Product Service

Choose certainty.
Add value.

Report On

Radio Testing of the
Yaesu UK Ltd GX6500 and GX6000
In accordance with IEC 62238

COMMERCIAL-IN-CONFIDENCE

Document 75934247 Report 05 Issue 2 November 2017

Product Service

TÜV SÜD Product Service, Octagon House, Concorde Way, Segensworth North,
Fareham, Hampshire, United Kingdom, PO15 5RL
Tel: +44 (0) 1489 558100. Website: www.tuv-sud.co.uk

REPORT ON

Radio Testing of the
Yaesu UK Ltd GX6500 and GX6000
In accordance with IEC 62238

Document 75934247 Report 05 Issue 2

November 2017

PREPARED FOR

Yaesu UK Ltd
Unit 12 Sun Valley Business Park
Winnal Industrial Estate
Winchester
SO23 0LB

PREPARED BY

Natalie Bennett
Senior Administrator, Project Support

APPROVED BY

Ryan Henley
Authorised Signatory

DATED 03 November 2017

This report has been up-issued to Issue 2 to include evidence of compliance in sections 2.1.6 and 2.6.1

UKAS TESTING
0141

Product Service

CONTENTS

Section		Page No
1	**REPORT SUMMARY**	**3**
1.1	Introduction	4
1.2	Brief Summary of Results	5
1.3	Application Form	6
1.4	Product Information	11
1.5	Deviations from the Standard	12
1.6	Modification Record	12
2	**TEST DETAILS**	**13**
2.1	Test of Generated Call Sequences	15
2.2	Multiple Watch Characteristics	18
2.3	DSC Receiver Adjacent Channel Selectivity	20
2.4	DSC Receiver Intermodulation Response	21
2.5	DSC Receiver Spurious Emissions	22
2.6	Verification of Correct Decoding of Various Types of DSC Calls	23
2.7	Reaction to VTS and AIS Channel Management DSC Transmissions	30
2.8	Simultaneous Reception	31
3	**TEST EQUIPMENT USED**	**32**
3.1	Test Equipment Used	33
3.2	Measurement Uncertainty	37
4	**PHOTOGRAPHS**	**38**
4.1	Photographs of Equipment Under Test (EUT)	39
5	**ACCREDITATION, DISCLAIMERS AND COPYRIGHT**	**40**
5.1	Accreditation, Disclaimers and Copyright	41

ANNEX A Manufacturers Declaration A.2

Product Service

SECTION 1

REPORT SUMMARY

Radio Testing of the
Yaesu UK Ltd GX6500 and GX6000
In accordance with IEC 62238

Product Service

1.1 INTRODUCTION

The information contained in this report is intended to show the verification of Radio Testing of the Yaesu UK Ltd GX6500 and GX6000 to the requirements of IEC 62238.

Objective	To perform Radio Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Yaesu UK Ltd
Model Number(s)	GX6500
Manufacturer Declared Variant*	GX6000
Serial Number(s)	SPP No 10 SPP No 16
Number of Samples Tested	2
Test Specification/Issue/Date	IEC 62238 (2003-03)
Incoming Release Date	Application Form 23 September 2016
Disposal Reference Number Date	Held Pending Disposal Not Applicable Not Applicable
Order Number Date	6098 16 March 2016
Start of Test	16 August 2016
Finish of Test	27 October 2017
Name of Engineer(s)	M Russell S Bennett G Lawler N Rousell M Musgrave

*See Annex A for Manufacturers Declaration

Product Service

1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with IEC 62238 is shown below.

Section	Specification Clause	Test Description	Result	Comments/Base Standard
DCS Receive				
2.3	10.3	DSC Receiver Adjacent Channel Selectivity	Pass	
2.4	10.5	DSC Receiver Intermodulation Response	Pass	
2.5	10.7	DSC Receiver Spurious Emissions	Pass	
2.6	10.8	Verification of Correct Decoding of Various Types Of DSC Calls	Pass	
2.7	10.9	Reaction to VTS and AIS Channel Management DSC Transmissions	Pass	
2.8	10.10	Simultaneous Reception	Pass	
VHF Receive				
2.2	9.13	Multiple Watch Characteristics	Pass	
DCS Transmit				
2.1	8.14	Test of Generated Call Sequences	Pass	

Product Service

1.3 APPLICATION FORM

1 APPLICATION FORM

EQUIPMENT DESCRIPTION	
Model Name/Number	Standard Horizon Quantum
Part Number	GX6500E and GX6000
Technical Description (Please provide a brief description of the intended use of the equipment)	GX6500E is a DSC Class D Fixed Mount Marine VHF Transceiver with built-in AIS Receiver and Transponder. The GX6000E is identical to the GX6500E but does not have the AIS Transponder fitted. The non EU versions are classified as GX6500 and GX6000 respectively.

