TEST REPORT

Report Number: 30451631
Project Number: 3045163

Report Date: August 4, 2003

Testing performed on the

Ethernet to Ethernet Router with 802.11b
Model Number: 3387W
FCC ID: GZ53387W
to

FCC Part 15.247 Direct Sequence

for

Netopia

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

Test Authorized by:
Netopia
46653 Fremont Blvd.
Fremont, CA 94538 USA

Prepared by: David Chernomordik **Date:** 8/4/03
David Chernomordik, EMC Technical Manager

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1.0 Summary of Tests

MODEL: 3387W
FCC ID: GZ53387W

TEST	REFERENCE	RESULTS
RF 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 performed. The EUT passed out-of-band antenna conducted emission
Radiated Emission in Restricted Bands	15.35(b)(c)	Complies
AC Conducted Emission	15.207	Complies
Radiated Emission from Digital Part	15.109	Complies
Radiated Emission from Receiver L.O.	15.109	N/A. The receiver tuned frequency is above 960 MHz
Antenna Requirement	15.203	Complies

2.0 General Description

2.1 Product Description

The 3387W is an IP Router, with four 10/100BASE-T Switched Ethernet LAN ports, a single 10/100BASE-T WAN interface, and an integrated 802.11b LAN interface.

Overview of the model 3387W

Applicant	Netopia
Trade Name & Model No.	Netopia / 3387W
FCC Identifier	GZ53387W
Use of Product	Ethernet to Ethernet Router with an integrated 802.11b wireless LAN interface.
Manufacturer & Model of Spread Spectrum Module	Netopia
Type of Transmission	Direct Sequence Spread Spectrum
Rated RF Output	100 mW
Frequency Range	2412 - 2462
Type of modulation	Differential Binary Phase Shift Keying (DBPSK) at 1Mb/s Differential Quadrature Phase Shift Keying (DQPSK) at 2Mb/s Complementary Code Keying (CCK) at 5.5Mb/s and 11Mb/s Packet Binary Convolution Coding (PBCC) at 5.5Mb/s, 11Mb/s, 22Mb/s
Number of Channel(s)	11
Antenna(s) & Gain,	SkyCross SMT-2TO6-M Tri-Band Omni-directional Antenna mounted directly onto the PCB; gain of 3.75dBi. Nearson S131CL-L-RMM-2450S Half Wave Dipole Omni-directional Antenna, with a right angle male MMCX connector; gain of 2dBi.
Antenna Requirement	Both antennas are connected to the radio inside the device; the device does not have external antenna connector.
Manufacturer Name & Address	Netopia, 46653 Fremont Blvd. Fremont, CA 94538 USA

EUT receive date:	July 10, 2003
EUT receive condition:	The EUT was received in good condition with no apparent damage.
Test start date:	July 11, 2003
Test completion date:	July 12, 2003

The test results in this report pertain only to the item tested.

2.2 Related Submittal(s) Grants

Declaration of Conformity (DoC) for FCC Part 15 Subpart B

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 part 2 of CFR 47.

2.4 Test Facility

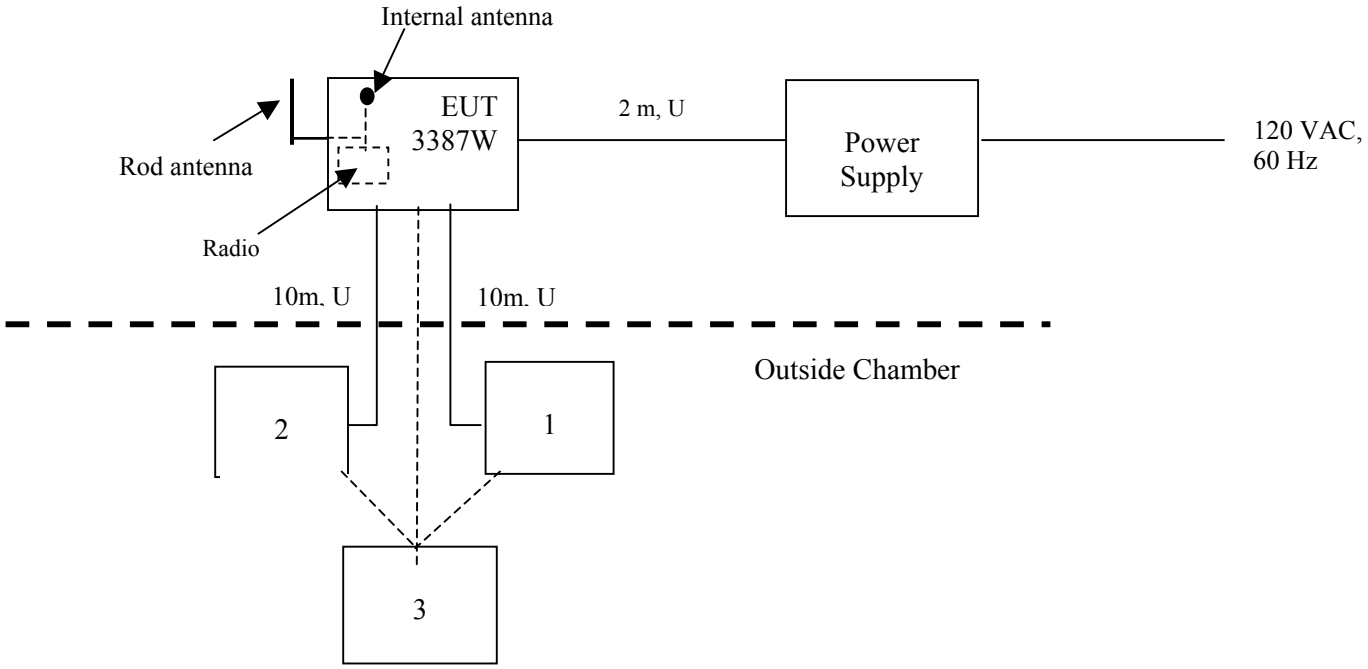
The test site and conducted measurement facility used to collect the radiated data is site 1 (10 m semi-anechoic chamber). This test facility and site measurement data have been fully placed on file with the FCC and A2LA accredited.

3.0 System Test Configuration

3.1 Support Equipment

Item #	Description	Model No.	Serial No.
1	Netopia Ethernet Router	3387W	Not Labeled
2	Netopia Ethernet Router	3387W	Not Labeled
3	Laptop Computer Dell Lattitude	PPS	4I83G

3.2 Block Diagram of Test Setup



Notes: Laptop was used to setup the routers and disconnected
Power Supply: CUI Inc. Model: 48-12-1000D

S = Shielded **U** = Unshielded	**F** = With Ferrite **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). During testing, all cables were manipulated to produce worst case emissions.

For radiated emission measurements, the EUT is attached to a cardboard box (if necessary) and placed on the wooden turntable. If the EUT attaches to peripherals, they are connected and operational (as typical as possible).

The signal is maximized through rotation and placement in the three orthogonal axes. 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.

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.

3.5 Mode of Operation During Test

During testing, the transmitter was setup to transmit continuously at maximum RF power on low, middle and high channels with four type of modulation: DBPSK, DQPSK, CCK, PBCC. The transmitter was controlled by the Laptop, which was disconnected after setup.
The support routers, connected to the EUT via Ethernet cables, were running Hyperterminal/Test and Diagnostics/Ping under MS Windows, through the serial console interface control cable.

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 Netopia prior to compliance testing)

3.7 Additions, deviations and exclusions from standards

No additions, deviations or exclusions from the standard were made.

4.0 Measurement Results

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

Requirements

For antennas with gains of 6 dBi or less, maximum allowed transmitter output is 1 watt (+30 dBm). For antennas with gains greater than 6 dBi, transmitter output level must be decreased by an amount equal to (GAIN - 6) 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 power at the EUT antenna terminals.

Test Result

Frequency (MHz)	Modulation	Output in mWatt
2412 (channel 1)	DBPSK	100.0
	DQPSK	100.0
	CCK	100.0
	PBCC	100.0
2437 (channel 6)	DBPSK	96.2
	DQPSK	98.1
	CCK	98.0
	PBCC	97.3
2462 (channel 11)	DBPSK	94.5
	DQPSK	96.2
	CCK	95.1
	PBCC	95.3

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

Requirements

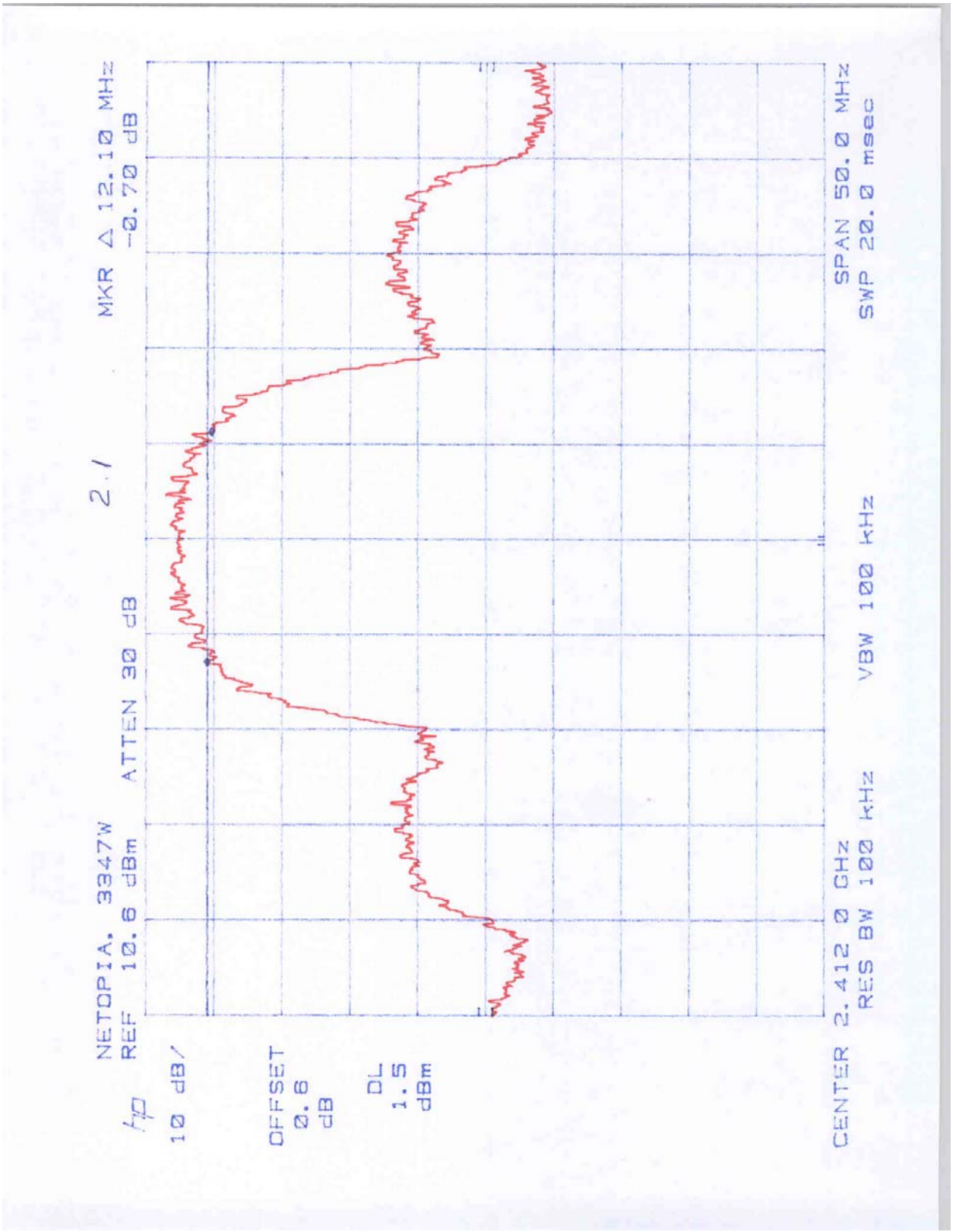
The minimum 6-dB bandwidth shall be at least 500 kHz

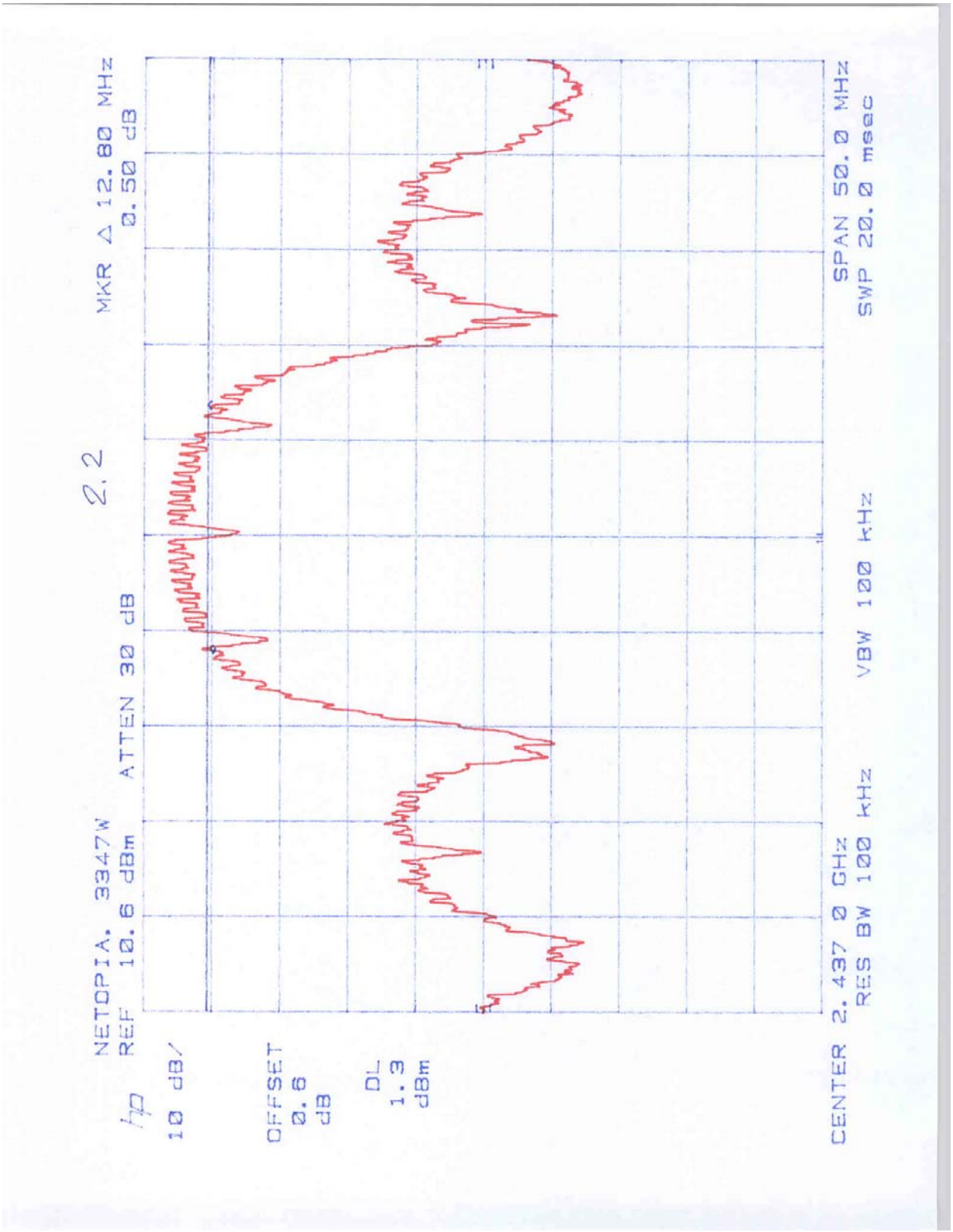
Procedure

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)	Modulation	6 dB Bandwidth (MHz)	Plot
2412	PBCC	12.10	2.1
2437	DBPSK	12.80	2.2
	DQPSK	12.90	2.3
	CCK	12.40	2.4
	PBCC	12.20	2.5
2462	PBCC	12.25	2.6


