



Federal Communications Commission



CFR 47, FCC PART 15, SUBPART E
UNLICENSED NATIONAL INFORMATION INFRASTRUCTURE DEVICES

CERTIFICATION

EMI TEST REPORT
ON
N2-X WIRELESS ETHERNET BRIDGE
5.3 - 5.7 GHz RADIO



PREPARED FOR:
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408/747-1490

FCC ID: EV9N2X5-3S1-16B

TEST REPORT NUMBER:
9080501A

DATE OF TEST:
JULY 12-22, 1999

IF THIS DOCUMENT IS REPRODUCED, IT MUST BE REPRODUCED IN ITS ENTIRETY.

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1.0 VERIFICATION OF COMPLIANCE

Description: The N2-X is a point to point Wireless Ethernet Bridge operating in the 5.3/5.7 GHz NII Band. The unit has an integrated radio, which operates in a full duplex mode, transmitting and receiving data over distances up to 8km.

Model Number: N2-X

Serial Number: pre-production prototype # 002

Applicant: Wireless, Inc.

Type of Test: CFR 47 FCC Part 15, Subpart B, Class A (Verification)
15.407 Subpart E, Unlicensed NII Devices, Certification,
Radiated and Conducted Emissions

Registration: NVLAP Code: 200089

Date of Test: July 12-22, 1999

Tested By: Suresh Kondapolli, Jook Lee, Chip Matheny

The above equipment was tested by Electronic Compliance Laboratories, Inc. and found to be in compliance with the requirements set forth in the CFR 47 FCC Rules and Regulations, Part 15 (Digital Devices) Part(s) 15.401 through 15.407 for Unlicensed National Information Infrastructure ("U-NII") Devices. The equipment, in the configuration described in this report, shows that the maximum emission levels emanating from this equipment are within the compliance requirements.

Date: 09/22/99

Chip Matheny
Technical Officer

Date: 09/25/99

Bill Anderson
Director of Product Development

2.0 GENERAL INFORMATION

Applicant: *Wireless, Inc.
5452 Betsy Ross Drive
Santa Clara, California 95054-1101*

Contact: Bill Anderson **Telephone:** 408/727-8383

E.U.T.: N2-X 5.3 / 5.7 GHz Full Duplex Radio Device

FCC Identifier: EV9N2X5-3S1-16B

Model Number: N2-X

Serial Number: Pre-production Prototype #001

Report Number: 9080501A

Date of Test: July - August, 1999

Manufacturer: Wireless, Inc.

Type of Test: FCC Part 15, Subpart B, Class A, 15.401-15.407, Subpart E
Radio Frequency Device (UNII) Certification

Frequency Range: 450 kHz to 30 MHz – Line Conducted Emissions
30 MHz to 1000 MHz - Radiated Emissions
2400 MHz to 40 GHz – Part 15.407

SUMMARY

Pass/Fail: **PASSED**

2.1 Radiated Emission Test:

The **N2-X** was placed on a 3/10-meter (OATS) Open Field Test Site. All emissions observed were below the applicable limit for Part 15, subpart B, Class A Digital Devices. The remainder of the Radiated testing was performed here as well. The emissions observed were below the FCC Part 15, Class A limit. Although, no emissions were detectable above the noise floor the test results are in **Appendix A**. See section 15.0 “Summary of Measurements” section, later in this report for results and appendices for reference.

2.2 AC Line Conducted Test:

The **N2-X** was placed in a screen room and connected to AC power through a LISN. All other associated peripherals and support equipment were connected to a separate power source. All emissions observed were below the FCC Class A limit. Test results are in **Appendix A**.

2.3 15.407 Operation within the 5.25-5.35 GHz band:

The **N2-X** met all the requirements. See data and plots in **Appendices C and D**.

3.0 TEST FACILITY

Name: ELECTRONIC COMPLIANCE LABORATORIES, INC.

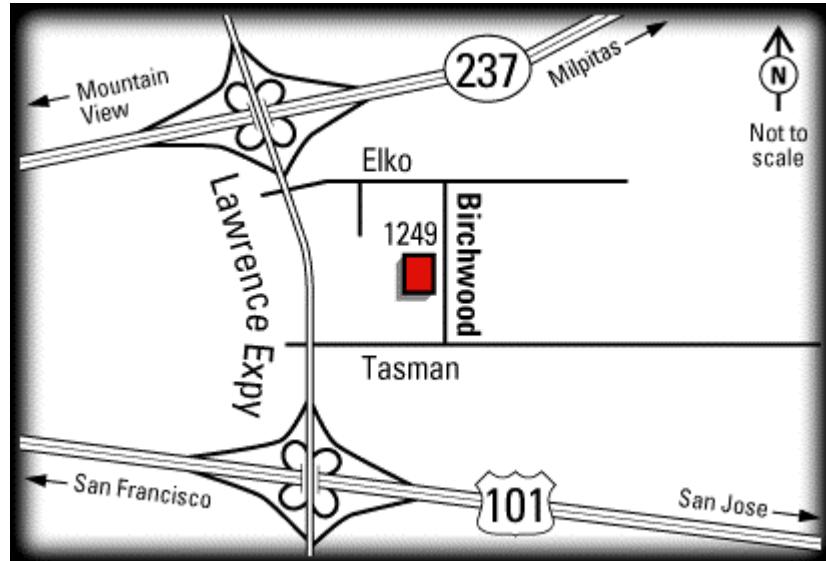
Location: 1249 Birchwood Drive
Sunnyvale, CA 94089

Site Filing: A site description is on file at the;
Federal Communications Commission
P.O. Box 429
Columbia, MD 21045

Types of Sites: Open Field Radiated and Indoor (Screen Room). Line Conducted:
All sites are constructed and calibrated to meet ANSI C63.4-1994
requirements. Test facility is recognized by the National Voluntary
Laboratory Accreditation Program for satisfactory compliance with
criteria established in Title 15, Part 285 Code of Federal
Regulations.

NVLAP Code: 20089 effective through: March 31, 2000

LOCATION OF THE SUNNYVALE TEST FACILITY



www.eclabs.com
800/707-LABS

4.0 TEST EQUIPMENT SETTINGS

4.1 Test Equipment Settings

Parameter	Line Conducted Emissions	Radiated Emissions
Bandwidth	9 kHz	120 kHz
*Detector Mode	Peak	Peak

*Unless otherwise specified

Units of Measurement

Measurements of radiated emissions are reported in terms of microvolts per meter or in dBuV/m at a specified distance. The indicated readings on the spectrum analyzer are converted to microvolts per meter or to dBuV/m by the use of appropriate conversion factors. Measurements of conducted interference are reported in units of microvolts or dBuV.

5.0 ANTENNAS

5.1 Antenna Table

Antenna Type	Frequency Range
Biconical	25 to 300 MHz
Log Periodic	300 to 1000MHz
Horn Double Ridge	1 to 18GHz
Horn Parabolic	4.9 to 10GHz
Horn Polarad	4.7 to 7.74GHz
Horn Polarad	8.3 to 10GHz

Correction Factors:

Programmed into the software

Antenna Height:

Varied from 1 to 4 meters above the ground plane

Polarization:

Vertical/Horizontal

Note: The antenna used at the time that the data was taken is indicated on each data page in the appendices. The correction factors and antenna polarization are also noted on each data page.

6.0 TEST EQUIPMENT

The following list contains equipment used at EC Laboratories, Inc. for compliance testing. The equipment conforms to the American National Standard Specifications for Electromagnetic Interference and Field Strength Instrumentation from 10 kHz to 1000 MHz.

6.1 Test Equipment Table

Description	Manufacturer	Serial No.	Model No.
EMI Receiver	HP	3325A00137	8546A
Peak Power Meter	HP	2131A01013	8900C
Power Sensor	HP	2551A01618	84811A
Spectrum Analyzer	HP	3137A01183	8563A
Spectrum Analyzer	HP	3741A00986	8564E
Pre-amp	HP	3113A05849	8447F
Pre-amp	HP	3008A00527	8449B
LISN	EM	2532	ANS-25/2
Biconical Antenna	EM	677	EM-6912
Log-Periodic Antenna	EM	858	EM-6950
Double Ridge Horn	EM	6231	EM 6961
Filter BP 1.2-4 GHz	FSY	001	HM1160-11SS
Filter BP 4-10 GHz	FSY	213	HM2950-15SS
Filter BP 10-18 GHz	FSY	001	HP8601-7SS
Filter BP 18-26 GHz	FSY	078	C21G-6.7G4SS

HP = Hewlett Packard

EM = Electro Metrics

FSY = FSY Microwave

Antennas used at the time the data was taken is indicated on each data page.
Antenna height and polarization are also noted on the data pages.

Calibration of the measuring instruments, including any accessories that may effect such calibration, are checked frequently to assure their accuracy. Adjustments are made and correction factors applied in accordance with instructions contained in the manual for the measuring instrument. All equipment is calibrated per EC Labs' Test Equipment Calibration Schedule as required per EN 45001 and NVLAP Accreditations.

7.0 DATA REPORTING FORMAT

The measurement results are expressed in accordance with FCC Part 15 Subpart B Class A limits, where applicable, are presented in tabular or graphical form.

7.1 Operating Conditions

The EUT was operated at the specified load conditions (mechanical and/or electrical) for which it was designed.

7.2 Conditions of the EUT

The EUT was operated for a sufficient period of time to approximate normal operating conditions.

7.3 Test Configuration

The equipment under test was configured and operated in a manner that tends to maximize its emission characteristics in a typical application. Power and signal distribution, ground, interconnecting cabling and physical placement of equipment were simulating the typical application and usage in so far as practicable. The EUT was furnished with rated voltage as specified by the manufacturer in the individual equipment's power requirements.

7.4 Test Platform

The EUT was placed on a non-conductive table having a height of 1 meter above the test site ground.

7.5 Maximization of Emissions

The test platform was rotated 360 degrees along with the moving of cabling and/or equipment in order to determine the maximum level of emissions.

7.6 Temperature

The ambient temperature of the testing location was within the range of 10 to 40 degrees Centigrade (50 to 104 Degrees Fahrenheit).

8.0 DETECTOR FUNCTIONS

On any frequency or frequencies below or equal to 1000 MHz, the limits shown below are based on measuring equipment employing a CISPR quasi-peak detector function and related measurement bandwidths.

On any frequency or frequencies above 1000 MHz, the radiated limits shown below are based on the use of measuring equipment employing an average detector function.

EC Laboratories uses the Peak detection mode for normal testing and initial screening of the EUT. The Peak detection mode will produce a measurement value that is always greater than, or equal to, the quasi-peak or average detection mode. Whenever the measurement value is 6 dB below the applicable limit or greater, the appropriate detector function will be employed and recorded.

8.1 Frequency Range of Investigation

The spectrum was investigated up to the frequency specified in the following table according to the highest clock frequency generated in the device.

Highest Frequency Used (Clock)	Upper Limit of Range Measured
Below 1.705 MHz	30 MHz
1.705 to 108 MHz	1000 MHz
108 to 500 MHz	2000 MHz
500 to 1000 MHz	5000 MHz
Above 1000 MHz	5th Harmonic or 40 GHz (Whichever is Lower)

9.0 FCC CLASS TYPES

9.1 Class A, Digital Device

A digital device that is marketed for use in a commercial, industrial or business environment, exclusive of a device which is marketed for use by the general public or is intended to be used in the home.

9.2 Class B, Digital Device

A digital device that is marketed for use in a residential environment notwithstanding use in commercial, business and industrial environments. Examples of such devices include, but are not limited to, personal computers, calculators, and similar electronic devices that are marketed for use by the general public.

Note: The responsible party may also qualify a device intended to be marketed in a commercial, business, or industrial environment as a Class B device, and in fact is encouraged to do so, provided that the device complies with the technical specifications for a Class B digital device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a digital device as a Class B digital device, regardless of its intended use.

(Code of Federal Regulations, Part 15, Subpart A, Sec. H&I)
(CFR 47, Parts 0 to 19, Revised as of October 1, 1990)

10.0 FCC LIMITS

10.1 Radiated Emission Limits

The field strength of radiated emissions for a Class A Digital Device, when measured at a distance of 10 meters, shall not exceed the limits given in the table below. The lower limit applies at the band edge.

The field strength of radiated emissions for a Class B Digital Device, when measured at a distance of 3 meters, shall not exceed the limits given in the table below. The lower limit applies at the band edge.

<u>Frequency</u> <u>(MHz)</u>	<u>Class A</u> <u>(3m) Limit</u> <u>(μV/m)</u>	<u>Class A</u> <u>(3m) Limit</u> <u>(dBμV/m)</u>	<u>Class A</u> <u>(10m) Limit</u> <u>(μV/m)</u>	<u>Class A</u> <u>(10m) Limit</u> <u>(dBμV/m)</u>	<u>Class B</u> <u>(3m) Limit</u> <u>(μV/m)</u>	<u>Class B</u> <u>(3m) Limit</u> <u>(dBμV/m)</u>
30-88	300	49.6	90	39.1	100	40.0
88-216	500	54.0	150	43.5	150	43.5
216-960	700	56.0	210	46.4	200	46.0
Above 960	1000	60.0	300	49.5	500	54.0

10.2 Conducted Emission Limit

For a digital device that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back into the AC power line on any frequency or frequencies within the band 450kHz to 30MHz shall not exceed the limits in the following table for the appropriate class. Compliance shall be based on the measurement of the Radio Frequency voltage between each power line and ground at the power terminals. The lower limit applies at the band edges.

<u>Frequency</u> <u>(MHz)</u>	<u>Class A Limit</u> <u>(μV)</u>	<u>Class A Limit</u> <u>(dBμV)</u>	<u>Class B Limit</u> <u>(μV)</u>	<u>Class B Limit</u> <u>(dBμV)</u>
0.45 to 1.705	1000	60.0	250	48.0
1.705 to 30.0	3000	69.5	250	48.0

11.0 TEST METHODS

11.1 Radiated Emissions Test Procedure

- (1) EUT and any other equipment and cables used with the EUT are placed on a non-conductive table 1-meter above a ground plane.
- (2) The EUT receives the normal AC Power at the base of the table.
- (3) All equipment and cables are placed in a manner, which tends to maximize their emission characteristics in a typical application.
- (4) The table is rotated 360 degrees to determine the maximum radial emissions.
- (5) The antenna height is varied between 1 meter and 4 meters above the ground plane to determine the maximum emissions. Appropriate antennas are used during the test in both the vertical and horizontal polarization.
- (6) The Spectrum Analyzer is scanned from 30 MHz to 1000 MHz for emissions. The applicable spectrum analyzer settings are:
 - a). Resolution Bandwidth = 100 kHz,
 - b). Normal Detector Mode = Peak (The Quasi-Peak is used when the emissions are near, or over the limit).
- (7) When an emission is found and maximized, the following actions are performed:
 - a). The emission frequency is entered into the computer.
 - b). The emission level is read from the spectrum analyzer in dBm and entered into the computer.
 - c). The antenna polarization is entered into the computer.
 - d). The computer converts the level in dBm to dB μ V and uses lookup tables to determine the coax cable loss, antenna factor, and pre-amp gain. A site correction factor is calculated for that particular frequency, and the data is printed out in tabular form.

11.2 Radiated Emissions Test Example

FREQ	SITE			FCC Limit		EUT Level (L1)	
	MHz	Raw (dBm)	CF (dB)	Corr'd (dB μ V)	Class A (dB μ V)	Class B (dB μ V)	Class A (dB)
65.4	-58	-14.5	34.5	39.1	40.0	-4.6	-5.5

Frequency = Frequency of emission in MHz
Raw dBm = Reading at Spectrum Analyzer (uncorrected)
Site CF = Correction Factor for coax/antenna/pre-amp for that frequency.
Note that a negative CF is the result of the gain of the pre-amp.
Corr'd dB μ V = Corrected emission level in dB μ V
FCC Limit A / B = Limit as stated in Part-15, Subpart B
EUT Level A* = Emission relative to the FCC Class A Limit.
EUT Level B* = Emission relative to the FCC Class B Limit.

Note: V/H is the antenna polarization (Vertical or Horizontal)
QP indicates the Quasi-Peak value.

*A negative value indicates that the emission is below (or meets) the limit and a positive value indicates that the emission is above (or exceeds) the limit.

11.3 Line Conducted Emissions Test Procedure

1. EUT and any other equipment and cables were placed on a non-conductive table one meter above a ground screen.
2. The EUT's Input Power line cord was connected to a Line Impedance Stabilization Network (LISN).
3. All other (Non-EUT) equipment received power from a separate AC Power Source. The LISN assembly has two monitoring points: Line 1 (AC-Hot) and Line 2 (AC-Neutral). Each monitoring point was scanned by the measuring equipment (the other point was terminated in 50 ohms) over the frequency range of 450kHz to 30MHz for conducted emissions.
4. When an emission is found, the following takes place:
 - a. The emission levels are maximized by equipment/cable placement.
 - b. Frequency and emission level data are entered into computer in dBm.
 - c. The monitoring point (Line 1 or 2) is entered into the computer.
 - d. The computer converts dBm to micro volts and uses a look-up table to find cable losses (in dB) at that frequency, calculates a corrected emission level, and compares the corrected emission level to the appropriate limit. The data is then printed out in tabular form.

