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DERA

DEFENCE EVALUATION and RESEARCH AGENCY
FRASER
Fort Cumberland Road
Portsmouth
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UK Restricted - Commercial

Report on Type-Approval Testing

MARITIME MOBILE VHF PORTABLE TRANSCEIVER Navico Model AXIS 30

DERA/SSWI/CR/ TT-08/98-1.0

Cover + iii + 72 pages + Annexes

Issue 1.0 - Date: June 1998

Commissioned by:

Navico Ltd
Star Lane
Margate
Kent
CT9 4NP

NAMAS

TESTING
NO 1217

Authorisation

	Name	Signature	Date
Report Originator	R. Thompson		01/06/98
Reviewer	D. Parr		1st June 1998
Quality Officer	R. Rogers		1ST JUNE '98

Issued by

Maritime Navigation Systems
DERA Fraser
Fort Cumberland Road
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Distribution List

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Issue	Date	Details of Changes
1.0	June 1998	First Issue

TYPE APPROVAL TESTING

Table of Contents

Section 1

Introduction

Introduction

This report has been compiled at the request of the Customer, Navico Ltd, as the conclusion to a successful program of Type Approval Testing.

1.1

The Navigation Equipment Test Laboratory at DERA Fraser, Portsmouth, operates as an independent test laboratory equipped to conduct Type Approval and Prototype Testing on a variety of equipment including Marine Navigational and Safety Equipment and Radiocommunications Equipment. DERA Fraser has been accredited by the United Kingdom Accreditation Service (UKAS) for testing against a wide range of Performance Specifications.

1.2

The testing and inspection of the Navico AXIS 30 VHF Handheld Radio Transceiver was conducted to the environmental and electrical requirements of the following Specification:

ETS 300 225 April 1997	"Technical characteristics and methods of measurement for survival craft portable VHF radiotelephone apparatus."

The Test Laboratory is UKAS accredited to carry out all environmental and electrical aspects of the above Specification.

1.3

UKAS accreditation does not apply to opinions and interpretations. Where any test is not UKAS accredited it will be indicated "NUA" (Not UKAS Accredited).

1.4

A single sample of the AXIS 30, Serial Number TA01, was supplied by Navico Ltd. for Type Approval Testing. There was **no** ancillary equipment associated with the AXIS 30.

1.5

Testing of the AXIS 30 to the requirements of Specification ETS 300 225, was carried out over the period from 28th April 1998 to 27th May 1998. Detailed particulars of the observations and measurements carried out are given in the CEPT Report Form for Testing which is included in this report.

Please note that a Manufacturer's waiver was supplied by Navico Ltd. (See Annex E) in order to satisfy the requirements of clause 7.7 (Corrosion Test) and clause 7.10 (Solar Radiation Test), of ETS 300 225. These two clauses were not tested by the Test Laboratory.

Section 2

APPLICATION FORM
FOR TESTING
TO ETS 300 225

Radio Equipment and Systems;
Technical characteristics and methods of
measurement for survival craft portable
VHF radiotelephone apparatus

APPLICANT'S DETAILS

CATEGORY OF APPLICANT (please tick relevant box opposite)

(a) [✓]MANUFACTURER

If box (b), (c) or (d) is ticked complete details in box below with respect to the manufacturer.

(b) [...] IMPORTER

(c) [...] DISTRIBUTOR

(d) [...] AGENT

COMPANY NAME: **Navico Ltd.**

ADDRESS: **Star Lane, Margate Kent, CT9 4NP.**

NAME FOR CONTACT PURPOSES: **Alan Wrigley**

TELEPHONE NUMBER: **01843 290 290**

FAX NUMBER: **01843 290 471**

TELEX NUMBER: **N/A**

MANUFACTURER'S DETAILS

COMPANY NAME: **AS ABOVE**

ADDRESS:

NAME FOR CONTACT PURPOSES

TELEPHONE NUMBER:

FAX NUMBER:

TELEX NUMBER:

TYPE DESIGNATION (1)

The type designation may be either a single alphanumeric code or an alphanumeric code divided into two parts

Please fill in

EITHER:

TYPE DESIGNATION AS A SINGLE ALPHANUMERIC CODE: .....

OR:

TYPE DESIGNATION IN TWO PARTS: .....

	1. EQUIPMENT SERIES NO. (2) ("MODEL NUMBER")	**AXIS 30** .....
AND	2. EQUIPMENT SPECIFIC NO. (3) ("IDENTIFICATION NO.")	**TA01** .....

(1) This is the manufacturer's numeric or alphanumeric code or name that is specific to a particular equipment. It may contain information in coded form on the characteristics of the equipment e.g. frequency, power. The manufacturer is free to choose the form of the type designation.

(2) This is the number, code or trade name used by the manufacturer to describe a series or 'family' of equipment of substantially the same mechanical and electrical construction which will include a number of related equipments. This number is often referred to as the "model number".

(3) This is the manufacturer's identification number given to a specific equipment in the series or 'family' of equipments. It is often referred to as the "identification number".

TYPE APPROVAL TO OTHER ETS

Has the equipment been previously type approved to other ETS?

[...] Yes ETS N^{O}

[✓] No

Give details of previous type approvals to the equipment:

N/A

TYPE OF EQUIPMENT	
Transmitter	[...]
Transmitter/Receiver	[✓]
Receiver	[...]
Simplex on single-frequency channel	[✓]
Simplex on two-frequency channel	[...]
Duplex	[...]
Integrated DSC unit	[...]
Integrated analog selective calling decoder	[...]
INTERFACES	
DSC at Audio Level	[...]
DSC at DC Level	[...]
Printer	[...]
External Loudspeaker	[...]
Remote Control	[...]
DSC Watchkeeping Receiver Antenna Output	[...]
DSC Watchkeeping Receiver Control	[...]

DUPLEX OPERATION

Is the equipment intended for Duplex Operation?;

[...] Yes

[✓] No

Is the equipment fitted with separate transmitter and receiver antenna sockets?

[...] Yes

[✓] No

Is the equipment fitted with a duplex filter as an integral part of the equipment with a single antenna connection socket?

[...] Yes

[✓] No

Is the duplex filter externally fitted and connected to the main equipment by co-axial cable(s)? N/A

[...] Yes

[...] No

Type and make of duplex filter:

N/A

TRANSMITTER AND RECEIVER CHARACTERISTICS

NUMBER OF CHANNELS:

[✓] ITU channels: **3**

[...] USA channels:

[...] PRIVATE channels:

[...] WEATHER channels:
(Rx only)

[...] MEMORY channels:

DSC CHANNEL(S) (if provided): **N/A**

[...] 70

[...] other:

CHANNEL SEPARATION: **25** kHz ..... kHz ..... kHz

ITU designation of class of emission(s):

1	**6**	**K**	**O**	**G**	**3**	**E**	**J**	**N**

ANTENNA IMPEDANCE **50 Ω** Unbalanced

TRANSMITTER TECHNICAL CHARACTERISTICS

TRANSMITTER FREQUENCY

Method of frequency generation:

[...] CRYSTAL

[✓] SYNTHESIZER

[...] OTHER:

Transmitter frequency bands:

156.3 to **156.85** MHz

TRANSMITTER MODULATION

Modulation Method:	**Variable**	**Reactance**
Occupied Bandwidth:	**16**	kHz
Maximum Frequency Deviation:	**5**	kHz

TRANSMITTER MODULATION INPUT CHARACTERISTICS

Microphone Impedance: 600 Ω [...] Balanced

[✓] Unbalanced

TRANSMITTER RF POWER CHARACTERISTICS

RATED TRANSMITTER EFFECTIVE RADIATED OUTPUT POWER (as stated by the manufacturer)

Maximum Output Power: 0.5 W

Reduced Output Power: N/A

Output Power Switch: [...] YES

[✓] NO

TRANSMITTER POWER SOURCE (1)

[...] AC Mains ..... (state voltage) [...] single phase

[...] three phase

..... AC Mains Frequency (Hz)

[✓] DC Voltage: **10.0 Volts**

[✓] DC Maximum Current: **0.360 A**

[...] Other:

BATTERY

[...] Nickel Cadmium

[...] Mercury

[...] Alkaline

[...] Lead Acid (Vehicle regulated)

[...] Leclanché

[✓] Lithium

[...] other: .....

8 Volts End point voltage as quoted by equipment manufacturer

(1) If a transmitter and receiver use the same power source, this should be declared. In such cases the box for the transmitter power source should be filled in.

RECEIVER TECHNICAL CHARACTERISTICS

RECEIVER FREQUENCY

Method of frequency generation:

[...] CRYSTAL

[✓] SYNTHESIZER

[...] Other: .....

Intermediate frequencies::

[✓] 1st **21.4** MHz

[✓] 2nd **455** kHz

[...] 3rd ..... kHz

Receiver frequency bands:

156.3 **to** **156.85** MHz

Is local oscillator injection frequency higher or lower than the receiver nominal frequency?

[...] Higher (for channel .... to ....)

[✓] Lower (for **ALL** channel)

RECEIVER MODULATION OUTPUT CHARACTERISTICS

RATED AUDIO OUTPUT POWER (as stated by the manufacturer)

Loudspeaker: **0.4** W **32** Ω

RECEIVER MULTIPLE WATCH FACILITIES

Dual watch facilities: [...] YES

[✓] NO

If YES then:

Selection of priority channel possible? [...] YES

[...] NO (=ch.....)

Multiple watch facilities: [...] YES

[✓] NO

If YES then:

Selection of priority channel possible? [...] YES

[...] NO (=chan.....)

Number of additional channels selectable: .....

Scan time programmable?: [...] YES

[...] NO

RECEIVER POWER SOURCE (1)

[...] AC Mains ..... (state voltage) [...] single phase

[...] three phase

..... AC Mains Frequency (Hz)

[✓] DC Voltage: **10.0 Volts**

[✓] DC Maximum Current: **0.360 A**

[...] Other

BATTERY

[...] Nickel Cadmium

[...] Mercury

[...] Alkaline

[...] Lead Acid (Vehicle regulated)

[...] Leclanché

[✓] Lithium

[...] other: .....

8 Volts End point voltage as quoted by equipment manufacturer

(1) If a transmitter and receiver use the same power source, this should be declared. In such cases the box for the transmitter power source should be filled in.

CONSTRUCTION OF EQUIPMENT	
[✓]	Single unit (1)
[...]	Multiple units
If multiple units, describe each one clearly:	

EXTREME TEMPERATURE RANGE OVER WHICH EQUIPMENT IS TO BE TESTED	
[✓]	-20 °C to +55 °C
[...]	-15 °C to +55 °C
[...]	Other: .....

(1) Unit means a physically separate item of the equipment.