NETOPIA. 3347W
REF 10.6 dBm
ATTEN 30 dB
10 dB/
OFFSET
0.6
dB
DL
1.5
dBm
MKR Δ 12.10 MHz
-0.70 dB
CENTER 2.412 0 GHz
RES BW 100 kHz
VBW 100 kHz
SPAN 50.0 MHz
SWP 20.0 msec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ATTEN 30 dB
10 dB/
OFFSET
0.6
dB
DL
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dBm
MKR Δ 12.80 MHz
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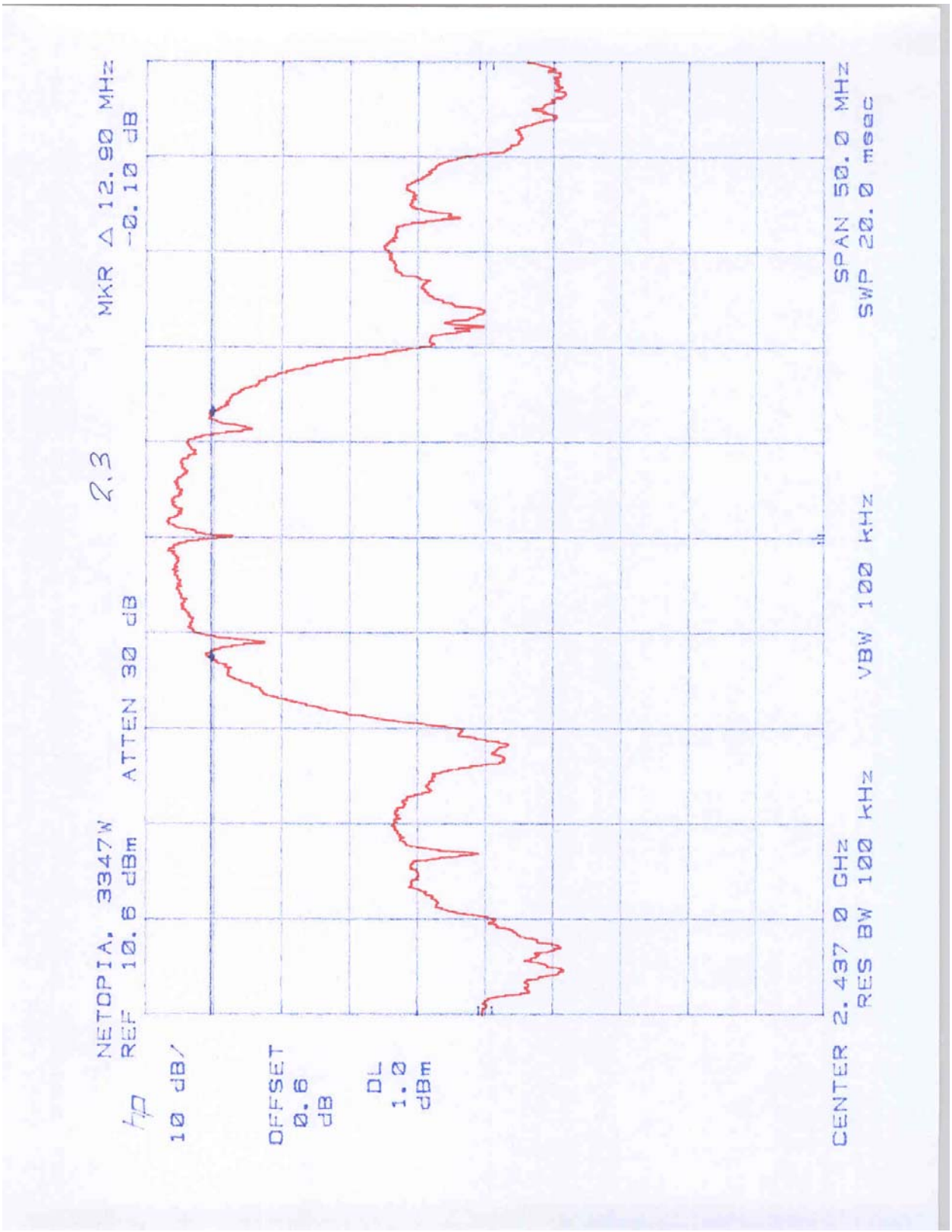
CENTER 2.437 0 GHz
RES BW 100 kHz
VBW 100 kHz
SPAN 50.0 MHz
SWP 20.0 msec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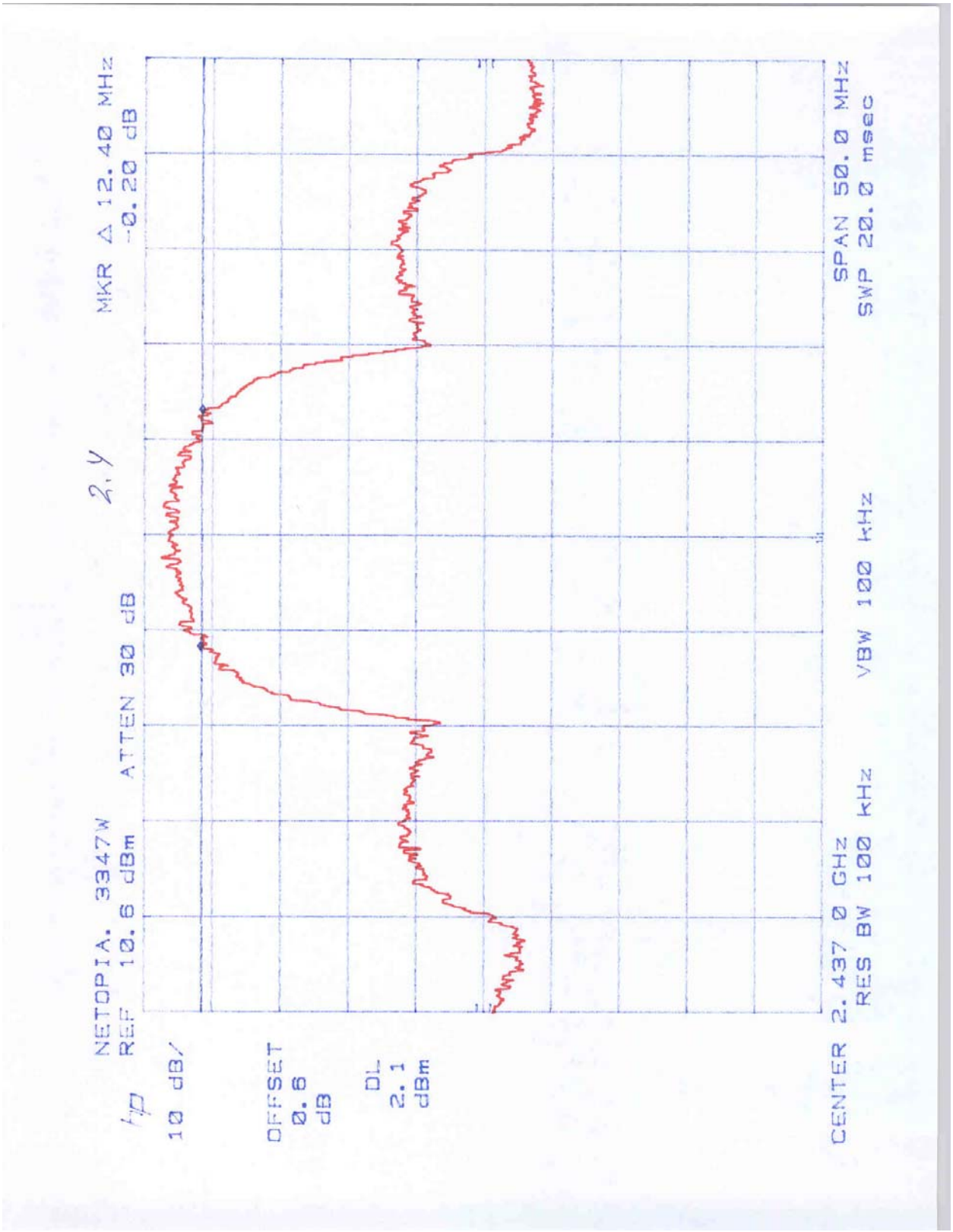
NETOPIA, 3347W
REF 10.6 dBm
ATTEN 30 dB
MKR Δ 12.90 MHz
-0.10 dB
10 dB/
OFFSET
0.6
dB
DL
1.0
dBm
CENTER 2.437 0 GHz
RES BW 100 kHz
VBW 100 kHz
SPAN 50.0 MHz
SWP 20.0 msec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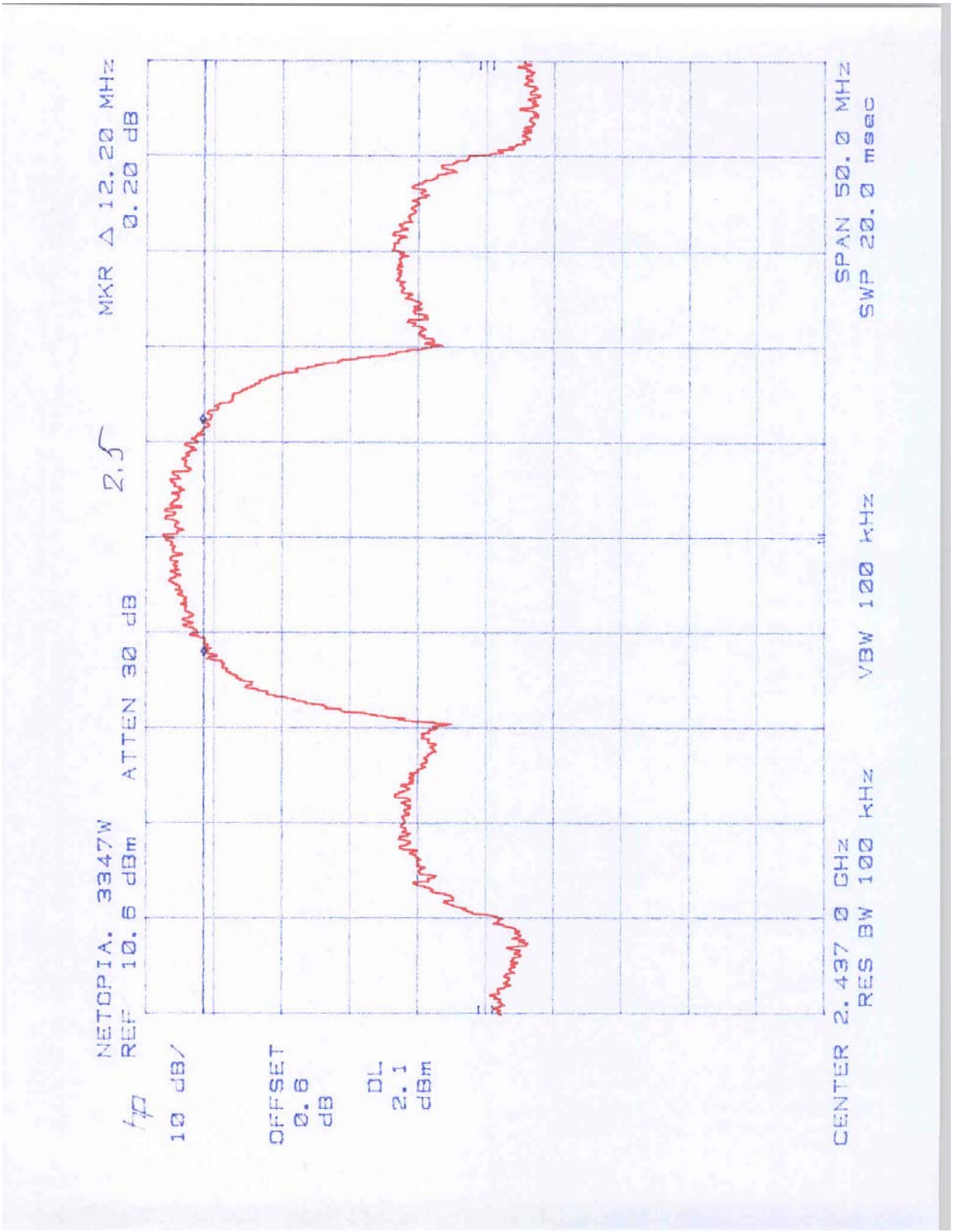
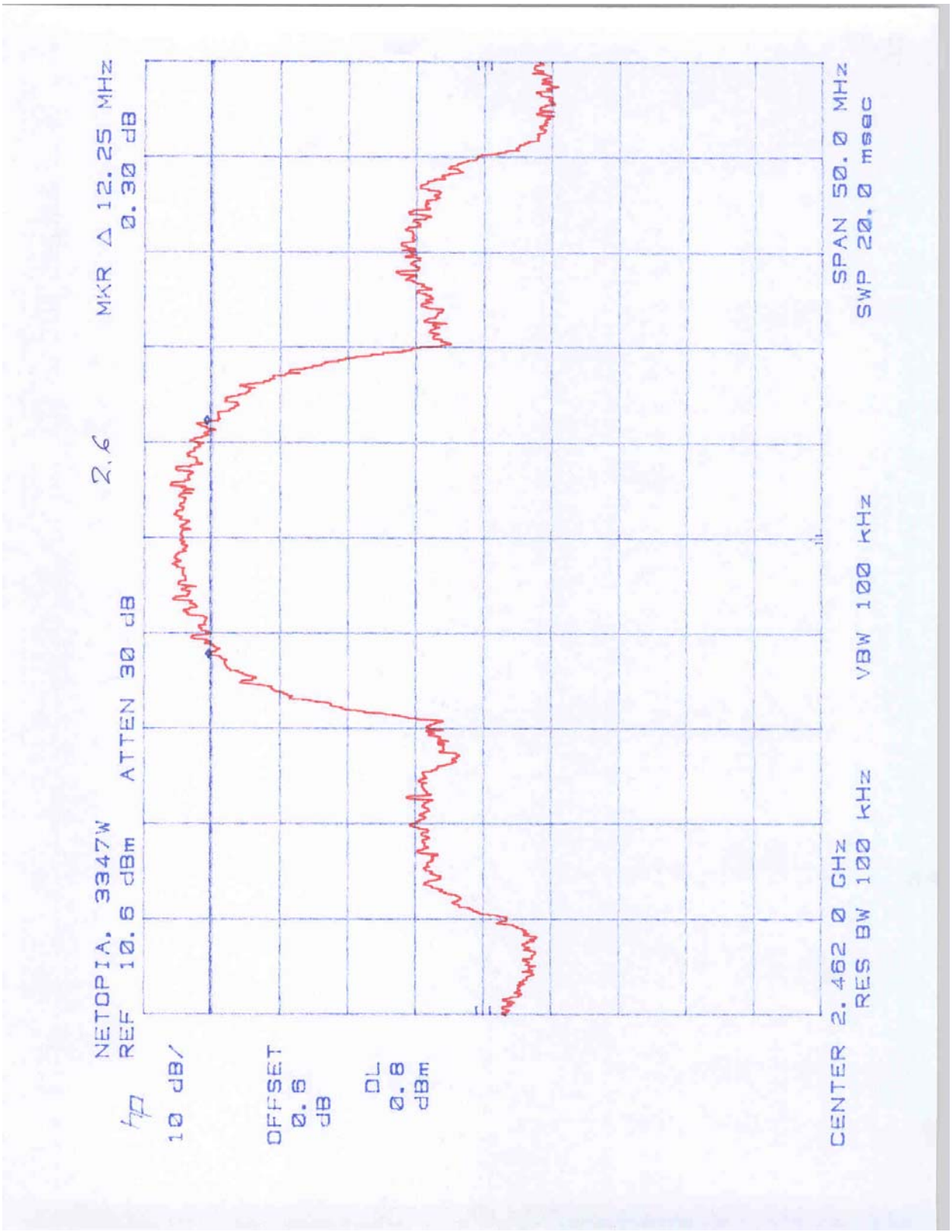
REF 10.6 dBm
ATTEN 30 dB
MKR Δ 12.40 MHz
-0.20 dB
2.4
10 dB/
OFFSET
0.6
dB
DL
2.1
dBm
CENTER 2.437 0 GHz
RES BW 100 kHz
VBW 100 kHz
SPAN 50.0 MHz
SWP 20.0 msec


NETOPIA, 3347W
REF 10.6 dBm
ATTEN 30 dB
MKR Δ 12.20 MHz
0.20 dB
2.5
10 dB/
OFFSET
0.6
dB
DL
2.1
dBm
CENTER 2.437 0 GHz
RES BW 100 kHz
VBW 100 kHz
SPAN 50.0 MHz
SWP 20.0 msec


NETOPIA, 3347W
REF 10.6 dBm
ATTEN 30 dB
10 dB/
OFFSET
0.6
dB
DL
0.8
dBm
2.6
MKR Δ 12.25 MHz
0.30 dB
CENTER 2.462 0 GHz
RES BW 100 kHz
VBW 100 kHz
SPAN 50.0 MHz
SWP 20.0 msec

4.3 Power Density Reading,
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:

SWEEP TIME (SEC) = (Fstop, kHz - Fstart, kHz)/3 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.

