

**FCC Part 15.247
Direct Sequence Test Report**

for
Symbol Technologies
on the
WLAN Compact Flash Card
Model: LA-4137
FCC ID: H9PLA4137P

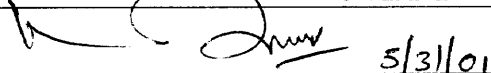
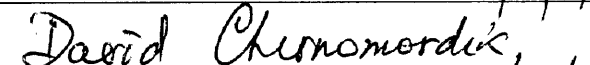
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 5/31/01	Suresh Kondapalli, Test Engineer
 5/31/01	David Chernomordik, Ph.D., EMC Site Manager

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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



Wansuck Horsey



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1.0 Summary of Tests


MODEL: Model: LA-4137

FCC ID: H9PLA4137P

TEST	REFERENCE	RESULTS
Output power	15.247(b)	Passed
6 dB Bandwidth	15.247(a)(2)	Passed
Power Density	15.247(d)	Passed
Out-of-band Antenna Conducted Emission	15.247(c)	Passed
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	15.35(b)(c)	Passed
AC Line-conducted Emission	15.207	Passed
Radiated Emission from Digital Part	15.109	Passed, see separate DoC report
Radiated Emission from Receiver L.O.	15.109	Not Applicable. The operating frequency is above 960 MHz
Processing Gain	15.247(c)	Passed, see exhibit "Processing Gain"
RF Exposure Requirement	2.1091	Passed, see exhibit "RF Exposure"
Antenna Requirement	15.203	Passed

Test Engineer: 
Suresh Kondapalli

Date: 5/31/01

EMC Site Manager:  Date: 5/31/01
David Chernomordik, Ph.D.
EMC Site Manager

Symbol Technologies, Model No. LA-4137
FCC ID: H9PLA4137P

Date of Test: April 1 to May 24, 2001

2.0 General Description

2.1 Product Description

The Symbol Technologies model LA-4137 is a 2.4 GHz Direct Sequence Spread Spectrum radio in the form of a PC Card that is used for wireless communication from a LAN to remote wireless devices.

This device is used in a portable configuration and can be located close to personnel. Antennas are mounted in pairs for diversity.

**Overview of WLAN Compact Flash Card
Model: LA-4137**

Applicant	Symbol Technologies
Trade Name & Model No.	Symbol Technologies, LA-4137
FCC Identifier	H9PLA4137P
Use of Product	Wireless LAN communications
Manufacturer & Model of Spread Spectrum Module	Symbol Technologies
Type of Transmission	Direct Sequence Spread Spectrum
Rated RF Output	89 mW, 19.5 dBm
Frequency Range	2412 - 2462
Number of Channel(s)	11
Antenna(s) & Gain,	PCB Chip, Model Trilogy CF, 2 dBi
Antenna Requirement	<input checked="" type="checkbox"/> The EUT uses a permanently connected antenna. <input type="checkbox"/> The antenna is affixed to the EUT using a unique connector which allows for replacement of a broken antenna, but DOES NOT use a standard antenna jack or electrical connector. <input type="checkbox"/> The EUT requires professional installation (attach supporting documentation if using this option).
Manufacturer name & address	Symbol Technologies 6480 Via Del Oro San Jose, CA 95119-1208

2.2 Related Submittal(s) Grants

None.

2.3 Test Methodology

Radiated emissions measurements were performed according to the procedures in ANSI C63.4 (1992). Radiated tests were performed at an antenna to LA-4137 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

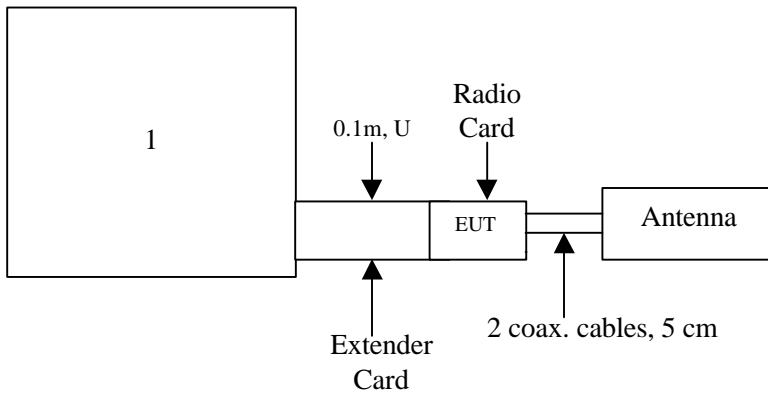
The open area test site and conducted measurement facility used to collect the radiated data is site 2 located in Menlo Park, California. This test facility and site measurement data have been fully placed on file with the FCC.

3.0 System Test Configuration

3.1 Support Equipment and description

Item #	Description	Model No.	Serial No.	FCC ID
1	Compaq Laptop Computer	Armada 500	1J0BFFH4Y30A	DoC

3.2 Block Diagram of Test Setup



m: Length in meters
U: Unshielded
S: Shielded

3.3 Justification

For radiated emission measurements the LA-4137 is placed on the wooden turntable. The LA-4137 is attached to peripherals and they are connected and operational (as typical as possible). The LA-4137 is wired to transmit full power. During testing, all cables were manipulated to produce worst case emissions.

