ELECTROMAGNETIC INTERFERENCE TEST REPORT

FOR

GENERAL ELECTRIC

Biax™ ELECTRONIC COMPACT FLUORESCENT LAMP

MODEL FLE28QBX/SPX27 (Rev. 3.1)

FCC ID: BLD28OLS-2

October 22, 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:	General Electric Company 1975 Noble Road East Cleveland, OH 44112
2.	Regulation:	CFR47-Part 18 RF Lighting Devices 18.305 & 18.307
3.	Measurement Method:	FCC/OST MP-5
4.	FCC ID:	BLD28OLS-2
5.	Model Number:	FLE28QBX/SPX27 (Rev. 3.1)
6.	Trade Name:	Biax™ Electronic Bulb
7.	Operating Frequency:	96 kHz
8.	Input Power:	120 VAC, 470 mA, 28 W
9.	Date of Test:	October 15 & 19, 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 a General Electric Biax™ Electronic Bulb, Model FLE28QBX/SPX27 (Rev. 3.1), FCC ID: BLD28OLS-2, were performed by me on October 15 & 19, 1998, and that the results of the measurements confirmed that the unit tested was 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.

10-22-98
Date

James R. Pollock, Pres.
Signature, Title

RADIO FREQUENCY EMISSION MEASUREMENTS

OBJECTIVE

To perform radio frequency interference measurements to ascertain that a General Electric FLE28QBX/SPX27 (Rev. 3.1) Biax™ Electronic Bulb complies with the requirements of Part 18 of the FCC Rules and Regulations for consumer RF lighting devices.

SUMMARY

The General Electric FLE28QBX/SPX27 (Rev. 3.1) Biax™ Electronic 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 conducted emissions noted are tabulated below.

CONDUCTED EMISSIONS

Frequency (MHz)	Line 1 (dBu)	Line 2 (dBu)	Consumer Limit (dBu)	Diff. (dB)
0.478	42.7 QP	43.2 QP	48 QP	- 4.8
0.576	43.9 QP	44.0 QP	48 QP	- 4.0
0.658	42.0 QP	41.2 QP	48 QP	- 6.0
0.760	42.4 QP	42.2 QP	48 QP	- 5.6
0.860	42.0 QP	44.3 QP	48 QP	- 3.7
1.04	42.4 QP	41.1 QP	48 QP	- 5.6
1.23	41.8 QP	43.2 QP	48 QP	- 4.8

The radiated emissions are tabulated in Table 1 and are all more than 20 dB below the consumer limit.

TEST INFORMATION

MANUFACTURER	General Electric Company 1975 Noble Rd. East Cleveland, OH 44112
TEST DATE	October 15 & 19, 1998
EQUIPMENT UNDER TEST Bulb	General Electric FLE28QBX/SPX27 (Rev. 3.1) Biax™ Electronic
MEASUREMENT EQUIPMENT	Hewlett-Packard Spectrum Analyzer Type 8568B with 8560A RF Section S/N 2216A02120 85662A Display Section S/N 2152A03686 85650A Quasi-Peak Adapter S/N 2043A00350 Calibrated 5/98 Singer Stoddart EMI Field Intensity Meter Model NM 37/57 S/N 0234-04233 Calibrated 5/98 Hewlett-Packard Preamplifier Model 8447D S/N 1725A01282 50 uH LISN's EMCO Biconical Antenna Model 3104 Freq. Range 20 - 200 MHz EMCO Log-Periodic Antenna Model 3146 Freq. Range 200 - 1000 MHz 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

The General Electric FLE28QBX/SPX27 (Rev. 3.1) Biax™ Electronic Bulb is designed to replace a standard incandescent lamp to provide an energy efficient light source. 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 lamp was tested using a metal lamp socket mounted in a plastic base. A two wire, unshielded, lamp cord, approximately 1 meter in length, was used. The connector was polarized so that the hot wire of the AC line was connected to the center conductor of the light socket. 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 lighting 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 and warmed up 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. Figure 1 shows the emissions between 450 kHz and 3.0 MHz, while Fig. 2 covers the 3 MHz to 30 MHz range. These figures show the peak levels observed during the analyzer scans. Figure 3 plots the emissions between 450 kHz and 1.4 MHz using a quasi-peak detector.

From an examination of Figs. 1 - 3, it can be seen that the conducted emissions from the General Electric FLE28QBX/SPX27 (Rev. 3.1) Biax™ Electronic Bulb do not exceed the FCC limit for consumer lighting devices of 250 uV (48 dBu).

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. Figure 4 covers the range of 30 - 200 MHz while Fig. 5 shows the 200 -1000 MHz range.

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 lamp could be rotated from the measurement position. 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 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.

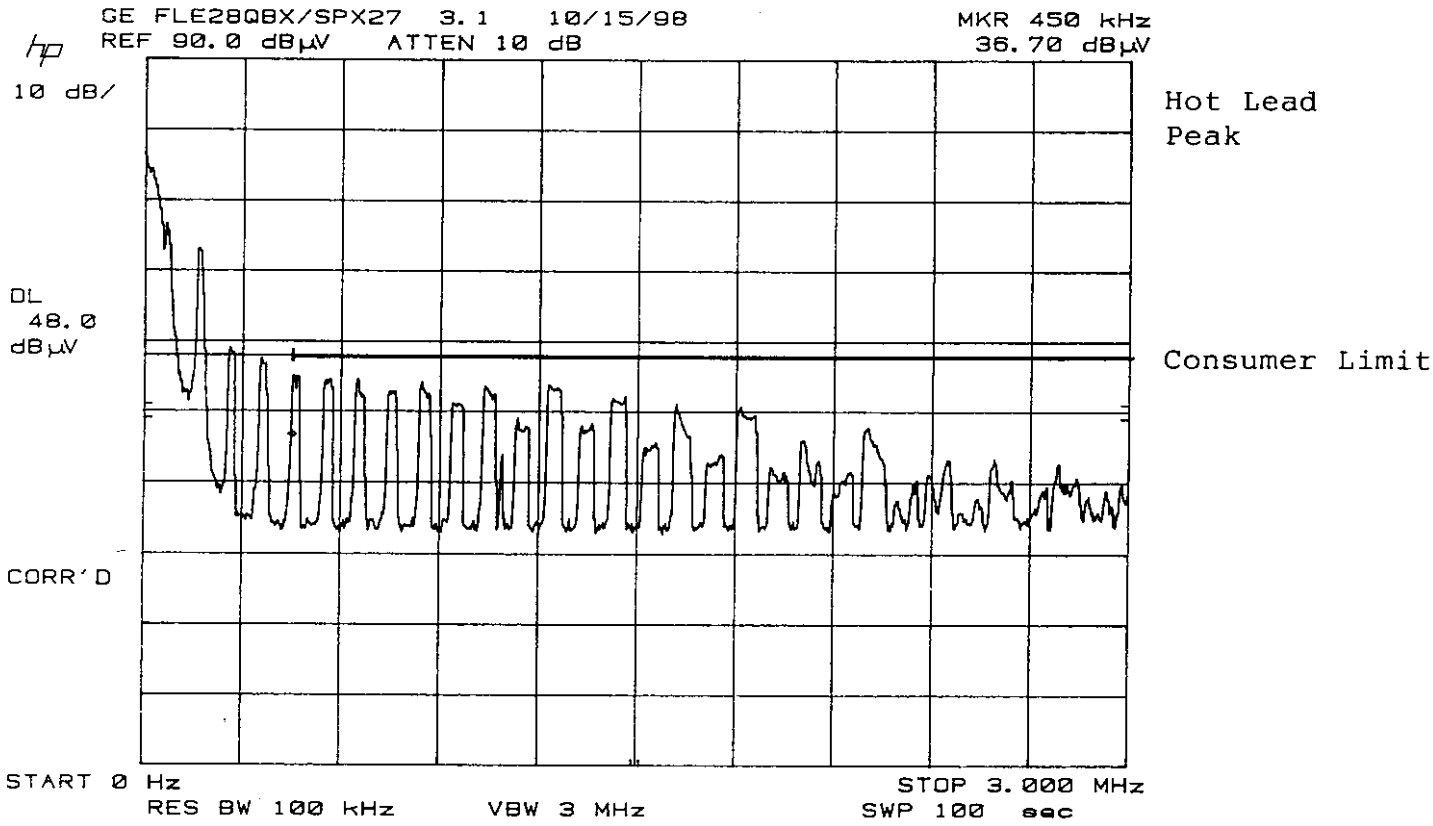
All measured values recorded in Table 1 are below the FCC limits for radiated emissions for consumer lighting devices.

