TEST REPORT

FROM

Ensemble Communications Inc.

Test of the Fiberless™ 2800 Series Outdoor Unit - Base Station (BS) and Customer Premises Equipment (CPE)

To CFR 47 part 101, subpart C (Oct 1998))

Test Report Serial No.: 001-2800-002 Rev C

This report supersedes 001-2800-002 Rev B

Remarks:

Equipment complied with the specification	[√]
Equipment did not comply with the specification	[ ]
Results were within measurement uncertainties	[ ]

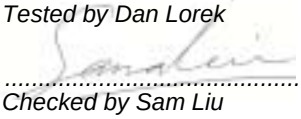
This Test Report is Issued Under the Authority of:

.....

Sam Liu, Director of Hardware Development

.....

Tested by Dan Lorek



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Checked by Sam Liu

Copy No:

Issue date: 11 May 2001

Issue to: Ensemble Communications, Inc.
9890 Towne Centre Drive
San Diego, California 92121

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CONTENTS

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1 Executive Summary

Purpose

The purpose of this test program was to demonstrate compliance of the Ensemble 2800 Series 28 GHz LMDS outdoor unit (ODU) transceiver (Ensemble part number (950-0044-001), 16200 Series Base Station Indoor Unit (BS-IDU), and 320 Series Customer Premises Equipment Indoor Unit (CPE-IDU) against the current FCC technical standards for digital radio relay system authorization requirements. The ODU transceiver demonstrated compliance against the standard "FCC CFR 47, part 101, subpart C (1998-10).

EUT Description

Consisting of four major components - the 16200 Series BS-IDU, 320 Series CPE-IDU, 2800 Series ODU transceiver, and the Fiberless Management System (FMS) - the Ensemble Fiberless™ System represents the highest functionality, the most flexible, and most easily deployable system on the market today.

The 16200 Series Base Station Indoor Unit and 320 Series Customer Premises Equipment Indoor Unit operate with a range of outdoor unit transceivers in the range of 10 to 45 GHz. The configuration tested operates in the 27.50 to 28.35 GHz frequency band. Both the 16200 Series BS-IDU and the 320 Series CPE-IDU are connected to the 2800 Series ODU transceiver by a single RG-6 coaxial cable and can be separated by up to 1000 feet.

The 16200 Series Base Station indoor unit, a 19" or 23" rack mountable, 10U box, features hot swappable cards for easy servicing and growth. It is designed to support up to eighteen 25 MHz carriers with network interfaces ranging from a single DS-3/E3 up to multiple OC-3s/STM-1s. Overall, a single base station rack can terminate up to 1.2 Gbit/s of backhaul network capacity supplied from TDM, IP, or ATM networks.

The 320 series CPE indoor unit is a compact 1.5U high, rackable/stackable box supporting up to 12 service ports. Combining the functionality of a broadband, burst modem and a multiservice access concentrator, the unit is customisable and scalable through deployment of different types of cards in three expansion slots. Interfaces offered include the full range for voice and data connections including T1/E1, 10/100BT, and V.35. Available services include TDM, Frame Relay, Ethernet, Native IP, FXO and FXS. Flexible deployment schemes allow multiple subscribers to be connected to a single CPE indoor unit or multiple CPE indoor units to be connected to a single CPE outdoor unit.

The 2800 Series outdoor unit comes in two form factors, the BS-ODU and the CPE-ODU. The form factors differ to accommodate the different BS and CPE antennas while the internal electronics remain the same. The 2800 Series BS-ODU is an integrated radio and antenna in a single, compact form factor that supports flexible, modular deployments of multiple sectorization schemes ranging from 3 to 90 degrees. Like the BS-ODU, the CPE-ODU is an integrated radio and parabolic antenna in a compact design of approximately 10 inches square.

The Fiberless system uses Ensemble's patented Adaptix technology for the air interface, which comprises an advanced feature set incorporating Adaptive Time Division Duplexing (Adaptive TDD), Adaptive Time Division Multiple Access (Adaptive TDMA) and Adaptive Modulation technologies. The Fiberless system allocates a time slot on demand to a specific customer, upstream or downstream at any modulation scheme at variable bandwidth amounts based on demand or service level agreement resulting in the most efficient air interface in the industry. As a result, Fiberless allows carriers to lead the market with both existing and new services while minimizing deployment and operation costs.

The Fiberless system uses its patented Adaptive TDD to support contiguous, asymmetrical spectrum band allocations. Adaptive TDD supports real-time asymmetry in a single channel to maximize efficiency and reduce capital and operational expenses. This innovative technology flexibly allocates upstream and downstream capacity on demand to ensure efficient use of channel bandwidth. The operational benefits result from no field activity related to changes in asymmetry on a channel, as an FDD system would require.

The Fiberless system uses Adaptive TDMA to allocate bandwidth instantaneously in variable packet sizes for each user's specific need while maintaining quality of service (QoS) on each link. Compared to first generation BWA systems that have a fixed frequency bandwidth allocation for each user, Adaptive TDMA can increase a carrier's revenues by a factor of 4 or more through the over-subscription of facilities while enabling market-leading, differentiated services.

The Fiberless system also uses Adaptive Modulation, which selects QPSK, QAM 16, and QAM 64 automatically on each burst, every one millisecond depending on the distance to the customer, environmental and other RF conditions. By automatically selecting the most efficient modulation scheme possible for each customer transmission, Ensemble's Adaptive Modulation technology maximizes both system range and capacity simultaneously. Maximum range is achieved by using QPSK while maximum capacity is achieved by using QAM 16 and QAM 64 for bursts where link conditions allow.

Results

See AnnexB-Graphical Results.

2 Technical Details

Purpose	To verify the 2800 Transceiver against the specification by means of a type test.
Applicant / Client	Ensemble Communications, Inc. 9890 Towne Centre Drive San Diego, CA 92129
Manufacturer	Ensemble Communications, Inc.
Laboratory performing the tests	Ensemble Communications, Inc. 9890 Towne Centre Drive San Diego, CA 92129
Test report reference number	001-2800-002 Rev C
Standard applied	CFR 47 part 101, subpart C (Oct 1998))
Dates of test (from - to)	March 5 - March 23, 2001
No of Units:	two
Equipment Category:	Microwave Fixed Link
Trade Name:	Fiberless 16200 / Fiberless 320
Type No:	Remec)
Technical Variants:	Base Station (BS) / CPE
ITU Emission Code(s):	25 M0D7W

UNIT NO 1

Type of Unit:	Non-protected Outdoor Unit (NP ODU)
Power Characteristics:	Nominal Output Power +30 dBm
Modulation:	4FSK
Transceiver Frequency Range:	27.515 GHz to 28.335 GHz Tx
Filter Frequency Range:	28 MHz
Temperature Range:	-33 to +55 degrees C

UNIT NO 2

Type of Unit:	Non-protected Outdoor Unit (NP ODU)
Power Characteristics:	Nominal Output Power +30 dBm
Modulation:	4FSK
Transceiver Frequency Range:	27.515 GHz to 28.335 GHz Tx
Filter Frequency Range:	28 MHz
Temperature Range:	-33 to +55 degrees C

UNIT NO 3

Type of Unit:	Non-Protected Indoor Baseband Unit (IDU)
Voltage Range:	Nominal 48 V DC, either polarity. , Extremes 19.2 to 57.6 V DC, either polarity.
Temperature Range:	-20 to +55 degrees C

UNIT NO 4

Type of Unit:	Non-Protected Indoor Baseband Unit (IDU)
Voltage Range:	Nominal 48 V DC, either polarity. , Extremes 19.2 to 57.6 V DC, either polarity.
Temperature Range:	-20 to +55 degrees C

3 Tests Required

Parameter	# Tests Performed	Variant(s) Used
Transmitter characteristics		
RF power output	18	QPSK, 16-QAM, 64-QAM
Modulation characteristics	30	QPSK, 16-QAM, 64-QAM
Occupied bandwidth	18	QPSK, 16-QAM, 64-QAM
Spurious emissions at antenna terminals	15	QPSK, 16-QAM, 64-QAM
Field strength of spurious radiation note 1	0 note 1	none note 1
Frequency stability	72	QPSK, 16-QAM, 64-QAM

Notes:

1. *Field strength of spurious radiation is not found in part 101 of the FCC rules, hence it is not reported here. However, manufacturers of part 101 equipment are encouraged to meet part 15 of the FCC rules with respect to field strength of spurious radiation.*

4 Measurements, Examinations and Derived Results

4.1 General observations

Equipment serial number(s)

Module:	Serial number:
16200 BS indoor unit (IDU) – MIC BOARD	302800260002
16200 BS outdoor unit (ODU)	A03401010093
320 CPE indoor unit (IDU)	113101120017
320 CPE outdoor unit (ODU)	A0002901080003

Additional notes:

1. This report contains the test results only. Details of the test methods used have been recorded and are kept on file by the laboratory. Wherever possible, the test methods described in specific standards have been used.

4.2 Test Results

4.2.1 Transmitter characteristics

4.2.1.1 RF power output

Ambient temperature: **25.0** °C Relative humidity: **35.0** %

Radio Parameters:

TX frequencies: bottom 27.515 GHz, middle 27.925GHz, top 28.335 GHz OP power: +25 dBm

Results:

TABLE OF OUTPUT POWER RESULTS (BS-ODU)

Test Conditions		Transmitter Power (dBm)								
		Low Channel			Mid Channel			High Channel		
		QPSK	16-QAM	64-QAM	QPSK	16-QAM	64-QAM	QPSK	16-QAM	64-QAM
T nom (**25.0**°C)	V nom (**-48V**)	21.39	18.88	17.78	22.11	19.60	18.50	19.53	17.02	15.92
Maximum output power observed		21.39 dBm			22.11 dBm			19.53 dBm		
Minimum output power observed		17.78 dBm			18.50 dBm			15.92 dBm		
Variation in output power observed		3.61 dB			3.61 dB			3.61 dB		

TABLE OF OUTPUT POWER RESULTS (CPE-ODU)

Test Conditions		Transmitter Power (dBm)								
		Low Channel			Mid Channel			High Channel		
		QPSK	16-QAM	64-QAM	QPSK	16-QAM	64-QAM	QPSK	16-QAM	64-QAM
T nom (**25.0**°C)	V nom (**-48V**)	21.20	18.74	17.66	20.96	18.49	17.41	20.89	18.42	17.34
Maximum output power observed		21.20 dBm			20.96 dBm			20.89 dBm		
Minimum output power observed		17.66 dBm			17.41 dBm			17.34 dBm		
Variation in output power observed		3.54 dB			3.55 dB			3.55 dB		

Specification:

Rated output power: +25 dBm

LIMITS **CLAUSE:** 101.113

Maximum Power (dBm)	+55 dBW EIRP [1]

Note 1: Base station antenna gain: 21 dBi typical. Subscriber antenna gain: 35 dBi typical.

Test Equipment Used:

#	Instrument	Manufacturer	Model #	Serial #	Calibration Date / Due
1	Power Meter	Agilent	E4419B	GB40203178	
2	Power Sensor	Agilent	8487A	3318A04252	09/02/01
3	High Freq. Cables	Megaphase			

4.2.1.2 Modulation characteristics

Ambient temperature: **25.0**°C Relative humidity: **35.0**%

Data Rate: QPSK; 40 4040 Mbit/s, 16-QAM; 80 Mbit/s, 64-QAM; 120 Mbit/s O/P Power: +25 dBm

Results:

SPECTRUM MASK PLOTS (CPE-ODU) LOW FREQUENCY: 27.515 GHZ

Reference to plot in Annex B-Graphical Results		
Test Conditions: T nom (25.0°C) V nom (-48V)		
QPSK	**16 QAM**	**64 QAM**
CPE086	CPE087	CPE088
CPE089	CPE090	CPE091

SPECTRUM MASK PLOTS (CPE-ODU) MID FREQUENCY: 27.925 GHZ

Reference to plot in Annex B-Graphical Results		
Test Conditions: T nom (25.0°C) V nom (-48V)		
QPSK	**16 QAM**	**64 QAM**
CPE092	CPE093	CPE094

SPECTRUM MASK PLOTS (CPE-ODU) HIGH FREQUENCY: 28.335 GHZ

Reference to plot in Annex B-Graphical Results		
Test Conditions: T nom (25.0°C) V nom (-48V)		
QPSK	16 QAM	64 QAM
CPE095	CPE096	CPE097
CPE098	CPE099	CPE100

SPECTRUM MASK PLOTS (BS-ODU) LOW FREQUENCY: 27.515 GHZ

Reference to plot in Annex B-Graphical Results		
Test Conditions: T nom (25.0°C) V nom (-48V)		
QPSK	16 QAM	64 QAM
BS082	BS085	BS086
BS083	BS084	BS087

SPECTRUM MASK PLOTS (BS-ODU) MID FREQUENCY: 27.925 GHZ

Reference to plot in Annex B-Graphical Results		
Test Conditions: T nom (25.0°C) V nom (-48V**)**		
QPSK	16 QAM	64 QAM
BS090	BS089	BS088

SPECTRUM MASK PLOTS (BS-ODU) HIGH FREQUENCY: 28.335 GHZ

Reference to plot in Annex B-Graphical Results		
Test Conditions: T nom (**25.0**°C) V nom (**-48V**)		
QPSK	**16 QAM**	**64 QAM**
BS091	BS092	BS093
BS094	BS095	BS096

Specification:

LIMITS CLAUSE: 101.111

Per CFR 47, Part 101.111 (a)(2)(ii), for operating frequencies above 15 GHz, in any 1 MHz band, the center frequency of which is removed from the assigned frequency by more than 50 percent up to and including 250 percent of the authorized bandwidth, the mean power of emissions must be attenuated below the mean output power of the transmitter as specified by the following equation but in no event less than 11 decibels:

$A = 11 + 0.4(P - 50) + 10 \log_{10} B$. (Attenuation greater than 56 decibels is not required.)

where:

A = Attenuation (in decibels) below the mean output power level.

P = Percent removed from the carrier frequency.

B = Authorized bandwidth in MHz

These masks are calculated at the maximum transmitter output power only.

Test Equipment Used:

#	Instrument	Manufacturer	Model #	Serial #	Calibration Date / Due
1	Power Meter	Agilent	E4419B	GB40203178	
2	Power Sensor	Agilent	8487A	3318A04252	09/02/01
3	Spectrum Analyser	Hewlett Pack	8565E	3711A00682	27/10/00
4	High Freq. Cables	Megaphase			

4.2.1.3 Occupied bandwidth

Ambient temperature: **25.0** °C Relative humidity: **35.0** %

Results:

TABLE OF OCCUPIED BANDWIDTH RESULTS (BS-ODU)

Test Conditions		Transmitter Occupied Bandwidth (MHz)		
		QPSK	16 QAM	64 QAM
T nom (**25.0**°C) V nom (**-48V**)	LB	BS097	BS098	BS099
	MB	BS100	BS101	BS102
	HB	BS103	BS104	BS105
Maximum occupied bandwidth observed (MHz)				
Minimum occupied bandwidth observed (MHz)		22.3	22.3	22.3
Variation in occupied bandwidth observed (MHz)				

TABLE OF OCCUPIED BANDWIDTH RESULTS (CPE-ODU)

Test Conditions		Transmitter Occupied Bandwidth (MHz)		
		QPSK	16 QAM	64 QAM
T nom (**25.0**°C) V nom (**-48V**)	LB	CPE101	CPE102	CPE103
	MB	CPE104	CPE105	CPE106
	HB	CPE107	CPE108	CPE109
Maximum occupied bandwidth observed (MHz)				
Minimum occupied bandwidth observed (MHz)		22.5	22.5	22.3
Variation in occupied bandwidth observed (MHz)				

Specification:

LIMITS CLAUSE: 101.109

Maximum authorized bandwidth	850 MHz

Test Equipment Used:

#	Instrument	Manufacturer	Model #	Serial #	Calibration Date / Due
1	Power Meter	Agilent	E4419B	GB40203178	
2	Power Sensor	Agilent	8487A	3318A04252	09/02/01
3	Spectrum Analyzer	Hewlett Pack	8565E	3711A00682	27/10/00
4	High Freq. Cables	Megaphase			

4.2.1.4 Spurious emissions at antenna terminals

Ambient temperature: **25.0** °C Relative humidity: **35.0**%

Data Rate: 40 Mbit/s Transmission Frequency: 27.925 GHz O/P Power: 25 dBm

Results:

SPURIOUS EMISSION PLOTS (CPE-ODU)

Plot Range Frequency (GHz)	Highest Level Observed (dBm)	Reference to plot in Annex B-Graphical Results
10 kHz-100 kHz	-79.00	CPE020
100 kHz-1.0	-64.67	CPE021
1.0-10.0	-60.17	CPE022
10.0-20.0	-57.67	CPE023
20.0-26.0	-55.83	CPE024
30.0-40.0	-53.33	CPE025
40.0-50.0	-50.83	CPE026
50-60.0	-44.35	CPE027
60-70.0	-44.35	CPE028
70-75.0	-43.35	CPE029
75-85.0	-47.48	CPE030
85-95.0	-48.15	CPE031
95-105.0	-46.98	CPE032
105-110.0	-46.82	CPE033

SPURIOUS EMISSION PLOTS (BS-ODU)

Plot Range Frequency (GHz)	Highest Level Observed (dBm)	Reference to plot in Annex B-Graphical Results
10 kHz-100 kHz	-90.17	BS013
100 kHz-1.0	-66.50	BS014
1.0-10.0	-67.50	BS015
10.0-26.5	-62.67	BS016
26.5-27.513	-73.00	BS017
28.33-30.0	-57.50	BS018
30.0-40.0	-60.17	BS019
40.0-50.57	-60.67	BS020
50-60.0	-44.35	BS021

Plot Range Frequency (GHz)	Highest Level Observed (dBm)	Reference to plot in Annex B-Graphical Results
60-70.0	-44.35	BS022
70-75.0	-43.35	BS023
75-85.0	-47.48	BS024
85-95.0	-48.15	BS025
95-105.0	-46.98	BS026
105-110.0	-46.82	BS027

Specification:

LIMITS CLAUSE: 101.111

Frequency Range	Required attenuation (dB)
10 kHz to 26.5 GHz	-38 dBc @ +25 dBm OP power (-13 dBm[1])
30 GHz to 50 GHz	-38 dBc @ +25 dBm OP power (-13 dBm[1])

*Note 1: In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43+10*log$_{10}$ (mean output power in Watts) decibels, or 80 decibels, whichever is the lesser attenuation.*

Note 2: The lower end of the unwanted emissions measurement was chosen to begin at 8GHz (less than 0.7F_c of the wave guide).

Test Equipment Used:

#	Instrument	Manufacturer	Model #	Serial #	Calibration Date / Due
1	Power Meter	Agilent	E4419B	GB40203178	
2	Power Sensor	Agilent	8487A	3318A04252	09/02/01
3	Spectrum Analyser	Hewlett Pack	8565E	3711A00682	27/10/00
4	Active Mixer	Stratest Labs			
5	Passive Mixer	Stratest Labs			
6	High Freq. Cables	Megaphase			

4.2.1.5 Frequency stability

Ambient temperature: **25.0**°C Relative humidity: **35.0** %

Results:

FREQUENCY ERROR (BS-ODU)

Test Conditions		Frequency Error (GHz)		
Temperature (Celsius)	**Power Supply (Volts)**	**Low Channel 27.515 GHz**	**Mid Channel 27.925 GHz**	**High Channel 28.335 GHz**
70	-48	27.514951	27.924950	28.334949
60	-48	27.514950	27.924949	28.334949
50	-48	27.514950	27.924950	28.334949
40	-48	27.514949	27.924949	28.334948
30	-48	27.514949	27.924948	28.334948
20	-48	27.514949	27.924948	28.334948
20	-40.8	27.514949	27.924948	28.334948
20	-55.2	27.514949	27.924948	28.334948
10	-48	27.514949	27.924948	28.334948
0	-48	27.514949	27.924948	28.334948
-10	-48	27.514949	27.924948	28.334948
-20	-48	27.514949	27.924949	28.334948
-30	-48	27.5149496	27.9249489	28.3349482
-40	-48	27.5149495	27.9249487	28.3349480

Test Conditions		Frequency Error (GHz)		
Temperature (Celsius)	**Power Supply (Volts)**	**Low Channel 27.515 GHz**	**Mid Channel 27.925 GHz**	**High Channel 28.335 GHz**
70	-48	-0.00017808	-0.00017905	-0.00017999
60	-48	-0.00018172	-0.00018263	-0.00017999
50	-48	-0.00018172	-0.00017905	-0.00017999
40	-48	-0.00018535	-0.00018263	-0.00018352
30	-48	-0.00018535	-0.00018621	-0.00018352
20	-48	-0.00018535	-0.00018621	-0.00018352
20	-40.8	-0.00018535	-0.00018621	-0.00018352
20	-55.2	-0.00018535	-0.00018621	-0.00018352
-10	-48	-0.00018535	-0.00018621	-0.00018352
-20	-48	-0.00018535	-0.00018263	-0.00018352
-30	-48	-0.00018317	-0.00018299	-0.00018281
-40	-48	-0.00018354	-0.00018371	-0.00018352

Test Conditions		Frequency Error (GHz)		
Temperature (Celsius)	**Power Supply (Volts)**	**Low Channel 27.515 GHz**	**Mid Channel 27.925 GHz**	**High Channel 28.335 GHz**
Variation in transmitter frequency observed (%)		0.00000545	0.00000466	0.00000353

FREQUENCY ERROR (CPE-ODU)

Test Conditions		Frequency Error (GHz)		
Temperature (Celsius)	**Power Supply (Volts)**	**Low Channel 27.515 GHz**	**Mid Channel 27.925 GHz**	**High Channel 28.335 GHz**
70	110	27.514973	27.924972	28.334972
60	110	27.514973	27.924972	28.334972
50	110	27.514973	27.924973	28.334971
40	110	27.514972	27.924973	28.334971
30	110	27.514972	27.924972	28.334971
20	110	27.514972	27.924972	28.334971
20	93.5	27.514972	27.924972	28.334971
20	126.5	27.514972	27.924972	28.334971
10	110	27.514972	27.924972	28.334971
0	110	27.514972	27.924972	28.334971
-10	110	27.514972	27.924972	28.334971
-20	110	27.514972	97.924972	28.334971
-30	110	27.5149724	27.9249721	28.3349716
-40	110	27.5149724	27.9249720	28.3349716

Test Conditions		Frequency Error (GHz)		
Temperature (Celsius)	**Power Supply (Volts)**	**Low Channel 27.515 GHz**	**Mid Channel 27.925 GHz**	**High Channel 28.335 GHz**
70	110	-0.00009813	-0.00010027	-0.00009882
60	110	-0.00009813	-0.00010027	-0.00009882
50	110	-0.00009813	-0.00009669	-0.00010235
40	110	-0.00010176	-0.00009669	-0.00010235
30	110	-0.00010176	-0.00010027	-0.00010235
20	110	-0.00010176	-0.00010027	-0.00010235
20	93.5	-0.00010176	-0.00010027	-0.00010235
20	126.5	-0.00010176	-0.00010027	-0.00010235
-10	110	-0.00010176	-0.00010027	-0.00010235
-20	110	-0.00010176	-0.00010027	-0.00010235
-30	110	-0.00010031	-0.00009991	-0.00010023

Test Conditions		Frequency Error (GHz)		
Temperature (Celsius)	**Power Supply (Volts)**	**Low Channel 27.515 GHz**	**Mid Channel 27.925 GHz**	**High Channel 28.335 GHz**
-40	110	-0.00010031	-0.00010027	-0.00010023
Variation in transmitter frequency observed (%)		0.00000218	0.00000358	0.00000141

Specification:

LIMITS **CLAUSE:** 101.107 (a)

Maximum frequency error (**%**)	**±0.001**

Test Equipment Used:

#	Instrument	Manufacturer	Model #	Serial #	Calibration Date / Due
1	Spectrum Analyser	Hewlett Packard	8565E	3711A00682	27/10/00
2	Temp Chamber	Bemco	F1001350-8	3673-9	
3	Power Supply	Agilent	6655A	US36391573	07/02/01
4	High Freq. Cables	Megaphase			

4.2.1.6 Automatic Transmit Power Control

Item	Yes	No
Equipment has ATPC:	√	
ATPC is a fixed permanent feature:	√	
ATPC range:	45dB	
ATPC step size:	0.2dB	
Output power tolerance across ATPC range:	±2dB	

4.2.1.7 RF Safety Evaluation

#	Item	Value
1	Maximum TX power	23dBm or 200mW
2	Highest gain CPE antenna	35 dBi
3	Max EIRP	58 dBm or 632 W

The Max EIRP value of 632 W is well below 1640W. Therefore, an RF warning label is not required.

4.2.1.8 Field Strength of Spurious Emissions

As required by 47 CFR 2.1053, *field strength of spurious radiation measurements* was performed. The unit was scanned over the frequency range of 9KHz to 110 GHz.

Spur Field Strength Based on Isotropic Radiation Pattern

P_{spur} =	**-65**	dBm	Worst Case Spur Power @ 100KHz - 1.0 GHz Radiated emission
G_{ant} =	0	dB	Antenna Gain (Assume Isotropic Radiation Pattern)
d =	3	m	Distance
P_{out} =	3.16E-10	W	Spur Power
G_{ant} =	1		Antenna Gain
EIRP =	3.16E-10	W	P_{out} * G_{ant}
S_r =	2.8E-12	W/m^2	Received Power Density = EIRP / ($4\pi r^2$)
E_r =	3.25E-05	V/m	Received Electric Field Strength = (S_r * 120π)^{½}
E_{spur} =	**30.22879**	dBuV/m	Field strength in dBuV/M = 20*log(E_r / 1e-6)

FCC Emission Mask Converted to Received Field Strength

P_{max} =	**-13**	dBm	Max Spur Level (a constant: 30 - 43 = -13)
G_{ant} =	0	dB	Antenna Gain (Assume Isotropic Radiation Pattern)
d =	3	m	Distance
P_{out} =	5.01E-05	W	Spur Power
G_{ant} =	1		Antenna Gain
EIRP =	5.01E-05	W	Pout * Gant
S_r =	4.43E-07	W/m^2	Received Power Density = EIRP / ($4\pi r^2$)
E_r =	0.012925	V/m	Received Electric Field Strength = (S_r * 120π)^{½}
E_{max} =	**82.22879**	dBuV/m	Field strength in dBuV/M = 20*log(E_r / 1e-6)

All of the measurable radiated emissions are related to the digital device portion of the EUT, and thus are compared to the 47CFR 15 Class B field strength limit. Mathematical calculations (shown above) indicate that these field strengths result from radiated power levels that are more than 35 dB below the –13 dBm limit for spurious emissions. There were no observable radiated emissions from the transmitter portion of the EUT.

5 Graphical Results

Graphical Results as referenced in the tables above are contained in Annex B.

6 Test Equipment Used

Nominal Test Temperature: 25C, Humidity: 35%

#	Instrument	Manufacturer	Model #	Serial #	Calibration Date / Due
1	Power Meter	Agilent	E4419B	GB40203178	
2	Power Sensor	Agilent	8487A	3318A04252	09/02/01
3	Spectrum Analyser	Hewlett Pack	8565E	3711A00682	27/10/00
4	Temp Chamber	Bemco	F1001350-8	3673-9	
5	Power Supply	Agilent	6655A	US36391573	07/02/01
6	Active Mixer	Ensemble			
7	Passive Mixer	Ensemble			
6	High Freq. Cables	Megaphase			

7 Summary Of Test Results

Parameter	C	NC	NT	NA	Reference to remark
Transmitter characteristics					
RF power output	X				
Modulation characteristics	X				
Occupied bandwidth	X				
Spurious emissions at antenna terminals	X				
Field strength of spurious radiation note 1				X	
Frequency stability	X				

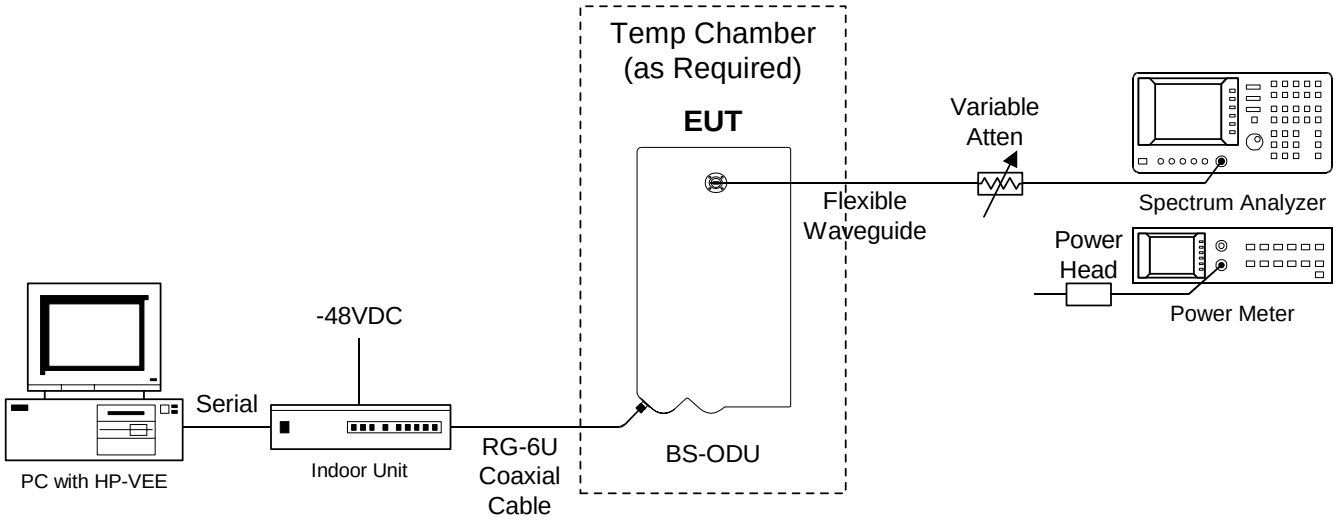
Note: *C:* *The parameter is compliant with the requirements.*

NC: *The parameter is not compliant with the requirements.*

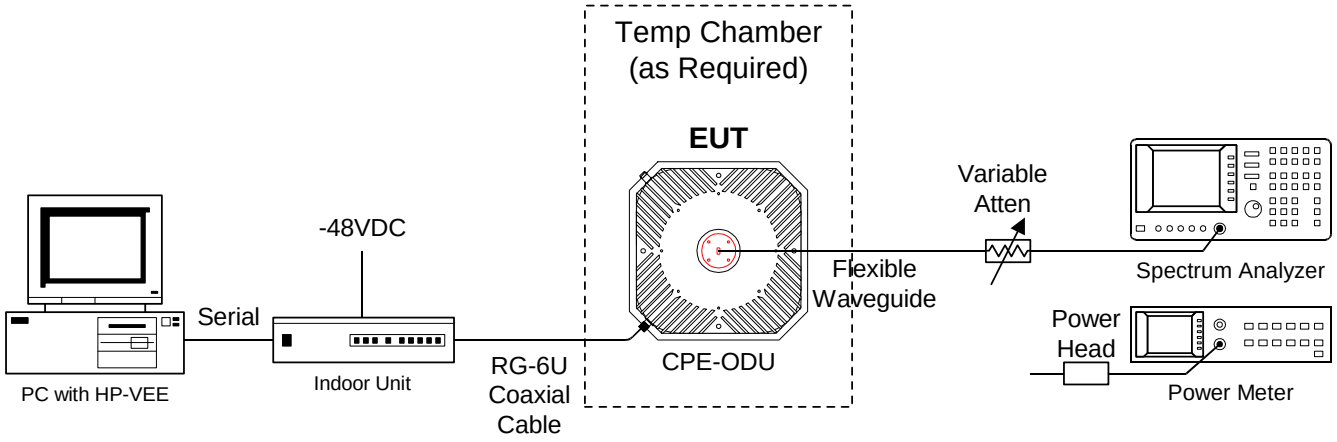
NT: *The parameter is not tested.*

NA: *The test of this parameter is not applicable.*

Annex A. Test set-up illustrations



Base Station (BS) Test Configuration



Customer Premises Equipment (CPE) Test Configuration

Annex B. Graphical Results

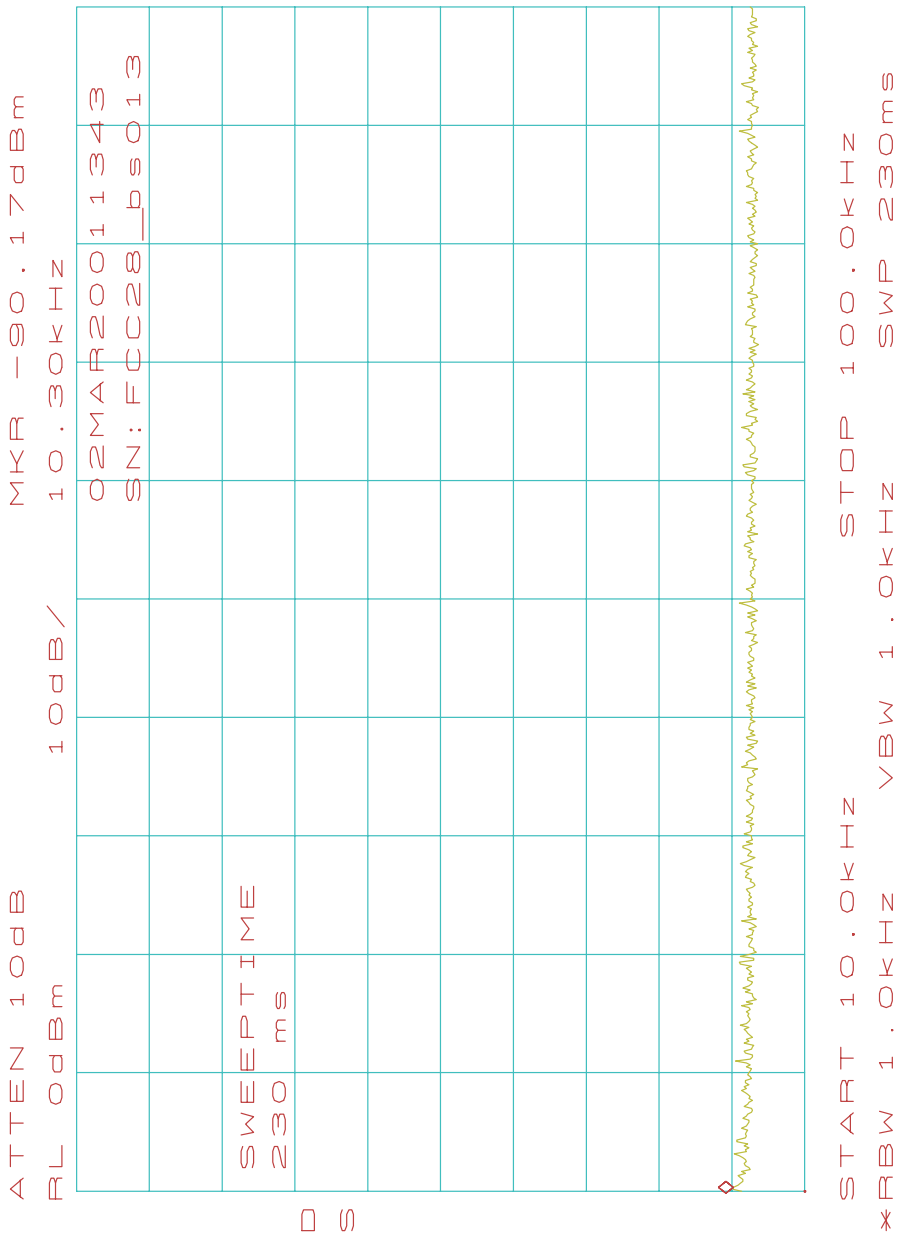
This report is accompanied by the following graphs indicated in the tables in Section 4.2 above.

