

WAYNE LANGSTON, INC.

Model: SeaBeacon 2 System 6 Racon

FCC ID:FAZSBCN2SYS6A

Date: 11-20-2002

Number of Pages: 58

WLI Project: 20021807

**FCC  
CERTIFICATION**

**TEST/MEASUREMENT REPORT**

Product Name: SeaBeacon 2 System 6 Racon

Model: SeaBeacon 2 System 6 Racon

Applicant/Manufacturer: Tideland Signal Corporation.  
4310 Directors Row  
P.O. Box  
Houston, Texas 77052-2430

Tested By Request of: Tideland Signal Corporation  
Paul Mueller

Testing Laboratory:  
Wayne Langston, Inc.  
P.O. Box 1377, League City, Texas 77574-1377  
Tel: 281-337-6785; Fax: 281-337-7217; email: langstoninc@msn.com

Test Results:

I certify that I am the technically qualified person responsible for preparation of the technical information contained in this application, and that it is complete and accurate to the best of my knowledge.

Tested By:   
Wayne P. Langston

Date: 11-20-2002

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THIS REPORT MUST NOT BE USED TO CLAIM PRODUCT ENDORSEMENT BY  
ANY AGENCY OF THE U.S. GOVERNMENT

# WAYNE LANGSTON, INC.

Model: SeaBeacon 2 System 6 Racon

FCC ID:FAZSBCN2SYS6A

Date: 11-20-2002

Page i of 58

WLI Project: 20021807

## TABLE OF CONTENTS

### 1. Introduction

#### 1.1 Test Facility

#### 1.2 Test Samples

#### 1.3 Test Results

### 1. Information required for Certification

#### 2 1033(a) FCC Form 7310

#### 2.1033(1) Applicant/Manufacturer

#### 2.1033(2) Equipment identification

#### 2.1033(3) Operations/Installation Manual

#### 2.1033(4) Type of Emission

#### 2.1033(5) Frequency Range

#### 2.1033(6) Range of Operating Power Level

#### 2.1033(7) Maximum power rating

#### 2.1033(8) Voltages/Current applied

#### 2.1033(9) Tune-up Procedure

#### 2.1033(10) Circuit Diagram

#### 2.1033(11) Label

#### 2.1033(12) Photographs

#### 2.1033(14) Measurement Data

#### 2.1046 Measurements required: RF Power Output

#### 2.1047 Modulation Characteristics

#### 2.1049 Occupied Bandwidth

#### 2.1051 Spurious emissions at antenna terminals

#### 2.1053 Field Strength of Spurious Radiation

#### 2.1055 Frequency Stability

#### 80.213(h) Modulation Requirements

#### 80.215(n)(3) Output Power

### Appendix A Radiated Interference Measurement Data

### Appendix B Occupied Bandwidth measurements

### Appendix C Spurious Emissions at Antenna Terminals

### Appendix D Output Power

### Exhibit 1 Label

### Exhibit 2 Block Diagram

# WAYNE LANGSTON, INC.

Model: SeaBeacon 2 System 6 Racon

Date: 11-20-2002

FCC ID:FAZSBCN2SYS6A

Page 1 of 58

WLI Project: 20021807

## **1. INTRODUCTION**

The following is a test and measurement report for Tideland Signal Corporation, Model SeaBeacon 2 System 6 Racon, 1m27pon. The system 6 is a dual band frequency agile marine radar beacon ( Racon) . The frequencies are derived from a Voltage controlled OSC resident on the VCO board.

As radar signals are detected on the RCV board and an appropriate response is generated based upon the frequency amplitude and pulse width of the received signal. Based upon this information the transmitter board is then instructed to respond with an appropriate transmit signal including the morse code selected by software option this function is field programmable by an authorized agent. All controls that are certification critical are made at the factory and the internal workings of the racon are nitrogen purged. The only software field programmable options are self-test and response code character and length.

### **1.1 Test Facility:**

Noted and Complies.

This test site is located adjacent to the building in League City, Texas, 77573. All equipment is calibrated, and the calibration period is 1 year. Wayne Langston, Inc. has received NVLAP Accreditation, Certificate No. 200021-0.

### **1.2 Test Samples:**

A representative sample of the Equipment Under Test (EUT), was tested and the test results for this sample provided are located in Appendix(s).

### **1.3 Test Results:**

The results from this testing apply only to the sample that was tested. The findings do not make any suggestions about how the product is to be used nor does Wayne Langston,

# WAYNE LANGSTON, INC.

Model: SeaBeacon 2 System 6 Racon

Date: 11-20-2002

FCC ID:FAZSBCN2SYS6A

Page 2 of 58

WLI Project: 20021807

Incorporated make any recommendations regarding the product's usage.

## **2. INFORMATION REQUIRED FOR TYPE ACCEPTANCE PER PART 2**

**2.1033(a)** A completed FCC Form 731 is included with this application.

**2.1033(1)** Applicant/Vendor/Manufacturer:  
Tideland Signal Corporation  
4310 Directors Row  
Houston , Texas 77092

**2.1033(2)** This equipment is identified as:

SeaBeacon 2 System 6 Racon

FCC ID: FAZSBCN2SYS6A

**2.1033(3)** Installation manual is not available to the user. A copy has been attached as a reference only.

**2.1033(4)** The circuit functions are described in the Appendix.

**2.1033(5)** The frequency range of the Racon on "S" band is 2900-3100 MHZ and on "X" band is 9400-9400 MHZ.

**2.1033(6)** The output power level is +19 dbm EIRP for "S" band and +19 dbm EIRP for "X" band.

**2.1033(7)** The maximum measured power of + 19 dbm/80mw EIRP.. The maximum output power described in 80.215 n (3) max output power equal to 20 watts or 43 dbm EIRP.

**2.1033(8)** The DC hookup voltage is + 9 volts to a max of + 36.

**2.1033(9)** All tune-up procedures are made at the factory. There is no power adjustments made during the installation of the equipment.

**2.1033(10)** Complete circuit diagram is attached to this application.

# WAYNE LANGSTON, INC.

Model: SeaBeacon 2 System 6 Racon

Date: 11-20-2002

FCC ID:FAZSBCN2SYS6A

Page 3 of 58

WLI Project: 20021807

- 2.1033(11)** Exhibit 1 is a label drawing.
- 2.1033(12)** Photographs are included in the photograph section.
- 2.1033(13)** N/A
- 2.1033(14)** The data required by Paragraph 2.1046 through 2.1057 are included with this report.

## **MEASUREMENT REQUIREMENTS (Paragraphs 2.985 et.seq)**

This section contains the results of measurements taken to demonstrate compliance with the conditions defined in the Commission's Rules, Part 80. The measurements were made using several different methods. The nature of the operation of the Racon precludes a normal test methodology. Each method is outlined at the beginning of the test paragraph. A summary follows:

Occupied bandwidth measurements were made with a test fixture to prevent frequency jumping. Output power was verified while the transmitter was allowed to operate receiving a signal and re-transmitting it in normal operation. Because of this some of the transmissions pictures show aliasing.

### **2.1046 Power Output**

The following power measurements were made at 3.0014 GHZ and 9.39982 GHZ.

The test set-up is as follows:

Appendix E has the printouts of the output power measurements

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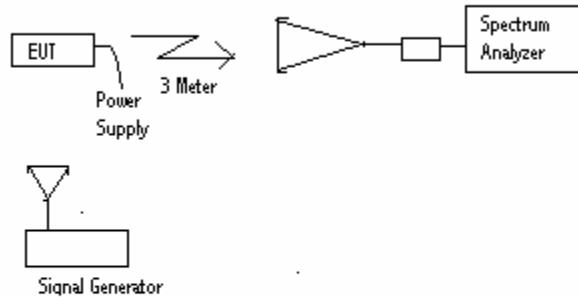
Model: SeaBeacon 2 System 6 Racon

FCC ID:FAZSBCN2SYS6A

Date: 11-20-2002

Page 4 of 58

WLI Project: 20021807



## **2.1047** Noted Modulation Characteristics

Pseudo digital technique is employed as the carrier is pulsed on and off to produce the complete set of Morse code telegraphy Note: (only characters that start in a dash are transmitted in the US). Only one character is generated per transmission.

## **2.1049** Occupied Bandwidth

The occupied bandwidth is define by the NTIA document "Manual of Regulations and Procedures for Federal Radio Frequency Management", 1/2000 as defined in Appendix J, Paragraph 3.1.

Bandwidth calculation

$B (-20\text{db}) = 6.36/t = 1.272 \text{ MHz and } 79.5 \text{ kHz respectively.}$

Using the pulse width as variable from 5usec to 80 usec.

Occupied Bandwidth /Emissions mask

Under the NTIA document, page 5-9 paragraph 5.2.2.2: General standards for the above 29.7 MHZ. States: (ref 80.211 (f) 1,2, and 3).

# WAYNE LANGSTON, INC.

Model: SeaBeacon 2 System 6 Racon

Date: 11-20-2002

FCC ID:FAZSBCN2SYS6A

Page 5 of 58

WLI Project: 20021807

The mean power of any emission supplied to the antenna transmission line, as compared to the fundamental, shall be in accordance with the following :

- 1) On any frequency removed from the assigned frequency by more than 50% and up to 100% of the authorized bandwidth at least 25 db of attenuation.
- 2) On any frequency removed more than 100% up to 250% at least 35db attenuation.
- 3) On any frequency removed by more than 200 % not exceed  $(43+10 \log 10)$  power in watts db.

During occupied bandwidth measurements, the EUT was forced to transmit on one continuous frequency. The graphs are contained in Appendix B

## **2.1051** Spurious Emissions

Appendix D describes spurious emissions out to a span of 250 MHZ of each transmitted frequency. The method used in the description was with the following test setup. No attempt was made to manually force the transponder to a single frequency. The measurements were made using a received signal that was in turn retransmitted on the appropriate frequency. All parameters are described on each graph

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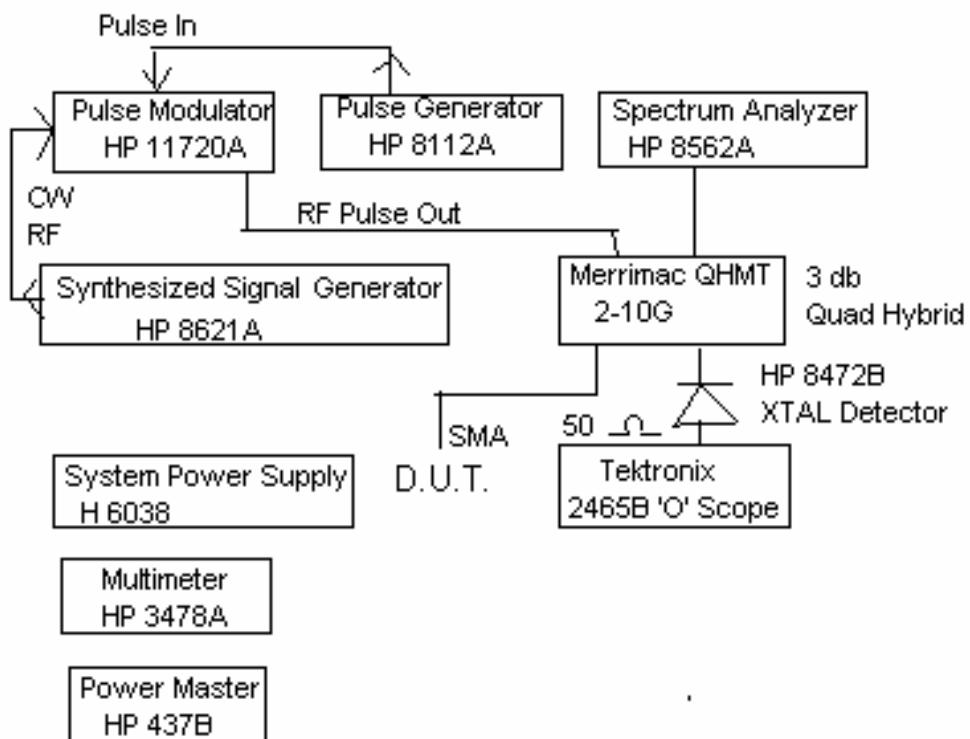
Model: SeaBeacon 2 System 6 Racon

FCC ID:FAZSBCN2SYS6A

Date: 11-20-2002

Page 6 of 58

WLI Project: 20021807



## 2.1053 Field Strength of Spurious Radiated

Field strength measurements of radiated spurious emissions were made on a three-meter

range maintained by Wayne Langston, Incorporated, at the League City, Texas facility.