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 LA-4137 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

For emissions testing, the units were setup to transmit continuously at the low, middle, and high frequencies.

3.6 Modifications Required for Compliance

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

4.0 Measurement Results

4.1 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 LA-4137 was connected to the input of a spectrum analyzer. Power was read directly and cable loss correction was included in the offset function of the spectrum analyzer to obtain the power at the LA-4137 antenna terminal.

Test Results

Frequency (MHz)	Output in dBm	Output in mWatt
2412	17.6	58
2437	19.5	89
2462	19.1	81

The maximum EIRP (with antenna gain 2 dBi) is 21.5 dBm.

Refer to the following plots for output power measurement:

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

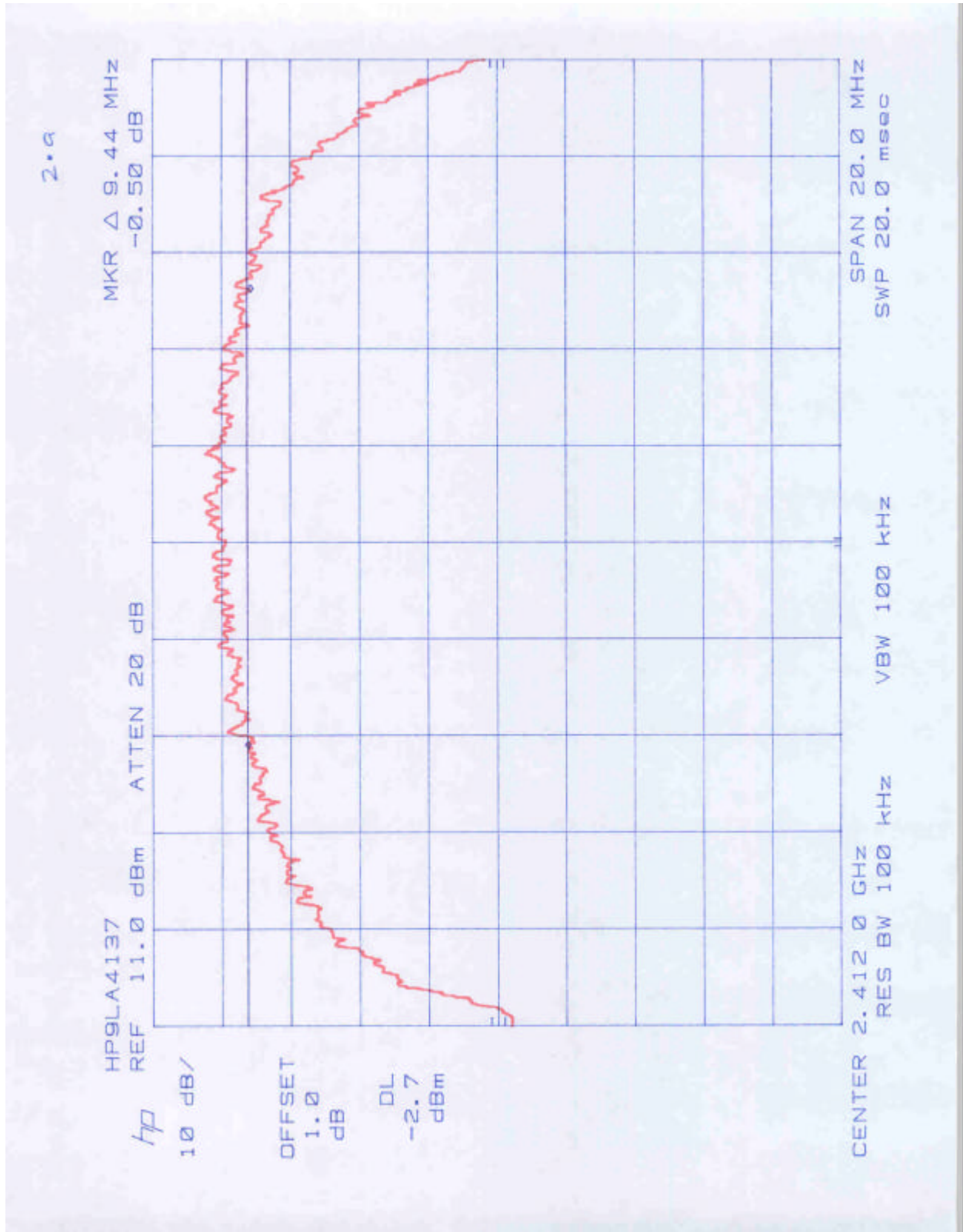
The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer RES BW was set to 100 kHz. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A PEAK output reading was taken, a DISPLAY line was drawn 6 dB lower than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

