ITS Intertek Testing Services

FCC Part 15.247 Test Report
for
Western Multiplex Corporation
on the
Tsunami
Model: 31145
FCC ID: HZB-S58-12

Test Report #: J99022866a
Date of Report: October 4, 1999

Job #: J99022866
Date of Test: September 7-13, 1999

Total No. of Pages Contained in this Report: 20 + data pages

NVLAP®

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Table of Contents

1.0 Summary of Tests

MODEL: 31145
FCC ID: HZB-S58-12

TEST	REFERENCE	RESULTS
Max. Output power	15.247(b)	Pass
6 dB Bandwidth	15.247(a)(2)	Pass
Max. Power Density	15.247(d)	Pass
Out of Band Antenna Conducted Emission	15.247(c)	Pass
Out of Band Radiated Emission	15.247(c)	Not Applicable
Radiated Emission in Restricted Bands	15.35(b)(c)	Pass
AC Conducted Emission	15.207	Pass
Radiated Emission from Digital Part	15.109	Pass
Radiated Emission from Receiver L.O.	15.109	Not Applicable
Processing Gain Measurements	15.247(e)	Provided by applicant
Antenna Requirement	15.203	Pass

Test Engineer: Xi-Ming Yang Date: 10-4-99
Xi-Ming Yang
Test Engineer

EMC Site Manager: David Chernomordik Date: 10/4/99
David Chernomordik, Ph.D.
EMC Site Manager

2.0 General Description

2.1 Product Description

The Tsunami is a 5.8 GHz spread spectrum 10BaseT wireless ethernet bridge. It provides point-to-point data link and wayside T1/E1 channels.

A pre-production version of the sample was received on September 7, 1999 in good condition.

Overview of Tsunami

Applicant	Western Multiplex Corporation
Trade Name & Model No.	Western Multiplex Corporation / 31145
FCC Identifier	HZB-S58-12
Use of Product	Point to point data link and wayside T1/E1 channels.
Manufacturer & Model of Spread Spectrum Module	Western Multiplex Corporation
Type of Transmission	Direct Sequence Spread Spectrum
Rated RF Output (mW)	0.22
Frequency Range (MHz)	5725-5850
Number of Channel(s)	4
Antenna(s) & Gain, dBi	29
Processing Gain Measurements	[X] Provided to ITS for submission with the application [ ] Will be provided directly to the FCC reviewing engineer by the client or manufacturer of the spread spectrum module
Antenna Requirement	[ ] The EUT uses a permanently connected antenna. [ ] 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. [X] The EUT requires professional installation (attach supporting documentation if using this option).
Manufacturer name & address	Western Multiplex Corporation 1196 Borregas Ave. Sunnyvale CA 94089

2.2 Related Submittal(s) Grants

Not applicable

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 **"Data Sheet"** of this Application. All other measurements were made in accordance with the procedures in part 2 of CFR 47.

2.4 Test Facility

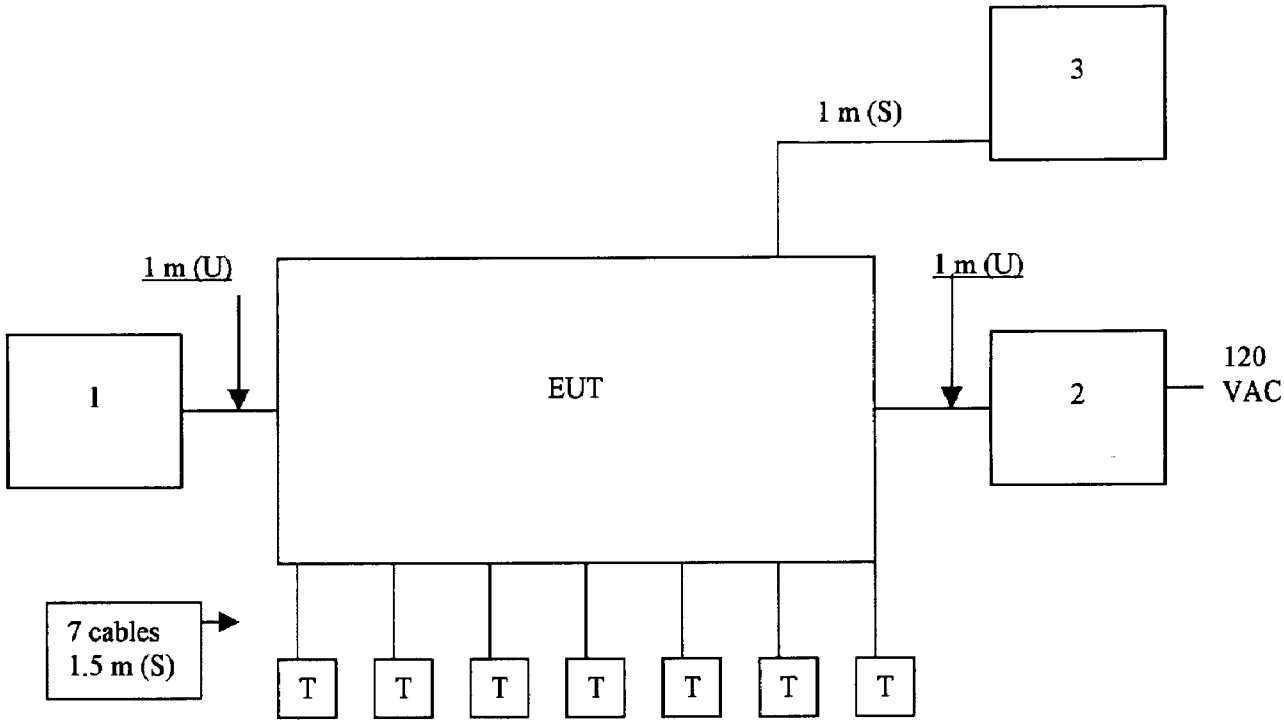
The open area test site and conducted measurement facility used to collect the radiated data is site 1. This test facility and site measurement data have been fully placed on file with the FCC and NVLAP accredited.

3.0 System Test Configuration

3.1 Support Equipment and description

Item #	Description	Model No.	Serial No.
1	Meridian telephone	M7100	960717
2	Extech power supply	EP-3003	D30030012
3	Comsat antennas	P-57C2414-1	129415

3.2 Block Diagram of Test Setup



* = EUT	S = Shielded;	F = With Ferrite
** = No ferrites on video cable	U = Unshielded	

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.

For radiated emission measurements, the EUT is attached to a cardboard box (if necessary) and placed on the wooden turntable. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). The EUT is wired to transmit full power.

The signal is maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

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

3.4 Software Exercise Program

No special software was used during the tests.

3.5 Mode of Operation During Test

The EUT was tested in transmit and receive modes.

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 Western Multiplex Corporation prior to compliance testing):

No modifications were installed by Intertek Testing Services.

3.7 Additions, deviations and exclusions from standards

No additions, exclusions, or deviations were made to the standard.

4.0 Measurement Results

4.1 Maximum Conducted Output Power at Antenna Terminals, FCC Rules 15.247(b):

Requirements:
The maximum peak output power shall not exceed 1 Watt. Systems operating in the 5725-5850 MHz band, used exclusively for fixed, point-to-point operations, may employ transmitting antenna with directional gain greater than 6 dB without any corresponding reduction in transmitting peak output power.

[X] The antenna port of the EUT was connected to the input of a power meter. Power was read directly and cable loss correction was added to the reading to obtain power at the EUT antenna terminals.

[ ] The antenna port of the EUT was connected to the input of a spectrum analyzer. The analyzer was set for maximum RES BW and power was read directly in dBm. External attenuation and cable loss were compensated for using the OFFSET function of the analyzer.

Max. antenna gain =29 dB		
Frequency (MHz)	**Output in dBm**	**Output in mWatt**
5741	23.0	200
5803	23.3	214
5834	23.2	209

Cable loss: __0__ dB External Attenuation: __0__ dB

Cable loss, external attenuation: [X] included in OFFSET function
[ ]added to SA raw reading

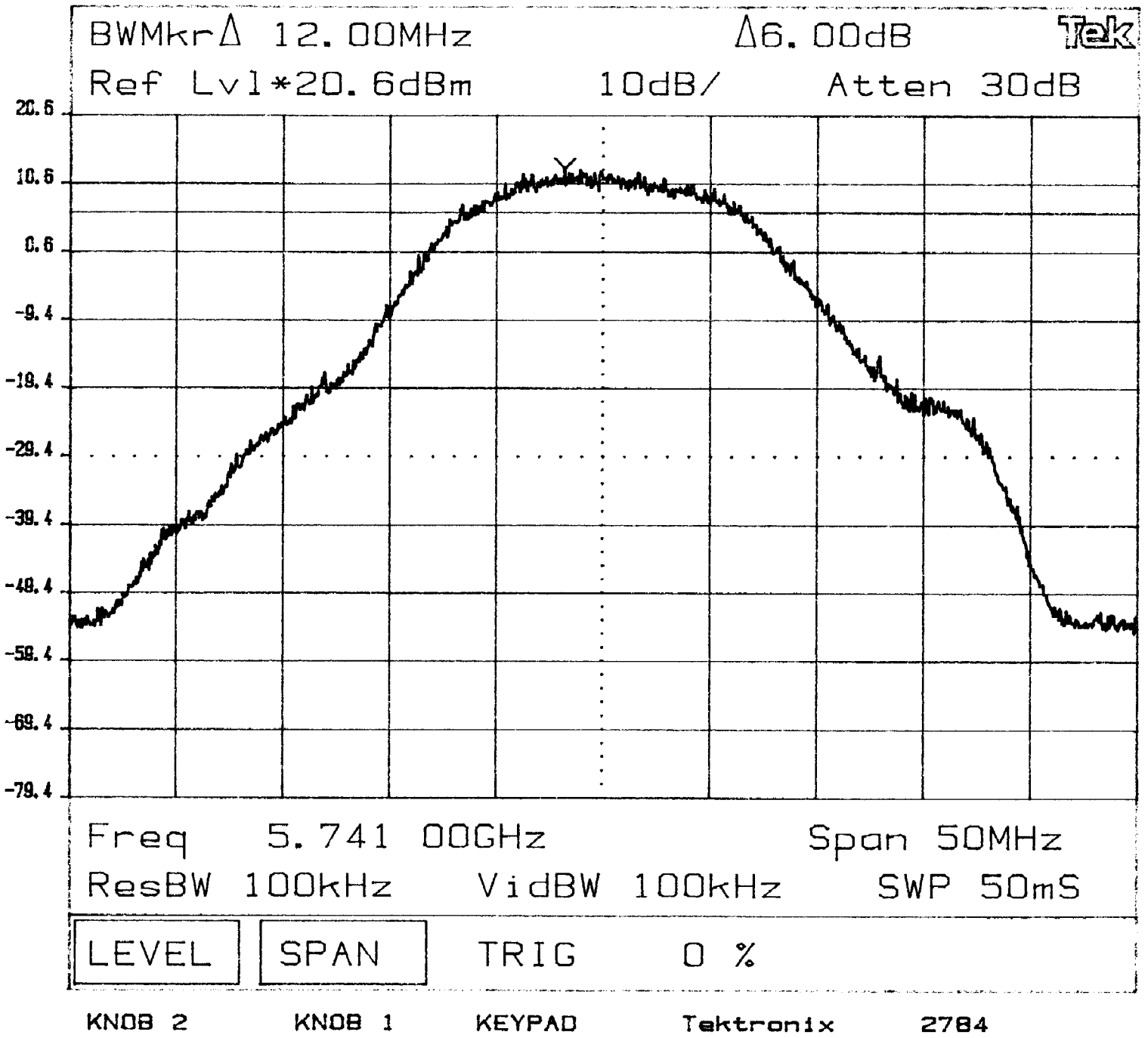
4.2 Minimum 6 dB RF Bandwidth, FCC Rule 15.247(a)(2):

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

Frequency (MHz)	Min. 6 dB Bandwidth (kHz)
5777.4	11200

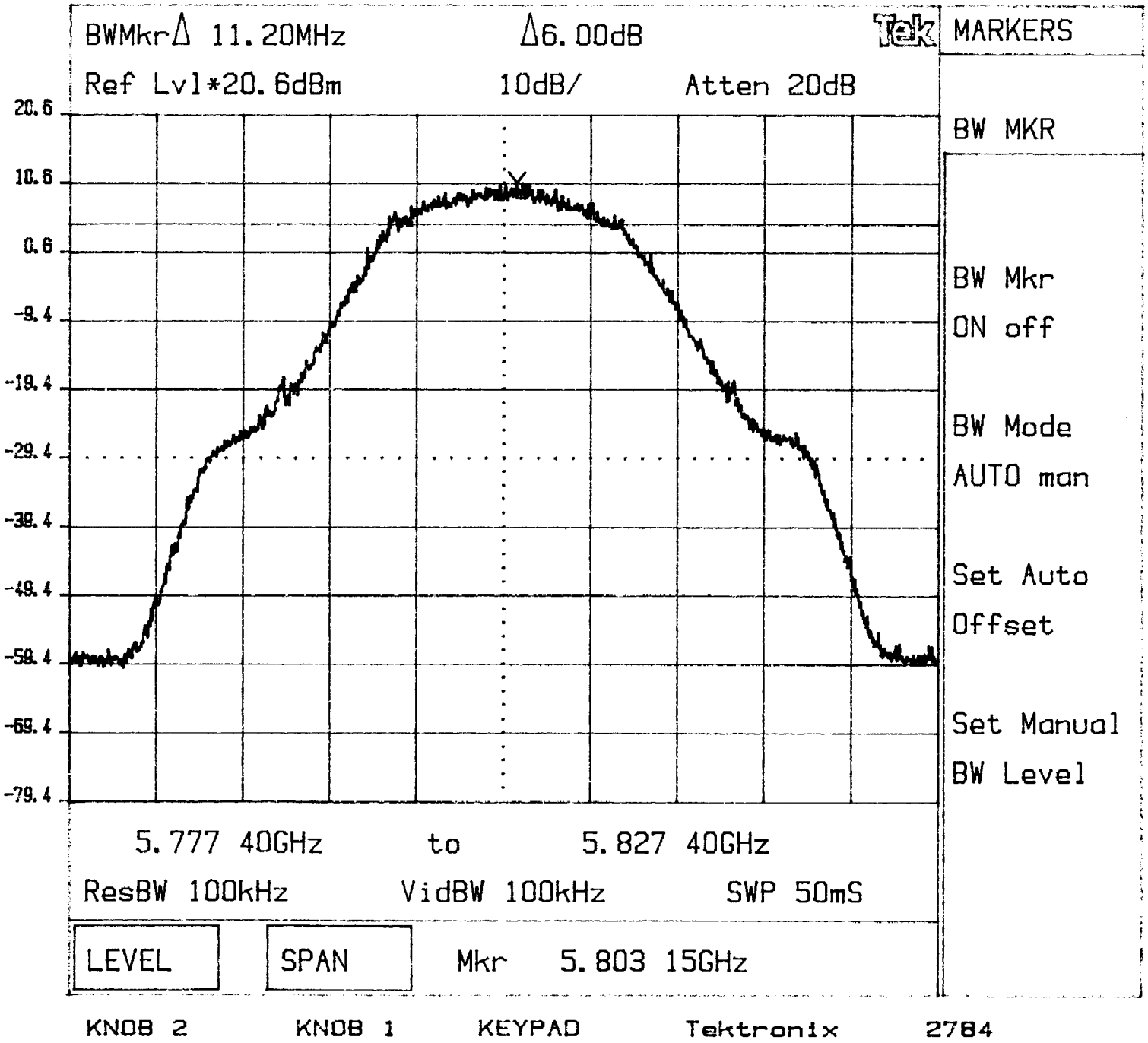
Refer to the following plots for 6 dB bandwidth sharp:

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

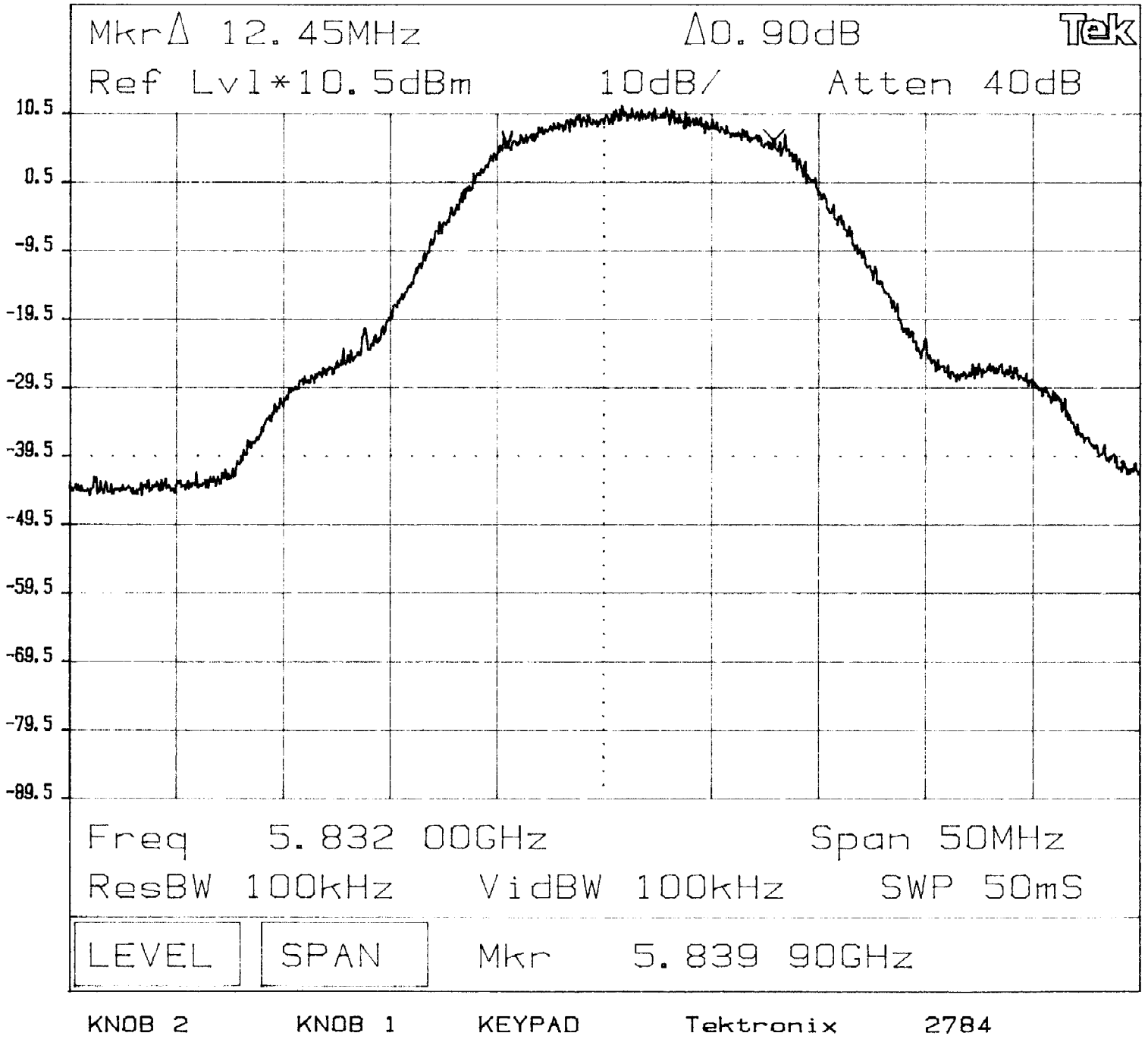

BWMkrΔ 12.00MHz
Δ6.00dB
Tek
Ref Lvl*20.6dBm
10dB/
Atten 30dB
20.6
10.6
0.6
-9.4
-19.4
-29.4
-39.4
-49.4
-59.4
-69.4
-79.4
Freq 5.741 00GHz
Span 50MHz
ResBW 100kHz
VidBW 100kHz
SWP 50mS
LEVEL
SPAN
TRIG
0 %
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

Plot 2.a

- b


BWMkrΔ 11.20MHz
Δ6.00dB
Tek
MARKERS
Ref Lvl*20.6dBm
10dB/
Atten 20dB
20.6
10.6
0.6
-9.4
-19.4
-29.4
-39.4
-49.4
-59.4
-69.4
-79.4
BW MKR
BW Mkr
ON off
BW Mode
AUTO man
Set Auto
Offset
Set Manual
BW Level
5.777 40GHz
to
5.827 40GHz
ResBW 100kHz
VidBW 100kHz
SWP 50mS
LEVEL
SPAN
Mkr 5.803 15GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

Plot 26


MkrΔ 12.45MHz
ΔO.90dB
Tek
Ref Lvl*10.5dBm
10dB/
Atten 40dB
10.5
0.5
-9.5
-19.5
-29.5
-39.5
-49.5
-59.5
-69.5
-79.5
-89.5
Freq 5.832 00GHz
Span 50MHz
ResBW 100kHz
VidBW 100kHz
SWP 50mS
LEVEL
SPAN
Mkr 5.839 90GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

Plot 2c

4.3 Maximum Power Density Reading, FCC Rule 15.247(d):

The spectrum analyzer RES BW was set to 3 kHz. The START and STOP frequencies were set to the band edges of the maximum output passband. If there is no clear maximum amplitude in any given portion of the band, it may be necessary to make measurements at a number of bands defined by several START and STOP frequency pairs. The specification calls for a 1 second interval at each 3 kHz bandwidth; total SWEEP TIME is calculated as follows:

SWEEP TIME (SEC) = (Fstop, kHz - Fstart, kHz)/3 kHz

Antenna output of the EUT was coupled directly to spectrum analyzer; if an external attenuator and/or cable was used, these losses are compensated for with the analyzer OFFSET function.

