

Test Report Prepared By:

**Electronics Test Centre
MPB Technologies Inc.
Unit 100
302 Legget Drive
Kanata Ontario K2K 1Y5**

MPBT Report No.: B20R1972

Customer No.: 990056

**Test Report for FCC Part 15.231:1996
Testing of the 418 MHz 400T Transmitter and 418 MHz 400T Receiver**

Test Personnel: G. Albert

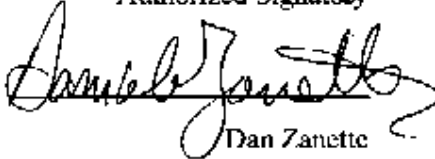
Prepared for:

**Base Aviation Ltd.
133 Prince William St.
Saint John, New Brunswick
Canada E2L 2B5**

**Mar-5-99.
B20R1972**



Client Acceptance
Authorized Signatory



Dan Zanette
Lab Supervisor Electromagnetic Services
Electromagnetic Division
Authorized Signatory

TABLE OF CONTENTS

ABBREVIATIONS

MEASUREMENT UNCERTAINTY

1.0 INTRODUCTION

1.1 SCOPE

1.2 APPLICANT

1.3 APPLICABILITY

1.4 TEST SAMPLE DESCRIPTION

1.5 GENERAL TEST CONDITIONS AND ASSUMPTIONS

1.6 SCOPE OF TESTING

1.6.1 VARIATIONS IN TEST METHODS

1.6.2 TEST SAMPLE MODIFICATIONS

2.0 TEST CONCLUSION

2.1a RADIATED EMISSIONS

2.1b BANDWIDTH

2.2 RADIATED EMISSIONS

3.0 TEST FACILITY

3.1 LOCATION

3.2 GROUNDING PLAN

3.3 POWER

3.4 TEST CONFIGURATION

4.0 TEST EQUIPMENT

4.1 RADIATED EMISSIONS

4.2 CONDUCTED EMISSIONS

4.3 EMI SPECTRUM ANALYZER AND RECIEVER

4.3.1 SPECTRUM ANALYZER

4.3.2 RECIEVER

APPENDICES

APPENDIX A:	418 MHz 400T Transmitter and 418 MHz 400T Receiver
APPENDIX B:	TEST REPORT DATA SHEETS AND PLOTS
APPENDIX C:	TEST EQUIPMENT REPORT
APPENDIX D:	PHOTOGRAPHS

ABBREVIATIONS**CE** - Conducted Emissions**H-Field** - Magnetic Field**CS** - Conducted Susceptibility(Immunity)**N/T** - Not Tested**ESD** - Electrostatic Discharge**N/A** - Not Applicable**EFT** - Electrical Fast Transient Burst**RE** - Radiated Emissions**E-Field** - Electric Field**MEASUREMENT UNCERTAINTY**

The following measurement uncertainty with 95% confidence level was calculated using the methods defined in NAMAS document NIS81: May 1994.

For Radiated E-Field EmissionsFrequency = $\pm 1 \times 0.001$ MHzAmplitude = $\pm 1 \times 4.01$ dB**For Conducted Emissions**Frequency = $\pm 1 \times 0.001$ MHzAmplitude = $\pm 1 \times 3.25$ dB**For Radiated Immunity E-Field**

Frequency = $< 5 \times 0.000000000001$ at center frequency < 21.25 MHz
 = < 0.8 MHz at center frequency ≥ 21.25 MHz

Amplitude = $< \pm 1.2$ dB at $+13$ dBm to -20 dBm (from 50 kHz to 680 MHz)
 = $< \pm 1.7$ dB at $+13$ dBm to -20 dBm (from 680 kHz to 1360 MHz)
 = $< \pm 1.7$ dB at -20 dBm to -143 dBm (from 50 kHz to 680 MHz)
 = $< \pm 2.2$ dB at -20 dBm to -143 dBm (from 680 kHz to 1360 MHz)

Harmonics = $< \pm -65$ dB below center frequency

1.0 INTRODUCTION

1.1 SCOPE

The purpose of this report is to present the findings and results of compliance testing performed per FCC Part 15.231:1996 as set forth in this document.

1.2 APPLICANT

This test report has been prepared for **Base Aviation Ltd.**, located at 133 Prince William St. in Saint John, New Brunswick Canada.

1.3 APPLICABILITY

All test procedures, limits, and results defined in this document apply to the **418 MHz 400T Transmitter and 418 MHz 400T Receiver**, which shall be referred to as the Equipment Under Test (EUT).

The results contained in this report relate only to the item tested.

This report does not imply product endorsement by NVLAP or the Canadian or US governments.

1.4 TEST SAMPLE DESCRIPTION

The sample provided for testing was a **418 MHz 400T Transmitter**
418 MHz 400T Receiver

Product Type: Battery powered transmitter, DC powered Receiver

Serial Number: Transmitter - 02383
Receiver - 02383

Part Number: Transmitter - RVC 400T
Receiver - RVC 400R

Cables: Receiver cable - CSA CMG 60°C FT-4 LL61365

Power Requirements: The transmitter will operate over the range of 6V to 9V. The receiver will operate with a +12VDC power supply

Peripheral Equipment: Antenna for Receiver.

1.5 GENERAL TEST CONDITIONS AND ASSUMPTIONS

The EUT was a 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: 17 to 23 C

Humidity: 45 to 75%

Barometric Pressure: 68 to 106 kPa

1.6 SCOPE OF TESTING

Tests were performed in accordance with CFR 47 FCC Part 15.231 1996.

1.6.1 Variations In Test Methods

There were no variations from the test procedures outlined above.

1.6.2 Test Sample Modifications

There were no test sample modifications.

2.0 TEST CONCLUSION

The EUT was subjected to the following tests. Compliance is designated by a **PASS** or **FAIL**.

The following table summarizes the test results and details the test 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).

Test Case	Test Type	Specification	Class/Level	Test Sample	Mod. State	Config.	ENGL/Qual	Result
2.1	Radiated Emissions	CFR 47 FCC Part 15.231 1996	231.b	418 MHz 400T Transmitter	None	Normal	Qual	Pass
2.2	Radiated Emissions	CFR 47 FCC Part 15.1996	A	418 MHz 400R Receiver	None	Normal	Qual	Pass

STATEMENT OF COMPLIANCE

The client equipment referred to in this report was found to comply with the requirements of CFR 47 FCC Part 15.231 1996.

2.1 RADIATED EMISSIONS

Test Summary	
Test Lab: MPB Technologies Inc. Kanata	Product: 418 MHz 400T Transmitter
Test Personnel: G. Albert	
Test Date: Feb-19-99.	

Test Description			
Objectives/Criteria	Specifications		
The Radiated E-Field emissions proliferated by a system or sub-system, measured at a distance of 3m from the EUT, shall not exceed the limits for the specifications as stated. Emission levels should meet the requirements with a margin of 6dB.	FCC Part 15. 231b: 1996 30 MHz - 10 GHz.		
	Freq MHz (dBμV/m)	Fund. (dBμV/m)	Spurious
	40.66-40.70	67.04	47
	70-130	61.94	41.9
	130-174	61.94-71.48	41.9-51.5
	174-260	71.48	51.5
	260-470	71.48-81.94	51.5-61.9
	>470	81.94	61.9
*All limits are @ 3m and are in dBμV/m.			

Test Result	
Marginal Pass	
Comments	
•Transmission automatically ceases in less than 5 sec FCC Part 15.231 a1. •Measured pulse width = 738 msec	
Vertical	Horizontal
418 MHz 64.3 dBμV/m pk	418 MHz 76.9 dBμV/m pk
Refer to Test Report Data sheets for more detail.	

2.1 BANDWIDTH

Test Summary	
Test Lab: MPB Technologies Inc. Kanata	Product: 418 MHz 400T Transmitter
Test Personnel: G. Albert	
Test Date: Feb-18-99.	

Test Description	
Objectives/Criteria	Specifications
The bandwidth of the EUT shall not exceed specified limits.	FCC Part 15.231: 1996 Bandwidth must be less than 0.25% of center frequency. Centre Frequency 418 MHz Measured Bandwidth 250 kHz (within specifications of 1.045 MHz)
Test Result	
PASS	
Comments	
Refer to Test Report Data Sheets for more detail.	

2.2 RADIATED EMISSIONS

Test Summary	
Test Lab: MPB Technologies Inc. Kanata	Product: 418 MHz 400T Receiver
Test Personnel: G. Albert	
Test Date: Feb-19-99.	

Test Description											
Objectives/Criteria	Specifications										
The Radiated E-Field emissions proliferated by a system or sub-system, measured at a distance of 3m from the EUT, shall not exceed the limits for the specifications as stated.	FCC Part 15: 1996 30 MHz - 5 GHz										
Emission levels should meet the requirements with a margin of 6dB.	<table> <tr> <th>Freq MHz</th><th>Fund. (dBμV/m)</th></tr> <tr> <td>30-88</td><td>50</td></tr> <tr> <td>88-216</td><td>53.5</td></tr> <tr> <td>216-960</td><td>56</td></tr> <tr> <td>> 960</td><td>54</td></tr> </table>	Freq MHz	Fund. (dB μ V/m)	30-88	50	88-216	53.5	216-960	56	> 960	54
Freq MHz	Fund. (dB μ V/m)										
30-88	50										
88-216	53.5										
216-960	56										
> 960	54										
	*All limits are @ 3m and are in dB μ V/m.										

Test Result			
Pass			
Comments			
Vertical		Horizontal	
433.87 MHz	31.8 dB μ V/m	864.58 MHz	38.0 dB μ V/m
433.91 MHz	27.8 dB μ V/m	433.87 MHz	35.2 dB μ V/m
1.3016 GHz	12.0 dB μ V/m	248.84 MHz	13.5 dB μ V/m
Refer to Test Report Data sheets for more detail.			

3.0 TEST FACILITY

3.1 LOCATION

The EUT was tested for Electromagnetic Compatibility at the Electronics Test Centre, located in Kanata, Ontario, Canada.

3.2 GROUNDING PLAN

The EUT was located on a wooden table top. The EUT was grounded according to the Clients specifications.

