FCC ID: NUC-BEPM10

Compliance Testing of:

External Programming Module (EPM)

Prepared for:

Pete Scharpf

Brady Worldwide, Inc.

Milwaukee, WI

Test Report Number: 300123

Date(s) of Testing:

March 15, 2000

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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 Title 47CFR, FCC Part 15 Section 2.948."

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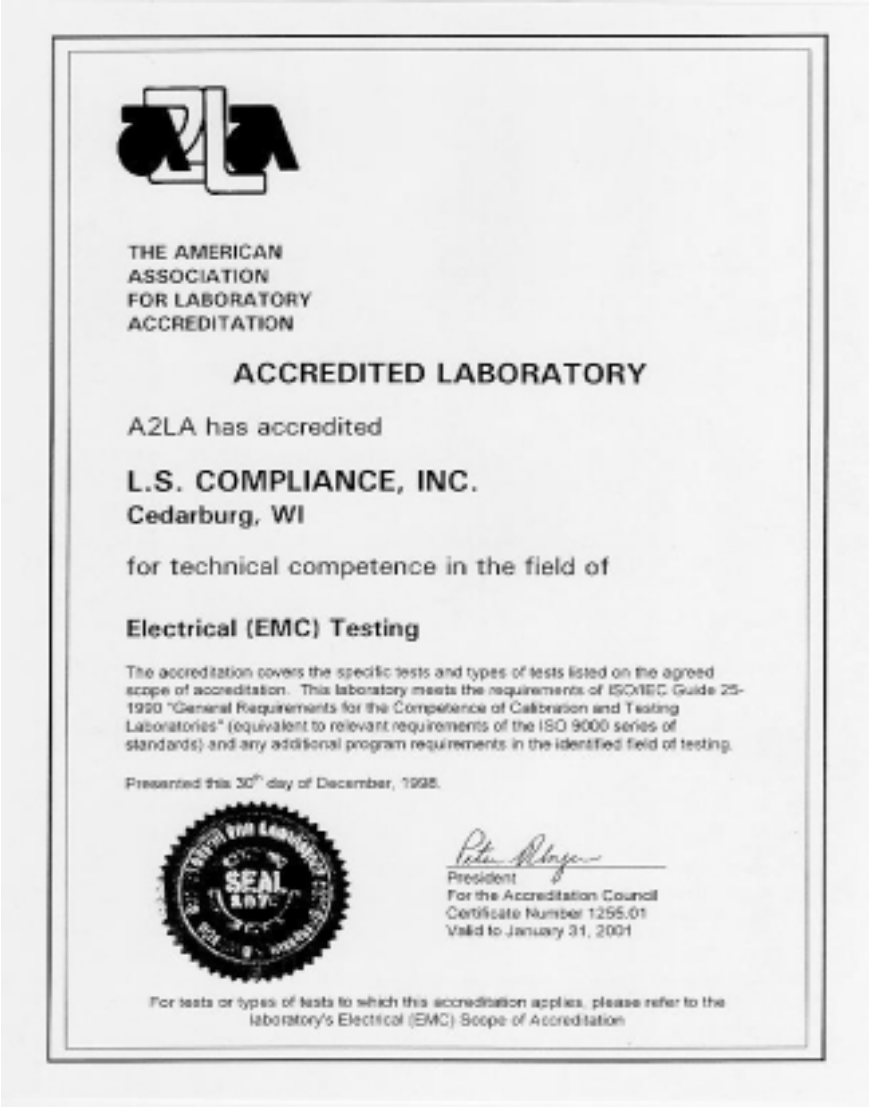

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ASSOCIATION
FOR LABORATORY
ACCREDITATION

ACCREDITED LABORATORY

A2LA has accredited

L.S. COMPLIANCE, INC.
Cedarburg, WI

for technical competence in the field of

Electrical (EMC) Testing

The accreditation covers the specific tests and types of tests listed on the agreed scope of accreditation. This laboratory meets the requirements of ISO/IEC Guide 25-1990 "General Requirements for the Competence of Calibration and Testing Laboratories" (equivalent to relevant requirements of the ISO 9000 series of standards) and any additional program requirements in the identified field of testing.

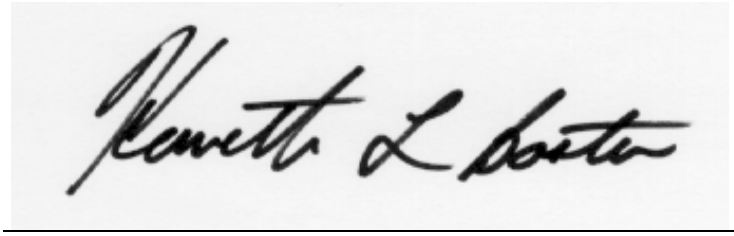
Presented this 30th day of December, 1998.

President
For the Accreditation Council
Certificate Number 1255.01
Valid to January 31, 2001

For tests or types of tests to which this accreditation applies, please refer to the laboratory's Electrical (EMC) Scope of Accreditation

SIGNATURE PAGE

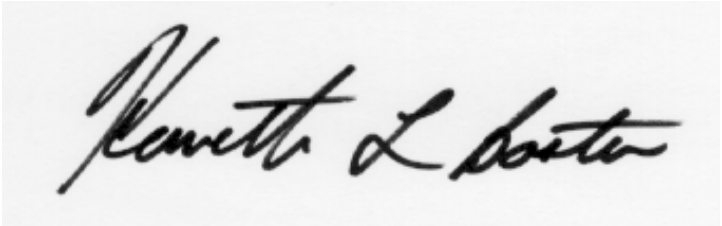
Prepared By:
Tested By:



25 April 2000

Kenneth L. Boston, EMC Lab Manager — Date

Approved By:



25 April 2000

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

1.3 SUMMARY OF TEST REPORT

MANUFACTURER:	Brady Worldwide Inc.
MODEL:	EPM, model number 63986
SERIAL:	00300P
DESCRIPTION:	Low power passive tag programming module, operating at 13.56 M
FREQUENCY RANGE:	TRANSMITTER; fixed frequency at 13.56 MHz

The EPM (External Programming Module) was found to **"meet"** the radiated emission specification of Title 47 CFR, FCC Part 15, subpart C.

