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20 Juli 2010

Prüfbericht / *Test Report* Nr. / *No.* 70464-02105-1 (Edition 1)

Auftraggeber *Applicant*	Weatherdock AG
Geräteart *Type of equipment*	AIS Search and Rescue Transmitter
Typenbezeichnung *Type designation*	easyRESCUE
Auftragsnummer / *Order No.*	---
Prüfgrundlage *Test standards*	IEC 61097-1-14 FDIS GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM (GMDSS) Part 14: AIS search and rescue transmitter (AIS-SART) - Operational and performance requirements, methods of testing and required test results

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Summary

Test Results	*Order No.* **---**

Tests were performed according to:
IEC 61097-14_FDIS

Test performed		***Test result***				
		Passed	*Not Passed*	*Not applicable*	*Not performed*	*Criterion*
Sections	*Test performed*					
7.2	Frequency error	☒	☐	☐	☐	
7.3	Conducted Power	☒	☐	☐	☐	
7.4	Radiated Power	☒	☐	☐	☐	
7.5	Modulation spectrum slotted transmission	☒	☐	☐	☐	
7.6	Transmitter test sequence and modulation accuracy	☒	☐	☐	☐	
7.7	Transmitter output power versus time function	☒	☐	☐	☐	
7.8	Spurious emissions from the transmitter	☒	☐	☐	☐	

Remarks:

The test results relate only to the individual item which has been tested. Without the written approval of the test laboratory this report may not be reproduced in extracts.

Date	*Tested by*	*Checked by*
20 July 2010	Johann Roidt Responsible for testing	Rainer Heller Acting laboratory manager

Test Result
☒ ***Passed***
☐ ***Not passed***

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Table of Contents

1 Administrative Data

Application details	
Applicant:	Weatherdock AG Sigmundstrasse 180 90431 Nürnberg, Germany
Contact person:	Mr. Wolfgang Werner, Mr. Jürgen Zimmermann
Order number:	---
Receipt of EUT:	June 10, 2010
Return of EUT:	N/A
Date(s) of test:	June 10 to June 21, 2010
Note(s):	---
Responsible for testing:	Mr. Johann Roidt
Responsible for test report:	Mr. Johann Roidt
Test report checked by:	Mr. Rainer Heller

Report details	
Report number:	70464-02105-1
Edition:	1
Issue date:	20 July 2010

2 Details about the Test Laboratory

Details about the Test Laboratory	
Company name:	TÜV SÜD SENTON GmbH
Address:	Äußere Frühlingstraße 45 D-94315 Straubing Germany
Laboratory accreditation:	DAR-Registration No. DAT-PL-171/94-03
Contact:	Mr. Johann Roidt Phone: +49 9421 5522-0 Fax: +49 9421 5522-99

3 Description of the Equipment Under Test

Equipment characteristics	
Type designation:	easyRESCUE
Parts of the system:	1
Options and accessories:	---
Type of equipment:	AIS Search and Rescue Transmitter
Serial number:	Serial Sample No.3
Manufacturer:	Weatherdock AG
Power supply:	Battery supply (lithium) Nominal: 12 V
Version of EUT:	Series version

4 Operation Mode and Configuration of EUT

Operation Mode(s)
AIS Test transmit mode

List of ports and cables				
No.	*Description*	*Classification*[1]	*Cable type*	*Cable length*
	No ports			

List of support devices				
No.	*Description*	*Type designation*	*Serial no. or ID*	*Manufacturer*
1	AIS test receiver	AIS6oo (BSH/46162/4321409/09)	1SS000321	Garmin
2	GPS-Repeater	GPS-Antenna (active)	GA29	Garmin
3			---	
4			---	

[1] Ports shall be classified as ac power, dc power or signal/control port.

5 Schematic Test Setup Configuration of EUT

Not applicable. Page intentionally blank

6 Performance Criteria and Methods of Observation

Not applicable for this series of tests.

7 Test Results

Physical Radio Tests

IEC 61097-14_FDIS			
Section(s)	*Test performed*	*Page*	*Test Result*
7.1	General Description		---
7.2	Frequency error		Test passed
7.3	Conducted power		Test passed
7.4	Radiated power		Test passed
7.5	Modulation spectrum slotted transmission		Test passed
7.6	Transmitter test sequence and modulation accuracy		Test passed
7.7	Transmitter output power versus time function		Test passed
7.8	Spurious emissions from the transmitter		Test passed

7.1 General Description

The purpose of these tests is to verify that the AIS-SART complies with the RF requirements under normal and extreme conditions. The tests are accomplished by the following procedures.

All the physical radio tests can be performed on either AIS 1 or AIS 2 unless otherwise stated.

Unless otherwise stated all the physical radio tests shall be performed with the modified AIS-SART.

The following tests shall be performed under normal conditions:

- conducted output power
- radiated output power with the standard AIS-SART
- conducted spurious emissions;
- frequency error;
- modulation accuracy;
- modulation spectrum slotted transmission;
- power versus time function;
- power as a function of time.

The following tests shall be performed under extreme conditions:

- conducted power;
- frequency error.
- transmitter test sequence and modulation accuracy

7.2 Frequency error

7.2.1 Test description

7.2.1 Purpose
The frequency error of the transmitter is the difference between the measured carrier frequency in the absence of modulation and its required frequency.

7.2.2 Method of measurement

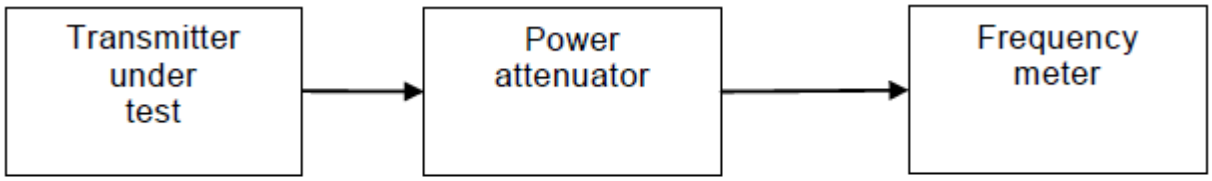


Figure 3 – Measurement arrangement

For the test proceed as follows.
a) The equipment shall be connected as illustrated in Figure 3.

b) The carrier frequency shall be measured in the absence of modulation.

c) The measurement shall be made under normal test conditions and extreme test conditions.

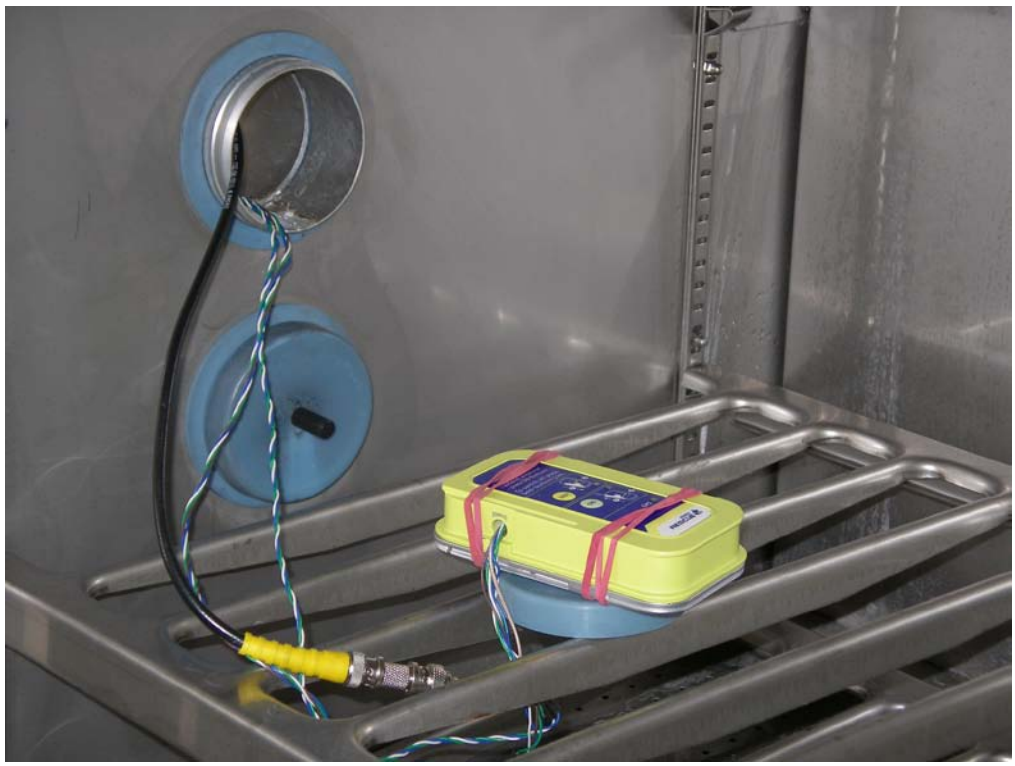
d) The test shall be performed on AIS 1 and AIS 2.

7.2.3 Required results
The frequency error shall not exceed ±0,5 kHz, under normal test conditions and ±1 kHz under extreme test conditions.

7.2.3 Test Equipment List

No.	Instrument/Ancillary	Type	Serial Number	Manufacturer	Cal. due
101	EMI test receiver	ESMI	839379/013 839587/006	Rohde & Schwarz	2012-01-06
105	EMI test receiver	ESPI7	836914/0002	Rohde & Schwarz	2011-03-07
108	Radio communication service monitor	CMS 54	838384/030	Rohde & Schwarz	2011-09-30
133	Diode detector negative	8473D	01492	Hewlett Packard	N/A
007	Temperature test chamber	KPK 200	A-2005	Feutron	2011-05-10

7.2.4 Test Setup



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Frequency Error

Prüfdatum / *Date of test:*	June 11, 2010
Prüfer / *Operator:*	Johann Roidt
Messplatz / *Test site:*	Non shielded room

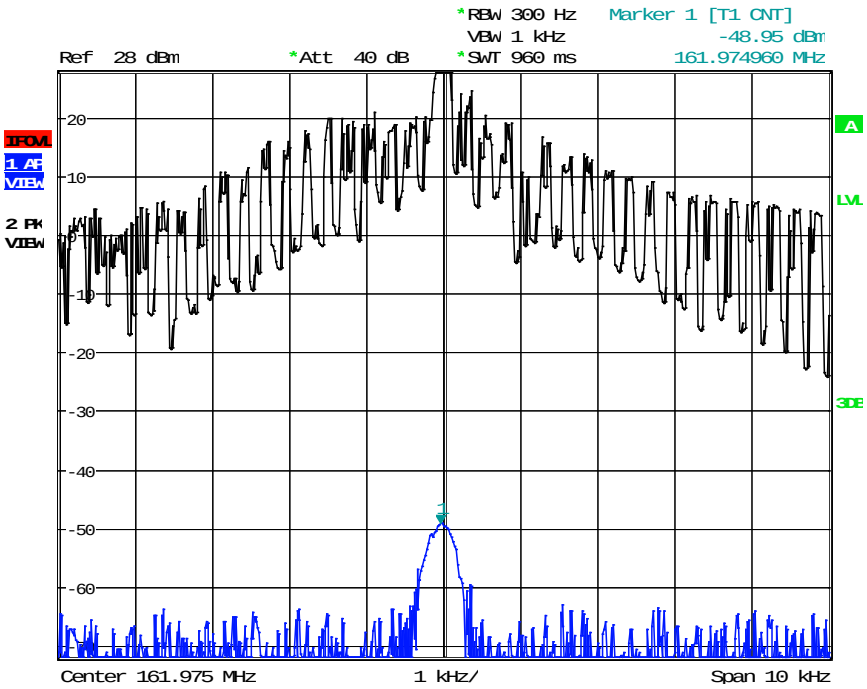
Prüfergebnis / *Test Result*

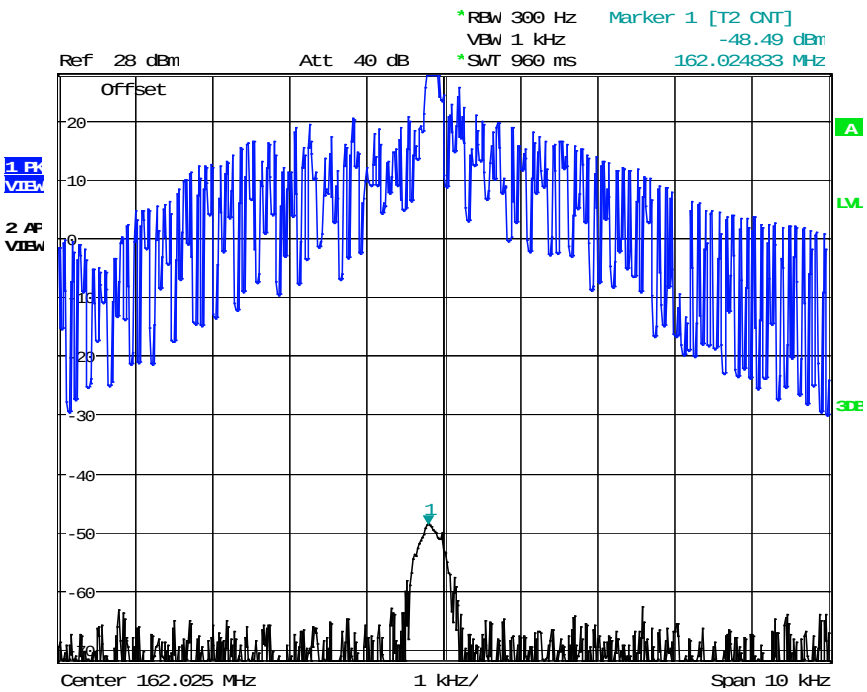
☒ **Erfüllt / *Passed***

☐ **Nicht erfüllt / *Not passed***

Luftdruck / *Barometric pressure:*	1006 hPa
Relative Luftfeuchtigkeit / *Relative humidity:*	47 %
Temperatur / *Ambient temperature:*	22 °C

Prüfgrundlage / *Specifications:*	IEC 61097-14_FDIS
Betriebsart / *Operation mode:*	The EUT was set into a special test mode, which provides a unmodulated test signal for a periode of 1 s. After a cooling periode of 2 s the test signal is provided again.
Kommentar / *Comment:*	The extreme conditions are: • low temperature (-20° C) with a battery near end of useful life (92 h) (see Annex: EasyRESCUE_BatteryTest_Annex, section 2.3) • high temperature (+55° C) with a full capacity battery





Frequency error at + 20 °C

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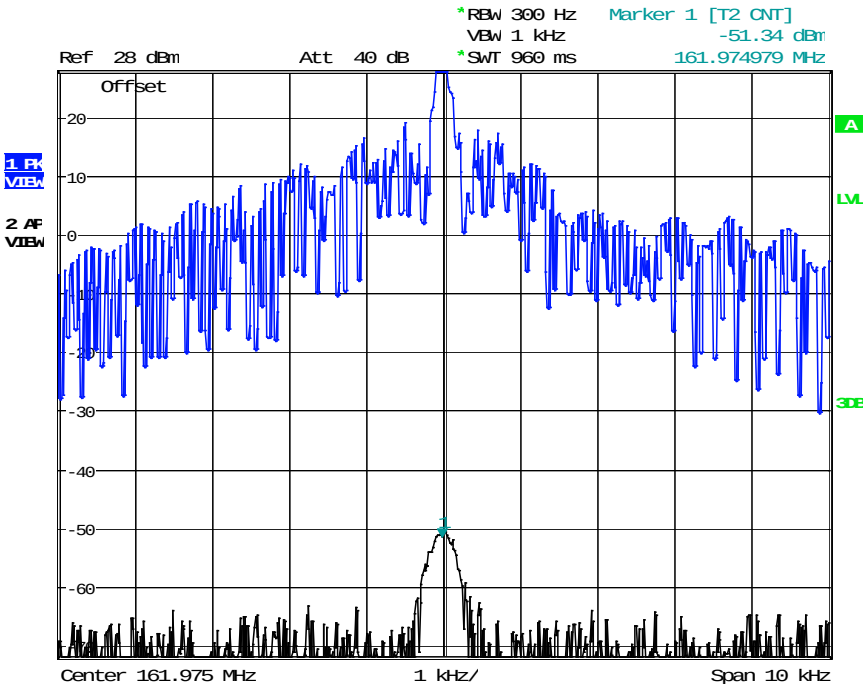

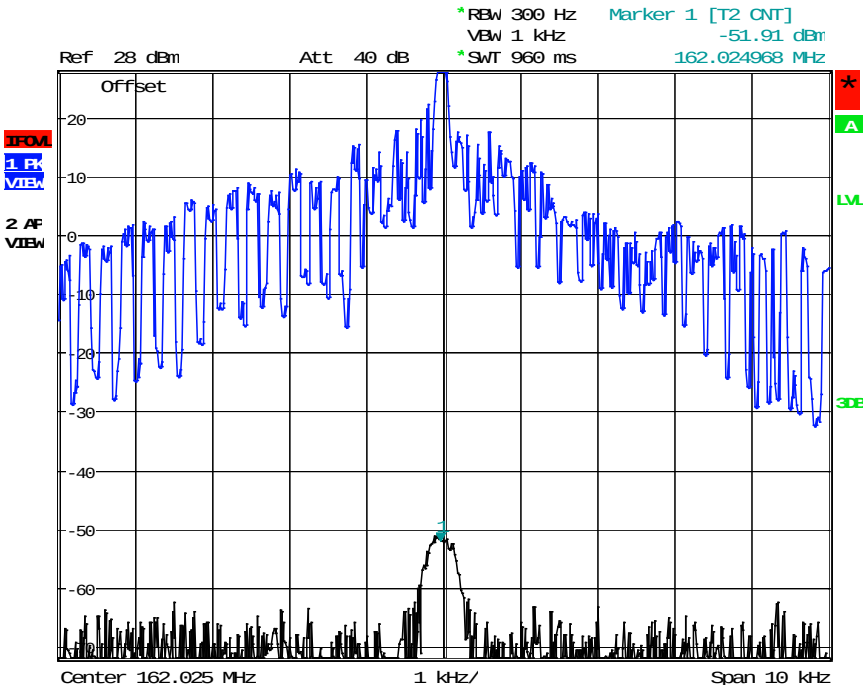

Frequency error at - 20 °C

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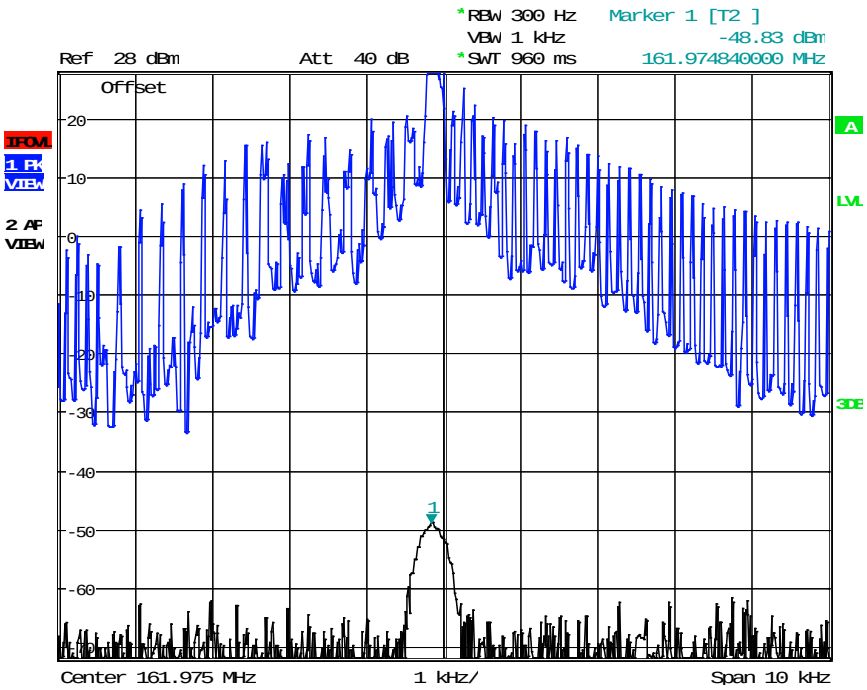
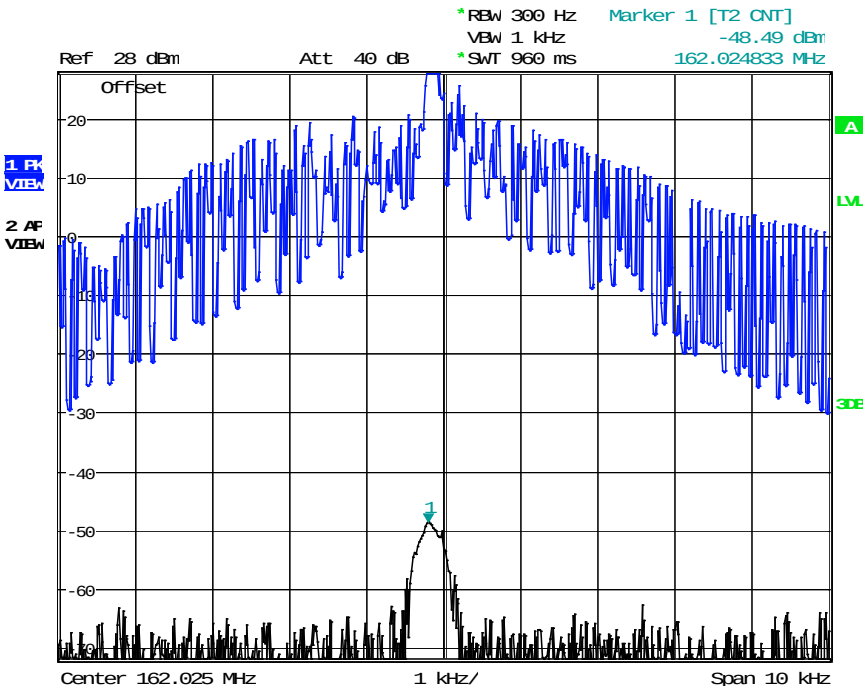




Frequency error at + 55 °C

7.3 Conducted power

7.3.1 Test description

7.3.1 Purpose

The purpose of this test is to verify that the output power from the AIS-SART is within the limits at extreme operating conditions..

