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DEFENCE EVALUATION AND RESEARCH AGENCY
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Electro-Magnetic Compatibility Testing

Report on the Testing
of
Halleria Close Corporation
TELLUSART MK11

DERA/SS/CI/R/EMC/TT - 24/99/1.0

Cover + IV + 2 pages + Appendices

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Commissioned by;

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1217

Authorisation

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ELECTRO-MAGNETIC COMPATIBILITY TESTING

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EMC Testing

*Report on the Testing
of*
**Halleria Close Corporation
Tellusart MK11**

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 Tellusart MK11 were designed to prove compliance with the EMC tests contained in British Standard EN 60945:1997.

- 1.2 The Tellusart MK11 has been previously Type Tested at TUV. The equipment has been resubmitted for revalidation tests to transfer the Tellusart MK11 into certification under the Marine Equipment directive.,
- 1.3 The Following tests of BS EN 60945:1997, were conducted on the submitted sample of the Tellusart MK11.

- | | |
|----------------|---|
| 1. Clause 9.3 | Radiated Emissions |
| 2. Clause 10.4 | Immunity to Radiated Radio Frequencies |
| 3. Clause 10.9 | Immunity to Electrostatic Discharge (ESD) |

The part of clause 9.3 detailing the measurement of magnetic H field was not conducted as the equipment being battery powered was not considered to produce electromagnetic phenomena in the frequency range specified in the clause.

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

2 Equipment under Test

- 2.1 The equipment submitted was a Search and Rescue Transponder that provides location information to search radar's operating in the X-band (9.2 – 9.5 GHz)

- 2.2 The unit was designated:-

Tellusart MK11 S/N 40684

3 Build Standard of Test Samples

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

4 Conduct of Testing.

- 4.1 The EMC tests were each conducted in accordance with the standard test method for BS EN 60945 testing at the laboratory of DERA Fraser. During the testing the SARTS performance was continuously monitored.
- 4.2 The tests selected were those considered necessary by the type approvals authority to revalidate the existing UK type approval of this equipment to the later editions of the IEC standards.
- 4.3 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.
- 4.4 A resume of each test conducted is contained in the standard report sheets contained in Appendix A.
- 5. Conclusions.**
- 5.1 The test sample of the Halleria Tellusart MK11 has now successfully passed a series of tests which indicate its compliance with the EMC criteria of BS EN 60945:1997.

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

Manufacturer: Halleria Close Corporation**File Ref. TT 24/99****Equipment Name: Tellusart MK11****Date of Issue. Feb 2000****Units Comprising "Equipment's under Test"**

Description	Type Number	Remarks
1 TELLUSART	S/N 40684	MK11

Representative System

The Tellusart unit was operated according to the manufacture's instructions printed on the case of the unit.

5. Methods of Testing and required test results		
5.2 Test Conditions	5.2.1 Normal Test Conditions	Test site used during testing was:- Defence Research Agency - Fraser, Portsmouth. Conditions during testing were within the range 25 ± 10 deg. C; $50\% \pm 25\%$ RH; 960 ± 100 mb. Unless otherwise stated.

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

Manufacturer: Halleria Close Corporation**File Ref. TT 24/99****Equipment Name: Tellusart MK11****Date of Issue. Feb 2000**

Test	Test Clause	Test Description
9.3 Radiated Emissions Note: 150KHz to 30MHz H field This measurement was not conducted as the EUT is a battery powered device and it was not considered that it would produce H field emissions in this frequency range.	9.3.1 Purpose	To measure any signals radiated by the EUT
	9.3.2 Procedures and Limits	To identify any potential emissions and to separate them from any ambient back ground, measurements were made in an anechoic screen room. As no significant emission was found within -6dB of the limit line, the EUT was not measured on the OATS. The measurements obtained from the EUT by the receiver operating in quasi-peak detection mode were compared against the limits as defined in table 5 of EN 60945:1997. These limits were programmed into the software that controlled the receiver. Measurements were conducted over the frequency range of 30 MHz to 1 GHz. See Appendix D for emissions plots.
	Equipment Used	2,29,8,9,5 (See appendix B)
	Result	Pass The Tellusart MK11 showed no emissions above the specification limit.

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

Manufacturer: Halleria Close Corporation**File Ref. TT 24/99****Equipment Name: Tellusart MK11****Date of Issue. Feb 2000**

Test	Test Clause	Test Description
10.4 Immunity to radiated radio frequencies	10.4.1 Purpose	To simulate the effects of radio transmitters at frequencies above 80 MHz when situated close to other equipment.
	10.4.2 Procedure and Limits	The test was conducted in an Anechoic Screened Room which was calibrated in accordance to IEC 1000 - 4 - 3:1995 The equipment was set up in accordance with figure 9. of EN 60945 The calibration of the chamber has been conducted as defined in IEC 1000-4-3 using the 16 pt calibration technique to construct a calibration file. The equipment is placed in the chamber and the calibration file is re-run. The equipment was set up according to the manufactures instruction manual using cables supplied. A CCTV using fibre optic links continuously monitored the equipment. An isotropic field sensor was placed close to the EUT to monitor the RF field strength. The software was programmed with the field strength, frequency range and modulation as described in para. 10.4.2 of EN 60945. The field was generated using both vertical and horizontal polarisation with the unit fully operational. A 9.4GHz transponder was used to generate a true target indication on the display. During this test the EUT was continuously monitored for levels outside the manufacture's specification.
	Equipment Used	12,13,2,45,32,36,17, 18,19,16,26,51,44,52, (See appendix B)
	Result Performance Criteria A	Pass The Tellusart MK11 system showed no malfunction or deviation from normal performance

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

Manufacturer: Halleria Close Corporation**File Ref. TT 24/99****Equipment Name: Tellusart MK11****Date of Issue. Feb 2000**

Test	Test Clause	Test Description
10.9 Immunity to Electrostatic Discharge (ESD)	10.9.1 Purpose	This test simulates the effect of electrostatic discharges from personnel.
	10.9.2 Procedure and Limits	The test was carried out in accordance with BS EN 61000 - 4 - 2, using an electrostatic discharge generator. The EUT was placed on but insulated from the ground plane. The test set-up conformed to figures 13 and 14 of EN 60945. Discharges from the generator were applied to those points and surfaces which are accessible to personnel. Each test point on the EUT was subjected to 10 positive and 10 negative contact discharges of 6KV. See photographs (Appendix D) for positions of test points. During the test the EUT was monitored to ensure that the equipment remained within the manufacturer's agreed specification.
	Equipment List	48 (See appendix B)
	Result Performance Criteria B	<u>Pass</u> The Tellusart MK11 system showed no malfunction or deviation from normal performance.

