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# L. S. Compliance, Inc.

*Compliance Testing of:*  
*Spray commander*  
*Pet Training System*

*Prepared for:*  
*Radia Technology Limited*

*Test Report Number: 300214*

*Date(s) of Testing: May 15, June 14, 2000*

***All results of this report relate only to the items that were tested.***

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**DESCRIPTION OF MEASUREMENT FACILITIES**

Site on File with the FCC

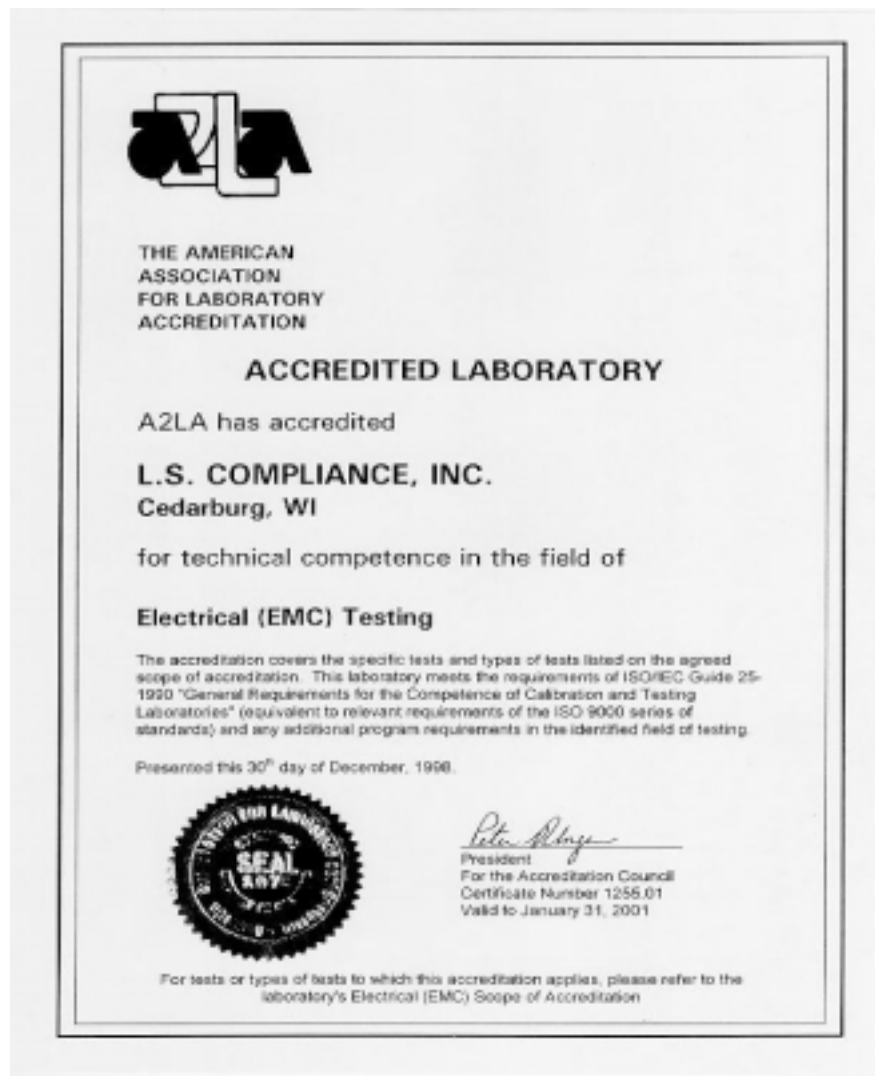
ID Number: 31040/SIT

1300F2

Site on file with Industry Canada:

ID Number: IC 3088

*“ 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. ”*





## ***SIGNATURE PAGE***

Tests performed by:

Prepared By:

Approved By:

June 21,  
2000

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Kenneth L. Boston, EMC Lab Manager

Date

PE #31926

Registered Professional Engineer

(State of Wisconsin)