7.3.2 Method of measurement

Connect the test unit to a power meter and record the conducted power at normal test conditions (P_{20}). Repeat the test for extreme low and high temperatures and record the values obtained from these measurements (P_{-20} and P_{55}).

Calculate the gain of the AIS-SART antenna using the following equation:

$$G = P_R - P_{20} - P_d$$

where

G is the antenna gain (dB);
P_R is the radiated power level as measured in 7.4.2 (dBm);
P_{20} is the conducted power level measured at normal test conditions (dBm);
P_d is the power output difference given in 5.5 (dB).

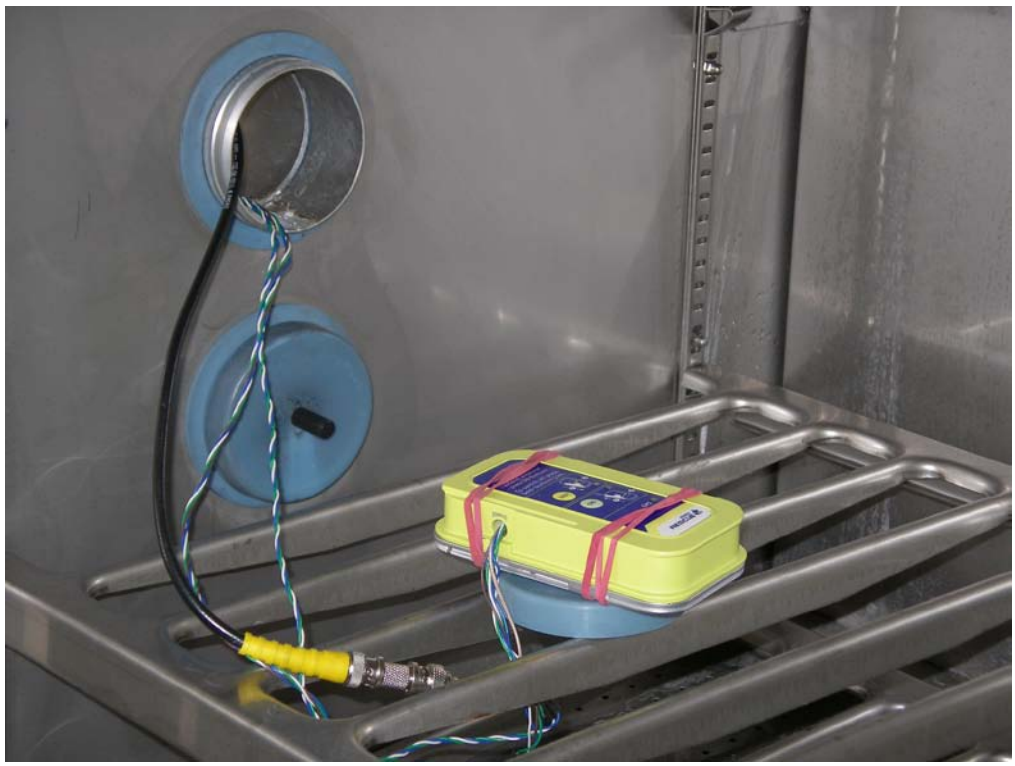
7.3.3 Required results

	Minimum limit		
P_R (minimum) [dBm]	27		
P_{20} [dBm]	-		
Calculated Gain ($G = P_R - P_{20} - P_d$) [dB]	-		
P_{-20} + G [dBm]	27		
P_{55} + G [dBm]	27		

7.3.4 Test Equipment List

No.	Instrument/Ancillary	Type	Serial Number	Manufacturer	Cal. due
101	EMI test receiver	ESMI	839379/013 839587/006	Rohde & Schwarz	2012-01-06
105	EMI test receiver	ESPI7	836914/0002	Rohde & Schwarz	2011-03-07
108	Radio communication service monitor	CMS 54	838384/030	Rohde & Schwarz	2011-09-30
133	Diode detector negative	8473D	01492	Hewlett Packard	N/A
007	Temperature test chamber	KPK 200	A-2005	Feutron	2011-05-10

7.3.5 Test Setup



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Conducted power

Prüfdatum / *Date of test:*	June 11, 2010
Prüfer / *Operator:*	Johann Roidt
Messplatz / *Test site:*	Non shielded room

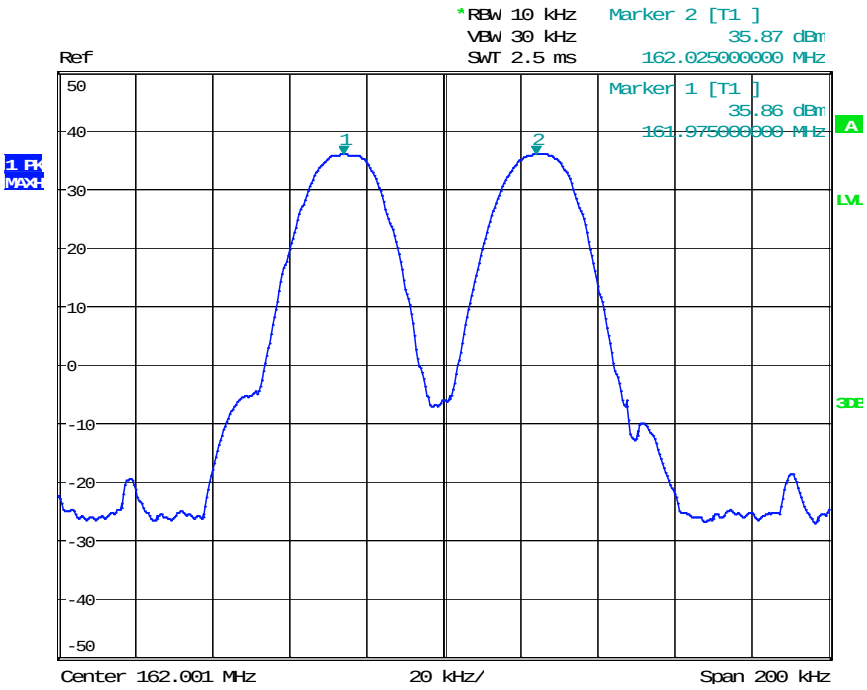
Prüfergebnis / *Test Result*
☒ **Erfüllt / *Passed***
☐ **Nicht erfüllt / *Not passed***

Luftdruck / *Barometric pressure:*	1006 hPa
Relative Luftfeuchtigkeit / *Relative humidity:*	47 %
Temperatur / *Ambient temperature:*	22 °C

Prüfgrundlage / *Specifications:*	IEC 61097-14_FDIS
Betriebsart / *Operation mode:*	The EUT was set into a special test mode, which provides a modulated test signal (IEC 61097-14, 5.6) for a periode of 1 s. After a cooling periode of 2 s the test signal is provided again.
Kommentar / *Comment:*	The extreme conditions are: • low temperature (-20° C) with a battery near end of useful life (92 h) (see Annex: EasyRESCUE_BatteryTest_Annex, section 2.3) • high temperature (+55° C) with a full capacity battery

	Minimum limit	**AIS 1**	**AIS 2**
P_R [dBm] (see section 7.4.5)	**27**	**32.56**	**32.57**
P_{20} [dBm]		**35.86**	**35.87**
$G= P_R - P_{20} - P_d$ [dB]		**-3.3**	**-3.3**
P_{-20} [dBm]		**35.62**	**35.63**
P_{55} [dBm]		**35.30**	**35.30**
P_{-20} + G [dBm]	**27**	**32.32**	**32.33**
P_{55} + G [dBm]	**27**	**32.00**	**32.00**

Pd = 0 dB (both EUT : "standard AIS-SART" and "modified AIS-SART" have got the same power amplifier output power)



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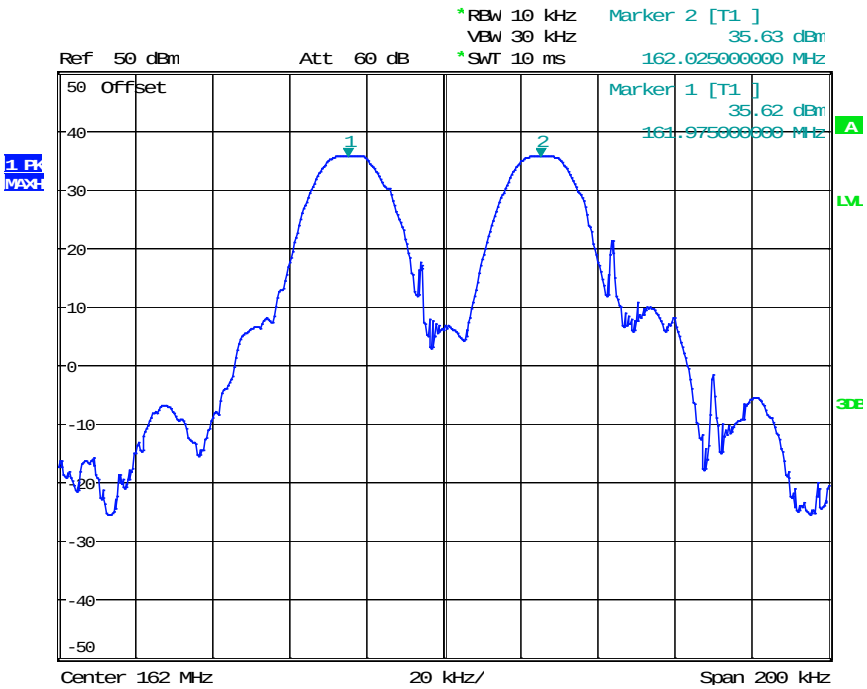
Conducted power at +20 °C



Date: 11.JUN.2010 13:28:02

Conducted power at -20 °C

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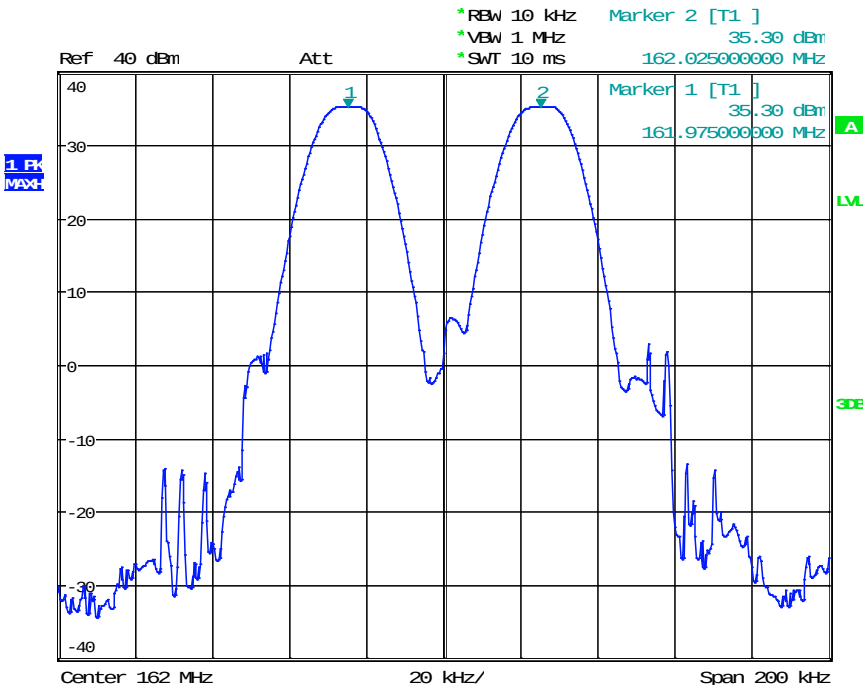


Date: 11.JUN.2010 12:13:37

Conducted power at +55 °C

7.4 Radiated power

7.4.1 Test description

7.3.1 Purpose

The purpose of this test is to verify that the output power from the AIS-SART is within the limits at extreme operating conditions..

7.4.2 Method of measurement

This test is only required to be performed at normal test conditions and shall use an AISSART whose battery has been ON for a minimum of 92 h. If the test exceeds 4 h, the battery may be replaced by another which has been pre-conditioned with at least 92 h of ON time.
Measurement of the radiated signals shall be made at a point 5 m or more from the AISSART.
The AIS-SART shall be mounted in its normal operating position with its antenna base 1 m above the ground plane on a non-conducting support.
The measurement antenna shall have vertical polarization mounted on a non-conducting support with its cable lying horizontally on the boom and run back to the supporting mast. The other end of the measurement antenna cable shall be connected to a measurement receiver located at the foot of the mast. The measurement shall be performed on a test site with a conductive ground plane of at least 3 m diameter and the height of the measurement antenna shall be adjusted to obtain the maximum reading on the measurement receiver up to a maximum of 30° elevation.
Precautions may be taken to eliminate reflections from the ground plane by using RF absorbing material at the position of the ground reflection.
Measure the received level at 4 different points in the azimuth plane by rotating the AIS-SART in steps of 90°. The minimum received level (P_{REC}) shall be recorded and used to calculate the radiated power at the normal operating temperature using the following equation:

$$P_R = P_{REC} - G_{REC} + L_C + L_P$$

where
P_R is the radiated power level from the AIS-SART (dBm);
P_{REC} is the measured power level from the measurement receiver (dBm);
G_{REC} is the antenna gain of the search antenna (dB);
L_C is the receive system attenuator and cable loss (dB);
L_P is the free space propagation loss (dB).

7.4.3 Required results

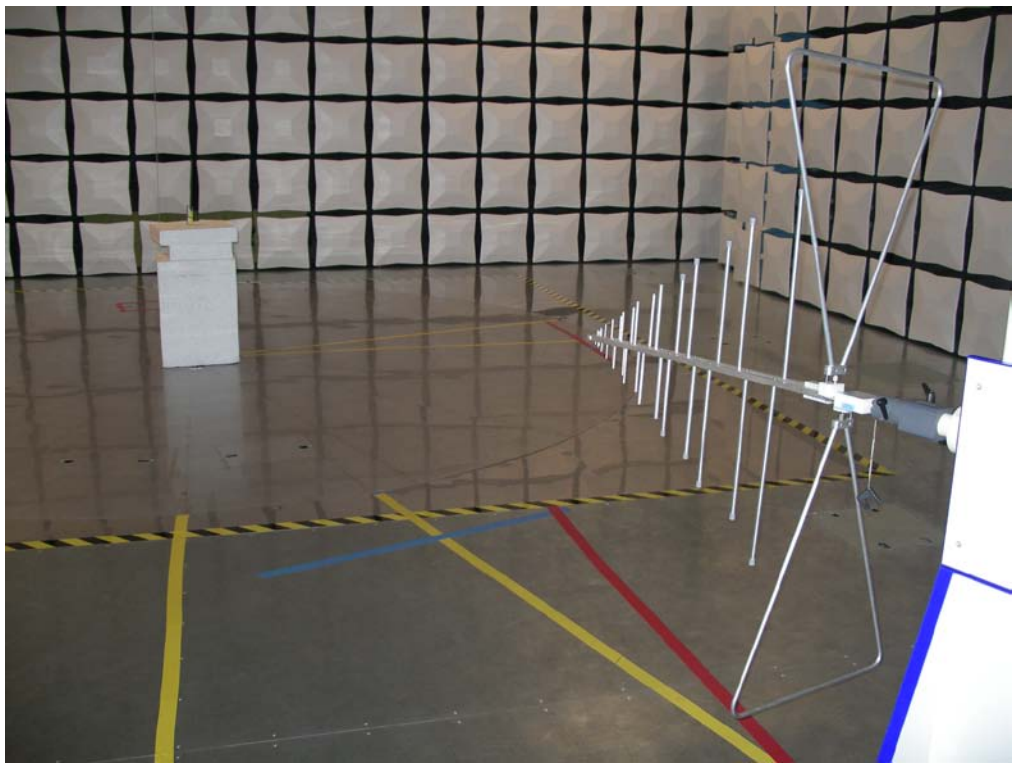
	Minimum limit		
P_R (minimum radiated power) [dBm]	27		

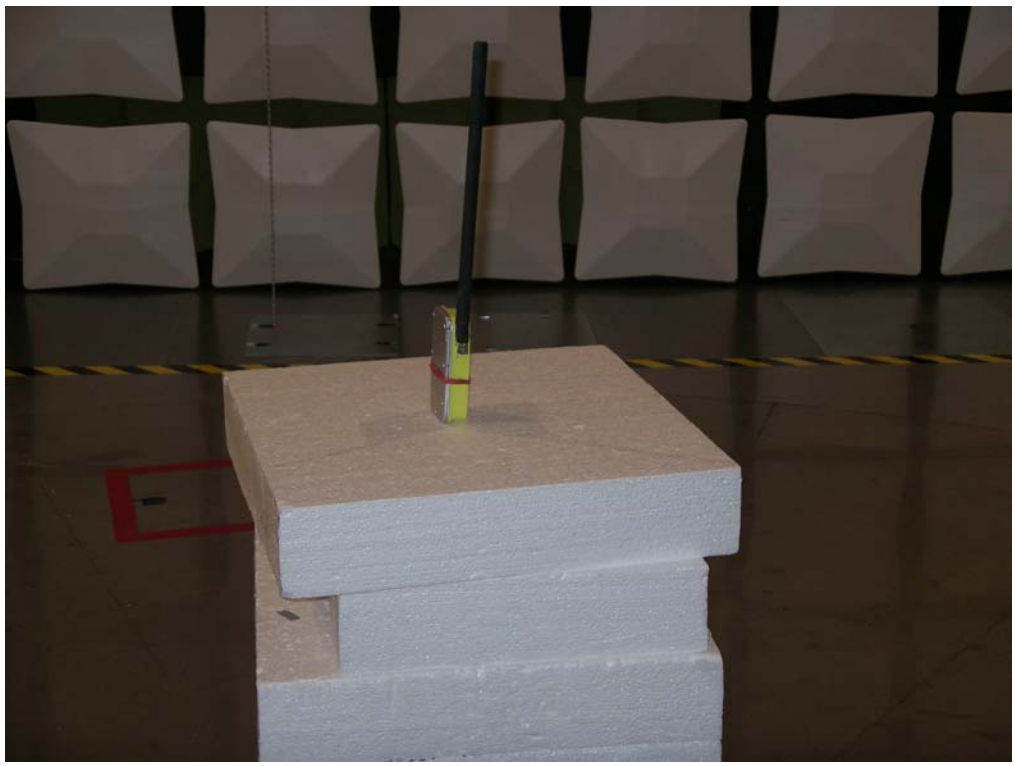
7.4.4 Test Equipment List

No.	Instrument/Ancillary	Type	Serial Number	Manufacturer	Cal. due
101	EMI test receiver	ESMI	839379/013 839587/006	Rohde & Schwarz	2012-01-06
105	EMI test receiver	ESPI7	836914/0002	Rohde & Schwarz	2011-03-07

108	Radio communication service monitor	CMS 54	838384/030	Rohde & Schwarz	2011-09-30
133	Diode detector negative	8473D	01492	Hewlett Packard	N/A
2005	Temperature test chamber	KPK 200	---	Feutron	2011-05-10
2044	EMI test receiver	ESU8	100232	Rohde & Schwarz	2010-11-21
2057	Semi anechoic room	No. 8	N/A	Albatross	N/A
1802	Trilog antenna Cabin no. 8	VULB 9163	9163-214	Schwarzbeck	2010-11-21

7.4.5 Test Setup





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Radiated power

Prüfdatum / *Date of test:*	10 June, 2010
Prüfer / *Operator:*	Johann Roidt
Messplatz / *Test site:*	Semi-anechoic room 8

Prüfergebnis / *Test Result*

☒ **Erfüllt / *Passed***

☐ **Nicht erfüllt / *Not passed***

Luftdruck / *Barometric pressure:*	1006 hPa
Relative Luftfeuchtigkeit / *Relative humidity:*	47 %
Temperatur / *Ambient temperature:*	22 °C

Prüfgrundlage / *Specifications:*	IEC 61097-14_FDIS
Betriebsart / *Operation mode:*	The EUT was set into a special test mode, which provides a modulated test signal (IEC 61097-14, 5.6) for a periode of 1 s. After a cooling periode of 2 s the test signal is provided again.
Kommentar / *Comment:*	The measured value P_R is the minimum of the four steps of 90 degrees.

	Minimum limit	AIS 1	AIS 2
P_R (minimum radiated power) [dBm]	**27**	**32.56**	**32.57**

7.5 Modulation spectrum slotted transmission

7.5.1 Test description

7.5.2 Purpose

This test is to ensure that the modulation and transient sidebands produced by the transmitter under normal operating conditions fall within the allowable mask

7.5.3 Method of measurement

The following method shall be applied.

a) The test shall use test signal number 3.

b) The AIS-SART shall be connected to a spectrum analyser. A resolution bandwidth of 1 kHz, video bandwidth of 3 kHz or greater and positive peak detection (maximum hold) shall be used for this measurement. A sufficient number of sweeps shall be used and sufficient transmission packets measured to ensure that the emission profile is developed.

