NORTEL
NORTHERN TELECOM

# EXHIBIT 1

# ENGINEERING BRIEF

**Applicant: Northern Telecom Inc.**

**For Type Acceptance on:**

**AB6NTGK05GA**

# 1.0 Introduction

This information is submitted in accordance with the FCC rules and regulations, Part 2, Subpart J, §2.983 through §2.999 for Type Acceptance of the Nortel (Northern Telecom) 1900MHz RF Front End Assembly as used on the 1.9GHz CDMA Indoor and Outdoor Base Station .

This 1900MHz CDMA RF Front End Assembly is intended for use in the Domestic Public Cellular Radio Telecommunications Service and is designed in accordance with the following standards:

- CFR 47, Part 24 - Personal Communications Services, Subpart E, *Broadband Personal Communications Service*
- CFR 47, Part 2 - Frequency Allocations and Radio Treaty Matters; General Rules and Regulations, Subpart J, *Equipment Authorization Procedures - Type acceptance*

## 2.0 Engineering Declaration

The 1900MHz CDMA RF Front End Assembly has been tested in accordance with the requirements contained in the Federal Communications Rules and Regulations Parts 2, 15 and 24. To the best of my knowledge, these tests were performed in accordance with good engineering practices using measurement procedures consistent with industry or commission standards and demonstrate that this equipment complies with the appropriate standards. All tests were conducted on a representative sample of the equipment for which Type acceptance is sought.

Apr. 6/98

Rupinder Randhawa

Date

Technical Manager, Regulatory

Nortel

Calgary, Alberta, Canada

# 3.0 Type Acceptance Application Requirements

## 3.1 Name of applicant

The applicant is Northern Telecom Incorporated.

## 3.2 Identification of Equipment

The equipment in this application is referred to as the 1900MHz Radio Frequency Front End (RFFE) Assembly. The Model Numbers for the 1900MHz RF Front End Assembly are:

NTGK05GA for the A and D bands

NTGK05HA for the B and E bands

NTGK05LA for the C and F bands

The FCC ID number sought in this family listing is AB6NTGK05GA.

## 3.3 Quantity Production

The 1900MHz RF Front End Assembly will be produced in quantity.

## 3.4 Technical Description

The 1900MHz RF Front End Assembly was originally approved as part of the Nortel 1.9GHz CDMA Base Station products. The Indoor 1.9GHz Base Station was approved under FCC ID AB6NTGD01AA and the Outdoor Base Station under FCC ID AB6NTGK03AA. The RFFE assembly is hereby being filed standalone independant of whether it is on with an indoor or outdoor base station.

The RFFE is housed in an environmentally sealed enclosure for outdoor mounting applications. This version is different from the original RFFE (approved together with the indoor and outdoor base stations) in that a new High Power Amplifier (HPA) will be used. The HPA is an OEM product designed for Nortel. The HPA is available in a 17W and 25W versions. Both versions are identical in design, but are tested by the vendor for 17W or 25W operation.

In addition to the HPA, the RFFE also houses the power converter module, a controller card, the Low Noise Amplifier (LNA) and the Duplexer.

### 3.4.1 Type or types of emission.

The 1900MHz RF Front End Assembly is designed to operate in digital mode. The emission type is F9W for CDMA mode. The emission designator is 1M25F9W.

### 3.4.2 Frequency range

| Frequency Block | Transmit Frequency Range (MHz) | Receiver Frequency Range (MHz) |
|---|---|---|
| A | 1930 - 1945 | 1850 - 1865 |
| B | 1950 - 1965 | 1870 - 1885 |
| C | 1975 - 1990 | 1895 - 1910 |
| D | 1945 - 1950 | 1865 - 1870 |
| E | 1965 - 1970 | 1885 - 1890 |
| F | 1970 - 1975 | 1890 - 1895 |

### 3.4.3 Range of operating power

The transmit power can be set to levels covering the range from 2W (33dBm) to 20.0W (43.0dBm).

### 3.4.4 Maximum power rating

The maximum RF power output is 20.0W (43.0dBm) at the output of the RFFE.

### 3.4.5 Power consumption

The DC current consumption of the HPA is:

| | | | | |
|---|---|---|---|---|
| 26Vdc | typ. | 6.5 A | max. | 10.0 A |

### 3.4.6 Function of each active circuit device

A list of the components used in the RFFE is shown in Exhibit 2.

**High Power Amplifier (HPA)**

The HPA provides amplification for the CDMA signal received from the base station. The HPA is available in a 17W (model # NTGK0518) and 25W (model # NTGK0533) versions. Both versions are identical and are tested by the vendor for 17W or 25W. The HPA uses a class AB biased Lateral Depletion Metal Oxide Semiconductor (LDMOS) RF transistors. This is the major difference between this HPA and the original design. The new HPA exhibits a considerable reduction in the conducted spurious emissions. Also, the class AB biasing demands less DC current than the old HPA when in idle mode.

**Power Converter Module**

This module converts the -48VDC input from the base station to +26VDC used by the control module, the LNA and the HPA

**Control Module**

### 3.4.7 Complete circuit diagrams

Circuit diagrams of the HPA are included in Exhibit 3.

### 3.4.8 User and Maintenance Manual

The Operating and Maintennance Manual is included Exhibit 4. The manual is over 400 pages and therefore only section relevent to the RFFE are included with this report.

### 3.4.9 Tune-up procedure

All frequency adjustments are set through autocal by the XDM computer. There are no frequency adjustments for this product.

### 3.4.10 Circuit description for frequency determining and stabilizing

The RFFE is not invloved in the frequency determining or stability of the CDMA signal. This is done at the Base station (BTS) with a GPS receiver. A description of this circuit is provided in the following paragraph.

The Global positioning receiver provides the BTS with a Stratum 1 type reference (10 MHz) derived from the Global Positioning Satellites. The frequency reference is used for frequency synthesis of the CHIP x8 generated in the TFU. The GPSR provides a 1PPS timing signal that is used for the time synchronization of the BSC subsystems. The frequency and timing outputs maintain the following criteria:

- 10 MHz output has a frequency accuracy of 1 X 10 /-11 per cycle

- 1 PPS output has a timing accuracy of +/- 1us per day

### 3.4.11 Circuit description for suppression of spurious radiation

The transmit front end provides filtering of the RF signal in order to meet FCC Specifications. For Radiated spurious suppression proper design techniques and the use of proper shielding techniques reduce the emission levels well below the permissible FCC limits.

## 3.5 Circuit description for limiting modulation

The RFFE is not involved in the signal modulation. A description is given below of the of the Walsh function used on the CDMA channel.

The Forward CDMA Channel consists of the following code channels: the Pilot Channel, up to one Sync Channel, up to seven Paging Channels, and a number of Forward Traffic Channels. Each code channel transmitted on the Forward CDMA Channel shall be spread with a Walsh function at a fixed chip rate of 102288 Mcps to provide orthogonal channelization among all code channels on a given Forward CDMA Channel. One of sixty-four time-orthogonal Walsh functions shall be used.

A code channel that is spread using Walsh function n shall be assigned to code channel number n (n = 0 to 63). Walsh function time alignment shall be such that the first Walsh chip begins at the even second time mark referenced to base station transmission time. The Walsh function spreading sequence shall repeat with a period of 52.08333 μs which is equal to the duration of one Forward Traffic Channel modulation symbol

Code channel number zero shall always be assigned to the Pilot Channel. If the Sync channel is present, lit shall be assigned code channel number 32. If paging Channels are present, they shall be assigned to code channel number sone through seven (inclusive) in sequence. The remaining code channels are available for assignment to the Forward Traffic Channels

## 3.6 Circuit description for limiting power

The RFIC (on the base station )is responsible for implementing ERP limiting module.

The module monitors the analog transmit total power and determines if the Power exceeds the maximum transmit total power. If it exceeds the maximum total transmit power, then the ERP limiting module tells the blossoming and wilting module to wilt until the sector total transmit power no longer exceeds the maximum transmit total power of 14 watts.

In order to recover from ERP limiting, if the sector is not at full blossom and the analog transmit total power does not exceed the maximum total transmit power, then the ERP limiting module tells the blossoming and wilting module to blossom the sector

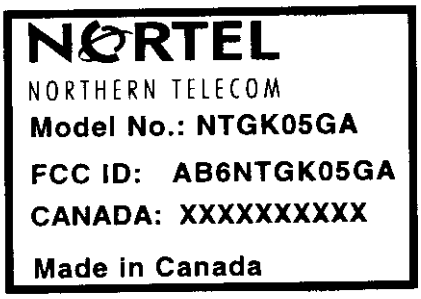
## 3.7 Photographs

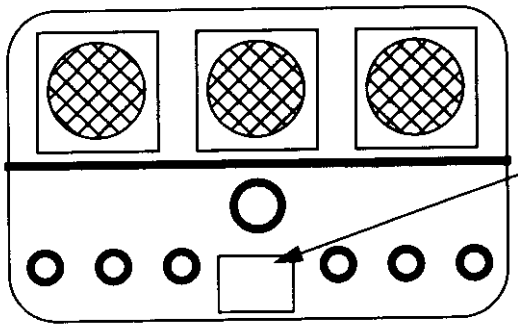
Photographs of the RFFE assembly is provided in Exhibit 5.

## 3.8 RF Radiation Effects

An internal Nortel document, "RF Exposure Guidelines for Cellular and PCS Antenna Sites" (Document no: SI-EMR-R01.4), is used for the deployment and installation of Nortel's wireless base station equipment with respect to the control of electromagnetic radiation (EMR) exposure. The objective of this document is to provide guidance on where antennas can be deployed, how to calculate power densities and safe distances, and how to protect users from excessive exposure to electromagnetic radiation.

## 3.9 Regulatory Label Sample




**Bottom side of the RFFE**

## 3.10 Standard Test Conditions and Test Equipment

The 1900 MHz TDMA Base Station was tested under the following standard test conditions unless otherwise noted:

Ambient Temperature: 20 - 35°C

Ambient Humidity: 20 to 40%

DC supply voltage: -48Vdc nominal)

## Test Equipment:

| Description | Manufacturer | Model | Serial | CalDue |
|---|---|---|---|---|
| Spectrum Analyzer | HP | 8563E | 3720A07052 | 06/02/98 |
| Power Meter | HP | 53489A | 3009A01319 | 11/15/98 |
| Power Sensor | HP | 8485A | 3318A15704 | 11/15/98 |
| 30dB Attenuator | Weinschel | 66-30-34 | BD8227 | 06/30/98 |
| Plotter | HP | 7550A | 2725A98925 | NA |
| EMI Receiver | R & S | ESAI-D | 804893252 | 11/21/98 |
| Spectrum Analyzer | R & S | FSEK | DE22471 | 11/28/98 |
| Biconolog Antenna | EMCO | 3141 | 9707-1008 | 07/13/99 |
| Horn Antenna | EMCO | 3115 | 9711-5362 | 05/06/99 |
| Multi-Device Controller | EMCO | 2090 | 9711-1270 | NA |
| Multi-Device Controller | EMCO | 2090 | 9711-1266 | NA |
| Low Noise Amplifier | MITEQ | 7300 | LNA-3 | Verified Before Use |
| Cable | Sucoflex | 104 | 115748/4 | NA |
| Cable | Sucoflex | 100 | C00001 | NA |
| Desktop Computer | Dell | MMP | C0Z46 | NA |
| | Xantrex | | | Verified Before Use |

# 4.0 Transmitter Test and Measurement Results

## 4.1 RF Power Output

**Standard:**

2.985, RF power output.

**FCC Part 24, Sub. E, Para. 24.232**

*(a) base stations are limited to 1640 watts peak equivalent isotroically radiated power (e.i.r.p.) power with an antenna height up to 300 meters HAAT. In no case may the peak output power of a base station transmitter exceed 100 watts.*

*(c) Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of rms equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.*

**Equipment:**

RFFE: Model # NTGK05GA for A/D Band, NTGK05HA for B/E Band and NTGK05LA for C/F Band
CDMA Indoor BTS Model # NTGD01AA

**Test Method:**

Operate the transmitter under the standard test conditions and measure the output power using a calibrated calorimetric power meter. The measurement is to be made with a 50 ohm resistive RF load. The EUT was connected to a resistive coaxial attenuator and the modulated power was measured by means of an RF Power meter. EIA Standard PN3383, Paragraph3.3 was used as a guide. The modulation scheme was configured as per the Table below for the power output measurement as recommended by PN3383.

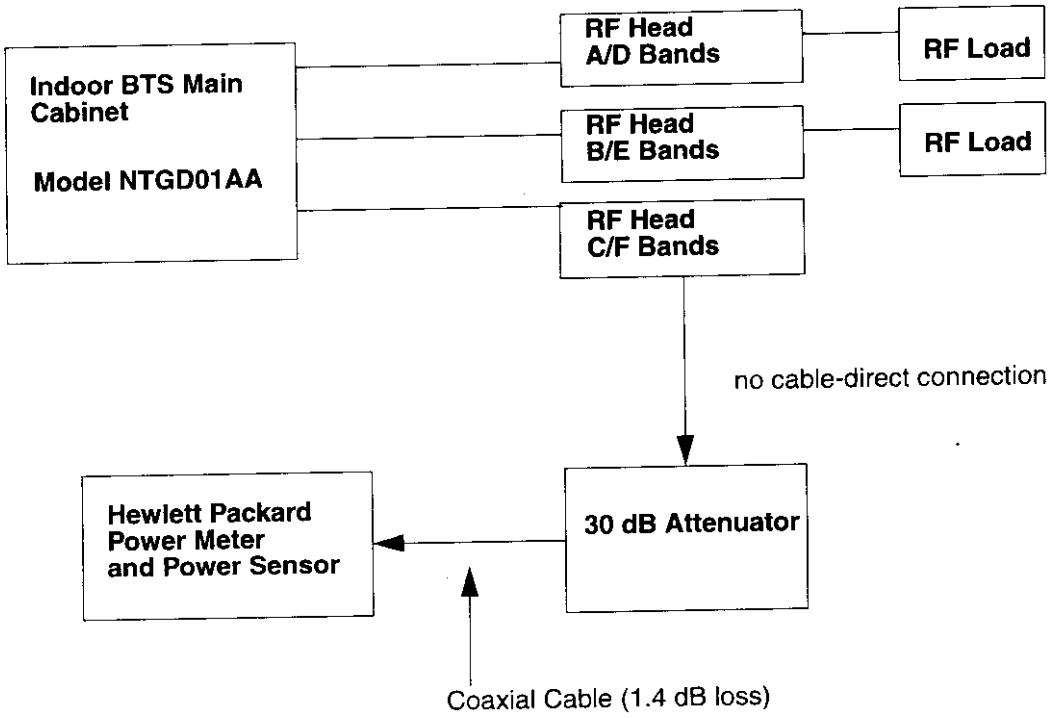
**Table 1:**

| Type | Number of Channels | Fraction of Power (Linear) | Fraction of Power (dB) | Comments |
|---|---|---|---|---|
| Pilot | 1 | .200 | -7.0 | Walsh 0 |
| Sync | 1 | 0.0471 | -13.3 | Walsh 32. always 1/8 rate |
| Paging | 1 | 0.1882 | -7.3 | Walsh 1, full rate only |

**Table 1:**

| Type | Number of Channels | Fraction of Power (Linear) | Fraction of Power (dB) | Comments |
|---|---|---|---|---|
| Traffic | 6 | 0.09412 | -10.3 each | Variable Walsh assignments, full rate only |
| | | | | |

## Test Setup:




## Results

Conforms. The maximum power output is 20.0 Watts (43.0dBm) for the RFFE.

# PEAK POWER MEASUREMENT

| TX Band (Channel #) | Fundamental Frequency (MHz) | Maximum Measured Level (dBm) | Base Station Peak Power Limit (dBm) |
|---|---|---|---|
| A (25) | 1931.25 | 42.9 | 50.0 |
| B (425) | 1951.25 | 42.9 | 50.0 |
| C (925) | 1976.25 | 42.9 | 50.0 |
| D (325) | 1946.25 | 43.0 | 50.0 |
| E (725) | 1966.25 | 42.9 | 50.0 |
| F (825) | 1971.25 | 42.9 | 50.0 |

## 4.2 Modulation Characteristics

**Standard:**

§2.987 a), Not applicable.

