FCC ID: N3M001GPT

COMPLIANCE TESTING

OF

GPT 900 MHZ TRANSMITTER

GPT MODEM

TESTS PERFORMED; 18 MARCH, 15 APRIL OF 1999

- RADIATED EMISSIONS TEST REPORT -

19 April, 1999

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DESCRIPTION OF MEASUREMENT FACILITIES

Site on File with the FCC

ID Number: 31040 / SIT

1300F2

" The site referenced above has been found to comply with the test site criteria found in ANSI C63.4-1992 and 47CFR Section 2.948."

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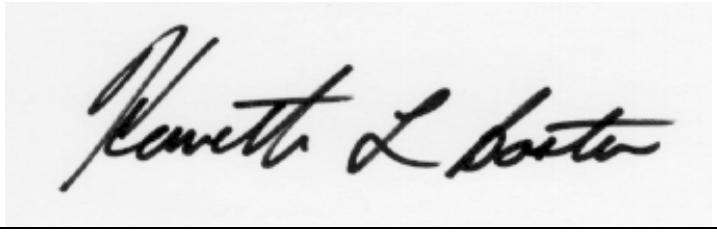
SIGNATURE PAGE

Testing by: 19 April 1999

Prepared By:

Approved By:  19 April 1999

Kenneth L. Boston, EMC Lab Manager Date
PE #31926
Registered Professional Engineer
(State of Wisconsin)

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1.3 SUMMARY OF TEST REPORT

MANUFACTURER:	GPT
MODEL:	RFDB Modem
SERIAL:	preproduction
DESCRIPTION:	900 MHz SMR modem, SMR service (Mobitex)
FREQUENCY RANGE:	896-901; 935-940 MHz

The Modem was found to "**meet”** the radiated emission specification of 47 CFR, 90.210d, and the Mobitex specification.

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1.4 INTRODUCTION

On March 18, and April 15 of 1999, a series of Radiated Emissions tests were performed on a sample model of the GPT 2 watt 900 MHz modem. These tests were performed using the test procedures outlined in ANSI C63.4-1992 for intentional radiators, and in accordance with the limits set forth in FCC Part 90.210d and the Bell South MIS, 1998. These tests were performed by Thomas T Lee and Kenneth L. Boston, PE, of L. S. Compliance, Inc. and witnessed by John Lofgren of L. S. Research.

1.5 PURPOSE

The above mentioned tests were performed in order to determine the compliance of the GPT product with limits contained in various provisions of Title 47 CFR, FCC Part 90.210.

All radiated emissions tests were performed to measure the emissions in the frequency bands described by the above sections, and to determine whether said emissions are below the limits established by the above sections. These tests were performed in accordance with the procedure described in the 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 (ANSI C63.4-1992). Another document used as reference for the EMI receiver specification was the International Special Committee on Radio Interference (CISPR) number 16-1 (1993). Reference was also made to sections of the Bell South MIS for 1998.

1.6 RADIATED EMISSIONS TEST SETUP

The test sample was operated within the 3 meter Semi-Anechoic, FCC listed chamber located at L.S. Compliance in Cedarburg, WI. The sample was placed on an 80cm high wooden table, which was centered on the flush-mounted 2m diameter metal turntable. The test sample was operated on a regulated 12 volt DC power source. The test sample was configured to run in a continuous transmit mode during the measurements, while the output port was terminated with a non-radiating 50 ohm dummy load. One test sample set to operate on two of the standard channels was tested as an intentional radiator, in order to determine compliance at a frequency of 896 and 900 MHz,

Please refer to Section 1.11 for pictures of the test setup.

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1.7 RADIATED EMISSION TEST PROCEDURE

The fundamental and spurious (harmonic) emissions of the transmitter were tested for compliance to Title 47 CFR, FCC Part 90. For the calculations used to determine the limits applicable for the test sample, refer to Appendix A. These limits are expressed in decibels (dB) above 1 microvolt per meter The fundamental and spurious (harmonic) emissions of the transmitter were tested for compliance to Title 47 CFR, FCC Part 90.210 limits for transmitters in the SMR services. For the calculations used to determine the limits applicable for the test sample, refer to Appendix A. These limits are expressed in decibels below carrier level. (-dBc) The samples were tested from the lowest frequency generated by the transmitter (without going below 9 kHz) to the 10th harmonic of the fundamental frequency generated by the device. The samples were placed on a nonconductive (wooden) pedestal in the 3 Meter chamber and the antenna mast was placed such that the antenna was 3m from the test object. A biconical antenna was used to measure emissions from 30 to 200 MHz, a log periodic was used to measure emissions from 200 to 1000 MHz, and a double ridged waveguide horn was used to measure emissions above 1 GHz. The test object was set to operate in continuous transmit, and the resultant signals were maximized by rotating the turntable 360 degrees, and by raising and lowering the antenna between 1 and 4 meters. The test object was also given several different orientations to determine the maximum signal levels, using both horizontal and vertical antenna polarities. Signal levels found were compared to an equivalent signal level of a generated carrier radiated from a dipole located at the EUT position.

The required level for the transmitter harmonics and spurious signals where measured by means of a radiated measurement made in the FCC listed 3 meter semi-anechoic chamber, and is found by the substitution method, as described in EIA / TIA 603 section 2.2.12.2. i, j, k, and l. This method was used to confirm the calculated radiated signal level of a -20 dBm carrier, while transmitting into a reference dipole. By the mathematical method found in appendix A, a field strength of 75.23 dBuV / m is derived. Actual field measurements of this radiated field strength were performed using a set of reference dipoles, and a calibrated generator, on the fundamental at 900 MHz. A comparison chart is given below. Because of the excellent correlation, the derived limit level was used for comparison of the signal levels for the harmonics above 1 GHz.