7.5.4 Required results

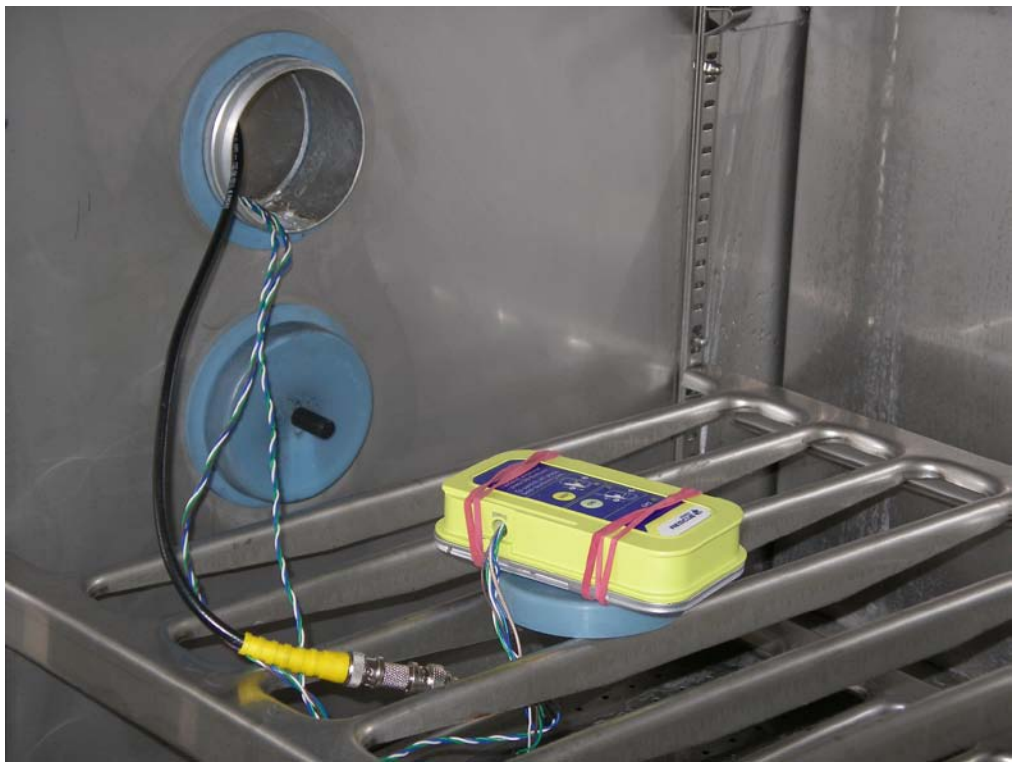
The spectrum for slotted transmission shall be within the emission mask as follows:

- 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 –20 dBc;
- at 25 kHz to 62,5 kHz removed from the carrier, the modulation and transient sidebands shall be below the lower value of –40 dBc;
- 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.

7.5.5 Test Equipment List

No.	Instrument/Ancillary	Type	Serial Number	Manufacturer	Cal. due
101	EMI test receiver	ESMI	839379/013 839587/006	Rohde & Schwarz	2012-01-06
105	EMI test receiver	ESPI7	836914/0002	Rohde & Schwarz	2011-03-07
108	Radio communication service monitor	CMS 54	838384/030	Rohde & Schwarz	2011-09-30
133	Diode detector negative	8473D	01492	Hewlett Packard	N/A
007	Temperature test chamber	KPK 200	A-2005	Feutron	2011-05-10

7.5.6 Test Setup



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Modulation spectrum slotted transmission

Prüfdatum / *Date of test:*	June 11, 2010
Prüfer / *Operator:*	Johann Roidt
Messplatz / *Test site:*	Non shielded room

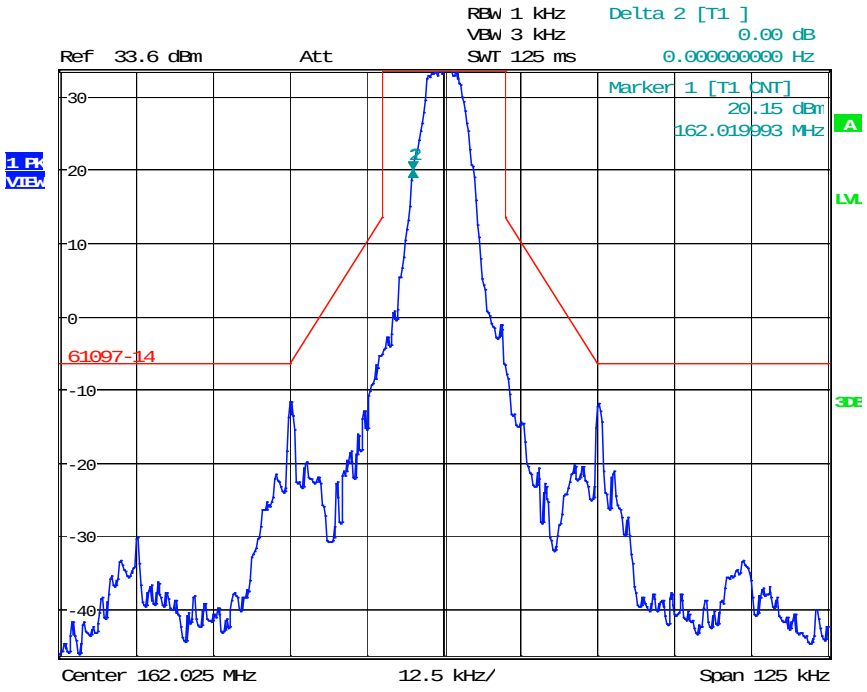
Prüfergebnis / *Test Result*

☒ **Erfüllt / *Passed***

☐ **Nicht erfüllt / *Not passed***

Luftdruck / *Barometric pressure:*	1006 hPa
Relative Luftfeuchtigkeit / *Relative humidity:*	47 %
Temperatur / *Ambient temperature:*	22 °C

Prüfgrundlage / *Specifications:*	IEC 61097-14_FDIS
Betriebsart / *Operation mode:*	The EUT was set into a special test mode, which provides a modulated test signal 3 (IEC 61097-14, 5.6)..
Kommentar / *Comment:*	



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Spectrum Mask at +20 °C

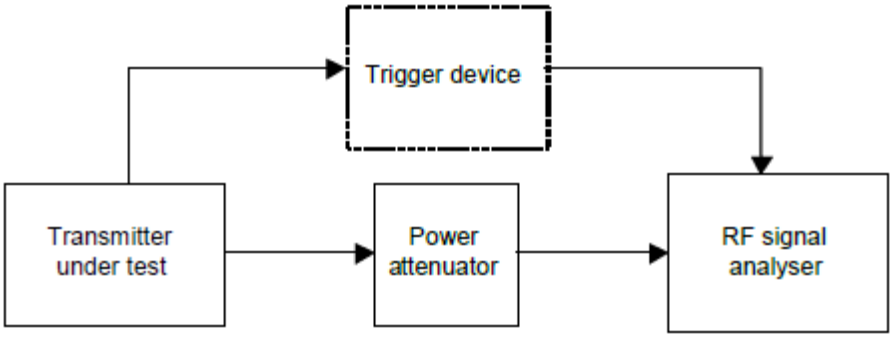
7.6 Transmitter test sequence and modulation accuracy

7.6.1 Test description

7.6.2 Purpose

The test is to verify that the training sequence starts with a 0 and is a 0101 pattern of 24 bits. The peak frequency deviation is derived from the baseband signal to verify modulation accuracy.

7.6.3 Method of measurement



The measurement procedure shall be as follows:

a) the equipment shall be connected in either configuration A or configuration B as shown in Figure 5. The trigger device is optional if the test equipment is capable of synchronising to the transmitted bursts;

b) the transmitter shall be tuned to AIS 2 (162,025 MHz);

c) the transmitter shall be modulated with test signal number 1;

d) the deviation from the carrier frequency shall be measured as a function of time;

e) the transmitter shall be modulated with test signal number 2,

f) the deviation from the carrier frequency shall be measured as a function of time ;

g) measurements shall be repeated at AIS 1;

h) the test shall be repeated under extreme test conditions.

7.6.4 Required results

Peak frequency deviation at various points within the data frame shall comply with Table 7. These limits apply to both the positive and negative modulation peaks. Bit 0 is defined as the first bit of the training sequence.

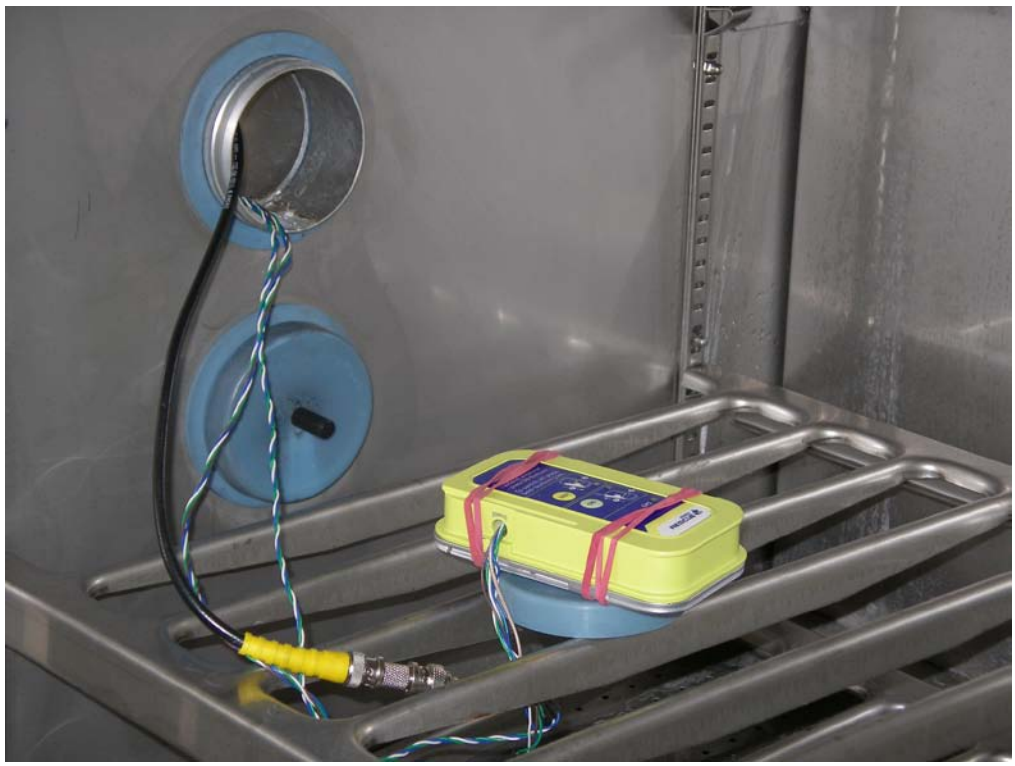
Table 7 – Peak frequency deviation versus time

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

7.6.5 Test Equipment List

No.	Instrument/Ancillary	Type	Serial Number	Manufacturer	Cal. due
101	EMI test receiver	ESMI	839379/013 839587/006	Rohde & Schwarz	2012-01-06
105	EMI test receiver	ESPI7	836914/0002	Rohde & Schwarz	2011-03-07
108	Radio communication service monitor	CMS 54	838384/030	Rohde & Schwarz	2011-09-30
133	Diode detector negative	8473D	01492	Hewlett Packard	N/A
007	Temperature test chamber	KPK 200	A-2005	Feutron	2011-05-10

7.6.6 Test Setup



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eMail: senton@tuev-sued.de

Transmitter test sequence and modulation accuracy

Prüfdatum / *Date of test:*	June 11, 2010
Prüfer / *Operator:*	Johann Roidt
Messplatz / *Test site:*	Non shielded room

Prüfergebnis / *Test Result*

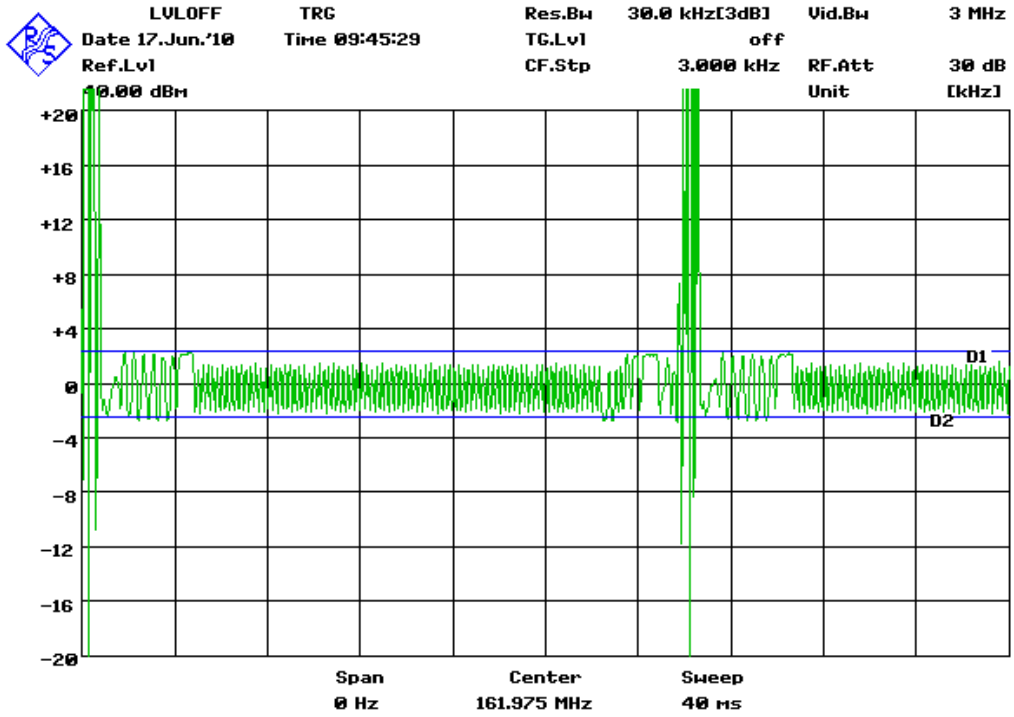
☒ **Erfüllt / *Passed***

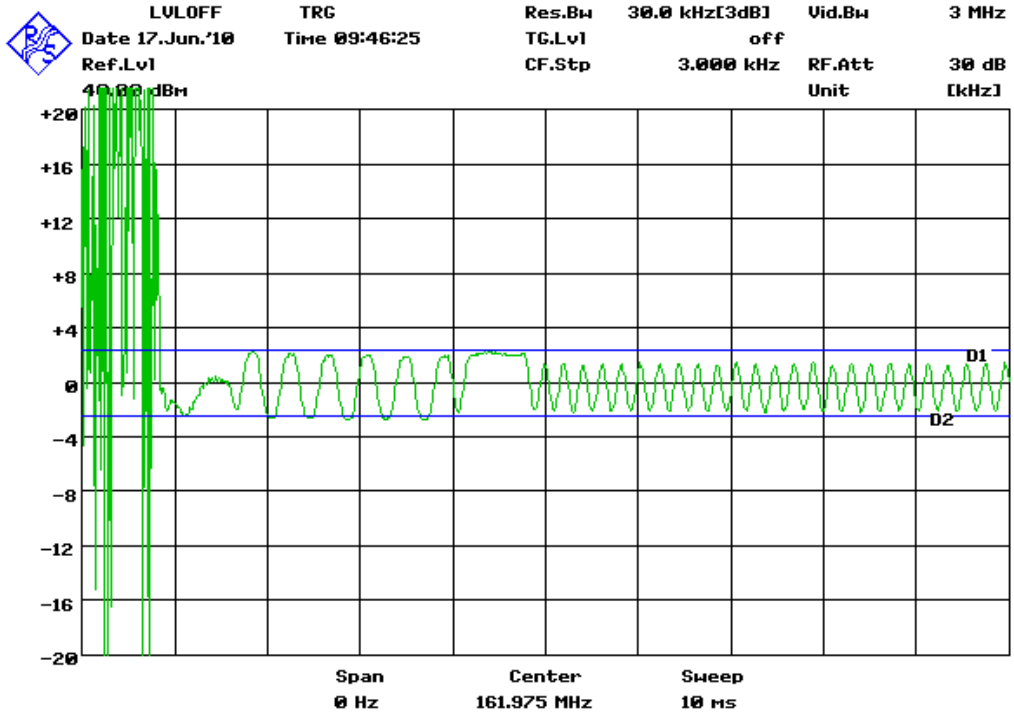
☐ **Nicht erfüllt / *Not passed***

Luftdruck / *Barometric pressure:*	1006 hPa
Relative Luftfeuchtigkeit / *Relative humidity:*	47 %
Temperatur / *Ambient temperature:*	22 °C

Prüfgrundlage / *Specifications:*	IEC 61097-14_FDIS
Betriebsart / *Operation mode:*	The EUT was set into a special test mode, which provides a modulated test signal 1 and 2 (IEC 61097-14, 5.6)..
Kommentar / *Comment:*	The extreme conditions are: • low temperature (-20° C) with a battery near end of useful life (92 h) (see Annex: EasyRESCUE_BatteryTest_Annex, section 2.3) • high temperature (+55° C) with a full capacity battery

Modulation accuracy plots at +22 °C





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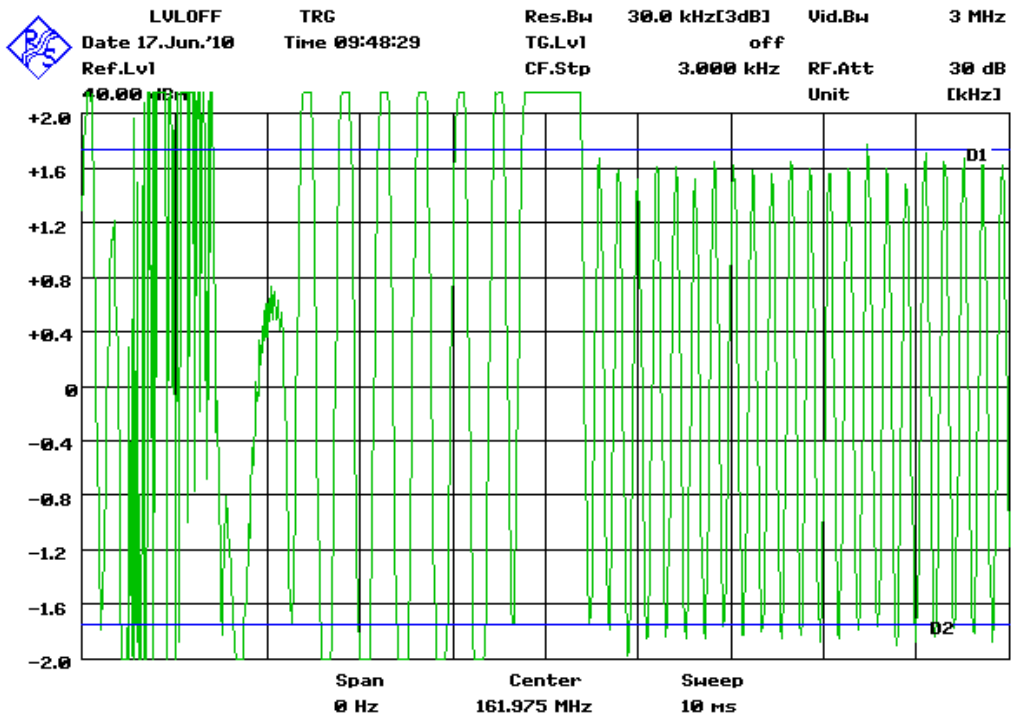
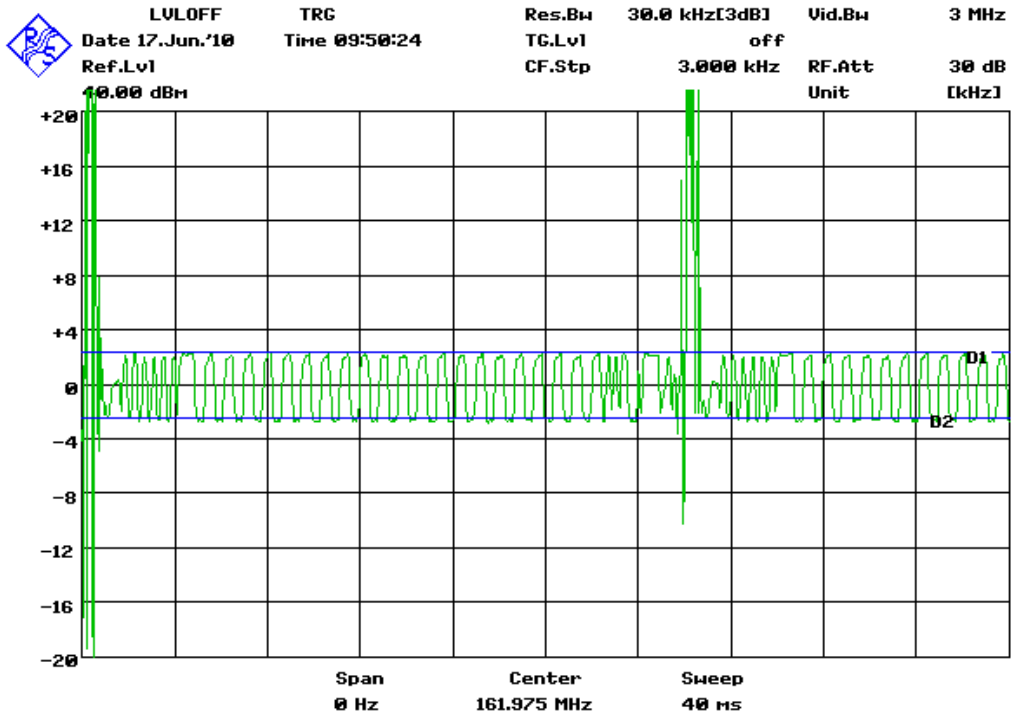
eMail: senton@tuev-sued.de





