



Test report no. : 191625-3

Item tested : AIS BS600

Type of equipment : AIS Base station

Client : Kongsberg Seatex



Nemko is granted accreditation by Norwegian Accreditation under registration number TEST 033

Part of:

IEC62320-1: 2009-05, ed 1.1

Ch 8 and 9 Physical radio Tests

Maritime navigation and radiocommunication equipment and systems -

Automatic identification system (AIS) -Part 1:AIS Base Stations –

Minimum operational and performance requirements, methods of testing and required test results

2013-06-13

Authorized by : 

Roy Uggerud
Technical Verifier



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1 GENERAL INFORMATION

1.1 Tested by

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Number of Pages: 39

1.2 Client Information

Name : Kongsberg Seatex
Address : NO-7462 Pirsenteret, Trondheim, Norway
Telephone : +47 73545500
Fax : +47 73515020

Contact:

Name : Frode Storesund
Telephone : +47 73 45 55 00
E-mail : frode.storesund@kongsberg.com

1.3 Manufacturer (if other than client)

..

2 Test Information

2.1 Tested Item

Name :	AIS BS600
Model/version :	BS600
Serial number :	-
Hardware identity and/or version:	-
Software identity and/or version :	-
Frequency Range :	156 – 163 MHz
Tunable Bands :	/
Number of Channels :	3 (156.025MHz, 161.975MHz & 162.025MHz)
Operating Modes :	Transceiver
Type of Modulation :	-
Emissions Designator :	/
User Frequency Adjustment :	None
Rated Output Power :	100mW, 2W & 12.5W
Type of Power Supply :	AC mains
Antenna Connector :	N
Antenna Diversity Supported :	/
Desktop Charger :	/

Description of Tested Device(s)

AIS base station

2.2 Test Environment

2.2.1 Normal test condition

Temperature:	22 – 25 °C
Relative humidity:	30 – 50 %
Normal test voltage:	230Vac

The values are the limit registered during the test period.

2.2.2 Extreme test conditions

Voltage

Minimum Voltage:	207 Vac
Maximum Voltage:	253 Vac

Temperature

Minimum Temp.:	-15 °C
Maximum Temp.:	+55 °C

2.3 Test Period

Item received date:	2012-01-16
Test period :	from 2012-01-16 to 2012-02-23

2.4 Test Engineer

G.Suhandhakumar

2.5 Test Equipment

See list of test equipment in clause 7.

2.6 Other Comments

The manufacturer's representative was present during all tests to monitor the PER(Packet error rate), to select the frequencies and to set-up communication.

The variation of $\pm 10\%$ does not make any influence on test results. This is because the EUT is supplied with regulated DC supply in the AIS unit.

3 TEST REPORT SUMMARY

3.1 General

The tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with

IEC 62320-1: 2009-05,ed.1.1: Maritime navigation and radiocommunication equipment and systems - Automatic identification system (AIS) -Part 1:AIS Base Stations –

Minimum operational and performance requirements, methods of testing and required test results

The test methods have been in accordance with Comlab 1003 where applicable.

Radiated tests were performed in accordance with Comlab 1003. Radiated emissions are made in a 3m anechoic chamber.


Production Unit

Pre-production Unit

**THIS TEST REPORT RELATES ONLY TO THE ITEM (S) TESTED.
Deviations from, additions to, or exclusions from the test specifications
are described in “Summary of Test Data”.**



TEST REPORT NO.: 191625-3

TESTED BY : 
G. Suhanthakumar, Test Engineer

DATE: 26.02.2013

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This test report applies only to the items and configurations tested.

3.2 Test Summary

Clause #	IEC 62320 Test description	Verdict
9.1	Transceiver protection test	P
TDMA Transmitters		
9.2.1	Frequency error at 25 kHz operation	P
9.2.3	Carrier power	P
9.2.4	Modulation spectrum, slotted transmission for 25 kHz channel separation	P
9.2.6	Transmitter test sequence and modulation accuracy verification for 25 kHz operation	P
9.2.8	Transmitter output power versus time function	P
9.2.9	Intermodulation attenuation	P *)
TDMA Receivers		
9.3.1	Sensitivity for 25 kHz operation	
9.3.3	Error behaviour at high input levels for 25 kHz operation	P
9.3.4	Co-channel rejection for 25 kHz operation	P
9.3.6	Adjacent channel selectivity for 25 kHz operation	P
9.3.8	Spurious response rejection for 25 kHz operation	P
9.3.10	Intermodulation response rejection for 25kHz operation	P
9.3.11	Blocking or desensitisation for 25 kHz operation	P
Conducted spurious emissions at the antenna		
9.4.1	Conducted spurious emission at the antenna from the receiver	P
9.4.2	Conducted spurious emission at the antenna from the transmitter	P

*) According to measuring method in EN 301 929 (Radio standard for maritime base stations).

Note:

- P** Passed, the equipment fulfils the requirement
- F** Failed, the equipment does not fulfil the requirement
- NA** Not applicable, the requirement is not applicable
- NT** Not tested, the test is not performed even though the requirement is relevant

4 Test Results

IEC 62320-1

4.1.1 *Transceiver protection test*

Clause 9.1

This test demonstrates that the transceiver is properly protected against malfunction due to faults in the antenna system. This shall be the first test applied to the EUT.

While the transmitter is transmitting at the highest output power, the antenna port shall first be short-circuited and then open-circuited, in each case for a period of 5 min.

The EUT shall transmit 225 single slot messages evenly spread across the 5 min period during the short-circuit condition and the open-circuit condition.

Verdict:

The EUT was functioning normal after the above mention action.

Required Results **Clause 9.1.3**

The proof that the transceiver is protected against malfunctions at the antenna terminal is substantiated by the ability to pass the remainder of the tests in this clause.

4.2 TRANSMITTER MEASUREMENTS

IEC 62320-1

4.2.1 Frequency Error

Clause 9.2.1

Carrier not modulated

Test Conditions		Frequency Error Hz		
		Regional Frequency 156.025 MHz	AIS 1 161.975 MHz	AIS 2 162.025 MHz
23°C	230Vac	156.02500	-	162.02500
-15°C	207Vac	156.02496	-	162.02496
	253Vac	156.02496	-	162.02496
+55°C	207Vac	156.02519	-	162.02520
	253Vac	156.02519	-	162.02520
Maximum frequency error (Hz)		+190	-	+200
Measurement uncertainty		$1 \cdot 10^{-7}$		

9.2.1.3 Required results

The frequency error shall not exceed $\pm 0,5$ kHz, under normal test conditions and ± 1 kHz under extreme test conditions.

Test Equipment Used: 11,15,22,23,24

IEC 62320-1

4.2.2 Carrier Output Power

Clause 9.2.3

Rated output power level (maximum): 12.5 W(40.97dBm)

Carrier not modulated

Test Conditions		Transmitter Power dBm		
		Regional Frequency 156.025 MHz LP/MP/HP	AIS 1 161.975 MHz	AIS 2 162.025 MHz LP/MP/HP
23°C	230Vac	20.58/33.55/40.91	-	19.87/32.75/40.70
-15°C	207Vac	21.69/33.80/42.15	-	20.07/32.94/41.20
	253Vac	21.69/33.80/42.15	-	20.07/32.94/41.20
+55°C	207Vac	20.88/33.83/42.12	-	20.14/33.03/40.70
	253Vac	20.88/33.83/42.12	-	20.14/33.03/40.70
Variation in output power under normal test conditions (dB)		+0.58/+0.55/-0.06	-	+0.13/-0.25/-0.27
Variation in output power under extreme test conditions (dB)		+1.69/+0.83/+1.18	-	+0.14/-0.06/+0.23
Measurement uncertainty		± 0.75 dB		

Low power- LP: 100mW (20 dBm)

Middle power-MP: 2W (33 dBm)

High power-HP: 12.5W (40.97 dBm)

9.2.3.3 Required results

P_c shall be within $\pm 1,5$ dB of the rated carrier power conducted.

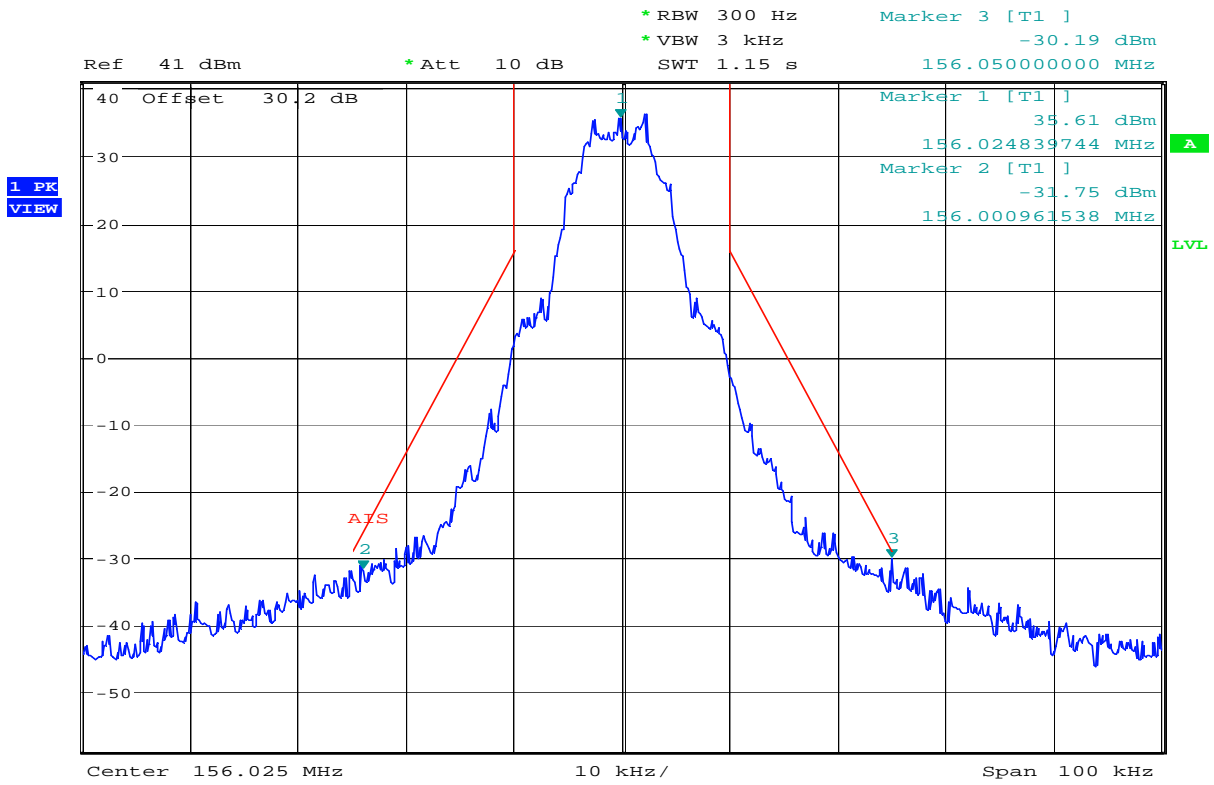
P_c under extreme test conditions shall be within ± 3 dB of the rated carrier power conducted.

