**FCC Part 15 Subpart E Test Report**
for
**Wireless Bypass**
on the
**Cable Access Radio CPE**
**Model: DL-5800C24**

**FCC ID: PPS-DL-5800C24**

Date of Report: June 26, 2001

Job # J20046196
Date of Test: June 11, 2001 – June 19, 2001

NVLAP®

Lab Code 100270-0

| | |
|---|---|
| | Nicholas Abbondante, Test Engineer |
| | Michael F. Murphy, Staff Engineer |

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## 1.0 Summary of Tests

**Wireless Bypass, Model: DL-5800C24**
**FCC ID: PPS-DL-5800C24**

| TEST | REFERENCE | RESULTS |
|---|---|---|
| Output power | 15.407 (a) | Pass |
| 26 dB Bandwidth* | 15.407 (a) | For calculation only |
| Power Density | 15.407 (a) (5) | Pass |
| The ratio of the peak excursion of the modulation envelope to the peak transmit power | 15.407 (a) (6) | Pass |
| Out of Band Antenna Conducted Emission | 15.407 (b) | Pass |
| Radiated Emission in Restricted Bands | 15.205 | Pass |
| AC Conducted Emission | 15.207 | Pass |
| Radiated Emission from Digital Module | 15.209 | Pass |
| Radiated Emission from Receiver | 15.209 | Pass |
| Radiation Exposure Requirement | 1.1310 | Pass |
| Frequency Stability | 15.407(g) | Pass |
| Antenna Requirement | 15.203 | Pass, Professional Install |

Test Engineer: _____ Date: 6/29/01
Nicholas Abbondante

Staff Engineer: _____ Date: 6/29/01
Michael F. Murphy

## 2.0 General Description

### 2.1 Product Description

The EUT Model No.: DL-5800C24 is an intentional transmitter used for wireless point-to-point and point-to-multipoint communications operating in the frequency range: 5.725-5.825 GHz.

A pre-production version of the sample was received on June 11, 2001 in good condition.

**Overview of the Cable Access Radio CPE**

| | |
|---|---|
| Applicant | Wireless Bypass, Inc. |
| Trade Name & Model No. | Cable Access Radio CPE, Model: DL-5800C24 |
| FCC Identifier | PPS-DL-5800C24 |
| Use of Product | Point-to-point fixed and point-to-multipoint wireless interconnect |
| Type of Transmission | QPSK, 16 QAM |
| Maximum RF Output (dBm) * | 17.5 dBm |
| Frequency Range (MHz) | 5.725 – 5.825 GHz |
| Number of Channel(s) | 2 |
| Antenna(s) & Gain, dBi | Point-to-Point:<br>Flat Panel Antenna, 23 dBi Parabolic Antenna, 28, 34.6, and 37.6 dBi<br>Point-to-Multipoint:<br>Flat Panel Antenna, 12, 15,16,18, and 23 dBi |
| Antenna Requirement | [ ] The EUT uses a permanently connected antenna.<br>[ ] The antenna is affixed to the EUT using a unique connector which allows for replacement of a broken antenna, but DOES NOT use a standard antenna jack or electrical connector.<br>[ x ] The EUT requires professional installation (attach supporting documentation if using this option). |
| Manufacturer name & address | Wireless Bypass, Inc.<br>43 Northwestern Drive<br>Salem, MA, 03079 |

* The output power depends on the gain of the antenna used.

### 2.2 Related Submittal(s)/Grants

Cable Access Radio Hub
Model: DL-5800H24
FCC ID: PPS-DL-5800H24

2.3 Test Methodology

Both AC mains line-conducted and radiated emissions measurements were performed according to the procedures in ANSI C63.4 (1992). Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the Tables in this Application. All other measurements were made in accordance with the procedures in part 2 of CFR 47.

2.4 Test Facility

Site 1C (Top Site) is a 3m and 10m sheltered emissions measurement range located in a light commercial environment in Boxborough, Massachusetts. It meets the technical requirements of ANSI C63.4-1992 and CISPR 22:1993/EN 55022:1994 for radiated and conducted emission measurements. The shelter structure is entirely fiberglass and plastic, with outside dimensions of 33 ft x 57 ft. The structure resembles a quonset hut with a center ceiling height of 16.5 ft.

The testing floor is covered by a galvanized sheet metal groundplane that is earth-grounded via copper rods around the perimeter of the site. The joints between individual metal sheets are bridged with a 2 inch wide metal strips to provide low RF impedance contact throughout. The sheets are screwed in place with stainless steel, round-head screws every three inches. Site illumination and HVAC are provided from beneath the ground reference plane through flush entry ports, the port covers are electrically bonded to the ground plane.

A flush metal turntable with 12 ft. diameter and 5000 lb. load capacity is provided for floor-standing equipment. A wooden table 80 cm high is used for table-top equipment. The turntable is electrically connected to the ground plane with three copper straps. The straps are connected to the turntable at the center of it with ground braid. The copper strap is directly connected to the groundplane at the edges of the turntable. The turntable is located on the south end of the structure and the antennas are mounted 3 and 10 meters away to the north. The antenna mast is a non-conductive with remote control of antenna height and polarization. The antenna height is adjustable from 1 to 4 meters.

All final radiated emission measurements are performed with the testing personnel and measurement equipment located below the ground reference plane. The site has a full basement underneath the turntable where support equipment may be remotely located. Operation of the antenna, turntable and equipment under test is controlled by remote controls that manipulate the antenna height and polarization and with a turntable control. Test personnel are located below the ellipse when measurements are performed, however the site maintains the ability of having personnel manipulate cables while monitoring test equipment. Ambient radiated emissions are 6 dB or more below the relevant FCC emission limits.

AC mains power is brought to the equipment under test through a power line filter, to remove ambient conducted noise. 50 Hz (240 VAC single phase), 60 Hz power (120 VAC single phase, 208 VAC three phase), and 60 Hz (480 VAC three phase) are available. Conducted emission measurements are performed with a Line Impedance Stabilization Network (LISN) or Artificial Mains Network (AMN) bonded to the ground reference plane. A removable vertical groundplane (2 meter X 2 meter area) is used for line-conducted measurements for table top equipment. The vertical groundplane is electrically connected to the reference groundplane.

## 3.0 System Test Configuration

### 3.1 Support Equipment, Cables, and Antenna List

| Description: | Model #: | Serial #: | FCC ID: |
|---|---|---|---|
| 3Com Cable Modem | 3CR29220 | HAZHA8BDF8 | N/L |
| 3Com Cable Modem | 3CR29220 | HAZHA8BDCO | N/L |
| RIC Monitor | X-554M | CZC000405074 | HSUTRLX-554 |
| Samtron Monitor | SC-528UXL | A9439024501 | CSYSC-528UX |
| 3Com Hub | 3C16592A | 0100/7D9F042259 | HED3C16593A |
| Riverdelta CMTS | BSR1000 | 0110A0006 | N/L |
| WIN Computer | WNP-II233-128-18.2 | WN9710-3754 | N/L |
| Compaq Computer | 5BW130 | 1X06DTY8120A | N/L |
| Compaq Mouse | 334584-007 | 334584-007 | JNZ201213 |
| Microsoft Mouse | 02695686 | 02695686 | C3KKMP1 |
| Compaq Keyboard | SDM454OUL | B354ABUOAJHPPO | N/L |
| NMB Keyboard | RT2348TW | C0281497 | AQ6-MTN71BZ15DIP |
| Cable Access Radio Hub | DL-5800H24 | ENG2 | (Pending) PPS-DL-5800H24 |

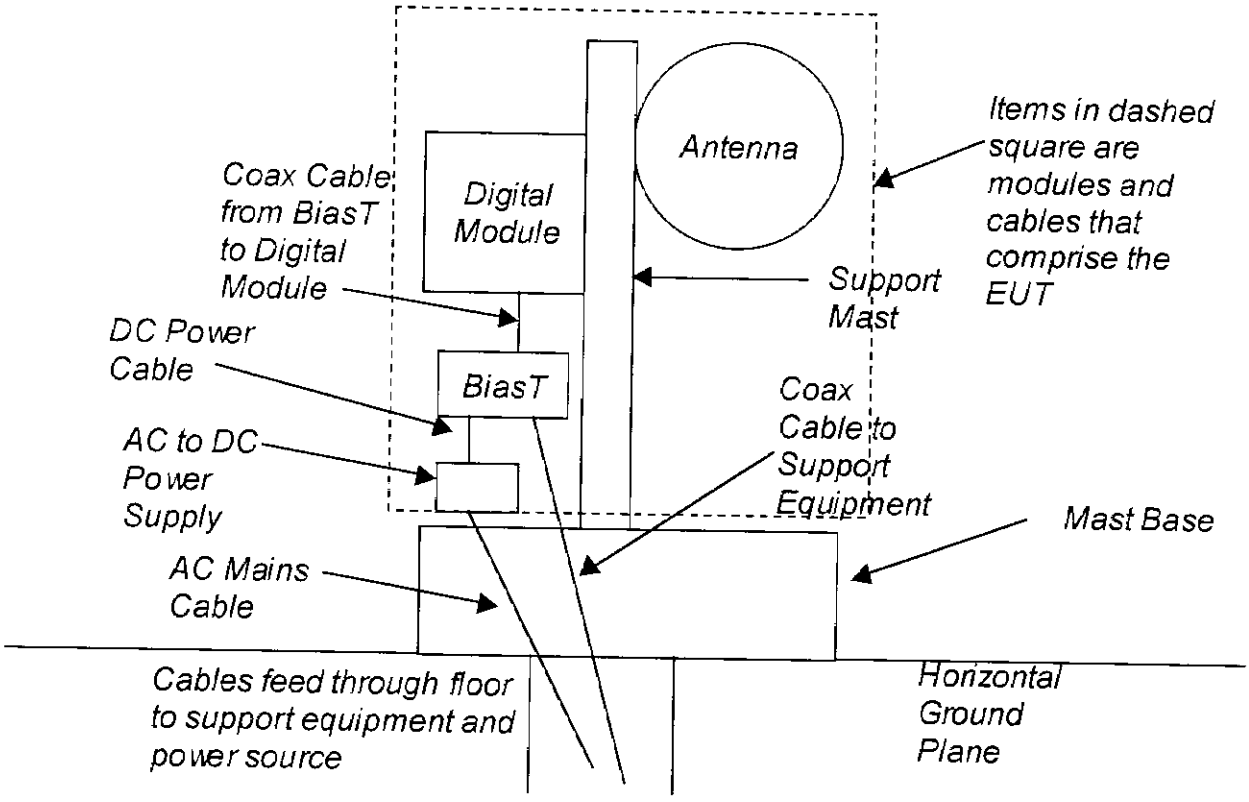
**Cables:**

| Description: | Shield: | Connector: | Length: | Quantity: |
|---|---|---|---|---|
| AC Mains | None | Plastic | 2 | 1 |
| Coaxial | Coaxial | Full 360° Metal | 3 | 1 |

**Antennas:**

| Description | Usage | Model No. |
|---|---|---|
| Cushcraft Flat Panel Antenna 12 dBi | Point-to-Multipoint | S57212AMP10SMF |
| Telex Flat Panel Antenna 15 dBi | Point-to-Multipoint | 5840AA |
| Radiowaves Flat Panel Antenna 16 dBi | Point-to-Multipoint | SEC-5H-16-90 |
| Gabriel Flat Panel Antenna 18 dBi | Point-to-Multipoint | DFPD 5-52 |
| Gabriel Flat Panel Antenna 23 dBi | Point-to-Multipoint, Point-to-Point | DFPD 1-52 |
| Radiowaves 2' Parabolic Antenna 28 dBi | Point-to-Point | SP2-5.8 |
| Radiowaves 4' Parabolic Antenna 34.6 dBi | Point-to-Point | SP4-5.8 |
| Radiowaves 6' Parabolic Antenna 37.6 dBi | Point-to-Point | SP6-5.8 |

3.2 Block Diagram of Test Setup



3.3 Justification

For emission testing, the Equipment Under Test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). During testing, all cables were manipulated to produce worst case emissions.

The EUT is wired to transmit full power.

The signal is maximized through 360 degree rotation. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance.

All support equipment was remotely located. The EUT was placed in the center of the turntable.

3.4 Software Exercise Program

The EUT exercise program used during testing was designed to exercise the various system components in a manner similar to a typical use. Data was transmitted through the system in order to activate the transmitter circuitry. The receiver circuitry was connected to the transmitted signal to activate receiver circuitry. Care was taken to ensure proper power supply voltages during testing.

3.5 Mode of operation during test

100% time transmitting signal on low and high channels.

3.6 Modifications required for Compliance

The following modifications were installed during compliance testing in order to bring the product into compliance (Please note that this list does not include changes made specifically by Wireless Bypass prior to compliance testing):

A prescan was performed to determine if the EUT had any spurious emissions. Due to the results of this scan, the following modifications were required:

1) Conductive gasket (Manufacturer: TennRich P/N:FBC0402) was placed between the access panel and the chassis of the EUT with paint removed for better conductive contact.

2) A minimum of 20' of coaxial cable must separate the BiasT Module of the EUT from the Digital Module.

3.7 Additions, deviations and exclusions from standards

No additions, deviations or exclusion have been made from standard.

## 4.0 Measurement Results

4.1 Conducted Output Power at Antenna Terminal
FCC Rule 15.407(a)

Requirement:

For fixed point-to-point U-NII devices operating in 5.725-5.825 GHz band, the peak transmit power shall not exceed the lesser of 1 W (30 dBm) or 17 dBm + 10Log(B), where B is the 26 dB emission bandwidth in MHz (for antenna gain up to 6 dBi).

Procedure:

The antenna port of the EUT was connected to the input of a power meter. Power was read directly from the meter and cable loss connection was added to the reading to obtain power at the EUT antenna terminal.

Result:

| Frequency, MHz | Output Power, mW | Output Power, dBm | Limit, dBm | Maximum allowed antenna gain, dBi |
|---|---|---|---|---|
| Low Channel: 5733 | 56.5 | 17.5 | 22.0 | 10.5(p-mp), 27.5(p-p) |
| High Channel: 5740 | 48.3 | 16.8 | 22.0 | 11.2(p-mp), 28.2(p-p) |

Note:

1. The EUT Output Power was set to maximum to produce the worse case test result.
2. When a higher gain antenna is used, the Output Power will be reduced further by a 1:1 ratio equal to the amount by which the antenna gain exceeds the allowed antenna gain for point to multipoint use and for point to point use.
3. (p-mp) refers to "Point to Multipoint" operation, while (p-p) refers to "Point to Point" operation.

4.2 26 dB Bandwidth
FCC Rule 15.407(a) (for calculation only)

The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer Res BW was set to 100 kHz. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A PEAK output reading was taken, a DISPLAY line was drawn 26 dB lower than PEAK level. The 26 dB bandwidth was determined from where the channel output spectrum intersected the display line.

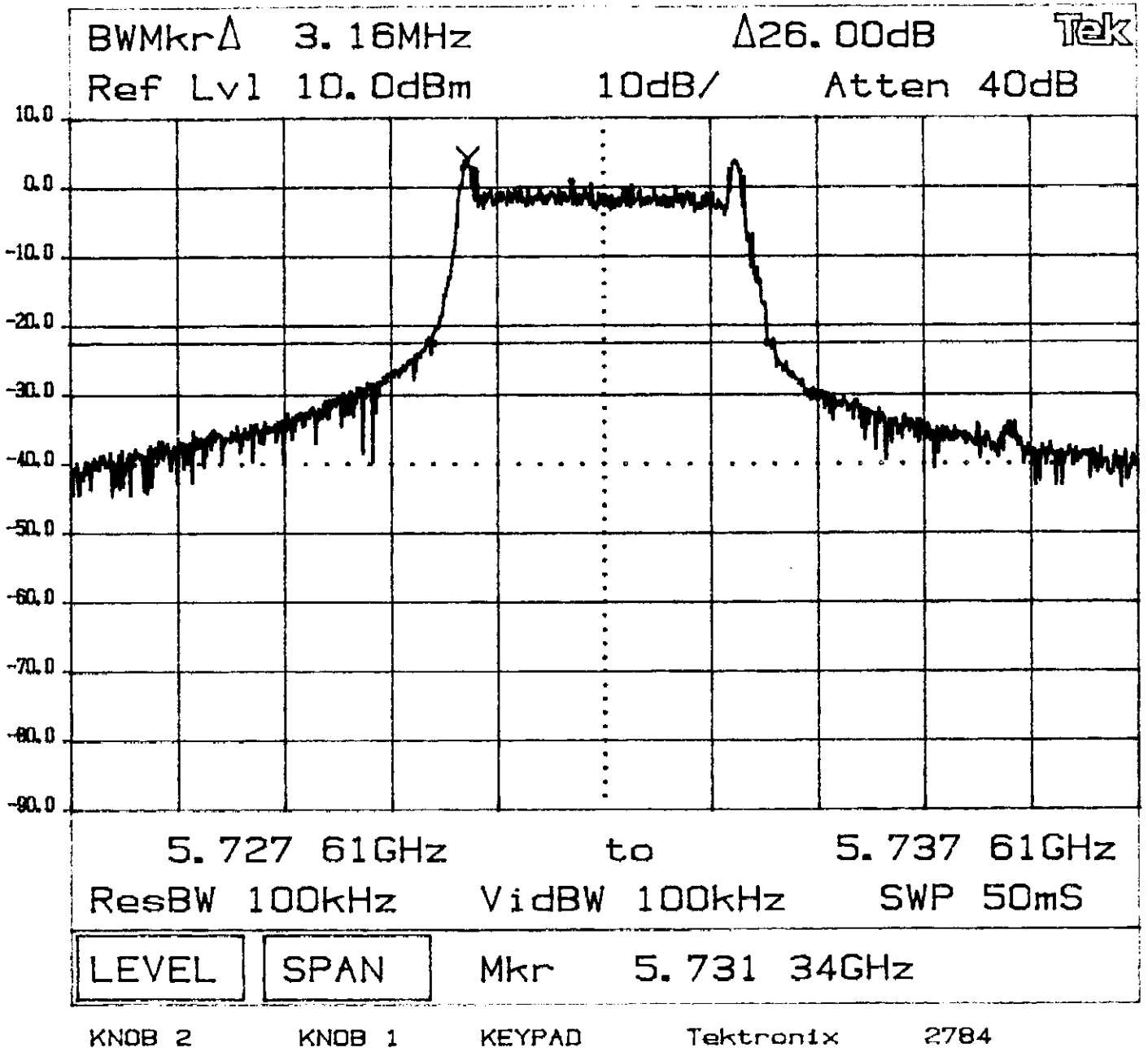
| Frequency, MHz | 26 dB Bandwidth, MHz |
|---|---|
| 5733 | 3.16 |
| 5740 | 3.18 |

Refer to the following plots for 26 dB bandwidth:

Plot 1a: Low Channel 26 dB Bandwidth
Plot 1b: High Channel 26 dB Bandwidth

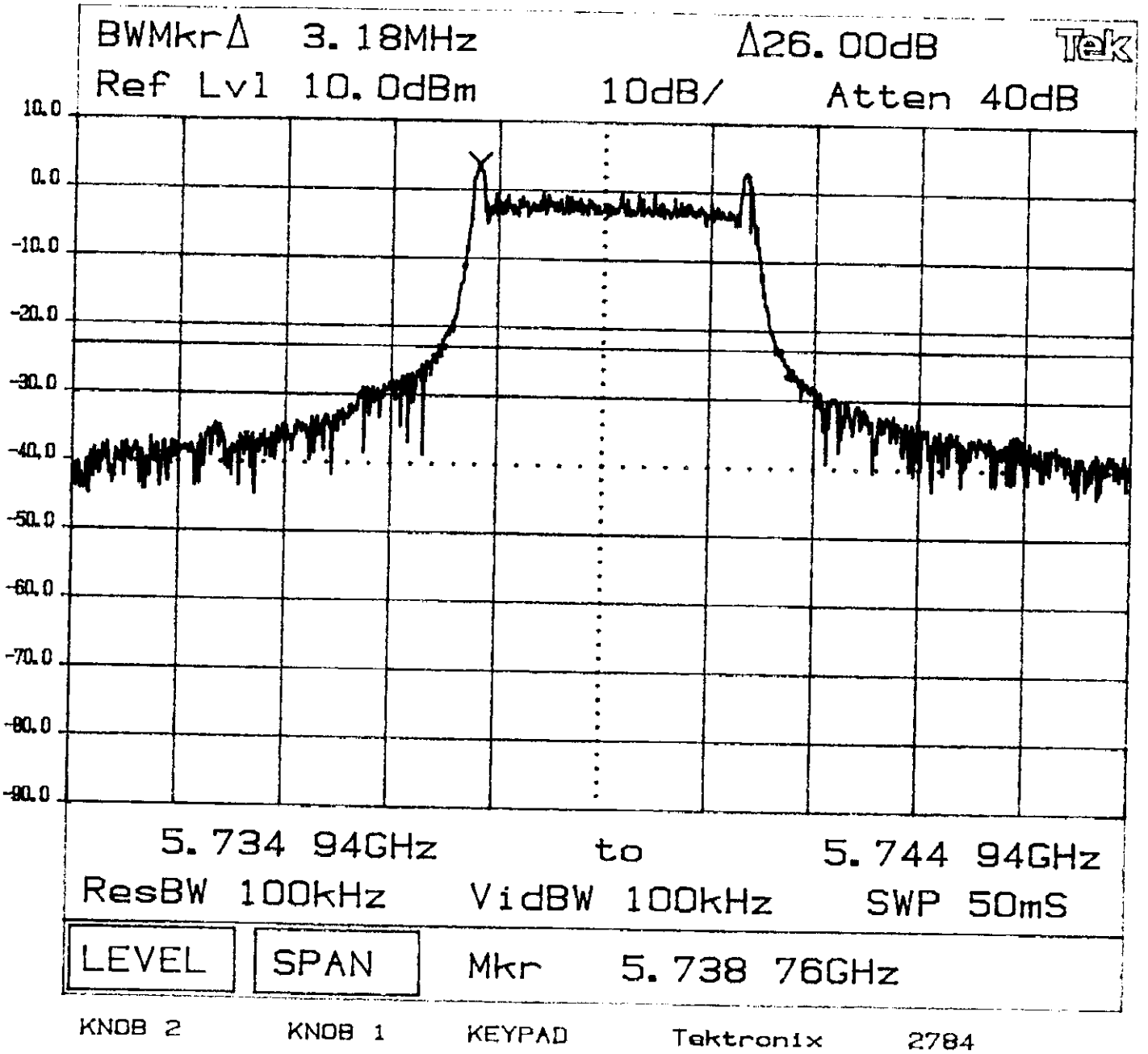
LOW FREQUENCY CHANNEL OF CPE 26dB BW

1a



HIGH FREQUENCY CHANNEL OF CPE 26dB BW

16



4.3 Power Density

Requirement:

For fixed point-to-point U-NII devices operating in 5.725-5.825 GHz band peak power spectral density shall not exceed 17 dBm in any 1 MHz band (for antenna gain up to 6 dBi for point to multipoint operation and gain up to 23 dBi for point to point operation). This gives an effective EIRP limit of 23.0 dBm for point to multipoint operation and 40 dBm for point to point operation.

Procedure:

Antenna output of the EUT was coupled directly to spectrum analyzer; an external attenuator and cable were used; the losses are 30 dB for the attenuator and 5.7 dB for the cable.

The spectrum analyzer Resolution Bandwidth was set to 1 MHz and Video Bandwidth was set to 3 MHz. The START and STOP frequencies were set to the band edges of the maximum output passband. The spectrum analyzer was set to video average, 100 sweeps were used. Maximum peak-power spectral density reading was recorded.

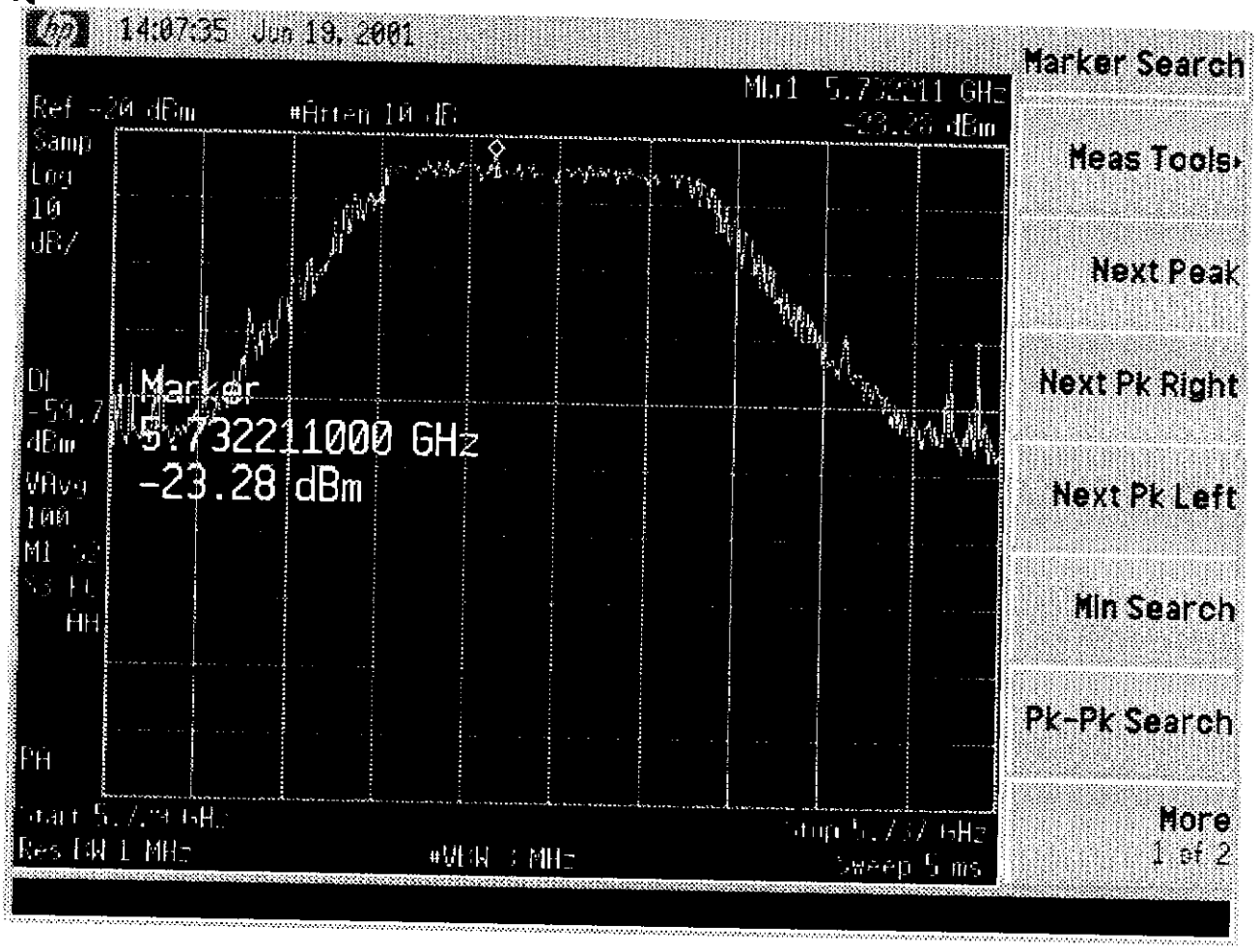
Result (includes losses through the measurement system):

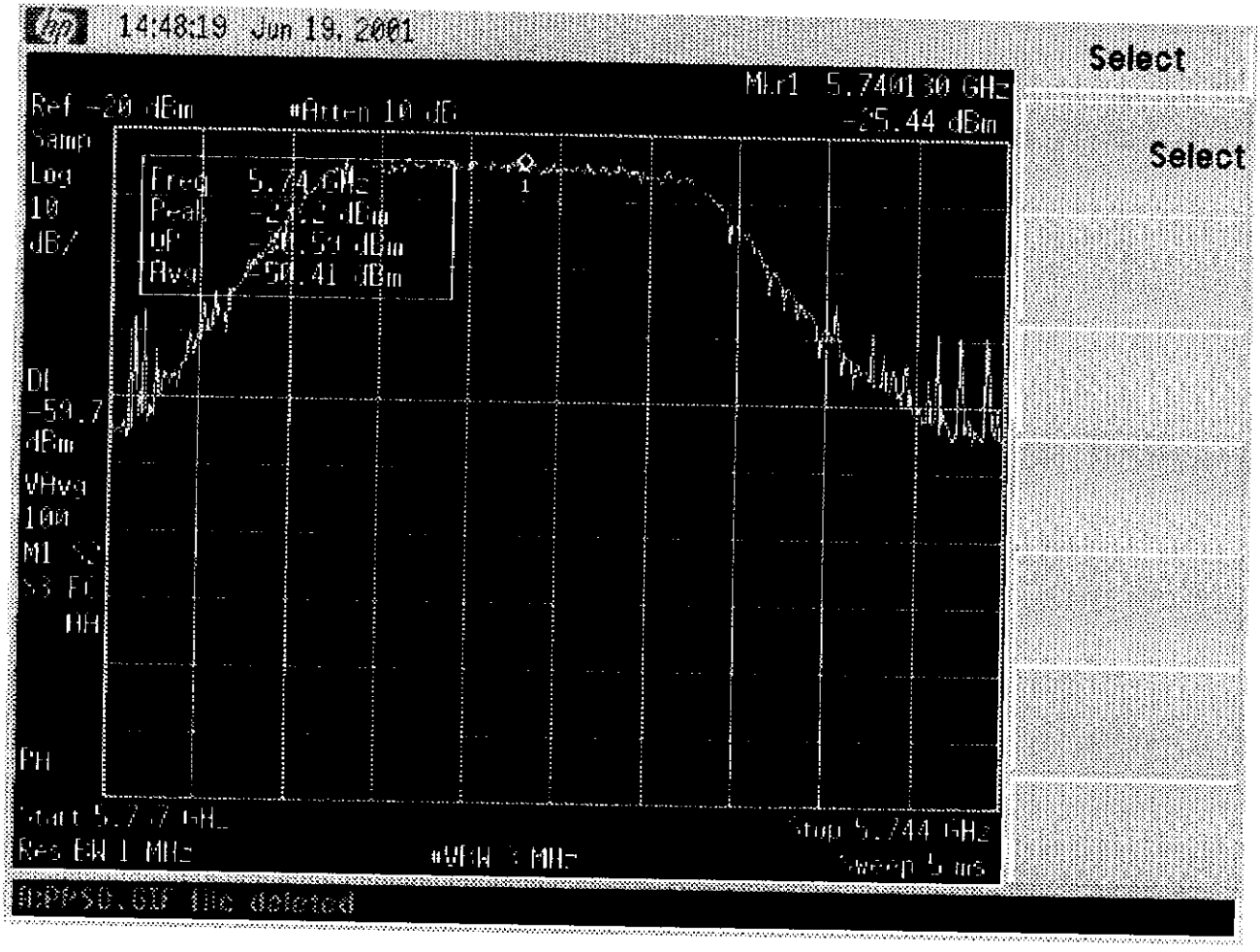
| Frequency MHz | Power Density DBm | EIRP Limit DBm | Maximum Allowed Antenna Gain dBi |
|---|---|---|---|
| 5733 | 12.4 | 23.0(p-mp), 40(p-p) | 10.6 (p-mp), 27.6 (p-p) |
| 5740 | 12.5 | 23.0(p-mp), 40(p-p) | 10.5 (p-mp), 27.5 (p-p) |

Refer to the following plots for power density data:

Plot 2a: Low Channel Power Density
Plot 2b: High Channel Power Density

Note:
1. (p-mp) refers to "Point to Multipoint" operation, while (p-p) refers to "Point to Point" operation.
2. When an antenna is used with gain higher than that specified as allowable for either point to point or point to multipoint operation, the output power shall be reduced by the amount in dB that the antenna gain exceeds the allowed antenna gain.


14:07:35 Jun 19, 2001
Ref -20 dBm
#Atten 10 dB
Mkr1 5.732211 GHz
-23.28 dBm
Samp
Log
10
dB/
Marker
5.732211000 GHz
-23.28 dBm
#VBW 3 MHz
Sweep 5 ms
Marker Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2


14:48:19 Jun 19, 2001
Select
Select
Ref -20 dBm
#Atten 10 dB
Mkr1 5.740130 GHz
-25.44 dBm
Samp
Log
10
dB/
Freq 5.74 GHz
Peak -24.2 dBm
dP -30.59 dBm
Avg -50.41 dBm
1
DL
-59.7
dBm
VAvg
100
MI
PH
Start 5.7 GHz
Res BW 1 MHz
#VBW 3 MHz
Stop 5.744 GHz
Sweep 5 ms
B2PPSD.GIF file deleted

4.4 The ratio of the peak excursion of the modulation envelope to the peak power
FCC Rule 15.407(a)(6)

Requirement:

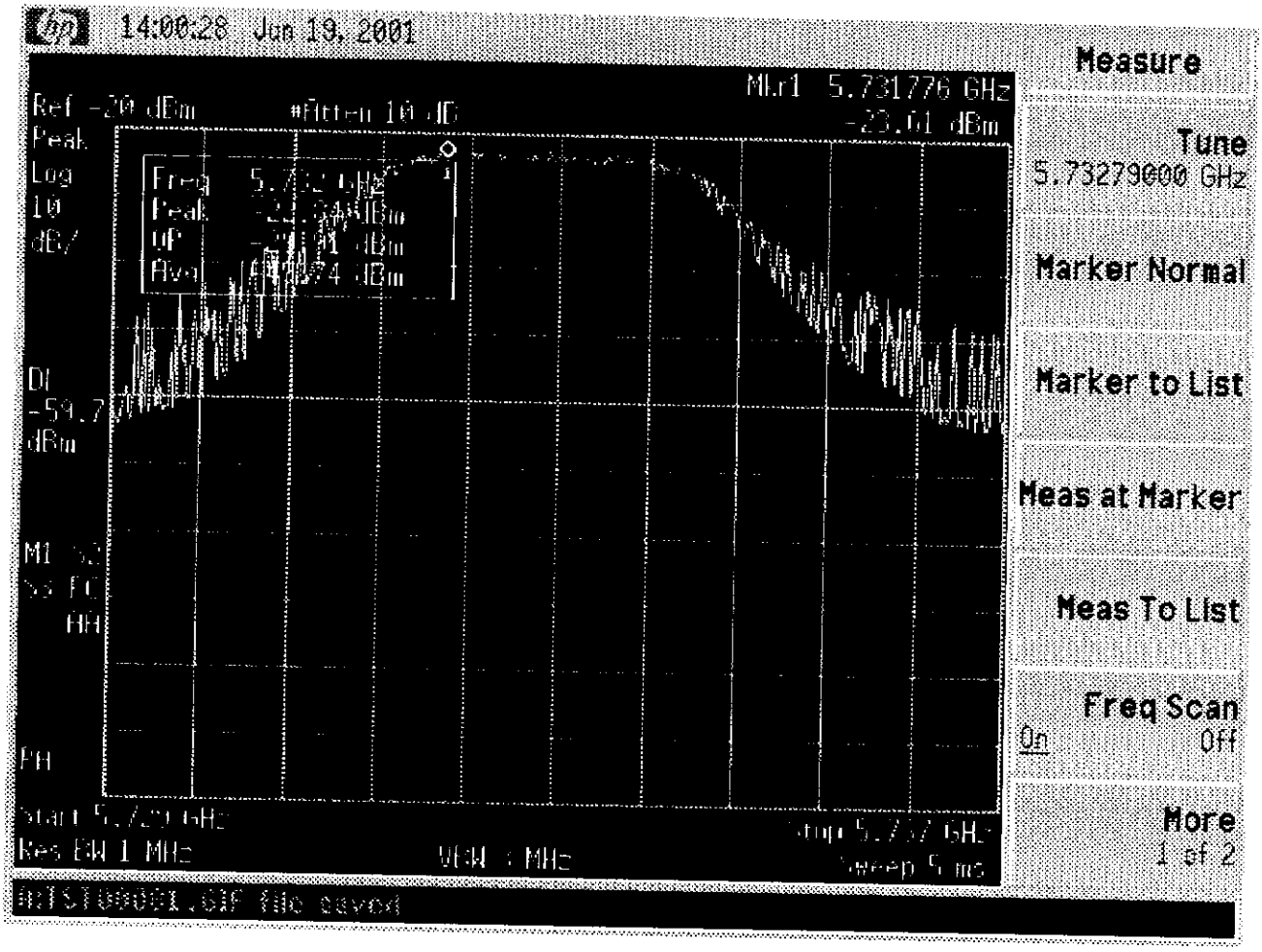
The ratio of the peak excursion of the modulation envelope to the peak transmit power shall not exceed 13 dB.

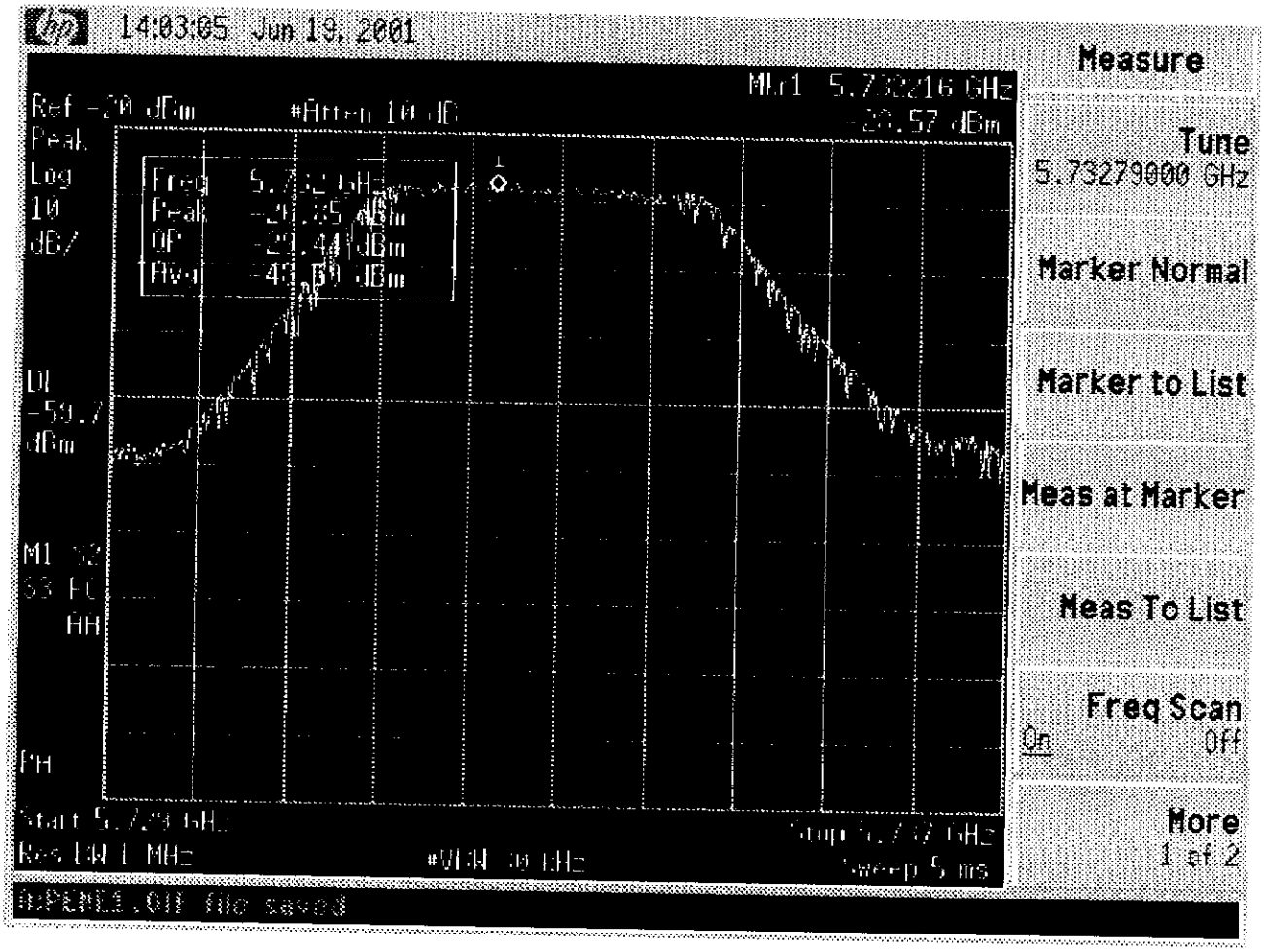
Procedure:

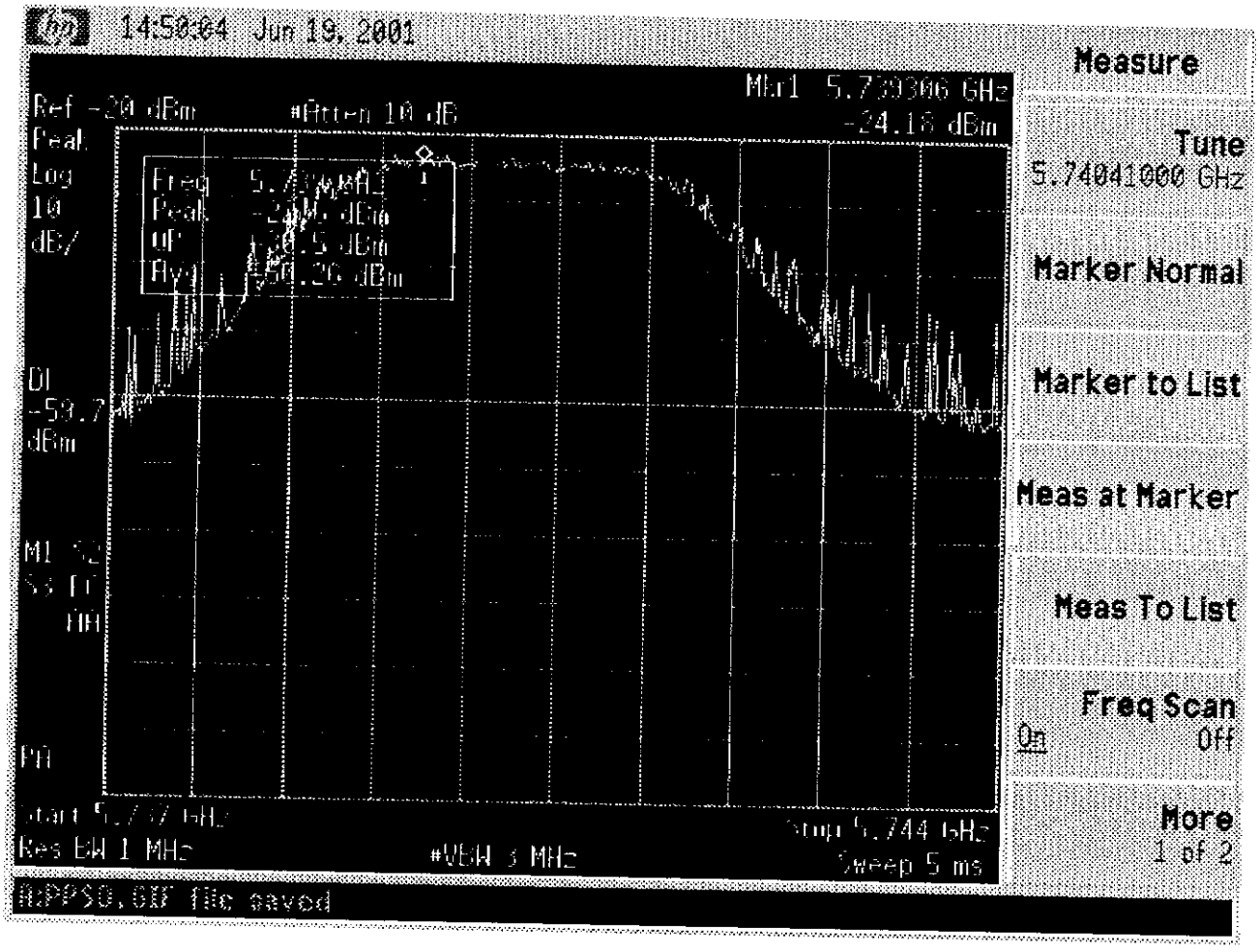
Spectrum Analyzer was connected to the output of the EUT. The Resolution Bandwidth was set to 1 MHz. Two plots were made in each band: with the Video Bandwidth set to 3 MHz and with the Video Bandwidth set to 30 kHz. The difference between spectrum analyzer readings indicates the ratio of the peak excursion of the modulation envelope to the peak transmit power.