## 4.3 Modulation Limiting

**Standard:**

§2.987(b) Not applicable as part 24 Subpart E)

## 4.4 Occupied Bandwidth

### Standard:

### REQUIREMENTS:

### FCC

Modulation requirements are not defined in Part 24, Subpart E of the FCC Rules and Regulations. For testing Part 2 of the FCC Rules will be used as a guideline.

### FCC Part 2, Para. 2.989

*The OBW, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the following conditions as applicable:*

*(g) Transmitter in which the modulating baseband comprises not more than three independent channels - when modulated by the full complement of signals for which the transmitter is rated. The level of modulation for each channel should be set to that prescribed in rule parts applicable to the services for which the transmitter is intended. If specific modulation levels are not set forth in the rules, the tests should provide the manufacturer's maximum rated condition.*

*(h) Transmitters employing digital modulation techniques - when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated. The signal shall be applied through any filter networks, pseudo-random generators or other devices required in normal service. Additionally, the occupied bandwidth shall be shown for operation with any devices used for modifying the spectrum when such devices are optional at discretion of the user.*

### Equipment:

RFFE: Model # NTGK05GA for A/D Band, NTGK05HA for B/E Band and NTGK05LA for C/F Band
CDMA Indoor BTS Model # NTGD01AA

### Test Method:

The transmitter was operated under the standard test conditions. The measurement is to be made with a 50 ohm resistive RF load. The test configuration was as per block diagram. As per correspondence from the FCC dated June 4, 1996 the current acceptable method for CDMA submittals under Part 24 was used. The spectrum analyzer used a RBW of 30 KHz and a VBW of 30 KHz and the Signal was averaged over 10 sweeps. The modulation scheme was configured as per the Table below for the power output measurement as recommended by PN3383.

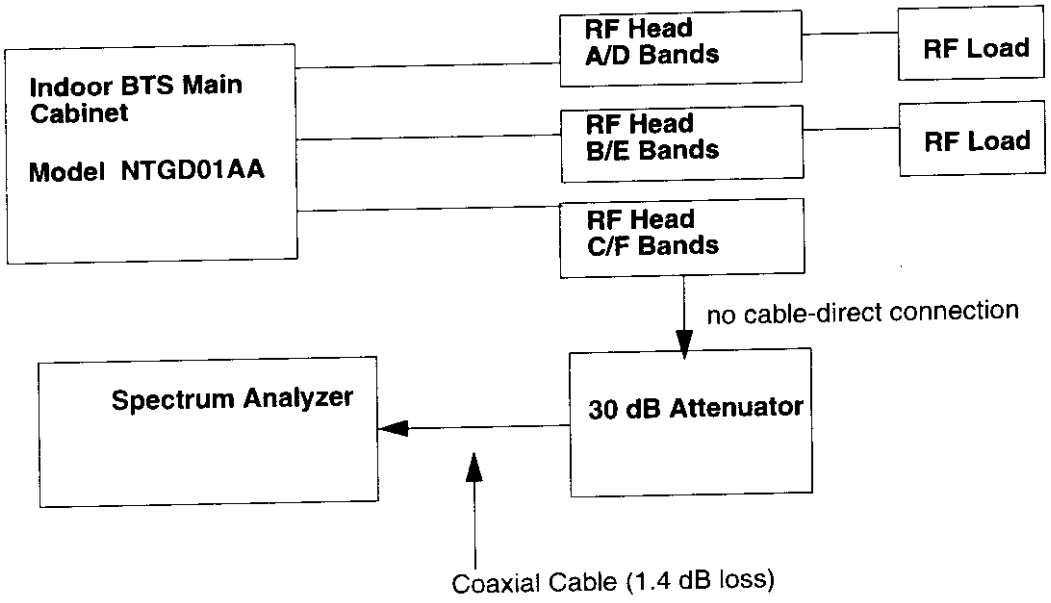
**Table 2:**

| Type | Number of Channels | Fraction of Power (Linear) | Fraction of Power (dB) | Comments |
|---|---|---|---|---|
| Pilot | 1 | .200 | -7.0 | Walsh 0 |

**Table 2:**

| Type | Number of Channels | Fraction of Power (Linear) | Fraction of Power (dB) | Comments |
|---|---|---|---|---|
| Sync | 1 | 0.0471 | -13.3 | Walsh 32. always 1/ 8 rate |
| Paging | 1 | 0.1882 | -7.3 | Walsh 1, full rate only |
| Traffic | 6 | 0.09412 | -10.3 each | Variable Walsh assignments, full rate only |
| | | | | |

## Test Setup:



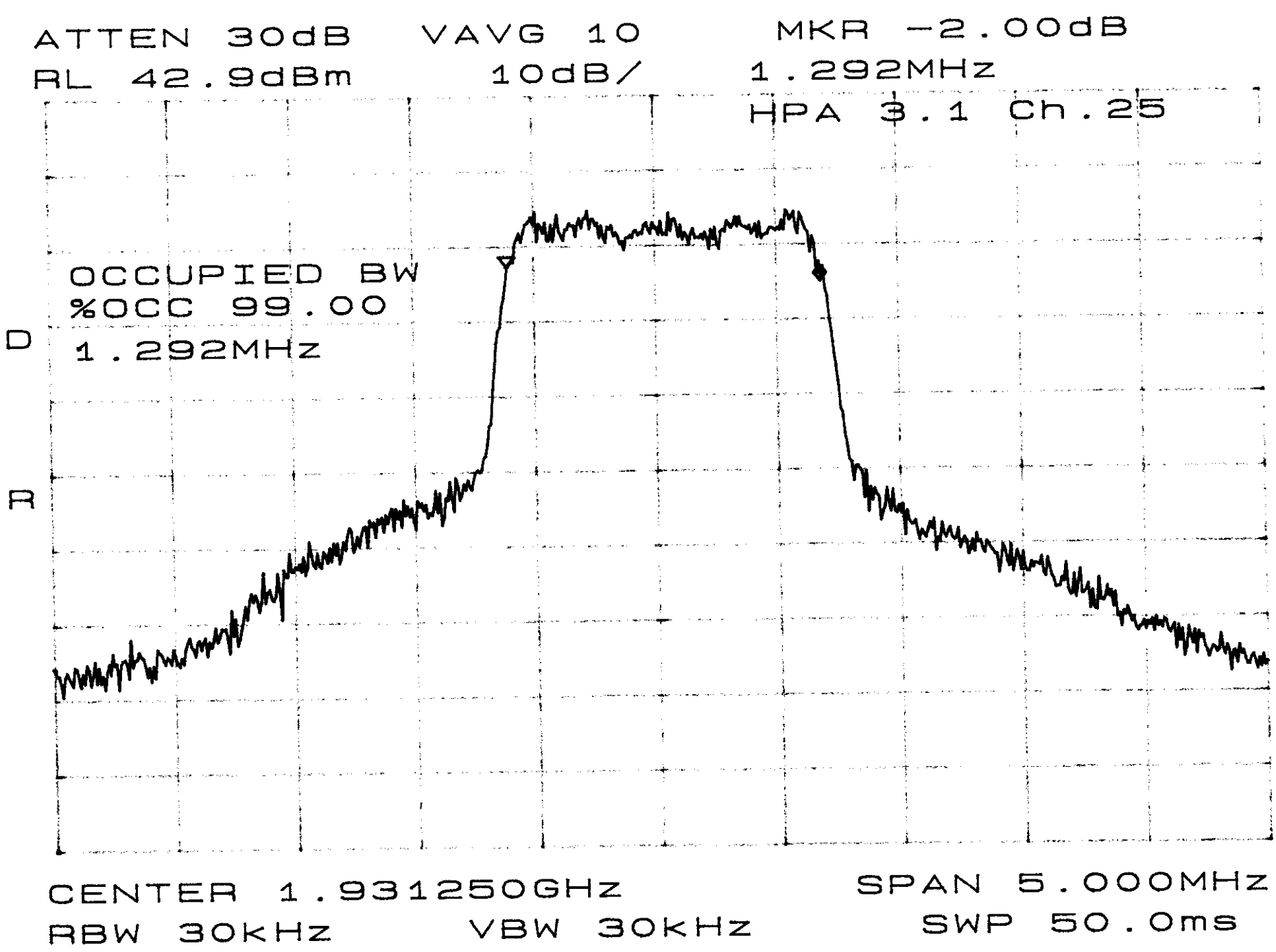

## Results:

**Conforms.** The test was performed on a channel near the bottom of every block and a channel near the top of every block. The 99% occupied bandwidth was measured and the results are summarized in the table below. The measurement plots for the 99% occupied bandwidth are also included.

**Measurement Results:**

| Channel Number | Fundamental Frequency (MHz) | Requested SCLPA output power (dBm) | 99% Occupied Bandwidth (MHz) |
|---|---|---|---|
| 25 | 1931.25 | 43.0 | 1.292 |
| 275 | 1943.75 | 43.0 | 1.283 |
| 325 | 1946.25 | 43.0 | 1.283 |
| 375 | 1948.75 | 43.0 | 1.283 |
| 425 | 1951.25 | 43.0 | 1.292 |
| 675 | 1963.75 | 43.0 | 1.275 |
| 725 | 1966.25 | 43.0 | 1.275 |
| 775 | 1968.75 | 43.0 | 1.275 |
| 825 | 1971.25 | 43.0 | 1.275 |
| 875 | 1973.75 | 43.0 | 1.292 |
| 925 | 1976.25 | 43.0 | 1.275 |
| 1175 | 1988.75 | 43.0 | 1.283 |

23 FEB 1998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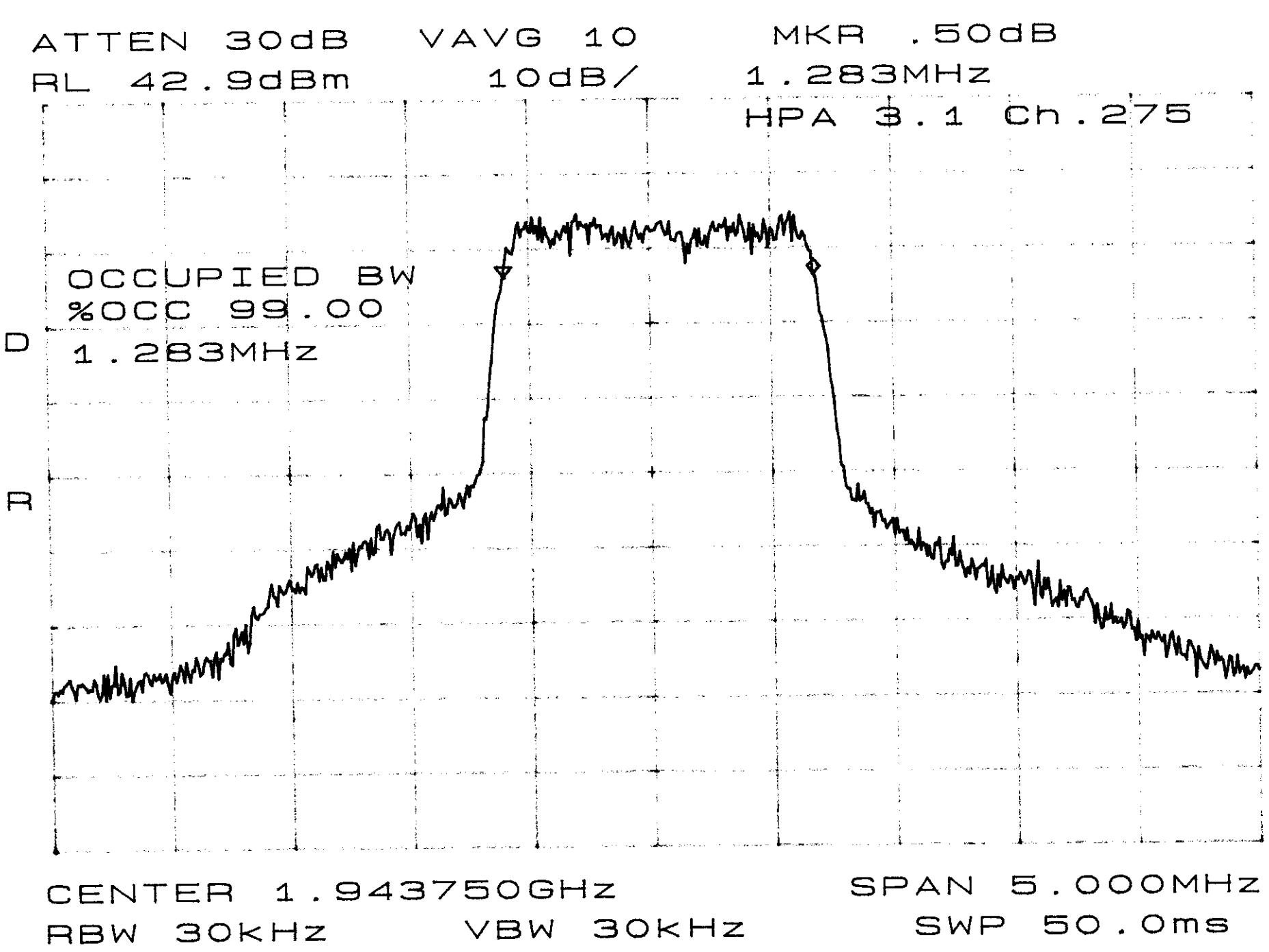
VAVG 10
MKR -2.00dB
RL 42.9dBm
10dB/
1.292MHz
HPA 3.1 Ch.25
OCCUPIED BW
%OCC 99.00
1.292MHz
D
R
CENTER 1.931250GHz
SPAN 5.000MHz
RBW 30kHz
VBW 30kHz
SWP 50.0ms

19 FEB 1998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RL 42.9dBm
10dB/
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OCCUPIED BW
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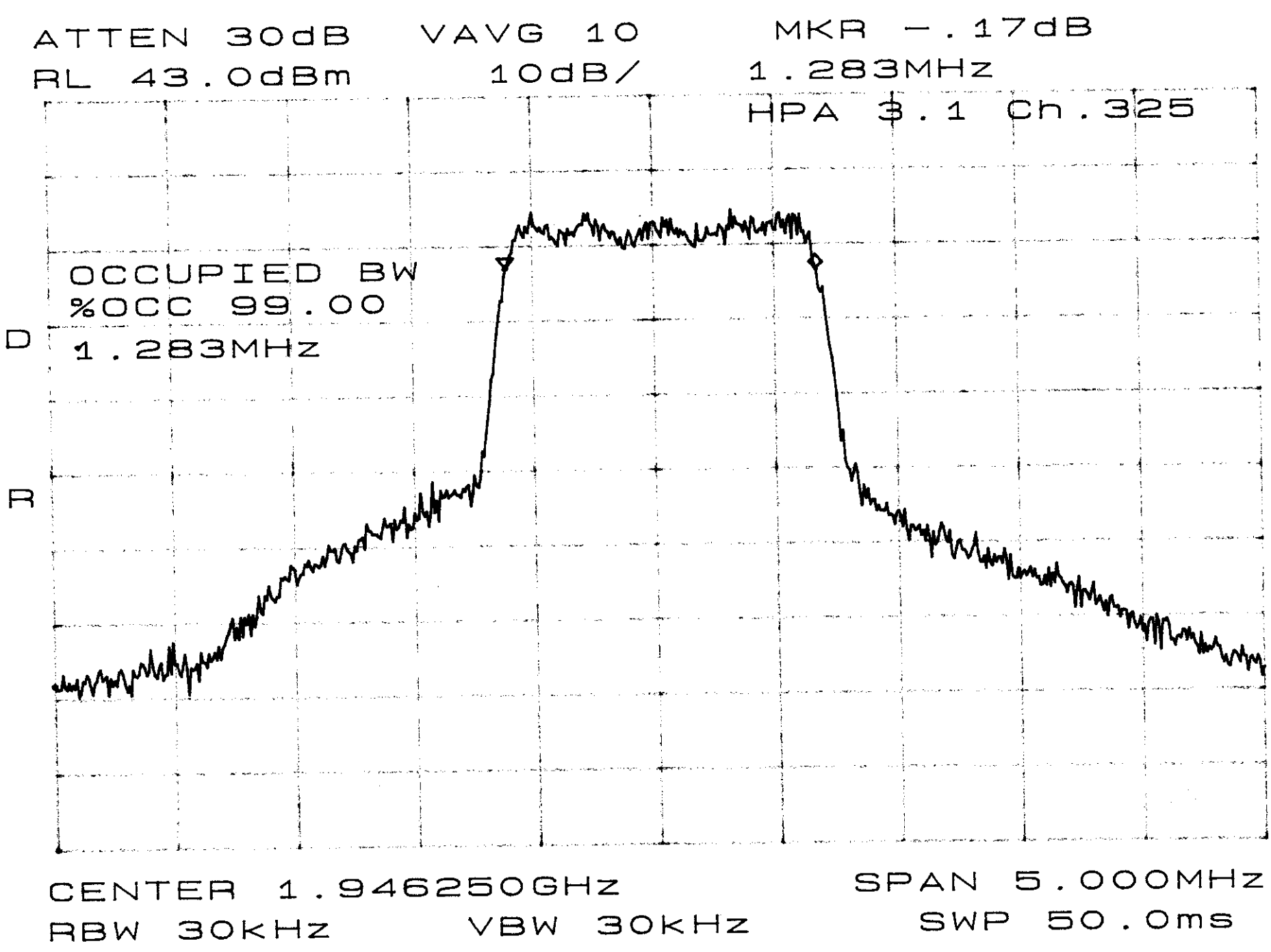
VBW 30kHz
SWP 50.0ms

