

4.6 Transmitter Radiated Emissions in Restricted Bands FCC Rule 15.205

Radiated emission measurements were performed from 30 MHz to 40,000 MHz. Spectrum Analyzer Resolution Bandwidth is 100 kHz or greater for frequencies 30 MHz to 1000 MHz, 1 MHz - for frequencies above 1000 MHz.

The EUT is placed on the wooden turntable. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). During testing, all cables were manipulated to produce worst case emissions. The signal is maximized through rotation. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance.

Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included. All measurements were performed with peak detection unless otherwise specified.

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

where FS = Field Strength in dB μ V/m

RA = Receiver Amplitude (including preamplifier) in dB μ V

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB

AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows:

$$FS = RR + LF$$

where FS = Field Strength in dB μ V/m

RR = RA - AG in dB μ V

LF = CF + AF in dB

Assume a receiver reading of 52.0 dB μ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

$$RA = 52.0 \text{ dB}\mu\text{V}$$

$$AF = 7.4 \text{ dB}$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$FS = RR + LF$$

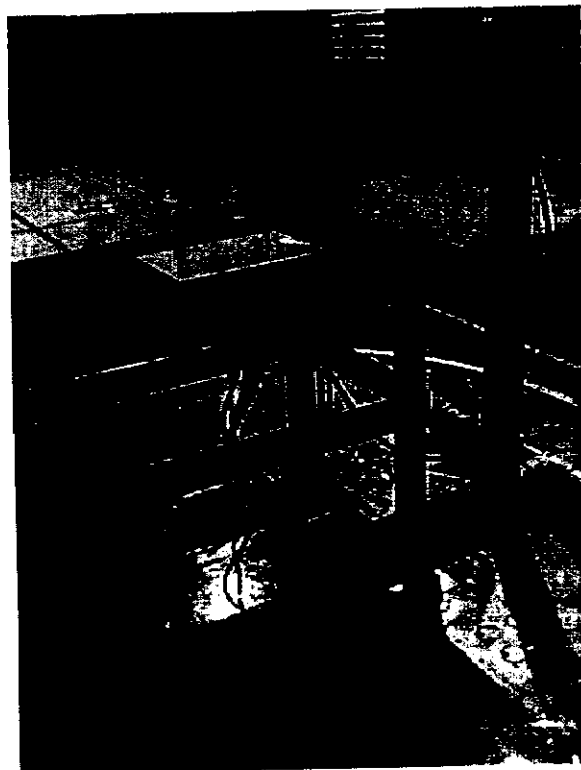
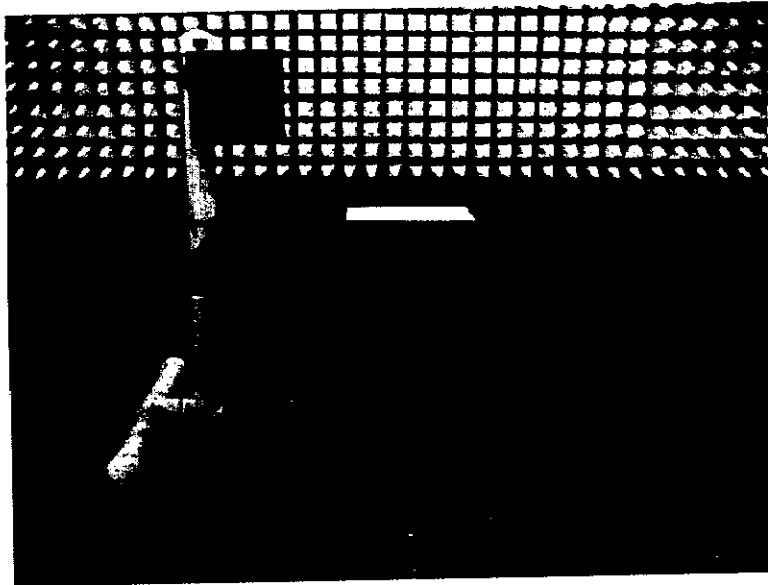
$$RR = 23.0 \text{ dB}\mu\text{V}$$