TYPE OF EQUIPMENT		
☐	Base Station	(Equipment fitted with an antenna socket for use with an external antenna, and intended for use in a fixed location).
☒	Mobile Station	(Mobile equipment fitted with an antenna socket, for use with an external antenna, normally used in a vehicle or as a transportable station).
☐	Hand Portable	(fitted with an antenna socket)
☐	Hand Portable	(without an external antenna socket integral antenna equipment, but fitted with a permanent internal or a temporary internal 50 ohm R.F. connector which allows access to the transmitter output and the receiver input)
☐	Other	

TYPE OF EQUIPMENT					
Base Station	☐	Mobile Station	☒	Hand Portable	☐
☒	Transmitter		☒	Simplex	
☒	Receiver		☐	Duplex	
☐	Transceiver		☐	Communal Site use (70dB limit)	

TRANSMITTER TECHNICAL CHARACTERISTICS		
FREQUENCY CHARACTERISTICS		
Transmitter channel switching frequency range:	156.025 to 157.4250	MHz (MHz Range)
Transmitter frequency alignment range:	156.025 to 157.4250	MHz (MHz Range)

Product Service

TRANSMITTER POWER CHARACTERSITICS								
Is transmitter intended for :								
Continuous duty					☐	Yes	☒	No
Intermittent duty only					☒	Yes	☐	No
If intermittent duty state DUTY CYCLE								
Transmitter ON	1	Seconds	Transmitter OFF	3	Seconds			
Is transmitter output power variable?					☒	Yes	☐	No
If yes								
RF output power (watts)	25	Maximum	1	Minimum				
Is the RF power								
continuously variable					☐	Yes	☒	No
Or								
stepped					☒	Yes	☐	No
If stepped	13.79				dB per step			

TRANSMITTER - MODULATION					
Amplitude	☐	Other	☐		
Frequency	☒	Details :			
Phase	☐				
Can the transmitter be operated without modulation (See Note 1)			☒	Yes	☐ No

Product Service

RECEIVER TECHNICAL CHARACTERISTICS			
Intermediate Frequencies			
☒	1st See Table Below	☒	2nd See Table Below
☒	3rd See Table Below		
Is local oscillator injection frequency higher or lower than the receiver nominal frequency?			
☐	Higher	☒	Lower
RECEIVER CHANNEL SWITCHING FREQUENCY RANGE	156.025 to 163.2750	MHz (MHz Range)	
RECEIVER FREQUENCY ALIGNMENT RANGE	156.025 to 163.2750	MHz (MHz Range)	

RECEIVER AUDIO (AF) CHARACTERISTICS						
MAXIMUM RATED AUDIO (AF) FREQUENCY OUTPUT POWER						
Into Loudspeaker	4.5	Watts				
Into Line		Watts				
Into Earpiece		Watts				
Balanced [Main Unit]			☒	Yes	☐	No
Unbalanced Extension RAM Microphone SSM-70H			☐	Yes	☐	No
Does connection carry DC voltage?			☐	Yes	☒	No
If Yes, please state value:						
Normal Audio load impedance:						
At Loudspeaker	8	Ohms Main Unit Amp= 8ohms standalone, 8+4ohms in parallel with EXT SPK				
At Line		Ohms				
At Earpiece		Ohms				
At audio accessory connection or facility socket (if fitted):						
Output	2.5W	Watts SSM-70H Audio switchable between INT and EXT Speaker				
Impedance	4	Ohms				
Max input level at audio accessory socket:						
Output	n/a	mV				
Impedance		Ohms				

TRANSMITTER AND RECEIVER CHARACTERISTICS		
Channel Separation:	25	kHz
State the maximum number of channels over which the equipment can operate	239	

IF Frequencies

Main 1st IF 21.70MHz 2nd IF 0.450MHz 2nd LO 21.25MHz
Sub 1st IF 30.40MHz 2nd IF 0.450MHz 2nd LO 29.95MHz Channel 70 receiver

AIS CH1 1st IF 47.25MHz 2nd IF 0.450MHz 2nd LO 46.80 MHz 3rd Overtone of 15.6MHz
CH2 1st IF 38.85MHz 2nd IF 0.450MHz 2nd LO 38.40 MHz 3rd Overtone of 19.2MHz

Software Revision Versions

9th August 2016
SPP#10 Radio 0.46.00 15/7/16 AIS Unit 0.65.00 03/8/16
SPP#16 Radio 0.46.00 15/7/16 AIS Unit 0.60.00 13/7/16
SPP#17 Radio 0.46.00 15/7/16 AIS Unit 0.60.00 13/7/16

23rd September 2016 AIS Firmware updated for GGA Updates on NMEA 0183 every 1 Second
SPP#16 Radio 0.46.00 15/7/16 AIS Unit0.80.00 19/9/16

Product Service

EXTREME TEMPERATURE RANGE over which equipment is to be type tested		
☒	-25°C to +55°C	
☐	-15°C to +55°C	
☐	-10°C to +55°C	

POWER SOURCE						
☐	AC mains			State voltage		
	AC supply frequency		(Hz)			
		VAC				
		Max Current				
		Hz				
☐	Single phase		☐	Three phase		
And / Or						
☒	External DC supply					
	Nominal voltage	13.8 V		Max Current	5.0	A
	Extreme upper voltage	11.0 V				
	Extreme lower voltage	16.0 V				
Battery						
☐	Nickel Cadmium		☐	Lead acid (Vehicle regulated)		
☐	Alkaline		☐	Leclanche		
☐	Lithium		☐	Other Details :		
	Volts nominal.					
End point voltage as quoted by equipment manufacturer				V		

