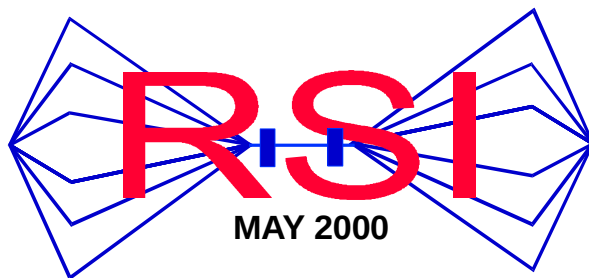


RUBICOM SYSTEMS, INC.



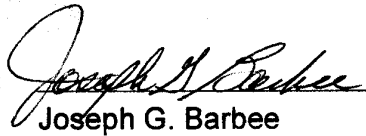
FCC INTENTIONAL RADIATOR
TEST REPORT
FOR THE
P-COM
POINT TO MULTIPOINT
28GHz SECTOR OUTDOOR UNIT



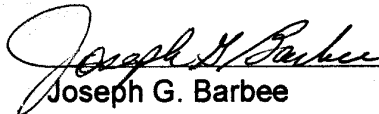
Rubicom Systems, Inc.
284 West Drive, Suite B
Melbourne, FL 32904

**FCC INTENTIONAL RADIATOR
TEST REPORT
FOR THE
P-COM
POINT TO MULTIPOINT
28GHz SECTOR OUTDOOR UNIT**

Prepared by:

 5/18/00
Joseph G. Barbee

Tested by:

 5/18/00
Joseph G. Barbee

Performed by:

RUBICOM SYSTEMS INC.
284 West Drive, Suite B
Melbourne, Florida 32904

Performed for:

P-COM
1801 Penn Street
Melbourne, Florida 32901

Date Completed: May 10, 2000

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ABSTRACT

This report presents test results of the emanations found emitting from the P-Com Point to Multipoint 28GHz Sector Outdoor Unit and the comparison of these emissions to the requirements of FCC, Title 47, Part 101 Fixed Point to Multipoint Microwave Service as required for a Digital Electronics Message Service. In accordance with Part 15.33(a)(2) radiated measurements were extended to 100GHz. The indoor unit (IDU) was tested to Part 15 requirements in a separate submission.

This testing was performed at Rubicom Systems, Inc. (RSI). The testing was performed for P-Com under purchase order F68979. The results of this test effort indicates compliance of the P-Com Point to Multipoint 28GHz Sector Outdoor Unit to FCC, Title 47 requirements.

1.0 INTRODUCTION

1.1 Propose

The purpose of this report is to show continued compliance of the P-COM Point to Multipoint 28GHz Sector Outdoor Unit (ODU) to the requirements of CFR 47, Part 101 Subpart C for Fixed Point to Multipoint Microwave Service and Part 15.209(a) and 15.205 for the general emission limits. The band of operation is 27.5GHz to 31.225GHz. The ODU test was performed in a semi-anechoic chamber at a distance of 1 meter and .33 meters above 18GHz. Emissions below 18GHz were performed on a 3 meter O.A.T.S. Distances are noted on the data plots.

1.2 Requirements

This report is to provide results of testing to CFR 47, Part 101 Subpart C (specifically 101.109, 101.111(2)(ii) and 101.113) for a 27.5GHz to 28.35GHz common carrier fixed point to multipoint microwave service terminal.

Bandwidth 101.109 (850MHz Max)

Emission Limitation 101.111(2)(ii)(iii)

Transmitter Power Limitation 100.113 (+55dBw EIRP)

Signals outside the intended band must be attenuated by 56dB at 250% of bandwidth, and 33dB of attenuation below the measured transmit level (123dBμV/m) for harmonics and spurious signals above the transmitter center frequency.

Signals appearing in the restricted bands must meet the requirements of 15.209. The lowest signal generated in the ODU is the 200MHz data from the Sector Indoor Unit.

1.3 Unit Under Test Description

The Point to Multipoint (PMP) Sector Subsystem consists of an Indoor Unit (IDU) and an Outdoor Unit (ODU) A total system can have up to 24 sector subsystems to provide 360° coverage. The product under test in this report is the Sector ODU. The ODU receives data at a 200mbit/s rate from the IDU along with the DC power to the ODU. This test covers the ODU only.

The two units are connected using 30 ft. of LMR 400 communications cable (50 ohms).

The Subsystem was configured as shown in Paragraph 5.0.

1.4 Modifications

The ODU required the following modifications:

ODU Chassis	•Gasket material added around ODU dome. Instrument Specialists Part # 8864-010-80
-------------	--

1.5 Summary of Results

Paragraph 6.0 of this document presents the results of the tabulated levels detected during testing of the Point to Multipoint 28GHz Sector Outdoor Unit. There were no failures after the modification was installed. The modification is noted in Paragraph 1.4. Both the applicable paragraphs of Part 15 and Part 101 are within the limits determined in this report.

2.0 APPLICABLE DOCUMENTS

The following documents form a part of this report to the extent expressed herein:

FCC Code of Federal Regulations Title 47, Part 15 and 101

ANSI C63.4-1992

FCC Characteristics of open Field Test Sites Bulletin OET 55, October
1989

3.0 TEST SITE DESCRIPTION

This testing was performed at Rubicom Systems, Inc. 3 meter test site and in a semi-anechoic chamber above 18GHz. The description of the measurement facility was found to be compliant with the requirements of section 2.948 of the FCC Rules. A copy of the compliance letter is attached to this report as Appendix A.

3.1 Environmental Conditions

This test effort was performed between May 2, 2000 through May 10, 2000. Typical conditions in the laboratory during this testing were:

Temperature: **78↓↑**

Barometer: **29.75 in.**

Humidity: **50%**

4.0 TEST INSTRUMENTATION

The following test equipment was used to perform this testing.

<u>Qty.</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model No.</u>	<u>Cal Due Date</u>
1	Coax Attenuator	Hewlett Packard	8494B	03/07/01
1	Bilog Antenna	Chase	CLB6111B	07/10/00
1	Standard Gain Horn	Flann	23240-20	NCR
1	Ridge Guide Horn	Electro Metrics	RGA-180	01/15/00
1	Standard Gain Horn	NARDA	Model 638	NCR
1	Standard Gain Horn	NARDA	V637	NCR
1	Standard Gain Horn	Millitech	SGH-22-PR000	NCR
1	Standard Gain Horn	Flann Microwave	27240-20	NCR
1	Spectrum Analyzer	Advantest	R3271	02/01/01
1	Harmonic Mixer	OML	WR22	09/02/00
1	Harmonic Mixer	OML	WR15	09/03/00
1	Harmonic Mixer	OML	WR10	09/03/00
1	Waveguide Adapter	OMNI	WR28-SMA	NCR
1	Standard Gain Horn	Custom Microwave	H06R	NCR
1	Meter	Hewlett Packard	436A	05/28/00
1	Sensor	Hewlett Packard	8487A	05/28/00
1	Antenna Adapter	Hill Manufacturing	1781702	NCR
1	WG to Coaxial Adapter	Hewlett Packard	P281A	NCR

5.0 TEST SAMPLE SETUP AND CONFIGURATIONS

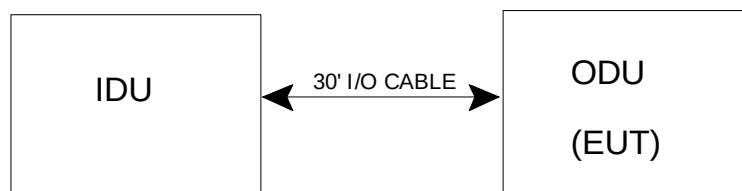
The unit was placed on a nonconductive table on the 3 meter OATS. The unit was powered from 120 VAC 60Hz filtered power. Measurements from 200MHz-18GHz were performed on the 3 meter site at 3 meter distance.

During radiated emissions above 18GHz the unit was placed on a table inside a test chamber (semi-anechoic) and rotated for maximum level at a 1 meter or .3 meter distance.

Photo 1 shows the typical radiated test setup on the OATS.

The configuration of the IDU and ODU were as listed below:

<u>Indoor Unit PCB's</u>	<u>Outdoor Unit</u>	<u>30 Ft. I/O Cable</u>
1 ea. Controller	1 ea. PTM	LMR-400, 50 ohm
1 ea. Demodulator	PTM 28GHz Low 1	Communication Cable
1 ea. Modulator	S/N: 28SL1A300001	
1 ea. E1/T1 Channel		
2 ea. Indoor Power Supplies		
1 ea. Outdoor Power Supply		



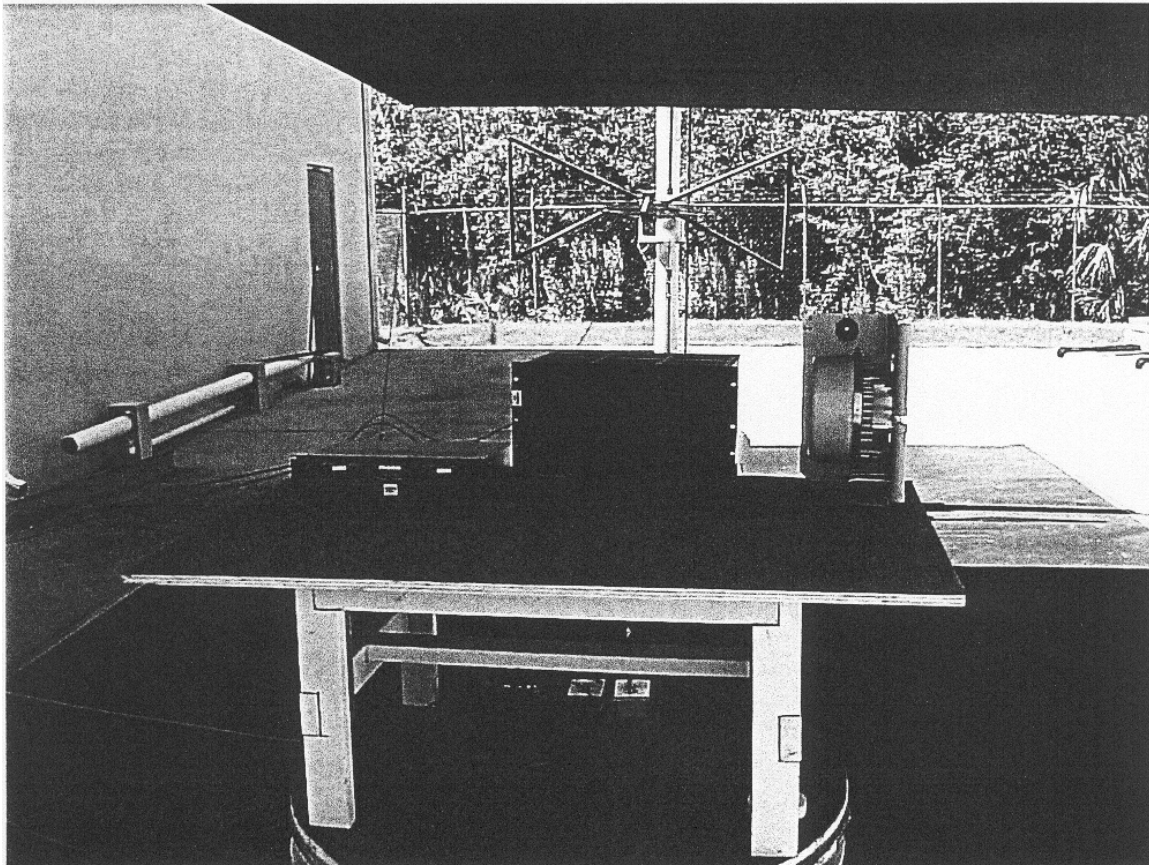


PHOTO 1

6.0 PROCEDURES AND RESULTS

6.1 General

The ODU was tested for radiated emissions on the 3 meter test site up to 18GHz. Above 18GHz the unit was tested inside a semi-anechoic chamber where the high frequency radiated measurements were completed to 100GHz. Power and bandwidth measurements were also performed in the chamber.

The ODU was not tested for power line conduction since it is powered by DC voltage from the IDU. Since the lowest frequency in the ODU is the 200mbit data input from the Sector IDU, the radiated measurements were started at 200MHz. The ODU was tested to Part 101 and the general requirements of 15.209. The following paragraphs present the test results and procedures for the testing.

6.1.1 Occupied Bandwidth (101.109)

Bandwidth requirements applicable to the 27.5GHz to 31.225GHz range is 850MHz maximum. Table 6.1.1-1 presents the 99.5% bandwidth measurements at the minimum , mid and maximum transmit frequencies with the minimum, mid and maximum modulation rates. Data Sheets 6.1.1-1 through 6.1.1-9 are included for reference.

RESULT: The maximum bandwidth measured was 18.79Hz. The unit complies with the <850MHz requirement.

EUT ODU/28GHz Low 1 ODUS/N 28SL1A300001MIN TX FREQ. 27.499 GHzMODULATION MIN 9.5 MHZMID 9.43 MHZMAX 9.64 MHZMID TX FREQ. 27.600 GHzMODULATION MIN 9.57 MHZMID 9.43 MHZMAX 9.29 MHZMAX TX FREQ. 27.710 GHzMODULATION MIN 9.86 MHZMID 10.21 MHZMAX 9.57 MHZ

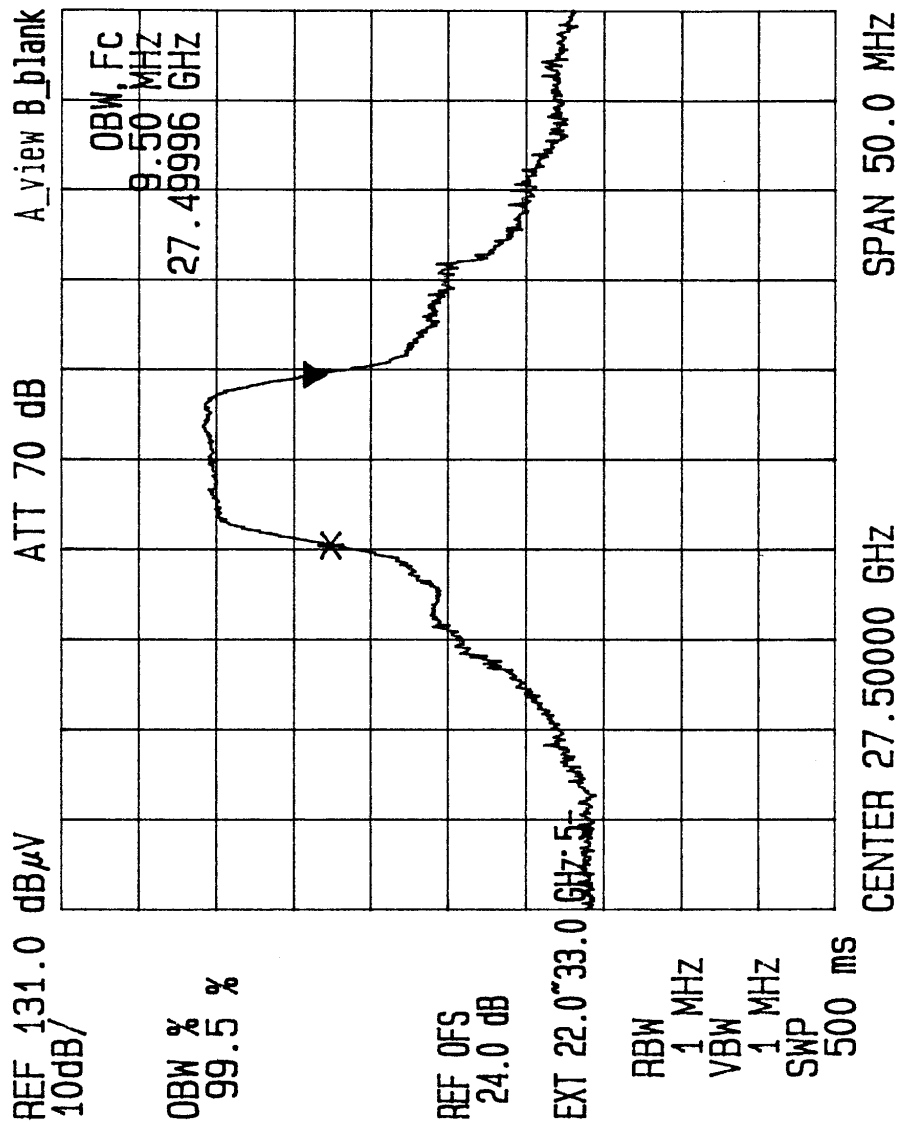
REQUIREMENT: <850MHz

TABULATED BANDWIDTHS

TABLE 6.1.1-1

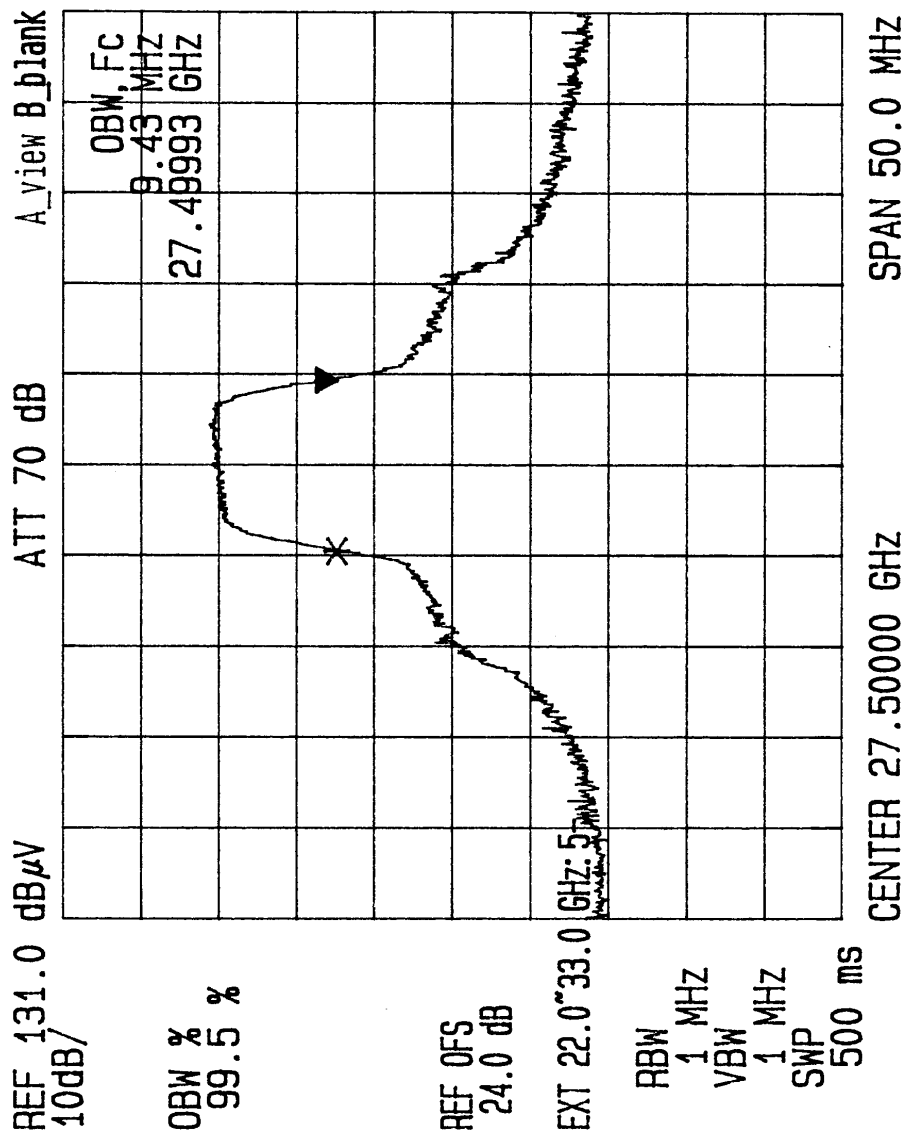


TEST: OCCUPIED B.W. EUT: P-COM HUB/28GHz ODU S/N: 130/118/00003
FREQ: CENTER 27.50 GHz SPEC: FCC ANT. HT/POL:
MODULATION: MIN. LINE UNDER TEST: CHANNEL 1 EUT POSITION:
DATE: 5-10-00 TEST SITE: ROOM 3 TESTER: AB



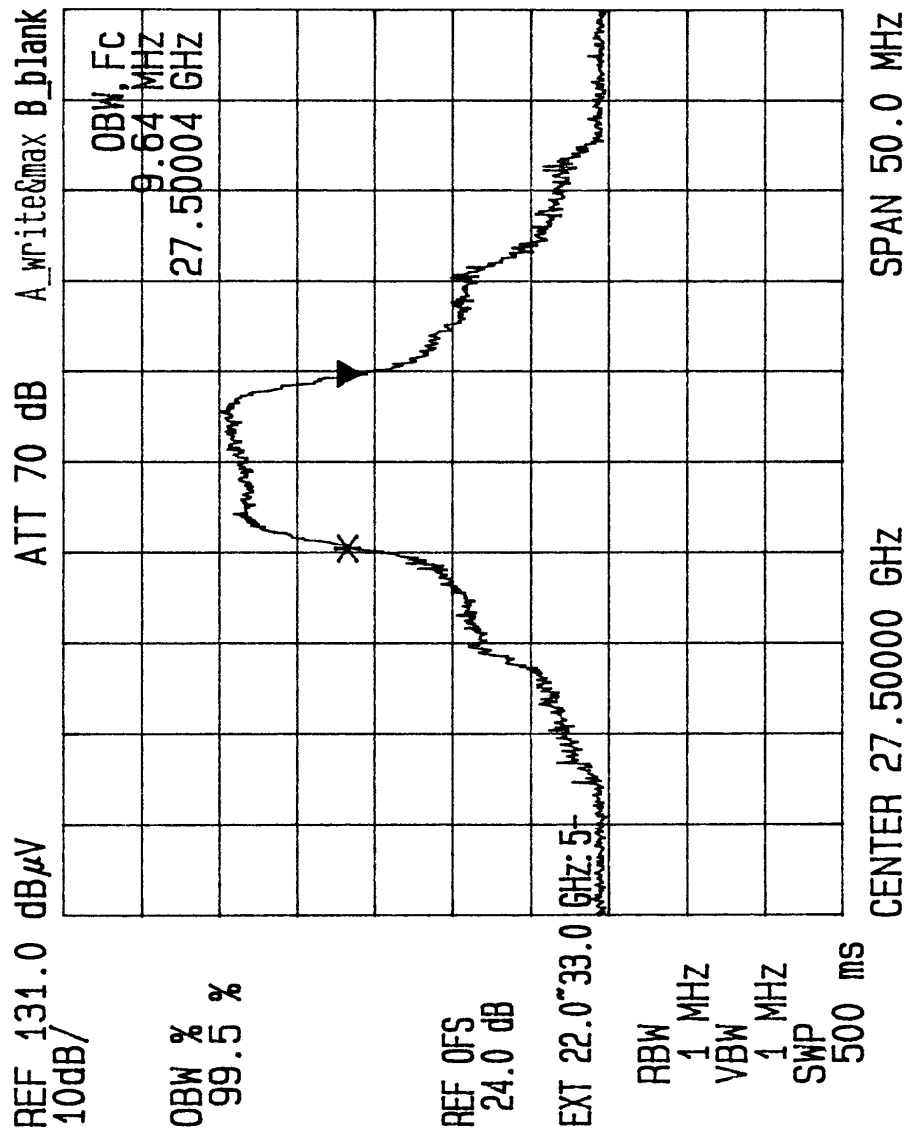


TEST: OCCUPIED B.W. EUT: P-COM HUB/28GHz ODU S/N: 130/118/00003
FREQ: CENTER 27.500 GHz SPEC: FCC ANT. HT/POL:
MODULATION: MID. LINE UNDER TEST: CHANNEL 1 EUT POSITION:
DATE: 5-10-00 TEST SITE: ROOM 3 TESTER: *[Signature]*



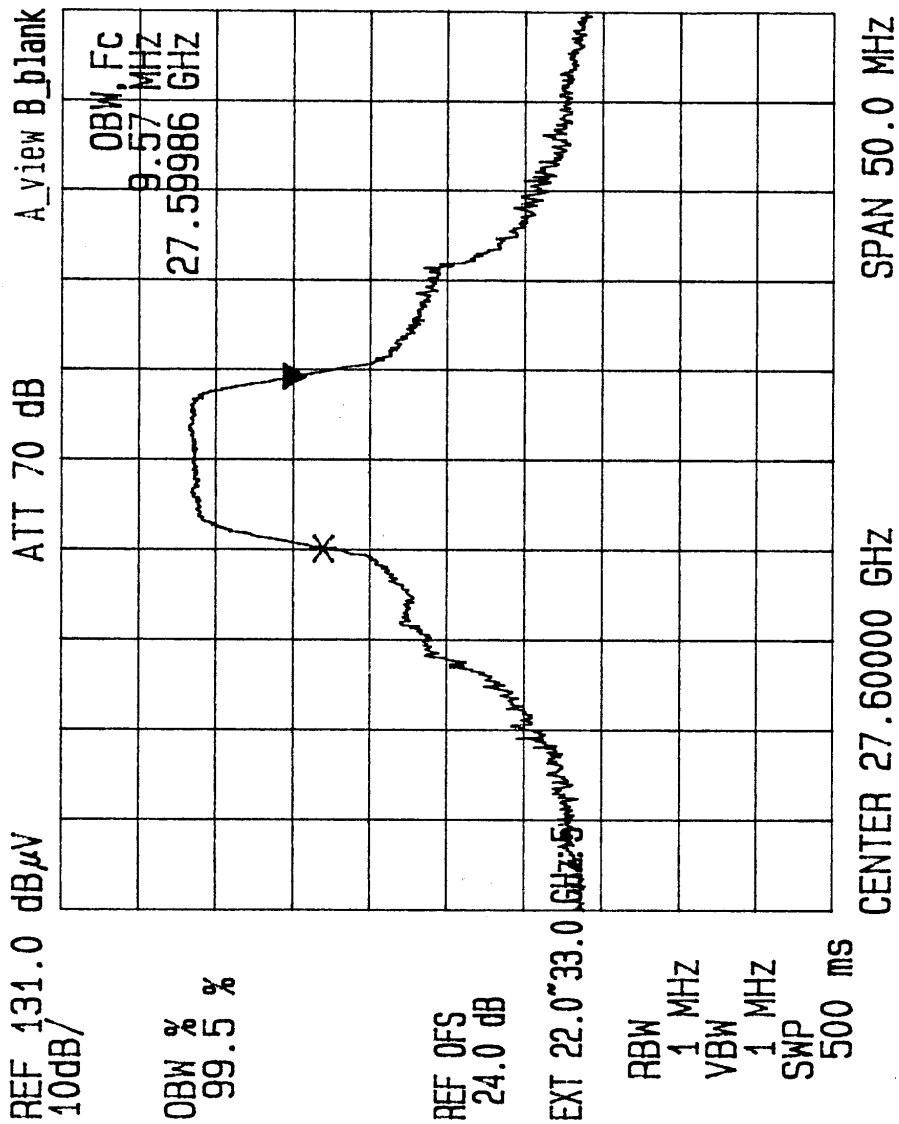


TEST: OCCUPIED B.W. EUT: P-COM HUB/28GHz ODU S/N: 130/118/00003
FREQ: CENTER 27.500 GHz SPEC: FCC ANT. HT/POL:
MODULATION: MAX. LINE UNDER TEST: CHANNEL 1 EUT POSITION:
DATE: 5-10-00 TEST SITE: ROOM 3 TESTER: *[Signature]*





