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Report On

Radio Testing of the
SRT Marine Technology Ltd AtoN Express
In accordance with IEC 62320

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Document 75925174 Report 01 Issue 1

June 2014



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Radio Testing of the
SRT Marine Technology Ltd AtoN Express
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Document 75925174 Report 01 Issue 1

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PREPARED FOR

SRT Marine Technology Ltd
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PREPARED BY

A handwritten signature in black ink, appearing to read 'N. Bennett', written over a horizontal line.

Natalie Bennett
Senior Administrator, Technical Solutions

APPROVED BY

A handwritten signature in black ink, appearing to read 'S. Bennett', written over a horizontal line.

Simon Bennett
Authorised Signatory

DATED

06 June 2014





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 8
1.5	Deviations from the Standard 9
1.6	Modification Record 9
2	TEST DETAILS 10
2.1	Frequency Error 11
2.2	Carrier Power 12
2.3	Modulation Spectrum Slotted Transmission 13
2.4	Transmitter Test Sequence and Modulation Accuracy 15
2.5	Transmitter Output Power Versus Time Function (FATDMA and RATDMA) 29
2.6	Spurious Emissions from the Transmitter 33
3	TEST EQUIPMENT USED 34
3.1	Test Equipment Used 35
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



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SECTION 1

REPORT SUMMARY

Radio Testing of the
SRT Marine Technology Ltd AtoN Express
In accordance with IEC 62320



1.1 INTRODUCTION

The information contained in this report is intended to show the verification of Radio Testing of the SRT Marine Technology Ltd AtoN Express to the requirements of IEC 62320.

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)	AtoN Express
Serial Number(s)	#4
Number of Samples Tested	1
Test Specification/Issue/Date	IEC 62320 (2008)
Incoming Release Date	Application Form 11 April 2014
Disposal Reference Number Date	Held Pending Disposal Not Applicable Not Applicable
Order Number Date	POR004373 19 December 2013
Start of Test	9 May 2014
Finish of Test	15 May 2014
Name of Engineer(s)	M Russell



1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with IEC 62320 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 APPLICATION FORM

APPLICANT'S DETAILS			
COMPANY NAME :SRT-Marine Technology Ltd...			
ADDRESS Wireless House, Westfield Industrial Estate, Midsomer Norton, Bath England.BA3 4BS			
NAME FOR CONTACT PURPOSES : Richard McMahon			
TELEPHONE NO+44(0)1761409500		FAX NO: +44(0)1761410093	
		E-MAIL: richard.mcmahon@srt-marine.com	

EQUIPMENT INFORMATION			
Model name/number	AtoN Express.	Identification/Part number	418-0013.
Hardware Version	418-0012:1/PCBA:011-0072:1.	Software Version	090200.01.00.04.
Manufacturer	SRT-Marine Technology Ltd.	Country of Origin	Hungary.
FCC ID	UYW-4180013	Industry Canada ID	7075-4180013
Technical description (a brief description of the intended use and operation)			
Type 1 AtoN for use on land or buoy			
<u>Supply Voltage:</u>			
☐ []	AC mains	State AC voltage V	and AC frequency Hz
☐ []	DC (external)	State DC voltage V	and DC current A
☒ [x]	DC (internal)	State DC voltage 3.7 V	and Battery type Li-on....
<u>Frequency characteristics:</u>			
Transmitter Frequency range	156.025 MHz to 162.025MHz	Channel spacing 25kHz.	(if channelized)
Receiver Frequency range (if different)	...N/A.... MHz to MHz	Channel spacing	(if channelized)
Designated test frequencies:			
Bottom:	MHz	Middle:	MHz Top:
Intermediate Frequencies :		19.655... MHz	
Highest Internally Generated Frequency :		LO=142.37MHz and RF = 162.025 MHz	
<u>Power characteristics:</u>			
Maximum transmitter power	2 W	Minimum transmitter power (if variable)	 W
☐ []	Continuous transmission		
☒ [X]	Intermittent transmission		
If intermittent, can transmitter be set to continuous transmit test mode? Y/N			
<u>Antenna characteristics:</u>			
☐ []	Antenna connector	State impedance	ohm
☐ []	Temporary antenna connector	State impedance	ohm
☒ [X]	Integral antenna Type	State gain	1 dBi
☐ []	External Antenna Type	State gain	dBi
<u>Modulation characteristics:</u>			
☐ []	Amplitude	☐ []	Other
☒ [X]	Frequency	Details: GMSK-TDMA.	
☐ []	Phase	(GMSK, QSPK etc)	
Can the transmitter operate un-modulated?		Y/N	
ITU Class of emission: 25K0Q1DDT			
<u>Battery/Power Supply</u>			
Model name/number	LIC/18650-22L	Identification/Part number	160-0001
Manufacturer	VARTA	Country of Origin	China
<u>Ancillaries (if applicable)</u>			
Model name/number	...N/A.....	Identification/Part number	...N/A.....
Manufacturer		Country of Origin	
<u>Extreme conditions:</u>			
Maximum temperature	...+55 °C	Minimum temperature	...-20 °C
Maximum supply voltage	...4.1 V	Minimum supply voltage	...3.66... V



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

Signature :

A handwritten signature in black ink, consisting of a large, stylized 'S' followed by a horizontal line that tapers off to the right.

Name : Richard McMahon
Position held : Certification Engineer
Date : 11.04.14



Product Service

1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was a SRT Marine Technology Ltd AtoN Express 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 State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
Serial Number: #4			
0	As supplied by manufacturer.	N/A	N/A
1	Changed (via serial interface) the non-volatile setting "modamp" from 350 to 348, reducing the modulation amplitude to avoid failures during the modulation accuracy test (Test Signal #2)	M Russell	12/05/2014

The table above details modifications made to the EUT during the test programme. The modifications incorporated during each test are recorded on the appropriate test pages.



Product Service

SECTION 2

TEST DETAILS

Radio Testing of the
SRT Marine Technology Ltd AtoN Express
In accordance with IEC 62320



Product Service

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

AtoN Express S/N: #4 - Modification State 1

2.1.3 Date of Test

14 May 2014 & 15 May 2014

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 22.7 - 25.5°C
Relative Humidity 31.7 - 41.8%

2.1.6 Test Results

Maximum rated output power – 2 W

Test Conditions		Frequency Error (kHz)	
		156.025 MHz	162.025 MHz
$T_{nom}(+22.7^{\circ}\text{C})$	$V_{nom}(3.7 \text{ V DC})$	-0.354	-0.38
$T_{min}(-20.0^{\circ}\text{C})$	$V_{min}(3.66 \text{ V DC})$	0.346	0.353
$T_{max}(+55.0^{\circ}\text{C})$	$V_{max}(4.1 \text{ V DC})$	-0.374	-0.437
Maximum frequency error (Hz)		-374	-437

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.