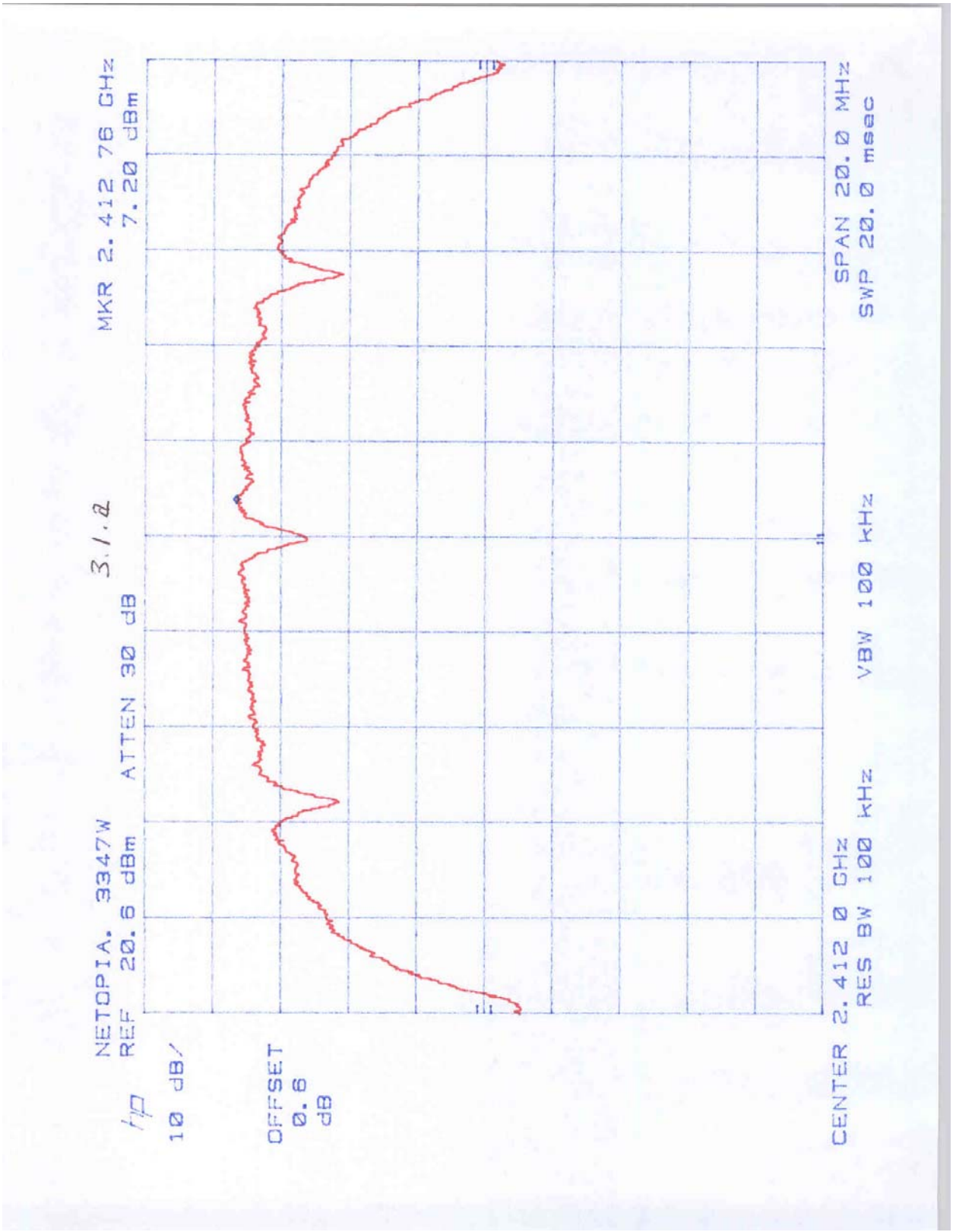
Test Result

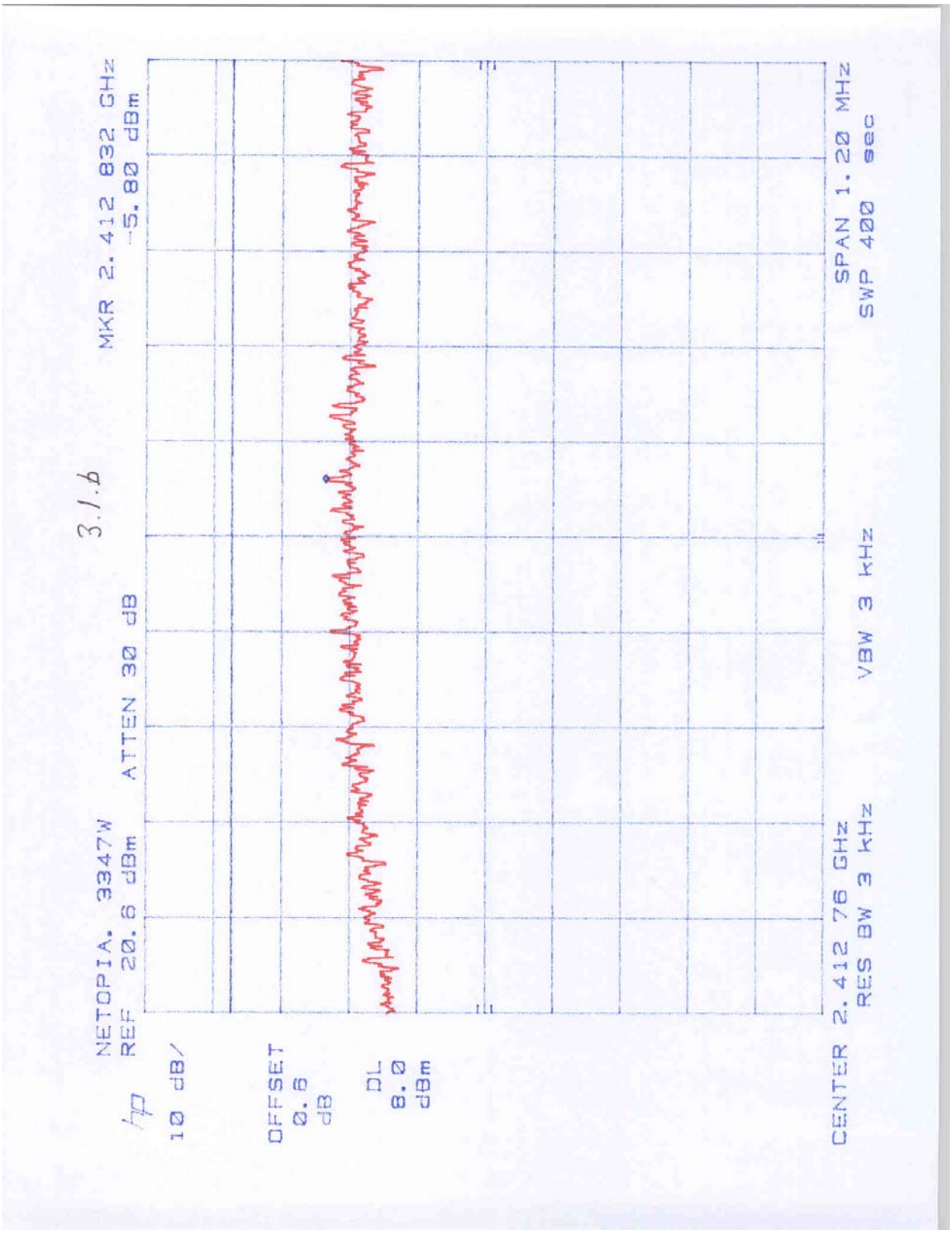
Frequency Span= 1200 kHz

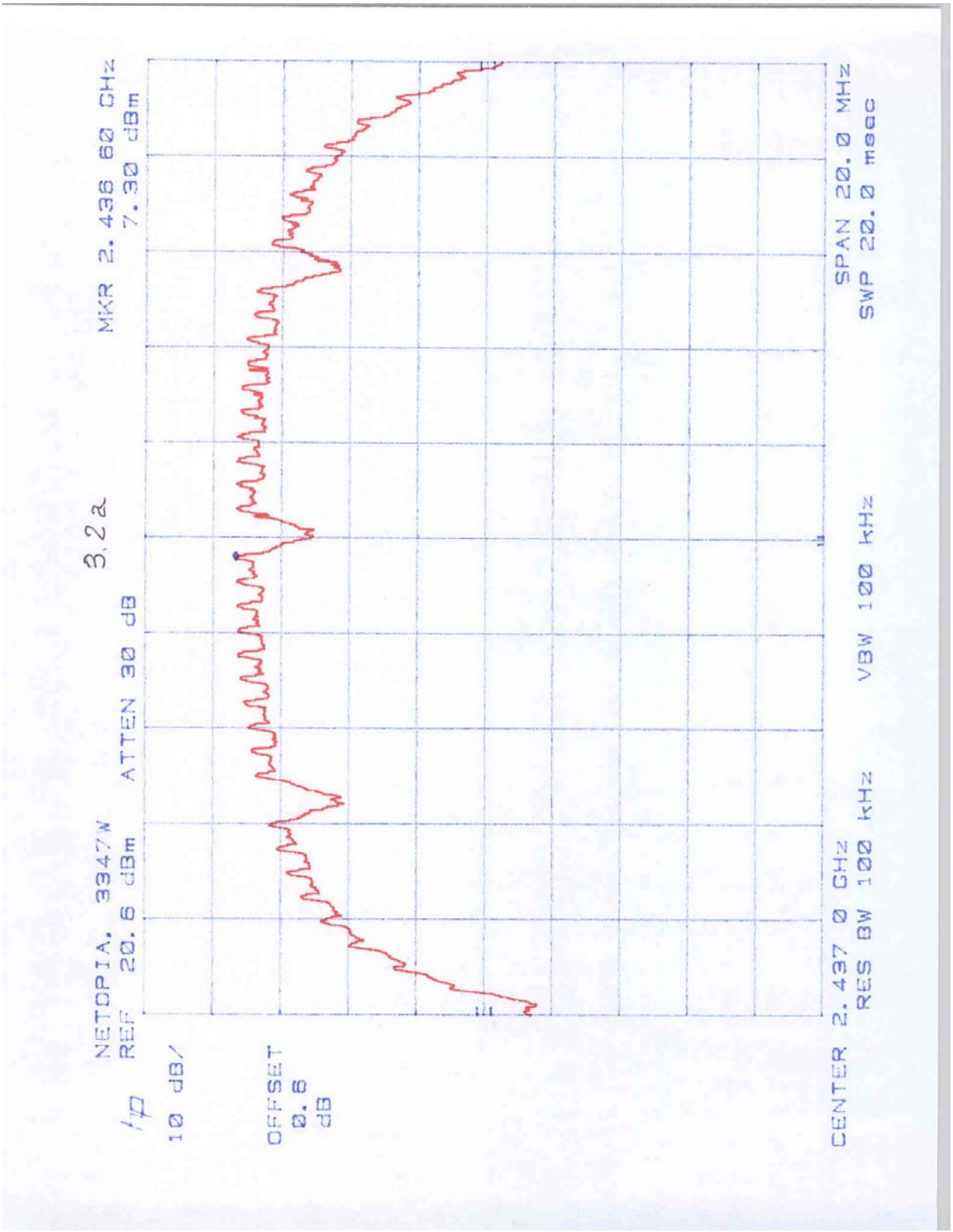
Sweep Time = Frequency Span/3 kHz
= 400 Seconds

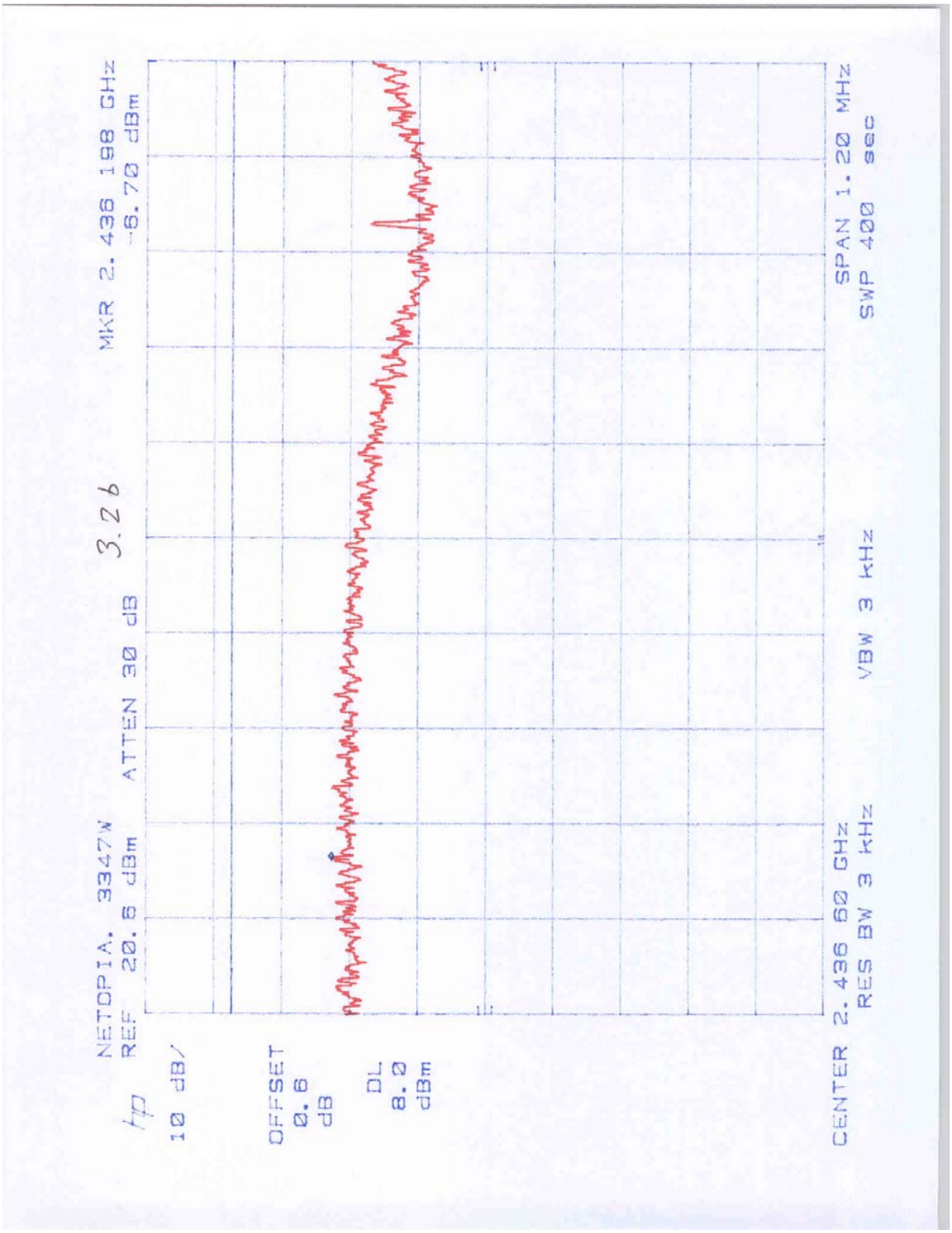
Frequency (MHz)	Modulation	Power Density (dBm)	Plot
2412	DQPSK	-5.8	3.1a, 3.1b
2437	DBPSK	-6.7	3.2a, 3.2b
	DQPSK	-6.7	3.3a, 3.3b
	CCK	-7.7	3.4a, 3.4b
	PBCC	-9.1	3.5a, 3.5b
2462	DQPSK	-7.1	3.6a, 3.6b

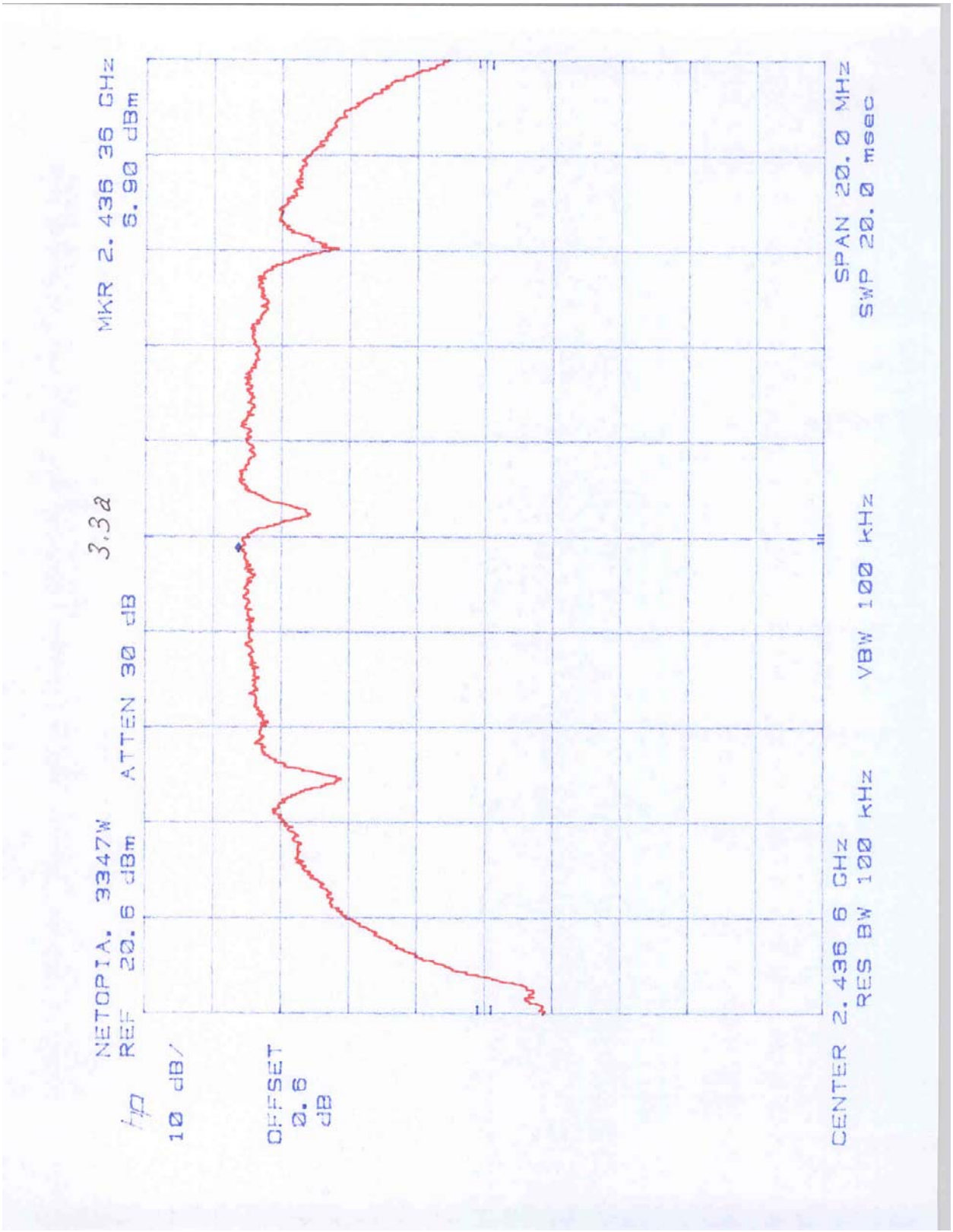
The EUT passed by 13.8 dB

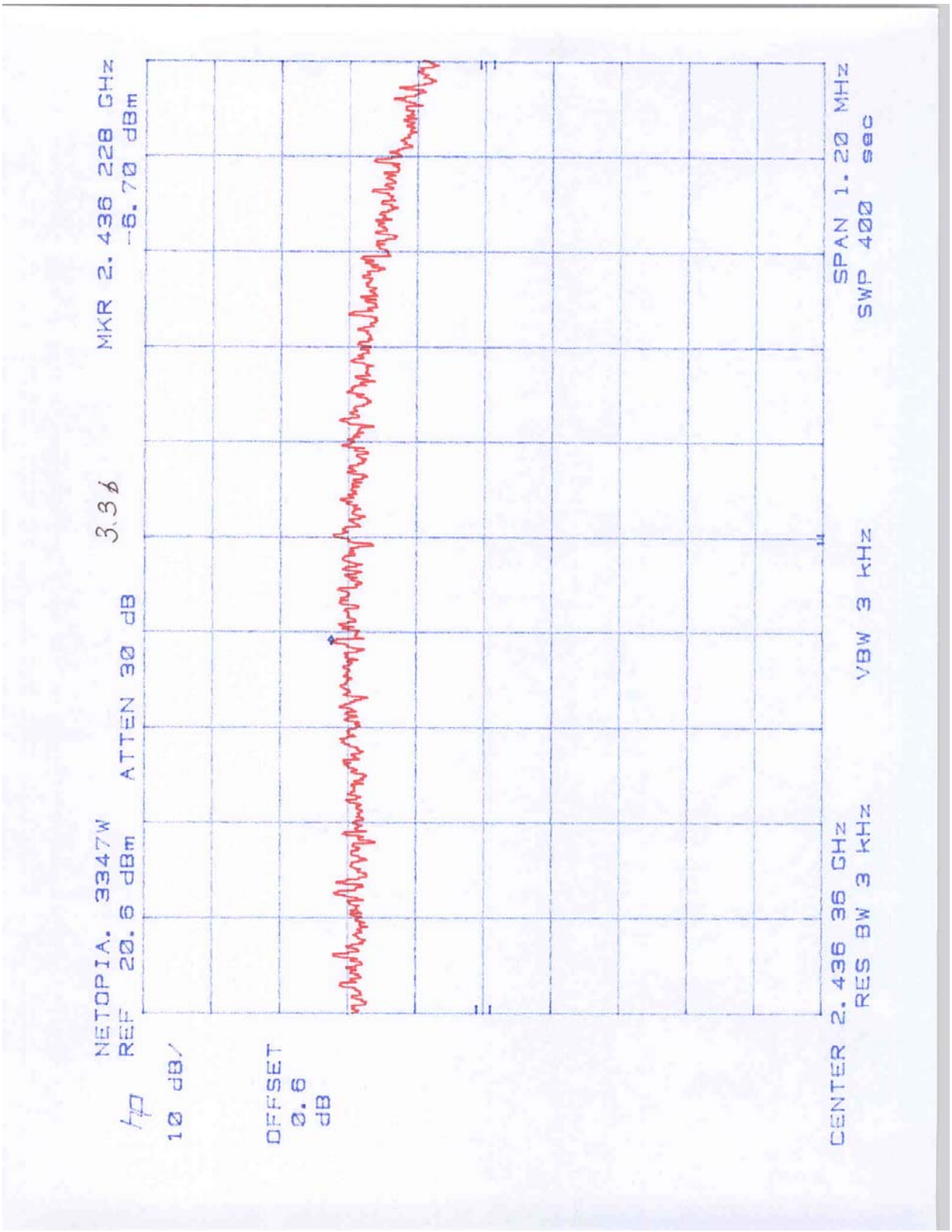

NETOPIA, 3347W
REF 20.6 dBm
ATTEN 30 dB
10 dB/
OFFSET
0.6
dB
MKR 2.412 76 GHz
7.20 dBm
3.1.2
CENTER 2.412 0 GHz
RES BW 100 kHz
VBW 100 kHz
SPAN 20.0 MHz
SWP 20.0 msec

