

Radio test report

20113071300

based on:
IEC 61993-2 First edition (Clause 15 only)

Automatic Identification System (AIS)
SAAB
R5 solid AIS system

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This report comprises of five modules. The total number of pages is: 47

Main module

1 Introduction

This report contains the result of tests performed by:

Telefication bv
Edisonstraat 12a
6902 PK Zevenaar
The Netherlands

Telefication complies with the accreditation criteria for test laboratories as laid down in ISO/IEC 17025:2005. The accreditation covers the quality system of the laboratory as well as the specific activities as described in the authorized annex bearing the accreditation number L021 and is granted on 30 November 1990 by the Dutch Council For Accreditation (RvA: Raad voor Accreditatie). The contents of this test report, if reproduced, shall be copied in full, unless special consent in writing for reproduction in part is granted by Telefication. Copyright of this test report is reserved to Telefication.

Ordering party:

Company name : Saab TransponderTech AB
Address : Läsblecksgatan 3
Zipcode : 589 41
City/town : Linköping
Country : Sweden
Date of order : 23 June 2011

2 Product

A sample of the following product was submitted for testing:

Product category	:	Automatic Identification System (AIS)
Manufacturer	:	Saab TransponderTech AB
Trade mark	:	SAAB
Type designation	:	R5 solid AIS system
Hardware version	:	--
Software version	:	Rev. 12
Serial number	:	000008

3 Test schedule

The test was carried out at the following location:

- Telefication BV Zevenaar

The tests were carried out between:

- 19 September and 1 December 2011

4 Product documentation

For production of this report no product documentation was used.

5 Observations and comments

Sections 12 and 13 of IEC 61993-2, first edition, are covered in Telefication test report 20113071200.

The device operates on channels 60 (156.025 MHz) and AIS 2 (162.025 MHz).

Use has been made of a software test tool, named “R5 Radio test tool”, provided by the applicant.

For the purpose of AIS receiver tests the device was put in AIS receiver test mode. In this mode Packet Error Rate (PER) statistics is output, which allows one to determine the 20% error rate threshold.

The test signal at the receiver input contains a message 8 data packet in every fifth TDMA slot (standard test signal no. 4 as defined in 10.4 of draft standard IEC 61993-2 edition 2).

The outputted PER statistics basically indicates the number of received messages.

For the purpose of DSC receiver tests the device was put in DSC receiver test mode. In this mode Bit Error Rate (BER) statistics is output, which allows one to determine the 1% error rate threshold.

The test signal at the receiver input is a continuous DSC dot pattern.

The outputted BER statistics basically indicates the number of bits received over a measurement period of 1000 bits.

For the purpose of AIS transmitter tests the device was put in TX test mode.

No external test signals were applied to the EUT i.e. the method in section 15.1.3 a) of IEC 61993-2 edition 1 was used.

The device has no DSC transmit functionality.

The device does not feature 12.5 kHz channel operation.

During the period of testing three consecutive firmware versions were implemented.

Release Version	Reason why
7	See below (‘Modifications to the sample’)
8	DSC receiver sensitivity at low temp. over the limit
9	Co-channel rejection did not fulfil the requirement
12	Final version

6 Modifications to the sample

Initially the sample did not fulfil the requirement for transmitter spurious emissions (clause 15.5.2 of IEC 61993-2 ed. 1).

For details of the hardware modification, see the manufacturer's declaration in section 'Additional information module' in this report.

Initially the sample did not fulfil the requirements for DSC receiver adjacent selectivity and intermodulation response rejection (clauses 15.4.4 and 15.4.6 of IEC 61993-2 ed. 1).

For details of the software modification, see the manufacturer's declaration in section 'Additional information module' in this report.

7 Summary

The product is intended for use in the following application area:

Universal Automatic Identification System (AIS)

The sample was tested according to the following specification:

IEC 61993-2 First edition (Clause 15 only)

8 Conclusions

The sample of the product showed **NO NON-COMPLIANCES** to the specification stated in chapter 7 of this report.

The results of the tests as stated in this report, are exclusively applicable to the product item as identified in this report. Telefication accepts no responsibility for any stated properties of product items in this test report, which are not supported by the tests as specified in section 7 “*Summary*”.

All tests are performed by:

name : ing. P.A. Suringa

function : Senior test engineer

signature :



Review of test methods and report by:

name : G. J. Gort

function : Senior test engineer

signature :



The above conclusions have been verified by the following signatory:

date : 26 January 2012

name : ing. A. van der Valk

function : Manager Laboratory

signature :



Test results module

1 Summary

LIST OF VERIFICATION

The list of measured or checked parameters called for in IEC 61993-2 Clause 15 is given below.

IEC 61993-2 Clause	GENERAL REQUIREMENTS	Remark	Performed verification (yes/no/n.a)
15 Physical Tests			
15.1 TDMA Transmitter			
15.1.1	Frequency Error	Note 1	yes
15.1.2	Carrier Power	Note 1	yes
15.1.3	Modulation Spectrum 25 kHz channel mode		yes
15.1.4	Modulation Spectrum 12.5 kHz channel mode	Note 2	n.a.
15.1.5	Transmitter Attack Time		yes
15.1.6	Transmitter Release Time		yes
15.2 DSC Transmissions			
15.2.1	Frequency error of the DSC Signal		n.a.
15.2.2	Modulation Rate		n.a.
15.3 TDMA Receivers			
15.3.1	Sensitivity - 25 kHz Operation		yes
15.3.2	Sensitivity - 12.5 kHz Operation	Note 2	n.a.
15.3.3	Error Behaviour at High Input Levels		yes
15.3.4	Co-Channel Rejection - 25 kHz Operation		yes
15.3.5	Co-Channel Rejection - 12.5 kHz Operation	Note 2	n.a.
15.3.6	Adjacent Channel selectivity - 25 kHz Operation		yes
15.3.7	Adjacent Channel selectivity - 12.5 kHz Operation	Note 2	n.a.
15.3.8	Spurious Response Rejection		yes
15.3.9	Intermodulation response rejection and blocking		yes
15.3.10	Transmit to receive switching time		yes
15.4 DSC Receiver			
15.4.1	Maximum sensitivity		yes
15.4.2	Error Behaviour at High Input Levels		yes
15.4.3	Co-Channel Rejection		yes
15.4.4	Adjacent Channel selectivity		yes
15.4.5	Spurious Response Rejection		yes
15.4.6	Intermodulation response Rejection		yes
15.4.7	Blocking or Desensitisation		yes
15.5 Conducted Spurious Emissions conveyed to the antenna			
15.5.1	Spurious Emissions from the Receiver		yes
15.5.2	Spurious Emissions from the Transmitter		yes

Note 1: Only applicable for lowest channel and highest channel frequencies.

Note 2: In anticipation of the new standard, this feature is not implemented by the applicant.

2 Test results

2.1 TDMA Transmitter (Clause 15.1)

2.1.1 Frequency Error (Clause 15.1.1)

Ambient temp.: 24 °C

R.H.: 50 %

TEST CONDITIONS		FREQUENCY ERROR (Hz)			
Temperature	Voltage	156.025 MHz	157.4125 MHz	160.6375 MHz	162.025 MHz
<i>T_{nom}</i> (+15 – 35 °C)	<i>V_{nom}</i> (24.0 V)	+4	X	X	+10
<i>T_{min}</i> (-15 °C)	<i>V_{min}</i> (21.6 V)	+33	X	X	+33
<i>T_{max}</i> (+55 °C)	<i>V_{max}</i> (31.2 V)	+11	X	X	+25
Measurement uncertainty		±1Hz			
Limits		≤ ±0.5 kHz under normal conditions, ≤ ±1 kHz under extreme conditions.			