Product Service

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

AtoN Express S/N: #4 - Modification State 1

2.2.3 Date of Test

9 May 2014 & 14 May 2014

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 23.8 - 28.3°C
Relative Humidity 36.3%

2.2.6 Test Results

Maximum Rated output power – 2 W

Test Conditions		Transmitter Power (W)	
		156.025 MHz	162.025 MHz
$T_{nom}(+23.8\text{ }^{\circ}\text{C})$	$V_{nom}(3.7\text{ V DC})$	2.415	2.404
$T_{min}(-20.0\text{ }^{\circ}\text{C})$	$V_{min}(3.66\text{ V DC})$	2.449	2.460
$T_{max}(+55.0\text{ }^{\circ}\text{C})$	$V_{max}(4.1\text{ V DC})$	2.079	2.079
Maximum Variation at normal conditions (dB)		+0.83	+0.81
Maximum Variation at extreme conditions (dB)		+0.89	+0.91

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.

Mod state 0: Ambient measurements Mod state 1: Extreme measurements



Product Service

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

AtoN Express S/N: #4 - Modification State 0

2.3.3 Date of Test

9 May 2014

2.3.4 Test Equipment Used

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

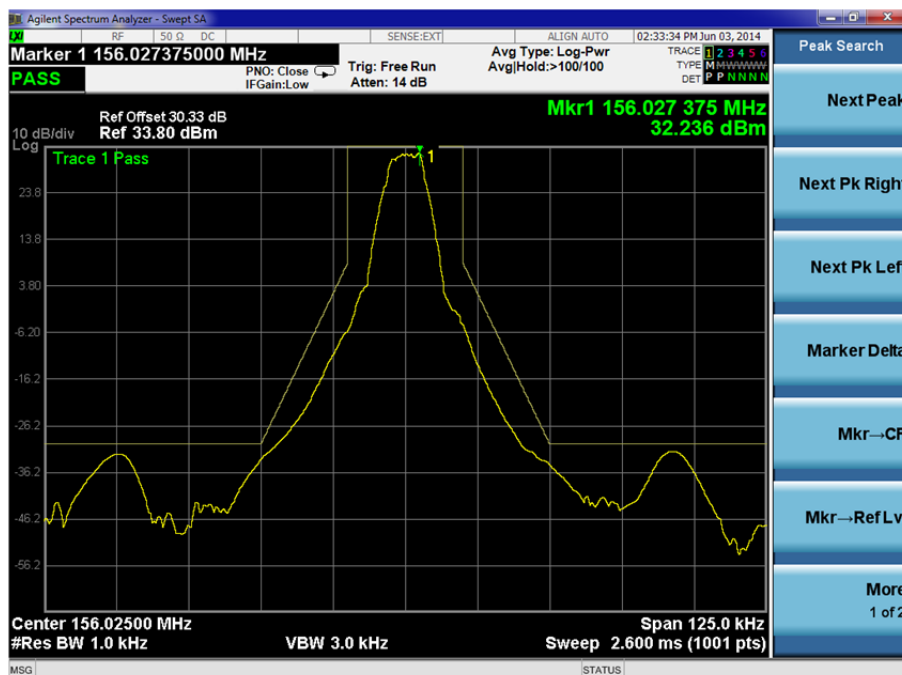
2.3.5 Environmental Conditions

Ambient Temperature 23.8°C
Relative Humidity 36.3%

2.3.6 Test Results

3.7 V DC Supply

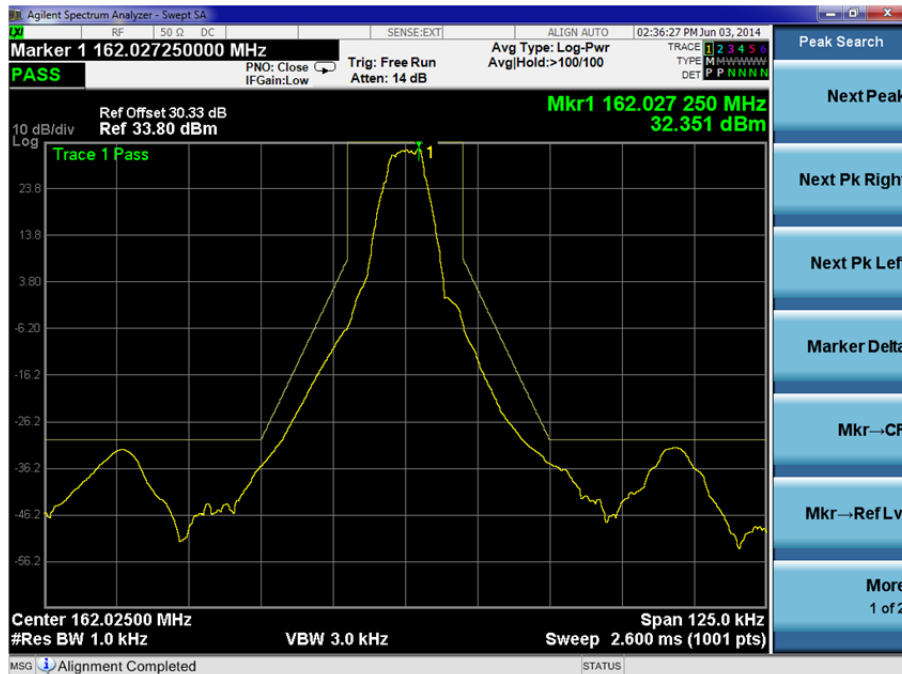
156.025 MHz





Product Service

162.025 MHz



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.



Product Service

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

AtoN Express S/N: #4 - Modification State 1

2.4.3 Date of Test

12 May 2014 & 14 May 2014

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	23.5°C
Relative Humidity	38.9%



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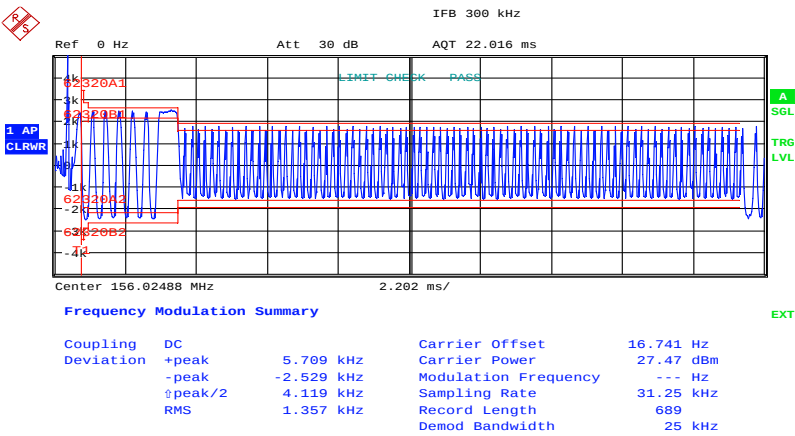
2.4.6 Test Results

