

EMI/EMC Test Report
For

Ascension Productions Inc., Lazer Runner Player Vest

To determine compliance with

FCC part 15, Class B
REPORT NO.: *314A02*

ELECTRONICS TEST CENTRE
MPB Technologies Inc.
TEST COMPLETED: *January 7, 1998*

Client: **Ascension Productions Inc.**

7927A Coronet Road,
Edmonton, AB
T6E 4N7

Tests performed by:


Jeffery Taylor
Test Technologist
EMI/EMC

Report prepared by:

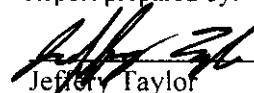

Jeffery Taylor
Test Technologist
EMI/EMC

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The results reported herein relate only to the item tested. This report shall not be reproduced, except in full, without the written approval of the Electronics Test Centre. Unless otherwise noted, the measurement uncertainty of the reported results is consistent with the requirements of the standard being evaluated.

1.0 Introduction

1.1 Scope

The purpose of this report is to present the findings and results of compliance testing performed, against the electromagnetic compatibility and interference specifications, standards and requirements set forth in this document.

1.2 Applicant

This test report has been prepared for:

Ascension Productions Inc.
7927A Coronet Road
Edmonton, AB
T6E 4N7

1.3 Applicability

All test procedures, limits, and results defined in this document apply to the Ascension Productions Inc. Lazer Runner Player Vest, which shall be referred to as the equipment under test (EUT).
The results contained in this report relate only to the item(s) tested.

1.4 Test sample description

The test sample, provided for testing by Ascension Productions Inc., was a Lazer Runner Player Vest. The Lazer Runner Player Vest tested was a vest, with a transmitter, a receiver, and a laser 'gun'. The Lazer Runner Player Vest was powered by a battery pack.
<other descriptions such as connections, manufacturer, and usage are to be included in parts lists and manuals>

1.5 General test conditions and assumptions

The EUT was setup and exercised using the configurations, modes of operation and arrangements defined in this report only. All inputs and outputs to and from other equipment associated with the EUT were adequately simulated.

Where relevant, the EUT was only tested using the monitoring methods and test criteria defined in this report.

All testing, unless otherwise noted, was performed under the following environmental conditions

Temperature: 25.2°C
Humidity: 35%
Barometric pressure: 101kpa

1.6 Scope of testing

Tests were performed in accordance with FCC part 15.249, Class B specification.

1.7 Variations in test methods

There were no variations

2.0 Test conclusion

The EUT was subjected to the following electromagnetic interference tests. Compliance to these tests is designated by a pass or fail.

The following table summarizes the test results and details the tests performed in terms of the specification and class or level applied, the unique test sample identification, and the EUT modification state, the mode of operation, configuration and cable arrangement (if applicable).

Summary chart

Test case	Test type	Specification	Class/level	Test sample	Mod. State	Config.	Eng. / qual.	Result
2.1	Radiated emissions	FCC part 15, Class B	B	Lazer Runner Player Vest	—	—	—	PASS

Abbreviations

Ce - conducted emissions

Cs - conducted susceptibility(immunity)

N/A - not applicable

N/t - not tested

Re - radiated emissions

Rs - radiated susceptibility(immunity)

Measurement uncertainty

For radiated e-field emissions:

Frequency = $\pm 1 \times 10^{-3}$ MHz

Amplitude = + 3.8 / -3.9 dB (from 30 MHz to 200 MHz)

Amplitude = ± 2.8 dB (from 200 MHz to 1000 MHz)

For conducted emissions:

Frequency = $\pm 1 \times 10^{-3}$ MHz

Amplitude = + 3.8 / -3.9 dB (from 30 MHz to 200 MHz)

Amplitude = ± 2.8 dB (from 200 MHz to 1000 MHz)

2.1 Radiated emissions

Test summary	
Test lab: MPB technologies inc. Airdrie Test personnel: Jeffery Taylor Test date: January 7, 1998	Product: Lazer Runner Player Vest

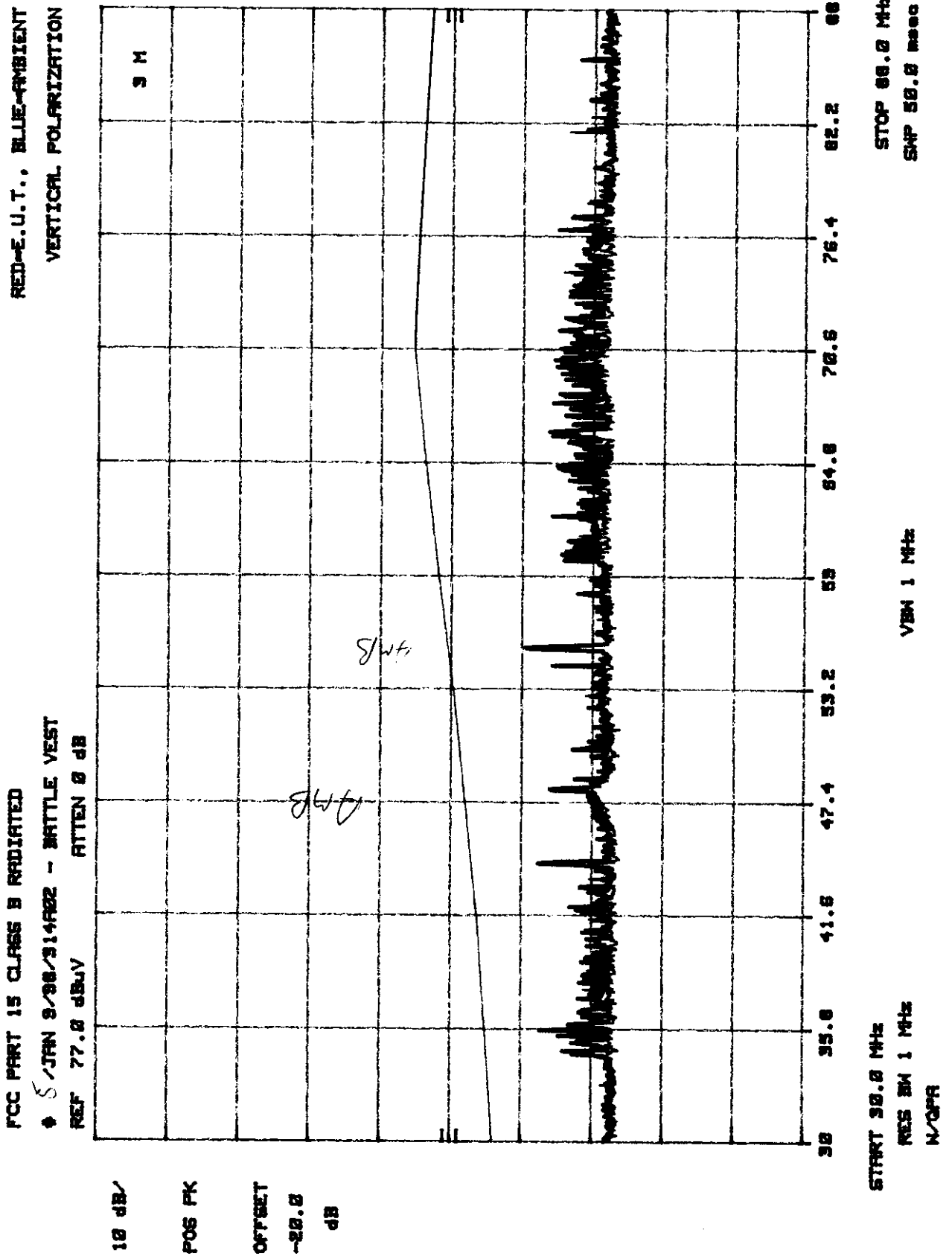
Test description									
Objectives/Criteria	Specifications								
The radiated e-field emissions radiated by a system or sub-system, measured at a distance of 3m from the EUT, shall not exceed the limits for FCC part 15, Class B specifications as stated.	FCC part 15, Class B 30 MHz to 1 GHz Measurement distance 3 m Radiated emissions limits dBμv <table> <tr> <th>Frequency MHz</th><th>class b</th></tr> <tr> <td>30 to 88</td><td>40</td></tr> <tr> <td>88 to 216</td><td>44</td></tr> <tr> <td>216 to 1000</td><td>46</td></tr> </table> Using a CISPR quasi-peak adapter	Frequency MHz	class b	30 to 88	40	88 to 216	44	216 to 1000	46
Frequency MHz	class b								
30 to 88	40								
88 to 216	44								
216 to 1000	46								

