

Western Multiplex Corporation, Model No: 40100-XXX

FCC ID: HZB-U58-S60

Date of Test: September 20 to 23, 2001

- 4.4 The ratio of the peak excursion of the modulation envelope
to the peak power
FCC Rule 15.407(a)(6)

Requirement:

The ratio of the peak excursion of the modulation envelope to the peak transmit power shall not exceed 13 dB.

Procedure:

Spectrum Analyzer was connected to the output of the EUT. The Resolution Bandwidth was set to 1 MHz. Two plots were made in each band: with the Video Bandwidth set to 7 MHz and with the Video Bandwidth set to 30 kHz. The difference between spectrum analyzer readings indicates the ratio of the peak excursion of the modulation envelope to the peak transmit power.

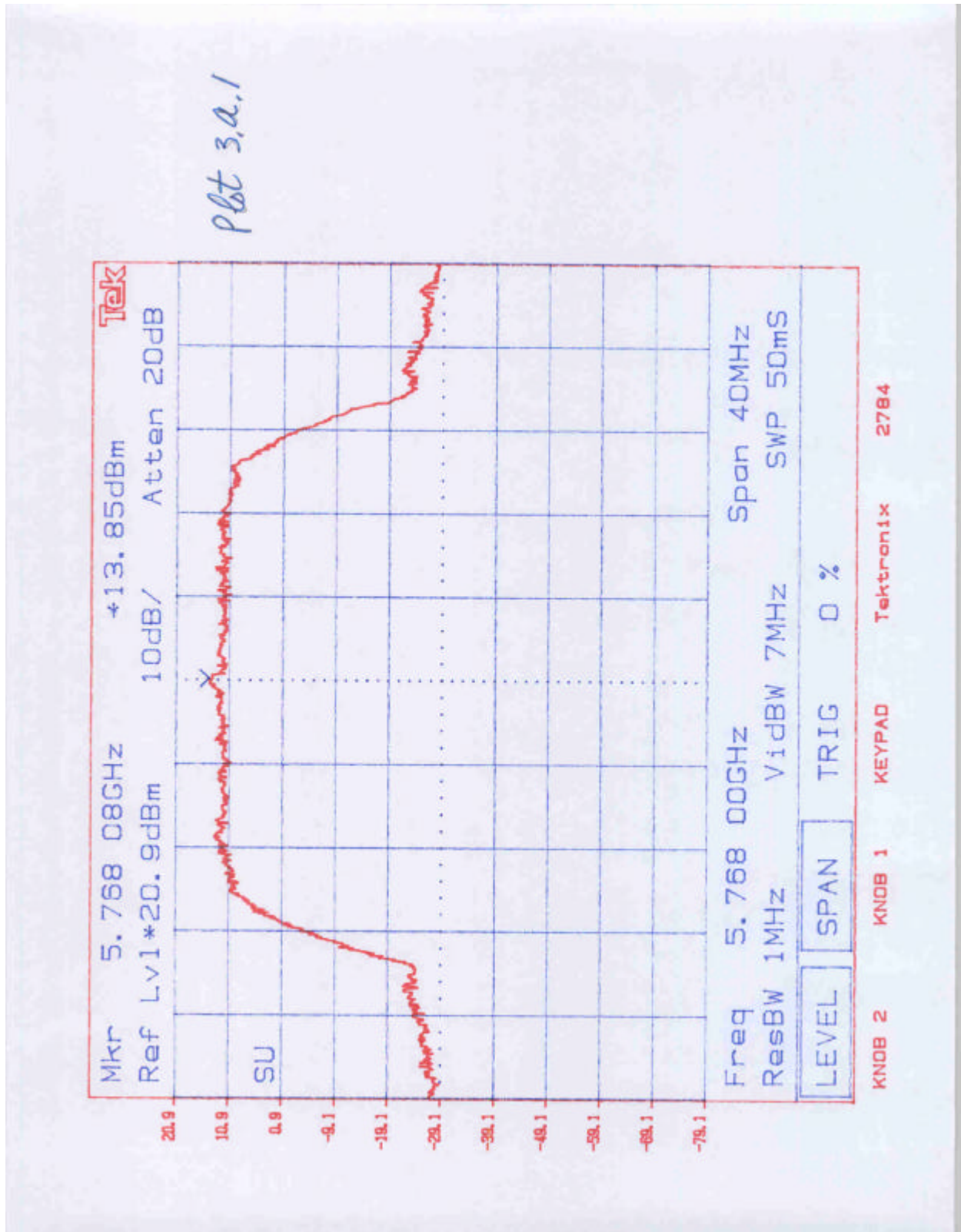
Test Result:

See attached plots for the ratio of the peak excursion of the modulation envelope to the peak power. The maximum Ratio is 7.3 dB.

15.407(a)(6)		
3.a.1 – 3.a.2	Ch 2	QAM16
3.b.1 – 3.b.2	Ch 2	QAM8
3.c.1 – 3.c.2	Ch 2	QPSK R $\frac{3}{4}$
3.d.1 – 3.d.2	Ch 2	QPSK R $\frac{1}{2}$