Test Equipment Used: 1,11,15,22,23

IEC 62320-1

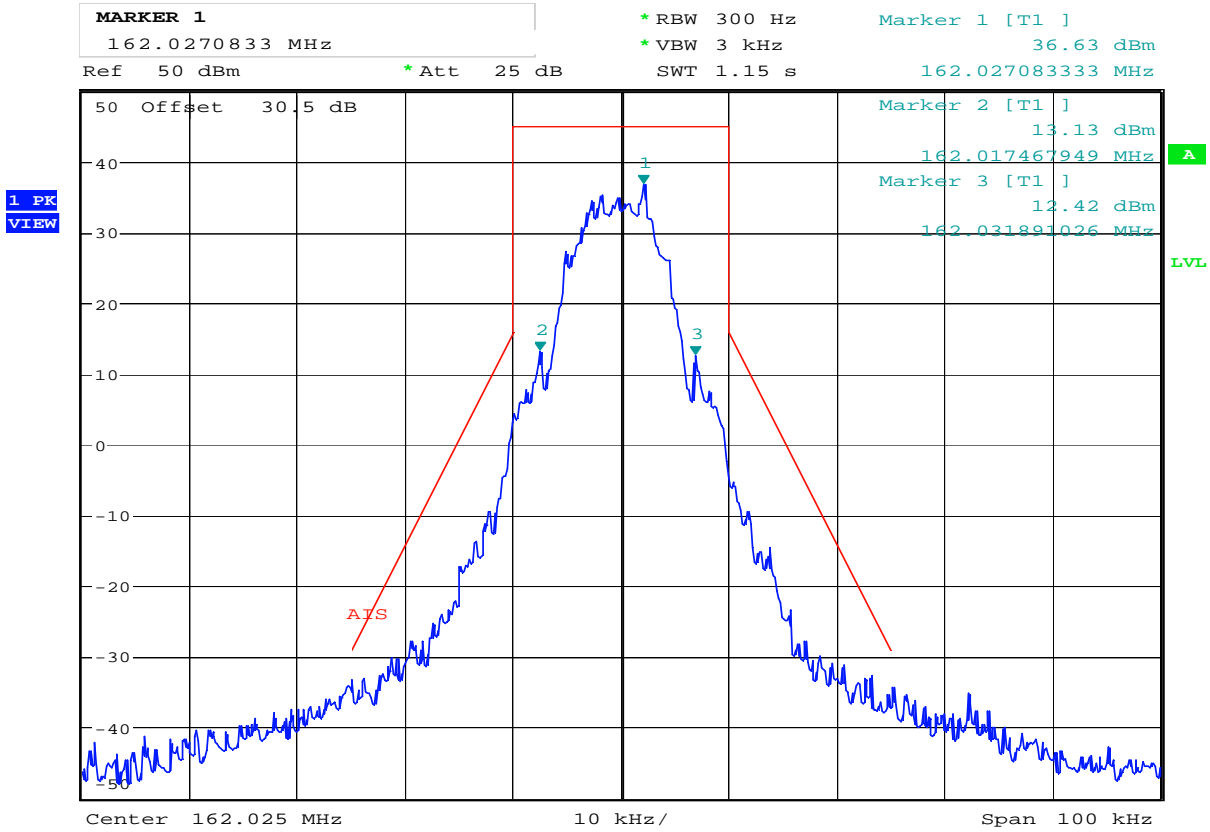
4.2.3 Modulation spectrum, slotted transmission for 25kHz channel separation

Clause 9.2.4



Date: 16.JAN.2012 10:42:54

Modulation spectrum for 156.025MHz



Date: 16.JAN.2012 10:24:50

Modulation spectrum for 162.025MHz

9.2.4.3 Required results

The modulation spectrum shall be within the mask detailed in Figure 9.

Test Equipment Used: 1,11

IEC 62320-1

4.2.4 Transmitter test sequence and modulation accuracy verification for 25kHz operation

Clause 9.2.6

	Test signal 1 (deviation) Hz	Test signal 2 (deviation) Hz
156.025MHz	1860	2450
162.025MHz	1770	2450
Measurement uncertainty	± 802Hz	

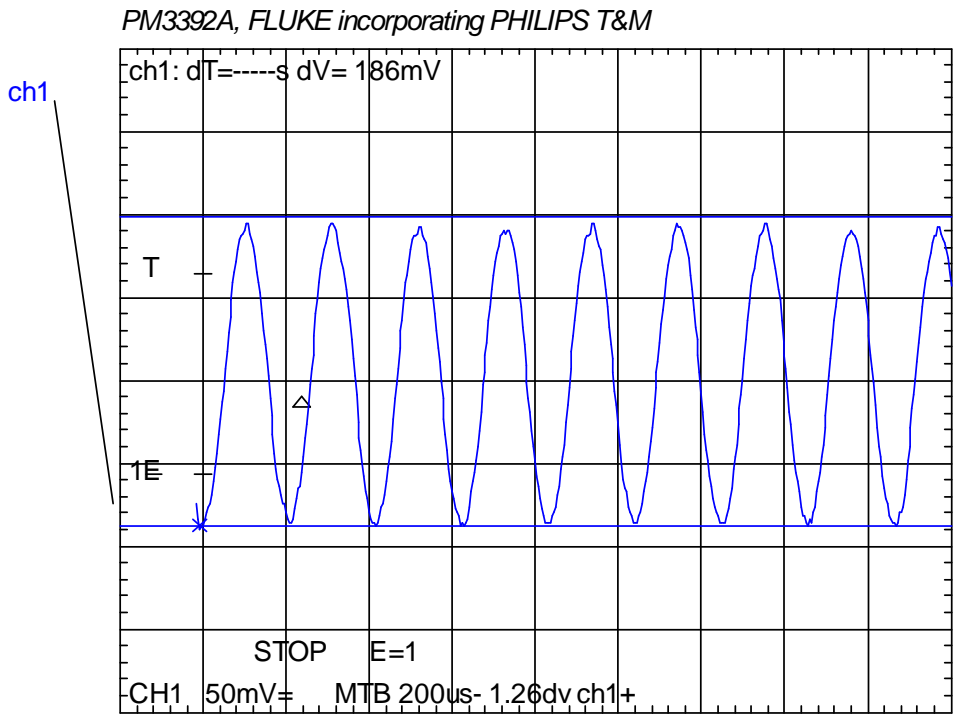
See attached graphs below

9.2.6.3 Required results

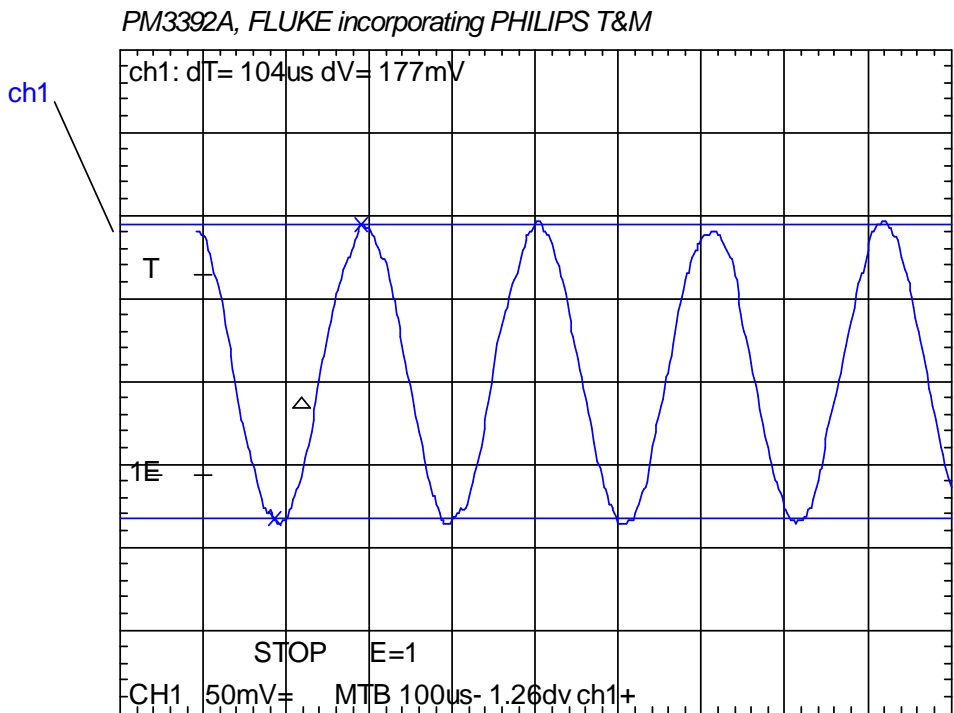
For test signal number 1: the training sequence shall start with a '0' bit and, the peak frequency deviation shall be 1 760 Hz + 352 Hz/ – 176 Hz.

For test signal number 2: The peak frequency deviation shall be 2 400 Hz ± 240 Hz.

