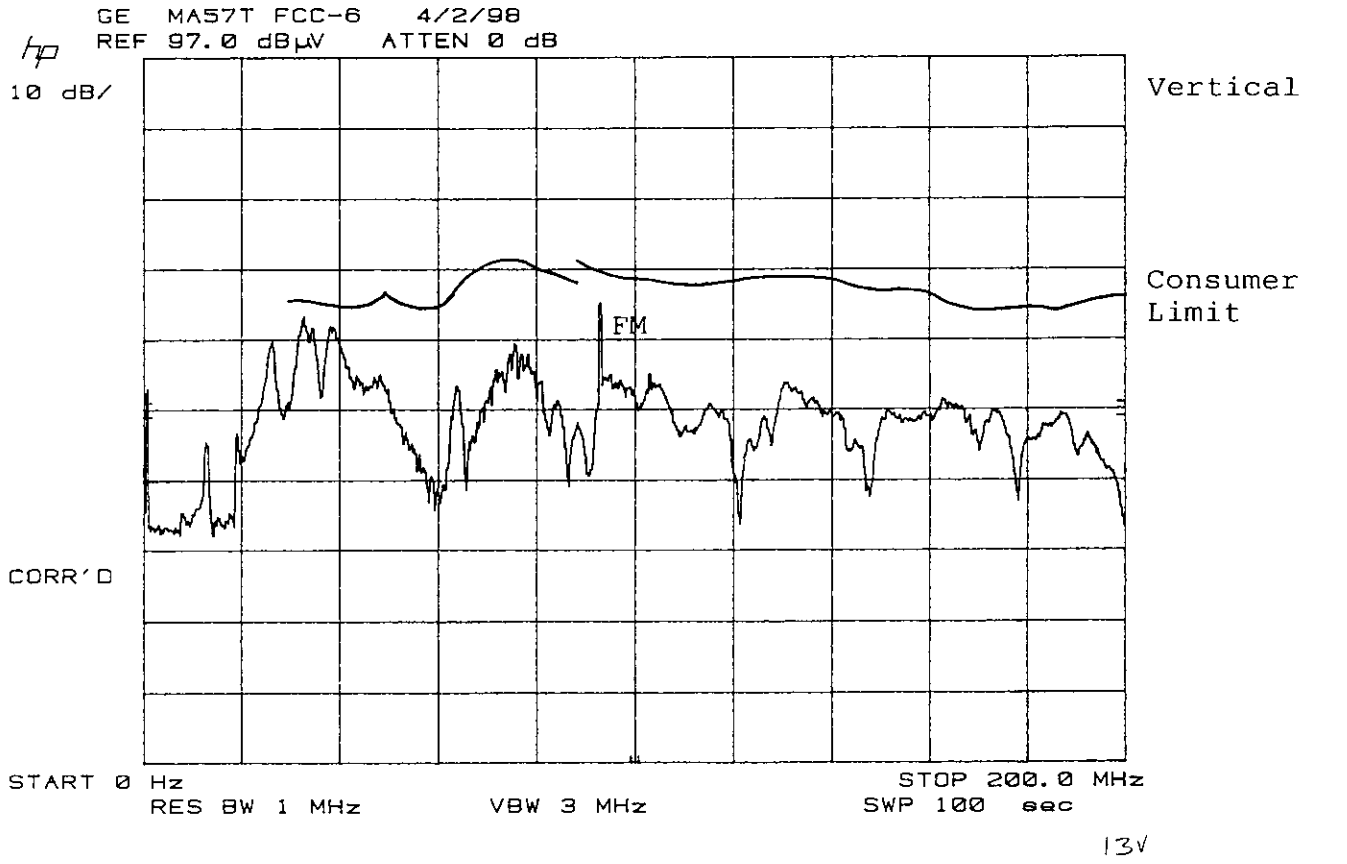