Test equipment used: (Item numbers)	14, 18
-------------------------------------	--------

2.1.2 Carrier Power (Clause 15.1.2)

Ambient temp.: 24 °C

R.H.: 50 %

Rated output carrier power: H.P. : 41 dBm (ref. ITU-R M.1371-3, table 3)
 L.P. : 30 dBm (ref. ITU-R M.1371-3, table 3)

TEST CONDITIONS		CARRIER POWER (dBm)							
		156.025 MHz		157.4125 MHz		160.6375 MHz		162.025 MHz	
Temperature	Voltage	H.P.	L.P.	H.P.	L.P.	H.P.	L.P.	H.P.	L.P.
<i>T_{nom}</i> (+15 – 35 °C)	<i>V_{nom}</i> (24.0 V)	40.6	31					40.8	30.5
<i>T_{min}</i> (-15 °C)	<i>V_{min}</i> (21.6 V)	40.9	31.6					41.1	31.7
<i>T_{max}</i> (+55 °C)	<i>V_{max}</i> (31.2 V)	40.4	28.8					40.4	32.0
Measurement uncertainty		0.2 dB							
Limits		<u>Normal test conditions:</u> - within ± 1.5 dB of the rated carrier power <u>Extreme test conditions:</u> - within +2.0 and -3.0 dB of the rated carrier power							

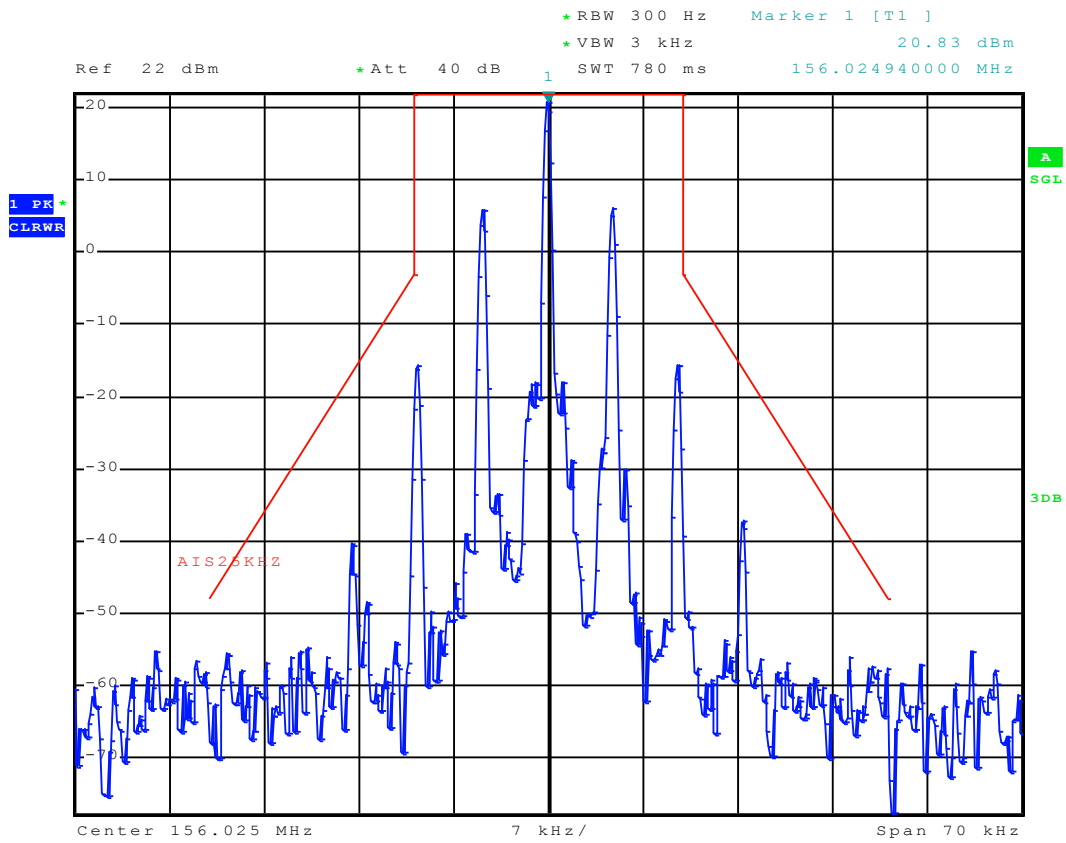
Test equipment used: (Item numbers)	5, 7, 18, 19
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2.1.3 Modulation Spectrum 25 kHz channel mode (Clause 15.1.3)

Ambient temp.: 22 °C R.H.: 51 %

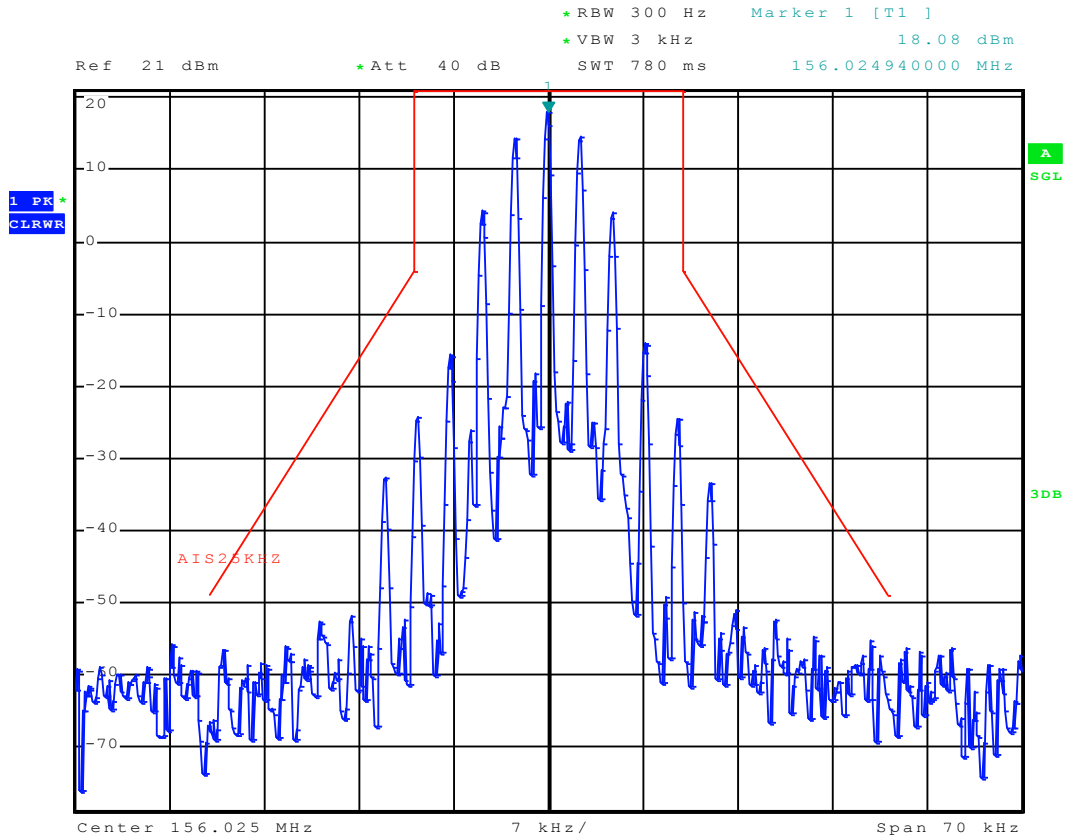
TX freq.: 156.025 MHz Carrier power: H. P.

