

**FCC PART 24 TYPE APPROVAL
EMI MEASUREMENT AND TEST REPORT
FOR
CELLULAR SPECIALTIES, INC.**

670 N. Commercial St.
Manchester NH 03101

FCC ID: NVRCSI110-02

February 4, 2000

This Report Concerns: <input checked="" type="checkbox"/> Original Report	Equipment Type: Amplifier
Test Engineer: John Chan	
Test Date: January 24, 2000	
Reviewed By: John Y. Chan – Engineering Manager	
Prepared By: Bay Area Compliance Laboratory Corporation 230 Commercial Street, Suite 2 Sunnyvale, CA 94086 (408) 732-9162	

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1 - GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

The *Cellular Specialties, Inc.*, FCC ID *NVRCSI110-02 (AMPLIFIER)* or the "EUT" as referred to in this report is a device using in enclosed structures where sufficient signal from local cell sites to operate cell phones was unavailable within the building. The device is connected to an external antenna, usually on the roof, and to one or more internal antennas placed strategically throughout the area where phone service is desired. The EUT measures 4.0" L x 3.5" W x 1.0" H.

1.2 Objective

This type approval report is prepared on behalf of *Cellular Specialties, Inc.* in accordance with Part 2, Subpart J, Part 15, Subparts A and B, and Part 24 Subpart E, of the Federal Communication Commissions rules.

The objective of the manufacturer is to demonstrate compliance with FCC rules for output power, 20 dB bandwidth, occupied bandwidth, spurious emission at antenna terminal, two-tone test, conducted and radiated margin.

1.3 Related Submittal(s)/Grant(s)

No Related Submittals

1.4 Test Methodology

All measurements contained in this report were conducted with ANSI C63.4 –1992, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz. All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

1.5 Test Facility

The Open Area Test site used by Bay Area Compliance Laboratory Corporation to collect radiated and conducted emission measurement data is located in the back parking lot of the building at 230 Commercial Street, Suite 2, Sunnyvale, California, USA.

Test sites at Bay Area Compliance Laboratory Corporation has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-1992.

The Federal Communications Commission and Voluntary Control Council for Interference has the reports on file and is listed under FCC file 31040/SIT 1300F2 and VCCI Registration No.: C-674 and R-657. The test sites has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, Bay Area Compliance Laboratory Corporation is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (NVLAP). The scope of the accreditation covers the FCC Method - 47 CFR Part 15 - Digital Devices, IEC/CISPR 22: 1993, and AS/NZS 3548: Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment test methods under NVLAP Lab Code 200167.

1.6 Test Equipment List

Manufacturer	Description	Model	Serial Number	Cal. Due Data
HP	Spectrum Analyzer	8566B	2610A02165	12/6/00
HP	Spectrum Analyzer	8593B	2919A00242	12/20/00
HP	Amplifier	8349B	2644A02662	12/20/00
HP	Quasi-Peak Adapter	85650A	917059	12/6/00
HP	Amplifier	8447E	1937A01046	12/6/00
A.H. System	Horn Antenna	SAS0200/571	261	12/27/00
Com-Power	Log Periodic Antenna	AL-100	16005	11/2/00
Com-Power	Biconical Antenna	AB-100	14012	11/2/00
Solar Electronics	LISN	8012-50-R-24-BNC	968447	12/28/00
Com-Power	LISN	LI-200	12208	12/20/00
Com-Power	LISN	LI-200	12005	12/20/00
BACL	Data Entry Software	DES1	0001	12/20/00
Rohde & Schwarz	Signal Generator	SMIQ03B	1125.5555.03	7/10/2002
Rohde & Schwarz	I/Q Modulation Generator	AMIQ	1110.2003.02	8/10/2002

1.7 Equipment Under Test (EUT)

Manufacturer	Description	Model	Serial Number	FCC ID
Cellular Specialties, Inc.	Amplifier	110 PCS	None	NVRCSI110-02

1.8 Support Equipment

Manufacturer	Description	Model	Serial Number	FCC ID
Rohde & Schwarz	Signal Generator	SMIQ03B	1125.5555.03	Doc
Rohde & Schwarz	I/Q Modulation Generator	AMIQ	1110.2003.02	Doc

1.9 EUT Configuration Details and List

NOT APPLICABLE

1.10 External I/O Cabling

Cable Description	Length (M)	Port/From	To
Shielded BNC Cable	2.0	Rohde & Schwarz	EUT

2 - SYSTEM TEST CONFIGURATION

2.1 Justification

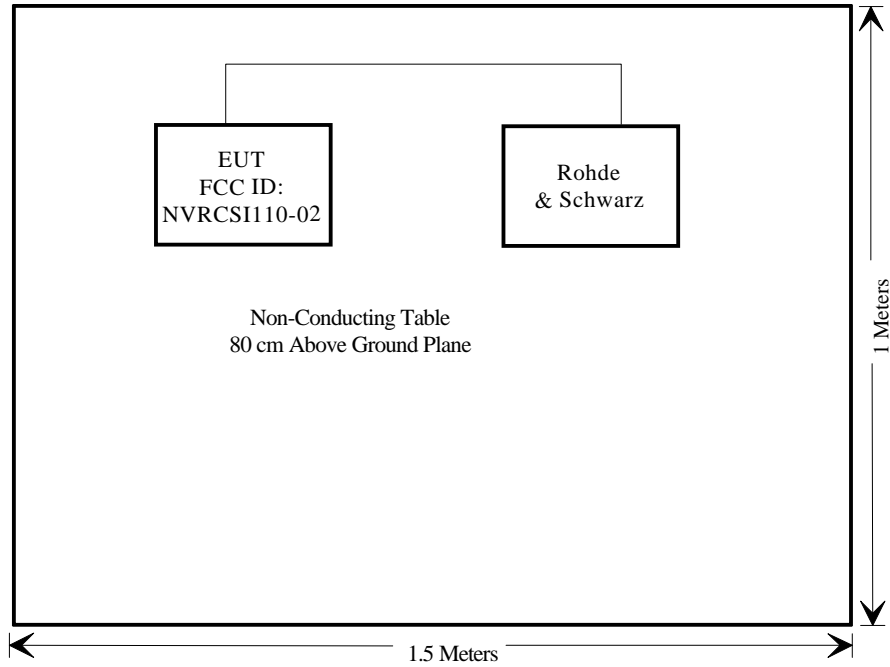
The EUT was configured for testing in a typical fashion (as normally used in a typical application).

The final qualification test was performed with the EUT operating at normal mode.

2.2 Block Diagram

Appendix A contains a copy of the EUT's block diagram as reference.

2.3 Test Setup Block Diagram



2.4 Equipment Modifications

No modifications were necessary for the EUT to comply.

3.0 Summary of Test Results

FCC RULE	DESCRIPTION OF TEST	RESULT
2.1046	RF power output	Pass
2.1047	Modulation Characteristics	Pass
2.1049	Emission, Occupied Bandwidth	Pass
2.1051	Spurious emissions at antenna terminals	Pass
2.1051	Two-Tone Test (Spurious emissions at antenna terminals)	Pass
2.1053	Field strength of spurious radiation	Pass
2.1055 (a)	Frequency stability vs. temperature	N/A
2.1055 (d)	Frequency stability vs. voltage	
15.107	AC Line Conducted emission	Pass

3.1.0 RF Power Output

Requirements: FCC Part 2.1046

3.1.1 Test Procedure

The antenna was removed and SMA connector was connected to the transmitter output. The transmitter output was connected to a calibrated coaxial attenuator (50 Ohm), the other end of which was connected to a spectrum analyzer. Transmitter output was read off the spectrum analyzer in dBm. The power output at the transmitter was determined by adding the value of the attenuator to the spectrum analyzer reading.

The test was performed at three frequencies (low, middle, and high channels) and on all power levels which can be setup on the transmitter.

3.1.2 Test equipment

Hewlett Packard HP8566B Spectrum Analyzer
Hewlett Packard HP 7470A Plotter
Rohde & Schwarz SMIQ03B Signal Generator
Rohde & Schwarz AMIQ I/Q Modulation Generator

3.1.3 Test Results

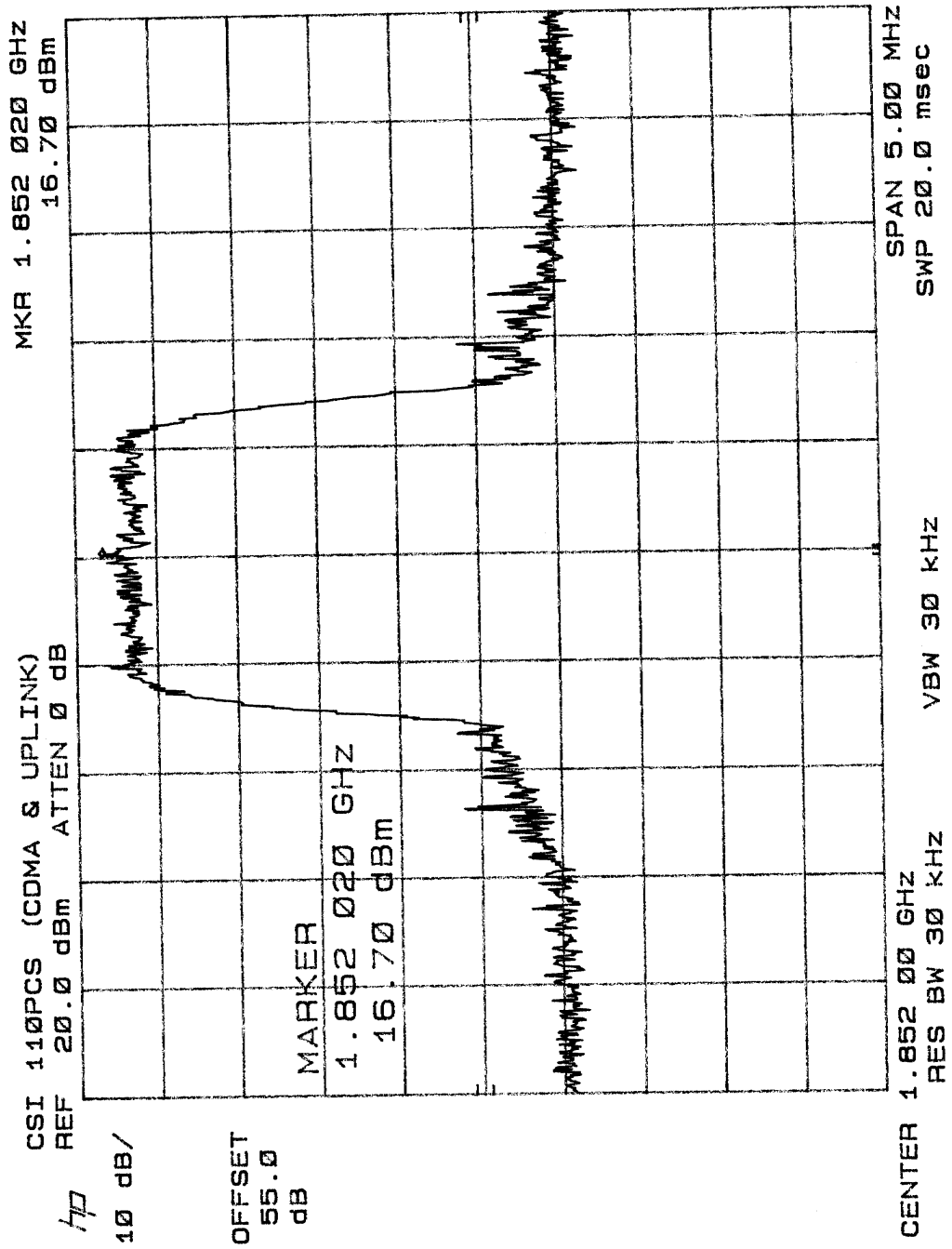
Refer to the attached to the following plots:

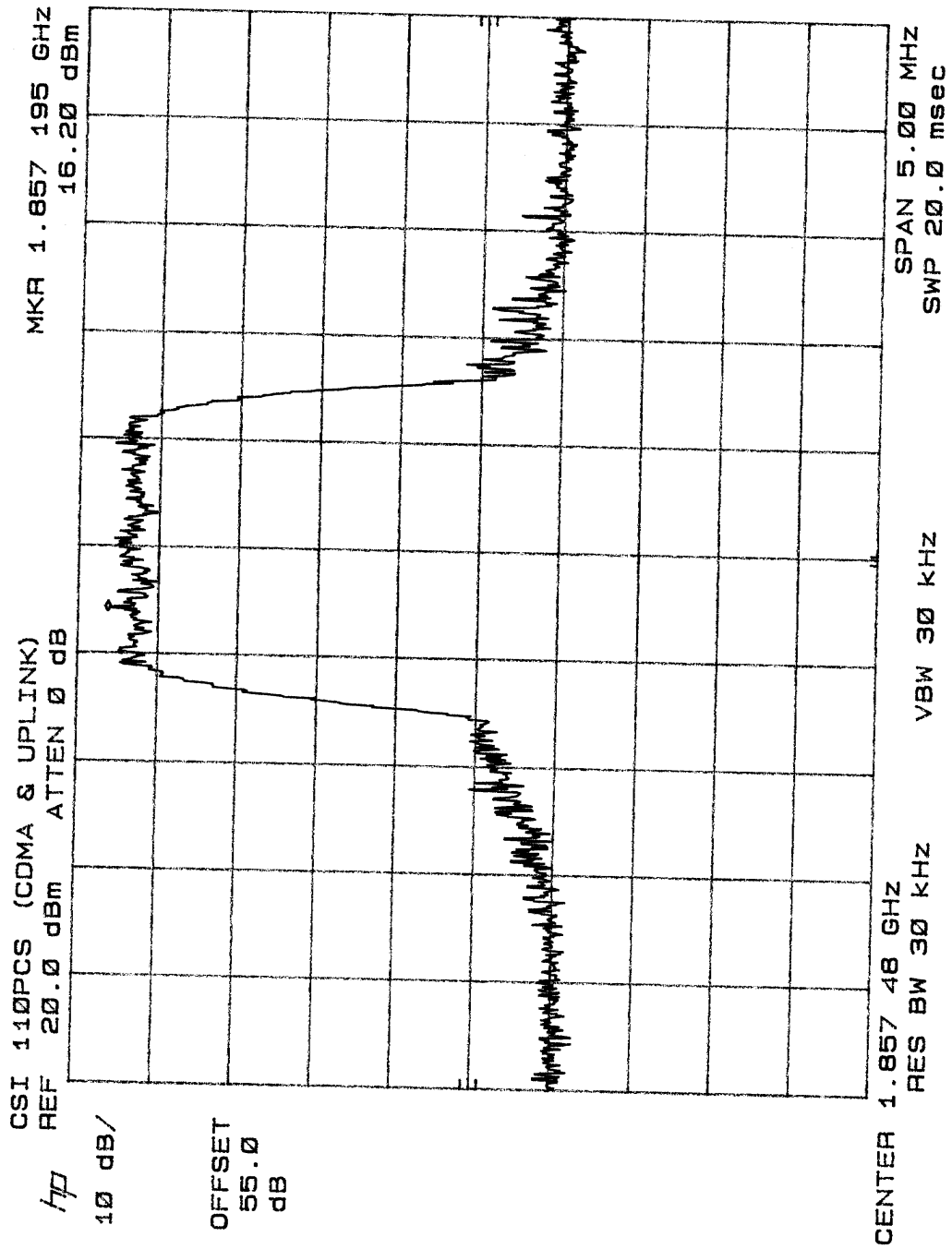
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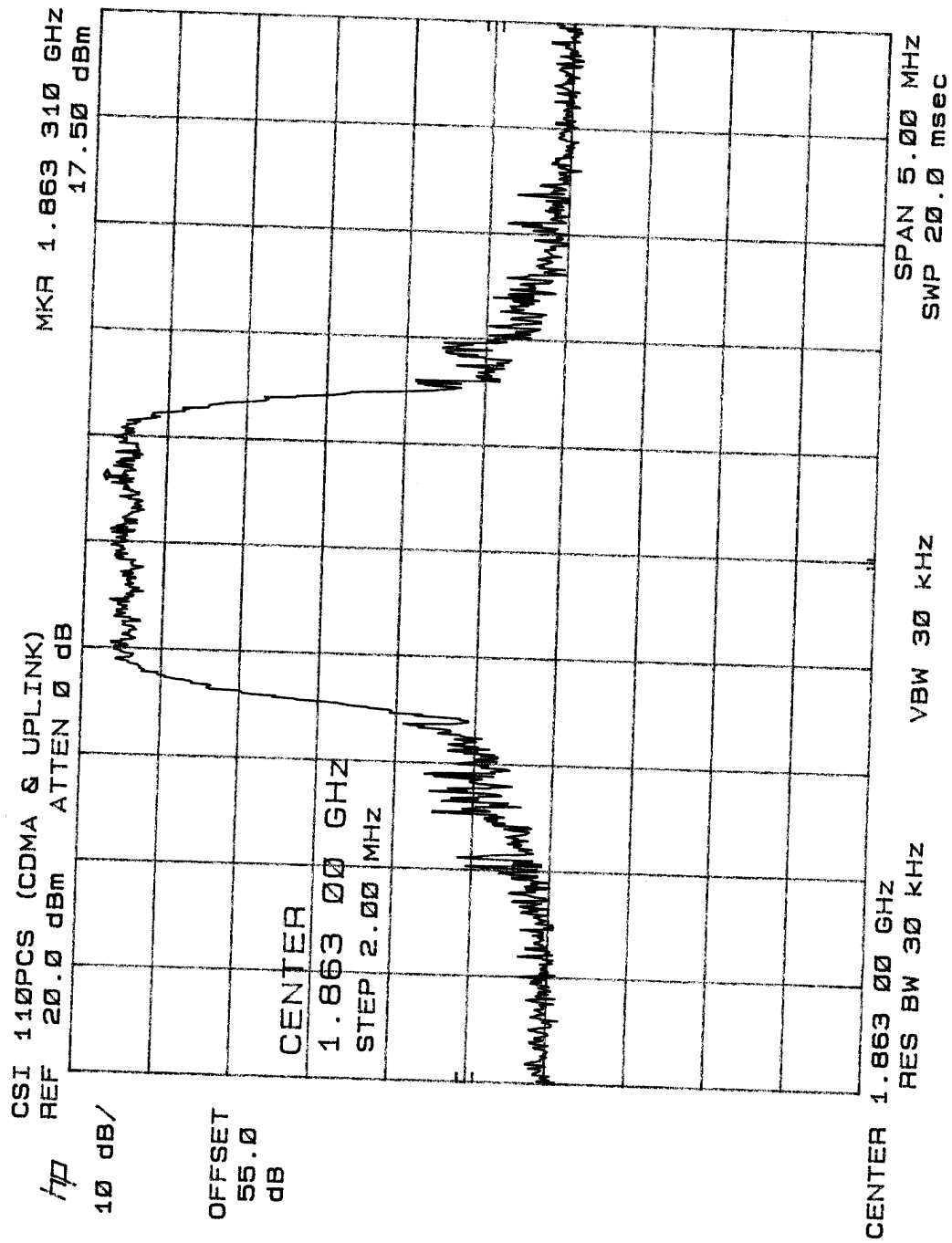
RF Power Output Plots		
CDMA	Low 15dBm	Page 21
	Middle 15dBm	Page 22
	High 15dBm	Page 23
GSM	Low 15dBm	Page 27
	Middle 15dBm	Page 28
	High 15dBm	Page 29
TDMA	Low 15dBm	Page 24
	Middle 15dBm	Page 25
	High 15dBm	Page 26

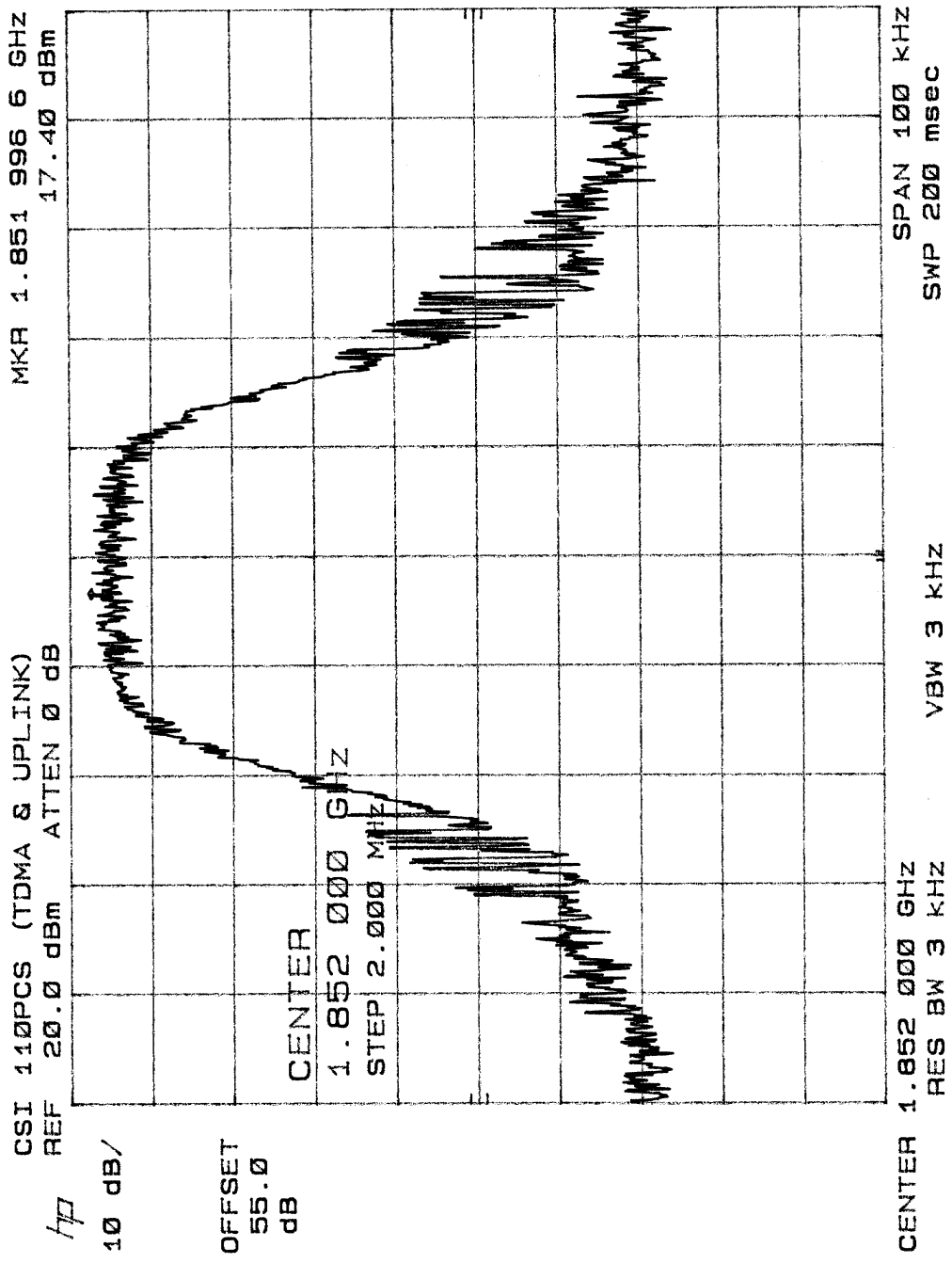
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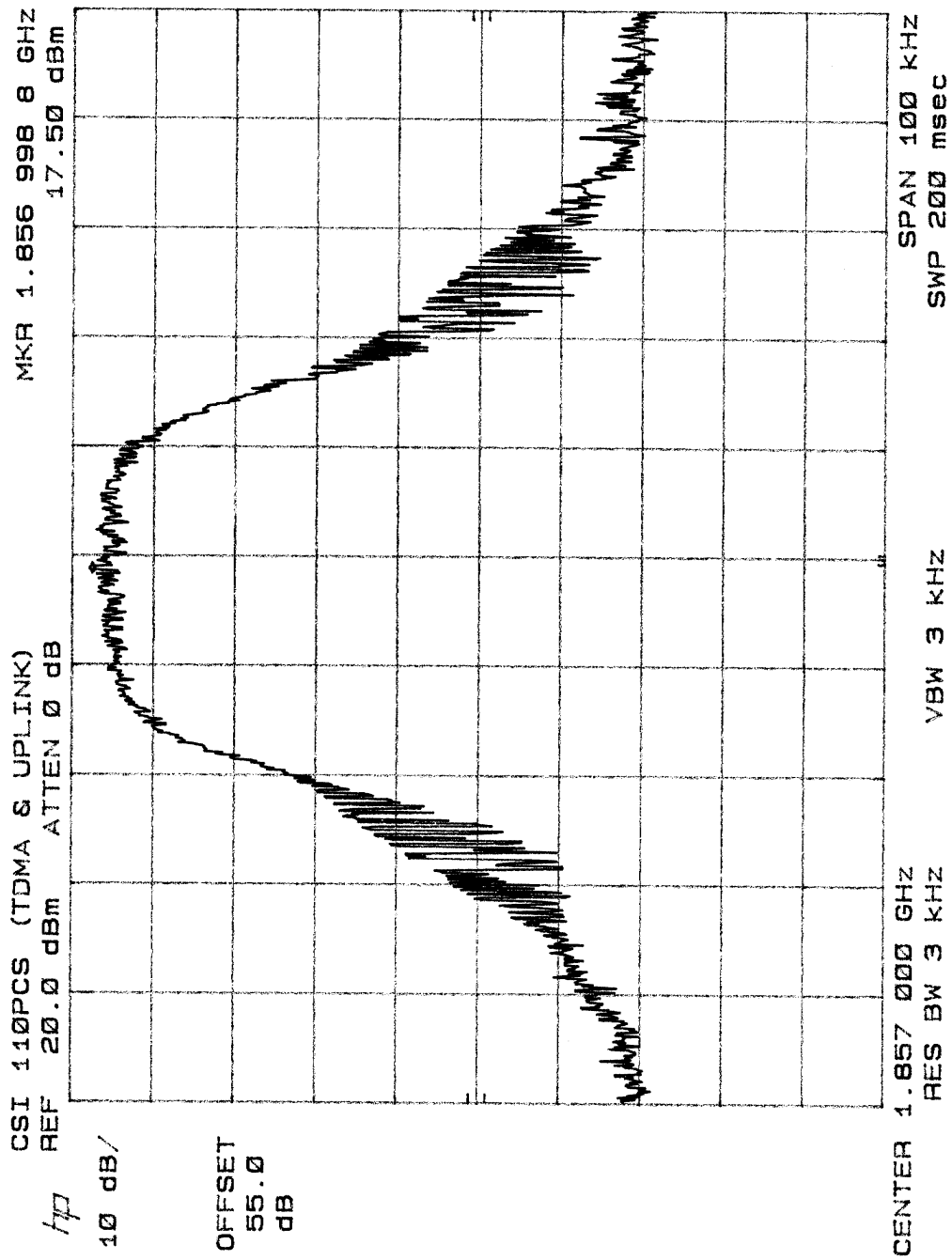
RF Power Output Plots		
GSM	Low 20dBm	Page 18
	Middle 20dBm	Page 19
	High 20dBm	Page 20
TDMA	Low 20dBm	Page 15
	Middle 20dBm	Page 16
	High 20dBm	Page 17
CDMA	Low 20dBm	Page 12
	Middle 20dBm	Page 13
	High 20dBm	Page 14