APPENDIX B

Schedule of Test Equipment

(Consists of 3 pages)

SCHEDULE OF TEST EQUIPMENT**Equipment Schedule (page 1 of 2)**

No	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	Oct 99
7	Capacitive 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	July 99
19	Isotropic field probe	Amplifier research	FP1000	75522	Oct 99
20	Isotropic field probe	Amplifier research	FP1000	75507	July 99
21	Isotropic filed probe	Amplifier research	FP1000	75510	Jan 99
22	LISN/AMN	Chase	MN2050	1561	Oct 98
23	LISN/AMN	Chase	MN2053	5277	Oct 98
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	
28	Measurement receiver	Chase	UHR 4000	16021	Sept 99
29	Measurement receiver	Chase	UHR 7000	1034	July 99
30	Millivoltmeter	Rohde & Schwarz	URV55	842702/025	July 99

Equipment Schedule (page 2 of 2)

No	Instrument	Manufacturer	Type	Serial Number	Calibrated On
31	Oscilloscope	Le Croy	9450A	9450 2804	May 99
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 x 5m x 3.6m	00513	Chase report 3 - 97
45	Signal generator	Marconi	2024	112224/033	July 99
46	Signal generator	Rohde & Schwarz	SMHU	835950/005	April 99
47	Signal generator	Rohde & Schwarz	APN04	861676/027	July 99
48	Static discharge gun	Schaffner	NSG433	102	Nov 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	June 99
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	June 99
60	Horn	Emco	M3115	9605/4679	June - 98
61	Dipole Antenna	Schwarzbeck	VHA 9103	7189	Relative
62	Dipole Antenna	Chase	VBA 6106	1103	Relative
63	Signal generator	Rohde & Schwarz	SMG	863099/47	July 99

Note:- This Schedule of Equipment list was reviewed and updated on 22/12/99 by R. Sharp.

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	dB μ V/m	± 2.9 dB
Electrical	Radiated RFI	dB μ V/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 C

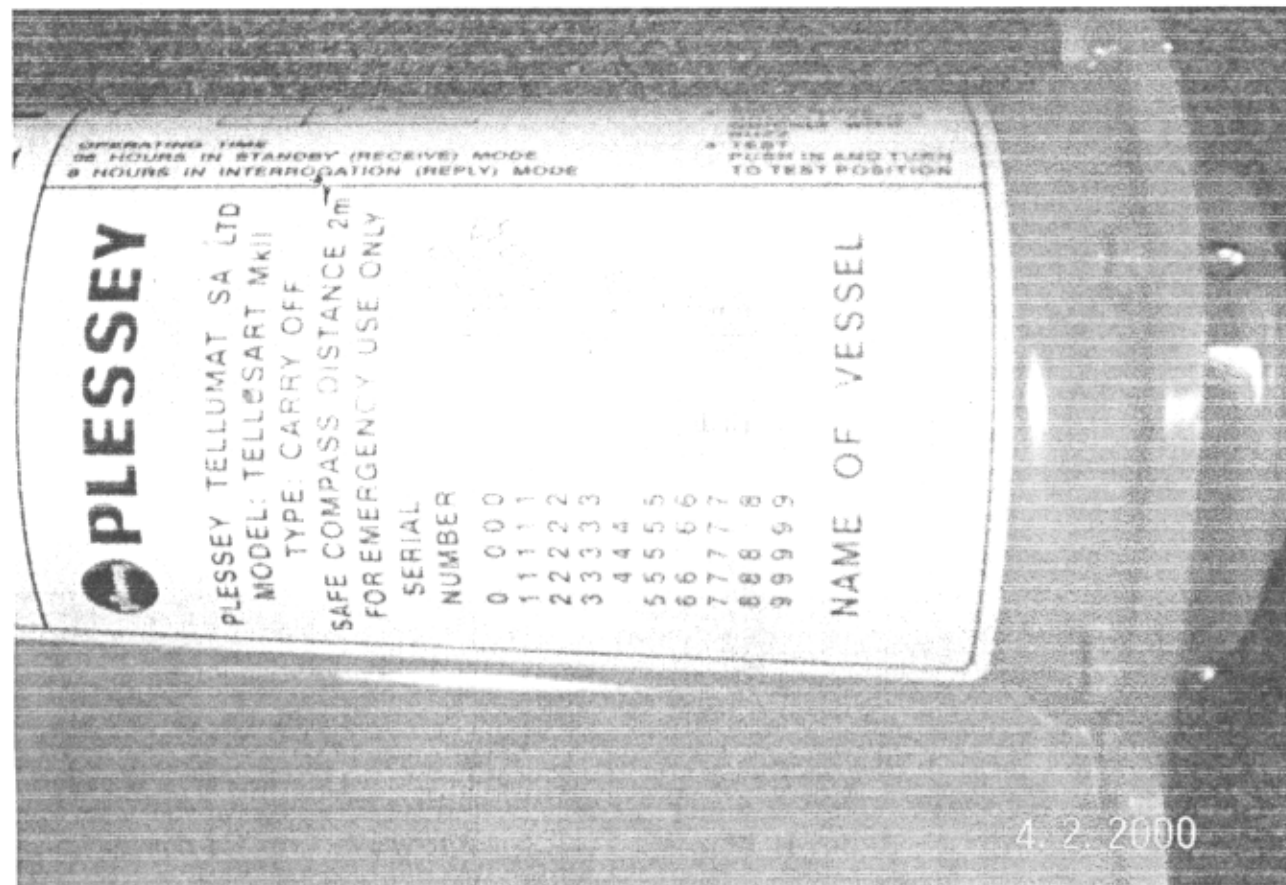
Photographs of Equipment

(consists of 4 pages)