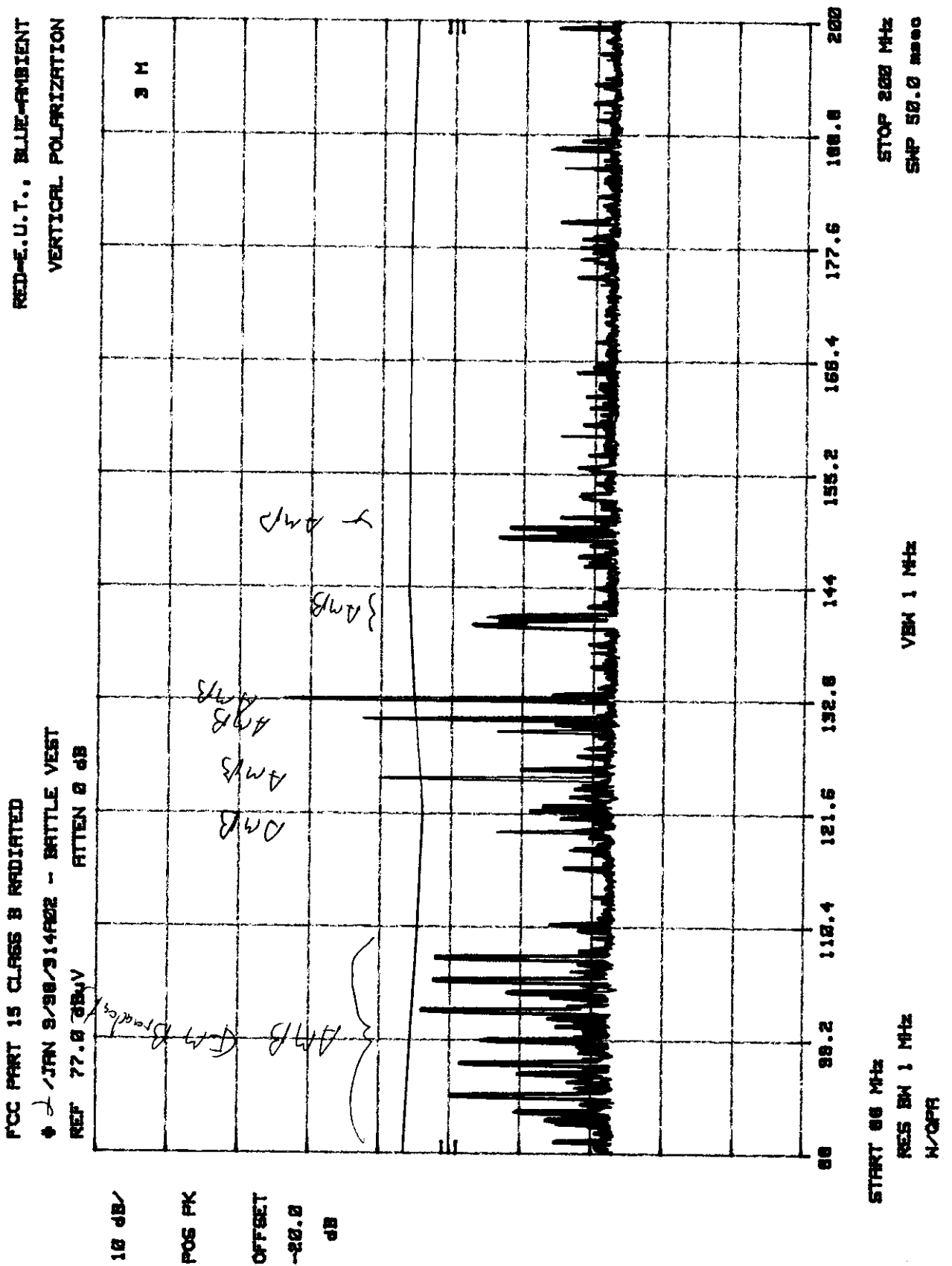
Test result
Pass
Comments
Refer to test report data sheets for more detail.

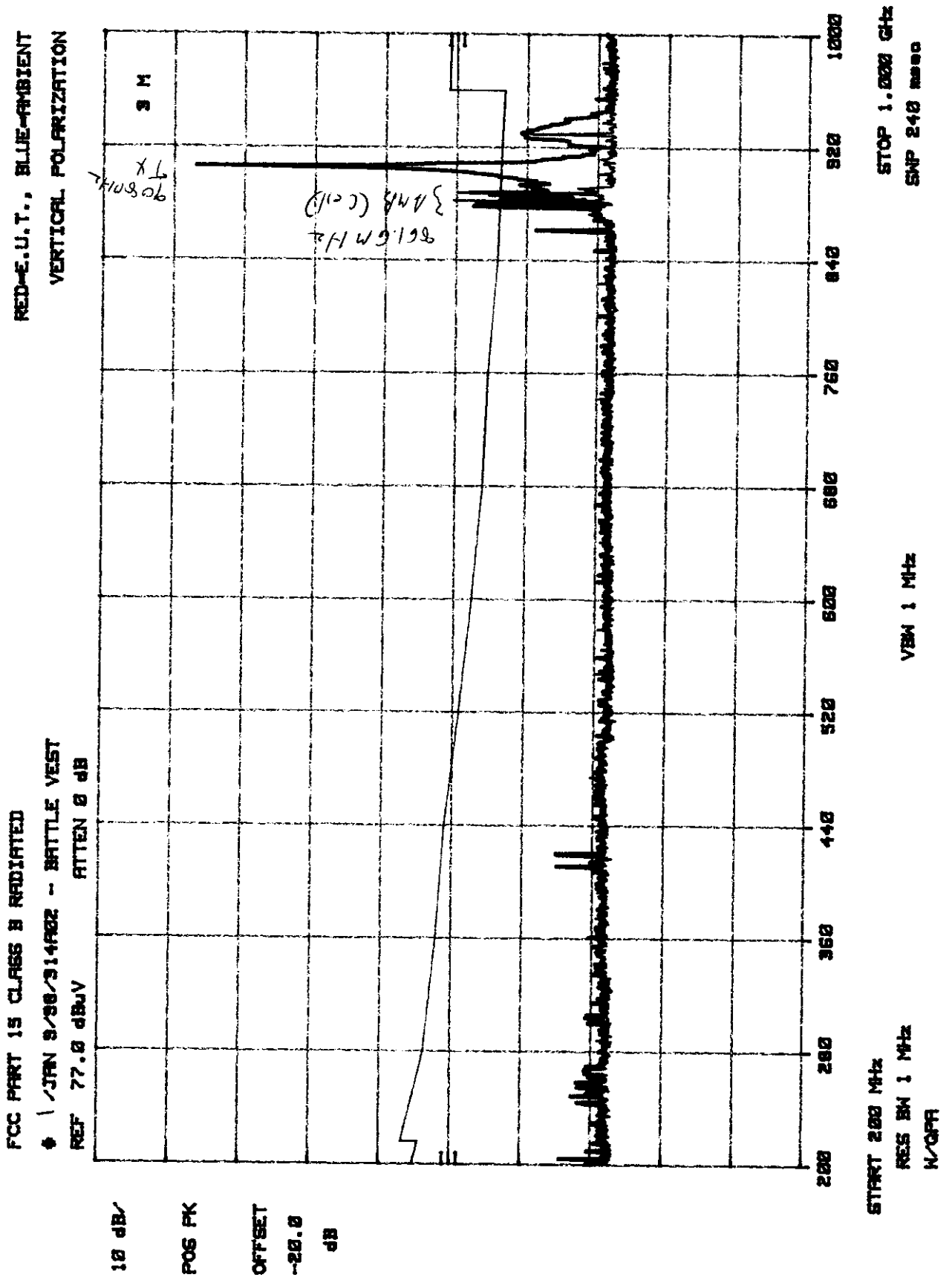
Appendix A
EUT description
(See attached documentation for detailed information.)