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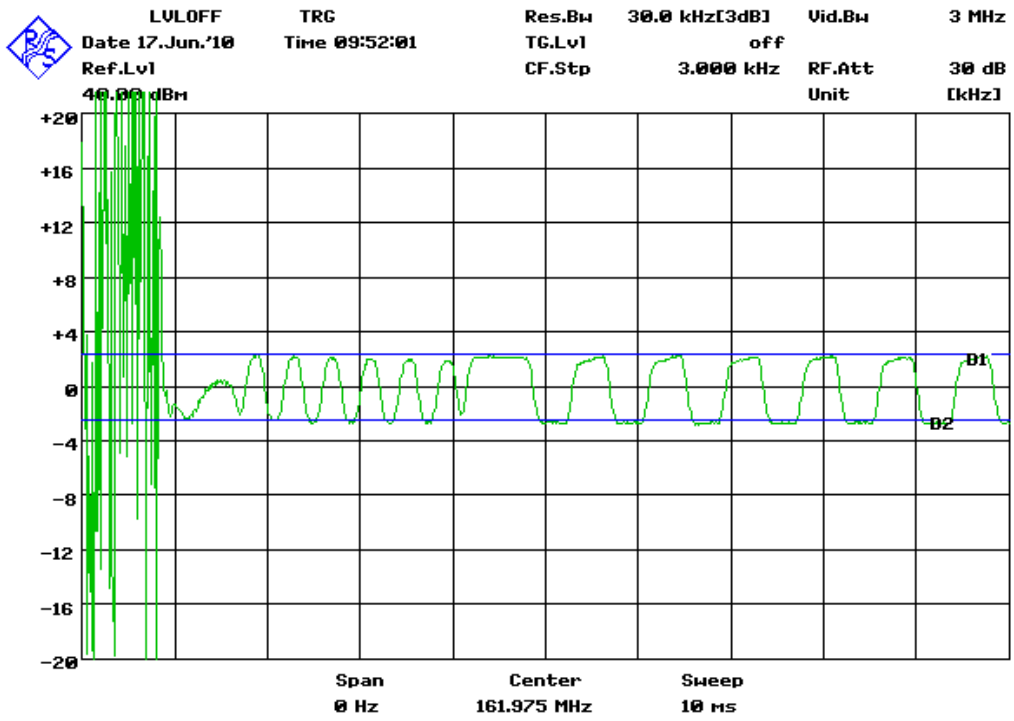

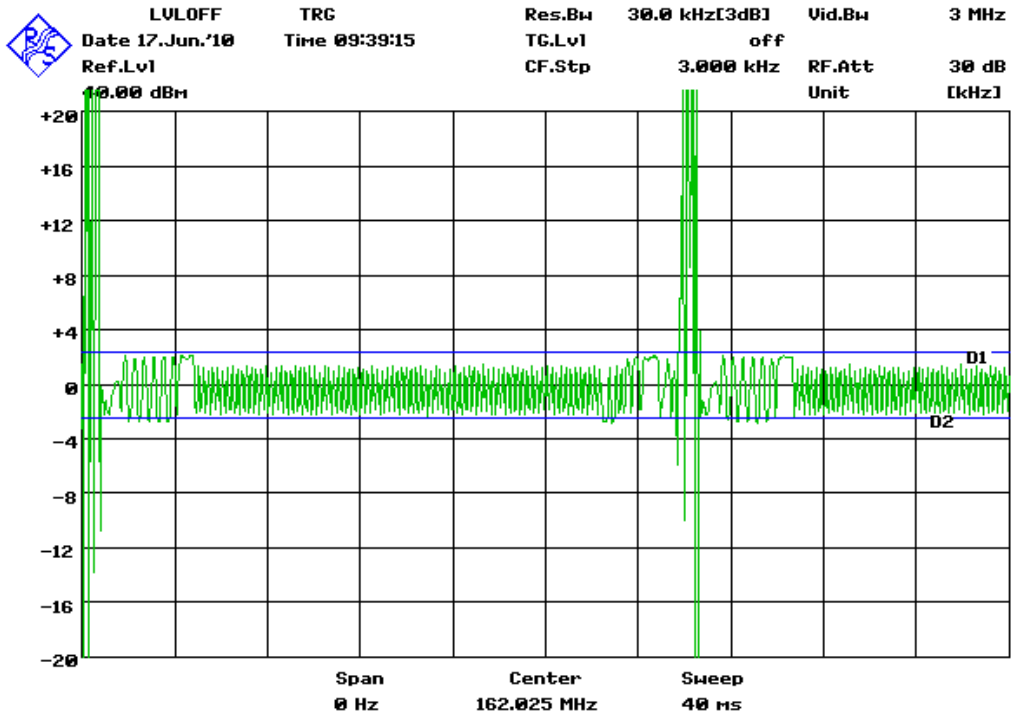

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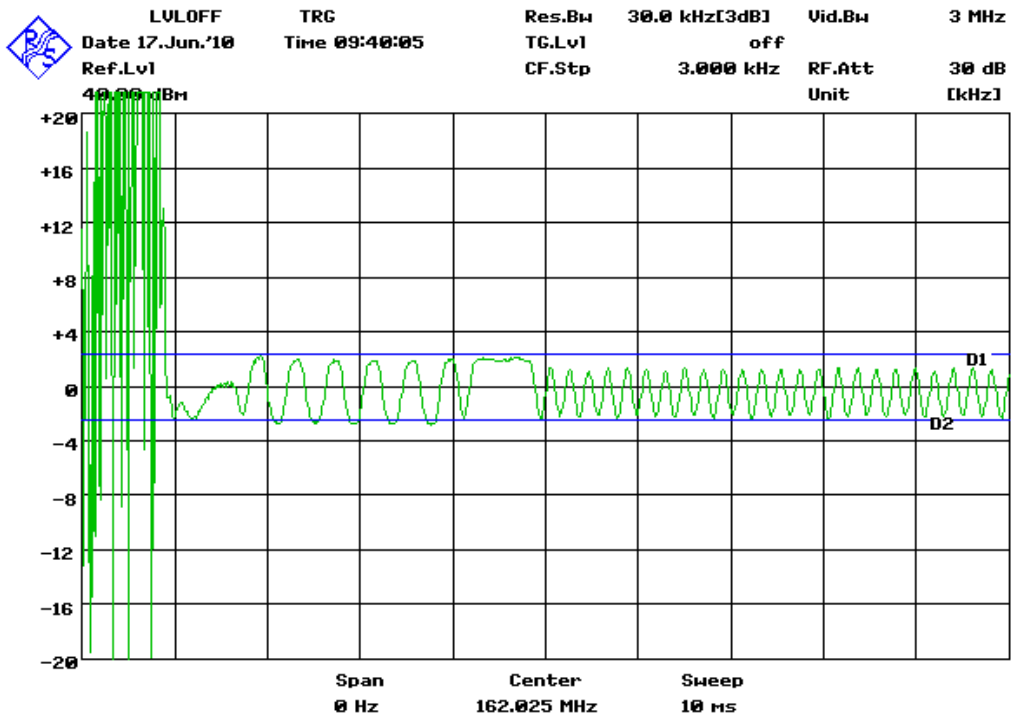

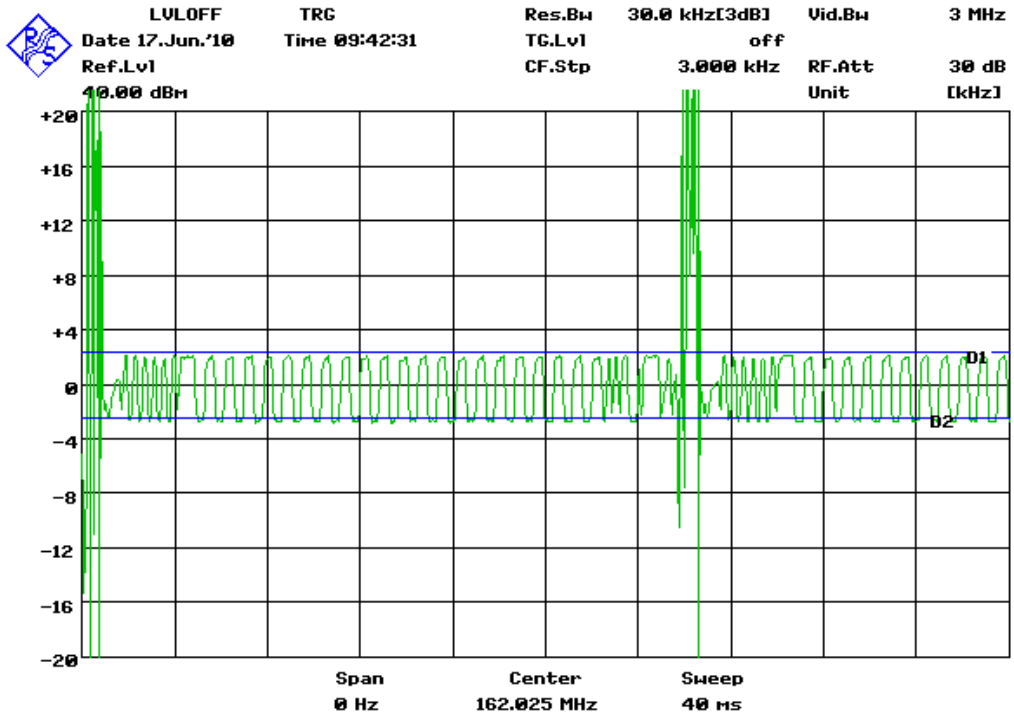

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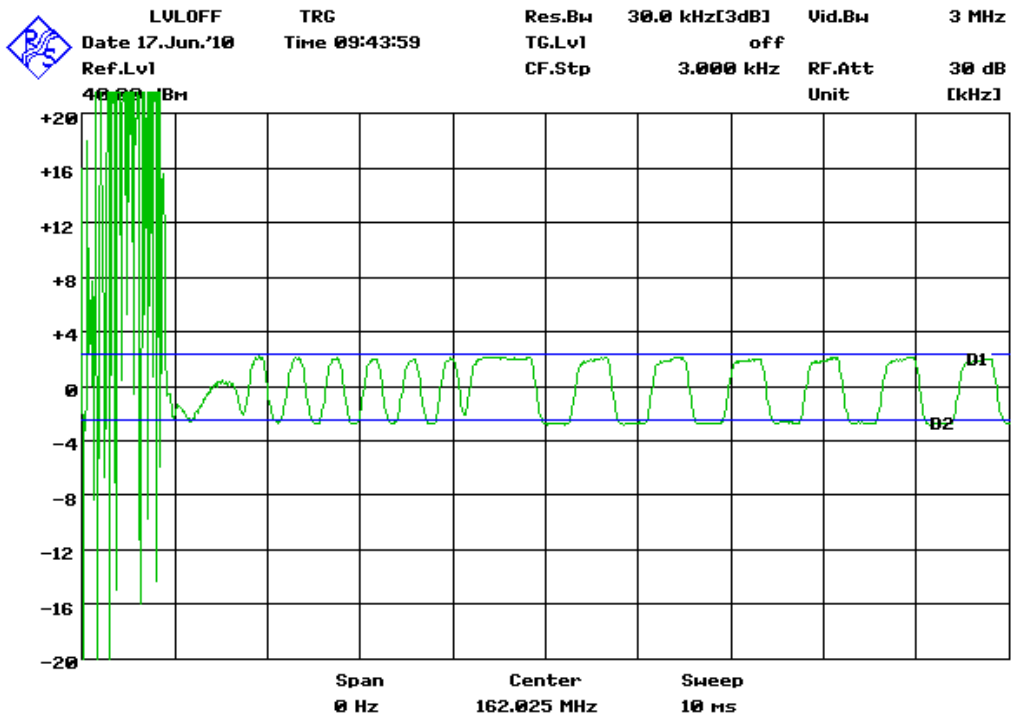
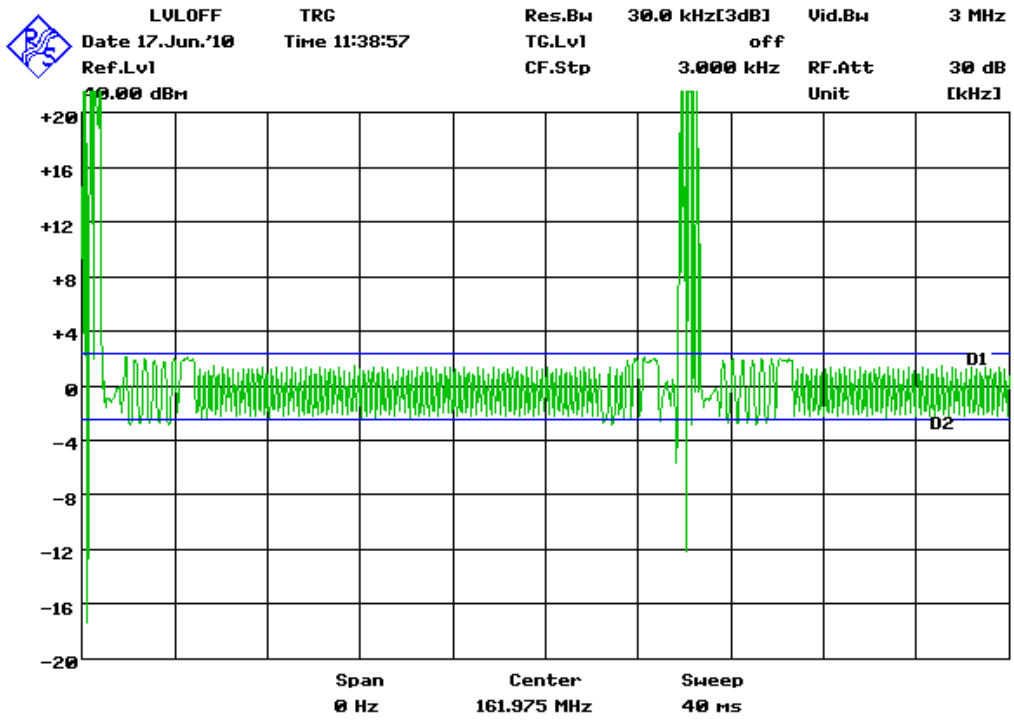
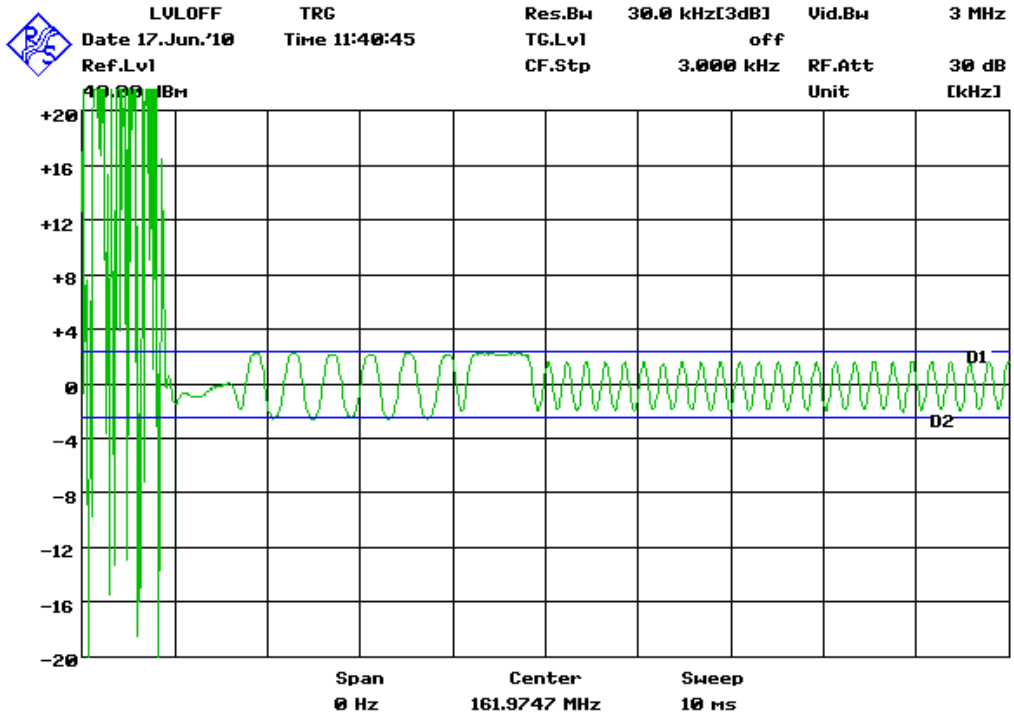
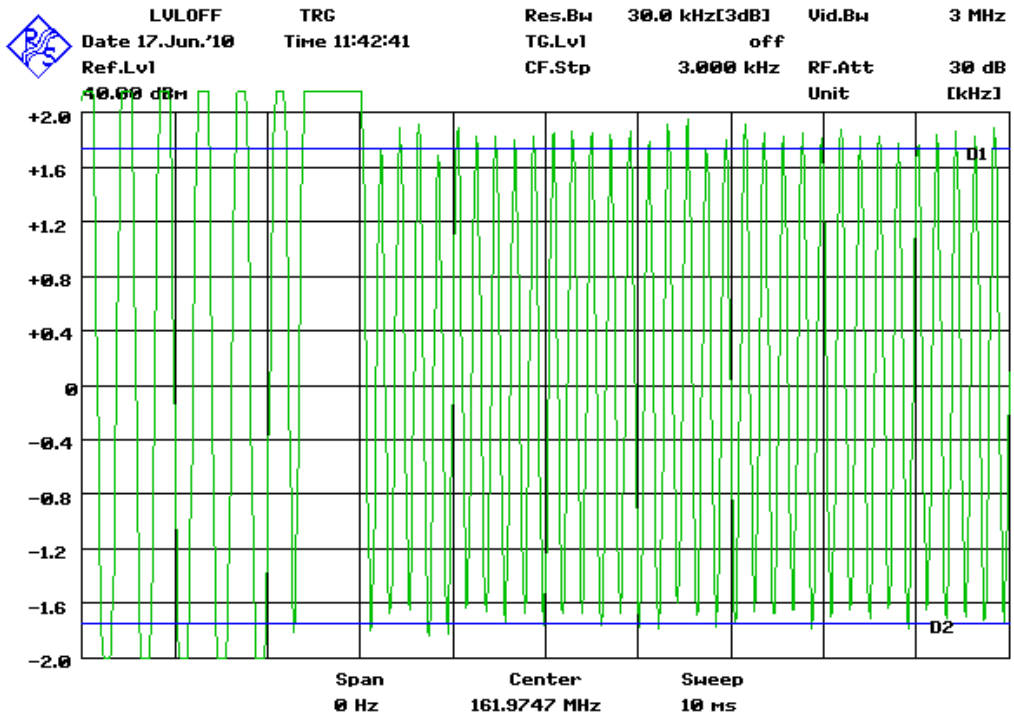