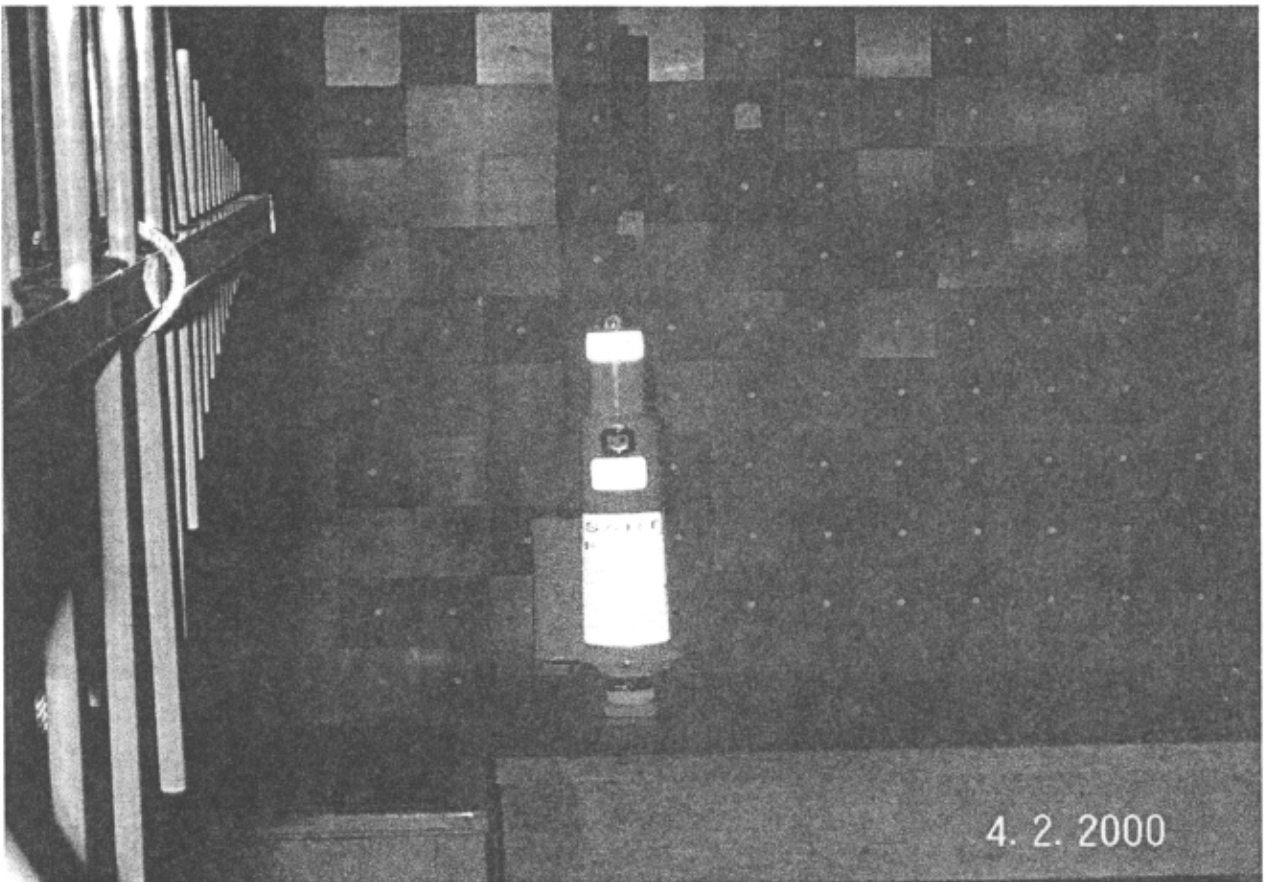
Photograph 1

Tellusart MK11

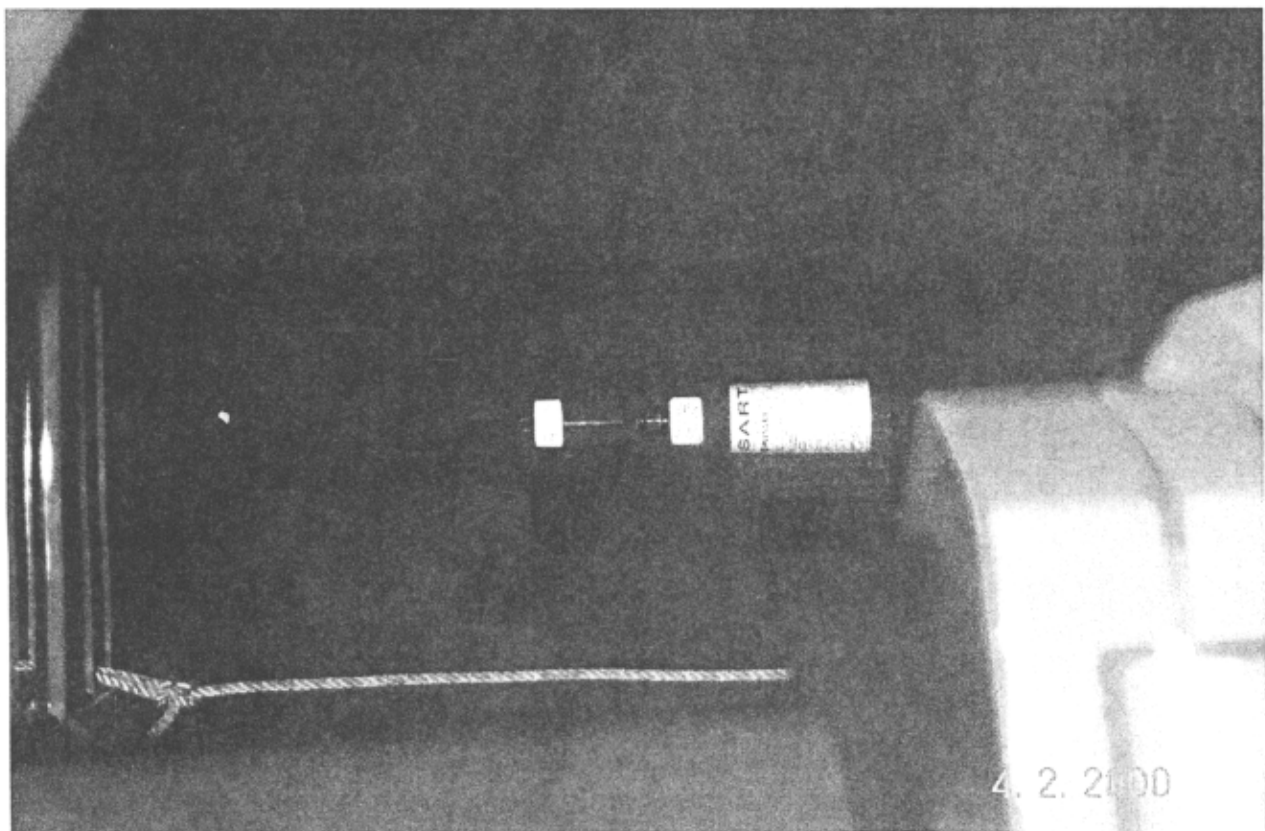


Photograph 2

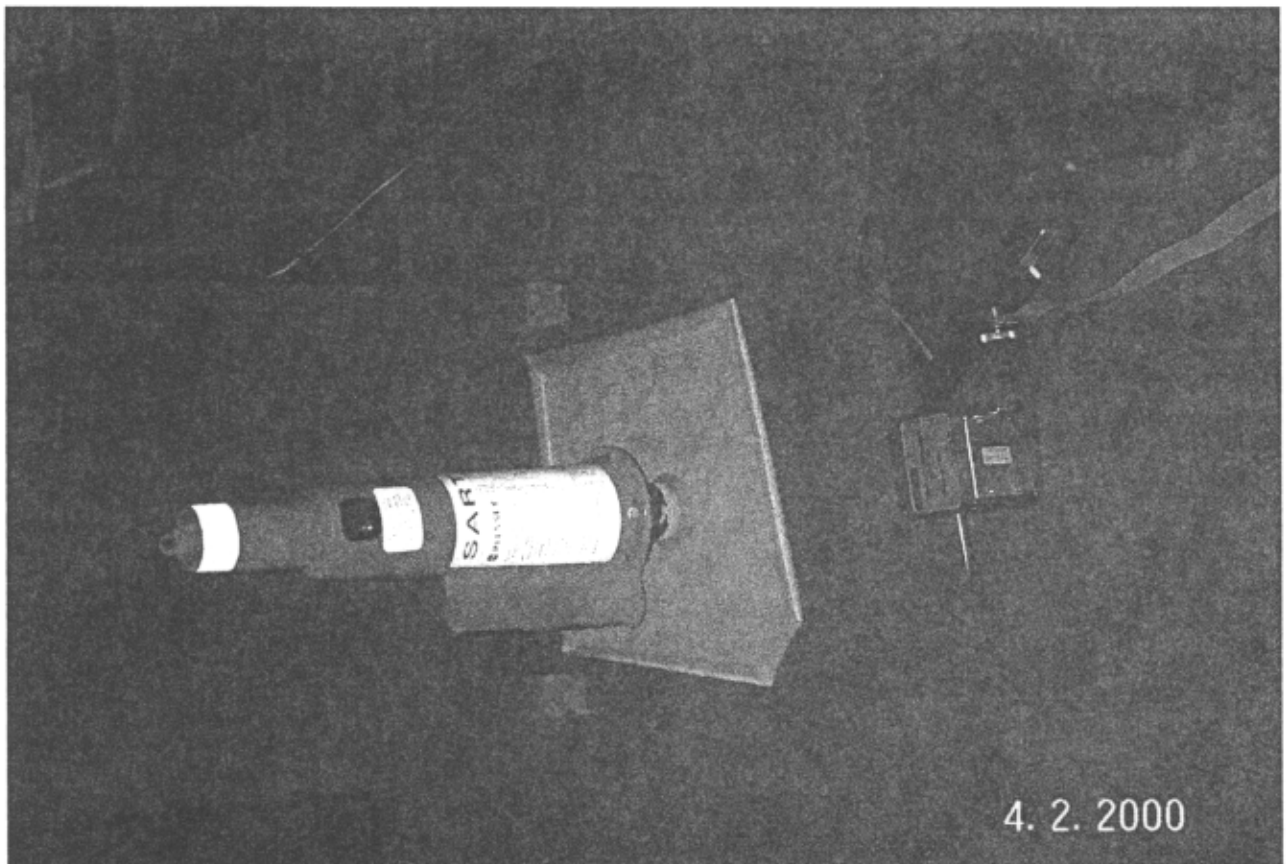