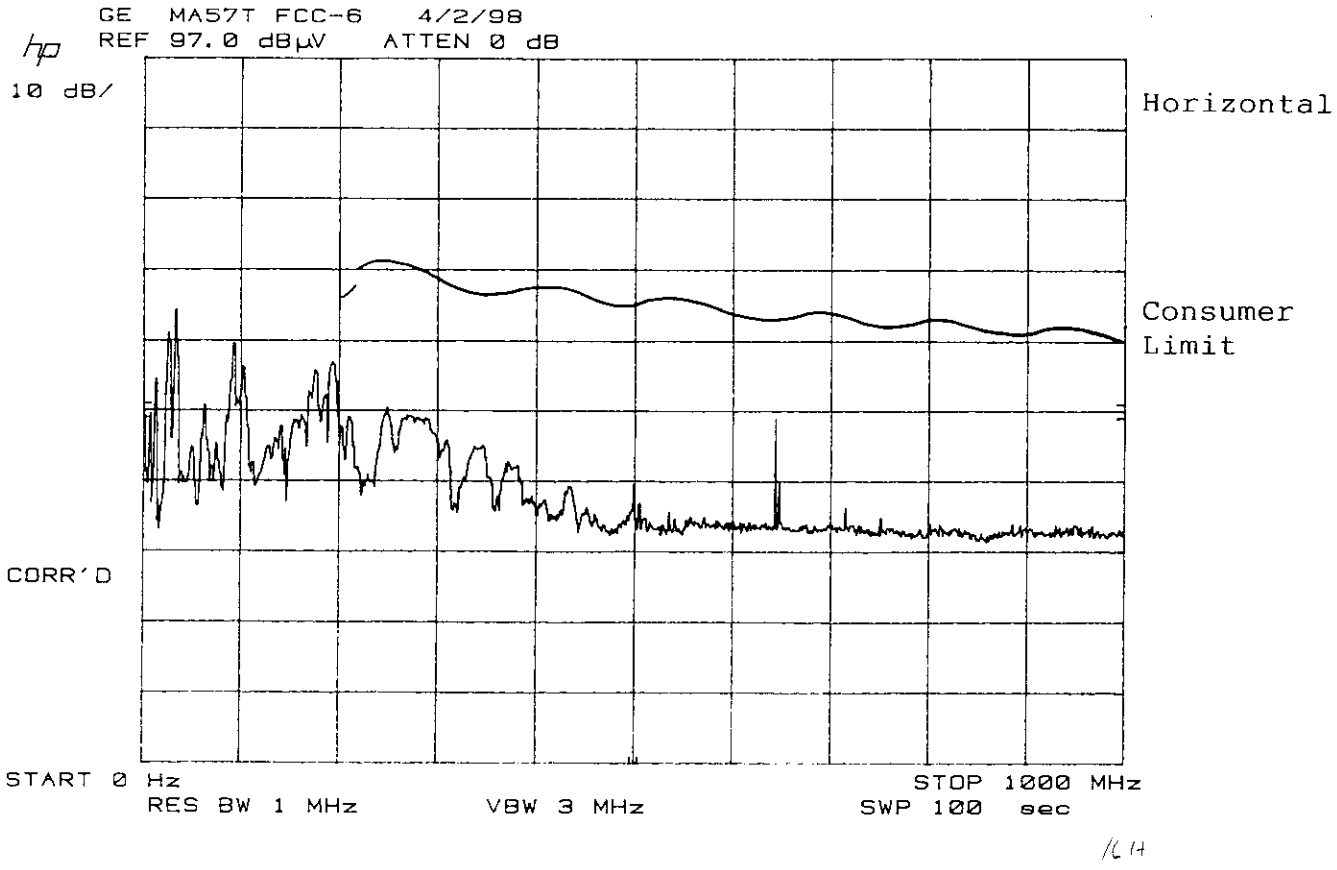




