

# **Radio test report**

## **20103677300 rev 2.0**

based on:  
IEC 61993-2 First edition 2001 (Clause 15 only)

AIS Class A and Inland Transponder  
CNS Systems  
VDL 6000

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This report comprises of five modules. The total number of pages is: 42

## Main module

### 1 Introduction

This report contains the result of tests performed by:

Telefication B.V.  
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 :	C.N.S. Systems AB
Address :	St. Larsgatan 32B
Zipcode :	582 24
City/town :	Linköping
Country :	Sweden
Date of order :	17 October 2011

## 2 Product

A sample of the following product was submitted for testing:

Product name : AIS Class A and Inland Transponder  
Manufacturer : C.N.S. Systems AB  
Trade mark : CNS Systems  
Type designation : VDL 6000  
Hardware version : 360005-10 (BB board), 360006-10 (RF board)  
Software version : hwtest\_16815.bin  
Serial number : 1.44-6000-00011  
FCC ID : Y83VDL6000-4X

## 3 Test schedule

The test was carried out at the following location:

- Telefication BV Zevenaar

The tests were carried out between:

- 8 November 2011 and 14 March 2012

## 4 Product documentation

For production of this report the following product documentation was used:

Description	Identification	Date
Installation, maintenance and repair manual, issue P1B	Doc. No. CNSS-11-1601	2012-01-10
Manual, part II user's guide, issue P3I	Doc. No. CNSS-03-2114	2011-11-07

The above-mentioned documentation will be filed at Telefication bv for a period of 10 years following the issue of this report.

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## 5 Observations and comments

The transponder contains two identical AIS receivers, A and B, and one DSC receiver. During testing of the TDMA part, receiver A was subjected to the tests.

## 6 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 2001 (Clause 15 only)

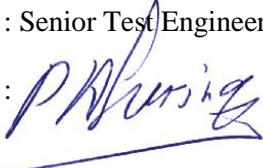
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## 7 Conclusions

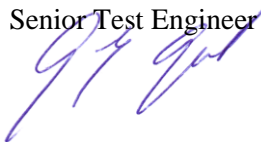
The sample of the product showed **NO NON-COMPLIANCES** to the specification stated in chapter 6 of this report.

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 6 “*Summary*”.

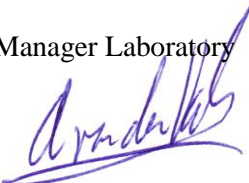
All tests are performed by:

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 : 1 June 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	15 PHYSICAL TESTS	Performed verification (yes/no/n.a)
15.1 TDMA Transmitter		
15.1.1	Frequency Error	yes
15.1.2	Carrier Power	yes
15.1.3	Modulation Spectrum 25 kHz channel mode	yes
15.1.4	Modulation Spectrum 12.5 kHz channel mode	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	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	n.a.
15.3.6	Adjacent Channel selectivity - 25 kHz Operation	yes
15.3.7	Adjacent Channel selectivity - 12.5 kHz Operation	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

## 2 Test results

### 2.1 TDMA Transmitter (Clause 15.1)

#### 2.1.1 Frequency Error (Clause 15.1.1)

Date of test: 9-3-2012  
Date of test: 12-3-2012

Ambient temp.: 23 °C  
Ambient temp.: 22 °C

R.H.: 33 %  
R.H.: 36 %

TEST CONDITIONS		FREQUENCY ERROR (Hz)			
Temperature	Voltage	156.025 MHz	157.4125 MHz	160.6375 MHz	162.025 MHz
$T_{nom}$ (+15 – 35 °C)	$V_{nom}$ (24.0 V)	-170	-170	-170	-180
$T_{min}$ (-15 °C)	$V_{min}$ (21.6 V)	-80	-90	-90	-90
$T_{max}$ (+55 °C)	$V_{max}$ (31.2 V)	-210	-210	-210	-210
Measurement uncertainty		±42 Hz			
Limits		$\leq \pm 0.5$ kHz under normal conditions, $\leq \pm 1$ kHz under extreme conditions.			

Test equipment used: (Item numbers)	2, 13, 19
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## 2.1.2 Carrier Power (Clause 15.1.2)

Date of test: 23-12-2011	Ambient temp.: 23 °C	R.H.: 38 %
Date of test: 27-12-2011	Ambient temp.: 21 °C	R.H.: 41 %
Date of test: 28-12-2011	Ambient temp.: 20 °C	R.H.: 42 %

Rated output carrier power:   H.P.   : 12.5 W (41 dBm)  
   L.P.   : 1 W (30 dBm)

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<sub>nom</sub></i> (+15 – 35 °C)	<i>V<sub>nom</sub></i> (24.0 V)	40.0	30.9	40.0	30.0	40.3	29.8	40.5	29.4
<i>T<sub>min</sub></i> (-15 °C)	<i>V<sub>min</sub></i> (21.6 V)	39.4	30.2	39.4	30.4	39.7	30.5	39.8	30.3
<i>T<sub>max</sub></i> (+55 °C)	<i>V<sub>max</sub></i> (31.2 V)	38.8	31.1	38.8	30.8	39.0	30.8	39.1	29.7
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 & -3.0 dB of the rated carrier power							

Test equipment used: (Item numbers)	2, 13, 19
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### 2.1.3 Modulation Spectrum 25 kHz channel mode (Clause 15.1.3)

#### 2.1.3.1 GMSK Spectrum TDMA at 156.025 MHz

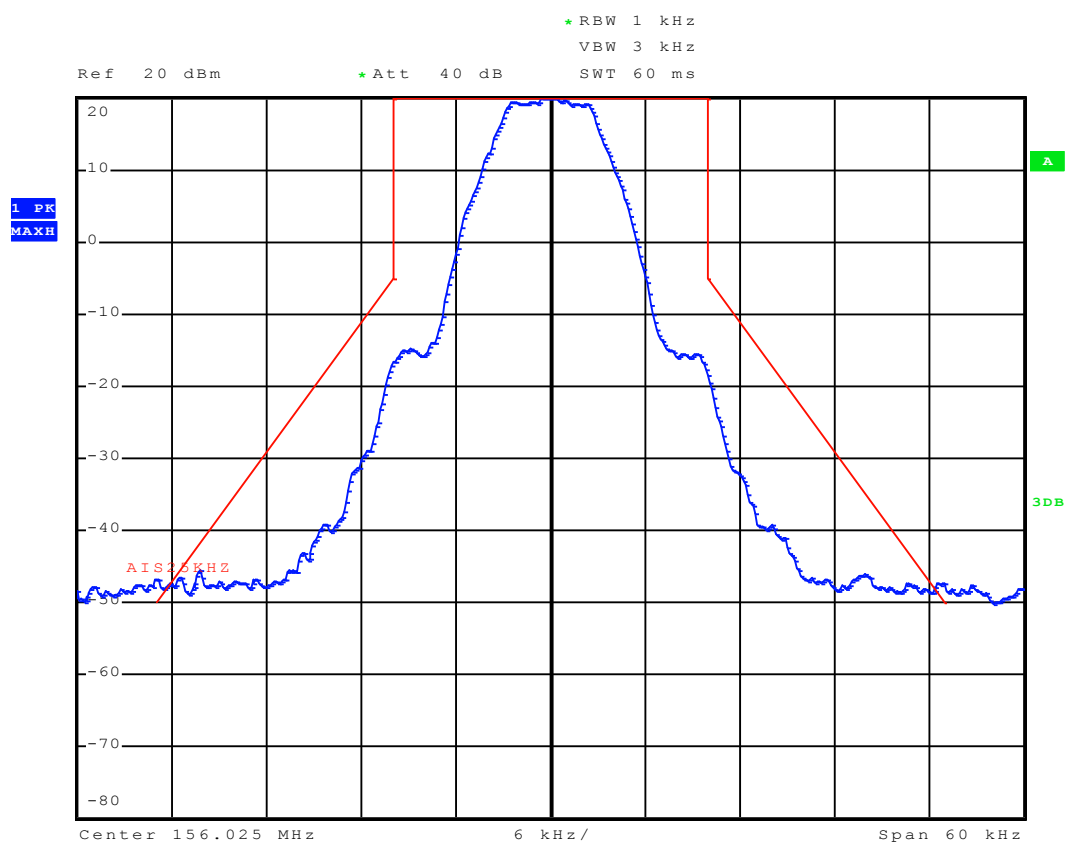
Date of test: 28-12-2011

Ambient temp.: 20 °C

R.H.: 42 %

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

(1) method of measurement: a)