RESULTS

The plots of the conducted emissions found in Figs. 1 - 3 show that the emissions are below the limits specified for consumer RF lighting devices in paragraph 18.307 of the FCC rules.

The results of the radiated emissions measurements taken on the open field site and tabulated in Table 1 indicated that the bulb tested also complies 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 table. At 34 MHz in Table 1, a quasi-peak value of 6.7 uV/m was obtained which is 23.5 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.

The FLE28QBX/SPX27 (Rev. 3.1), FCC ID: BLD28OLS-2, as installed in the lighting fixture, does comply with the requirements for radiated and conducted radio frequency emissions for consumer RF lighting devices as provided for in paragraphs 18.3054 and 18.307 of the Federal Communications Commission's Rules and Regulations.



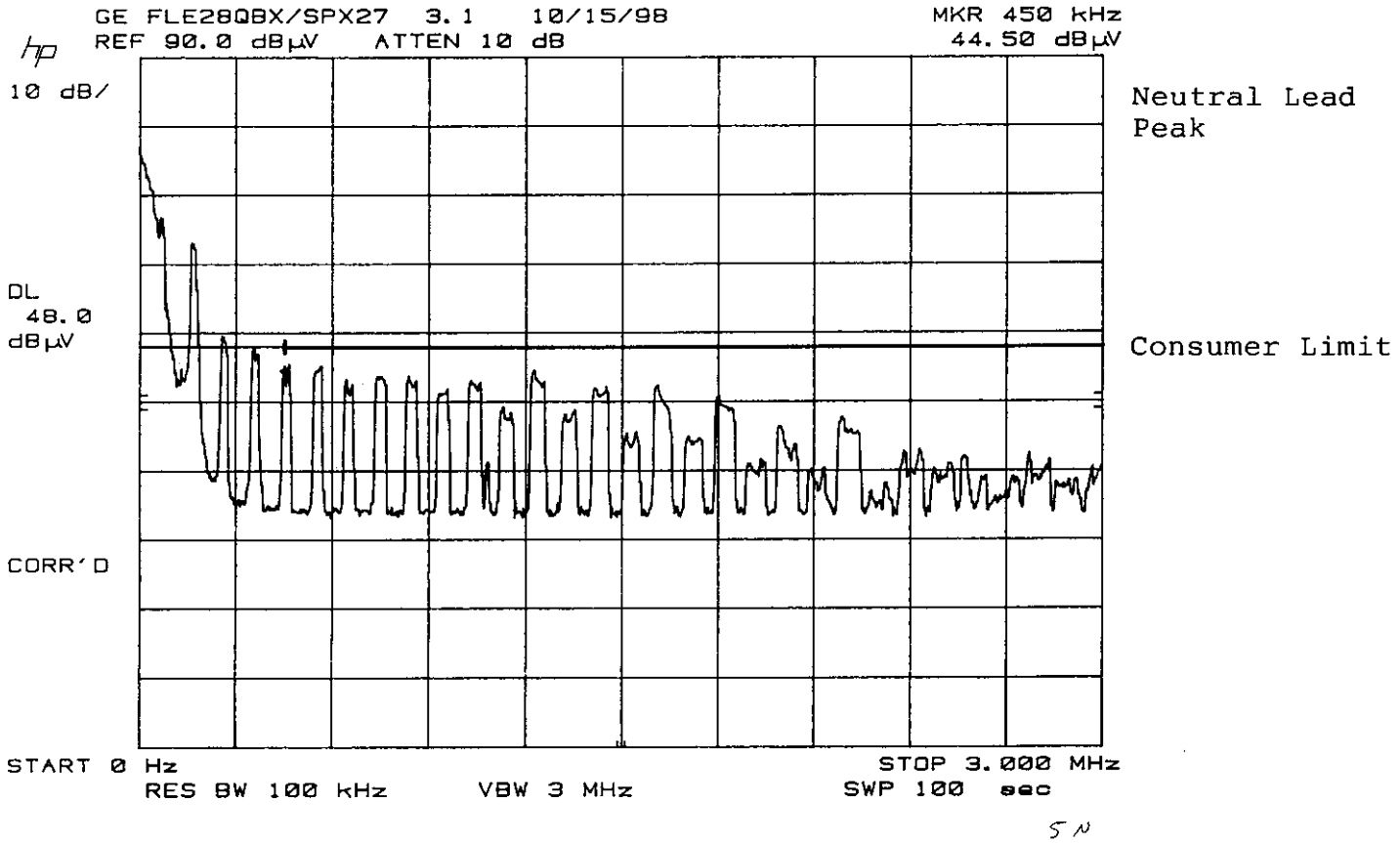
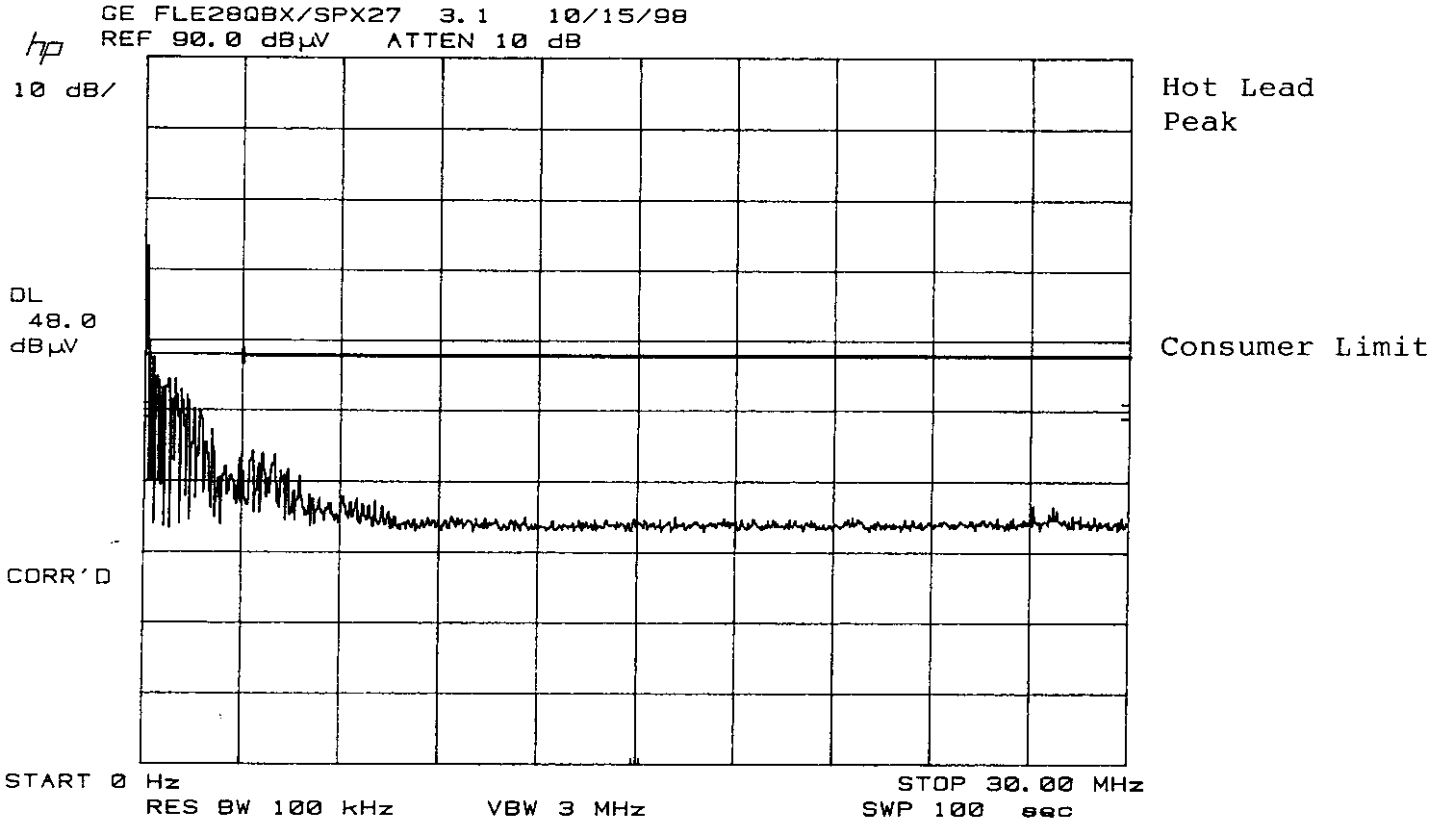