TEST: OCCUPIED B.W. EUT: P-COM HUB/28GHz ODU S/N: 130/118/00003
FREQ: CENTER 27.600 GHz SPEC: FCC 101.111 ANT. HT/POL:
MODULATION: MIN. LINE UNDER TEST: CHANNEL 11 EUT POSITION:
DATE: 5-10-00 TEST SITE: ROOM 3 TESTER: AB



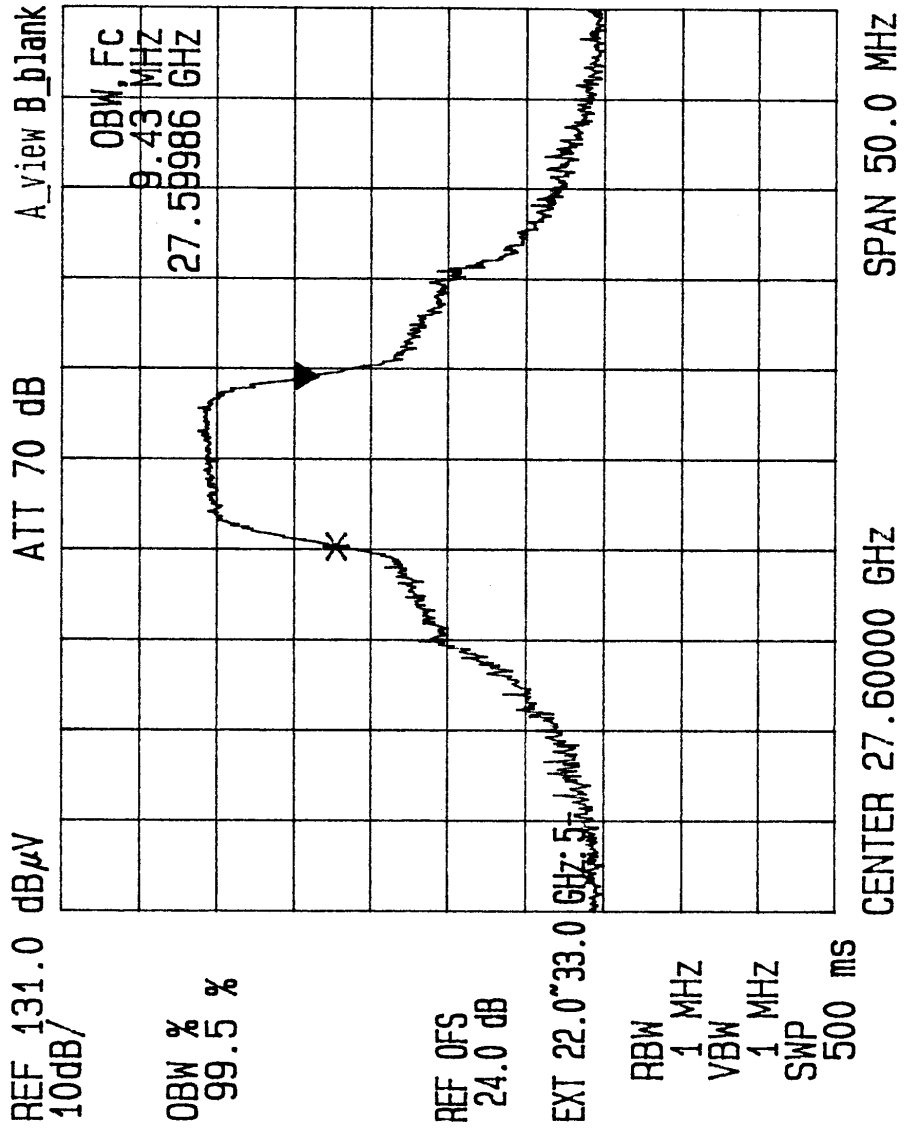
Graph4.tif (2252x2864x2 tiff)

JA-1666-2

DATA SHEET 6.1.1-4



TEST: OCCUPIED B.W. EUT: P-COM HUB/28GHz ODU S/N: 130/118/00003
FREQ: CENTER 27.600 GHz SPEC: FCC 101.111 ANT. HT/POL:
MODULATION: MID. LINE UNDER TEST: CHANNEL 11 EUT POSITION:
DATE: 5-10-00 TEST SITE: ROOM 3 TESTER: AB



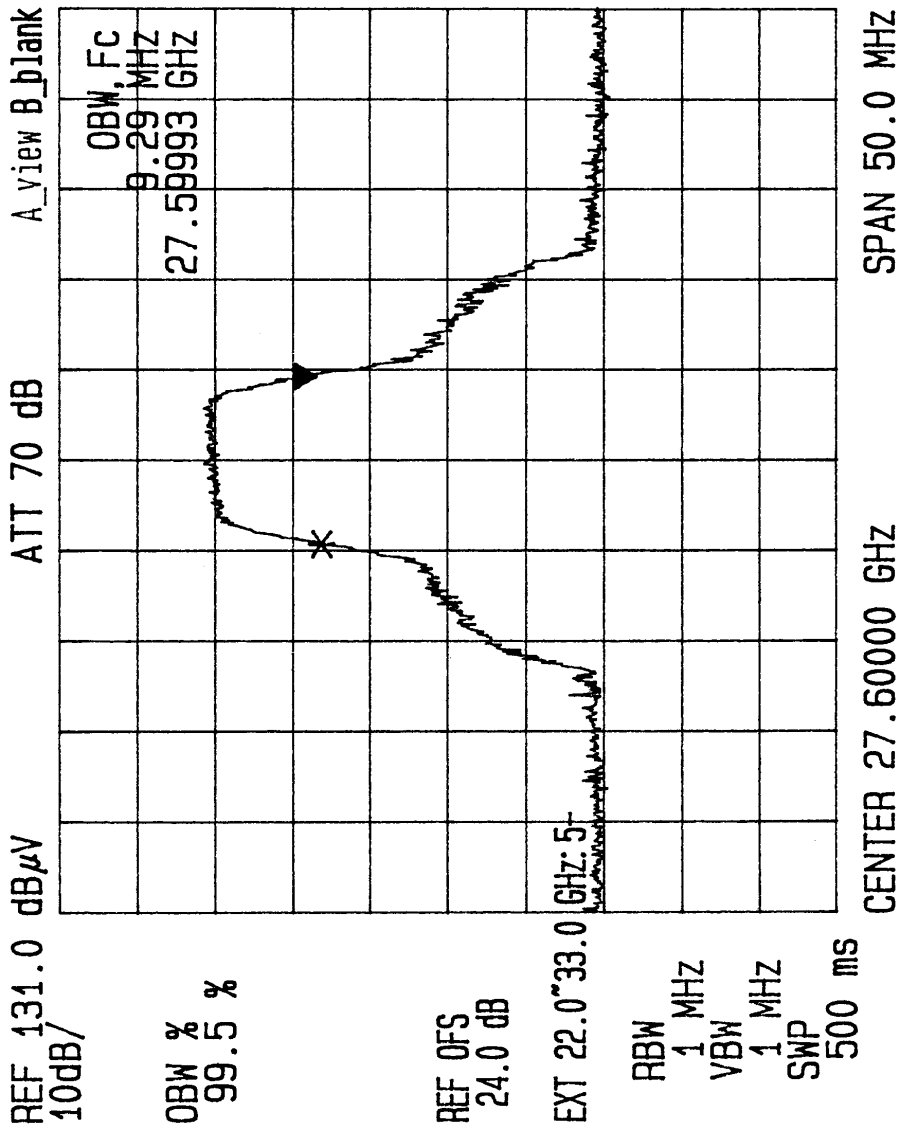
Graph5.tif (2244x2860x2 tiff)

JA-1666-2

DATA SHEET 6.1.1-5

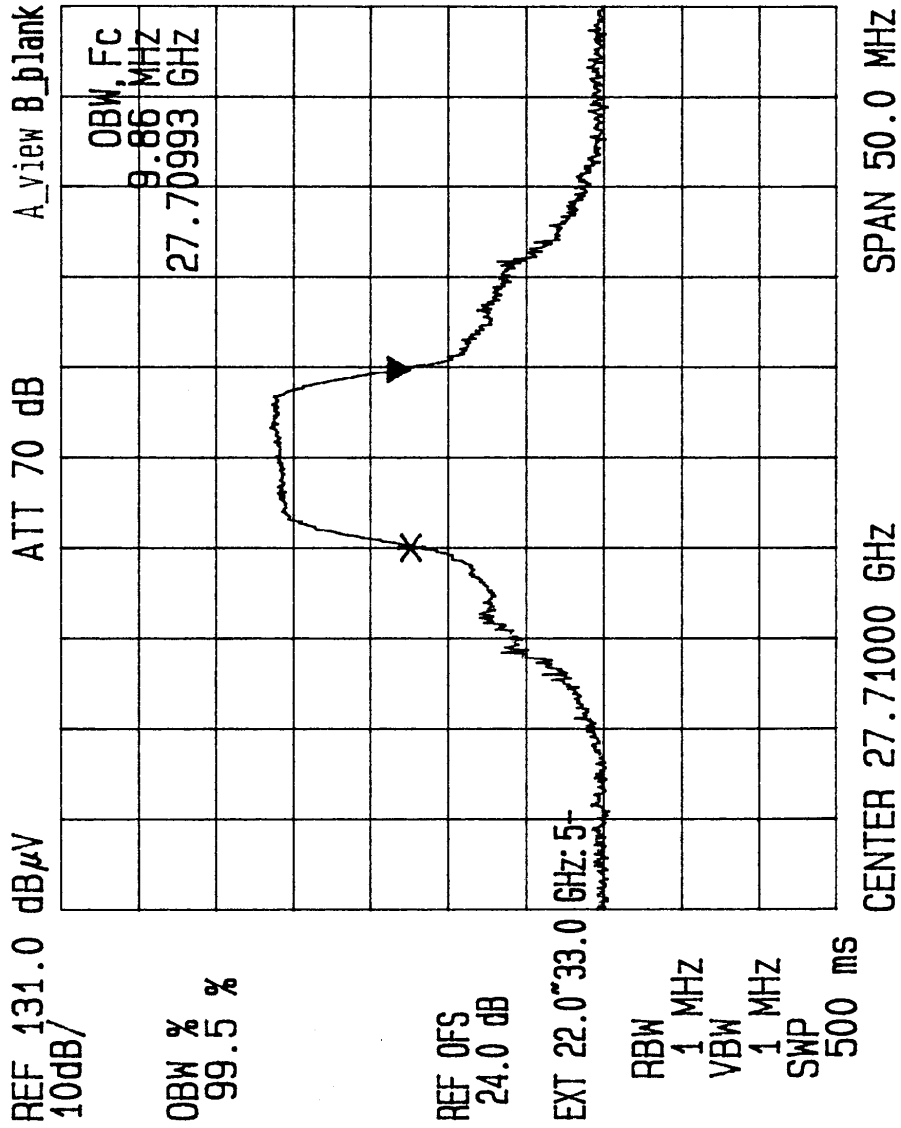


TEST: OCCUPIED B.W. EUT: P-COM HUB/28GHz ODU S/N: 130/118/00003
FREQ: *center* 27.600 GHz SPEC: FCC 101.111 ANT.HT/POL:
MODULATION: MAX. LINE UNDER TEST: CHANNEL 11 EUT POSITION:
DATE: 5-10-00 TEST SITE: ROOM 3 TESTER: *AB*



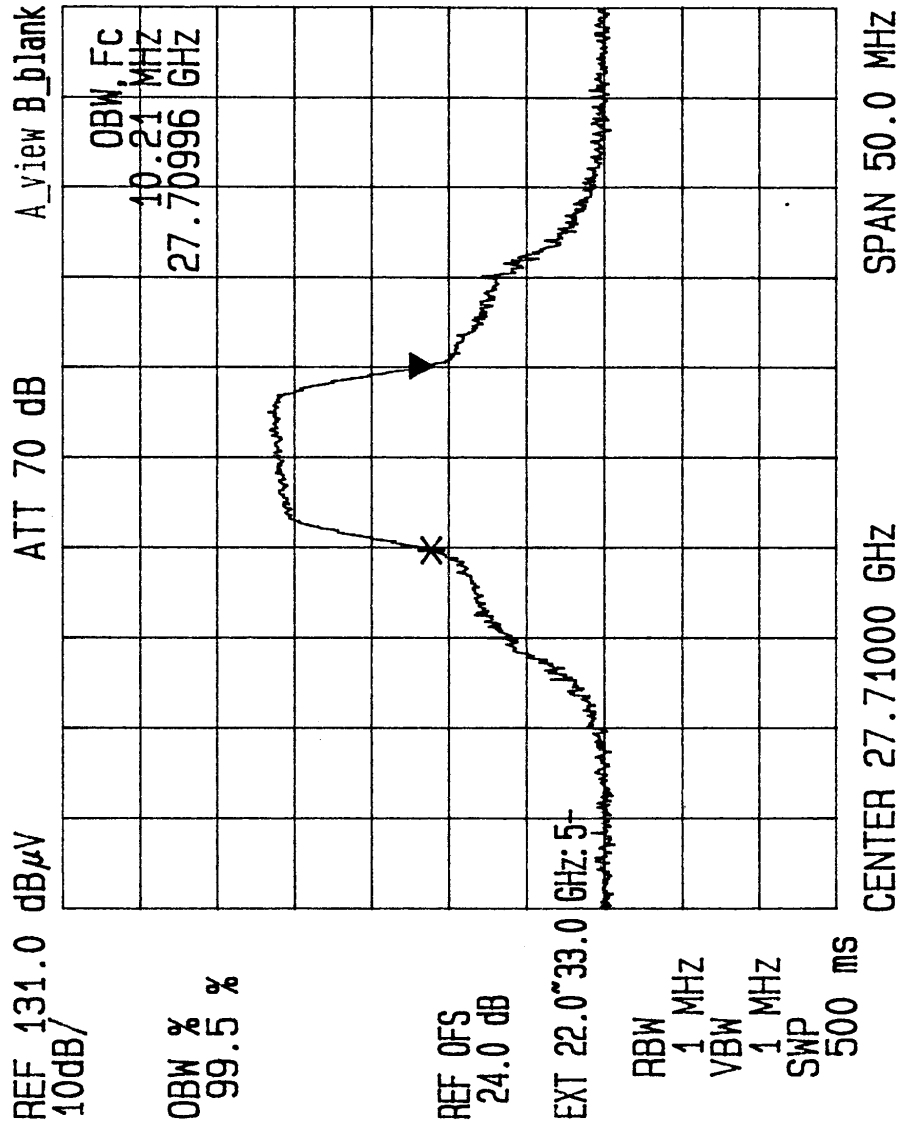


TEST: OCCUPIED B.W. EUT: P-COM HUB/28GHz ODU S/N: 130/118/00003
FREQ: CENTER 27.710 GHz SPEC: FCC 101.111 ANT. HT/POL:
MODULATION: MIN. LINE UNDER TEST: CHANNEL 22 EUT POSITION:
DATE: 5-10-00 TEST SITE: ROOM 3 TESTER: *AB*





TEST: OCCUPIED B.W. EUT: P-COM HUB/28GHz ODU S/N: 130/118/00003
FREQ: *27.710 GHz* SPEC: FCC 101.111 ANT.HT/POL:
MODULATION: MID. LINE UNDER TEST: CHANNEL 22 EUT POSITION:
DATE: *5-10-00* TEST SITE: ROOM 3 TESTER: *AB*





TEST: OCCUPIED B.W. EUT: P-COM HUB/28GHz ODU S/N: 130/118/00003
FREQ: ~~Center~~ 27.71 GHz SPEC: FCC 101.111 ANT.HT/POL:
MODULATION: MAX. LINE UNDER TEST: CHANNEL 22 EUT POSITION:
DATE: 5-10-00 TEST SITE: ROOM 3 TESTER: AB

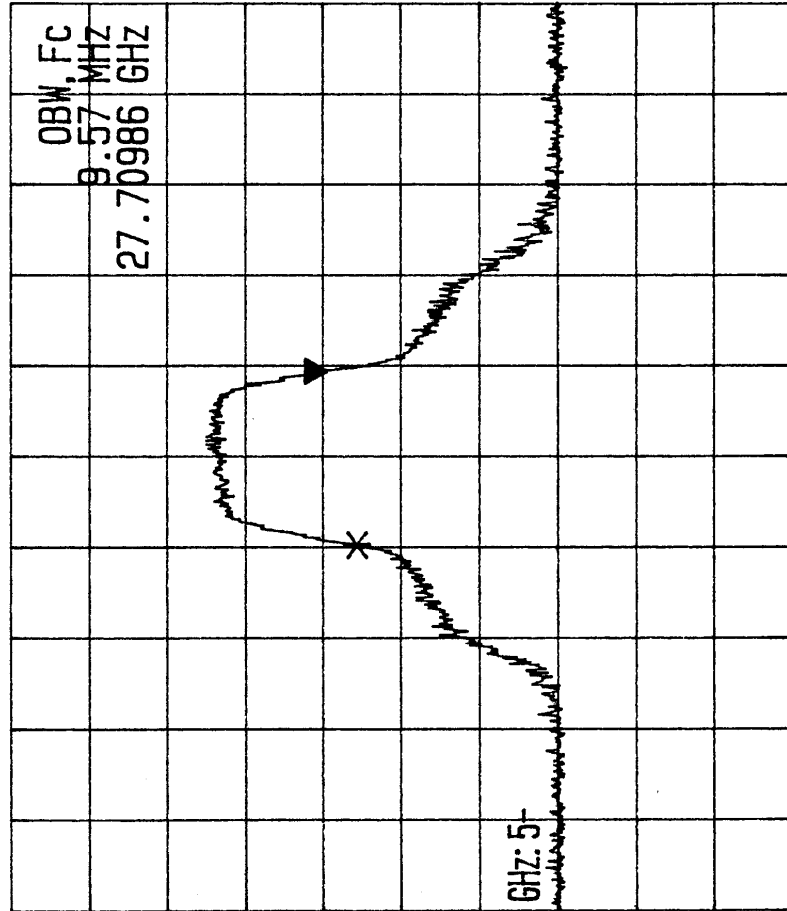
REF 131.0 dB μ V ATT 70 dB A_view B_blank
10dB/

OBW %
99.5 %

REF OFS
24.0 dB

EXT 22.0~33.0 GHz: 5+

RBW 1 MHz
VBW 1 MHz
SWP 500 ms



CENTER 27.71000 GHz SPAN 50.0 MHz

6.1.2 Transmitter Power Limitations

Power measurements were made at the input to the antenna.

Measurements were made using a Hewlett Packard Model 436A power meter with a Model 8487A power sensor. An antenna adapter for conversion to 2.9mm connector by Hill Mfg. (Model 1781702) was used for the power measurement.

Antenna gain (dBi) was added to the measurements in dBw to obtain the EIRP.

Table 6.1.2-1 presents the tabulated results.

Results: The output was compliant to the required 55dBw by greater than 54dB.

Power Output Measurement

Frequencies: Min = 27.500GHz, Mid = 27.600GHz, Max = 27.710GHz

<u>Freq.</u>	<u>Modulation</u>	Measured <u>Power</u> <u>dBw</u>	<u>Ant.</u> <u>Gain</u>	<u>ERIP</u> <u>dBw</u>	<u>Ref.</u> <u>55dBw</u>
Min	Min	-9.6	17.7	8.1	-46.9
	Mid	-10.3	17.7	7.4	-47.6
	Max	-12.0	17.7	5.7	-49.3
Mid	Min	-9.7	17.7	8.0	-47.0
	Mid	-10.6	17.7	7.1	-47.9
	Max	-12.1	17.7	5.6	-49.4
Max	Min	-9.6	17.7	8.1	-46.9
	Mid	-10.6	17.7	7.1	-47.9
	Max	-12.2	17.7	5.5	-49.5

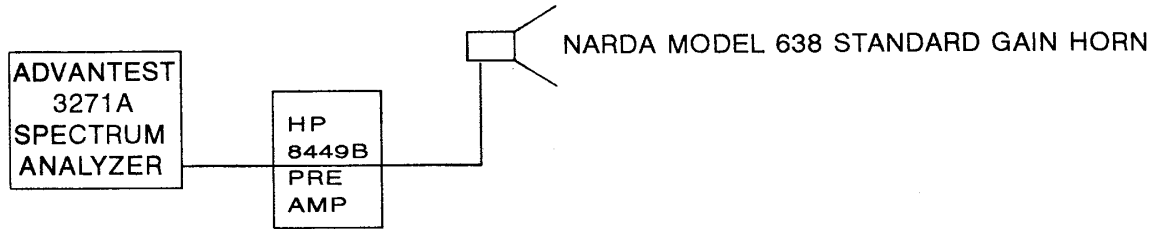
Table 6.1.2-1

6.1.3 Radiated Emissions, Part 15 and Part 101

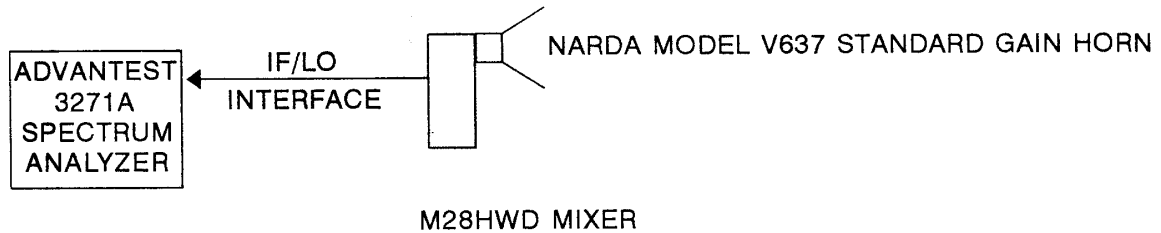
This paragraph presents the radiated emissions for the 28GHz Sector Outdoor Unit tested to the requirements of part 15.207 and 209, and the transmitter requirements to Part 101.111. Figure 6.1.3-1 presents the mixer setups used to cover the 100GHz range.

18-26.5GHZ EQUIPMENT SETUP

JA-1666-2



26.5-40GHz EQUIPMENT SETUP



33-50GHz EQUIPMENT SETUP

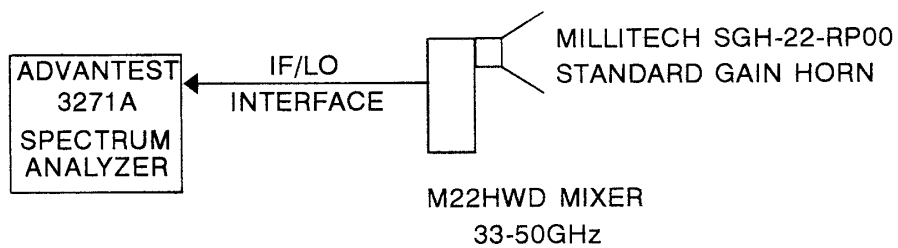
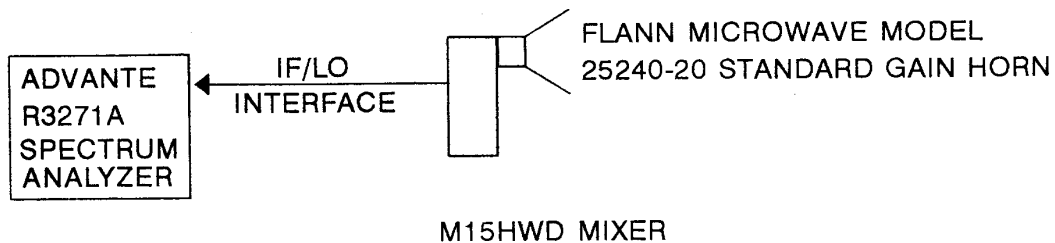


FIGURE 6.1.3-1

50-75GHz EQUIPMENT SETUP

JA-1666-2



75-110GHz EQUIPMENT SETUP

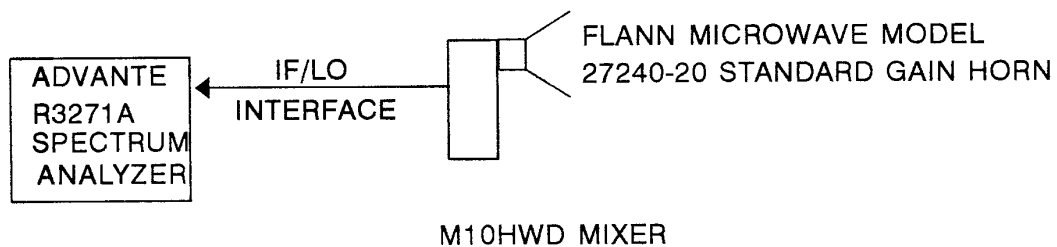


FIGURE 6.1.3-1 CONT.

6.1.3.1 Radiated 15.209(a)/101.111)

Radiated measurements were performed starting at 200MHz and extended out to 100GHz to include the requirements for covering the 28GHz transmitter harmonics and spurious emissions. Quasi-peak detection was used from 200MHz to 1GHz. From 1GHz to 40GHz, both peak and average measurements were performed. Above 40GHz the peak measurements at 1MHz bandwidth were measured. The harmonics were measured at the min, mid and max TX frequencies. A scan at mid frequency was performed to 100GHz for spurious content. Both vertical and horizontal polarization is included in the data. Photo 6.1.3.1-1 shows the test site with the unit in place inside the enclosure.

Table 6.1.3.1-1 is a tabulated list of the signals detected including the transmitter frequency and harmonics.

Results - The system does not have signals that appear above the requirement of Part 15 or Part 101 as tested in this report. In areas where the sensitivity was lacking several techniques were used such as moving in closer or narrowing the bandwidths.

RSI is confident that the methods used show the unit compliant.