AUTOMATIC EQUIPMENT SWITCH OFF			
If the equipment is designed to automatically switch off at a predetermined voltage level which is higher or lower in value than the battery minimum and minimum calculated values this shall be clearly stated.			
☐	Applies		V cut-off voltage
☒	Does not apply		

Product Service

ALIGNMENT RANGE			
The definition of the alignment range AR1 and AR2 are given in Sub Clauses 3.1.2 and 3.1.3 of the Standard. The applicant should ensure that the sample equipment(s) submitted are operational on the appropriate channel(s) as given in Sub Clauses 3.1.5 through to 3.1.11 and tick the appropriate box.			
	3.1.5	One sample single channel equipment of category AR1	☐
Or	3.1.6	Three samples of single channel equipments of category AR2	☐
Or	3.1.7	One sample two channel equipment of category AR1	☐
Or	3.1.8	Three samples of two channel equipment of category AR2	☐
Or	3.1.9	One sample multichannel equipment of category AR1	☐
Or	3.1.10	Three samples of multichannel equipment of category AR2	☒
Or	3.1.11	One sample of multichannel equipment of category AR2 where the switching range equals the alignment range	☐

CHANNEL IDENTIFICATION			
Each equipment, whether one or more submitted for tests shall carry clear identification (such as a serial number), together with the frequencies associated with the channel identification displayed on the equipment.			
Equipment Identification eg Serial Number	Channel Number	Transmit Nominal Freq MHz	Receive Nominal Freq MHz
SPP#10 * See Revision Table			
SPP#16 * See Revision Table			
SPP#17 * See Revison Table			

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

Signature:  Name: Paul Bigwood

Position Held: Technical Manager Date: R1 10th August 2016
R2 23rd September 2016

Product Service

1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was a Yaesu UK Ltd GX6500 and GX6000 as shown in the photograph below. A full technical description can be found in the manufacturer's documentation.

Equipment Under Test

Product Service

1.5 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standard were made during testing.

1.6 MODIFICATION RECORD

Modification 0 - No modifications were made to the test sample during testing.

Product Service

SECTION 2

TEST DETAILS

Radio Testing of the
Yaesu UK Ltd GX6500 and GX6000
In accordance with IEC 62238

2.1 TEST OF GENERATED CALL SEQUENCES

2.1.1 Specification Reference

IEC 62238, Clause 8.14
ITU-R M.493-13, Annex 1
ITU-R M.493-11, Annex 1

2.1.2 Equipment Under Test and Modification State

GX6500 and GX6000 S/N: SPP No 10 - Modification State 0

2.1.3 Date of Test

12 October 2016

2.1.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.5 Environmental Conditions

Ambient Temperature	24.1°C
Relative Humidity	40.6%

2.1.6 Test Results

DSC Transmit

Call Sent	Received without error	Telecommand 1	Telecommand 2
Distress	Yes	107	100
	Raw DSC Symbols: 116 116 108 24 70 12 34 50 100 126 90 00 16 126 126 126 127 11		
	Call Id: Time: Carrier: Workstation: Operator: Station: Format: From: Nature: TSC: End Of Sequence:	1035785 161012 08:50:05 ch70 TUV-S1 op1 Test Station Distress 247012345 Undesignated F3E/G3E simplex EOS	
All Ships Urgency	Yes	100	126

	Raw DSC Symbols: 116 116 110 24 70 12 34 50 100 126 90 00 16 126 126 126 127 09		
	Call Id: Time: Carrier: Station: Format: Category: From: Tele1: Tele2: RxFreq: End Of Sequence:	1035796 161012 08:57:39 ch70 Test Station All Ships Urgency 247012345 F3E/G3E simplex No information ch16 EOS	
All Ships Safety	Yes	100	126
	Raw DSC Symbols: 116 116 108 24 70 12 34 50 100 126 90 00 16 126 126 126 127 11		
	Call Id: Time: Carrier: Station: Format: Category: From: Tele1: Tele2: RxFreq: End Of Sequence:	1035797 161012 08:59:44 ch70 Test Station All Ships Safety 247012345 F3E/G3E simplex No information ch16 EOS	
Individual Routine	Yes	100	126
	Raw DSC Symbols: 120 120 12 34 56 78 90 100 24 70 12 34 50 100 126 90 00 06 126 126 126 117 17		
	Call Id: Time: Carrier: Station: Format: Category: To: From: Tele1: Tele2: RxFreq:	1035798 161012 09:02:53 ch70 Test Station Individual Routine 123456789 247012345 F3E/G3E simplex No information ch6	

	End Of Sequence:	ARQ	
Group Routine	Yes	100	126
	Raw DSC Symbols: 114 114 01 23 45 67 80 100 24 70 12 34 50 100 126 90 00 06 126 126 126 127 59		
	Call Id: Time: Carrier: Station: Format: Category: To: From: Tele1: Tele2: RxFreq: End Of Sequence:	1035799 161012 09:05:12 ch70 Test Station Group Routine 12345678 247012345 F3E/G3E simplex No information ch6 EOS	