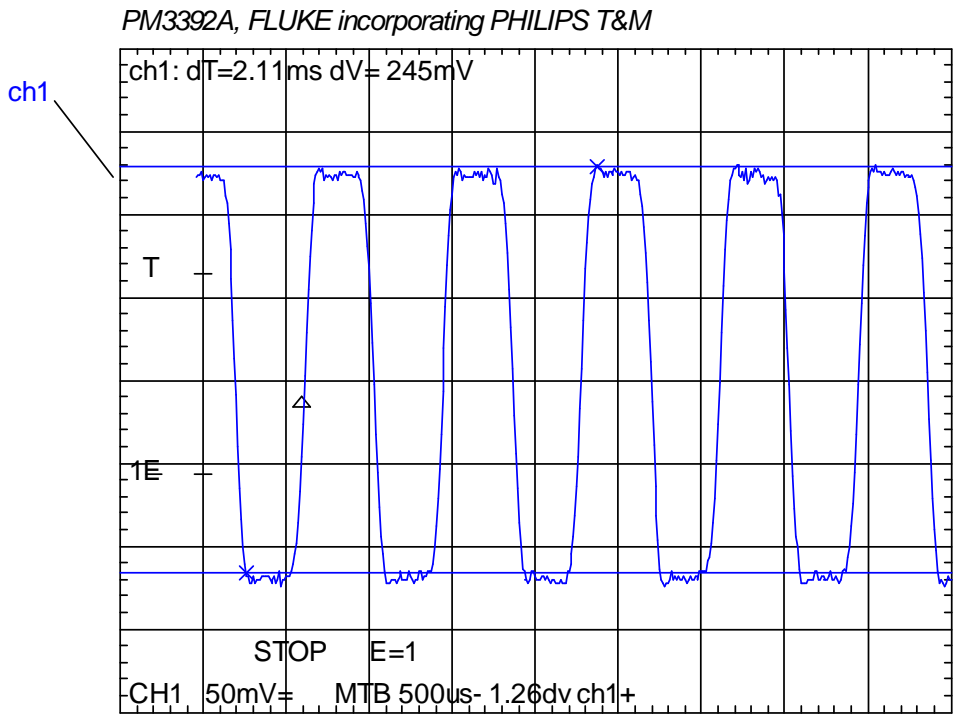
Test Equipment Used: 2,11,13,14,17



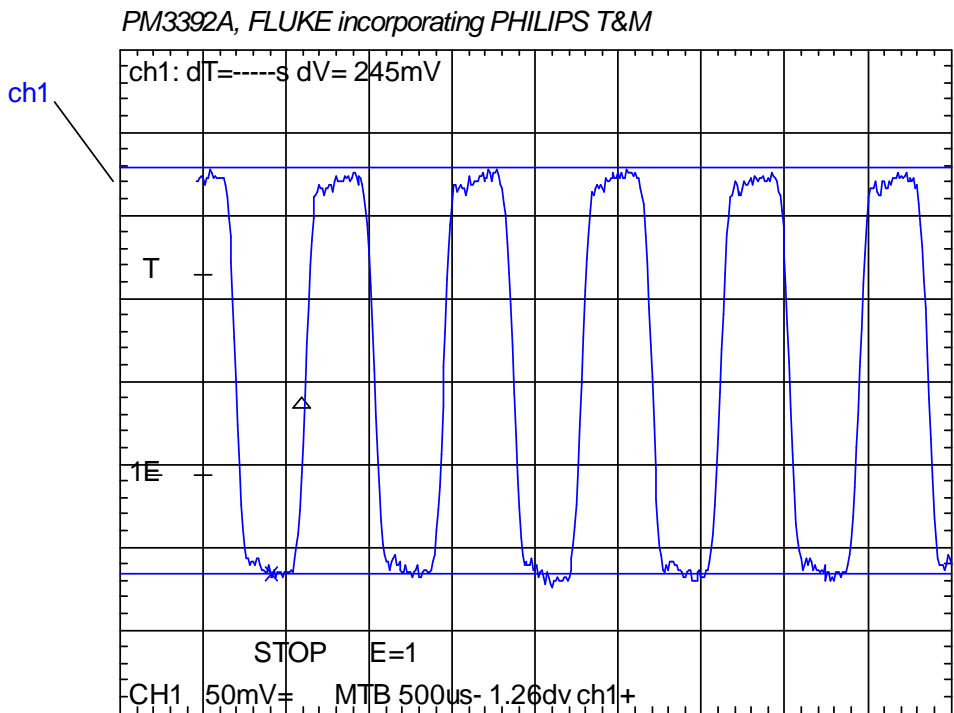
Test signal 1 – 156.025MHz



Test signal 1 – 162.025MHz



Test signal 2 – 156.025MHz



Test signal 2 – 162.025MHz

IEC 62320-1

4.2.5 Transmit out-put power versus time function

Clause 9.2.8

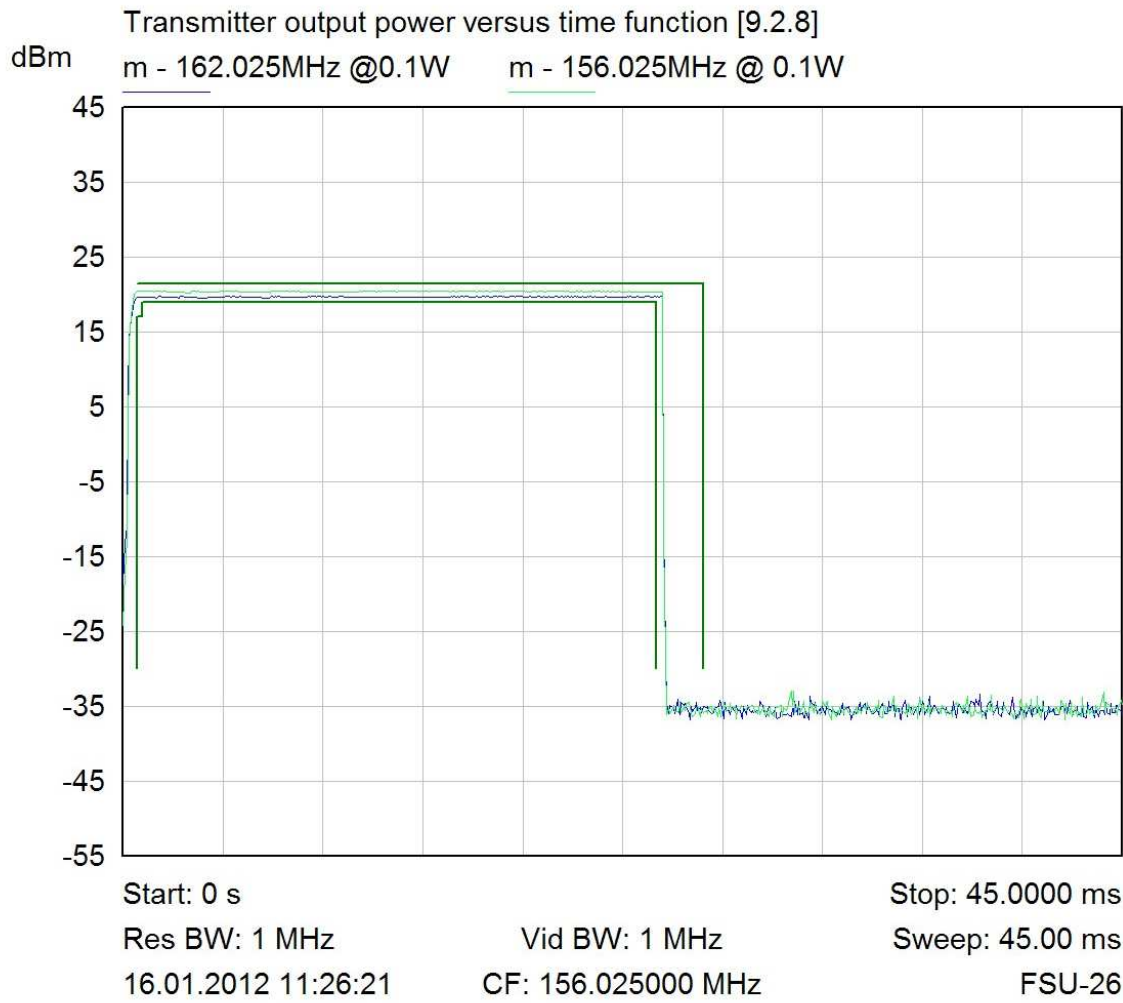
	Within the mask
156.025MHz	Yes
162.025MHz	Yes
Measurement uncertainty	± 0.75 dB

See attached graphs below

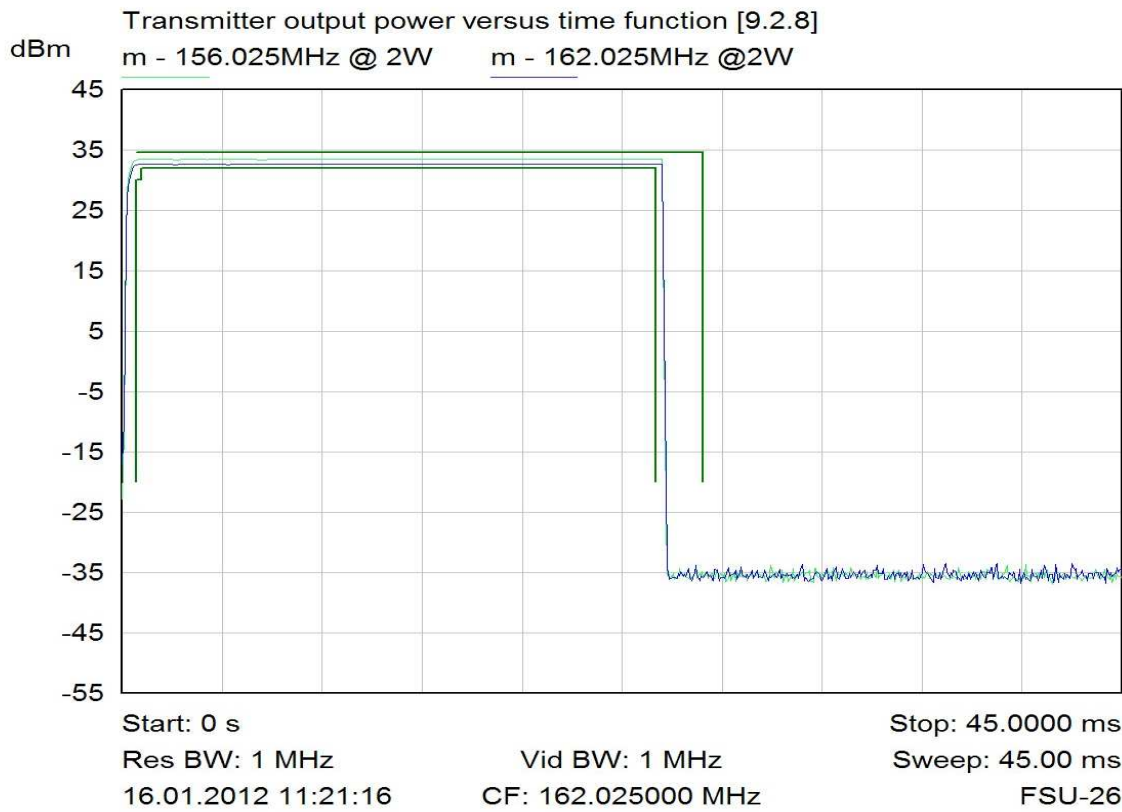
9.2.8.3 Required result

The transmitter power shall remain within the mask shown in Figure 12 and associated timings given in Table 13.

