MEASUREMENT AND TECHNICAL REPORT

HM ELECTRONICS
6675 Mesa Ridge Road
San Diego, CA 92121-2937

DATE: 05 December 2000

This Report Concerns:	Original Grant: X	Class II Change:
Equipment Type:	COM400CC, Model K23724	
Deferred grant requested per 47 CFR 0.457(d)(1)(ii)?	Yes: **Defer until:**	No: X
Company Name **agrees to notify the Commission by:** **of the intended date of announcement of the product so that the grant can be issued on that date.**	N/A	
Transition Rules Request per 15.37?	Yes:	*No:

(*) FCC Part 2, Paragraphs 2.1053, 2.1049, 2.1051; and Part 90, Paragraph 90.217

Report Prepared by:

TÜV PRODUCT SERVICE
10040 Mesa Rim Road
San Diego, CA 92121-2912
Phone: 858 546 3999
Fax: 858 546 0364

TABLE OF CONTENTS

1 GENERAL INFORMATION

1.1 Product Description

Components of EUT			
Description	Model Number	Serial Number	FCC ID Number
Collar Communicator COM400CC	K23724	--	BYMCOM400CC
OPERATING MODE(S):	Normal		
I/O CABLES			
Headset connector, analog, (1), No shielding; 5-pin custom connector; audio port termination; appx. 1' cable; removable			
POWER CORDS			
N/A, battery operated			
POWER INTERFACE			
FREQUENCY/AC/DC VOLTAGE:	Battery, DC		
INTERFACING AND/OR SIMULATORS PERIPHERAL EQUIPMENT:			
DESCRIPTION	MODEL #	SERIAL #	FCC ID
Headset	HS11	--	None

1 GENERAL INFORMATION (continued)

1.2 Related Submittal/Grant

None

1.3 Tested System Details

The FCC IDs for all equipment, plus descriptions of all cables used in the tested system are:

None

1.4 Test Methodology

Purpose of Test: To demonstrate compliance with the ANSI C63.4 setup.

Test Performed:

x 1. Conducted Emissions, FCC Part 2, Paragraphs 2.1049, 2.1051, & Part 90, Paragraph 90.217
2. Radiated Emissions, EN55022: 1992 Class B limit, 30 - 1,000 MHz, 10 meters
x 3. Radiated Emission per FCC Part 2, Paragraph 2.1053
4. Engineering evaluations

1.5 Test Facility

The open area test site and conducted measurement data were tested by:

TÜV PRODUCT SERVICE
10040 Mesa Rim Road
San Diego, CA 92121-2912
Phone: 619 546 3999
Fax: 619 546 0364

The Test Site Data and performance comply with ANSI 63.4 and are registered with the FCC, 7435 Oakland Mills Rd, Columbia Maryland 21046. All Measurement Data is acquired according to the content of FCC Measurement Procedure and ANSI C63.4, unless supplemented with additional requirements as noted in the test report.

1.6 Part 2 Requirements

Frequency Range: Transmit: 468.4875 to 469.8875 MHz
Receive: 457.5125 to 467.6125 MHz

Maximum Power Rating: 50 mW

DC Voltages applied to dc currents into the final radio frequency amplifying device for normal operation over the power range:
Final gain stage on the transmit strip is Q5.
Q5 collector is 5 Vdc
Q5 collector I is 20 mA **Values at 50 mW power rating. 50 mW is the only setting that is used.**
Q5 base is 3.5 Vdc
Q5 base I is 1 mA

Description of all circuitry and devices provdied for determining and stabilizing frequency:
Transmit frequency is determined by phase locked loop on the 1st mixer (IC2) IC on the transceiver board. See writeup on transceiver board theory of operation.

Description of circuits or devices employed for suppression of spurious radiation, for limiting modulation, and for limiting power:
Modulation is limited by the AK2345 tone chip IC6 on the transceiver board. The IC has an internal limiter circuit. Power is limited by the supply voltage. Spurious signals are suppressed by saw filter (FL3) and by out filter (L7, L8, L9, C32, C33, C37, C38, C39).

2. SYSTEM TEST CONFIGURATION

2.1 Justification

The COM400CC, Model K23724 was initially tested for FCC emission in the following configuration:

See Block Diagram.

2.2 EUT Exercise Software

None

2.3 Special Accessories

None

2.4 Modification

None

2.5 Configuration of Tested System

See Block Diagram.

3 RADIATED EMISSION DATA/EQUIPMENT

The following data lists the significant emission frequencies, measured levels, correction factor (which includes cable and antenna corrections), the corrected reading, and the limit.

See following page(s).

Radiated Electromagnetic Emissions

TÜV PRODUCT SERVICE

Test Report #:	**S0411 Run 02**	Test Area:	Site 1 3 meters	Temperature:	25 °C
Test Method:	Spurious Emissions 2.1053	Test Date:	25-Oct-2000	Relative Humidity:	45 %
EUT Model #:	COM400CC	EUT Power:	Internal Battery	Air Pressure:	100.0 kPa
EUT Serial #:	K23724 w/HS5-LT			Page:	1 of 2
Manufacturer:	HM Electronics				
EUT Description:	Intercom System				
Notes:	Transmit Mode				

Level Key	
Pk – Peak	Nb – Narrow Band
Qp – QuasiPeak	Bb – Broad Band
Av - Average	

FREQ	LEVEL	CABLE / ANT / PREAMP	FINAL	POL / HGT / AZ	DELTA1 (dB)	DELTA2 (dB)
(MHz)	(dBuV)	(dB) (dB\m) (dB)	(dBuV/m)	(m) (DEG)	FCC Part 90.210(c)	N/A
Low Channel						
468.49	77.1 Qp	6.0 / 17.6 / 0.0	100.7	V / 1.0 / 0.0	N/A	N/A
936.98	36.6 Qp	9.0 / 23.5 / 0.0	69.1	V / 1.0 / 0.0	-13.2	N/A
936.98	43.1 Qp	9.0 / 23.5 / 0.0	75.6	H / 1.0 / 0.0	-6.7	N/A
468.49	76.2 Qp	6.0 / 17.6 / 0.0	99.8	H / 1.0 / 0.0	N/A	N/A
Mid Channel						
469.14	77.6 Qp	6.0 / 17.7 / 0.0	101.3	H / 1.0 / 0.0	N/A	N/A
469.14	75.8 Qp	6.0 / 17.7 / 0.0	99.5	V / 1.0 / 0.0	N/A	N/A
938.28	40.3 Qp	9.0 / 23.4 / 0.0	72.7	V / 1.0 / 0.0	-9.6	N/A
938.28	45.2 Qp	9.0 / 23.4 / 0.0	77.6	H / 1.0 / 0.0	-4.7	N/A
High Channel						
469.89	77.8 Qp	6.0 / 17.7 / 0.0	101.5	H / 1.0 / 0.0	N/A	N/A
469.89	75.5 Qp	6.0 / 17.7 / 0.0	99.2	V / 1.0 / 0.0	N/A	N/A
939.78	37.8 Qp	9.0 / 23.3 / 0.0	70.1	V / 1.0 / 0.0	-12.2	N/A
939.78	45.6 Qp	9.0 / 23.3 / 0.0	77.9	H / 1.0 / 0.0	-4.4	N/A

Tested by: Jim Owen (Printed)  (Signature)

Radiated Electromagnetic Emissions

TÜV PRODUCT SERVICE

Test Report #:	**S0411 Run 01**	Test Area:	Site 3 Roof	Temperature:	25 °C
Test Method:	Spurious Emissions 2.1053	Test Date:	11-Oct-2088	Relative Humidity:	45 %
EUT Model #:	COM400CC	EUT Power:	Internal Battery	Air Pressure:	100.0 kPa
EUT Serial #:	K23724 w/HS5-LT			Page:	1 of 3
Manufacturer:	HM Electronics				
EUT Description:	Intercom System				
Notes:	Transmit Mode				

Level Key	
Pk – Peak	Nb – Narrow Band
Qp – QuasiPeak	Bb – Broad Band
Av - Average	

FREQ	LEVEL	CABLE / ANT / PREAMP	FINAL	POL / HGT / AZ	DELTA1 (dB)	DELTA2 (dB)
(MHz)	(dBuV)	(dB) (dB\m) (dB)	(dBuV/m)	(m) (DEG)	FCC Part 90.210	N/A
High Band						
1879.50	68.2 Pk	4.2 / 28.3 / 39.8	60.8	H / 1.0 / 202.0	-21.4	N/A
1879.50	67.3 Av	4.2 / 28.3 / 39.8	59.9	H / 1.0 / 202.0	-22.3	N/A
2349.40	70.4 Pk	4.8 / 30.1 / 39.6	65.6	H / 1.2 / 142.0	-16.6	N/A
2349.40	70.2 Av	4.8 / 30.1 / 39.6	65.4	H / 1.2 / 142.0	-16.8	N/A
2819.30	71.8 Pk	5.5 / 31.3 / 39.5	69.1	H / 1.2 / 142.0	-13.1	N/A
2819.30	71.8 Av	5.5 / 31.3 / 39.5	69.1	H / 1.2 / 142.0	-13.1	N/A
3289.20	57.0 Pk	6.3 / 32.3 / 39.4	56.2	H / 1.2 / 142.0	-26.0	N/A
1409.66	62.6 Pk	3.6 / 26.4 / 40.4	52.2	H / 2.0 / 193.0	-30.0	N/A
1409.66	59.0 Pk	3.6 / 26.4 / 40.4	48.6	V / 1.5 / 95.0	-33.6	N/A
1879.50	65.9 Pk	4.2 / 28.3 / 39.8	58.5	V / 1.5 / 278.0	-23.7	N/A
2349.40	63.6 Pk	4.8 / 30.1 / 39.6	58.8	V / 1.5 / 313.0	-23.4	N/A
2819.30	72.7 Pk	5.5 / 31.3 / 39.5	70.0	V / 1.5 / 191.0	-12.2	N/A
3289.20	58.2 Pk	6.3 / 32.3 / 39.4	57.4	V / 1.5 / 172.0	-24.8	N/A
Mid Band						
1407.40	58.6 Pk	3.6 / 26.4 / 40.4	48.2	V / 1.2 / 219.0	-34.0	N/A
1876.50	66.0 Pk	4.2 / 28.3 / 39.8	58.6	V / 1.2 / 180.0	-23.6	N/A
2345.60	65.7 Pk	4.8 / 30.0 / 39.6	60.9	V / 1.2 / 180.0	-21.3	N/A
2345.60	64.6 Av	4.8 / 30.0 / 39.6	59.8	V / 1.2 / 180.0	-22.4	N/A
2814.80	70.1 Pk	5.5 / 31.3 / 39.5	67.4	V / 1.1 / 293.0	-14.8	N/A
2814.80	70.1 Av	5.5 / 31.3 / 39.5	67.4	V / 1.1 / 293.0	-14.8	N/A
3289.20	57.4 Pk	6.3 / 32.3 / 39.4	56.6	V / 2.0 / 158.0	-25.6	N/A
1876.60	68.0 Pk	4.2 / 28.3 / 39.8	60.6	H / 1.5 / 275.0	-21.6	N/A
1876.60	67.1 Av	4.2 / 28.3 / 39.8	59.7	H / 1.5 / 275.0	-22.5	N/A
2345.70	68.7 Pk	4.8 / 30.0 / 39.6	63.9	H / 1.2 / 303.0	-18.3	N/A
2345.70	67.9 Av	4.8 / 30.0 / 39.6	63.1	H / 1.2 / 303.0	-19.1	N/A
2814.80	70.9 Pk	5.5 / 31.3 / 39.5	68.2	H / 1.2 / 303.0	-14.0	N/A
2814.80	70.6 Av	5.5 / 31.3 / 39.5	67.9	H / 1.2 / 303.0	-14.3	N/A
3284.00	56.1 Pk	6.3 / 32.3 / 39.4	55.3	H / 1.2 / 13.0	-26.9	N/A

Tested by: Jim Owen (Printed) Jim Owen (Signature)

Radiated Electromagnetic Emissions

TÜV PRODUCT SERVICE

Test Report #:	S0411 Run 01	Test Area:	Site 3 Roof	Temperature:	25 °C
Test Method:	Spurious Emissions 2.1053	Test Date:	11-Oct-2088	Relative Humidity:	45 %
EUT Model #:	COM400CC	EUT Power:	Internal Battery	Air Pressure:	100.0 kPa
EUT Serial #:	K23724 w/HS5-LT			Page:	2 of 3
Manufacturer:	HM Electronics				
EUT Description:	Intercom System				
Notes:	Transmit Mode				

Level Key	
Pk – Peak	Nb – Narrow Band
Qp – QuasiPeak	Bb – Broad Band
Av - Average	

FREQ	LEVEL	CABLE / ANT / PREAMP	FINAL	POL / HGT / AZ	DELTA1 (dB)	DELTA2 (dB)
(MHz)	(dBuV)	(dB) (dB\m) (dB)	(dBuV/m)	(m) (DEG)	FCC Part 90.210	N/A
1407.40	66.3 Pk	3.6 / 26.4 / 40.4	55.9	H / 1.2 / 12.0	-26.3	N/A
Low Band						
1405.46	69.0 Pk	3.5 / 26.4 / 40.4	58.5	H / 1.5 / 13.0	-23.7	N/A
1873.95	72.9 Pk	4.1 / 28.3 / 39.8	65.5	H / 1.0 / 5.0	-16.7	N/A
1873.95	72.9 Av	4.1 / 28.3 / 39.8	65.5	H / 1.0 / 5.0	-16.7	N/A
2342.44	76.7 Pk	4.8 / 30.0 / 39.6	71.9	H / 1.0 / 5.0	-10.3	N/A
2342.44	76.7 Av	4.8 / 30.0 / 39.6	71.9	H / 1.0 / 5.0	-10.3	N/A
2810.92	78.0 Pk	5.5 / 31.3 / 39.5	75.3	H / 1.0 / 316.0	-6.9	N/A
2810.92	78.0 Av	5.5 / 31.3 / 39.5	75.3	H / 1.0 / 316.0	-6.9	N/A
3279.40	61.6 Pk	6.2 / 32.3 / 39.4	60.8	H / 1.0 / 316.0	-21.4	N/A
3279.40	60.9 Av	6.2 / 32.3 / 39.4	60.1	H / 1.0 / 316.0	-22.1	N/A
3747.90	54.5 Pk	6.9 / 33.6 / 40.0	55.0	H / 1.0 / 316.0	-27.2	N/A
4216.40	54.5 Pk	7.2 / 34.0 / 40.6	55.2	H / 1.0 / 316.0	-27.0	N/A
4684.90	55.1 Pk	7.3 / 34.0 / 40.6	55.9	H / 1.0 / 316.0	-26.3	N/A
1405.50	67.6 Pk	3.5 / 26.4 / 40.4	57.1	V / 1.0 / 343.0	-25.1	N/A
1873.95	68.5 Pk	4.1 / 28.3 / 39.8	61.1	V / 1.0 / 230.0	-21.1	N/A
1873.95	68.5 Av	4.1 / 28.3 / 39.8	61.1	V / 1.0 / 230.0	-21.1	N/A
2342.50	68.5 Pk	4.8 / 30.0 / 39.6	63.7	V / 1.0 / 56.0	-18.5	N/A
2810.90	71.6 Pk	5.5 / 31.3 / 39.5	68.9	V / 1.0 / 56.0	-13.3	N/A
2810.90	71.6 Av	5.5 / 31.3 / 39.5	68.9	V / 1.0 / 56.0	-13.3	N/A
3279.40	54.5 Pk	6.2 / 32.3 / 39.4	53.7	V / 1.1 / 282.0	-28.5	N/A
3747.90	54.5 Pk	6.9 / 33.6 / 40.0	55.0	V / 1.1 / 282.0	-27.2	N/A

Tested by: Jim Owen (Printed) Jim Owen (Signature)