BS013

Spurious Emission Plots (BS-ODU)

10 kHz-100 kHz

Highest Level Observed (dBm): -90.17

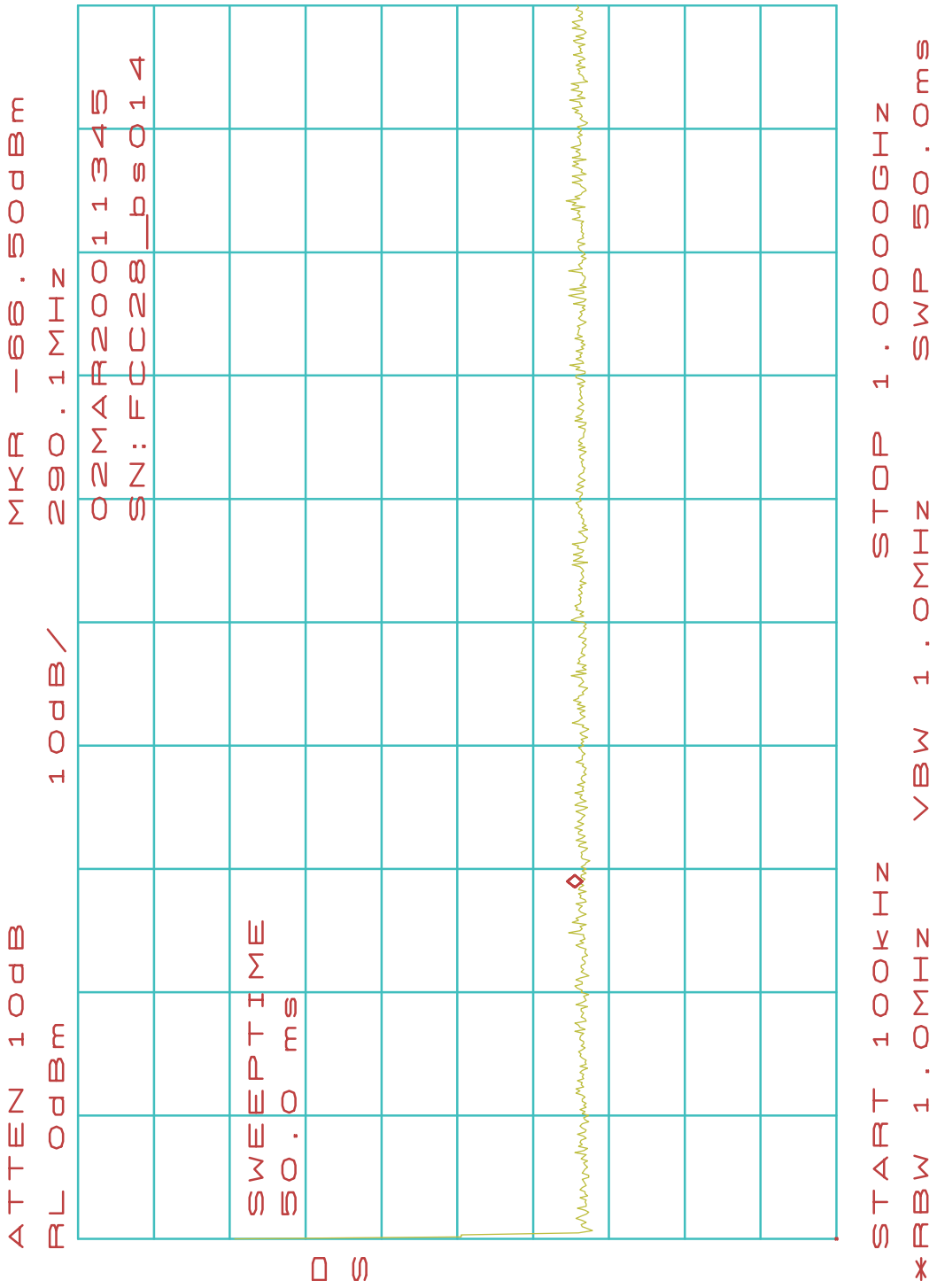


BS014

Spurious Emission Plots (BS-ODU)

100 kHz-1.0 GHz

Highest Level Observed (dBm): -66.50

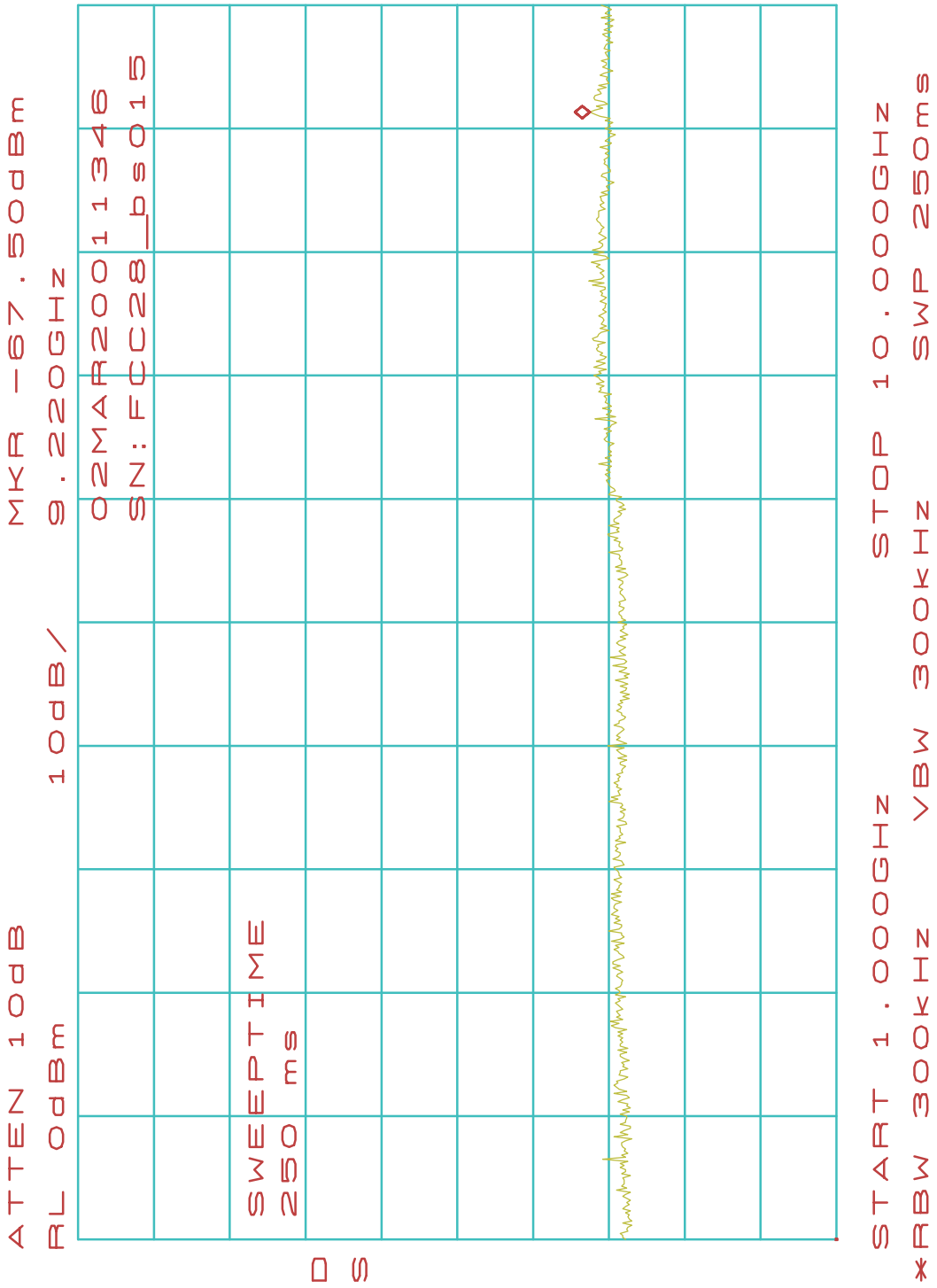


BS015

Spurious Emission Plots (BS-ODU)

1.0-10.0 GHz

Highest Level Observed (dBm): -67.50

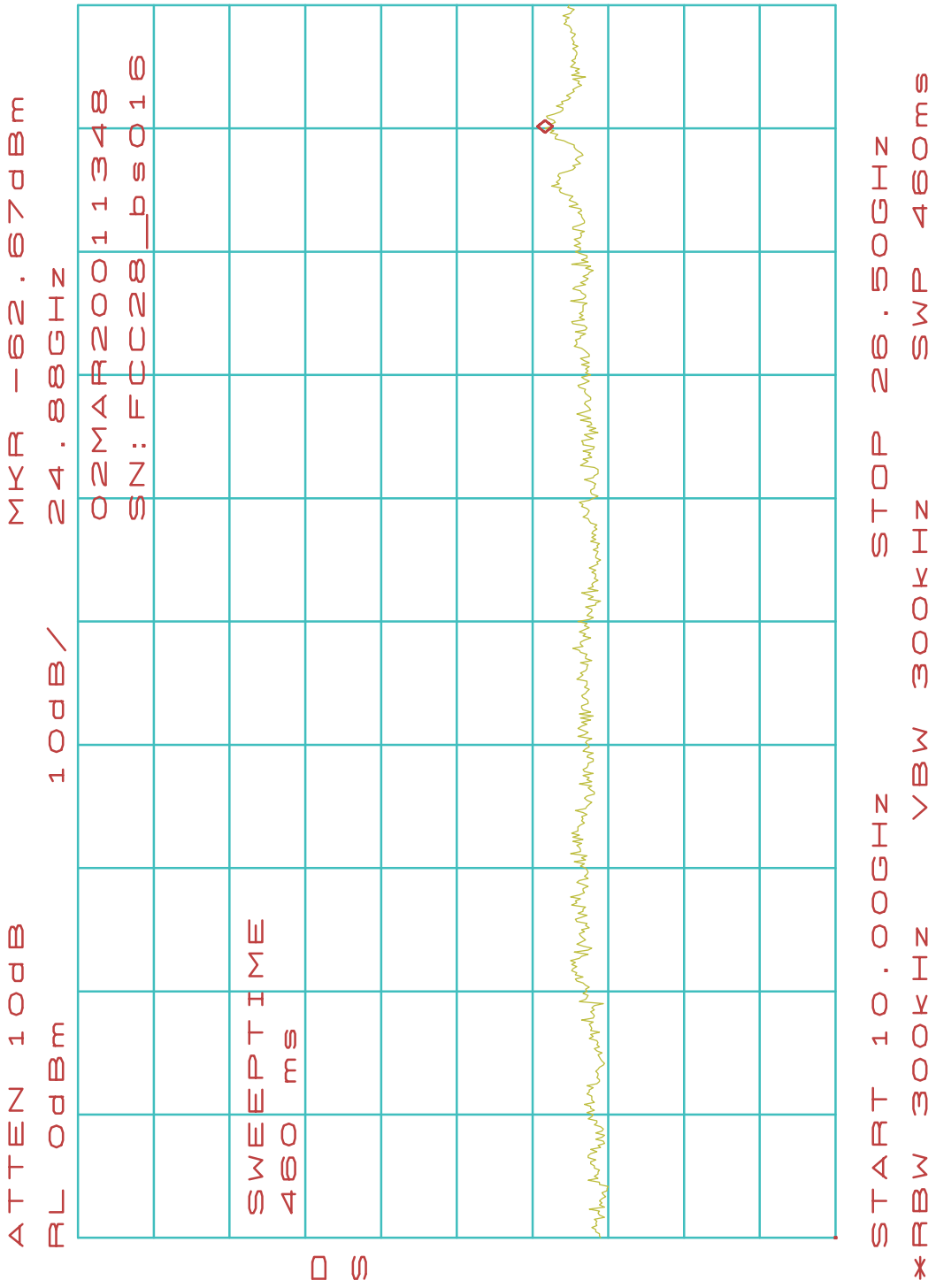


BS016

Spurious Emission Plots (BS-ODU)

10.0-26.5 GHz

Highest Level Observed (dBm): -62.67

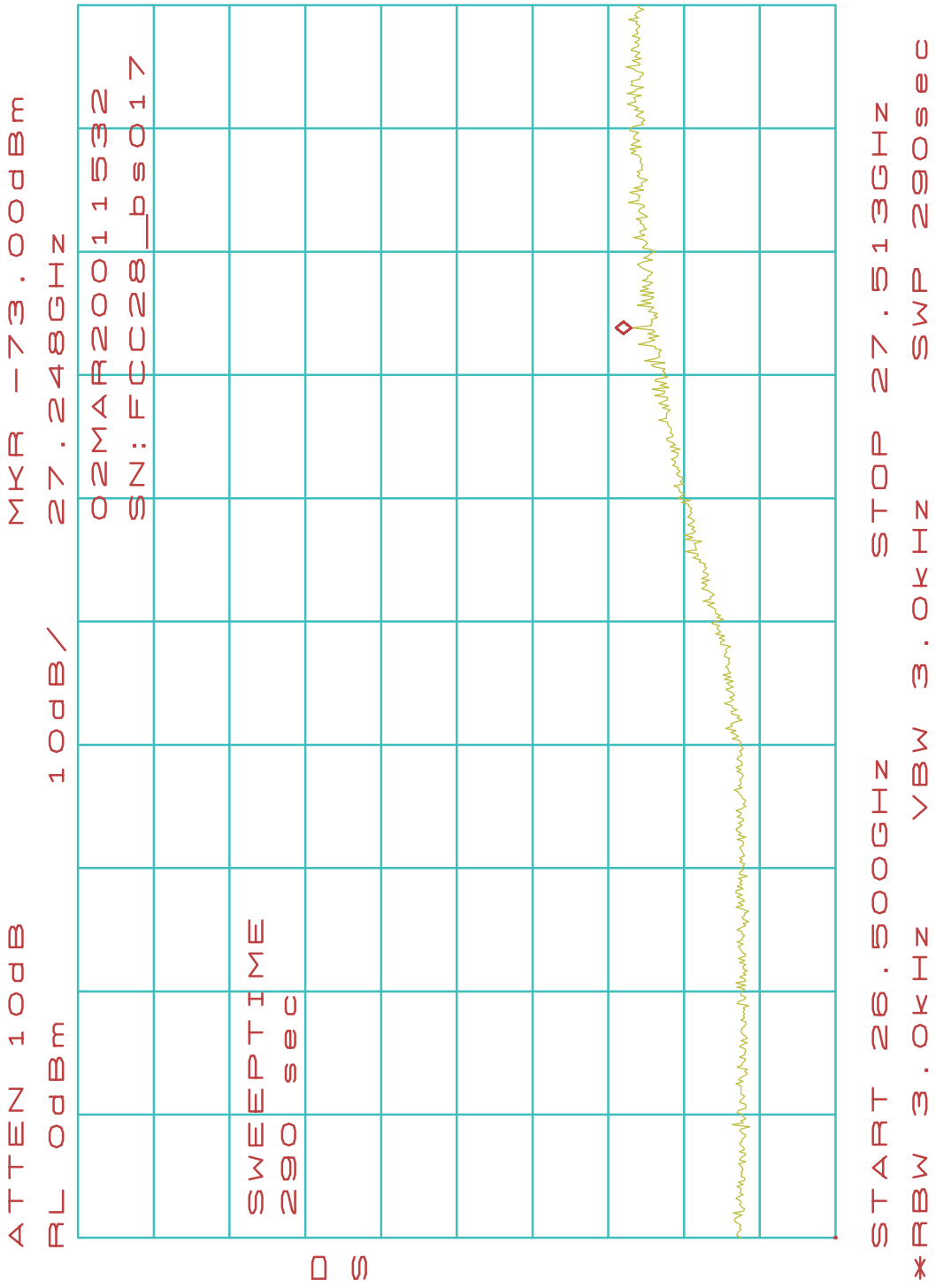


BS017

Spurious Emission Plots (BS-ODU)

26.5-27.513 GHz

Highest Level Observed (dBm): -73.00

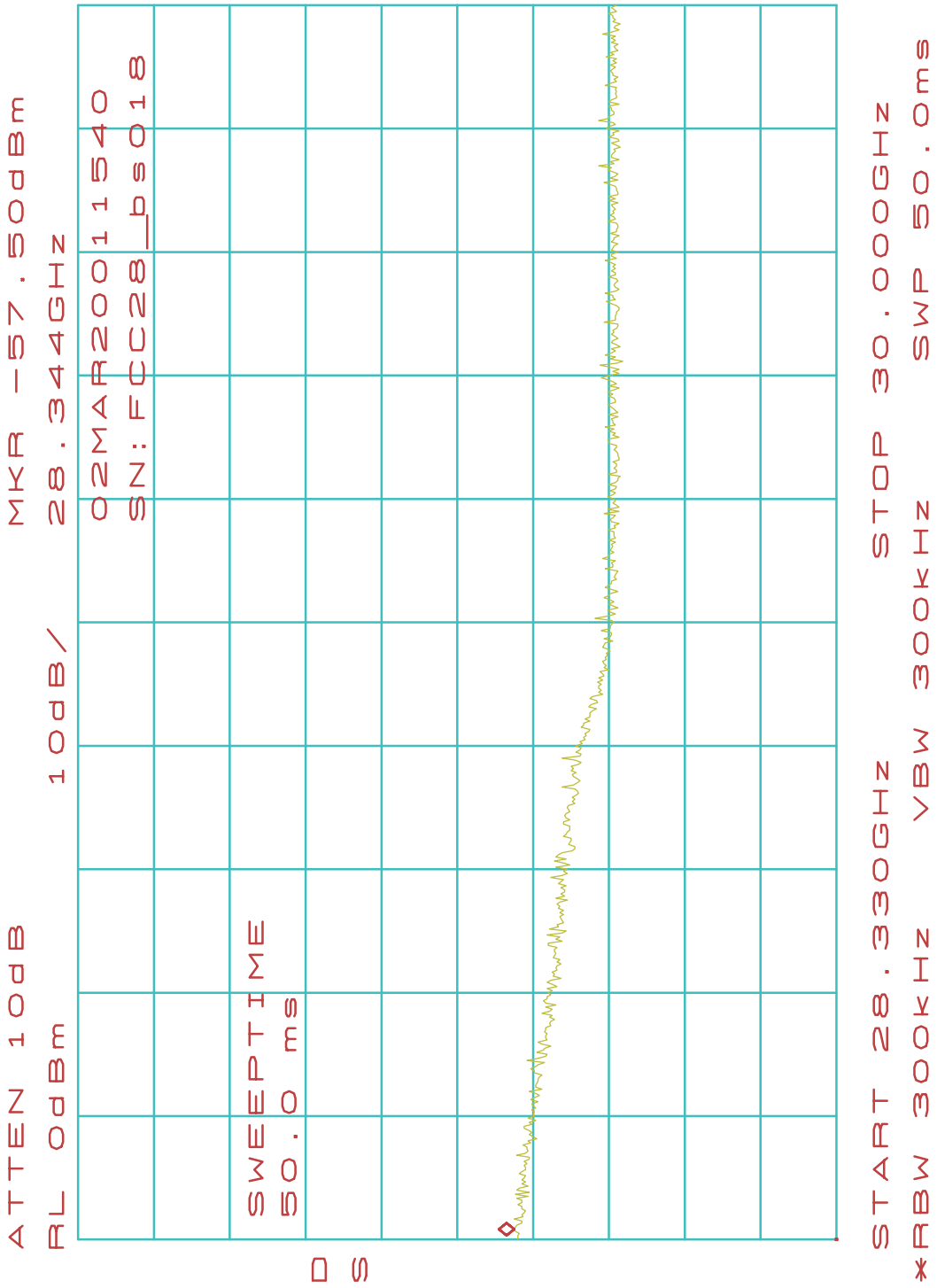


BS018

Spurious Emission Plots (BS-ODU)

28.33-30.0 GHz

Highest Level Observed (dBm): -57.50

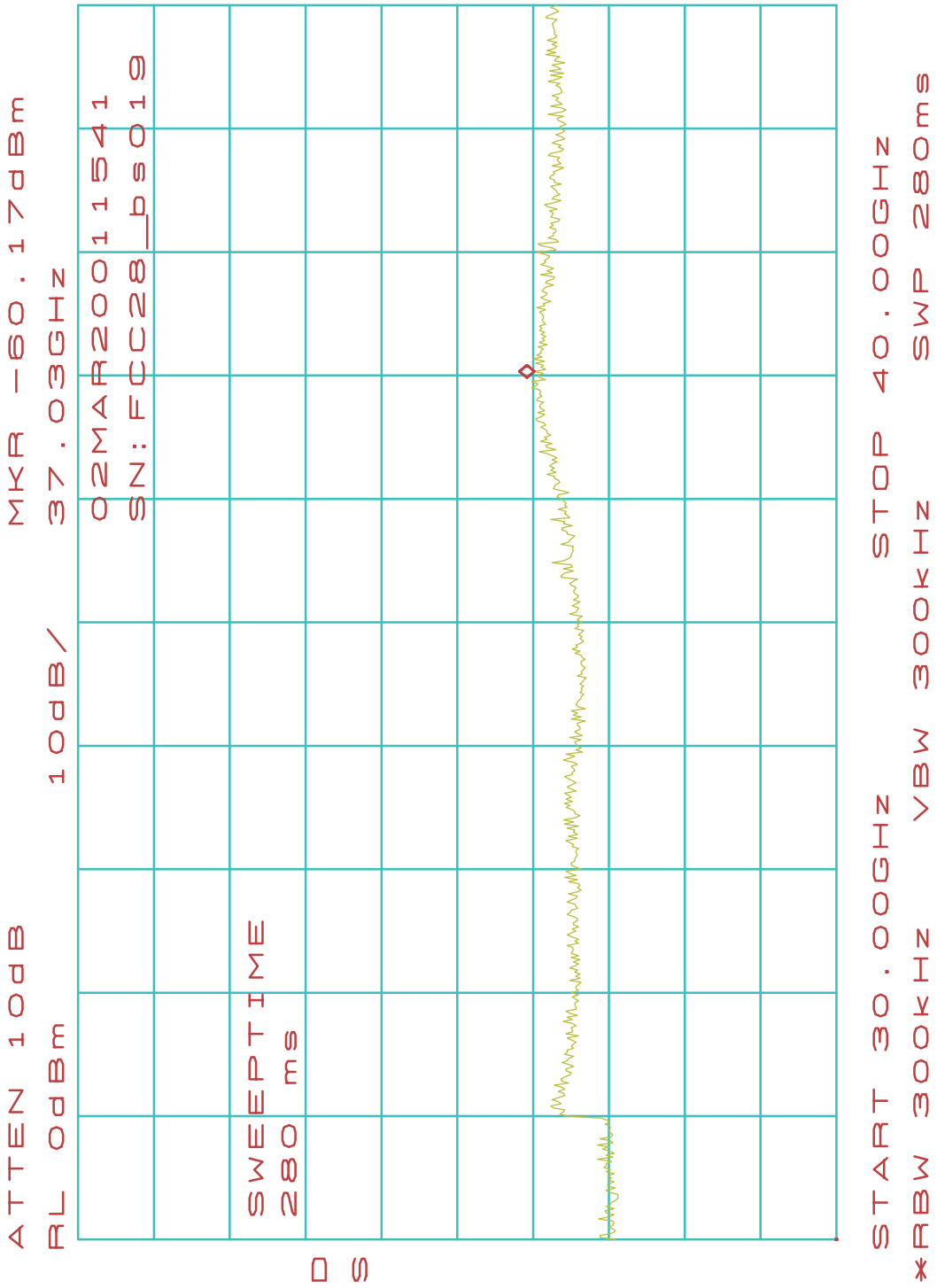


BS019

Spurious Emission Plots (BS-ODU)

30.0-40.0 GHz

Highest Level Observed (dBm): -60.17

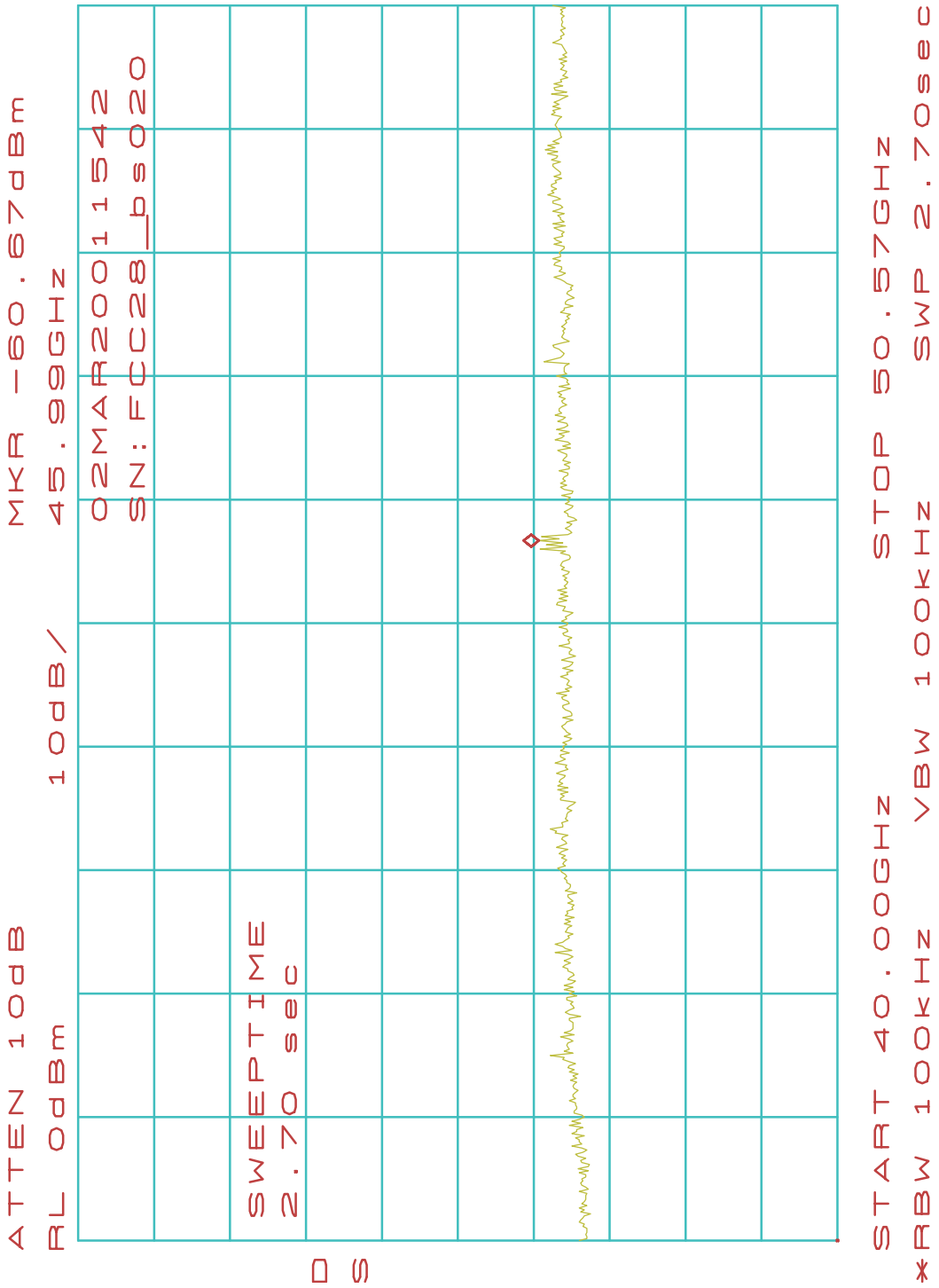


BS020

Spurious Emission Plots (BS-ODU)

40.0-50.57 GHz

Highest Level Observed (dBm): -60.67

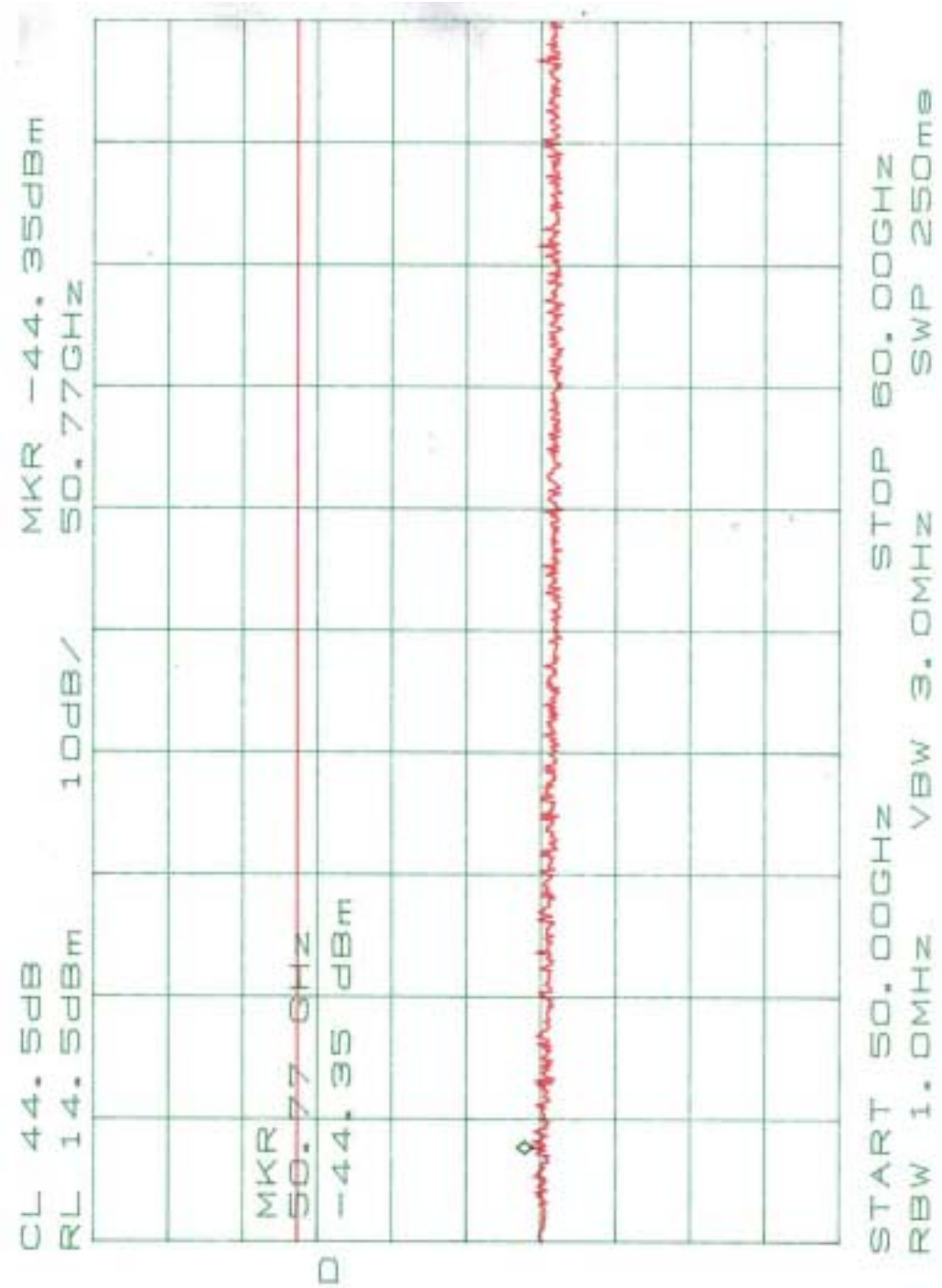


BS021

Spurious Emission Plots (BS-ODU)

50.0-60.0 GHz

Highest Level Observed (dBm): -44.35

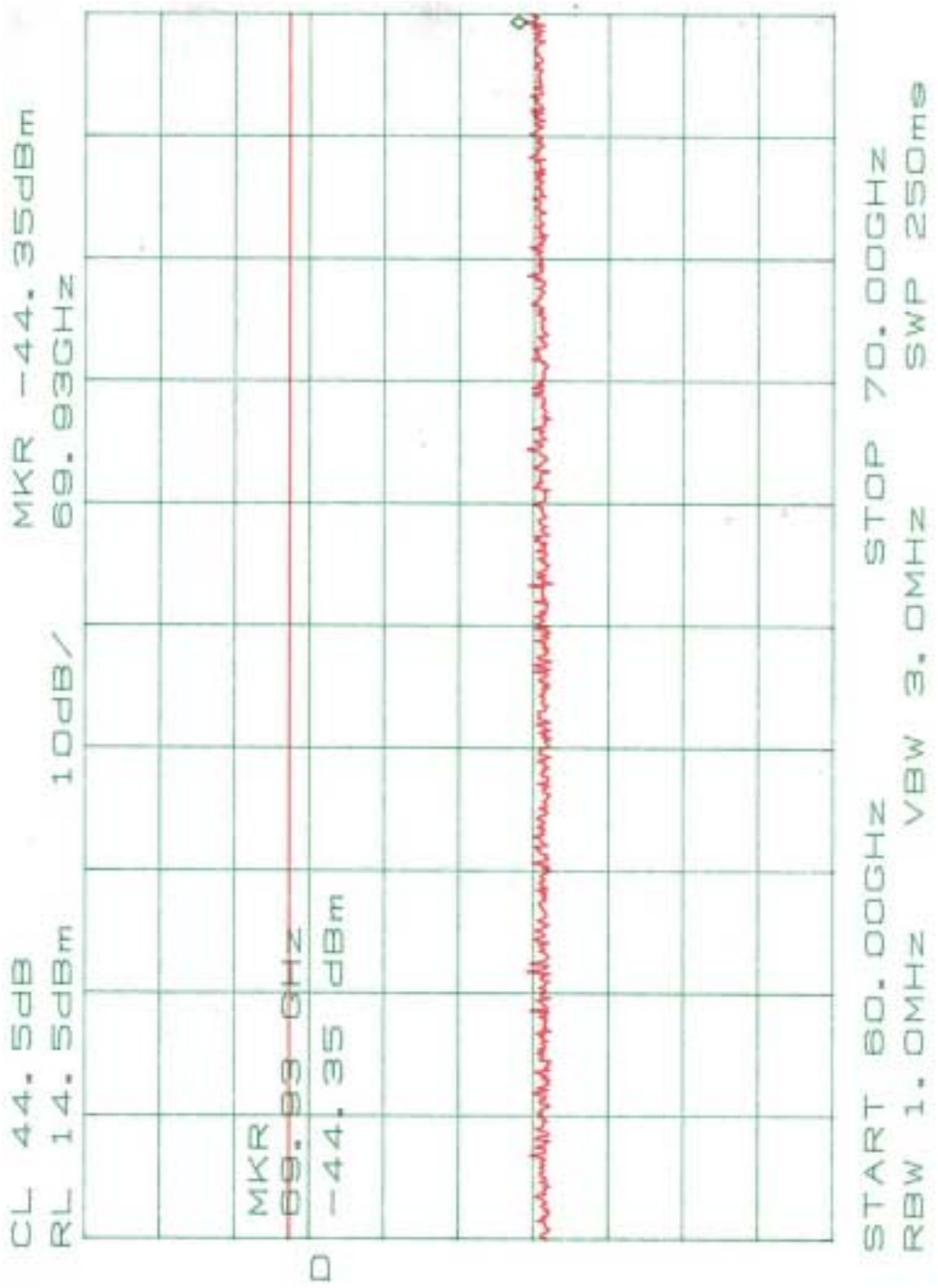


BS022

Spurious Emission Plots (BS-ODU)

60.0-70.0 GHz

Highest Level Observed (dBm): -44.35

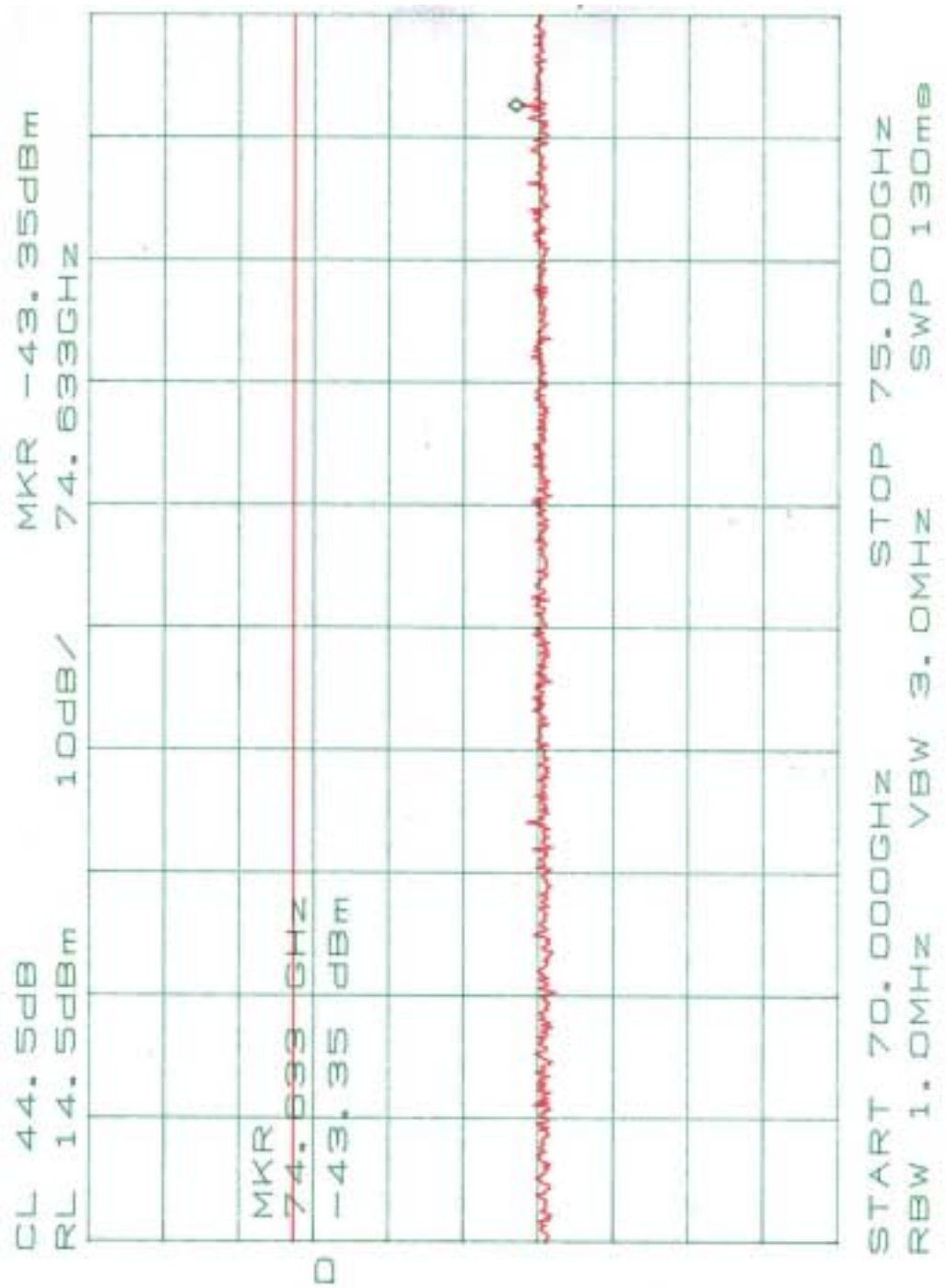


BS023

Spurious Emission Plots (BS-ODU)

70.0-75.0 GHz

Highest Level Observed (dBm): -43.35

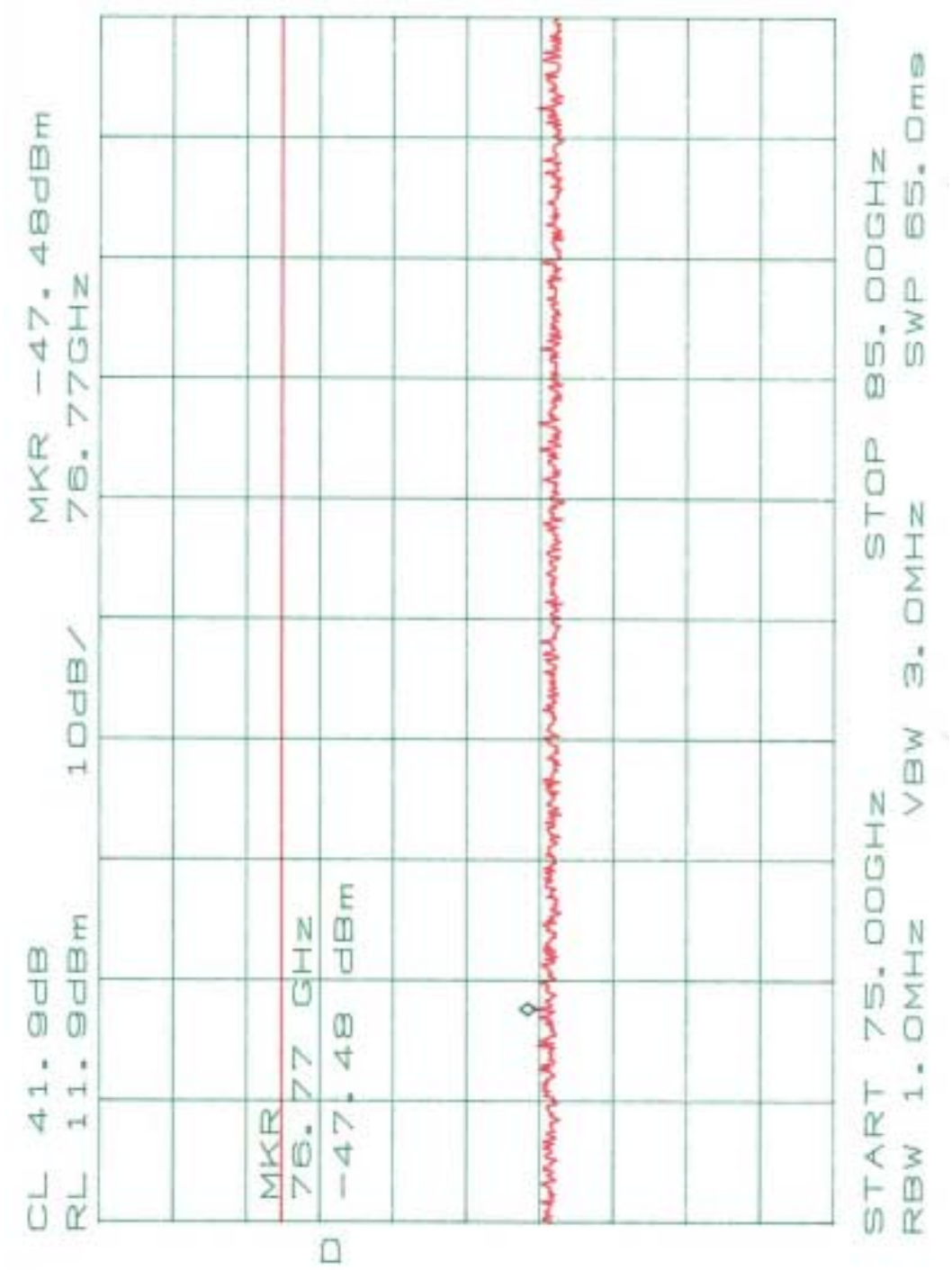


BS024

Spurious Emission Plots (BS-ODU)

75.0-85.0 GHz

Highest Level Observed (dBm): -47.48

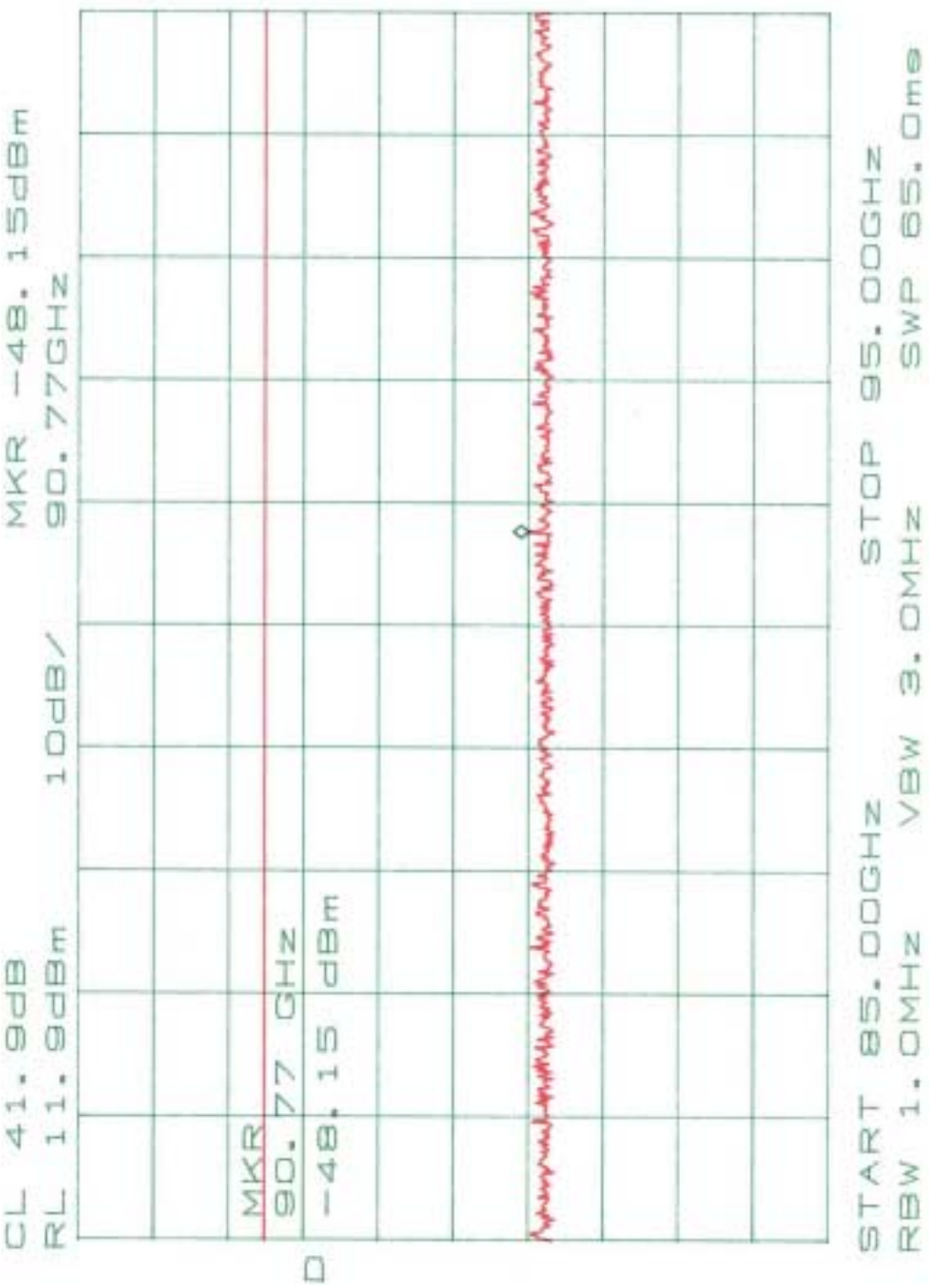


BS025

Spurious Emission Plots (BS-ODU)