Frequency (MHz)	Reading(Vert) (dBuV / m)	Reading (Horiz) (dBuV / m)	Calculated level (dBuV / m)	Delta (Vert) (dB)	Delta (Horiz) (dB)
900	74.5	77.4	75.2	-0.7	2.2

1.8 TEST EQUIPMENT UTILIZED FOR RADIATED EMISSIONS TEST

A list of the test equipment and antennas used for the tests can be found in Section 1.13, which includes the calibration information as well as the equipment description. All equipment is calibrated and used according to the user manuals supplied by the manufacturer. All antenna calibrations were performed at a N.I.S.T traceable site, and the resultant correction factors were entered into the Hewlett Packard 8546A EMI receiver software database. The connecting cables used were also measured for loss using a calibrated signal generator and the HP 8546A EMI receiver. The resulting loss factors were entered into the HP 8546A database. This allowed for automatic changes in the antenna correction factor, as well as cable loss or other corrections, to be added to the EMI receiver display while taking measurements. Thus, the resulting data taken from the HP 8546A is an actual reading and can be entered into the database as a corrected meter reading. The HP 8546A EMI receiver was operated with a bandwidth of 10 kHz when receiving signals below 1 GHz, and with a bandwidth of 1 MHz when receiving signals above 1 GHz, in accordance with Part 90. Both the peak and Quasi-peak detector functions were used.

1.9 AC line CONDUCTED EMISSION TEST

Due to the fact that this product was operated from a separate DC source, as opposed to using an AC power cord, it was not necessary to perform a test for AC Conducted Emissions.

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1.10– Photos taken during testing

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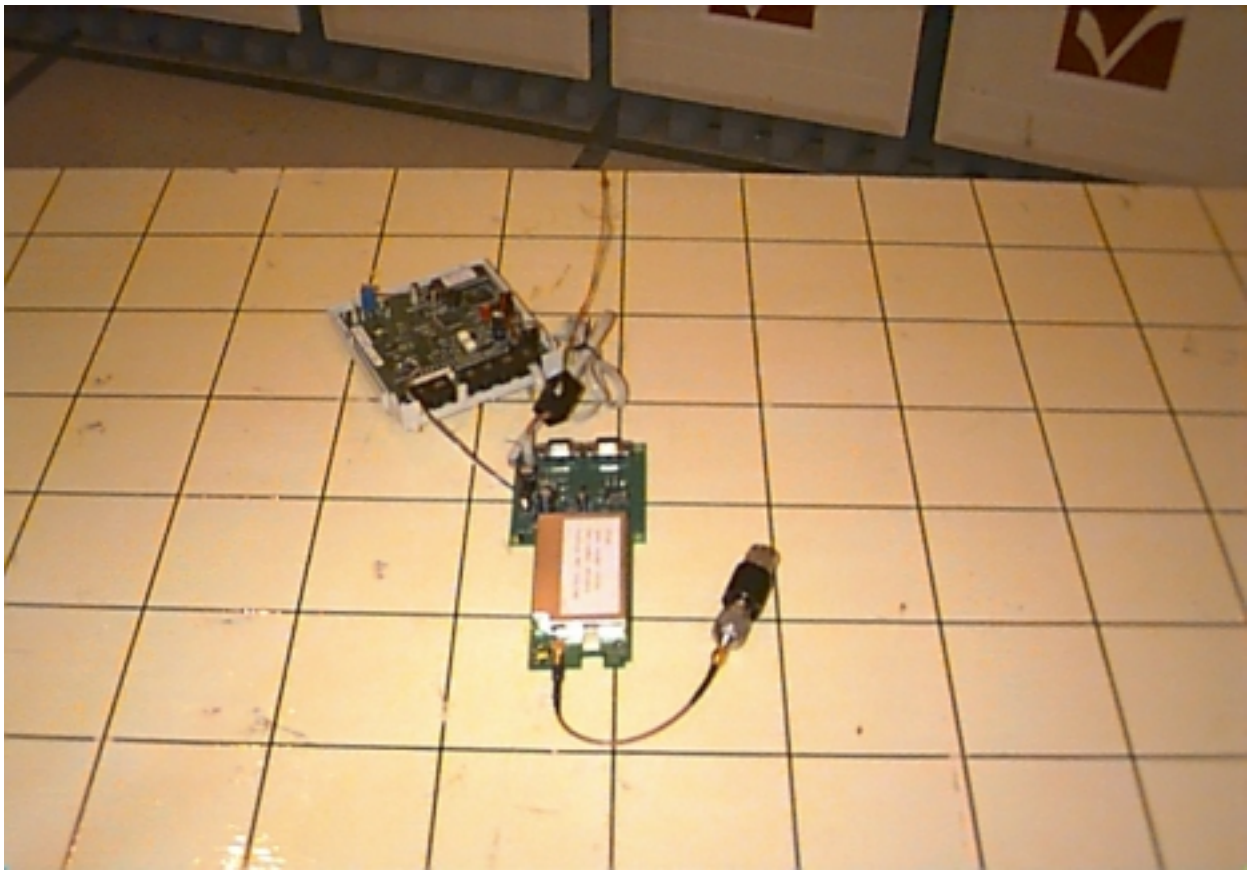

View of the GPT transmitter during the Radiated Emissions tests.

