

TEST REPORT

Report Number: 30276571
Project Number: 3027657

Report Date: August 21, 2002
Date of Test: May 18 to August 20, 2002

Testing performed on the

Unlicensed Spread Spectrum Transceiver
FCC ID: HZB-US5358-GX1
IC: 1856-U5358GX1
to

FCC Part 15.247 Direct Sequence Spread Spectrum
for

Proxim Corporation

Test Performed by:
Intertek Testing Services
1365 Adams Court
Menlo Park, CA 94025

Test Authorized by:
Proxim Corporation
1196 Borregas Avenue,
Sunnyvale, CA 94089 USA



Warnock Hersey



Prepared by: David Chernomordik Date: 12/11/02
David Chernomordik



Reviewed by: Ollie Moyrong Date: 12/11/02
Ollie Moyrong



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Intertek Testing Services NA, Inc.
1365 Adams Court, Menlo Park, CA 94025
Telephone 650-463-2900 Fax 650-463-2910 Home Page www.etlsemko.com



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1.0 Summary of Tests

**FCC ID: HZB-US5358-GX1
IC: 1856-U5358GX1**

TEST	REFERENCE	RESULTS
Output power	15.247(b)	Complies
6 dB Bandwidth	15.247(a)(2)	Complies
Power Density	15.247(d)	Complies
Out-of-band Antenna Conducted Emission	15.247(c)	Complies
Out-of-band Radiated Emission (except emissions in restricted bands)	15.247(c)	Not Applicable. The EUT passed out-of-band antenna conducted emission
Radiated Emission in Restricted Bands	15.209, 15.205	Complies
AC Line-conducted Emission	15.207	Complies with Class B requirements
Radiated Emission from Digital Part	15.109	Complies with Class A requirements *
Radiated Emission from Receiver L.O.	15.109	Not Applicable. The operating frequency is above 960 MHz
RF Exposure Requirement	2.1091	Complies, see exhibit "RF Exposure"
Antenna Requirement	15.203	Not Applicable. The EUT requires professional installation

* According to the applicant, the EUT is not used in residential area.

2.0 General Description

2.1 Product Description

The HZB-US5358-GX1 is a product family designed to offer outdoor point-to-point wireless link using 5.25-5.35GHz and 5.725-5.725/5.850GHz frequency bands.

The product hardware include two major subassemblies consisting of an IDU (indoor unit) and an RF Unit. The IDU Unit contains the power supply, modem, multiplexing functions, system control, user and data interfaces, and orderwire. The RF Unit contains all RF related functions. There are four separate Line Interface Cards (LIUs) offering different data interfaces of different capacities. One LIU is used for each product model. The four LIUs are:

- LIU-1: Provides 1, or 2, or 4, or 8 T1 or E1 interface(s), or a 100BaseT interface using RJ45 connectors.
- LIU-2: Provides a DS3 interface using BNC connectors
- LIU-3: Provides 16T1 or 12 E1 interfaces using RJ45 connectors
- LIU-4: Provides 28 T1 or 21 E1 interfaces using 64-pin (telco) DSX connectors

Depending on the configuration of the product, which is a combination of software setup and hardware configuration (use of a certain LIU card and diplexer), the product is capable of offering outdoor point to point wireless links with certain data capacities and interfaces under the provision of UNII rules (15.407) or spread spectrum rules (15.247). Different RF transmit channel plans are available corresponding to different data bandwidth. For marketing purpose, different model names and numbers are given to distinguish different combination of data capacity and interfaces. Please refer to the following table for a list of all product models in the product family and relevant information of test/certification concern on each model.

A pre-production version of the EUT was received on May 17, 2002 in good operating condition.

Model Name	Model Number	IDU with:				ODU with:			Channel Center Frequencies (MHz)
		LIU-1	LIU-2	LIU-3	LIU-4	Filter 1 5.25- 5.35G	Filter 2 5.725-5.825G UNII	Filter 3 5.8G ISM	
Lynx.GX 16T1 5.8 GHz ISM System	52290- 10xx			x				x	5745/5830
Lynx.GX 12E1 5.8 GHz ISM System	52250- 20xx			x				x	5745/5830
Lynx.GX 8E1 5.8 GHz ISM System	51145- 20xx	x						x	5734/5756/5819/5841
Lynx.GX 8T1 5.8 GHz ISM System	51145- 10xx	x						x	5734/5756/5819/5841
Lynx.GX 4T1 5.8 GHz ISM System	51850- 10xx	x						x	5731.5/5745.0/5758.5/5816.5/5830.0/ 5843.5
Lynx.GX 4E1 5.8 GHz ISM System	51850- 20xx	x						x	5731.5/5745.0/5758.5/5816.5/5830.0/ 5843.5
Lynx.GX 2T1 5.8 GHz ISM System	51600- 10xx	x						x	5728.5/5735.0/5741.5/5748.0/5754.5/ 5761.0/5813.5/5820.0/5826.5/5833.0/ 5839.5/5846.0
Lynx.GX 2E1 5.8 GHz ISM System	51700- 20xx	x						x	5728.5/5735.0/ 5741.5/5748.0/5754.5/5761.0/ 5813.5/5820.0/5826.5/5833.0/5839.5/ 5846.0
Lynx.GX 1T1 5.8 GHz ISM System	51000- 10xx	x						x	5727/5731/5735/5739/5743/5747/ 5751/5755/ 5759/5763/ 5812/5816/ 5820/5824/5828/5832/5836/5840/ 5844/5848
Lynx.GX 1E1 5.8 GHz ISM System	51400- 20xx	x						x	5727/5731/5735/5739/5743/5747/ 5751/5755/ 5759/5763/ 5812/5816/ 5820/5824/5828/5832/5836/5840/ 5844/5848
Tsunami 10 + T1 5.8 GHz ISM System	51145- 41xx	x						x	5734/5756/5819/5841
Tsunami 10 + E1 5.8 GHz ISM System	51145- 42xx	x						x	5734/5756/5819/5841

Overview of the EUT

Applicant	Proxim Corporation
Manufacturer	Proxim Corporation
Trade Name	Lynx/Tsunami
Model No.	See table in sec. 2.1
FCC/IC Identifier	FCC ID: HZB-US5358-GX1 IC: 1856-U5358GX1
Use of Product	Point-to-point fixed wireless communication network
Type of Transmission	FDD
Type of Modulation	QPSK
Symbol rate	2.7 Msps, 4.5 Msps, 9 Msps, 13.5 Msps, 27 Msps
Rated RF Output (dBm)	The output power depends on the gain of the antenna used. Maximum Peak Power is 28.3 dBm
Frequency Range (MHz)	5727 – 5848 MHz
Number of Channel(s)	See table in sec. 2.1
Antenna(s) & Gain, dBi	2' Parabolic Antenna, 28.5 dBi 8' Parabolic Antenna, 39.7 dBi 1' Flat Panel Antenna, 23.5 dBi 2' Flat Panel Antenna, 28.0 dBi
Antenna Requirement	The EUT requires professional installation (supporting documentation is attached)
Applicant name & address	Proxim Corporation 1196 Borregas Avenue, Sunnyvale, CA 94089 USA

2.2 Related Submittal(s) Grants

FCC Part 15 Subpart E, U-NII Radio.

2.3 Test Methodology

Both AC mains line-conducted and radiated emissions measurements were performed according to the procedures in ANSI C63.4 (1992). Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Data Sheet**" of this Application. All other measurements were made in accordance with the procedures in parts 2 and 15 of CFR 47.

2.4 Test Facility

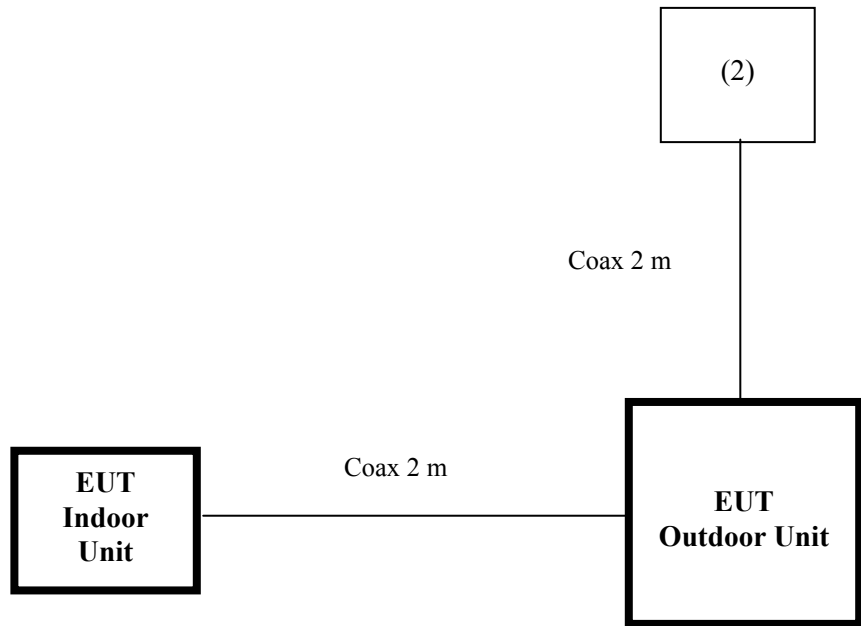
The open area test site and conducted measurement facility used to collect the radiated data is site 1 1 (10-m semi-anechoic chamber). This test facility and site measurement data have been fully placed on file with the FCC and A2LA accredited.