Complete description and measurement data have been placed on file with the

Commission. The equipment was scanned for radiated emissions in a Semi Anechoic Chamber

prior to open-field testing.

The Racon was place on a rotating wooden test stand approximately one meter in height. The Racon's output was terminated with a 50 ohm dummy load on both the S band and X band Outputs. The emission spectrum was examined up to 20 Gig using a TEK 491/HP 8591 Spectrum Analyzer down converter and WLI log periodic antenna and appropriate horizontal antennae. A Mini Circuits broadband amplifier was used to provide 10 db or 20 db gain when

# WAYNE LANGSTON, INC.

Model: SeaBeacon 2 System 6 Racon

Date: 11-20-2002

FCC ID:FAZSBCN2SYS6A

Page 7 of 58

WLI Project: 20021807

necessary. At each frequency, the device was rotated through 360 degrees, and the antenna was

raised and lowered from one to three meters. Measurements were made using both vertically and

horizontally polarized antennas. In each case, only the maximum radiation measured and a signal

substitution was performed per TIA 603. All emissions not reported were more than 20 dB

below the specified limit. The reference level for spurious radiation's was taken at an ideal dipole

excited by the rated output power according to the following relationship. The transmissions were compared to the  $43 + 10 \log$  or limit – 13 dbm..

Note: level = Antenna factor (Isotopic)+ mixer/pad loss – preamp gain  
+ coax, mixer, pad – preamp gain

## 2.1055 Frequency stability

No frequency stability measurements were made. However, the manufacturers specification is:

$\pm 1$  MHz Long Pulse,  $\pm 2$  MHz Short Pulse, and is 100% verified.

See Manufacturer Note.

## **Part 80** other special measurements

80.213 (h) Radar transponder coast stations using the 2.92 to 3.1 GHz or 9.32 to 9.5 GHz Band must operate in a variable frequency mode and respond on their operating frequencies with a max error equivalent to 100 meters ( 667Ns). Additionally, their response must be encoded with a morse character starting with dash. The duration of a dot is defined as equal to the width of the space and 1/3 the width of a morse dash. The duration of the response code must not exceed 50

# WAYNE LANGSTON, INC.

Model: SeaBeacon 2 System 6 Racon

FCC ID:FAZSBCN2SYS6A

Date: 11-20-2002

Page 8 of 58

WLI Project: 20021807

exceed 50 micro-seconds. The sensitivity of the station must be adjustable so that received signals below -10 dbm at the antennae will not activate the transponder.

	<u>Measured</u>	<u>Spec</u>	<u>Results</u>
Max error equivalent	Actual 630 NS	667NS max	Complies
Characters start with a dash	(only character that start with a dash used in U.S.)		Complies
Dash 13.5 $\mu$ sec			Complies
Dot 4.5 $\mu$ sec (Dot is 1/3 of the dash)	This is equal to the length of the space		Complies
Width of the characters			Complies
Duration of the response code	5-80 Micro-seconds		Complies
Receiver sensitivity	-5.5 db		Complies

## Part 80.215(n) (3)

For all other transponder stations the output power must not exceed 20 watts or 43 dbm

Power Limitations:

	<u>EIRP</u>	<u>Complies</u>
Actual Xband	+ 19 dbm	Yes
Sband	+ 19 dbm	Yes

Measurements were made @ 3 meter distance using signal substitution method of TIA 603

Level = antenna factor (Isotopic) + coax loss (mixer/pad loss) - preamp gain

WAYNE LANGSTON, INC.

Model: SeaBeacon 2 System 6 Racon

Date: 11-20-2002

FCC ID:FAZSBCN2SYS6A

Photographs

WLI Project: 20021807

Appendix A

Radiated Interference Measurement Data

# WAYNE LANGSTON, INC.

Model: SeaBeacon 2 System 6 Racon

FCC ID:FAZSBCN2SYS6A

Date: 11-20-2002

Photographs

WLI Project: 20021807

TEST: Check One:	Test Type: Check One	End Results: Check One
FCC (Part 80) [x]	Radiated [x]	Pass [ ]
EN550_22/Cispr 22 [ ]	Conducted [ ]	Fails [ ]
Immunity: IEC 801- [ ]	Both [ ]	
Other (please define): <u>Part 80 Scan</u>		

---

EUT Model #/Name: SeaBeacon 2 System 6 Racon

---

EUT Description: Refer to Manufacturer's User/Operations Manual

EUT Support Equipment:	Serial #	Model #	FCC
ID # <u> </u>	<u>Idle State</u>		

---

Software: Client provided (if any)

---

EUT Classification: Class "A" [ ]; Class "B" [ ]

<u>Test Equipment/Model #</u>	<u>Serial #</u>	<u>Cal. Date</u>
[ ] AH Systems/SAS-200/S12	303	08/03
[ ] Compliance Design/Lisn		08/03
[ ] Rhode & Schwarz	879691/09	Daily
[x] Hewlett Packard 8591E	3501A03599	08/03
[ ] Hewlett Packard 8640B	1532A03642	08/03
[ ] Roberts Tuned Dipoles Std.	N/A	Per ANSI Ref. Std.
[x] Rhode & Schwarz	HL023	08/03
[ ] Rhode & Schwarz/ESH3	872318/03	08/03
[ ] Polard/ESH3-Z2	N/A	08/03
[ ] Polard/HFH2-Z2	N/A	08/03
[ ] Electro-Metrics/ESA-100	307	08/03
[x] Electro-Metrics Biconical	BIA 3432	08/03
[ ] TEM Chamber/None	none	Per IEC 801-3
[ ] Mini-Circuits Power Amp/None	100102	08/03
[ ] Mini-Circuits/AFL-1000LN	10093	08/03
[ ] Mini-Circuits/CAT-3(3dB,500Ohm Pad)	None	08/03
[ ] HP Oscilloscope/54600A	3134A04619	08/03
[ ] Mini-Circuits 50 dB Pad/NTRM 50	10018	None Required
[ ] Schaffner NSG433		08/03
[ ] Schaffner NSG1046		
[x] Mini Circuit Pre-Amp	1023	08/03
[x] Mini Circuit Down Converter	1042	08/03
[x] AHSystems 1-13 Gig Log or 0239		08/03

## Miscellaneous Support Equipment

<u>Equipment/Model</u>	<u>Serial</u>	<u>FCC ID</u>
[ ] Dell 320 SLi PC	1Y10Y	EZK320SLi
[ ] Epson LX 800 Printer	011216166	BKM5VEP70RA
[ ] IBM Thinkpad	None	AN02618M481

# WAYNE LANGSTON, INC.

Model: SeaBeacon 2 System 6 Racon

FCC ID:FAZSBCN2SYS6A

Date: 11-20-2002

Photographs

WLI Project: 20021807

Frequency	Signal Substitution Dbm	Rotation 0°	Antenna Height	Limit dbm
125.0	-86	180	1.5V	-13
181.7	-83	140	2.0V	-13
24.3	-86	150	2.0V	-13
472.3	-83	140	2.5V	-13
545.0	-89	180	2.0V	-13
623.8	-63	180	2.0V	-13
1.76 Gig	-61	180	2.0V	-13
8.8 Gig	-80	180	2.5V	-13
66.8	-86	140	1.5V	-13
160.0	-83	180	1.5V	-13
472.3	-79	180	2.0V	-13
541.0	-86	180	2.0V	-13
623.8	-69	180	2.5V	-13
624	-70	170	2.5V	-13
2.4 Gig	-68	180	2.5V	-13

## TEST RESULTS

Freq. (MHz)	Level (dB)	A <sub>f</sub> /C <sub>L</sub> (dB)	H <sub>A</sub> (M) Hor/Ver	Rotation °	Results (dB)	Comments
125.6	5.1	16.0	1.0V	140	21.1	Limit 43
181.7	2.3	17.0	1.0V	180	19.3	Limit 43
211.3	1.4	21.0	1.0V	140	22.4	“ “
472.3	4.0	29.0	1.5V	100	33.0	Limit 46
545.0	2.1	32.0	1.5V	180	34.1	“ “ (11.9 under)
623.8	-1.0	35.0	2.0V	180	34.0	Limit 46
1.7 Gig	-3.1	34.0	2.0V	140	30.9	Limit 54
8.8 Gig	-7.0	37.0	1.0V	140	30.0	Limit 54
66.8	2.1	12.0	1.5H	180	14.0	Limit 40
160	2.1	18.0	2.0H	140	20.1	Limit 43
481	1.3	32.0	2.5H	140	33.3	Limit 46
541.0	1.1	32.0	2.5H	180	33.1	Limit 46
624	-2.1	36.0	2.0H	180	34.0	Limit 46
2.4 Gig	-5-1	34.0	1.5H	180	28.9	Limit 54

Using the values and procedures outlined in TIA/603. Section 2.2.12.

# WAYNE LANGSTON, INC.

Model: SeaBeacon 2 System 6 Racon

FCC ID:FAZSBCN2SYS6A

Date: 11-20-2002

Photographs

WLI Project: 20021807

RCV Reading Value = (Signal Generator) + (Antenna factor) + (Coax Loss).

Attached are the Antenna calibration data for antennas used at the particular frequency.

## 3 Meter Calibration Gain and Antenna Factors for Log Periodic

Model: SAS-200/512

S/N: 303

Date: 08-08-03

Frequency (MHz)	Antenna Factor (db)	Gain dBi
190	13.6	2.22
200	12.0	4.26
225	12.9	4.39
250	13.4	4.80
275	14.0	5.03
300	14.8	4.98
325	15.3	5.18
350	16.2	4.92
375	16.8	4.92
400	17.2	5.08
425	18.1	4.71
450	18.2	5.11
475	18.8	4.98
500	19.3	4.92
525	19.7	4.94
550	20.5	4.55
575	20.9	4.53
600	21.5	4.30
625	21.7	4.46
650	21.8	4.70
675	22.0	4.83
700	22.5	4.64
725	22.8	4.65
750	23.0	4.74
775	22.9	5.13
800	23.5	4.80
Frequency	Antenna	Gain

WAYNE LANGSTON, INC.

Model: SeaBeacon 2 System 6 Racon

Date: 11-20-2002

FCC ID:FAZSBCN2SYS6A

Photographs

WLI Project: 20021807

(MHz)	Factor (db)	dBi
825	23.7	4.87
850	24.4	4.43
875	24.7	4.38
900	24.6	4.73
925	24.8	4.76
950	25.1	4.70
975	25.3	4.72
1000	25.6	4.64
1100	26.8	4.27
1200	27.1	4.73
1300	28.0	4.52
1400	28.6	4.56
1500	30.8	2.96
1600	31.4	2.92
1700	30.8	4.05
1800	31.9	3.45

3 Meter Calibration  
Gain & Antenna Factors for Log Periodic

Model: SAS-200/511

S/N: 004

Date: 8-8-03

Frequency (MHz)	Antenna Factor (db)	Gain dBi
1.0	25.2	5.04
1.5	27.7	6.06
2.0	30.4	5.86
2.5	32.2	6.00
3.0	33.2	6.58
3.5	34.2	5.58
4.0	34.8	7.48
4.5	36.0	7.31
5.0	36.3	7.92
5.5	37.3	7.75
6.0	37.6	8.20
Frequency	Antenna	Gain

# WAYNE LANGSTON, INC.

Model: SeaBeacon 2 System 6 Racon

FCC ID:FAZSBCN2SYS6A

Date: 11-20-2002

Photographs

WLI Project: 20021807

(MHz)	Factor (db)	dBi
6.5	38.7	7.80
7.0	39.2	7.94
7.5	39.7	8.04
8.0	40.2	8.10
8.5	40.3	8.53
9.0	41.2	8.13
9.5	41.5	8.30
10.0	42.1	8.14
10.5	42.2	8.47
11.0	42.7	8.37
11.5	43.5	7.96
12.0	43.8	8.03
12.5	44.5	7.68

Add antenna Factor plus cable loss to receiver reading in dBuV to convert to field intensity in dBuV/Meter.