85.0-95.0 GHz

Highest Level Observed (dBm): -48.15

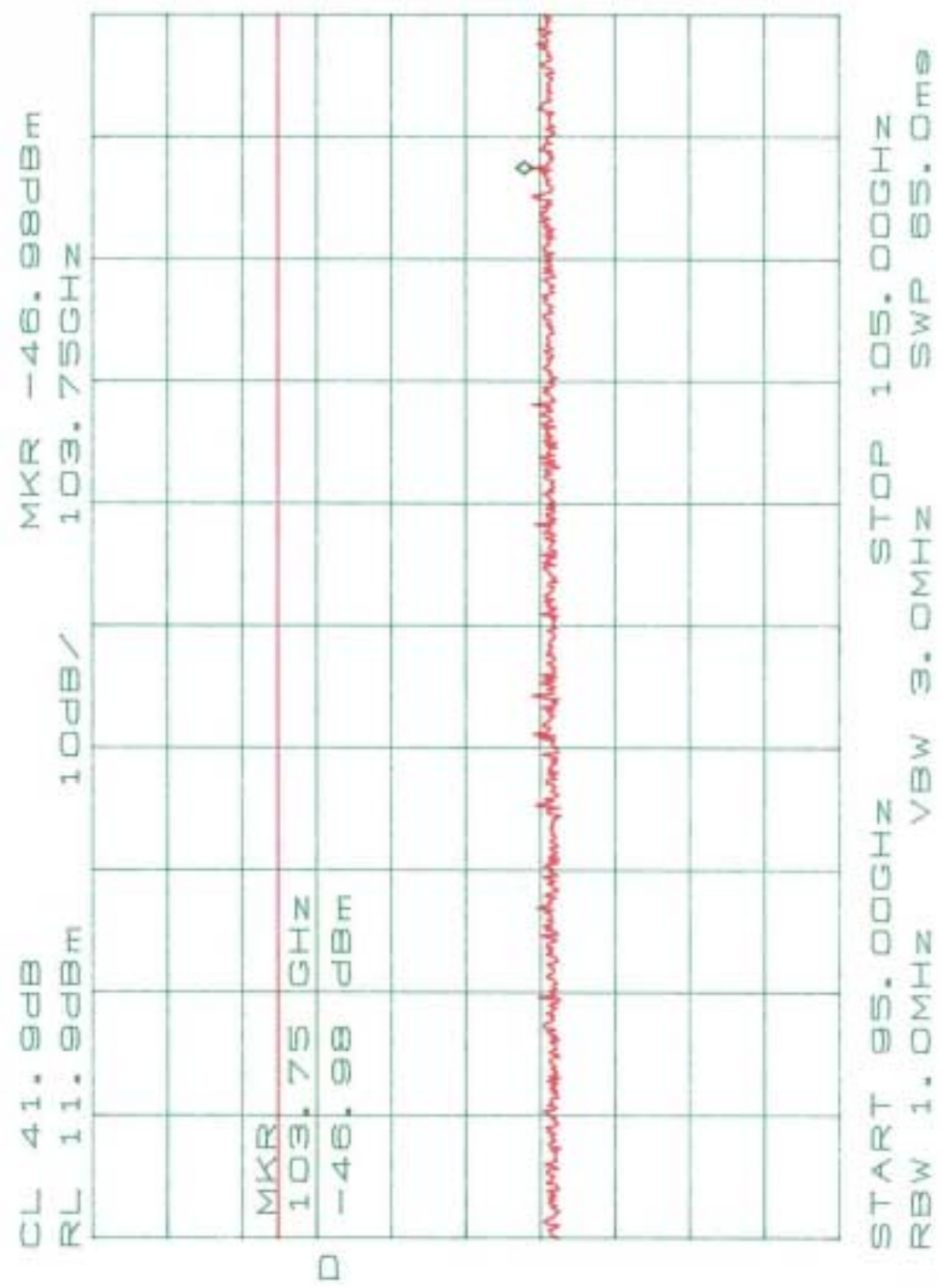


BS026

Spurious Emission Plots (BS-ODU)

95.0-105.0 GHz

Highest Level Observed (dBm): -46.98

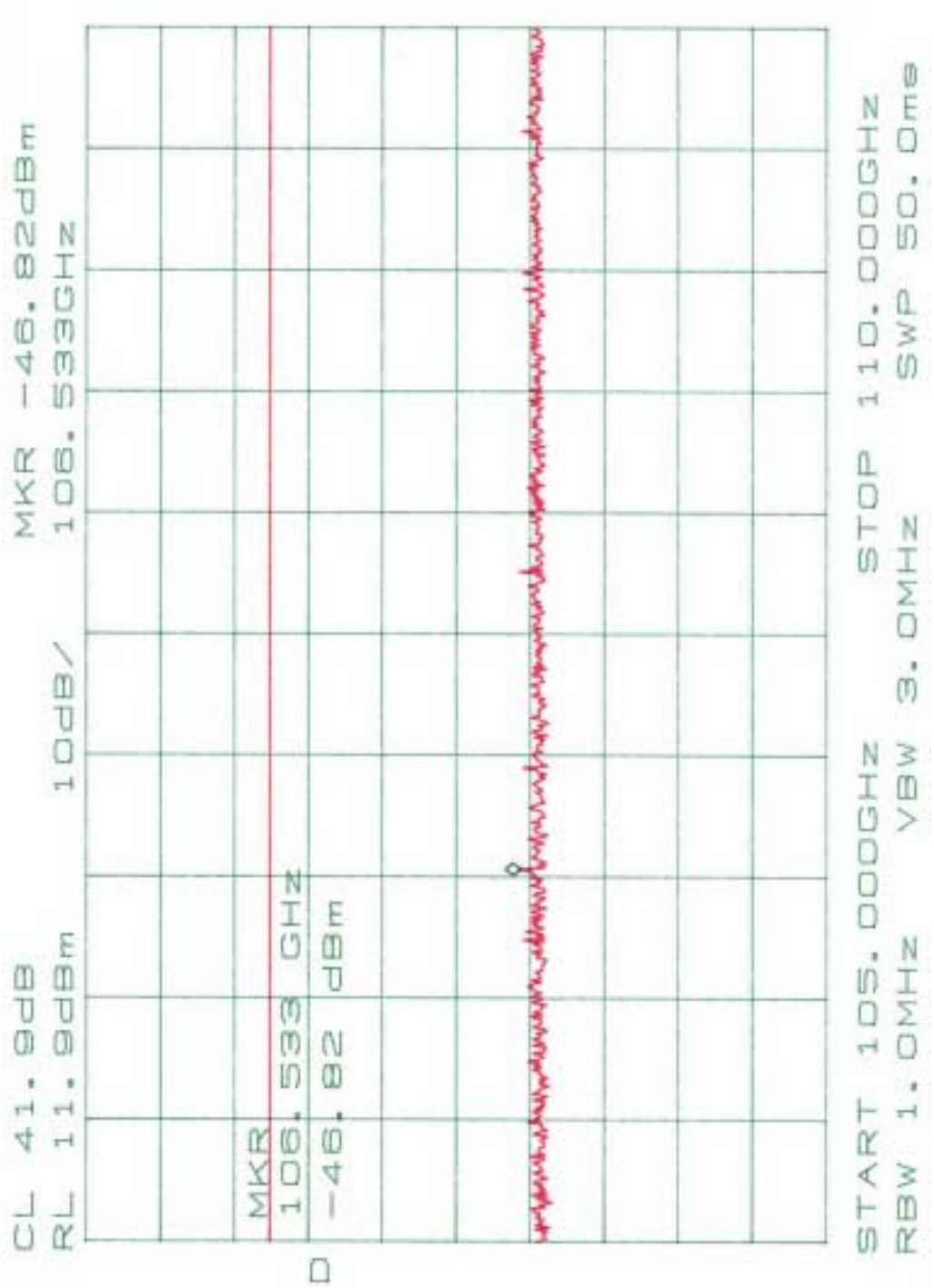


BS027

Spurious Emission Plots (BS-ODU)

105.0-110.0 GHz

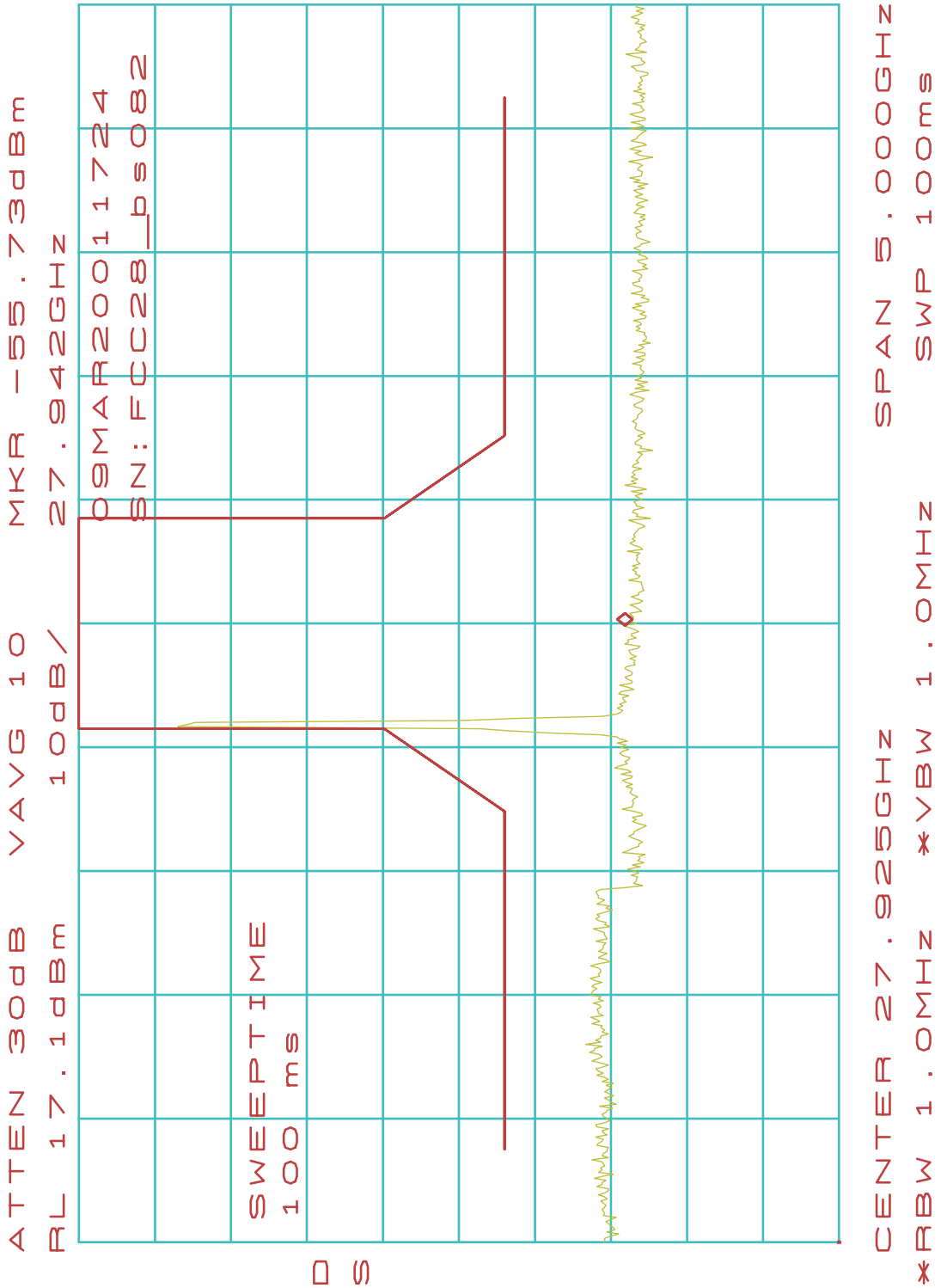
Highest Level Observed (dBm): -46.82



BS082

Spectrum Mask Plots (BS-ODU) Low Frequency: 27.515 GHZ

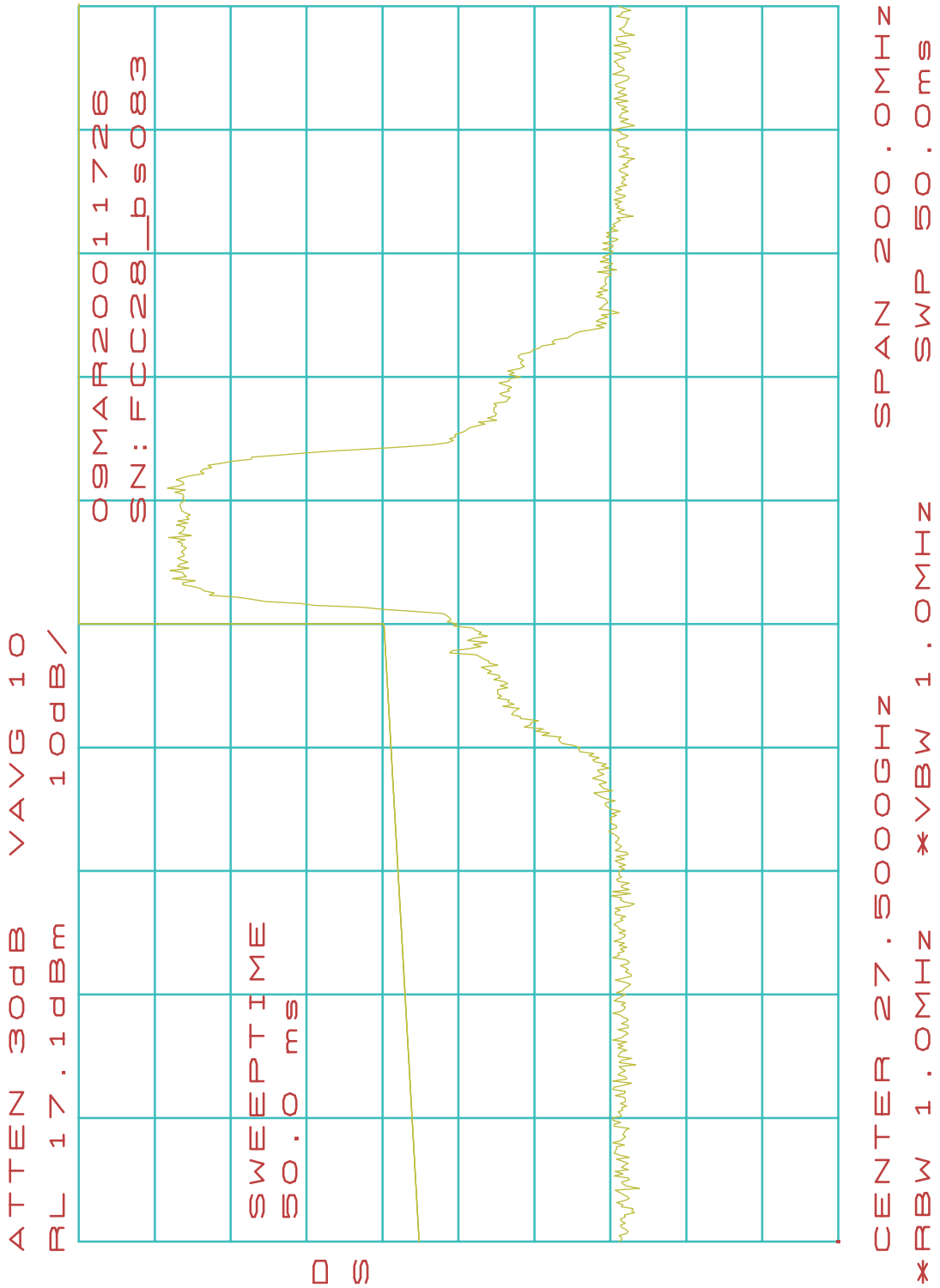
QPSK:



BS083

Spectrum Mask Plots (BS-ODU) Low Frequency: 27.515 GHZ

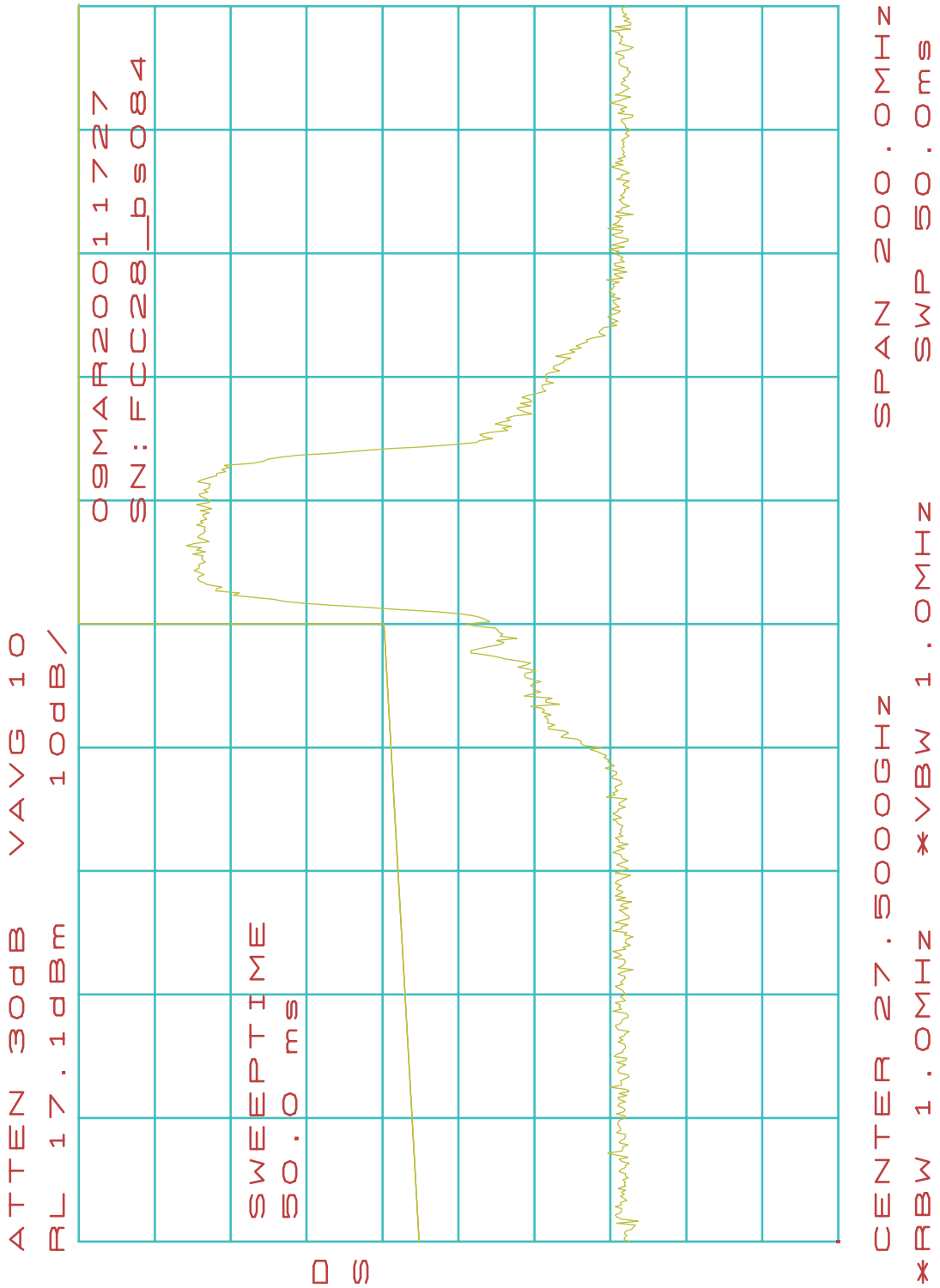
QPSK:



BS084

Spectrum Mask Plots (BS-ODU) Low Frequency: 27.515 GHZ

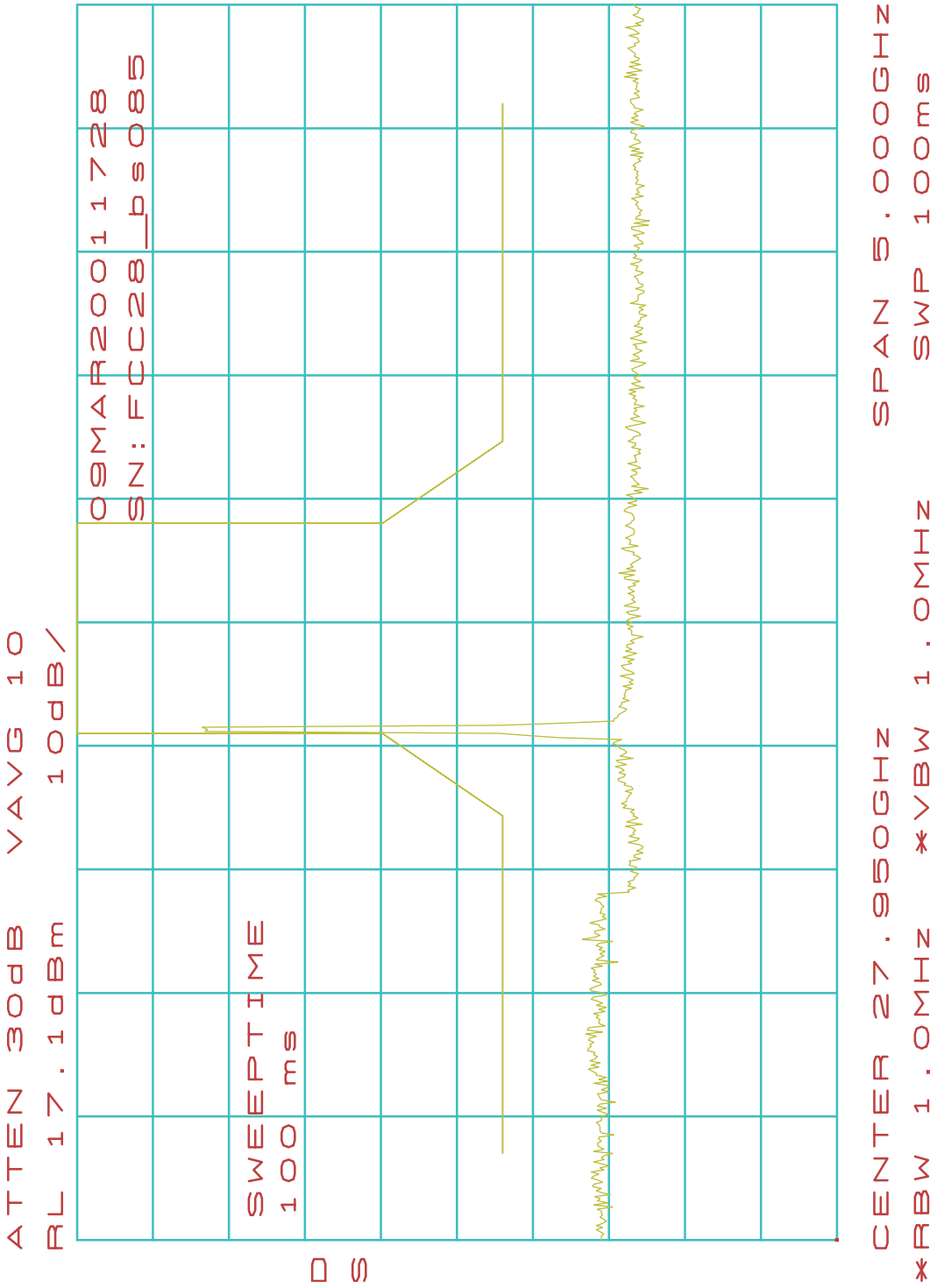
16-QAM:



BS085

Spectrum Mask Plots (BS-ODU) Low Frequency: 27.515 GHZ

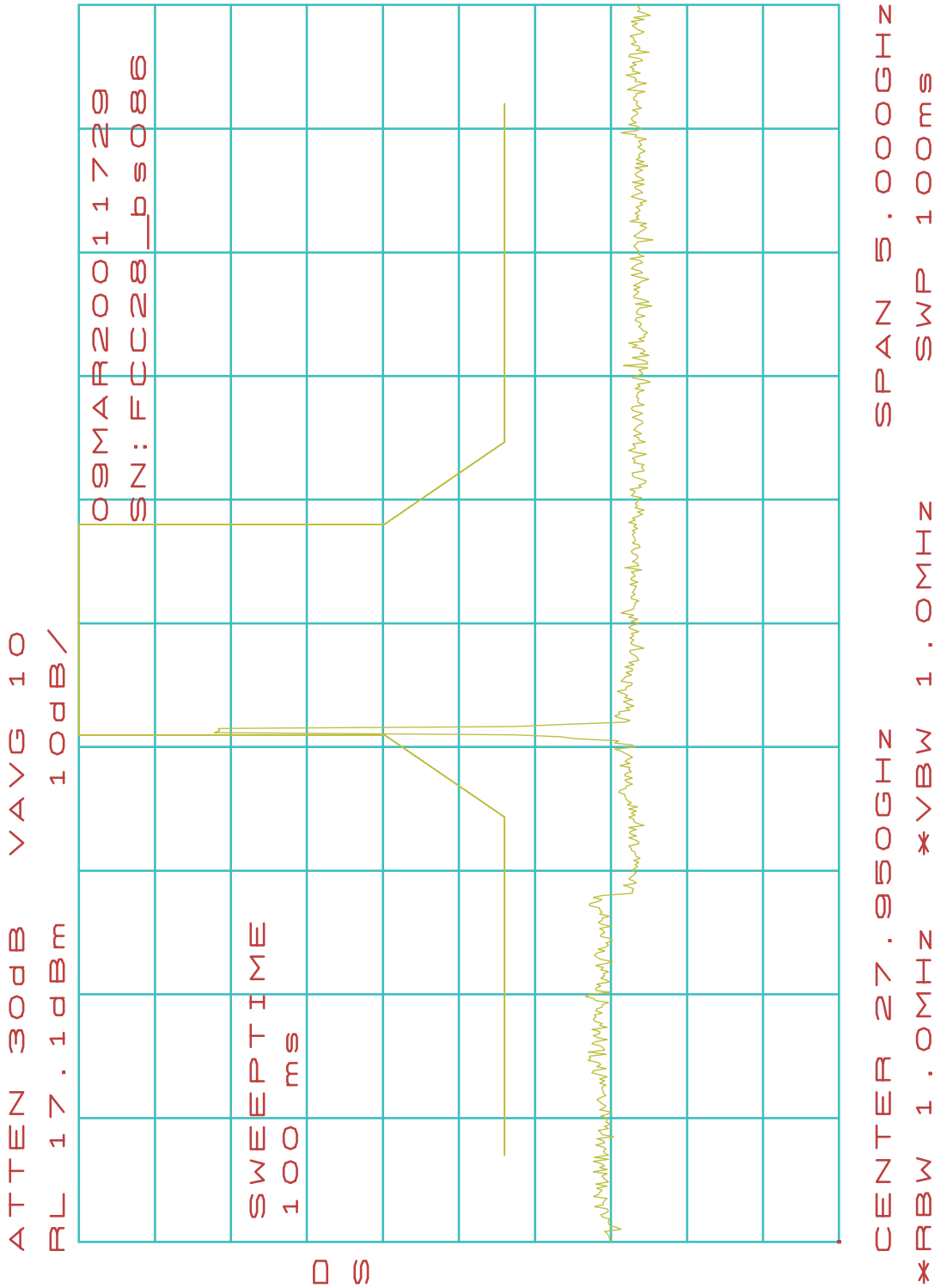
16-QAM:



BS086

Spectrum Mask Plots (BS-ODU) Low Frequency: 27.515 GHZ

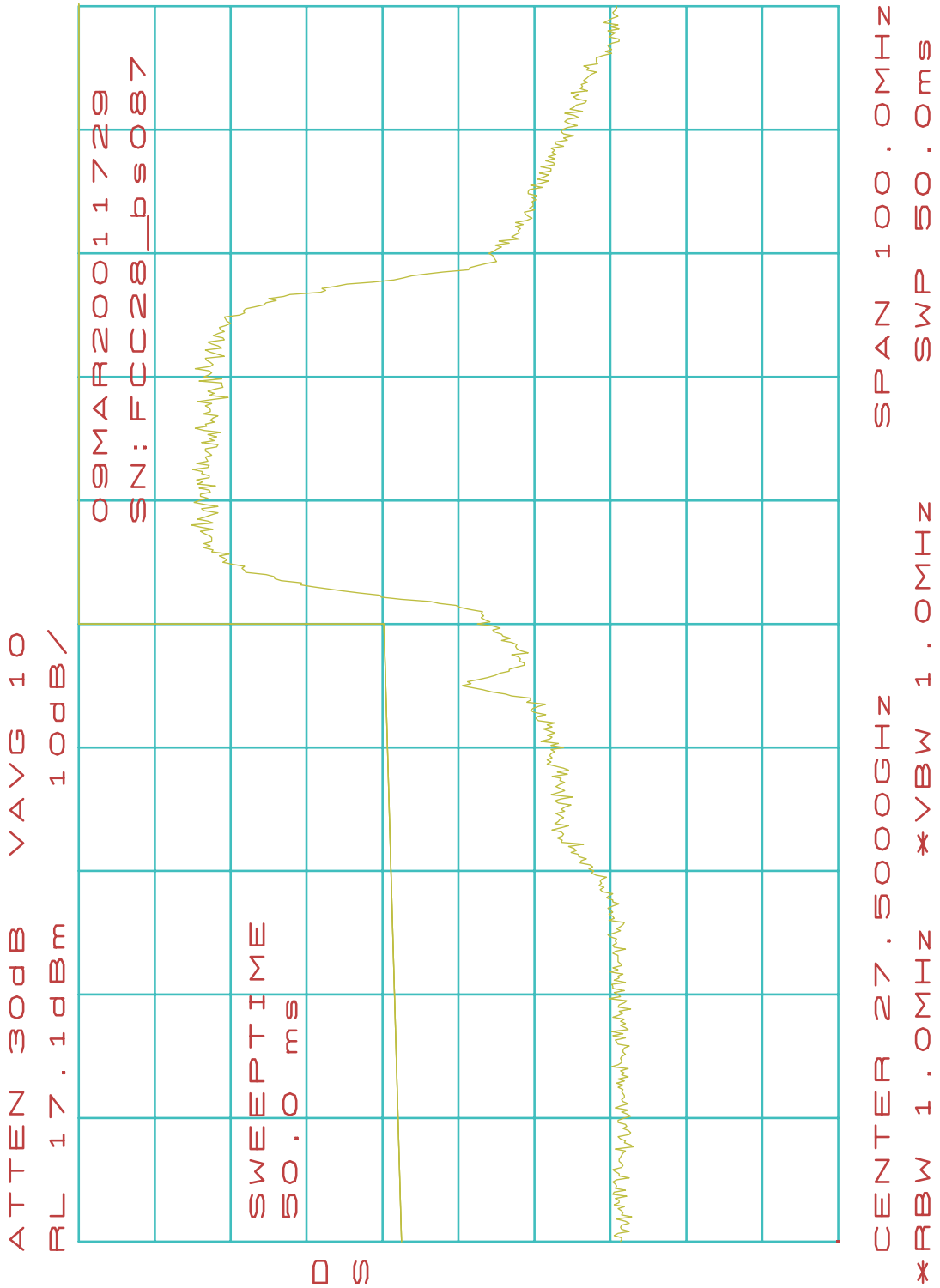
64-QAM:



BS087

Spectrum Mask Plots (BS-ODU) Low Frequency: 27.515 GHZ

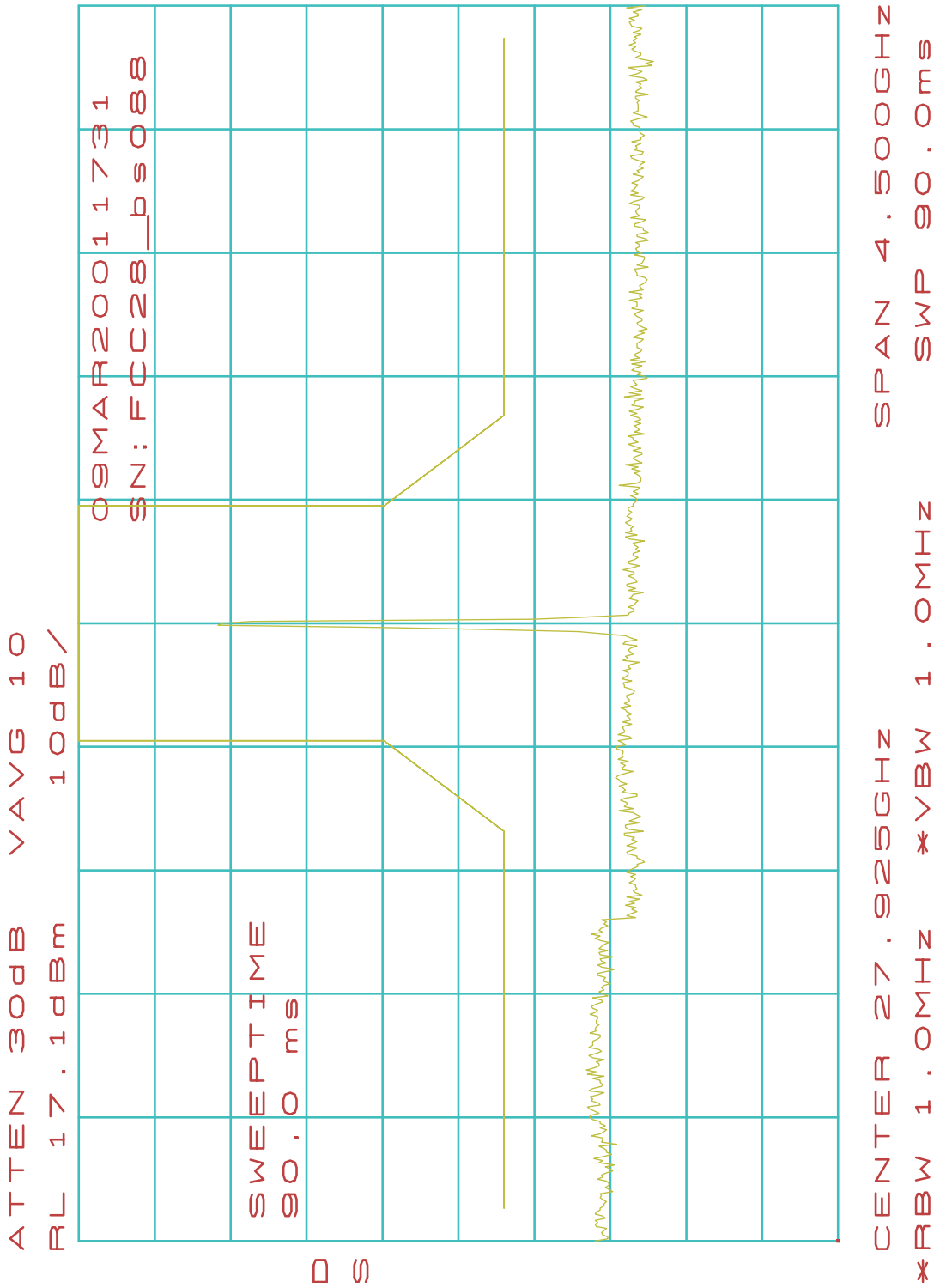
64-QAM:



BS088

Spectrum Mask Plots (BS-ODU) Mid Frequency: 27.925 GHZ

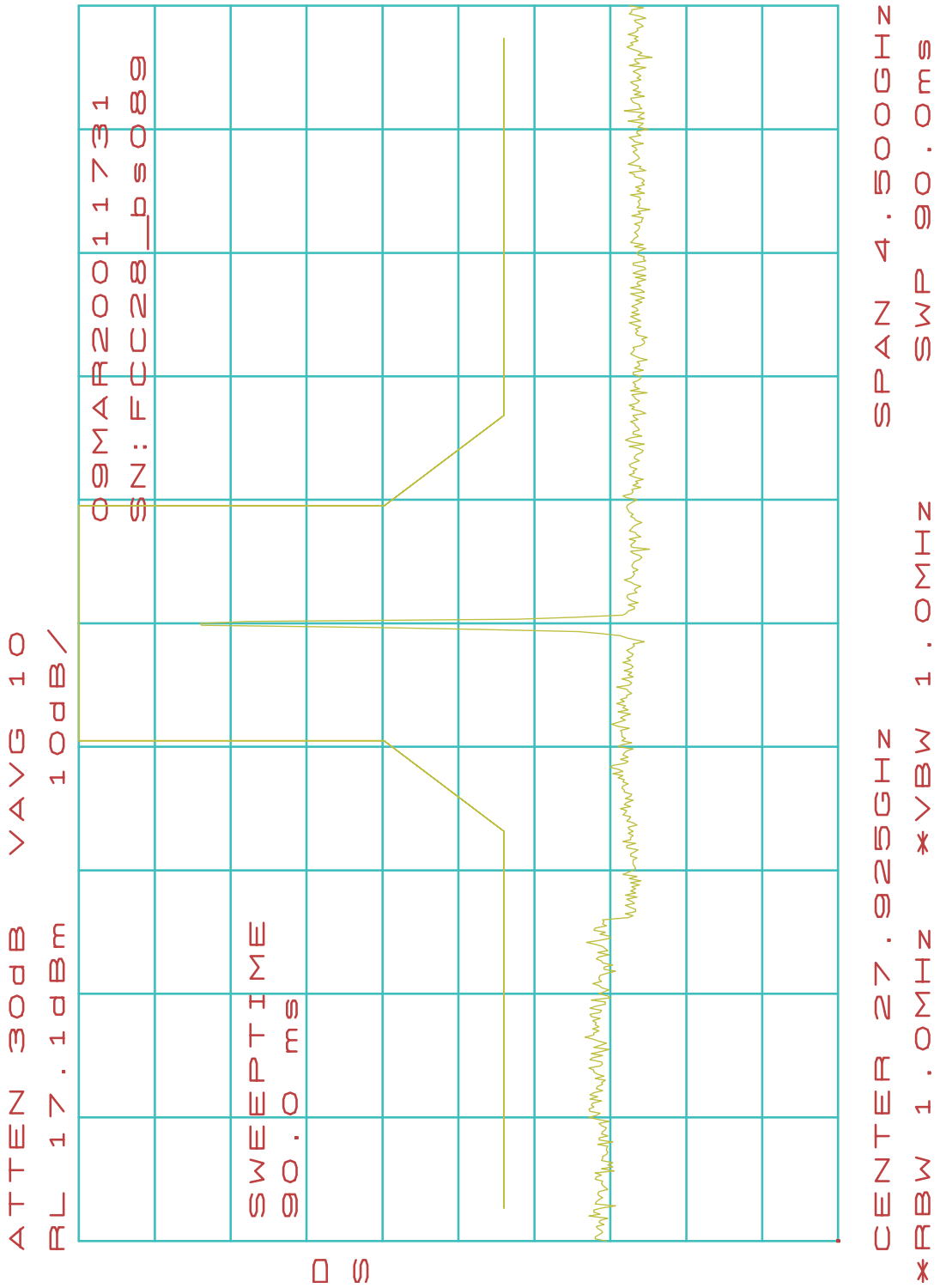
64-QAM:



BS089

Spectrum Mask Plots (BS-ODU) Mid Frequency: 27.925 GHZ

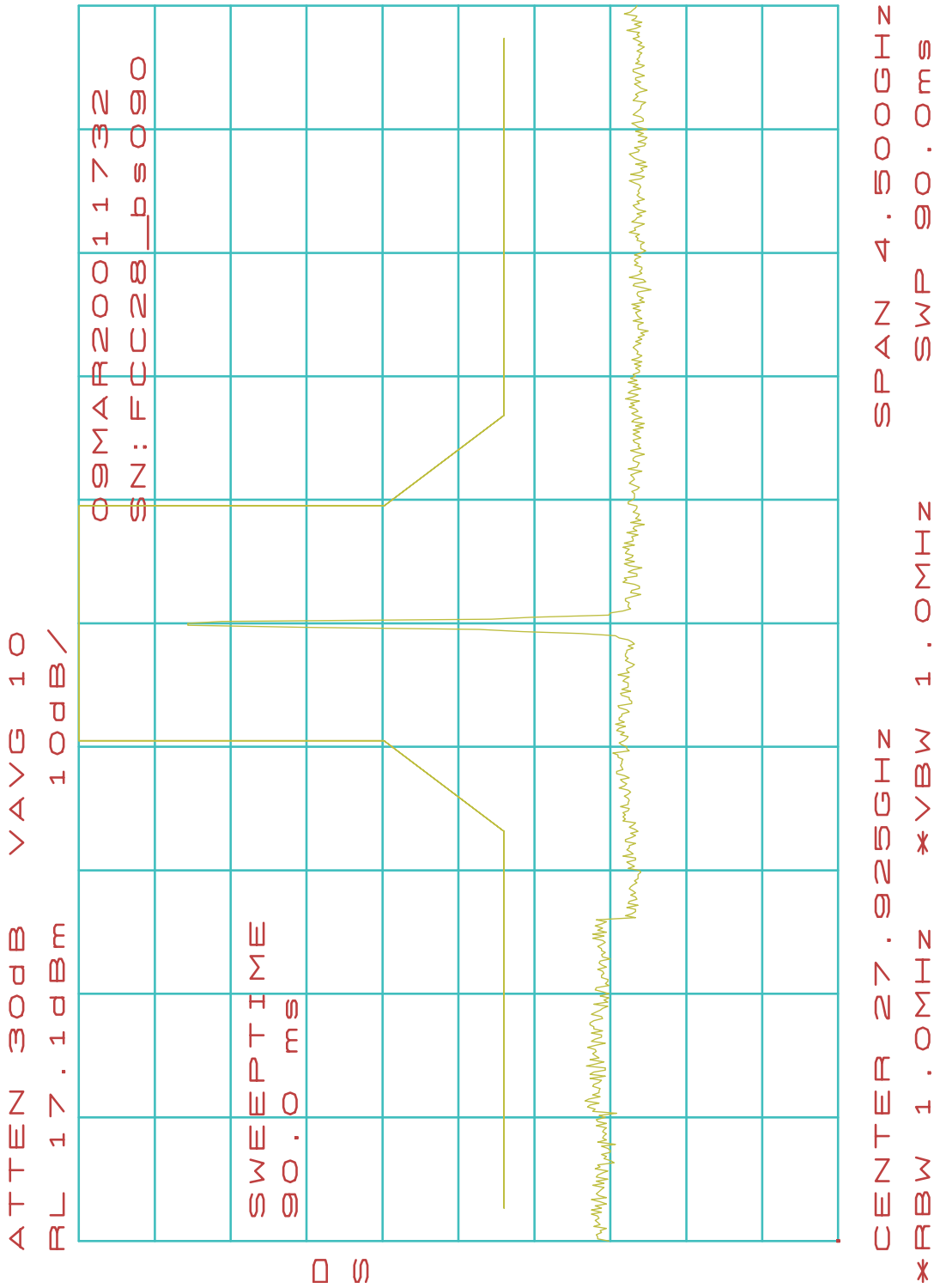
16-QAM:



BS090

Spectrum Mask Plots (BS-ODU) Mid Frequency: 27.925 GHZ

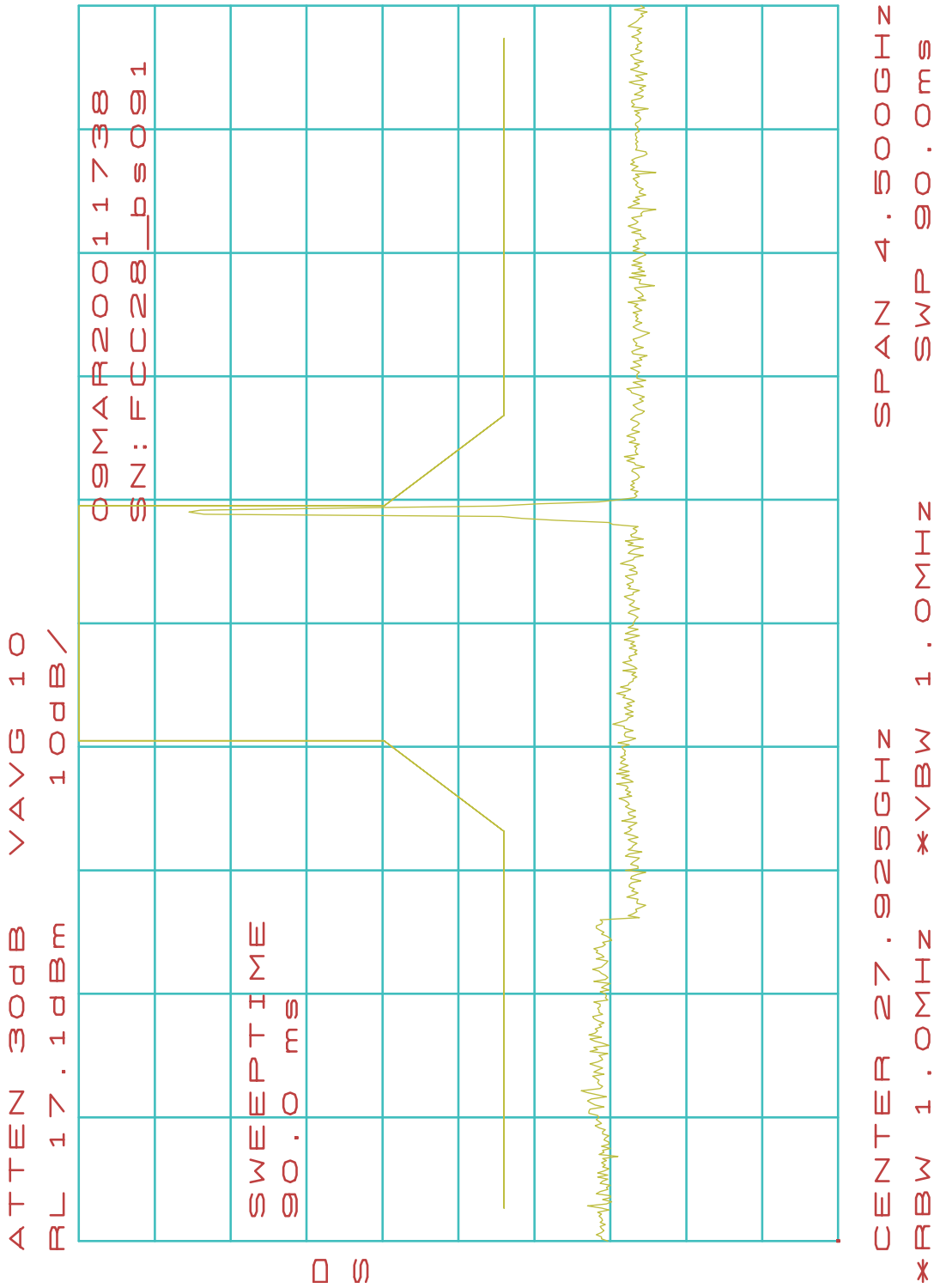
QPSK:



BS091

Spectrum Mask Plots (BS-ODU) High Frequency: 28.335 GHZ

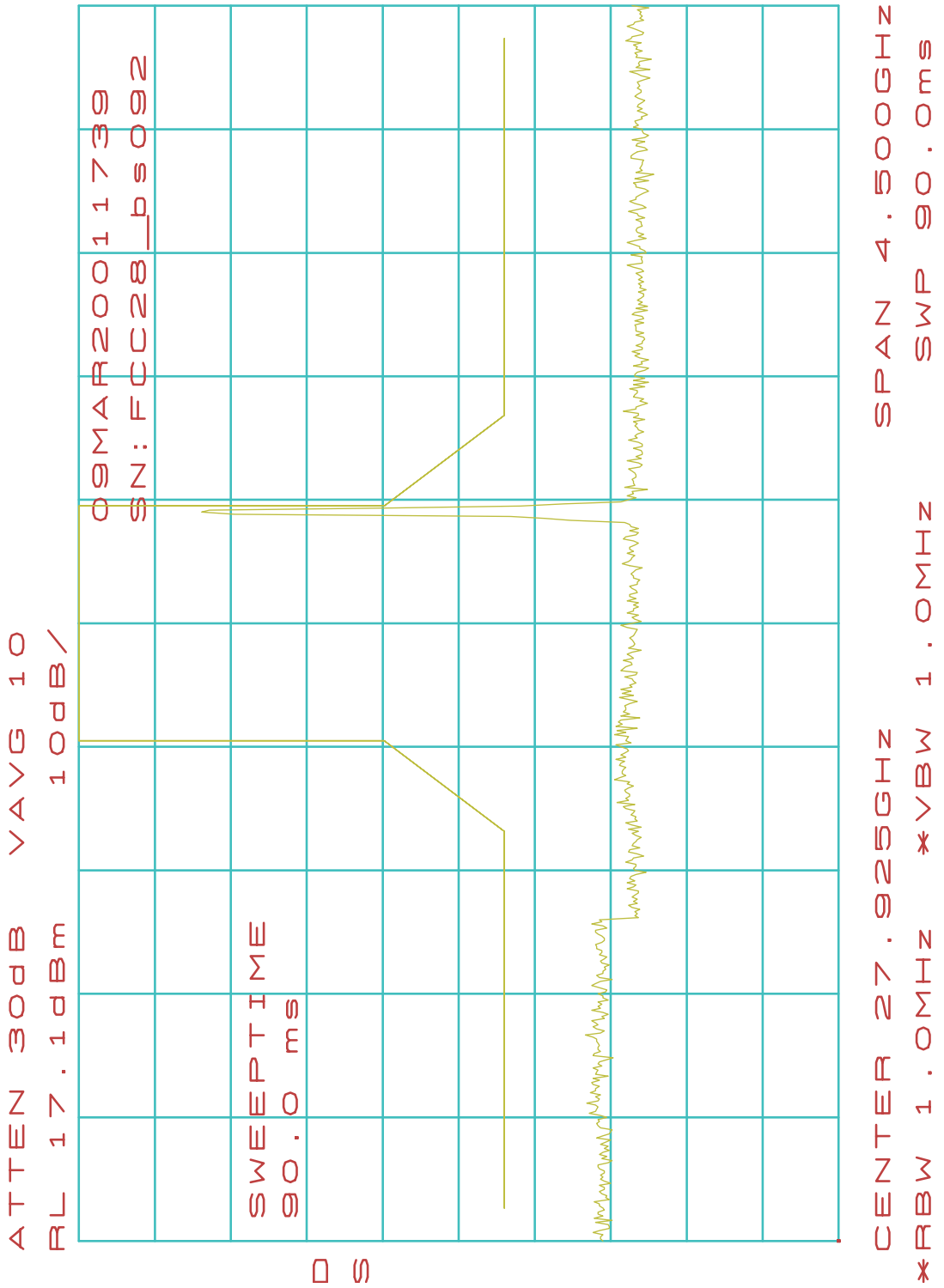
QPSK:



BS092

Spectrum Mask Plots (BS-ODU) High Frequency: 28.335 GHZ

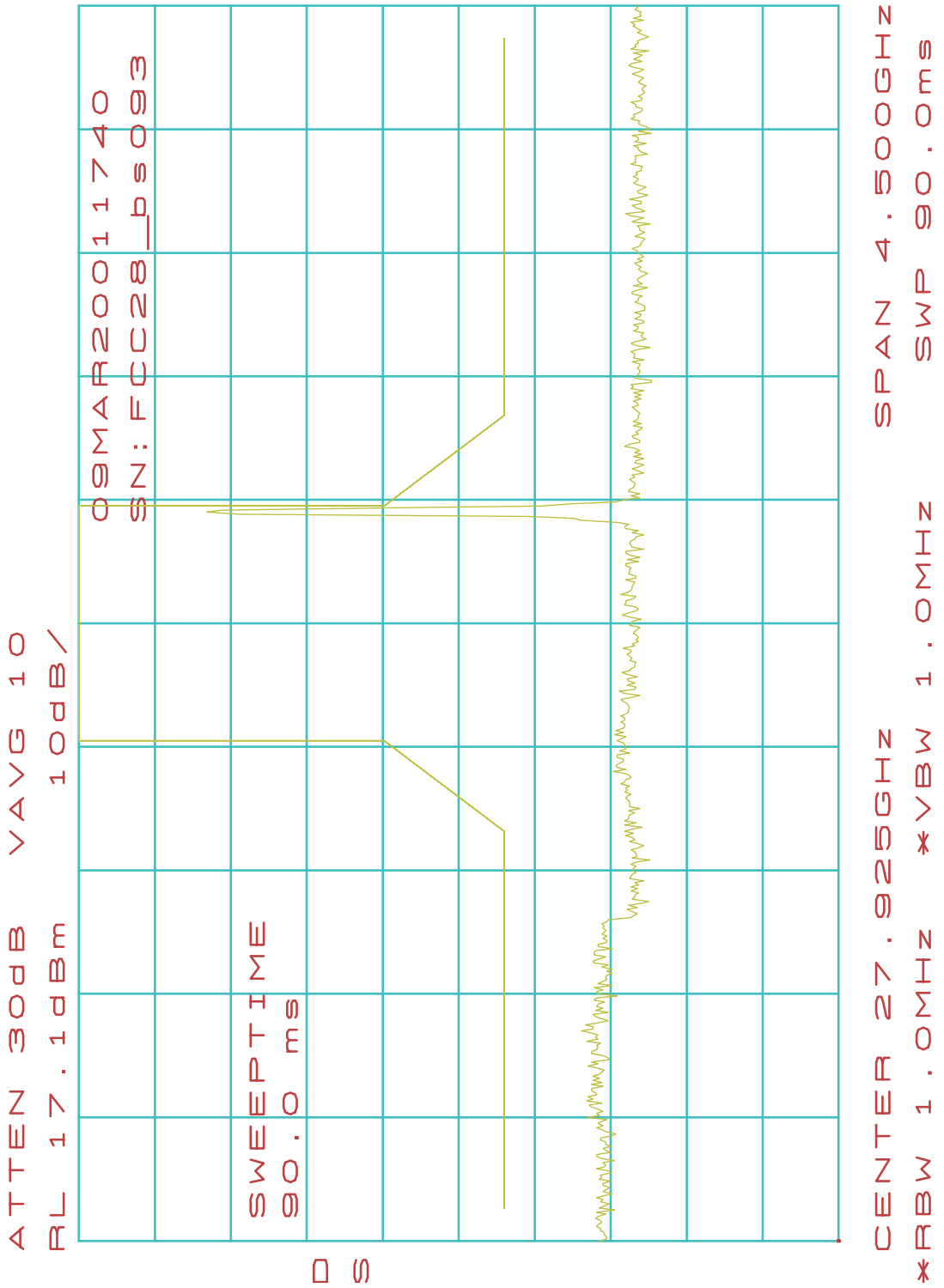
16-QAM:



BS093

Spectrum Mask Plots (BS-ODU) High Frequency: 28.335 GHZ

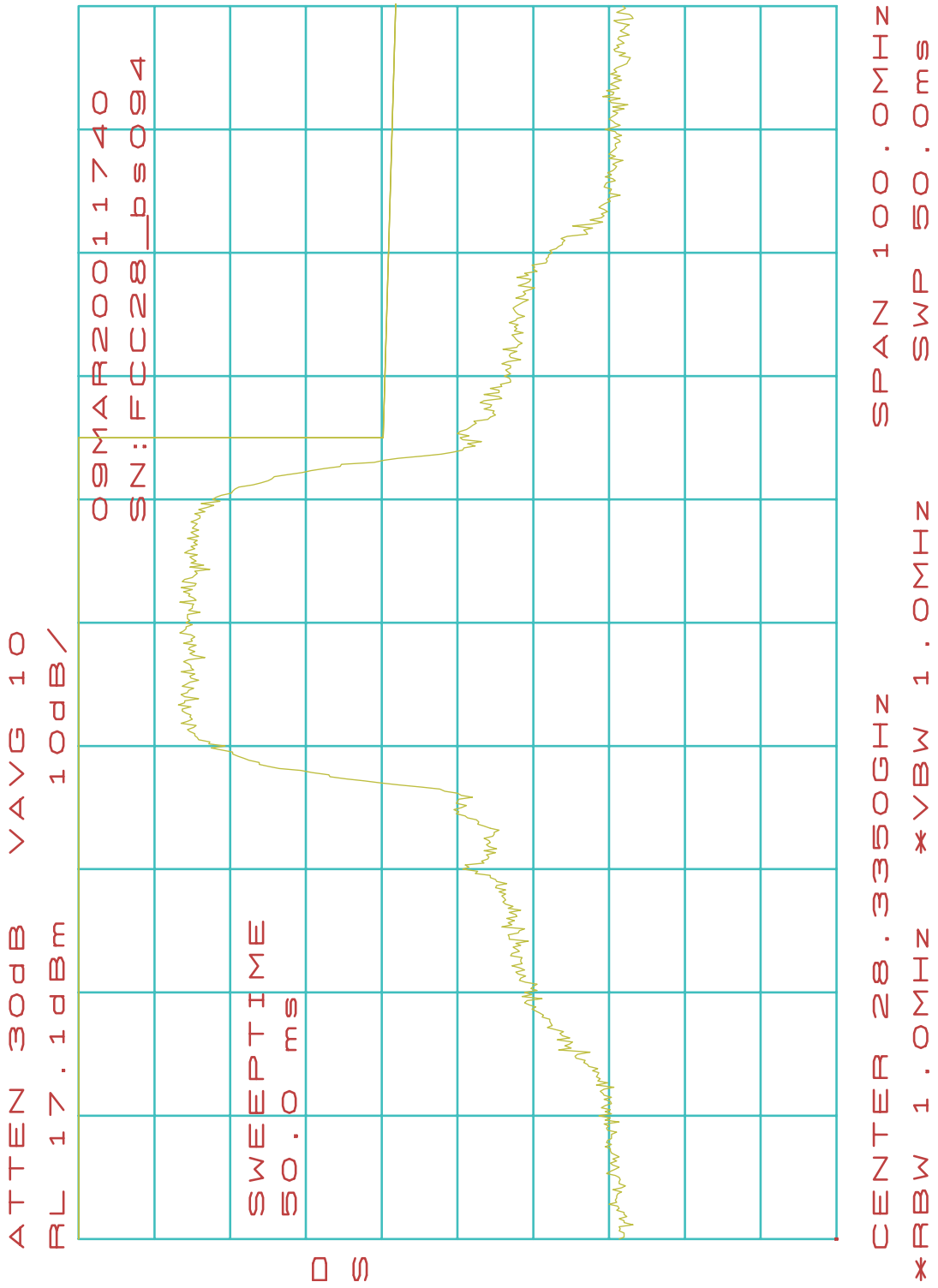
64-QAM:



BS094

Spectrum Mask Plots (BS-ODU) High Frequency: 28.335 GHZ

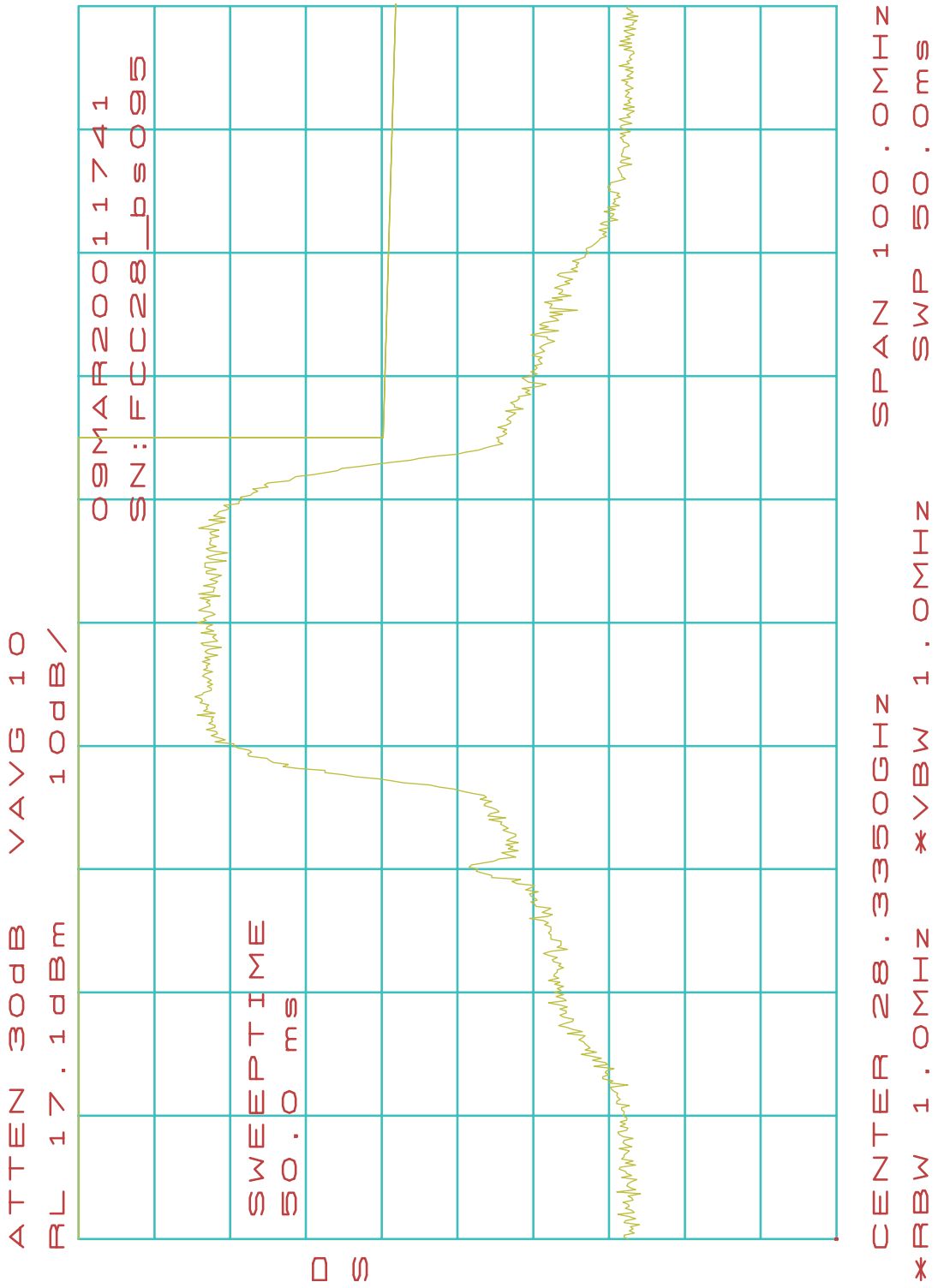
QPSK:



BS095

Spectrum Mask Plots (BS-ODU) High Frequency: 28.335 GHZ

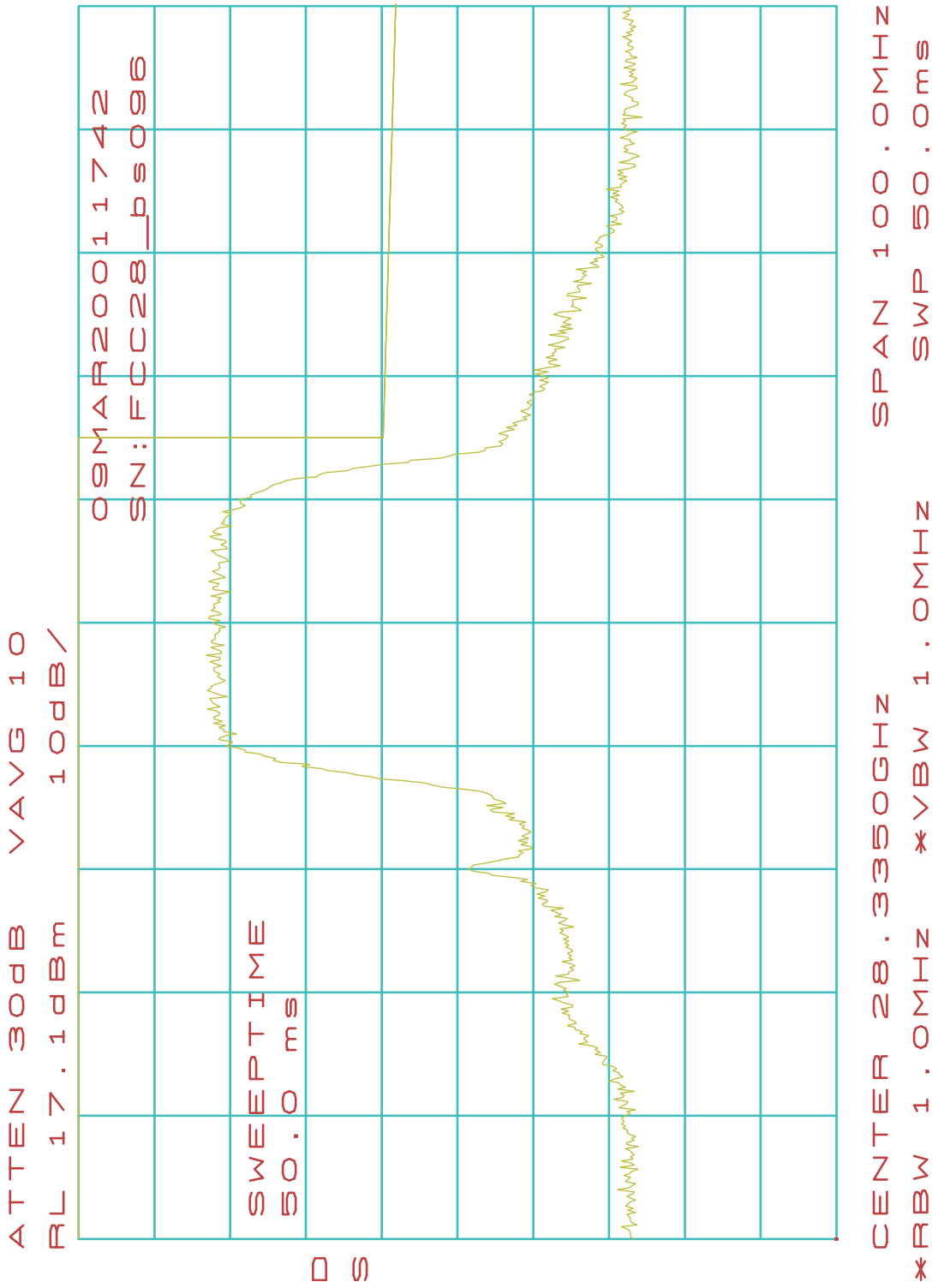
16-QAM:



BS096

Spectrum Mask Plots (BS-ODU) High Frequency: 28.335 GHZ

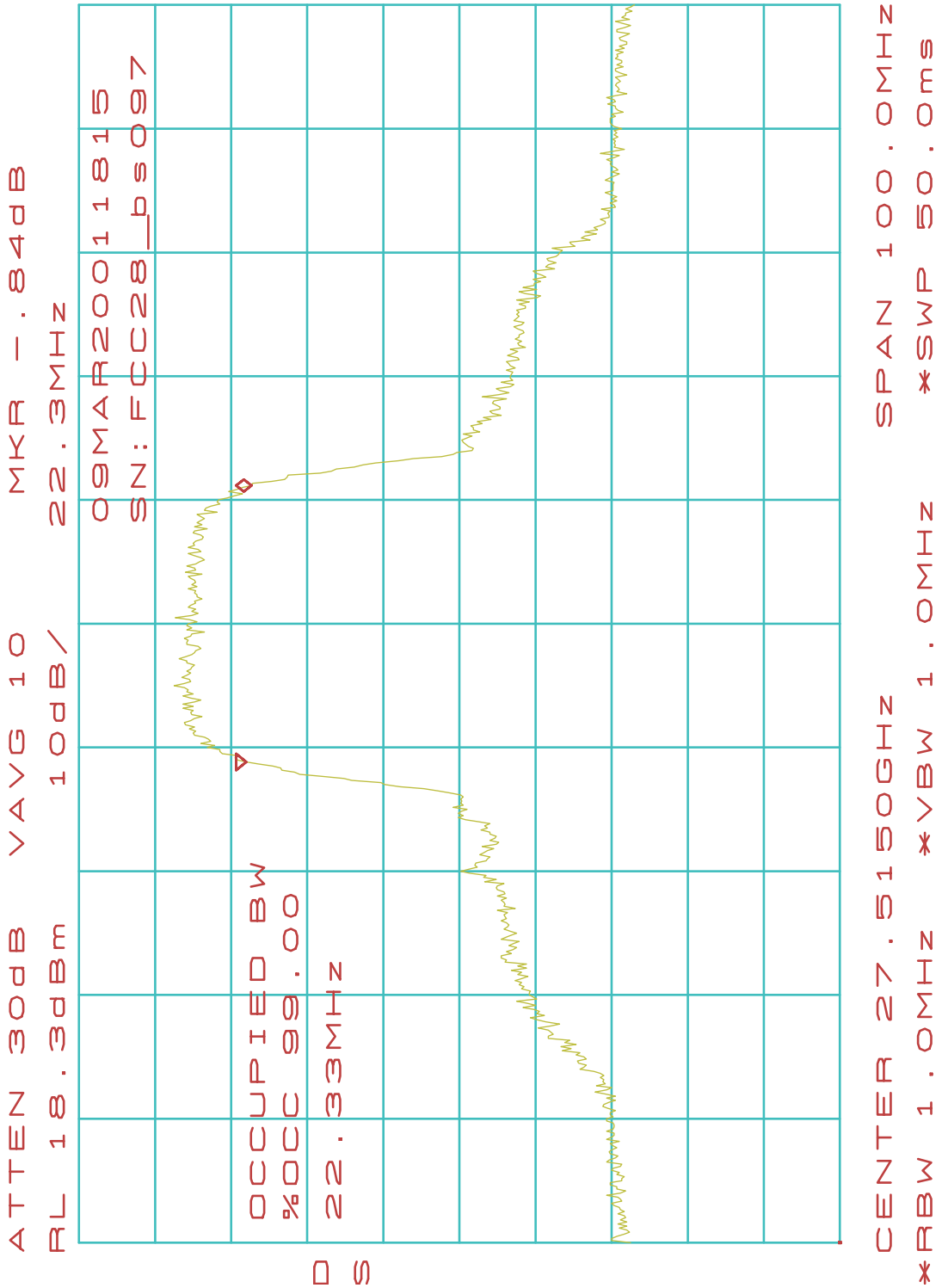
64-QAM:



BS097

Table Of Occupied Bandwidth Results (BS-ODU)

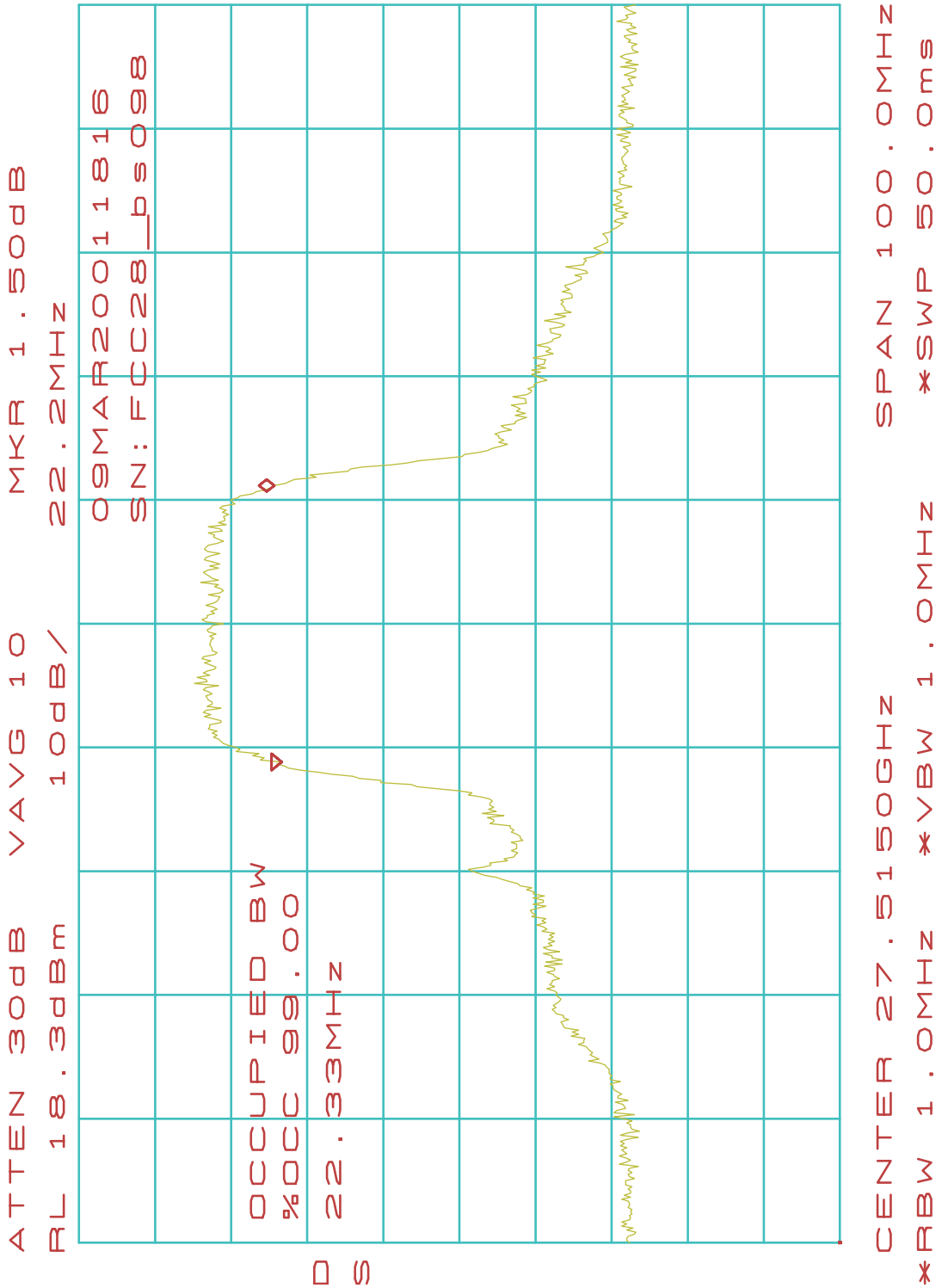
QPSK Low Band:



BS098

Table Of Occupied Bandwidth Results (BS-ODU)

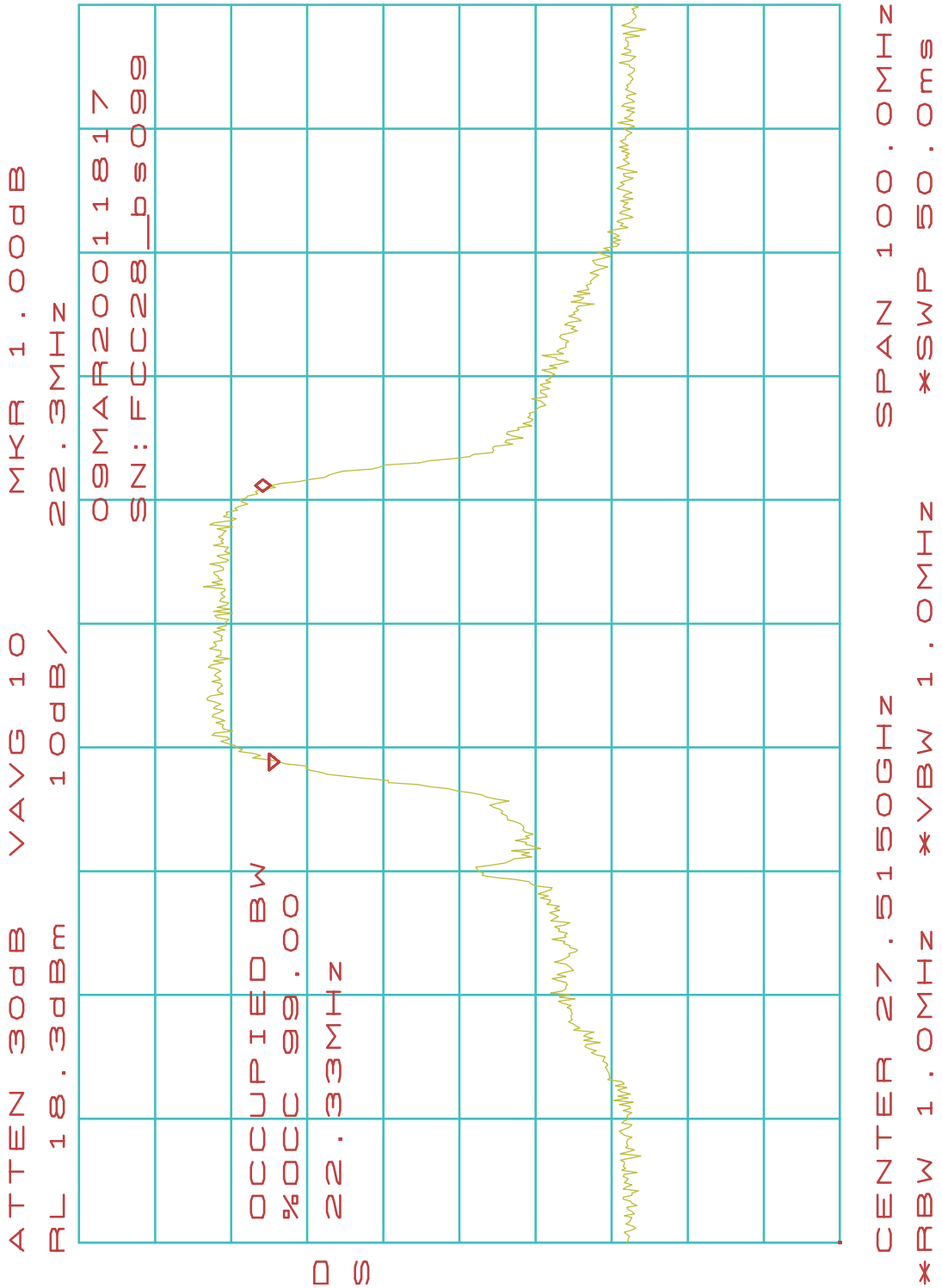
16-QAM Low Band:



BS099

Table Of Occupied Bandwidth Results (BS-ODU)

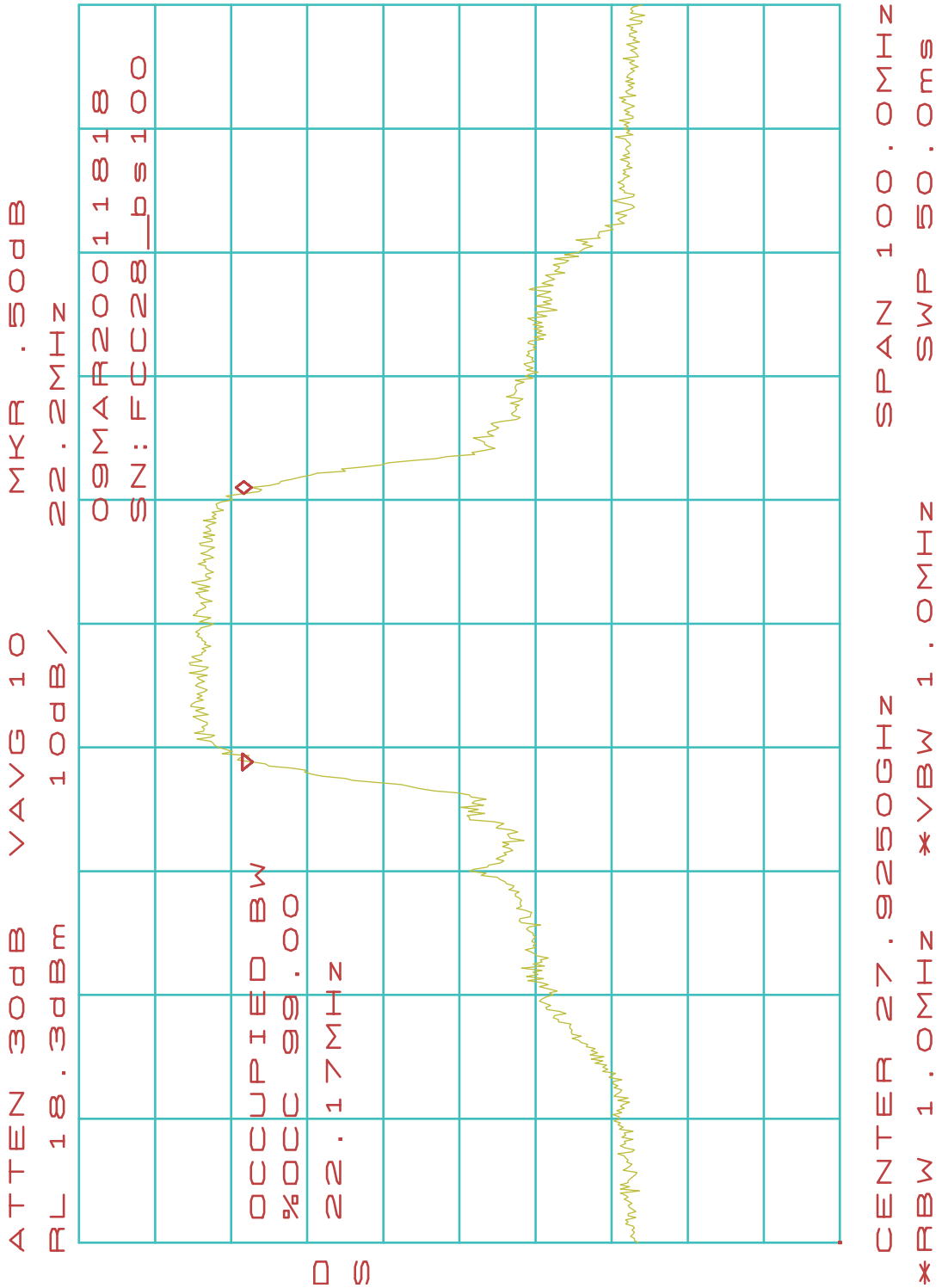
64-QAM Low Band:



BS100

Table Of Occupied Bandwidth Results (BS-ODU)