3.0 System Test Configuration

3.1 Support Equipment and description

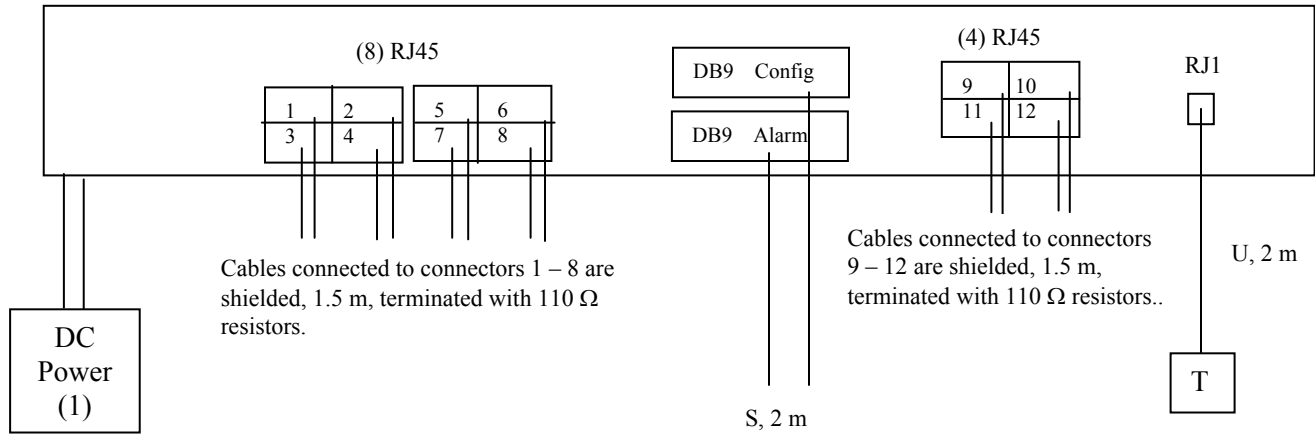
Item #	Description	Model No.	Serial No.
1	HP DC Power Supply	6296A	2234A-04250
2	Gabriel Electronics 1' Directional Flat Panel Antenna	DFPD1-52	N/A
2	Gabriel Electronics 2' Directional Flat Panel Antenna	DFPD2-52	N/A
2	Gabriel Electronics 2' Parabolic Antenna	SSP2-52B	N/A
2	Gabriel Electronics 8' Parabolic Antenna	SSD8-52	N/A

3.2 Block Diagram of Test Setup

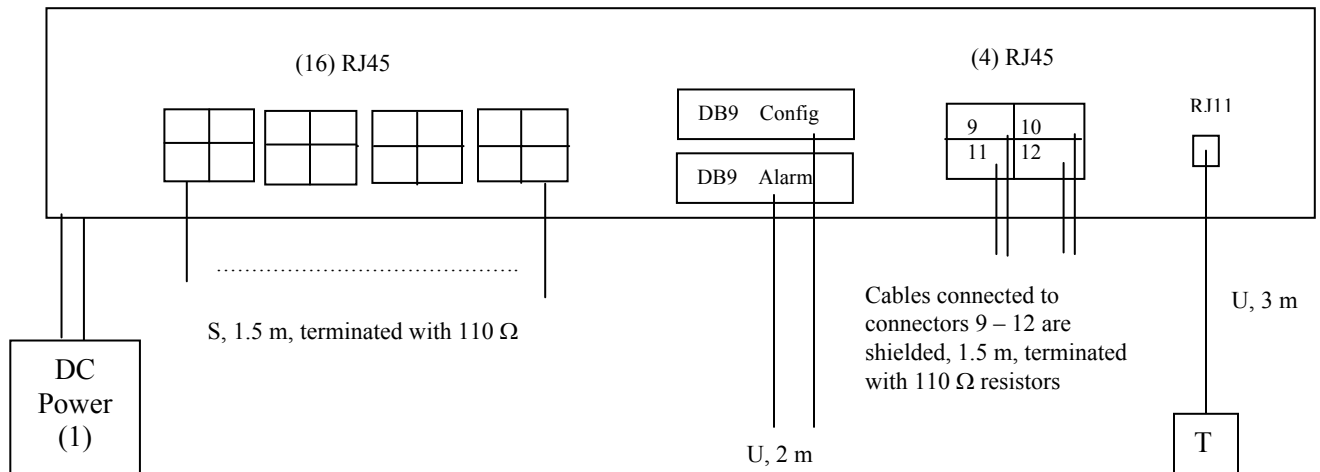


EUT Indoor Unit consists of (4) separate configurations, LIU-1, 2, 3, 4, which are diagramed on the following pages of this report.

LIU-1



LIU-3



S = Shielded	F = With Ferrite
U = Unshielded	m = Length in Meters

3.3 Justification

For emission testing, the Equipment Under Test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). The EUT was wired to transmit full power.

The tests were performed on the lowest, middle and highest available channels. The channels were chosen from the table in section 2.1 (1T1/1E1 configuration):

5727 MHz – the lowest channel,
5763 MHz – the middle channel,
5848 MHz – the highest channel.

In addition, the emission tests were performed on the widest channels in 16T1/12E1 configuration: 5745 MHz and 5830 MHz. For antenna conducted, the worst case result reported is for 5745 MHz.

Radiated emission test was performed with all antennas listed in section 3.1.
Care was taken to ensure proper power supply voltages during testing.

3.4 Software Exercise Program

The EUT exercise program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use. For emissions testing, the units were setup to transmit continuously to simplify the measurement methodology.

3.5 Mode of operation during test

100% time transmitting signal on different channels.

3.6 Modifications required for Compliance

Intertek Testing Services installed no modifications during compliance testing in order to bring the product into compliance (Please note that this does not include changes made specifically by Proxim Corporation prior to compliance testing).

3.7 Additions, deviations and exclusions from standards

No additions, deviations or exclusion have been made from standard.

4.0 Measurement Results

4.1 Conducted Output Power at Antenna Terminals FCC Rules 15.247(b):

Requirements

For systems operating in the 5725 - 5850 MHz band that are used exclusively for fixed, point-to-point operations, and maximum allowed transmitter output is 1 watt (+30 dBm).

Procedure

The antenna port of the EUT was connected to the input of a peak power meter. Power was read directly and cable loss correction was added to the reading to obtain the power at the EUT's antenna terminal.

Test Results

Frequency (MHz)	Configuration	Output Power
5727	1T1/1E1	28.3 dBm
5745	16T1/12E1	25.5 dBm
5763	1T1/1E1	28.0 dBm
5848	1T1/1E1	26.8 dBm

4.2 6 dB RF Bandwidth
FCC Rule 15.247(a)(2):

Requirements

The minimum 6-dB bandwidth shall be at least 500 kHz

Procedure

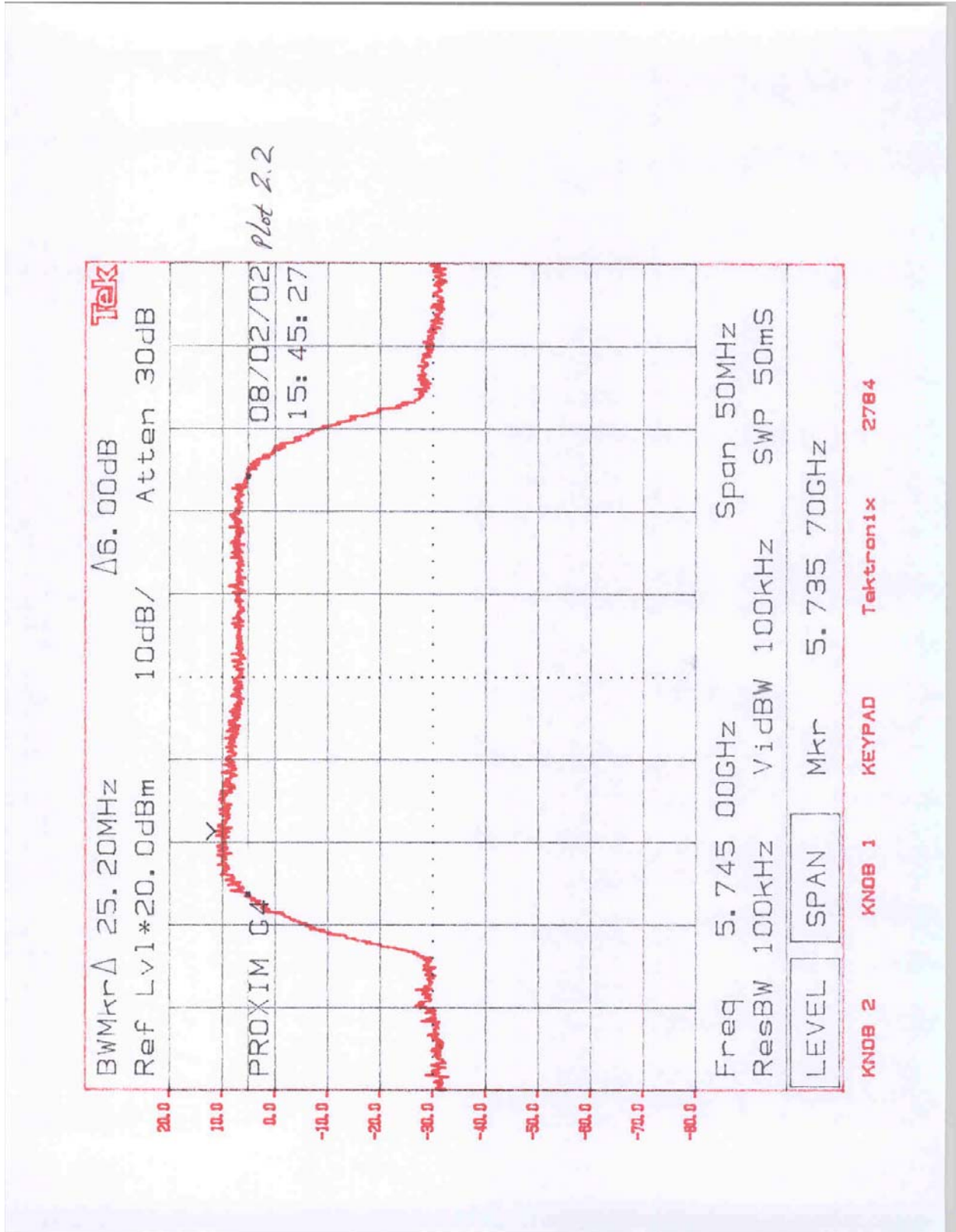
The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer RES BW was set to 100 kHz. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A PEAK output reading was taken; a DISPLAY line was drawn 6 dB lower than PEAK level. The 6-dB bandwidth was determined from where the channel output spectrum intersected the display line.