Fig. 1
CONDUCTED EMISSIONS
GE FLE28QBX/SPX27 (Rev. 3.1)
FCC ID: BLD28OLS-2
450 kHz - 3.0 MHz Peak



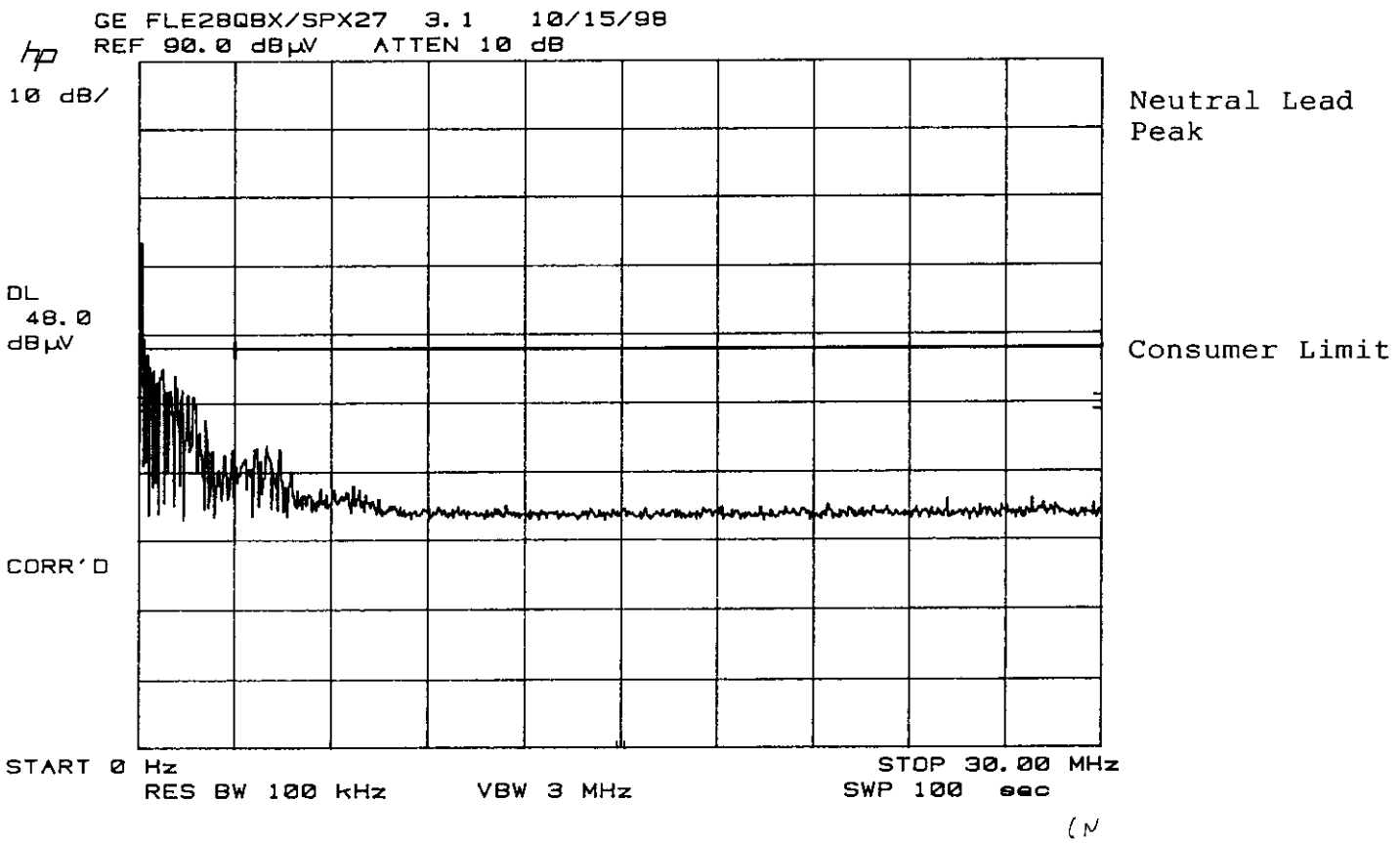
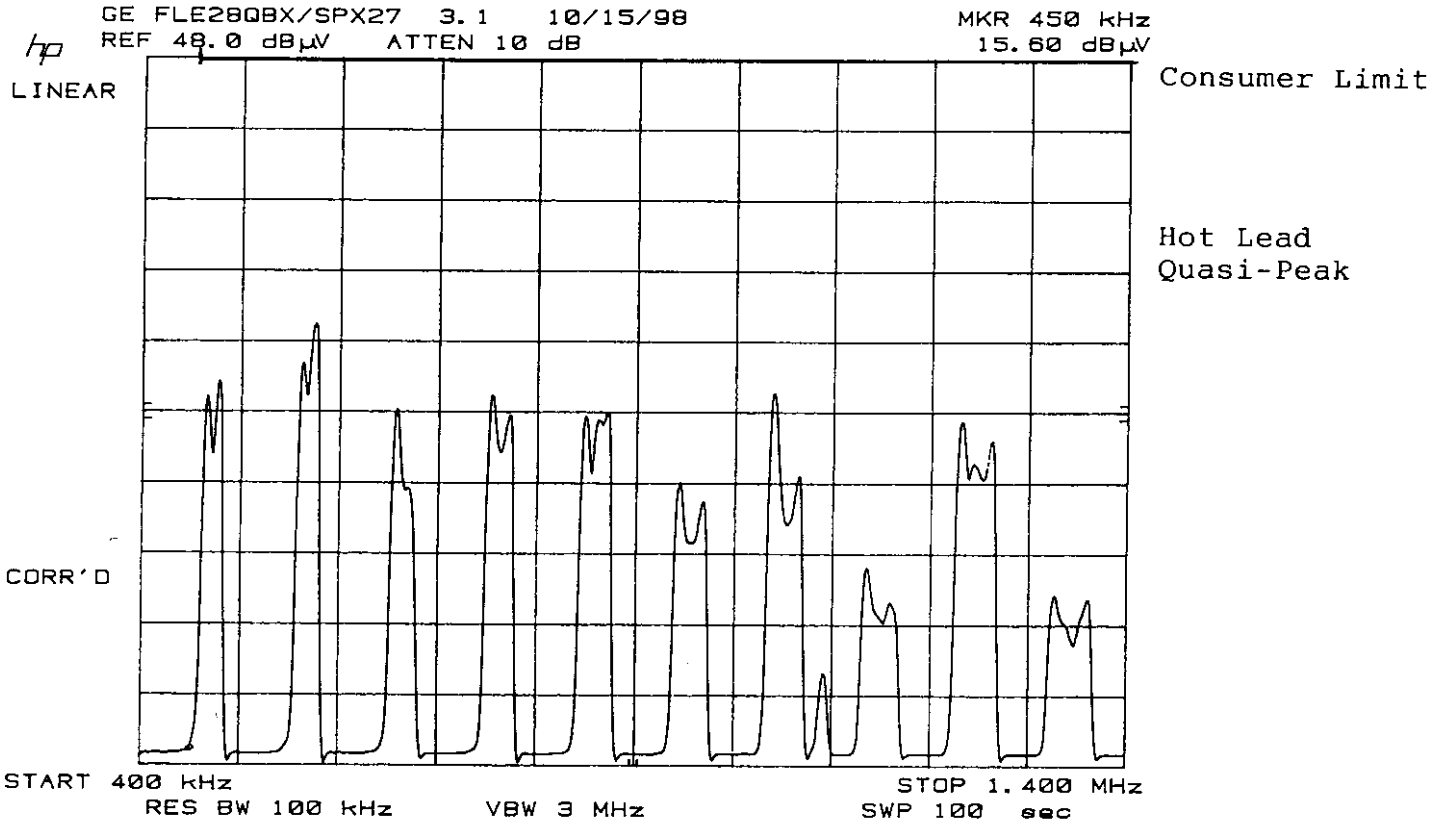