3.7 V DC Supply

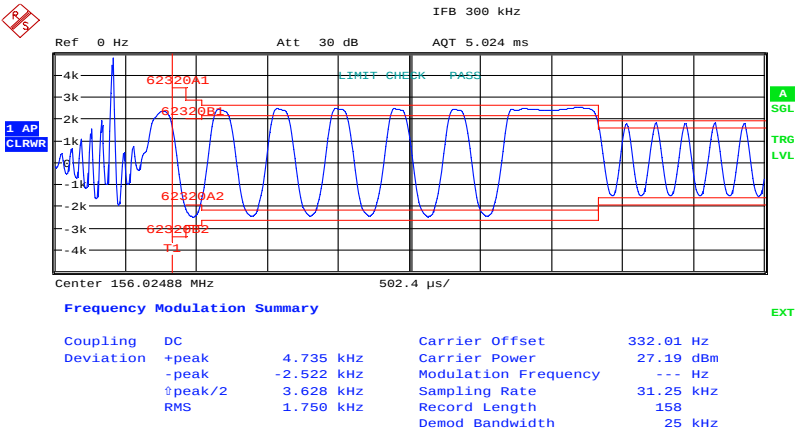
156.025 MHz

23.5 °C, 3.7 V DC

Test Signal Number 1



Date: 12.MAY.2014 15:06:28

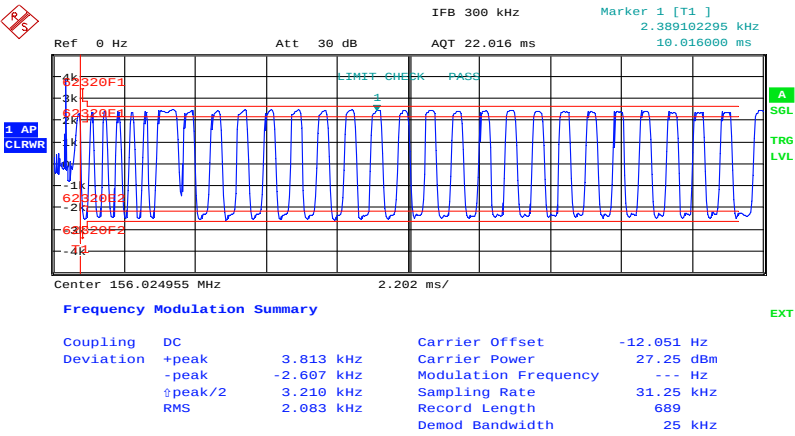


Date: 12.MAY.2014 15:06:56

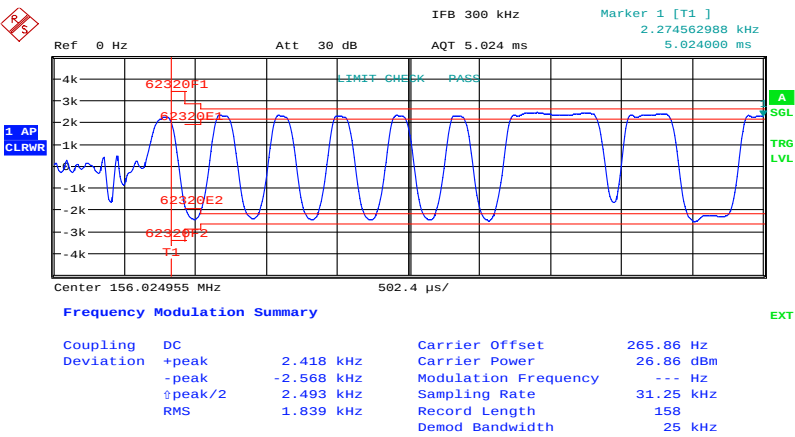


Product Service

Test Signal Number 2



Date: 12.MAY.2014 14:34:13



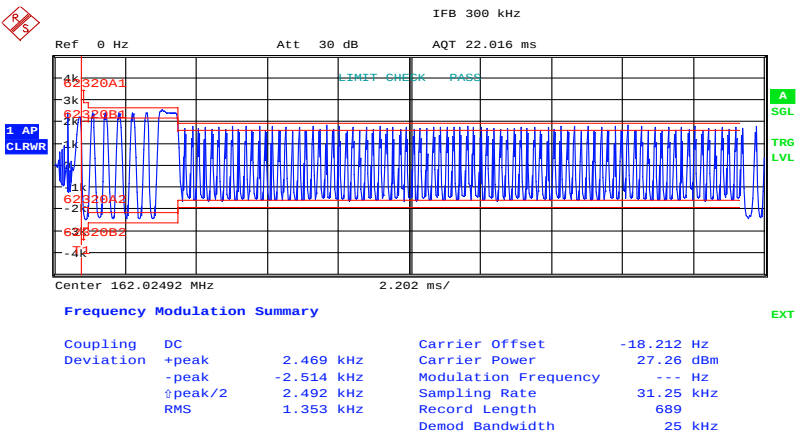
Date: 12.MAY.2014 14:39:52



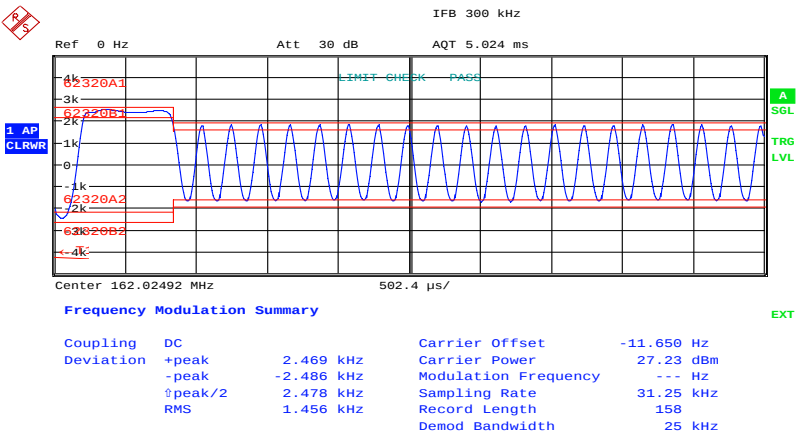
Product Service

162.025 MHz

Test Signal Number 1



Date: 12.MAY.2014 15:01:42

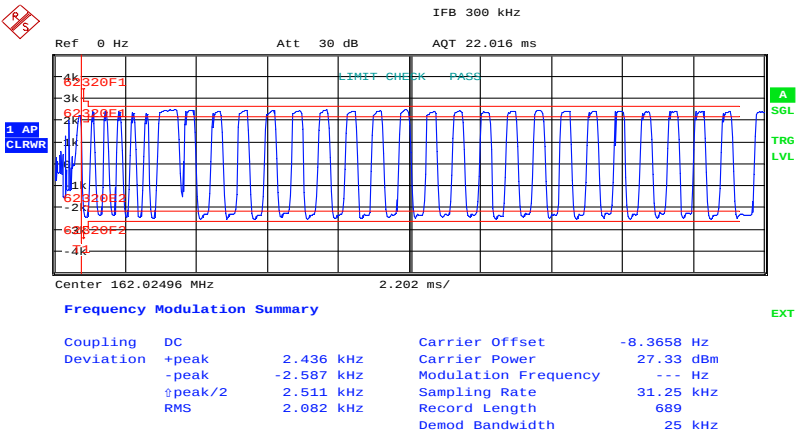


Date: 12.MAY.2014 15:03:59

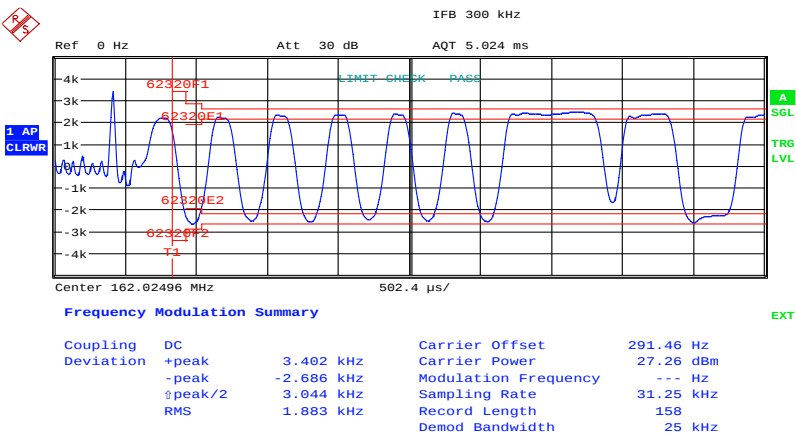


Product Service

Test Signal Number 2



Date: 12.MAY.2014 14:48:14