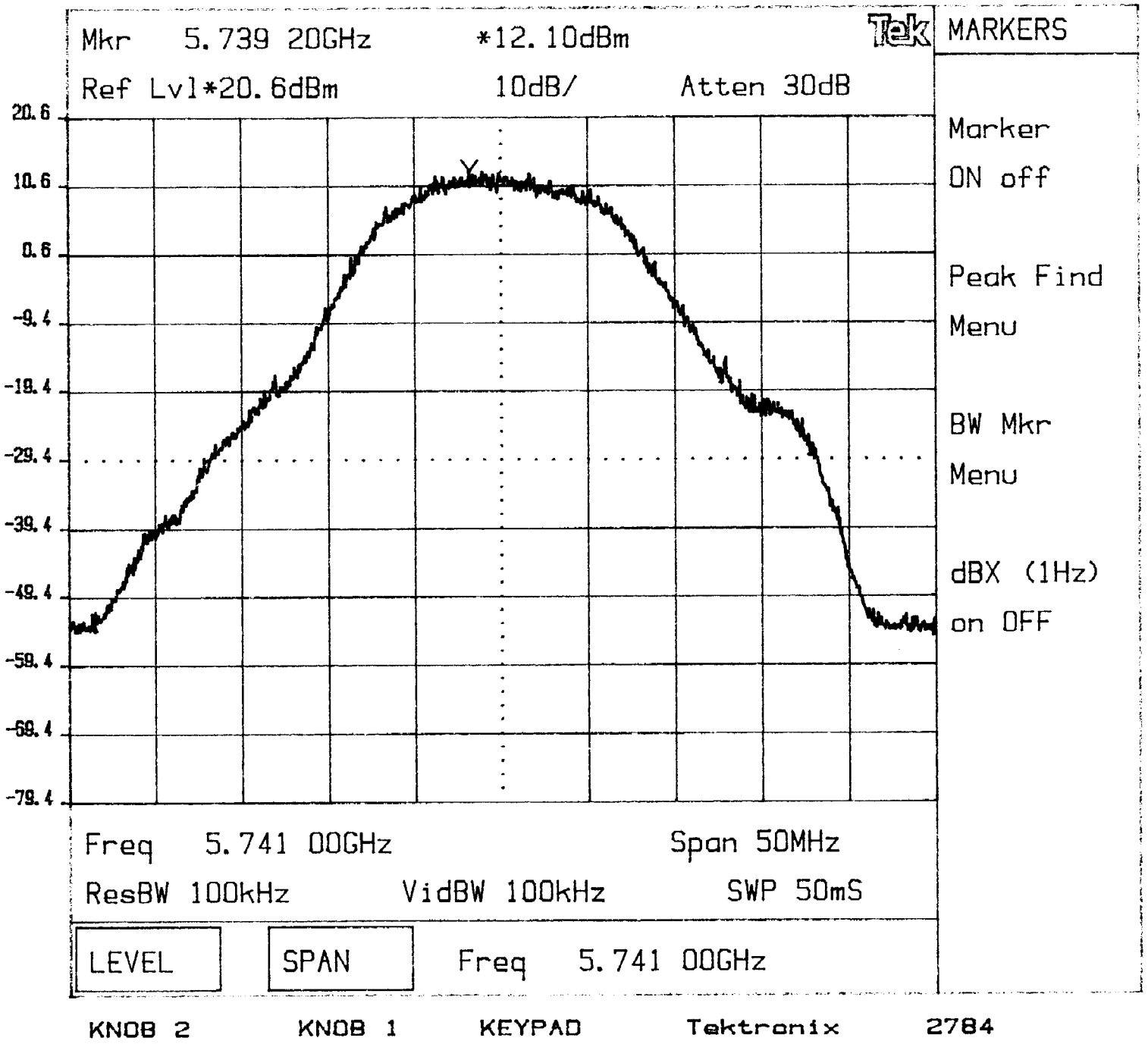
Frequency (MHz)	Power Density (dBm)
5834	-2.4

Frequency Span = 600 kHz

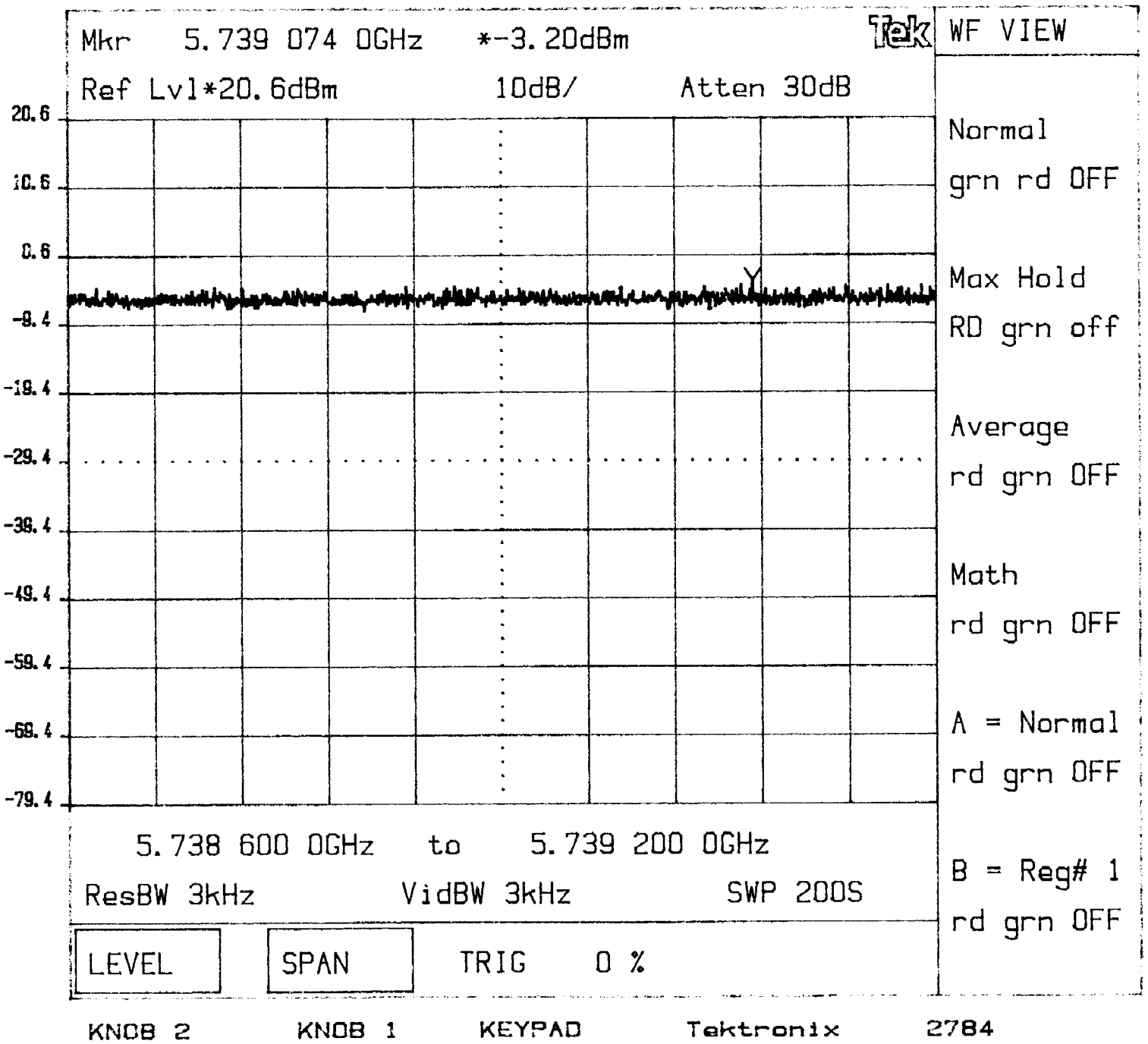
Sweep Time = Frequency Span/3 kHz
= 200 seconds

Refer to the following plots for power density data:

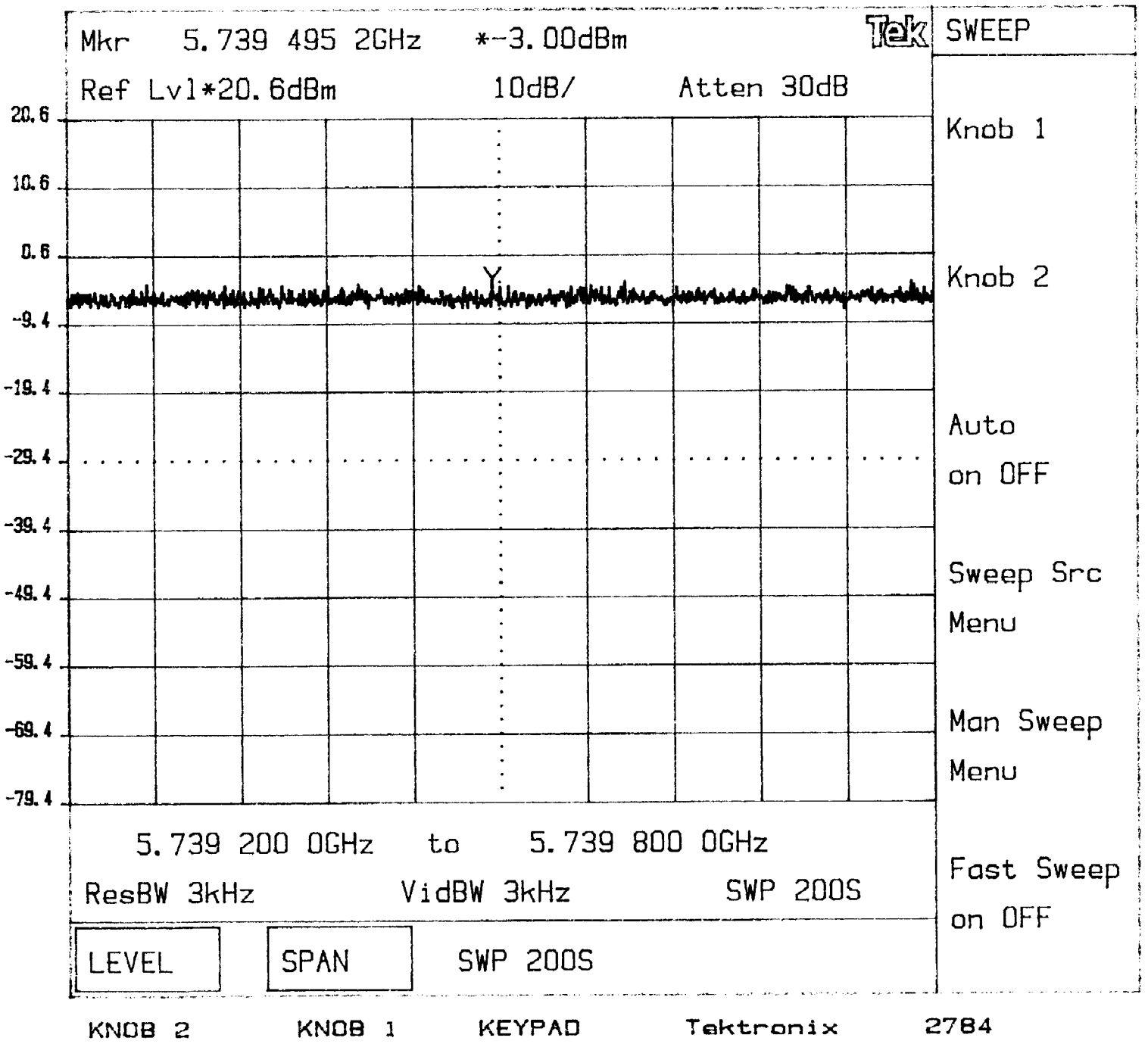
Plot 3a.1-3a.3: Low Channel Power Density
Plot 3b.1-3b.3: Middle Channel Power Density
Plot 3c.1-3c.3: High Channel Power Density


Mkr 5.739 20GHz *12.10dBm
Tek
MARKERS
Ref Lvl*20.6dBm 10dB/ Atten 30dB
20.6
10.6
0.6
-9.4
-19.4
-29.4
-39.4
-49.4
-59.4
-69.4
-79.4
Marker
ON off
Peak Find
Menu
BW Mkr
Menu
dBX (1Hz)
on OFF
Freq 5.741 00GHz
Span 50MHz
ResBW 100kHz
VidBW 100kHz
SWP 50mS
LEVEL
SPAN
Freq 5.741 00GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

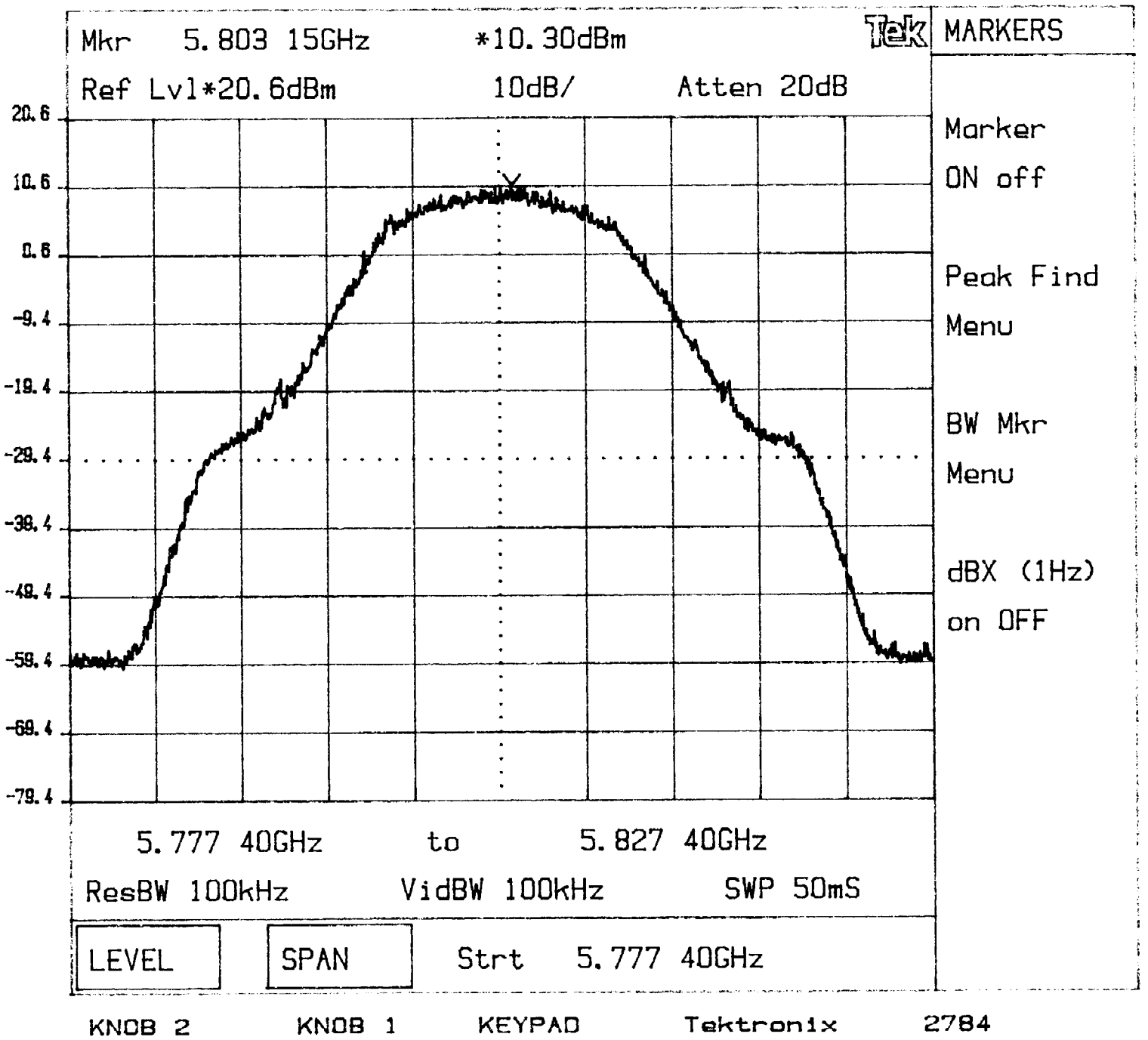
Plot 3.21


Mkr 5.739 074 0GHz *-3.20dBm
Tek
WF VIEW
Ref Lvl*20.6dBm 10dB/ Atten 30dB
20.6
10.6
0.6
-9.4
-19.4
-29.4
-39.4
-49.4
-59.4
-69.4
-79.4
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
5.738 600 0GHz to 5.739 200 0GHz
ResBW 3kHz VidBW 3kHz SWP 200S
LEVEL
SPAN
TRIG 0 %
KNOB 2 KNOB 1 KEYPAD Tektronix 2784

