EMC Testing

Report on the Testing
of
McMurdo
EPIRB E3

1 Introduction

1.1 The Maritime Navigational Systems (MNS), DERA Fraser, Portsmouth, part of the Defence Evaluation and Research Agency is an independent Shoreside test laboratory equipped to conduct Type Approval and Prototype Testing on Marine Navigational, Radio Communications and Safety Equipment. The Test Laboratories at DERA Fraser have been Accredited by the United Kingdom Accreditation Service (UKAS), under their NAMAS scheme, for Performance and Environmental testing on a wide range of Electronic, Mechanical, Marine Navigational and Safety Equipment. This accreditation embraces EN45001, EN29000, and ISO/IEC Guide 25.

The tests conducted on the EPIRB E3 were designed to prove compliance with the EMC tests contained in British Standards Institute (BSI) EN 60945:1997.

The Emergency Position-Indicating Radio Beacon (EPIRB) E3 is a float free maritime distress beacon that transmits on 2 frequencies, 406 MHz and 121.5MHz. At 406 MHz it transmits a digital distress signal to satellites. The 121.5MHz signal is for search and rescue operations. The EPIRB consists of two mouldings a transparent top dome and a main body. The main body is sprayed internally with a conductive coating to achieve good EMC performance. The EPIRB is activated automatically when in the water or it can be switched on manually. The EPIRB also has a Xenon flash tube which is visible through the clear top dome. The bottom moulding houses the 9V lithium battery and 2 printed circuit boards. The EPIRB is programmed via an infra-red data link, enabling the vessels unique identity number to be programmed in.

1.2 The Following tests of EN 60945:1997, were conducted on the submitted sample of the EPIRB E3 distress beacon.

Test Clause	Description of Test	Date of Test	Result of Test
Clause 9.3	Radiated Emissions	20-11-98	Pass
Clause 10.4	RF electromagnetic field 80 MHz - 1000 MHz	12-11-98	Pass
Clause 10.9	Electrostatic Discharge	20-11-98	Pass

Clauses 9.2,10.2, 10.3, 10.5, 10.6, 10.7 10.8, are not applicable because this equipment is battery powered and has no external cables.

An additional test was requested by the manufacturer to cover an FCC requirement. This test was 47CFR Ch1 (10-1-97 Edition). The EPIRB E3 passed this test

The standard report sheets for these tests are contained in Appendix A.

2. Equipment under Test

2.1 The equipment submitted comprised of 1 item, EPIRB model E3 This item formed the complete system.

2.2 The unit was designated:-

EPIRB Type: E3 Sr. No: B005

The system was powered by a lithium battery of 9V.

3 Build Standard of Test Samples

3.1 The test sample provided by McMurdo was stated as representative of the normal production build.

4 Conduct of Testing.

4.1 The EMC tests were each conducted in accordance with the DERA Fraser laboratory's standard test method NETL/M/100 for the basic standards referred to in BS EN 60945.

4.2 Immunity tests involving continuous phenomena were conducted to indicated levels marginally above the specification criteria to allow for the uncertainty of measurement in the test equipment producing the disturbing signal.

5 Conclusions.

5.1 The test sample of a McMurdo EPIRB E3 has now successfully passed a series of tests which indicate its compliance with the EMC criteria of both BS EN 60945:1997 and FCC 47CFR Ch 1 (10 - 1 - 97 Edition).

DERA

FRASER, PORTSMOUTH PO4 9LJ

Maritime Navigation Systems Group
Type Test Results Sheet
BS EN 60945:1997

Manufacturer: McMurdo Limited **File Ref.** TT 07/98

Equipment Name: EPIRB E3 **Date of issue. Dec** 98

Spurious Radiation FCC 47CFR Special Test Requested by Customer		Spurious frequencies as defined in clause 2.997 of 47CFR were measured (9KHz to 4.06025GHz). The allowable bandwidths for the modulation schemes is defined in clause 80.0250f 47CFR, this equates to 25KHz for the 121.5 MHz signal and 20KHz for the 406.025 MHz signal. The emissions limits close to the carrier for the EPIRB are defined in clause 80.211e of 47CFR. This results in limits of -25dBc between ± 6.25KHz and ± 12.5 KHz away from the carrier for the 121.65MHz frequency. For the 406.025MHz frequency the -25 dBc limits lie between ± 5KHz and ± 10KHz away from the carrier. Outside this frequency range the limit is -30 dBc. The measurements were conducted over the frequency range of 1GHz to 4.06025 GHz . See the previous section for results up to 1GHz. A wide band horn antenna coupled to a spectrum analyser was used to measure the spurious radiation levels. See appendix E for plots
	Equipment Used	59,60,61,62 (See appendix B)
Result	Pass	The EPIRB E3 showed no emissions above the specification limit.

SCHEDULE OF TEST EQUIPMENT

Equipment Schedule (page 1 of 2)						
No	**Used**	**Instrument**	**Manufacturer**	**Type**	**Serial Number**	**Calibrated On**
1	√	Antenna Bi-log	Chase	CBL 6112A	2138	9 - 98
2	√	Antenna Bi-log	Chase	CBL 6121A	1035	10 - 98
3		Antenna Bi-conical	Schwarzbeck			
4		Antenna log-periodic	Schwarzbeck			
5		Attenuator	Tenuline	Mod.8343-060	503	Non-cal
6		Burst generator	Schaffner	NSG 1025	339	7 - 98
7		Capacative coupling clamp	Seaward	N/A	K48 0005	Non-cal (Physical)
8	√	Control computer	Hewlett Packard	VE 486	FR60881348	Non-cal
9	√	Control software	Chase	EMS 9920	N/A	Non-cal
10		Control Computer	DRA	486DX	9207-0336	Non-cal
11		Control Software	Chase	CIS9940	N/A	Non-cal
12	√	Control computer	Hewlett Packard	VE 486	FR60976452	Non-cal
13	√	Control software	Chase	CIS 9942	N/A	Non-cal
14		Current clamp	Chase	CIP9136	1045	Cal on use
15		Current clamp calibration jig	Chase	N/A	1067	Non-cal (Physical)
16	√	Field monitor	Amplifier research	FM1000	60687	Non-cal
17	√	Humidity/Temp Sensor	Novasina	MS1-E	136	Internal
18	√	Isotropic field probe	Amplifier research	FP1000	75523	10 - 98
19		Isotropic field probe	Amplifier research	FP1000		7 - 98
20		Isotropic field probe	Amplifier research	FP1000	75507	
21		Isotropic filed probe	Amplifier research	FP1000	75510	
22		LISN/AMN	Chase	MN2050	1561	7 - 98
23		LISN/AMN	Chase	MN2053	5277	
24		LISN/AMN	Solar Electronics	0828-50-TS-24-BNC	901263	
25		LISN/AMN	Solar Electronics	0828-50-TS-24-BNC	901264	
26		LISN/AMN	Solar Electronics	8116-50-TS-100-N	967609	
27		LISN/AMN	Solar Electronics	8116-50-TS-100-N	967610	

Equipment Schedule (page 2 of 2)						
No	**Used**	**Instrument**	**Manufacturer**	**Type**	**Serial Number**	**Calibrated On**
28		Measurement receiver	Chasc	UHR 4000	16021	8 - 98
29	√	Measurement receiver	Chase	UHR 7000	1034	7 - 98
30		Millivoltmeter	Rohde & Schwarz	URV55	842702/025	4 - 98
31		Oscilloscope	Le Croy	9450A	9450 2804	
32	√	Power amplifier - RF	IFI (1kW)	406	1178-2068	Relative
33		Power amplifier - RF	Kalmus	225LC	7736-1	Relative
34		Power amplifier - RF	Kalmus	116FC	740 823 001A	Relative
35		Power amplifier - RF	Amplifier research	150L		Relative
36	√	Power amplifier - RF	IFI	SMCC	AG 290997	Relative
37		Power amplifier - AF	B & K Electronics	1kW Module	8/95	Relative
38		Power Meter	Marconi			
39		Power Meter	Rohde & Schwarz	392.4017.04	834414/021	Relative
40		Power supply - DC	Sonnenschein	Ulimatic	12097961	Non-cal
41		Power supply - DC	Farnell	LT 30-2	002170-XTX1-1	Non-cal
42		Power supply - DC	Farnell	AP60-150	000255	Non-cal
43		Power Supply / Harmonic test system	Hewlett Packard	6842A	3531A-00132	Cal on use
44	√	Screened room (Anechoic)	Belling-Lee Intec	7m × 5m × 3.6m	00513	Chase report 3 - 97
45	√	Signal generator	Marconi	2024	112224/033	4 - 98
46		Signal generator	Rohde & Schwarz	SMHU	835950/005	3 - 98
47		Signal generator	Rohde & Schwarz	APN04	861676/027	5 - 98
48	√	Static discharge gun	Schaffner	NSG433	102	10 - 98
49		Transformer	Solar Electronics	6220-2	No serial	Non-cal
50		40 Watt terminator	Narda	Mod.376NM	17	
51		30 dB Attenuator	Bird	8329-300	3882	
52	√	CCTV Camera	Sony	SSC-C37	17201	Non-cal
53		Surge Generator	KeyTech	CE - 50	9605486	cal on use
54		Surge Software	KeyTech	E500 Surgeware	V4.12(C) 1996	Non-cal
55		Comms Analyser	Rohde & Schwatz	CMTA 94	861093/001	3 - 98
56		Comms Service monitor	Rohde & Schwatz	CMS 54	840.0009.54	12 - 97
57		Wattmeter	Feedback	EW 1604	1604/1/21	10 - 98
58		GPS receiver	Magnavox	MX 100	No serial	Non - Cal
59	√	Spectrum Analyser	HP	8563A	3133A00878	March 98
60	√	Horn	Emco	M3115	9605/4679	June - 98
61	√	Dipole Antenna	Schwarzbeck	VHA 9103	7189	Relative
62	√	Dipole Antenna	Chase	VBA 6106	1103	Relative

Table of Uncertainty of Measurement.