OTHER ITEMS SUPPLIED

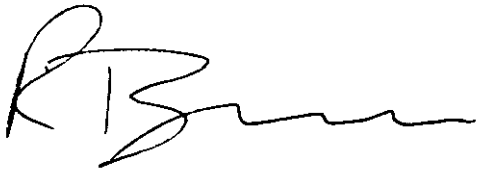
Spare batteries	[✓] Yes
	[...] No
Battery charging device	[...] Yes
	[✓] No
Special tools for dismantling equipment	[...] Yes
	[✓] No
Test interface box (if applicable)	[✓] Yes
	[...] No
Full documentation on equipment (Handbook and circuit diagrams)	[✓] Yes
	[...] No
Others	[...] Yes
	[✓] No
	If YES, please specify :

DECLARATION

Are the equipments submitted representative production models?	[...] Yes
	[✓] No
If not are the equipments pre-production models?	[✓] Yes
	[...] No
If pre-production equipments are submitted will the final production equipments be identical in <u>all</u> respects with the equipment tested?	[✓] Yes
	[...]No

If no supply full details:

I hereby declare that I am entitled to sign on behalf of the applicant and that the information is correct and complete.

Signature: 

Name: **Richard Thompson**

Position held: **Test Engineer**

Date: **29/05/98**

Section 3

General Requirements

CONSTRUCTION

CLAUSE 4.1

	Satisfactory: Yes	No
■ Design	Yes	
■ Design and number of controls	Yes	
■ The equipment shall comprise at least:		
→ an integral transmitter/receiver including antenna and battery;	Yes	
→ an integral control unit including a press-to -transmit switch;	Yes	
→ an internal microphone and loudspeaker	Yes	
■ Equipment shall be either, highly visible yellow or orange in colour	Yes	
■ Suitable for use on board ships and survival craft	Yes	
■ Accessibility	Yes	
■ Easy Identification of components	Yes	
■ Documentation	Yes	
■ Method of attaching the equipment to the user's clothing (SOLAS 1974 Chapter III)	Yes	
■ Equipment shall be of small size and lightweight	Yes	

FREQUENCIES AND POWER

CLAUSE 4.2

	Satisfactory: Yes	No
■ Capable of operating on:		
→ Single-frequency channels with manual control (Simplex)	Yes	
→ Two-frequency channels with manual control (Simplex)	N/A	N/A
→ Two-frequency channels without manual control (Duplex)	N/A	N/A
■ Operation on channel 16and at least one other channel (Appendix 18 of the R.R.)	Yes	
■ Independent selection of transmitting and receiving frequencies shall not be possible	Yes	
■ Operational within 5 seconds after switching on	Yes	
■ Meets the requirements within 1 minute	Yes	
■ Transmission inhibited during channel switching operations	Yes	

CONTROLS

CLAUSE 4.3

Satisfactory:	
Yes	No

■ Channel Selector	
→ Channel designator as in Appendix 18 of the R.R.	Yes
→ Channel designator legible irrespective of the external lighting conditions	Yes

■ Marking of channel 16	Yes
→ Marking of channel 70	N/A N/A

■ Selection of channel 16	Yes
→ Selection of channel 70	N/A N/A

■ Mandatory controls and indicators	
→ On/off switch for the entire installation with a visual indication	Yes
→ A manual non-locking push-to -talk switch	Yes
→ A switch for reducing the transmitter output power to no more than 1 Watt	Yes
→ A volume control to adjust the AF output power	Yes
→ A squelch control	Yes
→ A transmit carrier indication	Yes

■ Compliance with the following:	
→ Inaccessibility of non-operational controls	Yes

SWITCHING TIMES

CLAUSE 4.4

■ Channel switching time - limit ≤ 5 seconds	Compliant
■ Time to change from:	
➔ Tx to Rx condition - limit ≤ 0.3 seconds	Compliant
➔ Rx to Tx condition - limit ≤ 0.3 seconds	Compliant

SAFETY PRECAUTIONS

CLAUSE 4.5

	Satisfactory: Yes	No
■ Protection against damage due to reversal of polarity of the battery	Yes	
■ Equipment free of sharp projections	Yes	
■ Declaration of Compass safe distance	Yes	
■ Protection against damage due to open circuit or short-circuited antenna terminals	Yes	

CLASS OF EMISSION AND MODULATION CHARACTERISTICS

CLAUSE 4.6

	Satisfactory: Yes	No
■ Class of emission G3E for speech	Yes	
■ 25 kHz channel spacing	Yes	
■ Frequency deviation ± 5 kHz for 100 % modulation	Yes	

BATTERY

CLAUSE 4.7

	Satisfactory: Yes	No
■ The battery shall be integrated in the equipment	Yes	
■ Capacity of the battery sufficient for at least 8 hours of continuous operation - at any temperature with a 1:9 transmit to receive ratio.	Yes	
■ Batteries easily replaced without the need for special tools and without any subsequent performance degradation	Yes	
■ Battery shelf life of at least 2 years	Yes	

LABELLING

CLAUSE 4.8

	Satisfactory: Yes	No
■ Labelling of Controls and indicators	Yes	
■ Instructions for operation	Yes	
■ Exterior of equipment marked with:		
→ Manufacturer identification	Yes	
→ Type Designation	Yes	
→ Serial Number	Yes	
■ Compass safety distance	Yes	
■ Labelling of Type and Designation of battery	Yes	
■ Labelling of the expiry date of any primary battery	Yes	

Section 4

CEPT Report form for Testing to ETS 300 225

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Report form for testing to ETS 300 225

Radio Equipment and Systems;
Technical characteristics and methods of measurement for survival craft portable VHF radiotelephone apparatus

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

LIST OF MEASUREMENTS

The list of measured or checked parameters called for in ETS 300 225 are given below:

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

For results in this Test Report which are not derived from objective measurements the Test Laboratory is expressing an opinion only.
This refers to all subjective judgement testing where a Yes or No answer is given to a specific feature or test.
Under no circumstances does the Test Laboratory accept any liability for consequent damages resulting from the expression of this opinion.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient Temperature: 16.0 °C

Relative Humidity: 43.2 %

ENVIRONMENTAL TESTS: DROP TEST

PERFORMANCE CHECKS

CLAUSE 7.4

MARINE PORTABLE VHF RADIO EQUIPMENT

Channel	Transmitter Output Power Referenced to ERP (W)	Transmitter Frequency Error (Hz)	Receiver Maximum Usable Sensitivity (dBμV emf)
16	0.541	-87	-6.0
Measurement Uncertainty	0.75 dB	5×10^{-8} ppm	2.5 dB
Limit	Between 0.25W and 1 W	± 1500	+ 6

TEST EQUIPMENT USED:

01, 04, 06, 25, 26 & 34.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient Temperature: 16.0 °C

Relative Humidity: 43.2 %

ENVIRONMENTAL TESTS: DROP TEST

PERFORMANCE CHECK: VISUAL INSPECTION

CLAUSE 7.4

MARINE PORTABLE VHF RADIO EQUIPMENT

Visible damage or deterioration: [ ] YES

[✓] NO

Observations: None.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient Temperature: 16.1 °C (Z-Plane 17.1 °C) Relative Humidity: 43.6 % (48.0 %)

ENVIRONMENTAL TESTS: VIBRATION

PERFORMANCE CHECKS **CLAUSE 7.5**

MARINE PORTABLE VHF RADIO EQUIPMENT

Equipment suspended: [ ] YES

[✓] NO

If YES, state the precise test conditions:

Channel	Vibration Direction	Endurance Frequency (Hz)	Transmitter Output Power Referenced to ERP (W)	Transmitter Frequency Error (Hz)	Receiver Maximum Usable Sensitivity (dBμV emf)
16	X	30			
			0.522	-6	-6.6
			(0.522*)	(-35*)	(-6.3*)
	Y	30			
			0.526	-34	-6.4
			(0.522*)	(-57*)	(-6.2*)
	Z	30			
			0.530	+54	-6.7
			(0.534*)	(+81*)	(-6.9*)
Measurement Uncertainty			**0.75 dB**	**5 x 10^{-8}ppm**	**2.5 dB**
Limit			**Between 0.25W and 1 W**	**± 1500**	**+ 6**

(* = Post Vibration Performance Checks)

X, Y = Mutual perpendicular directions in the horizontal plane
Z = Vertical direction

TEST EQUIPMENT USED:

01, 04, 06, 25, 26, 34 & 42.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient Temperature: 16.1 °C

Relative Humidity: 43.6 %

ENVIRONMENTAL TESTS: VIBRATION

CLAUSE 7.5

PERFORMANCE CHECK: VISUAL INSPECTION

MARINE PORTABLE VHF RADIO EQUIPMENT

Visible damage or deterioration: [ ] YES

[✓] NO

Observations: None.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient Temperature: 16.1 °C

Relative Humidity: 43.6 %

ENVIRONMENTAL TESTS: VIBRATION

CLAUSE 7.5

RESONANCE FREQUENCIES

MARINE PORTABLE VHF RADIO EQUIPMENT

Equipment suspended: [ ] YES

[✓] NO

If YES, state the precise test conditions:

Found during performance check: All resonance frequencies observed had a Q factor ≤ 5.

Vibration Direction	Resonance Frequencies (Hz)				
X	-	-	-	-	-
Y	-	-	-	-	-
Z	-	-	-	-	-

X, Y = Mutual perpendicular directions in the horizontal plane
Z = Vertical direction

TEST EQUIPMENT USED:

01, 04, 06, 25, 26, 34 & 42.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient Temperature: 19.0 °C

Relative Humidity: 34.9 %

ENVIRONMENTAL TESTS: DRY HEAT CYCLE

PERFORMANCE CHECKS

CLAUSE 7.6.2

MARINE PORTABLE VHF RADIO EQUIPMENT

Test Temperature: [...] For internally mounted equipment

[✓] For externally mounted/portable equipment

Channel	Transmitter Output Power Referenced to ERP (W)	Transmitter Frequency Error (Hz)	Receiver Maximum Usable Sensitivity (dBμV emf)
16	0.488	-152	-2.8
Measurement Uncertainty	**0.75 dB**	**5×10^{-8}ppm**	**2.5 dB**
Limit	**Between 0.25W and 1 W**	**± 1500**	**+ 6**

TEST EQUIPMENT USED:

01, 04, 06, 24, 25, 26, 31, 32 & 34.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient Temperature: 19.0 °C

Relative Humidity: 34.9 %

ENVIRONMENTAL TESTS: DRY HEAT CYCLE

PERFORMANCE CHECK: VISUAL INSPECTION

CLAUSE 7.6.2

MARINE PORTABLE VHF RADIO EQUIPMENT

Visible damage or deterioration: [ ] YES

[✓] NO

Observations: None.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient Temperature: 22.5 °C Relative Humidity: 31.4 %