Modulation Accuracy plots at -20 °C



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Vid.Bw 3 MHz
Date 17.Jun.'10
Time 11:42:41
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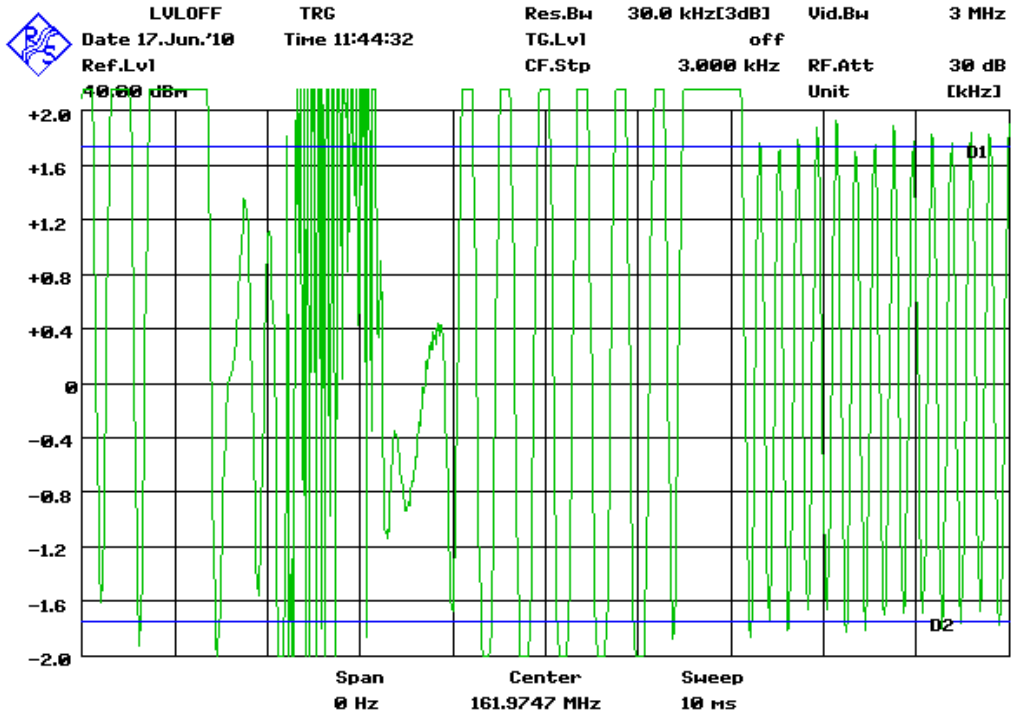
Ref.Lvl
CF.Stp 3.000 kHz
RF.Att 30 dB
40.00 dBm
Unit [kHz]
+2.0
+1.6
+1.2
+0.8
+0.4
0
-0.4
-0.8
-1.2
-1.6
-2.0
D1
D2
Span
Center
Sweep
0 Hz
161.9747 MHz
10 ms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Vid.Bw 3 MHz
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Time 11:44:32
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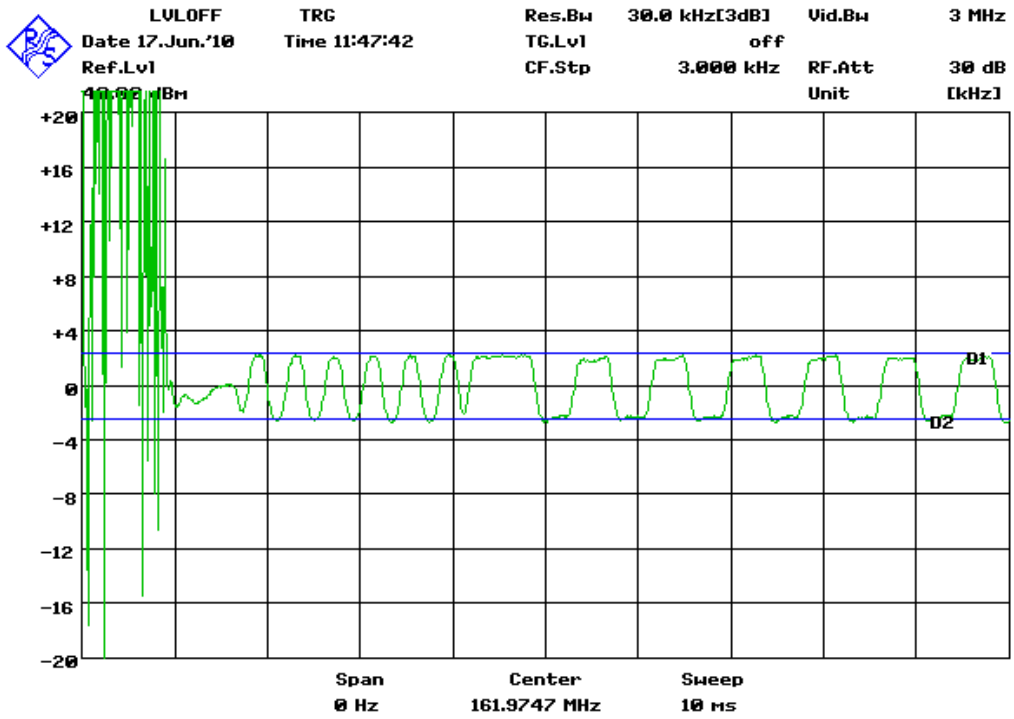
Ref.Lvl
CF.Stp 3.000 kHz
RF.Att 30 dB
40.00 dBm
Unit [kHz]
+2.0
+1.6
+1.2
+0.8
+0.4
0
-0.4
-0.8
-1.2
-1.6
-2.0
D1
D2
Span
Center
Sweep
0 Hz
161.9747 MHz
10 ms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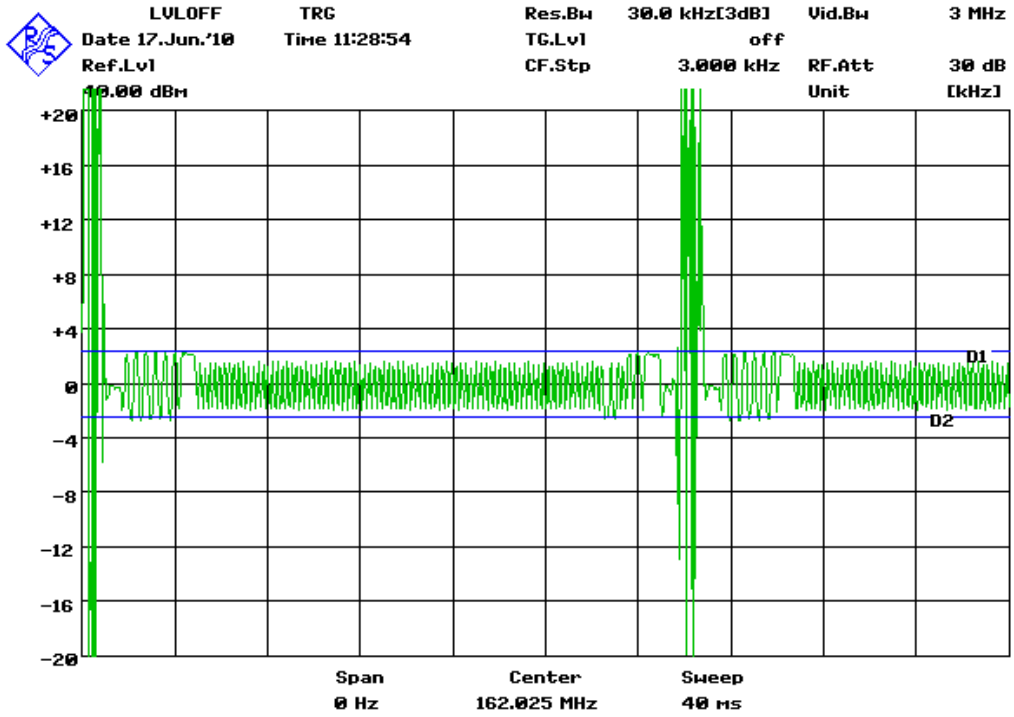
Vid.Bw 3 MHz
Date 17.Jun.'10
Time 11:47:42
TG.Lvl off
Ref.Lvl
CF.Stp 3.000 kHz
RF.Att 30 dB
10.02 dBm
Unit [kHz]
+20
+16
+12
+8
+4
0
-4
-8
-12
-16
-20
D1
D2
Span
Center
Sweep
0 Hz
161.9747 MHz
10 ms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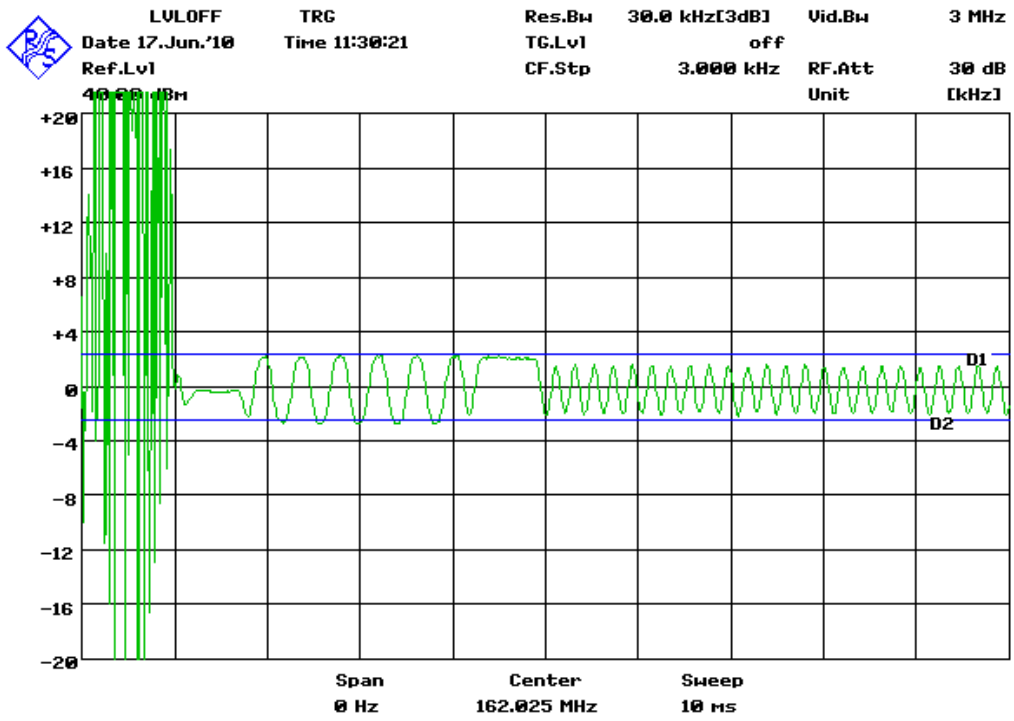
Vid.Bw 3 MHz
Date 17.Jun.'10
Time 11:28:54
TG.Lvl off
Ref.Lvl
CF.Stp 3.000 kHz
RF.Att 30 dB
10.00 dBm
Unit [kHz]
+20
+16
+12
+8
+4
0
-4
-8
-12
-16
-20
D1
D2
Span
Center
Sweep
0 Hz
162.025 MHz
40 ms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TRG
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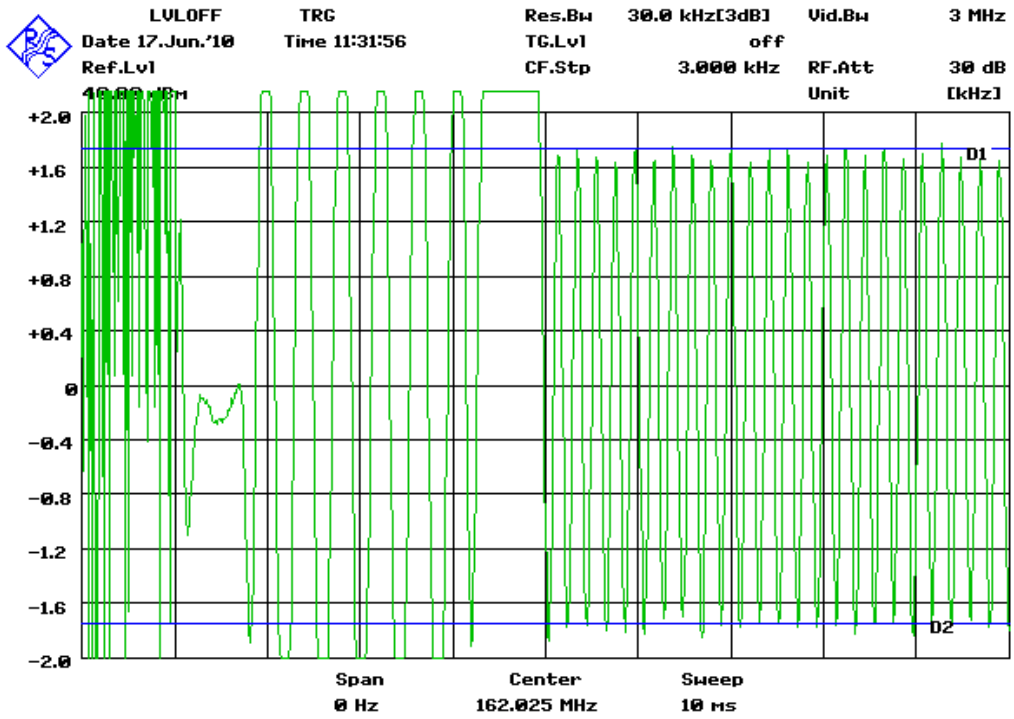
Vid.Bw 3 MHz
Date 17.Jun.'10
Time 11:30:21
TG.Lvl off
Ref.Lvl
CF.Stp 3.000 kHz
RF.Att 30 dB
Unit [kHz]
+20
+16
+12
+8
+4
0
-4
-8
-12
-16
-20
D1
D2
Span
0 Hz
Center
162.025 MHz
Sweep
10 ms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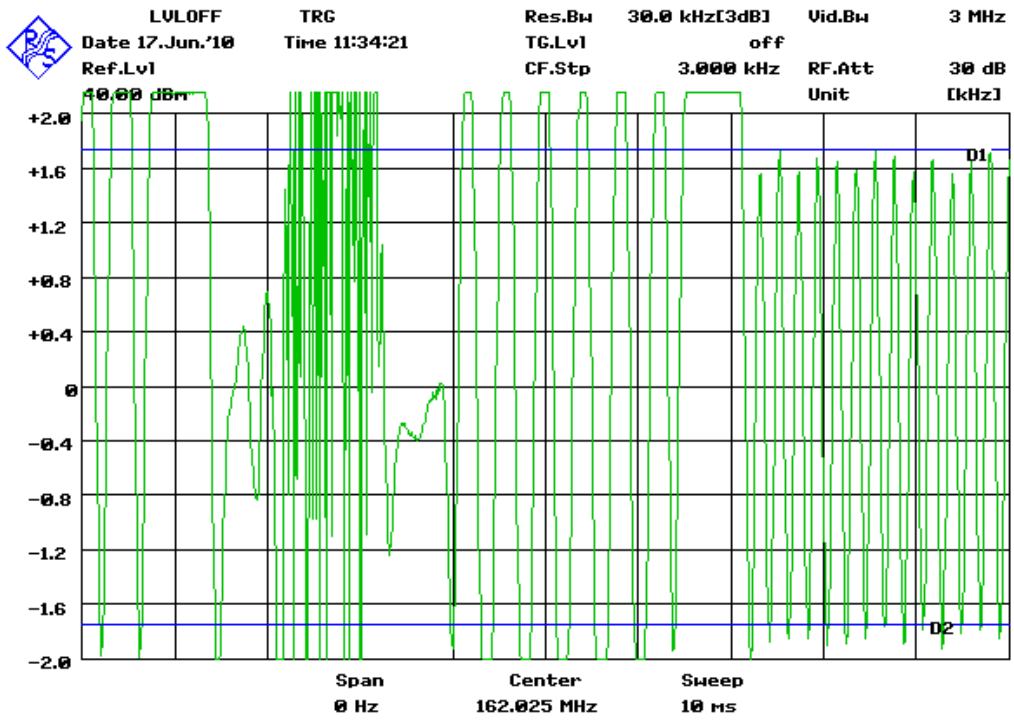
Vid.Bw 3 MHz
Date 17.Jun.'10
Time 11:31:56
TG.Lvl off
Ref.Lvl
CF.Stp 3.000 kHz
RF.Att 30 dB
Unit [kHz]
+2.0
+1.6
+1.2
+0.8
+0.4
0
-0.4
-0.8
-1.2
-1.6
-2.0
D1
D2
Span
0 Hz
Center
162.025 MHz
Sweep
10 ms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Vid.Bw 3 MHz
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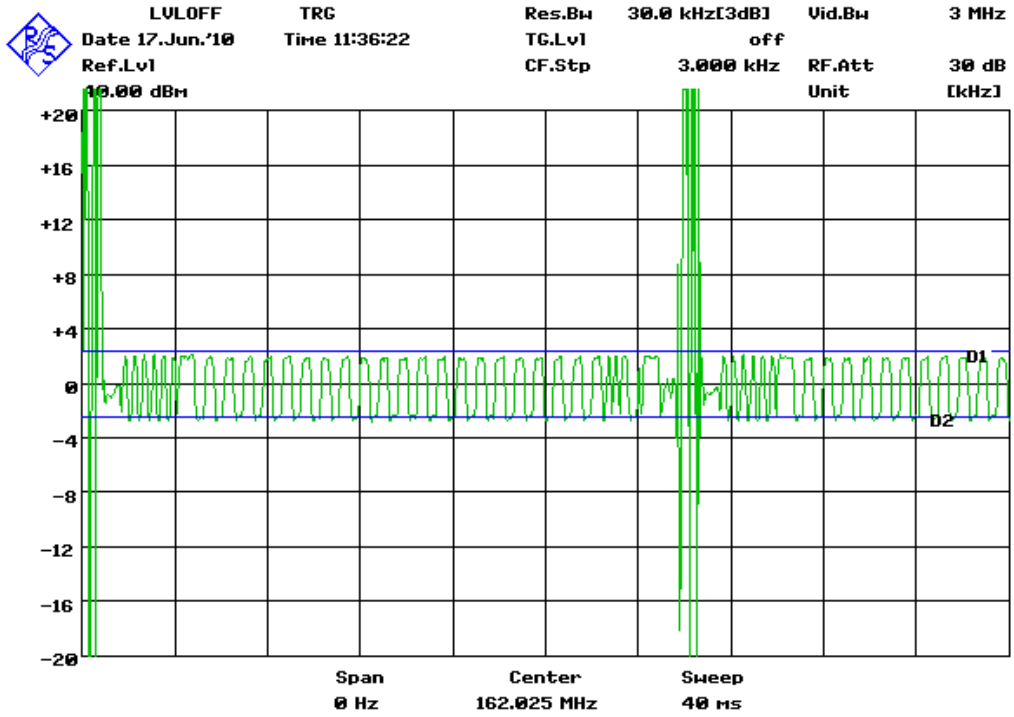
Time 11:34:21
TG.Lvl off
Ref.Lvl
CF.Stp 3.000 kHz
RF.Att 30 dB
10.00 dBm
Unit [kHz]
+2.0
+1.6
+1.2
+0.8
+0.4
0
-0.4
-0.8
-1.2
-1.6
-2.0
D1
D2
Span
Center
Sweep
0 Hz
162.025 MHz
10 ms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Vid.Bw 3 MHz
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Time 11:36:22
TG.Lvl off
Ref.Lvl
CF.Stp 3.000 kHz
RF.Att 30 dB
10.00 dBm
Unit [kHz]
+20
+16
+12
+8
+4
0
-4
-8
-12
-16
-20
D1
D2
Span
Center
Sweep
0 Hz
162.025 MHz
40 ms