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Emissions Test Conditions: RADIATED SPURIOUS EMISSIONS

The measurements were performed at the following test location :

☐ **- Test not applicable**

■ - Roof (Small Open Area Test Site)
☐ - Canyon #1 (10- and 30-Meter Open Area Test Site), Carroll Canyon, San Diego
☐ - Canyon #2 (3- and 10-Meter Open Area Test Site), Carroll Canyon, San Diego

Testing was performed at a test distance of:

☐ - 1 meters
■ - 3 meters
☐ - 10 meters

Test Equipment Used :

Model #	Manufacturer	Description	Serial #	Prop. #	Cal Date
8566B	Hewlett Packard	Spectrum Analyzer	2311A02209	407	11/01
85662B	Hewlett Packard	Spectrum Analyzer Display	2309A04682	406	11/01
LPB2520/A	Antenna Research	LPB	1169	738	05/01
ESVS30	Rhode & Schwarz	Receiver	833825/003	466	12/00

Remarks: _____

3.1 Field Strength Calculation

If a preamplifier was used during the Radiated Emission Testing, it is required that the amplifier gain must be subtracted from the Spectrum Analyzer (Meter) Reading. In addition, a correction factor for the antenna , cable used and a distance factor, if any, must be applied to the Meter Reading before a true field strength reading can be obtained. In the automatic measurement, these considerations are automatically presented as a part of the print out. In the case of manual measurements and for greater efficiency and convenience, instead of using these correlation factors for each meter reading, the specification limit was modified to reflect these correlation factors at each frequency value so that the meter readings can be compared directly to the modified specification limit. This modified specification limit is referred to as the "Corrected Meter Reading Limit" or simply the CMRL, which is the actual field strength present at the antenna. The quantity can be derived in the following manner:

Corrected Meter Reading Limit (CMRL) = SAR + AF + CL - AG - DC

Where, SAR = Spectrum Analyzer Reading
AF = Antenna Factor
CL = Cable Loss
AG = Amplifier Gain (if any)
DC = Distance Correction (if any)

Assume the following situation: A meter reading of 29.4 dBuV was obtained from a Class A computing device measured at 83 MHz. Assume an antenna factor of 9.2 dB, a cable loss of 1.4 dB and amplifier gain of 20.0 dB at 83 MHz. The final field strength would be determined as follows:

CMRL = 29.4 dBuV + 9.2dB = 1.4 dB - 20 dB/M - 0.0 dB

CMRL = 20.0 dBuV/M

This result is well below the FCC and CSA Class A limit of 29.5 dbuV/m at 83 MHz.

For the manual mode of measurement, a table of corrected meter reading limit was used to permit immediate comparison of the meter reading to determine if the measure emission amplitude exceeded the specification limit at that specific frequency.

4 CONDUCTED EMISSION DATA/EQUIPMENT

HME ELECTRONICS

See following page(s).

Emissions Test Conditions: CONDUCTED EMISSIONS, Part 2, Paragraphs 2.1049, 2.1051 and Part 90, Paragraph 90.217

The measurements were performed at the following test location :

☐ - Test not applicable

SR-2, Shielded Room, 12’ x 24’ x 10’, Metal Chamber

Test Equipment Used :

Model #	Manufacturer	Description	Serial #	Prop. #	Cal Date
85660B	Hewlett Packard	Spectrum Analyzer	2311A02209	407	11/01
8566B	Hewlett Packard	Spectrum Analyzer Display	2309A04682	406	11/01
HP8594E	Hewlett Packard	Spectrum Analyzer	3303A00365	430	05/01

Remarks: _____

Project Nr. S0411
HM Electronics
COM400CC

OUTPUT POWER MEASUREMENT RESULTS

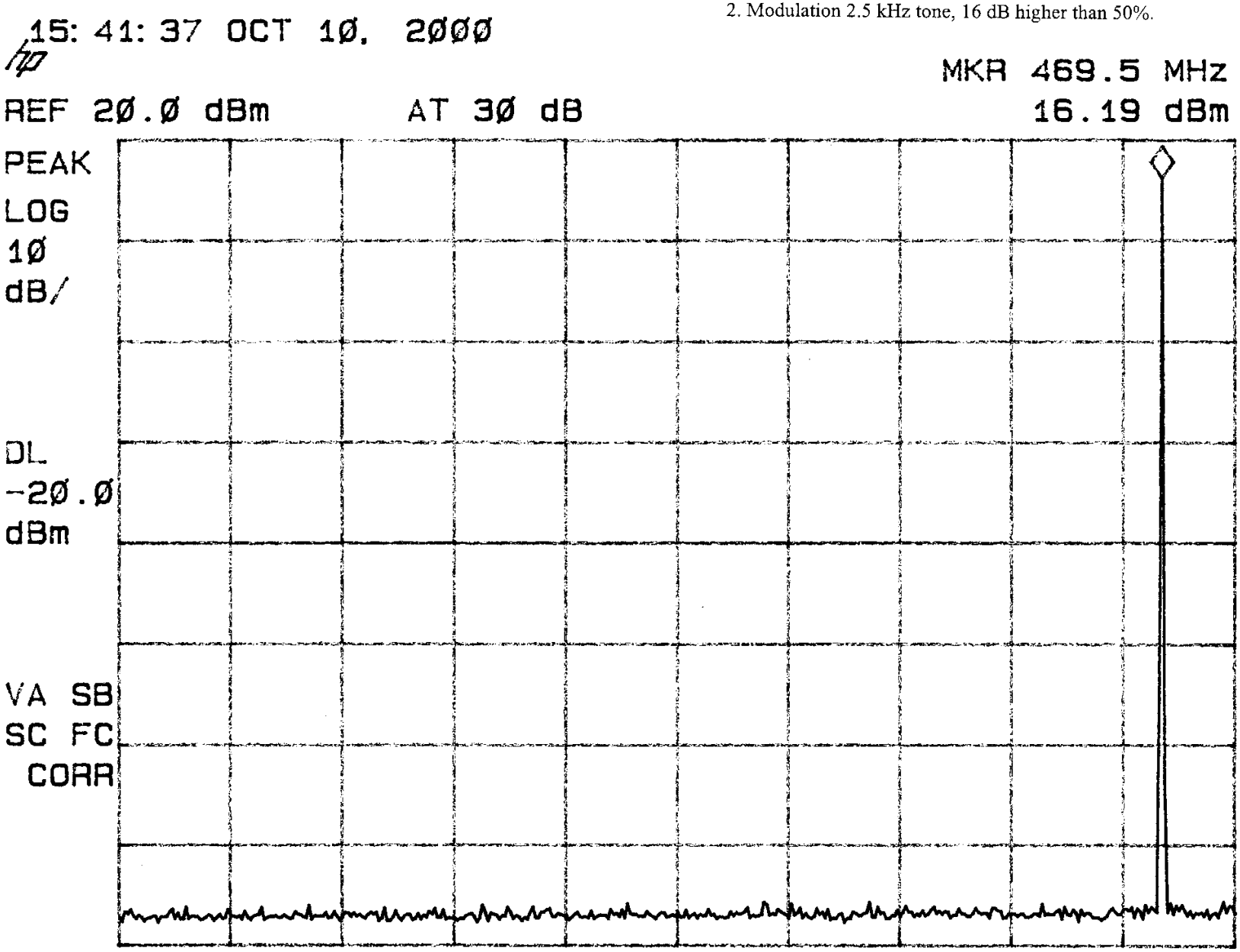
LOW	MID	HIGH
468.4875 MHz	469.1375 MHz	469.8875 MHz
16.57 dBm	15.49 dBm	15.58 dBm
45.394 mW	35.400 mW	36.141 mW

Equipment Used:

HP 8594E PN: 430

Modulation 2.5 kHz tone
16 dB higher than 50%

TEST: Conducted Spurious, Part 2, Para. 2.1051
NOTES: 1. Low Channel
2. Modulation 2.5 kHz tone, 16 dB higher than 50%.



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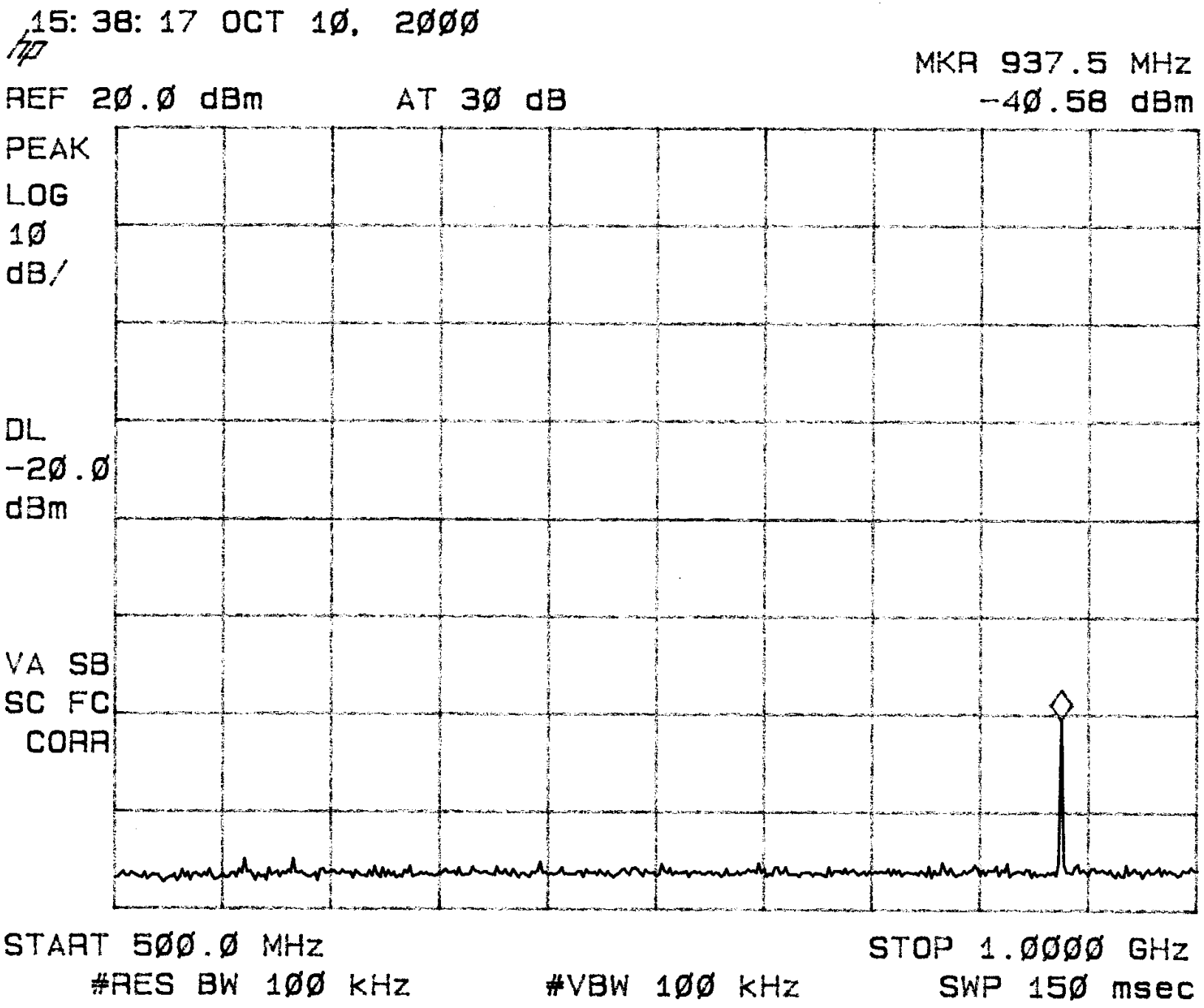
TEST: Conducted Spurious, Part 2, Para. 2.1051

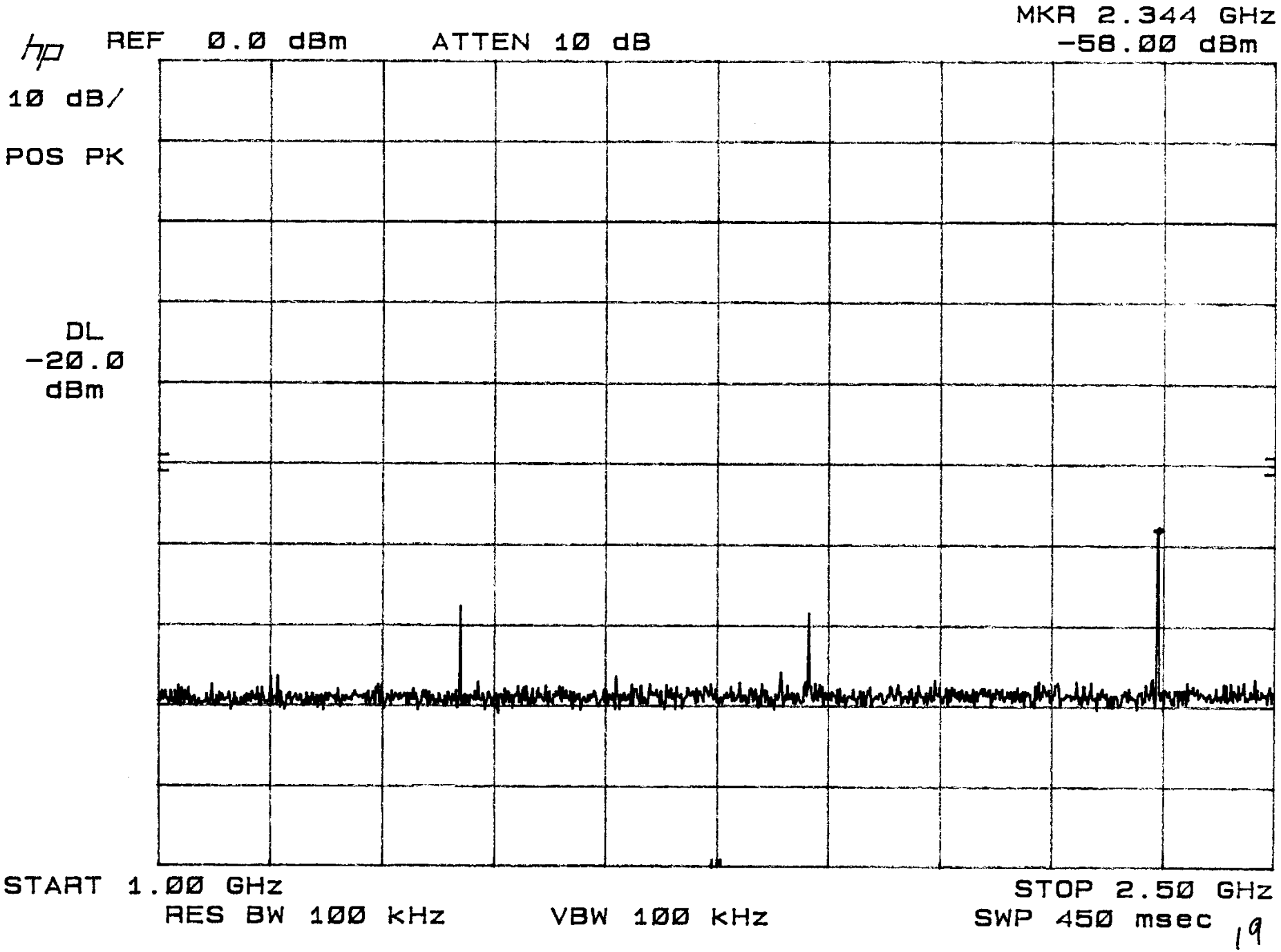
NOTES: 1. Low Channel
2. Modulation 2.5 kHz tone, 16 dB higher than 50%.