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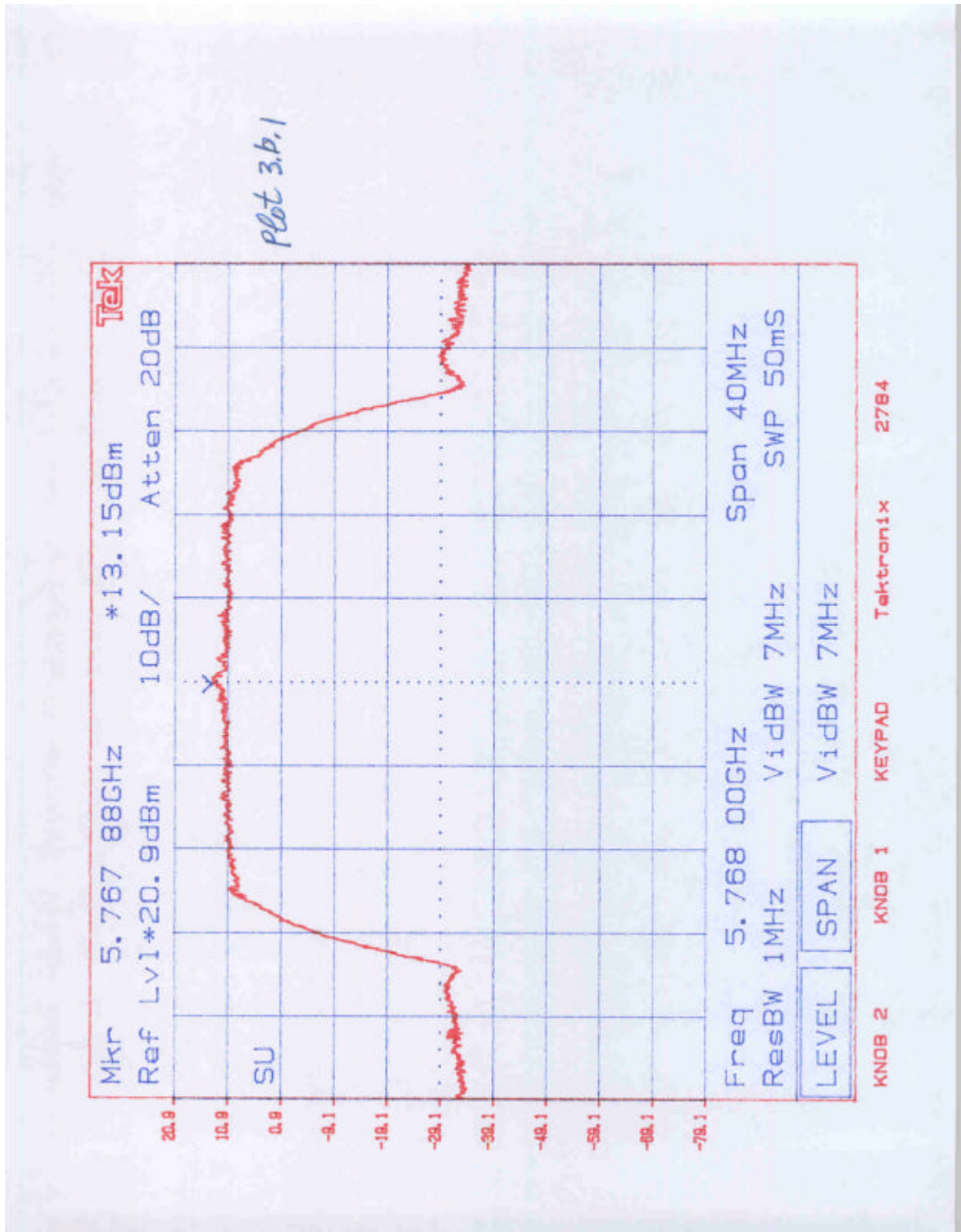
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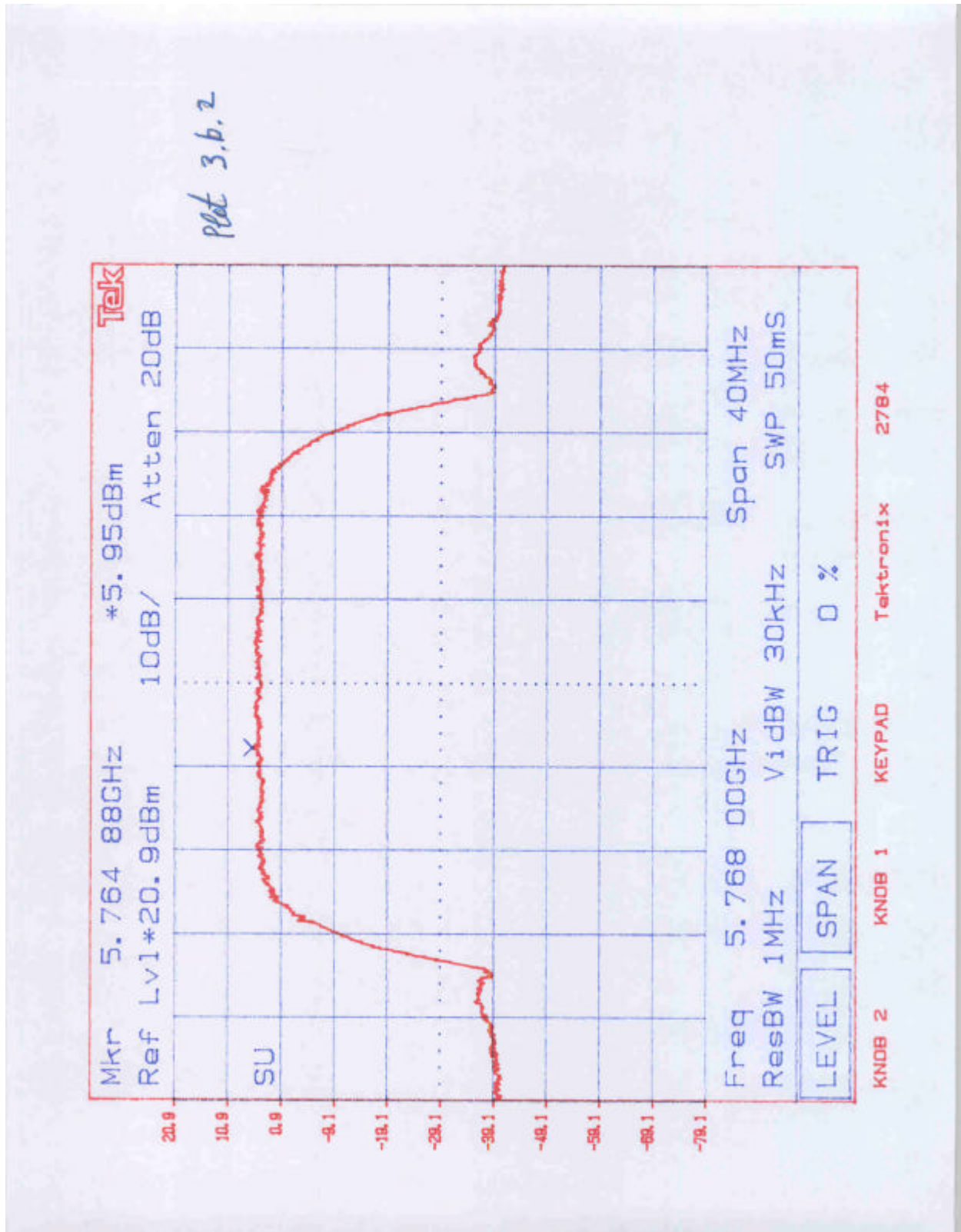