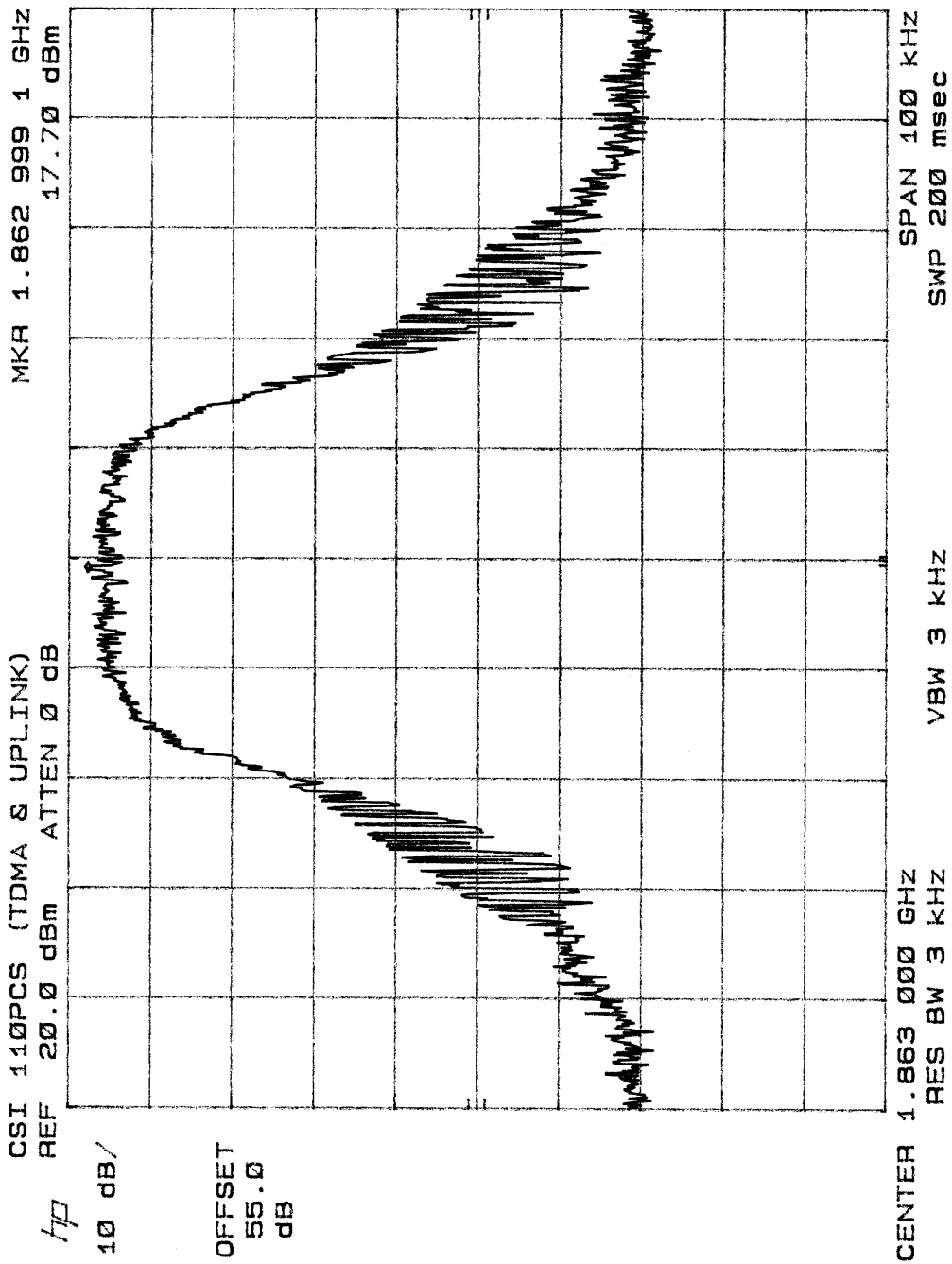


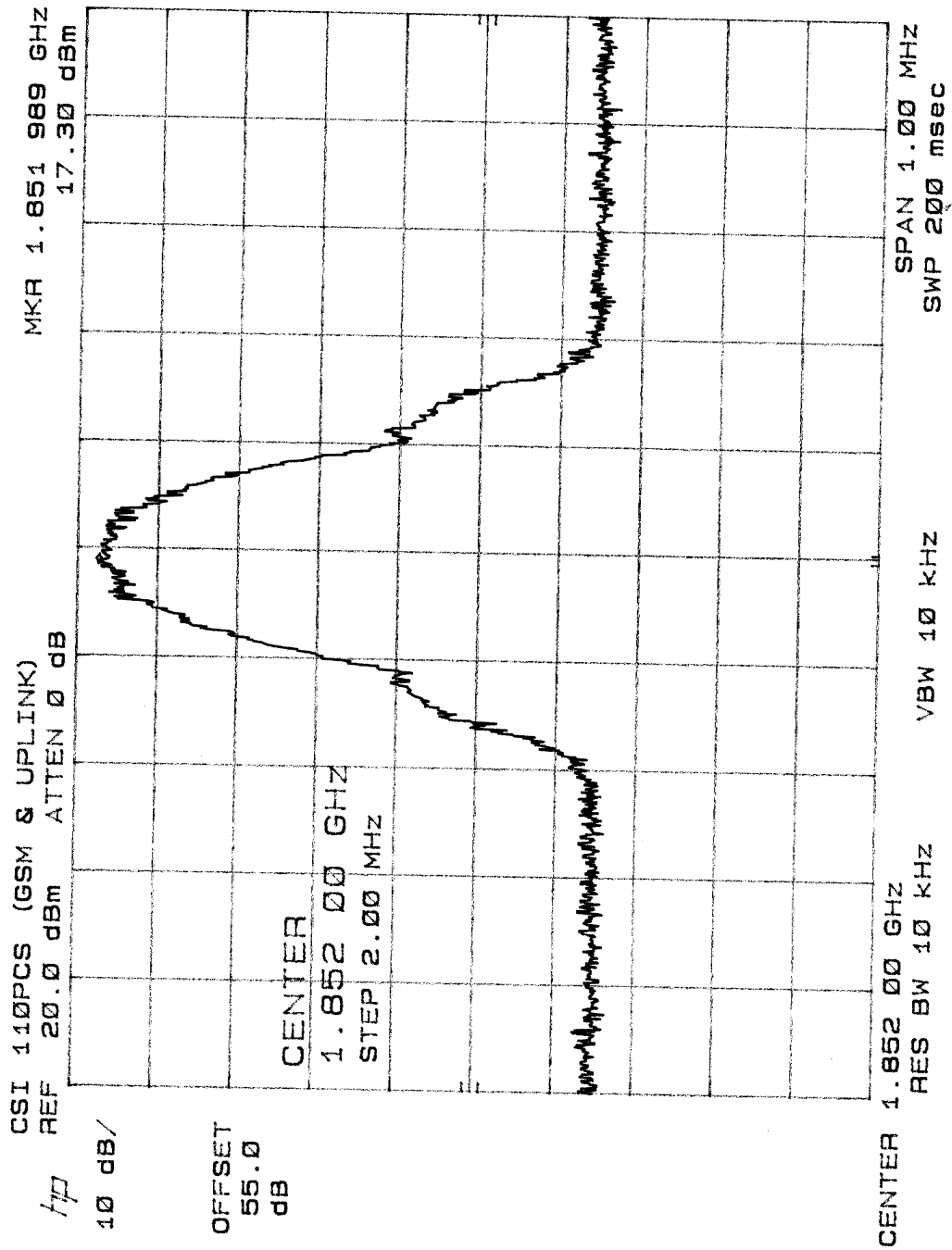


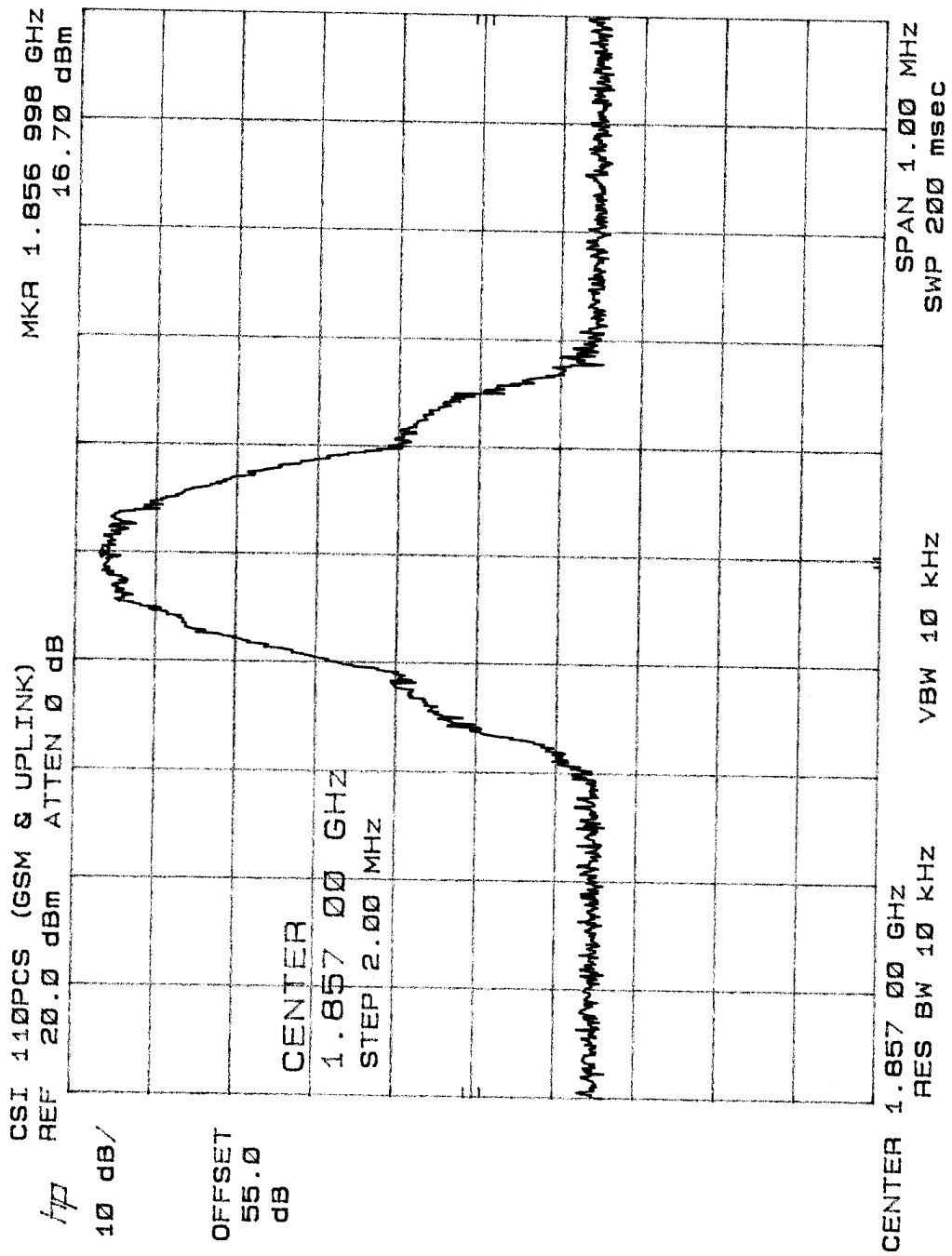


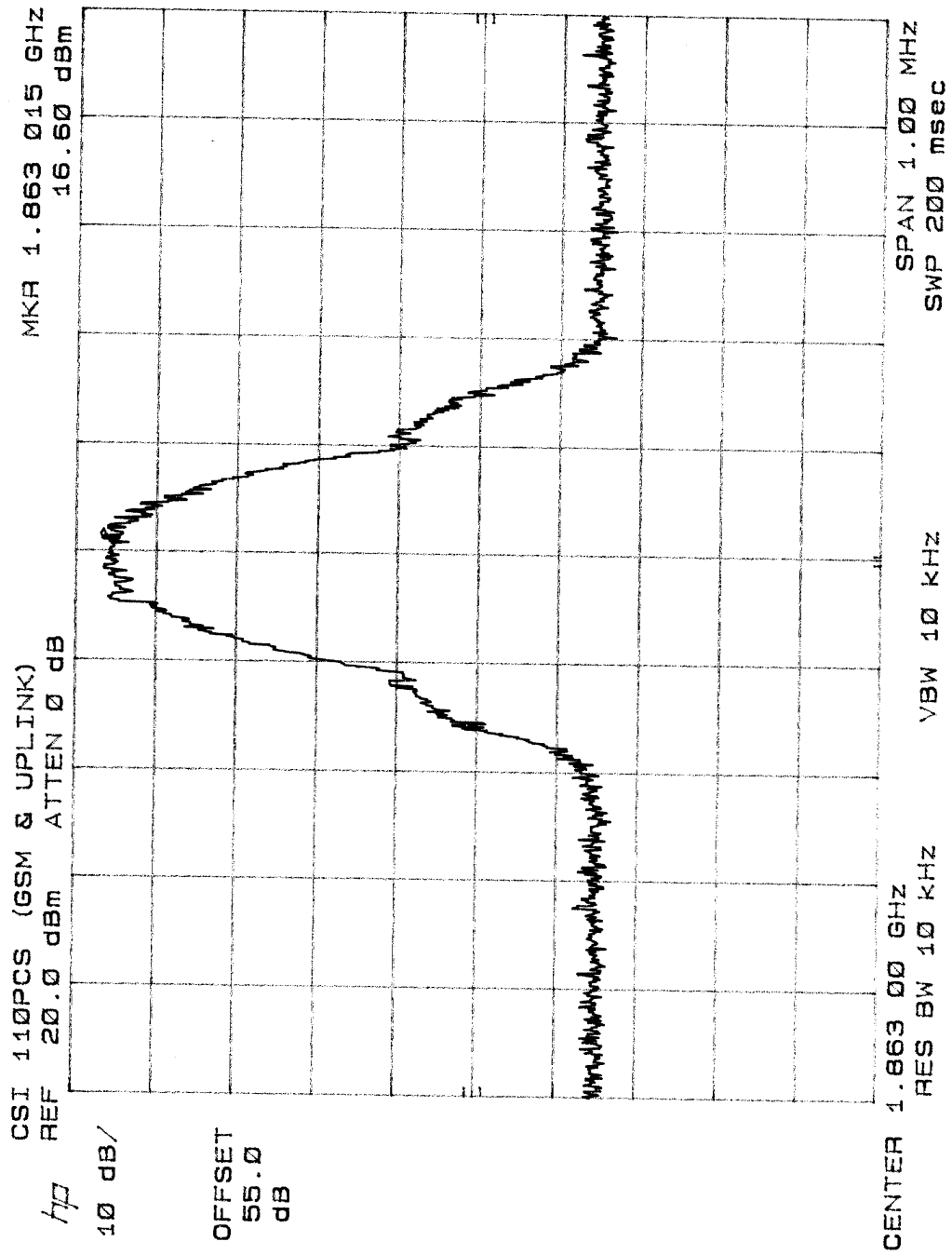


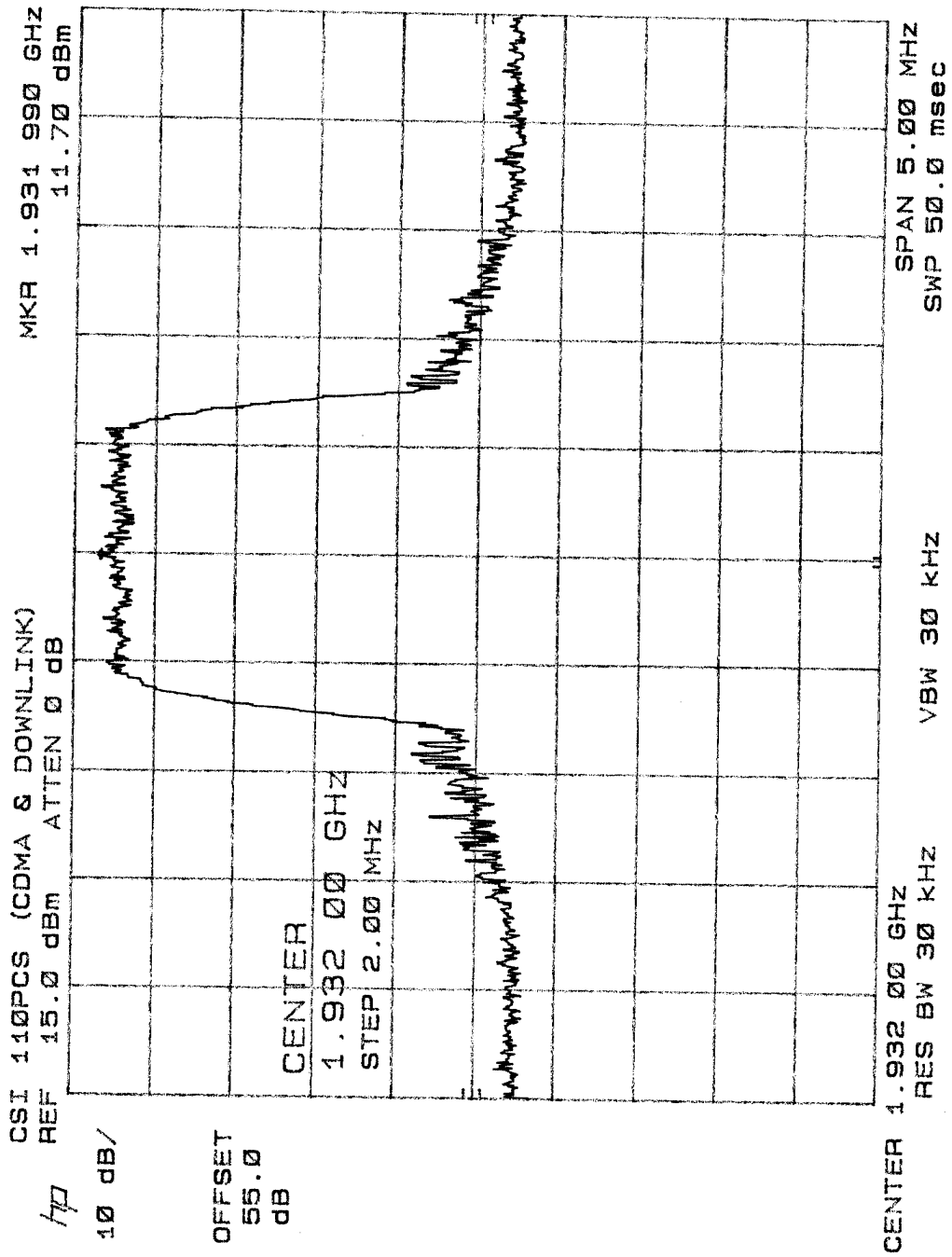


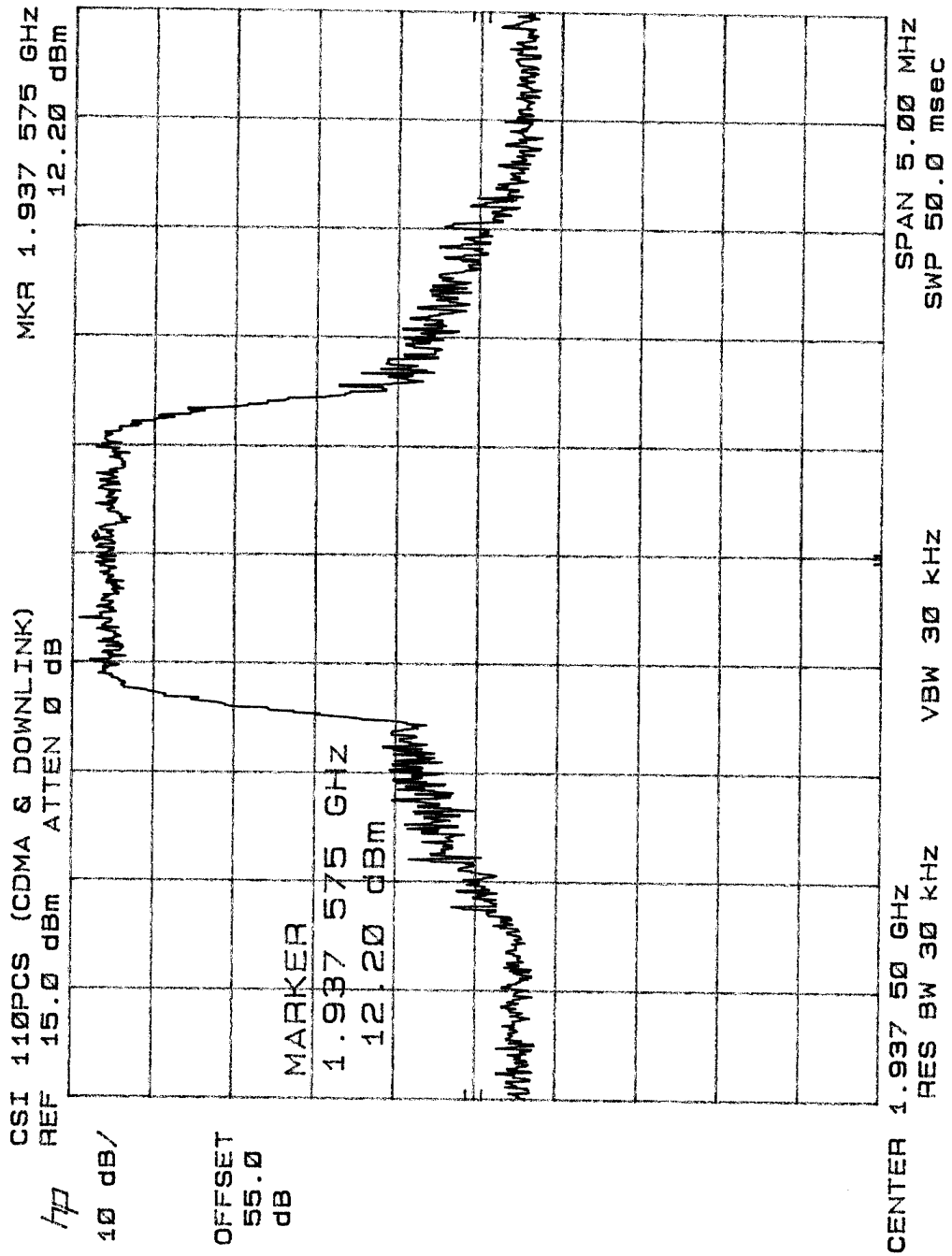


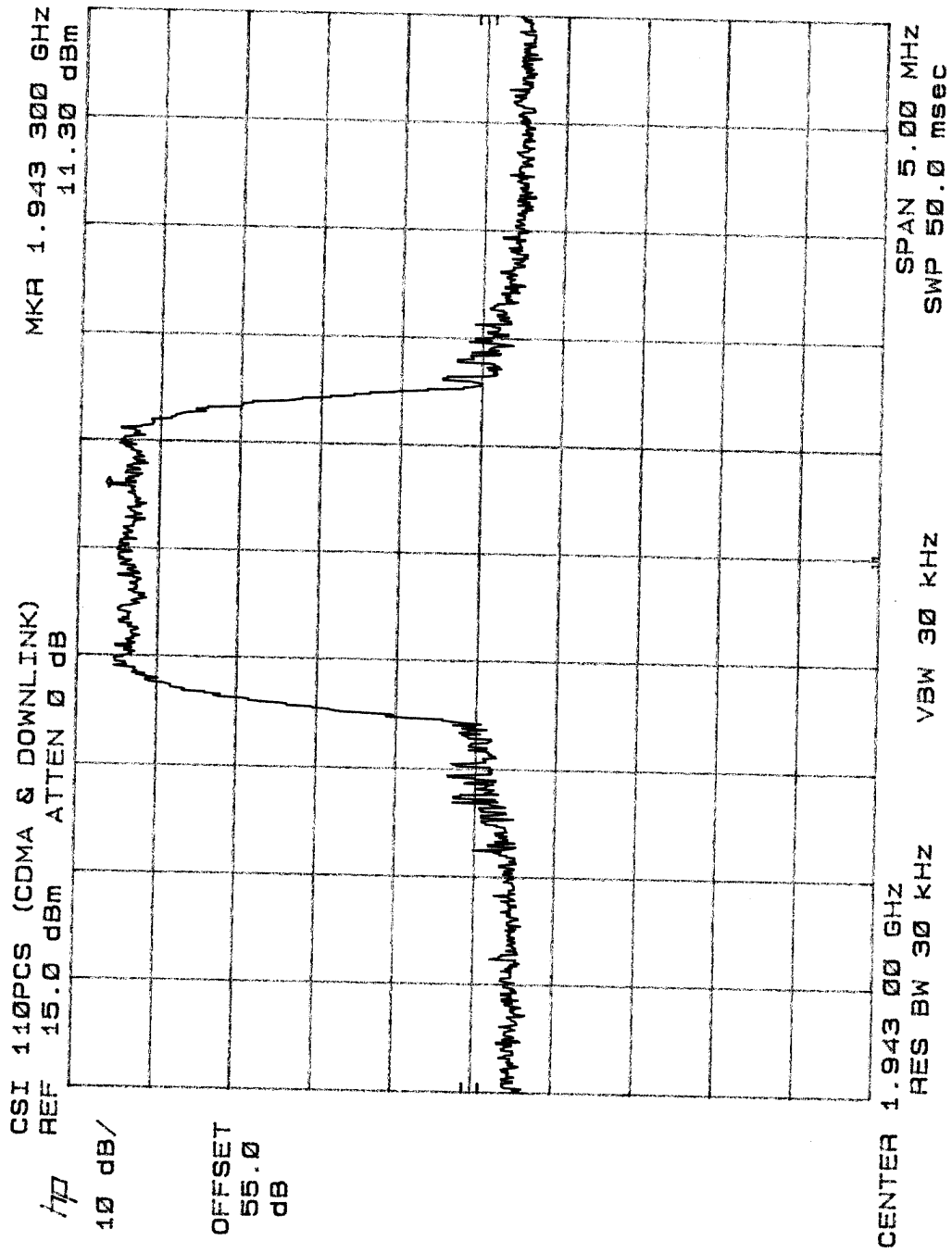


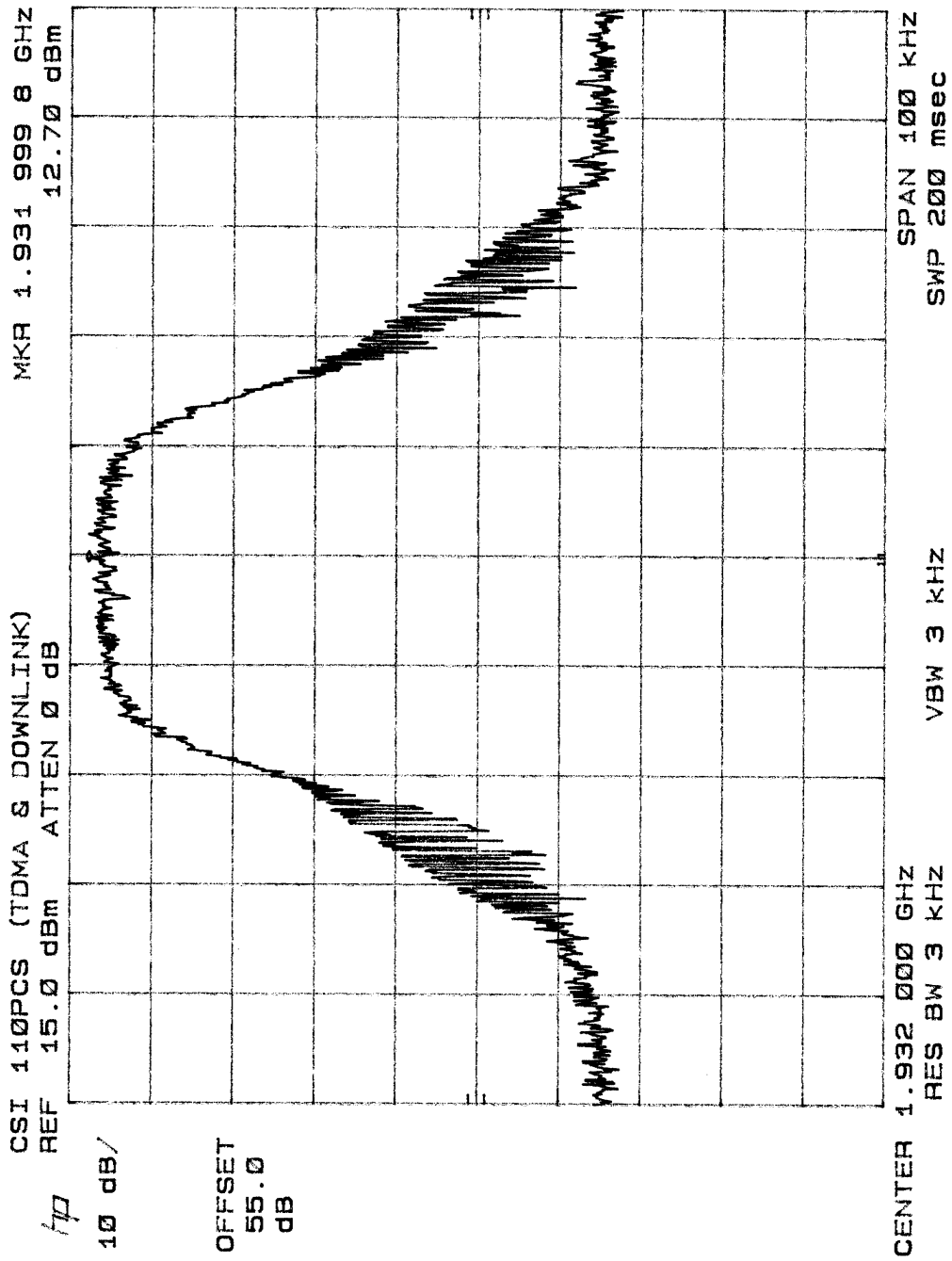


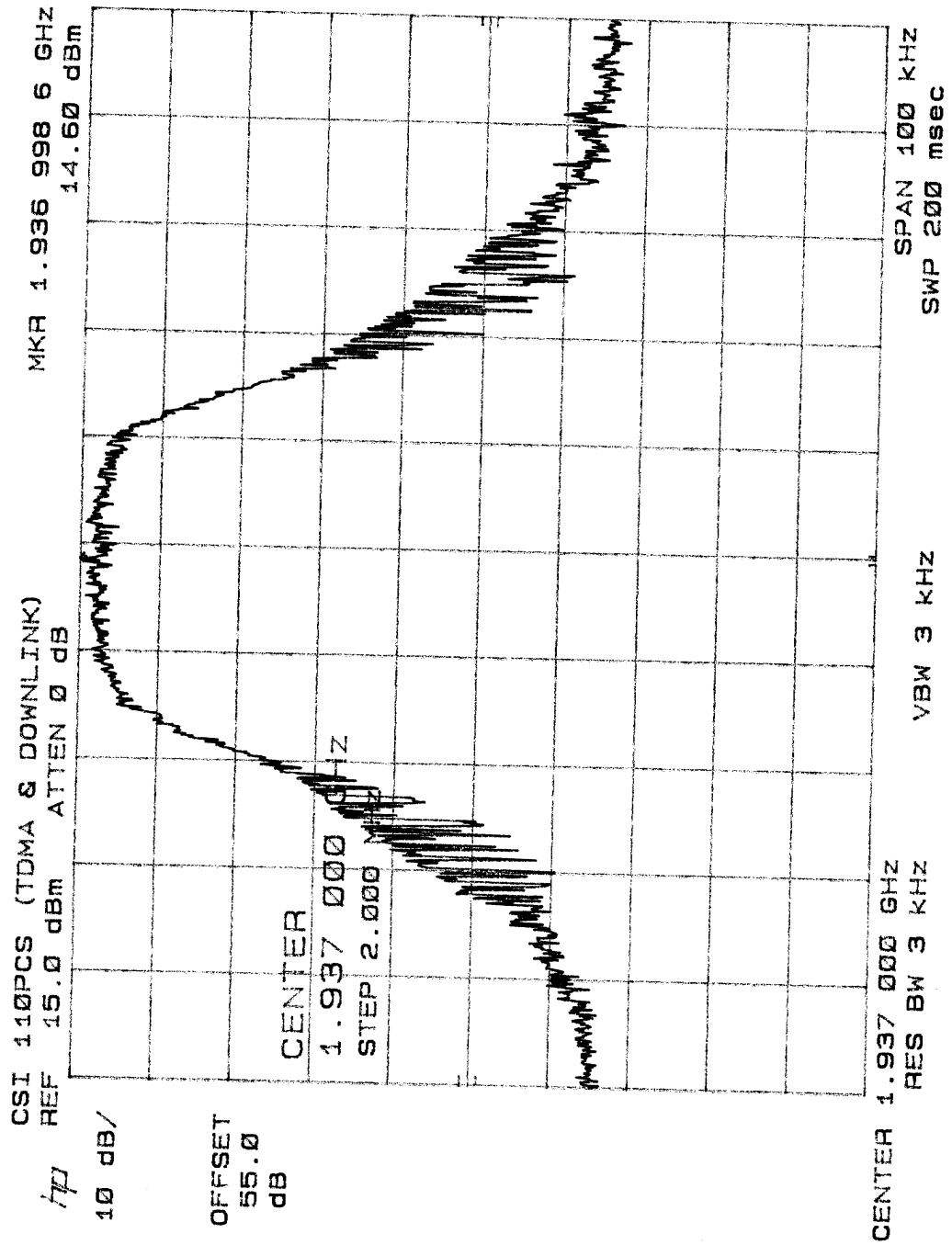


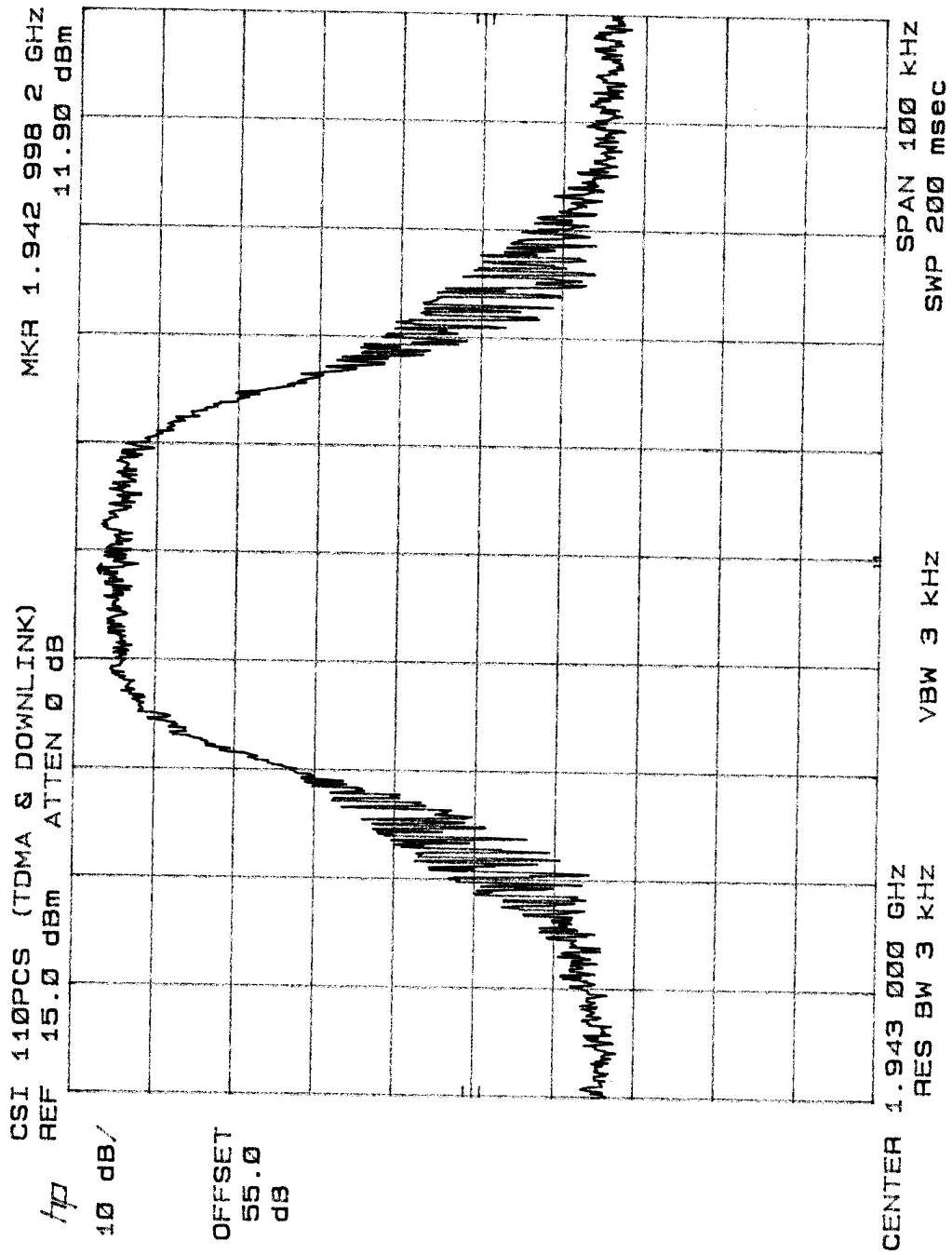


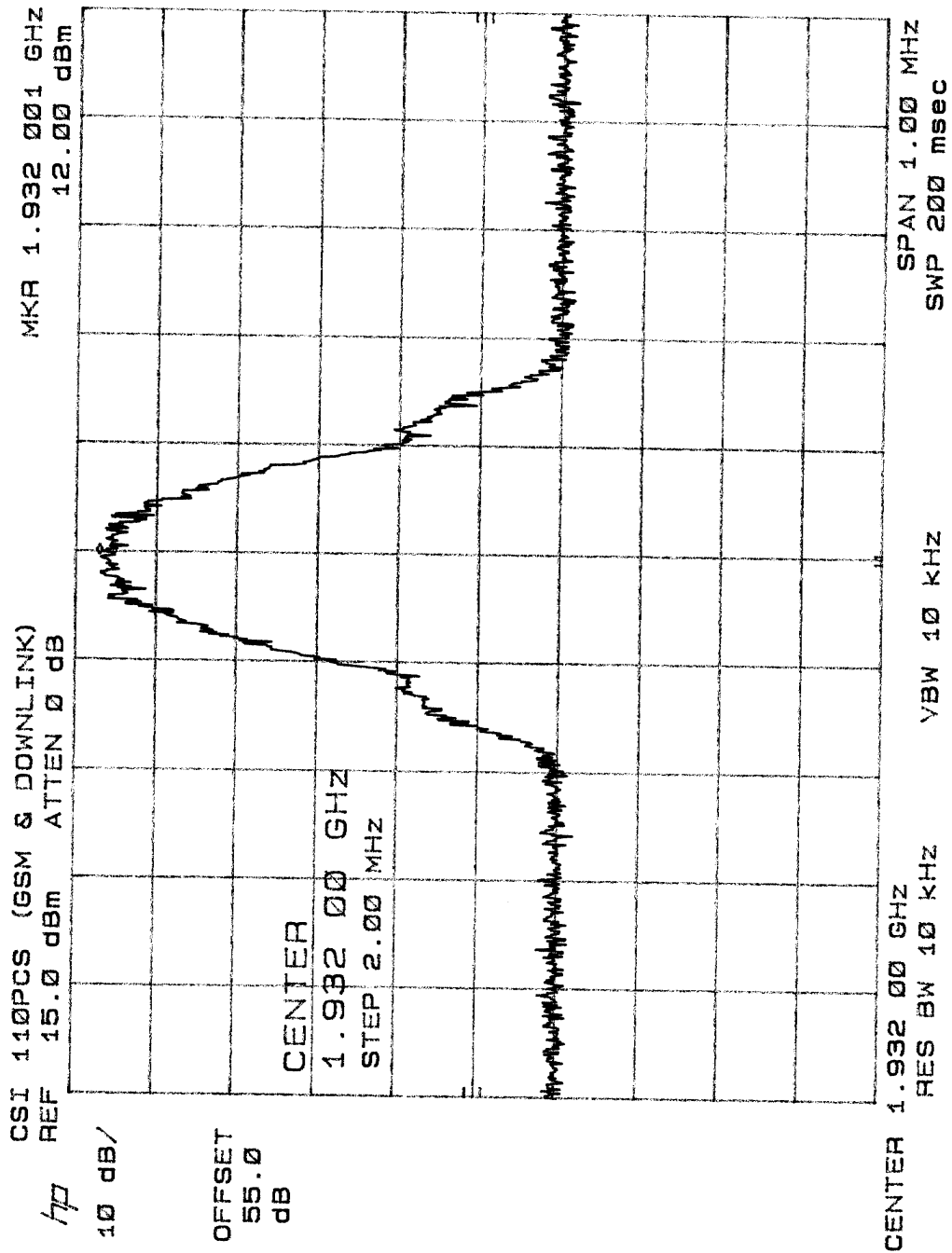


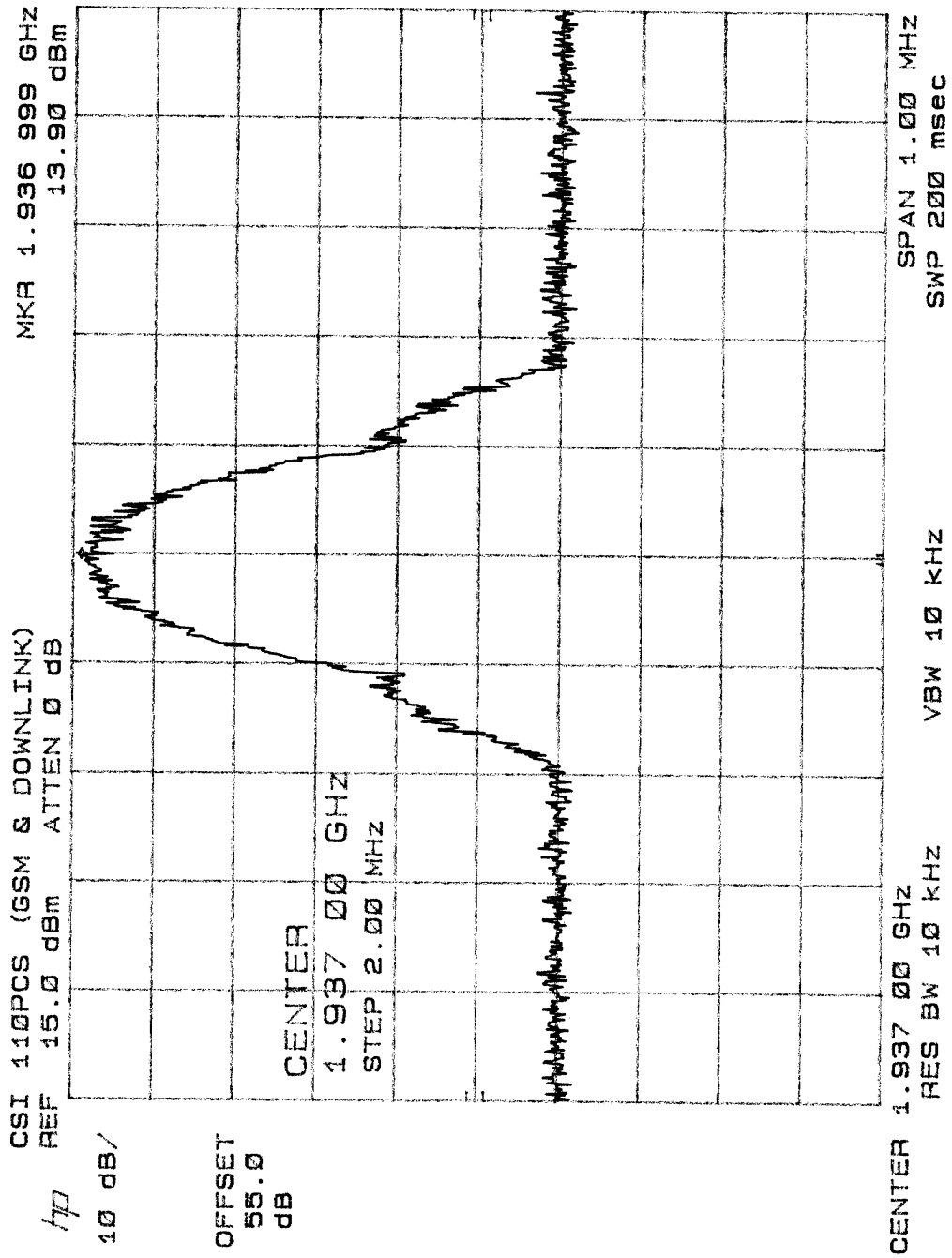


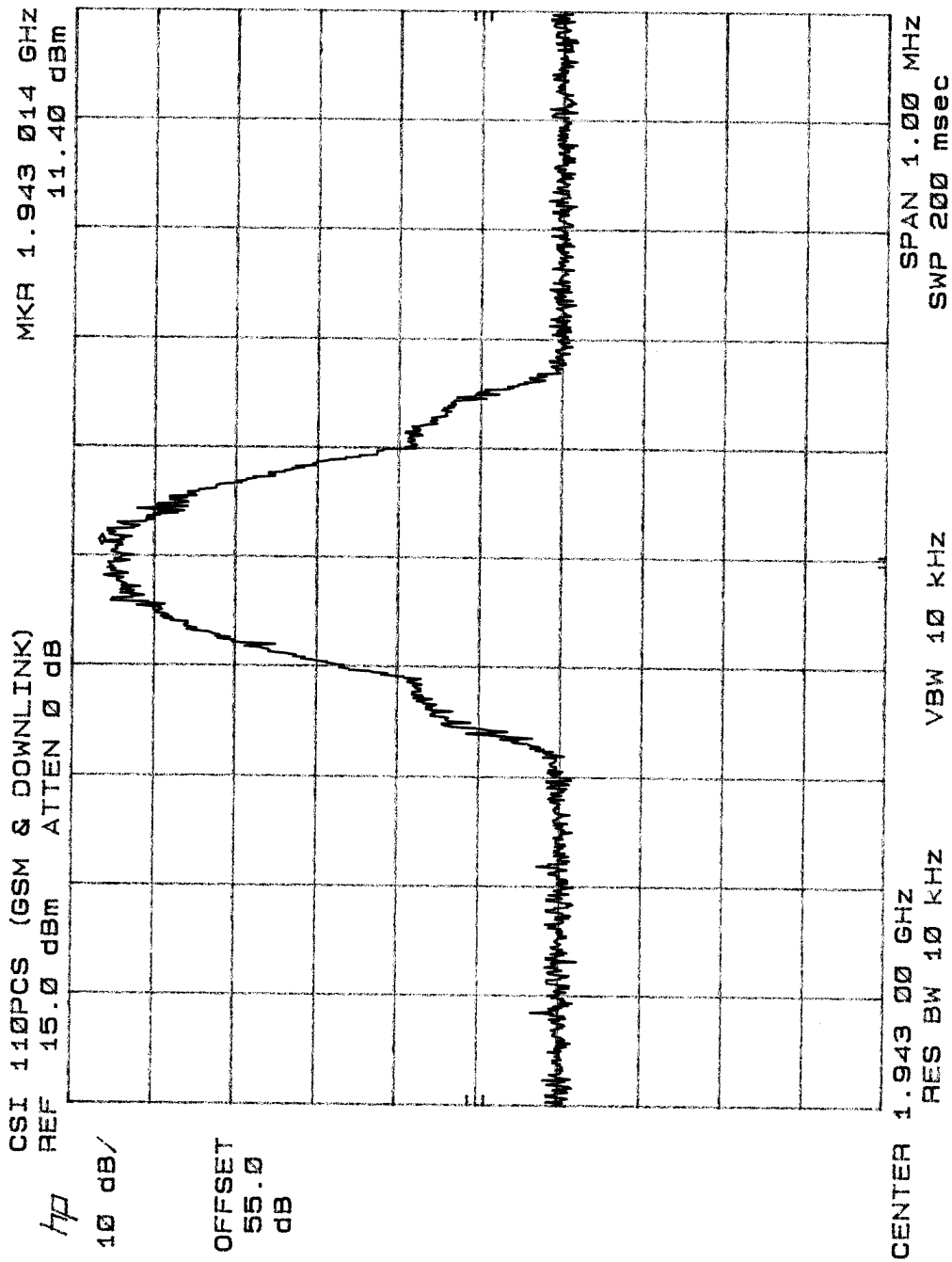












3.2.0 Modulation Characteristics

Requirement: FCC 2.987

3.2.1 Test Procedure

For this device, three digital modes are used by EUT. The RF carrier was modulated by the Rohde and Schwarz AMIQ I/Q and Rohde and Schwarz SMIQ03B. Since digital is used and no analog, frequency response of EUT was not performed. Test was performed both at Uplink and DownLink.

3.2.2 Test Equipment

Hewlett Packard HP8566B Spectrum Analyzer
 Hewlett Packard HP 7470A Plotter
 Rohde & Schwarz SMIQ03B Signal Generator
 Rohde & Schwarz AMIQ I/Q Modulation Generator

3.2.3 Test Results:

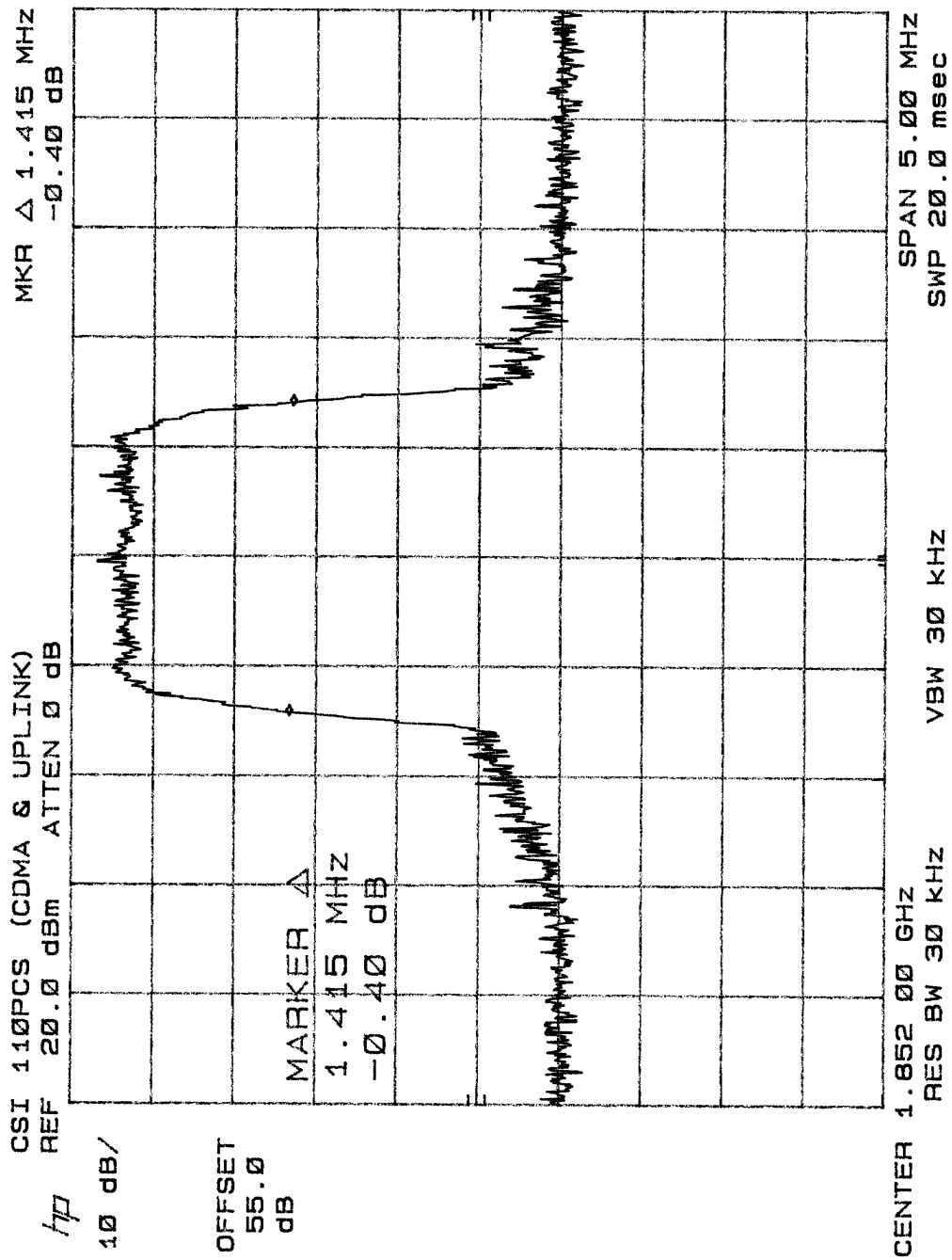
Included are plots of the digital modulation for low, middle and high channel showing the 20dB bandwidth.

