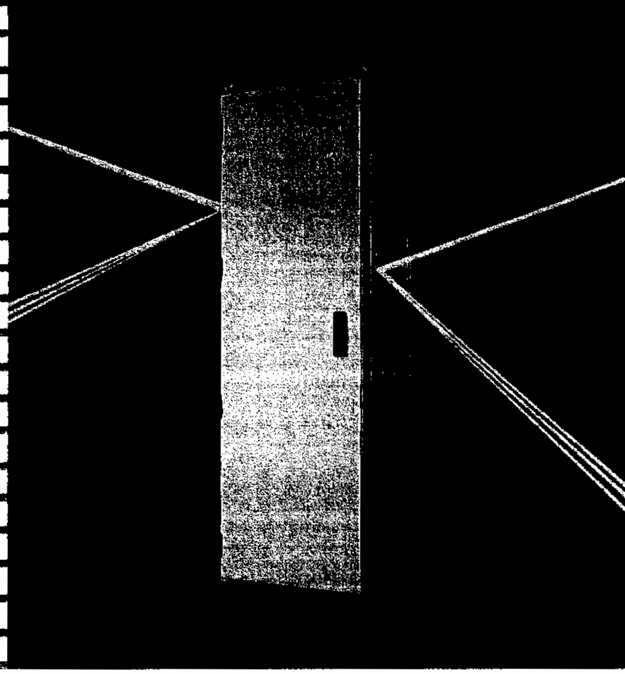
Optima High-Performance MIL-SPEC Cabinet System

For Military and Defense Environments



Designed for Your TEMPEST Applications!

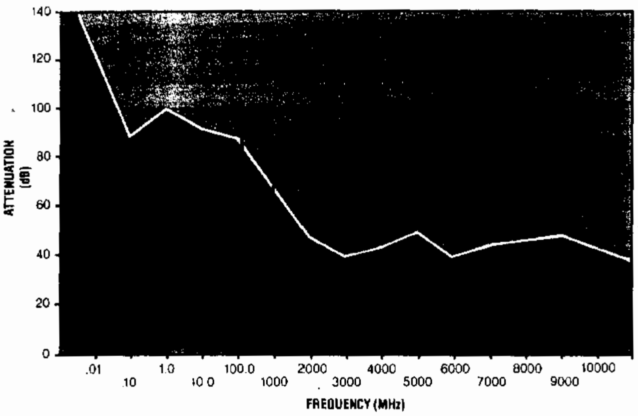
Gichner

Optima® Enclosures

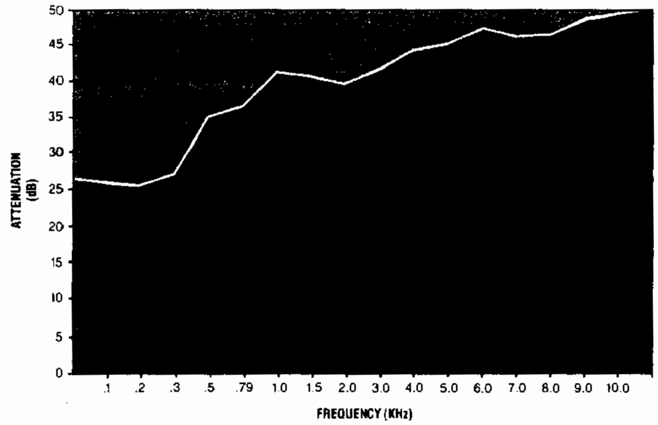
Test Results: March 1988

Independent Lab Tested at NTS. Model HD-701930, including front and rear doors, and a connector panel.

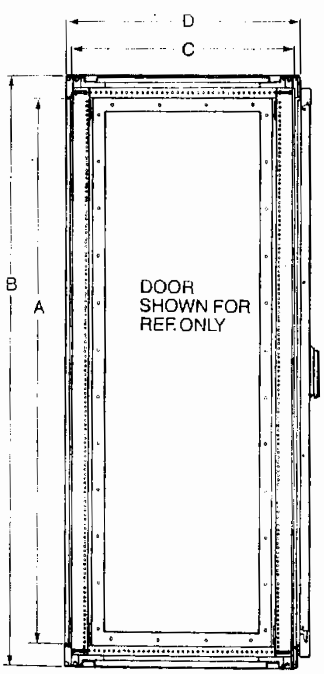
E-Field



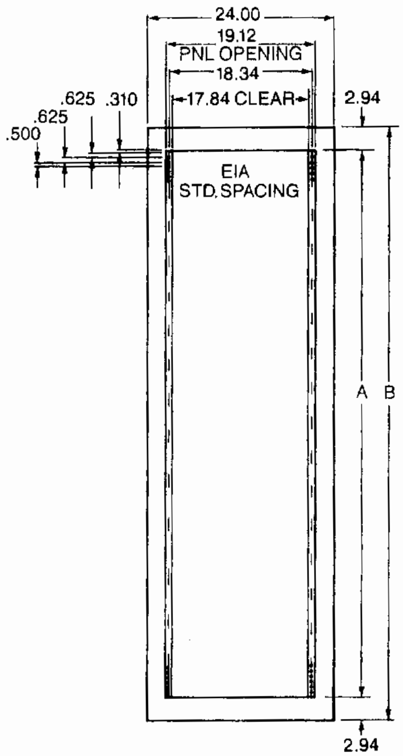
H-Field



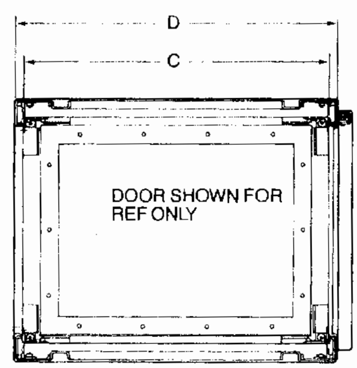
Dimensions



SIDE VIEW



FRONT VIEW



TOP VIEW

DIMENSIONS (inches)

A	B	C	D
35.12	41.00	22.50	24.00
52.62	58.50	22.50	24.00
70.12	76.00	22.50	24.00
35.12	41.00	28.50	30.00
52.62	58.50	28.50	30.00
70.12	76.00	28.50	30.00
35.12	41.00	34.50	36.00
52.62	58.50	34.50	36.00
70.12	76.00	34.50	36.00

The Optima MIL-SPEC Cabinet System

Simply, the MIL-SPEC Cabinet System is a self-contained environment for housing and protecting sensitive electronic equipment against the hazards of particular hostile environments. However, there are important differences between this system and others.