Product Service

2.2 MULTIPLE WATCH CHARACTERISTICS

2.2.1 Specification Reference

IEC 62238, Clause 9.13

2.2.2 Equipment Under Test and Modification State

GX6500 and GX6000 S/N: SPP No 10 - Modification State 0

2.2.3 Date of Test

13 October 2016, 19 October 2016 & 20 October 2016

2.2.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.2.5 Environmental Conditions

Ambient Temperature	23.9 - 25.0°C
Relative Humidity	28.7 - 34.3%

2.2.6 Test Results

VHF Receive

Simplex

Test Conditions		Scanning Time (s)	Dwell on priority (ms)	Dwell on Additional (s)
T_{nom} (25.0°C)	V_{nom} (12.0 V DC)	1.56144	142.34	1.4191
T_{min}(-15.0°C)	V_{min} (10.8 V DC)	1.56061	142.91	1.4177
T_{max}(+55.0°C)	V_{max} (15.6 V DC)	1.56305	141.25	1.4218

Duplex

Test Conditions		Scanning Time (s)	Dwell on priority (ms)	Dwell on Additional (s)
T_{nom} (25.0°C)	V_{nom} (12.0 V DC)	1.56428	142.98	1.42130
T_{min}(-15.0°C)	V_{min} (10.8 V DC)	1.56262	141.72	1.42090
T_{max}(+55.0°C)	V_{max} (15.6 V DC)	1.56158	140.38	1.4212

Remarks

It was confirmed under all test conditions, with both simplex and duplex channels, that when the signal on the priority channel was switched on the scanning on the priority channel stopped within the period of the last burst (on the additional channel) and the dwell time of the priority channel.

Limit Clause 9.13.3

Scanning Period	≤ 2 s
Dwell Time (Priority Channel)	≤ 150 ms
Dwell Time (Additional Channel)	Between 850 ms and 2 s

Product Service

2.3 DSC RECEIVER ADJACENT CHANNEL SELECTIVITY

2.3.1 Specification Reference

IEC 62238, Clause 10.3

2.3.2 Equipment Under Test and Modification State

GX6500 and GX6000 S/N: SPP No 10 - Modification State 0

2.3.3 Date of Test

29 September 2016, 30 September 2016 & 3 October 2016

2.3.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.3.5 Environmental Conditions

Ambient Temperature	19.9 - 21.6°C
Relative Humidity	47.8 - 69.5%

2.3.6 Test Results

DCS Receive

12.0 V DC Supply

Test Conditions		Bit Error Ratio	
		156.525 MHz	
		+25 kHz	-25kHz
T_{nom} (19.9°C)	V_{nom} (12.0 V DC)	0	0
T_{min}(-15.0°C)	V_{min} (10.8 V DC)	0	0
T_{max}(+55.0°C)	V_{max} (15.6 V DC)	0	0

Limit Clause 10.3.3

The bit error ratio shall be less than 10^{-2}.

Product Service

2.4 DSC RECEIVER INTERMODULATION RESPONSE

2.4.1 Specification Reference

IEC 62238, Clause 10.5

2.4.2 Equipment Under Test and Modification State

GX6500 and GX6000 S/N: SPP No 10 - Modification State 0

2.4.3 Date of Test

3 October 2016

2.4.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.4.5 Environmental Conditions

Ambient Temperature	19.9°C
Relative Humidity	47.8%

2.4.6 Test Results

DCS Receive

12.0 V DC Supply

Frequency Increments of Unwanted Signals	Bit Error Rate
	156.525 MHz
+ 50/100 kHz	0
- 50/100 kHz	0

Limit Clause 10.5.3

The BER shall not exceed 10^{-2}.

2.5 DSC RECEIVER SPURIOUS EMISSIONS

2.5.1 Specification Reference

IEC 62238, Clause 10.7

2.5.2 Equipment Under Test and Modification State

GX6500 and GX6000 S/N: SPP No 10 - Modification State 0

2.5.3 Date of Test

12 September 2016

2.5.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.5.5 Environmental Conditions

Ambient Temperature	23.6°C
Relative Humidity	47.9%

2.5.6 Test Results

DCS Receive

12.0 V DC Supply

156.525 MHz

Frequency (MHz)	Spurious Emission Level (nW)
*	

*No emissions were detected within 6 dB below the limit.

Limit Clause 10.7.3

Frequency Range	9 kHz to 2 GHz
Limit	≤2.0 nW (-57.0 dBm)

2.6 VERIFICATION OF CORRECT DECODING OF VARIOUS TYPES OF DSC CALLS

2.6.1 Specification Reference

IEC 62238, Clause 10.8
ITU-R M.493-13, Annex 1
ITU-R M.493-11, Annex 1

2.6.2 Equipment Under Test and Modification State

GX6500 and GX6000, S/N: Sample 10 - Modification State 0

2.6.3 Date of Test

27-September-2017

2.6.4 Test Method

This test was performed in accordance with IEC 62238, clause 10.8.2.

