

FCC Part 15.249 Test Report
For
Sonus Telecom, Inc.
on the
Cordless Telephone
Model: GH2400N
FCC ID: OU3GH2400N

Test Report # J20006239

Date of Report: April 10, 2000



NVLAP Laboratory Code 200201-0
Accredited for testing to FCC Parts 15

Tested by:	<i>Xi-Ming Yang</i>	Xi-Ming Yang
Reviewer:	<i>David Chernomordik</i>	David Chernomordik

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1 JOB DESCRIPTION

1.1 Client Information

The EUT has been tested at the request of

Company: Sonus Telecom, Inc.
123 Bldg., 2-Dong, Suite 714, 75-1 Gochuck-Dong
Youngdungpo-Gu, Seoul
Korea

Name of contact: Bryan Lee
Telephone: (822) 6090-3000
Fax: (822) 6090-3002

1.2 Equipment under test (EUT)

Equipment type: Cordless Telephone system

Equipment class: Low Power transmitter

Model number(s): GH2400N

FCC ID: OU3GH2400N

Manufacturer: SAME as above.

Use of Product : Voice communications

Production is planned: Yes, No

Technical Specifications:

Type of Emission	
Modulation	Analog
Range of RF Output	0.5 W (Peak EIRP)
Means for variation of operating power	None
Frequency Range	to MHz
Max. number of Channels	
Antenna	Handset: Base Unit:
Detachable antenna ?	No
External input	<ul style="list-style-type: none"> • Audio Voice • PSTN

EUT receive date: March 30, 2000
 EUT received condition: Good condition prototype
 Test start date: March 30, 2000
 Test end date: April 6, 2000

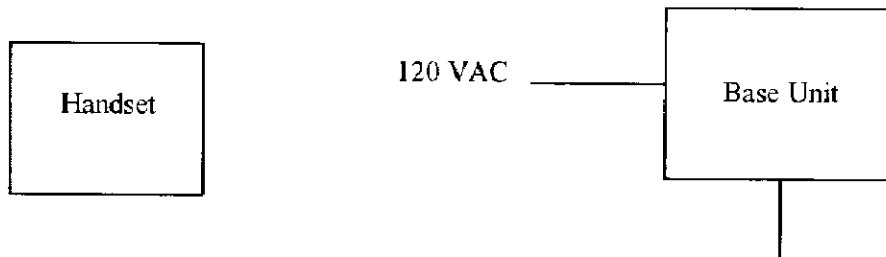
1.3 Test plan reference

FCC Part 2.1033, FCC Part 15.249

1.4 System test configuration

1.4.1 System block diagram & Support equipment

The diagrams shown below details the placement of the equipment under test on the turntable.



S: Shielded	U: Unshield	F: With Ferrite Core
--------------------	--------------------	-----------------------------

Support equipment					
Equip. #	Equipment	Manufacturer	Model #	S/N #	FCC ID
1	Telephone Simulator				NA

1.4.2 Justification

The system was configured for testing in a typical manner in accordance with ANSI C63.4 standard.

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.

1.4.3 Mode(s) of operation

The handset and Base unit was powered from fully charged batteries and AC adapter. During tests, EUT was operating at continuous transmitting mode.

1.5 Modifications required for compliance

No modifications were implemented by Intertek Testing Services.

2 TEST SUMMARY

FCC RULE	DESCRIPTION OF TEST	RESULT	PAGE
Handset			
15.249a	Field Strength of Emissions	90.4 dB(μ V/m)	5
15.249c	Field Strength of Spurious Radiation	Worst case Freq.: MHz Margin: dB	6
15.203	Antenna requirement	Complies	8
15.205	Restricted bands of operation	Worst case Freq.: MHz Margin: dB	
15.207	Line Conducted Emissions	N/A	N/A
Base Unit			
15.249a	Field Strength of Emissions	DB(μ V/m)	5
15.249c	Field Strength of Spurious Radiation	Worst case Freq.: MHz Margin: dB	6
15.203	Antenna requirement	Complies	8
15.205	Restricted bands of operation	Worst case Freq.: MHz Margin: dB	
15.207	Line Conducted Emissions	Worst case Freq.: MHz Margin: dB	9

3 FIELD STRENGTH OF EMISSIONS

3.1 Test Description

Parameter:	FCC § 15.249a
Requirement:	FCC § 15.249a
Fundamental: Harmonics	

3.2 Test Procedure

For the measurements, the EUT is attached to a cardboard box (if necessary) and placed on the wooden turntable which is 0.8m above the ground plane on an open site. 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.

Radiated emission measurements were performed from 30 MHz to the 10th harmonic of transmitter frequency. Analyzer resolution is 100 kHz or greater for 30 MHz to 1000 MHz, 1 MHz for >1000 MHz.

Measurements were performed for lowest and highest channels.

3.3 Test Results

See attached.

3.4 Modifications made during testing

None

3.5 Test Instrumentation

Hewlett Packard HP8566B Spectrum Analyzer (S.A.)

EMCO 3115 Horn Antenna

HP Pre-amp

Radiated Emissions Test Data

Company: Sonus	Model #: GH 2400N	Standard: FCC § 15.249
EUT: 2.4 GHz Cordless Phone	S/N #:	Limits: 12
Project #: J20009278	Test Date: Mar 30, 2000	Test Distance: 3 meters
Test Mode: Base low channel	Engineer: Barry S.	Duty Relaxation: 0 dB

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	8	3	19	8	10	13	12			0
Model:	EMCO 3135	CDI-B100	0	CDI-P100	AFT15855	ACC7400	Gm_M+L	None	None	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/O	#	#	H/V	dB(1/m)	dB	dB	dB	dB(μV/m)	dB(μV/m)	dB
2402.55	58.5	Peak	8		V	29.6	0.0	2.3	0.0	90.4	94.0	-3.6
4805.10	28.4	Peak	8	8	V	33.5	28.1	3.2	0.0	37.0	74.0	-37.0
4805.10	22.0	Ave.	8	8	V	33.5	28.1	3.2	0.0	30.6	54.0	-23.4
7207.65	31.0	Peak	8	8	V	38.0	28.0	4.3	0.0	45.3	74.0	-28.7
7207.65	25.6	Ave.	8	8	V	38.0	28.0	4.3	0.0	39.9	54.0	-14.1
9610.20	32.0	Peak	8	8	V	39.3	27.3	5.0	0.0	49.0	74.0	-25.0
9610.20	26.0	Ave.	8	8	V	39.3	27.3	5.0	0.0	43.0	54.0	-11.0
12012.75	38.0	Peak	8	10	V	42.5	39.1	5.9	0.0	47.3	74.0	-26.8
12012.75	33.3	Ave.	8	10	V	42.5	39.1	5.9	0.0	42.6	54.0	-11.5
14415.3	39.3	Peak	8	10	V	41.5	37.8	6.5	0.0	49.5	74.0	-24.5
14415.3	32.9	Ave.	8	10	V	41.5	37.8	6.5	0.0	43.1	54.0	-10.9
16817.85	40.9	Peak	8	10	V	41.5	39.4	7.2	0.0	50.2	74.0	-23.9
16817.85	34.9	Ave.	8	10	V	41.5	39.4	7.2	0.0	44.2	54.0	-9.8
19220.4	37.3	Peak	21	13	V	40.2	23.3	0.0	-9.5	44.7	74.0	-29.3
19220.4	30.3	Ave.	21	13	V	40.2	23.3	0.0	-9.5	37.7	54.0	-16.3
21622.95	42.3	Peak	21	13	V	40.3	23.3	0.0	-9.5	49.8	74.0	-24.2
21622.95	33.2	Ave.	21	13	V	40.3	23.3	0.0	-9.5	40.7	54.0	-13.3
24025.5	42.3	Peak	21	13	V	40.4	24.2	0.0	-9.5	49.0	108.0	-59.0
24025.5	35.1	Ave.	21	13	V	40.4	24.2	0.0	-9.5	41.8	108.0	-66.2

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.

Radiated Emissions Test Data

Company: Sonus	Model #: GH 2400N	Standard: FCC § 15.249
EUT: 2.4 GHz Cordless Phone	S/N #:	Limits: 12
Project #: J20009278	Test Date: Mar 30, 2000	Test Distance: 3 meters
Test Mode: Hand hi channel	Engineer: Barry S.	Duty Relaxation: 0 dB

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	8	3	19	8	10	13	12			0
Model:	EMCG 3115	CDI B100	9	CDL P100	AFT15855	ACO/400	Grn_M+L	Norm	None	None

Frequency	Reading	Detector	Ant. #	Amp. #	Ant. Pol.	Ant. Factor	Pre-Amp	Insert. Loss	D. C. F.	Net	Limit @3m	Margin
MHz	dB(µV)	PIA/Q	#	#	H/V	dB(1/m)	dB	dB	dB	dB(µV/m)	dB(µV/m)	dB
2476.45	55.3	Peak	8		V	29.6	0.0	2.3	0.0	87.2	94.0	-6.8
4952.90	30.7	Peak	8	8	V	33.5	28.1	3.2	0.0	39.3	74.0	-34.7
4952.90	22.8	Ave.	8	8	V	33.5	28.1	3.2	0.0	31.4	54.0	-22.6
7429.35	32.2	Peak	8	8	V	38.0	28.0	4.3	0.0	46.5	74.0	-27.5
7429.35	25.7	Ave.	8	8	V	38.0	28.0	4.3	0.0	40.0	54.0	-14.0
9905.80	32.5	Peak	8	8	V	39.3	27.6	5.0	0.0	49.2	74.0	-24.8
9905.80	26.2	Ave.	8	8	V	39.3	27.6	5.0	0.0	42.9	54.0	-11.1
12382.25	41.2	Peak	8	10	V	42.5	39.1	5.9	0.0	50.5	74.0	-23.6
12382.25	33.5	Ave.	8	10	V	42.5	39.1	5.9	0.0	42.8	54.0	-11.3
14858.7	39.0	Peak	8	10	V	42.1	37.4	6.8	0.0	50.5	74.0	-23.6
14858.7	33.6	Ave.	8	10	V	42.1	37.4	6.8	0.0	45.1	54.0	-9.0
17335.15	39.2	Peak	8	10	V	43.8	38.8	7.5	0.0	51.7	74.0	-22.3
17335.15	34.2	Ave.	8	10	V	43.8	38.8	7.5	0.0	46.7	54.0	-7.3
19811.6	39.4	Peak	21	13	V	40.3	23.3	0.0	-9.5	46.9	74.0	-27.1
19811.6	31.2	Ave.	21	13	V	40.3	23.3	0.0	-9.5	38.7	54.0	-15.3
22288.05	41.4	Peak	21	13	V	40.3	23.3	0.0	-9.5	48.9	74.0	-25.1
22288.05	34.6	Ave.	21	13	V	40.3	23.3	0.0	-9.5	42.1	54.0	-11.9

- 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.

4 SPURIOUS EMISSIONS (EXCEPT HARMONICS)

4.1 Test Description

Parameter:	FCC § 15.249c
Requirement:	FCC § 15.249c
Attenuation limits:	≤ 50 dB or FCC § 15.209

4.2 Test Procedure

For measurement below 1 GHz, the EUT was placed inside a TEM cell (stripline) connected to a spectrum analyzer from one side and to 50 ohm termination from one side and to 50 ohm termination from another. For measurement above 1 GHz, a horn antenna was placed at a distance of 10-15 cm from EUT and connected to a spectrum analyzer. Several plots were made to show emissions from 1 MHz up to 10th harmonic.

4.3 Test Results

See attached plots.

4.4 Modifications made during testing

None

4.5 Test Instrumentation

Hewlett Packard HP8566B Spectrum Analyzer (S.A.)