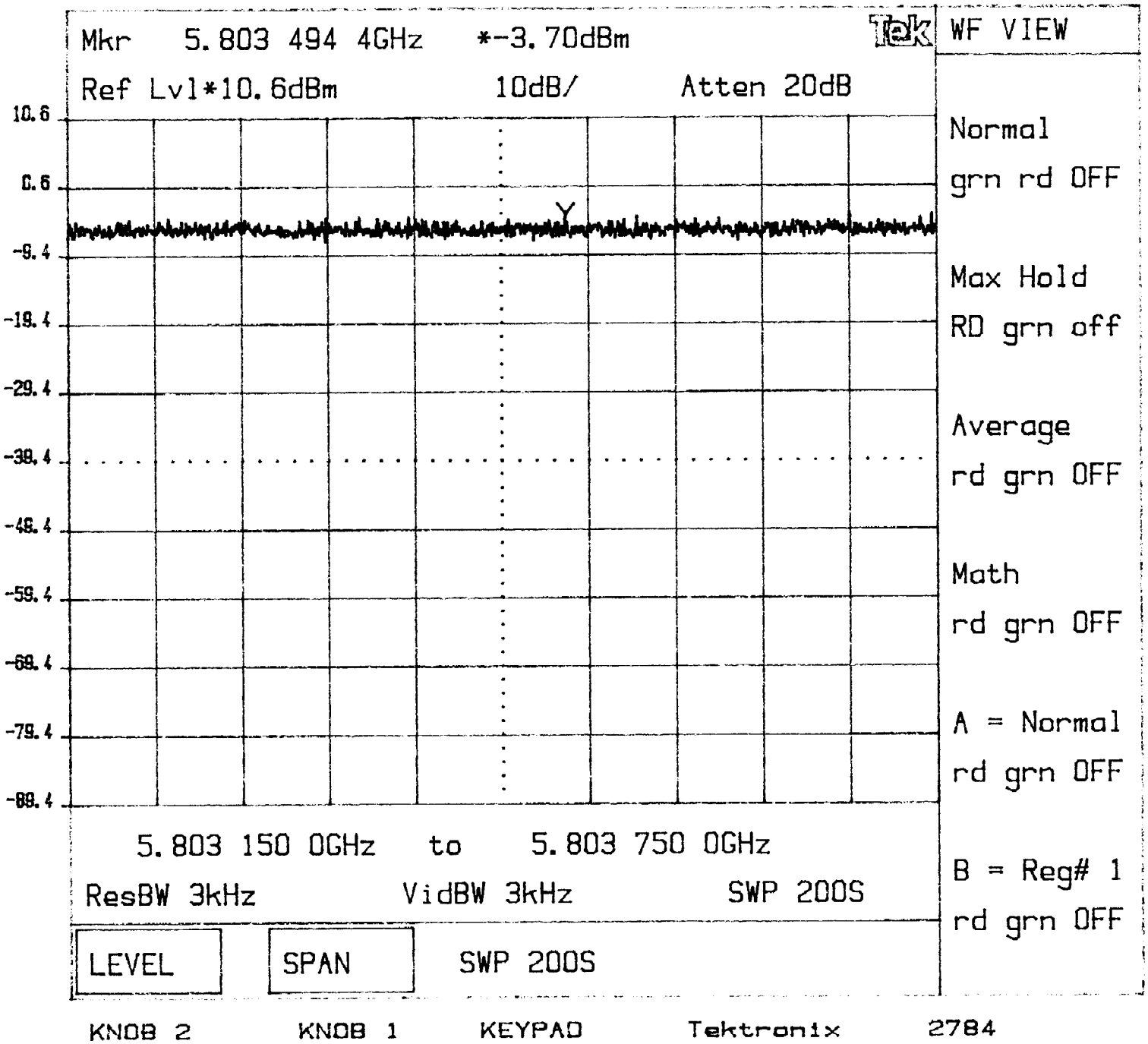
Plot 3.22


Mkr 5.739 495 2GHz *-3.00dBm
Tek
SWEEP
Ref Lvl*20.6dBm 10dB/ Atten 30dB
20.6
10.6
0.6
-9.4
-19.4
-29.4
-39.4
-49.4
-59.4
-69.4
-79.4
Knob 1
Knob 2
Auto
on OFF
Sweep Src
Menu
Man Sweep
Menu
5.739 200 0GHz to 5.739 800 0GHz
ResBW 3kHz VidBW 3kHz SWP 200S
Fast Sweep
on OFF
LEVEL
SPAN
SWP 200S
KNOB 2 KNOB 1 KEYPAD Tektronix 2784

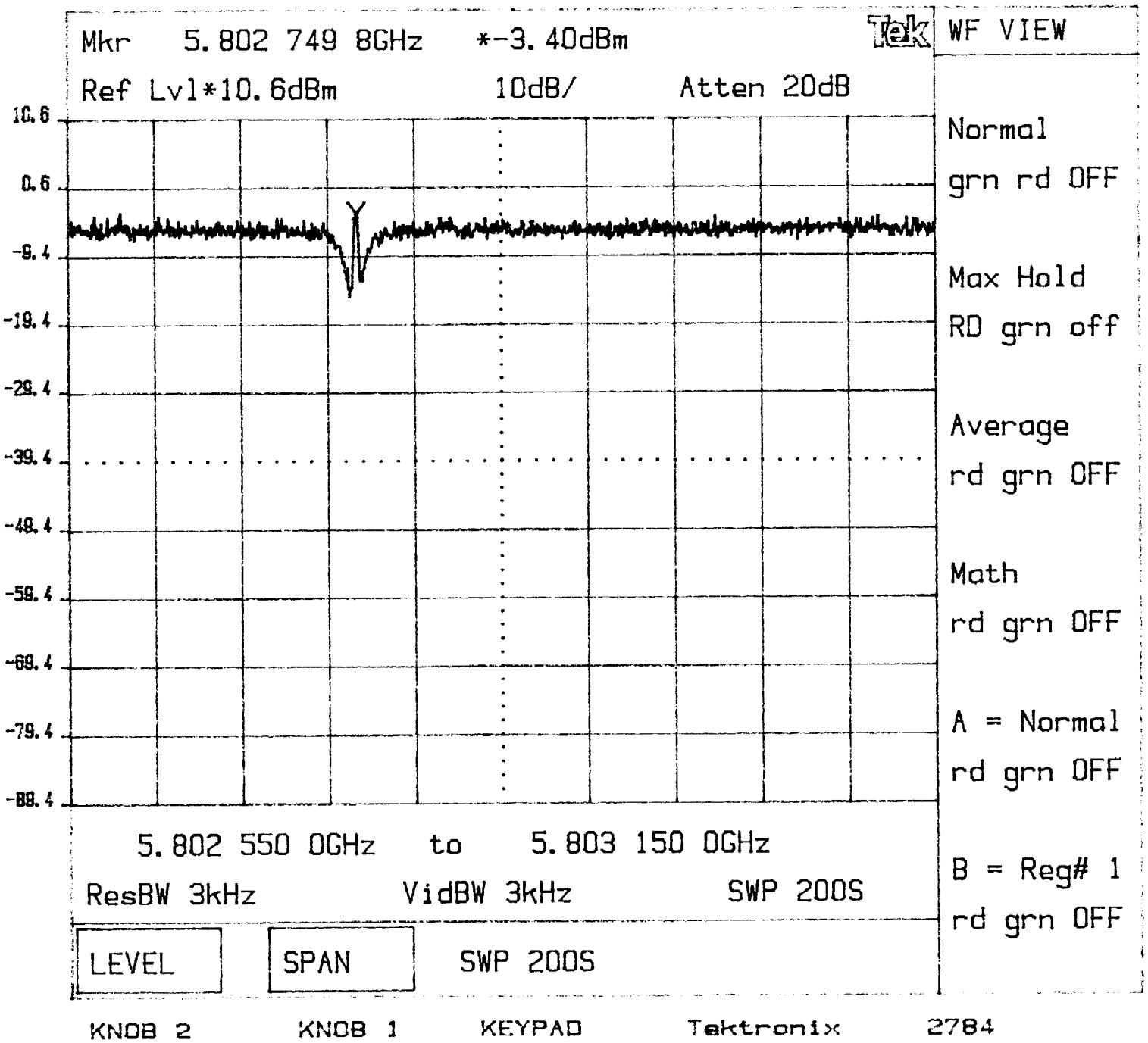
Plot 3.23


Mkr 5.803 15GHz *10.30dBm
Ref Lvl*20.6dBm 10dB/ Atten 20dB
20.6
10.6
0.6
-9.4
-19.4
-29.4
-39.4
-49.4
-59.4
-69.4
-79.4
5.777 40GHz to 5.827 40GHz
ResBW 100kHz VidBW 100kHz SWP 50mS
LEVEL
SPAN
Strt 5.777 40GHz
MARKERS
Marker
ON off
Peak Find
Menu
BW Mkr
Menu
dBX (1Hz)
on OFF
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

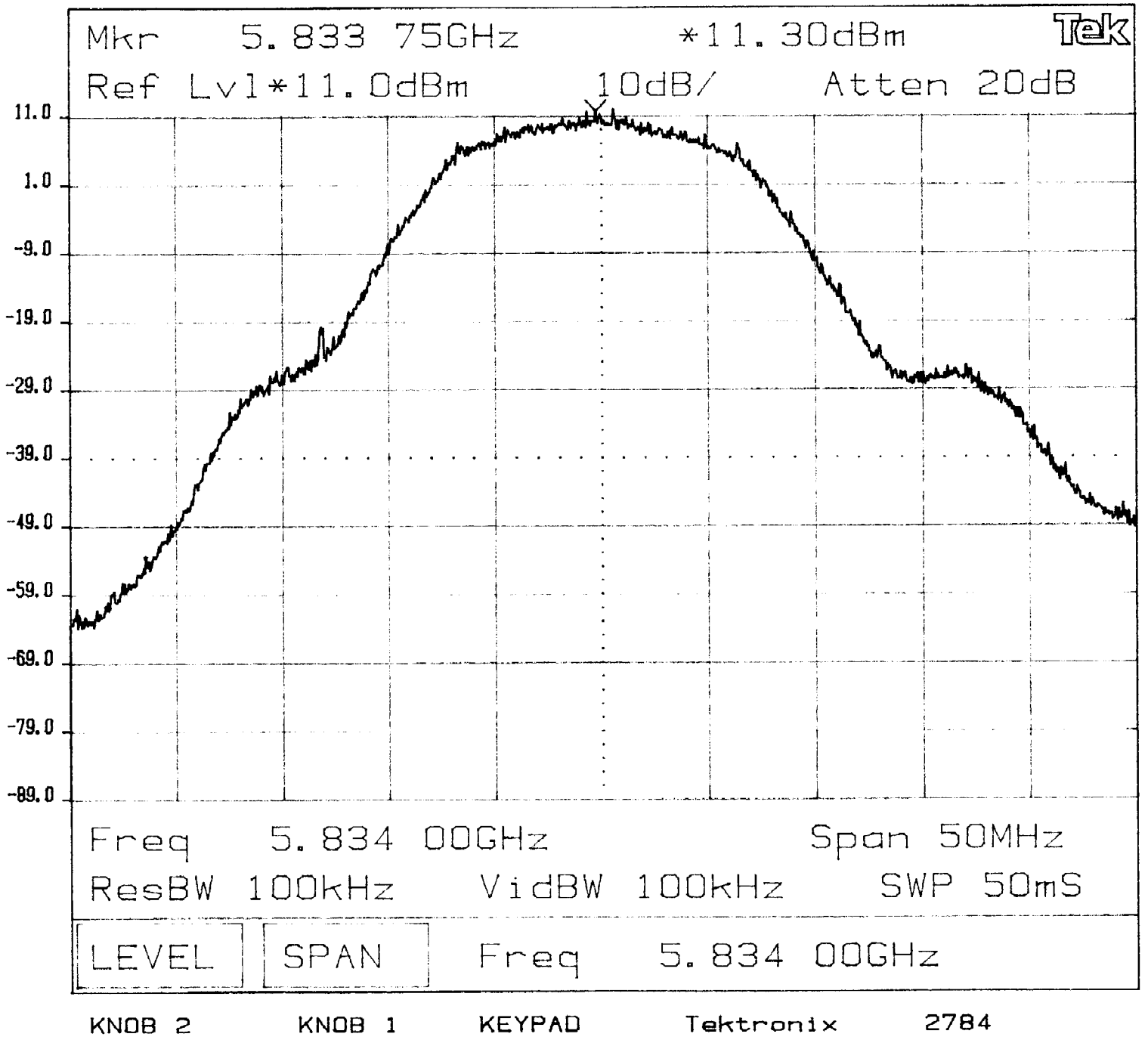
Plot 3.6.1


Mkr 5.803 494 4GHz *-3.70dBm
Ref Lvl*10.6dBm 10dB/ Atten 20dB
10.6
0.6
-9.4
-19.4
-29.4
-39.4
-49.4
-59.4
-69.4
-79.4
-89.4
5.803 150 0GHz to 5.803 750 0GHz
ResBW 3kHz VidBW 3kHz SWP 200S
LEVEL
SPAN
SWP 200S
WF VIEW
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
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

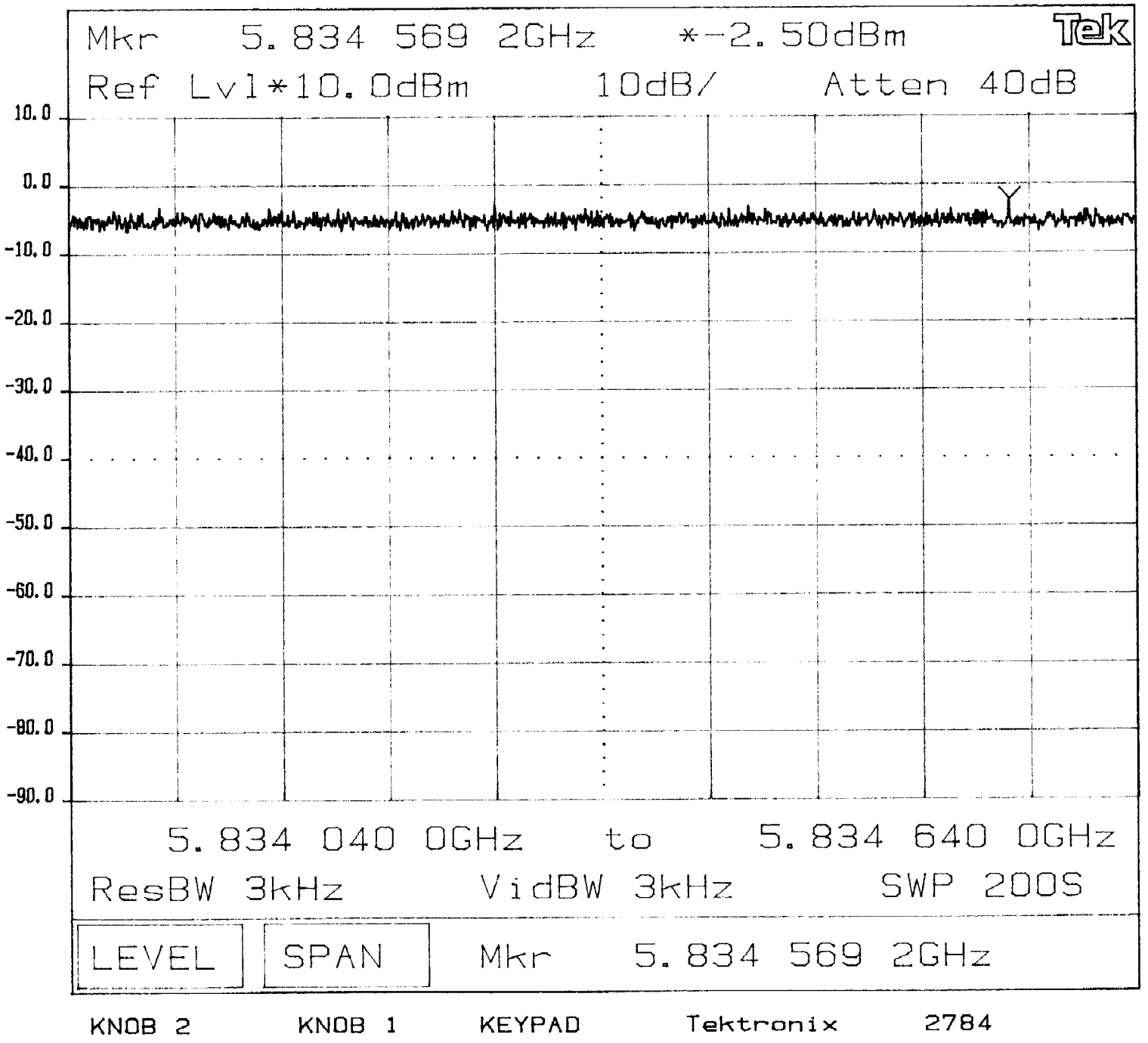
Plot 3, b. 2


Mkr 5.802 749 8GHz *-3.40dBm
Ref Lvl*10.6dBm 10dB/ Atten 20dB
10.6
0.6
-9.4
-19.4
-29.4
-39.4
-49.4
-59.4
-69.4
-79.4
-89.4
5.802 550 0GHz to 5.803 150 0GHz
ResBW 3kHz VidBW 3kHz SWP 200S
LEVEL
SPAN
SWP 200S
WF VIEW
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
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

Plot 3.b.3


Mkr 5.833 75GHz *11.30dBm
Tek
Ref Lvl *11.0dBm 10dB/ Atten 20dB
11.0
1.0
-9.0
-19.0
-29.0
-39.0
-49.0
-59.0
-69.0
-79.0
-89.0
Freq 5.834 00GHz
Span 50MHz
ResBW 100kHz
VidBW 100kHz
SWP 50mS
LEVEL
SPAN
Freq 5.834 00GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