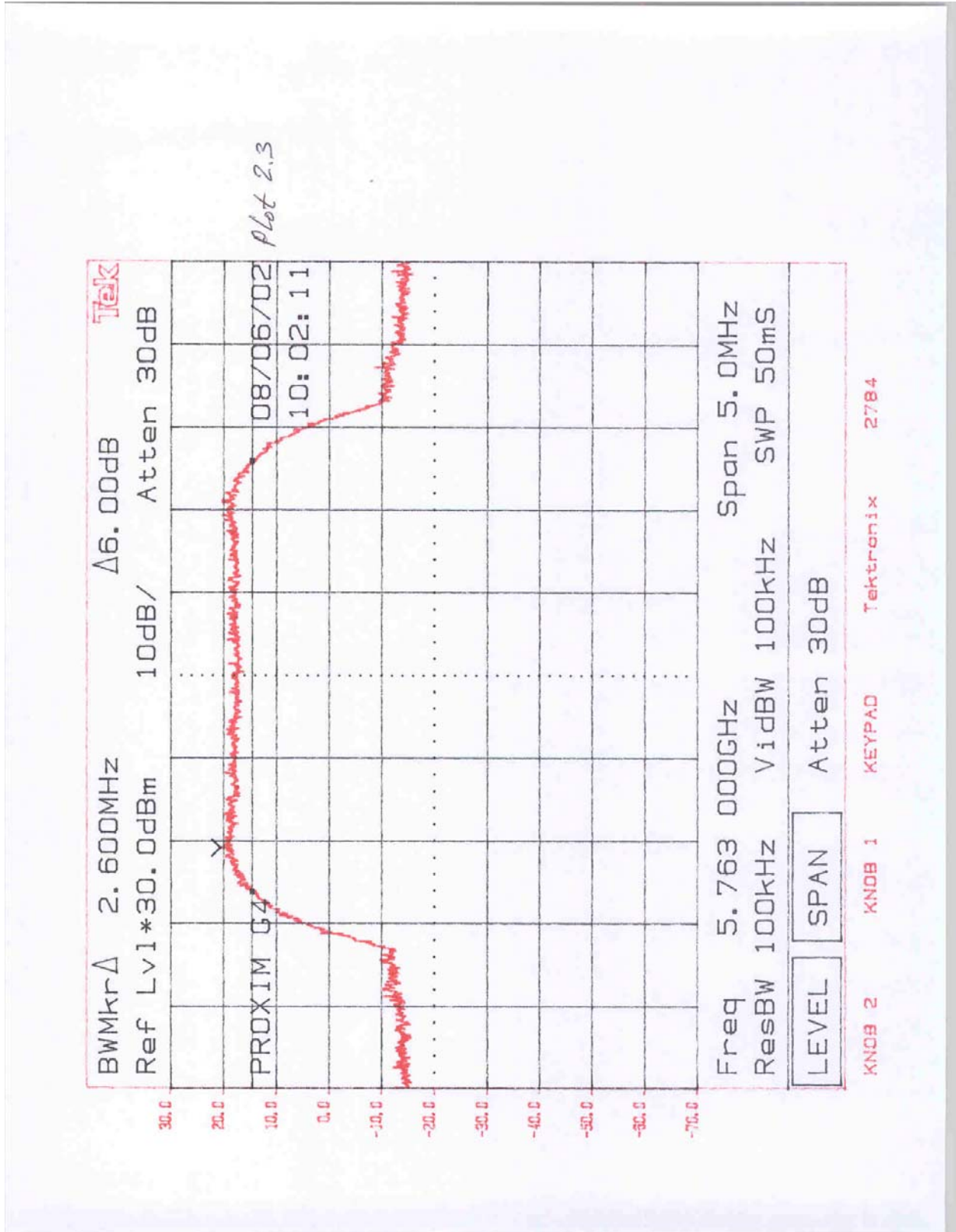
Test Result

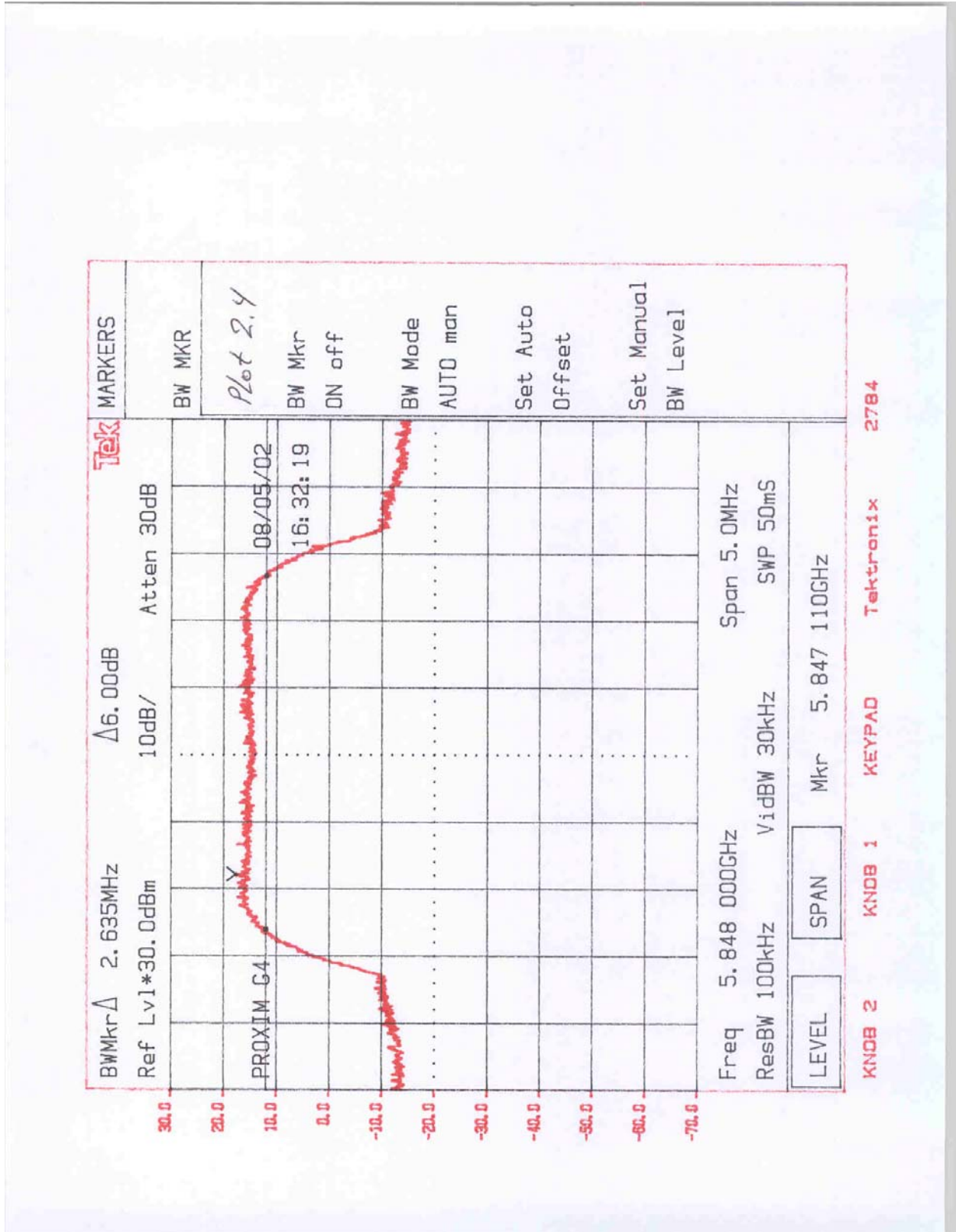
Frequency (MHz)	Configuration	6 dB Bandwidth
5727	1T1/1E1	2.62 MHz
5745	16T1/12E1	25.2 MHz
5763	1T1/1E1	2.60 MHz
5848	1T1/1E1	2.64 MHz

Refer to the following plots 2.1-2.4 for 6 dB bandwidth:









4.3 Power Density
FCC Rule 15.247(d)

Requirements

The peak power spectral density shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Procedure

The spectrum analyzer RES BW was set to 3 kHz. The START and STOP frequencies were set to the band edges of the maximum output passband. If there is no clear maximum amplitude in any given portion of the band, it may be necessary to make measurements at a number of bands defined by several START and STOP frequency pairs. Total SWEEP TIME is calculated as follows:

$$\text{SWEEP TIME (SEC)} = (\text{Fstop, kHz} - \text{Fstart, kHz}) / 3 \text{ kHz}$$

Antenna output of the EUT was coupled directly to spectrum analyzer; if an external attenuator and/or cable was used, these losses are compensated for with the analyzer OFFSET function.