3.3 POWER

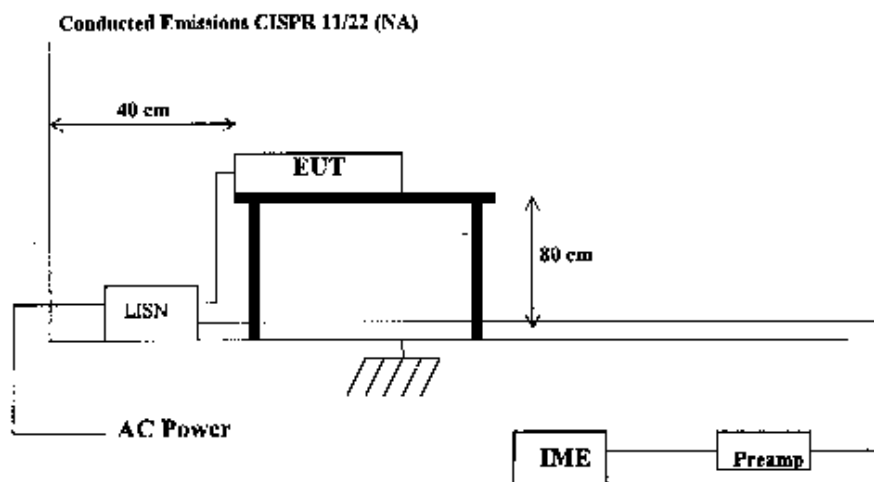
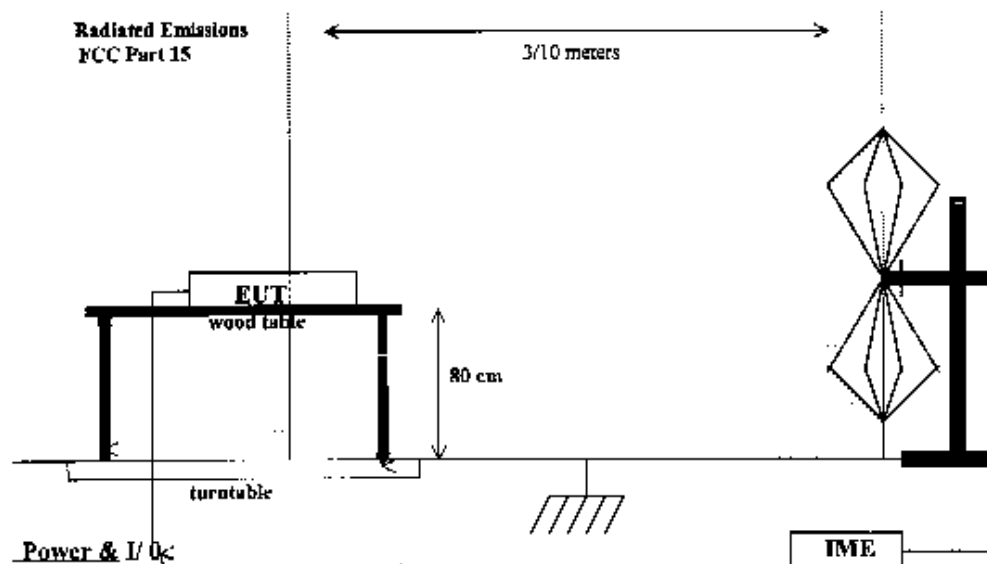
DC power was supplied via a CORCOM RFI feed through, 60 Ampere wall mounted filter. Bonding to hydro ground is via one inch grounding braid straps.

3.4 EMISSIONS PROFILE

Ambient conducted and radiated electromagnetic emission profiles were generated throughout the tests and are included in the Test Report Data sheets.

3.5 TEST CONFIGURATION

The following diagrams illustrate the configuration of the EUT test and measurement equipment used for CISPR Radiated and Conducted Emissions Testing.



4.0 TEST EQUIPMENT

The following equipment was utilized for this procedure. All measurement devices are calibrated annually, traceable to NIST. Please refer to Appendix C for calibration data.

4.1 RADIATED EMISSIONS

- a) Spectrum Analyzer
- b) Receiver with CISPR Quasi-peak Adapter
- c) Power Isolation Transformers
- d) Biconilog antenna (25 MHz to 2ghz), DRG Horn (1GHz-18GHz)
- e) Antenna mast positioner, and controller
- f) Flush-mounted turntable, and controller

4.2 CONDUCTED EMISSIONS

- a) Spectrum Analyzer
- b) Line Impedance
- c) CISPR Quasi-peak Adapter
- d) Power Isolation Transformer
- e) Personal Computer and EMI/EMC Software

4.3 EMI SPECTRUM ANALYZER AND RECEIVER

4.3.1 Spectrum Analyzer Range 1 of 2

Start Frequency	0.15 MHz
Stop Frequency	30 MHz
Transducer	115N per CISPR 16
Quasi-Peak Bandwidth	9 kHz
Spectrum Analyzer BW	10kHz
Video Bandwidth	100kHz
Reference Level	100dBµV

Spectrum Analyzer Range 2 of 2

Start Frequency	30 MHz
Stop Frequency	61000 MHz
Transducer	Biconilog Antenna
Quasi-Peak Bandwidth	120 kHz
Spectrum Analyzer BW	120 kHz
Video Bandwidth	1 MHz

4.3.2 Receiver

Transducer	Biconilog Antenna
Quasi-Peak Bandwidth	120 kHz
Measurement Window	20dBµV