Plot 3.c1


Mkr 5.834 569 2GHz *-2.50dBm
Tek
Ref Lvl*10.0dBm 10dB/ Atten 40dB
10.0
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
5.834 040 0GHz to 5.834 640 0GHz
ResBW 3kHz VidBW 3kHz SWP 200S
LEVEL
SPAN
Mkr 5.834 569 2GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
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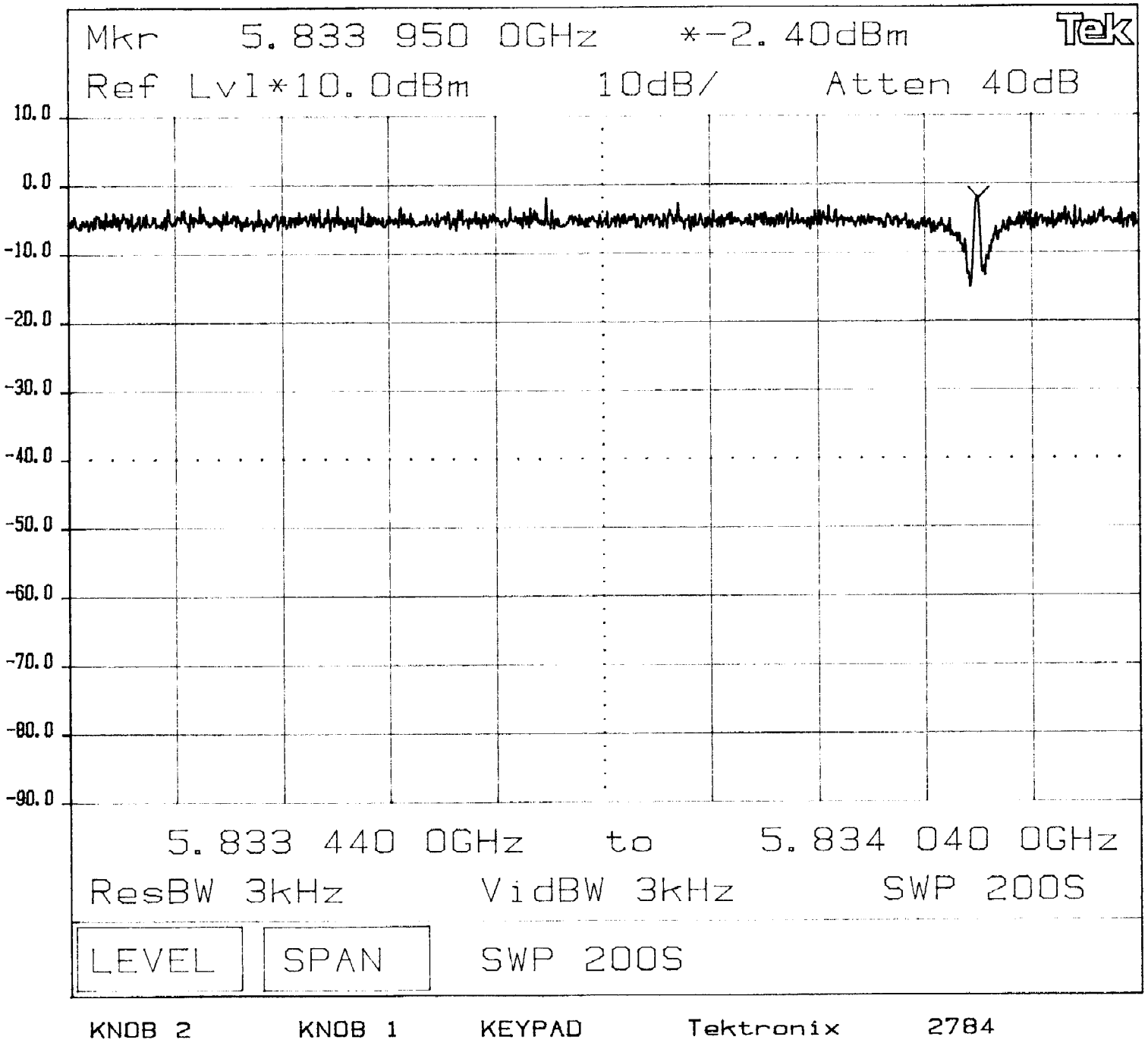
Plot 3c2


Mkr 5.833 950 0GHz *-2.40dBm
Tek
Ref Lvl*10.0dBm 10dB/ Atten 40dB
10.0
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
5.833 440 0GHz to 5.834 040 0GHz
ResBW 3kHz VidBW 3kHz SWP 200S
LEVEL
SPAN
SWP 200S
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

Plot 3.c 3

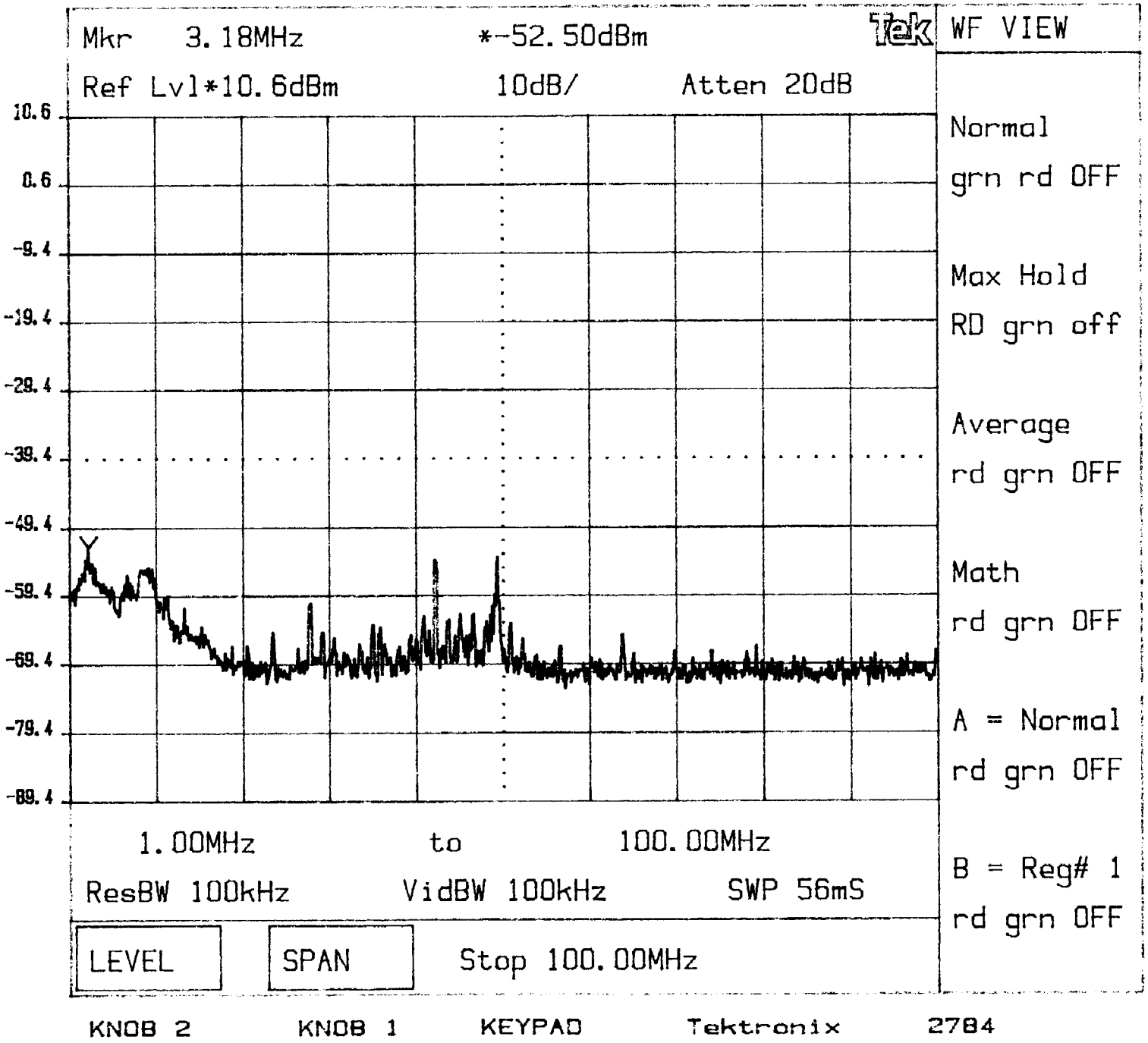
4.4 Out of Band Conducted Emissions, FCC Rule 15.247(c):

In any 100 kHz bandwidth outside the EUT passband, the RF power produced by the modulation products of the spreading sequence, the information sequence, and the carrier frequency shall be at least 20 dB below that of the maximum in-band 100 kHz emission, or else shall meet the general limits for radiated emissions at frequencies outside the passband, whichever results in lower attenuation.

All other types of emissions from the EUT shall meet the general limits for radiated frequencies outside the passband.

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

Plot 4a.1 - 4a.5: Low Channel Emissions
Plot 4b.1 - 4b.4: Middle Channel Emissions
Plot 4c.1 - 4c.7: High Channel Emissions


Mkr 3.18MHz
*-52.50dBm
Tek
WF VIEW
Ref Lvl*10.6dBm
10dB/
Atten 20dB
10.6
0.6
-9.4
-19.4
-29.4
-39.4
-49.4
-59.4
-69.4
-79.4
-89.4
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
1.00MHz
to
100.00MHz
ResBW 100kHz
VidBW 100kHz
SWP 56mS
LEVEL
SPAN
Stop 100.00MHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
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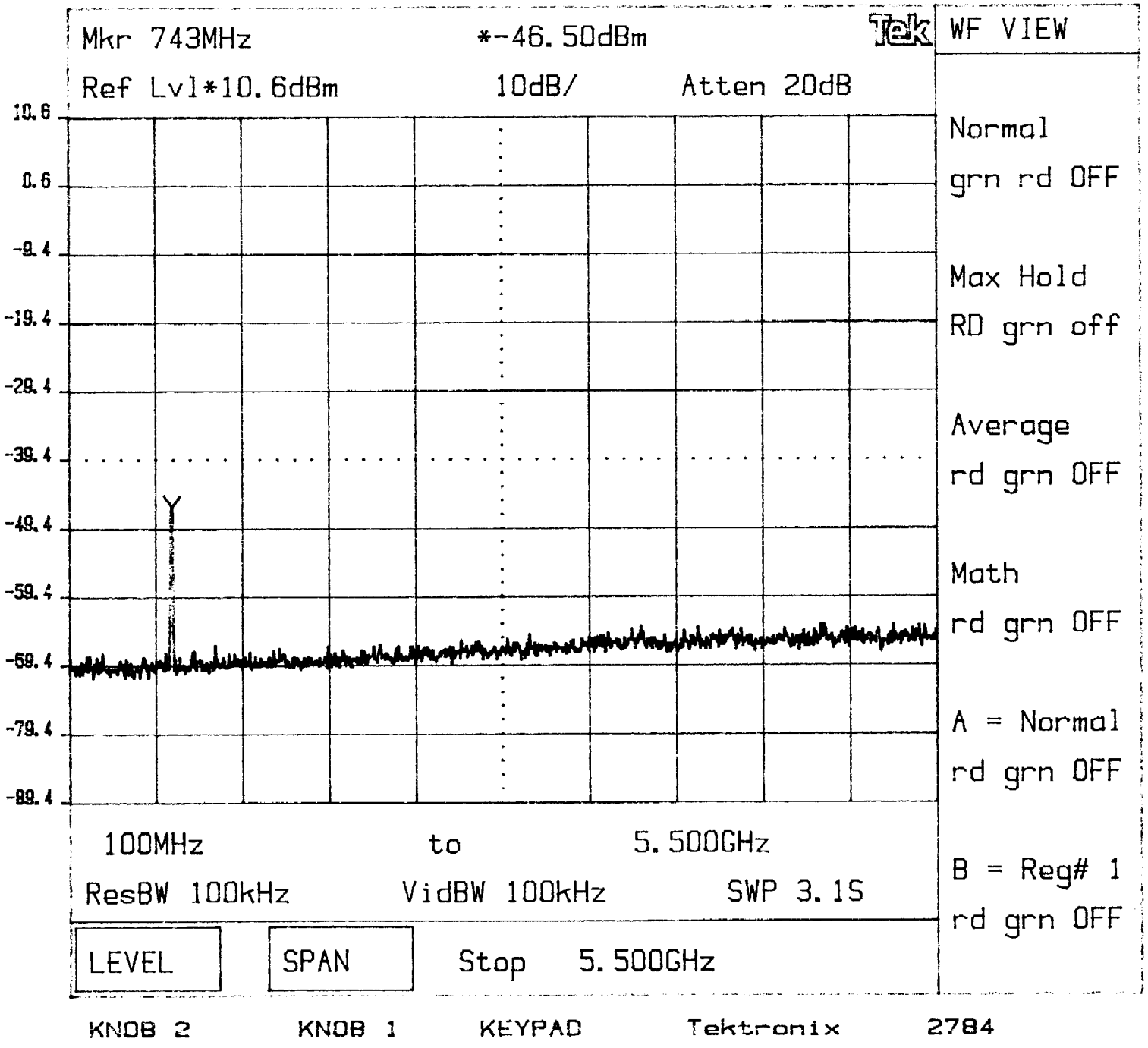
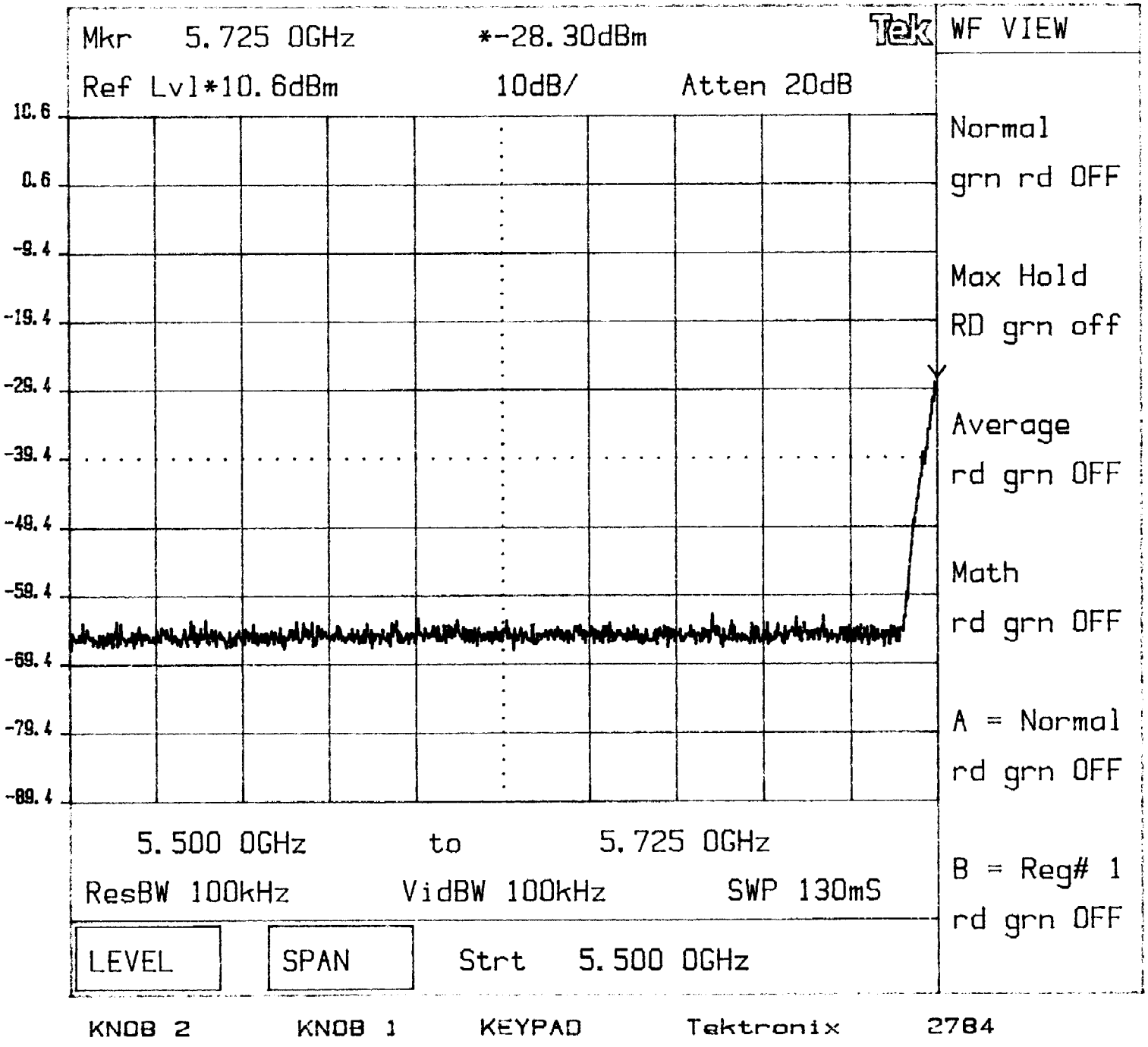
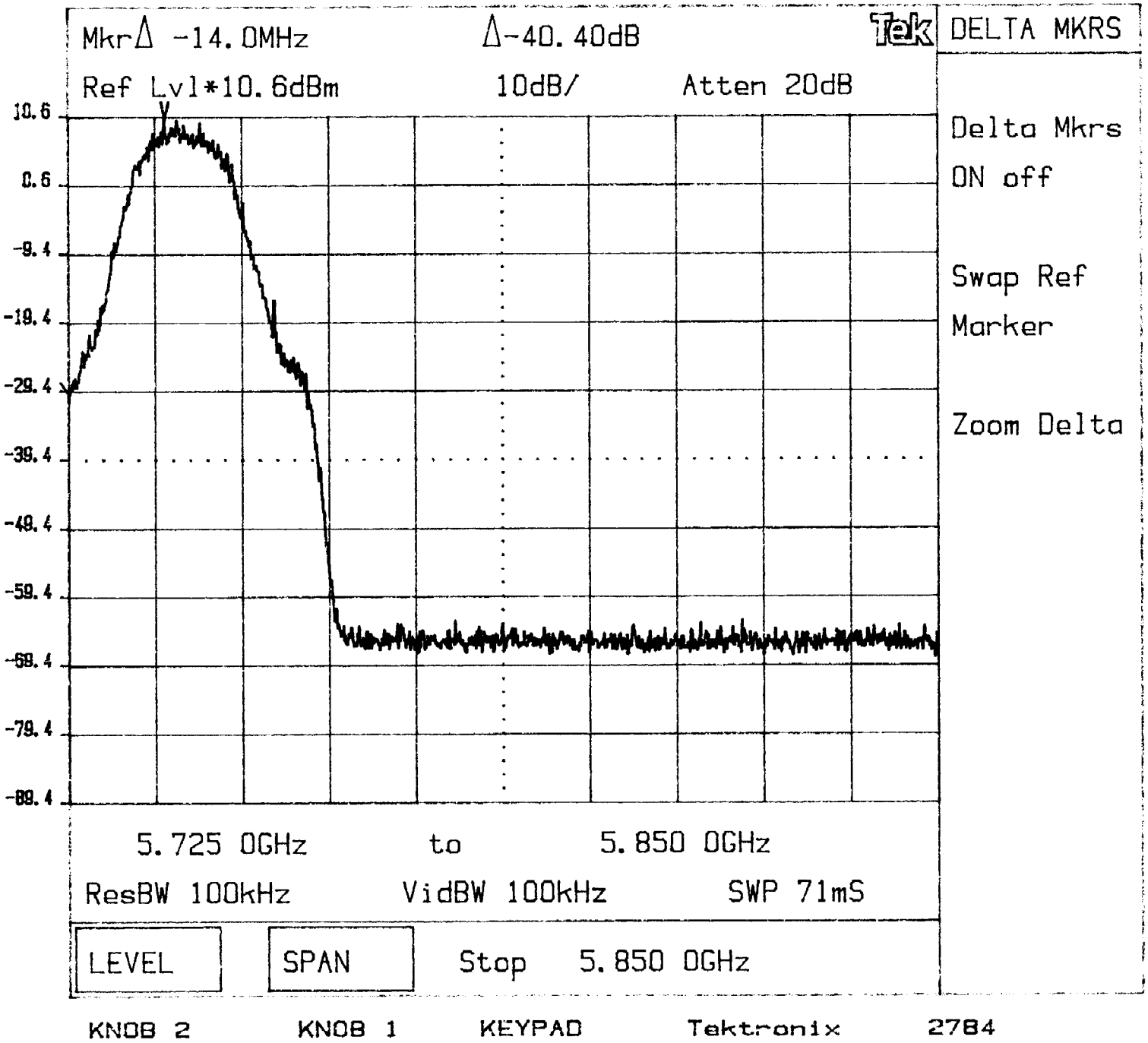
Plot 4a1