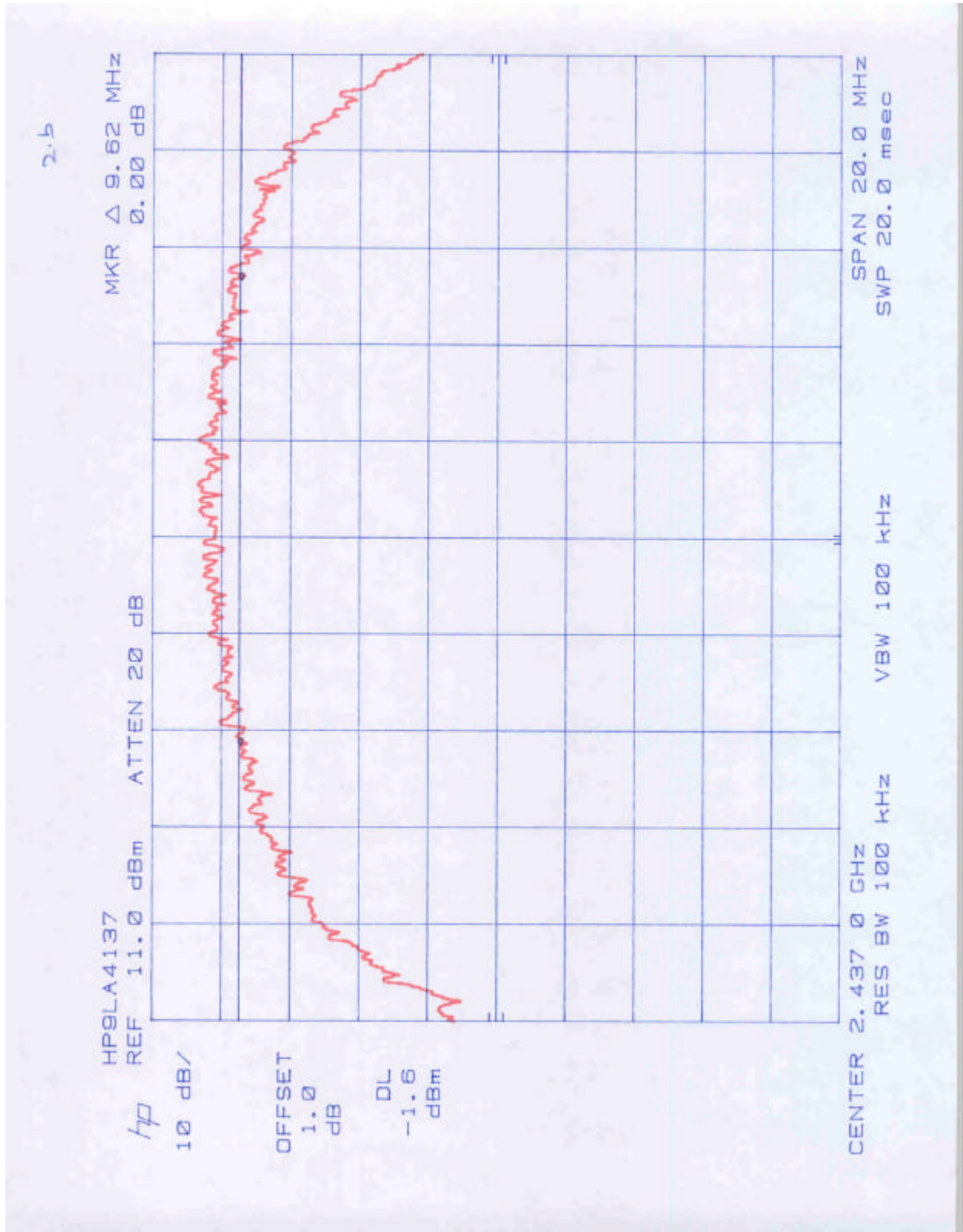
Test Result

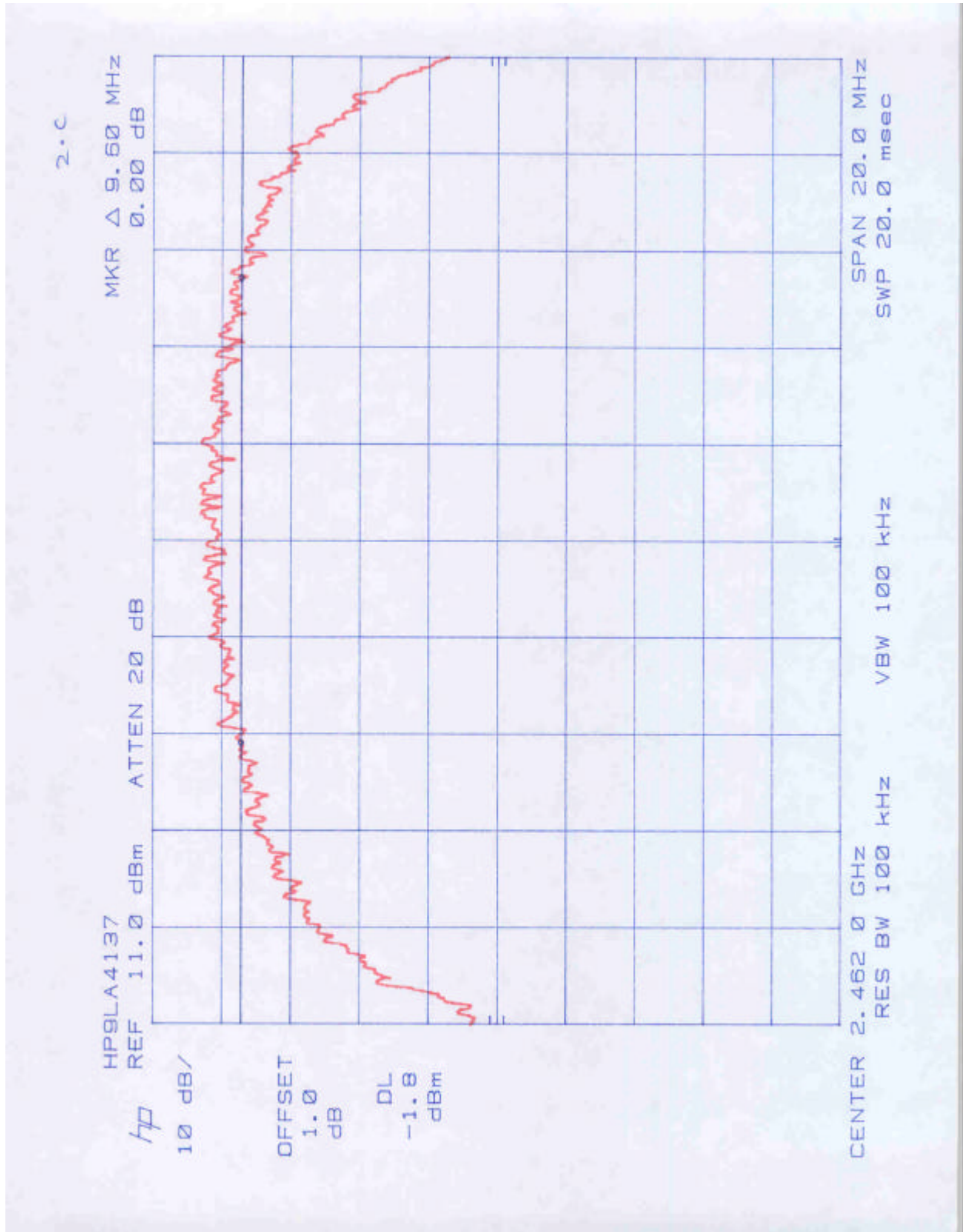
Frequency (MHz)	6 dB Bandwidth
2412	9.44 MHz
2437	9.62 MHz
2462	9.60 MHz

Refer to the following plots for 6 dB bandwidth:

- Plot 2a: Low Channel 6 dB RF Bandwidth
- Plot 2b: Middle Channel 6 dB RF Bandwidth
- Plot 2c: High Channel 6 dB RF 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

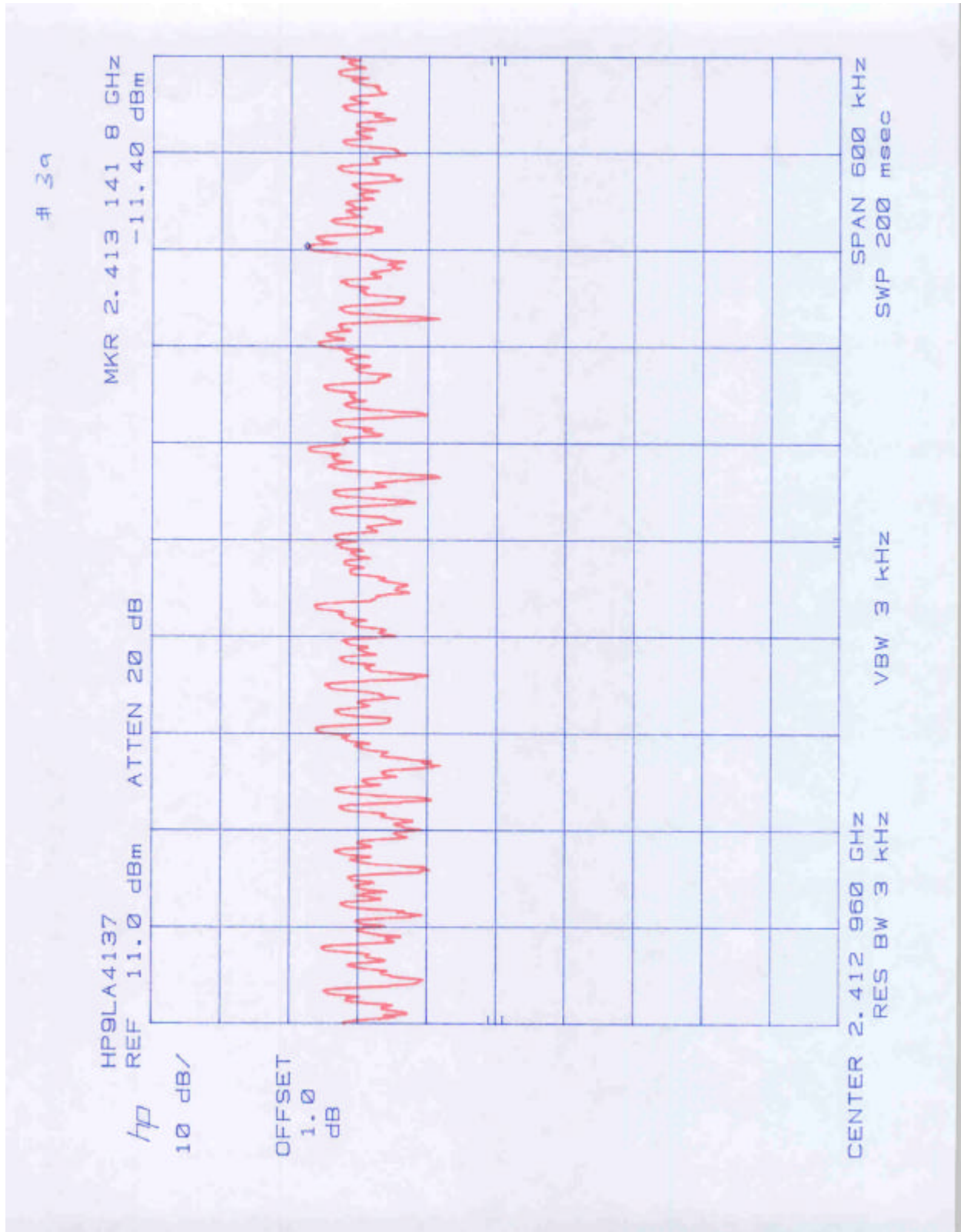
Frequency (MHz)	Power Density (dBm)
2463	-8.7