Date: 12.MAY.2014 14:58:24

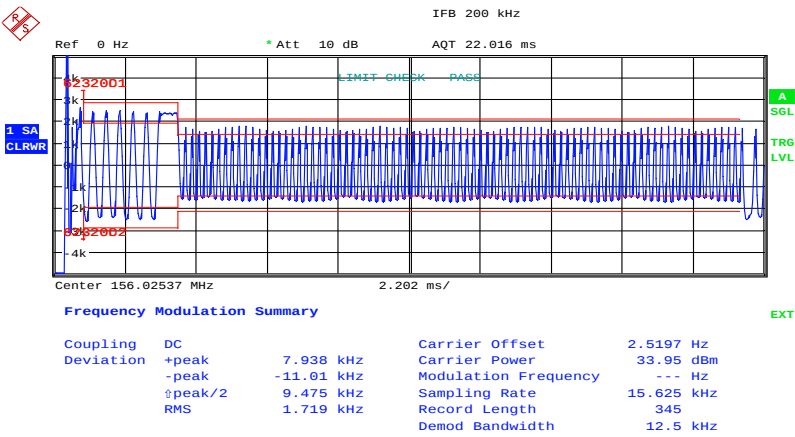


Product Service

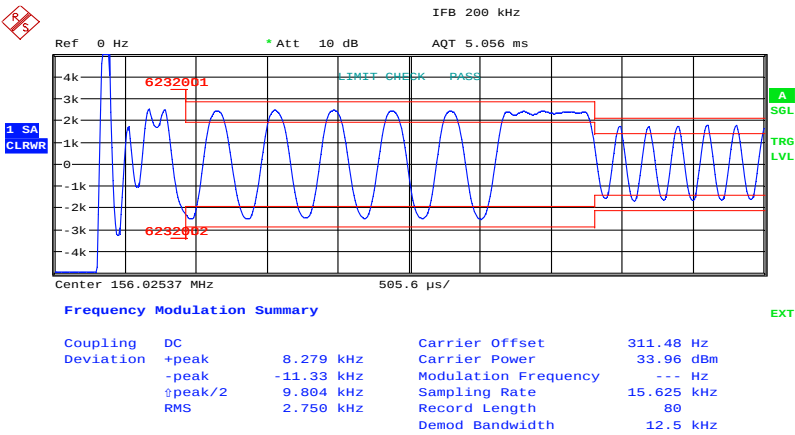
-20.0°C, 3.66 V DC

156.025 MHz

Test Signal Number 1



Date: 14.MAY.2014 16:44:12

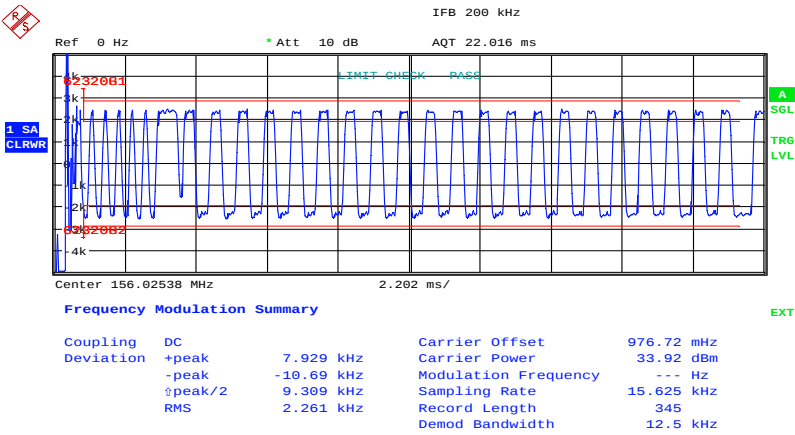


Date: 14.MAY.2014 16:44:40

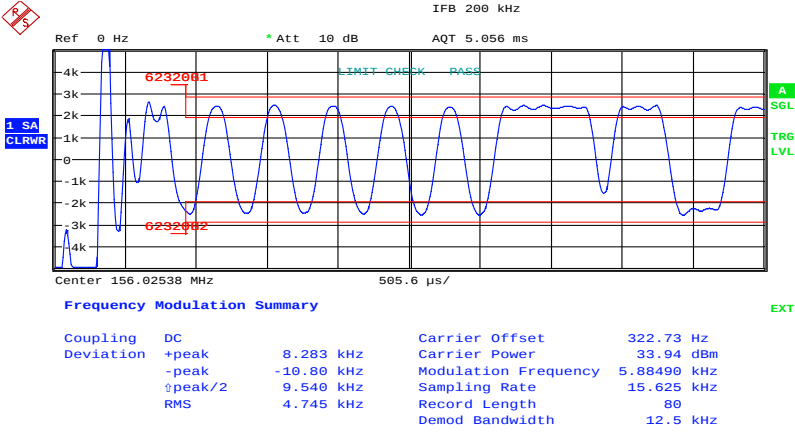


Product Service

Test Signal Number 2



Date: 14.MAY.2014 16:51:44



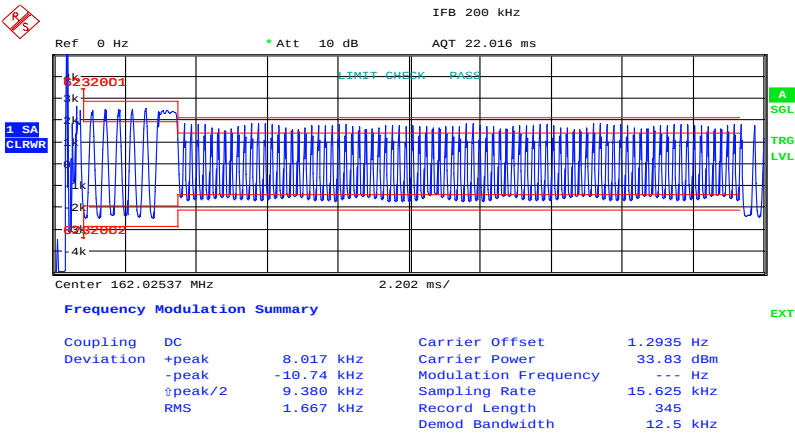
Date: 14.MAY.2014 16:51:28



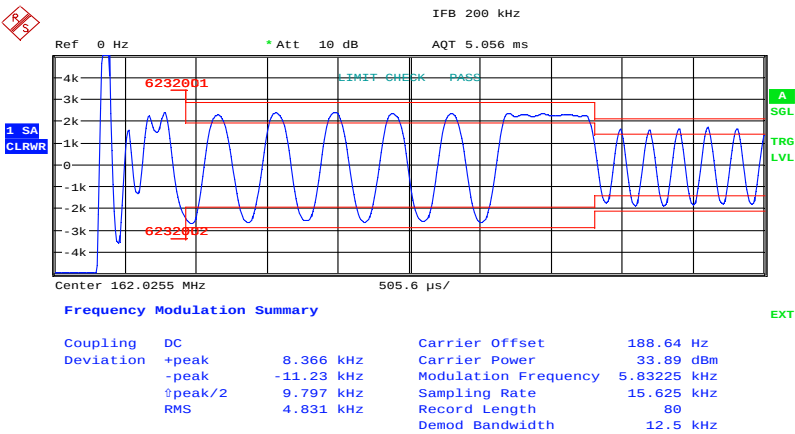
Product Service

162.025 MHz

Test Signal Number 1



Date: 14.MAY.2014 16:47:12

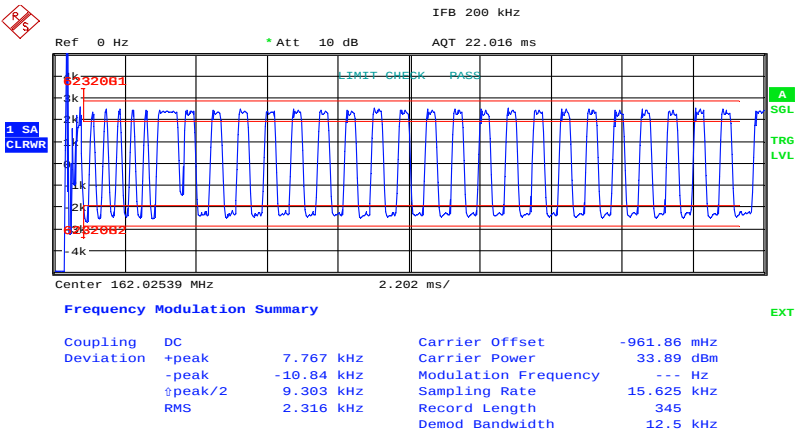


Date: 14.MAY.2014 16:46:18

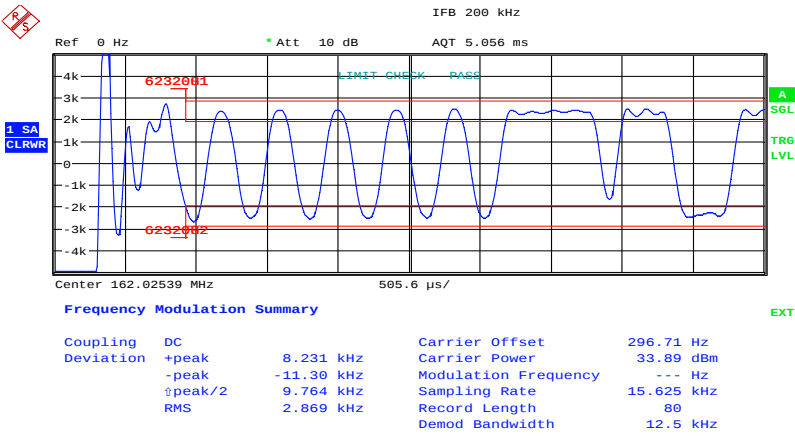


Product Service