1.3 SUMMARY OF TEST REPORT

MANUFACTURER: Radia Technology Limited  
MODEL: Multivet- Spray Commander  
SERIAL: not applied  
DESCRIPTION: remote control for a pet training system  
FREQUENCY RANGE: TRANSMITTER; 912.0 Mhz fixed frequency

The Spray commander remote control transmitter was found to **meet** the radiated emission specification of Title 47 CFR FCC, Part 15, subpart C. for an intentional radiator



## 1.4 INTRODUCTION

On May 15 and June 14 of 2000, a series of Radiated Emissions tests were performed on two sample models of the spray commander transmitter, a small handheld unit which is designed to transmit a coded signal used to activate a pet training spray module. 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 15.249 for a low powered transmitter. These tests were performed by Kenneth L. Boston, PE, of L. S. Compliance, Inc.

## 1.5 PURPOSE

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

15.109            15.249  
15.205  
15.209

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. The sample was placed on an 80cm high wooden pedestal, which was centered on the flush-mounted 2m diameter metal turntable. The test sample was operated on its own [new] internal battery. The battery voltage at the beginning of the tests was measured to be 6.5 volts. One of the test samples contained modified software, allowing it to transmit a continuous modulated signal, in order to facilitate measurement of the fundamental, spurious and harmonic emissions. The other test sample was left as manufactured, with the transmitter sending out one short burst whenever the keypad was depressed.

Please refer to Section 1.11 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 Title 47 CFR, FCC Part 15.249 limits for low powered (ISM) devices. For the calculations used to determine the limits applicable for the two test samples, refer to Appendix A. These limits are expressed in decibels (dB) above 1 microvolt per meter ( $\mu\text{V}/\text{m}$ ). 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 appropriate limits were also observed when any spurious signals were located within any of the restricted bands as described in Part 15.205a. These frequencies, and their associated limits, are referenced in Section 1.10. 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 (1 meter from 1 to 9 ghz) from the test object. A biconical antenna or tuned dipole was used to measure emissions from 30 to 200 MHz, a log periodic or tuned dipole 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 programmed 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.

No significant emissions were found aside from the transmitter fundamental and several harmonics, plus some low level spurious (reference oscillator) signal near the fundamental carrier. The unit was scanned for emissions while in continuous transmit, over the range 30 to 10,000 MHz to establish compliance with Part 15.209 and 15.249.





## 1.8 TEST EQUIPMENT UTILIZED FOR RADIATED EMISSIONS TEST

A list of the test equipment, cables 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 120 kHz when receiving signals below 1 GHz, and with a bandwidth of 1 MHz when receiving signals above 1 GHz, in accordance with CISPR 16. Both the Quasi-peak and Average detector functions were used.

## 1.9 CONDUCTED EMISSION TEST

Due to the fact that this product operated on its own internal battery power, as opposed to using a power cord, it was not necessary to perform a test for Conducted Emissions.



Manufacturer: Radia Technology Limited

Model: Spray Commander

Serial Number(s): not applied

**1.10 - Restricted Bands affecting this product**

Frequency (MHz)	Limit ( $\mu$ V)	Limit (dB/ $\mu$ V/m)
960-1240	500	54.0
1300-1427	500	54.0
1435-1626.5	500	54.0
1645.5-1646.5	500	54.0
1660-1710	500	54.0
1718.8-1722.2	500	54.0
2200-2300	500	54.0
2310-2390	500	54.0
2483.5-2500	500	54.0
2655-2900	500	54.0
3260-3267	500	54.0
3332-3339	500	54.0
3345.8-3358	500	54.0
3600-4400	500	54.0
4500-5150	500	54.0
5350-5460	500	54.0
7250-7750	500	54.0
8025-8500	500	54.0
9000-9200	500	54.0

### 1.11 – Photos taken during testing



View of the Spray Commander transmitter during the Radiated Emissions tests. This view shows the orientation of the product corresponding to zero degrees azimuth in position. (horizontal polarity).