Mkr 743MHz
*-46.50dBm
Tek
WF VIEW
Ref Lvl*10.6dBm
10dB/
Atten 20dB
10.6
0.6
-9.4
-19.4
-29.4
-39.4
-49.4
-59.4
-69.4
-79.4
-89.4
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
100MHz
to
5.500GHz
ResBW 100kHz
VidBW 100kHz
SWP 3.1S
LEVEL
SPAN
Stop 5.500GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

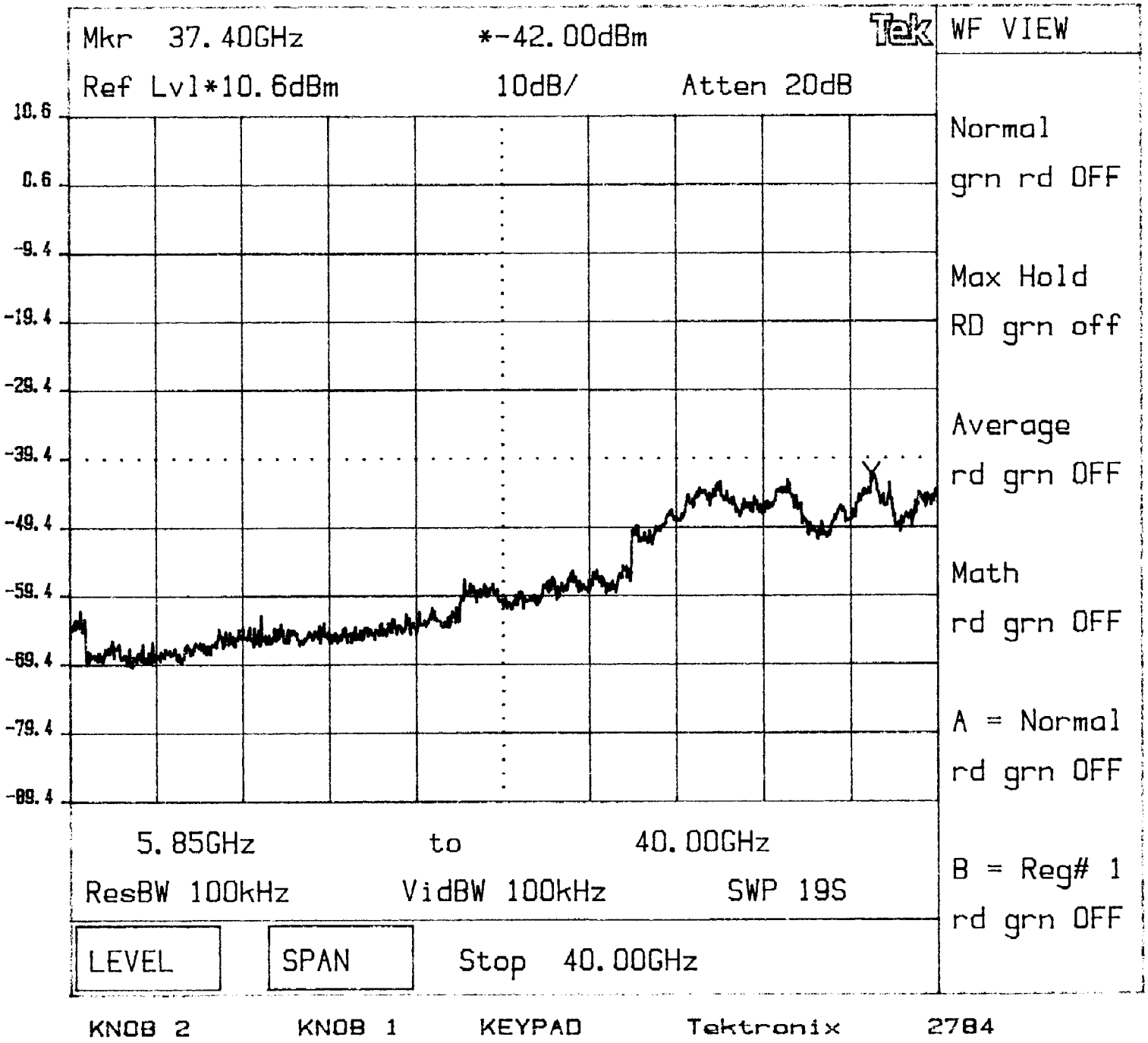
Plot 4.22


Mkr 5.725 0GHz
*-28.30dBm
Tek
WF VIEW
Ref Lvl*10.6dBm
10dB/
Atten 20dB
10.6
0.6
-9.4
-19.4
-29.4
-39.4
-49.4
-59.4
-69.4
-79.4
-89.4
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
5.500 0GHz
to
5.725 0GHz
ResBW 100kHz
VidBW 100kHz
SWP 130mS
LEVEL
SPAN
Strt 5.500 0GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

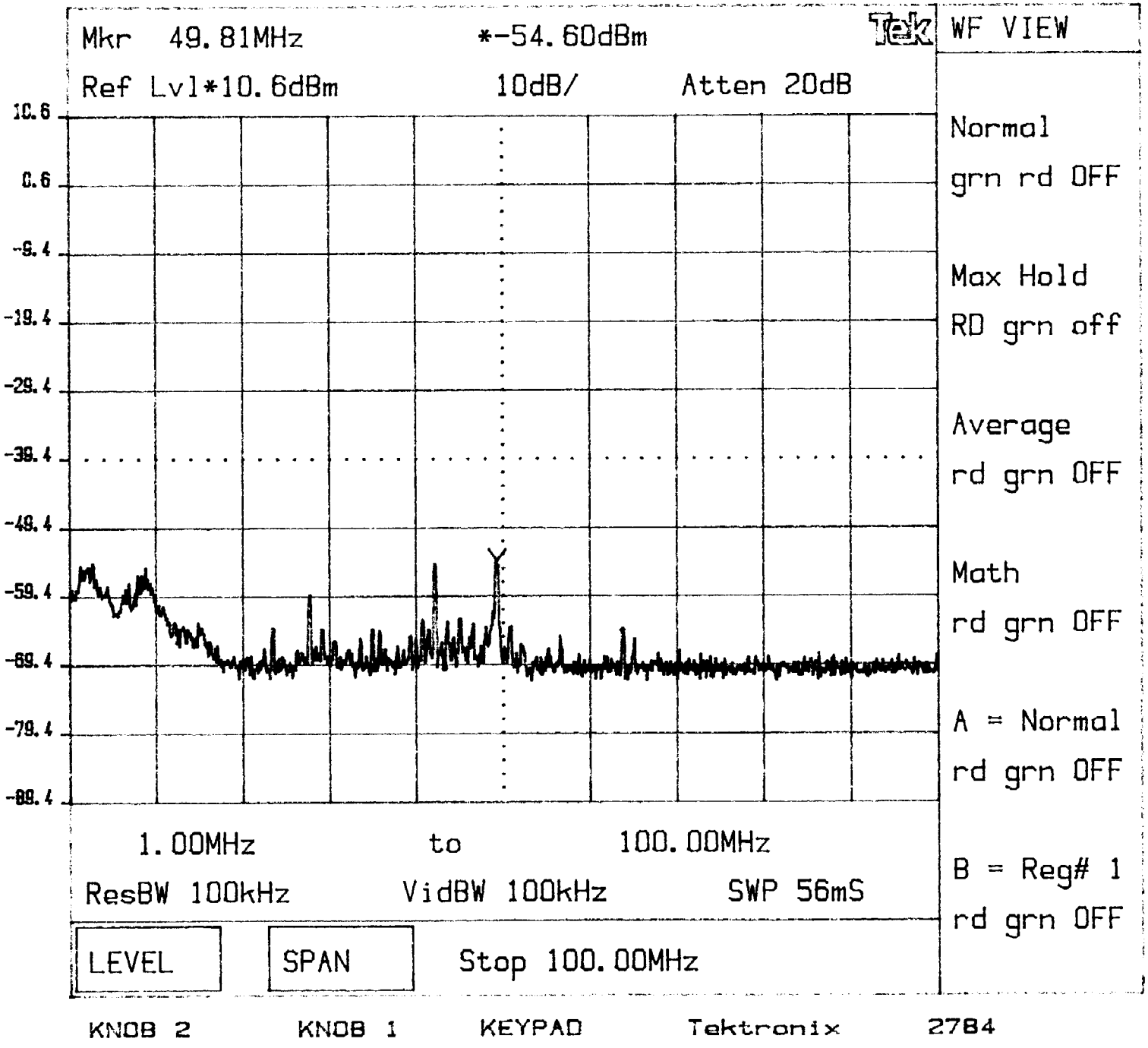
Plot 4.23


MkrΔ -14.0MHz
Δ-40.40dB
Tek
DELTA MKRS
Ref Lvl*10.6dBm
10dB/
Atten 20dB
10.6
0.6
-9.4
-19.4
-29.4
-39.4
-49.4
-59.4
-69.4
-79.4
-89.4
Delta Mkrs
ON off
Swap Ref
Marker
Zoom Delta
5.725 0GHz
to
5.850 0GHz
ResBW 100kHz
VidBW 100kHz
SWP 71mS
LEVEL
SPAN
Stop 5.850 0GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

Plot 4.24

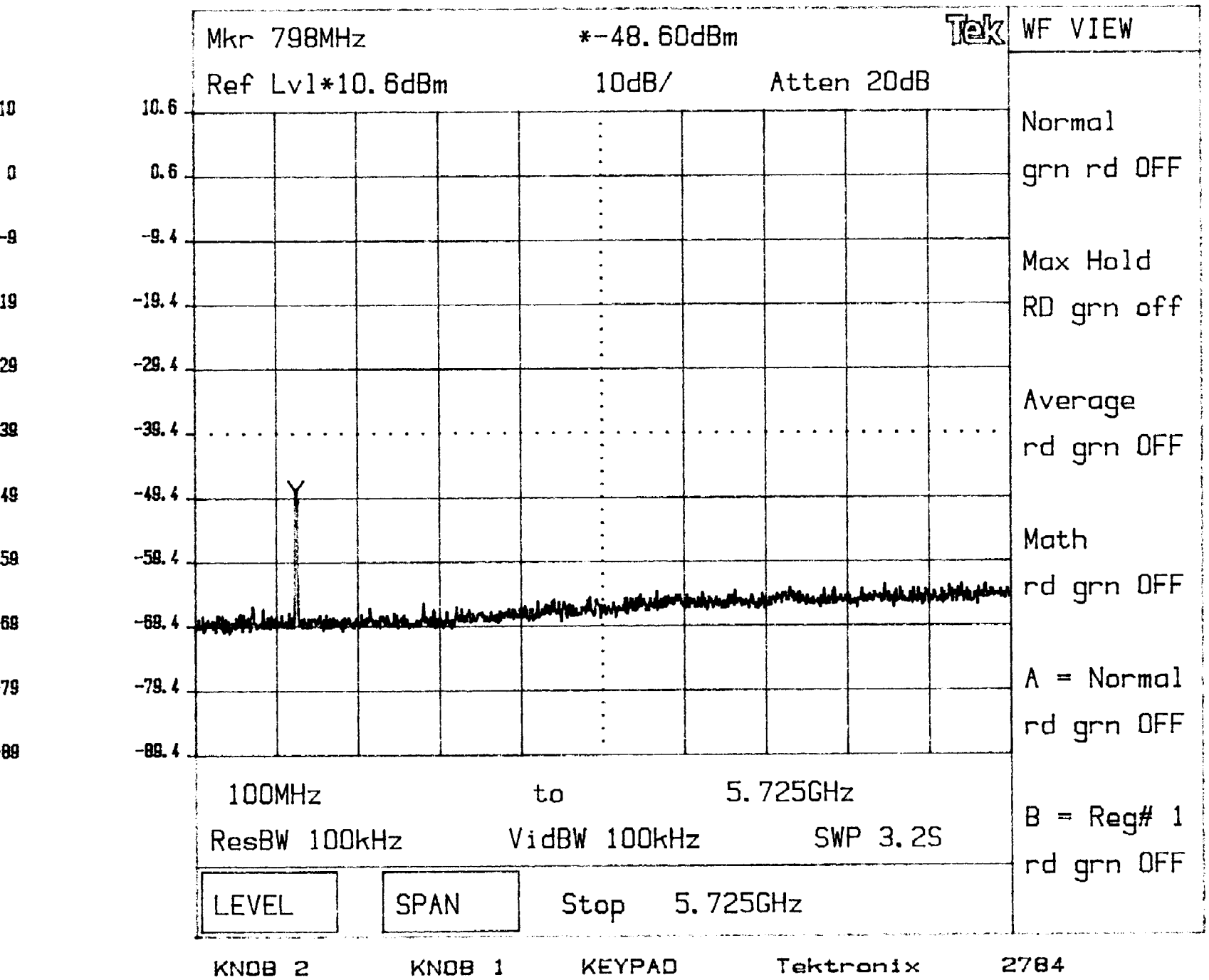

Mkr 37.40GHz
*-42.00dBm
Tek
WF VIEW
Ref Lvl*10.6dBm
10dB/
Atten 20dB
10.6
0.6
-9.4
-19.4
-29.4
-39.4
-49.4
-59.4
-69.4
-79.4
-89.4
Normal
grn rd OFF
Max Hold
RD grn off
Average
rd grn OFF
Math
rd grn OFF
A = Normal
rd grn OFF
B = Reg# 1
rd grn OFF
5.85GHz
to
40.00GHz
ResBW 100kHz
VidBW 100kHz
SWP 19S
LEVEL
SPAN
Stop 40.00GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

Plot 4.a 5


Mkr 49.81MHz
*-54.60dBm
Tek
WF VIEW
Ref Lvl*10.6dBm
10dB/
Atten 20dB
10.6
0.6
-9.4
-19.4
-29.4
-39.4
-49.4
-59.4
-69.4
-79.4
-89.4
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
1.00MHz
to
100.00MHz
ResBW 100kHz
VidBW 100kHz
SWP 56mS
LEVEL
SPAN
Stop 100.00MHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