20 Feb 1998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1.283MHz
D
R
CENTER 1.946250GHz
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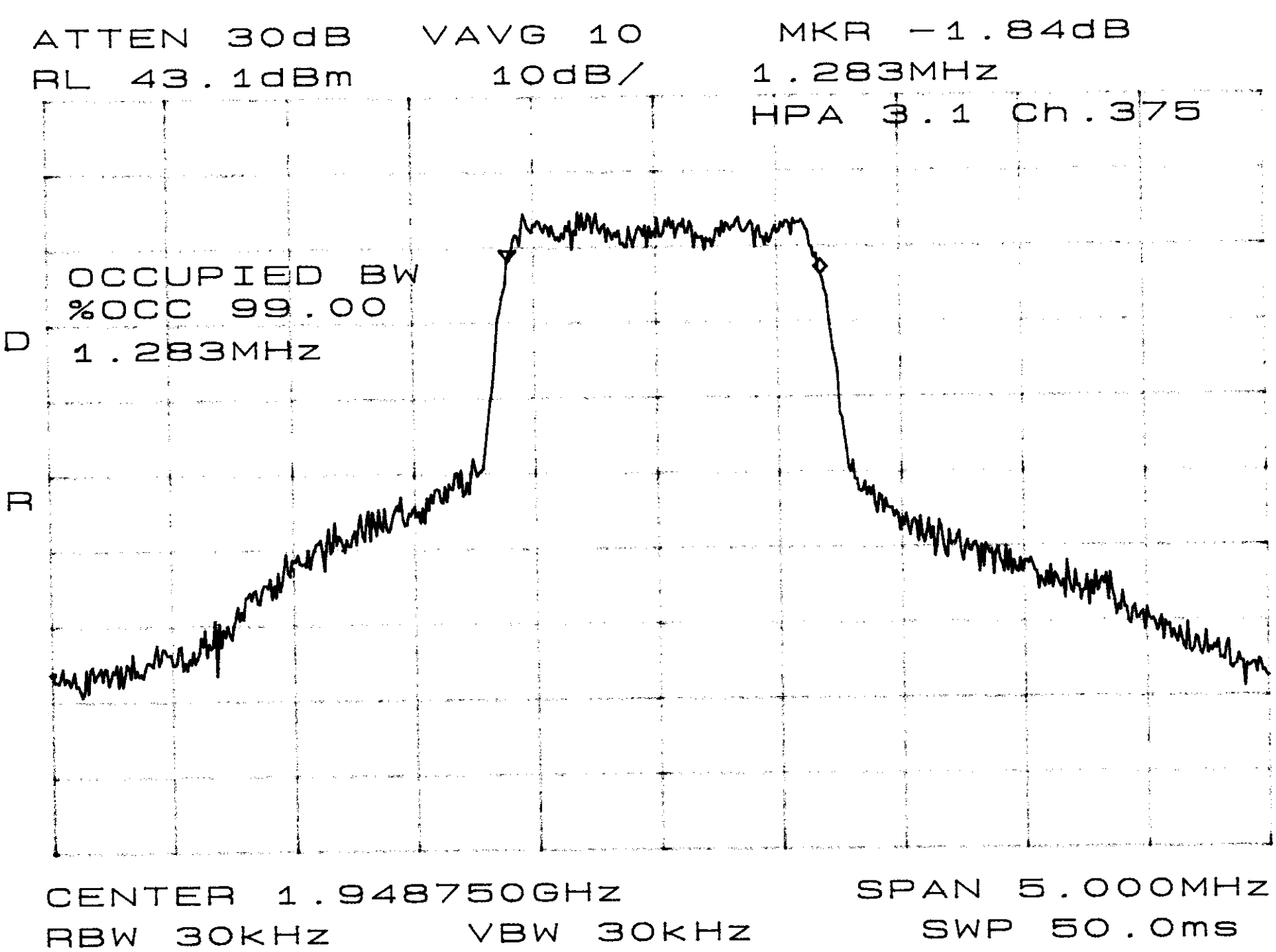
RBW 30kHz
VBW 30kHz
SWP 50.0ms

20 FEB 1998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10dB/
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%OCC 99.00
1.283MHz
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R
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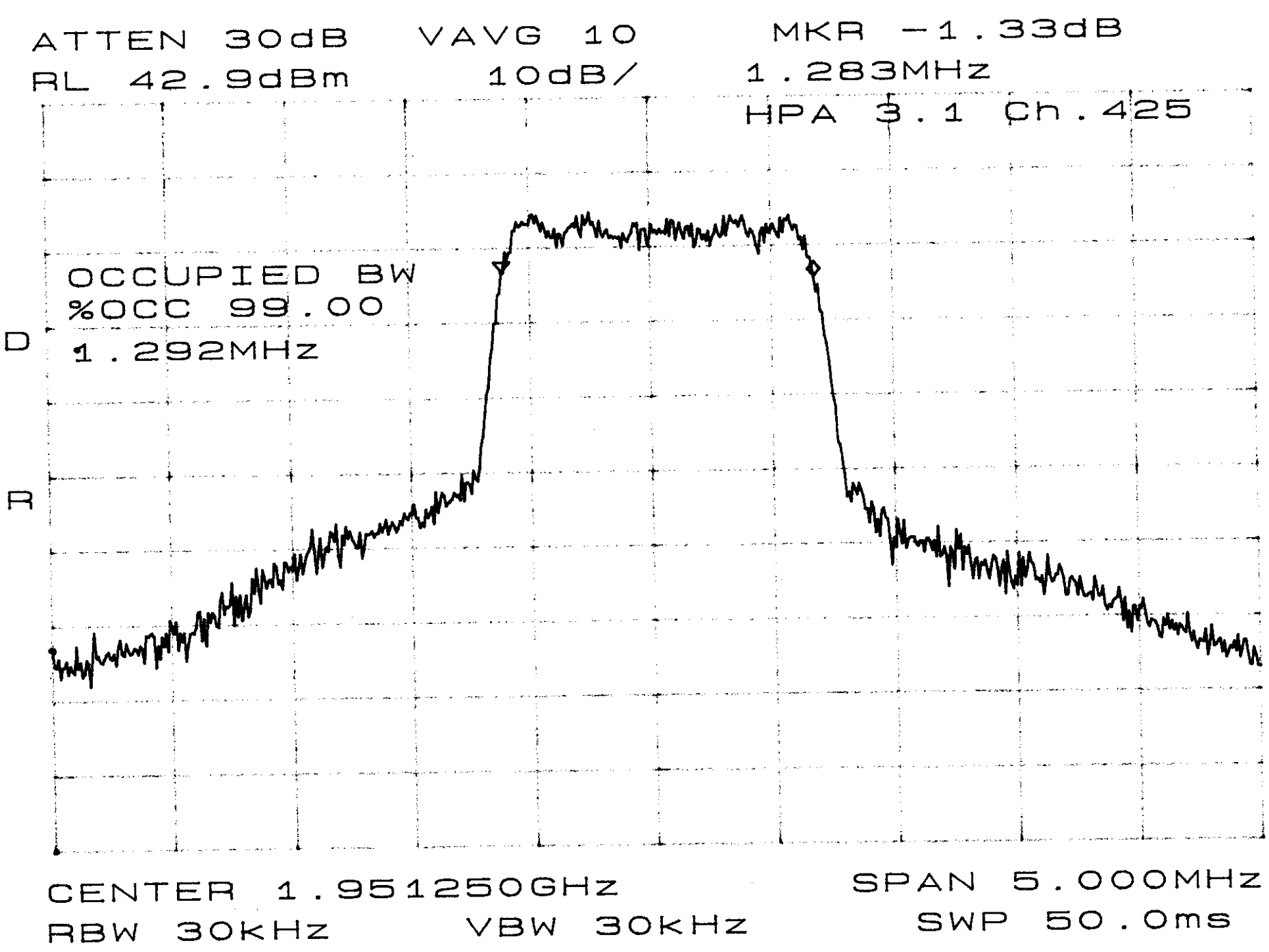
VBW 30kHz
SWP 50.0ms

20 Feb 1998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10dB/
1.283MHz
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OCCUPIED BW
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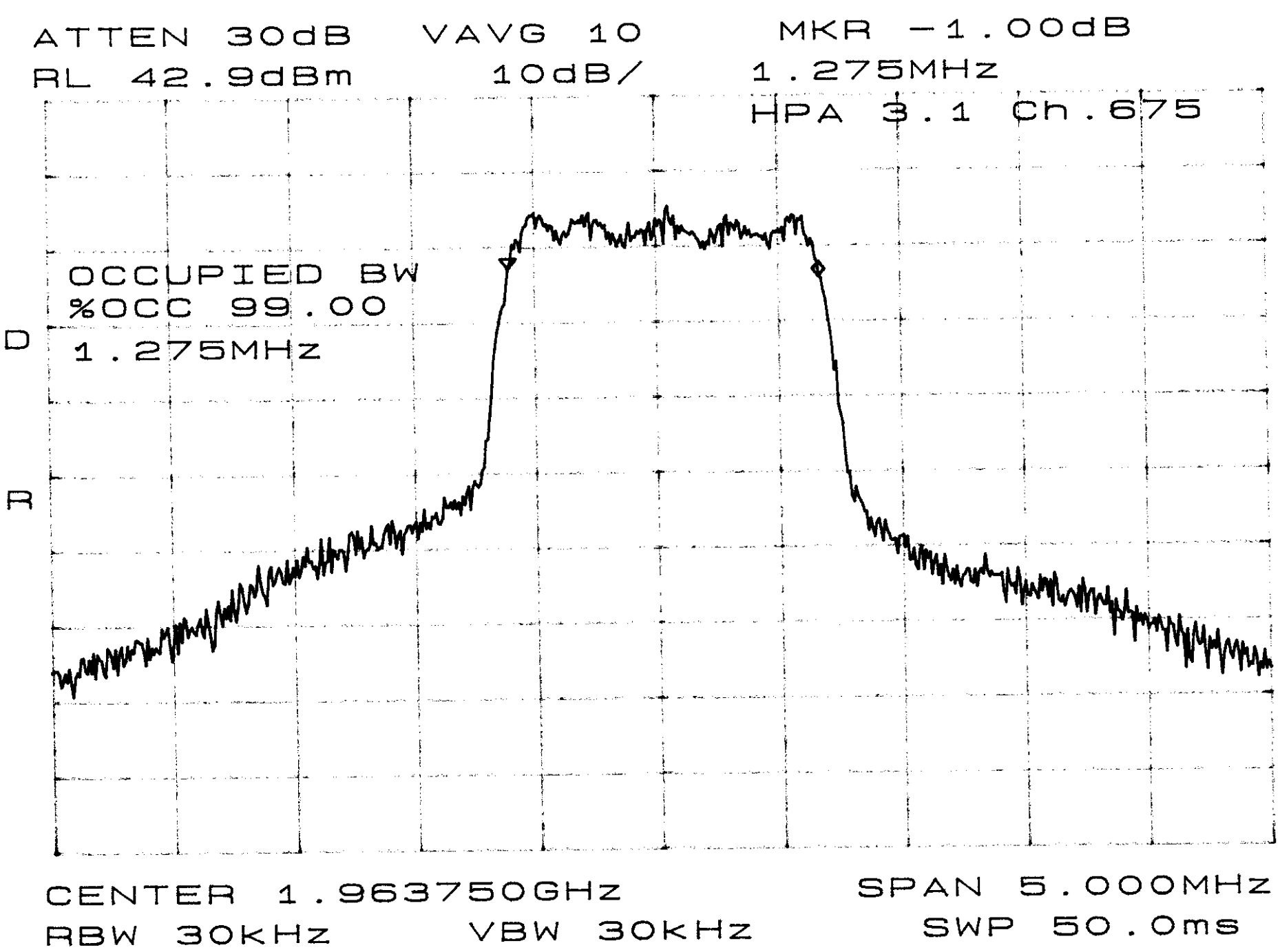
VBW 30kHz
SWP 50.0ms

20 Feb 1998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10dB/
1.275MHz
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%OCC 99.00
1.275MHz
D
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SPAN 5.000MHz
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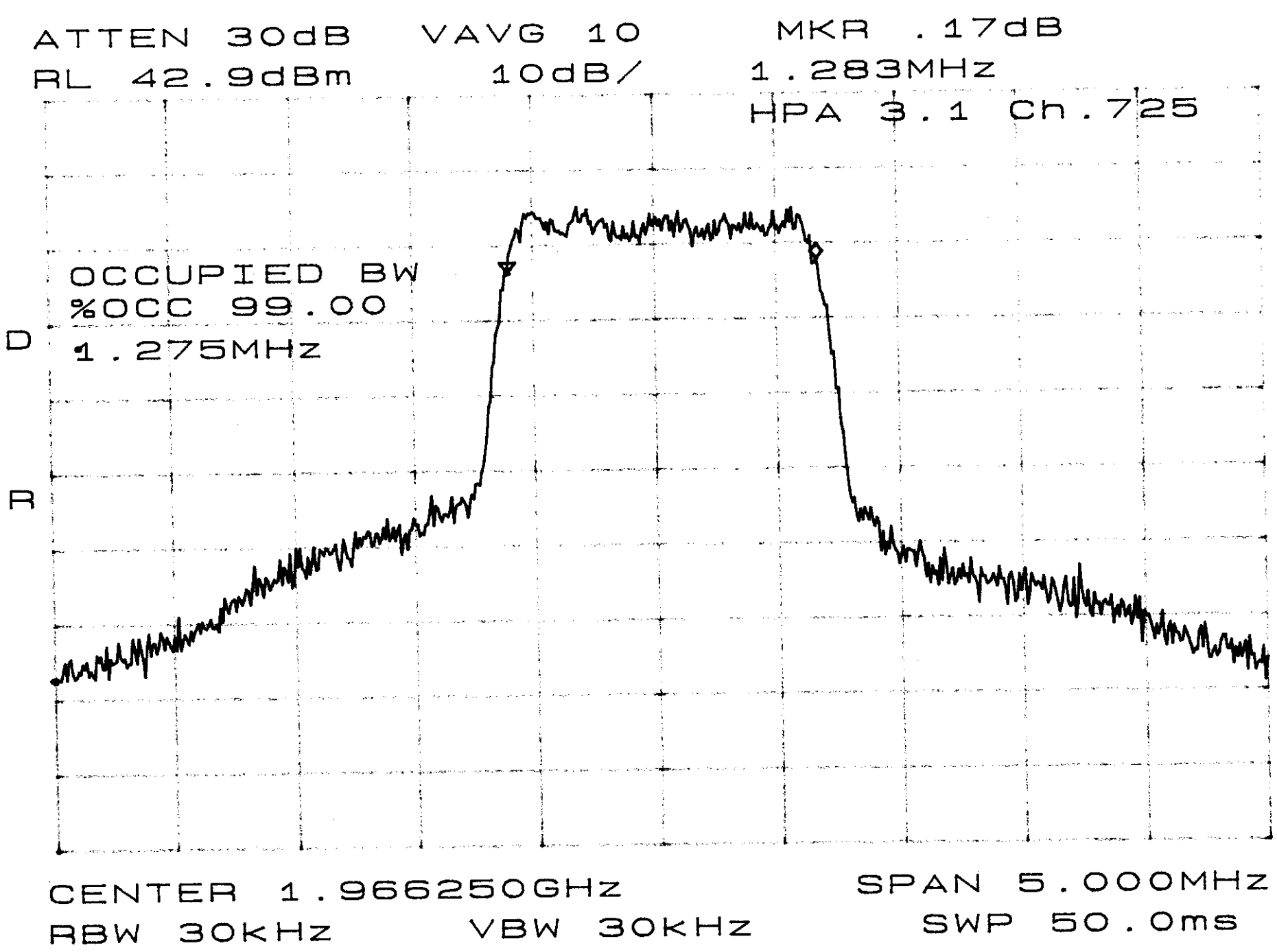
VBW 30kHz
SWP 50.0ms

