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Report On

Radio Testing of the
SRT Marine Technology Ltd AtoN TRS-418-0003/TR-418-0001
In accordance with IEC 62320-2: AIS AtoN Stations

COMMERCIAL-IN-CONFIDENCE

Document 75917597 Report 06 Issue 2 November 2012

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REPORT ON

Radio Testing of the
SRT Marine Technology Ltd AtoN TRS-418-0003/TR-418-0001
In accordance with IEC 62320-2: AIS AtoN Stations

Document 75917597 Report 06 Issue 2

November 2012

PREPARED FOR

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DATED 28 November 2012

This report has been up-issued to Issue 2 to include Conducted Emissions results.

Product Service

CONTENTS

Product Service

SECTION 1

REPORT SUMMARY

Radio Testing of the
SRT Marine Technology Ltd AtoN TRS-418-0003/TR-418-0001
In accordance with IEC 62320-2: AIS AtoN Stations

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Radio Testing of the SRT Marine Technology Ltd AtoN TRS-418-0003/TR-418-0001 to the requirements of IEC 62320-2: AIS AtoN Stations.

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	SRT Marine Technology Ltd
Model Number(s)	Carbon
Serial Number(s)	TUV Ref 75917597 TSR00025 TUV Ref 75917597 TSR00026 TUV Ref 75917597 TSR00027
Number of Samples Tested	3
Test Specification/Issue/Date	IEC 62320-2 (2008)
Incoming Release Date	Declaration of Build Status 12 October 2012
Disposal Reference Number Date	Held Pending Disposal Not Applicable Not Applicable
Order Number Date	POR003047 22 March 2012
Start of Test	10 October 2012
Finish of Test	27 November 2012
Name of Engineer(s)	S Bennett B Airs R Henley

Product Service

1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with IEC 62320-2 is shown below.

Section	Spec Clause	Test Description	Result	Comments/Base Standard
Transmit				
2.1	7.1.1.1	Frequency Error	Pass	
2.2	7.1.1.2	Carrier Power	Pass	
2.3	7.1.1.3	Modulation Spectrum Slotted Transmission	Pass	
2.4	7.1.1.4	Transmitter Test Sequence and Modulation Accuracy	Pass	
2.5	7.1.1.5	Transmitter Output Power Versus Time Function (FATDMA and RATDMA)	Pass	
2.6	7.1.3.2	Spurious Emissions from the Transmitter	Pass	

Product Service

1.3 DECLARATION OF BUILD STATUS

Manufacturer	SRT Marine Ltd
Country of origin	United Kingdom
UK Agent	SRT Marine Ltd
Technical Description	AtoN (Aids to Navigation)
Model No	TRS & TR
Part No	418-0003 & 418-0001
Serial No	Sample 1- P216-FTU-20, Sample 2- P216-FTU-21, Sample 3- P216-FTU-30.
Drawing Number	418-0003 & 418-0001
Build Status	Mod 11 (supplied)
Software Issue	080200.00.09.11
IC ID	7075A-4180003
FCC ID	UYW-418-0003

Signature

Richard McMahon

Date 12th October 2012

Note: This document has been prepared to enable manufacturers with no mechanism for producing their own Declaration of Build Status, to declare the build state of the equipment submitted for test.

No responsibility will be accepted by TÜV Product Service as to the accuracy of the information declared in this document by the manufacturer.

1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was a SRT Marine Technology Ltd AtoN TRS-418-0003/TR-418-0001 as shown in the photograph below. A full technical description can be found in the manufacturer's documentation.

Equipment Under Test

1.5 DEVIATIONS FROM THE STANDARD

No deviations from the application test standard or test plan were made during testing.

1.6 MODIFICATION RECORD

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

Modification 1 – EUT ref 75917597 TSR00026 re calibration. Calibration carried out by SRT Marine. No further modifications declared.

Product Service

SECTION 2

TEST DETAILS

Radio Testing of the
SRT Marine Technology Ltd AtoN TRS-418-0003/TR-418-0001
In accordance with IEC 62320-2: AIS AtoN Stations

2.1 FREQUENCY ERROR

2.1.1 Specification Reference

IEC 62320, Clause 7.1.1.1

2.1.2 Equipment Under Test and Modification State

EUT REF: 75917597 TSR0025 - Modification State 0

2.1.3 Date of Test

15 October 2012 & 23 October 2012

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 22.3°C
Relative Humidity 31.4 - 44.0%

2.1.6 Test Results

Maximum rated output power – 12.5 W

Test Conditions		Frequency Error (kHz)	
		156.025 MHz	162.025 MHz
T_{nom}(+22.3°C)	V_{nom}(12 V DC)	+0.156	+0.128
T_{min}(-25.0°C)	V_{min}(9.6 V DC)	+0.172	+0.120
T_{max}(+55.0°C)	V_{max}(31.2 V DC)	+0.108	+0.062
Maximum freq. error (Hz)		+172	+128

Limit Clause 7.1.1.1.3

The frequency error shall not exceed ± 0.5 kHz, under normal test conditions and ± 1 kHz under extreme test conditions.

2.2 CARRIER POWER

2.2.1 Specification Reference

IEC 62320, Clause 7.1.1.2

2.2.2 Equipment Under Test and Modification State

EUT REF: 75917597 TSR0025 - Modification State 0
EUT REF: 75917597 TSR0026 - Modification State 1

2.2.3 Date of Test

15 October 2012 & 22 October 2012

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	22.3 - 25.2°C
Relative Humidity	31.4 - 44.2%

2.2.6 Test Results

Maximum Rated output power – 12.5 W

Test Conditions		Transmitter Power (W)	
		156.025 MHz	162.025 MHz
T_{nom}(+22.3 °C)	V_{nom}(12 V DC)	11.940	9.977
T_{min}(-25.0°C)	V_{min}(9.6 V DC)	7.261	6.531
T_{max}(+55.0°C)	V_{max}(31.2 V DC)	11.940	9.333
Maximum Variation at normal conditions (dB)		-0.199	-0.929
Maximum Variation at extreme conditions (dB)		-2.359	-2.819

Minimum Rated output power – 1 W

Test Conditions		Transmitter Power (W)	
		156.025 MHz	162.025 MHz
T_{nom}(+22.3 °C)	V_{nom}(12 V DC)	1.064	0.887
T_{min}(-25.0°C)*	V_{min}(9.6 V DC)	0.959	1.019
T_{max}(+55.0°C)*	V_{max}(31.2 V DC)	1.384	1.279
Maximum Variation at normal conditions (dB)		0.269	-0.521
Maximum Variation at extreme conditions (dB)		1.411	1.069

*Test carried out with TSR sample REF 75917597 TSR0026 – modification state 1.

Limit Clause 7.1.1.2.3

*P*c shall be within ± 1.5 dB of the rated nominal power under normal conditions and within ± 3 dB of the rated nominal power under extreme conditions.

2.3 MODULATION SPECTRUM SLOTTED TRANSMISSION

2.3.1 Specification Reference

IEC 62320, Clause 7.1.1.3

2.3.2 Equipment Under Test and Modification State

EUT REF: 75917597 TSR0025 - Modification State 0

2.3.3 Date of Test

10 October 2012

2.3.4 Test Equipment Used

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

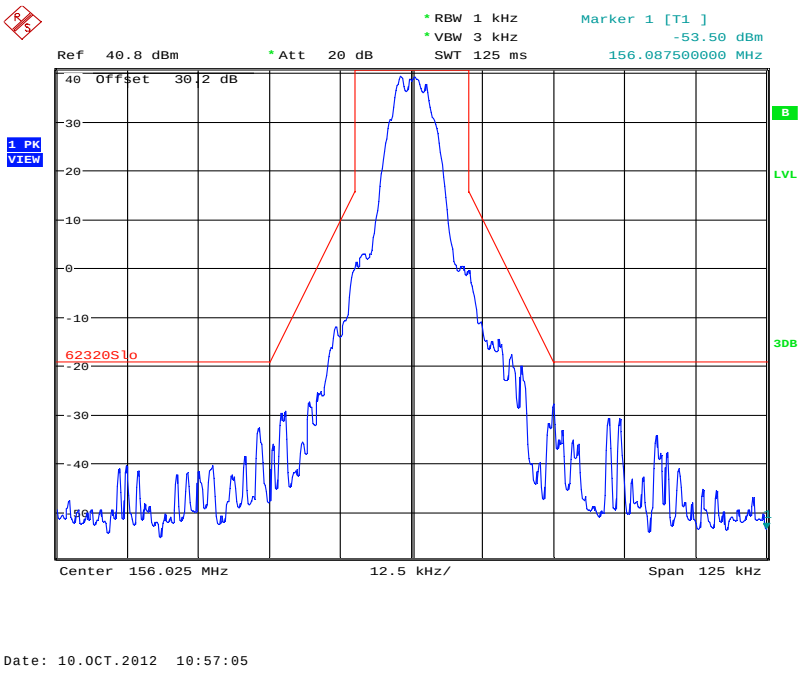
2.3.5 Environmental Conditions

Ambient Temperature	22.2°C
Relative Humidity	34.3%

2.3.6 Test Results

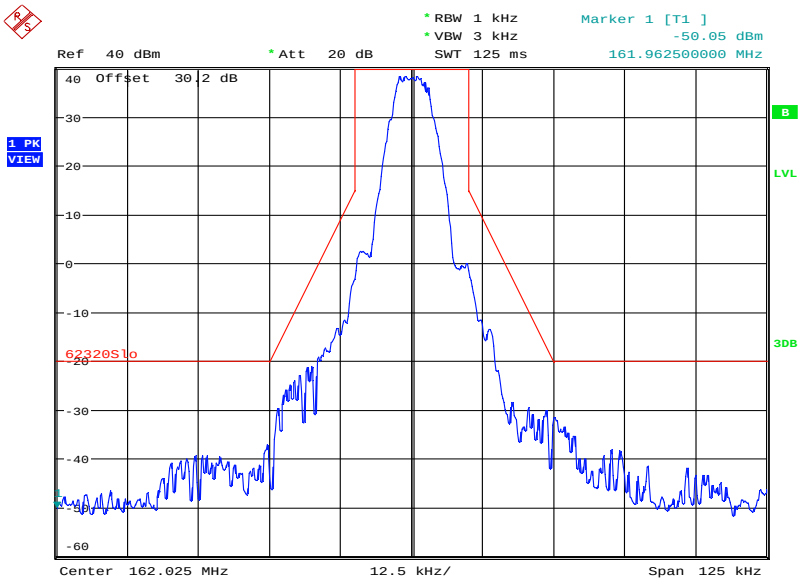
12 V DC Supply

156.025 MHz



Product Service

162.025 MHz



Date: 10.OCT.2012 11:46:43

Limit Clause 7.1.1.3.3

The spectrum for slotted transmission shall be within the emission mask as follows:

- In the region between the carrier and ± 10 kHz removed from the carrier, the modulation and transient sidebands shall be below 0 dBc
- At 10 kHz removed from the carrier, the modulation and transient sidebands shall be below -25 dBc
- At 25 kHz to ± 62.5 kHz removed from the carrier, the modulation and transient sidebands shall be below the lower value of –60 dBc or -30 dBm
- In the region between ± 10 kHz and ± 25 kHz removed from the carrier, the modulation and transient sidebands shall be below a line specified between these two points.

The reference level for the measurement shall be the carrier power (conducted) recorded for the appropriate test frequency in 7.1.1.2.

Also, please refer to the mask shown in figure 10 of the specification.

2.4 TRANSMITTER TEST SEQUENCE AND MODULATION ACCURACY

2.4.1 Specification Reference

IEC 62320, Clause 7.1.1.4

2.4.2 Equipment Under Test and Modification State

EUT REF: 75917597 TSR0026 - Modification State 1

2.4.3 Date of Test

22 October 2012

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	25.1°C
Relative Humidity	44.9%

Product Service

Test Results

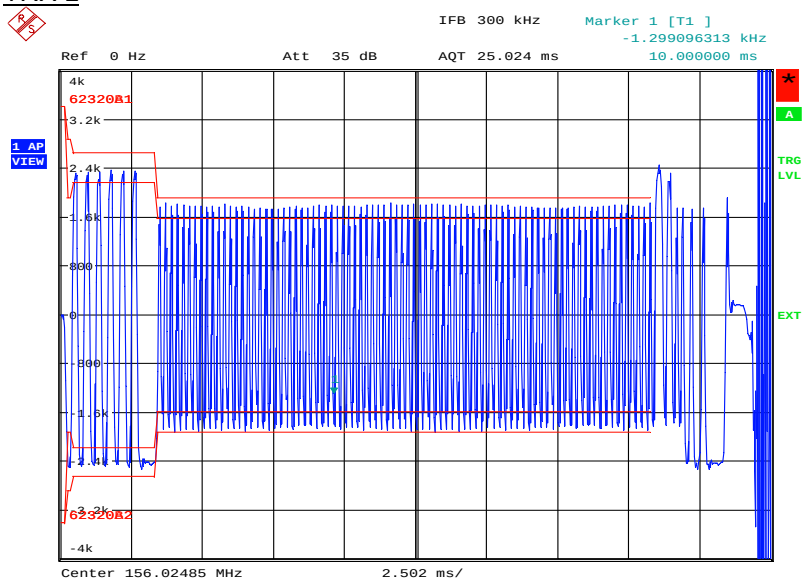
12 V DC Supply

156.025 MHz

25.1 °C

Test Signal Number 1

TRX 1



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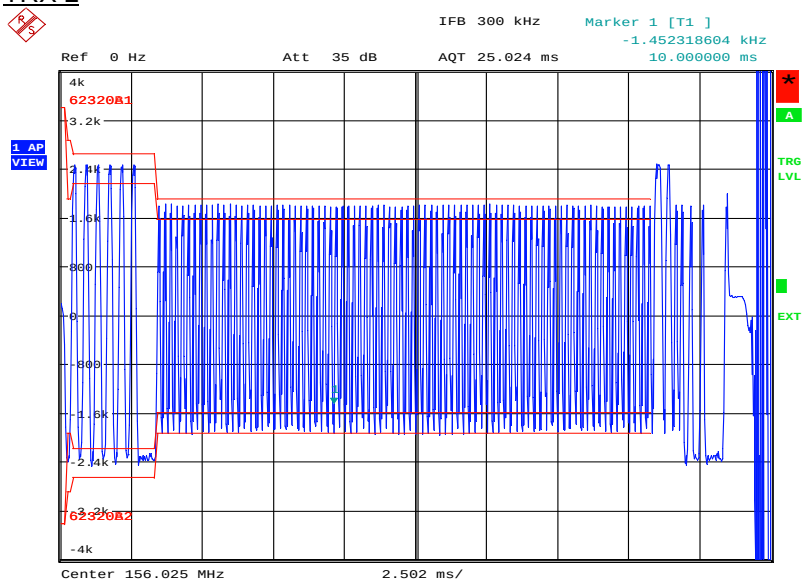
TRX 2

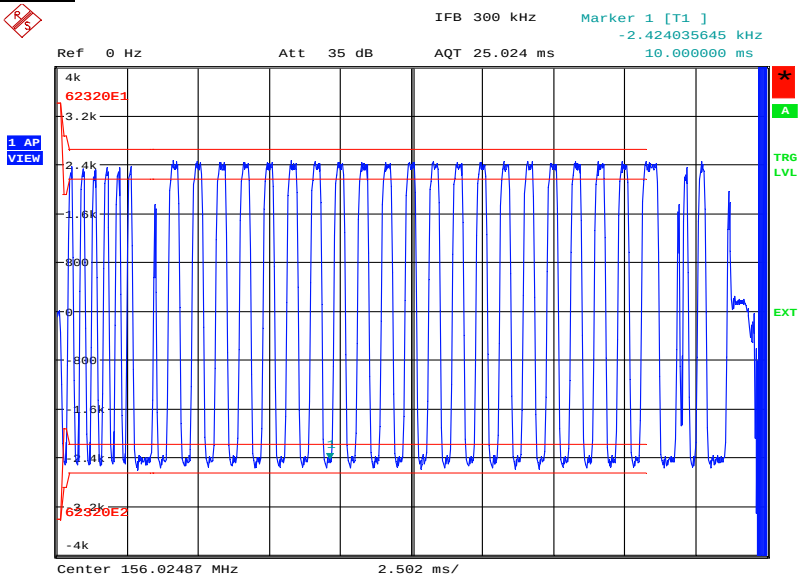


Date: 22.OCT.2012 12:03:35

Product Service

Test Signal Number 2

TRX 1



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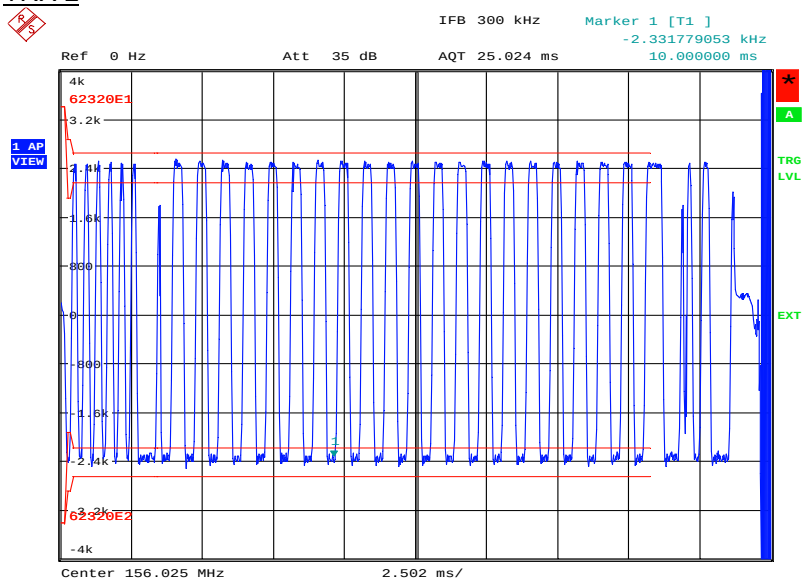