Test Result

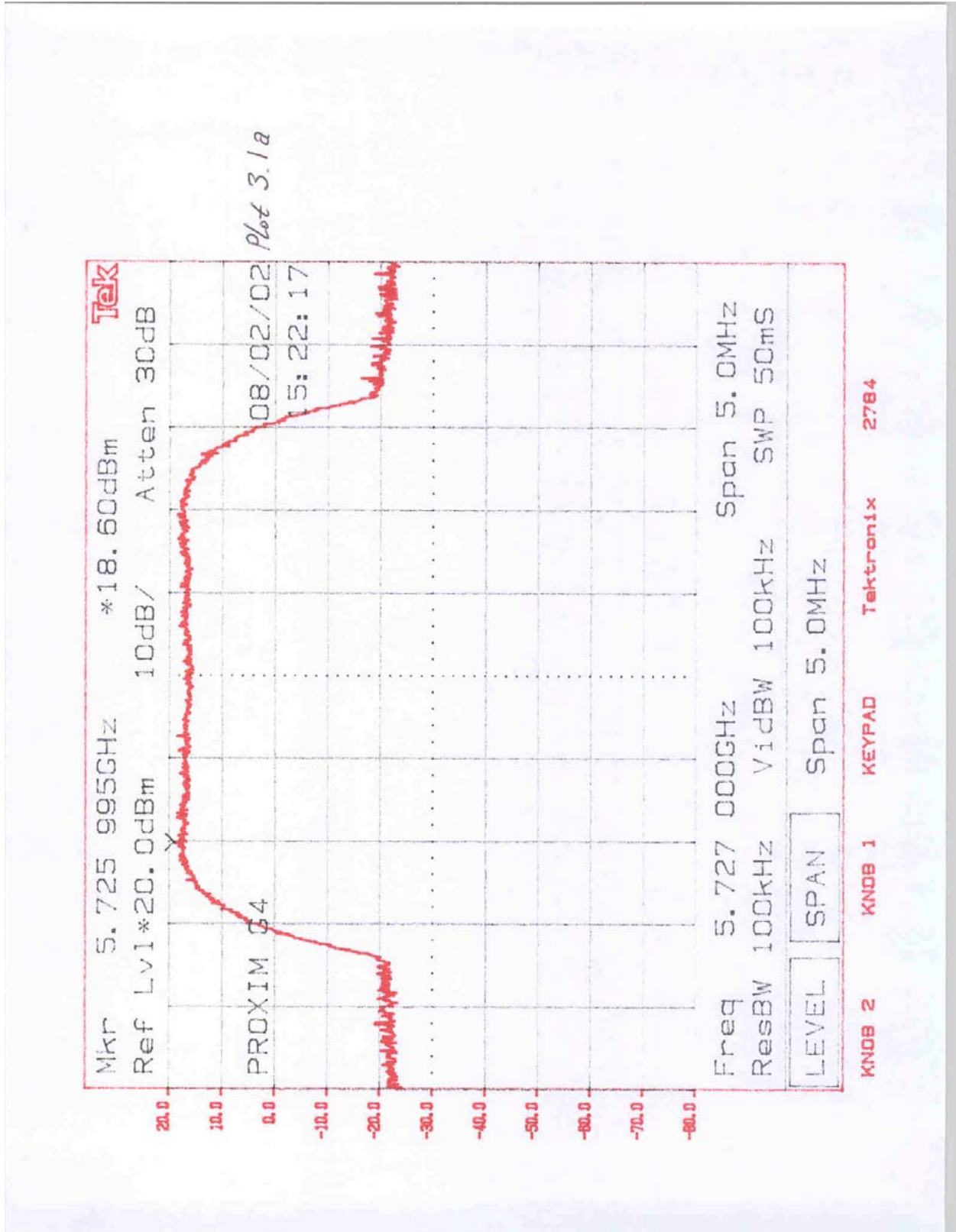
Frequency (MHz)	Configuration	Power Density
5727	1T1/1E1	5.2 dBm
5745	16T1/12E1	-2.9 dBm
5763	1T1/1E1	7.7 dBm
5848	1T1/1E1	5.5 dBm