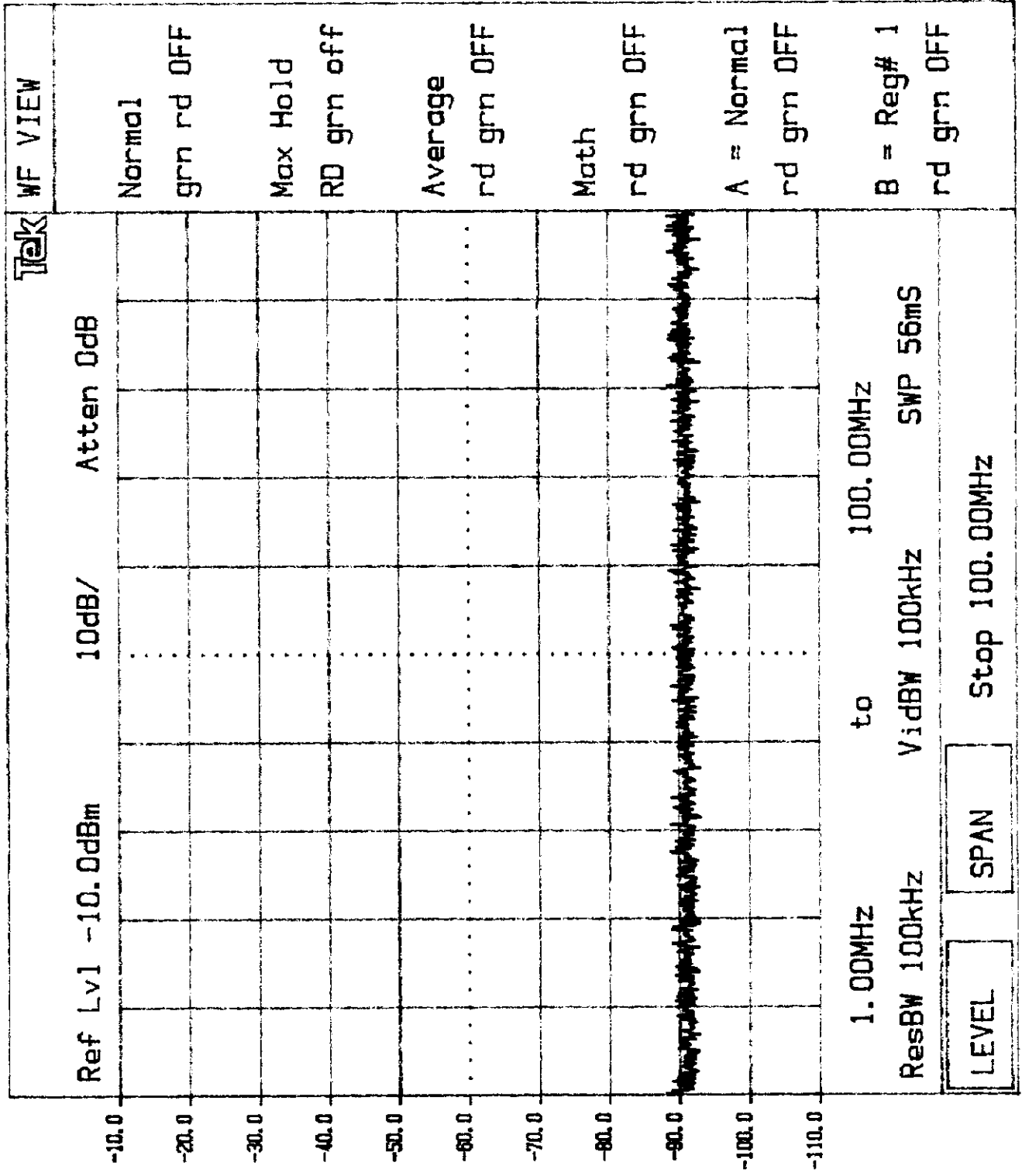
EMCO 3115 Horn Antenna

Pre-amplifiers

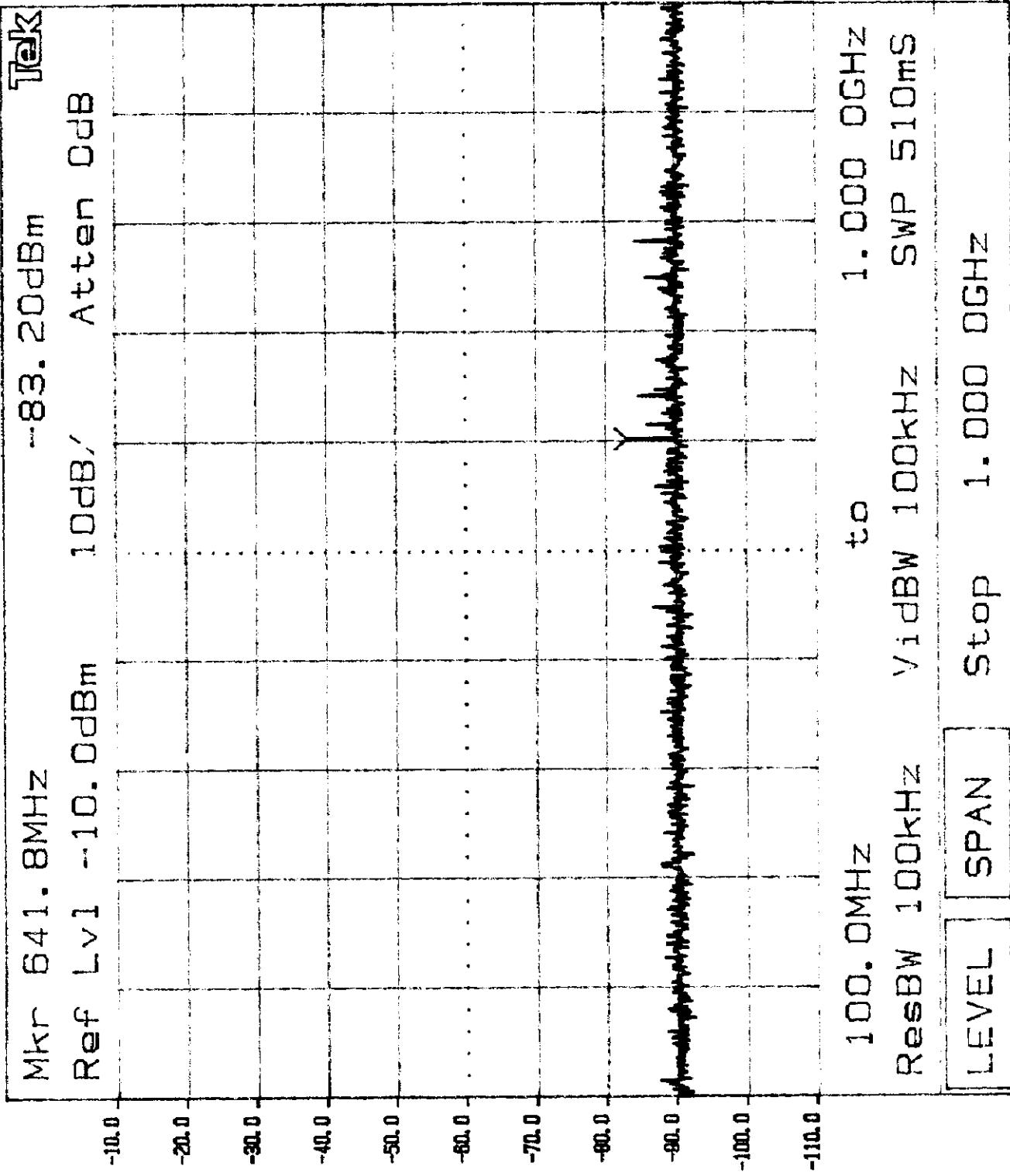
OUT OF BAND EMISSION PLOTS

Plot #	Description
4.1.a – 4.1.f	Base unit, Low channel
4.2.a – 4.2.f	Base unit, High channel
4.3.a – 4.3.f	Handset, Low channel
4.4.a – 4.4.f	Handset, High channel