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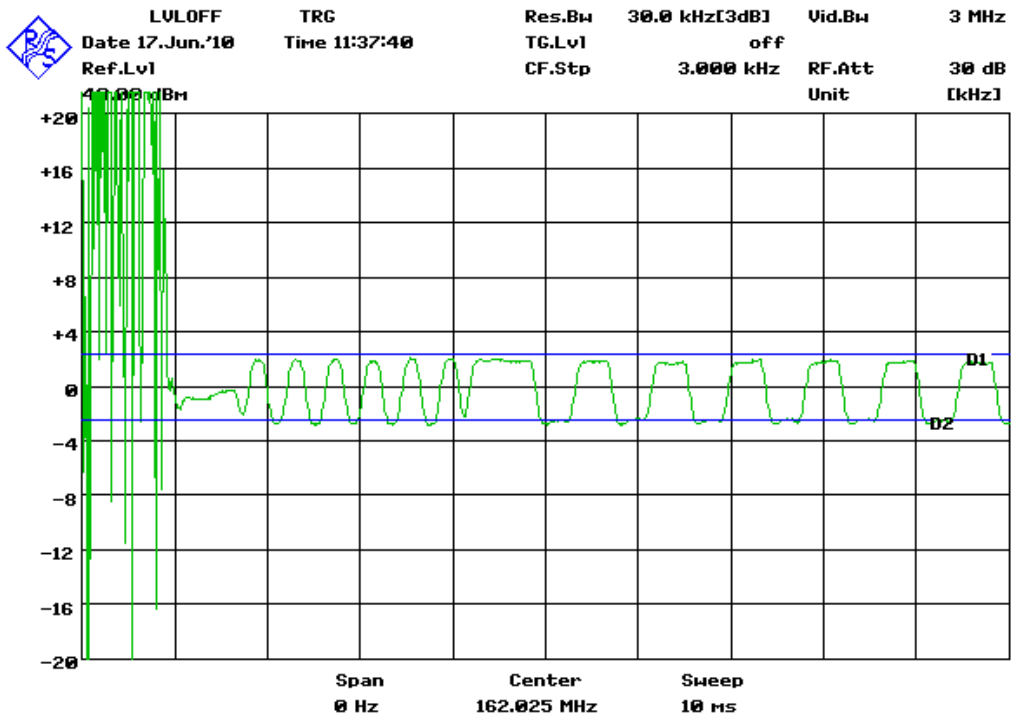
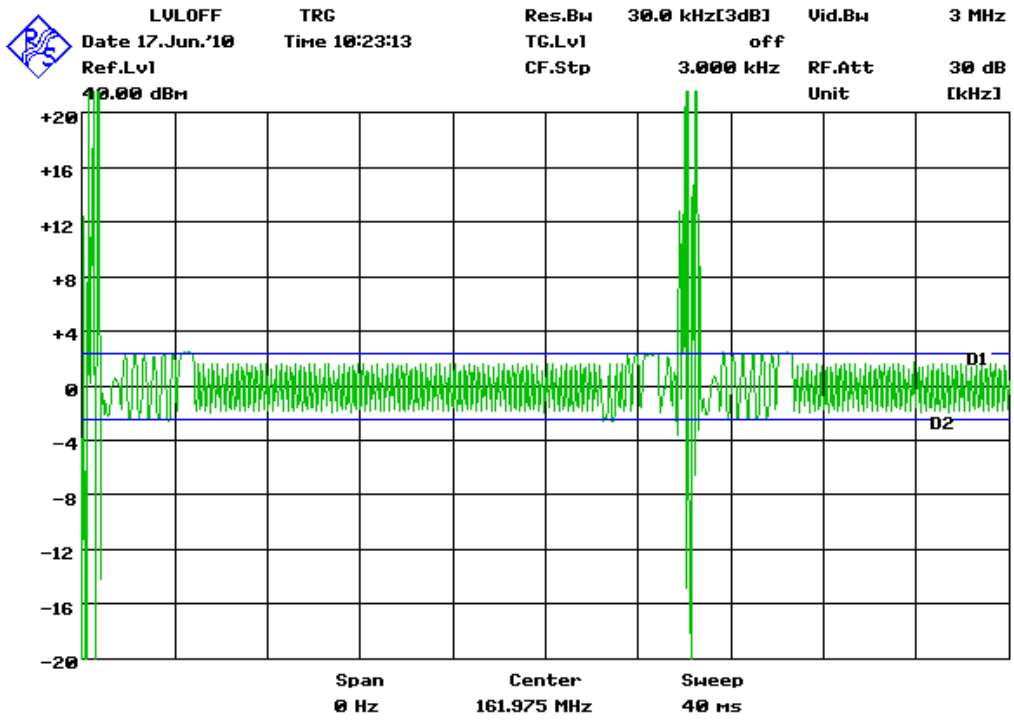
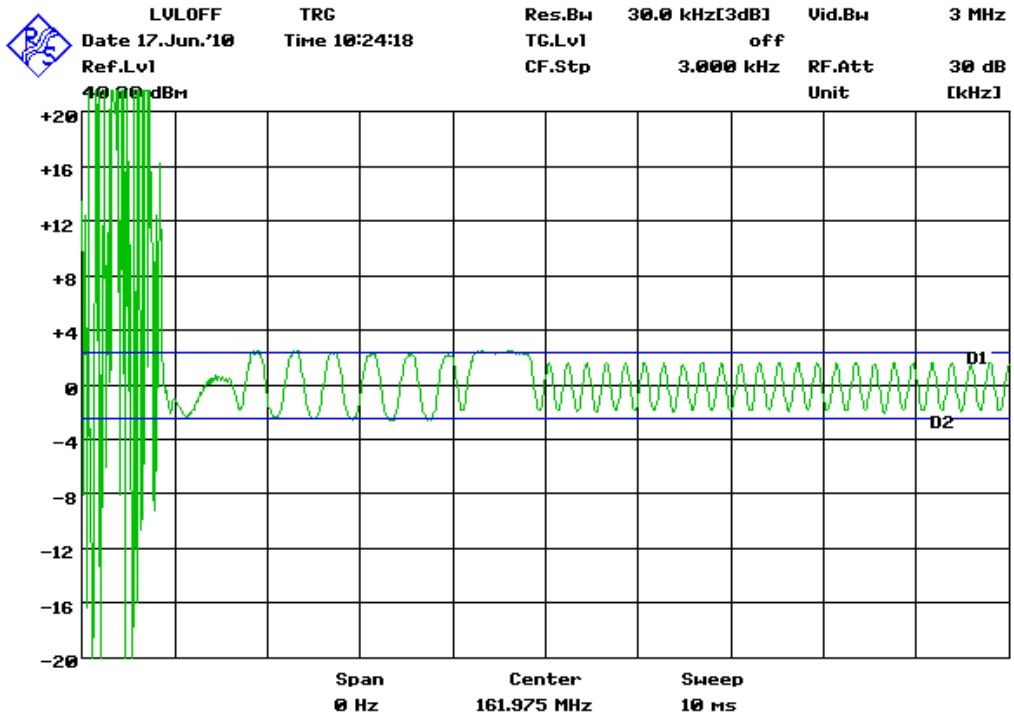
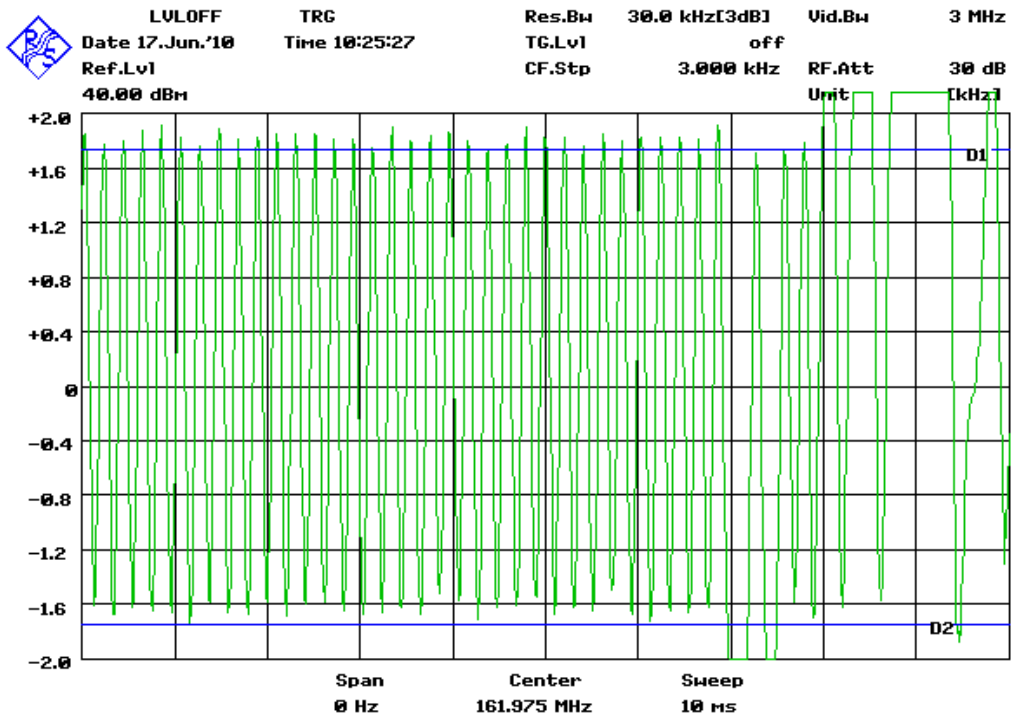


Modulation accuracy plots at +55 °C



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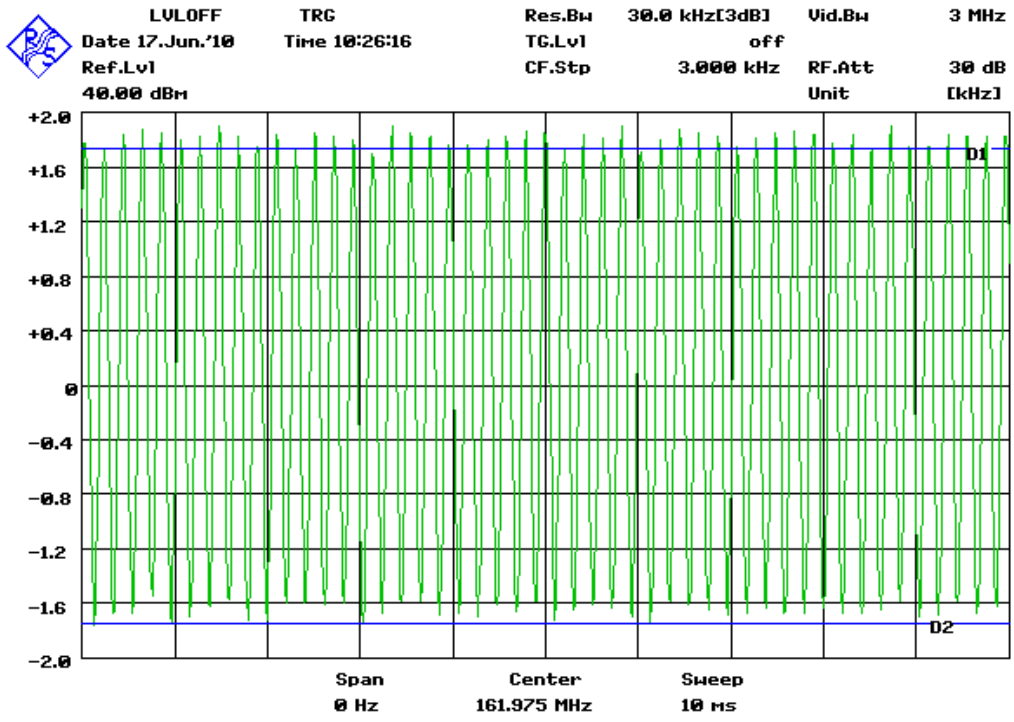
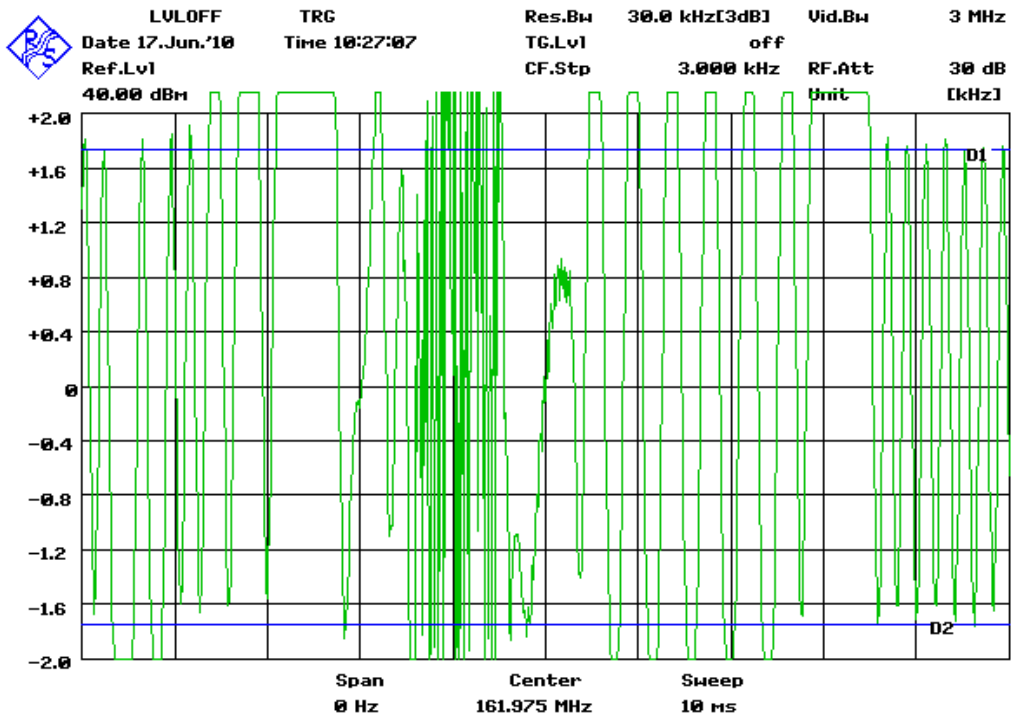
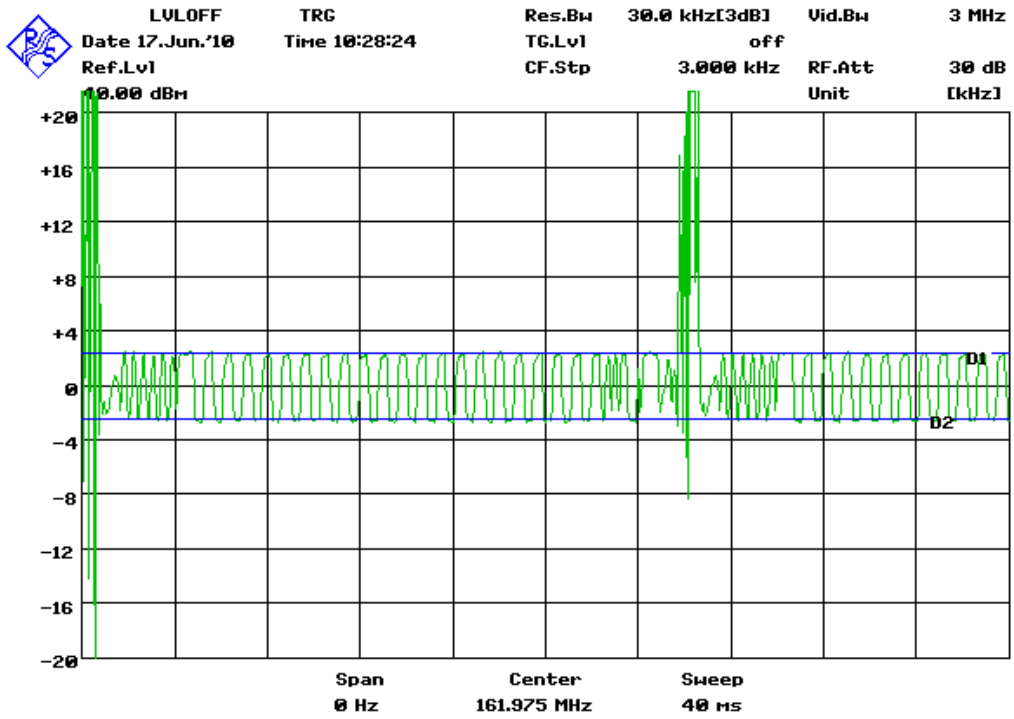
TRG
Res.Bw 30.0 kHz[3dB]
Vid.Bw 3 MHz
Date 17.Jun.'10
Time 10:25:27
TG.Lvl off
Ref.Lvl
CF.Stp 3.000 kHz
RF.Att 30 dB
40.00 dBm
Unit [kHz]
+2.0
+1.6
+1.2
+0.8
+0.4
0
-0.4
-0.8
-1.2
-1.6
-2.0
D1
D2
Span
Center
Sweep
0 Hz
161.975 MHz
10 ms


LVLOFF
TRG
Res.Bw 30.0 kHz[3dB]
Vid.Bw 3 MHz
Date 17.Jun.'10
Time 10:26:16
TG.Lvl off
Ref.Lvl
CF.Stp 3.000 kHz
RF.Att 30 dB
40.00 dBm
Unit [kHz]
+2.0
+1.6
+1.2
+0.8
+0.4
0
-0.4
-0.8
-1.2
-1.6
-2.0
D1
D2
Span
Center
Sweep
0 Hz
161.975 MHz
10 ms


LVLOFF
TRG
Res.Bw 30.0 kHz[3dB]
Vid.Bw 3 MHz
Date 17.Jun.'10
Time 10:27:07
TG.Lvl off
Ref.Lvl
CF.Stp 3.000 kHz
RF.Att 30 dB
40.00 dBm
Unit [kHz]
+2.0
+1.6
+1.2
+0.8
+0.4
0
-0.4
-0.8
-1.2
-1.6
-2.0
D1
D2
Span
0 Hz
Center
161.975 MHz
Sweep
10 ms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Vid.Bw 3 MHz
Date 17.Jun.'10
Time 10:28:24
TG.Lvl off
Ref.Lvl
CF.Stp 3.000 kHz
RF.Att 30 dB
Unit [kHz]
+20
+16
+12
+8
+4
0
-4
-8
-12
-16
-20
D1
D2
Span
0 Hz
Center
161.975 MHz
Sweep
40 ms

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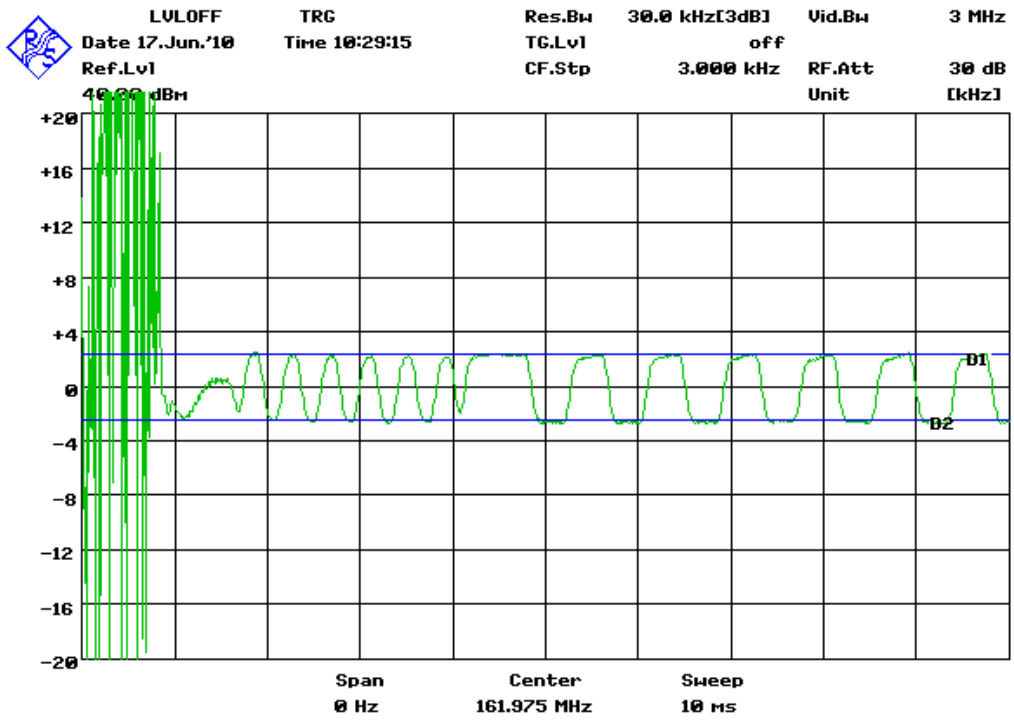