An example of the printout and definitions follows:

11.4 Line Conducted Emissions Test Example

FREQ	SITE			FCC Limit		EUT Level (L1)	
	MHz	Raw (dBm)	CF (dB)	Corr'd (dB μ V)	Class A (dB μ V)	Class B (dB μ V)	A (dB)
1.85	-57	15.0	65.0	69.5	48.0	-4.5	+17

Frequency	= Frequency of emission in MHz
Raw dBm	= Reading at Spectrum Analyzer (uncorrected)
Site CF	= Correction Factor for cable loss
Corr'd dB μ V	= Corrected emission level in dB μ V
FCC Limit A / B	= Conducted Emission level limit in dB μ V
EUT Level 1*	= Emission relative to the FCC Class A Limit
EUT Level 2*	= Emission relative to the FCC Class B Limit

Note: L1 is AC-Hot, L2 is AC-Neutral
QP is a Quasi-Peak value
AV is an Average value

*A negative value indicates that the emission is below (or meets) the limit and a positive value indicates that the emission is above (or exceeds) the limit.

12.0 EQUIPMENT UNDER TEST (EUT)

The N2-X is a point to point Wireless Ethernet Bridge operating in the 5.3/5.7 GHz NII Band. The unit has an integrated radio, which operates in a full duplex mode, transmitting and receiving data over distances up to 8km.

The unit is equipped from the factory with four (4) output power settings for each of the eight (8) transmit channels available. The levels change approximately 3 dB between each of the settings, a total of 9 dB of power variation from the highest power to the lowest level. These four (4) power settings directly correspond to gain of the four (4) antennas presently being submitted for Certification under this application filing. The variance in power level setting combined with the difference in gain, from the antenna types, provides the manufacturer with the desired flexibility required to offer their customers with cost effective solutions for the lack connectivity to the vast range of information and resources available via the Internet. The same flexibility was required by the manufacturer to meet the regulatory compliance issues with respect to the EIRP limits specified. The N2-X was tested and will ship with, a standard six (6) foot coaxial cable which contributes approximately 2.6 dB of Loss which provides a near optimal receiver noise figure for any of the four (4) antennas submitted with this application. Thus providing the customers the best cost performance tradeoff options for links of varying distances and geographical or geometrical specific burdens.

13.0 SUPPORT EQUIPMENT

Equipment Type: Laptop Computer
Model Number: ThinkPad 2635
Serial Number: 78-HLI3097/11
Manufacturer: IBM ThinkPad
Comments:

Equipment Type: EtherNet Switch
Model Number: FS3208
Serial Number: 61-10141-00-C
Manufacturer: Asante Technologies
Comments:

Equipment Type: Antenna
Model Number: SSP2-52A
Serial Number: T56595
Manufacturer: Gabriel
Comments: 25" Parabolic

Equipment Type: Antenna
Model Number: DFPD .5-52
Serial Number: P63130
Manufacturer: Gabriel
Comments: 6" Flat Panel

Equipment Type: Antenna
Model Number: DFPD 1-52
Serial Number: P63519
Manufacturer: Gabriel
Comments: 1' Flat Panel

Equipment Type: Antenna
Model Number: DFPD 2-52
Serial Number: N/A
Manufacturer: Gabriel
Comments: 2' Flat Panel

14.0 EQUIPMENT CONFIGURATION

14.1 Radiated Emissions Testing (OATS)

All of the equipment and cables were placed in worst case positions to maximize emissions.

Interconnecting cables were of the type and length specified in the individual equipment requirements.

Grounding was in accordance with the manufacturer's requirements and conditions for intended use.

14.2 Radiated Emissions Testing (OATS)

The EUT was placed on a wooden table approximately 1 meter in height located on the center of the 3 meter turntable where it was configured and set up to operate and function for normal performance, intended to simulate the application in the field. A tripod was set up directly in front of the EUT where the antennas were mounted, tested and the measurements were then referenced to the applicable specifications in FCC Part(s) 15. A detailed description of the testing methodology and the results are available later in this report and photographs of the actual test set-up can be found in **Appendix E**. Test methods and information are outlined in Section 15.0, directly following. Results of the measurements and conclusions can be found in the specified Appendices.

14.3 Conducted Measurements

FCC ID: EV9N2X5-3S1-16B

WIRELESS, INC.

Refer to the following Section (15.0) for a detailed description of the testing methodology, spreadsheets and final test results. Photographs of the set-up configurations can also be found in **Appendix E**.

15.0 SUMMARY OF TESTS

The **N2-X Wireless Ethernet Bridge** is a wireless point to point communications system operating in the 5.3/5.7 GHz range. This operation falls under NII as authorized in CFR 47, FCC Rules and Regulations, Part(s) 15.400- 15.407. The Unit's design is intended to provide data links over distances up to 8km and has been designed in a weatherproof outdoor enclosure. The **N2-X** transmits and receives at rate of 8.192 Mbits/sec. and operates in the full duplex mode. The radio modulates using 25% excess bandwidth BPSK resulting in a transmitter -3dB bandwidth of approximately 9 MHz, and a -26 dB bandwidth of approximately 13 MHz. The **N2-X** transmits in the 5.250 to 5.350 GHz, and receives in the band 5.725 to 5.825 GHz.

Tests were performed using four (4) different types of antennas, all manufactured by Gabriel Electronics, Inc. with various levels of gain (dBi). Measurements were taken at the four (4) different power settings, for the Low, Middle and High channels (Ch.1, Ch.5, Ch.8). This Power Setting option is preset at the factory but can be adjusted in the field but only by a "Professional Installer", or again back at the factory. See data sheets provided in **Appendix C**. Test firmware resident in the EUT was used to perform the testing. The N2-X Radio has been designed with the flexibility to perform in a variety of configurations to meet specific geographic demands for different environments, locations, structures and other conditions, which may vary per installation. The variable power settings at the output, enables the manufacturer to obtain optimum performance and maximize overall efficiency. The N2-X has eight (8) channels throughout the designated band. Each channel has four (4) different power settings which are adjusted approximately 3 dB between each setting, a range of 9 dB, Highest setting to the lowest. Again, these settings are selected by the "Professional Installation Field Service Unit, contracted to perform the installation. Refer to the "Theory of Operation" for more technical information and to spreadsheets located in **Appendix C, D** for the results of the measurements.

15.1 Explanation of Test Methodology

A Spreadsheet (NII Worksheet) was developed to try to simplify the complexity of the test plan that would have to encompass hundreds of sets of data for the various configurations. The purpose was to provide an accurate tool for expediting this test matrix and as an end result provide accurate information immediately following the testing in the event of a failure or the need for implementing modifications or a design change. The results would there. The "NII Worksheet" can capture an abundant amount of data, calculate and compile it quickly, and relocate the results into a format for evaluation in a much, abbreviated timeframe. The actual test methods used for instrumentation, set up and the measurements are as stated in the following paragraphs. For a better understanding of the "NII worksheet" a "cut and paste" description is available for review in **Appendix B**. If there are any questions feel free to contact Chip Matheny at the lab any time.

15.2 15.407(a)(2) Peak Transmit Power

The N2-X was set to transmit continuously on the low, middle, and high frequency via the channel selection address switches, located in the rear of the unit. Refer to EUT photographs in **Appendix I** for details. The 26dB bandwidth was measured for each frequency at all four (4) power levels. The data was recorded and plots at the highest Power setting. The peak transmit power limit is the lesser of either 24dBm (250mW) or

11dBm + 10Log(26 dB BW) as shown in data sheets provided in **Appendix C**. The peak transmit power limit was reduced by the number of dB that the antenna gain exceeded 6 dBi. With the four (4) different antennas combined with the variations in Output Power levels, four (4) total per channel. The "NII Worksheet" calculated the measurements, referenced the data to the desired specification and displayed the results in the format shown in **Appendix B**, which was compared to the applicable limits. The data sheets also include the calculations for each of the antennas, at all four (4) power levels. Some of which will not be submitted for approval at specific power level settings with this application. The data sheet titled "Final Results", indicates the ones to be considered for approval. A detailed description of the selected antennas is available in **Appendix G**, for the specific Power Setting or outline of the data sheet as well as the methodology used can be seen in **Appendix B**.

The Output Power was measured with the Spectrum Analyzer RBW set to 1MHz and VBW to 30kHz. The analyzer span was set to 1 MHz, the trace set for Max Hold, and the frequency set to the center of the selected EUT frequency. The peak reading of the analyzer was recorded. The analyzer frequency was shifted by 1 MHz and the procedure was repeated. This was done for 10 MHz on each side of the EUT center frequency. Table 1 shows the results for the LO, MID and HI Channels. The Power Level was set to the Highest setting. The Antenna selected for this Table has the lowest gain (dBi). This antenna met all the specified limits at each of the power settings. Data Sheets are available for review in **Appendix C**.

Freq. (GHz)	Peak Transmit Power (dBm)	Antenna Gain (dBi)	Limit (dBm) based on 26 dB BW	Limit - Excess Antenna Gain (dBm)	DELTA (dB)
5.26	7.64	17.5	22.01	10.51	-2.87
5.30	8.06	17.5	22.06	10.56	-2.50
5.33	8.22	17.5	22.38	10.88	-2.66

Table 1. Peak Transmit Power vs. Limit

Peak Spectral Power Density

Peak Power Spectral Density measurements were taken at the same time as the output power. The peak spectral density limit is 11 dBm in any 1 MHz band. This limit is reduced by the number of dB that the antenna gain exceeds 6 dBi, making the limit -11.5 dBm. The **N2 - X** does not meet the specification at the three mid points for two of the power setting in Channel 1, the low frequency band. The results for all four (4) Power settings can be seen in the data Sheets titled "POWER MEASUREMENTS" in **Appendix C**.

15.2 15.407(a)6 Peak Excursion to Peak Transmit Power

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

Freq. (GHz)	Peak Transmit Power (dBm)	Peak Excursion Power (dBm)	Delta (dB)	Limit (dB)
5.26	7.64	11.17	3.53	13
5.30	8.06	11.33	3.27	13
5.33	8.22	11.17	2.95	13

15.3 15.407(b)(3) OUT OF BAND EMISSIONS

The spectrum analyzer plots titled " OUT OF BAND - LOWER BAND EDGE " shows the output spectrum of the EUT when set to it's lowest transmitting frequency. The spectrum analyzer plots titled " OUT OF BAND - UPPER BAND EDGE" shows the output spectrum of the EUT when set to it's highest transmitting frequency. The analyzer was placed in MAX HOLD mode, and several sweeps were recorded. The resultant plots show that the EUT emissions were at least 60 dB down from the band edges to 10MHz above and below the band edges.

The spectrum analyzer plots titled " OUT OF BAND - LOWER BAND EDGE + 10MHz" shows the output spectrum of the EUT when set to it's lowest transmitting frequency. The spectrum analyzer plots titled " OUT OF BAND - UPPER BAND EDGE + 10 MHz" shows the output spectrum of the EUT when set to it's highest transmitting frequency. The analyzer was placed in MAX HOLD mode, and several sweeps were recorded. The resultant plots show that the EUT emissions were at least 60 dB down for frequencies greater than 10 MHz above and below the band edges.

The spreadsheet in **Appendix D** shows the EIRP of the out of band emissions, up to 20 MHz away from the band edge, is better than -27 dBm / MHz.

The spectrum analyzer plots labeled "OUT OF BAND <30 MHz - 6 GHz", " OUT OF BAND 6 - 13 GHz", "OUT OF BAND 13 - 26.5 GHz", "OUT OF BAND 26.5 - 31GHz", and "OUT OF BAND 31 - 40 GHz", show that emissions measured in ≥ 100 kHz bandwidth are more than 20 dB below the highest level of the desired power outside of the 5.225 - 5.325 GHz band. Test data and plots are shown in **Appendix D**.

15.4 15.205 RESTRICTED BAND RADIATION LIMITS

The EUT was placed on a wooden table resting on a turntable. The wooden table was approximately 1 meter above the ground plane of the 3 meter test site. The search antenna was moved in to 1 meter when necessary to improve the noise floor, and the appropriate range factor was applied. While the EUT was transmitting uninterrupted random data on each of the low / mid / high channels and with the spectrum analyzer on MAX HOLD, the turntable was rotated, and the search antenna raised and lowered in an attempt to maximize the received radiated emission level. Test results are attached in **Appendix F** in tabular form showing that no spurious signals were detected above the 74 dB_{UV}/m peak / 54dB_{UV}/m average limits. Peak measurements were made with a RBW and VBW = 1 MHz. Average measurements were made with a RBW = 1 MHz and a VBW = 10 Hz. The **N2-X** harmonics were only measured up to 3rd due to measuring equipment limitations. The Out of Band plots in **Appendix D** indicate that no harmonics are seen above the noise floor.

15.5 15.209 RADIATED EMISSIONS

The attached table shows that the Class A radiated limits from 30 - 1000 MHz are not exceeded by the EUT. The EUT was set in a "receive only" mode during this test. The EUT was placed near one edge of a wooden table resting on a turntable. The wooden table was approximately 1 meter above the ground plane of the 3 meter test site. The search antennas were located at 3 meters. Measurements were made in accordance with ANSI C63.4-1994. Test Data provided in **Appendix A**.

15.6 15.207 AC LINE CONDUCTED EMISSIONS

The RF line conducted levels for emissions in the 0.45 - 30 MHz band must not exceed 250 μ V when measured with a LISN. Attached graphs and tabular data show that emissions are below the 250 μ V (48 dB μ V) maximum allowed level. Test Data and supporting plots are available in **Appendix A**.

15.7 15.203 ANTENNA REQUIREMENT

The unit requires professional installation and is therefore exempt from the requirements of 15.203. This product has a standard N type Antenna connector to provide a coupling to the intentional radiator.

FCC ID: 2AV9NZA5-3ST-10B
WIRELESS, INC.

APPENDIX A

Radiated / Conducted Emissions

ELECTRONIC COMPLIANCE LABORATORIES, INC.
1249 BIRCHWOOD DRIVE, SUNNYVALE, CALIFORNIA 94089
408/747-1490 www.edlabs.com 800/707-LABS

APPENDIX B

EXPLANATION OF METHODOLOGY

SUMMARY OF MEASUREMENTS

EXPLANATION OF METHODOLOGY

1 NII Band Worksheet

This Spreadsheet titled the "N2X Worksheet" was designed primarily to quickly collect data and provide information for all aspects of the Radio's performance from operation in the field to how it compares with the limits specified by Regulatory Agencies worldwide. With all the possible equipment configurations and variations with respect to a specific application in the field, it was necessary to generate a tool that compiles all the information required to support modifications and design changes necessary to deliver superior performance for which it was designed. This tool should enable the "Factory Tuned Selection" process to operate smoothly. This is a SAMPLE of how the data was extrapolated the actual submitted data is located in the appendices to follow. Hopefully, it will be clear as to how the selections were determined for acceptance and Certification...

After the frequency range for the desired band has imported for the 1 MHz steps, The "Raw Readings" data is placed into the center column. The third column, titled "POWER OUT", converts the reading in to milliwatts and the SUM is then calculated in the bottom cell. Representative of the Peak Power Total in milliwatts.

The 20 dB bandwidth measurement is then entered in the upper right side above this table as well as the gain (dB) for the particular antenna you wish to evaluate against the limits.

The program will allow you to take in consideration any Loss. When the loss has been calculated insert the number here and that number will be subtracted when working out the Total measurement in dB milliwatts. All measurements were taken with a 6 ft. coaxial cable with measured loss of 2.8 dB.

This is where the Peak Transmit Power (PTP) LIMIT is calculated. That LIMIT is then transferred down to the SUMMARY tables below (section 2).

N2X 5.3 GHz NII Radio		CHANNEL 1 -	
Date: 6/24/99	26 dB BW(1MHz) =	5.2608 GHz	12.63
File Name: 6.3MHzSET01	PTP Limit=	22.01	22.01
Tested By: Suresh	Antenna gain (dB) =	17.5	17.5
RRW= 1 MHz	Ant. gain - 6dB(dB) =	11.5	11.5
VSWR: 30:1 Hz	PTP Limit - Ant. Gain(dB) =	16.51	16.51
Span: 1 MHz			
FREQUENCY Analyzer Readings (GHz)		POWER OUT	
5.2508	36.83	Peak (mW)	0.000
5.2518	39.37	0.000	0.000
5.2528	31.62	0.000	0.001
5.2538	39.33	0.013	0.013
5.2548	39.80	0.147	0.147
5.2558	4.33	0.689	0.689
5.2568	1.42	1.073	1.073
5.2578	9.33	1.398	1.398
5.2588	1.33	1.259	1.259
5.2598	1.00	1.778	1.778
5.2608	2.56	1.393	1.393
5.2618	1.44	1.211	1.211
5.2628	8.83	0.962	0.962
5.2638	4.17	0.562	0.562
5.2648	2.56	0.117	0.117
5.2658	9.33	0.008	0.008
5.2668	29.83	0.001	0.001
5.2678	32.80	0.000	0.000
5.2688	36.87	0.000	0.000
5.2698	49.83	0.000	0.000
5.2708	38.80	0.000	0.000
		0.00	0.00
		16.58	16.58
Insertion Loss (dB) =		Correction Factor =	
			2.600
SUMMARY MODEL: 6.5 DFPS.5-32		DELTA	
PLAT PAIR:	Measurement	Limits	
PTP (mW)	1.15	22.00	-20.85
PTP (dBm)	-1.99	-0.10	-1.89
ERP (dBm)	26.51	27.00	-0.89

Notes: The above measurements made at the Highest Output Power setting w/lowest antenna gain.
Please refer to Chart PTP.1.0 for best results for other Antenna configurations.