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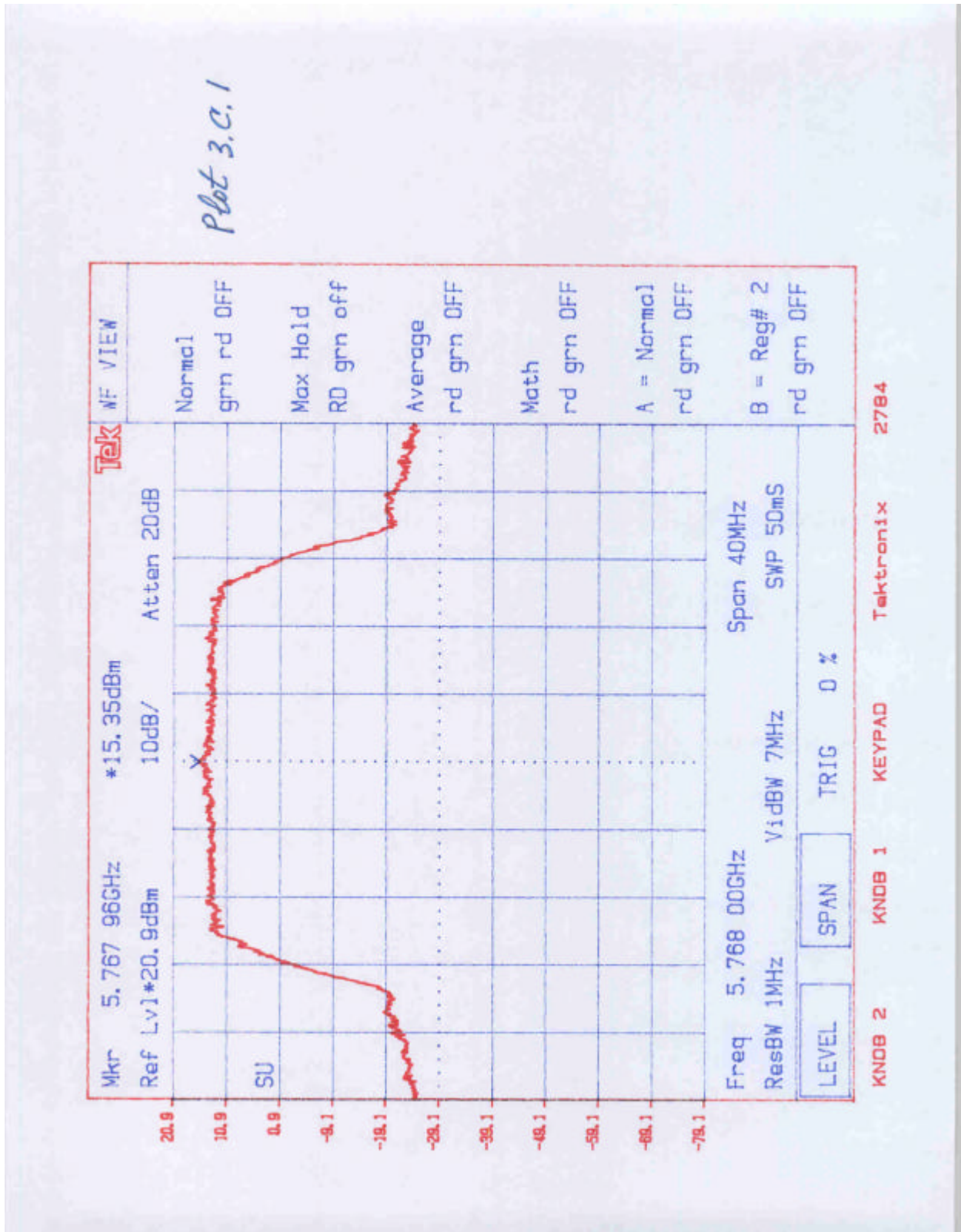
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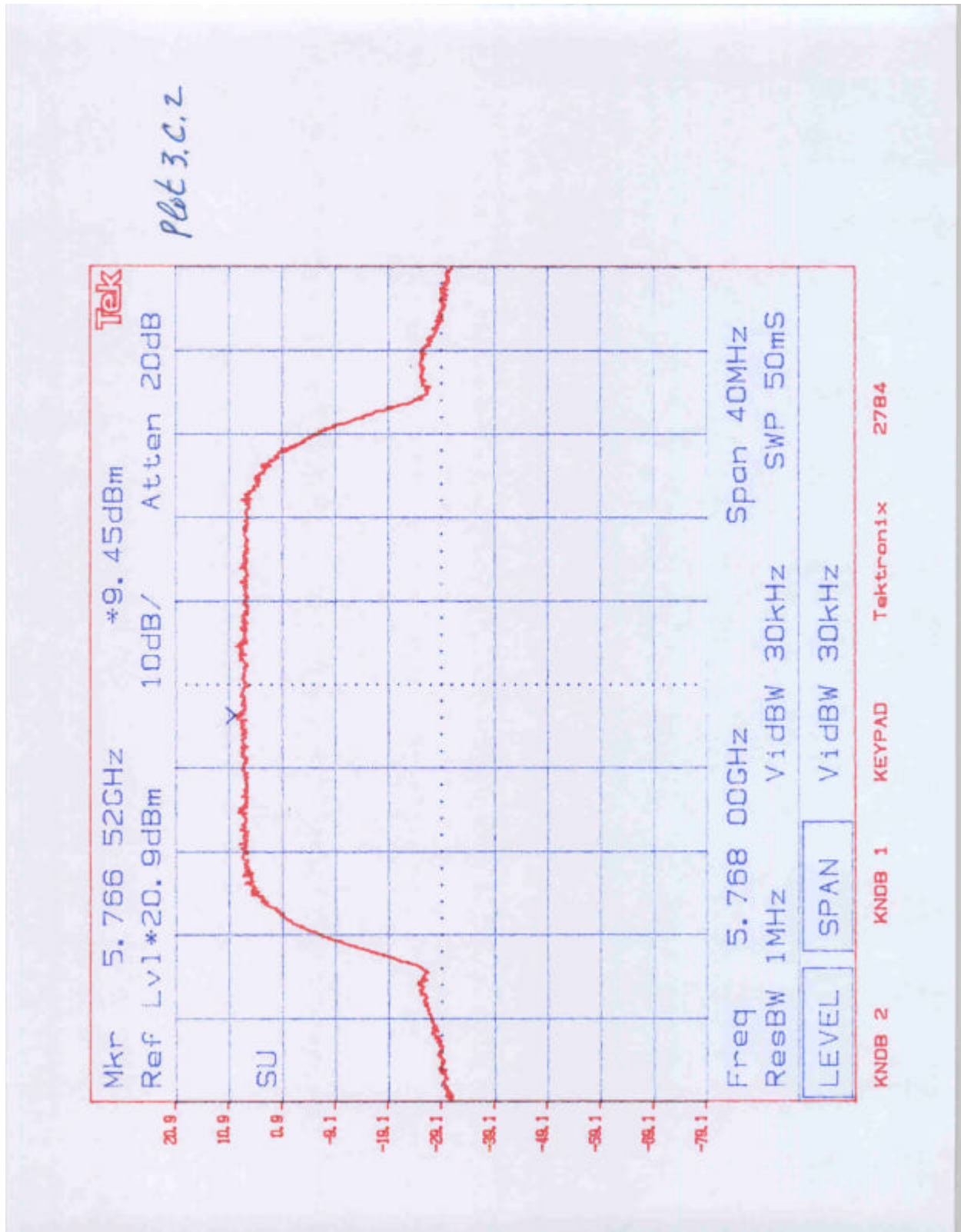