This product is a composite device, with the digital section subject to verification. Therefore this technical report will primary contain data that is pertinent to the certification of the transmitter section of the product.

1.4 INTRODUCTION

On March 15, 2000, a series of Radiated Emissions tests were performed on a sample model of the Brady EPM tag reader unit. This is a transmitter, which is designed to send out a polling signal to a small passive tag transponder, which then responds with a short burst of data transmission which comprises an I.D. code. This data burst is received by the tag reader and recognized by the internal programming of the tag reader processor. These tests were performed using the test procedures outlined in ANSI C63.4-1992 for intentional radiators, and in accordance with the general limits set forth in FCC Part 15.209 for a low power transmitter. Tests were also performed as outlined in ANSI C63.4-1992 for non-intentional radiators, in order to allow verification of emissions from the digital section of the product. These tests were performed by Kenneth L. Boston, PE, of L. S. Compliance, Inc. and witnessed by Peter Scharpf of Brady Worldwide, Inc.

1.5 PURPOSE

The above mentioned tests were performed in order to determine the compliance of the product with limits contained in various provisions of Title 47 CFR, FCC Part 15, including:

15.109 15.209
15.205 15.207

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).

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 and also on the 10 meter Open Air Test Site located outside the L.S. Compliance facility. The test sample was operated with power supplied by a Condor SA-121AOU-1 wall outlet power supply (s/n 6137470), plugged into 115 VAC. During operation, the device was operated alongside the equipment normally positioned with this product during the programming cycle. This consisted of a Brady model 200M printer(s/n 105-511-00000-12). The test sample was positioned upon an 80 cm high wooden table, which was positioned upon the 2 meter turntable within the chamber. The measurement antenna, mounted upon a motorized mast was then placed 3 meters from the product perimeter. This allowed the EPM to be scanned in both azimuth and elevation. For low frequency measurements, the product was operated while positioned upon the same table, positioned upon the 2 meter turntable located on the 10 meter OATS facility. The measurement antenna, an active loop antenna, was positioned

10 meters away, and oriented to give maximum signal levels. These 10 meter OATS measurements were performed for the transmitter fundamental, and any lower frequency harmonics that could be observed. The 3 meter chamber was used for the measurement of harmonics and spurious products up to 1000 MHz.

Please refer to Section 1.10 for pictures of the test setup.

1.7 RADIATED EMISSION TEST PROCEDURE

The fundamental and spurious (harmonic) emissions of the transmitter were tested for compliance to the general limits given in Title 47 CFR, FCC Part 15.209. 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 (μV/m). 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 test sample was activated, by means of placing a passive tag near the probe section of the product, and while positioned on an 80 cm high non-conductive table. The test sample was setup in the 3 Meter FCC listed Semi-Anechoic chamber located at L. S. Compliance, upon the 2 meter turntable in the chamber, and an antenna mast was placed 3 meters from the test object perimeter. 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. The test object was placed in continuous transmit, and the spurious signals were maximized by rotating the turntable 360 degrees, and by raising and lowering the antenna between 1 and 4 meters, and was tested using both horizontal and vertical antenna polarities. Brief scans below 30 MHz were also performed in the chamber, using an active loop antenna as the sensing antenna. Information from this 3 meter test was used to identify frequencies for further investigation, during the emissions tests on the 10 meter OATS. For measurement of the transmitter fundamental, a magnetic loop antenna was used, which was placed at a separation distance of 10 meters upon an FCC listed OATS located at the L. S. Compliance facility in Cedarburg , WI. The fixture was set up on top of the 2 meter flush mounted turntable installed at the 10 meter OATS. The loop and fixture orientation was then varied to obtain the maximum signal levels and then readings were taken. The resultant signal was compared with the 15.209 limit, as well as the 15.225 limit. Above 30 MHz, suspect frequencies were also measured using the biconical or log periodic antennas, mounted on a 4 meter adjustable mast, at 3 meters in the chamber. The results are tabulated in the charts found in Appendix B.

The unit was scanned for emissions in transmit mode, over the range 1 MHz to 1000 MHz to establish compliance with Part 15.209 for the transmitter. Any significant spurious signals, other than the noise floor of the system, are tabulated in the data section found in Appendix B. Signature scans (taken at 3 meters) can be found in Appendix C.

1.8 TEST EQUIPMENT UTILIZED FOR THE RADIATED EMISSIONS TEST

A list of the test equipment and antennas used for the tests can be found in Section 1.12, 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 9 kHz when receiving signals below 30 MHz; with a bandwidth of 120 kHz when receiving signals above 30 MHz and below 1 GHz, and with a bandwidth of 1 MHz when receiving signals above 1 GHz, in accordance with CISPR 16. The peak, Quasi-peak, and Average detector functions were used.

1.9 AC Line Conducted Emission Test:

The EPM was positioned on a Plastic 80cm high cart, and placed in the FCC listed shielded room. A LISN was used to connect to the test sample through a short jumper cable. The HP Transient Limiter was connected between the LISN and the HP 8546A EMI receiver by way of an RG214 cable. On the HP 8546A, the marker was tuned to the most significant spurious emissions which were then measured using the Average and Quasi-Peak detectors. The frequency range from 0.15 to 30 MHz was inspected in accordance with FCC Part 15 emissions. The test sample was powered by an AC wall transformer plugged into the LISN, which was powered by a filtered 115 VAC outlet. The sample was operated in transmit mode during the conducted emissions testing. Both L1 and L2 were tested for conducted emission pursuant to FCC Part 15. Readings were then taken using the Quasi-Peak detector, and the measurement results can be found in Appendix B, with signature scans located in Appendix C.