Fig. 2
CONDUCTED EMISSIONS
GE FLE28QBX/SPX27 (Rev. 3.1)
FCC ID: BLD28OLS-2
3 MHz - 30 MHz Peak



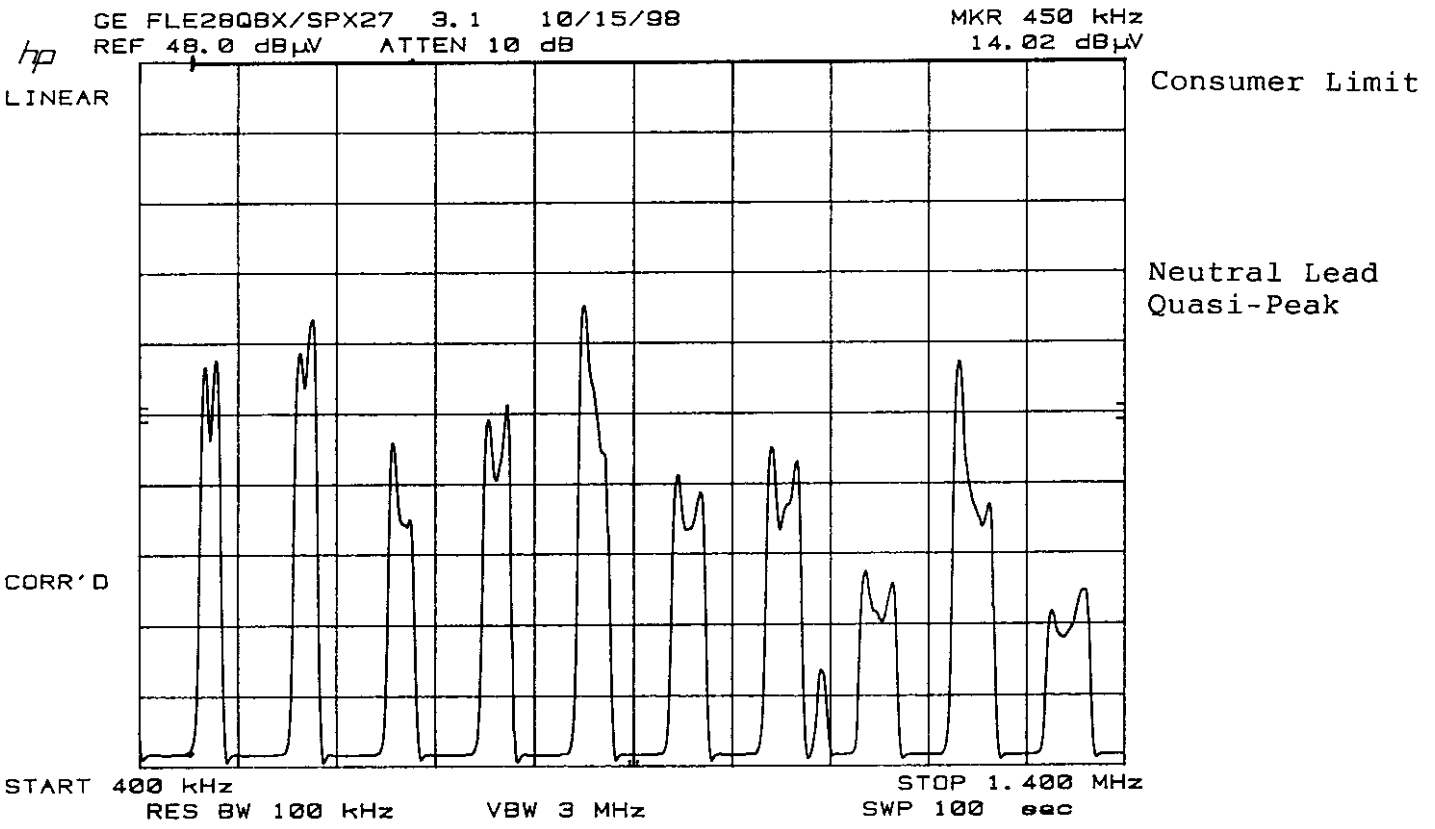
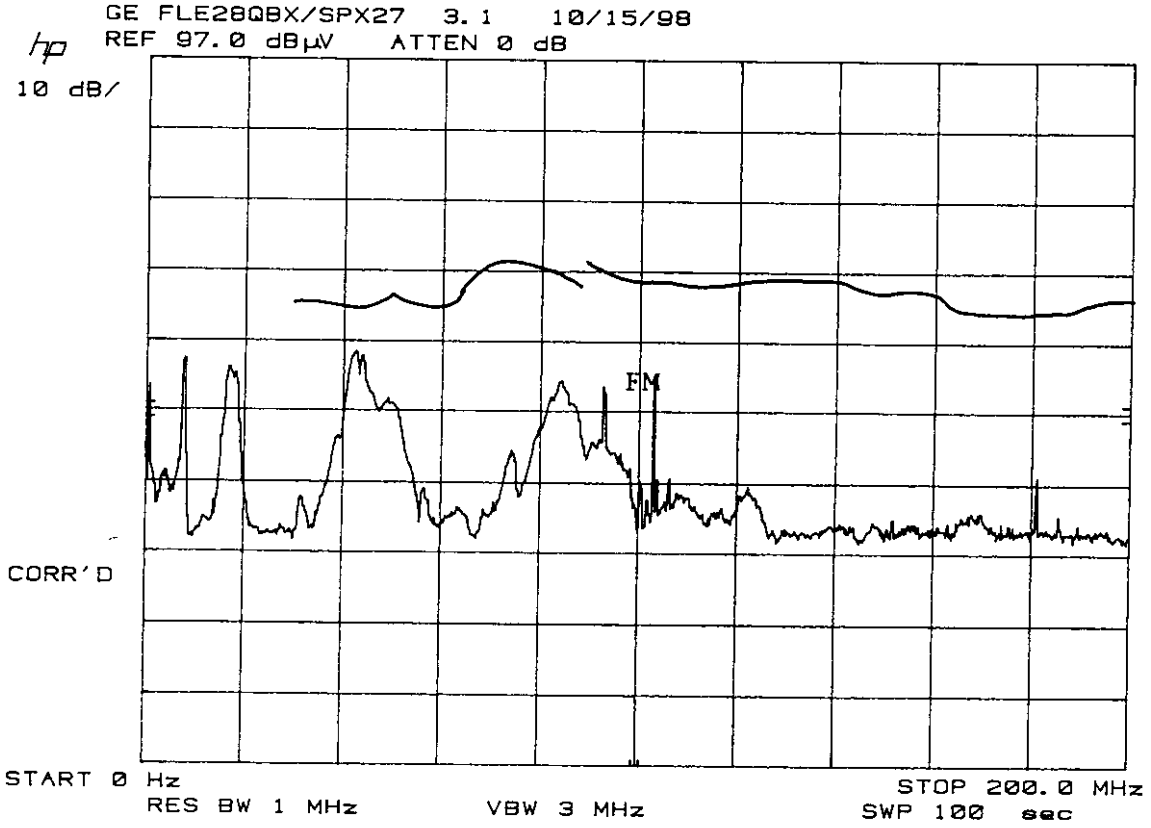


Fig. 3