2.6.5 Environmental Conditions

Ambient Temperature	22.0 °C
Relative Humidity	59.4 %

2.6.6 Test Results

DC Powered - VHF & DSC Transceiver

Call Sent	Channel (MHz)	Received Without Error	Telecommand 1	Telecommand 2
Distress	156.525	Yes	107	100
		DSC Symbols: 112 112 00 46 61 00 00 107 99 99 99 99 99 88 88 100 127 112		
		Call ID: TX Offset: TX Interval: Carrier: Workstation: Operator: Station: Format: From: Nature: Subsequent Comms: EOS: Sync:	1000015 00:00:00 15 min ch70 TESTPC-ICS tuvadmin TUV test station Distress 004661000 Undesignated F3E/G3E simplex EOS No	

Call Sent	Channel (MHz)	Received Without Error	Telecommand 1	Telecommand 2
		EUT Displayed "RX DISTRESS 004661000 RPT DISTRESS UNDESIGNATED" Note the EUT automatically changes to CH16		
All Ships Distress Ack	156.525	Yes	107	100
		DSC Symbols: 116 116 112 00 46 61 00 00 110 12 34 56 78 90 107 99 99 99 99 99 88 88 100 127 104		
		Call ID: TX Offset: TX Interval: Carrier: Workstation: Operator: Station: Format: Category: From: TeleCmd1: DistressID: Nature: Subsequent Comms: EOS: Sync:	1000023 00:00:00 15 min ch70 TESTPC-ICS tuvadmin TUV test station All Ships Distress 004661000 Distress Acknowledgement 123456789 Undesignated F3E/G3E simplex EOS No	
		EUT Displays: "RX DISTRESS ACK SHIP IN DISTRESS 123456789 UNDESIGNATED" EUT prompts change to channel 16.		
All Ships Relay	156.525	Yes	112	107
		DSC Symbols: 116 116 112 00 46 61 00 00 112 126 126 126 126 126 107 99 99 99 99 99 88 88 100 127 10		
		Operator: Station: Format: Category: From: TeleCmd1: Nature: Subsequent Comms: EOS: Sync:	tuvadmin TUV test station All Ships Distress 004661000 Distress Relay Undesignated F3E/G3E simplex EOS No	

Call Sent	Channel (MHz)	Received Without Error	Telecommand 1	Telecommand 2
		The EUT displayed: "RX DISTRESS RELAY 004661000 SHIP IN DISTRESS UNDESIGNATED"		
All Ships Urgency	156.525	Yes	100	126
		DSC Symbols: 116 116 110 00 46 61 00 00 100 126 90 00 16 90 00 16 127 108		
		Call ID: TX Offset: TX Interval: Carrier: Workstation: Operator: Station: Format: Category: From: TeleCmd1: TeleCmd2: TxFreq: RxFreq: EOS: Sync:	1000018 00:00:00 15 min ch70 TESTPC-ICS tuvadmin TUV test station All Ships Urgency 004661000 F3E/G3E simplex No information ch16 ch16 EOS No	
		EUT Displayed: "RX ALL SHIPS CALL 004661000 URGENCY 1st TELEC F3E/G3E SIMP"		
All Ships Safety	156.525	Yes	100	126
		DSC Symbols: 116 116 108 00 46 61 00 00 100 126 90 00 16 90 00 16 127 110		
		Call ID: TX Offset: TX Interval: Carrier: Workstation: Operator: Station: Format: Category: From: TeleCmd1: TeleCmd2: TxFreq: RxFreq: EOS: Sync:	1000017 00:00:00 15 min ch70 TESTPC-ICS tuvadmin TUV test station All Ships Safety 004661000 F3E/G3E simplex No information ch16 ch16 EOS No	
		The EUT displayed: "RX ALL SHIPS CALL 004661000 SAFETY 1ST TELEC: F3E/G3E		

Product Service

Call Sent	Channel (MHz)	Received Without Error	Telecommand 1	Telecommand 2
		SIMP"		
Individual Urgency	156.525	Yes	100	126
		DSC Symbols: 120 120 24 70 12 34 50 110 00 46 61 00 00 100 126 90 00 16 90 00 16 117 40		
		Call ID: TX Offset: TX Interval: Carrier: Workstation: Operator: Station: Format: Category: To: From: TeleCmd1: TeleCmd2: TxFreq: RxFreq: EOS: Sync:	1000021 00:00:00 15 min ch70 TESTPC-ICS tuvadmin TUV test station Individual Urgency 247012345 004661000 F3E/G3E simplex No information ch16 ch16 ARQ No	
		The EUT displays: "RX INDIVIDUAL CALL URGENCY 1st TELEC: F3E/G3E SIMP" Note, prompts EUT to change to CH16		
Individual Safety	156.525	Yes	100	126
		DSC Symbols: 120 120 24 70 12 34 50 108 00 46 61 00 00 100 126 90 00 16 90 00 16 117 42		
		Call ID: TX Offset: TX Interval: Carrier: Workstation: Operator: Station: Format: Category: To: From: TeleCmd1: TeleCmd2: TxFreq: RxFreq: EOS: Sync:	1000020 00:00:00 15 min ch70 TESTPC-ICS tuvadmin TUV test station Individual Safety 247012345 004661000 F3E/G3E simplex No information ch16 ch16 ARQ No	