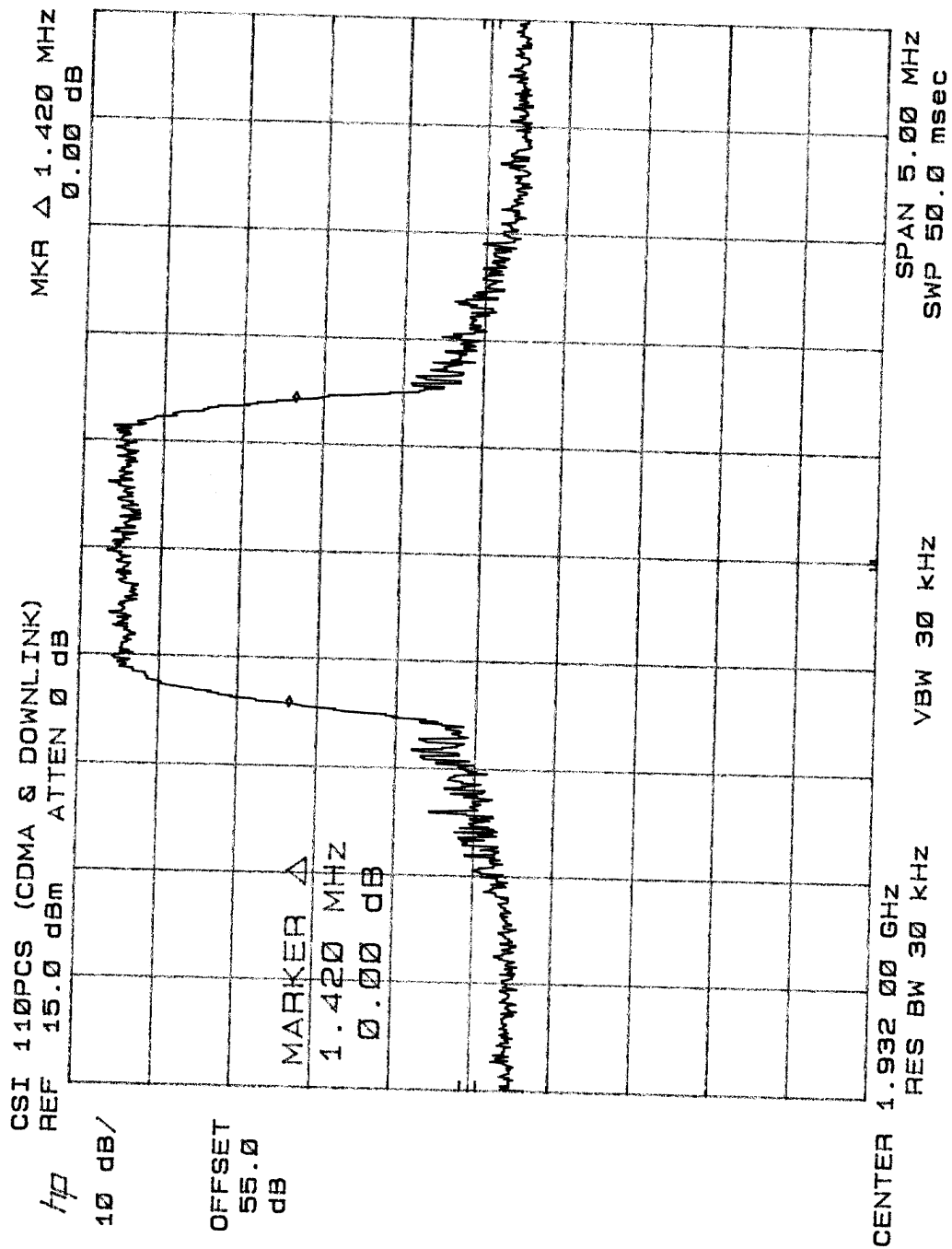
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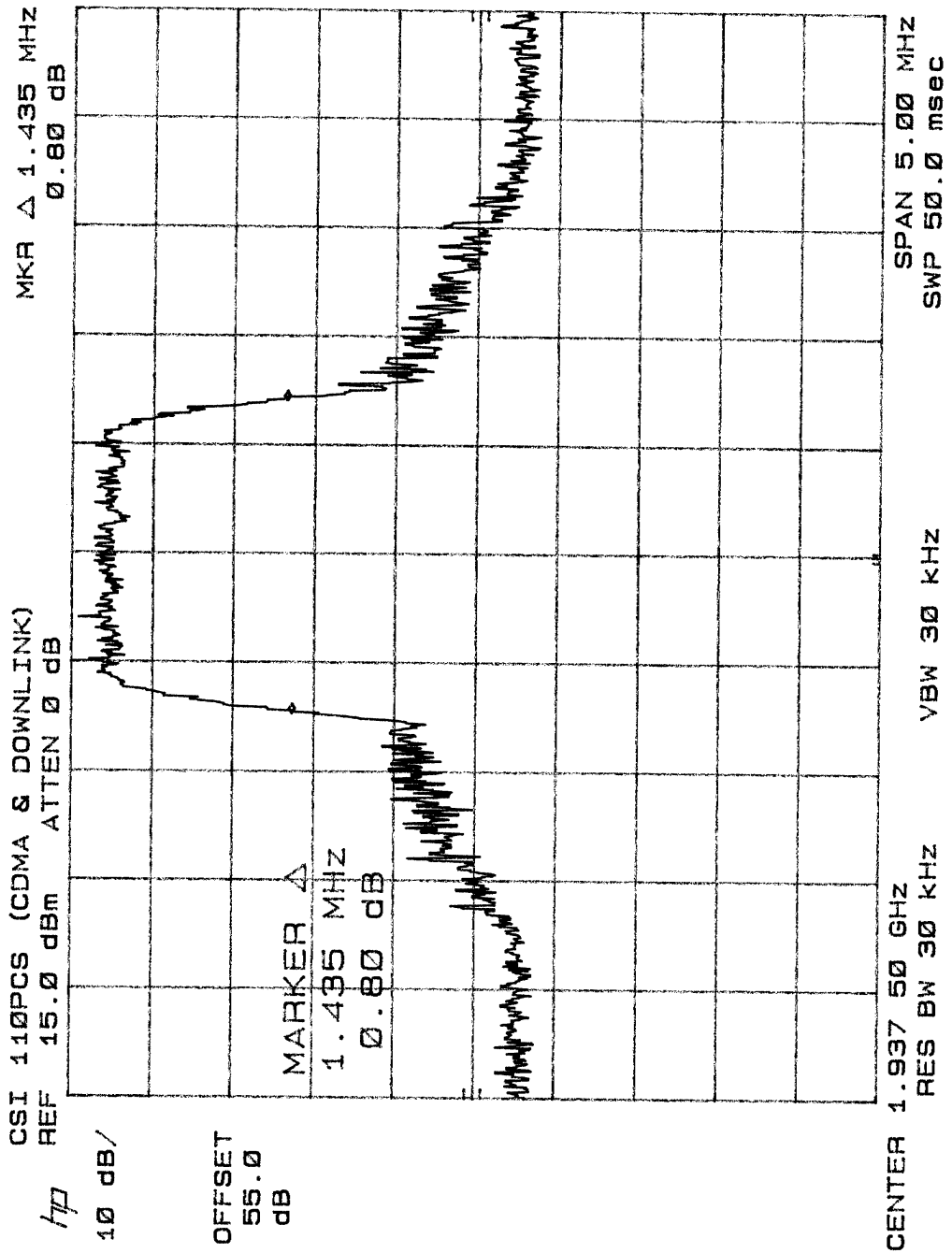
Modulation		
CDMA	Low	Page 32
	Middle	Page 33
	High	Page 34
GSM	Low	Page 38
	Middle	Page 39
	High	Page 40
TDMA	Low	Page 35
	Middle	Page 36
	High	Page 37

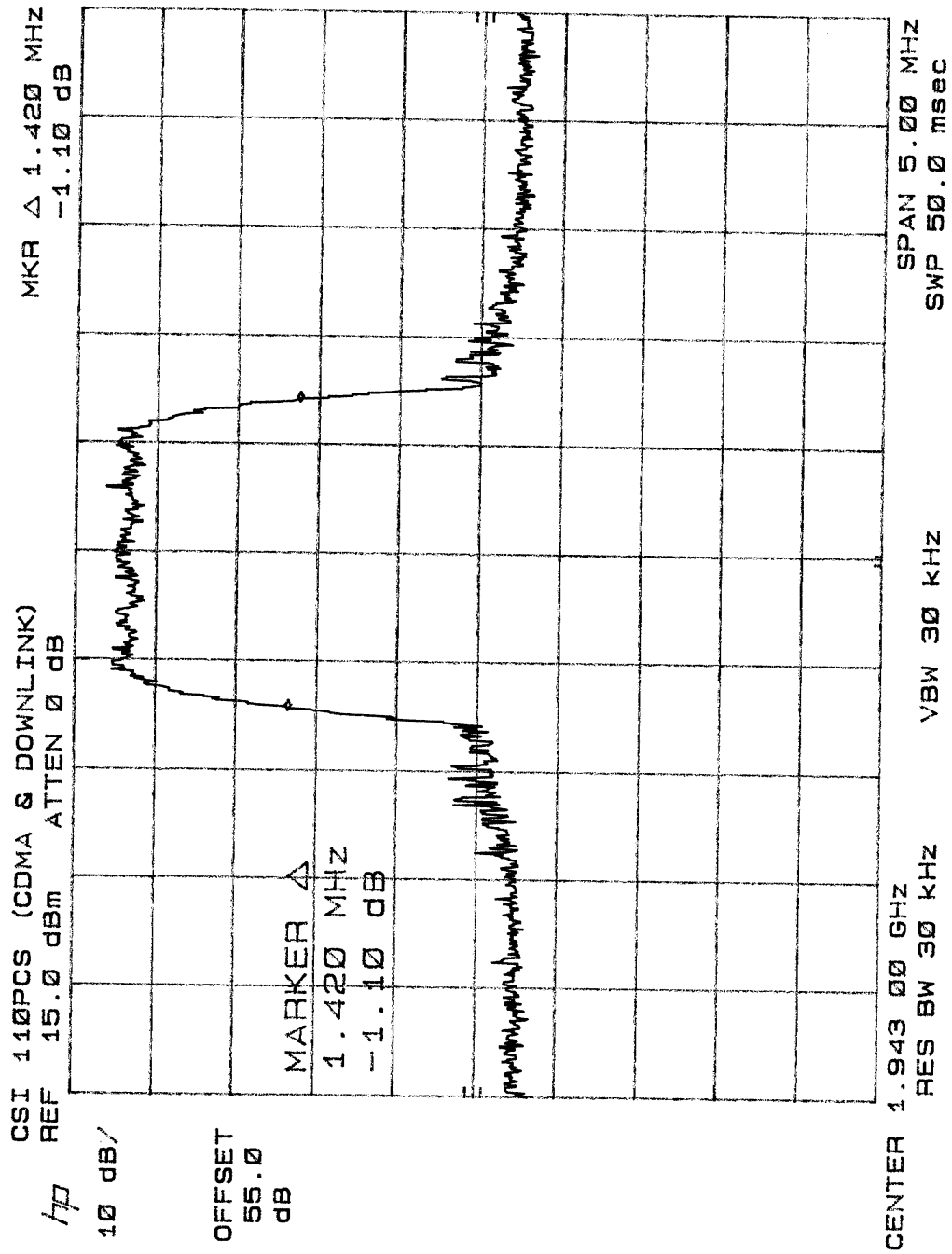
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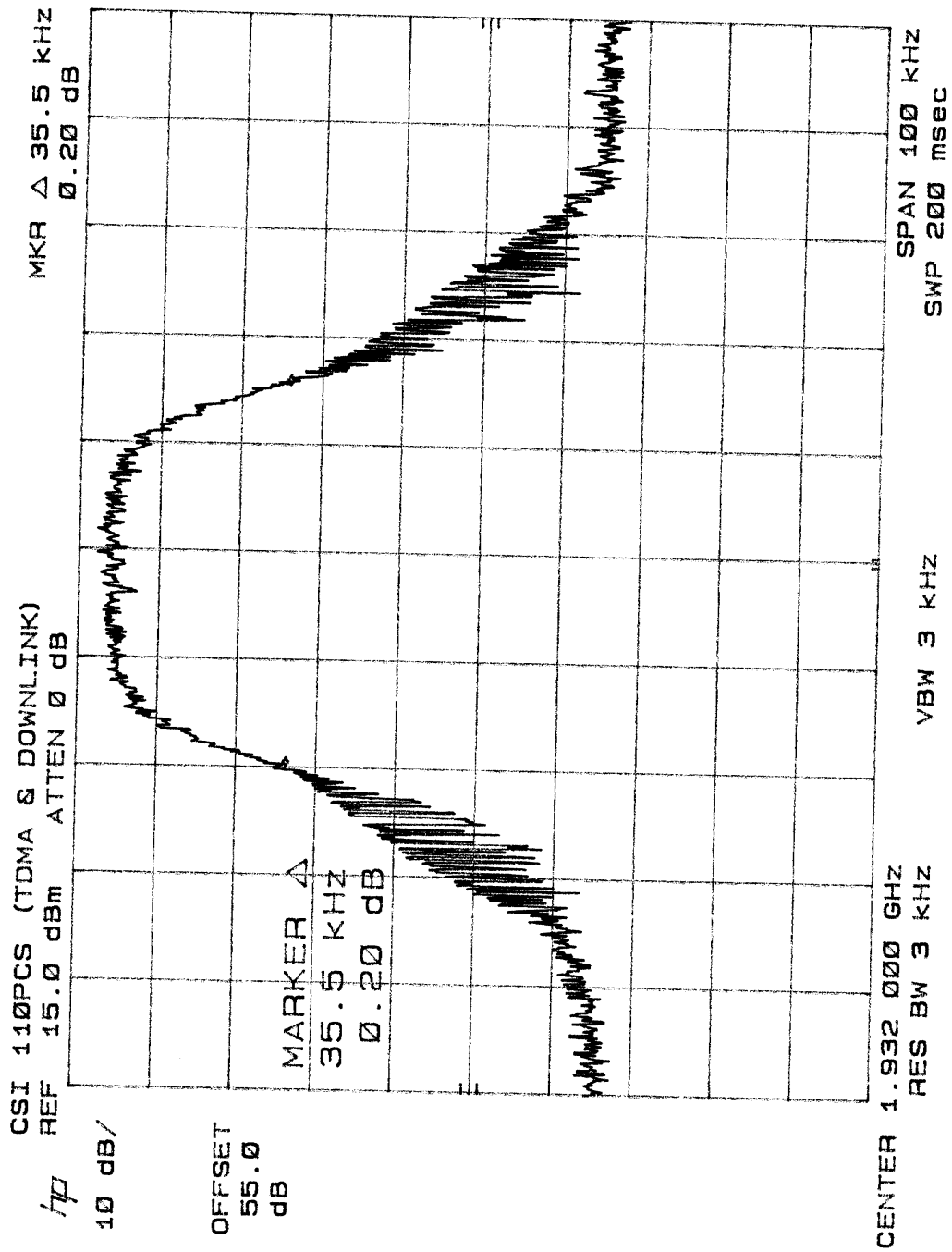
Modulation		
GSM	Low	Page 46
	Middle	Page 47
	High	Page 48
TDMA	Low	Page 43
	Middle	Page 44
	High	Page 45
CDMA	Low	Page 31
	Middle	Page 41
	High	Page 42