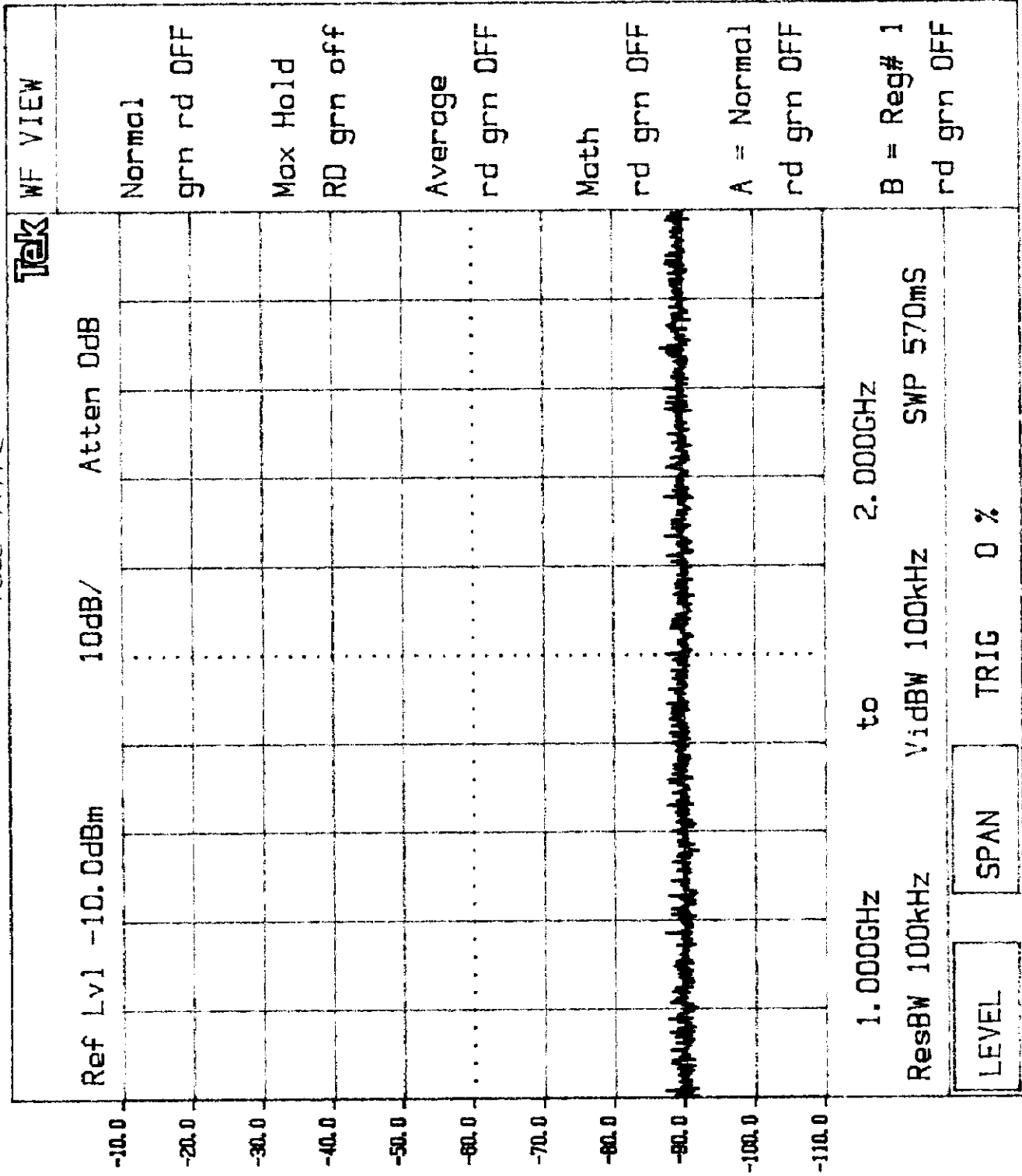
Plot 4.1.2



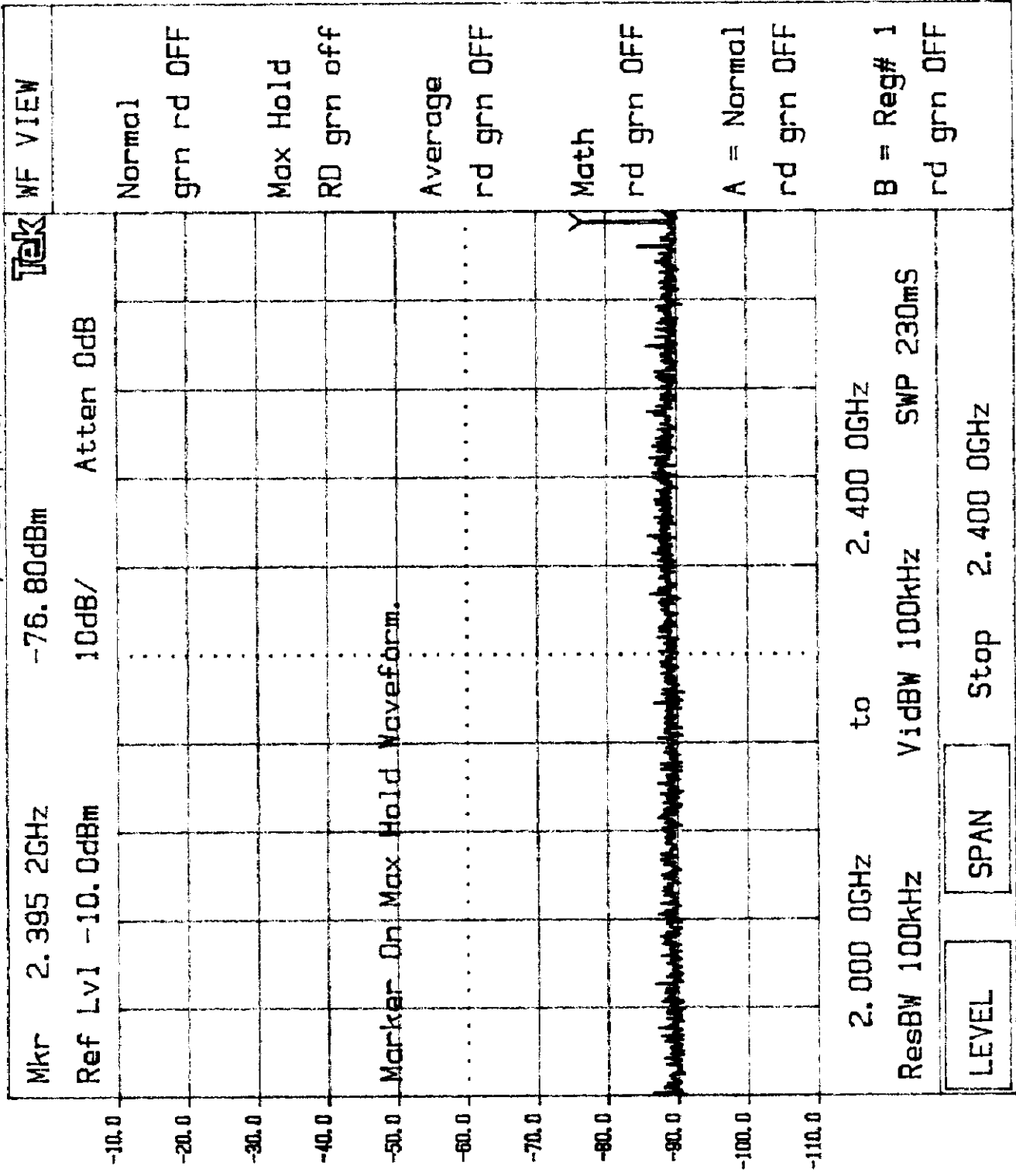
Plot 4.1.6



Plot 4.1.C



Plot 4, 1, d



WF VIEW

Normal
grn rd OFF

Max Hold
RD grn off

Average
rd grn OFF

Math
rd grn OFF

A = Normal
rd grn OFF

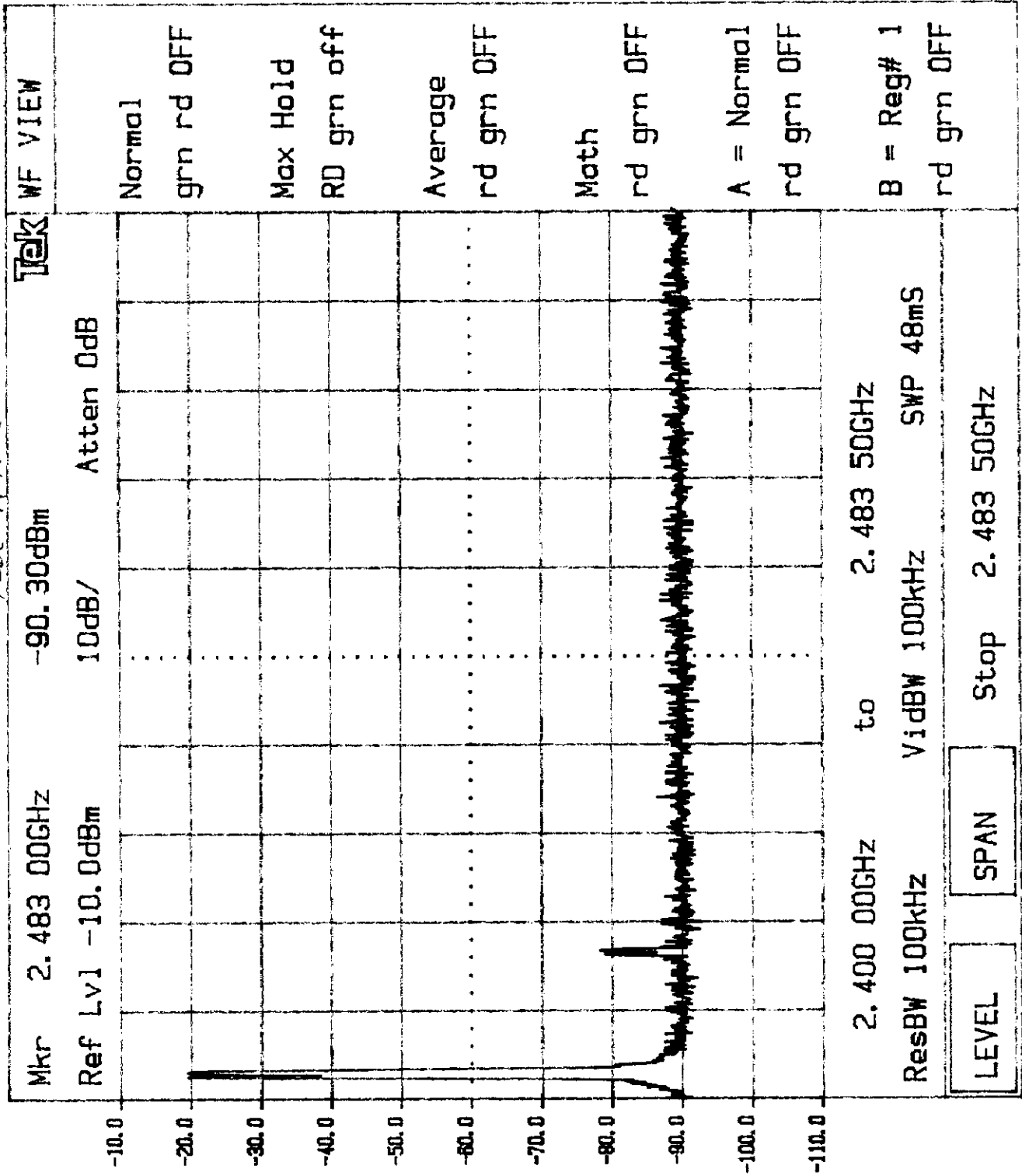
B = Reg# 1
rd grn OFF

LEVEL

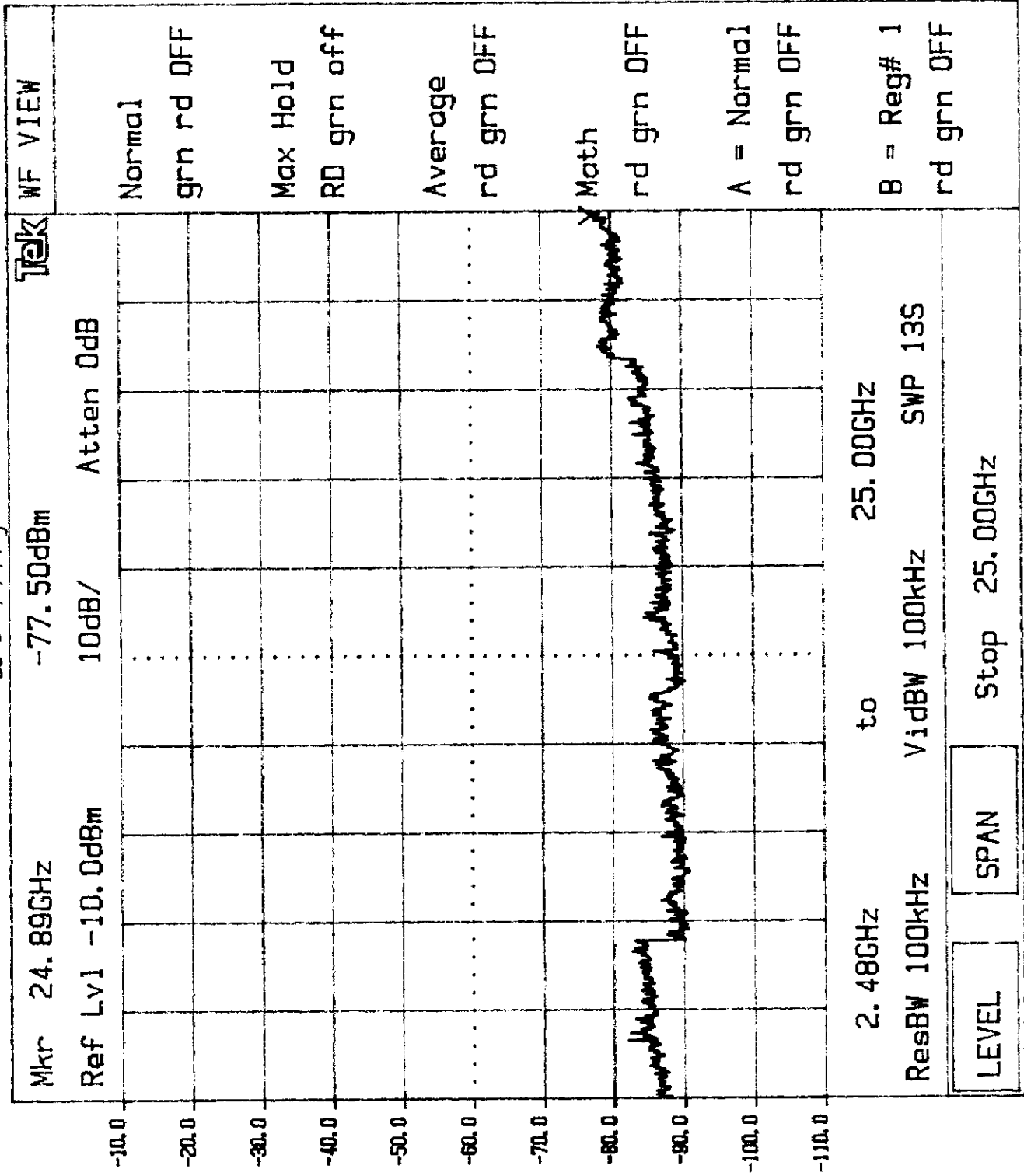
SPAN

Stop 2.400 0GHz

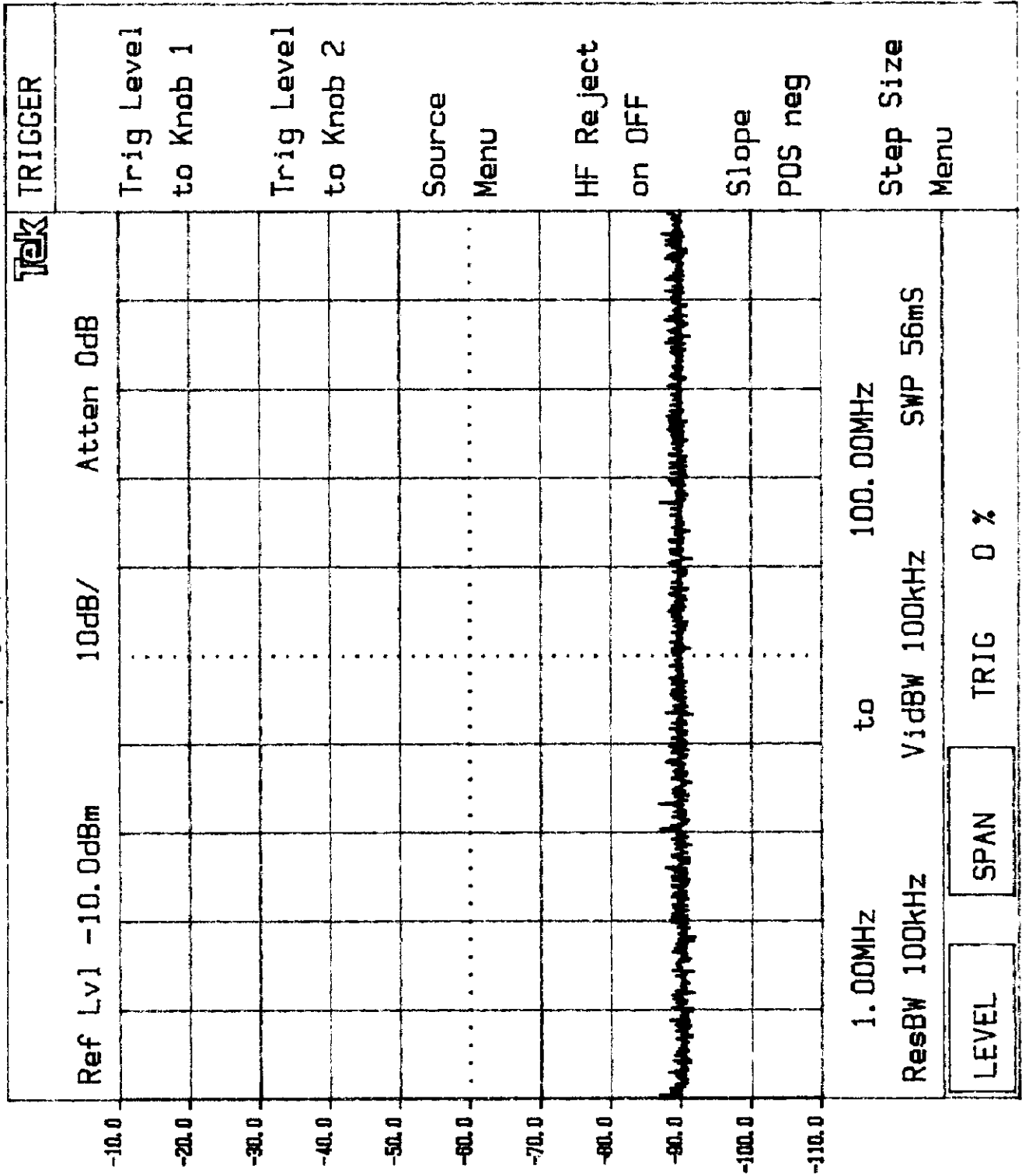
Plot 4, 1, 2



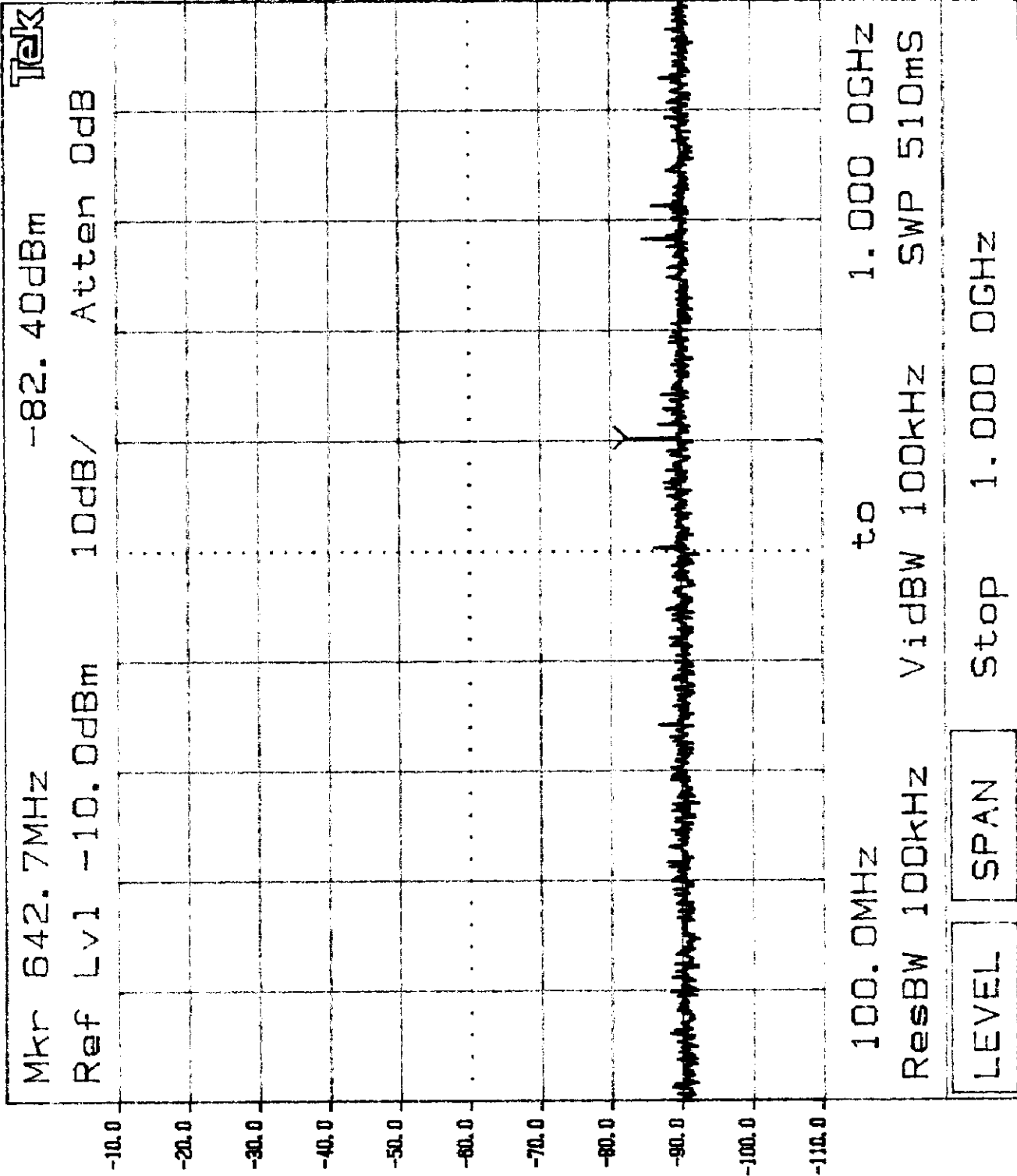
Plot 4.1.f



Plot 4.2.2



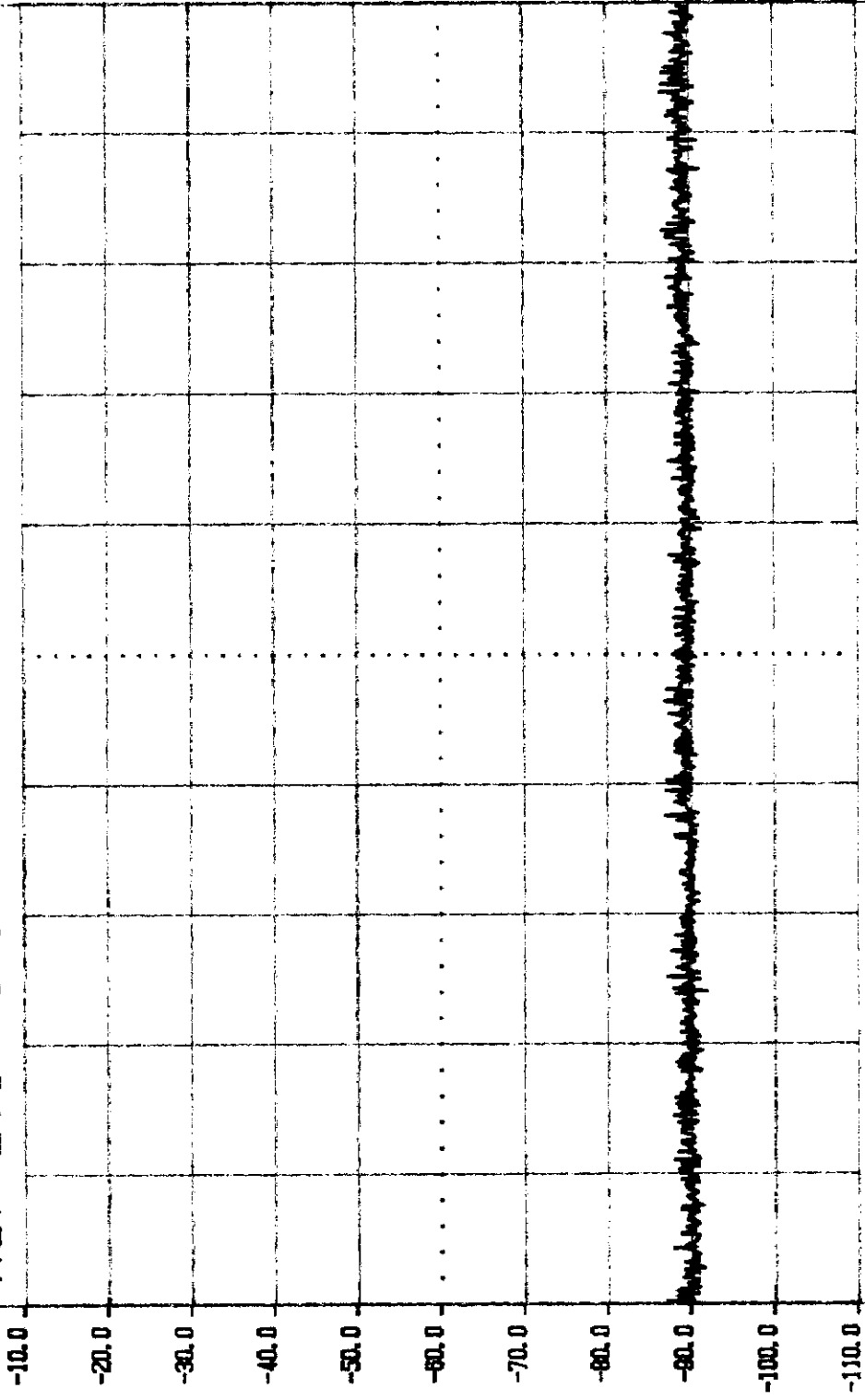