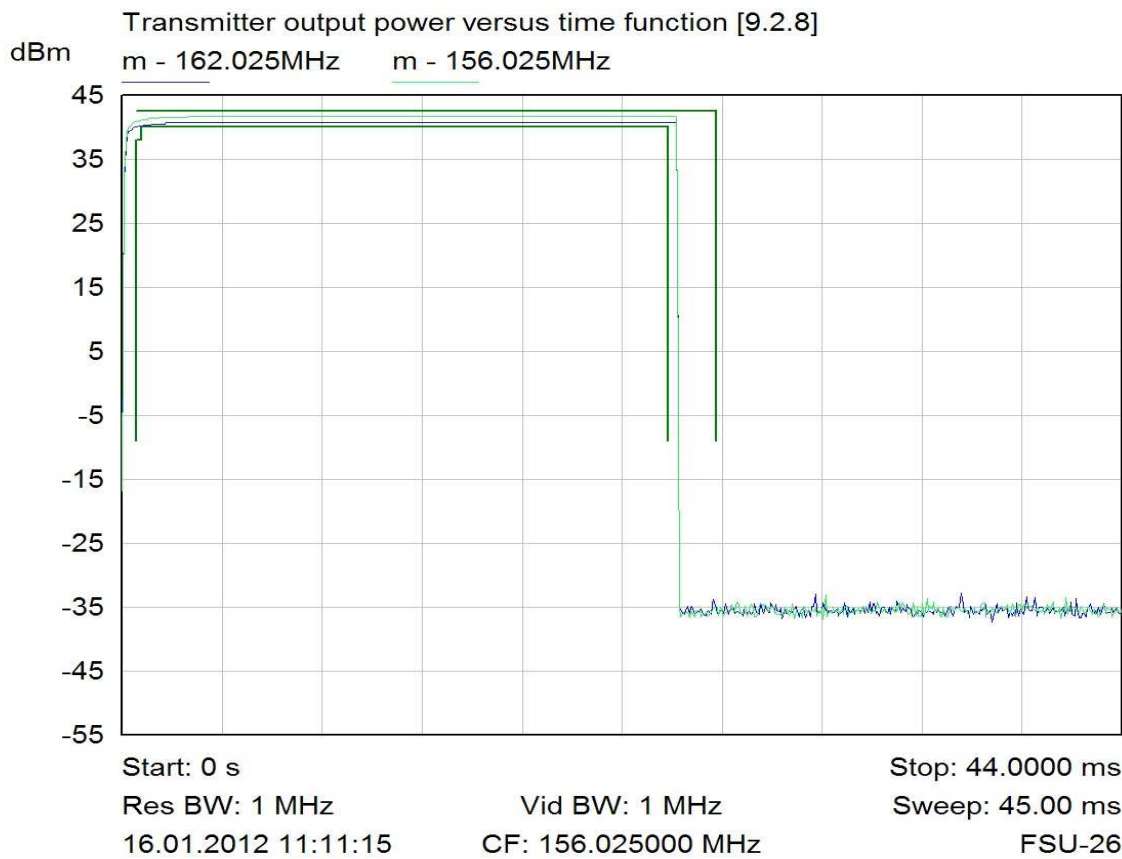
Test Equipment Used: 1,11



@100mW



@2W



@12.5W

IEC 62320-1

4.2.6 Intermodulation attenuation

Clause 9.2.9

Transmitter unmodulated

Power level at which the measurement has been performed: 12.5W

	Intermodulation (dB)			
	-100kHz	-50kHz	+50kHz	+100kHz
156.025MHz	48.16	45.47	59.13	53.88
162.025MHz	50.00	50.40	66.59	53.44
Measurement uncertainty	+1.5 /-1.7 dB			

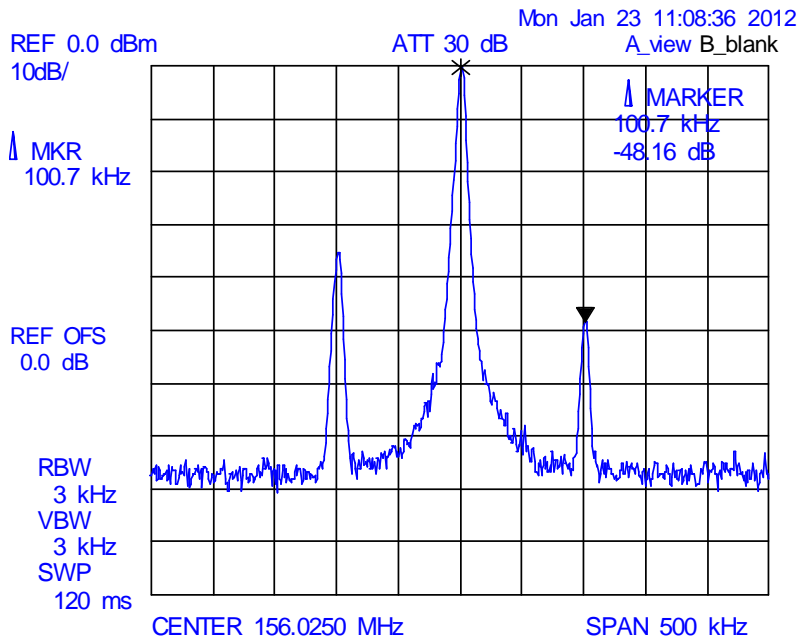
The intermodulation attenuation is not performed as defined in the standard. The input level is 20 dB less than what is defined in the standard. This is according to other base station standards made by ETSI, i.e. EN 301 929 for maritime base stations.

See attached graphs below

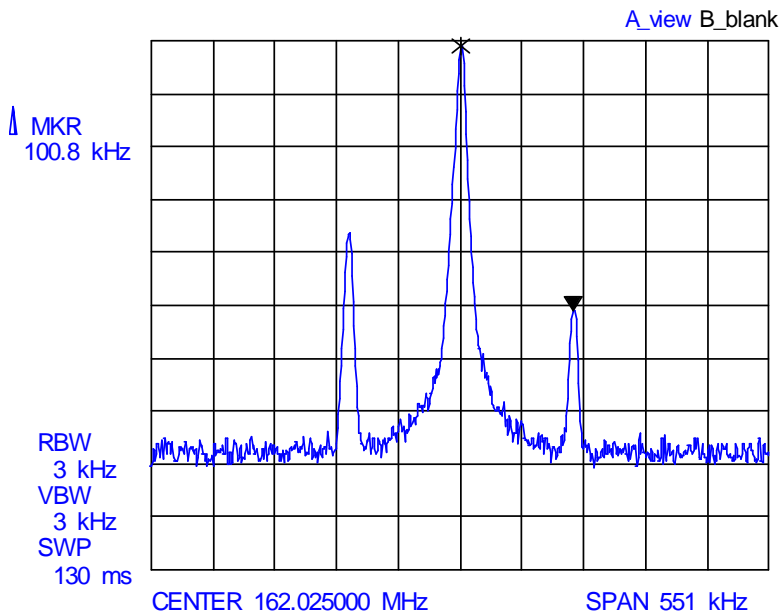
9.2.9.3 Required results

The intermodulation ratio shall be not less than 40 dB.