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1.11 SUMMARY OF RESULTS AND CONCLUSIONS

Based on the procedures outlined in this report, and the test results included in appendices B and C, it can be determined that the Modem does indeed "**meet"** the emission requirements of Title 47 CFR, FCC Part 90 for a Transmitter in the SMR service.

The enclosed test results pertain to the samples of the test item listed, and only for the tests performed on the data sheets. Any subsequent modification or changes to the test items could invalidate the data contained herein, and could therefore invalidate the findings of this report.

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1.13 - Test Equipment

Asset #	Manufacturer	Model #	Serial #	Description	Due Date
AA960003	EMCO	3121C	786	Dipole Set Antenna	7/14/99
AA960004	EMCO	3146	9512-4276	Log Periodic Antenna	9/12/99
AA960005	EMCO	3110B	9601/2280	Biconical Antenna	9/12/99
AA960007	EMCO	3115	99111-4198	Double Ridged Guide/Horn Antenna	7/20/99
EE960004	EMCO	2090	9607-1164	Mast/Ttable Controller	I.O
EE960013	HP	8546A	3617A00320	Receiver RF Section W/Display and RF filter section	8/12/99
CC000130	HP	8596E	3205A00103	Spectrum Analyzer	8/12/99

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APPENDIX A:

SAMPLE CALCULATIONS

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FIELD STRENGTH OF FUNDAMENTAL FREQUENCIES:

Conducted: Measured at 33.0 dBm for the 2 watt power level.

FIELD STRENGTH OF SPURIOUS/HARMONIC FREQUENCIES:

All out of band spurious emissions must be below the mean power of the carrier by at least:

50 + 10 log(carrier power)

which for the 2.0 watt rating on the test sample is:

50+ 10 log(2.0)
50 + 3.0 = 53 dBc,
which is the level below the mean carrier for spurs / harmonics

-53 dBc from 33.0 dBm = -20.0 dBm

FIELD STRENGTH OF PART 90 LIMIT: **AT R = 3 METERS DSTANCE**

FROM THE STANDARD REFERENCE FORMULA FOR POWER TRANSMITTED VERSUS ELECTRIC FIELD:

$$Pt = (R^{**}) \times |E|^{**} / 30$$

Then to convert to dB:

$$Pt = 20\log|E| + 20\log(R) - 10\log(30)$$

Insert additional terms to convert watts to milli-watts (in dB) and volts to micro-volts (in dBuV):

$$Pt = 20\log|Euv| - 20\log(1{,}000{,}000) + 10\log(1000) + 20\log(3) - 10\log(30)$$

$$Pt = 20\log|Euv| - 120 + 30 + 9.54 - 14.77$$

$$Pt = 20\log|Euv| - 95.23$$

OR; $20\log|Euv| = Pt$ (in dBm, from above) + 95.23

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|E| (in dBuV) = -20 dBm + 95.23 = 75.23 dBuV/m , at 3 meters

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APPENDIX B:

DATA CHARTS

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Measurement of Electromagnetic Radiated Emission within 3 Meter FCC Listed Chamber

Frequency Range inspected: 30 to 3500 MHz

Date of Test:	March 18, April 15, 1999	Manufacturer:	GPT
Location:	L. S. Compliance, Inc.	Model No.:	RFDB
	W66 N220 Commerce Court	Operating Freq.	896-904 MHz, Tx
	Cedarburg, WI 53012		935-940 MHz, Rx
Specifications:	47CFR FCC 90.210 d	Serial No.:	Prototype
Distance:	3 meters	Configuration:	
Equipment:	HP 8546A EMI Receiver	Detector(s) Used:	Peak
	EMCO 3115 Double Ridged Waveguide		896.0125 MHz
	EMCO 3146A Log Periodic		900.3375 MHz
	EMCO 3110B Biconical		

The following table depicts the level of significant fundamental and harmonic emissions found:

Higher order harmonics were found to be below the noise floor of the receiving system:

Frequency (MHz)	Antenna Polarity	Height (meters)	Azimuth (0° - 360°)	EMI Meter Reading (dB μV/m)	TX Frequency (MHz)	90.210D Limit (dB μV/m)	Margin (dB)
180.23	H	1.8	120	45.5	896	75.2	29.7
196.61	H	1.8	140	45.5	896	75.2	29.7
857.61	H	1.0	50	41.4	896	75.2	33.8
857.61	V	1.15	190	37.8	896	75.2	37.4
896.16	V	1.3	230	39.7	896	75.2	35.5
896.16	H	1.6	345	39.3	896	75.2	35.9
934.4	V	1.0	200	37.8	896	75.2	37.4
1792.0	H	1.1	310	62.2	896	75.2	13.0
2688.0	V	1.0	180	71.1	896	75.2	4.1
3584.0	V	1.05	160	63.6	896	75.2	11.6

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900.5	H	1.0	45	45.1	900	75.2	30.1
938.76	H	1.5	290	35.2	900	75.2	40.0
1800.66	H	1.05	310	53.5	900	75.2	21.7
2701.0	V	1.0	185	70.9	900	75.2	4.3
3601.33	V	1.1	165	54.5	900	75.2	20.7

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APPENDIX C:

GRAPHS

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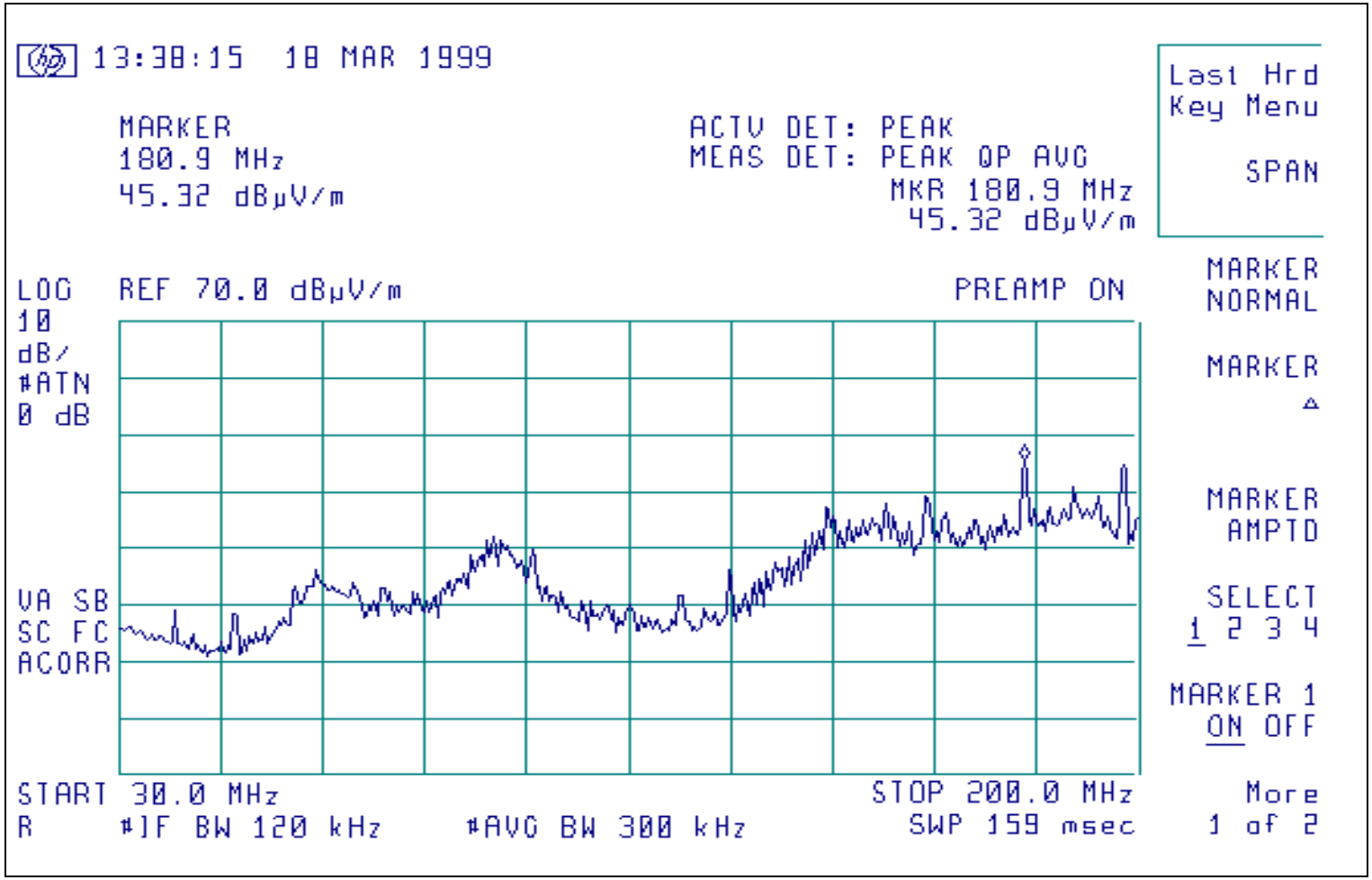
both channels, emissions from 30-200 MHz, horizontal polarity