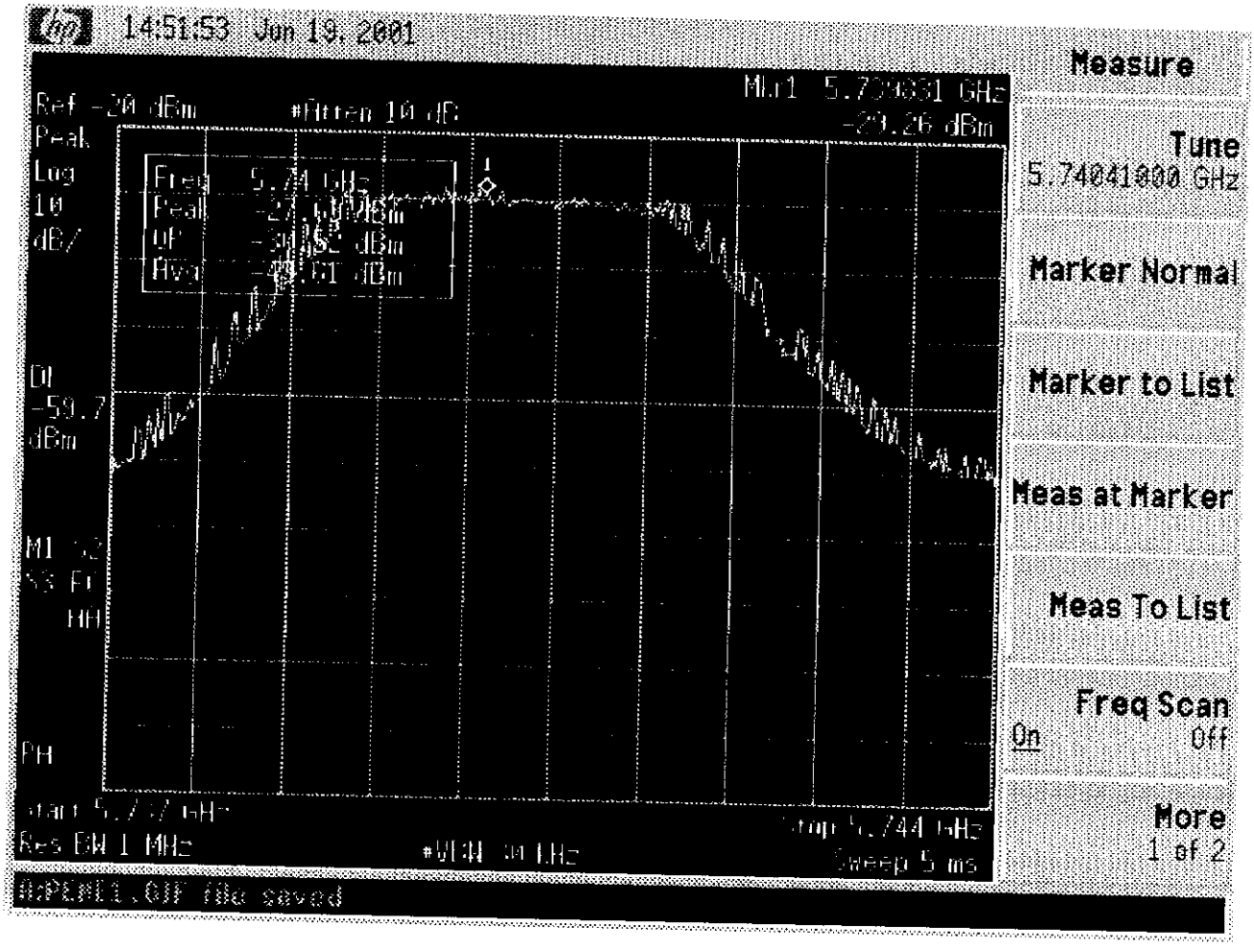
Test Result:

See attached plots 3.a1, 3.a2 and 3.b1, 3.b2. for the ratio of the peak excursion of the modulation envelope to the peak power. The maximum Ratio is 5.0 dB.


14:00:28 Jun 19, 2001
Ref -20 dBm
#Atten 10 dB
Mkr1 5.731776 GHz
-23.61 dBm
Peak
Log
10
dB/
Freq 5.732 GHz
Peak -23.34 dBm
dB -30.01 dBm
Avg 40.74 dBm
DL
-59.7
dBm
M1
FH
Start 5.720 GHz
Res BW 1 MHz
VBW 3 MHz
Stop 5.747 GHz
Sweep 5 ms
Measure
Tune
5.73279000 GHz
Marker Normal
Marker to List
Meas at Marker
Meas To List
Freq Scan
On
Off
More
1 of 2


14:03:05 Jun 19, 2001
Mkr1 5.732216 GHz
-29.57 dBm
Ref -20 dBm
#Atten 10 dB
Peak
Log
10
dB/
Freq 5.732 GHz
Peak -20.65 dBm
QP -29.44 dBm
Avg -43.89 dBm
DL
-59.7
dBm
M1 S2
53 FC
AA
PH
Start 5.729 GHz
Res BW 1 MHz
#VBW 30 kHz
Stop 5.737 GHz
Sweep 5 ms
Measure
Tune
5.73279000 GHz
Marker Normal
Marker to List
Meas at Marker
Meas To List
Freq Scan
On
Off
More
1 of 2


14:50:04 Jun 19, 2001
Ref -20 dBm
#Atten 10 dB
Mkr1 5.730306 GHz
-24.16 dBm
Peak
Log
10
dB/
Freq 5.730306 GHz
Peak -24.16 dBm
dB -30.5 dBm
Avg -50.26 dBm
Cl
-50.7
dBm
Start 5.717 GHz
Res BW 1 MHz
#VBW 3 MHz
Stop 5.744 GHz
Sweep 5 ms
A:PPS0.GIF file saved
Measure
Tune
5.74041000 GHz
Marker Normal
Marker to List
Meas at Marker
Meas To List
Freq Scan
On
Off
More
1 of 2


14:51:53 Jun 19, 2001
Ref -20 dBm
#Atten 10 dB
Mkr1 5.720881 GHz
-29.26 dBm
Peak
Log
10
dB/
Freq 5.74 GHz
Peak -27.69 dBm
Offset -30.52 dBm
Avg -43.67 dBm
Offset
-59.7
dBm
PH
Start 5.7 GHz
Res BW 1 MHz
#VBW 3 MHz
Stop 5.744 GHz
Sweep 5 ms
d:PEAK1.GIF file saved
Measure
Tune
5.74041000 GHz
Marker Normal
Marker to List
Meas at Marker
Meas To List
Freq Scan
On Off
More
1 of 2

4.5 Out-of-Band Emissions
FCC Rule 15.407(b)

Requirement:

For transmitters operating in the 5.725-5.825 GHz band: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an EIRP of –17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an EIRP of –27 dBm/MHz.

The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

Note that this gives a spurious emission limit of 80 dBuV for out of band emissions, which far exceeds the limits set forth in 15.209. Therefore the limits of 15.209 were applied to any radiated emissions below 1 GHz.

Procedure:

For radiated spurious measurements, the spectrum analyzer was connected to an antenna set that spanned the range from 30 MHz to 40 GHz. The EUT was connected to the highest and lowest gain antenna of each type marketed with the EUT. For frequencies above 1 GHz, the Resolution Bandwidth was set to 1 MHz, and average measurements were performed. For frequencies below 1 GHz, the Resolution Bandwidth was set 100 kHz, and quasi-peak measurements were performed. Several plots were made in the frequency range from 30 MHz to 40 GHz. For band edge measurements, the spectrum analyzer was connected directly to the EUT antenna port via a 30 dB attenuator and a cable with 5.7 dB of loss at the transmit frequency range.

Result:

Note that all emissions detected above 1 GHz were determined to be ambient (by interrupting power to the EUT and observation that the emissions still persisted) with exception to the fundamental transmit frequency, which is measured elsewhere in this report. Also note that the marker resolution of the analyzer lead to inaccuracy in the frequency value of the fundamental emission. These values are not being measured. Photos are provided.

Refer to the following plots and data tables for spurious radiated emissions data:
Plot 4.a1 – 4.a8 and Table A: 2' Parabolic 28 dBi Gain (Point-Point)
Plot 4.b1 – 4.b8 and Table B: 6' Parabolic 37.6 dBi Gain (Point-Point)
Plot 4.c1 – 4.c8 and Table C: Flat Panel 23 dBi Gain (Point-Point)
Plot 4.d1 – 4.d8 and Table D: Flat Panel 23 dBi Gain (Point-Multipoint)
Plot 4.e1 – 4.e8 and Table E: Flat Panel 12 dBi Gain (Point-Multipoint)

Refer to the following plots for antenna conducted band edge measurements:
Plot 4.f1 – 4.f2: Low Channel Band Edge Measurements, 5733 MHz.
Plot 4.g1 – 4.g2: High Channel Band Edge Measurements, 5740 MHz.

The EUT was scanned for spurious emissions while connected to the highest and lowest gain antennas of each type that is marketed with the EUT. Band edge measurements were taken by directly connecting the spectrum analyzer to the EUT antenna port.

| Operating frequency | Frequency, MHz | Conducted Level, dBm | EIRP Limit, dBm/MHz |
|---|---|---|---|
| 5733 MHz | 5725 | -26.2 from plot 4.f1 | -17 |
| | 5825 | -45.3 from plot 4.f2 | -17 |

| Operating frequency | Frequency, MHz | Conducted Level, dBm | Limit, dBm/MHz |
|---|---|---|---|
| 5740 MHz | 5724 | -32.0 from plot 4.g1 | -17.0 |
| | 5826 | -35.7 from plot 4.g2 | -17.0 |

# Intertek Testing Services

**Radiated Emissions / Interference**

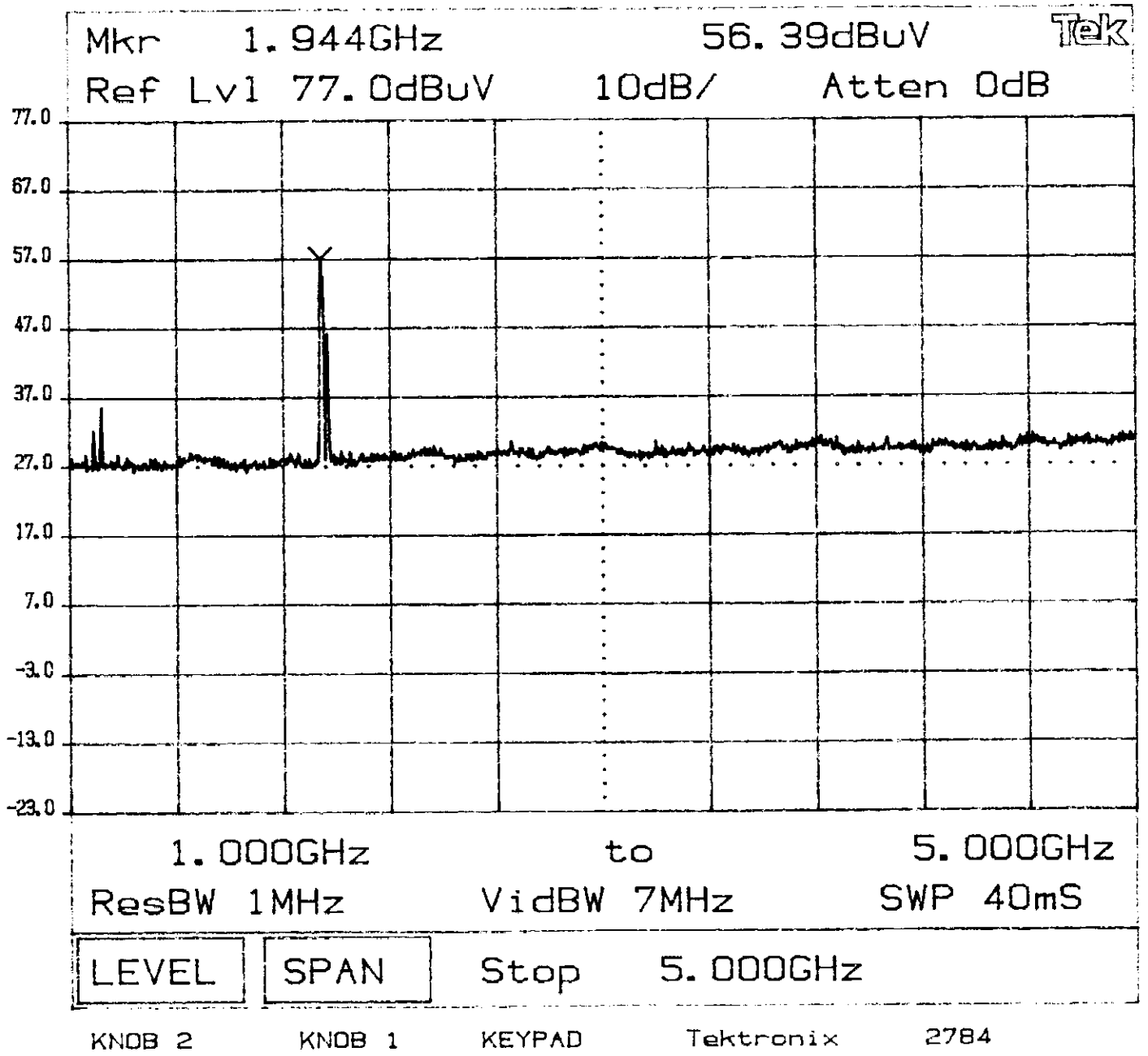
*Table: A*

| | | | |
|---|---|---|---|
| Company: | Wireless Bypass | ested by: | Nicholas Abbondante |
| Model: | DL-5800C | Location: | Site 1C |
| Job No.: | J20046196 | Detector: | HP 8546A |
| Date: | 06/15/01 | Antenna: | LOG1 |
| Standard: | FCC15 | PreAmp: | 0 |
| Class: | A Group: None | Cable(s): | 1C, 3 METER, PRIMAR |
| Notes: | Radiowaves 2' parabolic on CPE | Distance: | 3 meters |

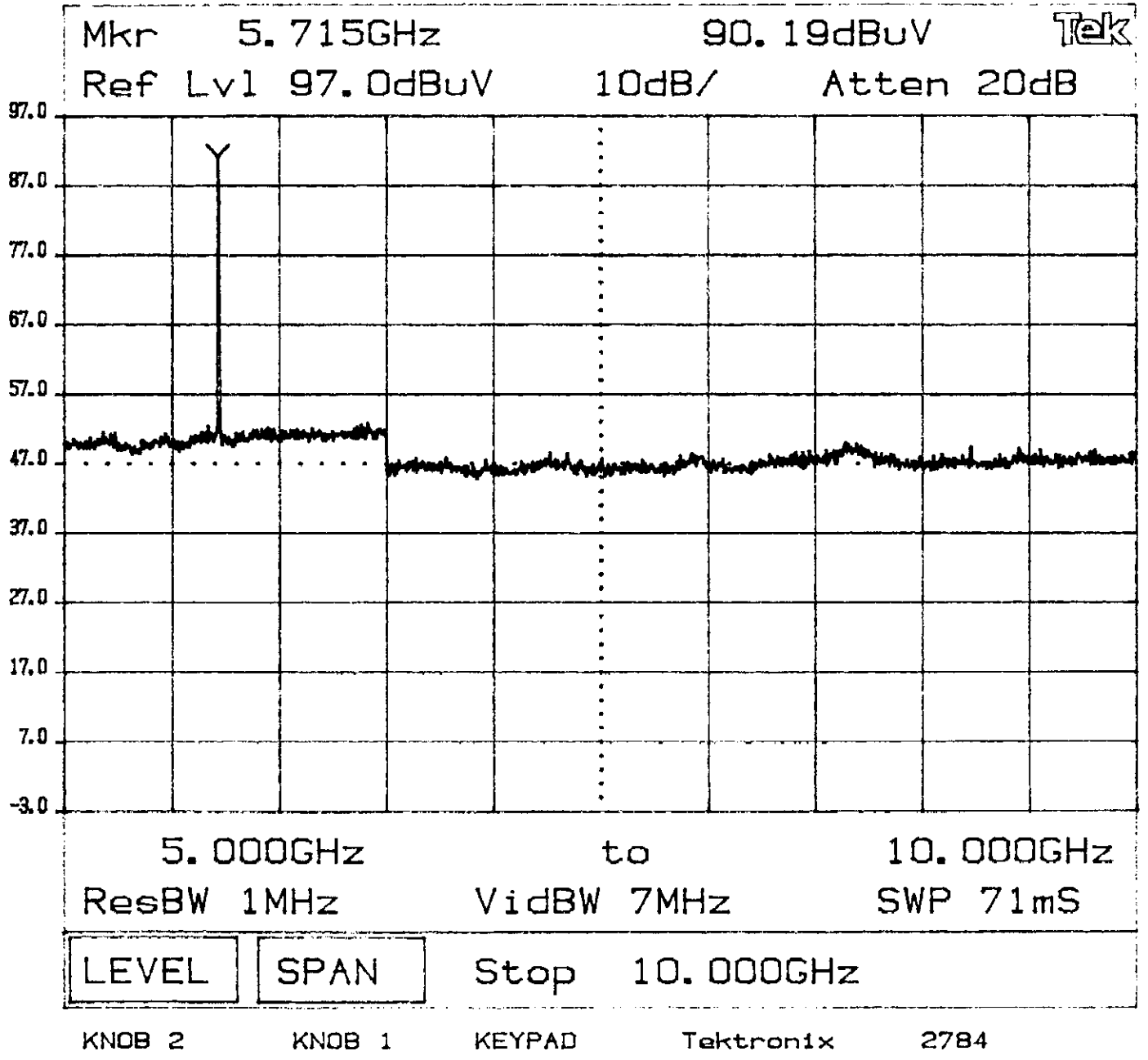
| Ant. Pol. (V/H) | Frequency MHz | Reading dB(uV) | Antenna Factor dB(1/m) | Cable Loss dB | Pre-amp Factor dB | Distance Factor dB | Net dB(uV/m) | Limit dB(uV/m) | Margin dB |
|---|---|---|---|---|---|---|---|---|---|
| V | 39.510 | 20.0 | 12.7 | 0.7 | 0.0 | 0.0 | 33.4 | 40.0 | -6.6 |
| V | 48.000 | 21.2 | 9.4 | 0.9 | 0.0 | 0.0 | 31.4 | 40.0 | -8.6 |
| V | 69.250 | 21.2 | 6.6 | 0.8 | 0.0 | 0.0 | 28.7 | 40.0 | -11.3 |
| V | 74.000 | 22.2 | 6.4 | 0.9 | 0.0 | 0.0 | 29.5 | 40.0 | -10.5 |
| V | 109.000 | 12.1 | 7.3 | 1.3 | 0.0 | 0.0 | 20.6 | 43.5 | -22.9 |
| V | 117.600 | 18.3 | 6.8 | 1.3 | 0.0 | 0.0 | 26.4 | 43.5 | -17.1 |
| V | 135.800 | 16.7 | 7.1 | 1.4 | 0.0 | 0.0 | 25.3 | 43.5 | -18.2 |

RADIO WAVES & PARABOLIC DISH

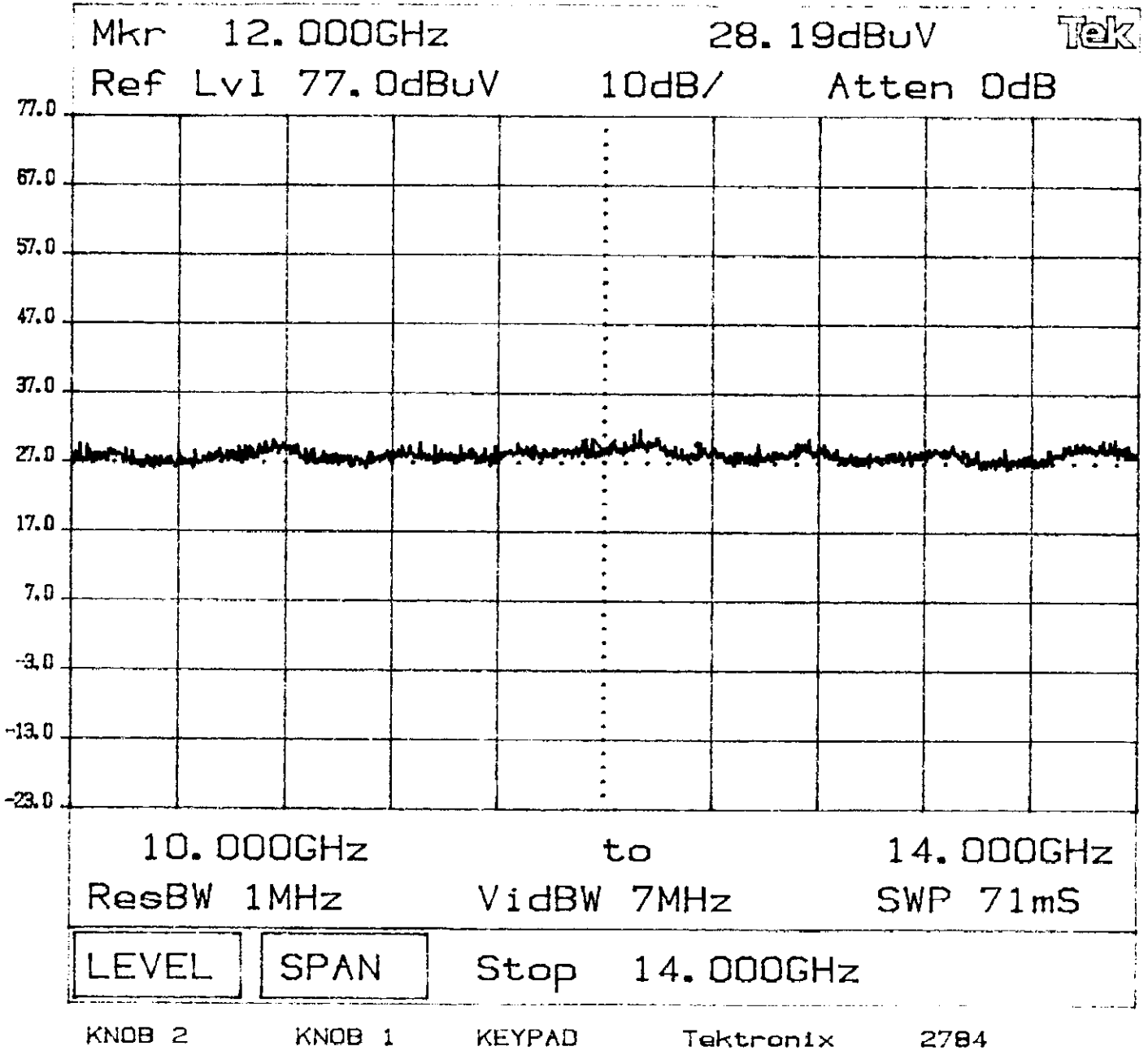
4a)



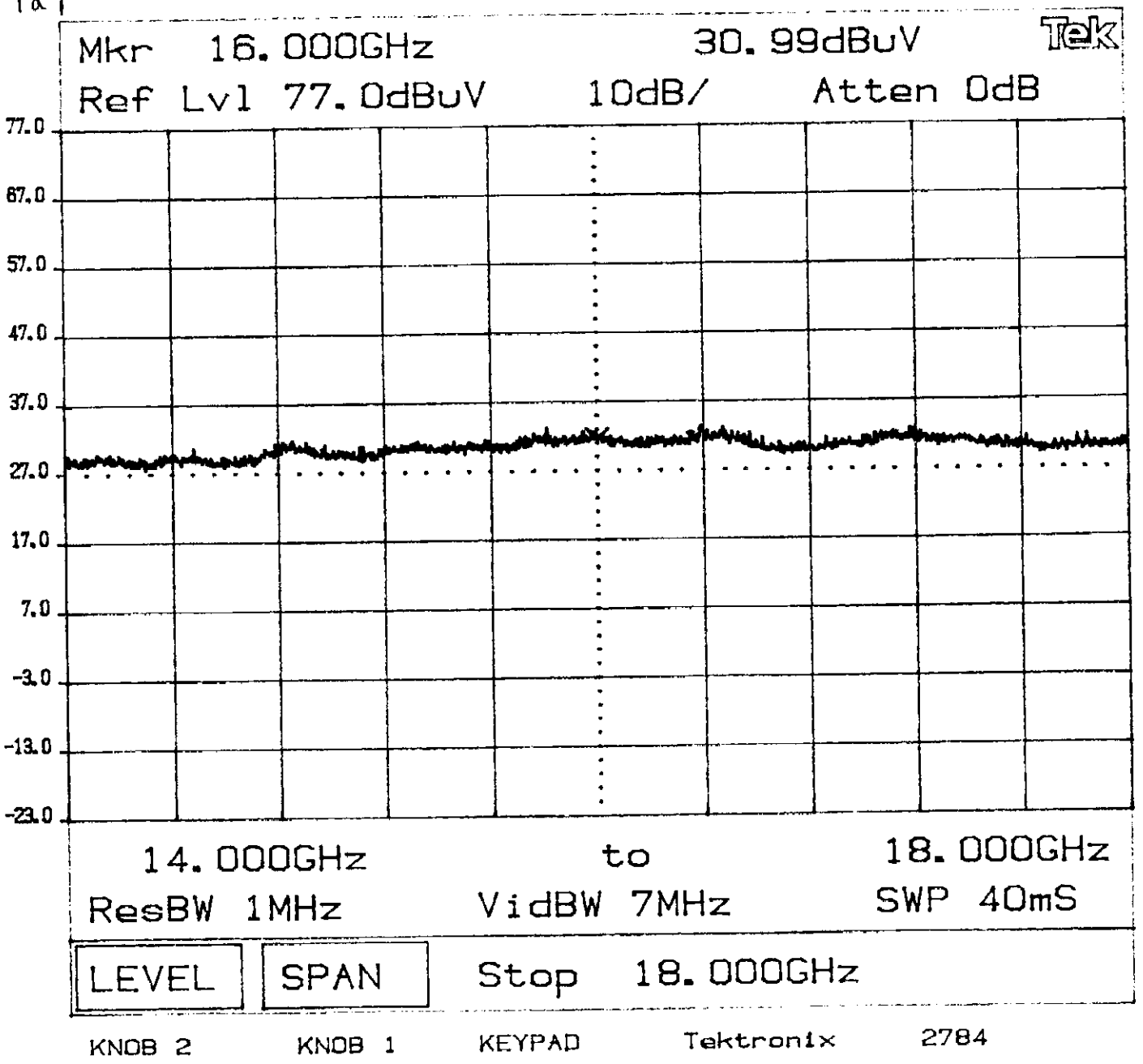
4a2


Mkr 5.715GHz
90.19dBuV
Tek
Ref Lvl 97.0dBuV
10dB/
Atten 20dB
97.0
87.0
77.0
67.0
57.0
47.0
37.0
27.0
17.0
7.0
-3.0
5.000GHz
to
10.000GHz
ResBW 1MHz
VidBW 7MHz
SWP 71mS
LEVEL
SPAN
Stop 10.000GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

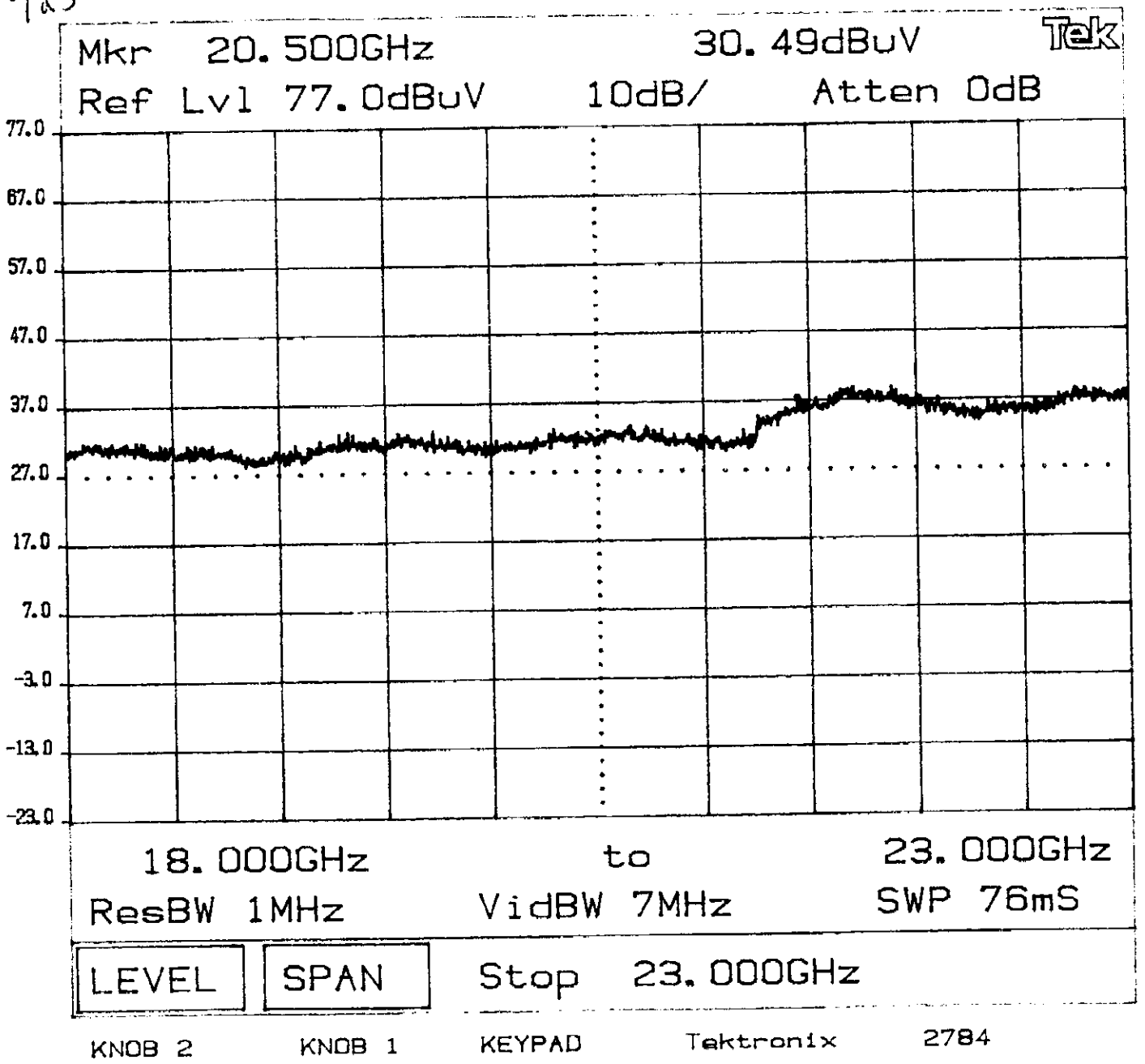
4.3


Mkr 12.000GHz
28.19dBuV
Tek
Ref Lvl 77.0dBuV
10dB/
Atten 0dB
77.0
67.0
57.0
47.0
37.0
27.0
17.0
7.0
-3.0
-13.0
-23.0
10.000GHz
to
14.000GHz
ResBW 1MHz
VidBW 7MHz
SWP 71mS
LEVEL
SPAN
Stop 14.000GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

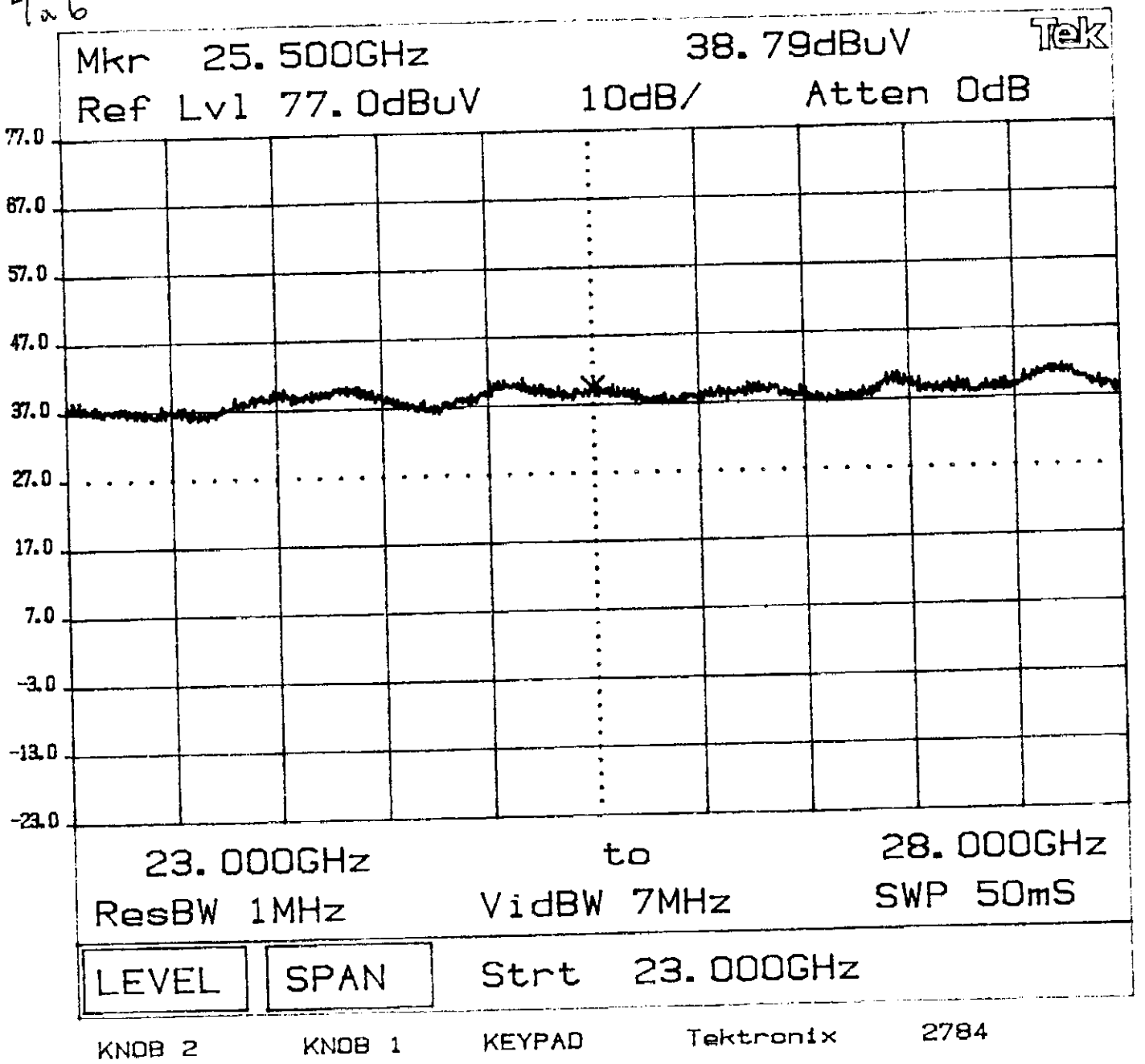
4.4


Mkr 16.000GHz
30.99dBuV
Tek
Ref Lvl 77.0dBuV
10dB/
Atten 0dB
77.0
67.0
57.0
47.0
37.0
27.0
17.0
7.0
-3.0
-13.0
-23.0
14.000GHz
to
18.000GHz
ResBW 1MHz
VidBW 7MHz
SWP 40mS
LEVEL
SPAN
Stop 18.000GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

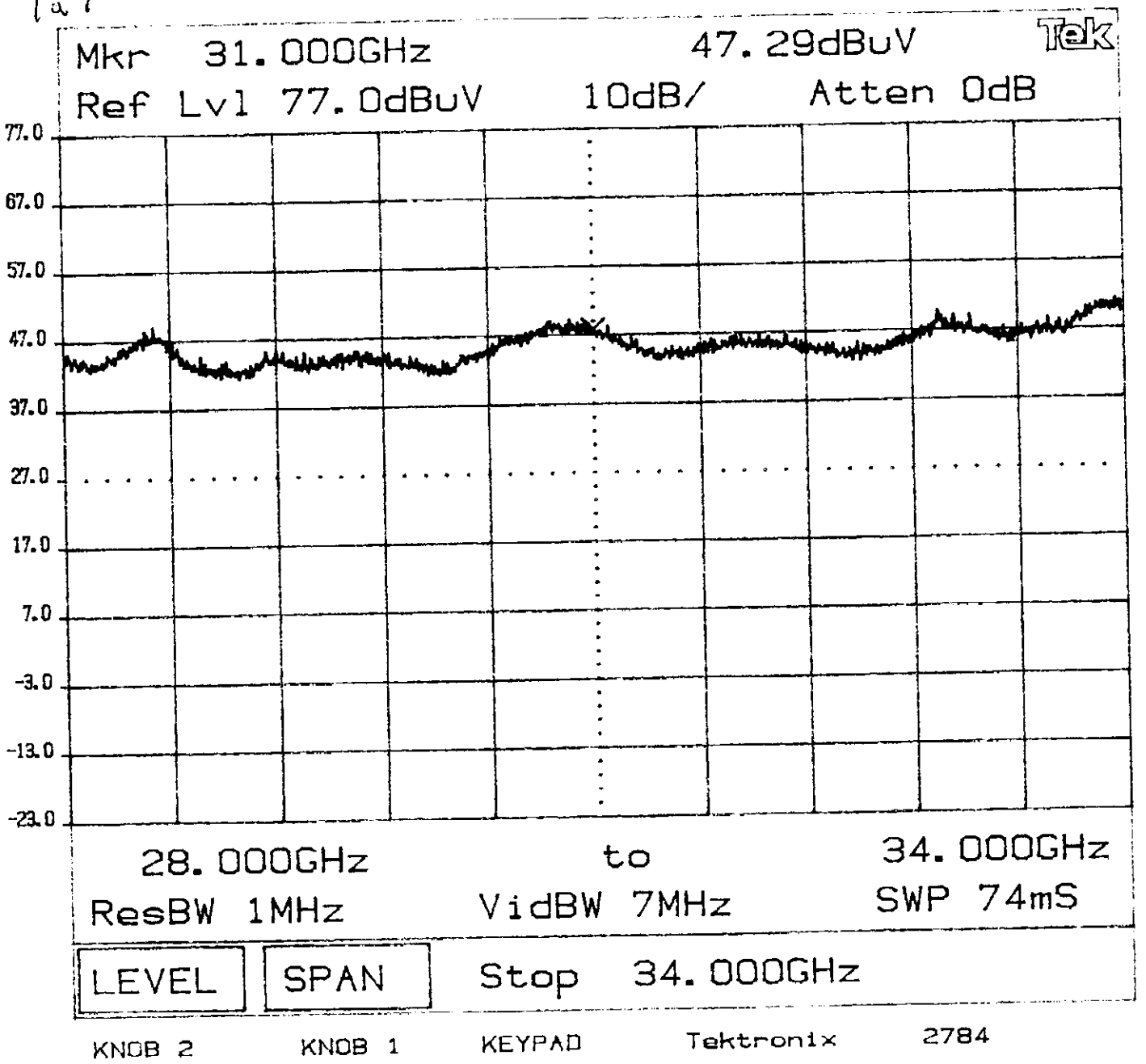
4a5


Mkr 20.500GHz
30.49dBuV
Tek
Ref Lvl 77.0dBuV
10dB/
Atten 0dB
77.0
67.0
57.0
47.0
37.0
27.0
17.0
7.0
-3.0
-13.0
-23.0
18.000GHz
to
23.000GHz
ResBW 1MHz
VidBW 7MHz
SWP 76mS
LEVEL
SPAN
Stop 23.000GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