ENVIRONMENTAL TESTS: DAMP HEAT CYCLE

PERFORMANCE CHECKS **CLAUSE 7.6.3**

MARINE PORTABLE VHF RADIO EQUIPMENT

Test Temperature: [...] For internally mounted equipment

[✓] For externally mounted/portable equipment

Channel	Transmitter Output Power Referenced to ERP (W)	Transmitter Frequency Error (Hz)	Receiver Maximum Usable Sensitivity (dBμV emf)
16	0.495	-368	-3.4
Measurement Uncertainty	**0.75 dB**	**5×10^{-8}ppm**	**2.5 dB**
Limit	**Between 0.25W and 1 W**	**± 1500**	**+ 6**

TEST EQUIPMENT USED:

01, 04, 06, 24, 25, 26, 31, 32 & 34.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient Temperature: 22.5 °C

Relative Humidity: 31.4 %

ENVIRONMENTAL TESTS: DAMP HEAT CYCLE

CLAUSE 7.6.3

PERFORMANCE CHECK: VISUAL INSPECTION

MARINE PORTABLE VHF RADIO EQUIPMENT

Visible damage or deterioration: [ ] YES

[✓] NO

Observations: None.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient Temperature: 20.5 °C

Relative Humidity: 36.9 %

ENVIRONMENTAL TESTS: LOW TEMPERATURE CYCLE

CLAUSE 7.6.4

PERFORMANCE CHECKS

MARINE PORTABLE VHF RADIO EQUIPMENT

Test Temperature: [...] For internally mounted equipment

[✓] For externally mounted/portable equipment

Channel	Transmitter Output Power Referenced to ERP (W)	Transmitter Frequency Error (Hz)	Receiver Maximum Usable Sensitivity (dBμV emf)
16	0.284	-561	-3.1
Measurement Uncertainty	**0.75 dB**	**5×10^{-8}ppm**	**2.5 dB**
Limit	**Between 0.25W and 1 W**	**± 1500**	**+ 6**

TEST EQUIPMENT USED:

01, 04, 06, 24, 25, 26, 31, 32 & 34.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient Temperature: 20.5 °C

Relative Humidity: 36.9 %

ENVIRONMENTAL TESTS: LOW TEMPERATURE CYCLE

PERFORMANCE CHECK: VISUAL INSPECTION

CLAUSE 7.6.4

MARINE PORTABLE VHF RADIO EQUIPMENT

Visible damage or deterioration: [ ] YES

[✓] NO

Observations: None.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient Temperature: 20.7 °C

Relative Humidity: 38.1 %

ENVIRONMENTAL TESTS: IMMERSION TEST

PERFORMANCE CHECKS

CLAUSE 7.8

MARINE PORTABLE VHF RADIO EQUIPMENT

Channel	Transmitter Output Power Referenced to ERP (W)	Transmitter Frequency Error (Hz)	Receiver Maximum Usable Sensitivity (dBμV emf)
16	0.518	-32	-5.8
Measurement Uncertainty	**0.75 dB**	**5×10^{-8} ppm**	**2.5 dB**
Limit	**Between 0.25W and 1 W**	**± 1500**	**+ 6**

TEST EQUIPMENT USED:

01, 04, 06, 25, 26, 31 & 34.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient Temperature: 20.7 °C

Relative Humidity: 38.1 %

ENVIRONMENTAL TESTS: IMMERSION TEST

PERFORMANCE CHECK: VISUAL INSPECTION **CLAUSE 7.8**

MARINE PORTABLE VHF RADIO EQUIPMENT

Water ingress: [ ] YES

[✓] NO

Observations: None.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient Temperature: 21.1 °C

Relative Humidity: 39.4 %

ENVIRONMENTAL TESTS: THERMAL SHOCK

CLAUSE 7.9

PERFORMANCE CHECKS

MARINE PORTABLE VHF RADIO EQUIPMENT

Channel	Transmitter Output Power Referenced to ERP (W)	Transmitter Frequency Error (Hz)	Receiver Maximum Usable Sensitivity (dBμV emf)
16	0.503	-82	-6.3
Measurement Uncertainty	**0.75 dB**	**5×10^{-8} ppm**	**2.5 dB**
Limit	**Between 0.25W and 1 W**	**± 1500**	**+ 6**

TEST EQUIPMENT USED:

01, 04, 06, 24, 25, 26, 31 & 34.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient Temperature: 21.1 °C

Relative Humidity: 39.4 %

ENVIRONMENTAL TESTS: THERMAL SHOCK

PERFORMANCE CHECK: VISUAL INSPECTION

CLAUSE 7.9

MARINE PORTABLE VHF RADIO EQUIPMENT

Water ingress: [ ] YES

[✓] NO

Observations: None.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient Temperature: 21.3 °C

Relative Humidity: 34.1 %

ENVIRONMENTAL TESTS: OIL RESISTANCE

PERFORMANCE CHECK: VISUAL INSPECTION

CLAUSE 7.11

MARINE PORTABLE VHF RADIO EQUIPMENT

Visible damage or deterioration: [ ] YES

[✓] NO

Observations: None.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient temperature: 14.5 °C Relative humidity: 67.2 %

TRANSMITTER TESTING

EFFECTIVE RADIATED POWER (ERP) **CLAUSE 8.1**

Channel	EFFECTIVE RADIATED POWER (ERP)	
	dBm	W
17	27.28	0.534
Measurement uncertainty	4 dB	
Limits	Between 0.25 W and 1 W	

TEST EQUIPMENT USED:

02, 03, 10, 17, 21, 25, 46, 47 & 52.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient temperature: 14.5 °C Relative humidity: 67.2 %

TRANSMITTER TESTING

SPURIOUS EMISSIONS (RADIATED) **CLAUSE 8.2**

FREQUENCY (MHz)	LEVEL OF SPURIOUS EMISSION (dBm) channel 16
313.699793	- 38.09
627.39996	- 44.25
784.24950	- 49.00
1254.79930	- 44.37
Measurement uncertainty	4 dB
Limit	30 MHz to 1 GHz: ≤ 0.25 μW (-36 dBm) 1 GHz to 2 GHz: ≤ 1 μW (-30 dBm)

TEST EQUIPMENT USED:

02, 03, 10, 17, 21, 22, 23, 25, 46 & 47.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient temperature: 14.5 °C Relative humidity: 67.2 %

RECEIVER TESTING

SPURIOUS EMISSIONS (RADIATED) **CLAUSE 8.3**

FREQUENCY (MHz)	LEVEL OF SPURIOUS EMISSION (dBm)
	channel
	16
541.7998	- 72.702
677.2497	- 80.35
948.1497	- 68.54
Measurement uncertainty	4 dB
Limit	30 MHz to 1 GHz: ≤ 2 nW (-57 dBm)

TEST EQUIPMENT USED:

02, 03, 10, 17, 21, 22, 23, 25, 46 & 47.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient temperature: 22.1 °C Relative humidity: 47.0 %

TRANSMITTER TESTING

FREQUENCY ERROR **CLAUSE 9.1**

TEST CONDITIONS		FREQUENCY ERROR (Hz)	
		channel 16	channel 6
Temperature	Voltage		
T_{nom} (22.1 °C)	V_{nom} (10.0 V)	+119	+112
T_{min} (-20 °C)	V_{min} (8.61 V)	-530	N/A
	V_{max} (12.69 V)	-520	N/A
T_{max} (+55°C)	V_{min} (8.61 V)	-204	N/A
	V_{max} (12.69 V)	-190	N/A
Measurement uncertainty		5×10^{-8} ppm	
Limits		± 1500 Hz	

(N/A - See subclause 9.1.2)

TEST EQUIPMENT USED:

01, 06, 14, 24, 25, 26, 31, 32 & 34.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient temperature: 22.4 °C Relative humidity: 46.5 %

TRANSMITTER TESTING

CARRIER POWER REFERENCED TO ERP

CLAUSE 9.2

Rated output power: 0.5 Watts (ERP)

TEST CONDITIONS		CARRIER POWER (W)		
		channel 16	channel 17	channel 6
Temperature	Voltage			
T_{nom} (22.4 °C)	V_{nom} (10.0 V)	0.495	0.495	0.495
T_{min} (-20°C)	V_{min} (8.61 V)	0.399	N/A	N/A
	V_{max} (12.69 V)	0.503	N/A	N/A
T_{max} (+55°C)	V_{min} (8.61 V)	0.315	N/A	N/A
	V_{max} (12.69 V)	0.330	N/A	N/A
Measurement uncertainty		0.75 dB		
Limits		Normal Test Conditions: Between 0.25 W and 1 W Extreme Test Conditions: Between 0.25 W and 1 W		

(N/A - See subclause 9.2.2)

TEST EQUIPMENT USED:

01, 04, 06, 14, 24, 25, 26, 31, 32 & 34.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient temperature: 22.7 °C Relative humidity: 45.8 %

TRANSMITTER TESTING

MAXIMUM PERMISSIBLE FREQUENCY DEVIATION **CLAUSE 9.3.2**

Channel	MODULATION FREQUENCY (Hz)	FREQUENCY DEVIATION IN kHz (δf)	
		δf (kHz)	
		+	-
16	100	1.36	1.36
	150	2.59	2.63
	200	3.89	3.99
	250	4.21	4.34
	300	4.36	4.26
	380	4.45	4.16
	480	4.43	4.15
	600	4.39	4.23
	760	4.39	4.30
	960	4.41	4.34
	1000	4.40	4.39
	1200	4.39	4.39
	1510	4.38	4.45
	1900	4.37	4.52
	2400	4.33	4.49
	3000	4.25	4.40
Measurement uncertainty		4 %	
Limits		δf ≤ 5 kHz	

TEST EQUIPMENT USED:

01, 06, 14, 25, 26, 31, 32 & 34.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient temperature: 23.0 °C Relative humidity: 45.8 %

TRANSMITTER TESTING

REDUCTION OF FREQUENCY DEVIATION AT MODULATION FREQUENCIES ABOVE 3 kHz

CLAUSE 9.3.3

MODULATION FREQUENCY (Hz)	FREQUENCY DEVIATION IN kHz (δf)	
	δf (kHz)	
	+	-
3000	3.98	4.15
3780	3.01	3.11
4750	1.92	1.97
5990	1.13	1.15
7540	0.652	0.678
9490	0.393	0.373
11940	0.245	0.247
15040	0.154	0.156
18930	0.094	0.103
23830	0.079	0.096
25000	0.054	0.058
Measurement uncertainty	0.5 dB	

LIMIT **CLAUSE 9.3.3.2**

CHANNEL SPACING (KHz)	LIMITS (KHz)	
25	For modulation frequency between 3 kHz & 6 kHz:	±3 kHz
	For modulation frequency of 6 kHz:	±1.5 kHz
	For modulation frequency between 6 kHz & 25 kHz:	-14 dB/octave relative to limit at 6 kHz