## 1.12 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 Spray Commander transmitter does **meet** the emission requirements of Title 47 CFR, FCC Part 15 Subpart C for an intentional radiator. The level of fifth harmonic emission of the sample was found to be only 1.1 dB below the limit in the worst case configuration. As this level is 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.

**1.13 - Test Equipment, cables used**

<b>Asset #</b>	<b>Manufacturer</b>	<b>Model #</b>	<b>Serial#</b>	<b>Description</b>	<b>Due Date</b>
AA960004	EMCO	3146	9512-4276	Log Periodic Antenna	3aug2000
AA960005	EMCO	3110B	9601/2280	Biconical Antenna	3aug2000
AA960007	EMCO	3115	99111-4198	Double Ridge Horn Antenna	1aug2000
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 section	23aug2000
CC000221	HP	E4407b	Us39160256	26.5 GHz Spectrum Analyzer	16june2000
N/a	LSC	Cable	0011	3 meter 1/2 " heliax Cable	23 Aug 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:**

### **CALCULATIONS**



Manufacturer: Radia Technology Limited

Model: Spray Commander

Serial Number(s): not applied

## **Calculation of Radiated Emissions limits for FCC Part 15.249**

### **FIELD STRENGTH OF FUNDAMENTAL FREQUENCIES:**

### **FIELD STRENGTH OF SPURIOUS/HARMONIC FREQUENCIES:**

❖ Where  $f_0 = 912 \text{ MHz}$

Fundamental:  $= 50,000 \mu\text{V/m} = 94.0 \text{ dB}\mu\text{V/m}$

Harmonic:  $= 500 \mu\text{V/m} = 54.0 \text{ dB}\mu\text{V/m}$

For other out-of band spurious signals, the 15.209 general limits apply:

$216\text{-}960 \text{ MHz} = 200 \mu\text{V/m} = 46 \text{ dB}\mu\text{V/m}$

$960\text{-}10,000 \text{ MHz} = 500 \mu\text{V/m} = 54.0 \text{ dB}\mu\text{V/m}$



## **APPENDIX B:**

### DATA CHARTS





## Measurement of Electromagnetic Radiated Emission within 3 Meter FCC Listed Chamber

Frequency Range inspected: 30 to 3500 MHz

Date of Test:	May 15, June 14, 2000	Manufacturer:	Radia Technology Ltd
Location:	L.S. Compliance, Inc. W66 N220 Commerce Court Cedarburg, WI 53012	Model No.:	Spray Commander
Specifications:	Title 47CFR, FCC Part 15.231b	Serial No.:	Not applied
Distance:	3 meters, 1 meter	Configuration:	Active, continuous modulated carrier
Equipment:	HP 8546A EMI Receiver EMCO 3115 Double Ridged Waveguide EMCO 3146A Log Periodic	Detector(s) Used:	Quasi-peak below 1 GHz Average above 1 GHz
Laboratory Conditions:	Temperature: 68-74 deg F Humidity: 35-50% ,		Pressure: 680-1060mbr

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

Harmonics greater than 20 dB below the limit were not reported.:

Frequency (MHz)	Antenna Polarity	Height (meters)	Azimuth (0° - 360°)	EMI Meter Reading (dB $\mu$ V/m)	In-band?	15.249 Limit (dB $\mu$ V/m)	Margin (dB)
897.9	H	1.1	90	41.0	Out	46.0	5.0
910.2	H	1.1	90	45.5	In	94.0	48.5
912.04	H	1.1	90	89.3	In	94.0	4.7
914.0	H	1.1	90	45.6	In	94.0	48.4
926.4	H	1.1	90	38.3	In	94.0	55.7
983.2	H	1.1	270	35.4	Out	46.0	10.6
1824.0	H	1.0	45	59.3	Out/harmonic	63.5	4.2
2736.1	H	1.0	130	58.2	Out/harmonic	63.5	5.3