- Identification label of Tellusart MK11



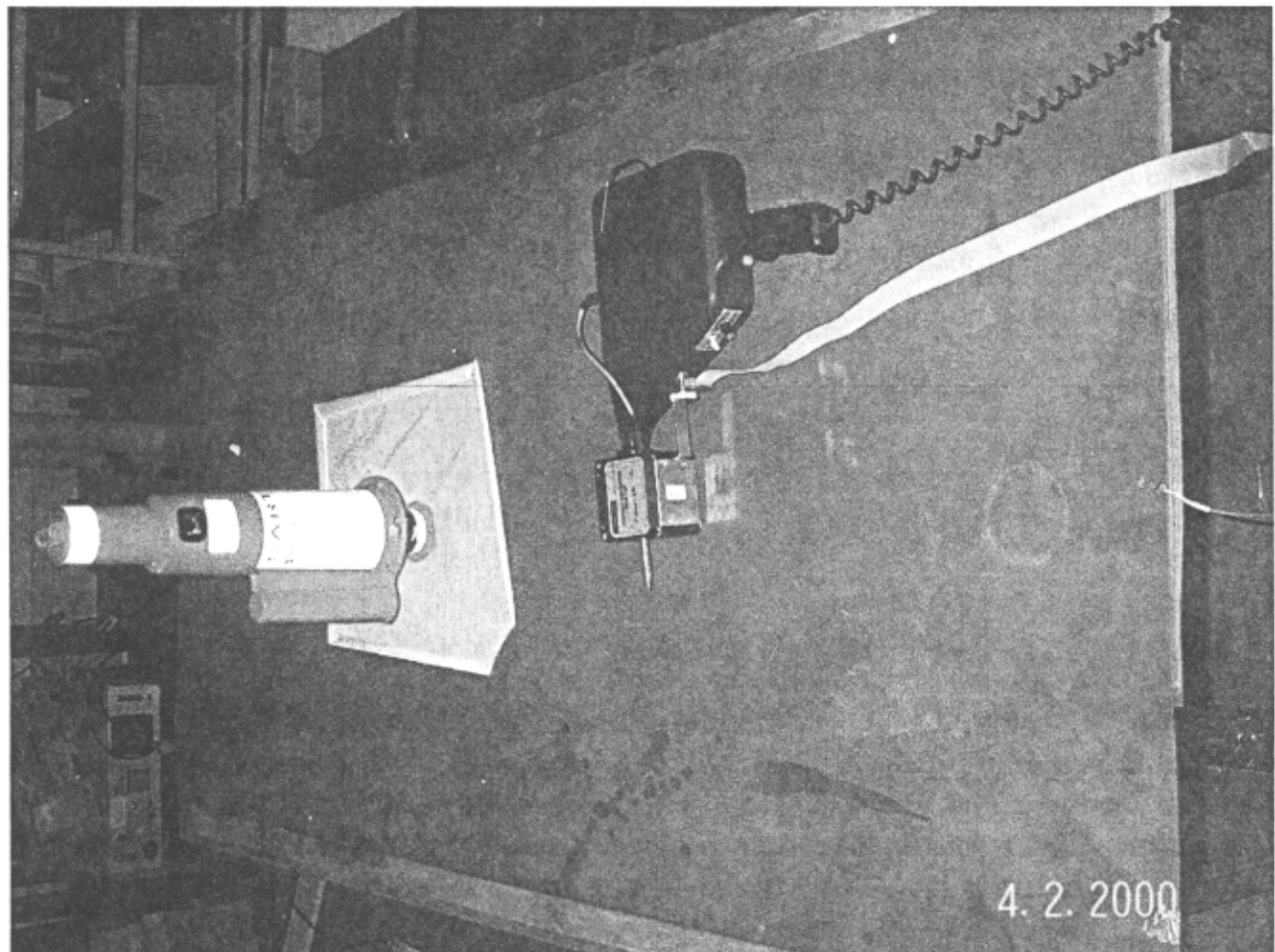
Photograph 3 View of Sart during Radiated RF V-Pol