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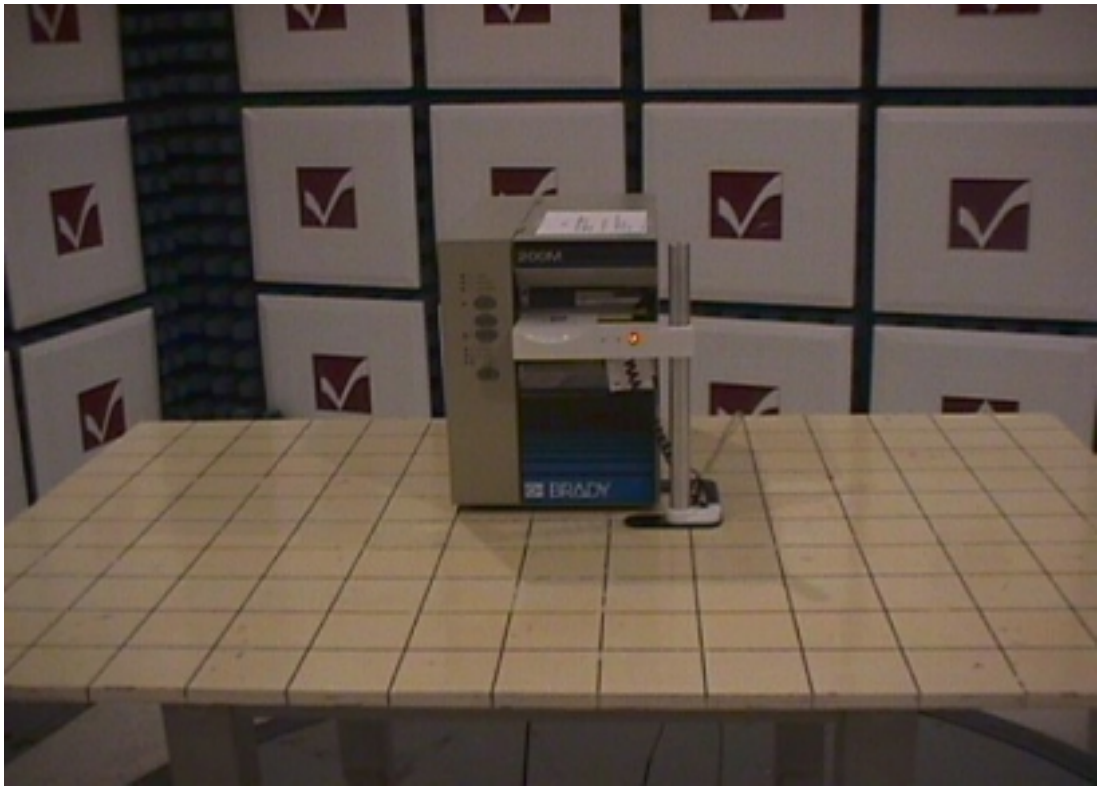
Manufacturer: Brady Worldwide, Inc.
Model: EPM
Serial Number(s): 00300P

1.10 – Photos taken during testing



Front view of the Brady EPM during the Radiated Emissions tests.

Close up view of the Brady EPM during the Conducted Emissions tests.

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 Brady EPM does **"meet"** the emission requirements of Title 47 CFR, FCC Part 15 Subpart C for an intentional radiator. The level of the 5th harmonic was found to be within 0.4 dB of the limit, and other signals were found to be within 2.1 and 2.3 dB of the limit. As these levels are within the tolerances of the test equipment and site employed, there is a possibility that this unit, or a similar unit selected out of production may not meet the required limit specification if tested by another agency.

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.

1.12 - Test Equipment

Asset #	Manufacturer	Model #	Serial#	Description	Due Date
AA960004	EMCO	3146	9512-4276	Log Periodic Antenna	3aug2000
AA960005	EMCO	3110B	9601/2280	Biconical Antenna	3aug2000
AA960006	EMCO	6502	2753	Active Loop antenna	3aug2000
EE960004	EMCO	2090	9607-1164	Mast/Ttable controller	I.O.
EE960014	HP	85460	3617A00320	EMI receiver Display section	23aug2000
EE960013	HP	85462	3205A00103	EMI receiver Preselector	23aug2000
AA960032	HP	11947A	3107A01708	Transient Limiter	I.O.
EE960009	EMCO	3810/2NM	9509/1152	10 Amp LISN	10sept2000
N/a	LSC	Cable	0011	3 meter 1/2 " heliax Cable	23 feb 2000
N/a	LSC	Cable	0038	1 meter RG214 Cable	7 June 2000
N/a	LSC	cable	0050	10 meter RG214 Cable	7 June 2000
N/a	LSC	attenuator		10 db attenuator	7 June 2000

APPENDIX A:

SAMPLE CALCULATIONS

FCC ID: NUC-BEPM10
Manufacturer: W H Brady
Model: EPM
Serial Number: 00300P

Calculation of Radiated Emissions limits for FCC Part 15.209; general limits for intentional radiators.

FIELD STRENGTH OF TRANSMITTER FUNDAMENTAL AND HARMONIC FREQUENCIES:

For the frequency range of 1705 kHz to 30 MHz the limit (at 10 meters) is found by:
LIMIT (dBuV / m)= 20log(30) + 19.08

For the frequency range of 30 MHz to 88 MHz the limit (at 3 meters) is found by:
LIMIT (dBuV / m) = 20log(100)

For the frequency range of 88 MHz to 216 MHz the limit (at 3 meters) is found by:
LIMIT (dBuV / m) = 20log(150)

For the frequency range of 216 MHz to 960 MHz the limit (at 3 meters) is found by:
LIMIT (dBuV / m) = 20log(200)

For the frequency range of 960 MHz to 40 GHz the limit (at 3 meters) is found by:
LIMIT (dBuV / m) = 20log(500)

Where the measurement distance was specified to be 30 meters, a correction factor was applied in order to permit measurement to be performed at a separation distance of 10 meters. In accordance with part 15.31(f)(2), the scaling factor that was used was the 40 dB per decade that is presented in the part.