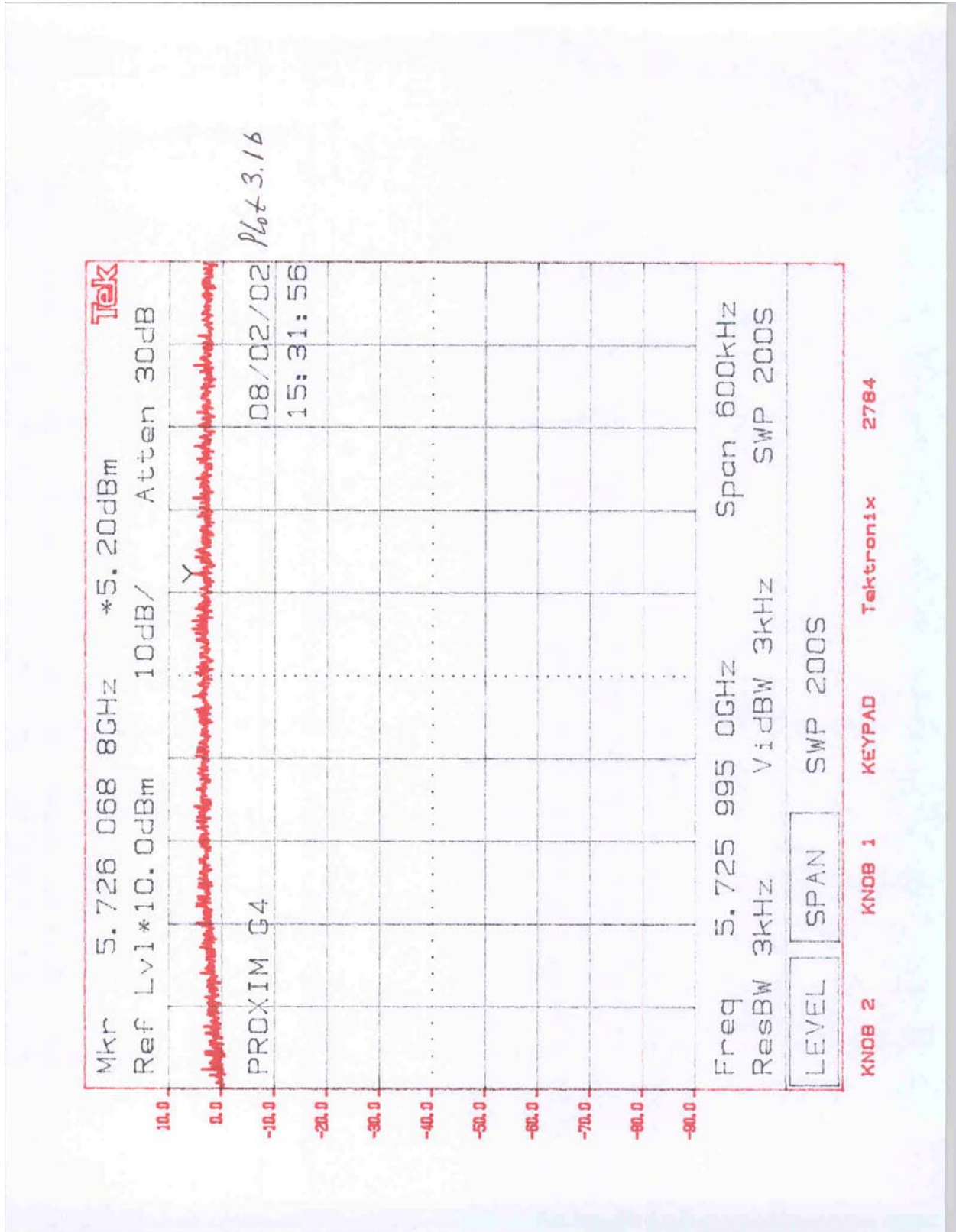
Frequency Span = 600 kHz

Sweep Time = Frequency Span / 3 kHz = 200 Seconds

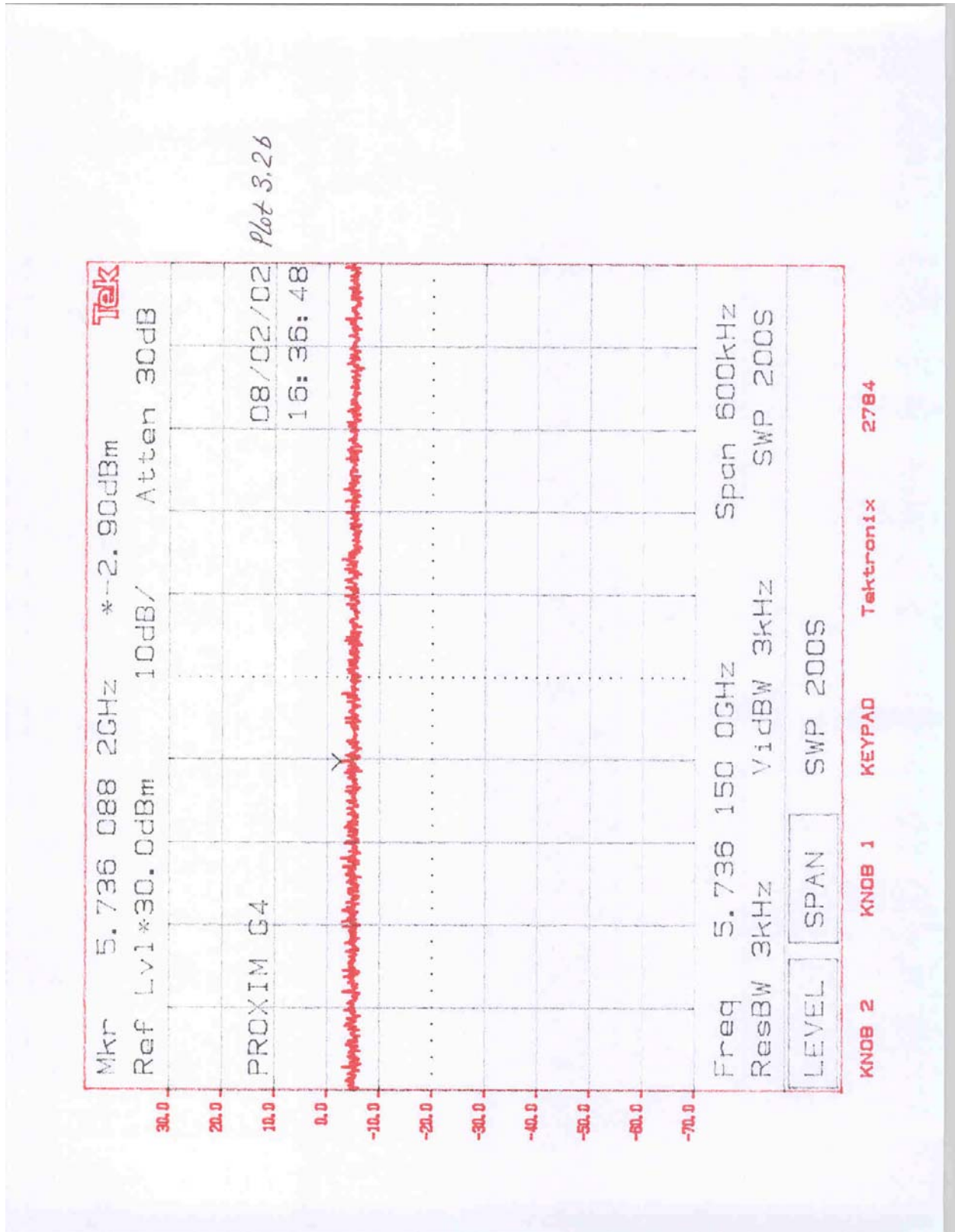
Refer to the following plots for power density data:

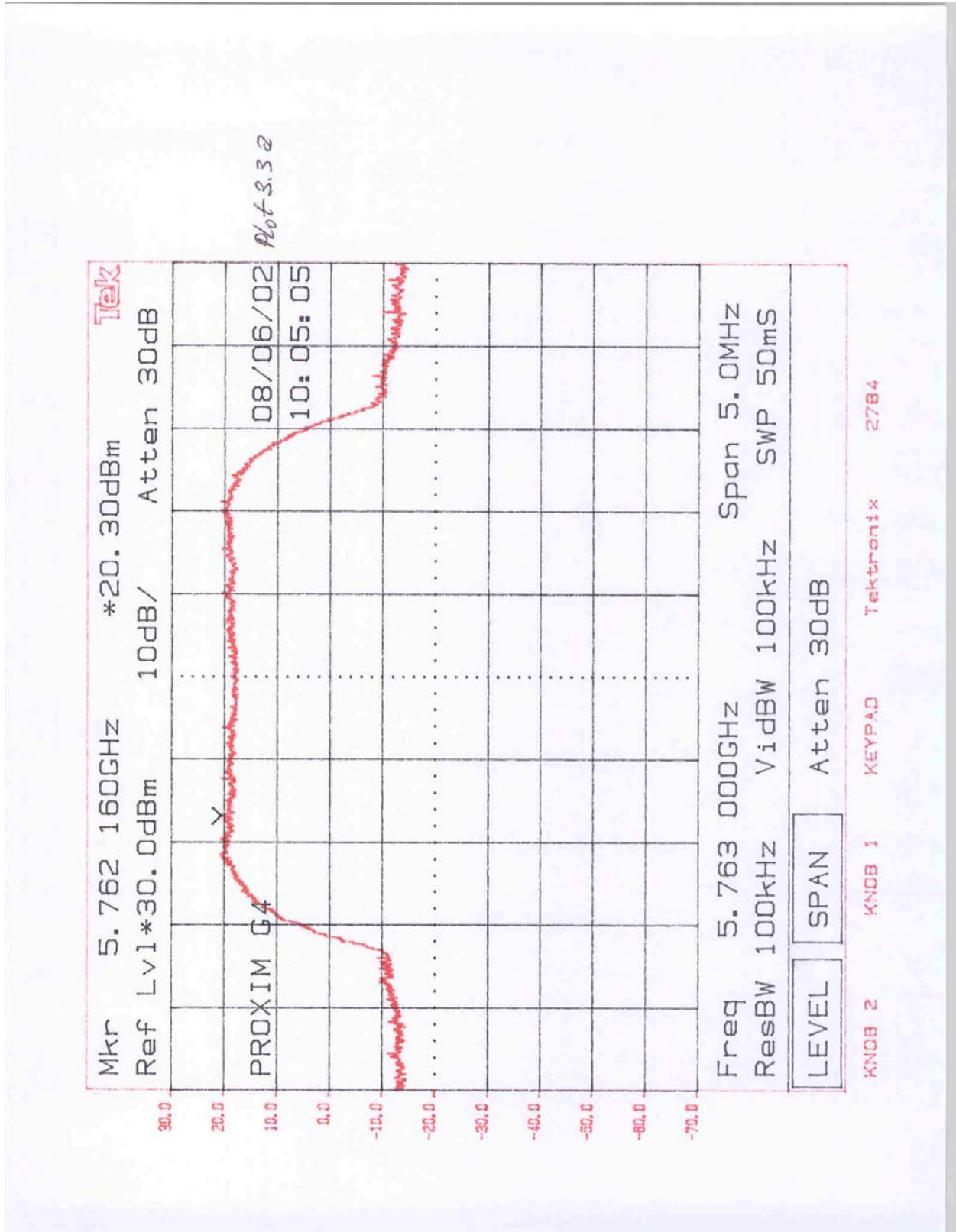
- Plot 3.1a – 3.1b: Low Channel Power Density
- Plot 3.2a – 3.2b: Middle Channel Power Density
- Plot 3.3a – 3.3b: Middle Channel Power Density
- Plot 3.4a – 3.4b: High Channel Power Density