Photograph 4 View of Sart during Radiated RF H-Pol



Photograph 7 View of SART during ESD Vertical Discharge testing



Photograph 8 View of SART during ESD Horizontal Discharge testing

APPENDIX D

Radiated Emissions Plots
Taken during testing of
HALLERIA TELLUSART MK11
to Clause 9.2 BS EN 60945:1997

(Consists of 6 pages)

Chase EMS 6.21

Notes

PASS

Analyse H-POL HALARIA TELLUSART MK11 TT24-99 12/01/00 30-300MHz

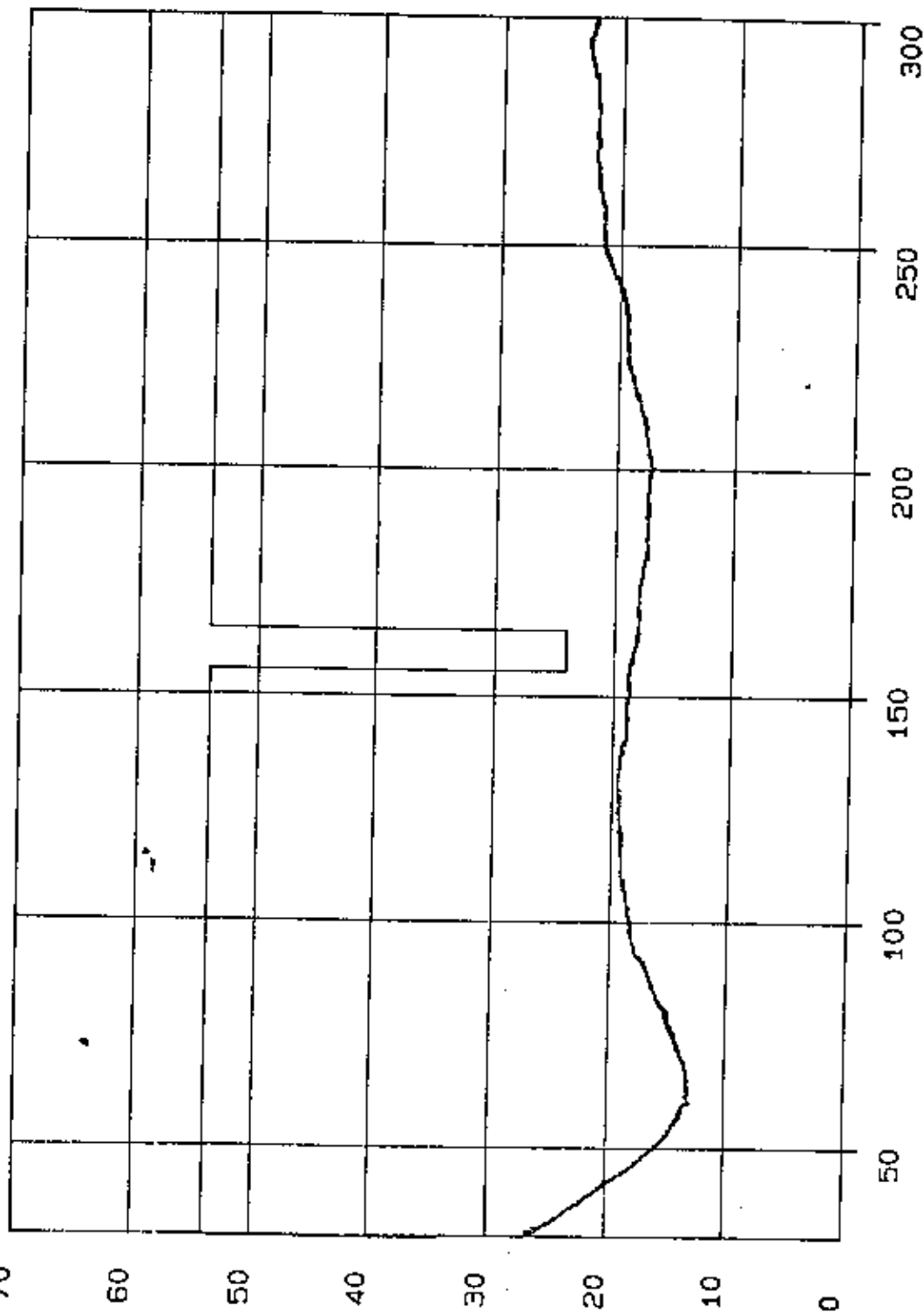
Test: 6. EN60945 120KHz B/W - 30MHz to 300MHz