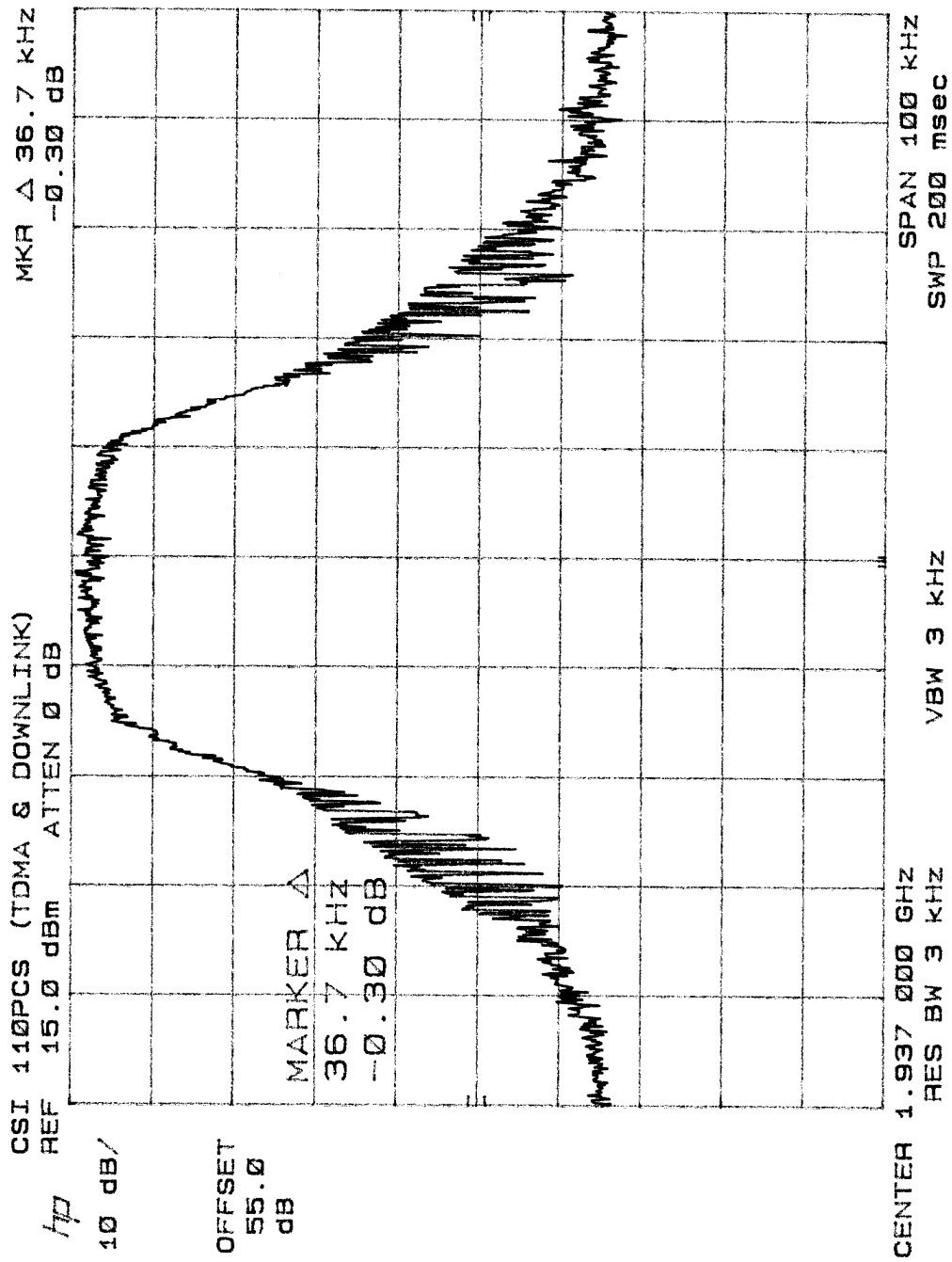


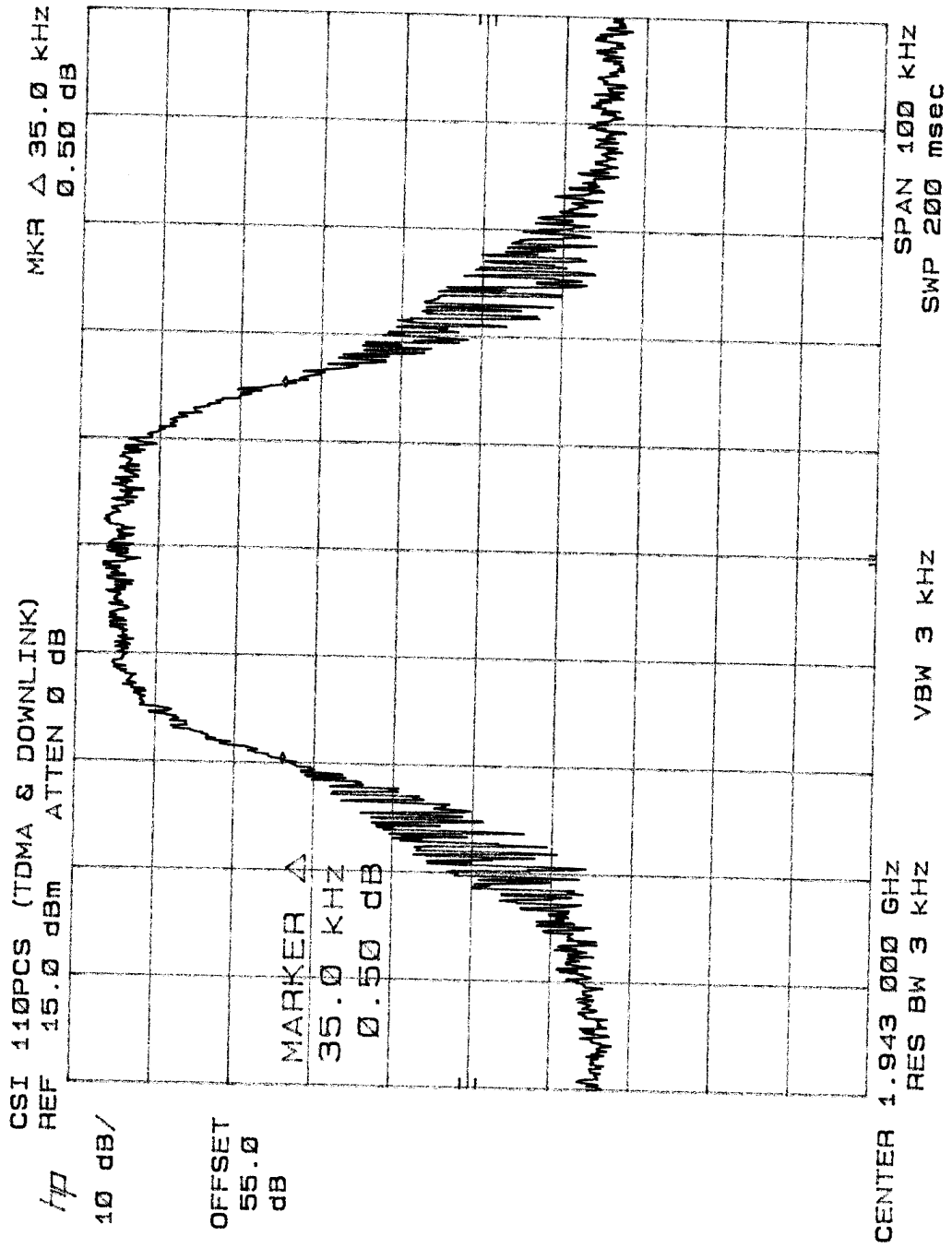


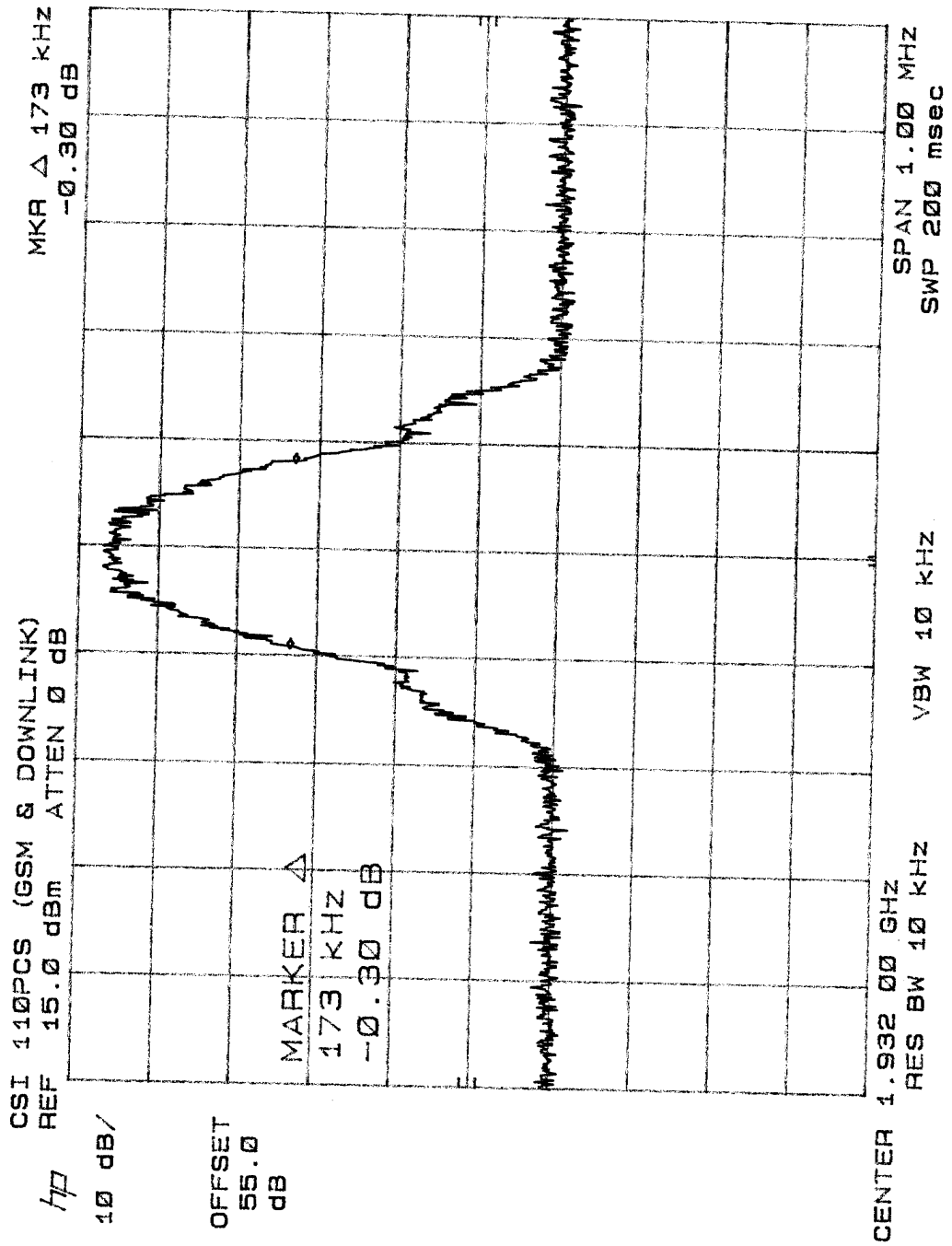


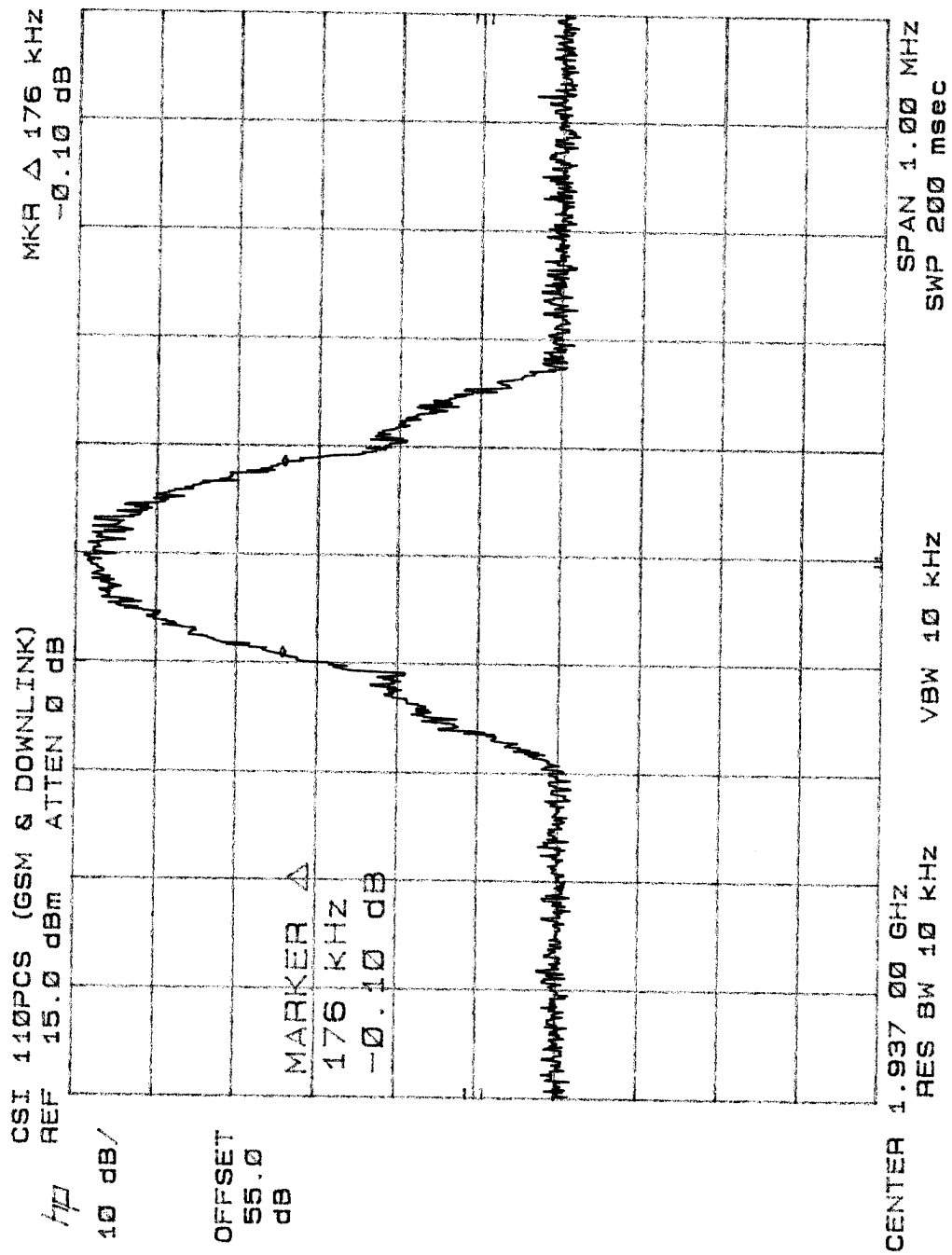


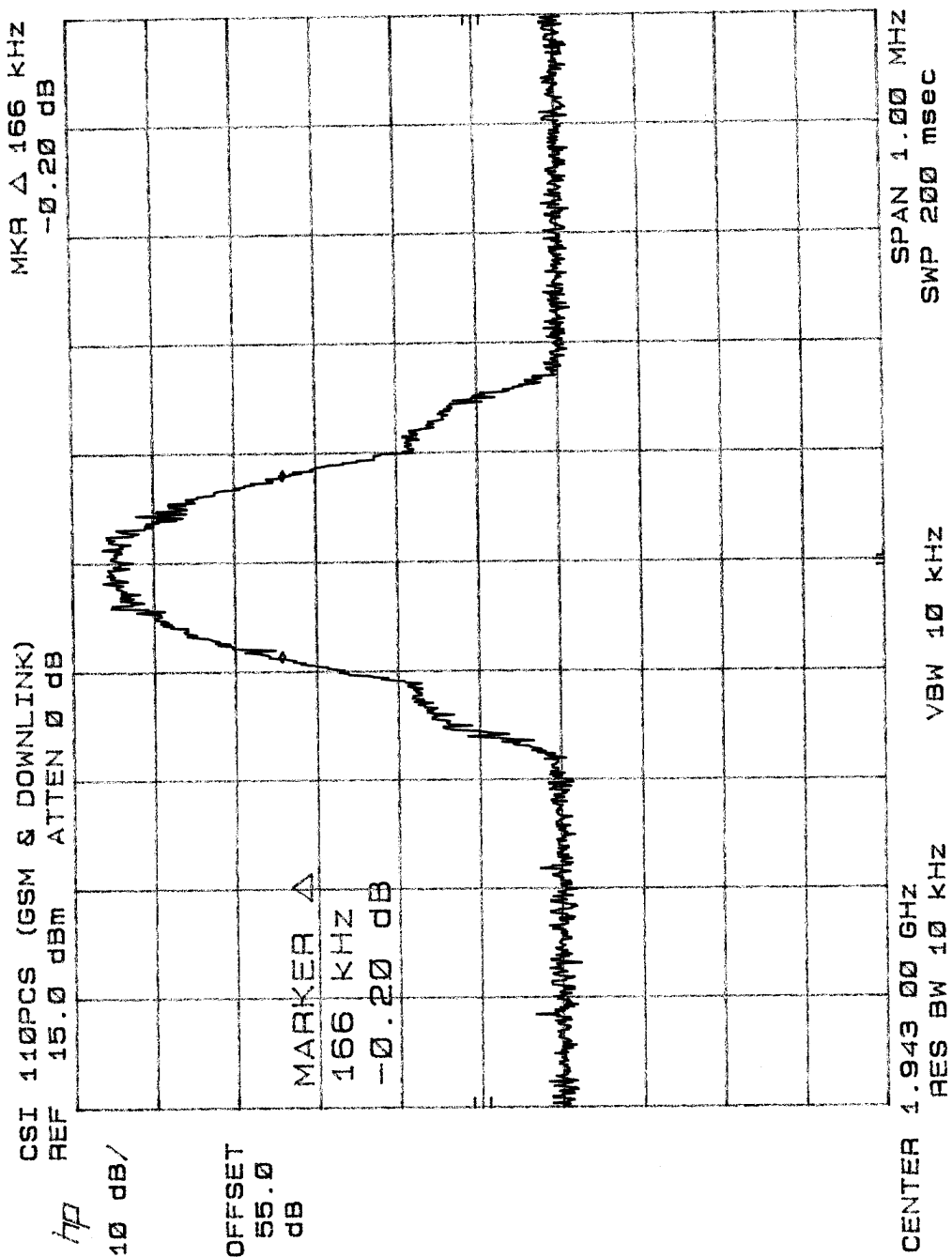


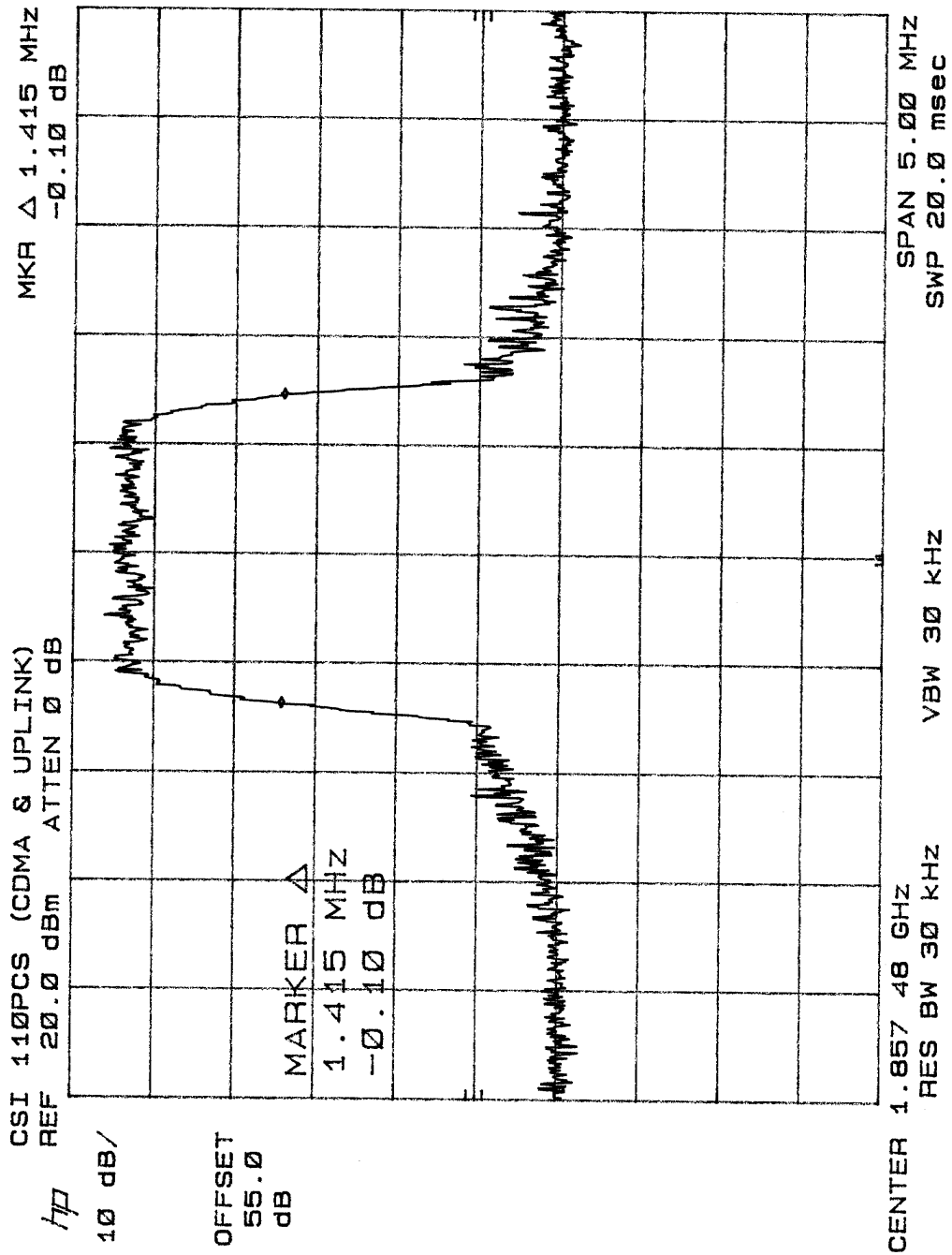


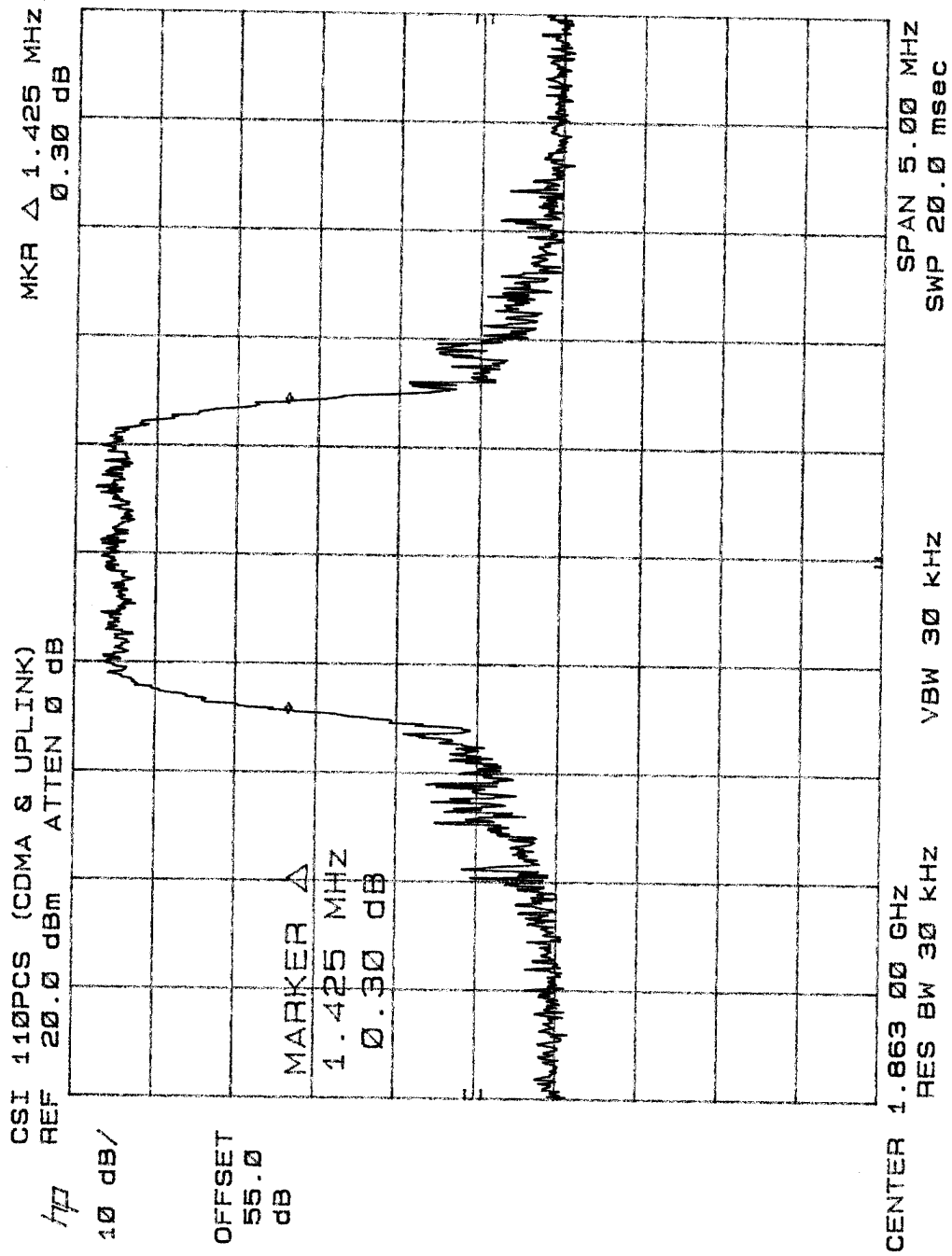


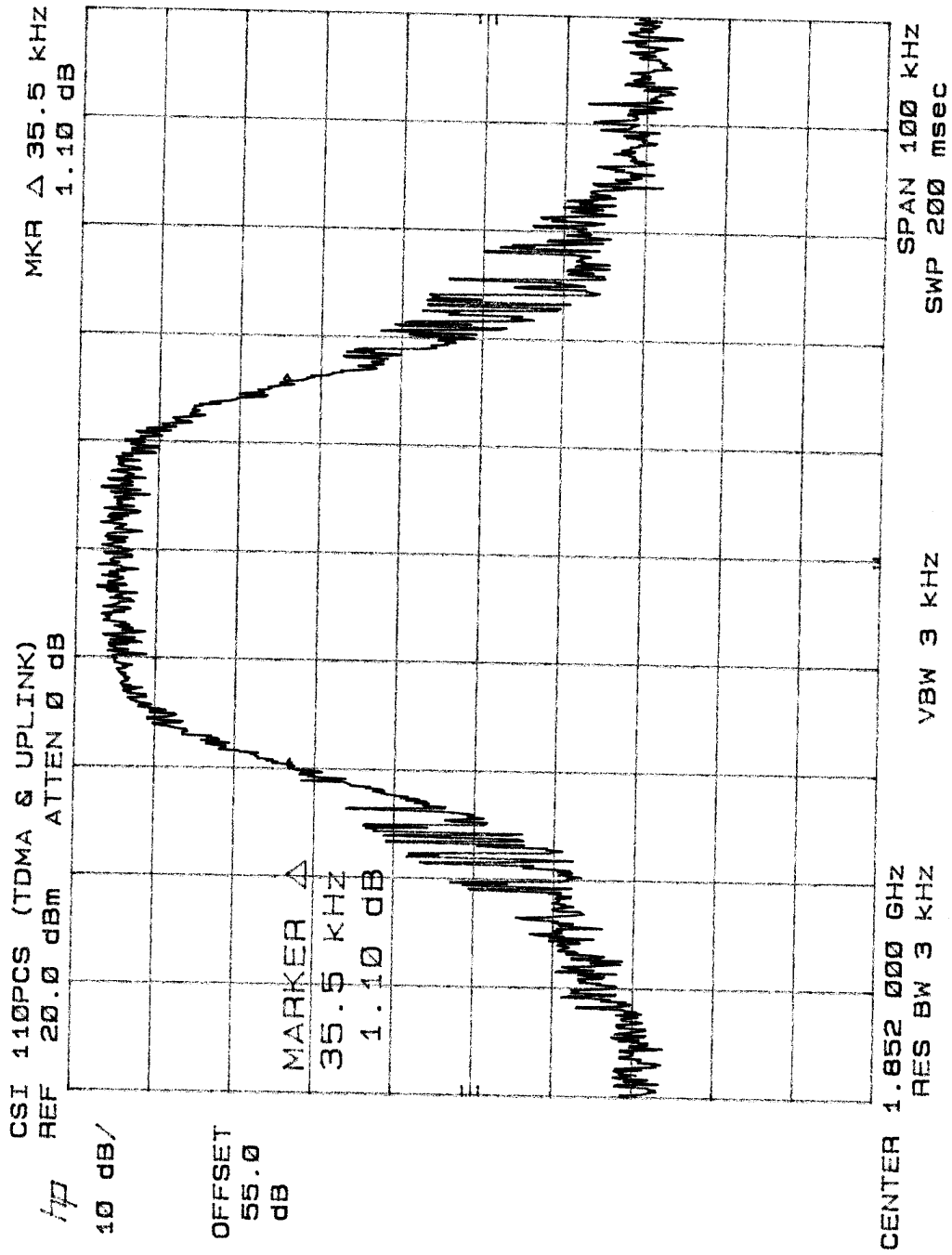


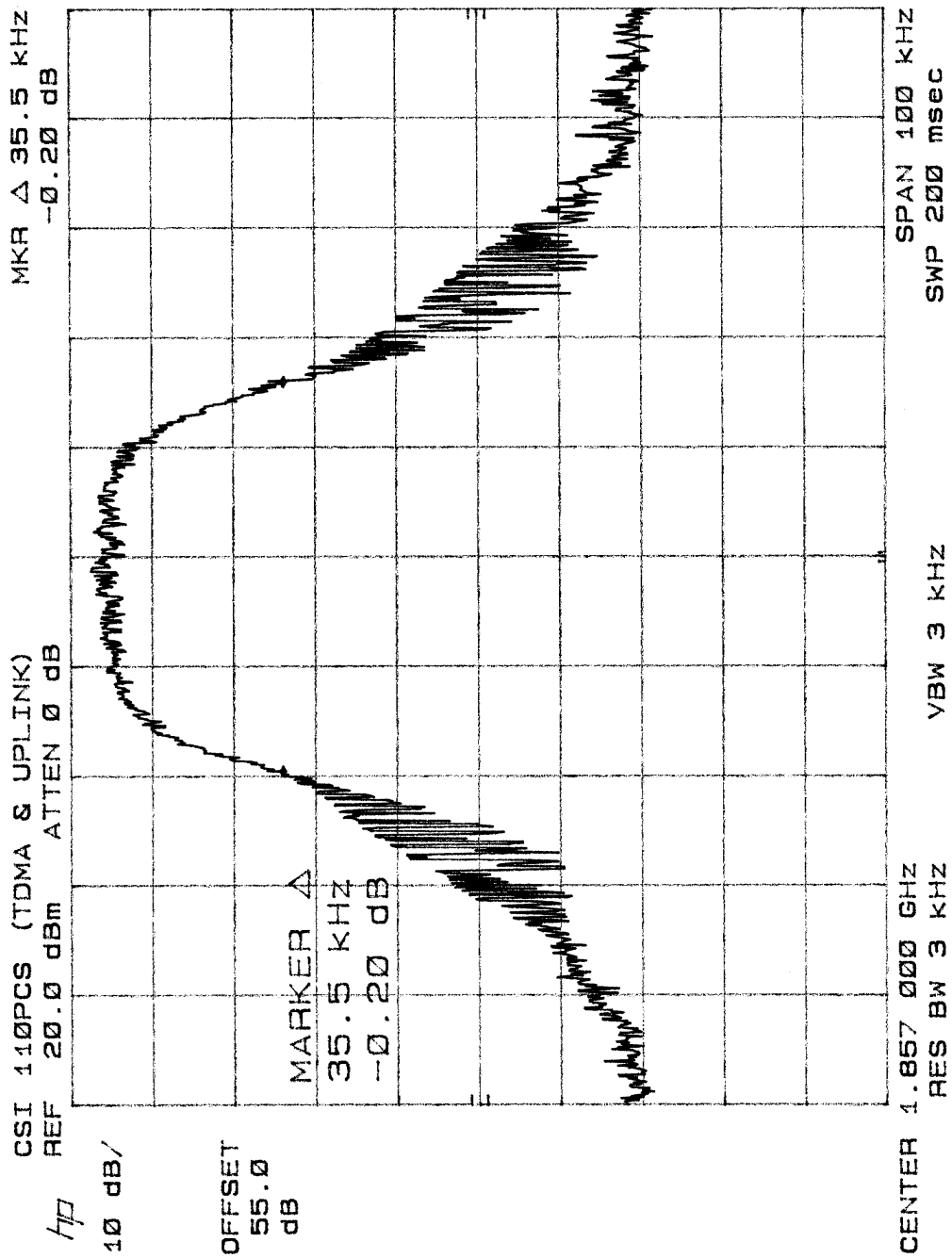


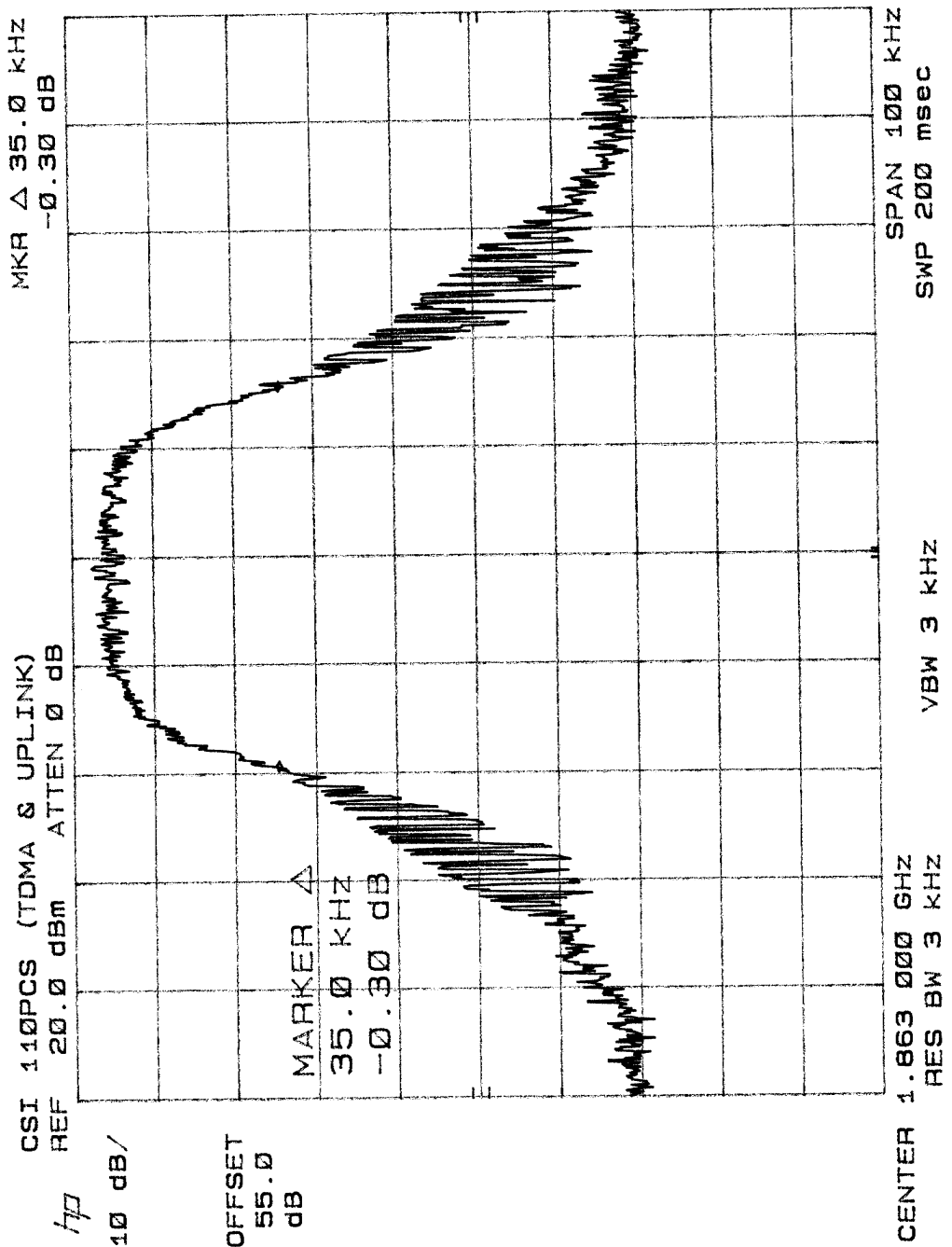


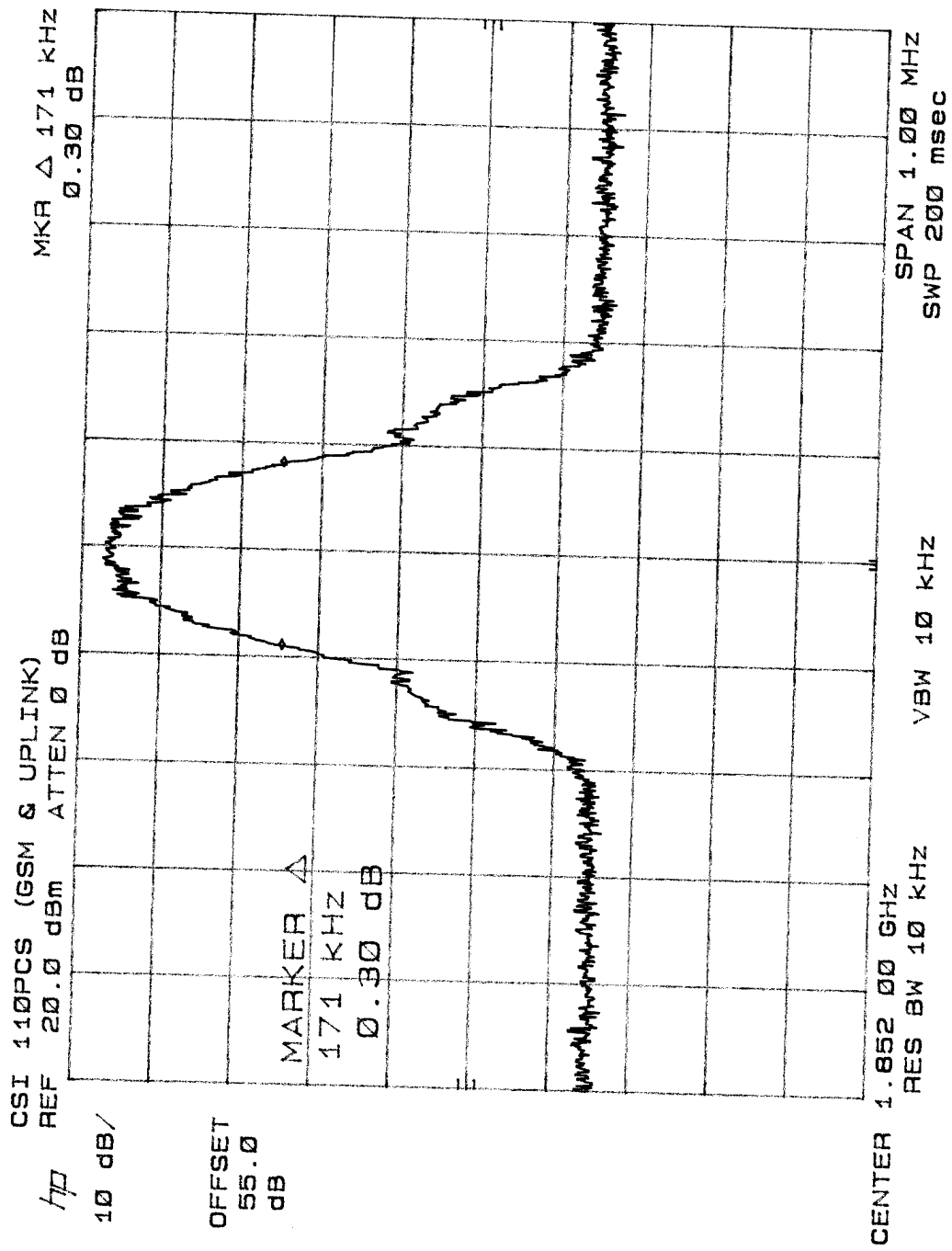


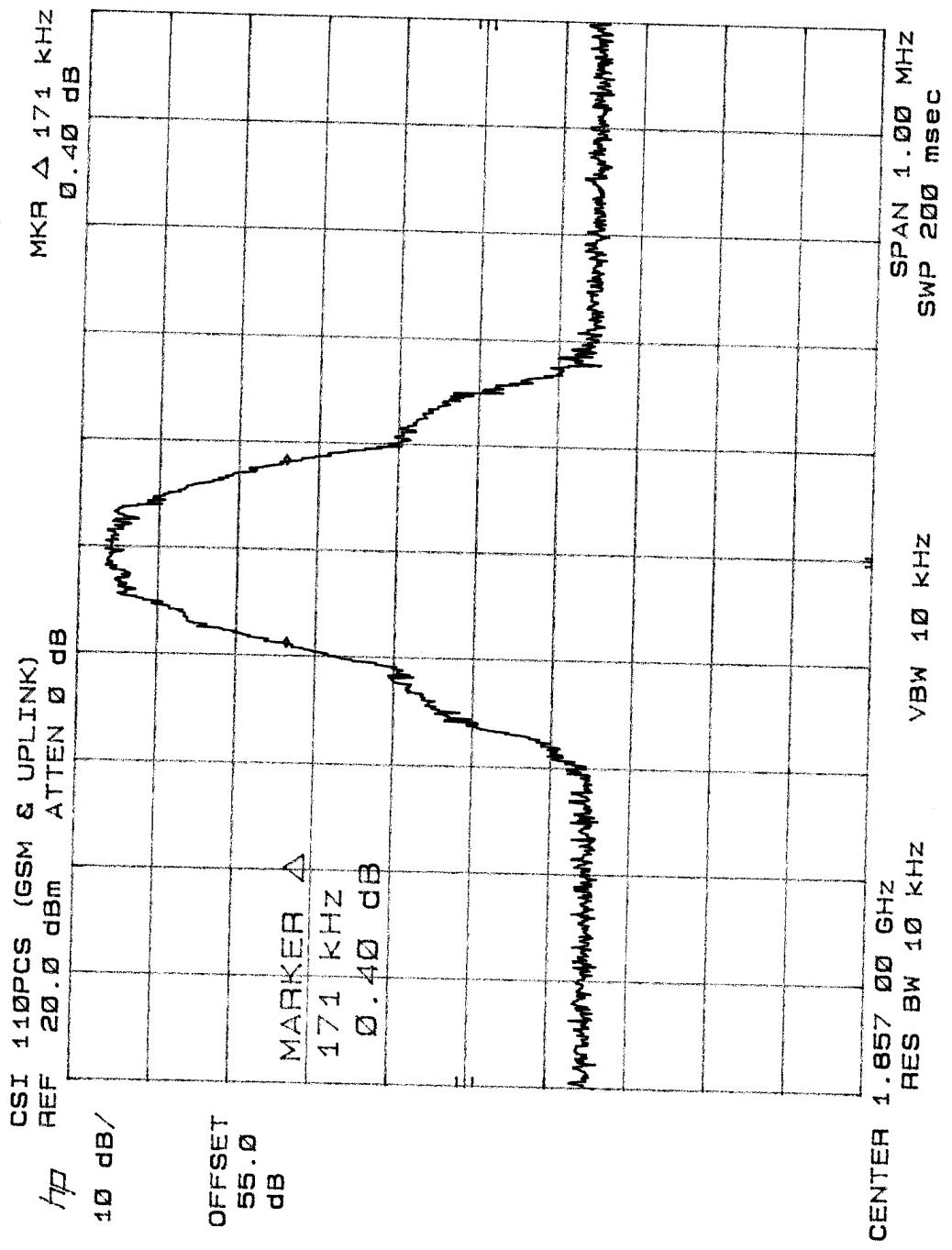


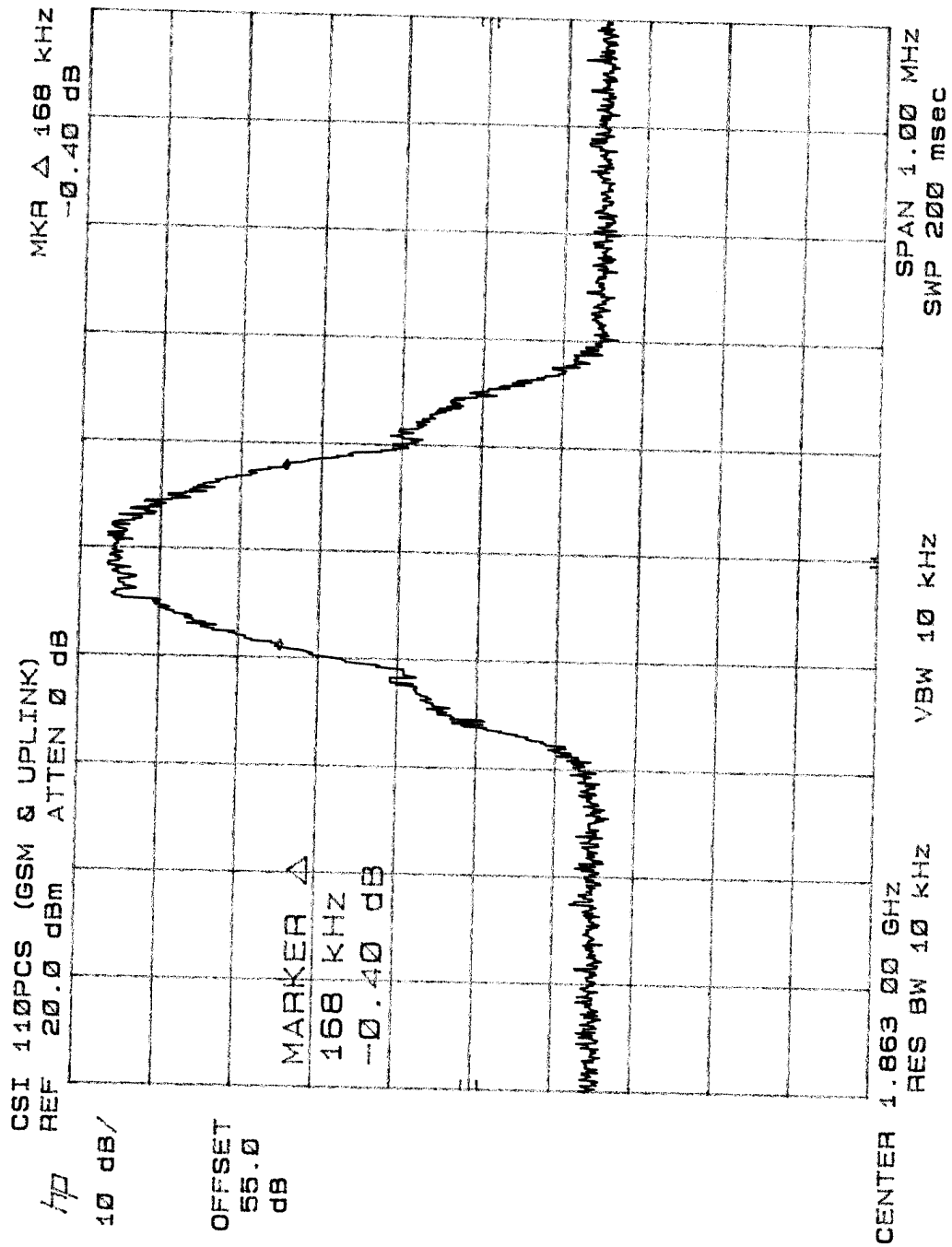












3.3.0 Emission Limitations, Occupied Bandwidth

Requirements: FCC 2.1049, FCC 24.238 (b). (The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26dB)

3.3.1 Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

The resolution bandwidth of the spectrum analyzer was set at 30 KHz and the spectrum was recorded in the frequency band ± 50 KHz from the carrier frequency.

3.3.2 Test Equipment

Hewlett Packard HP8566B Spectrum Analyzer
 Hewlett Packard HP 7470A Plotter
 Rohde & Schwarz SMIQ03B Signal Generator
 Rohde & Schwarz AMIQ I/Q Modulation Generator

3.3.3 Test Results

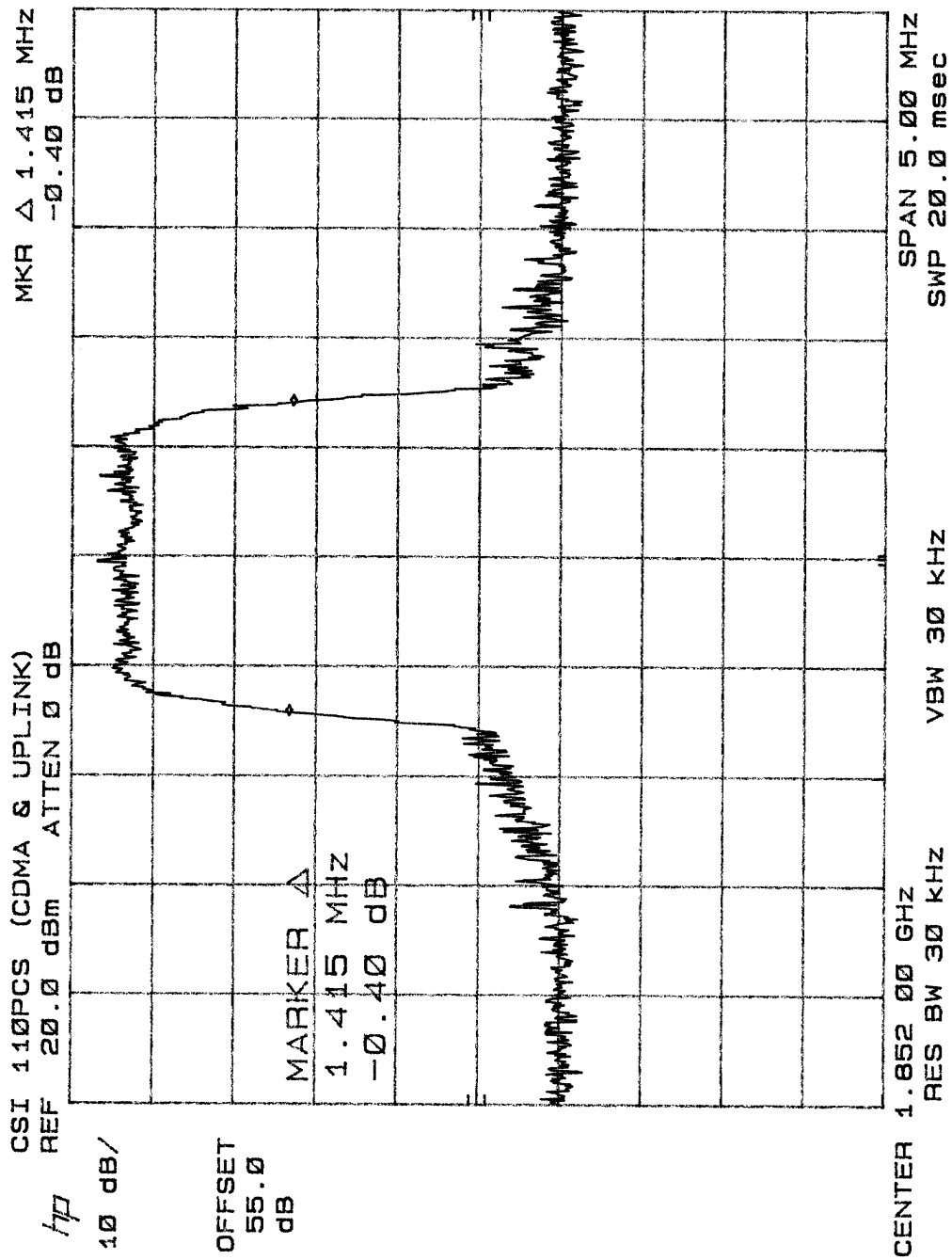
Refer to the attached Plots

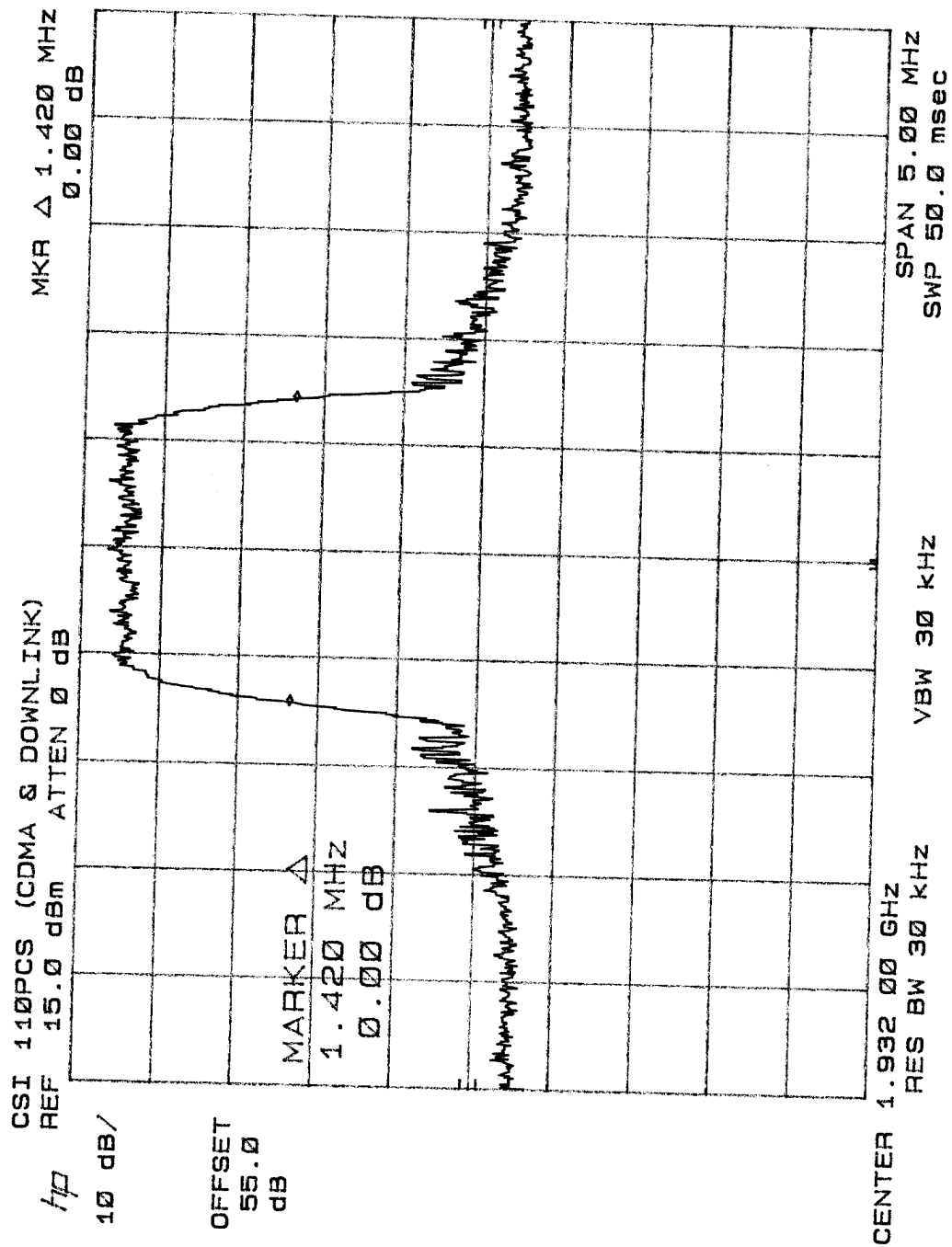
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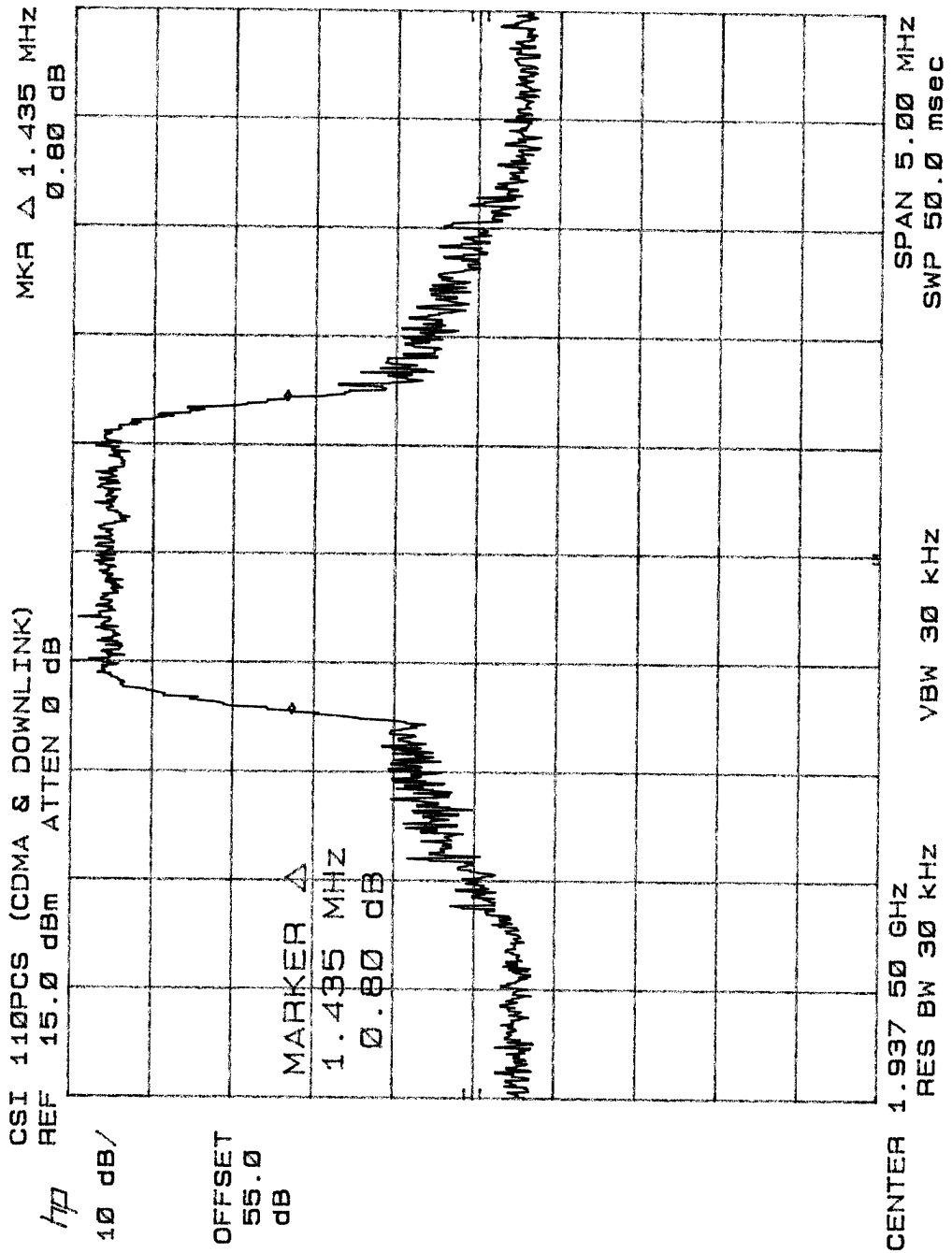
Occupied Bandwidth		
CDMA	Low	Page 51
	Middle	Page 52
	High	Page 53
GSM	Low	Page 57
	Middle	Page 58
	High	Page 59
TDMA	Low	Page 54
	Middle	Page 55
	High	Page 56

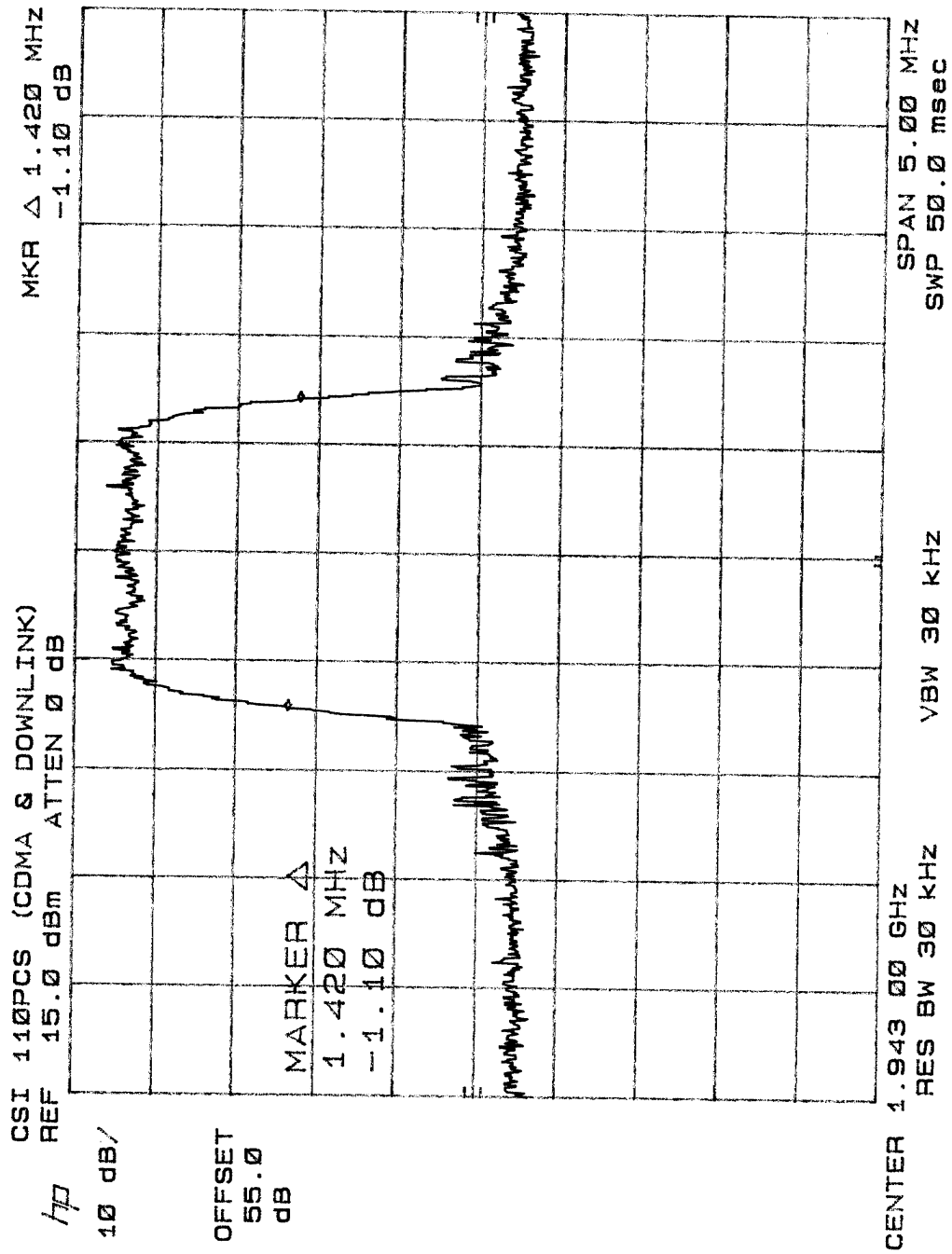
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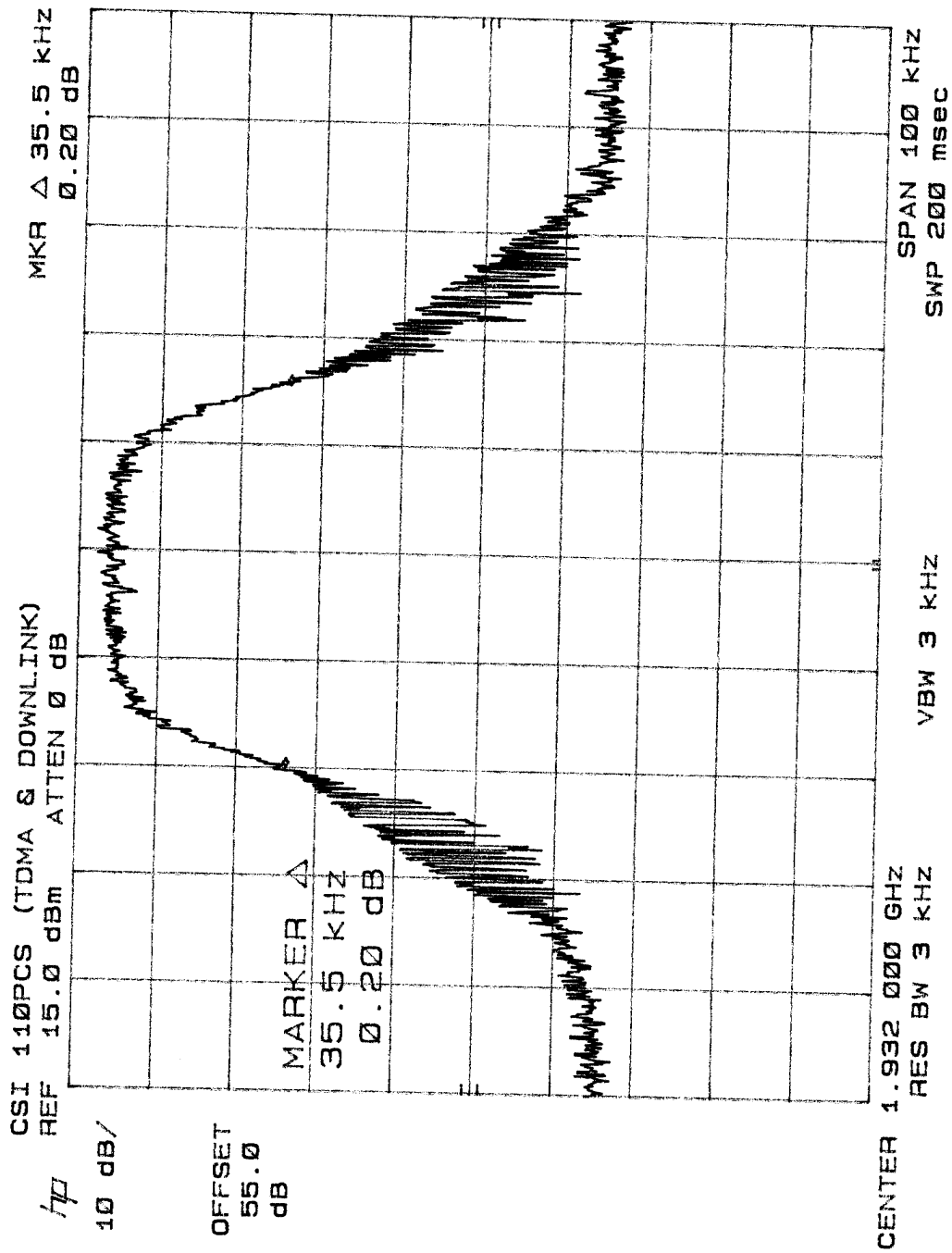
RF Power Output Plots		
TDMA	Low	Page 65
	Middle	Page 66
	High	Page 67
GSM	Low	Page 62
	Middle	Page 63
	High	Page 64
CDMA	Low	Page 50
	Middle	Page 60
	High	Page 61