(1) TDMA Type 1 mode (Standard Test Signal Number 2):



Remark: the plot above is taken with 20 dB external attenuation.

(2) TDMA Type 2 ((Standard Test Signal Number 3):



Remark: the plot above is taken with 20 dB external attenuation.

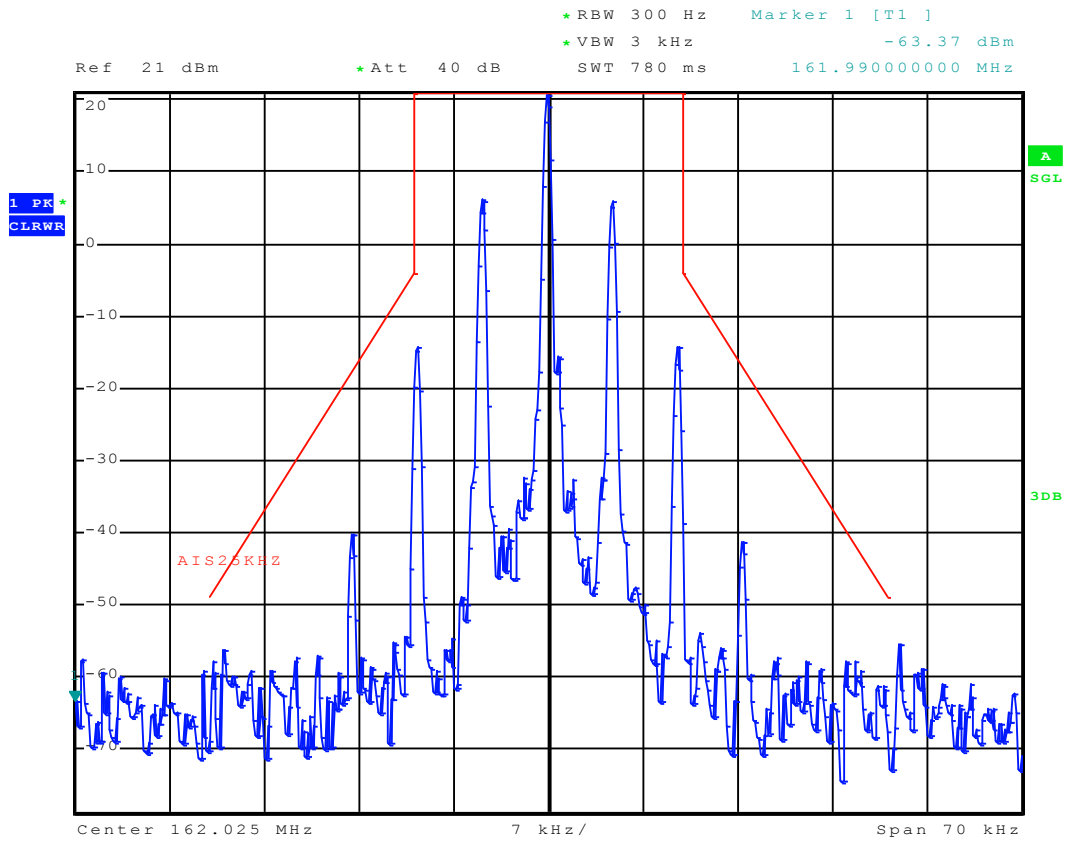
Test equipment used: (Item numbers)	2, 12, 17, 18
-------------------------------------	---------------

Modulation Spectrum 25 kHz channel mode (Clause 15.1.3) (cont'd)

Ambient temp.: 22 °C R.H.: 51 %

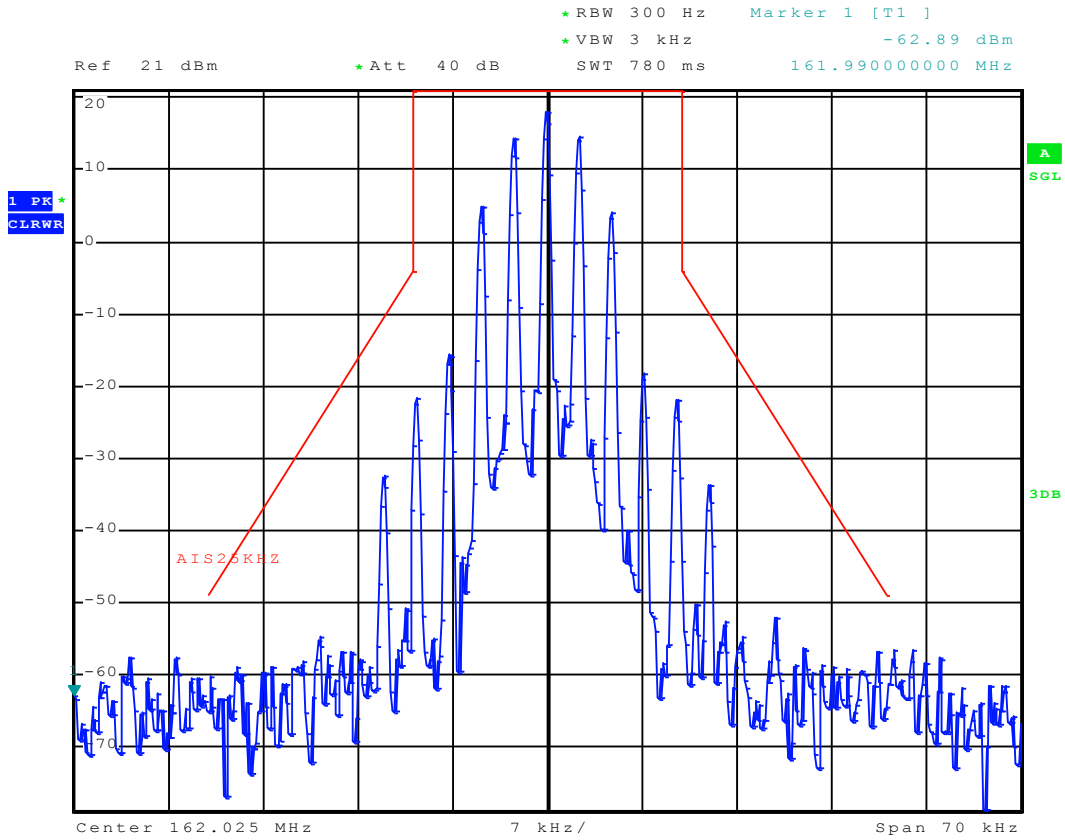
TX freq.: 162.025 MHz Carrier power: H. P.

(1) TDMA Type 1 mode (Standard Test Signal Number 2):



Remark: the plot above is taken with 20 dB external attenuation.

(2) TDMA Type 2 ((Standard Test Signal Number 3):



Remark: the plot above is taken with 20 dB external attenuation.

