

Test Report

Report Number:

F190015E1

Equipment under Test (EUT):

**AIS Class B Transponder
CAMINO-108S**

Applicant:

Alltek Marine Electronics Corporation

Manufacturer:

Alltek Marine Electronics Corporation



Deutsche
Akkreditierungsstelle
D-PL-17186-01-01
D-PL-17186-01-02
D-PL-17186-01-03

References

[1] **IEC 62287-1 Edition 3.0 2017-04**, Maritime navigation and radiocommunication equipment and systems – Class B shipborne equipment of the automatic identification system (AIS) – Part 1: Carrier-sense time division multiple access (CSTDMA) techniques

Test Result

The requirements of the tests performed as shown in the overview (clause 4) were fulfilled by the equipment under test. The complete test results are presented in the following.

Tested and
written by: _____
Name: Thomas KÜHN

Signature: 
Date: 23.07.2019

Authorized
reviewer: _____
Name: Bernd STEINER

Signature: 
Date: 23.07.2019

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1 Identification

1.1 Applicant

Name:	Alltek Marine Electronics Corporation
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Country:	Taiwan
Name for contact purposes:	Mr. H.A. CHEN
eMail Address:	ch@alltekmarine.com
Applicant represented during the test by the following person:	None

1.2 Manufacturer

Name:	Alltek Marine Electronics Corporation
Address:	14F-2, No. 237, Sec. 1, Datong Rd., Xizhi Dist., New Taipei City, 22161
Country:	Taiwan
Name for contact purposes:	Mr. H.A. CHEN
eMail Address:	ch@alltekmarine.com
Manufacturer represented during the test by the following person:	None

1.3 Test Laboratory

The tests were carried out by: **PHOENIX TESTLAB GmbH**
Königswinkel 10
32825 Blomberg
Germany

Accredited by *Deutsche Akkreditierungsstelle GmbH* in compliance with
DIN EN ISO/IEC 17025 under Reg. No. **D-PL-17186-01-02**.

1.4 EUT (Equipment Under Test)

Test object: *	AIS Class B Transponder with antenna splitter
Type: *	CAMINO-108S
Serial number:	A8K08S002
Printed circuit designation: *	M-PCB-S162MBV1, M-PCB-B108MBV1 and M-PCB-B108IOBV1
Software version: *	V1.2.8

*: Declared by the applicant.

1.5 Technical Data Of Equipment

Power supply: *	External DC power supply		
Supply voltage: *	$U_{\text{Nom}} = 12.0 \text{ V}_{\text{DC}}$	$U_{\text{Min}} = 9.6 \text{ V}_{\text{DC}}$	$U_{\text{Max}} = 31.2 \text{ V}_{\text{DC}}$
Alignment range: *	156.025 to 162.025 MHz		
Switching range: *	156.025 to 162.025 MHz		
Channel separation: *	25 kHz		
Data rate: *	9600 bps per channel		
Rated RF output power: *	2 W / 33 dBm		

*: Declared by the applicant

Ports/Connectors

Identification	Connector		Length
	EUT	Ancillary	
PWR/Data	12-pin connector	None	1 m
GPS	TNC	-	Not used during test
VHF Radio	SO-239	-	Not used during test
Antenna	SO-239	N-connector	0.5 m
NMEA2000	5-pin M12-Connector	-	Not used during test
USB	Mini-USB	USB	Not used during test
FM	SMA	-	Not used during test

1.6 Dates

Date of receipt of test sample:	07.01.2019
Start of test:	08.07.2019
End of test:	16.07.2019

2 Operational States

The EUT is an AIS class B transceiver with antenna splitter. It contains two AIS receivers, which are continuously receiving on a certain frequency, an AIS transmitter, which operates on one channel and an antenna splitter board.

If not otherwise stated, for the documented receiver tests the receivers were set as follows: receiver A receiving on 156.025 MHz and receiver B receiving on 162.025 MHz.

If not otherwise stated, the EUT was powered by an external DC power supply with 12 V_{DC}.