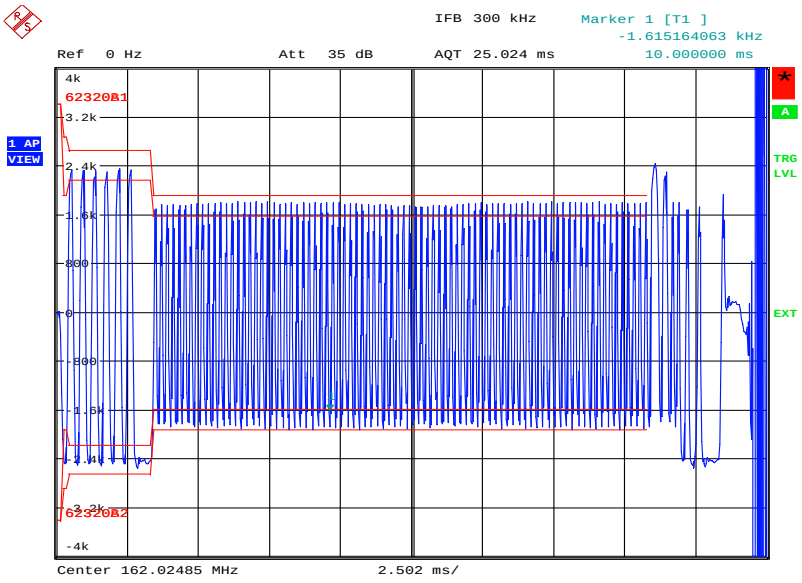
Date: 22.OCT.2012 11:37:04

Product Service

162.025 MHz

Test Signal Number 1

TRX 1



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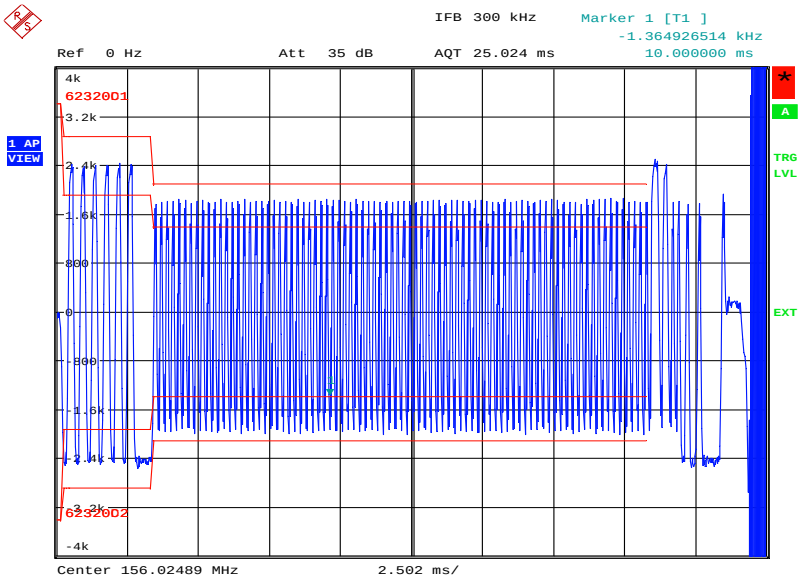
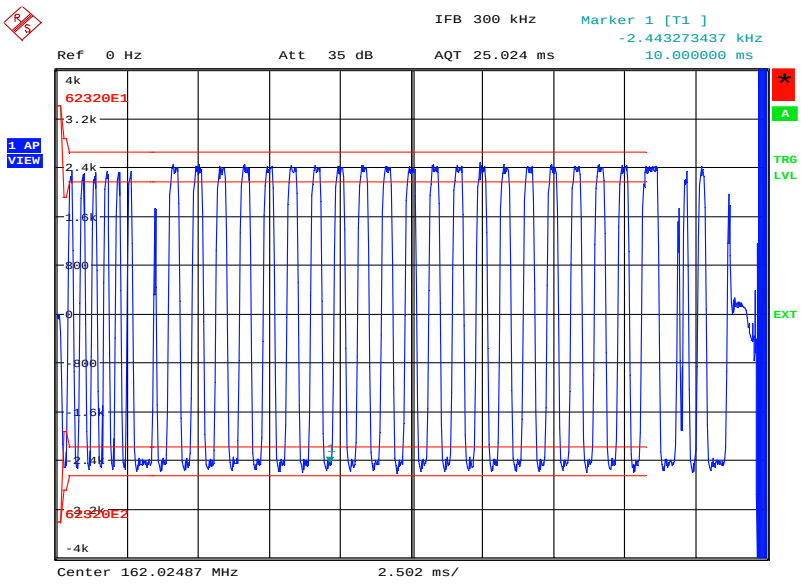


Date: 22.OCT.2012 13:25:14

Product Service

Test Signal Number 2

TRX 1



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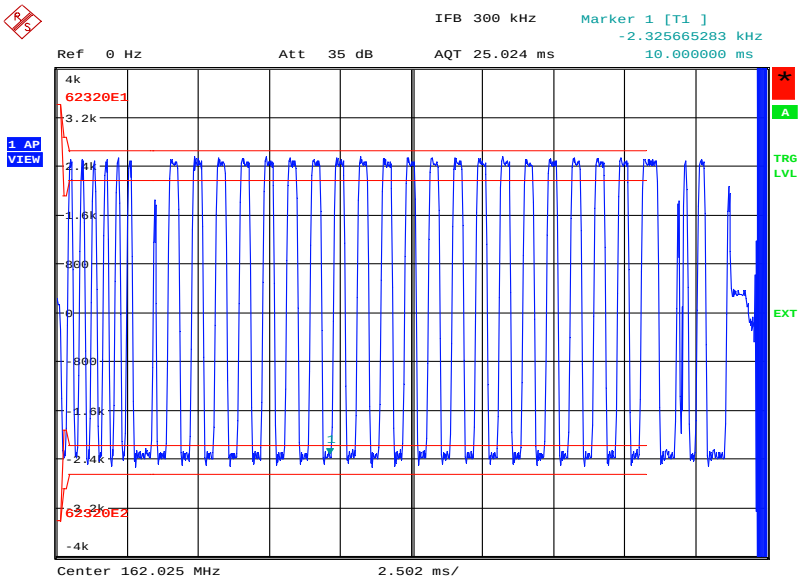
TRX 2



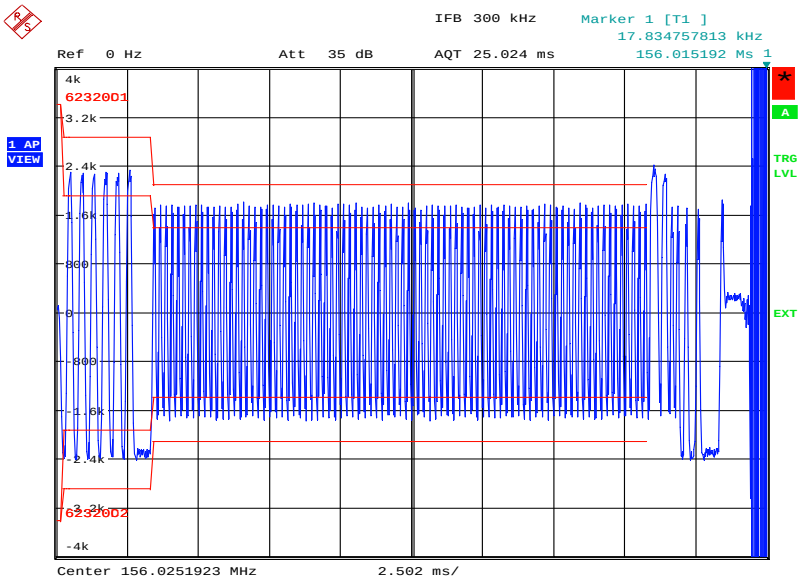
Date: 22.OCT.2012 11:33:06

-25.0 °C, 9.6 V DC

156.025 MHz

Test Signal Number 1

TRX 1



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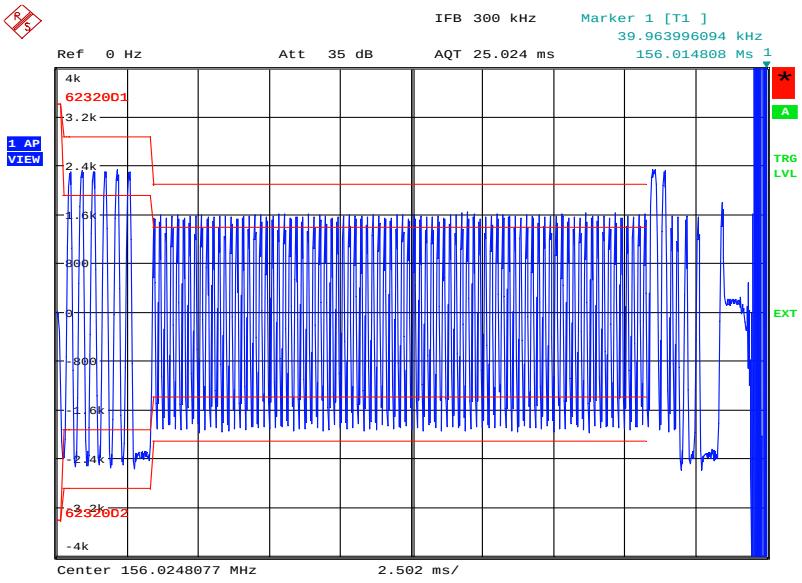
TRX 2