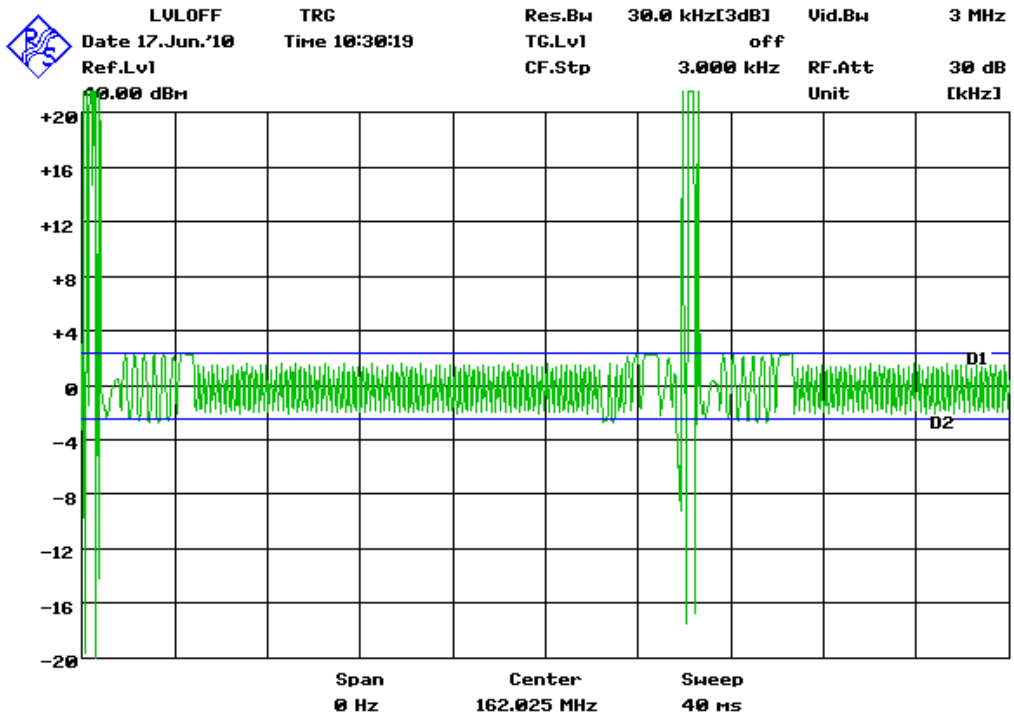
LVLOFF
TRG
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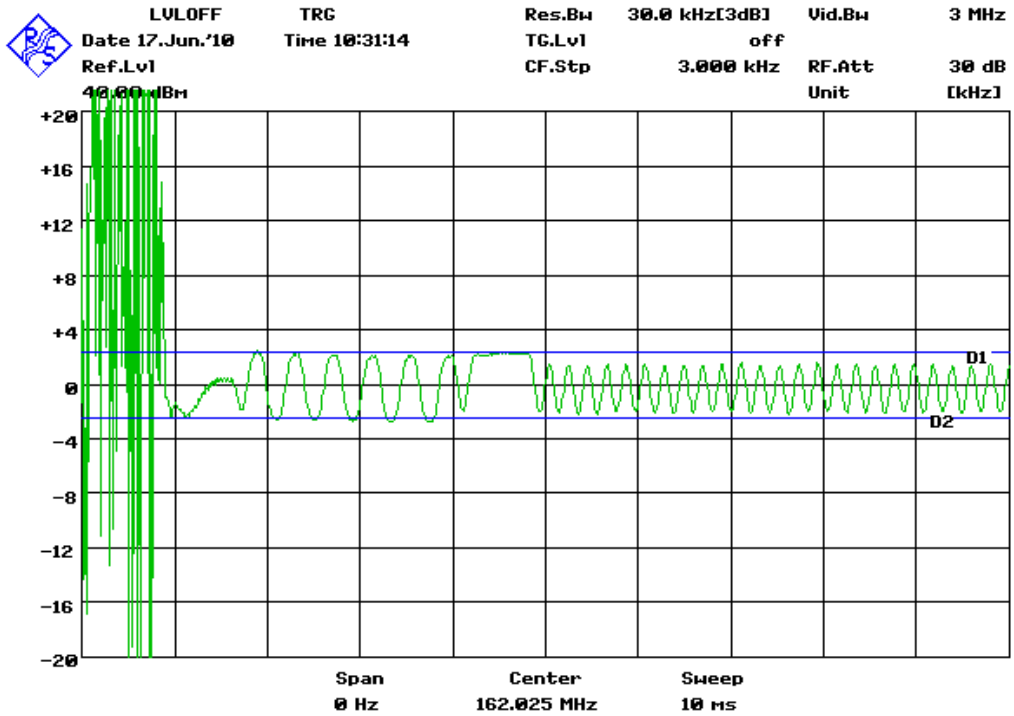
Vid.Bw 3 MHz
Date 17.Jun.'10
Time 10:30:19
TG.Lvl off
Ref.Lvl
CF.Stp 3.000 kHz
RF.Att 30 dB
40.00 dBm
Unit [kHz]
+20
+16
+12
+8
+4
0
-4
-8
-12
-16
-20
D1
D2
Span
0 Hz
Center
162.025 MHz
Sweep
40 ms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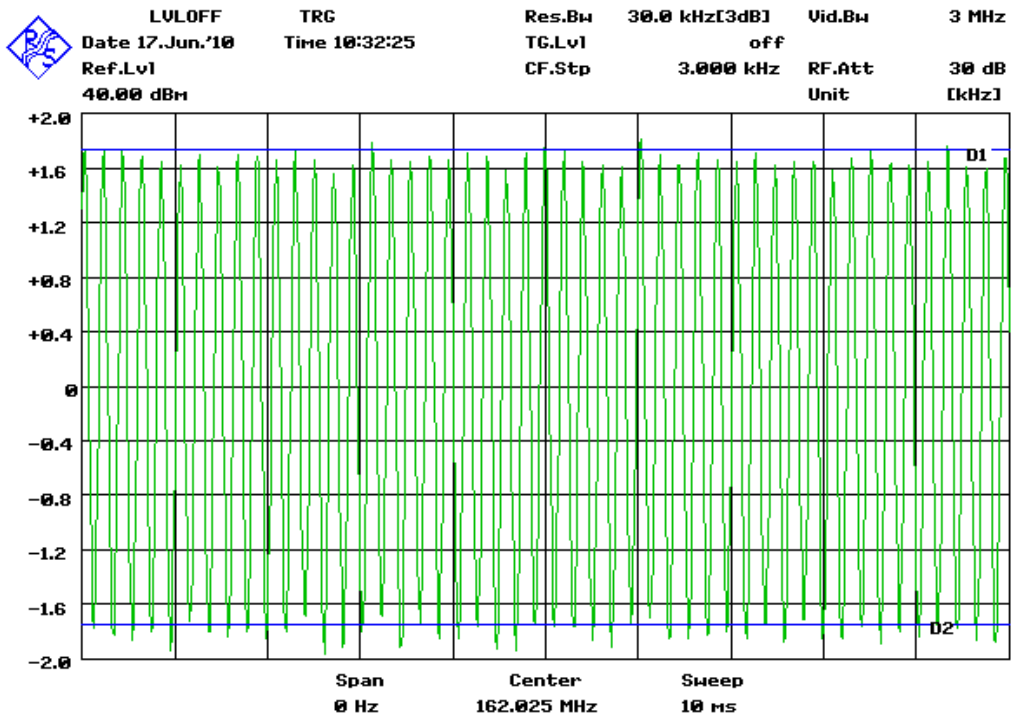
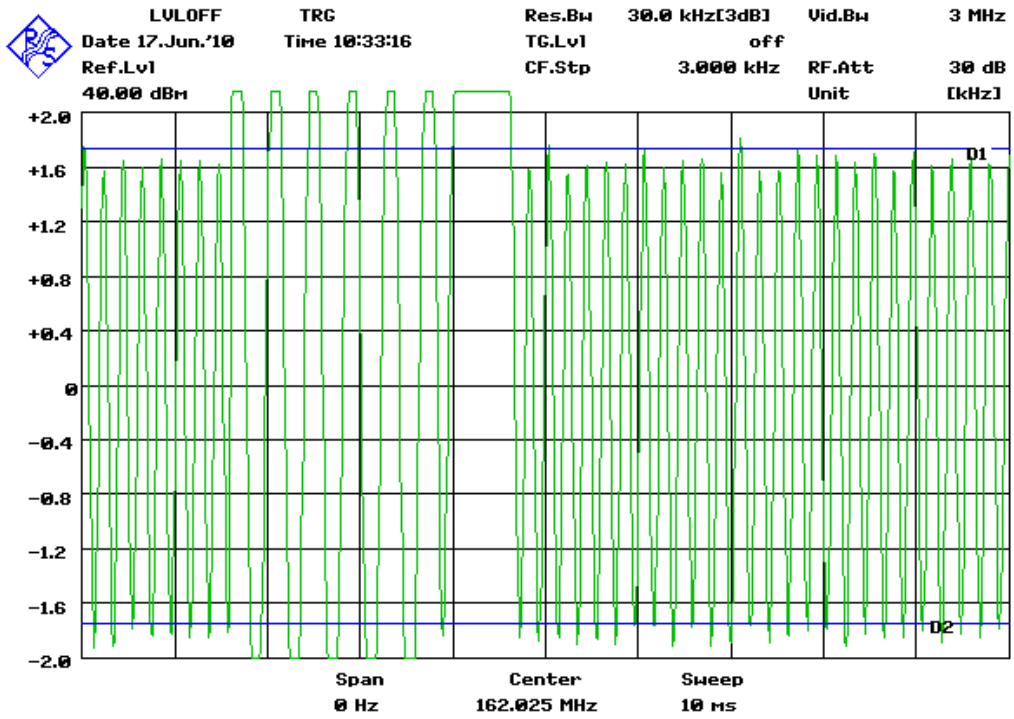
TRG
Res.Bw 30.0 kHz[3dB]
Vid.Bw 3 MHz
Date 17.Jun.'10
Time 10:31:14
TG.Lvl off
Ref.Lvl
CF.Stp 3.000 kHz
RF.Att 30 dB
40.00 dBm
Unit [kHz]
+20
+16
+12
+8
+4
0
-4
-8
-12
-16
-20
D1
D2
Span
0 Hz
Center
162.025 MHz
Sweep
10 ms


LVLOFF
TRG
Res.Bw 30.0 kHz[3dB]
Vid.Bw 3 MHz
Date 17.Jun.'10
Time 10:32:25
TG.Lvl off
Ref.Lvl
CF.Stp 3.000 kHz
RF.Att 30 dB
40.00 dBm
Unit [kHz]
+2.0
+1.6
+1.2
+0.8
+0.4
0
-0.4
-0.8
-1.2
-1.6
-2.0
D1
D2
Span
0 Hz
Center
162.025 MHz
Sweep
10 ms


LVLOFF
TRG
Res.Bw 30.0 kHz[3dB]
Vid.Bw 3 MHz
Date 17.Jun.'10
Time 10:33:16
TG.Lvl off
Ref.Lvl
CF.Stp 3.000 kHz
RF.Att 30 dB
40.00 dBm
Unit [kHz]
+2.0
+1.6
+1.2
+0.8
+0.4
0
-0.4
-0.8
-1.2
-1.6
-2.0
D1
D2
Span
0 Hz
Center
162.025 MHz
Sweep
10 ms

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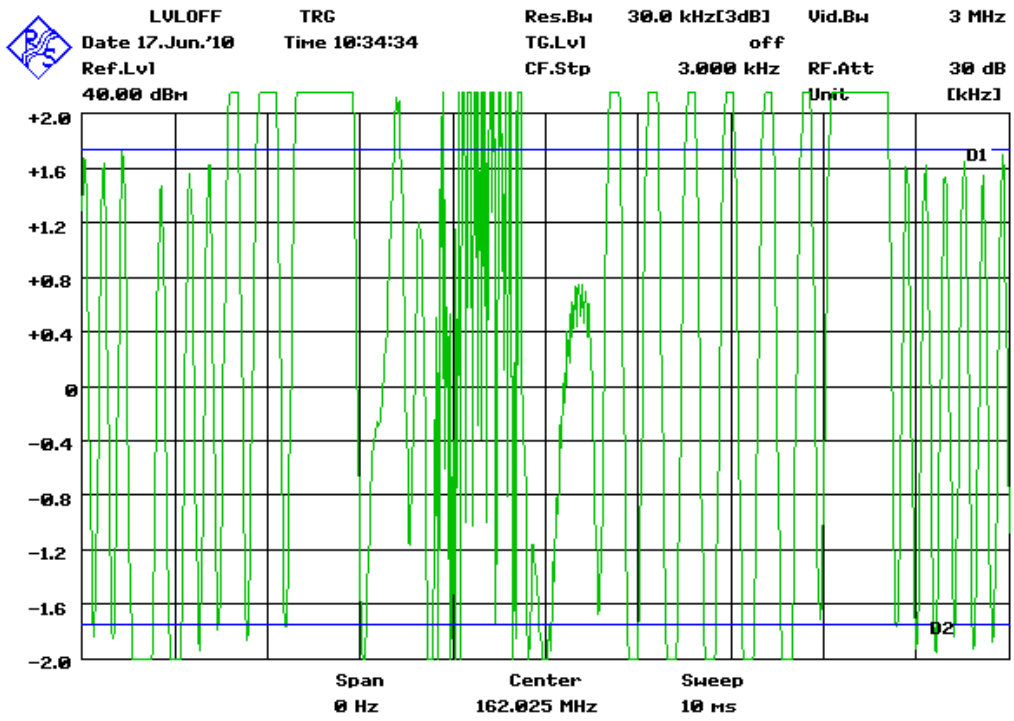

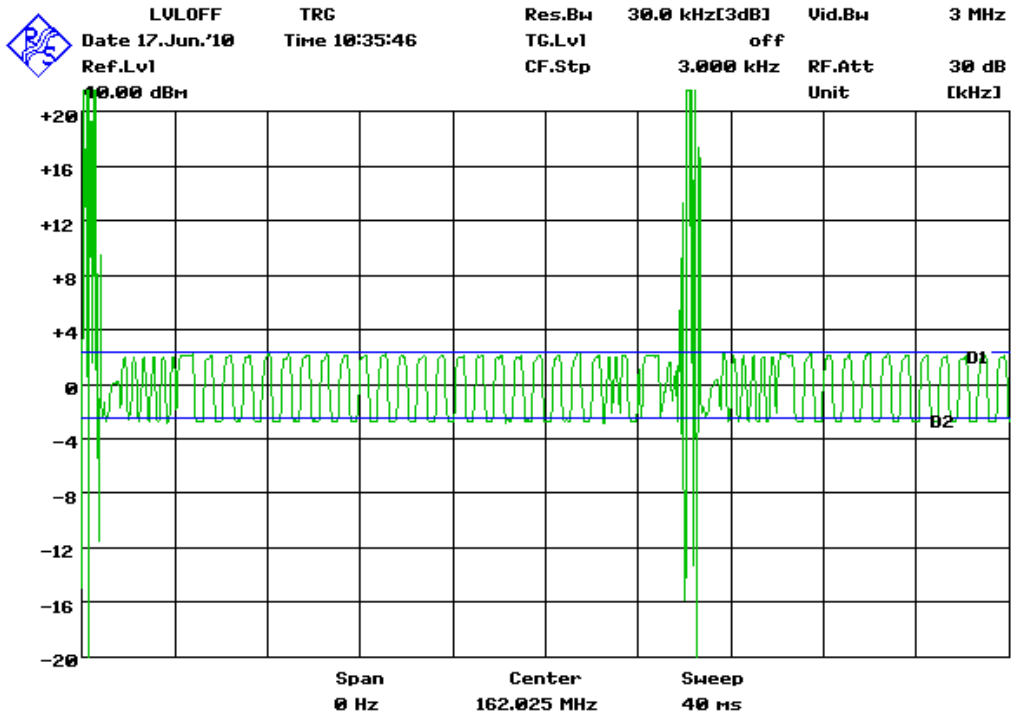

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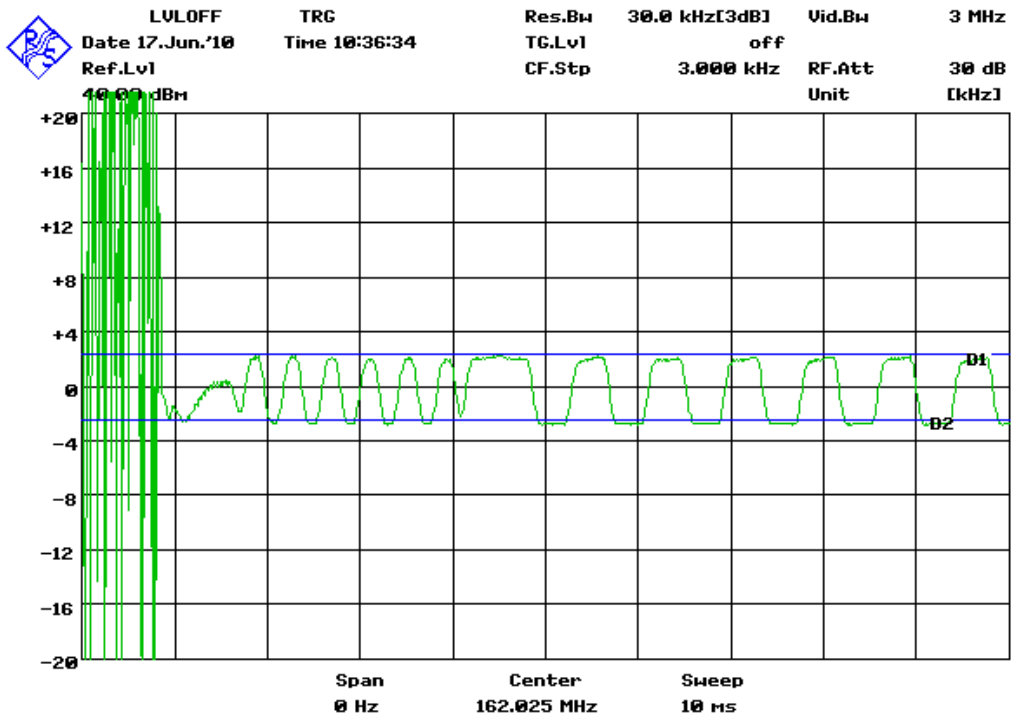


7.7 Transmitter output power versus time function

7.7.1 Test description

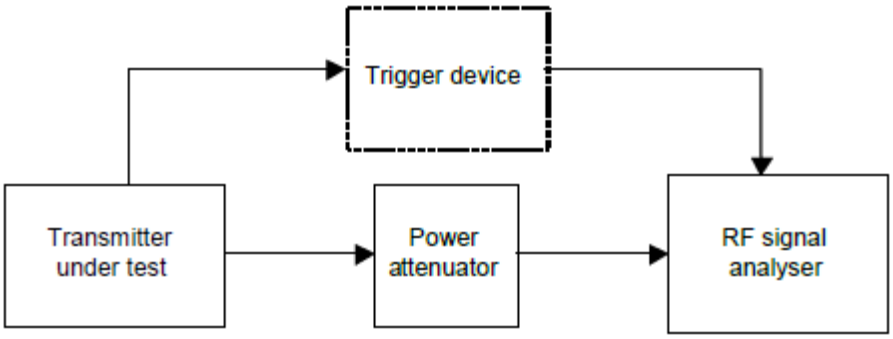
Transmitter output power versus time function is a combination of the transmitter delay, attack time, release time and transmission duration as defined in Table 8 where
a) transmitter delay time ($T_A - T_0$) is the time between the start of the slot and the moment when the transmit power may exceed –50 dB of the steady-state power (P_{SS}),

b) transmitter attack time ($T_{B2} - T_A$) is the time between the transmit power exceeding -50 dBc and the moment when the transmit power maintains a level within +1,5 dB – 1 dB from P_{SS},

c) transmitter release time ($T_F - T_E$) is the time between the end flag being transmitted and the moment when the transmitter output power has reduced to a level 50 dB below P_{SS} and remains below this level thereafter.

d) transmission duration ($T_F - T_A$) is the time from when power exceeds –50 dBc to when the power returns to and stays below –50 dBc.

7.7.2 Method of measurement



The measurement shall be carried out by transmitting test signal number 1 (note that this test signal generates one additional stuffing bit within its CRC portion).
The AIS-SART shall be connected to a spectrum analyser.
A resolution bandwidth of 1 MHz, video bandwidth of 1 MHz and a sample detector shall be used for this measurement.

The analyser shall be in zero-span mode for this measurement. The spectrum analyser shall be synchronised to the nominal start time of the slot (T_0), which may be provided externally, or from the AIS-SART.

7.7.3 Required results

The transmitter power shall remain within the mask shown in Figure 6 and associated timings given in Table 8.

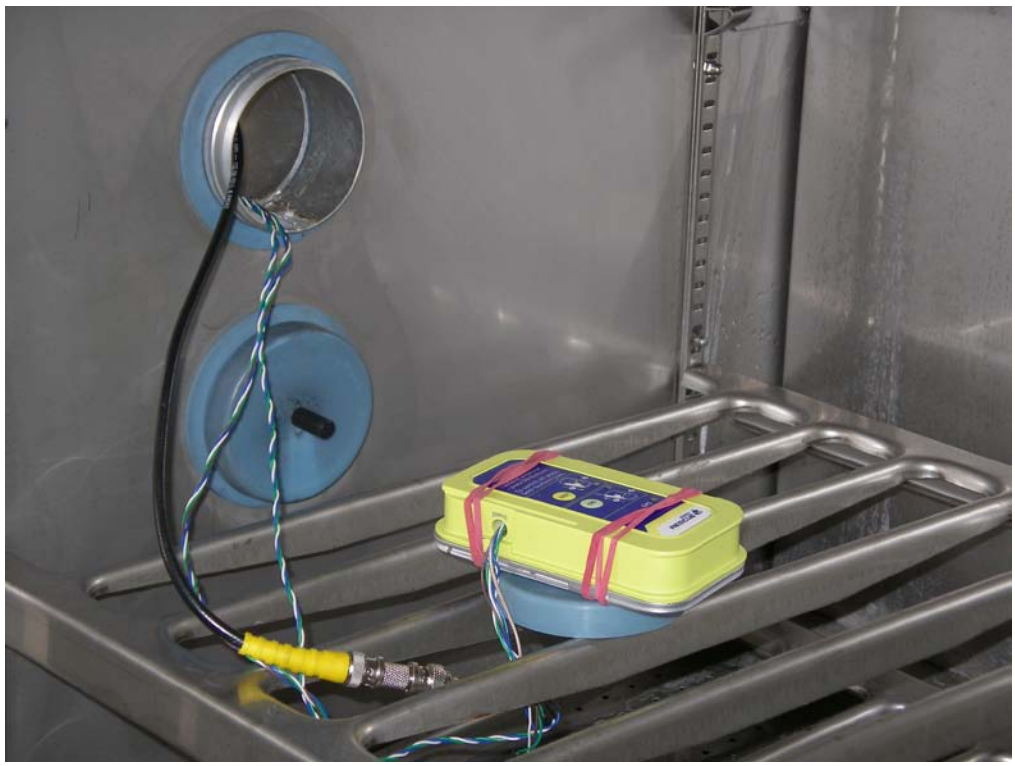
Table 8 – Definition of timings

Reference		Bits	Time (ms)	Definition
T_0		0	0	Start of transmission slot. Power shall NOT exceed –50 dB of P_{SS} before T_0
T_A		0 to 6	0 to 0,625	Power exceeds –50 dB of P_{SS}
T_B	T_{B1}	6	0,625	Power shall be within +1.5 or –3 dB of P_{SS}
	T_{B2}	8	0,833	Power shall be within +1.5 or –1 dB of P_{SS} (start of Training sequence)
T_E (includes 1 stuffing bit)		233	24,271	Power shall remain within +1.5 or –1 dB of P_{SS} during the period T_{B2} to T_E
T_F (includes 1 stuffing bit)		241	25,104	Power shall be –50 dB of P_{SS} and stay below this
T_G		256	26,667	Start of next transmission time period

7.7.4 Test Equipment List

No.	Instrument/Ancillary	Type	Serial Number	Manufacturer	Cal. due
101	EMI test receiver	ESMI	839379/013 839587/006	Rohde & Schwarz	2012-01-06
105	EMI test receiver	ESPI7	836914/0002	Rohde & Schwarz	2011-03-07
108	Radio communication service monitor	CMS 54	838384/030	Rohde & Schwarz	2011-09-30
133	Diode detector negative	8473D	01492	Hewlett Packard	N/A
007	Temperature test chamber	KPK 200	A-2005	Feutron	2011-05-10

7.7.5 Test Setup



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Transmitter output power versus time function

Prüfdatum / *Date of test:*	June 11, 2010
Prüfer / *Operator:*	Johann Roidt
Messplatz / *Test site:*	Non shielded room

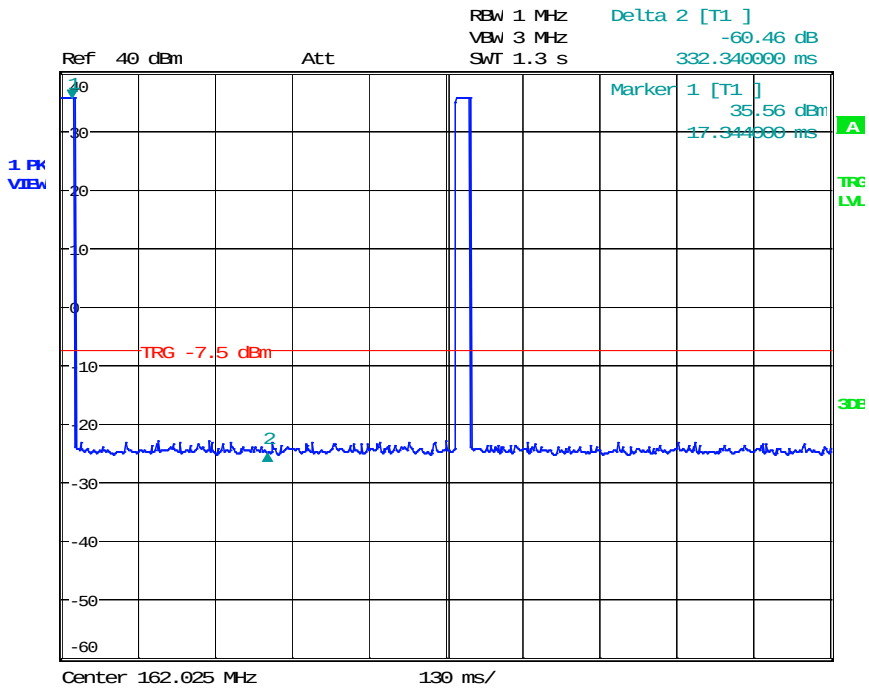
Prüfergebnis / *Test Result*

☒ **Erfüllt / *Passed***

☐ **Nicht erfüllt / *Not passed***

Luftdruck / *Barometric pressure:*	1006 hPa
Relative Luftfeuchtigkeit / *Relative humidity:*	47 %
Temperatur / *Ambient temperature:*	22 °C

Prüfgrundlage / *Specifications:*	IEC 61097-14_FDIS
Betriebsart / *Operation mode:*	The EUT was set into a special test mode, which provides the test signal 1 (IEC 61097-14, 5.6).
Kommentar / *Comment:*	Final evaluation by the German "Bundesamt für Seeschifffahrt und Hydrographie".