Test Signal Number 2



Date: 14.MAY.2014 16:48:19



Date: 14.MAY.2014 16:48:50

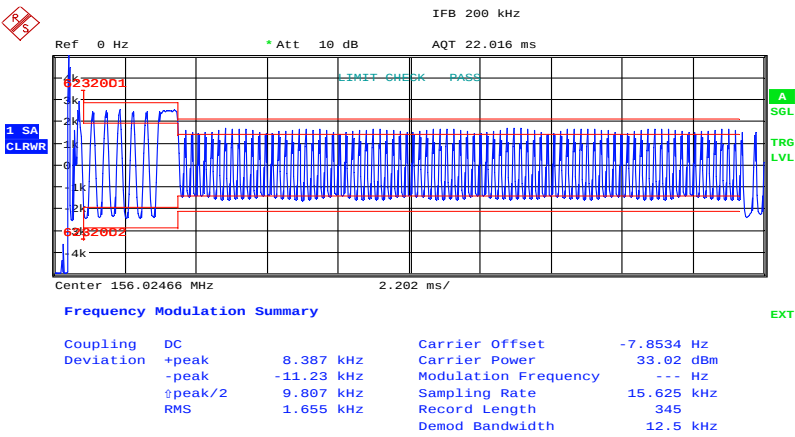


Product Service

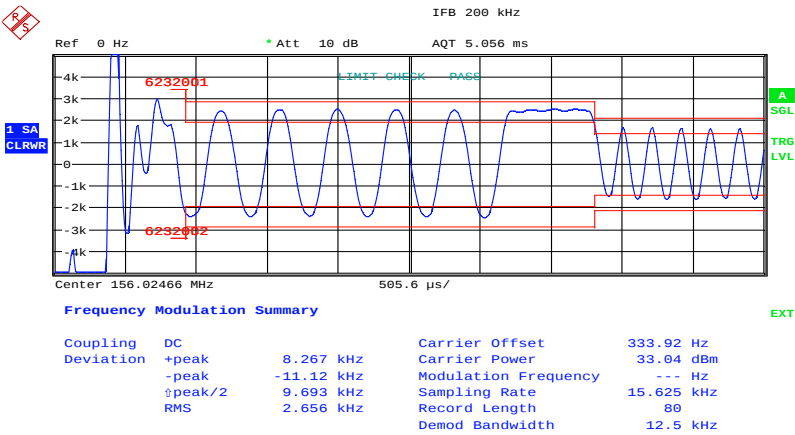
+55.0°C, 4.1 V DC

156.025 MHz

Test Signal Number 1



Date: 14.MAY.2014 13:09:21

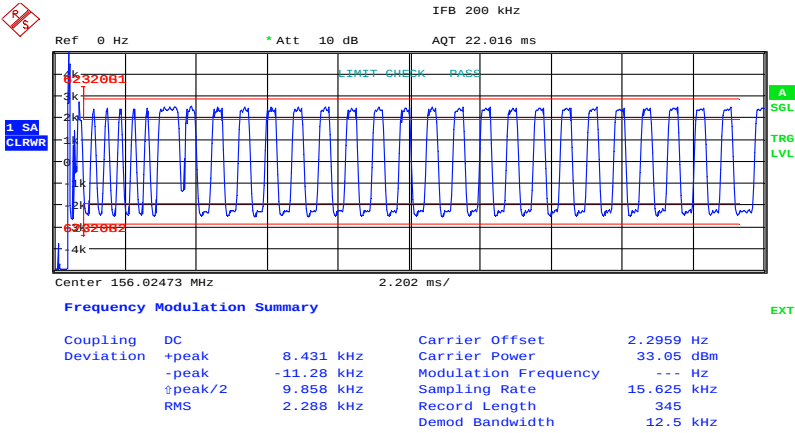


Date: 14.MAY.2014 13:10:04

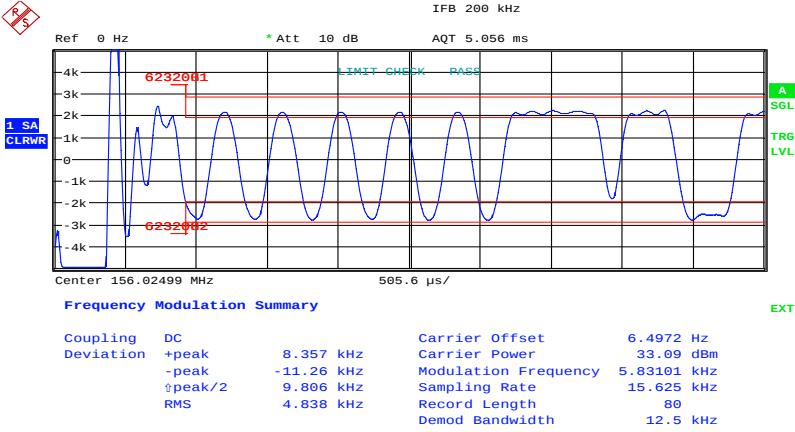


Product Service

Test Signal Number 2



Date: 14.MAY.2014 13:51:48



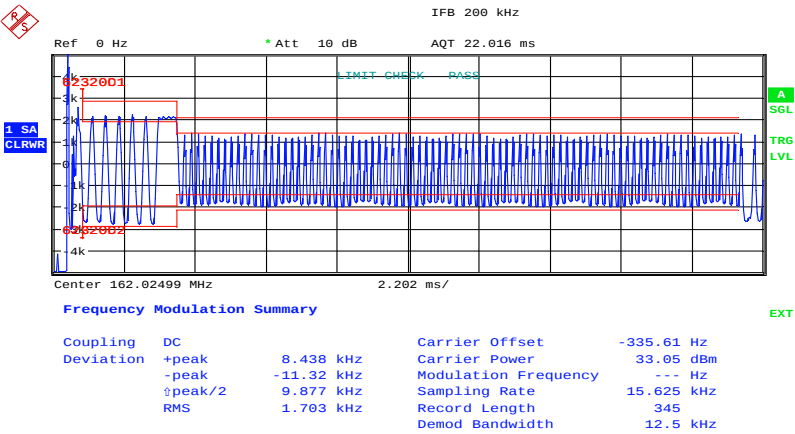
Date: 14.MAY.2014 13:51:04



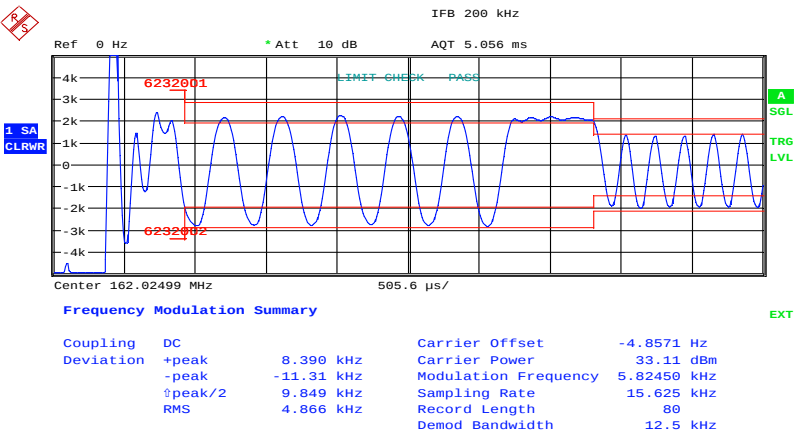
Product Service

162.025 MHz

Test Signal Number 1



Date: 14.MAY.2014 13:12:05

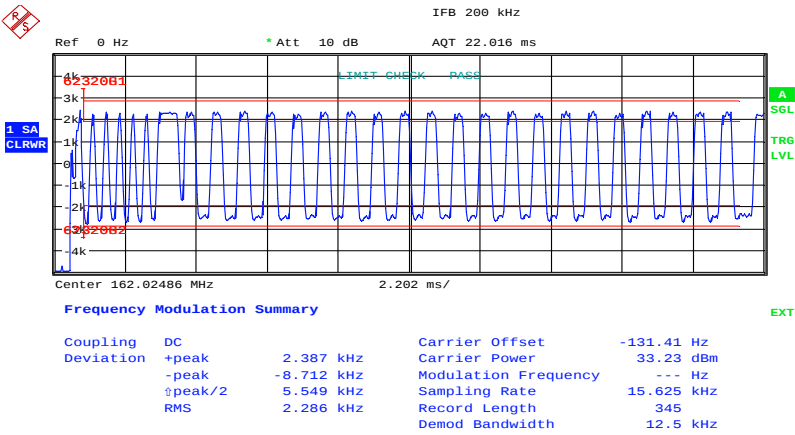


Date: 14.MAY.2014 13:11:45