EUT

Description to be provided by

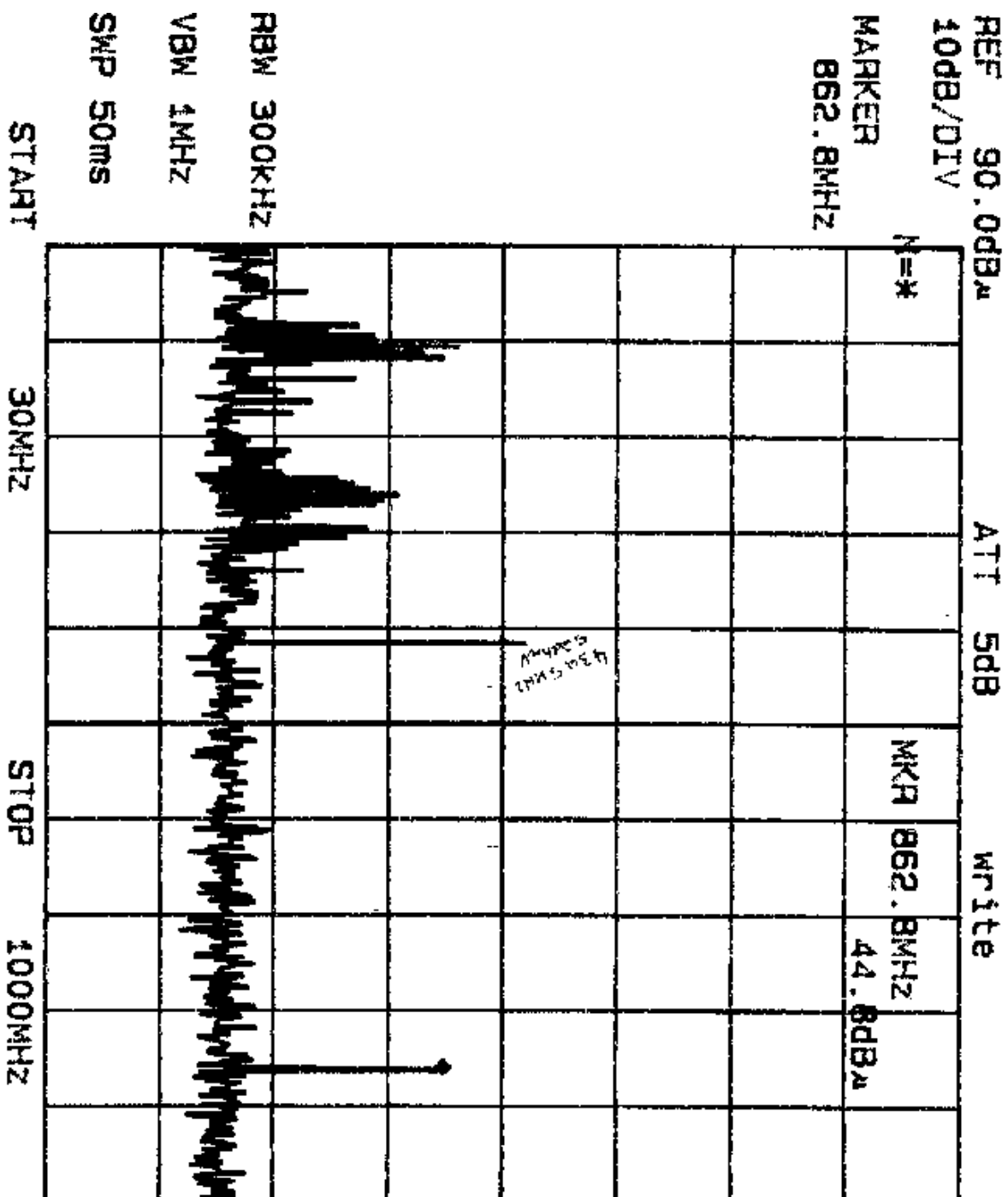
The CLIENT

Appendix A

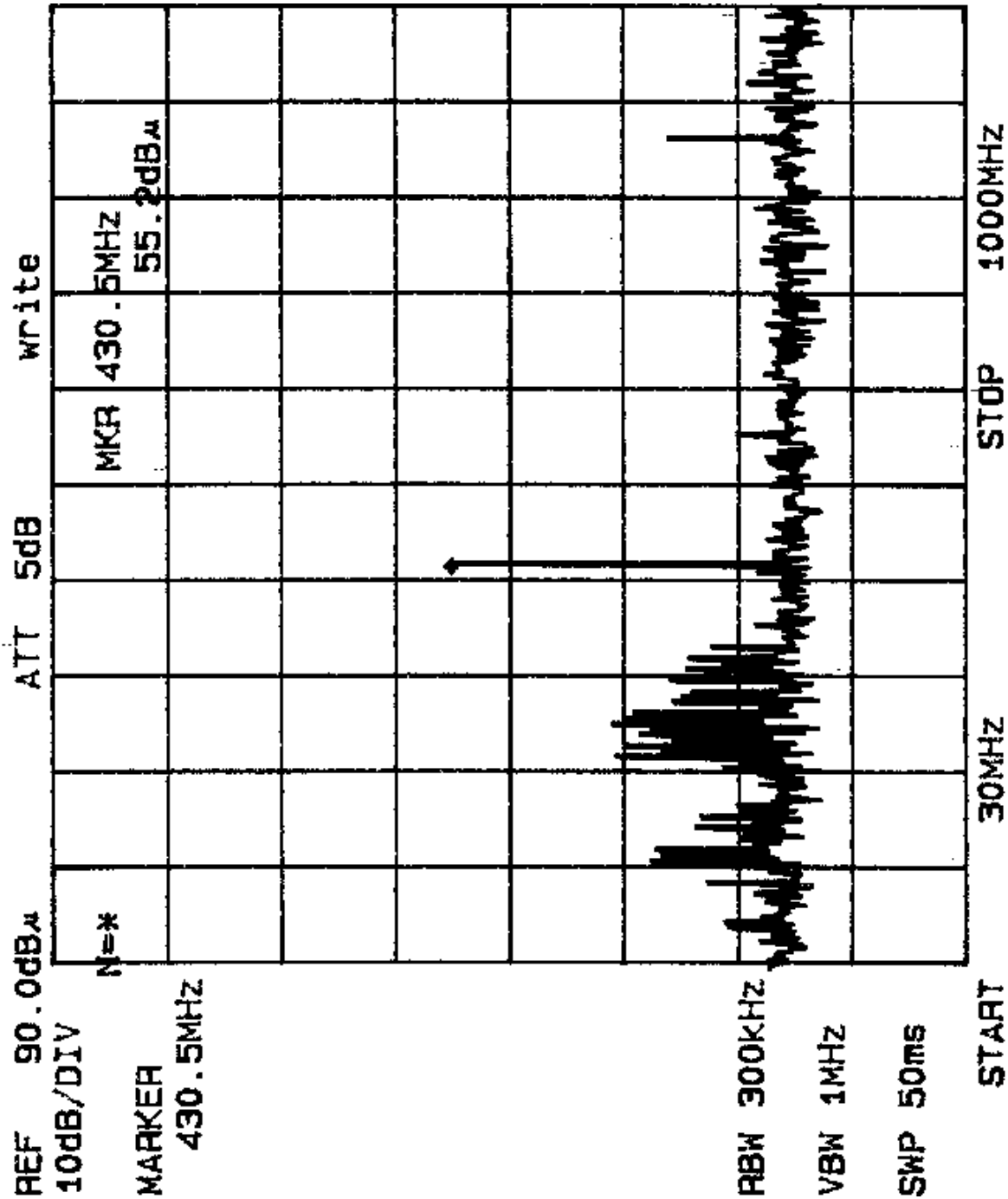
418 MHz 400T Transmitter

418 MHz 400T Receiver

Pre-Scan Rx



Pre-Scan Rx



Pre-Score
K2

REF 75.0dB
10dB/DIV

RBW 30kHz

ABW 30kHz

VBW 1MHz

501 DHS

START

1.000GHz

STOP

3.600GHz

write

ATT 5dB

75.0dBu

米
日
芝

HKH

1.293GHz

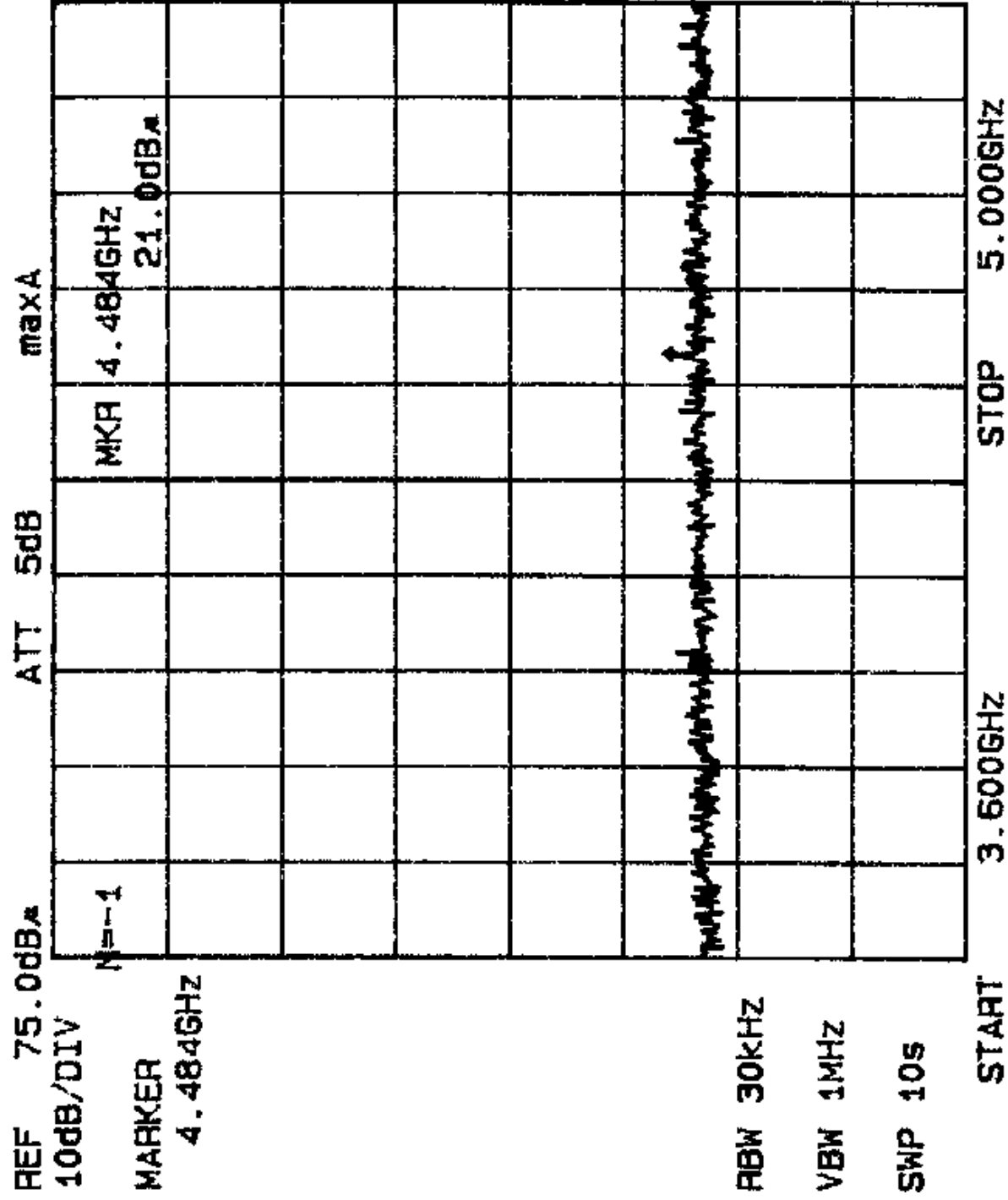
24.0dB_n

START

1.000GHz

STOP

3.600GHz

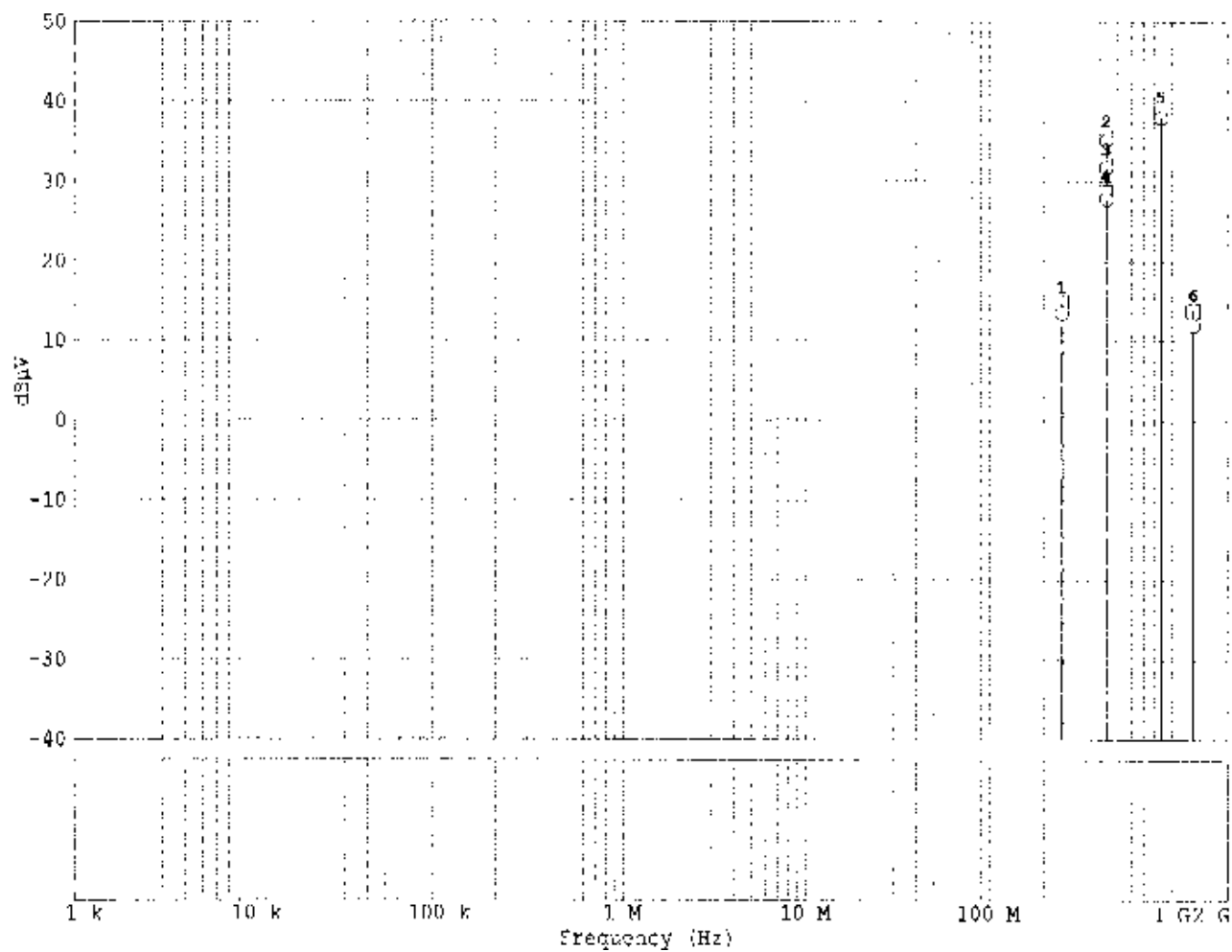


Electronics Test Center (GERS)

Printed: 03/10/99 14:16:19

DataLog File: Enter - 413RX.DL
Measurements Unit: dBpV/m

Num	Frequency	Bandwidth	Atten	Corr	Peak	Raw		Ant Mast	EIRP	Limit	Delta	Limit Line
						QPeak	QPeak					
1	248.835800 MHz	120 kHz	0.0	0.0	14.9	13.5	3.13.0	1.65m horiz	184°	46.0	-32.3	FCC15B
2	423.865000 MHz	120 kHz	10.0	0.0	35.7	35.2	7.65.2	0.98m horiz	183°	46.0	-10.5	FCC15B
3	423.968500 MHz	120 kHz	10.0	0.0	32.2	31.8	34.3	1.65m vert	313°	46.0	-14.0	FCC15B
4	423.917000 MHz	120 kHz	10.0	0.0	28.8	27.8	27.9	1.64m vert	313°	46.0	-13.1	FCC15B
5	864.580000 MHz	120 kHz	10.0	0.0	36.7	39.0	1.58.0	3.94m horiz	13°	46.0	-3.0	FCC15B
6	1.301636000 GHz	120 kHz	0.0	0.0	13.9	12.0	12.3	1.73m vert	84°	54.0	-4.6	FCC15B