(See Annex C for Plot of results)

TEST EQUIPMENT USED:

01, 06, 14, 25, 26, 31, 32 & 34.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient temperature: 23.0 °C Relative humidity: 45.8 %

TRANSMITTER TESTING

LIMITATION CHARACTERISTICS OF THE MODULATOR **CLAUSE 9.4**

Rated output: 0.5 Watts ()ERP)

Test Conditions		FREQUENCY DEVIATION IN KHz (δf)	
		channel 16	
Temperature	Voltage	HP	
		+	-
T_{nom} (23.0 °C)	V_{nom} (10.0 V)	4.13	4.12
T_{min} (-20 °C)	V_{min} (8.61 V)	4.32	4.14
	V_{max} (12.69 V)	4.37	4.20
T_{max} (+55 °C)	V_{min} (8.61 V)	3.94	3.92
	V_{max} (12.69 V)	3.96	3.94
Measurement uncertainty		0.5 dB	
Limits (subclause 9.4.3)		The frequency deviation shall be contained between ± 3.5kHz & ± 5kHz	

TEST EQUIPMENT USED:

01, 06, 14, 24, 25, 26, 31, 32 & 34.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient temperature: 24.3 °C Relative humidity: 47.0 %

TRANSMITTER TESTING

SENSITIVITY OF THE MODULATOR, INCLUDING MICROPHONE **CLAUSE 9.5**

Channel	Frequency Deviation (kHz)	
	+	-
16	2.47	2.41
Measurement uncertainty	3.2 dB	
Limits	The frequency deviation shall be between ± 1.5kHz & ± 3kHz	

TEST EQUIPMENT USED:

01, 06, 14, 25, 26, 31, 32, 34, 43, 44, 45, 50 & 51.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient temperature: 23.1 °C Relative humidity: 45.8 %

TRANSMITTER TESTING

AUDIO-FREQUENCY RESPONSE **CLAUSE 9.6**

Modulation Frequency (Hz)	Modulation Index m (dB) channel 156.8 MHz	
	+ Deviation	- Deviation
300	0.31	0.09
380	-0.19	-0.05
480	-0.29	0.21
600	0.09	0
760	0.24	0.21
960	0.36	0.21
1000	0	0
1200	0.42	0.36
1510	0.50	0.66
1900	0.66	0.70
2400	0.70	0.83
3000	0.06	0.31
Measurement uncertainty	0.4 dB	
Limits	$-3 \leq m \leq +1$ dB	

TEST EQUIPMENT USED:

01, 06, 14, 25, 26, 31, 32 & 34.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient temperature: 22.9 °C Relative humidity: 48.4 %

TRANSMITTER TESTING

AUDIO-FREQUENCY HARMONIC DISTORTION OF THE EMISSION **CLAUSE 9.7**

Test Conditions		Modulation Frequency (Hz)	Audio Frequency Harmonic Distortion (%)
			channel 16
Temperature	Voltage		
T_{nom} (22.9 °C)	V_{nom} (10.0 V)	300	1.03
		1000	1.33
T_{min} (-20 °C)	V_{min} (8.61 V)	1000	0.99
	V_{max} (12.69 V)	1000	0.96
T_{max} (+55 °C)	V_{min} (8.61 V)	1000	1.06
	V_{max} (12.69 V)	1000	1.02
Measurement Uncertainty			0.1 dB (1 %)
Limit			≤ 10 %

TEST EQUIPMENT USED:

01, 06, 14, 24, 25, 26, 31, 32 & 34.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient temperature: 23.0 °C Relative humidity: 48.8 %

TRANSMITTER TESTING

ADJACENT CHANNEL POWER **CLAUSE 9.8**

MEASUREMENT OFFSET	ADJACENT CHANNEL POWER (dBc)
	156.8 MHz
+25 KHz	-70.9
-25 KHz	-78.7
Measurement uncertainty	5 dB
Limits	≤ -70 dBc

TEST EQUIPMENT USED:

01, 07, 14, 25, 26, 31, 32 & 34.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient temperature: 23.0 °C Relative humidity: 51.7 %

TRANSMITTER TESTING

RESIDUAL MODULATION **CLAUSE 9.9**

Channel	Level of Residual Modulation (dB)
16	- 46.8
Measurement uncertainty	0.7 dB
Limit	≤ -40 dB

TEST EQUIPMENT USED:

01, 06, 14, 25, 26, 31, 32 & 34.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient temperature: 24.2 °C Relative humidity: 47.3 %

TRANSMITTER TESTING

TRANSIENT FREQUENCY BEHAVIOUR **CLAUSE 9.10**

Channel	Maximum Frequency Difference (kHz)		
	TRANSIENT TIMES (ms)		
	t1 (5ms)	t2 (20ms)	t3 (5ms)
16	< 1.0	< 2.0	0
Measurement uncertainty	8 %		
Limits	≤ 25 kHz	≤ 12.5 kHz	≤ 25 kHz

Confirm that during the periods t1 and t3 the frequency difference does not exceed the value of one channel separation:

YES [✓] **NO [ ]**

(See Annex B)

Confirm that during the period t2 the frequency difference does not exceed the value of half a channel separation:

YES [✓] **NO [ ]**

(See Annex B)

TEST EQUIPMENT USED:

01, 02, 03, 04, 05, 06. 07, 08, 09, 10, 12, 13, 14, 16, 17, 18, 25, 26, 27, 31, 32 & 34.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient temperature: 22.5 °C Relative humidity: 46.3 %

RECEIVER TESTING

HARMONIC DISTORTION AND RATED AUDIO-FREQUENCY OUTPUT POWER **CLAUSE 10.1**

Rated AF output power: 0.4 W
Requirement: ≥ 0.2 W

Test Conditions		Modulation Frequency (Hz)	Test Signal Level (dBμV emf)	Audio Frequency Harmonic Distortion (%) channel 16		
Temperature	Voltage			156.8 MHz	156.8015 MHz	156.7985 MHz
T_{nom} (22.5 °C)	V_{nom} (10.0 V)	300	100	0.66	N/A	N/A
		1000	100	3.42	N/A	N/A
T_{min} (-20°C)	V_{min} (8.61 V)	1000	100	3.53	5.71	2.07
	V_{max} (12.69 V)	1000	100	3.56	5.61	2.02
T_{max} (+55°C)	V_{min} (8.61 V)	1000	100	4.79	3.80	3.72
	V_{max} (12.69 V)	1000	100	5.73	4.99	3.33
Measurement Uncertainty				0.1 dB (1 %)		
Limit				≤ 10 %		

(N/A - See Subclause 10.1.2 of ETS 300 225 April 1997)

TEST EQUIPMENT USED:

01, 06, 14, 24, 25, 26, 31, 32 & 34.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient temperature: 22.7 °C Relative humidity: 46.5 %

RECEIVER TESTING

AUDIO-FREQUENCY RESPONSE **CLAUSE 10.2**

Modulation Frequency (Hz)	AF Output Power (dB) channel		
	156.7985 MHz	156.8 MHz	156.8015 MHz
300	5.49	5.62	5.95
380	5.05	5.01	5.40
480	4.23	4.26	4.63
600	3.24	3.21	3.55
760	1.85	1.89	2.08
960	0.31	0.33	0.35
1000	0	0	0
1200	-1.40	-1.41	-1.54
1510	-3.35	-3.30	-3.73
1900	-5.49	-5.46	-6.11
2400	-7.48	-7.90	-8.65
3000	-9.69	-10.77	-11.27
Measurement uncertainty	4 %		
Limits	500 Hz to 3kHz: Between +1 dB and -3 dB; 300 Hz: ≤ -3 dB to -6 dB; - from a 6 dB/octave decreasing curve passing through the measured point at 1000Hz		

(See Annex D for Plot of results)

TEST EQUIPMENT USED:

01, 06, 14, 25, 26, 31, 32 & 34.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient temperature: 22.8 °C Relative humidity: 46.6 %

RECEIVER TESTING

MAXIMUM USABLE SENSITIVITY

CLAUSE 10.3

TEST CONDITIONS		RECEIVER SENSITIVITY (dBμV emf) channel 16 156.8 MHz
T_{nom} (22.8 °C)	V_{nom} (10.0 V)	-6.6
T_{min} (-20 °C)	V_{min} (8.61 V)	-7.8
	V_{max} (12.69 V)	-7.4
T_{max} (+55 °C)	V_{min} (8.61 V)	-3.9
	V_{max} (12.69 V)	-3.8
Measurement uncertainty		2.5 dB
Limits		Normal Test Conditions: RF Level ≤ + 6 dBμV AF Output Power 50 % of Rated AF Output Power Extreme Test Conditions: RF Level ≤ + 12 dBμV AF Output Power 50 % of Rated AF Output Power

TEST EQUIPMENT USED:

01, 06, 14, 24, 25, 26, 31, 32 & 34.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient temperature: 23.4 °C Relative humidity: 48.1 %

RECEIVER TESTING

CO-CHANNEL REJECTION **CLAUSE 10.4**

FREQUENCY OF UNWANTED SIGNAL	REJECTION RATIO (dB) CARRIER FREQUENCY 156.8 MHz
f +3000 Hz	-8.9
f	-10.0
f -3000 Hz	-8.6
Measurement uncertainty	3.0
Limits	Between -10 and 0

The lowest value of the thirteen measurement results noted shall be recorded as the Co-channel rejection.