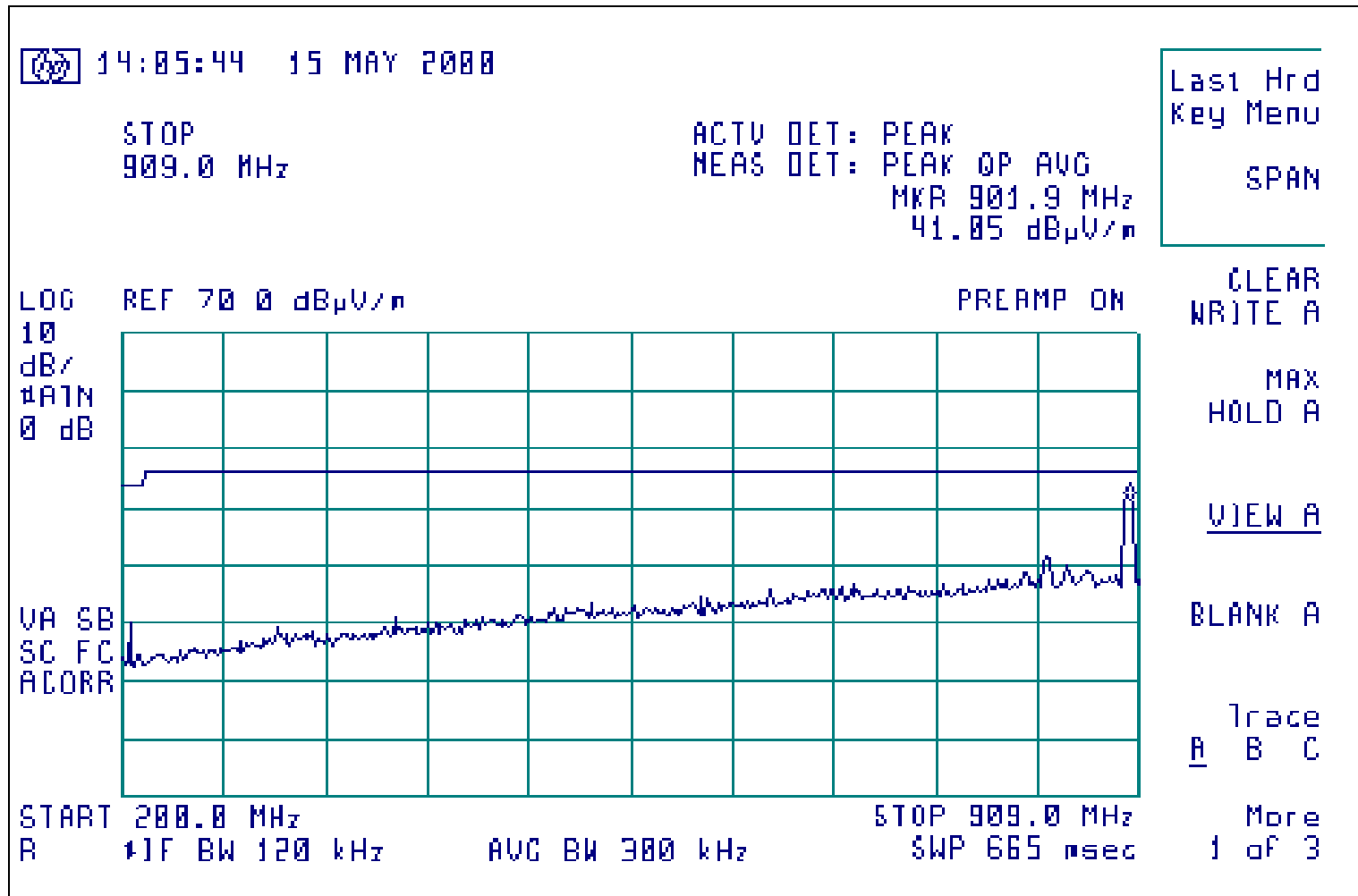
3648.2	H	1.0	135	60.2	Out/harmonic	63.5	3.3
4560.1	H	1.0	310	62.4	Out/harmonic	63.5	1.1