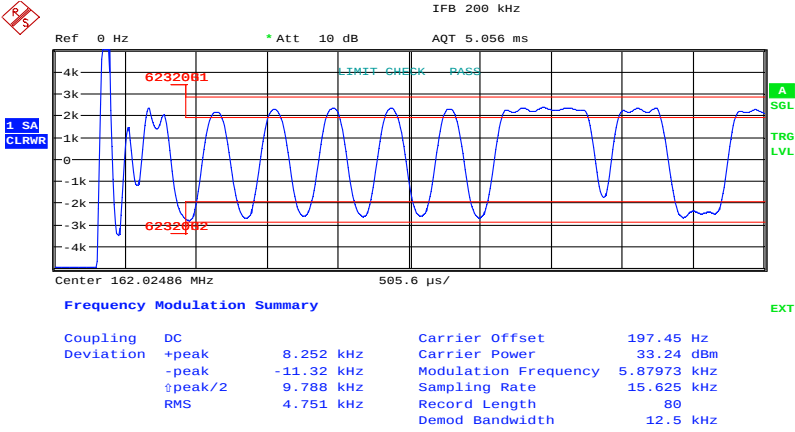


Product Service

Test Signal Number 2



Date: 14.MAY.2014 13:42:07



Date: 14.MAY.2014 13:42:49



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 $\pm$ 480 Hz			
Bit 4 to bit 31	2400 Hz $\pm$ 240 Hz	2 400 Hz $\pm$ 480 Hz	2 400 Hz $\pm$ 240 Hz	2 400 Hz $\pm$ 480 Hz
Bit 32 to bit 199	1740 Hz $\pm$ 175 Hz	1 740 Hz $\pm$ 350 Hz	2 400 Hz $\pm$ 240 Hz	2 400 Hz $\pm$ 480 Hz

Note: For Test Signal 2, at the end of the start flag there is the following bit pattern: 101, in this case, the modulation is held to the limits for Test Signal 1, this performance requirement is driven by ITU R M.1371 4, Table 5 but not reflected in the Limit Clause, 7.1.4.3, of IEC 62320-2.