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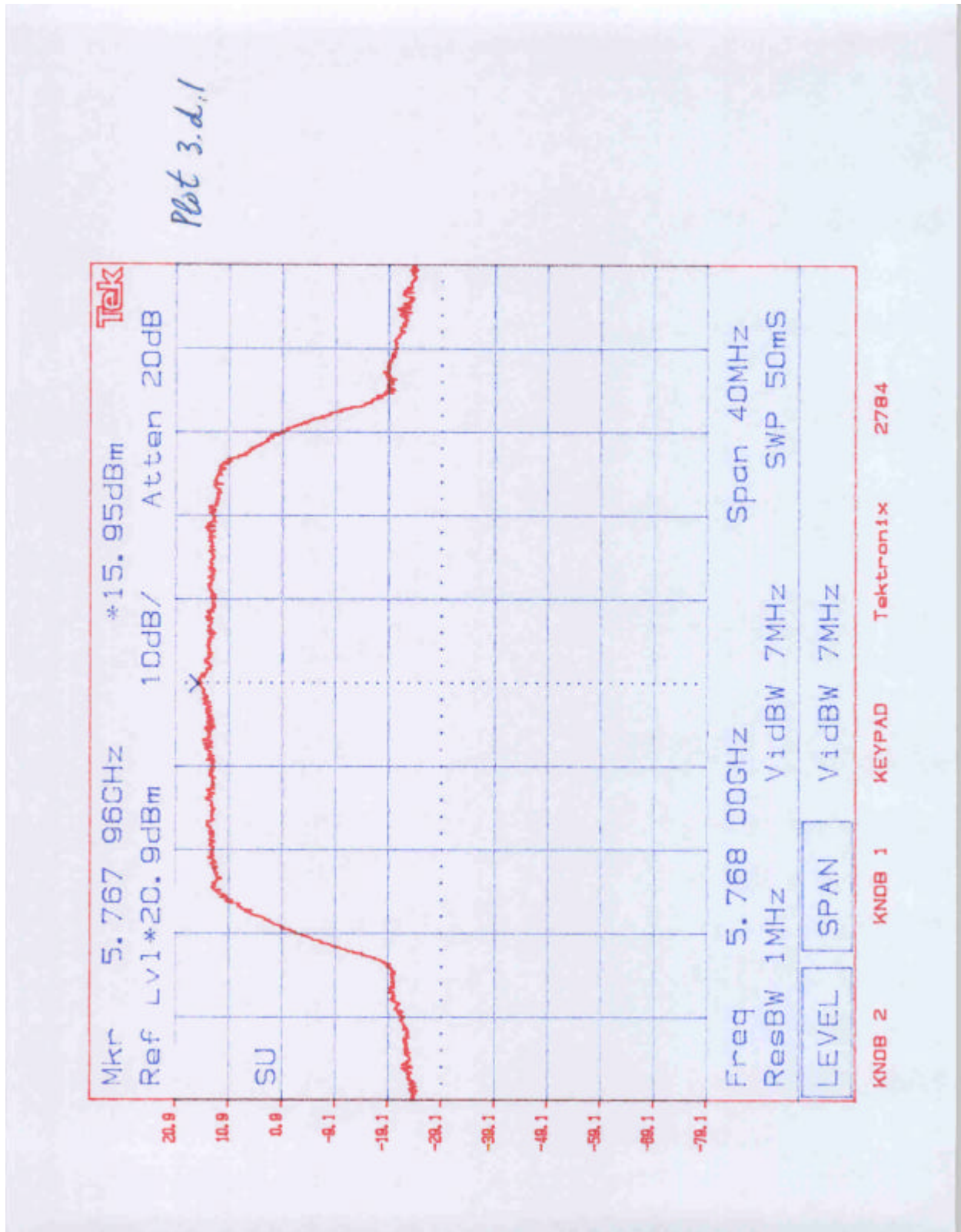
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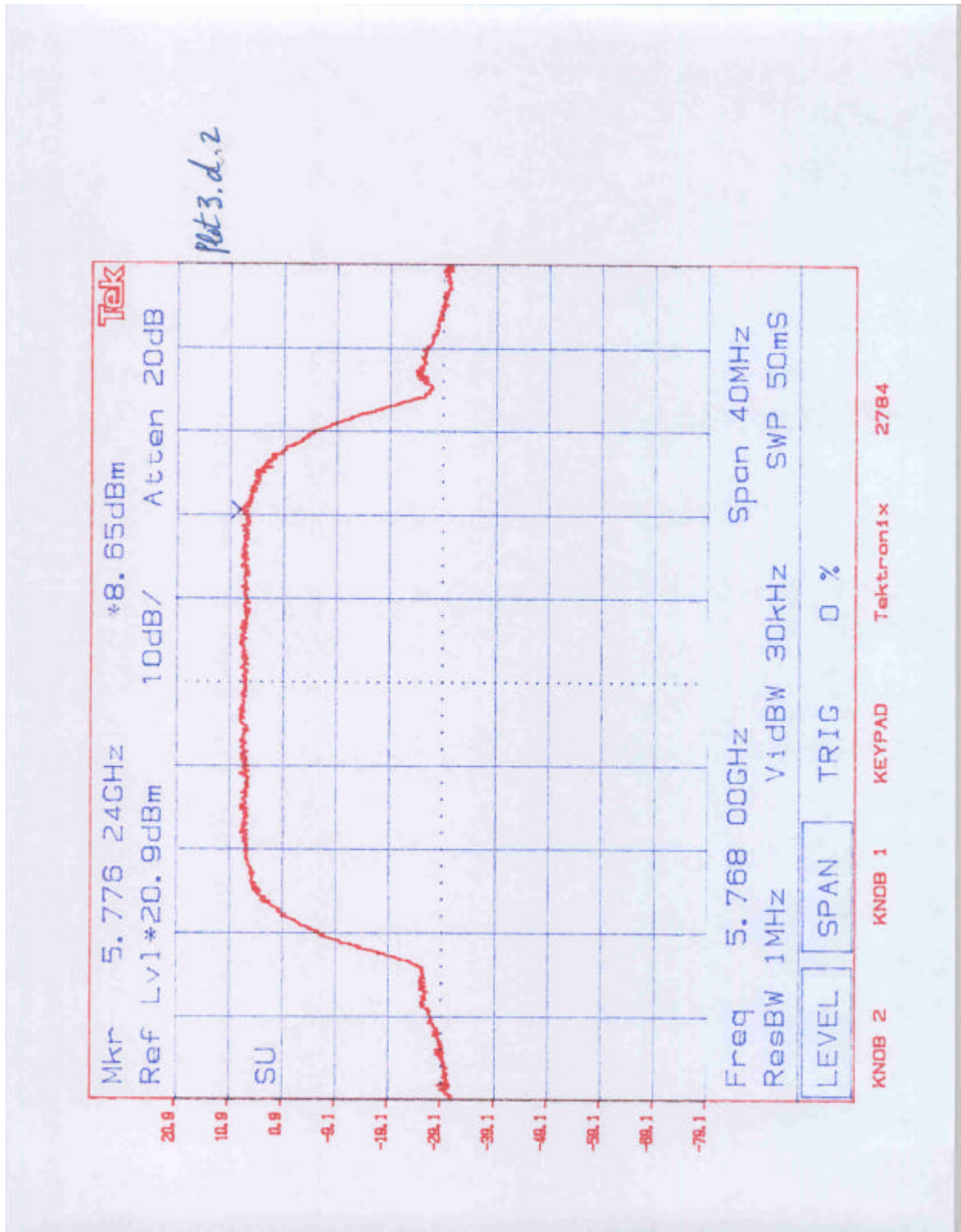
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Western Multiplex Corporation, Model No: 40100-XXX**FCC ID: HZB-U58-S60****Date of Test: September 20 to 23, 2001**