Plot 4.2.b



Plot 4.2.c

Tek

Ref Lvl -10.0dBm 10dB/ Atten 0dB

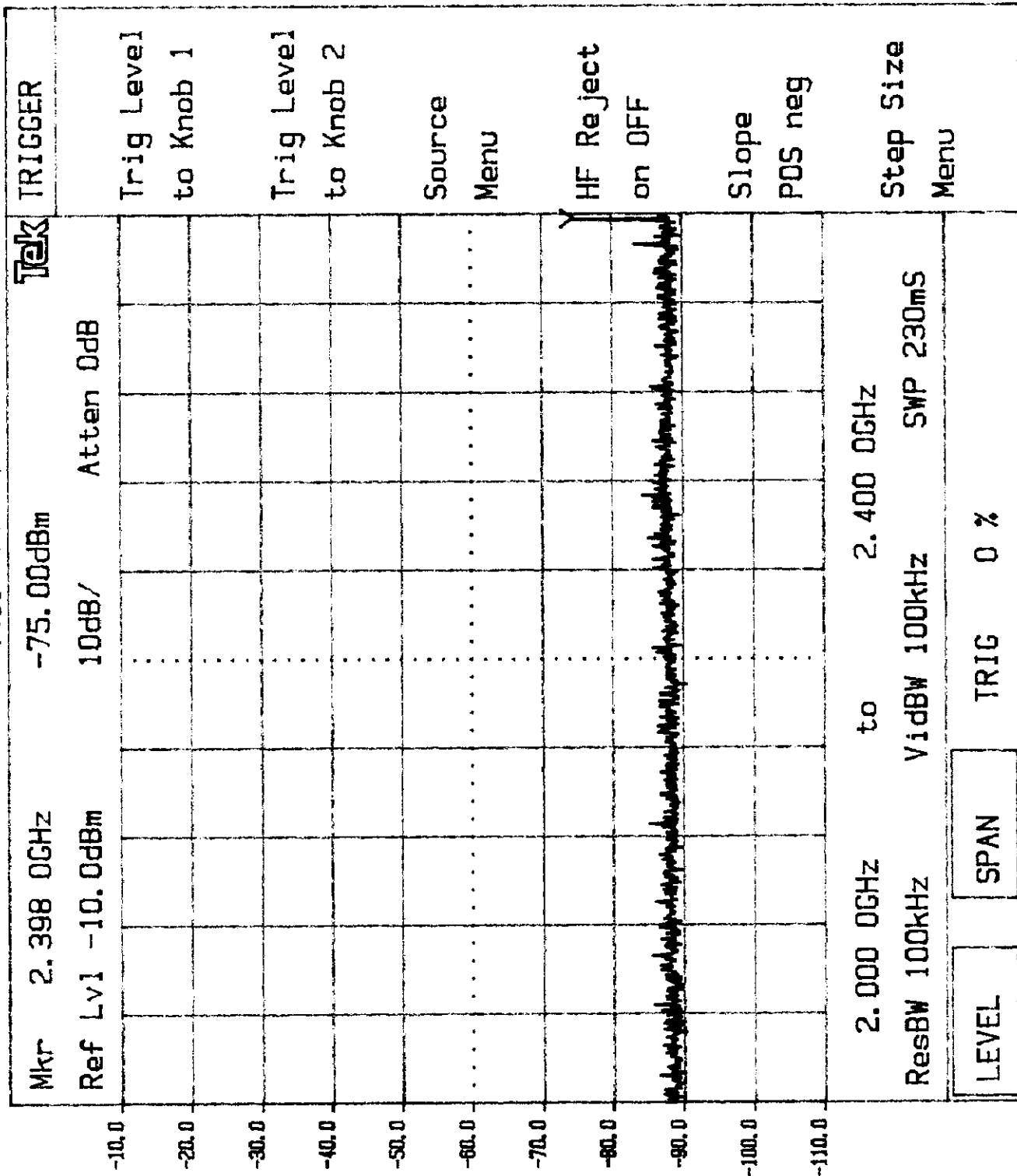


1.000GHz to 2.000GHz
ResBW 100kHz VidBW 100kHz SWP 570ms

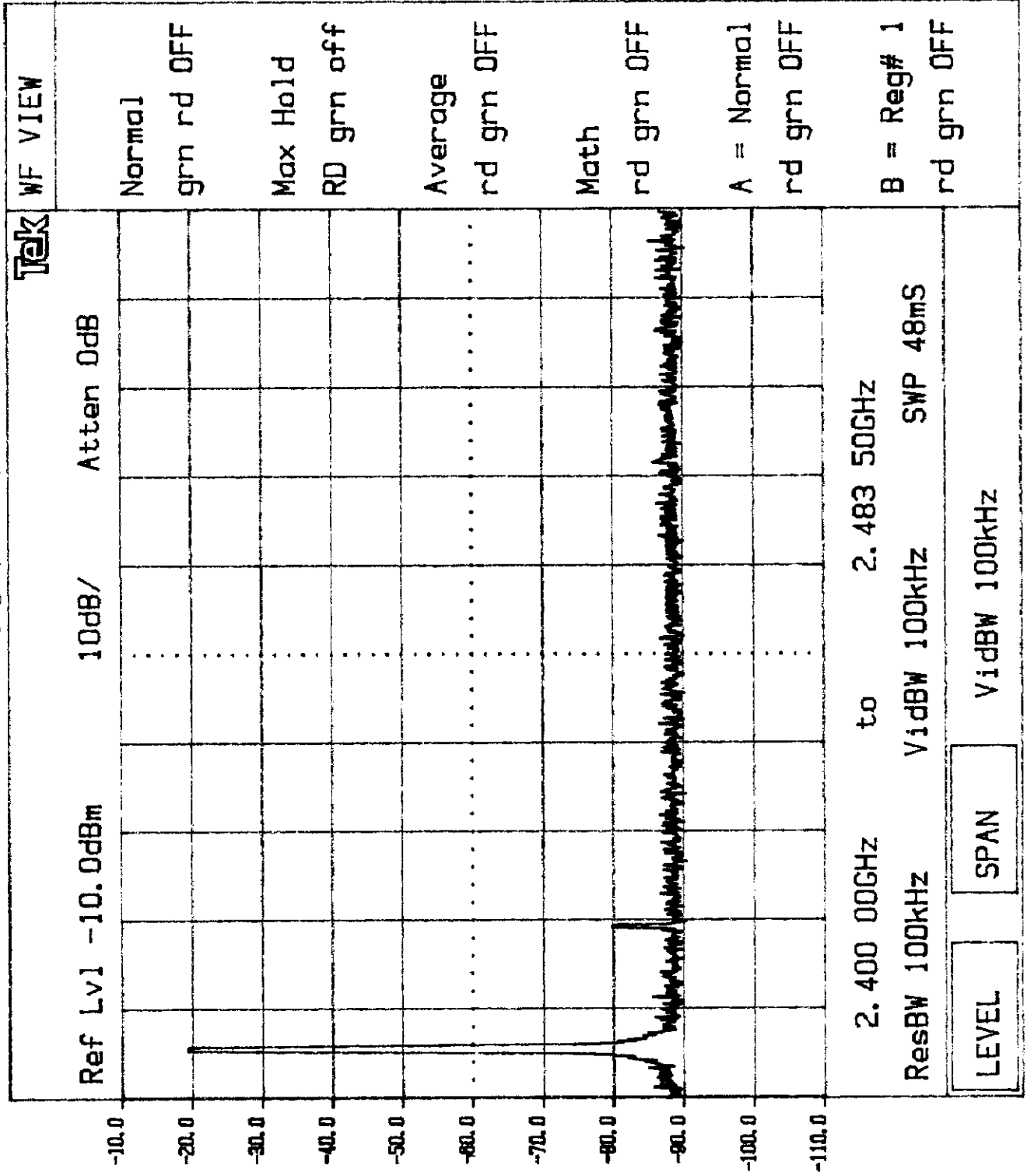
LEVEL SPAN

Stop 2.000GHz

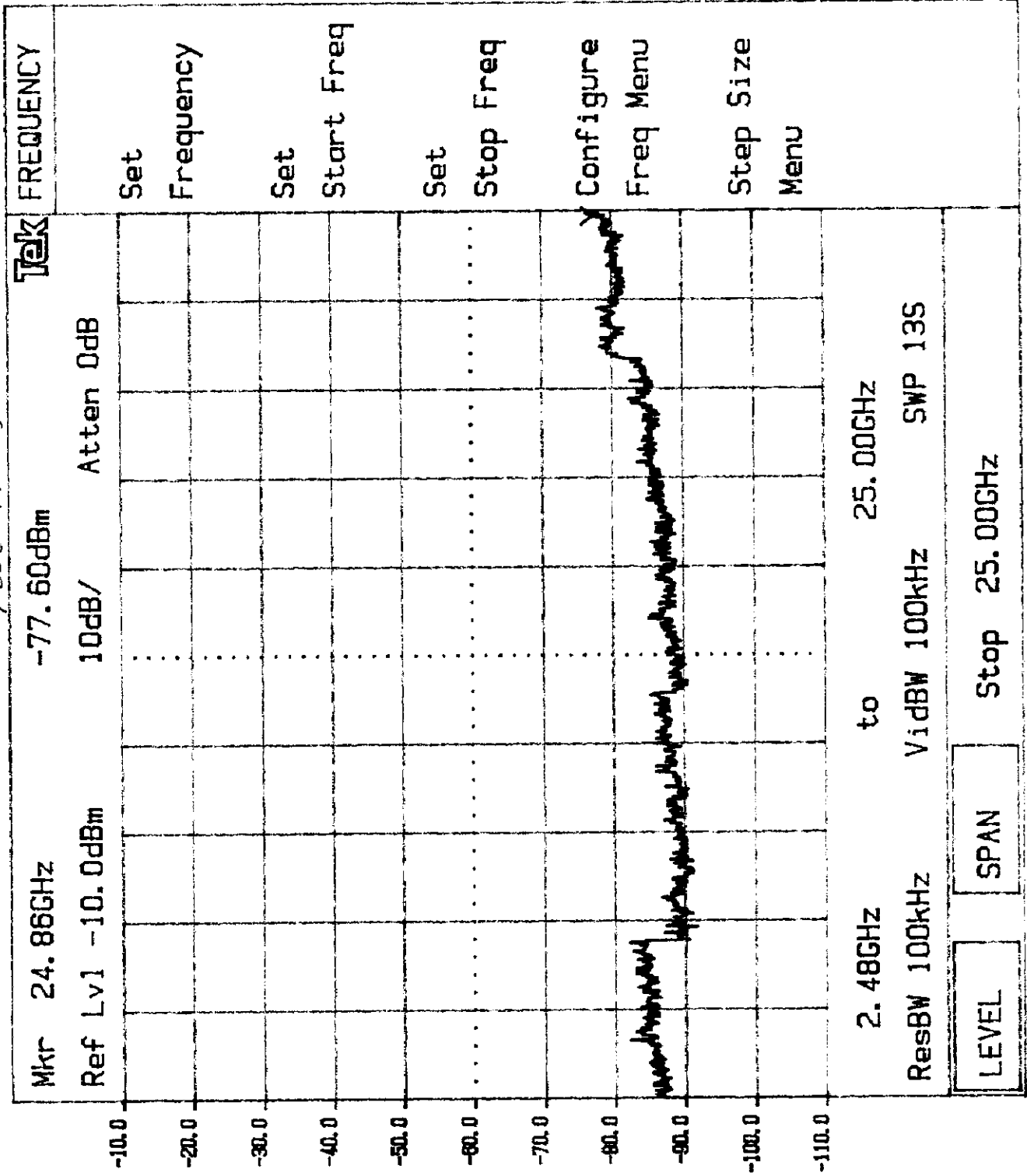
Plot 4.2.d



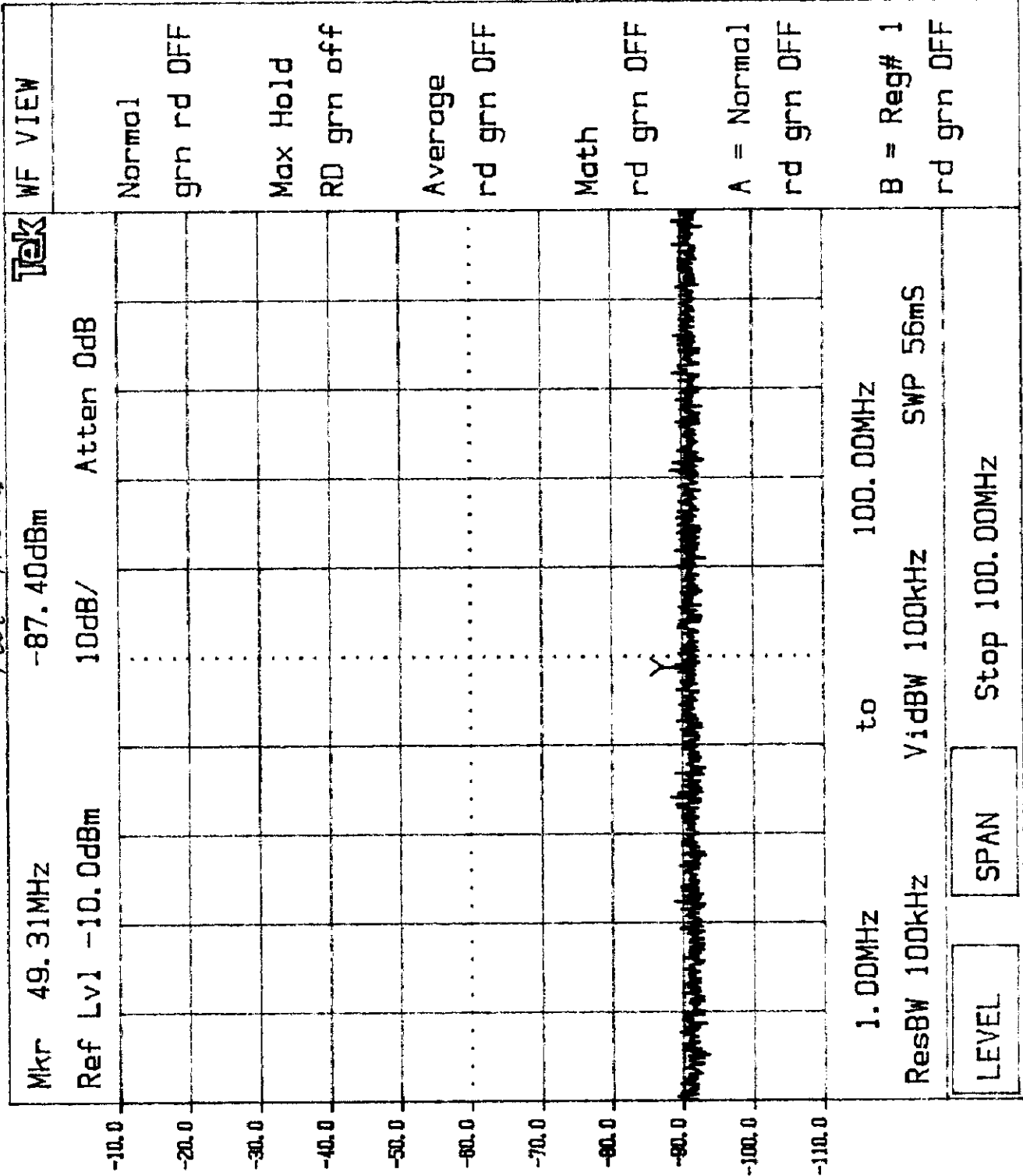
Plot 4.2.e



Plot 4.2.f



Plot 4.3 a



WF VIEW

Normal
grn rd OFF

Max Hold
RD grn off

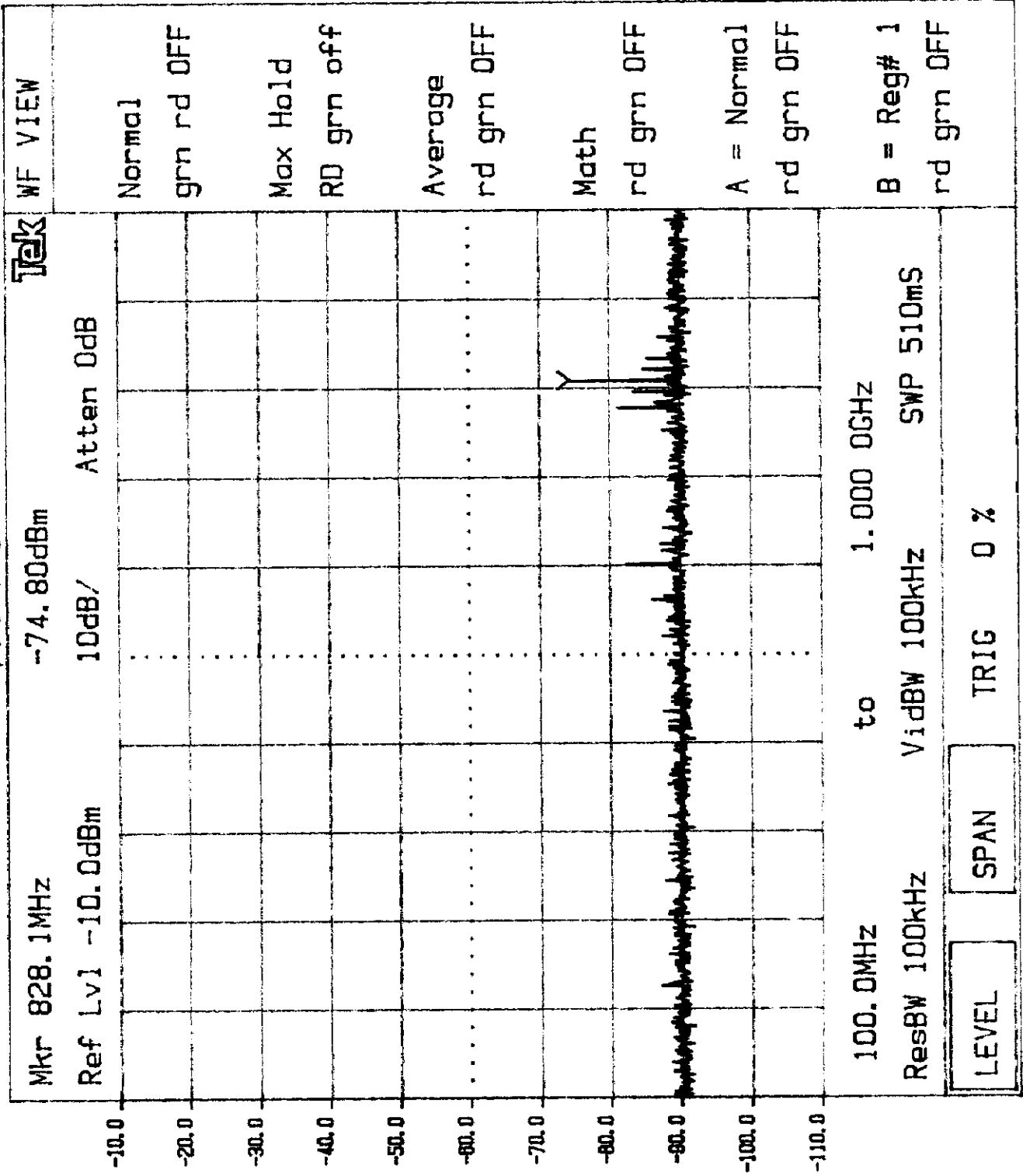
Average
rd grn OFF

Math
rd grn OFF

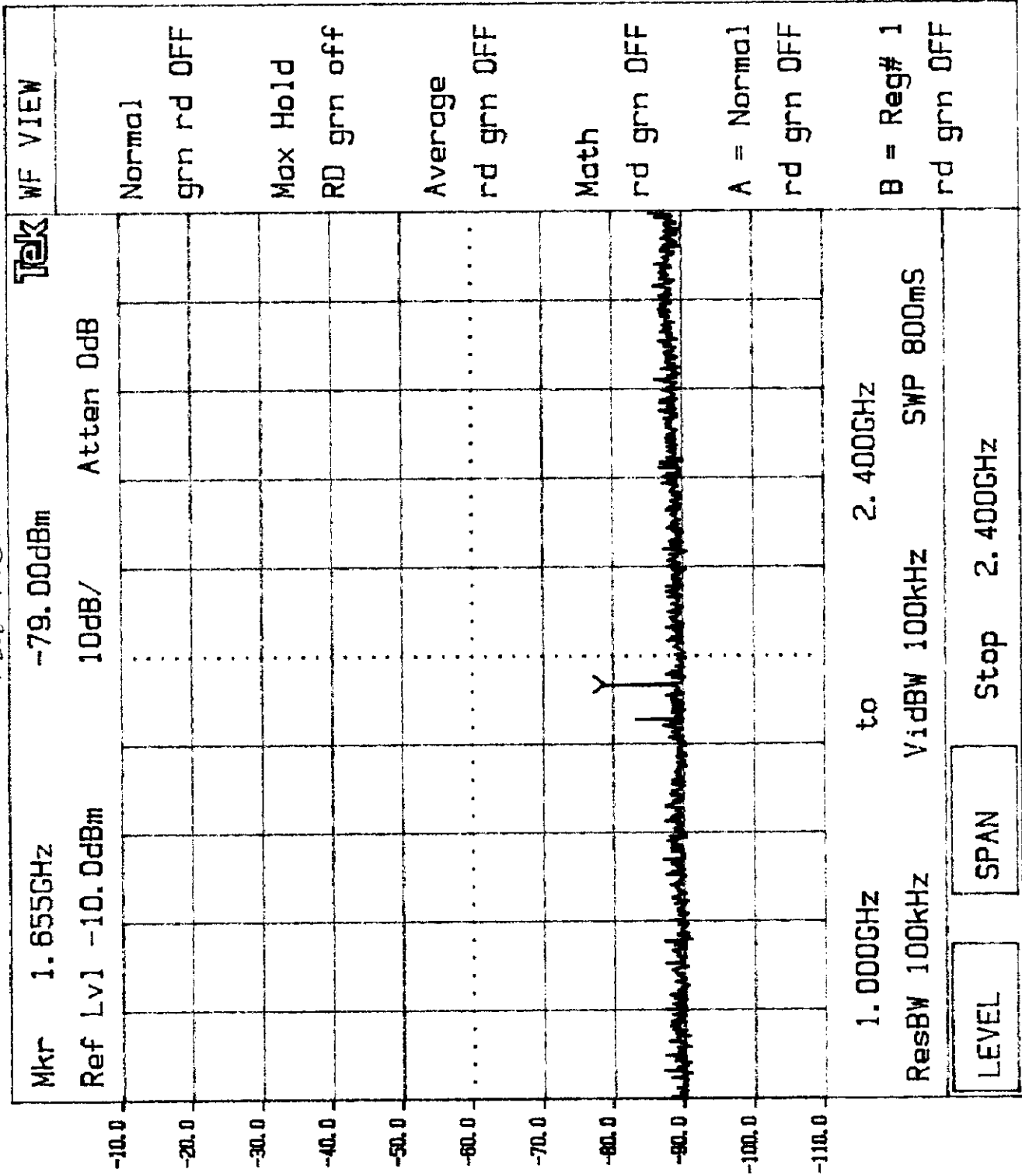
A = Normal