The MASK requirement of 101.111(2)(ii) is shown in Data Sheets 6.1.3.1-1 through 6.1.3.1-9. The maximum attenuation requirement of 56dB at the 250% points is applicable.

Outside the 250% bandwidth the limit was established at 33dB attenuation required below transmitter. The measurements were made using the radiated technique. The transmitter output for this application is approximately 50dB below the allowed 55dBw EIRP.

Plotted data for the quasi peak and peak scans over the entire 200MHz-100GHz range are presented on Data Sheets 6.1.3.1-10 through 6.1.3.1-25.

Average data plots to 40GHz are presented on Data Sheets 6.1.3.1-26 through 6.1.3.1-45.

Ambient data for the 200MHz-100GHz range for this test effort is on file at Rubicom Systems, Inc. under JA-1666 should it be needed.

JA-1666-2

PHOTO 6.1.3.1-1

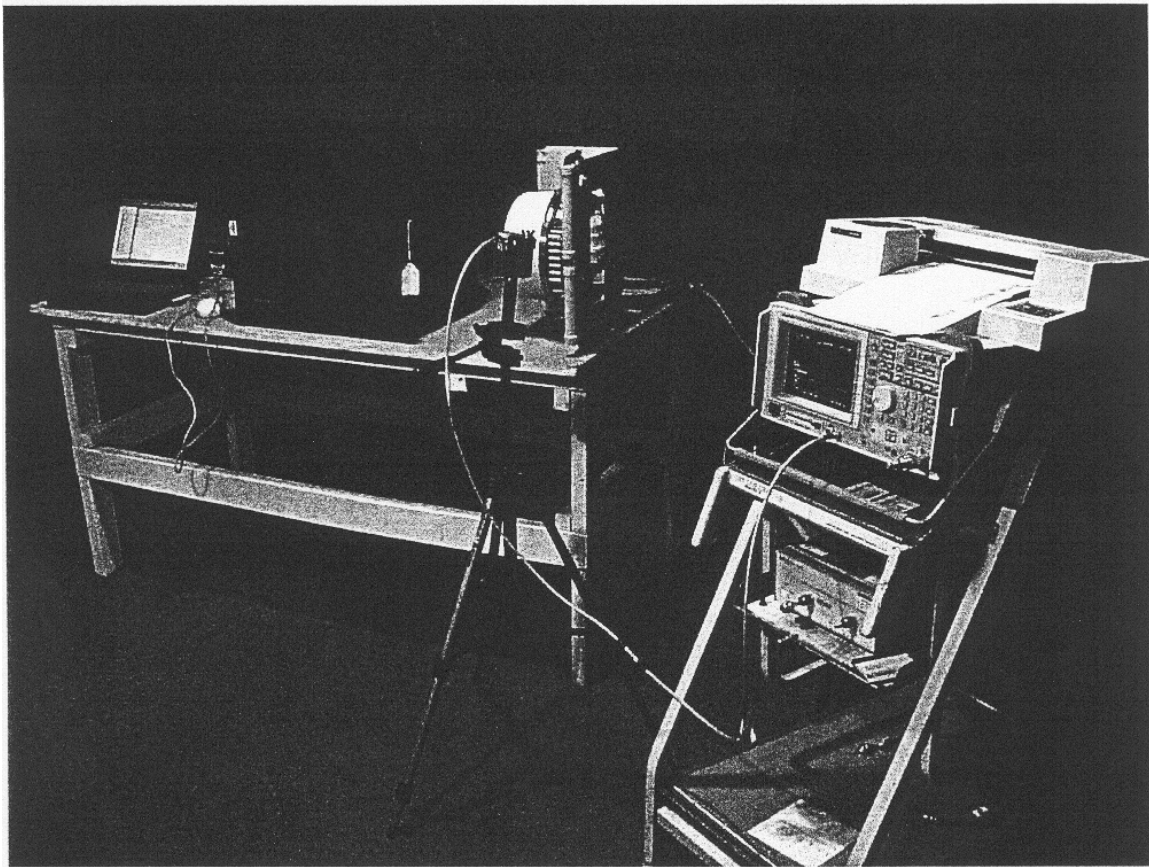


PHOTO 6.1.3.1-1

FCC RADIATED EMISSIONS TABULATED RESULTS

EUT MODEL: P-COM 28GHz SECTOR OUTDOOR UNITS/N: 28SL1A300001 DATE: 05/04/00 TESTER: JB

FREQUENCY (GHZ)	ANTENNA POL.	MEASURED (dB μ V/m)	Q.P. LIMIT (dB μ V/m @ 3 METERS)	MARGIN (dB)
27.6GHz	H	151	N/A	N/A
27.6GHz	V	134	N/A	N/A
55.2GHz	H	<100	118	<-18
55.2GHz	V	<100	118	<-18
82.8GHz	H	<117	118	<-1*
82.8GHz	V	<117	118	<-1*

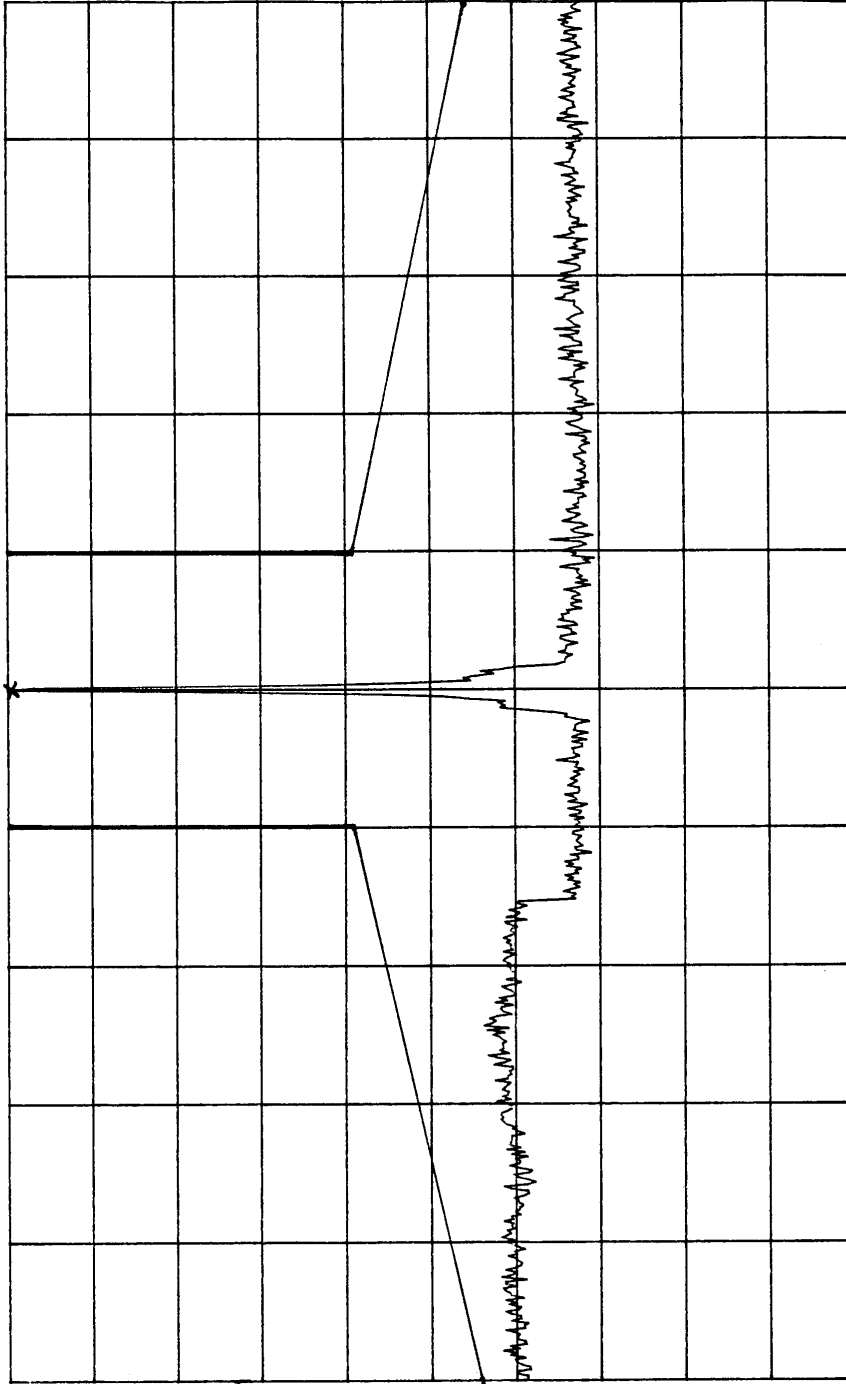
* NO SIGNALS DETECTED AT HARMONIC FREQUENCIES

TABLE 6.1.3.1-1

TEST: EMISSION MASK EUT: P-COM HUB/28GHz ODU S/N: 130/118/00003
FREQ: CENTER 27.5 GHz SPEC: FCC ANT. HT/POL:
MODULATION: MIN. LINE UNDER TEST: CHANNEL 1 EUT POSITION:
DATE: 5-9-00 TEST SITE: ROOM 3 TESTER: AD

ATTEN 20dB
RL 10.0dBm

10dB/



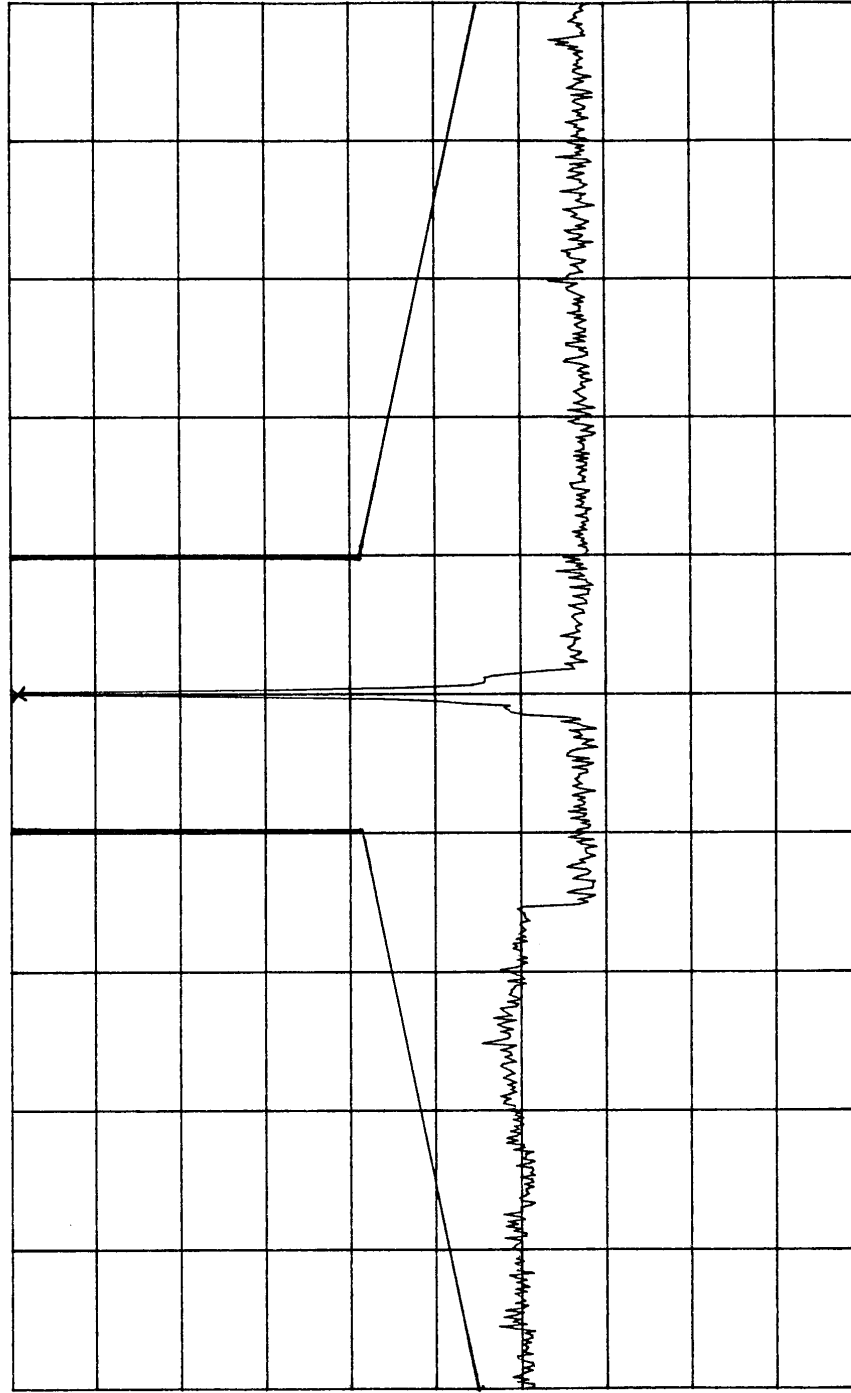
D

CENTER 27.498GHZ SPAN 4.250GHZ
BW 1 CMH7 VBW 1 CMH7 SWP 85.0ms

TEST: EMISSION MASK EUT: P-COM HUB/28GHz ODU S/N: 130/118/00003
 FREQ: CENTER 27.50 GHz SPEC: FCC ANT. HT/POL:
 MODULATION: MID. LINE UNDER TEST: CHANNEL 1 EUT POSITION:
 DATE: 5-9-00 TEST SITE: ROOM 3 TESTER: *AB*

ATTEN 20dB
 RL 10.0dBm

10dB/



D

DATA SHEET 6.1.3.1-2

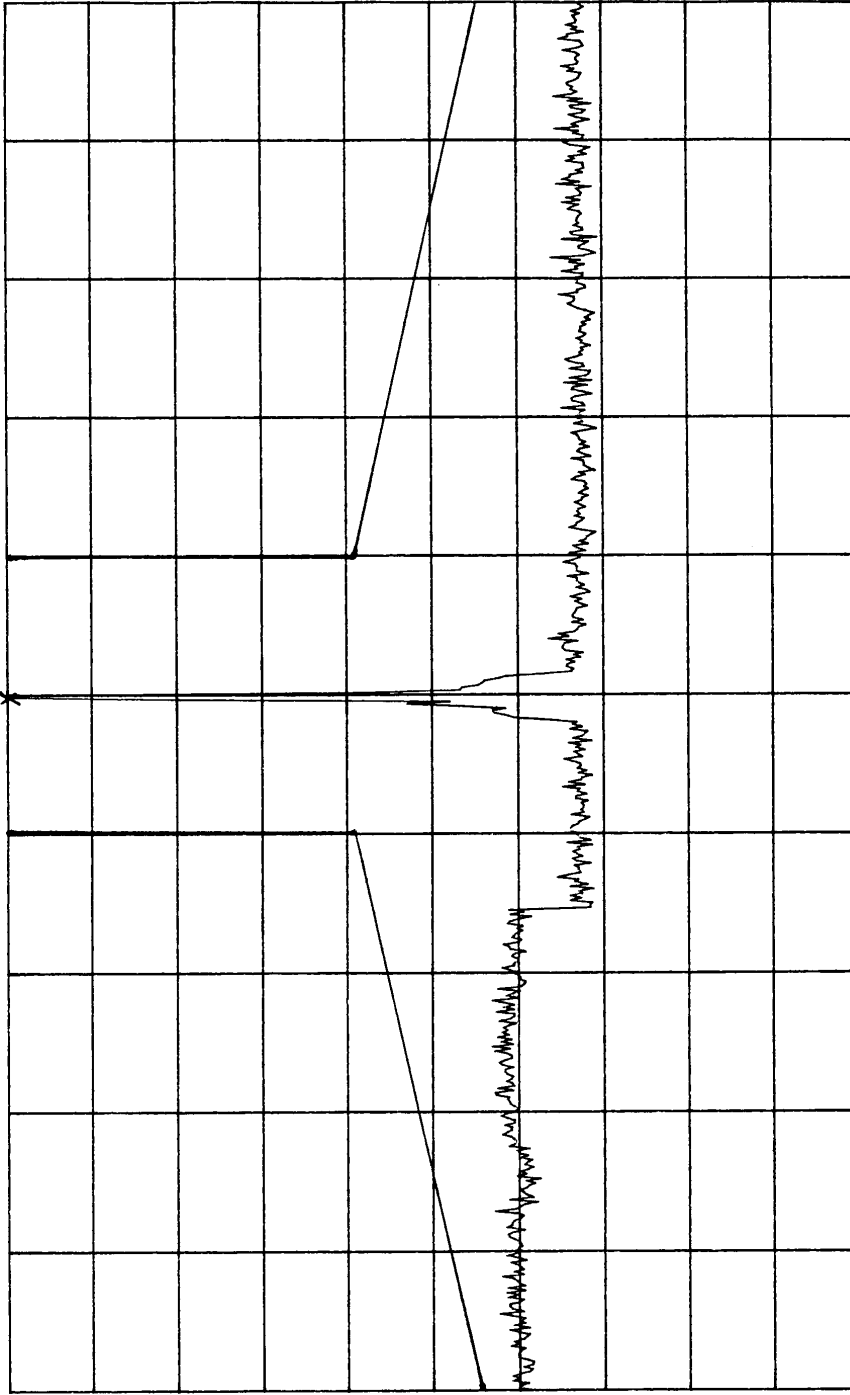
CENTER 27.498GHz SPAN 4.250GHz
 PRW 1.0MHz VRW 1.0MHz SWP 85.0ms

TEST: EMISSION MASK EUT: P-COM HUB/28GHz ODU S/N: 130/118/00003
 FREQ: *CENTEL* 27.50 GHz SPEC: FCC ANT. HT/POL:
 MODULATION: MAX. LINE UNDER TEST: CHANNEL 1 EUT POSITION:
 DATE: *5-9-00* TEST SITE: ROOM 3 TESTER: *AS*

ATTEN 20dB

RL 10.0dBm

10dB/



D

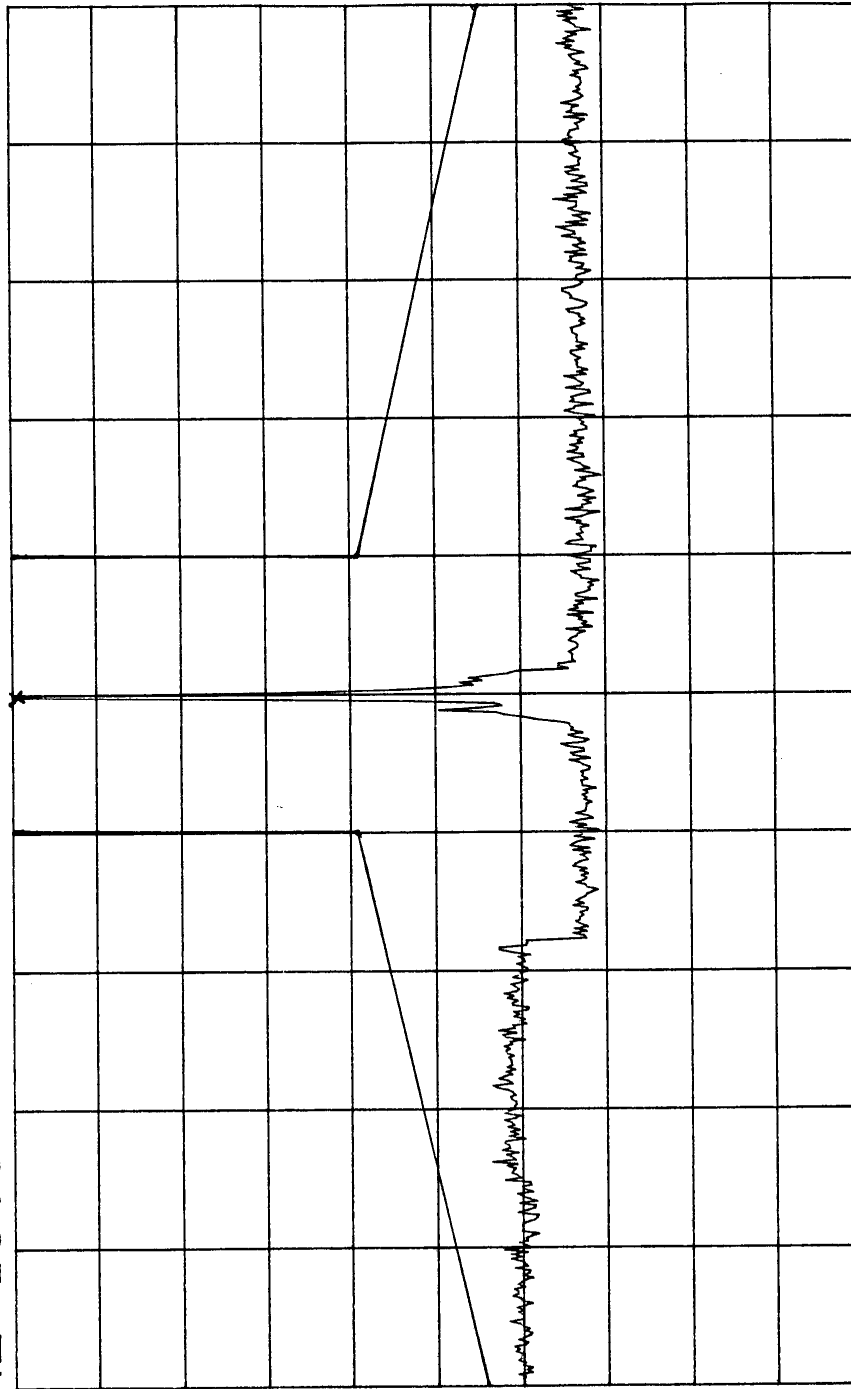
CENTER 27.505GHZ SPAN 4.250GHZ
 RBW 1.0MHZ VBW 1.0MHZ SWP 85.0ms

JA-1666-2

TEST: EMISSION MASK EUT: P-COM HUB/28GHz ODU S/N: 130/118/00003
 FREQ: CENTER 27.600 SPEC: FCC 101.111 ANT.HT/POL:
 MODULATION: MIN. LINE UNDER TEST: CHANNEL 11 EUT POSITION:
 DATE: 5-9-00 TEST SITE: ROOM 3 TESTER: *AKS*

ATTEN 20dB
 PL 10.0dBm

10dB/



D

DATA SHEET 6.1.3.1-4

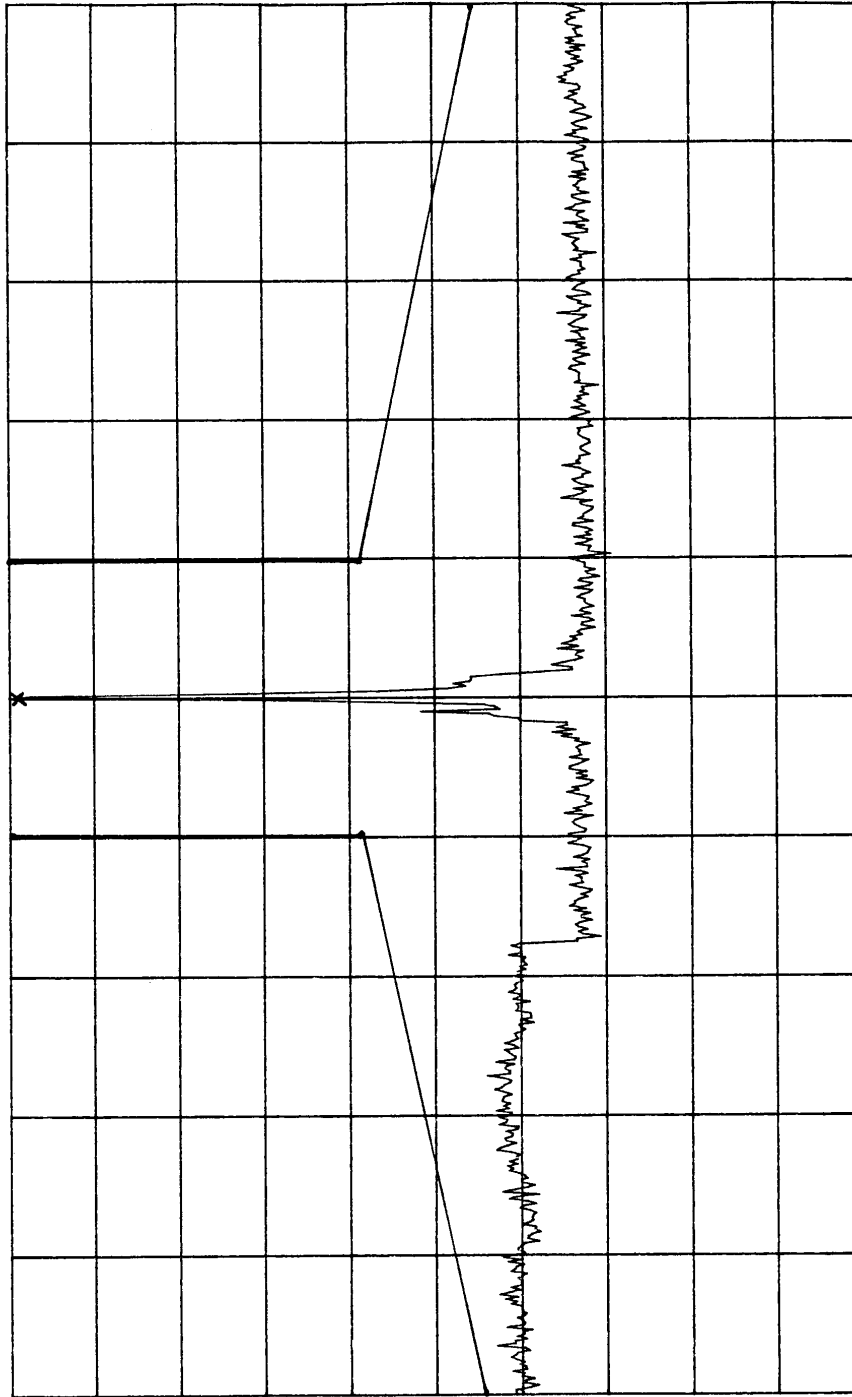
CENTER 27.604GHz SPAN 4.250GHz
 RBW 1.0MHz VBW 1.0MHz SWP 85.0ms

TEST: EMISSION MASK EUT: P-COM HUB/28GHz ODU S/N: 130/118/00003
 FREQ: *CENTER 27.60 GHz* SPEC: FCC 101.111 ANT. HT/POL:
 MODULATION: MID. LINE UNDER TEST: CHANNEL 11 EUT POSITION:
 DATE: *5-9-00* TEST SITE: ROOM 3 TESTER: *AB*

ATTEN 20dB

RL 10.0dBm

10dB/



Graph14.tif (2288x2948x2 tiff)