TEST: Conducted Spurious, Part 2, Para. 2.1051

NOTES: 1. Low Channel

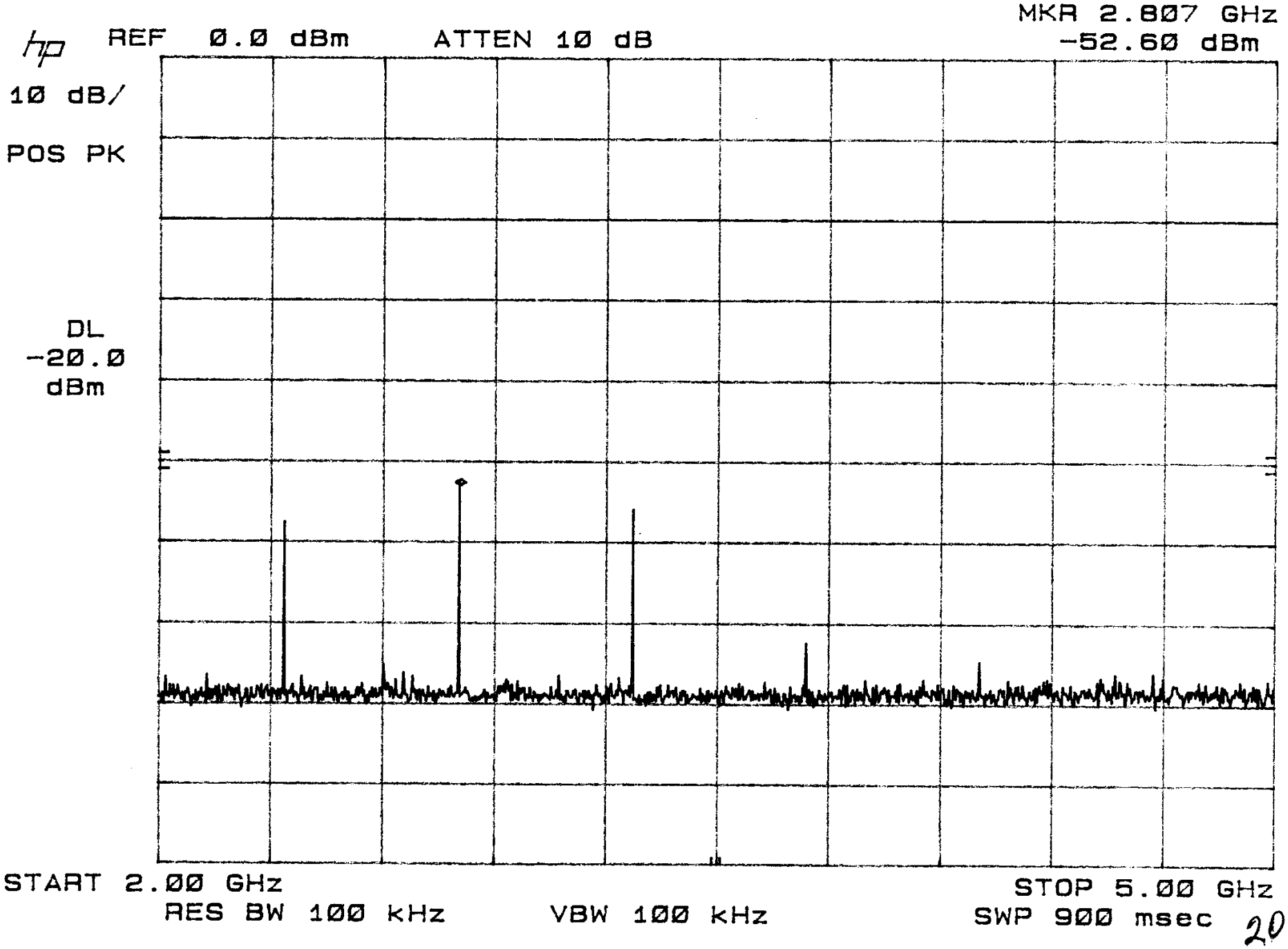
2. Modulation 2.5 kHz tone, 16 dB higher than 50%.



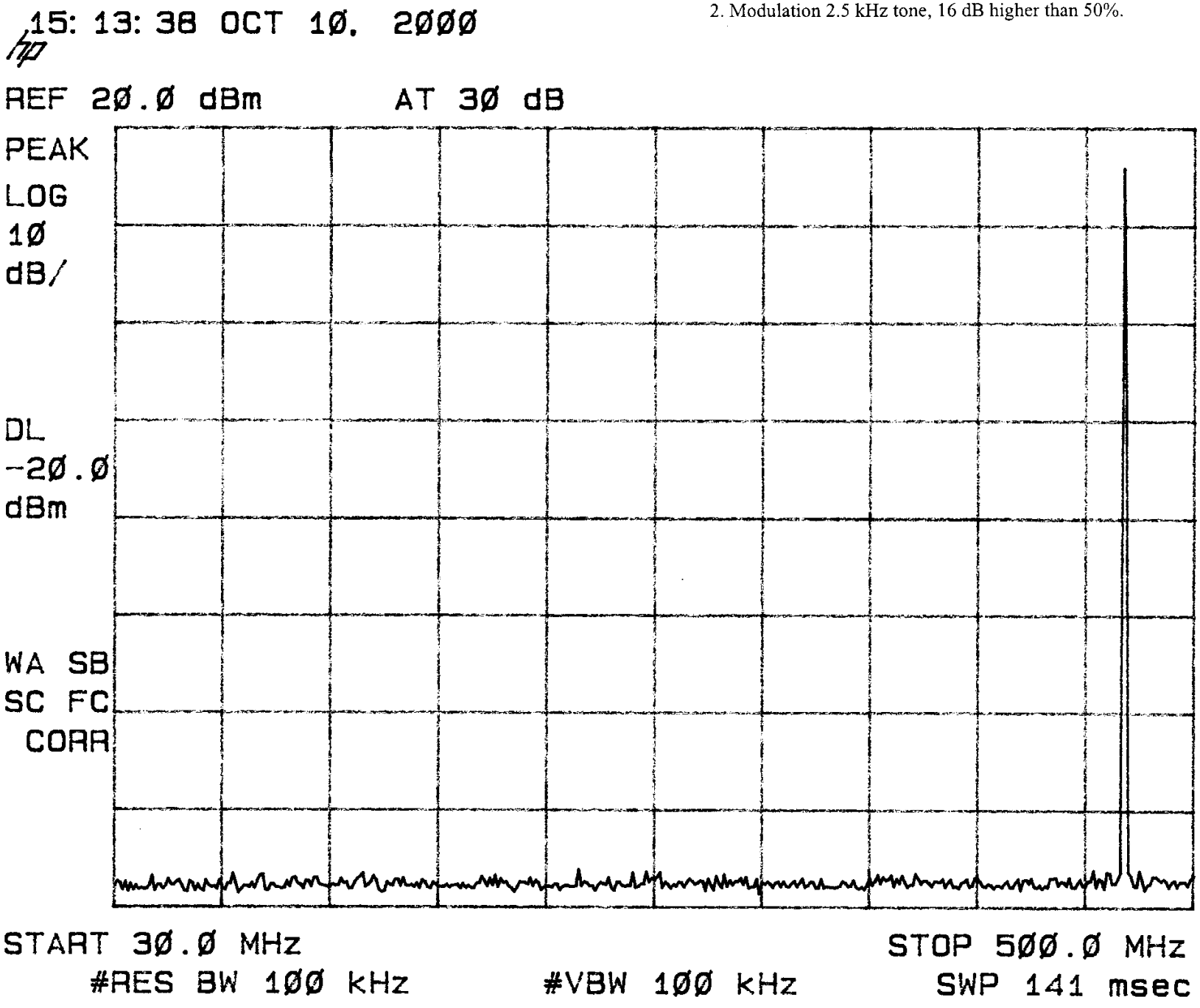
TEST: Conducted Spurious, Part 2, Para. 2.1051

NOTES: 1. Low Channel

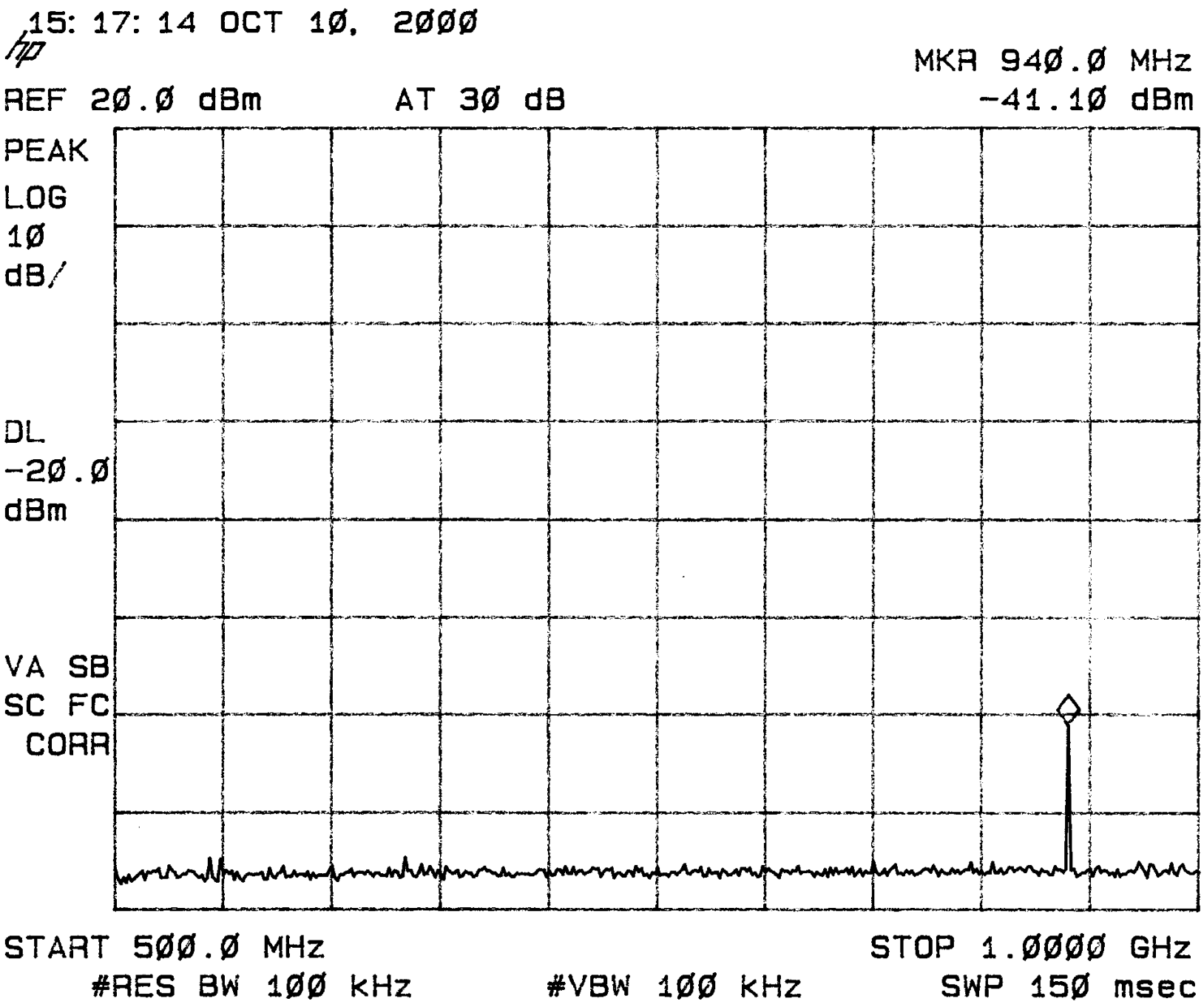
2. Modulation 2.5 kHz tone, 16 dB higher than 50%.



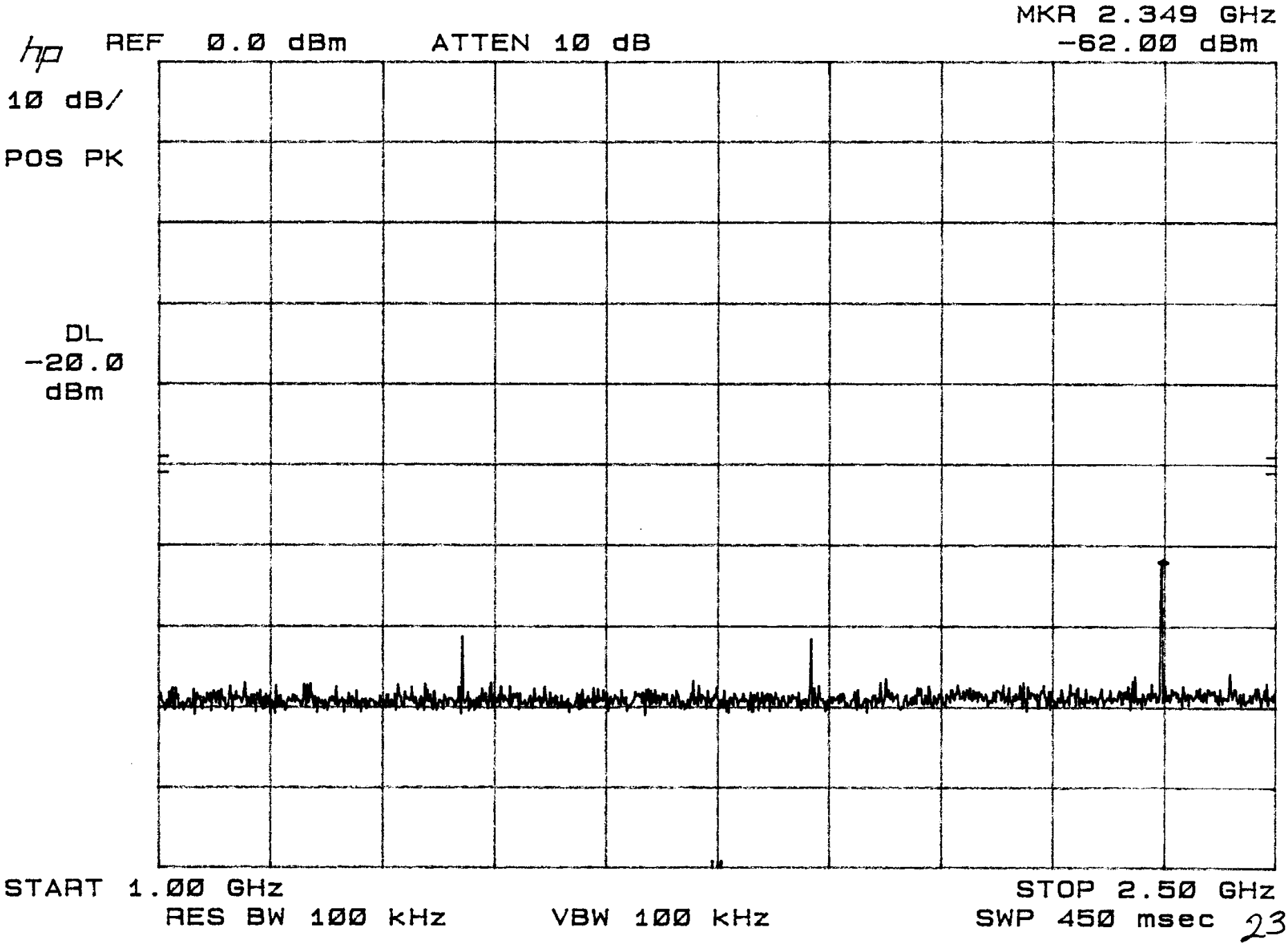
TEST: Conducted Spurious, Part 2, Para. 2.1051
NOTES: 1. Mid Channel
2. Modulation 2.5 kHz tone, 16 dB higher than 50%.