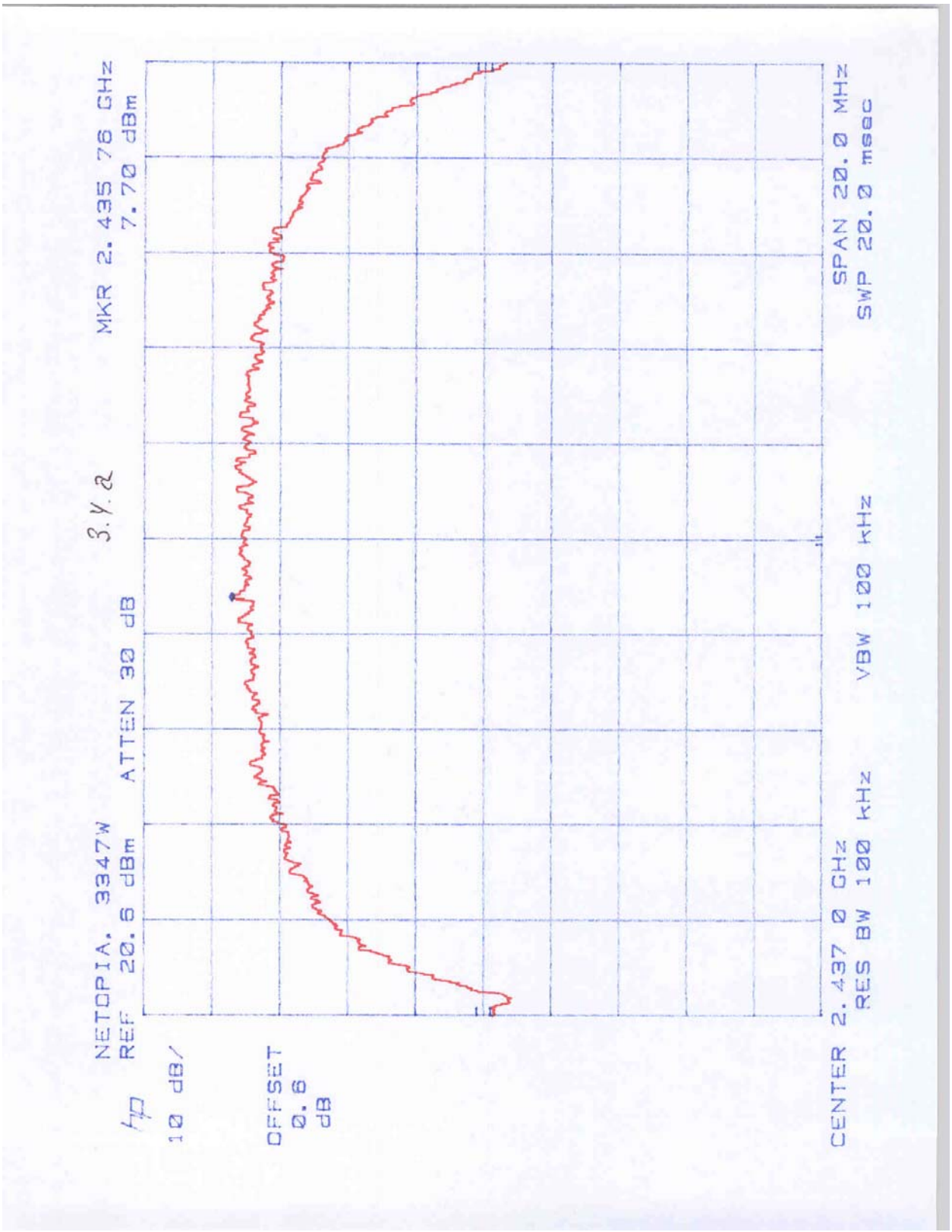

NETOPIA, 3347W
REF 20.6 dBm
ATTEN 30 dB
10 dB/
OFFSET
0.6
dB
DL
8.0
dBm
MKR 2.412 832 GHz
-5.80 dBm
CENTER 2.412 76 GHz
RES BW 3 kHz
VBW 3 kHz
SPAN 1.20 MHz
SWP 400 sec
3.1.b

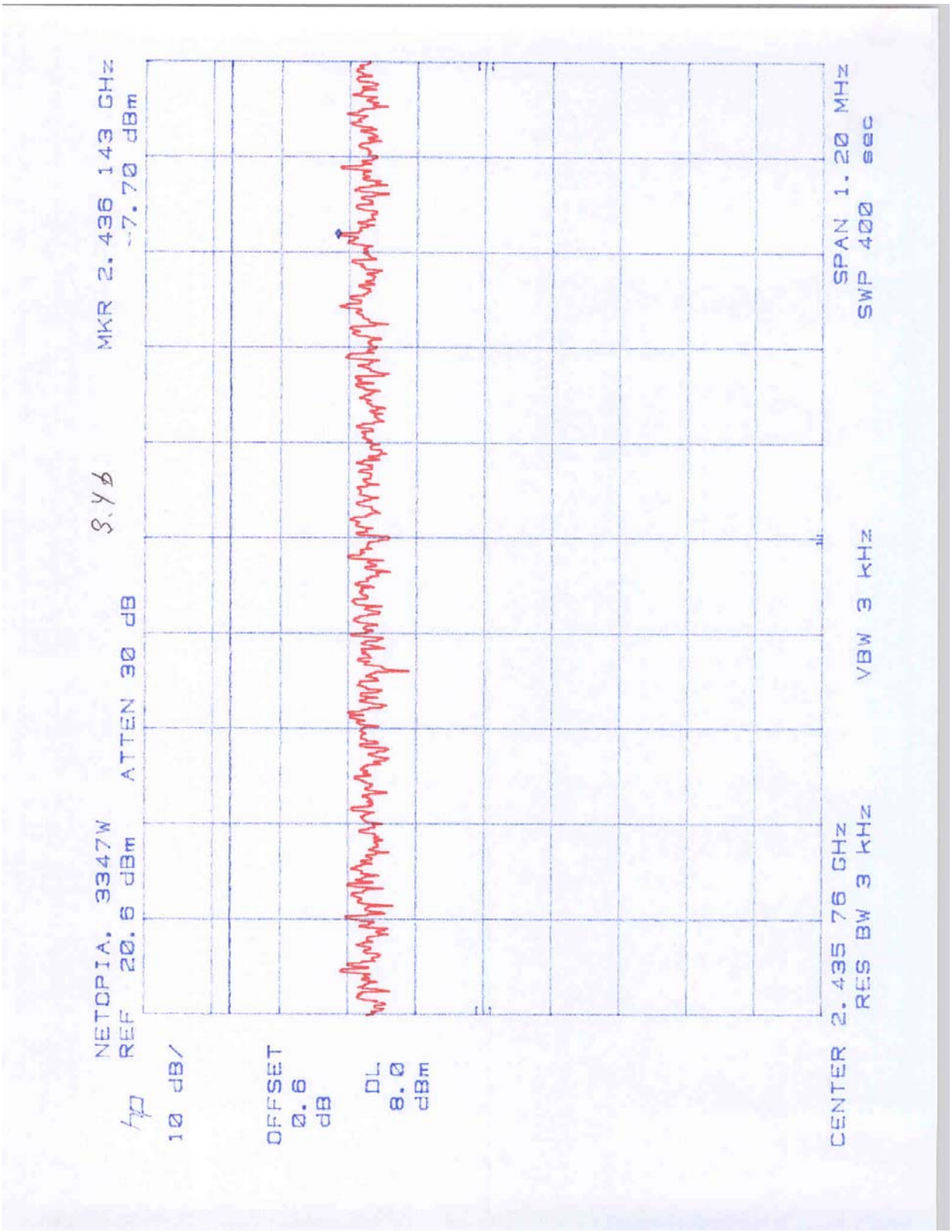

NETOPIA, 3347W
REF 20.6 dBm
ATTEN 30 dB
10 dB/
OFFSET
0.6
dB
MKR 2.436 60 GHz
7.30 dBm
3.2a
CENTER 2.437 0 GHz
RES BW 100 kHz
VBW 100 kHz
SPAN 20.0 MHz
SWP 20.0 msec

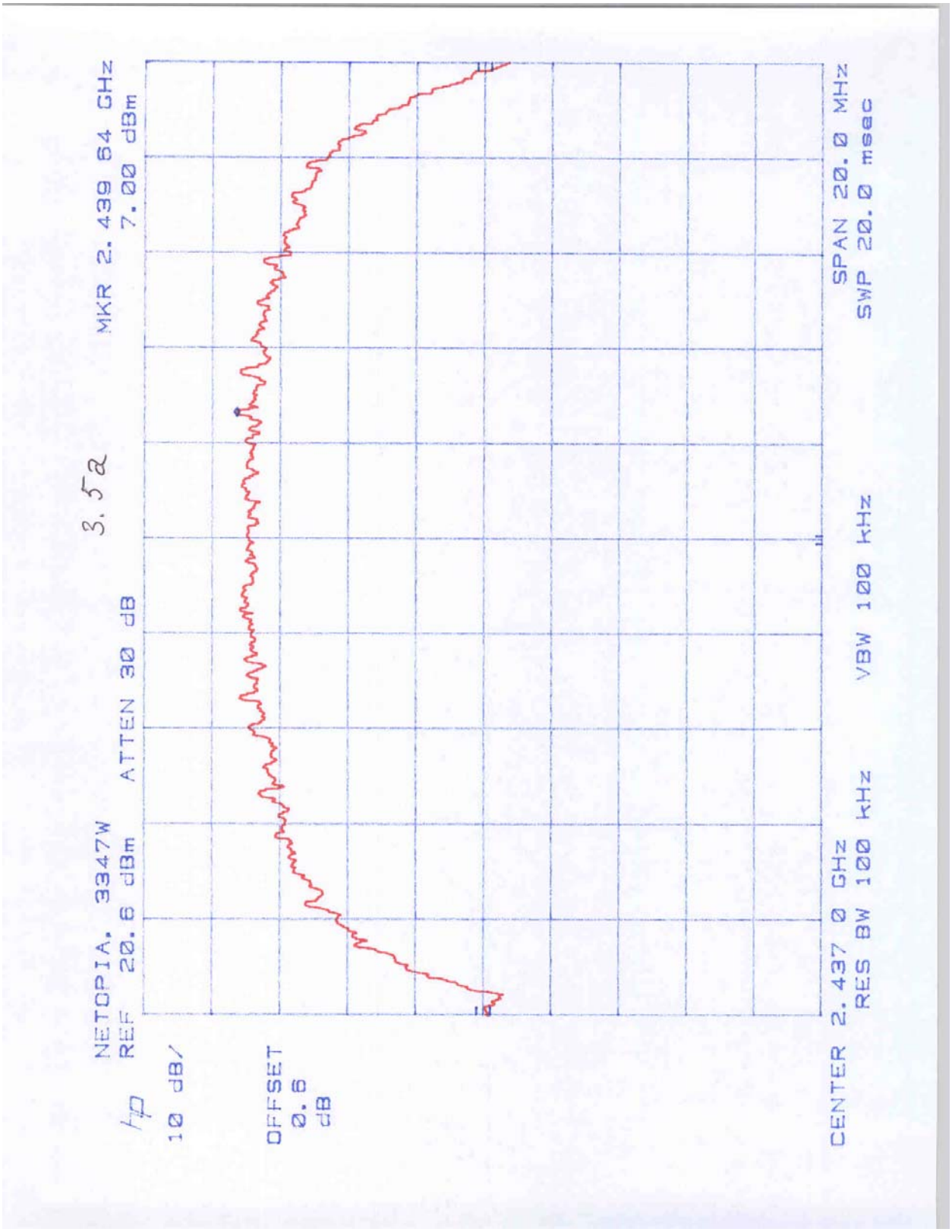

NETOPIA, 3347W
REF 20.6 dBm
ATTEN 30 dB
3.26
MKR 2.436 198 GHz
-6.70 dBm
hp
10 dB/
OFFSET
0.6
dB
DL
8.0
dBm
CENTER 2.436 60 GHz
RES BW 3 kHz
VBW 3 kHz
SPAN 1.20 MHz
SWP 400 sec

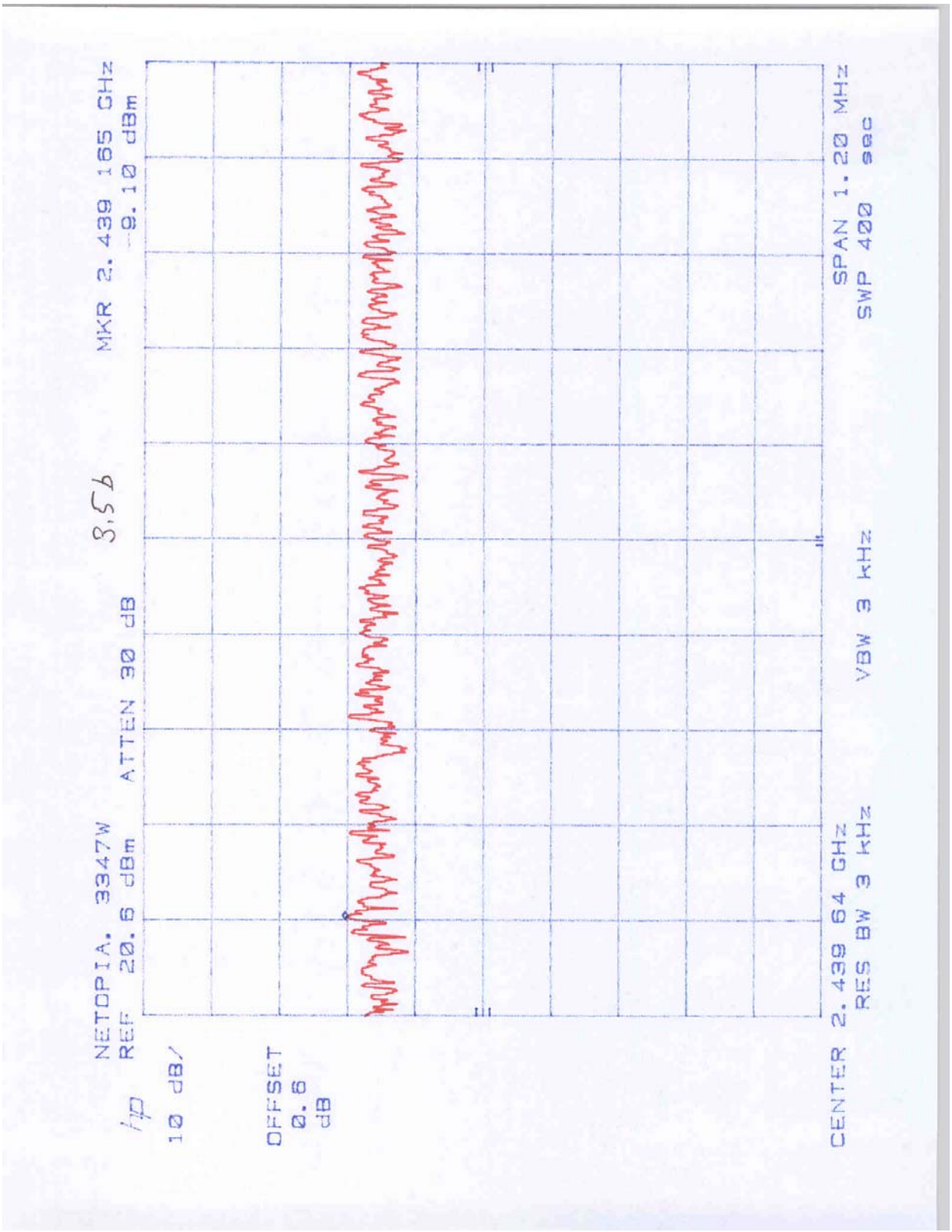

NETOPIA, 3347W
REF 20.6 dBm
ATTEN 30 dB
3.3a
10 dB/
OFFSET
2.6
dB
MKR 2.436 36 GHz
6.90 dBm
CENTER 2.436 9 GHz
RES BW 100 kHz
VBW 100 kHz
SPAN 20.0 MHz
SWP 20.0 msec


NETOPIA. 3347W
REF 20.6 dBm
ATTEN 30 dB
3.3ϕ
MKR 2.436 228 GHz
-6.70 dBm
SPAN 1.20 MHz
SWP 400 sec
VBW 3 kHz
RES BW 3 kHz
CENTER 2.436 36 GHz
10 dB/
OFFSET
2.6
dB


NETOPIA, 3347W
REF 20.6 dBm
ATTEN 30 dB
MKR 2.435 76 GHz
7.70 dBm
3.Y.2
10 dB/
OFFSET
0.6
dB
CENTER 2.437 0 GHz
RES BW 100 kHz
VBW 100 kHz
SPAN 20.0 MHz
SWP 20.0 msec


NETOPIA, 3347W
REF 20.6 dBm
ATTEN 30 dB
S.Y.S
MKR 2.436 143 GHz
-7.70 dBm
SPAN 1.20 MHz
SWP 400 sec
VBW 3 kHz
CENTER 2.435 76 GHz
RES BW 3 kHz
10 dB/
OFFSET
0.6
dB
DL
8.0
dBm