TEST EQUIPMENT USED:

01, 06, 08, 09, 13, 14, 25, 26, 31, 32 & 34.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient temperature: 23.5 °C Relative humidity: 48.2 %

RECEIVER TESTING

ADJACENT CHANNEL SELECTIVITY **CLAUSE 10.5**

TEST CONDITIONS		UNWANTED SIGNAL + AND - RELATIVE TO WANTED RATIO (dB) channel	
		156.775 MHz -	156.825 MHz -
T_{nom} (23.5 °C)	V_{nom} (10.0 V)	74.9	74.2
T_{min} (-20.0 °C)	V_{min} (8.61 V)	75.6	74.6
	V_{max} (12.69 V)	76.0	75.4
T_{max} (+55.0 °C)	V_{min} (8.61 V)	76.9	76.9
	V_{max} (12.69 V)	76.9	76.9
Measurement uncertainty		3.0	

LIMITS CLAUSE 10.5.3

CHANNEL SPACING (KHz)	Under normal test conditions	Under extreme test conditions
25	70 dB	60 dB

TEST EQUIPMENT USED:

01, 06, 08, 09, 13, 14, 24, 25, 26, 31, 32 & 34.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient temperature: 24.2 °C Relative humidity: 47.4.%

RECEIVER TESTING

SPURIOUS RESPONSE REJECTION

CLAUSE 10.6

SPURIOUS RESPONSES	REJECTION RATIO (dB)
	CHANNEL
	16
21.399300 MHz	89.2
113.998700 MHz	77.5
156.775 MHz (Adjacent Channel)	77.5
156.825 MHz (Adjacent Channel)	75.6
157.710000 MHz	79.7
158.797500 MHz	88.6*
292.196600 MHz	77.7
655.593500 MHz	76.7
698.397800 MHz	75.6
790.997500 MHz	75.6
1197.196750 MHz	79.6
1239.995850 MHz	76.6
Measurement uncertainty	3.5

(* See Blocking Measurements, clause 10.8, on Page 69)

LIMIT CLAUSE 10.6.3

Limit	70 dB

TEST EQUIPMENT USED:

1, 06, 08, 09, 11, 13, 14, 24, 25, 26, 31, 32, 34, 35, 36, 37, 39 & 40.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient temperature: 23.3 °C Relative humidity: 48.5 %

RECEIVER TESTING

INTERMODULATION RESPONSE REJECTION **CLAUSE 10.7**

FREQUENCY INCREMENTS OF UNWANTED SIGNALS	CHANNEL RATIO (dB) channel 16
+50/+100 KHz	70.1
-50/-100 KHz	69.8
Measurement uncertainty	3.0
Limit	greater than 68.0 dB

TEST EQUIPMENT USED:

1, 06, 08, 09, 12, 13, 14, 15, 25, 26, 31, 32, 34,.48 & 49.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient temperature: 23.5 °C Relative humidity: 48.2 %

RECEIVER TESTING

BLOCKING OR DESENSITISATION

CLAUSE 10.8

FREQUENCY OF UNWANTED SIGNAL	BLOCKING RATIO (dB)
	CHANNEL
	16
f+10 MHz	101.4
f+5 MHz	100.4
f+2 MHz	88.4**
f+1 MHz	95.9
f-1 MHz	97.3
f-2 MHz	90.8
f-5 MHz	101.4
f-10 MHz	101.5
Measurement uncertainty	3.5

** See Page 67

LIMIT CLAUSE 10.8.3

The blocking ratio, for any frequency within the specified ranges shall not be less than 90 dBμV (emf), except at frequencies on which spurious responses are found, clause 10.6 refers.

TEST EQUIPMENT USED:

01, 06, 08, 09, 13, 14, 25, 26, 31, 32 & 34.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient temperature: 22.8 °C

Relative humidity: 46.6 %

RECEIVER TESTING

AMPLITUDE RESPONSE OF THE RECEIVER LIMITER

CLAUSE 10.9

RF input to Receiver	AUDIO OUTPUT POWER (dBm) CARRIER FREQUENCY 156.8 MHz
6 dB μV	19.96
100 dB μV	19.76
Variation of AF output power level (dB)	0.20 dB
Measurement uncertainty	1.5 dB
Limit	≤ 3 dB

TEST EQUIPMENT USED:

1, 06, 14, 25, 26, 31, 32 & 34.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

Ambient temperature: 22.8 °C

Relative humidity: 47.7 %

RECEIVER TESTING

NOISE

CLAUSE 10.10

Channel	Noise Level (dB)
16	-44.75
Measurement Uncertainty	1.5 dB
Limit	≤ -40

TEST EQUIPMENT USED:

01, 06, 14, 25, 26, 31, 32 & 34.

TEST REPORT REFERENCE: DERA/SSWI/CR/TT-08/98-1.0

TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries such as cables are identified (numbered) by the Test Laboratory.

Number	Instrument/Ancillary	Type	Manufacturer	Serial Number
01	Test Analyzer	CMTA	RHODE & SCHWARZ	861093/001
02	Signal Generator	SMIIU	RHODE & SCHWARZ	865950/005
03	Spectrum Analyzer	HP8563A	HP	3313A00878
04	Power Attenuator	765-10	NARDA	9501
05	Power Attenuator	765-20	NARDA	9504
06	N-Type Cable	SEALFLEX2	ITT SEALECTRO	D3197
07	N-Type Cable	SEALFLEX2	ITT SEALECTRO	D6039
08	N-Type Cable	SEALFLEX2	ITT SEALECTRO	D3209
09	N-Type Cable	SEALFLEX2	ITT SEALECTRO	D3210
10	Precision Attenuators	HP11581A	HP	CSC10592
11	Filter	BANDREJECT	K & L	40
12	Power Divider	4901.17.A	SUHNER	WHITE
13	Power Divider	4901.17.A	SUHNER	BLACK
14	DVM	79	FLUKE	60031113
15	Radiocomms Analyzer	CMS 54	RHODE & SCHWARZ	849037/004
16	Oscilloscope	9450A	LeCROY	9450
17	Graphics Plotter	HP7550A	HP	2520A21789
18	Crystal Detector	HP423A	HP	12086
19	Signal Generator	HP8640B	HP	2849A30536
20	50 Ω Precision Termination	6500.17.A	SUHNER	NONE
21	Bi-conical Antenna	BBA9106	SCHWARZBECK	7189
22	Log-periodic Antenna	UHALP9107	SCHWARZBECK	9107994
23	Horn Antenna	96001	AILTECH	2389
24	Climatic Chamber	P/T-P/RH-RR10D	FISONS	4175B
25	Temperature probe	msl	NOVASINA	NONE
26	Cables	BNC	RADIO SPARES	NONE
27	N-Type Male/Male Adaptor	32N-50-0-51	SUHNER	BLACK
28	Power Meter	436A	HP	1161A00582
29	Power Sensor	8481A	HP	1550A05694
30	Frequency Counter	1995	RACAL DANA	19307
31	GPS Frequency Reference	HP58503A	HP	3548A00454
32	Regulated Power Supply	AP60-150	FARNELL	000255
33	Stabilized Power Supply	LT30-1	FARNELL	000347
34	Cable	BNC to OPEN	RADIO SPARES	NONE
35	Spurious Response Detector	SRDU	RHODE & SCHWARZ	RSS/003
36	SMA Cable	065-9AA-0500-000	ITT SEALECTRO	A3338
37	SMA Cable	065-9AA-0750-000	ITT SEALECTRO	20121
38	N-Type Cable	SEALFLEX2	ITT SEALECTRO	D3163
39	ACP Filter	21.4 MHz-6KHz	QUARTZTEK	9651-001
40	ACP Mixer	5/1350 MHz	OLEKTRON	0-CBD-9007
41	Screened Room	SHIELDED	BELLING LEE INTEC LTD.	00513
42	Vibration Table	ACTUATOR	SERVOTEST	2150
43	SOUND LEVEL METER	TYPE 2209	BRUEL & KJOER	698986
44	AMPLIFIER	KA-3750	TRIO	020197
45	SPEAKER	NONE	S.B. DAVENPORT LTD.	01E8B7
46	N-Type Cable 20m	NPS-1553-20000-NPS	RHOPHASE	L3634
47	N-Type Cable 25m	NPS-1553-25000-NPS	RHOPHASE	M2064
48	N-Type Cable	SEALFLEX2	ITT SEALECTRO	D6040
49	N-Type Cable	SEALFLEX2	ITT SEALECTRO	D3211
50	1/3 Octave Filter Set	TYPE 1616	BRUEL & KJOER	794257
51	Condenser Microphone	TYPE 4165	BRUEL & KJOER	708259
52	Calibrated dipole set	156.8 MHz	NONE	GREEN

TYPE-APPROVAL TESTING

ANNEX A

PHOTOGRAPHS

MARITIME MOBILE VHF PORTABLE TRANSCEIVER
Navico Model AXIS 30

Serial Number TA01

(consists of 6 photographs)

TYPE-APPROVAL TESTING

ANNEX B

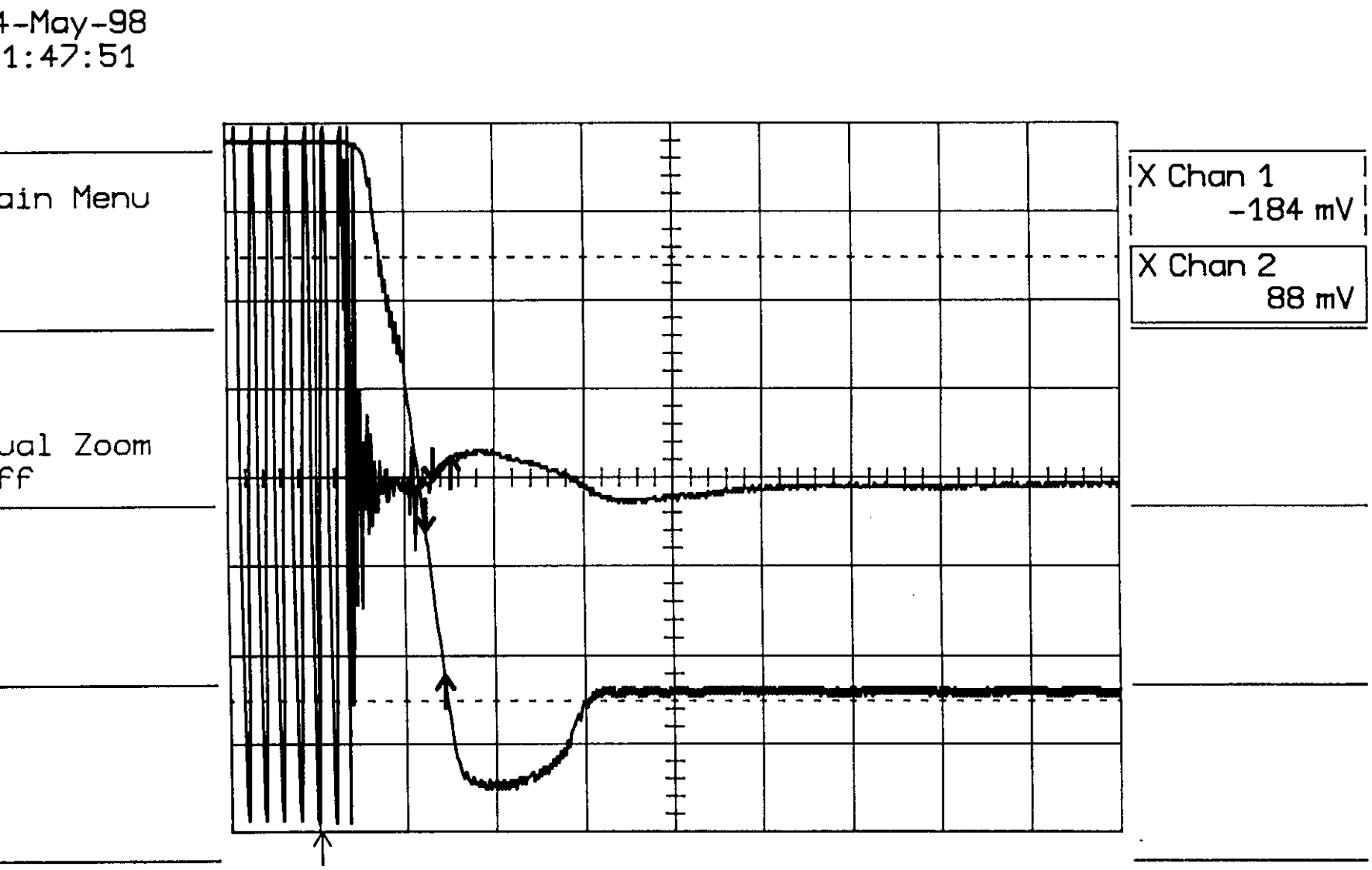
PLOTS OF TRANSMITTER TRANSIENT FREQUENCY BEHAVIOUR

MARITIME MOBILE VHF PORTABLE TRANSCEIVER
Navico Model AXIS 30

Serial Number TA01

(consists of 4 plots)