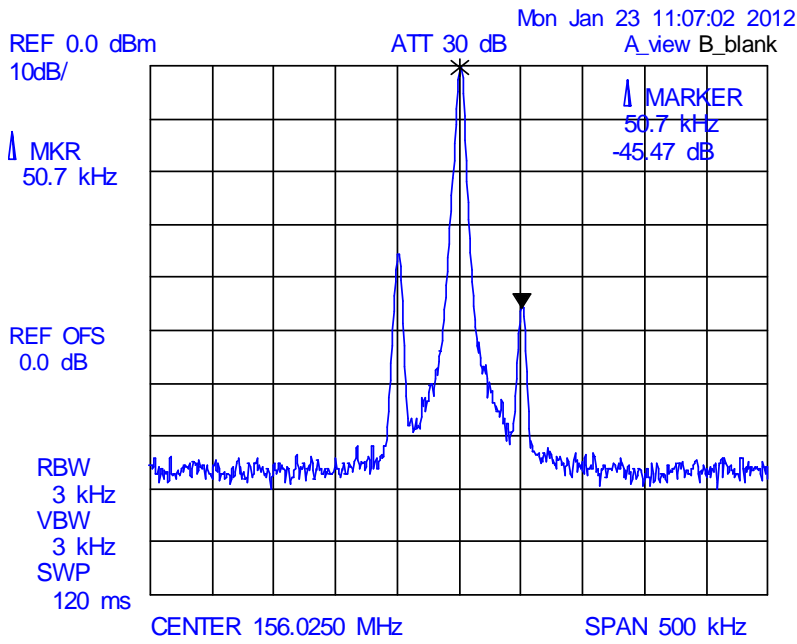
Test Equipment Used: 2,8,10,11,18,19,21



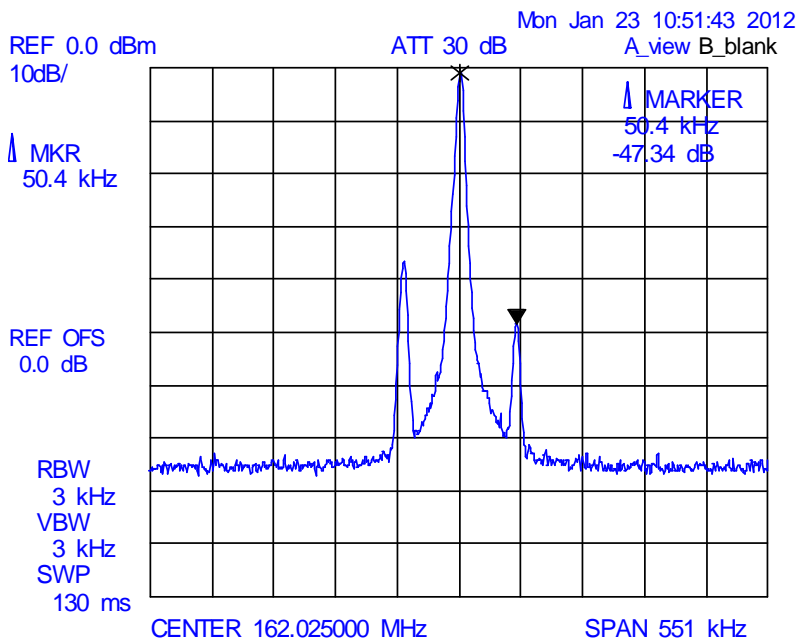
-100kHz@156.025MHz



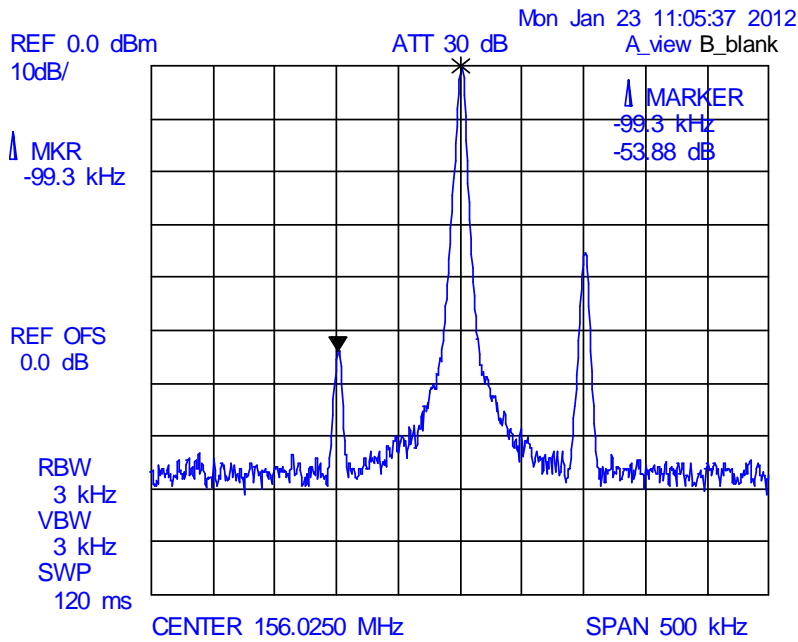
-100kHz@162.025MHz



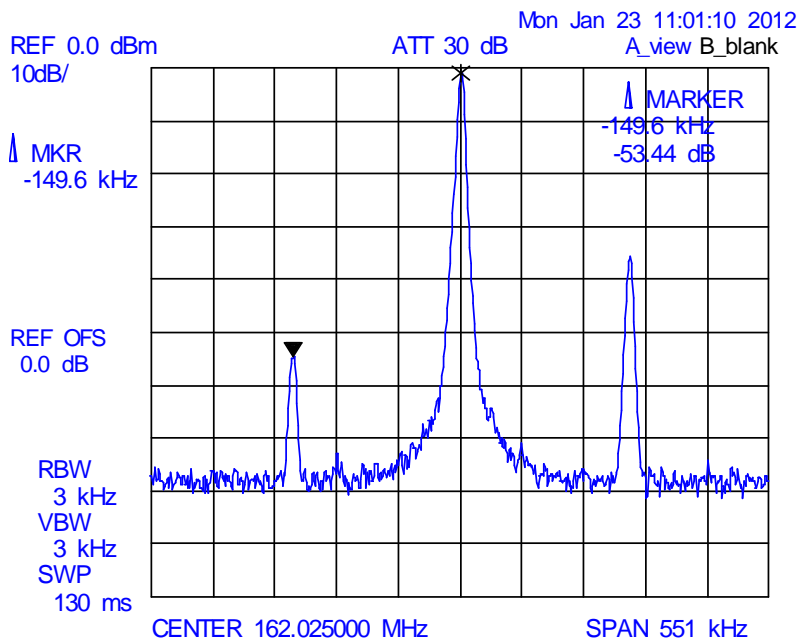
-50kHz@156.025MHz



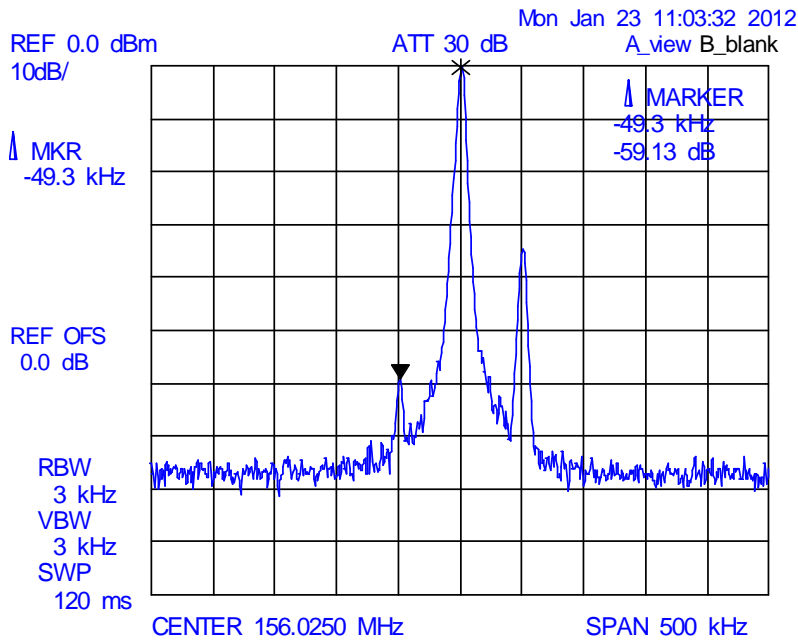
-50kHz@162.025MHz



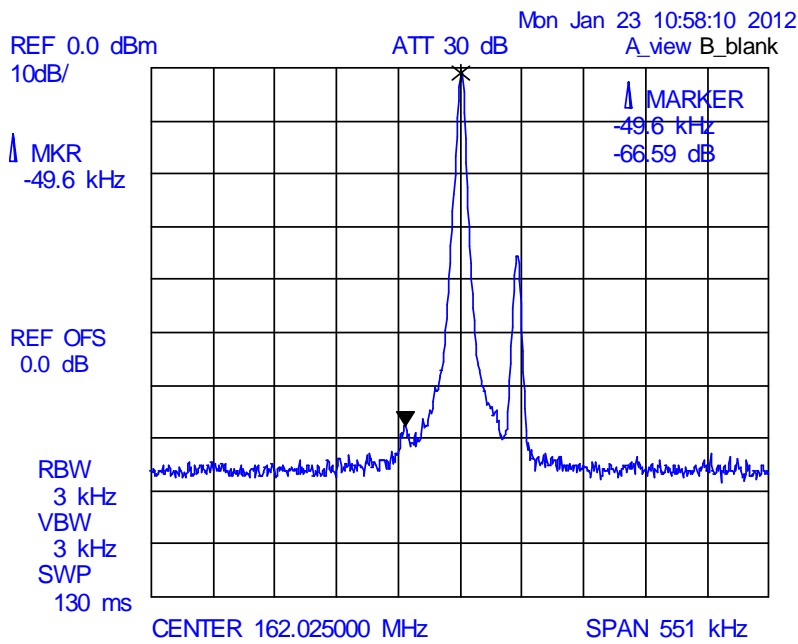
+100kHz@156.025MHz



+100kHz@162.025MHz



+50kHz@156.025MHz



+50kHz@162.025MHz

IEC 62320-1

4.2.7 Conducted spurious emission at the antenna from the transmitter

Clause 9.4.2

Transmitter unmodulated

Power level at which the measurement has been performed: 12.5W

Spurious Emissions								
Regional Frequency 156.025 MHz			AIS 1 161.975 MHz			AIS 2 162.025 MHz		
Freq. MHz	Bandw. kHz	Level dBm	Freq. MHz	Bandw. kHz	Level dBm	Freq. MHz	Bandw. kHz	Level dBm
-	-	-	-	-	-	324.05	100	-45.70
			-	-	-	0.009 -1000	10	
-	-	-	-	-	-	1000 - 2000	1000	
-	-	-	-	-	-	All others	-	*
Measurement uncertainty			Frequency ≤ 2 GHz: ±0.9 dB					

*more than 10 dB below the limits. (9 kHz – 2 GHz)

Bandwidth (kHz) refers to the bandwidth of the measuring receiver.