3 Additional Information

The test-signals were generated by AIS-simulators supplied by the applicant. For the receiver-tests the output-signal of the simulators were used to modulate calibrated RF-generators from PHOENIX TESTLAB. The received data-telegrams were compared with the transmitted data-telegrams and the packet error rate was calculated with the help of a test-software (Camino 108S/B600S Certification Program) on a laptop PC connected to the NMEA0183 port of the EUT (via an NMEA0183 to RS232 converter, supplied by the applicant).

A number of 200 Packets (unless otherwise stated) were used to calculate the Packet Error Rate PER.

Test-signal overview:

Test-signal:	Mode:	Bit pattern:
4	AIS	Pseudo Random Bit Sequence (defined in part 8.3.4) [1]
5	AIS	Pseudo Random Bit Sequence (defined in part 8.3.5) [1]

The EUT contains also a GPS receiver. Object of this test report is the AIS transceiver part of the EUT only.

4 Overview

Clause	Test Parameter	Status	Refer to page	Result
11.1 [1] TDMA transmitter				
11.1.1 [1]	Frequency error	Not ordered by the Applicant		
11.1.2 [1]	Carrier power	Applicable	8	Passed
11.1.3 [1]	Transmission spectrum	Not ordered by the Applicant		
11.1.4 [1]	Modulation accuracy	Not ordered by the Applicant		
11.1.5 [1]	Transmitter output power versus time function	Not ordered by the Applicant		
11.2 [1] TDMA receiver				
11.2.1 [1]	Sensitivity	Applicable	9	Passed
11.2.2 [1]	Error behaviour at high input level	Applicable	10	Passed
11.2.3 [1]	Co-channel rejection	Not ordered by the applicant		
11.2.4 [1]	Adjacent channel selectivity	Not ordered by the applicant		
11.2.5 [1]	Spurious response rejection	Applicable	11	Passed
11.2.6 [1]	Intermodulation response rejection and blocking	Applicable	13	Passed
11.2.7 [1]	Blocking or desensitisation	Applicable	14	Passed
11.3 [1] Conducted spurious emissions				
11.3.1 [1]	Spurious emissions from the receiver	Applicable	16	Passed
11.3.2 [1]	Spurious emissions from the transmitter	Applicable	17	Passed

5 Results

5.1 Carrier Power (conducted)

Subclause 11.1.2 [1]

Ambient temperature	22 °C	Relative humidity	57 %
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Operation mode: Intermittent transmission without modulation on 156.025 MHz

Test conditions		Carrier power (Conducted)	Limit	Result
T_{nom} (+20°C)	U_{nom} (12.0 V DC)	32.7 dBm	31.5 dBm to 34.5 dBm	Passed
T_{min} (-15°C)	U_{min} (9.6 V DC)	32.2 dBm	30.0 dBm to 36.0 dBm	Passed
	U_{max} (31.2 V DC)	33.9 dBm	30.0 dBm to 36.0 dBm	Passed
T_{max} (+55°C)	U_{min} (9.6 V DC)	31.6 dBm	30.0 dBm to 36.0 dBm	Passed
	U_{max} (31.2 V DC)	32.8 dBm	30.0 dBm to 36.0 dBm	Passed
Measurement uncertainty		+ 0.66 dB / - 0.72 dB		

Operation mode: Intermittent transmission without modulation on 162.025 MHz

Test conditions		Carrier power (Conducted)	Limit	Result
T_{nom} (+20°C)	U_{nom} (12.0 V DC)	32.6 dBm	31.5 dBm to 34.5 dBm	Passed
T_{min} (-15°C)	U_{min} (9.6 V DC)	32.2 dBm	30.0 dBm to 36.0 dBm	Passed
	U_{max} (31.2 V DC)	33.3 dBm	30.0 dBm to 36.0 dBm	Passed
T_{max} (+55°C)	U_{min} (9.6 V DC)	31.2 dBm	30.0 dBm to 36.0 dBm	Passed
	U_{max} (31.2 V DC)	31.8 dBm	30.0 dBm to 36.0 dBm	Passed
Measurement uncertainty		+ 0.66 dB / - 0.72 dB		

Remark: This measurement was carried out with a spectrum analyser with average detector and max-hold over 200 transmissions.