Fig. 4
RADIATED EMISSIONS
MAGNETEK/GE FEH552D/DV/120
FCC ID: NE455DVLC
30 MHz - 200 MHz



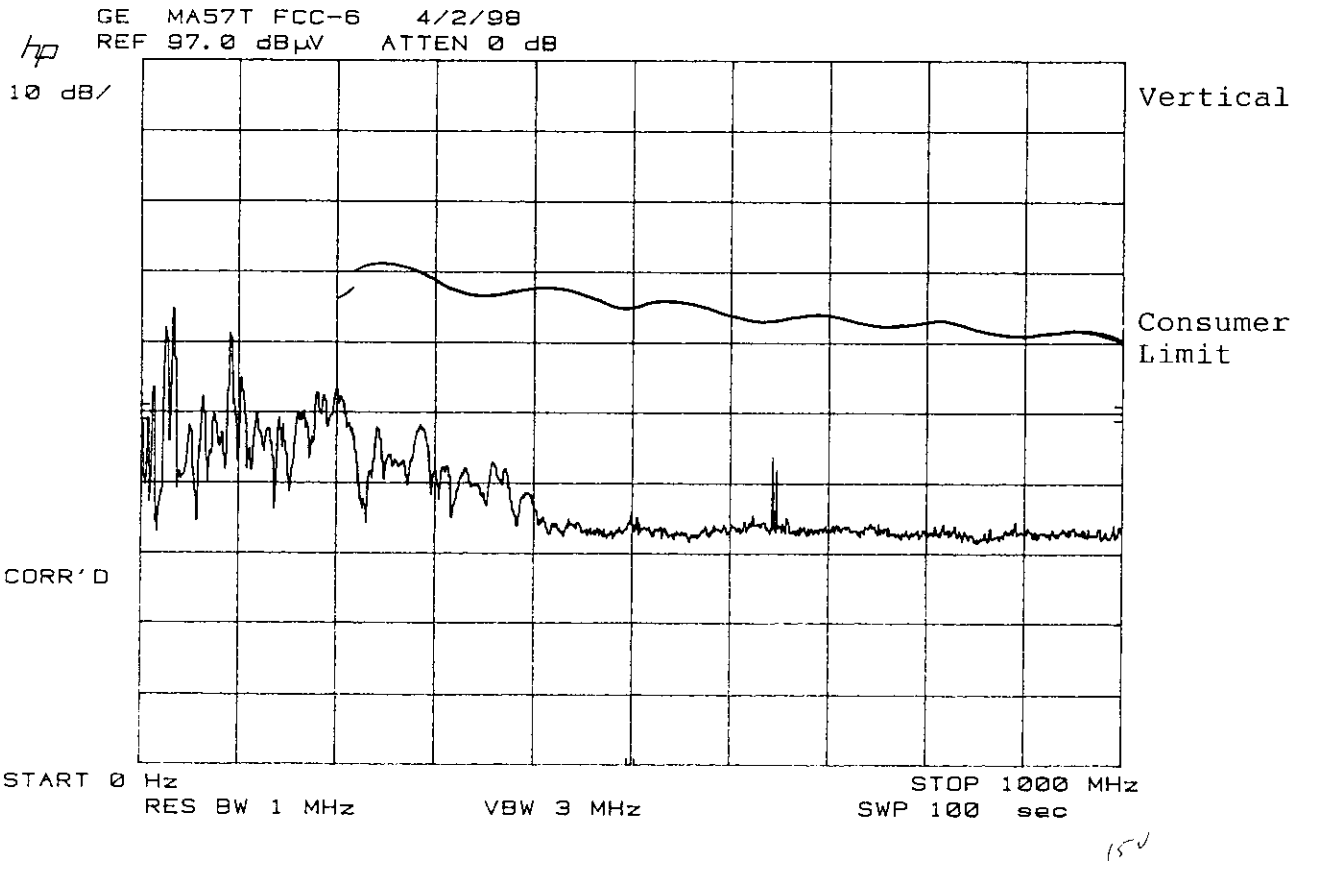




Fig. 5
RADIATED EMISSIONS
MAGNETEK/GE FEH552D/DV/120
FCC ID: NE455DVLC
200 MHz - 1000 MHz