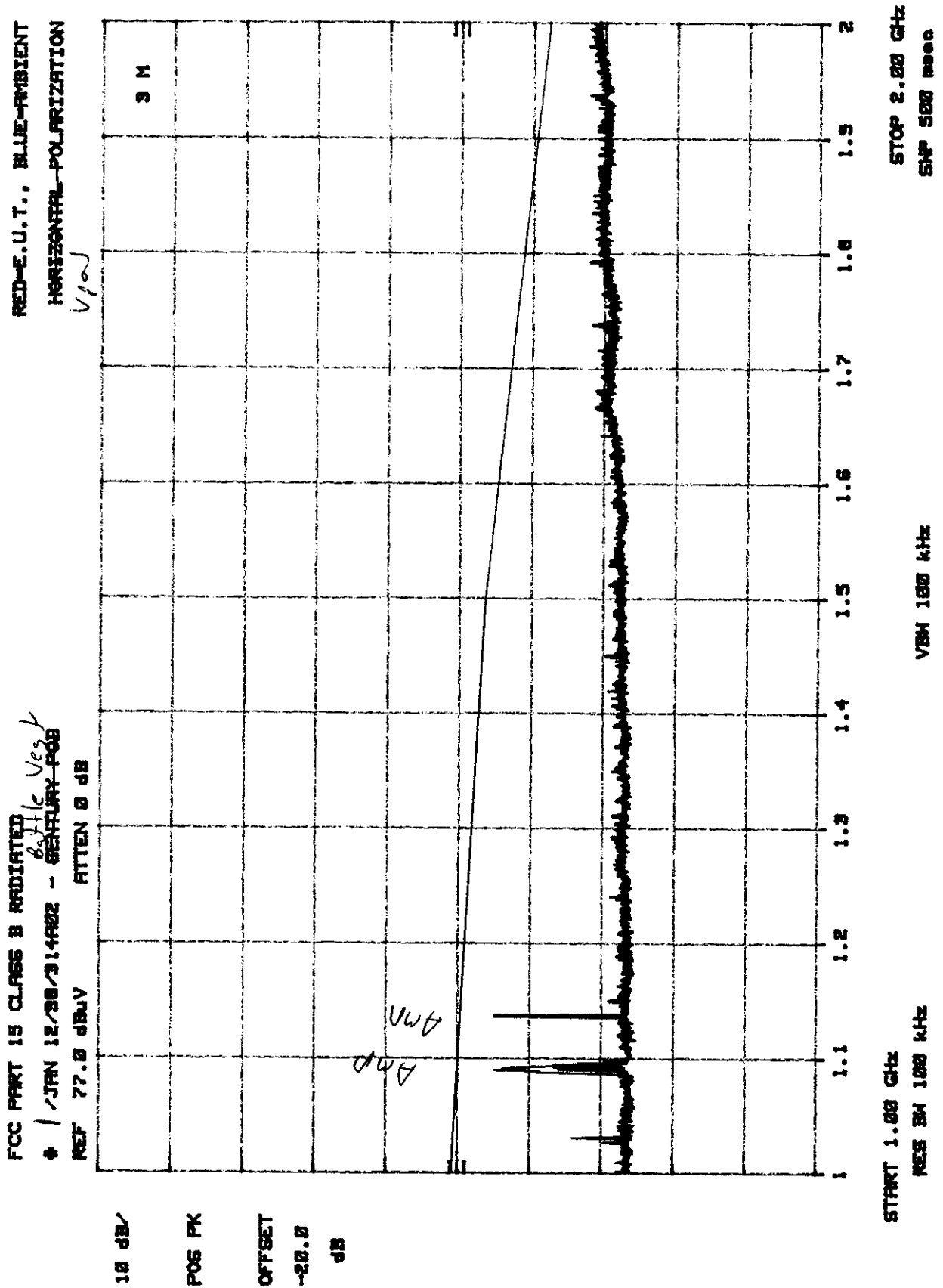
Appendix B
Test report data sheets

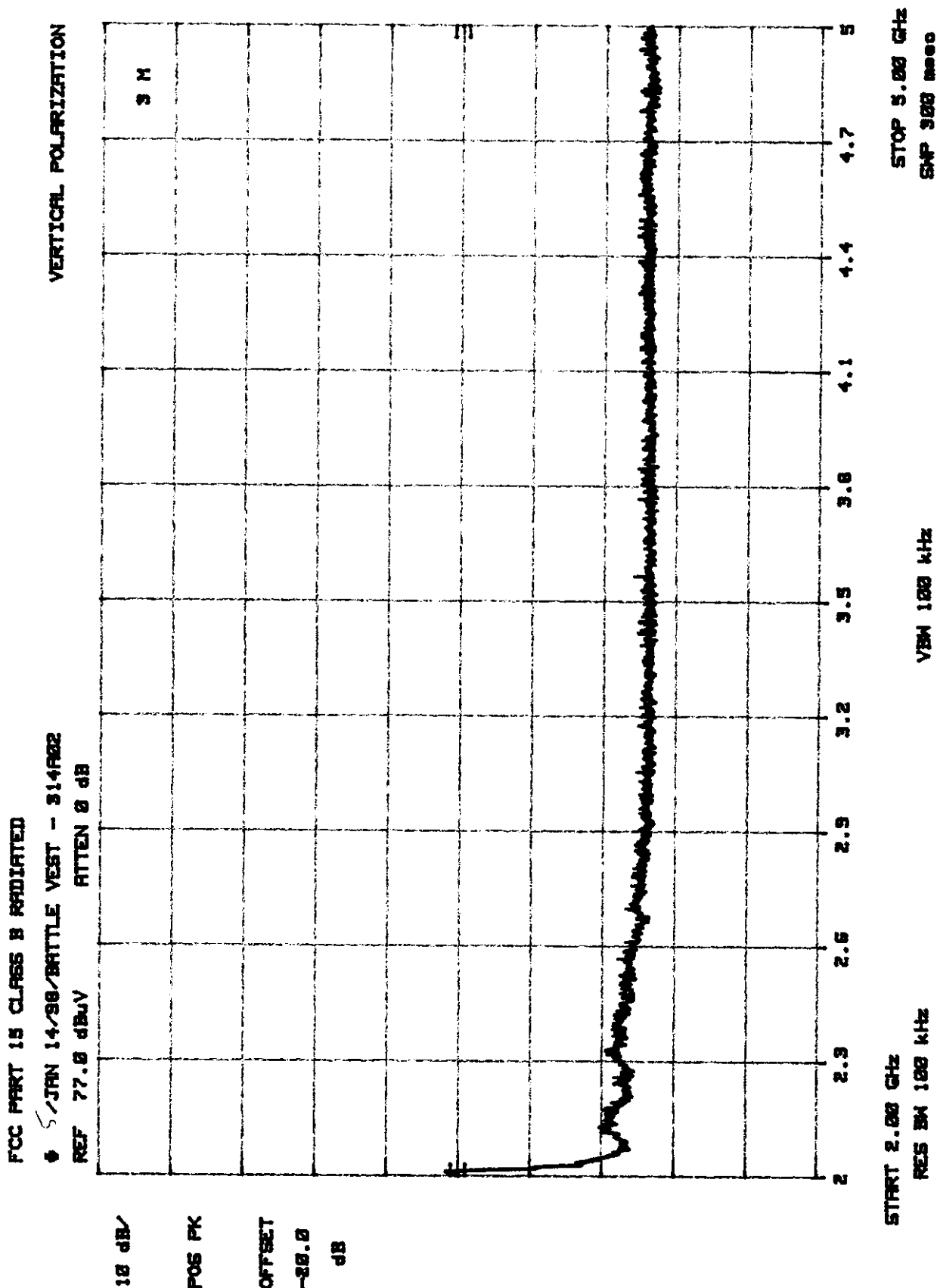
Emission Plots	pg. 8-19
Spurious Emissions	20
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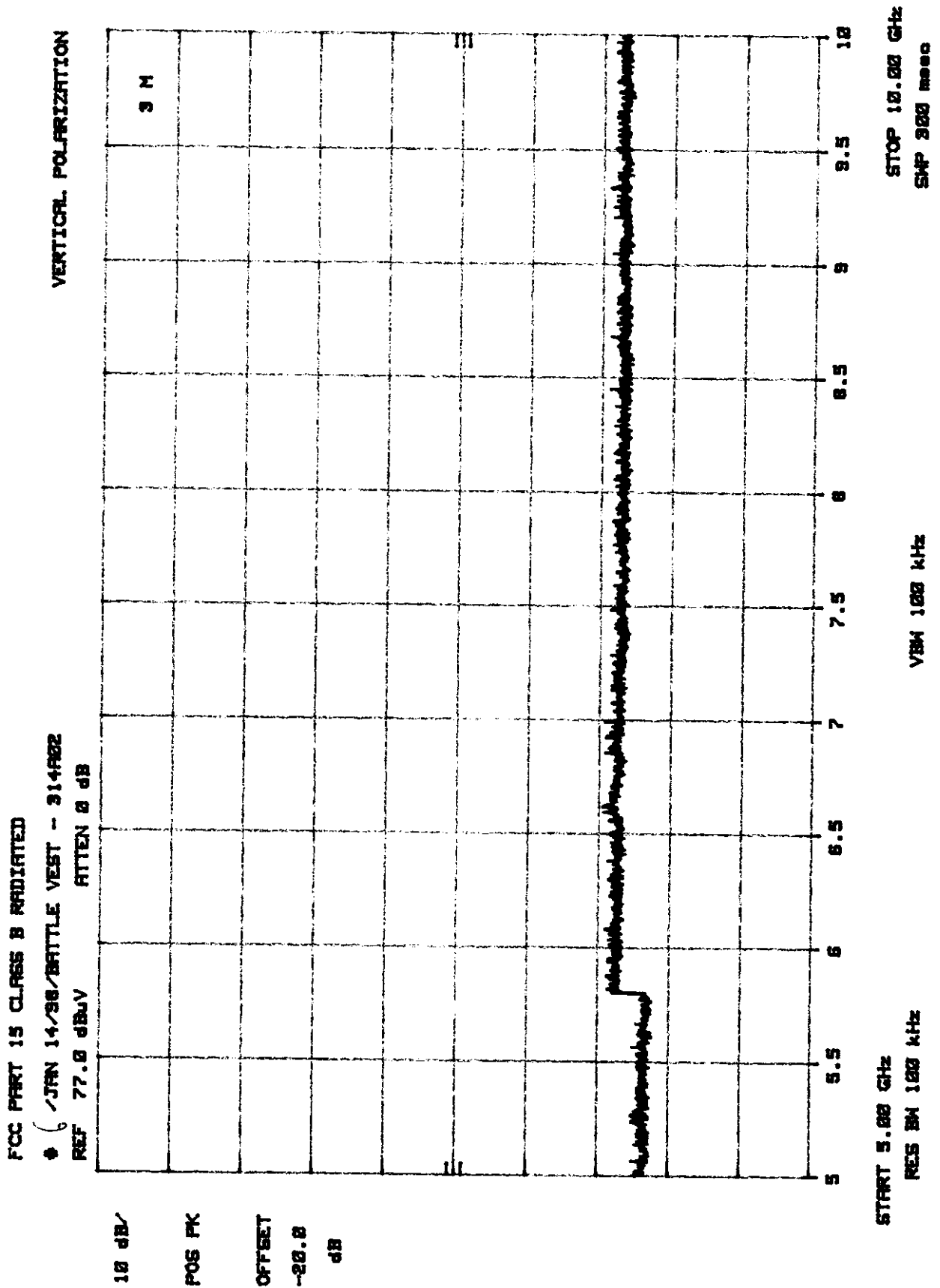