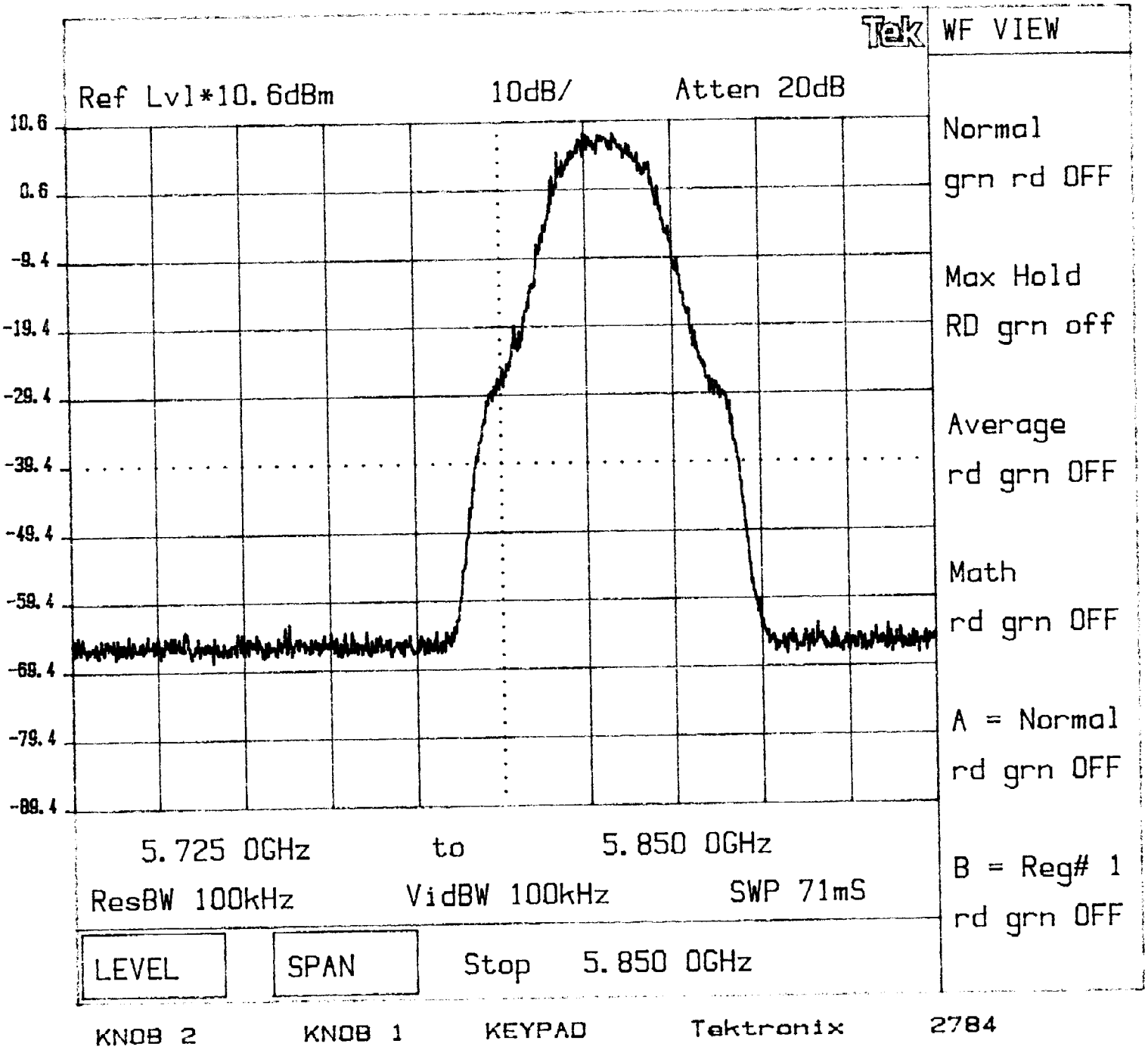
Plot 4.6.1

b

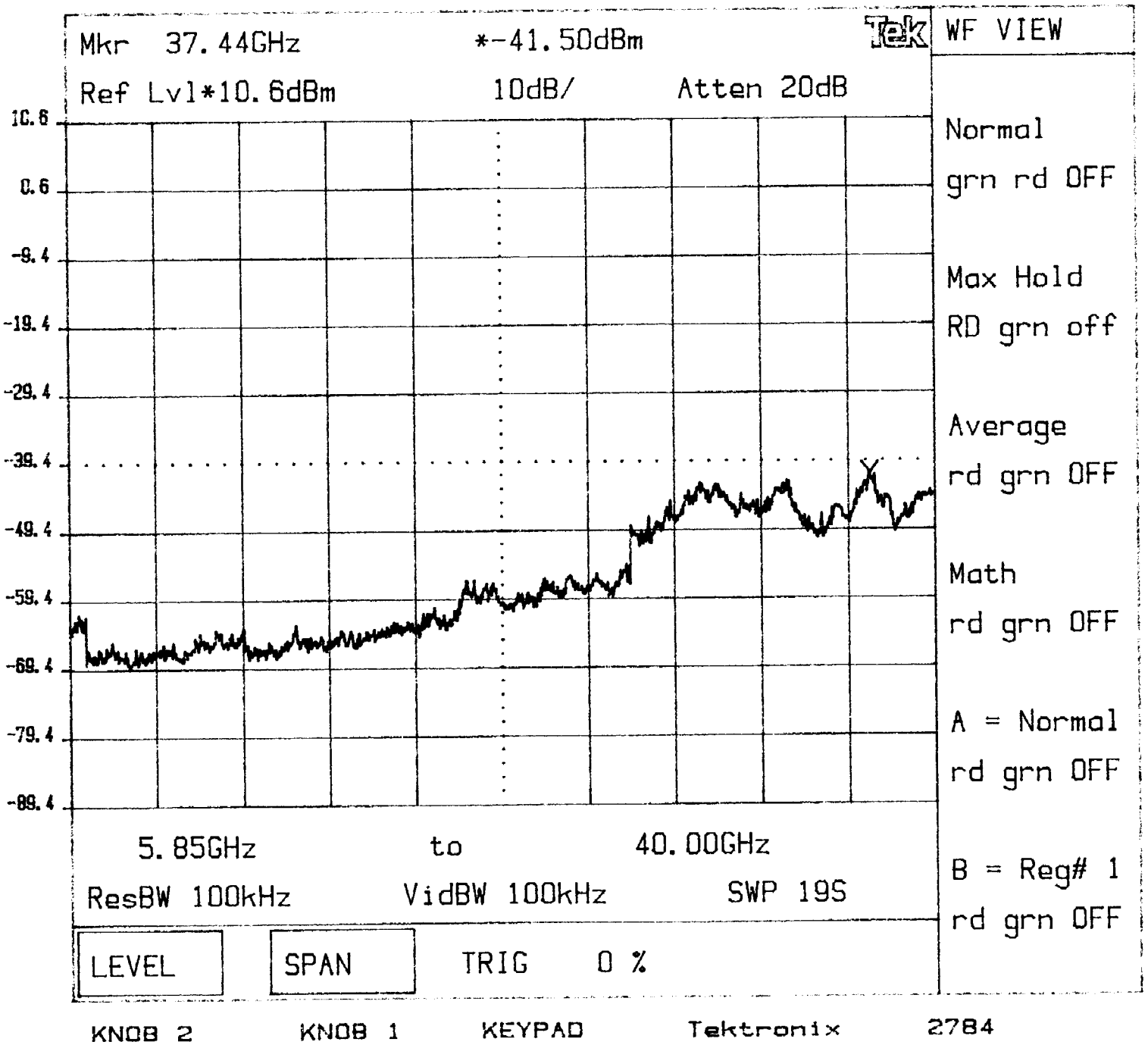

Mkr 798MHz
*-48.60dBm
Tek
WF VIEW
Ref Lvl*10.6dBm
10dB/
Atten 20dB
10.6
0.6
-9.4
-19.4
-29.4
-39.4
-49.4
-59.4
-69.4
-79.4
-89.4
Normal
grn rd OFF
Max Hold
RD grn off
Average
rd grn OFF
Math
rd grn OFF
A = Normal
rd grn OFF
B = Reg# 1
rd grn OFF
100MHz
to
5.725GHz
ResBW 100kHz
VidBW 100kHz
SWP 3.2S
LEVEL
SPAN
Stop 5.725GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

Plot 4.62

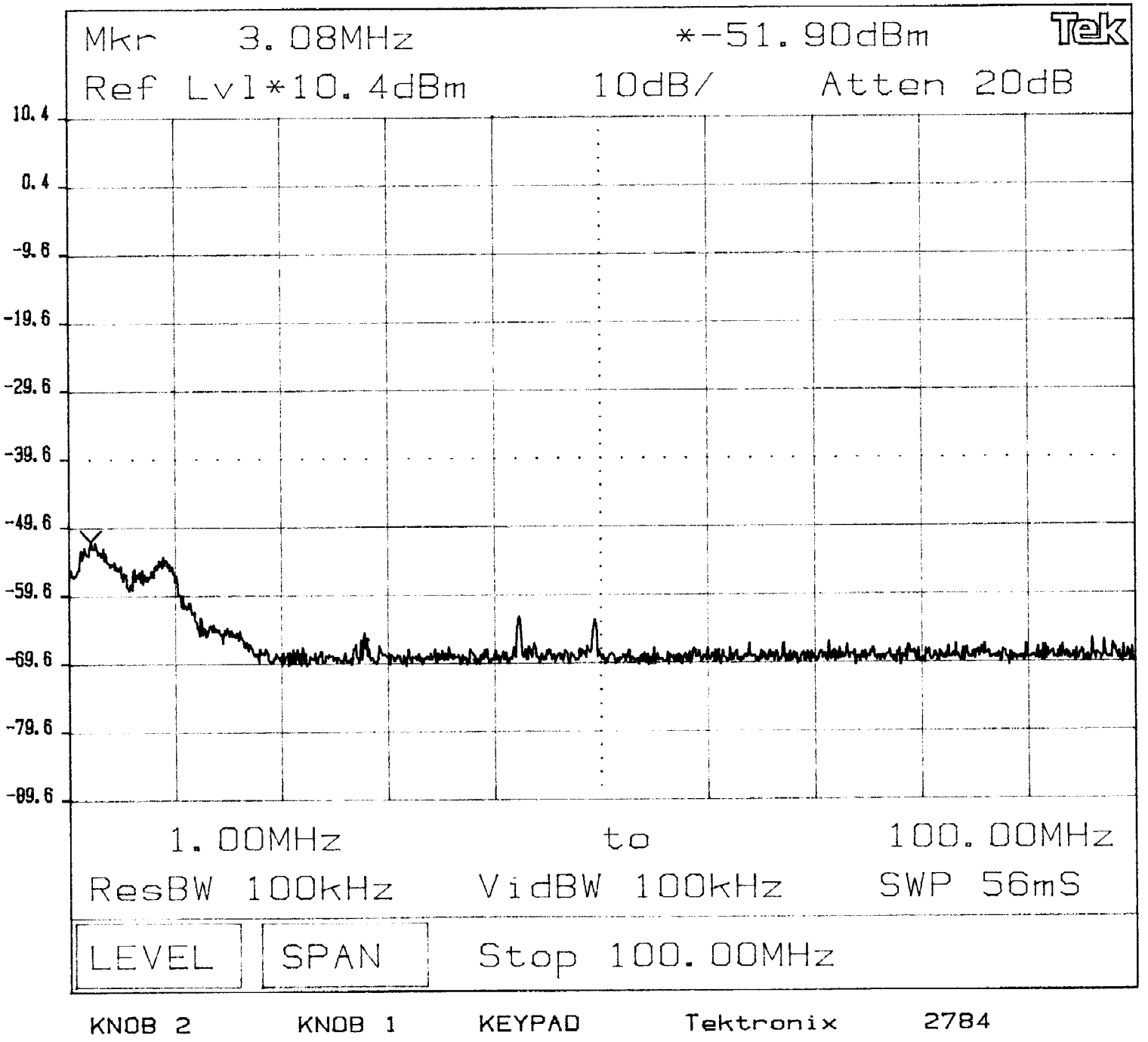
b


Tek
WF VIEW
Ref Lvl*10.6dBm
10dB/
Atten 20dB
10.6
0.6
-9.4
-19.4
-29.4
-39.4
-49.4
-59.4
-69.4
-79.4
-89.4
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
5.725 0GHz
to
5.850 0GHz
ResBW 100kHz
VidBW 100kHz
SWP 71mS
LEVEL
SPAN
Stop 5.850 0GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

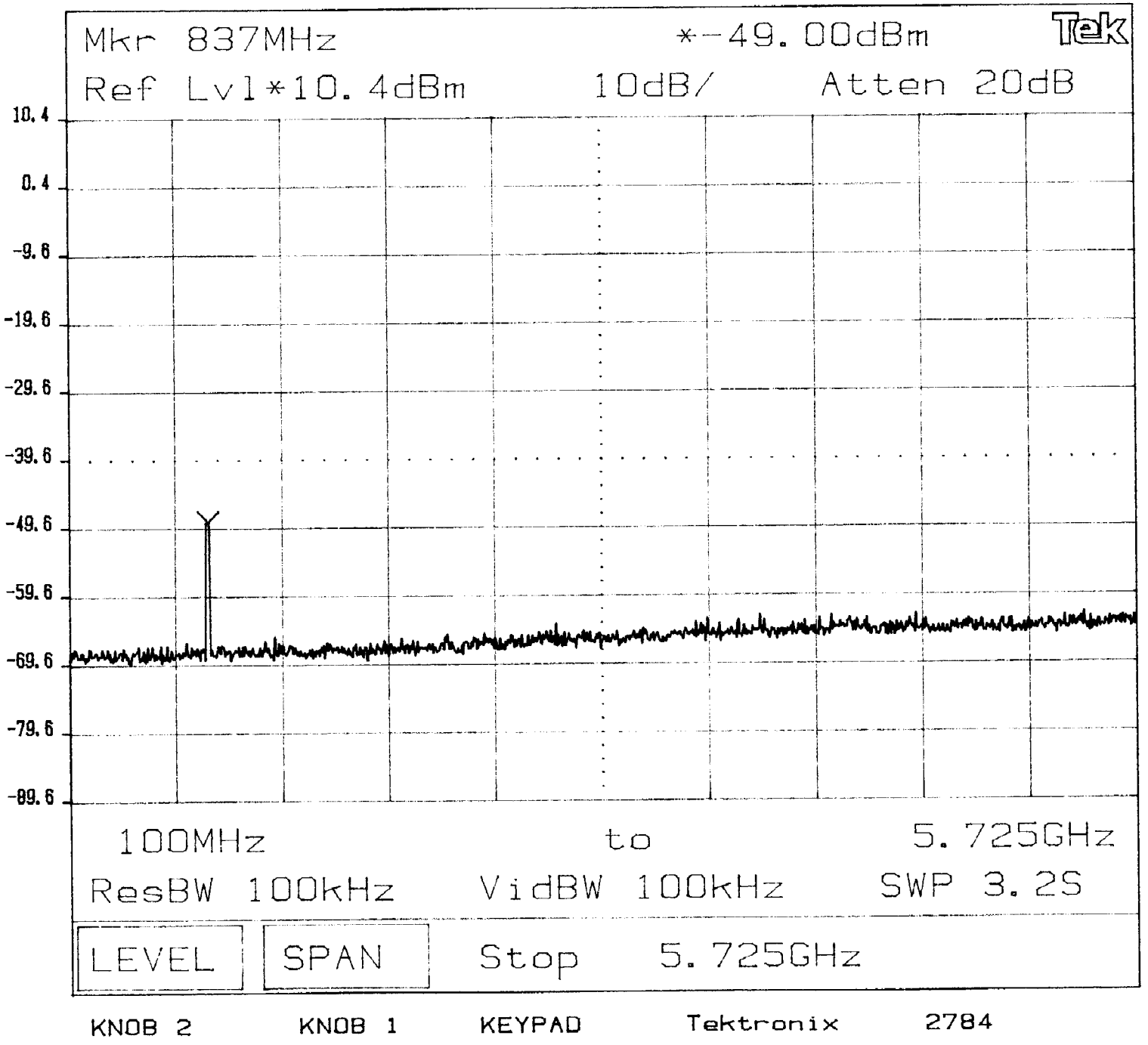
Plot 4.6.3


Mkr 37.44GHz
*-41.50dBm
Tek
WF VIEW
Ref Lvl*10.6dBm
10dB/
Atten 20dB
10.6
0.6
-9.4
-19.4
-29.4
-39.4
-49.4
-59.4
-69.4
-79.4
-89.4
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
5.85GHz
to
40.00GHz
ResBW 100kHz
VidBW 100kHz
SWP 19S
LEVEL
SPAN
TRIG
0 %
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

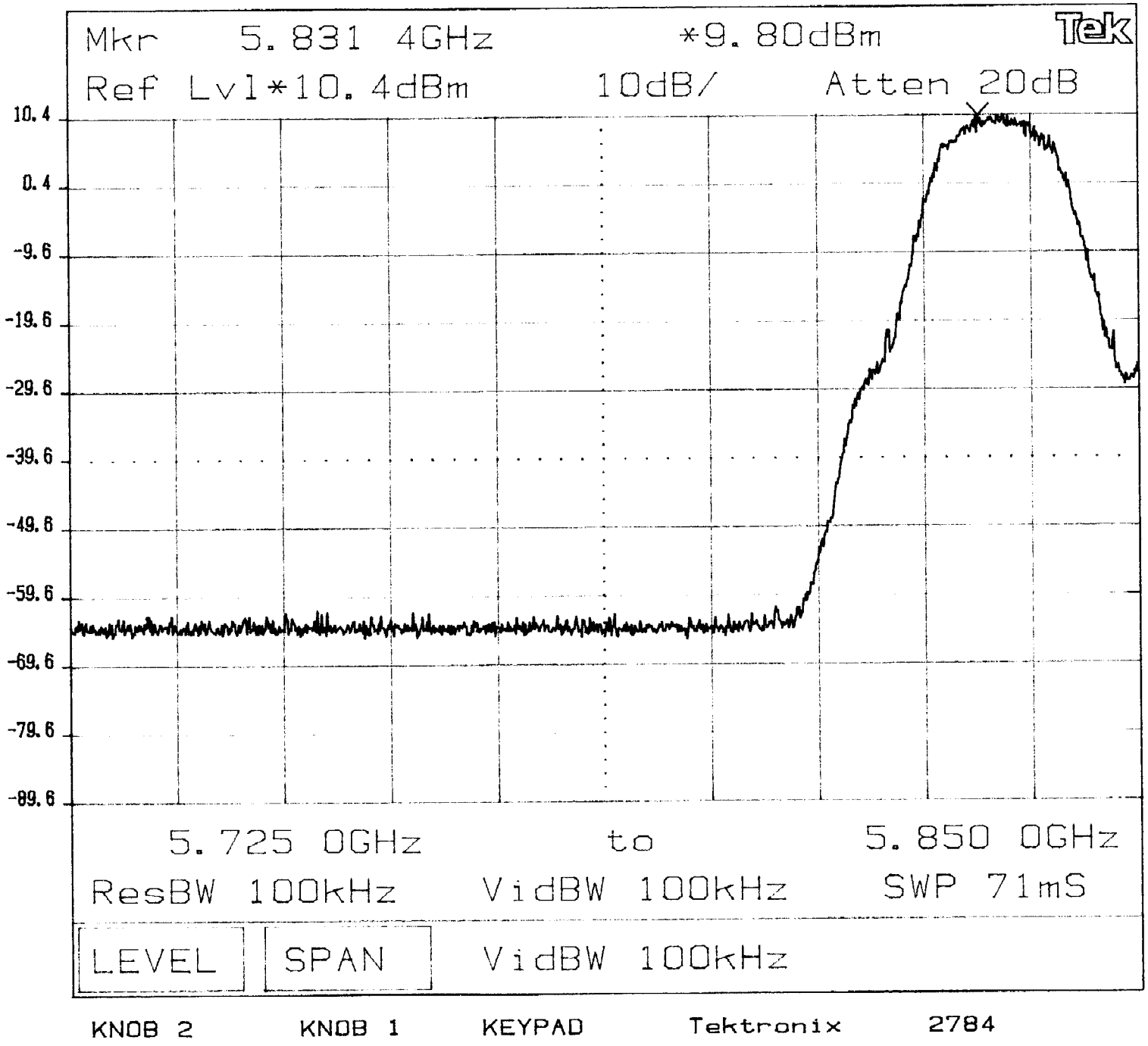
Plot 4.6.4


Mkr 3.08MHz
*-51.90dBm
Tek
Ref Lvl*10.4dBm
10dB/
Atten 20dB
10.4
0.4
-9.6
-19.6
-29.6
-39.6
-49.6
-59.6
-69.6
-79.6
-89.6
1.00MHz
to
100.00MHz
ResBW 100kHz
VidBW 100kHz
SWP 56mS
LEVEL
SPAN
Stop 100.00MHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

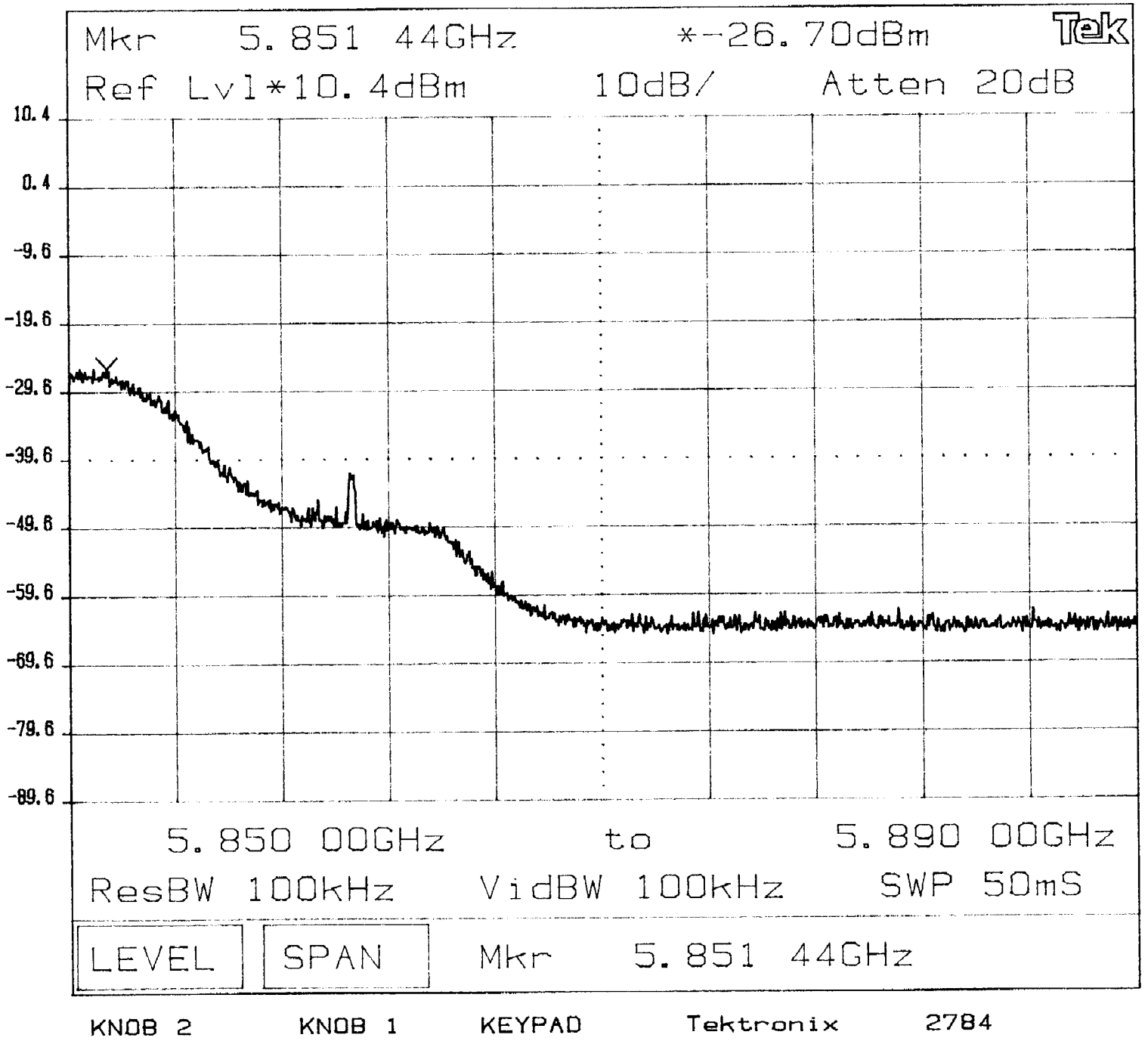
plot 4.c1


Mkr 837MHz
*-49.00dBm
Tek
Ref Lvl*10.4dBm
10dB/
Atten 20dB
10.4
0.4
-9.6
-19.6
-29.6
-39.6
-49.6
-59.6
-69.6
-79.6
-89.6
100MHz
to
5.725GHz
ResBW 100kHz
VidBW 100kHz
SWP 3.2S
LEVEL
SPAN
Stop 5.725GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