Test equipment used: (Item numbers)

### 2.1.3.2 GMSK Spectrum TDMA at 162.025 MHz

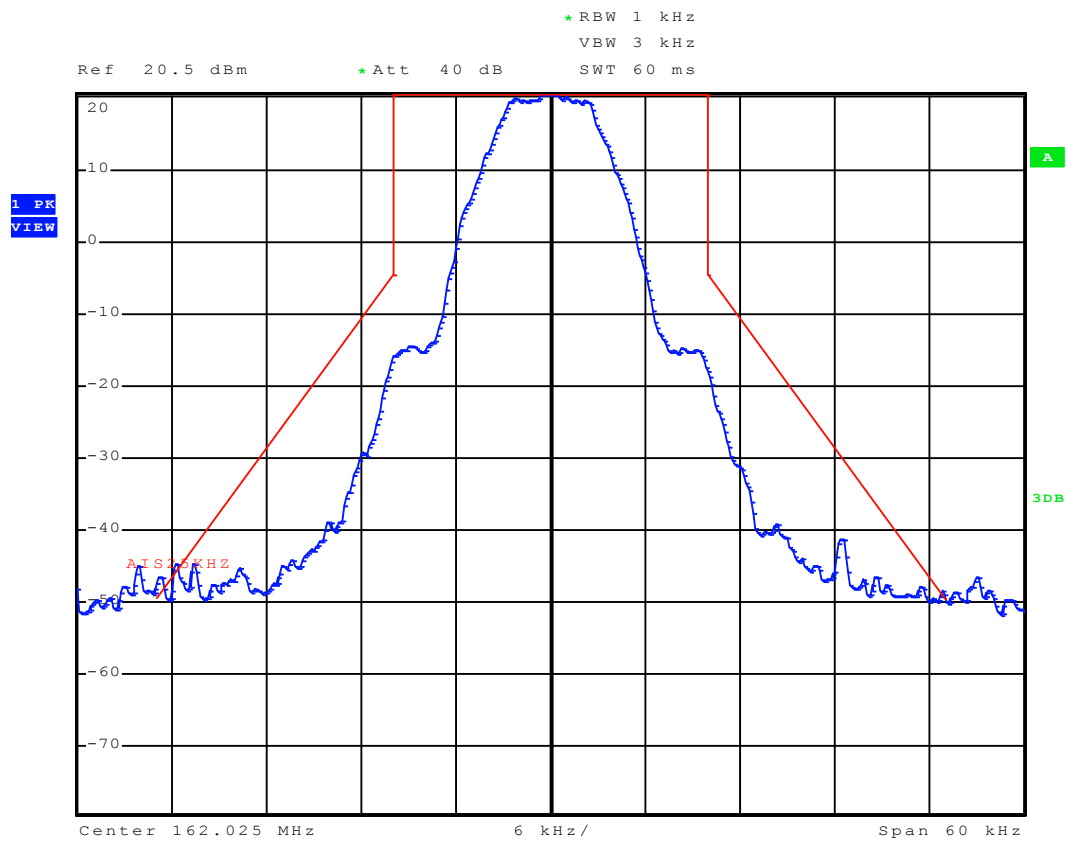
Date of test: 28-12-2011

Ambient temp.: 20 °C

R.H.: 42 %

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

(1) method of measurement: a)



Remark: Reference levels are relative

Test equipment used: (Item numbers)	2, 19
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#### 2.1.4 Transmitter Attack Time (Clause 15.1.5)

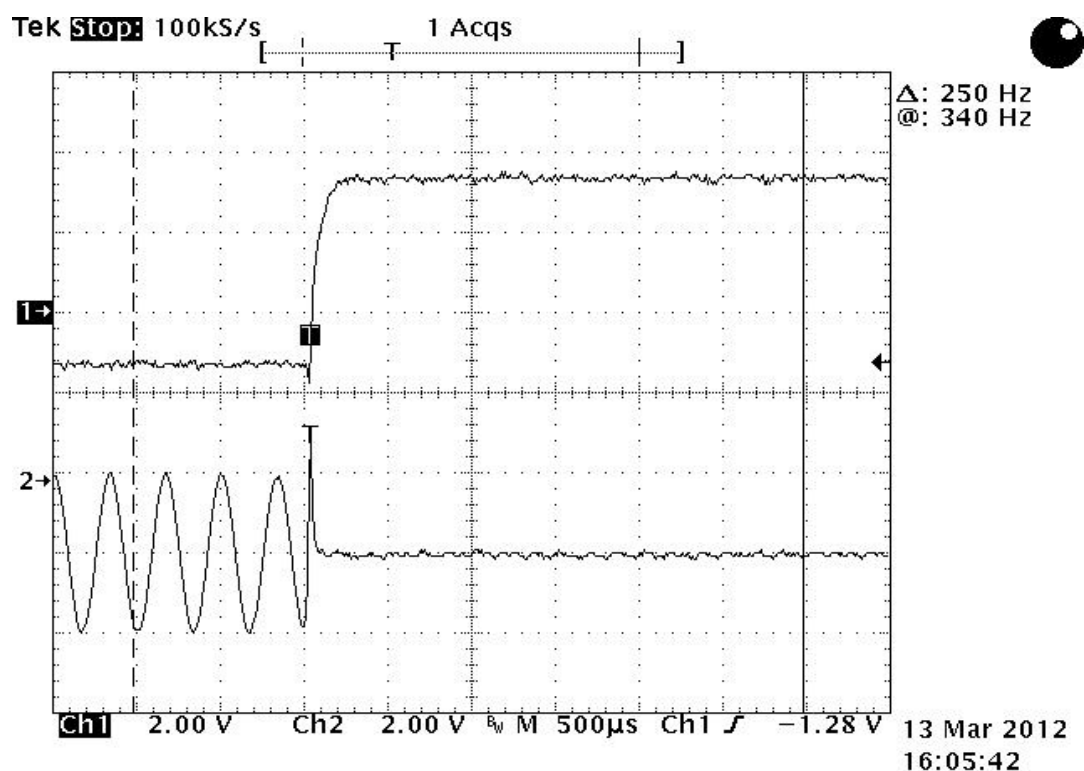
Date of test: 28-12-2011

Ambient temp.: 20 °C

R.H.: 41 %

TX freq.: 156.025 MHz

Carrier power: H. P.