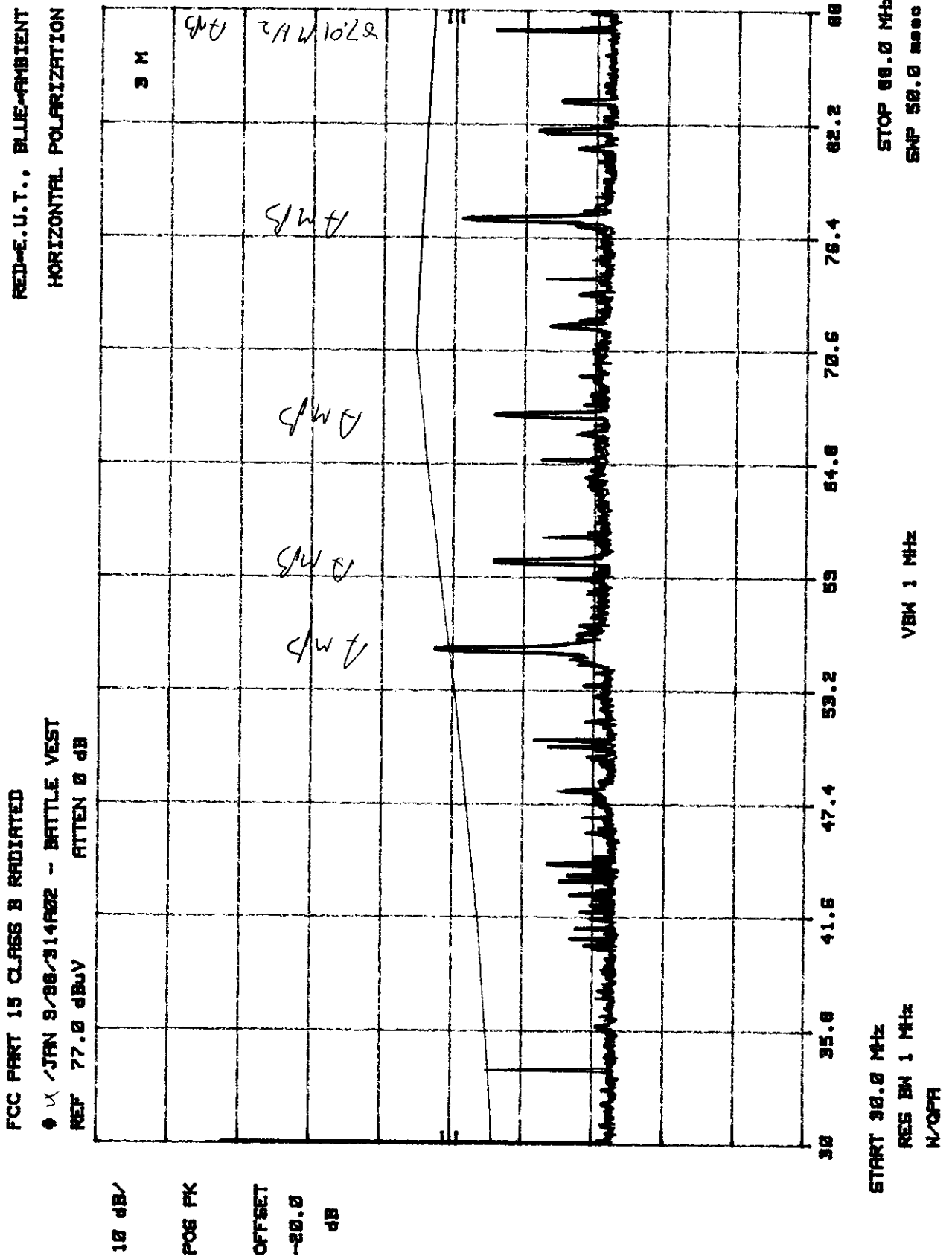






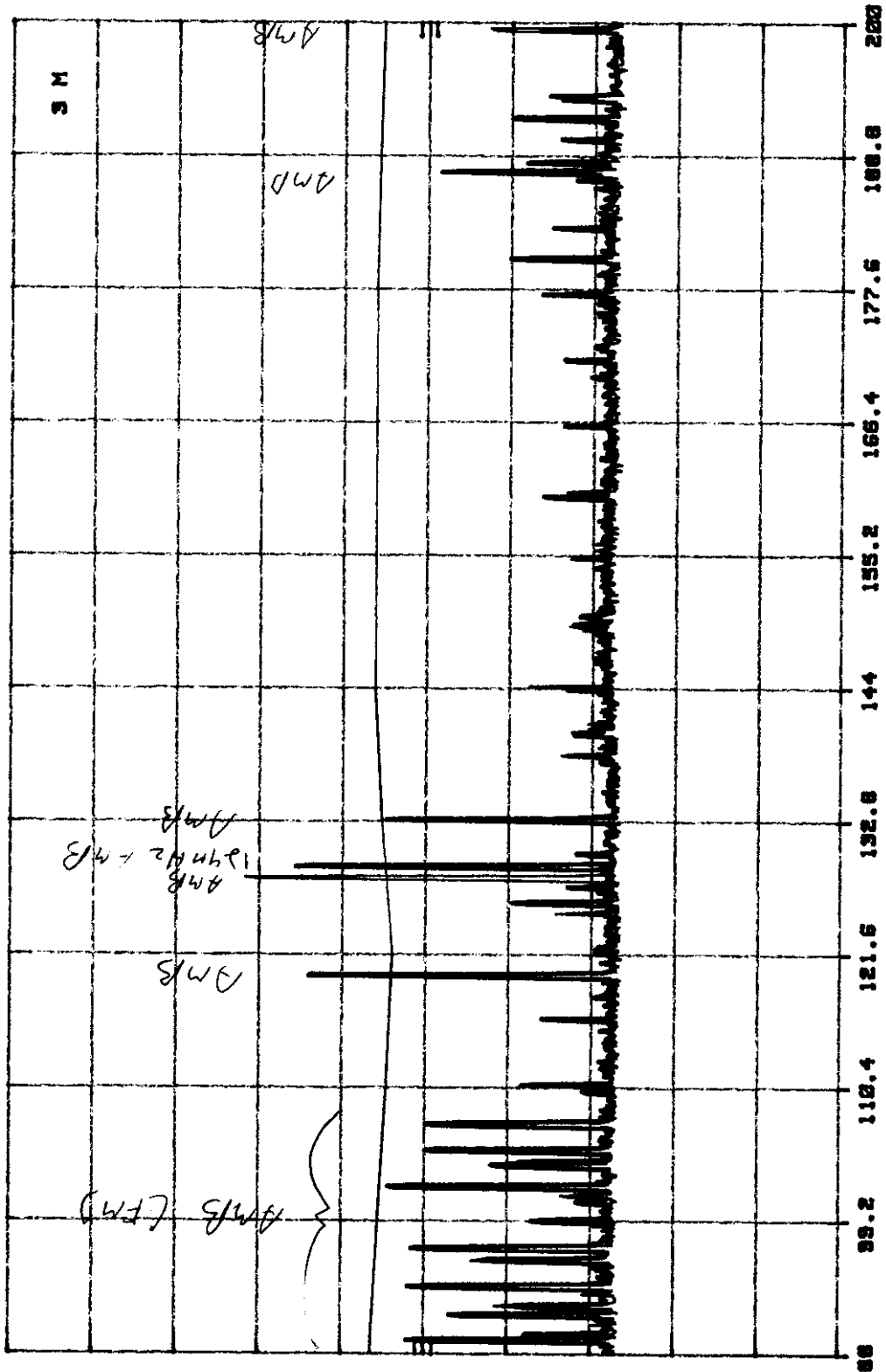






RED=E.U.T., BLUE=AMBIENT
HORIZONTAL POLARIZATION

FCC PART 15 CLASS B RADIATED
JAN 9/98/314A02 - BATTLE VEST
REF 77.0 dBuV ATTEN 0 dB

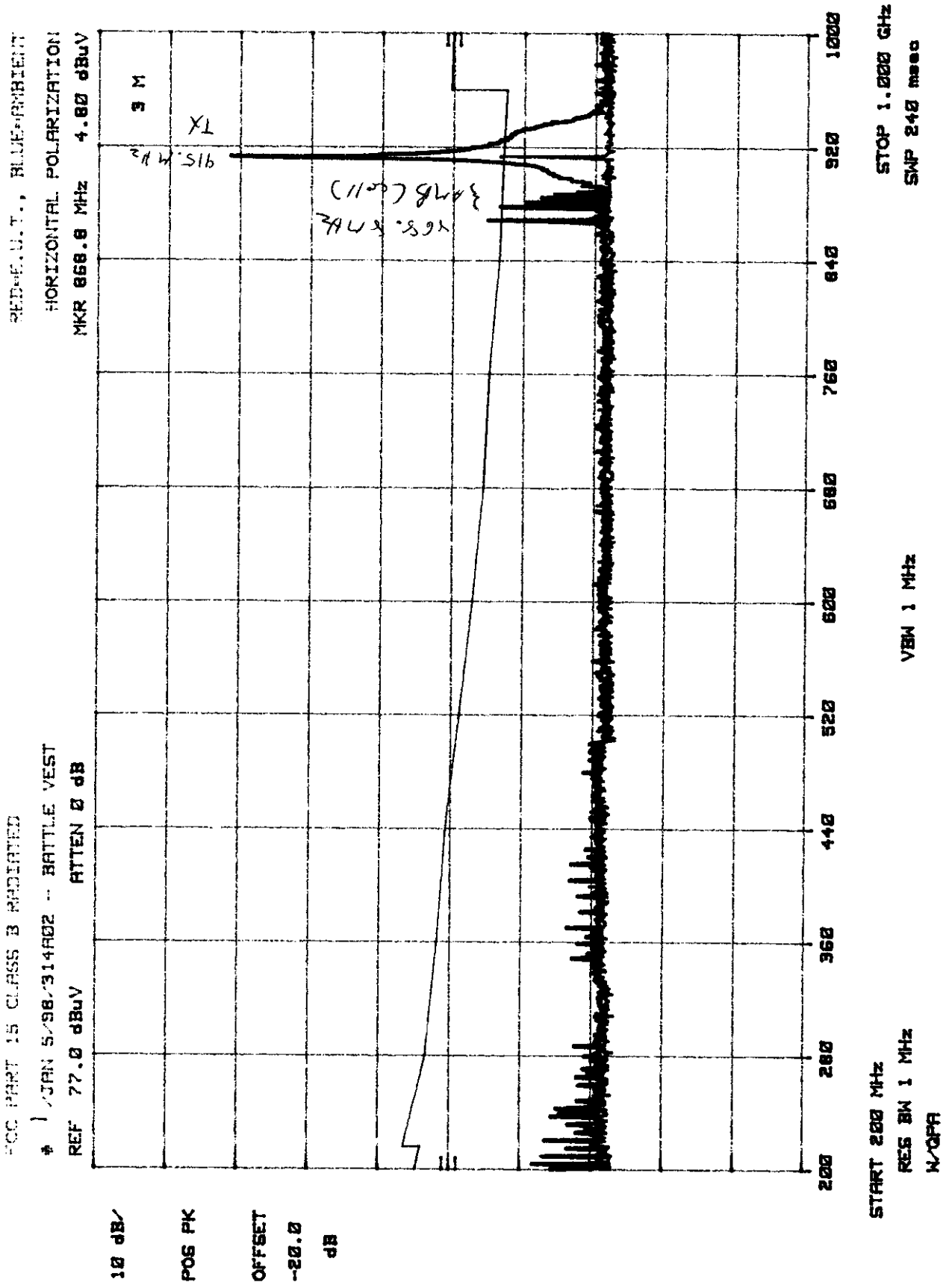


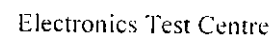
STOP 200 MHz
SWP 50.0 MHz

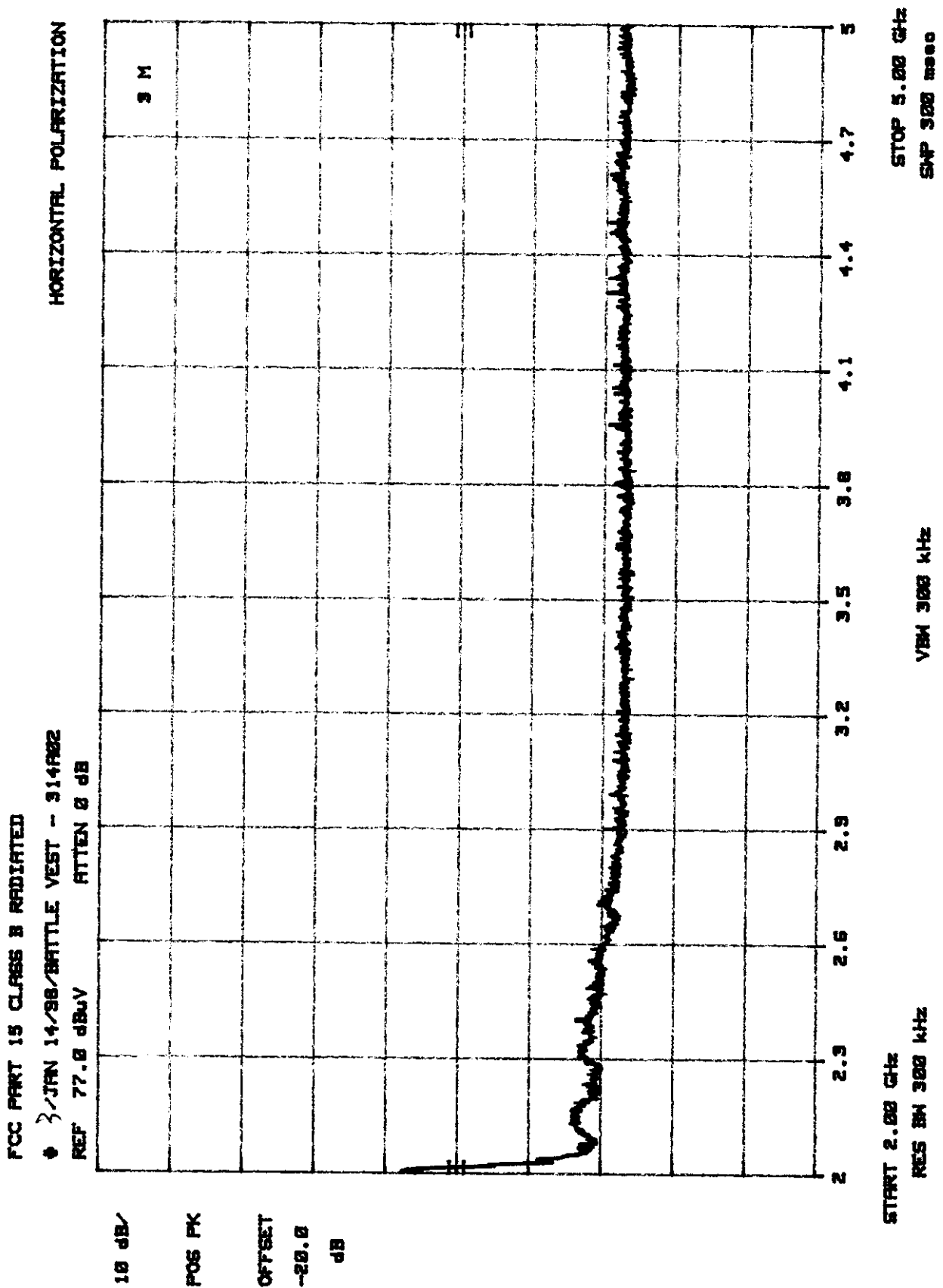
VBW 1 MHz

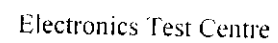
START 88 MHz
RES BW 1 MHz
W/GPA

10 dB
POS PK
OFFSET
-20.0
dB









Spurious emissions

Freq.	Polarization	Detector	Measured power	Cable Factor	Antenna Factor	Actual Value	Limit
869.991MHz	Hpol	QP	16.9dBuV	3.7dB	22.1dB	42.7dBuV	46dBuV
870.007MHz	Vpol	QP	14.7dBuV	3.7dB	21.9dB	29.9dBuV	46dBuV
1.740GHz	Hpol	AVG	8.8dBuV	7.9dB	28.1dB	44.8dBuV	54dBuV

Carrier related harmonics

Freq	Polarization	Measured Power	Cable Factor	Antenna Factor	Actual Value	Limit