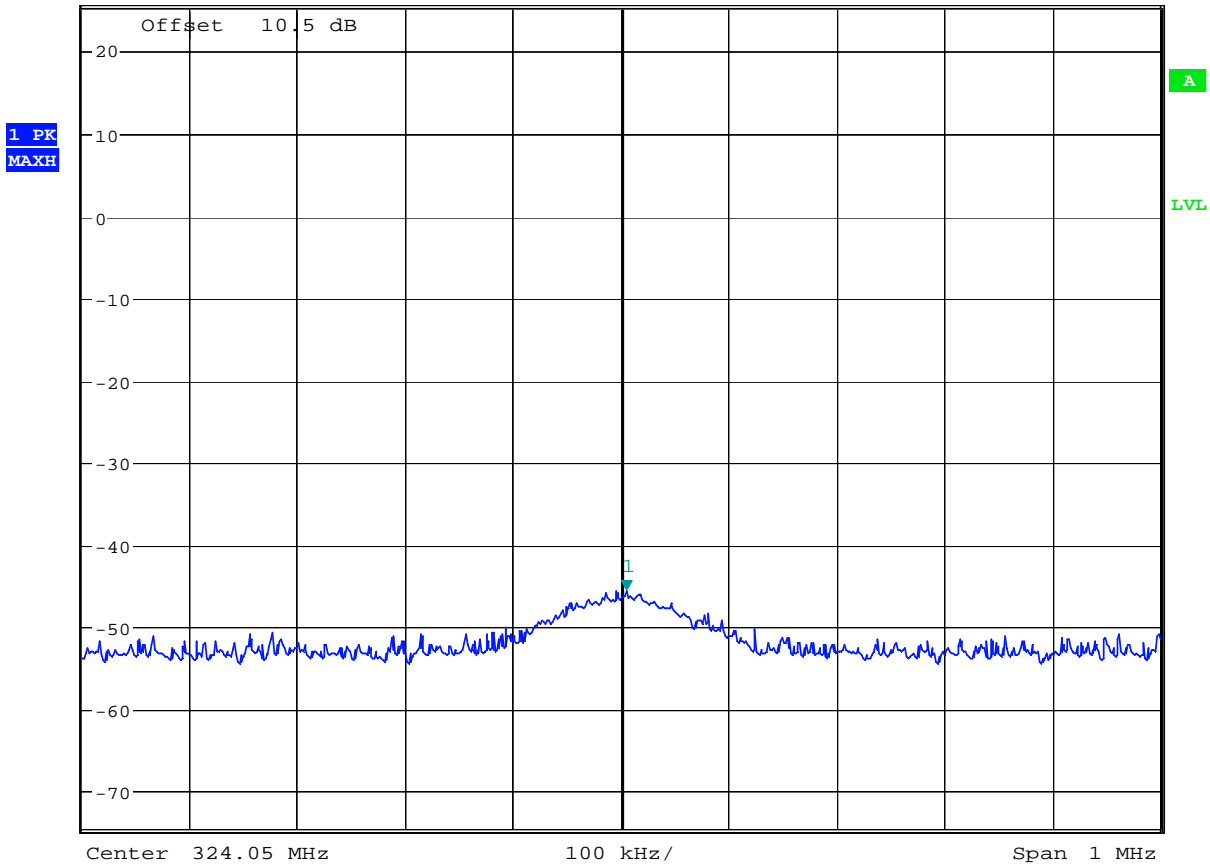
Power Source: AC mains

9.4.2.3 Required results

Frequency range	9 kHz to 1 GHz	above 1 to 2GHz
Tx operating	0,25 µW (-36,0 dBm)	1,00 µW (-30,0 dBm)

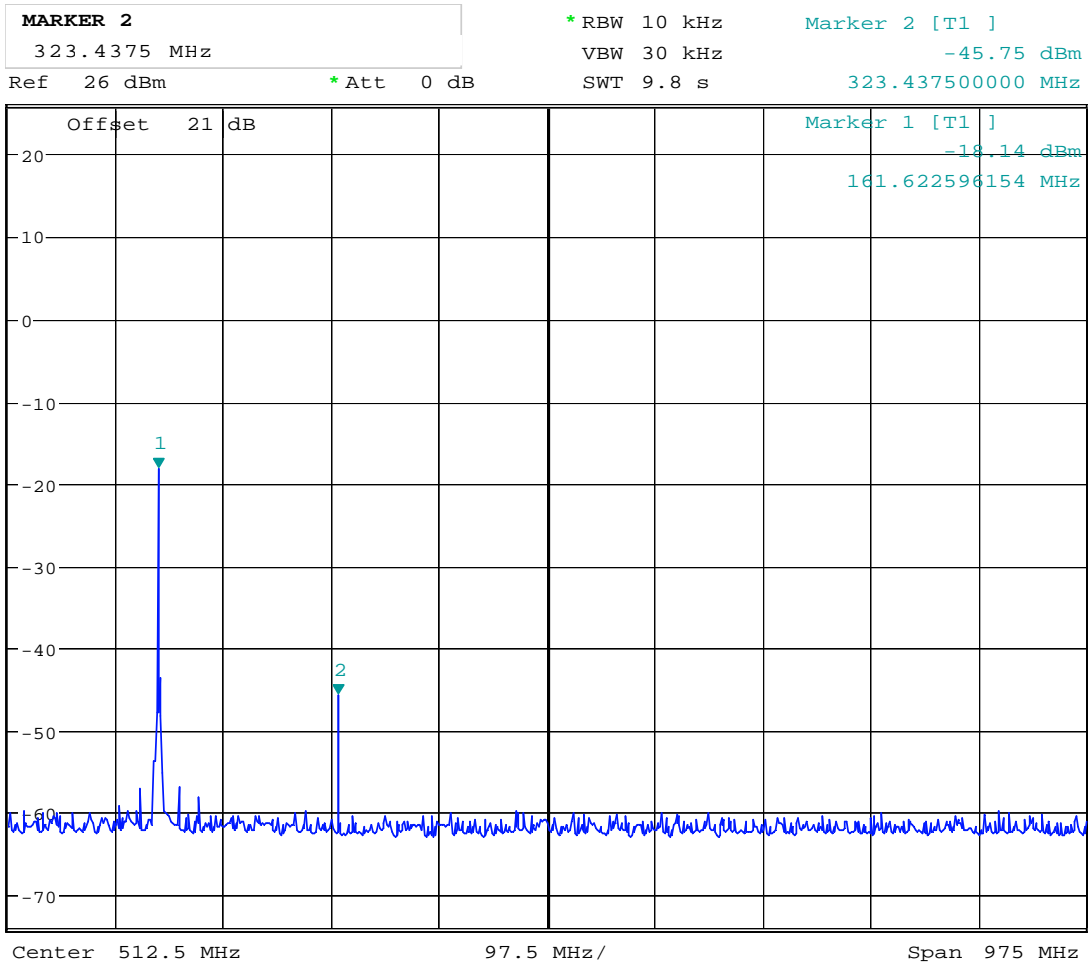
Test Equipment Used: 1,4,5,6,7,10,13

MARKER 1
 324.0548077 MHz
 Ref 25.5 dBm * Att 10 dB
 * RBW 100 kHz Marker 1 [T1]
 VBW 300 kHz -45.70 dBm
 SWT 2.5 ms 324.054807692 MHz



Date: 16.JAN.2012 09:38:42

2nd harmonic of 162.025MHz (used band pass filter)



Date: 16.JAN.2012 09:57:59

Only apre scan to determine the spurious frequency – 9kHz to 1000MHz

4.3 RECEIVER MEASUREMENTS

IEC 62320-1

4.3.1 Sensitivity

Clause 9.3.1

Test Conditions		Frequency (MHz)	RX1	PER	RX2	PER	RX3	PER %
			dBm	%	dBm	%	dBm	
			RX1		RX2		RX2	
23°C	230Vac	156.025	-117.9	11.5	-117.9	9	-115.9	7
		162.025	-117.9	15	-116.9	5.5	-115.9	14.5
-15°C	207Vac	156.025	-115.5	1	-115.5	0	-115.5	3
		162.025	-115.5	0.5	-115.5	0.5	-115.5	8
	253Vac	156.025	-115.5	1	-115.5	0	-115.5	3
		162.025	-115.5	0.5	-115.5	0.5	-115.5	8
+55°C	207Vac	156.025	-115.5	0.5	-115.5	1.5	-115.5	0
		162.025	-115.5	0	-115.5	2.0	-115.5	10.5
	253Vac	156.025	-115.5	0.5	-115.5	1.5	-115.5	0
		162.025	-115.5	0	-115.5	2.0	-115.5	10.5
Measurement uncertainty			+ 1.1/- 1.2 dB					

9.3.2.3 Required result

A minimum PER of 20 % is required.

Test Equipment Used: 1,3,8,9,10,11,13,15,22,23,24

IEC 62320-1

4.3.2 Error behaviour at high input levels for 25kHz operation

Clause 9.3.3

Rf Input To Receiver	PER %		
	RX1	RX2	RX3
-77 dBm	0.5	0	0
-7 dBm	0.5	0	0
Measurement uncertainty	-		

Input signal of 161.975MHz is modulated with test signal number 3 as specified in the standard.

9.3.3.3 Required results

The PER shall not exceed 1 % in either case.

Test Equipment Used: 1,3,10,12,13

IEC 62320-1

4.3.3 Co-Channel Rejection for 25kHz operation

Clause 9.3.4

	Co-Channel Rejection PER (%)		
	Rx1	Rx2	Rx3
156.025 MHz	0	0	0.5
162.025 MHz	0	0	0
Measurement uncertainty	-		

The level of the wanted signal : -104 dBm

The level of the unwanted signal: -114 dBm

The lowest value of the five measurement results noted shall be recorded as the co-channel rejection.

9.3.4.3 Required result

The PER shall not exceed 20 %.

Test Equipment Used: 1,3,10,12,13

IEC 62320-1

4.3.4 Adjacent Channel Selectivity for 25kHz operation

Clause 9.3.6

	Adjacent Channel Selectivity					
	PER(%)					
	RX1		RX2		RX3	
	+	-	+	-	+	-
156.025MHz	0.5	0	0.5	0.5	0.5	0
162.025MHz	0	0	0	1	0	0
Measurement uncertainty	-					

The level of the wanted signal : -104 dBm

The level of the unwanted signal: -34 dBm

9.3.4.3 Required result

The PER shall not exceed 20 %.