Product Service

Call Sent	Channel (MHz)	Received Without Error	Telecommand 1	Telecommand 2
		EUT Displays: "RX INDIVIDUAL CALL SAFETY 1st TELEC: F3E/G3E SIMP" Note the EUT prompts change to CH16		
Individual Routine	156.525	Yes	100	126
		DSC Symbols: 120 120 24 70 12 34 50 100 00 46 61 00 00 100 126 90 00 23 90 00 23 117 34		
		Call ID: TX Offset: TX Interval: Carrier: Workstation: Operator: Station: Format: Category: To: From: TeleCmd1: TeleCmd2: TxFreq: RxFreq: EOS: Sync:	1000019 00:00:00 15 min ch70 TESTPC-ICS tuvadmin TUV test station Individual Routine 247012345 004661000 F3E/G3E simplex No information ch23 ch23 ARQ No	
		The EUT Displayed: "RX INDIVIDUAL CALL ROUTINE 1st TELEC: F3E/G3E SIMP CHANNEL 23" I.E. The EUT prompts change to channel 23.		
Group Routine	156.525	Yes	100	126
		DSC Symbols: 114 114 03 34 45 55 50 100 00 46 61 00 00 100 126 90 00 23 90 00 23 127 105		

Call Sent	Channel (MHz)	Received Without Error	Telecommand 1	Telecommand 2
		Call ID: TX Offset: TX Interval: Carrier: Workstation: Operator: Station: Format: Category: To: From: TeleCmd1: TeleCmd2: TxFreq: RxFreq: EOS: Sync:	1000025 00:00:00 15 min ch70 TESTPC-ICS tuvadmin TUV test station Group Routine 033445555 004661000 F3E/G3E simplex No information ch23 ch23 EOS No	
		EUT Displays: "RX GROUP CALL 1st TELEC: F3E/G3E SIMP CHANNEL 23 CALLER 004661000" The EUT changes to channel 23 automatically		

Table 1 - Received Calls

Requirement	Check Performed (Yes/No)	Errors Found (Yes/No)
Confirm that the decoded call sequences at the output of the receiver have been examined for correct technical format, including error check characteristics.	Yes	No
Confirm that the checks have been made to ensure accordance between printer output and display:	Yes	No
It has been verified that the equipment is capable of switching to a channel identified in the DSC call:		

Table 2 - Performed Checks

<ReportComment>

IEC 62238, Limit Clause 10.8.3

The requirements of ITU-R Recommendation M.493-11 regarding message composition and content shall be met.

The decoded call sequences at the output of the receiver shall be examined for correct technical format, including error-check characters.

When receiver measurements are made by use of a printer or a computer, a check shall be made to ensure accordance between printer output and display indication.

It shall be verified that the equipment is capable of switching to the channels identified in the DSC call.

2.7 REACTION TO VTS AND AIS CHANNEL MANAGEMENT DSC TRANSMISSIONS

2.7.1 Specification Reference

IEC 62238, Clause 10.9

2.7.2 Equipment Under Test and Modification State

GX6500 and GX6000 S/N: SPP No 10 - Modification State 0

2.7.3 Date of Test

12 October 2016

2.7.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.7.5 Environmental Conditions

Ambient Temperature	24.5°C
Relative Humidity	37.8%

2.7.6 Test Results

DCS Receive

	Confirm (Y or N)
Not sound an alarm	Y
Not display a message (An accurate informative display is permissible but not required)	Y
Not transmit a response	Y
Not suggest a transmitted response	Y
Not lock up	Y
Not require operator intervention	Y

Limit Clause 10.9.3

The equipment shall not sound an alarm, display a message (an accurate, informative display is permissible but not required), transmit a response or suggest a transmitted response, lock up, or require operator intervention.

Product Service

2.8 SIMULTANEOUS RECEPTION

2.8.1 Specification Reference

IEC 62238, Clause 10.10

2.8.2 Equipment Under Test and Modification State

GX6500 and GX6000 S/N: SPP No 10 - Modification State 0

2.8.3 Date of Test

3 October 2016

2.8.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.8.5 Environmental Conditions

Ambient Temperature	22.3°C
Relative Humidity	39.0%

2.8.6 Test Results

DCS Receive

156.525 MHz

SINAD (dB) No DSC Signal	SINAD (dB) DSC Signal Applied	Bit Error Rate
36.47	36.47	0