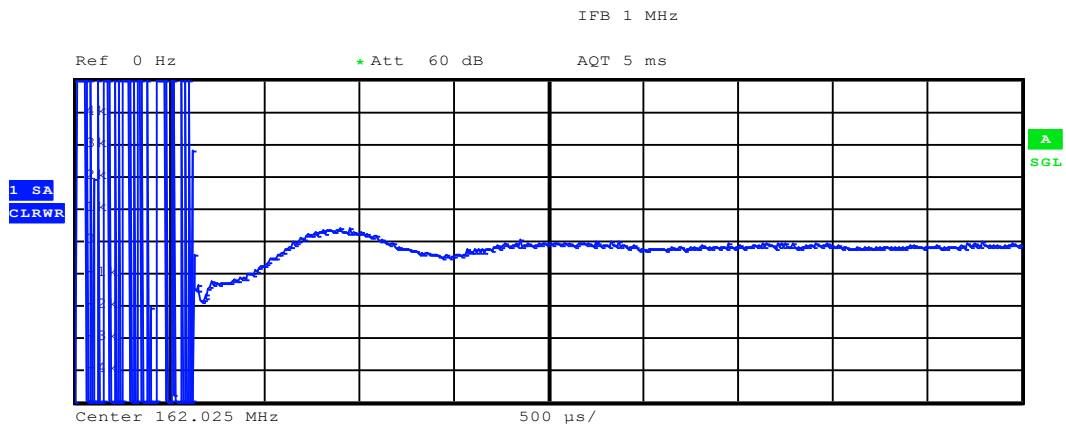
Test equipment used: (Item numbers)	2, 12, 17, 18
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2.1.4 Transmitter Attack Time (Clause 15.1.5)

Ambient temp.: 25 °C R.H.: 52 %

TX freq.: 162.025 MHz
Carrier power: H. P.

PLOT OF FREQUENCY BEHAVIOUR



Frequency Modulation Summary

Coupling	DC	Carrier Offset	-140.70 Hz
Deviation	+peak 66.14 kHz	Carrier Power	19.96 dBm
	-peak -63.98 kHz	Modulation Frequency	--- Hz
	↑peak/2 65.06 kHz	Sampling Rate	125 kHz
	RMS 11.70 kHz	Record Length	626
		Demod Bandwidth	100 kHz

Vertical units: 1kHz/div
Horizontal units: 500 µs/div

Measurement Uncertainty: ± 18 Hz

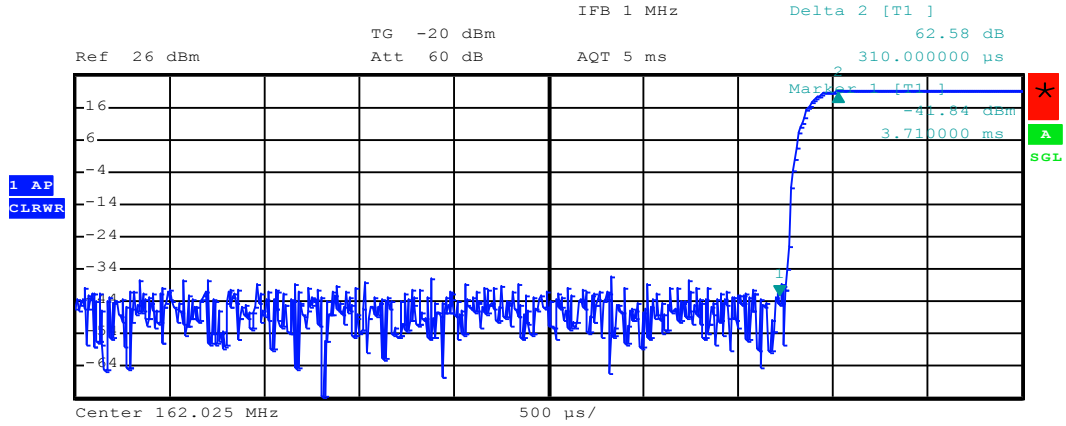
Result from plot above: within 500 Hz after 1 msec.

Limit:

- Carrier frequency Fc: within ± 1 kHz of its required value after 1 ms.

Test equipment used: (Item numbers)	2, 18
-------------------------------------	-------

PLOT OF RF POWER BEHAVIOUR



Amplitude Modulation Summary

Carrier Power	3.96 dBm
Modulation Frequency	--- Hz
Modulation Depth	99.997 %
Sampling Rate	125 kHz
Record Length	626
Demod Bandwidth	100 kHz

Horizontal units: 500 µsec/div

Results from plot above: attack time 310 µsec.
 after 310 µsec power level within 1.5 dB

Measurement Uncertainty: +/- 12 µsec.

Limit:

- Transmitter attack time T_0 : within 1 ms,
- Transient power level: within ± 1.5 dB of its final value at any time,

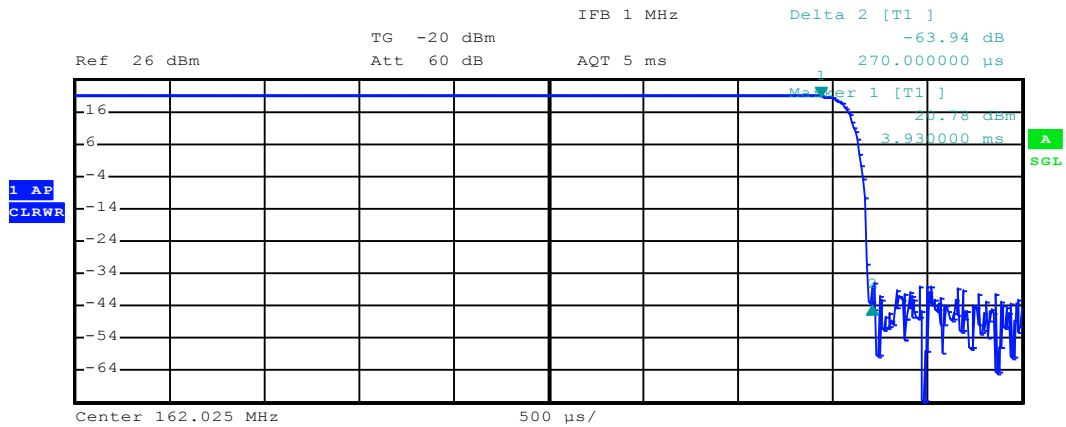
Test equipment used: (Item numbers)	2, 18
-------------------------------------	-------

2.1.5 Transmitter Release Time (Clause 15.1.6)

Ambient temp.: 23 °C R.H.: 50 %

TX freq.: 162.025 MHz
Carrier power: H. P.

PLOT OF RF POWER BEHAVIOUR



Amplitude Modulation Summary

Carrier Power	20.86 dBm
Modulation Frequency	--- Hz
Modulation Depth	99.997 %
Sampling Rate	125 kHz
Record Length	626
Demod Bandwidth	100 kHz

Horizontal units: 500 µsec/div

Result as indicated in plot above: 270 µsec.