Limit: Subclause 11.1.2.3 [1]

At all test frequencies, the carrier power shall be $33 \text{ dBm} \pm 1.5 \text{ dBm}$ under normal test conditions.
At all test frequencies, the carrier power shall be $33 \text{ dBm} \pm 3 \text{ dBm}$ under extreme test conditions.

Test equipment used (refer clause 6):

4, 14, 15, 19, 20

5.2 Sensitivity

Subclause 11.2.1 [1]

Ambient temperature	22 °C	Relative humidity	57 %
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Operation mode: Receive on 156.025 MHz (-107 dBm (normal) / -104 dBm (normal ± 500 Hz) / -101 dBm (extreme) conditions)

Wanted signal: Test signal 5

Test conditions		Frequency	Packet Error Rate PER	Result
Temperature	Voltage			
T_{nom} (+ 20 °C)	U_{nom} (12.0 V DC)	156.0245 MHz	3.9 %	Passed
		156.0250 MHz	5.7 %	Passed
		156.0255 MHz	0.9 %	Passed
T_{min} (-15 °C)	U_{min} (9.6 V DC)	156.0250 MHz	1.3 %	Passed
	U_{max} (31.2 V DC)	156.0250 MHz	2.6 %	Passed
T_{max} (55 °C)	U_{min} (9.6 V DC)	156.0250 MHz	0.4 %	Passed
	U_{max} (31.2 V DC)	156.0250 MHz	1.3 %	Passed
Measurement uncertainty		+ 0.9 dB / - 1.0 dB		

Operation mode: Receive on 162.025 MHz (-107 dBm (normal) / -104 dBm (normal ± 500 Hz) / -101 dBm (extreme) conditions)

Wanted signal: Test signal 5

Test conditions		Frequency	Packet Error Rate PER	Result
Temperature	Voltage			
T_{nom} (+ 20 °C)	U_{nom} (12.0 V DC)	162.0245 MHz	0.0 %	Passed
		162.0250 MHz	1.7 %	Passed
		162.0255 MHz	0.0 %	Passed
T_{min} (-15 °C)	U_{min} (9.6 V DC)	162.0250 MHz	6.1 %	Passed
	U_{max} (31.2 V DC)	162.0250 MHz	2.2 %	Passed
T_{max} (55 °C)	U_{min} (9.6 V DC)	162.0250 MHz	0.0 %	Passed
	U_{max} (31.2 V DC)	162.0250 MHz	0.0 %	Passed
Measurement uncertainty		+ 0.9 dB / - 1.0 dB		

Limit: Subclause 11.2.1.3 [1]

The PER shall not exceed 20 % (with a wanted signal level of -107 dBm (normal conditions), -104 dBm (normal conditions ± 500 Hz) and -101 dBm (extreme conditions)).

Test equipment used (refer clause 6):

7, 14, 15, 19

5.3 Error Behaviour At High Input Levels

Subclause 11.2.2 [1]

Ambient temperature	22 °C
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Relative humidity	43 %
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Operation mode: Receive on 156.025 MHz

RF-input signal level	Packet Error Rate PER	Result
- 77 dBm	0.4 %	Passed
- 7 dBm	0.0 %	Passed
Measurement uncertainty	+ 0.9 dB / - 1.0 dB	

Operation mode: Receive on 162.025 MHz

RF-input signal level	Packet Error Rate PER	Result
- 77 dBm	0.0 %	Passed
- 7 dBm	0.0 %	Passed
Measurement uncertainty	+ 0.9 dB / - 1.0 dB	

Limit: Subclause 11.2.2.3 [1]

The maximum PER shall not exceed 2 % at -77 dBm and 10 % at -7 dBm.