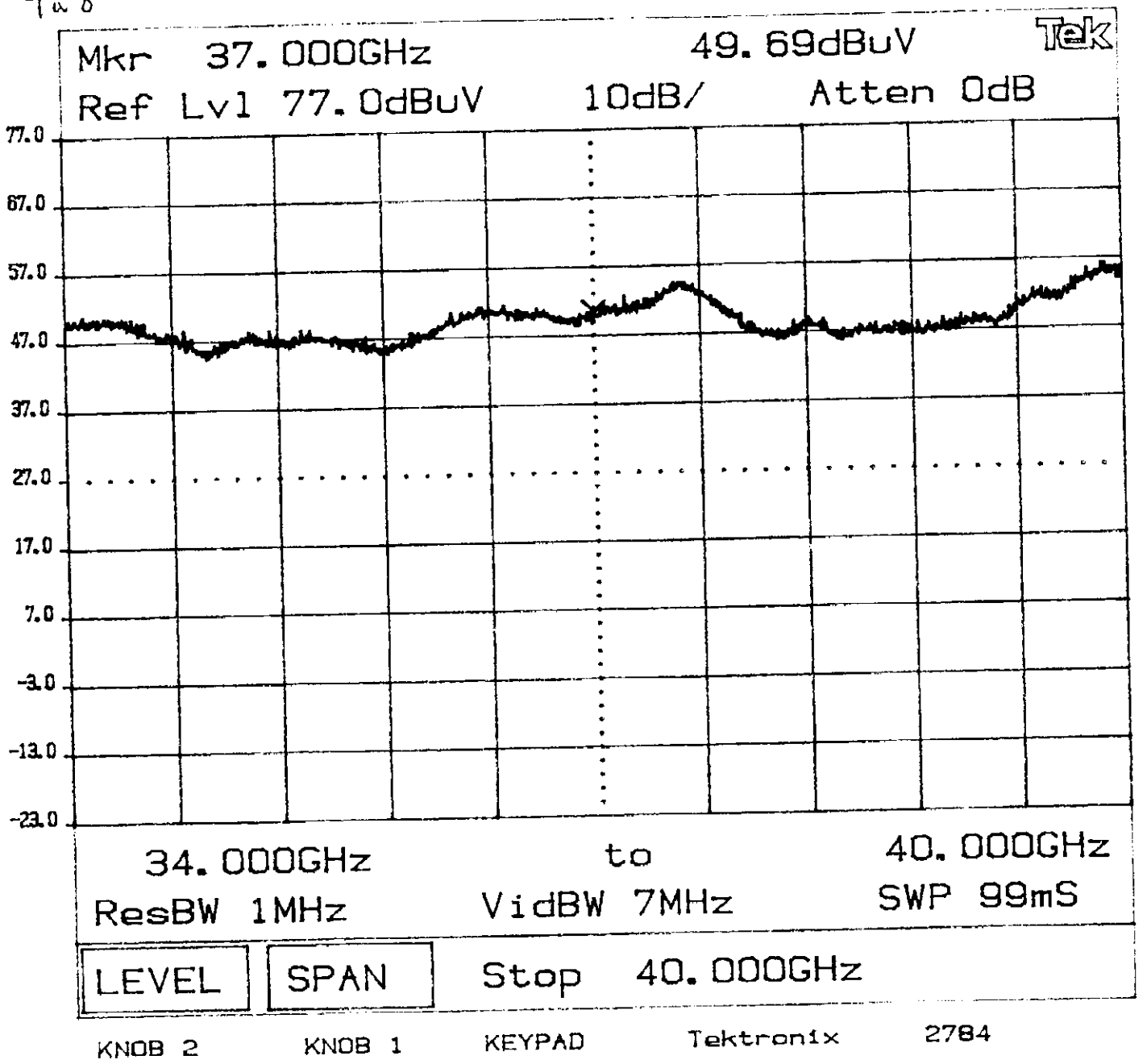
4.6


Mkr 25.500GHz
38.79dBuV
Tek
Ref Lvl 77.0dBuV
10dB/
Atten 0dB
77.0
67.0
57.0
47.0
37.0
27.0
17.0
7.0
-3.0
-13.0
-23.0
23.000GHz
to
28.000GHz
ResBW 1MHz
VidBW 7MHz
SWP 50mS
LEVEL
SPAN
Strt 23.000GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

4a7


Mkr 31.000GHz
47.29dBuV
Tek
Ref Lvl 77.0dBuV
10dB/
Atten 0dB
77.0
67.0
57.0
47.0
37.0
27.0
17.0
7.0
-3.0
-13.0
-23.0
28.000GHz
to
34.000GHz
ResBW 1MHz
VidBW 7MHz
SWP 74mS
LEVEL
SPAN
Stop 34.000GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

4 of 8


Mkr 37.000GHz
49.69dBuV
Tek
Ref Lvl 77.0dBuV
10dB/
Atten 0dB
77.0
67.0
57.0
47.0
37.0
27.0
17.0
7.0
-3.0
-13.0
-23.0
34.000GHz
to
40.000GHz
ResBW 1MHz
VidBW 7MHz
SWP 99mS
LEVEL
SPAN
Stop 40.000GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

# Intertek Testing Services

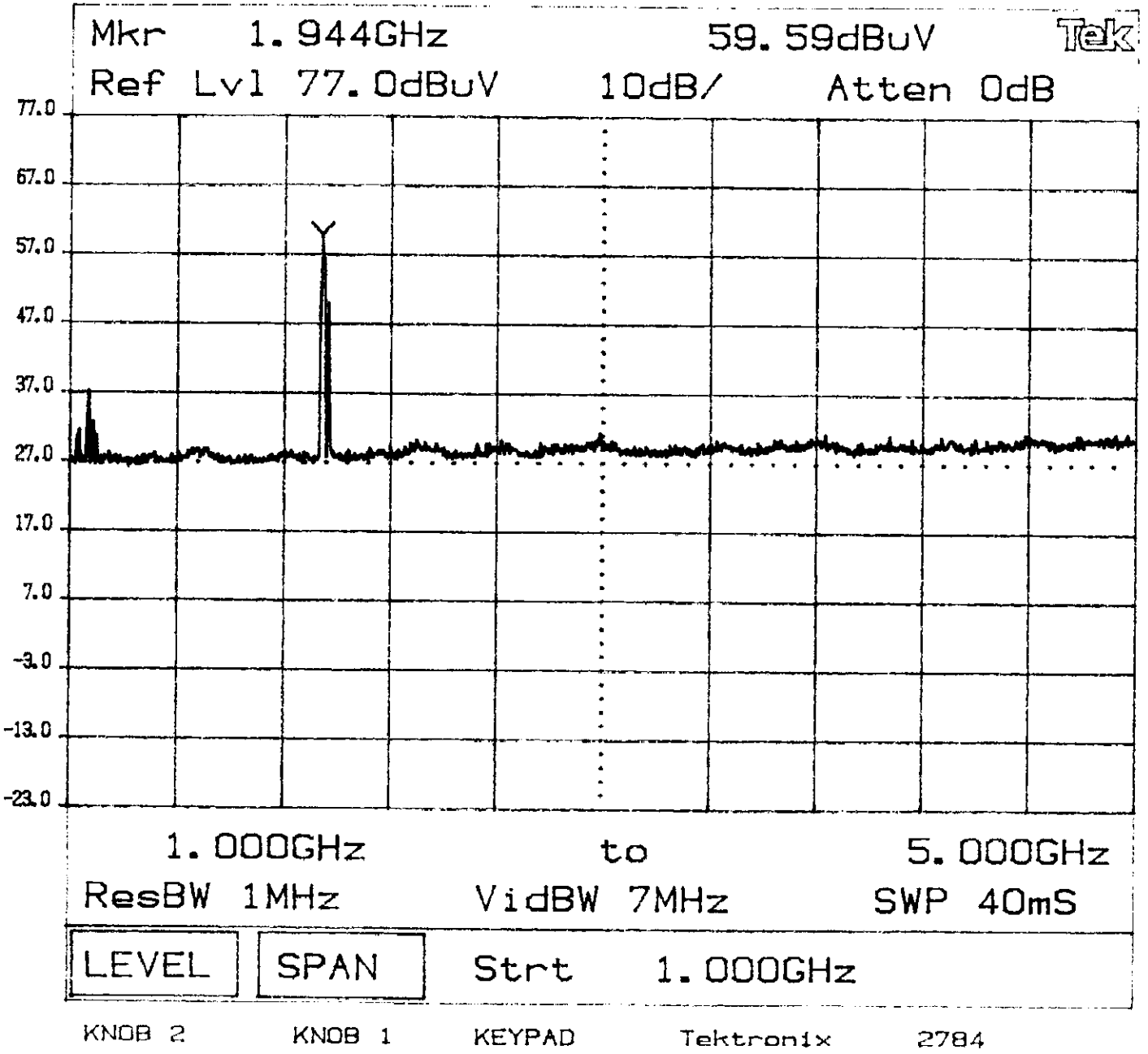
**Radiated Emissions / Interference**

*Table: B*

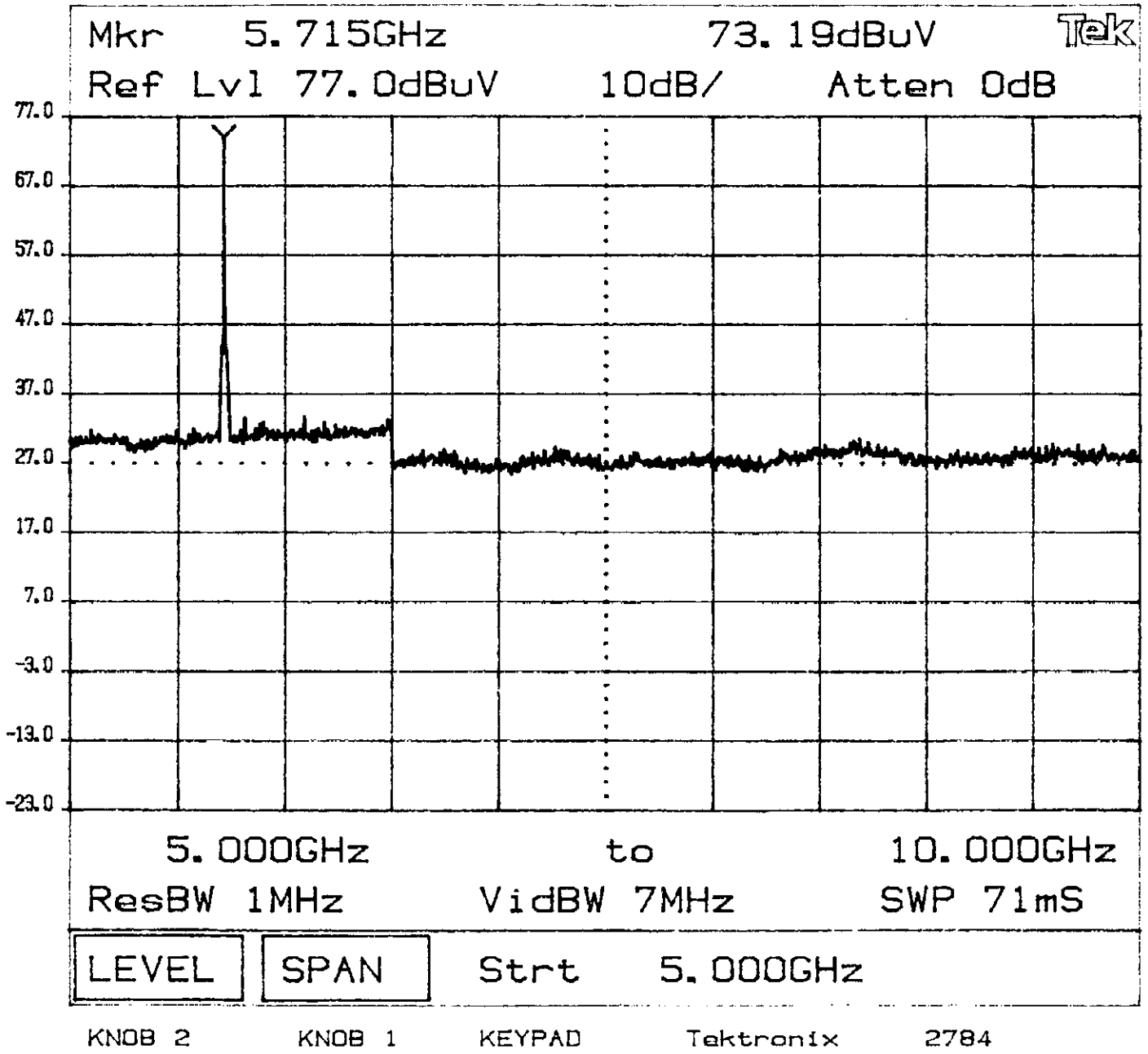
| | | | |
|---|---|---|---|
| *Company:* | *Wireless Bypass* | *ested by:* | *Nicholas Abbondante* |
| *Model:* | *DL-5600C* | *Location:* | *Site 1C* |
| *Job No.:* | *J20046196* | *Detector:* | *HP 8546A* |
| *Date:* | *05/14/01* | *Antenna:* | *LOG1* |
| *Standard:* | *FCC15* | *PreAmp:* | *0* |
| *Class:* | *A* *Group: None* | *Cable(s):* | *1C, 3 METER, PRIMAR* |
| *Notes:* | *Radiowaves 6' Parabolic on CPE* | *Distance:* | *3* *meters* |

| *Ant. Pol. (V/H)* | *Frequency MHz* | *Reading dB(uV)* | *Antenna Factor dB(1/m)* | *Cable Loss dB* | *Pre-amp Factor dB* | *Distance Factor dB* | *Net dB(uV/m)* | *Limit dB(uV/m)* | *Margin dB* |
|---|---|---|---|---|---|---|---|---|---|
| *V* | *40.120* | *20.8* | *12.4* | *0.7* | *0.0* | *0.0* | *33.9* | *40.0* | *-6.1* |
| *V* | *43.520* | *20.0* | *11.1* | *0.8* | *0.0* | *0.0* | *31.8* | *40.0* | *-8.2* |
| *V* | *74.540* | *23.5* | *6.4* | *0.9* | *0.0* | *0.0* | *30.8* | *40.0* | *-9.2* |
| *V* | *108.800* | *19.5* | *7.3* | *1.3* | *0.0* | *0.0* | *28.0* | *43.5* | *-15.5* |
| *V* | *118.300* | *17.3* | *6.8* | *1.3* | *0.0* | *0.0* | *25.4* | *43.5* | *-18.1* |
| *V* | *133.700* | *17.5* | *7.0* | *1.4* | *0.0* | *0.0* | *25.9* | *43.5* | *-17.6* |

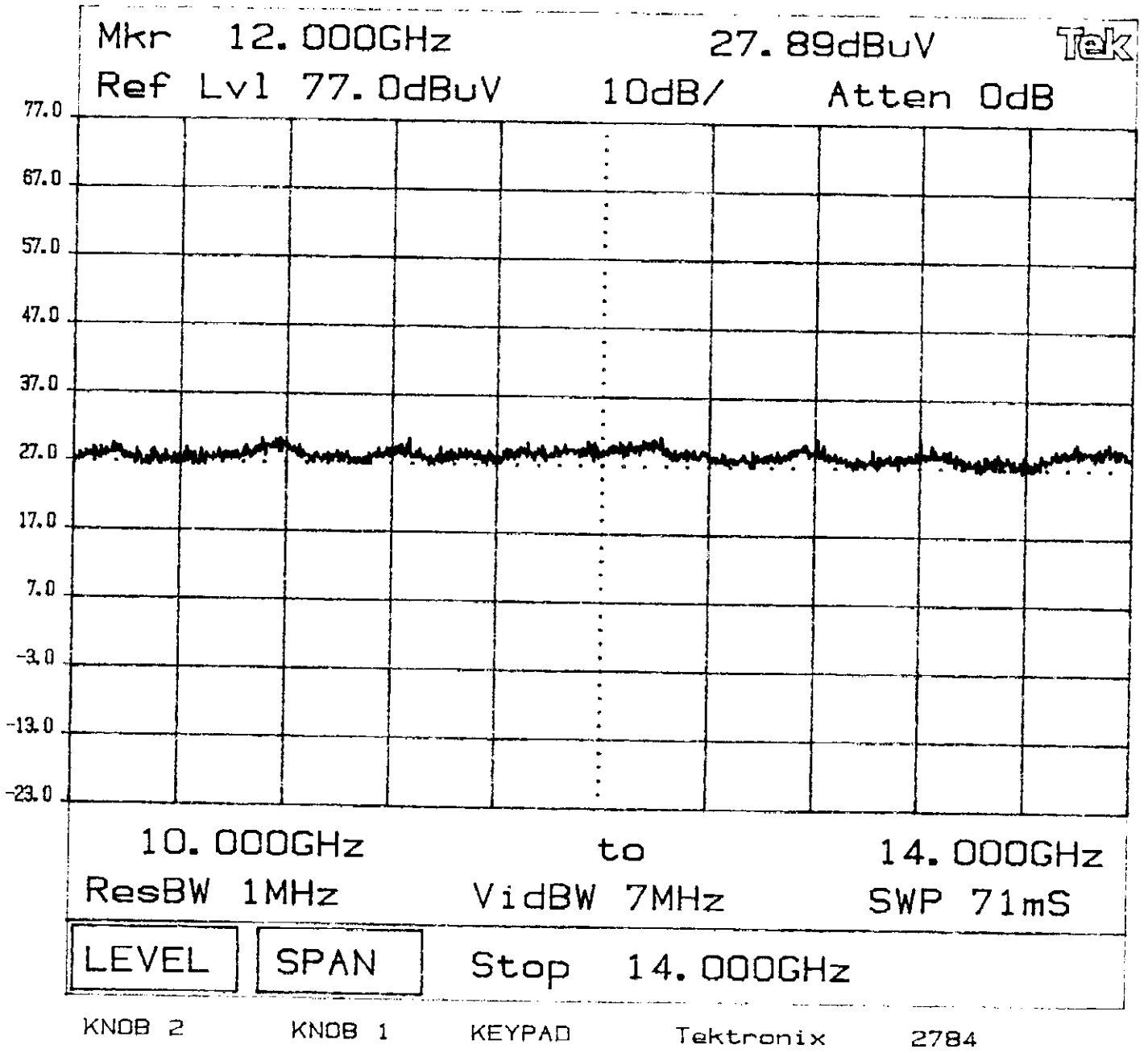
461


Mkr 1.944GHz
59.59dBuV
Tek
Ref Lvl 77.0dBuV
10dB/
Atten 0dB
77.0
67.0
57.0
47.0
37.0
27.0
17.0
7.0
-3.0
-13.0
-23.0
1.000GHz
to
5.000GHz
ResBW 1MHz
VidBW 7MHz
SWP 40mS
LEVEL
SPAN
Strt 1.000GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

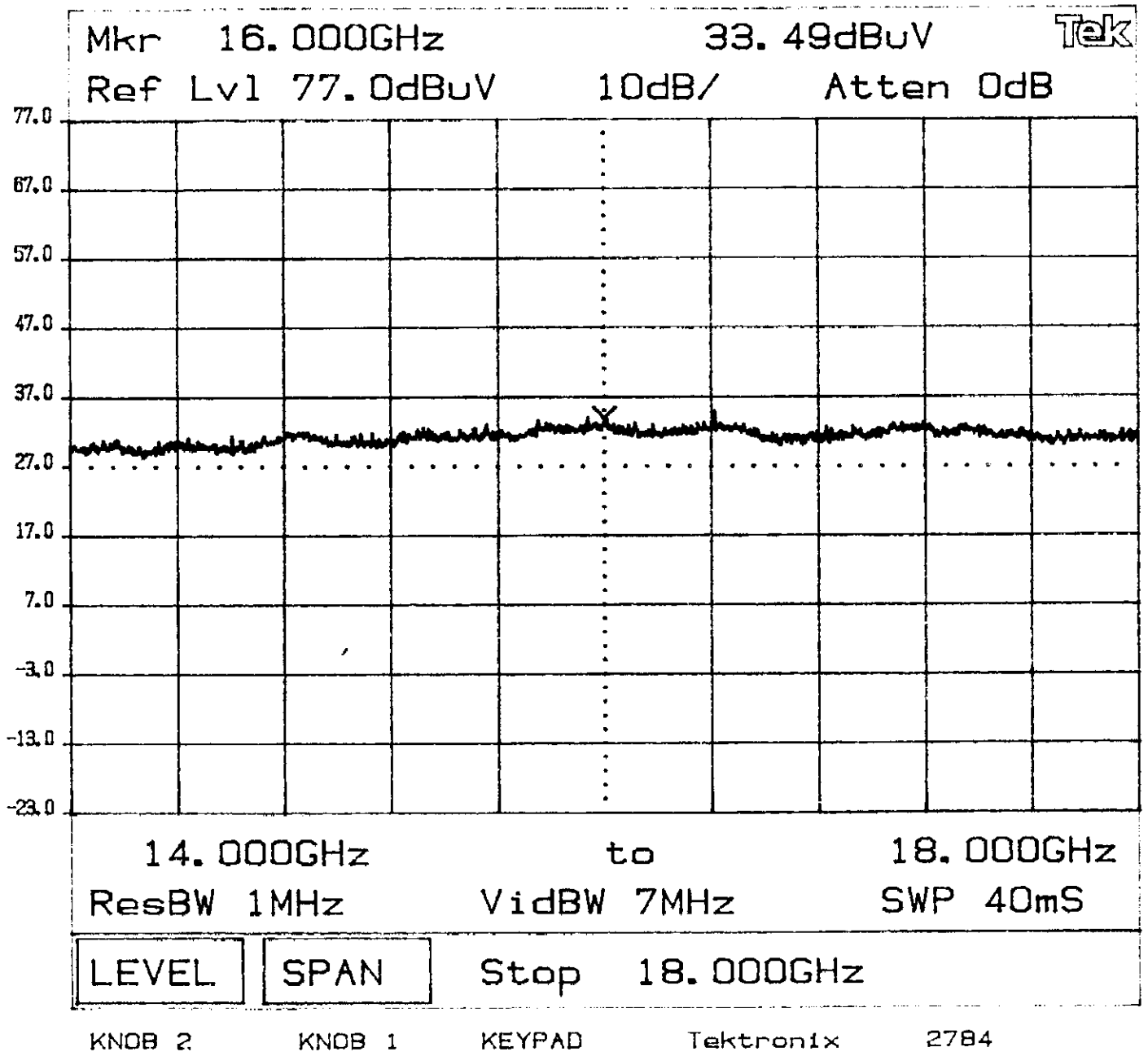
462


Mkr 5.715GHz 73.19dBuV
Tek
Ref Lvl 77.0dBuV 10dB/ Atten 0dB
77.0
67.0
57.0
47.0
37.0
27.0
17.0
7.0
-3.0
-13.0
-23.0
5.000GHz to 10.000GHz
ResBW 1MHz VidBW 7MHz SWP 71mS
LEVEL
SPAN
Strt 5.000GHz
KNOB 2 KNOB 1 KEYPAD Tektronix 2784

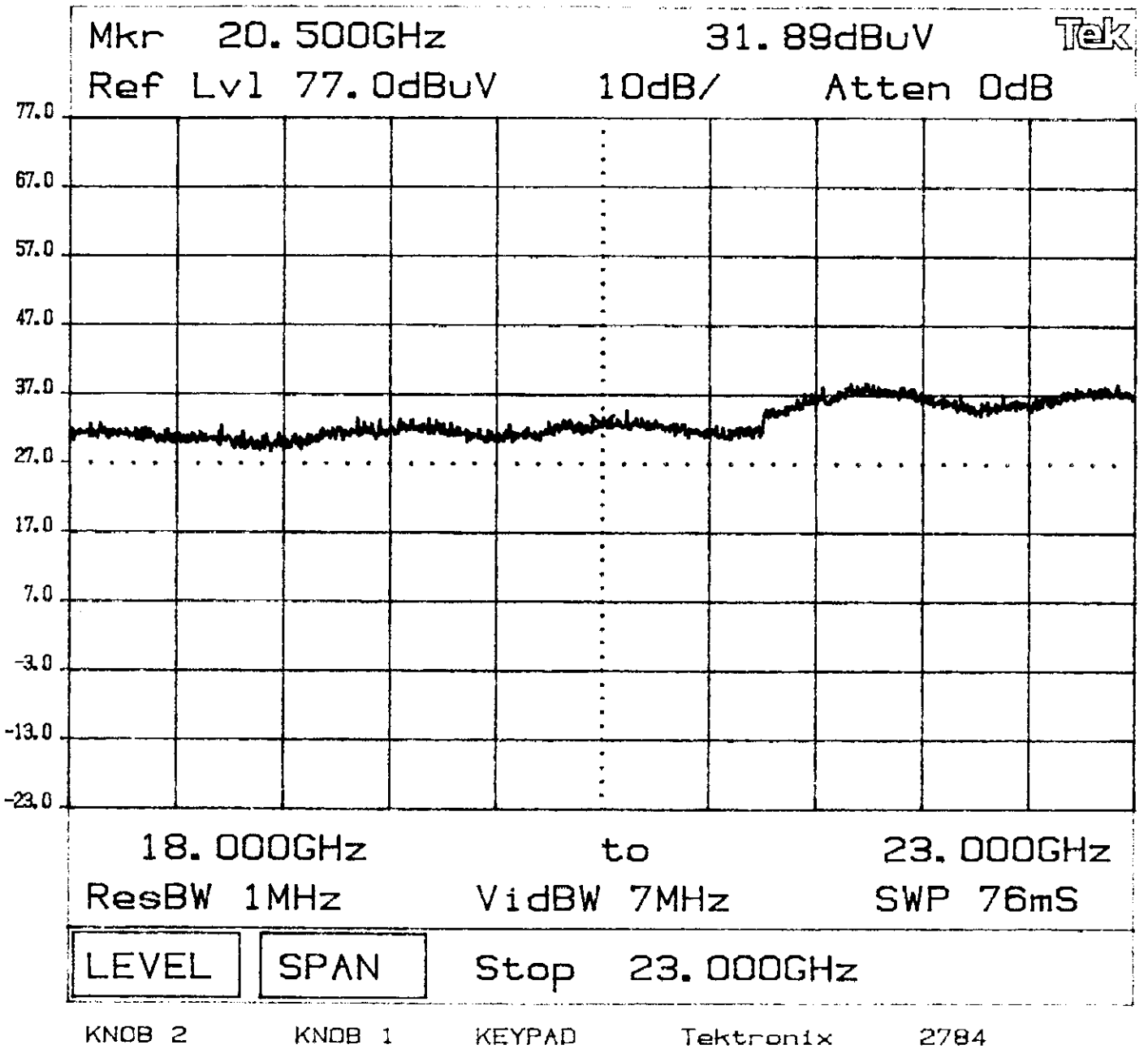
463


Mkr 12.000GHz
27.89dBuV
Tek
Ref Lvl 77.0dBuV
10dB/
Atten 0dB
77.0
67.0
57.0
47.0
37.0
27.0
17.0
7.0
-3.0
-13.0
-23.0
10.000GHz
to
14.000GHz
ResBW 1MHz
VidBW 7MHz
SWP 71mS
LEVEL
SPAN
Stop 14.000GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

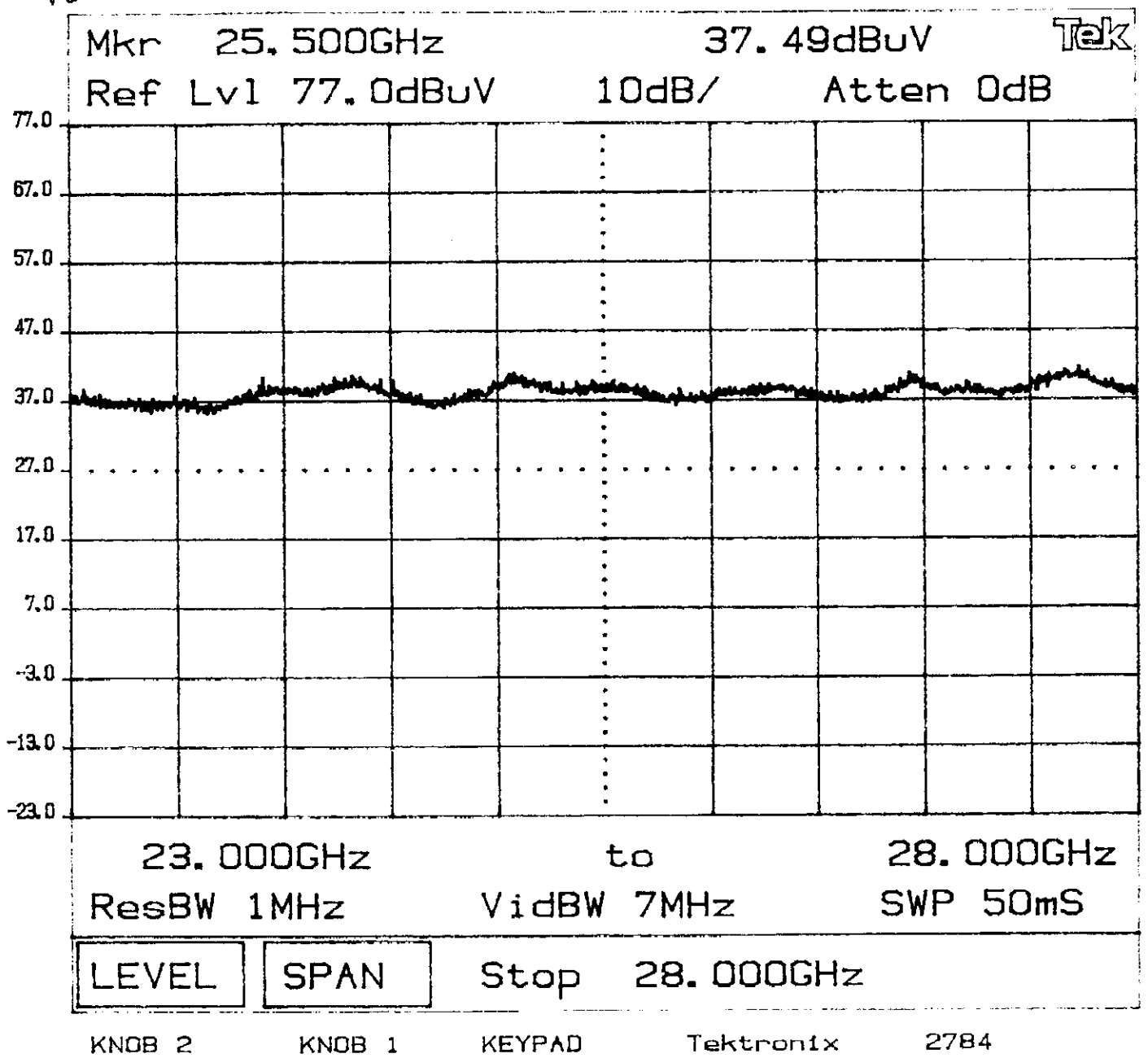
464


Mkr 16.000GHz
33.49dBuV
Tek
Ref Lvl 77.0dBuV
10dB/
Atten 0dB
77.0
67.0
57.0
47.0
37.0
27.0
17.0
7.0
-3.0
-13.0
-23.0
14.000GHz
to
18.000GHz
ResBW 1MHz
VidBW 7MHz
SWP 40mS
LEVEL
SPAN
Stop 18.000GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

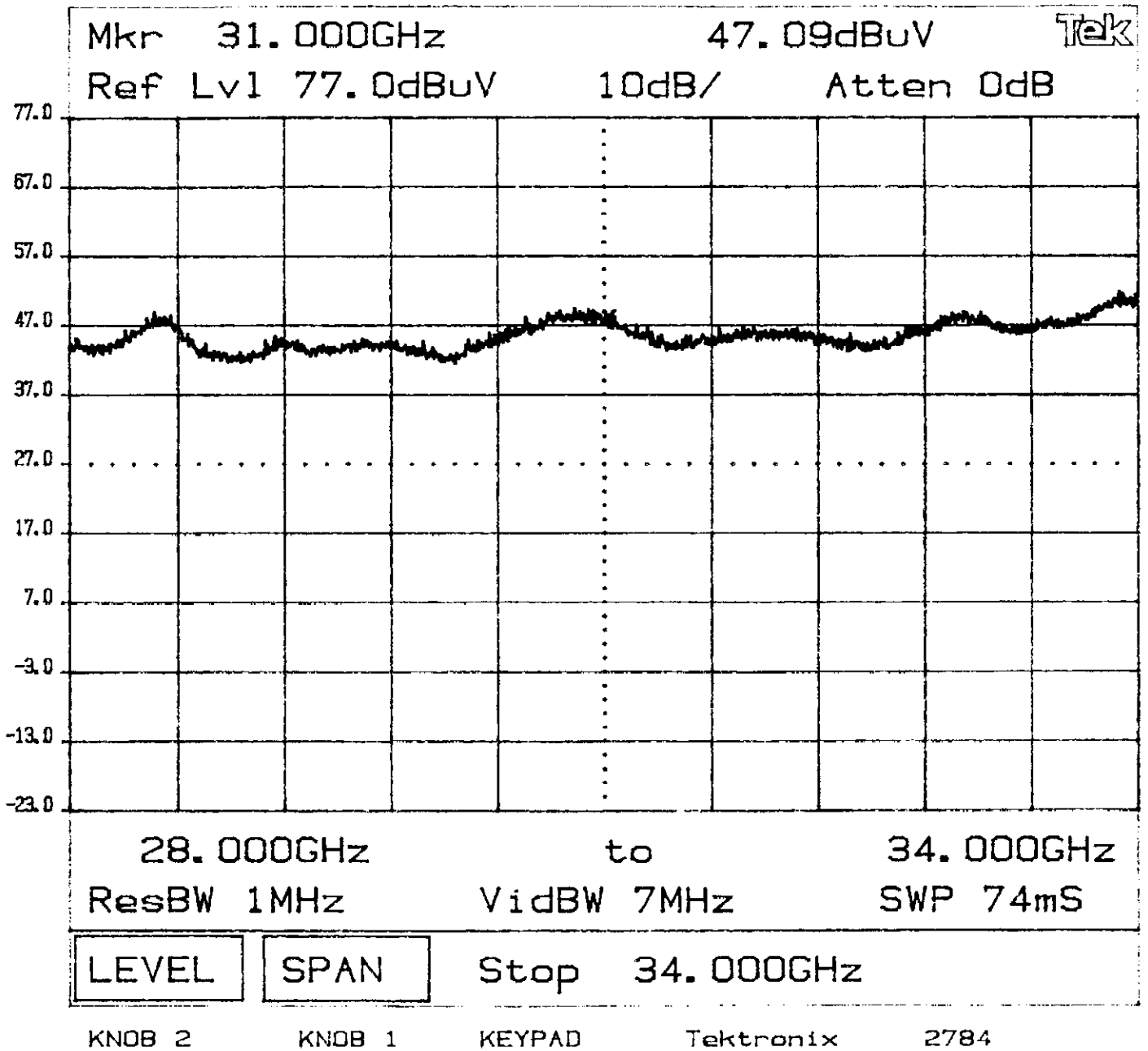
465


Mkr 20.500GHz
31.89dBuV
Tek
Ref Lvl 77.0dBuV
10dB/
Atten 0dB
77.0
67.0
57.0
47.0
37.0
27.0
17.0
7.0
-3.0
-13.0
-23.0
18.000GHz
to
23.000GHz
ResBW 1MHz
VidBW 7MHz
SWP 76mS
LEVEL
SPAN
Stop 23.000GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

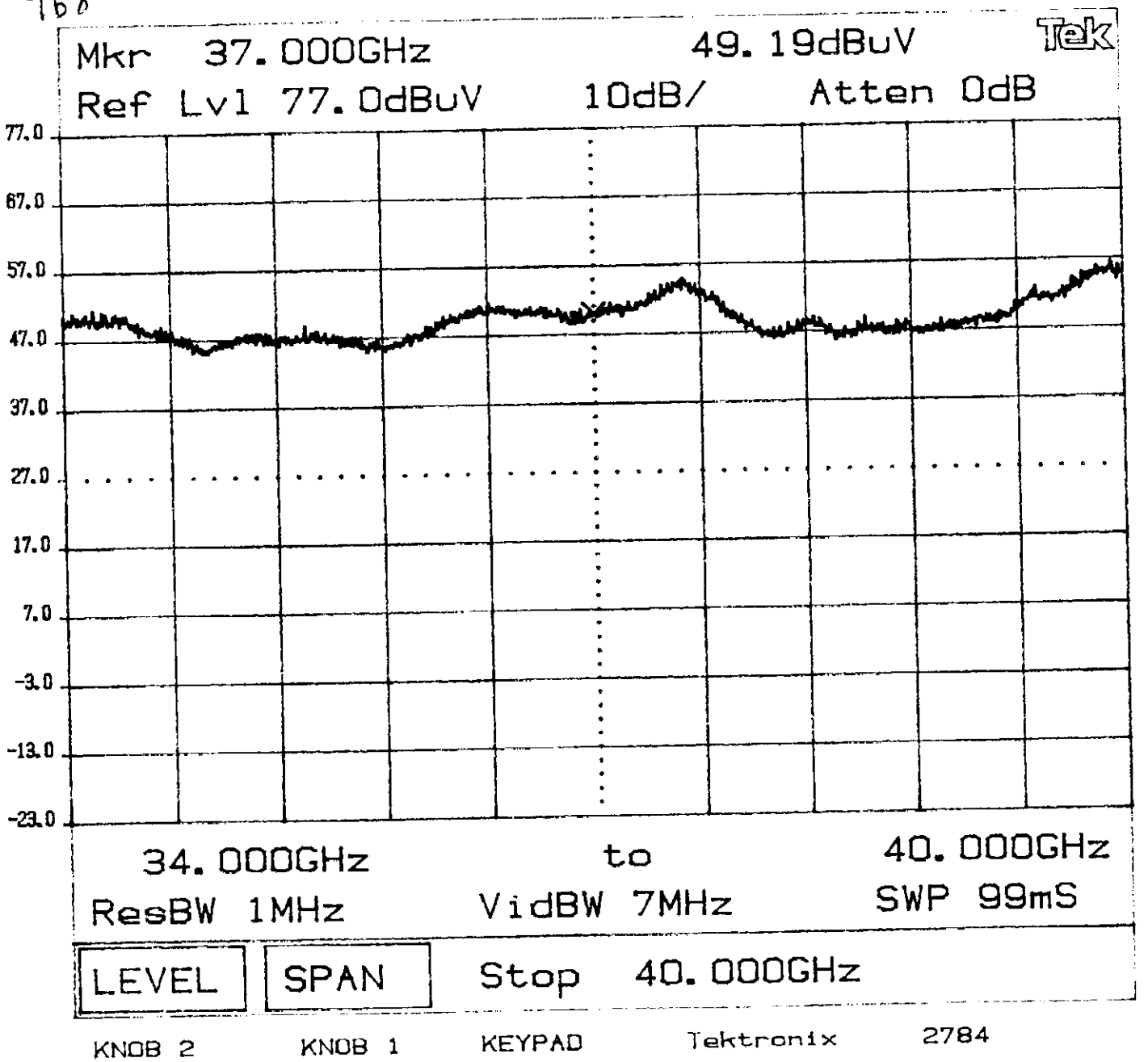
466


Mkr 25.500GHz
37.49dBuV
Tek
Ref Lvl 77.0dBuV
10dB/
Atten 0dB
77.0
67.0
57.0
47.0
37.0
27.0
17.0
7.0
-3.0
-13.0
-23.0
23.000GHz
to
28.000GHz
ResBW 1MHz
VidBW 7MHz
SWP 50mS
LEVEL
SPAN
Stop 28.000GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