QUANTITY (steady state)			Uncertainty of Measurement
Temperature -40°C to + 150°C (applied condition)			± 0.5°C
Electrical	DC Voltage	Direct measurement	± 0.5%
Electrical	AC Voltage (RMS)		± 1.5%
Electrical	AC Frequency, Power (Hz)		± 1%
Electrical	Conducted RFI	dBμV/m	± 2.9 dB
Electrical	Radiated RFI	dBμV/m	± 3.8 dB
Electrical	Frequency	MHz	±0.01%
Electrical	AF/RF voltage	RMS	±0.2V%
Electrical	Field Strength	V/m(30M-1GHz)	-0, +15%

APPENDIX E

Spurious Radiation Plots

Taken during testing of

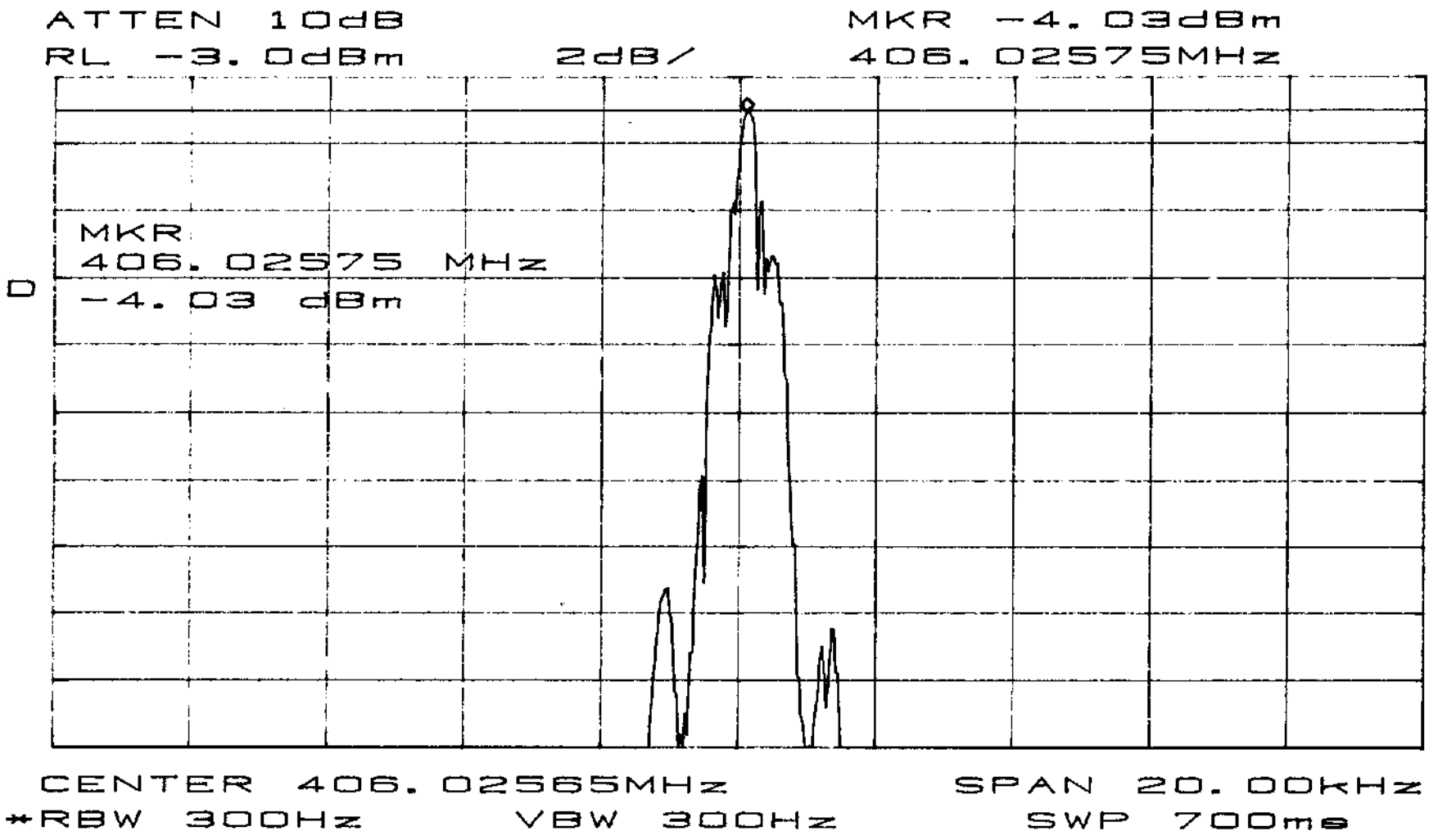
EPIRB E3

to FCC 47CFR Ch1 (10-1-97 Edition)

(Consists of 18 pages)