Calibration per SAE ARP-958

Horizontal:

3160-08	12.5 Gig – 18 Gig	37.1 dB	16.7 dbi
3160-09	18.0 Gig – 26.5 Gig	40.3 dB	16.8 dbi
3160-10	26.5 Gig – 40.0 Gig	43.5 dB	17.0 dbi

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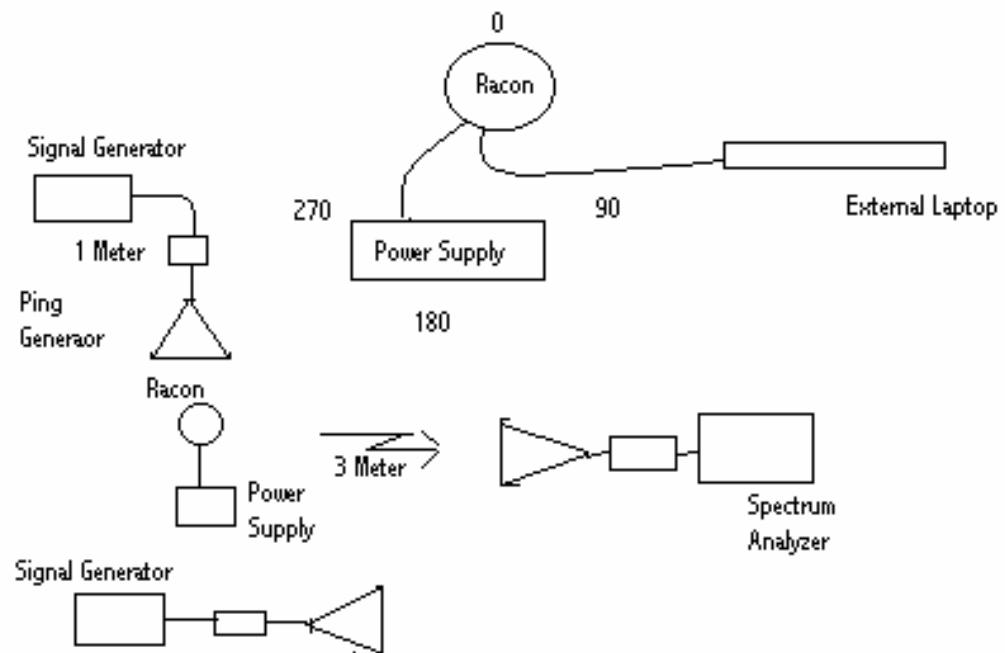
Model: SeaBeacon 2 System 6 Racon

FCC ID:FAZSBCN2SYS6A

Date: 11-20-2002

Photographs

WLI Project: 20021807



WAYNE LANGSTON, INC.

Model: SeaBeacon 2 System 6 Racon

Date: 11-20-2002

FCC ID:FAZSBCN2SYS6A

Photographs

WLI Project: 20021807

APPENDIX B

Occupied Bandwidth Measurements

WAYNE LANGSTON, INC.

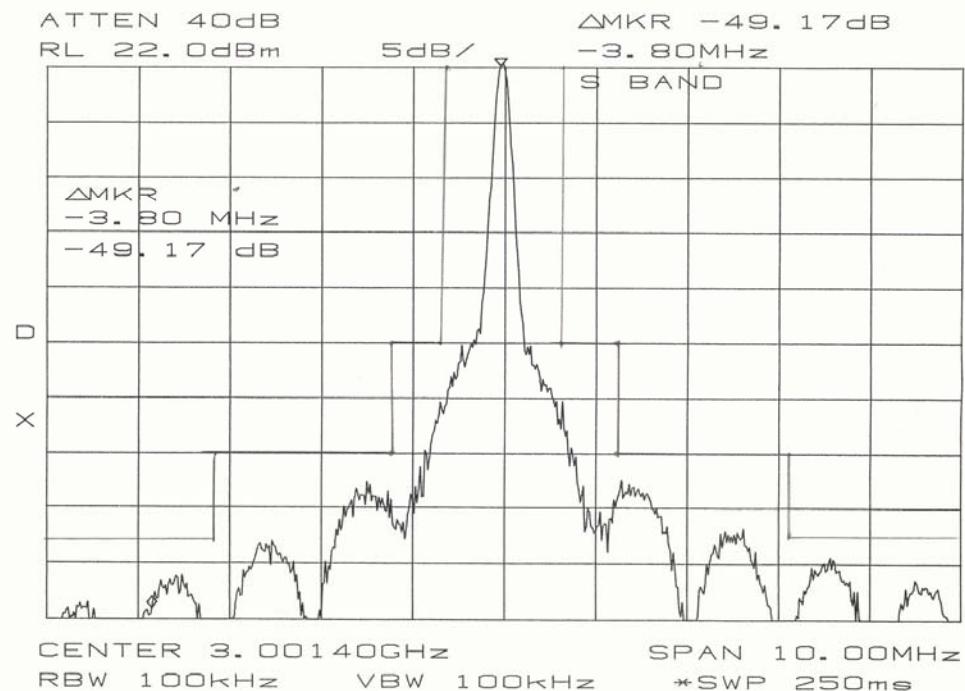
Model: SeaBeacon 2 System 6 Racon

FCC ID:FAZSBCN2SYS6A

Date: 11-20-2002

Photographs

WLI Project: 20021807



WAYNE LANGSTON, INC.

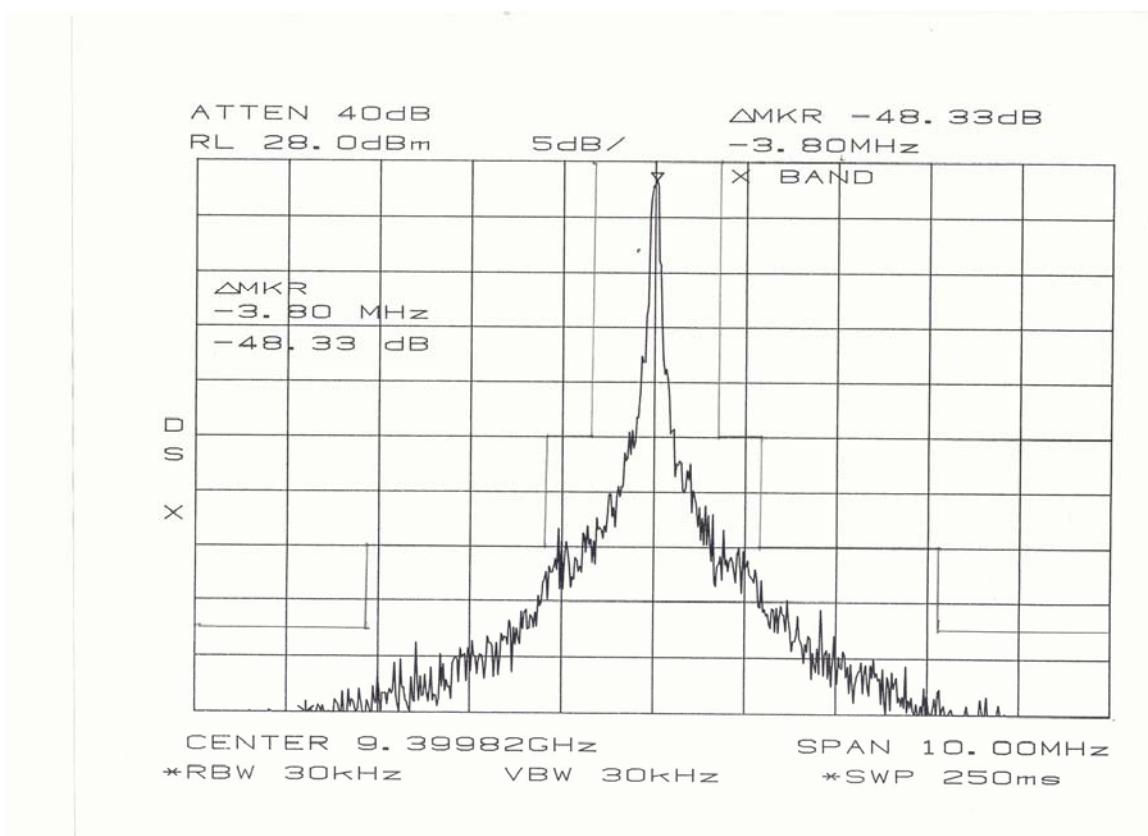
Model: SeaBeacon 2 System 6 Racon

FCC ID:FAZSBCN2SYS6A

Date: 11-20-2002

Photographs

WLI Project: 20021807



WAYNE LANGSTON, INC.

Model: SeaBeacon 2 System 6 Racon

FCC ID:FAZSBCN2SYS6A

Date: 11-20-2002

Photographs

WLI Project: 20021807

APPENDIX C

Spurious Emissions at Antenna Terminals

Power Level: +30 dbm

Frequency: .3.0 GHZ center

WAYNE LANGSTON, INC.

Model: SeaBeacon 2 System 6 Racon

FCC ID:FAZSBCN2SYS6A

Date: 11-20-2002

Photographs

WLI Project: 20021807

Frequency: agile

3.1 GHZ-2.9 GHZ

Frequency (MHz)	Emission Level (dBc)	Limit for (dBc)	Comments
304.9	-89.3	-43dbc	
609.9	-89.7	Dto	
762.8	-87.3	Dto	
1208.8	-80.3	Dto	
1702.50	-80.0	Dto	
3404	-87.0	Dto	

Power level +30 dbm

Frequency 9.4 GHZ center

Frequency: agile

9.320-9.5GHZ

Frequency (MHz)	Emission Level (dBc)	Limit for (dBc)	Comments
304.6	-87.6	-43dbc	
609.7	-86.7	Dto	
732.5	-86.2	Dto	
1204.8	-81.4	Dto	
1301.50	-81.2	Dto	
3300	-84.9	Dto	

Power level +30 dbm

Emission Levels preceded by a “<” indicate frequencies which were found to be below the spectrum analyzer’s noise as indicated.

WAYNE LANGSTON, INC.

Model: SeaBeacon 2 System 6 Racon

Date: 11-20-2002

FCC ID:FAZSBCN2SYS6A

Photographs

WLI Project: 20021807

APPENDIX D

OUTPUT POWER

WAYNE LANGSTON, INC.