NETOPIA, 3347W
REF 20.6 dBm
ATTEN 30 dB
10 dB/
OFFSET
0.6
dB
MKR 2.439 64 GHz
7.00 dBm
3.52
CENTER 2.437 0 GHz
RES BW 100 kHz
VBW 100 kHz
SPAN 20.0 MHz
SWP 20.0 msec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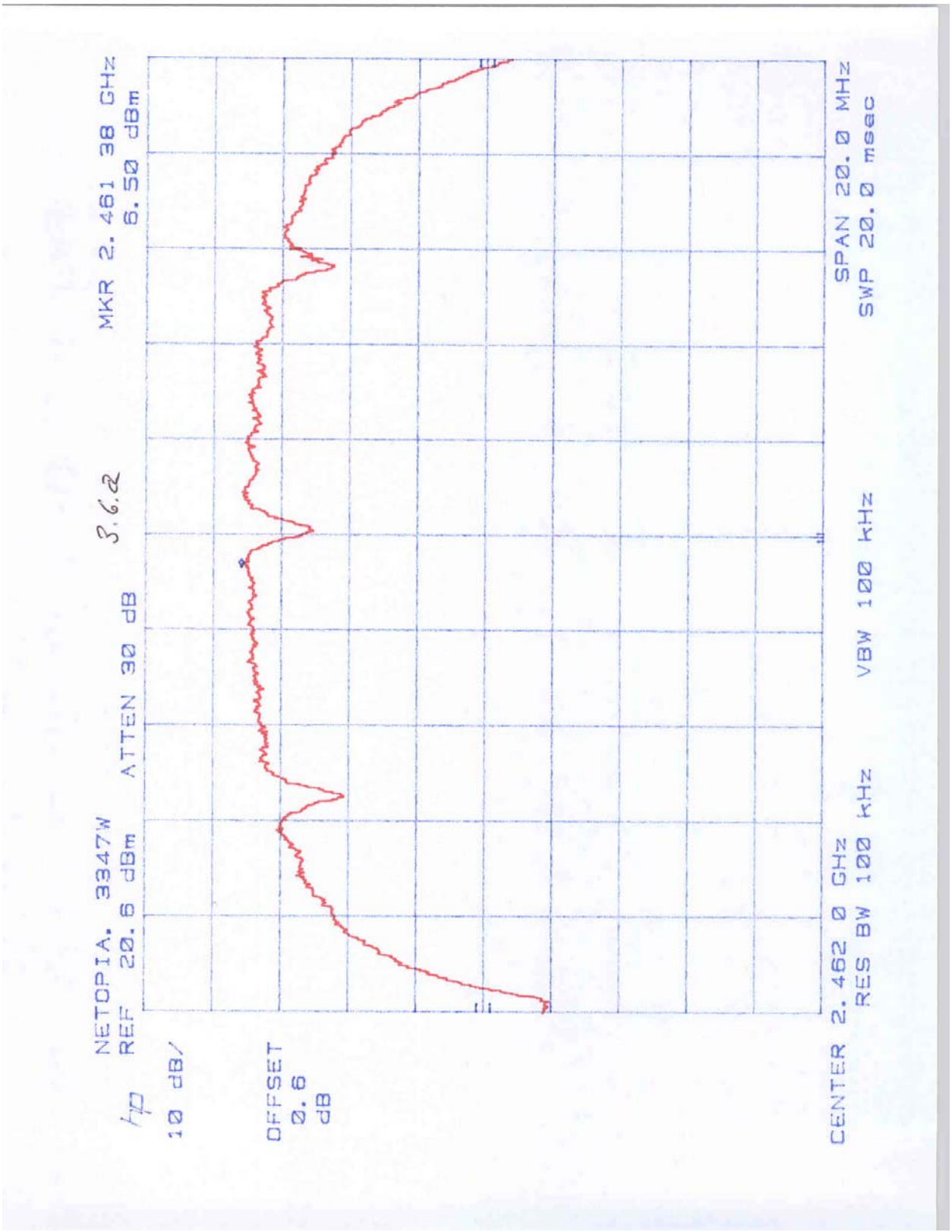
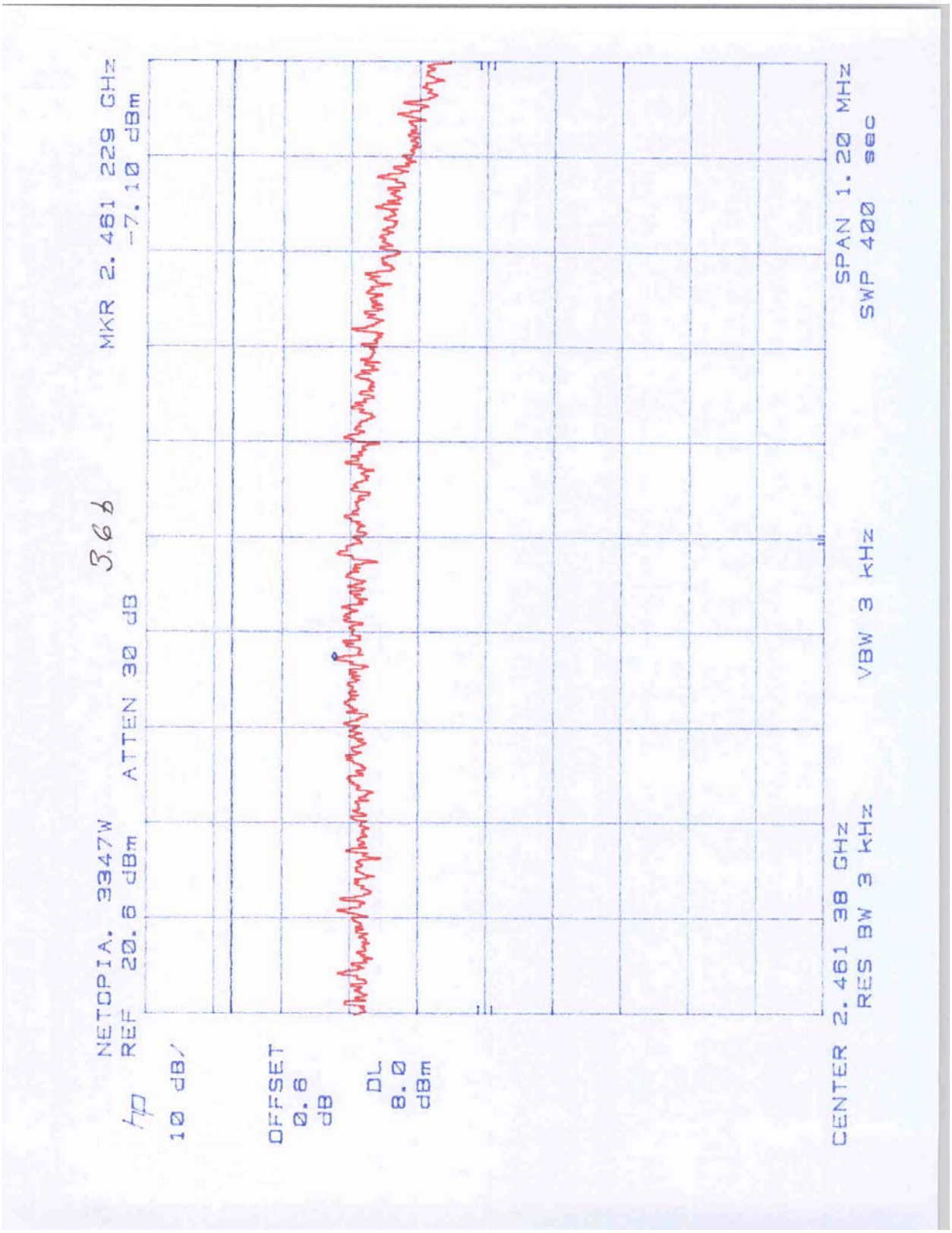
REF 20.6 dBm
ATTEN 30 dB
10 dB/
OFFSET
0.6
dB
MKR 2.439 165 GHz
-9.10 dBm
3.56
CENTER 2.439 64 GHz
RES BW 3 kHz
VBW 3 kHz
SPAN 1.20 MHz
SWP 400 sec


NETOPIA, 3347W
REF 20.6 dBm
ATTEN 30 dB
3.6.2
MKR 2.461 38 GHz
6.50 dBm
SPAN 20.0 MHz
SWP 20.0 msec
VBW 100 kHz
10 dB/
OFFSET
0.6
dB
CENTER 2.462 0 GHz
RES BW 100 kHz


NETOPIA. 3347W
REF 20.6 dBm
ATTEN 30 dB
10 dB/
OFFSET
0.6
dB
DL
8.0
dBm
MKR 2.461 229 GHz
-7.10 dBm
3.6 b
CENTER 2.461 38 GHz
RES BW 3 kHz
VBW 3 kHz
SPAN 1.20 MHz
SWP 400 sec

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

Requirements

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

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 25 GHz.

Test Result

Refer to the plots in Appendix A for the test result:

Out-of-Band conducted emissions	
Plots 4a.1 - 4a.5	Out-of-band low Channel Emissions
Plots 4b.1 - 4b.5	Out-of-band middle Channel Emissions
Plots 4c.1 - 4c.5	Out-of-band high Channel Emissions

4.5 Out of Band Radiated Emissions (except emissions in restricted bands)
FCC Rule 15.247(c)

For out of band radiated emissions (except for frequencies in restricted bands) that are close to or that exceed the 20 dB attenuation requirement described in the specification, radiated measurements were performed at a 3 m separation distance to determine whether these emissions complied with the general radiated emission requirement.

Not performed, the EUT passed out-of-band antenna conducted emission test.

4.6 Transmitter Radiated Emissions in Restricted Bands, FCC Rule 15.35(b), (c):

Procedure

Radiated emission measurements were performed from 30 MHz to 25,000 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 a plastic 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.

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(μV/m)
RA = Receiver Amplitude (including preamplifier) in dB(μV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

Assume a receiver reading of 52.0 dB(μV) 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 dB is subtracted, giving field strength of 32 dB(μV/m). This value in dB(μV/m) was converted to its corresponding level in μV/m.
RA = 52.0 dB(μV)
AF = 7.4 dB(1/m)
CF = 1.6 dB
AG = 29.0 dB
FS = 52.0+7.4+1.6-29.0 = 32 dB(μV/m)
Level in μV/m = Common Antilogarithm [(32 dBμV/m)/20] = 39.8 μV/m

Result

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

The field strength at the Band-edge frequencies was calculated as $E_F = E_o - \Delta$.

Where:

E_F = Field Strength of Band-edge Frequency
E_O = Field Strength of Fundamental Frequency
Δ = Delta between the levels of emissions at Fundamental Frequency and at Band-edge Frequency

The EUT passed the test by 0.7 dB.

Internal antenna

Temperature: 21.0 C							Netopia			
Humidity: 39.8 %							Model: 3387W			
Test date: July 12, 2003										
Frequency MHz	Polarity	Detector	SA reading dB(uV)	Cable loss dB	Pre- amp gain dB	Ant. factor dB(1/m)	D.C.F dB	Field Strength dB(uV/m)	Limit dB(uV/m)	Margin dB
Tx, @ 2412 MHz										
4824	V	Peak	40.2	8.5	35.8	34.9	0	48.0	74.0	-26.0
4824	V	Aver	29.1	8.5	35.8	34.9	0	36.9	54.0	-17.1
7236	H	Peak	45.8	9.2	35.4	37.7	0	57.3	74.0	-16.7
7236	H	Aver	36.6	9.2	35.4	37.7	0	48.1	54.0	-5.9
12060	V/H	Peak	39.2*	6.5	37.1	41.2	-9.5	40.3	74.0	-33.7
12060	V/H	Aver	28.7*	6.5	37.1	41.2	-9.5	29.8	54.0	-14.2
14472	V/H	Peak	40.2*	7.3	37.1	41.2	-9.5	42.1	74.0	-31.9
14472	V/H	Aver	29.7*	7.3	37.1	41.2	-9.5	31.6	54.0	-22.4
19296	V/H	Peak	40.7*	9.7	24.0	40.2	-9.5	57.1	74.0	-16.9
19296	V/H	Aver	30.5*	9.7	24.0	40.2	-9.5	46.9	54.0	-7.1
Tx, @ 2437 MHz										
4874	V	Peak	39.2	8.5	35.8	34.9	0	47.0	74.0	-27.0
4874	V	Aver.	28.3	8.5	35.8	34.9	0	36.1	54.0	-17.9
7311	H	Peak	46.7	9.2	35.4	37.7	0	58.2	74.0	-15.8
7311	H	Aver	38.2	9.2	35.4	37.7	0	49.7	54.0	-4.3
12185	V/H	Peak	39.2*	6.5	37.1	41.2	-9.5	40.3	74.0	-33.7
12185	V/H	Aver	28.7*	6.5	37.1	41.2	-9.5	29.8	54.0	-14.2
19496	V/H	Peak	40.7*	9.7	24.0	40.2	-9.5	57.1	74.0	-16.9
19496	V/H	Aver	30.5*	9.7	24.0	40.2	-9.5	46.9	54.0	-7.1
Tx, @ 2462 MHz										
4924	H	Peak	42.2	8.5	35.8	34.9	0	50.0	74.0	-24.0
4924	H	Aver	32.7	8.5	35.8	34.9	0	40.5	54.0	-13.5
7386	V	Peak	44.5	9.2	35.4	37.7	0	56.0	74.0	-18.0
7386	V	Aver	34.0	9.2	35.4	37.7	0	45.5	54.0	-8.5
12310	V/H	Peak	39.2*	6.5	37.1	41.2	-9.5	40.3	74.0	-33.7
12310	V/H	Aver	28.7*	6.5	37.1	41.2	-9.5	29.8	54.0	-14.2
19696	V/H	Peak	40.7*	9.7	24.0	40.2	-9.5	57.1	74.0	-16.9
19696	V/H	Aver	30.5*	9.7	24.0	40.2	-9.5	46.9	54.0	-7.1
22158	V/H	Peak	41.0*	11.5	24.0	40.3	-9.5	59.3	74.0	-14.7
22158	V/H	Aver	31.4*	11.5	24.0	40.3	-9.5	49.8	54.0	-4.3

* Noise floor

Internal Antenna

Temperature: 21.0 C								Netopia		
Humidity: 39.8 %								Model: 3387W		
Test date: July 12, 2003										
Frequency MHz	Polarity	Detector	SA reading dB(uV)	Cable loss dB	Pre- amp gain dB	Ant. factor dB(1/m)	D.C.F dB	Field Strength dB(uV/m)	Limit dB(uV/m)	Margin dB
Tx, @ 2412 MHz										
4824	V	Peak	43.9	8.5	35.8	34.9	0	51.7	74.0	-22.3
4824	V	Aver	30.8	8.5	35.8	34.9	0	38.6	54.0	-15.6
7236	H	Peak	45.8	9.2	35.4	37.7	0	57.4	74.0	-16.6
7236	H	Aver	36.6	9.2	35.4	37.7	0	48.1	54.0	-5.9
12060	V/H	Peak	39.2*	6.5	37.1	41.2	-9.5	40.3	74.0	-33.7
12060	V/H	Aver	28.7*	6.5	37.1	41.2	-9.5	29.8	54.0	-14.2
14472	V/H	Peak	40.2*	7.3	37.1	41.2	-9.5	42.1	74.0	-31.9
14472	V/H	Aver	29.7*	7.3	37.1	41.2	-9.5	31.6	54.0	-22.4
19296	V/H	Peak	40.7*	9.7	24.0	40.2	-9.5	57.1	74.0	-16.9
19296	V/H	Aver	30.5*	9.7	24.0	40.2	-9.5	46.9	54.0	-7.1
Tx, @ 2437 MHz										
4874	V	Peak	42.5	8.5	35.8	34.9	0	50.3	74.0	-23.7
4874	V	Aver.	29.8	8.5	35.8	34.9	0	37.6	54.0	-16.4
7311	H	Peak	46.7	9.2	35.4	37.7	0	58.2	74.0	-15.8
7311	H	Aver	38.0	9.2	35.4	37.7	0	49.5	54.0	-4.5
12185	V/H	Peak	39.2*	6.5	37.1	41.2	-9.5	40.3	74.0	-33.7
12185	V/H	Aver	28.7*	6.5	37.1	41.2	-9.5	29.8	54.0	-14.2
19496	V/H	Peak	40.7*	9.7	24.0	40.2	-9.5	57.1	74.0	-16.9
19496	V/H	Aver	30.5*	9.7	24.0	40.2	-9.5	46.9	54.0	-7.1
Tx, @ 2462 MHz										
4924	H	Peak	39.2	8.5	35.8	34.9	0	47.0	74.0	-27.0
4924	H	Aver	27.9	8.5	35.8	34.9	0	35.7	54.0	-18.3
7386	V	Peak	44.9	9.2	35.4	37.7	0	56.4	74.0	-17.6
7386	V	Aver	34.6	9.2	35.4	37.7	0	46.1	54.0	-7.9
12310	V/H	Peak	39.2*	6.5	37.1	41.2	-9.5	40.3	74.0	-33.7
12310	V/H	Aver	28.7*	6.5	37.1	41.2	-9.5	29.8	54.0	-14.2
19696	V/H	Peak	40.7*	9.7	24.0	40.2	-9.5	57.1	74.0	-16.9
19696	V/H	Aver	30.5*	9.7	24.0	40.2	-9.5	46.9	54.0	-7.1
22158	V/H	Peak	41.0*	11.5	24.0	40.3	-9.5	59.3	74.0	-14.7
22158	V/H	Aver	31.4*	11.5	24.0	40.3	-9.5	49.8	54.0	-4.3

* Noise floor

Radiated Emission in Restricted Bands at the band-edge frequencies
(measured using the "delta" method)

Rod antenna

Frequency MHz	Polarity	Detector	SA reading dB(uV)	Cable loss dB	Pre- amp gain dB	Ant. factor dB(1/m)	Field Strength at 3 m dB(uV/m)	Limit at 3 m dB(uV/m)	Margin dB
2412.0	V	Peak	75.8	6.1	0	30.5	112.4	-	-
2412.0	V	Aver.	68.6	6.1	0	30.5	105.2	-	-
2310 - 2390		Aver					105.2 - 54.3=50.9*	54.0	-3.1
2462.0	V	Peak	72.8	6.1	0	30.5	109.4	-	-
2462.0	V	Aver.	65.5	6.1	0	30.5	102.1	-	-
2483.5 - 2500		Aver.					102.1 – 54.2=47.9**	54.0	-6.1