Two things needs to be entered here. The 20 dB Bandwidth in MHz and the gain for the specific Antenna being investigated. It will make the adjustments to the actual calculated value, if required.

Peak Power Measurement is were taken with a Peak Power Meter, for reference only.

The last column on the right hand side of the Antenna Summary (sec 2) titled "DELTA" takes the measurement and compares the reading to the referenced specification. The values are in reference to limits. This data is transferred and stored in the next in the section where it is placed in the allocated table based on the power setting which the measurement was recorded.

2 Antenna Summary

With the table above, after the "raw data" has been entered in the middle column for each of the Power settings. Based on the entered 26 dB bandwidth measurement and the power level, the program will do the calculations for that particular power output and the antenna gain, and then stores the results in the far right column titled "DELTA".

This is actually a "measurement versus limit" or specification. The tables have already been configured for the applicable antenna gain in dB. The program calculates the difference and posts the data accordingly.

The data is traceable by color as well, if a colored copy can be made available or via a colored computer monitor.

- SSP2-52A [Red] High Power Setting
- DFPS.5-32 [Blue] Low Power Setting
- DFPS1-52 [Green] Low/Medium Setting
- DFPS 2-52 [Yellow] High/Medium Setting

SUMMARY MODEL: 6.5P2-52A		DELTA	
PARABOLIC	Measurement	Limits	
PTP (mW)	10.58	22.00	-11.44
PTP (dBm)	7.64	-0.06	7.73
ERP (dBm)	29.74	27.00	2.74

SUMMARY MODEL: DFPS.5-32		DELTA	
PLAT PAIR	Measurement	Limits	
PTP (mW)	5.45	22.00	-16.55
PTP (dBm)	4.76	-0.10	4.87
ERP (dBm)	32.86	27.00	5.86

SUMMARY MODEL: DFPS1-52		DELTA	
PLAT PAIR	Measurement	Limits	
PTP (mW)	2.65	21.98	-19.33
PTP (dBm)	1.63	-0.12	1.75
ERP (dBm)	29.73	27.00	2.73

SUMMARY MODEL: DFPS 2-52		DELTA	
PLAT PAIR	Measurement	Limits	
PTP (mW)	1.15	22.00	-20.85
PTP (dBm)	-1.99	-0.10	-1.89
ERP (dBm)	26.51	27.00	-0.89

DATA COLLECTION

CHANNEL REFERENCE TABLES

3

SWITCH SET Summary

26 dB Bandwidth measurement is recorded and entered in both tables, the "NI Worksheet" and the "SWITCH SET Summary" require that this be entered manually. This is how the "subset tables" get set up with the appropriate tracking to the allocated cells for the transfer of information.

After the "Raw Readings" are have been inserted in the "NI worksheet" and has made the conversion to a value, in milliwatts, at the bottom of that column, place that value in the applicable cell based on the power level and the Switch setting.

Parabolic Antenna SSP2-52A

5.3 GHz

POWER SWITCH SET

26 dB BW/MHz

PTP Limit

Antenna Gain (dBi)

Att. Gain - 5dB(dB)

PTP Limit - Att. Gain(dB)

SW 1

SW 2

SW 3

SW 4

CHANNEL 1

Reference Table

SW 1

SW 2

SW 3

SW 4

SW 1

SW 2

SUMMARY OF MEASUREMENTS

6

FINAL SUMMARY TABLE

FINAL CALCULATED MEASUREMENTS

EXAMPLE

FAILING RESULTS		
-19.33	-1.75	-2.73
PASSING RESULTS	20.85	-0.99

After all the measurements have been taken and the "RAW" readings have been imported into the appropriate column on the "N1 Worksheet", section 1 of this document, the data has now been run through the calculations process and has been extrapolated for each of the four (4) antennas at each of the four(4) power settings. The data now needs to be compiled and this PTP Table 1 is what we come up with.

The table is divided into three sections representing the three (3) channels investigated for this submittal. The format of the data is configured differently than in the previous tables basically to encompass the entire data package for all the channels. It is displayed from the highest power setting to the lowest, where as, SW1 using the highest and SW4 being the lowest output power for Channels 1, 5 and 8. The antennas were configured in a similar fashion with the highest gain antenna at the top of each of the sections representing 1 of the 3 channels. The data has been compiled so that a each antenna has its own table. Formating the results in a "Antenna specific" type of arrangement. A different format than what was previously displayed but helpful to see the correlation between the various power levels and the different antenna gain(s).

Refer to Appendix C and D for the final results and the selection of the antennas, specifically being submitted for certification at this time.

PTP TABLE 1

WIRELESS, INC.

N2-X

5.3 GHz CHANNEL 1

Parabolic		SSP2-52A	SW 1	SW 2	SW 3	SW 4	RESULTS
DATA	RESULTS	Initial (mW)	-11.44	-16.65	-19.33	-20.86	SW4 TOTAL PASS
VERSUS	VERSUS	Initial (mW)	7.73	4.87	1.75	-1.89	
LIMIT	LIMIT	Initial (mW)	-7.95	5.95	2.73	-0.99	
Flat Panel		DFPD2-52	SW 1	SW 2	SW 3	SW 4	SW4 TOTAL PASS
DATA	RESULTS	Initial (mW)	-11.43	-16.65	-19.33	-20.86	
VERSUS	VERSUS	Initial (mW)	7.12	4.27	1.16	-2.49	
LIMIT	LIMIT	Initial (mW)	8.14	5.26	2.13	-1.45	
Flat Panel		DFPD1-52	SW 1	SW 2	SW 3	SW 4	SW3 TOTAL PASS
DATA	RESULTS	Initial (mW)	-11.43	-16.65	-19.33	-20.86	
VERSUS	VERSUS	Initial (mW)	2.63	-0.23	-3.35	-4.49	
LIMIT	LIMIT	Initial (mW)	3.64	6.76	-2.37	-1.45	
Flat Panel		DFPS5-52	SW 1	SW 2	SW 3	SW 4	SW1 TOTAL PASS
DATA	RESULTS	Initial (mW)	-11.43	-16.65	-19.33	-20.86	
VERSUS	VERSUS	Initial (mW)	-0.87	-5.73	-8.85	-12.49	
LIMIT	LIMIT	Initial (mW)	-1.95	4.74	-25.37	-28.99	

(+) below LIMIT (-) above LIMIT

5.3 GHz CHANNEL 5

Parabolic		SSP2-52A	SW 1	SW 2	SW 3	SW 4	RESULTS
DATA	RESULTS	Initial (mW)	-10.41	-15.80	-19.35	-20.87	SW4 TOTAL PASS
VERSUS	VERSUS	Initial (mW)	8.11	5.41	2.01	-1.78	
LIMIT	LIMIT	Initial (mW)	3.16	6.47	3.09	-0.71	
Flat Panel		DFPD2-52	SW 1	SW 2	SW 3	SW 4	SW4 TOTAL PASS
DATA	RESULTS	Initial (mW)	-10.42	-15.80	-19.35	-20.87	
VERSUS	VERSUS	Initial (mW)	7.56	4.81	1.41	-2.38	
LIMIT	LIMIT	Initial (mW)	8.56	5.87	2.49	-1.31	
Flat Panel		DFPD1-52	SW 1	SW 2	SW 3	SW 4	SW3 TOTAL PASS
DATA	RESULTS	Initial (mW)	-10.42	-15.80	-19.35	-20.87	
VERSUS	VERSUS	Initial (mW)	3.00	0.31	-0.66	-2.38	
LIMIT	LIMIT	Initial (mW)	4.06	1.37	-2.01	-1.31	
Flat Panel		DFPS5-52	SW 1	SW 2	SW 3	SW 4	SW1 TOTAL PASS
DATA	RESULTS	Initial (mW)	-10.42	-15.80	-19.35	-20.87	
VERSUS	VERSUS	Initial (mW)	-2.59	-5.19	-8.59	-12.38	
LIMIT	LIMIT	Initial (mW)	-1.44	4.12	-25.01	-28.81	

(+) below LIMIT (-) above LIMIT

5.3 GHz CHANNEL 8

Parabolic		SSP2-52A	SW 1	SW 2	SW 3	SW 4	RESULTS
DATA	RESULTS	Initial (mW)	-12.00	-18.13	-19.84	-21.50	SW4 TOTAL PASS
VERSUS	VERSUS	Initial (mW)	7.28	5.05	1.54	-2.23	
LIMIT	LIMIT	Initial (mW)	2.66	6.53	3.00	-0.74	
Flat Panel		DFPD2-52	SW 1	SW 2	SW 3	SW 4	SW4 TOTAL PASS
DATA	RESULTS	Initial (mW)	-11.99	-16.13	-19.64	-21.50	
VERSUS	VERSUS	Initial (mW)	6.88	4.45	0.94	-2.83	
LIMIT	LIMIT	Initial (mW)	8.97	5.53	2.40	-1.34	
Flat Panel		DFPD1-52	SW 1	SW 2	SW 3	SW 4	SW3 TOTAL PASS
DATA	RESULTS	Initial (mW)	-11.99	-16.13	-19.64	-21.50	
VERSUS	VERSUS	Initial (mW)	2.18	-0.05	-3.56	-2.83	
LIMIT	LIMIT	Initial (mW)	3.57	1.43	-2.10	-1.34	
Flat Panel		DFPS5-52	SW 1	SW 2	SW 3	SW 4	SW1 TOTAL PASS
DATA	RESULTS	Initial (mW)	-11.99	-16.13	-19.64	-21.50	
VERSUS	VERSUS	Initial (mW)	-0.32	-5.55	-8.06	-12.83	
LIMIT	LIMIT	Initial (mW)	-1.93	4.07	-25.10	-28.84	

(+) below LIMIT (-) above LIMIT

This is just a SAMPLE of the table for "proof of concept" purposes only.

On the Final Data submittal, the column on the right will specify which antennas are to be considered for Certification and for what power levels we would like the Grant to include.

SUMMARY OF MEASUREMENTS

7

TABLES USED FOR FINAL DATA

5.3 "RAW" Data

CHANNEL 1

UWB BAND		FINAL DATA			5.3 GHz Channel 1			5.3 GHz Date: 8/25	
SW(16-21)	12.63	12.58	12.54	12.58	12.60	12.60	12.60	REV. C	8/25/05
SW(16)	Fx (W)	Px (mW)	Px (mW)	Px (mW)	Px (W)	Px (mW)	Px (mW)	Fx (mW)	
SW(16)	0.690	44.90	0.069	44.90	0.690	44.90	0.690	0.690	
SW(17)	0.690	44.90	0.069	44.90	0.690	44.90	0.690	0.690	
SW(18)	0.690	44.90	0.069	44.90	0.690	44.90	0.690	0.690	
SW(19)	0.691	34.81	0.069	34.81	0.690	42.33	0.690		
SW(20)	0.615	22.90	0.066	22.90	0.693	38.83	0.691		
SW(21)	0.615	22.90	0.066	22.90	0.693	38.83	0.691		
SW(22)	0.647	11.71	0.074	11.71	0.637	46.06	0.618		
SW(23)	0.689	4.96	0.389	4.96	0.179	41.06	0.079		
SW(24)	0.679	2.06	0.562	2.06	0.282	4.17	0.121		
SW(25)	1.258	1.55	0.708	1.258	0.348	4.17	0.152		
SW(26)	1.259	1.55	0.655	1.259	0.316	4.17	0.141		
SW(27)	1.276	0.30	0.937	1.276	0.430	4.17	0.171		
SW(28)	1.44	1.292	0.058	1.44	0.216	4.17	0.141		
SW(29)	0.803	1.211	0.061	0.803	0.398	4.17	0.138		
SW(30)	0.617	0.642	0.051	0.617	0.261	4.33	0.117		
SW(31)	0.682	0.38	0.293	0.682	0.141	41.06	0.063		
SW(32)	0.611	12.32	0.089	12.32	0.826	16.84	0.013		
SW(33)	0.698	24.11	0.064	27.89	0.892	30.83	0.061		
SW(34)	0.691	34.30	0.069	36.89	0.890	42.83	0.069		
SW(35)	0.690	41.81	0.069	44.59	0.890	47.56	0.069		
SW(36)	0.690	45.11	0.069	46.17	0.890	48.15	0.069		
SW(37)	0.690	42.82	0.069	45.67	0.890	49.83	0.069		
PTOTAL	343	10.58	416.32	5.45	389.51	2.85	562	5.15	

FREQUENCY TABLE									
5.2908	5.3007	5.3104					5.7756	5.7758	5.7855
5.2909	5.3008	5.3105					5.7757	5.7759	5.7856
5.2910	5.3009	5.3106					5.7758	5.7760	5.7857
5.2911	5.3010	5.3107					5.7759	5.7761	5.7858
5.2912	5.3011	5.3108					5.7760	5.7762	5.7859
5.2913	5.3012	5.3109					5.7761	5.7763	5.7860
5.2914	5.3013	5.3110					5.7762	5.7764	5.7861
5.2915	5.3014	5.3111					5.7763	5.7765	5.7862
5.2916	5.3015	5.3112					5.7764	5.7766	5.7863
5.2917	5.3016	5.3113					5.7765	5.7767	5.7864
5.2918	5.3017	5.3114					5.7766	5.7768	5.7865
5.2919	5.3018	5.3115					5.7767	5.7769	5.7866
5.2920	5.3019	5.3116					5.7768	5.7770	5.7867
5.2921	5.3020	5.3117					5.7769	5.7771	5.7868
5.2922	5.3021	5.3118					5.7770	5.7772	5.7869
5.2923	5.3022	5.3119					5.7771	5.7773	5.7870
5.2924	5.3023	5.3120					5.7772	5.7774	5.7871
5.2925	5.3024	5.3121					5.7773	5.7775	5.7872
5.2926	5.3025	5.3122					5.7774	5.7776	5.7873
5.2927	5.3026	5.3123					5.7775	5.7777	5.7874
5.2928	5.3027	5.3124					5.7776	5.7778	5.7875
5.2929	5.3028	5.3125					5.7777	5.7779	5.7876
5.2930	5.3029	5.3126					5.7778	5.7780	5.7877
5.2931	5.3030	5.3127					5.7779	5.7781	5.7878
5.2932	5.3031	5.3128					5.7780	5.7782	5.7879
5.2933	5.3032	5.3129					5.7781	5.7783	5.7880
5.2934	5.3033	5.3130					5.7782	5.7784	5.7881
5.2935	5.3034	5.3131					5.7783	5.7785	5.7882
5.2936	5.3035	5.3132					5.7784	5.7786	5.7883
5.2937	5.3036	5.3133					5.7785	5.7787	5.7884
5.2938	5.3037	5.3134					5.7786	5.7788	5.7885
5.2939	5.3038	5.3135					5.7787	5.7789	5.7886
5.2940	5.3039	5.3136					5.7788	5.7790	5.7887
5.2941	5.3040	5.3137					5.7789	5.7791	5.7888
5.2942	5.3041	5.3138					5.7790	5.7792	5.7889
5.2943	5.3042	5.3139					5.7791	5.7793	5.7890
5.2944	5.3043	5.3140					5.7792	5.7794	5.7891
5.2945	5.3044	5.3141					5.7793	5.7795	5.7892
5.2946	5.3045	5.3142					5.7794	5.7796	5.7893
5.2947	5.3046	5.3143					5.7795	5.7797	5.7894
5.2948	5.3047	5.3144					5.7796	5.7798	5.7895
5.2949	5.3048	5.3145					5.7797	5.7799	5.7896
5.2950	5.3049	5.3146					5.7798	5.7800	5.7897
5.2951	5.3050	5.3147					5.7799	5.7801	5.7898
5.2952	5.3051	5.3148					5.7800	5.7802	5.7899
5.2953	5.3052	5.3149					5.7801	5.7803	5.7900
5.2954	5.3053	5.3150					5.7802	5.7804	5.7901
5.2955	5.3054	5.3151					5.7803	5.7805	5.7902
5.2956	5.3055	5.3152					5.7804	5.7806	5.7903
5.2957	5.3056	5.3153					5.7805	5.7807	5.7904
5.2958	5.3057	5.3154					5.7806	5.7808	5.7905
5.2959	5.3058	5.3155					5.7807	5.7809	5.7906
5.2960	5.3059	5.3156					5.7808	5.7810	5.7907
5.2961	5.3060	5.3157					5.7809	5.7811	5.7908
5.2962	5.3061	5.3158					5.7810	5.7812	5.7909
5.2963	5.3062	5.3159					5.7811	5.7813	5.7910
5.2964	5.3063	5.3160					5.7812	5.7814	5.7911
5.2965	5.3064	5.3161					5.7813	5.7815	5.7912
5.2966	5.3065	5.3162					5.7814	5.7816	5.7913
5.2967	5.3066	5.3163					5.7815	5.7817	5.7914
5.2968	5.3067	5.3164					5.7816	5.7818	5.7915
5.2969	5.3068	5.3165					5.7817	5.7819	5.7916
5.2970	5.3069	5.3166					5.7818	5.7820	5.7917
5.2971	5.3070	5.3167					5.7819	5.7821	5.7918
5.2972	5.3071	5.3168					5.7820	5.7822	5.7919
5.2973	5.3072	5.3169					5.7821	5.7823	5.7920
5.2974	5.3073	5.3170					5.7822	5.7824	5.7921
5.2975	5.3074	5.3171					5.7823	5.7825	5.7922
5.2976	5.3075	5.3172					5.7824	5.7826	5.7923
5.2977	5.3076	5.3173					5.7825	5.7827	5.7924
5.2978	5.3077	5.3174					5.7826	5.7828	5.7925
5.2979	5.3078	5.3175					5.7827	5.7829	5.7926
5.2980	5.3079	5.3176					5.7828	5.7830	5.7927
5.2981	5.3080	5.3177					5.7829	5.7831	5.7928
5.2982	5.3081	5.3178					5.7830	5.7832	5.7929
5.2983	5.3082	5.3179					5.7831	5.7833	5.7930
5.2984	5.3083	5.3180					5.7832	5.7834	5.7931
5.2985	5.3084	5.3181					5.7833	5.7835	5.7932
5.2986	5.3085	5.3182					5.7834	5.7836	5.7933
5.2987	5.3086	5.3183					5.7835	5.7837	5.7934
5.2988	5.3087	5.3184					5.7836	5.7838	5.7935
5.2989	5.3088	5.3185					5.7837	5.7839	5.7936
5.2990	5.3089	5.3186					5.7838	5.7840	5.7937
5.2991	5.3090	5.3187					5.7839	5.7841	5.7938
5.2992	5.3091	5.3188					5.7840	5.7842	5.7939
5.2993	5.3092	5.3189					5.7841	5.7843	5.7940
5.2994	5.3093	5.3190					5.7842	5.7844	5.7941
5.2995	5.3094	5.3191					5.7843	5.7845	5.7942
5.2996	5.3095	5.3192					5.7844	5.7846	5.7943
5.2997	5.3096	5.3193					5.7845	5.7847	5.7944
5.2998	5.3097	5.3194					5.7846	5.7848	5.7945
5.2999	5.3098	5.3195					5.7847	5.7849	5.7946
5.3000	5.3099	5.3196					5.7848	5.7850	5.7947
5.3001	5.3100	5.3197					5.7849		