Electronics Test Center, Kanata
EMISSION LEVEL [dBuV] PEAK

18 Feb 1999 16:13:55

hp

100

FCC Part 15 RE Class A & B

Plot #3 Model#RVC 400T (Tx)
Base Aviation Ltd.
ETC# 1972, PRESCAN horz pol

80

60

40

20

1000

CLASS A (GP)

302.5 MHz

250.6 MHz

98.40 MHz

98.40 MHz

FREQUENCY [MHz]

10000

Electronics Test Center (CATS)

Printed: 02/13/99 16:36:54

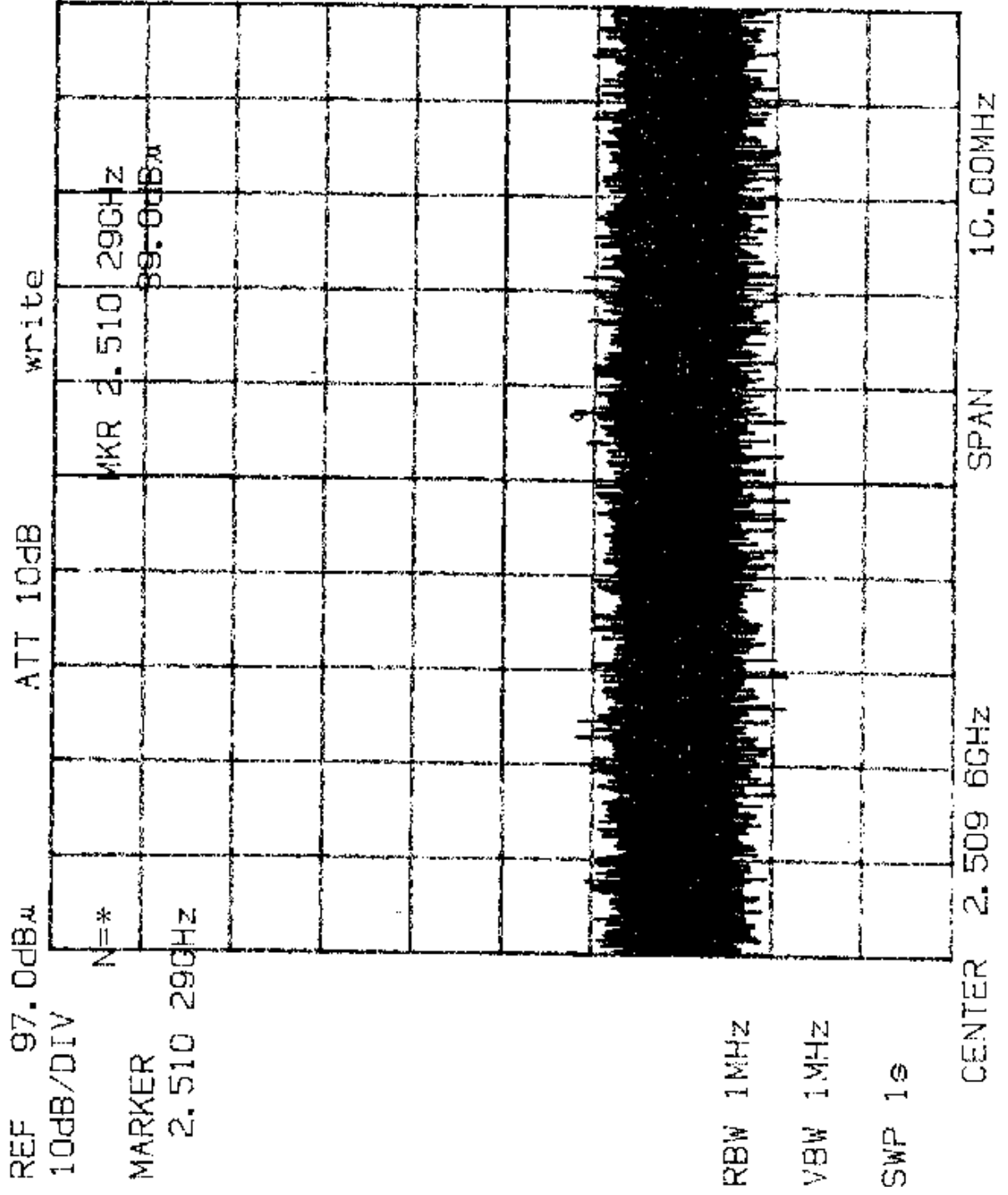
Datalog file: Enter - 1972TX.CL
Measurement Units: dBuV/m

Num	Frequency	Bandwidth	Corr	Peak	Raw		QPeak	Ant Mast	EUT	Date	Time
					QPeak	Peak					
1	418.300000 MHz	120 kHz	17.6	65.2	46.7	64.3	2.28m	vert	29°	02/13/99	16:29:31
2	418.300000 MHz	120 kHz	17.6	77.8	59.3	76.8	0.38m	horiz	260°	07/13/99	16:53:25