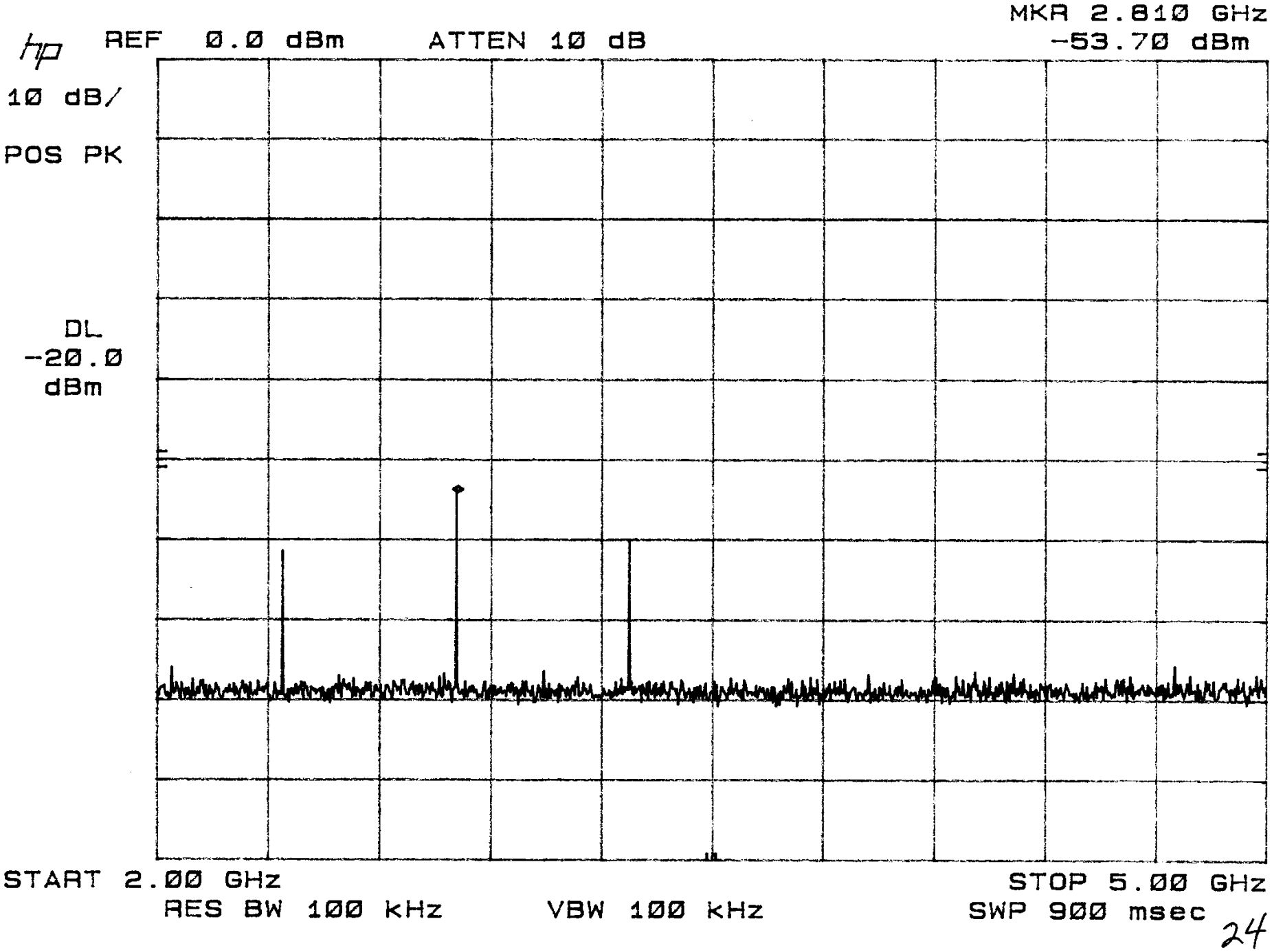
TEST: Conducted Spurious, Part 2, Para. 2.1051
NOTES: 1. Mid Channel
2. Modulation 2.5 kHz tone, 16 dB higher than 50%.



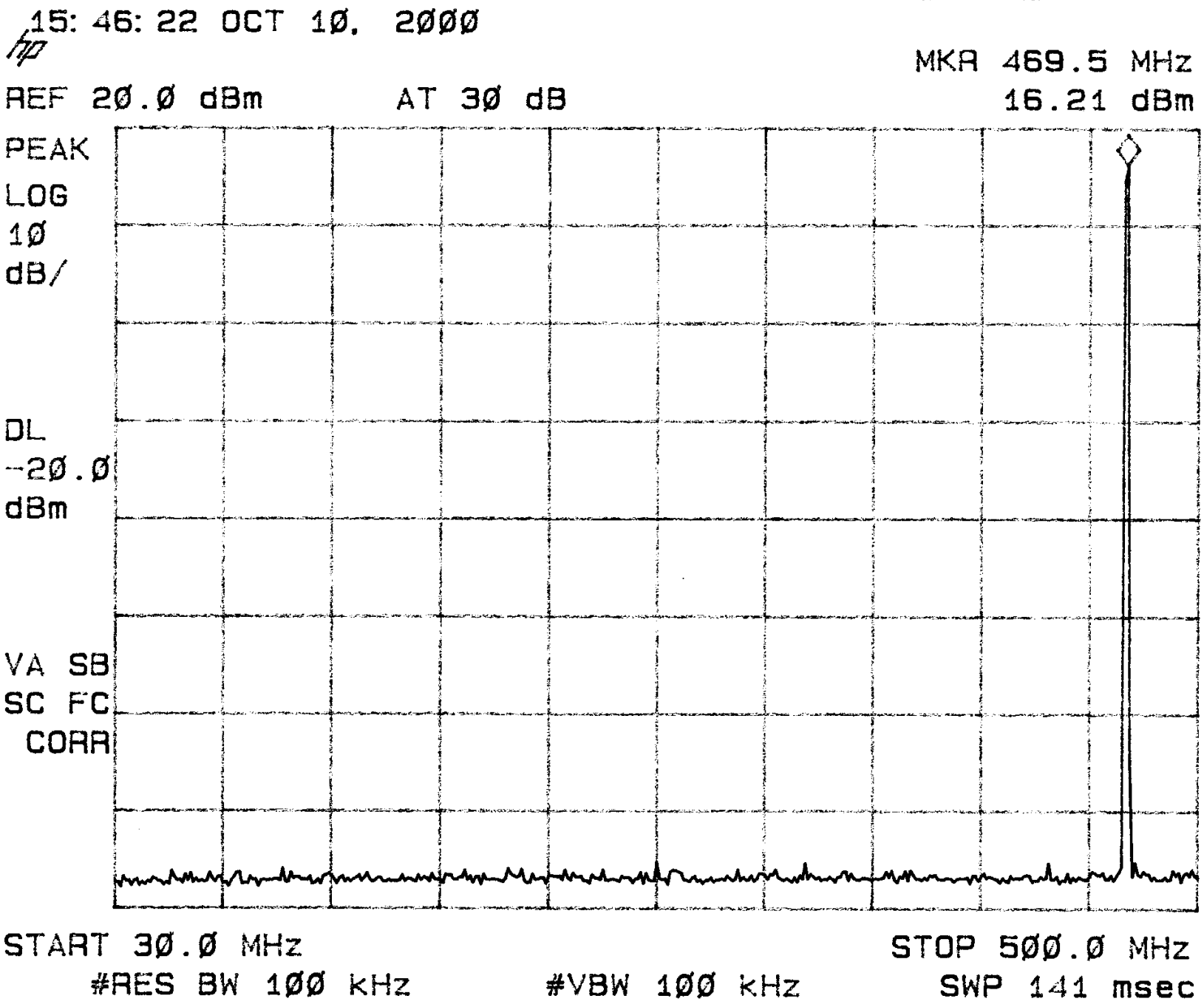
TEST: Conducted Spurious, Part 2, Para. 2.1051
NOTES: 1. Mid Channel
2. Modulation 2.5 kHz tone, 16 dB higher than 50%.



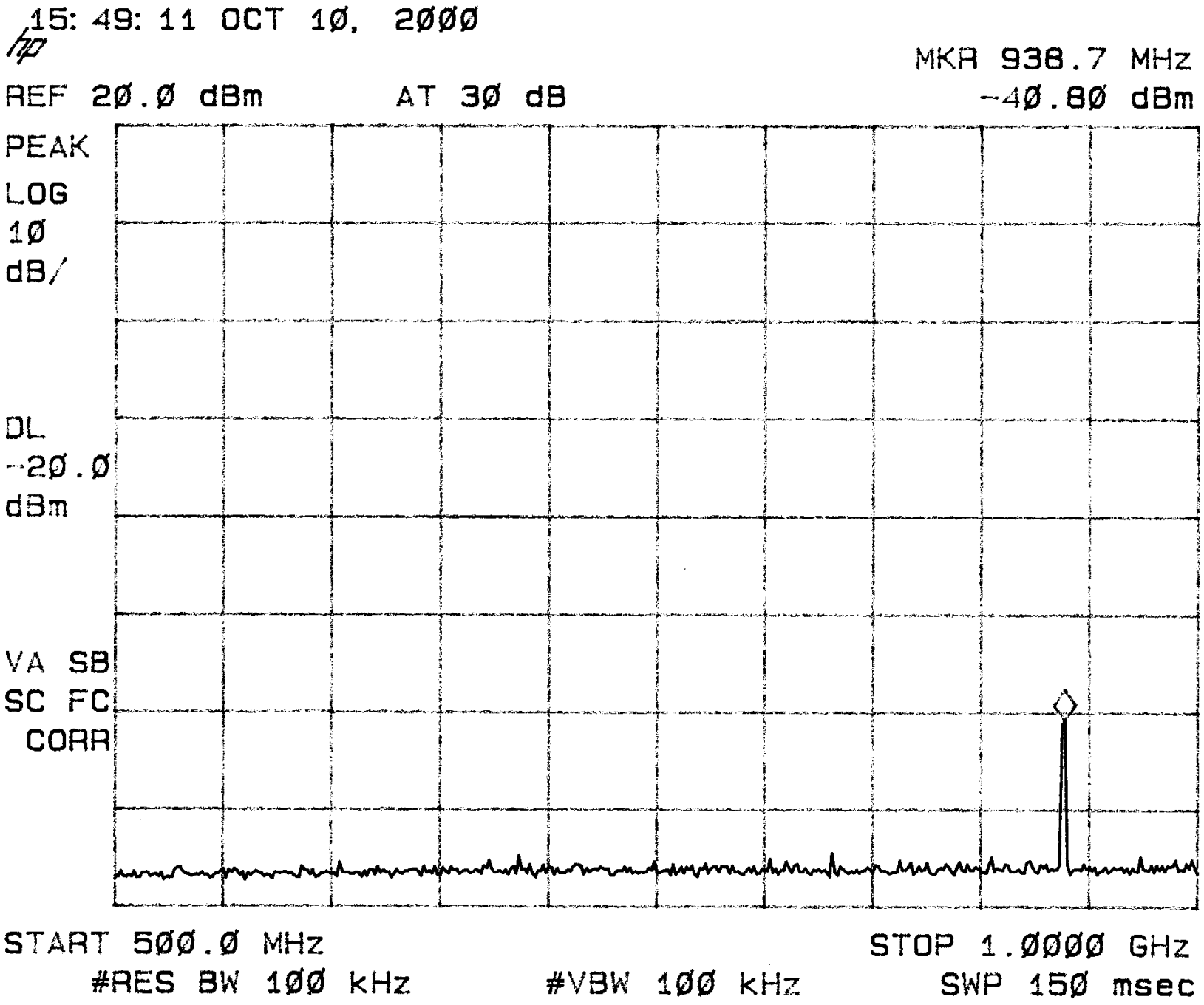
TEST: Conducted Spurious, Part 2, Para. 2.1051
NOTES: 1. Mid Channel
2. Modulation 2.5 kHz tone, 16 dB higher than 50%.



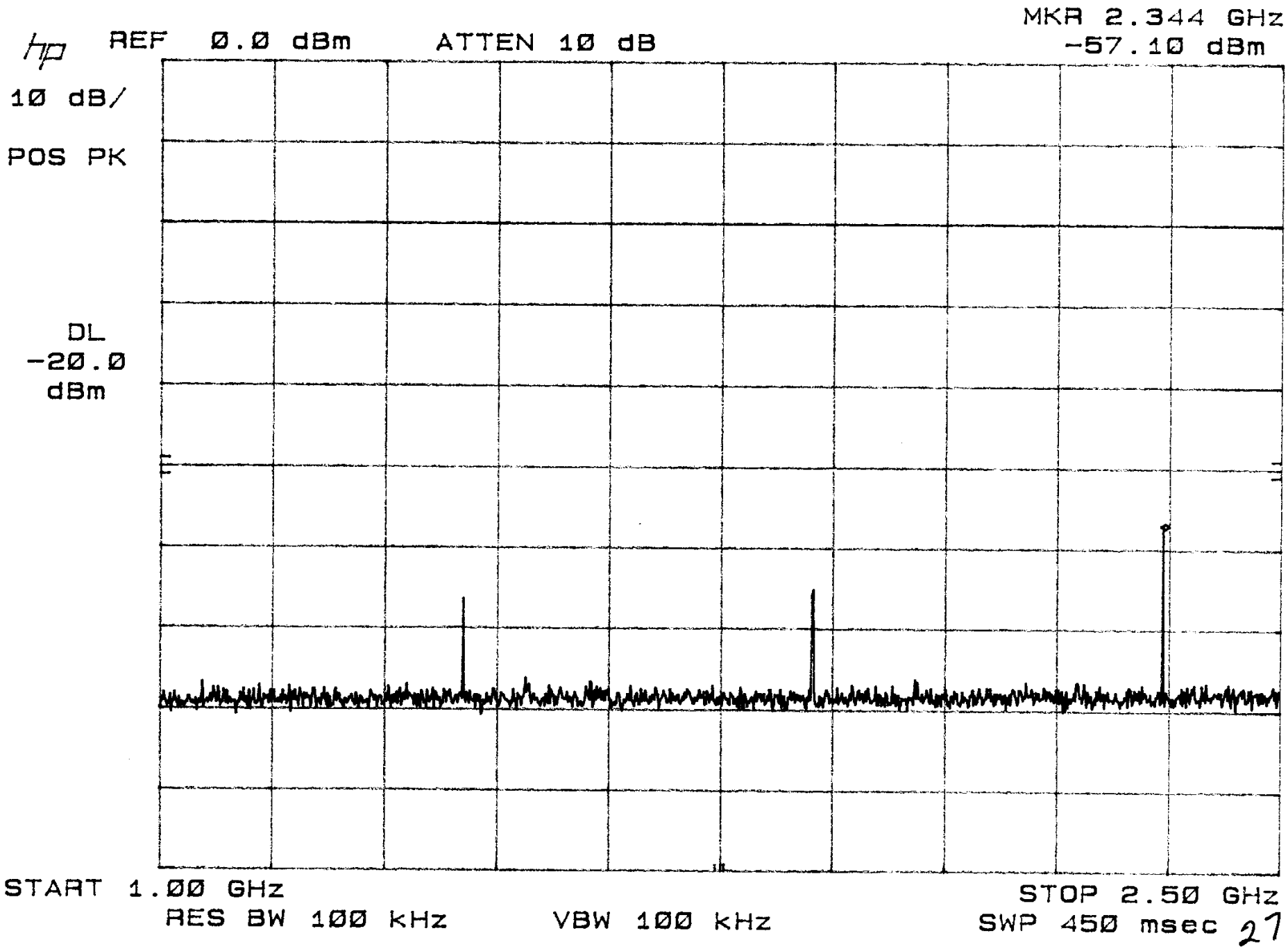
TEST: Conducted Spurious, Part 2, Para. 2.1051
NOTES: 1. High Channel
2. Modulation 2.5 kHz tone, 16 dB higher than 50%.