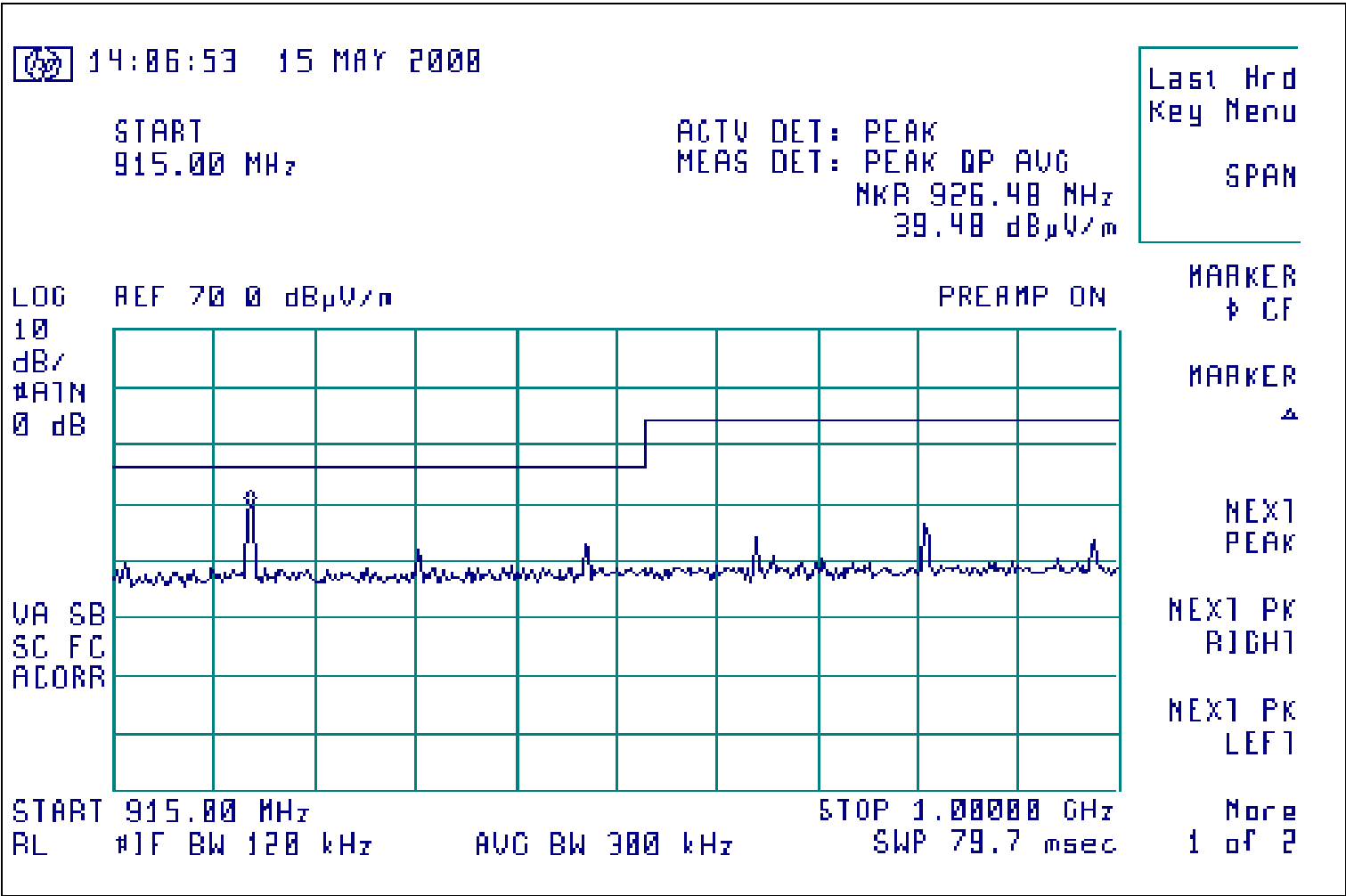
## **APPENDIX C:**

### GRAPHS