23 Feb 1998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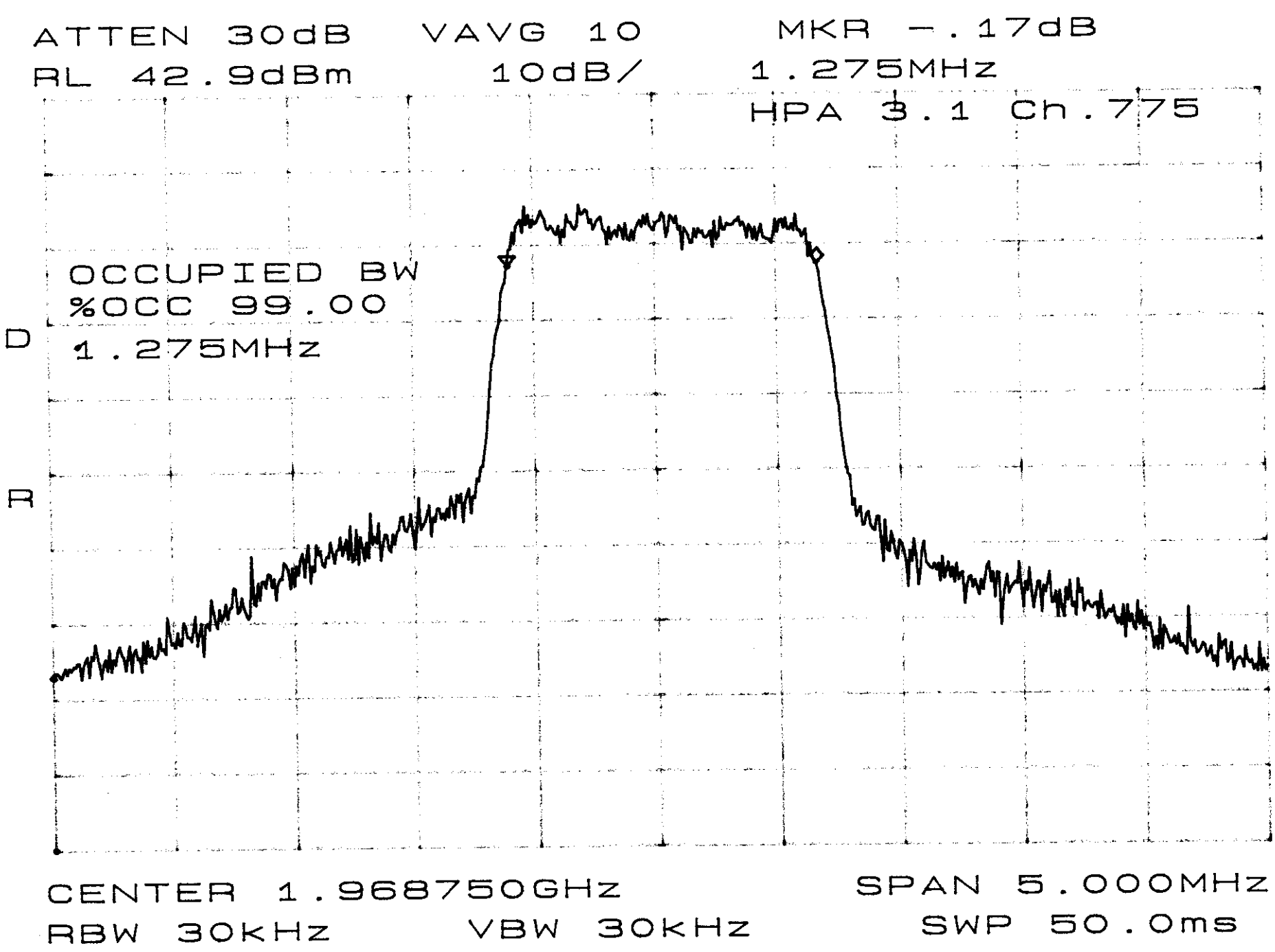
VAVG 10
MKR .17dB
RL 42.9dBm
10dB/
1.283MHz
HPA 3.1 Ch.725
OCCUPIED BW
%OCC 99.00
1.275MHz
D
R
CENTER 1.966250GHz
SPAN 5.000MHz
RBW 30kHz
VBW 30kHz
SWP 50.0ms

20 FEB 1998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MKR -.17dB
RL 42.9dBm
10dB/
1.275MHz
HPA 3.1 Ch.775
OCCUPIED BW
%OCC 99.00
1.275MHz
D
R
CENTER 1.968750GHz
SPAN 5.000MHz
RBW 30kHz
VBW 30kHz
SWP 50.0ms

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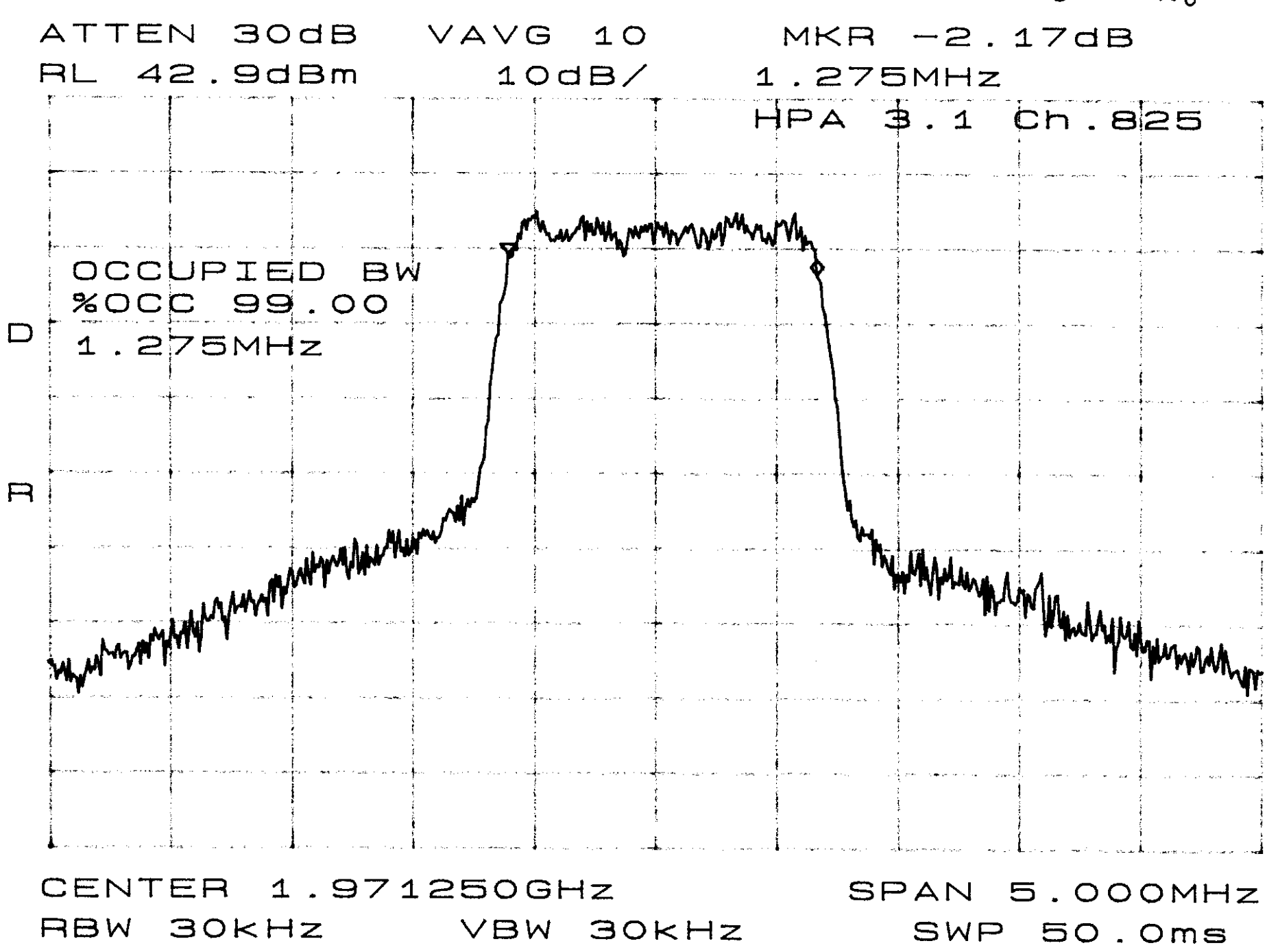
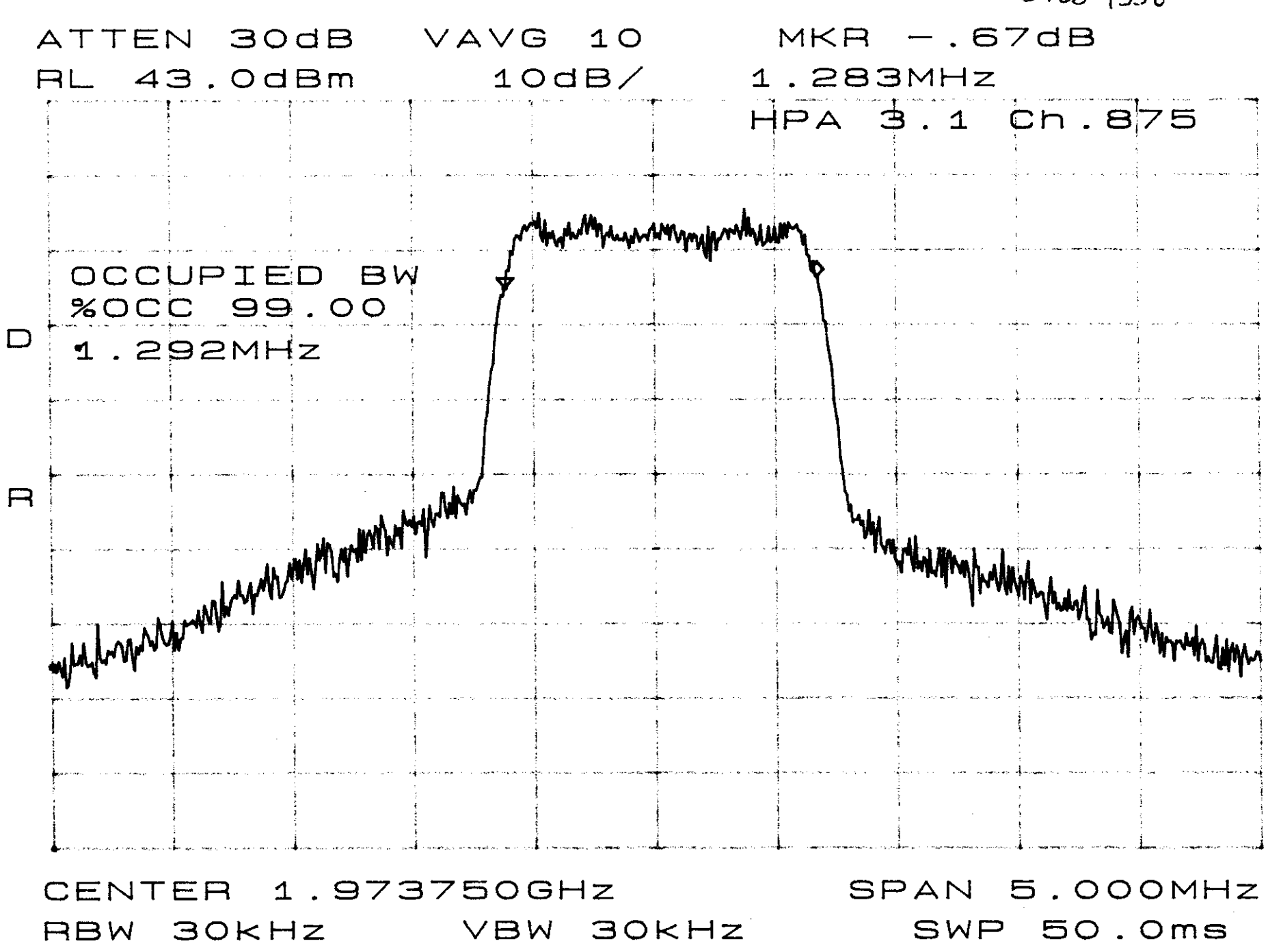

ATTEN 30dB
VAVG 10
MKR -2.17dB
RL 42.9dBm
10dB/
1.275MHz
HPA 3.1 Ch.825
OCCUPIED BW
%OCC 99.00
1.275MHz
D
R
CENTER 1.971250GHz
SPAN 5.000MHz
RBW 30kHz
VBW 30kHz
SWP 50.0ms

23 FEB 1998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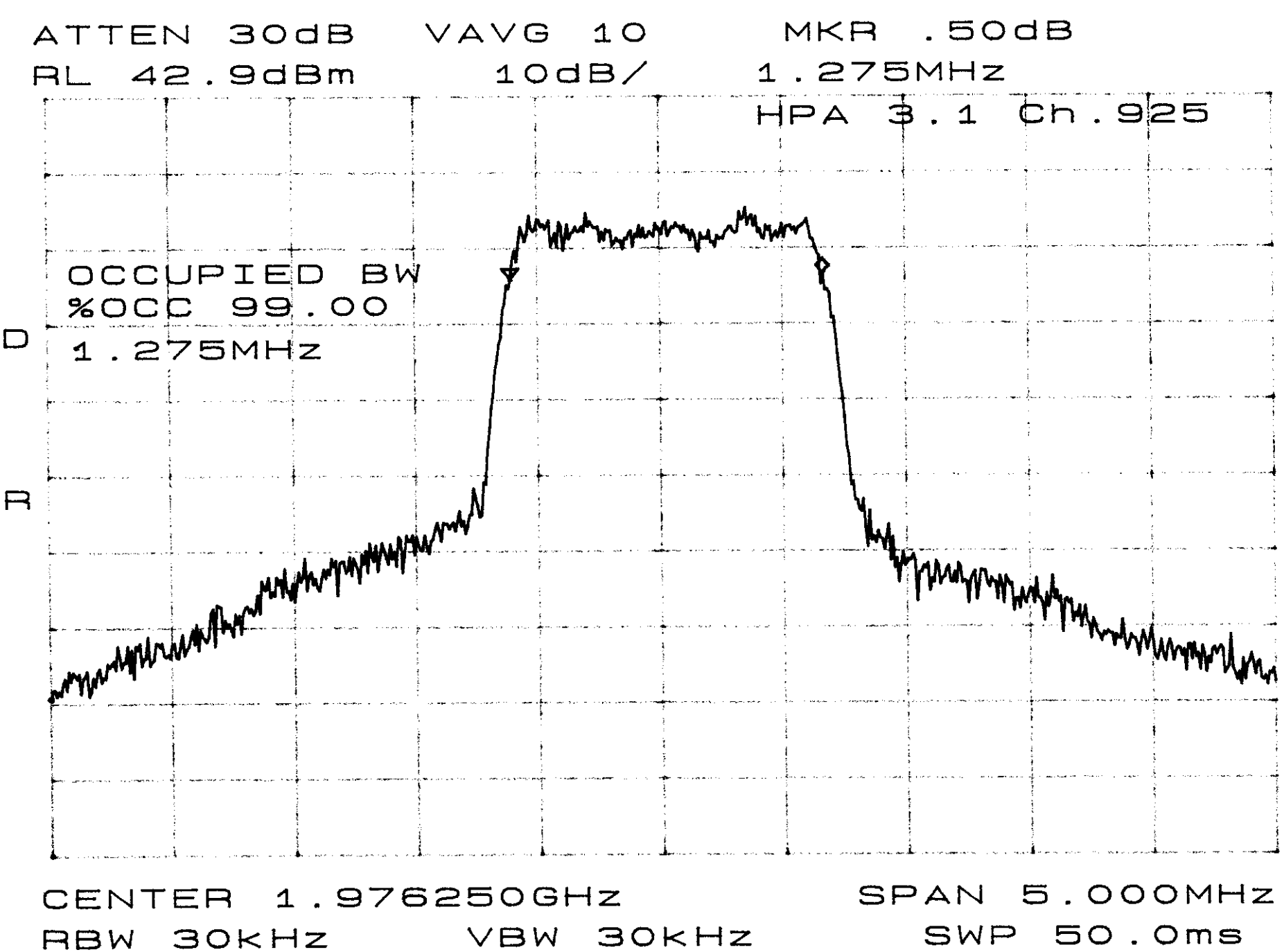
VAVG 10
MKR -.67dB
RL 43.0dBm
10dB/
1.283MHz
HPA 3.1 Ch.875
OCCUPIED BW
%OCC 99.00
1.292MHz
D
R
CENTER 1.973750GHz
SPAN 5.000MHz
RBW 30kHz
VBW 30kHz
SWP 50.0ms