CENTER 27.597GHz SPAN 4.250GHz
 RBW 1.0MHz VBW 1.0MHz SWP 85.0ms

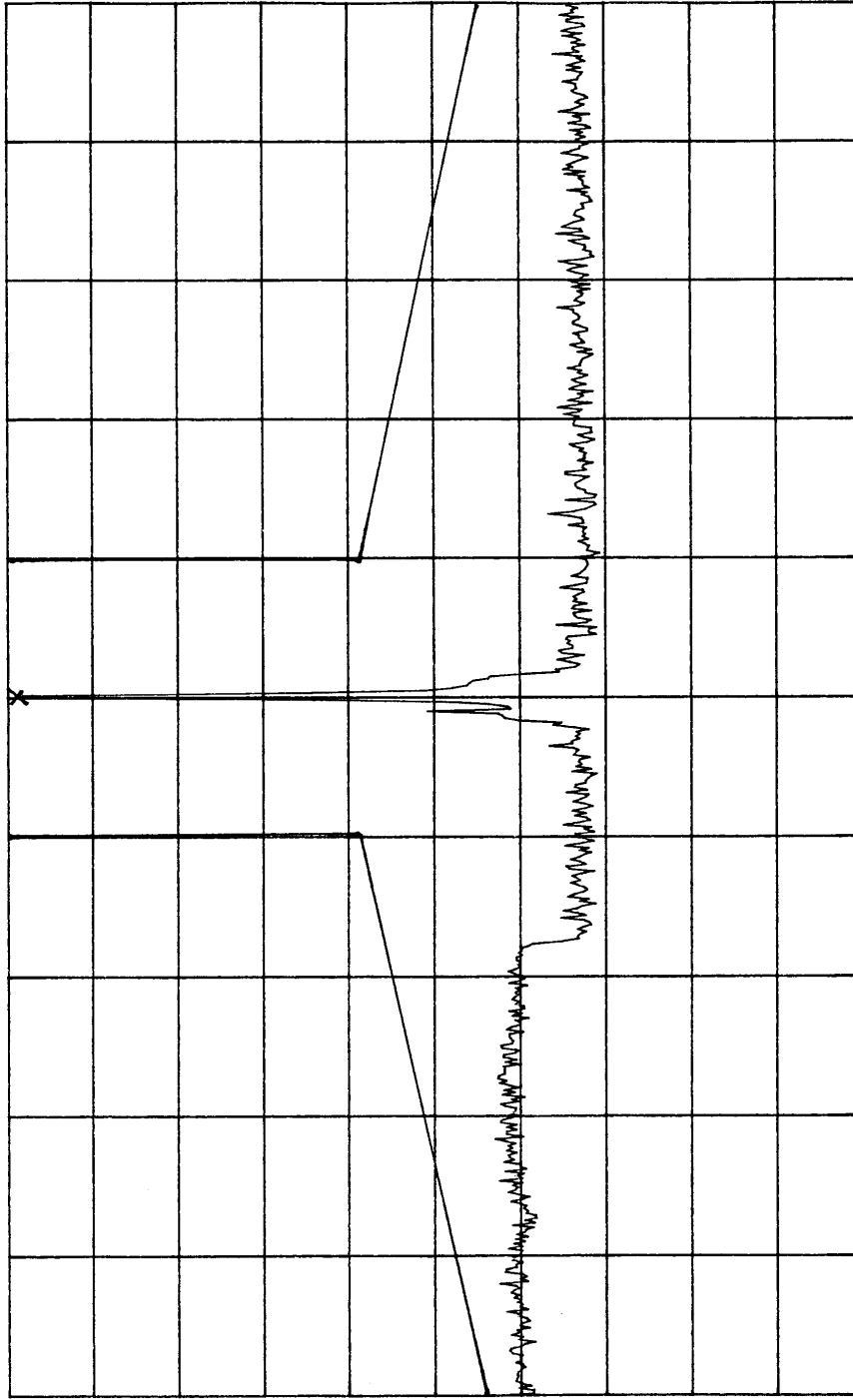
JA-1666-2

TEST: EMISSION MASK EUT: P-COM HUB/28GHz ODU S/N: 130/118/00003
 FREQ: *CENTER 27.60 GHz* SPEC: FCC 101.111 ANT.HT/POL:
 MODULATION: MAX. LINE UNDER TEST: CHANNEL 11 EUT POSITION:
 DATE: *5-9-00* TEST SITE: ROOM 3 TESTER: *AB*

ATTEN 20dB

RL 10.0dBm

10dB/



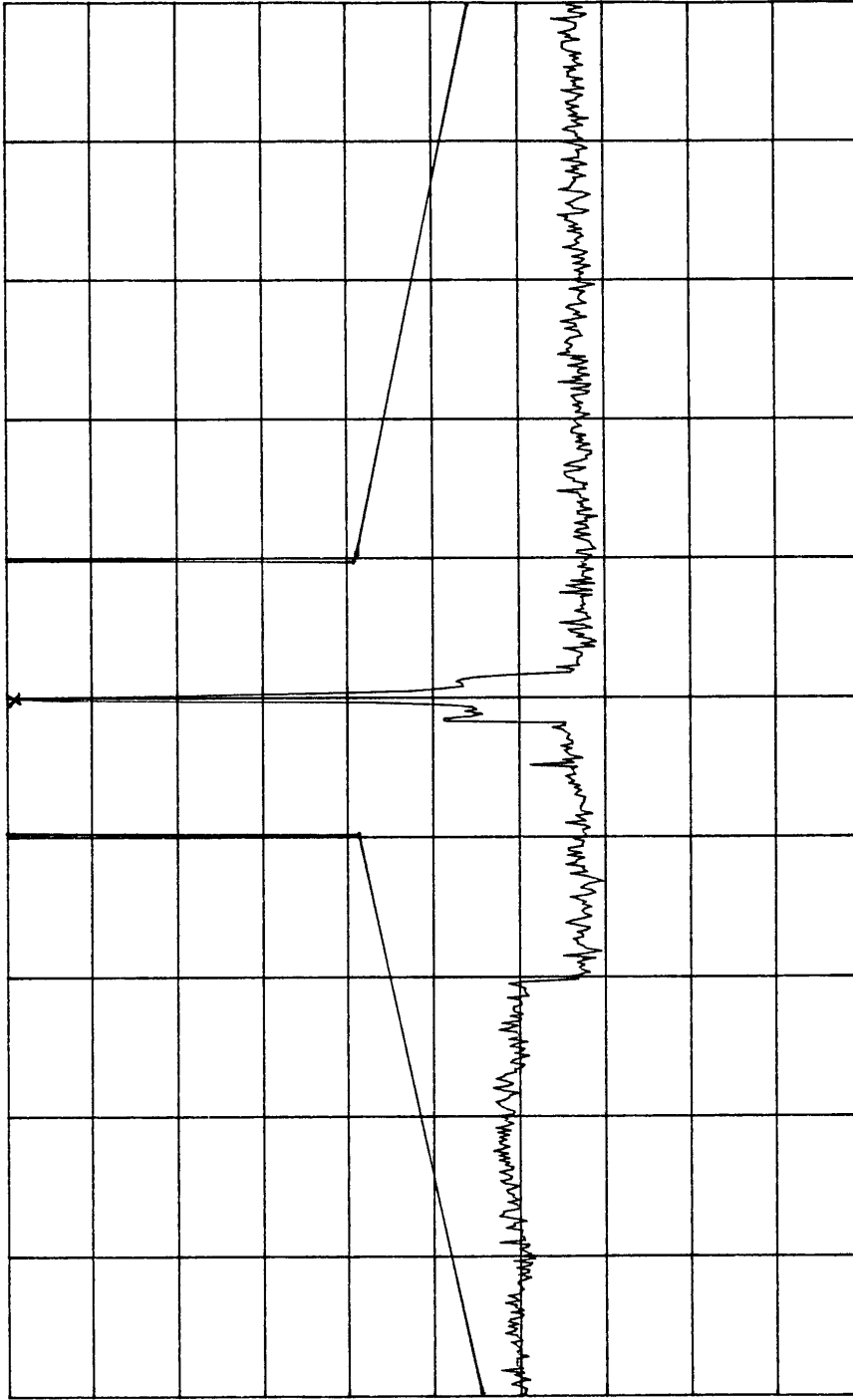
D

DATA SHEET 6.1.3.1-6

CENTER 27.597GHz SPAN 4.250GHz
 RBW 1.0MHz SWP 85.0ms
 VBW 1.0MHz

TEST: EMISSION MASK EUT: P-COM HUB/28GHz ODU S/N: 130/118/00003
FREQ: ~~CENTER~~ 27.71 GHz SPEC: FCC 101.111 ANT.HT/POL:
MODULATION: MIN. LINE UNDER TEST: CHANNEL 22 EUT POSITION:
DATE: 5-9-00 TEST SITE: ROOM 3 TESTER: *AB*

ATTEN 20dB
RL 10.0dBm 10dB/



D

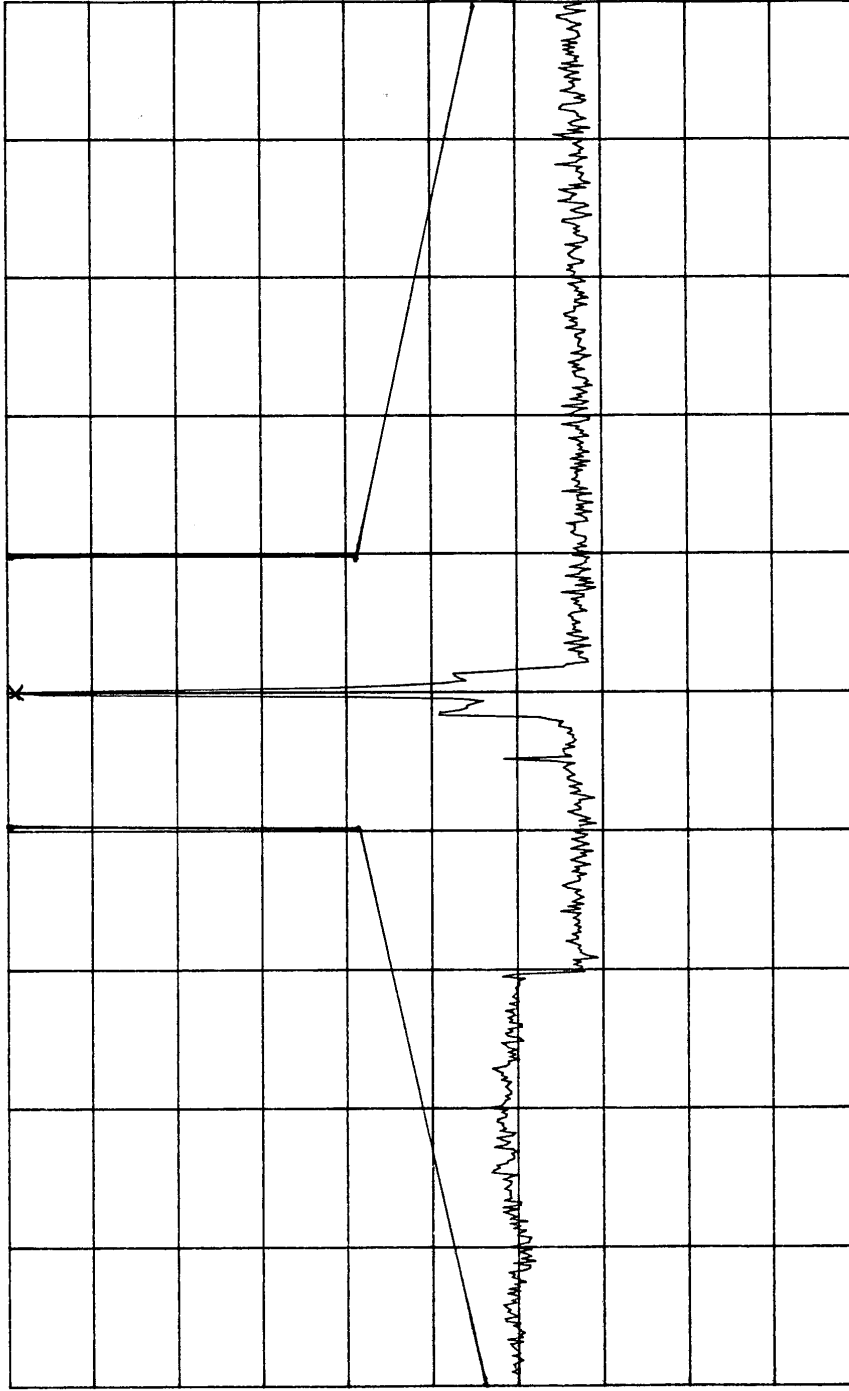
CENTER 27.710GHz SPAN 4.250GHz
RBW 1.0MHz VBW 1.0MHz SWP 85.0ms

TEST: EMISSION MASK EUT: P-COM HUB/28GHz ODU S/N: 130/118/00003
FREQ: CENTER 27.71 SPEC: FCC 101.111 ANT.HT/POL:
MODULATION: MID. LINE UNDER TEST: CHANNEL 22 EUT POSITION:
DATE: 5-9-00 TEST SITE: ROOM 3 TESTER: AB

ATTEN 20dB

RL 10.0dBm

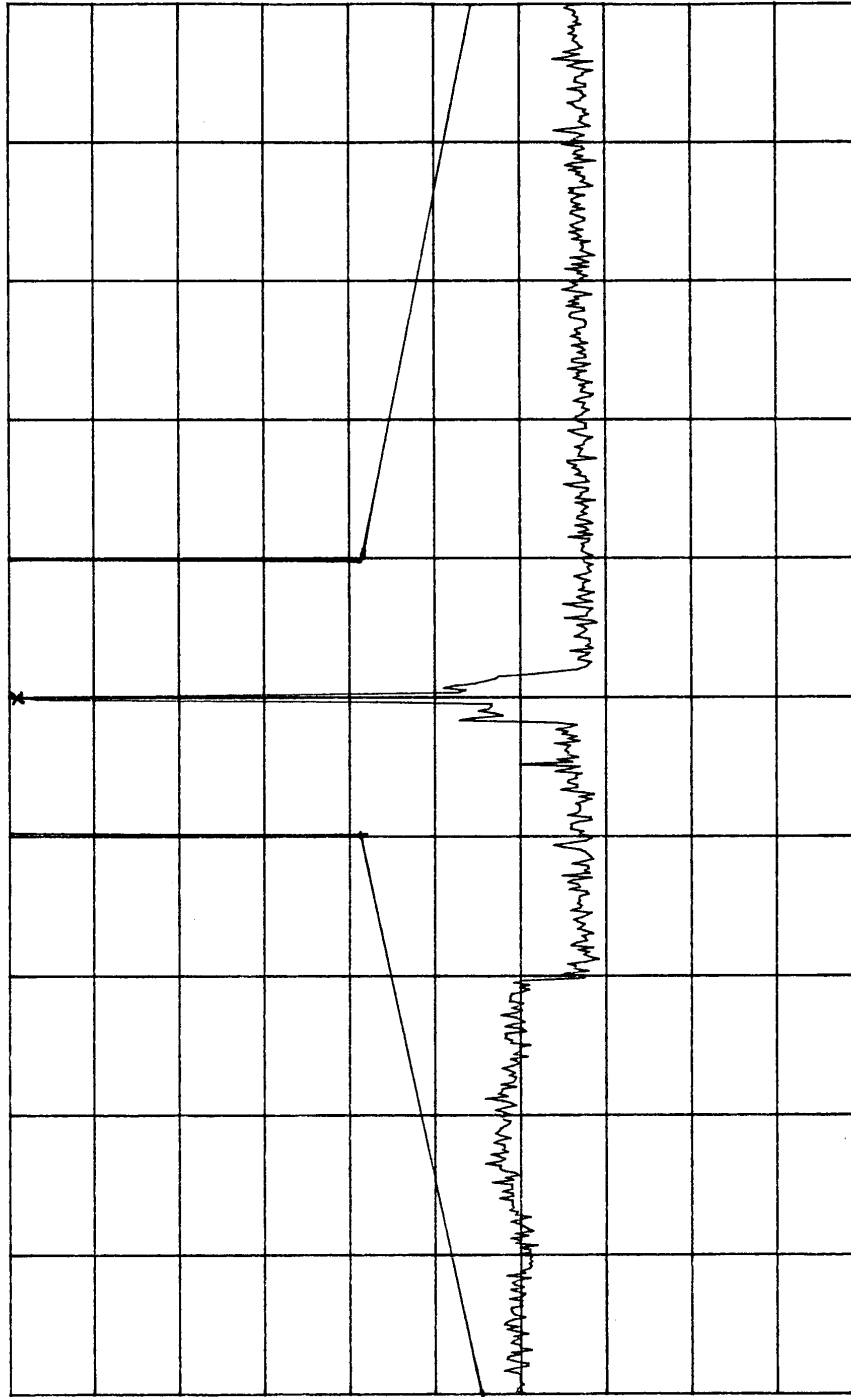
10dB/



D

CENTER 27.710GHZ SPAN 4.250GHZ
RBW 1.0MHZ VBW 1.0MHZ SWP 85.0ms

ATTEN 2008
RL 10.00BE

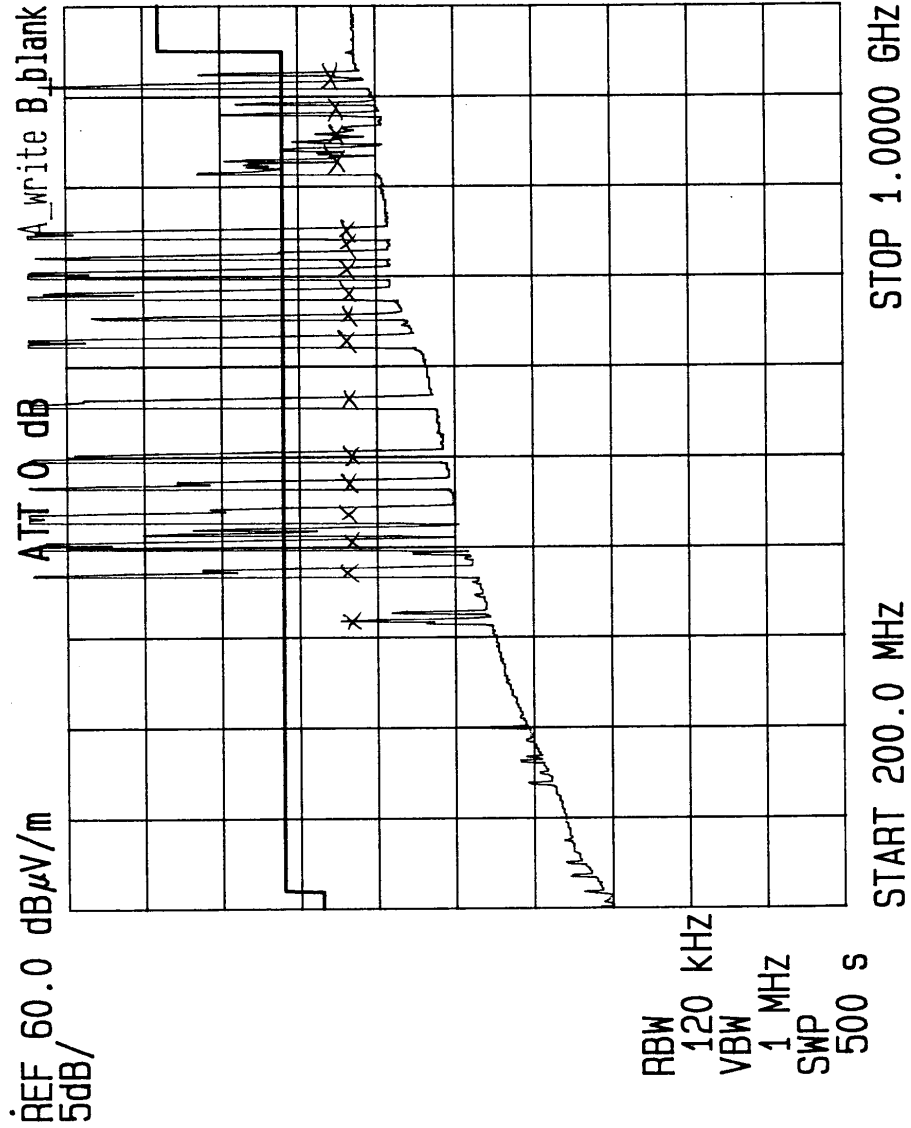


CENTER 27.710GHZ
SPAN 4.250GHZ

COMM 4 COMM 4 COMM 4
SWD RF CES



TEST: FCC RADIATED EUT: P-COM HUB/28GHz ODU S/N: 130/118/00001
FREQ: 200MHz-1GHz SPEC: FCC INT. RAD. ANT. HT/POL: 1-4m\ H
DETECTOR: QUASI PEAK LINE UNDER TEST: N/A EUT POSITION: 0-360°
DATE: 5-4-00 TEST SITE: O.A.T.S. TESTER: *AD*



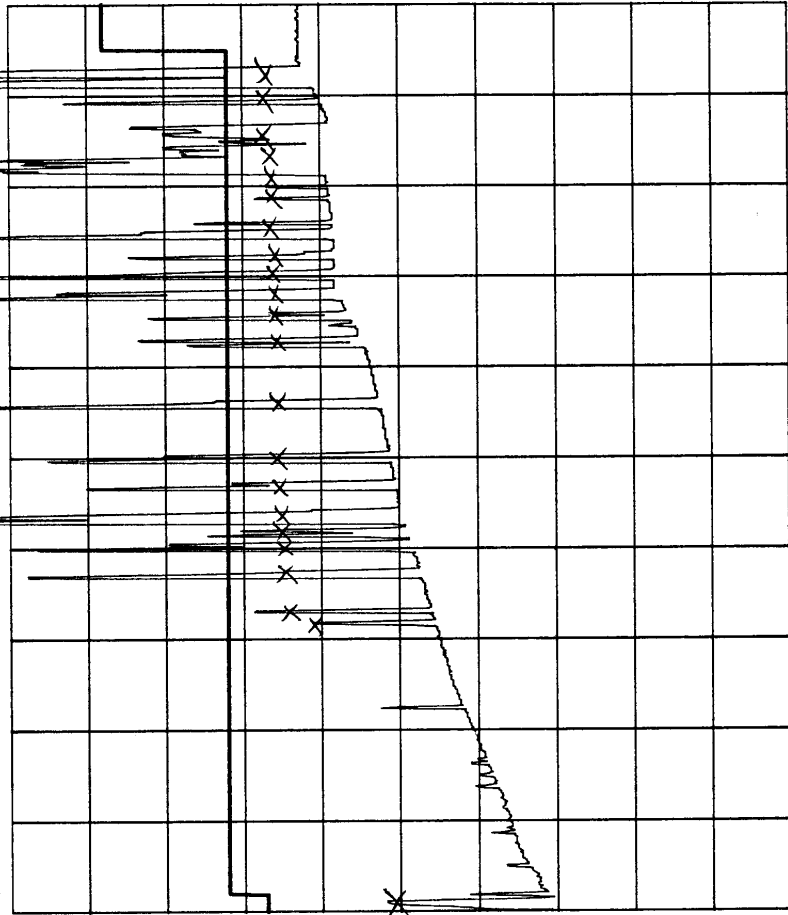


TEST: FCC RADIATED EUT: P-COM HUB/28GHz ODU S/N: 130/118/00001
FREQ: 200MHz-1GHz SPEC: FCC INT. RAD. ANT. HT/POL: 1-4m V
DETECTOR: QUASI PEAK LINE UNDER TEST: N/A EUT POSITION: 0-300°
DATE: 5-4-02 TEST SITE: O.A.T.S. TESTER: *AB*

REF 60.0 dB μ V/m
5dB/

A Write B Blank

ATT 0 dB



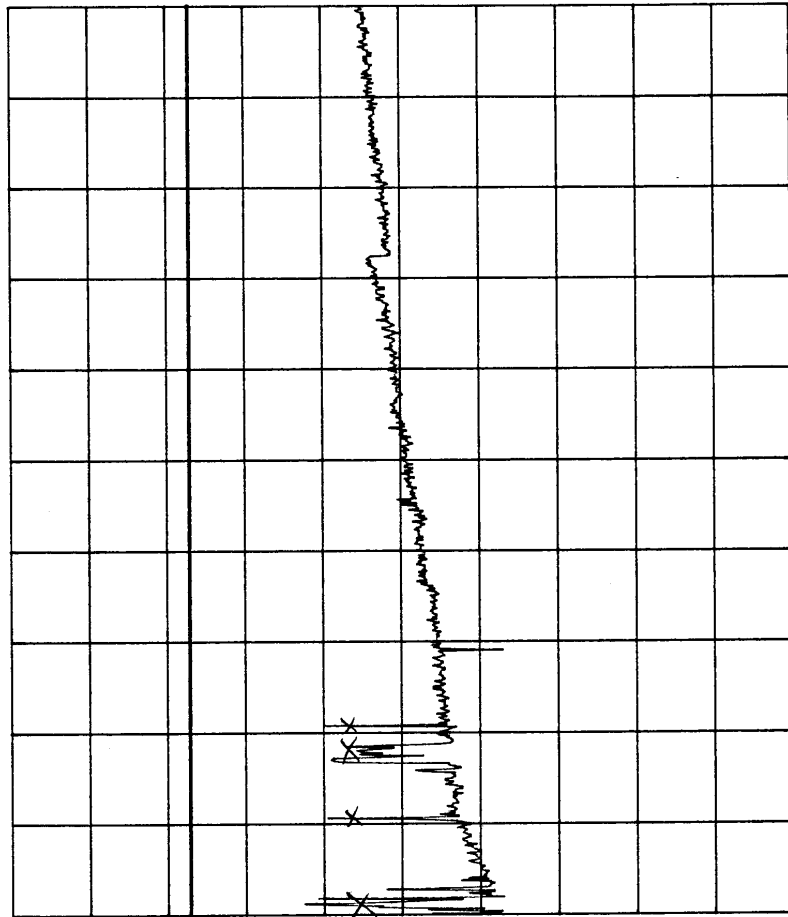
RBW 120 KHz
VBW 1 MHz
SWP 500 s

START 200.0 MHz STOP 1.000 GHz



TEST: RAD. EMISSIONS EUT: P-COM HUB/28GHz ODU S/N: 130/118/00001
FREQ: 1G-10GHz SPEC: FCC INT. RAD. ANT.HT/POL: 1-4m | H
DETECT: PEAK LINE UNDER TEST: N/A EUT POSITION: 0-360°
DATE: 5-4-00 TEST SITE: O.A.T.S TESTER: AB