4.5 Out-of-Band Conducted Emissions FCC Rule 15.407(b)

Requirement:

For transmitters operating in the 5.25-5.35 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz. Devices operating in the 5.25-5.35 GHz band that generate emissions in the 5.15-5.25 GHz band must meet all applicable technical requirements for operation in the 5.15-5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5.15-5.25 GHz band.

For transmitters operating in the 5.725-5.825 GHz band: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an EIRP of -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an EIRP of -27 dBm/MHz.

The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

Procedure:

Spectrum Analyzer was connected to the output of the EUT. For measurements above 1 GHz, the Resolution Bandwidth was set to 1 MHz and the Video Bandwidth was set to 7 MHz; the Spectrum Analyzer was set to perform average by sampling, 100 sweeps was used. For measurements below 1 GHz, the Resolution Bandwidth and the Video Bandwidth were set 100 kHz. Several plots were made in the frequency range from 30 MHz to 40 GHz.

The tests were performed for three modulation: QAM16, QAM8, QPSK $R^{3/4}$.
Note: QPSK $R^{3/4}$ is the worst case for QPSK $R^{3/4}$ and QPSK $R^{1/2}$.

Result:

Refer to the following plots (on the next pages) for out-of-band conducted emissions data.

The EUT complies with out-of-band conducted emissions limits, calculated as EIRP Limit minus Antenna Gain (21 dBi):

- 48 dBm/MHz, for frequencies 30 - 5715 MHz,
- 48 dBm/MHz, for frequencies 5835 - 40 GHz,
- 38 dBm/MHz, for frequencies 5715 - 5725 MHz,
- 38 dBm/MHz, for frequencies 5825 - 5835 MHz,

except for frequencies 731.3 MHz, 759.4 MHz, 801.2 MHz (see plots: 4.c1, 4.d1, 4.e1, 4.f1, 4.g1, 4.h1, 4.i1). On those frequencies the antenna gain is unknown, therefore radiated emission tests were performed (see test data in section 4.6).

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15.407(b), Out-of-Band emissions		
4.a.1 – 4.a.8 *	Ch 0	QAM16
4.b.1 – 4.b.8 *	Ch 2	QAM16
4.c.1 – 4.c.9 *	Ch 5	QAM16
4.d.1 – 4.d.8 **	CH 0	QAM8
4.e.1 – 4.e.7 **	CH 2	QAM8
4.f.1 – 4.f.10 **	Ch 5	QAM8
4.g.1 – 4.g.10 ***	Ch 0	QPSK R $\frac{3}{4}$
4.h.1 – 4.h.7 ***	Ch 2	QPSK R $\frac{3}{4}$
4.i.1 – 4.i.11 ***	Ch 5	QPSK R $\frac{3}{4}$

* See Appendix A for plots
 ** See Appendix B for plots
 *** See Appendix C for plots

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4.6 Radiated Emissions
FCC Rules 15.109, 15.209, 15.205Procedure

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 dBμV/m

RA = Receiver Amplitude (including preamplifier) in dBμV

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 dBμV/m

RR = RA - AG in dBμV

LF = CF + AF in dB

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

RA = 52.0 dBμV

AF = 7.4 dB

RR = 23.0 dBμV

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CF = 1.6 dB

LF = 9.0 dB

AG = 29.0 dB

FS = RR + LF

FS = 23 + 9 = 32 dB μ V/m

Level in μ V/m = Common Antilogarithm [(32 dB μ V/m)/20] = 39.8 μ V/m

Result

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

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Radiated Emissions Test Data

Company:	Western Multiplex Inc	Model #:	40100-XXX	Standard	FCC § 15.407
EUT:	PMP Subscriber unit	S/N #:		Limits	11
Project #:	3008928	Test Date:	Sep 19, 2001	Test Distance	3 meters
Test Mode:	Tx @5740.40MHz	Engineer:	Suresh K	Duty Relaxation	0 dB

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	8	21	22	0	13	10	21	0	0	0
Model:	EMCO 3115	3160-9	3160-10	None	ACO/400	AFT18855	Grn	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
5740.40E+0	81.7	Peak	8	0	H	36.6	0.0	3.7	0.0	122.0	-	-
5740.40E+0	66.2	Ave.	8	0	H	36.6	0.0	3.7	0.0	106.5	-	-
1.15E+4	38.0	Peak	8	10	H	40.4	39.9	5.6	0.0	44.1	74.0	-29.9
1.15E+4	27.9	Ave.	8	10	H	40.4	39.9	5.6	0.0	34.0	54.0	-20.0
1.72E+4	38.5	Peak	8	10	H	42.2	38.8	7.5	0.0	49.4	74.0	-24.6
1.72E+4	28.5	Ave.	8	10	H	42.2	38.8	7.5	0.0	39.4	54.0	-14.6
2.30E+4	39.9 *	Peak	21	13	H	40.4	23.3	8.5	-9.5	56.0	74.0	-18.0
2.30E+4	28.2 *	Ave.	21	13	H	40.4	23.3	8.5	-9.5	44.3	54.0	-9.7
2.87E+4	37.3 *	Peak	22	13	H	43.4	24.2	9.2	-9.5	56.2	74.0	-17.8
2.87E+4	27.5 *	Ave.	22	13	H	43.4	24.2	9.2	-9.5	46.4	54.0	-7.6
3.44E+4	43.6 *	Peak	22	13	H	43.6	25.9	10.0	-9.5	64.5	74.0	-9.5
3.44E+4	33.1 *	Ave.	22	13	H	43.6	25.9	10.0	-9.5	51.3	54.0	-2.7

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 3 dB below the limits.
	f) Measurements above 20 GHz were made at 1 m distance
	g) * noise floor

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Radiated Emissions Test Data

Company:	Western Multiplex Inc	Model #:	40100-XXX	Standard	FCC § 15.407
EUT:	PMP Subscriber unit	S/N #:		Limits	11
Project #:	3008928	Test Date:	Sep 19, 2001	Test Distance	3 meters
Test Mode:	Transmitter@5768.0MHz	Engineer:	Suresh K	Duty Relaxation	0 dB