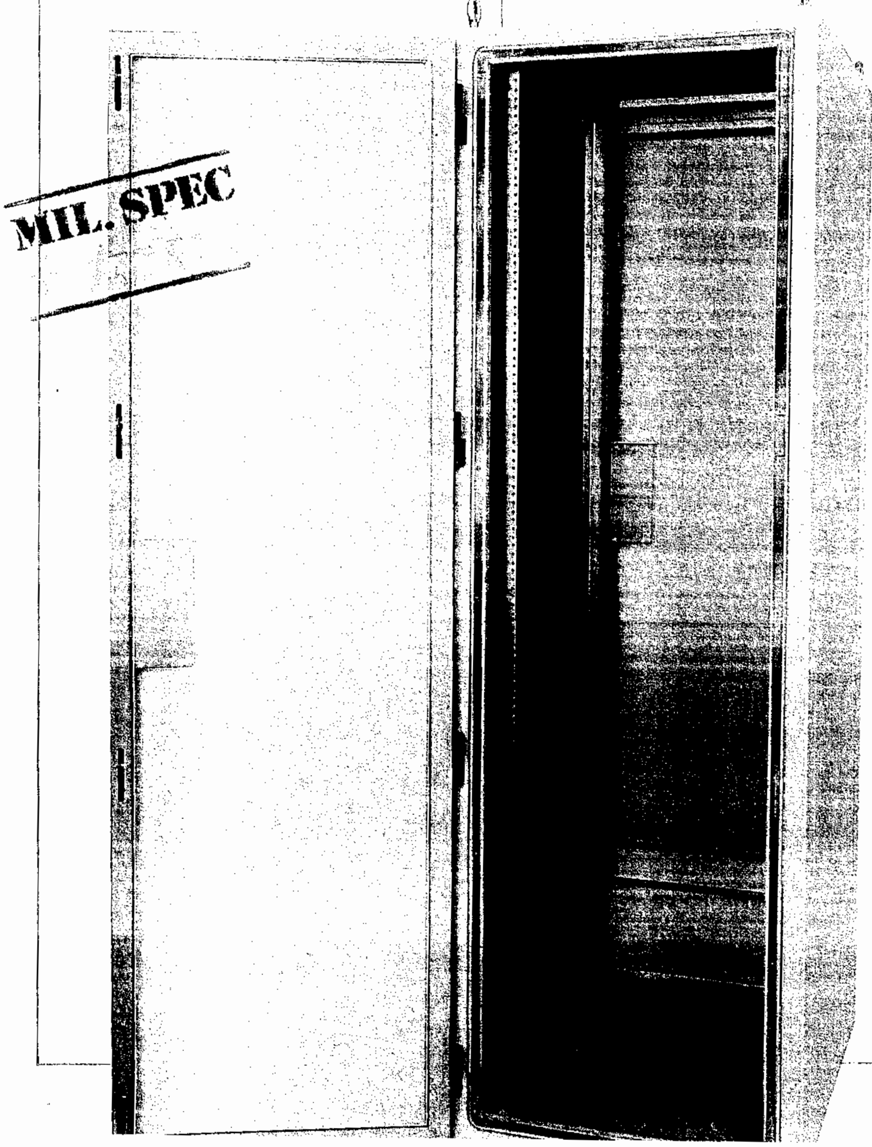
Frame design — structured for strength

Beyond the Cabinet System's all-welded 12 gauge steel frame construction, is a feature that offers packaging engineers for military systems a new, higher level of performance and integrity.

Universal recess adjustment feature for variable panel mounting rail depths.

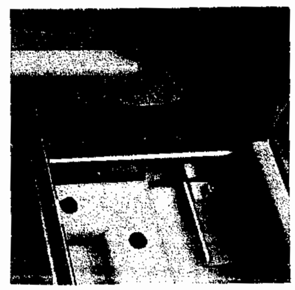
Structural integrity of all-welded 12 gauge steel frame is supplemented with concealed screws and cage nuts.

Eight, 3-dimensional support braces, one at each corner intersection, provide added resistance to demanding compressive and torsional loads present under many system applications. For further security, the optional crane lifting eyes are mounted directly through the top corner support braces. The 12 ga. steel braces are universal in design, and are present in all cabinet sizes and configurations.



Flexibility through modular design

The Optima MIL-SPEC Cabinet System and its unique modular construction design, can adapt to the equipment-mounting and protection needs of virtually any electronic system. It can accommodate unique customer specifications, such as shielding, shock and vibration, mobility, cooling with shielded air-vent panels, chassis mounting and input/output provisions. Cost-efficiently.



3-dimensional steel support braces at each corner intersection provide added resistance to compressive and torsional loads.

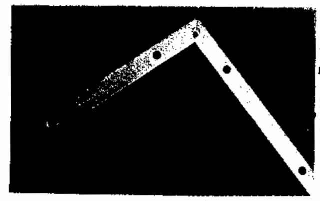
Using the latest CAD technology, Optima's design and development team has engineered the MIL-SPEC Cabinet System for applications requiring any combination of Tempest, EMP or EMI/RFI shielded environment. To do this Optima first evaluated a broad list of military standards for EMI/RFI shielding, quality control and structural integrity (see back page.)

Cooling system options are available to meet system requirements.

Flexibility features

- For crane lifting — lifting eyes
- For mobility — casters
- For floor mounting — bolt down through corner braces
- Adjustable panel mounting rails
- Fork lift provisions
- Screening against EMI/RFI
- Input/output provision
- Cooling and ventilation
- Multi-bay arrangement
- Shielded plexiglas doors or windows

Performance Features: The Optima MIL-SPEC Cabinet System



Shielded honeycomb air vent panels are optional.

Frame: *(12 ga. CRS) all-welded construction.*

Crane lifting eyes: *(forged steel) are mounted through the top corner support braces, and are capable of supporting 1,000 lbs. weight each, (safe working load).*

3-dimensional support braces: *(12 ga. steel) at each corner intersection, provide added resistance to demanding compressive and torsional loads present under many military applications.*

Top and Side Panels: *(16 ga. CRS) are attached to framework by concealed screws and cage nuts.*

EMI/RFI suppression *is achieved with tin-coated, copper-clad steel wire mesh knitted over a double silicon elastomer core. This gasket system provides excellent resilience, conductivity and compression characteristics to ensure electromagnetic compatibility in a hostile environment.*

Panel mounting rails: *(12 ga. CRS) are fully adjustable on the front-rear plane; punched and tapped in accordance with EIA-STD-RS 310C for 10-32 hardware.*

Panel mounting rail supports: *(12 ga. CRS.) are secured to the frame corner support brace. Punched and tapped # 1/4-20 hardware on 1.00" centers to provide universal adjustment.*

Front and rear doors: *are surface-mounted and may be provided with vents and honeycomb filters, dust arrestors or both.*

Single-handed, 4-point latching system *features hardened steel needle bearings and nylon rollers which reduce physical effort needed to achieve controlled compression of shielding gasket.*

Door hinge: *heavy-duty, zinc die-cast with 1/4" diameter stainless steel pivot pins, provides 180 degree opening for unrestricted access and lift off door provision.*

Input/output panels *are traditionally recognized to be a custom requirement. Here Optima offers the flexibility in design to provide effective cable-routing to specific customer requirements.*

Removable bottom panel: *is suitable for power supply mounting or other heavy-duty application.*

Base: *(12 ga. CRS) provides stability in heavy-duty applications where floor or caster mounting is required.*

Retractable stabilizer: *(2" x 1" CRS hollow tubing) allows heavy-duty slide mounted chassis to be extended without the possibility of overturning the cabinet.*

Casters: *are available with a wide variety of load capacities, ranging from 840 lbs. to 3,000 lbs.*

Gichner and Optima: A Merger of Experience and Engineering.

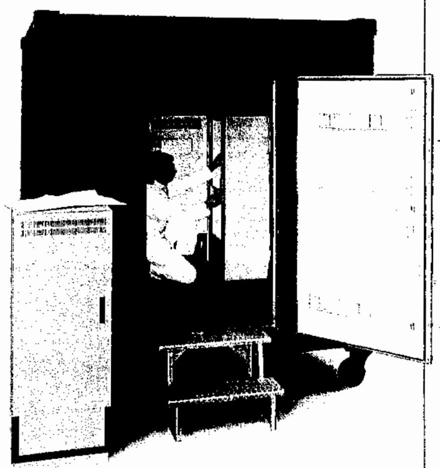
Take the foremost manufacturer in transportable, military electronic enclosures and team it up with a leading name in quality-engineered, commercial electronic enclosures. That's Gichner/Optima Enclosures. Two names that have over 40 years of combined experience in the electronic enclosure field. And the advanced engineering skills to prove it.

Gichner. A World Leader In Military Enclosure Systems.

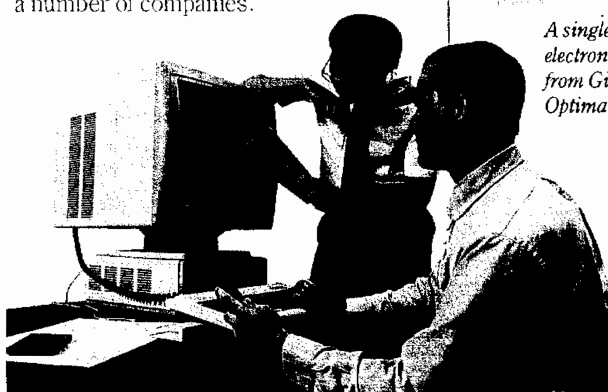
Gichner Shelter Systems designs and manufactures rugged, yet lightweight, mobile structures that are used by every branch of the Armed Forces and our NATO Allies. Gichner is also just as expert at integrating these structures with everything needed to install the most advanced electronic systems. It's customers include prime contractors such as IBM, Raytheon, Westinghouse, Ford Aerospace and GTE as well as the DoD. Since 1967, the company has built more than 25,000 such structures, far more than any other manufacturer.