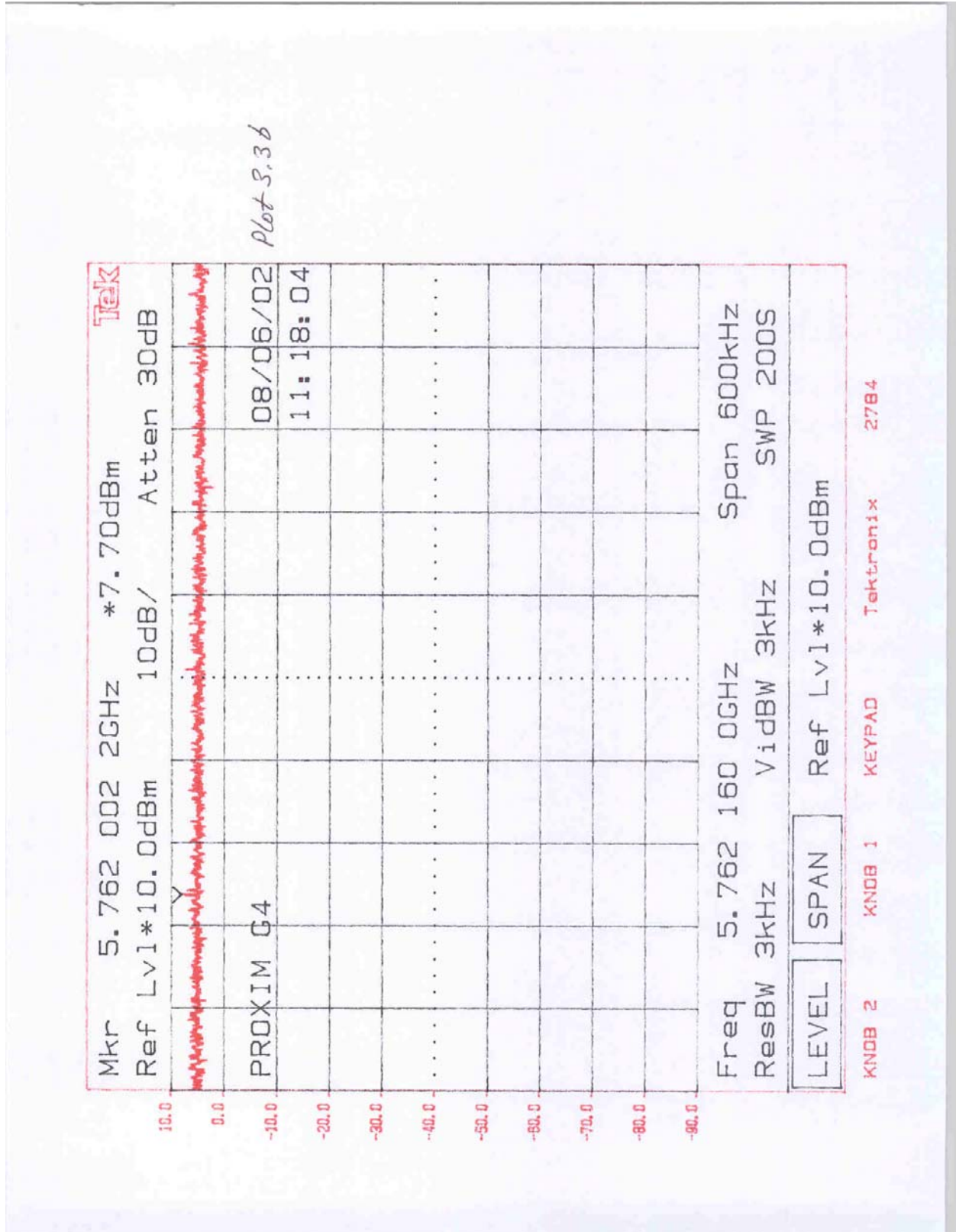


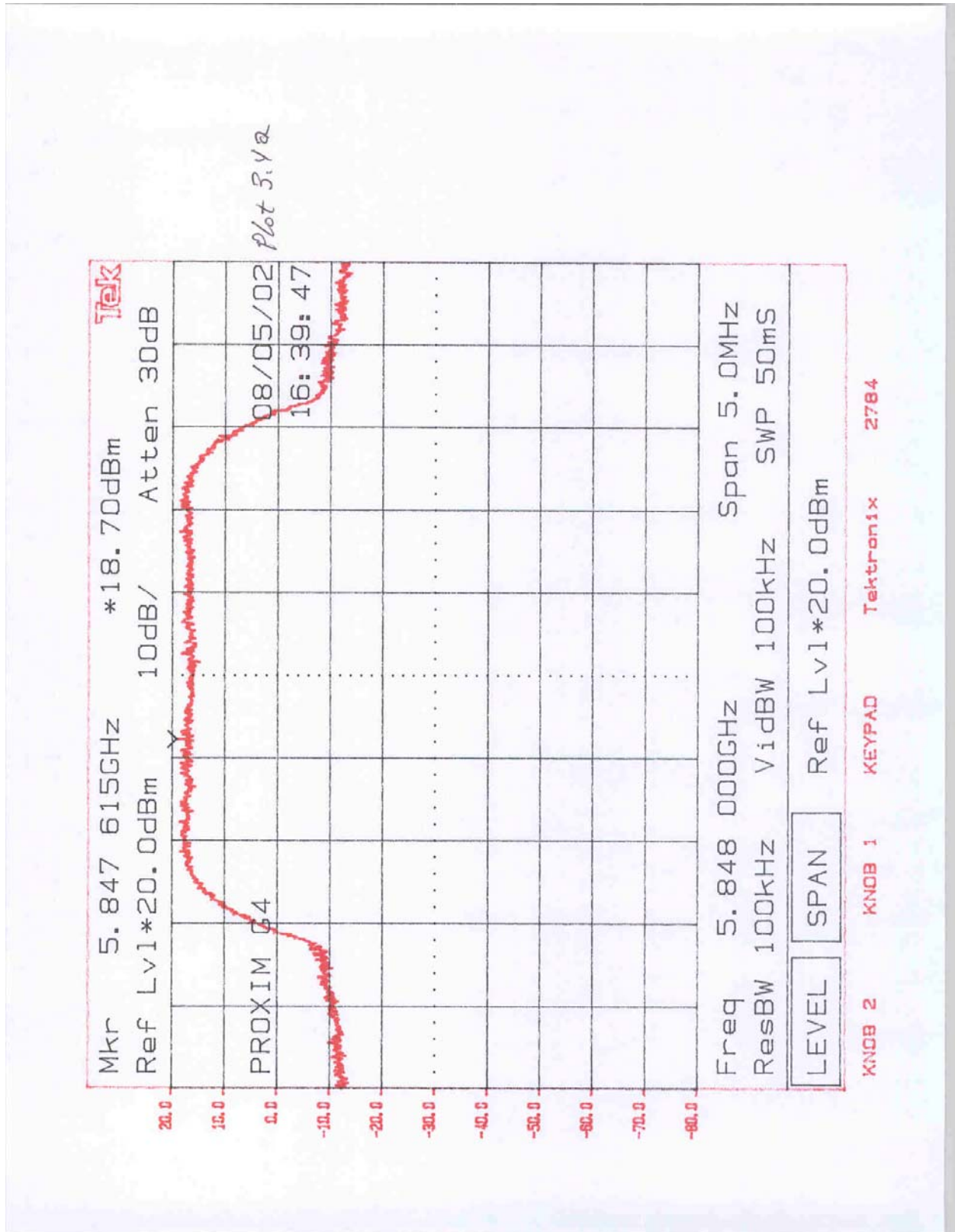


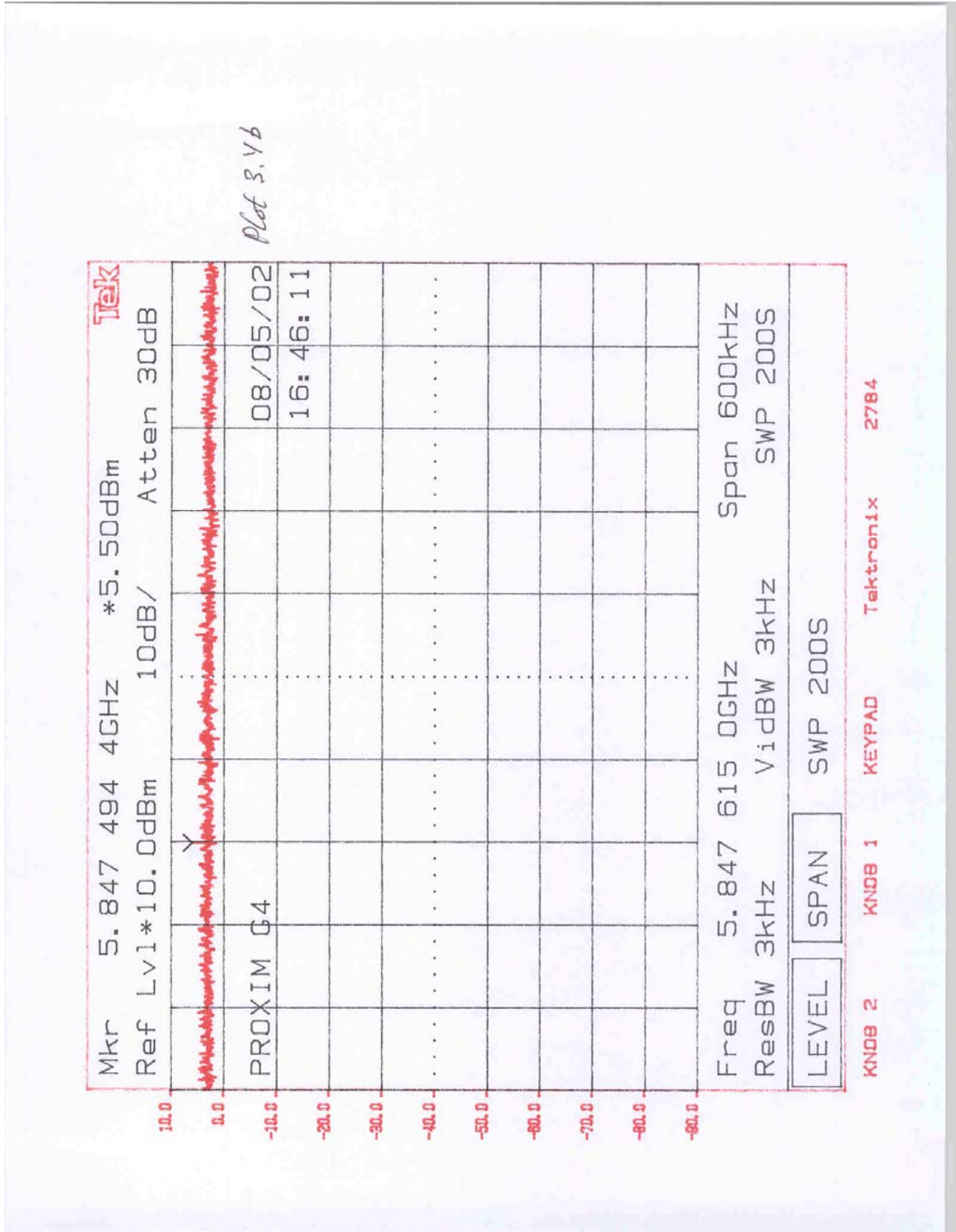












4.4 Out-of-Band Conducted Emissions
FCC Rule 15.247(c):

Requirements

In any 100 kHz bandwidth outside the EUT passband, the RF power shall be at least 20 dB below that of the maximum in-band 100 kHz emission.

Procedure

A spectrum analyzer was connected to the antenna port of the transmitter. Analyzer Resolution Bandwidth was set to 100 kHz. For each channel investigated, the in-band and out-of-band emission measurements were performed. The out-of-band emissions were measured from 10 MHz to 40 GHz.

Test Result

For the test result, refer to the plots in Appendix A.
The out-of-band emissions more than 20 dB below the level on the fundamental frequency.

4.5 Transmitter Radiated Emissions
FCC Rules: 15.247 (c), 15.205, 15.209

Procedure

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:

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

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(1/m)

AG = Amplifier Gain in dB

Att = External attenuator (if used)

Assume a receiver reading of 52.0 dB(μ V) is obtained. The antennas factor of 7.4 dB(1/m) and cable factor of 1.6 dB is added. The amplifier gain of 29.0 dB is subtracted, giving field strength of 32.0 dB(μ V/m). This value in dB(μ V/m) was converted to its corresponding level in μ V/m.