1.830GHz	Hpol	10.9dBuV	8.0dB	28.4dB	47.3dBuV	54dBuV

Bandwidth measurements

The Lazer Runner Battle Vest has several different possible operating frequencies. the lowest, the middle, and the highest where measured.

908MHz

Freq.	Polarization	Detector	Measured power	Cable Factor	Antenna Factor	Actual Value	Limit
<u>Fundamental Frequency</u>							
908.023MHz	Hpol	QP	40.4dBuV	3.8dB	23.7dB	67.9dBuV	94dBuV
908.024MHz	Vpol	QP	42.4dBuV	3.8dB	22.9dB	69.1dBuV	94dBuV
<u>Lower Band Limit</u>							
902MHz	Hpol	QP	11.6dBuV	3.8dB	23.6dB	39.0dBuV	54dBuV
902MHz	Vpol	QP	13.5dBuV	3.8dB	23.6dB	40.9dBuV	54dBuV
<u>Upper Band Limit</u>							
928MHz	Hpol	QP	5.4dBuV	3.8dB	22.8dB	32.0dBuV	54dBuV
928MHz	Vpol	QP	6.6dBuV	3.8dB	23.0dB	33.4dBuV	54dBuV

915MHZ

<u>Fundamental Frequency</u>							
914.994MHz	Hpol	QP	39.3dBuV	3.8dB	23.9dB	67.0dBuV	94dBuV