REF 97.0 dB μ V/m ATT 0 dB A_write B_blank
10dB/



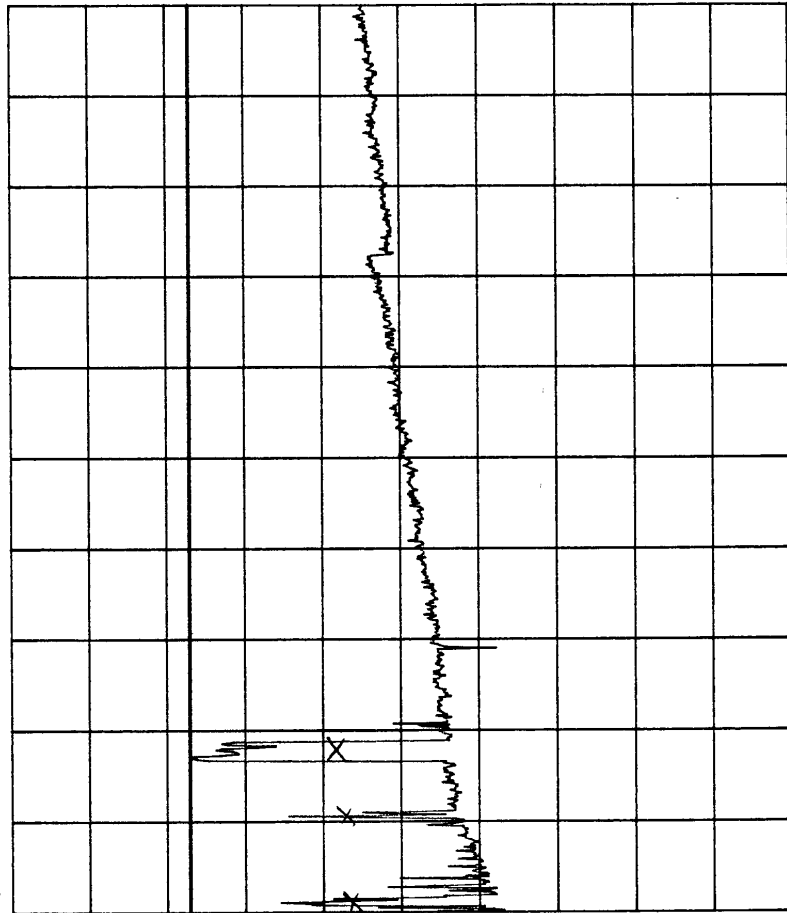
RBW 1 MHz
VBW 1 MHz
SWP 200 s

START 1.000 GHz STOP 10.000 GHz



TEST: RAD. EMISSIONS EUT: P-COM HUB/28GHz ODU S/N: 130/118/00001
FREQ: 1G-10GHz SPEC: FCC INT. RAD. ANT. HT/POL: 1-4m V
DETECT: PEAK LINE UNDER TEST: N/A EUT POSITION: 0-300'
DATE: 5-4-00 TEST SITE: O.A.T.S. TESTER: AB

REF 97.0 dB μ V/m ATT 0 dB A_write B_blank
10dB/



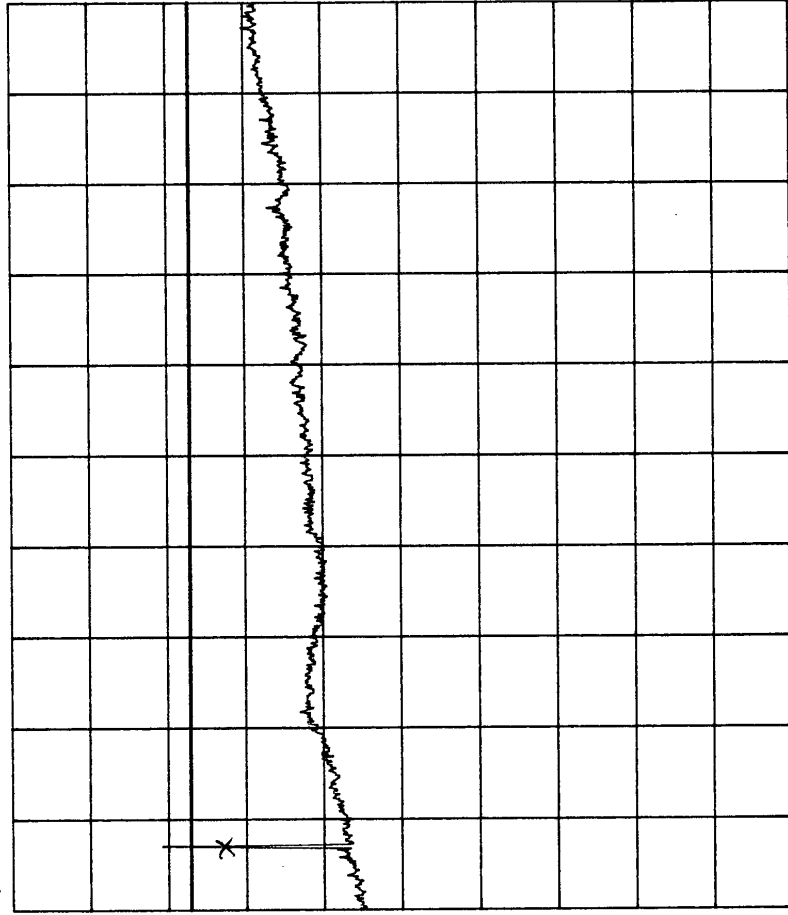
RBW 1 MHz
VBW 1 MHz
SWP 200 s

START 1.000 GHz STOP 10.000 GHz



TEST: FCC RADIATED EUT: P-COM HUB/28GHz ODU S/N: 130/118/00001
 FREQ: 10GHz-18GHz SPEC: FCC INT. RAD. ANT. HT/POL: 1-4\H
 DETECTOR: PEAK LINE UNDER TEST: N/A EUT POSITION: 0-340°
 DATE: 5-4-00 TEST SITE: O.A.T.S. TESTER: *AB*

REF 97.0 dB μ V/m ATT 0 dB A_write B_blank
 10dB/



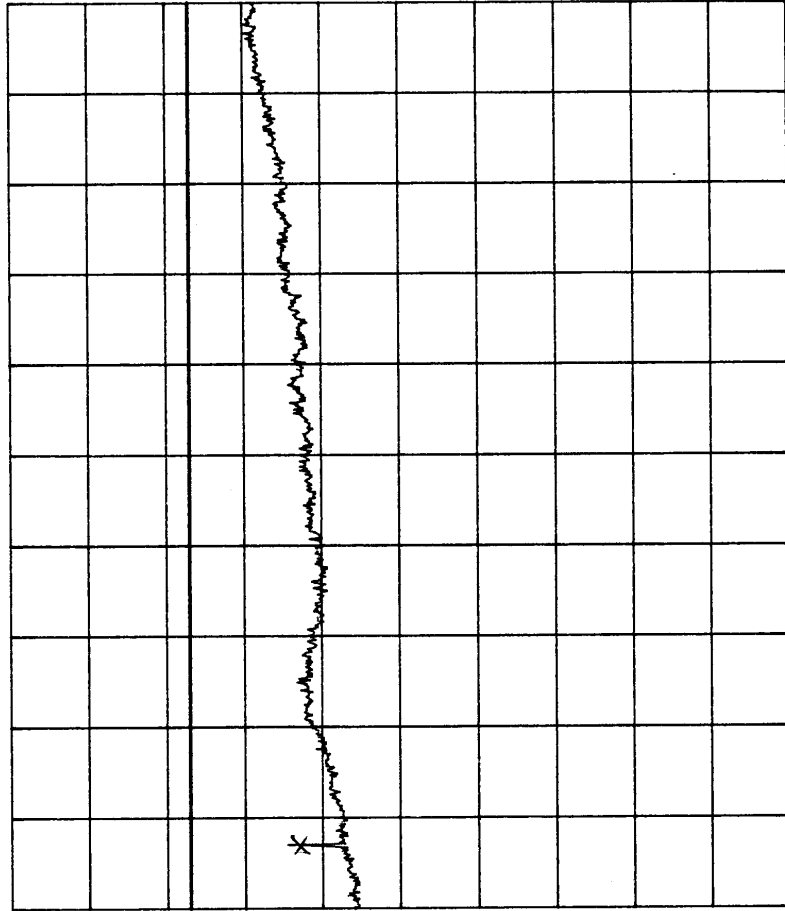
RBW 1 MHz
 VBW 1 MHz
 SWP 200 s

START 10.000 GHz STOP 18.000 GHz



TEST: FCC RADIATED EUT: P-COM HUB/28GHz ODU S/N: 130/118/00001
FREQ: 10GHz-18GHz SPEC: FCC INT. RAD. ANT. HT/POL: 1-4m V
DETECTOR: PEAK LINE UNDER TEST: N/A EUT POSITION: 0-360°
DATE: 5-4-00 TEST SITE: O.A.T.S. TESTER: *[Signature]*

REF 97.0 dB μ V/m ATT 0 dB A_write B_blank
10dB/



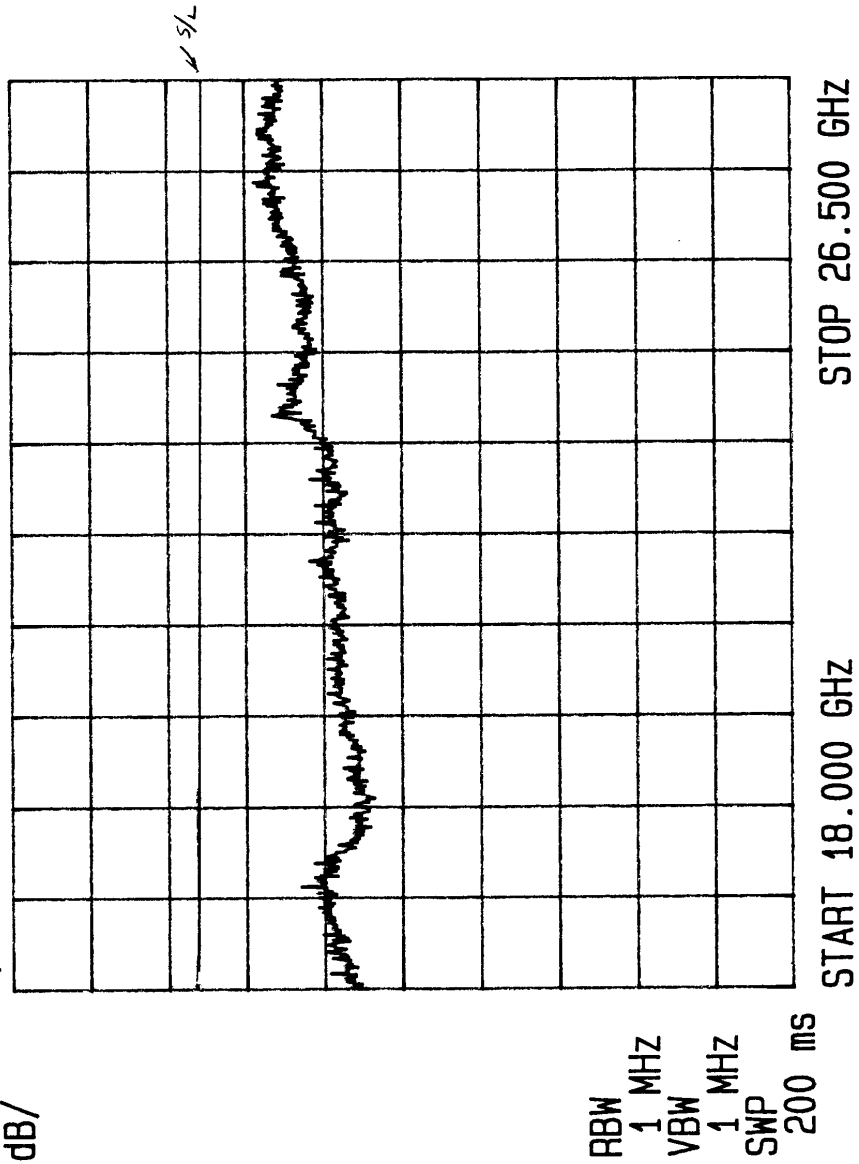
RBW 1 MHz
VBW 1 MHz
SWP 200 s

START 10.000 GHz STOP 18.000 GHz



TEST: FCC RADIATED EUT: P-COM HUB/28GHz ODU S/N: 130/118/00001
FREQ: 18GHz-26.5GHz SPEC: FCC INT. RAD. ANT. HT/POL: *45°* H
DETECTOR: PEAK LINE UNDER TEST: N/A EUT POSITION: *Front*
DATE: *5-3-00* TEST SITE: ROOM 3/OATS TESTER: *[Signature]*

REF 97.0 dB μ V/m ATT 0 dB A_write B_blank
10dB/



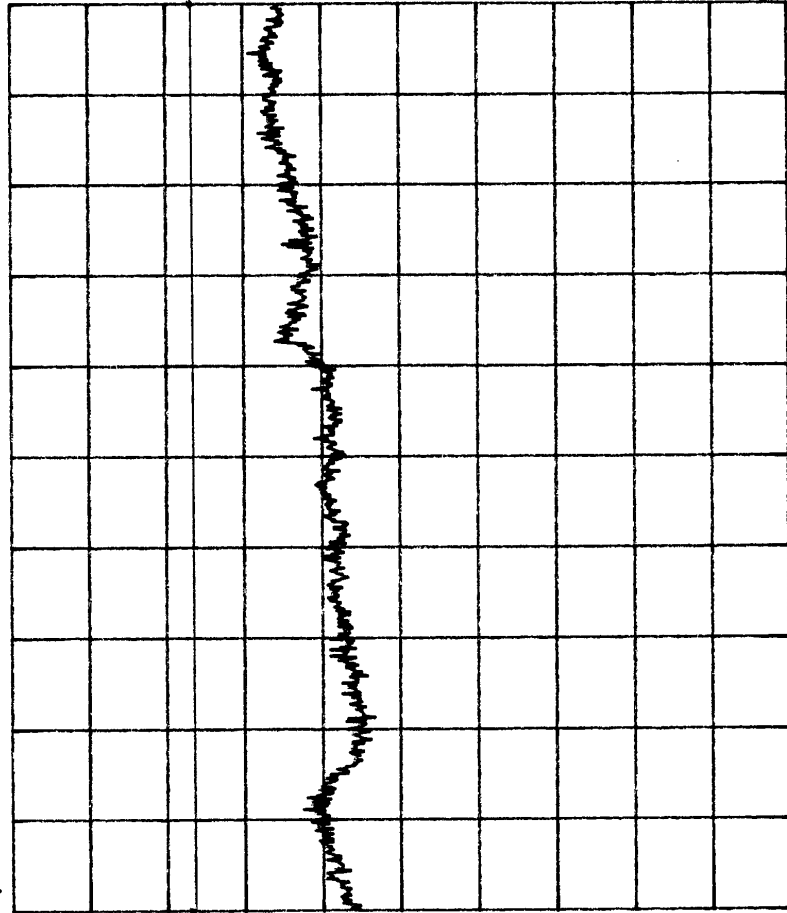


TEST: FCC RADIATED	EUT: P-COM HUB/28GHz ODU	S/N: 130/118/00001
FREQ: 18GHz-26.5GHz	SPEC: FCC INT. RAD.	ANT.HT/POL: 1, 4 V
DETECTOR: PEAK	LINE UNDER TEST: N/A	EUT POSITION: <i>flant</i>
DATE: 5-3-00	TEST SITE: ROOM 3/OATS	TESTER: <i>[Signature]</i>

REF 97.0 dB μ V/m
10dB/

ATT 0 dB

A_write B_blank



RBW 1 MHz
VBW 1 MHz
SWP 200 ms

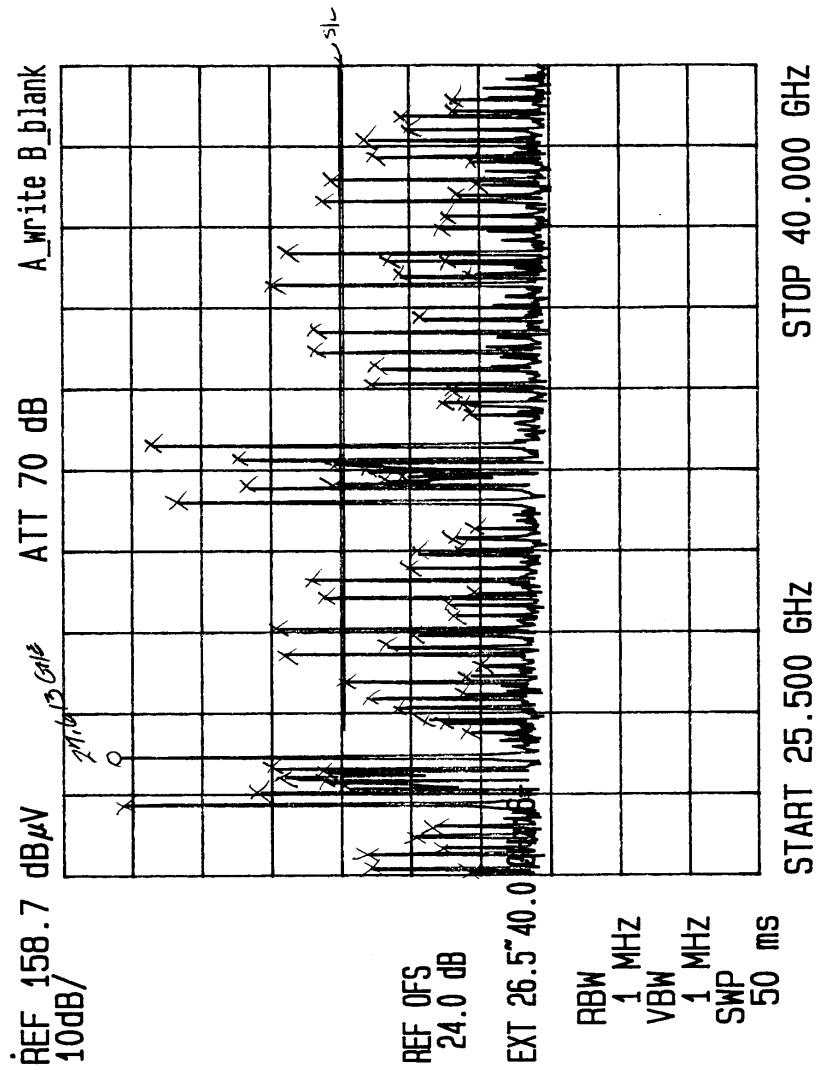
START 18.000 GHz

STOP 26.500 GHz

JA-1666-2



TEST: FCC RADIATED EUT: P-COM HUB/28GHz ODU S/N: 130/118/00001
 FREQ: 26.5GHz-40GHz SPEC: FCC INT. RAD. ANT. HT/POL: 2.12 H
 DETECTOR: PEAK LINE UNDER TEST: N/A EUT POSITION: In Room
 DATE: 5-2-00 TEST SITE: ROOM 3/OATS TESTER: *[Signature]*

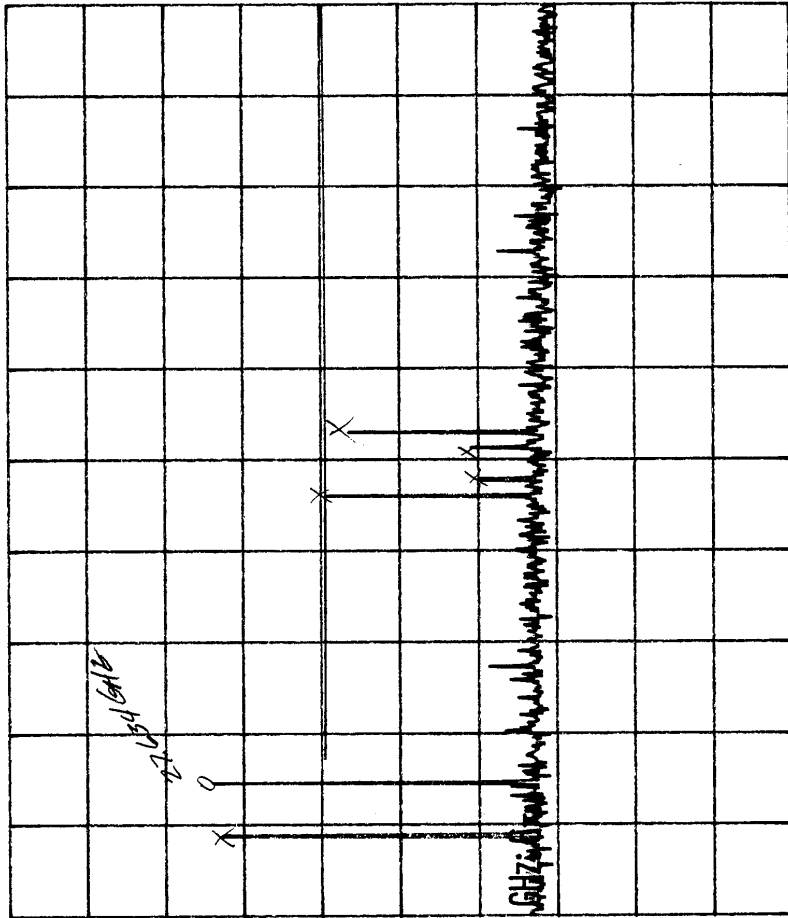


DATA SHEET 6.1.3.1-18



TEST: FCC RADIATED EUT: P-COM HUB/28GHz ODU S/N: 130/118/00001
FREQ: 26.5GHz-40GHz SPEC: FCC INT. RAD. ANT. HT/POL: ~ 1.2 V
DETECTOR: PEAK LINE UNDER TEST: N/A EUT POSITION: In line
DATE: 5-2-00 TEST SITE: ROOM 3/OATS TESTER: (signature)

REF 158.7 dB μ V ATT 70 dB A_write B_blank
10dB/



REF OFS
24.0 dB

EXT 26.5~40.0 GHz

RBW 1 MHz
VBW 1 MHz
SWP 50 ms

START 25.500 GHz STOP 40.000 GHz



TEST: FCC RADIATED EUT: P-COM HUB/28GHz ODU S/N: 130/118/00001
FREQ: 40GHz-50GHz SPEC: FCC INT. RAD. ANT. HT/POL: H
DETECTOR: PEAK LINE UNDER TEST: N/A EUT POSITION:
DATE: 5-2-00 TEST SITE: ROOM 3 OATS TESTER: [Signature]

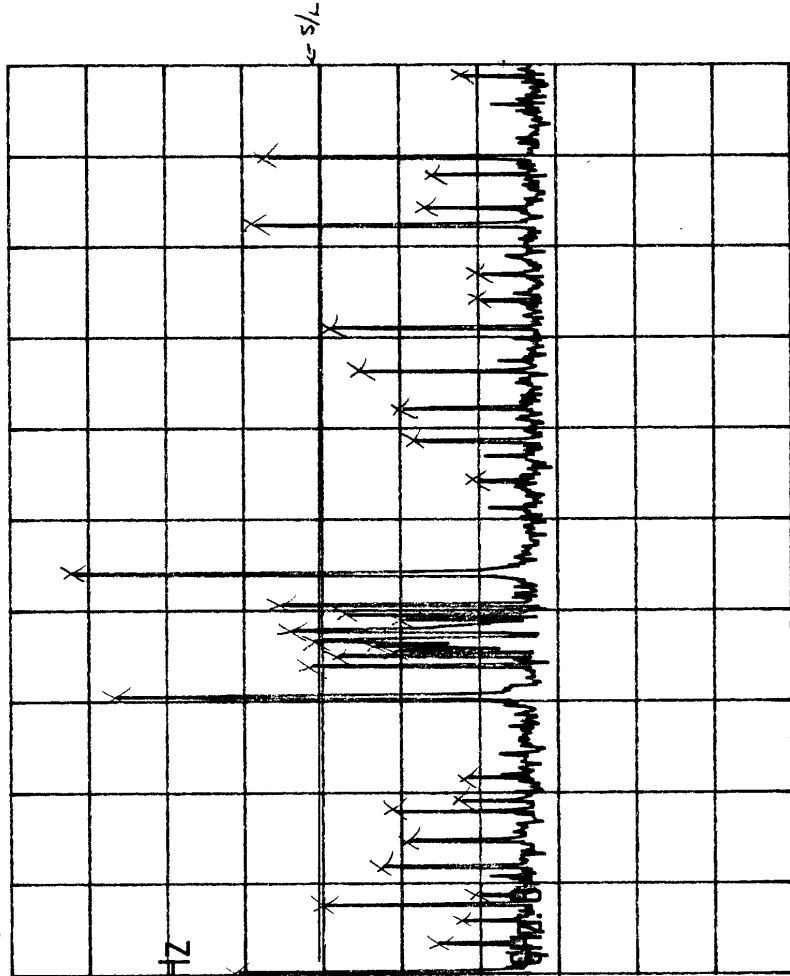
REF 157.2 dB μ V ATT 70 dB A_write B_blank
10dB/