rd grn OFF

B = Reg# 1
rd grn OFF

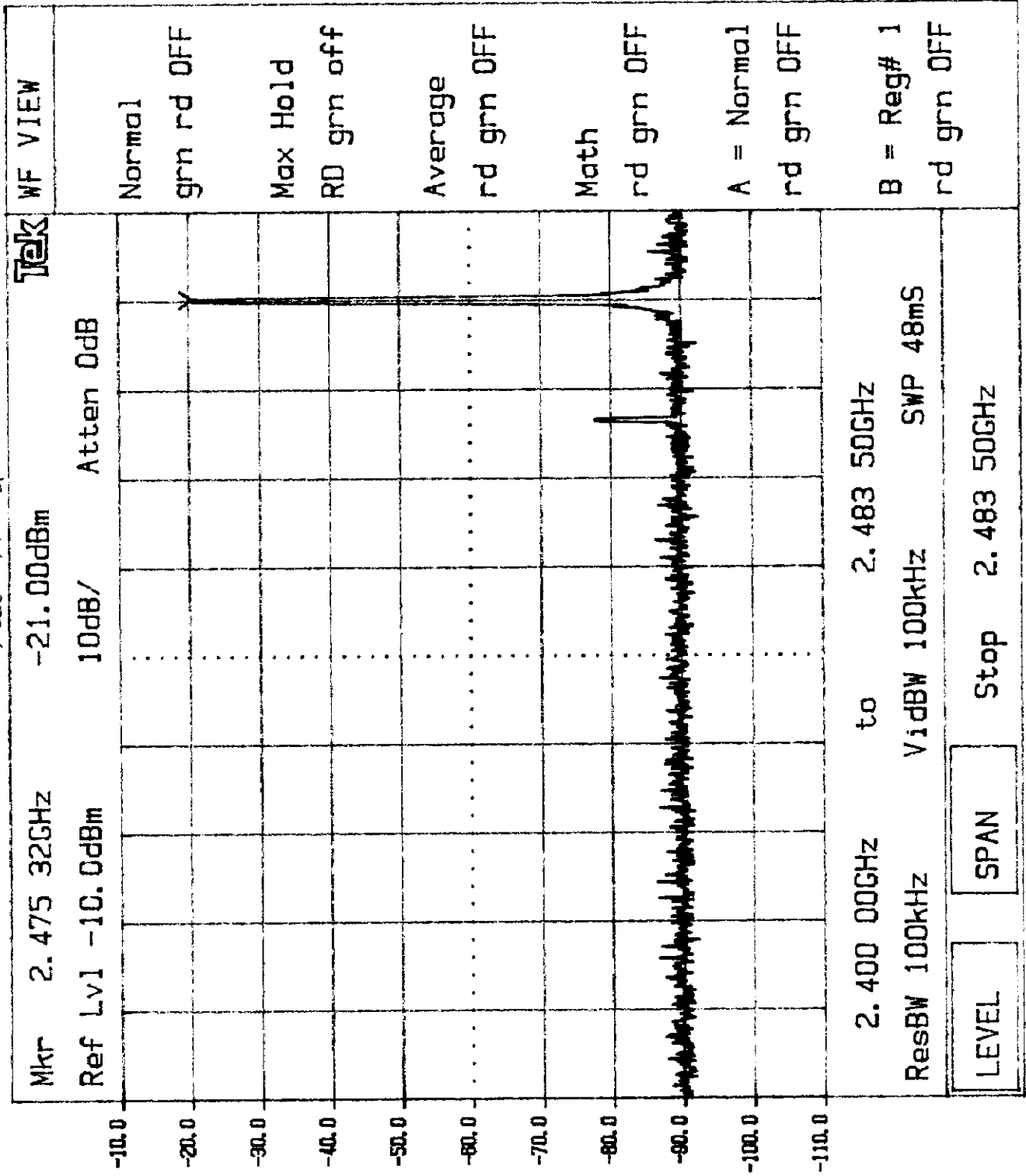
Plot 4.3.6



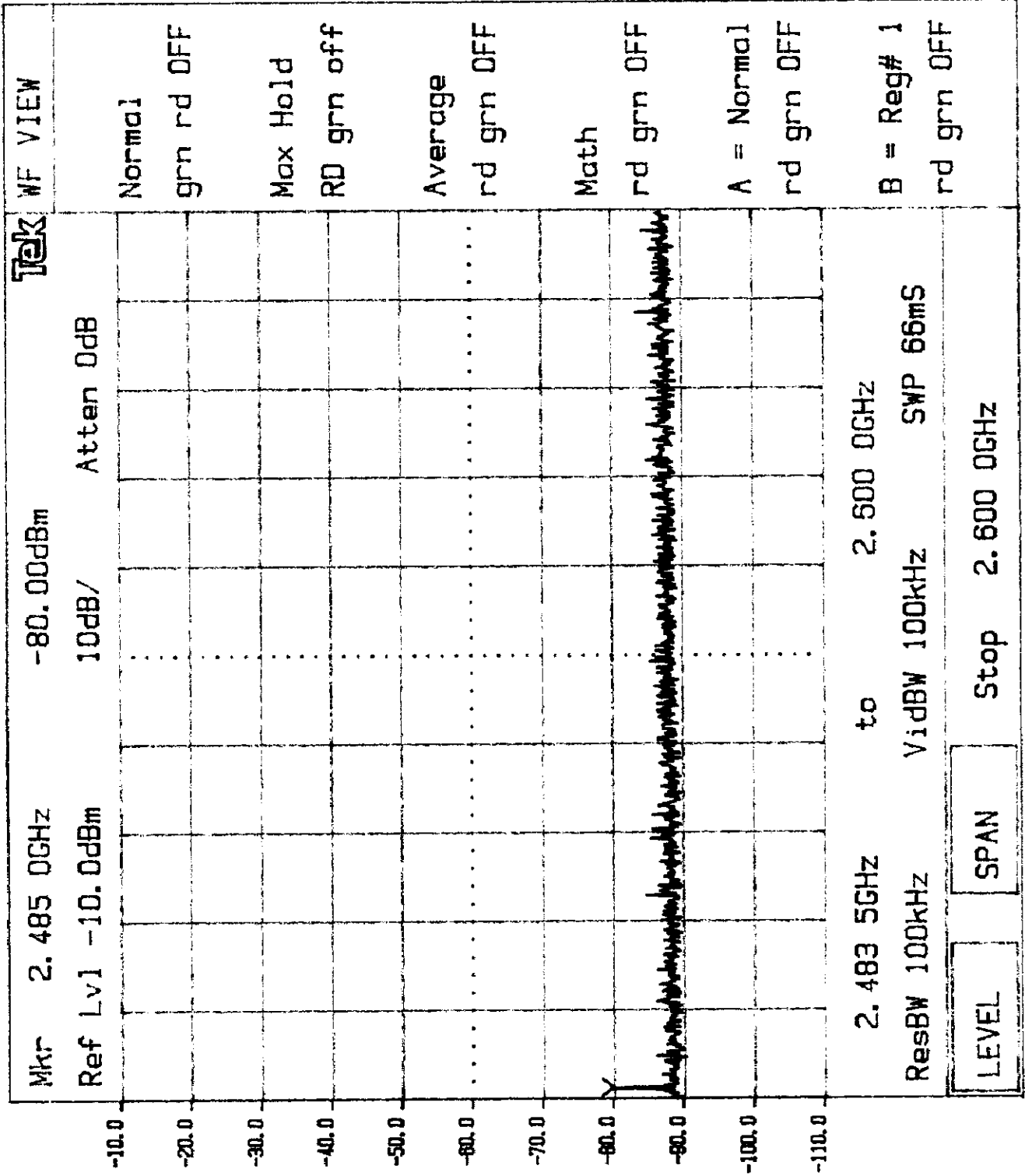
Plot 4.3.C



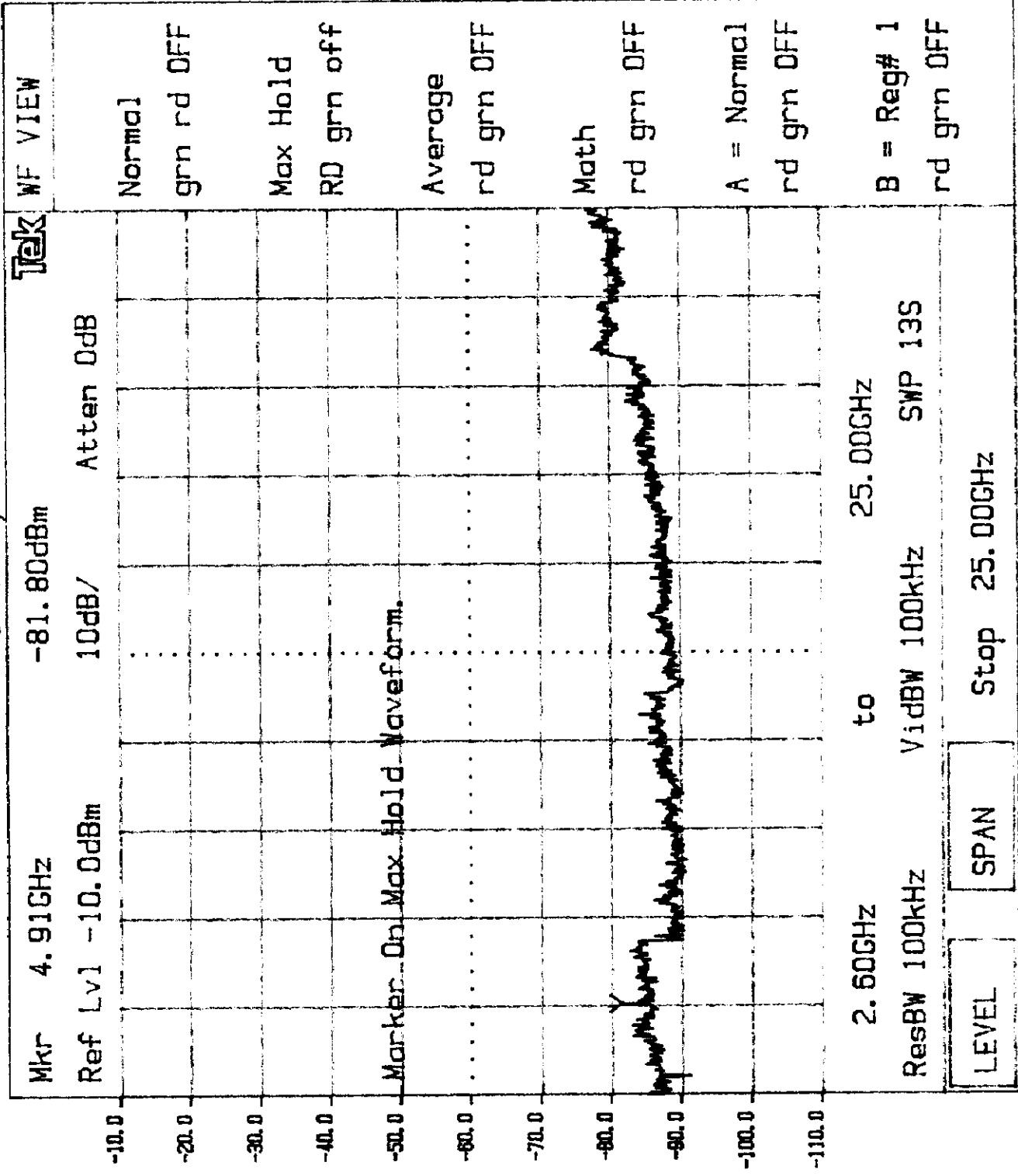
Plot 4.3 d



Plot 4.3 e



Plot 4.3.f

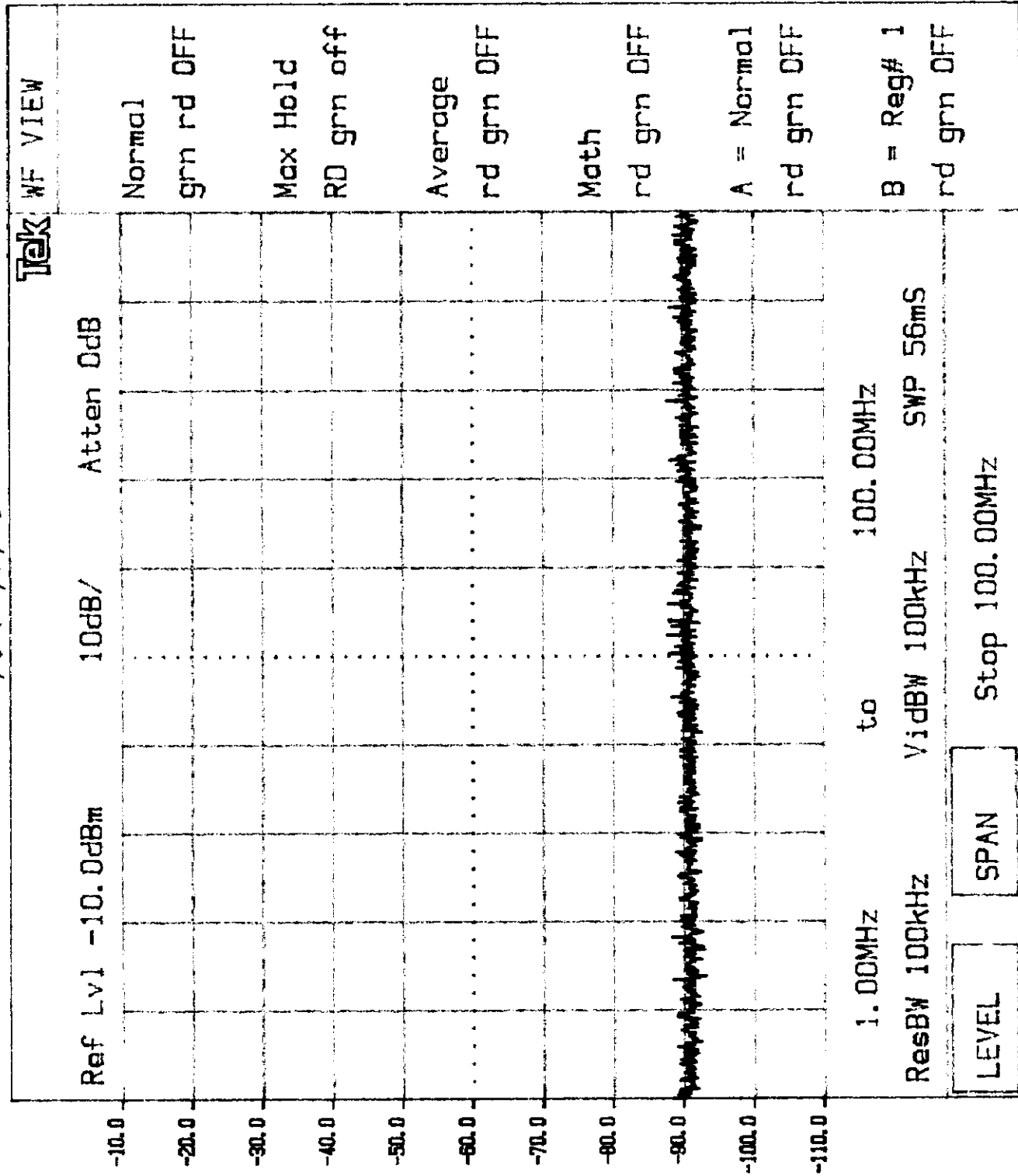


Tek

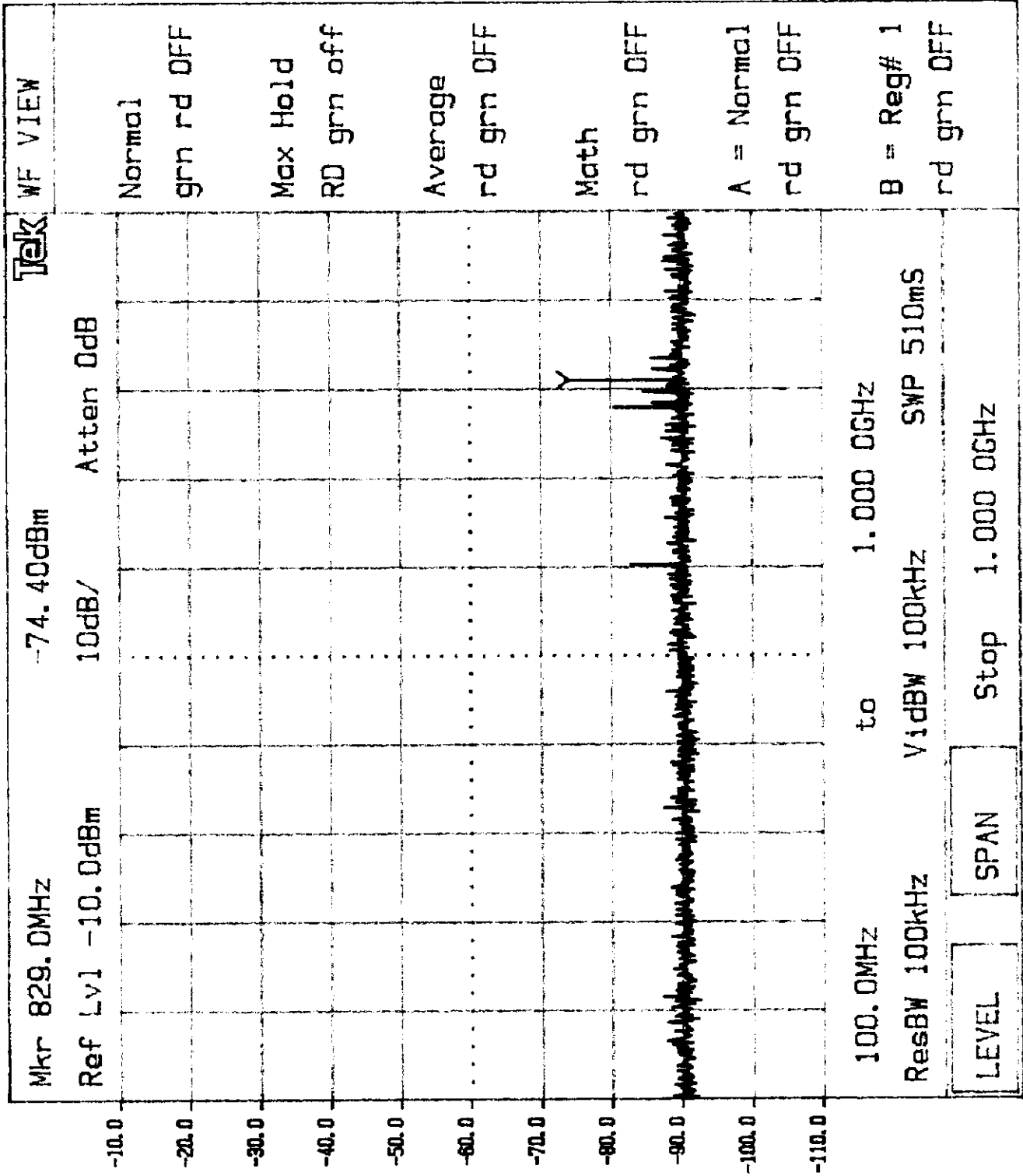
WF VIEW

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

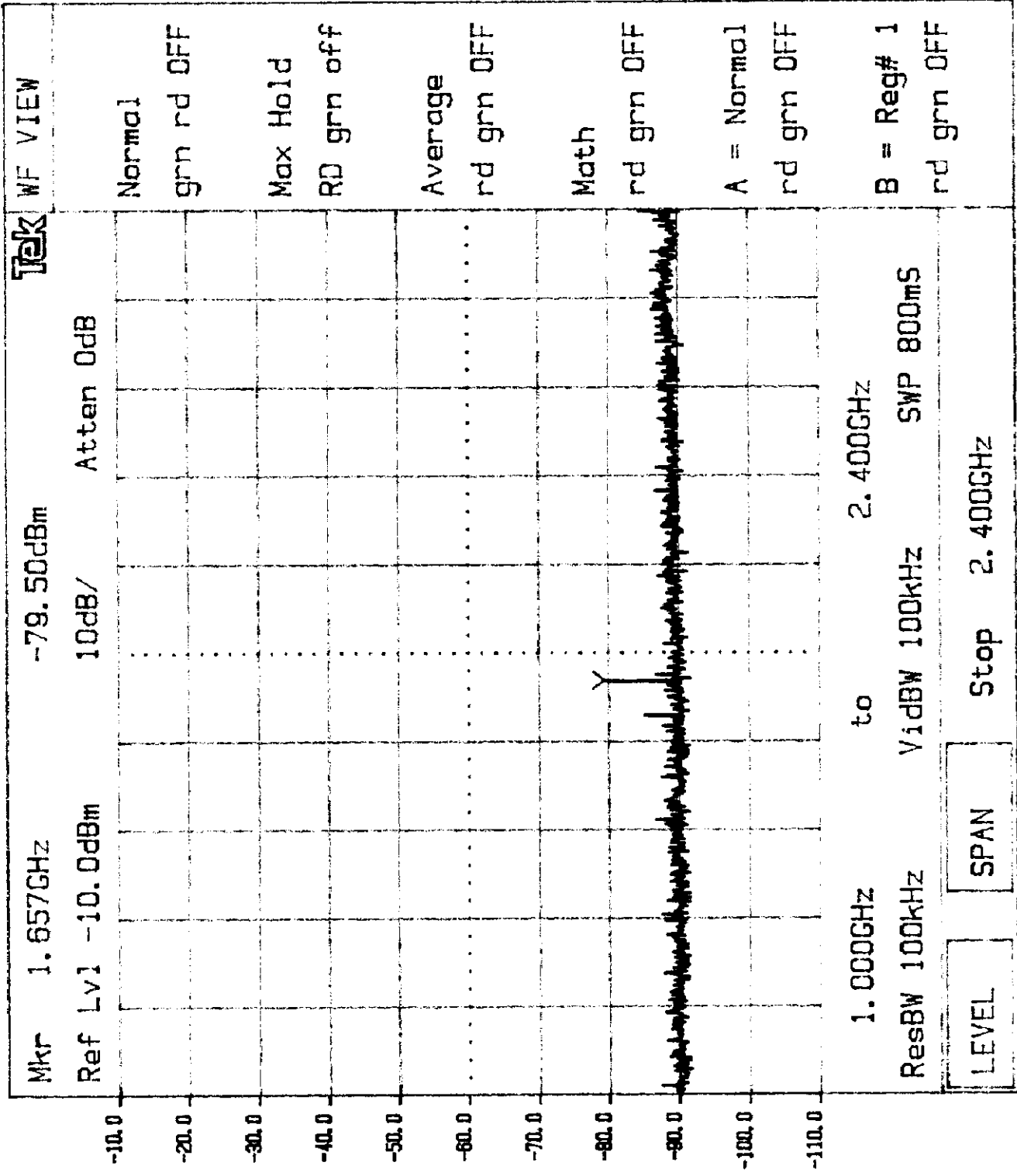
Plot 4.4.12



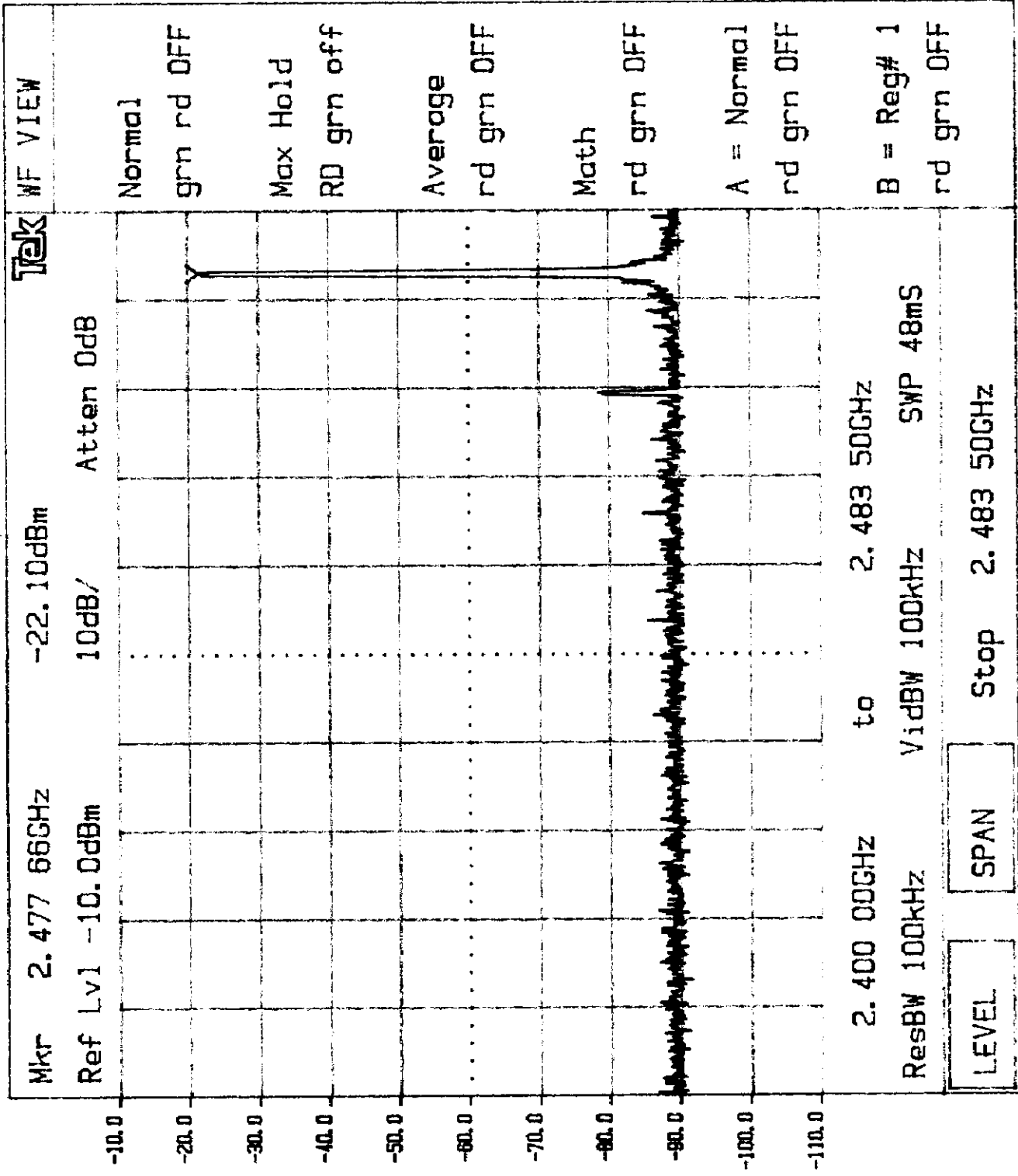
Plot 4.4. b



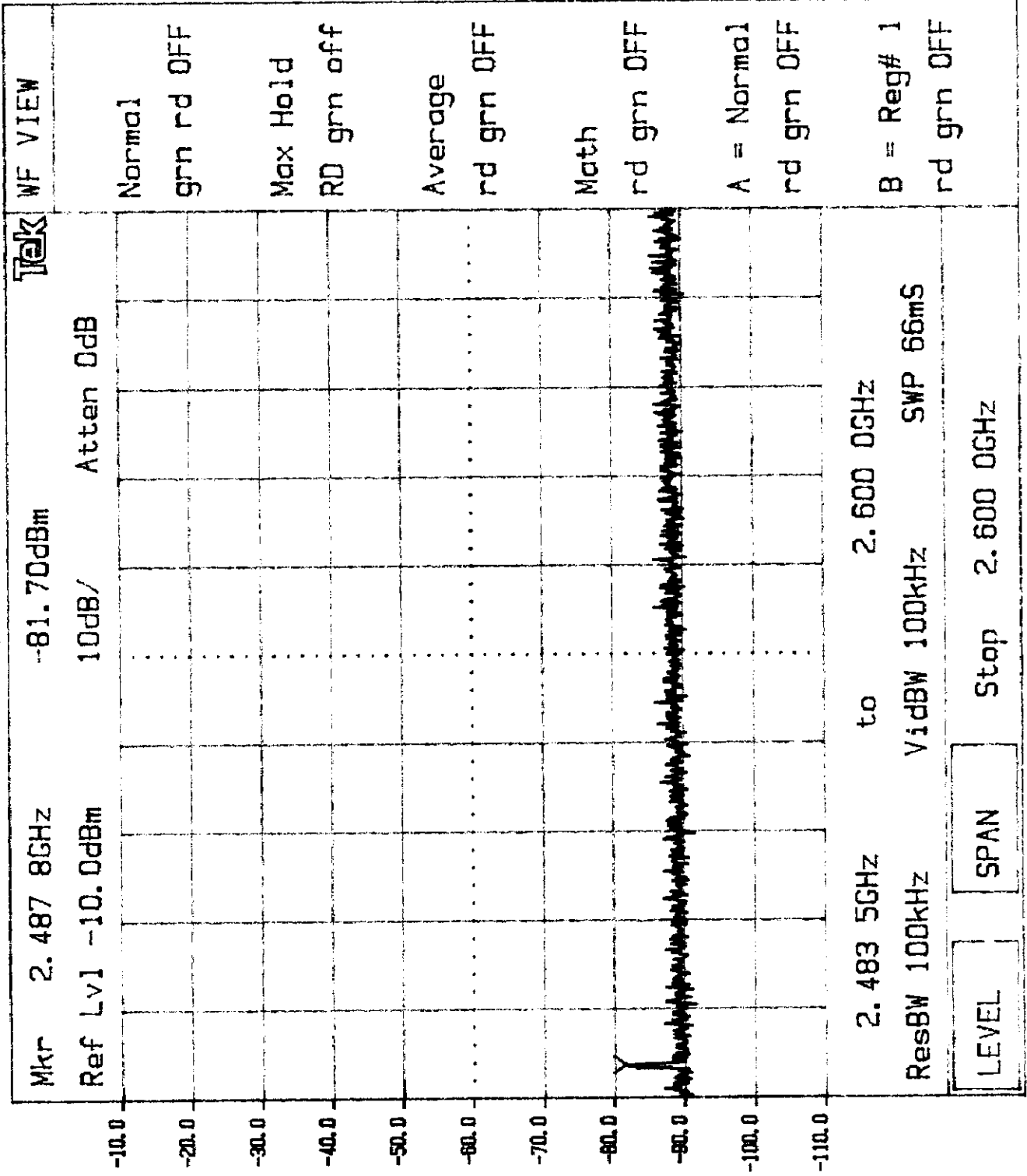
Plot 4.Y.C