Plot 4.c2

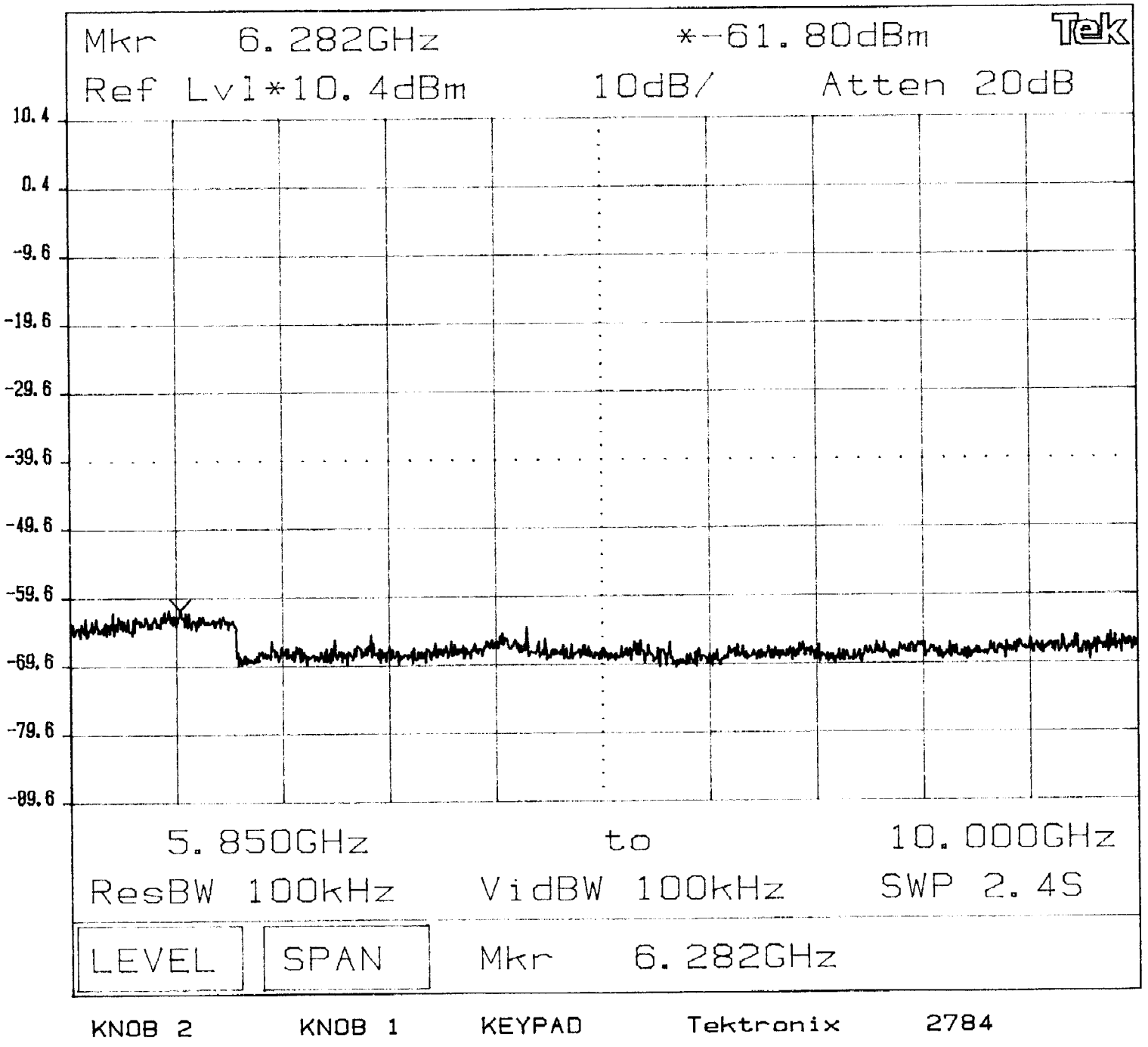

Mkr 5.831 4GHz *9.80dBm
Tek
Ref Lvl*10.4dBm 10dB/ Atten 20dB
10.4
0.4
-9.6
-19.6
-29.6
-39.6
-49.6
-59.6
-69.6
-79.6
-89.6
5.725 0GHz to 5.850 0GHz
ResBW 100kHz VidBW 100kHz SWP 71mS
LEVEL
SPAN
VidBW 100kHz
KNOB 2 KNOB 1 KEYPAD Tektronix 2784

Plot 4.c3

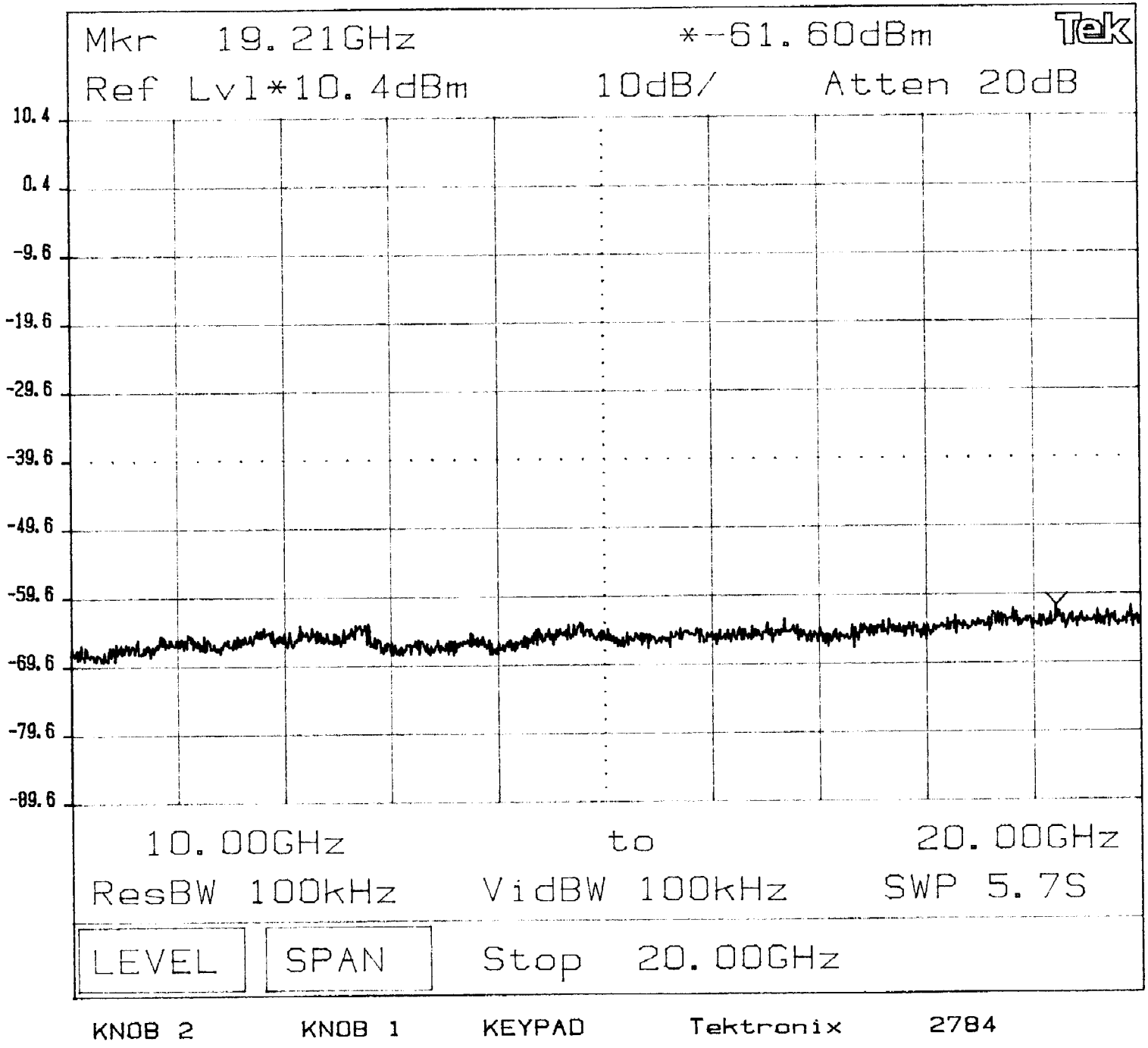

Mkr 5.851 44GHz
*-26.70dBm
Tek
Ref Lvl*10.4dBm
10dB/
Atten 20dB
10.4
0.4
-9.6
-19.6
-29.6
-39.6
-49.6
-59.6
-69.6
-79.6
-89.6
5.850 00GHz
to
5.890 00GHz
ResBW 100kHz
VidBW 100kHz
SWP 50mS
LEVEL
SPAN
Mkr 5.851 44GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

Plot 4.c 4

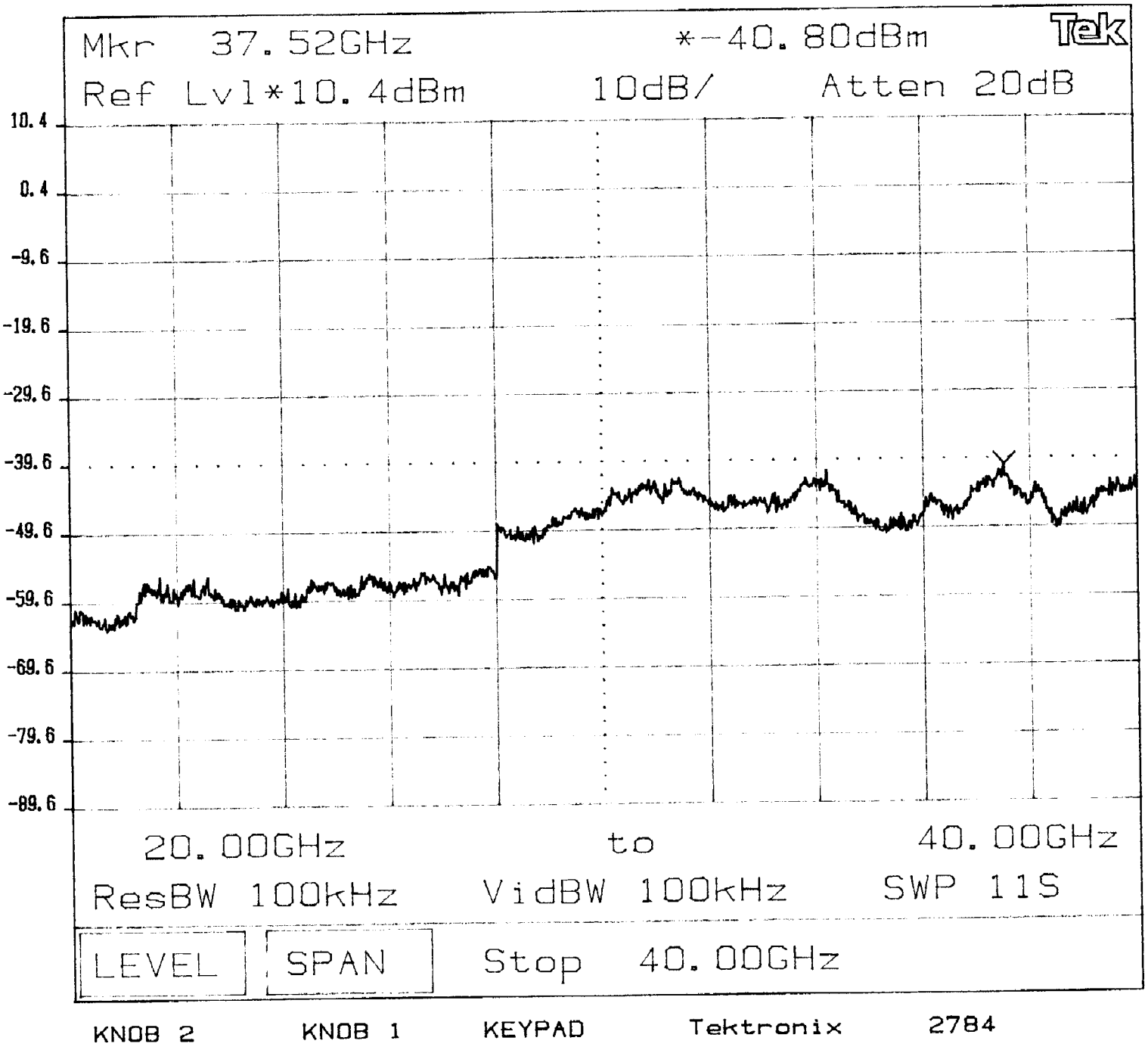
4.6.5


Mkr 6.282GHz
*-61.80dBm
Tek
Ref Lvl*10.4dBm
10dB/
Atten 20dB
10.4
0.4
-9.6
-19.6
-29.6
-39.6
-49.6
-59.6
-69.6
-79.6
-89.6
5.850GHz
to
10.000GHz
ResBW 100kHz
VidBW 100kHz
SWP 2.4S
LEVEL
SPAN
Mkr 6.282GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

Plot 4.c5


Mkr 19.21GHz
*-61.60dBm
Tek
Ref Lvl*10.4dBm
10dB/
Atten 20dB
10.4
0.4
-9.6
-19.6
-29.6
-39.6
-49.6
-59.6
-69.6
-79.6
-89.6
10.00GHz
to
20.00GHz
ResBW 100kHz
VidBW 100kHz
SWP 5.7S
LEVEL
SPAN
Stop 20.00GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

Plot 4.c 6


Mkr 37.52GHz
*-40.80dBm
Tek
Ref Lvl*10.4dBm
10dB/
Atten 20dB
10.4
0.4
-9.6
-19.6
-29.6
-39.6
-49.6
-59.6
-69.6
-79.6
-89.6
20.00GHz
to
40.00GHz
ResBW 100kHz
VidBW 100kHz
SWP 11S
LEVEL
SPAN
Stop 40.00GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

Plot 4c7

4.5 Out of Band Radiated Emissions (for emissions in 4.4 that are less than 26 dB below carrier), FCC Rule 15.247(c):

For out of band emissions that are close to or that exceed the 20 dB attenuation requirement described in the specification, radiated measurements were performed at a 3 m separation distance to determine whether these emissions complied with the general radiated emission requirement.

[X] Not required
[ ] See attached data sheet

4.6 Transmitter Radiated Emissions in Restricted Bands, FCC Rule 15.35(b), (c):

Radiated emission measurements were performed from 30 MHz to 40 GHz. Analyzer resolution is 100 kHz or greater for 30 MHz to 1000 MHz, 1 MHz for >1000 MHz.

Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included. All measurements were performed with peak or quasi-peak detection below 1 GHz and with peak and average detection above 1 GHz.

The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

ITS Intertek Testing Services

Radiated Emissions Test Data

Company:	Glenayre Western Multiplex	**Model #:**	**Standard_**	**FCC § 15.247 (R.B.)**	
EUT:	Radio	**S/N #:**	**Limits**	11	
Project #:	J99022866	**Test Date:** Sep. 10, 1999	**Test Distance_**	3	meters
Test Mode:	Tx Mode	**Engineer:** Xi-Ming Y.	**Duty Relaxation**	0	dB

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	2	21	8	13	10	8	0	12	10	0
Model:	EMCO 3143	3160-9	EMCO 3115	ACO/400	AFT18655	CDI_P1000	None	Grn_M+L	Green_M	None

Frequency	Reading	Detector	Ant	Amp.	Ant. Pol.	Ant. Factor	Pre-Amp	Insert. Loss	D. C. F.	Net	Limit @3m	Margin
MHz	dB(μV)	P/A/Q	#	#	H/V	dB(1/m)	dB	dB	dB	dB(μV/m)	dB(μV/m)	dB
Low Ch.												
1.15E+4	39.5	Peak	8	10	H	40.1	39.9	7.2	0.0	46.9	74.0	-27.1
1.15E+4	28.1	Ave.	8	10	H	40.1	39.9	7.2	0.0	35.5	54.0	-18.5
2.30E+4	36.0	Peak	21	13	H	40.4	23.3	7.5	-9.5	51.1	74.0	-22.9
2.30E+4	26.0	Ave.	21	13	H	40.4	23.3	7.5	-9.5	41.1	54.0	-12.9
Mid Ch.												
1.16E+4	40.0	Peak	8	10	H	42.4	39.7	7.4	0.0	50.1	74.0	-23.9
1.16E+4	28.5	Ave.	8	10	H	42.4	39.7	7.4	0.0	38.6	54.0	-15.4
2.32E+4	36.0	Peak	21	13	H	40.4	23.3	7.5	-9.5	51.1	74.0	-22.9
2.32E+4	26.0	Ave.	21	13	H	40.4	23.3	7.5	-9.5	41.1	54.0	-12.9
High Ch												
1.17E+4	39.5	Peak	8	10	H	42.4	39.7	7.4	0.0	49.6	74.0	-24.4
1.17E+4	28.0	Ave.	8	10	H	42.4	39.7	7.4	0.0	38.1	54.0	-15.9

Notes:

a) D.C.F.:Distance Correction Factor

b) Insert. Loss (dB) = Cable A + Cable B + Cable C .

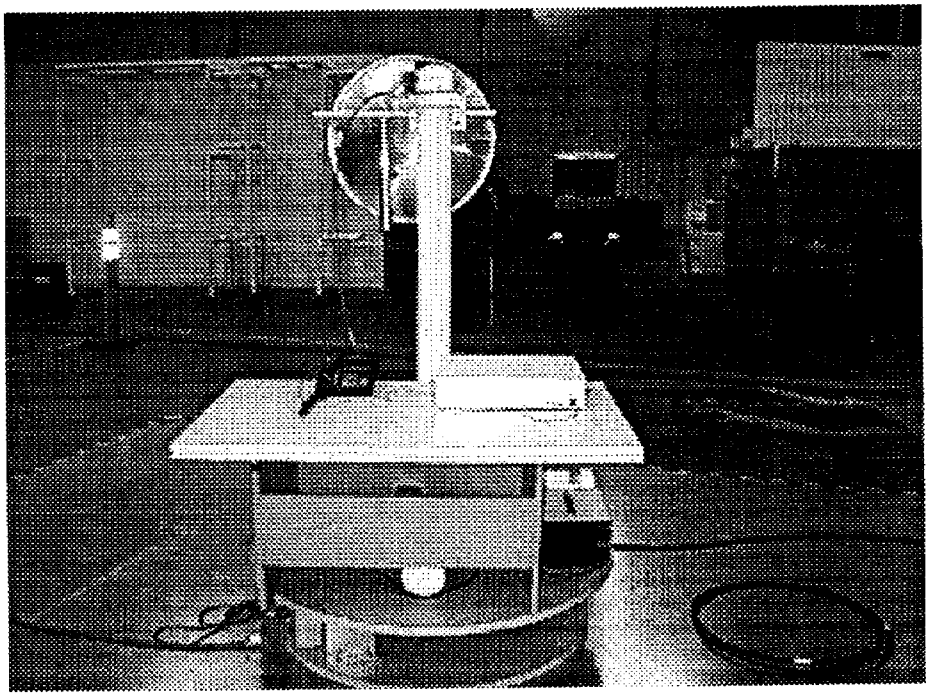
c) Net (dB) = Reading + Antenna Factor - Pre-amp + Insert. Loss. - Transducer Loss - Duty Relaxation (transmitter only).