From 30 meters down to 10 meters: FACTOR(dB) = 40log(30 / 10) = 19.08 dB

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Manufacturer: Brady Worldwide

Model: EPM

Serial Number: 00300P

LIMITS FOR READINGS TAKEN AT 10 METERS

Frequency (MHz)	**FCC limit (uV/m) 15.225**	**FCC limit (dBuV/m)**	**Scaling factor**	**Adjusted limit (dBuV/m)**
13.56	10,000 @ 30m	80.00	19.08	99.08
Frequency (MHz)	**FCC limit (uV/m) 15.209**	**FCC limit (dBuV/m)**	**Scaling factor**	**Adjusted limit (dBuV/m)**
1.705-30.0	30.00 @30m	29.54	19.08	48.62

General limits are given in uV/m in 15.209b, for a 3 meter distance, and can be converted into dBuV/m using the formulas given on the preceding page.

Frequency (MHz)	**FCC limit (uV/m)**	**FCC limit (dBuV/m)**
30-88	100	40.0
88-216	150	43.5
216-960	200	46.0
960-40000	500	54.0

APPENDIX B:

DATA CHARTS

FCC ID: NUC-BEPM10

Measurement of Radiated Emissions inside the 3 Meter Semi-Anechoic Chamber

Frequency Range inspected: 30 to 1000 MHz

Date of Test:	March 15, 2000	Manufacturer:	Brady Worldwide, Inc
Location:	L.S. Compliance, Inc. W66 N220 Commerce Court Cedarburg, WI 53012	Model No.:	63986, EPM
Specifications:	Title 47CFR, FCC Part 15.209	Serial No.:	00300P
Distance:	3 meters	Configuration:	Active, transmitting
Equipment:	HP 8546A EMI Receiver EMCO 3146A Log Periodic EMCO 3110B Biconical	Detector(s) Used:	Quasi-Peak

The following table depicts the level of significant 15.209 spurious emissions

Frequency (MHz)	Polarity	Height (meters)	Azimuth (degrees)	Quasi-peak (dBuV/m)	Part 15 limit (dBuV/m)	Margin (dB)
31.77	V	1.0	90	33.2	40.0	6.8
40.68	V	1.0	90	32.5	40.0	7.5
63.42	V	1.0	315	37.9	40.0	2.1
67.80	V	1.0	315	39.6	40.0	0.4
169.54	V	1.0	300	33.5	43.5	10.0
63.83	H	1.5	90	37.7	40.0	2.3

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Measurement of Radiated Emission upon the 10 Meter FCC Listed OATS

Frequency range inspected: 0.009 MHz to 30 MHz

Date of Test:	March 15, 2000	Manufacturer:	Brady Worldwide, Inc
Location:	L.S. Compliance, Inc. W66 N220 Commerce Court Cedarburg, WI 53012	Model No.:	EPM
Specifications:	Title 47CFR, FCC Part 15.209, 15.225	Serial No.:	00300P
Distance:	10 meters	Configuration:	Active, transmitting
Equipment:	HP 8546A EMI Receiver EMCO 6502 Active Loop	Detector(s) Used:	Quasi-peak,

Readings taken at 10 meters, with the antenna and the product oriented for maximum signal levels:

Frequency (MHz)	Quasi-peak reading	Limit (dBuV/m)	Margin (dB)
13.56	37.9	48.6	10.7

The maximum signal level measured, and presented above, is greater than 20 dB below the levels allowed by part 15.225, for a 13.56 MHz transmitter.

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AC LINE CONDUCTED EMISSIONS (L1 & L2)

Date of Test:	March 15, 2000	Manufacturer:	Brady worldwide
Location:	L. S. Compliance, Inc. W66 N220 Commerce Court Cedarburg, WI 53012	Model No.:	EPM
Specifications	15.207	Serial No.:	00300P
Equipment:	HP 8546A EMI Receiver EMCO LISN HP Transient Limiter	Configuration: Detector(s) Used:	Active transmit Quasi-peak

Frequency (MHz)	Line	EMI Meter Reading (dB µV)	FCC 15.107 Limit (dB µV)	Margin (dB)
0.495	L1	44.8	48.0	3.2
0.753	L1	42.1	48.0	5.9
0.999	L1	37.9	48.0	10.1
1.509	L1	34.2	48.0	13.8
1.758	L1	36.4	48.0	11.6
2.001	L1	37.3	48.0	10.7
2.504	L1	37.9	48.0	10.1
2.749	L1	41.9	48.0	6.1
13.562	L1	34.7	48.0	13.3
0.499	L2	37.8	48.0	10.2
0.749	L2	38.0	48.0	10.0
0.996	L2	36.5	48.0	11.5
1.497	L2	35.5	48.0	12.5
1.746	L2	38.3	48.0	9.7
2.494	L2	41.6	48.0	6.4
2.751	L2	38.3	48.0	9.7
3.247	L2	36.5	48.0	11.5
3.495	L2	35.1	48.0	12.9
13.563	L2	34.1	48.0	13.9

APPENDIX C:

GRAPHS

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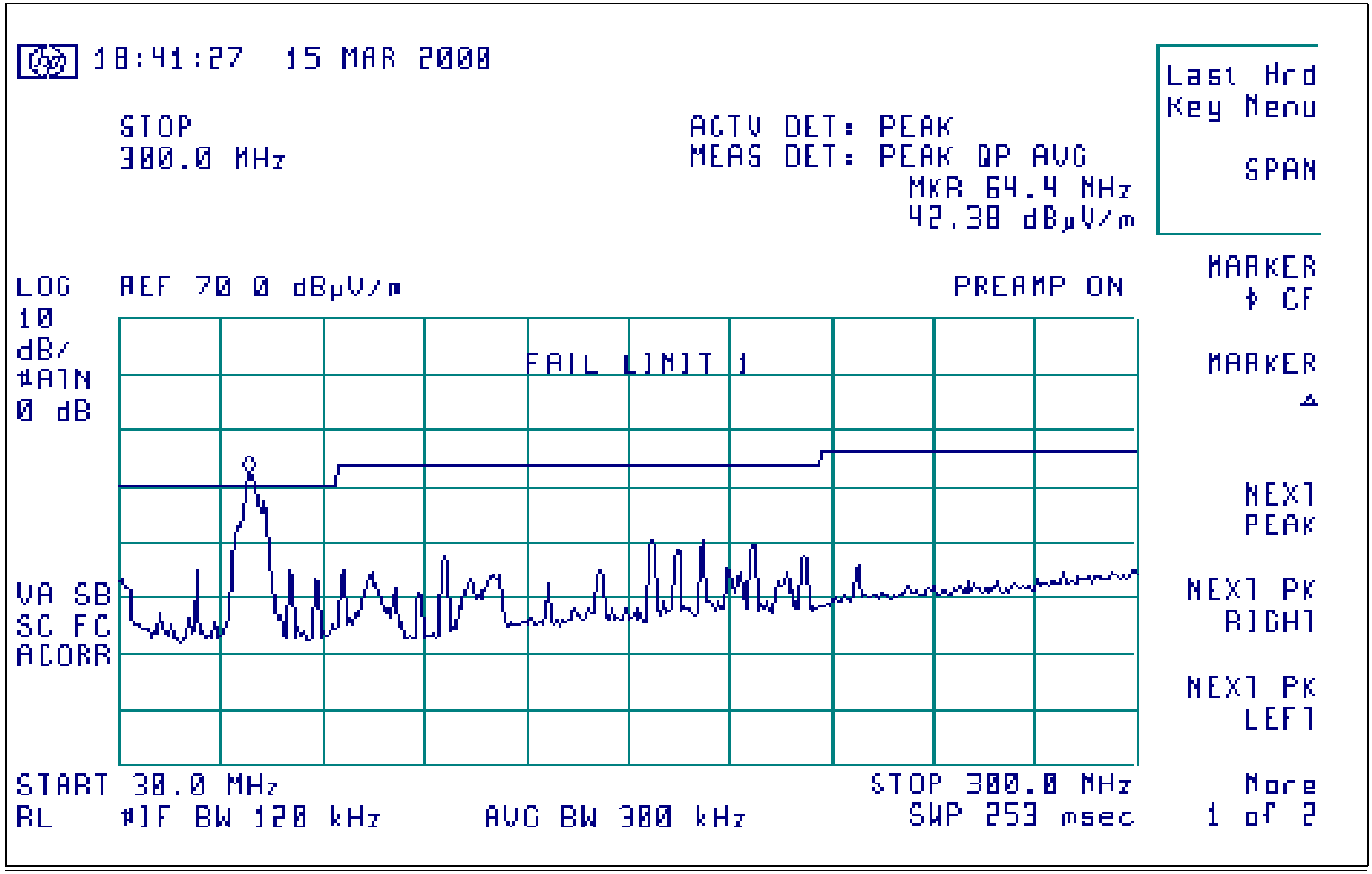
Signature Scan of the Radiated Emissions of the Brady EPM, horizontal polarity, 30-300 MHz