467


Mkr 31.000GHz
47.09dBuV
Tek
Ref Lvl 77.0dBuV
10dB/
Atten 0dB
77.0
67.0
57.0
47.0
37.0
27.0
17.0
7.0
-3.0
-13.0
-23.0
28.000GHz
to
34.000GHz
ResBW 1MHz
VidBW 7MHz
SWP 74mS
LEVEL
SPAN
Stop 34.000GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

468


Mkr 37.000GHz
49.19dBuV
Tek
Ref Lvl 77.0dBuV
10dB/
Atten 0dB
77.0
67.0
57.0
47.0
37.0
27.0
17.0
7.0
-3.0
-13.0
-23.0
34.000GHz
to
40.000GHz
ResBW 1MHz
VidBW 7MHz
SWP 99mS
LEVEL
SPAN
Stop 40.000GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

# Intertek Testing Services

**Radiated Emissions / Interference**

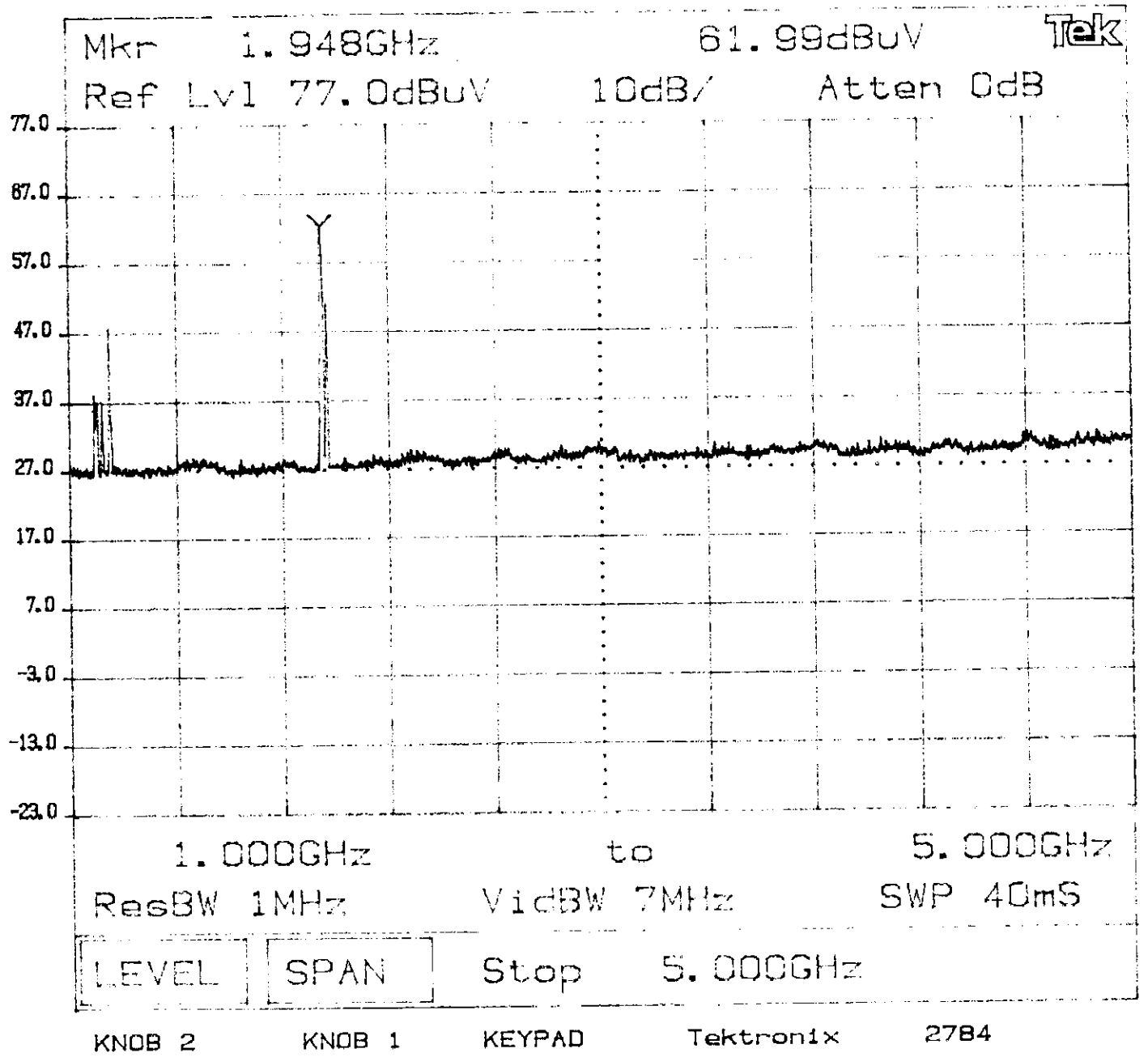
*Table: C*

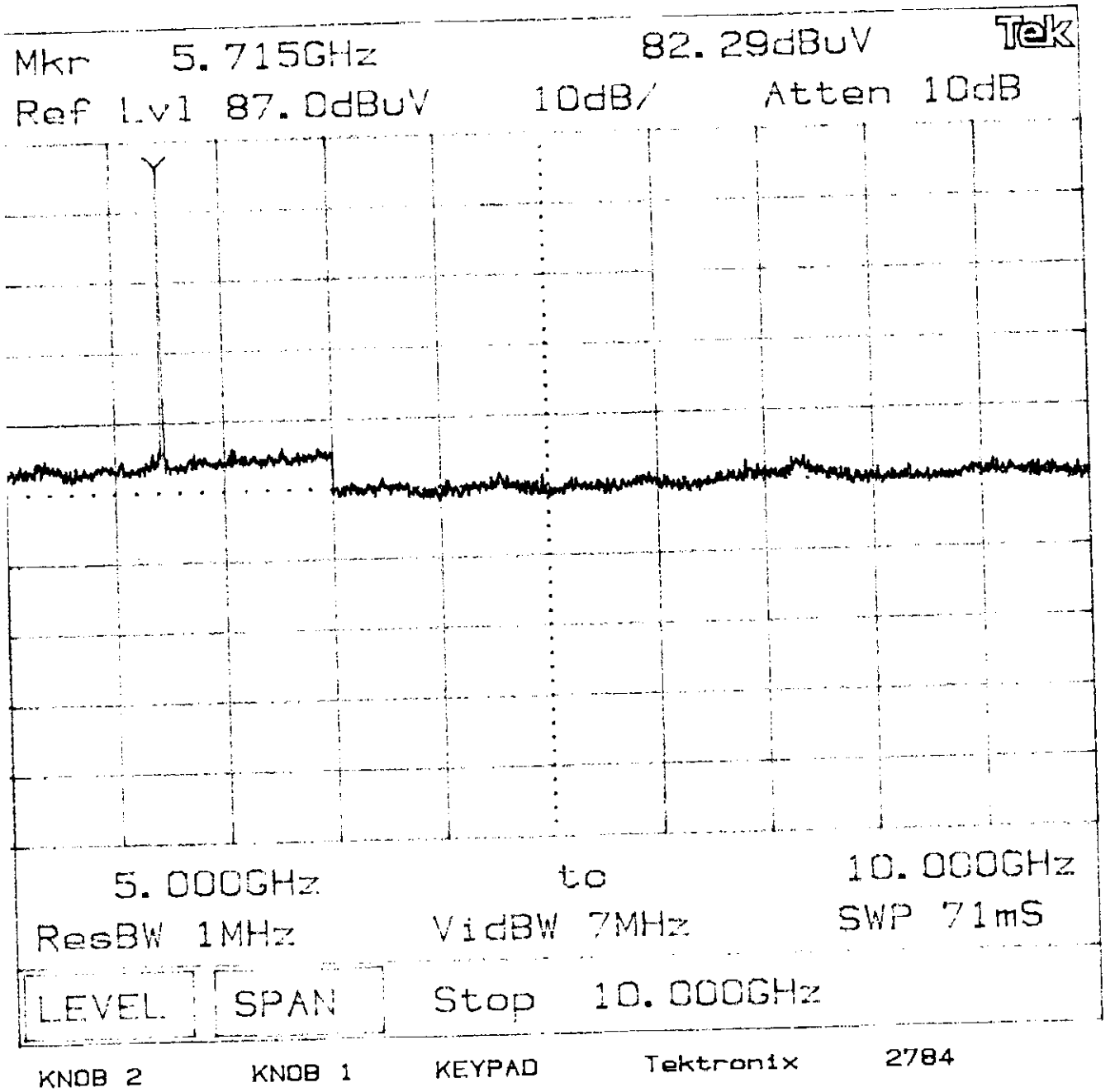
| | | | |
|---|---|---|---|
| *Company:* | *Wireless Bypass* | *ested by:* | *Nicholas Abbondante* |
| *Model:* | *DL-5800C* | *Location:* | *Site 1C* |
| *Job No.:* | *J20046196* | *Detector:* | *HP 8546A* |
| *Date:* | *06/15/01* | *Antenna:* | *LOG1* |
| *Standard:* | *FCC15* | *PreAmp:* | *0* |
| *Class:* | *A* *Group: None* | *Cable(s):* | *1C, 3 METER, PRIMAR* |
| *Notes:* | *Gabriel Flat panel on CPE p-p* | *Distance:* | *3* *meters* |

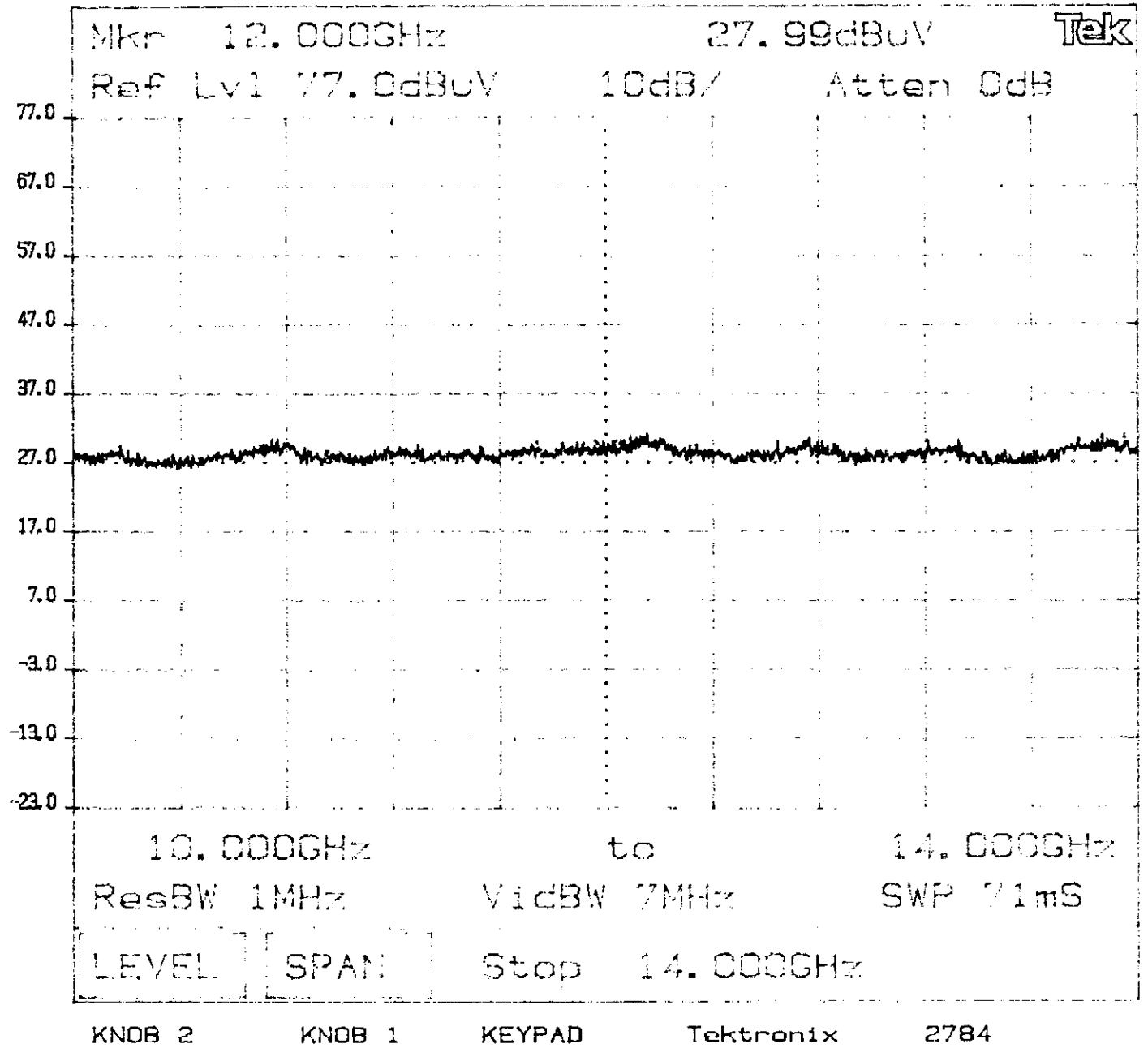
| *Ant. Pol. (V/H)* | *Frequency MHz* | *Reading dB(uV)* | *Antenna Factor dB(1/m)* | *Cable Loss dB* | *Pre-amp Factor dB* | *Distance Factor dB* | *Net dB(uV/m)* | *Limit dB(uV/m)* | *Margin dB* |
|---|---|---|---|---|---|---|---|---|---|
| *V* | *43.520* | *19.5* | *11.1* | *0.8* | *0.0* | *0.0* | *31.3* | *40.0* | *-8.7* |
| *V* | *45.680* | *19.8* | *10.2* | *0.8* | *0.0* | *0.0* | *30.9* | *40.0* | *-9.1* |
| *V* | *74.630* | *21.8* | *6.4* | *0.9* | *0.0* | *0.0* | *29.1* | *40.0* | *-10.9* |
| *V* | *86.070* | *19.6* | *6.8* | *1.2* | *0.0* | *0.0* | *27.6* | *40.0* | *-12.4* |
| *V* | *108.800* | *20.2* | *7.3* | *1.3* | *0.0* | *0.0* | *28.7* | *43.5* | *-14.8* |
| *V* | *121.800* | *17.1* | *6.7* | *1.3* | *0.0* | *0.0* | *25.1* | *43.5* | *-18.4* |
| *V* | *135.800* | *16.5* | *7.1* | *1.4* | *0.0* | *0.0* | *25.1* | *43.5* | *-18.4* |

GABRIEL FLAT PANEL ON CPE P-1

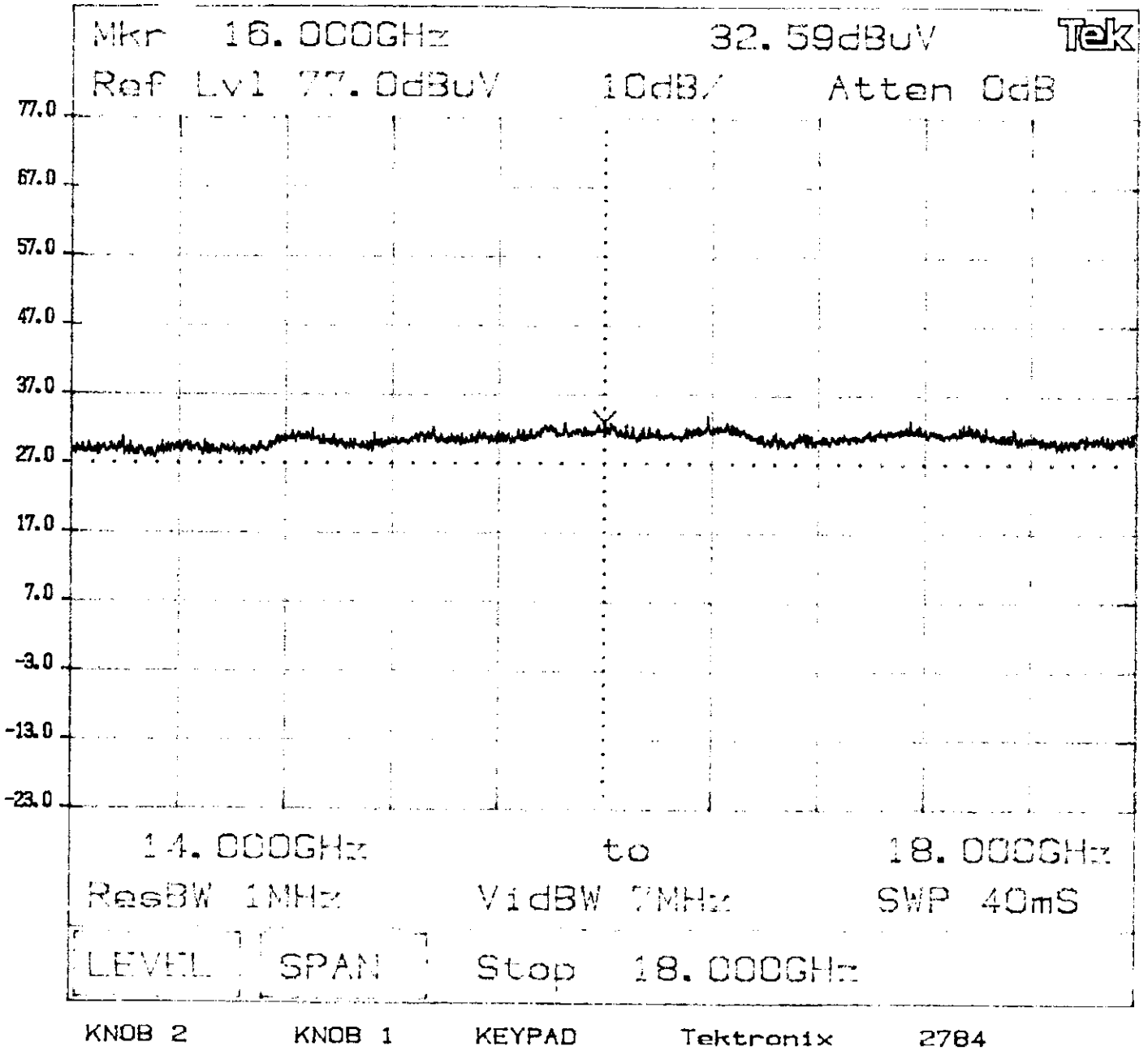
4c1



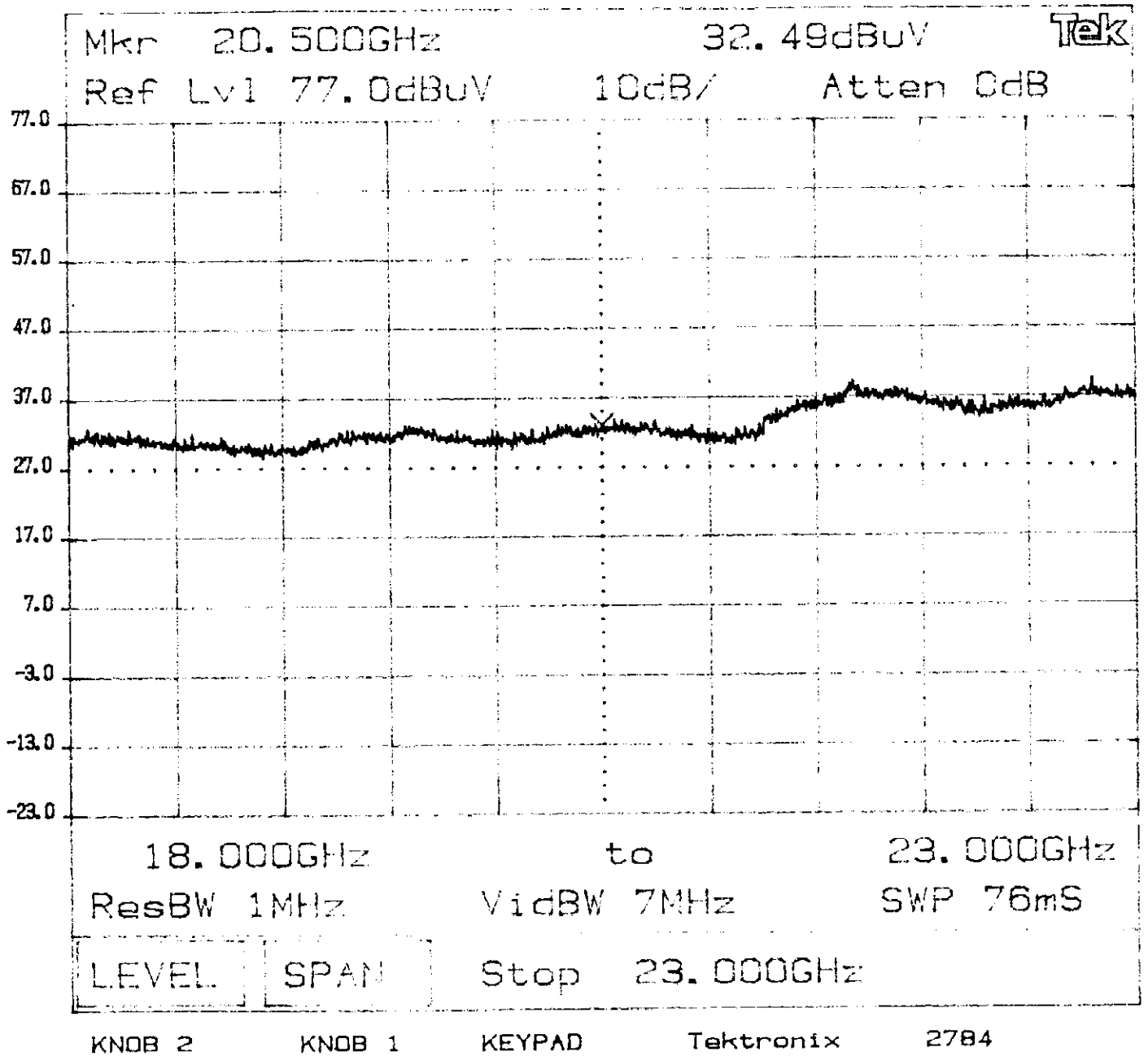

Mkr 5.715GHz
82.29dBuV
Tek
Ref Lvl 87.0dBuV
10dB/
Atten 10dB
5.000GHz
to
10.000GHz
ResBW 1MHz
VidBW 7MHz
SWP 71mS
LEVEL
SPAN
Stop 10.000GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784


Mkr 12.000GHz
27.99dBuV
Tek
Ref Lvl 77.0dBuV
10dB/
Atten 0dB
77.0
67.0
57.0
47.0
37.0
27.0
17.0
7.0
-3.0
-13.0
-23.0
10.000GHz
to
14.000GHz
ResBW 1MHz
VidBW 7MHz
SWP 71mS
LEVEL
SPAN
Stop 14.000GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

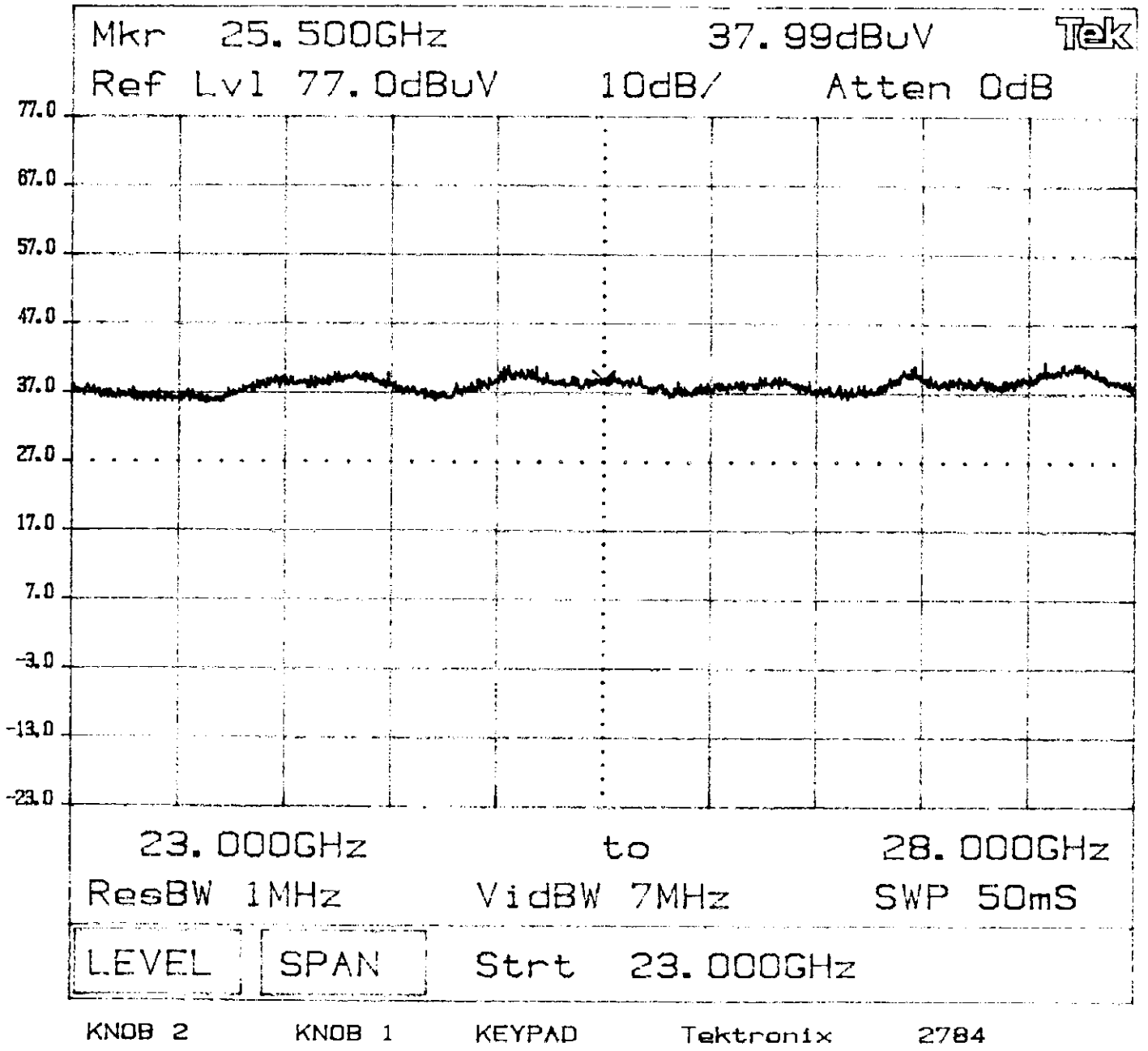
4.4


Mkr 16.000GHz
32.59dBuV
Tek
Ref Lvl 77.0dBuV
10dB/
Atten 0dB
77.0
67.0
57.0
47.0
37.0
27.0
17.0
7.0
-3.0
-13.0
-23.0
14.000GHz
to
18.000GHz
ResBW 1MHz
VidBW 7MHz
SWP 40mS
LEVEL
SPAN
Stop 18.000GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

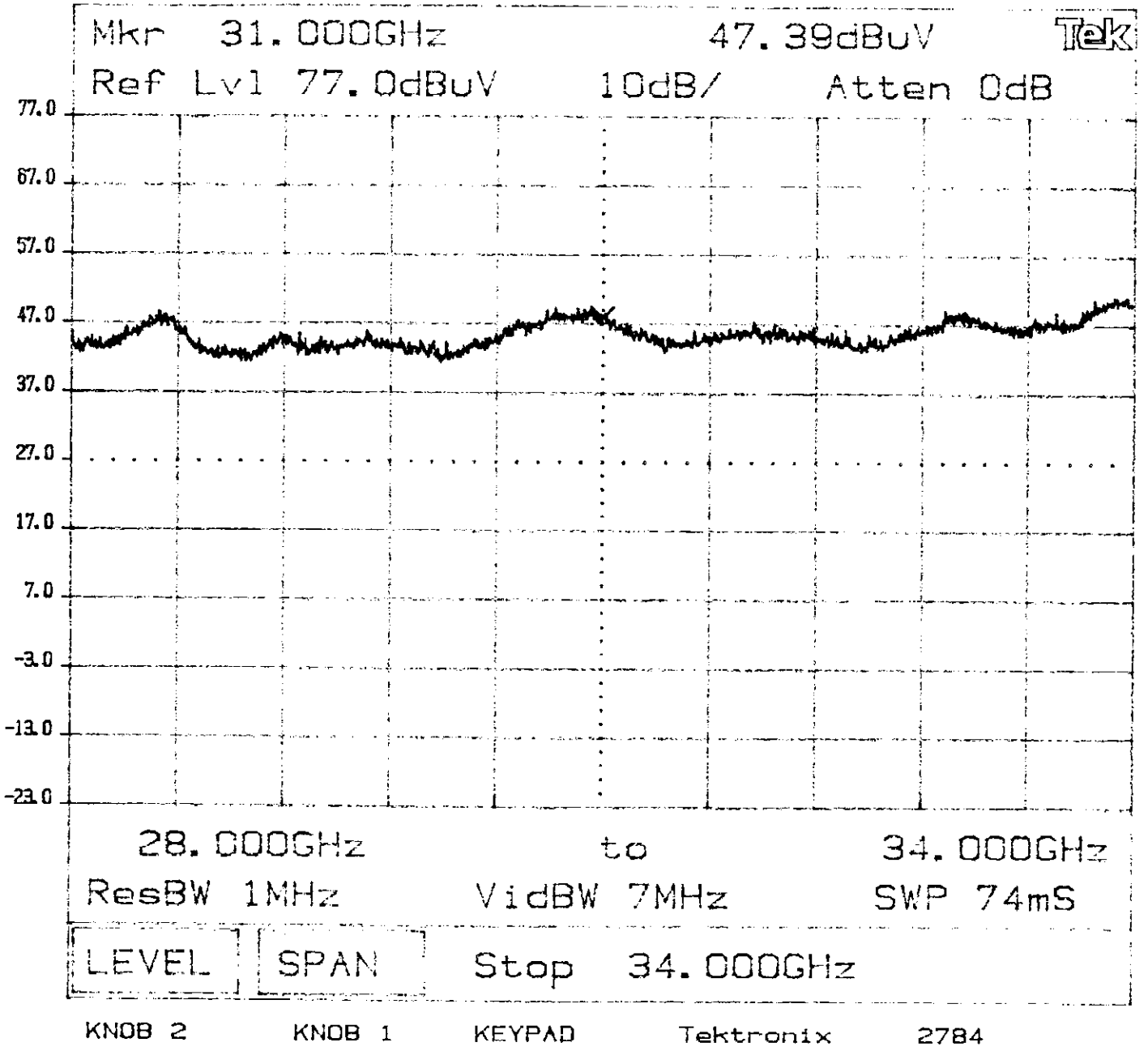
4.5


Mkr 20.500GHz
32.49dBuV
Tek
Ref Lvl 77.0dBuV
10dB/
Atten 0dB
77.0
67.0
57.0
47.0
37.0
27.0
17.0
7.0
-3.0
-13.0
-23.0
18.000GHz
to
23.000GHz
ResBW 1MHz
VidBW 7MHz
SWP 76mS
LEVEL
SPAN
Stop 23.000GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

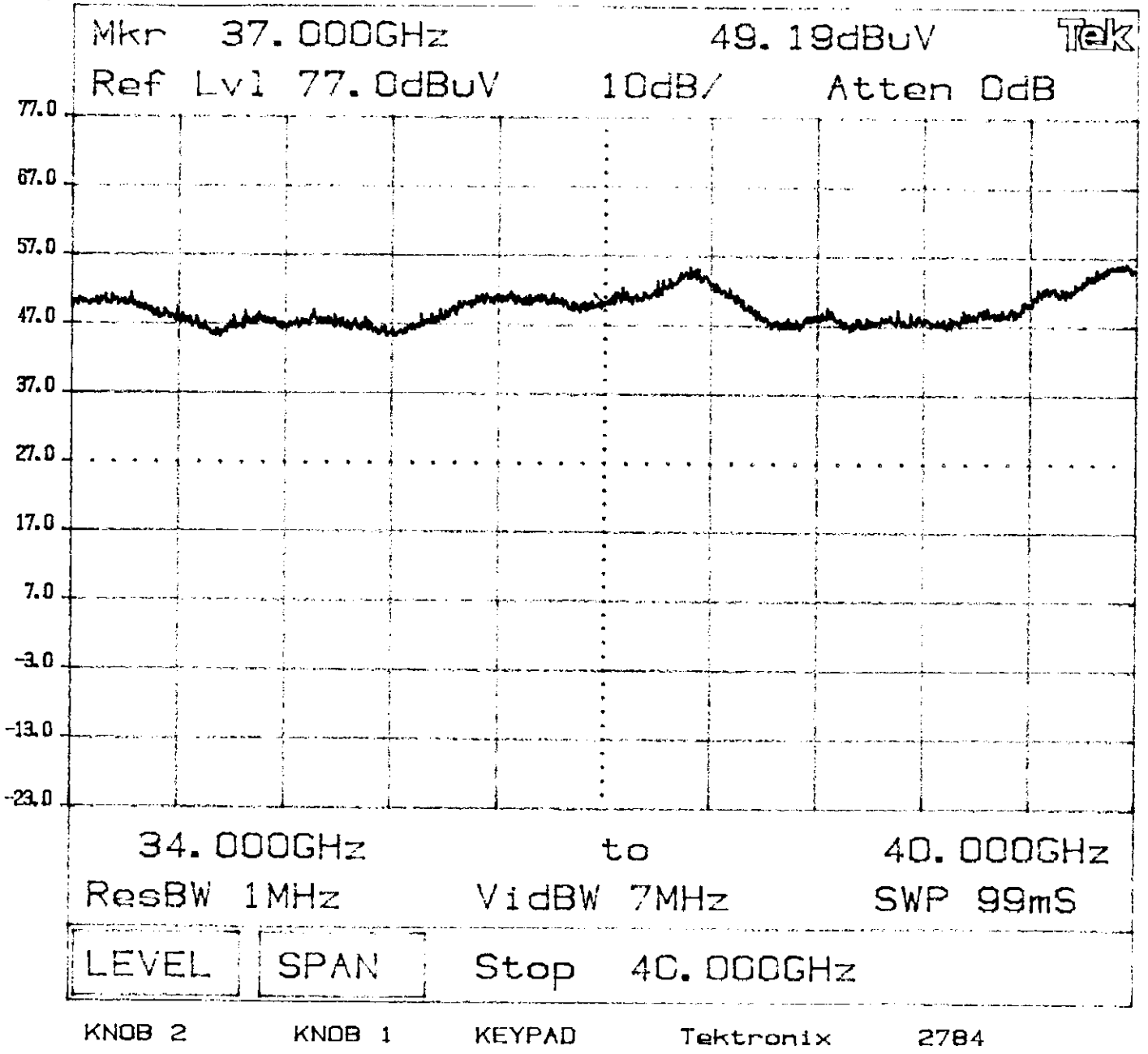
4.6


Mkr 25.500GHz
37.99dBuV
Tek
Ref Lvl 77.0dBuV
10dB/
Atten 0dB
77.0
67.0
57.0
47.0
37.0
27.0
17.0
7.0
-3.0
-13.0
-23.0
23.000GHz
to
28.000GHz
ResBW 1MHz
VidBW 7MHz
SWP 50mS
LEVEL
SPAN
Strt 23.000GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

4c7


Mkr 31.000GHz
47.39dBuV
Tek
Ref Lvl 77.0dBuV
10dB/
Atten 0dB
77.0
67.0
57.0
47.0
37.0
27.0
17.0
7.0
-3.0
-13.0
-23.0
28.000GHz
to
34.000GHz
ResBW 1MHz
VidBW 7MHz
SWP 74mS
LEVEL
SPAN
Stop 34.000GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

4c8


Mkr 37.000GHz
49.19dBuV
Tek
Ref Lvl 77.0dBuV
10dB/
Atten 0dB
77.0
67.0
57.0
47.0
37.0
27.0
17.0
7.0
-3.0
-13.0
-23.0
34.000GHz
to
40.000GHz
ResBW 1MHz
VidBW 7MHz
SWP 99mS
LEVEL
SPAN
Stop 40.000GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

# Intertek Testing Services

**Radiated Emissions / Interference**

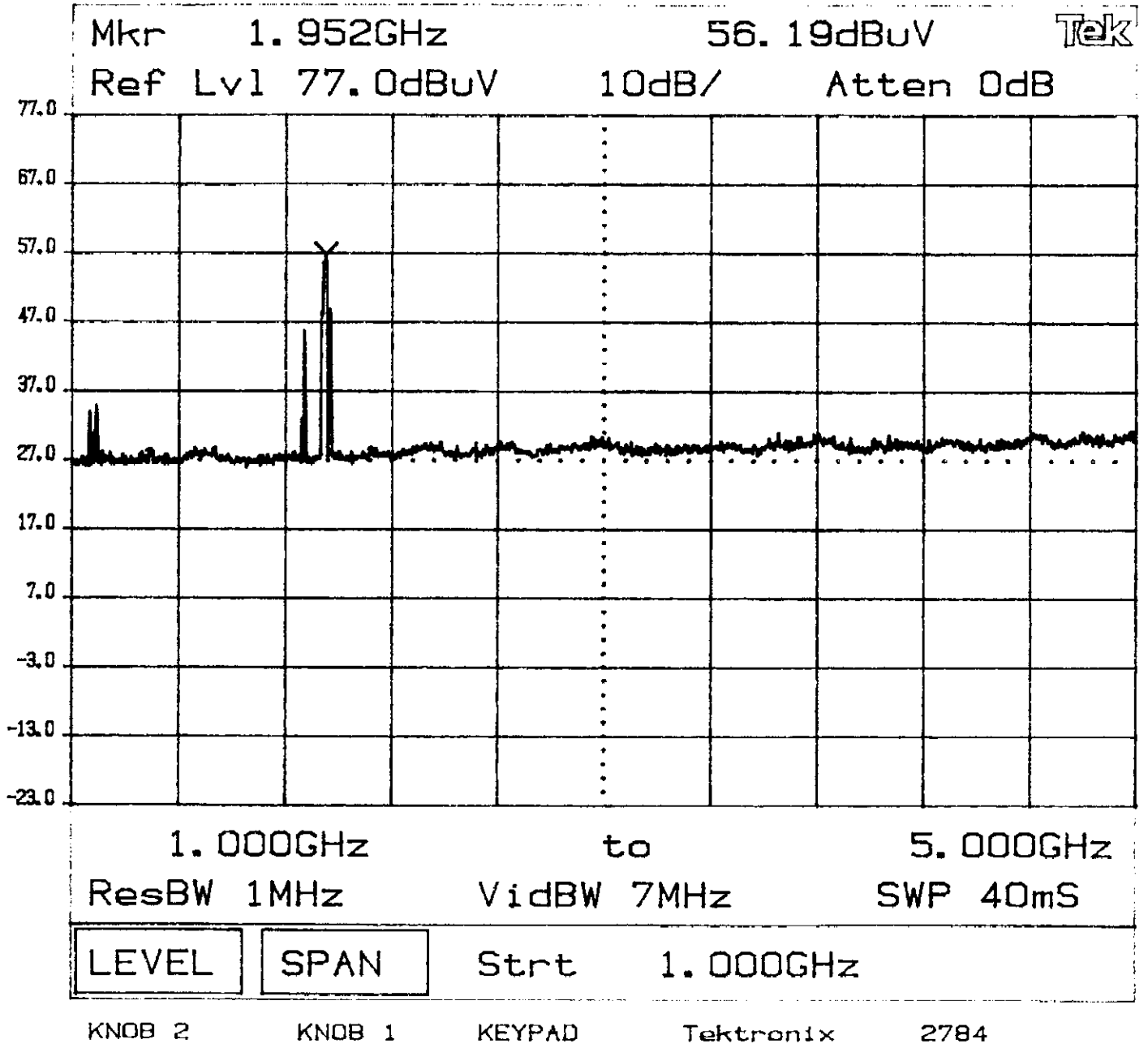
*Table: D*

| | | | |
|---|---|---|---|
| *Company:* | *Wireless Bypass* | *ested by:* | *Nicholas Abbondante* |
| *Model:* | *DL-5800C* | *Location:* | *Site 1C* |
| *Job No.:* | *J20046196* | *Detector:* | *HP 8546A* |
| *Date:* | *06/14/01* | *Antenna:* | *LOG1* |
| *Standard:* | *FCC15* | *PreAmp:* | *0* |
| *Class:* | *A* *Group:* *None* | *Cable(s):* | *1C, 3 METER, PRIMAR* |
| *Notes:* | *Gabriel Flat Panel Antenna on CPE p-mp* | *Distance:* | *3* *meters* |