Measurement Uncertainty: +/- 12 µsec

Limit:

Transmitter release time T_r : within 1 ms,

Test equipment used: (Item numbers)	2, 18
-------------------------------------	-------

2.2 TDMA Receiver (Clause 15.3)

2.2.1 Sensitivity - 25 kHz Operation (Clause 15.3.1)

Ambient temp.: 22 °C

R.H.: 51 %

TEST CONDITIONS		SENSITIVITY LEVEL	
		Fn: 156.025 MHz	Fn: 162.025 MHz
Temperature	Voltage	RF level (dBm)	RF level (dBm)
<i>T_{nom}</i> (+15 – 35 °C)	<i>V_{nom}</i> (24.0 V)	-112	-114
<i>T_{min}</i> (-15 °C)	<i>V_{min}</i> (21.6 V)	-114	-111
<i>T_{max}</i> (+55 °C)	<i>V_{max}</i> (31.2 V)	-112	-107
Measurement uncertainty		±1.0 dB	
Limits		≤ - 107 dBm with a PER of 20% under normal test conditions, ≤ - 101 dBm with a PER of 20% under extreme test conditions,	

Test equipment used: (Item numbers)	9, 12, 17
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2.2.2 Error Behaviour at High Input Levels (15.3.3)

Ambient temp.: 23 °C

R.H.: 50 %

TEST CONDITIONS		Packet Error Rate (%)	
		Fn = 156.025 MHz (CH 60)	
Standard Test Signal		standard test signal no. 4 as defined in 10.4 of draft standard IEC 61993-2 edition 2	
Input signal (dBm)		-77	-7
Temperature	Voltage	0	0
<i>Tnom</i> (+15 – 35 °C)	<i>Vnom</i> (24.0 V)		
Measurement uncertainty		±1.0 dB	
Limits		Difference < 1%	

Test equipment used: (Item numbers)	9, 12
-------------------------------------	-------

2.2.3 Co-channel rejection - 25 kHz Operation (Clause 15.3.4)

Ambient temp. 21 °C

R.H.: 41 %

TEST CONDITIONS		CO-CHANNEL REJECTION RATIO (dB)	
Temperature	Voltage	Fn = 162.025 MHz	
<i>T_{nom}</i> (+15 – 35 °C)	<i>V_{nom}</i> (24.0 V)	Fn +3 kHz	-8.0
		Fn	-9.0
		Fn –3 kHz	-8.0
Measurement uncertainty		+1.57/-1.71 dB	
Limits		Between -10.0 dB and 0 dB.	

Remark: Unwanted signal modulated with 400 Hz/ 3kHz deviation

TEST CONDITIONS		CO-CHANNEL REJECTION RATIO (dB)	
Temperature	Voltage	Fn = 162.025 MHz	
<i>T_{nom}</i> (+15 – 35 °C)	<i>V_{nom}</i> (24.0 V)	Fn +3 kHz	-9.0
		Fn	-6.0
		Fn –3 kHz	-10.0
Measurement uncertainty		+1.57/-1.71 dB	
Limits		Between -10.0 dB and 0 dB.	

Remark: Unwanted signal modulated with GMSK test signal #2, 2.4 kHz deviation, BT 0.4

Test equipment used: (Item numbers)	8, 9, 11, 12
-------------------------------------	--------------

2.2.4 Adjacent Channel selectivity - 25 kHz Operation (Clause 15.3.6)

Ambient temp.: 24 °C

R.H.: 53 %

TEST CONDITIONS		ADJACENT CHANNEL SELECTIVITY (dB)	
		Fn: 162.025 (MHz)	
Temp.	Voltage	Unwanted signal – 25 kHz	Unwanted signal + 25 kHz
<i>T_{nom}</i> (+15 – 35 °C)	<i>V_{nom}</i> (24.0V)	70	70
<i>T_{min}</i> (-15 °C)	<i>V_{min}</i> (21.6 V)	70	70
<i>T_{max}</i> (+55 °C)	<i>V_{max}</i> (31.2 V)	69.5	69.5
Measurement uncertainty		+1.57/-1.71 dB	
Limits		≥ 70.0 dB @ ≤20% PER under normal test conditions, ≥ 60.0 dB @ ≤20% PER under extreme test conditions.	

Test equipment used: (Item numbers)	8, 9, 11, 12, 17
-------------------------------------	------------------

2.2.5 Spurious Response Rejection (Clause 15.3.8)

Ambient temp.: 23 °C

R.H.: 51 %

Tested frequency: 162.025 MHz

Funw (MHz)	SPURIOUS RESPONSE REJECTION RATIO (dB)
99.975	70
230.975	70
293.025	> 80
361.975	> 90
424.025	> 80
492.975	> 75
555.025	> 75
623.975	80
686.025	> 80
754.975	> 80
817.025	> 80
885.975	> 80
948.025	> 80
1016.975	> 80
1079.025	> 80
*	--
Measurement uncertainty	+ 1.63/-1.79 dB
Limit	The rejection ratio shall not be less than 70 dB

Funw = unwanted frequency

*: Rejection on all other spurious responses: >80 dB.

- (1) Frequency of the Receiver (f_R): 162.025 MHz
- (2) Frequency of the local oscillator signal applied to the 1st mixer of the Receiver (f_{LO}): 131 MHz
- (3) Intermediate frequencies (f_{I1}, f_{I2}, f_{I3}): $f_{I1} = 31.025$ MHz
- (4) Switching range of the Receiver (sr): 156.025 to 162.025 MHz

Test equipment used: (Item numbers)	8, 9, 11, 12, 17
-------------------------------------	------------------

2.2.6 Intermodulation response rejection and blocking (Clause 15.3.9)

Ambient temp.: 22 °C

R.H.: 51 %

TEST CONDITIONS		PACKET ERROR RATE (%)	
		Fn = 156.025 MHz	Fn = 162.025 MHz
Temperature	Voltage	Test #1	Test #2
<i>T_{nom}</i> (+15 – 35 °C)	<i>V_{nom}</i> (24.0 V)	10	20
Measurement uncertainty		+1.20/-1.25dB (intermod. resp. rej.); +1.57/-1.71 dB (blocking)	
Limits		≤ 20% PER	

TEST CONFIGURATION				
	Generator A wanted –101 dBm	Generator B unwanted –27 dBm unmodulated	Generator C unwanted –27 dBm Mod. 400Hz / 3 kHz	Generator D unwanted –15 dBm unmodulated
Test #1	156.025MHz (Fn)	Fn + 500 kHz	Fn + 1000 kHz	Fn + 5.725
Test #2	162.025MHz (Fn)	Fn - 500 kHz	Fn - 1000 kHz	Fn - 5.725

Test equipment used: (Item numbers)	8, 9, 10, 11, 12, 17, 21
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2.2.7 Transmit to receive switching time (Clause 15.3.10)

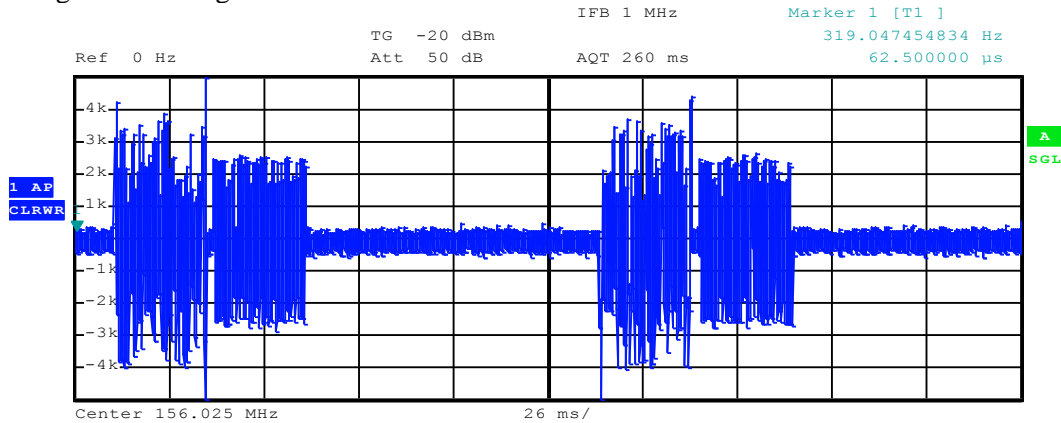
Ambient temp.: 23 °C

R.H.: 50 %

TEST CONDITIONS		PACKET ERROR RATE (%)
Temperature	Voltage	Fn = 156.025 MHz
<i>T_{nom}</i> (+15 – 35 °C)	<i>V_{nom}</i> (24.0 V)	10
Limits		≤ 20% PER

Remark: The wanted signal level was -107 dBm

The plot below shows the first (26 msec) slot, being the transmission slot and the second (26 msec) slot being the receiving slot.