Limit Clause 10.10.3

SINAD Ratio (dB)	≥ 20 dB in presence of DSC Signal
Bit Error Rate	≤ 10^{-2}

Product Service

SECTION 3

TEST EQUIPMENT USED

Product Service

3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.1 - Test of Generated Call Sequences					
Modem (MF/HF/VHF DSC)	ICS	PLT02249	120	12	5-Aug-2017
Attenuator (30dB/50W)	Aeroflex / Weinschel	47-30-34	3164	12	16-Dec-2016
Hygrometer	Rotronic	I-1000	3220	12	23-Aug-2017
Communications Receiver, AM, FM,& WFM	ICOM	IC-R5	3330	-	O/P Mon
Attenuator (20dB, 150W)	Narda	769-20	3367	12	31-May-2017
4 Channel PSU	Rohde & Schwarz	HMP4040	4736	-	TU
30dB Attenuator	Narda	766-30	4783	12	3-Oct-2017
Section 2.2 - Multiple Watch Characteristics					
Signal Generator	Rohde & Schwarz	SMX	115	12	11-Jul-2017
AF Load (16ohm)	ASL (TUV)	16ohm	427	12	8-Feb-2017
AF Load (16ohm)	ASL (TUV)	SJ2	432	12	8-Feb-2017
Temperature Chamber	Montford	2F3	467	-	O/P Mon
Crystal Detector (Pos O/P)	ASL (TUV)	RAB1	479	-	TU
Power Divider	Weinschel	1506A	603	12	7-Jun-2017
Step Attenuator	Rohde & Schwarz	DPSP	1672	-	O/P Mon
Signal Generator (250kHz to 4GHz)	Agilent Technologies	E4433B	2893	12	18-Aug-2017
Thermocouple Thermometer	Fluke	51	3174	12	9-Dec-2016
Hygrometer	Rotronic	I-1000	3220	12	23-Aug-2017
Power Divider	Weinschel	1506A	3345	12	7-Jun-2017
Attenuator (20dB, 150W)	Narda	769-20	3367	12	31-May-2017
TRUE RMS MULTIMETER	Fluke	179	4006	12	9-Dec-2016
Oscilloscope	Agilent Technologies	DSO9104A	4142	12	15-Sep-2017
4 Channel PSU	Rohde & Schwarz	HMP4040	4736	-	TU
Section 2.3 - DSC Receiver Adjacent Channel Selectivity					
Digital Time Analyser	Marconi	2850-BS	80	-	TU
DSC Decoder/Encoder	TUV SUD Product Service	DSC TPOO1	81	-	TU
Signal Generator	Rohde & Schwarz	SMX	115	12	11-Jul-2017
Temperature Chamber	Montford	2F3	467	-	O/P Mon
Power Splitter	Weinschel	1506A	607	12	31-Mar-2017
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	5-Mar-2017
Thermocouple Thermometer	Fluke	51	3174	12	9-Dec-2016
Hygrometer	Rotronic	I-1000	3220	12	23-Aug-2017
DSC Pre-Emphasis Unit for VHF Modem	TUV SUD Product Service	RAB 200701	3314	12	12-Feb-2017
Signal Generator, 9kHz to 3GHz	Rohde & Schwarz	SMA 100A	3494	12	22-Apr-2017
TRUE RMS MULTIMETER	Fluke	179	4006	12	9-Dec-2016
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	5-Mar-2017
4 Channel PSU	Rohde & Schwarz	HMP4040	4736	-	TU

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.4 - DSC Receiver Intermodulation Response					
Signal Generator	Hewlett Packard	ESG4000A	38	12	26-May-2017
Digital Time Analyser	Marconi	2850-BS	80	-	TU
DSC Decoder/Encoder	TUV SUD Product Service	DSC TPOO1	81	-	TU
Signal Generator	Rohde & Schwarz	SMX	115	12	11-Jul-2017
Power Splitter	Weinschel	1506A	607	12	31-Mar-2017
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	5-Mar-2017
Hygrometer	Rotronic	I-1000	3220	12	23-Aug-2017
DSC Pre-Emphasis Unit for VHF Modem	TUV SUD Product Service	RAB 200701	3314	12	12-Feb-2017
Power Divider	Weinschel	1506A	3345	12	7-Jun-2017
Signal Generator, 9kHz to 3GHz	Rohde & Schwarz	SMA 100A	3494	12	22-Apr-2017
DC - 12.4 GHz 10 dB Attenuator 1 W	Suhner	6810.17.A	3964	12	23-Oct-2016
DC - 12.4 GHz 10 dB Attenuator	Suhner	6810.17.A	3965	12	23-Oct-2016
TRUE RMS MULTIMETER	Fluke	179	4006	12	9-Dec-2016
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	5-Mar-2017
4 Channel PSU	Rohde & Schwarz	HMP4040	4736	-	TU
Section 2.5 - DSC Receiver Spurious Response					
Signal Generator	Hewlett Packard	ESG4000A	38	12	26-May-2017
Digital Time Analyser	Marconi	2850-BS	80	-	TU
DSC Decoder/Encoder	TUV SUD Product Service	DSC TPOO1	81	-	TU
Signal Generator	Rohde & Schwarz	SMX	115	12	11-Jul-2017
Multimeter	Fluke	75 Mk3	455	12	14-Sep-2017
Power Splitter	Weinschel	1506A	607	12	31-Mar-2017
Signal Generator	Hewlett Packard	8663A	765	12	9-Nov-2016
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	5-Mar-2017
Hygrometer	Rotronic	I-1000	2891	12	23-Aug-2017
DSC Pre-Emphasis Unit for VHF Modem	TUV SUD Product Service	RAB 200701	3314	12	12-Feb-2017
Tunable Notch Filter	Wainwright	WRCD 130.0/170.0-0.05/50-5EEK	3412	-	TU
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	15-Sep-2017
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	8-Sep-2017
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	5-Mar-2017
4 Channel PSU	Rohde & Schwarz	HMP4040	4736	-	TU
Section 2.6 - Verification Of Correct Decoding Of Various Types Of DSC Calls					
Power Supply Unit	Hewlett Packard	6267B	21	-	TU
Signal Generator	Rohde & Schwarz	SMX	115	12	12-Jul-2018
Modem (MF/HF/VHF DSC)	ICS	PLT02249	120	12	03-Aug-2018
Power Attenuator (30dB)	Rohde & Schwarz	RBU	2746	12	16-Feb-2017
Hygrometer	Rotronic	I-1000	3220	12	30-Aug-2018
Sensor Module	Hewlett Packard	11722A	3293	12	08-Dec-2017
True RMS Multimeter	Fluke	179	4007	12	14-Sep-2018
DSC Pre-empahsis Unit	TUV SUD Product Service	n/a	4369	12	03-Aug-2018
4 Channel PSU	Rohde & Schwarz	HMP4040	4736	-	TU
Section 2.7 - Reaction to VTS and AIS Channel Management DSC Transmissions					
Signal Generator	Rohde & Schwarz	SMX	115	12	11-Jul-2017