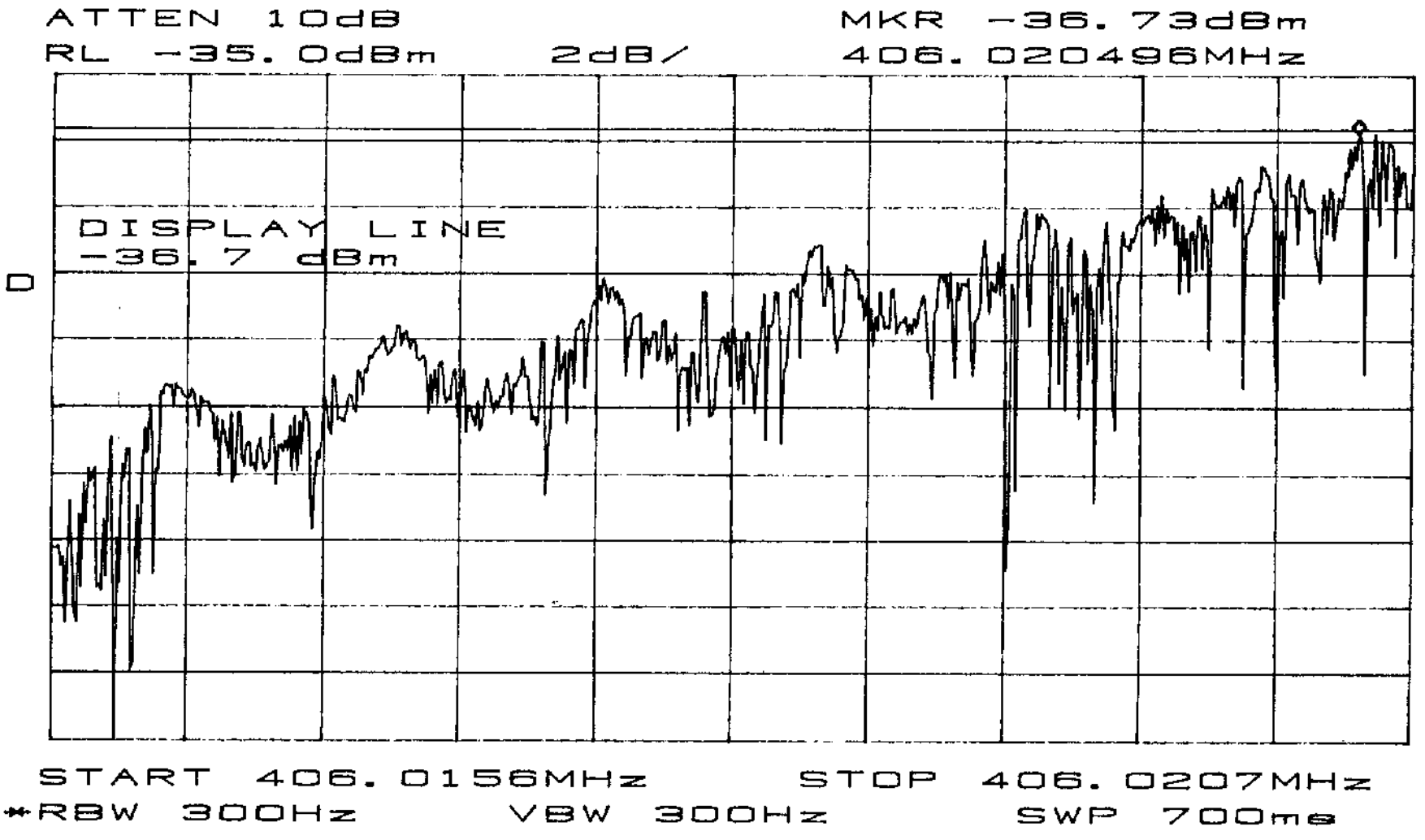
PLOT 1 McMURDO EPIRB E3 SCREEN ROOM FCC #47CFR CARRIER LEVEL 20·11·98

TT 07/98 B. Hawkins PASS

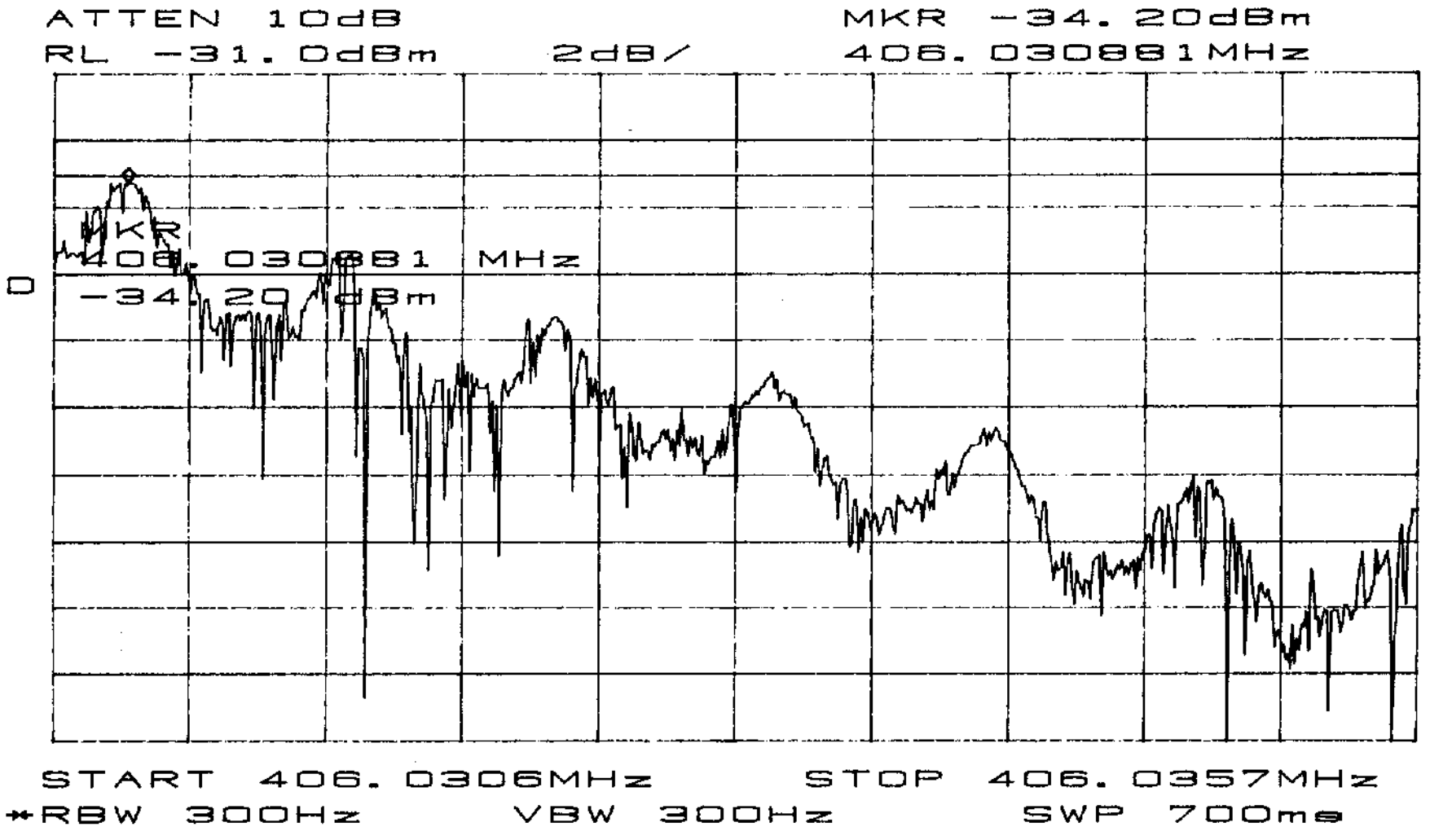


PLOT 2 McMURDO EPIRB E3 SCREEN ROOM FCC 47 CFR CLOSE TO CARRIER EMISSIONS 20.11.98

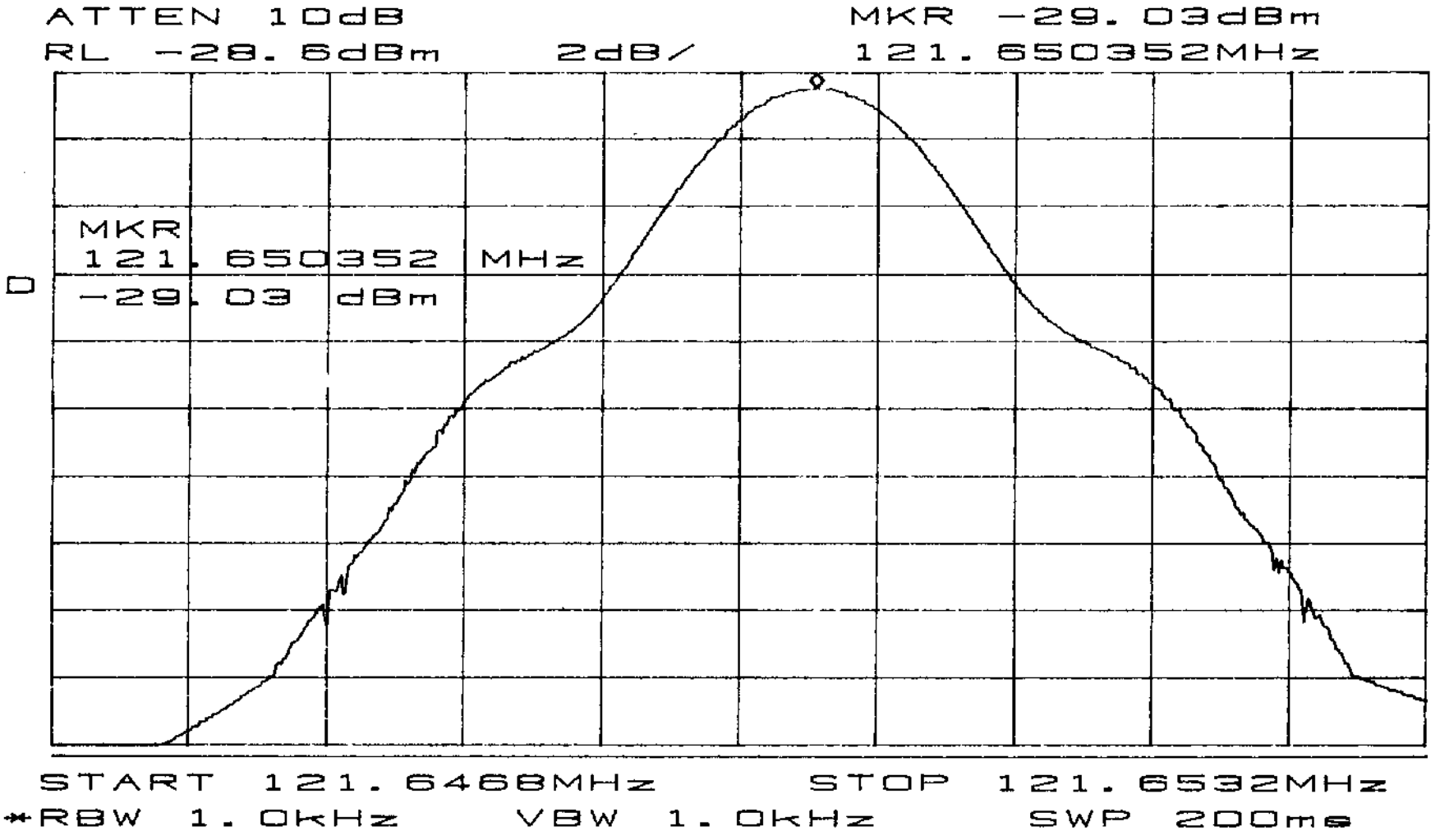
TT07/98 B. Hawkins PASS



PLOT 3 McMURDO EPIRB E3 SCREEN ROOM FCC 47CFR CLOSE TO CARRIER EMISSIONS 20·11·98