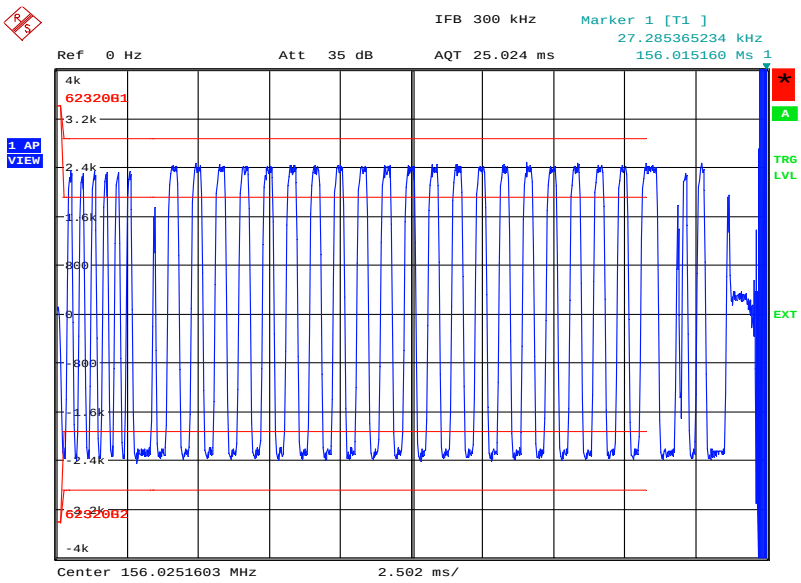


Date: 22.OCT.2012 15:15:41

Product Service

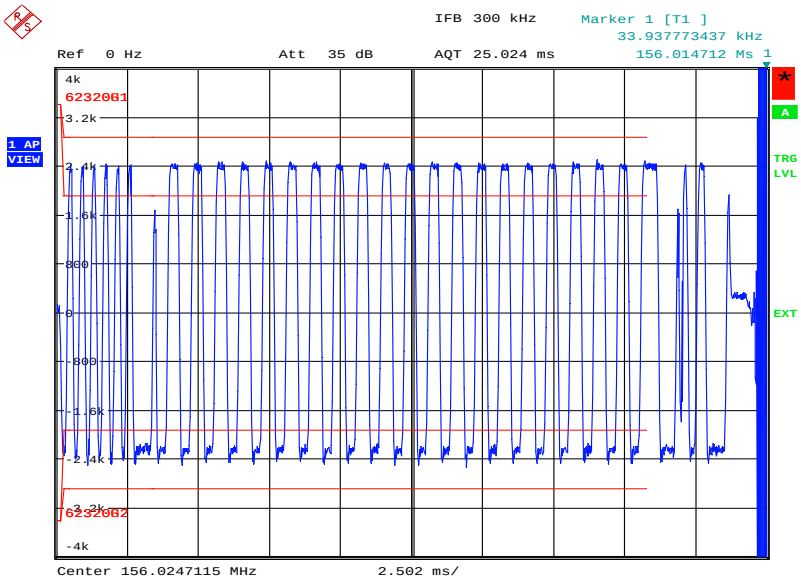
Test Signal Number 2

TRX 1



Date: 22.OCT.2012 15:21:58

TRX 2



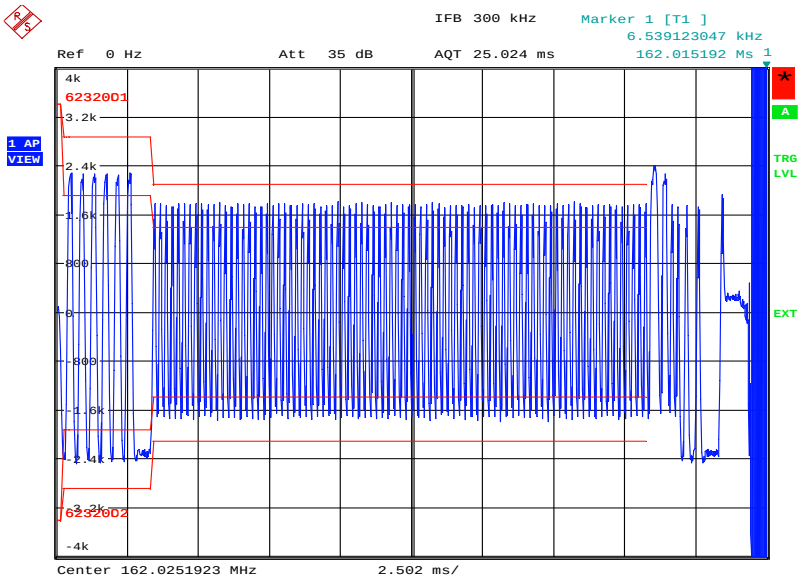
Date: 22.OCT.2012 15:26:21

Product Service

162.025 MHz

Test Signal Number 1

TRX 1



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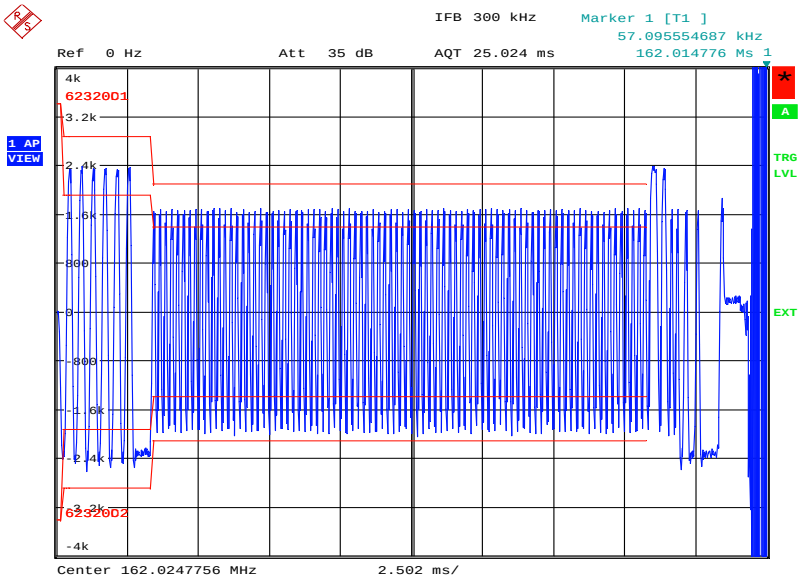
TRX 2

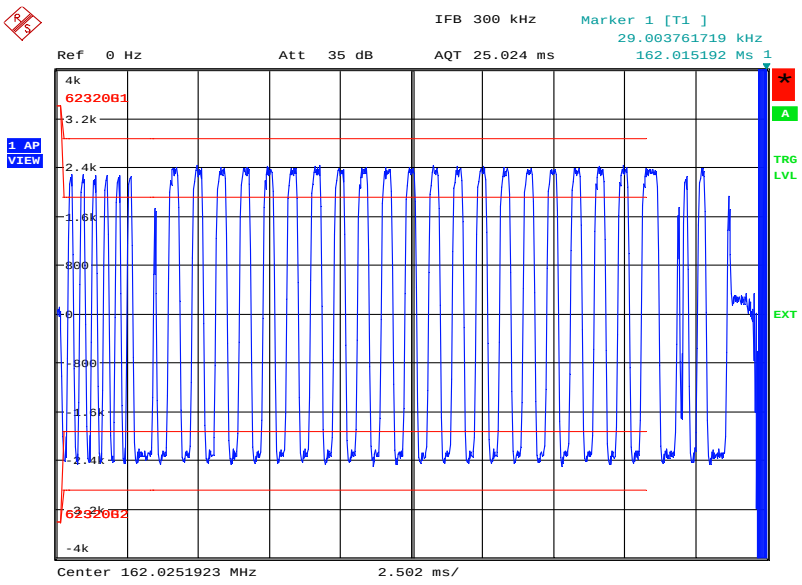


Date: 22.OCT.2012 15:17:29

Product Service

Test Signal Number 2

TRX 1



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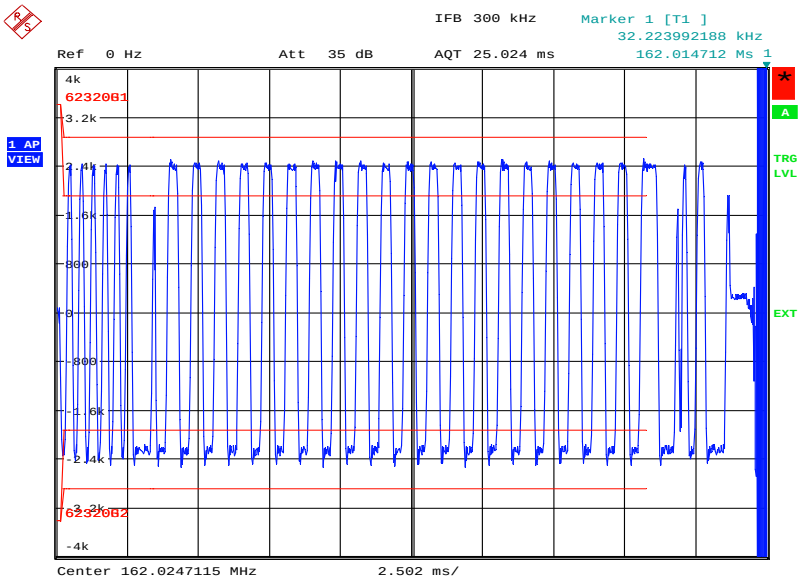
TRX 2