Optima Enclosures. A Leading Name in Electronic Cabinets.

Optima has been making enclosures for some of the most respected companies in every part of the electronics market since 1962. The company has earned wide recognition for quality-engineered, heavy-duty vertical cabinets, electronic desk systems and instrument cases in both standard and modified/custom configurations. Further, Optima enjoys special "preferred vendor" status with a number of companies.



A single source for EMI/RFI shielded electronic enclosures of every size, from Gichner Mobile Shelters to Optima Heavy-duty Cabinets.

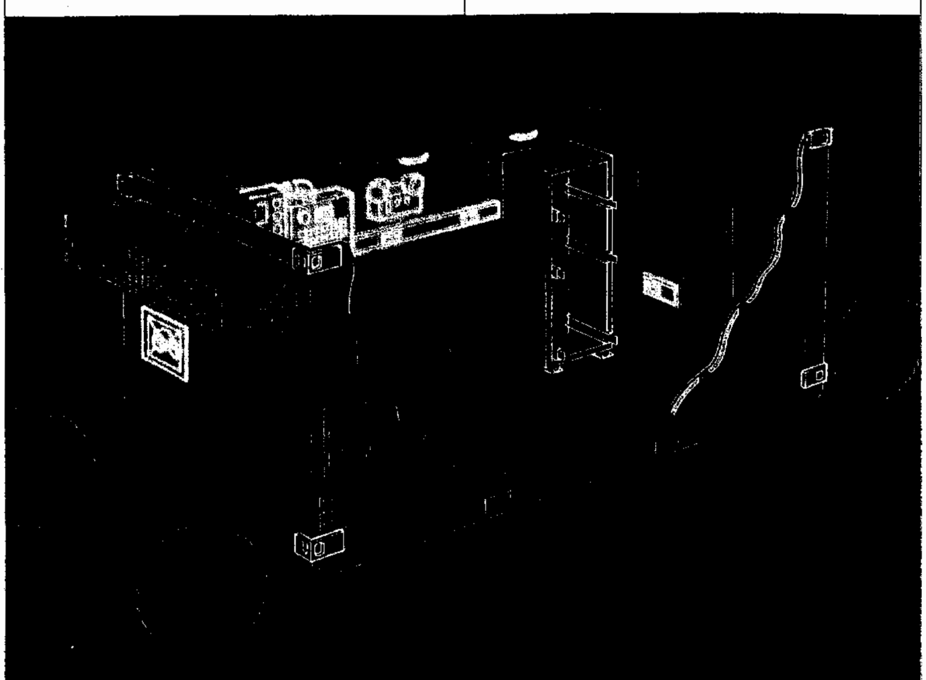


Optima's responsive in-house engineering support includes a state-of-the-art CAD system.

Engineering Support for Meeting the Toughest MIL Standards

As specialists in EMI/RFI shielded enclosures, as well as those designed to meet other MIL-Standards, Optima is well equipped to offer a sophisticated level of engineering support to their customer's own design teams. In fact, we offer a complete capability, from problem-solving concepts and prototypes to the final production, working closely and cooperatively with customers each step of the way.

For innovative solutions to your exacting requirements, call on Optima for reliable support services, including assistance with packaging selection, design and modification, quality certification, layout drawings, and contract testing.



Gichner's unique ability to both build and integrate shelter subsystems.

COPY NO. 4

SHIELDING EFFECTIVENESS TESTING OF THE OPTIMA TEMPEST RACK

ISSUE : 1 SEPTEMBER 1985

REPORT NO. 173117/1

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Report on

SHIELDING EFFECTIVENESS TESTING OF THE OPTIMA TEMPEST RACK

ISSUE : 1 SEPTEMBER 1985

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APPROVED BY : ...James Wood........ J. V. WOOD
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MANAGER

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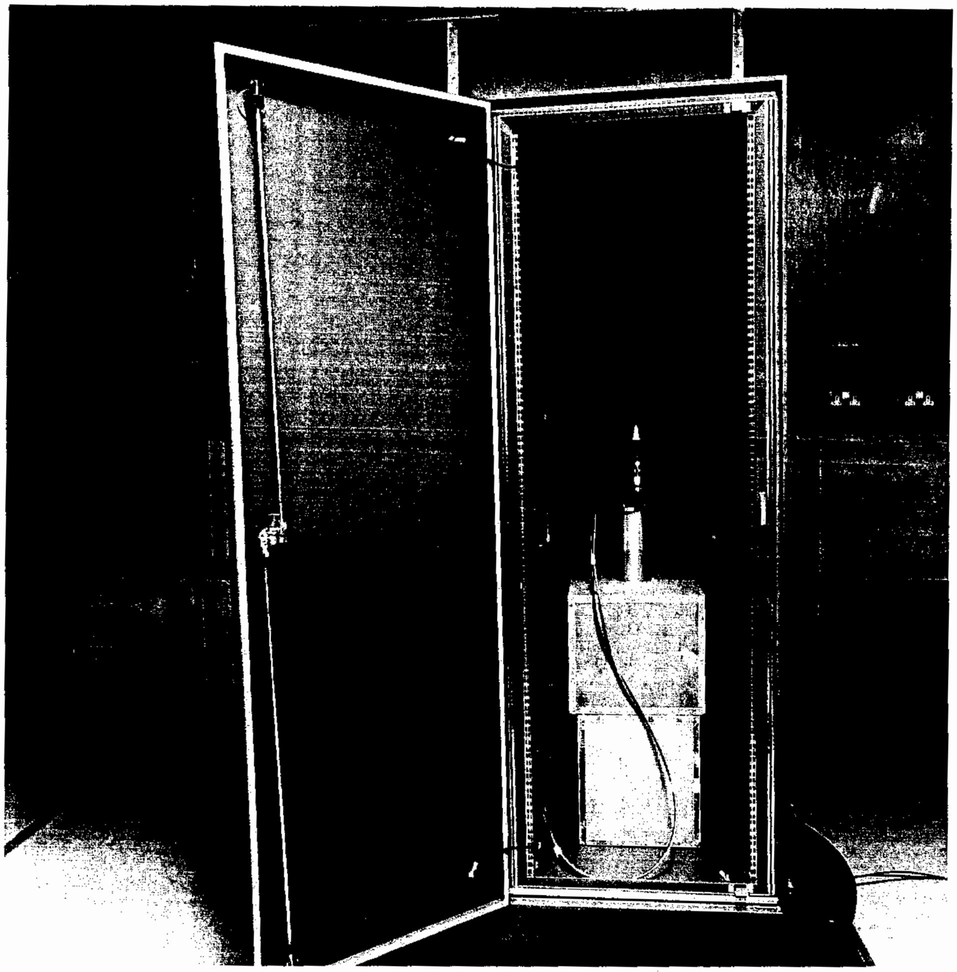

PHOTOGRAPH OF SIMILAR TEST SET-UP (STANDARD RACK)

(NEGATIVE NO. TA927/4)

1.1 STATUS

1.1.1	MANUFACTURING DESCRIPTION :	TEMPEST Rack.
1.1.2	OBJECTIVE :	(i) To perform Electric Field Shielding Effectiveness Tests over the frequency range 20MHz to 18GHz (ii) To perform Magnetic Field Shielding Effectiveness Tests over the frequency range 20Hz to 50kHz.
1.1.3	MANUFACTURER :	Optima
1.1.4	MANUFACTURERS TYPE OR MODEL NUMBER :	R35UX900
1.1.5	SERIAL NUMBER :	85001
1.1.6	DRAWING NUMBER : ISSUE : DATE :	Not Available Not Applicable Not Applicable
1.1.7	TEST SPECIFICATION NUMBER : ISSUE : DATE :	Not Applicable Not Applicable Not Applicable
1.1.8	PAS REGISTRATION NUMBER :	0040
1.1.9	QUANTITY OF ITEMS TESTED :	One
1.1.10	SECURITY CLASSIFICATION OF ITEM :	Unclassified
1.1.11	INCOMING RELEASE : DATE :	Not Formally Released Not Applicable
1.1.12	DISPOSAL : REFERENCE : DATE :	Packing Note 09533 5.8.85
1.1.13	ORDER NUMBER : DATE :	15730 26.6.85
1.1.14	START OF TEST :	15.7.85
1.1.15	FINISH OF TEST :	26.7.85

Titchfield, Fareham, Hampshire, PO14 4QA

1.2 TEST OBSERVATIONS

During testing it was observed that the cabinet offered no attenuation to magnetic fields below 200Hz.