APPENDIX C

PEAK POWER MEASUREMENTS

SEE ATTACHED PDF FILE TITLED “APPENDIX C”

APPENDIX D

OUT OF BAND MEASUREMENTS PLOTS AND DATA

SEE ATTACHED PDF FILE TITLED "APPENDIX D"

Pout 5.2608 GHz

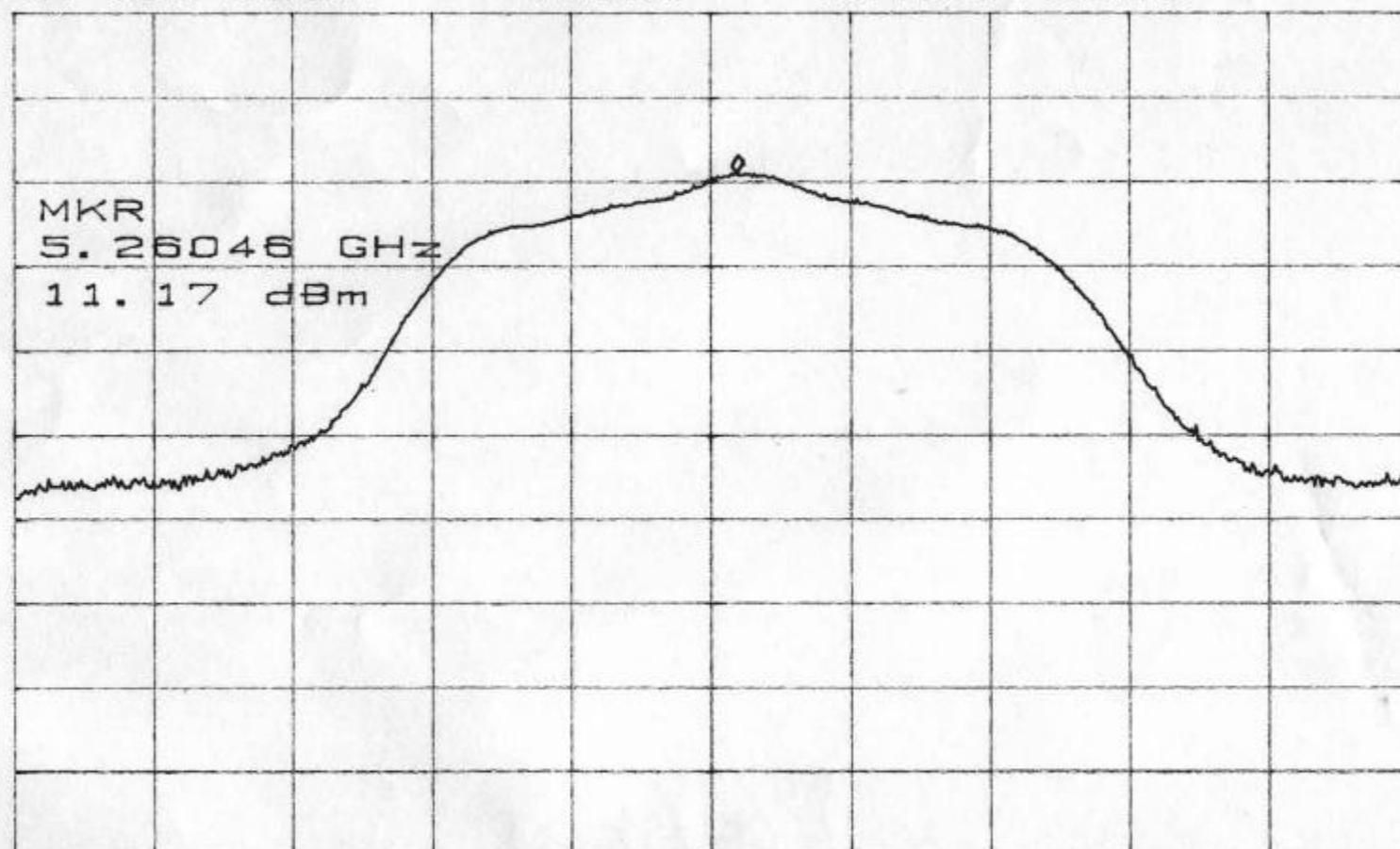
ATTEN 40dB

RL 30.0dBm

10dB/

MKR 11.17dBm

5.26046GHz



CENTER 5.26000GHz

*RBW 2.0MHz

VBW 3.0MHz

SPAN 25.00MHz

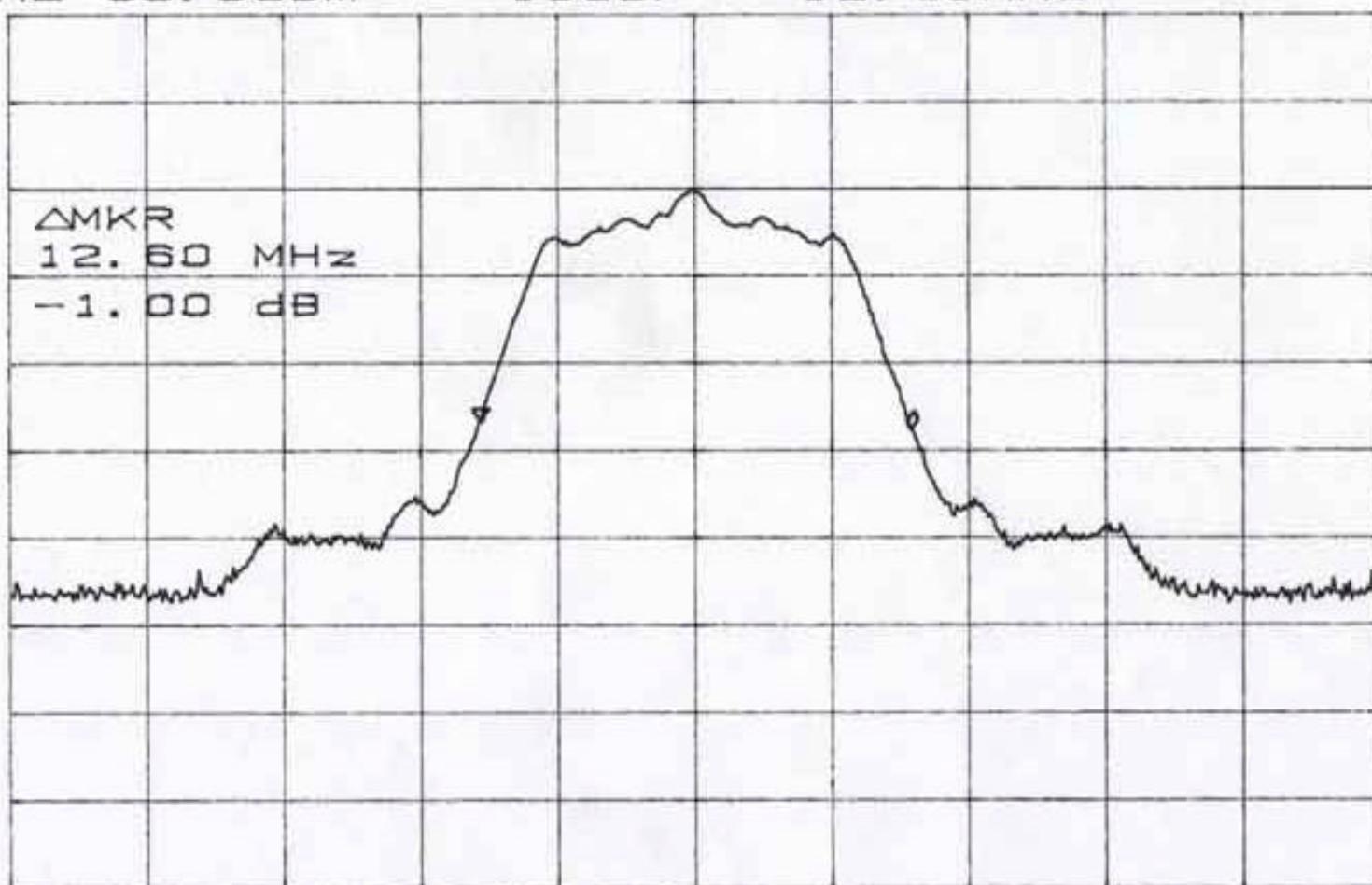
SWP 50.0ms

5.2608 GHz 26 dB Bandwidth

ATTEN 40dB
RL 30.0dBm

10dB/

ΔMKR -1.00dB
12.60MHz



CENTER 5. 260 BOGHN

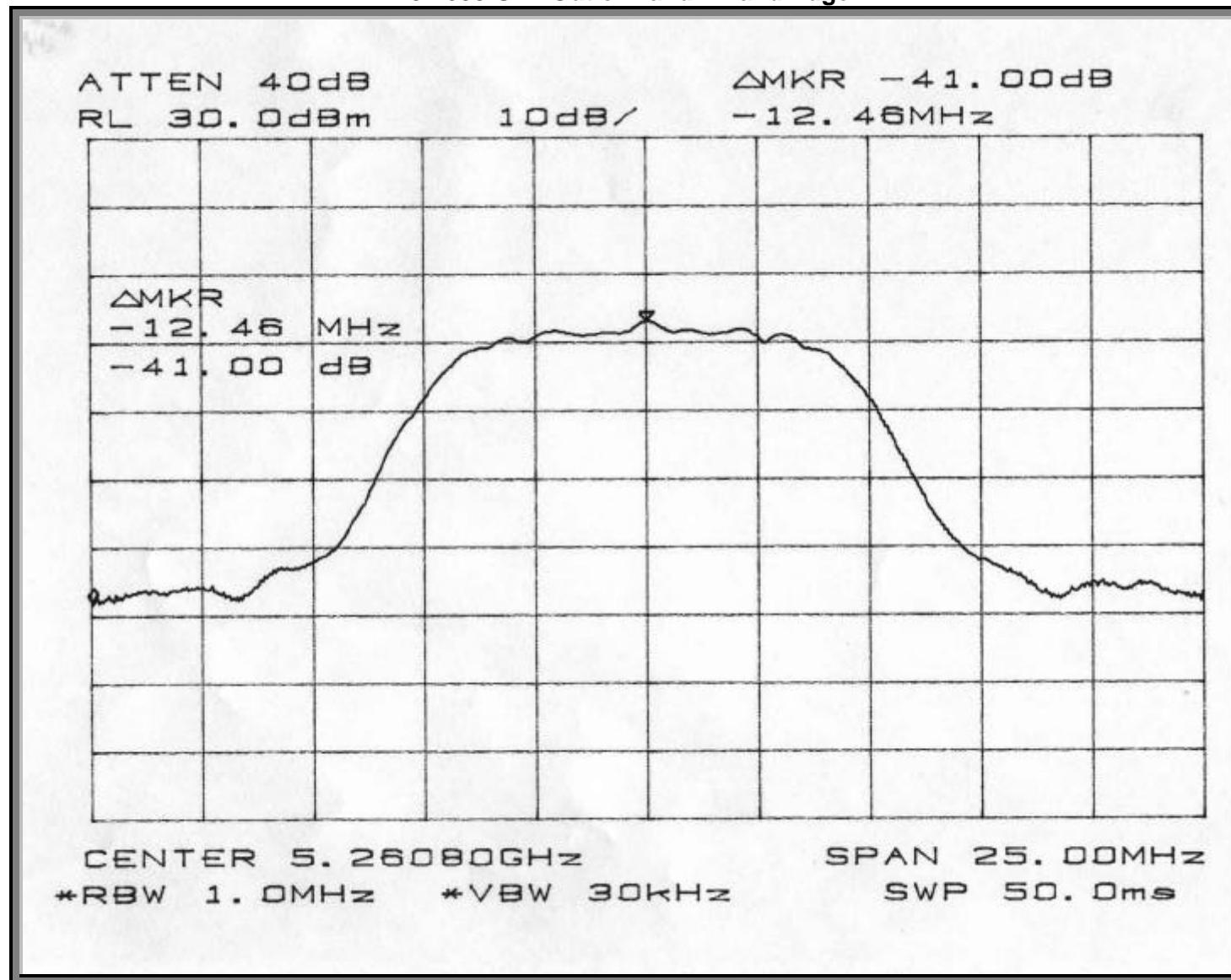
*RBW 1. OMHN

VBW 1.0MHz

SPAN 40.00MHz

SWP 50.0ms

5.2608 GHz Out of Band – Band Edge

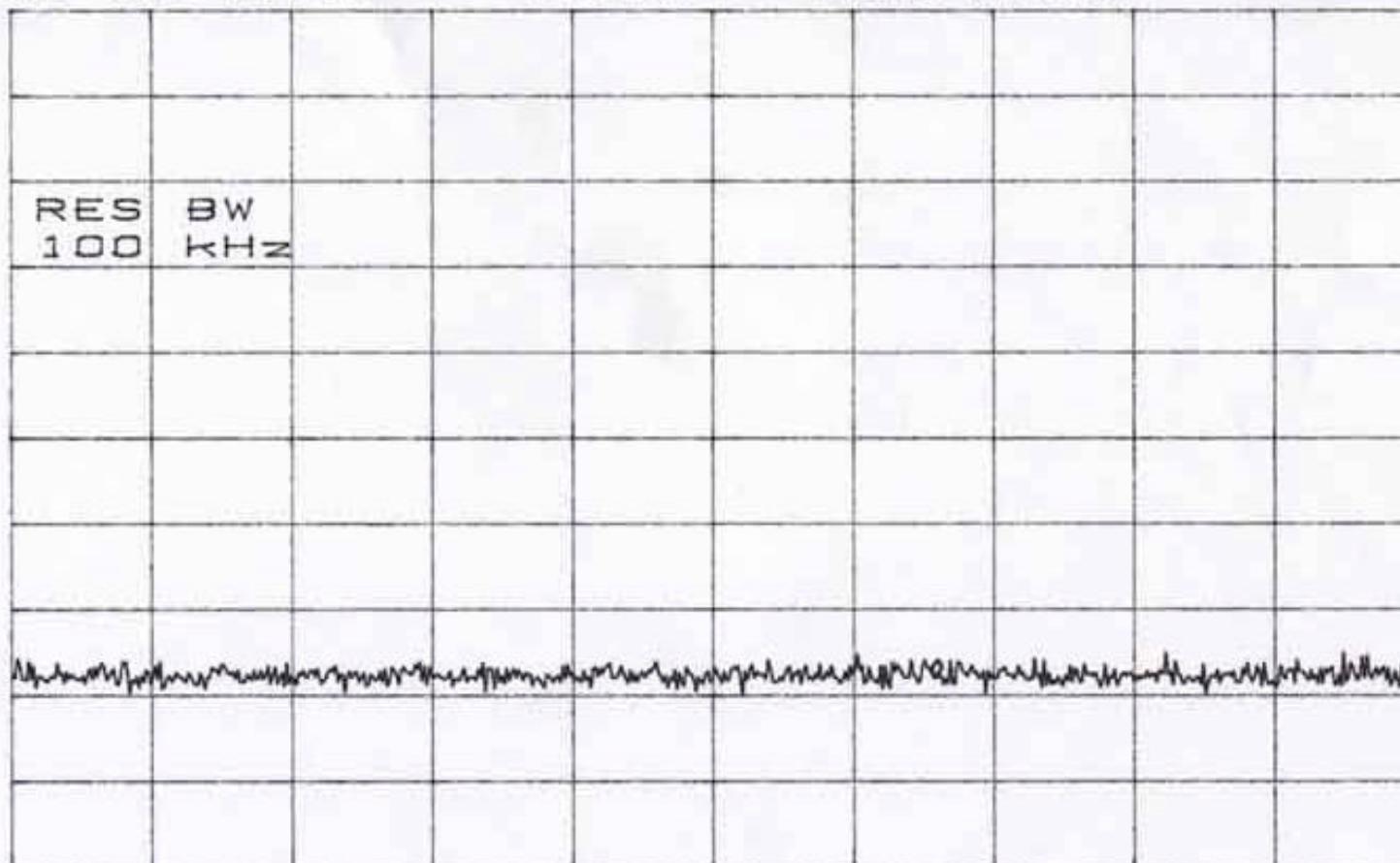


5.2608 GHz Out of Band 30 MHz to 1 GHz

ATTEN 40dB
RL 30. 0dBm

10dB/

MKR -47. 83dBm