CONDUCTED EMISSIONS
GE FLE28QBX/SPX27 (Rev. 3.1)
FCC ID: BLD28OLS-2
450 kHz - 1.4 MHz Quasi-Peak



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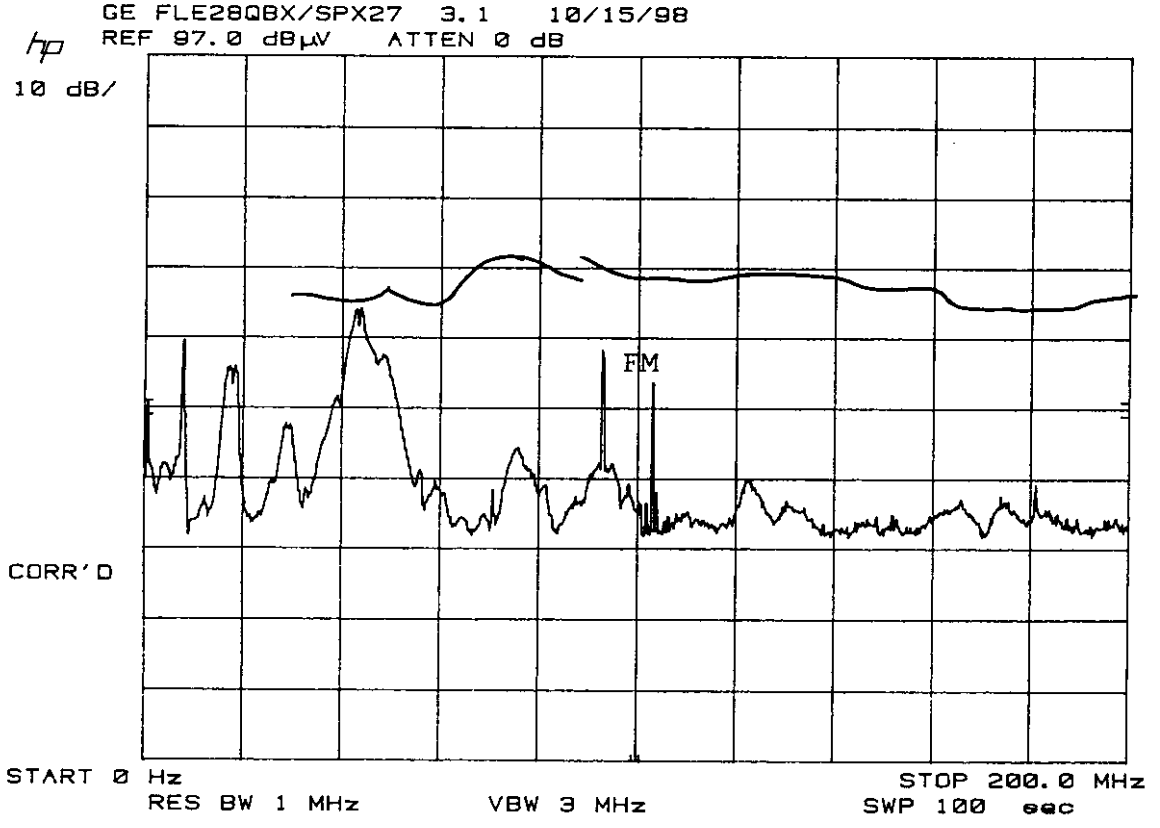