TT07/98 B. Hawkins PASS

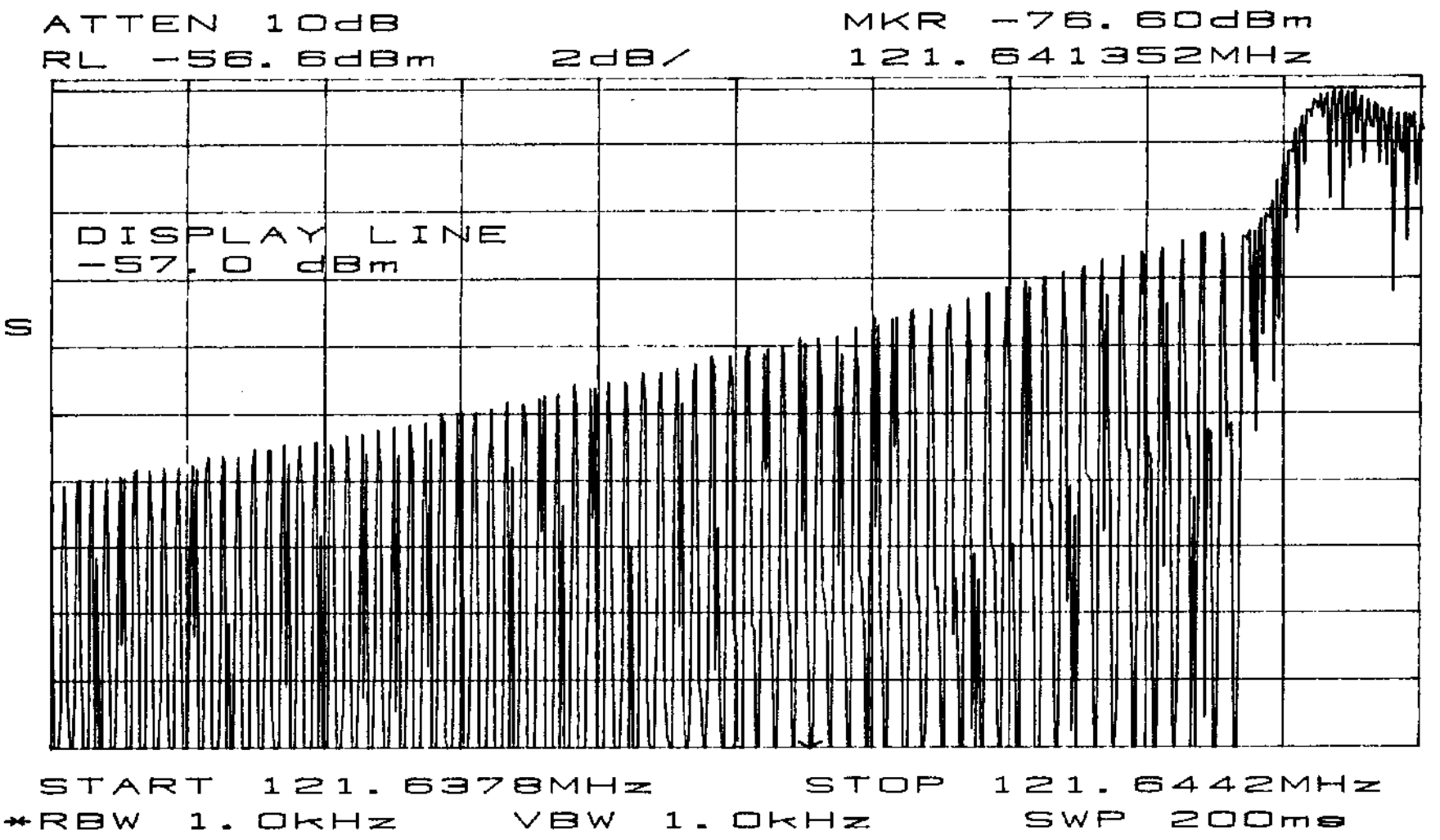


TT07/98 B. Hawkins PASS



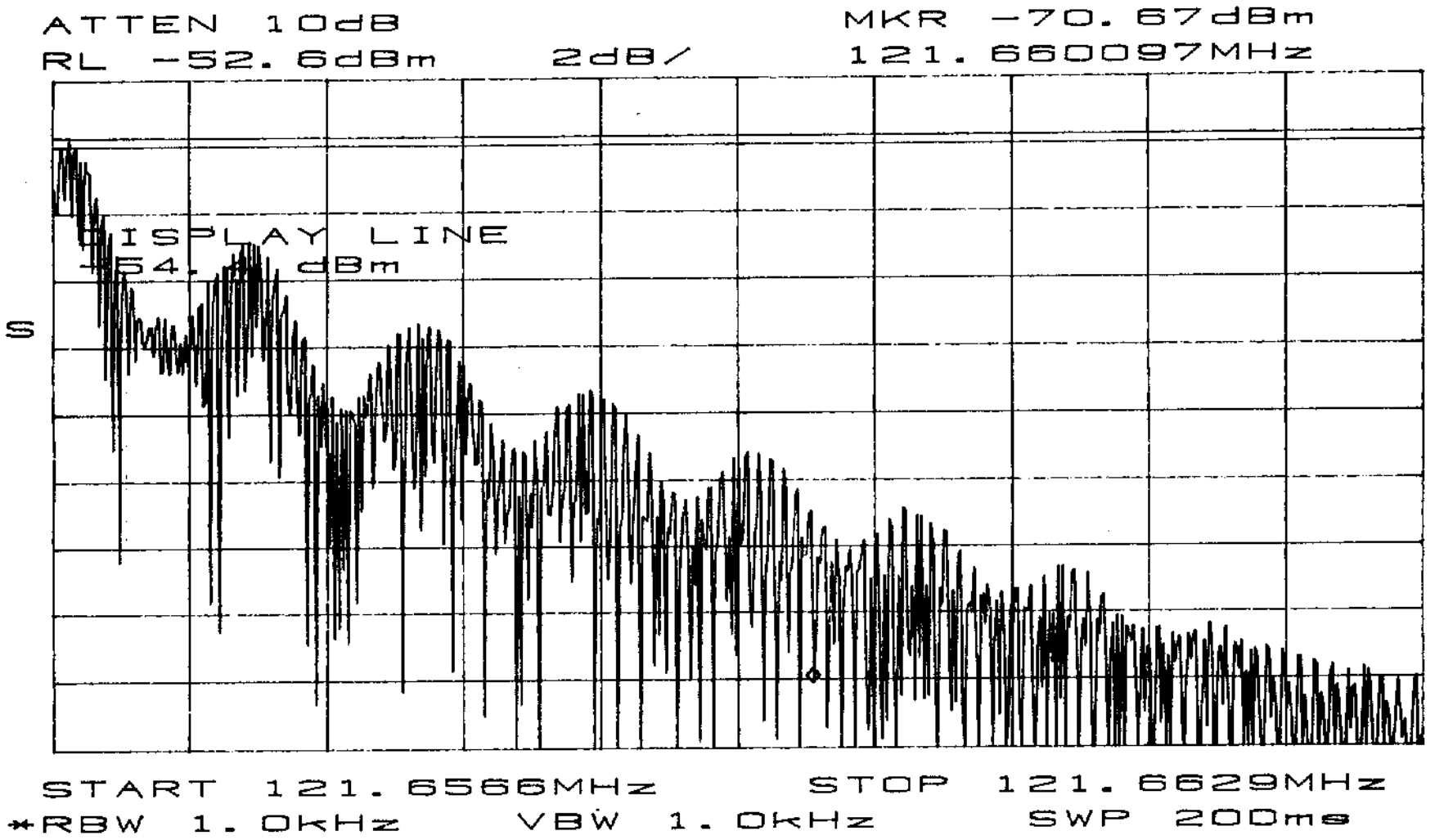
PLOT 5 McMURDO EPIRB E3 SCREEN ROOM FCC 47 CFR CLOSE TO CARRIER EMISSIONS 20.11.98

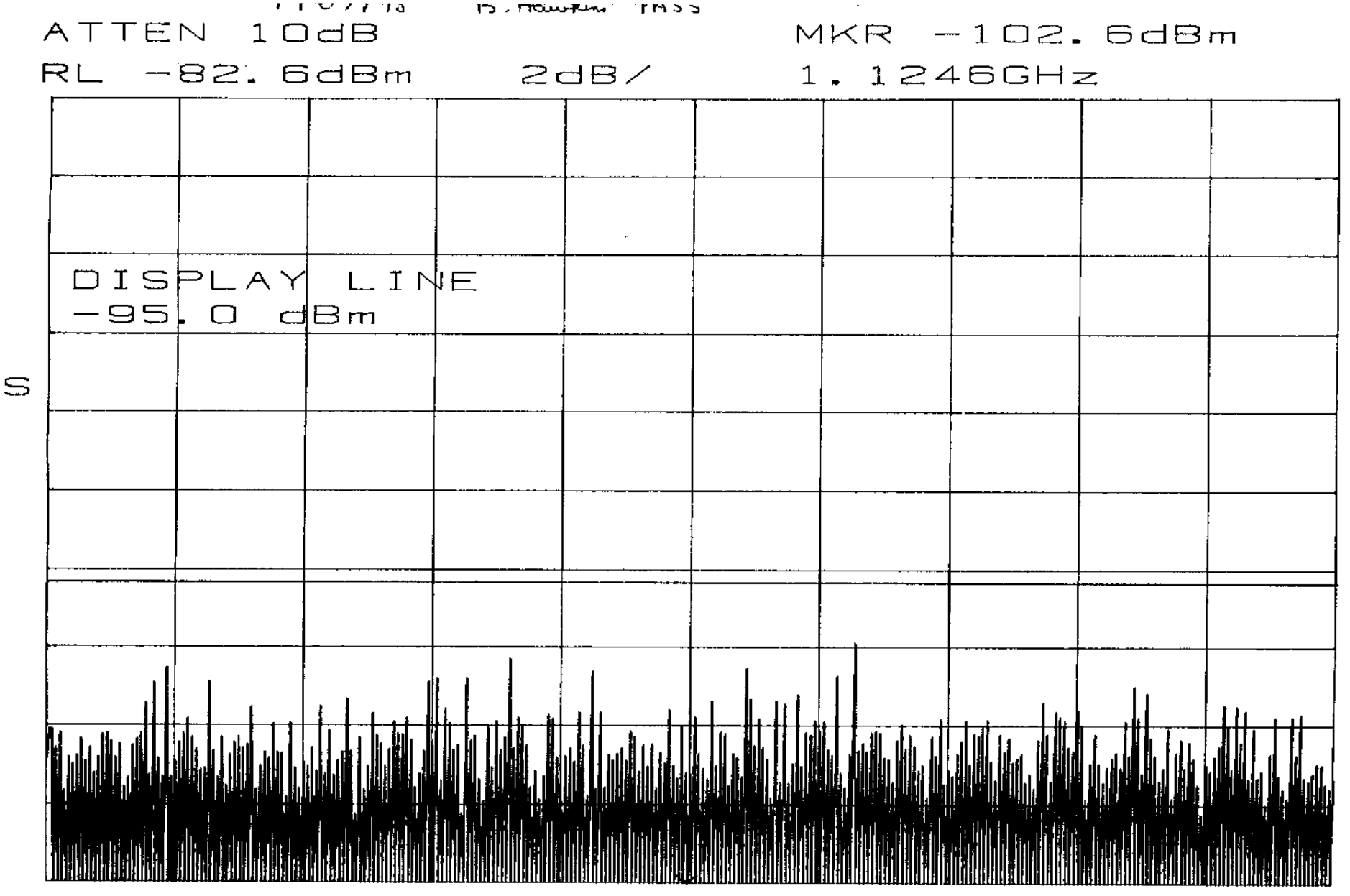
TT07/98 B. Hawkins PASS



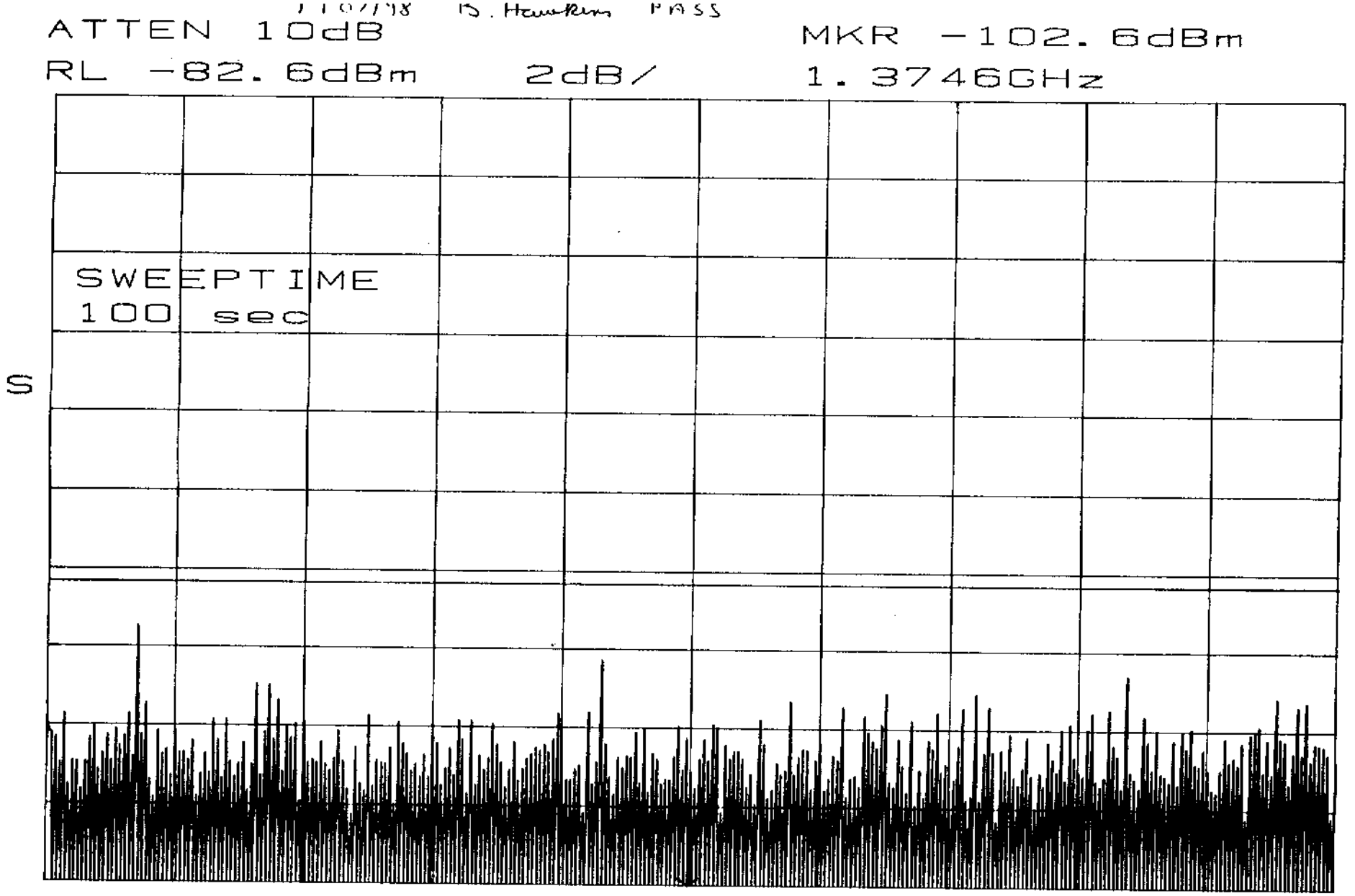
PLOT 6 MCMURDO EPIRB E3 SCREEN ROOM FCC 47CFR CLOSE TO CARRIER EMISSIONS 20/11/98