Lower trace:

Vertical units: 9 kHz/div

Horizontal units: 500  $\mu$ s

Measurement Uncertainty:  $\pm 2\%$

Limit:

- Transmitter attack time  $T_0$ : within 1 ms,
- Transient power level: within  $\pm 1.5$  dB of its final value at any time,
- Carrier frequency  $F_c$ : within  $\pm 1$  kHz of its required value after 1 ms.

Test equipment used: (Item numbers)	1, 4, 5, 8, 10, 11, 18, 19
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## 2.1.5 Transmitter Release Time (Clause 15.1.6)

Date of test: 28-12-2011

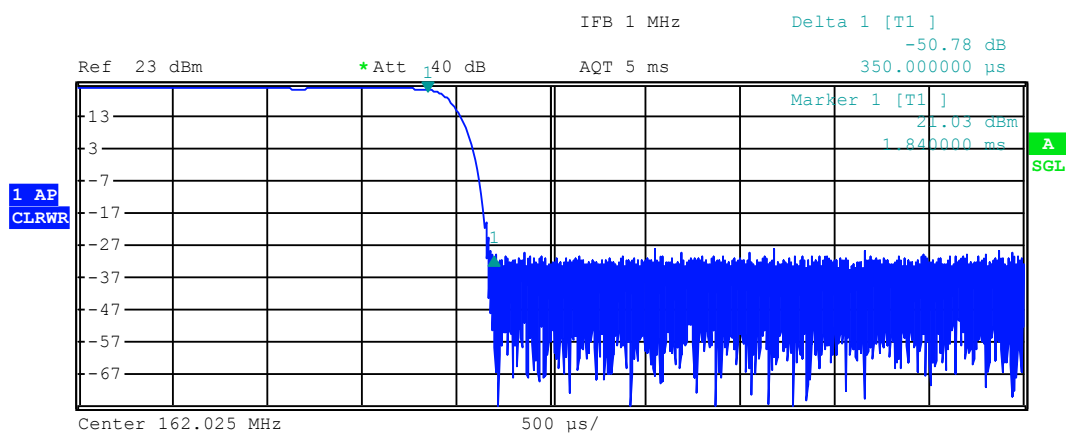
Ambient temp.: 20 °C

R.H.: 42 %

TX freq.: 162.025 MHz

Carrier power: H. P.

### PLOT OF RF POWER BEHAVIOUR



#### Amplitude Modulation Summary

Carrier Power	14.76 dBm
Modulation Frequency	--- Hz
Modulation Depth	99.999 %
Sampling Rate	8 MHz
Record Length	40001
Demod Bandwidth	5 MHz

Result from plot above: 350 μsec.

Measurement Uncertainty:  $\pm 2$  %

Limit:

Transmitter release time  $T_r$ : within 1 ms,

Test equipment used: (Item numbers)	2, 19
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## 2.2 TDMA Receivers (Clause 15.3)

### 2.2.1 Sensitivity - 25 kHz Operation (Clause 15.3.1)

Date of test: 8-12-2011  
Date of test: 27-12-2011

Ambient temp.: 22 °C  
Ambient temp.: 21 °C

R.H.: 37 %  
R.H.: 42 %

TEST CONDITIONS		SENSITIVITY LEVEL	
		Fn: 156.025 MHz	Fn: 162.025 MHz
Temperature	Voltage	RF level (dBm)	RF level (dBm)
<i>T<sub>nom</sub></i> (+15 – 35 °C)	<i>V<sub>nom</sub></i> (24.0 V)	-111 (14 %)	-110 (11 %)
<i>T<sub>min</sub></i> (-15 °C)	<i>V<sub>min</sub></i> (21.6 V)	-108.3 (19 %)	-104.8 (20 %)
<i>T<sub>max</sub></i> (+55 °C)	<i>V<sub>max</sub></i> (31.2 V)	-110 (15 %)	-109.7 (14 %)
Measurement uncertainty		±1.2 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)	8, 11, 12
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## 2.2.2 Error Behaviour at High Input Levels (Clause 15.3.3)

Date of test: 10-11-2011

Ambient temp.: 21 °C

R.H.: 47 %

TEST CONDITIONS		Packet Error Rate (%)	
		Fn = 156.025 MHz (CH 60)	
Standard Test Signal		as described in clause 15.3.1	
Input signal (dBm)		-77	-7
Temperature	Voltage		
<i>T<sub>nom</sub></i> (+15 – 35 °C)	<i>V<sub>nom</sub></i> (24.0 V)	0	0
Measurement uncertainty		±1.0 dB	
Limits		Difference < 1%	

Test equipment used: (Item numbers)	8, 11, 12
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### 2.2.3 Co-channel Rejection - 25 kHz Operation (Clause 15.3.4)

Date of test: 9-3-2012  
Date of test: 12-3-2012

Ambient temp.: 23 °C  
Ambient temp.: 22 °C

R.H.: 33 %  
R.H.: 36 %

#### Test #1

TEST CONDITIONS		CO-CHANNEL REJECTION RATIO (dB)	
Temperature	Voltage	Fn = 156.025 MHz	
$T_{nom}$ (+15 – 35 °C)	$V_{nom}$ (24.0 V)	Fn +3 kHz	-10 (11%)
		Fn	-10 (19%)
		Fn –3 kHz	-10 (8%)
Measurement uncertainty		±1.2 dB	
Limits		Between -10.0 dB and 0 dB.	

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

#### Test #2

TEST CONDITIONS		CO-CHANNEL REJECTION RATIO (dB)	
Temperature	Voltage	Fn = 159.025 MHz	
$T_{nom}$ (+15 – 35 °C)	$V_{nom}$ (24.0 V)	Fn +3 kHz	-10 (20 %)
		Fn	-6 (20 %)
		Fn –3 kHz	-10 (20 %)
Measurement uncertainty		±1.2 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)	7, 8, 11, 12 (test #2); 8, 10, 11, 12 (test #1)
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## 2.2.4 Adjacent Channel selectivity - 25 kHz Operation (Clause 15.3.6)

Date of test: 9-3-2012  
Date of test: 12-3-2012

Ambient temp.: 23 °C  
Ambient temp.: 22 °C

R.H.: 33 %  
R.H.: 36 %

TEST CONDITIONS		ADJACENT CHANNEL SELECTIVITY (dB)	
		Fn: 159.025 (MHz)	
Temp.	Voltage	Unwanted signal – 25 kHz	Unwanted signal + 25 kHz
<i>T<sub>nom</sub></i> (+15 – 35 °C)	<i>V<sub>nom</sub></i> (24.0V)	70 (1 %)	70 (0 %)
<i>T<sub>min</sub></i> (-15 °C)	<i>V<sub>min</sub></i> (21.6 V)	60 (0 %)	60 (0 %)
<i>T<sub>max</sub></i> (+55 °C)	<i>V<sub>max</sub></i> (31.2 V)	60 (0 %)	60 (0 %)
Measurement uncertainty		±1.2 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, 10, 11, 12
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## 2.2.5 Spurious Response Rejection (Clause 15.3.8)

Date of test: 10-11-2011

Ambient temp.: 21 °C

R.H.: 47 %

Tested frequency: 156.025 MHz

Funw (MHz)	SPURIOUS RESPONSE REJECTION RATIO (dB)
154.075	70 (20 %)
154.365	73 (20 %)
156.83	73 (20 %)
159.28	73 (20 %)
160.905	76 (20 %)
246.025	$\geq 80$
447.05	$\geq 80$
*	*
Measurement uncertainty	$\pm 1.2$ dB (in band and out band)
Limit	The rejection ratio shall not be less than 70 dB @ PER $\leq 20$ %

Funw = unwanted frequency

\*: Rejection on all other spurious responses was  $\geq 80$  dB.