Test Equipment Used: 1,3,10,12,13

IEC 62320-1

4.3.5 Spurious Response Rejection for 25kHz operation

Clause 9.3.8

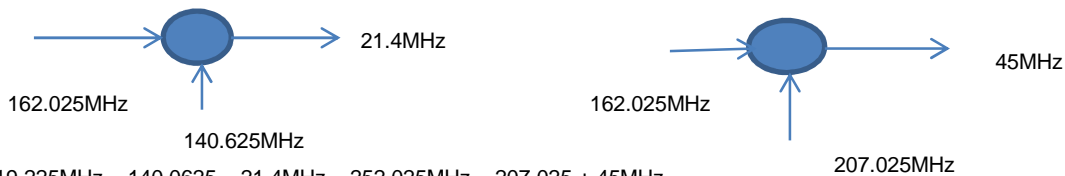
Spurious Response Rejection					
RX1		RX2		RX3	
Frequency MHz	PER %	Frequency MHz	PER %	Frequency MHz	PER %
119.225	0.5	119.225	0	252.025	0
302.550	0	302.550	0	458.950	0
443.125	0	443.125	0	665.925	0
583.900	0	583.900	0	872.900	0
259.750	0	259.750	0	368.950	0
400.325	0	400.325	0	575.925	0
540.700	0	540.700	0	782.900	0
Measurement uncertainty		-			

The level of the wanted signal : -101 dBm

The level of the unwanted signal: -31 dBm

The searching was performed through out the range. Only at the mirror frequency the response was noted significantly.

LO: 21.4 MHz and 45MHz



$119.225\text{MHz} = 140.625 - 21.4\text{MHz}$, $252.025\text{MHz} = 207.025 + 45\text{MHz}$

9.3.8.9 Required results

At any frequency separated from the specified frequency of the receiver by two channels or more, the PER shall not exceed 20 %.

Test Equipment Used: 1,3,10,12,13,14

IEC 62320-1

4.3.6 Intermodulation Response Rejection

Clause 9.3.10

	Intermodulation Response Rejection PER (%)		
	Rx1	RX2	Rx3
156.025MHz	0	0.5	0
162.025MHz	1	0.5	0
Measurement uncertainty	-		

The level of the wanted signal : -101 dBm

The level of the unwanted signal: -27 dBm

9.3.10.3 Required results

The PER shall not exceed 20 %.

Test Equipment Used: 1,3,10,12,13

IEC 62320-1

4.3.7 Blocking Or Desensitisation for 25kHz

Clause 9.3.11

Frequency Of Wanted Signal	Blocking Or Desensitisation Ratio PER (%)		
	Rx1	Rx2	RX3
156.025MHz			
161.750MHz	0	0	0.5
162.025MHz			
156.300MHz	1.5	0	1
Measurement uncertainty	-		

9.3.11.3 Required results

The PER shall not exceed 20 %.

Test Equipment Used: 1,3,10,12,13,14

IEC 62320-1

4.3.8 Conducted spurious emission at the antenna from the receiver

Clause 9.4.1

Spurious Emissions								
Regional Frequency 156.025 MHz			AIS 1 161.975 MHz			AIS 2 162.025 MHz		
Freq. MHz	Bandw. kHz	Level dBm	Freq. MHz	Bandw. kHz	Level dBm	Freq. MHz	Bandw. kHz	Level dBm
-	-	-	-	-	-	0.009 - 1000	100	None detected
-	-	-	-	-	-	1000 - 2000	1000	None detected
Measurement uncertainty			Frequency ≤ 2 GHz: ±0.9 dB					

* More than 10dB below the limits. (9 kHz – 2 GHz)

Power Source : AC mains

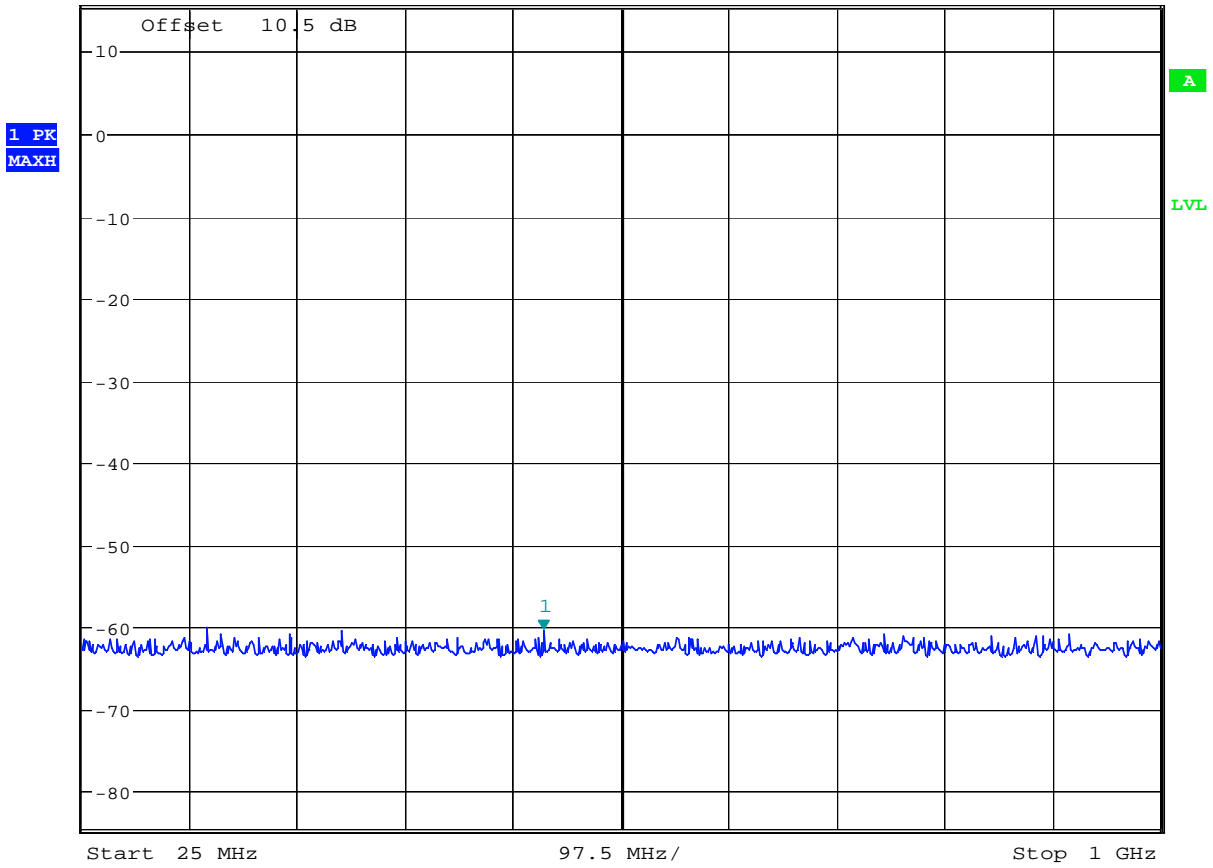
Bandwidth (kHz) refers to the bandwidth of the measuring receiver.

9.4.1.3 Required results

Conducted	Frequency Range	Limits
	9 KHz to 1000 MHz	2,0 nW (-57,0 dBm)
	above 1000 MHz	20,0 nW (-47,0 dBm)

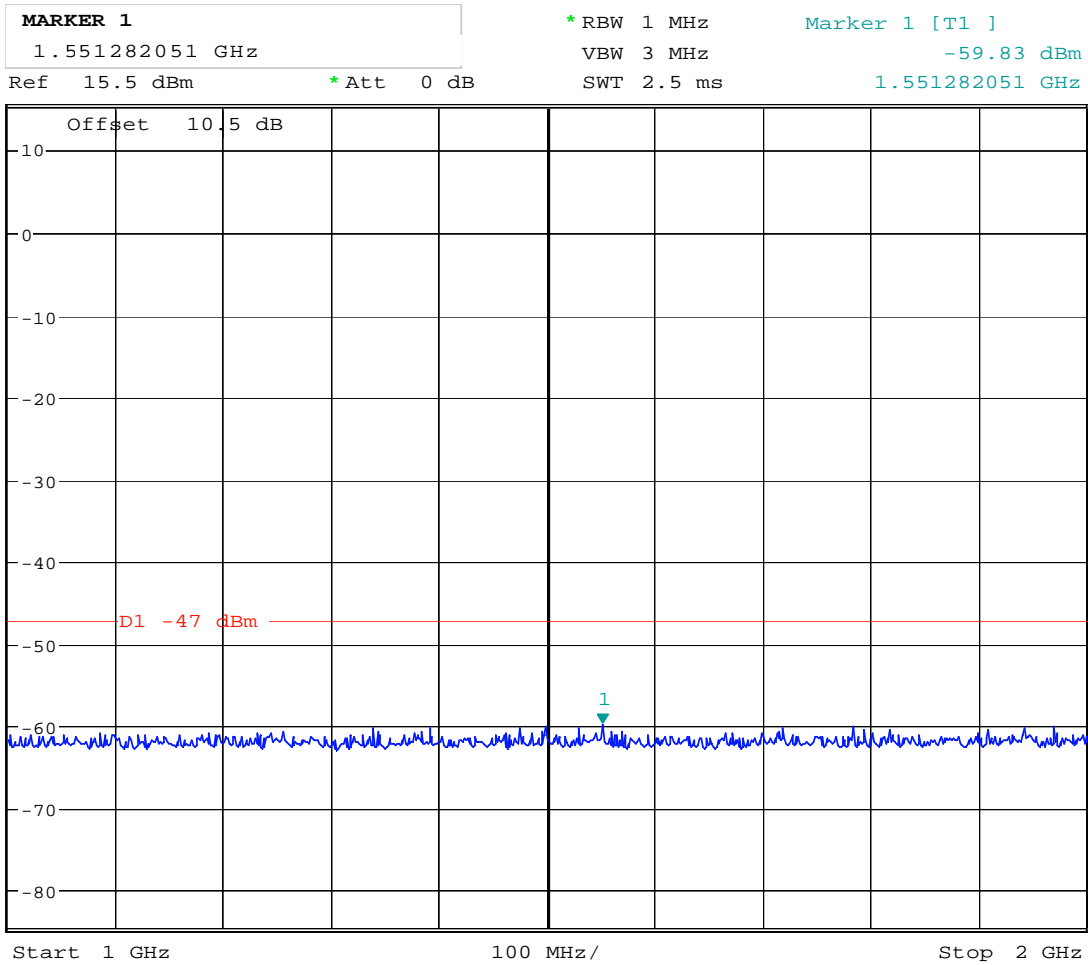
Test Equipment Used: 1,4,5,6,7,10,13

MARKER 1
442.1875 MHz
Ref 15.5 dBm * Att 0 dB * RBW 100 kHz Marker 1 [T1]
VBW 300 kHz -60.44 dBm
SWT 100 ms 442.187500000 MHz