Product Service

Modem (MF/HF/VHF DSC)	ICS	PLT02249	120	12	5-Aug-2017
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	5-Mar-2017
Attenuator (30dB/50W)	Aeroflex / Weinschel	47-30-34	3164	12	16-Dec-2016
Hygrometer	Rotronic	I-1000	3220	12	23-Aug-2017
DSC Pre-Emphasis Unit for VHF Modem	TUV SUD Product Service	RAB 200701	3314	12	12-Feb-2017
Attenuator (20dB, 150W)	Narda	769-20	3367	12	31-May-2017
TRUE RMS MULTIMETER	Fluke	179	4006	12	9-Dec-2016
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	5-Mar-2017
4 Channel PSU	Rohde & Schwarz	HMP4040	4736	-	TU
30dB Attenuator	Narda	766-30	4783	12	3-Oct-2017

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.8 - Simultaneous Reception					
Digital Time Analyser	Marconi	2850-BS	80	-	TU
DSC Decoder/Encoder	TUV SUD Product Service	DSC TPOO1	81	-	TU
Signal Generator	Rohde & Schwarz	SMX	115	12	11-Jul-2017
Power Splitter	Weinschel	1506A	607	12	31-Mar-2017
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	5-Mar-2017
Audio Analyser	Hewlett Packard	8903B	1350	12	16-Nov-2016
Hygrometer	Rotronic	I-1000	3220	12	23-Aug-2017
DSC Pre-Emphasis Unit for VHF Modem	TUV SUD Product Service	RAB 200701	3314	12	12-Feb-2017
Attenuator (20dB, 150W)	Narda	769-20	3367	12	31-May-2017
Signal Generator, 9kHz to 3GHz	Rohde & Schwarz	SMA 100A	3494	12	22-Apr-2017
TRUE RMS MULTIMETER	Fluke	179	4006	12	9-Dec-2016
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	5-Mar-2017
4 Channel PSU	Rohde & Schwarz	HMP4040	4736	-	TU

TU – Traceability Unscheduled
O/P MON – Output Monitored with Calibrated Equipment

3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:-

Test Discipline	MU
Multiple Watch Characteristics	-
DSC Receiver Adjacent Channel Selectivity	± 2.6 dB
DSC Receiver Intermodulation Response	± 1.7 dB
DSC Receiver Spurious Emissions	± 2.0 dB
Reaction to VTS and AIS Channel Management DSC Transmissions	-
Simultaneous Reception	± 1.8 dB
Test of Generated Call Sequences	-

Product Service

SECTION 4

PHOTOGRAPHS

Product Service

4.1 PHOTOGRAPHS OF EQUIPMENT UNDER TEST (EUT)

Front View

Rear View

Product Service

SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

Product Service

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

This report relates only to the actual item/items tested.

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA (Not UKAS Accredited).

Product Service

ANNEX A

MANUFACTURERS DECLARATION

Product Service

Yaesu GX6500 and GX6000 Model descriptions and differences.

The GX6000E and GX6500E are two models in a new range of Class D VHF Marine Transceivers.

Both models have a Class D GMDSS compatible encoder and decoder with compliance to ITU-R M.493-13 and NMEA 0183 and NMEA 2000 compliant interfaces.

Both models have dedicated Channel 70 Receivers for DSC decoding and two dedicated AIS channel receivers with individual AIS decoders.

The GX6500E has an additional board fitted to provide a dual channel AIS transponder with an external dedicated GPS Aerial (SCU-31) included with this variant.

The GX6500E is the default configuration, with the GX6000E declared as a technical variant.

Both models are identical in design and construction and have identical firmware. The GX6000E does not have the GX6500E AIS Module installed nor the PCB connectors installed.

All testing has been carried out on the GX6500E as this is the model with all the possible internal options installed.

Yaesu asserts that the EMC emissions and immunity for the two models are identical and the EMC emissions and immunity test reports that tested the GX6500E equally apply to the GX6000E variant.

Signed:

Paul Bigwood
Yaesu Musen Co. Ltd
10th February 2017