914.995MHz	Vpol	QP	43.5dBuV	3.8dB	22.9dB	70.2dBuV	94dBuV
<u>Lower Band Limit</u>							
902MHz	Hpol	QP	9.2dBuV	3.8dB	23.7dB	36.7dBuV	54dBuV
902MHz	Vpol	QP	10.7dBuV	3.8dB	23.6dB	38.4dBuV	54dBuV
<u>Upper Band Limit</u>							
928MHz	Hpol	QP	7.4dBuV	3.8dB	22.8dB	34.0dBuV	54dBuV
928MHz	Vpol	QP	9.7dBuV	3.8dB	23.0	36.5dBuV	54dBuV

922MHz

<u>Fundamental Frequency</u>							
921.995MHz	Hpol	QP	39.5dBuV	3.8dB	24.1dB	67.4dBuV	94dBuV
921.994MHz	Vpol	QP	43.5dBuV	3.8dB	22.9dB	70.2dBuV	94dBuV
<u>Lower Band Limit</u>							
902MHz	Hpol	QP	6.0dBuV	3.8dB	23.7dB	33.5dBuV	54dBuV
902MHz	Vpol	QP	8.3dBuV	3.8dB	23.6dB	36.3dBuV	54dBuV
<u>Upper Band Limit</u>							
928MHz	Hpol	QP	11.8dBuV	3.8dB	22.8dB	38.4dBuV	54dBuV
928MHz	Vpol	QP	14.0dBuV	3.8dB	23.0dB	40.8dBuV	54dBuV

Appendix C

Photographs

Appendix D

Information and labeling requirements.