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	22	8	21	8	10	13	21	0	0	0
Model:	3160-10	EMCO 3115	3160-9	CDI_P1000	AFT18855	ACO/400	Grn	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
5768.06E+0	82.9	Peak	8	0	H	36.6	0.0	3.7	0.0	123.2	-	-
5768.06E+0	69.8	Ave.	8	0	H	36.6	0.0	3.7	0.0	110.1	-	-
1.15E+4	44.2	Peak	8	10	H	40.4	39.7	5.8	0.0	50.7	74.0	-23.3
1.15E+4	32.5	Ave.	8	10	H	40.4	39.7	5.8	0.0	39.0	54.0	-15.0
1.73E+4	39.4	Peak	8	10	H	42.2	38.8	7.5	0.0	50.3	74.0	-23.7
1.73E+4	28.0	Ave.	8	10	H	42.2	38.8	7.5	0.0	38.9	54.0	-15.1
2.31E+4	39.1 *	Peak	21	13	H	40.4	23.3	8.5	-9.5	55.2	74.0	-18.8
2.31E+4	28.3 *	Ave.	21	13	H	40.4	23.3	8.5	-9.5	44.4	54.0	-9.6
2.88E+4	36.5 *	Peak	22	13	H	43.4	24.2	9.2	-9.5	55.4	74.0	-18.6
2.88E+4	26.7 *	Ave.	22	13	H	43.4	24.2	9.2	-9.5	45.6	54.0	-8.4
3.46E+4	42.0 *	Peak	22	13	H	43.6	23.8	10.0	-9.5	62.3	74.0	-11.7
3.46E+4	31.7 *	Ave.	22	13	H	43.6	23.8	10.0	-9.5	52.0	54.0	-2.0

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 3 dB below the limits.
	f) Measurements above 20 GHz were made at 1 m distance
	g) * noise floor

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Radiated Emissions Test Data

Company:	Western Multiplex Inc	Model #:	40100-XXX	Standard	FCC § 15.407
EUT:	PMP Subscriber unit	S/N #:		Limits	11
Project #:	3008928	Test Date:	Sep 19, 2001	Test Distance	3 meters
Test Mode:	Transmitter@5809.56MHz	Engineer:	Suresh K	Duty Relaxation	0 dB

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	22	8	21	8	10	13	21	0	0	0
Model:	3160-10	EMCO 3115	3160-9	CDI_P1000	AFT18855	ACO/400	Grn	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
5809.56E+0	78.9	Peak	8	0	H	36.6	0.0	3.7	0.0	119.2	-	-
5809.56E+0	65.4	Ave.	8	0	H	36.6	0.0	3.7	0.0	105.7	-	-
1.16E+4	42.9	Peak	8	10	H	40.4	39.7	5.8	0.0	49.4	74.0	-24.6
1.16E+4	32.1	Ave.	8	10	H	40.4	39.7	5.8	0.0	38.6	54.0	-15.4
1.74E+4	38.9	Peak	8	10	H	42.2	38.8	7.5	0.0	49.8	74.0	-24.2
1.74E+4	28.2	Ave.	8	10	H	42.2	38.8	7.5	0.0	39.1	54.0	-14.9
2.32E+4	39.1 *	Peak	21	13	H	40.4	23.3	8.5	-9.5	55.2	74.0	-18.8
2.32E+4	27.2 *	Ave.	21	13	H	40.4	23.3	8.5	-9.5	43.3	54.0	-10.7
2.90E+4	36.5 *	Peak	22	13	H	43.5	25.9	9.2	-9.5	53.8	74.0	-20.2
2.90E+4	26.4 *	Ave.	22	13	H	43.5	25.9	9.2	-9.5	43.7	54.0	-10.3
3.49E+4	42.0 *	Peak	22	13	H	43.6	23.8	10.0	-9.5	62.3	74.0	-11.7
3.49E+4	31.4 *	Ave.	22	13	H	43.6	23.8	10.0	-9.5	51.7	54.0	-2.3

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 3 dB below the limits.
	f) Measurements above 20 GHz were made at 1 m distance
	g) * noise floor

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Job No.: 3008928
Company: Western Multiplex
Model: PMP Subscriber Unit
Test Mode: Tx/Rx
Engineer: Ollie Moyrong
Date: September_18_2001

FCC Part 15.109 Class B Radiated Emissions

Frequency (MHz)	Antenna Location (m)	Antenna Polariz. (H/V)	Reading (dBuV)	Antenna Factor (dB/m)	Preamplifier (dB)	Dist. Corr. Factor (dB)	Cable Loss (dB)	Corrected Reading (dBuV/m)	Limit At 3 m (dBuV/m)	Margin (dB)
35.0	3.0	V	35.1	8.2	-18.4	0.0	1.5	26.4	40.0	-13.6
35.4	3.0	V	38.6	8.2	-18.4	0.0	1.5	29.9	40.0	-10.1
51.0	3.0	V	37.1	5.0	-18.5	0.0	2.1	25.7	40.0	-14.3
56.8	3.0	V	34.3	5.7	-18.5	0.0	2.1	23.6	40.0	-16.4
64.2	3.0	V	38.4	5.8	-18.7	0.0	2.3	27.8	40.0	-12.2
64.8	3.0	V	39.7	5.8	-18.7	0.0	2.3	29.1	40.0	-10.9
80.0	3.0	V	36.7	6.7	-18.8	0.0	2.4	27.0	40.0	-13.0
103.4	3.0	V	27.0	7.2	-19.0	0.0	2.7	17.9	43.5	-25.6
112.8	3.0	V	32.3	7.1	-19.0	0.0	2.7	23.1	43.5	-20.4
731.3	3.0	V	31.9	20.7	-32.0	0.0	3.5	24.1	46.0	-21.9
759.4	3.0	V	30.0	20.7	-32.0	0.0	3.5	22.2	46.0	-23.8
801.2	3.0	V	32.0	20.7	-32.0	0.0	3.5	24.2	46.0	-21.8

Notes: Negative signs (-) in the Margin column signify levels below the limit.
All readings are peak measurements.
All other emissions not reported are at least 10 dB below the applicable limits.
Frequency range of investigation is 30 MHz - 1 GHz.