TT07/98 B. Hawkins PASS




ATTEN 10dB
MKR -102.6dBm
RL -82.6dBm
2dB/
1.1246GHz
DISPLAY LINE
-95.0 dBm
S
START 1.0000GHz
STOP 1.2500GHz
*RBW 1.0kHz
VBW 1.0kHz
SWP 100sec

7/07/98 B. Hawkins PASS

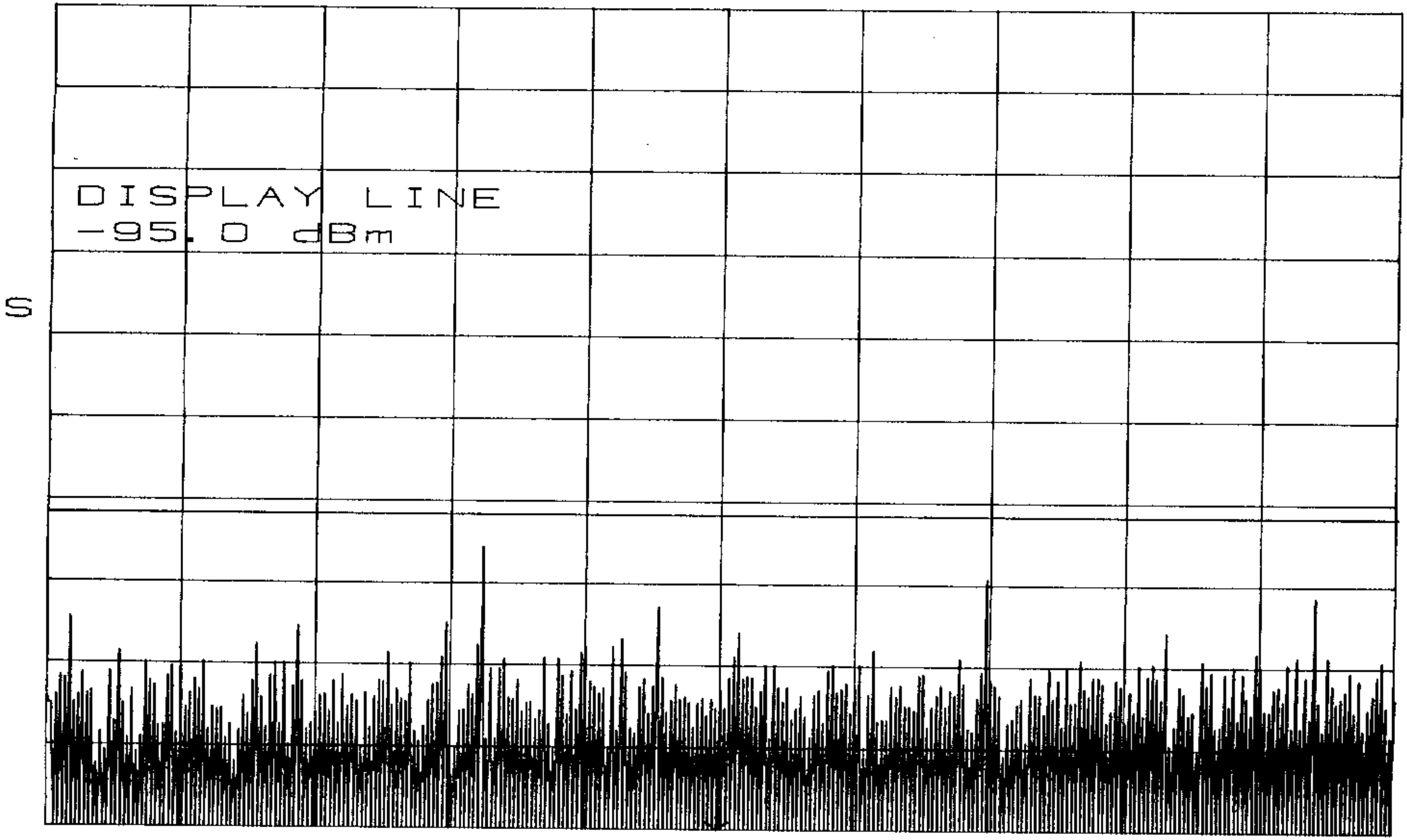


PLOT 9 MEMO 00 EPIRB ES SCREEN ROOM FCC H/LFR SPURIOUS EMISSIONS 11.11.98

TT07/98 B. Hawkins PASS

ATTEN 10dB MKR -102.6dBm

RL -82.6dBm 2dB/ 1.6246GHz



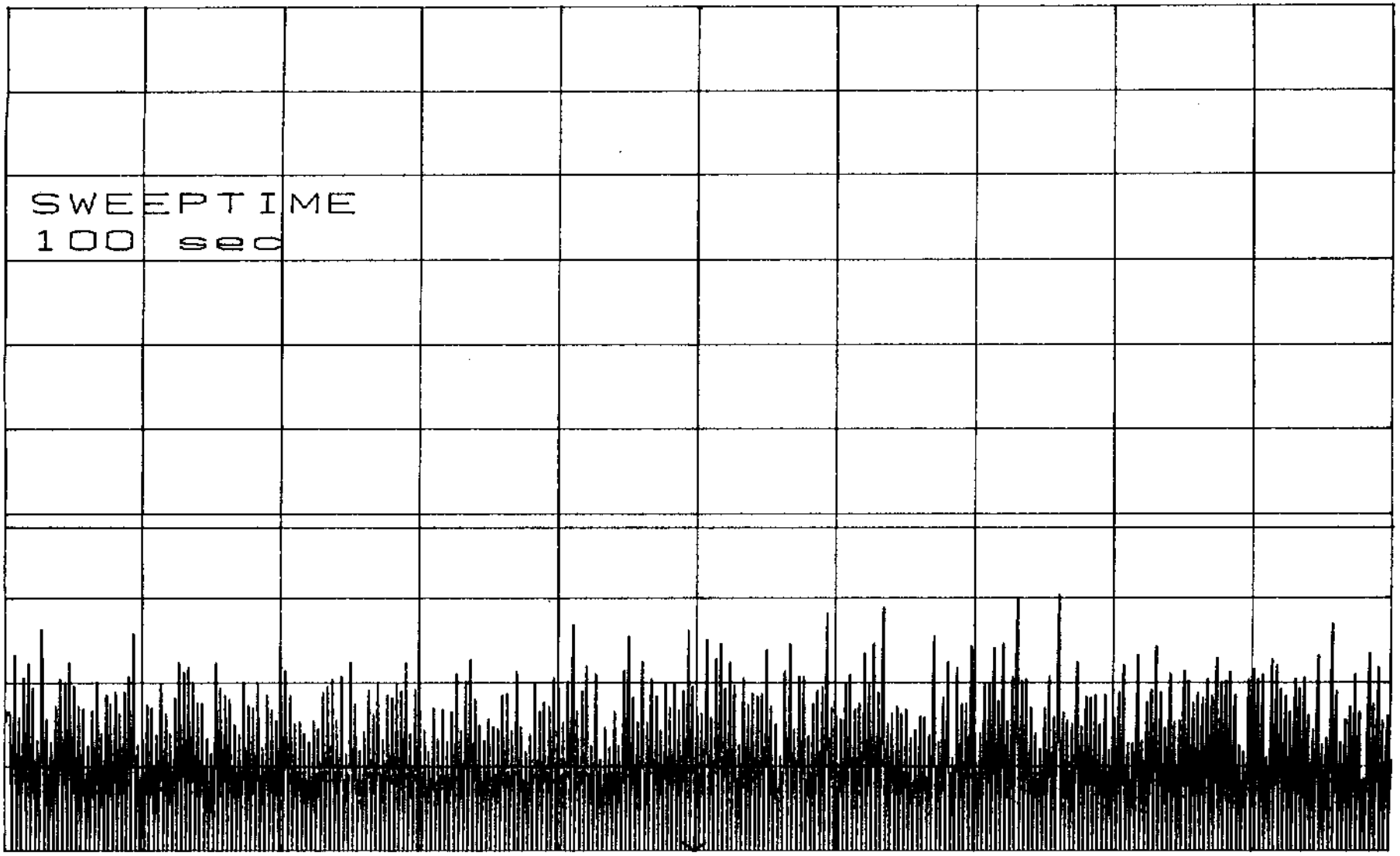
START 1.5000GHz STOP 1.7500GHz

*RBW 1.0kHz VBW 1.0kHz SWP 100sec