Frequency Modulation Summary

Coupling	DC	Carrier Offset	-85.385 Hz
Deviation	+peak	Carrier Power	-5.14 dBm
	-peak	Modulation Frequency	--- Hz
	↑peak/2	Sampling Rate	125 kHz
	RMS	Record Length	32501
		Demod Bandwidth	100 kHz

Test equipment used: (Item numbers)	2, 9, 11, 18, 21
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2.3 DSC Receiver (Clause 15.4)

2.3.1 Maximum sensitivity (Clause 15.4.1)

Ambient temp.: 22 °C

R.H.: 51 %

TEST CONDITIONS		SENSITIVITY LEVEL (dBm)		
		Fn: 156.525 MHz (CH 70)		
Temperature	Voltage	Fn	Fn - 1.5 kHz	Fn + 1.5 kHz
<i>T_{nom}</i> (+15 – 35 °C)	<i>V_{nom}</i> (24.0 V)	-118.5	-117	-117
<i>T_{min}</i> (-15 °C)	<i>V_{min}</i> (21.6 V)	-119	-118	-118
<i>T_{max}</i> (+55 °C)	<i>V_{max}</i> (31.2 V)	-119	-116	-117
Measurement uncertainty		±1.0 dB		
Limits		≤ - 107 dBm with a BER of 1% under normal test conditions, ≤ - 101 dBm with a BER of 1% under extreme test conditions,		

Test equipment used: (Item numbers)	9, 20
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2.3.2 Error Behaviour at High Input Levels (Clause 15.4.2)

Ambient temp.: 24 °C

R.H.: 50 %

CHANNEL 70: Fn: 156.525 MHz

TEST CONDITIONS		BIT ERROR RATE (%)
Temperature	Voltage	RF input -7 dBm / Standard Test Signal #1
<i>T_{nom}</i> (+15 – 35 °C)	<i>V_{nom}</i> (24.0 V)	0
Measurement uncertainty		±1.2 dB
Limits		BER <1%

Test equipment used: (Item numbers)	9, 20
-------------------------------------	-------

2.3.3 Co-Channel Rejection (Clause 15.4.3)

Ambient temp.: 24 °C

R.H.: 50 %

CHANNEL 70: Fn: 156.525 MHz

TEST CONDITIONS		CO-CHANNEL REJECTION RATIO (dB)	
		Standard Test Signal #1/ -104 dBm	
		Unwanted signal (Fn: 156.525 MHz)	
Temperature	Voltage	Unwanted signal	
<i>T_{nom}</i> (+15 – 35 °C)	<i>V_{nom}</i> (24.0 V)	Fn + 3 kHz	- 8
		Fn	- 8
		Fn - 3 kHz	- 8
Measurement uncertainty		+1.57/-1.71 dB	
Limits		Between -10.0 dB and 0 dB @ BER < 1%	

Test equipment used: (Item numbers)	8, 9, 11
-------------------------------------	----------

2.3.4 Adjacent Channel selectivity (Clause 15.4.4)

Ambient temp.: 23 °C

R.H.: 57 %

TEST CONDITIONS		ADJACENT CHANNEL SELECTIVITY (dB)	
		Fn = 156.525 MHz (CH70)	
Temp.	Voltage	Funw =Fn - 25 kHz	Funw =Fn + 25 kHz
<i>Tnom</i> (+15 – 35 °C)	<i>Vnom</i> (24.0V)	70	70
<i>Tmin</i> (-15 °C)	<i>Vmin</i> (21.6 V)	61	61
<i>Tmax</i> (+55 °C)	<i>Vmax</i> (31.2 V)	63	63
Measurement uncertainty		+1.57/-1.71 dB	
Limits		≥ 70.0 dB @ BER <1% under normal test conditions, ≥ 60.0 dB @ BER <1% under extreme test conditions.	

Funw = unwanted frequency modulated with 400 Hz/ 3 kHz deviation

Test equipment used: (Item numbers)	8, 9, 11
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2.3.5 Spurious Response Rejection (Clause 15.4.5)

Ambient temp.: 24 °C

R.H.: 50 %

CHANNEL 70: Fn: 156.525 MHz

Funw (MHz)	SPURIOUS RESPONSE REJECTION RATIO (dB)
105.475	90
236.475	> 90
287.525	> 90
367.475	80
418.525	> 90
498.275	> 80
549.525	> 90
629.475	> 80
680.525	> 80
760.475	> 80
811.525	> 90
891.475	> 80
942.525	> 90
1022.475	> 80
*	
Measurement uncertainty	+ 1.63/-1.79 dB
Limit	≥ 70 dB @ BER < 1%

Funw = unwanted frequency

*: Rejection on all other spurious responses is > 80 dB.

- (1) Frequency of the Receiver (f_R): 156.525 MHz
- (2) Frequency of the local oscillator signal applied to the 1st mixer of the Receiver (f_{LO}): 131 MHz
- (3) Intermediate frequencies (f_{I1}, f_{I2}, f_{I3}): $f_{I1} = 25.525$ MHz
- (4) Switching range of the Receiver (sr): 156.025 to 162.025 MHz

Test equipment used: (Item numbers)	8, 9
-------------------------------------	------

2.3.6 Intermodulation response Rejection (Clause 15.4.6)

Ambient temp.: 23 °C

R.H.: 57 %

CHANNEL 70: Fn: 156.525 MHz

TEST CONDITIONS		Intermodulation response rejection ratio (dB)	
Temperature	Voltage	Test #1	Test #2
<i>T_{nom}</i> (+20 °C)	<i>V_{nom}</i> (24.0 V)	66.5	67.4
Measurement uncertainty		+1.20/-1.25dB	
Limits		≥ 65.0 dB at BER < 1%	

Remark: test configuration

	Generator A wanted -104 dBm	Generator B unwanted -39 dBm unmodulated	Generator C unwanted -39 dBm Mod. 400Hz / 3 kHz
Test #1	156.525MHz (Fn)	Fn + 50 kHz	Fn + 100 kHz
Test #2	156.525MHz (Fn)	Fn - 50 kHz	Fn - 100 kHz

Test equipment used: (Item numbers)	2, 8, 9, 10, 11, 20
-------------------------------------	---------------------