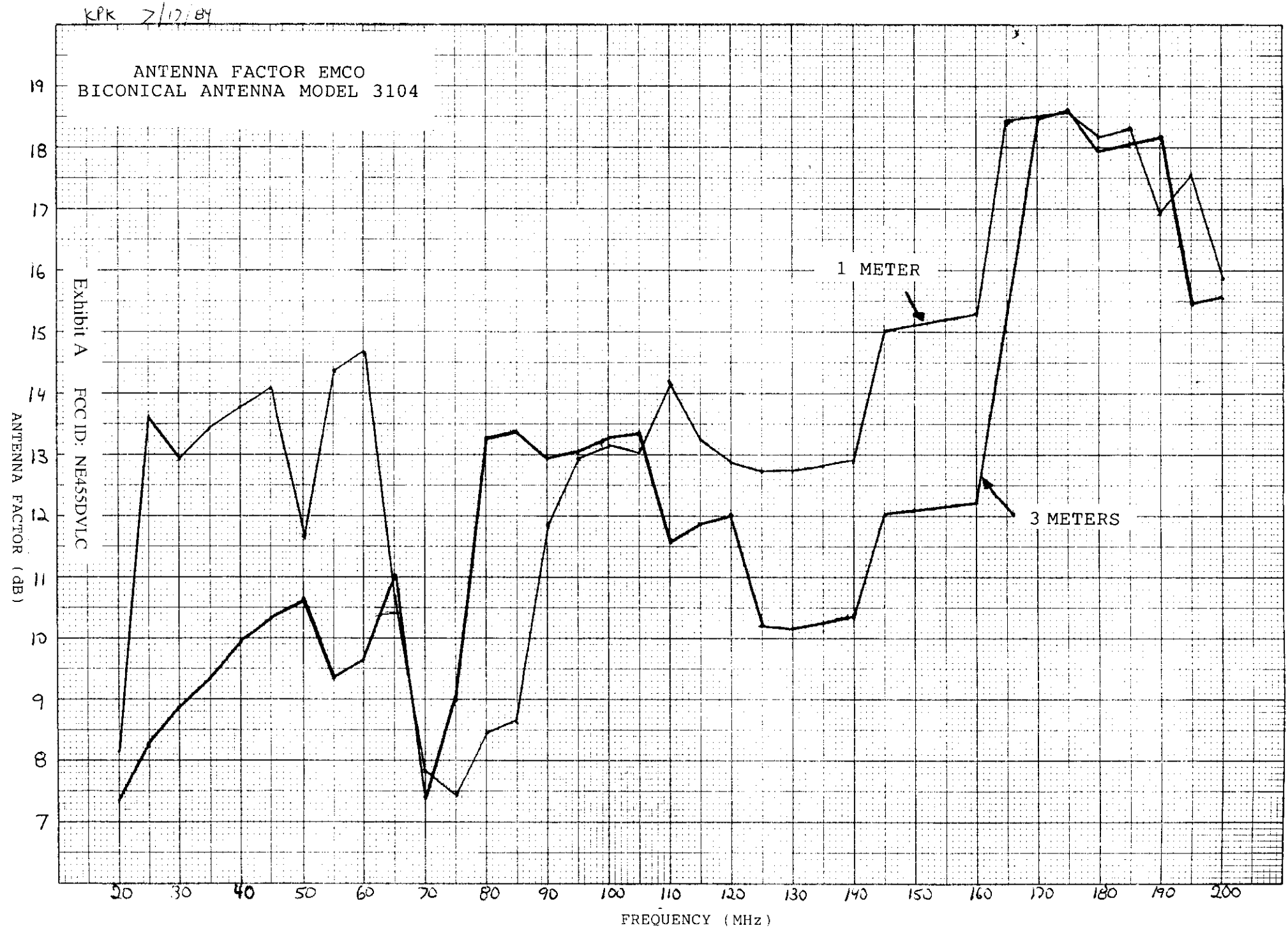
TABLE 1 OPEN FIELD TEST SUMMARY, RADIATED EMISSIONS
MAGNETEK ELECTRONIC FLUORESCENT DIMMING BALLAST
MODEL FEH552D/DV/120 FCC ID: NE455DVLC
TEST DATE APRIL 13 1998
MEASUREMENT DISTANCE, 3 METERS