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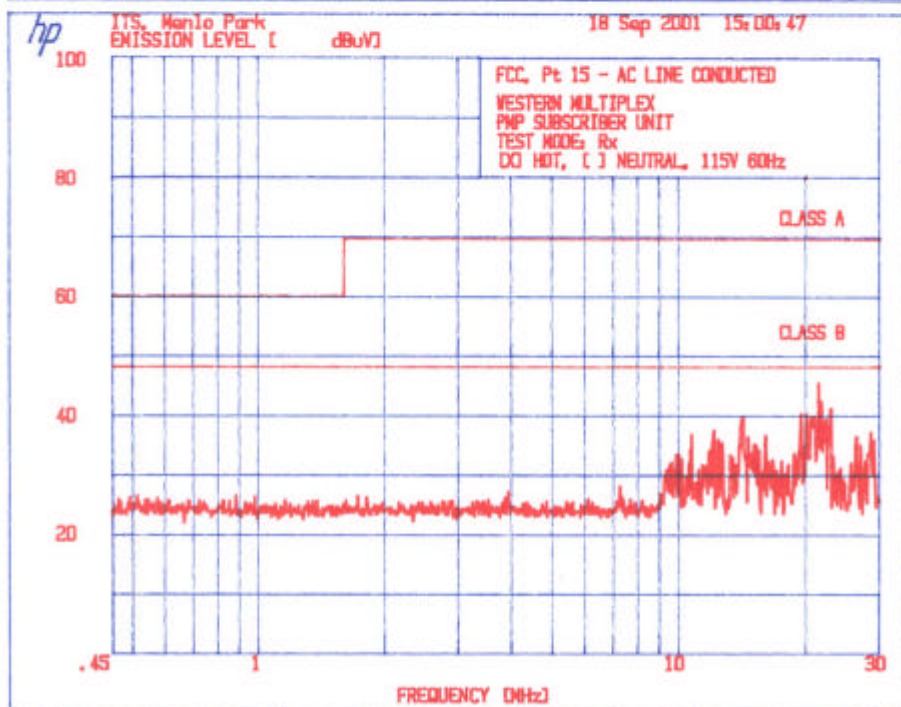
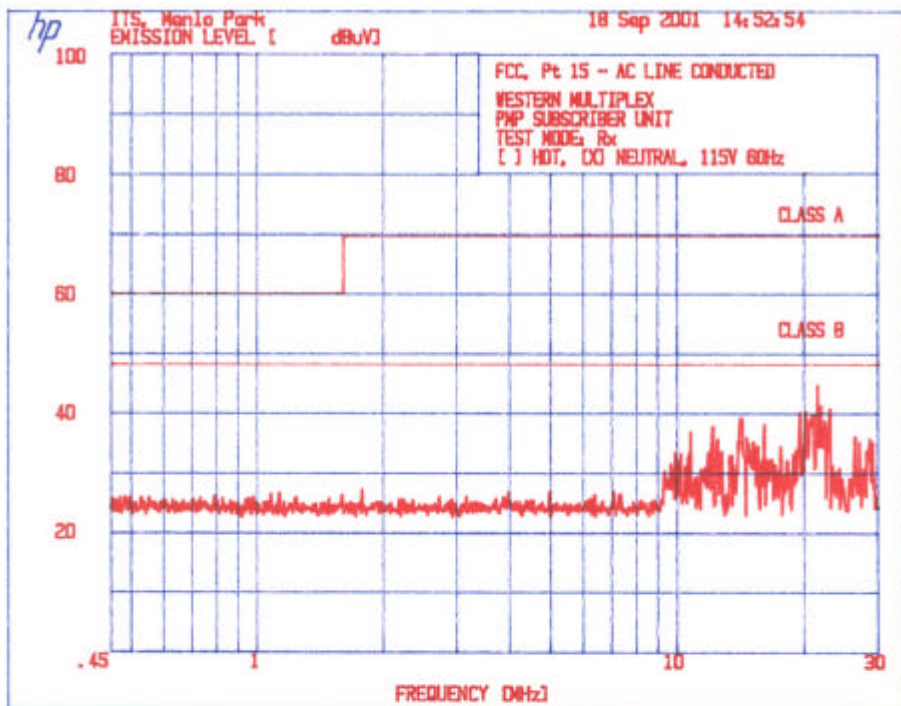
4.7 AC Line Conducted Emission
FCC Rule 15.207

AC line conducted emission test was performed according the ANSI C63.4 standard. The EUT was connected to DC Power Supply which was connected to AC Line through the LISNs.

For the test result, see attached plot.

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5.0 List of Test Equipment

EQUIPMENT	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. INTERVAL	CAL. DUE
Spectrum Analyzer w/85650 QP Adapter	Hewlett Packard	8566B	2416A00317 2043A00251	12	4/6/02
Spectrum Analyzer w/8650 QP Adapter	Hewlett Packard	8568B	1912A0053 2521A01021	12	2/23/02
Spectrum Analyzer	Tektronix	2784	B3020108	12	8/8/02
Double-ridged Horn Antenna	EMCO	3115	9107-3712	12	3/17/02
Horn Antenna	EMCO	3160-09	Not Labeled	#	#
Horn Antenna	EMCO	3160-10	Not Labeled	#	#
Pre-Amplifier	CDI	P950	ITS009	12	7/2/02
Pre-Amplifier	Sonoma Inst.	310	185634	12	4/25/02
Pre-Amplifier	CDI	P1000	N/A	12	10/06/01
Pre-Amplifier	Avantek	AFT-18855	8723H705	12	10/5/01
Pre-amplifier	CTT	ACO/400	47526	12	10/5/01
Power Meter	Hewlett Packard	8900D	3607U00673	12	8/8/02
LISN	Solar Electronics	8025-50-TS-24-BNC	912434	12	6/11/02
LISN	Solar Electronics	8028-50-TS-24-BNC	941502	12	2/7/02

No Calibration Required

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6.0 Document History

Revision/ Job Number	Writer Initials	Date	Change
1.0 / 3008928	SS	September 20, 2001	Original document