Appendix B
TEST REPORT DATA SHEETS
and PLOTS

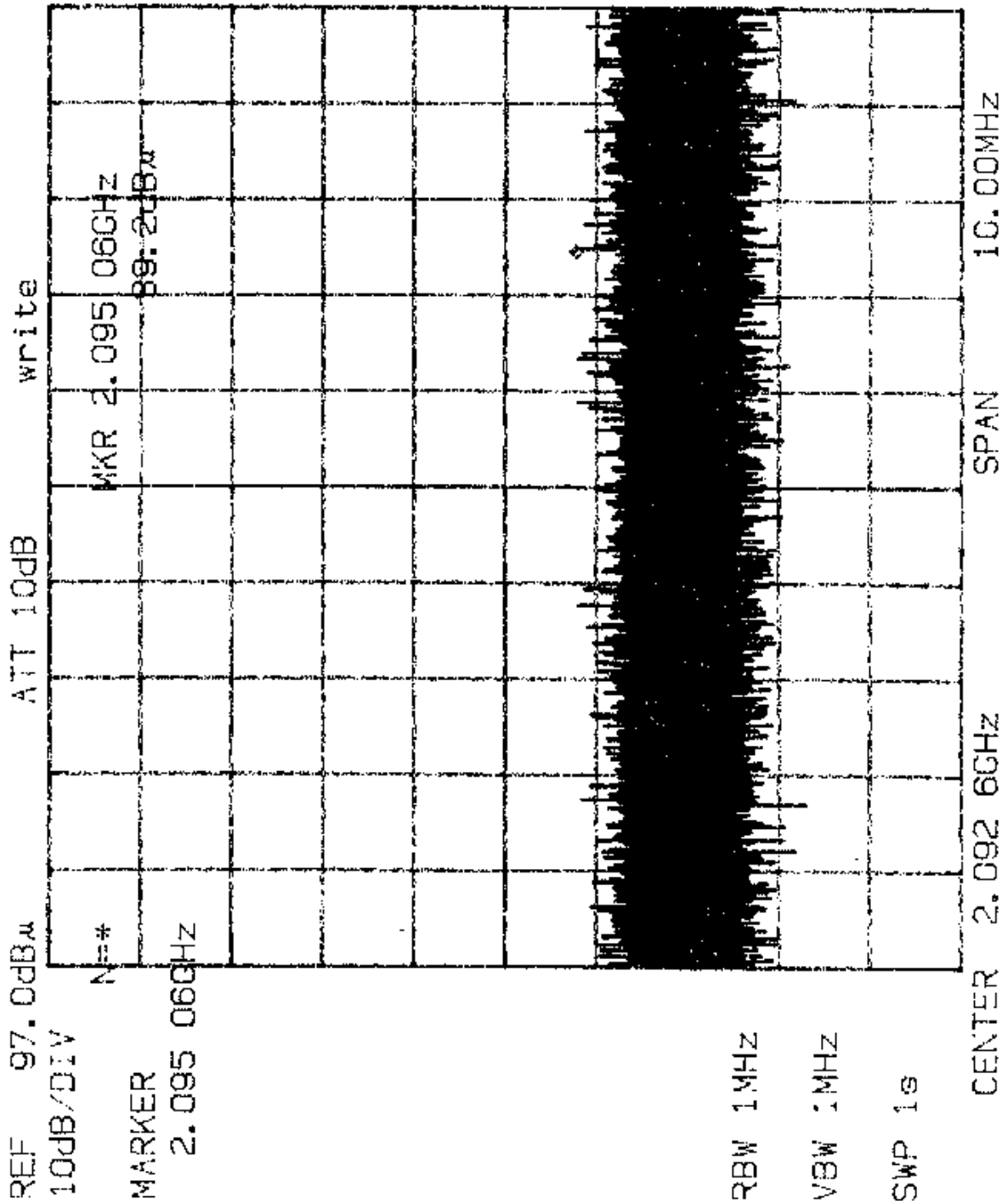
Horizontal

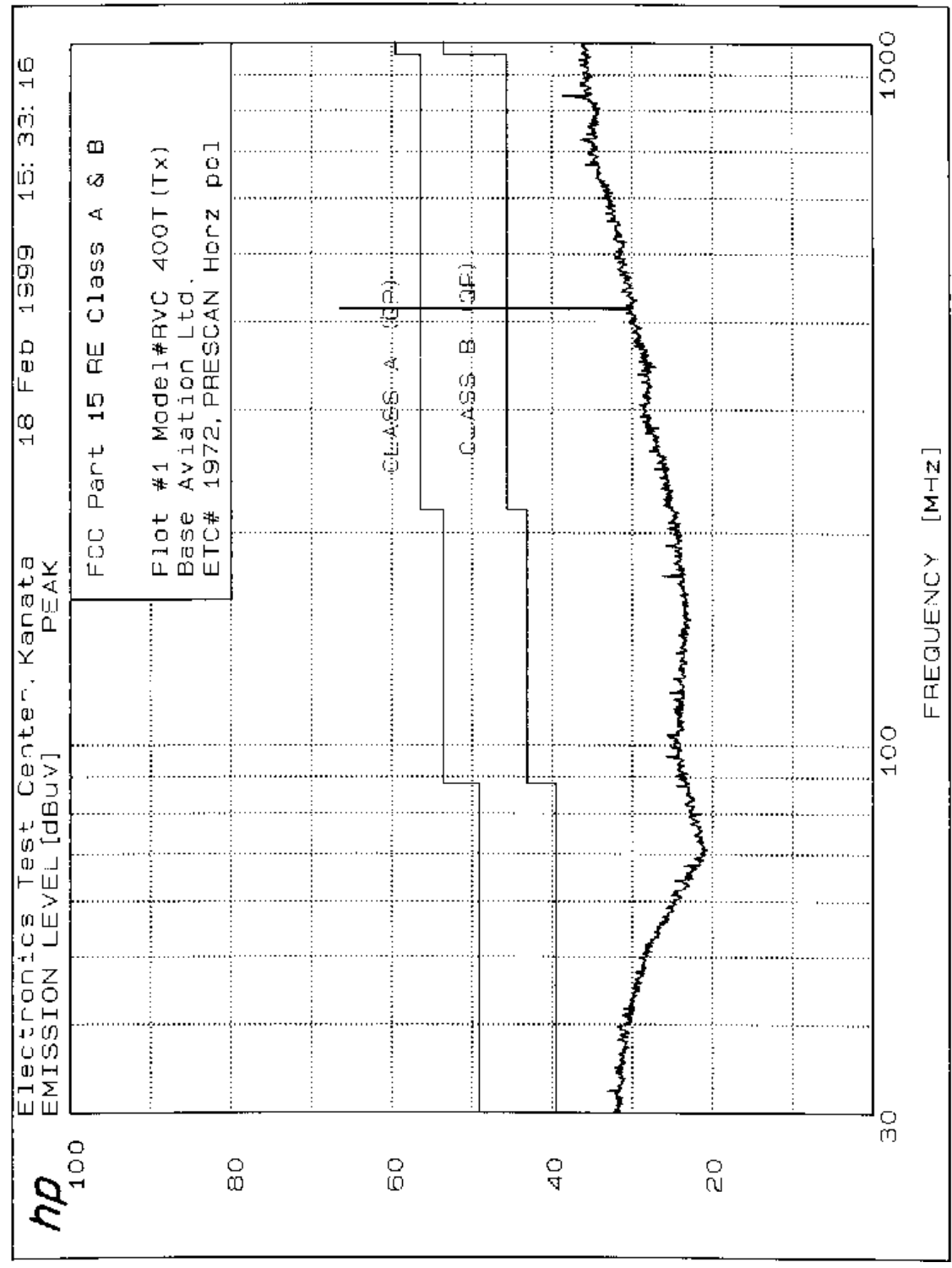
Feb/20/98



Horizontal

Feb/29/99



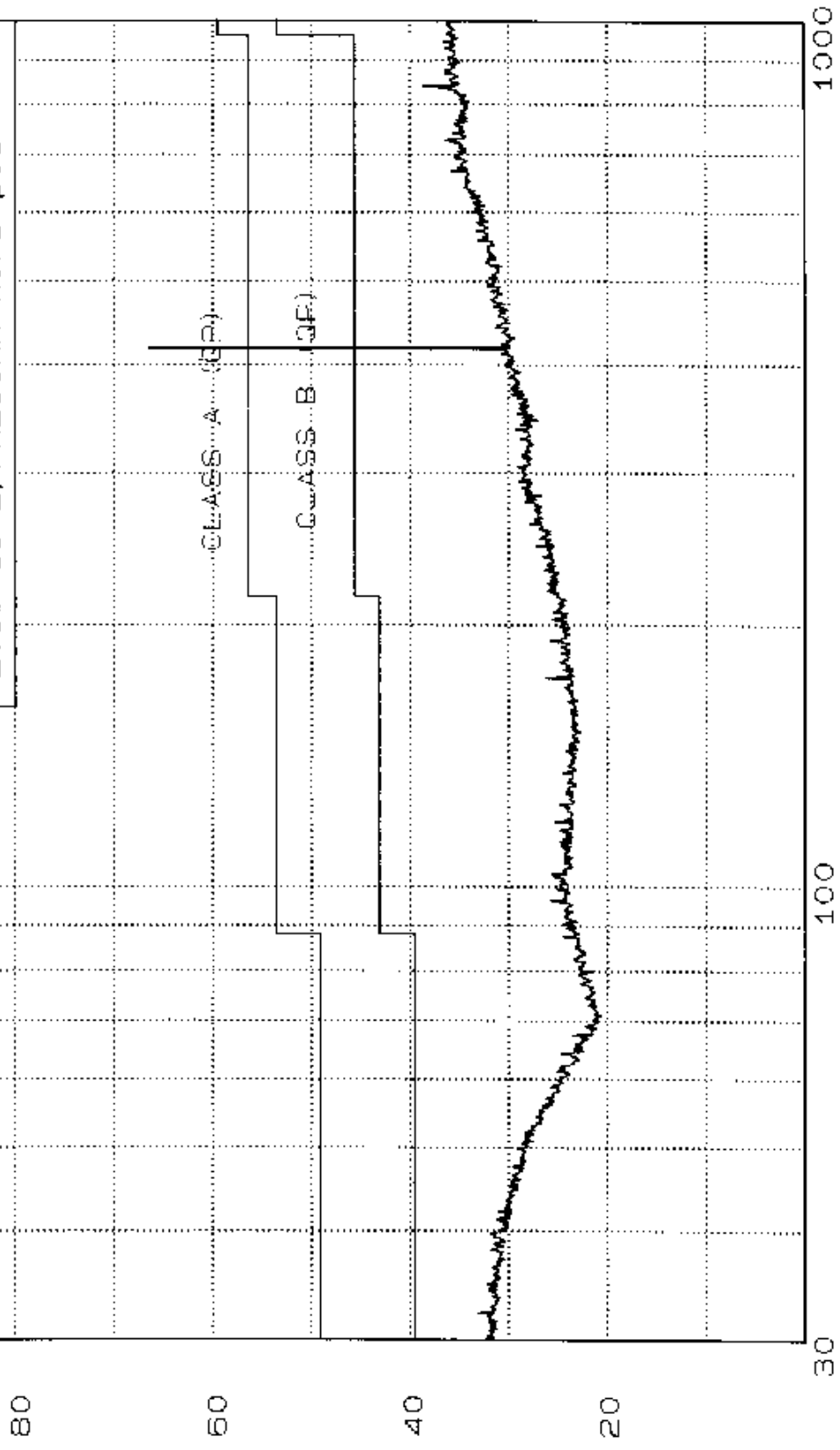


FREQUENCY [MHz]

hp
100

FCC Part 15 RE Class A & B

Plot #1 Model#RVC 400T (Tx)
Base Aviation Ltd.
ETC# 1972, PRESCAN Horiz p01



FREQUENCY [MHz]

EMERG-ST-Down

Base Aviation Ltd.

65181939

70

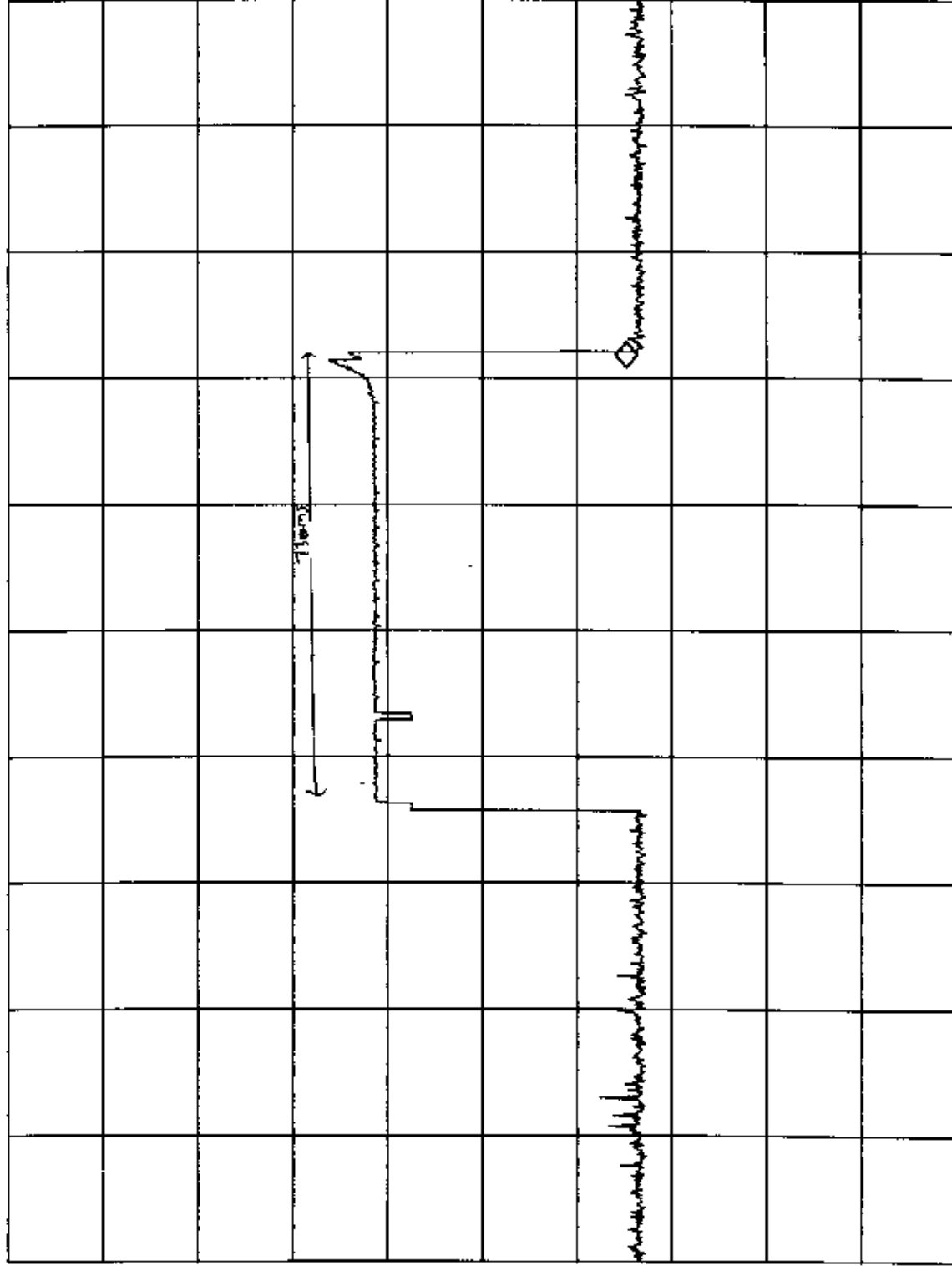
BP 11

POS
EK

MKR 1.442 sec
33.50 dBuV

ATTEN 10 dB

REF 100.0 dBuV



CENTER 418.000 000 MHZ

RES BW 1 MHz (i)

VBW 1 MHz

SPAN 0 Hz

SWP 2.00 sec

550056 : M 2

wd: 1972

THROT 418 MHz Tx

Base Aviation Ltd.