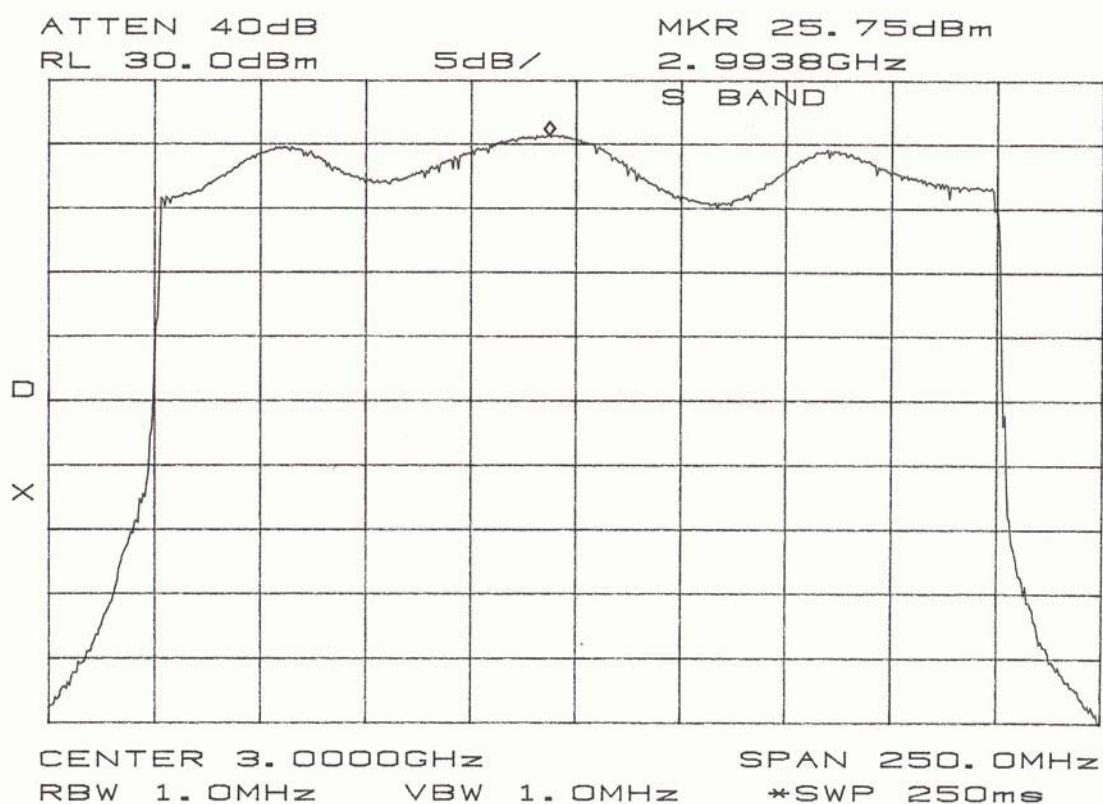
Model: SeaBeacon 2 System 6 Racon

FCC ID:FAZSBCN2SYS6A

Date: 11-20-2002

Photographs

WLI Project: 20021807



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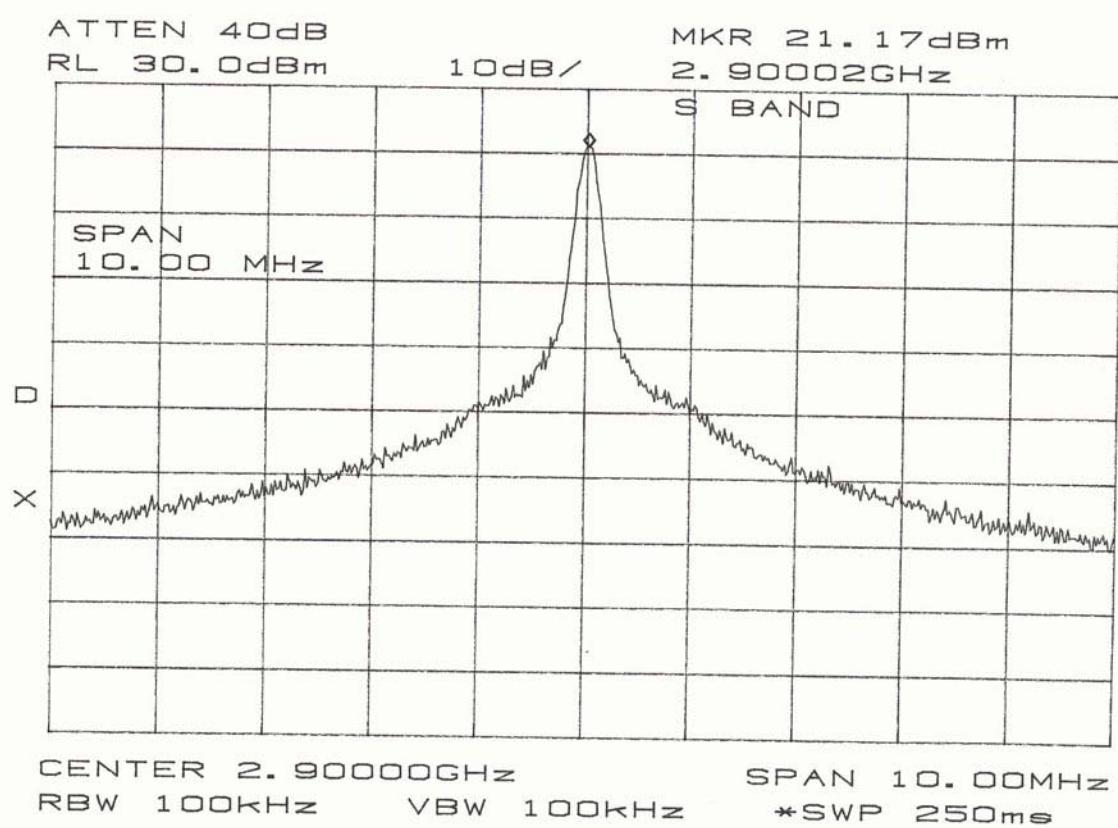
Model: SeaBeacon 2 System 6 Racon