23 FEB 1998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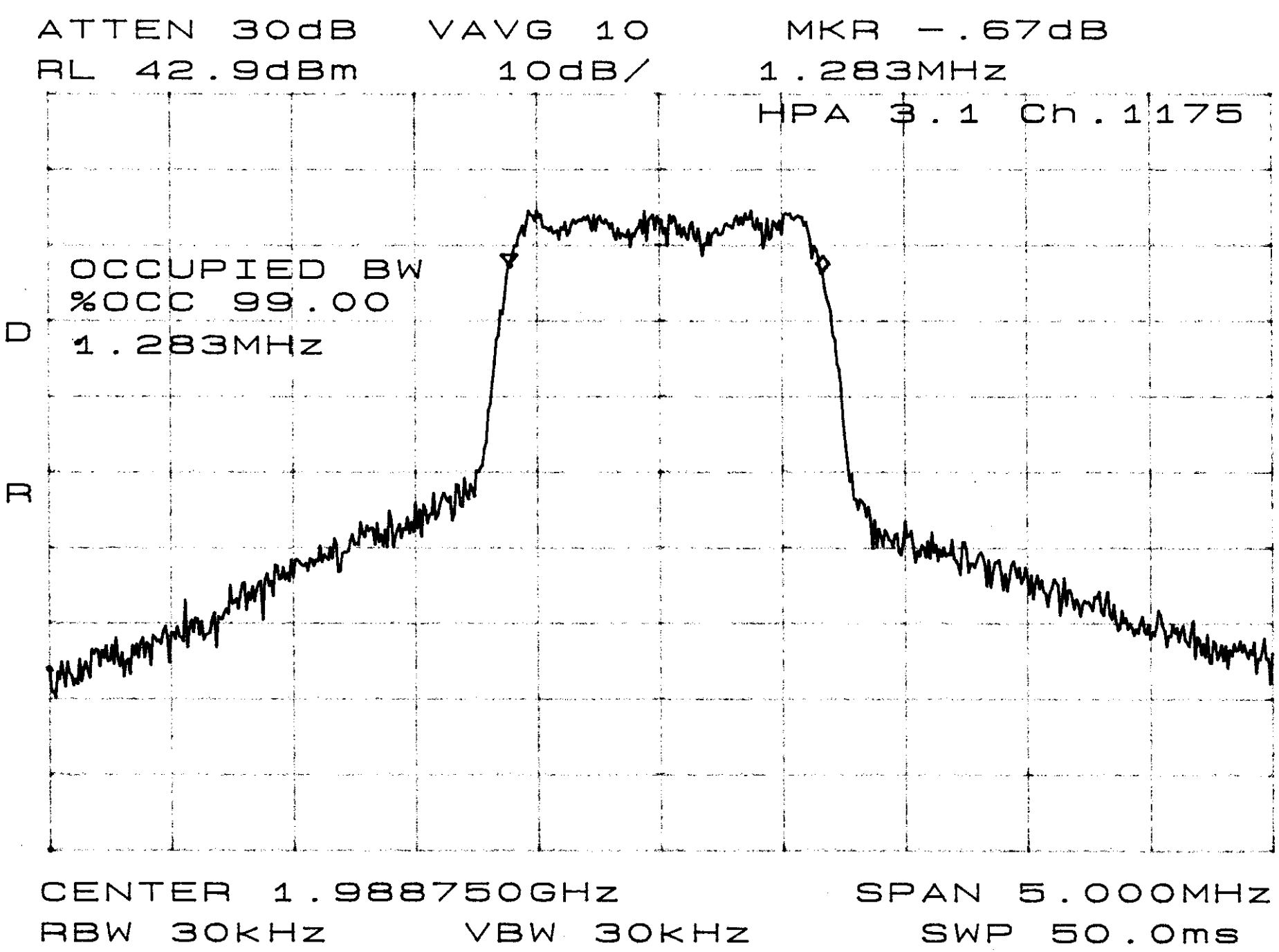
MKR .50dB
RL 42.9dBm
10dB/
1.275MHz
HPA 3.1 Ch.925
OCCUPIED BW
%OCC 99.00
1.275MHz
D
R
CENTER 1.976250GHz
SPAN 5.000MHz
RBW 30kHz
VBW 30kHz
SWP 50.0ms

23 FEB 1998


ATTEN 30dB
VAVG 10
MKR -.67dB
RL 42.9dBm
10dB/
1.283MHz
HPA 3.1 Ch.1175
OCCUPIED BW
%OCC 99.00
1.283MHz
D
R
CENTER 1.988750GHz
SPAN 5.000MHz
RBW 30kHz
VBW 30kHz
SWP 50.0ms

## 4.5 Spurious Emissions at Antenna Terminals

**Standard:**

**FCC REQUIREMENTS:**

**FCC Part 24, Sub. E, Para. 24.238**

*(a) On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB.*

*(b) Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.*

*(c) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.*

*(d) The measurements of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.*

*(e) When an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in this section.*

**METHOD OF MEASUREMENTS:**

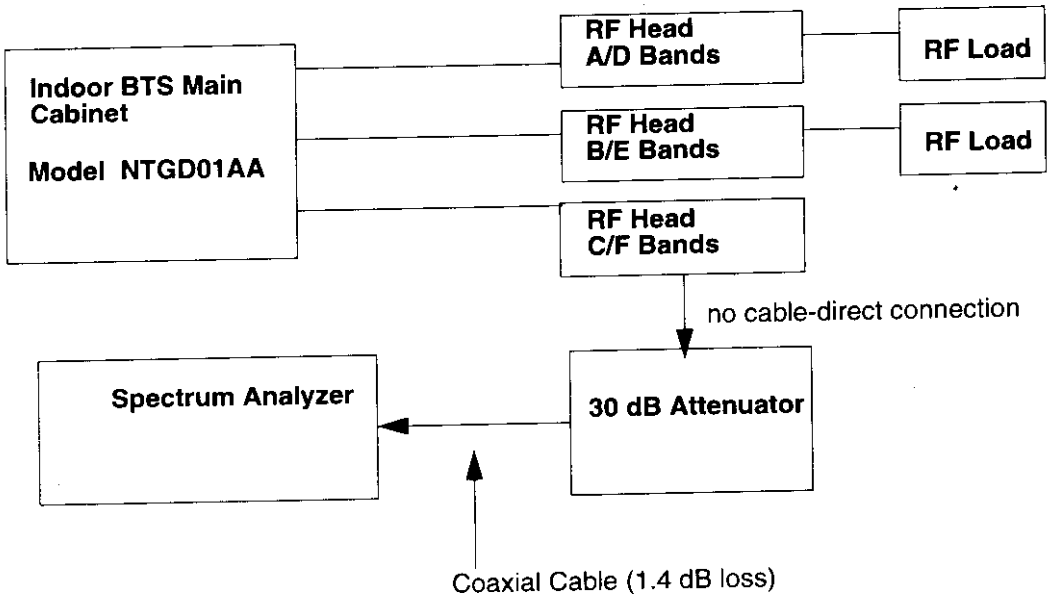
**FCC CFR 47, Para. 2.997 - Frequency spectrum to be investigated**

*The spectrum should be investigated from the lowest radio generated in the equipment up to at least the 10th harmonic of the carrier frequency or to the highest frequency practicable in the present state of the art of measuring techniques, whichever is lower. Particular attention should be paid to harmoncs and subharmonics of the carrier frequency. Radiation at the frequencies of multiplier stages should be checked. The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.*

**EQUIPMENT**

RFFE: Model # NTGK05GA for A/D Band, NTGK05HA for B/E Band and NTGK05LA for C/F Band
CDMA Indoor BTS Model # NTGD01AA

## Test Setup:




**TEST METHOD**

Operate the transmitter under the standard test conditions. Measure the harmonic and spurious emissions from 1 MHz to 10 GHz.

**Out of Band Spurious Emissions Measurement Procedure**

**1 MHz band immediately adjacent to the PCS Block:**

As per correspondence from the FCC dated June 4, 1996 the current acceptable method for CDMA submittals under Part 24 was used. The spectrum analyzer used a RBW of 30 KHz and a VBW of 30 KHz and the Signal was averaged over 10 sweeps. The modulation scheme was configured as per the Table below for the power output measurement as recommended by PN3383. Outside of the Bandedges the spectrum was searched from the lowest Frequency generated in the BTS up to 20 GHz, for any detected emissions a 1 MHz RBW and VBW was used to take the measurement.

One measurement in the upper and lower band will be taken for a total of two measurements for band edge requirements..

## Minimum Standard:

Spurious emissions on any frequency outside of the PCS band shall be less than -13 dBm.

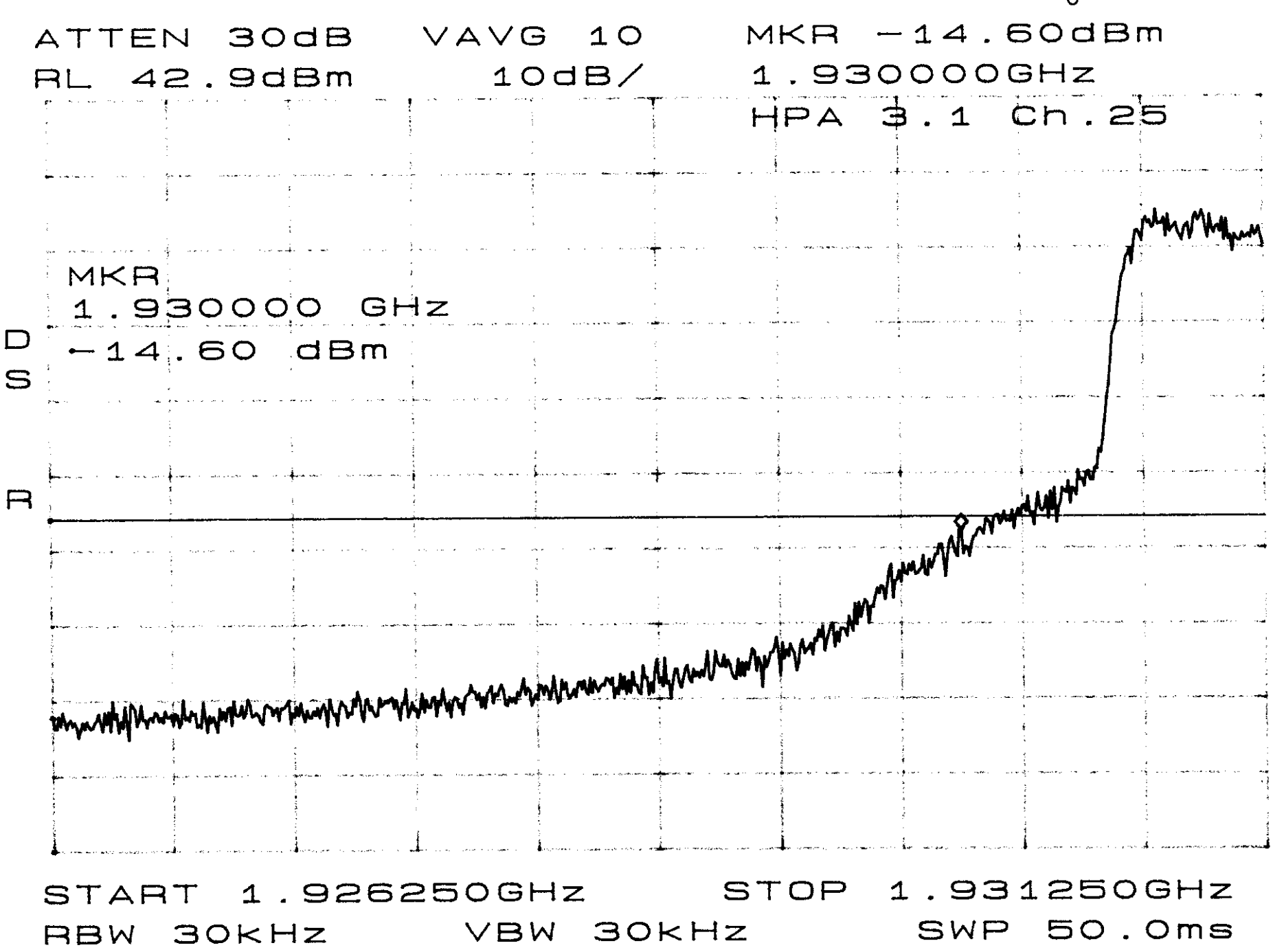
## Results:

**Conforms**. The worst case emission detected from the Antenna port on the RFFEs was -13.77 dBm at 1950MHz, which is the edge of the B band. No other emissions were detected from 150 KHz to 20 GHz. See Tables below for summary of test results. Measurement plots are also included.

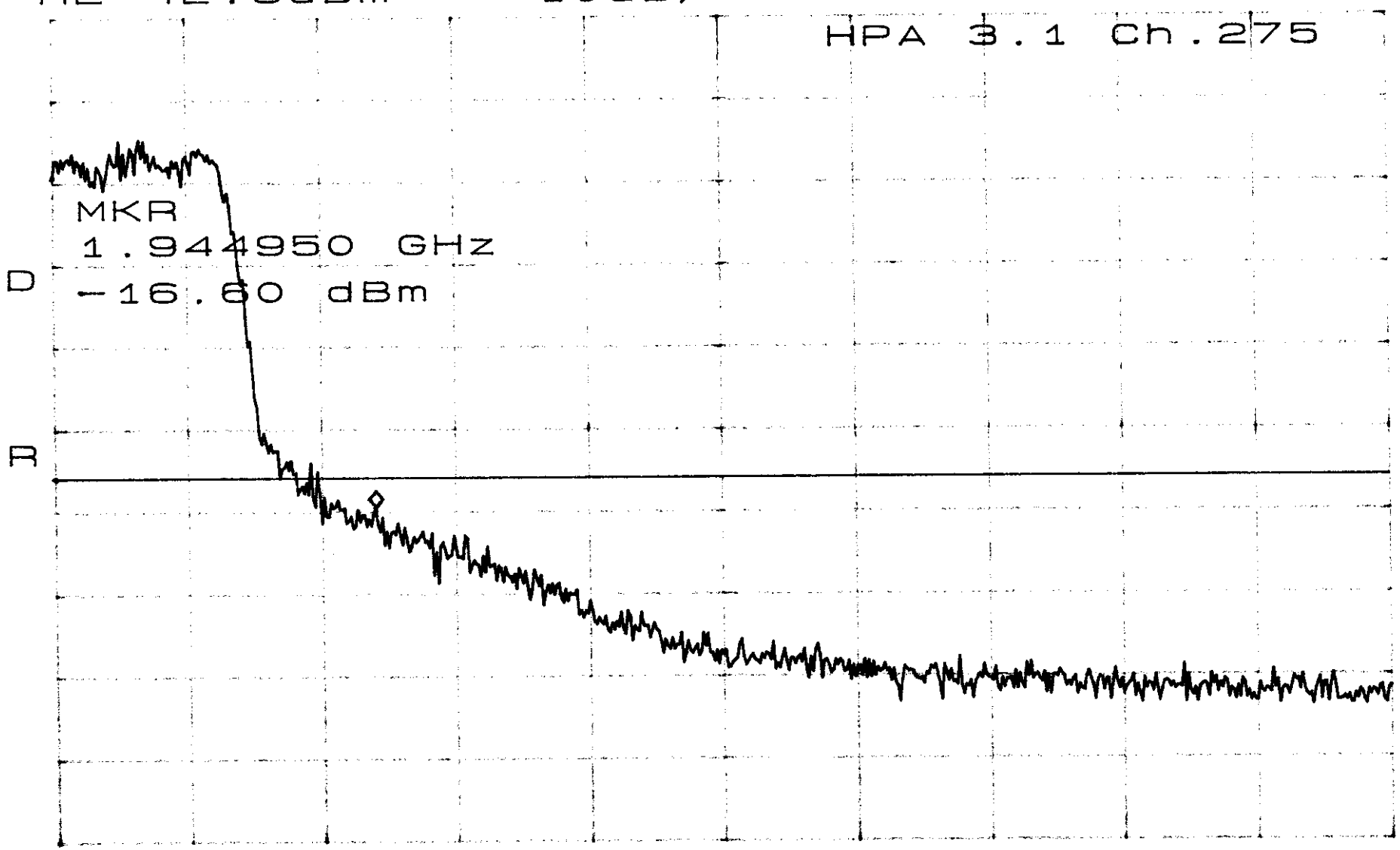
**Table:3** Spurious Emissions at Antenna Terminals (RFFE)

| Channel (MHz) | Transmitter Frequency (MHz) | Emission Frequency (MHz) | Corrected Level (dBm) | Emission Limit (dBm) |
|---|---|---|---|---|
| 25 | 1931.25 | 1930.00 | -14.6 | -13 |
| 275 | 1943.75 | 1944.95 | -16.6 | -13 |
| 325 | 1946.25 | 1945.00 | -14.17 | -13 |
| 375 | 1948.75 | 1949.95 | -14.57 | -13 |
| 425 | 1951.25 | 1950.00 | -13.77 | -13 |
| 675 | 1963.75 | 1964.95 | -18.27 | -13 |
| 725 | 1966.25 | 1965.00 | -14.43 | -13 |
| 775 | 1968.75 | 1969.95 | -19.6 | -13 |
| 825 | 1971.25 | 1970.00 | -17.77 | -13 |
| 875 | 1973.75 | 1974.95 | -17.83 | -13 |
| 925 | 1976.25 | 1975.00 | -18.43 | -13 |
| 1175 | 1988.75 | 1989.95 | -16.77 | -13 |