AXIS 30 SWITCH ON TRANSIENT

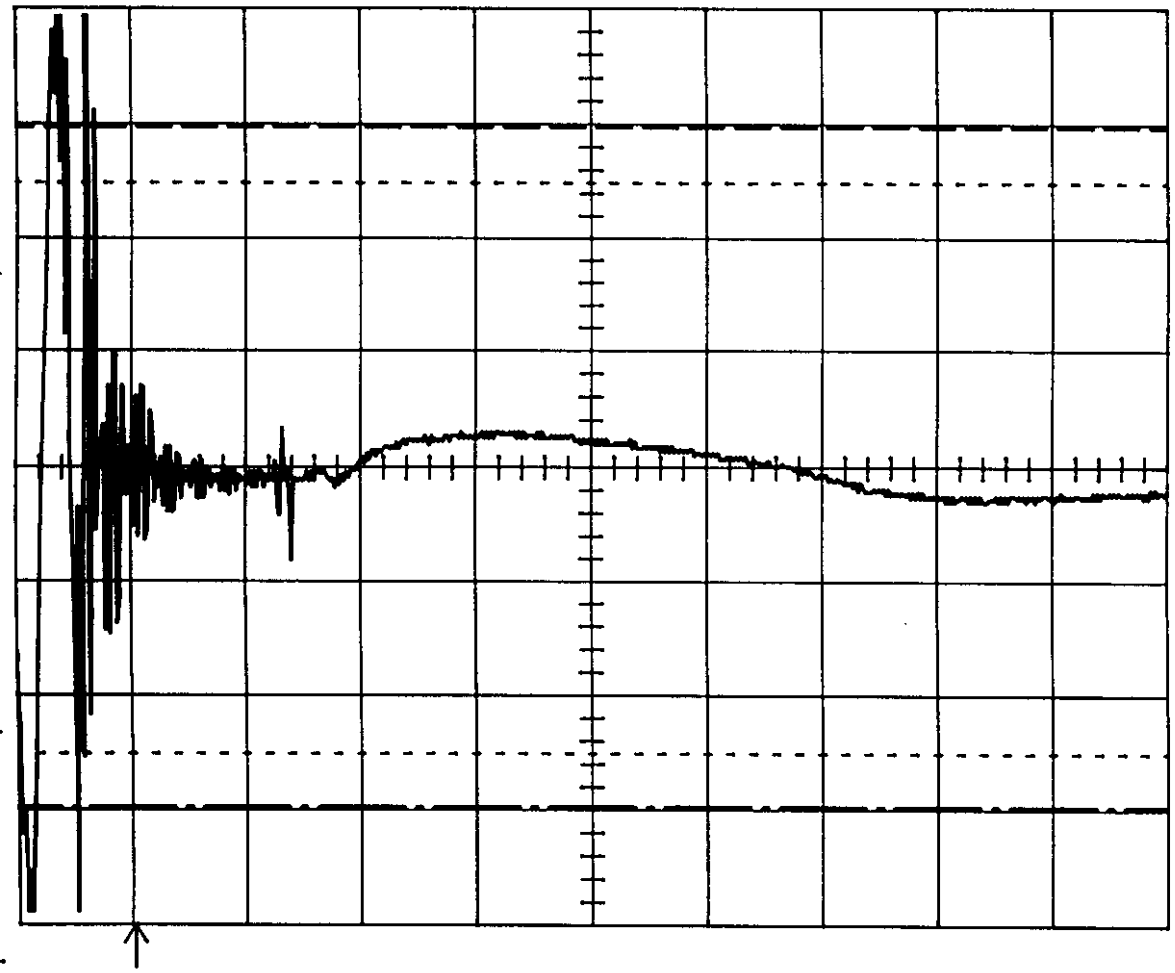


RESTRICTED - COMMERCIAL

AXIS 30 SWITCH ON TRANSIENT (EXPANDED VIEW)