Feb/18/99

hp

10 dB/

POS PK

REF 100.0 dBuV

ATTEN 10 dB

MKR 920.0 msec
32.40 dBuV

MARKER

920.0 msec

200 MHz

CENTER 418.000 300 MHz

RES BW 1 MHz (i)

VBW 1 MHz

SPAN 0 Hz

SWP 2.00 sec

CN: 990086
wa: 1970

REEL-418 MHz Tx

Base Aviation Ltd.

Feb/18/99

hp

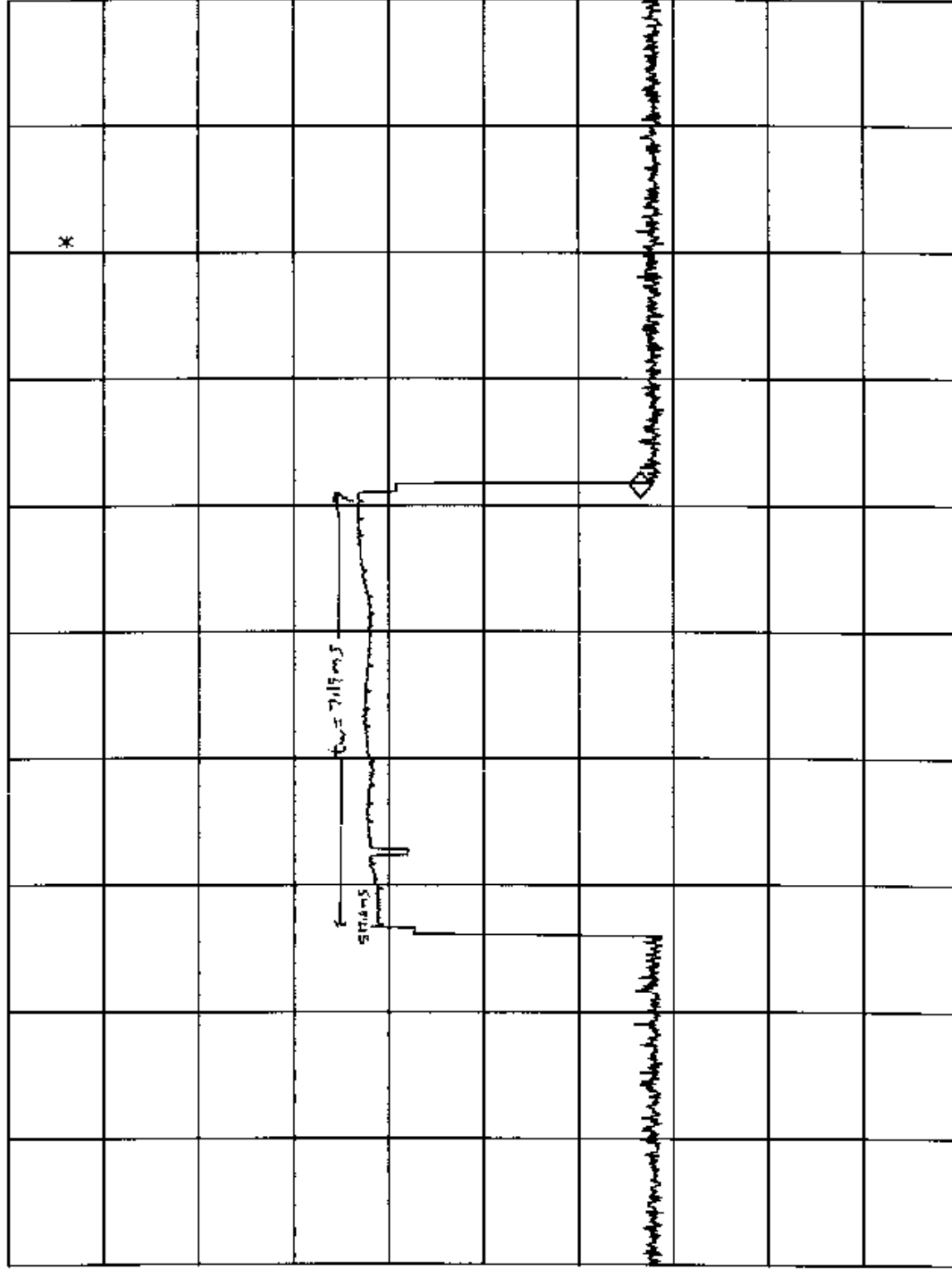
10 dB/

POS PK

MKR 1.237 sec
32.20 dBuV

ATTEN 10 dB

REF 100.0 dBuV



SWP 2.00 sec

VBW 1 MHz

RES BW 1 MHz (1)

CN:990056
W0:1972

PTO - 418 MHz Tx

Base Aviation Ltd.

Feb/18/99.

hp

10 dB/

POS PK

REF 100.0 dBuV ATTN 10 dB MKR 1.275 sec 32.80 dBuV

MARKER

1.275
sec

535ms

738ms

CENTER 418.000 000 MHz

RES BW 1 MHz (1)

VBW 1 MHz

SPAN 0 Hz

SMP 2.00 sec

CN: 990056

wa: 1978

Worst Case Bandwidth Measured - within specifications of 1.045 MHz

Feb/18/99

hp

10 dB/

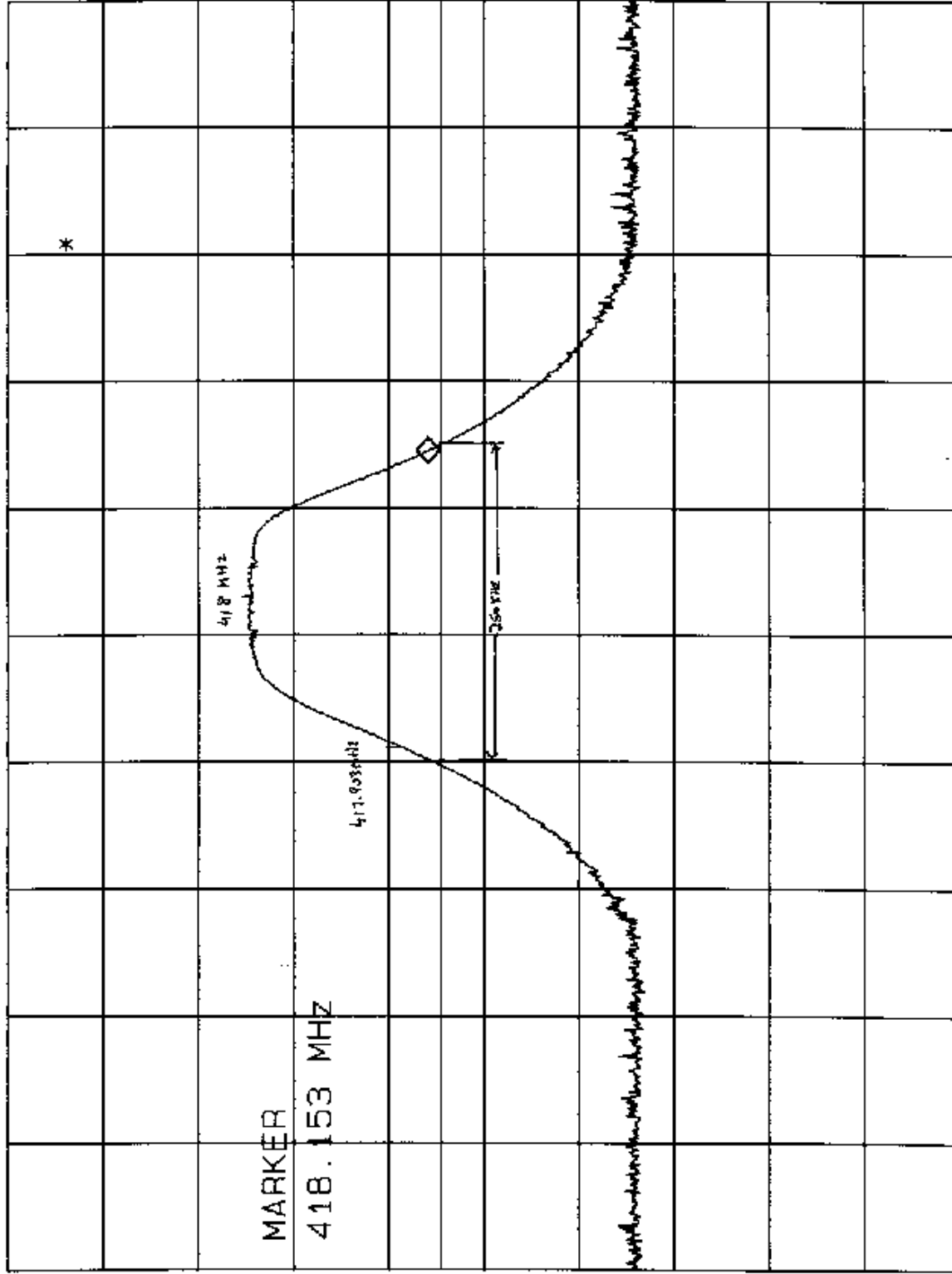
POS PK

DL
54.5
dBuV

MR 418.153 MHz
54.60 dBuV

ATTEN 10 dB

REF 100.0 dBuV



CENTER 418.00 MHz

RES BW 3 MHz (i)

VBW 1 MHz

SPAN 1.00 MHz

SWP 200 msec

CM:950054

wa:1992

hp

100

FCC Part 15 RE Class A & B
Plot #3 Model#RVC 400T (Tx)
Base Aviation Ltd.
ETC# 1972, PRESCAN Vert pol

80

60

40

20

1000

10000

CLASS A (QPS)