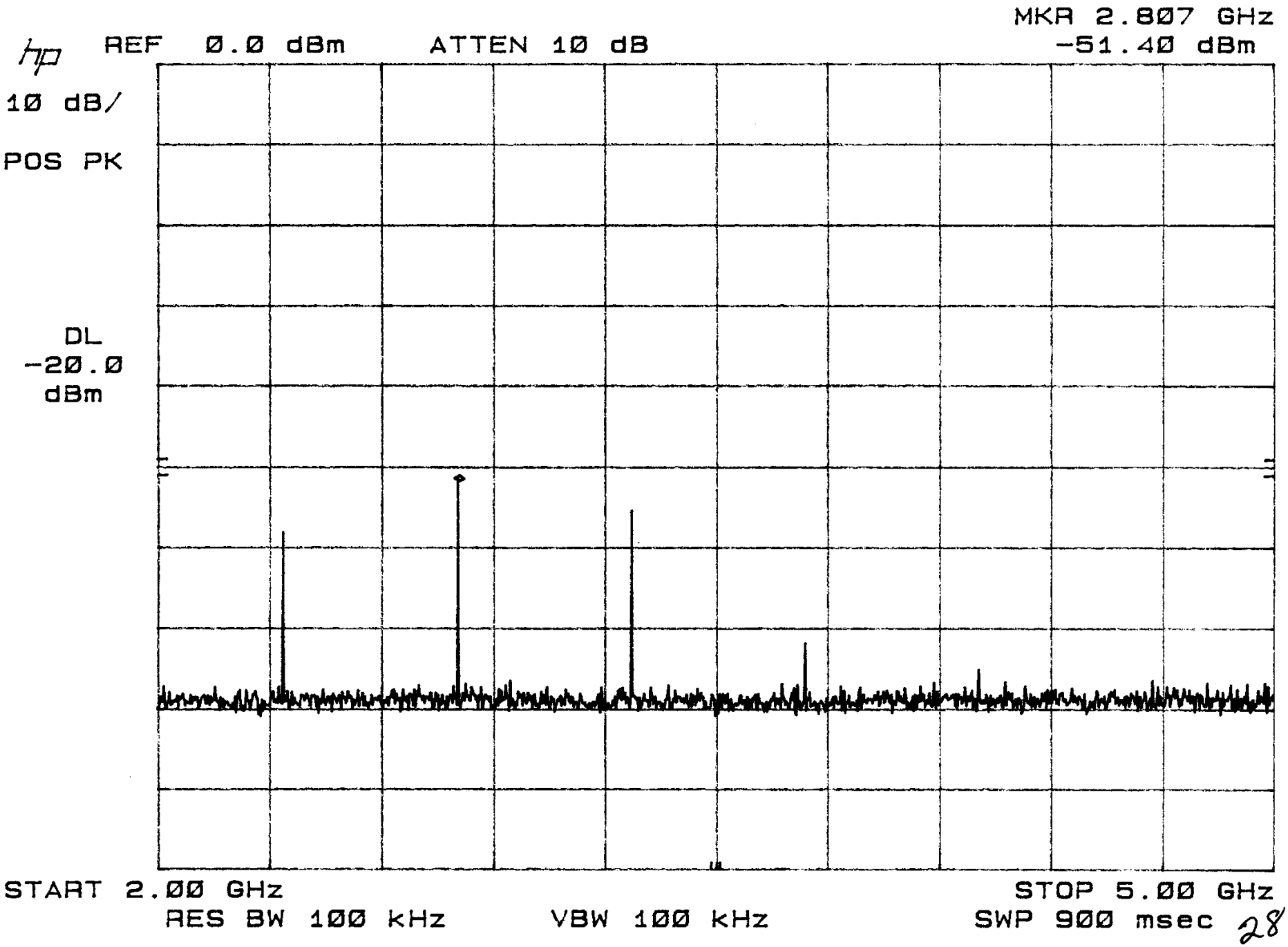
TEST: Conducted Spurious, Part 2, Para. 2.1051
NOTES: 1. High Channel
2. Modulation 2.5 kHz tone, 16 dB higher than 50%.



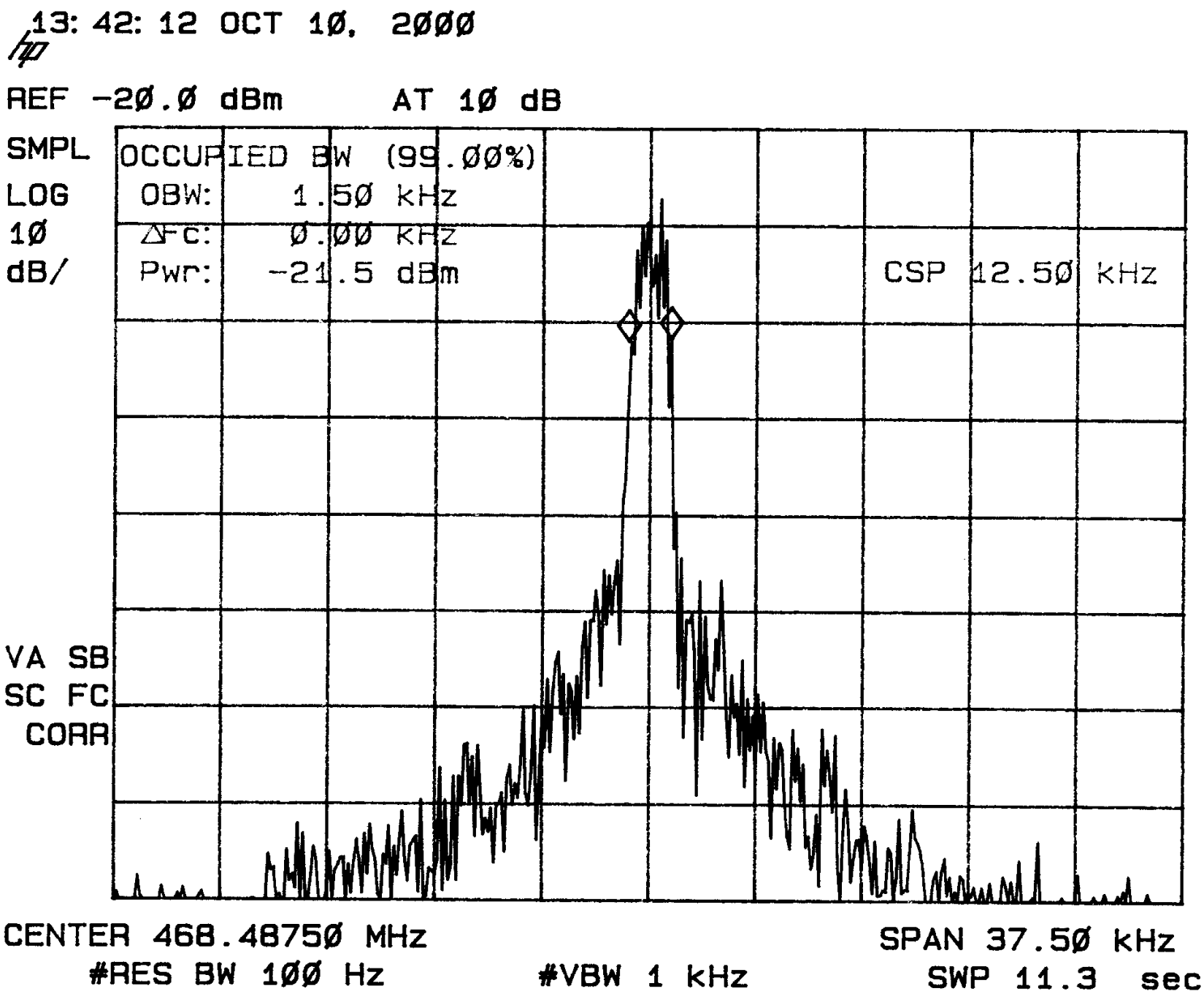
TEST: Conducted Spurious, Part 2, Para. 2.1051
NOTES: 1. High Channel
2. Modulation 2.5 kHz tone, 16 dB higher than 50%.



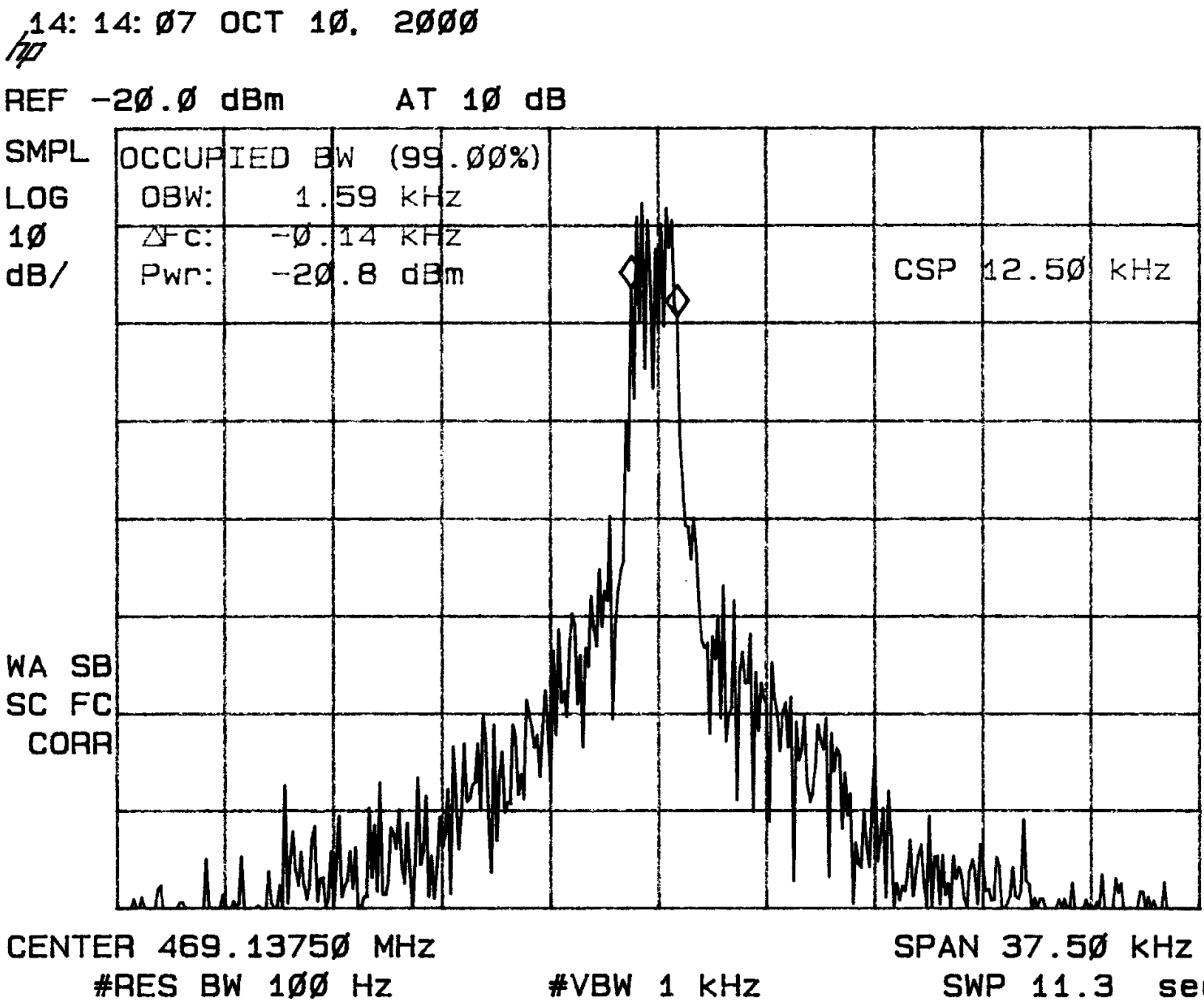
TEST: Conducted Spurious, Part 2, Para. 2.1051
NOTES: 1. High Channel
2. Modulation 2.5 kHz tone, 16 dB higher than 50%.



TEST: Occupied Bandwidth, Part 2, Para. 2.1049
NOTE: Modulation 2.5 kHz tone, 16 dB higher than 50%.

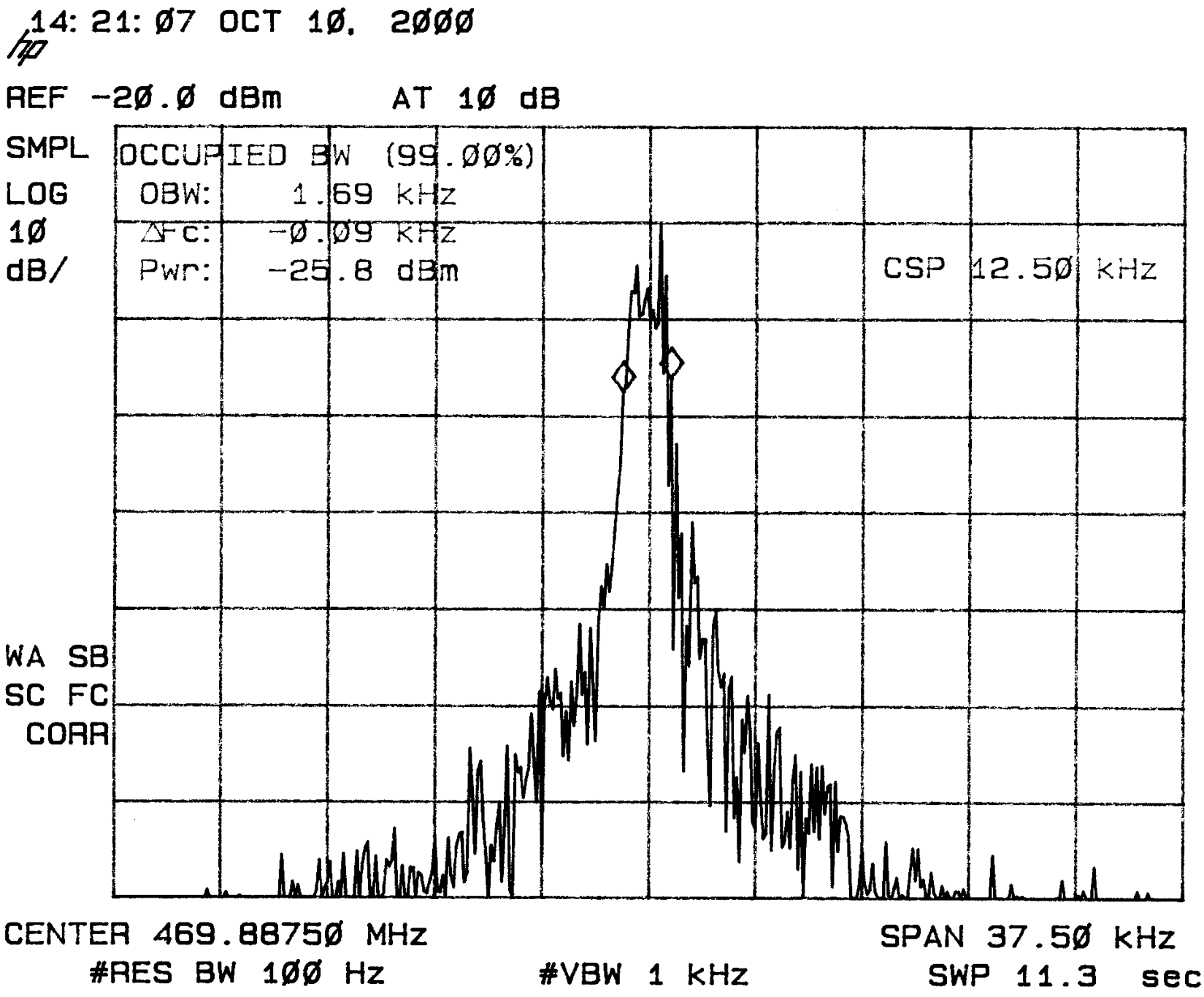


TEST: Occupied Bandwidth, Part 2, Para. 2.1049
Modulation 2.5 kHz tone, 16 dB higher than 50%.