2.3.7 Blocking or Desensitisation (Clause 15.4.7)

Ambient temp.: 23 °C

R.H.: 57 %

CHANNEL 70: Fn: 156.525 MHz

Unwanted frequency (MHz)	BLOCKING RATIO (dB) @ BER = 1%
Fn -10	86.5
Fn - 9	86.5
Fn - 8	86.5
Fn - 7	86.5
Fn - 6	86.5
Fn - 5	85.5
Fn - 4	85.5
Fn - 3	85.5
Fn - 2	85.5
Fn - 1	84.8
Fn + 1	84.8
Fn + 2	85.5
Fn + 3	85.5
Fn + 4	84.0
Fn + 5	84.0
Fn + 6	84.0
Fn + 7	84.0
Fn + 8	84.5
Fn + 9	84.5
Fn + 10	84.5
Measurement uncertainty	+1.57/-1.71 dB
Limit	≥ 84 dB @ BER < 1% except at spurious response frequencies

Test equipment used: (Item numbers)	8, 9, 11, 20
-------------------------------------	--------------

2.4 Conducted Spurious Emissions conveyed to the antenna (Clause 15.5)

2.4.1 Spurious Emissions from the Receiver (Clause 15.5.1)

Ambient temp.: 23 °C

R.H.: 50 %

TDMA Receiver

$F_n = 162.025$ MHz

SPURIOUS EMISSIONS POWER LEVEL	
Spurious frequency (MHz)	Power level (dBm)
129.3765	-60.3
All other	See plot
Measurement uncertainty	+1.65/-2.03 dB
Limit (150 kHz - 2 GHz)	≤ -57 dBm (2 nW) for 150 kHz - 1 GHz, ≤ -47 dBm (20 nW) for 1 GHz - 2 GHz.

Test equipment used: (Item numbers)	2
-------------------------------------	---

2.4.2 Spurious Emissions from the Transmitter (Clause 15.5.2)

Ambient temp.: 22 °C

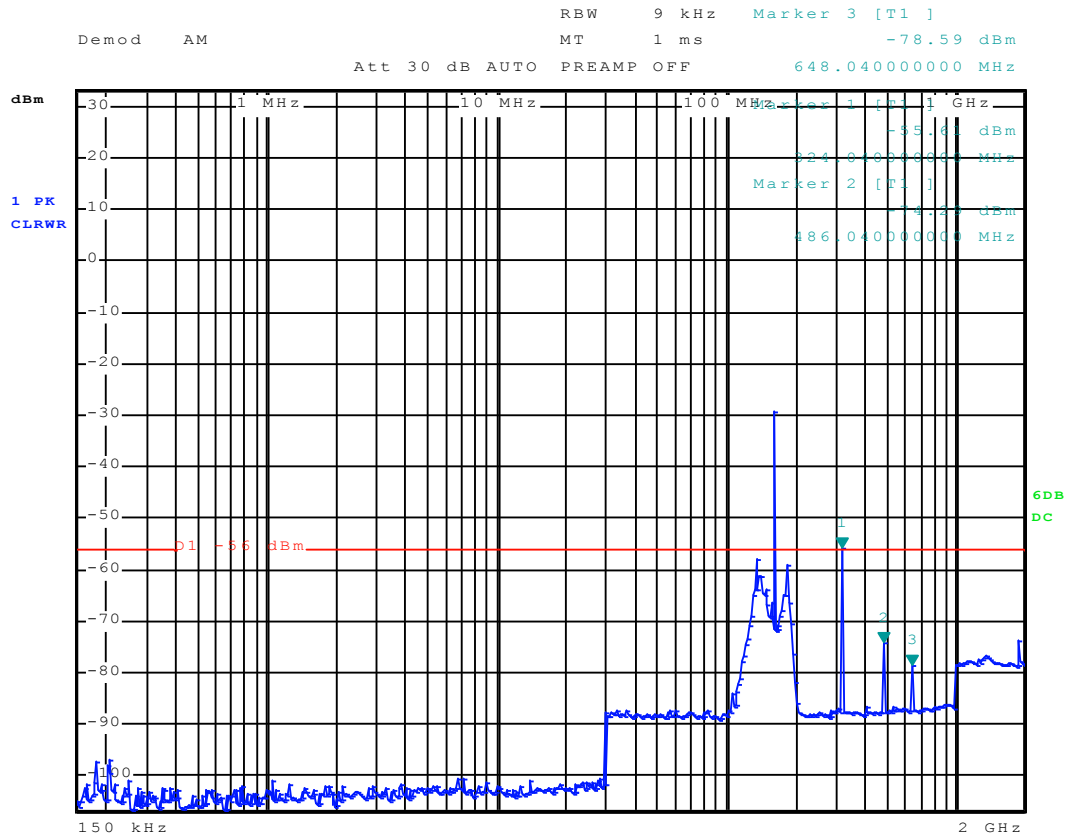
R.H.: 41 %

$F_n = 162.025$ MHz

SPURIOUS EMISSIONS POWER LEVEL	
Spurious frequency (MHz)	Power level (dBm)
324.05	-36
486.08	-54.3
648.10	-58.6
all other	see plot
Measurement uncertainty	+1.38/-1.61 dB
Limit (150 kHz - 2 GHz)	≤ -36 dBm (0.25 μ W) for 150 kHz - 1 GHz, ≤ -30 dBm (1 μ W) for 1 GHz - 2 GHz.

Remark: Test was carried out on high power.

Spectrum Plot 0.00015 – 2 GHz (TX transmitting at 162.025 MHz)



Test equipment used: (Item numbers)	1, 15, 18
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Used test equipment module

Item	Description	Manufacturer	Model	Reference
1	EMI test receiver	R & S	ESCI	TE 11128
2	Spectrum analyser	R & S	FSP40	TE 11125
3	Power supply	Delta	SM6020	TE 00849
4	Power sensor	HP	8481A	TE 00355
5	Power meter	R & S	NRVS	TE 00414
6	Environmental chamber	CTS	C-40/350	TE 00741
7	RF probe	R & S	URV5-Z2	TE 00009
8	Signal generator	Marconi	2042	TE 00030
9	Signal generator	Marconi	2042	TE 00413
10	Signal generator	HP	8657B	TE 00335
11	Combiner	R & S	DVU-4	TE 00241
12	Programmable modulation generator	Sine Qua Non	PMG1	TE 01056
13	DMM	Fluke	87	TE 00210
14	Frequency counter	HP	5350B	TE 00252
15	Tuneable Notch filter	Telonic	TTR190-3EE	TE 00557
16	GPS Time base receiver	HP	58503A	TE 00222
17	Power supply	Delta	E060-06	TE 00597
18	Attenuator 20 dB/100W	Tenuline	8343-200	TE 00127
19	RF termination	Tenuline	8080	TE00126
20	V4 marine comm. syst.	ICS electronics	PLT 002249	TE 01167
21	Isolator	Pamtech	VDT1030-50A	TE 00537
22	Signal generator	HP	8642B	TE 00424

Photographs module

List of Photographs

Photograph 1: <i>Front view</i>	39
Photograph 2: <i>Rear view</i>	40

Photograph 1: *Front view*



Photograph 2: *Rear view*



Revision history

REVISION	DATE	REMARKS	BY
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Additional information module

This module contains 5 pages of information provided by the applicant.



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Saab TransponderTech AB

**R5 TECHNICAL CONSTRUCTION FILE
(TCF) for R5 Solid AIS System**

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Christin Andersson

2011-10-19

.....
Signatures/Names

.....
Date

Saab Transpondertech AB

.....
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A 2011-10-19**Saab TransponderTech AB****1 Objective**

This technical construction file (TCF) is a description of the main changes that are done after the testing during time period 19/9-14/10 at Telefication. The R5 Solid AIS System has been tested by Telefication and the tests that have been done so far are listed in section 3.