-May-98
:27:56

in Menu

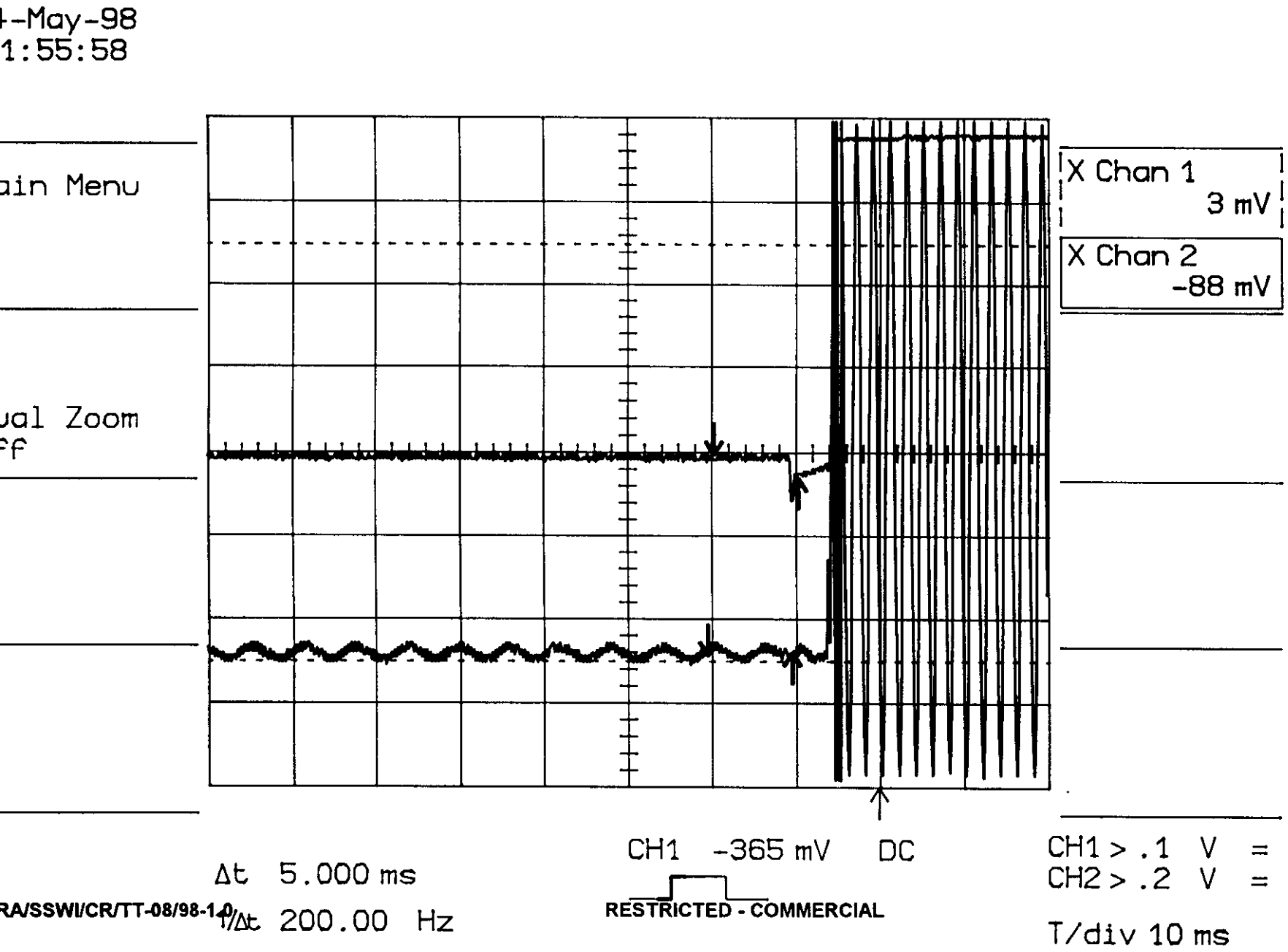


CH1 -339 mV DC

CH1 > .1 V =
CH2 > .2 V =

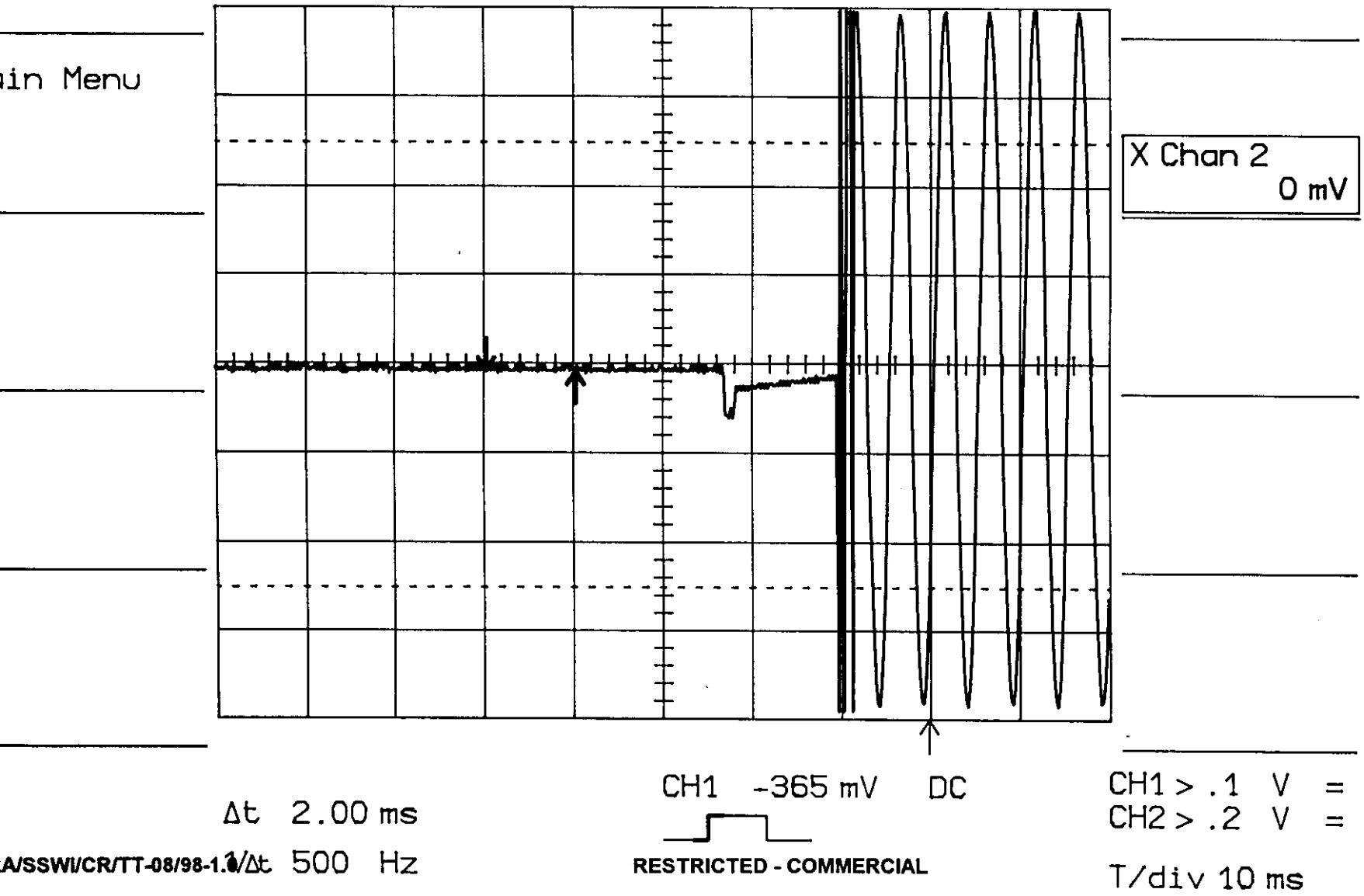
T/div 10 ms (2ms)

AXIS 30 SWITCH OFF TRANSIENT



RESTRICTED - COMMERCIAL

AXIS 30 SWITCH OFF TRANSIENT (EXPANDED VIEW)



RESTRICTED - COMMERCIAL

TYPE-APPROVAL TESTING

ANNEX C

PLOT OF RESULTS FOR REDUCTION OF FREQUENCY DEVIATION AT MODULATION FREQUENCIES ABOVE 3 kHz

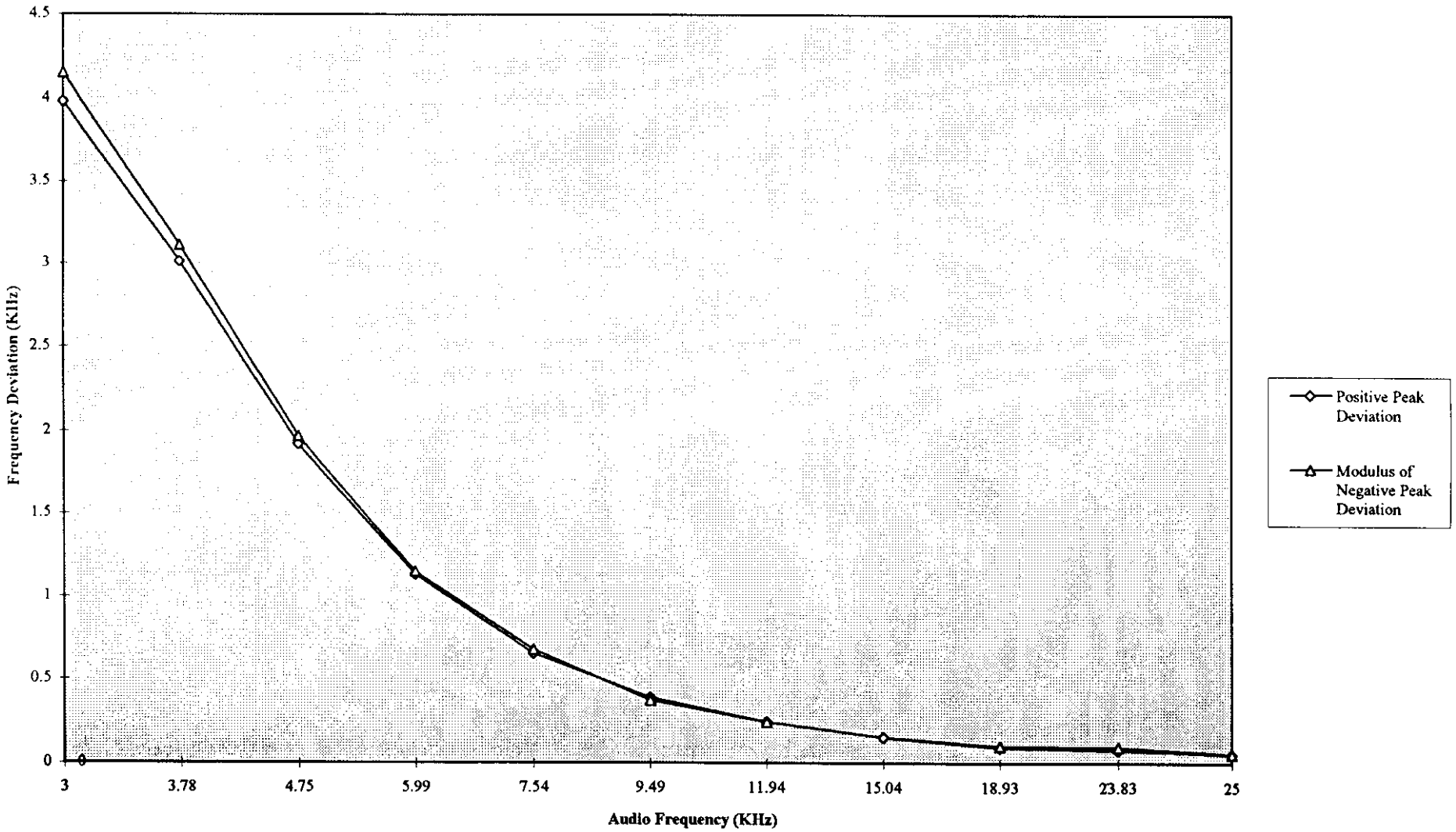
(See Section 4 page 54)

MARITIME MOBILE VHF PORTABLE TRANSCEIVER
Navico Model AXIS 30

Serial Number TA01

(consists of 1 plot)

Reduction of Frequency Deviation at Modulation Frequencies above 3 KHz



TYPE-APPROVAL TESTING

ANNEX D

PLOT OF RESULTS FOR RECEIVER AUDIO FREQUENCY RESPONSE

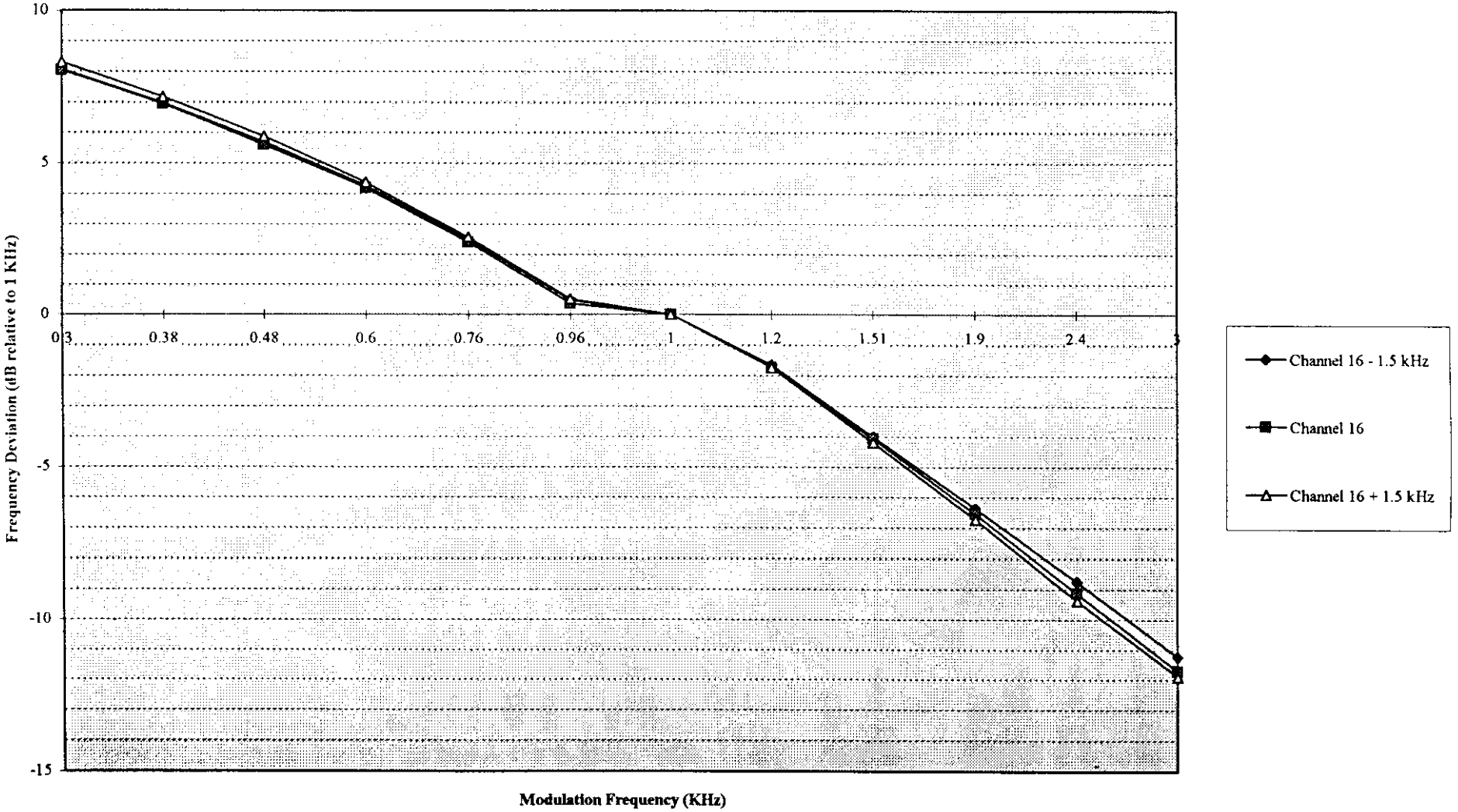
(See Section 4 page 63)

MARITIME MOBILE VHF PORTABLE TRANSCEIVER
Navico Model AXIS 30

Serial Number TA01

(consists of 1 plot)

Receiver Audio Frequency Response



TYPE-APPROVAL TESTING

ANNEX E

MANUFACTURER'S WAIVER FOR CLAUSES 7.7 AND 7.10 OF ETS 300 225

MARITIME MOBILE VHF PORTABLE TRANSCEIVER
Navico Model AXIS 30

Serial Number TA01

(consists of 4 pages)

NAVICO

NAVICO LIMITED
STAR LANE MARGATE KENT CT9 4NP
UNITED KINGDOM
TEL: (01843) 290290 FAX: +44 1843 290471
NAVIGATION & COMMUNICATIONS SYSTEMS

15 May, 1998

Our Ref: AW/sas

Mr. R. Thompson,
DERA Fraser,
Fort Cumberland Road,
Portsmouth,
PO4 9LJ

Dear Richard,

Please find enclosed our request to waiver tests relating to solar radiation and salt spray testing regarding submission for TA for AXIS 30. Sections 7.7 and 7.10 of ETS300-225 refer.