258.4MHz

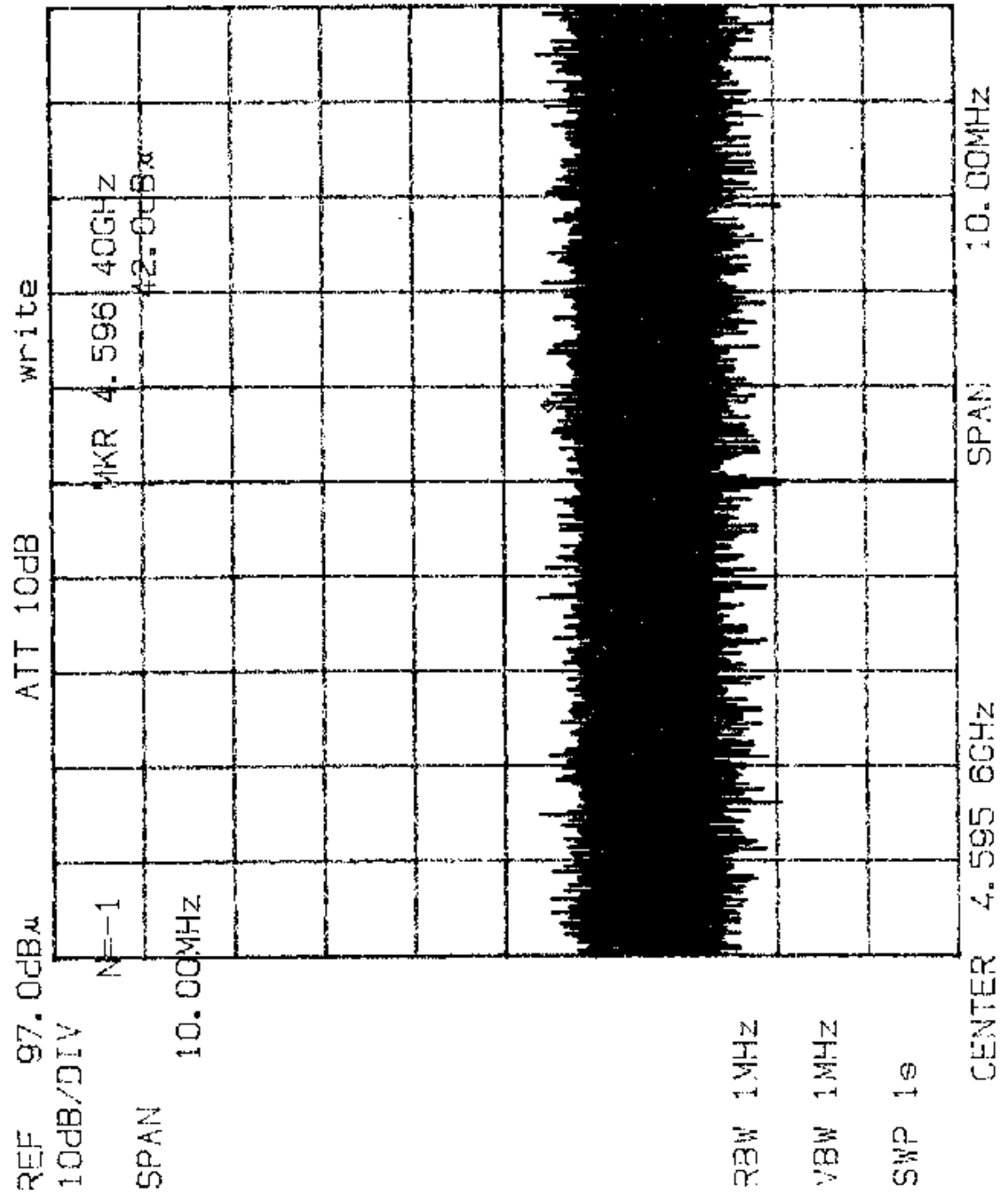
259.6MHz

258.4MHz

4595.6MHz

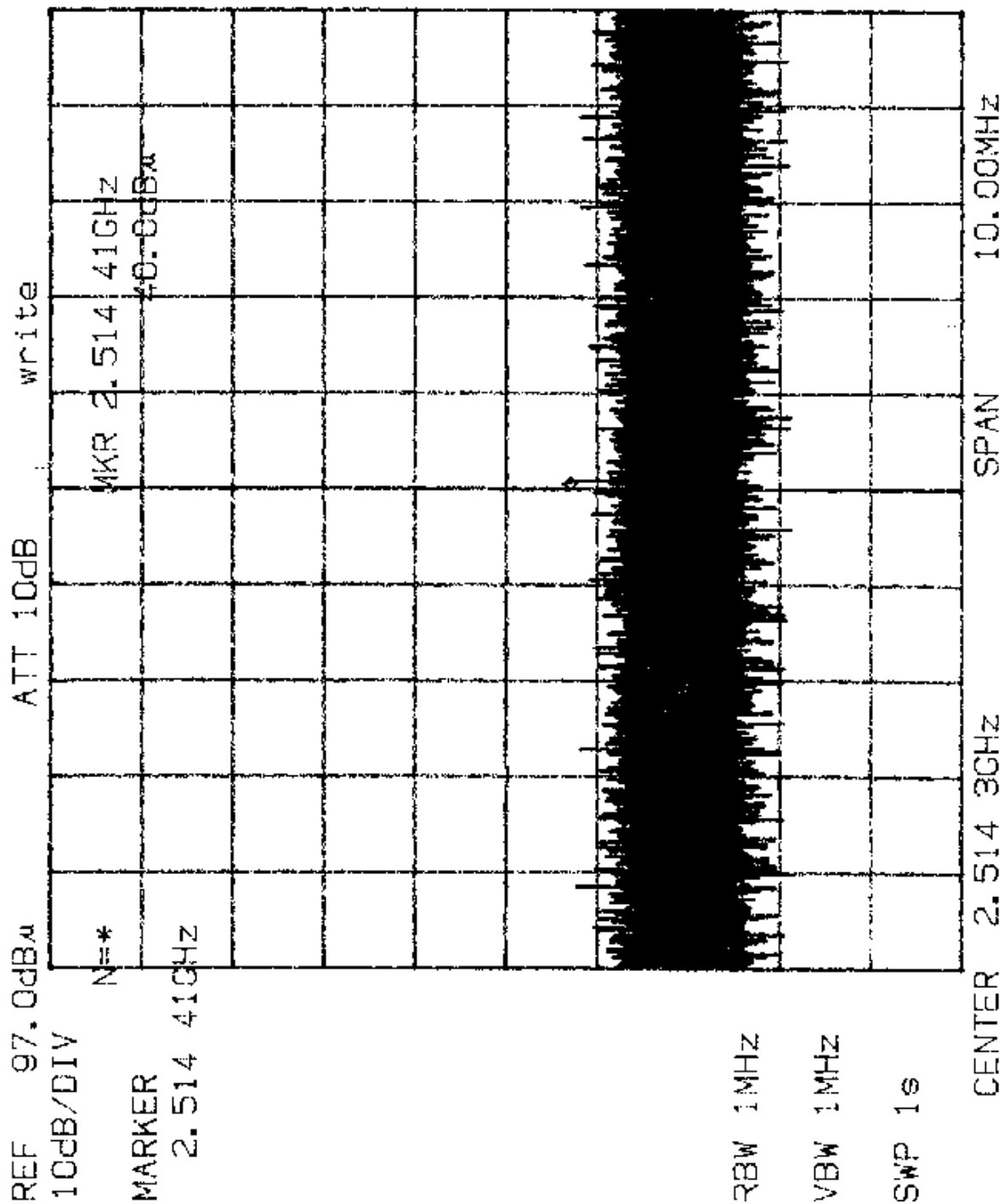
FREQUENCY [MHz]

Vertical



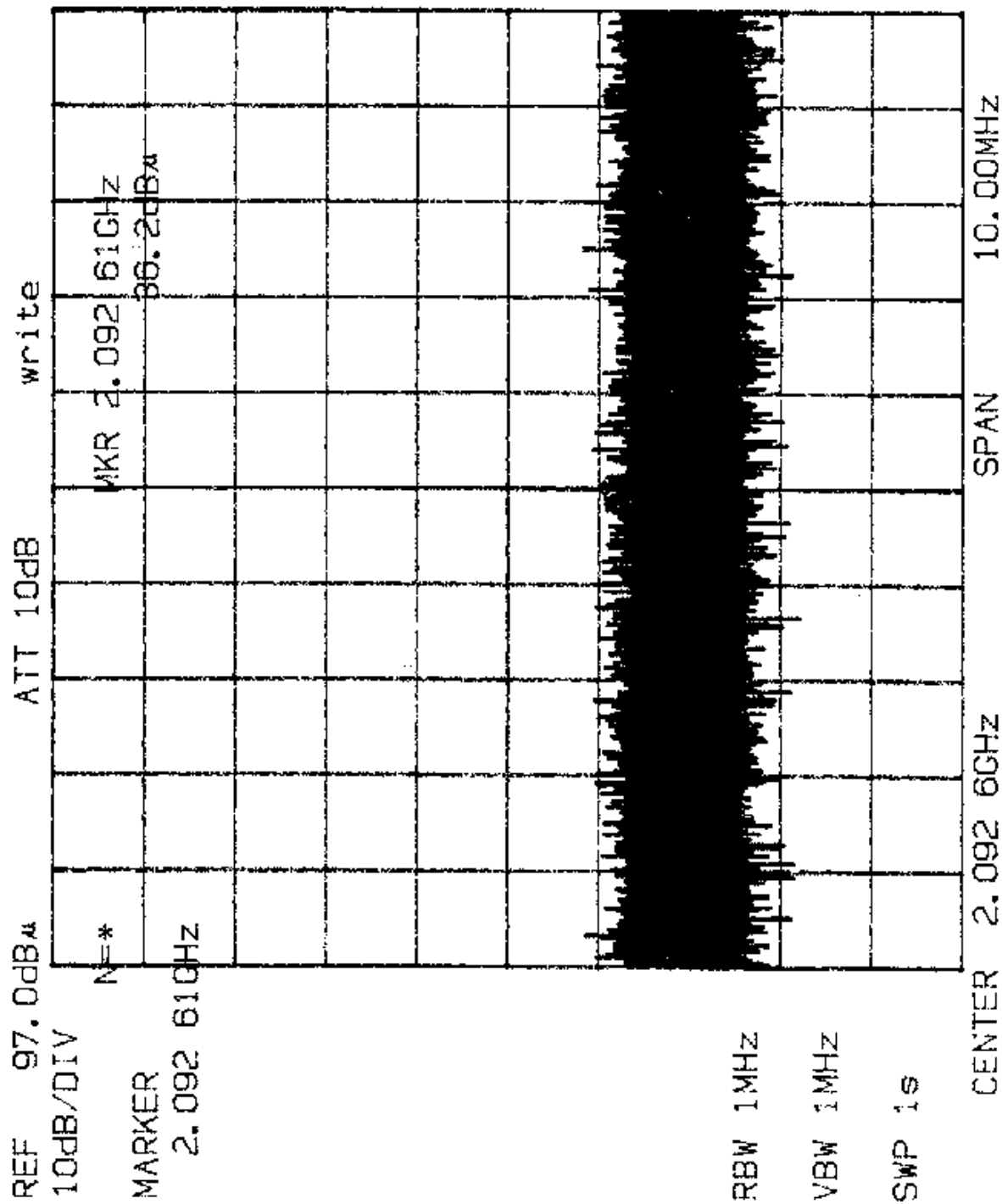
Feb/20/99

Vertical



Feb/20/99.