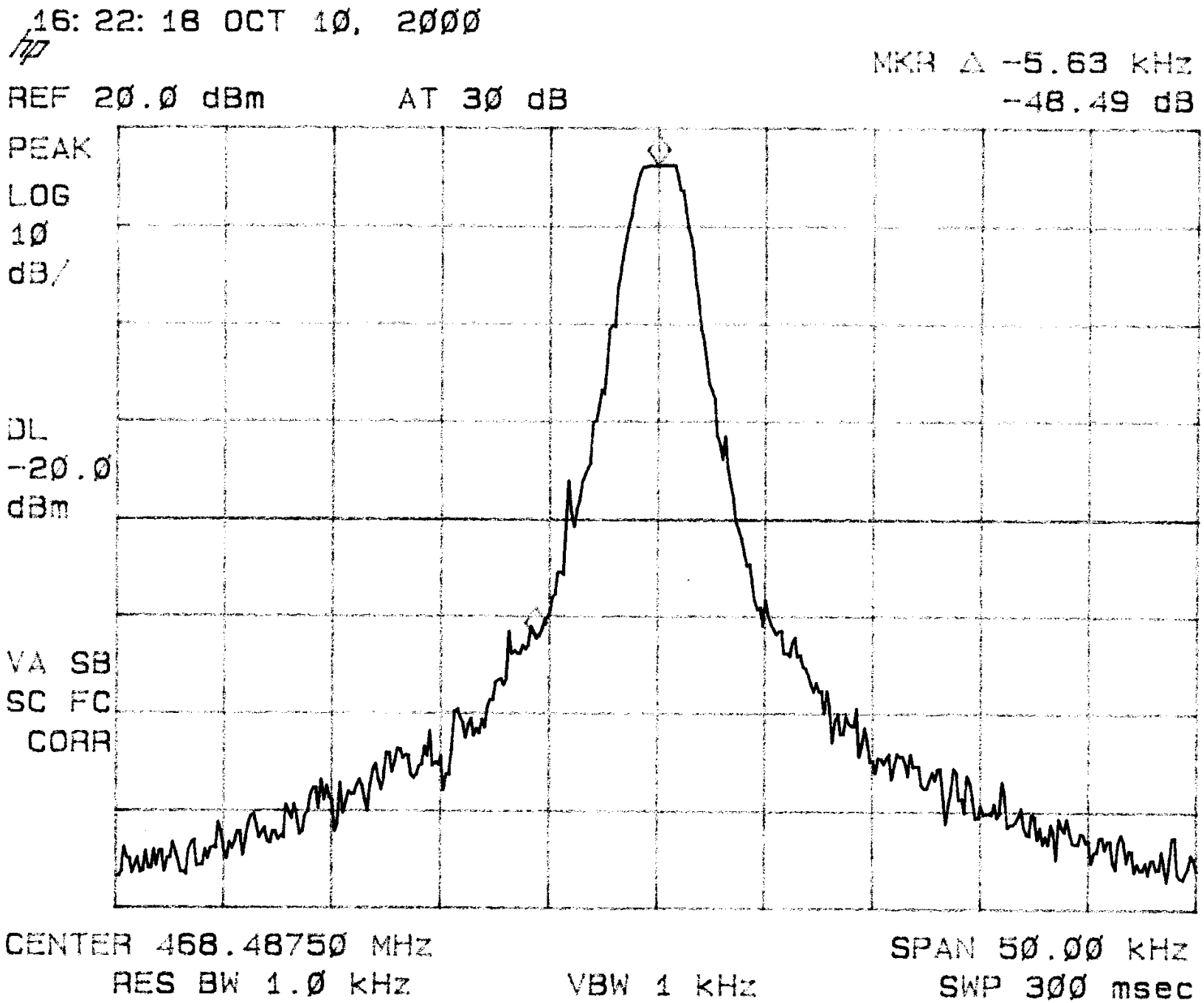


30

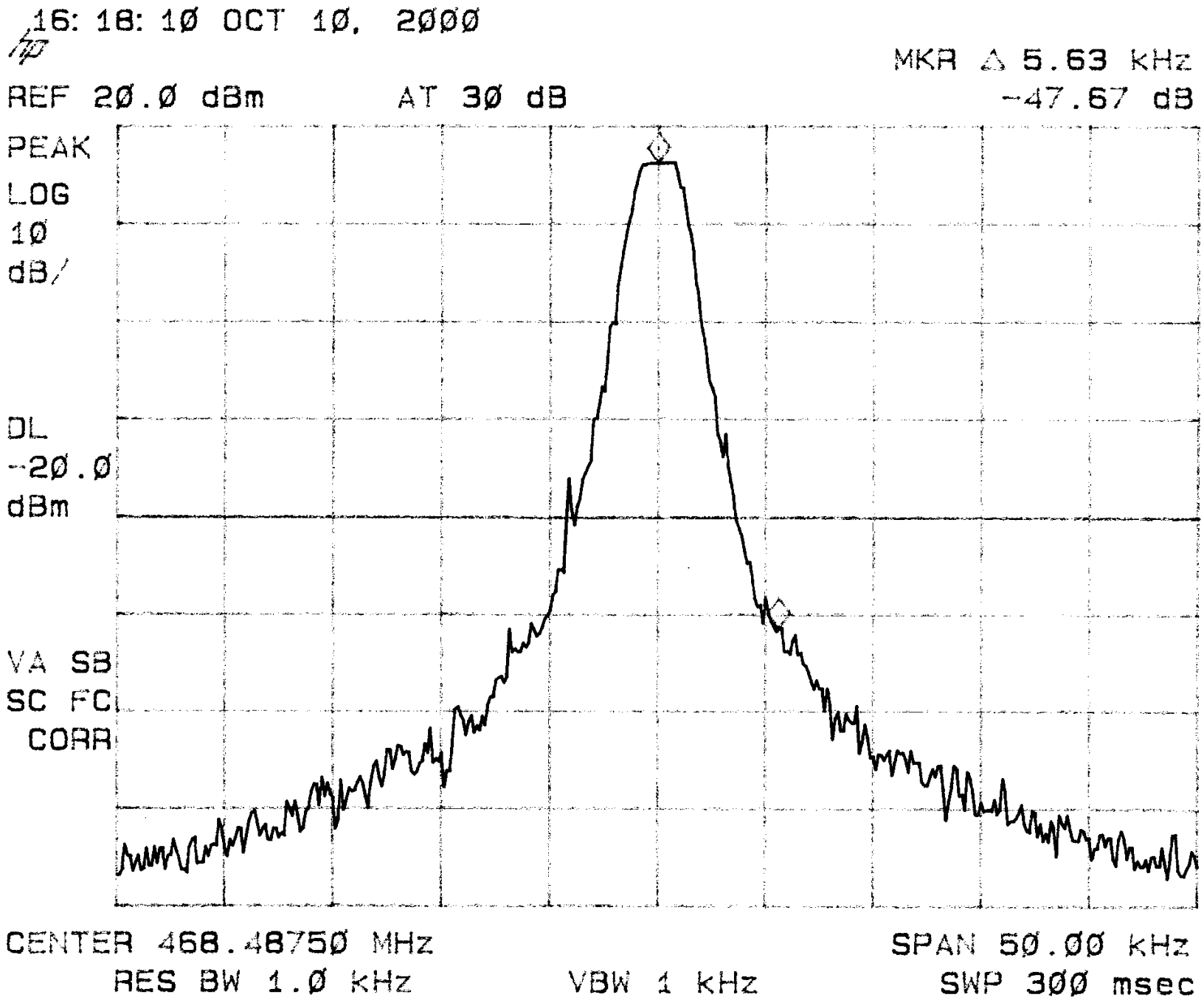
TEST: Occupied Bandwidth, Part 2, Para. 2.1049
Modulation 2.5 kHz tone, 16 dB higher than 50%.



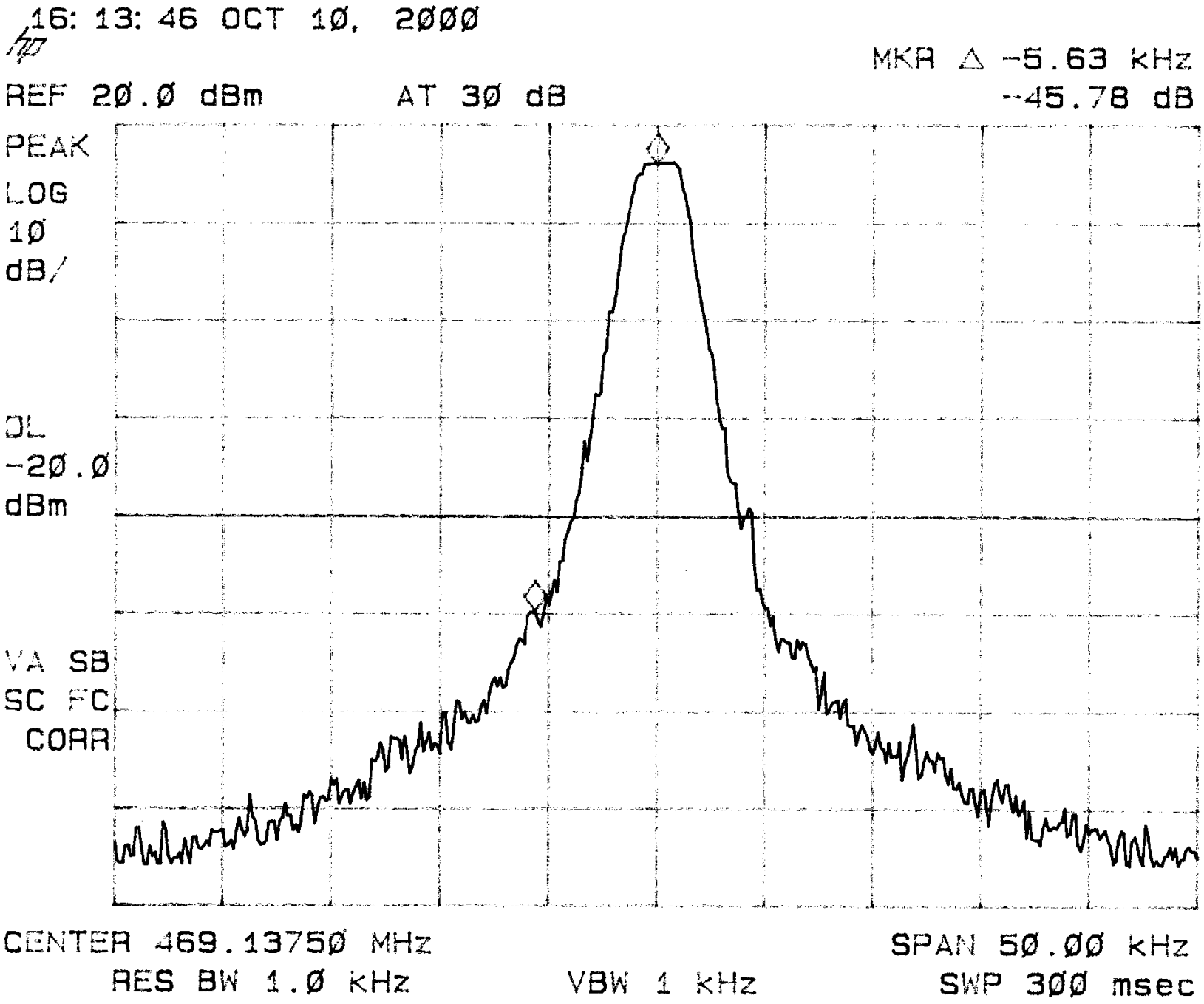
TEST: Exemption from standard emission mask plot, FCC Part 90, Paragraph 90.217
NOTES: 1. Low Channel
2. Modulation 2.5 kHz tone, 16 dB higher than 50%.



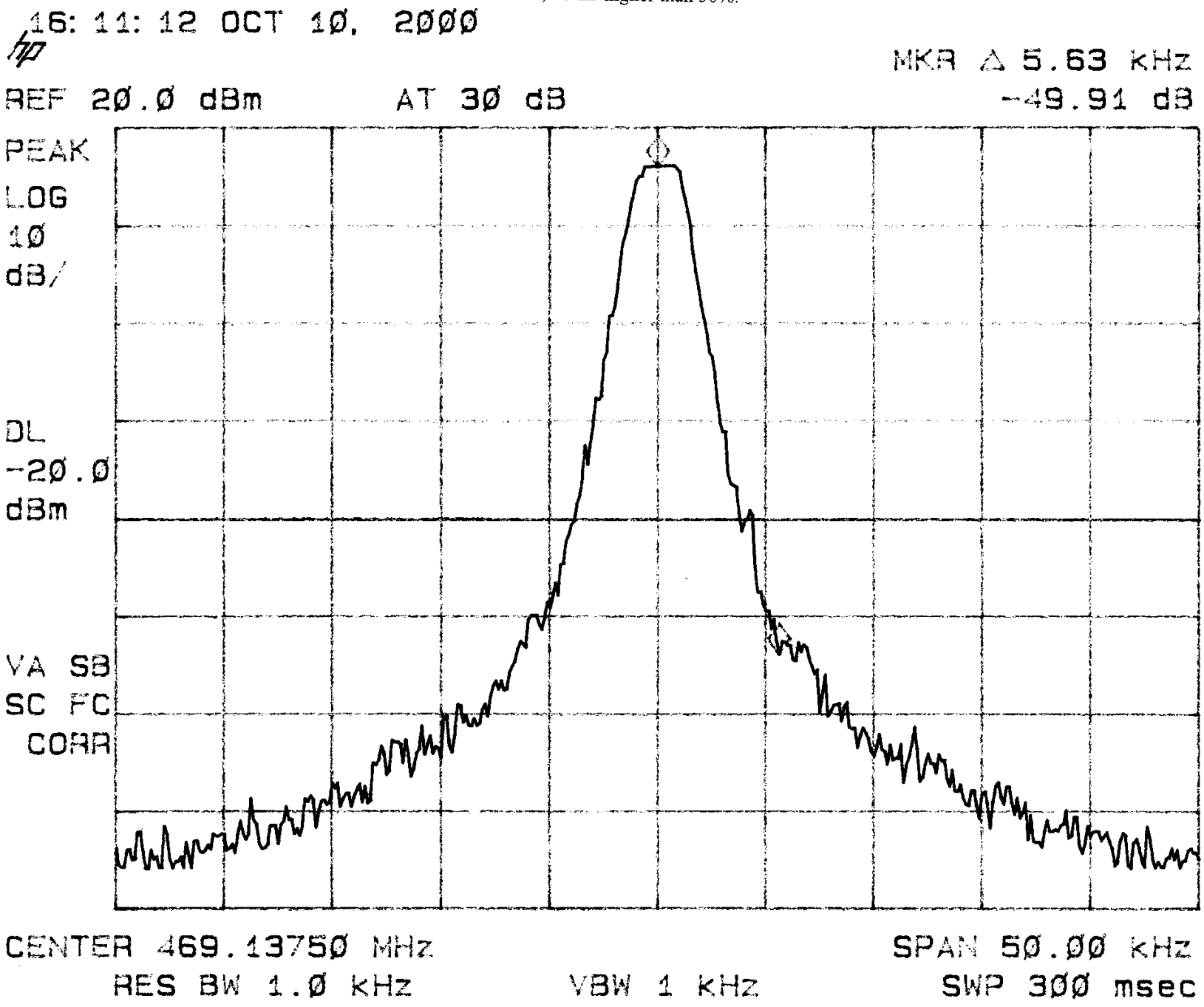
TEST: Exemption from standard emission mask plot, FCC Part 90, Paragraph 90.217
NOTES: 1. Low Channel
2. Modulation 2.5 kHz tone, 16 dB higher than 50%.