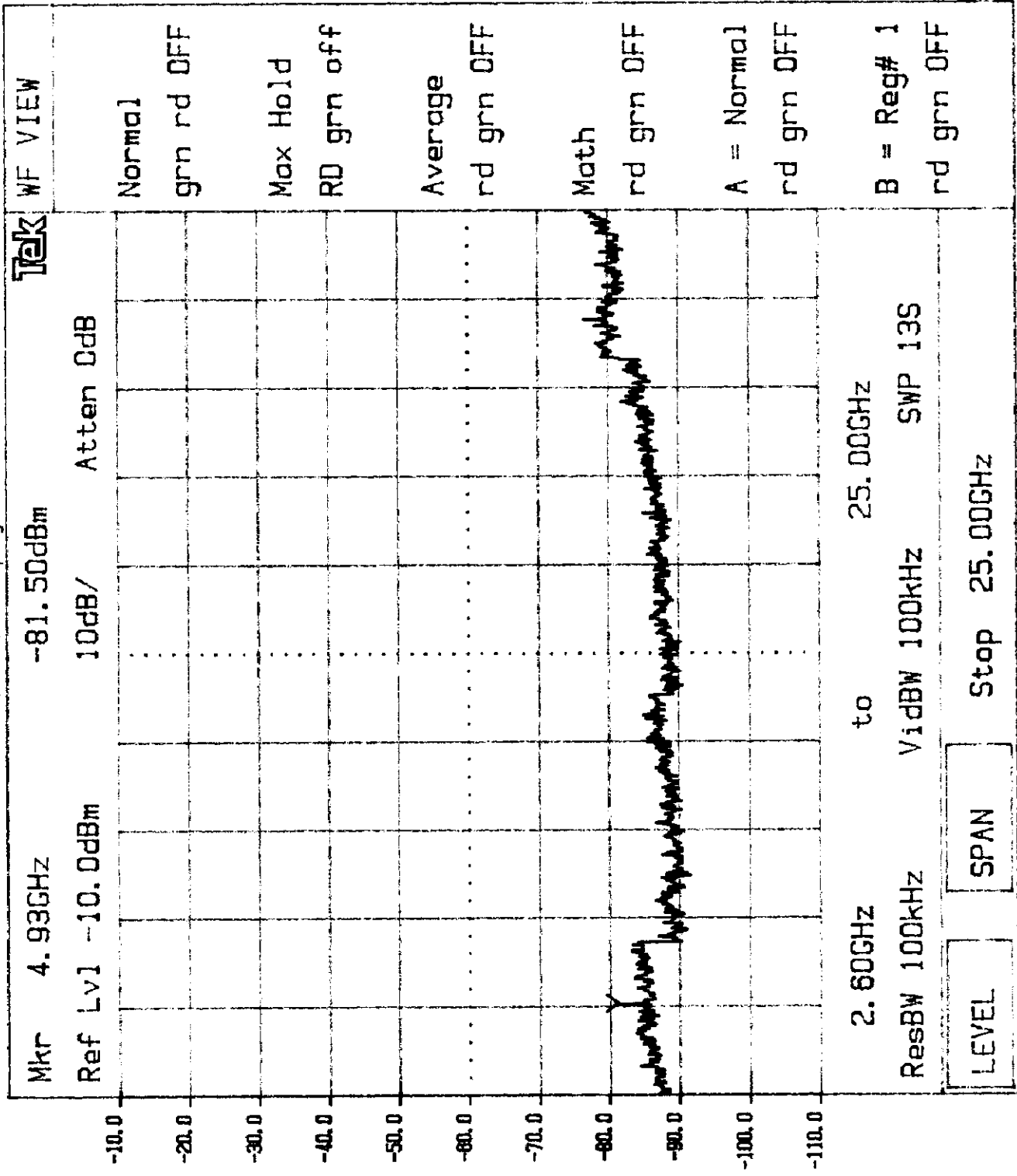
Plot 4.4. d



Plot 4.4.e



Plot 4.4.f



5 ANTENNA REQUIREMENTS

5.1 Test description

Parameter:	FCC § 15.203
Requirement:	FCC § 15.203
Descriptions:	No antenna other than furnished by the responsible party shall be used with the device.

5.2 Test Procedure

None

5.3 Test Results

The device is considered to comply with the requirements by

	Description
X	Permanently attached antenna
	Using an antenna with a unique coupling connector

5.4 Modifications made during testing

None

5.5 Test instrumentation