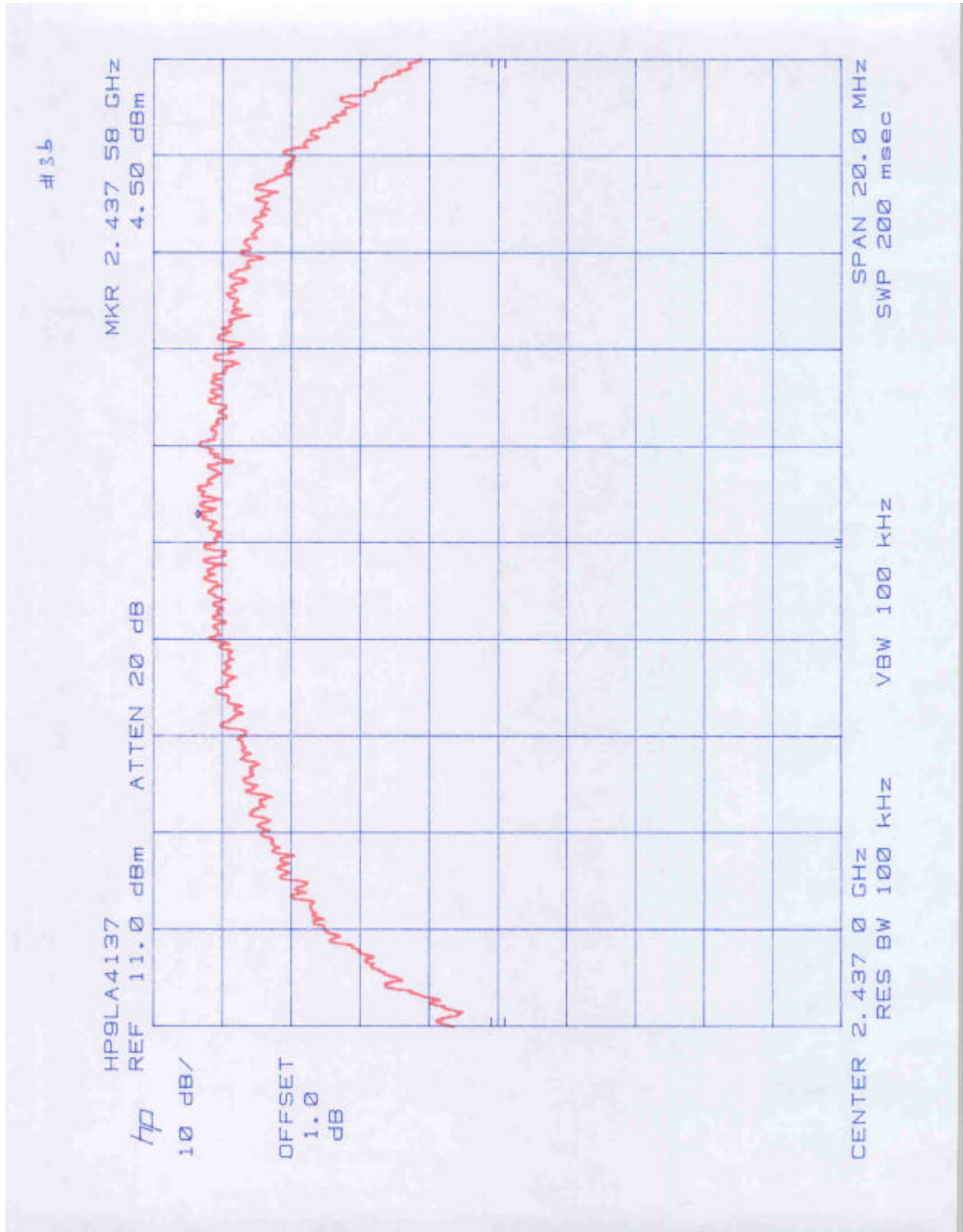
Frequency Span = 600 kHz

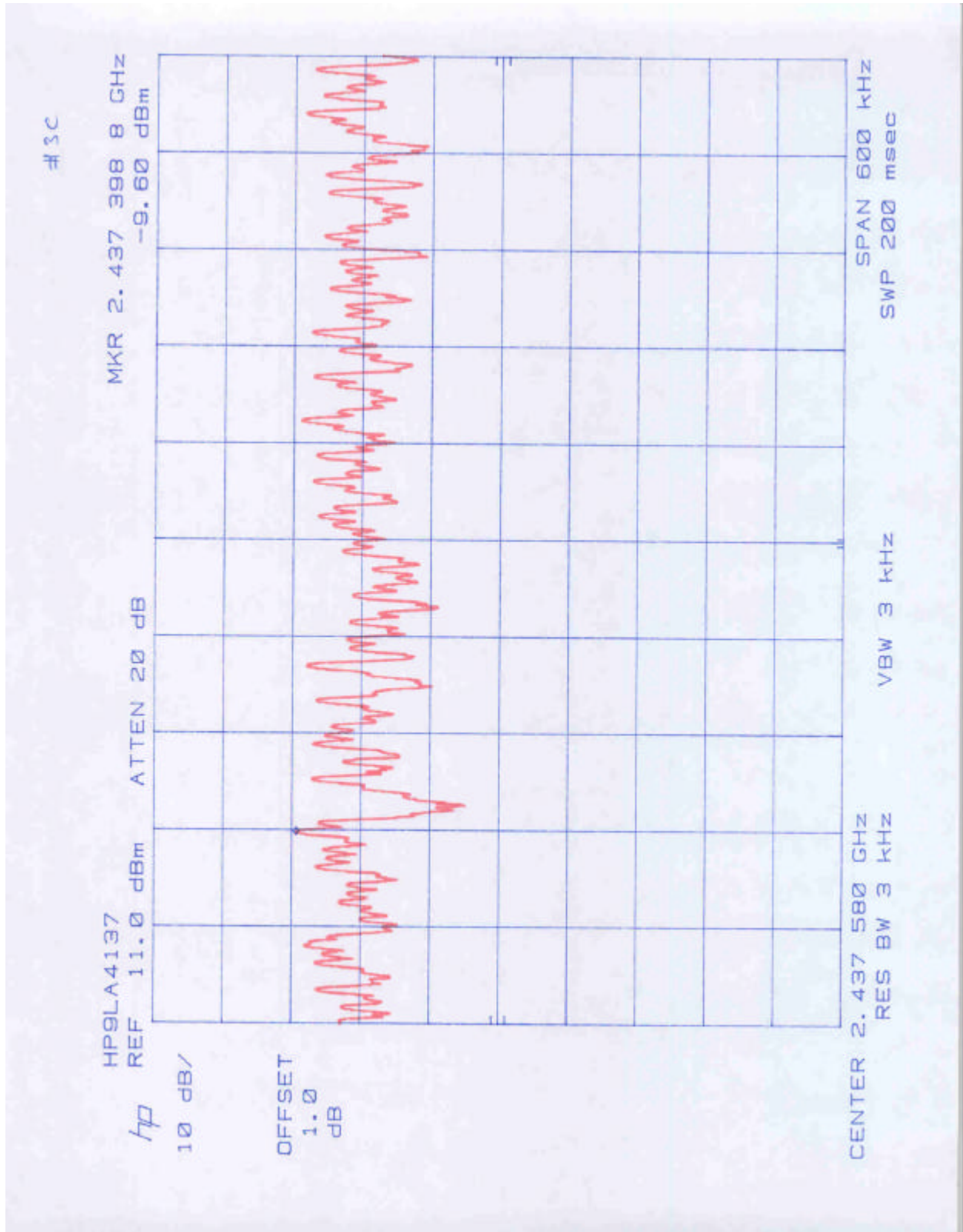
Sweep Time = Frequency Span/3 kHz
= 200 Seconds