10/7/98 M. Hawkins PASS

ATTEN 10dB MKR −102.6dBm

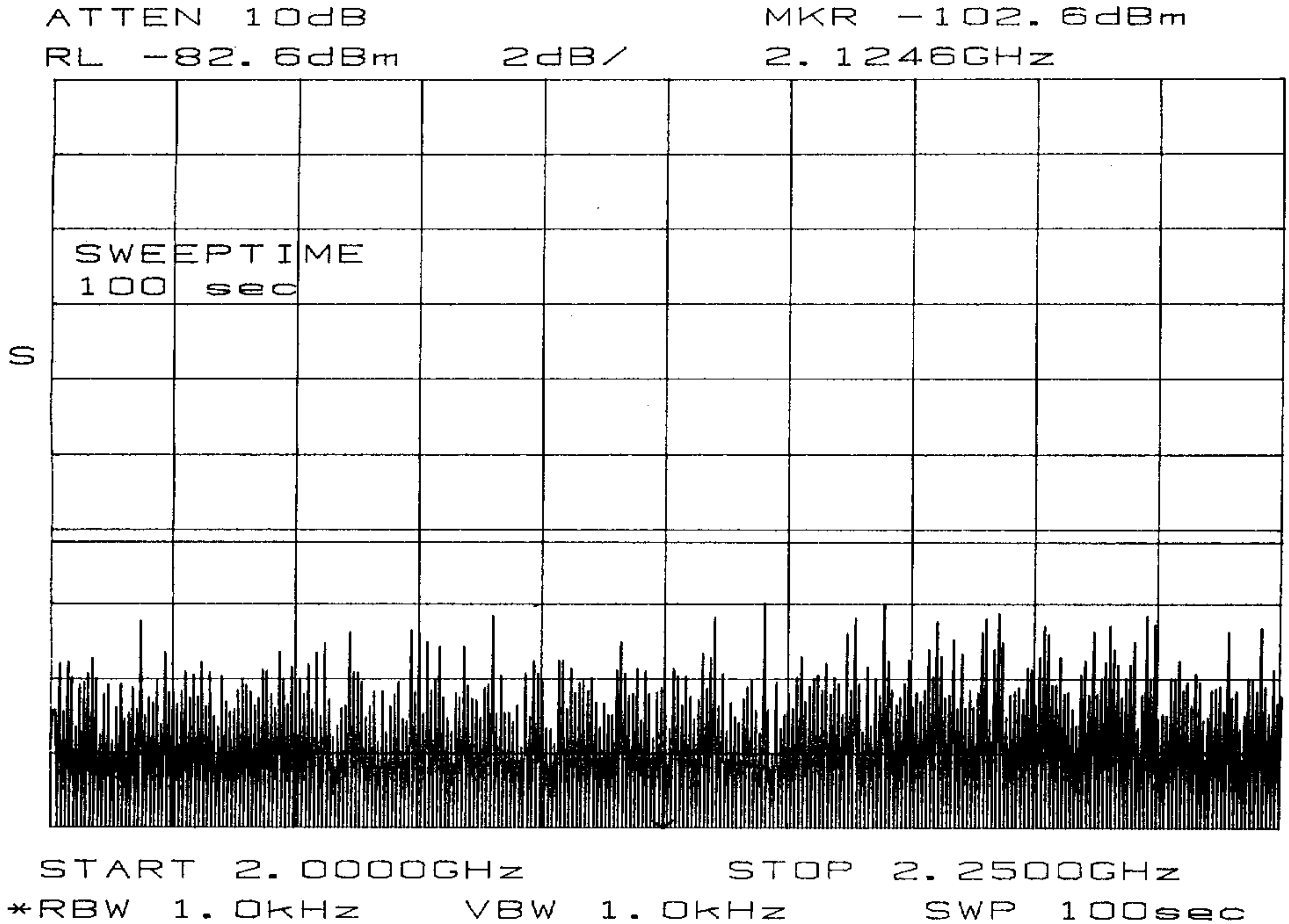
RL −82.6dBm 2dB/ 1.8746GHz



START 1.7500GHz STOP 2.0000GHz

*RBW 1.0kHz VBW 1.0kHz SWP 100sec

1/10/98 D. Hawkins PASS

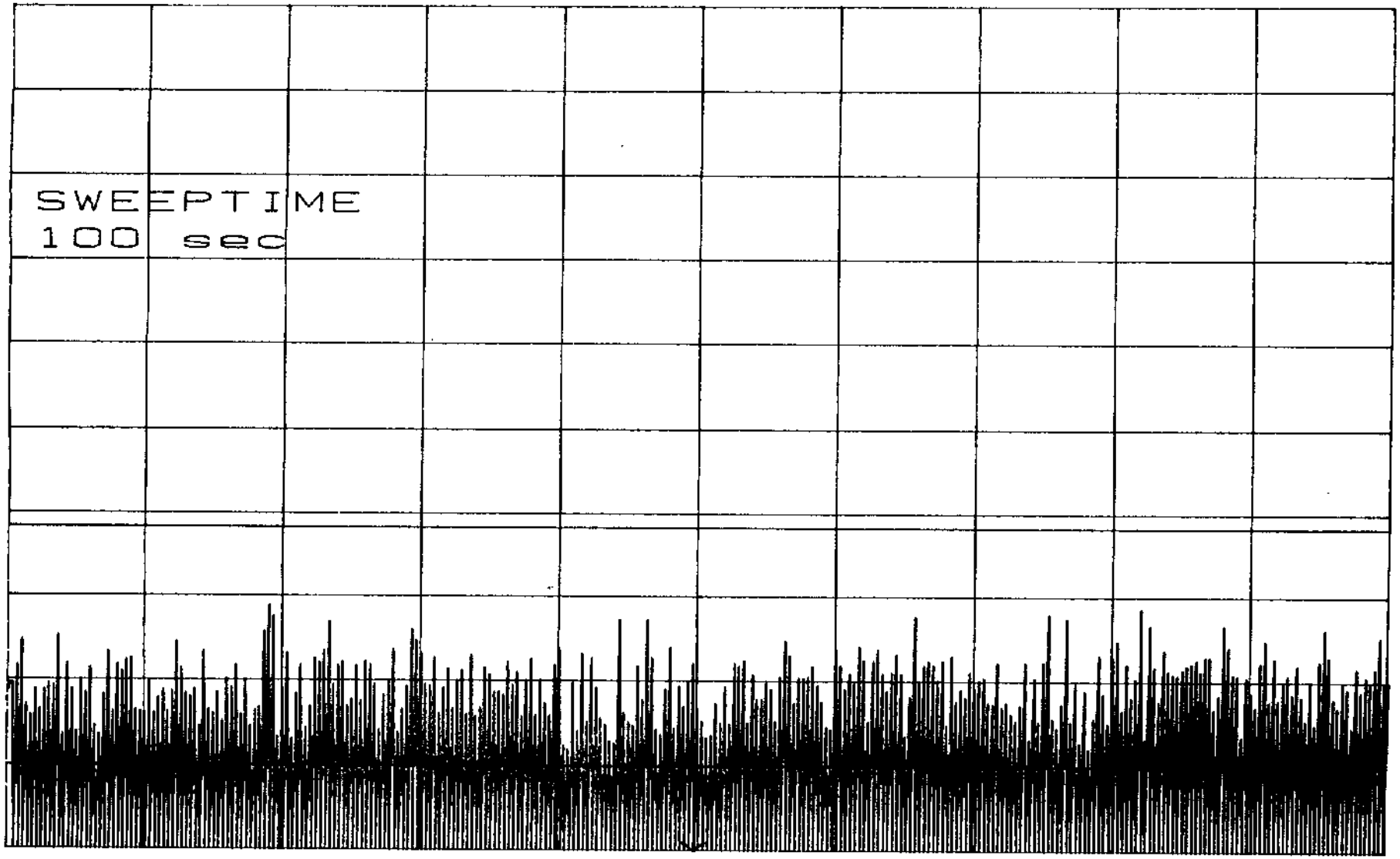


PLOT ~~NO~~ ~~MEMORIES~~ ATTKB LS SCREEN ROOM FCC 4/CHK SPURIOUS EMISSIONS 19-11-98

TT07/98 B. Hawkins PASS

ATTEN 10dB MKR −102.6dBm

RL −82.6dBm 2dB/ 2.3746GHz

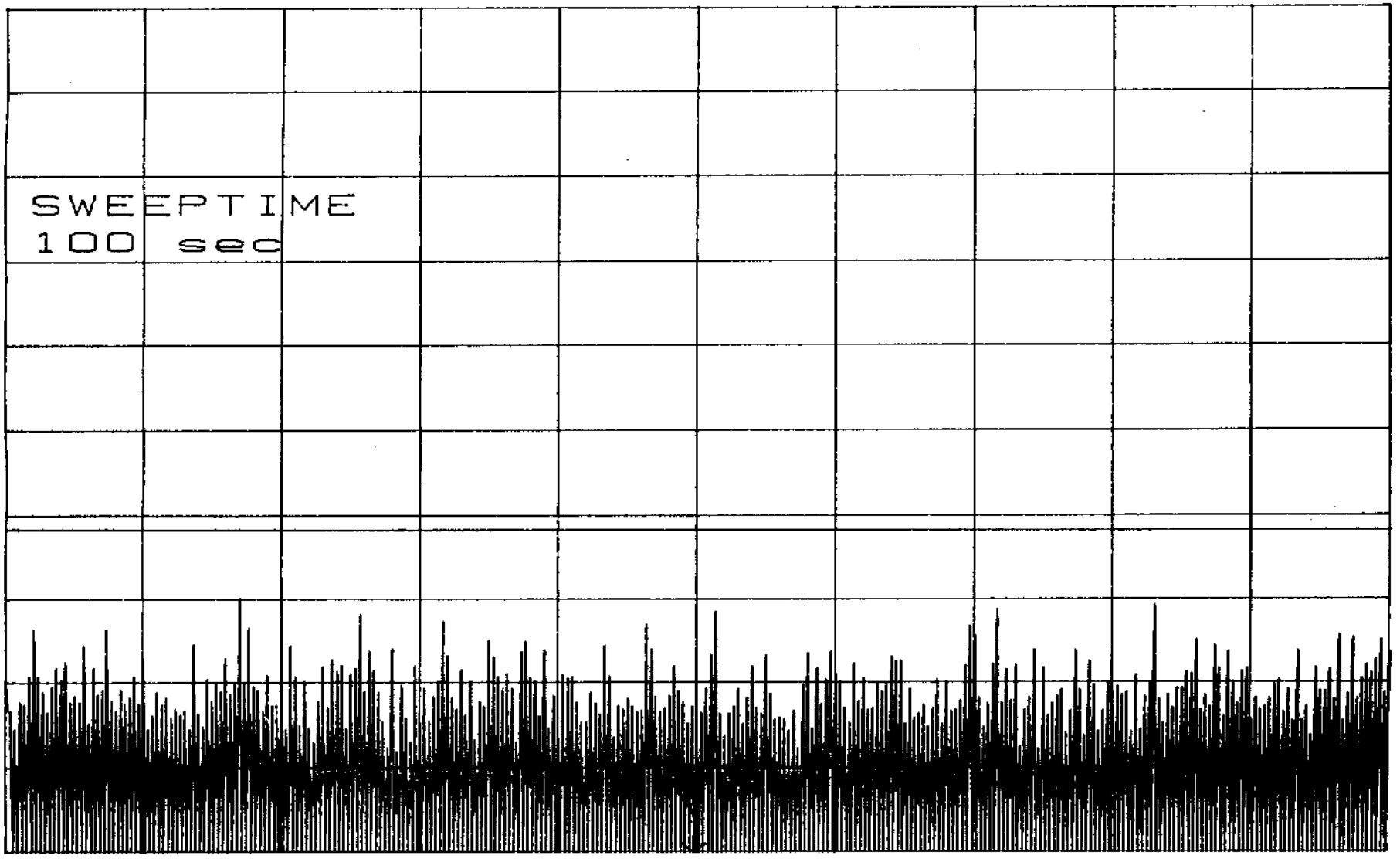


START 2.2500GHz STOP 2.5000GHz

*RBW 1.0kHz VBW 1.0kHz SWP 100sec