RF level

dBuV/m

H-POL HALARI

CISPR



Lin Freq. (30 - 300) MHz

Limit EN60945 RADIATED Emission

Chase EMS 6.21

Notes

PASS, *JP* *11/20/99*

Analyse V-POL HALLERIA TELLUSART MK11 TT24-99 12/01/99

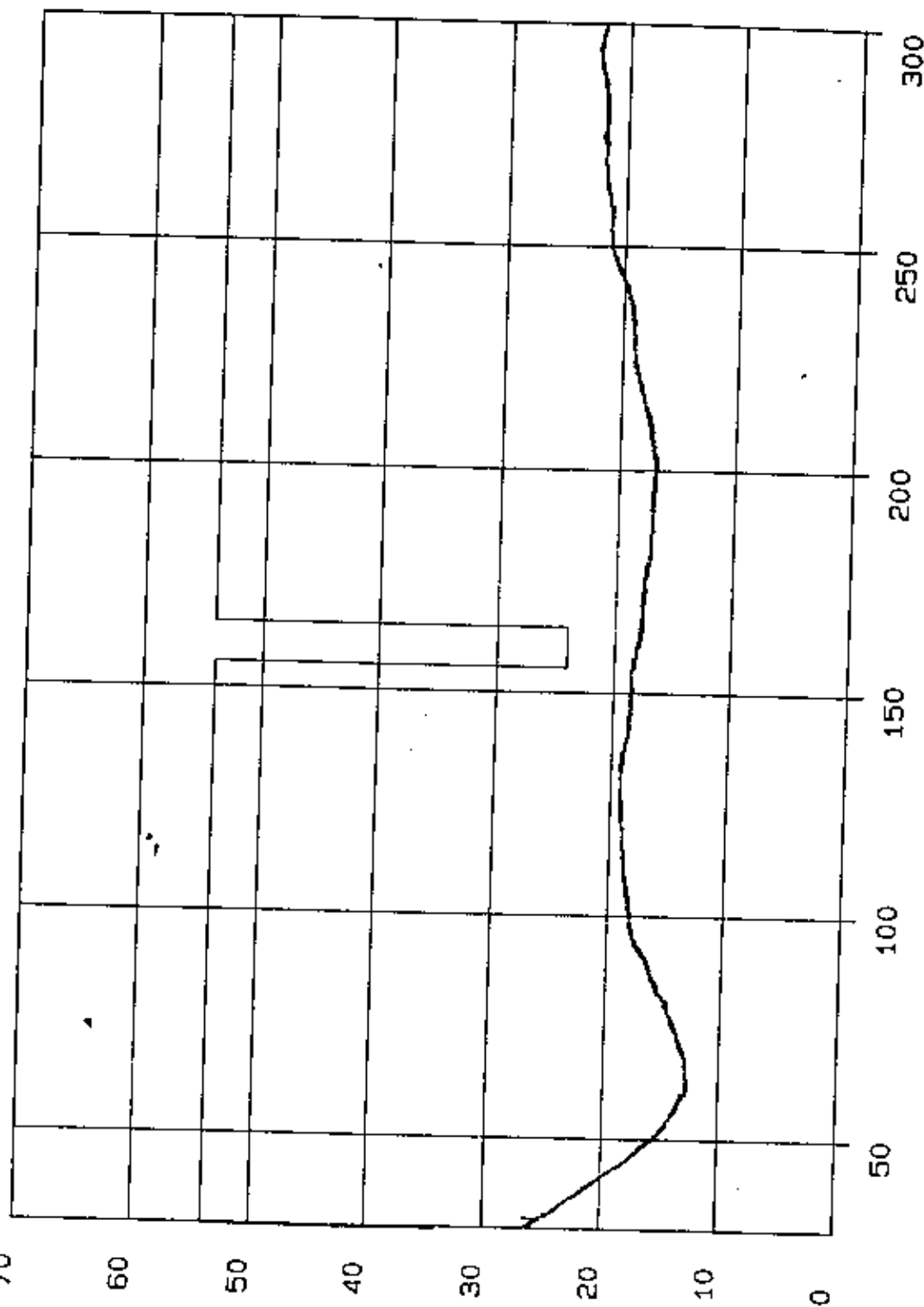
Test: 6. EN60945 120KHz B/W - 30MHz to 300MHz

RF level 70

dBuV/m

V-POL HALLER

CISPR



Lin Freq. (30 - 300) MHz

Limit EN60945 RADIATED Emission

Chase EMS 6.21

Notes

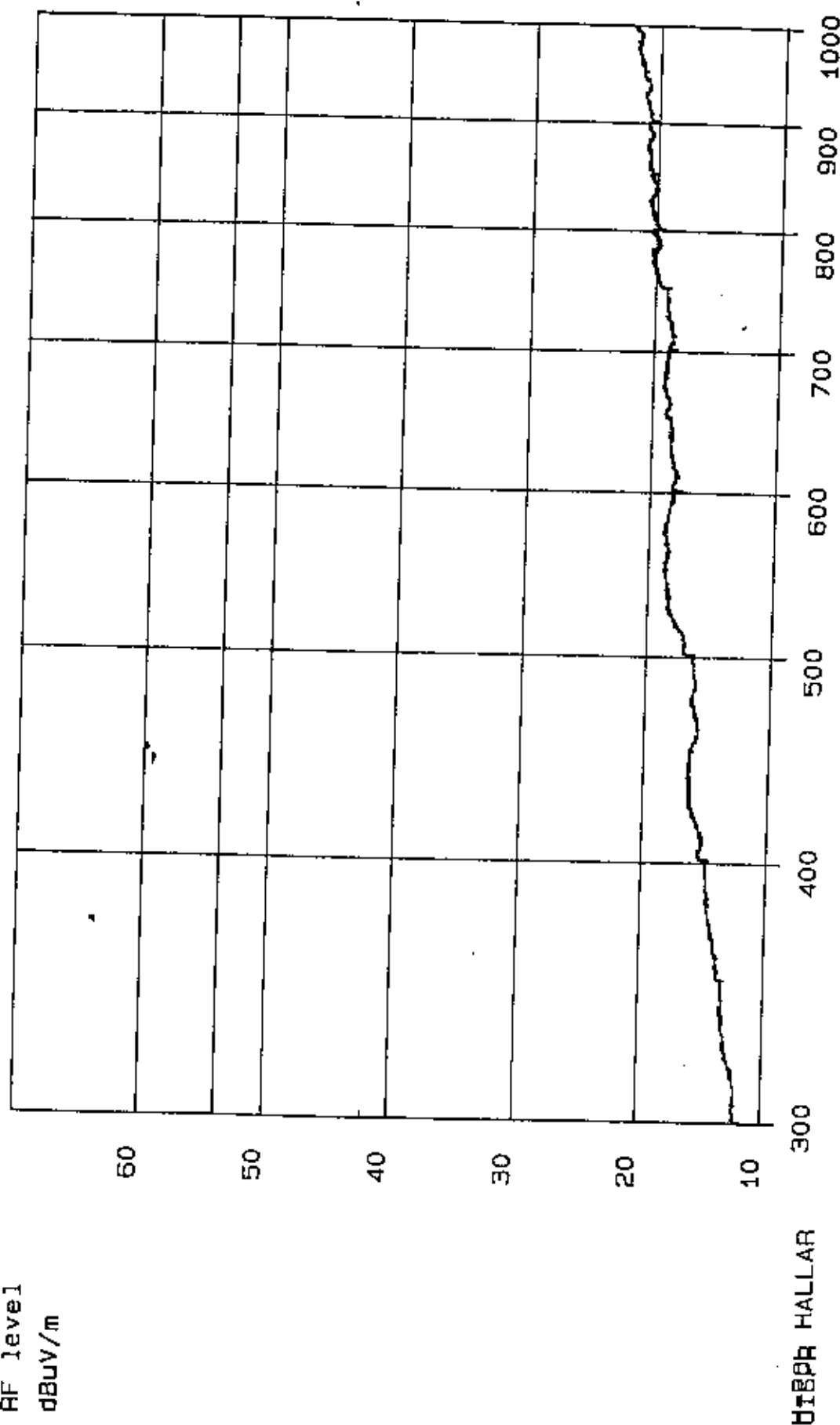
PASS *DP*

Analyse H-POL HALLARIA TELLUSART MK11 TT24-99 12-01-00 300-1GHz

Test: 7. EN60945 120kHz B/W - 300MHz to 1GHz

RF level

dBuV/m



Chase EMS 6.21

Notes

PASS - D. J. J. J.