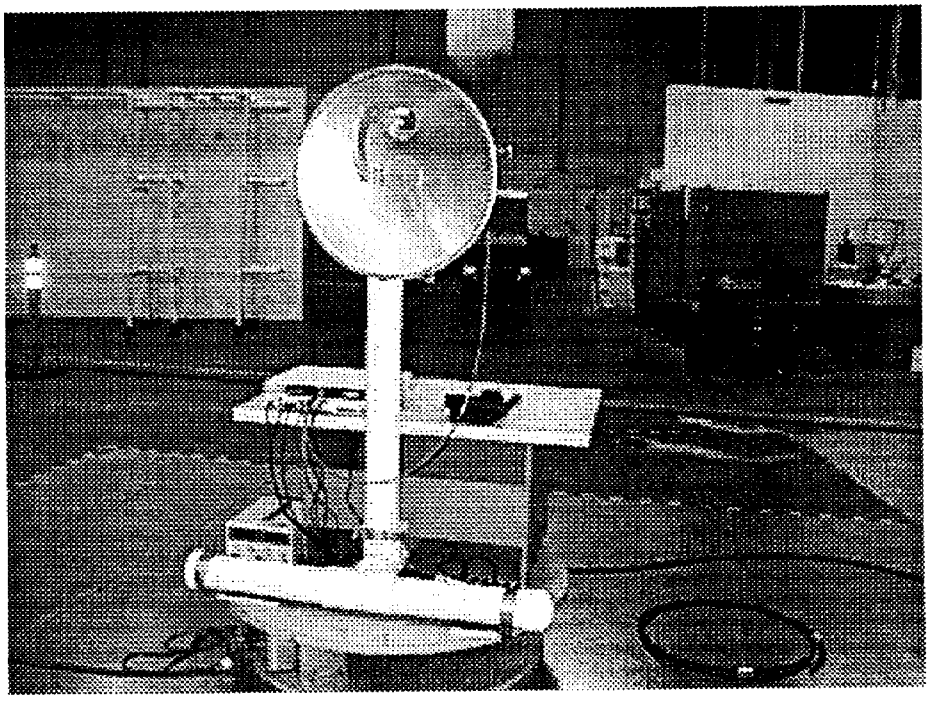
d) Negative signs (-) in Margin column signify levels below the limits.

e) All other emissions not reported are below the equipment noise floor which is at least 20 dB below the limits.

f) Frequency Higher then 20GHz is measured at 1m distance

4.7 Configuration Photographs – Radiated Emissions

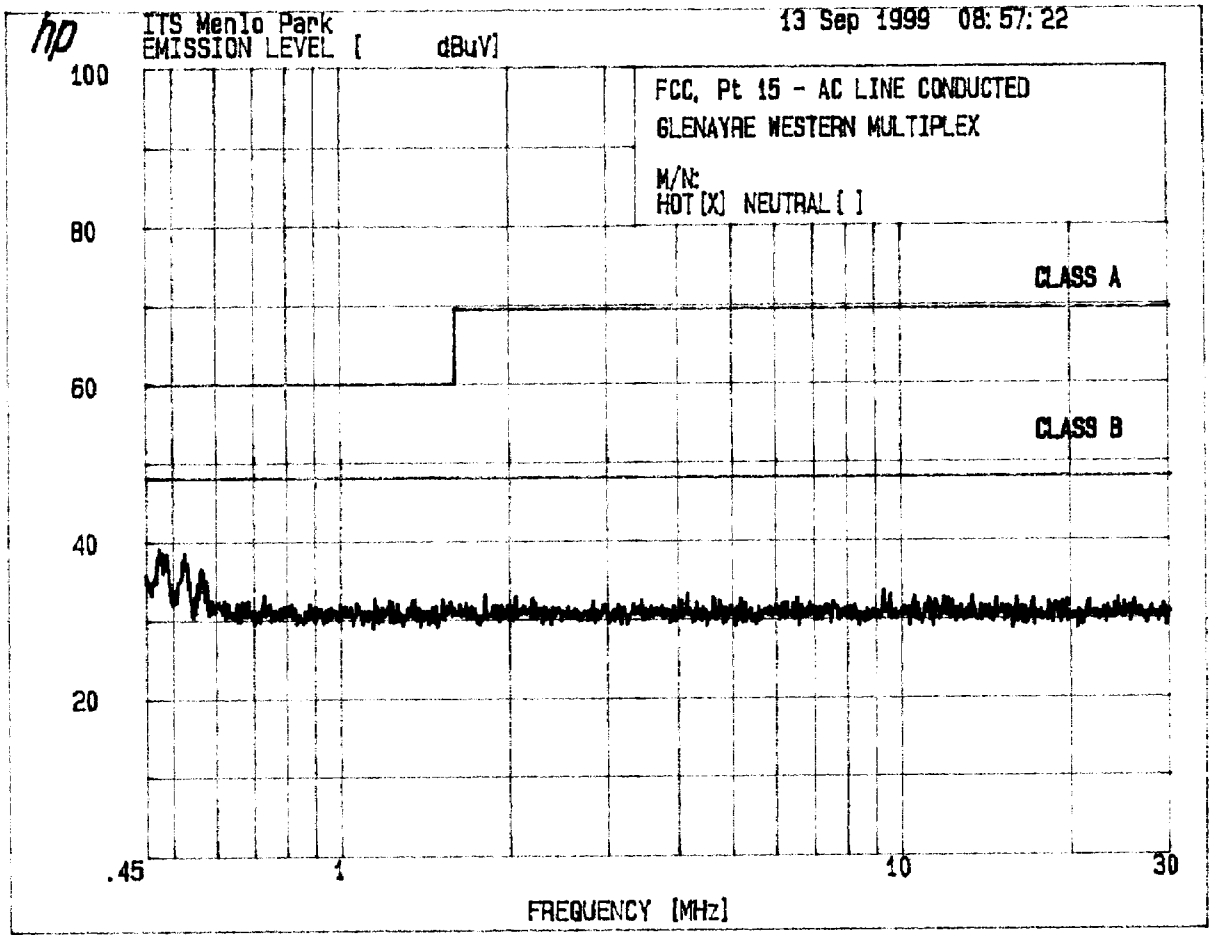


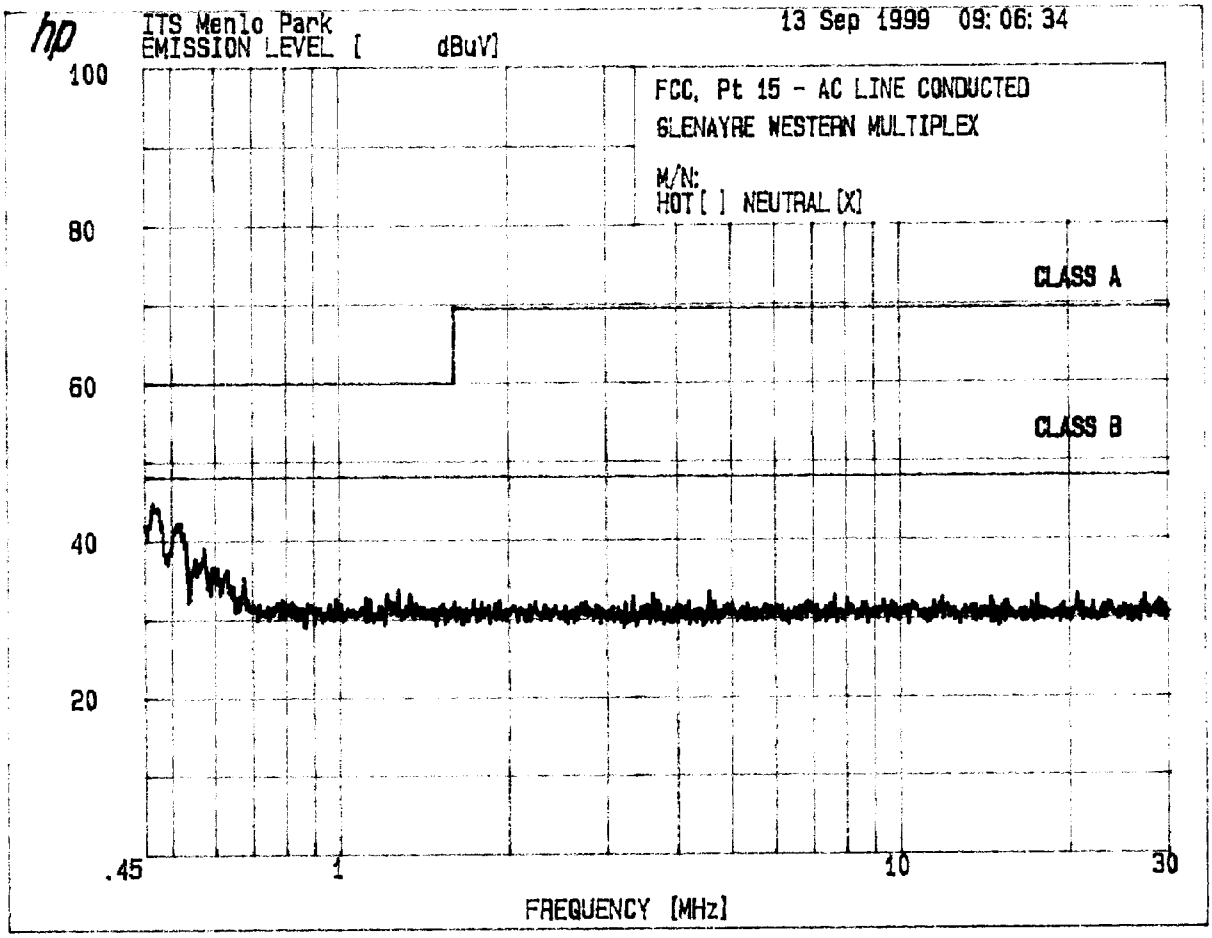


4.8 AC Line Conducted Emission, FCC Rule 15.207:

[ ] Not required; battery operation only

[X] Test data attached


hp
ITS Menlo Park
EMISSION LEVEL [dBuV]
13 Sep 1999 08:57:22
FCC, Pt 15 - AC LINE CONDUCTED
GLENAYRE WESTERN MULTIPLEX
M/N:
HOT [X] NEUTRAL [ ]
CLASS A
CLASS B
100
80
60
40
20
.45
1
10
30
FREQUENCY [MHz]


hp
ITS Menlo Park
EMISSION LEVEL [dBuV]
13 Sep 1999 09:06:34
FCC, Pt 15 - AC LINE CONDUCTED
GLENAYRE WESTERN MULTIPLEX
M/N:
HOT [ ] NEUTRAL [X]
CLASS A
CLASS B
100
80
60
40
20
.45
1
10
30
FREQUENCY [MHz]

ITS Menlo Park 15 Sep 1998 09:06:34

3. FCC CFR 47, Pt 15
3.1 FCC, Pt 15 - AC LINE CONDUCTED

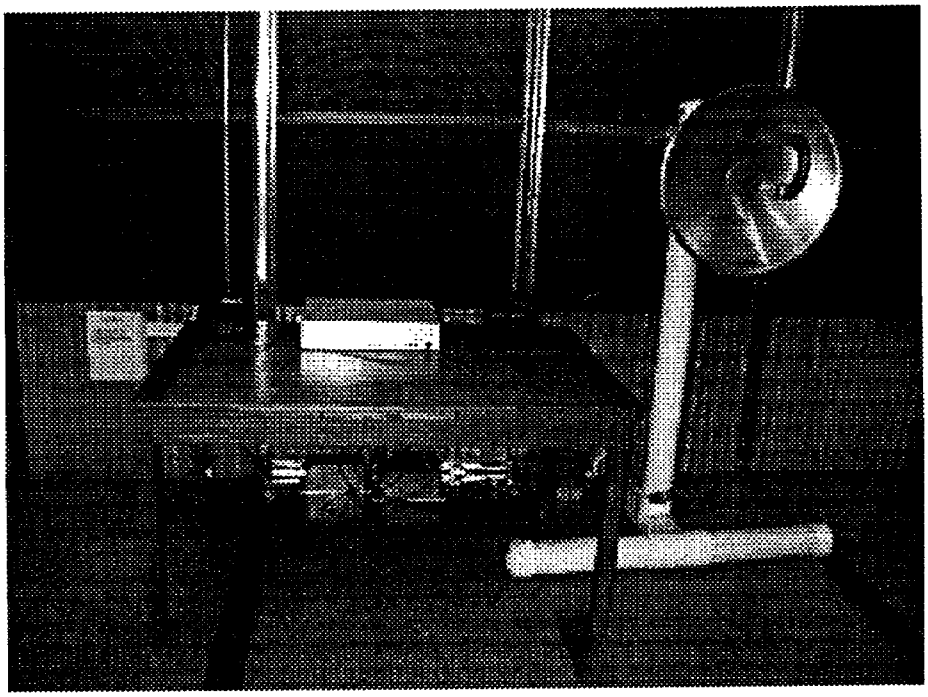
GLENAYRE WESTERN MULTIPLEX

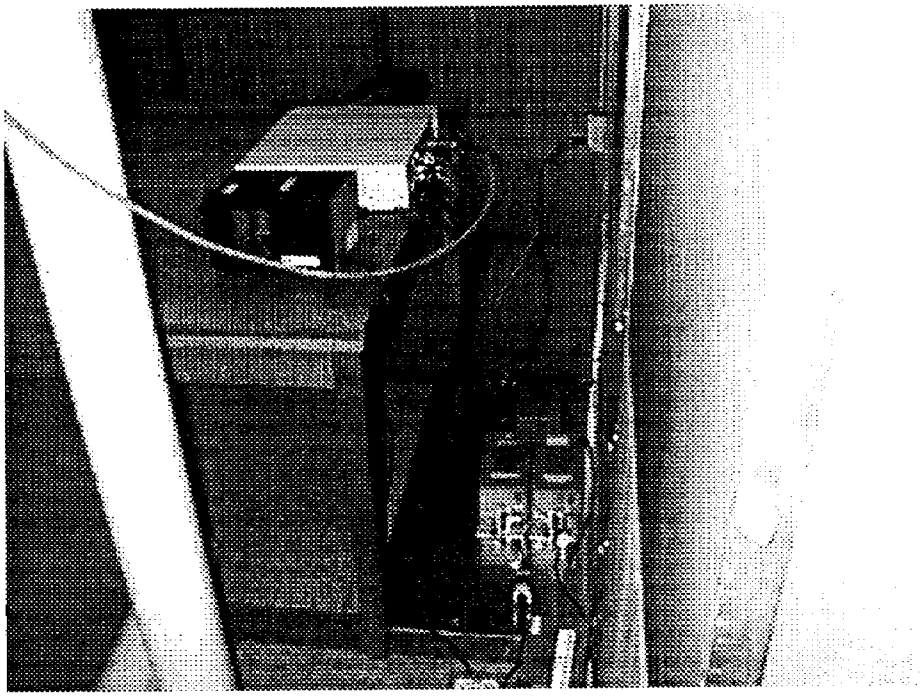
M/N:
HOT[ ] NEUTRAL[X]

PEAKS FOUND ABOVE 40 dBuV

PEAK#	FREQ (MHz)	AMPL(dBuV)
1	.4673	44.7
2	.5168	42.1

4.9 Configuration Photographs – AC Line Conducted Emissions





4.10 Radiated Emissions from Digital Section of Transceiver (Transmitter), FCC Ref: 15.109

[ ] Not required - No digital part
[X] Test results are attached
[ ] Included in the separate DOC report.

ITS Intertek Testing Services

Radiated Emissions Test Data

Company:	Glenayre Western Multiplex	**Model #:**		**Standard**	FCC § 15B
EUT:	Radio	**S/N #:**		**Limits**	2
Project #:	J99022866	**Test Date:**	Sep. 10, 1999	**Test Distance**	3 meters
Test Mode:	Tx Mode	**Engineer:**	Xi-Ming Y.	**Duty Relaxation**	0 dB

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	2	21	8	5	10	8	0	0	10	0
Model:	EMCO 3145	3146-9	EMCO 3115	CDI_P950	AFT18655	CDI_P1000	None	None	Green_M	None

Frequency	Reading	Detector	Ant.	Amp.	Ant. Pol.	Ant. Factor	Pre-Amp	Insert. Loss	D. C. F.	Net	Limit @3m	Margin
MHz	dB(µV)	P/A/Q	#	#	H/V	dB(1/m)	dB	dB	dB	dB(µV/m)	dB(µV/m)	dB
238.60E+0	45.3	Peak	2	5	H	11.5	18.4	0.0	0.0	38.4	46.0	-7.6
250.56E+0	45.4	Peak	2	5	H	12.4	18.2	0.0	0.0	39.6	46.0	-6.4
267.29E+0	37.8	Peak	2	5	H	12.9	18.2	0.0	0.0	32.5	46.0	-13.5
344.67E+0	45.0	QP	2	5	H	15.1	17.9	0.0	0.0	42.2	46.0	-3.8
360.00E+0	42.6	QP	2	5	H	15.6	17.4	0.0	0.0	40.8	46.0	-5.2
371.19E+0	44.0	Peak	2	5	H	15.7	17.4	0.0	0.0	42.3	46.0	-3.7

Notes:

a) D.C.F.:Distance Correction Factor

b) Insert. Loss (dB) = Cable A + Cable B + Cable C .

c) Net (dB) = Reading + Antenna Factor - Pre-amp + Insert. Loss. - Transducer Loss - Duty Relaxation (transmitter only).

d) Negative signs (-) in Margin column signify levels below the limits.

e) All other emissions not reported are below the equipment noise floor which is at least 20 dB below the limits.

4.11 Radiated Emissions from Receiver Section of Transceiver (L.O. Radiation), FCC Ref: 15.109, 15.111

[X] Not required - EUT operation above 960 MHz only

[ ] Not required - EUT is transmitter only

[ ] Not performed; exempt until June 1999

[ ] Test results are attached

4.12 Processing Gain Measurements, FCC Rule 15.247(e)

The processing gain shall be determined from the ratio in dB of the signal to noise ratio with the system spreading code turned OFF, to the signal to noise ratio with the system spreading code turned ON, as measured at the demodulated output of the receiver. The processing gain shall be at least 10 dB for a direct sequence spread spectrum system.

X	Refer to attached test procedure and data sheets in Exhibit 13 – Processing Gain.
	Refer to circuit analysis and processing gain calculations provided by manufacturer.

4.13 Transmitter Duty Cycle Calculation and 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)

[X]Duty cycle correction was not used.

5.0 Document History

Revision/Job Number	Date	Change
1.0 / J9022866	10/4/99	Original document