Product Service

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

AtoN Express S/N: #4 - Modification State 0

2.5.3 Date of Test

9 May 2014

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	23.8°C
Relative Humidity	36.3%



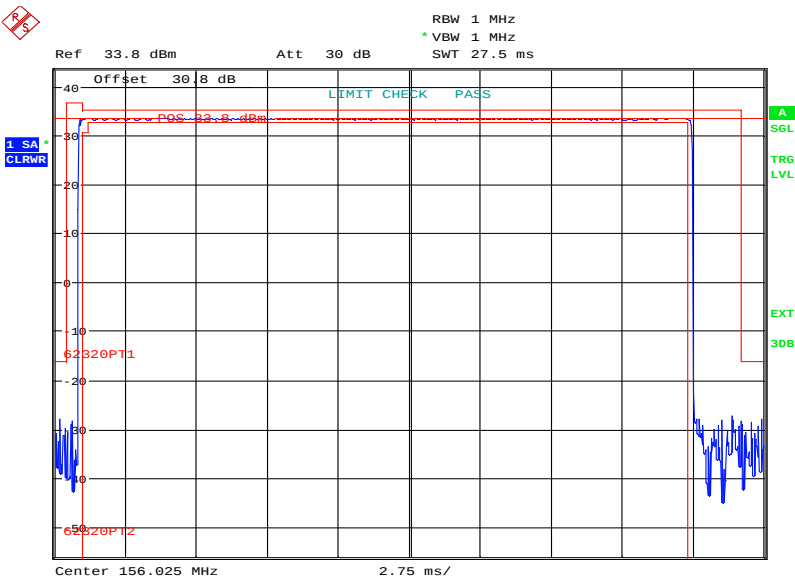
Product Service

2.5.6 Test Results

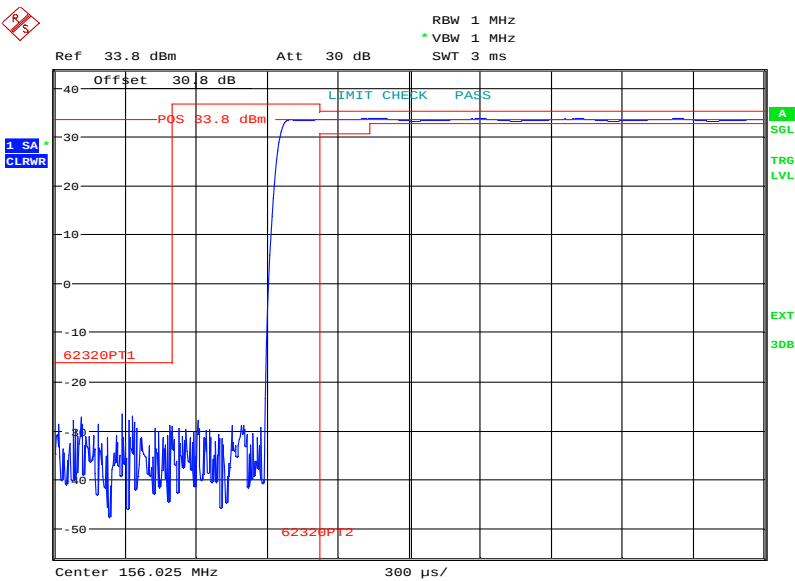
3.7 V DC Supply

Plots

156.025 MHz



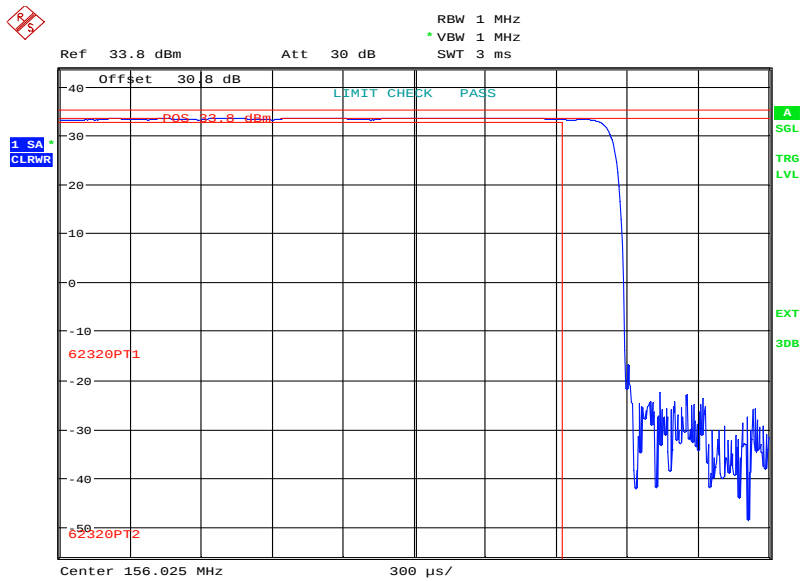
Date: 9.MAY.2014 10:35:59



Date: 9.MAY.2014 10:54:04

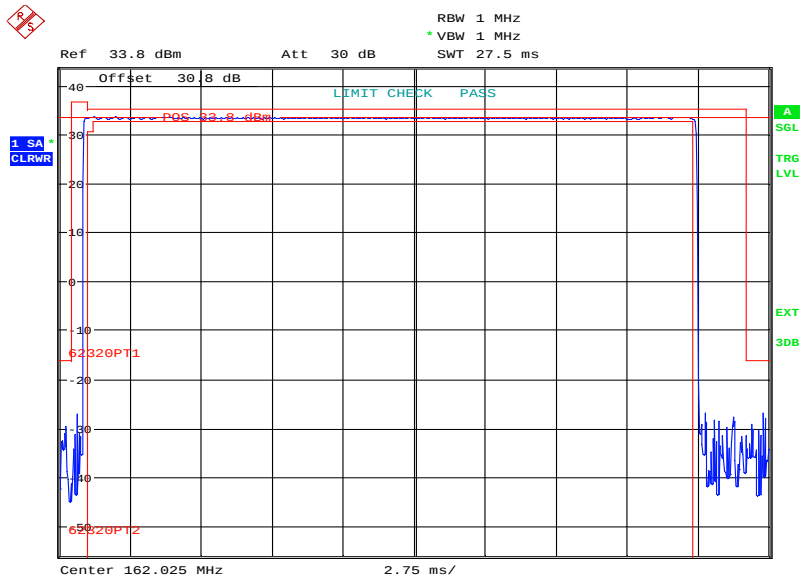


Product Service



Date: 9.MAY.2014 10:56:18

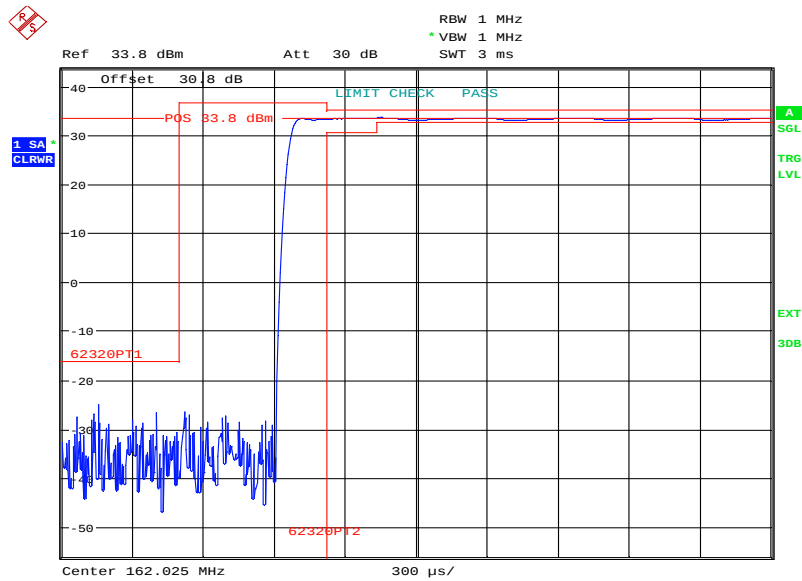
162.025 MHz



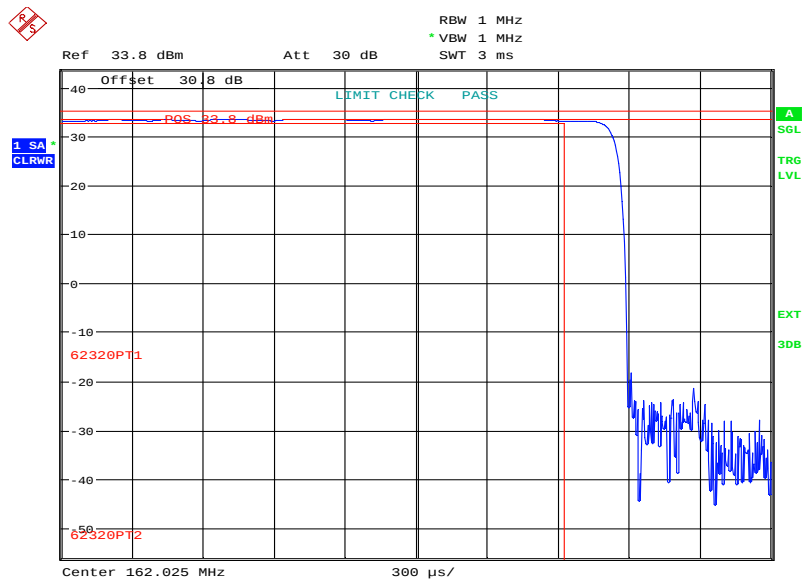
Date: 9.MAY.2014 10:55:14



Product Service



Date: 9.MAY.2014 10:59:42



Date: 9.MAY.2014 10:58:53

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.



Product Service

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

AtoN Express S/N: #4 - Modification State 1

2.6.3 Date of Test

13 May 2014

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 22.4°C

Relative Humidity 38.4%

2.6.6 Test Results

Transmitter operating

3.7 V DC Supply

Frequency (MHz)	Emission result (dBm)
136.547	-41.23

No other emissions were detected within a 6 dB of the limit.

Limit Clause 7.1.3.2.3

Frequency range	9 kHz to 1 GHz	1 GHz to 4 GHz
Transmitter operating	-36.0 dBm	-30.0 dBm



Product Service

SECTION 3

TEST EQUIPMENT USED



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					
Power Supply Unit	Hewlett Packard	6267B	21	-	TU
Digital Temperature Indicator + T/C	Fluke	51	412	12	12-Feb-2015
Temperature Chamber	Montford	2F3	467	-	O/P Mon
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	22-Jul-2014
Multimeter	Iso-tech	IDM101	2419	12	9-Oct-2014
Hygrometer	Rotronic	I-1000	3220	12	16-Jul-2014
Attenuator (30dB, 150W)	Narda	769-30	3369	12	29-May-2014
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	4-Jul-2014
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	22-Jul-2014
Section 2.2 - Carrier Power					
Power Supply Unit	Hewlett Packard	6267B	21	-	TU
Digital Temperature Indicator + T/C	Fluke	51	412	12	12-Feb-2015
Temperature Chamber	Montford	2F3	467	-	O/P Mon
Multimeter	Iso-tech	IDM101	2419	12	9-Oct-2014
Hygrometer	Rotronic	I-1000	3220	12	16-Jul-2014
Attenuator (30dB, 150W)	Narda	769-30	3369	12	29-May-2014
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	4-Jul-2014
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	13-Sep-2014
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	18-Sep-2014
Section 2.3 - Modulation Spectrum Slotted Transmission					
Power Supply Unit	Hewlett Packard	6267B	21	-	TU
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	22-Jul-2014