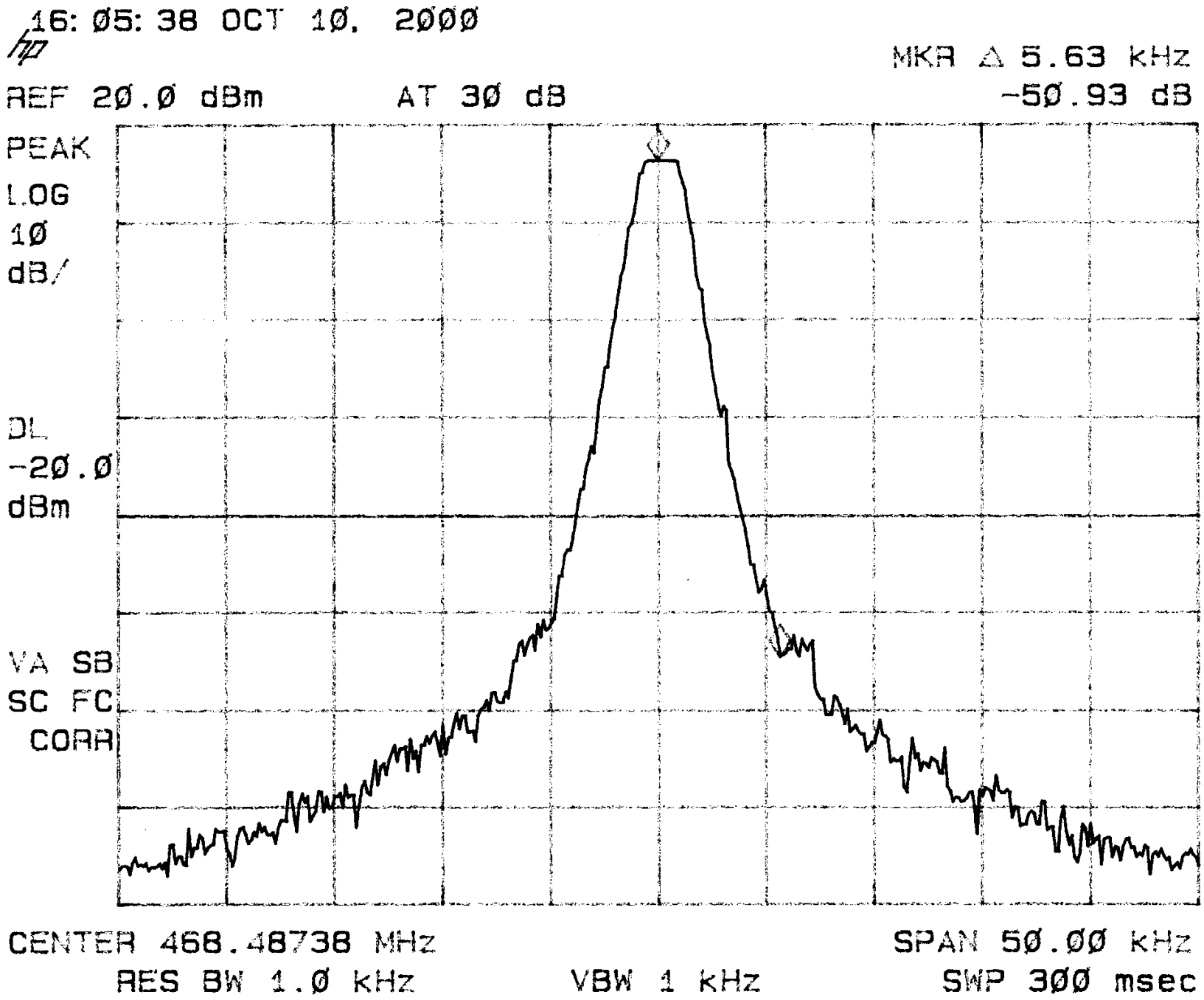
TEST: Exemption from standard emission mask plot, FCC Part 90, Paragraph 90.217
NOTES: 1. Mid Channel
2. Modulation 2.5 kHz tone, 16 dB higher than 50%.



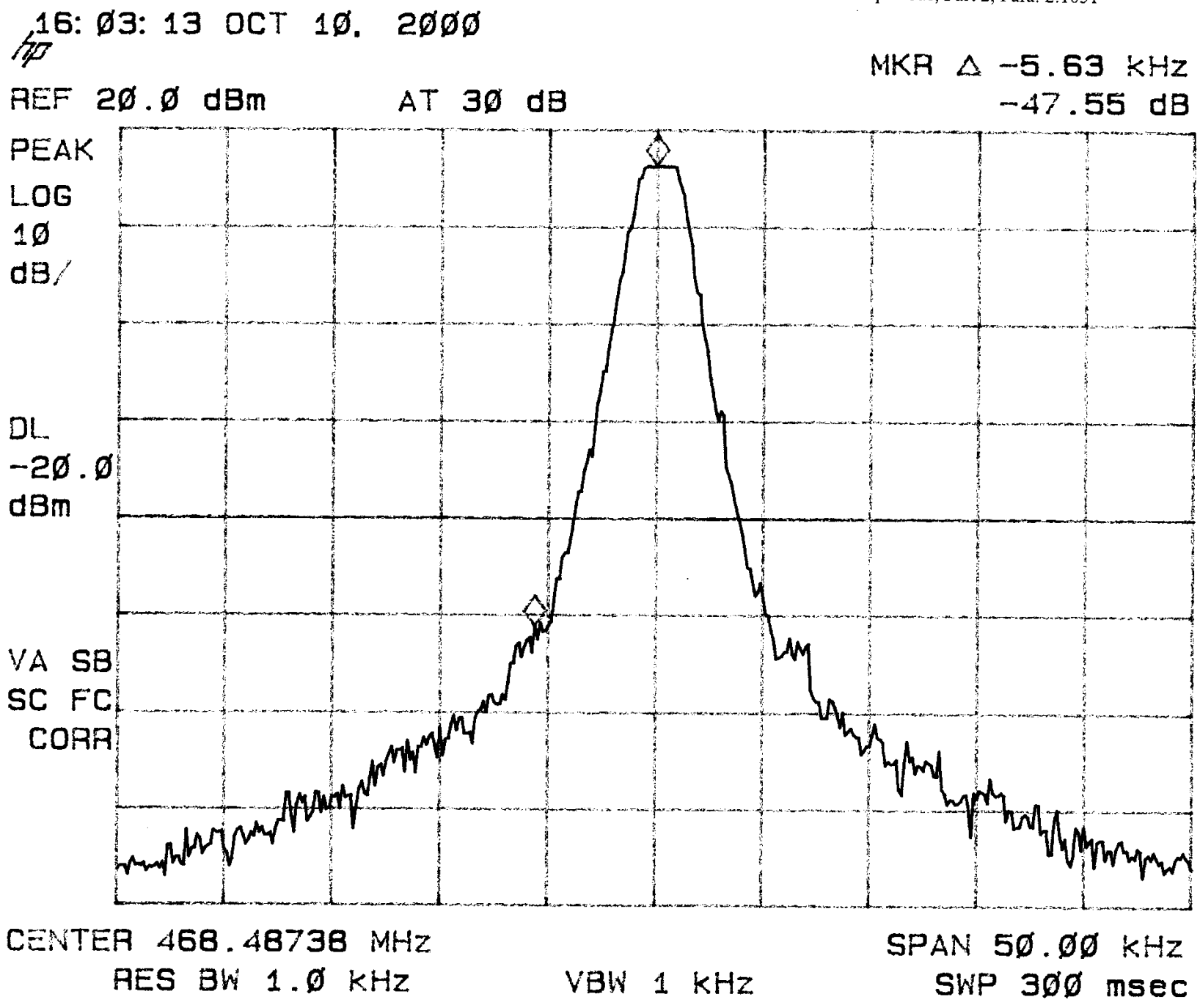
TEST: Exemption from standard emission mask plot, FCC Part 90, Paragraph 90.217
NOTES: 1. Mid Channel
2. Modulation 2.5 kHz tone, 16 dB higher than 50%.



TEST: Exemption from standard emission mask plot, FCC Part 90, Paragraph 90.217
NOTES: 1. High Channel
2. Modulation 2.5 kHz tone, 16 dB higher than 50%.



TEST: Exemption from standard emission mask plot, FCC Part 90, Paragraph 90.217
NOTES: 1. High Channel
2. Modulation 2.5 kHz tone, 16 dB higher than 50%. TEST: Conducted Spurious, Part 2, Para. 2.1051



Emissions Test Conditions: FREQUENCY STABILITY (Tests performed by HM Electronics)
DATA/EQUIPMENT

9 Nov, 00

Information regarding testing of COM400CC at HM Electronics.

The following tests on the COM400CC were performed on the dates noted:

1. Frequency Stability vs. Temperature — 12 October 2000 and 13 Oct 2000
2. Audio Frequency Response — 13 October 2000
3. Modulation Limiting — 13 October 2000

The tests were performed by: Eligio Rollo, Technician, HME Engineering Dept.
The tests were supervised by: Seth Schlam, Engineer, HME Engineering Services Dept.

Equipment used for these tests, and calibration data for the equipment is as follows:

1. Temperature Chamber: Environtronics Model ST1, S/N 079010030
   Performance Verification: July 2000 by HM Electronics
   next due: July 2001
   Note: Temperature Monitoring verified by Fluke Digital Multimeter with Thermocouple Module.

2. Fluke Multimeter: Fluke model D800, S/N 3085032
   Calibration Date: 4/21/2000
   next due: 4/21/2001
   Calibration by: Excalibur Engineering
   3198-C Airport Loop Drive
   Costa Mesa Ca. 92626

3. Fluke Thermocouple Converter: Fluke model 80TK, S/N AA00091737
   Calibration Date: August 3, 2000
   next due: August 3, 2002
   Calibration by: Excalibur Engineering

4. Hewlett Packard RF Communications Test Set: Model HP8920A, S/N 3141A00596
   Calibration Date: November 18, 1998
   next due: November 18, 2000
   Calibration by: Certified Metrology Services Inc.
   1425 Russ Blvd.
   San Diego, Ca. 92101

The above information is true and correct.

Seth Schlam,

Seth Schlam

HM Electronics Engineering Services

COM400CC Frequency Stability vs. Temperature Test Data
Requirement: 47 CFR 2.1055
Test Method: EIA – TIA – 603 (93) para 2.2.2

The COM400CC was temperature soaked at –30 degrees C overnight prior to taking the first test reading. For each step in temperature, the unit was temp soaked for ½ hour prior to taking the test reading. The readings were taken while the unit remained in the environmental chamber. Data is shown in table 1 below. A graph of the data is shown in Figure 1.

Temp (Deg. C)	ACF (MHz)	MCF (MHz)	PPM error	Time
- 30	469.1375	469.1324011	10.86	12:00 PM
- 20	469.1375	469.135488	4.28	12:30 PM
- 10	469.1375	469.137076	.90	1:00 PM
0	469.1375	469.137981	1.02	1:30 PM
+ 10	469.1375	469.138022	1.11	2:00 PM
+ 20	469.1375	469.138022	1.11	2:30 PM
+ 30	469.1375	469.137729	.48	3:00 PM
+ 40	469.1375	469.137412	.18	3:30 PM
+ 50	469.1375	469.137251	.53	4:00 PM
+ 60	469.1375	469.136354	2.44	8:00 AM

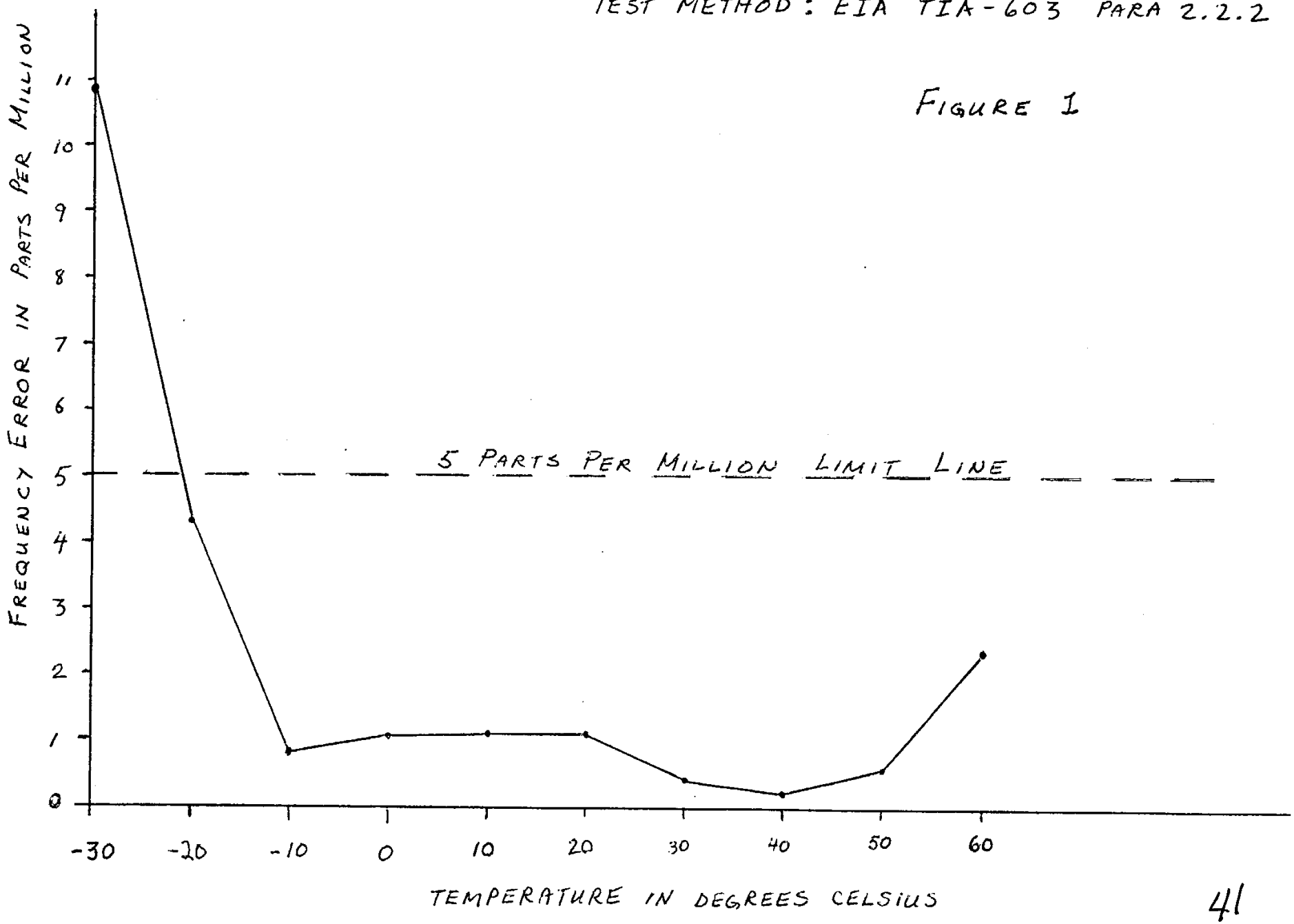
Table 1.

ACF = Assigned Center Frequency
MCF = Measured Center Frequency
PPM = Parts Per Million

REQUIREMENT : 47CFR 2.1055 FREQUENCY STABILITY

TEST METHOD : EIA TIA-603 PARA 2.2.2

FIGURE 1



COM4ØØCC - FREQUENCY STABILITY VS. TEMPERATURE

COM400CC Audio Frequency Response
Requirement: 47 CFR 2.1047 (a)
Test Method: EIA-TIA-603 (93) para. 2.2.6

Note: Due to subaudible tones used for control (CTCSS continuous tone controlled squelch system) the COM400CC has a low end frequency of 300 Hz for audio. The high end is approximately 3000 Hz. The data readings below were taken from 3000 to 5000 Hz audio input, as shown in table 2 below. This data is graphed in Figure 2 , against the 6 dB per Octave line.