This attenuation factor improved as the test frequency was increased but the attenuation offered by the door seams were consistently poor over the complete frequency range of test, e.g. 10Hz - 50kHz.

With regard to E-field shielding effectiveness tests it was found that the 'worst case' area was the side termed 'side 1', figure 2.1.2 page 2.4 refers.

It was observed that the attenuation of the cabinet to E-fields varied on average between 50 and 75dB over the frequency range 20MHz - 18GHz. Between 30 and 50MHz, the results showed a deviation from the average to give a suggested figure of 115dBs. Figures 2.3.22 and 2.3.23 illustrate this.

The fall off rate appertaining to the attenuation afforded by the cabinet to an Electromagnetic Pulse (EMP) was found to be approximately 50dB/decade. Figure 2.3.24 refers.

1.3 CONCLUSIONS AND RECOMMENDATIONS

It can be concluded that, as a stand alone unit, the cabinet offers reasonable attenuation with respect to E-fields. Conversely, it can be further concluded, that the attenuation offered by the cabinet to magnetic fields in the area of the door seams is poor. Other areas of the cabinet show an improved attenuation factor with respect to magnetic fields with the exception of fields generated below 200Hz.

It is recommended that the door seals are reviewed if the attenuation they offer to magnetic fields is considered unsatisfactory. However, remedial action necessary to overcome this problem may prove impractical.

2.1 TEST CONDITIONS AND TEST MEHTODS

2.1.1 Test Conditions

E-field Shielding Effectiveness Tests were carried out within the confines of a screened enclosure. Measurements were made, over the frequency range 20MHz to 18GHz, via a fibre-optic link coupled to a power meter. The transmitter associated with the fibre-optic link was mounted on a wooden platform at a mid-point within the cabinet under test. A suitable E-field antenna was connected to the transmitter. The cabinet was mounted on a rotating wooden platform and the area of the cabinet which afforded the least attenuation was determined. All E-field tests were carried out with the cabinet in this position. Figure 2.1.1, page 2.3 refers.

Magnetic Field Shielding Effectiveness Tests were performed outside the screened enclosure. The test set-up employed was as for E-field tests except that the E-field antenna connected to the fibre-optic transmitter was replaced by a magnetic loop antenna and a spectrum analyzer replaced the power meter. The transmitting magnetic loop was positioned at discreet points, as numerically indicated in figure 2.1.2, page 2.4.

2.1.2 Test Methods

Using the test set ups shown in Figures 2.4.1 and 2.4.2 initial runs were made to set a field strength that could be adequately measured inside the cabinet. The cabinet was then rotated to determine the worst point and the field strengths recorded. The same conditions were maintained, except that the cabinet was removed, and the field strengths with no cabinet present recorded, these have been referred to as the reference on the graphical results.

The difference between these two results being the attenuation afforded by the cabinet.

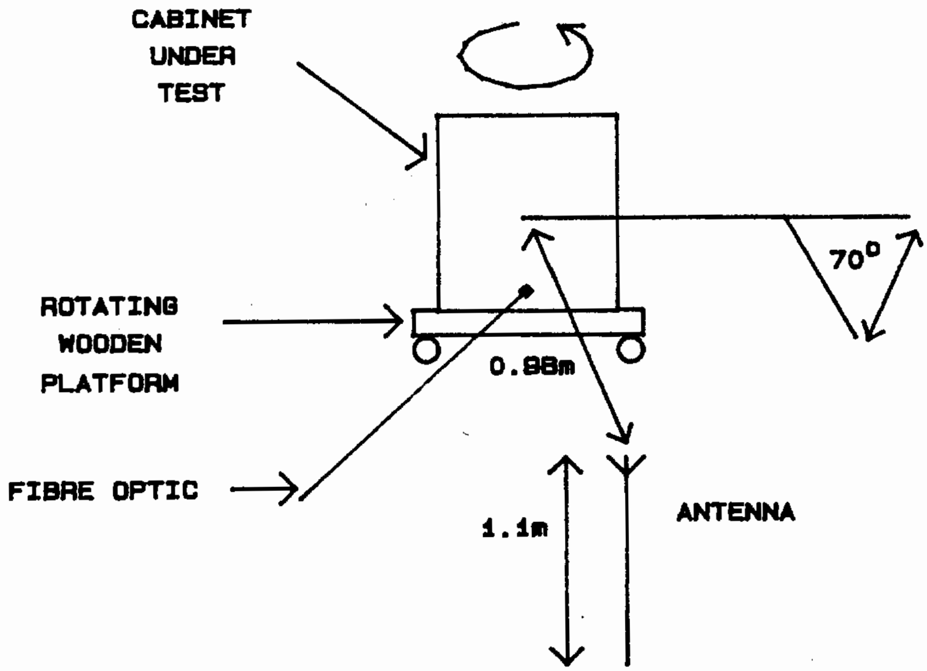

FIGURE 2.1.1. E-FIELD SHIELDING EFFECTIVENESS TEST SET-UP WITHIN THE SCREENED ENCLOSURE

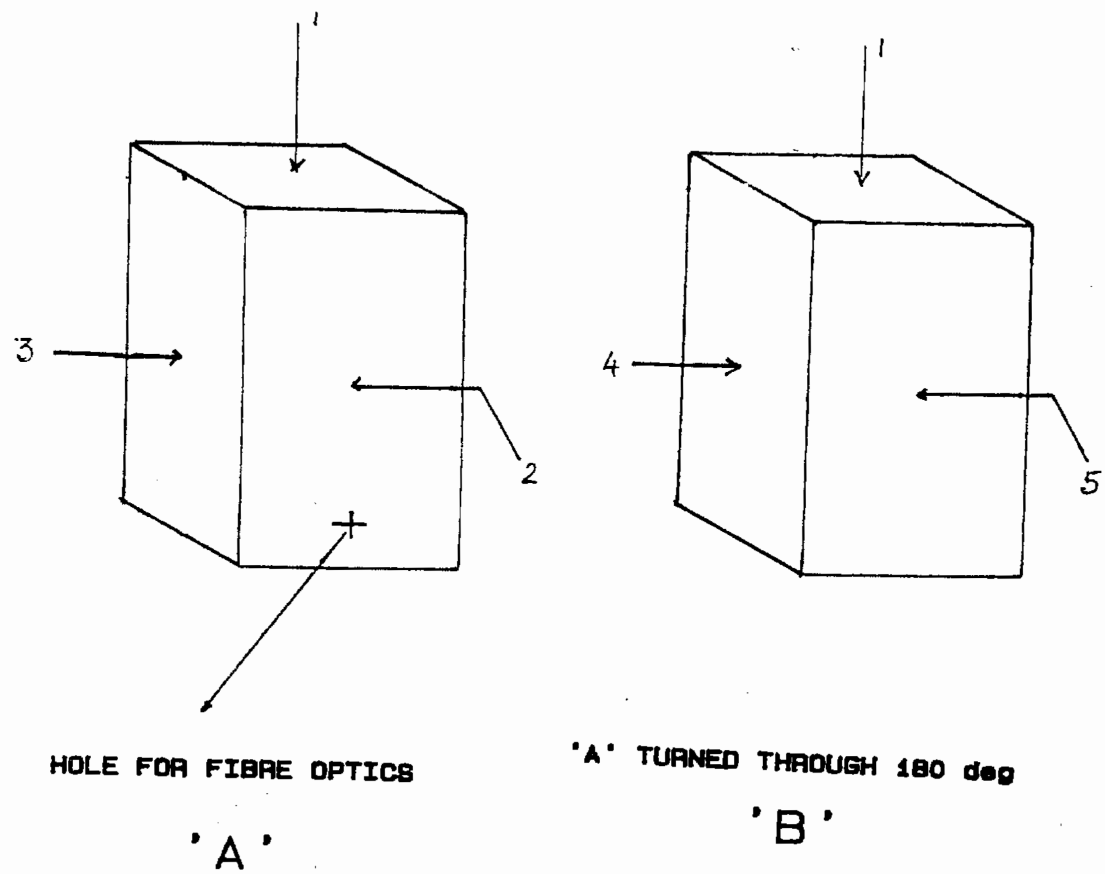

FIGURE 2.1.2 POINTS AT WHICH TRANSMITTING MAGNETIC LOOP WAS PLACED.