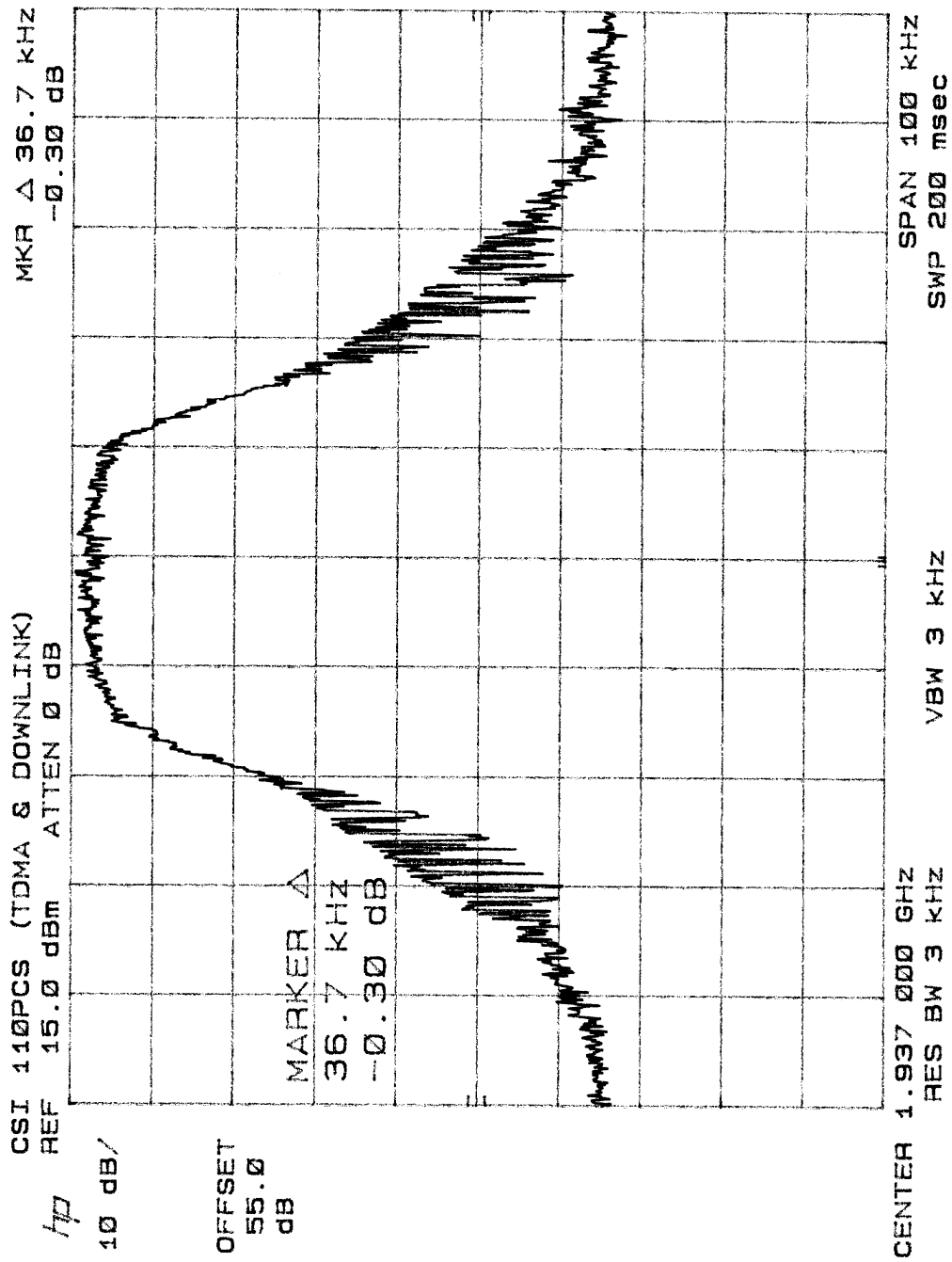


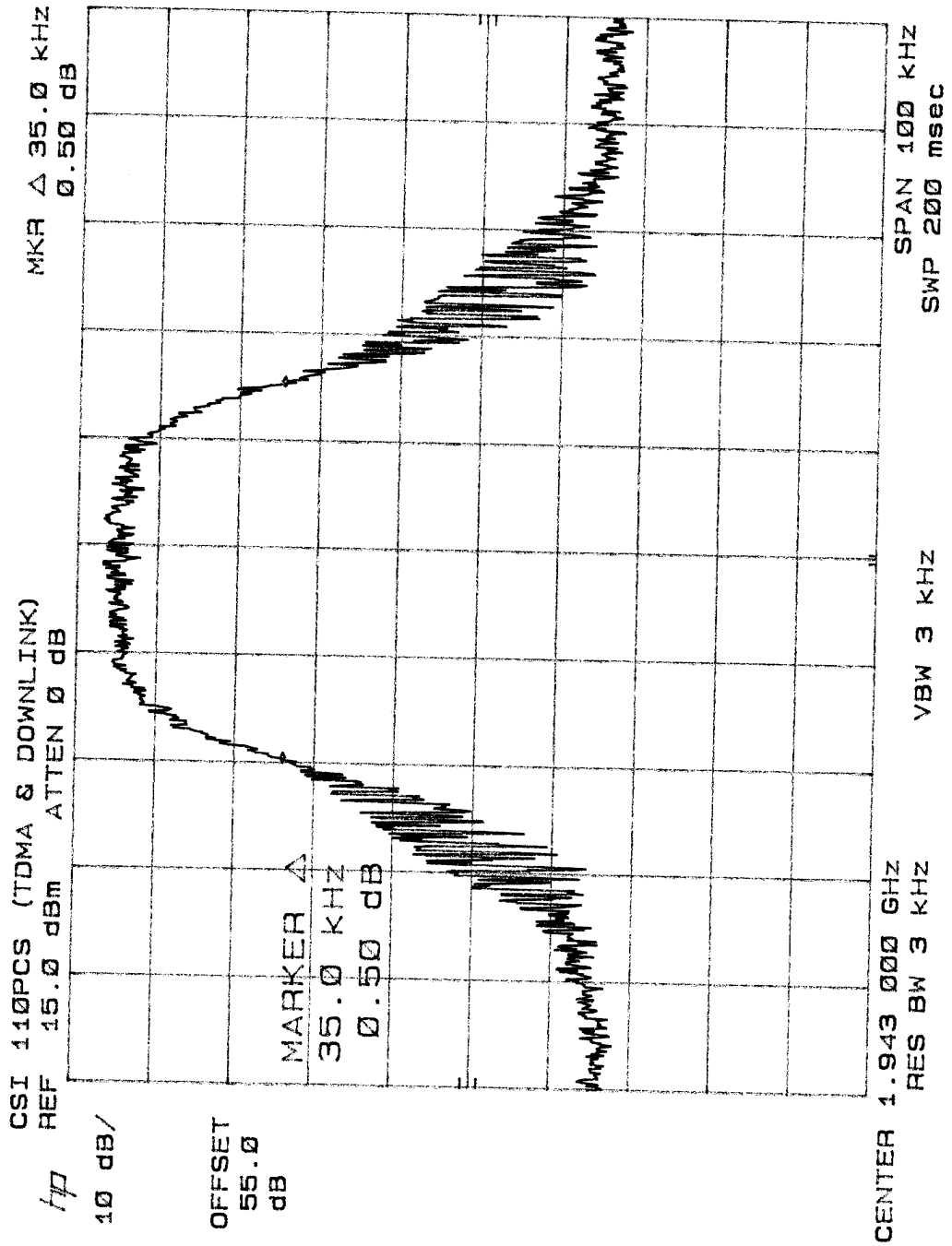


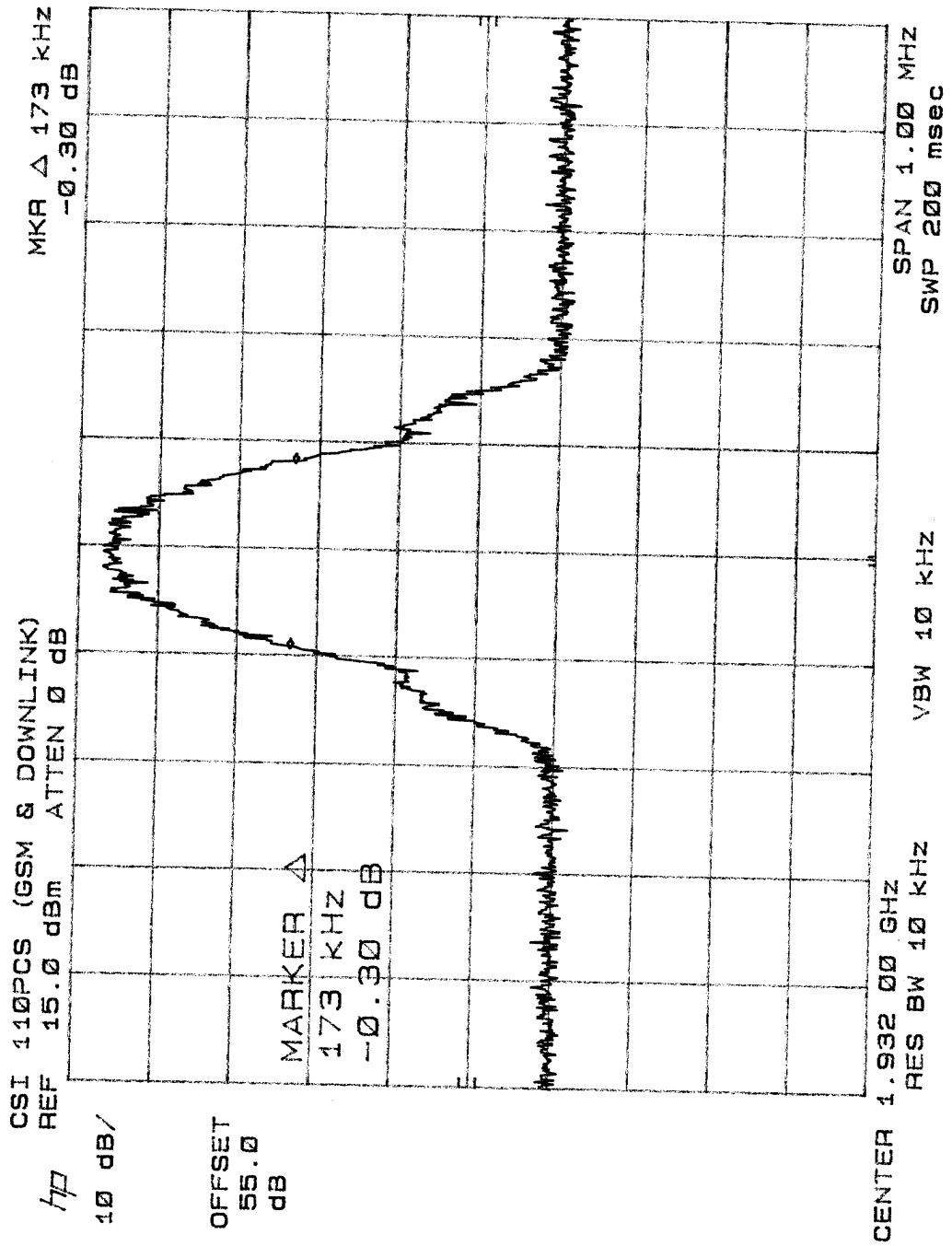


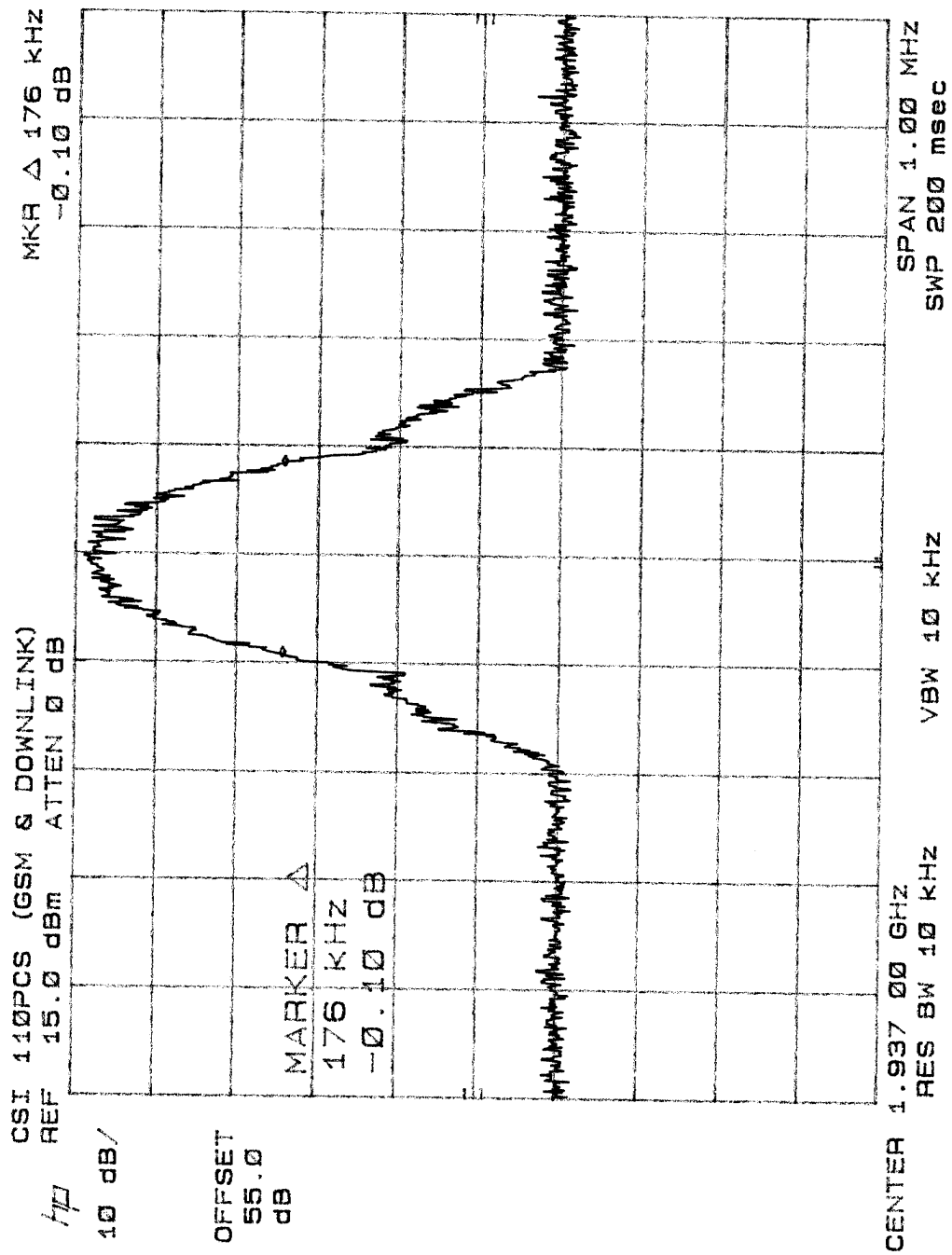


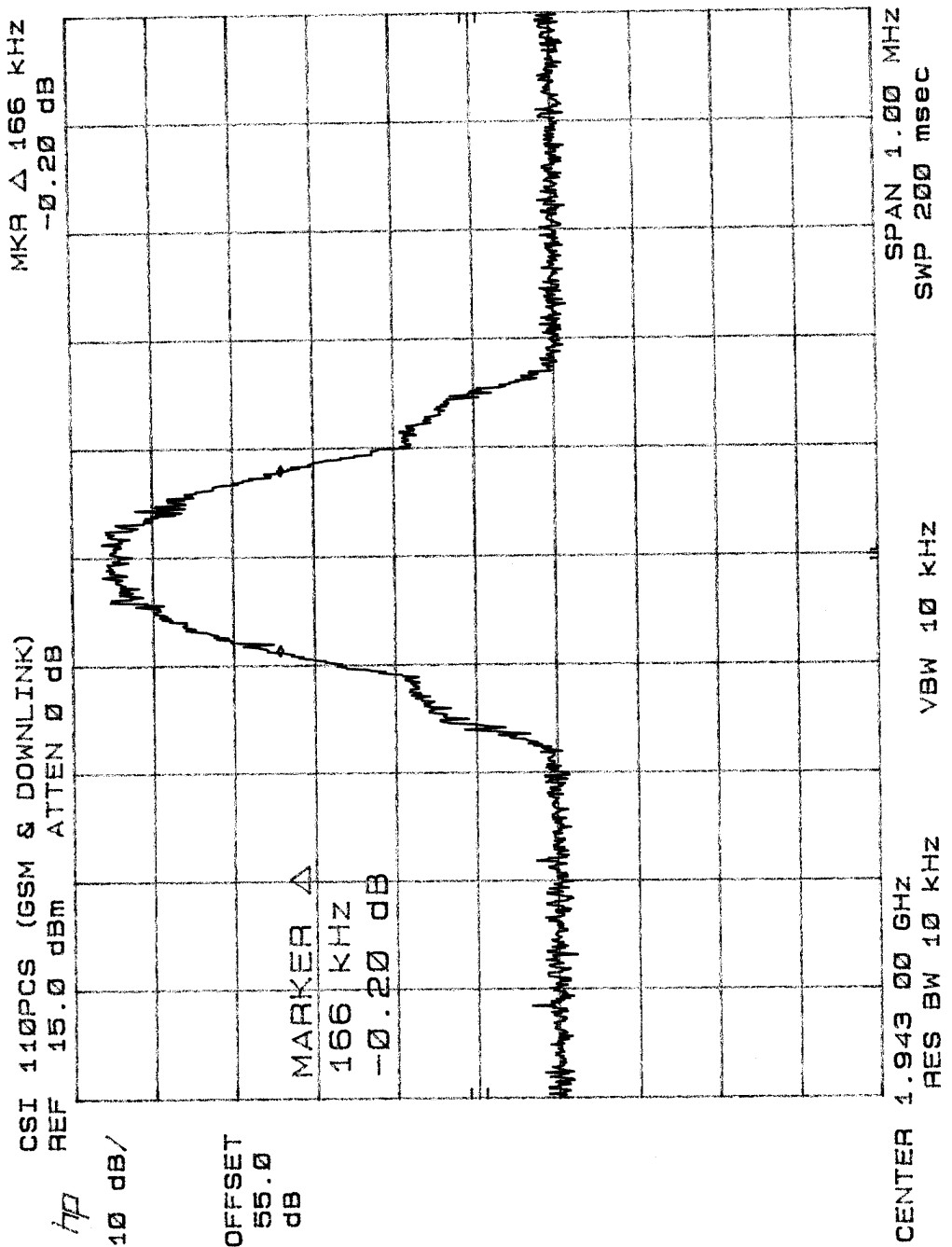


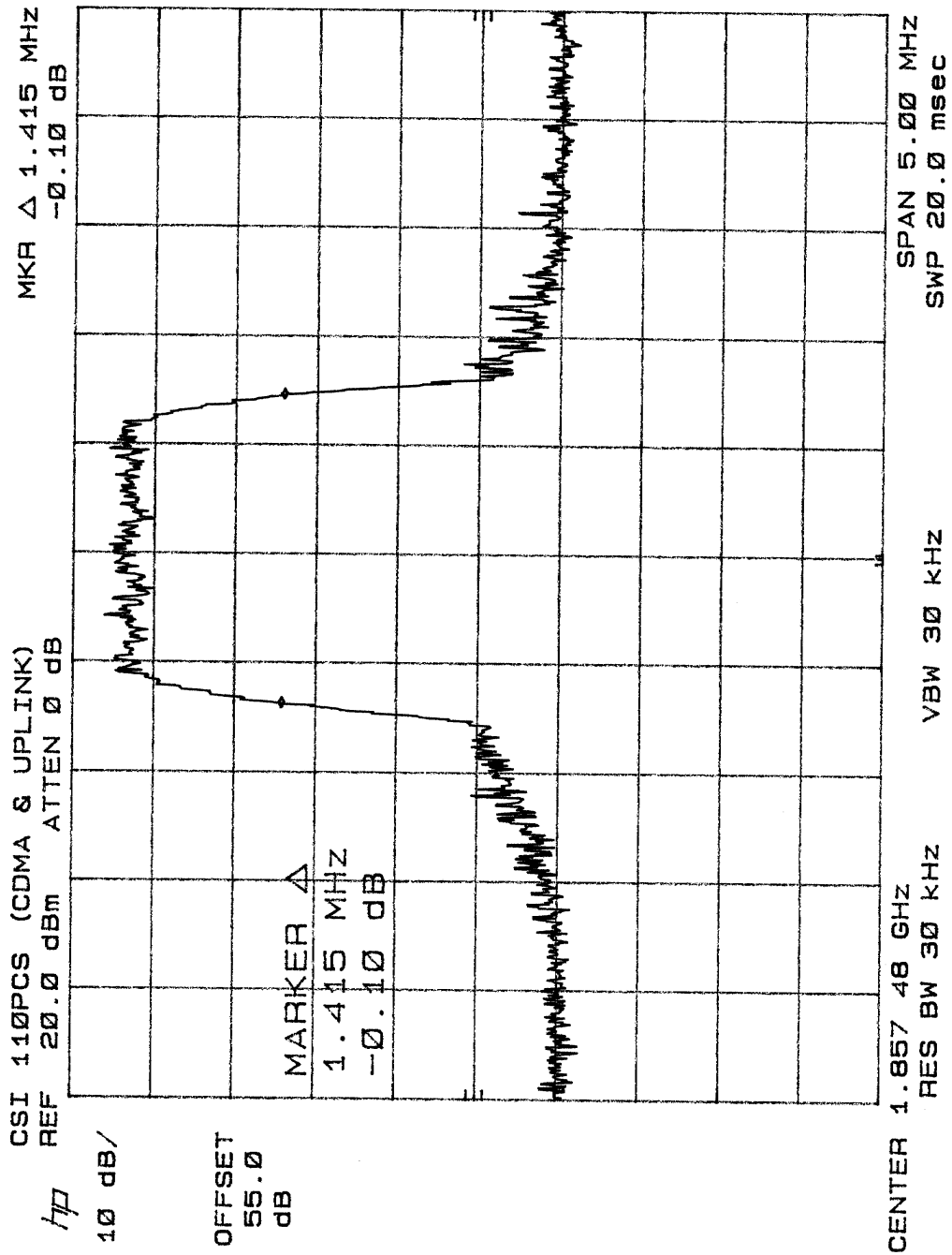


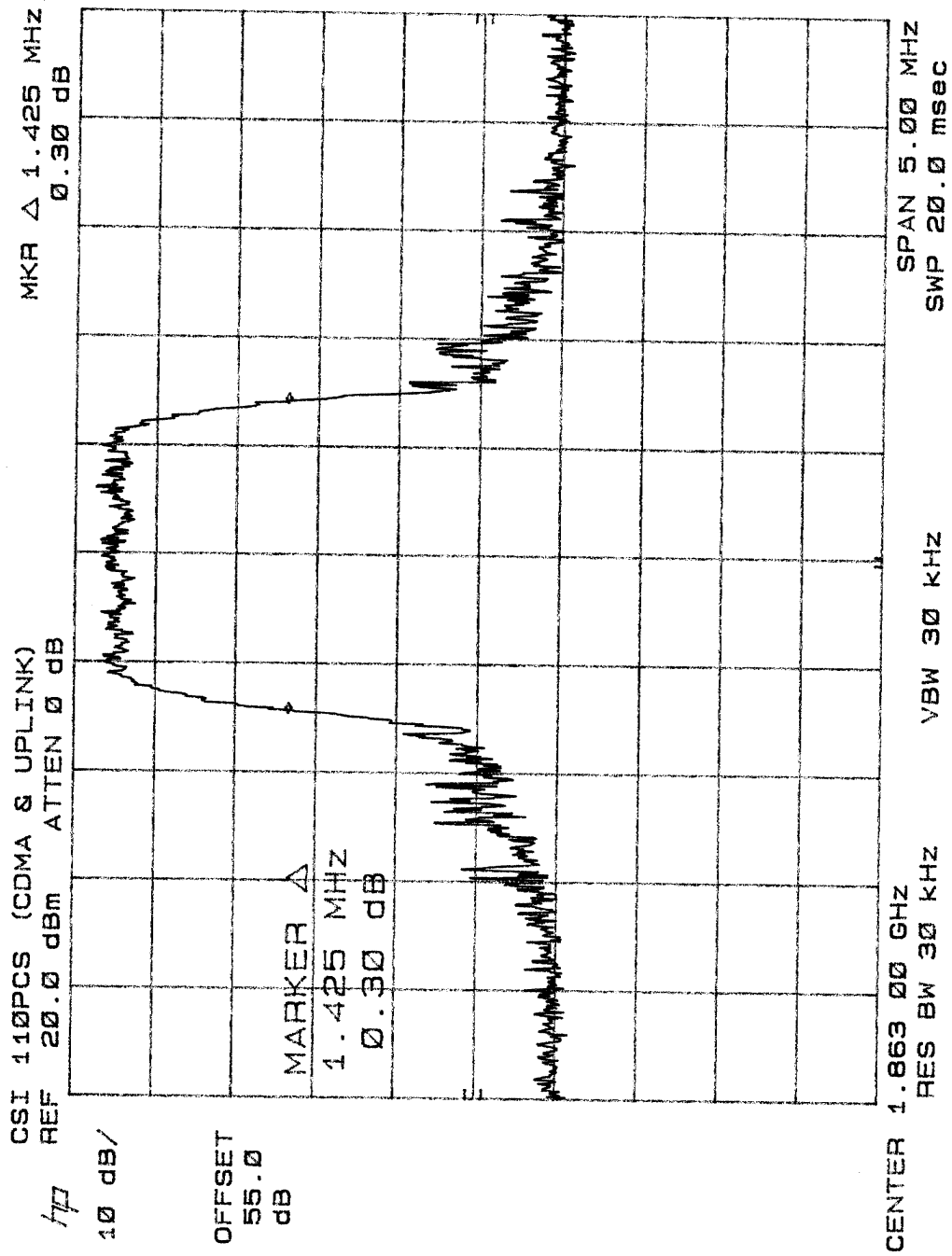


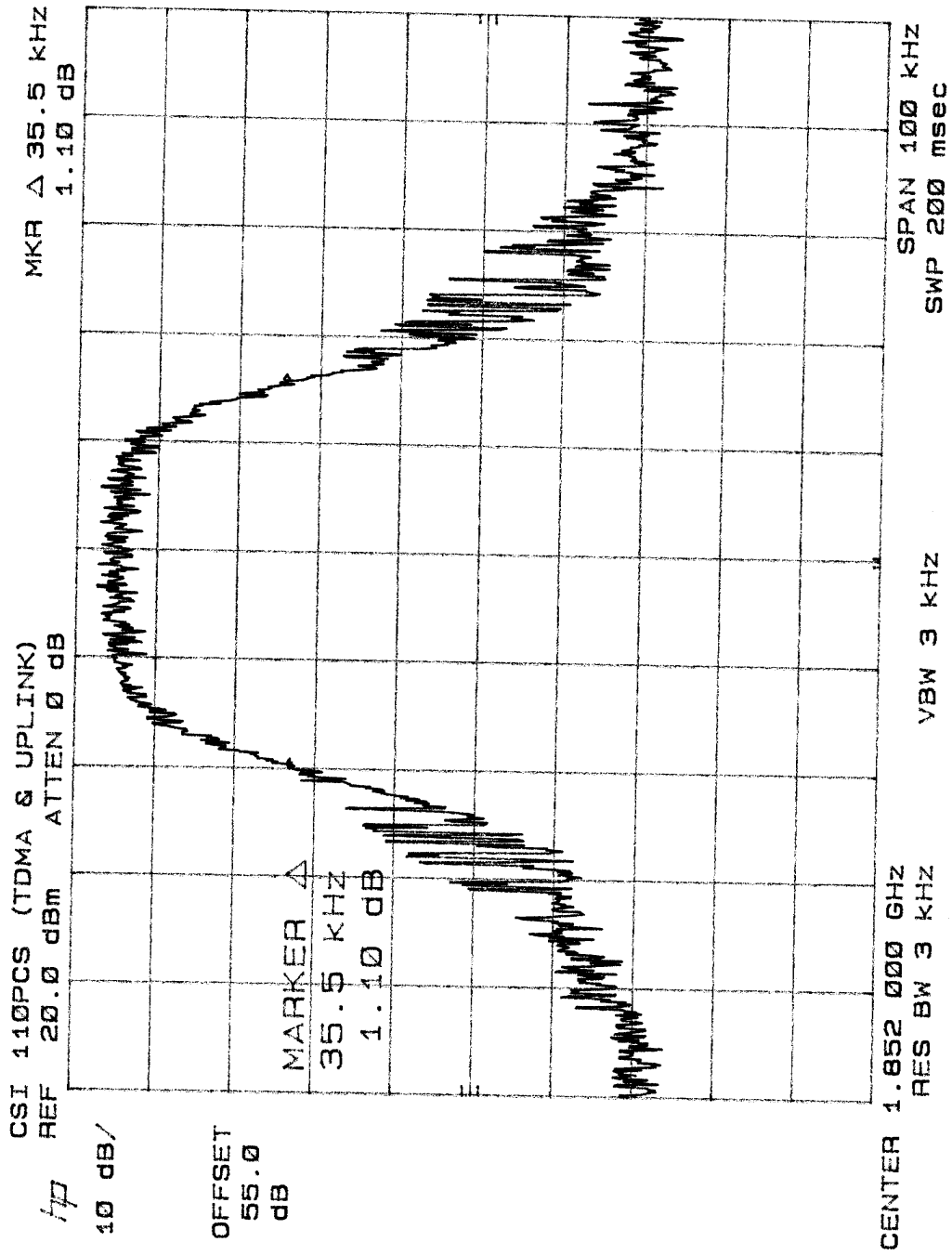


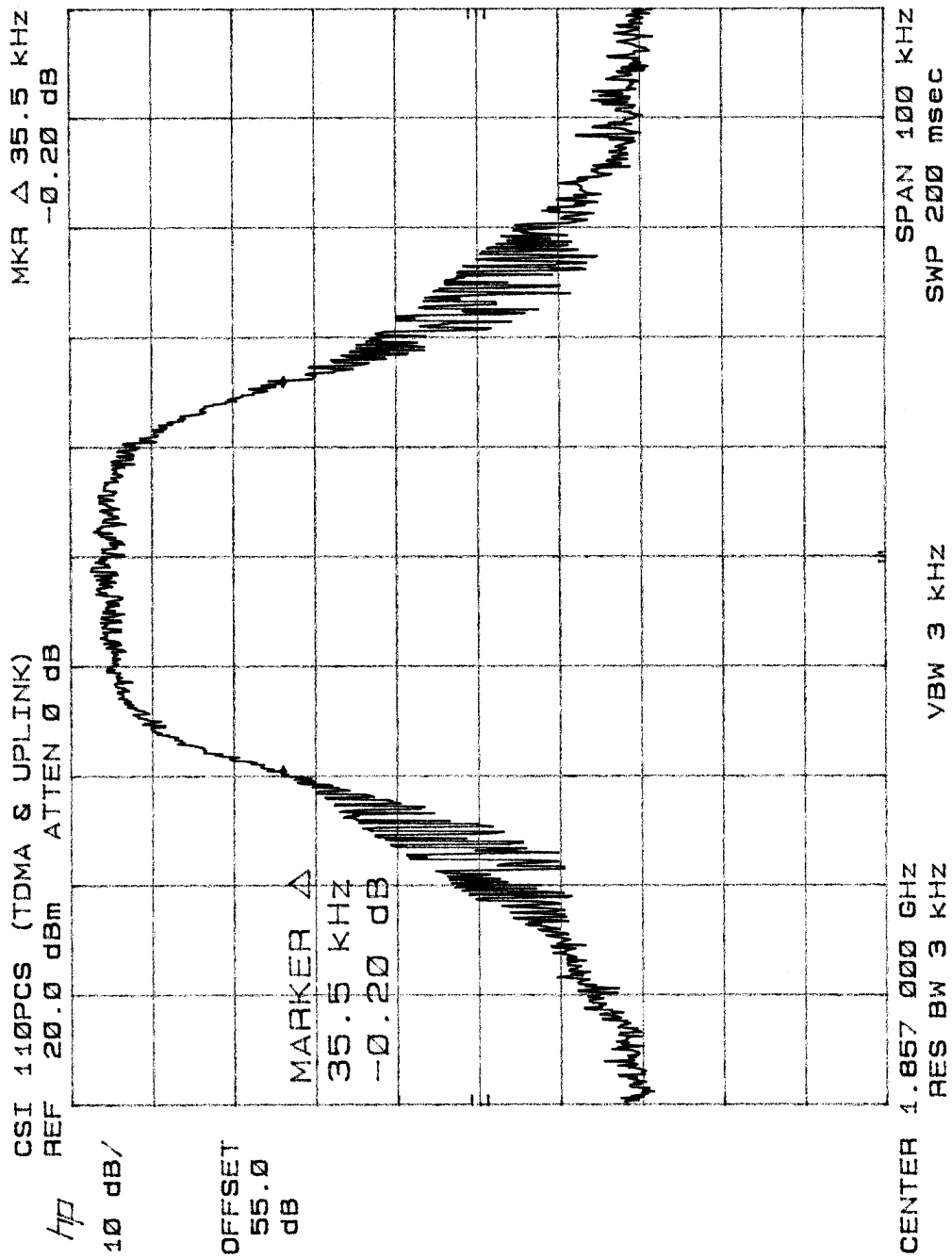


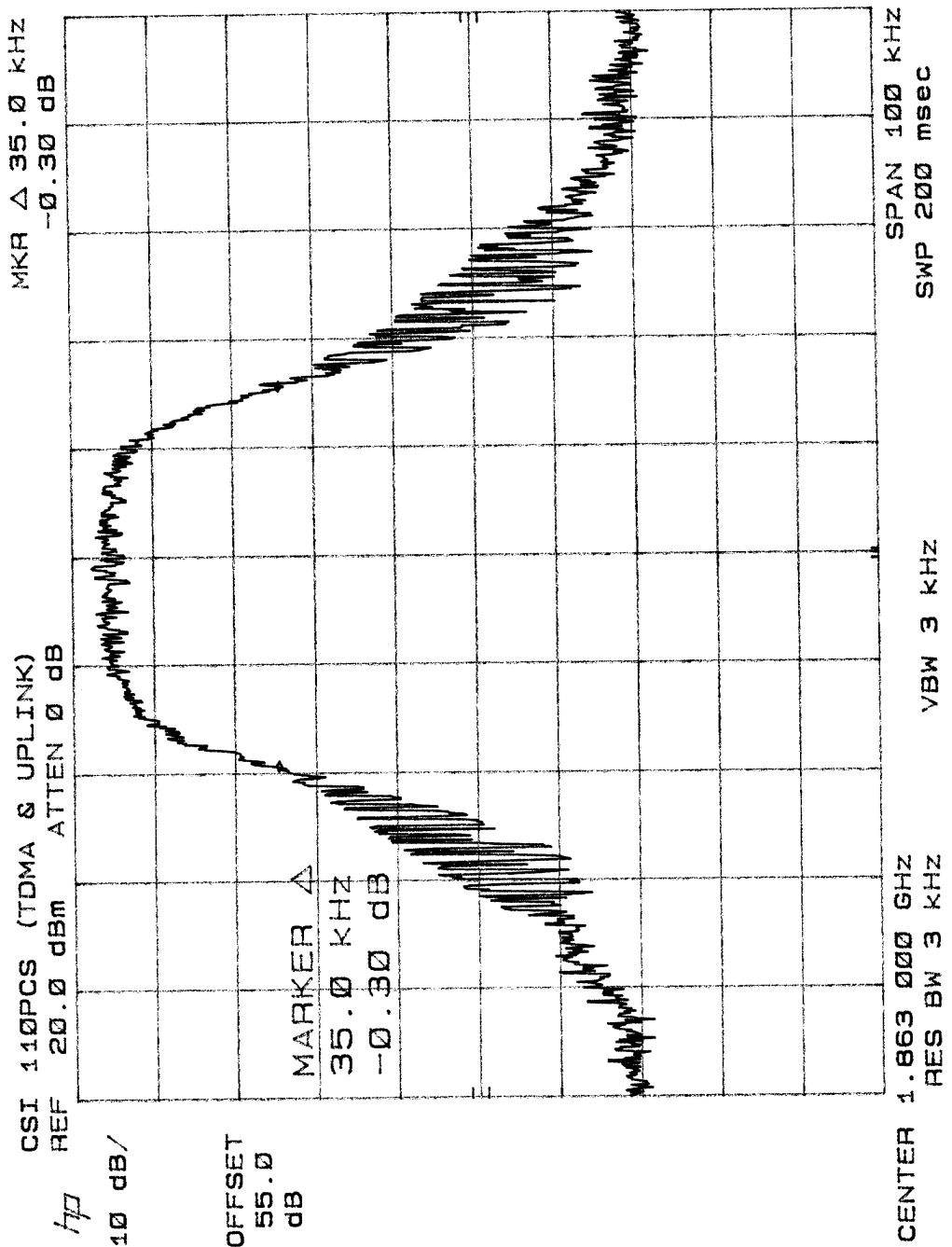


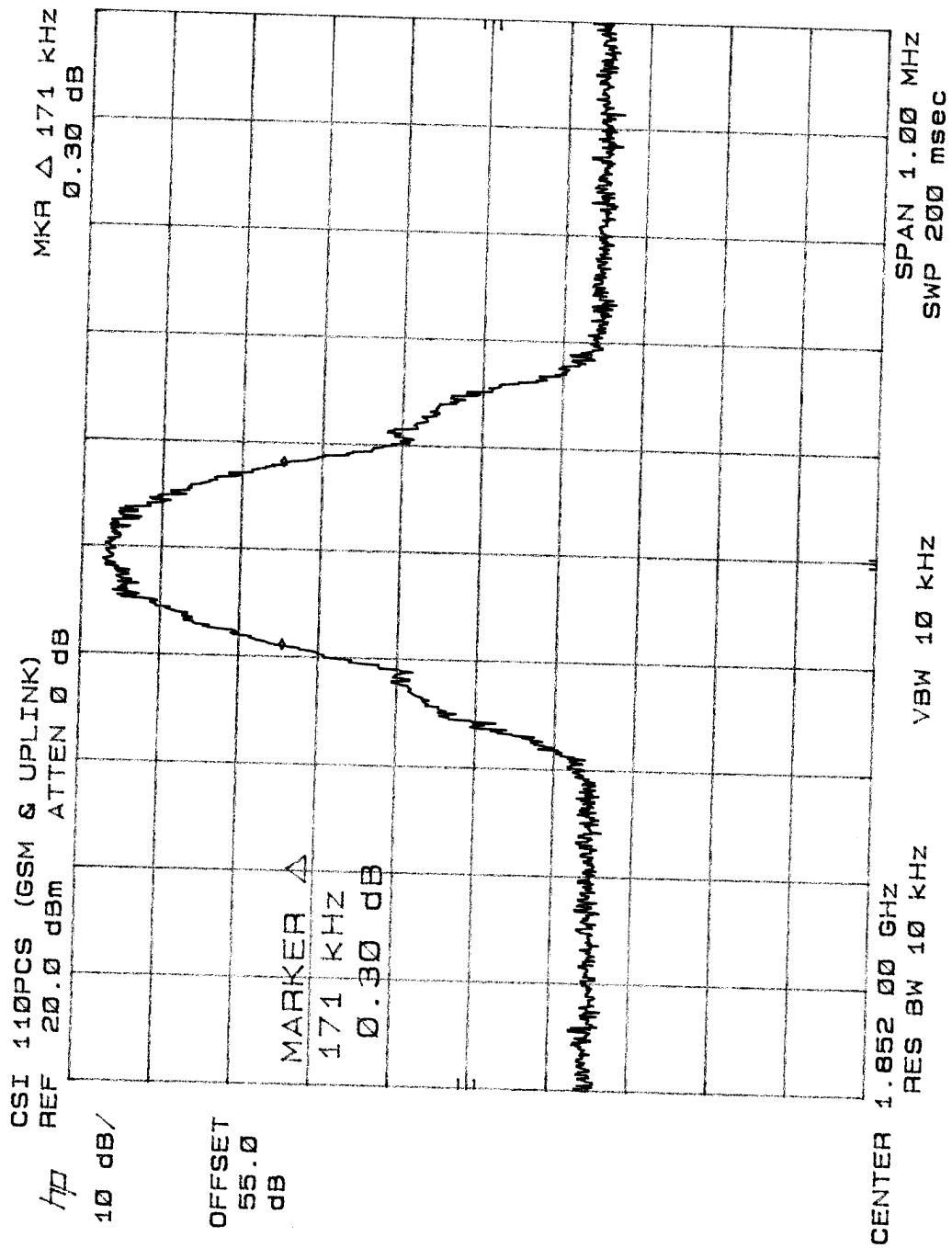


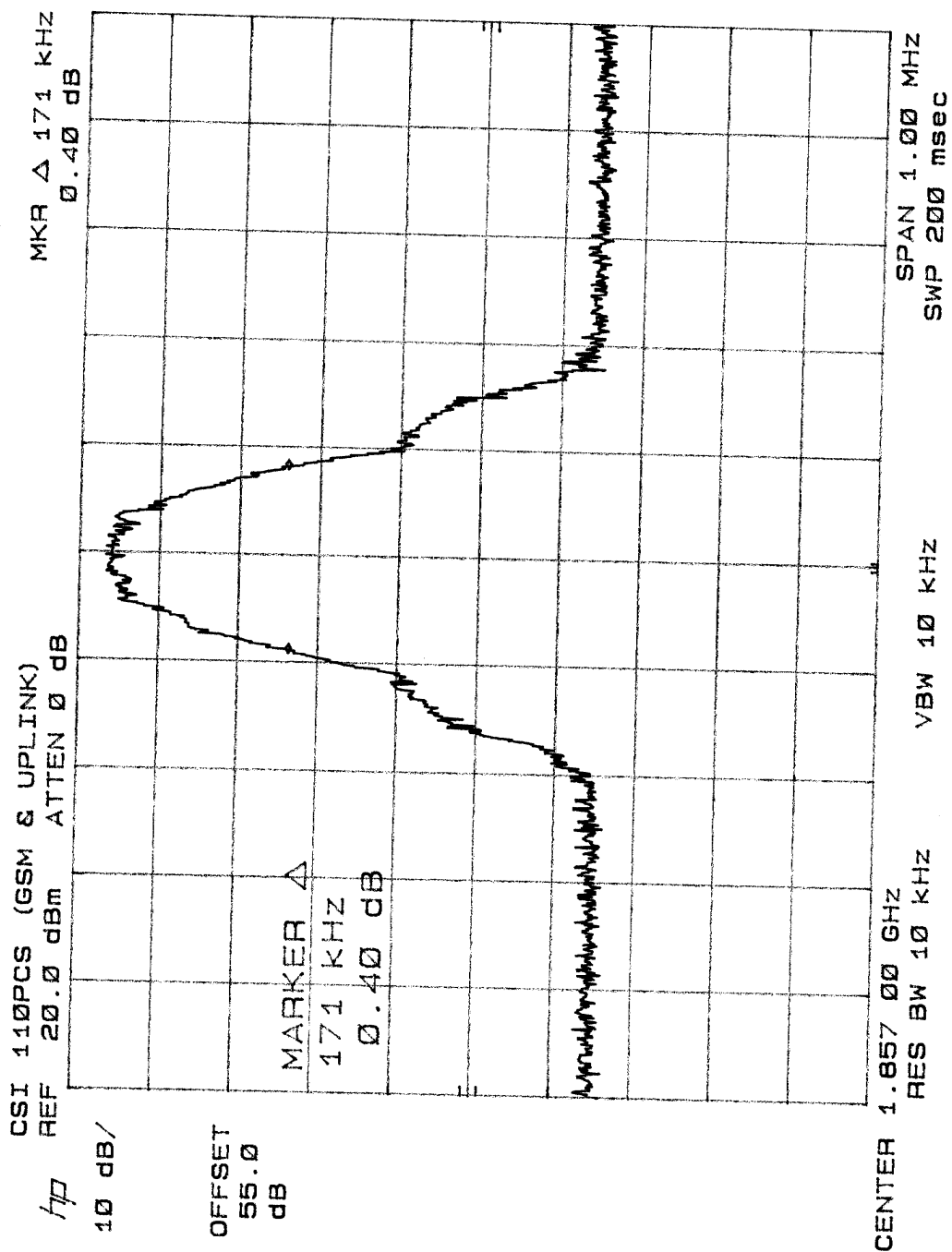


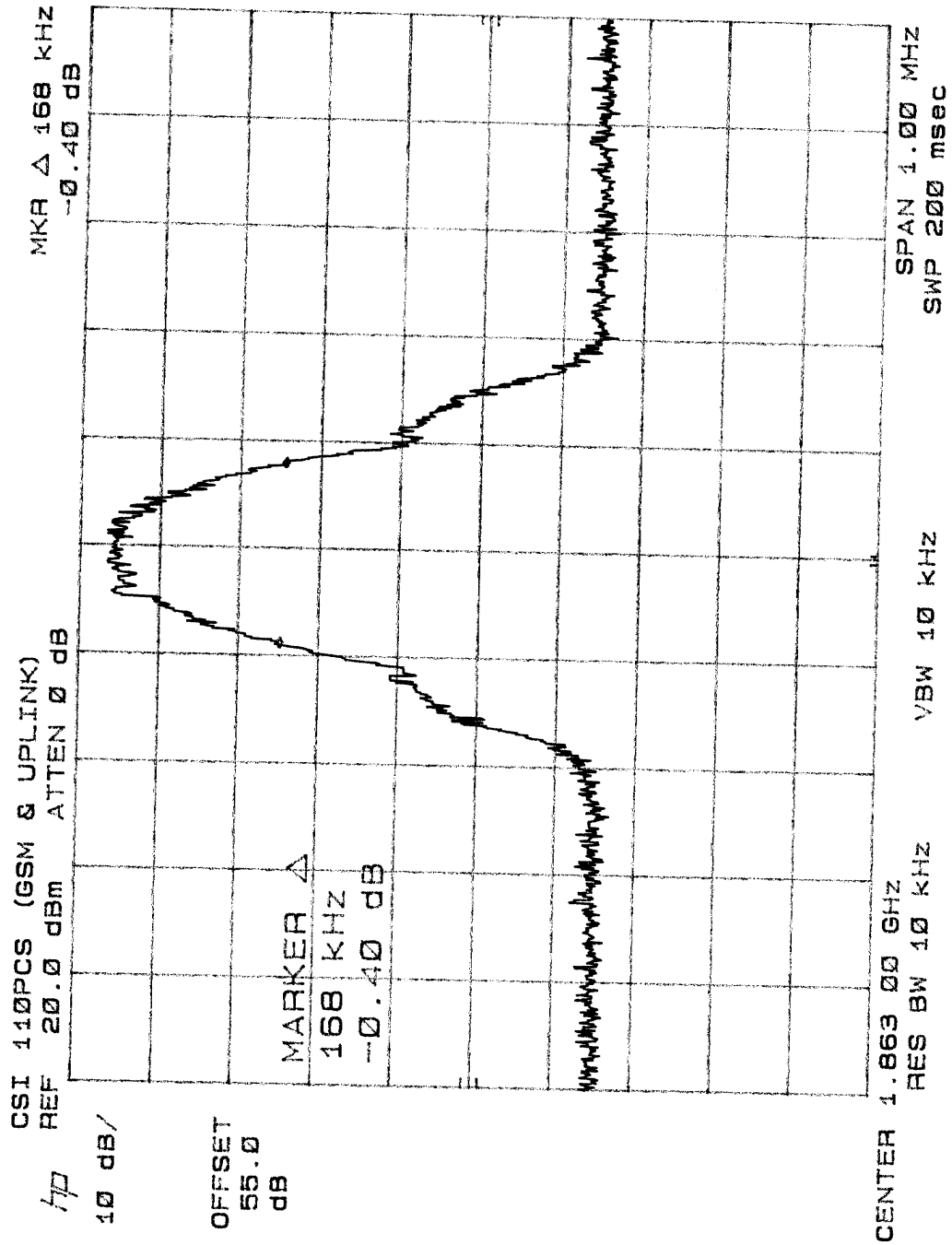












3.4.0 Out of Band Emissions at Antenna Terminals

Requirements : FCC 24.238

Out of Band Emissions:

The mean power of emissions must be attenuated below the mean power of the unmodulated carrier (P) on any frequency twice or more than twice the fundamental frequency by at least $43 + 10 \log P$ dB.

Mobile Emissions in Base Frequency Range:

The mean power of any emissions appearing in the base station frequency range from cellular mobile transmitters operated must be attenuated to a level not to exceed -80 dBm at the transmit antenna connector.

3.4.1 Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.

3.4.2 Test Equipment

HP 8566B Spectrum Analyzer
 HP 7470A Plotter
 Hewlett Packard HP8566B Spectrum Analyzer
 Hewlett Packard HP 7470A Plotter
 Rohde & Schwarz SMIQ03B Signal Generator
 Rohde & Schwarz AMIQ I/Q Modulation Generator

3.4.3 Test Results

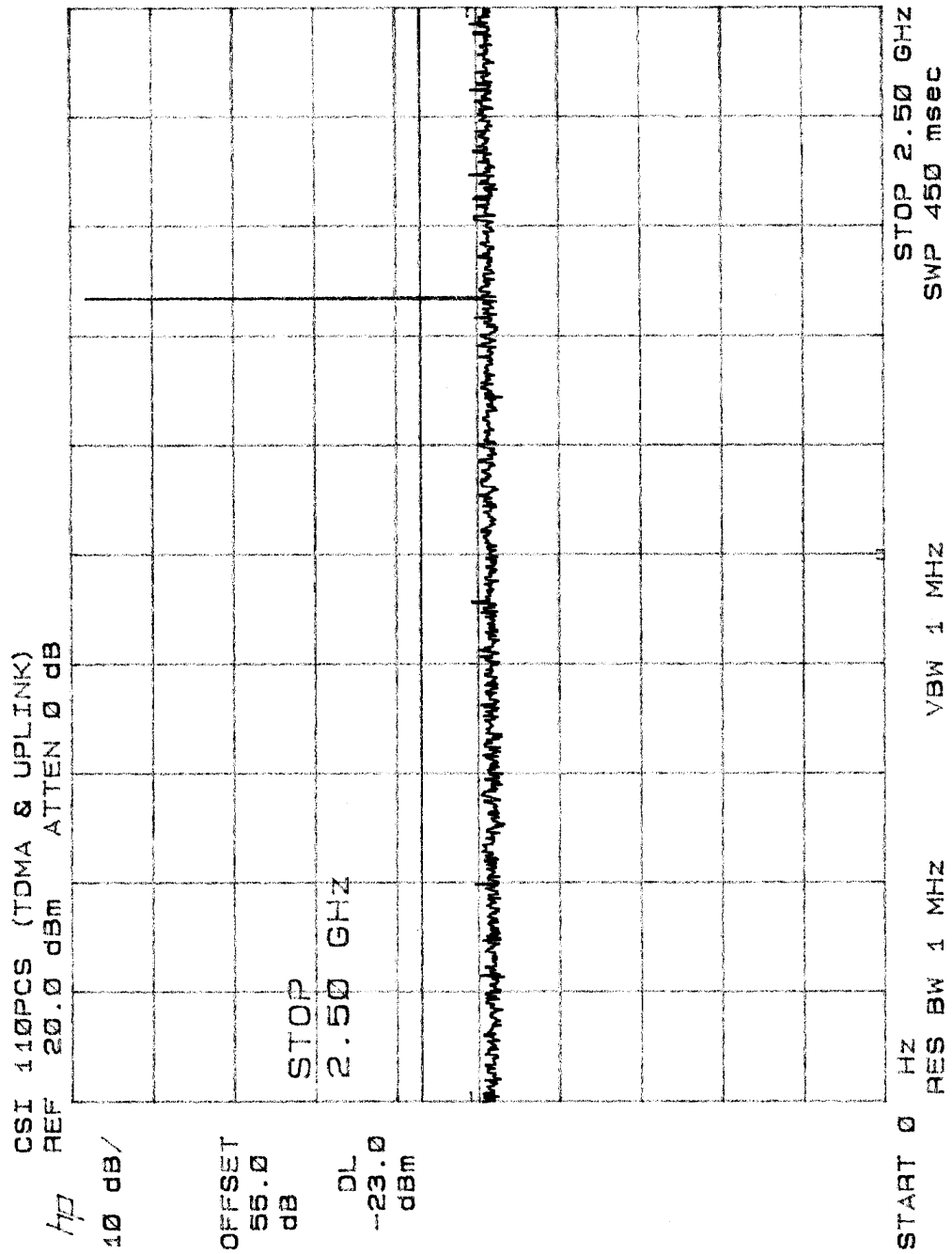
Refer to the attached plots.

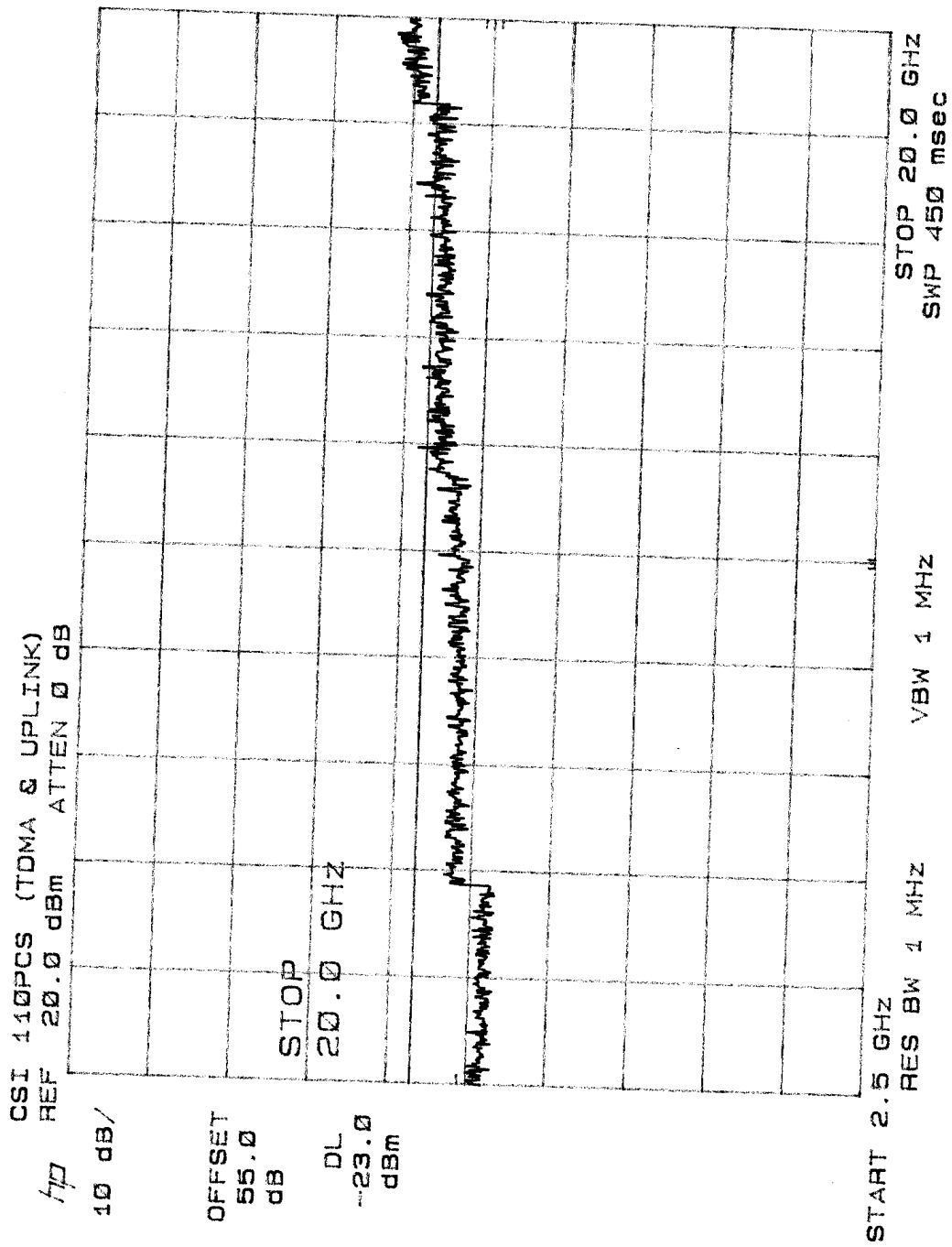
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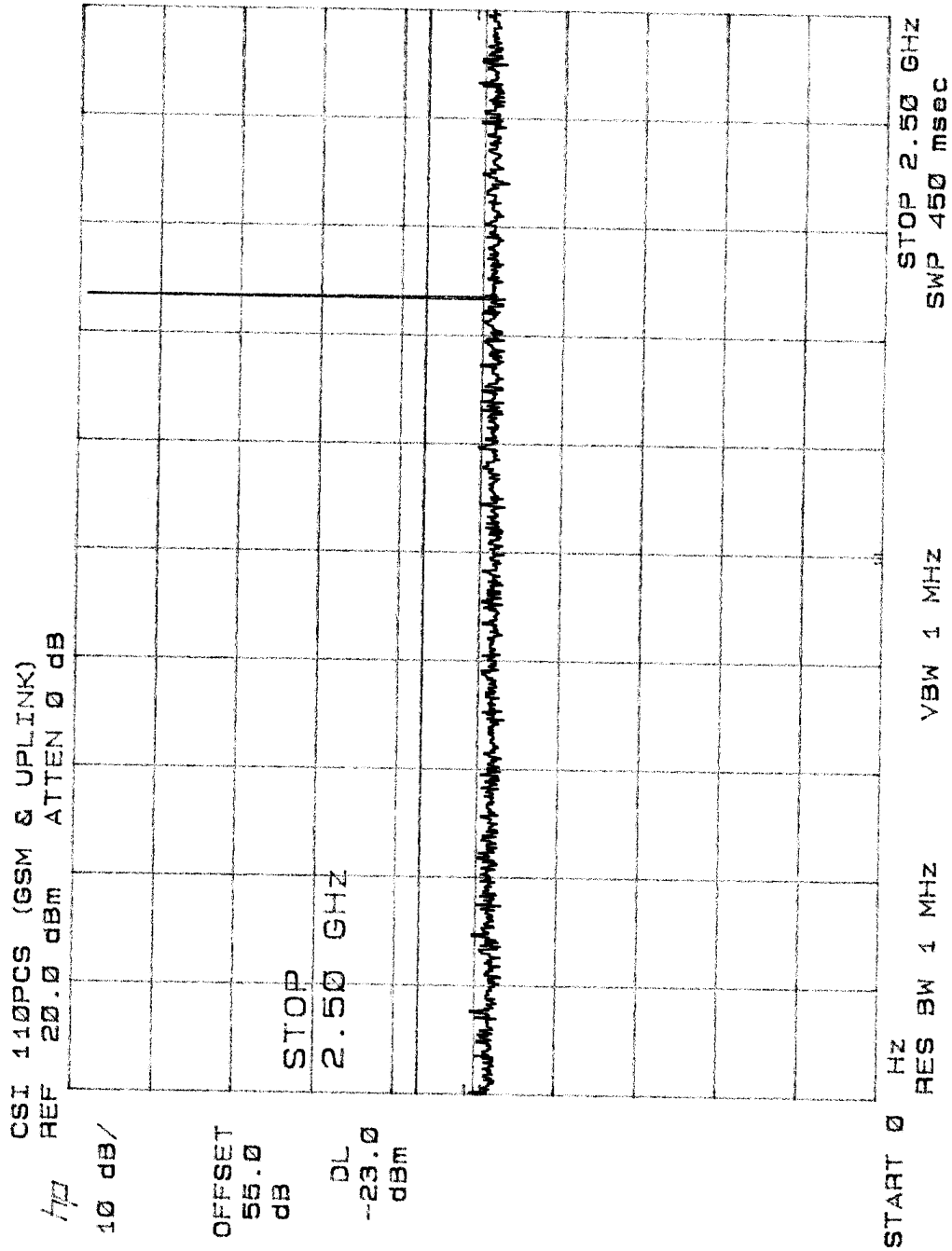
Out of Band Emissions at Antenna Terminals	
CDMA	Page 75-76
TDMA	Page 79-80
GSM	Page 77-78

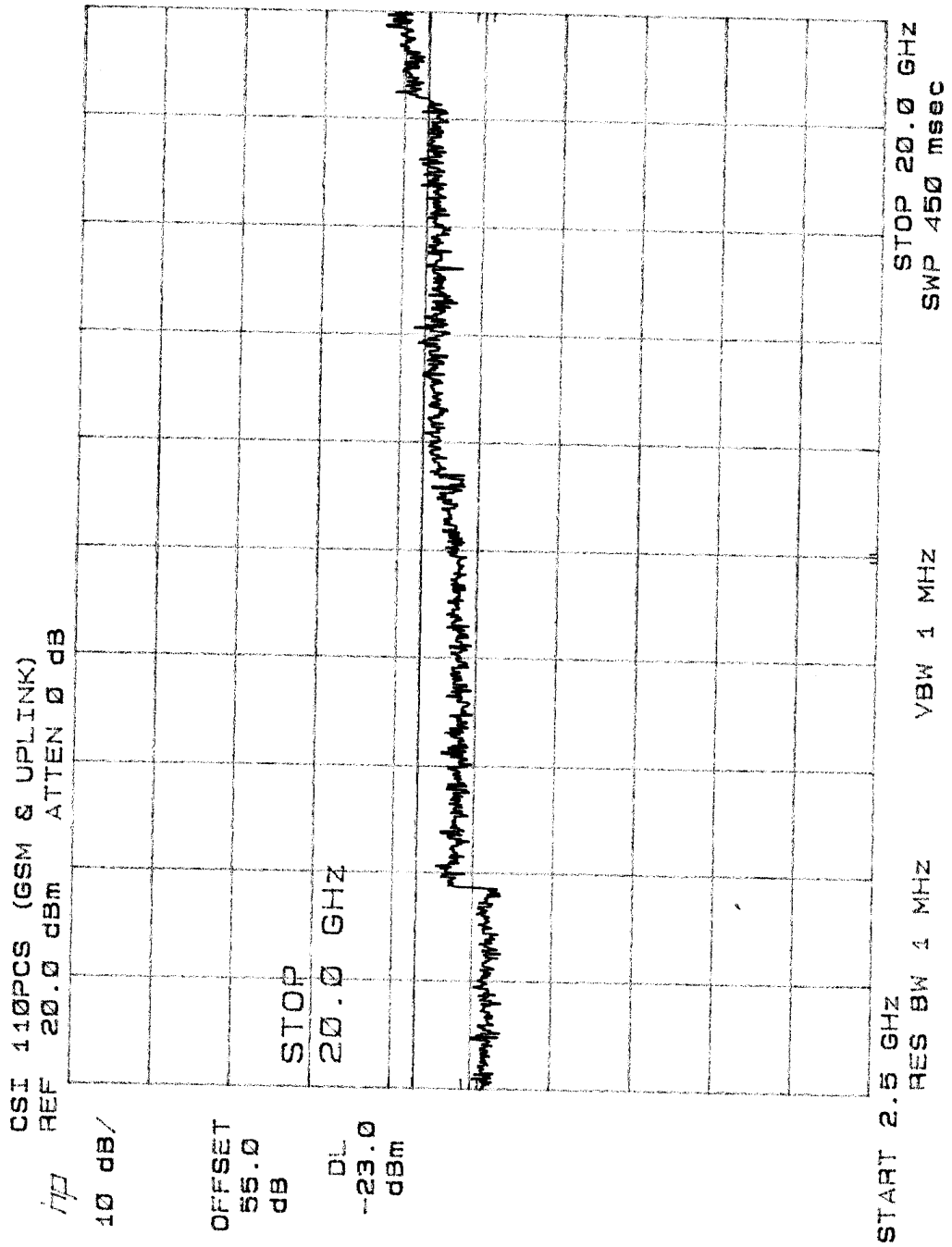
UPLINK

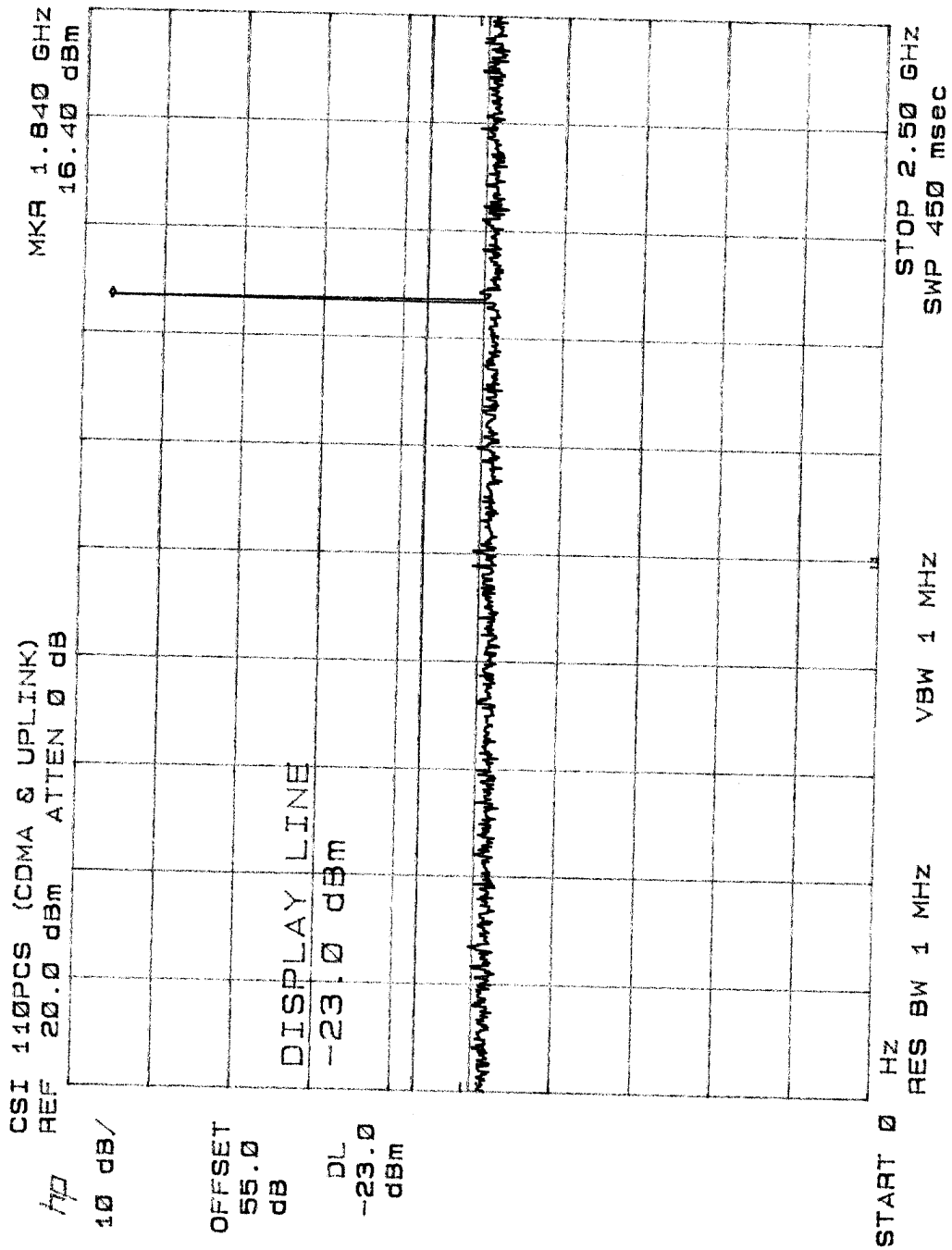
Out of Band Emissions at Antenna Terminals	
CDMA	Page 73-74
TDMA	Page 69-70
GSM	Page 71-72