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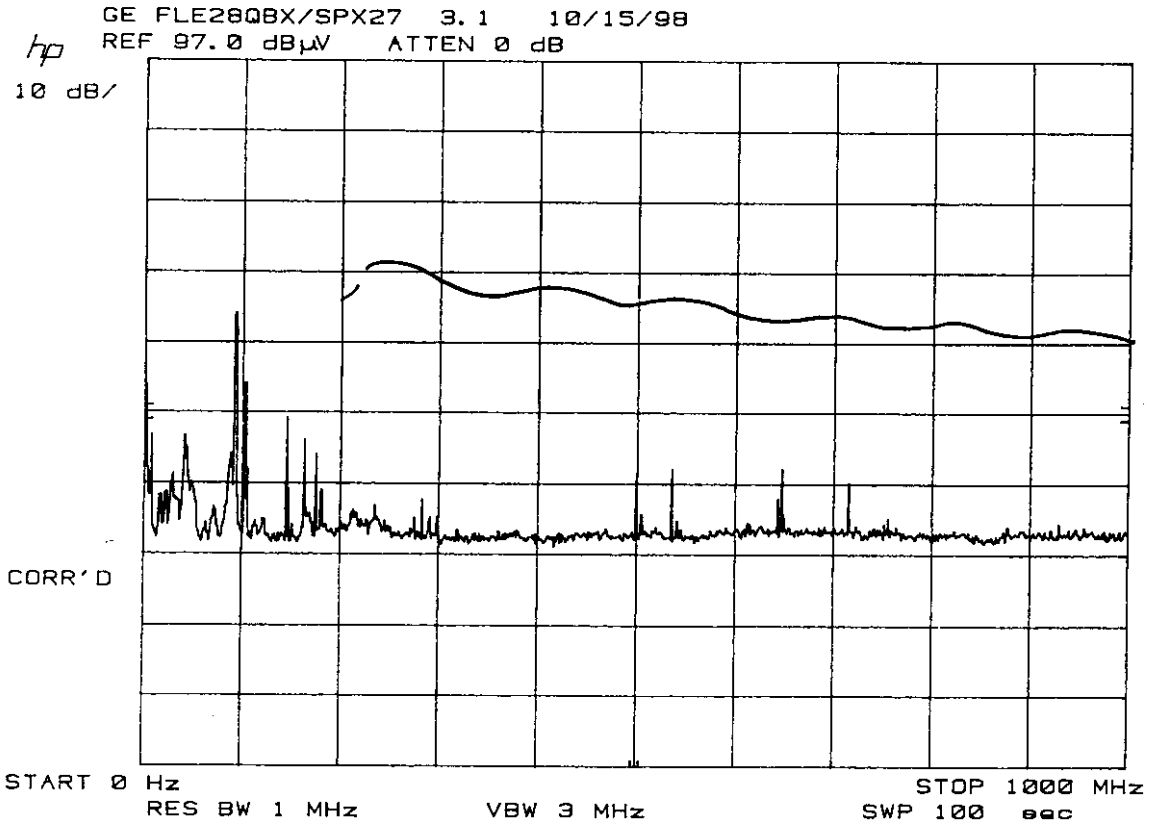
Fig. 4
RADIATED EMISSIONS
GE FLE28QBX/SPX27 (Rev. 3.1)
FCC ID: BLD28OLS-2
30 MHz - 200 MHz