KEY

1 = Top of Cabinet
2 = Side
3 = Door
4 = Door
5 = Side

2.2 TECHNICAL DESCRIPTION AND EUT OPERATING MODES

The equipment under test was a screened cabinet designed to minimise the electromagnetic interference contribution of equipments housed within it.

The cabinet was tested as a stand alone unit.

2.3 RESULTS

The results are graphically presented in Figures 2.3.1 to 2.3.24

Figure 2.3.1 to 2.3.10 show the magnetic field detected within the cabinet for a given externally generated magnetic field as illustrated. This external field was introduced at various points on the cabinet; the figure sub-titles refer. Figure 2.3.1 shows the results for all sides over the frequency range 20Hz to 600Hz as no difference between sides could be detected.

Figures 2.3.11 to 2.3.19 present the resultant attenuation of the cabinet to a magnetic field at these points.

Figure 2.3.20 and 2.3.21 show the E-field detected within the cabinet for a given externally generated field, as illustrated.

Figures 2.3.22 and 2.3.23 present the resultant attenuation of the cabinet to this E-field.

In instances where the attenuation offered by the cabinet has precluded the measurement of a field within it, the minimum discernable signal (MDS) of the measurement system has been presented.

Figure 2.3.24 shows the predicted field inside the cabinet due to an electromagnetic pulse of 50kV/m peak voltage, 50nS time to peak and a 1uS return to zero.

This prediction has been based on the calculated E-field results due to an EMP. These calculated E-field results were obtained by performing a Fourier Transform of the Time Domain equation for an EMP:-

$$E(t) = Eo\ (e^{-\alpha t} - e^{-\beta t})$$

which gives :-

$$E(w) = \int E(t) e^{-2wt} dt$$

The frequency range of the prediction was limited to 10kHz to 100MHz, as above 100MHz the energy content becomes insignificant. Only the E-field is considered as far field conditions apply. Where the E-field attenuation measurements where impractical, i.e. below 20MHz the characteristics where extrapolated to give the results shown in Figure 2.3.22. The results presented were obtained by subtracting the measured attenuation of the cabinet from the predicted E-field.