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

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

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

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

$$Att = 0 \text{ dB}$$

$$FS = 52+7.4+1.6-29.0+0 = 32.0 \text{ dB}(\mu\text{V}/\text{m})$$

$$\text{Level in } \mu\text{V}/\text{m} = \text{Common Antilogarithm} [(32.0 \text{ dB}\mu\text{V}/\text{m})/20] = 39.8 \mu\text{V}/\text{m}$$

Result

The data in Appendix B list the significant emission frequencies, the limit and the margin of compliance.
The EUT passed by 15.9 dB.

4.6 Radiated Emissions from Digital Section of Transceiver
FCC Ref: 15.109

Procedure

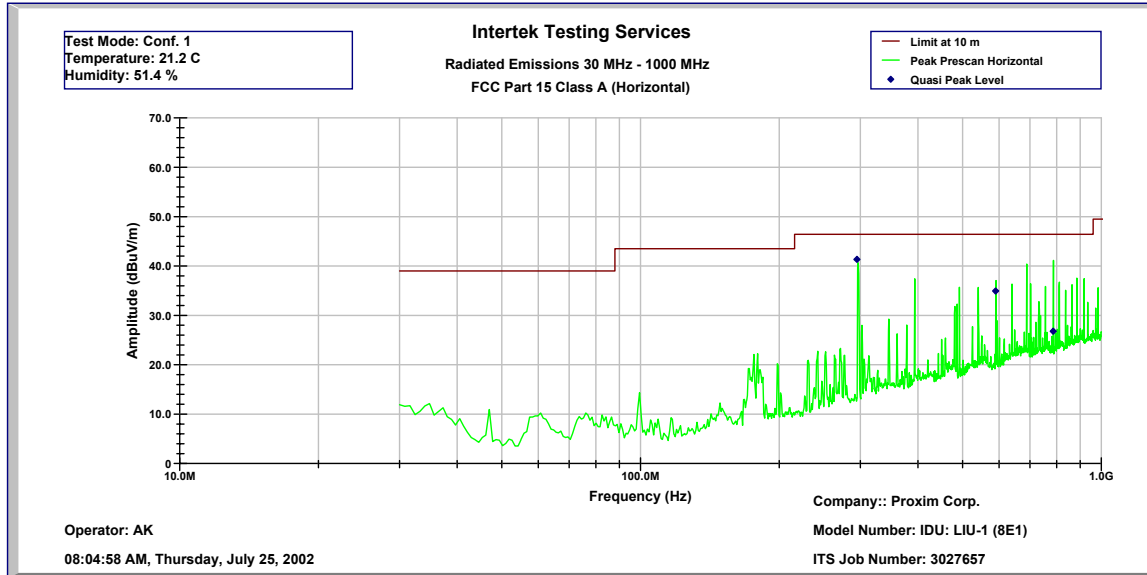
Radiated emission measurements were performed from 30 MHz to 1000 MHz. Spectrum Analyzer Resolution Bandwidth is 100 kHz or greater. See also section 4.5.

Both Line Interface Card (LIU-1 and LIU-2) in worse case configuration, described in sec. 2.1 and 3.2, were tested.

Result

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

The EUT passed Class A Limit by 2.7 dB. According to the applicant, the EUT is not used in residential area.



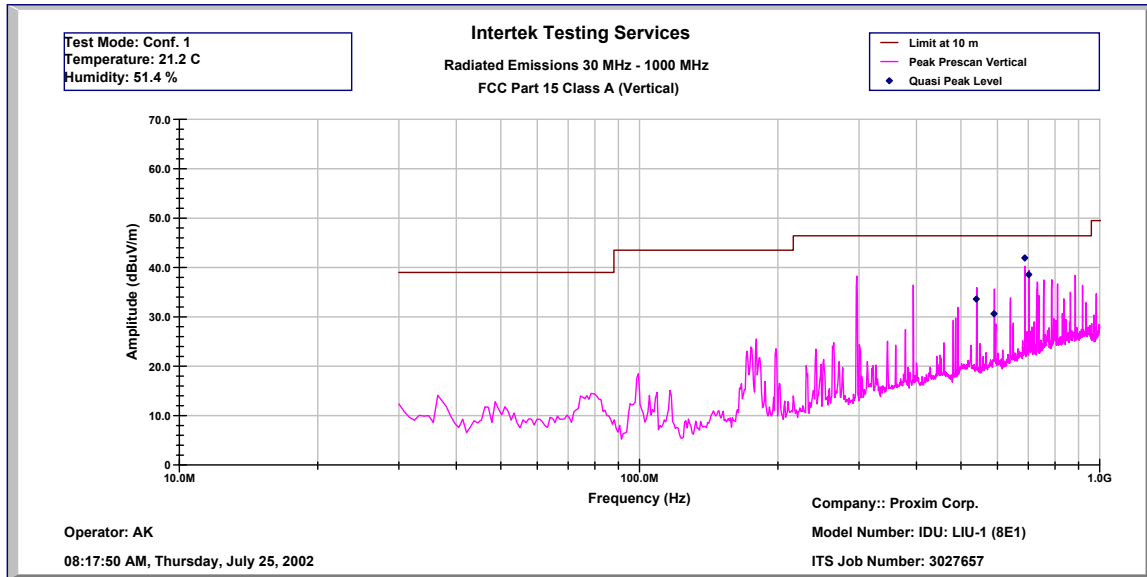
Intertek Testing Services
Radiated Emissions 30 MHz - 1000 MHz
FCC Part 15 Class A (QP-Horizontal)

Operator: AK
ITS Job Number: 3027657
Wed Dec 11 16:49:21 2002

Company: Proxim Corp.

Frequency	QP Level	Limit@10m	QP Margin
MHz	(dBuV/m)	(dBuV/m)	(dB)
294.90	41.3	46.4	-5.1
589.80	34.9	46.4	-11.5
786.40	26.8	46.4	-19.6

Test Mode: Conf. 1 IDU: LIU-1 (8E1)
Temperature: 21.2 C
Humidity: 51.4 %



Intertek Testing Services
Radiated Emissions 30 MHz - 1000 MHz
FCC Part 15 Class A (QP-Vertical)

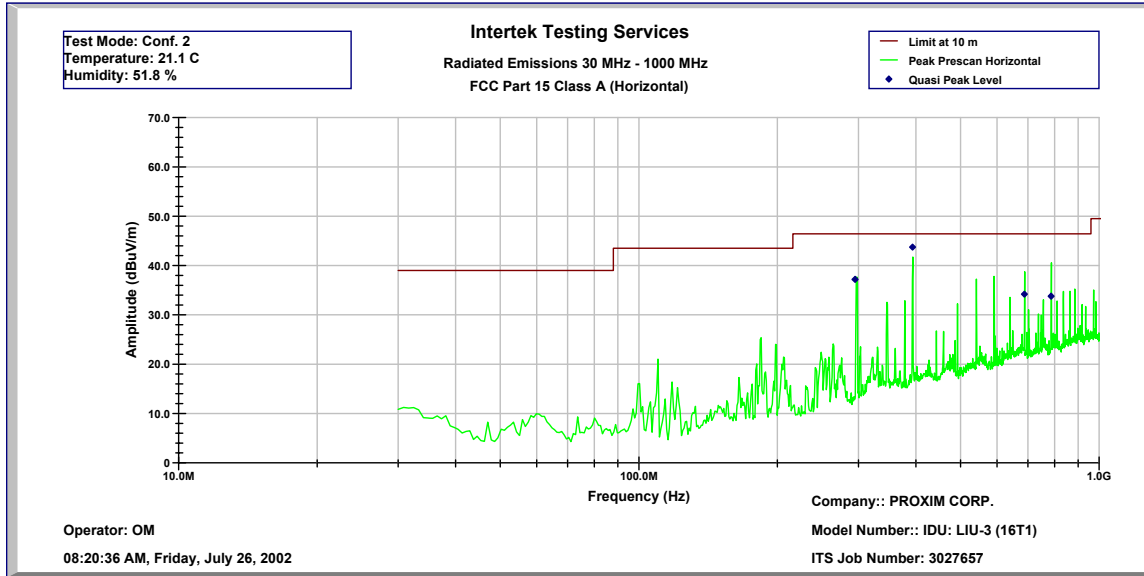
Operator: AK
ITS Job Number: 3027657
Wed Dec 11 16:49:59 2002

Company:: Proxim Corp.