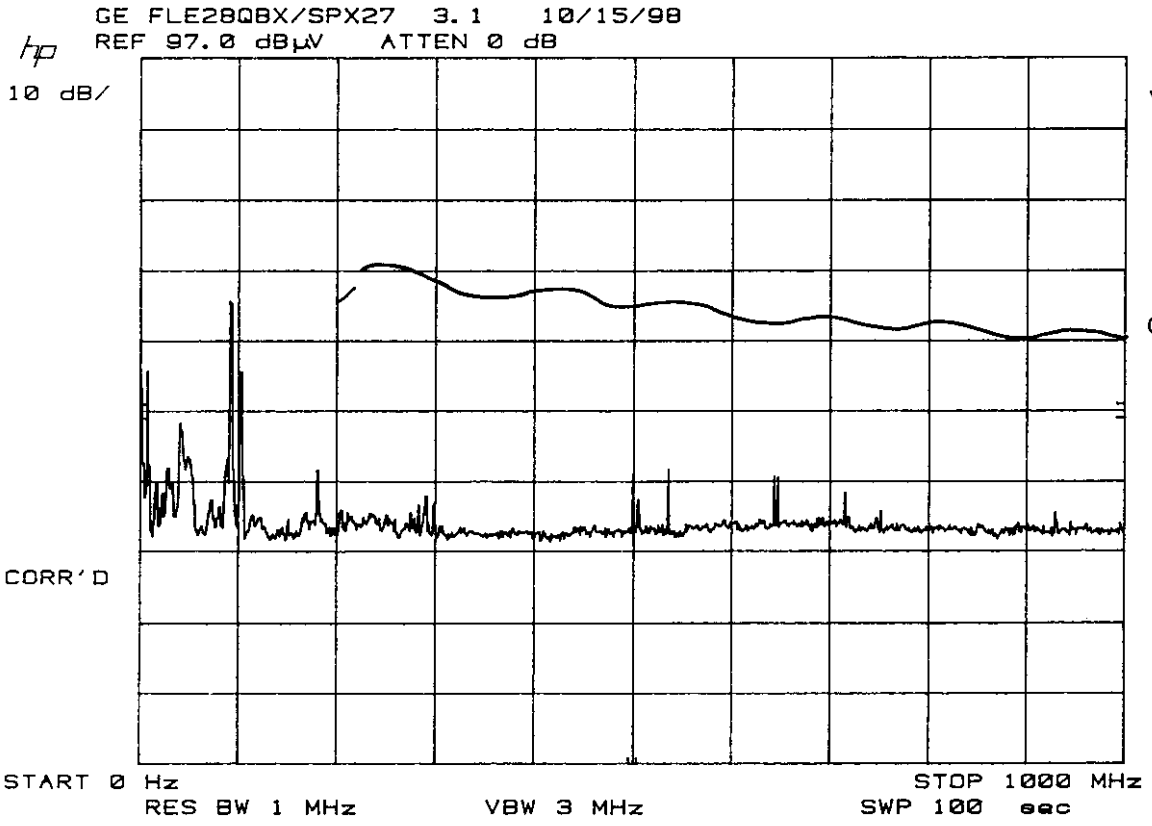


Fig. 5
RADIATED EMISSIONS
GE FLE28QBX/SPX27 (Rev. 3.1)
FCC ID: BLD28OLS-2
200 MHz - 1000 MHz

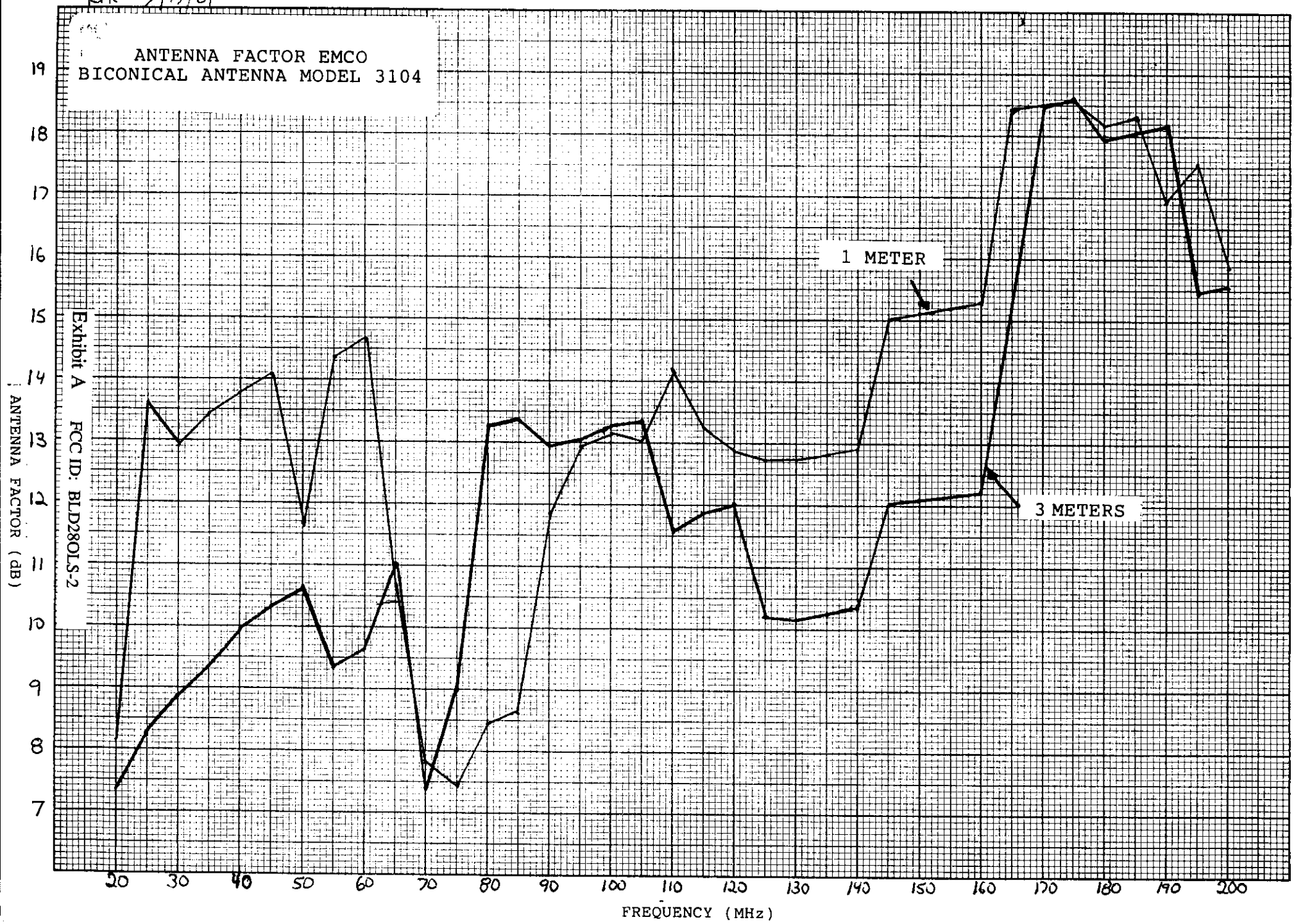
TABLE 1 OPEN FIELD TEST SUMMARY, RADIATED EMISSIONS
GENERAL ELECTRIC FLE28QBX/SPX27 Rev. 3.1
ELECTRONIC QUADRUPLE BIAX COMPACT FLUORESCENT LAMP
FCC ID; BLD280LS-2 TEST SAMPLE "ATC" OCT 19 1998
MEASUREMENT DISTANCE, 3 METERS

FREQ. MHZ	SIGNAL DBUV	ANTENNA FACTOR	COAX FACTOR	E UV/M	DB VS. FCC A	DB VS. FCC B	ANTENNA TYPE
34.0	7.0	9.3	0.2	6.7	-33.0	-23.5	BCON.V
35.8	8.0	9.4	0.3	7.7	-31.8	-22.3	BCON.V
36.0	1.0	9.5	0.3	3.4	-38.8	-29.3	BCON.H
44.5	6.0	10.3	0.3	6.7	-33.0	-23.4	BCON.H
46.5	7.0	10.4	0.3	7.7	-31.8	-22.3	BCON.V
54.0	4.0	9.6	0.3	5.0	-35.6	-26.1	BCON.V
56.0	4.0	9.4	0.3	4.9	-35.8	-26.3	BCON.H
73.0	5.5	8.4	0.4	5.1	-35.3	-25.8	BCON.V
85.0	4.0	13.4	0.4	7.7	-31.8	-22.2	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 7/17/84