ATTEN 10dB MKR −102.6dBm

RL −82.6dBm 2dB/ 2.6246GHz



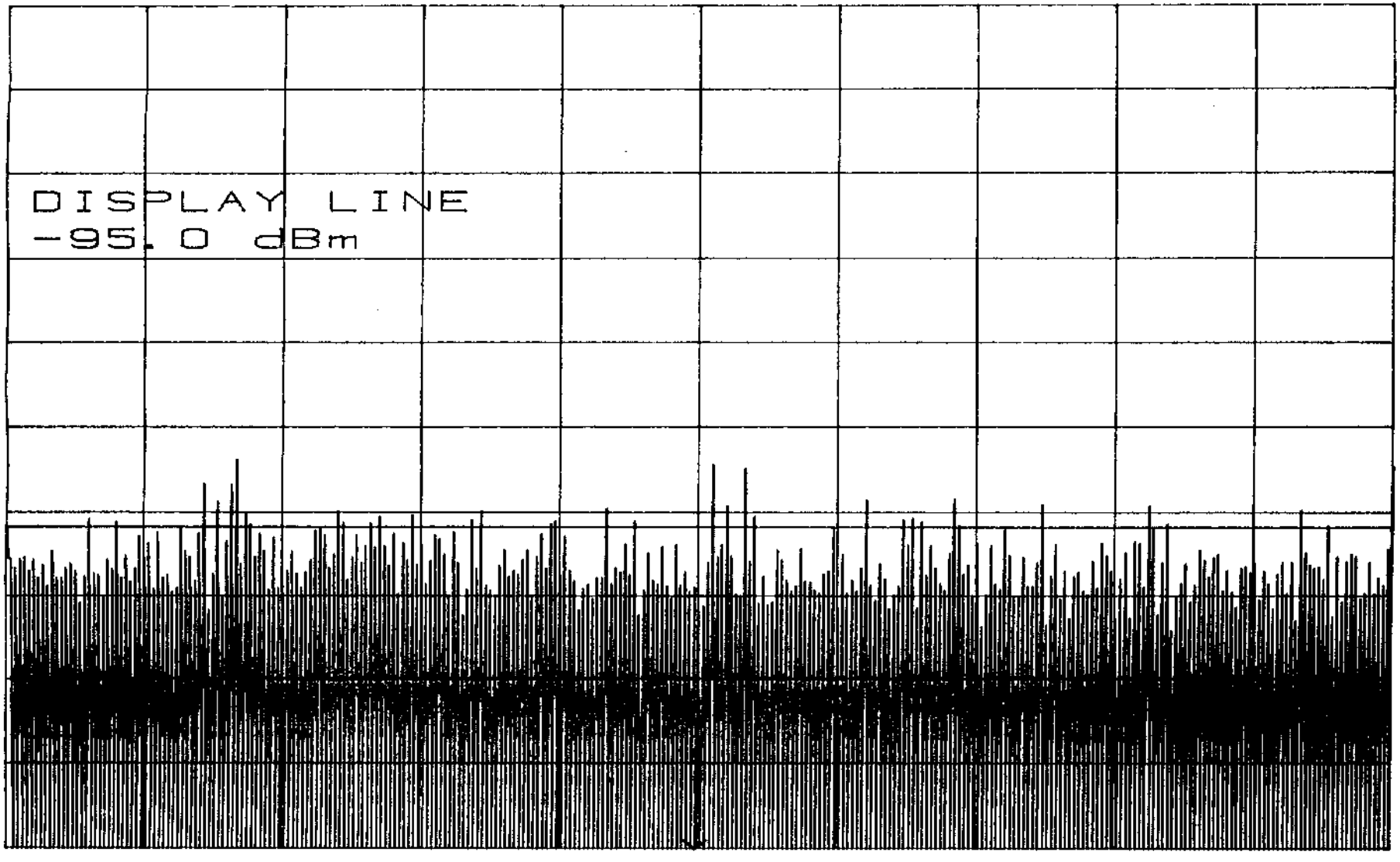
START 2.5000GHz STOP 2.7500GHz

*RBW 1.0kHz VBW 1.0kHz SWP 100sec

11/07/98 B. Hawkins PASS

ATTEN 10dB MKR -102.6dBm

RL -82.6dBm 2dB/ 2.8746GHz



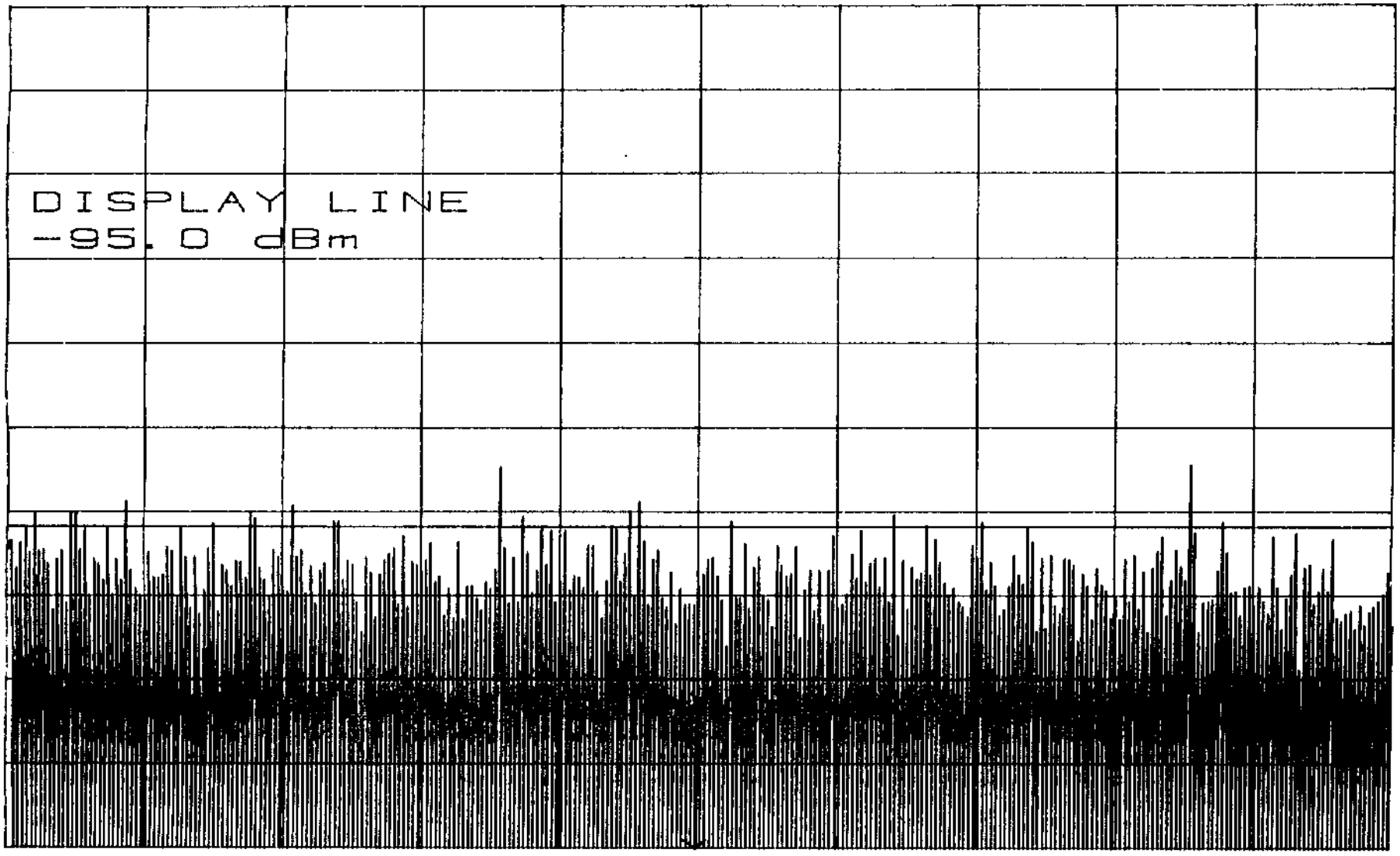
START 2.7500GHz STOP 3.0000GHz

*RBW 1.0kHz VBW 1.0kHz SWP 100sec

B. Hawkins FMJS

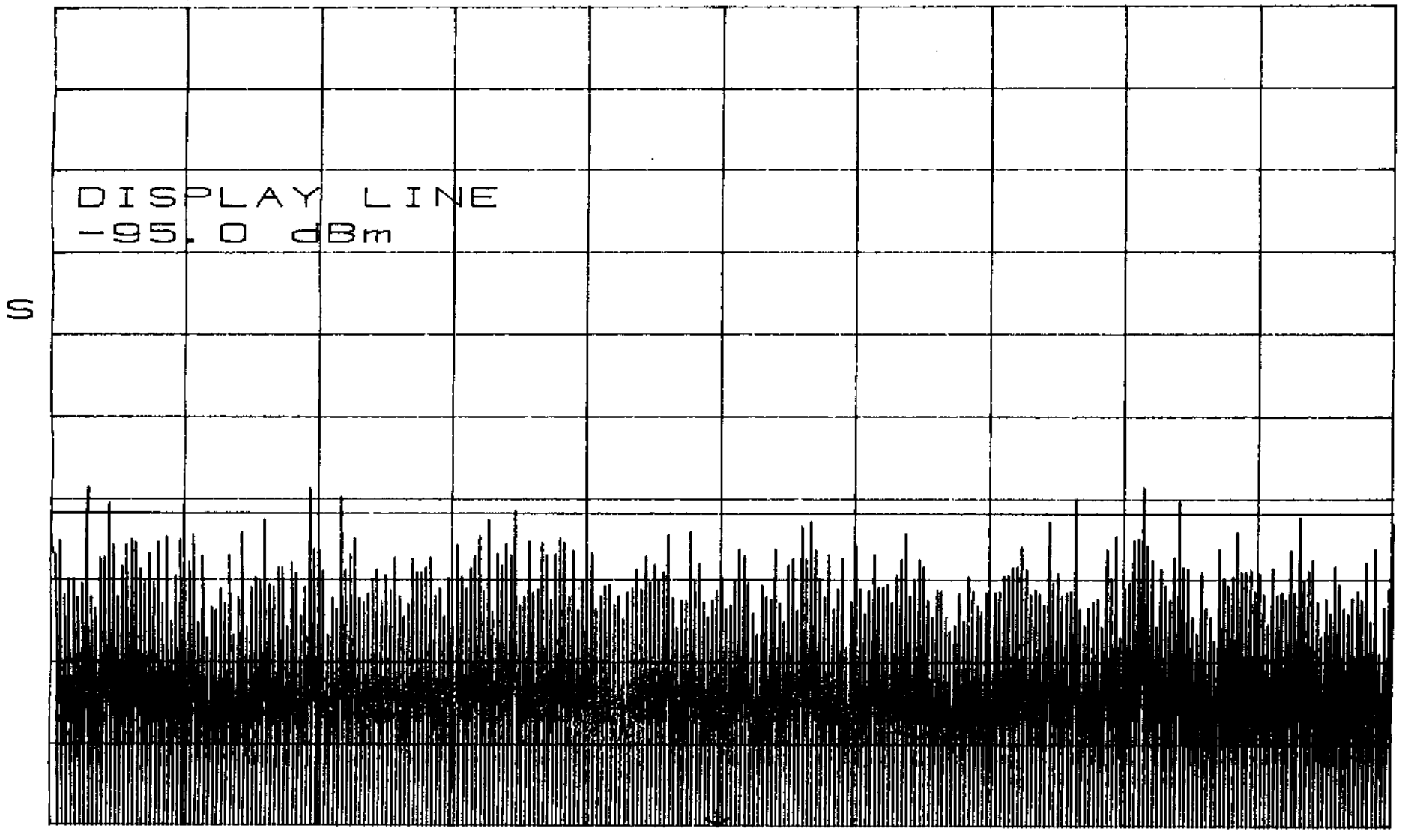
ATTEN 10dB MKR −102.6dBm

RL −82.6dBm 2dB/ 3.1246GHz



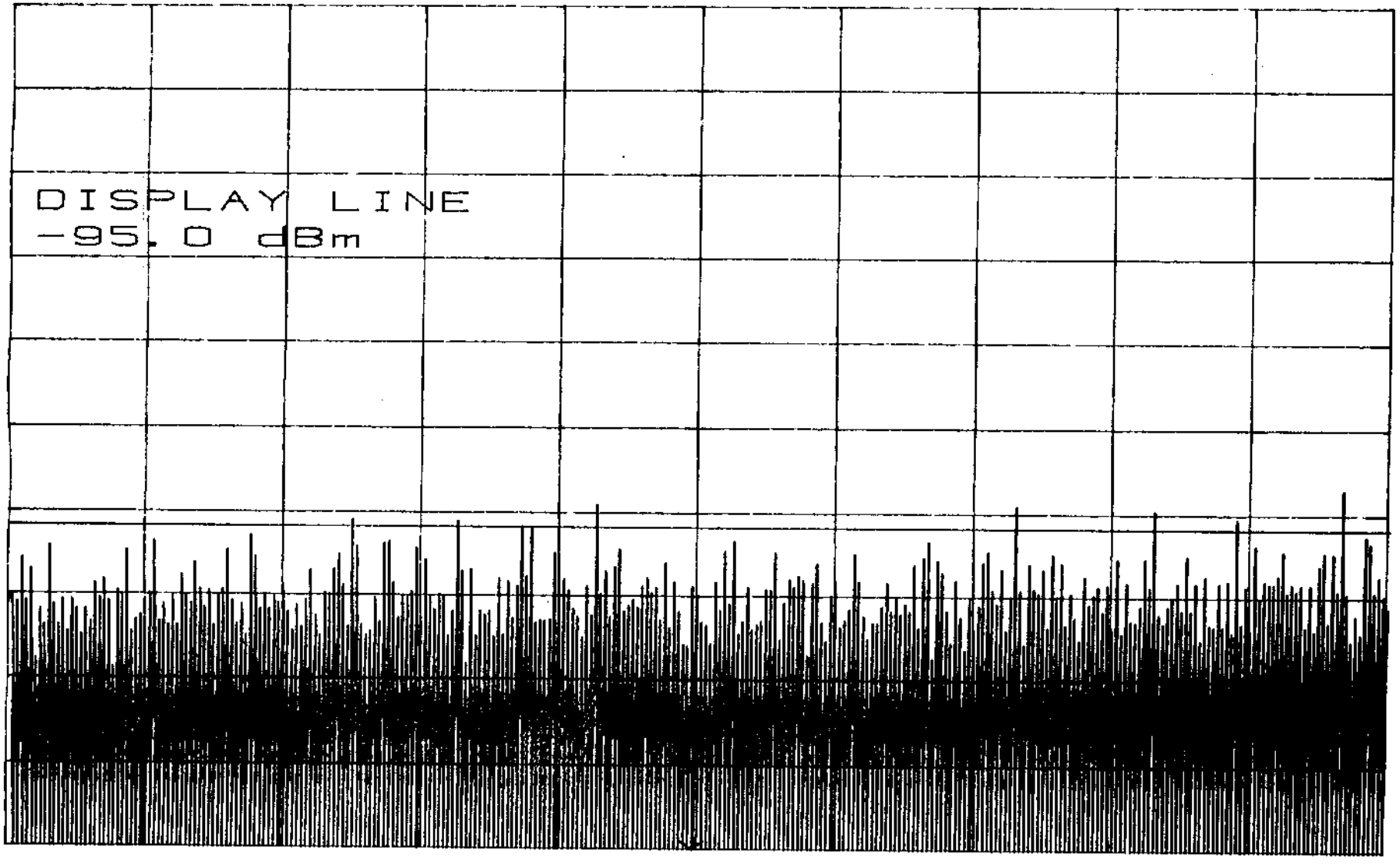