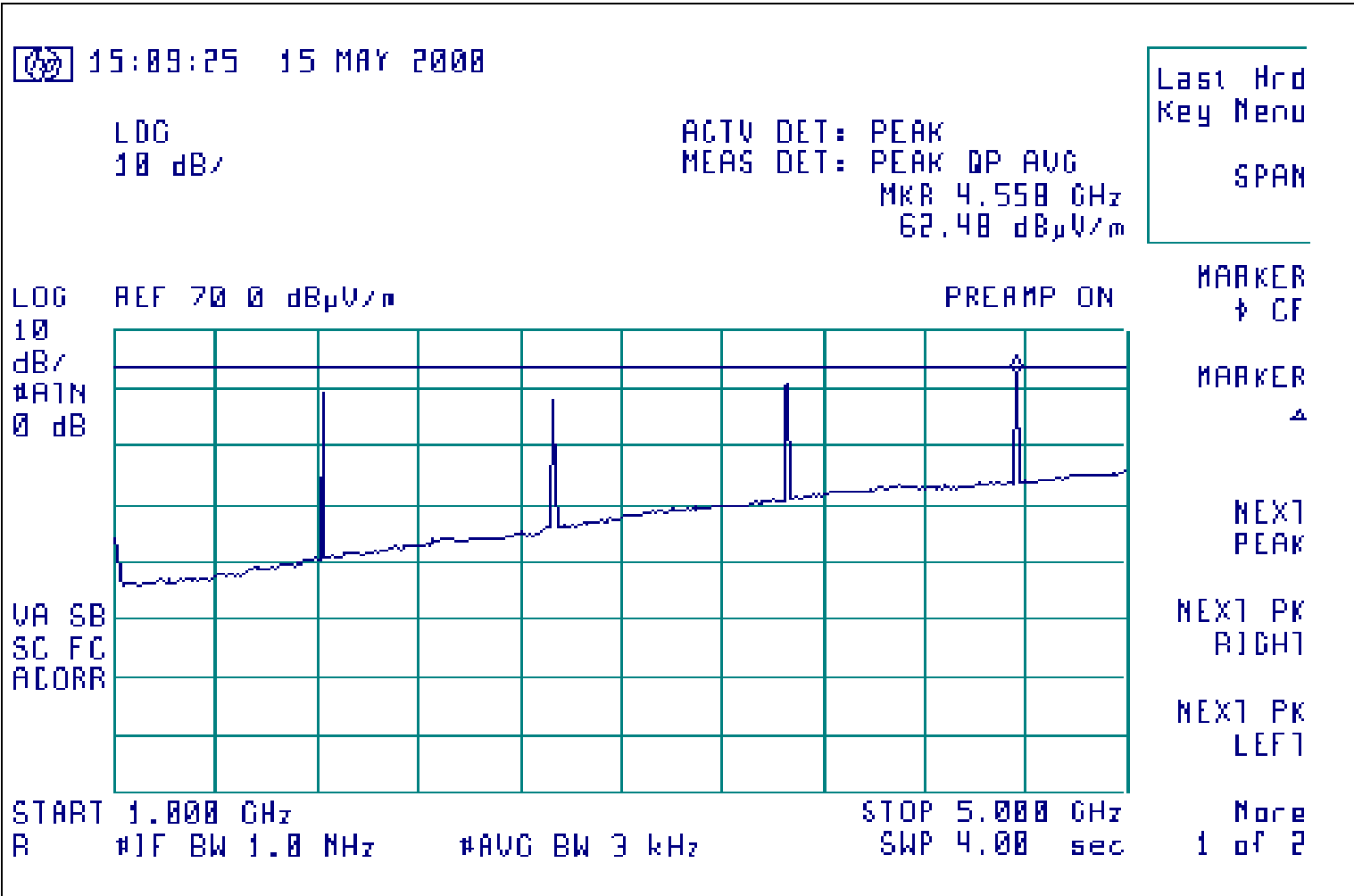
**Transmitter, emissions 200 MHz-1 GHz, horizontal polarity**