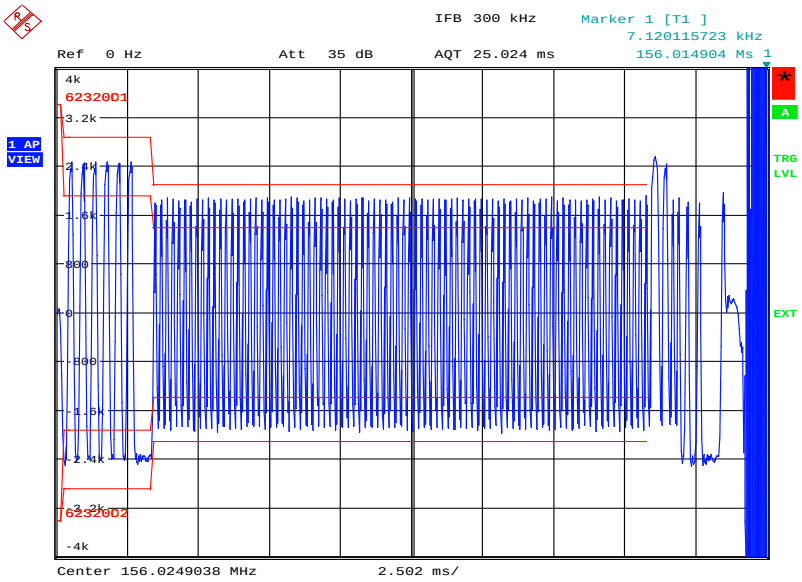
Date: 22.OCT.2012 15:29:53

+55.0°C, 31.2 V DC

156.025 MHz

Test Signal Number 1

TRX 1



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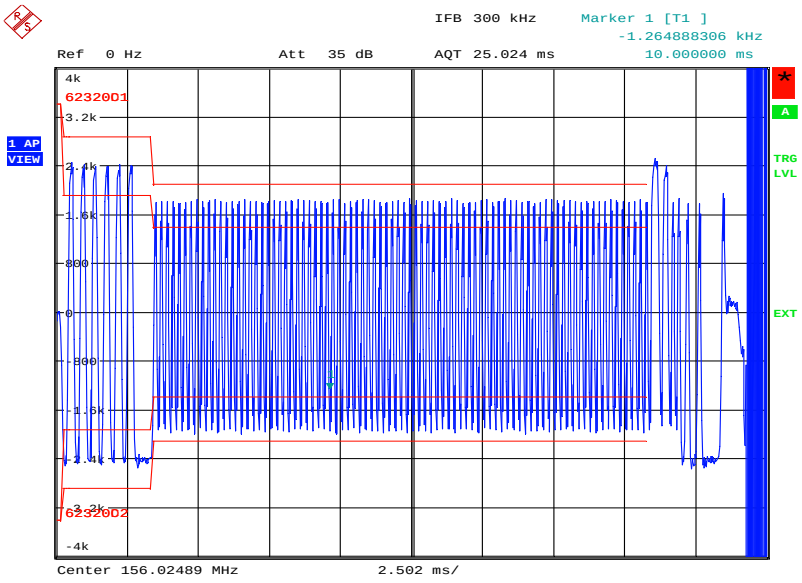
TRX 2



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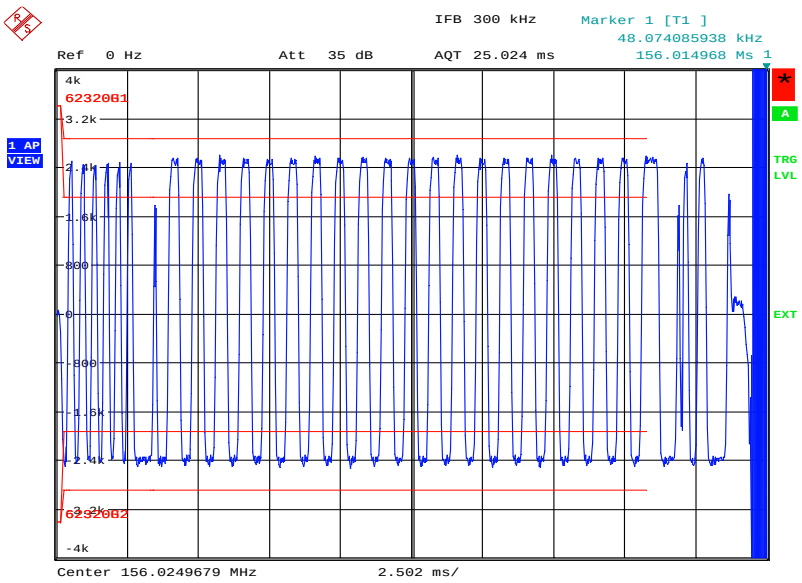
Product Service

Test Signal Number 2

TRX 1



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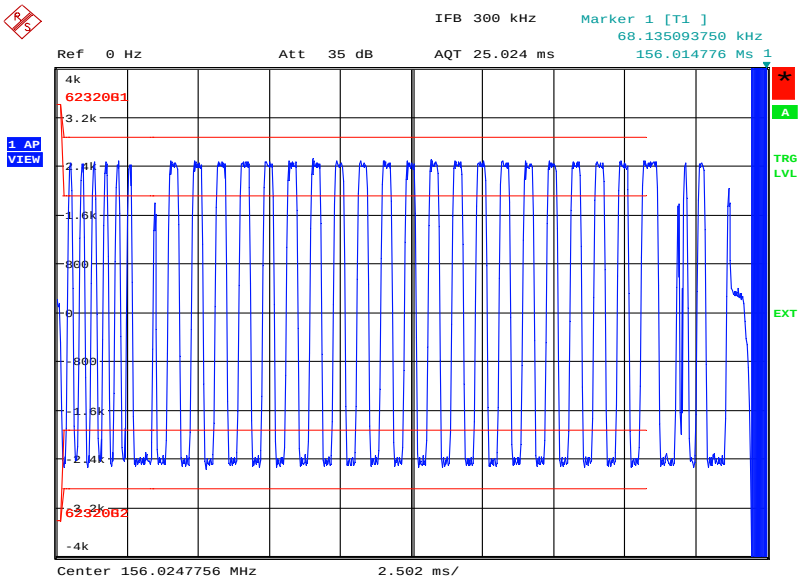
TRX 2



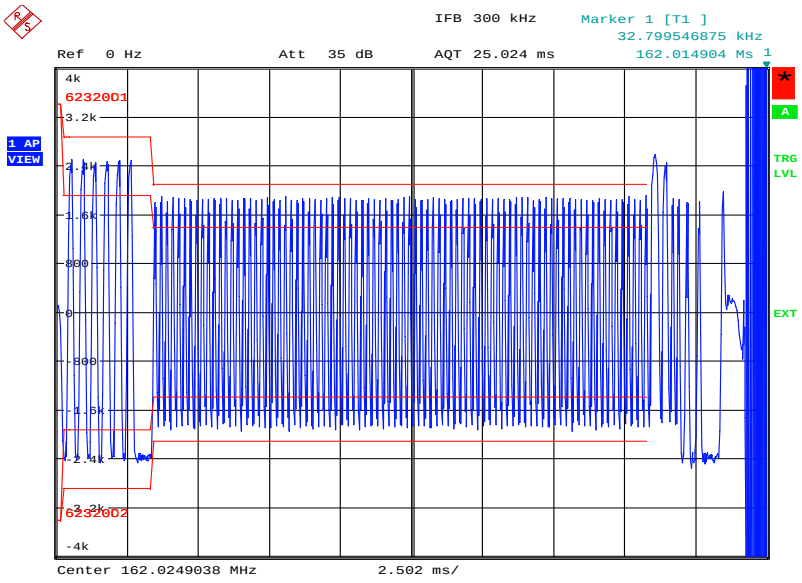
Date: 22.OCT.2012 13:47:15

Product Service

162.025 MHz

Test Signal Number 1

TRX 1



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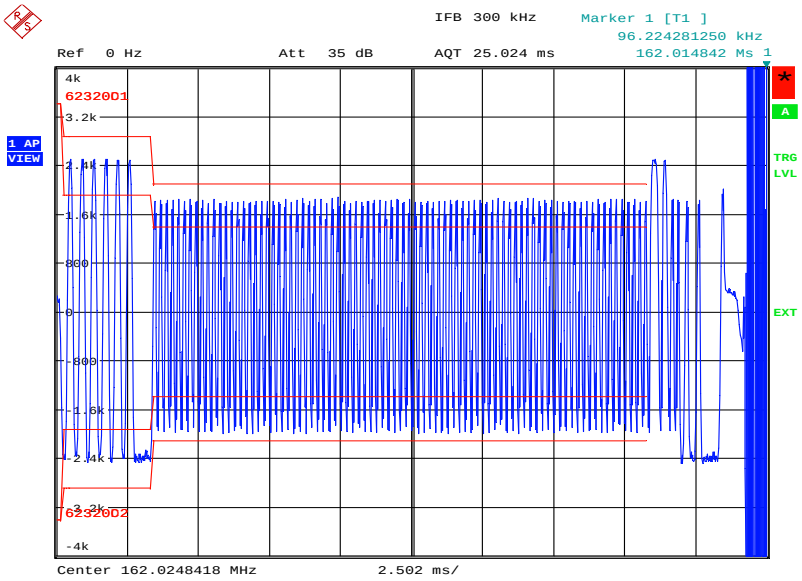
TRX 2



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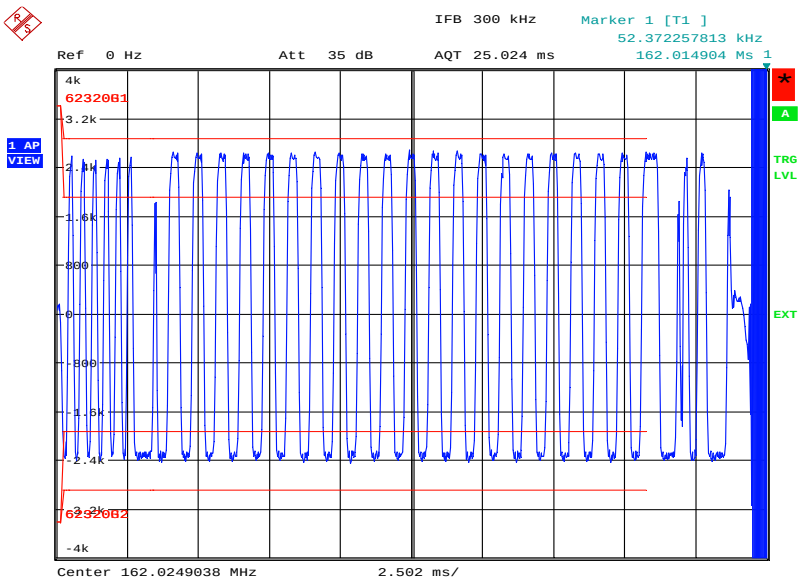
TRX 1