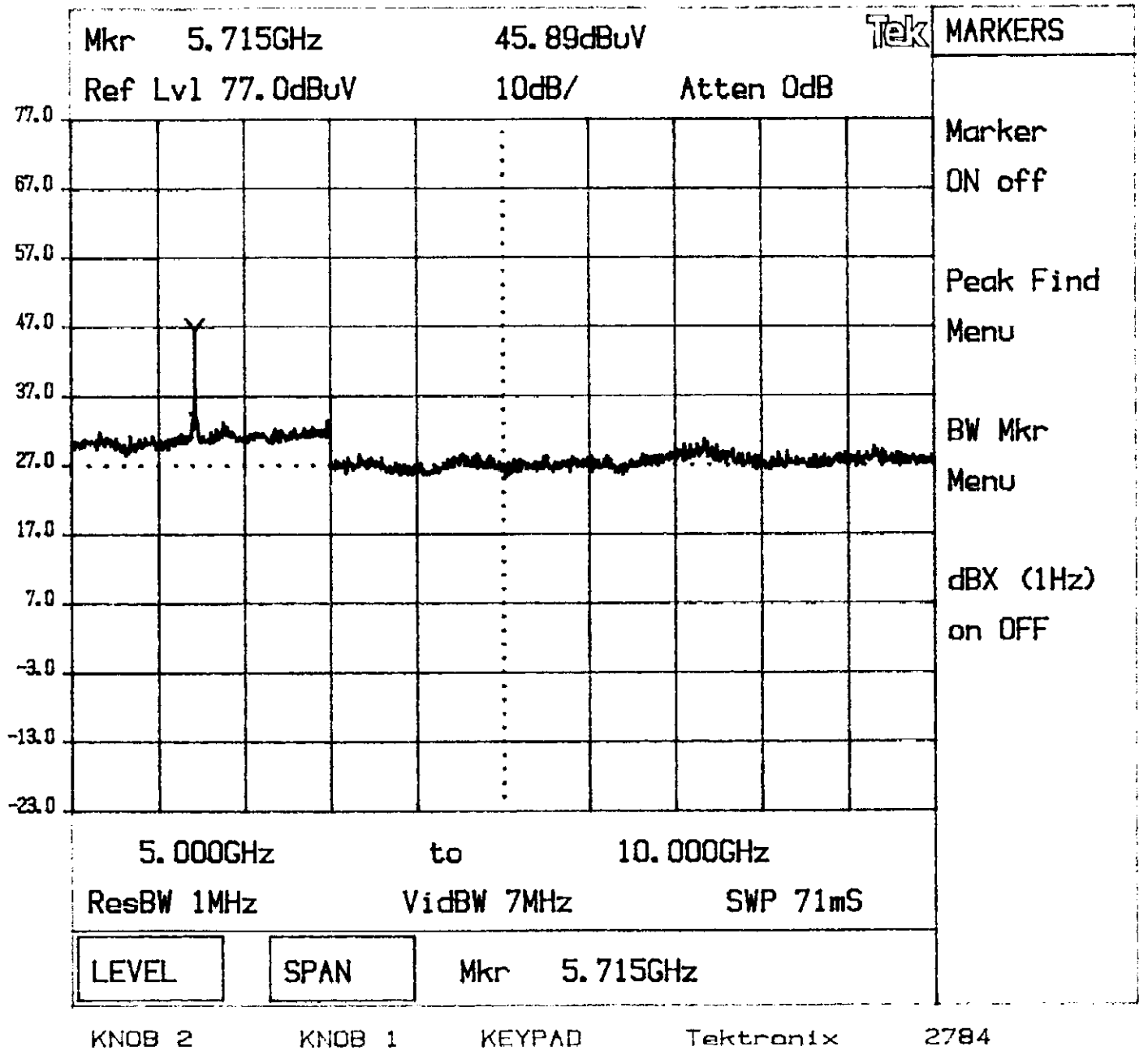
| *Ant. Pol. (V/H)* | *Frequency MHz* | *Reading dB(uV)* | *Antenna Factor dB(1/m)* | *Cable Loss dB* | *Pre-amp Factor dB* | *Distance Factor dB* | *Net dB(uV/m)* | *Limit dB(uV/m)* | *Margin dB* |
|---|---|---|---|---|---|---|---|---|---|
| *V* | *40.340* | *20.8* | *12.3* | *0.7* | *0.0* | *0.0* | *33.8* | *40.0* | *-6.2* |
| *V* | *46.390* | *16.9* | *10.0* | *0.8* | *0.0* | *0.0* | *27.7* | *40.0* | *-12.3* |
| *V* | *74.560* | *18.6* | *6.4* | *0.9* | *0.0* | *0.0* | *25.9* | *40.0* | *-14.1* |
| *V* | *108.800* | *21.5* | *7.3* | *1.3* | *0.0* | *0.0* | *30.0* | *43.5* | *-13.5* |
| *V* | *117.600* | *18.0* | *6.8* | *1.3* | *0.0* | *0.0* | *26.1* | *43.5* | *-17.4* |
| *V* | *132.300* | *15.4* | *6.9* | *1.4* | *0.0* | *0.0* | *23.7* | *43.5* | *-19.8* |

GABRIEL FLAT PANEL ON CPE AMP

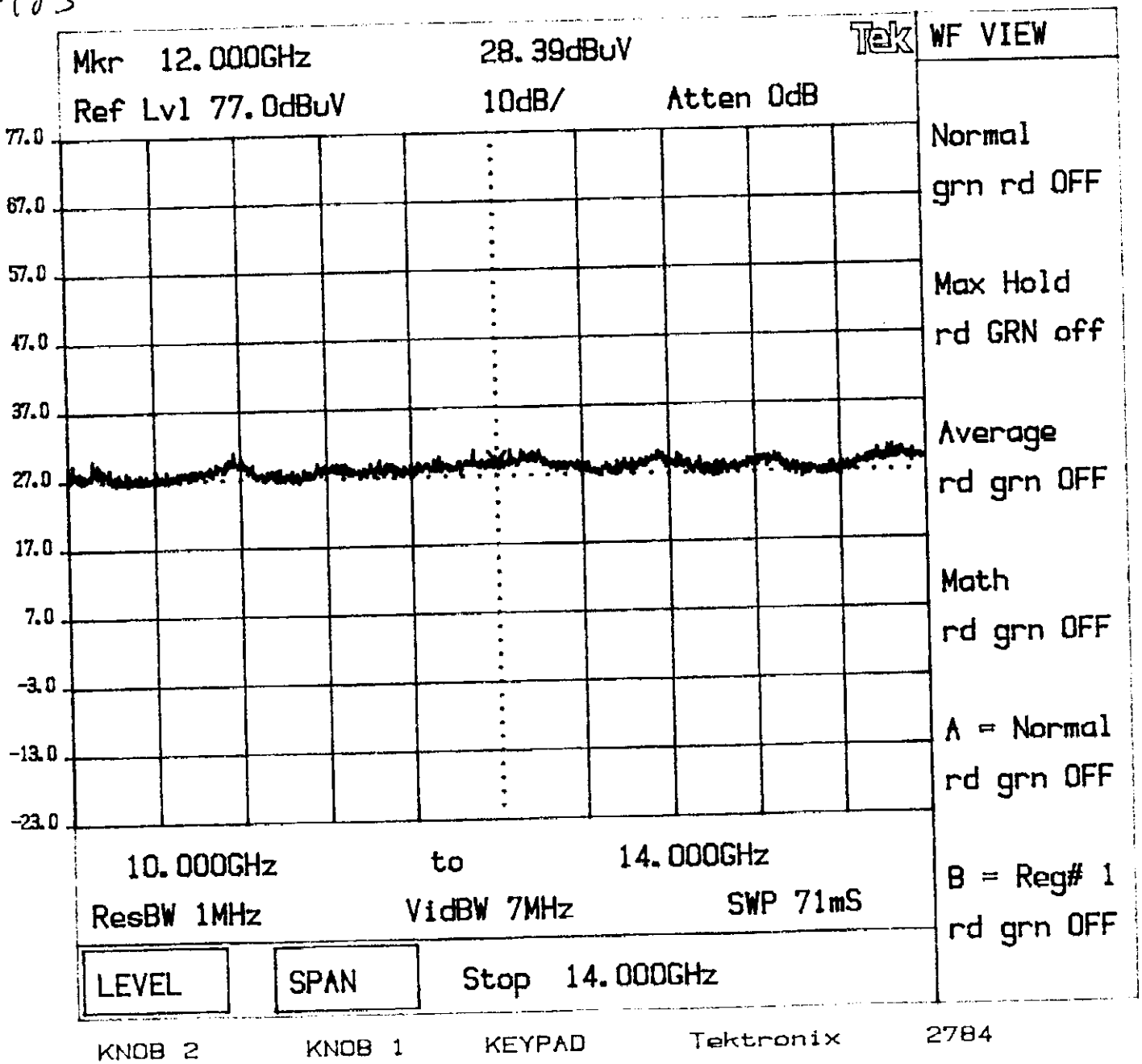
401



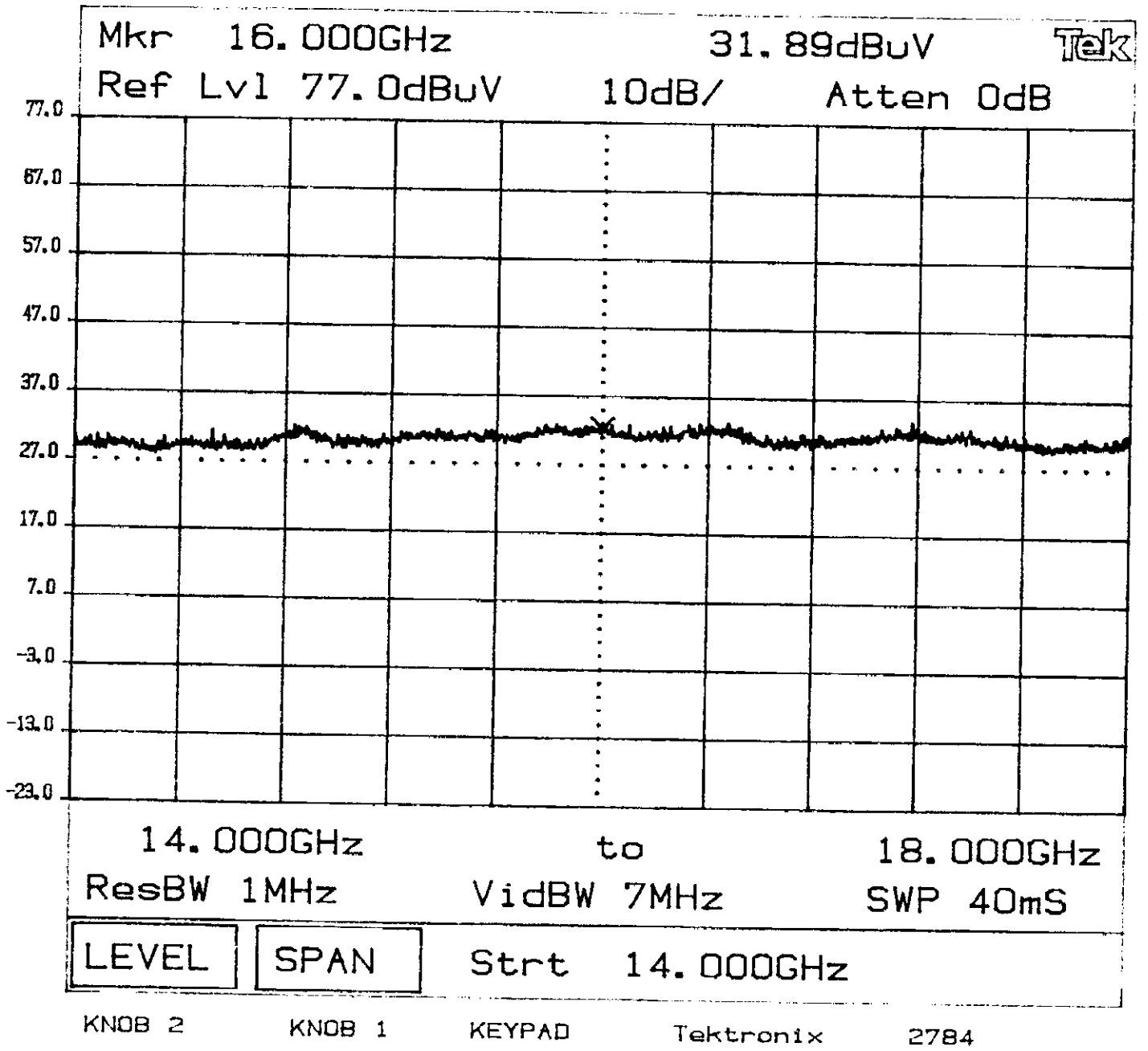
402


Mkr 5.715GHz
45.89dBuV
Tek
MARKERS
Ref Lvl 77.0dBuV
10dB/
Atten 0dB
77.0
67.0
57.0
47.0
37.0
27.0
17.0
7.0
-3.0
-13.0
-23.0
Marker
ON off
Peak Find
Menu
BW Mkr
Menu
dBX (1Hz)
on OFF
5.000GHz
to
10.000GHz
ResBW 1MHz
VidBW 7MHz
SWP 71mS
LEVEL
SPAN
Mkr 5.715GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

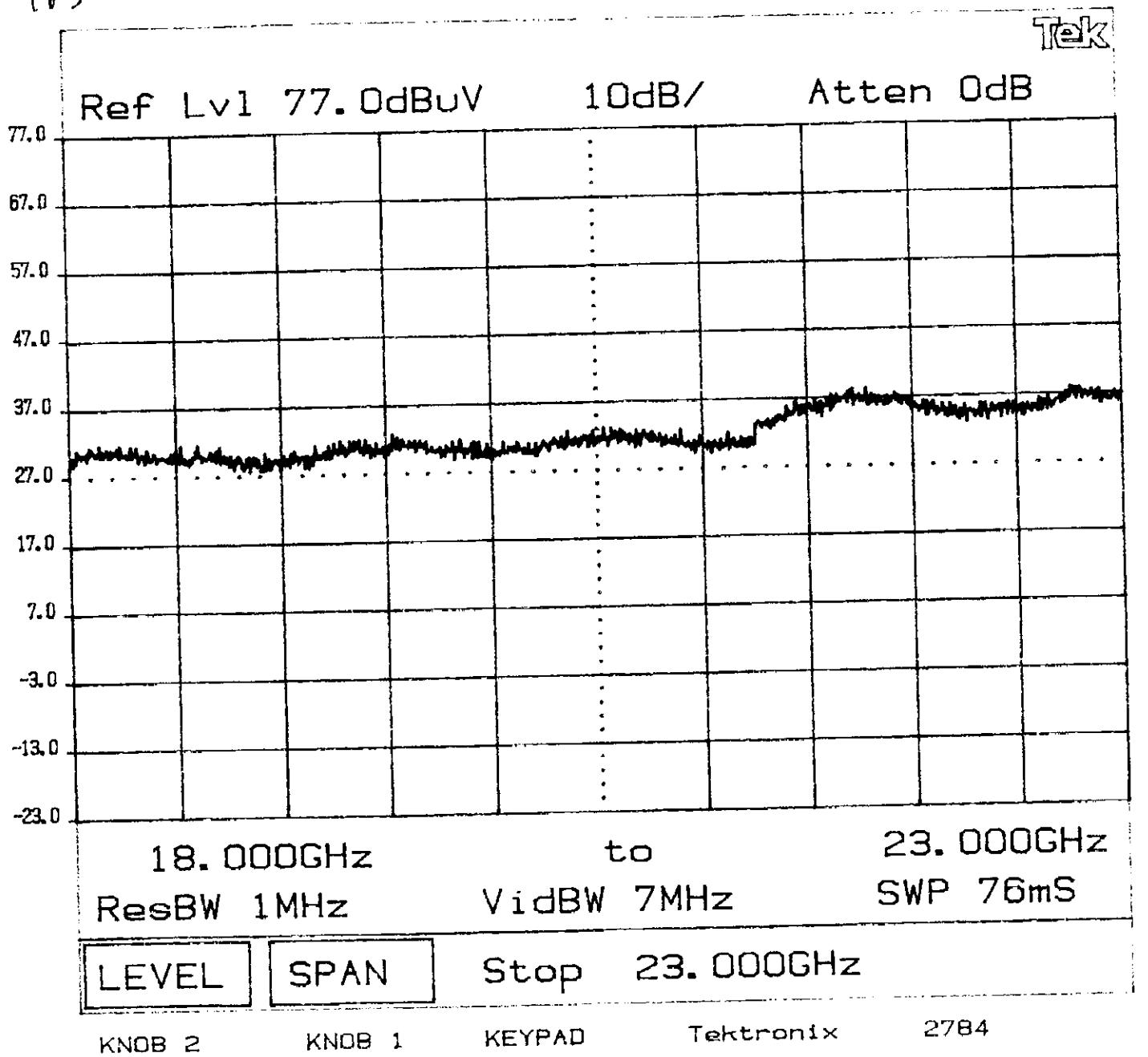
423

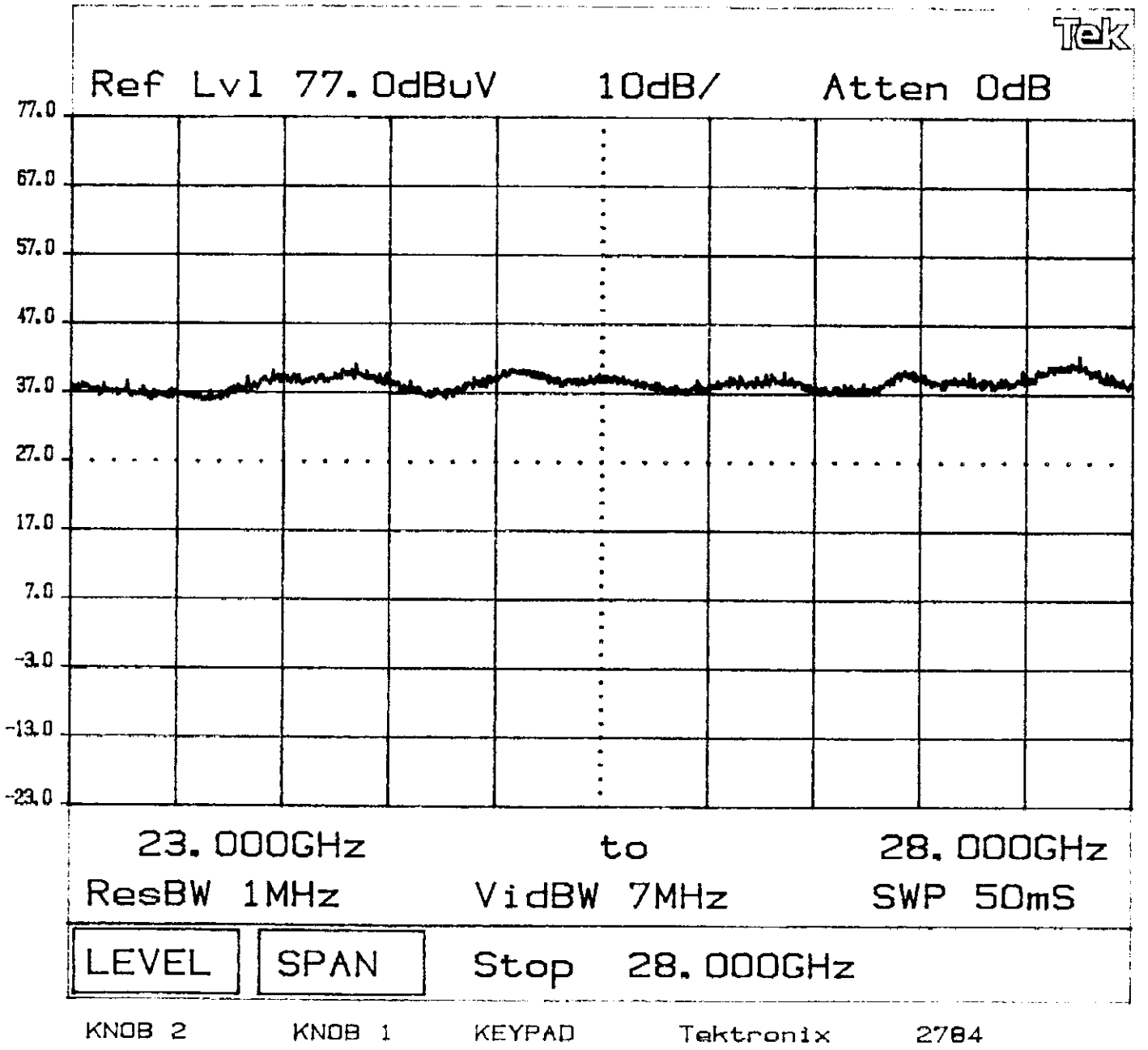

Mkr 12.000GHz
28.39dBuV
Tek
WF VIEW
Ref Lvl 77.0dBuV
10dB/
Atten 0dB
77.0
67.0
57.0
47.0
37.0
27.0
17.0
7.0
-3.0
-13.0
-23.0
Normal
grn rd OFF
Max Hold
rd GRN off
Average
rd grn OFF
Math
rd grn OFF
A = Normal
rd grn OFF
B = Reg# 1
rd grn OFF
10.000GHz
to
14.000GHz
ResBW 1MHz
VidBW 7MHz
SWP 71mS
LEVEL
SPAN
Stop 14.000GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

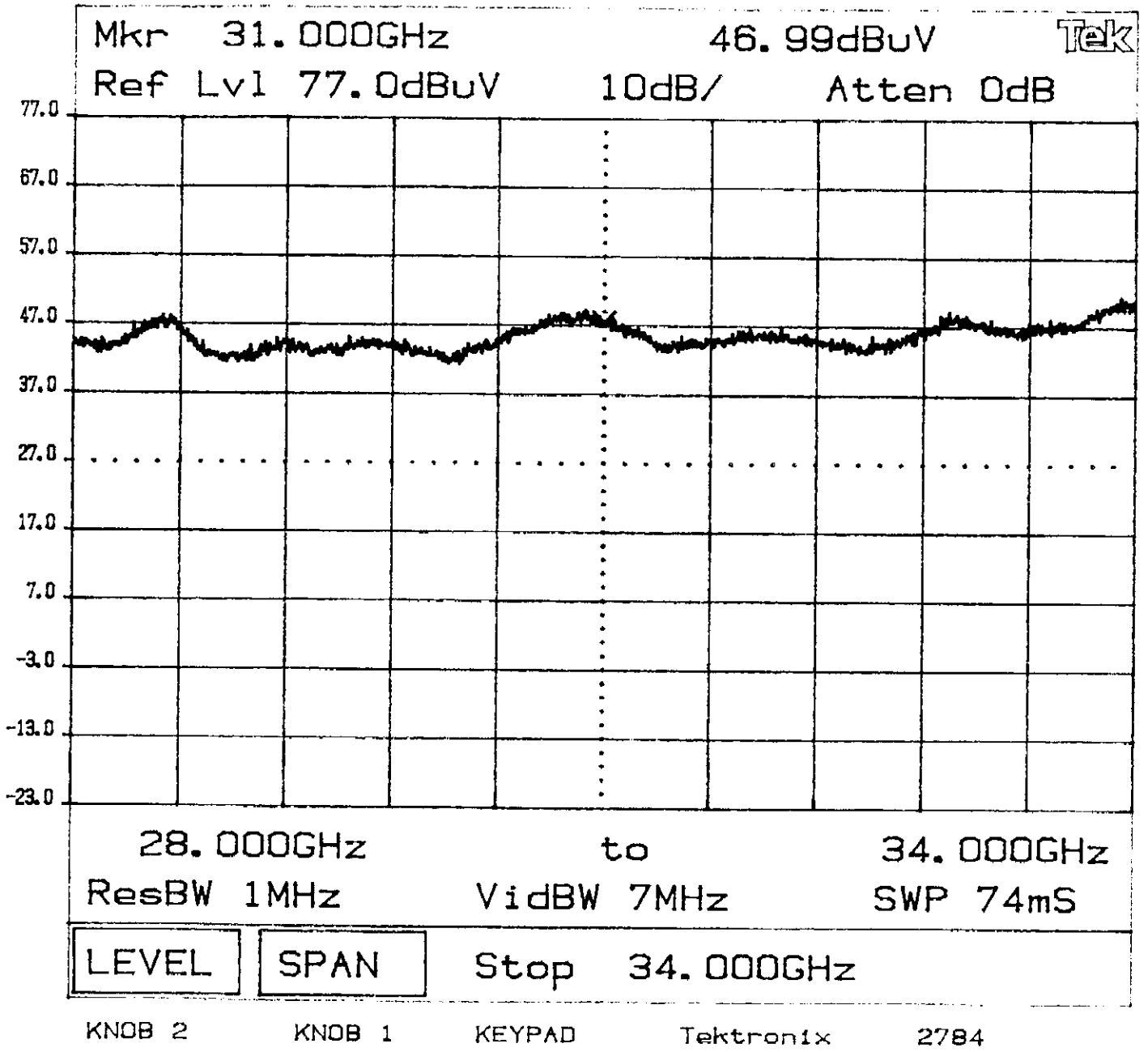
404


Mkr 16.000GHz
31.89dBuV
Tek
Ref Lvl 77.0dBuV
10dB/
Atten 0dB
77.0
67.0
57.0
47.0
37.0
27.0
17.0
7.0
-3.0
-13.0
-23.0
14.000GHz
to
18.000GHz
ResBW 1MHz
VidBW 7MHz
SWP 40mS
LEVEL
SPAN
Strt 14.000GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

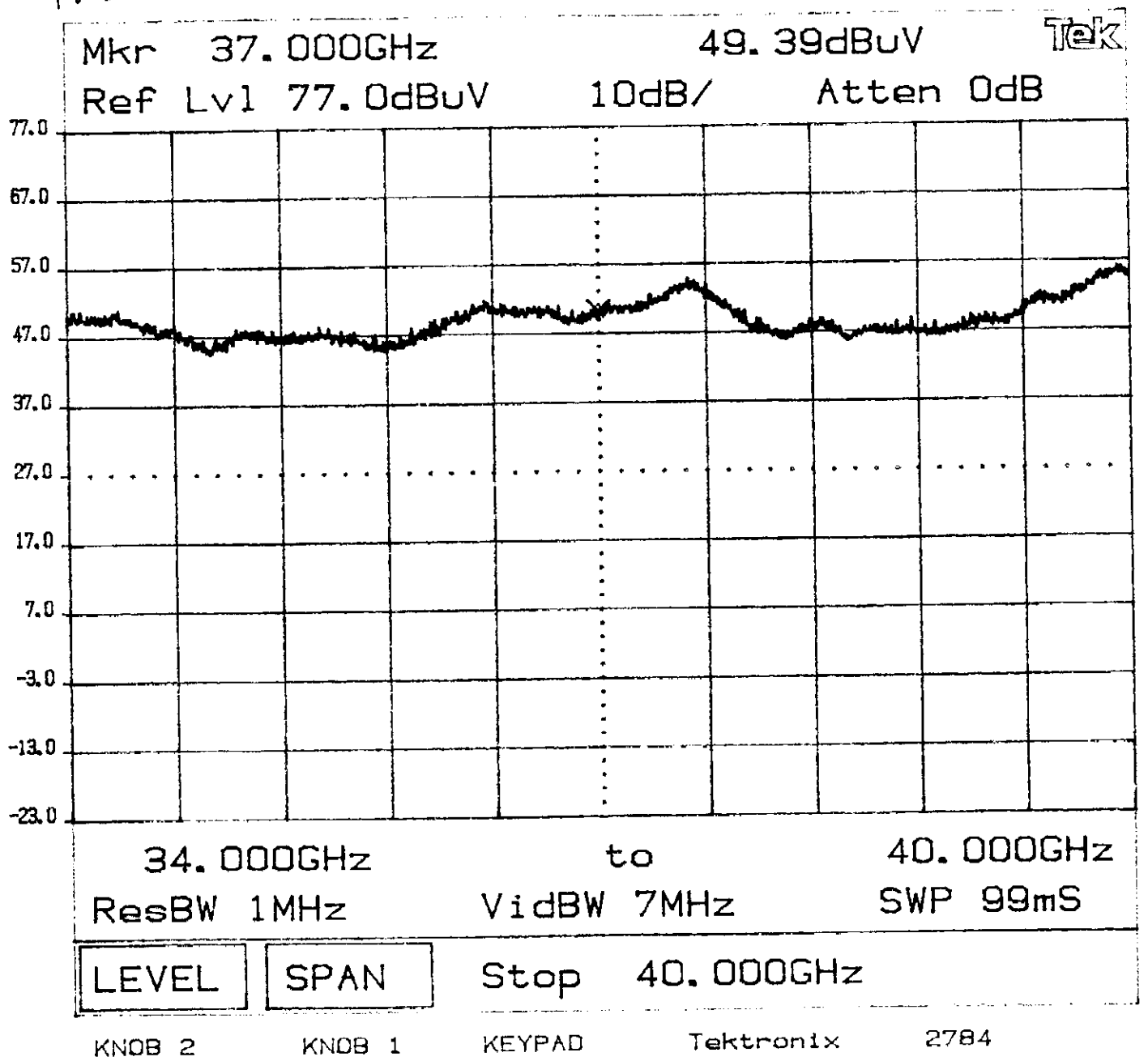
415


Tek
Ref Lvl 77.0dBuV
10dB/
Atten 0dB
77.0
67.0
57.0
47.0
37.0
27.0
17.0
7.0
-3.0
-13.0
-23.0
18.000GHz
to
23.000GHz
ResBW 1MHz
VidBW 7MHz
SWP 76mS
LEVEL
SPAN
Stop 23.000GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784


Tek
Ref Lvl 77.0dBuV
10dB/
Atten 0dB
77.0
67.0
57.0
47.0
37.0
27.0
17.0
7.0
-3.0
-13.0
-23.0
23.000GHz
to
28.000GHz
ResBW 1MHz
VidBW 7MHz
SWP 50mS
LEVEL
SPAN
Stop 28.000GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784


Mkr 31.000GHz
46.99dBuV
Tek
Ref Lvl 77.0dBuV
10dB/
Atten 0dB
77.0
67.0
57.0
47.0
37.0
27.0
17.0
7.0
-3.0
-13.0
-23.0
28.000GHz
to
34.000GHz
ResBW 1MHz
VidBW 7MHz
SWP 74mS
LEVEL
SPAN
Stop 34.000GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

428


Mkr 37.000GHz
49.39dBuV
Tek
Ref Lvl 77.0dBuV
10dB/
Atten 0dB
77.0
67.0
57.0
47.0
37.0
27.0
17.0
7.0
-3.0
-13.0
-23.0
34.000GHz
to
40.000GHz
ResBW 1MHz
VidBW 7MHz
SWP 99mS
LEVEL
SPAN
Stop 40.000GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

# Intertek Testing Services

**Radiated Emissions / Interference**

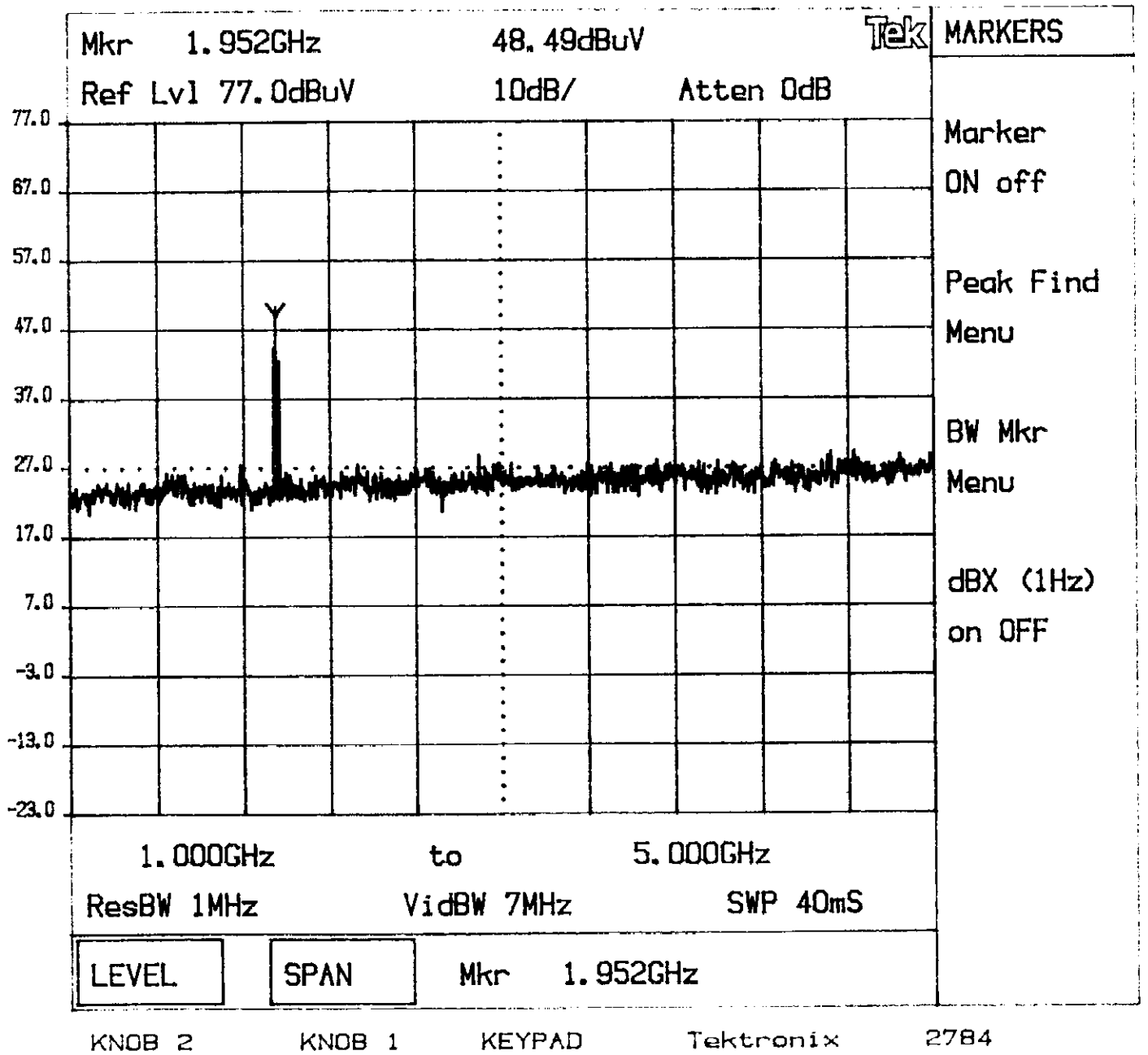
*Table: E*

| | | | |
|---|---|---|---|
| Company: | Wireless Bypass | Tested by: | Nicholas Abbondante |
| Model: | DL-5800C | Location: | Site 1C |
| Job No.: | J20046196 | Detector: | HP 8546A |
| Date: | 05/14/01 | Antenna: | LOG1 |
| Standard: | FCC15 | PreAmp: | 0 |
| Class: | A Group: None | Cable(s): | 1C, 3 METER, PRIMAR |
| Notes: | Cushcraft patch antenna on CPE | Distance: | 3 meters |

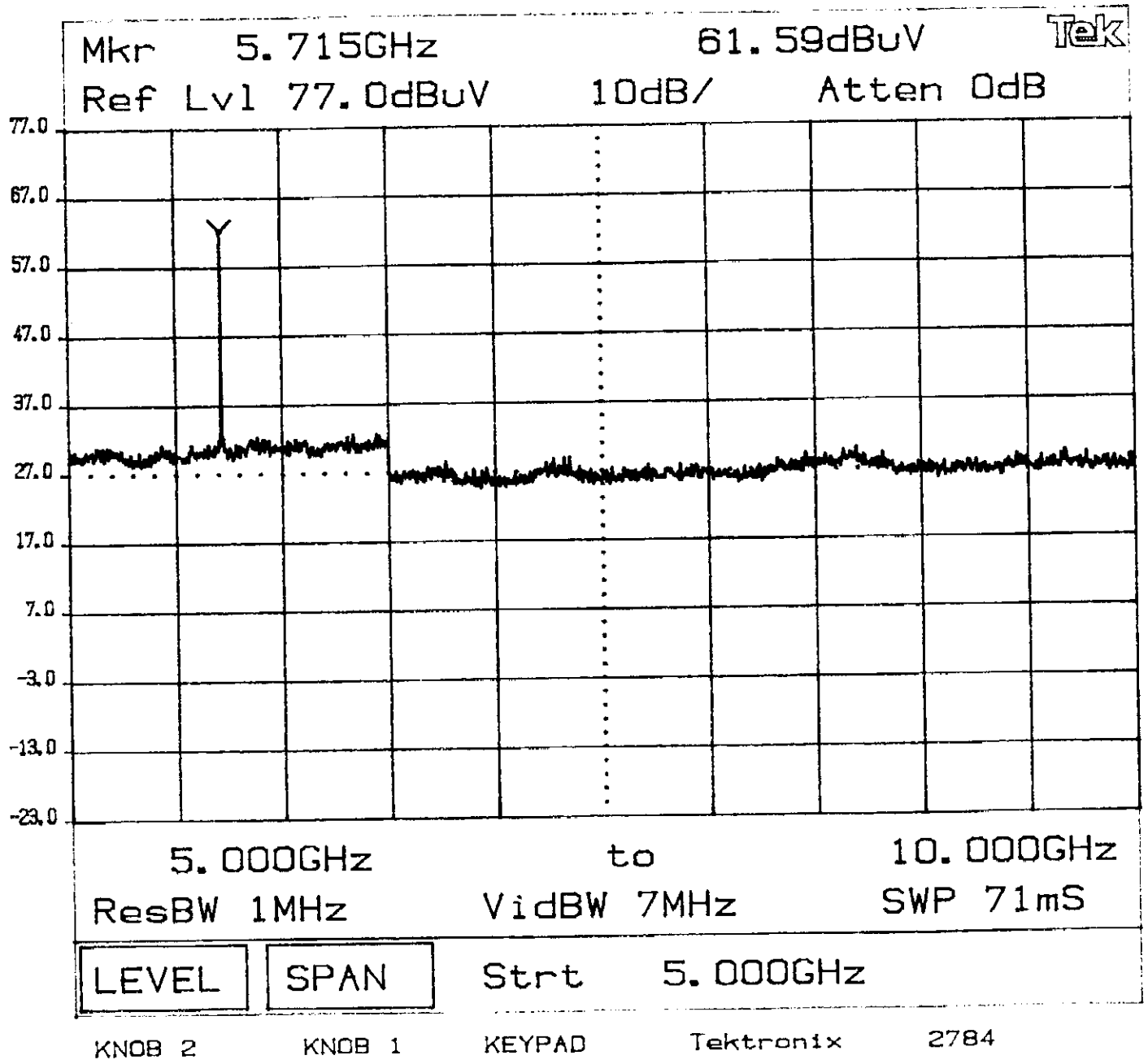
| Ant. Pol. (V/H) | Frequency MHz | Reading dB(uV) | Antenna Factor dB(1/m) | Cable Loss dB | Pre-amp Factor dB | Distance Factor dB | Net dB(uV/m) | Limit dB(uV/m) | Margin dB |
|---|---|---|---|---|---|---|---|---|---|
| V | 40.340 | 22.1 | 12.3 | 0.7 | 0.0 | 0.0 | 35.1 | 40.0 | -4.9 |
| V | 51.020 | 21.1 | 8.5 | 0.9 | 0.0 | 0.0 | 30.5 | 40.0 | -9.5 |
| V | 73.970 | 19.1 | 6.4 | 0.9 | 0.0 | 0.0 | 26.4 | 40.0 | -13.6 |
| V | 108.800 | 20.1 | 7.3 | 1.3 | 0.0 | 0.0 | 28.6 | 43.5 | -14.9 |
| V | 137.700 | 17.3 | 7.3 | 1.4 | 0.0 | 0.0 | 26.0 | 43.5 | -17.5 |
| V | 154.900 | 12.7 | 8.6 | 1.5 | 0.0 | 0.0 | 22.8 | 43.5 | -20.7 |