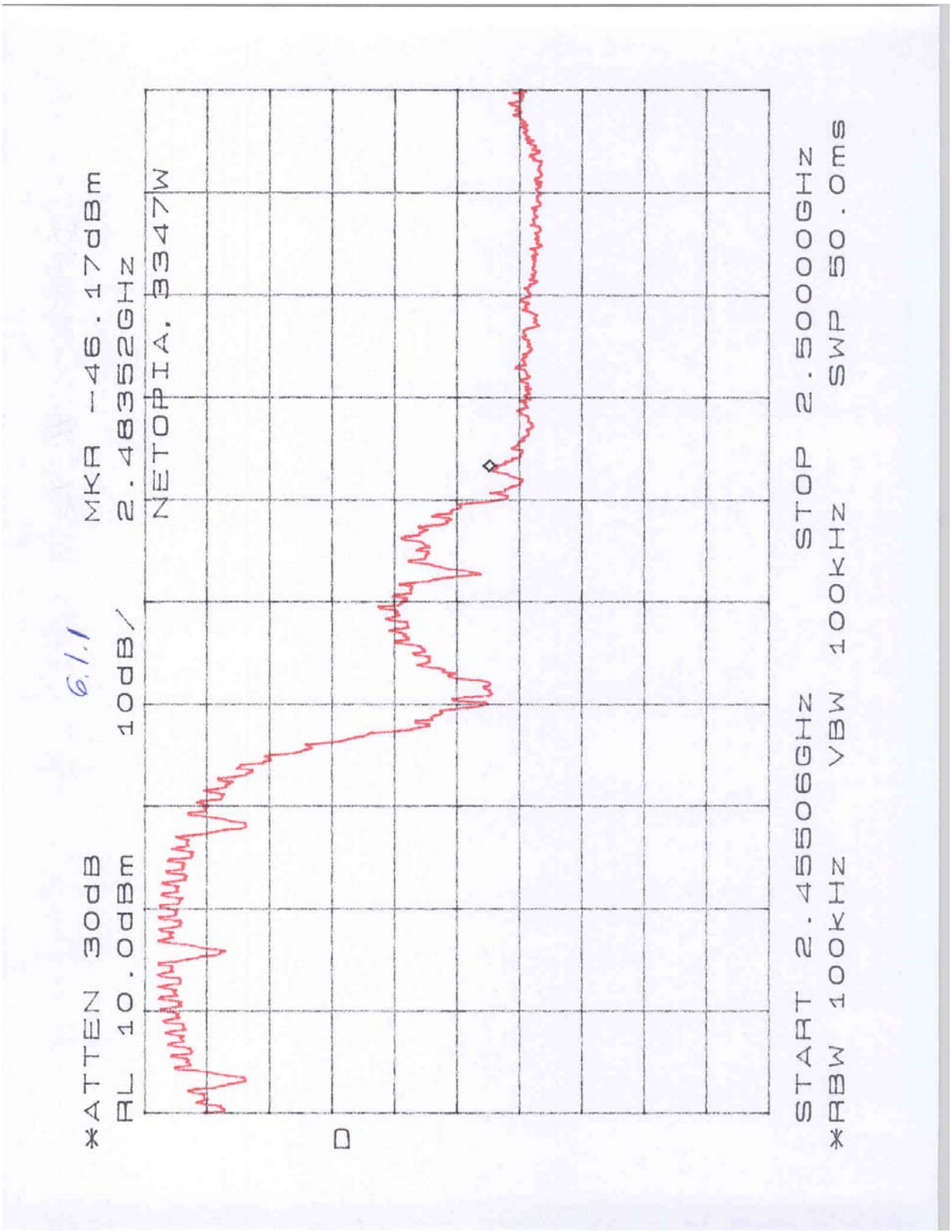
internal antenna

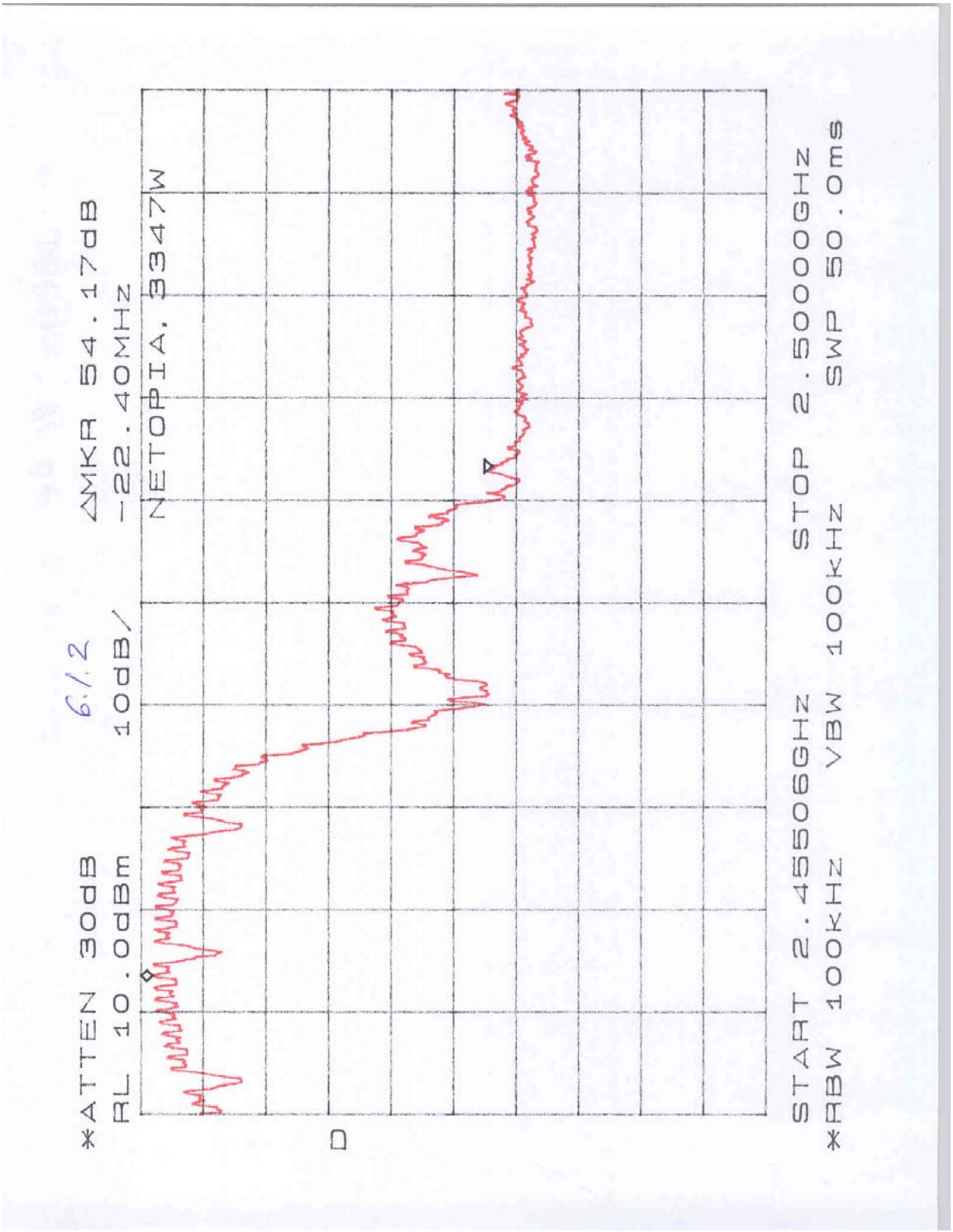
Frequency MHz	Polarity	Detector	SA reading dB(uV)	Cable loss dB	Pre- amp gain dB	Ant. factor dB(1/m)	Field Strength at 3 m dB(uV/m)	Limit at 3 m dB(uV/m)	Margin dB
2412.0	V	Peak	78.1	6.1	0	30.5	114.7	-	-
2412.0	V	Aver.	69.9	6.1	0	30.5	107.5	-	-
2310 - 2390		Aver					107.5 - 54.3=53.2*	54.0	-0.8
2462.0	V	Peak	77.8	6.1	0	30.5	114.4	-	-
2462.0	V	Aver.	70.9	6.1	0	30.5	107.5	-	-
2483.5 - 2500		Aver.					107.5 – 54.2=53.3**	54.0	-0.7

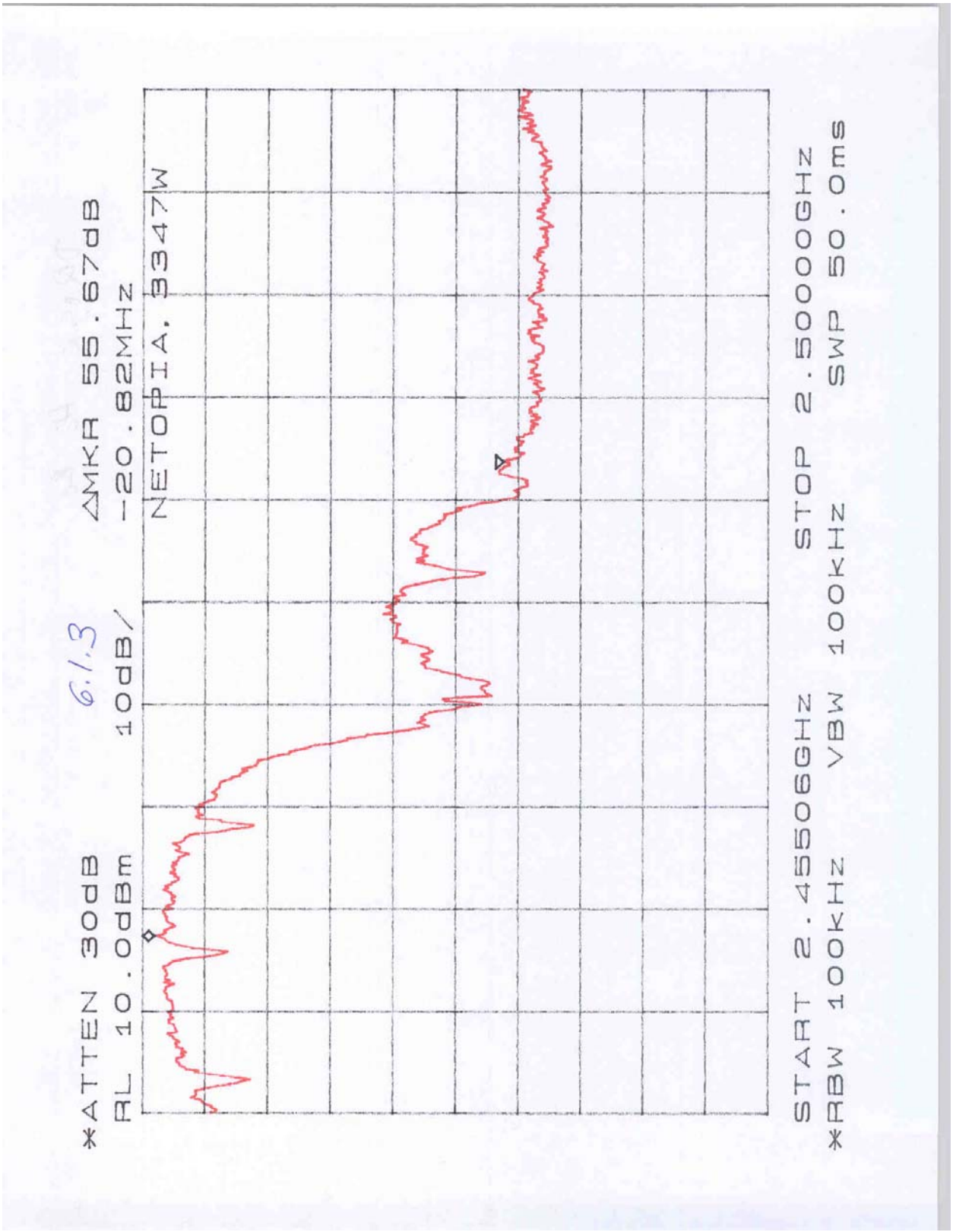
* delta = 54.3 dB is obtained from plot 6.2.1
** delta = 54.2 dB is obtained from plot 6.1.2

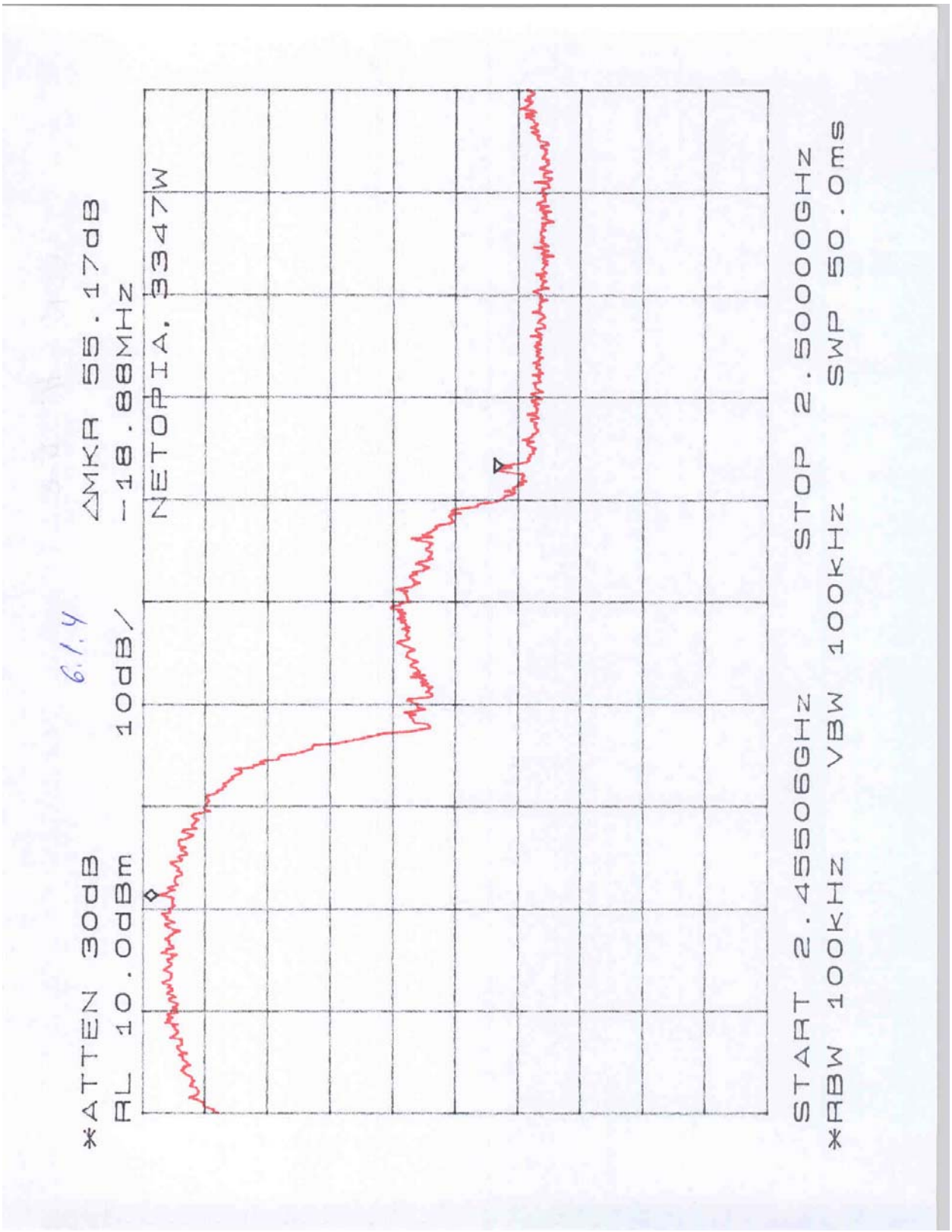
Refer to the following plots:

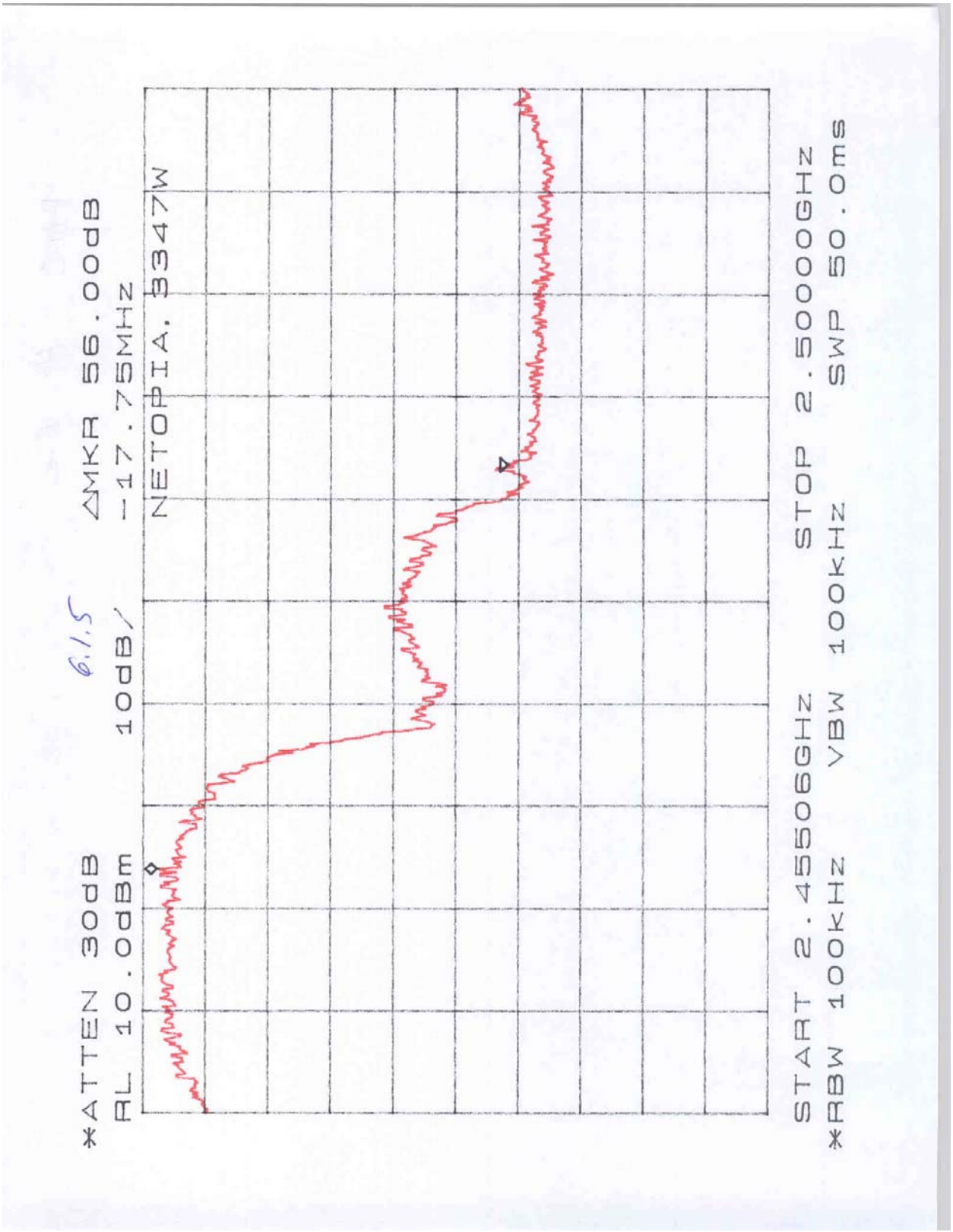
Band-edge frequency	Modulation	Delta, dB	Plot
High	DBPSK	54.2	6.1.1, 6.1.2
	DQPSK	55.7	6.1.3
	CCK	55.2	6.1.4
	PBCC	56.0	6.1.5
Low	DBPSK	54.3	6.2.1
	DQPSK	54.8	6.2.2
	CCK	54.7	6.2.3, 6.2.4
	PBCC	55.8	6.2.5