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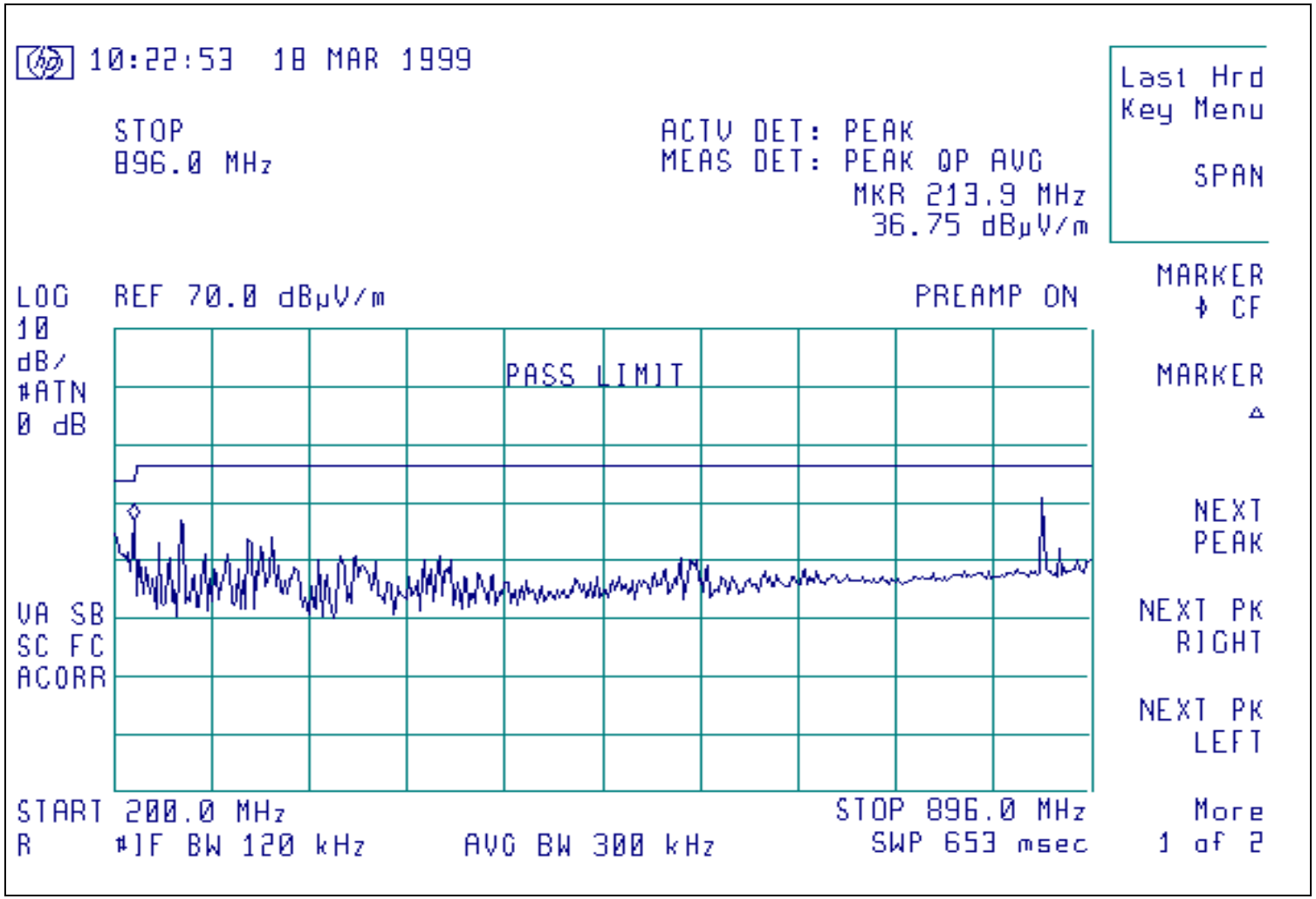
896 Tx, Emissions below 896 MHz, Horizontal polarity



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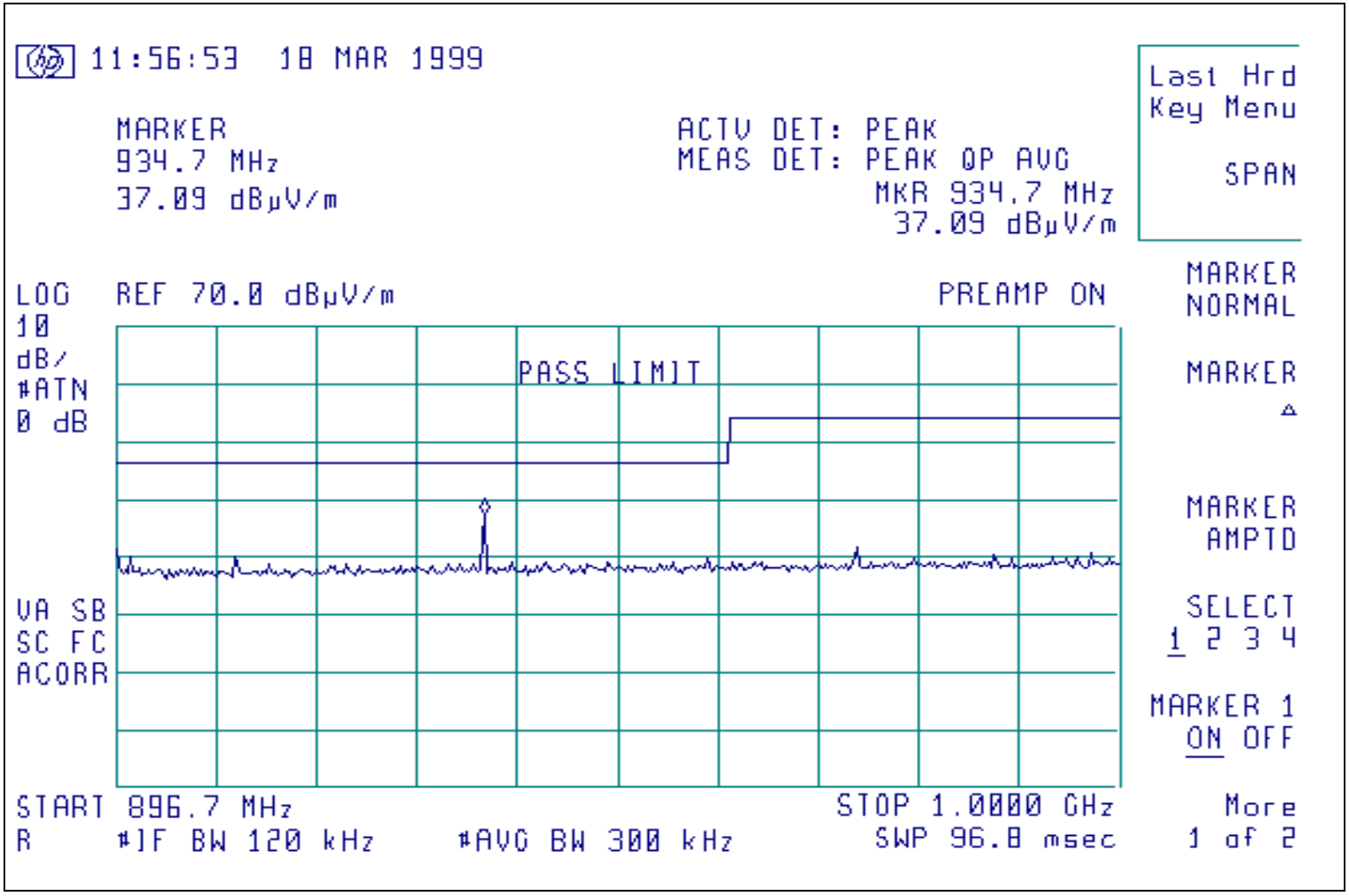
896 Tx, Emissions from 896 to 1 GHz, Vertical polarity