COMMSCOPE PATCH ON CPE

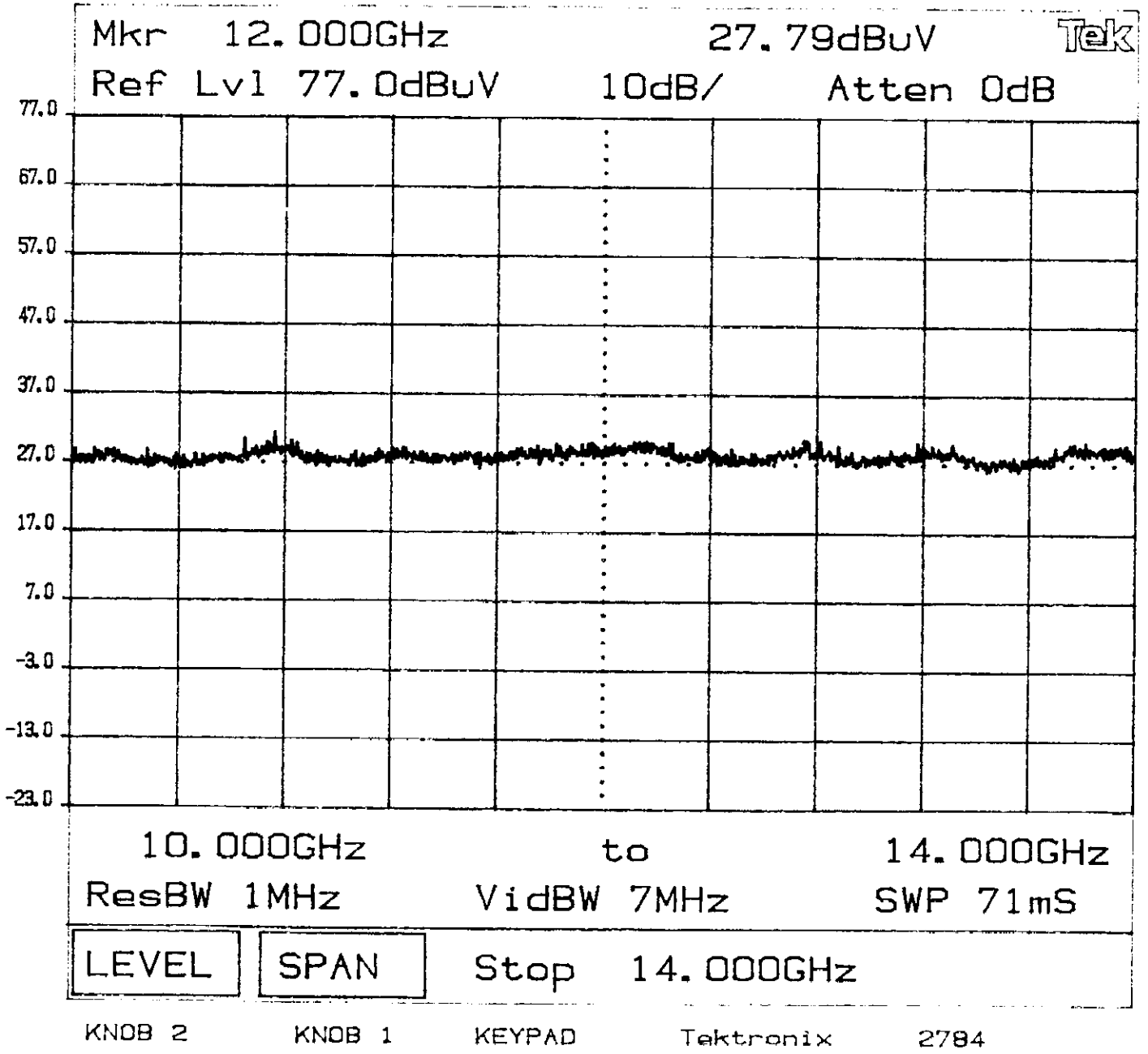
4el



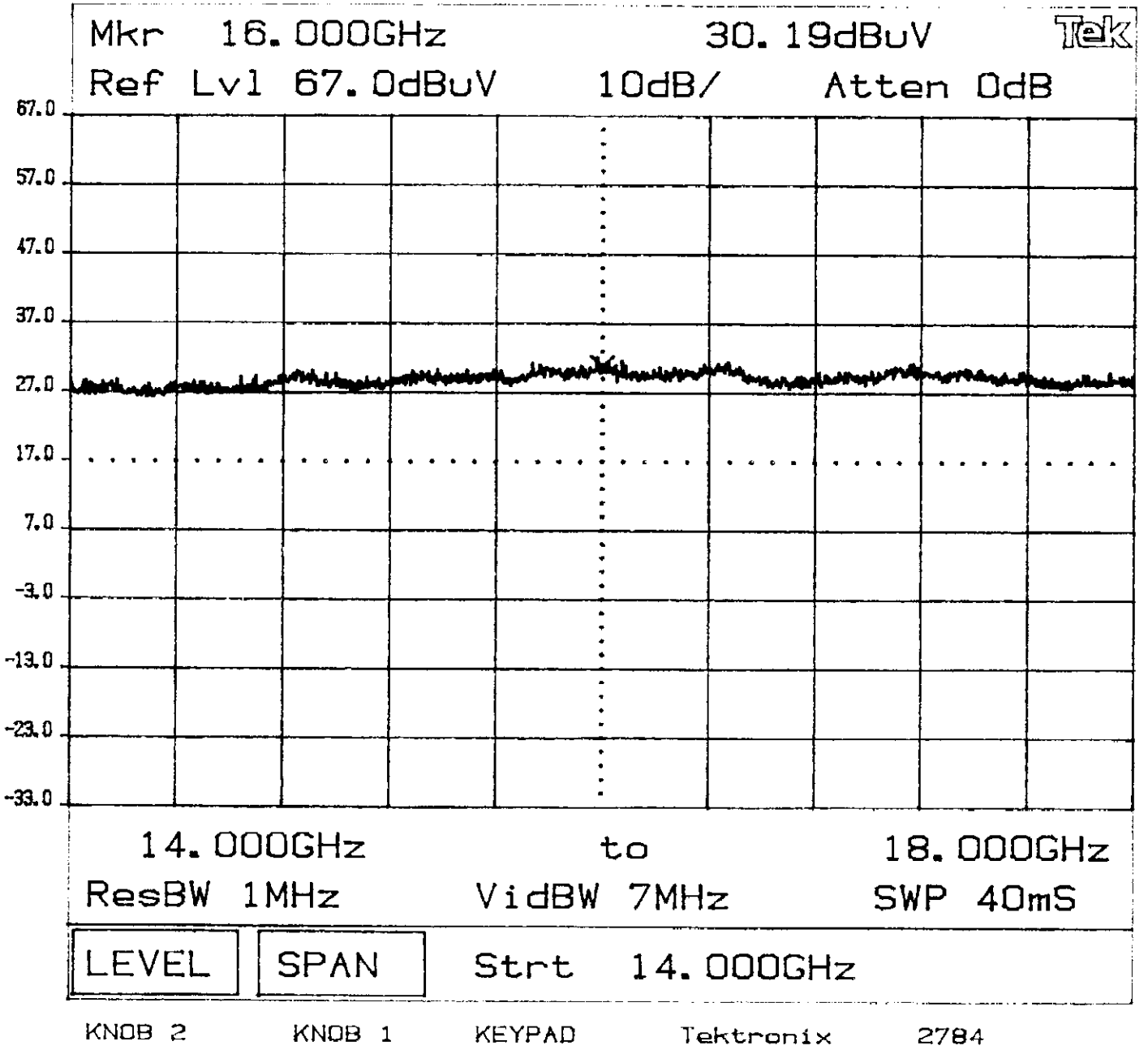
4e2


Mkr 5.715GHz
61.59dBuV
Tek
Ref Lvl 77.0dBuV
10dB/
Atten 0dB
77.0
67.0
57.0
47.0
37.0
27.0
17.0
7.0
-3.0
-13.0
-23.0
5.000GHz
to
10.000GHz
ResBW 1MHz
VidBW 7MHz
SWP 71mS
LEVEL
SPAN
Strt 5.000GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

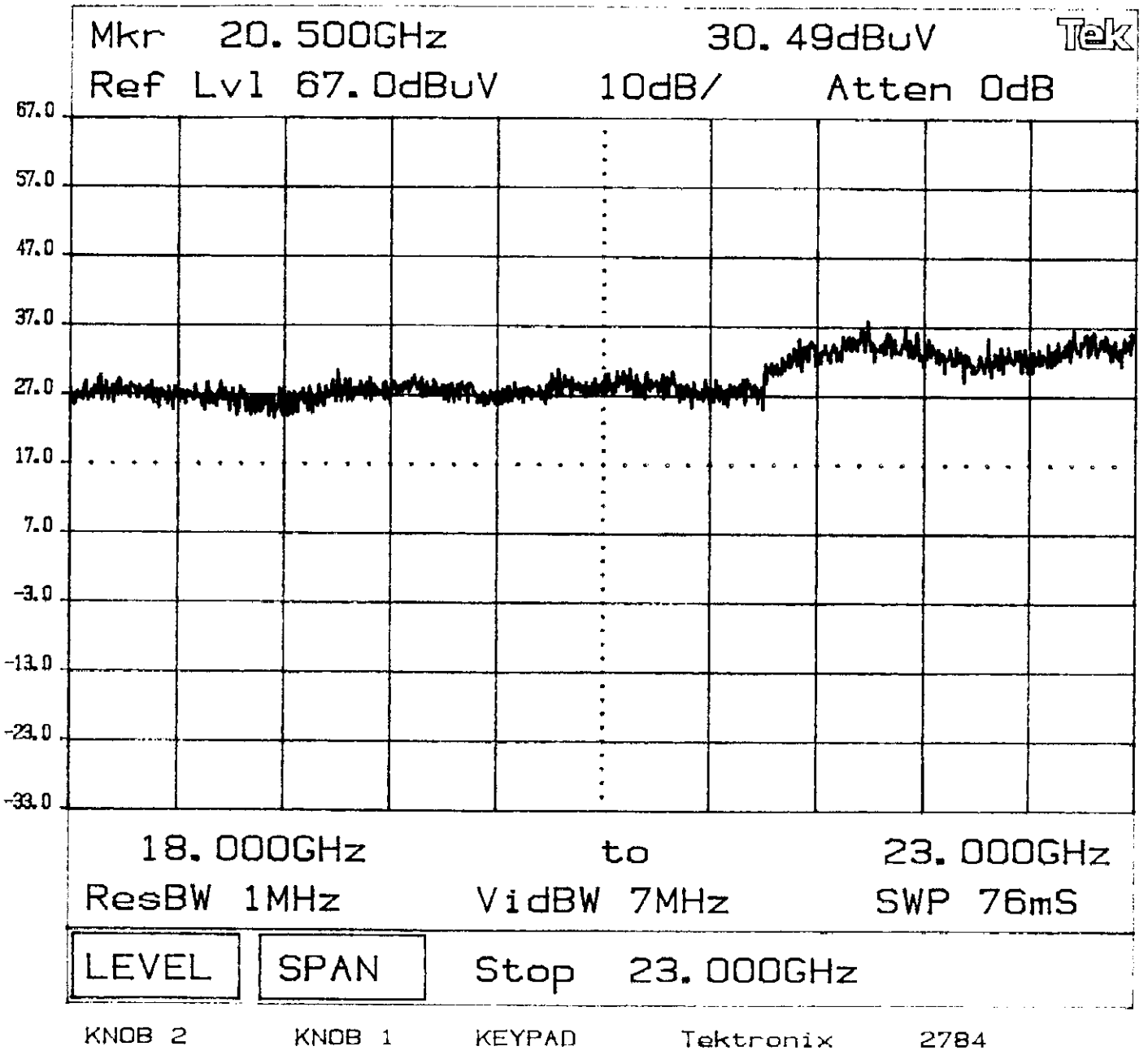
4e3


Mkr 12.000GHz
27.79dBuV
Tek
Ref Lvl 77.0dBuV
10dB/
Atten 0dB
77.0
67.0
57.0
47.0
37.0
27.0
17.0
7.0
-3.0
-13.0
-23.0
10.000GHz
to
14.000GHz
ResBW 1MHz
VidBW 7MHz
SWP 71mS
LEVEL
SPAN
Stop 14.000GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

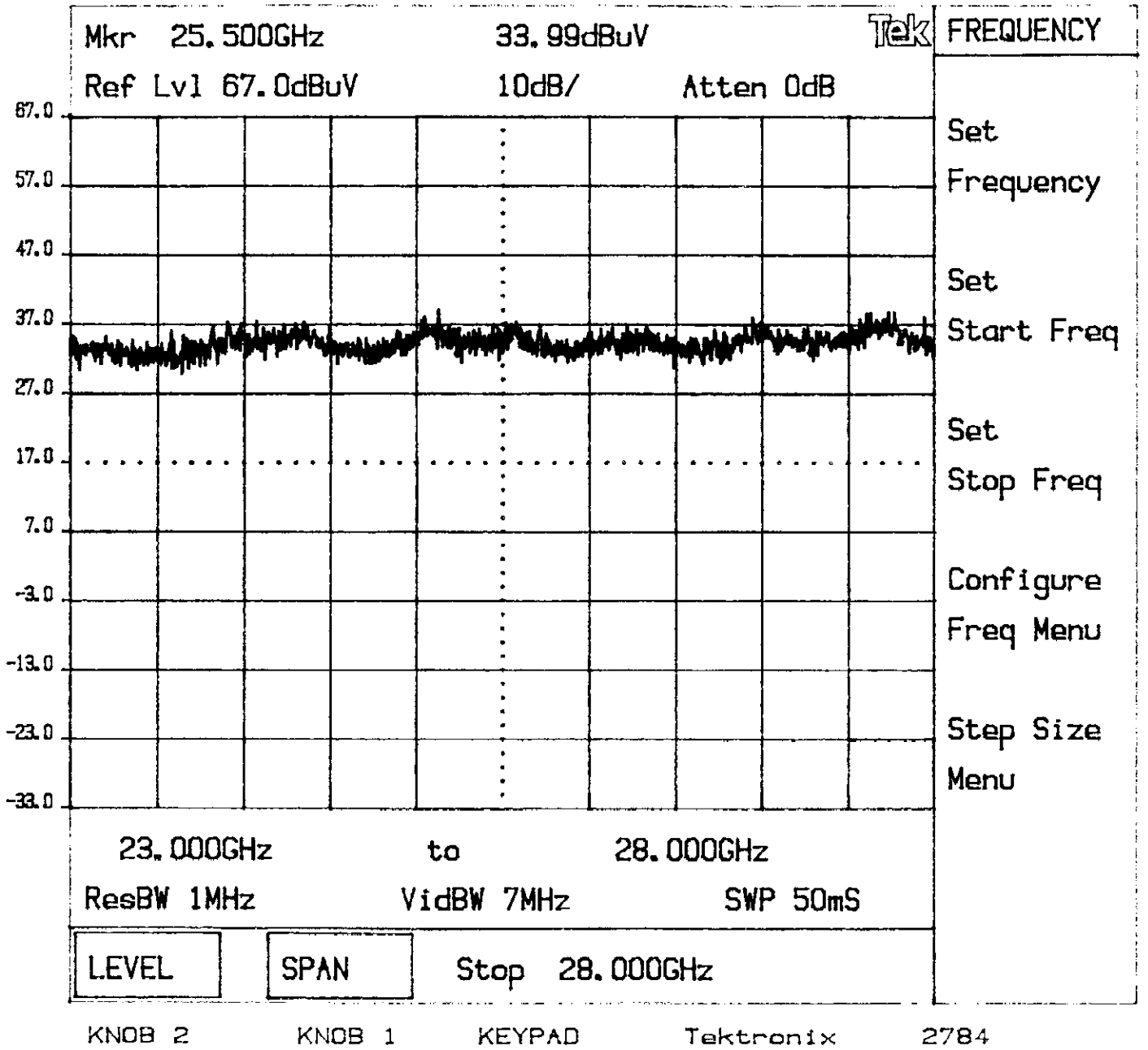
4e4


Mkr 16.000GHz
30.19dBuV
Tek
Ref Lvl 67.0dBuV
10dB/
Atten 0dB
67.0
57.0
47.0
37.0
27.0
17.0
7.0
-3.0
-13.0
-23.0
-33.0
14.000GHz
to
18.000GHz
ResBW 1MHz
VidBW 7MHz
SWP 40mS
LEVEL
SPAN
Strt 14.000GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

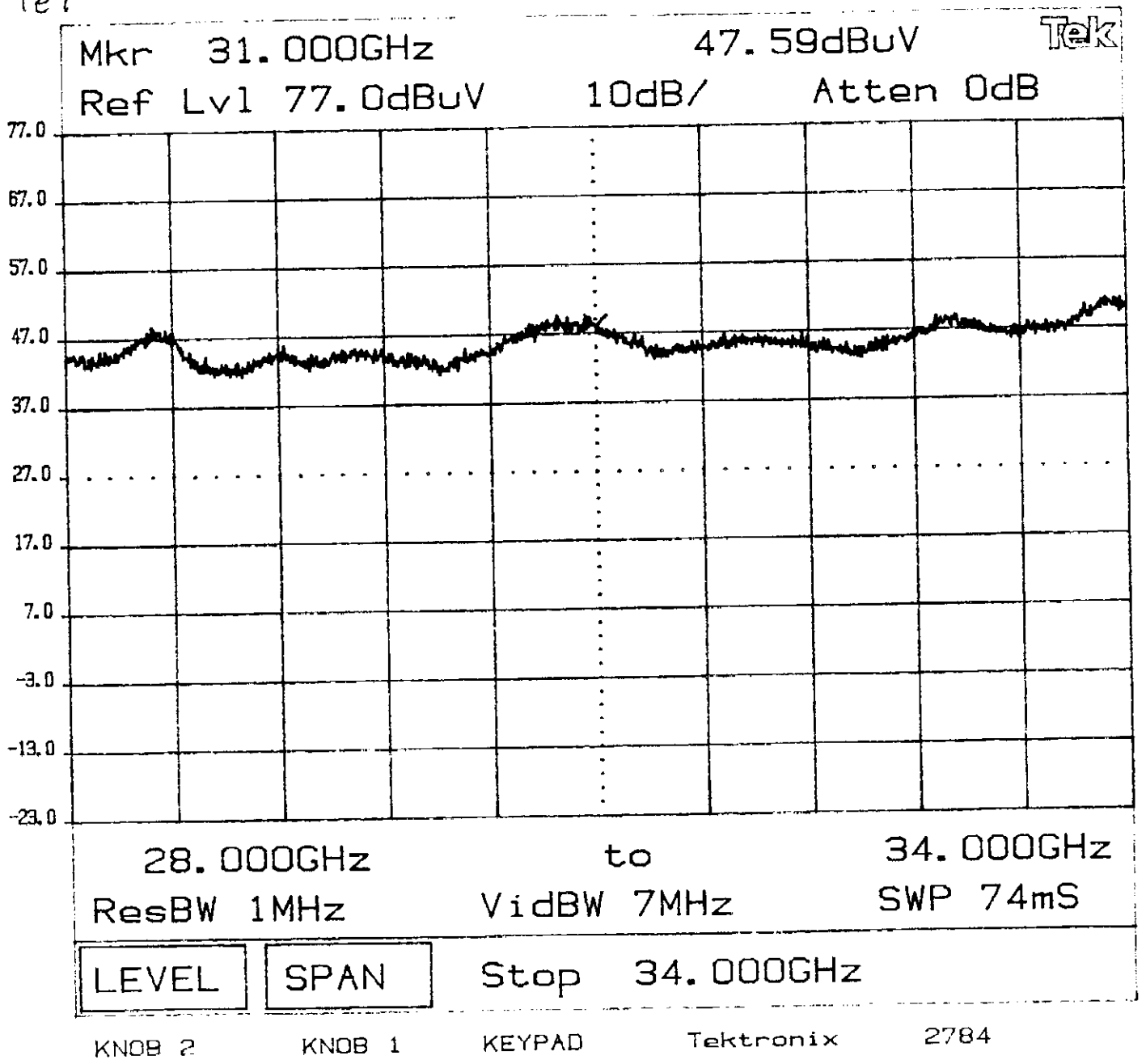
4e5


Mkr 20.500GHz
30.49dBuV
Tek
Ref Lvl 67.0dBuV
10dB/
Atten 0dB
67.0
57.0
47.0
37.0
27.0
17.0
7.0
-3.0
-13.0
-23.0
-33.0
18.000GHz
to
23.000GHz
ResBW 1MHz
VidBW 7MHz
SWP 76mS
LEVEL
SPAN
Stop 23.000GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

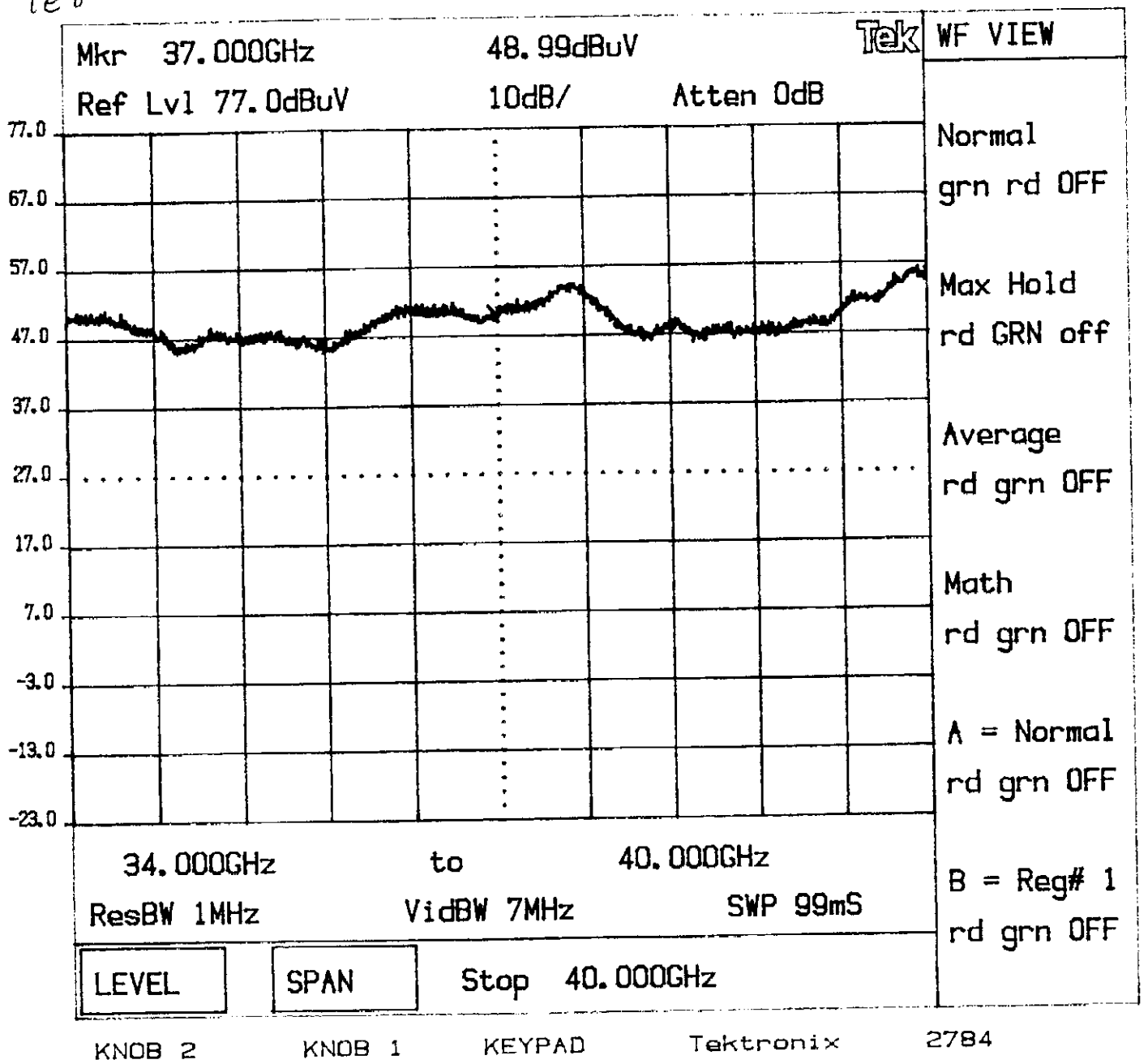
4e6

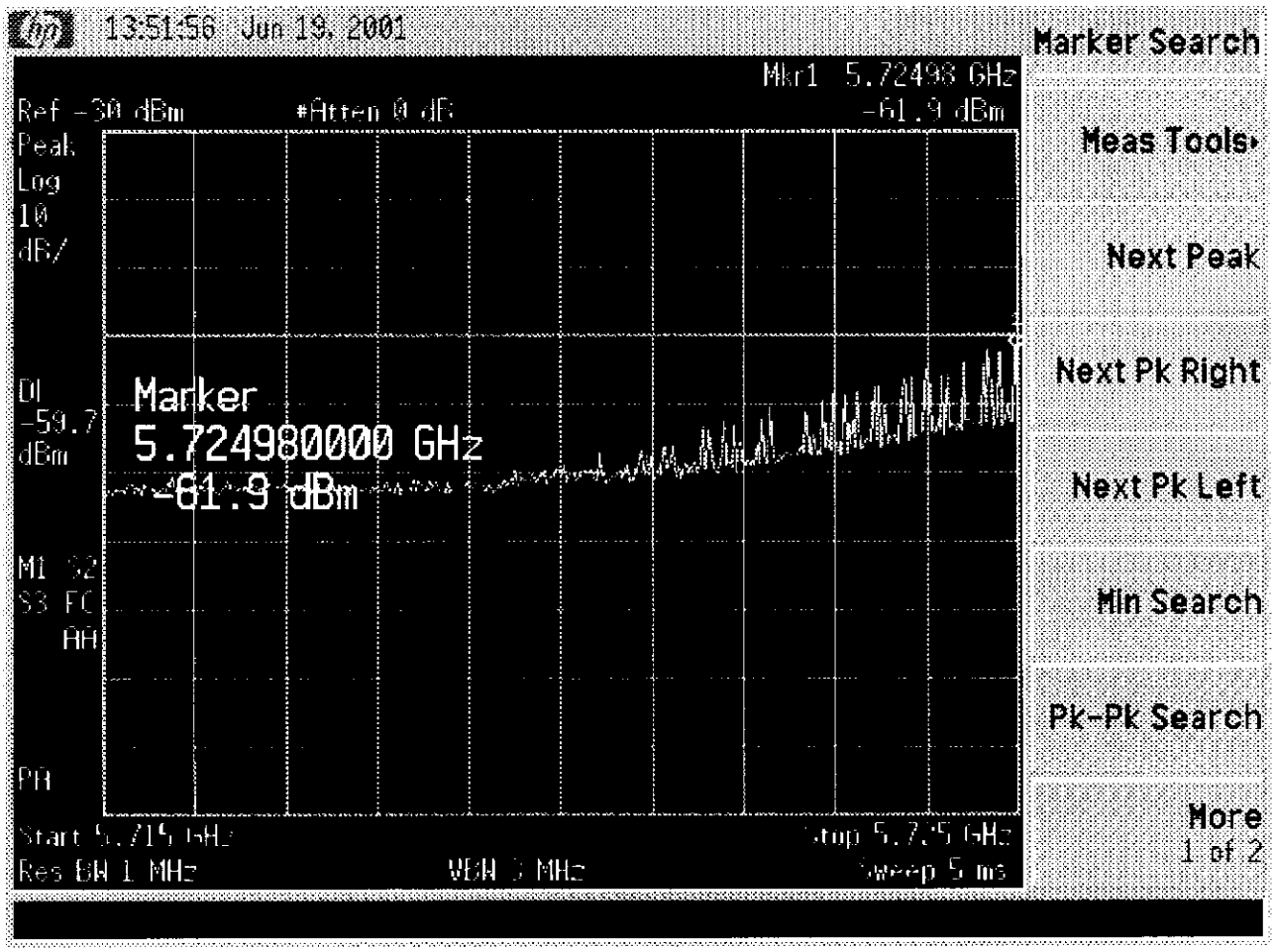

Mkr 25.500GHz
33.99dBuV
Tek
FREQUENCY
Ref Lvl 67.0dBuV
10dB/
Atten 0dB
67.0
57.0
47.0
37.0
27.0
17.0
7.0
-3.0
-13.0
-23.0
-33.0
Set Frequency
Set Start Freq
Set Stop Freq
Configure Freq Menu
Step Size Menu
23.000GHz
to
28.000GHz
ResBW 1MHz
VidBW 7MHz
SWP 50mS
LEVEL
SPAN
Stop 28.000GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

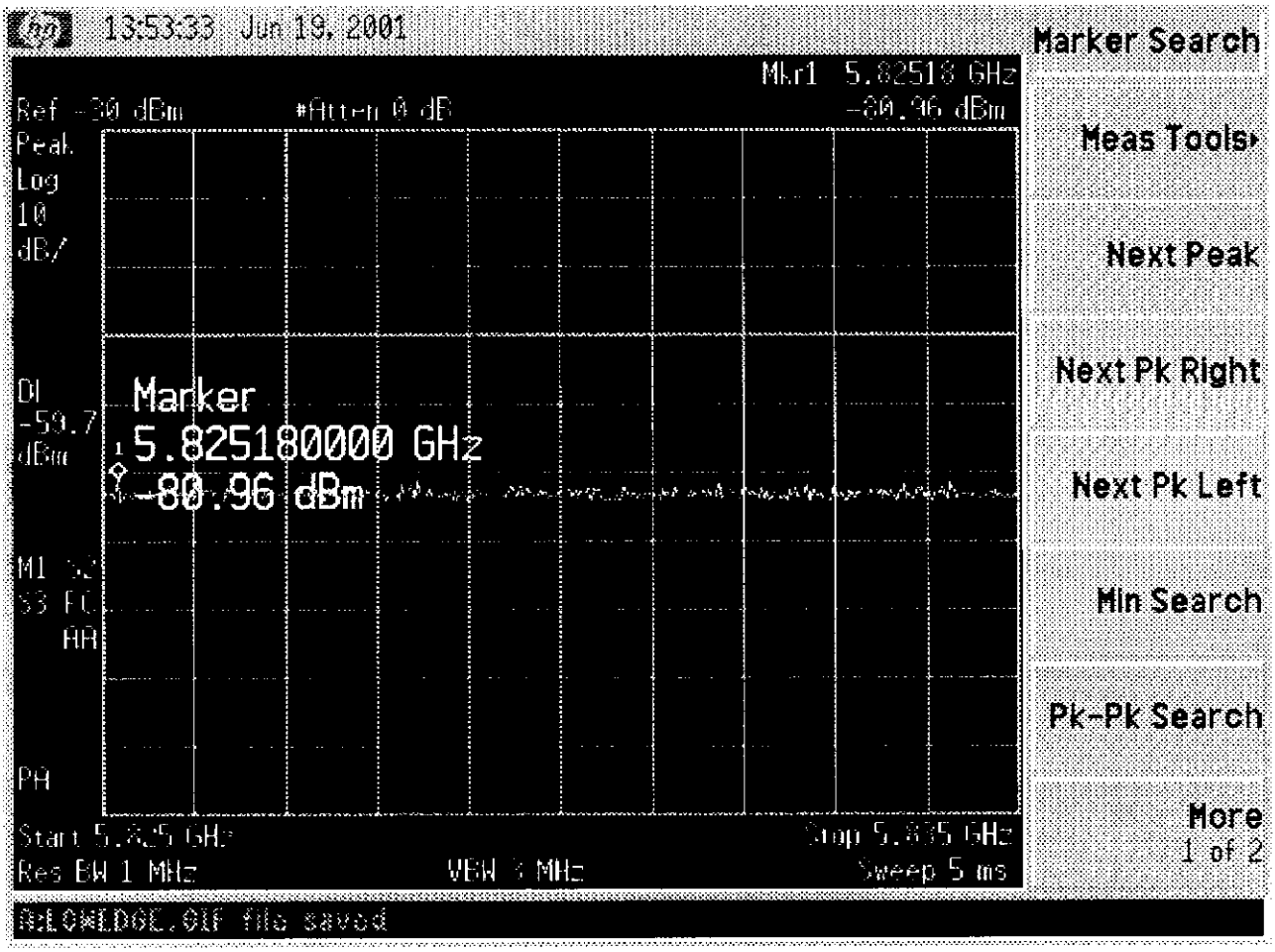
4e7

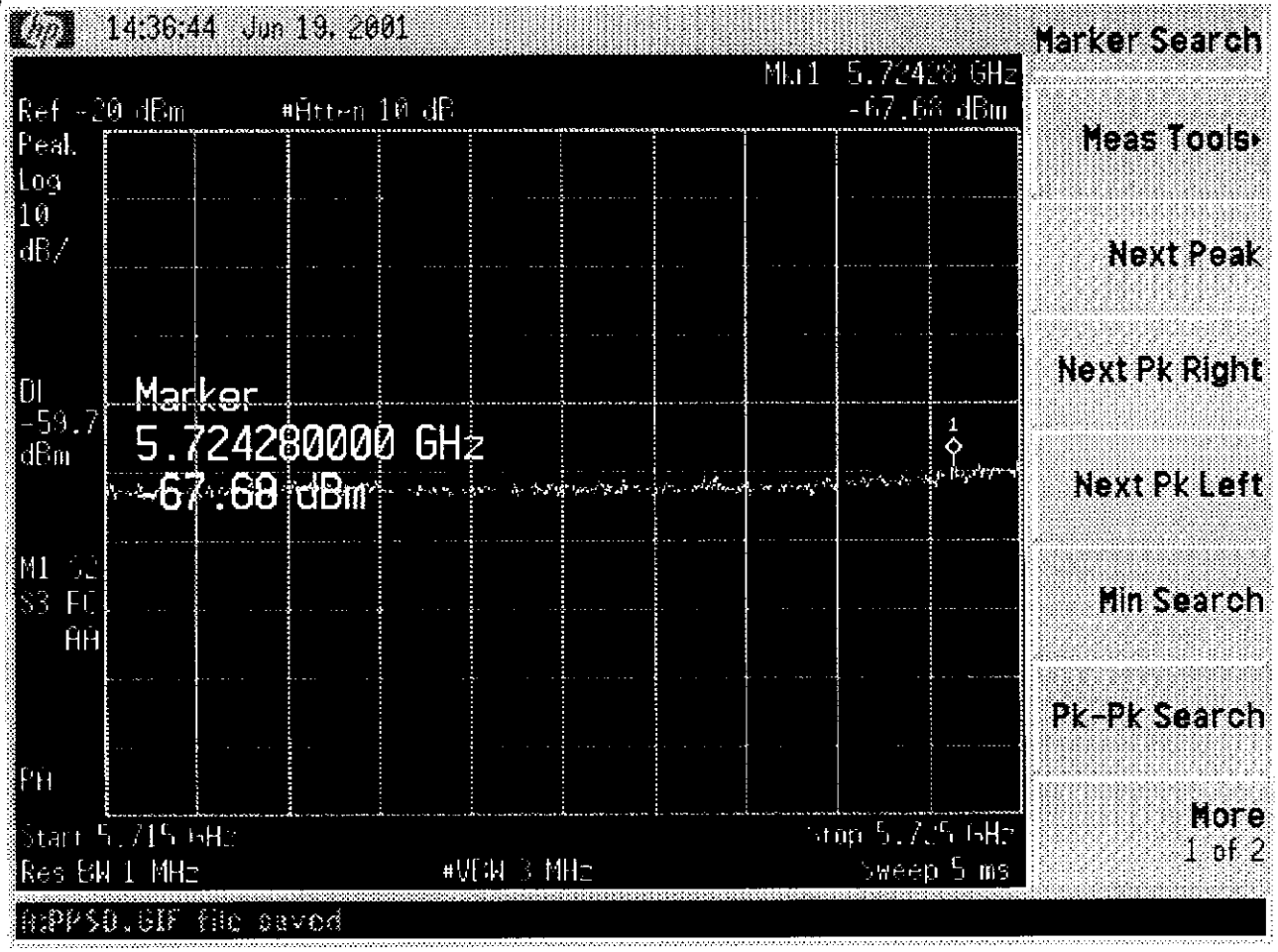

Mkr 31.000GHz
47.59dBuV
Tek
Ref Lvl 77.0dBuV
10dB/
Atten 0dB
77.0
67.0
57.0
47.0
37.0
27.0
17.0
7.0
-3.0
-13.0
-23.0
28.000GHz
to
34.000GHz
ResBW 1MHz
VidBW 7MHz
SWP 74mS
LEVEL
SPAN
Stop 34.000GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

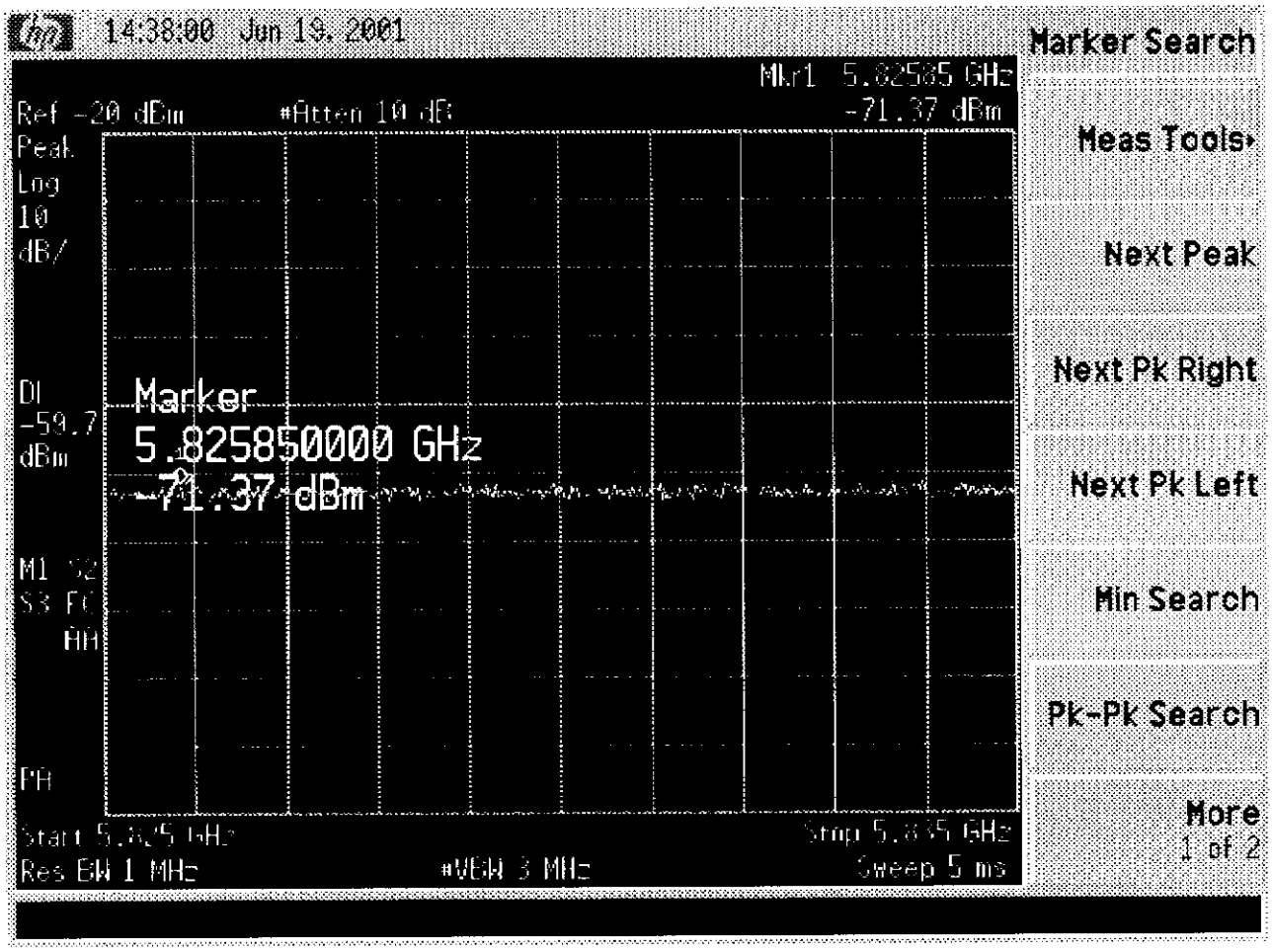
4e8


Mkr 37.000GHz
48.99dBuV
Tek
WF VIEW
Ref Lvl 77.0dBuV
10dB/
Atten 0dB
77.0
67.0
57.0
47.0
37.0
27.0
17.0
7.0
-3.0
-13.0
-23.0
Normal
grn rd OFF
Max Hold
rd GRN off
Average
rd grn OFF
Math
rd grn OFF
A = Normal
rd grn OFF
B = Reg# 1
rd grn OFF
34.000GHz
to
40.000GHz
ResBW 1MHz
VidBW 7MHz
SWP 99mS
LEVEL
SPAN
Stop 40.000GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784


13:51:56 Jun 19, 2001
Mkr1 5.72498 GHz
Ref -30 dBm
#Atten 0 dB
-61.9 dBm
Peak
Log
10
dB/
Marker
5.724980000 GHz
-61.9 dBm
Start 5.715 GHz
Res BW 1 MHz
VBW 3 MHz
Stop 5.725 GHz
Sweep 5 ms
Marker Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