*Remark: The first six stated results are found during the search of the “limited frequency range”, which was calculated to be:  $152.525 \leq f_i \leq 249.525$  MHz.  
The results stated thereafter are found during the search of the frequencies outside the “limited frequency range”.*

Notes:

- (1) Frequency of the receiver ( $f_R$ ): 156.025 MHz
- (2) Frequency of the local oscillator signal applied to the 1st mixer of the Receiver ( $f_{LO}$ ): 201.025 MHz
- (3) Intermediate frequencies ( $f_{I1}$ ,  $f_{I2}$ ,  $f_{I3}$ ):  $f_{I1}$ , = 45 MHz
- (4) Switching range of the Receiver (sr): 156.025 to 162.025 MHz

Test equipment used: (Item numbers)	8, 10, 11, 12
-------------------------------------	---------------

## 2.2.6 Intermodulation response rejection and blocking (Clause 15.3.9)

Date of test: 9-11-2011

Ambient temp.: 21 °C

R.H.: 47 %

### Intermodulation

TEST CONDITIONS		PACKET ERROR RATE (%)	
		Fn = 156.025 MHz	Fn = 162.025 MHz
Temperature	Voltage	Test #1	Test #2
$T_{nom}$ (+15 – 35 °C)	$V_{nom}$ (24.0 V)	0	0
Measurement uncertainty		±1.7 dB	
Limits		≤ 20% PER	

### *Remark: test configuration*

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

### Blocking

TEST CONDITIONS		BLOCKING RATIO (dB) at % PER	
		Fn = 156.025 MHz	Fn = 162.025 MHz
Temperature	Voltage	Test #1	Test #2
$T_{nom}$ (+15 – 35 °C)	$V_{nom}$ (24.0 V)	89 (4 %)	86 (0 %)
Measurement uncertainty		±1.2 dB (in band and out band)	
Limits		≥ 86 dB @ 20% PER	

### *Remark: test configuration*

	Generator unwanted –15 dBm unmodulated
Test #1	Fn + 5.725
Test #2	Fn - 5.725

Test equipment used: (Item numbers)	8, 9, 10, 11, 12 (intermodulation); 8, 11, 12, 14 (blocking)
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## 2.2.7 Transmit to receive switching time (Clause 15.3.10)

Date of test: 13-3-2012

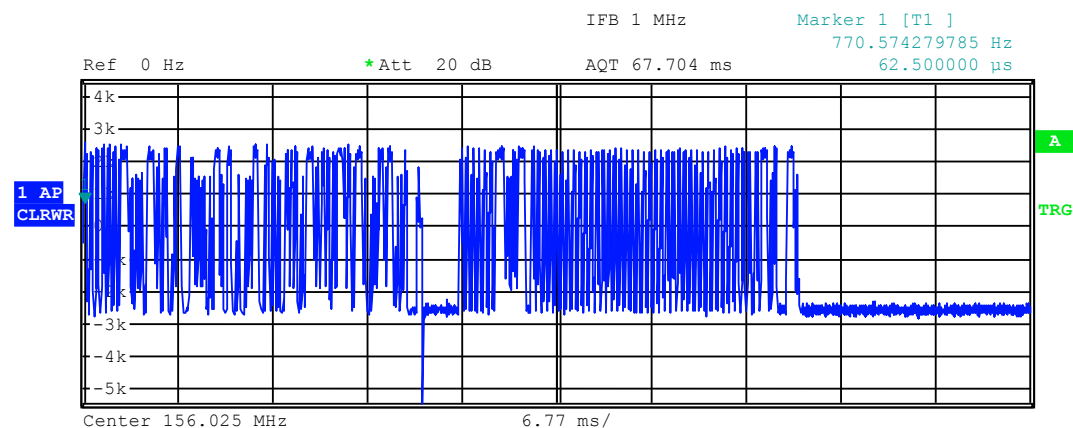
Ambient temp.: 23 °C

R.H.: 37 %

TEST CONDITIONS		PACKET ERROR RATE (%)
Temperature	Voltage	Fn = 156.025 MHz
<i>T</i> <sub>nom</sub> (+15 – 35 °C)	<i>V</i> <sub>nom</sub> (24.0 V)	18
Limits		≤ 20% PER

*Remark: The wanted signal level was -112 dBm*

The plot below shows the first (26.7 msec) slot, being the transmission slot and the second (26.7 msec) slot being the receiving slot.



### Frequency Modulation Summary

Coupling	DC	Carrier Offset	-281.56 Hz	
Deviation	+peak	2.604 kHz	Carrier Power	2.73 dBm
	-peak	-13.37 kHz	Modulation Frequency	-- Hz
	±peak/2	7.989 kHz	Sampling Rate	125 kHz
	RMS	2.136 kHz	Record Length	8464
			Demod Bandwidth	100 kHz

Test equipment used: (Item numbers)	2, 8, 11, 17, 19, 21, 22
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## 2.3 DSC Receiver (Clause 15.4)

### 2.3.1 Maximum sensitivity (Clause 15.4.1)

Date of test: 5-12-2011  
Date of test: 8-12-2011

Ambient temp.: 21 °C  
Ambient temp.: 20 °C

R.H.: 38 %  
R.H.: 38 %

TEST CONDITIONS		SENSITIVITY LEVEL (dBm)		
		Fn: 156.525 MHz (CH 70)		
Temperature	Voltage	Fn	Fn - 1.5 kHz	Fn + 1.5 kHz
$T_{nom}$ (+15 – 35 °C)	$V_{nom}$ (24.0 V)	-109	-109	-110
$T_{min}$ (-15 °C)	$V_{min}$ (21.6 V)	-114	-111	-111
$T_{max}$ (+55 °C)	$V_{max}$ (31.2 V)	-112.5	-108	-111
Measurement uncertainty		±1.2 dB		
Limits		$\leq$ - 107 dBm with a BER of 1% under normal test conditions, $\leq$ - 101 dBm with a BER of 1% under extreme test conditions,		

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

### 2.3.2 Error Behaviour at High Input Levels (Clause 15.4.2)

Date of test: 8-12-2011

Ambient temp.: 20 °C

R.H.: 38 %

CHANNEL 70: Fn: 156.525 MHz

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

Test equipment used: (Item numbers)	8, 11, 12
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### 2.3.3 Co-Channel Rejection (Clause 15.4.3)

Date of test: 6-12-2011

Ambient temp.: 22 °C

R.H.: 35 %

CHANNEL 70: Fn: 156.525 MHz

TEST CONDITIONS		CO-CHANNEL REJECTION RATIO (dB)	
		Standard Test Signal #1/ -104 dBm	
Temperature	Voltage	Unwanted signal	
$T_{nom}$ (+15 – 35 °C)	$V_{nom}$ (24.0 V)	Fn + 3 kHz	-4
		Fn	-3.5
		Fn - 3 kHz	-4
Measurement uncertainty		± 1.2 dB	
Limits		Between -10.0 dB and 0 dB @ BER < 1%	