2 Technical documentation**2.1 Description of the modifications of R5 Solid****2.1.1 Hardware**

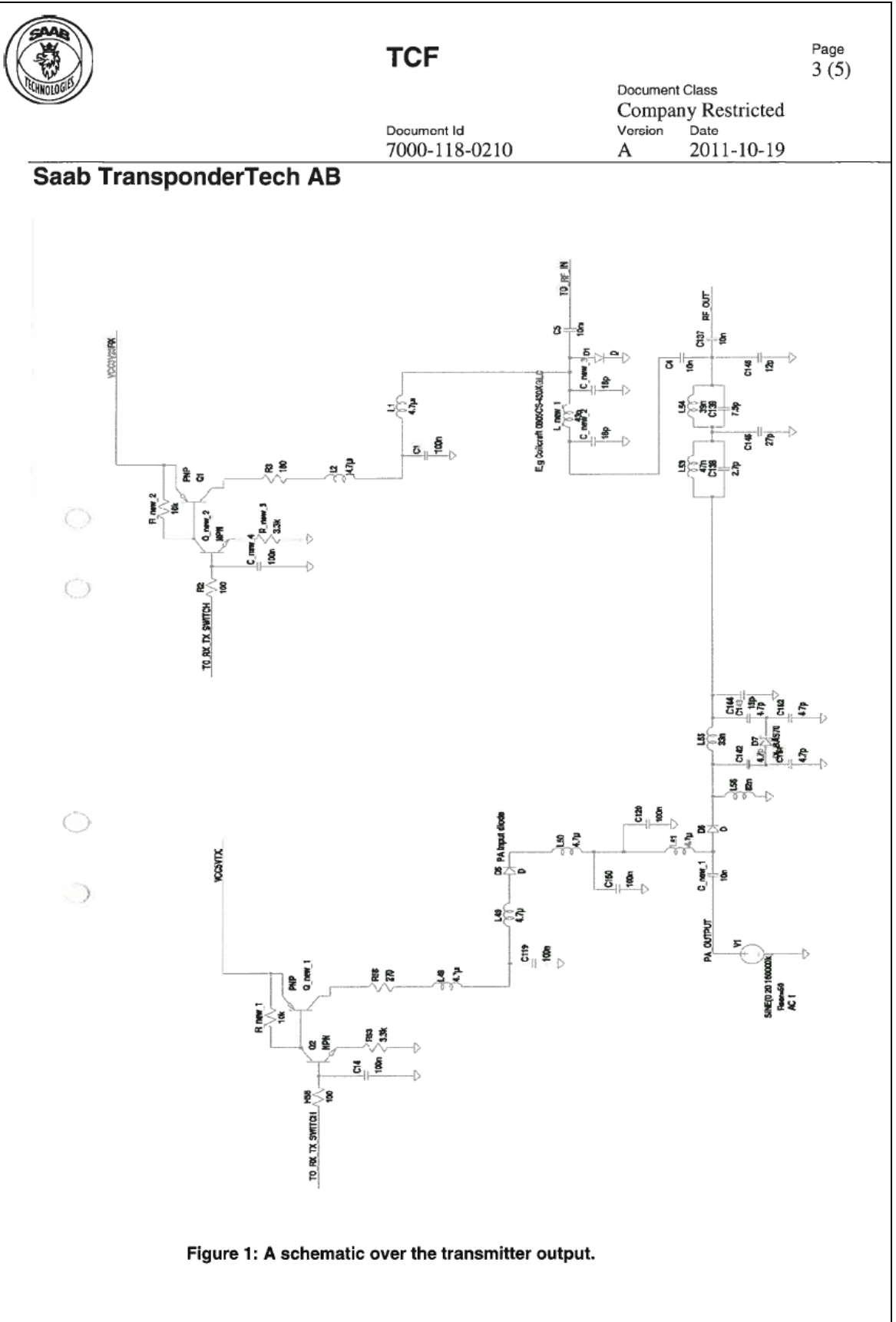
Two spurious emissions have been removed, harmonic overtone 1 and 2 ($2 \cdot 162.025\text{MHz}$ and $3 \cdot 162.025\text{MHz}$ if the transmitter frequency is 162.025MHz). There was a damping diode (D6) that created the harmonic overtones. In figure 1 there is a schematic over the transmitter output. The damping diode (D6) is moved to the output on PA (pin 4) via a capacitor of 10nF . The filter (L53, L54, etc) will remove the harmonic overtones created by D6. RX damping diodes D1, D2 are removed and superseded by a diode (D1) of the same type and connected to GND and preceded by a PI filter C-L-C of $18\text{pF}-43\text{nH}-18\text{pF}$.

2.1.2 Software

A spurious emission from the display clock has been moved from the frequency band $155-163\text{MHz}$. The frequency of the spurious emission was before the modification 156.525MHz and after the modification it is below 155MHz . The display clock has changed from 6.522MHz to 7.50MHz .

2.2 Drawing and scheme

A schematic over the transmitter output is shown below.




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3 List of tests/requirements:

15.1.1	Frequency Error	IEC 61993-2 ed.1
15.1.2	Carrier Power	IEC 61993-2 ed.1
15.1.3	Modulation spectrum 25kHz channel mode	IEC 61993-2 ed.1
15.1.5	Transmitter attack time	IEC 61993-2 ed.1
15.1.6	Transmitter Release Time	IEC 61993-2 ed.1
15.3.1	Sensitivity – 25 kHz operation	IEC 61993-2 ed.1
15.3.3	Error behaviour at high input levels	IEC 61993-2 ed.1
15.3.6	Adjacent channel selectivity – 25 kHz operation	IEC 61993-2 ed.1
15.3.8	Spurious response rejection	IEC 61993-2 ed.1
15.3.9	Intermodulation response rejection and blocking	IEC 61993-2 ed.1
15.3.10	Transmit to receive switching time	IEC 61993-2 ed.1
15.4.2	Error behaviour at high input levels	IEC 61993-2 ed.1
15.4.3	Co-channel rejection	IEC 61993-2 ed.1
15.4.4	Adjacent channel selectivity	IEC 61993-2 ed.1
15.4.5	Spurious response rejection	IEC 61993-2 ed.1
15.4.6	Intermodulation response rejection	IEC 61993-2 ed.1
15.4.7	Blocking or desensitisation	IEC 61993-2 ed.1
15.5.1	Spurious emissions from the receiver	IEC 61993-2 ed.1
10.5	EFT	EN60945
10.3	Conducted immunity	EN60945
10.4	Radiated immunity	EN60945

Table 1: Approved tests during time period 19/9-14/10 at Telefication

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Version Date of Issue
A 2011-10-19**Saab TransponderTech AB****DECLARATION OF CONFORMITY (DoC)**

We, Saab TransponderTech AB, Låsblecksgatan 3, Linköping, Sweden, declare under our sole responsibility that the changes described in section 2 for product **R5 Solid AIS System** do not affect the compliance of the requirements in section 3.

Notified body involved:Telefication B.V.
Edinstraat 12a
6902 PK Zevenaar, The Netherlands

2011-10-19

Christian Andersson
Product Manager