START 3.0000GHz STOP 3.2500GHz

*RBW 1.0kHz VBW 1.0kHz SWP 100sec


ATTEN 10dB
MKR -102.6dBm
RL -82.6dBm
2dB/
3.3746GHz
DISPLAY LINE
-95.0 dBm
S
START 3.2500GHz
STOP 3.5000GHz
*RBW 1.0kHz
VBW 1.0kHz
SWP 100sec

ATTEN 10dB MKR -102.6dBm

RL -82.6dBm 2dB/ 3.6246GHz

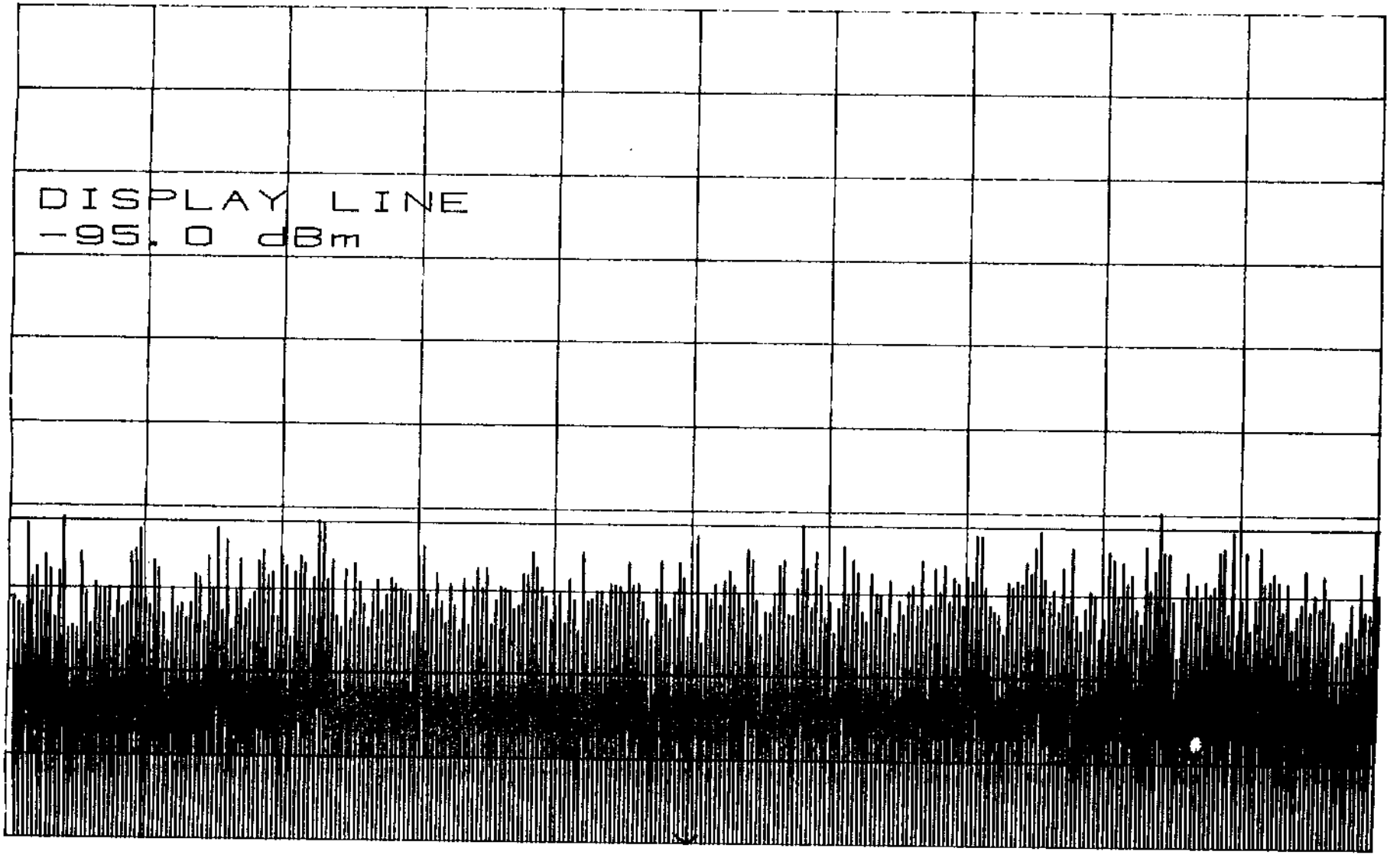


START 3.5000GHz STOP 3.7500GHz

*RBW 1.0kHz VBW 1.0kHz SWP 100sec

B. Hawkins PASS

ATTEN 10dB
RL -82.6dBm
2dB/
MKR -102.6dBm
3.9046GHz



START 3.7500GHz
STOP 4.0603GHz
*RBW 1.0kHz
VBW 1.0kHz
SWP 100sec