D-1.1 Industry Canada requirements

Industry Canada has labeling requirements for digital apparatus. Section 6.2 of ices-003 issue 2 specifies the requirements as follows.

6.2 A written notice indicating compliance must accompany each unit of digital apparatus to the end user. The notice shall be in the form of a label that is affixed to the apparatus. Where because of insufficient space or other restrictions it is not feasible to affix a label to the apparatus, the notice may be in the form of a statement included in the user's manual.

The suggested text for the notice, in English and in French, is as follows. RF causing equipment regulations.

This Class [*] digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe [*] respecte toutes les exigences du règlement sur le matériel brouilleur du Canada.

[*] insert either "a" or "b" but not both as appropriate for the equipment requirements.

D-1.2 FCC requirements

The FCC has labeling requirements for computing devices. Section 15.19 of the FCC rules specifies the requirements as follows.

15.19 labeling requirements

(a) in addition to the requirements in part 2 of this chapter, a device subject to certification, notification or verification shall be labeled as follows:

(1) receivers associated with the operation of a licensed radio service, e.g., FM broadcast under part 73, land mobile operation under part 90, etc., Shall bear the following statement in a conspicuous location on the device:

This device complies with part 15 of the FCC rules. Operation is subject to the condition that this device does not cause harmful interference.

(2) a stand-alone cable input selector switch, shall bear the following statement in a conspicuous location on the device:

This device is verified to comply with part 15 of the FCC rules for use with cable television service.

(3) all other devices shall bear the following statement in a conspicuous location on the device:

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

(b) where a device is constructed in two or more sections connected by wires and marketed together, the statement specified in this section is required to be affixed only to the main control unit.

(c) when the device is so small or for such use that it is not practicable to place the statement specified in this section on it, the information required by these paragraphs shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed be

placed on the container in which the device is marketed. However, the FCC identifier or the unique identifier, as appropriate, must be displayed on the device.

The FCC has a requirement to provide user information in the equipment manuals of all devices subject to part 15.

15.21 information to user

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

The electronics test centre recommends that the following statement be placed in a prominent location in the text of the manual.

Note: equipment changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

The FCC has a requirement to provide user information in equipment manuals of computing devices. Section 15.105 of the FCC rules specifies the requirements as follows.

15.105 information to the user

(a) for a class a digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

Note: this equipment has been tested and found to comply with the limits for a class a digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

(b) for a class b digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

Note: this equipment has been tested and found to comply with the limits for a class b digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

Re-orient or relocate the receiving antenna.

Increase the separation between the equipment and the receiver.

Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

Consult the dealer or an experienced radio/tv technician for help.

(c) the provisions of paragraphs (a) and (b) do not apply to digital devices exempted from the technical standards under the provisions of section 15.103.

(d) for systems incorporating several digital devices, the statement shown in paragraph (a) or (b) needs to be contained only in the instruction manual for the main control unit.

Appendix E Test facility

1.0 Location

Tests were performed at the Electronics Test Centre:

Street address:

27 East Lake Hill
Airdrie, Alberta
T4B 2B7

Mailing address:

P.O. box 3485
Airdrie, Alberta
TAB 2B7

Tel: (403) 912-0037

Fax: (403) 912-0083

RF anechoic chamber

References to the RF anechoic chamber (RFAC) identify the test chamber located in the main building complex at the electronics test centre. Its usable working space measures 8 m long x 4.9 m wide x 5.2 m high. The floor, walls and ceiling consist of annealed steel panels. The walls and ceiling are covered with 122 cm long pyramidal cones made of anechoic material. The floor supports a 15 cm high steel computer floor that acts as a ground plane. Test instrumentation is located in two shielded equipment vestibules located at the side of the main room. Cables are routed through bulkhead panels between the rooms as required. Power feeds are routed into the main room and vestibules through power line filters providing at least 100 MHz of attenuation between 10 kHz and 10 GHz.

Open field test site

References to the open area test site (oats) identify the open area located on the property of the electronics test centre. It conforms to the requirements of csa c108.8-m1983 and ANSI c63.4. A metal ground plane and an all weather structure constructed of wood and fiberglass are provided. Fiberglass antenna masts are located 3, 10, and 30 meters from a rotateable wooden turntable. The 30 meter mast is located outside the all weather structure. Test instrumentation is located below the metal ground plane. Antenna cables are routed through conduits buried beneath the ground plane. Power feeds and cables that connect the test sample to auxiliary instrumentation are routed through a hole in the ground plane at the centre of the turntable. Power is provided to the underground facility through filters having at least 100 MHz of attenuation between 10 kHz and 10 GHz. Test instrumentation is powered by a line isolation transformer. Calibration of the oats was performed in accordance with ANSI c63.4. A report has been submitted to the FCC.

1.1 Grounding plan

The EUT was located on a on wooden table and grounded to the power mains..

1.2 Power

Ac power was supplied via ac mains for the base and battery was used for the remote.

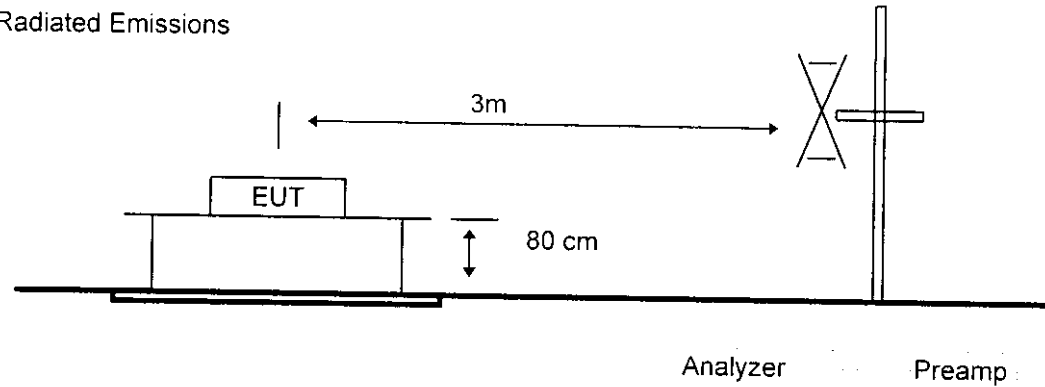
1.3 Emissions profile

Recent ambient and conducted electromagnetic emission profiles were generated through-out the tests and are included in the report.

1.4 Test configuration

The following diagrams illustrate the configuration of the EUT test and measurement equipment used for FCC radiated and conducted emissions testing.

Radiated Emissions



Appendix F Test equipment

Equipment calibration

All measurement instrumentation conforms to ANSI c63.2. Calibration is maintained in accordance with manufacturer recommendations, NATO aqap-6, and MIL-STD-45662. Each measurement device is labeled with it's etc asset number and calibration due date.