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

### 2.3.4 Adjacent Channel selectivity (Clause 15.4.4)

Date of test: 12-3-2012  
Date of test: 13-3-2012

Ambient temp.: 23 °C  
Ambient temp.: 22 °C

R.H.: 36 %  
R.H.: 35 %

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)	73	70
<i>Tmin</i> (-15 °C)	<i>Vmin</i> (21.6 V)	74	70
<i>Tmax</i> (+55 °C)	<i>Vmax</i> (31.2 V)	75	71
Measurement uncertainty		± 1.2 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)	7, 8, 9, 11, 12,
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### 2.3.5 Spurious Response Rejection (Clause 15.4.5)

Date of test: 7-12-2011  
Date of test: 8-12-2011

Ambient temp.: 21 °C  
Ambient temp.: 21 °C

R.H.: 39 %  
R.H.: 38 %

CHANNEL 70: Fn: 156.525 MHz

Funw (MHz)	SPURIOUS RESPONSE REJECTION RATIO (dB)
160.45	75
121.74	70
*	
Measurement uncertainty	$\pm 1.2$ dB (in band and out band)
Limit	$\geq 70$ dB @ BER < 1%

Funw = unwanted frequency

\*: Rejection on all other spurious responses is  $\geq 80$  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 ( $f_{LO}$ ): XX MHz
- (3) Intermediate frequencies ( $f_{I1}, f_{I2}, f_{I3}$ ):  $f_{I1} =$  YYY MHz
- (4) Switching range of the Receiver (sr): 156.025 to 162.025 MHz

Test equipment used: (Item numbers)	8, 10, 11, 12
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### 2.3.6 Intermodulation response Rejection (Clause 15.4.6)

Date of test: 6-12-2011

Ambient temp.: 22 °C

R.H.: 35 %

CHANNEL 70: Fn: 156.525 MHz

TEST CONDITIONS		Intermodulation response rejection ratio (dB)	
Temperature	Voltage	Test #1	Test #2
$T_{nom}$ (+20 °C)	$V_{nom}$ (24.0 V)	76	75
Measurement uncertainty		± 1.7dB	
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)	8, 9, 10, 11, 12
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### 2.3.7 Blocking or Desensitisation (Clause 15.4.7)

Date of test: 6-12-2011

Ambient temp.: 22 °C

R.H.: 36 %

CHANNEL 70: Fn: 156.525 MHz

Unwanted frequency (MHz)	Level (dBm) Wanted	Level (dBm) Unwanted	BLOCKING RATIO (dB) @ BER = 1%
Fn -10	-104	-11	93
Fn - 9	-104	-11	93
Fn - 8	-104	-11	93
Fn - 7	-104	-12	92
Fn - 6	-104	-12	92
Fn - 5	-104	-12	92
Fn - 4	-104	-20	84
Fn - 3	-104	-15	89
Fn - 2	-104	-15	89
Fn - 1	-104	-15	89
Fn + 1	-104	-14	90
Fn + 2	-104	-14	90
Fn + 3	-104	-13	91
Fn + 4	-104	-18	86
Fn + 5	-104	-12	92
Fn + 6	-104	-12	92
Fn + 7	-104	-12	92
Fn + 8	-104	-12	92
Fn + 9	-104	-12	92
Fn + 10	-104	-12	92
Measurement uncertainty			± 1.2 dB (in band and out band)
Limit			≥ 84 dB @ BER < 1% except at spurious response frequencies

Test equipment used: (Item numbers)

8, 10, 11, 12

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

### 2.4.1 Spurious Emissions from the Receiver (Clause 15.5.1)

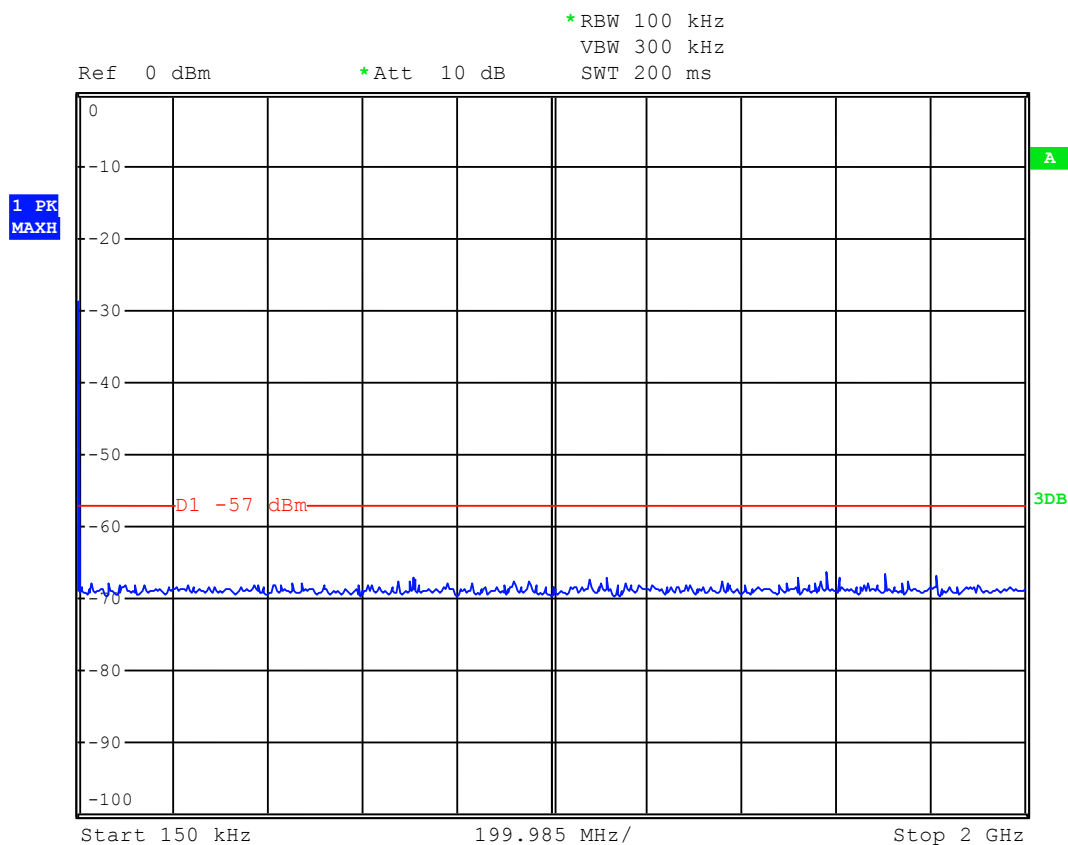
Date of test: 9-11-2011

Ambient temp.: 21 °C

R.H.: 47 %

TDMA Receiver

Fn =



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)

Date of test: 8-3-2012

Ambient temp.: 23 °C

R.H.: 33 %

 $F_n = 156.025 \text{ MHz}$ 

SPURIOUS EMISSIONS POWER LEVEL	
Spurious frequency (MHz)	Power level (dBm)
312.05	-43.1
468.075	$\leq -55$
Measurement uncertainty	$\pm 1.5 \text{ dB}$
Limit (150 kHz - 2 GHz)	$\leq -36 \text{ dBm (0.25 } \mu\text{W) for 150 kHz - 1 GHz,}$ $\leq -30 \text{ dBm (1 } \mu\text{W) for 1 GHz - 2 GHz.}$

*Remarks: Test was carried out with high power setting.*

*Results are obtained by substitution measurement.*

Test equipment used: (Item numbers)	2, 15, 19
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## Used test equipment module