Frequency (Hz)	FM Deviation (Hz)	Audio Freq Response (dB
300	120	-9.54
400	160	-7.04
500	197	-5.23
600	230	-3.89
700	260	-2.82
800	295	-1.72
900	327	-0.83
1000 * Ref Lvl	360	0.0
1100	395	+0.80
1200	430	+1.54
1300	465	+2.22
1400	500	+2.85
1500	535	+3.44
1600	571	+4.00
1700	607	+4.53
1800	644	+5.05
1900	678	+5.49
2000	713	+5.93
2100	749	+6.36
2200	781	+6.72
2300	812	+7.06
2400	842	+7.38
2500	870	+7.66
2600	895	+7.91
2700	917	+8.12
2800	934	+8.28

Table 2.

Table 2. Audio Frquency Response for COM400CC (continued)

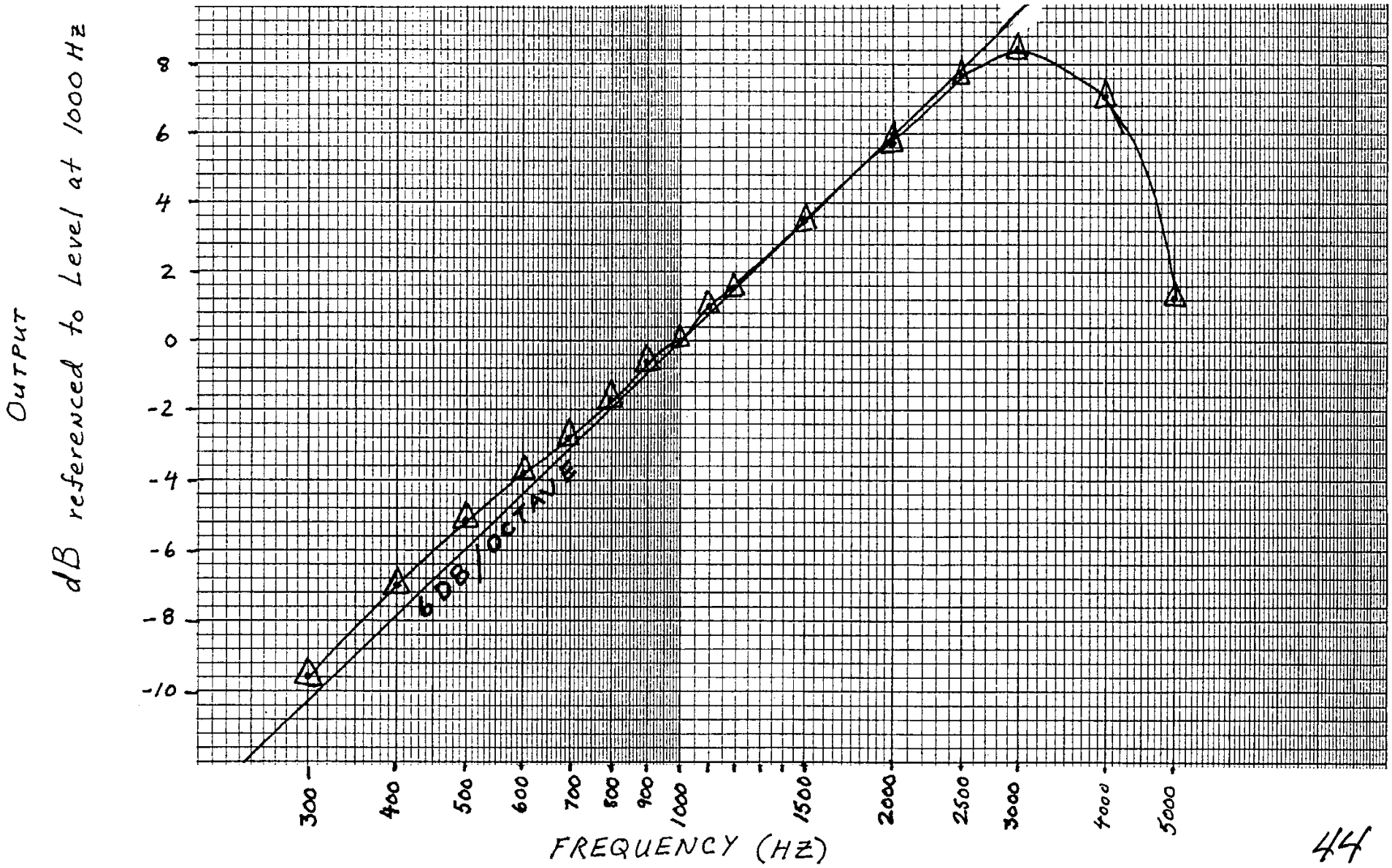
Frequency (Hz)	FM Deviation (Hz)	Audio Freq Response (dB)
2900	950	+8.42
3000	960	+8.51
3100	970	+8.60
3200	970	+8.60
3300	970	+8.60
3400	960	+8.51
3500	946	+8.39
3600	928	+8.22
3700	908	+8.03
3800	881	+7.77
3900	851	+7.47
4000	818	+7.12
4100	782	+6.73
4200	742	+6.28
4300	701	+5.78
4400	661	+5.27
4500	619	+4.70
4600	577	+4.09
4700	535	+3.44
4800	494	+2.74
4900	455	+2.03
5000	418	+1.29

Requirement: CFR 2.1047(a)

COM 400CC

Test Method EIA-TIA-603 para. 2.2.6

AUDIO FREQUENCY RESPONSE 300 TO 5000 Hz



COM400CC Modulation Limiting
Requirement: 47 CFR 2.1047 (b)
Test Method: EIA – TIA – 603 (93) para. 2.2.3

Test data for the Modulation Limiting test is shown in table 3 for Positive Peak Detection and in table 4 for Negative Peak Detection. Figures 3 and 4 show the graphs of the data.

Table 3 Max FM Deviation (+ Peak Detector) vs. Audio Input Frequency

Audio Freq (Hz)	Max. FM Deviation (Hz)		Audio Freq (Hz)	Max. FM Deviation (Hz)
300	1780		2700	3340
400	2480		2800	3430
500	2980		2900	3340
600	3290		3000	3400
700	3520		3100	3340
800	3660		3200	3280
900	3720		3300	3280
1000	3720		3400	3080
1100	3680		3500	3130
1200	3630		3600	3000
1300	3580		3700	2770
1400	3560		3800	2650
1500	3540		3900	2610
1600	3500		4000	2370
1700	3460		4100	2200
1800	3420		4200	2130
1900	3390		4300	2070
2000	3370		4400	1980
2100	3230		4500	1760
2200	3280		4600	1570
2300	3300		4700	1550
2400	3300		4800	1560
2500	3300		4900	1560
2600	3410		5000	1240

Table 4 Max FM Deviation (- Peak Detector) vs. Audio Input Frequency

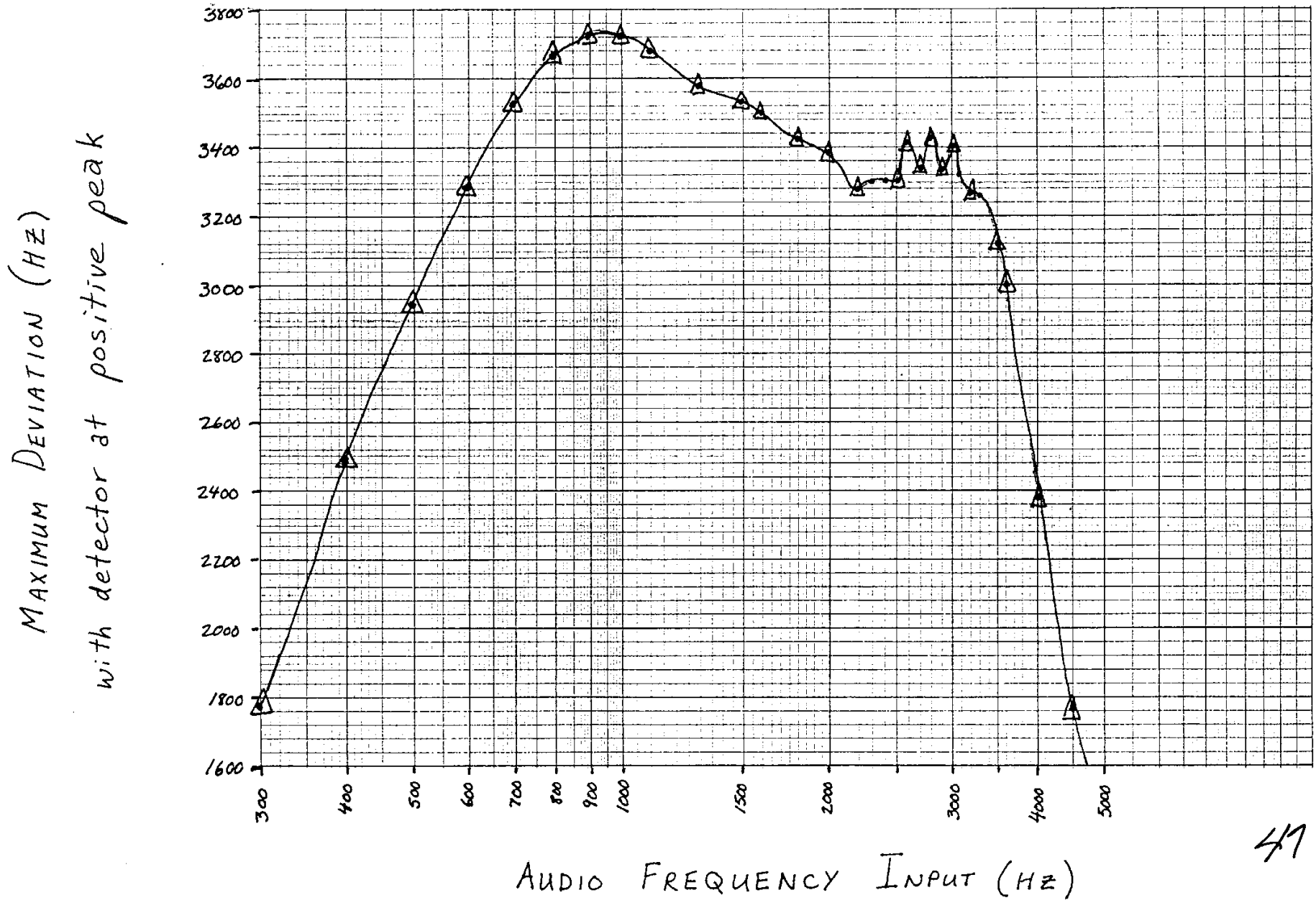
Audio Freq (Hz)	Max. FM Deviation (Hz)		Audio Freq (Hz)	Max. FM Deviation (Hz)
300	1730		2700	3420
400	2440		2800	3390
500	2890		2900	3460
600	3200		3000	3360
700	3410		3100	3400
800	3560		3200	3330
900	3630		3300	3320
1000	3660		3400	3310
1100	3640		3500	3140
1200	3610		3600	3140
1300	3570		3700	3060
1400	3510		3800	3060
1500	3460		3900	2730
1600	3420		4000	2720
1700	3370		4100	2700
1800	3340		4200	2640
1900	3330		4300	2300
2000	3300		4400	2360
2100	3330		4500	2180
2200	3330		4600	2060
2300	3370		4700	2060
2400	3390		4800	1780
2500	3420		4900	1820
2600	3500		5000	1770

Requirement 47CFR 2.1047(b)
Test Method EIA-TIA-603(93)
PARA. 2.2.3

COM4ØØCC

MODULATION LIMITING

Figure 3

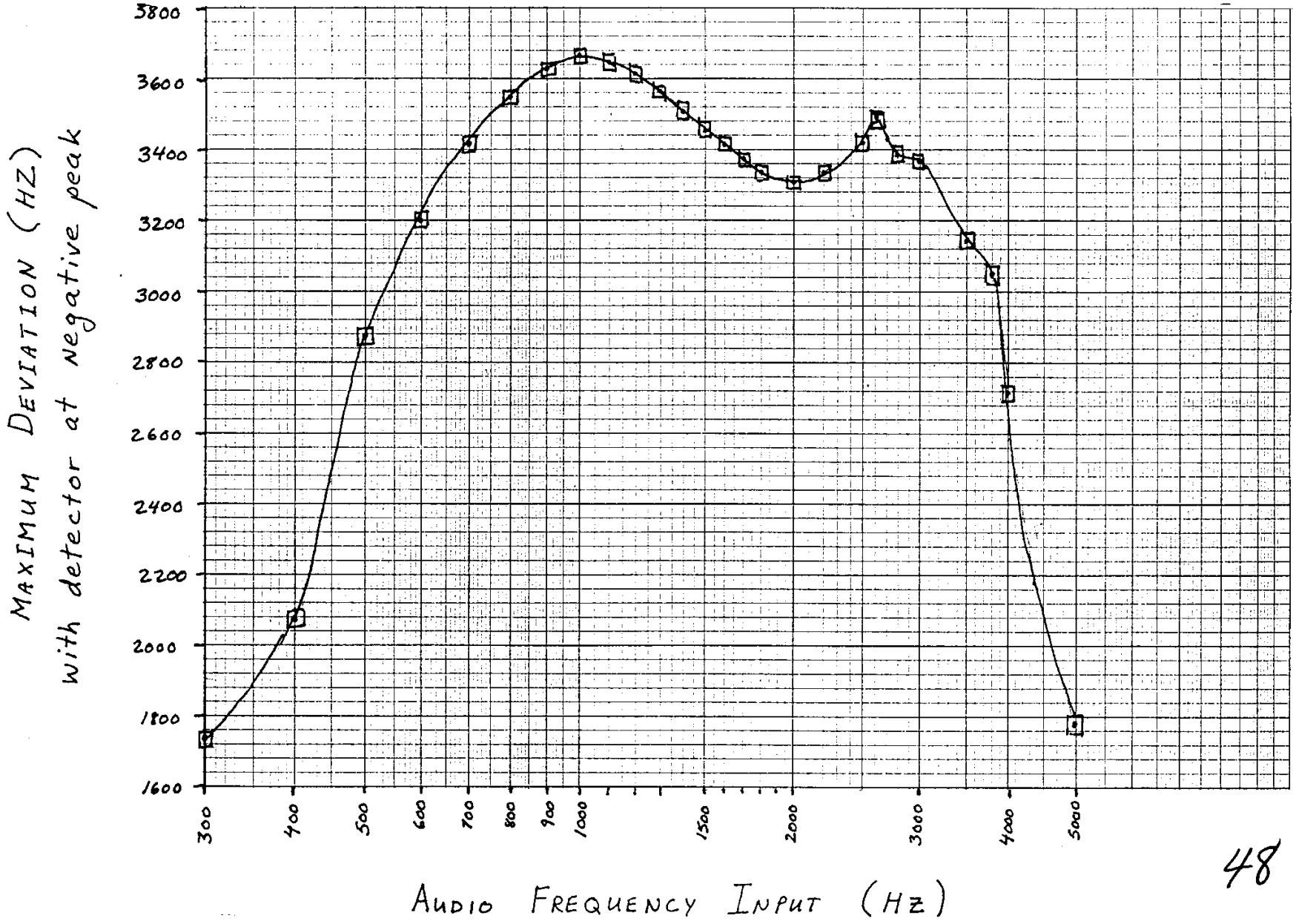


REQUIREMENT 47CFR 2.1047(b)

TEST METHOD EIA-TIA-603(93)
PARA. 2.2.3

COM400CC
MODULATION LIMITING

Figure 4



5 SUMMARY:

All tests according to *FCC Part 2, Paragraphs 2.1053, 2.1049, 2.1051; and Part 90, Paragraph 90.217** were

■ - Performed

☐ - **Not** Performed

The Equipment Under Test

■ - **Fulfills** the *FCC Part 2, Paragraphs 2.1053, 2.1049, 2.1051; and Part 90, Paragraph 90.217** requirements.

- TÜV PRODUCT SERVICE, INC. -

Responsible Engineer:

Jim Owen (EMC Engineer)

(*) 2.1055 tests performed by HM Electronics. See Attestation Statement.