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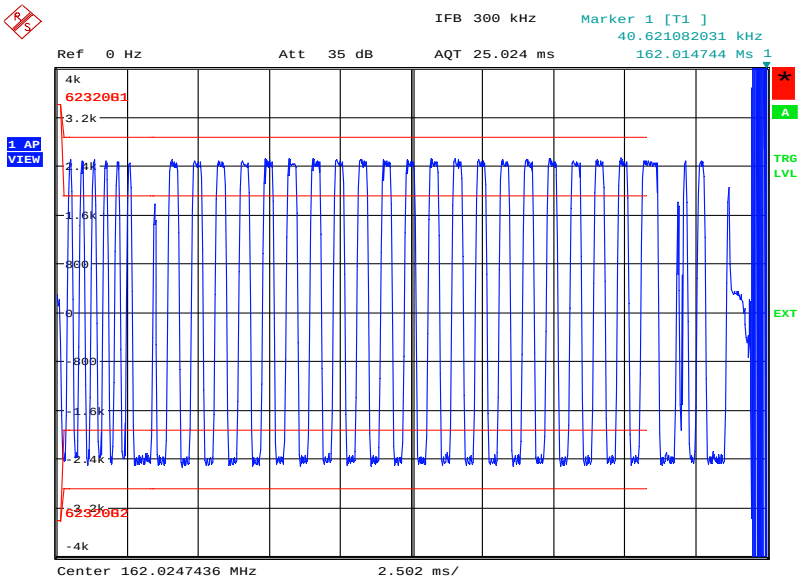
TRX 2



Date: 22.OCT.2012 13:48:25

Limit Clause 7.1.1.4.3

In each case, verify that the training sequence begins with '0'.

Peak frequency deviation at various points within the data frame shall comply with Table 17. These limits apply to both the positive and negative modulation peaks. Bit 0 is defined as the first bit of the training sequence.

Measurement period from centre to centre of each bit	Test Signal 1		Test Signal 2	
	Normal	Extreme	Normal	Extreme
Bit 0 to bit 1	< 3400 Hz			
Bit 2 to bit 3	2400 Hz ± 480 Hz			
Bit 4 to bit 31	2400 Hz ±240 Hz	2 400 Hz ±480 Hz	2 400 Hz ±240 Hz	2 400 Hz ±480 Hz
Bit 32 to bit 199	1740 Hz ± 175 Hz	1 740 Hz ±350 Hz	2 400 Hz ±240 Hz	2 400 Hz ±480 Hz

2.5 TRANSMITTER OUTPUT POWER VERSUS TIME FUNCTION (FATDMA AND RATDMA)

2.5.1 Specification Reference

IEC 62320, Clause 7.1.1.5

2.5.2 Equipment Under Test and Modification State

EUT REF: 75917597 TSR0025 - Modification State 0

2.5.3 Date of Test

10 October 2012

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	25.6°C
Relative Humidity	31.5%

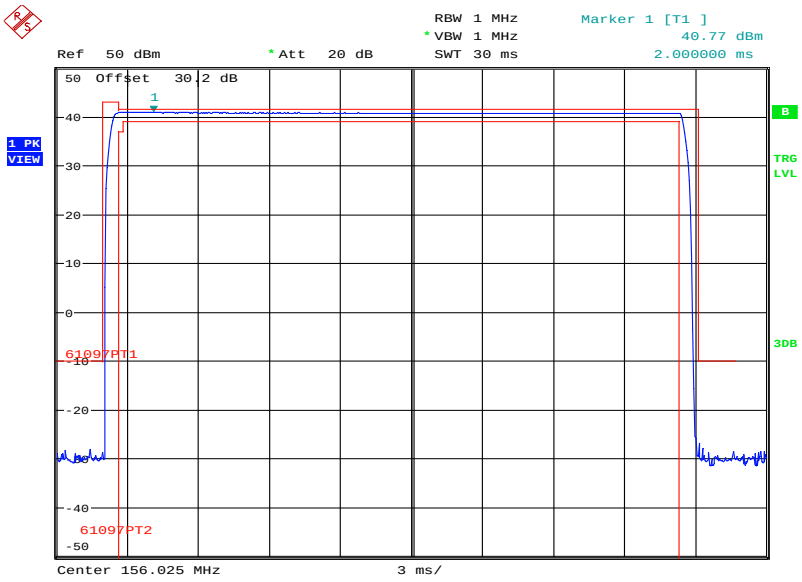
Product Service

2.5.6 Test Results

12 V DC Supply

Plots

156.025 MHz



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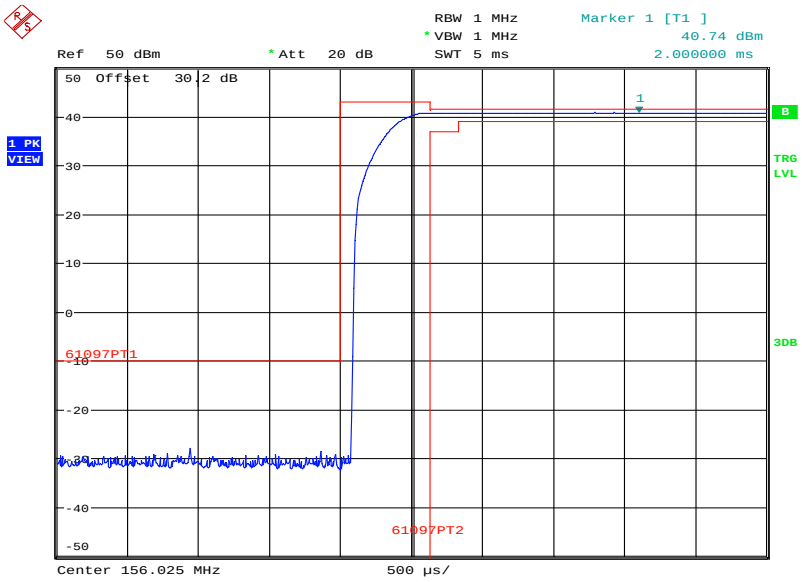

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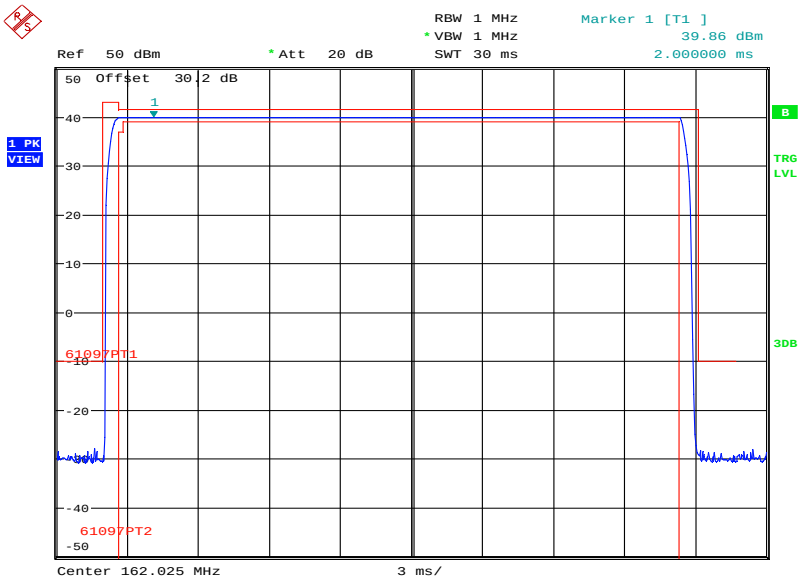
Product Service

162.025 MHz



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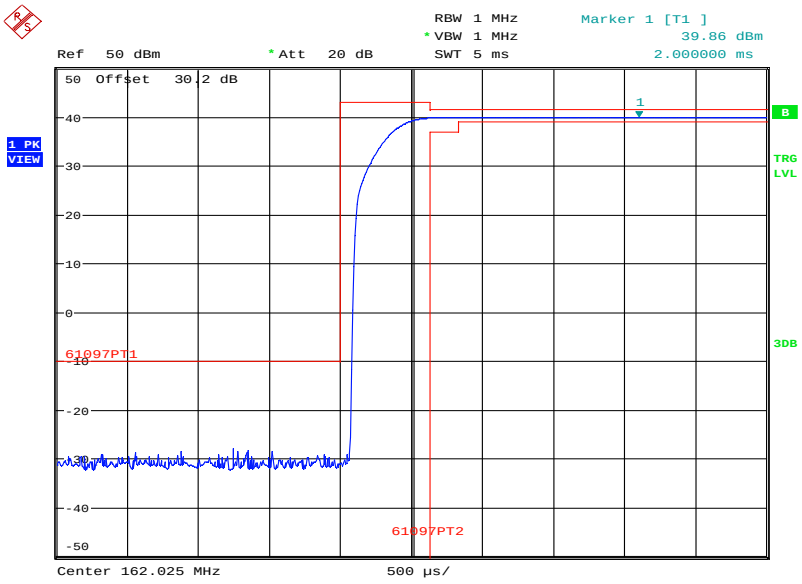


Date: 10.OCT.2012 14:09:42

Limit Clause 7.1.1.5.3

The transmitter power shall remain within the mask shown in figure 12 of the specification and associated timings given in table 18 of the specification.