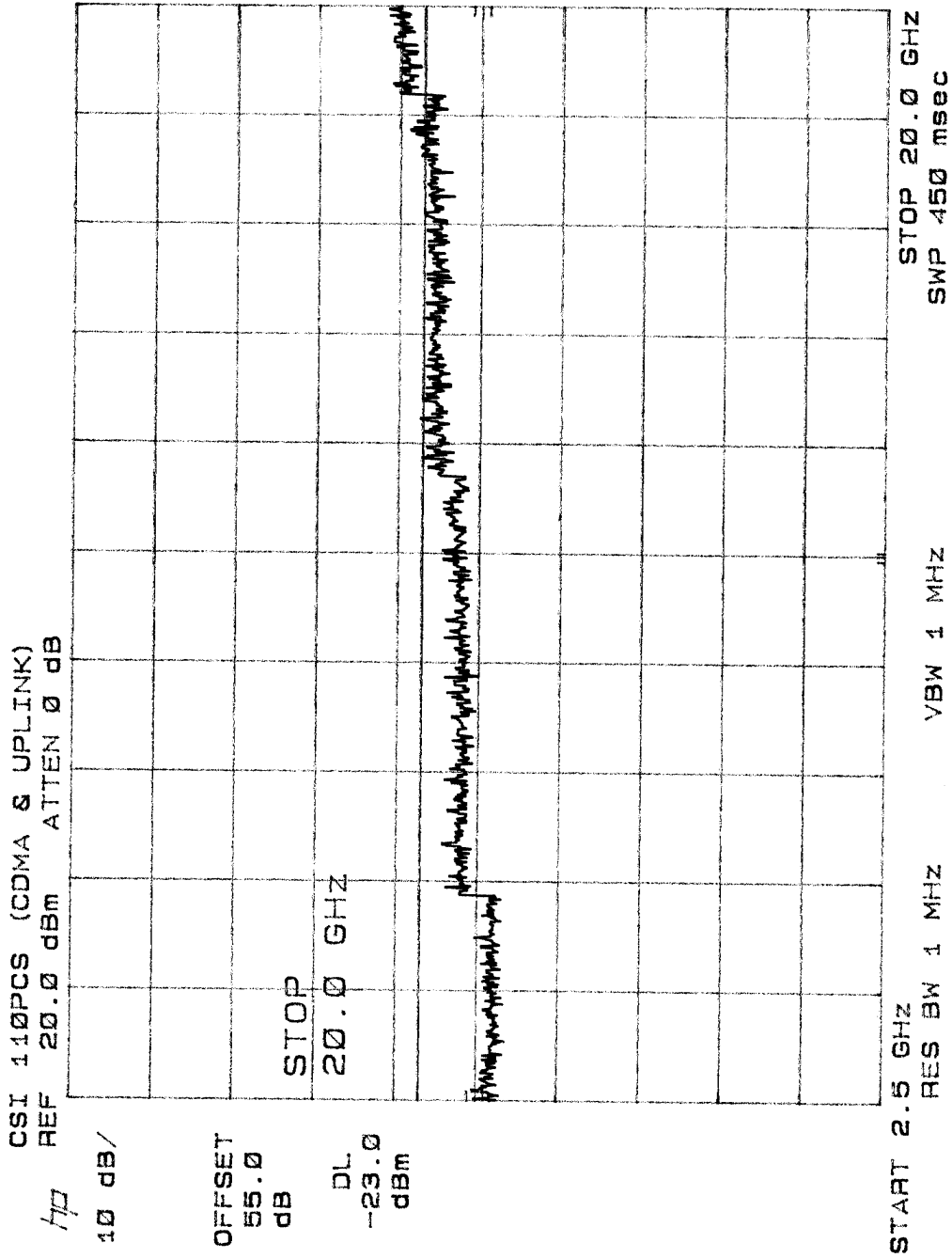


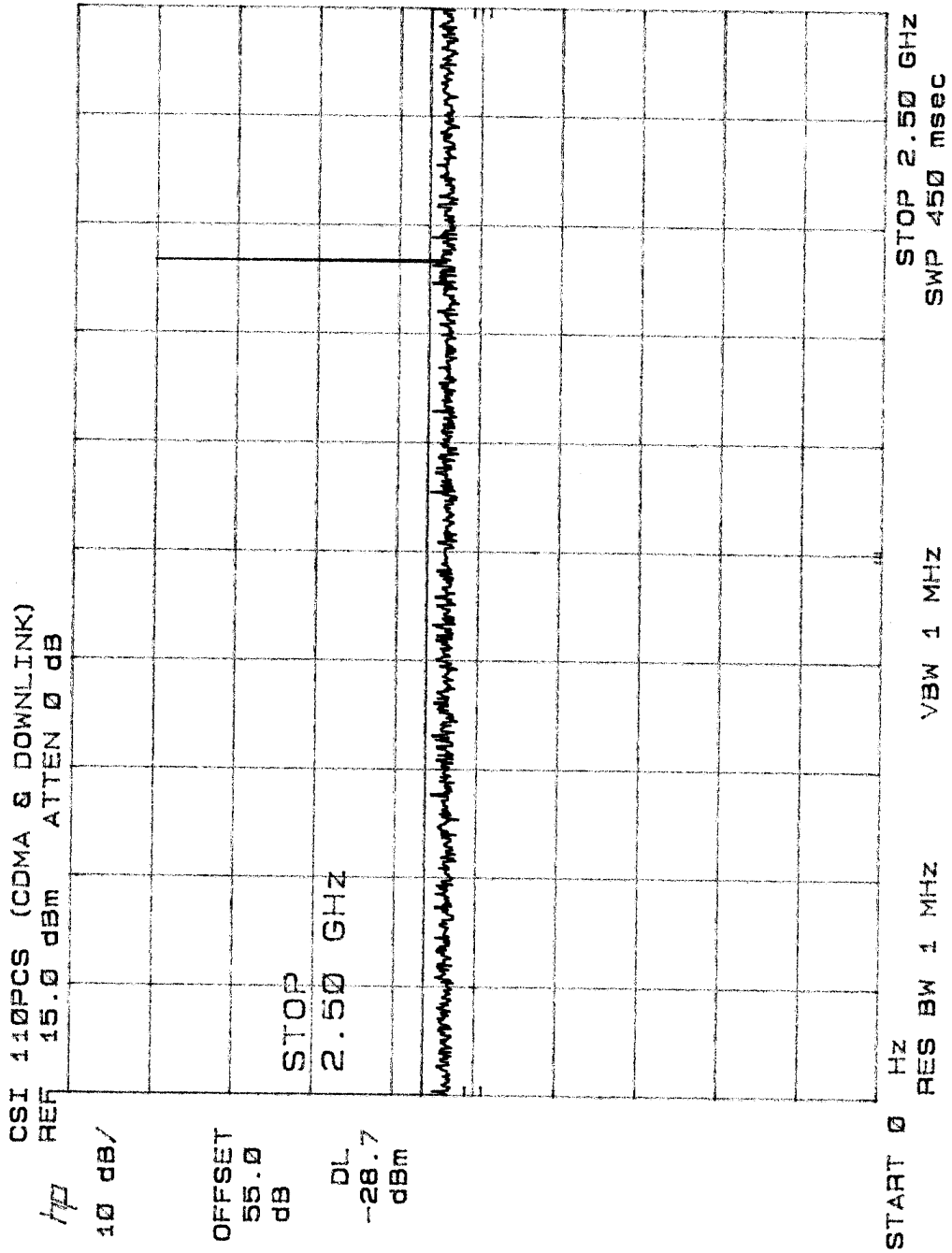


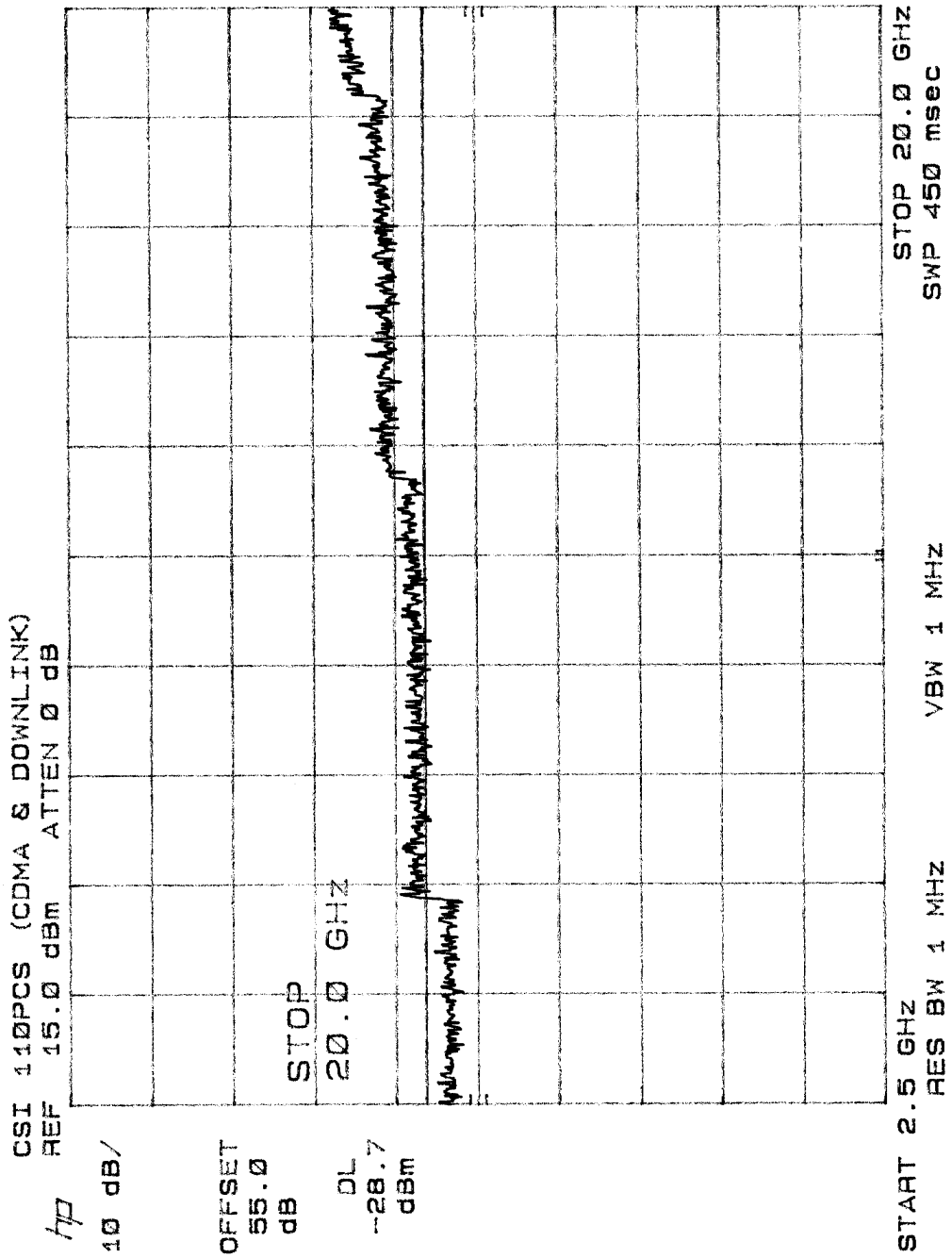


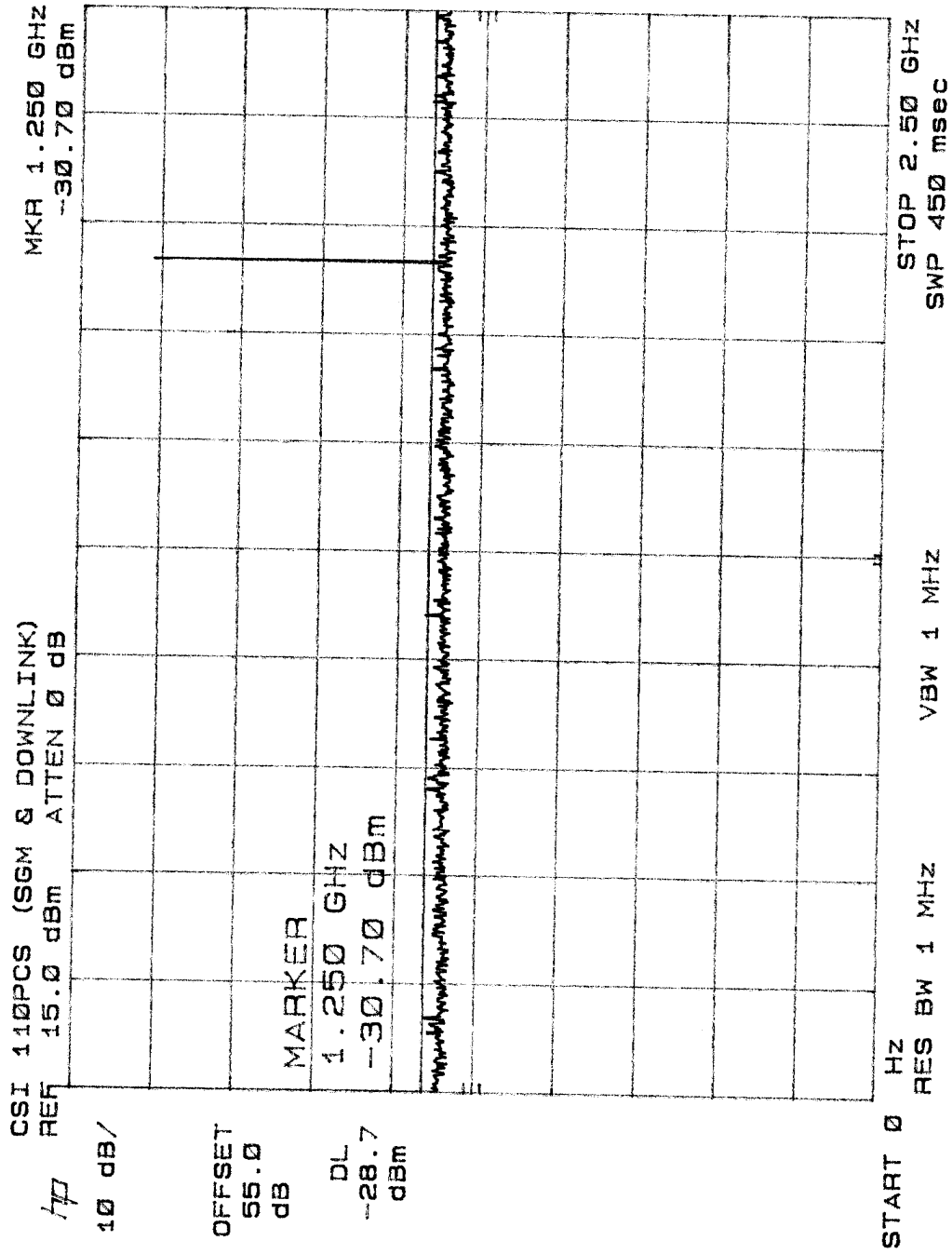


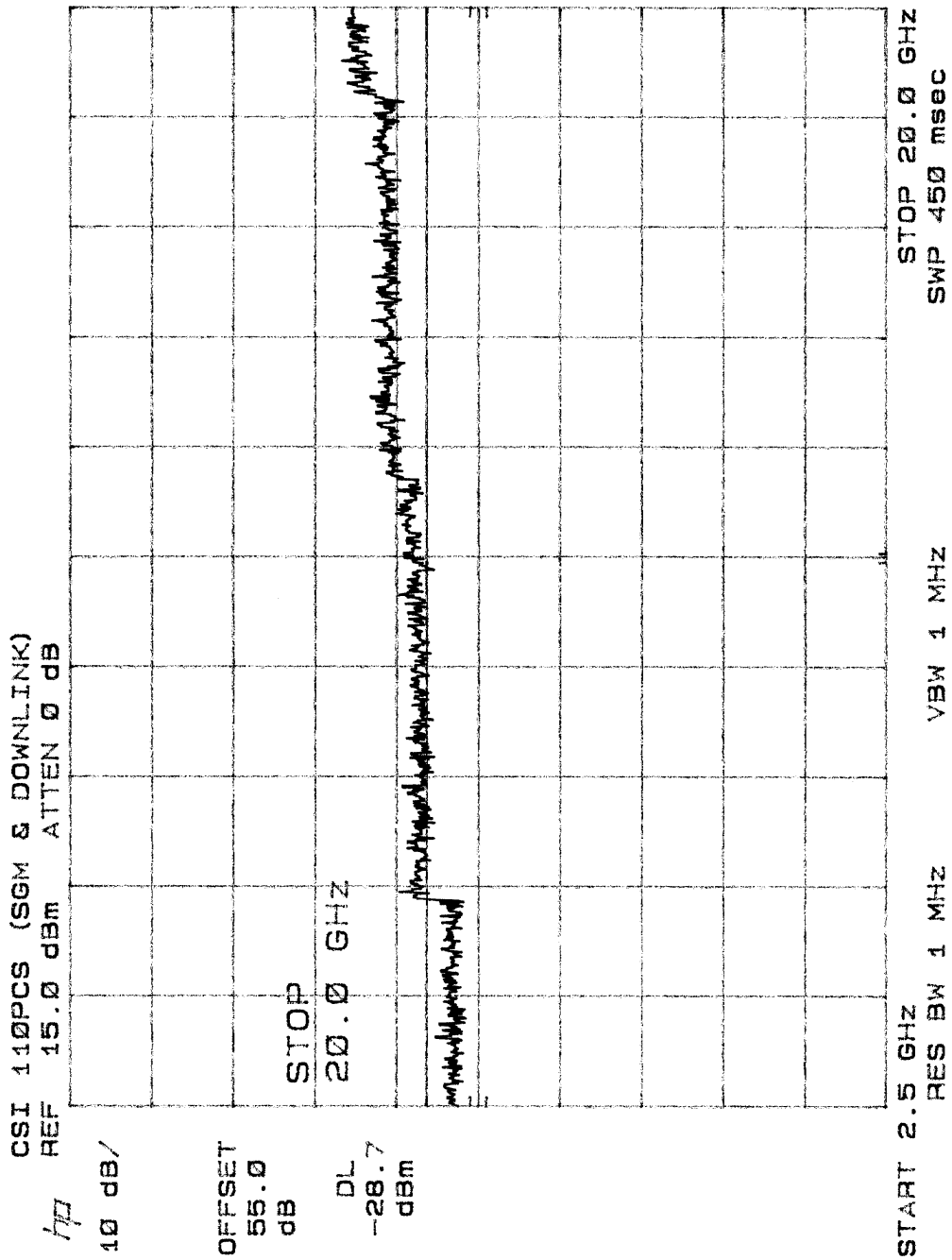


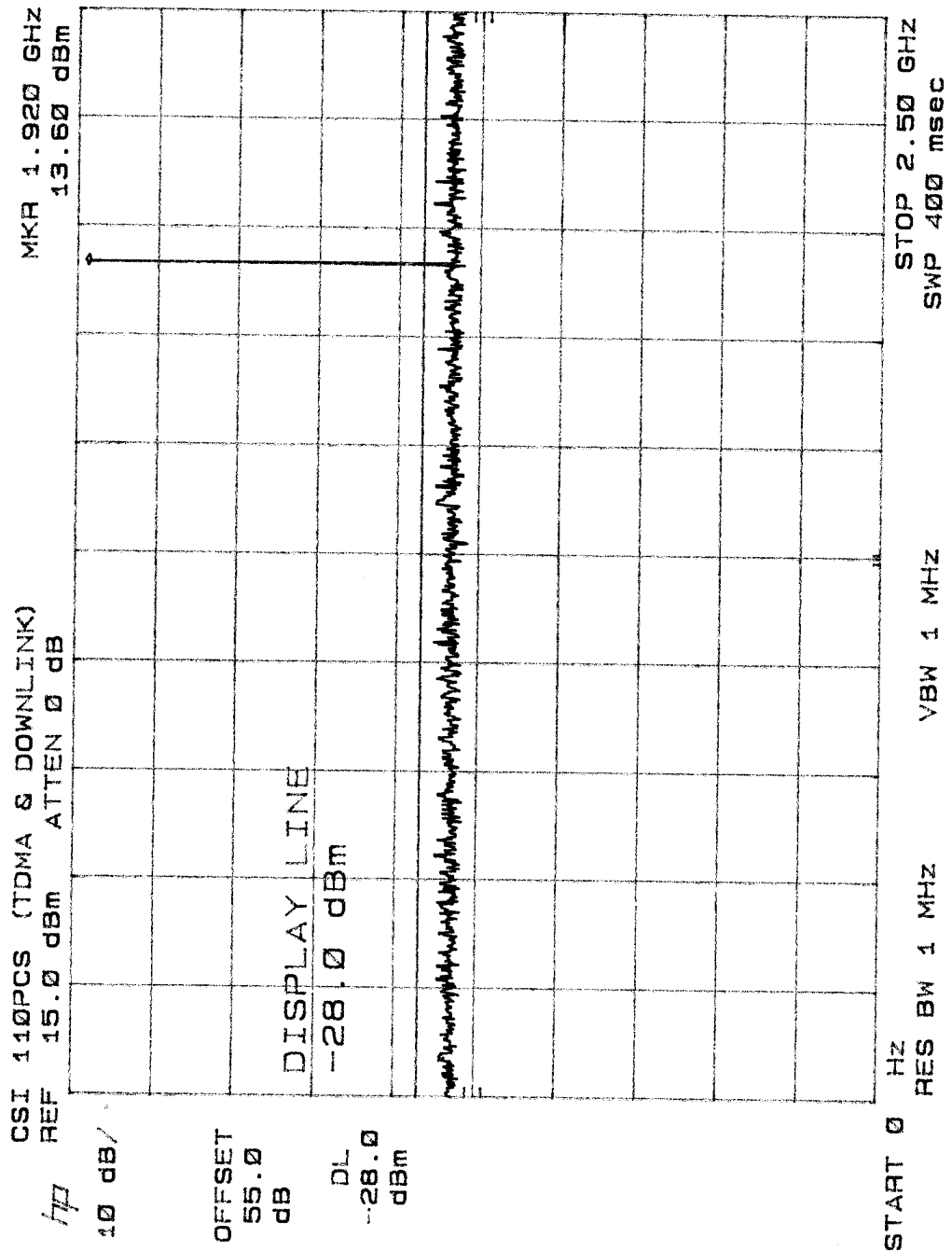


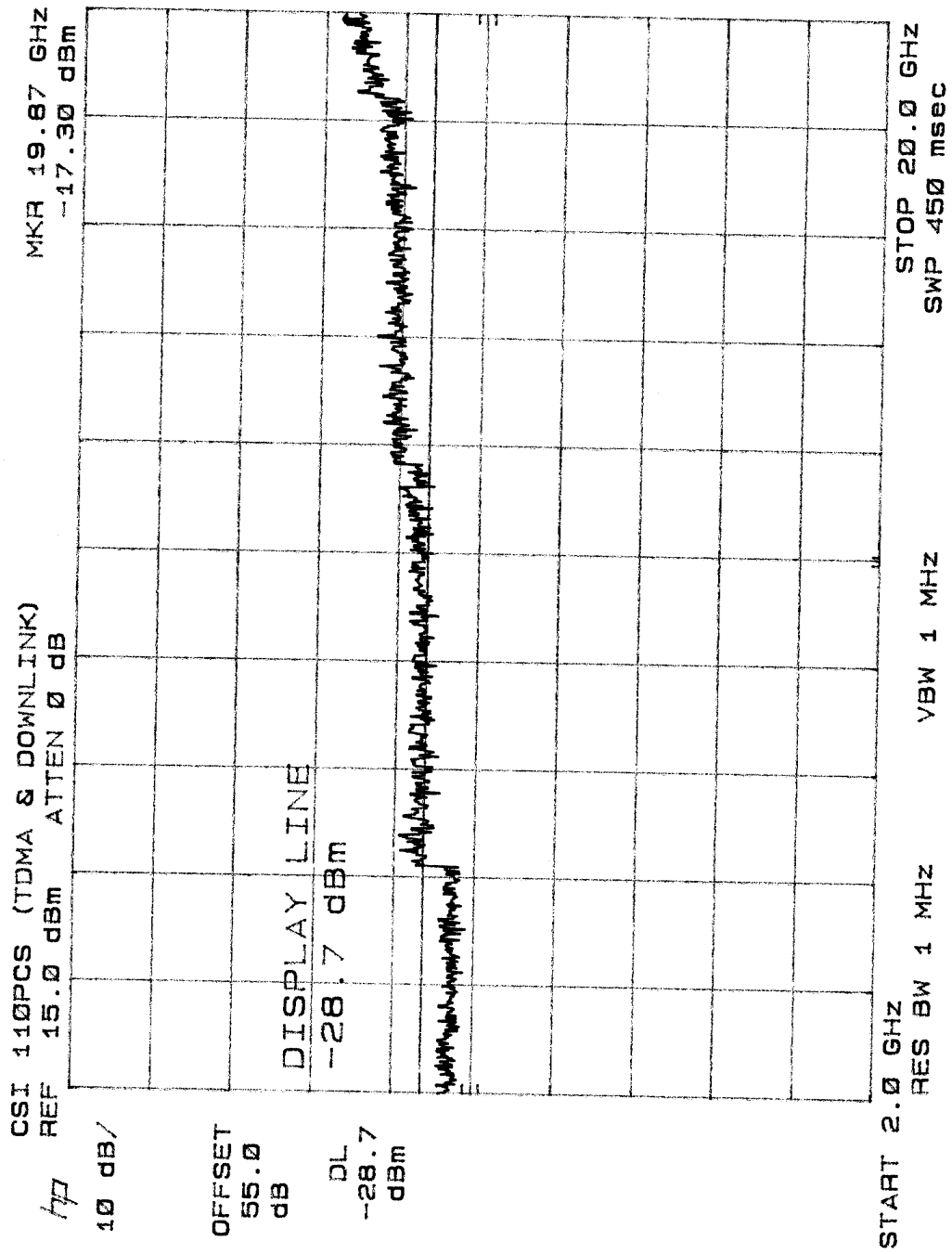












3.5.0 Out of Band Emissions at Antenna Terminals (Two-Tone Test)

Requirements : IS-138A (3.4.4):

Intermodulation products must be attenuated below the rated power of the EUT by at least $43 + 10\log(P)$, or 60 dB, whichever is lesser attenuation. Equivalent to -13 dBm.

3.5.1 Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic. Two input signals are equal in level (and can be raised equally), were send to the EUT.

3.5.2 Test Equipment

HP 8566B Spectrum Analyzer
 HP 7470A Plotter
 Hewlett Packard HP8566B Spectrum Analyzer
 Hewlett Packard HP 7470A Plotter
 Rohde & Schwarz SMIQ03B Signal Generator
 Rohde & Schwarz AMIQ I/Q Modulation Generator

3.5.3 Test Results

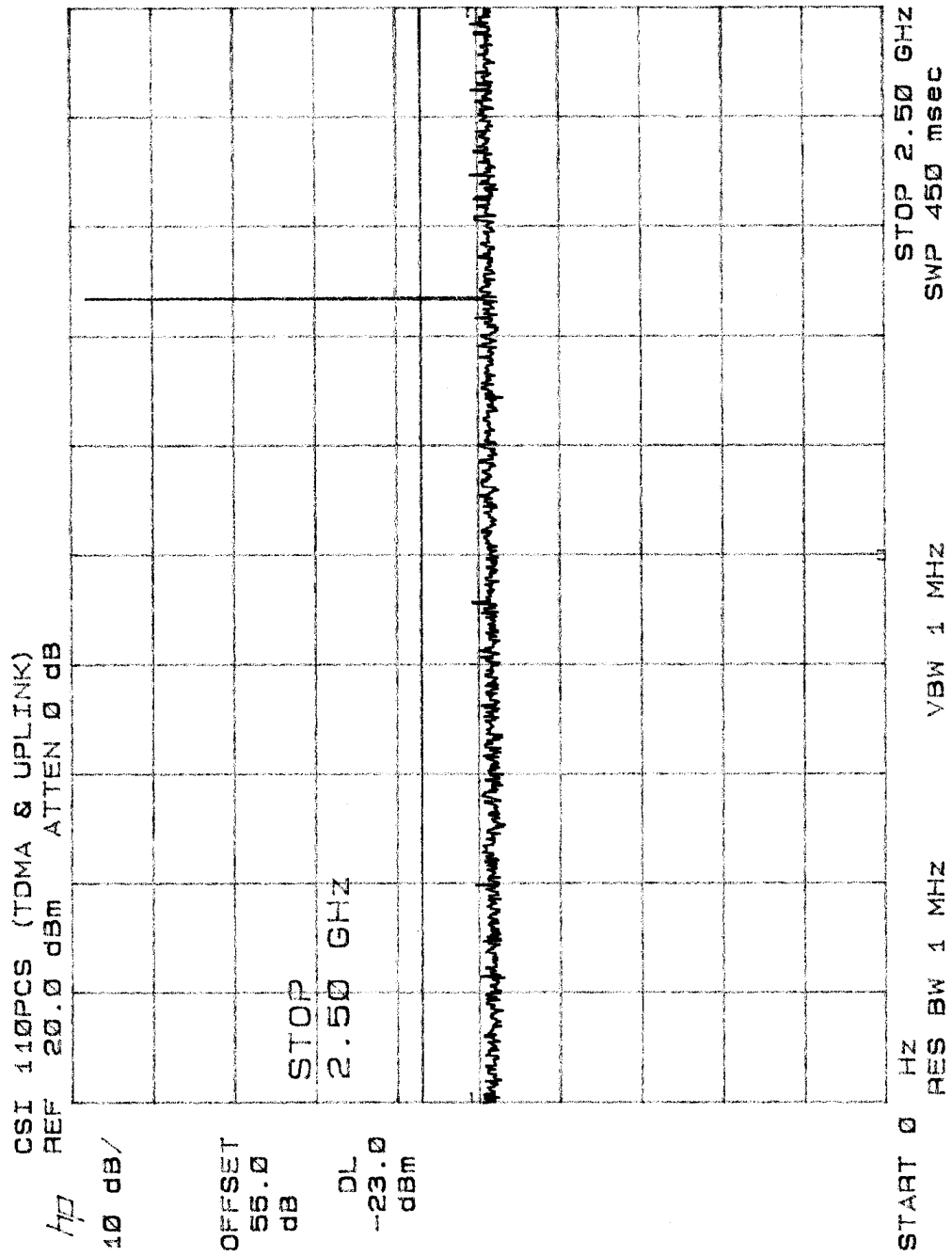
Refer to the attached plots.

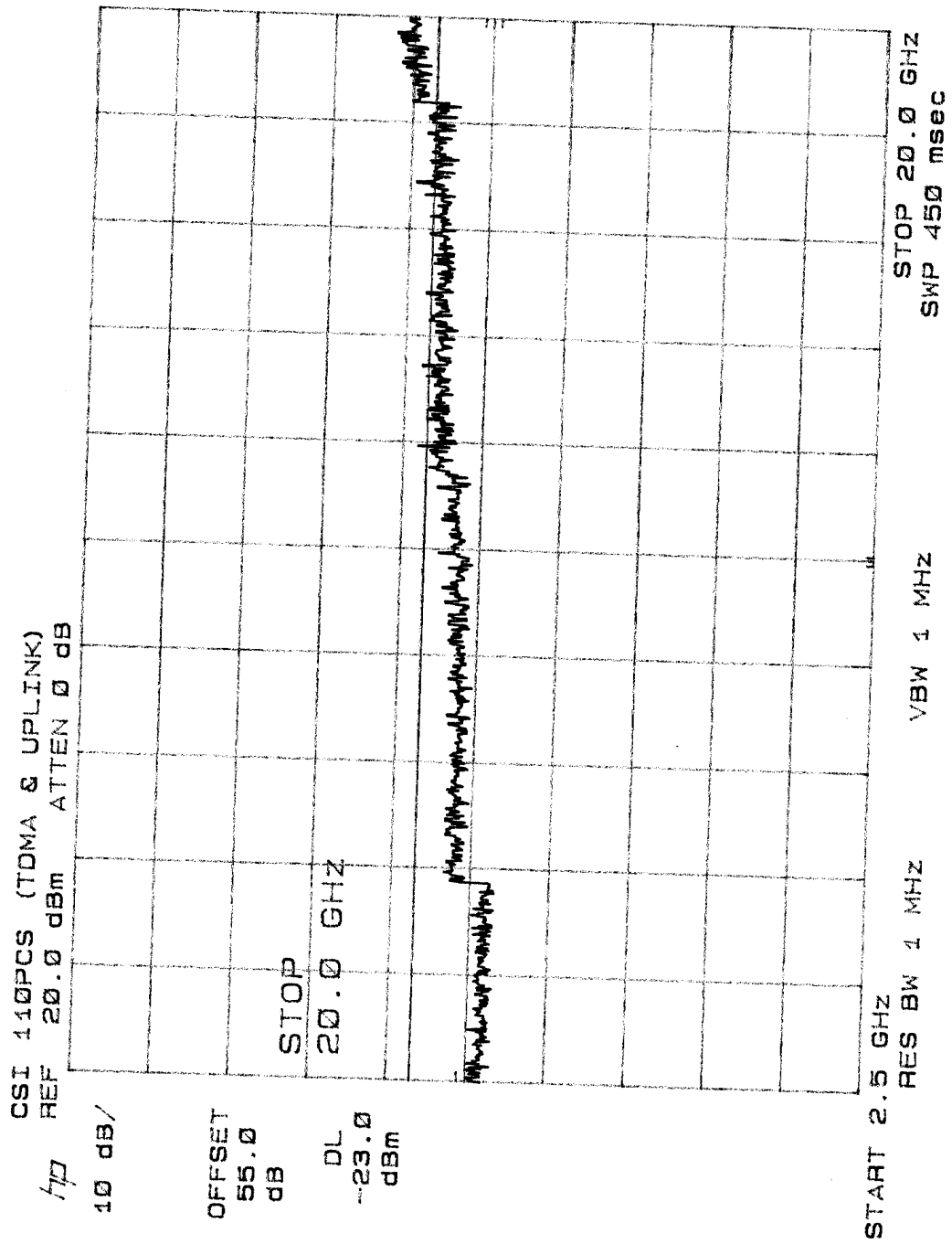
DOWNLINK

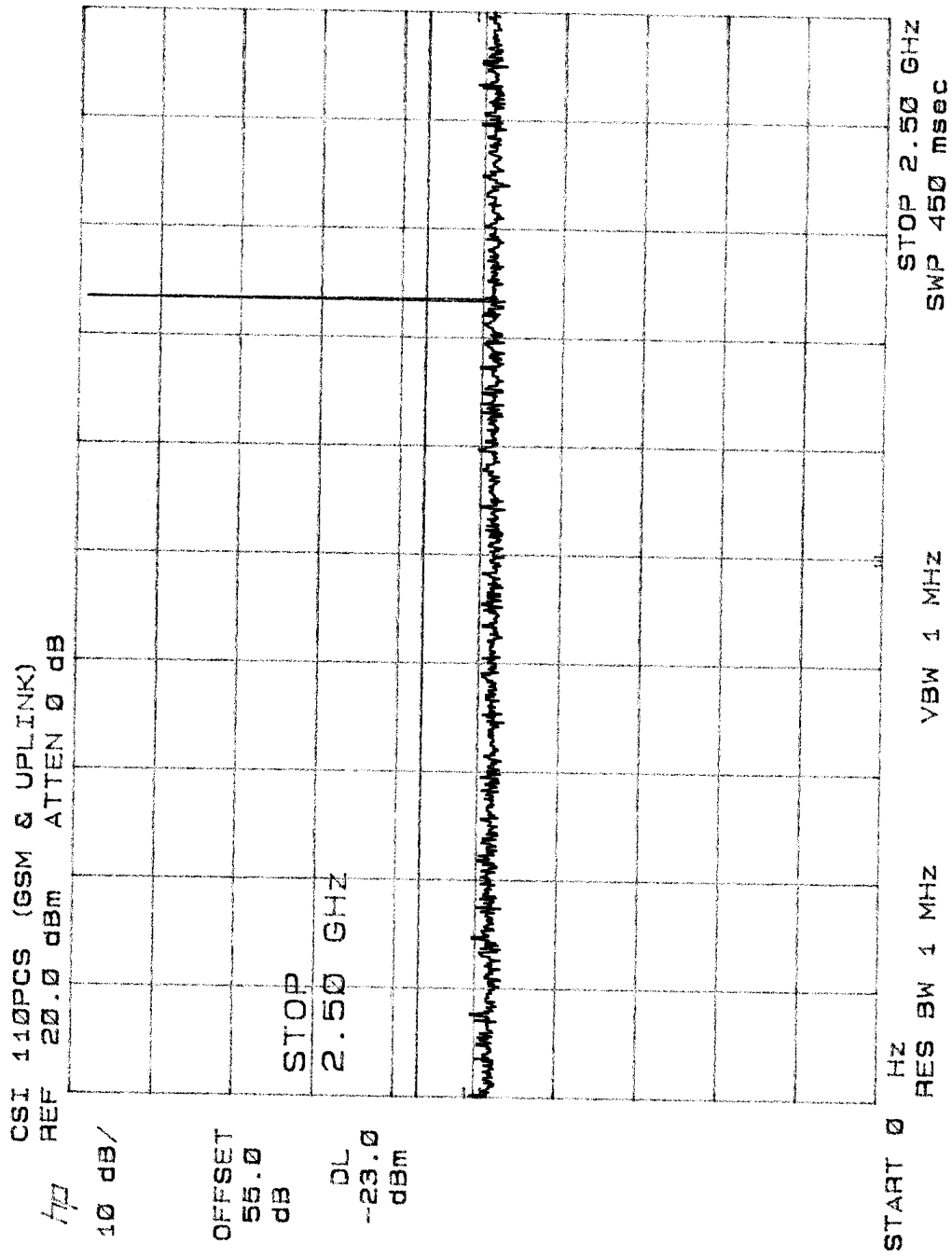
Out of Band Emissions at Antenna Terminals (Two-Tone Test)	
CDMA	Page 88, 89, 94
TDMA	Page 92, 93, 95
GSM	Page 90, 91

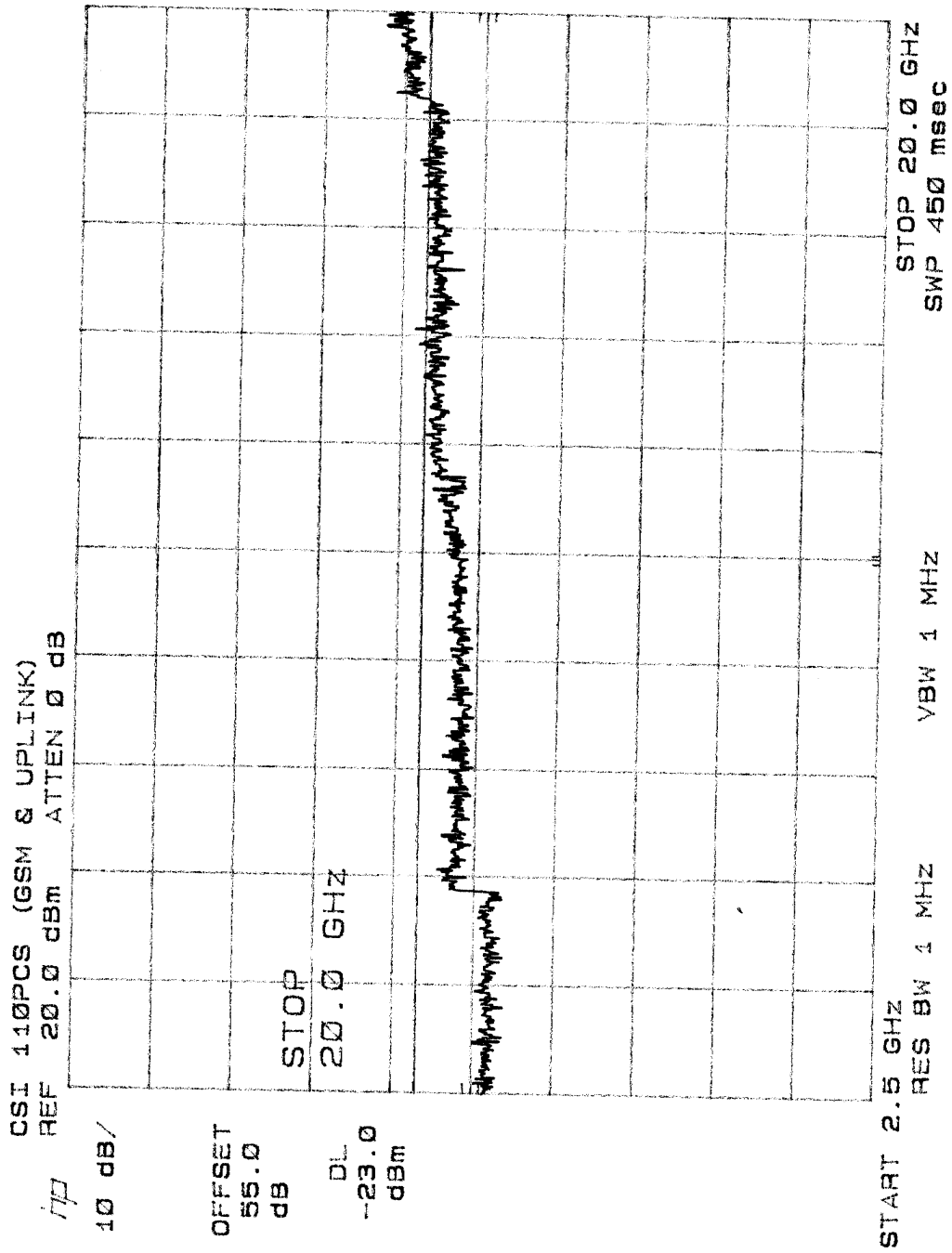
UPLINK

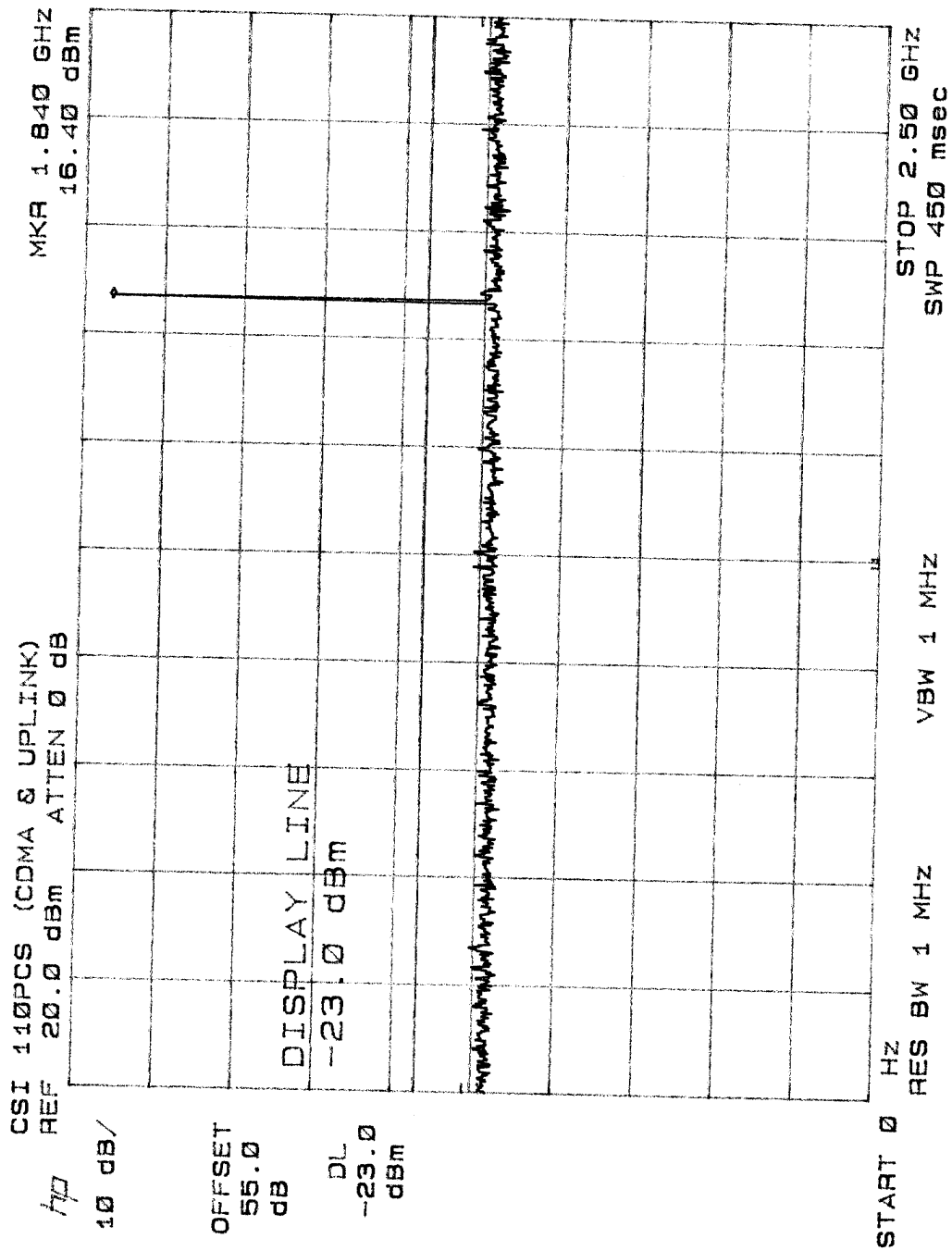
Out of Band Emissions at Antenna Terminals (Two-Tone Test)	
CDMA	Page 86, 87
TDMA	Page 82, 83
GSM	Page 84, 85