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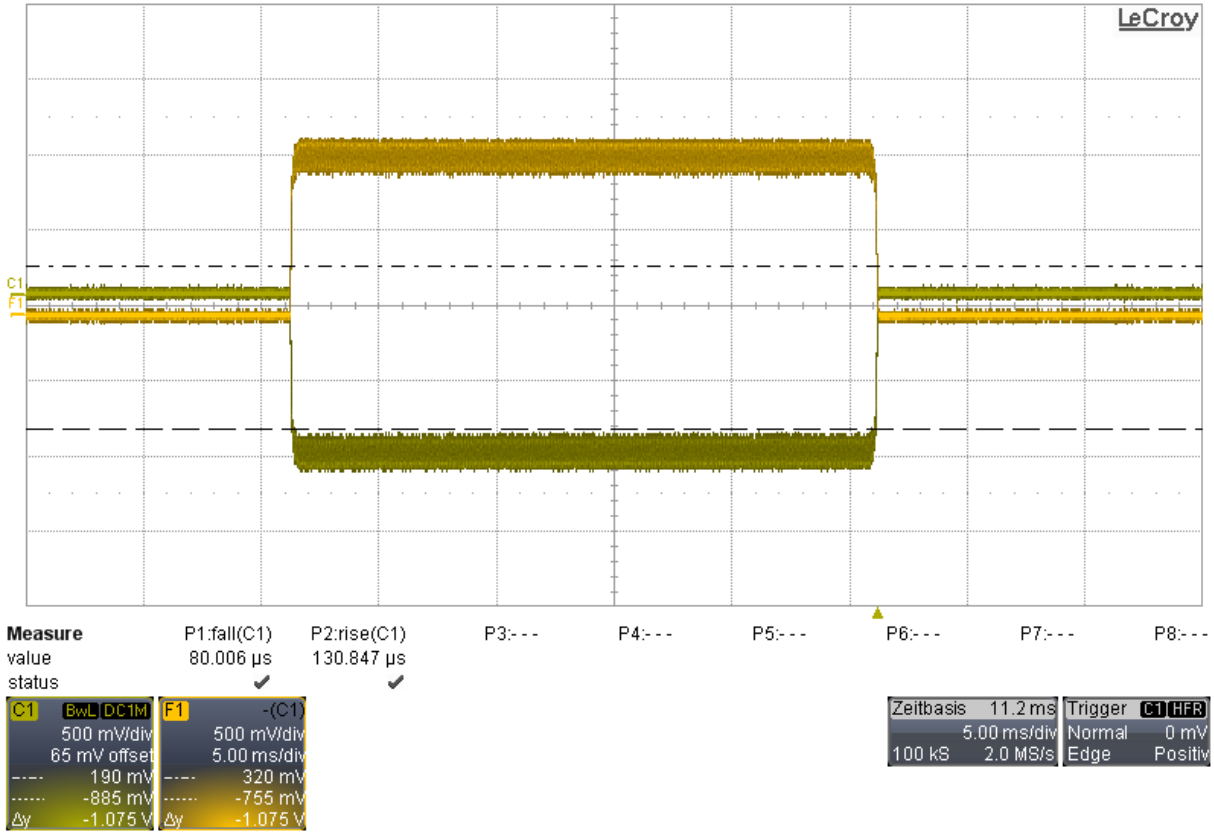
Transmitter output power versus time function at +20 °C



7.8 Spurious emissions from the transmitter

7.8.1 Test description

7.8.2 Method of measurement

The measurements shall be made at the transmitter output at 50 using a receiver or a spectrum analyser with its bandwidth set to between 100 kHz and 120 kHz or its nearest setting thereto, over the following frequency bands:
108 MHz to 137 MHz, 156 MHz to 161,5 MHz, 406,0 MHz to 406,1 MHz and 1 525 MHz to 1 610 MHz.

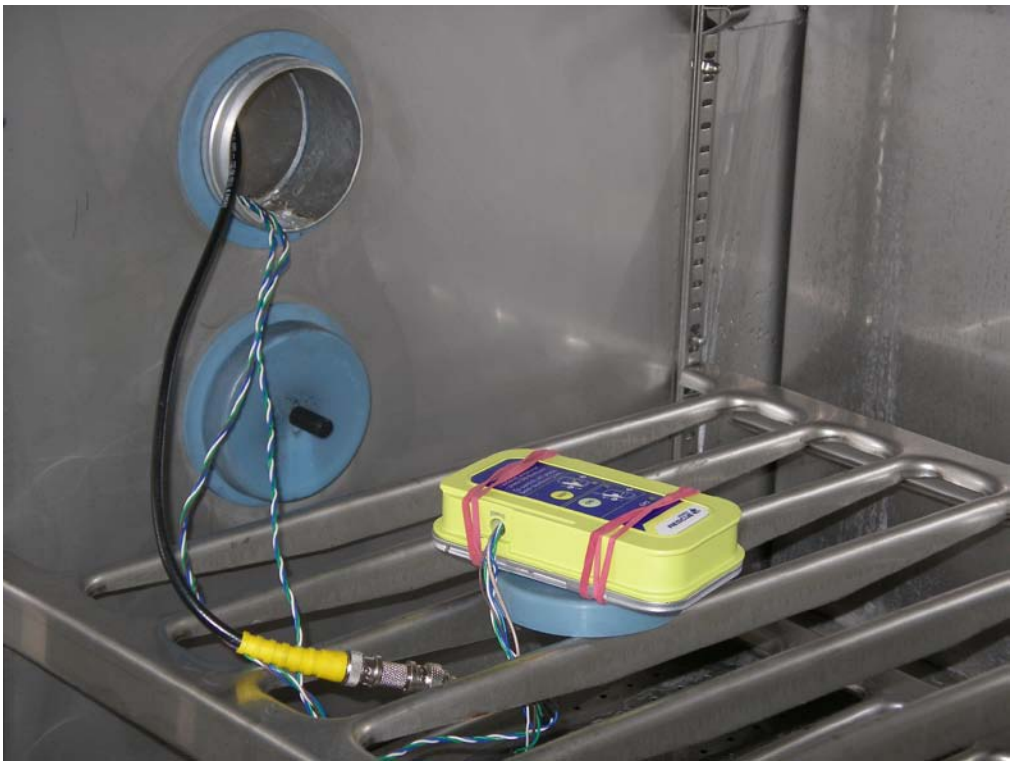
7.8.3 Required results

No signal level within these bands shall exceed 25 µW.

7.8.4 Test Equipment List

No.	Instrument/Ancillary	Type	Serial Number	Manufacturer	Cal. due
101	EMI test receiver	ESMI	839379/013 839587/006	Rohde & Schwarz	2012-01-06
105	EMI test receiver	ESPI7	836914/0002	Rohde & Schwarz	2011-03-07
108	Radio communication service monitor	CMS 54	838384/030	Rohde & Schwarz	2011-09-30
133	Diode detector negative	8473D	01492	Hewlett Packard	N/A
007	Temperature test chamber	KPK 200	A-2005	Feutron	2011-05-10

7.8.5 Test Setup



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Spurious emissions from the transmitter

Prüfdatum / *Date of test:*	June 11, 2010
Prüfer / *Operator:*	Johann Roidt
Messplatz / *Test site:*	Non shielded room

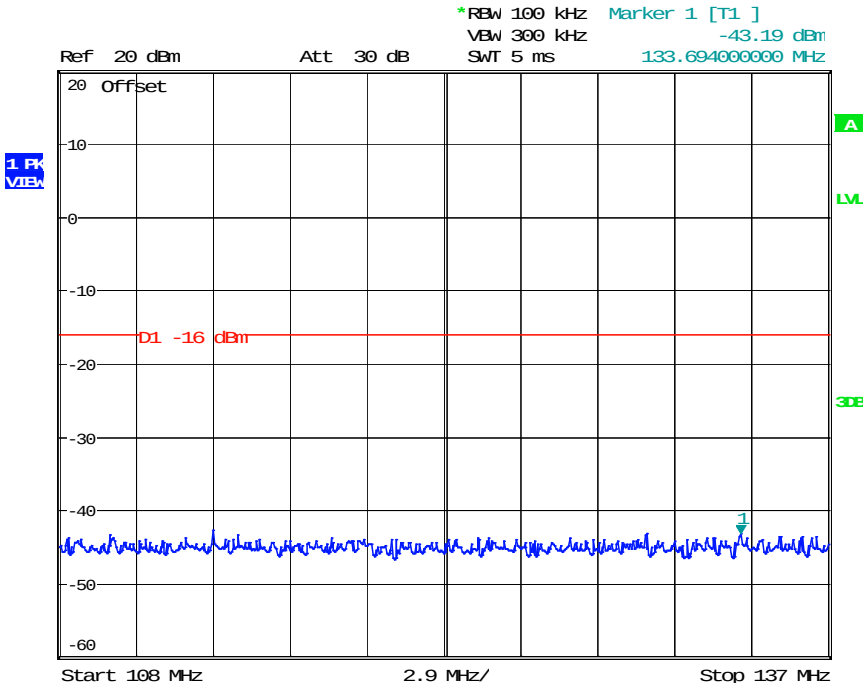
Prüfergebnis / *Test Result*

☒ **Erfüllt / *Passed***

☐ **Nicht erfüllt / *Not passed***

Luftdruck / *Barometric pressure:*	1006 hPa
Relative Luftfeuchtigkeit / *Relative humidity:*	47 %
Temperatur / *Ambient temperature:*	22 °C

Prüfgrundlage / *Specifications:*	IEC 61097-14_FDIS
Betriebsart / *Operation mode:*	The EUT was set into a special test mode, which provides a modulated test signal 3 (IEC 61097-14, 5.6).for a periode of 1 s. After a cooling periode of 2 s the test signal is provided again.
Kommentar / *Comment:*	



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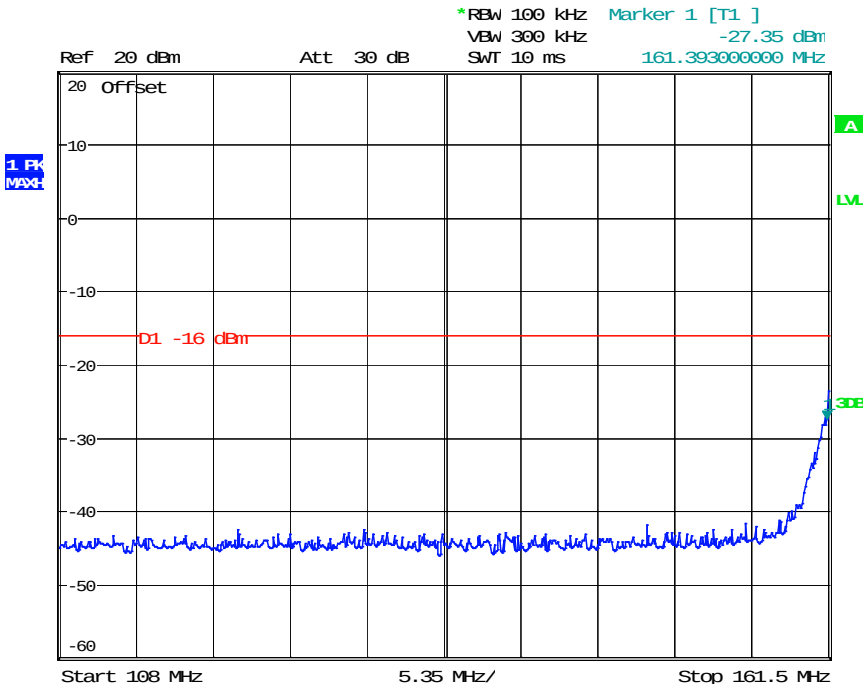

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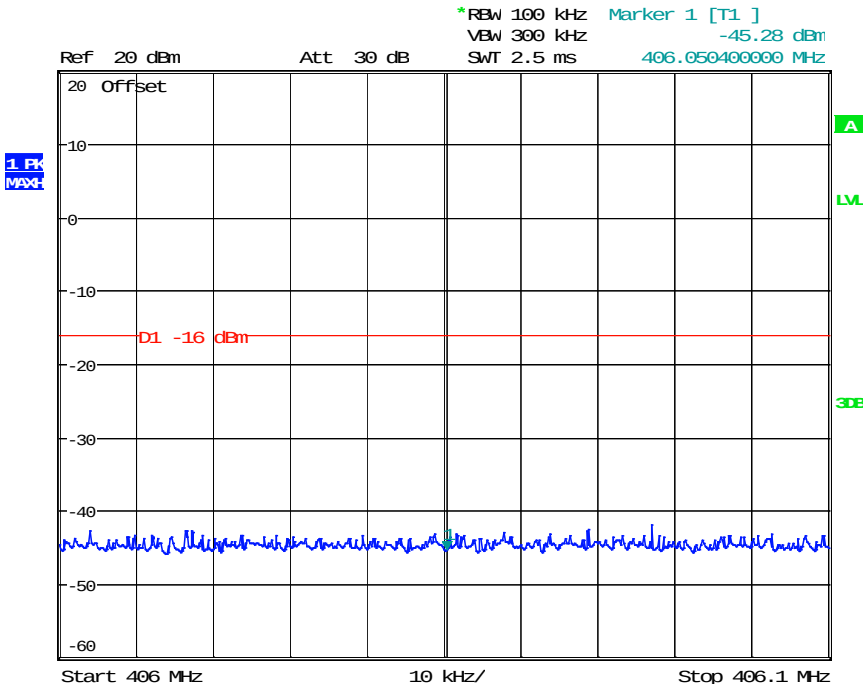

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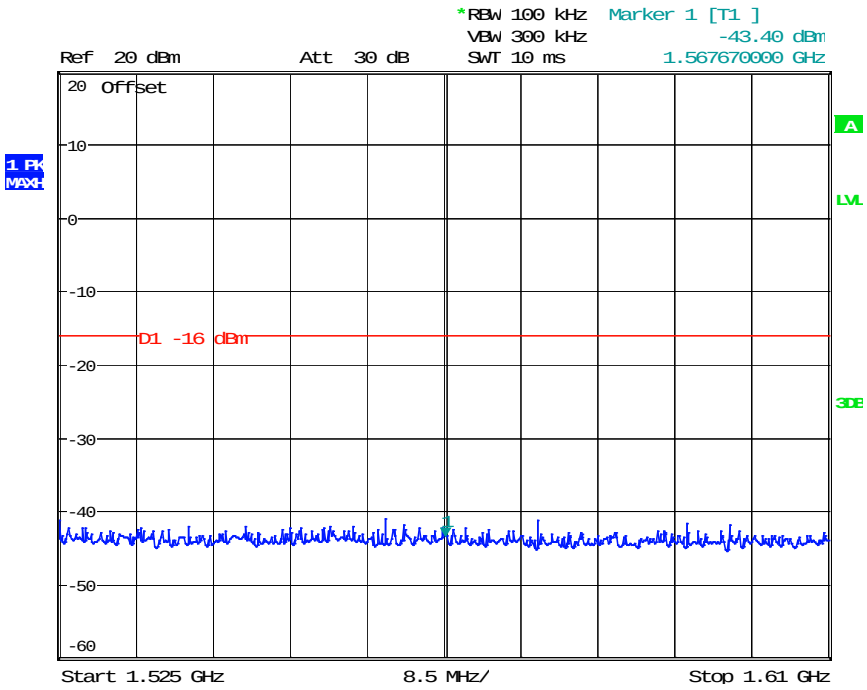

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8 Referenced Regulations

European publication	*International publication*	*Title*
EN 60945:2002	IEC 60945:2002	Maritime navigation and radiocommunication equipment and systems . General requirements . Methods of testing and required test results (IEC 60945:2002); EN 60945:2002
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9 Measurement Uncertainty Values

Radio Interference Emission Testing			
Test	k_p	*Expanded Uncertainty*	*Note*
Conducted Voltage Emission			
9 kHz to 150 kHz (50Ω/50µH V-NetznachbildungAMN)	2	± 3.8 dB	1
150 kHz to 30 MHz (50Ω/50µH V-NetznachbildungAMN)	2	± 3.4 dB	1
100 kHz to 200 MHz (50Ω/5µH NetznachbildungAMN)	2	± 3.6 dB	1
Discontinuous Conducted Emission			
9 kHz to 150 kHz (50Ω/50µH V-NetznachbildungAMN)	2	± 3.8 dB	1
150 kHz to 30 MHz (50Ω/50µH V-NetznachbildungAMN)	2	± 3.4 dB	1
Conducted Current Emission			
9 kHz to 200 MHz	2	± 3.5 dB	1
Magnetic Fieldstrength			
9 kHz to 30 MHz (with loop antenna)	2	± 3.9 dB	1
9 kHz to 30 MHz (large-loop antenna 2 m)	2	± 3.5 dB	1
Radiated Emission			
Test distance 3 m			
30 MHz to 300 MHz	2	± 4.9 dB	1
300 MHz to 1 GHz	2	± 5.0 dB	1
1 GHz to 6 GHz	2	± 4.6 dB	1
Test distance 10 m			
30 MHz to 300 MHz	2	± 4.9 dB	1
300 MHz to 1 GHz	2	± 4.9 dB	1
Radio Interference Power			
30 MHz to 300 MHz	2	± 3.5 dB	1
Harmonic Current Emissions			4
Voltage Changes, Voltage Fluctuations and Flicker			4

Immunity Testing			
Test	k_p	*Expanded Uncertainty*	*Note*
Electrostatic Discharges			4
Radiated RF-Field			
Pre-calibrated field level	2.05	+21.9 / -18.0 %	3
Dynamic feedback field level	2.05	+21.2 / -17.5 %	3
Electrical Fast Transients (EFT) / Bursts			4
Surges			4
Conducted Disturbances, induced by RF-Fields	2	+30.3 / -23.2 %	2
Power Frequency Magnetic Field	2	+20.7 / -17.1 %	2
Pulse Magnetic Field			4
Voltage Dips, Short Interruptions and Voltage Variations			4
Oscillatory Waves			4
Conducted Low Frequency Disturbances			
Voltage setting	2	± 0.9 %	2
Frequency setting	2	± 0.1 %	2
Electrical Transient Transmission in Road Vehicles			4

Note 1:
The expanded uncertainty reported according to CISPR 16-4-2:2003-11 is based on a standard uncertainty multiplied by a coverage factor of kp = 2, providing a level of confidence of p = 95.45%

Note 2:
The expanded uncertainty reported according to UKAS Lab 34 (Edition 1, 2002-08) is based on a standard uncertainty multiplied by a coverage factor of kp = 2, providing a level of confidence of p = 95.45%

Note 3:
The expanded uncertainty reported according to UKAS Lab 34 (Edition 1, 2002-08) is based on a standard uncertainty multiplied by a coverage factor of kp = 2.05, providing a level of confidence of p = 95.45%

Note 4:
It has been demonstrated that the used test equipment meets the specified requirements in the standard with at least a 95% confidence.

10 Revision History

Revision History			
Edition	*Date*	*Issued by*	*Modifications*
1	20.07.2010	J. Roidt	First Edition