$$LF = 9.0 \text{ dB}$$

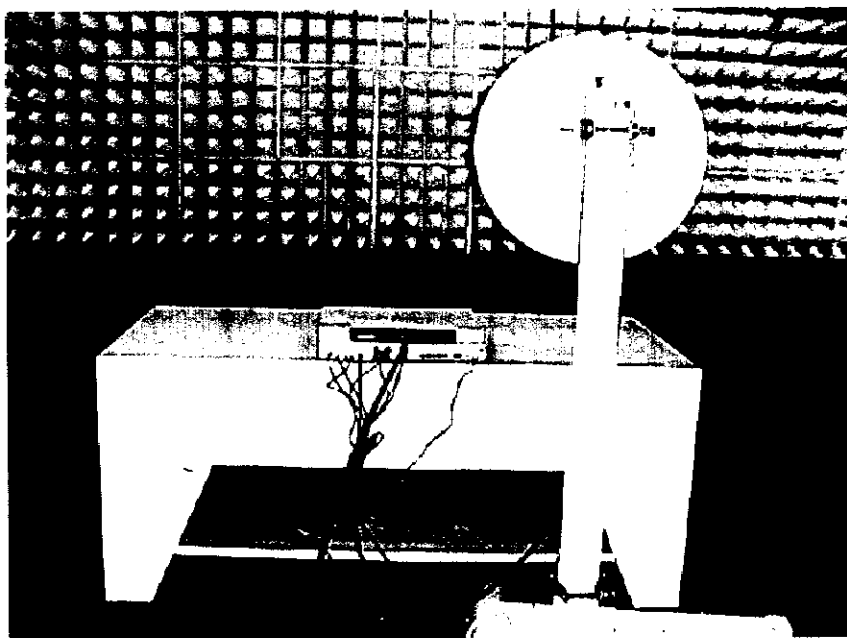
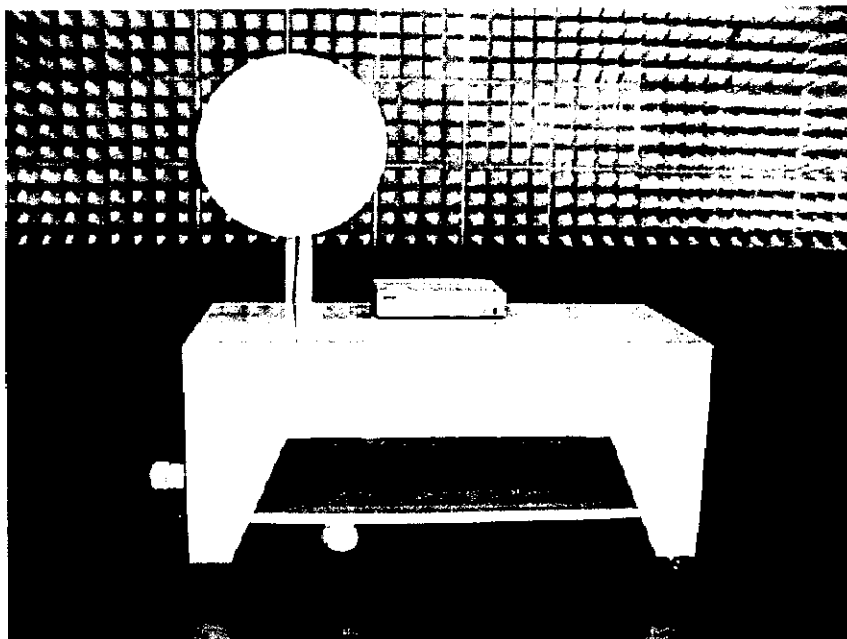
$FS = 23 + 9 = 32 \text{ dB}\mu\text{V/m}$

Level in $\mu\text{V/m}$ = Common Antilogarithm $[(32 \text{ dB}\mu\text{V/m})/20] = 39.8 \mu\text{V/m}$

Configuration Photograph



Configuration Photograph Continued)