Item	Description	Manufacturer	Model	Reference
1	Digitizing oscilloscope	Tektronix	TDS 680B	TE 00204
2	Spectrum analyser	R & S	FSP40	TE 11125
3	Power supply	Delta	SM6020	TE 00849
4	RF mixer	HP	10514A	TE 00417
5	10 MHz Transient detector	Telefication	1576T2	TE 00800
6	Environmental chamber	CTS	C-40/350	TE 00741
7	Digital RF signal generator	E4431B	Agilent	--
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	RF generator	HP	8640B	TE 00374
15	Tuneable band reject filter	K&L	3TNF-100/200-N/N	TE 00588
16	GPS Time base receiver	HP	58503A	TE 00222
17	Pulse generator	HP	8012B	TE 00225
18	Attenuator 20 dB/100W	Tenuline	8343-200	TE 00127
19	Attenuator 20 dB/100W	Tenuline	8343-200	TE00072
20	DSC VHF modem	ICS electronics	PLT 002249	TE 01167
21	Pulse/function generator	HP	8111A	TE 00347
22	GMSK modulator	Telefication	61993-2	TE 01061

## Photographs module

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Photograph 1: *Product front view*

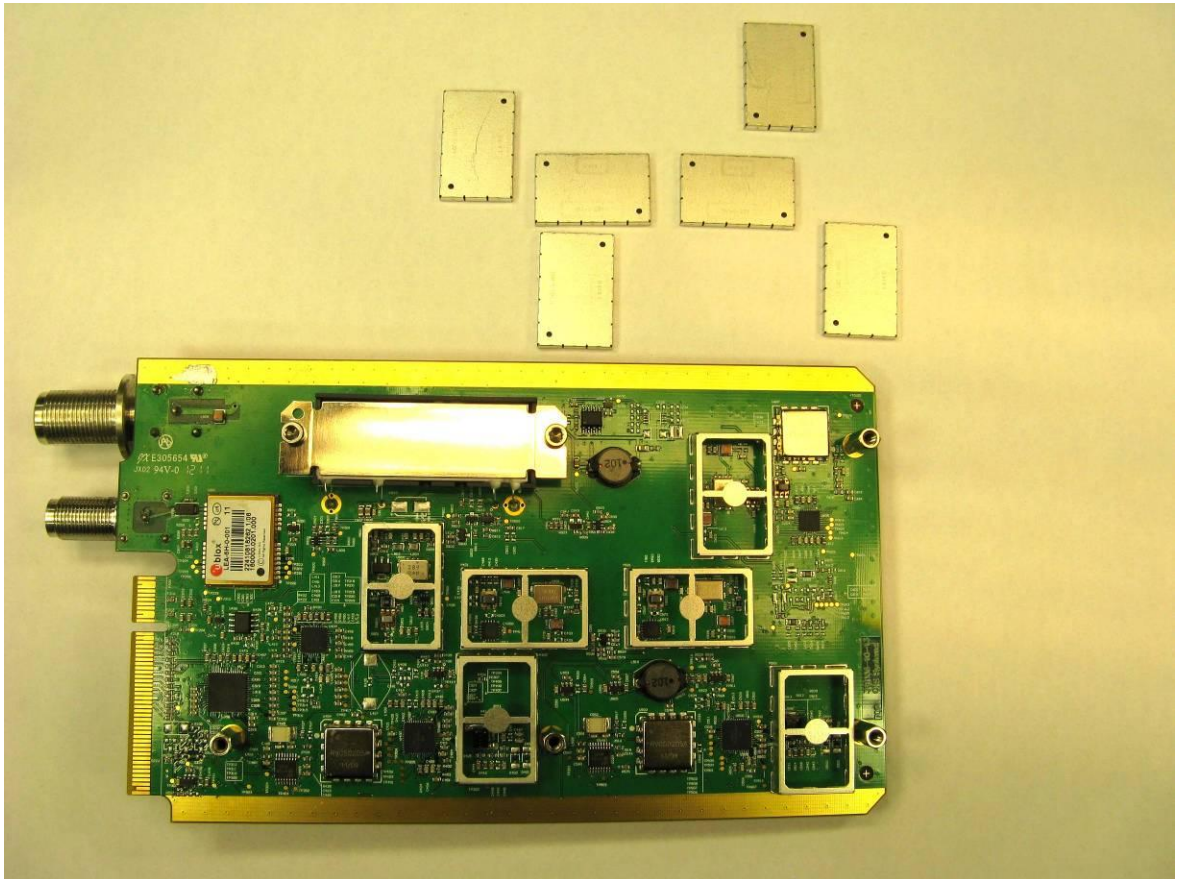




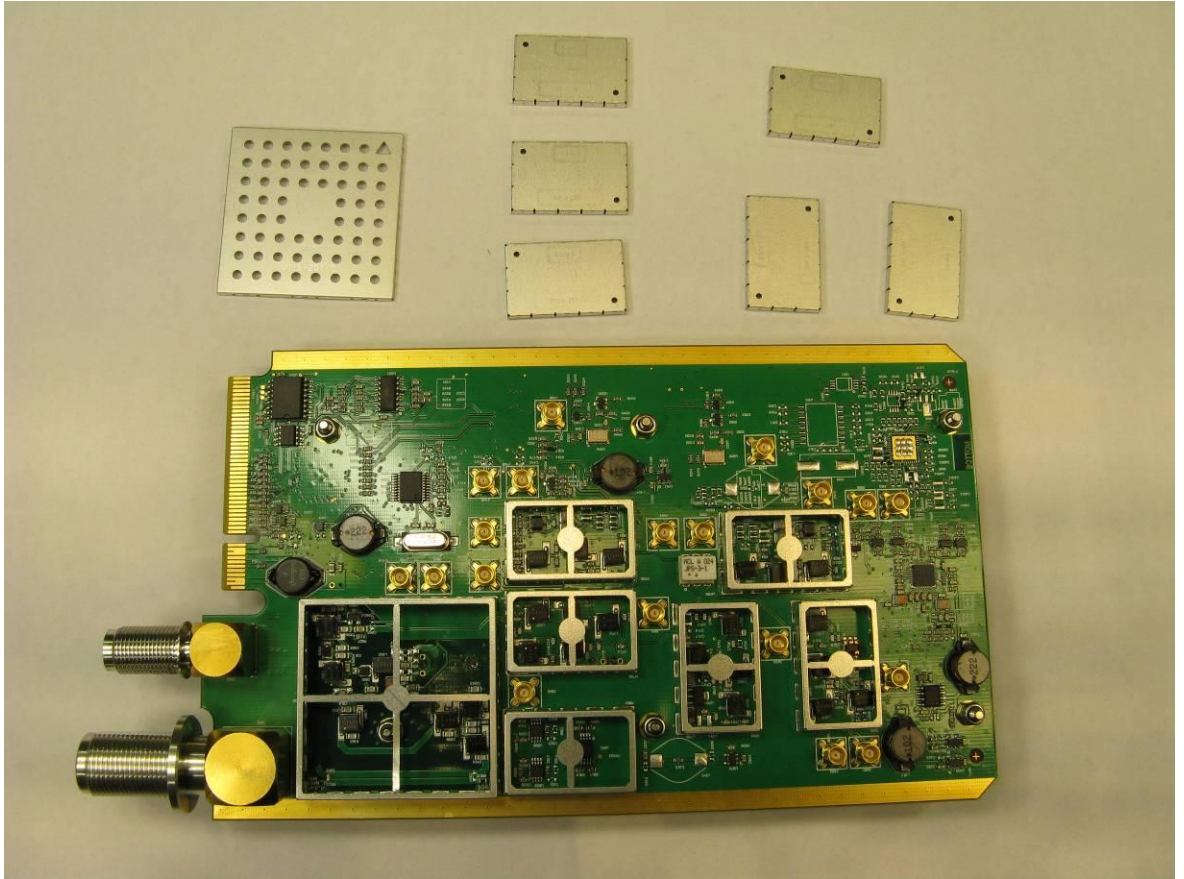
Photograph 2: *Product rear view*



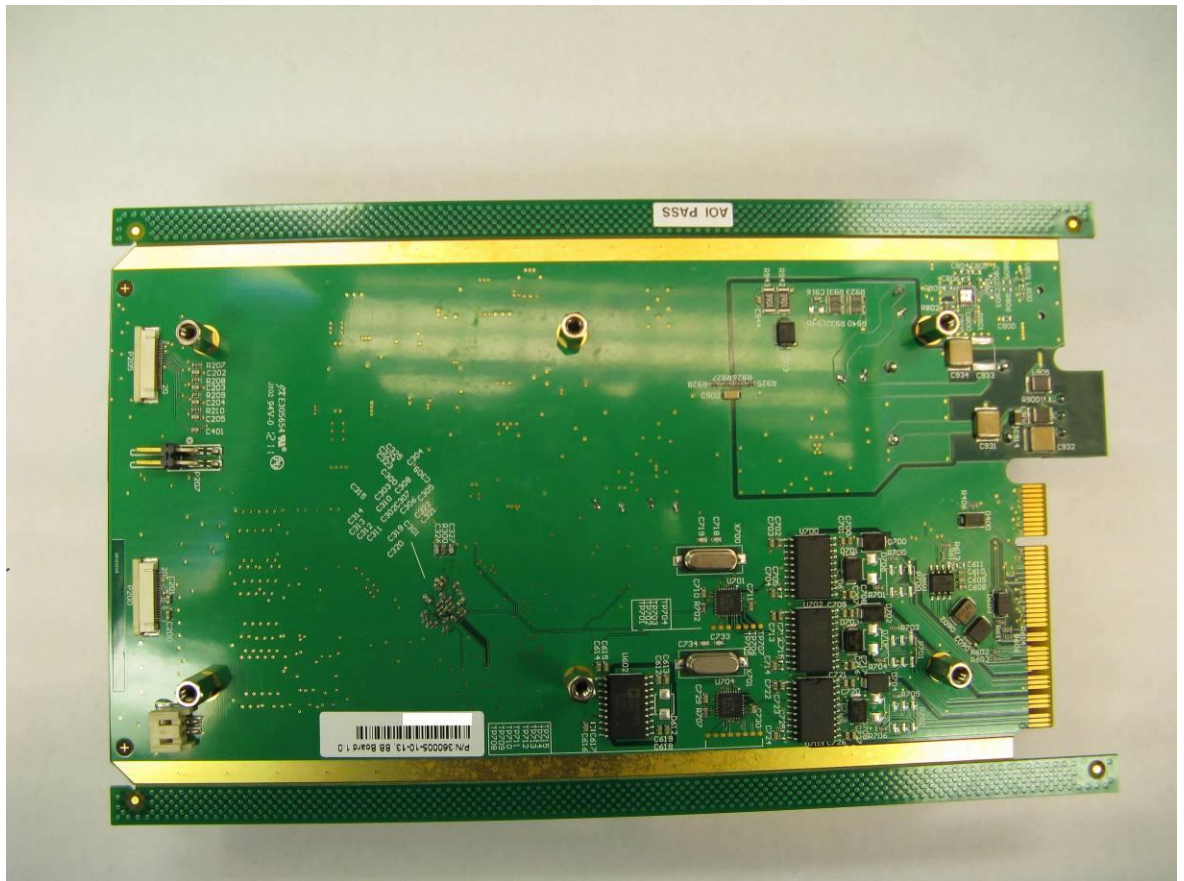
Photograph 3: *RF board bottom side*



Photograph 4: *RF board top side*

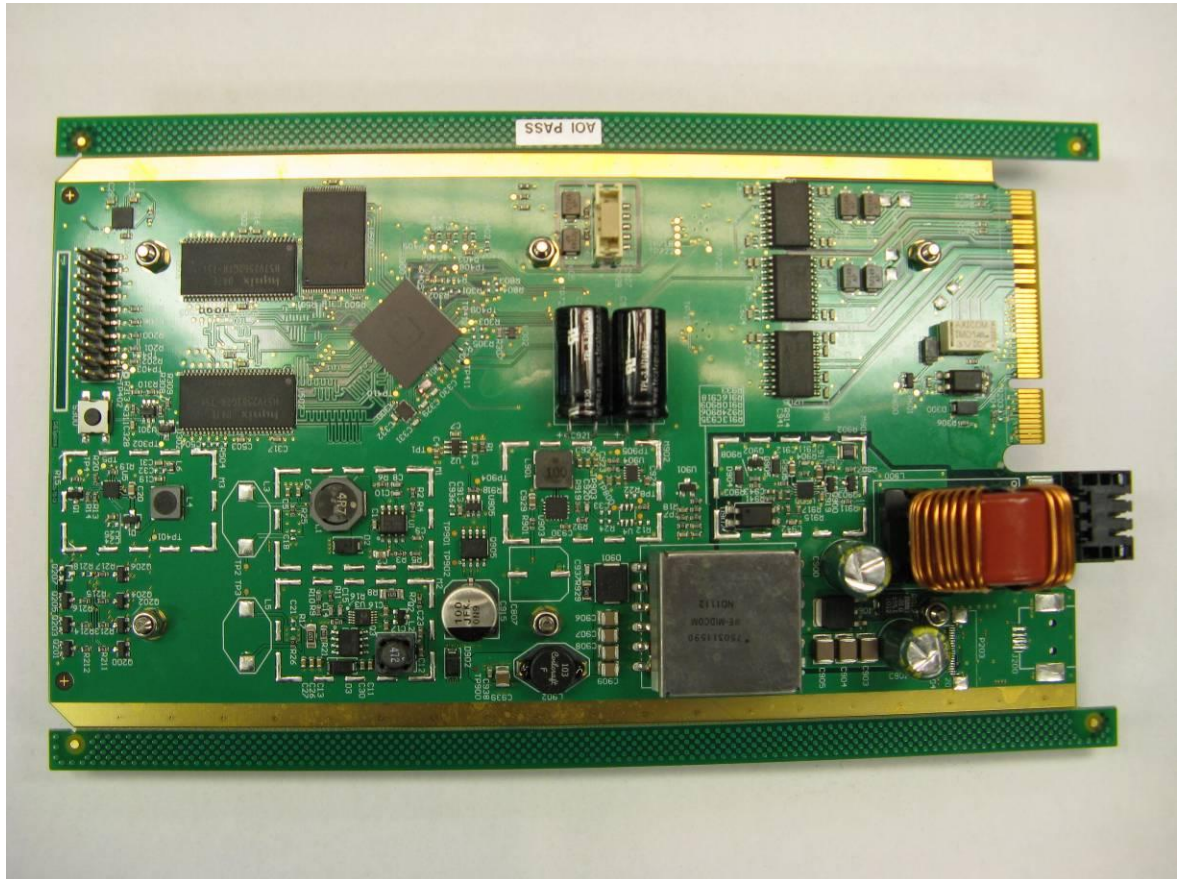


Photograph 5: *Baseband board side 1*

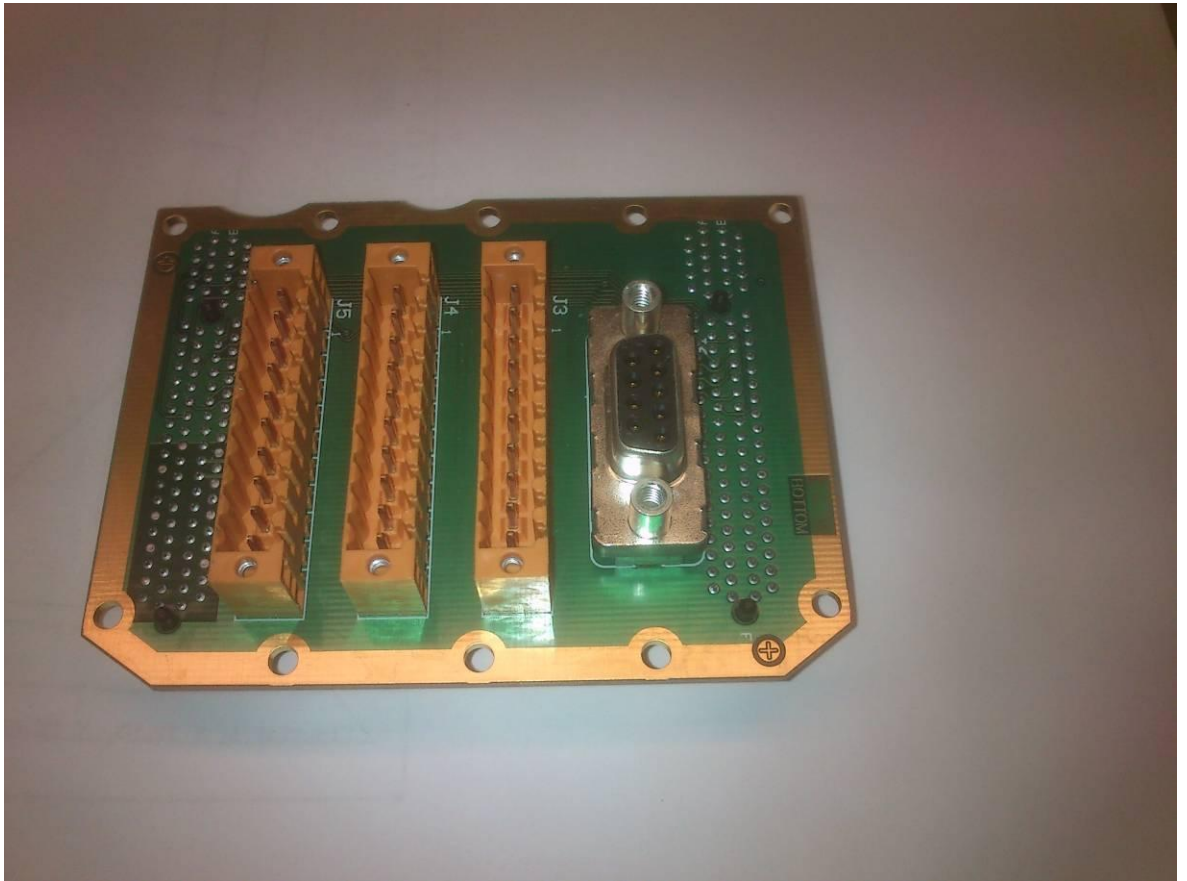




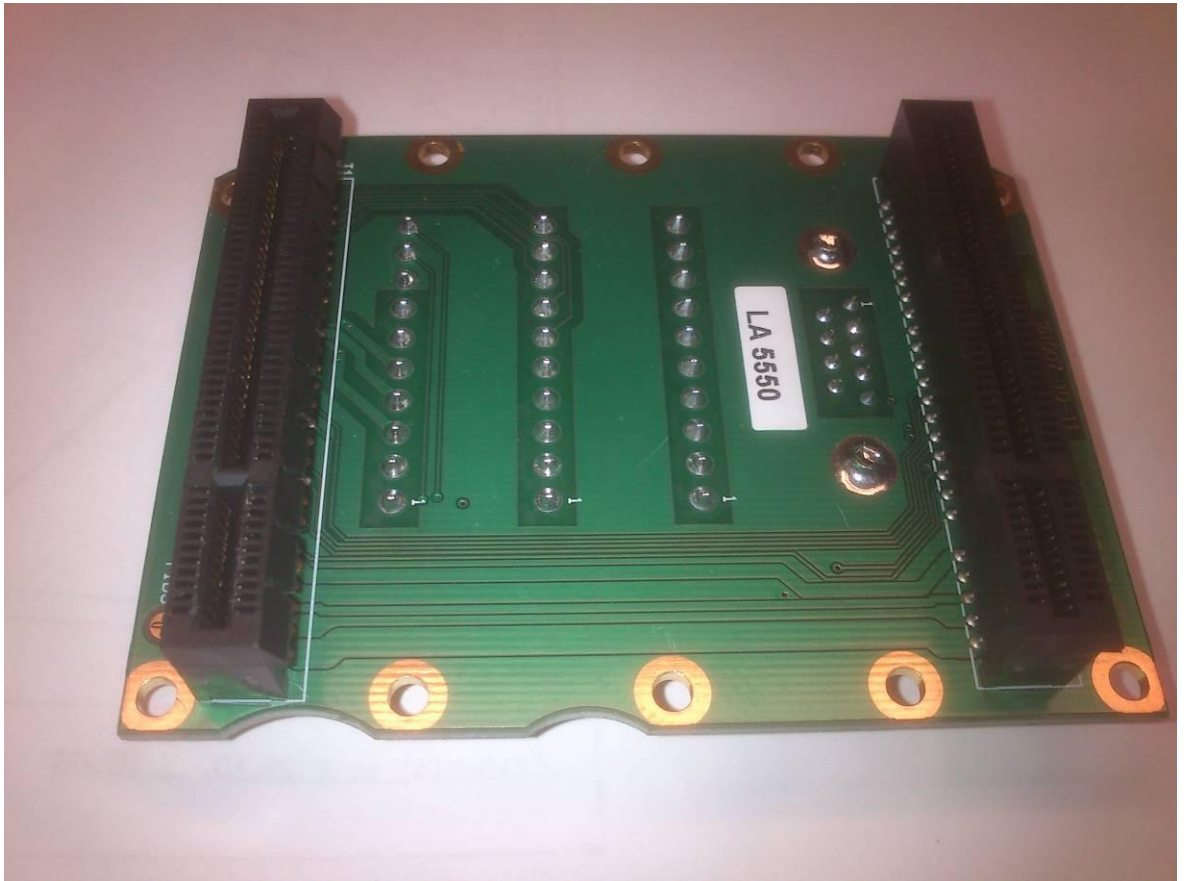
Photograph 6: *Baseband board side 2*



Photograph 7: *Back plane board outer side*



Photograph 8: *Back plane board inner side*



Photograph 9: *Labelling Class A*





Photograph 10: *Labelling Inland/Class A*



## Revision history

revision	date	remarks	revised by
1.0	16 May 2012	- in 'Photographs module' two photographs replaced by two with correct labeling	P.A. Suringa
2.0	1 June 2012	- section 5 of 'Main module' : the fact that only receiver A has been tested; - section 2.2.5 of 'Test results module': clarification of limited frequency range and LO freq. changed from 201.125 MHz into 201.025 MHz; - section 2.3.7 of 'Test results module': levels of wanted and unwanted signals added.	P.A. Suringa