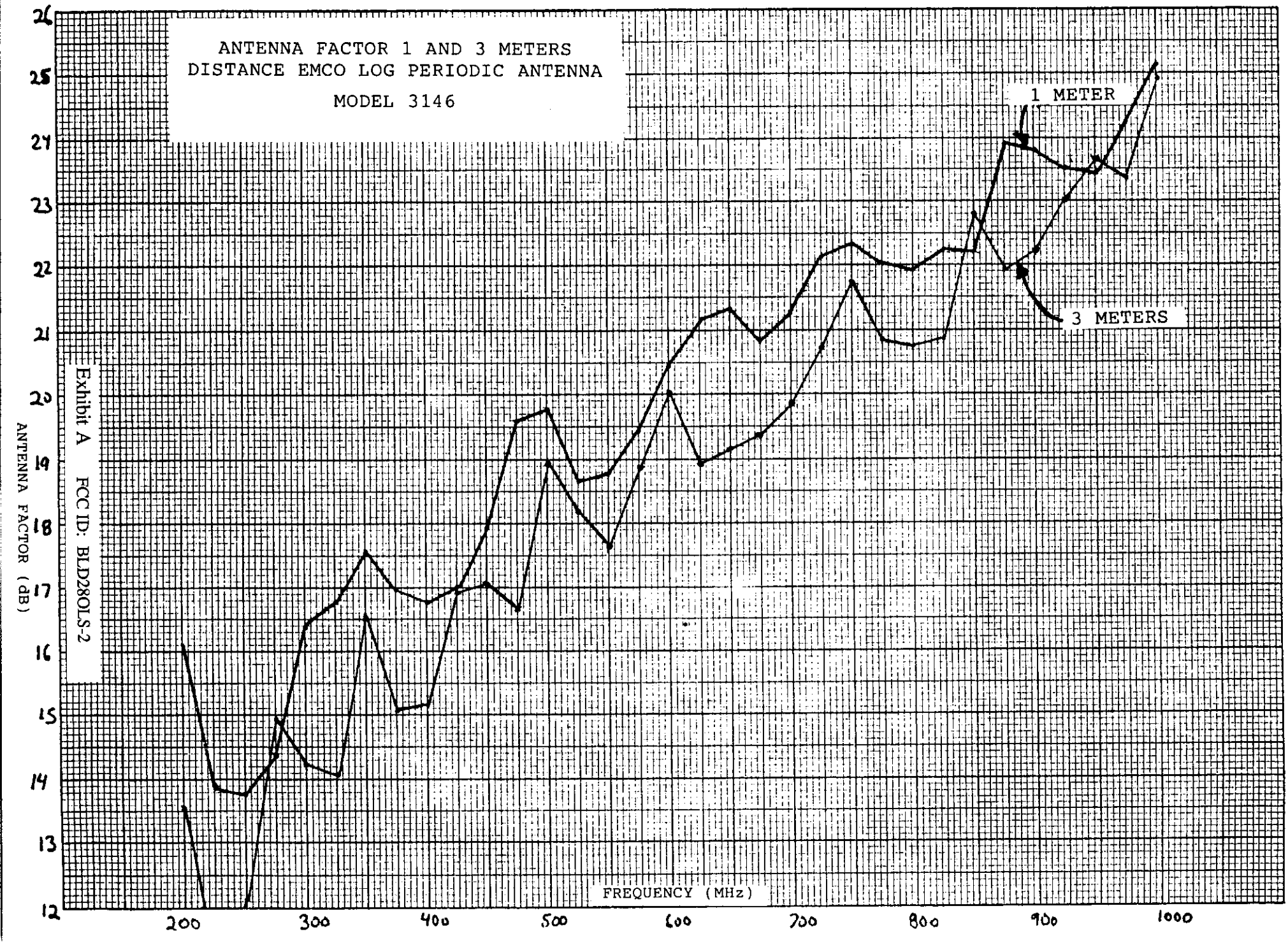
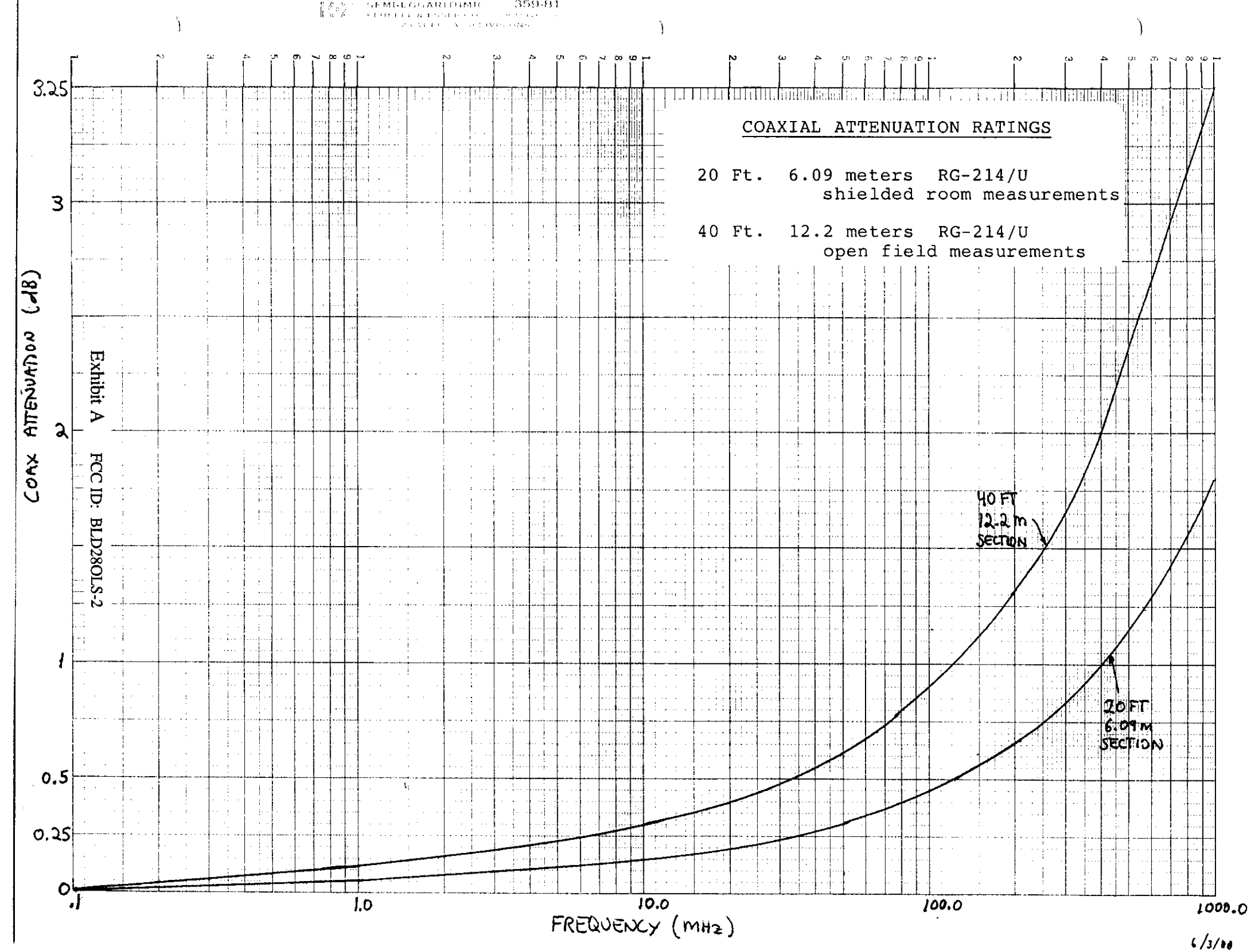


Exhibit A FCC ID: BLD28OLS-2


COAXIAL ATTENUATION RATINGS
20 Ft. 6.09 meters RG-214/U
shielded room measurements
40 Ft. 12.2 meters RG-214/U
open field measurements
40 FT
12.2 m
SECTION
20 FT
6.09 m
SECTION
COAX ATTENUATION (dB)
FREQUENCY (MHz)
3.25
3
2
1
0.5
0.25
0
.1
1.0
10.0
100.0
1000.0
Exhibit A
FCC ID: BLD28OLS-2
6/3/88