CENTER
45.000 GHz

REF OFS
22.5 dB

EXT 33.0~50.0

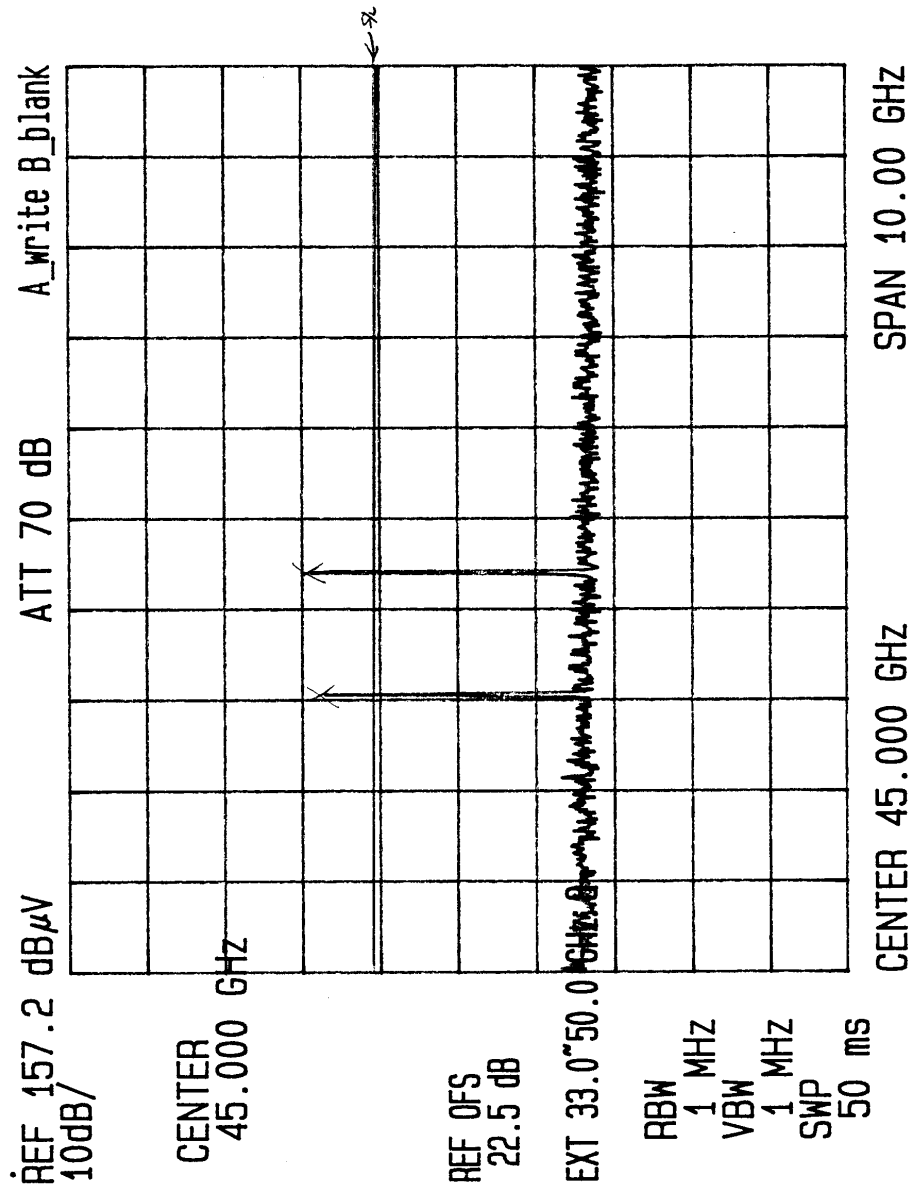
RBW 1 MHz
VBW 1 MHz
SWP 50 ms



CENTER 45.000 GHz SPAN 10.00 GHz



TEST: FCC RADIATED EUT: P-COM HUB/28GHz ODU S/N: 130/118/00001
FREQ: 40GHz-50GHz SPEC: FCC INT. RAD. ANT. HT/POL: V
DETECTOR: PEAK LINE UNDER TEST: N/A EUT POSITION:
DATE: 5-2-00 TEST SITE: ROOM 3/OATS TESTER:





TEST: FCC RADIATED EUT: P-COM HUB/28GHz ODU S/N: 130/118/00001
FREQ: 50GHz-75GHz SPEC: FCC INT. RAD. ANT. HT/POL: H
DETECTOR: PEAK LINE UNDER TEST: N/A EUT POSITION:
DATE: 5-2-00 TEST SITE: ROOM 3/OATS TESTER: *[Signature]*

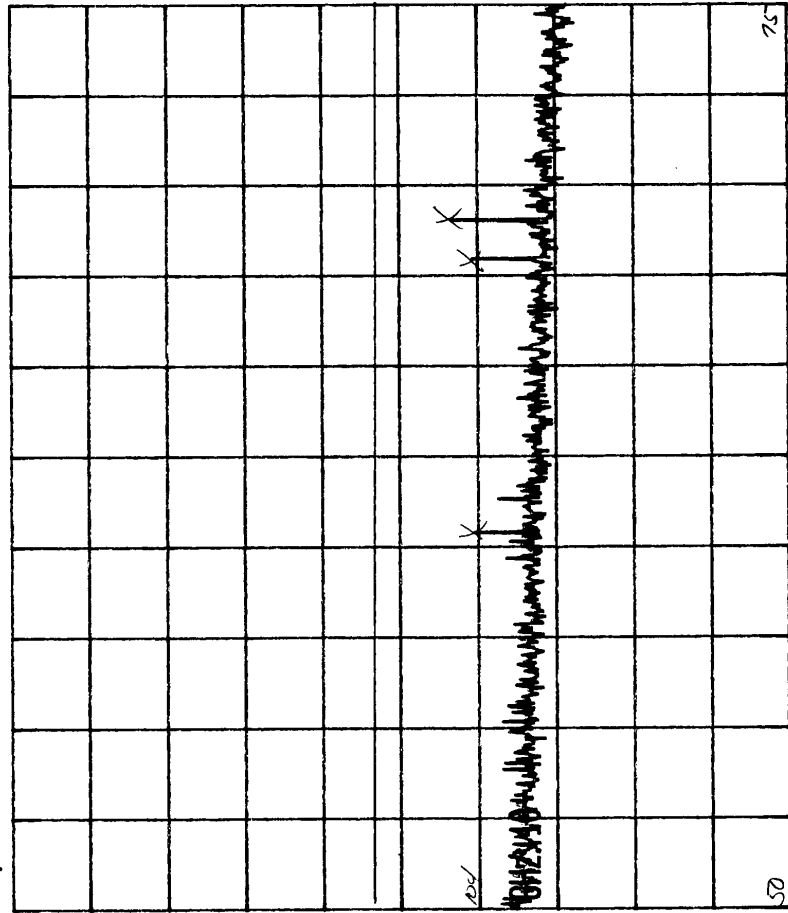
REF 164.7 dB μ V/m ATT 70 dB A_write B_blank
10dB/

AVG. LOSS
31.70 dB

REF OFS
26.0 dB

EXT 50.0~75.0

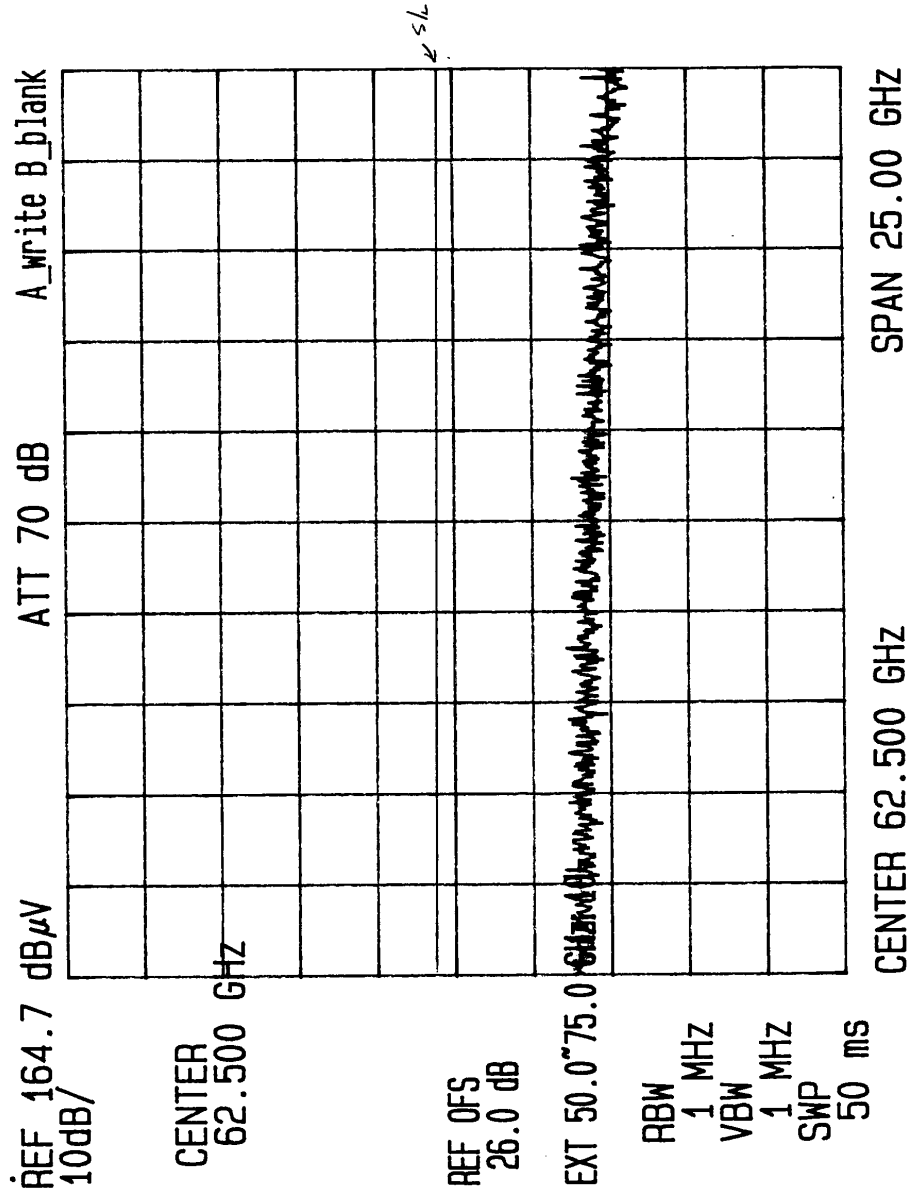
RBW 1 MHz
VBW 1 MHz
SWP 50 ms



CENTER 62.500 GHz SPAN 25.00 GHz



TEST: FCC RADIATED EUT: P-COM HUB/28GHz ODU S/N: 130/118/00001
FREQ: 50GHz-75GHz SPEC: FCC INT. RAD. ANT. HT/POL: V
DETECTOR: PEAK LINE UNDER TEST: N/A EUT POSITION:
DATE: 5-2-00 TEST SITE: ROOM 3/OATS TESTER:



Graph32.tif (2236x2852x2 tiff)

JA-1666-2

DATA SHEET 6.1.3.1-23



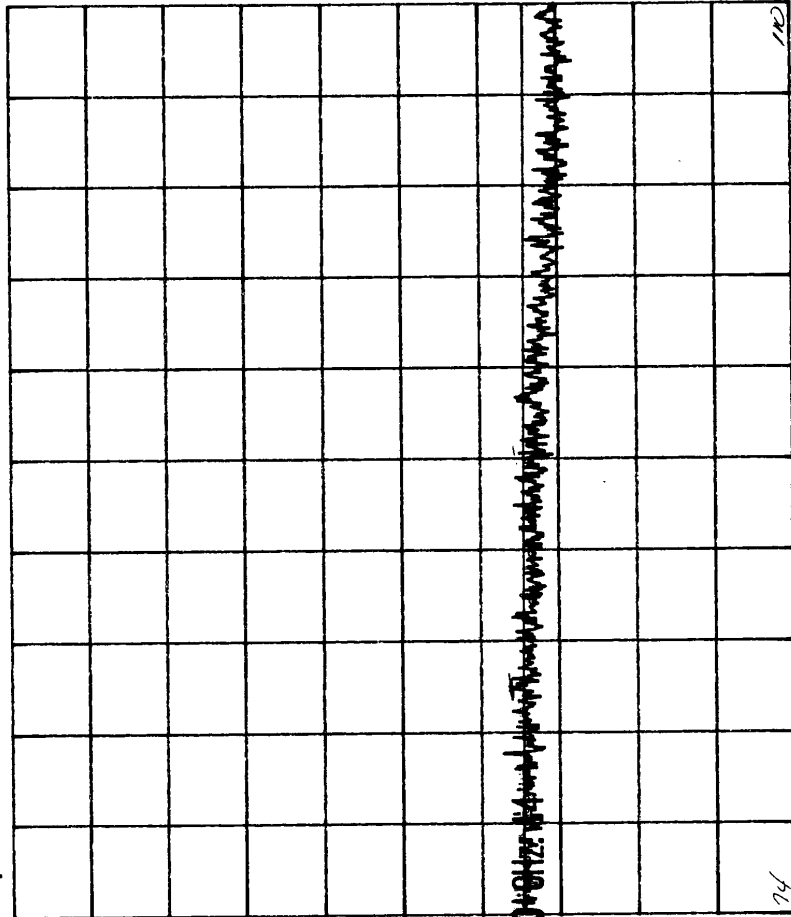
TEST: FCC RADIATED EUT: P-COM HUB/28GHz ODU S/N: 130/118/00001
FREQ: 75GHz-100GHz SPEC: FCC INT. RAD. ANT.HT/POL: 1.1m H
DETECTOR: PEAK LINE UNDER TEST: N/A EUT POSITION: Peak
DATE: 5-2-00 TEST SITE: ROOM 3/OATS TESTER: [Signature]

REF 183.2 dB μ V ATT 70 dB A_write B_blank
10dB/

REF OFS
29.5 dB

EXT 75.0~110.0 GHz 10dB/

RBW 1 MHz
VBW 1 MHz
SWP 80 ms





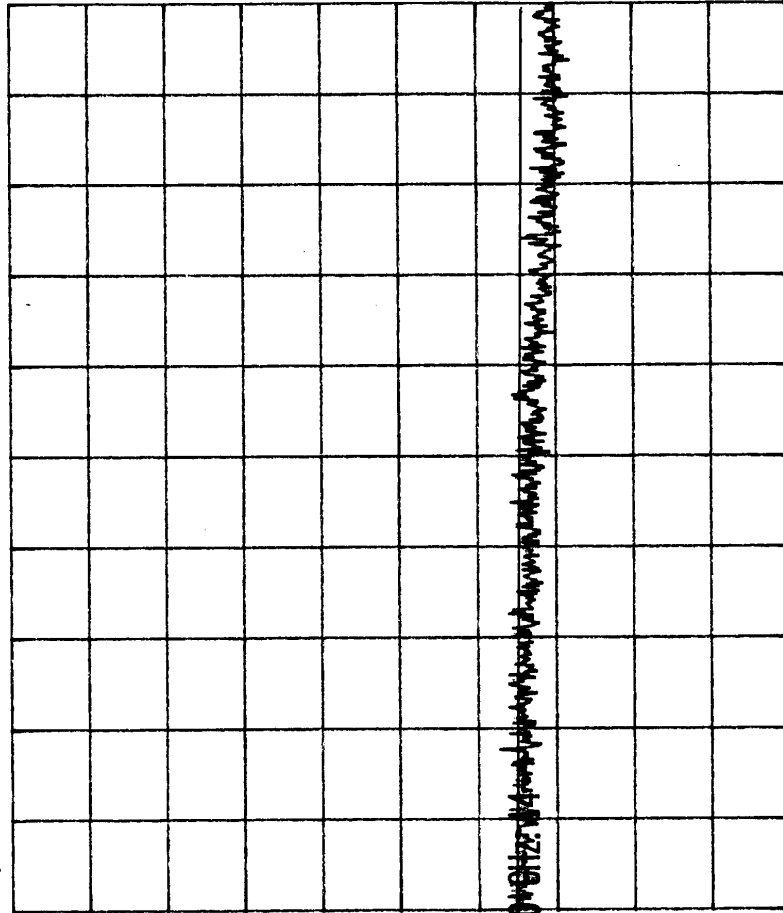
TEST: FCC RADIATED EUT: P-COM HUB/28GHz ODU S/N: 130/118/00001
FREQ: 75GHz-100GHz SPEC: FCC INT. RAD. ANT.HT/POL: V
DETECTOR: PEAK LINE UNDER TEST: N/A EUT POSITION:
DATE: 5-2-00 TEST SITE: ROOM 3/OATS TESTER:

REF 183.2 dB μ V ATT 70 dB A write B blank
10dB/

REF OFS
29.5 dB

EXT 75.0~110.0 MHz

RBW 1 MHz
VBW 1 MHz
SWP 80 ms

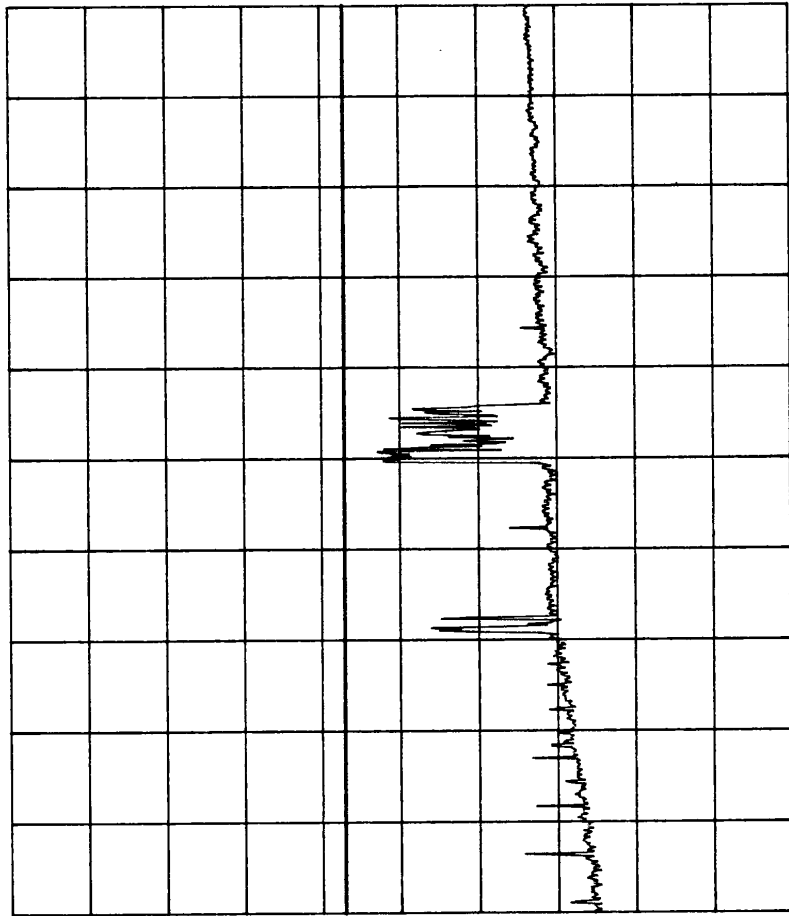


CENTER 92.000 GHZ SPAN 36.00 GHZ



TEST: FCC RADIATED EUT: P-COM HUB/28GHz ODU S/N: 130/118/00001
FREQ: 1GHz-4GHz SPEC: FCC INT. RAD. ANT. HT/POL: 1-4\ H
DETECTOR: AVERAGE LINE UNDER TEST: N/A EUT POSITION: 0-360°
DATE: 3-4-00 TEST SITE: O.A.T.S. TESTER: *AB*

REF 97.0 dB μ V/m ATT 0 dB A_write B_blank
10dB/

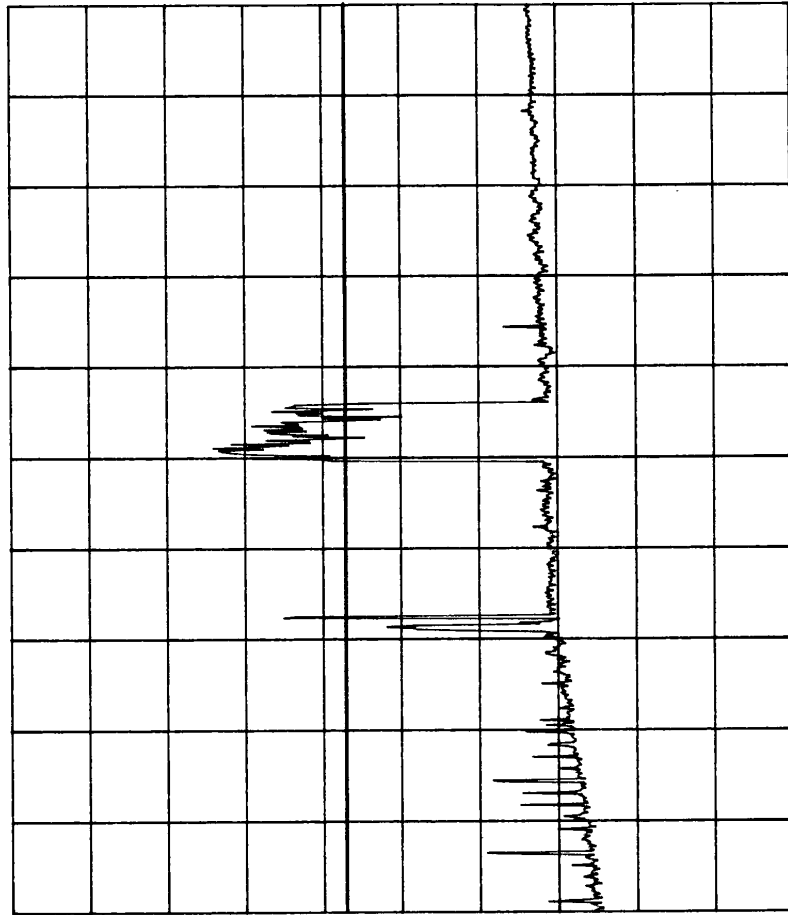


RBW 1 MHz
VBW 10 Hz
SWP 600 s



TEST: FCC RADIATED EUT: P-COM HUB/28GHz ODU S/N: 130/118/00001
FREQ: 1GHz-4GHz SPEC: FCC INT. RAD. ANT. HT/POL: 1-7m \ V
DETECTOR: AVERAGE LINE UNDER TEST: N/A EUT POSITION: 0.300
DATE: 5-4-00 TEST SITE: O.A.T.S TESTER: AB

REF 97.0 dB μ V/m ATT 0 dB A_write B_blank
10dB/



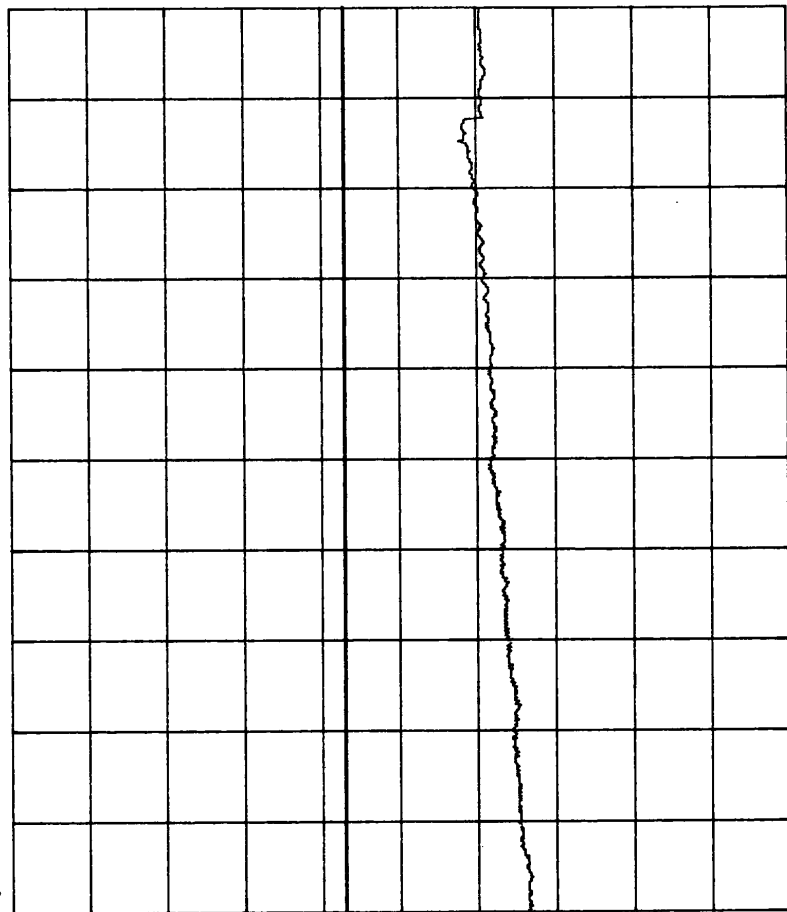
RBW 1 MHz
VBW 10 Hz
SWP 600 s

START 1.000 GHz STOP 4.000 GHz



TEST: FCC RADIATED EUT: P-COM HUB/28GHz ODU S/N: 130/118/00001
FREQ: 4GHz-8GHz SPEC: FCC INT. RAD. ANT. HT/POL: 1-4m H
DETECTOR: AVERAGE LINE UNDER TEST: N/A EUT POSITION: 0-360
DATE: 5-4-00 TEST SITE: O.A.T.S TESTER: *AB*

REF 97.0 dB μ V/m ATT 0 dB A_write B_blank
10dB/



RBW 1 MHz
VBW 10 Hz
SWP 800 s

START 4.000 GHz STOP 8.000 GHz

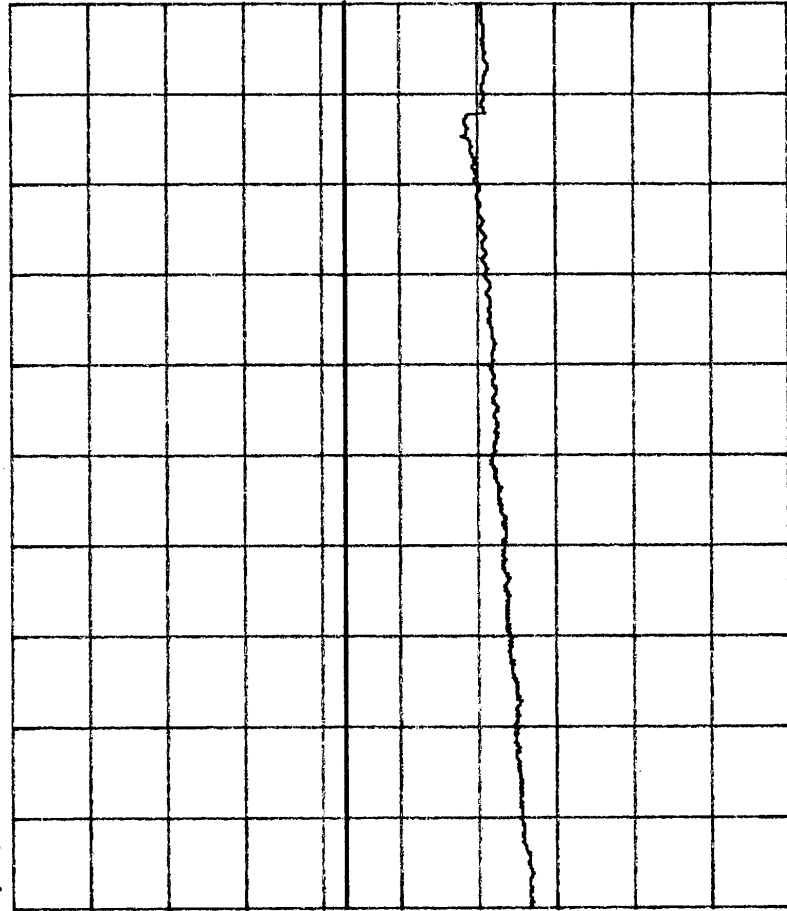


TEST: FCC RADIATED	EUT: P-COM HUB/28GHz ODU	S/N: 130/118/00001
FREQ: 4GHz-8GHz	SPEC: FCC INT. RAD.	ANT. HT/POL: <i>A-1m</i> V
DETECTOR: AVERAGE	LINE UNDER TEST: N/A	EUT POSITION: <i>0-360°</i>
DATE: <i>5-1/-00</i>	TEST SITE: O.A.T.S	TESTER: <i>AB</i>