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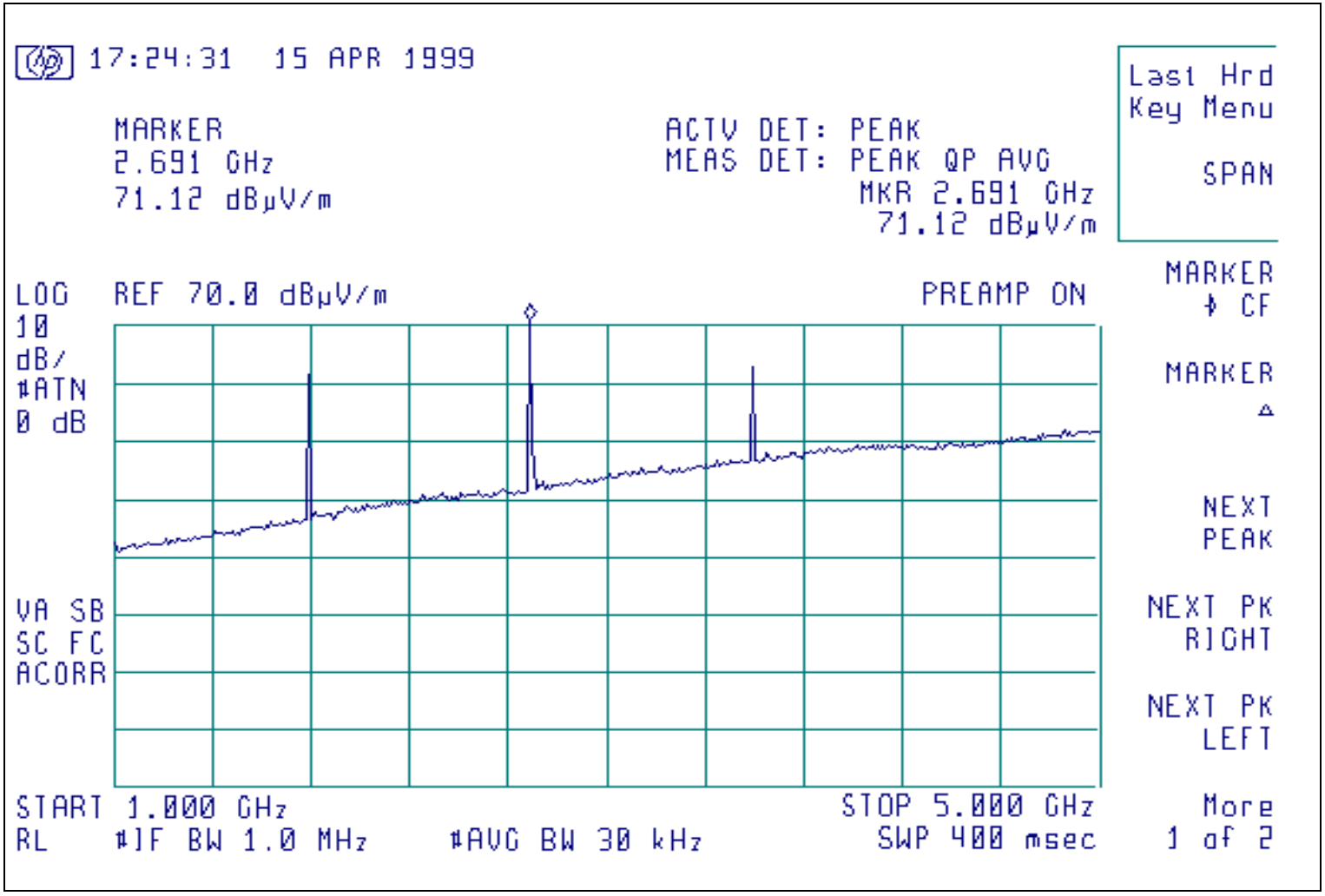
896 Tx, Emissions above 1 GHz, Vertical polarity