FCC ID:FAZSBCN2SYS6A

Date: 11-20-2002

Photographs

WLI Project: 20021807



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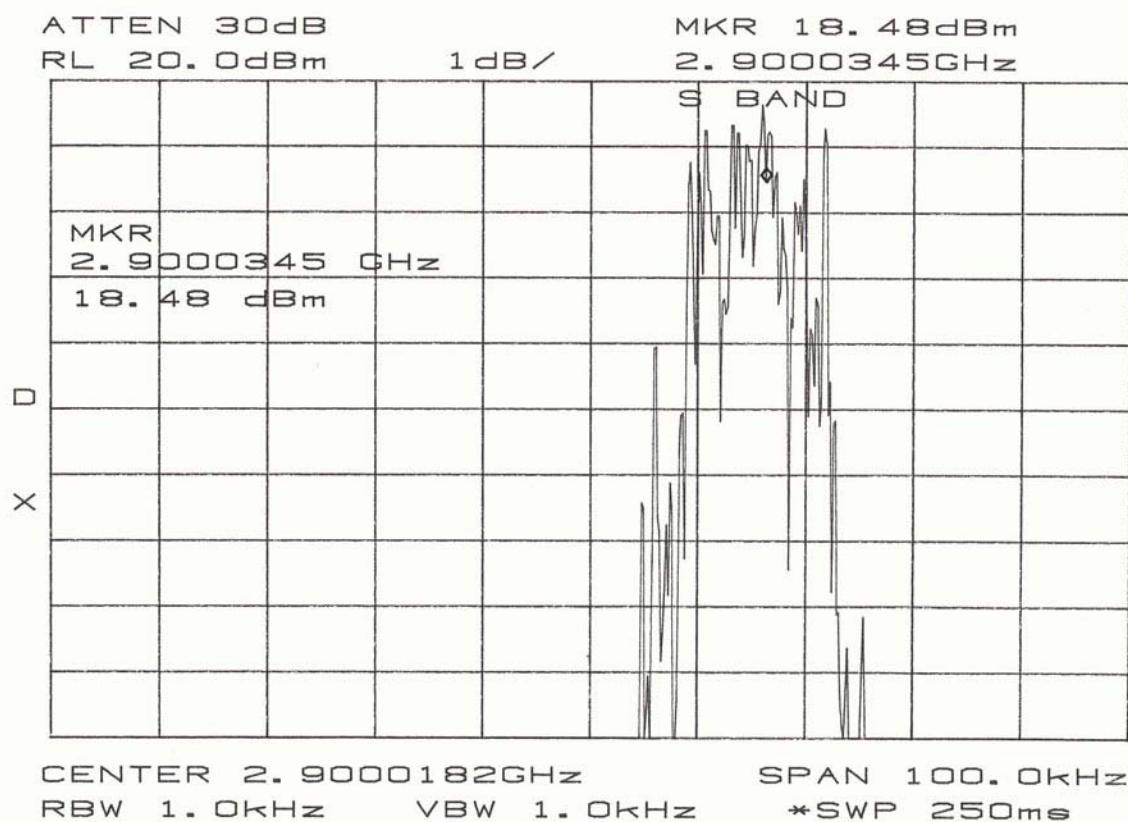
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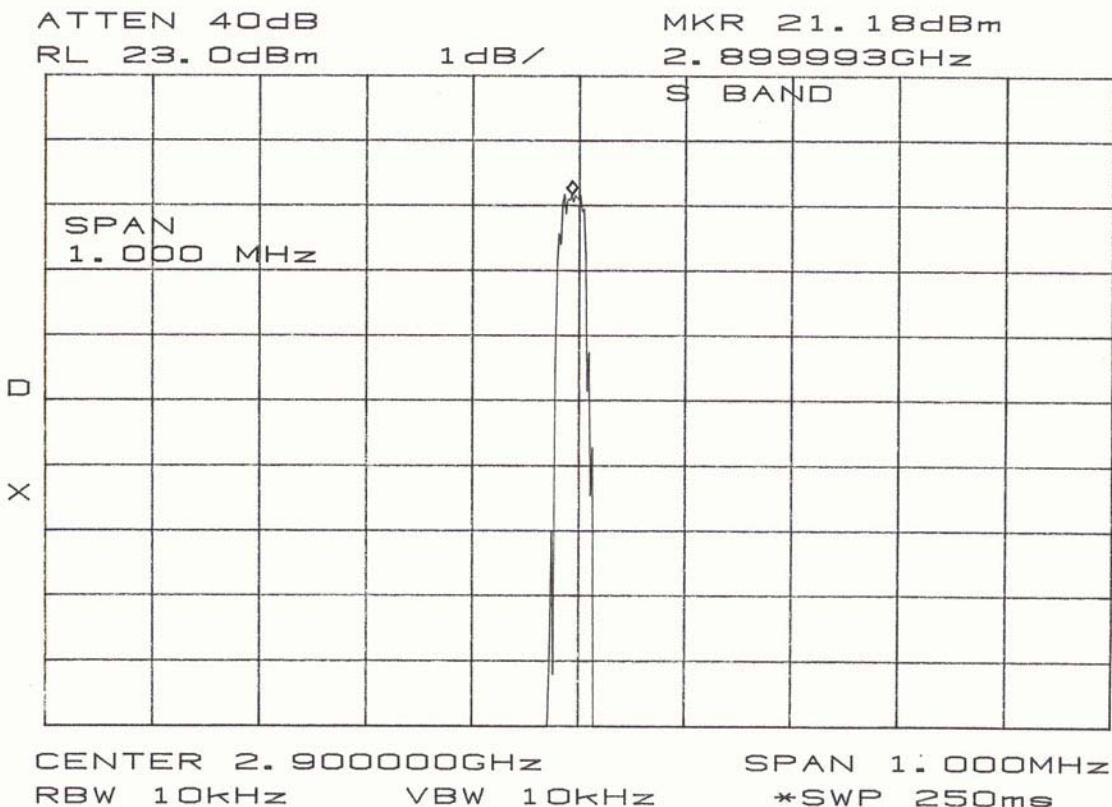
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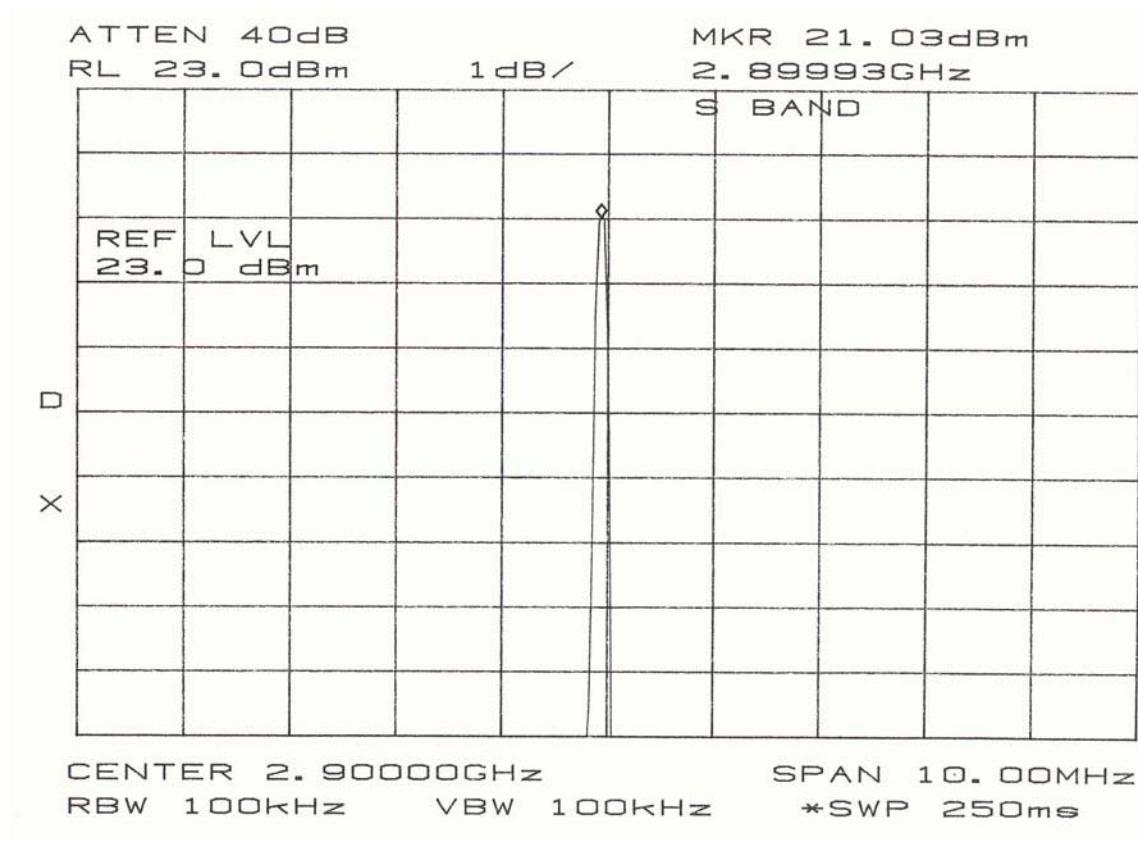
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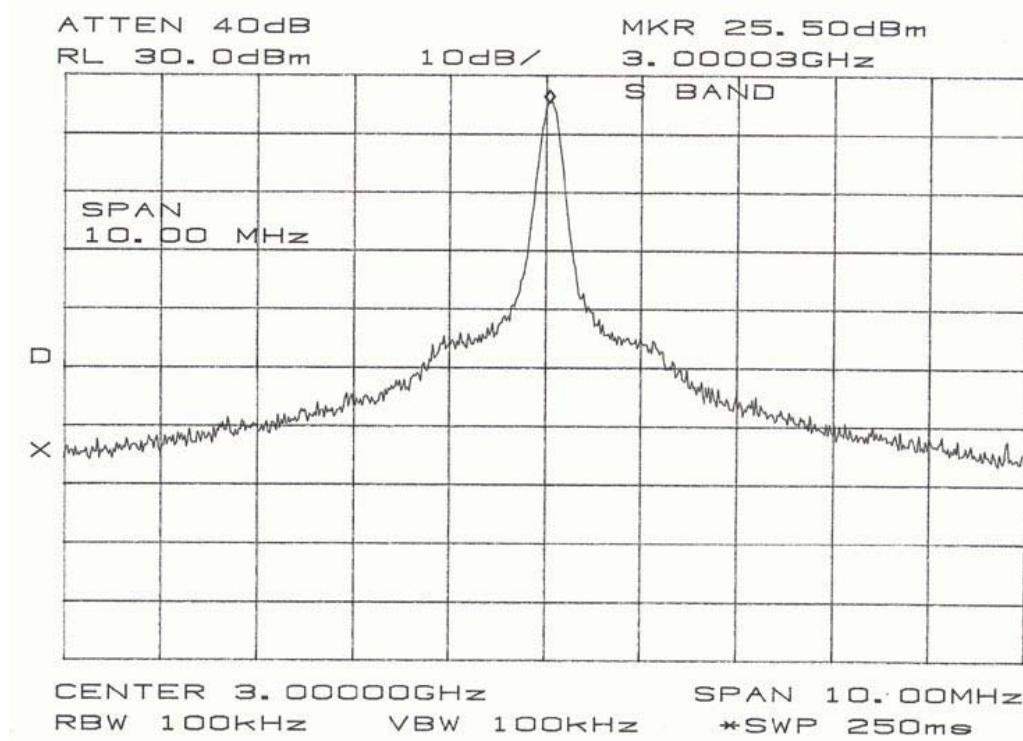
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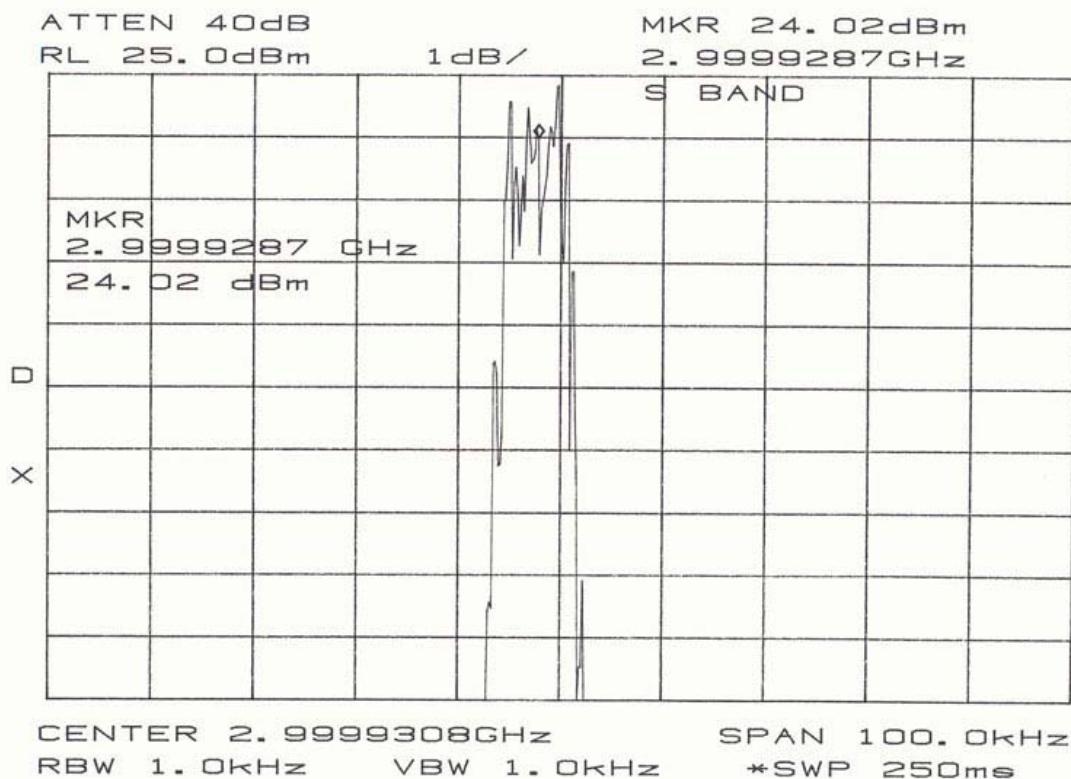
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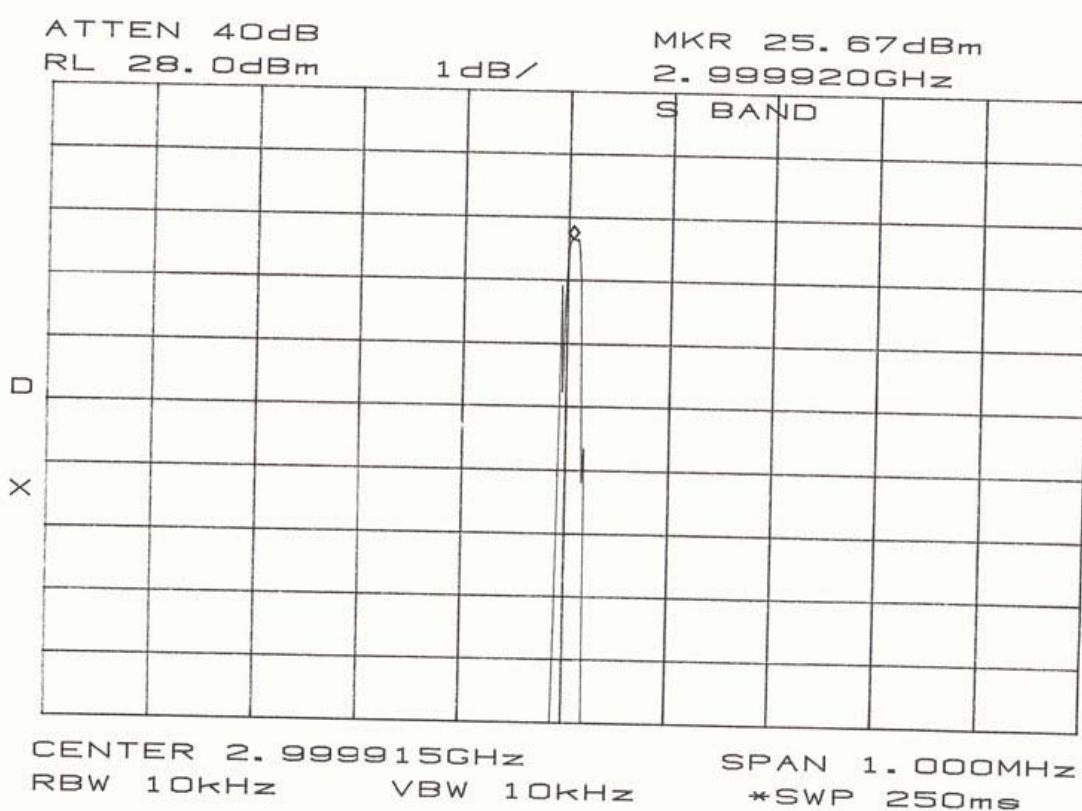
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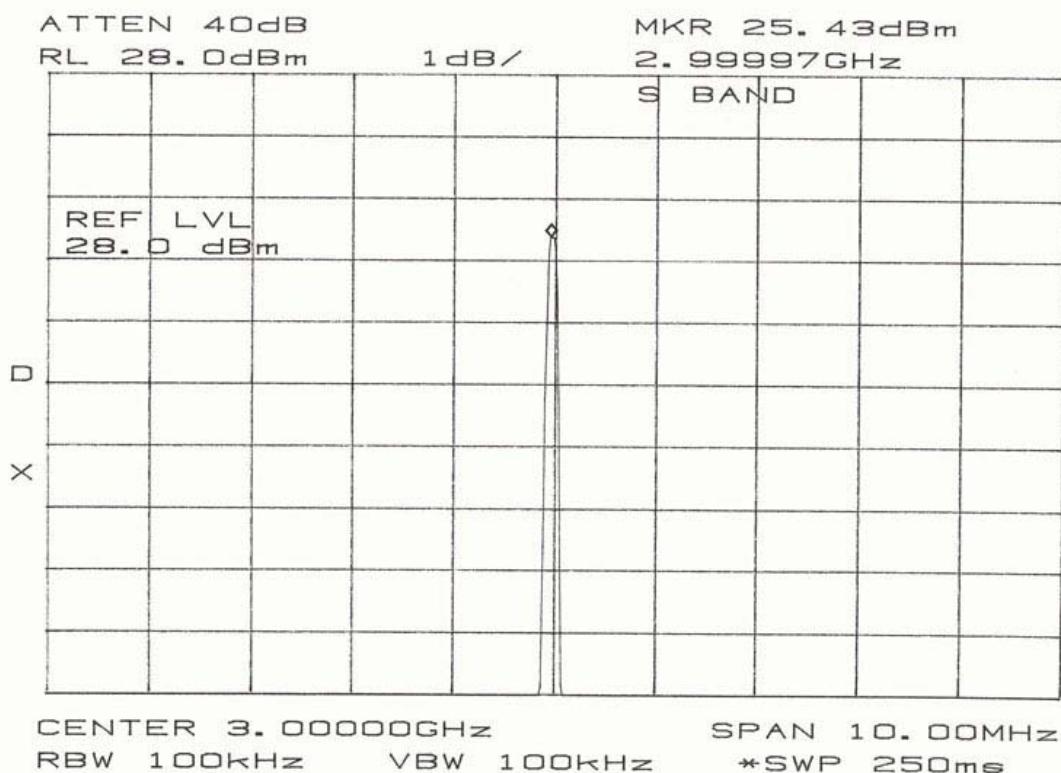