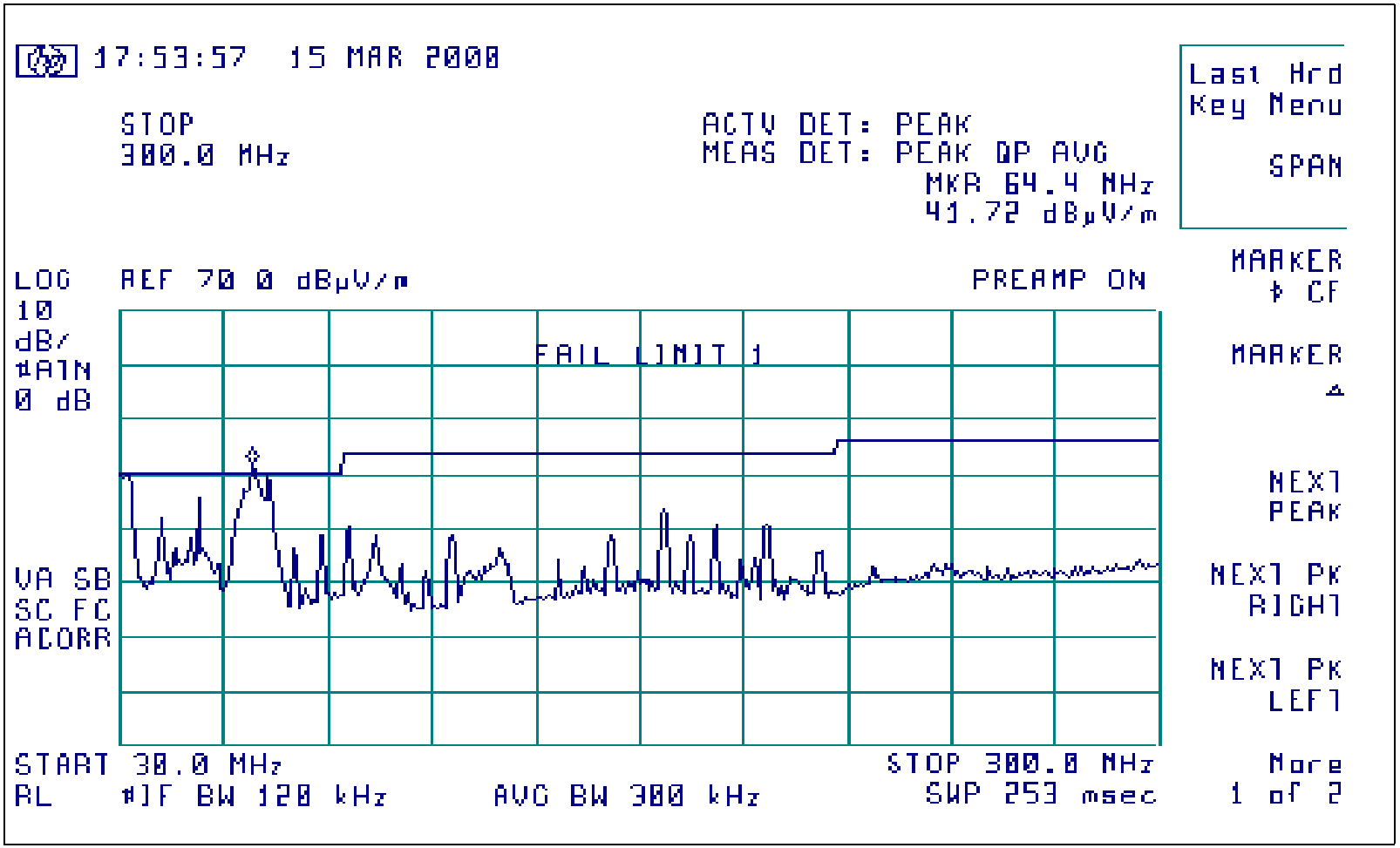
Inside 3 meter Chamber, Peak hold scan,



FCC ID: NUC-BEPM10

Signature Scan of the Radiated Emissions of the Brady EPM, vertical polarity, 30-300 MHz

Inside 3 meter Chamber, Peak hold scan,



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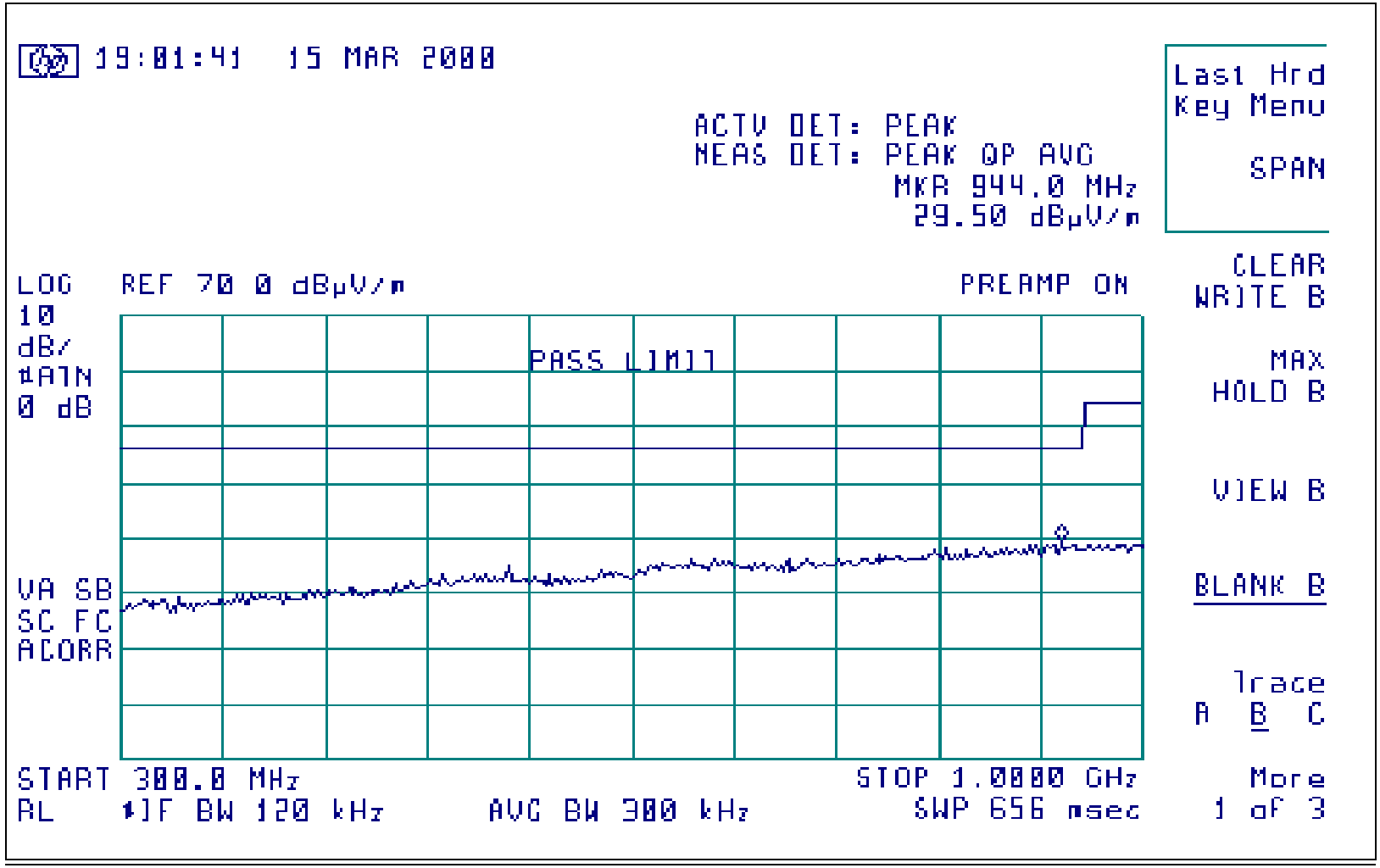
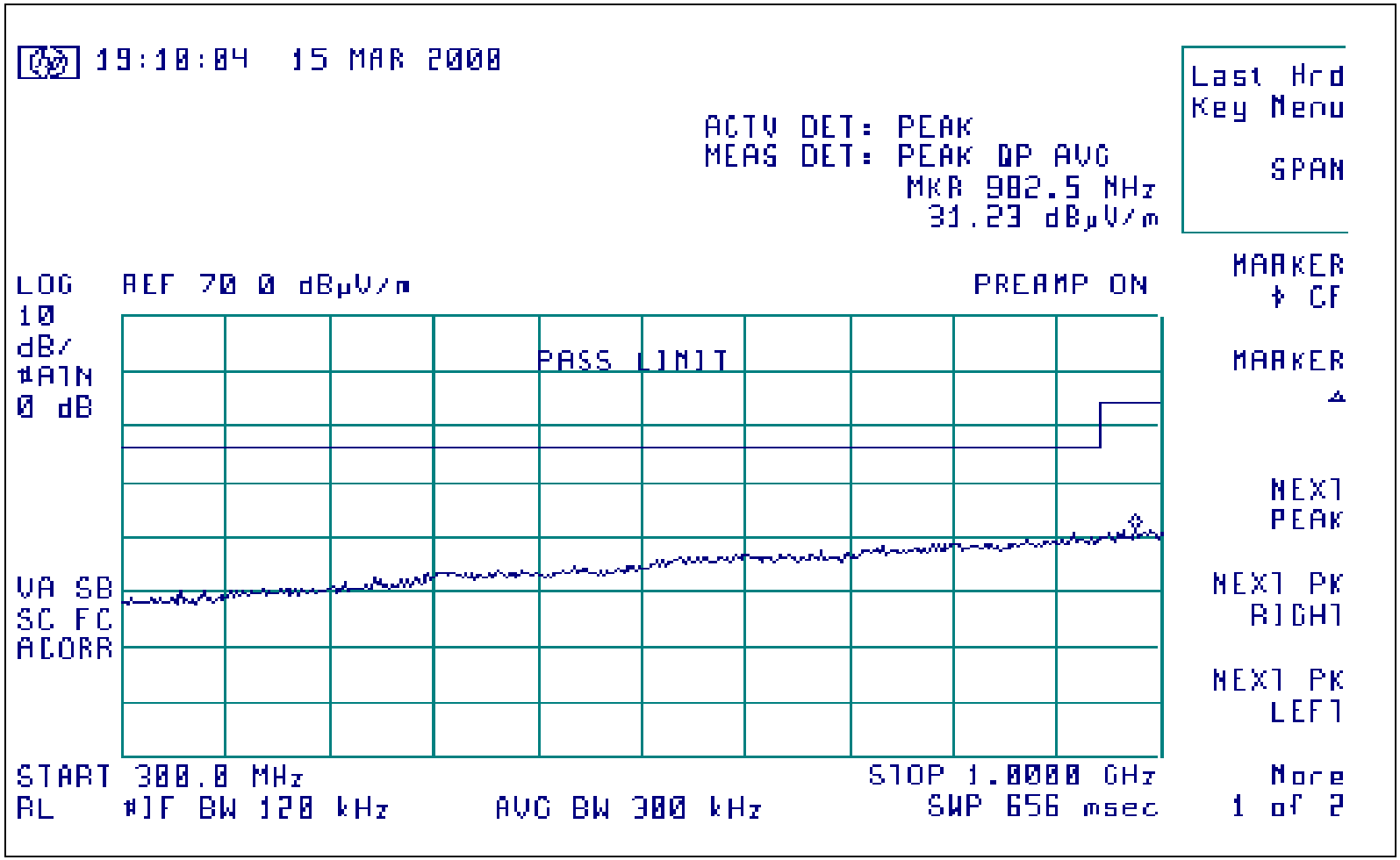
Signature Scan of the Emissions of the Brady EPM, Vertical polarity, from 300 MHz to 1000 MHz
Inside 3 meter Chamber, Peak hold scan