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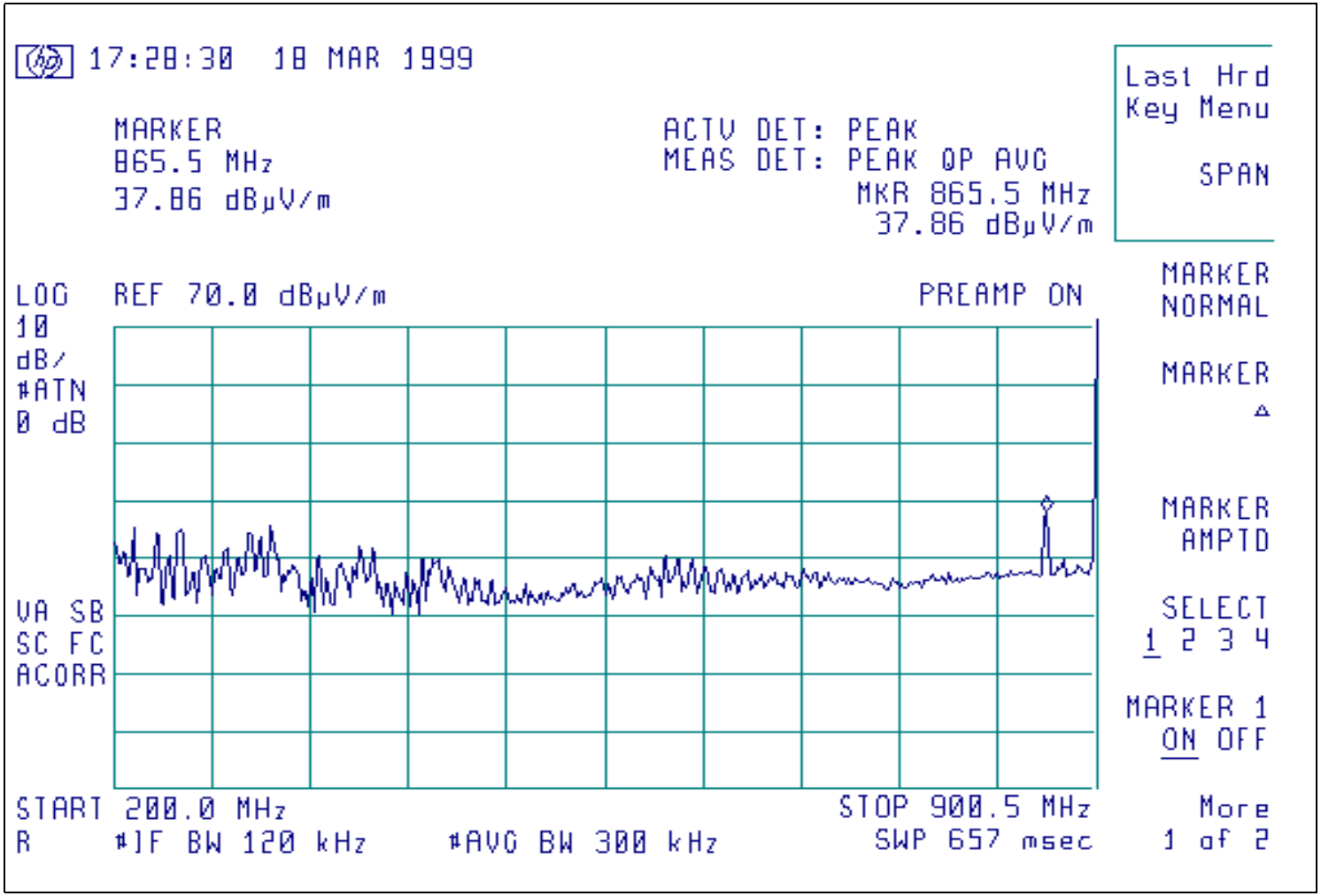
900 Tx, emissions below 900 MHz, horizontal polarity



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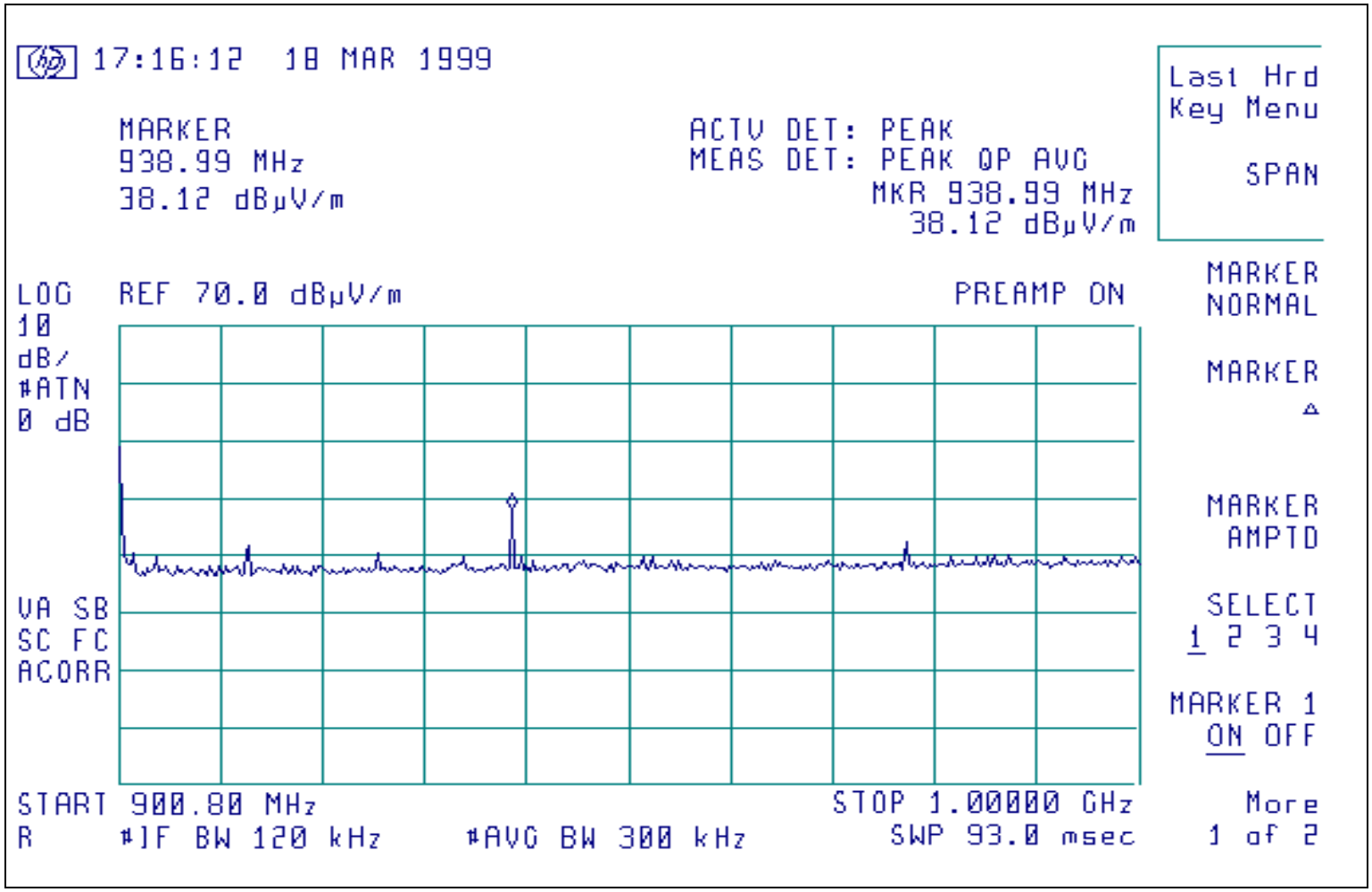
900 Tx, emissions below 1 GHz, horizontal polarity