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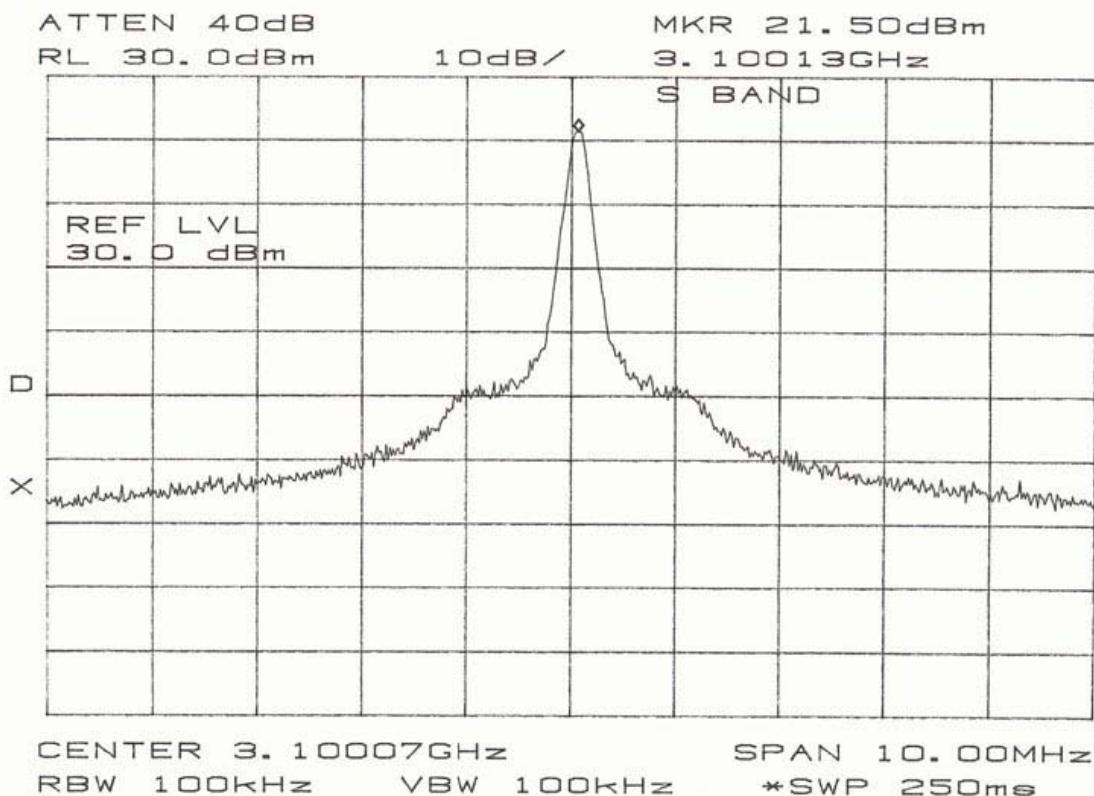
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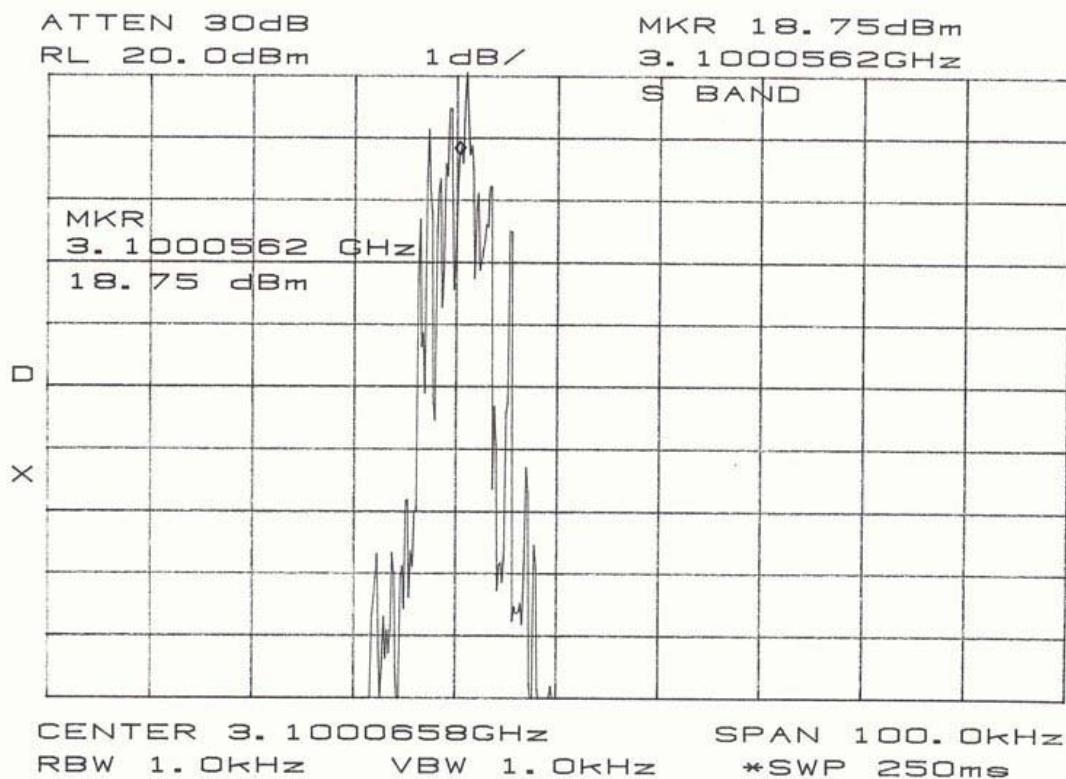
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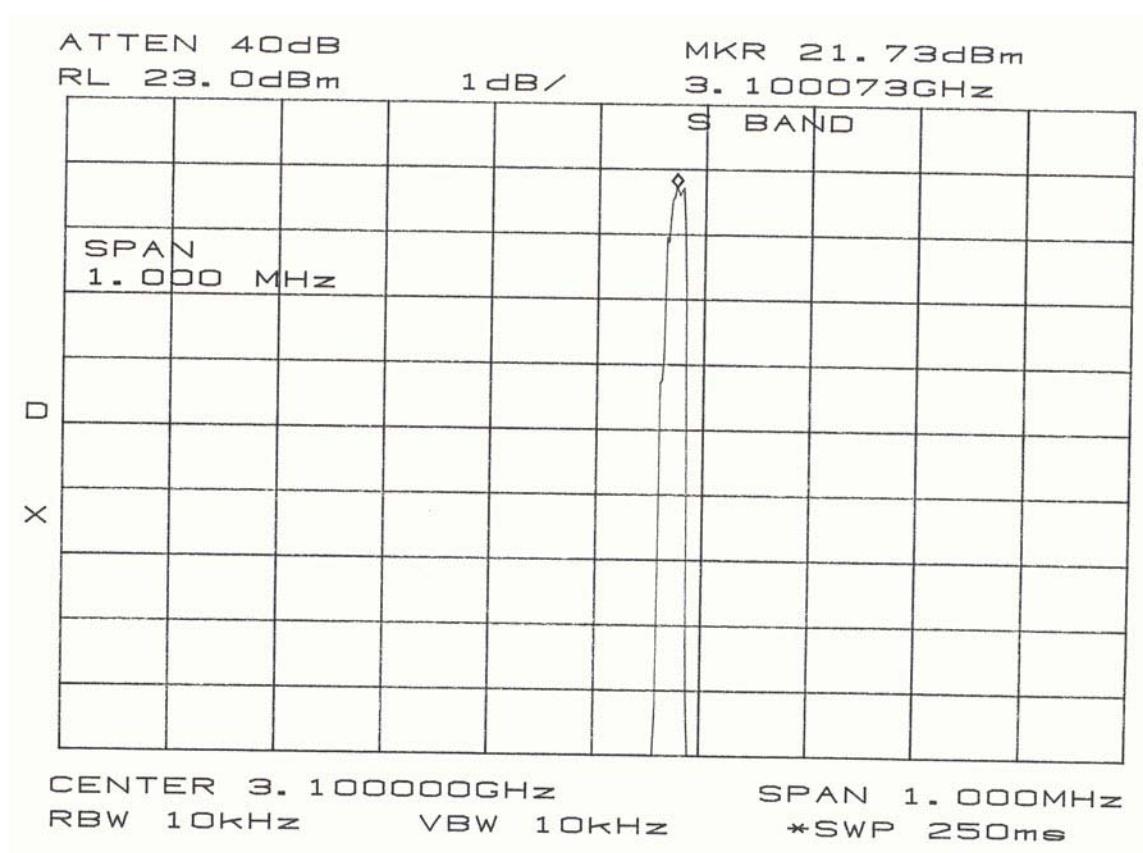
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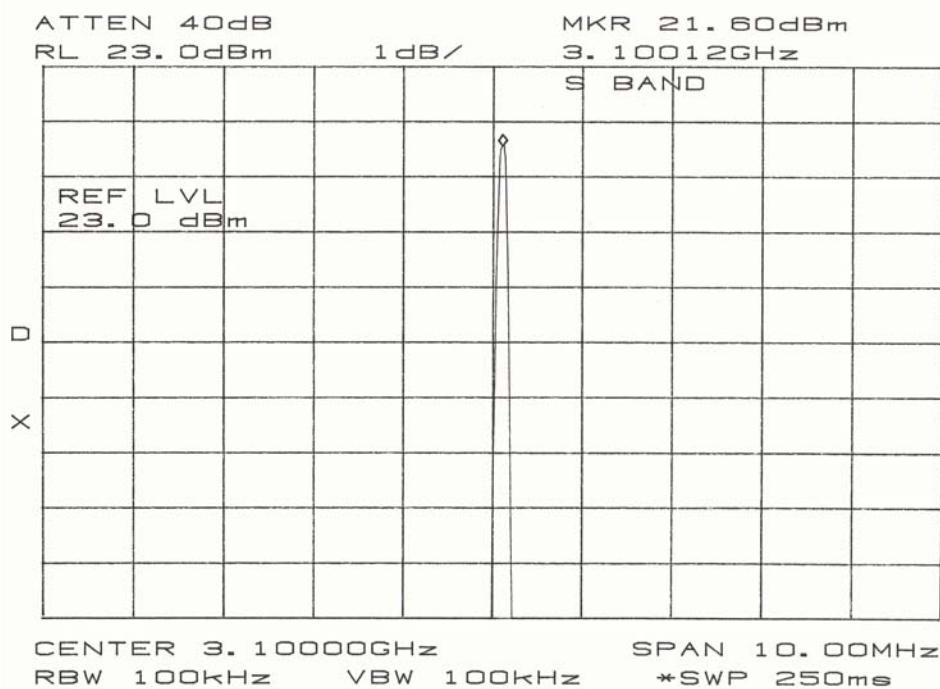
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11-20-02			
9.5	10 KHz	1 dB/div	-7.7 dB
	100 KHz		-4.17
	1 MHz		-3.6
	10 MHz		-3.92
	250 MHz	5 dB/div	-3.58
9.4	10 KHz	1 dB/div	-7.48
	100 KHz		-4.3
	1 MHz		-3.82
	10 MHz		-4.13
	250 MHz	5 dB/div	-3.75
9.3	10 KHz	1 dB/div	-7.73 <del>-7.88</del>
	100 KHz		-4.28 <del>-4.1</del>
	1 MHz		-3.92 <del>-3.6</del>
	10 MHz		-4.17 <del>-3.83</del>
	250 MHz	5 dB/div	-3.58
E.R.Bug			