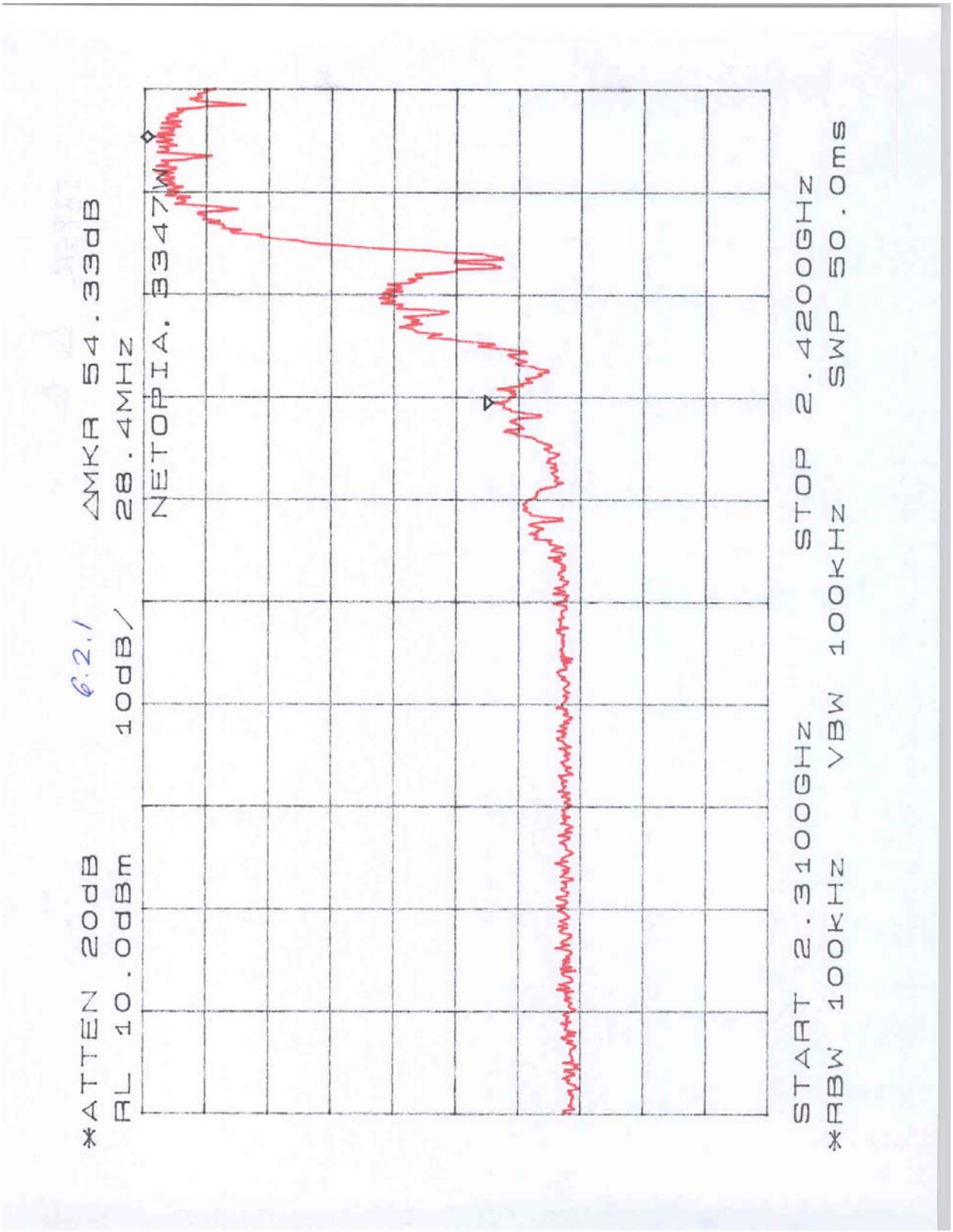

6.1.1
*ATTEN 30dB
RL 10.00dBm
10dB/
MKR -46.17dBm
2.483552GHz
NETOPIA, B347W
D
START 2.455066GHz
*RBW 100KHz
VBW 100KHz
STOP 2.500006GHz
SWP 50.0ms

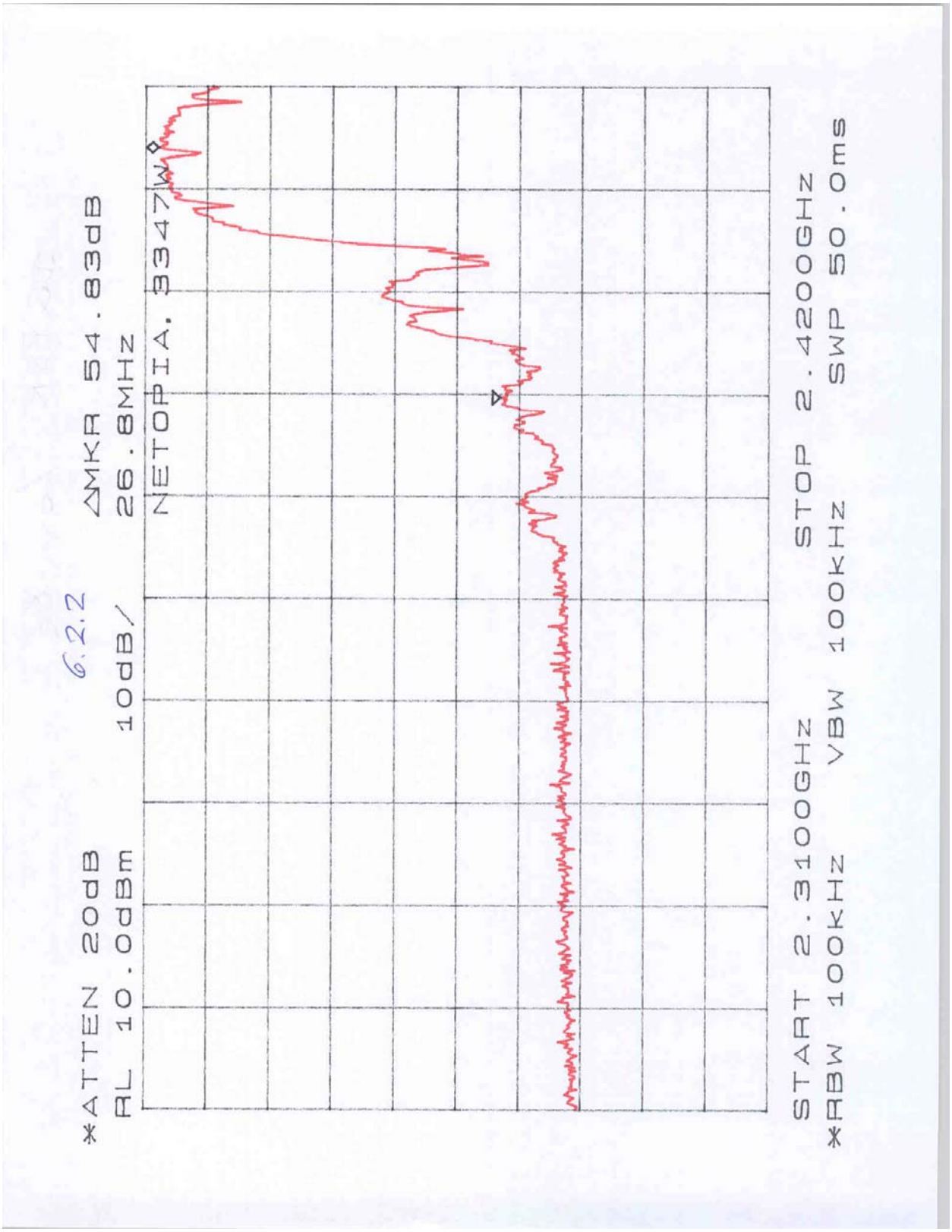

*ATTEN 30dB
RL 10.0dBm
10dB/
ΔMKR 54.17dB
-22.40MHz
NETOPIA, 3347W
6.1.2
START 2.455066GHz
*RBW 100KHz
VBW 100KHz
STOP 2.500000GHz
SWP 50.0ms

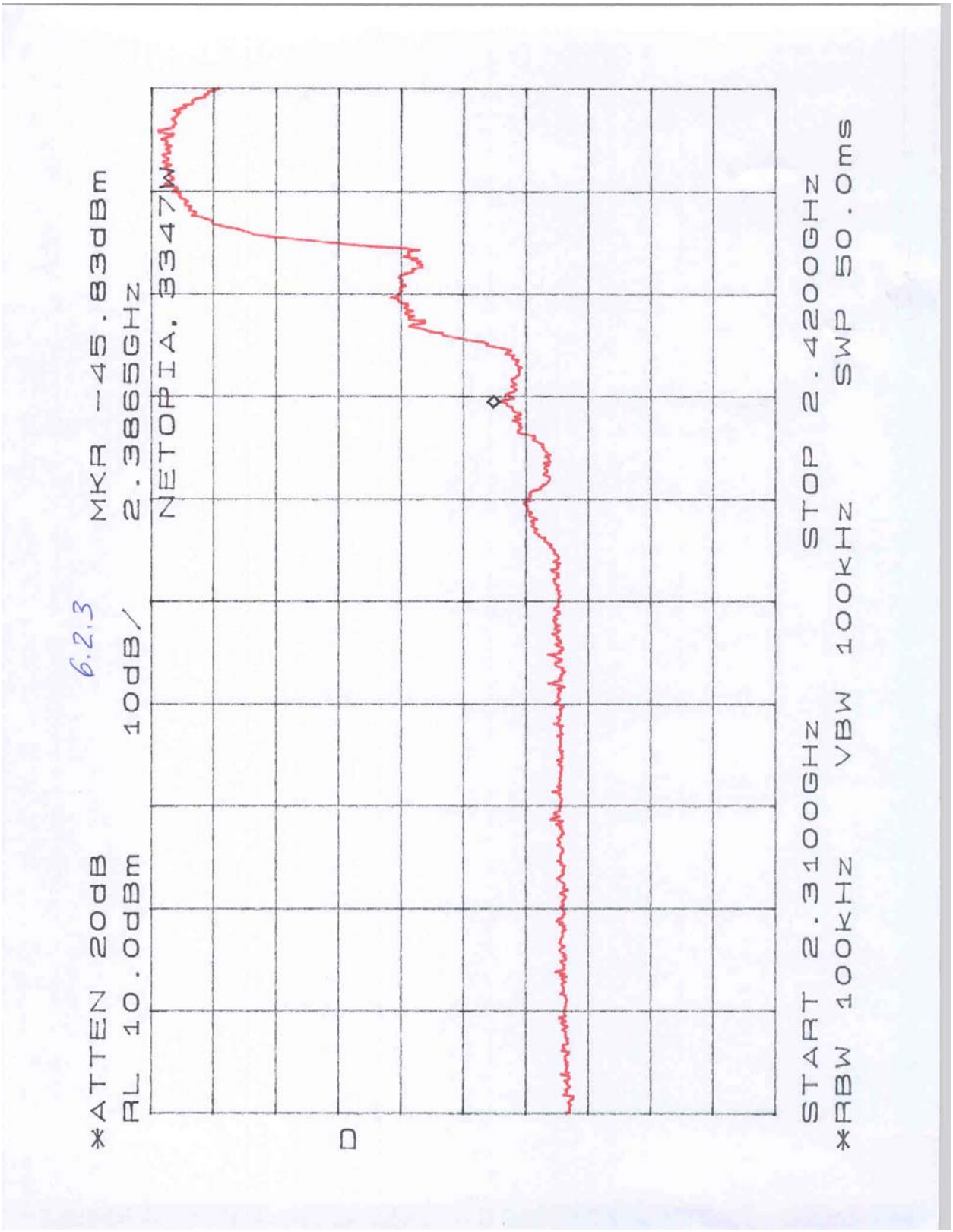

*ATTEN 30dB
RL 10.0dBm
10dB/
ΔMKR 55.67dB
-20.82MHz
NETOPIA, 3347W
6.1.3
START 2.455066GHz
*RBW 100KHz
VBW 100KHz
STOP 2.500006GHz
SWP 50.0ms

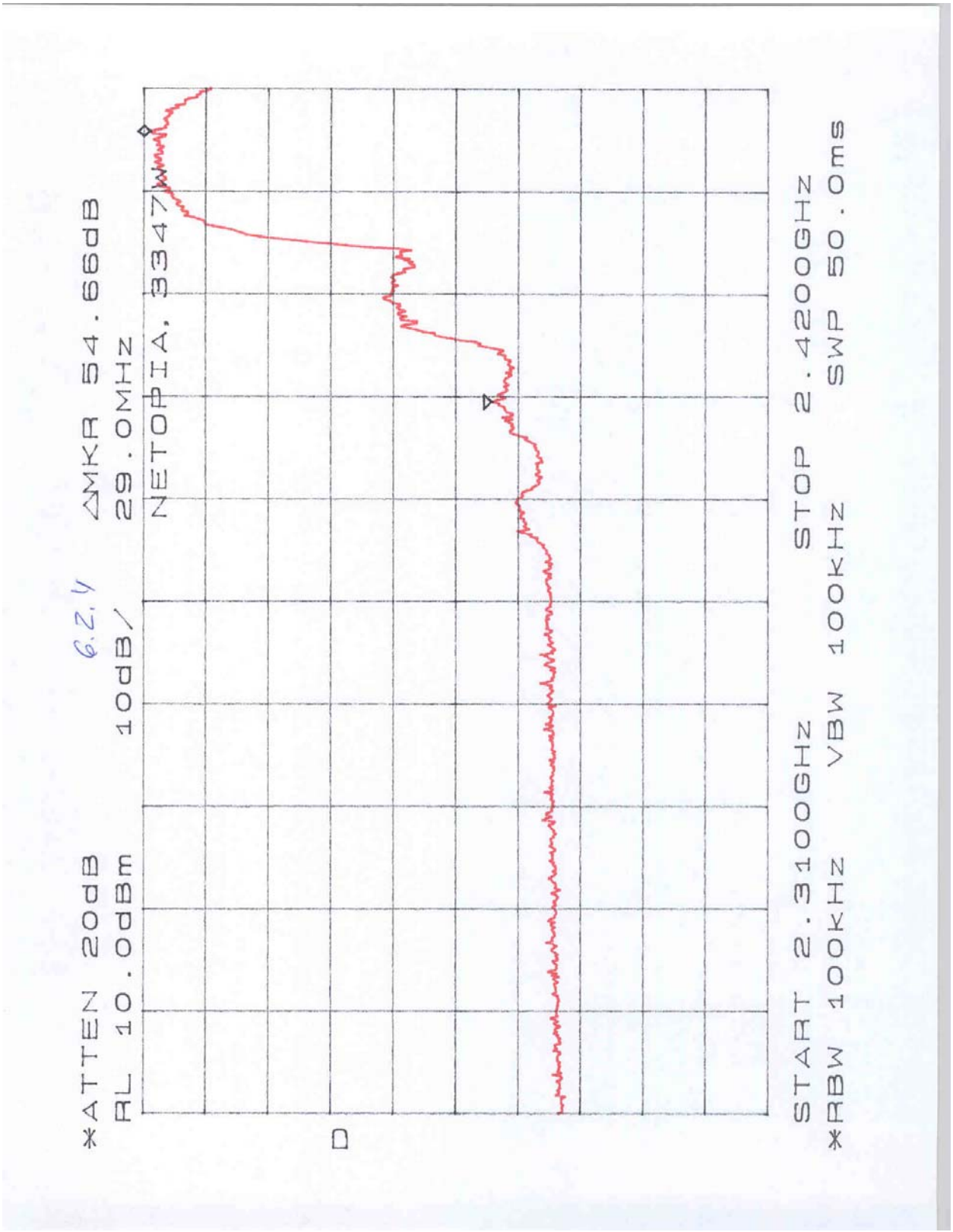

6.1.4
*ATTEN 30dB
RL 10.00dBm
10dB/
ΔMKR 55.17dB
-18.88MHz
NETOPIA, 3347W
START 2.45506GHz
*RBW 100KHz
VBW 100KHz
STOP 2.50006GHz
SWP 50.0ms