668. 6MHz



START 30. 0MHz
*RBW 100kHz

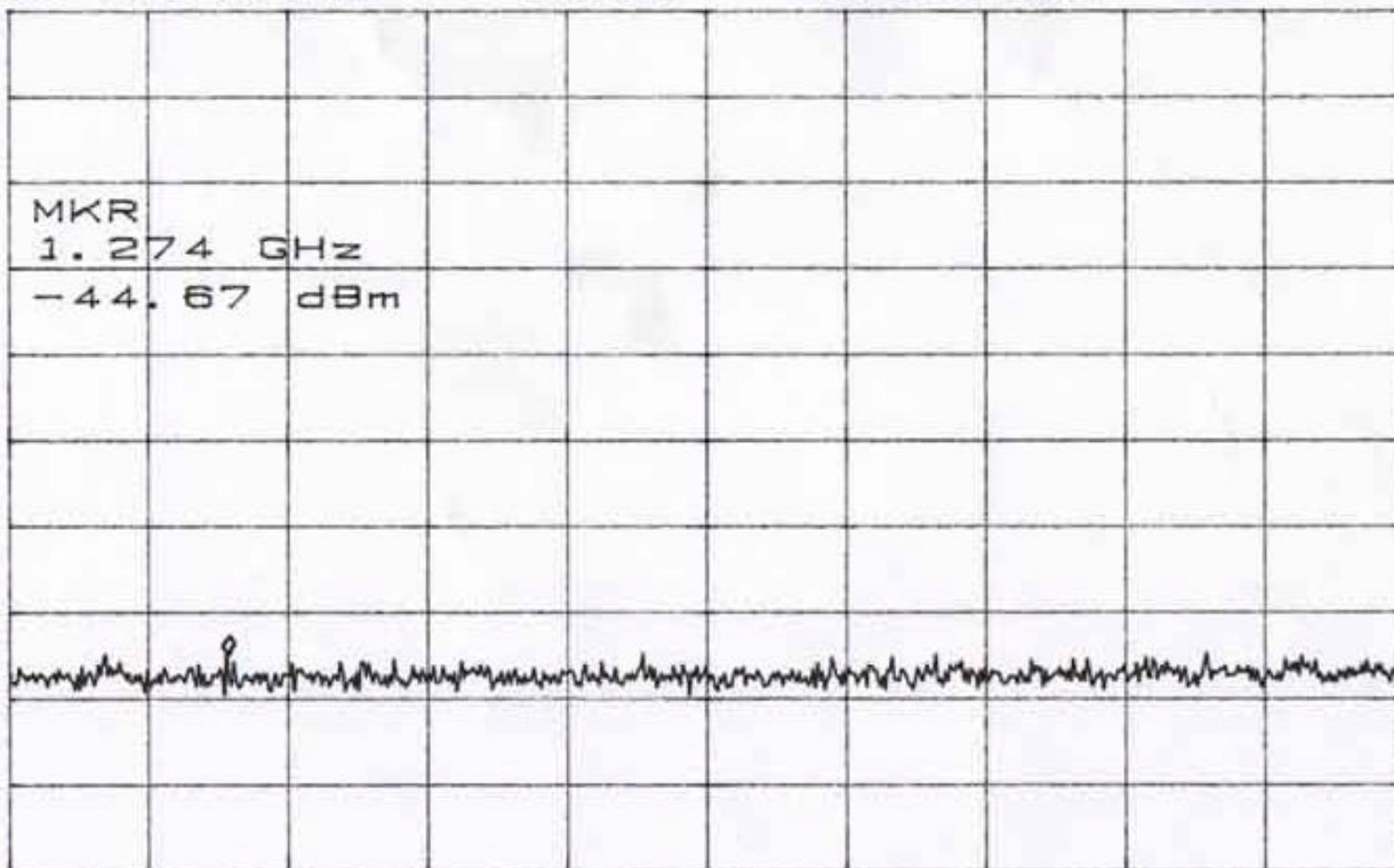
STOP 1. 0000GHz
VBW 100kHz
SWP 250ms

5.2608 GHz Out of Band 1 GHz to 2.75 GHz

ATTEN 40dB
RL 30.0dBm

10dB/

MKR -44.67dBm
1.274GHz



START 1.000GHz STOP 2.750GHz
*RBW 100kHz VBW 100kHz SWP 440ms

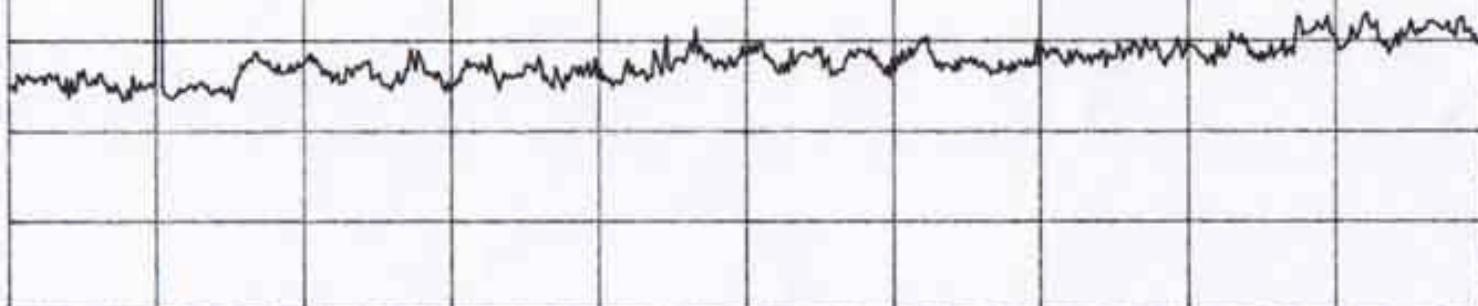
5.2608 GHz Out of Band 2.75 GHz to 26.5 GHz

ATTEN 40dB
RL 30.0dBm

10dB/

MKR 3.83dBm
5.20GHz

MKR
5. 20 GHz
3. 00 dB



START 2.75GHz

STOP 26. 50GHZ

*RBW 1991

VBW 100kHz

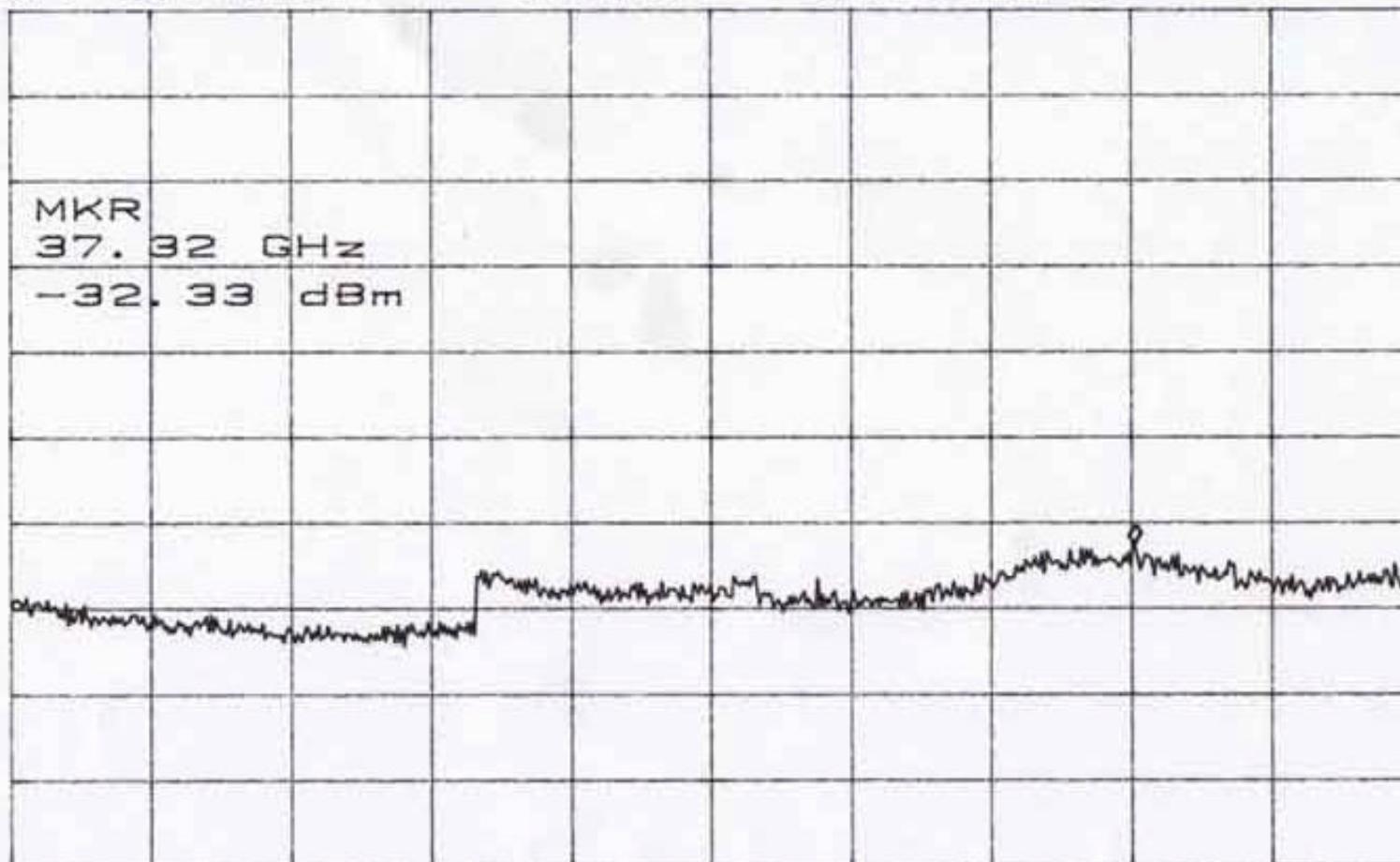
SWP 6.00sec

5.2608 GHz Out of Band 26.5 GHz to 40 GHz

ATTEN 40dB
RL 30. 0dBm

10dB/

MKR -32. 33dBm
37. 32GHz



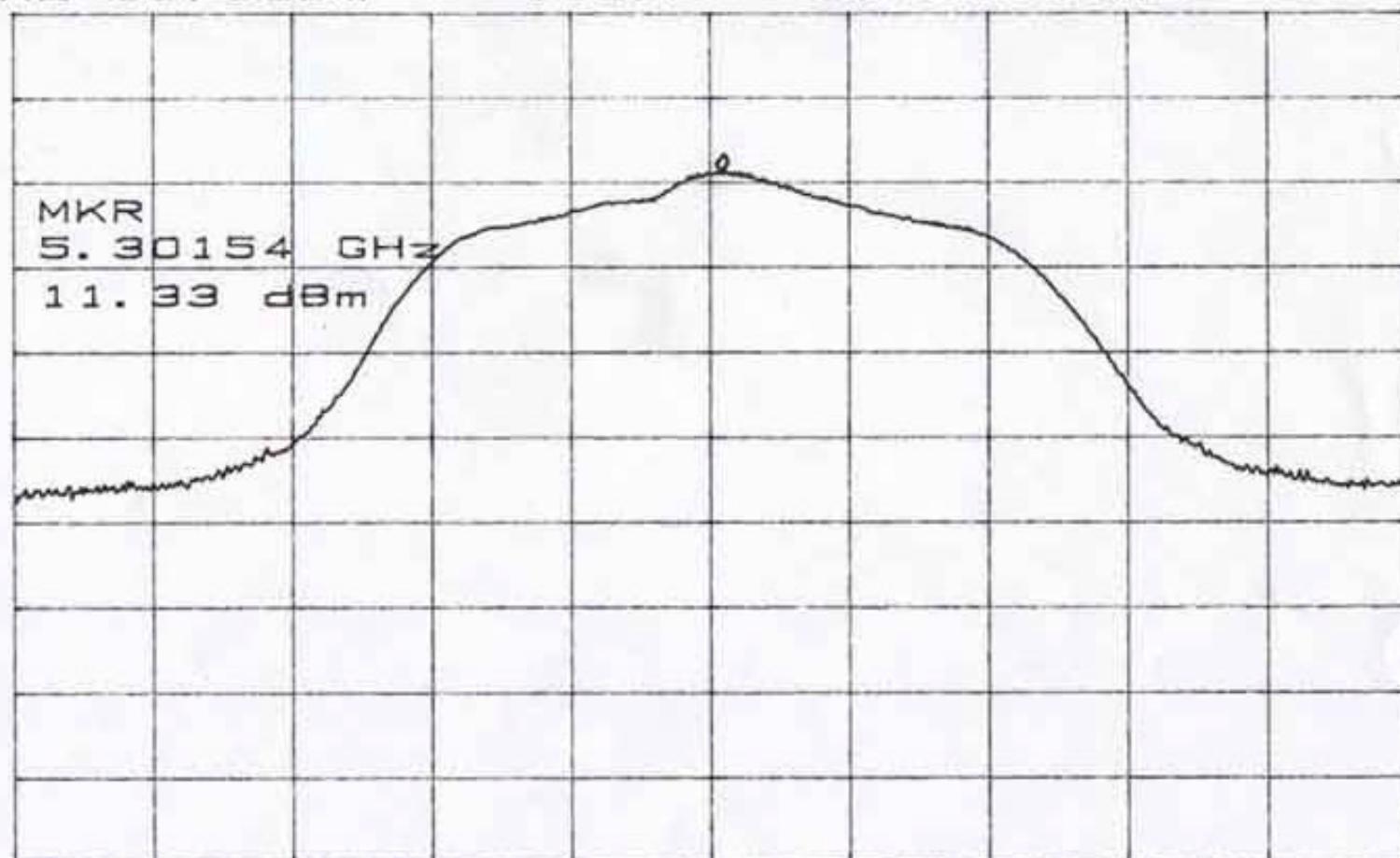
START 26. 50GHz STOP 40. 00GHz
*RBW 100kHz VBW 100kHz SWP 3. 40sec