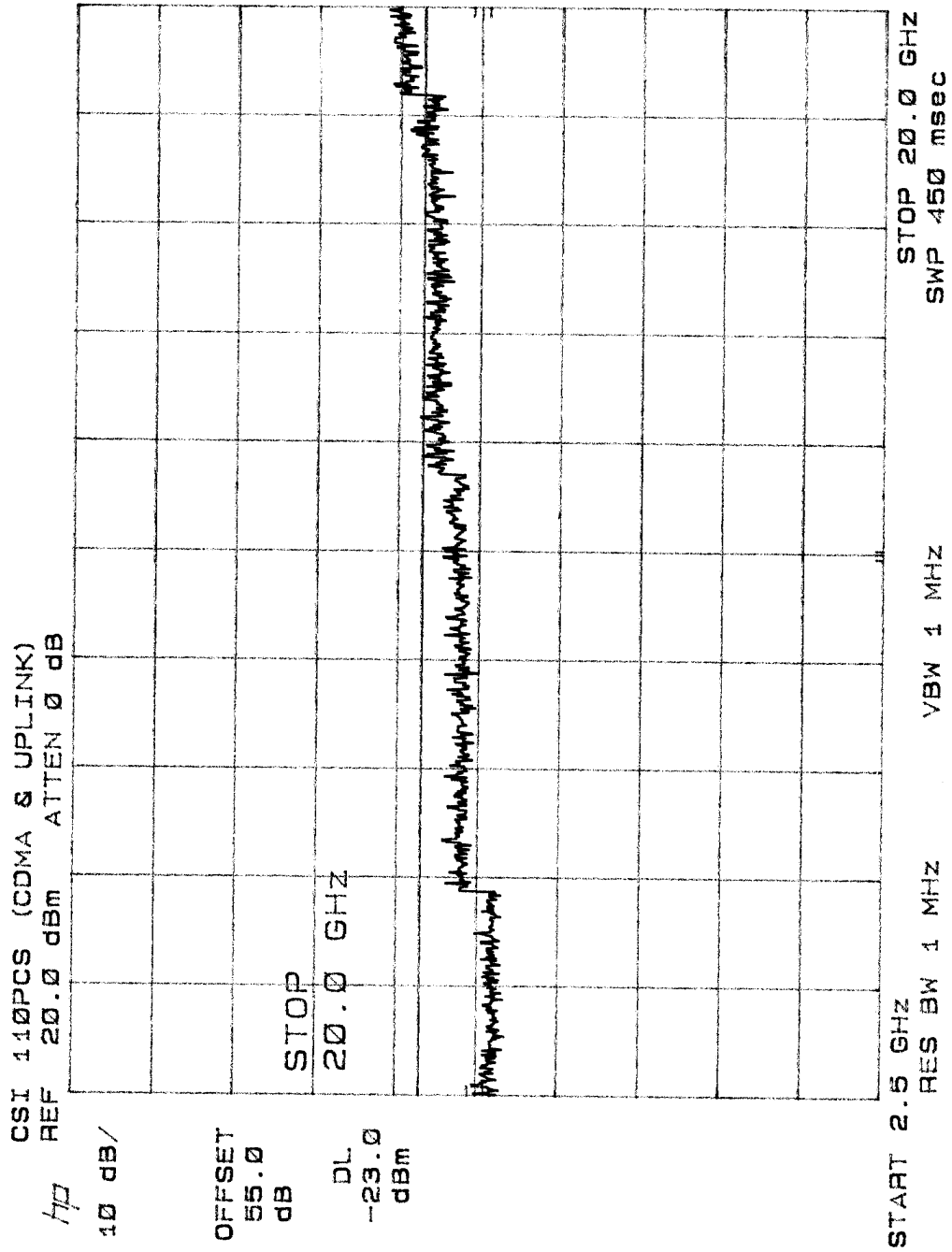


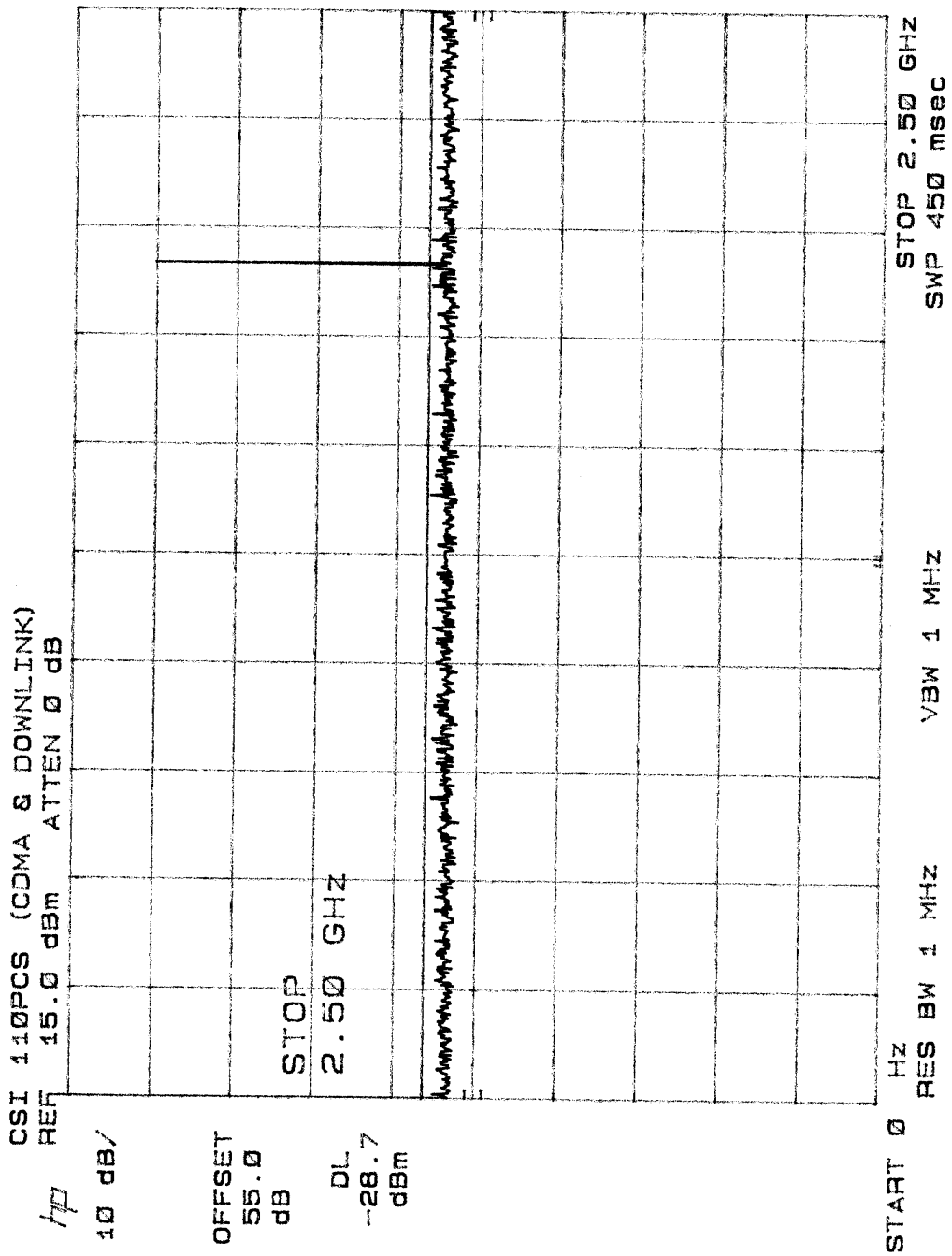


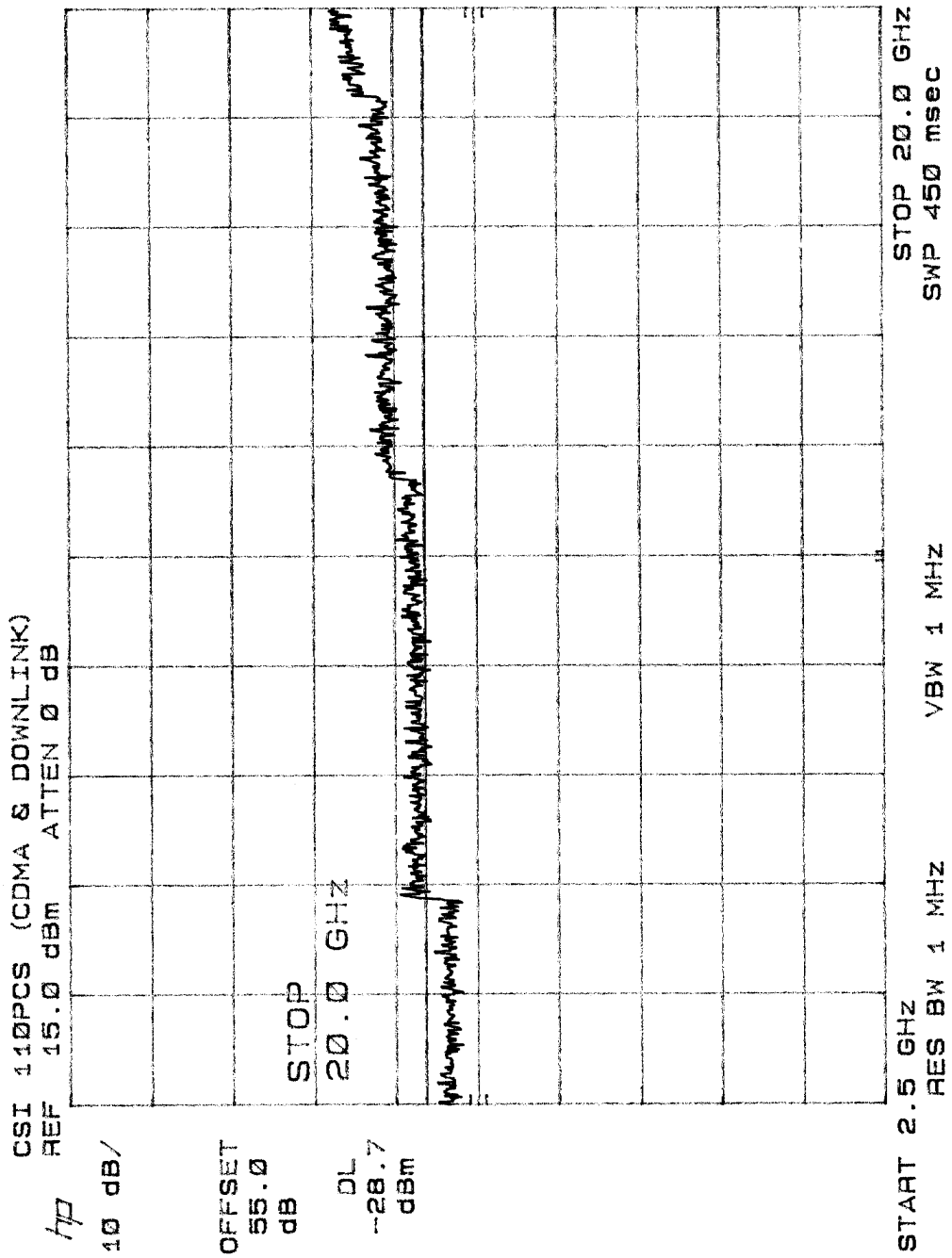


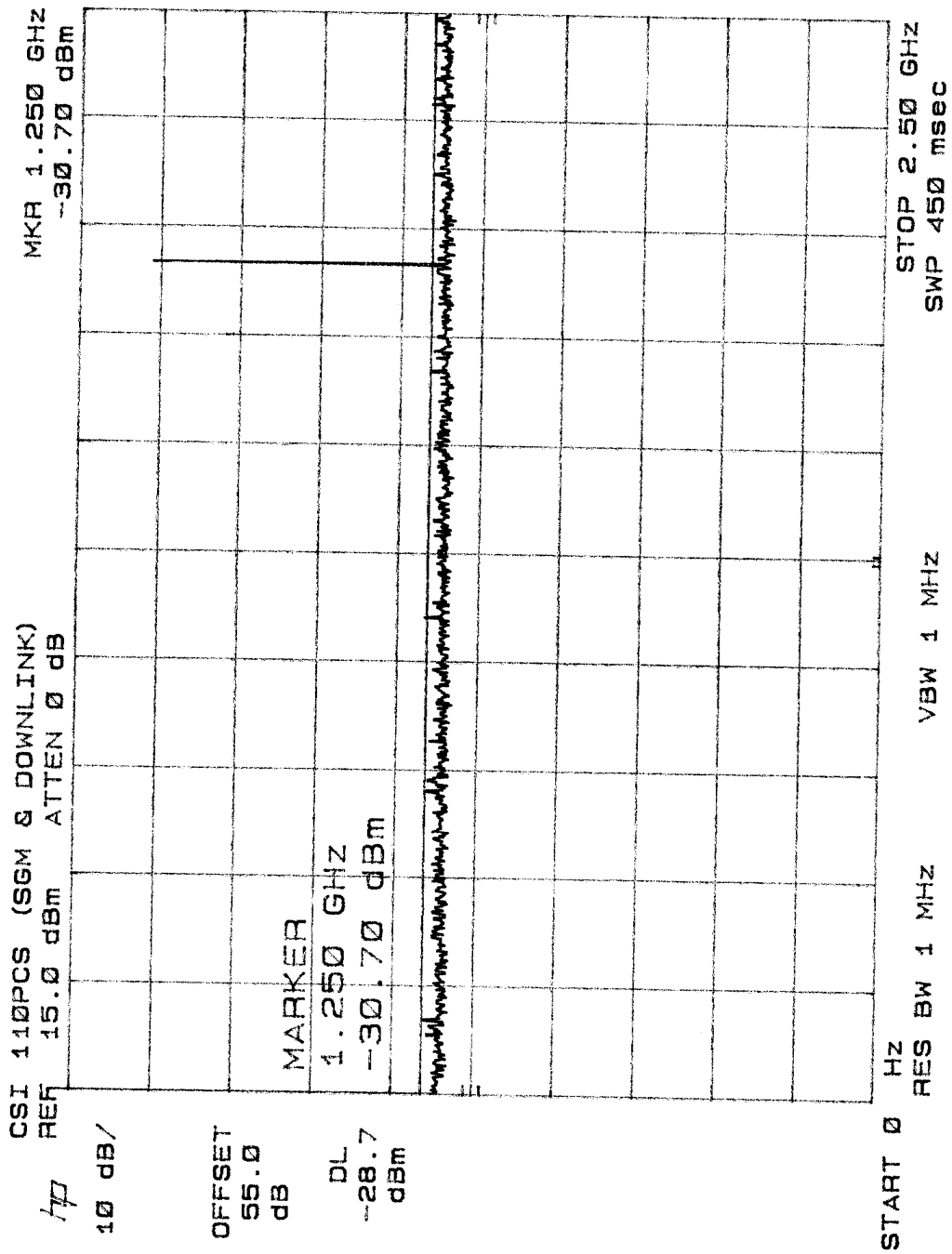


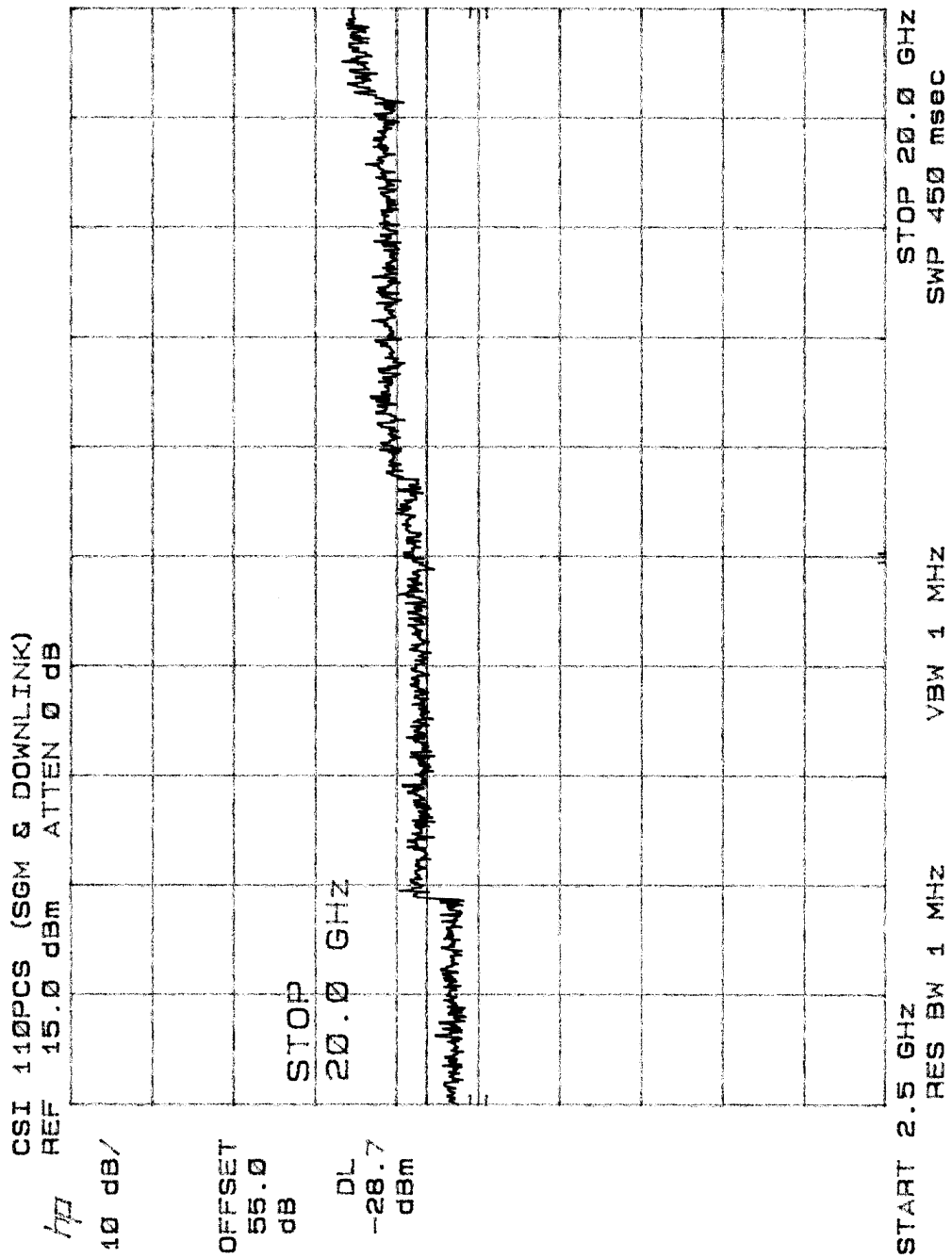


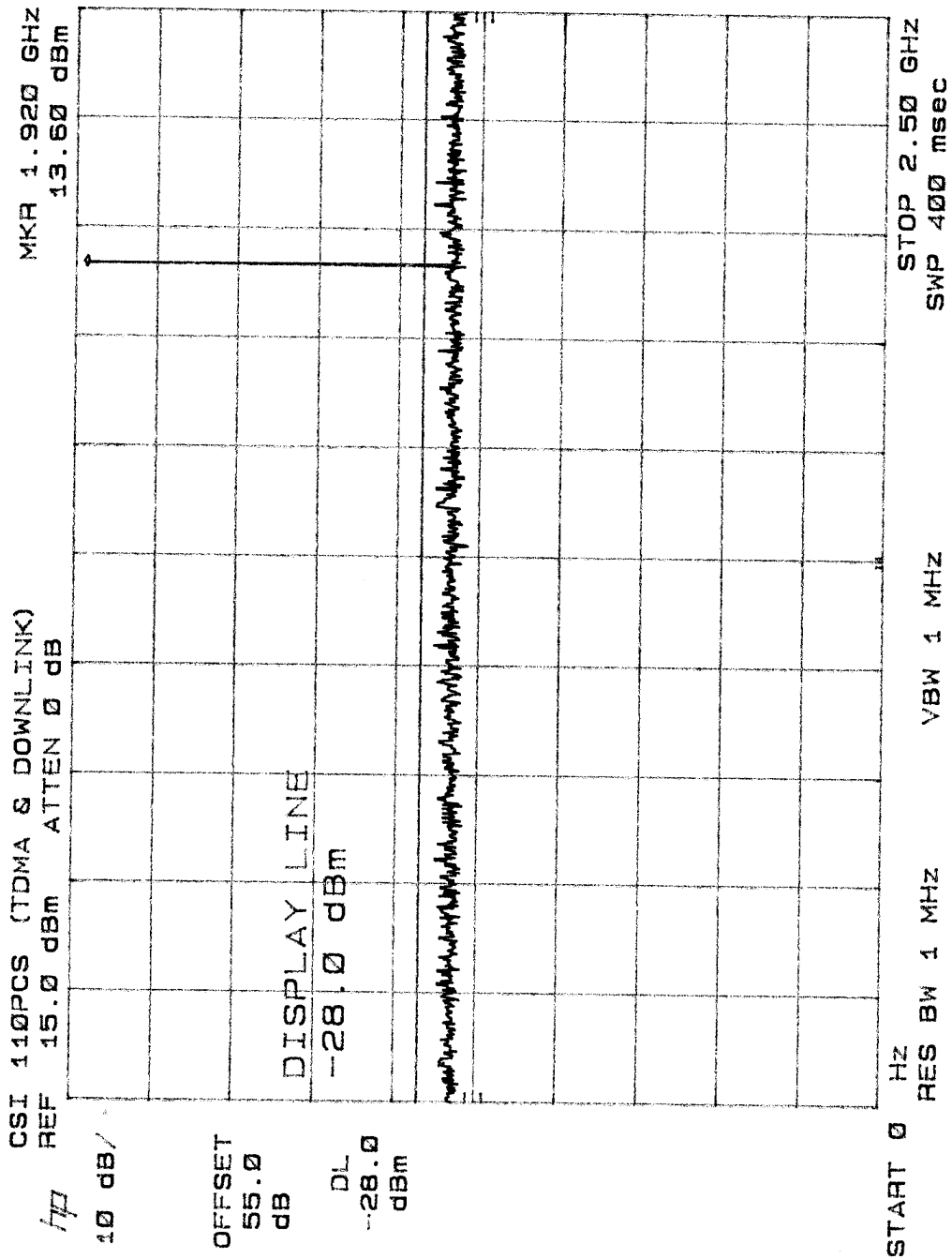


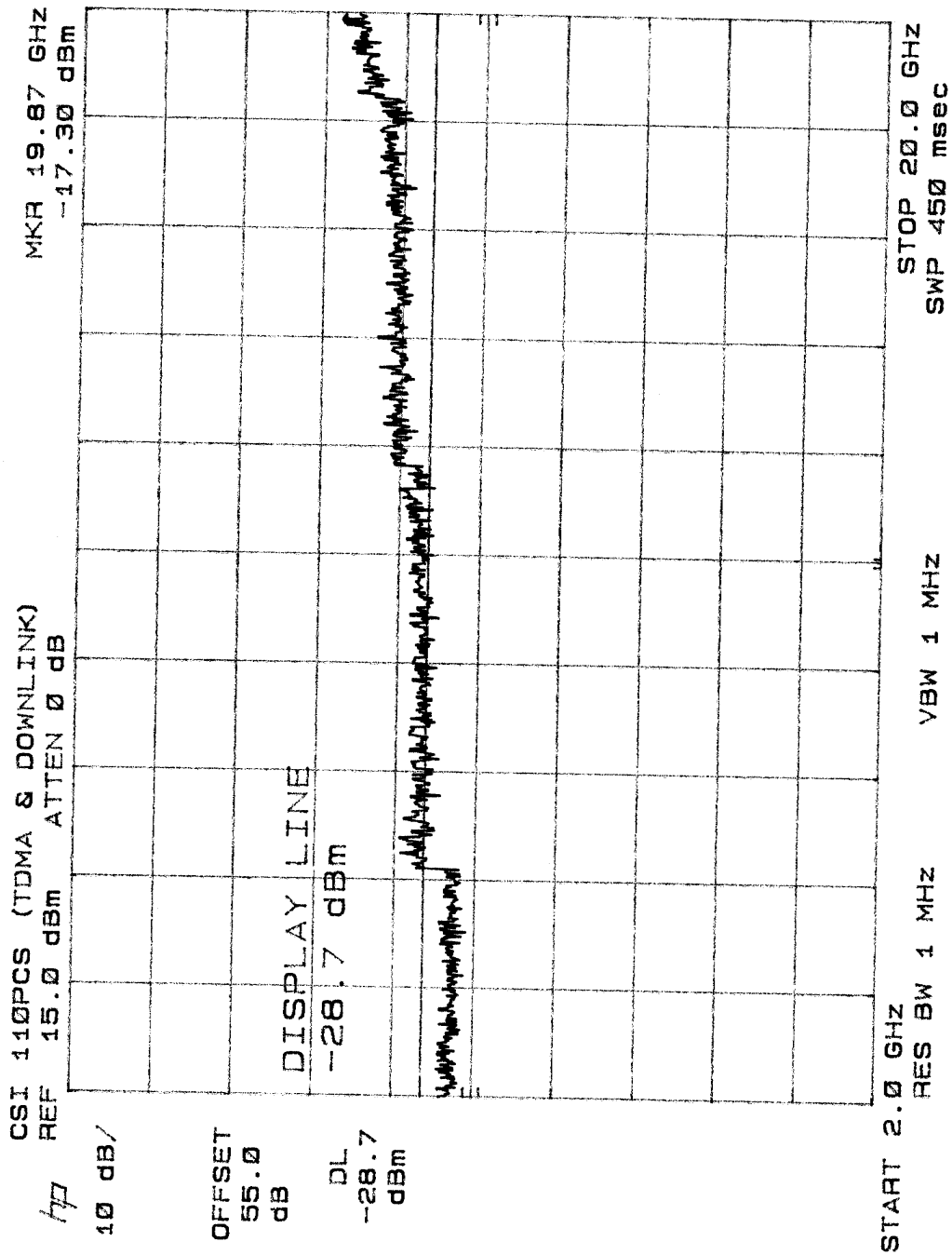


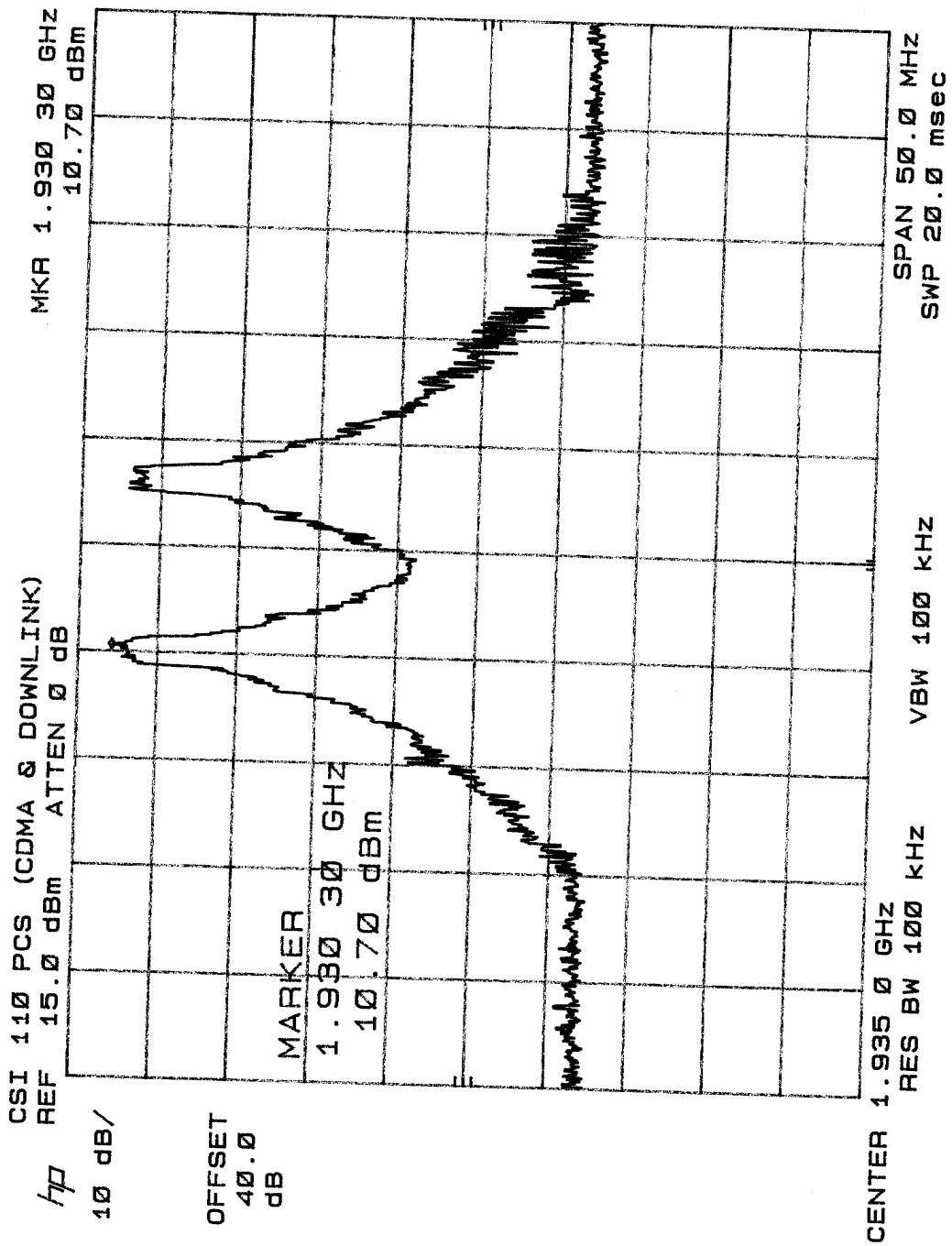


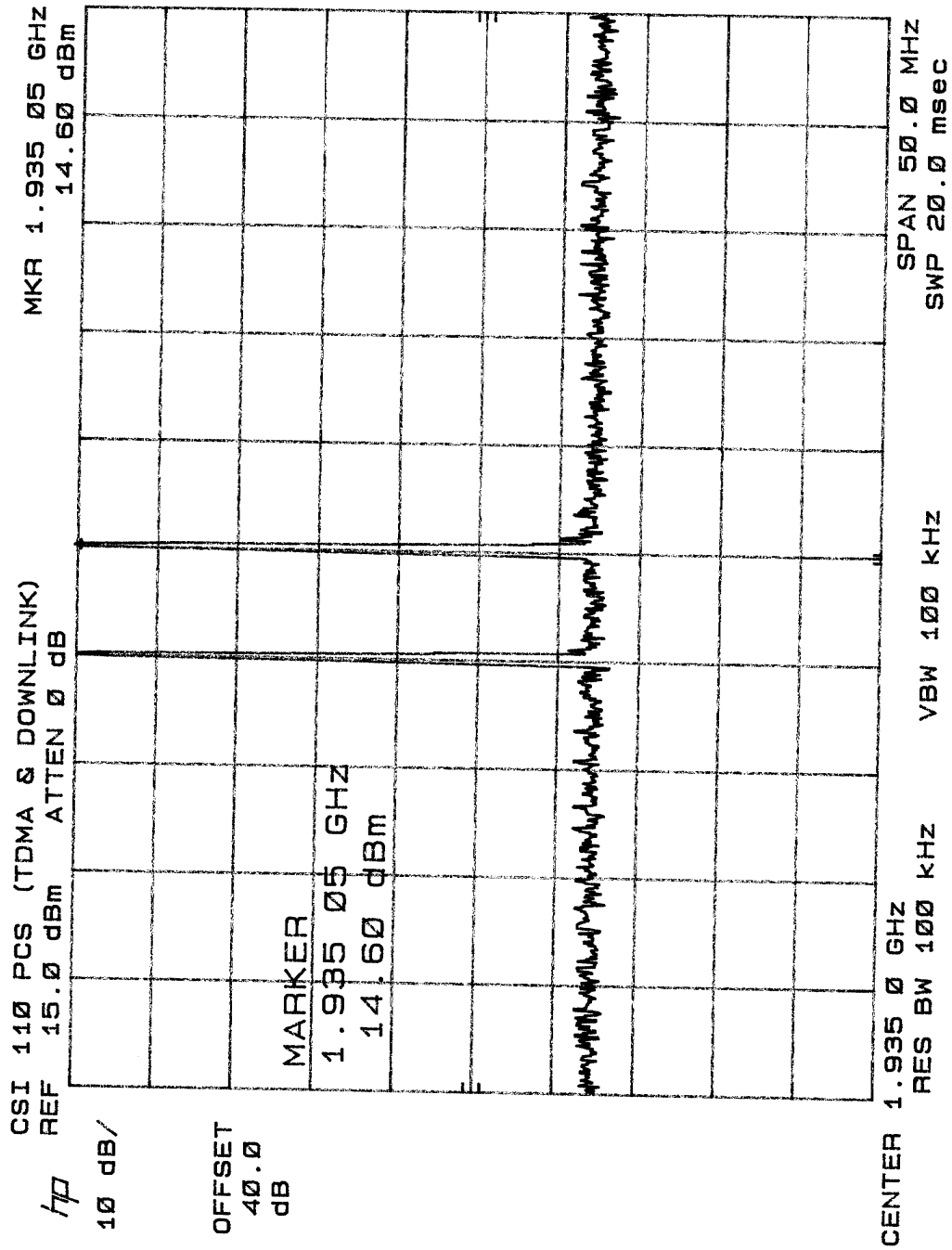












3.6.0 Field Strength of Spurious Radiation (30 MHz- 190000MHz)

Requirements: FCC 2.1053

3.6.1 Test Procedure

The measurement antenna was placed at a distance of 3 meter from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT.

The frequency range up to tenth harmonics of each of the three fundamental frequency (low, middle, and high channels) was investigated.

The spurious emissions attenuation was calculated as the difference between EIRP in dB(pW) at the fundamental frequency and at the spurious emissions frequency.

3.6.2 Test Equipment

A.H. System Horn Antenna

High Pass Filter

Preamplifier

Hewlett Packard HP8566B Spectrum Analyzer

Hewlett Packard HP 7470A Plotter

Rohde & Schwarz SMIQ03B Signal Generator

Rohde & Schwarz AMIQ I/Q Modulation Generator

3.6.3 Test Results

Refer to the attached data sheets.

3.6.3.a Final Scan, EUT was tested at 1850MHz, Uplink.

INDICATED		TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC CLASS B	
Frequency	Ampl.	Angle	Height	Polar	Antenna	Cable	Amp.	Corr. Ampl.	Limit	Margin
MHz	dBμV/m	Degree	Meter	H/ V	dBμV/m	dB	dB	dBμV/m	dBμV/m	dB
1850.0	107.0	180	1.0	V	25.3	2.6	22.0	112.9		
1850.0	114.0	90	1.1	H	25.3	2.6	22.0	119.9		
5550.0	46.0	180	1.0	V	34.1	5.4	15.0	70.5	76.9	-6.4
5550.0	44.0	150	1.0	H	34.1	5.4	15.0	68.5	76.9	-8.4
7400.0	40.0	180	1.1	H	35.1	5.6	15.0	65.7	76.9	-11.2
7400.0	38.2	225	1.0	V	35.1	5.6	15.0	63.9	76.9	-13.0
3700.0	44.0	180	1.0	V	30.3	4.3	15.0	63.6	76.9	-13.3
3700.0	43.0	200	1.1	H	30.3	4.3	15.0	62.6	76.9	-14.3

3.6.3.b Final Scan, EUT was tested at 1865 MHz, Uplink.

INDICATED		TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC CLASS B	
Frequency	Ampl.	Angle	Height	Polar	Antenna	Cable	Amp.	Corr. Ampl.	Limit	Margin
MHz	dBμV/m	Degree	Meter	H/ V	dBμV/m	dB	dB	dBμV/m	dBμV/m	dB
1865.0	101.0	180	2.0	V	25.3	2.6	22.0	106.9		
1865.0	108.5	180	1.0	H	25.3	2.6	22.0	114.4		
7460.0	45.8	180	1.0	V	35.1	5.6	15.0	71.5	78.4	-6.9
5595.0	46.3	180	1.8	V	34.1	5.4	15.0	70.8	78.4	-7.6
7460.0	44.0	225	1.0	H	35.1	5.6	15.0	69.7	78.4	-8.7
5595.0	45.0	90	1.0	H	34.1	5.4	15.0	69.5	78.4	-8.9
3730.0	43.9	90	1.0	V	30.3	4.3	15.0	63.5	78.4	-14.9
3730.0	43.2	180	1.8	H	30.3	4.3	15.0	62.8	78.4	-15.6

3.6.3.c Final Scan, EUT was tested at 1857.5 MHz, Uplink.

INDICATED		TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC CLASS B	
Frequency	Ampl.	Angle	Height	Polar	Antenna	Cable	Amp.	Corr. Ampl.	Limit	Margin
MHz	dB μ V/m	Degree	Meter	H/ V	dB μ V/m	dB	dB	dB μ V/m	dB μ V/m	dB
1857.5	109.0	90	1.0	H	25.3	2.6	22.0	114.9		
1857.5	114.0	200	1.9	V	25.3	2.6	22.0	119.9		
5572.5	44.0	180	1.0	V	34.1	5.4	15.0	68.5	76.9	-8.4
7430.0	41.9	225	1.0	V	35.1	5.6	15.0	67.6	76.9	-9.3
5572.5	43.0	180	1.0	H	34.1	5.4	15.0	67.5	76.9	-9.4
7430.0	41.3	90	1.0	H	35.1	5.6	15.0	67.0	76.9	-9.9
3715.0	44.6	180	1.0	V	30.3	4.3	15.0	64.2	76.9	-12.7
3715.0	43.0	180	1.0	H	30.3	4.3	15.0	62.6	76.9	-14.3

3.6.3.d Final Scan, EUT was tested at 1930 MHz, Downlink.

INDICATED		TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC CLASS B	
Frequency	Ampl.	Angle	Height	Polar	Antenna	Cable	Amp.	Corr. Ampl.	Limit	Margin
MHz	dB μ V/m	Degree	Meter	H/ V	dB μ V/m	dB	dB	dB μ V/m	dB μ V/m	dB
1930.0	101.0	90	1.1	H	25.3	2.6	22.0	106.9		
1930.0	115.0	90	1.0	V	25.3	2.6	22.0	120.9		
7720.0	45.0	180	1.0	H	35.1	5.6	15.0	70.7	77.9	-7.2
7720.0	44.0	180	1.0	V	35.1	5.6	15.0	69.7	77.9	-8.2
5790.0	44.3	125	1.5	H	34.1	5.4	15.0	68.8	77.9	-9.1
5790.0	43.0	160	1.4	V	34.1	5.4	15.0	67.5	77.9	-10.4
3860.0	46.0	180	1.0	V	30.3	4.3	15.0	65.6	77.9	-12.3
3860.0	45.0	180	1.0	H	30.3	4.3	15.0	64.6	77.9	-13.3

3.6.3.e Final Scan, EUT was tested at 1945 MHz, Downlink.

INDICATED		TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC CLASS B	
Frequency	Ampl.	Angle	Height	Polar	Antenna	Cable	Amp.	Corr. Ampl.	Limit	Margin
MHz	dB μ V/m	Degree	Meter	H/ V	dB μ V/m	dB	dB	dB μ V/m	dB μ V/m	dB
1945.0	108.0	120	1.0	H	25.3	2.6	22.0	113.9		
1945.0	115.0	90	1.0	V	25.3	2.6	22.0	120.9		
7780.0	43.9	225	1.0	H	35.1	5.6	15.0	69.6	77.9	-8.3
5835.0	45.0	160	1.0	V	34.1	5.4	15.0	69.5	77.9	-8.4
5835.0	44.9	180	1.1	H	34.1	5.4	15.0	69.4	77.9	-8.5
7780.0	41.2	180	v	V	35.1	5.6	15.0	66.9	77.9	-11.0
3890.0	46.9	180	1.0	H	30.3	4.3	15.0	66.5	77.9	-11.4
3890.0	46.0	170	1.0	V	30.3	4.3	15.0	65.6	77.9	-12.3

3.6.3.f Final Scan, EUT was tested at 1837.5 MHz, Downlink.

INDICATED		TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC CLASS B	
Frequency	Ampl.	Angle	Height	Polar	Antenna	Cable	Amp.	Corr. Ampl.	Limit	Margin
MHz	dB μ V/m	Degree	Meter	H/ V	dB μ V/m	dB	dB	dB μ V/m	dB μ V/m	dB
1937.5	106.8	90	1.0	H	25.3	2.6	22.0	112.7		
1937.5	115.0	125	1.0	V	25.3	2.6	22.0	120.9		
5812.5	45.2	180	1.0	V	34.1	5.4	15.0	69.7	77.9	-8.2
5812.5	45.0	150	1.1	H	34.1	5.4	15.0	69.5	77.9	-8.4
7750.00	43.0	180	1.0	H	35.1	5.6	15.0	68.7	77.9	-9.2
7750.00	42.1	180	1.0	V	35.1	5.6	15.0	67.8	77.9	-10.1
3875.0	46.3	170	1.0	H	30.3	4.3	15.0	65.9	77.9	-12.0
3875.0	45.5	225	1.2	V	30.3	4.3	15.0	65.1	77.9	-12.8

3.7.0 Frequency Stability vs Temperature

Requirements: FCC 2.1055

3.7.1 Test Procedure

The equipment under test was connected to an external DC power supply and the RF output was connected to a frequency counter via feed-through attenuators. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the counter.

3.7.2 Test Equipment

Temperature Chamber -50° to $+100^{\circ}\text{C}$
Hewlett Packard 5383A Frequency Counter
Goldstar DC Power Supply, GR303
Rohde & Schwarz ESVP Test Receiver

3.7.3 Test Results

N/A

3.8.0 Frequency Stability vs Voltage

Requirements: FCC 2.1055

Frequency Tolerance: ± 2.5 ppm

3.8.1 Test Procedure

An external variable DC power supply was connected to the battery terminals of the equipment under test. The voltage was set to 115% of the nominal value and was then decreased until the transmitter light no longer illuminated; i.e., the battery end point. The output frequency was recorded for each battery voltage.

3.8.2 Test Equipment

Hewlett Packard 5883A Frequency Counter
DC Power Supply
Goldstar Rohde & Schwarz ESVPGR303 Test Receiver

3.8.3 Test Results

N/A

4 - CONDUCTED EMISSIONS TEST DATA

4.1 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, and LISN.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement at BAEL is ± 2.4 dB.

4.2 EUT Setup

The measurement was performed at the **Open Area Test Site**, using the same setup per ANSI C63.4 - 1992 measurement procedure. The specification used was with FCC Class B limits.

4.3 Spectrum Analyzer Setup

The spectrum analyzer was set with the following configurations during the conduction test:

Start Frequency	450 kHz
Stop Frequency	30 MHz
Sweep Speed	Auto
IF Bandwidth	100 kHz
Video Bandwidth	100 kHz
Quasi-Peak Adapter Bandwidth.....	9 kHz
Quasi-Peak Adapter Mode.....	Normal

4.4 Test Procedure

During the conducted emission test, the power cord of the host system was connected to the auxiliary outlet of the first LISN.

Maximizing procedure was performed on the six (6) highest emissions of each modes tested to ensure EUT is compliant with all installation combination.

All data was recorded in the peak detection mode. Quasi-peak readings were only performed when an emission was found to be marginal (less than -4 dB μ V). Quasi-peak readings are distinguished with a "Qp".

4.5 Summary of Test Results

According to the data in section 3.6, the EUT complied with the FCC Conducted margin for a Class B device and these test results is deemed satisfactory evidence of compliance with ICES-003 of the Canadian Interference-Causing Equipment Regulations, with the *worst* margin reading of:

-3.8 dB μ V at 0.450 MHz in the Neutral mode power supply.

4.6 Conducted Emissions Test Data

4.6.1 Test Data with SPI Power Supply, 0.45 - 30 MHz.

LINE CONDUCTED EMISSIONS				FCC CLASS B	
Frequency	Amplitude	Detector	Phase	Limit	Margin
MHz	dB μ V	Qp/Ave/Peak	Line/Neutral	dB μ V	dB
0.450	44.2	QP	Neutral	48	-3.8
0.450	43.1	QP	Line	48	-4.9
5.980	38.2	QP	Neutral	48	-9.8
5.680	37.8	QP	Neutral	48	-10.2
2.400	33.6	QP	Line	48	-14.4
3.790	33.4	QP	Line	48	-14.6

4.7 Plot of Conducted Emissions Test Data

Plot(s) of Conducted Emissions Test Data is presented in the following Appendix of this report as reference.

Appendix A – AGENCY AUTHORIZATION LETTER



Cellular Specialties 670 N. Commercial St. Manchester NH 03101
Ph: 603-626-6677 Fax: 603-626-6042

17 January 2000

FEDERAL COMMUNICATIONS COMMISSIONS
Authorization and Evaluation Division
7435 Oakland Mills Road
Columbia, MD 21046

Subject: Agent Authorization

To whom it may concern:

Cellular Specialties, Inc. hereby authorizes Bay Area Compliance Laboratory Corporation to act on its behalf in all matters relating to application for equipment authorization, including the signing of all documents relating to these matters. All acts carried out by Bay Area Compliance Laboratory Corporation on our behalf shall have the same effect as our own action.

Sincerely,

A handwritten signature in cursive script, appearing to read "Fred Goodrich".

Fred Goodrich, President
Cellular Specialties, Inc.