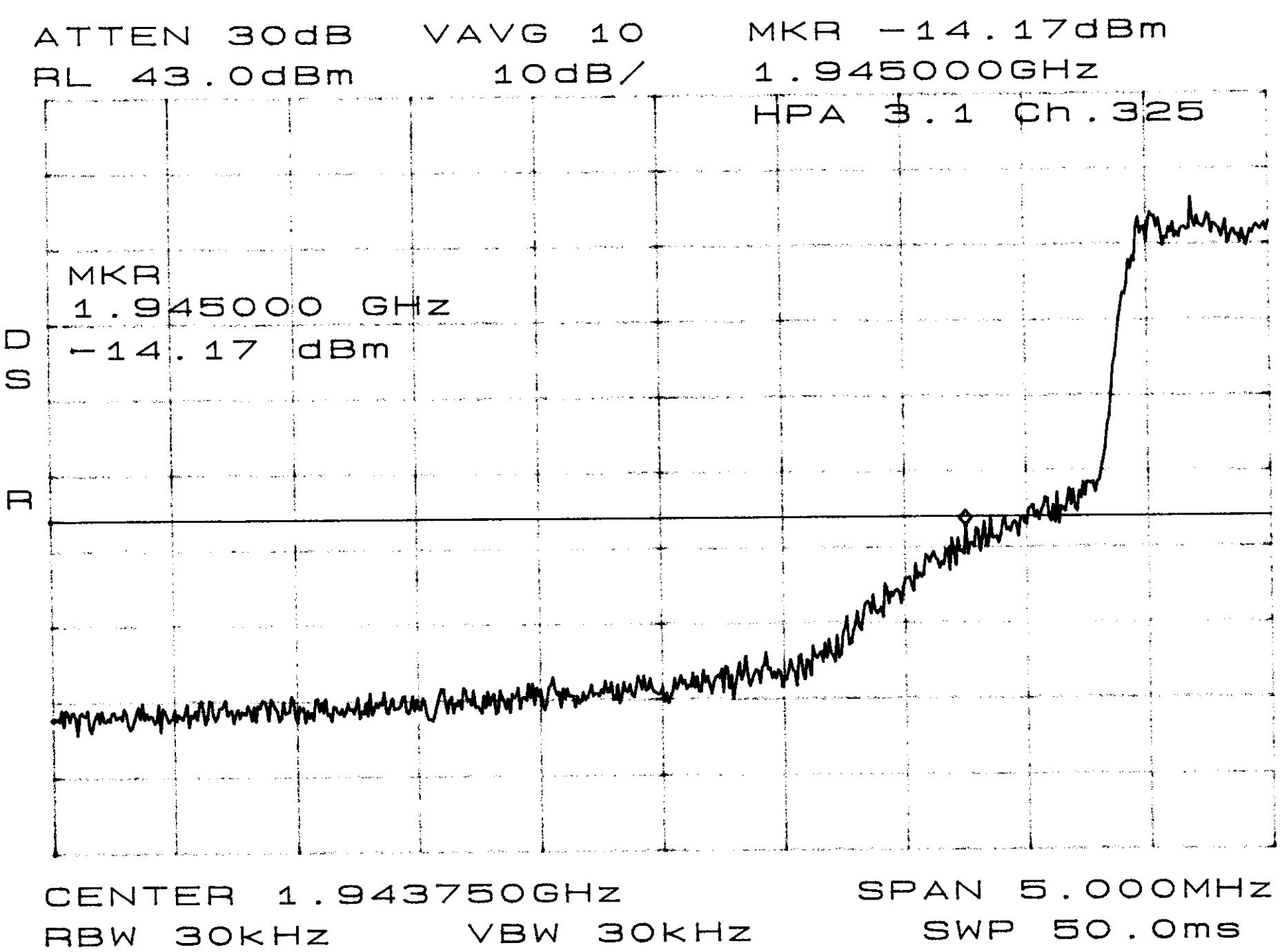
23 Feb 1998


ATTEN 30dB
VAVG 10
MKR -14.60dBm
RL 42.9dBm
10dB/
1.930000GHz
HPA 3.1 Ch.25
MKR
1.930000 GHz
-14.60 dBm
D
S
R
START 1.926250GHz
STOP 1.931250GHz
RBW 30kHz
VBW 30kHz
SWP 50.0ms

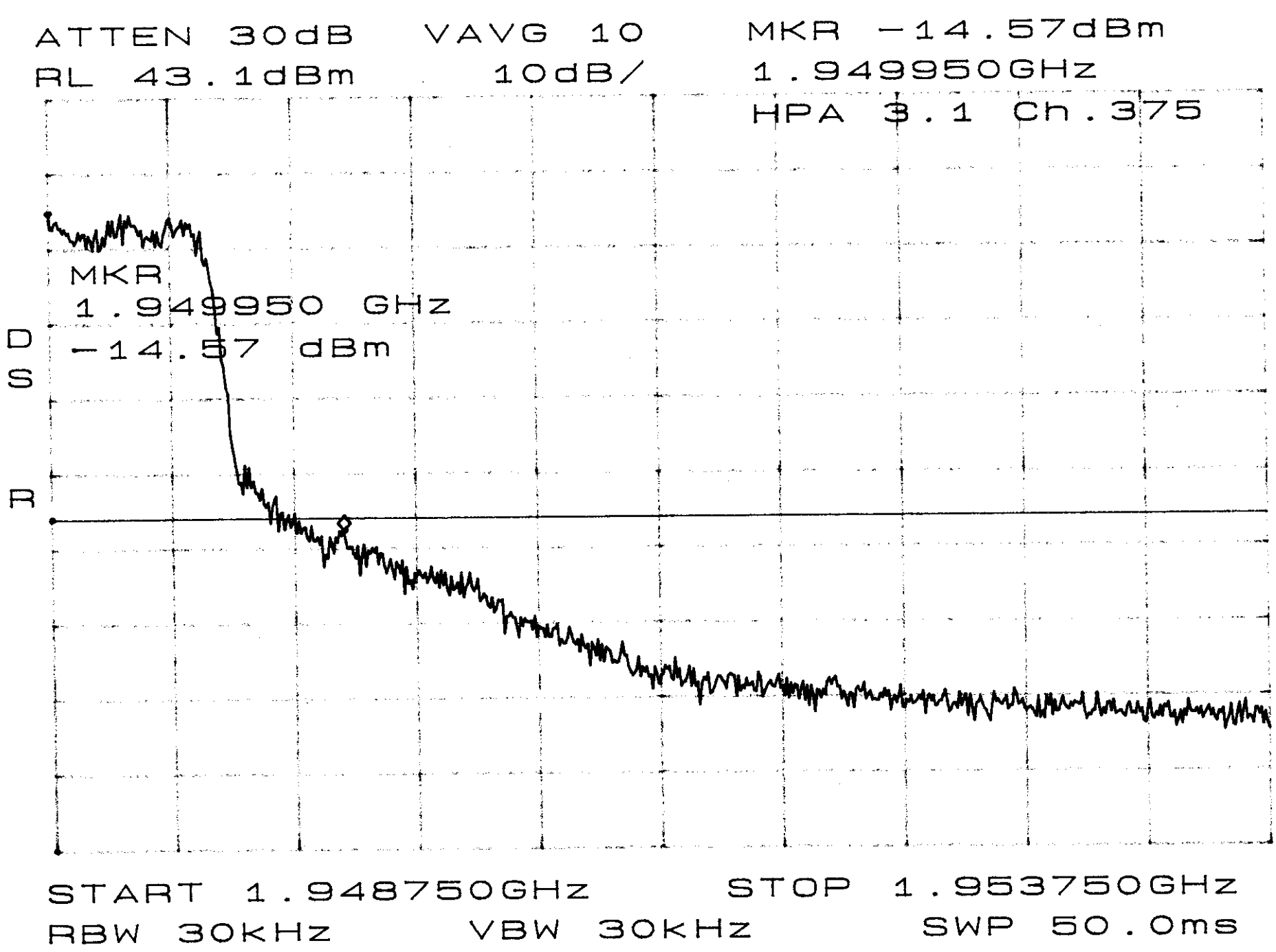
19 FEB 1998


ATTEN 30dB
VAVG 10
MKR -16.60dBm
RL 42.9dBm
10dB/
1.944950GHz
HPA 3.1 Ch.275
MKR
1.944950 GHz
-16.60 dBm
D
R
CENTER 1.946250GHz
SPAN 5.000MHz
RBW 30kHz
VBW 30kHz
SWP 50.0ms

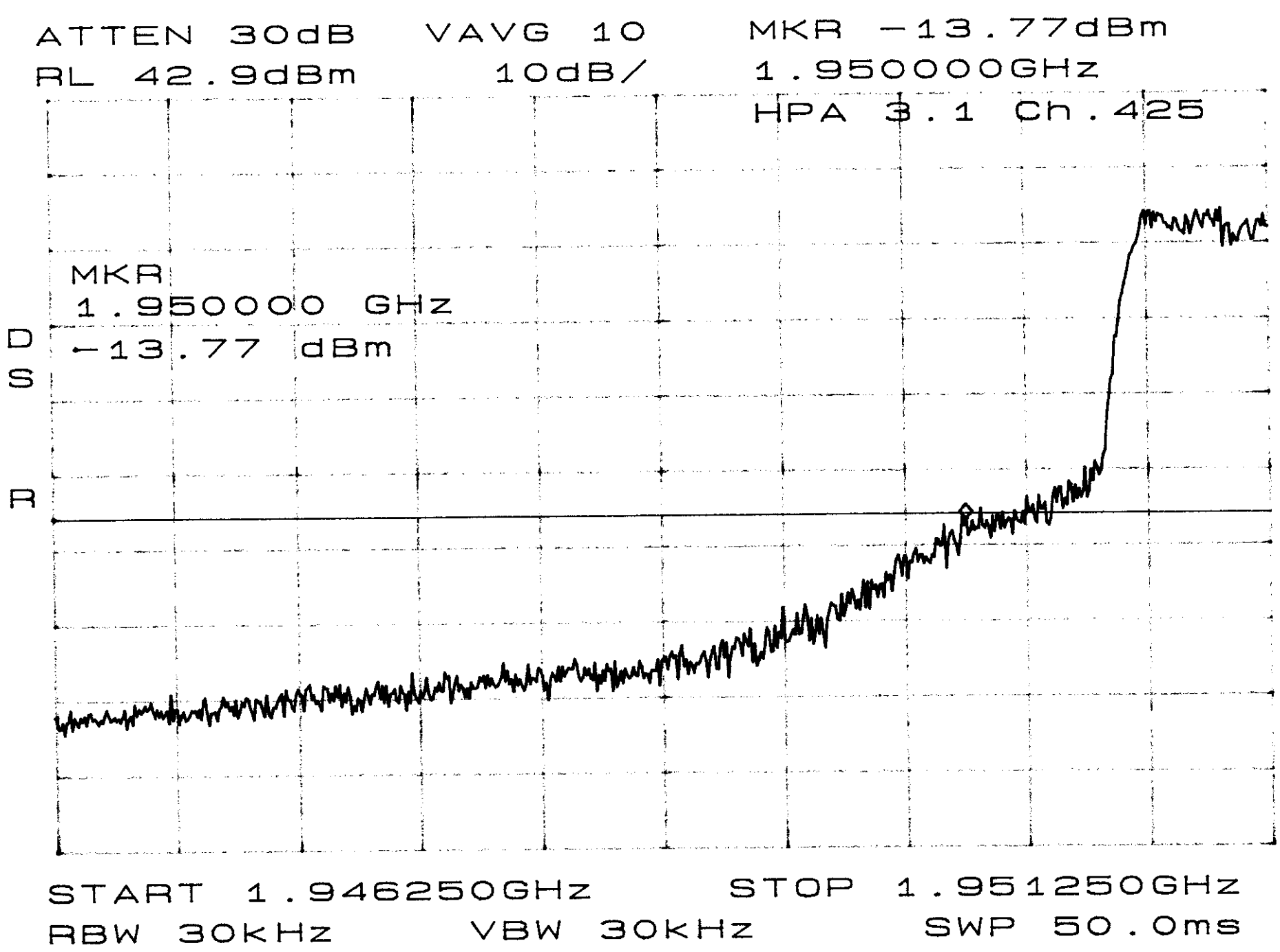
20 Feb 1998


ATTEN 30dB
VAVG 10
MKR -14.17dBm
RL 43.0dBm
10dB/
1.945000GHz
HPA 3.1 Ch.325
MKR
1.945000 GHz
-14.17 dBm
D
S
R
CENTER 1.943750GHz
SPAN 5.000MHz
RBW 30kHz
VBW 30kHz
SWP 50.0ms