Pout 5.3017 GHz

ATTEN 40dB
RL 30.0dBm

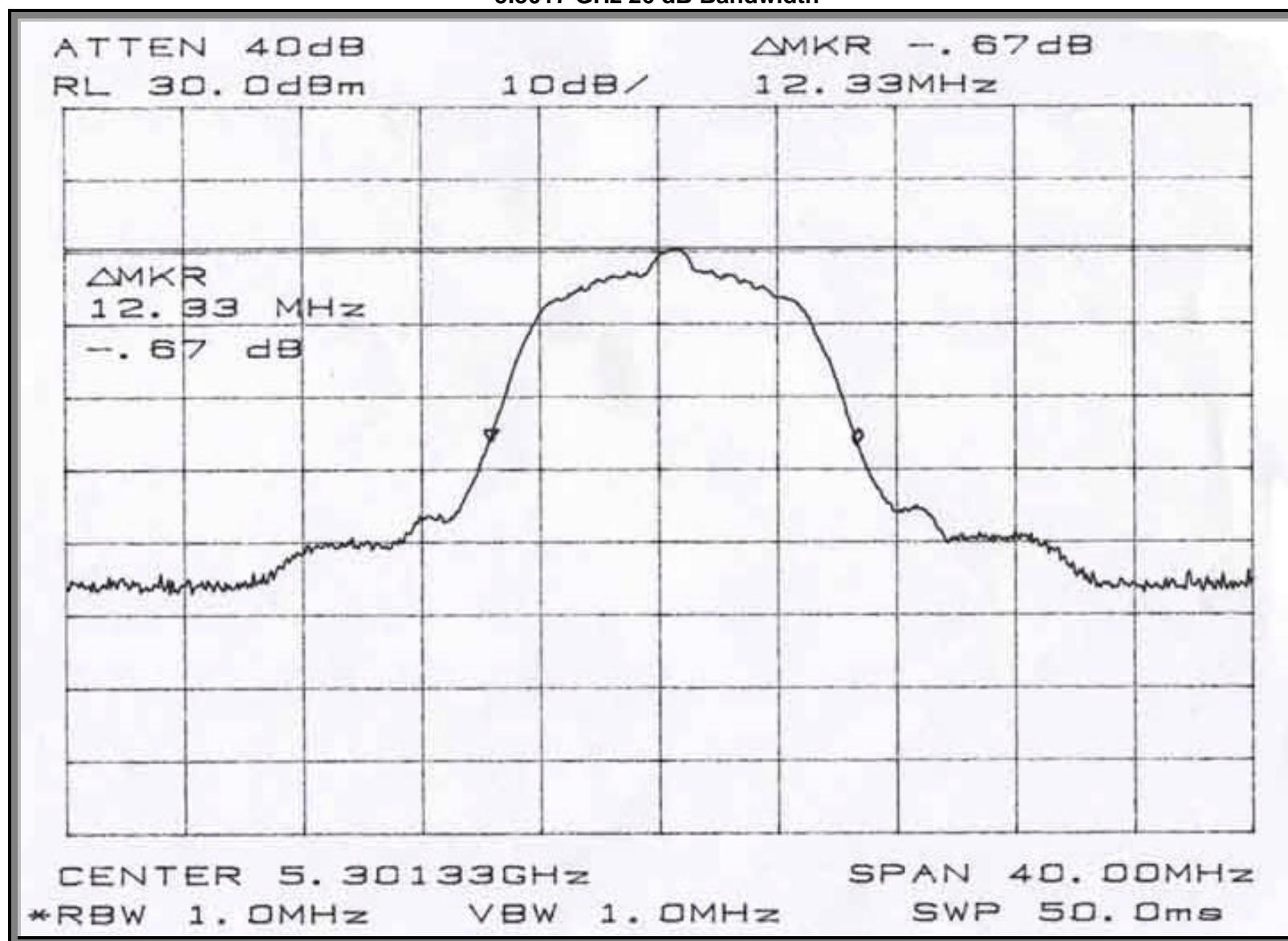
10dB/

MKR 11.33dBm
5.30154GHz



CENTER 5.30133GHz SPAN 25.00MHz
*RBW 2.0MHz VBW 3.0MHz SWP 50.0ms

5.3017 GHz 26 dB Bandwidth

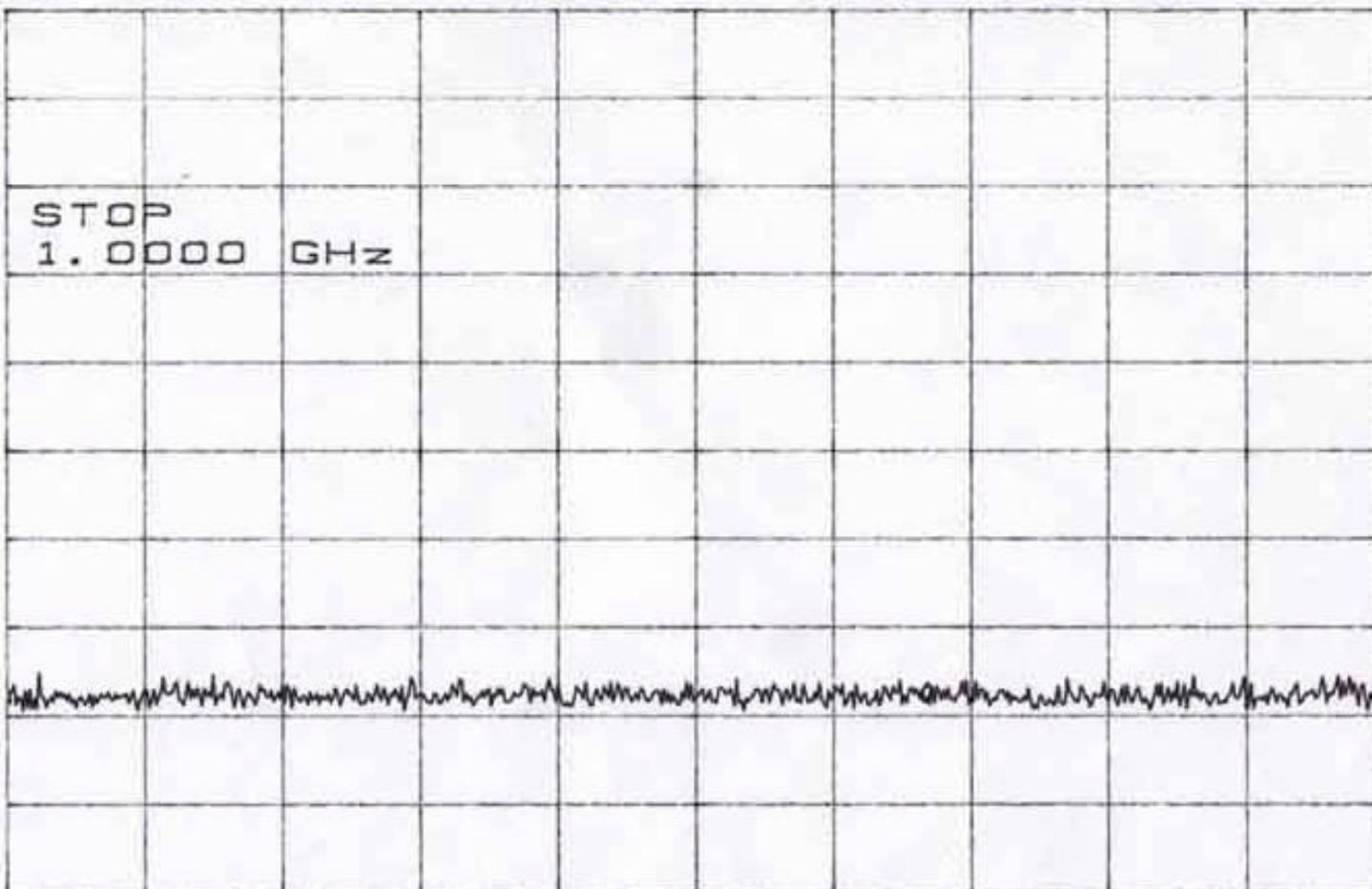


5.3017 GHz Out of Band 30 MHz to 1 GHz

ATTEN 40dB
RL 30.0dBm

10dB/

MKR -48.33dBm
676.7MHz



START 30.0MHz
*RBW 100kHz

STOP 1.0000GHz
VBW 100kHz

SWP 250ms

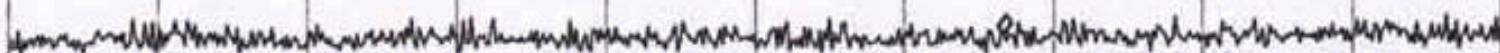
5.3017 GHz Out of Band 1 GHz to 2.75 GHz