REF 97.0 dB μ V/m
10dB/

ATT 0 dB

A_write B_blank



RBW 1 MHz
VBW 10 Hz
SWP 800 s

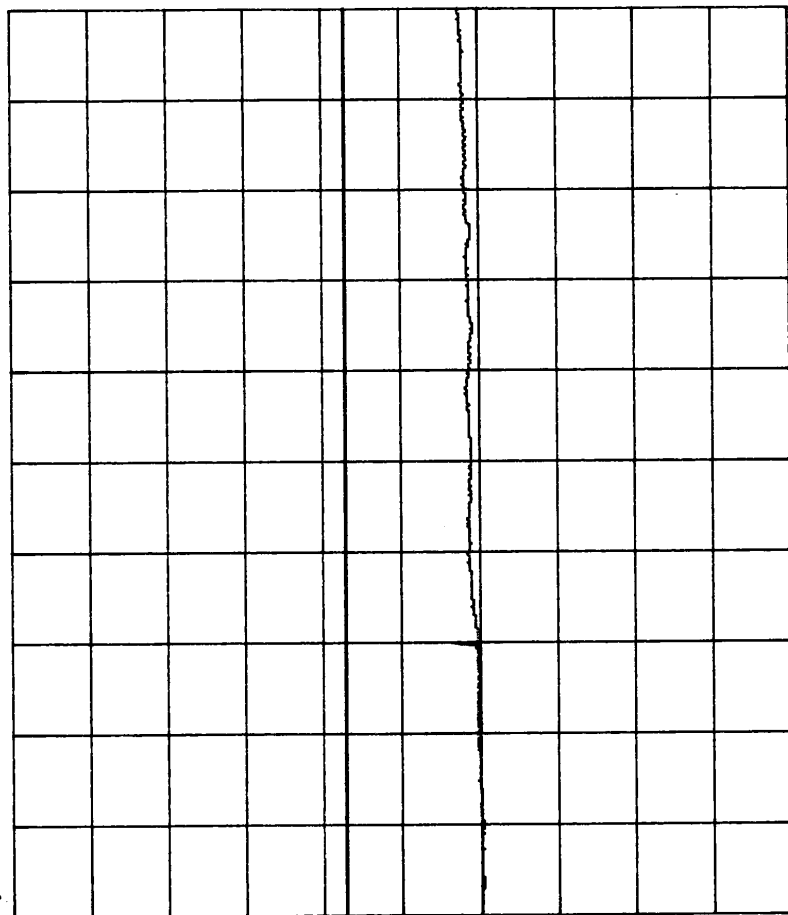
START 4.000 GHz

STOP 8.000 GHz



TEST: FCC RADIATED EUT: P-COM HUB/28GHz ODU S/N: 130/118/00001
 FREQ: 8GHz-10GHz SPEC: FCC INT. RAD. ANT. HT/POL: 1-4m \ H
 DETECTOR: AVERAGE LINE UNDER TEST: N/A EUT POSITION: 0-340'
 DATE: 5-4-00 TEST SITE: O.A.T.S. TESTER: *AD*

REF 97.0 dB μ V/m ATT 0 dB A_write B_blank
 10dB/



RBW 1 MHz
 VBW 10 Hz
 SWP 400 S

START 8.000 GHz STOP 10.000 GHz

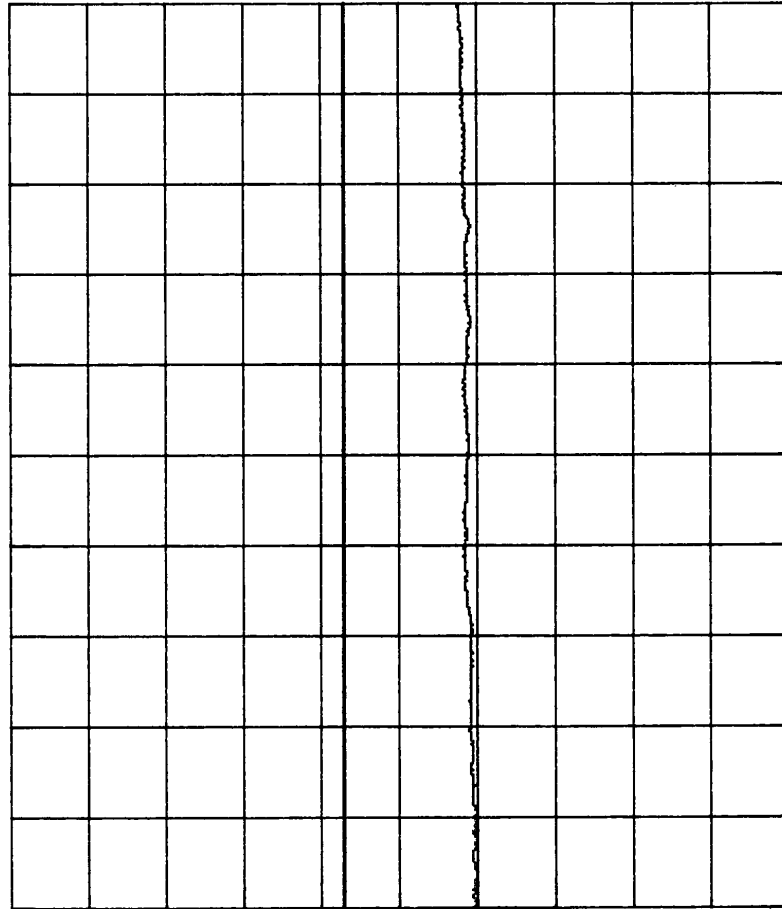


TEST: FCC RADIATED	EUT: P-COM HUB/28GHz ODU	S/N: 130/118/00001
FREQ: 8GHz-10GHz	SPEC: FCC INT. RAD.	ANT.HT/POL: 1-4m \ V
DETECTOR: AVERAGE	LINE UNDER TEST: N/A	EUT POSITION: 0-360°
DATE: 5-4-00	TEST SITE: O.A.T.S	TESTER: AB

REF 97.0 dB μ V/m
10dB/

ATT 0 dB

A_write B_blank

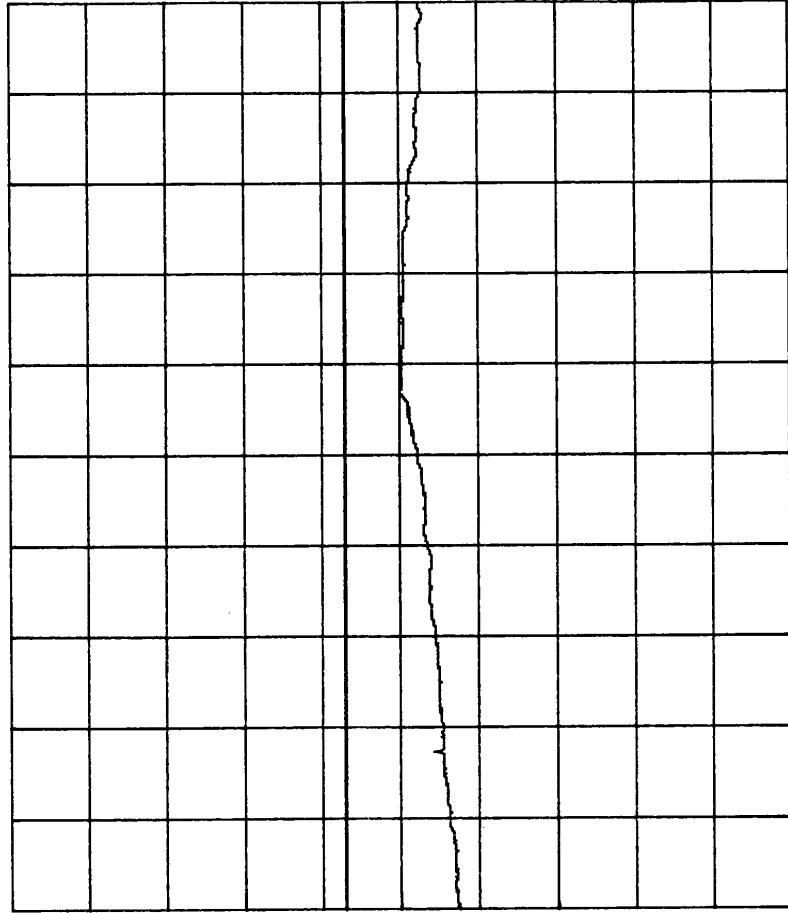


RBW 1 MHz
VBW 10 Hz
SWP 400 S



TEST: FCC RADIATED EUT: P-COM HUB/28GHz ODU S/N: 130/118/00001
FREQ: 10GHz-13GHz SPEC: FCC INT. RAD. ANT. HT/POL: 1-4m\ H
DETECTOR: AVERAGE LINE UNDER TEST: N/A EUT POSITION: 0-360'
DATE: 5-4-00 TEST SITE: O.A.T.S. TESTER: AB

REF 97.0 dB μ V/m ATT 0 dB A write B blank
10dB/



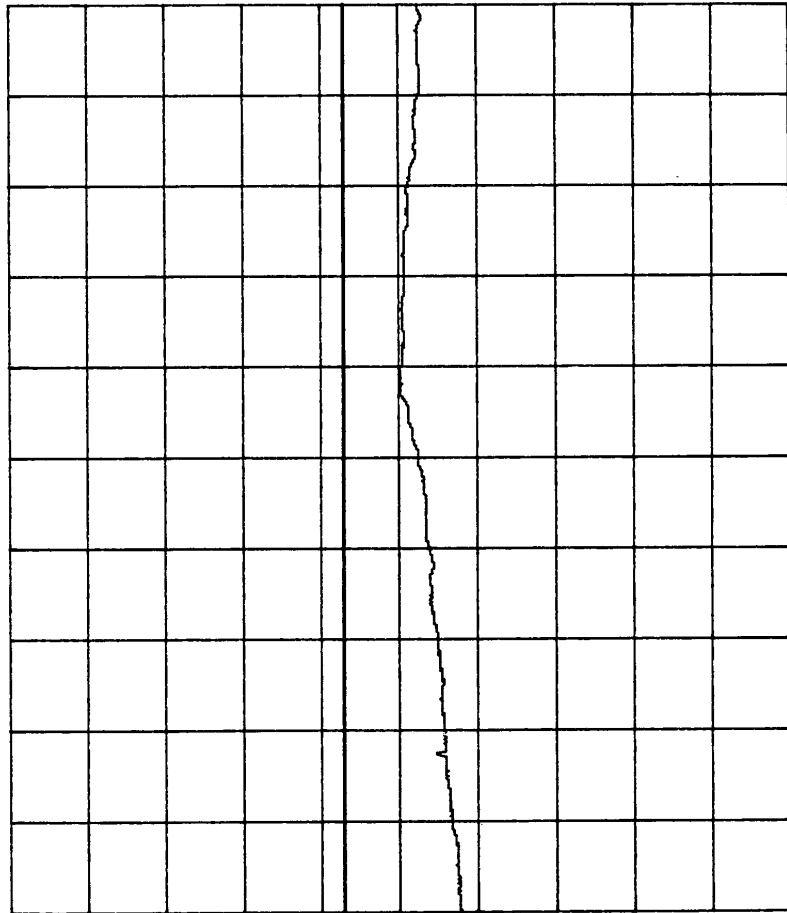
RBW 1 MHz
VBW 10 Hz
SWP 600 s

START 10.000 GHz STOP 13.000 GHz



TEST: FCC RADIATED EUT: P-COM HUB/28GHz ODU S/N: 130/118/00001
FREQ: 10GHz-13GHz SPEC: FCC INT. RAD. ANT. HT/POL: 1-4m V
DETECTOR: AVERAGE LINE UNDER TEST: N/A EUT POSITION: C-360°
DATE: 5-4-00 TEST SITE: O.A.T.S. TESTER: *AB*

REF 97.0 dB μ V/m ATT 0 dB A_write B_blank
10dB/



RBW 1 MHz
VBW 10 Hz
SWP 600 s

START 10.000 GHz STOP 13.000 GHz

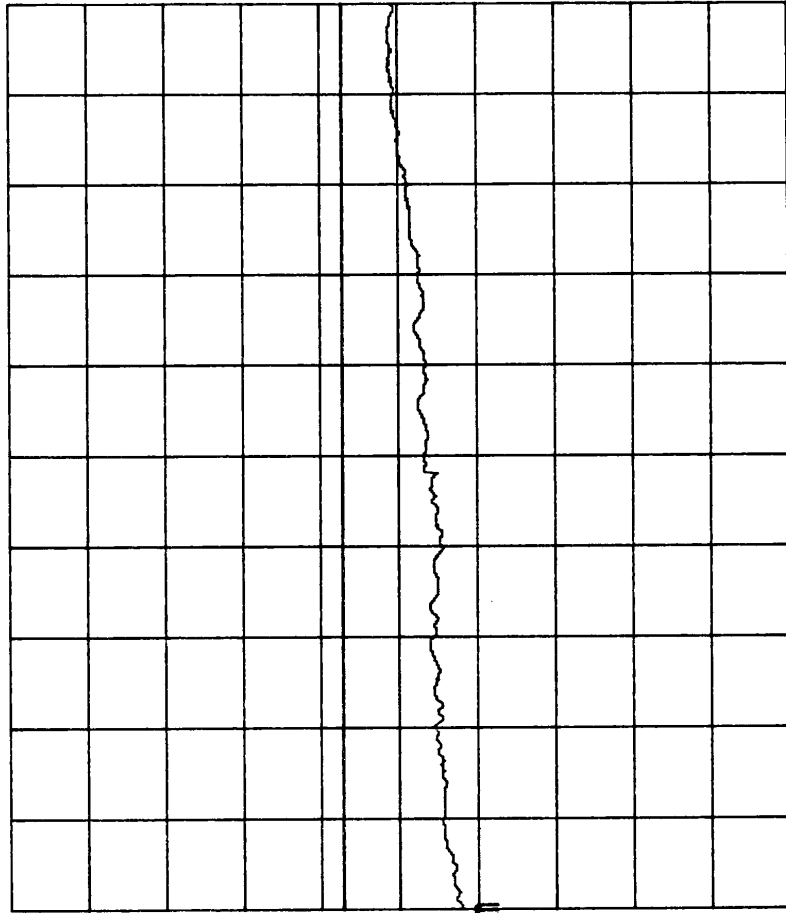


TEST: FCC RADIATED	EUT: P-COM HUB/28GHz ODU	S/N: 130/118/00001
FREQ: 13GHz-18GHz	SPEC: FCC INT. RAD.	ANT. HT/POL: 1-4 m H
DETECTOR: AVERAGE	LINE UNDER TEST: N/A	EUT POSITION: 0-360°
DATE: 5-4-00	TEST SITE: O.A.T.S	TESTER: <i>AB</i>

REF 97.0 dB μ V/m
10dB/

ATT 0 dB

A_write B_blank



DL 54.0 dB μ V/m

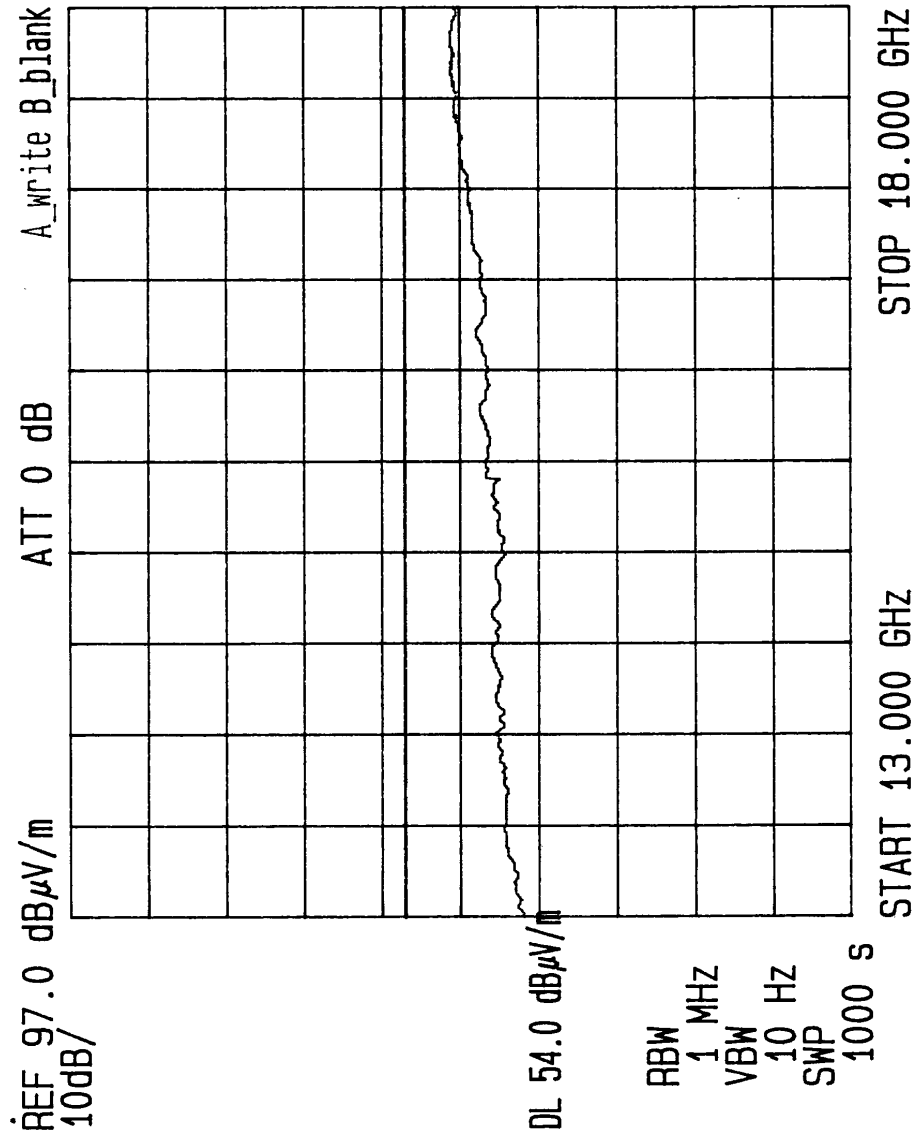
RBW 1 MHz
VBW 10 Hz
SWP 1000 S

START 13.000 GHz

STOP 18.000 GHz



TEST: FCC RADIATED EUT: P-COM HUB/28GHz ODU S/N: 130/118/00001
FREQ: 13GHz-18GHz SPEC: FCC INT. RAD. ANT. HT/POL: 1-4m V
DETECTOR: AVERAGE LINE UNDER TEST: N/A EUT POSITION: 0-360
DATE: 5-4-00 TEST SITE: O.A.T.S. TESTER: AB



Graph44.tif (2228x2844x2 tiff)

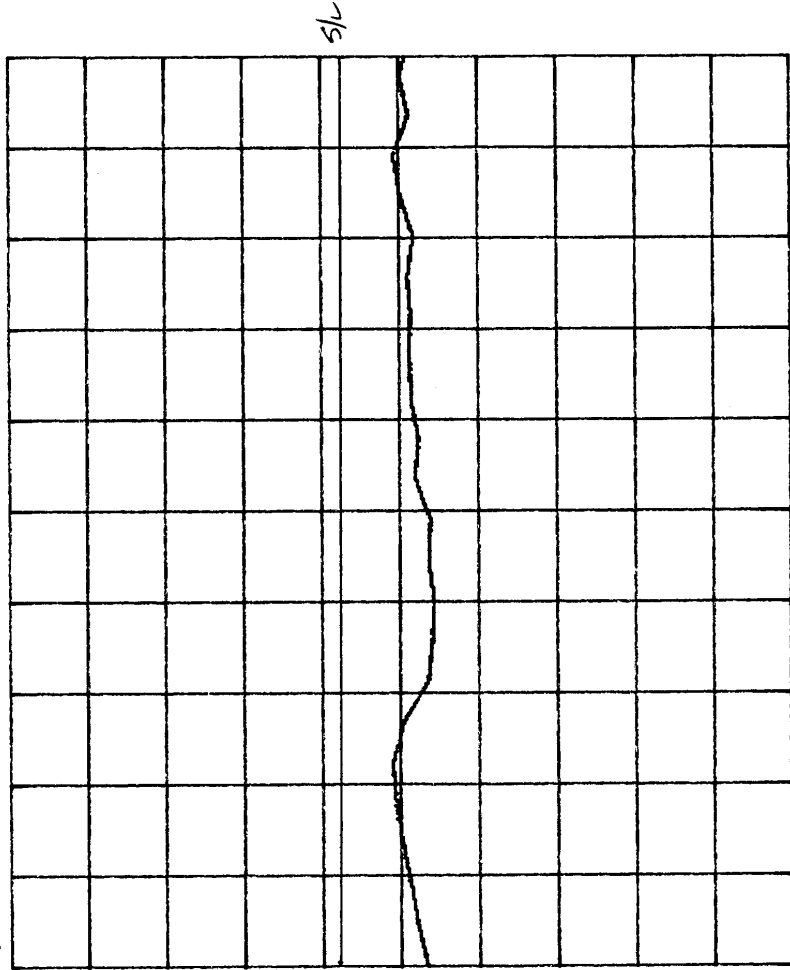
JA-1666-2

DATA SHEET 6.1.3.1-35



TEST: FCC RADIATED EUT: P-COM HUB/28GHz ODU S/N: 130/118/00001
FREQ: 18GHz-22.5GHz SPEC: FCC INT. RAD. ANT.HT/POL: H
DETECTOR: AVERAGE LINE UNDER TEST: N/A EUT POSITION:
DATE: 5-3-00 TEST SITE: ROOM 3/OATS TESTER: *[Signature]*

REF 97.0 dB μ V/m ATT 0 dB A_write B_blank
10dB/



RBW 1 MHz
VBW 10 Hz
SWP 900 s

START 18.000 GHz STOP 22.500 GHz

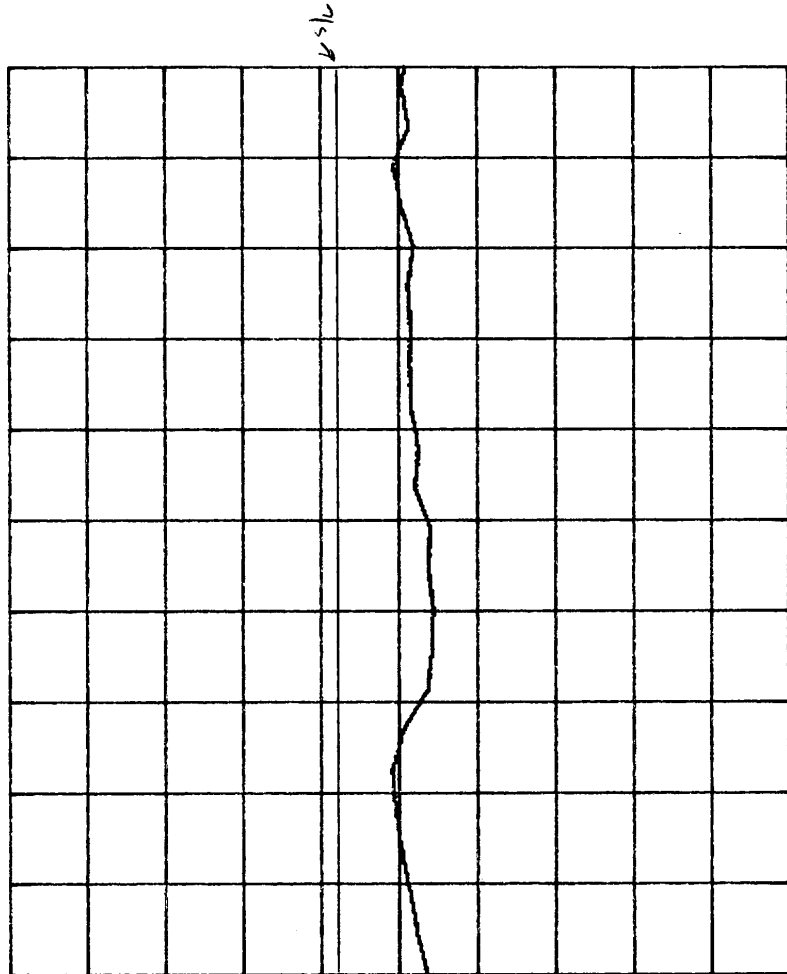


TEST: FCC RADIATED	EUT: P-COM HUB/28GHz ODU	S/N: 130/118/00001
FREQ: 18GHz-22.5GHz	SPEC: FCC INT. RAD.	ANT.HT/POL: V
DETECTOR: AVERAGE	LINE UNDER TEST: N/A	EUT POSITION:
DATE: 6-3-06	TEST SITE: ROOM 3/OATS	TESTER:

REF 97.0 dB μ V/m
10dB/

ATT 0 dB

A_write B_blank



RBW 1 MHz
VBW 10 Hz
SWP 900 s

START 18.000 GHz

STOP 22.500 GHz

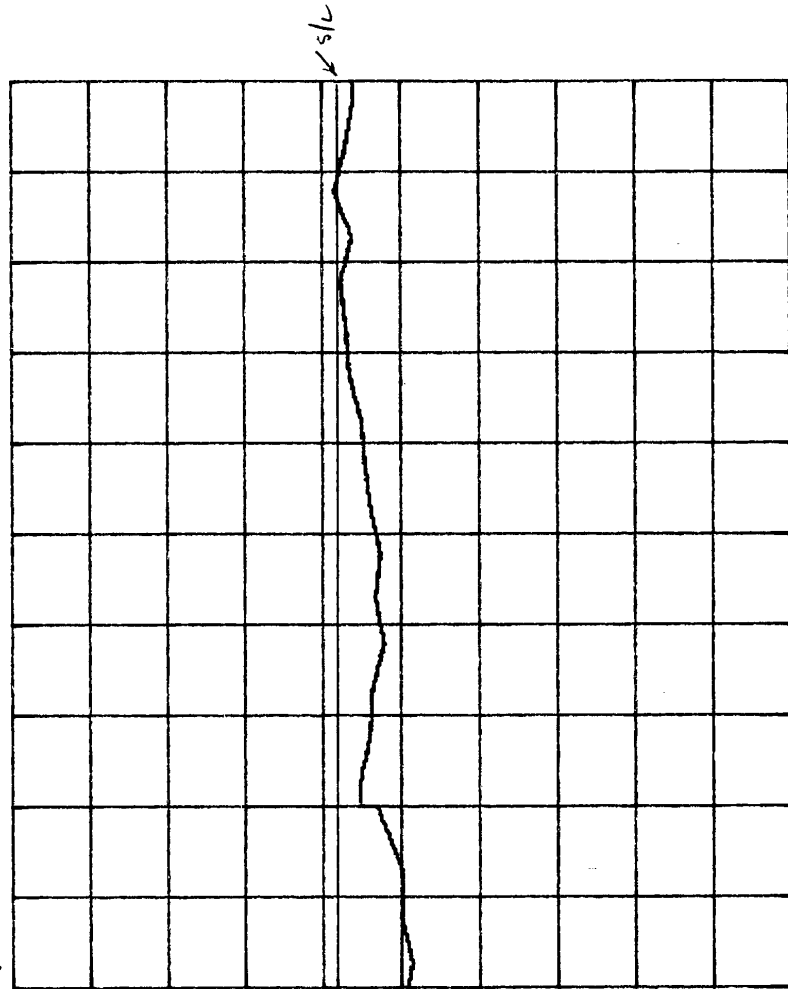


TEST: FCC RADIATED	EUT: P-COM HUB/28GHz ODU	S/N: 130/118/00001
FREQ: 22.5GHz-26.5GHz	SPEC: FCC INT. RAD.	ANT. HT/POL: H
DETECTOR: AVERAGE	LINE UNDER TEST: N/A	EUT POSITION:
DATE: 5-3-00	TEST SITE: ROOM 3/OATS	TESTER: <i>[Signature]</i>