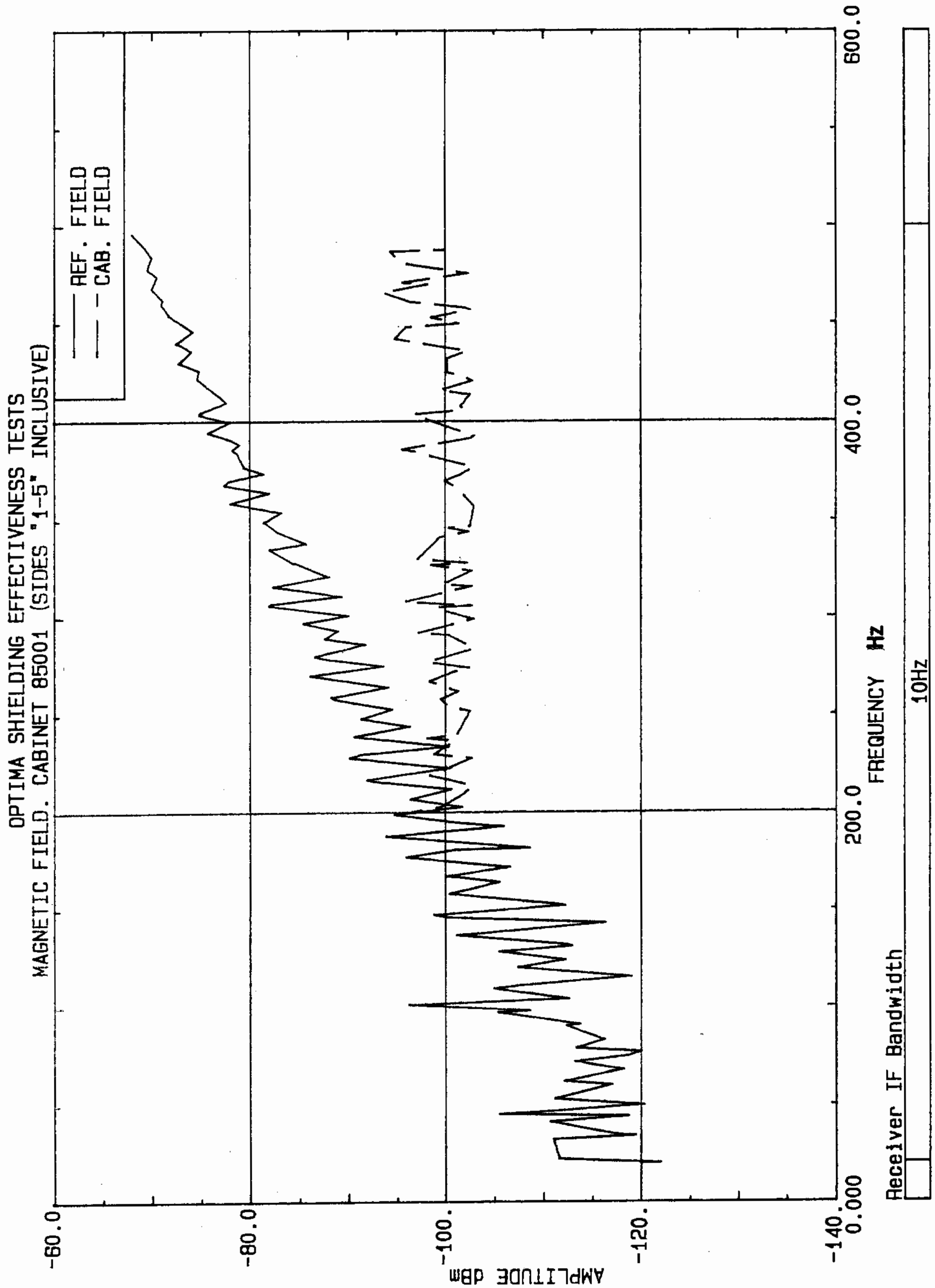

Figure No 2.3.1

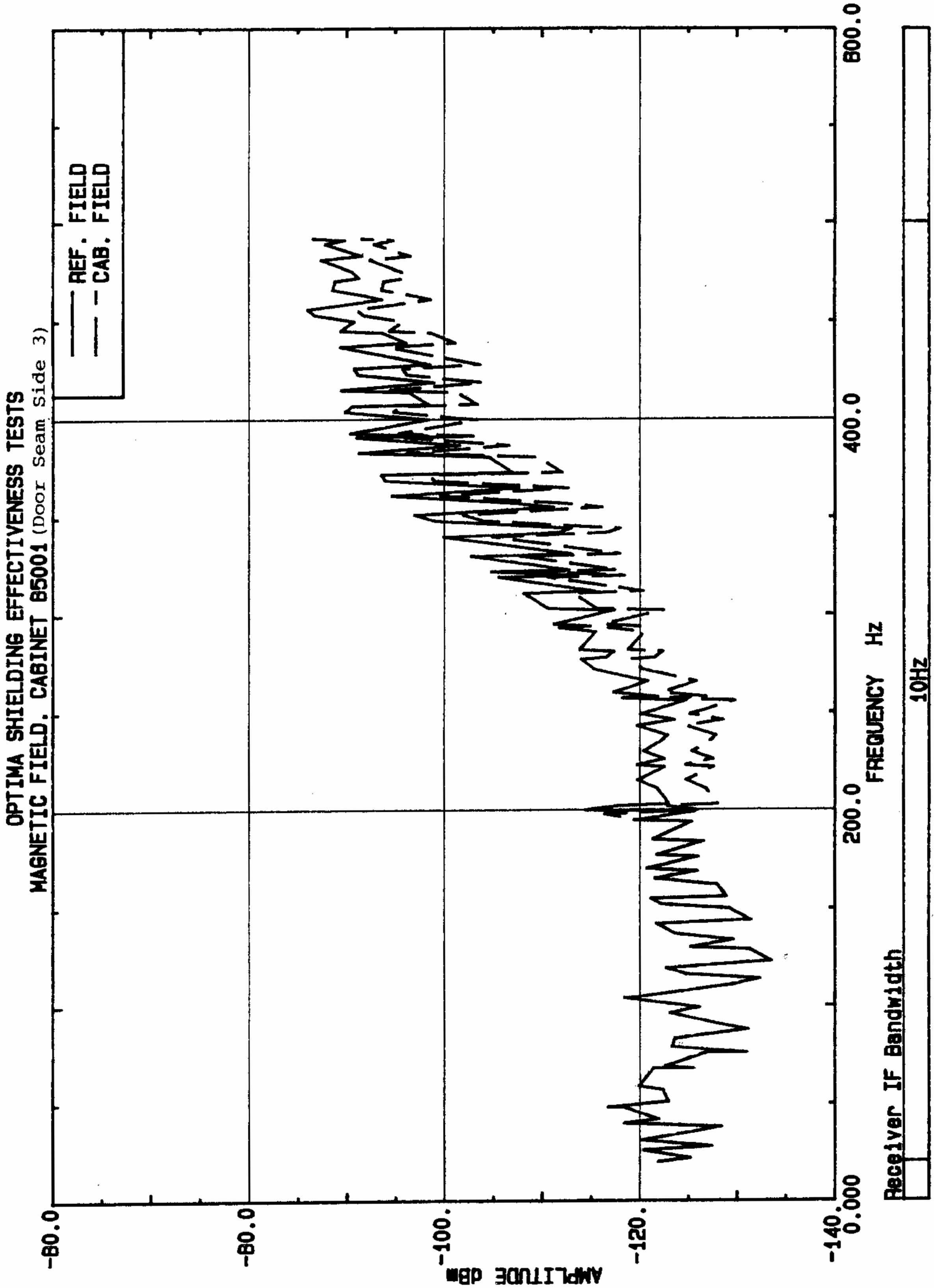

Figure No. 2.3.2

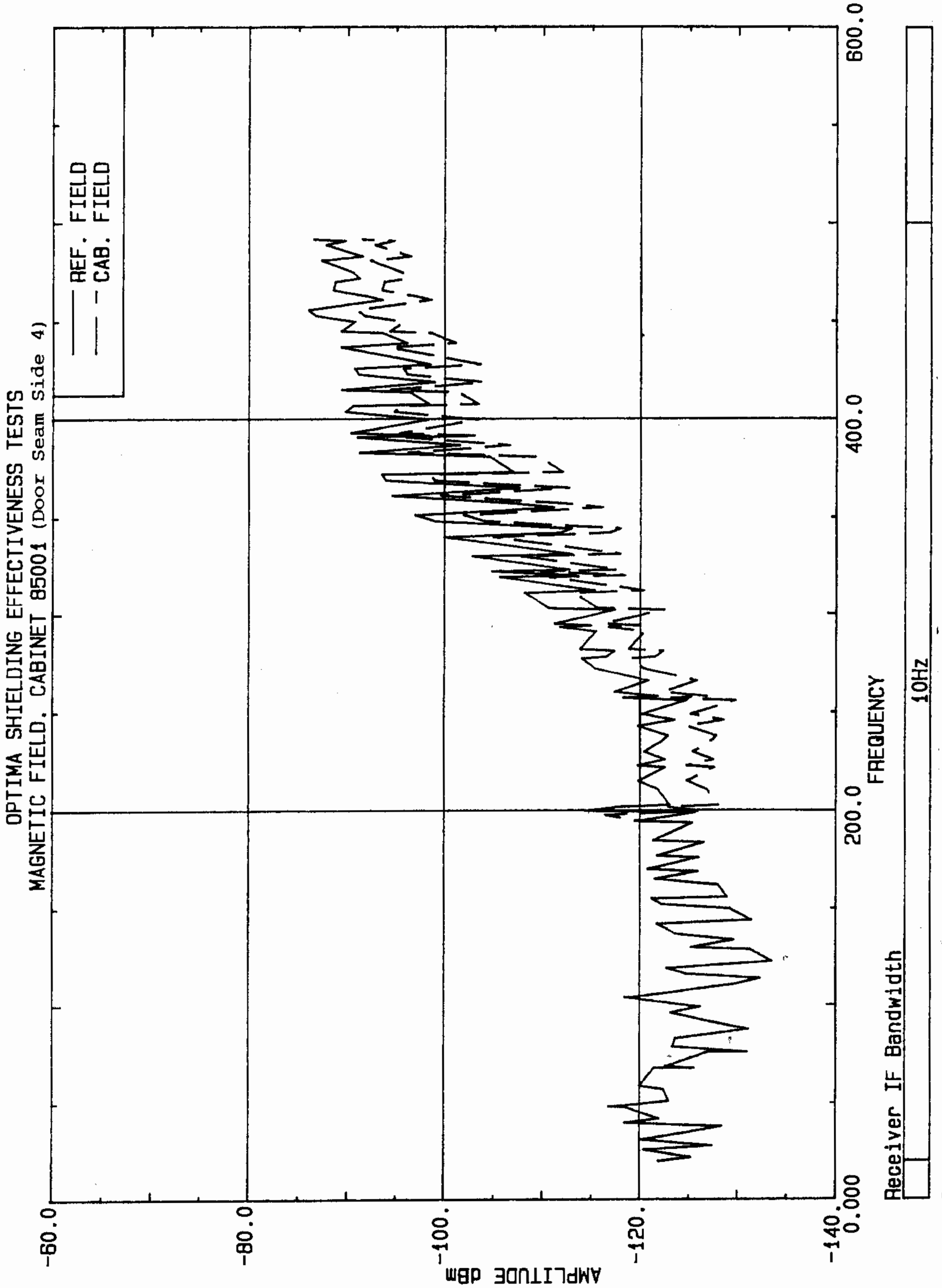

Figure No. 2.3.3

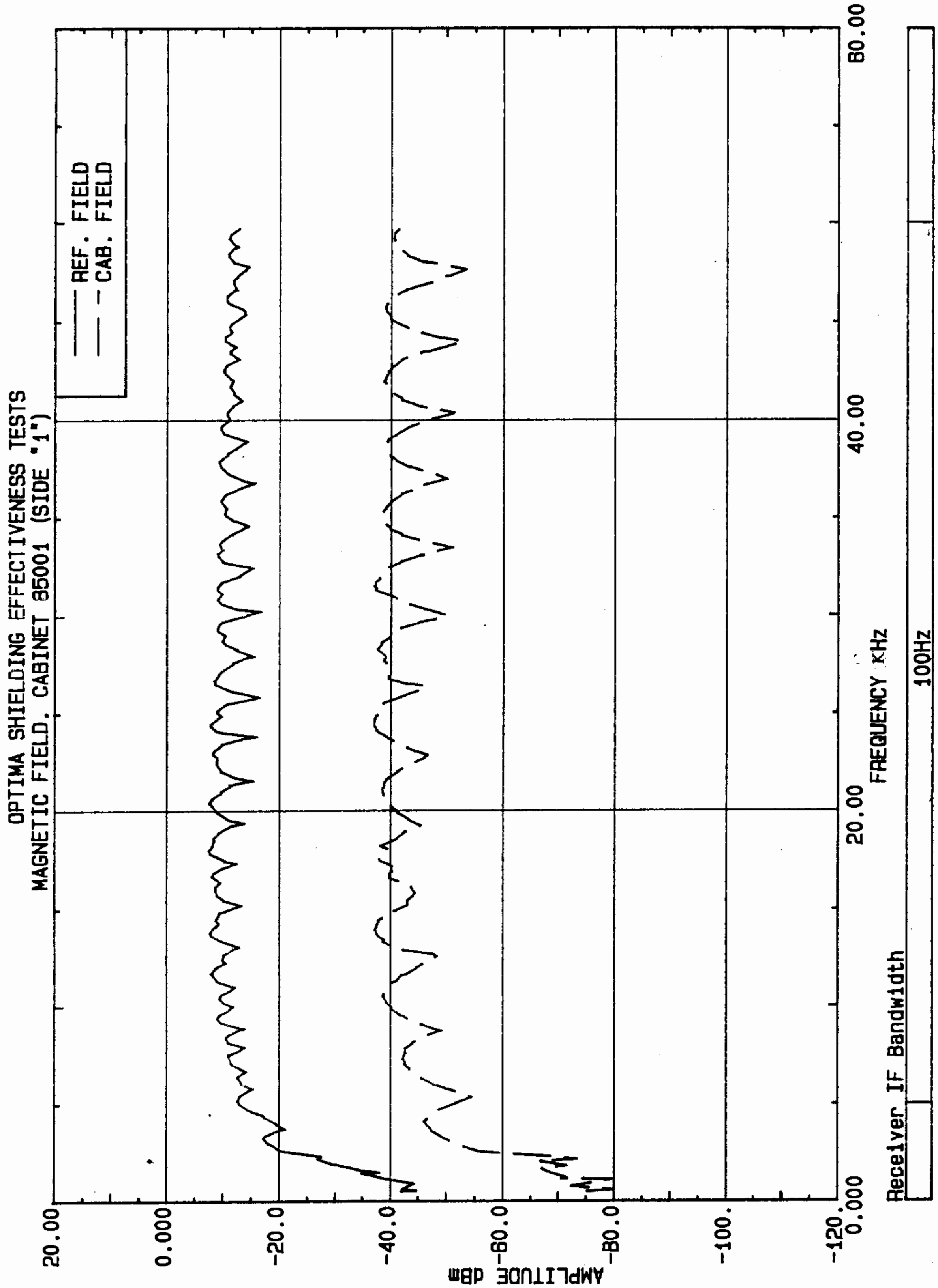

Figure No. 2.3.4

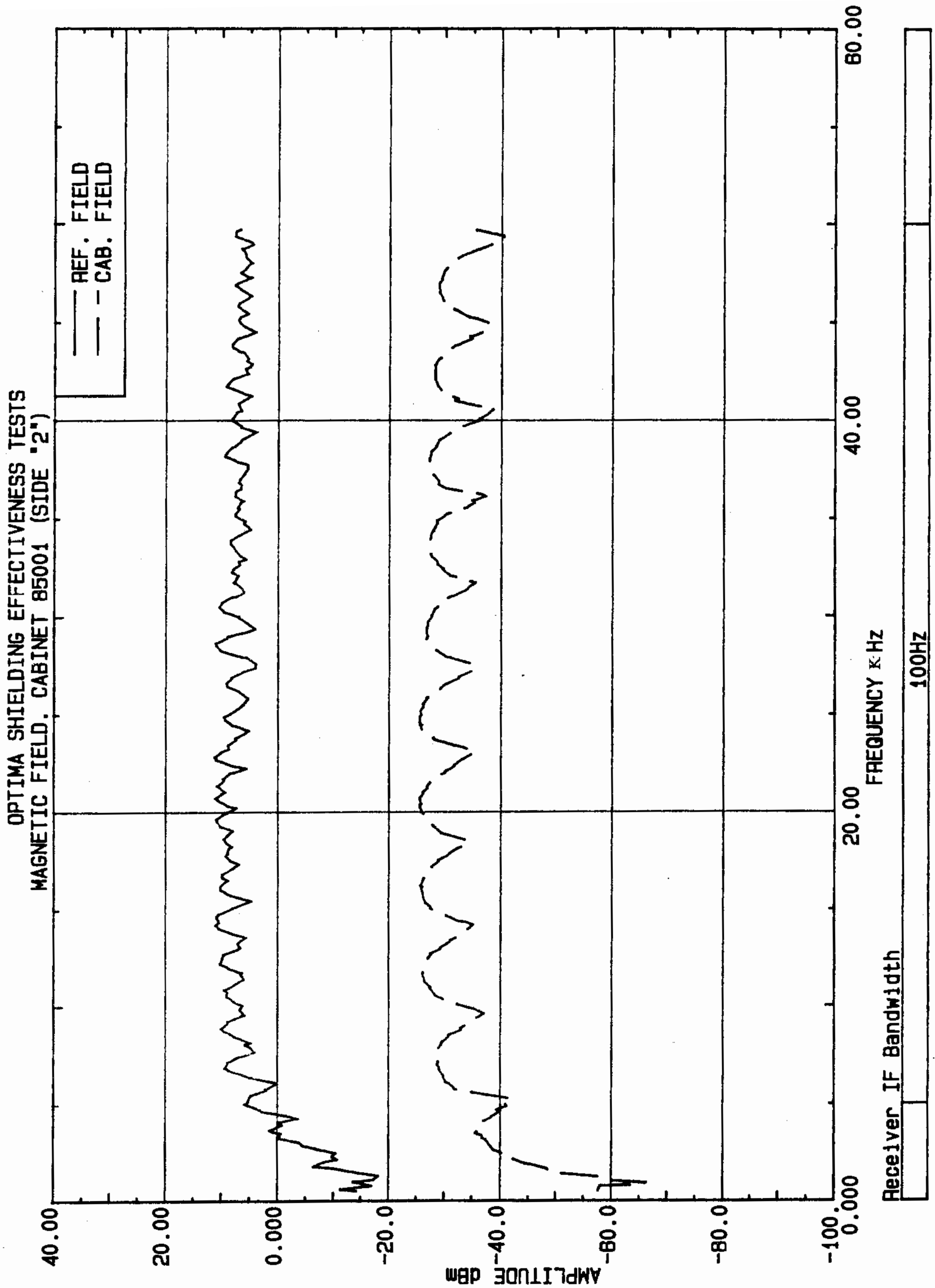

Figure No. 2.3.5

2.4 TEST EQUIPMENT USED

2.4.1 TEST EQUIPMENT USED

See Table 2.4.1

Key to Manufacturers:-

EOD - Electro-Optic Developments
HEW - Hewlett Packard
IFI - Instruments for Industry
NAR - Narda
TEX - Texscan

2.4.2 MEASUREMENT UNCERTAINTY

2.4.2.1 For a 95% confidence level, the measurement uncertainties for defined systems, in accordance with the recommendations of DEF- STAN 0026 Issue 1 February 1982 are

2.4.2.2 For the Power Meter and Sensor : ±0.33dB.

2.4.2.3 For the Spectrum Analyser

Frequency readout Accuracy

(a) For Spans less than 5MHz : ±(20% of Freq. Span + Freq. ref. error x Centre Freq. + 10Hz)

(b) For Spans greater than 5MHz : ±(2% of Freq. Span + n x 100kHz + Freq. ref. error x Centre Freq.)

where n = 1 for Centre frequencies 100Hz to 5.8GHz
n = 2 for Centre frequencies 5.8GHz to 12.5GHz

Amplitude

(a) Linear : ±3% of Reference level

(b) Log :

Incremental	Cumulative
±0.1dB/dB over 0 to 80dB display	less than ±1.0dB max over 0 to 80dB display, 20-30°C
	less than ±1/5dB max over 0 to 90dB display

This calculation does not take into account any Antenna/sensor used.