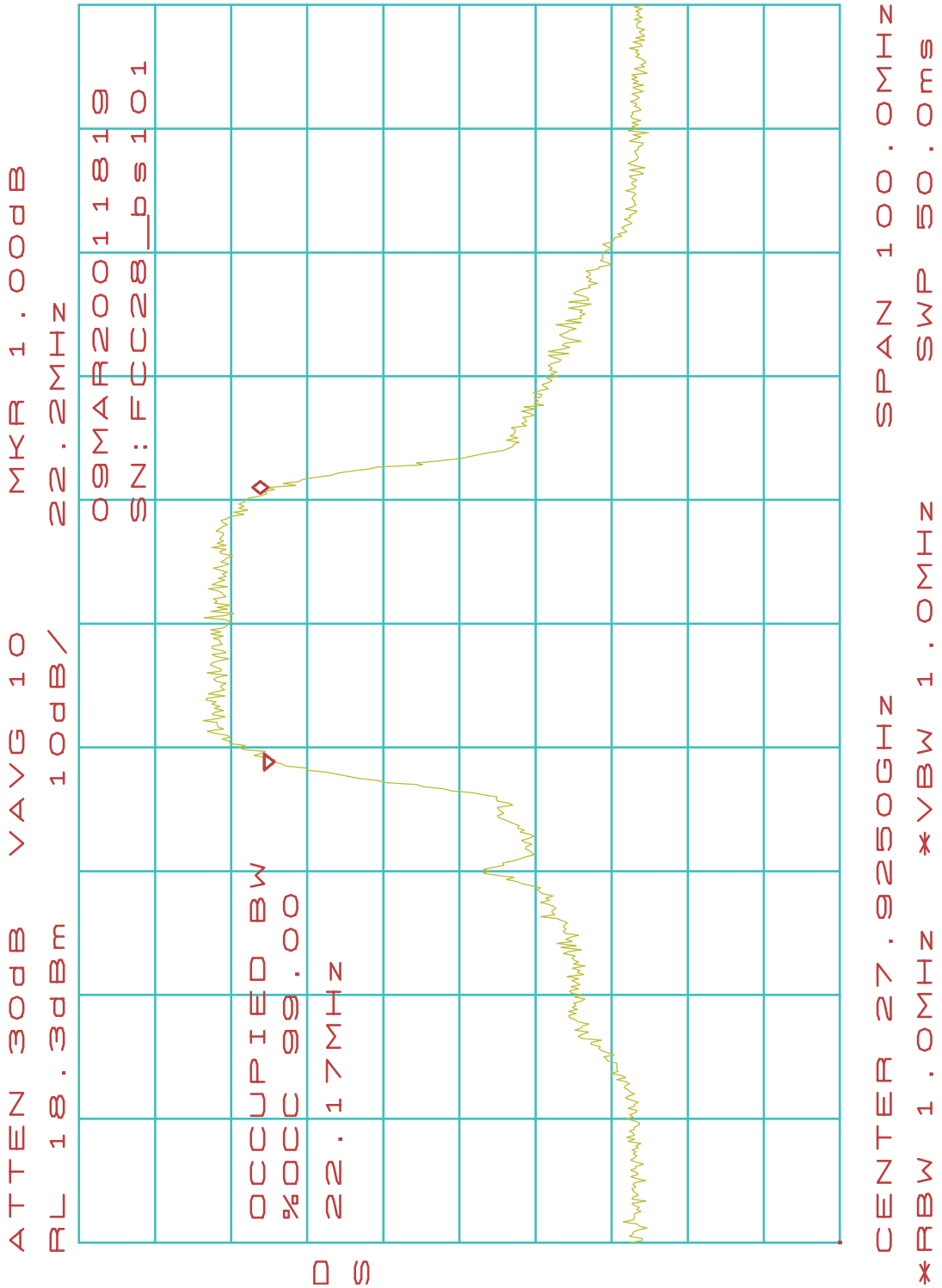
QPSK Mid Band:



BS101

Table Of Occupied Bandwidth Results (BS-ODU)

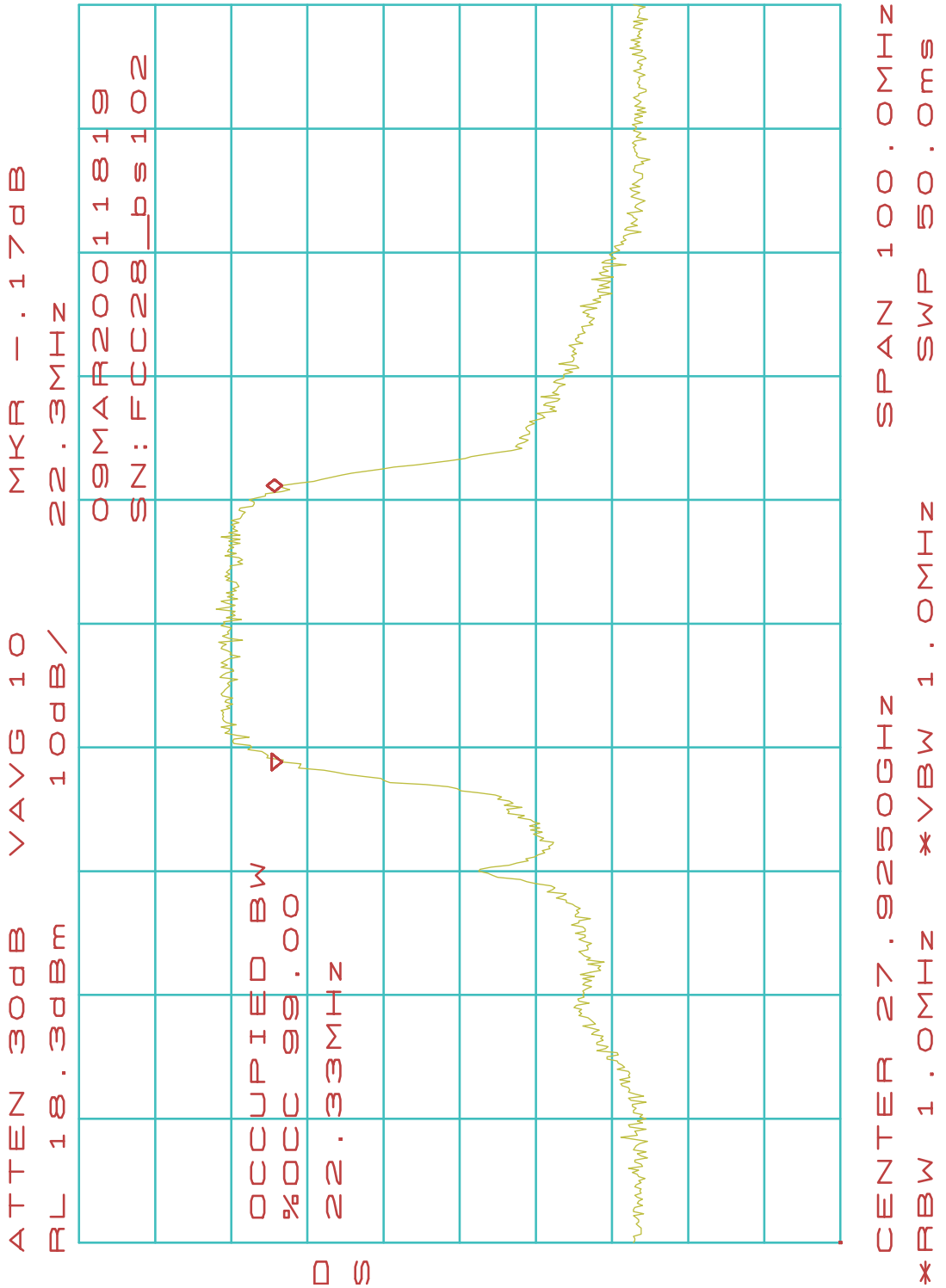
16-QAM Mid Band:



BS102

Table Of Occupied Bandwidth Results (BS-ODU)

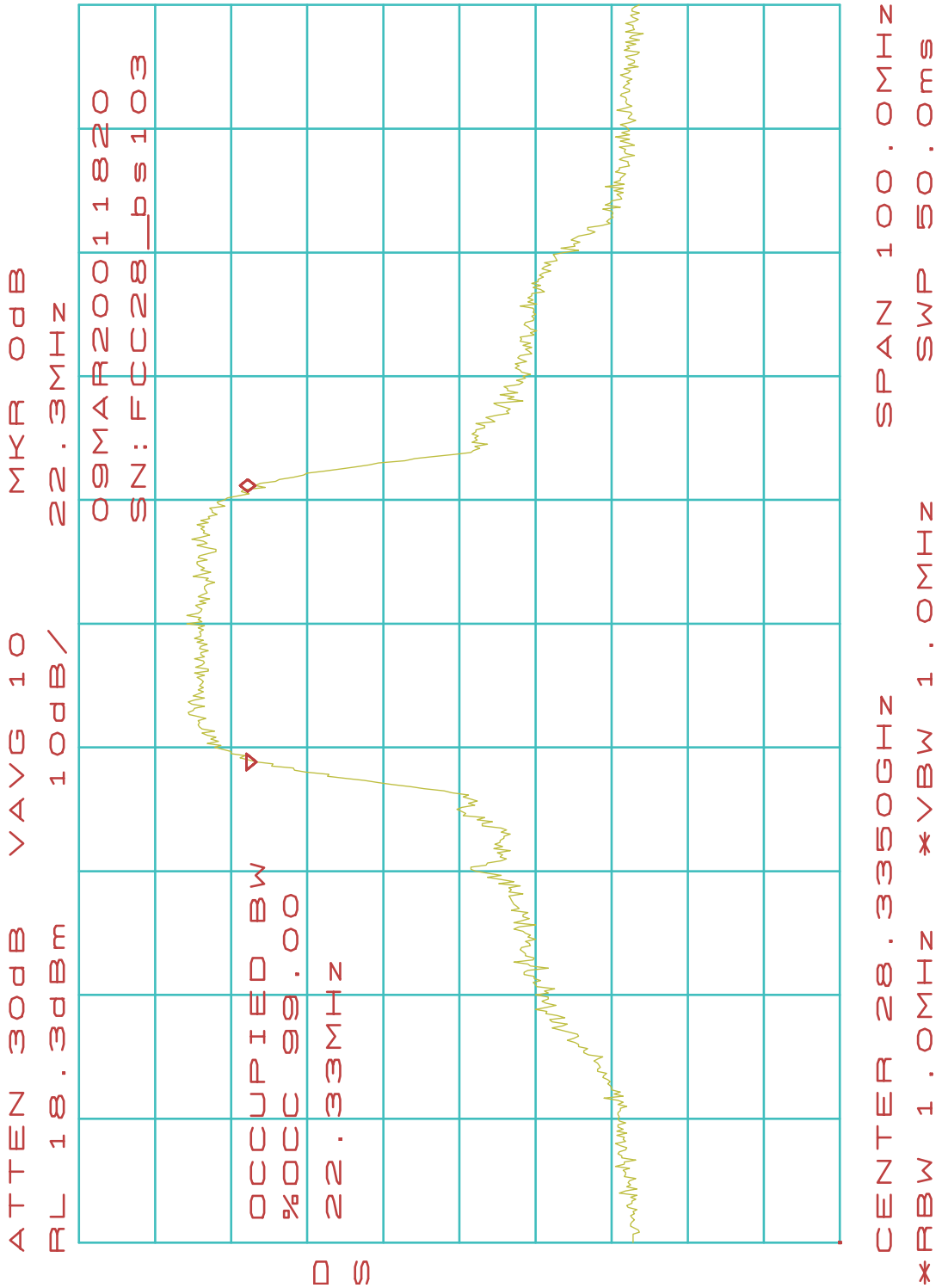
64-QAM Mid Band:



BS103

Table Of Occupied Bandwidth Results (BS-ODU)

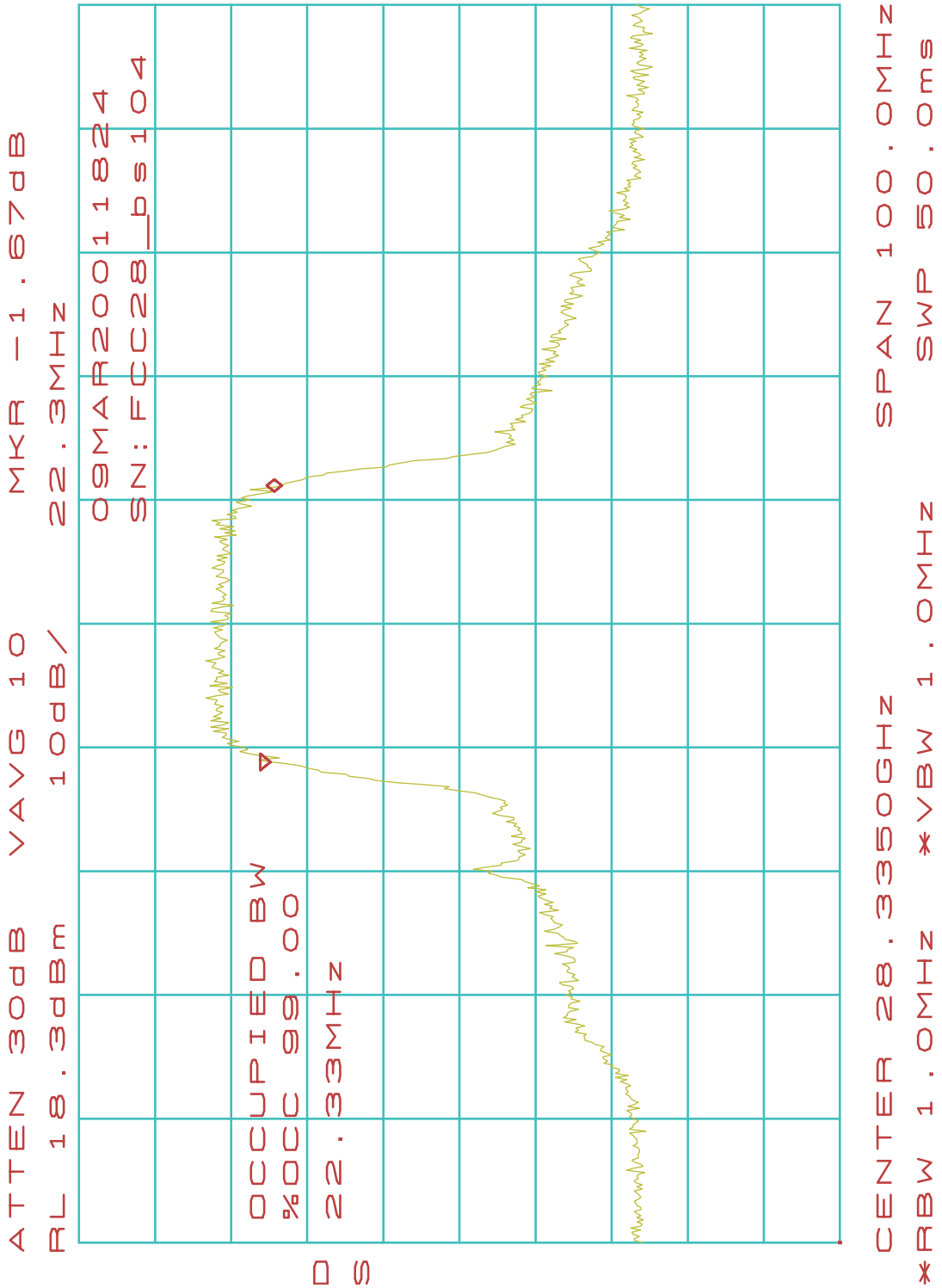
QPSK High Band:



BS104

Table Of Occupied Bandwidth Results (BS-ODU)

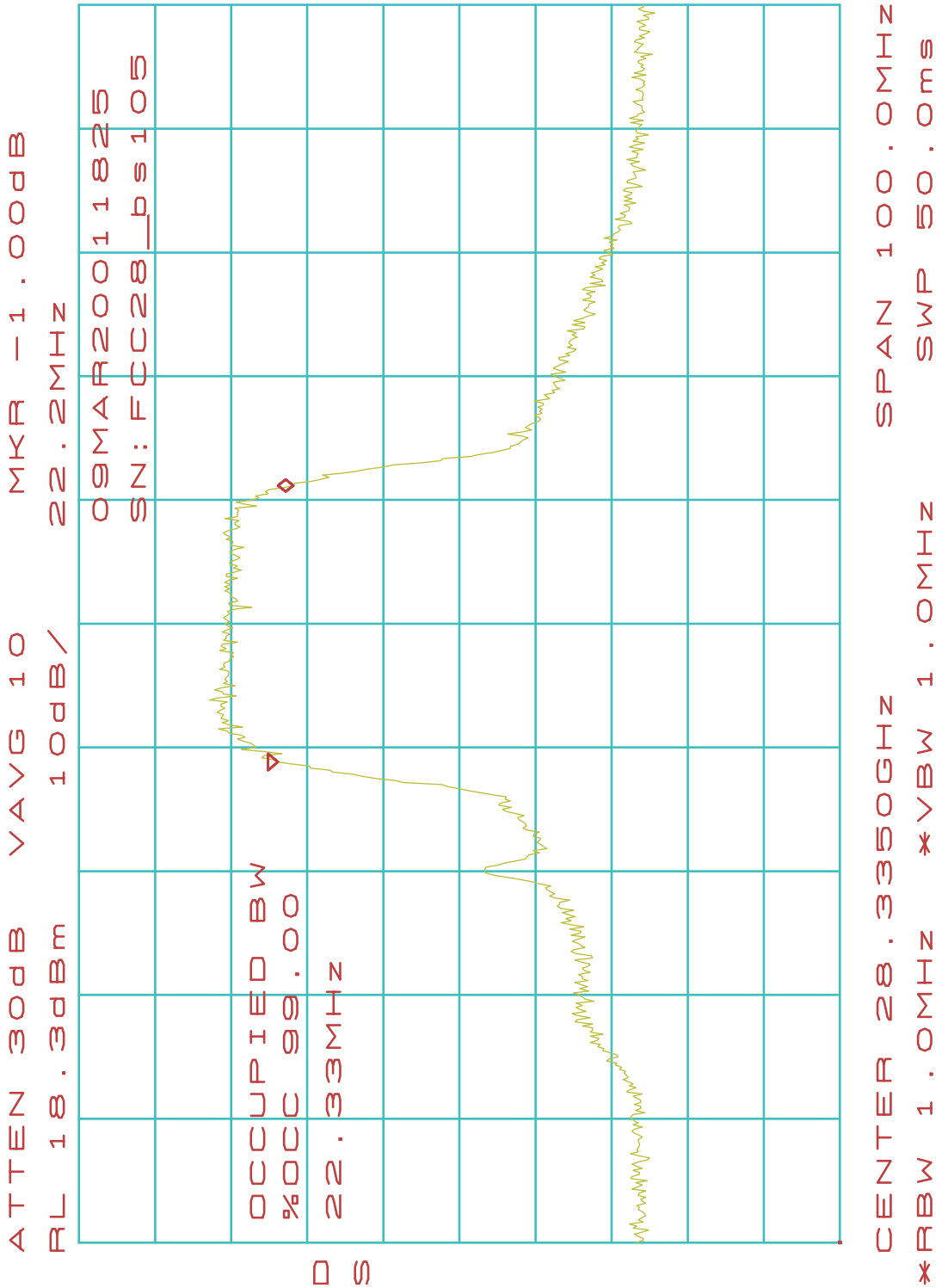
16-QAM High Band:



BS105

Table Of Occupied Bandwidth Results (BS-ODU)

64-QAM High Band:

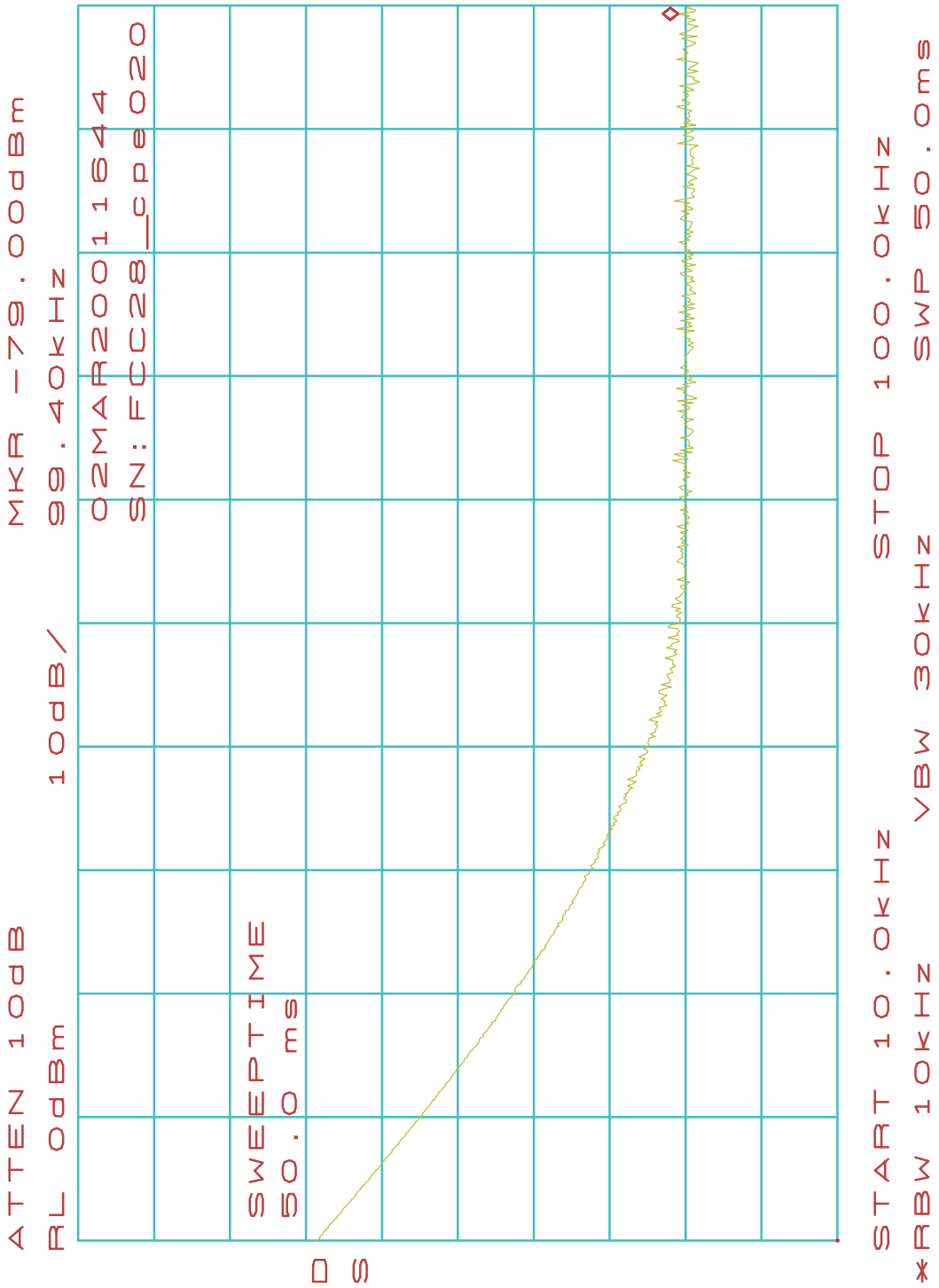


CPE020

Spurious Emission Plots (CPE-ODU)

10 kHz-100 kHz

Highest Level Observed (dBm): -79.00

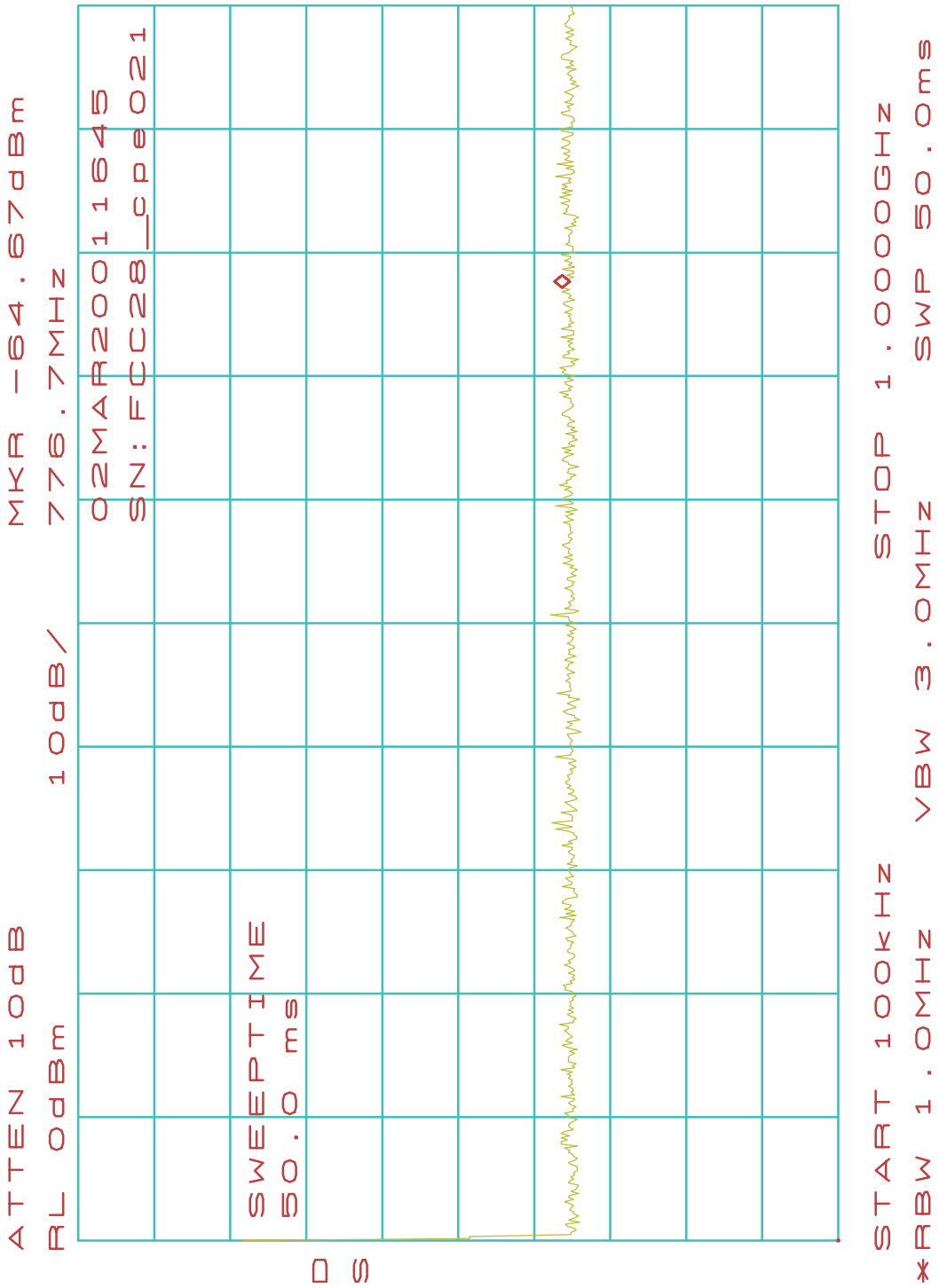


CPE021

Spurious Emission Plots (CPE-ODU)

100 kHz-1.0 MHz

Highest Level Observed (dBm): -64.67

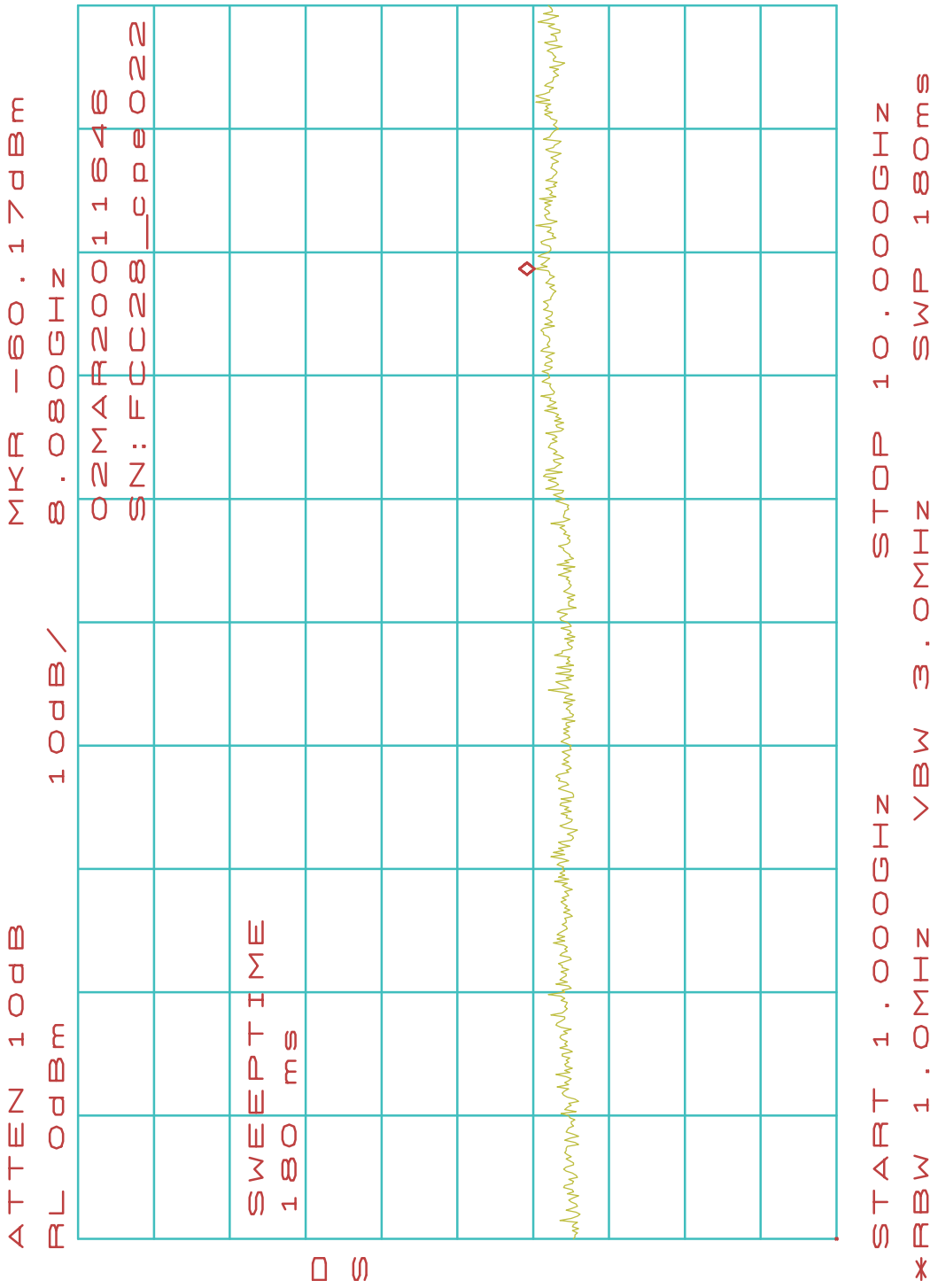


CPE022

Spurious Emission Plots (CPE-ODU)

1.0-10.0 GHz

Highest Level Observed (dBm): -60.17

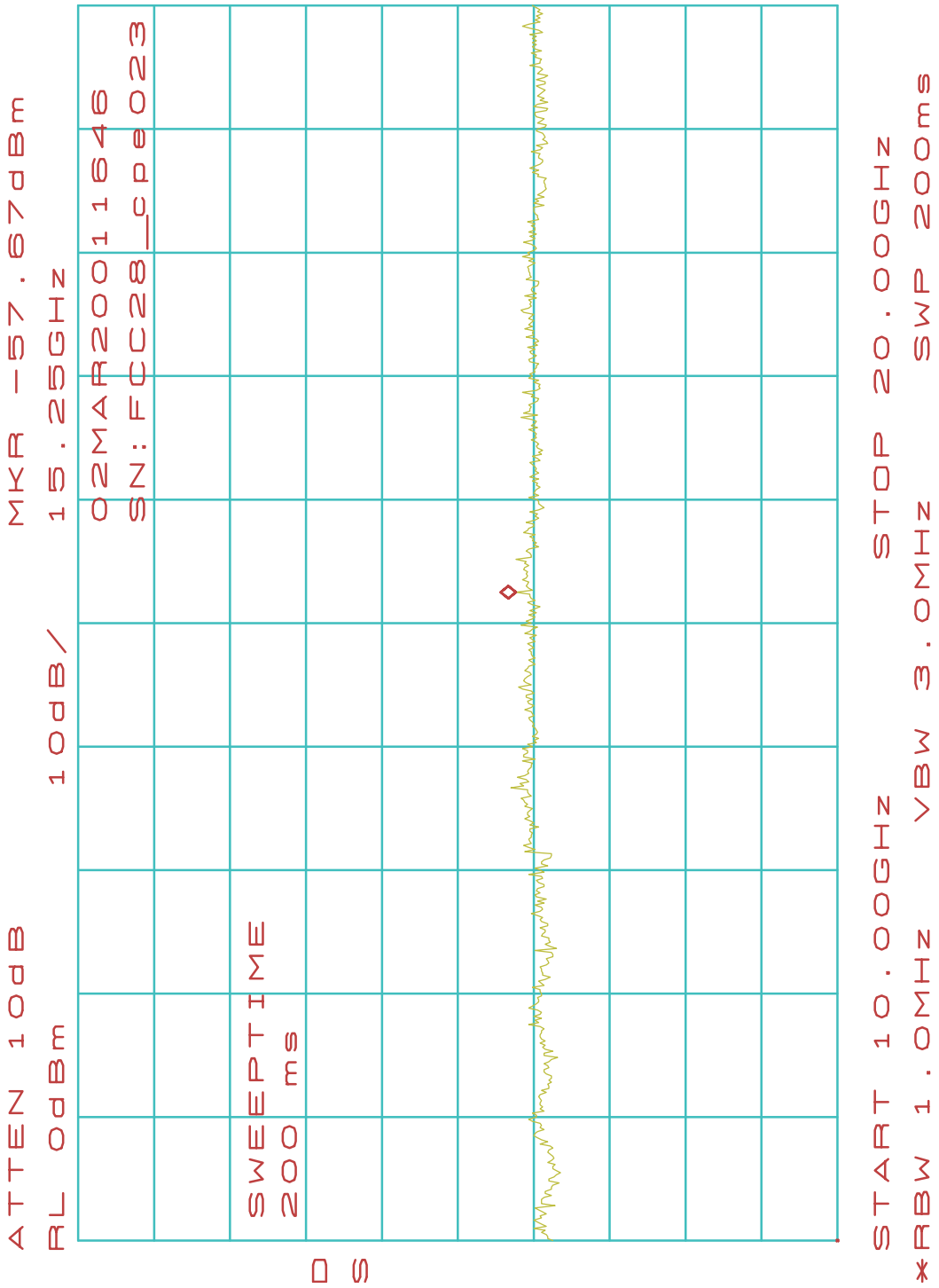


CPE023

Spurious Emission Plots (CPE-ODU)

10.0-20.0 GHz

Highest Level Observed (dBm): -57.67

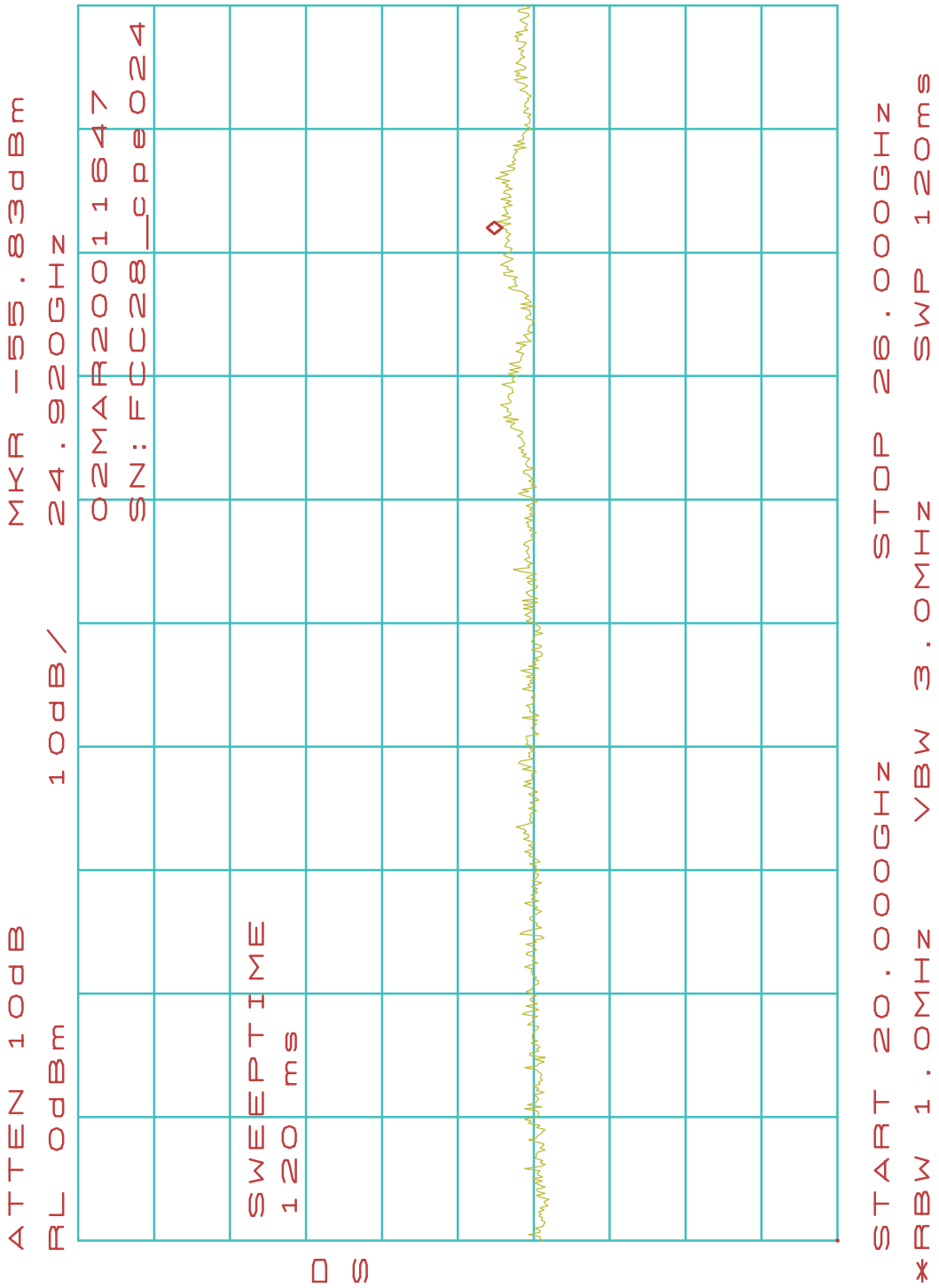


CPE024

Spurious Emission Plots (CPE-ODU)

20.0-26.0 GHz

Highest Level Observed (dBm): -55.83

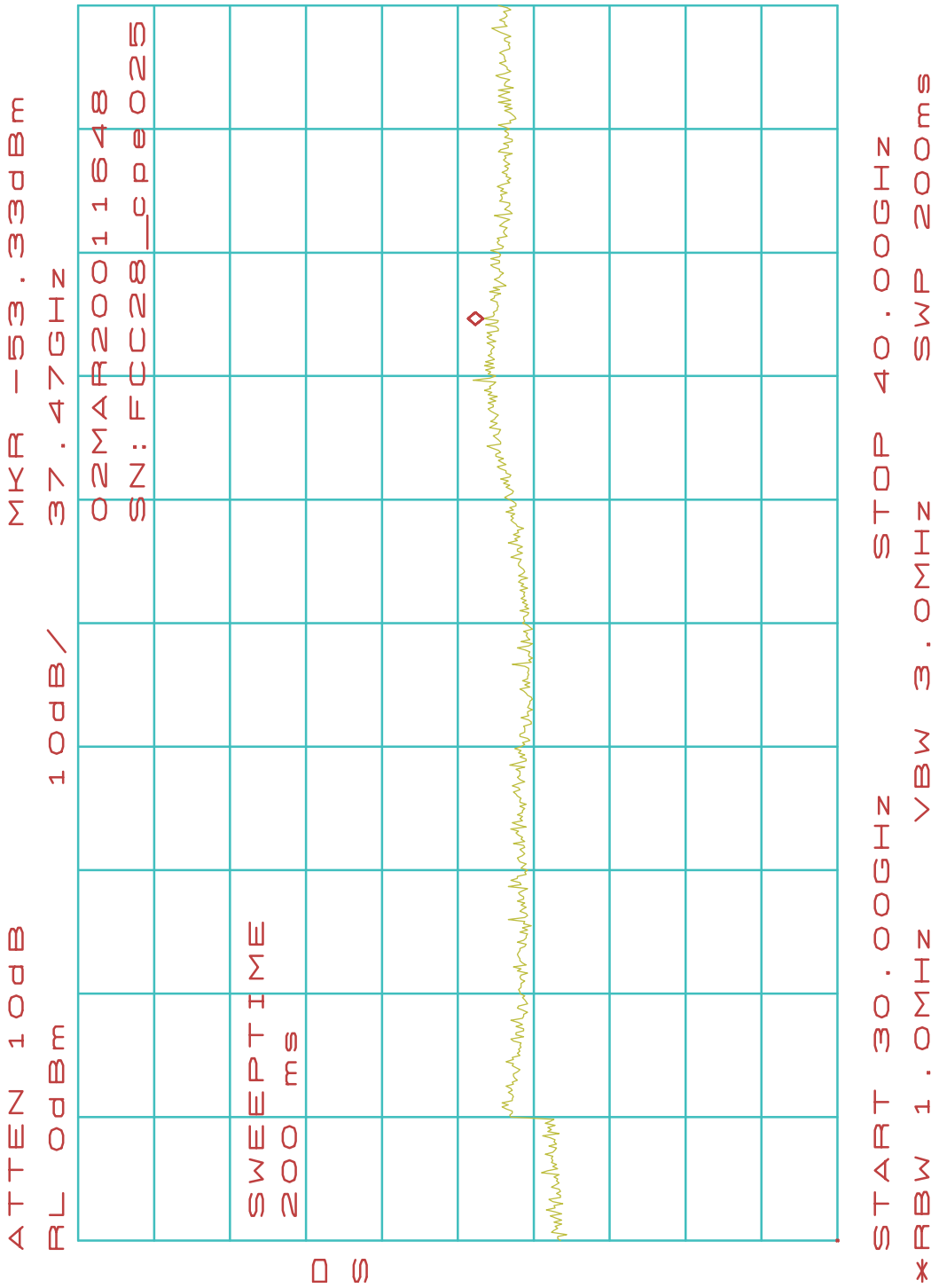


CPE025

Spurious Emission Plots (CPE-ODU)