WAYNE LANGSTON, INC.

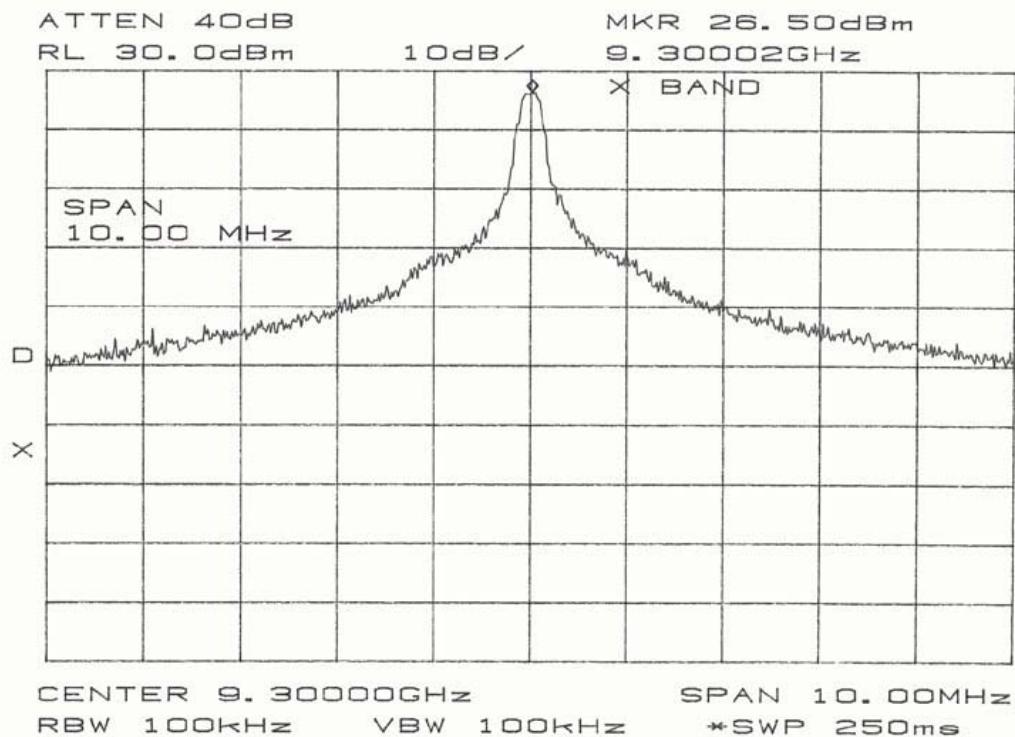
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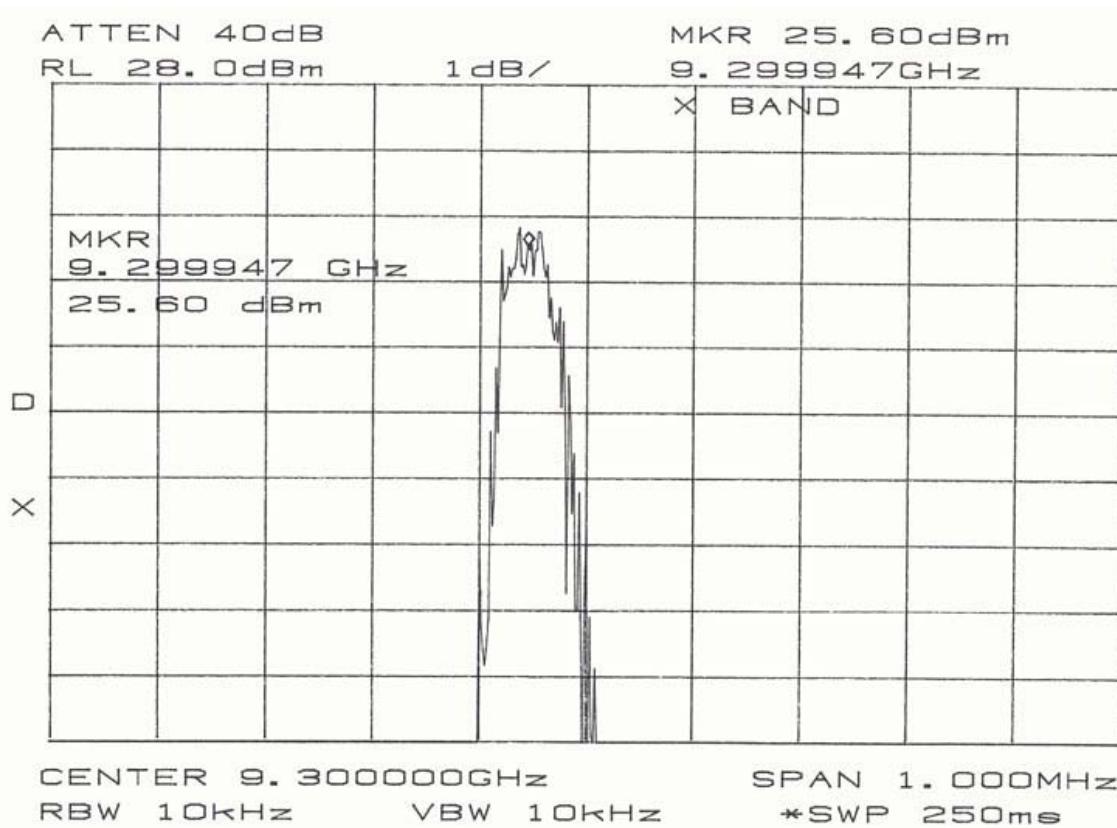
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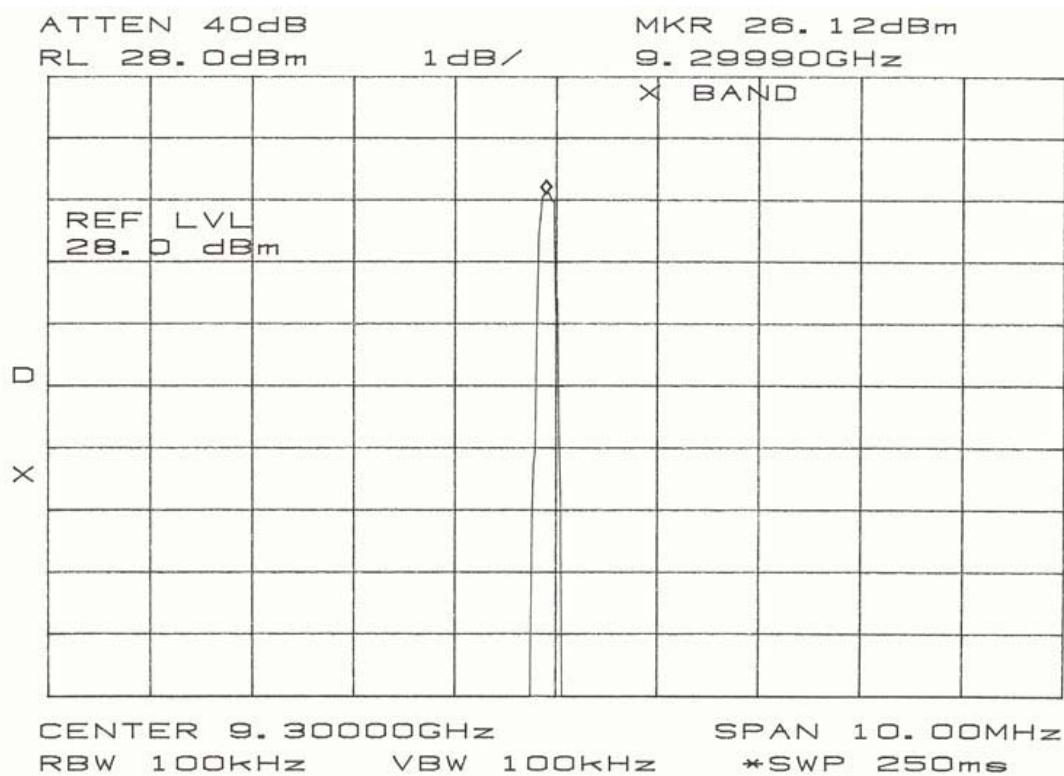
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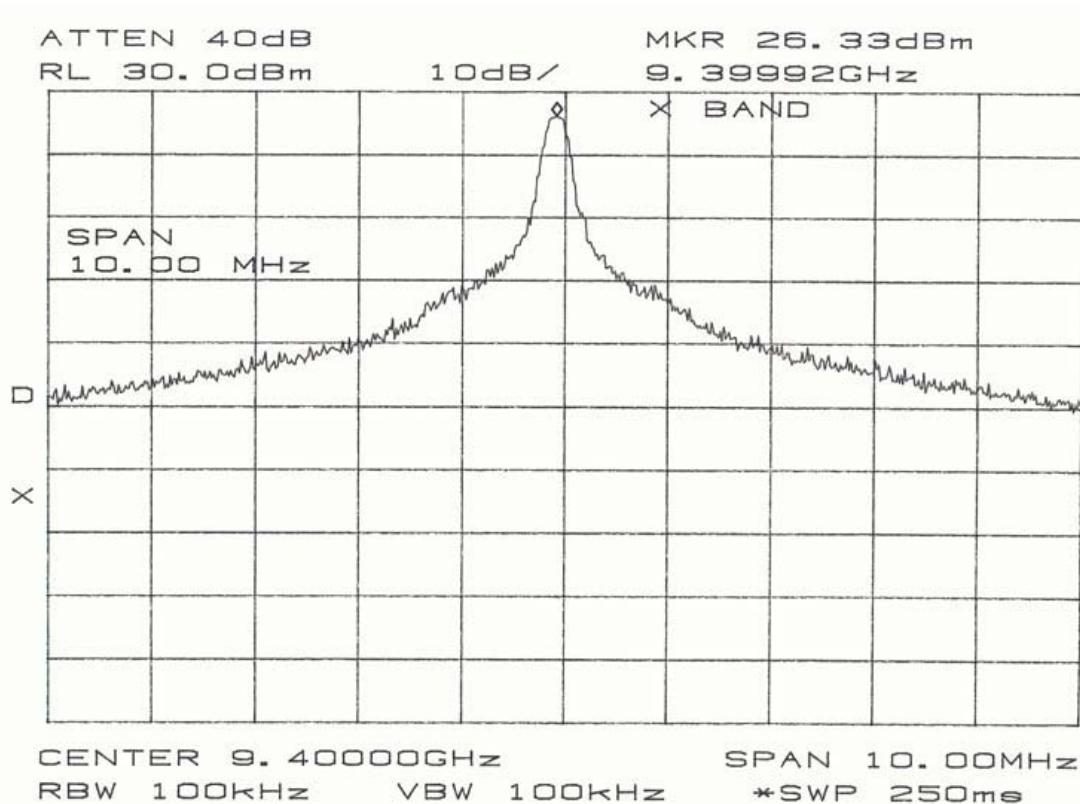