Analyse HALLERIA TELLUSART MK111 TT24-99 12-99 300-1GHz V-POL

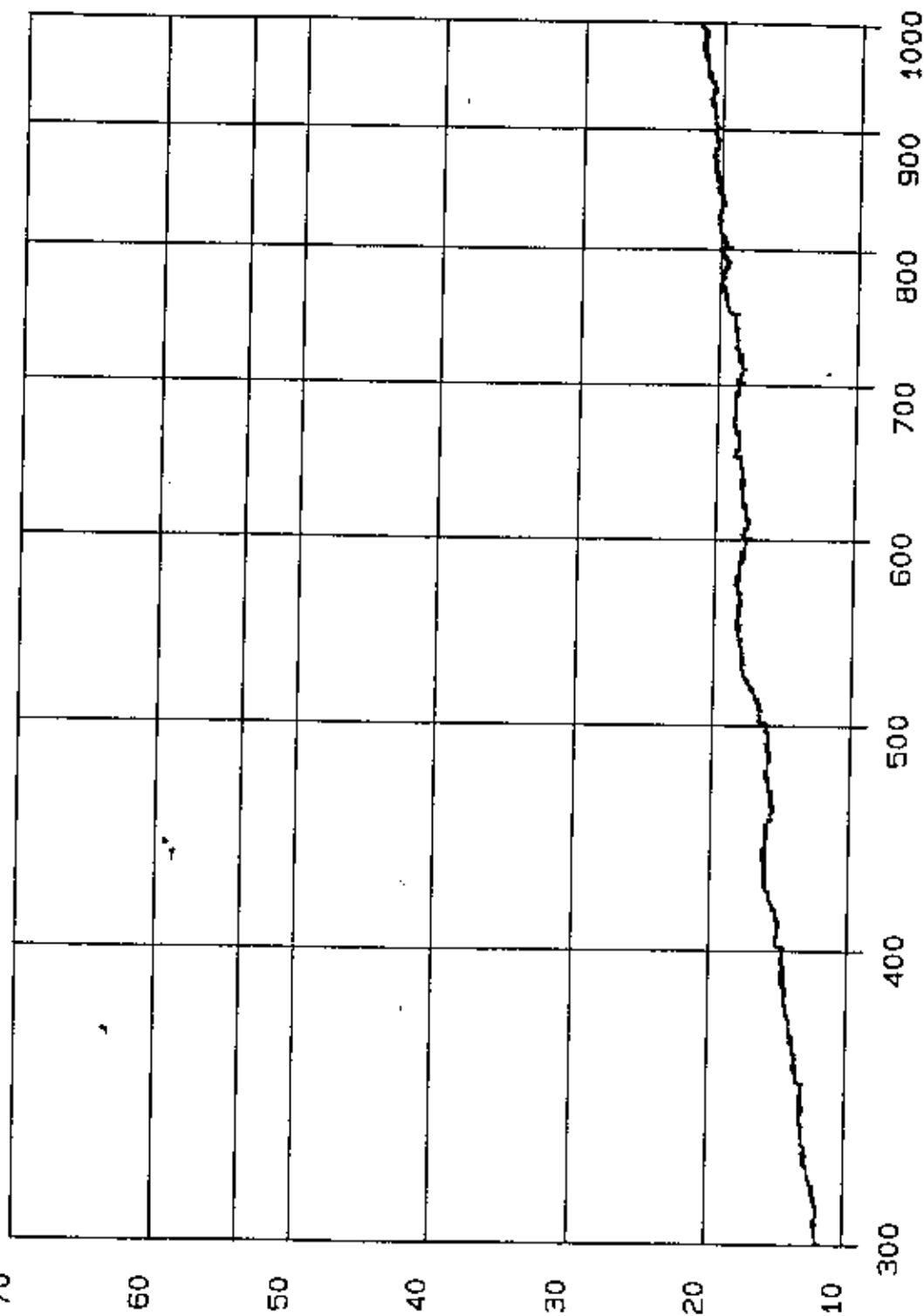
Test: 7. EN50945 120kHz B/W - 300MHz to 1GHz