I would appreciate it if you could add the technical note to the file that I provided you with in the relevant section.

Yours sincerely,

A.Wrigley,
Technical Director

NOTES ON THE MATERIALS USED FOR AXIS 30

The construction of the AXIS 30 was the materials that have been chosen to be resistant to salt water exposure, solar radiation and oil resistance.

The main material of the case and battery pack is a plastic chosen for required properties including UV stability - cycloy 1200.

The front label is manufactured from a polycarbonate material as used in yachting instruments which do shows no significant degradation over many years mounted outside on a yacht, exposed to salt water spray and extensive exposure to the sun.

The glue fixing the label is a 3M product suitable for the environment, with no appreciable effect on bond strength with exposure to solar radiation or water.

The antenna sleeve is manufactured from neoprene, similar to seals used in Corus and other external applications, chosen for a balance of UV and salt water resistance. The top cap of the antenna is a dip moulding manufactured in a material designed for external applications.

The only exposed metal parts are case fixing screws which are manufactured in stainless steel and the battery contacts - these are made from brass with good surface finish which has a plating of 5 microns nickel with a 0.35 micron gold plating overall. The use of the gold plating is chosen to avoid effects of corrosion.

A.Wrigley
15th May, 1998

ANTENNA DIP MOULDING

PROPERTY	TEST METHOD	UNITS	STANDARD GRADES					MATT GRADES			TEXTURED GRADES	LIGHT STABLE	FOOD CONTACT & MEDICAL			GLASS CLEAR	HIGH & LOW TEMP GRADES			FLAME RETARDANT		OIL RESISTANCE	CHEMICAL RESISTANCE
			SF30	DM50	DM60	DM70	DM85	SM50	MP50	MP70	TF50	LS70	FC60	MG40	MG75	GC40	HT50	HT80	LT50	FR50	FR60	OR50	CRP100
DENSITY	BS2782 620A	g/cc	1.10	1.13	1.15	1.17	1.20	1.14	1.16	1.17	1.13	1.17	1.20	1.21	1.19	1.13	1.15	1.18	1.16	1.23	1.25	1.23	1.15
TENSILE STRENGTH	BS2782 301E	MPa	5.0	9.0	10.5	12.0	15.0	7.5	6.5	9.0	4.0	12.0	15.0	8.0	13.0	9.0	11.0	15.0	8.5	9.5	10.5	7.5	10.5
ELONGATION AT BREAK	BS2782 301E	%	400	400	400	375	250	300	300	200	250	375	300	375	350	400	400	350	350	400	400	425	300
COLDFLEX TEMP	BS2782 104B	°C	-55	-43	-38	-30	-33	-40	-38	-25	-40	-30	-31	-44	-31	-	-52	-37	-48	-24	-17	-31	-40
MAX. WORKING TEMPERATURE		°C Cont °C Int	60 80	60 80	60 80	60 80	60 80	60 80	60 80	60 80	60 80	60 80	60 80	- -	- -	60 80	90 140	90 140	60 80	80 100	80 100	60 80	60 80
SHORE A HARDNESS	BS903 Part A7		30	50	60	70	85	50	50	70	45	70	80	40	75	50	55	85	50	50	60	40	60
VOLUME RESISTIVITY		10⁹ ohm. cm	-	0.94	1.1	0.6	0.2	-	-	-	-	-	-	-	-	-	1.5	-	-	-	-	-	-
BREAKDOWN VOLTAGE	BS2782 221A	KV	-	11	11	10.8	6.5	-	-	-	-	10.8	-	-	-	-	13.5	-	-	-	-	-	-
ELECTRIC STRENGTH	BS2782 221A	KV. MM	-	4.2	4.4	4.1	2.5	-	-	-	-	4.1	-	-	-	-	5.2	-	-	-	-	-	-
OXYGEN INDEX		% Oxygen	22	20.9	21.9	22	23	21	21	22	-	22	-	-	-	21	-	-	-	28	28	20.4	22
TYPICAL USES			Grips, Covers, Sleeves, Gaiters, Bellows, Cable shrouds, Dowel bar sleeves					Automotive interior covers/gaiters, grips, furniture, bellows			Grips/Sleeves	Exterior applications eg. Yacht fittings *	Container lids, Medical Covers, tubes, valves, connectors			Various	Busbar covers, Automotive applications			Cable shrouds, dustcovers and bellows for electrical applications		Automotive covers	Protective covers

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1998-04-30 10:01

Plascoat

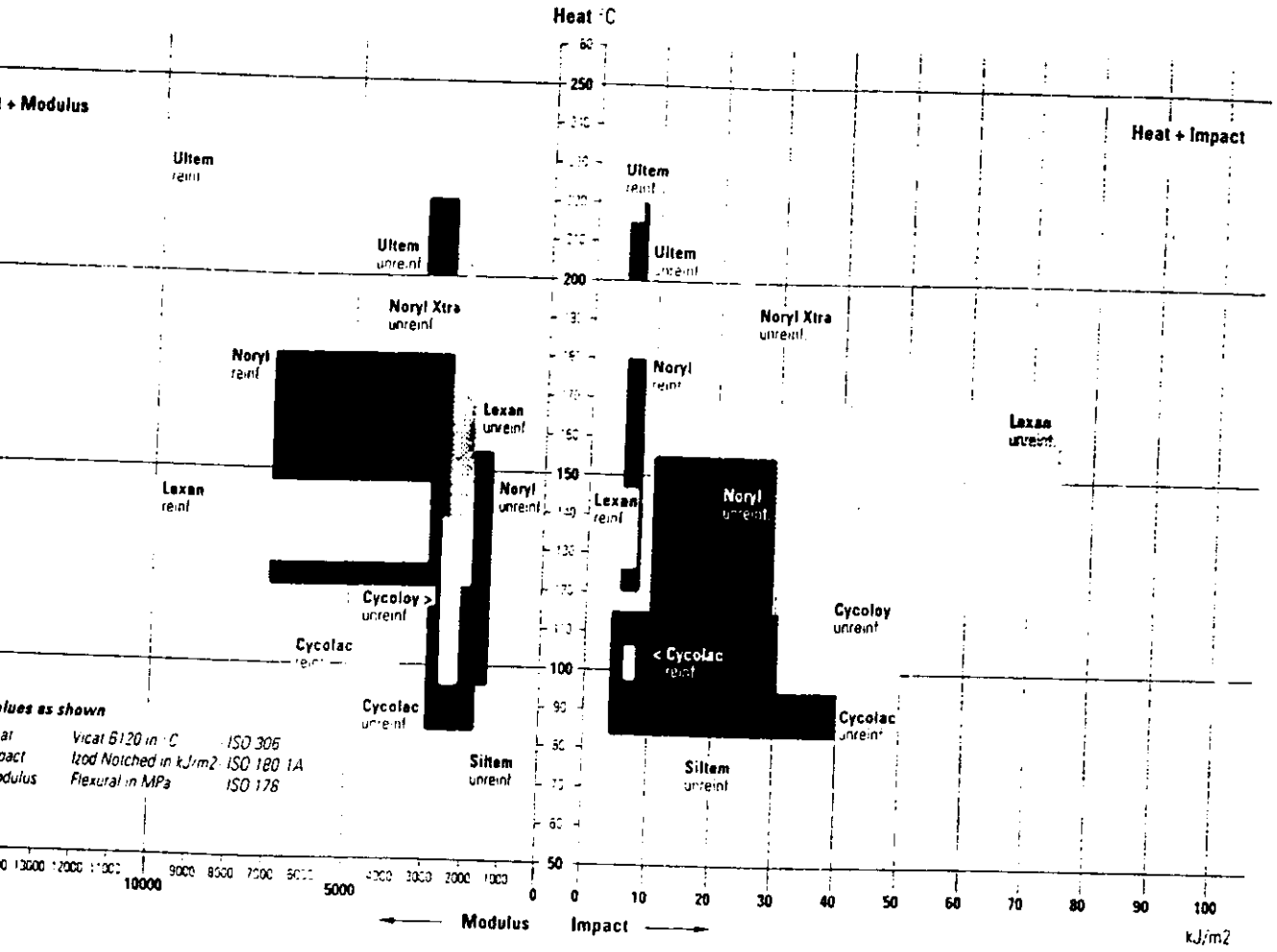
Plascoat Systems Limited
Trading Estate, Farnham,
Surrey, GU9 9NY, England
Telephone: [44] (0) 252 733777

Plascoat Europe (France) S.A.
15, Rue D'Anjou F38070
St. Quentin Fallavier
France

Plascoat Europe BV
Kerkweg 11, Postbus 9,
3214ZG Zuidland, The Netherlands

duct Characteristics

rphous



	Strengths	Limitations
	• Good impact performance • Dimensional Stability • Low Creep • No Warpage • Low Uniform Shrinkage • Transparency possible	• Chemical Resistance • Flow • Fatigue Resistance
mance engin	• High Tensile Strength • Good Impact Performance • Paintability	• Limited Design Integration (Processing Method) • Part Trimming
	• Toughness • High Gloss • Colours (Magic) • Decorability • Processability	• Limited Heat Resistance
ce	• Good Impact performance • Processability • UV Stability	

	Strengths	Limitations
Lexan – Impact Performance – Transparency	• Toughness • Dimensional Stability • High Transparency • UV Stability • Flame Retardancy • Bright Colours	• Notch Sensitivity • Low Hydrolytic Stability
Noryl – Property Balance	• Electricals • Hydrolytic Stability • Dimensional Stability • Processing Stability	• UV Colour Shift • No Transparency
Noryl Xtra – Property Balance	• Low Corrosivity/Low Toxicity when burning • Heat Resistance • Low Water Absorption • Hydrolytic Stability	• UV Colour Shift
Ultem – High Performance	• Strength • Heat Resistance • Chemical Resistance	• Notch Sensitivity • Amber Colour