2.6 SPURIOUS EMISSIONS FROM THE TRANSMITTER

2.6.1 Specification Reference

IEC 62320, Clause 7.1.3.2

2.6.2 Equipment Under Test and Modification State

EUT REF: 75917597 TSR0027 - Modification State 0

2.6.3 Date of Test

26 and 27 November 2012

2.6.4 Test Equipment Used

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

2.6.5 Environmental Conditions

Ambient Temperature	24.3°C
Relative Humidity	36.2%

2.6.6 Test Results

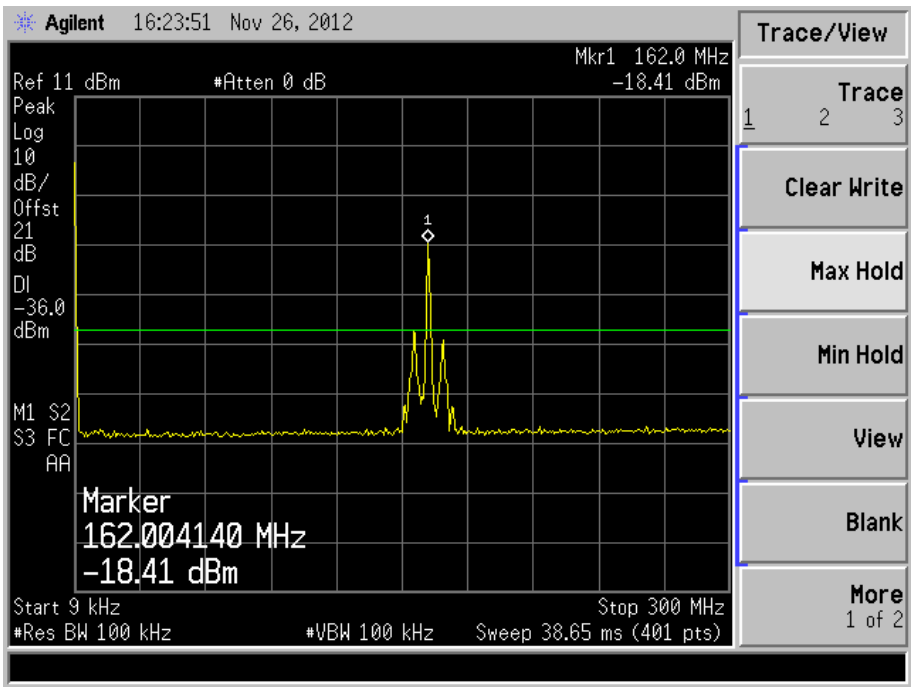
Maximum rated output power – 12.5 W

Channel (MHz)	Frequency (MHz)	Level (dBm)
161.975	155.425000	-36.00
	155.875000	-36.00
	161.909812	-39.50
	161.520000	-38.30
	162.429700	-38.00
	168.537500	-36.80
	170.025000	-44.70
162.025	155.420000	-36.00
	155.720000	-36.00
	161.961781	-38.50
	161.573900	-37.70
	161.732300	-36.00
	162.183300	-39.80
	162.320200	-36.20
	162.479900	-37.70
	168.337500	-37.60
	168.637500	-37.10
	170.100000	-42.00