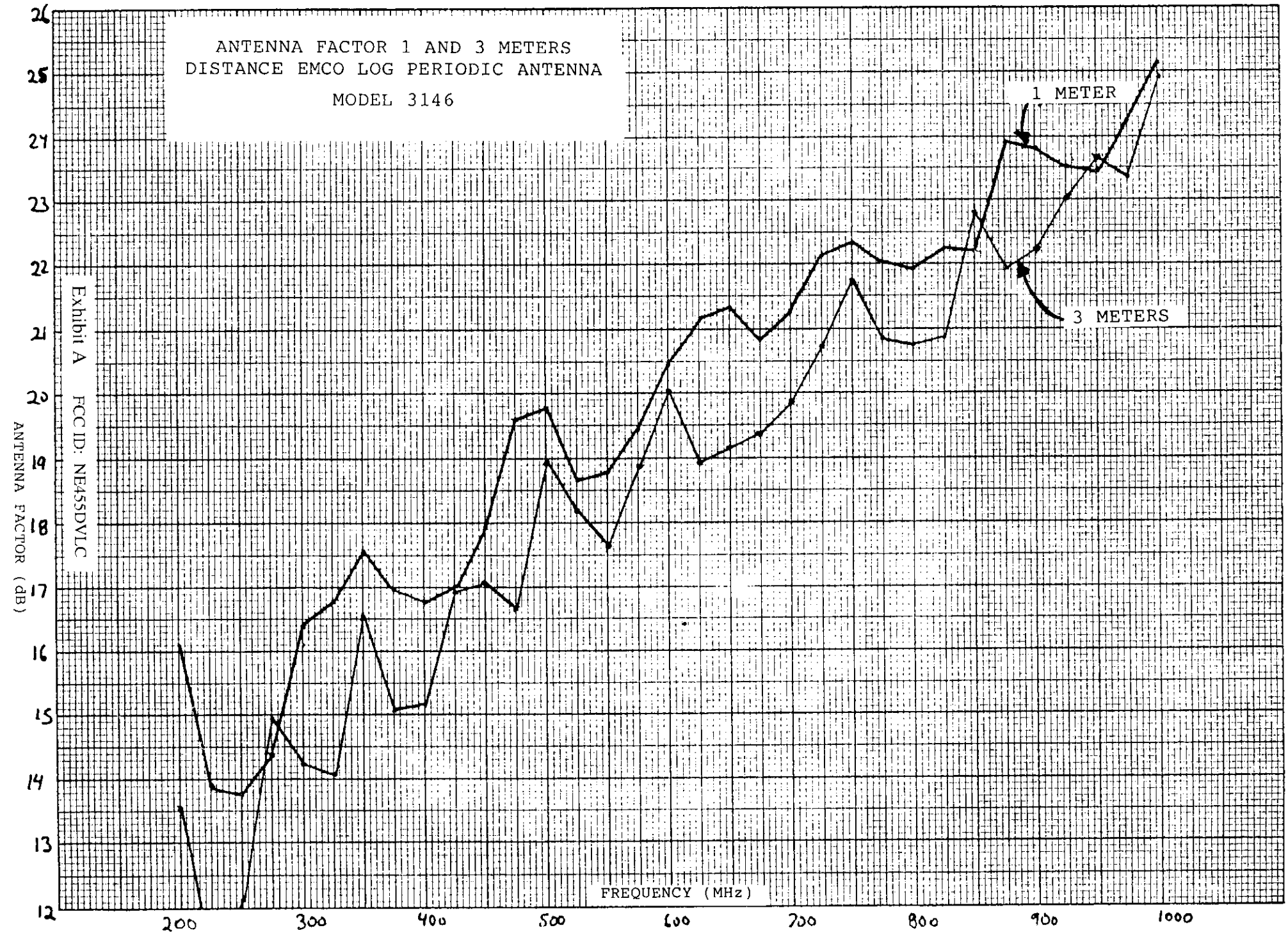
| FREQ. MHZ | SIGNAL DBUV | ANTENNA FACTOR | COAX FACTOR | E UV/M | DB VS. FCC A | DB VS. FCC B | ANTENNA TYPE |
|---|---|---|---|---|---|---|---|
| 56.0 | 12.0 | 9.4 | 0.3 | 12.2 | -27.8 | -18.3 | BCON.V |
| 60.0 | 18.0 | 9.6 | 0.3 | 25.0 | -21.6 | -12.0 | BCON.V |
| 66.0 | 19.0 | 10.3 | 0.4 | 30.4 | -19.9 | -10.3 | BCON.V |
| 70.0 | 20.0 | 7.4 | 0.4 | 24.4 | -21.8 | -12.2 | BCON.V |
| 72.0 | 22.0 | 8.0 | 0.4 | 33.1 | -19.1 | -9.6 | BCON.V |
| 74.0 | 18.0 | 8.7 | 0.4 | 22.5 | -22.5 | -12.9 | BCON.V |
| 75.0 | 20.0 | 9.0 | 0.4 | 29.4 | -20.2 | -10.6 | BCON.V |
| 76.0 | 23.0 | 9.8 | 0.4 | 45.9 | -16.3 | -6.8 | BCON.V |
| 80.0 | 20.0 | 13.3 | 0.4 | 48.1 | -15.9 | -6.4 | BCON.V |
| 83.0 | 18.0 | 13.3 | 0.4 | 38.6 | -17.8 | -8.3 | BCON.V |
| 84.0 | 19.0 | 13.4 | 0.4 | 43.4 | -16.8 | -7.2 | BCON.V |
| 86.0 | 19.0 | 13.3 | 0.4 | 43.2 | -16.8 | -7.3 | BCON.V |
| 92.0 | 17.0 | 13.0 | 0.4 | 33.3 | -23.5 | -13.1 | BCON.V |
| 97.0 | 15.0 | 13.2 | 0.4 | 26.9 | -25.4 | -14.9 | BCON.V |
| 112.0 | 12.0 | 11.7 | 0.5 | 16.2 | -29.8 | -19.3 | BCON.V |
| 120.0 | 10.0 | 12.0 | 0.5 | 13.3 | -31.5 | -21.0 | BCON.V |