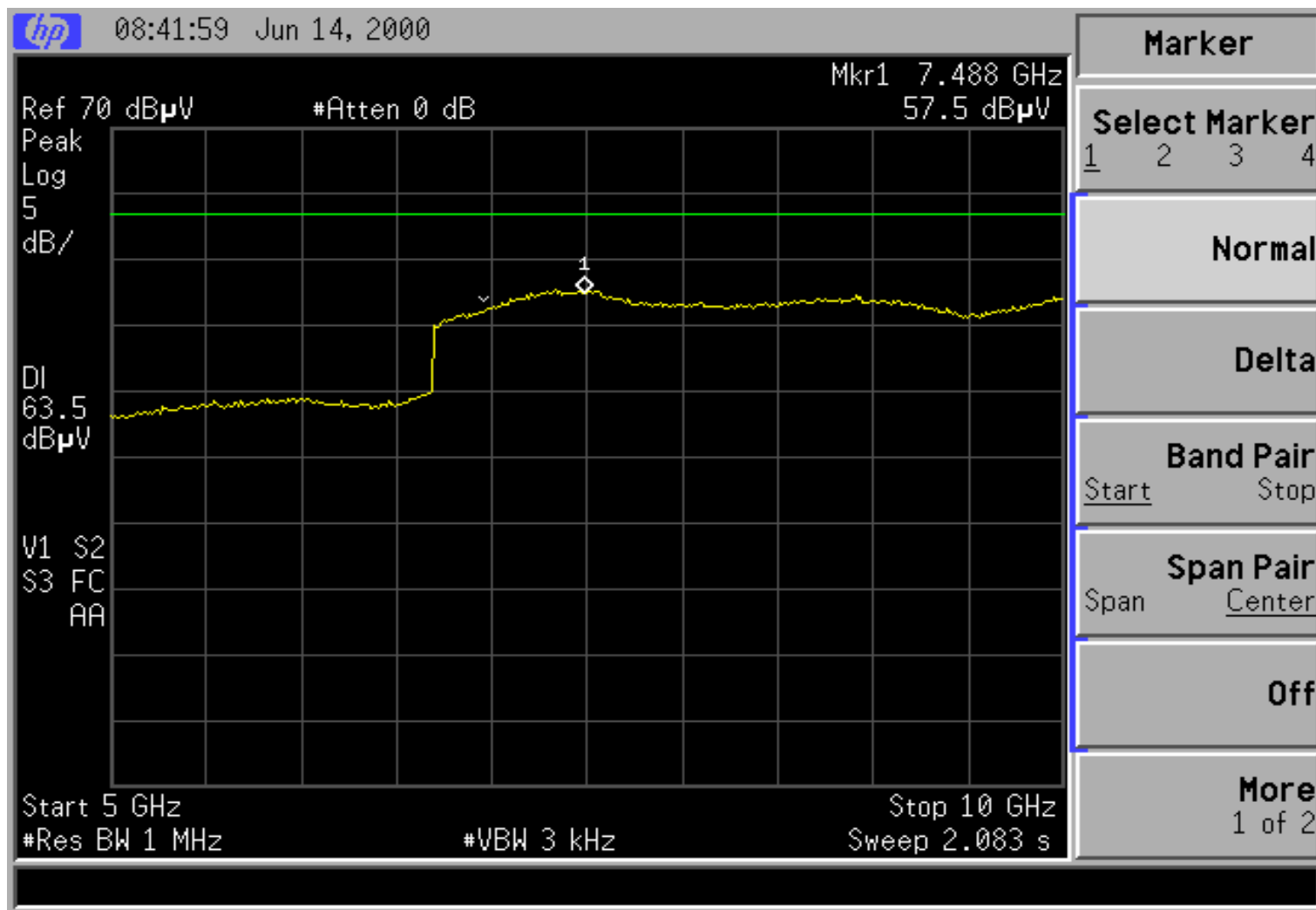
Transmitter, emissions 200-1 GHz, horizontal polarity