ATTEN 40dB
RL 30.0dBm

10dB/

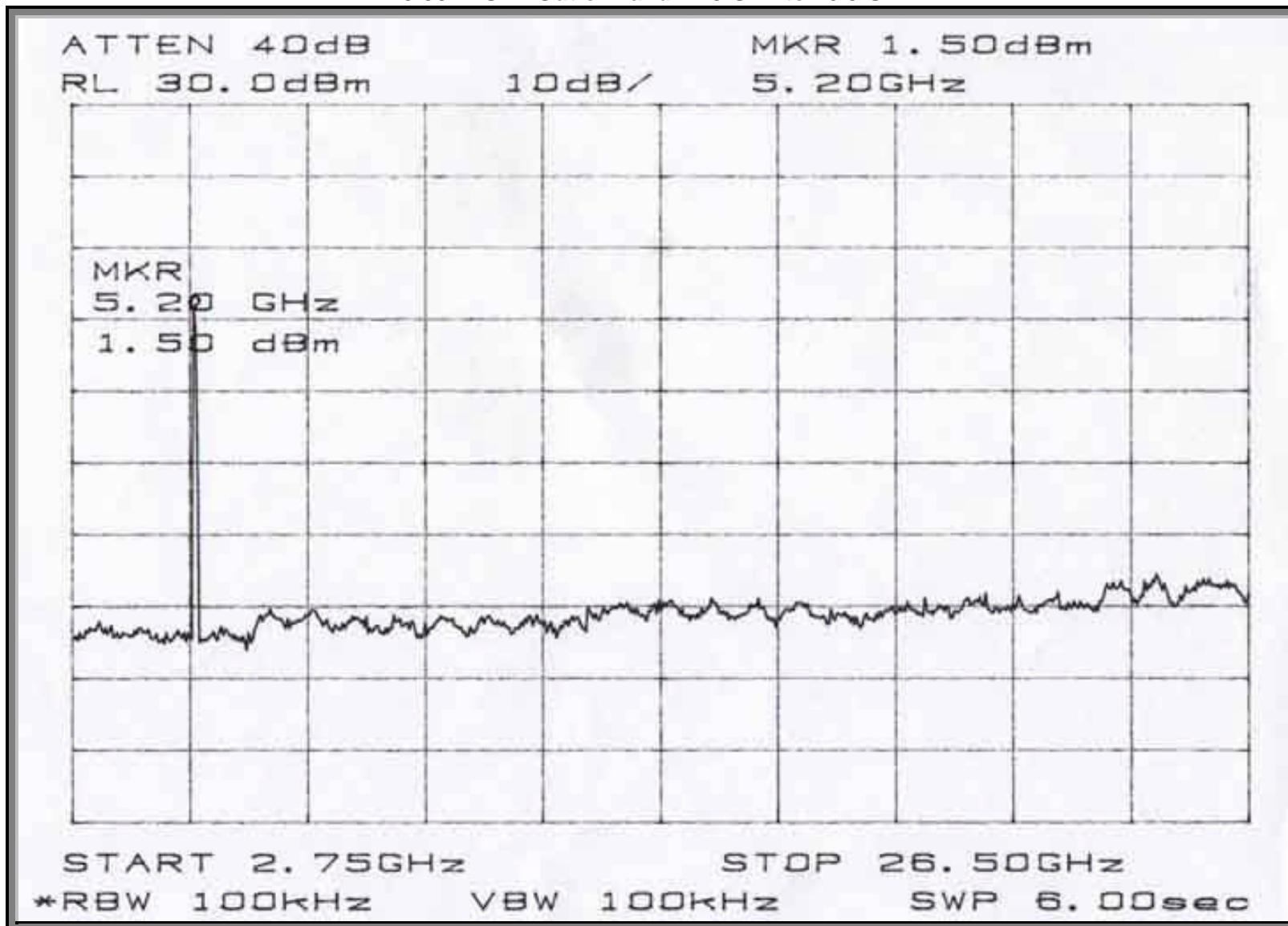
MKR -46.83dBm
2.167GHz

STOP
2.750 GHz



START 1.000GHz STOP 2.750GHz
*RBW 100kHz VBW 100kHz SWP 440ms

5.3017 GHz Out of Band 2.75 GHz to 26.5 GHz

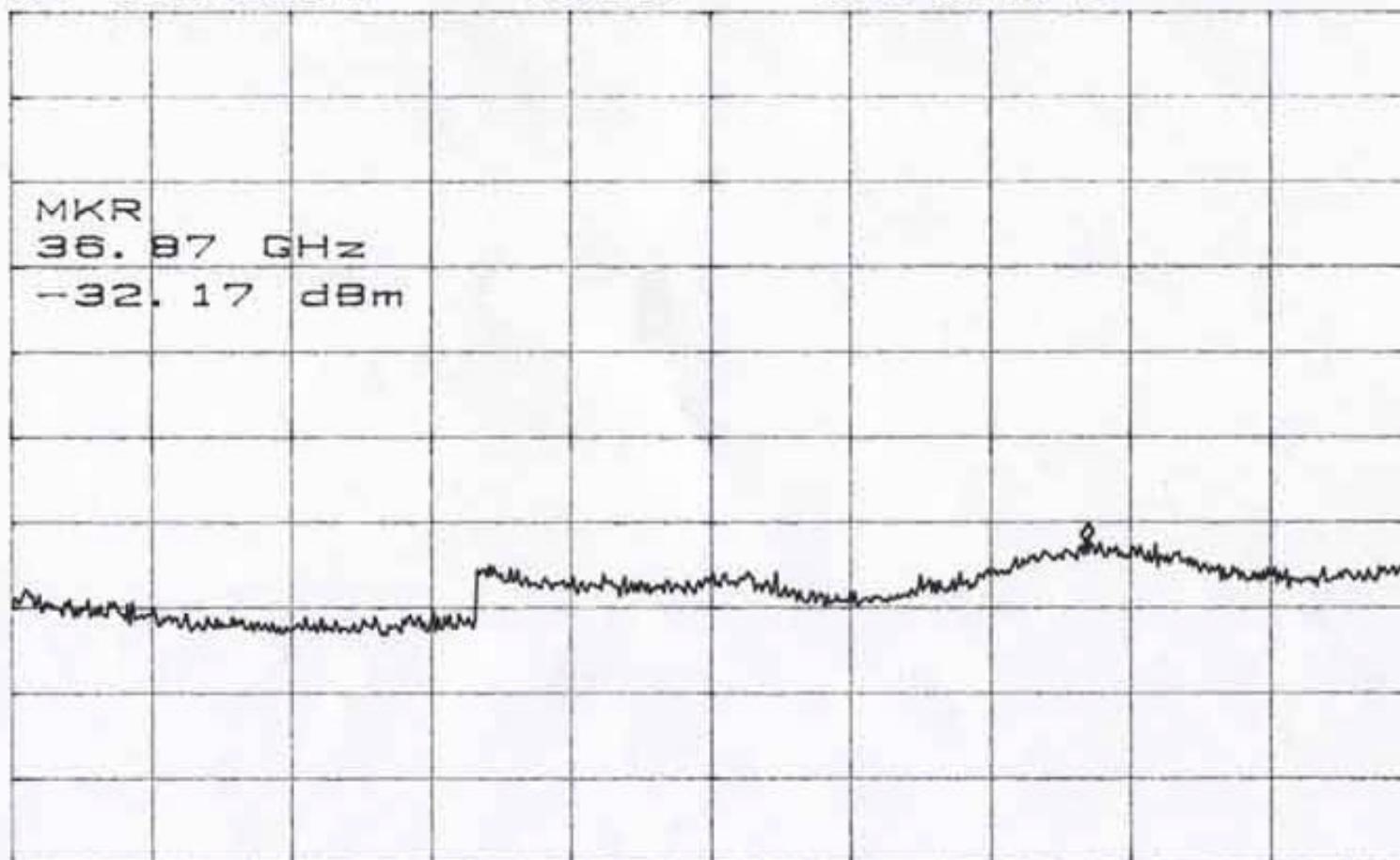


5.3017 GHz Out of Band 26.5 GHz to 40 GHz

ATTEN 40dB
RL 30. 0dBm

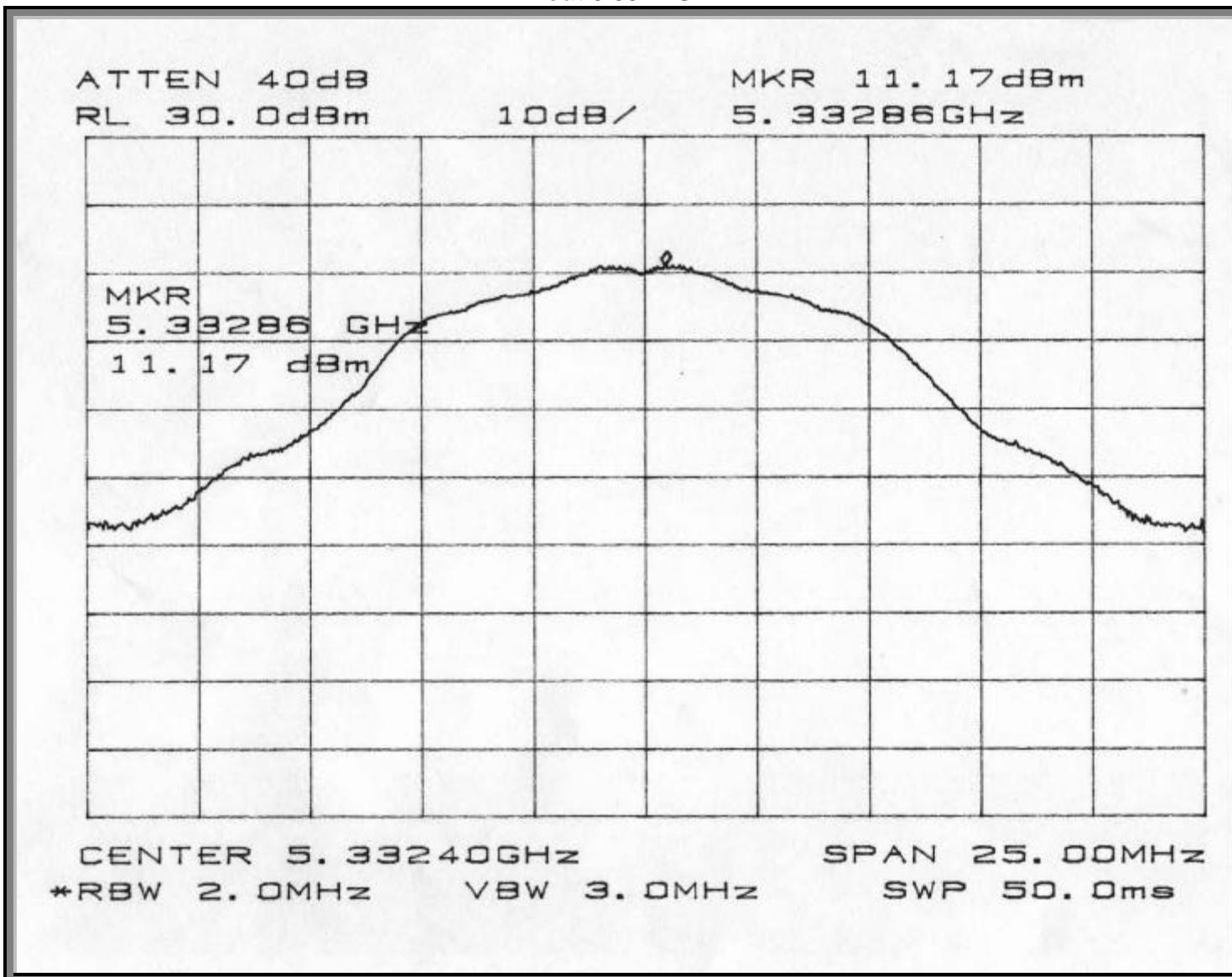
10dB/

MKR -32. 17dBm
36. 87GHz



START 26. 50GHz STOP 40. 00GHz
*RBW 100kHz VBW 100kHz SWP 3. 40sec

Pout 5.3377 GHz

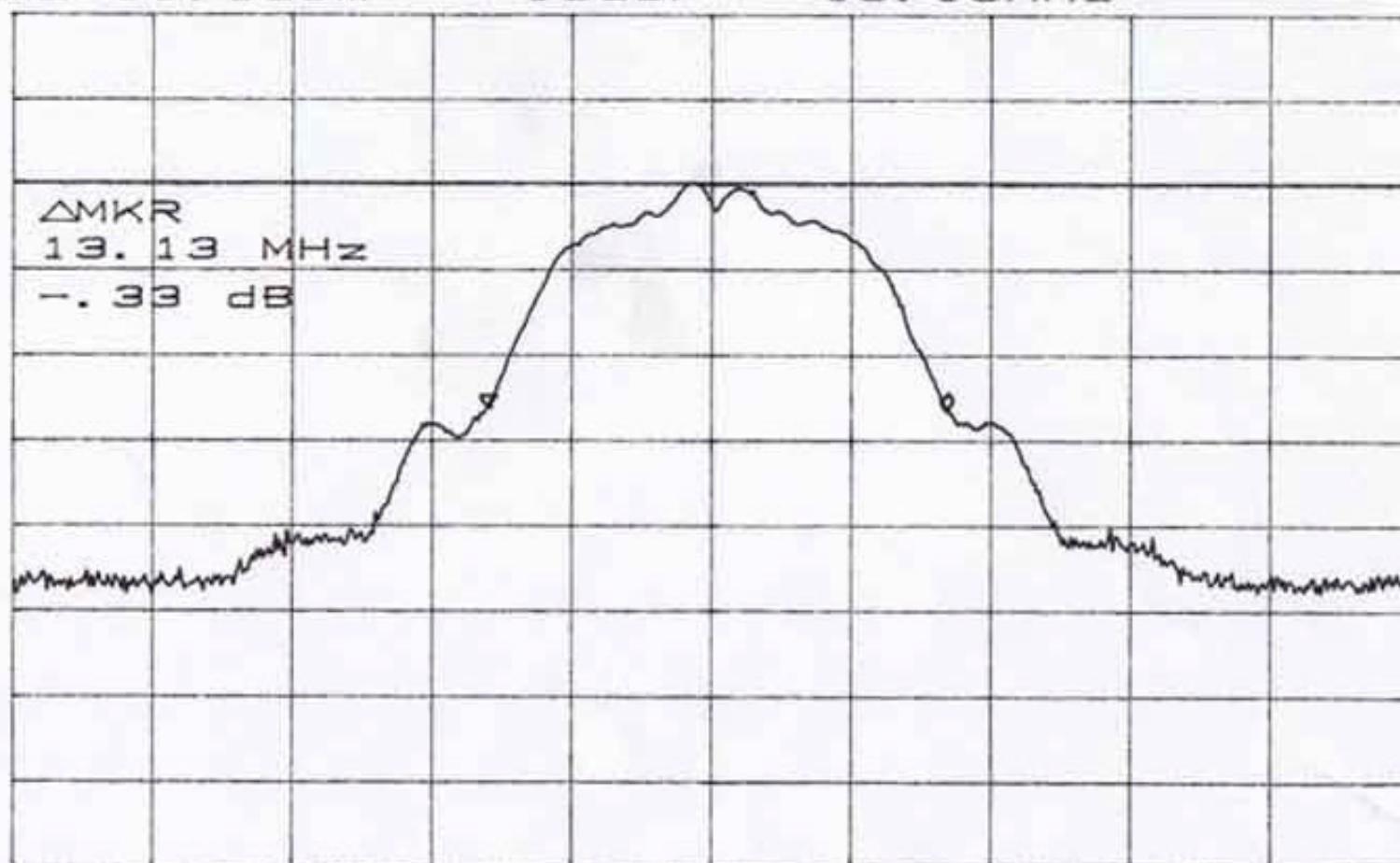


5.3377 GHz 26 dB Bandwidth

ATTEN 40dB
RL 30. 0dBm

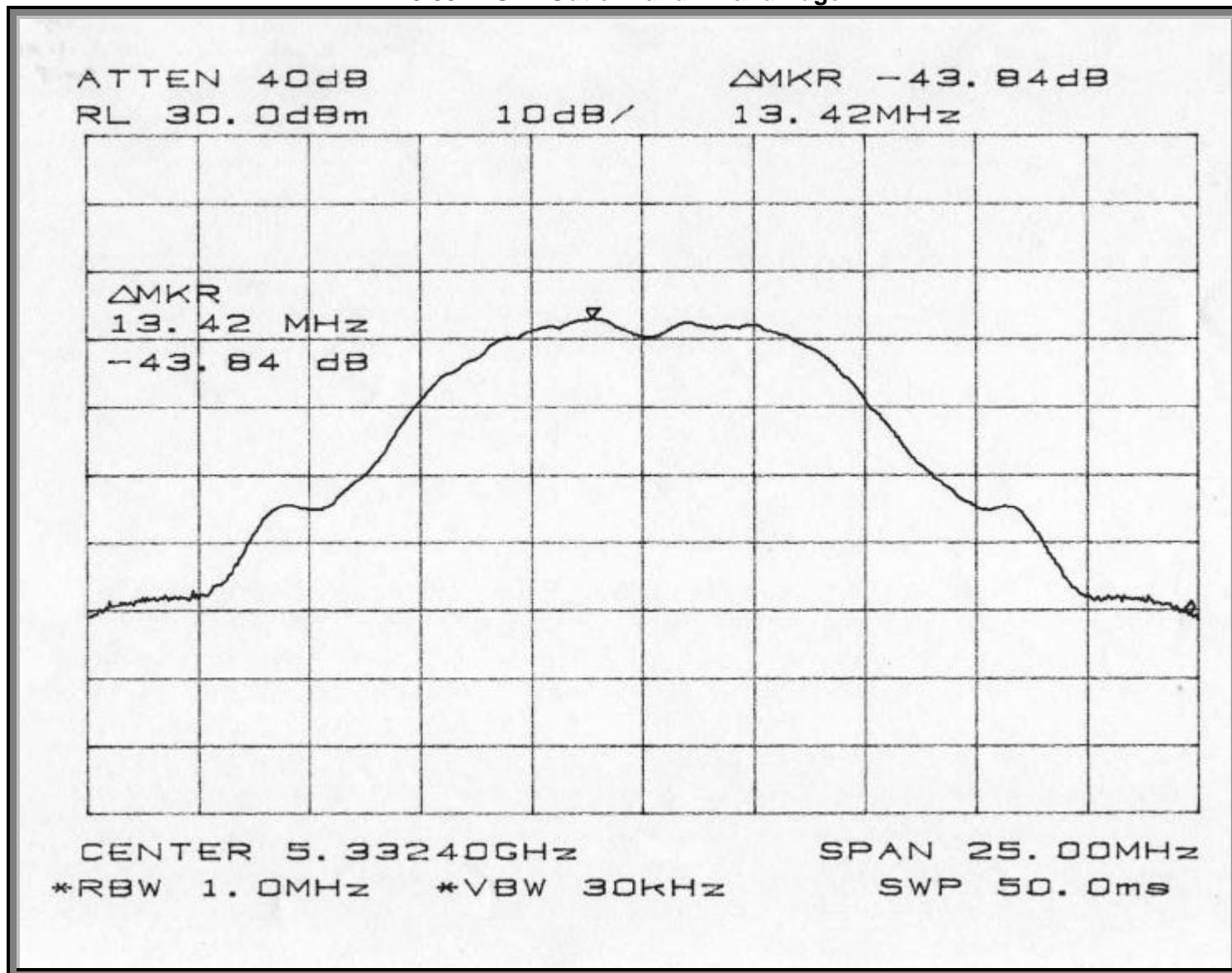
10dB/

ΔMKR -. 33dB
13. 13MHz

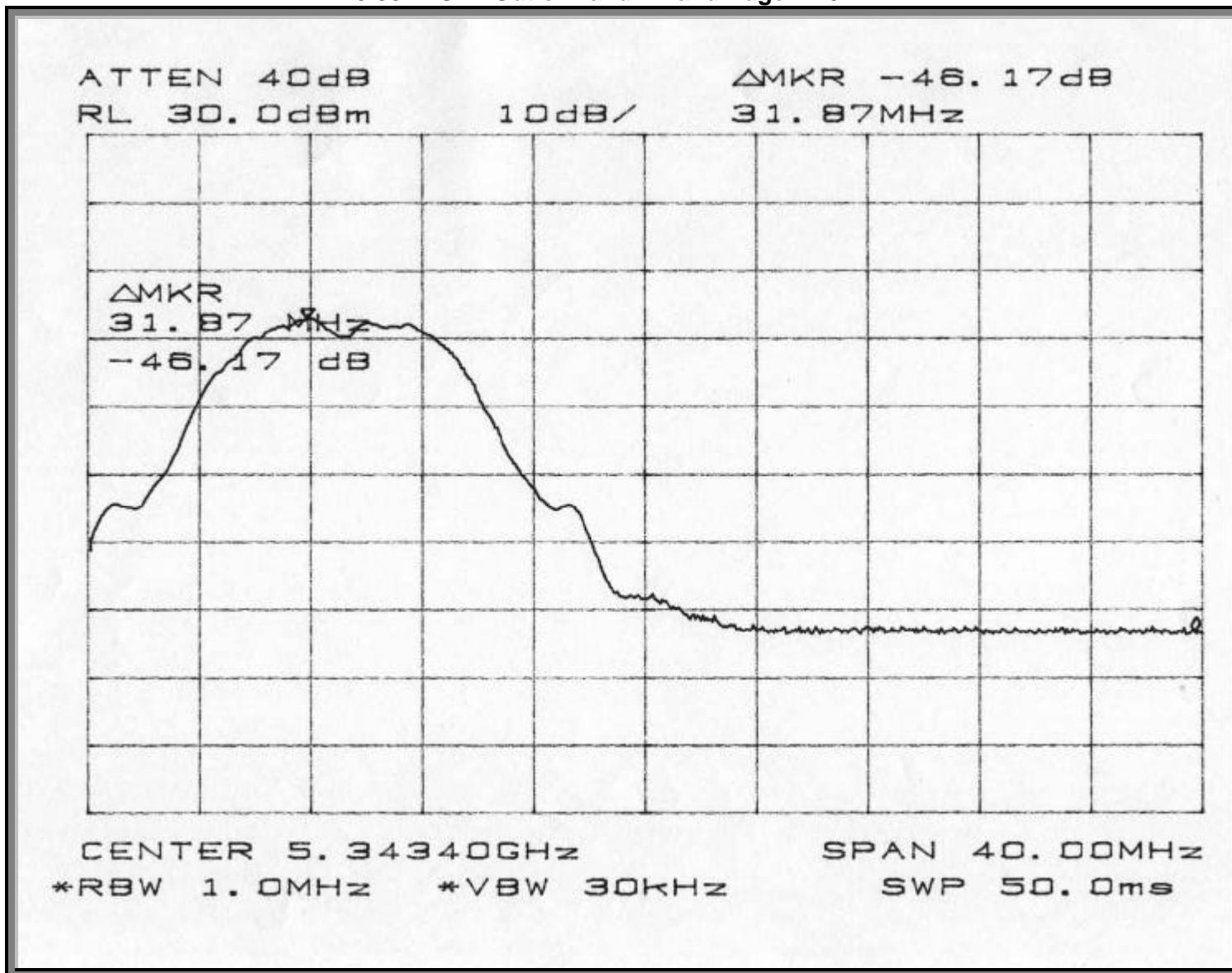


CENTER 5. 33240GHz SPAN 40. 00MHz
*RBW 1. 0MHz VBW 1. 0MHz SWP 50. 0ms

5.3377 GHz Out of Band – Band Edge



5.3377 GHz Out of Band – Band Edge + 10 MHz

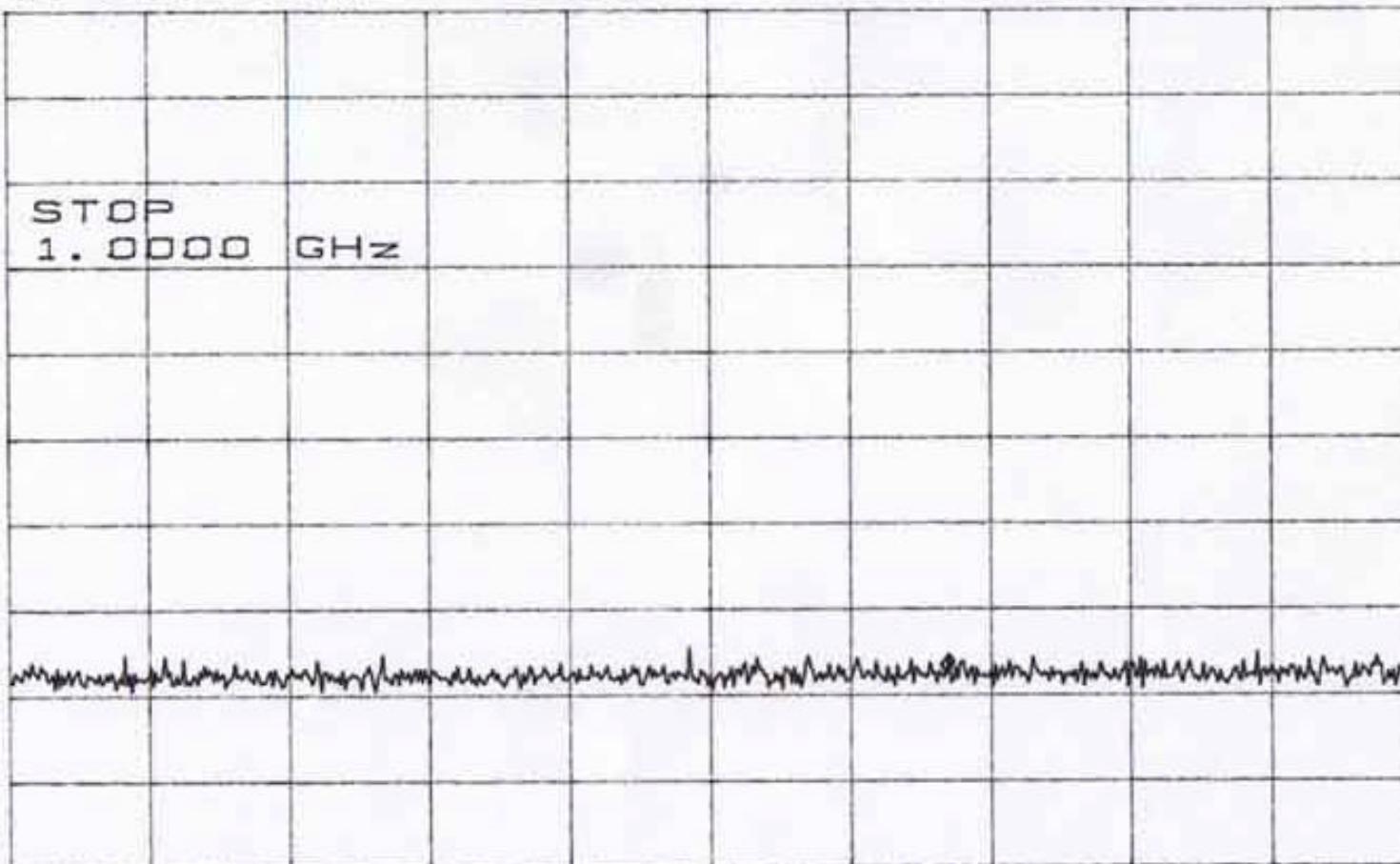


5.3377 GHz Out of Band 30 MHz to 1 GHz

ATTEN 40dB
RL 30. 0dBm

10dB/

MKR -47. 33dBm
678. 3MHz



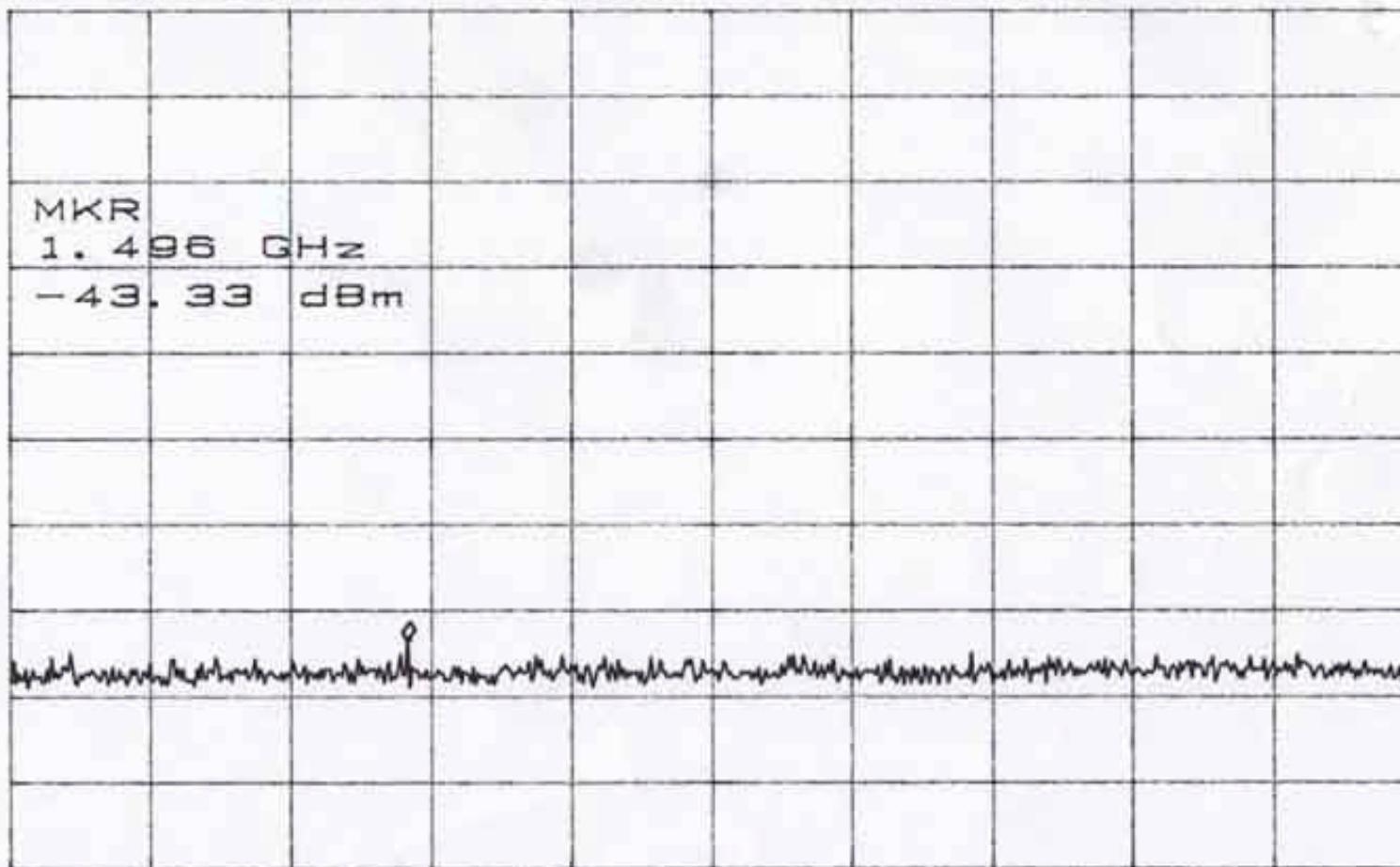
START 30. 0MHz STOP 1. 0000GHz
*RBW 100kHz VBW 100kHz SWP 250ms

5.3377 GHz Out of Band 1 GHz to 2.75 GHz

ATTEN 40dB
RL 30.0dBm

10dB/

MKR -43.33dBm
1.496GHz



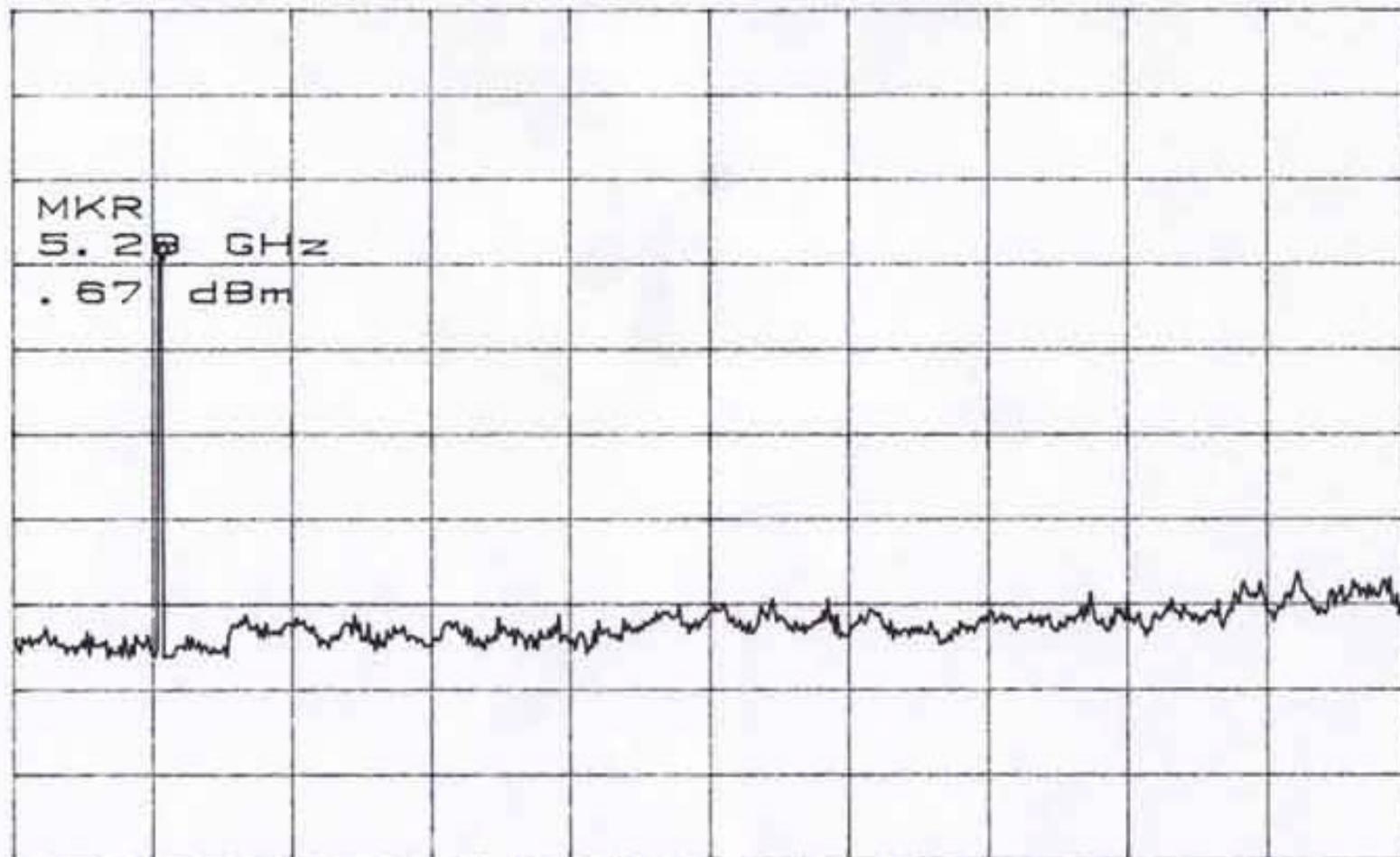
START 1.000GHz STOP 2.750GHz
*RBW 100kHz VBW 100kHz SWP 440ms

5.3377 GHz Out of Band 2.75 GHz to 26.5 GHz

ATTEN 40dB
RL 30.0dBm

10dB/

MKR .67dBm
5.28GHz



START 2.75GHz

STOP 26.50GHz

*RBW 100kHz

VBW 100kHz

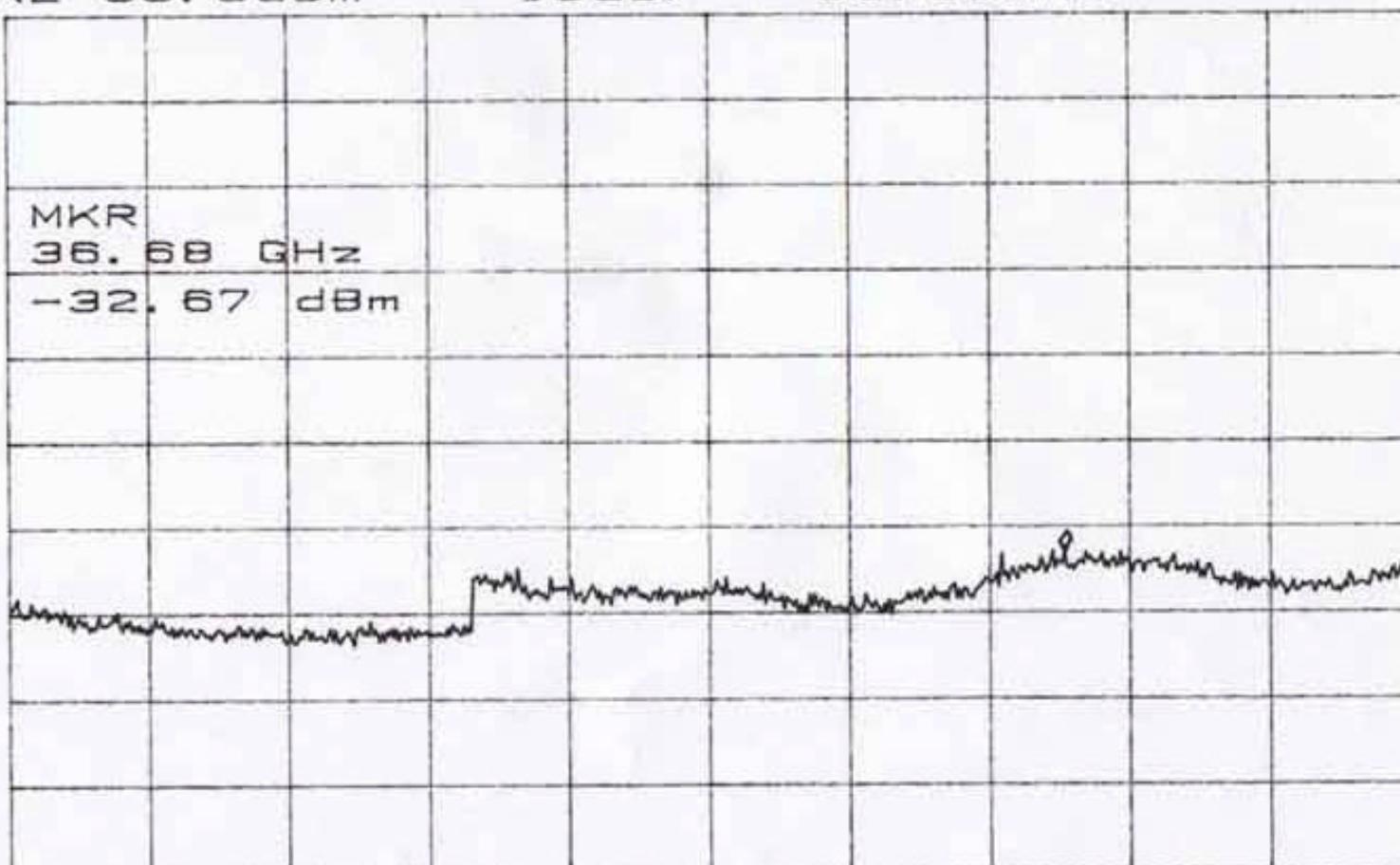
SWP 6.00sec

5.2608 GHz Out of Band 26.5 GHz to 40 GHz

ATTEN 40dB
RL 30.0dBm

10dB/

MKR -32.67dBm
36.68GHz



START 26.53GHz STOP 40.00GHz
*RBW 100kHz VBW 100kHz SWP 3.40sec

APPENDIX E

SET-UP CONFIGURATION

SEE ATTACHED PDF FILE TITLED “APPENDIX E”

APPENDIX F

Restricted Band Data

SEE ATTACHED PDF FILE TITLED “APPENDIX F”

APPENDIX G

ANTENNA INFORMATION

SEE ATTACHED PDF FILE TITLED “APPENDIX G”

APPENDIX H
LABELING REQUIREMENTS
LABEL and LOCATION

LABELING REQUIREMENTS

LABEL REQUIREMENTS, Class B Certified Digital Device

A CLASS B Digital Device subject to Certification by the FCC shall bear the following statement in conspicuous location on the device.

(Name of Grantee)

FCC ID:

The device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

The label is to be located in a "conspicuous location". This is any location readily visible to the user of the device without the use of tools.