Multimeter	Iso-tech	IDM101	2419	12	9-Oct-2014
Hygrometer	Rotronic	I-1000	3220	12	16-Jul-2014
Attenuator (30dB, 150W)	Narda	769-30	3369	12	29-May-2014
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	4-Jul-2014
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	13-Sep-2014
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	18-Sep-2014
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	22-Jul-2014
Section 2.4 - Transmitter Test Sequence and Modulation Accuracy					
Power Supply Unit	Hewlett Packard	6267B	21	-	TU
Digital Temperature Indicator + T/C	Fluke	51	412	12	12-Feb-2015
Temperature Chamber	Montford	2F3	467	-	O/P Mon
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	22-Jul-2014
Multimeter	Iso-tech	IDM101	2419	12	9-Oct-2014
Hygrometer	Rotronic	I-1000	3220	12	16-Jul-2014
Attenuator (30dB, 150W)	Narda	769-30	3369	12	29-May-2014
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	4-Jul-2014
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	22-Jul-2014
Section 2.5 - Transmitter Output Power Versus Time Function (FATDMA and RATDMA)					
Power Supply Unit	Hewlett Packard	6267B	21	-	TU
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	22-Jul-2014
Multimeter	Iso-tech	IDM101	2419	12	9-Oct-2014
Hygrometer	Rotronic	I-1000	3220	12	16-Jul-2014
Attenuator (30dB, 150W)	Narda	769-30	3369	12	29-May-2014
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	4-Jul-2014
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	22-Jul-2014



Product Service

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.6 - Spurious Emissions from the Transmitter					
Power Supply Unit	Hewlett Packard	6267B	21	-	TU
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	22-Jul-2014
High Pass Filter	Mini-Circuits	NHP-300	1640	12	21-Aug-2014
Multimeter	Iso-tech	IDM101	2419	12	9-Oct-2014
Hygrometer	Rotronic	I-1000	3220	12	16-Jul-2014
Attenuator (30dB, 150W)	Narda	769-30	3369	12	29-May-2014
Tunable Notch Filter	Wainwright	WRCD 130.0/170.0- 0.05/50-5EEK	3412	-	TU
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	4-Jul-2014
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	13-Sep-2014
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	18-Sep-2014
Frequency Standard	Spectracom	Secure Sync 1200- 0408-0601	4393	6	22-Jul-2014

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
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
Spurious Emissions from the Transmitter	± 2.0 dB



Product Service

SECTION 4

PHOTOGRAPHS



Product Service

4.1 PHOTOGRAPHS OF EQUIPMENT UNDER TEST (EUT)



View 1



View 2



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.

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