Test Result

The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

Radiated Emissions Test Data

Company:	Western Multiplex Corporation	Model #:	27750	Standard_	FCC § 15.247 (R.B.)
EUT:	U-NII Radio	FCC ID:	HZB-U53-45	Limits_	11
Project #:	J20033825	Test Date:	December 10, 2000	Test Distance_	3 meters
Test Mode:	Tx @ 5275 MHz, DFPD 1-52 Antenna	Engineer:	Xi-Ming Y.	Duty Relaxation	0 dB

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	14	21	22	10	13	0	12	0	0	0
Model:	EMCO 3115	3160-9	3160-10	AFT18855	ACO/400	None	NPS366	None	None	None

Frequency	Reading	Detector	Ant.	Amp.	Ant. Pol.	Ant. Factor	Pre-Amp	Insert. Loss	D. C. F.	Net	Limit @3m	Margin
MHz	dB(μV)	P/A/Q	#	#	H/V	dB(1/m)	dB	dB	dB	dB(μV/m)	dB(μV/m)	dB
1.06E+4	37.2	Peak	14	10	V	39.8	39.5	7.0	0.0	44.5	74.0	-29.5
1.06E+4	27.0	Ave.	14	10	V	39.8	39.5	7.0	0.0	34.3	54.0	-19.7
1.58E+4	36.5	Peak	14	10	H	42.2	38.4	8.7	0.0	49.0	74.0	-25.0
1.58E+4	27.0	Ave.	14	10	H	42.2	38.4	8.7	0.0	39.5	54.0	-14.5
2.11E+4	37.0	Peak	21	13	V	40.3	23.3	10.2	-9.5	54.7	74.0	-19.3
2.11E+4	27.2	Ave.	21	13	V	40.3	23.3	10.2	-9.5	44.9	54.0	-9.1
3.17E+4	45.0	Peak	22	13	H	43.5	25.9	0.0	-9.5	53.1	74.0	-20.9
3.17E+4	35.0	Ave.	22	13	H	43.5	25.9	0.0	-9.5	43.1	54.0	-10.9

Notes:	a) D.C.F.:Distance Correction Factor
	b) Insert. Loss (dB) = Cable A + Cable B + Cable C .
	c) Net (dB) = Reading + Antenna Factor - Pre-amp + Insert. Loss. - Transducer Loss - Duty Relaxation (transmitter only).
	d) Negative signs (-) in Margin column signify levels below the limits.
	e) All other emissions not reported are below the equipment noise floor which is at least 10 dB below the limits.
	f) Measurements at frequencies above 19 GHz were made at 1 m distance

Radiated Emissions Test Data

Company:	Western Multiplex Corporation	Model #:	27750	Standard_	FCC § 15.247 (R.B.)
EUT:	U-NII Radio	FCC ID:	HZB-U53-45	Limits_	11
Project #:	J20033825	Test Date:	December 10, 2000	Test Distance_	3 meter
Test Mode:	Tx @ 5325 MHz, DFPD 1-52 Antenna	Engineer:	Xi-Ming Y.	Duty Relaxation	0 dB

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	14	21	22	10	13	0	12	0	0	0
Model:	EMCO 3115	3160-9	3160-10	AFT18855	ACO/400	None	NPS365	None	None	None

Frequency	Reading	Detector	Ant. #	Amp. #	Ant. Pol.	Ant. Factor	Pre-Amp	Insert. Loss	D. C. F.	Net	Limit @3m	Margin
MHz	dB(μV)	P/A/Q	#	#	H/V	dB(1/m)	dB	dB	dB	dB(μV/m)	dB(μV/m)	dB
1.07E+4	37.5	Peak	14	10	V	39.8	39.5	7.0	0.0	44.8	74.0	-29.2
1.07E+4	27.3	Ave.	14	10	V	39.8	39.5	7.0	0.0	34.6	54.0	-19.4
1.60E+4	36.0	Peak	14	10	V	42.3	38.4	8.7	0.0	48.6	74.0	-25.4
1.60E+4	26.0	Ave.	14	10	V	42.3	38.4	8.7	0.0	38.6	54.0	-15.4
2.13E+4	37.0	Peak	21	13	V	40.3	23.3	10.2	-9.5	54.7	74.0	-19.3
2.13E+4	27.2	Ave.	21	13	V	40.3	23.3	10.2	-9.5	44.9	54.0	-9.1