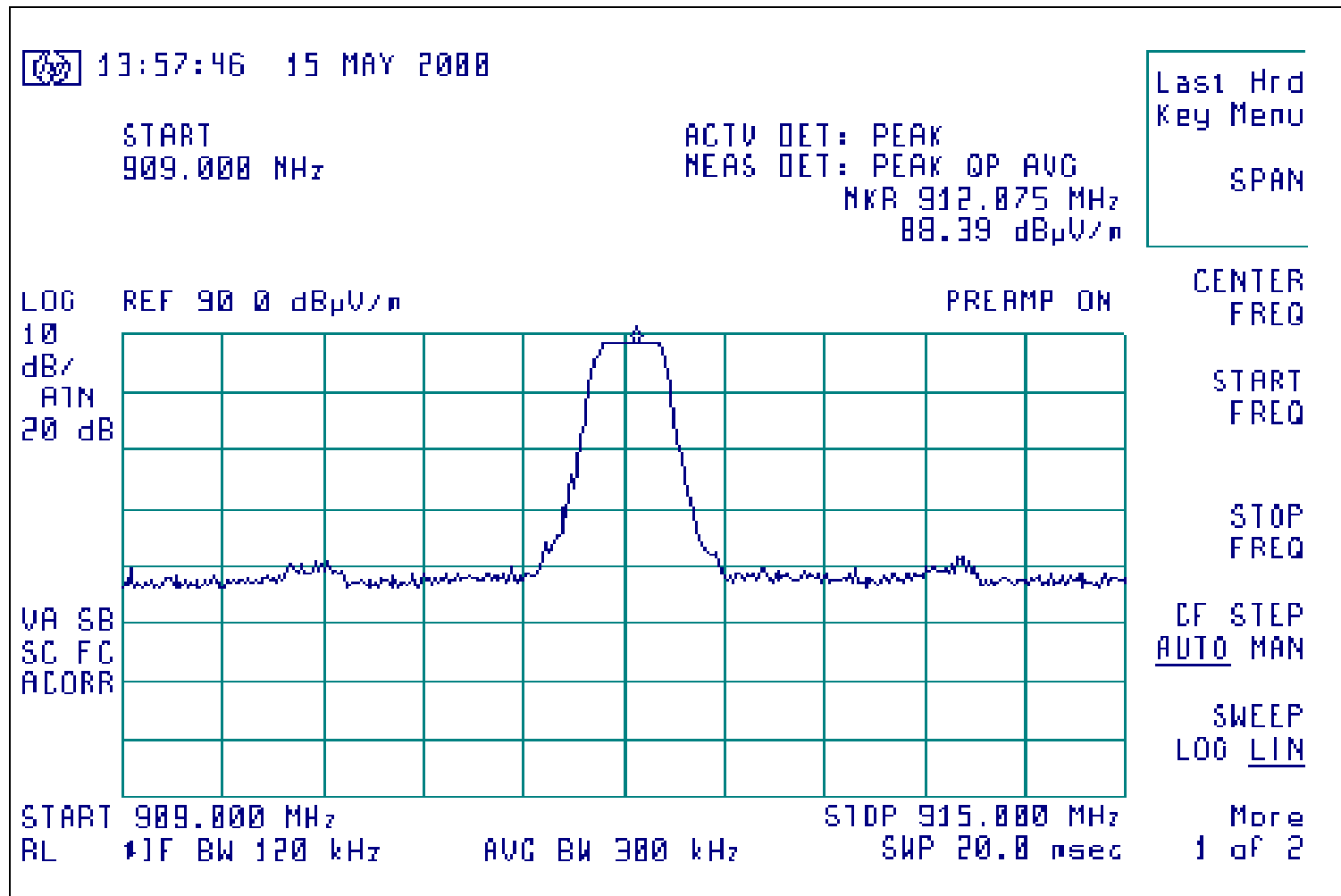


Transmitter, emissions 1-5 GHz, horizontal polarity, sample transmitting carrier



**912 MHz Transmitter, emissions 5-10 GHz, horizontal polarity, sample transmitting carrier**







**912 MHz Transmitter, emissions from 30-200 MHz, horizontal polarity**