RF level 70

dBuV/m

HALLERIA TE 60

CISPR

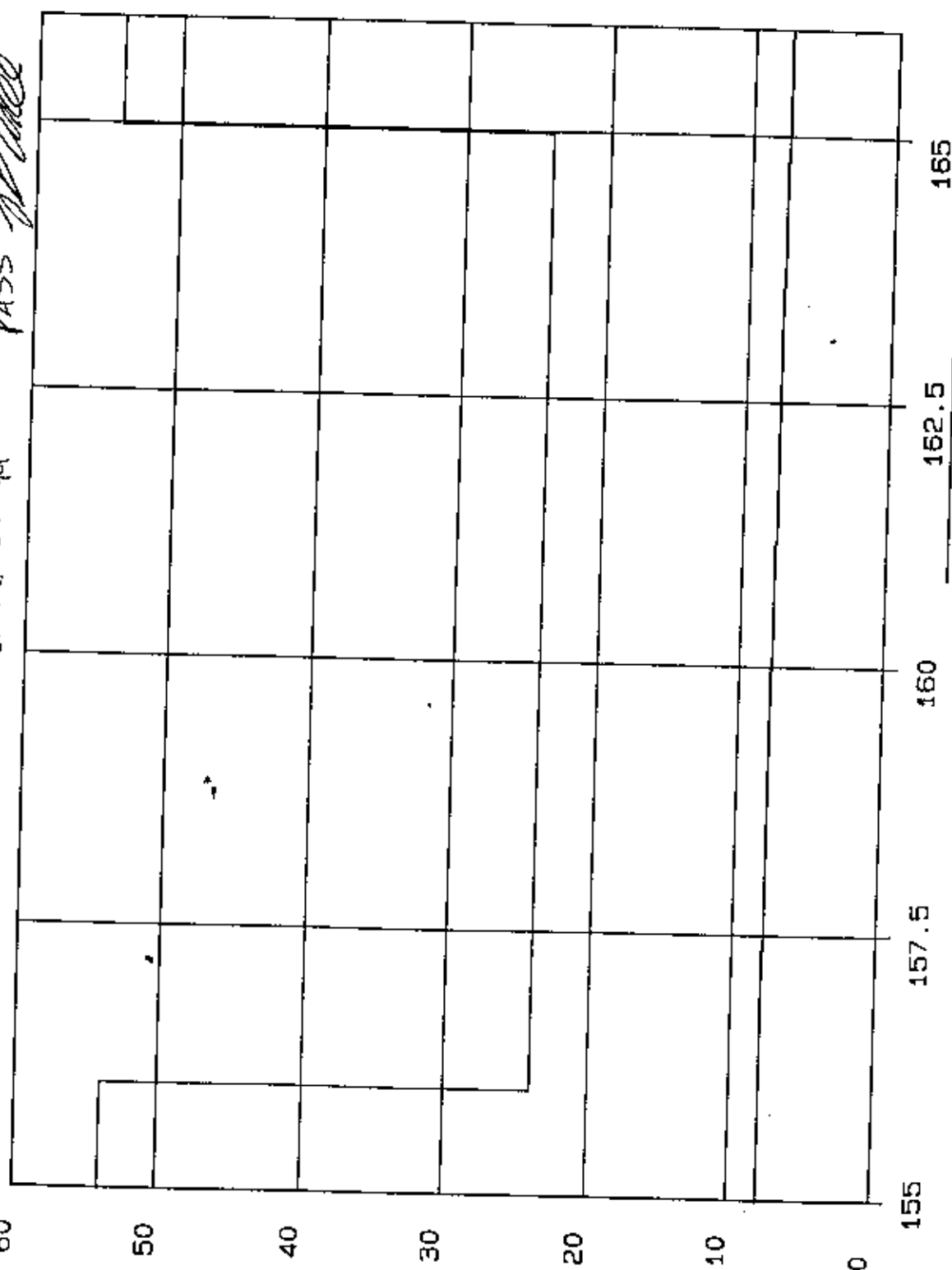


Log Freq. (0.3 - 1) GHz

Limit EN50945 RADIATED Emission

Chase EMS 6.21

Notes V-POL HALLERZIA TELCOSART MK II TT24-99
 Test: 5. EN60945 10kHz B/W - Marine Band (BiLog) 12-01-99 PASS *SP*



Radiated Emissions Plot 6 TT 24-99

Chase EMS 6.21

Notes

PASS

to wire

Analyse H-POL HALLERIA TELLUSSART MK11 TT24-99 MARINE 12/01/00

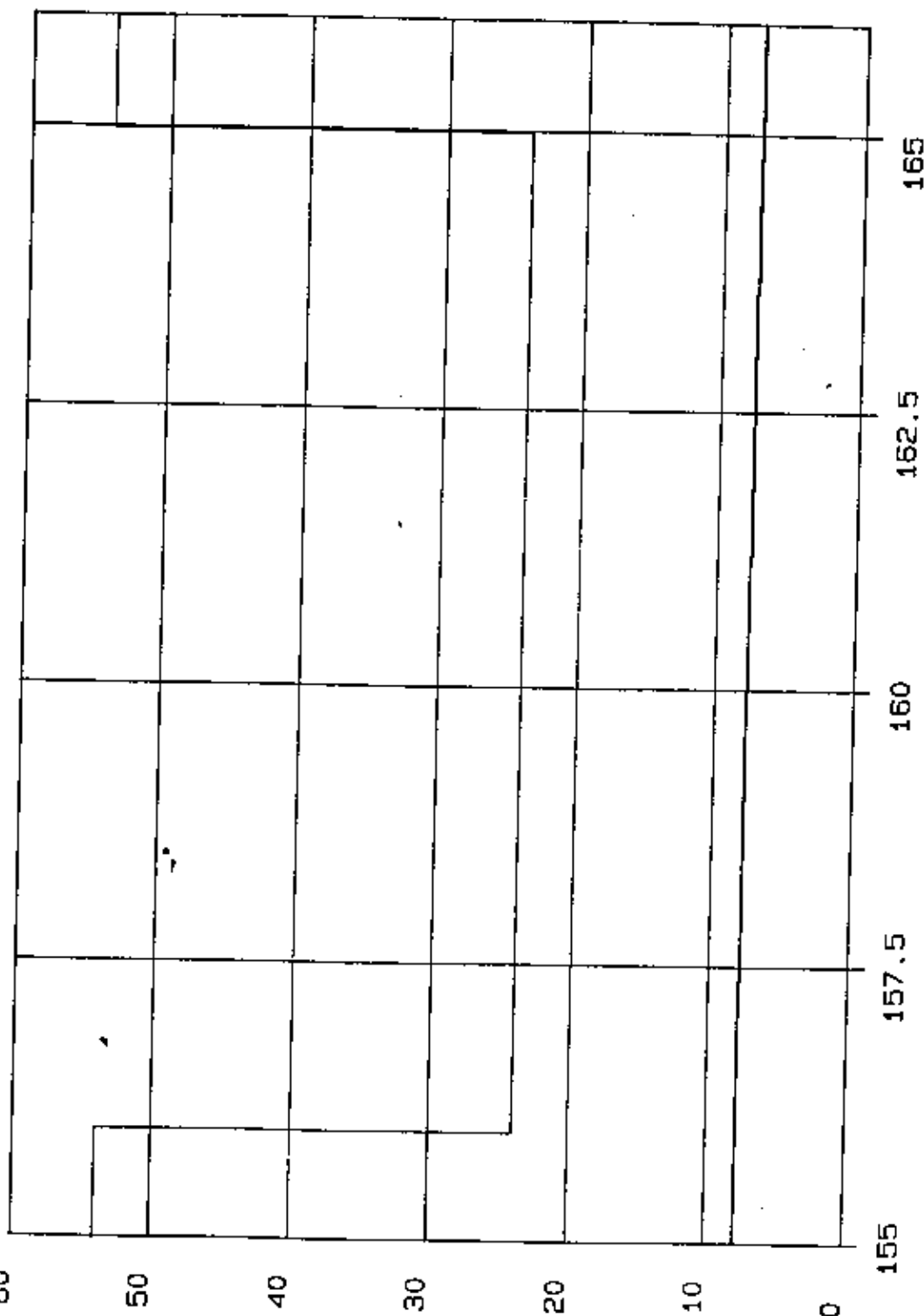
Test: 5. EN60945 10kHz B/W - Marine Band (BiLog)

RF level 50

dBuV/m

H-POL HALLER 50

CISPR



Lin Freq. (155 - 166) MHz

Limit EN60945 RADIATED Emission