Date: 16.JAN.2012 10:04:27

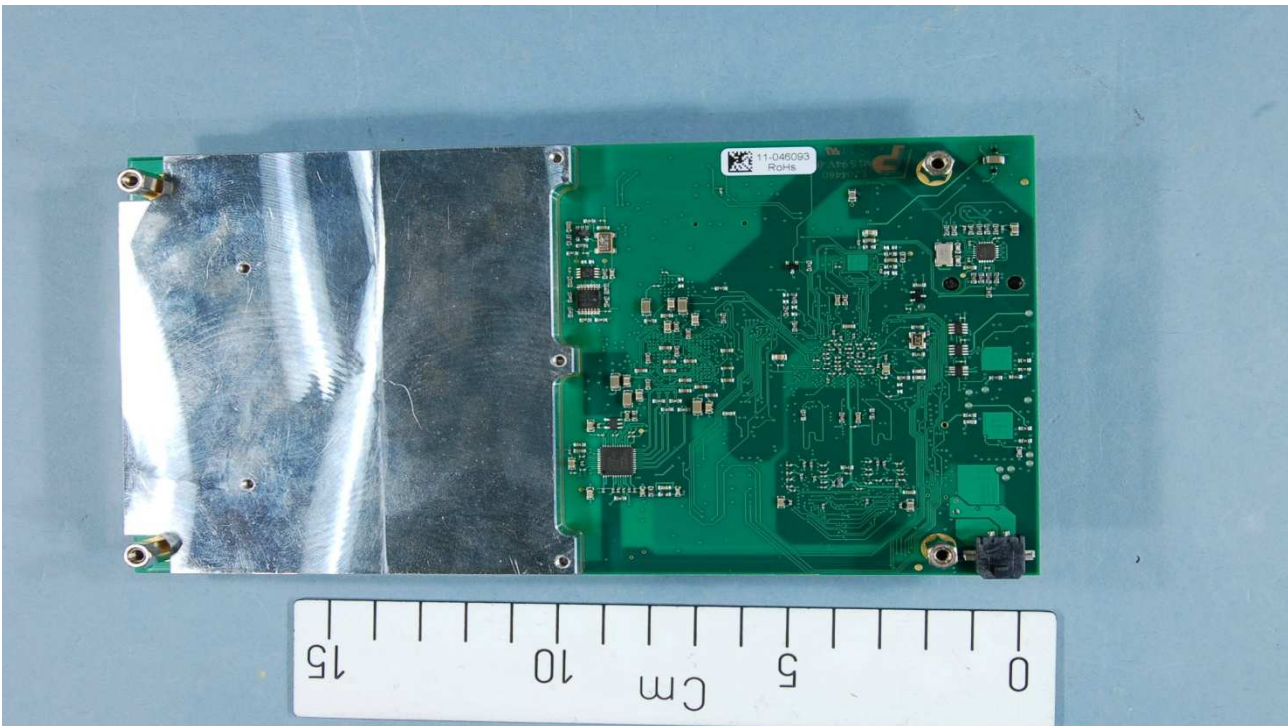
RX: 25 - 1000MHz



Date: 16.JAN.2012 10:05:19

RX: 1 - 2GHz

5 PHOTOGRAPHS OF THE EUT



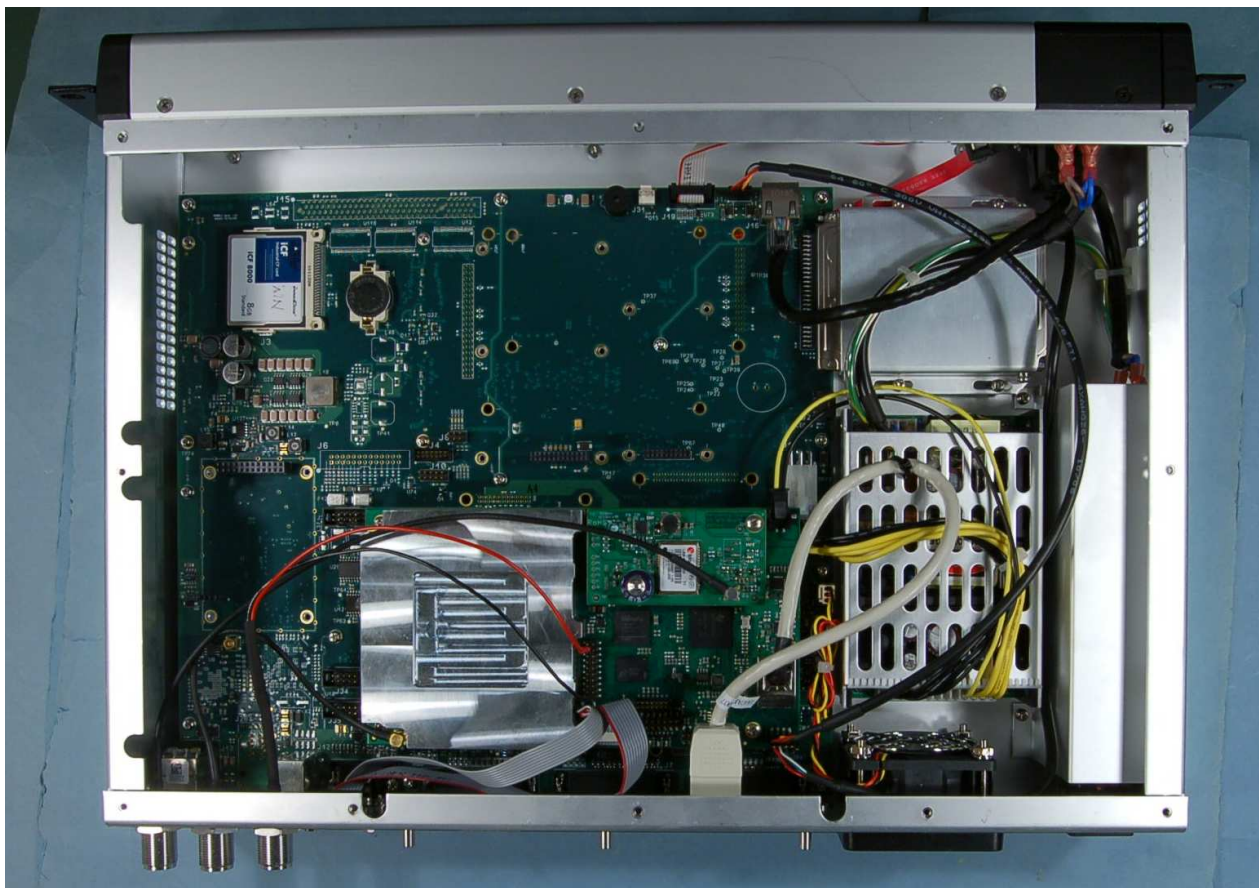
AIS module of BS600



Front view – BS600



Rear view(View of ports) – BS600



Inside view – BS600

6 Test Equipment Used

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the testhouse.

No.	Ref.	Type of Instrument	Manufacturer	Type	Cal. date	Cal. Due
1.	1504	EMI Receiver	R&S	FSU26	04.11.2011	04.11.2012
2.	1123	Spektrum Analyzer	Advantest	R3271	25.03.2010	25.03.2012
3.	130	Attenuator Adjustable	R&S	DPU	21.10.2011	21.10.2013
4.	1170	Filter Band Pass	Trilithic	5VF500/1000	Cal b4 use	Cal b4 use
5.	46	Filter Band Pass	Texn	5VF190/375	Cal b4 use	Cal b4 use
6.	1174	Filter Band Pass	Trilithic	5VF1000/2000	Cal b4 use	Cal b4 use
7.	1169	Filter Band Pass	Trilithic	5VF250/500	Cal b4 use	Cal b4 use
8.	1007	Attenuator	Narda	765-10	18.10.2011	18.10.2013
9.	1196	Attenuator	Narda	768-20	16.09.2010	16.09.2012
10.	1195	Attenuator	Narda	768-30	16.09.2010	16.09.2012
11.	1194	Attenuator	Narda	768-30	18.10.2011	18.10.2013
12.	1554	Generator, RF	Marconi	2040	12.12.2011	12.12.2013
13.	1079	Generator, AF../UHF	R&S	SMHU56	02.03.2010	02.03.2012
14.	1087	Radiocomm Analyzer	R&S	CMTA 54	22.02.2010	22.02.2012
15.	1083	Climate Chamber Temp	ACS	TY80	18.03.2010	18.03.2012
16.	666	Power Supply	Oltronix	B603D	Cal b4 use	Cal b4 use
17.	1239	Oscilloscope	Philips	PM3392A	15.10.2009	15.10.2012
18.	52	Circulator, 160 -	PHIL	2722 162	Cal b4 use	Cal b4 use
19.	53	Circulator, 160 -	PHIL	2722 162	Cal b4 use	Cal b4 use
20.	1191	Attenuator	Narda	768-30	16.09.2010	16.09.2012
21.	1156	Amplifier RF, GTEM	Amp.Res.	25W1000M1	Cal b4 use	Cal b4 use
22.		AC voltage regulator			NA	NA
23.	1598	Multimeter	Fluke	87V	03.11.2011	03.11.2012
24.	1013	Counter Freq	HP	5385A	02.11.2011	02.11.2013