FCC ID: NUC-BEPM10

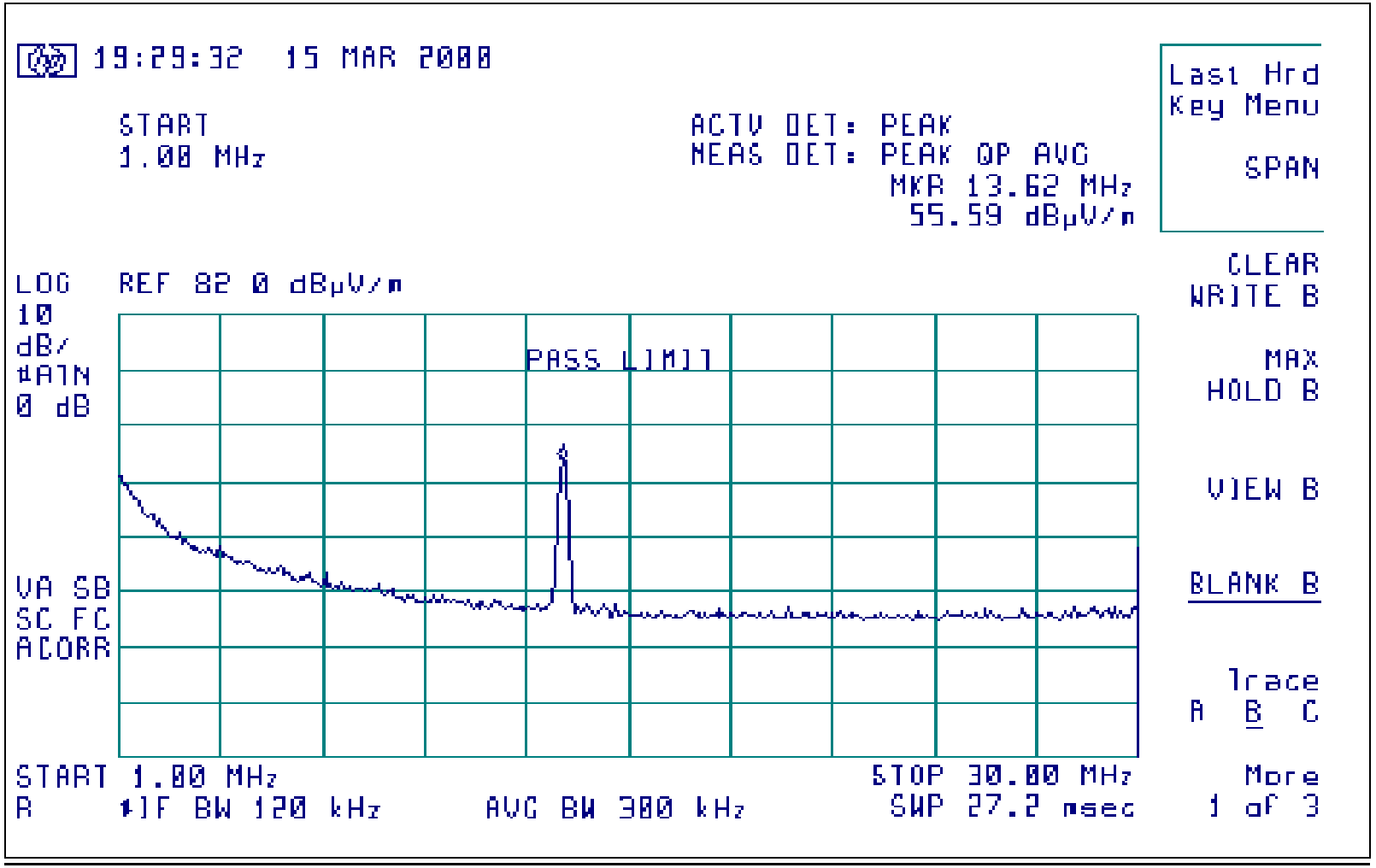
Signature Scan of the Emissions of the Brady EPM, Horizontal polarity, from 300 MHz to 1000 MHz