2.4.1 TABLE OF TEST EQUIPMENT USED

INSTRUMENT	MAKER	TYPE NO	SERIAL NO	EMC	CAL. DUE
HIGH POWER AMPLIFIER	TEX	1500L	4749	1055	*
FUNCTION GENERATOR	HEW	3314A	2141A03191	1074	1. 8.85
SWEEPER OSCILLATOR	HEW	8350B	2304U00313	648	3.12.85
HPIB EXTENDER	HEW	37203B	2040U04160	588	T.U.
DIGITAL POWER METER	HEW	436A	194300782	321	17.12.85
POWER SENSOR	HEW	8484A	1916A04428	403	10.11.85
POWER SENSOR	HEW	8482A	2349A07547	777	1. 8.85
SPECTRUM ANALYSER	HEW	8568A	1745A0016	184	13. 9.85
ANTENNA	IFI	EFG-3	262	955	*
CAVITENNA RESONATOR	TEX	AT2000	4667/021	1057	*
DIRECTIONAL COUPLER	HEW	11692D	1212A 0077	42	1. 8.85
BIDIR. COAX COUPLER	NAR	3020A	02124	208	9. 9.85
DUAL DIRECTION COUPLER	HEW	778D		1005	19. 9.85
FIBRE OPTIC LINK	EOD	10000-4	-	-	+

* = Monitored Using Calibrated Equipment
\+ = Used for Comparison Only
T.U. = Traceability Unscheduled

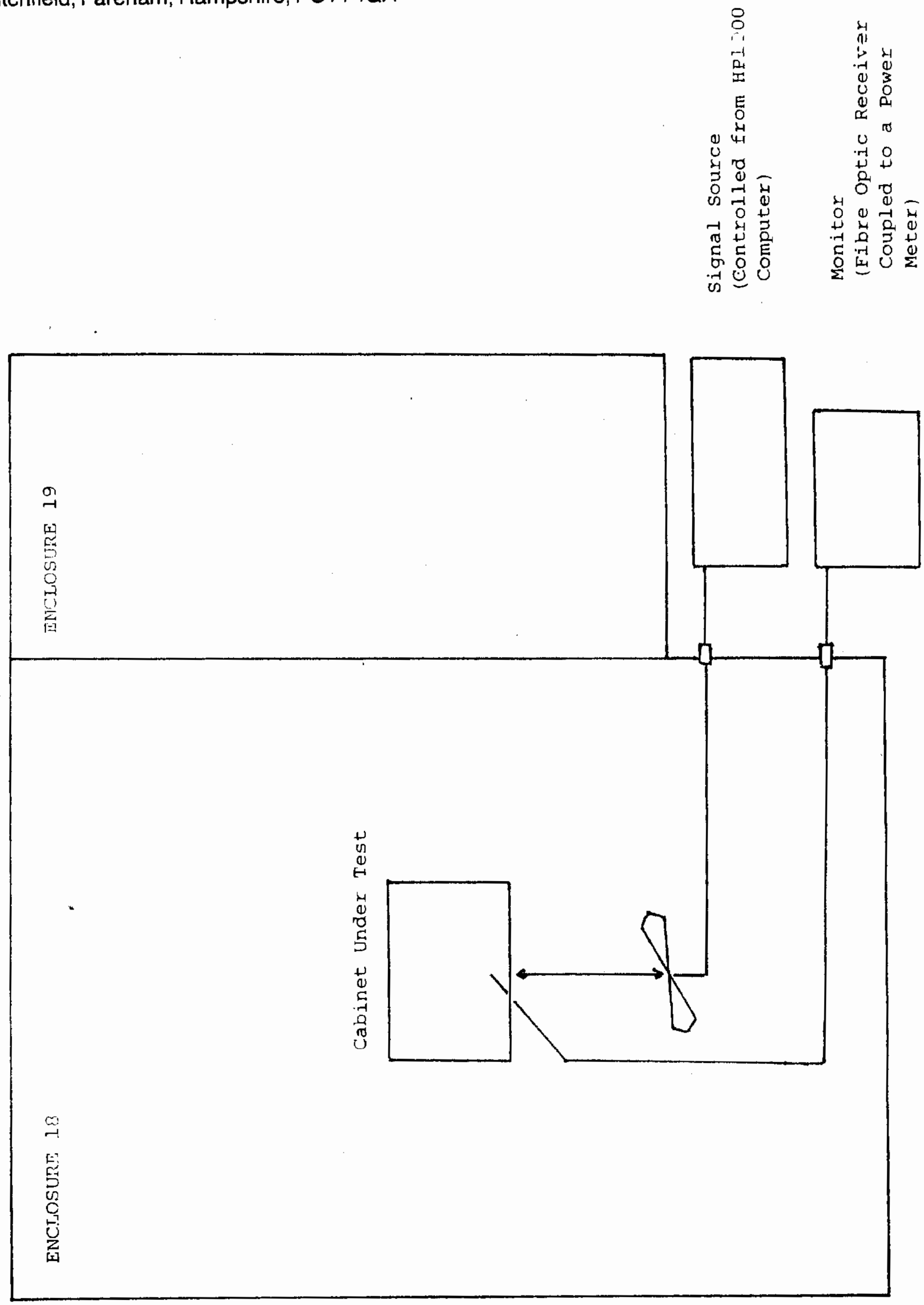

FIGURE 2.4.1 TEST SET-UP E-FIELD MEASUREMENTS

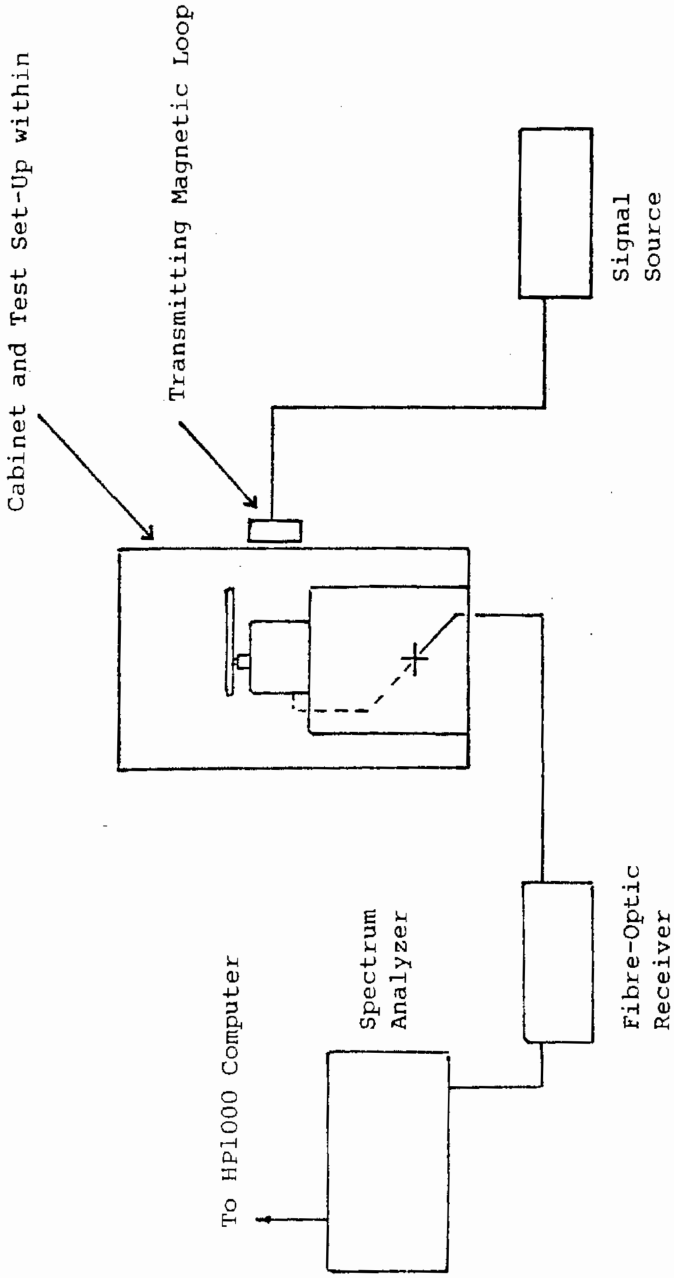

Figure 2.4.2 TEST SET-UP H-FIELD MEASUREMENTS

2.5 DEFINITIONS AND ABBREVIATIONS

2.5.1 DEFINITIONS

(a) ELECTROMAGNETIC COMPATABILITY

The capability of electronic equipments or systems to operate with a defined margin of safety in an intended operational environment at designed levels of efficiency without degredation due to interference.

(b) CONDUCTED INTERFERENCE

Undesired electromagnetic energy which is propogated along a conductor.

(c) EMISSION

Electromagnetic energy propogated from a source by radiation or conduction.

(d) RADIATED INTERFERENCE

Unwanted radiated and inductive field componants in space.

(e) SUSCEPTIBILITY

The characteristic of electronic equipment that permits undesirable responses when subjected to electromagnetic energy.

2.5.2 ABBREVIATIONS

EMC - Electro-magnetic Compatability
EUT - Equipment Under Test