30.0-40.0 GHz

Highest Level Observed (dBm): -53.33

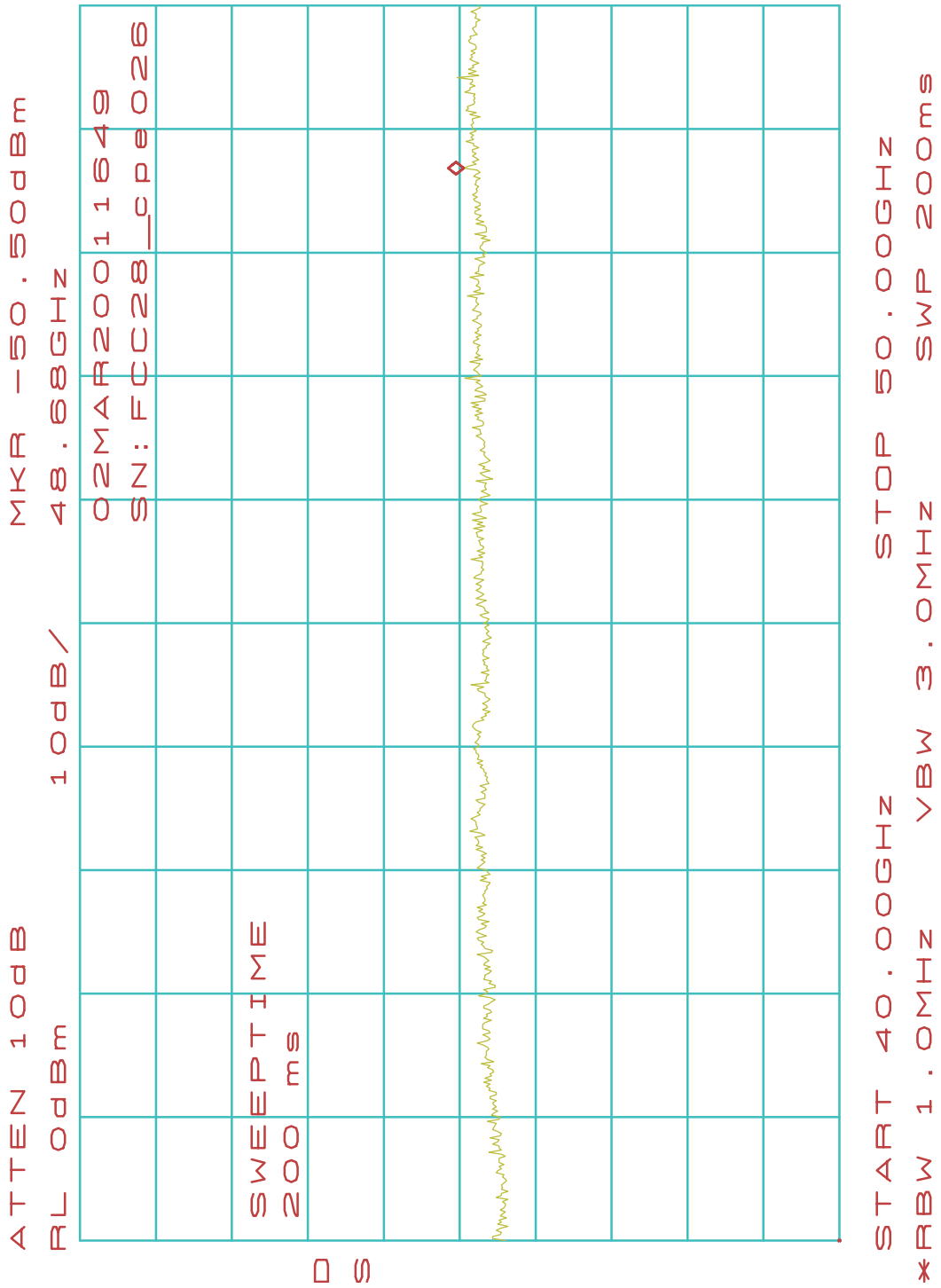


CPE026

Spurious Emission Plots (CPE-ODU)

40.0-50.0 GHz

Highest Level Observed (dBm): -50.83

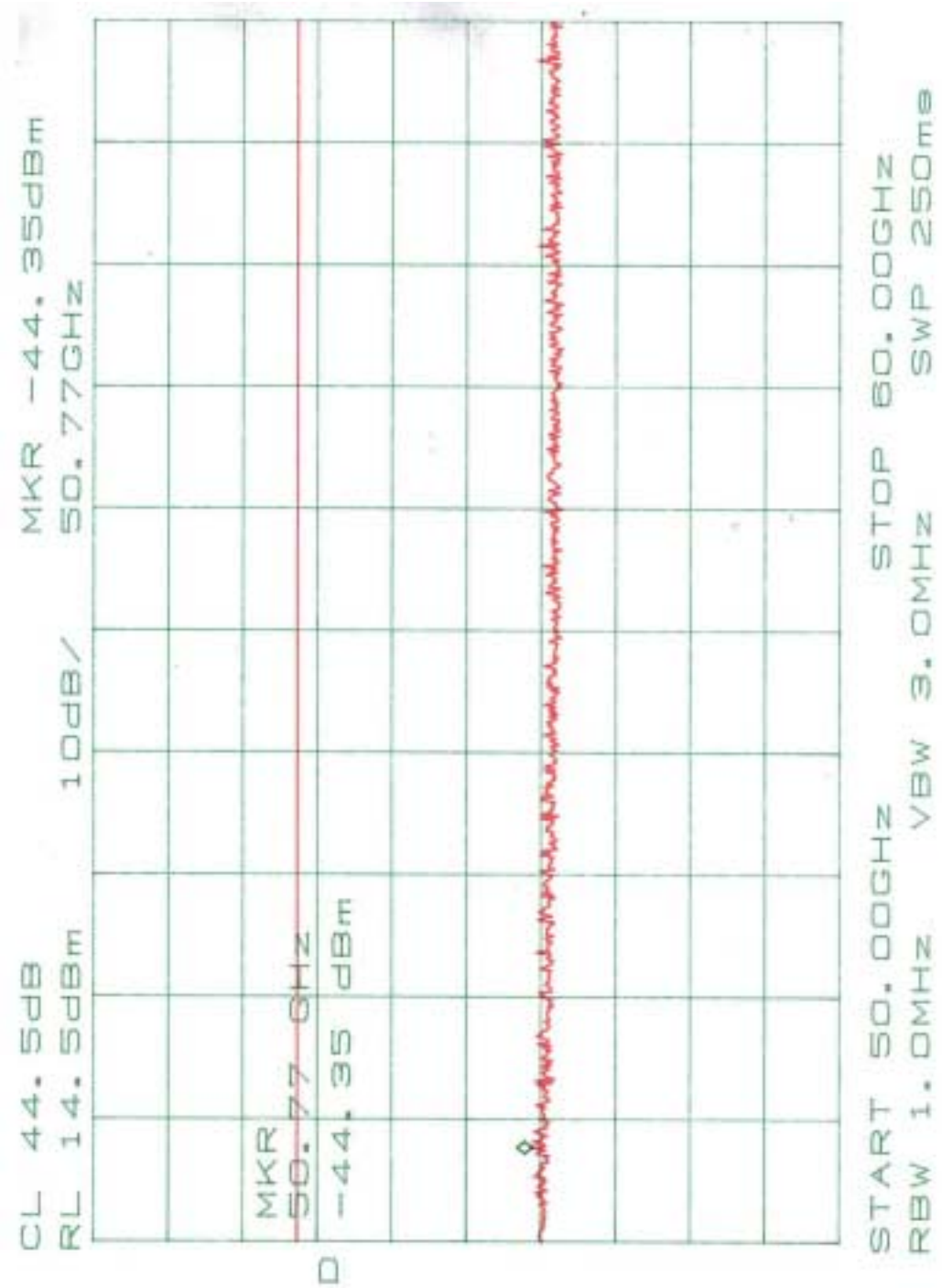


CPE027

Spurious Emission Plots (CPE-ODU)

50.0-60.0 GHz

Highest Level Observed (dBm): -44.35

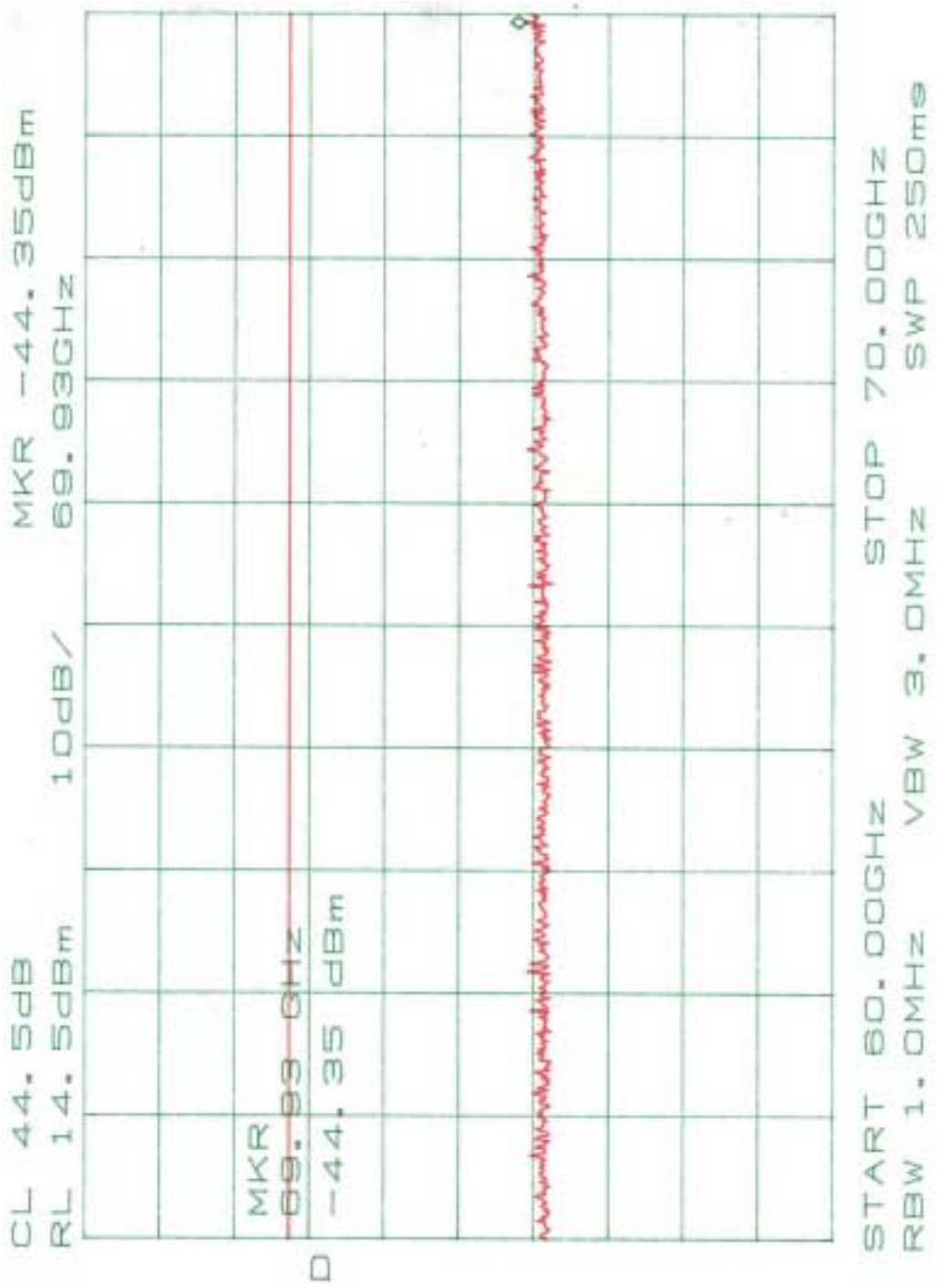


CPE028

Spurious Emission Plots (CPE-ODU)

60.0-70.0 GHz

Highest Level Observed (dBm): -44.35

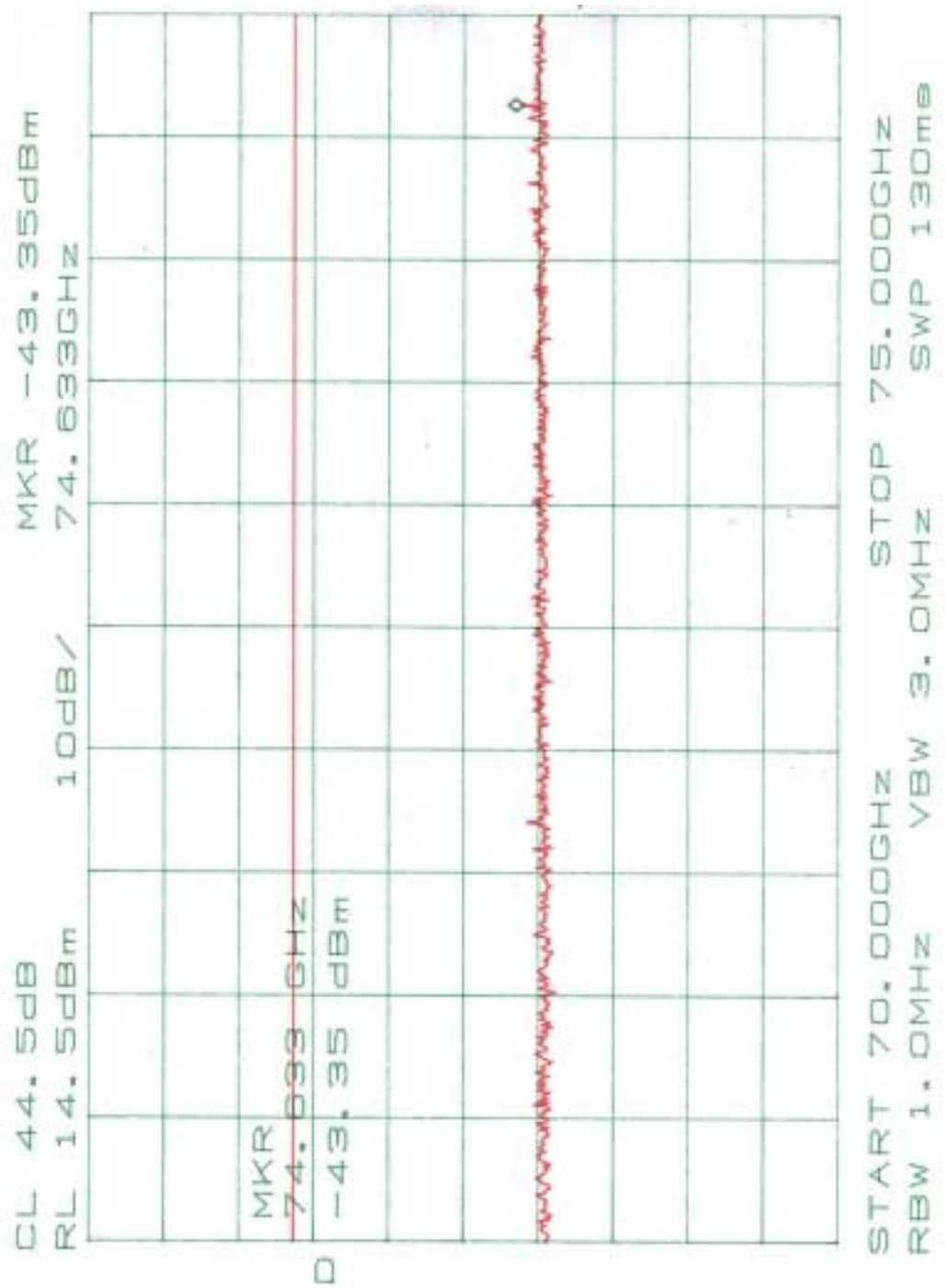


CPE029

Spurious Emission Plots (CPE-ODU)

70.0-75.0 GHz

Highest Level Observed (dBm): -43.35

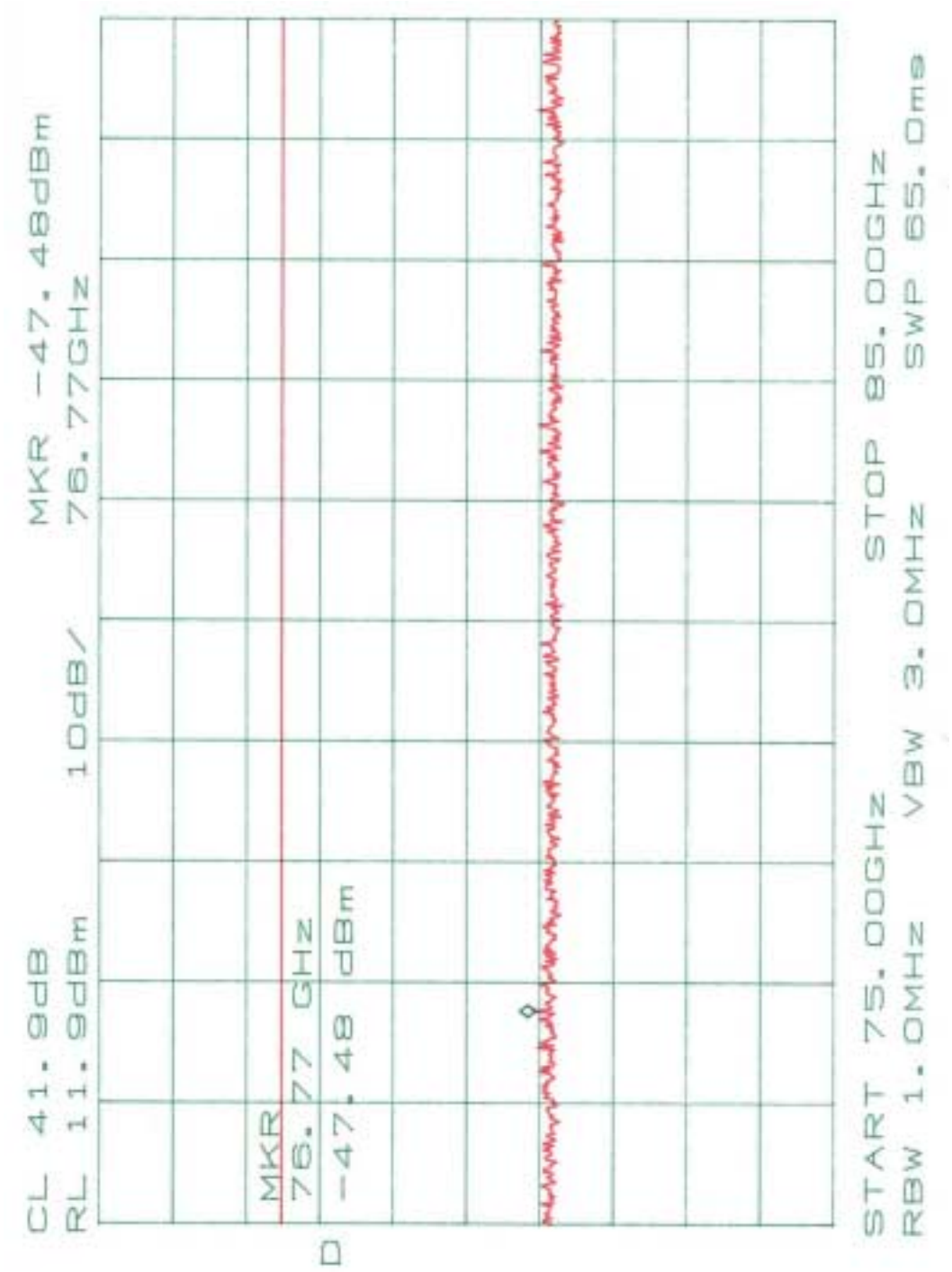


CPE030

Spurious Emission Plots (CPE-ODU)

75.0-85.0 GHz

Highest Level Observed (dBm): -47.48

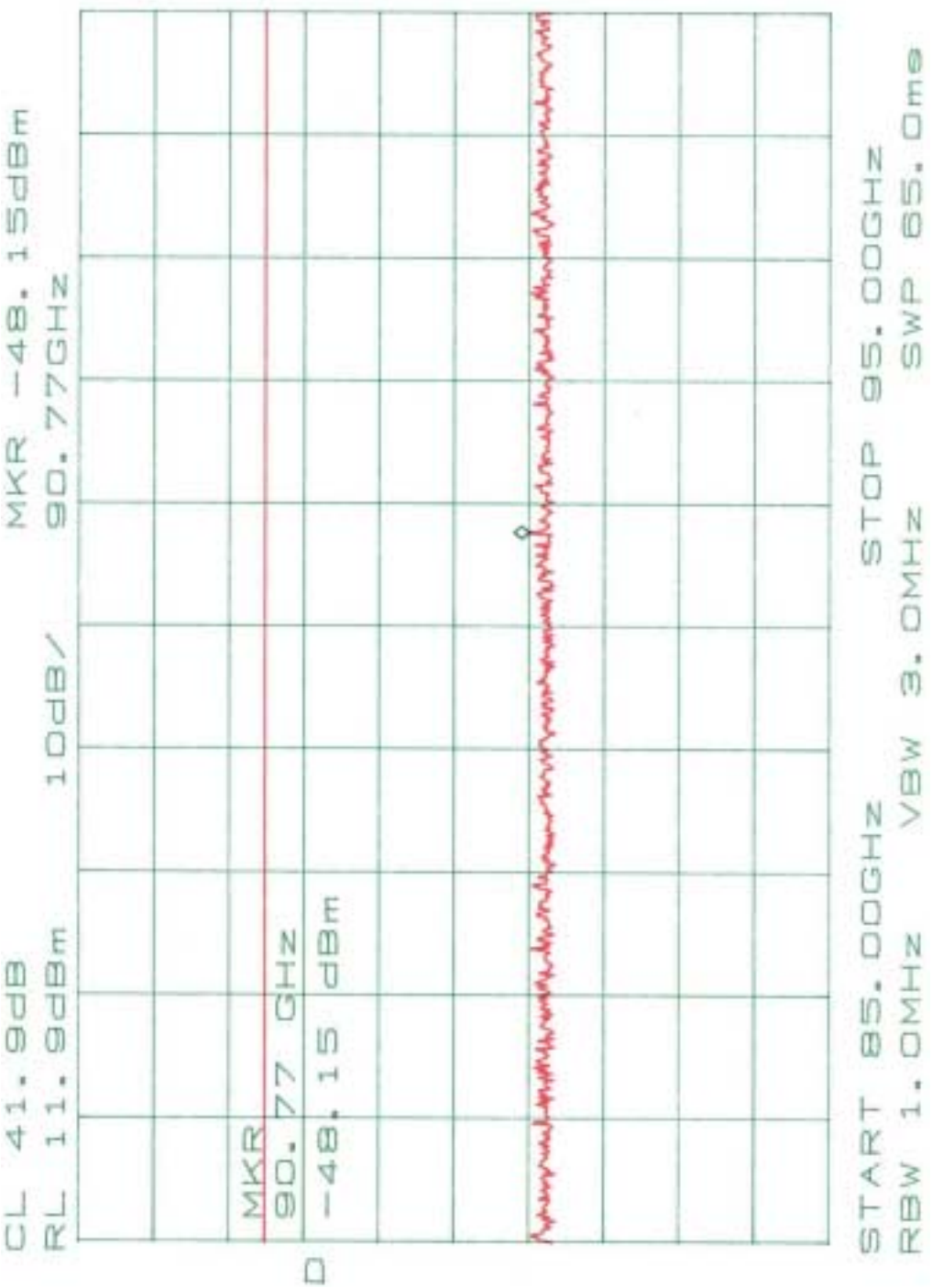


CPE031

Spurious Emission Plots (CPE-ODU)

85.0-95.0 GHz

Highest Level Observed (dBm): -48.15

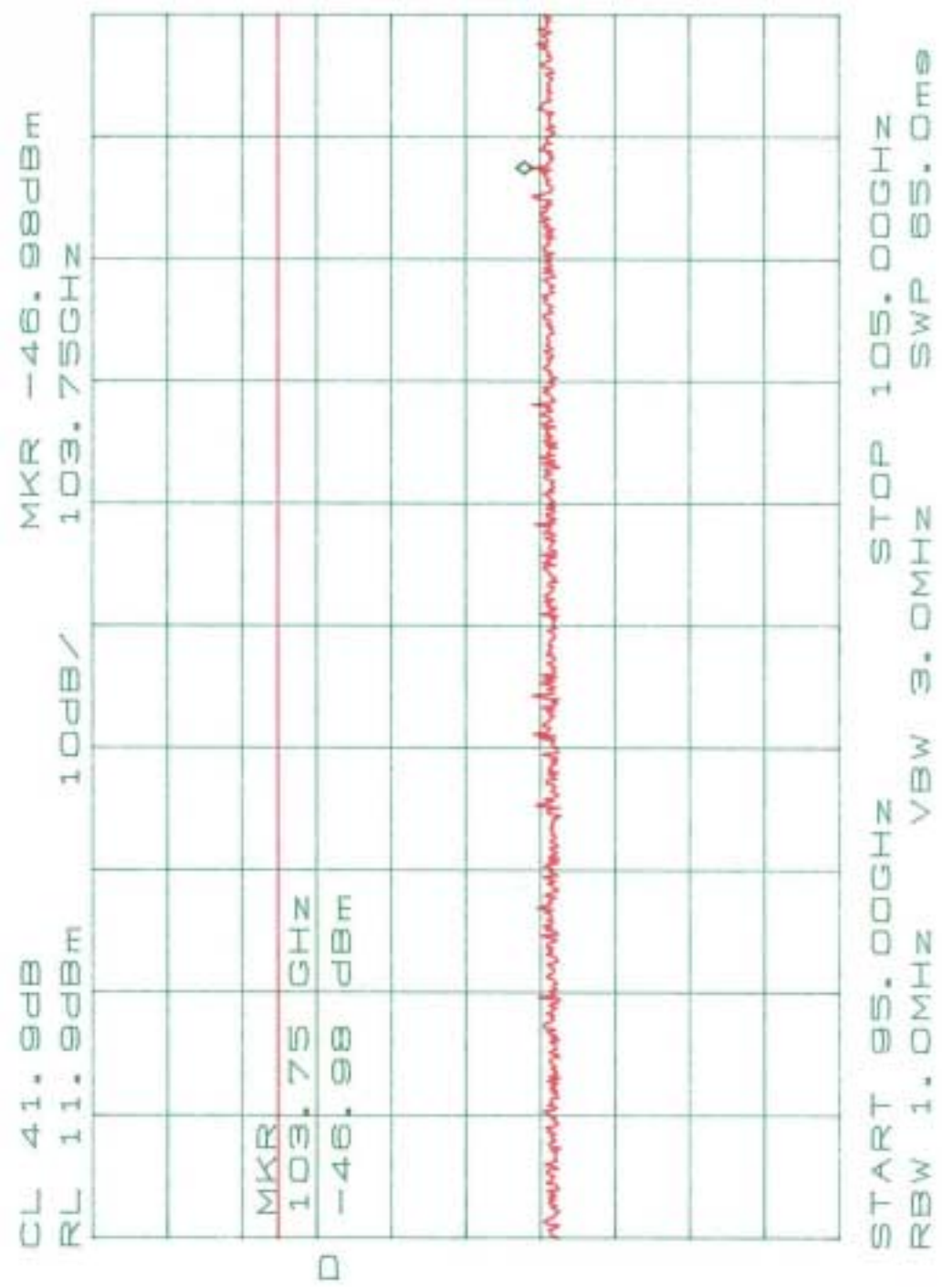


CPE032

Spurious Emission Plots (CPE-ODU)

95.0-105.0 GHz

Highest Level Observed (dBm): -46.98

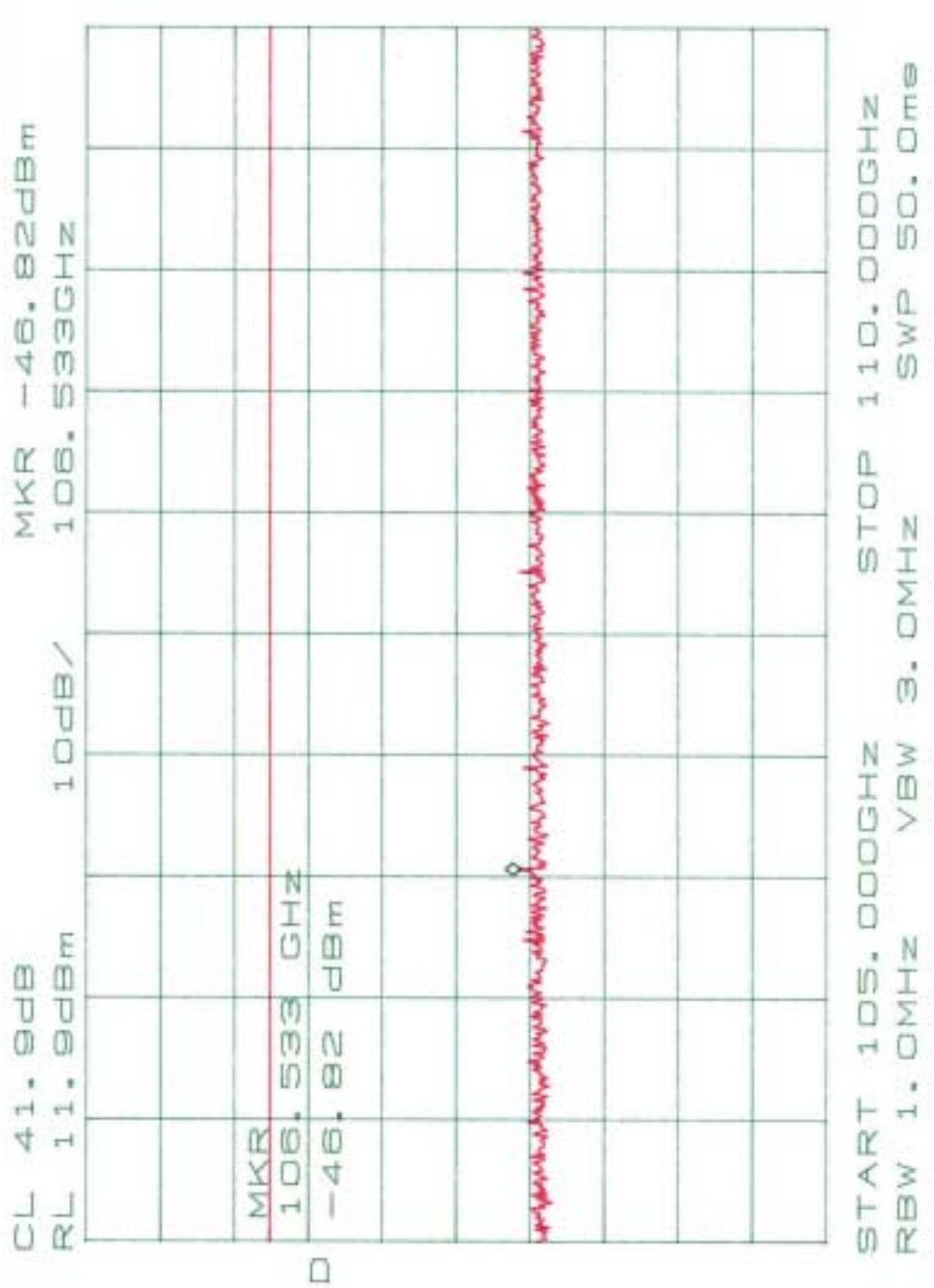


CPE033

Spurious Emission Plots (CPE-ODU)

105.0-110.0 GHz

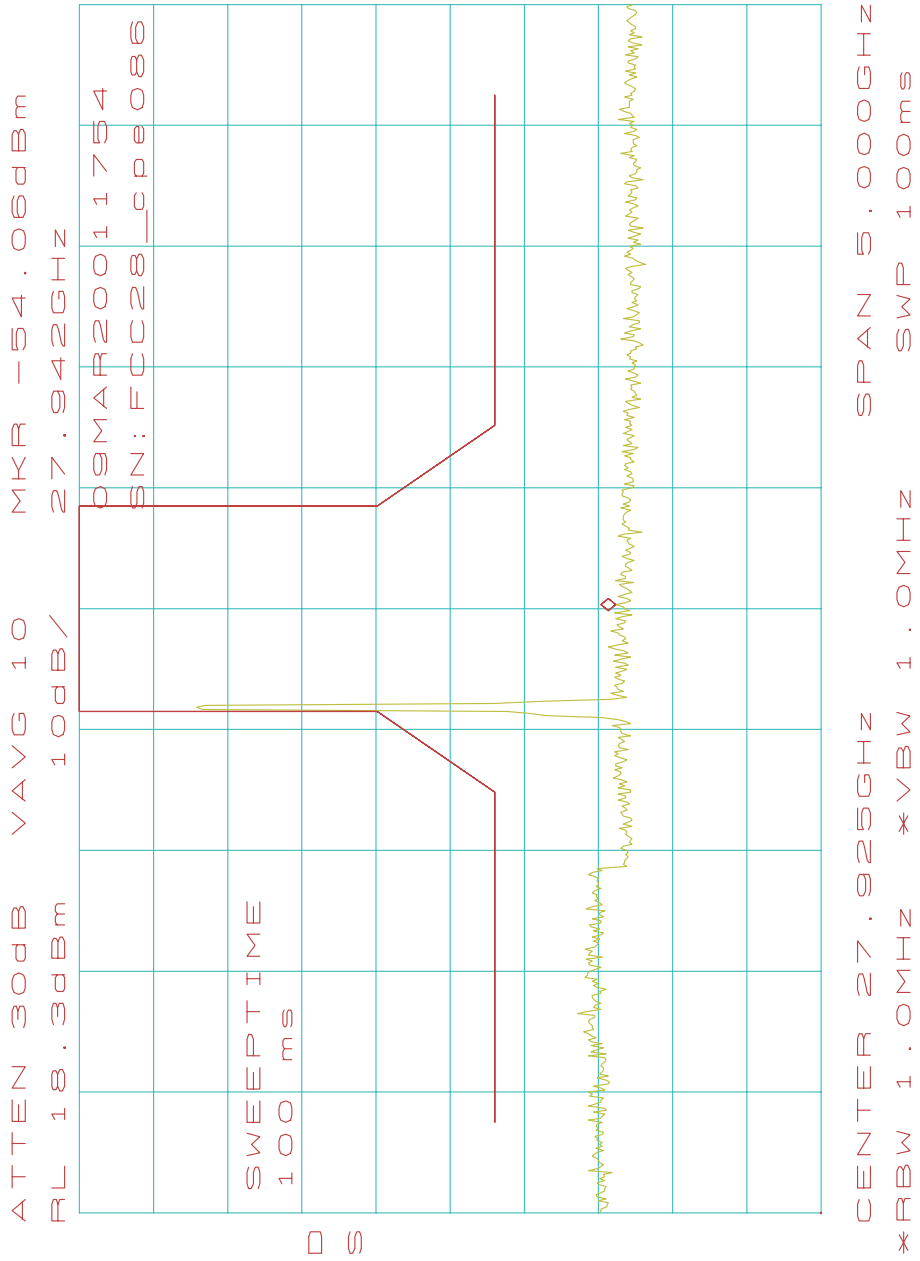
Highest Level Observed (dBm): -46.82



CPE086

Spectrum Mask Plots (CPE-ODU) Low Frequency: 27.515 GHZ

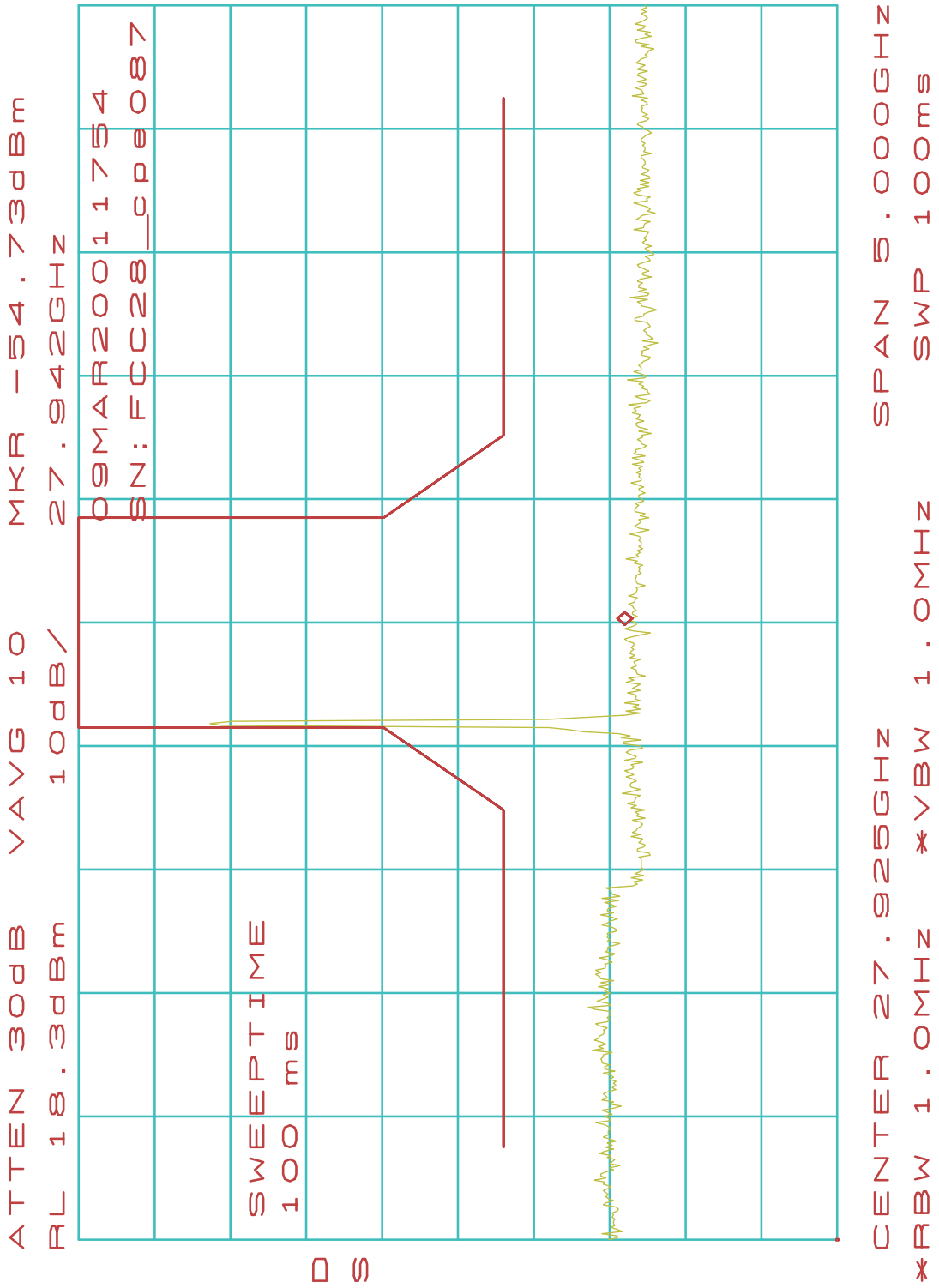
QPSK:



CPE087

Spectrum Mask Plots (CPE-ODU) Low Frequency: 27.515 GHZ

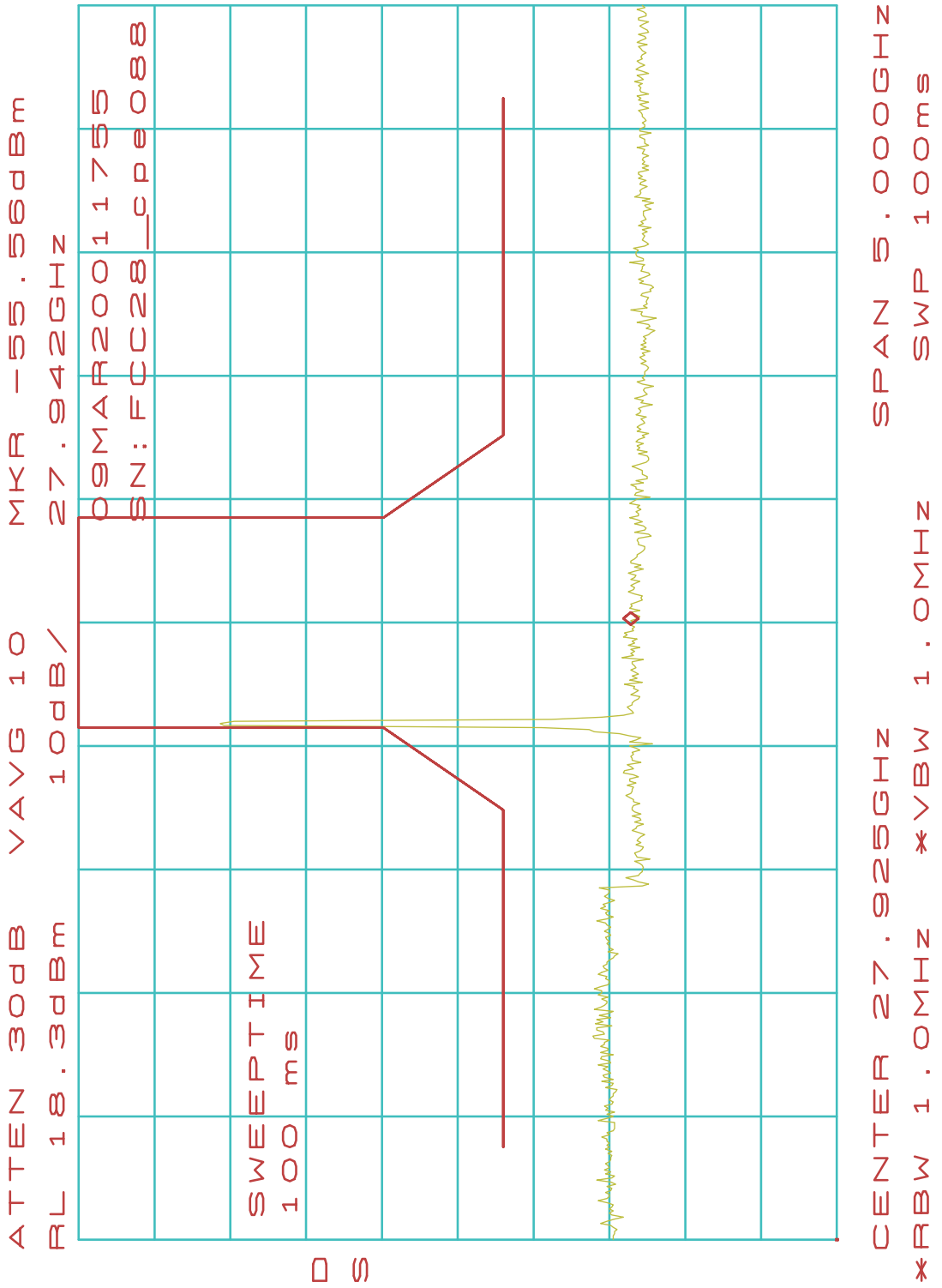
16-QAM:



CPE088

Spectrum Mask Plots (CPE-ODU) Low Frequency: 27.515 GHZ

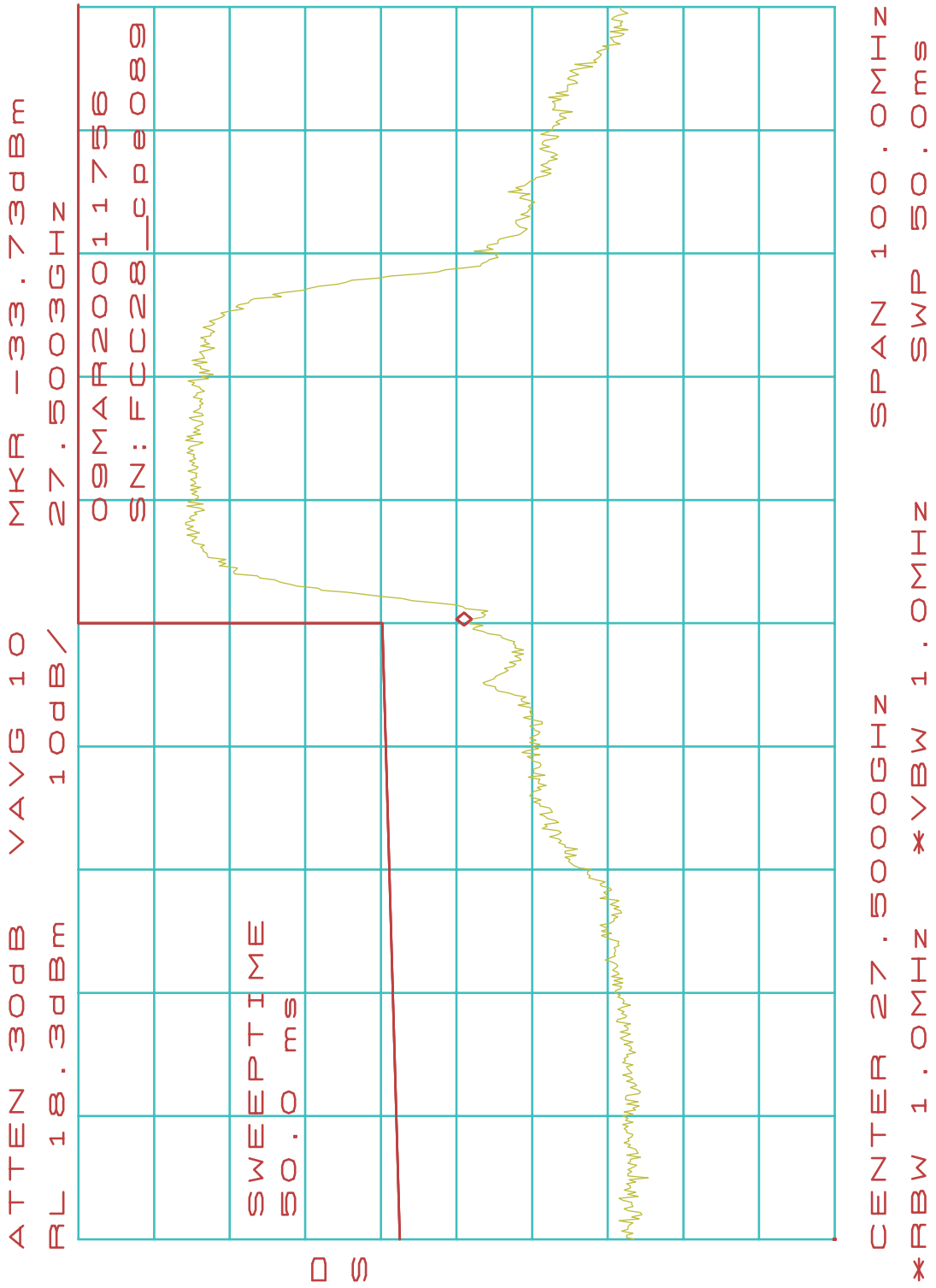
64-QAM:



CPE089

Spectrum Mask Plots (CPE-ODU) Low Frequency: 27.515 GHZ

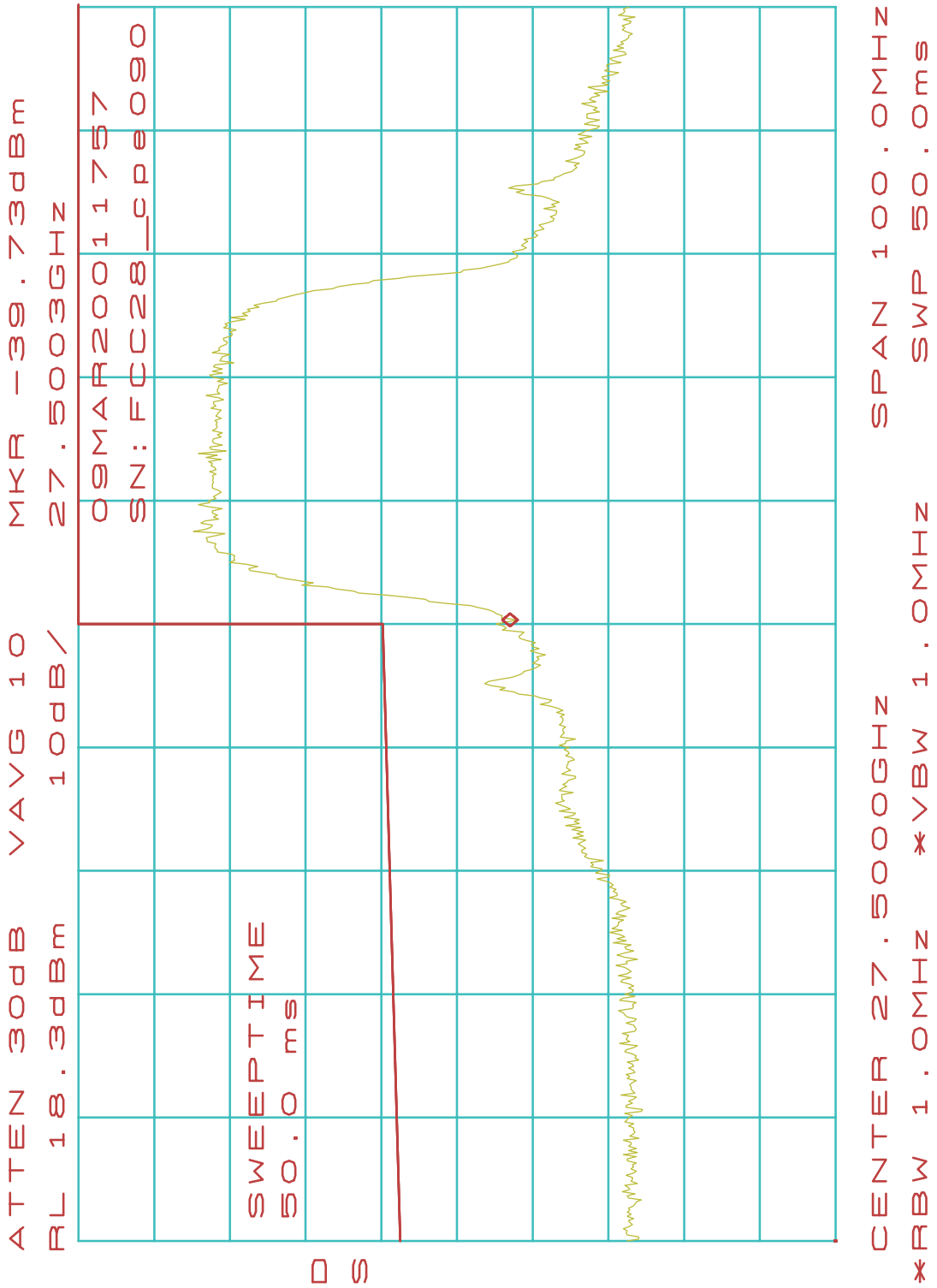
QPSK:



CPE090

Spectrum Mask Plots (CPE-ODU) Low Frequency: 27.515 GHZ

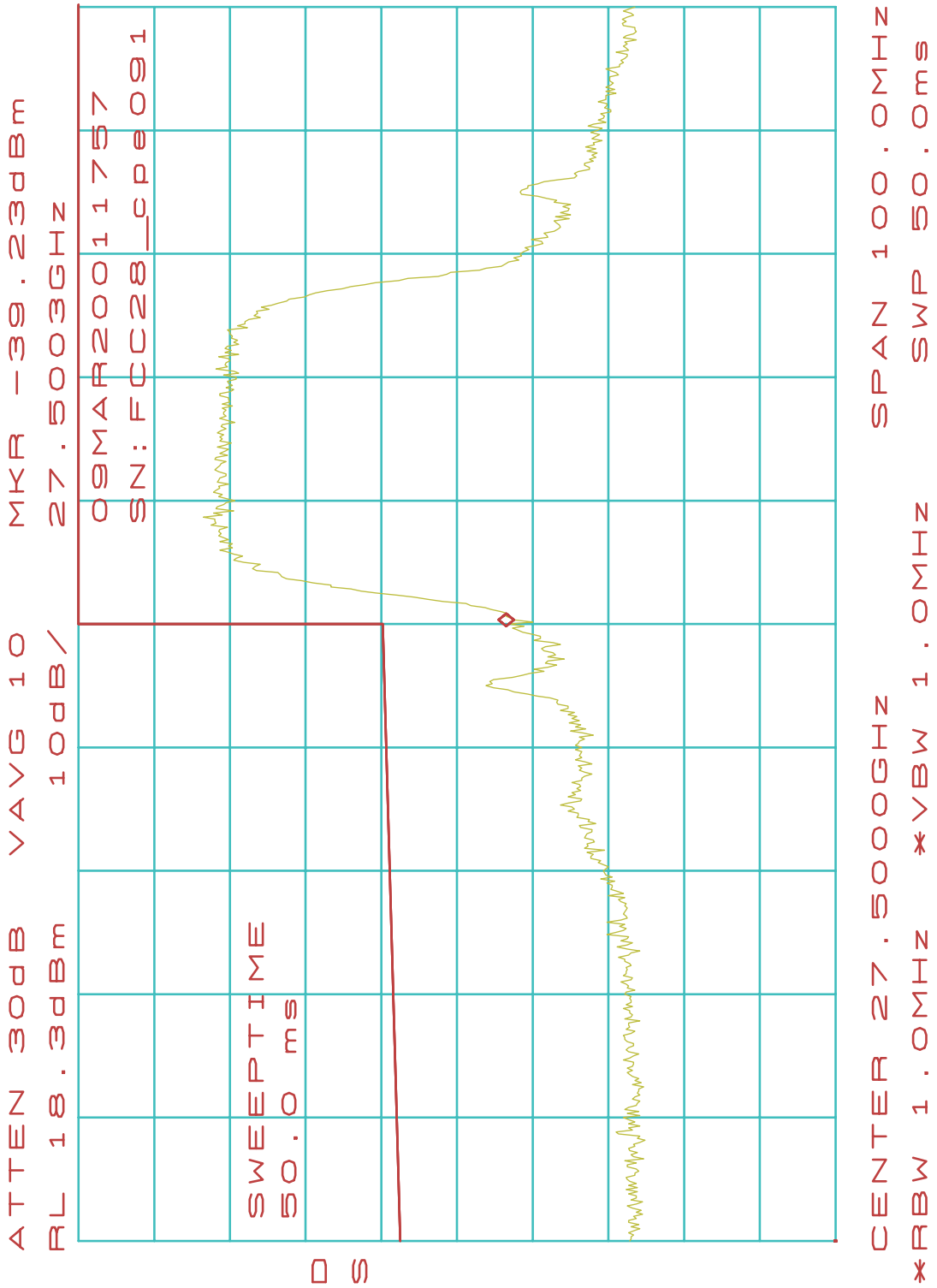
16-QAM:



CPE091

Spectrum Mask Plots (CPE-ODU) Low Frequency: 27.515 GHZ

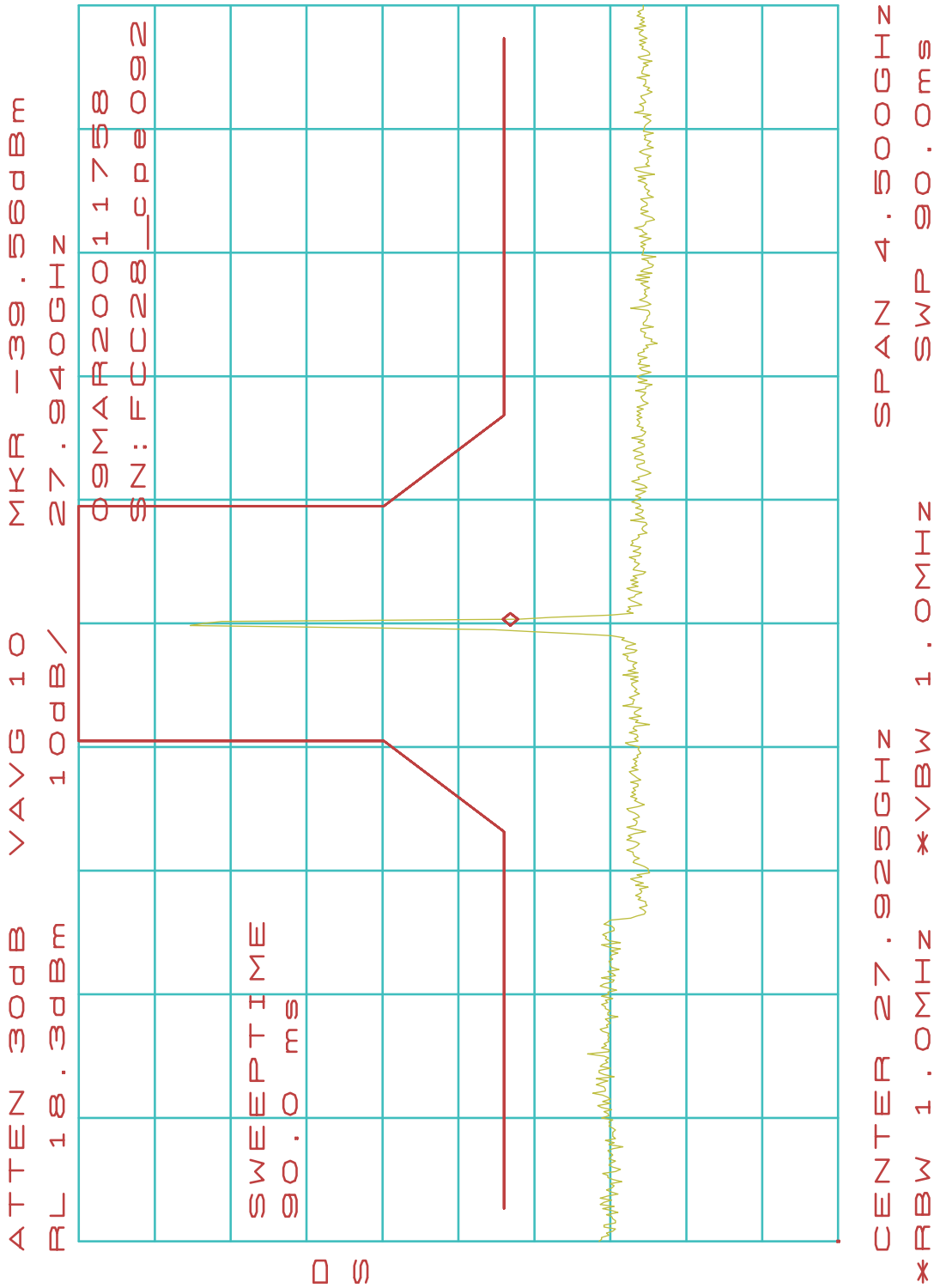
64-QAM:



CPE092

Spectrum Mask Plots (CPE-ODU) Mid Frequency: 27.925 GHZ

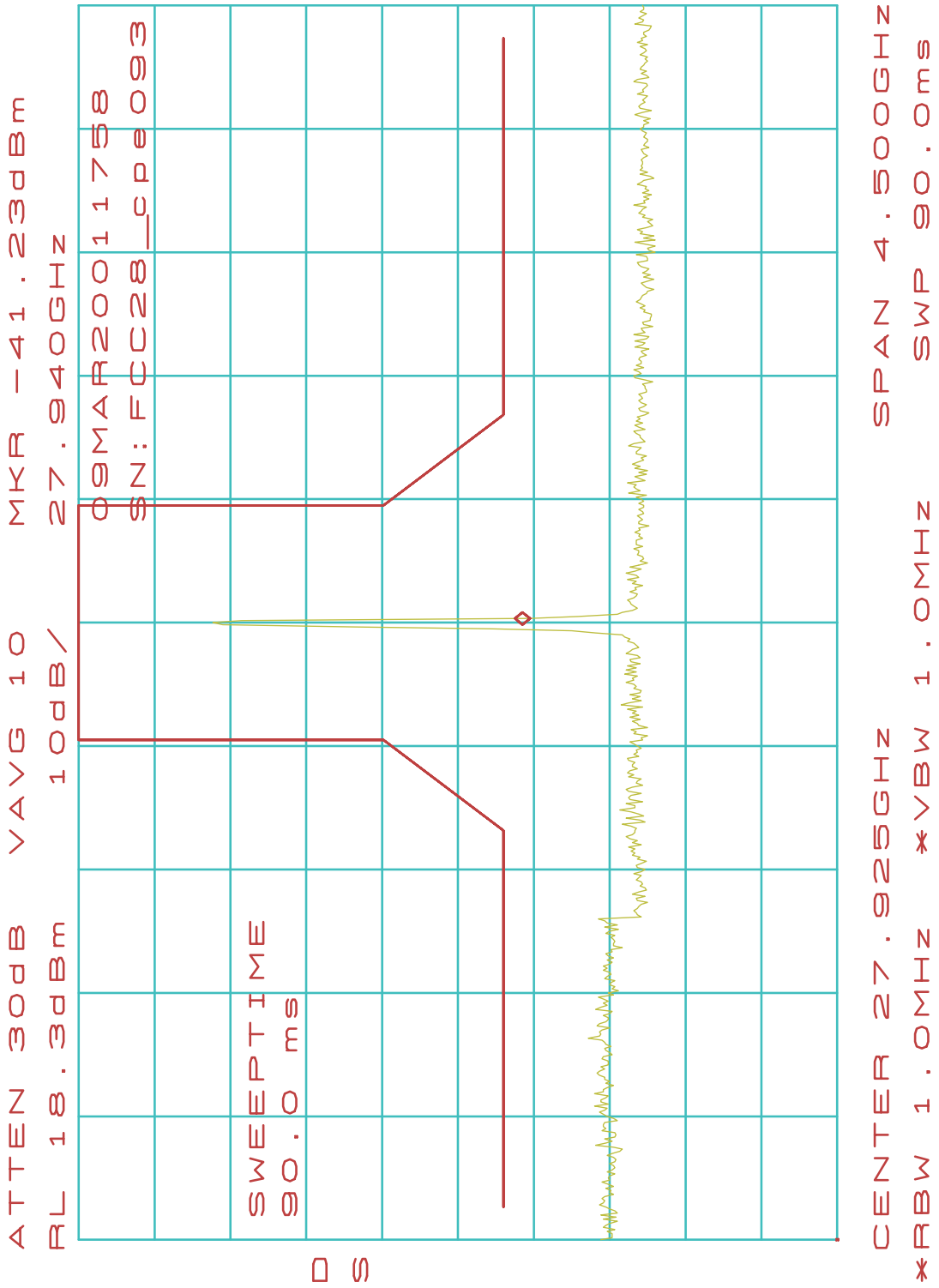
QPSK:



CPE093

Spectrum Mask Plots (CPE-ODU) Mid Frequency: 27.925 GHZ

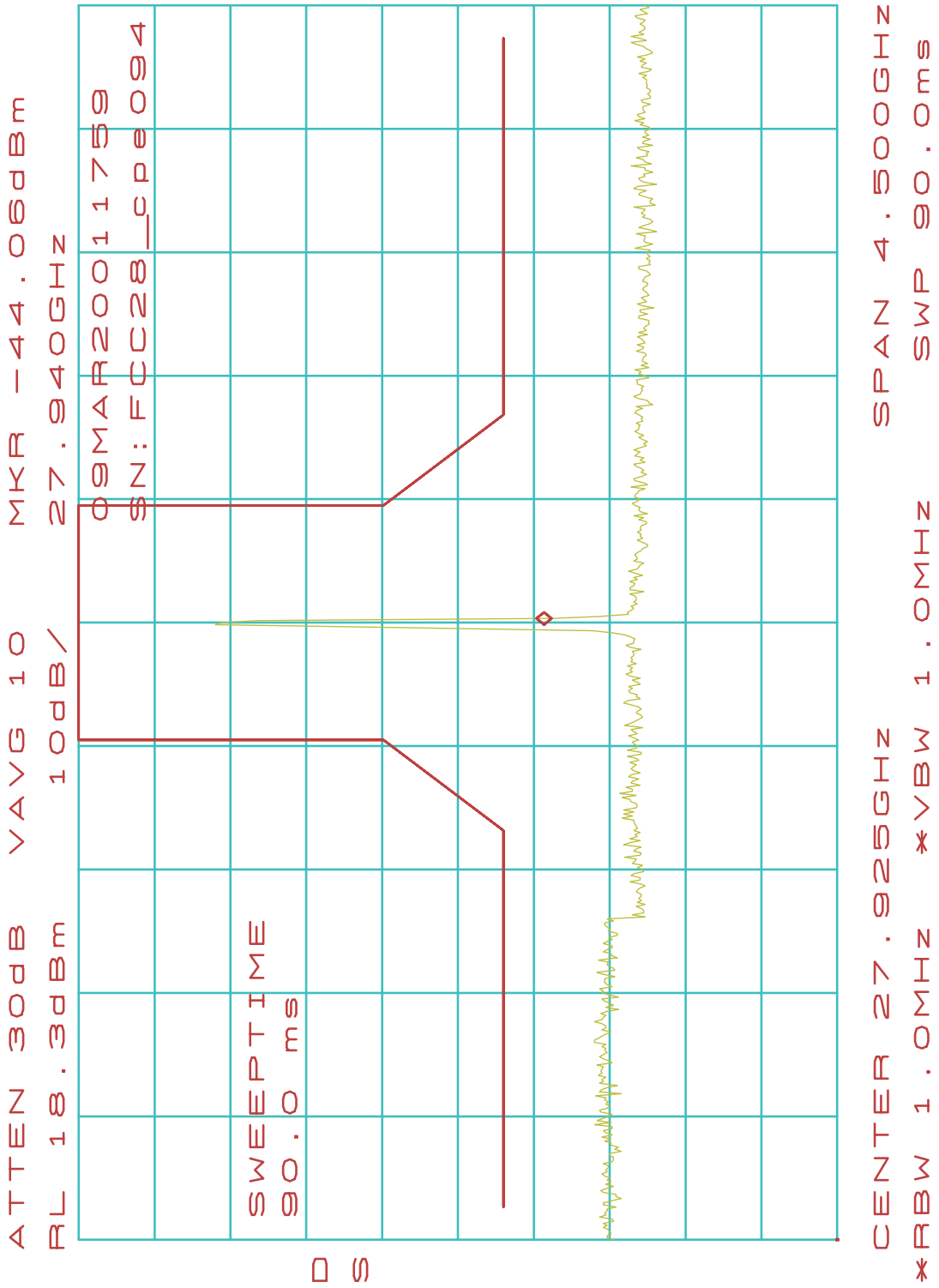
16-QAM:



CPE094

Spectrum Mask Plots (CPE-ODU) Mid Frequency: 27.925 GHZ

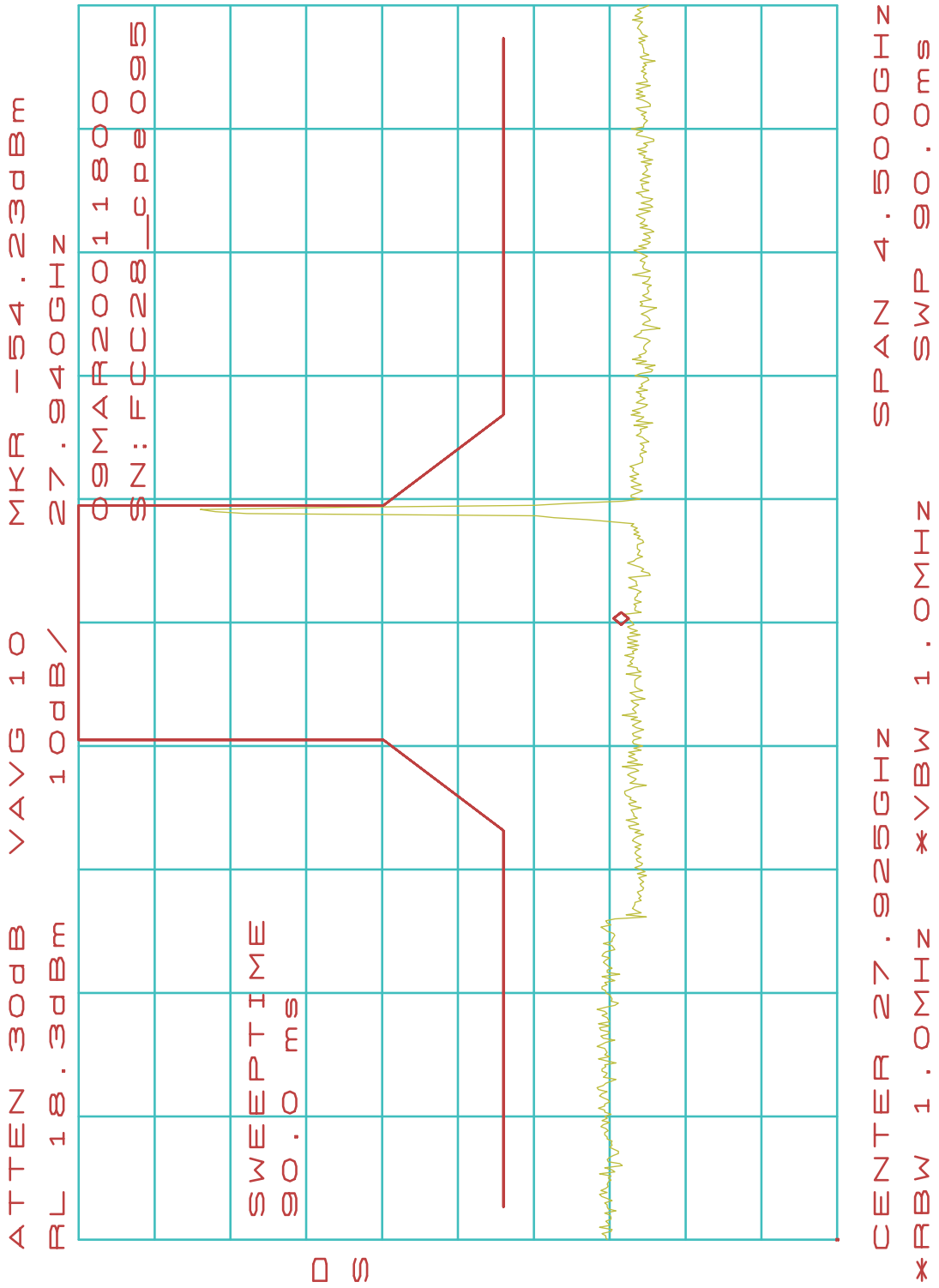
64-QAM:



CPE095

Spectrum Mask Plots (CPE-ODU) High Frequency: 28.335 GHZ

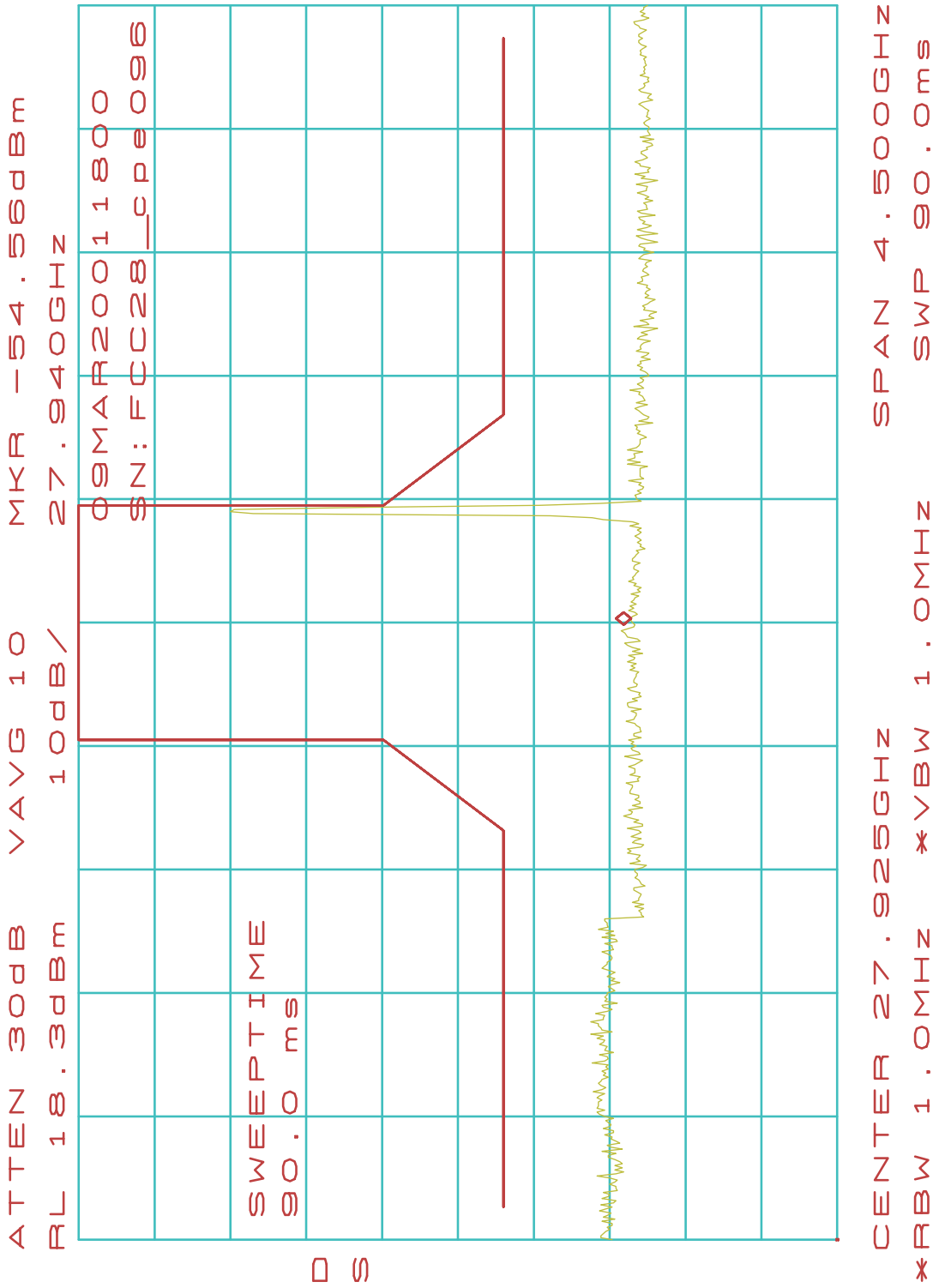
QPSK:



CPE096

Spectrum Mask Plots (CPE-ODU) High Frequency: 28.335 GHZ

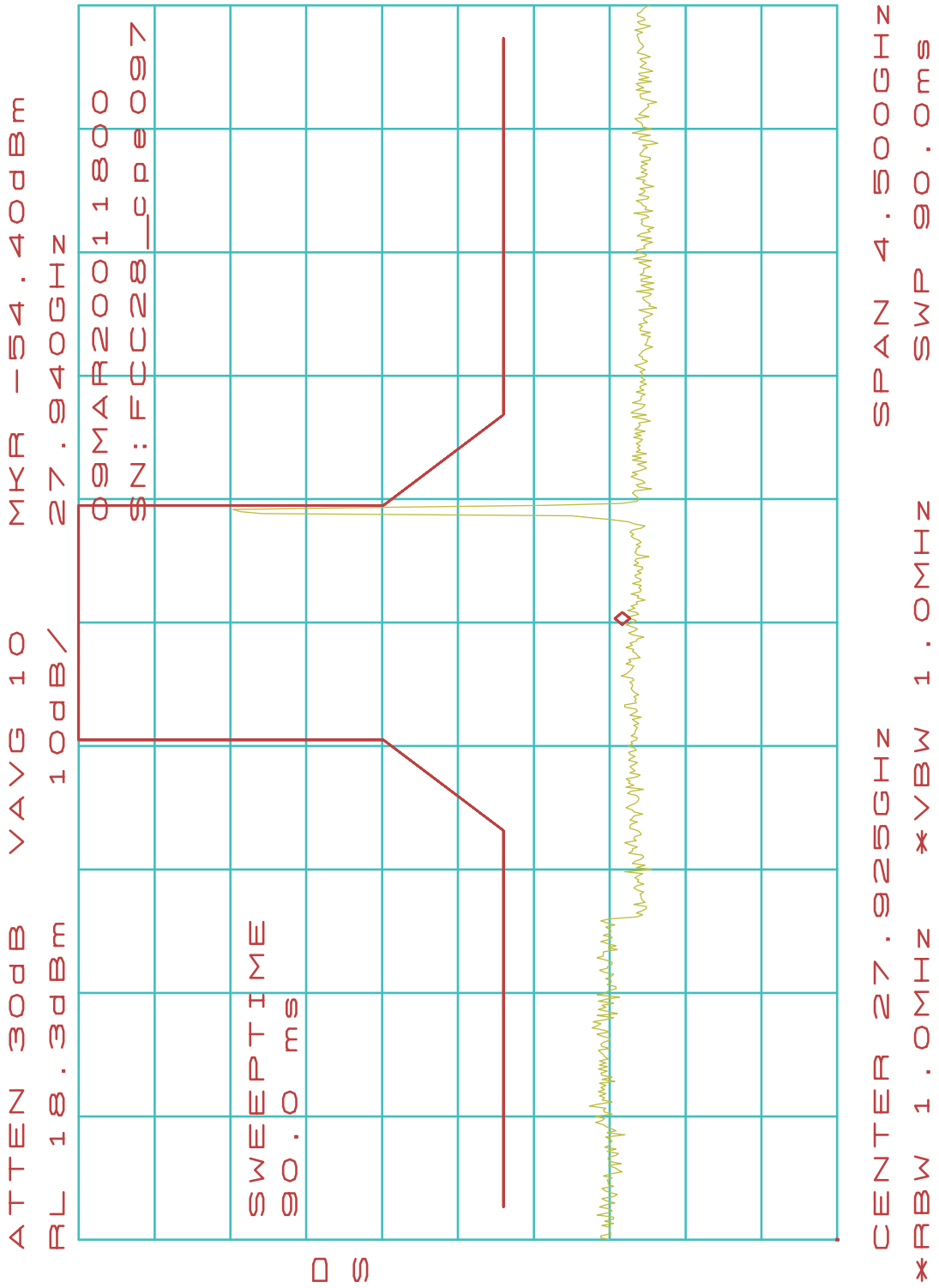
16-QAM:



CPE097

Spectrum Mask Plots (CPE-ODU) High Frequency: 28.335 GHZ

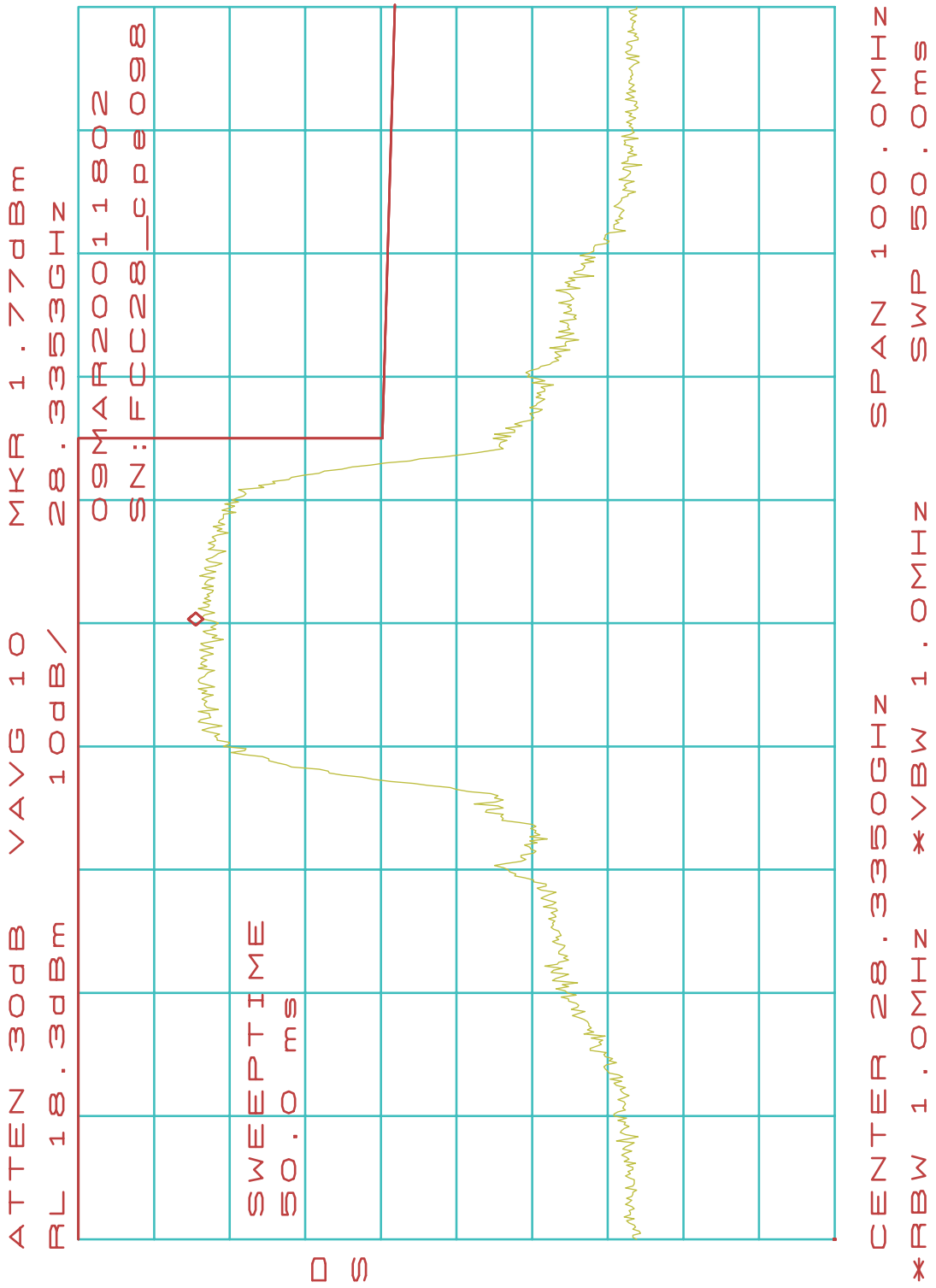
64-QAM:



CPE098

Spectrum Mask Plots (CPE-ODU) High Frequency: 28.335 GHZ

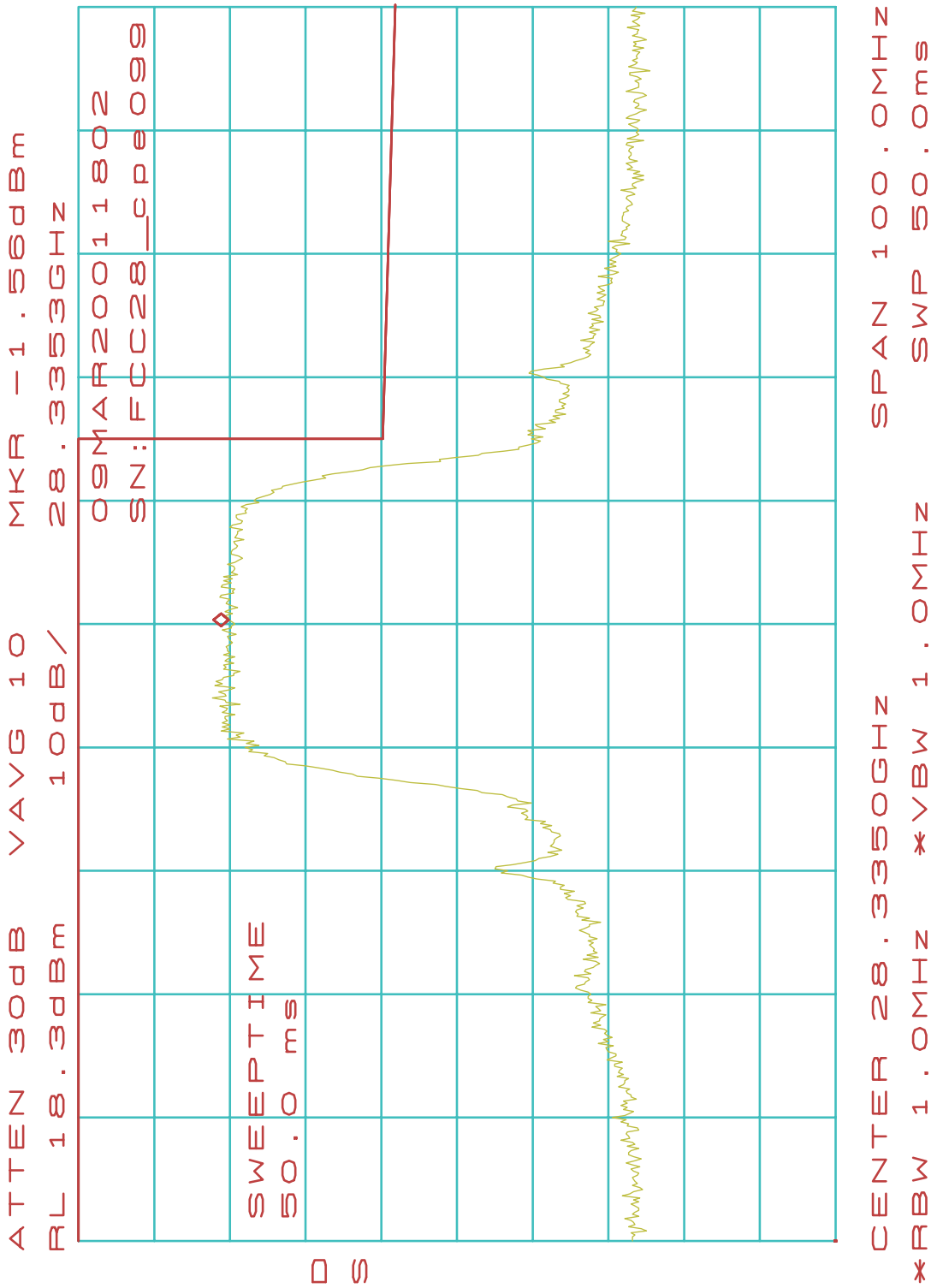
QPSK:



CPE099

Spectrum Mask Plots (CPE-ODU) High Frequency: 28.335 GHZ

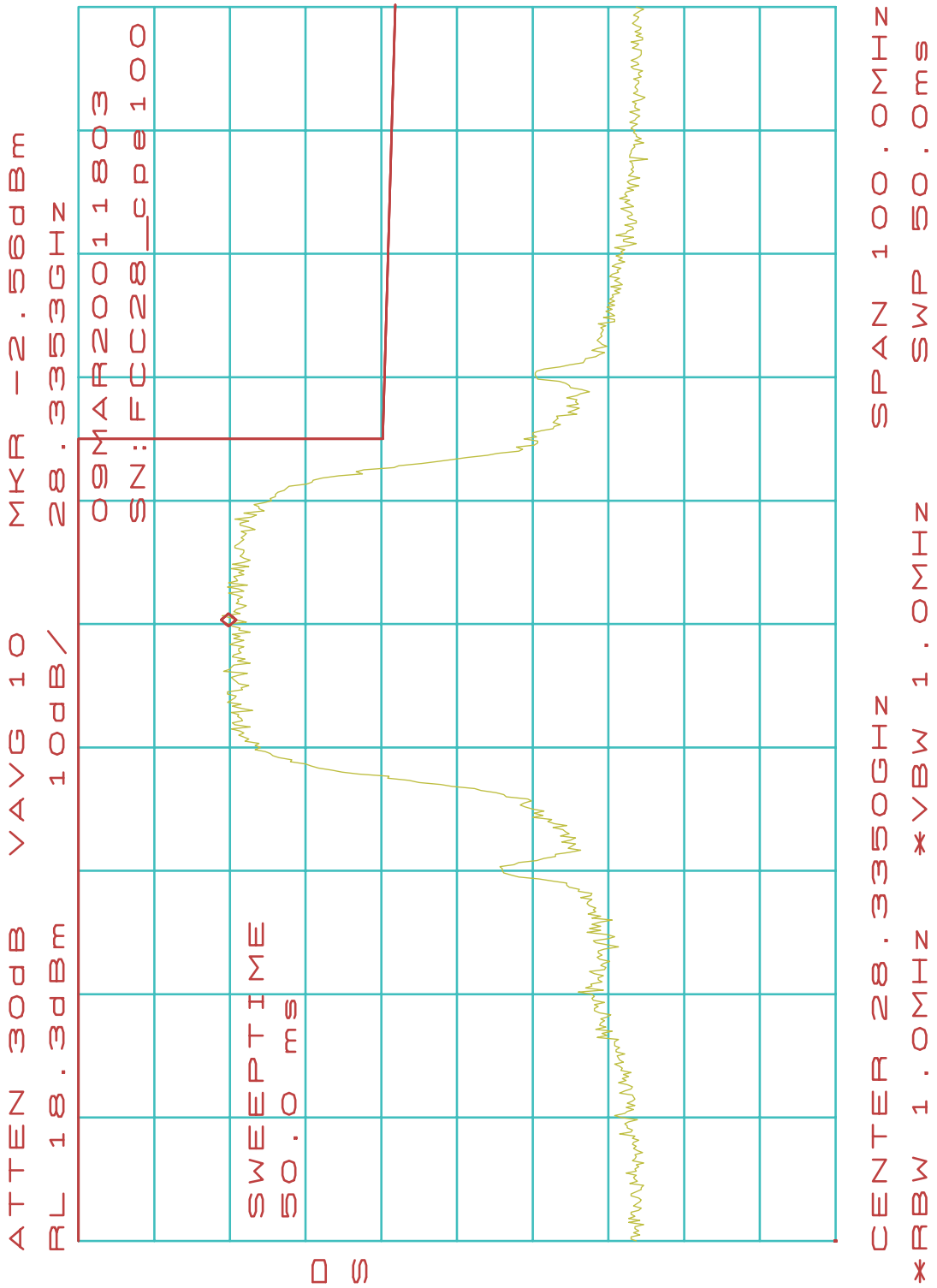
16-QAM:



CPE100

Spectrum Mask Plots (CPE-ODU) High Frequency: 28.335 GHZ

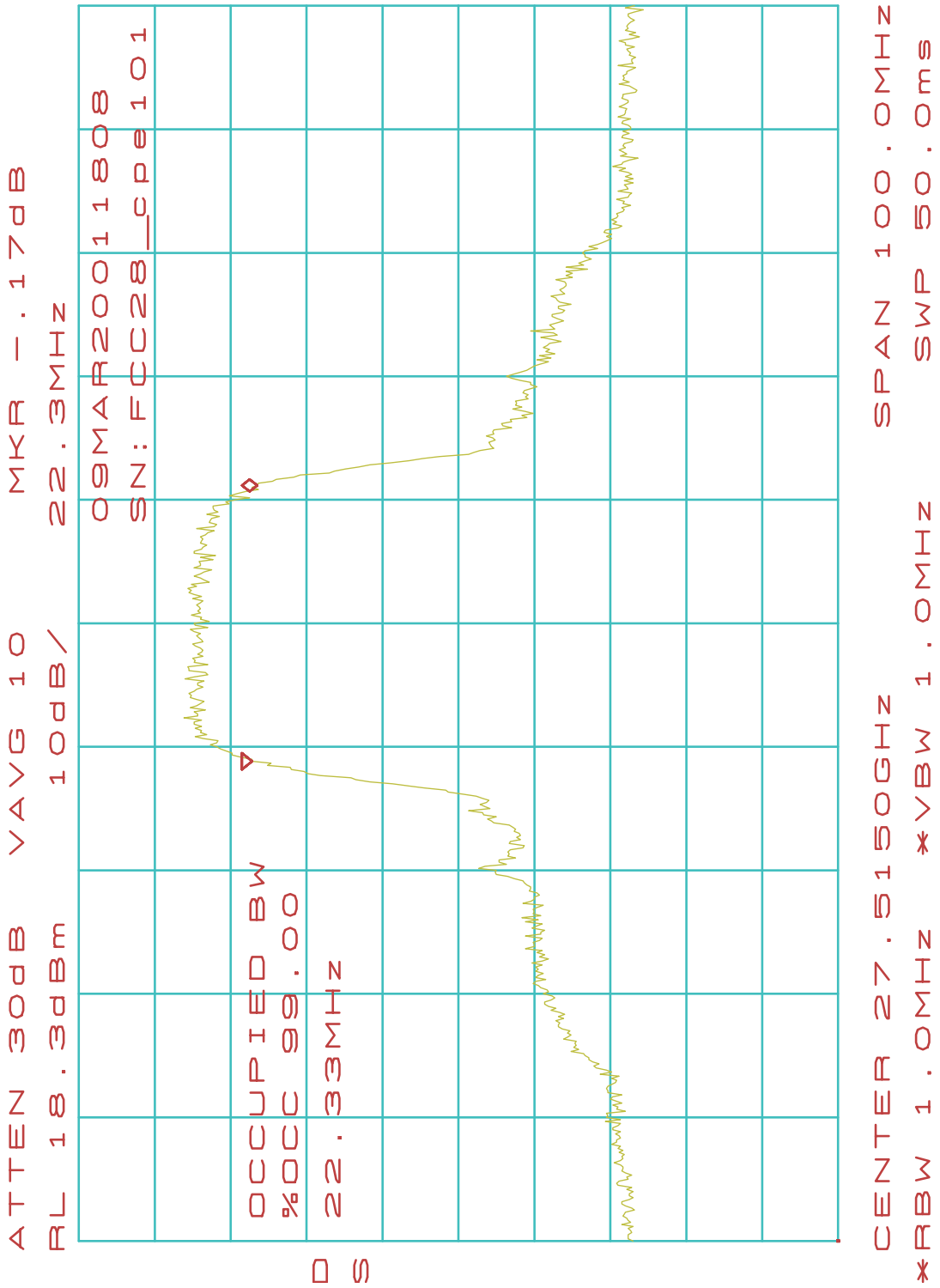
64-QAM:



CPE101

Table Of Occupied Bandwidth Results (CPE-ODU)

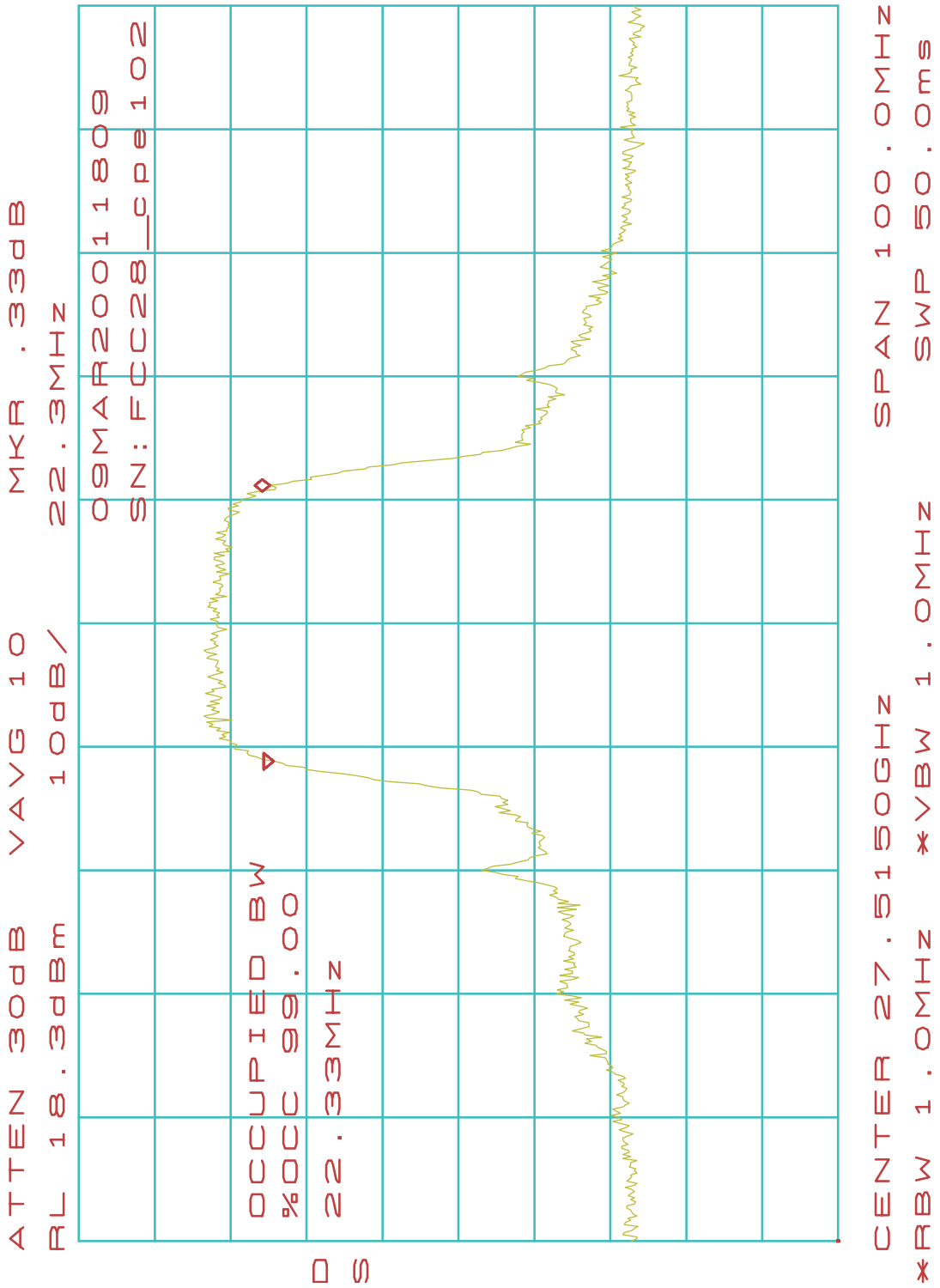
QPSK Low Band:



CPE102

Table Of Occupied Bandwidth Results (CPE-ODU)

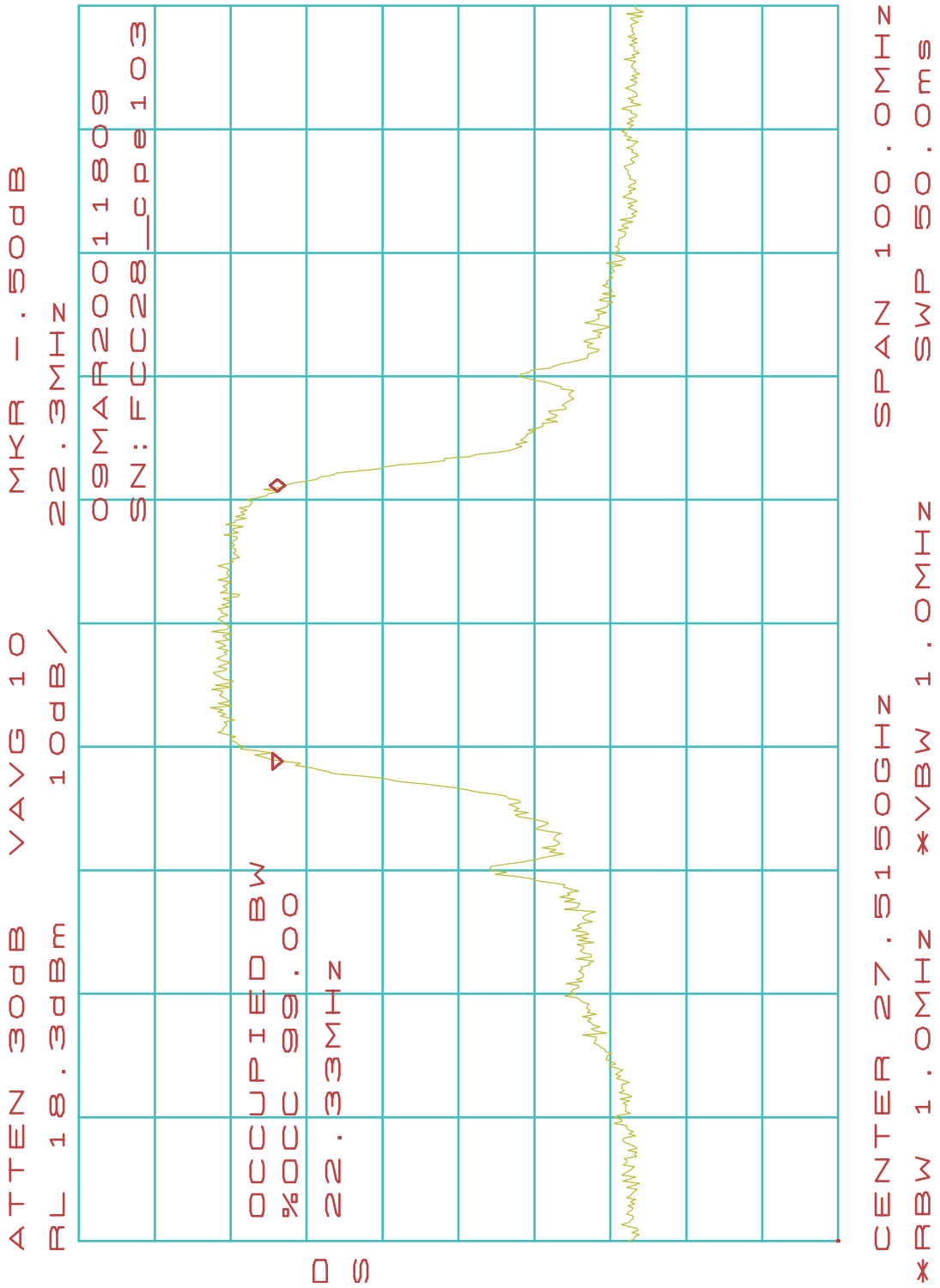
16-QAM Low Band:



CPE103

Table Of Occupied Bandwidth Results (CPE-ODU)

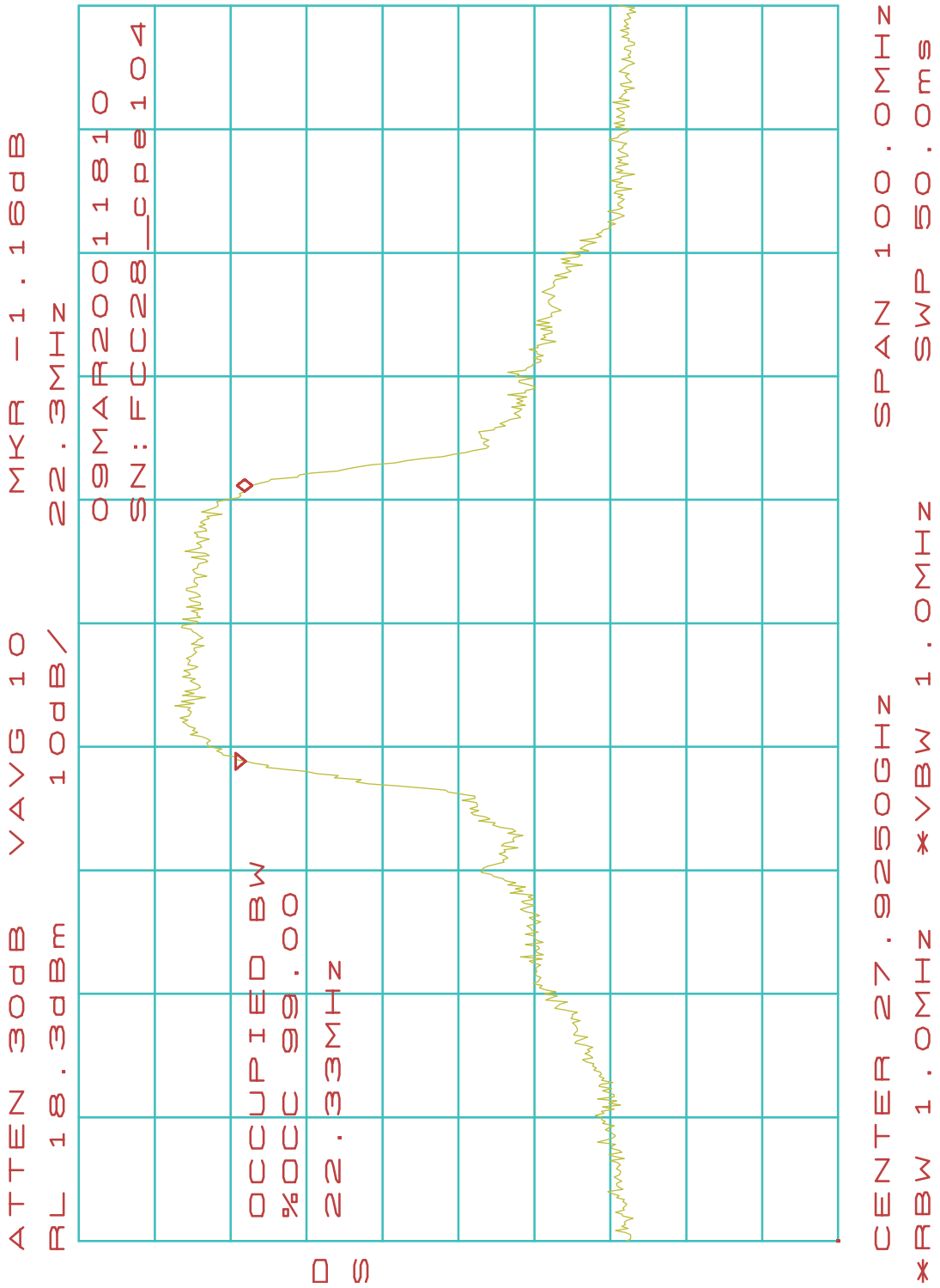
64-QAM Low Band:



CPE104

Table Of Occupied Bandwidth Results (CPE-ODU)

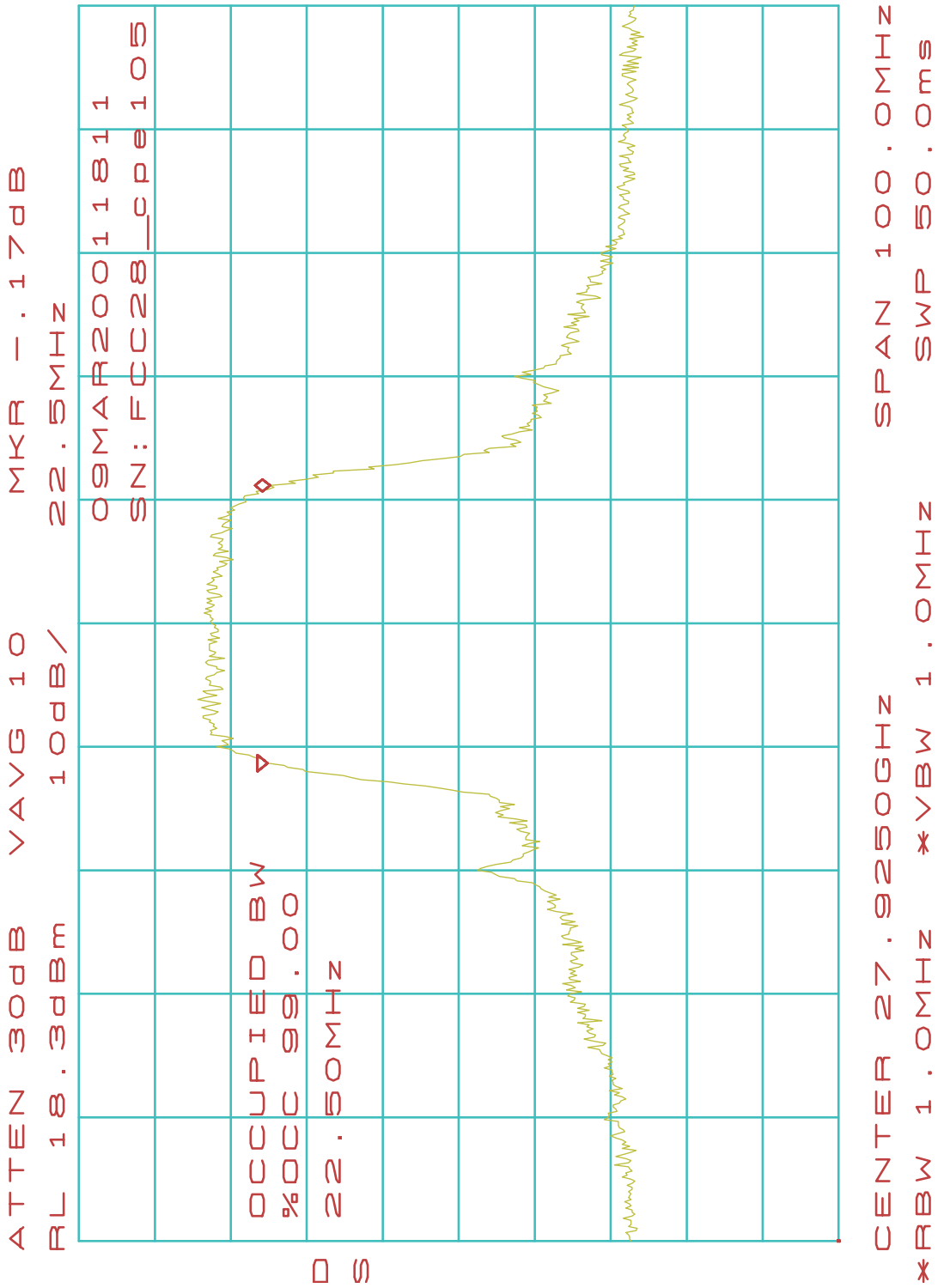
QPSK Mid Band:



CPE105

Table Of Occupied Bandwidth Results (CPE-ODU)

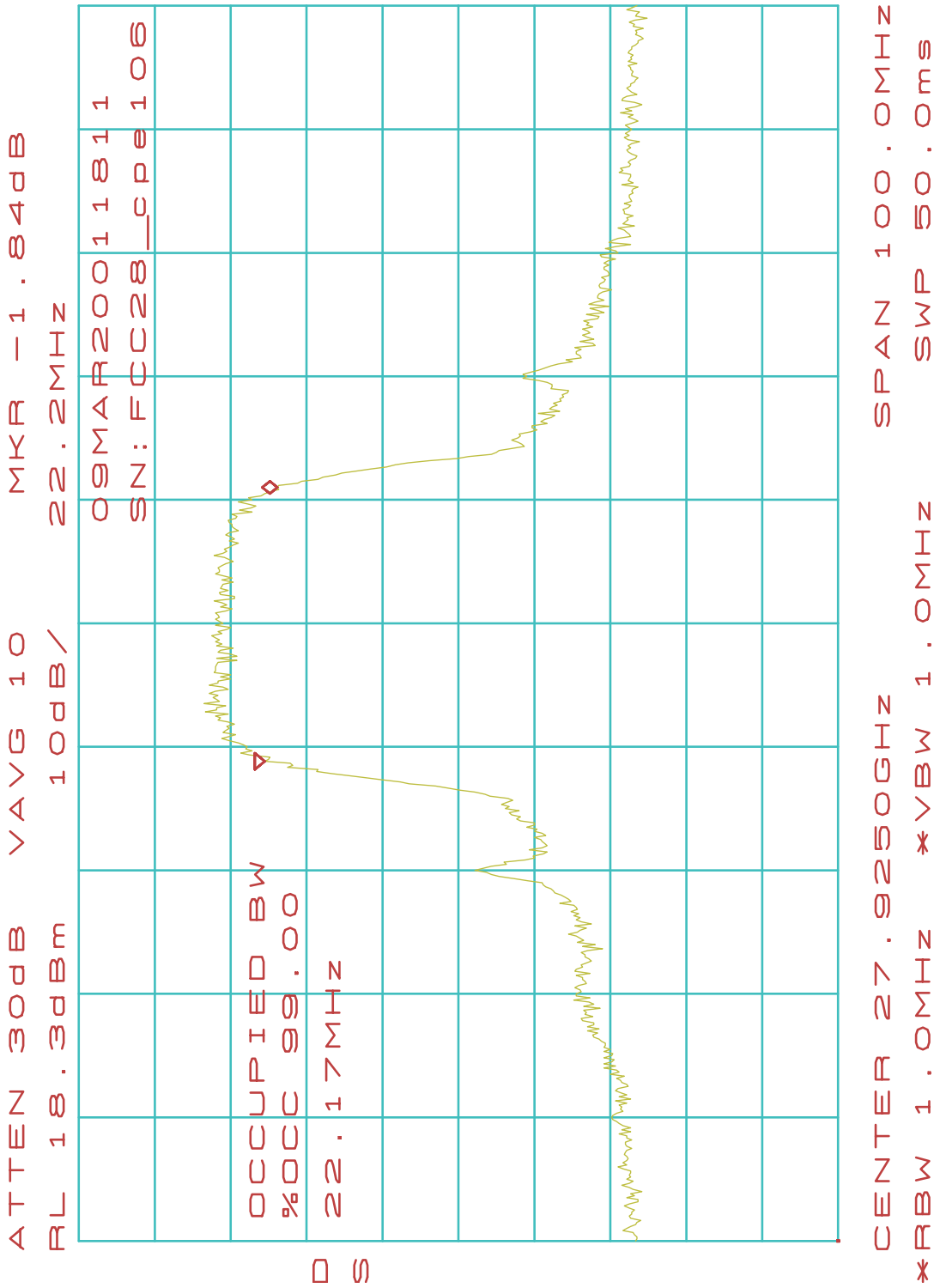
16-QAM Mid Band:



CPE106

Table Of Occupied Bandwidth Results (CPE-ODU)

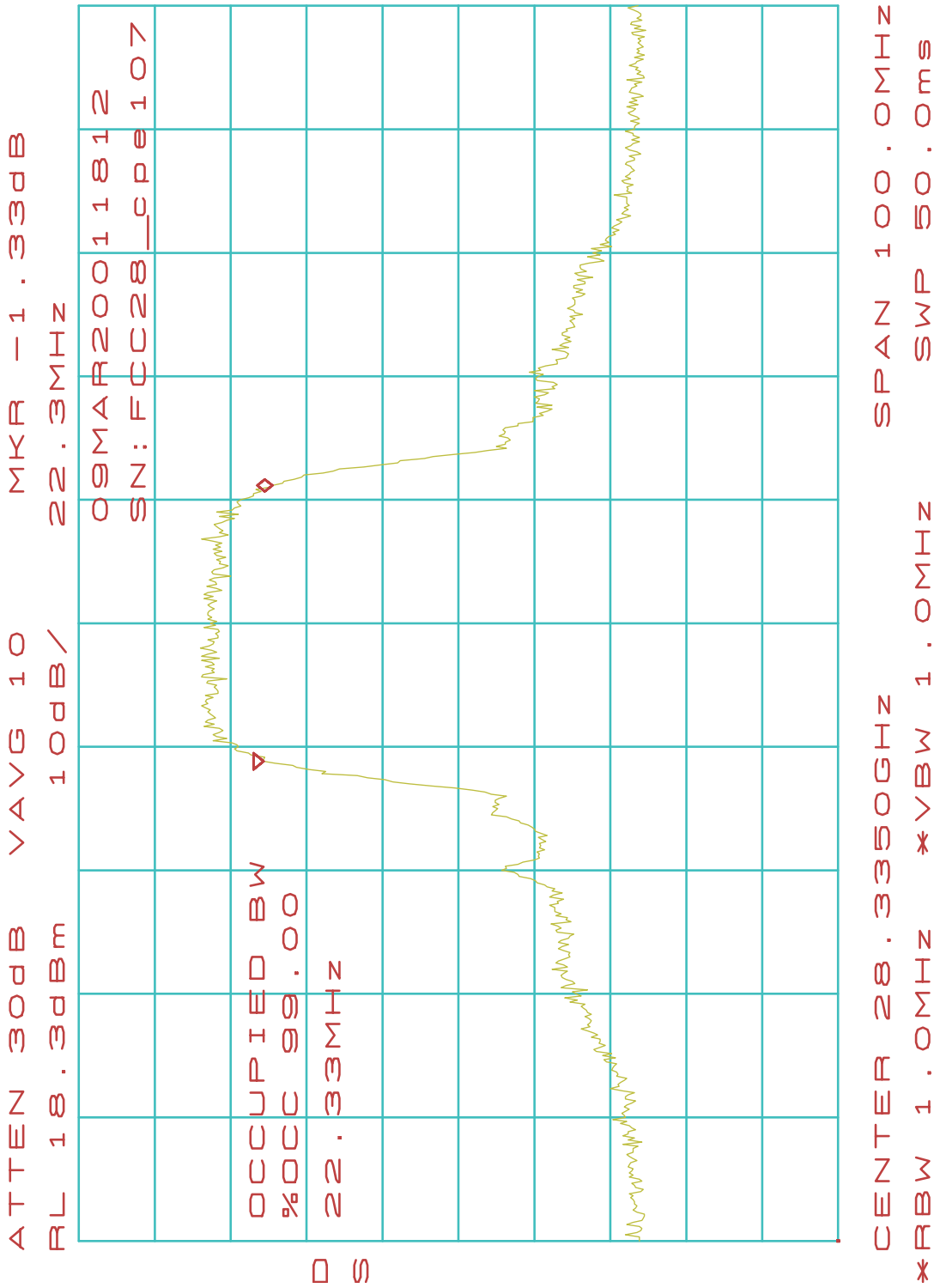
64-QAM Mid Band:



CPE107

Table Of Occupied Bandwidth Results (CPE-ODU)

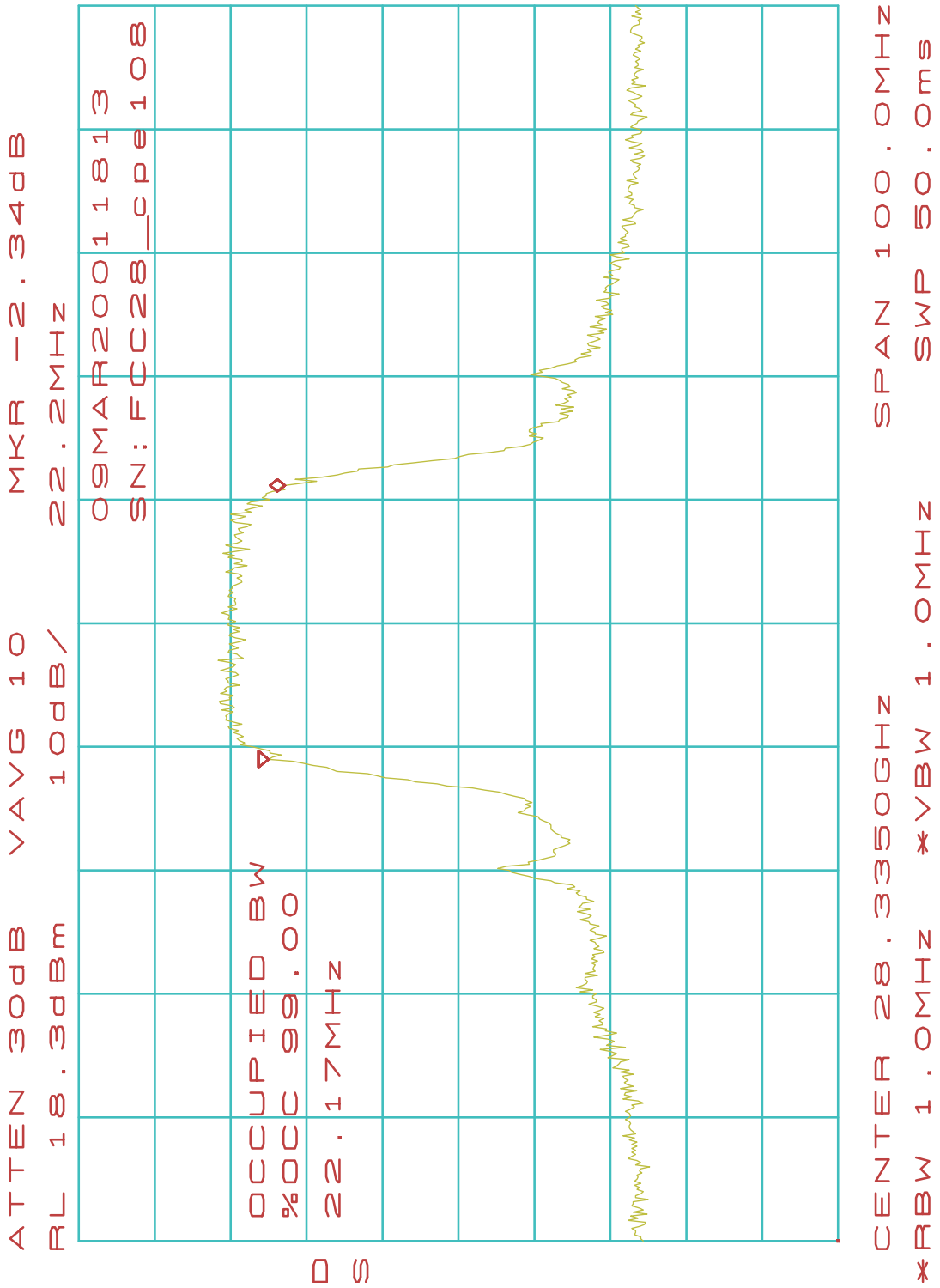
QPSK High Band:



CPE108

Table Of Occupied Bandwidth Results (CPE-ODU)

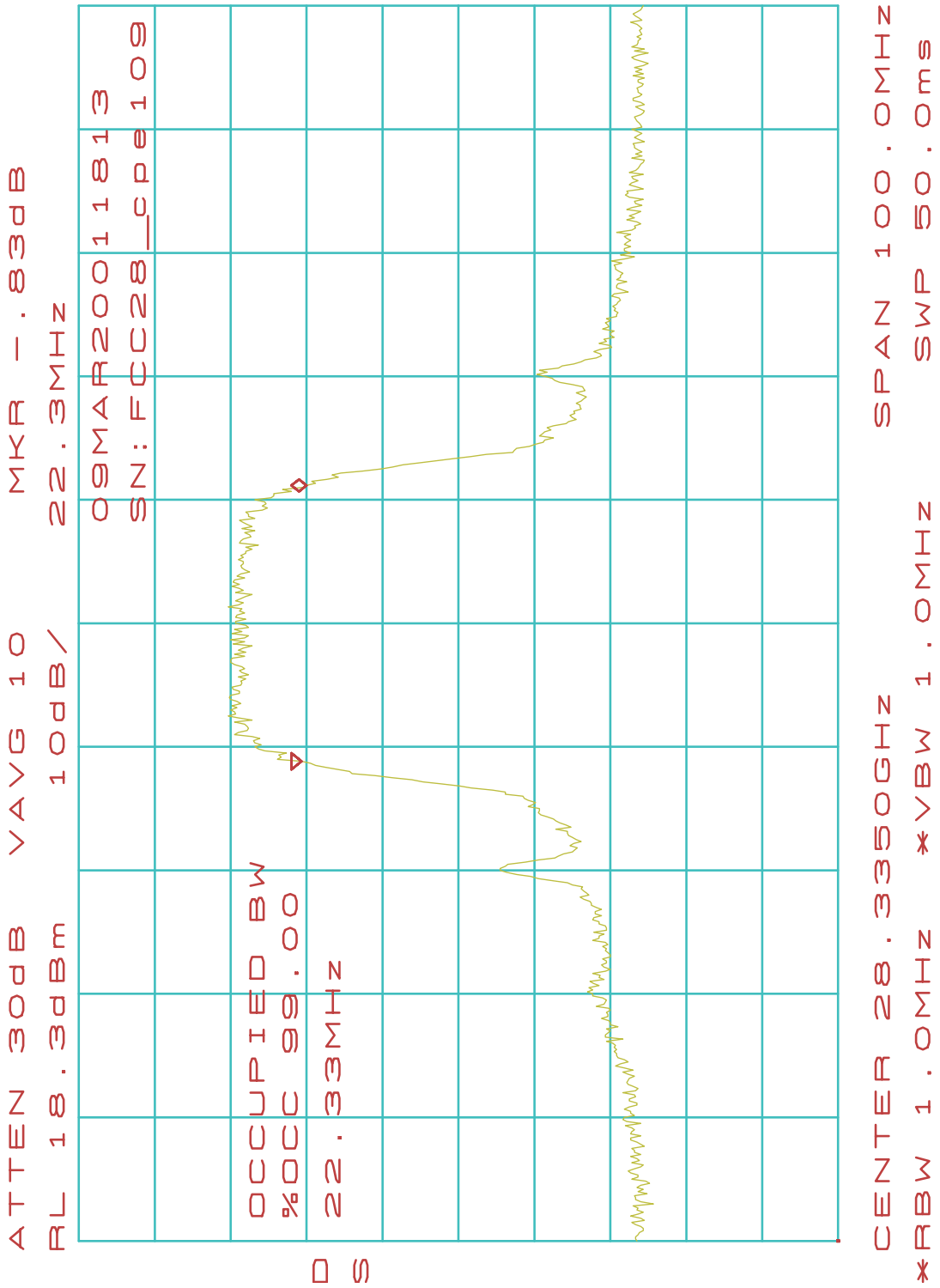
16-QAM High Band:



CPE109

Table Of Occupied Bandwidth Results (CPE-ODU)

64-QAM High Band:



Fields Used in Document

SET model-name (ref EUT):

SET Standards:

SET serial-number (SerialNo):

SET Old Serial Num (OldSerialNum):

SET issue-date (Issue):

SET manu :

SET manu-address line 1 (manuadd1):

SET manu-address line 2 (manuadd2):

SET QPSKRate :

SET QAM16Rate :

SET QAM64Rate :

SET nomOP:

SET NomVolt:

SET OPmax:

SET OPClause::

SET FreqErrUnits:

SET FreqErrLimit:

SET FreqErrClause:

SET Ambient

SET RH