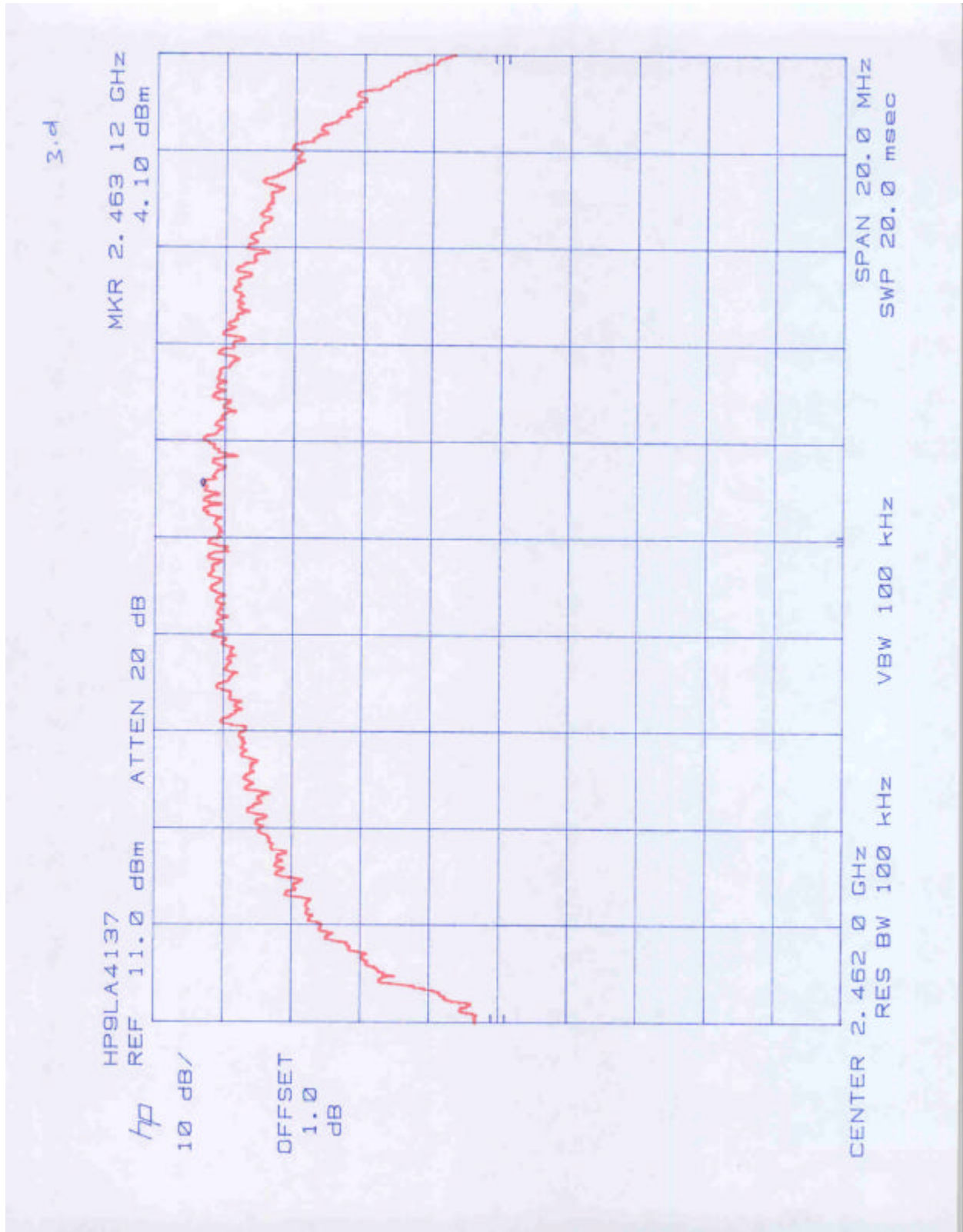
Refer to the following plots for power density data:

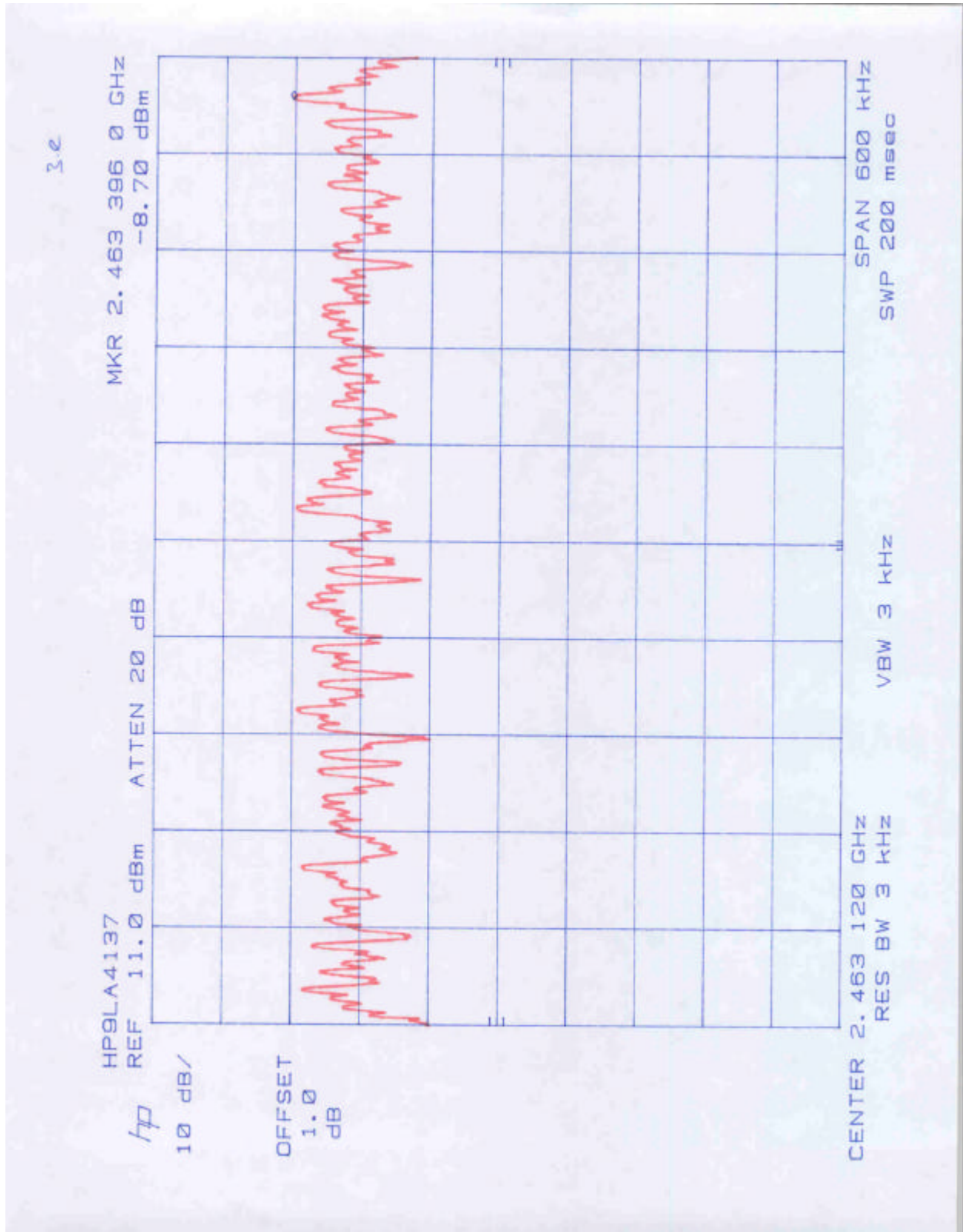
- Plot 3a – 3b: Low Channel Power Density
- Plot 3c – 3d: Middle Channel Power Density
- Plot 3e – 3f: High Channel Power Density