The label is to be permanently attached to the equipment in such a manner that the label can normally be expected to remain fastened and legible during the equipment's expected useful life.

Where the device is constructed in tow or more sections connected by wires and marketed together, the statement specified in this section is required to be affixed only to the main control unit.

When the device is so small or for such use that it is not practicable to place the statement specified above on it, this required information shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier must be displayed on the device.

USER INFORMATION

For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statements, placed in a prominent location in the user's operation manual.

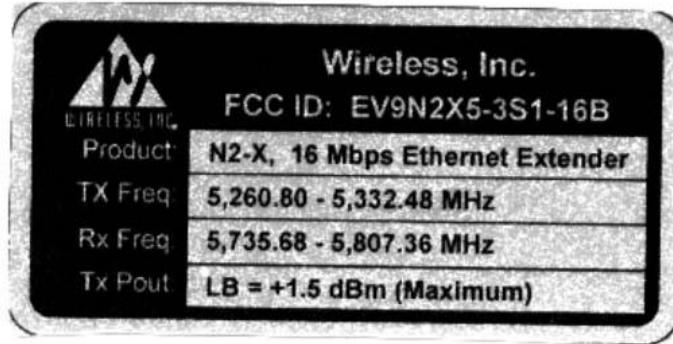
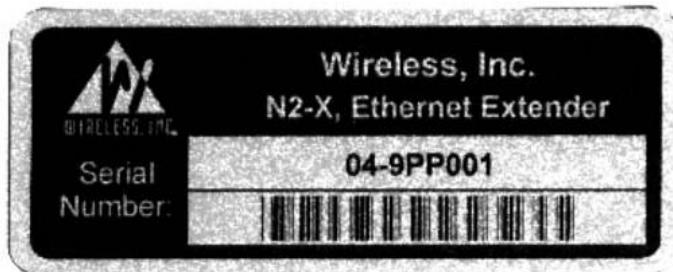
NOTE: This equipment has been tested and found to comply with the limits for Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio and television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- ◆ •Re-orient or relocate the receiving antenna.

ELECTRONIC COMPLIANCE LABORATORIES, INC.
1249 BIRCHWOOD DRIVE SUNNYVALE CALIFORNIA 94089

- ◆ •Increase the separation between the equipment and receiver.
- ◆ •Connect the equipment into an outlet on a circuit, different from that which the receiver is connected.
- ◆ •Consult the dealer or an experienced radio/TV technician for help.
- ◆ •For systems incorporating several digital devices, the statement shown above, needs to be contained only in the instruction manual for the main control unit.
- ◆ •Where special accessories, such as shielded cables, are required in order to meet FCC emission limits, appropriate instructions regarding the need to use such accessories must be contained in the operator's manual.
- ◆ •The operators manual must caution the user that changes or modifications not expressly approved by the manufacturer could void their right to operate the equipment.

The above radio interference statement is to be bound in the same manner as the operators manual. A loose-leaf insert page in a bound manual would not meet this requirement.



APPENDIX I

EUT PHOTOGRAPHS

APPENDIX J
PROPRIETARY INFORMATION
CONFIDENTIALITY REQUESTS

SEE ATTACHED PDF FILE TITLED "APPENDIX J"