Vertical



Appendix C

TEST EQUIPMENT REPORT

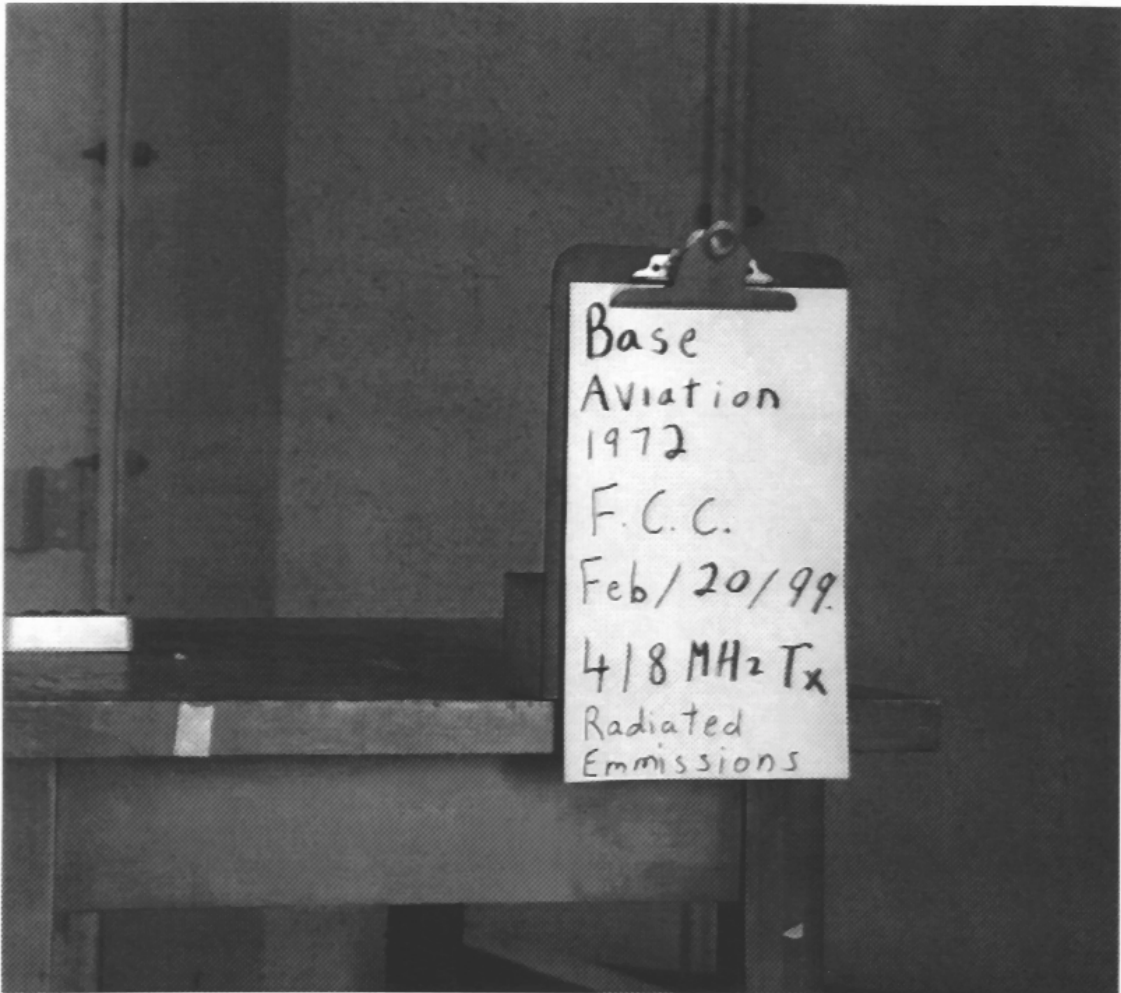
TEST EQUIPMENT REPORT
FACILITY: Electronics Test Centre (Ottawa)

COMP/PART: FCC 15 18		Class: A B			
ENGINEER:		Date:			
UNIT No	MAKE	DESCRIPTION	MODEL#	SERIAL #	RECAL
4297	Hewlett Packard	Spectrum Analyzer	HP8566B	2818A16945/2747A05484	Jul-25-99
2436	Hewlett Packard	Quasi Peak Adapter	85650A	A208596	Jul-27-99
2831	Advantest	Spectrum Analyzer	R4136	71220067	Nov-19-99
2316	Electrometrics	Preamplifier (10 kHz- 1 GHz)	BPA1000	900710	Jul-27-99
2432	Ant. Research	Biconilog	LPB-2520	1021	Jan-05-99
4281	Ant. Research	Biconilog	LPB-2520A	1048	Dec-29-99
4825	Cable	3 Meter Cable OATS		1	Jan-20-00
4826	Cable	10 Meter Cable OATS		1	Jan-20-00
4830	Andrews/Alpha	CE Cable Chamber 3 (2 Parts)			Jun-19-99
4828	MPBT	Open Area Test Site	Site 9		Nov-01-99
4807	Pacific	Power Supply	110E	200	Monitored
2342	Hammond	Power Isolation Transformer	198KS	D892J	Monitored
4821	DSI System	EMI Test Receiver	RX-200	512	Jan-4-99
4822	DSI System	Computer	P-166MMX		Jan-4-99
4503	Sunol	Turntable/Tower Controller	Count 94	022497-1	Monitored
	Sunol	Tower			Monitored
	Sunol	Turntable			Monitored
		Personal Computer	486		
4269	Solar	LISN (FCC)	8012-50-R-24BNC	829036	Jul-30-99
2418	Solar	LISN (CISPR)	9252-50-R-24BNC	951316	Jul-30-99
4286	R&S	Test Receiver	ESVP	879783/003	Monitored
2365	Electrometrics	Pre-selector	EM2701	183	Monitored
4530	Emco	Biconical Antenna	3104	3813	Jul-24-99
2319	Electrometrics	DRG Horn Antenna	RGA60	2966	Jan-07-99
2366	Miteq	Pre-Amplifier (1 - 20 GHz)	AFS440100220045-8P44	327221	Jul-27-99
2427	Electrometrics	Transient Limiter	EM-7600	264	Jan-11-99
4557	Kay Electric	Attenuator	431-C	173-11	Feb-04-99
4512	Electrometrics	Log Periodic Antenna	LPA-25	1041	Dec-28-99

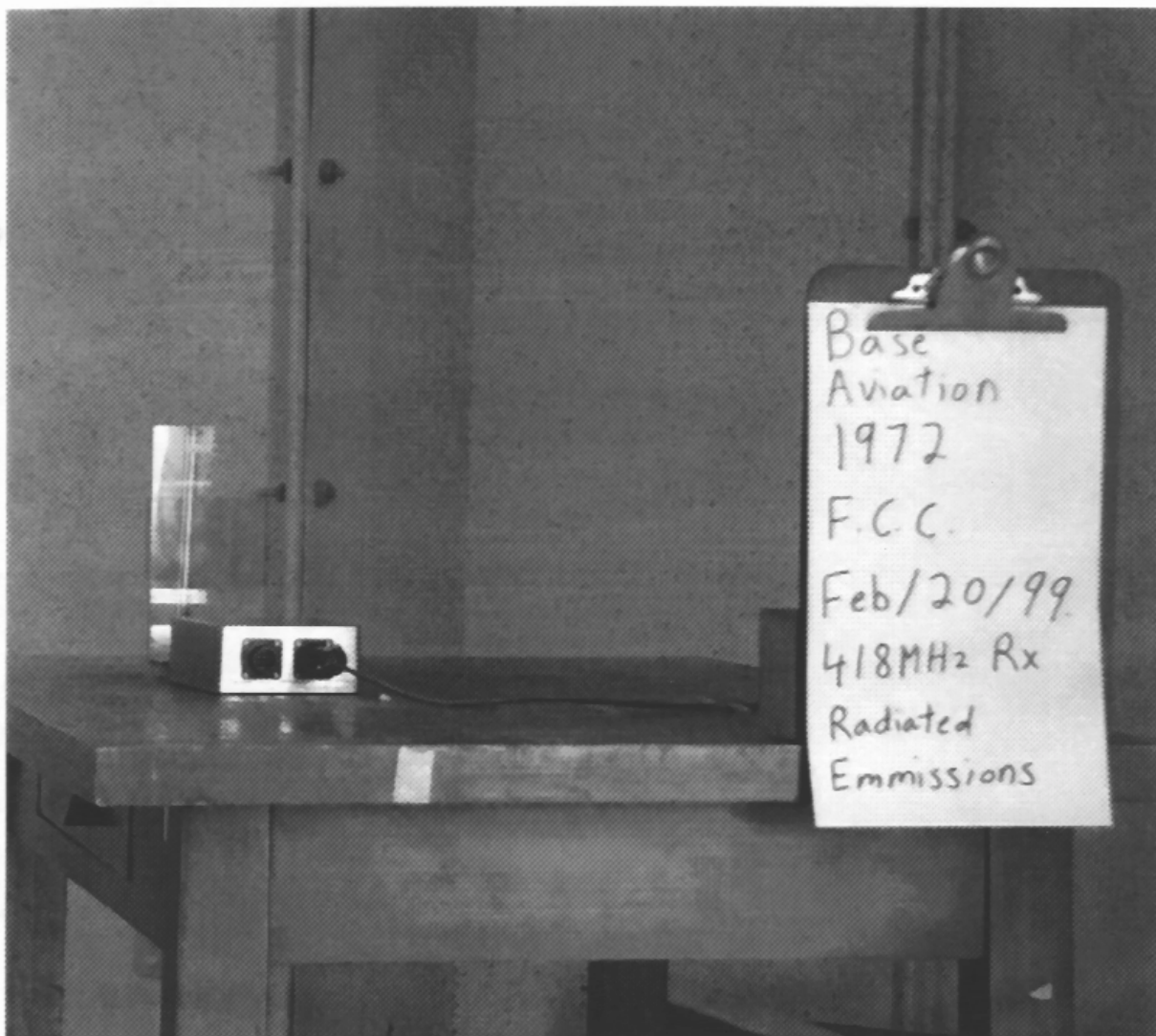
Appendix D

PHOTOGRAPHS

Representing Set Up and Maximized Emissions



Base
Aviation
1972
F.C.C.
Feb/20/99
418 MHz Tx
Radiated
Emmissions



Base
Aviation
1972
F.C.C.
Feb/20/99
418MHz Rx
Radiated
Emmissions

Base
Aviation
1972

F.C.C.

Feb/20/99.

418MHz Rx

Radiated

Emmissions