Inside 3 meter Chamber, Peak hold scan



FCC ID: NUC-BEPM10

Signature scan of emissions from 1 to 30 MHz, performed at 3 meter distance, in 3 meter chamber



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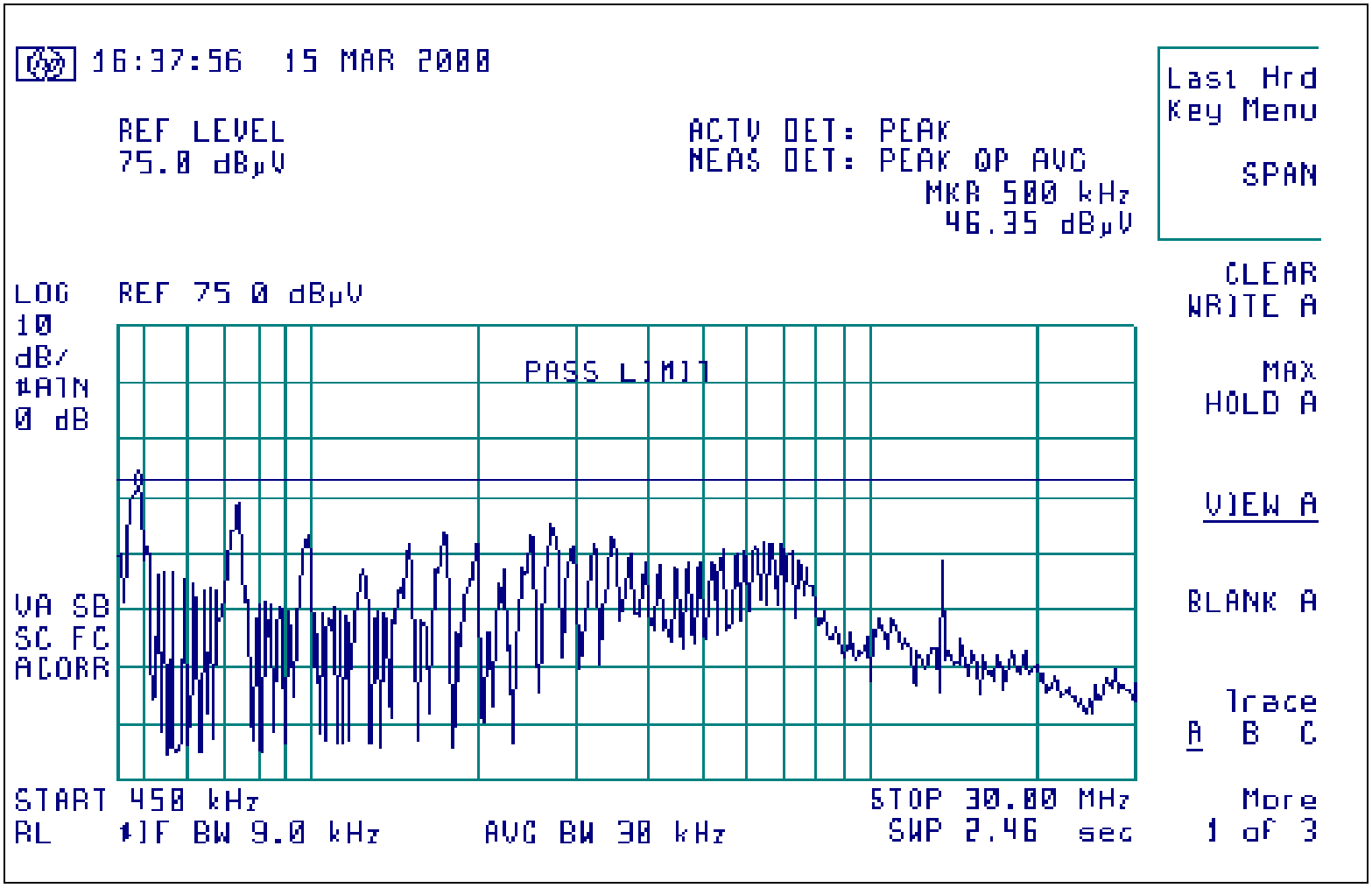
Signature scan of Conducted Emissions, L1



FCC ID: NUC-BEPM10

Signature scan of Conducted Emissions, L2