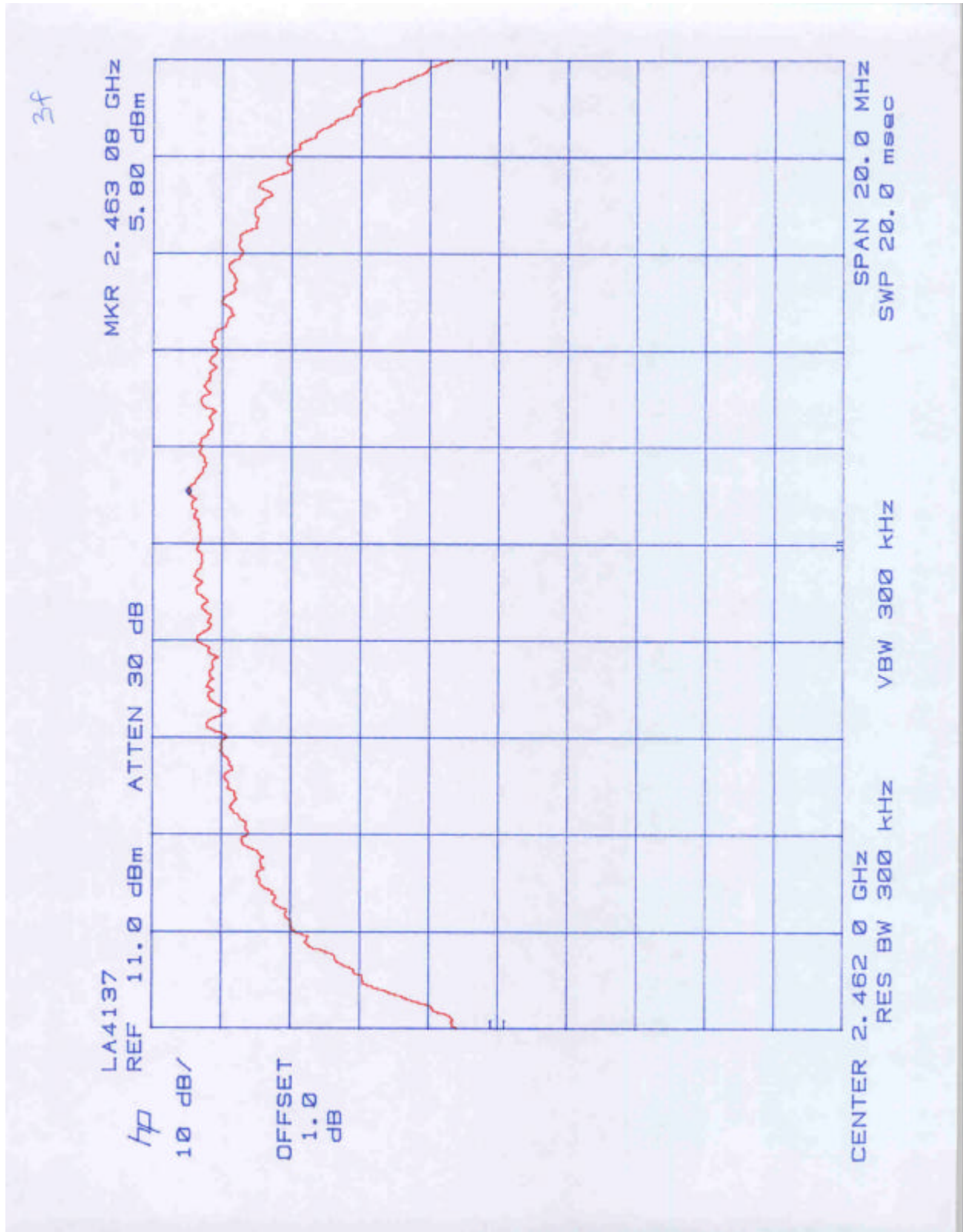












4.4 Out-of-Band Conducted Emissions
FCC Rule 15.247(c):

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.

Test Result

Refer to the following plots for out of band conducted emissions data:

- Plot 4a1 – 4a8: Low Channel Emissions
- Plot 4b1 – 4b7: Middle Channel Emissions
- Plot 4c1 – 4c7: High Channel Emissions