None

6 AC LINE CONDUCTED EMISSIONS**6.1 Test description**

Parameter:	ANSI C63.4
Requirement:	FCC § 15.207
Limits:	≤ 250 μV within the band 450 kHz to 30 MHz

6.2 Test Procedure

The EUT was connected to the DC power supply, that was connected to the AC line through the LISNs. Both HOT and NEUTRAL leads were tested.

AC line conducted emission measurements were performed from 0.45 MHz to 30 MHz. Analyzer resolution is 10 kHz or greater.

6.3 Test Results

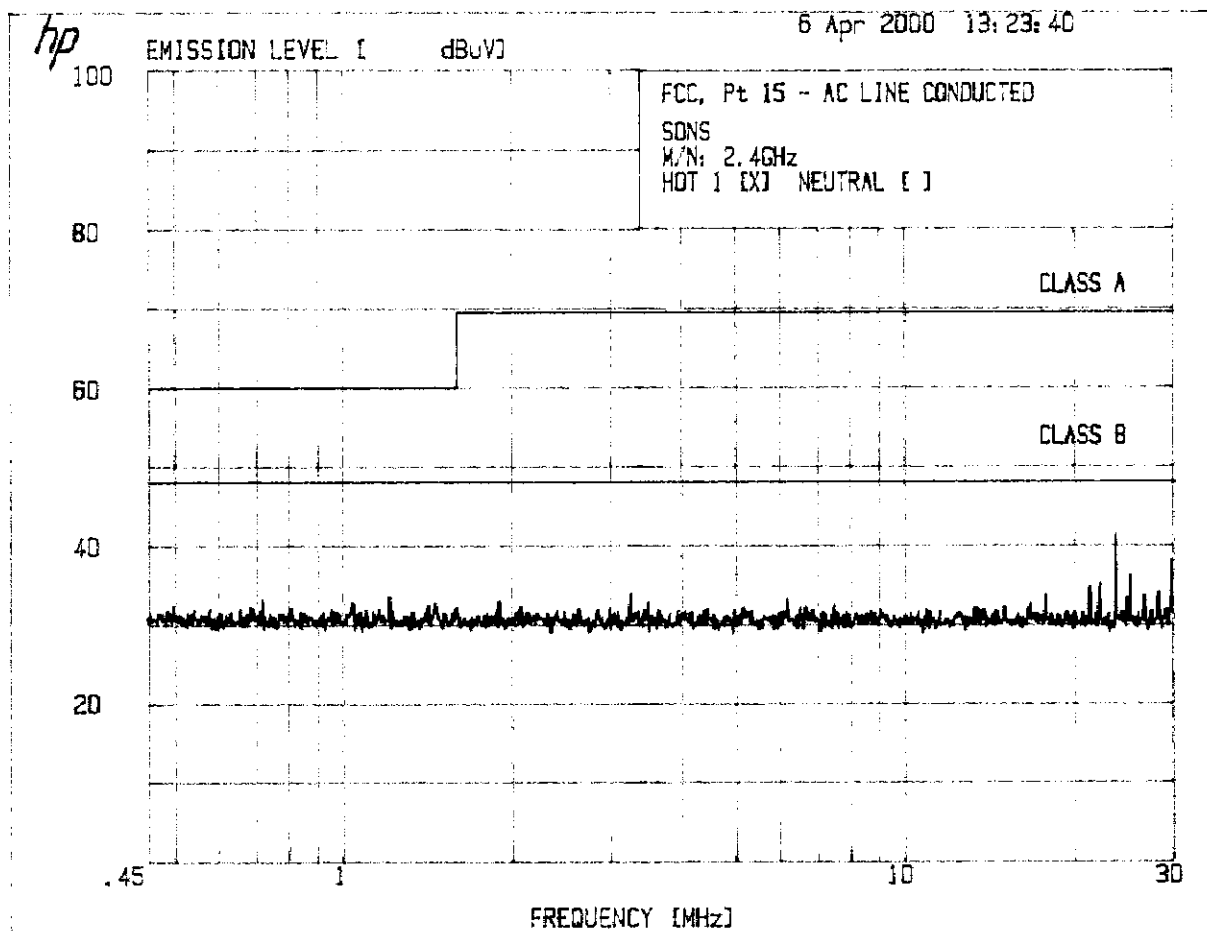
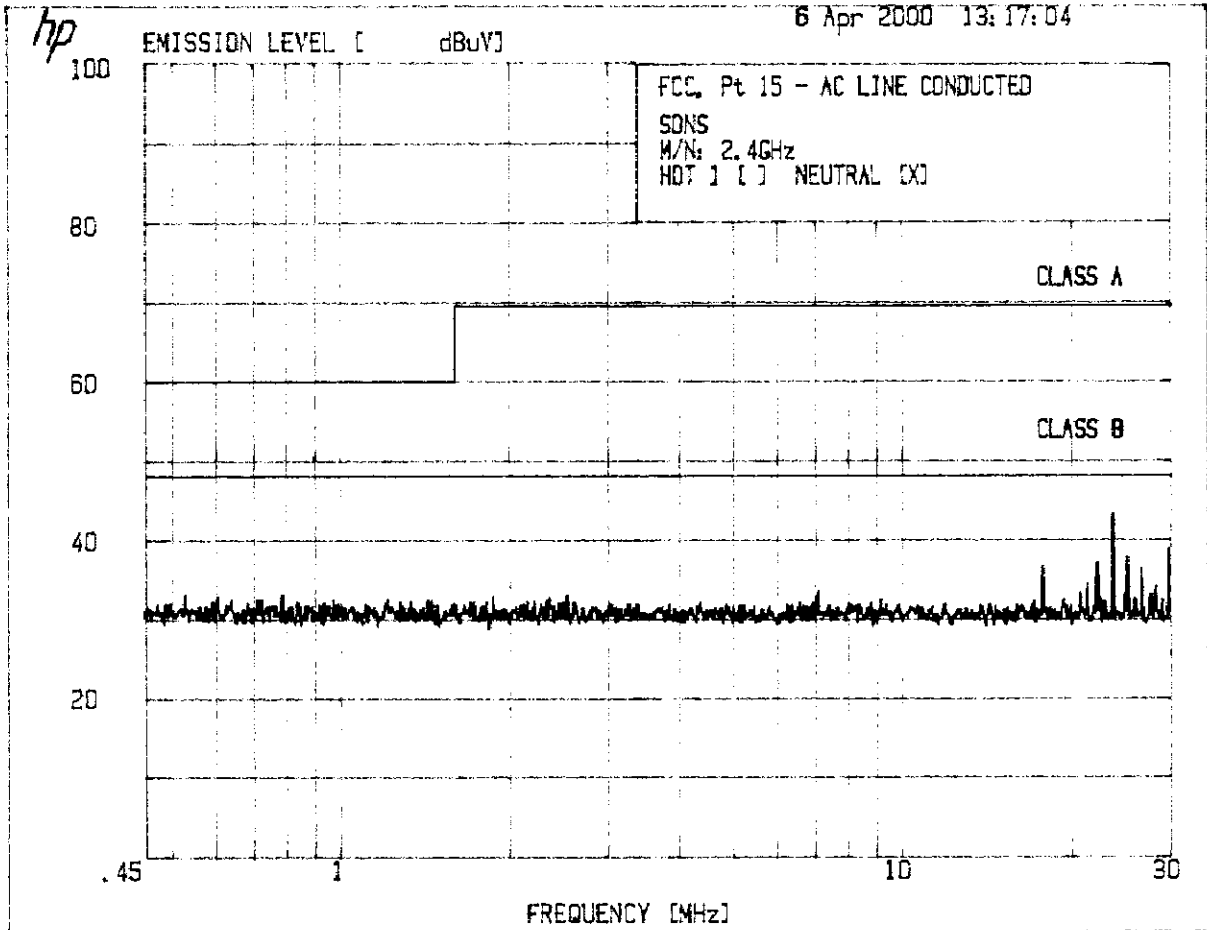
Handset	Base Unit
Not applicable, EUT is battery powered only	See attached. Passed by 4.7 dB

6.4 Modifications made during testing

None

6.5 Test instrumentation

- HP 8566B Spectrum Analyzer
- LISN



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6 Apr 2000 18:23:40

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3. FCC OFF 47, Pt 15

3.1 FCC, Pt 15 - AC LINE CONDUCTED

=====

SOME

M/N: 2.4GHz

HOT 1 [X] NEUTRAL []

PEAKS FOUND ABOVE 35 dBuV

PEAK#	FREQ (MHz)	AMPL (dBuV)
1	22.37	35.3
2	23.82	41.4
3	25.26	36.3
4	29.87	38.2