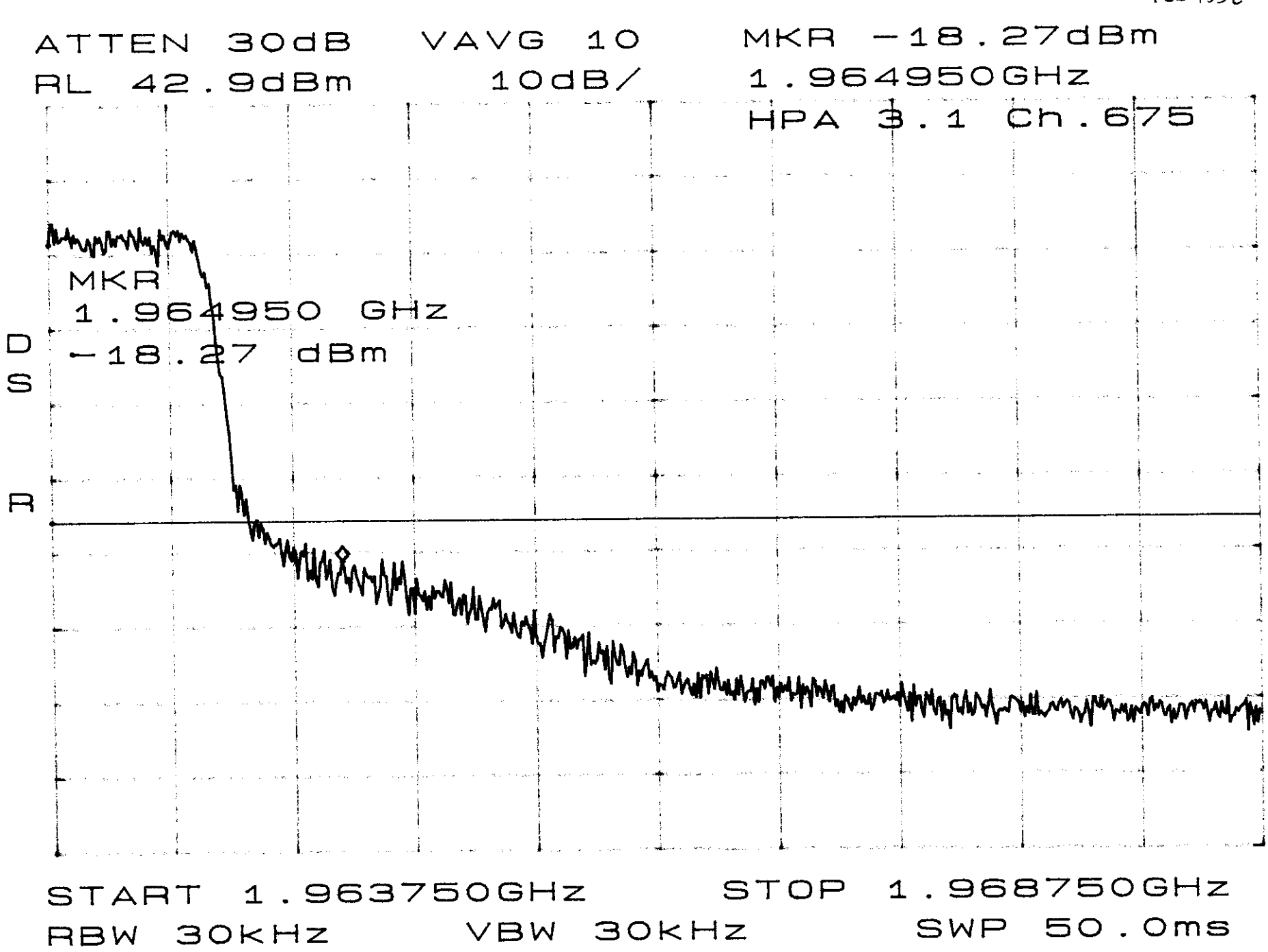
20 FEB 1998


ATTEN 30dB
VAVG 10
MKR -14.57dBm
RL 43.1dBm
10dB/
1.949950GHz
HPA 3.1 Ch.375
MKR
1.949950 GHz
-14.57 dBm
D
S
R
START 1.948750GHz
STOP 1.953750GHz
RBW 30KHz
VBW 30KHz
SWP 50.0ms

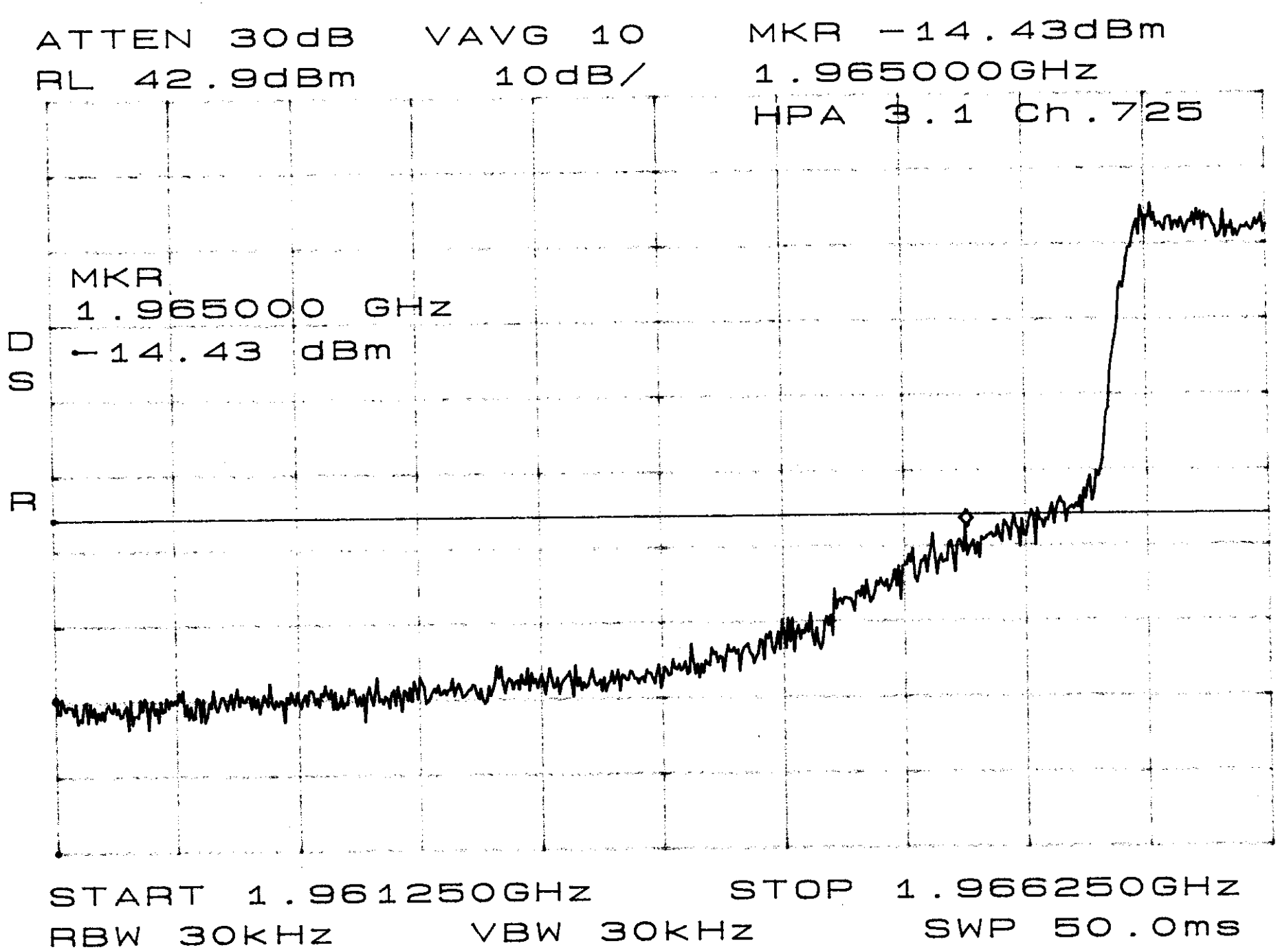
20 FEB 1998


ATTEN 30dB
VAVG 10
MKR -13.77dBm
RL 42.9dBm
10dB/
1.950000GHz
HPA 3.1 Ch.425
MKR
1.950000 GHz
-13.77 dBm
D
S
R
START 1.946250GHz
STOP 1.951250GHz
RBW 30kHz
VBW 30kHz
SWP 50.0ms

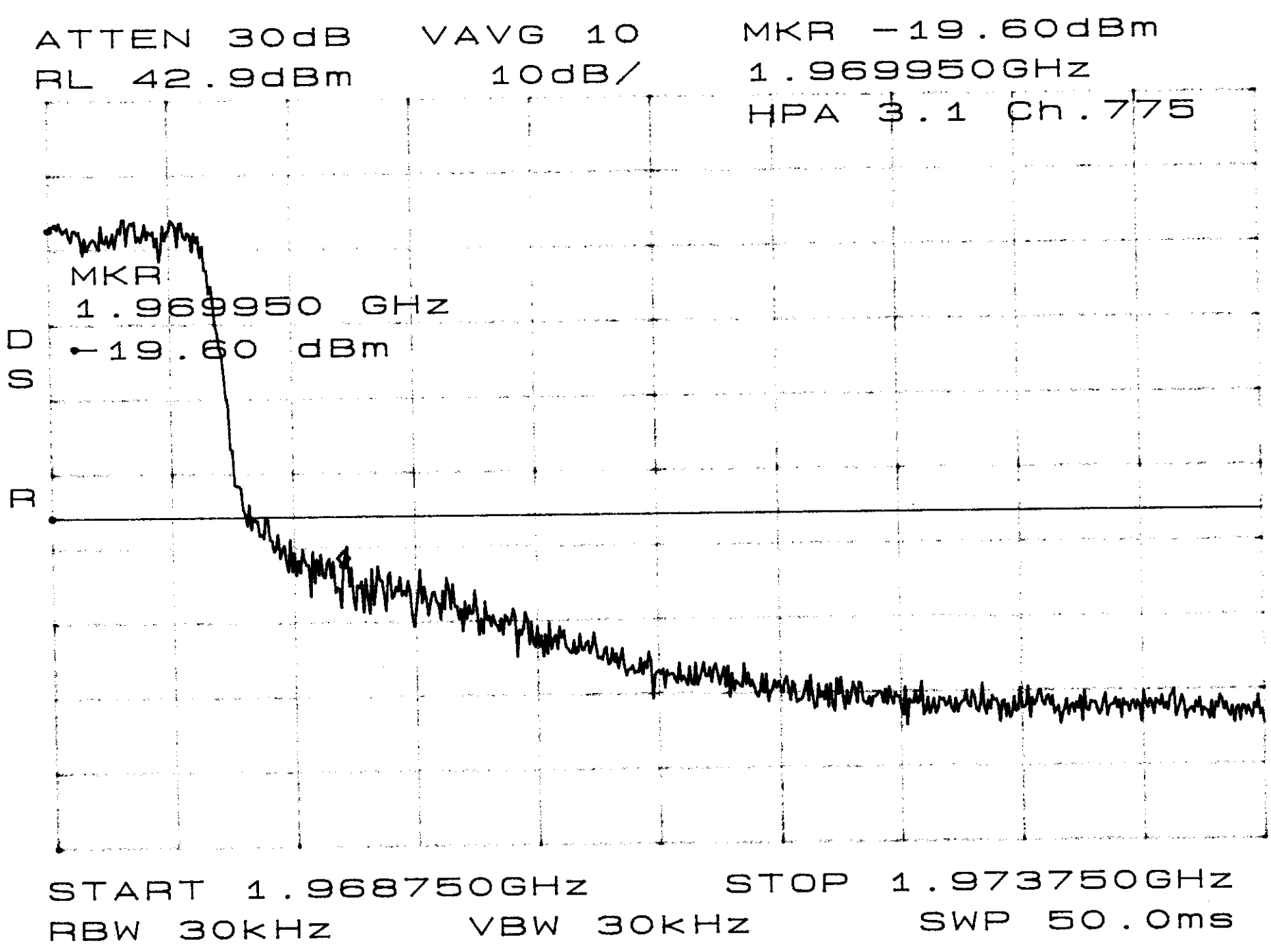
20 FEB 1998


ATTEN 30dB
VAVG 10
MKR -18.27dBm
RL 42.9dBm
10dB/
1.964950GHz
HPA 3.1 Ch.675
MKR
1.964950 GHz
-18.27 dBm
D
S
R
START 1.963750GHz
STOP 1.968750GHz
RBW 30KHz
VBW 30KHz
SWP 50.0ms

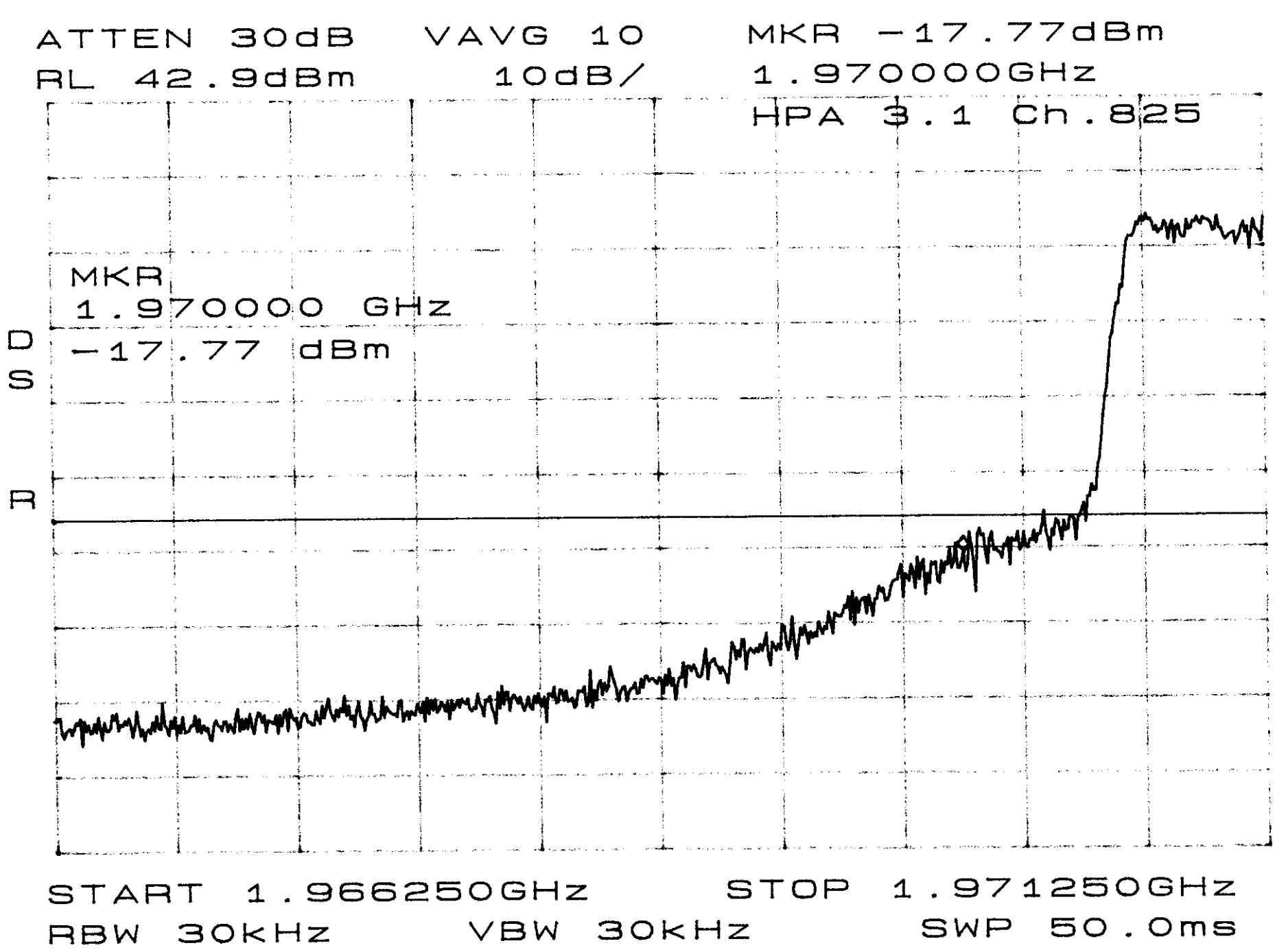
23 Feb 1998


ATTEN 30dB
VAVG 10
MKR -14.43dBm
RL 42.9dBm
10dB/
1.965000GHz
HPA 3.1 Ch.725
MKR
1.965000 GHz
-14.43 dBm
D
S
R
START 1.961250GHz
STOP 1.966250GHz
RBW 30KHz
VBW 30KHz
SWP 50.0ms