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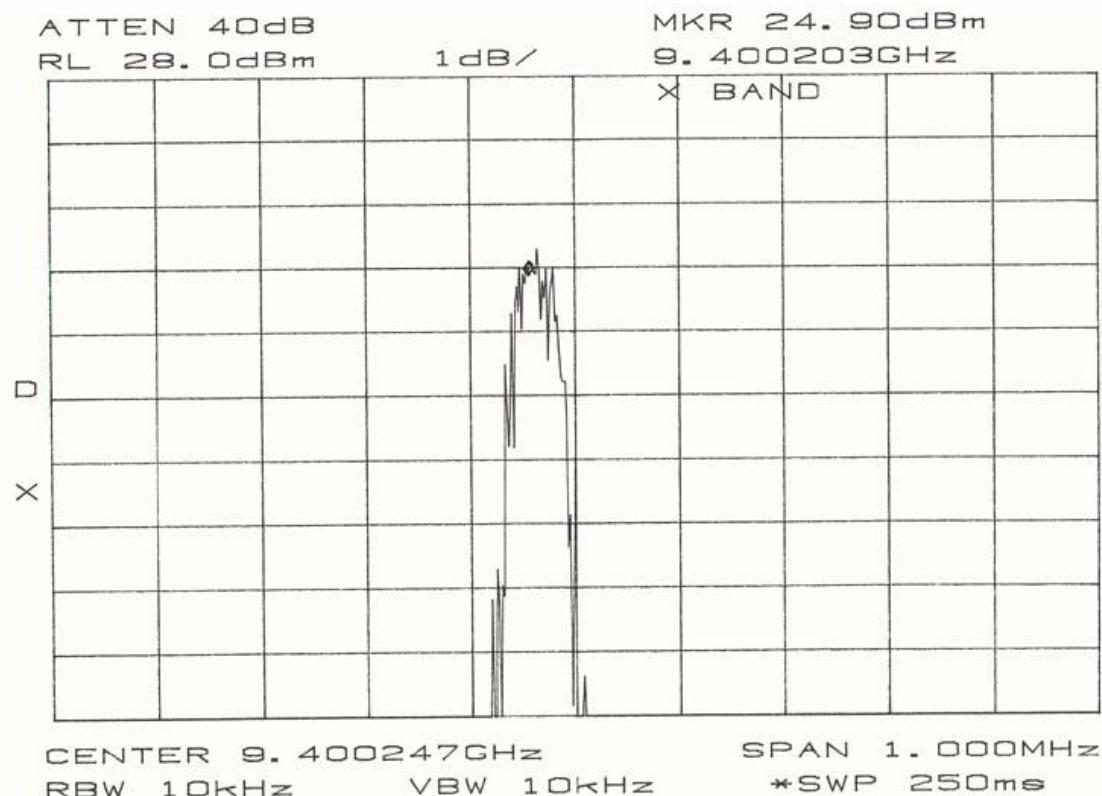
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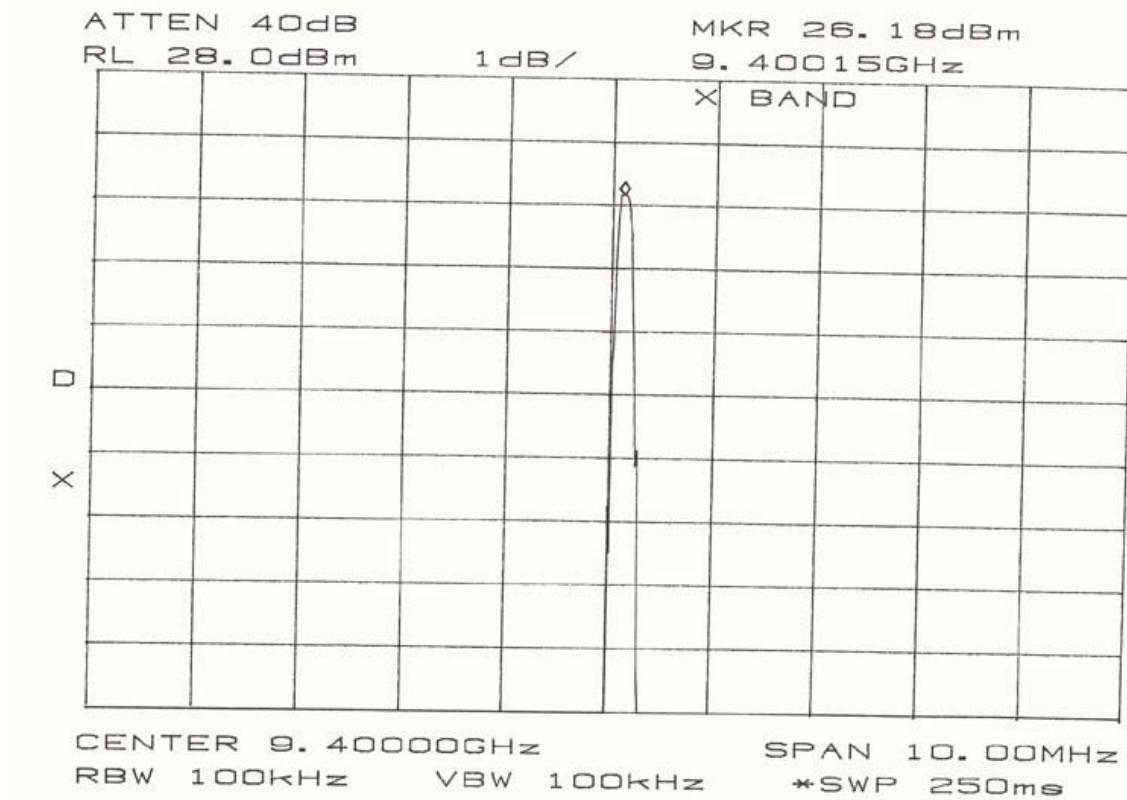
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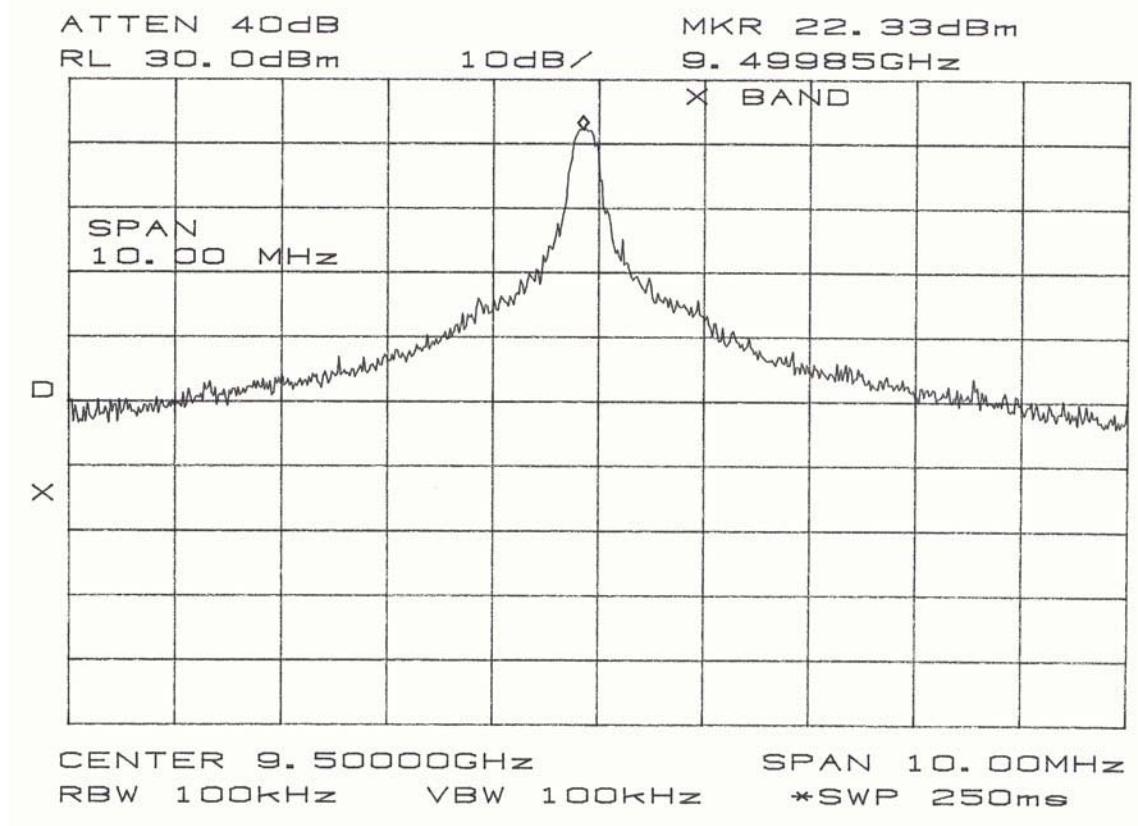
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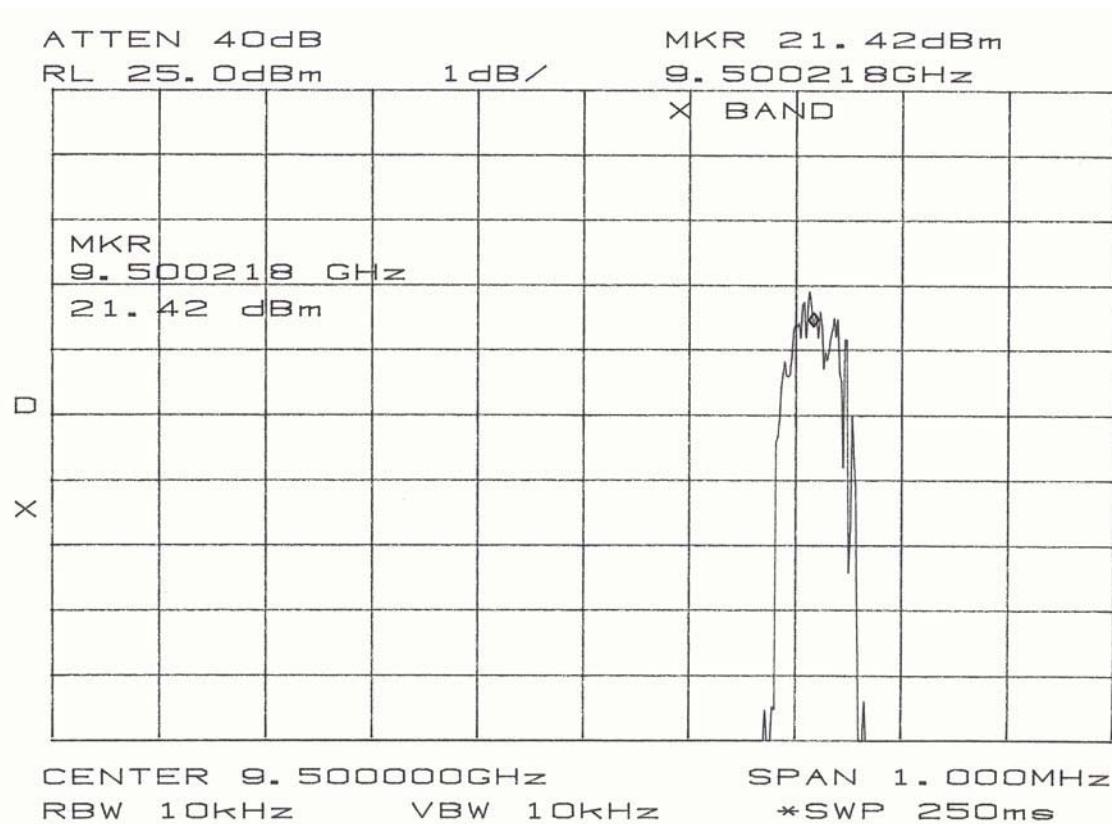
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