REF 97.0 dB μ V/m
10dB/

ATT 0 dB

A_write B_blank



RBW 1 MHz
VBW 10 Hz
SWP 800 s

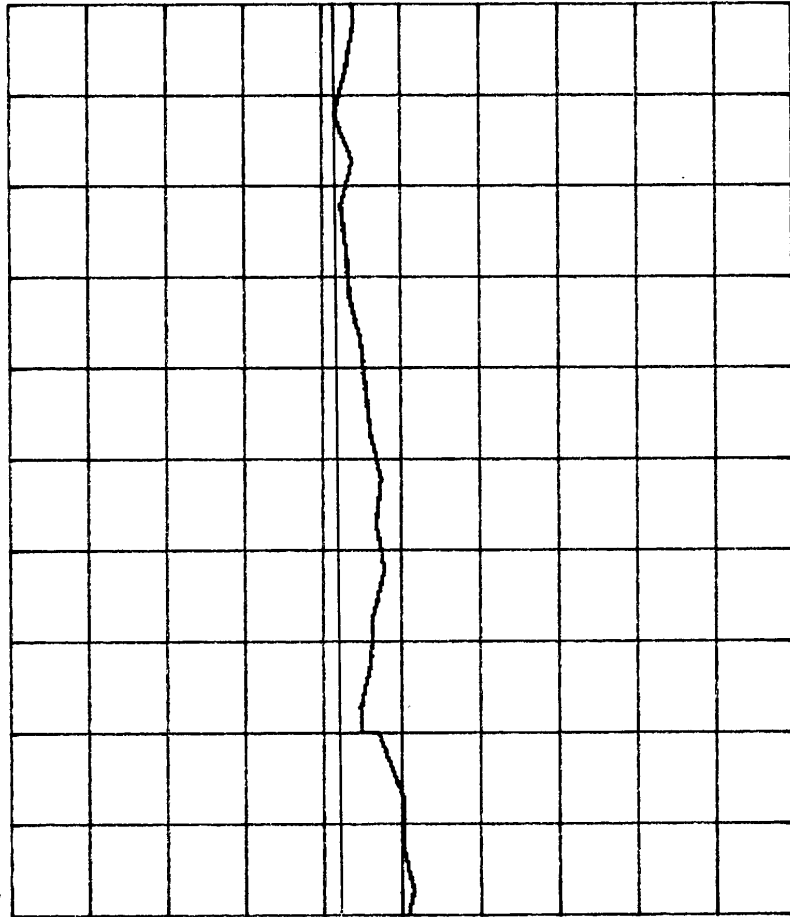
START 22.500 GHz

STOP 26.500 GHz



TEST: FCC RADIATED EUT: P-COM HUB/28GHz ODU S/N: 130/118/00001
FREQ: 22.5GHz-26.5GHz SPEC: FCC INT. RAD. ANT. HT/POL: V
DETECTOR: AVERAGE LINE UNDER TEST: N/A EUT POSITION:
DATE: 5-3-00 TEST SITE: ROOM 3/OATS TESTER: *[Signature]*

REF 97.0 dB μ V/m ATT 0 dB A_write B_blank
10dB/

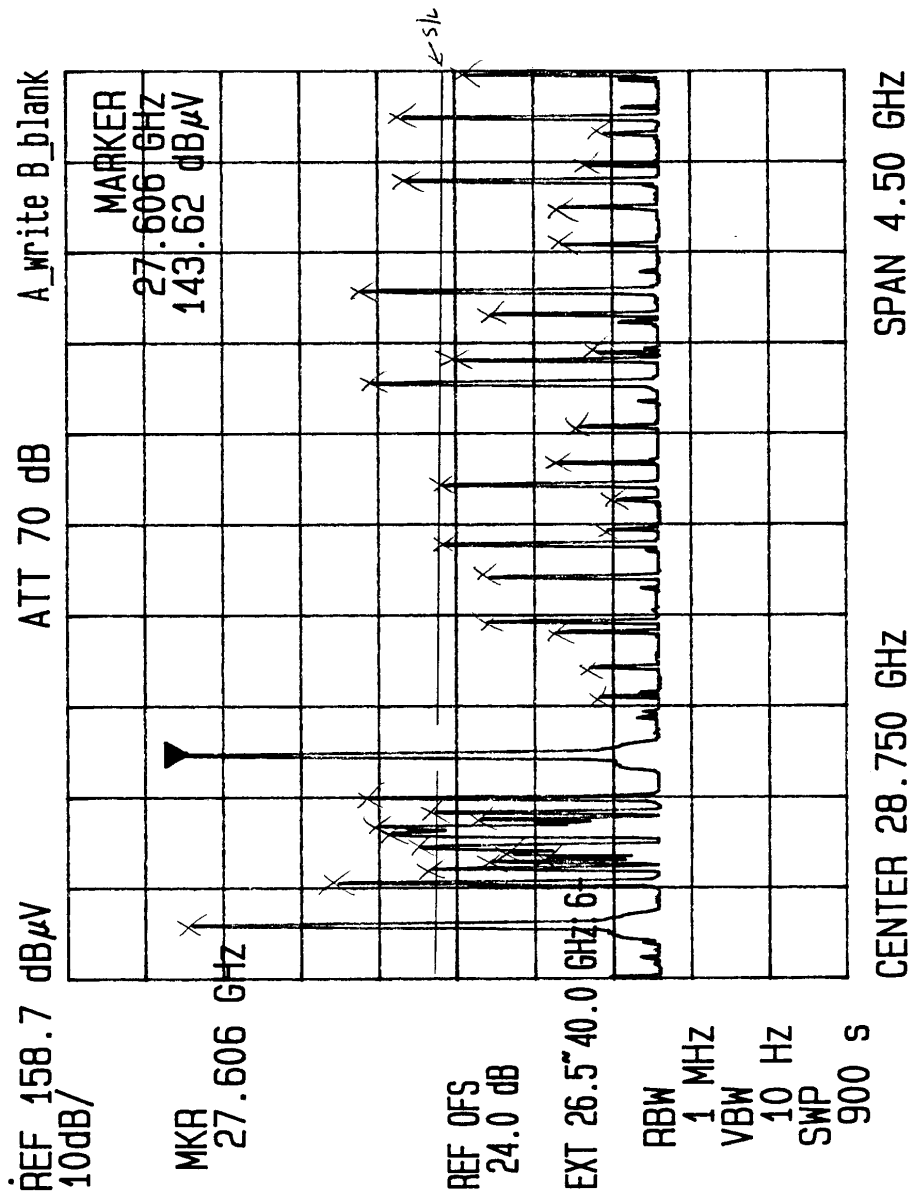


RBW 1 MHz
VBW 10 Hz
SWP 800 s

START 22.500 GHz STOP 26.500 GHz



TEST: FCC RADIATED EUT: P-COM HUB/28GHz ODU S/N: 130/118/00001
FREQ: 26.5GHz-31GHz SPEC: FCC INT. RAD. ANT. HT/POL: H
DETECTOR: AVERAGE LINE UNDER TEST: N/A EUT POSITION:
DATE: 5-2-00 TEST SITE: ROOM 3/OATS TESTER:





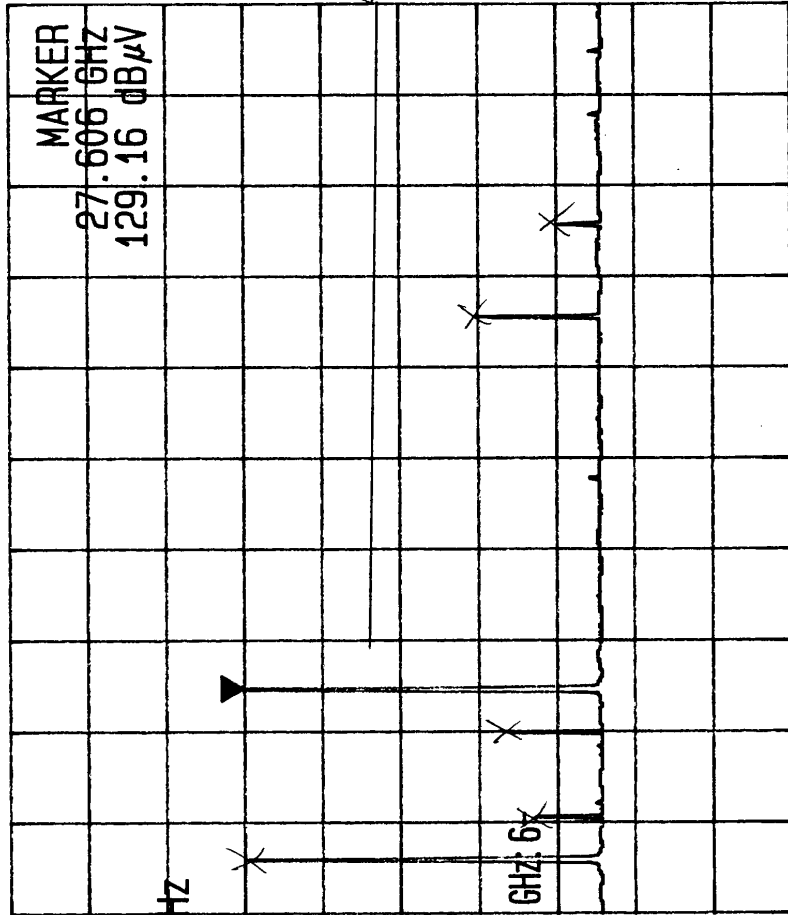
TEST: FCC RADIATED EUT: P-COM HUB/28GHz ODU S/N: 130/118/00001
FREQ: 26.5GHz-31GHz SPEC: FCC INT. RAD. ANT. HT/POL: V
DETECTOR: AVERAGE LINE UNDER TEST: N/A EUT POSITION:
DATE: 5-2-00 TEST SITE: ROOM 3/OATS TESTER: [Signature]

REF 158.7 dB μ V
10dB/

ATT 70 dB

A_write B_blank

MKR
27.606 GHz



REF OFS
24.0 dB

EXT 26.5~40.0 GHz: 6x

RBW
1 MHz
VBW
10 Hz
SWP
900 s

CENTER 28.750 GHz

SPAN 4.50 GHz

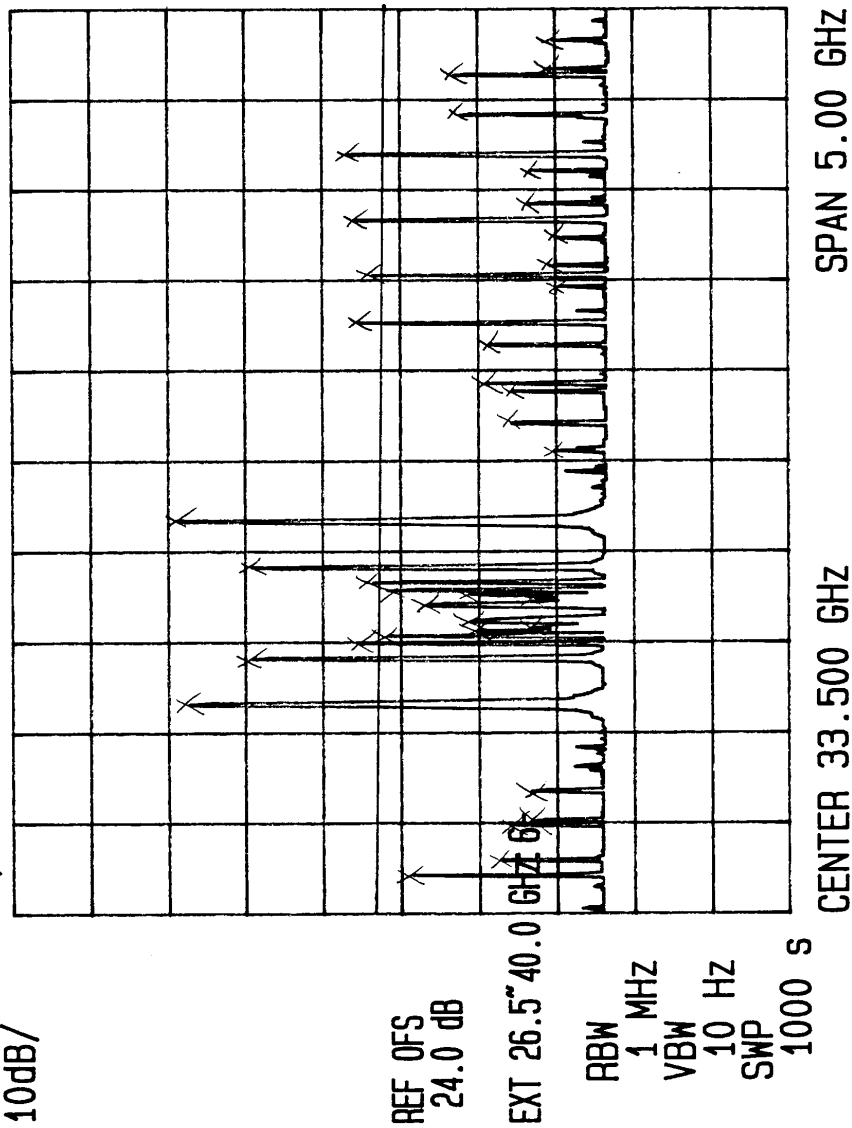


TEST: FCC RADIATED	EUT: P-COM HUB/28GHz ODU	S/N: 130/118/00001
FREQ: 31GHz-36GHz	SPEC: FCC INT. RAD.	ANT. HT/POL: H
DETECTOR: AVERAGE	LINE UNDER TEST: N/A	EUT POSITION:
DATE: 5-2-00	TEST SITE: ROOM 3/OATS	TESTER:

REF 158.7 dB μ V
10dB/

ATT 70 dB

A_write B_blank



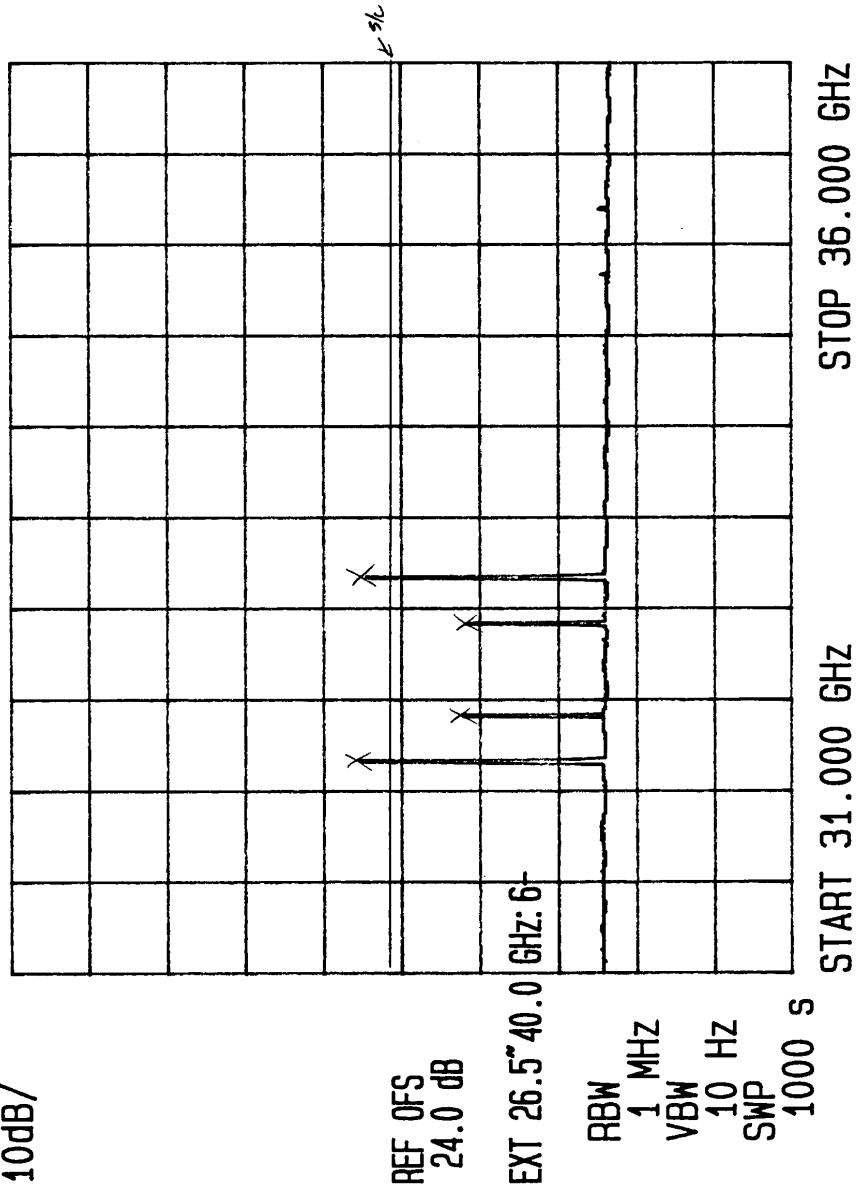


TEST: FCC RADIATED	EUT: P-COM HUB/28GHz ODU	S/N: 130/118/00001
FREQ: 31GHz-36GHz	SPEC: FCC INT. RAD.	ANT.HT/POL: V
DETECTOR: AVERAGE	LINE UNDER TEST: N/A	EUT POSITION:
DATE: 5-2-00	TEST SITE: ROOM 3/OATS	TESTER: [Signature]

REF 158.7 dB μ V
10dB/

ATT 70 dB

A_write B_blank



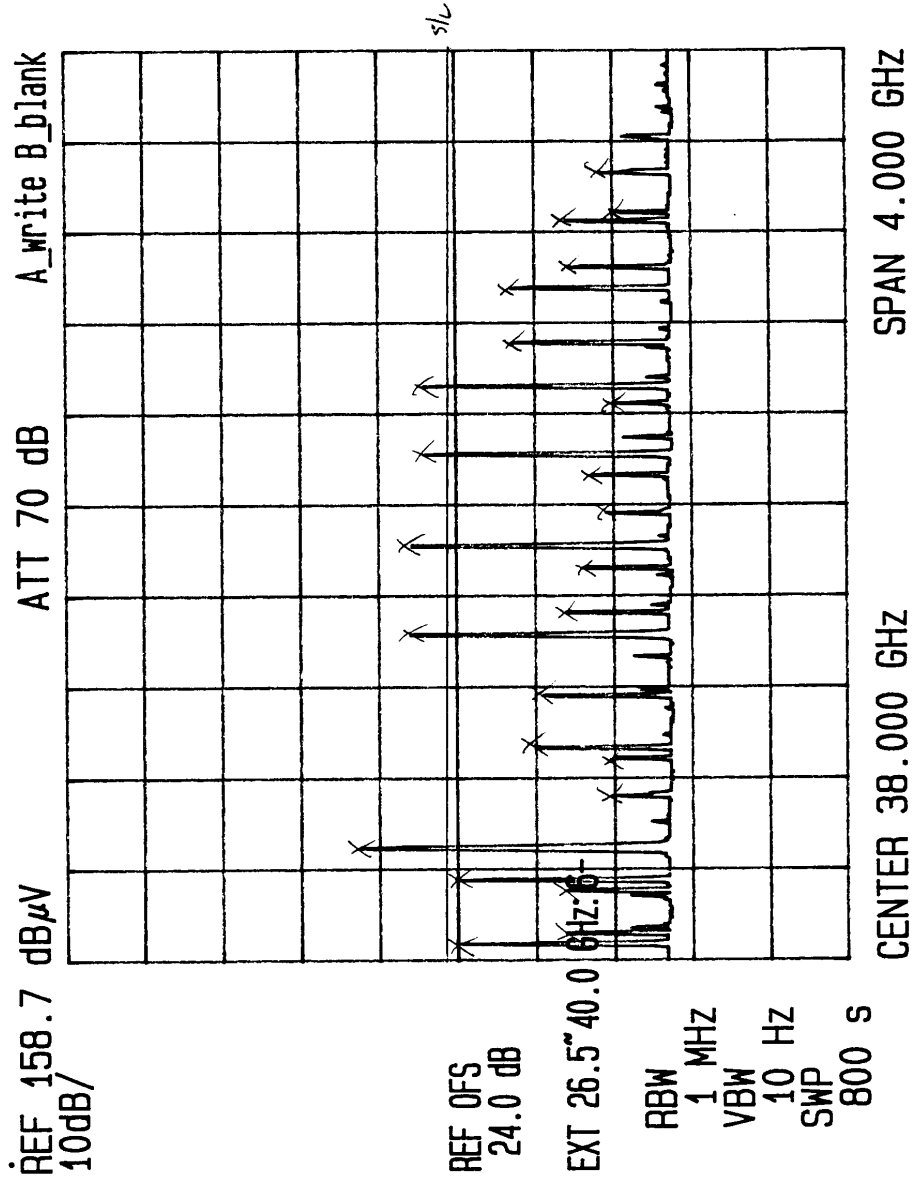
Graph52.tif (2228x2860x2 tiff)

JA-1666-2

DATA SHEET 6.1.3.1-43



TEST: FCC RADIATED EUT: P-COM HUB/28GHz ODU S/N: 130/118/00001
FREQ: 36GHz-40GHz SPEC: FCC INT. RAD. ANT. HT/POL: H
DETECTOR: AVERAGE LINE UNDER TEST: N/A EUT POSITION:
DATE: 5-2-00 TEST SITE: ROOM 3/OATS TESTER:



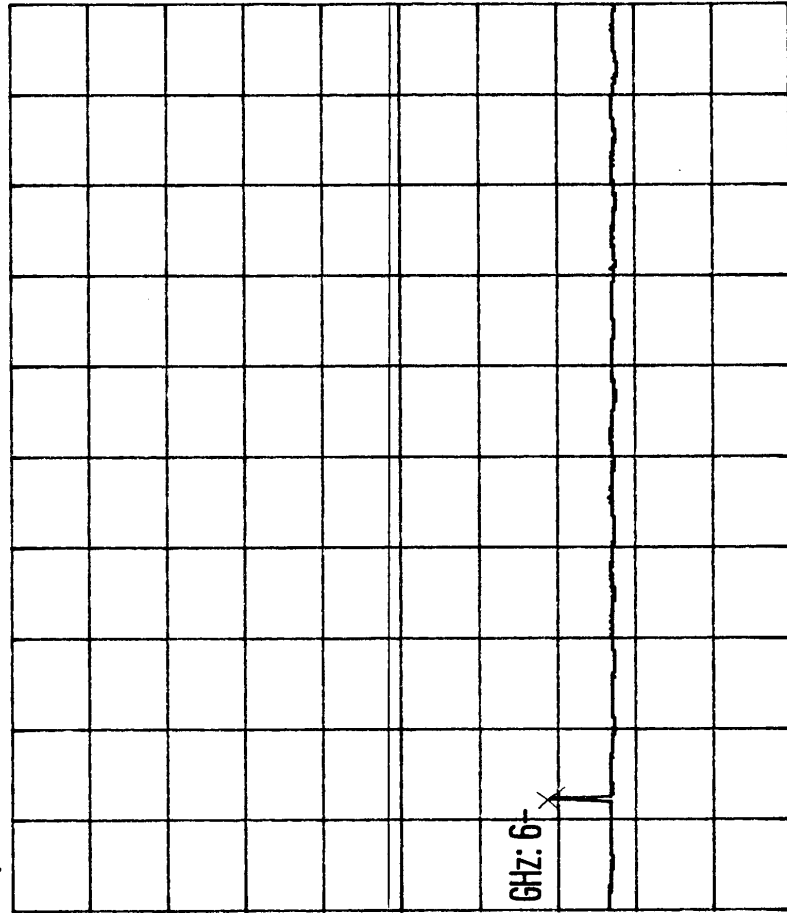


TEST: FCC RADIATED	EUT: P-COM HUB/28GHz ODU	S/N: 130/118/00001
FREQ: 36GHz-40GHz	SPEC: FCC INT. RAD.	ANT. HT/POL: V
DETECTOR: AVERAGE	LINE UNDER TEST: N/A	EUT POSITION:
DATE: 5-2-00	TEST SITE: ROOM 3/OATS	TESTER: <i>[Signature]</i>

REF 158.7 dB μ V
10dB/

ATT 70 dB

A_write B_blank



REF OFS
24.0 dB

EXT 26.5~40.0 GHz: 6+

RBW
1 MHz

VBW
10 Hz

SWP
800 s

APPENDIX A

App.tif (1984x2004x2 tiff)

FEDERAL COMMUNICATIONS COMMISSION
Laboratory Division
7435 Oakland Mills Road
Columbia, MD. 21046

December 16, 1999

Registration Number: 90911

Rubicom Systems, Inc.
284 West Drive, Suite B
Melbourne, FL 32904

Attention: Joseph Barbee

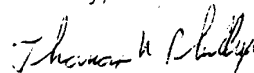
Re: Measurement facility located at Melbourne
3 meter site
Date of Listing: December 16, 1999

Gentlemen:

Your submission of the description of the subject measurement facility has been reviewed and found to be in compliance with the requirements of Section 2.948 of the FCC Rules. The description has, therefore, been placed on file and the name of your organization added to the Commission's list of facilities whose measurement data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Please note that this filing must be updated for any changes made to the facility, and at least every three years from the date of listing the data on file must be certified as current.

If requested, the above mentioned facility has been added to our list of those who perform these measurement services for the public on a fee basis. An up-to-date list of such public test facilities is available on the Internet on the FCC Website at WWW.FCC.GOV, E-Filing, OET Equipment Authorization Electronic Filing.

Sincerely,



Thomas W Phillips
Electronics Engineer