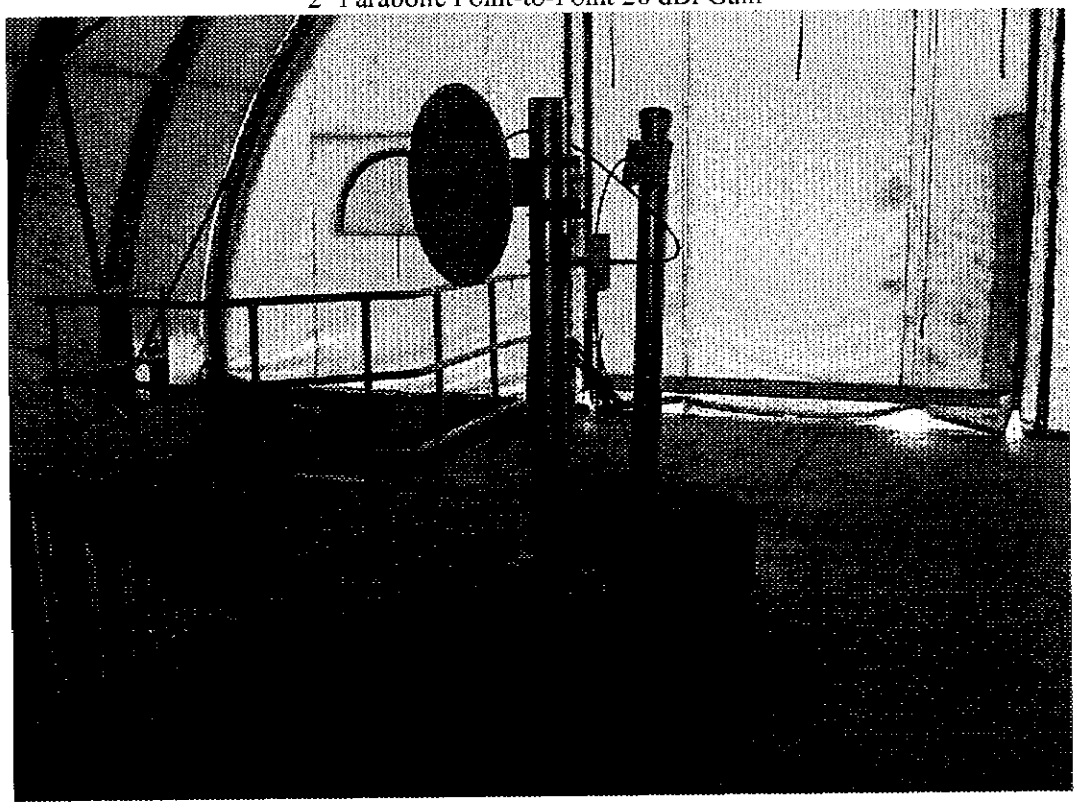

13:53:33 Jun 19, 2001
Mkr1 5.82518 GHz
Ref -30 dBm
#Atten 0 dB
-80.96 dBm
Peak
Log
10
dB/
Marker
5.825180000 GHz
-80.96 dBm
Start 5.25 GHz
Res BW 1 MHz
VBW 1 MHz
Stop 5.835 GHz
Sweep 5 ms
Marker Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2
A:LOWLDGL.GIF file saved

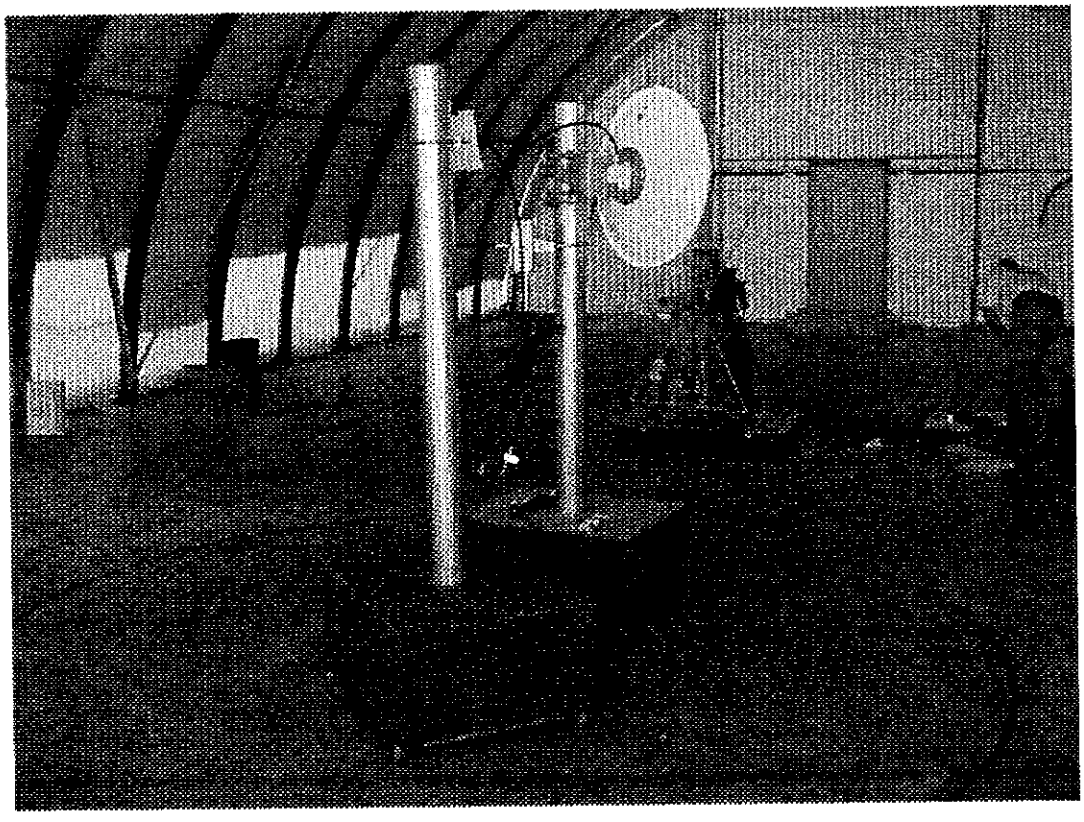

14:36:44 Jun 19, 2001
Mkr1 5.72428 GHz
Ref -20 dBm
#Atten 10 dB
-67.68 dBm
Peak
Log
10
dB/
Marker
5.724280000 GHz
-67.68 dBm
Offset
-59.7
dBm
1
M1 S2
S3 FC
AA
PH
Start 5.715 GHz
Stop 5.725 GHz
Res BW 1 MHz
#VBW 3 MHz
Sweep 5 ms
A:PPSD.GIF file saved
Marker Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2


14:38:00 Jun 19, 2001
Mkr1 5.82585 GHz
Ref -20 dBm
#Atten 10 dB
-71.37 dBm
Peak
Log
10
dB/
Marker
5.825850000 GHz
-71.37 dBm
Start 5.725 GHz
Stop 5.925 GHz
Res BW 1 MHz
#VBW 3 MHz
Sweep 5 ms
Marker Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

Configuration Photograph

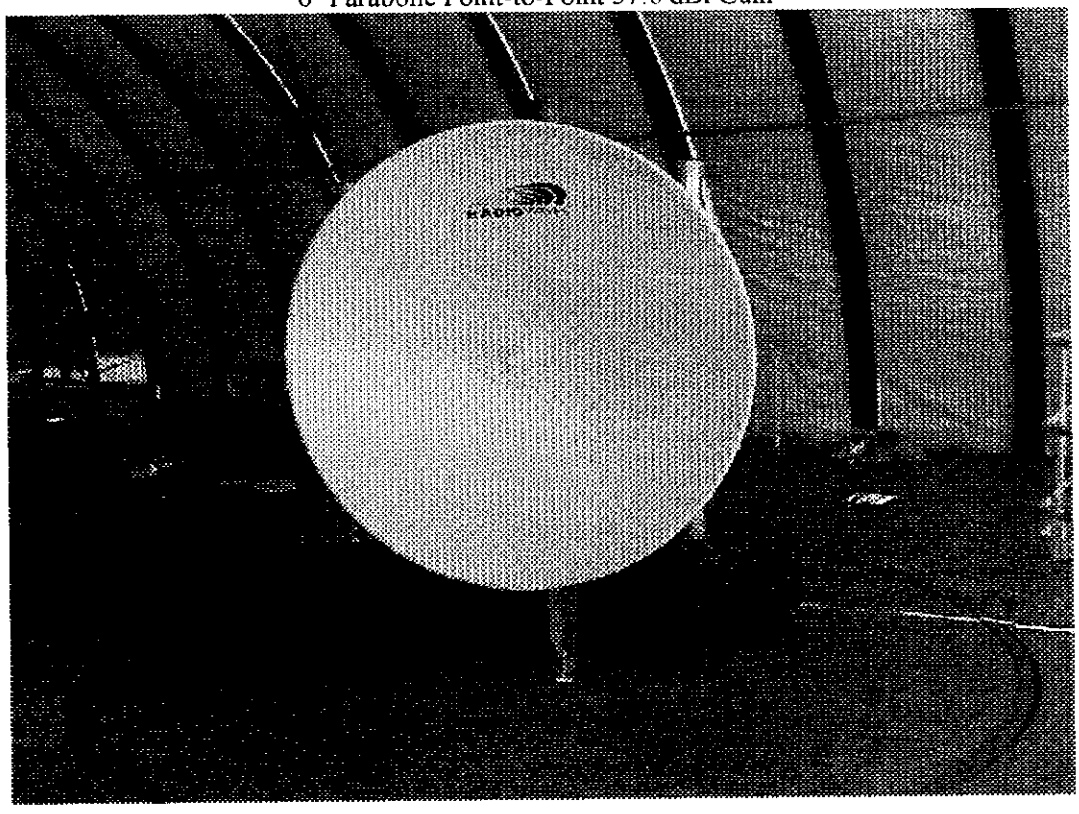
2' Parabolic Point-to-Point 28 dBi Gain

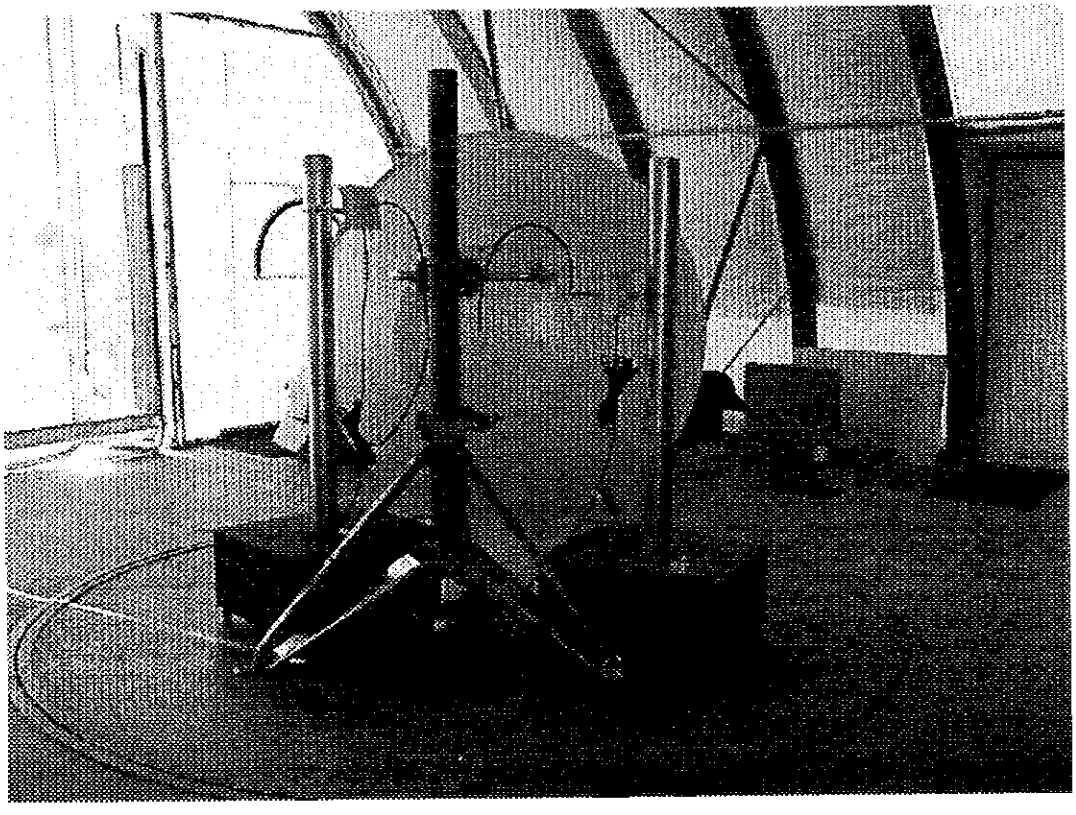




Configuration Photograph (Continued)

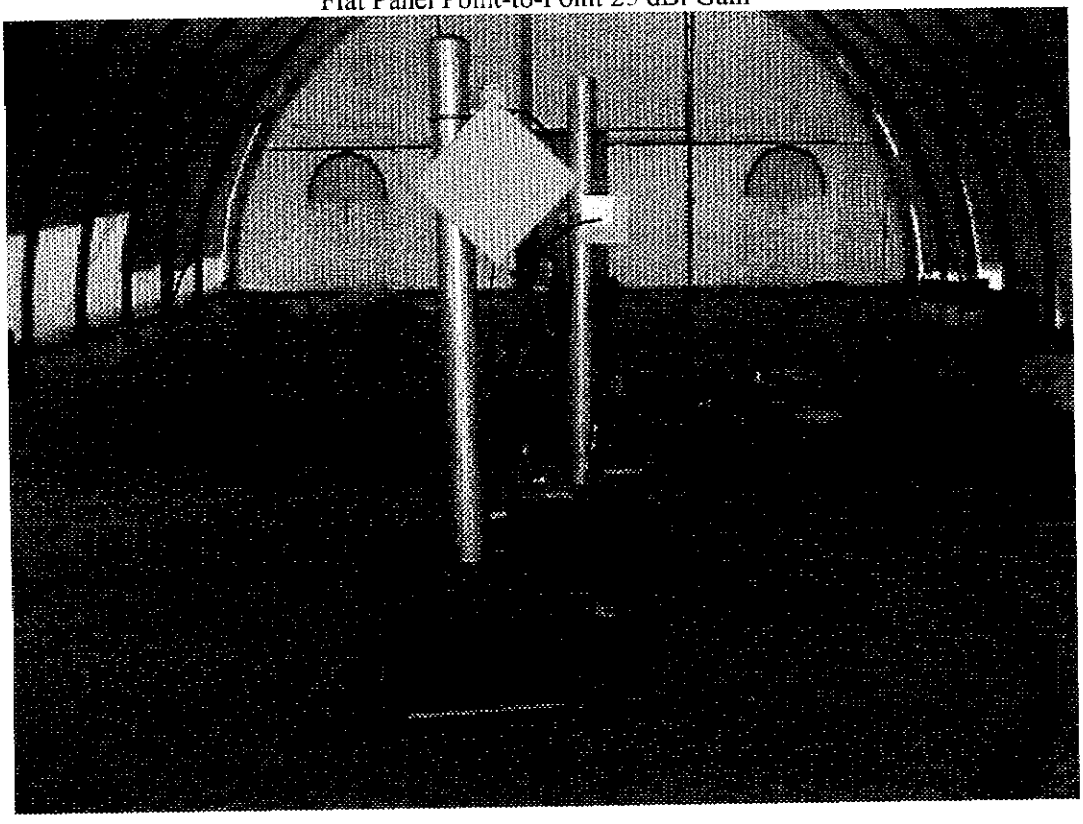
6' Parabolic Point-to-Point 37.6 dBi Gain

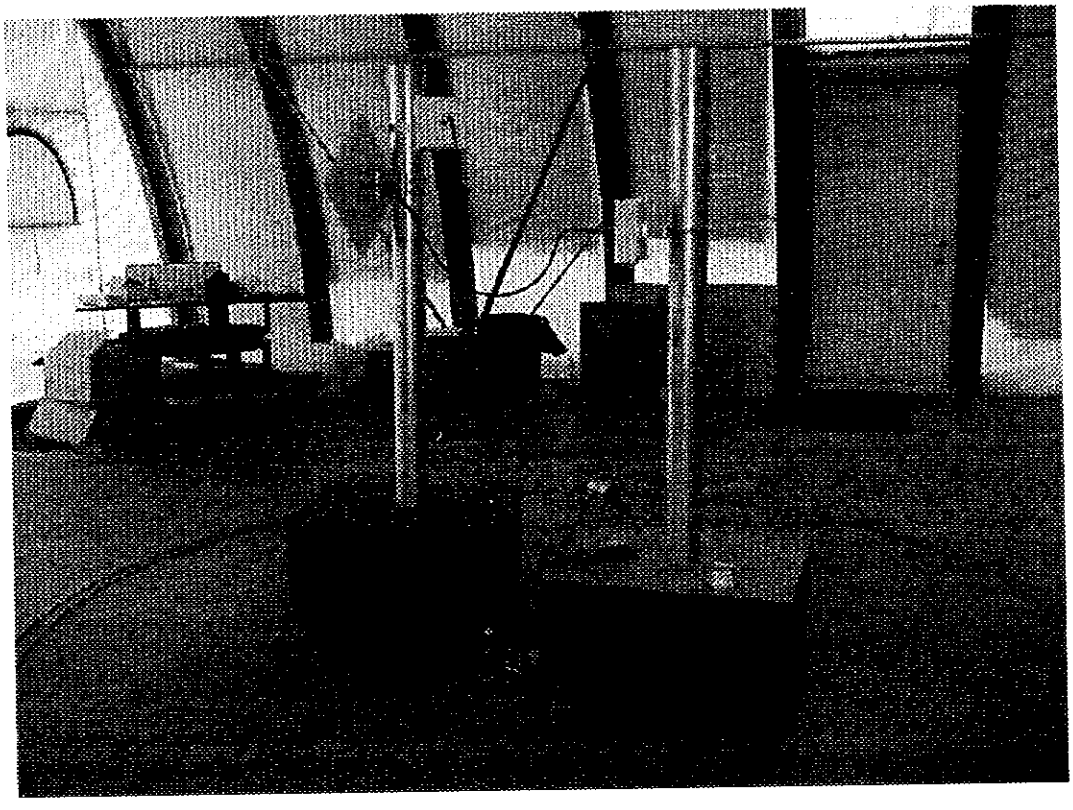




Configuration Photograph (Continued)

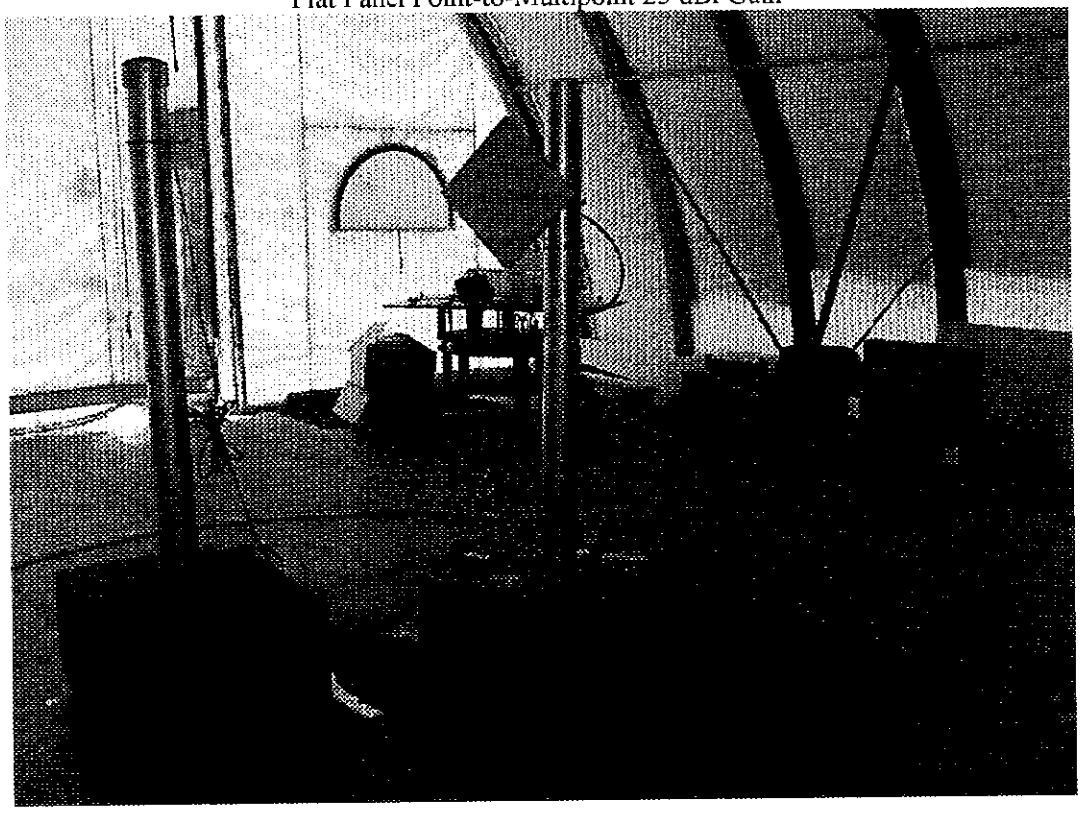
Flat Panel Point-to-Point 23 dBi Gain

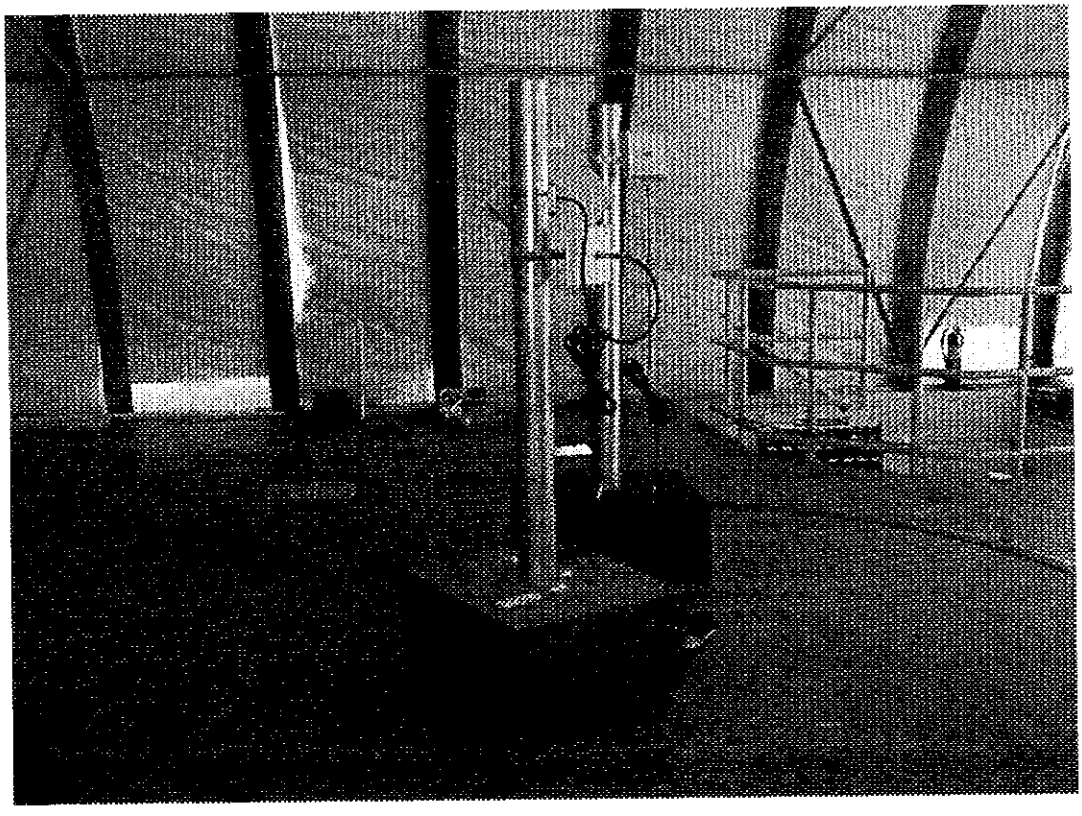




Configuration Photograph (Continued)

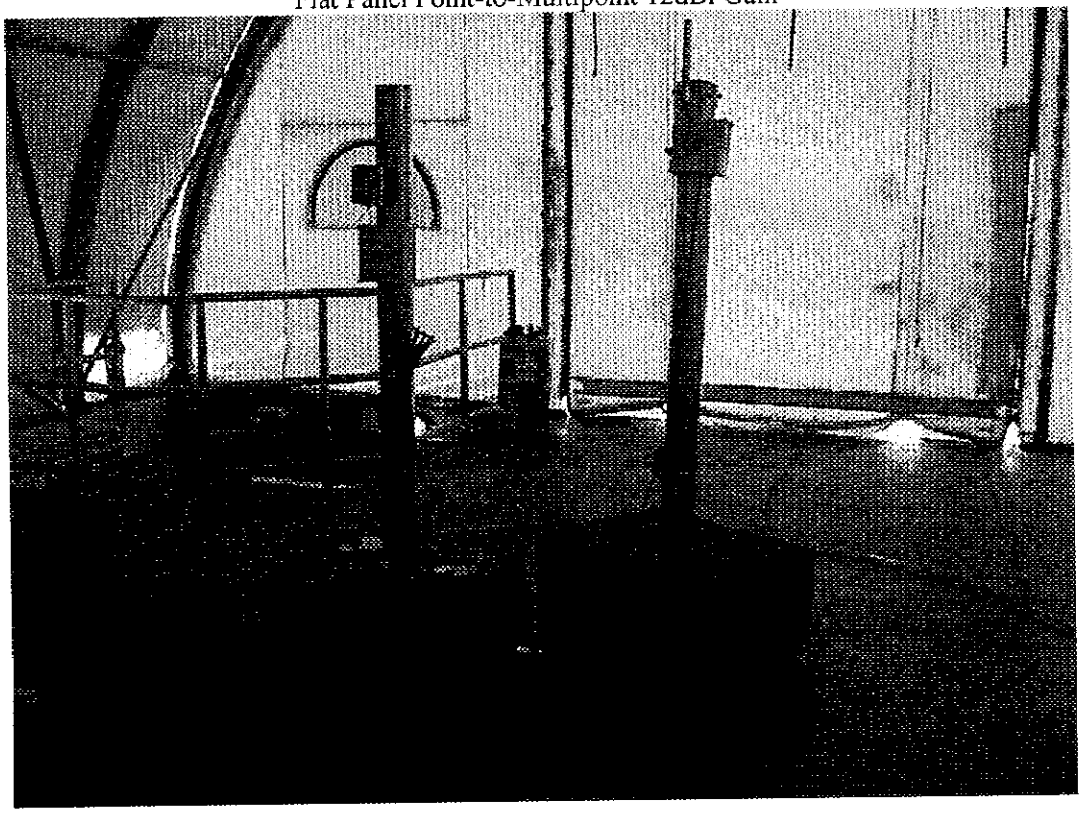
Flat Panel Point-to-Multipoint 23 dBi Gain

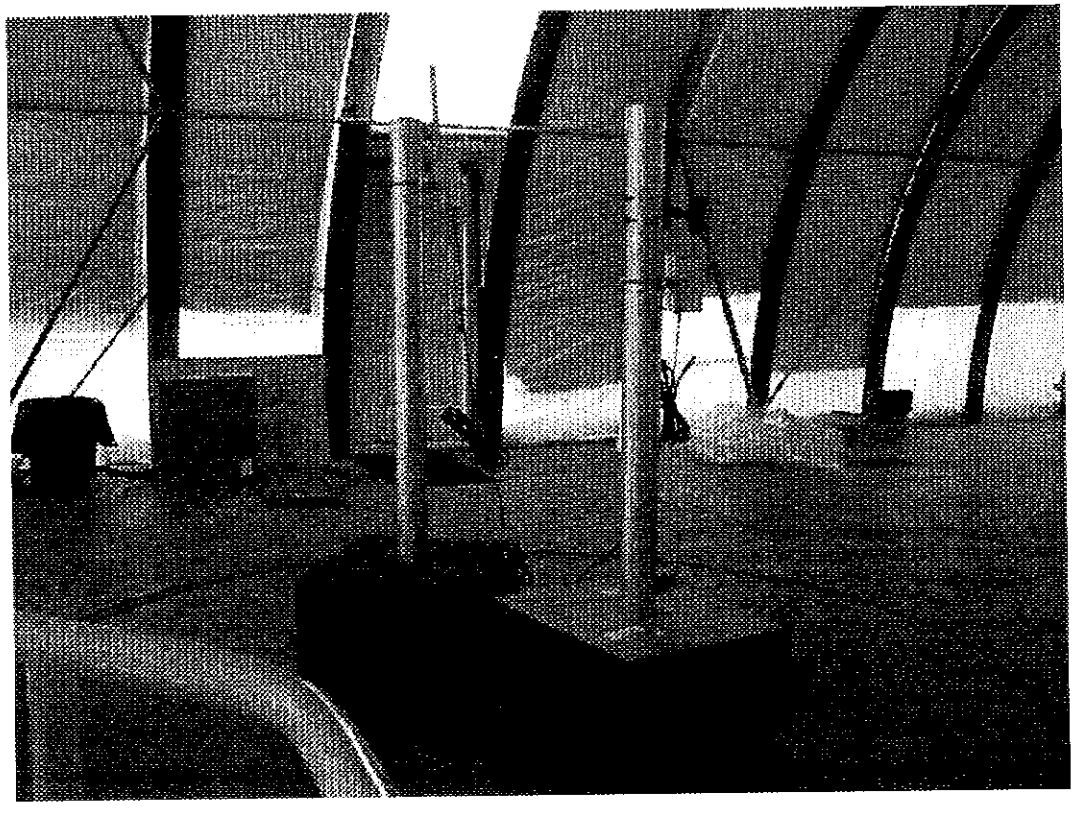




Configuration Photograph (Continued)

Flat Panel Point-to-Multipoint 12dBi Gain





4.6 Transmitter Radiated Emissions in Restricted Bands
FCC Rule 15.205

Radiated emission measurements were performed from 30 MHz to 40,000 MHz. Spectrum Analyzer Resolution Bandwidth is 100 kHz or greater for frequencies 30 MHz to 1000 MHz, 1 MHz - for frequencies above 1000 MHz.

The EUT is placed on the wooden turntable. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). During testing, all cables were manipulated to produce worst case emissions. The signal is maximized through rotation. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance.

A sample calculation is included. All measurements were performed with quasi-peak detection unless otherwise specified. Emissions within the restricted bands are subject to the limits set forth in 15.209. No emissions were detected above 1 GHz. Refer to section 4.5 for data.

Field Strength Calculation
The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG
where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows:

FS = RR + LF
where FS = Field Strength in dBμV/m
RR = RA - AG in dBμV
LF = CF + AF in dB

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

| | |
|---|---|
| RA = 52.0 dBμV | AF = 7.4 dB |
| RR = 23.0 dBμV | CF = 1.6 dB |
| LF = 9.0 dB | AG = 29.0 dB |
| FS = RR + LF | FS = 23 + 9 = 32 dBμV/m |

Level in μV/m = Common Antilogarithm [(32 dBμV/m)/20] = 39.8 μV/m

4.8 AC Line Conducted Emission
FCC Rule 15.207

4.8.1 Line Conducted Emission Limits

**Conducted Emissions Limits, Section 15.107(a)**

| Frequency (MHz) | Class B (uV) | Class B (dBuV) |
|---|---|---|
| 0.45 - 1.705 | 250 | 48 |
| 1.705 to 30.000 | 250 | 48 |

*Note: Three sets of units are commonly used for EMI measurement, decibels below one milliwatt (-dBm), decibels above a microvolt (dBμV), and microvolts (μV). To convert between them, use the following formulas: 20 LOG$_{10}$(μV) = dBμV, dBm = dBμV-107.*

Test Result

See Table F.
The EUT passed the test

# Intertek Testing Services

**Conducted Emissions / Interference**

*Table: F*

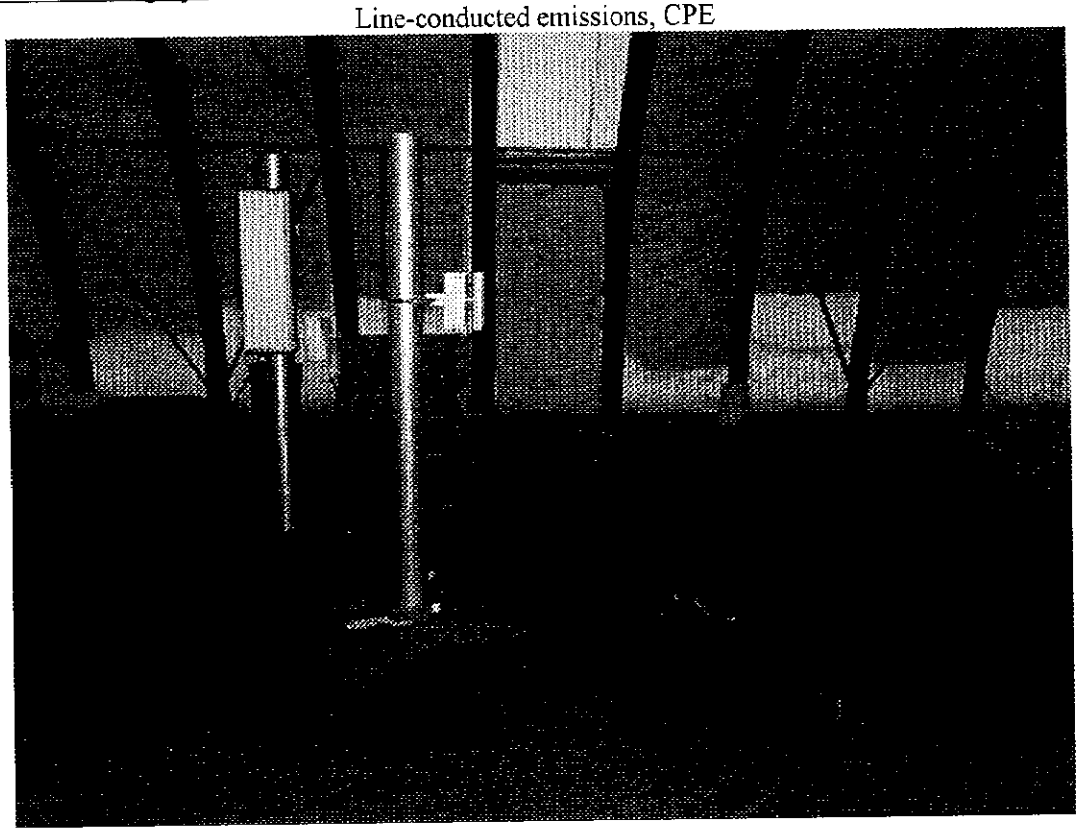
*Company:* Wireless Bypass
*Model:* DL-5800C
*Job No.:* J20046196
*Date:* 06/12/01
*Standard:* FCC15E
*Class:* A *Group:* None
*Notes:*
*System Loss:* Includes the Cable and LISN loss.

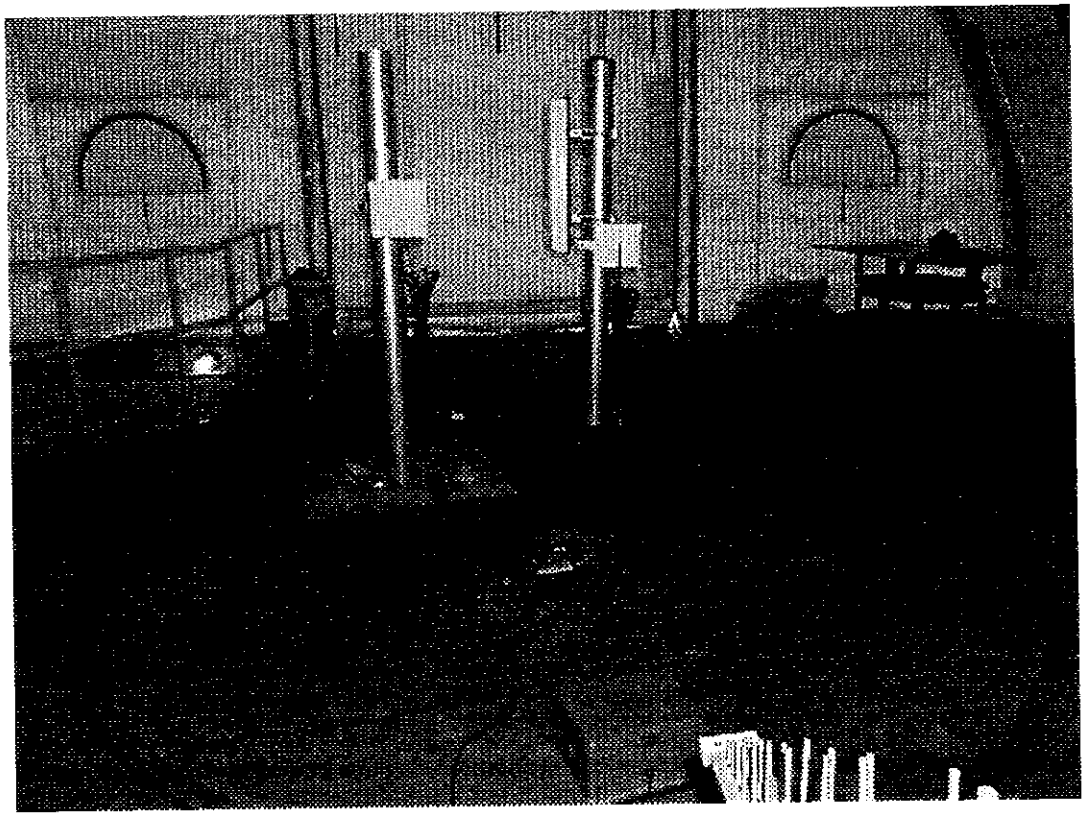
*Tested by:* Nicholas Abbondante
*Location:* Site 1C
*Detector:* Agilent E7405A
*Cable(s):* 1C, CBL11
*Limiter:* no

| Frequency MHz | Reading Side A dB | Reading Side B dB | Attenuator Factor dB | System Loss dB | Quasi-Peak Net dB(uV) | Quasi-Peak Limit dB(uV) | Quasi-Peak Margin dB |
|---|---|---|---|---|---|---|---|
| 0.633 | 2.3 | 4.5 | 20.0 | 1.3 | 25.8 | 48.0 | -22.2 |
| 0.949 | 4.1 | 6.3 | 20.0 | 0.5 | 26.8 | 48.0 | -21.2 |
| 2.741 | 4.6 | 8.2 | 20.0 | 0.4 | 28.6 | 48.0 | -19.4 |
| 5.905 | 12.1 | 12.2 | 20.0 | 0.6 | 32.8 | 48.0 | -15.2 |
| 10.960 | 14.2 | 15.9 | 20.0 | 0.6 | 36.5 | 48.0 | -11.5 |
| 16.230 | 17.9 | 18.8 | 20.0 | 0.8 | 39.6 | 48.0 | -8.4 |
| 19.180 | 19.3 | 20.1 | 20.0 | 0.9 | 41.0 | 48.0 | -7.0 |
| 22.760 | 18.9 | 19.6 | 20.0 | 1.0 | 40.6 | 48.0 | -7.4 |

Configuration Photograph

Line-conducted emissions, CPE





4.9 Radiated Emissions from Digital Section
FCC Rule 15.109

Test was performed as described in the section 4.6.

The digital section was scanned at the same time as the entire system. Test data can be found in section 4.5. The limits are equivalent to the limits of 15.209.

4.10 Radiated Emissions from Receiver Section
FCC Ref: 15.109, 15.111

The receiver was scanned at the same time as the entire system and according to the procedure set forth in section 4.6. The limits are equivalent to those set forth in 15.209. Test data can be found in section 4.5.

4.11 Transmitter Duty Cycle Calculation / Measurements
FCC Rule 15.35(b), (c)

The EUT antenna output port was connected to the input of the spectrum analyzer. The analyzer center frequency was set to EUT RF channel carrier. The SWEEP function on the analyzer was set to ZERO SPAN. The transmitter ON time was determined from the resultant time-amplitude display.