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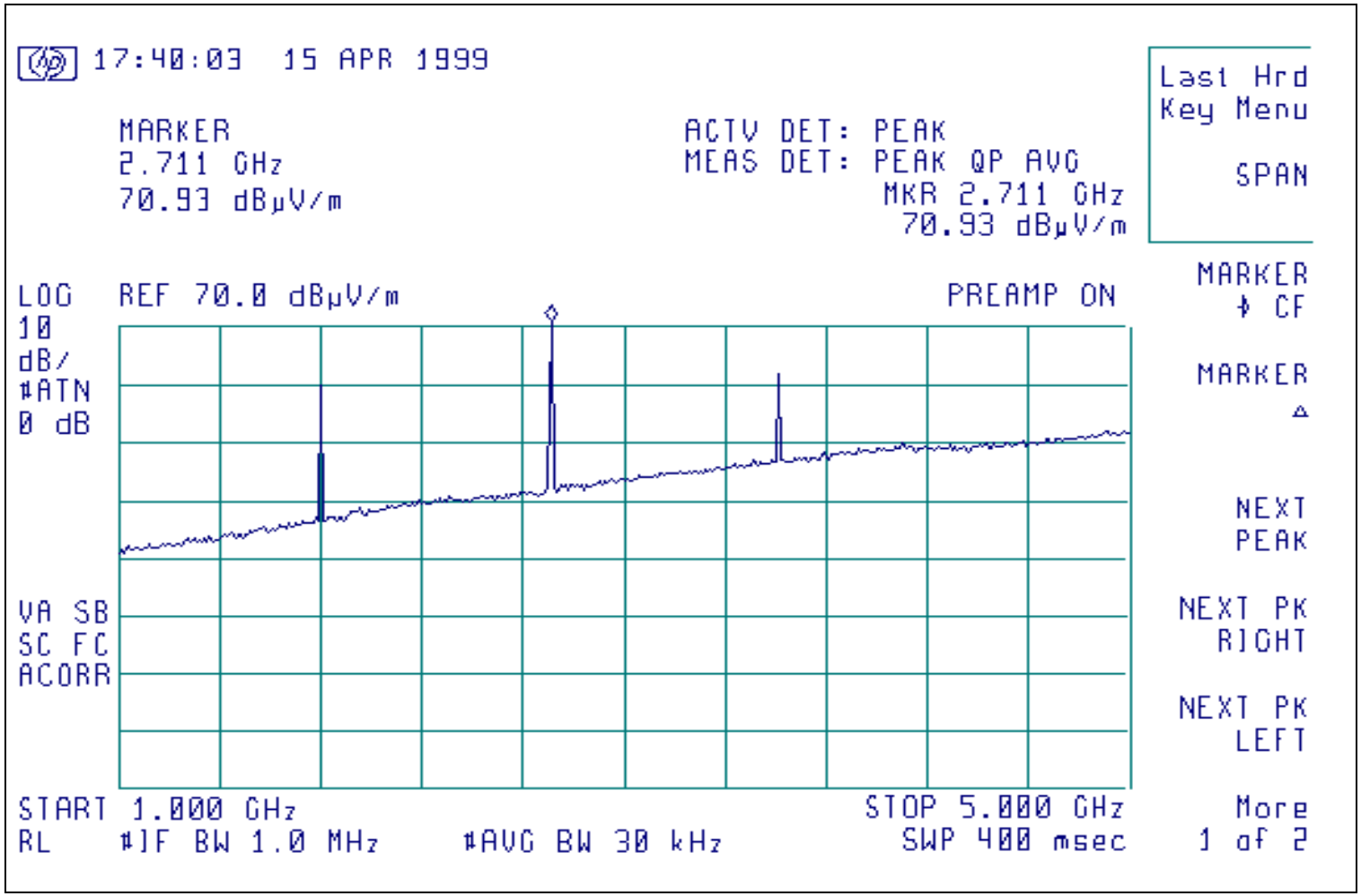
900 Tx, emissions above 1 GHz, Vertical polarity



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