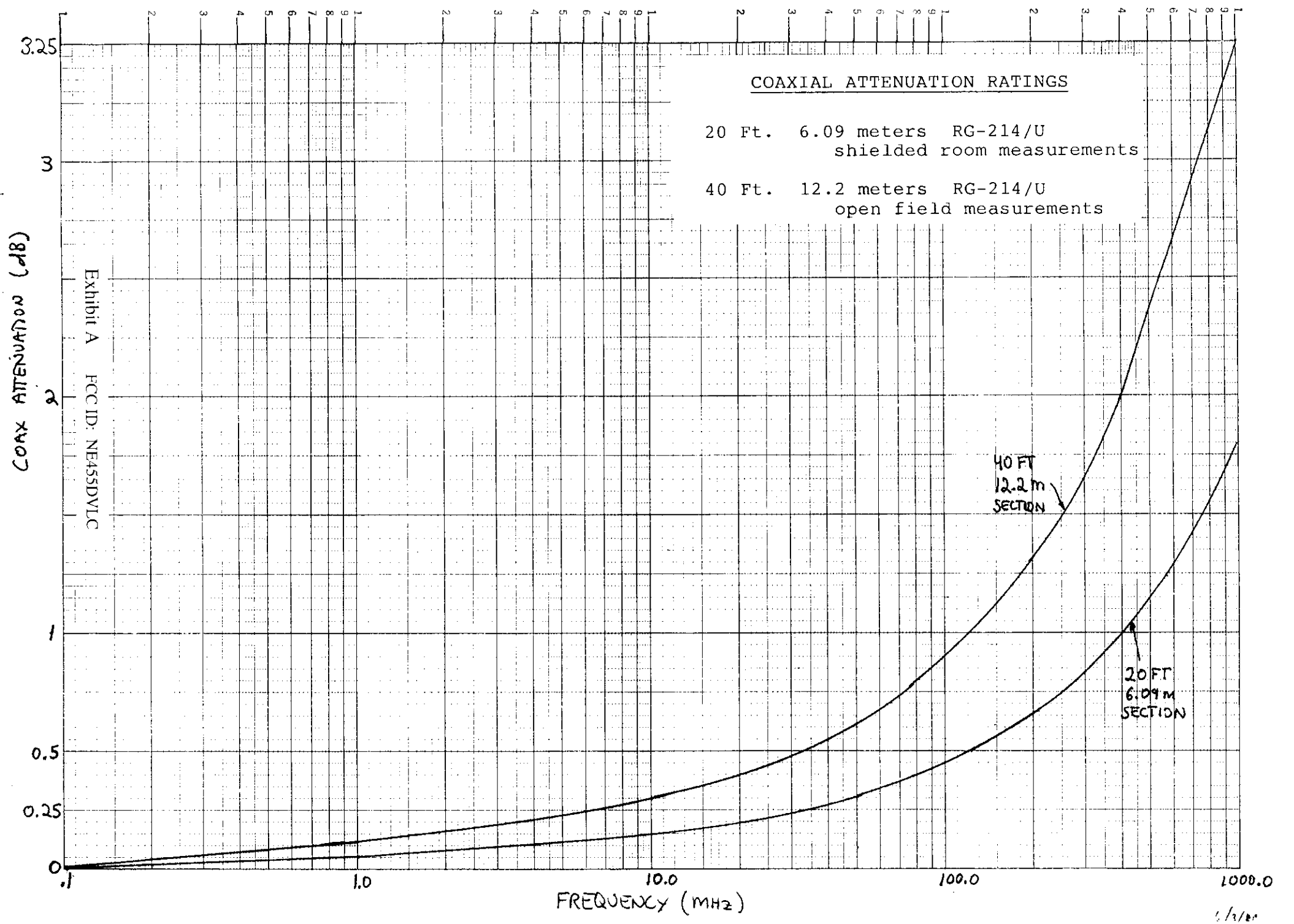
# A P P E N D I X

| | |
|---|---|
| Antenna Factors: | EMCO 3104 Biconical Antenna |
| | EMCO 3146 Log Periodic Antenna |
| Coax Factors: | RG-214/U Coax |

KPK 2/12/84


ANTENNA FACTOR EMCO
BICONICAL ANTENNA MODEL 3104
Exhibit A FCC ID: NE455DVLC
1 METER
3 METERS
ANTENNA FACTOR (dB)
FREQUENCY (MHz)
19
18
17
16
15
14
13
12
11
10
9
8
7
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200


ANTENNA FACTOR 1 AND 3 METERS
DISTANCE EMCO LOG PERIODIC ANTENNA
MODEL 3146
1 METER
3 METERS
Exhibit A FCC ID: NE455DVLC
ANTENNA FACTOR (dB)
FREQUENCY (MHz)
26
25
24
23
22
21
20
19
18
17
16
15
14
13
12
200
300
400
500
600
700
800
900
1000



# GE/MagneTek

## Electronic Fluorescent Dimming Ballast with Bulb

## System Electrical Parameters

| Parameter | | | |
|---|---|---|---|
| ***Input:*** | | | |
| Voltage {Vac} | 120(nom.) | 120(nom.) | 120(nom.) |
| Power Level | Low | Med. | High |