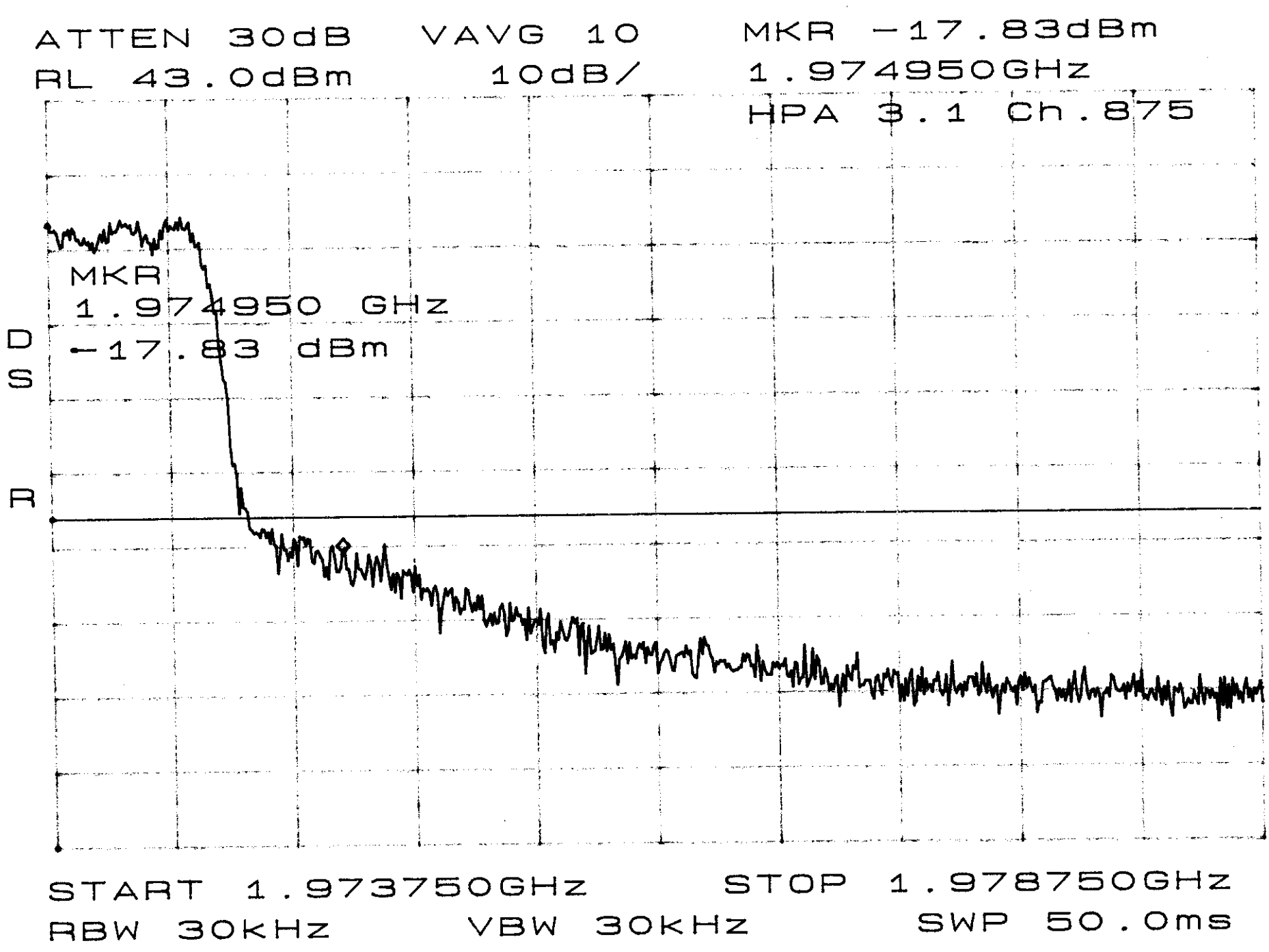
20 FEB 1998


ATTEN 30dB
VAVG 10
MKR -19.60dBm
RL 42.9dBm
10dB/
1.969950GHz
HPA 3.1 Ch.775
MKR
1.969950 GHz
-19.60 dBm
D
S
R
START 1.968750GHz
STOP 1.973750GHz
RBW 30kHz
VBW 30kHz
SWP 50.0ms

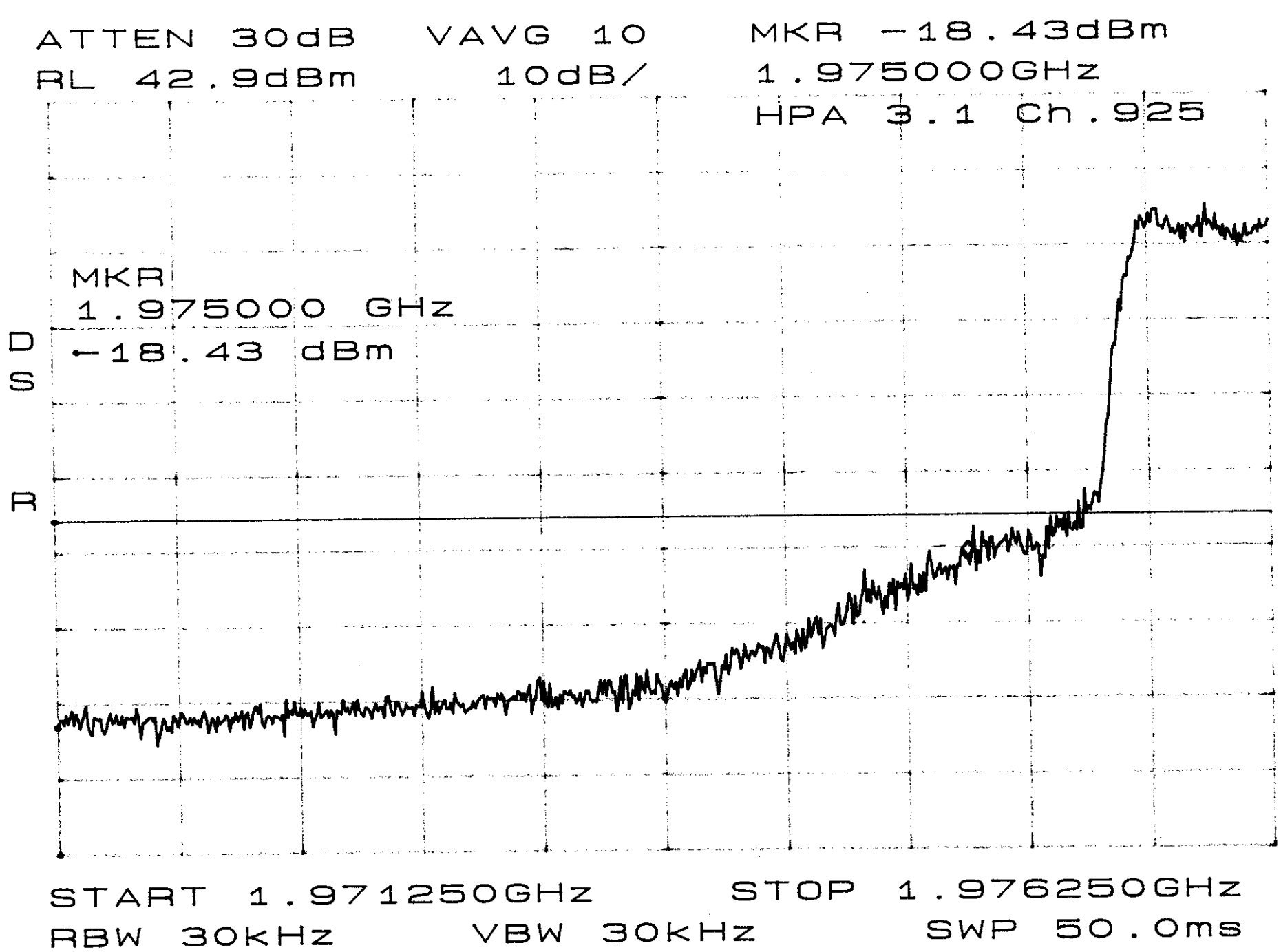
23 FEB 1998


ATTEN 30dB
VAVG 10
MKR -17.77dBm
RL 42.9dBm
10dB/
1.970000GHz
HPA 3.1 Ch.825
MKR
1.970000 GHz
-17.77 dBm
D
S
R
START 1.966250GHz
STOP 1.971250GHz
RBW 30kHz
VBW 30kHz
SWP 50.0ms

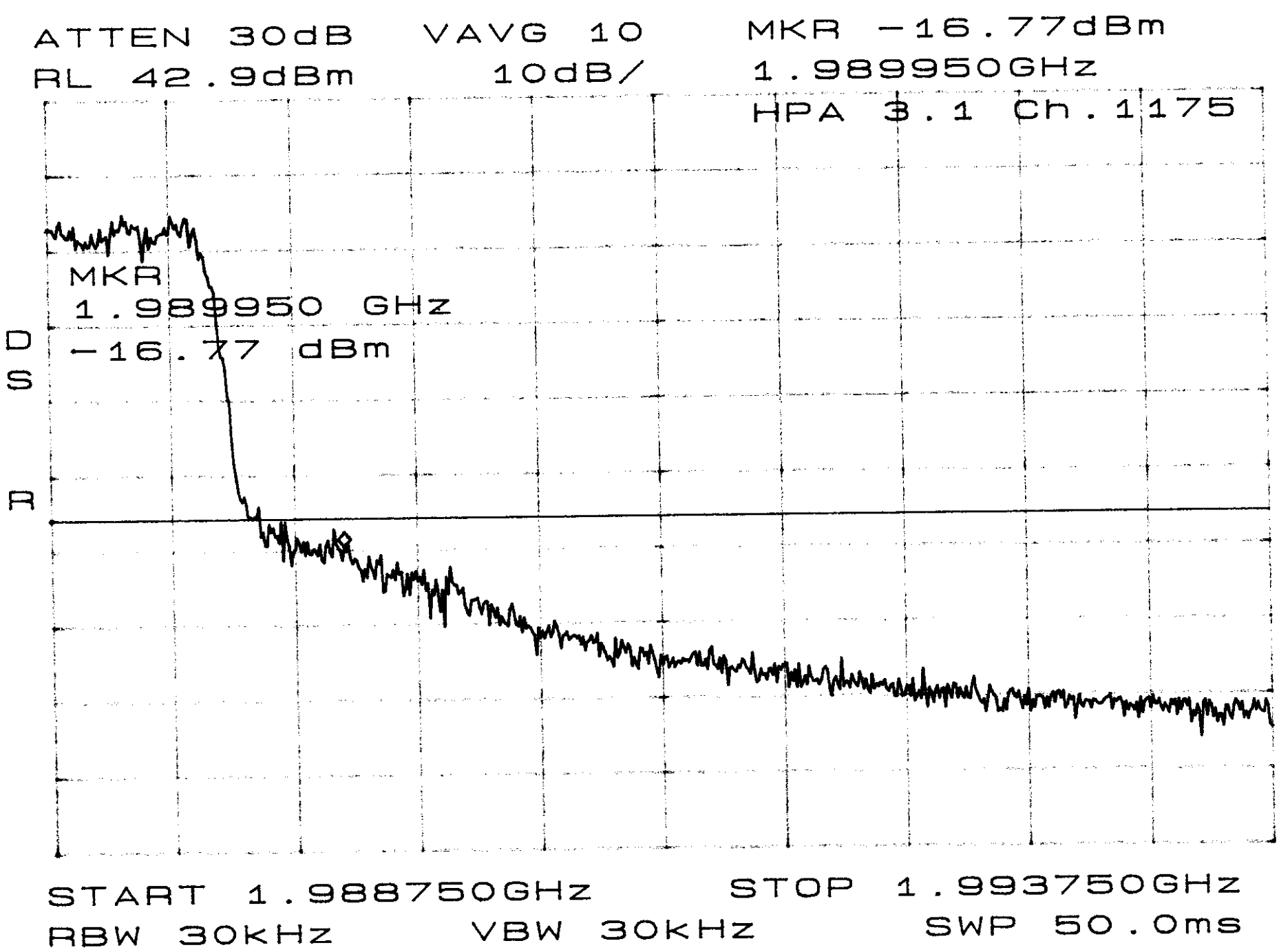
23 FEB 1998


ATTEN 30dB
VAVG 10
MKR -17.83dBm
RL 43.0dBm
10dB/
1.974950GHz
HPA 3.1 Ch.875
MKR
1.974950 GHz
-17.83 dBm
D
S
R
START 1.973750GHz
STOP 1.978750GHz
RBW 30kHz
VBW 30kHz
SWP 50.0ms

23 FEB 1998


ATTEN 30dB
VAVG 10
MKR -18.43dBm
RL 42.9dBm
10dB/
1.975000GHz
HPA 3.1 Ch.925
MKR
1.975000 GHz
-18.43 dBm
D
S
R
START 1.971250GHz
STOP 1.976250GHz
RBW 30KHz
VBW 30KHz
SWP 50.0ms

23 FEB 1998


ATTEN 30dB
VAVG 10
MKR -16.77dBm
RL 42.9dBm
10dB/
1.989950GHz
HPA $3.1 Ch.1175
MKR
1.989950 GHz
-16.77 dBm
D
S
R
START 1.988750GHz
STOP 1.993750GHz
RBW 30KHz
VBW 30KHz
SWP 50.0ms

## 4.6 Frequency Stability

Frequency stability is provided by the GPS receiver which is part of the Base Station. The Base Station has already received approval (FCC ID AB6NTGD01AA for the Indoor and NTGK03AA for the outdoor).

# 5.0 Field Strength of Spurious and Harmonic Radiation

## Standard:

2.993 Field Strength of Spurious and Harmonic Radiation

### FCC Part 24, Sub. E, Para. 24.238

*(a) On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB.*

*(b) Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.*

*(c) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.*

*(d) The measurements of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.*

*(e) When an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in this section.*

### METHOD OF MEASUREMENTS:

Refer to ANSI 63.4-1992, Para. 8 for detailed radiated emissions measurement procedures.

### FCC CFR 47, Para. 2.997 - Frequency spectrum to be investigated

*The spectrum was investigated from the lowest radio generated in the equipment up to at least the 10th harmonic of the carrier frequency or to the highest frequency practicable in the present state of the art of measuring techniques, whichever is lower. Particular attention should be paid to harmonics and subharmonics of the carrier frequency. Radiation at the frequencies of multiplier stages should be checked. The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.*

### FCC CFR 47, Para. 2.993 - Field Strength Spurious Emissions

*(a)Measurements was made to detect spurious emissions radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data were supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph 2.989(c) as appropriate. For equipment operating on frequencies below 890 MHz, an Open Field Test is normally required, with the measuring instrument antenna located in the far field at all test frequencies. In event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurement will be accepted of the equipment as installed. Such measurements must be accompanied by a*

*description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with the reference to the rated power output of the transmitter, assuming all emissions are radiated from half-wave dipole antennas.*

*(b) Measurements specified in paragraph (a) of this section shall be made for the following equipment:*

*(1) Those in which the spurious emission are required to be 60 dB or more below the mean power of the transmitter.*

*(2) All equipment operating on frequencies higher than 25 MHz*

*(3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.*

*(4) Other types of equipment as required, when deemed necessary by the Commission.*

## Test Method:

Radiated emission measurement procedures were performed as outlined in Section 8 of the ANSI C63.4 measurement standard. The RFFE (with the new 3.1 HPA) was tested to the applicable limits of the FCC rules. For Radiated emission measurements the measurement distance between the center of the measurement antenna and the periphery of equipment under test was 10 meters. In order to maximize all emission levels from the equipment, the emissions were searched with the receive antenna at varied height levels. The equipment was also rotated a full 360 degrees on the turntable with the receive antenna at varying height levels (1 to 4 meters). Tests were made with the antenna positioned in both the horizontal and vertical planes of polarization. The BTS was setup in the shielded room below the tuntable and the three RFFEs were placed on the turntable. The BTS being controlled via system simulation software (emulating actual use) a call was established on a channel at the lower edge of the band, transmitting at full rated power into a 50 ohm load on all RFFE's. The spectrum was investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency. The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value were not reported. A 1 MHz resolution bandwidth and Video Bandwidth was used for all measurements.

## Minimum Standard:

Field strength measurements of radiated spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements must not exceed 43 + 10log (mean output power in watts) below the unmodulated carrier. The reference level for spurious radiation was taken at an ideal dipole excited by the rated output power according to the following relationship:

$$E = \frac{\sqrt{(49.2)(Pt)}}{R}$$

Note:Reference Data for Radio Engineers, Pg. 676. International Telephone and Telephone Corporation, Fourth Edition.

Where:

E = electric Field Intensity in Volts/Meter

Pt = Transmitter Power in Watts

R = Measurements distance in Meters

$$E = \frac{\sqrt{49.2(20)}}{10} = 3.14 Volts/Meters = 129.9 B\mu V/m$$

Paragraph 24.238 requires that spurious radiated emission be attenuated at least 43 + 10 logP (mean output power in watts) below the unmodulated carrier.

In this case, the rated power of 20.0 watts (43.0 dBm) requires a minimum attenuation of 43 + 10 log 20.0 =56.0 dB below the reference level of 129.9 dBuV/m calculated above (for 10m measurement distance); therefore, the criteria is 73.9 dBuV/m (129.9 - 56.0).

## Sample Field Strength Calculation:

The field strength is calculated by adding the Antenna Factor and Cable Factor to the measured reading. The basic equation with a sample calculation is as follows:

Calculation:

Corr. Level (dBuV) = Measured Level (dBuV) + CorrectionFactor (dB)

Correction Factor = Antenna Factor (dB) + Cable Factor (dB)-preamplifier Factor (dB)

(Amplifier gain only used on emissions above 1 GHz)

Correction Factors include Antenna Correction Factor, Cable losses and preamplifier gain. All are combined and shown as one data entry called Correction Factors.

## Results:

**Conforms**. No emissions within 20 dB of the permissable level were detected from the RFFE Assemblies.