Notes:	a) D.C.F.:Distance Correction Factor
	b) Insert. Loss (dB) = Cable A + Cable B + Cable C .
	c) Net (dB) = Reading + Antenna Factor - Pre-amp + Insert. Loss. - Transducer Loss - Duty Relaxation (transmitter only).
	d) Negative signs (-) in Margin column signify levels below the limits.
	e) All other emissions not reported are below the equipment noise floor which is at least 10 dB below the limits.
	f) Measurements at frequencies above 19 GHz were made at 1 m distance

Radiated Emissions Test Data

Company:	Western Multiplex Corporation	Model #:	27750	Standard_	FCC § 15.247 (R.B.)
EUT:	Tsunami U-NII Radio	S/N #:	HZB-U53-45	Limits_	11
Project #:	J20033825	Test Date:	March 22, 1001	Test Distance_	3 meters
Test Mode:	Tx @ 5275MHz, SSP2-52B Antenna	Engineer:	Xi-Ming Y.	Duty Relaxation	0 dB

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	14	21	22	10	13	0	12	0	0	0
Model:	EMCO 3115	3160-9	3160-10	AFT18855	ACO/400	None	NPS366	None	None	None

Frequency	Reading	Detector	Ant.	Amp.	Ant. Pol.	Ant. Factor	Pre-Amp	Insert. Loss	D. C. F.	Net	Limit @3m	Margin
MHz	dB(μV)	P/A/Q	#	#	H/V	dB(1/m)	dB	dB	dB	dB(μV/m)	dB(μV/m)	dB
1.06E+4	37.0	Peak	14	10	V	39.8	39.5	7.0	0.0	44.3	74.0	-29.7
1.06E+4	27.8	Ave.	14	10	V	39.8	39.5	7.0	0.0	35.1	54.0	-18.9
1.58E+4	36.8	Peak	14	10	H	42.2	38.4	8.7	0.0	49.3	74.0	-24.7
1.58E+4	27.9	Ave.	14	10	H	42.2	38.4	8.7	0.0	40.4	54.0	-13.6
2.11E+4	37.2	Peak	21	13	V	40.3	23.3	10.2	-9.5	54.9	74.0	-19.1
2.11E+4	27.4	Ave.	21	13	V	40.3	23.3	10.2	-9.5	45.1	54.0	-8.9
3.17E+4	45.3	Peak	22	13	H	43.5	25.9	0.0	-9.5	53.4	74.0	-20.6
3.17E+4	35.2	Ave.	22	13	H	43.5	25.9	0.0	-9.5	43.3	54.0	-10.7

Notes:	a) D.C.F.: Distance Correction Factor
	b) Insert. Loss (dB) = Cable A + Cable B + Cable C .
	c) Net (dB) = Reading + Antenna Factor - Pre-amp + Insert. Loss. - Transducer Loss - Duty Relaxation (transmitter only).
	d) Negative signs (-) in Margin column signify levels below the limits.
	e) All other emissions not reported are below the equipment noise floor which is at least 10 dB below the limits.
	f) Measurements at frequencies above 19 GHz were made at 1 m distance

Radiated Emissions Test Data

Company:	Western Multiplex Corporation	Model #:	27750	Standard	FCC § 15.247 (R.B.)
EUT:	Tsunami U-NII Radio	FCC ID:	HZB-U53-45	Limits	11
Project #:	J20033825	Test Date:	March 22, 1001	Test Distance	3 meters
Test Mode:	Tx @ 5325MHz, SSP2-52B Antenna	Engineer:	Xi-Ming Y.	Duty Relaxation	0 dB

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	14	21	22	10	13	0	12	0	0	0
Model:	EMCO 3115	3160-9	3160-10	AFT18855	ACO/400	None	NPS366	None	None	None