Duty cycle = Maximum ON time in 100 msec/100

Duty cycle correction, dB = 20 * log (DC)

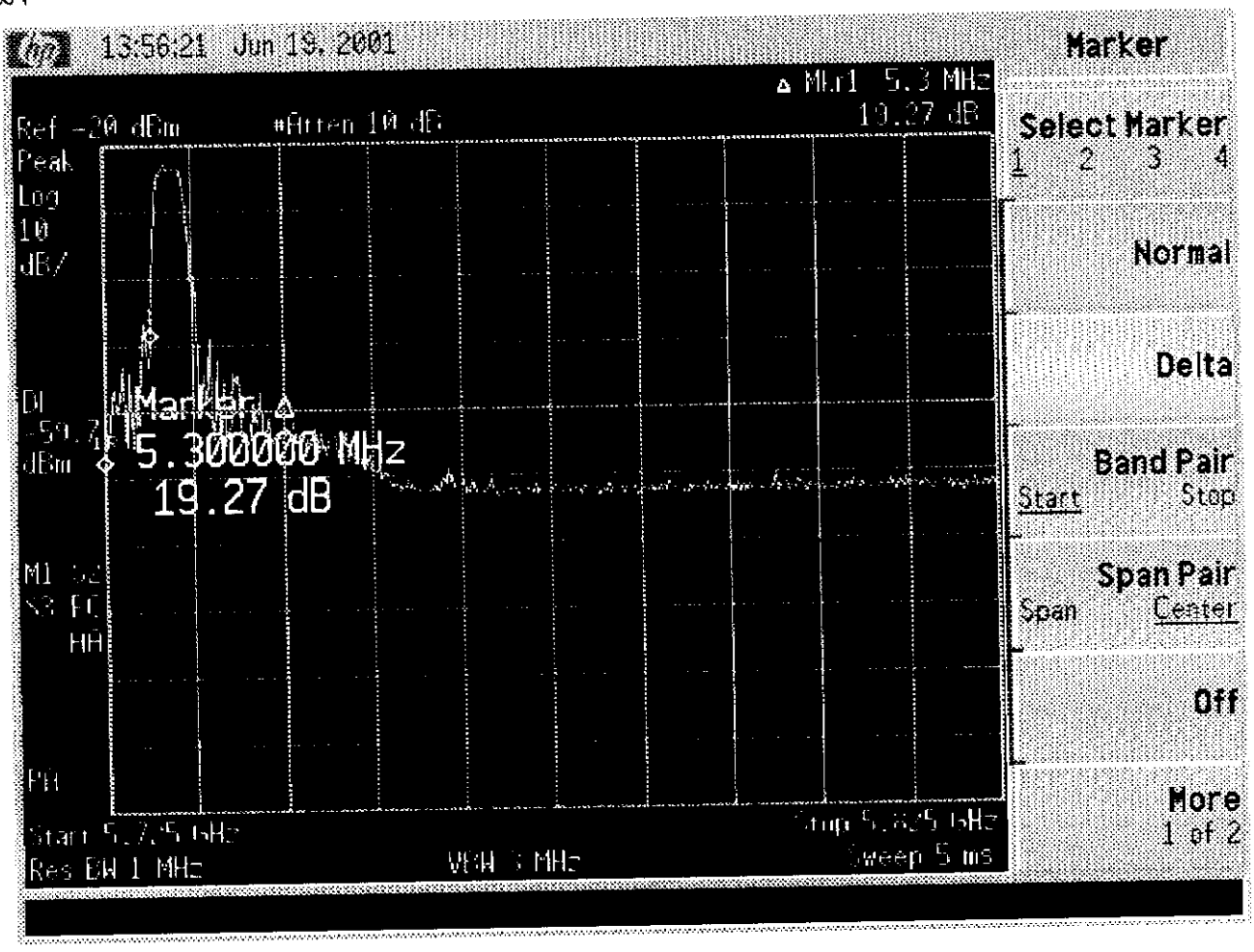
| | |
|---|---|
| | See attached spectrum analyzer chart(s) for transmitter timing |
| | See transmitter timing diagram provided by manufacturer |
| X | Not applicable. |

4.12 Frequency Stability
FCC Rule 15.407(g)

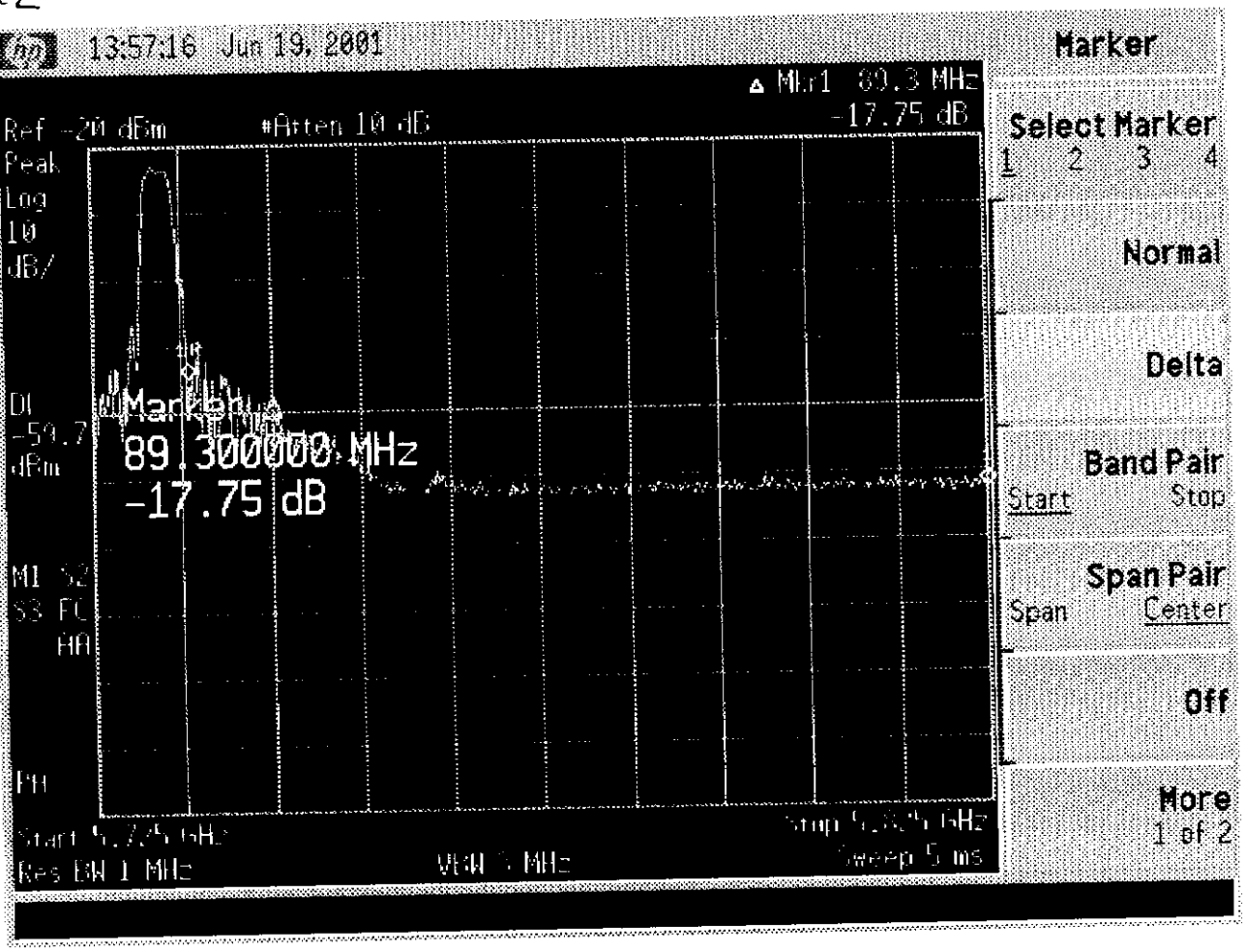
The EUT antenna output was connected directly to the input of the spectrum analyzer via a 30 dB attenuation pad and a high frequency cable with 5.7 dB of loss. Measurements were made from the 26dBc bandwidth point, or lower, of the fundamental frequency to the nearest band edge for both the high and low band edges. The frequency margin between these two points was then compared with the worst case frequency stability for the oscillators used. It was found that the frequency margin was much greater than the possible frequency deviation of the fundamental, so the EUT passes.

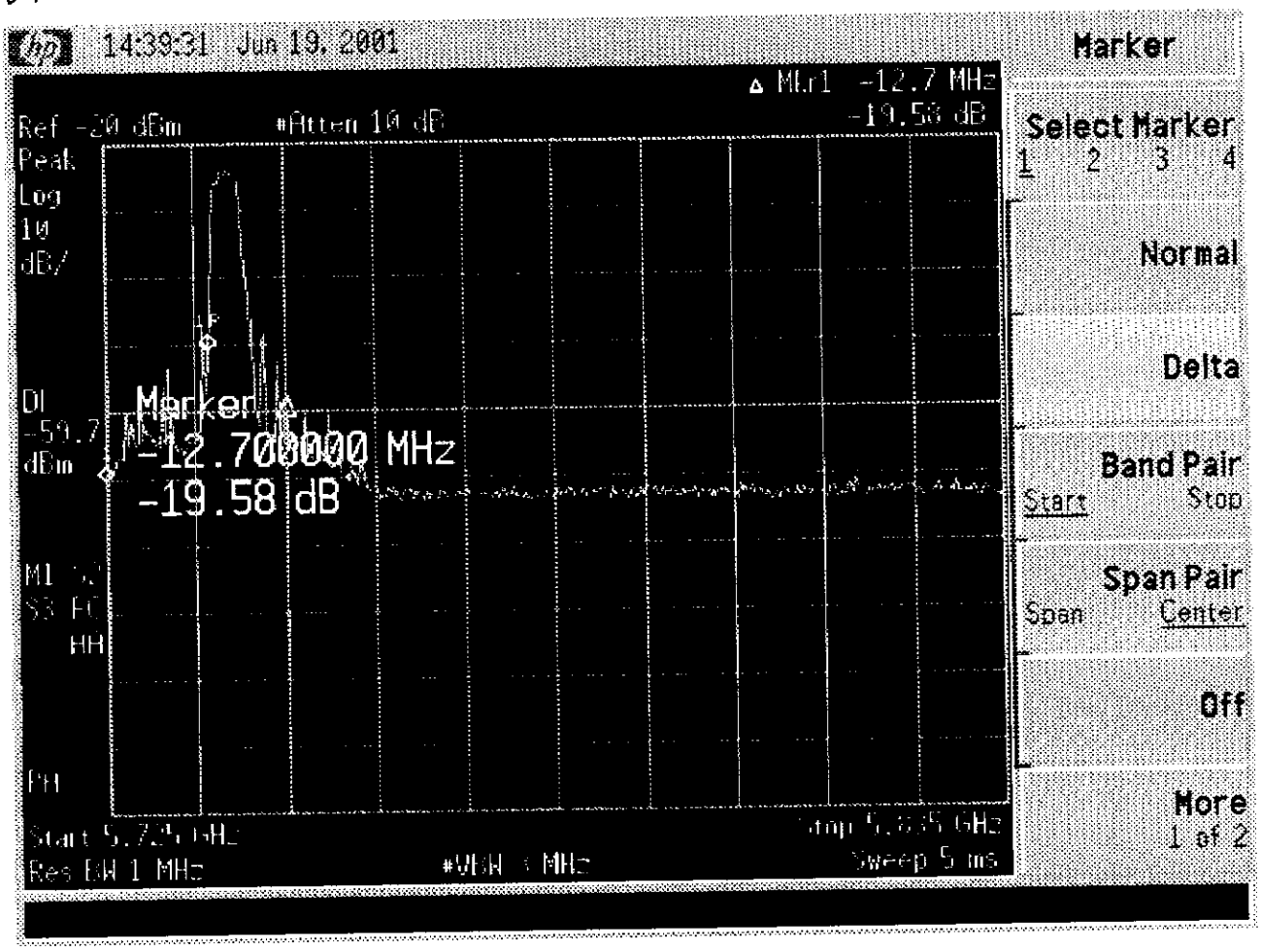
Refer to Exhibit A for a discussion of the worst case frequency stability of the EUT. Refer to the following plots for supporting data:

Plot 5.a1-5.a2: Frequency Stability Margin Low Channel
Plot 5.b1-5.b2: Frequency Stability Margin High Channel


13:56:21 Jun 19, 2001
Marker
Ref -20 dBm
#Atten 10 dB
Peak
Log
10
dB/
Marker 1
5.300000 MHz
19.27 dB
Res BW 1 MHz
VBW 3 MHz
Sweep 5 ms
Select Marker
1 2 3 4
Normal
Delta
Band Pair
Start Stop
Span Pair
Span Center
Off
More
1 of 2

5a2


13:57:16 Jun 19, 2001
Ref -20 dBm
#Atten 10 dB
Peak
Log
10
dB/
Mkr1 89.3 MHz
-17.75 dB
Marker
89.300000 MHz
-17.75 dB
Marker
Select Marker
1 2 3 4
Normal
Delta
Band Pair
Start Stop
Span Pair
Span Center
Off
More
1 of 2
Res BW 1 MHz
VBW 3 MHz
Sweep 5 ms


14:39:31 Jun 19, 2001
Marker
Δ Mkr1 -12.7 MHz
-19.58 dB
Ref -20 dBm
#Atten 10 dB
Peak
Log
10
dB/
Marker
-12.700000 MHz
-19.58 dB
Select Marker
1 2 3 4
Normal
Delta
Band Pair
Start
Stop
Span Pair
Span
Center
Off
More
1 of 2
Res BW 1 MHz
#VBW 1 MHz
Sweep 5 ms

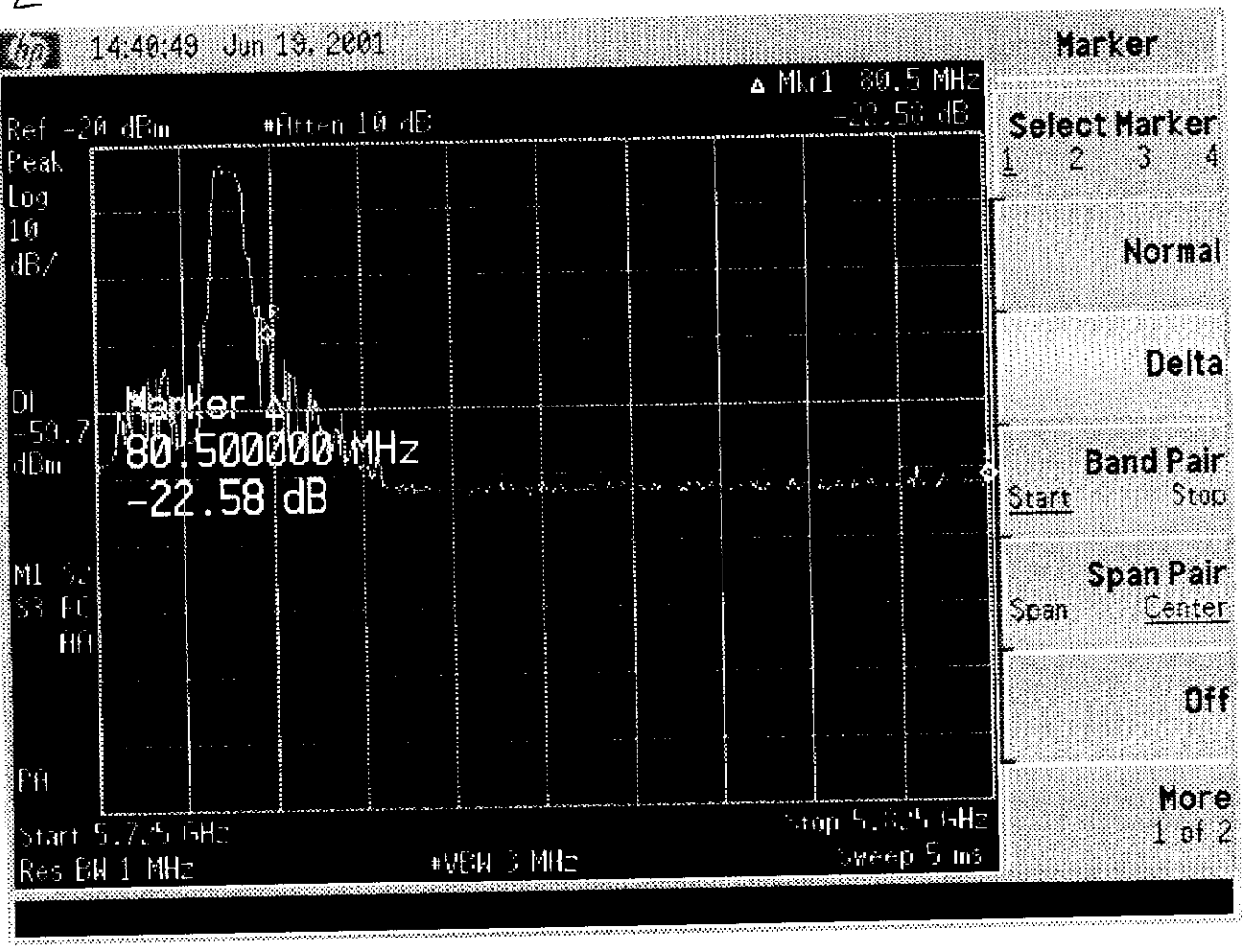

14:40:49 Jun 19, 2001
Ref -20 dBm
#Atten 10 dB
Peak
Log
10
dB/
Marker
80.500000 MHz
-22.58 dB
Start 5.745 GHz
#VBW 3 MHz
Stop 5.755 GHz
Res BW 1 MHz
Sweep 5 ms
Marker
Select Marker
1 2 3 4
Normal
Delta
Band Pair
Start Stop
Span Pair
Span Center
Off
More
1 of 2

EXHIBIT A

**Wireless Bypass**

*wireless solutions for CMTS and CATV distribution*

06/20/2001

# Transmitter Mute Switch & Transmitter Frequency Stability

To Whom It May Concern:

Wireless Bypass has built a transmitter mute function into the U-NII models PPS-DL5800H24 & PPS-DL5800C24. These mute functions can be traced using the supplied documentation. Specifically, the transmitter mute will take effect from 90% to 10% in less than 1 millisecond in the event of a PLL out of lock, and less than 1 microsecond in the absence of data.

Frequency stability of the PPS-DL5800C24 is controlled by one upconversion at 5.700 GHz. Overall stability over temperature is +/- 1.0 PPM & over time +/- 1.0 PPM yielding a total of +/- 11,400 hz over time and temp.

Frequency stability of the PPS-DL5800H24 is controlled by two upconversions. One conversion is at 625 MHz, and the other is at 5.700 GHz. Overall stability over temperature is +/- 1.0 PPM & over time +/- 1.0 PPM yielding a total of +/- 12,650 hz over time and temp.

The attached crystal specification is applicable to all cases.

Thank you for your help in this matter,

David Blumberg,
Wireless Bypass
43 Northwestern Drive
Salem NH 03079

VTXO700

# MODEL VTXO700

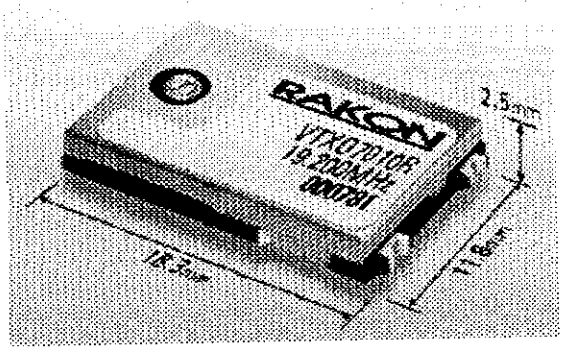
**Voltage Controlled Temperature Compensated Crystal Oscillators**
Low profile surface mountable VCTCXO available in custom frequencies from 8.2MHz to 32MHz with a clipped sinewave output

## Product Description

This Colpitts oscillator uses the direct two–port temperature compensation method. Operating on the fundamental mode, the circular AT–cut crystal is housed in the environmentally rugged UM–1 SLIM resistance weld package.

The product can be configured to operate on any voltage between 2.7V and 5V. A mechanical trimmer is available for adjusting the frequency.

Customized frequencies readily available make this model suitable for many timing and frequency applications where an HCMOS output is required.




**Features**

- Compatible with normal solder reflow processes
- Excellent temperature stability performance
- Able to operate over industrial temperature ranges
- Low hysteresis
- Low power consumption
- Excellent vibration performance
- Very good phase noise performance
- Frequency control ranges from 6 to 50ppm available

## 1.0 *SPECIFICATION REFERENCES*

| | | |
|---|---|---|
| 1.1 | **Model Description** | VTXO710R 10.0 MHz |
| 1.2 | **Reference Number** | 3515 |
| 1.3 | **Company** | Wireless Bypass |

## 2.0 *FREQUENCY CHARACTERISTICS*

| *Line* | *Parameter* | *Test Condition* | *Min.* | *Max.* | *Units* |
|---|---|---|---|---|---|
| 2.1 | **Nominal Frequency** | Nominal Frequency referenced to 25 deg. C. | | 10.0 | MHz |
| 2.2 | **Frequency calibration** | Frequency at 23 deg. C +/–2 deg. C (see Note 1) | | 1.0 | +/–ppm |
| 2.3 | **Frequency stability over temperature** | Referenced to frequency reading at 25 deg. C. Temperature varied at max. of 2 deg. C per minute. Control voltage held at voltage control range midpoint. (Note 2) | | 1.0 | +/–ppm |
| 2.4 | **Temperature range** | The operating temperature range over which the frequency stability is measured (Note 3) | –20.0 | 70.0 | Degrees C |
| 2.5 | **Frequency perturbations** | Peak to peak amplitude of frequency perturbation within operating temperature range (Note 1) | | 0.5 | ppm |
| 2.6 | **Frequency slope** | Minimum of 1 frequency reading every 2 degrees C, over the operating | | 0.5 | ppm/deg C |

| | | | | | |
|---|---|---|---|---|---|
| | **of perturbations** | temperature range (Note 1) | | | |
| 2.7 | **Static temperature hysteresis** | Frequency change after reciprocal temperature ramped over the operating range. Frequency measured before and after at 25 deg C | | 0.4 | +/−ppm |
| 2.8 | **Supply voltage stability** | Supply voltage varied +/−5% at 25 deg C. Frequencies above 25MHz are not able to be specified below the max. value given. (Note 1) | | 0.3 | +/−ppm |
| 2.9 | **Load sensitivity** | +/−10% load change | | 0.2 | +/−ppm |
| 2.10 | **Root Allan Variance** | 1 second Tau. (Note 1) | | 1.0 | ppb |
| 2.11 | **Long term stability** | Frequency drift over 1 year (Note 1) | | 1.0 | +/−ppm |
| 2.12 | **G Sensitivity** | Gamma vector of all three axes from 30Hz to 1500Hz (Note 1) | | 1.0 | ppb/G |
| 2.13 | **Trimmer adjustment** | Manual adjustment using trimmer tool | 3.0 | | +/−ppm |

## 3.0 *POWER SUPPLY*

| *Line* | *Parameter* | *Test Condition* | *Min.* | *Max.* | *Units* |
|---|---|---|---|---|---|
| 3.1 | **Supply voltage** | Supply voltage range based on nominal 5V | 4.75 | 5.25 | V |
| 3.2 | **Current** | At Max. supply voltage | | 2.0 | mA |

## 4.0 *CONTROL VOLTAGE*

| *Line* | *Parameter* | *Test Condition* | *Min.* | *Max.* | *Units* |
|---|---|---|---|---|---|
| 4.1 | **Control voltage range** | Determined by supply voltage (Note 5). The nominal control voltage value is midway between the minimum and maximum. | 0.5 | 4.5 | V |
| 4.2 | **Frequency tuning** | Frequency shift from Min. to Max. control voltages (Note 6) | 6.0 | | ppm |
| 4.3 | **Frequency tuning linearity** | Deviation from straight line curve fit (Note 1) | | 20.0 | % |
| 4.4 | **Port input impedance** | | 100.0 | | K Ohms |

## 5.0 *OSCILLATOR OUTPUT*

| *Line* | *Parameter* | *Test Condition* | *Min.* | *Max.* | *Units* |
|---|---|---|---|---|---|
| 5.1 | **Output waveform** | Clipped sinewave | | | |
| 5.2 | **Output voltage level** | At min. supply voltage | 1.0 | | V |
| 5.3 | **Output load resistance** | Operating range | 18.0 | 22.0 | K Ohms |

| | | | | | |
|---|---|---|---|---|---|
| 5.4 | **Output load capacitance** | Operating range | 4.5 | 5.5 | pF |

## 6.0 *SSB PHASE NOISE*

| *Line* | *Parameter* | *Test Condition* | *Min.* | *Max.* | *Units* |
|---|---|---|---|---|---|
| | *Quiescent measurement at room temperature. Phase noise dependent on oscillator frequency. The dBc/Hz are typical values.* | | | | |
| 6.1 | **SSB Phase noise density** | 1Hz offset | | −70.0 | dBc/Hz |
| 6.2 | **SSB Phase noise density** | 10Hz offset | | −100.0 | dBc/Hz |
| 6.3 | **SSB Phase noise density** | 100Hz offset | | −130.0 | dBc/Hz |
| 6.4 | **SSB Phase noise density** | 1KHz offset | | −145.0 | dBc/Hz |
| 6.5 | **SSB Phase noise density** | 10KHz offset | | −150.0 | dBc/Hz |

## 7.0 *ENVIRONMENTAL*

*The oscillator shall meet electrical characteristics and suffer no physical damage after being subject to the following conditions:*

| | | |
|---|---|---|
| 7.1 | **Shock** | Half sinewave acceleration of 100G peak amplitude for 11ms duration, 3 cycles each plane. |
| 7.2 | **Random Vibration** | 10G RMS 30Hz to 1500Hz duration of 6 Hours. |
| 7.3 | **Humidity** | After 48hours at 85 deg C +/−2% deg C 85% relative humidity non−condensing |
| 7.4 | **Thermal shock test** | Exposed at −40 deg C for 30 minutes then to 85 deg C for 30 minutes constantly for a period of 5 days. |
| 7.5 | **Storage temperature** | −40 to 85 deg C |

## 8.0 *MARKING*

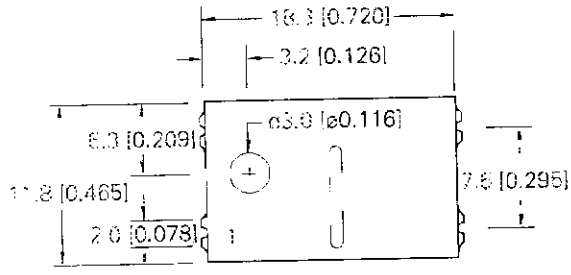
| | | |
|---|---|---|
| 8.1 | **Type** | Engrave |
| 8.2 | **Line 1** | Rakon logo |
| 8.3 | **Line 2** | Model descriptive |
| 8.4 | **Line 3** | Frequency in MHz (to 3 decimal places or greater depending on the no. of significant digits after the decimal point) |
| 8.5 | **Line 4** | Date code WWYY |

## 9.0 *MANUFACTURING INFORMATION*

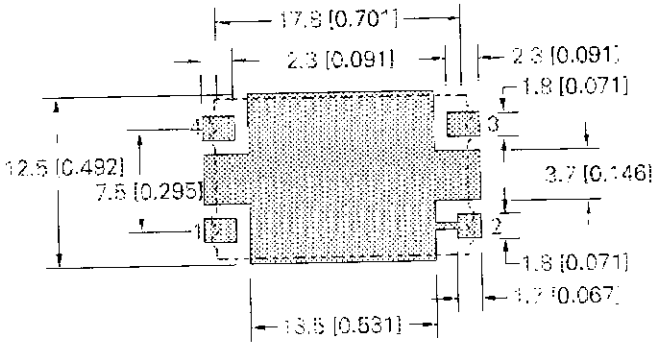
| | | |
|---|---|---|
| 9.1 | **Reflow and washing** | Able to withstand normal solder reflow processes but not aqueous washing due to presence of trimmer with open dielectric exposure. |
| 9.2 | **Packaging description** | Tape and reel |

## 10.0 *SPECIFICATION NOTES*

| | | |
|---|---|---|
| 10.1 | **Note 1** | The Max. value is the specification. A Min. value, if present, indicates the tightest specification available. |
| 10.2 | **Note 2** | A max. frequency stability over the temperature is required to be specified. For this model, values between to +/−1ppm and +/−10ppm are available. Standard options are +/−1ppm, +/−1.5ppm, +/−2ppm and +/−2.5ppm. |
| 10.3 | **Note 3** | The operating temperature range needs to be specified. The extremes for this model are −40 and +85 deg C. If either or both ends of the operating temperature range are at these extremes, then the frequency stability options are limited to greater than +/−1.5ppm. |
| 10.4 | **Note 4** | Standard power supply options are 2.7V, 3V, 3.3V, 4V or 5V, but any value between Min. & Max. is available. |
| 10.5 | **Note 5** | This range is normally 0.5V to Supply voltage less 0.5V i.e. for a supply voltage of 3V, the range is 0.5V to 2.5V. |
| 10.6 | **Note 6** | The Min value is the specification. A Max value, if present, indicates the widest tuning range available for this model (subject to other parameters). |

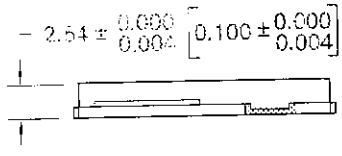



TOP VIEW

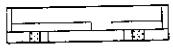



TOP VIEW
RECOMMENDED PAD LAYOUT

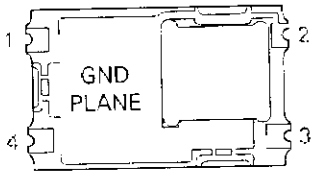
END VIEW




SIDE VIEW



END VIEW

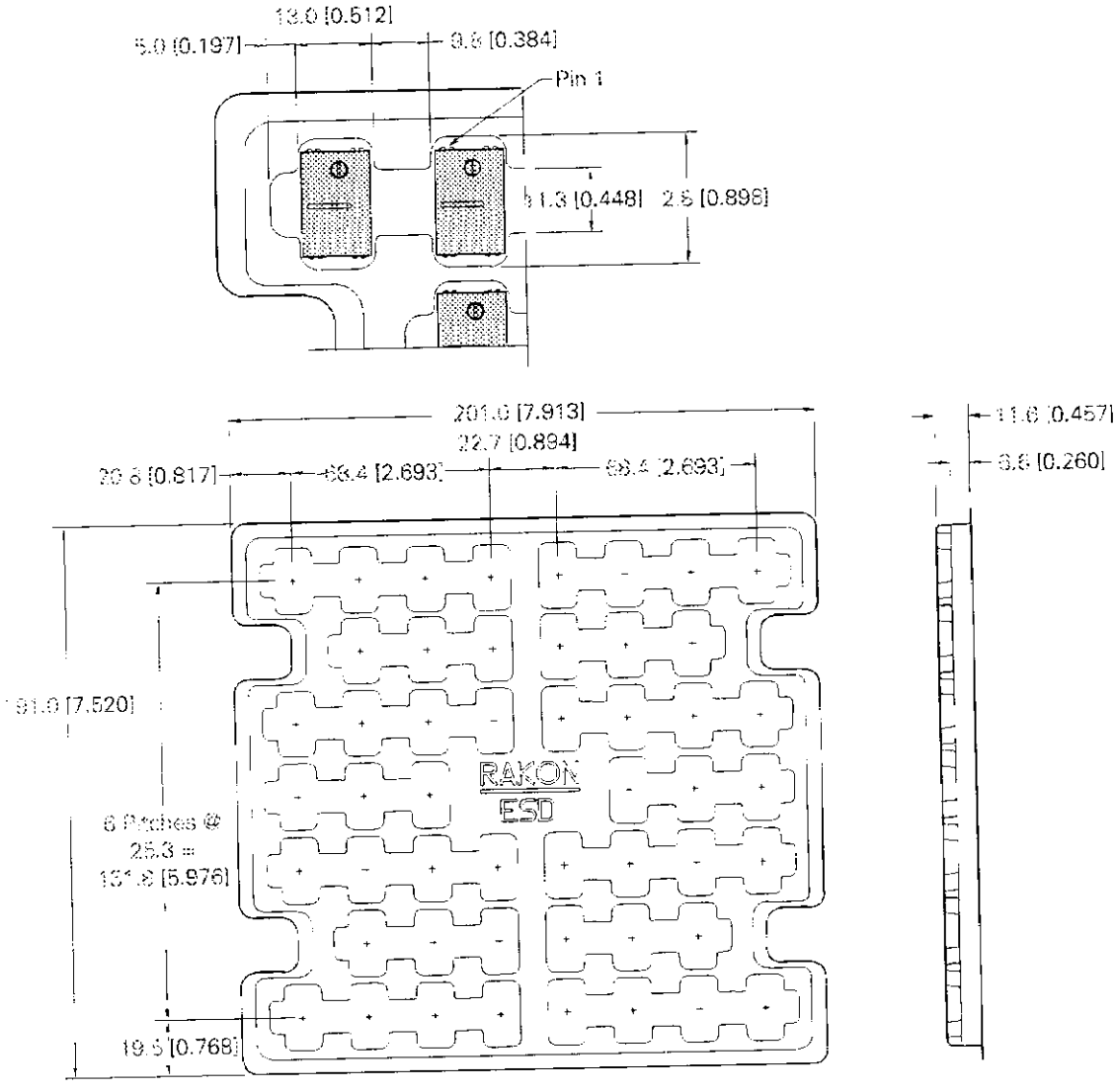



BOTTOM VIEW

| PIN CONNECTIONS | |
|---|---|
| 1 | CONTROL VOLTAGE |
| 2 | COMMON & CASE |
| 3 | OUTPUT |
| 4 | +Vcc |

Note: 1. 2.54 Max Without Label

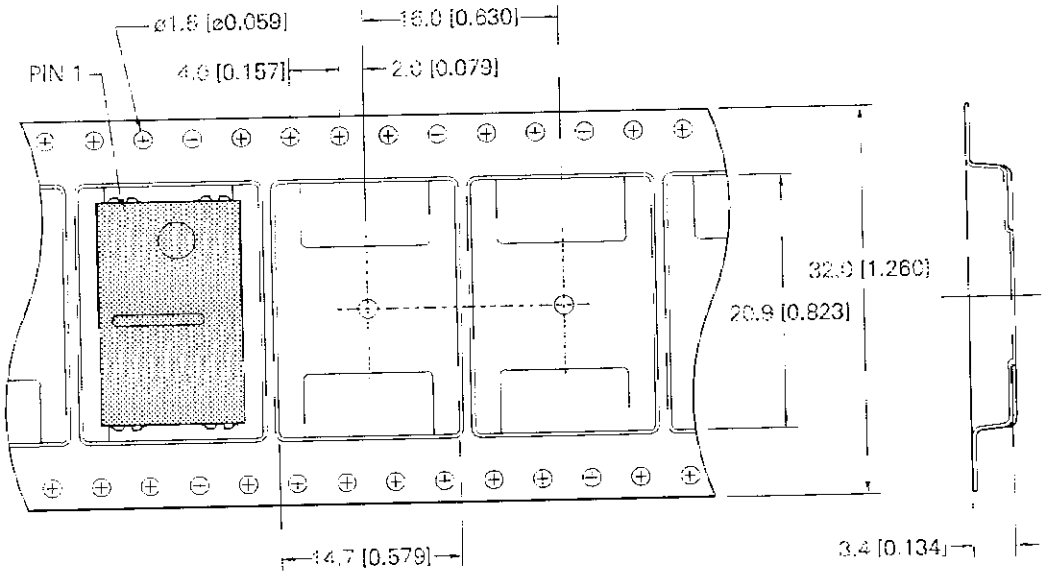
| | | | |
|---|---|---|---|
| TITLE: VTXO700 MODEL | FILENAME: CAT024 | REVISION: B | Tolerances: XX =±0.5, X.X =±0.10, X.XX =±0.05, X.XXX =±0.05, X° =±1.0°, Hole =±0.10 |
| RELATED DRAWINGS: VTXO CLIPPED SINEWAVE<br>TEST CIRCUIT (CAT135)<br>700 SERIES TRAY (CAT095) | | DATE: 27 JAN 99<br>SCALE: 2:1<br>Millimetres [inch] | RAKON PRECISION QUARTZ CRYSTALS |

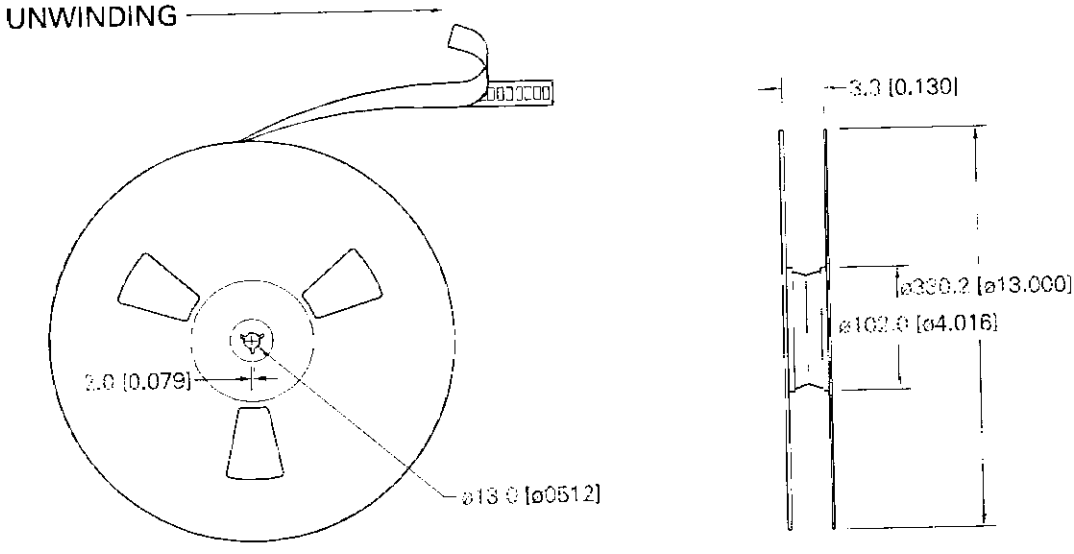



TRAY DETAIL (Scale 1:2)
50 Oscilators Per Tray
21 (20+1 top) Trays Per Small Box
4 Small Boxes Per Large Box

| | | | |
|---|---|---|---|
| TITLE: 700 SERIES TRAY | FILENAME: CAT095 | REVISION: A | |
| RELATED DRAWINGS: TXO700 MODEL (CAT017)<br>VTXO700 MODEL (CAT024) | | DATE: 24 JULY 98 | |
| | | SCALE: 1:1 | |
| | | Millimetres [inch] | |

RAKON PRECISION QUARTZ CRYSTALS

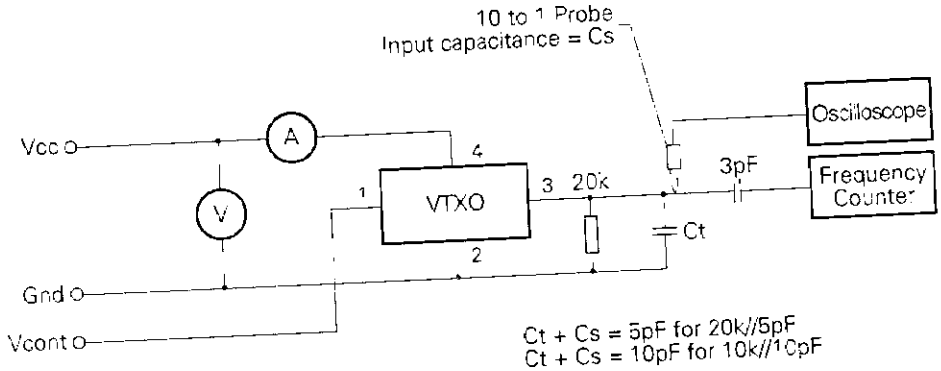



REEL DETAIL
SCALE 1:5

| | | | |
|---|---|---|---|
| TITLE: 700 TAPE & REEL | FILENAME: CAT098 | REVISION: A | Tolerances: XX =±0.5, X.X =±0.10, X.XX =±0.05, X.XXX =±0.05, X° =±1.0°, Hole =±0.10 |
| RELATED DRAWINGS: TXO700 VTXO700 | | DATE: 16 DEC 98 | |
| | | SCALE: 2:1 1:5 | |
| | | Millimetres [inch] | |

RAKON PRECISION QUARTZ CRYSTALS




| | | | |
|---|---|---|---|
| TITLE: VTXO CLIPPED SINEWAVE TEST CIRCUIT | FILENAME: CAT135 | REVISION: A | |
| RELATED DRAWINGS: VTXO400, VTXO4080, VTXO4080S, VTXO500, VTXO700 | | DATE: 3 SEPT 98 | |
| | | SCALE: NTS | |
| | | Millimetres [inch] | |

RAKON PRECISION QUARTZ CRYSTALS







MA, 01

## 5.0 List of Test Equipment

| Equipment | Manufacturer | Model | Serial # | Cal. Due |
|---|---|---|---|---|
| Spectrum Analyzer | Agilent | E7405A | US40240205 | 11/28/01 |
| Spectrum Analyzer | Tektronix | 2784 | B010153 | 12/13/01 |
| EMI Receiver Set W/RF Filter | Hewlett Packard | 85462A | 3325A00160 | 12/28/01 |
| Plotter, Digital Pen | Hewlett Packard | 7470A | 2308A23938 | # |
| Cable, SMA-SMA <18GHz | Sucoflex | 104PE | CBLSHF203 | 8/21/01 |
| Attenuator, 30 dB | Weinschel Corp. | 23-30-34 | AR6008 | 8/14/01 |
| High Frequency Horn Antenna | EMCO | 3116 | 9310-2222 | 2/04/02 |
| Horn Antenna | EMCO | 3115 | 9610-4980 | 11/01/01 |
| Antenna | EMCO | 3142 | 9701-1116 | 7/18/01 |
| MW Cable (DC-40GHz) 24" | Astrolab | 32029-2-2909K-24TC | CBL049 | 8/17/01 |
| MW Cable (DC-40GHz) 48" | Astrolab | 32029-2-2909K-48TC | CBL050 | 8/17/01 |
| Cable, BNC/BNC | Alpha | RG58B/U | CBL110E | 9/10/01 |
| LISN, 50uH, .01-50MHz, 24A | Solar Electronics | 9252-50-R-24-BNC | 941712 | 5/02/02 |
| Attenuator, 20 dB | Mini Circuits | 20 dB, 50 Ohm | DS25A | 8/14/01 |
| Peak Power Meter | Hewlett Packard | 8900D | 3607U00673 | 7/31/01 |
| Peak Power Sensor | Hewlett Packard | 84811A | 3318A05091 | 8/01/01 |

# Calibration is not required