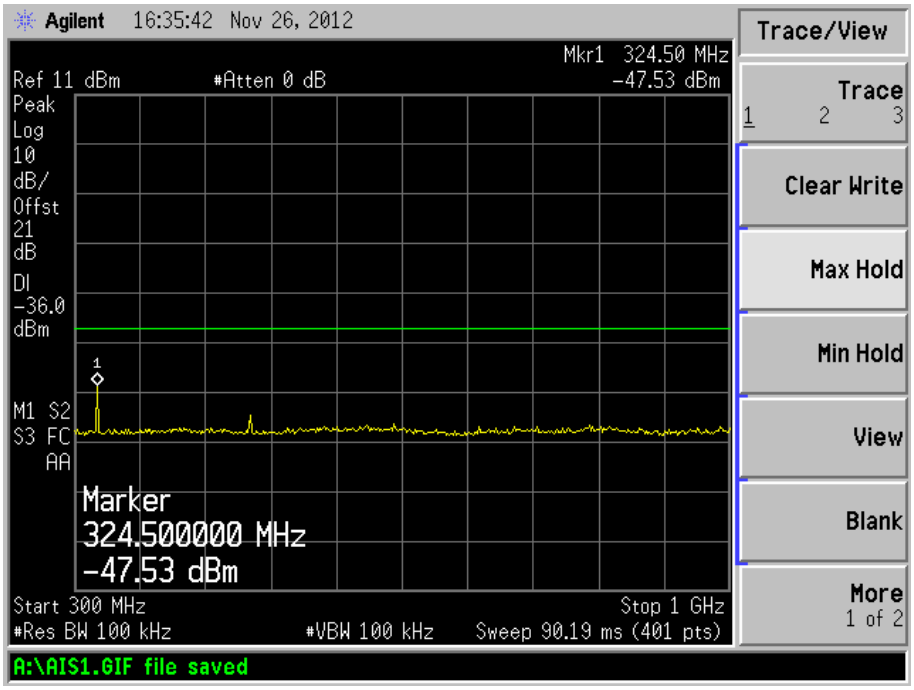
Product Service

161.975 MHz

9 kHz to 300 MHz

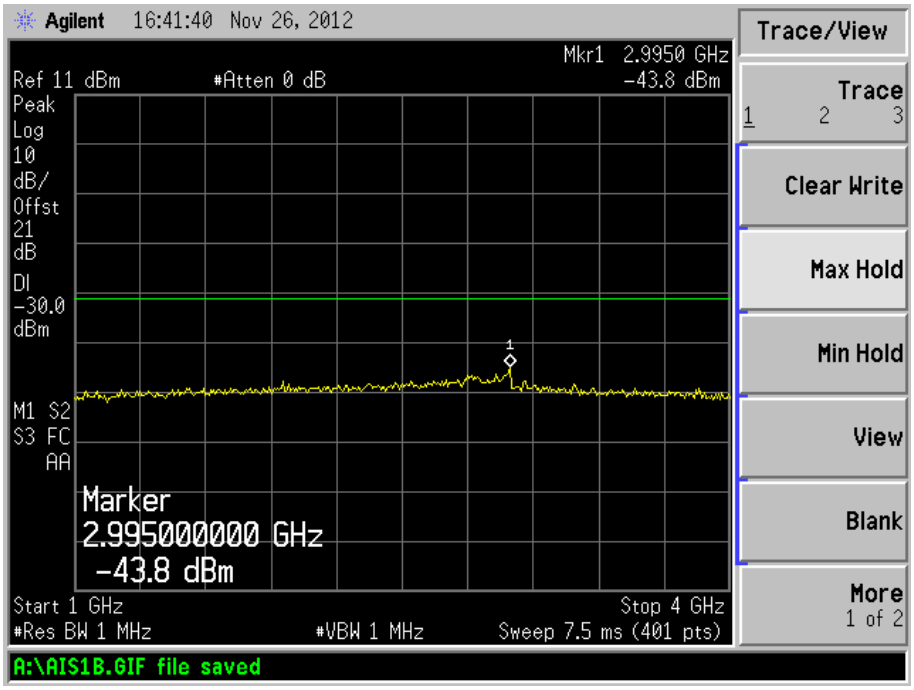


300 MHz to 1 GHz



Product Service

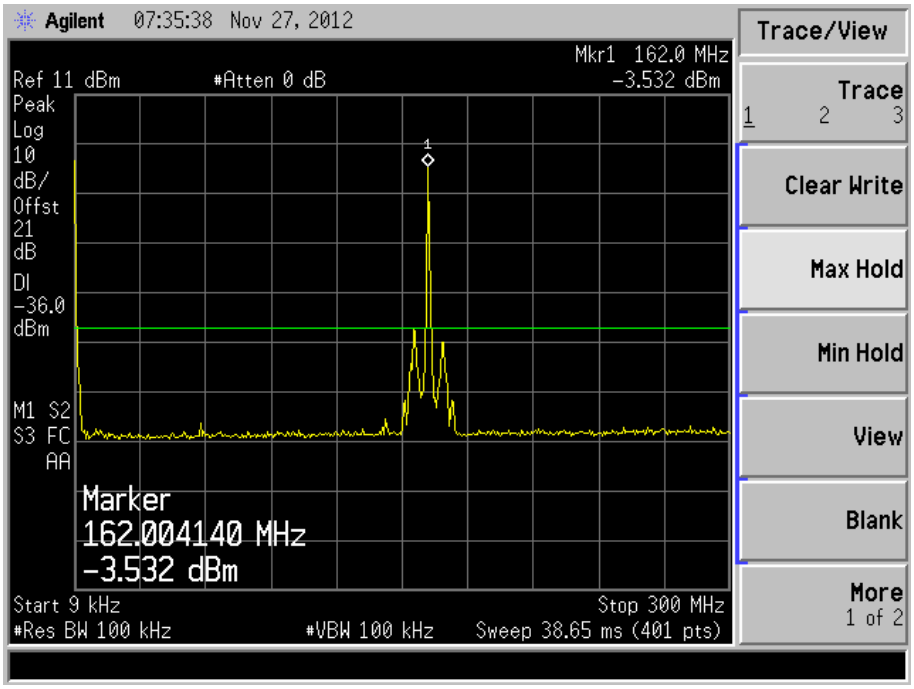
1 GHz to 4 GHz



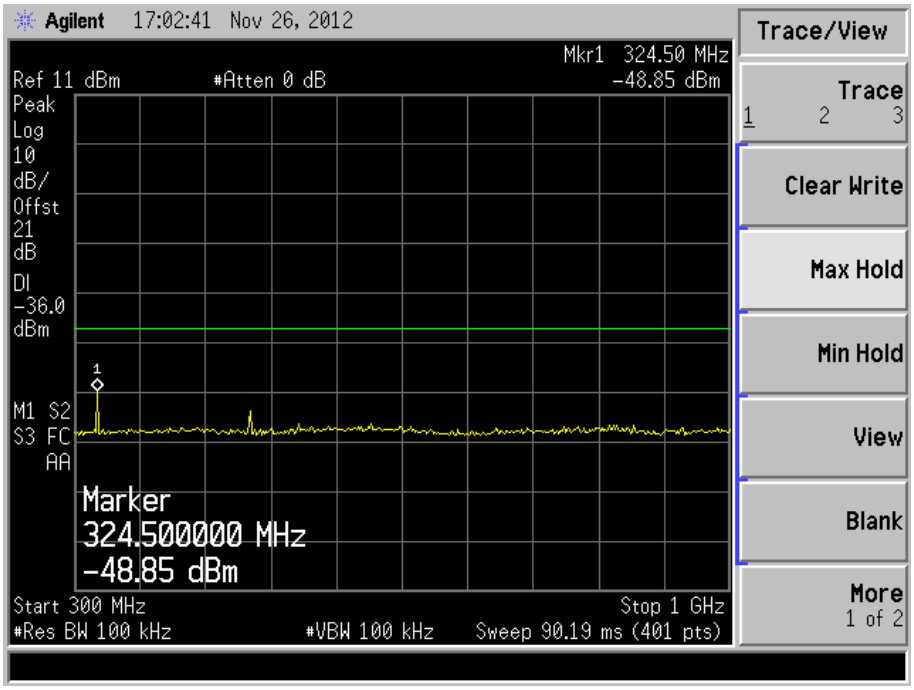
Product Service

162.025 MHz

9 kHz to 300 MHz

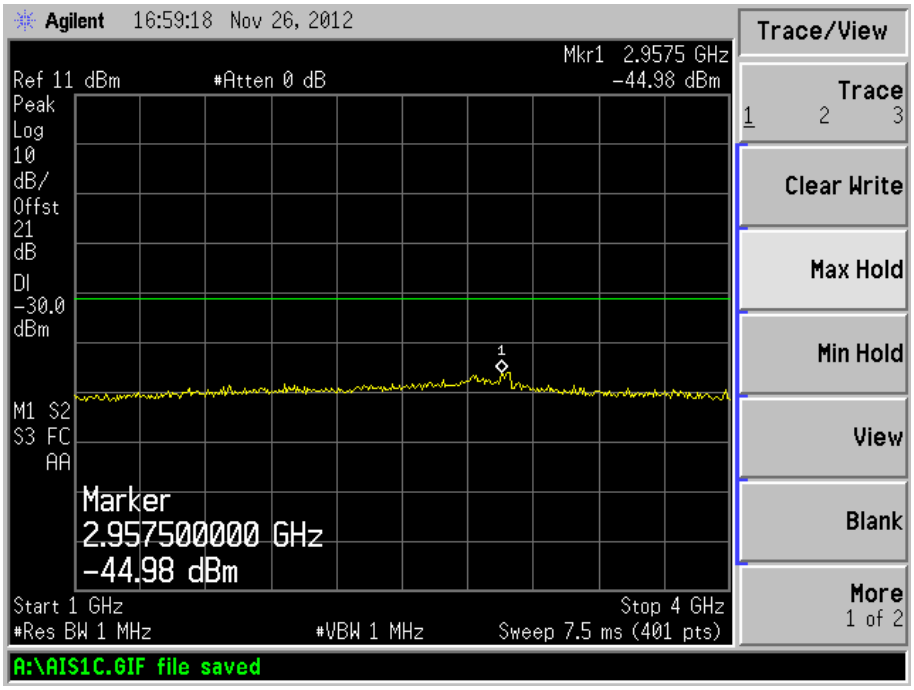


300 MHz to 1 GHz



Product Service

1 GHz to 4 GHz



Limit Clause 7.1.3.2.3

The power of any spurious emission outside ± 62,5 kHz of the transmitting frequency shall not exceed – 36 dBm in the frequency range 9 kHz to 1 GHz and – 30 dBm in the frequency range 1 GHz to 4 GHz.

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 - Frequency Error					
Signal Generator	Rohde & Schwarz	SMX	115	12	5-Jul-2013
Climatic Chamber	Votsch	VT4002	161	-	O/P Mon
Multimeter	Fluke	75 Mk3	455	12	16-Jan-2013
Power Supply Unit	Farnell	H60-25	1092	-	O/P Mon
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	19-Jan-2013
Hygrometer	Rotronic	I-1000	2891	12	21-May-2013
Thermocouple Thermometer	Fluke	51	3172	12	30-Jul-2013
Attenuator (30dB, 150W)	Narda	769-30	3369	12	28-May-2013
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	9-May-2013
'N' - 'N' RF Cable (1m)	Rhophase	NPS-1803-1000-NPS	3700	12	12-Jan-2013
'N' - 'N' RF Cable (1m)	Rhophase	NPS-1803-1000-NPS	3701	12	12-Jan-2013
Section 2.2 – Carrier Power					
Signal Generator	Rohde & Schwarz	SMX	115	12	5-Jul-2013
Climatic Chamber	Votsch	VT4002	161	-	O/P Mon
Multimeter	Fluke	75 Mk3	455	12	16-Jan-2013
Power Supply Unit	Farnell	H60-25	1092	-	O/P Mon
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	19-Jan-2013
Hygrometer	Rotronic	I-1000	2891	12	21-May-2013
Attenuator (10dB, 50W)	Aeroflex / Weinschel	47-10-34	3166	12	27-Jun-2013
Thermocouple Thermometer	Fluke	51	3172	12	30-Jul-2013
Attenuator (30dB, 150W)	Narda	769-30	3369	12	28-May-2013
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	9-May-2013
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	31-Aug-2013
'N' - 'N' RF Cable (1m)	Rhophase	NPS-1803-1000-NPS	3700	12	12-Jan-2013
'N' - 'N' RF Cable (1m)	Rhophase	NPS-1803-1000-NPS	3701	12	12-Jan-2013
Section 2.3, 2.4 and 2.5 - Modulation Spectrum Slotted Transmission, Transmitter Test Sequence and Modulation Accuracy and Transmitter Output Power Versus Time Function (FATDMA and RATDMA)					
Signal Generator	Rohde & Schwarz	SMX	115	12	5-Jul-2013
Climatic Chamber	Votsch	VT4002	161	-	O/P Mon
Multimeter	Fluke	75 Mk3	455	12	16-Jan-2013
Power Supply Unit	Farnell	H60-25	1092	-	O/P Mon
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	19-Jan-2013
Hygrometer	Rotronic	I-1000	2891	12	21-May-2013
Attenuator (10dB, 50W)	Aeroflex / Weinschel	47-10-34	3166	12	27-Jun-2013
Thermocouple Thermometer	Fluke	51	3172	12	30-Jul-2013
Attenuator (30dB, 150W)	Narda	769-30	3369	12	28-May-2013
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	9-May-2013
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	31-Aug-2013
'N' - 'N' RF Cable (1m)	Rhophase	NPS-1803-1000-NPS	3700	12	12-Jan-2013
'N' - 'N' RF Cable (1m)	Rhophase	NPS-1803-1000-NPS	3701	12	12-Jan-2013
'N' - 'N' RF Cable (1m)	Rhophase	NPS-1803-1000-NPS	3701	12	12-Jan-2013

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.6 - Spurious Emissions from the Transmitter					
DC Power Supply	Hewlett Packard	6269B	326	-	TU
Spectrum Analyser	Hewlett Packard	E4407B	1154	12	17-Jul-2013
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	19-Jan-2013
High Pass Filter	Mini-Circuits	NHP-300	1640	12	15-Aug-2013
Multimeter	Iso-tech	IDM101	2424	12	10-Sep-2013
Hygrometer	Rotronic	I-1000	2891	12	21-May-2013
Hygrometer	Rotronic	I-1000	3220	12	13-Jun-2013
Attenuator (20dB, 150W)	Narda	769-20	3367	12	28-May-2013
Attenuator (30dB, 150W)	Narda	769-30	3369	12	28-May-2013
Signal Generator: 10MHz to 20GHz	Rohde & Schwarz	SMR20	3475	12	20-Dec-2012
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	31-Aug-2013
'N' - 'N' RF Cable (1m)	Rhophase	NPS-1803-1000-NPS	3701	12	12-Jan-2013
1 Metre N Type Cable	Rhophase	NPS-1601A-1000-NPS	4102	12	1-Jun-2013

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
Frequency Error	± 11 Hz
Carrier Power	± 0.45 dB
Modulation Spectrum Slotted Transmission	± 2.0 dB
Transmitter Output Power Versus Time Function (FATDMA and RATDMA)	± 2.0 dB
Transmitter Test Sequence and Modulation Accuracy	± 2.0 dB

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

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).