Frequency	Reading	Detector	Ant.	Amp.	Ant. Pol.	Ant. Factor	Pre-Amp	Insert. Loss	D. C. F.	Net	Limit @3m	Margin
MHz	dB(μV)	P/A/Q	#	#	H/V	dB(1/m)	dB	dB	dB	dB(μV/m)	dB(μV/m)	dB
1.07E+4	38.0	Peak	14	10	V	39.8	39.5	7.0	0.0	45.3	74.0	-28.7
1.07E+4	27.9	Ave.	14	10	V	39.8	39.5	7.0	0.0	35.2	54.0	-18.8
1.60E+4	36.5	Peak	14	10	V	41.8	38.4	8.8	0.0	48.7	74.0	-25.3
1.60E+4	26.5	Ave.	14	10	V	41.8	38.4	8.8	0.0	38.7	54.0	-15.3
2.13E+4	37.1	Peak	21	13	V	40.3	23.3	10.2	-9.5	54.8	74.0	-19.2
2.13E+4	27.2	Ave.	21	13	V	40.3	23.3	10.2	-9.5	44.9	54.0	-9.1

Notes:	a) D.C.F.: Distance Correction Factor
	b) Insert. Loss (dB) = Cable A + Cable B + Cable C.
	c) Net (dB) = Reading + Antenna Factor - Pre-amp + Insert. Loss. - Transducer Loss - Duty Relaxation (transmitter only).
	d) Negative signs (-) in Margin column signify levels below the limits.
	e) All other emissions not reported are below the equipment noise floor which is at least 10 dB below the limits.
	f) Measurements at frequencies above 19 GHz were made at 1 m distance

4.8 AC Line Conducted Emission FCC Rule 15.207

4.8.1 Line Conducted Emission Limits

Conducted Emissions Limits, Section 15.107(a)

Frequency (MHz)	Class B (μV)	Class B (dB μV)
0.45 - 1.705	250	48
1.705 to 30.000	250	48

Note: Three sets of units are commonly used for EMI measurement, decibels below one milliwatt (-dBm), decibels above a microvolt (dB μV), and microvolts (μV). To convert between them, use the following formulas: $20 \text{ LOG}_{10}(\mu V) = \text{dB}\mu V$, $\text{dBm} = \text{dB}\mu V - 107$.

Test Result

See plots on the following pages.
The EUT passed the test

22 Feb 2001 11:35:19

EMISSION LEVEL [dBuV]

100

80

60

40

20

.45

1

10

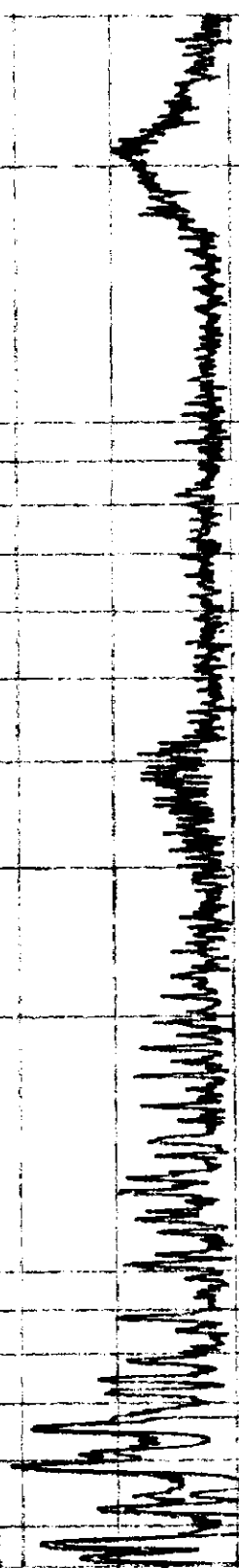
30

FREQUENCY [MHz]