Calibration accuracy

test equipment used to provide quantitative measurements are calibrated with standards traceable to the national research council, national institute of standards and technology or other national standards. Instrumentation systems for emissions measurements have the following accuracy's:

Frequency: $\pm 2\%$

Amplitude: ± 2 MHz

Test equipment descriptions

Instrument	Manufacturer	Model no.	Asset no.	Calibration status
Spectrum analyzer	Hewlett Packard	8566b	9565	Annual calibration
Spectrum analyzer	Hewlett Packard	8566b	9168	Annual calibration

Measurement range: 100 Hz to 22 GHz

Resolution bandwidth: 3 MHz bandwidths of 10 Hz to 3 MHz in a 1, 3, 10 sequence.

Amplitude measurement range: -134 dBm to + 30 dBm

Dynamic range spurious response: for signals < -40 dBm all harmonic and intermodulation distortion > 70 dBm below input signal.

RF input: 100 Hz to 22 GHz precision female type n connector.

Input swr: 1.2, 100 Hz to 2.5 GHz; 1.5, 2.5 GHz to 5.8 GHz; 1.9, 5.8 GHz to 22 GHz with 10 dB input attenuation.

Instrument	Manufacturer	Model no.	Asset no.	Calibration status
RF preselector	Hewlett Packard	85685a	9563	Annual calibration
RF preselector	Hewlett Packard	85685a	9728	Annual calibration

Measurement range: 20 Hz to 2 GHz

Displayed average noise level: -115 dBm, 9 kHz to 50 kHz; -132 dBm, 50 kHz to 1 MHz; -150 dBm, 1 MHz to 1500 MHz; -147 dBm, 1500 MHz to 2000 MHz.

Residual response: -90 dBm, 2 kHz to 1 MHz; -112 dBm, 1 MHz to 2000 MHz.

RF input: 20 Hz to 2 GHz precision female type n connector.

Input swr: < 1.5

Instrument	Manufacturer	Model no.	Asset no.	Calibration status
Quasi-peak Adapter	Hewlett Packard	85650a	9243	Annual calibration

Amplitude accuracy: bypass mode, ± 0.3 dB; normal mode, ± 1.0 dB

Frequency accuracy in normal mode: 200 Hz bw, ± 10 Hz; 9 kHz bw, ± 4.5 kHz; 120 kHz bw, ± 60 kHz

Instrument	Manufacturer	Model no.	Asset no.	Calibration status
Graphics plotter	Hewlett Packard	7475a	9570	Annual Inspection
Graphics plotter	Hewlett Packard	7475a	9114	Annual Inspection

Media sizes: 8.5 x 11 in. (ansi a) and 11 x 17 in. (ansi b)

Pens: automatically changes up to 6 fiber tip pens.

Resolution: 0.025 mm (0.001 in.) Is the smallest addressable step size.

Repeatability: a. With the same pen: 0.1 mm (0.004 in.).

B. From pen to pen: 0.2 mm (0.008 in.).

Interfaces: HP-ib (ieee 488-1978), RS-232-c/ccitt, hp-il.

Instrument	Manufacturer	Model no.	Asset no.	Calibration status
Biconical antenna	EMCO	3104	9257	Annual calibration
Biconical antenna	EMCO	3104	9655	Annual calibration
Hp biconical antenna	EMCO	3109	20720	Annual calibration

Measurement range: 20 MHz to 200 MHz

Power handling capability: 100 W

Maximum continuous power: 50 W

Average vswr: 2.5:1

Maximum vswr: 10:1

Impedance: 50 ohms

Instrument	Manufacturer	Model no.	Asset no.	Calibration status
Log periodic antenna	Rhode & schwarz	H1023-a2	9188	Annual calibration
HF log periodic antenna	EMCO	3147	20721	Annual calibration
Conical log spiral antenna	EMCO	3101	9329	Annual calibration

Measurement range: 80 MHz to 1300 MHz (h1023-a2)

200 MHz - 5000 MHz (3147)

200 MHz - 1000 MHz (3101)

Power handling capability: 100 w

Vswr: less than 2.5

Input impedance: 50 ohms

Instrument	Manufacturer	Model no.	Asset no.	Calibration status
Biconal-log	ARA	Lpb-2520/a	4318	Annual calibration

Measurement range: 25 MHz to 2000 MHz

Power handling capability: 1000 W

Average vswr: 2:1

Impedance: 50 ohms

Instrument	Manufacturer	Model no.	Asset no.	Calibration status
Line impedance stabilization network	EMCO	3825/2r	9331	Annual inspection
Line impedance stabilization network	EMCO	3825/2r	9259	Annual inspection
Line impedance Stabilization network	EMCO	3825/2	20719	Annual inspection

Isolation frequency range: 10 kHz to 100 MHz

Power source frequencies: 0 Hz to 400 Hz

Current rating: 25 amps

The 3825/2r lsn is designed to stabilize test units which operate with two line, single phase power.

Instrument	Manufacturer	Model no.	Asset no.	Calibration status
Termination 50 ohms, 10 w	Weinschel	F1418	9746	Annual calibration
Termination 50 ohms, 10 w	Weinschel	F1418	9745	Annual calibration

Operation range: dc to 18 GHz

Nominal impedance: 50 ohms

Maximum power rating: 10 w average, 1 kW peak (5 us pulse width).

Maximum vswr: 1.15, dc to 4 GHz; 1.2, 4 to 8 GHz; 1.25, 8 to 12.4 GHz; 1.40, 12.4 to 18 GHz.

Instrument	Manufacturer	Model no.	Asset no.	Calibration status
3 m site mast	EMCO	1050	9197	N/A
10 m site mast	EMCO	1050	9199	N/A
30 m site mast	EMCO	1050	9200	N/A

Mast construction: rectangular fiberglass tubing.

Low friction skids are built into the column to allow smooth motion of the platform assembly.

Instrument	Manufacturer	Model no.	Asset no.	Calibration status
3 m site mast Controller	EMCO	1050c	9449	N/A
10 m site mast Controller	EMCO	1050c	9448	N/A
30 m site mast Controller	EMCO	1050c	9446	N/A

The platform is raised and lowered by a ½ h.p. motor, gear reduction system, and brake located at the base of the mast.

The controller will accept preset values for the minimum and maximum heights desired.

Instrument	Manufacturer	Model no.	Asset no.	Calibration status
Turntable	EMCO	1060	9198	N/A

Consists of a three meter diameter flush mount turntable with a 2500 lb capacity which is gear driven from the turntable motor.

Instrument	Manufacturer	Model no.	Asset no.	Calibration status
Turntable Controller	EMCO	1060c	9447	N/A

The turntable is rotated from a remote location by a motor, gear reduction system, and brake located at the base of the turntable.

The controller will accept preset values for the minimum and maximum heights desired.

Open field test site - test equipment list

Instrument	Manufacturer	Model #	Asset #	Calibration status
Spectrum analyzer	Hewlett Packard	8566b	9168	Annual calibration due: 29 nov 98
RF preselector	Hewlett Packard	85685a	9728	Annual calibration 29 nov 98
Quasi-peak Adapter	Hewlett Packard	85650a	9243	Annual calibration due: 29 nov 98
Rigged horn	Tensor	4105	9588	Annual calibration due: 02 may 98
Microwave amp	Hewlett Packard	8349	9244	Annual calibration due: 12 may 98
Biconalog antenna	ARA	Lpb- 2520/a	4318	Annual calibration due: 24 may 98
HF log periodic	ARA	3147	20721	Annual calibration due: 1 may 98
Turntable	EMCO	1060	9198	N/A
Turntable controller	EMCO	1060c	9447	N/A
10 meter site Mast	EMCO	1050	9199	N/A
10 meter site Mast controller	EMCO	1050c	9448	N/A

End of document