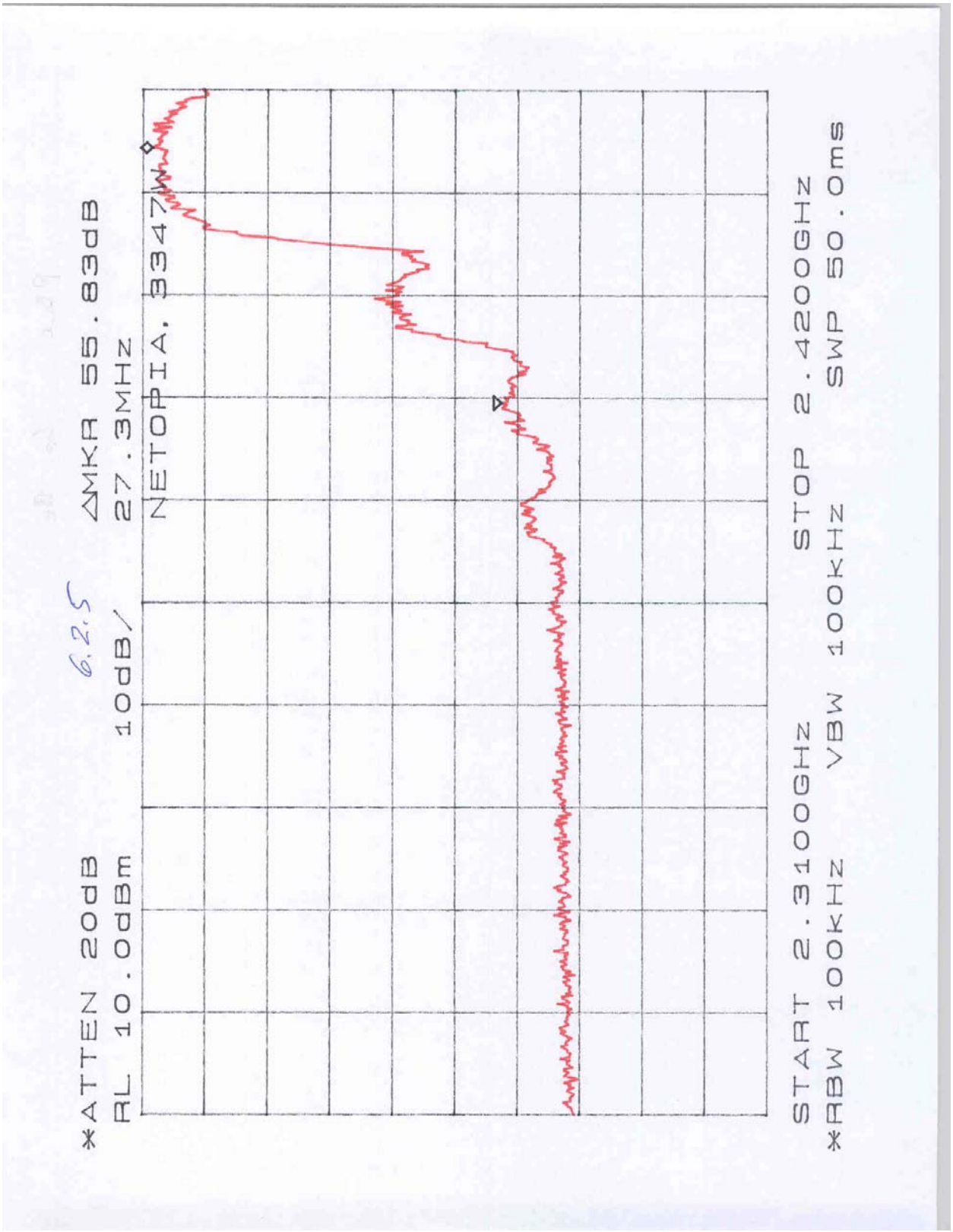

*ATTEN 30dB
RL 10.00dBm
10dB/
ΔMKR 56.00dB
-17.75MHz
NETOPIA, 3347W
6.1.5
START 2.45506GHz
*RBW 100KHz
VBW 100KHz
STOP 2.50000GHz
SWP 50.0ms


6.2.1
*ATTEN 20dB
RL 10.0dBm
10dB/
ΔMKR 54.33dB
28.4MHz
NETOPIA, B347W
START 2.3100GHz
*RBW 100KHz
VBW 100KHz
STOP 2.4200GHz
SWP 50.0ms


6.2.2
*ATTEN 20dB
RL 10.00dBm
10dB/
ΔMKR 54.83dB
26.8MHz
NETOPIA. 3347W
START 2.3100GHz
*RBW 100KHz
STOP 2.4200GHz
VBW 100KHz
SWP 50.0ms


6.2.3
*ATTEN 20dB
RL 10.0dBm
10dB/
MKR -45.83dBm
2.38865GHz
NETOPIA. 3347W
D
START 2.31000GHz
*RBW 100KHz
VBW 100KHz
STOP 2.42000GHz
SWP 50.0ms


6.2.4
*ATTEN 20dB
RL 10.00dBm
10dB/
ΔMKR 54.66dB
29.0MHz
NETOPIA, 3347
START 2.3100GHz
*RBW 100KHz
VBW 100KHz
STOP 2.4200GHz
SWP 50.0ms

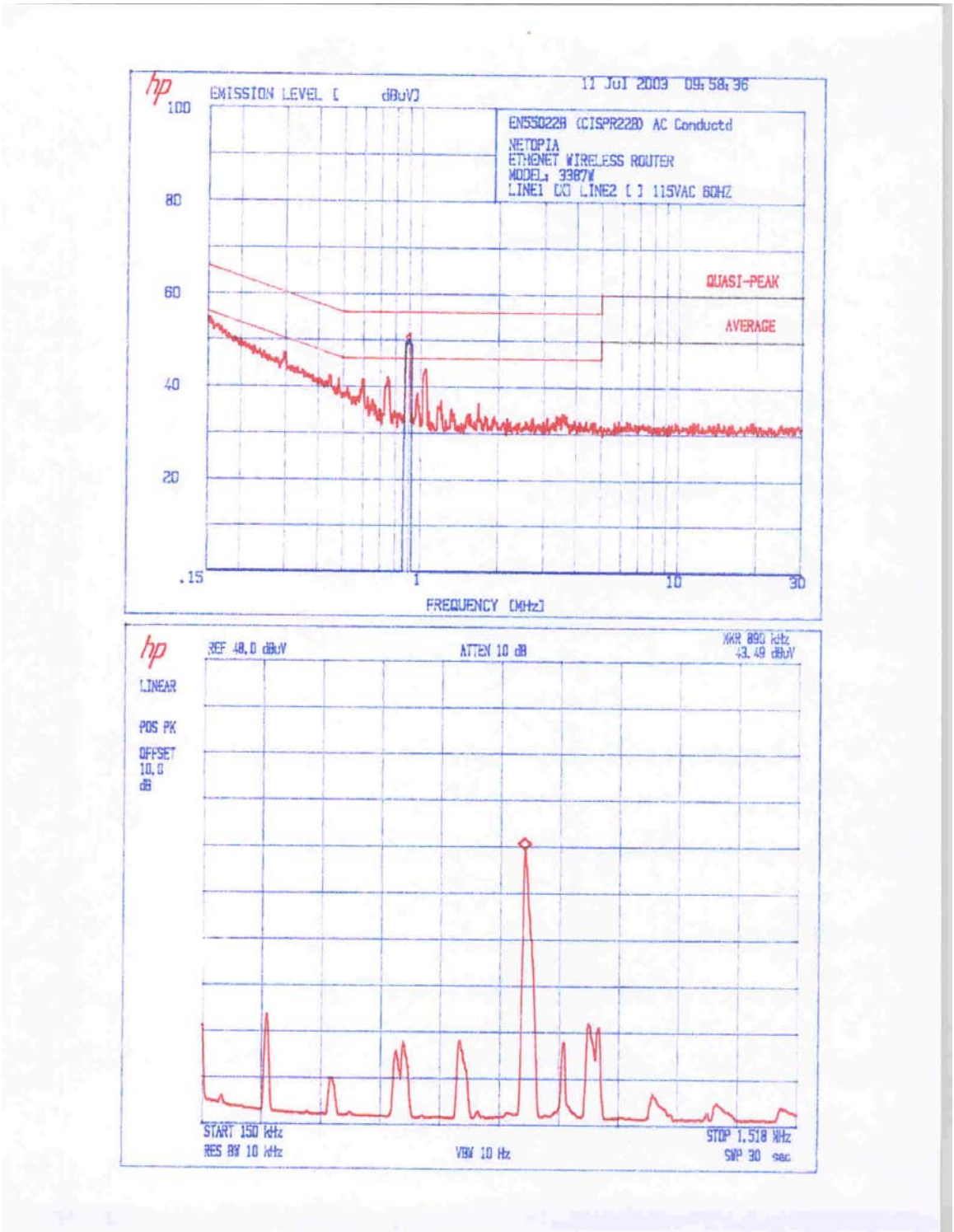

*ATTEN 20dB
RL 10.0dBm
10dB/
ΔMKR 55.83dB
27.3MHz
NETOPIA, 3347W
6.2.5
START 2.3100GHz
*RBW 100KHz
VBW 100KHz
STOP 2.4200GHz
SWP 50.0ms

4.7 AC Line Conducted Emission,
FCC Rule 15.207:

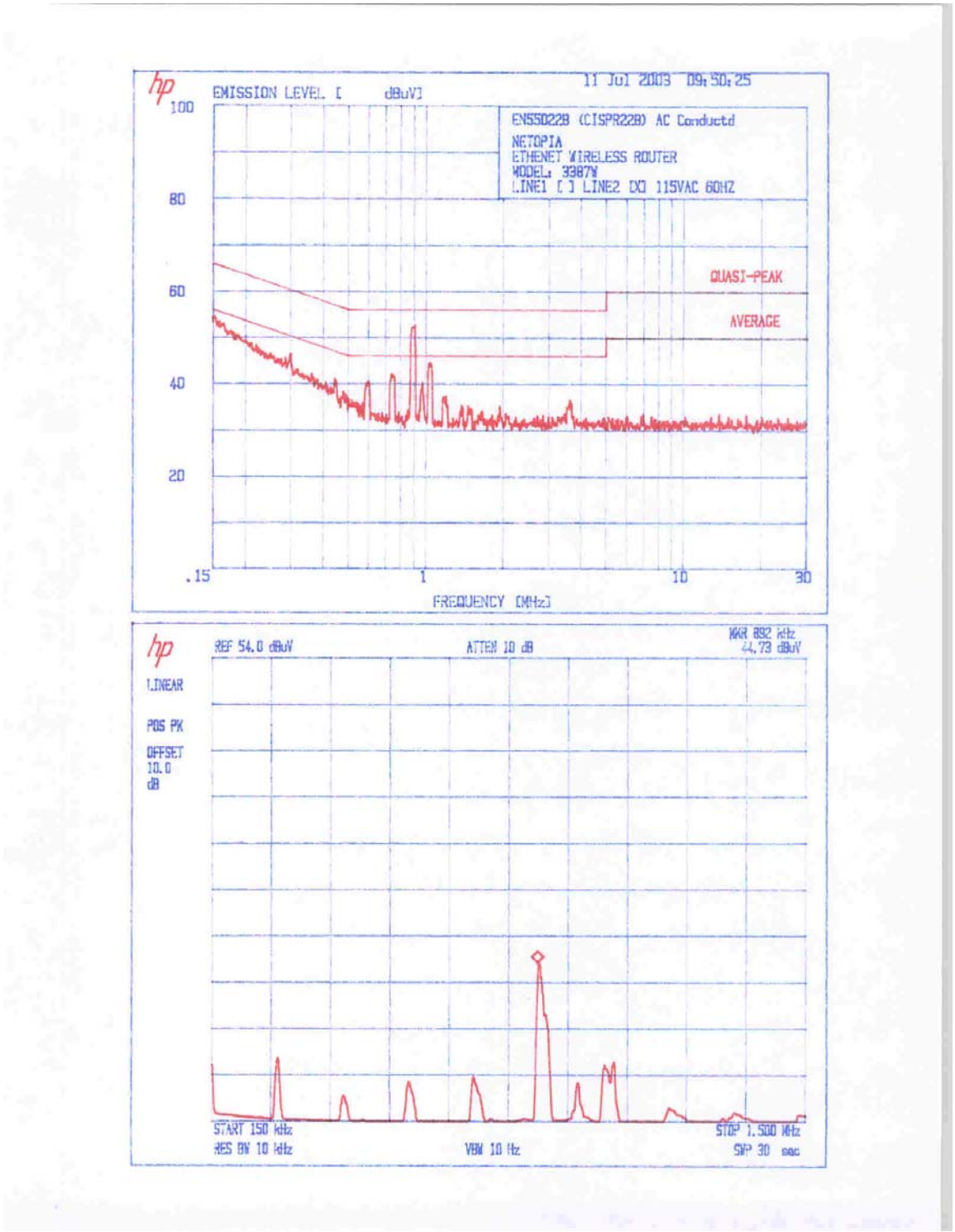
AC line conducted emission test was performed according the ANSI C63.4 standard. The EUT was connected to AC Line through the LISN.

For the test result, see attached plots 7.1, 7.2.
The EUT passed by 1.3 dB.

Plot #7.1


EMISSION LEVEL [dBuV]
11 Jul 2003 09:58:36
EN55022B (CISPR22B) AC Conductd
NETOPIA
ETHERNET WIRELESS ROUTER
MODEL: 3387W
LINE1 [X] LINE2 [ ] 115VAC 60HZ
QUASI-PEAK
AVERAGE
100
80
60
40
20
.15
1
10
30
FREQUENCY [MHz]
REF 48.0 dBuV
ATTEN 10 dB
MKR 890 kHz
43.49 dBuV
LINEAR
POS PK
OFFSET
10.0
dB
START 150 kHz
RES BW 10 kHz
VBW 10 Hz
STOP 1.518 MHz
SWP 30 sec

Plot #7.2


EMISSION LEVEL [dBuV]
11 Jul 2003 09:50:25
EN55022B (CISPR22B) AC Conductd
NETOPIA
ETHENET WIRELESS ROUTER
MODEL: 3387W
LINE1 [ ] LINE2 [X] 115VAC 60HZ
QUASI-PEAK
AVERAGE
100
80
60
40
20
.15
1
10
30
FREQUENCY [MHz]
REF 54.0 dBuV
ATTEN 10 dB
MKR 892 kHz
44.73 dBuV
LINEAR
POS PK
OFFSET
10.0
dB
START 150 kHz
RES BW 10 kHz
VBW 10 Hz
STOP 1.500 MHz
SWP 30 sec

4.8 Radiated Emissions from Digital Section of Transceiver (Transmitter)
FCC Ref: 15.109

Test results are attached

Radiated Emissions 30 MHz - 1000 MHz
FCC Part 15 Class B (QP-Horizontal)

Operator: Arkadi Kaplan
Model Number: 3387W
ITS Job Number: 3045856
Fr. July 11 8:07:23 2003
Company: Netopia

Frequency MHz	Quasi Pk FS dB(uV/m)	Limit@3 dB(uV/m)	Margin dB	RA dB(uV)	AG dB	CF dB	AF dB(1/m)	DCF dB
299.9	30.0	46.0	-16.0	33.3	32.2	5.3	13.1	10.5
400.0	39.4	46.0	-6.6	38.7	32.3	5.8	16.8	10.5
499.9	45.4	46.0	-0.6	42.5	32.4	6.7	18.1	10.5
588.0	43.6	46.0	-2.4	39.0	32.5	6.8	19.8	10.5
699.9	45.9	46.0	-0.1	40.2	32.6	7.0	20.8	10.5
899.9	40.4	46.0	-5.6	31.0	32.0	7.4	23.4	10.5

Test Mode: Normal
Temperature: 20.1 C
Humidity: 42.6 %

Radiated Emissions 30 MHz - 1000 MHz
FCC Part 15 Class B (QP-Vertical)

Operator: Arkadi Kaplan
Model Number: 3387W
ITS Job Number: 3045856
Fr. July 11 8:17:02 2003
Company: Netopia

Frequency MHz	Quasi Pk FS dB(uV/m)	Limit@3m dB(uV/m)	Margin dB	RA dB(uV)	AG dB	CF dB	AF dB(1/m)	DCF dB
699.9	41.5	46.0	-4.5	35.2	32.6	7.0	21.3	10.5
899.9	42.0	46.0	-4.0	32.5	32.0	7.4	23.5	10.5

Test Mode: Normal
Temperature: 20.1 C
Humidity: 42.6 %

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

Not required - EUT tuned frequency is above 960 MHz.

4.10 Radiation exposure

The 3387W is a Wireless Ethernet Router. It is desktop or wall-mounted device used with AC power adapter in mobile application, at least 20 cm from any body part of the user or near by persons.

The maximum conducted power is 20.0 dBm, antenna is fix-mounted, 3.75 dBi gain (maximum). Therefore, to comply with RF Exposure Requirement, the MPE is calculated.

The maximum Peak EIRP calculated is 0.24 W. The Power Density can be calculated using the formula

$$S = EIRP/ 4\pi D^2$$

Where: S is Power Density in W/m^2
D is the distance from the antenna.

In the table below, the calculated Power Density at different distances and MPE Limit for general population/uncontrolled exposure are presented.

Distance, m	Power Density, W/m^2	MPE, W/m^2
0.05	7.6	10.0
0.10	1.9	10.0
0.15	0.85	10.0
0.20	0.45	10.0

As can be seen from the data, the MPE is well below the limit at 10 cm and more.

5.0 List of Test Equipment

Measurement equipment used for emission compliance testing utilized the equipment on the following list:

Equipment	Manufacturer	Model/Type	Serial #	Cal Int	Cal Due
BI-Log Antenna	EMCO	3143	9509-1160	12	9/19/03
Horn Antenna	EMCO	3115	8812-3049	12	8/03/03
Horn Antenna	EMCO	3160-09	ITS51	#	#
Pre-Amplifier	ITS	ITSPA-1	44156	12	8/16/03
Pre-amplifier	CTT	ACO/400	47526	12	10/5/03
Pre-Amplifier	Avantek	AFT-18855	8723H705	12	10/5/03
Power Meter	Hewlett Packard	8900D	3607U00673	12	1/02/04
Spectrum Analyzer w/85650 QP Adapter	Hewlett Packard	8566B	2416A00317 2043A00251	12	10/29/03
Spectrum Analyzer Display w/85650 QP Adapter	Hewlett Packard	85662B	2403A06796	12	10/29/03
Spectrum Analyzer	Hewlett Packard	8565E	AE9674	12	5/27/04
Spectrum Analyzer w/8650 QP Adapter	Hewlett Packard	8568B	1912A0053 2521A01021	12	11/20/03
LISN	FCC	FCC-LISN-50-50-M-H	2012	12	1/23/04
Pulse Limiter	Hewlett Packard	11947A	2820A00184	12	9/3/03

No Calibration required

6.0 Document History

Revision/ Job Number	Writer Initials	Date	Change
1.0 / 3045163	DC	August 4, 2003	Original document

Appendix A

Out-of-Band conducted emissions	
Plots 4a.1 - 4a.5	Out-of-band low Channel Emissions
Plots 4b.1 - 4b.5	Out-of-band middle Channel Emissions
Plots 4c.1 - 4c.5	Out-of-band high Channel Emissions