| Current {A} | .340 | .820 | .970 |
| Power {W} | 17 | 52 | 63.7 |
| Power Factor | .5 ± .1 | .5 ± .1 | .5 ± .1 |
| THD {%} | <170% | <170% | <170% |
| ***Output:*** | | | |
| Oper. Freq. {KHz} | 87.0 ± 5% | 49 ± 2% | 48.5 ± 3% |
| Lamp Power {W} | 15 | 48 | 57 |

NOTES: 1. Product Model #: FEH552D/DV/120 - Electronic Variable Dimming 55Watt Fluorescent Ballast Adapter (*) for use with F552D/827/4P 2D™ Lamp

2. FCC ID: NE455DVLC (Ballast manufactured by MagneTek S.p.A., ITALY)

| REV | ECO NO | DATE | APPROVAL | GE Lighting — GENERAL ELECTRIC CO, Cleveland, OH | | | |
|---|---|---|---|---|---|---|---|
| | | | | FEH552D/DV/120 System Electrical Parameters | | | |
| | | | | SIZE A | PRELIMINARY PROPRIETARY | DWG NO: Sketch: 130A09 | REV 1 |
| DRAWN: J. BOYLE | | | 15 APR-98 | ENGRG: J. BOYLE | | | |
| CHECKED: | | | | ISSUED: | | | SHEET 1 OF 1 |

Exhibit B Model # FEH552D/DV/120
System Electrical Parameters
FCC ID: NE455DVLC