Frequency Quasi Pk FS Limit @ 10m Margin

MHz	(dBUV/m)	(dBUV/m)	(dB)
539.81	33.6	46.4	-12.8
589.80	30.6	46.4	-15.8
688.10	41.9	46.4	-4.5
701.75	38.6	46.4	-7.8

Test Mode: Conf. 1 IDU: LIU-1 (8E1)
Temperature: 21.2 C
Humidity: 51.4 %

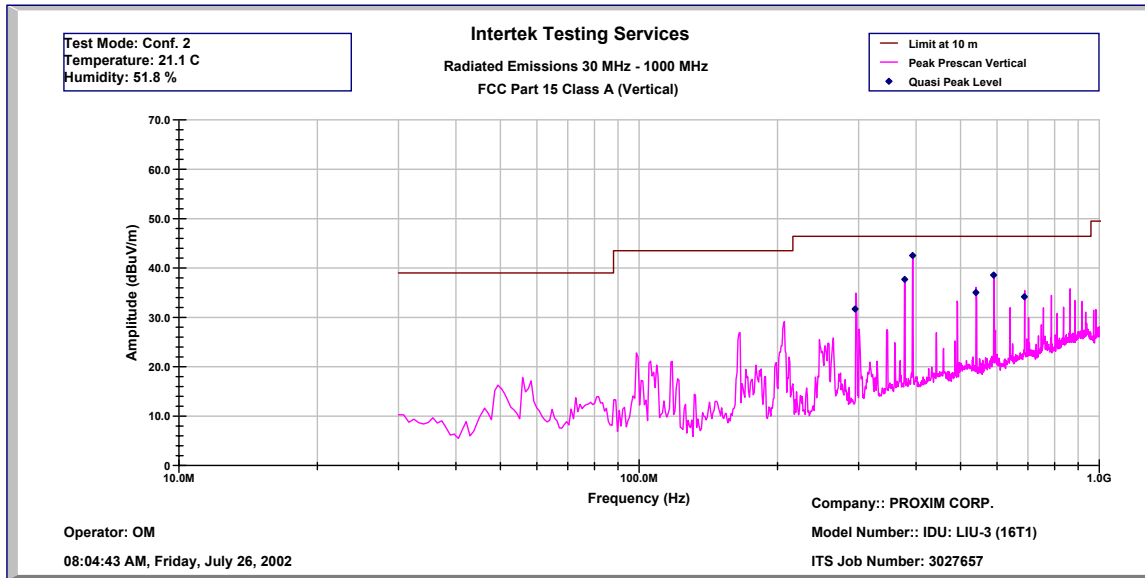


Intertek Testing Services
Radiated Emissions 30 MHz - 1000 MHz
FCC Part 15 Class A (QP-Horizontal)

Operator: OM
ITS Job Number: 3027657
Wed Dec 11 17:12:09 2002

Frequency	Quasi Pk FS	Limit@10m	Margin	RA	CF	AF	AG
MHz	(dBuV/m)	(dBuV/m)	(dB)	(dbuV)	(dB)	(dB)	(dB)
294.90	37.2	46.4	-9.2	44.2	5.1	12.7	24.8
393.20	43.7	46.4	-2.7	46.7	5.6	16.0	24.6
688.10	34.2	46.4	-12.2	31.0	6.4	20.2	24.5
786.41	33.8	46.4	-12.6	30.5	6.9	21.4	24.5

Test Mode: Conf. 2 IDU: LIU-3 (16T1)
Temperature: 21.1 C
Humidity: 51.8 %



Intertek Testing Services
Radiated Emissions 30 MHz - 1000 MHz
FCC Part 15 Class A (QP-Vertical)

Operator: OM
ITS Job Number: 3027657
Wed Dec 11 17:08:25
2002

Company: PROXIM CORP.

Frequency	Quasi Pk FS	Limit@10m	Margin	RA	CF	AF	AG
MHz	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(dB)	(dB)	(dB)
294.90	31.7	46.4	-14.7	38.7	5.1	13.4	24.8
377.86	37.7	46.4	-8.7	41.3	5.6	15.9	24.6
393.20	42.5	46.4	-3.9	45.5	5.6	16.0	24.6
539.81	35.0	46.4	-11.4	35.2	6.2	18.3	24.6
589.80	38.5	46.4	-7.9	36.9	6.4	20.7	24.6
688.11	34.2	46.4	-12.2	31.4	6.4	20.7	24.5

Test Mode: Conf. 2
Temperature: 21.1 C
Humidity: 51.8 %
IDU: LIU-3 (16T1)

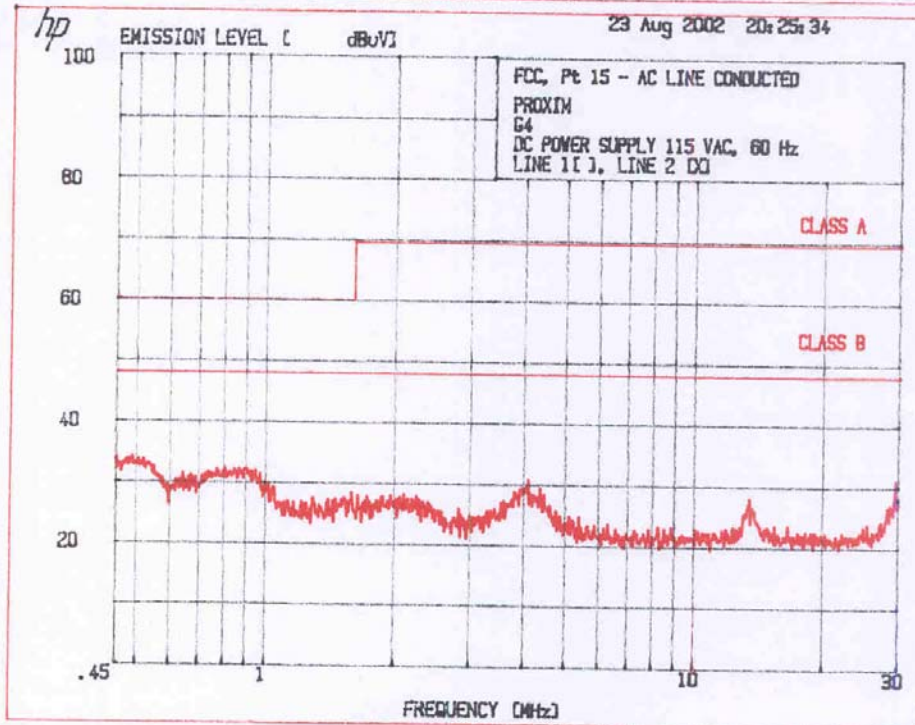
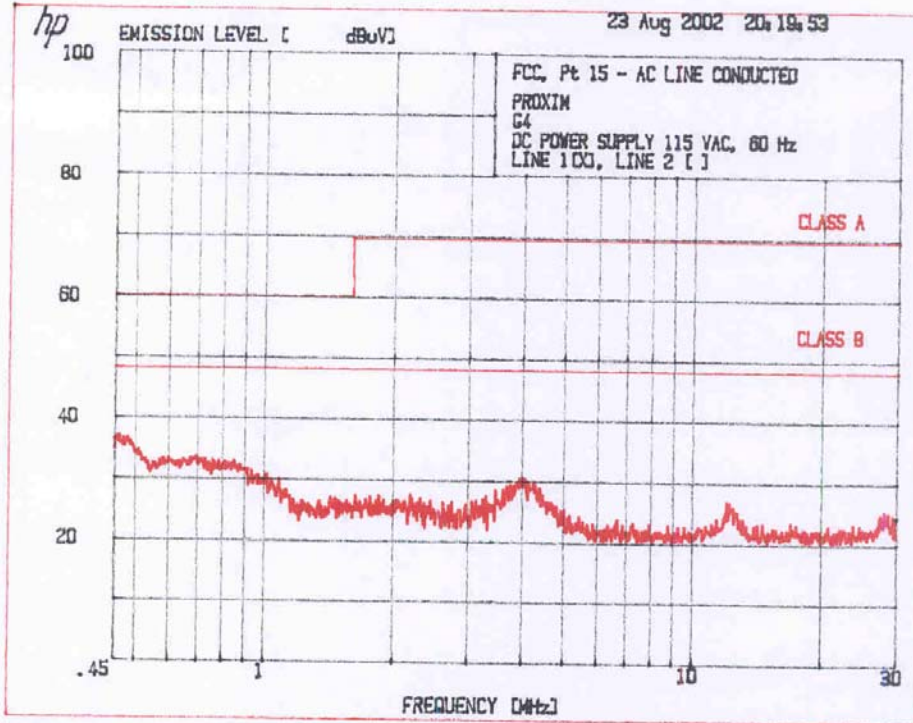
4.7 Radiated Emissions from Receiver Section of Transceiver (L.O. Radiation)
FCC Ref: 15.109, 15.111

Not required - EUT operation above 960 MHz only.

4.8 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 a DC Power Supply which was connected to AC Line through the LISNs.

For the test result, refer to the attached plot.
The EUT passed by 11 dB.



5.0 List of test Equipment

Equipment	Manufacturer	Model/Type	Serial #	Cal Int	Cal Due
BI-Log Antenna	EMCO	3143	9509-1164	12	3/04/03
Pre-Amplifier	Sonoma Inst.	310	185634	12	01/10/03
RF Filter Section	Hewlett Packard	85460A	3448A00267	12	7/16/03
EMI Receiver	Hewlett Packard	8546A	3710A00373	12	7/16/03
Spectrum Analyzer	Tektronix	2784	B3020108	12	8/08/03
Spectrum Analyzer w/8650 QP Adapter	Hewlett Packard	8568B	1912A0053 2521A01021	12	3/15/03
Double-ridged Horn Antenna	EMCO	3115	8812-3049	12	4/03/03
Horn Antenna	EMCO	3160-09	-	#	#
Horn Antenna	EMCO	3160-10	-	#	#
Pre-Amplifier	Miteq	AMF-4D-001180-24-10P	799159	12	04/05/03
Pre-amplifier	CTT	ACO/400	47526	12	10/5/02
Pre-Amplifier	Avantek	AFT-18855	8723H705	12	10/5/02
Power Meter	Hewlett Packard	8900D	3607U00673	12	7/8/03
LISN	FCC	FCC-LISN-50-50-M-H	2011	12	1/02/03

No calibration required

6.0 Document History

Revision/ Job Number	Writer Initials	Date	Change
1.0 / 3027657	SS	August 21, 2002	Original document