FCC, Pt 15 - AC LINE CONDUCTED
WESTERN MULTIPLEX
U-NII Radio
MODEL: 27750
LINE1 [] LINE2 [X] 115VAC 60Hz

CLASS A

CLASS B



hp

LINEAR

POS PK

OFFSET

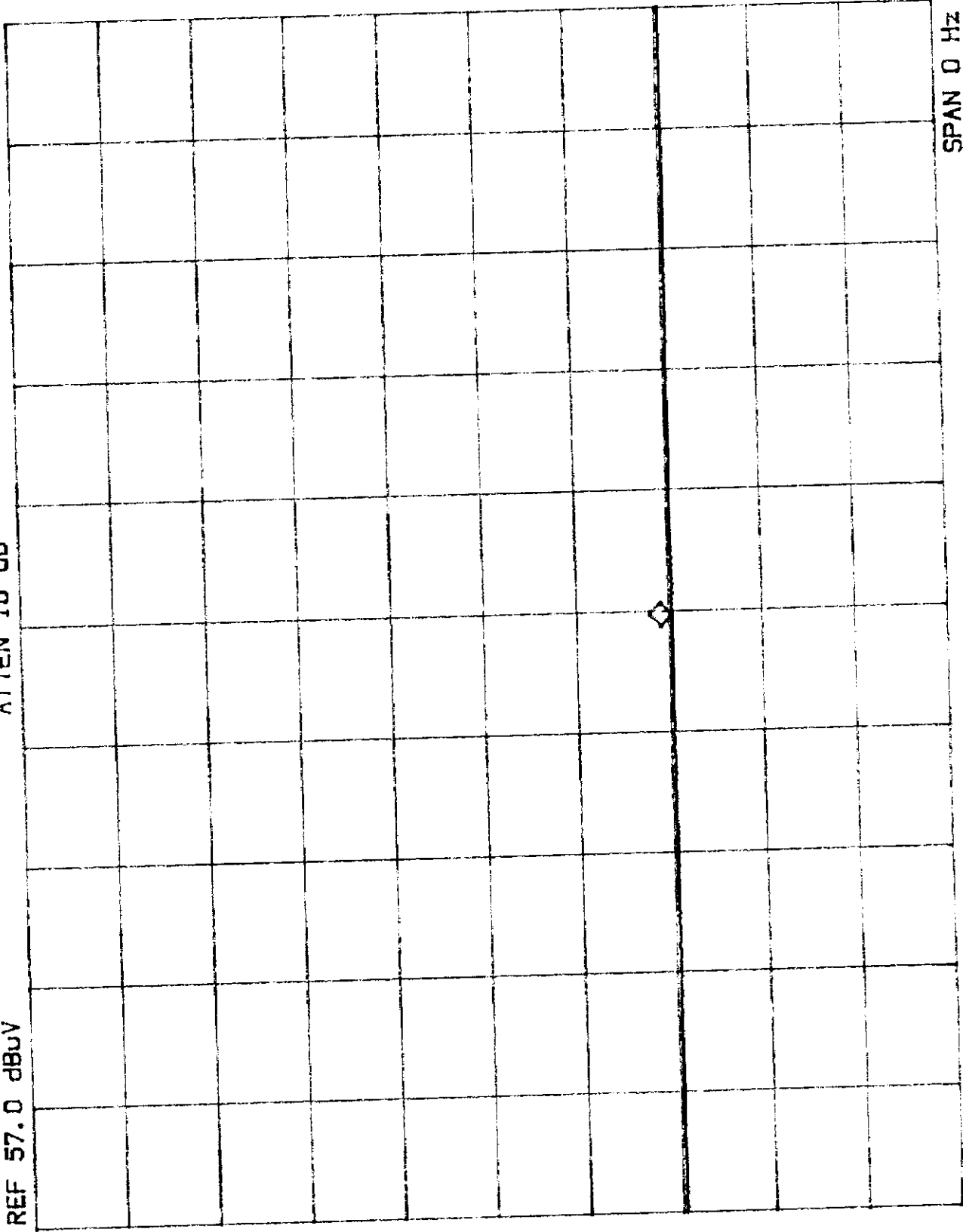
10.0

dB

MKR 1.500 sec
46.46 dBuV

ATTEN 10 dB

QUASI-PEAK LINE2
REF 57.0 dBuV



SPAN 0 Hz
SWP 3.0 sec

VBW 100 kHz

CENTER 588 kHz
RES BW 100 kHz

22 Feb 2001 11:17:22

EMISSION LEVEL [dBuV]