Test equipment used (refer clause 6):

7, 14, 15

5.4 Spurious Response Rejection

Subclause 11.2.5 [1]

Ambient temperature	22 °C	Relative humidity	43 %
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Operation mode: Receive on 156.025 MHz (receiver channel A, 1st LO-Freq. = 111.025 MHz)
 IF frequencies: IF₁ = 45 MHz, IF₂ = 455 kHz
 Wanted signal: P = -101 dBm
 Unwanted signal: Modulated with 400 Hz / 3 kHz deviation, P = -31 dBm

Results of the specific frequencies of interest			
Definition	Unwanted frequency	Packet Error Rate PER	Result
1st IF	45.000 MHz	0.0 %	Passed
1st LO-Freq. – IF	66.025 MHz	0.4 %	Passed
2 x 1st LO-Freq. – IF	177.050 MHz	0.4 %	Passed
2 x 1st LO-Freq. + IF	267.050 MHz	0.9 %	Passed
3 x 1st LO-Freq. – IF	288.075 MHz	1.3 %	Passed
3 x 1st LO-Freq. + IF	378.075 MHz	1.7 %	Passed
4 x 1st LO-Freq. – IF	399.100 MHz	1.3 %	Passed
4 x 1st LO-Freq. + IF	489.100 MHz	1.3 %	Passed
Measurement uncertainty		+ 0.8 dB / - 0.9 dB	

Limited frequency range: 62.570 MHz to 165.480 MHz (stepped with 5 kHz)
 Operation mode: Receive on 156.025 MHz (receiver channel A, 1st LO-Freq. = 111.025 MHz)
 IF frequencies: IF₁ = 45 MHz, IF₂ = 455 kHz
 Wanted signal: P = -101 dBm
 Unwanted signal: Modulated with 400 Hz / 3 kHz deviation,
 P = -31 dBm (measurement) / -21 dBm (searching over the limited frequency range)

Results of the measurement over the limited frequency range			
Definition	Unwanted frequency	Packet Error Rate PER	Result
Search result	154.820 MHz	11.8 %	Passed
Search result	155.115 MHz	7.0 %	Passed
Search result	155.285 MHz	1.7 %	Passed
Search result	155.530 MHz	0.4 %	Passed
Search result	155.630 MHz	0.4 %	Passed
Search result	155.725 MHz	9.2 %	Passed
Search result	156.330 MHz	7.9 %	Passed
Search result	158.835 MHz	5.3 %	Passed
Search result	159.035 MHz	1.7 %	Passed
Search result	159.440 MHz	0.9 %	Passed
Search result	160.175 MHz	0.4 %	Passed
Search result	163.125 MHz	2.6 %	Passed

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Spurious response rejection (Continued):

Operation mode: Receive on 162.025 MHz (receiver channel B, 1st LO-Freq. = 140.625 MHz)
 IF frequencies: IF₁ = 21.4 MHz, IF₂ = 455 kHz
 Wanted signal: P = -101 dBm
 Unwanted signal: Modulated with 400 Hz / 3 kHz deviation, P = -31 dBm

Results of the specific frequencies of interest			
Definition	Unwanted frequency	Packet Error Rate PER	Result
1 st IF	21.400 MHz	1.7 %	Passed
1 st LO-Freq. – IF	119.225 MHz	0.0 %	Passed
2 x 1 st LO-Freq. – IF	259.850 MHz	1.3 %	Passed
2 x 1 st LO-Freq. + IF	302.650 MHz	0.0 %	Passed
3 x 1 st LO-Freq. – IF	400.475 MHz	0.0 %	Passed
3 x 1 st LO-Freq. + IF	443.275 MHz	0.0 %	Passed
4 x 1 st LO-Freq. – IF	541.100 MHz	0.9 %	Passed
4 x 1 st LO-Freq. + IF	583.900 MHz	0.0 %	Passed
Measurement uncertainty		+ 0.8 dB / - 0.9 dB	

Limited frequency range: 109.770 MHz to 165.480 MHz (stepped with 5 kHz)
 Operation mode: Receive on 162.025 MHz (receiver channel B, 1st LO-Freq. = 140.625 MHz)
 IF frequencies: IF₁ = 21.4 MHz, IF₂ = 455 kHz
 Wanted signal: P = -101 dBm
 Unwanted signal: Modulated with 400 Hz / 3 kHz deviation, P = -31 dBm (measurement) / -21 dBm (searching over the limited frequency range)

Results of the measurement over the limited frequency range			
Definition	Unwanted frequency	Packet Error Rate PER	Result
Search result	155.835 MHz	3.5 %	Passed
Search result	159.525 MHz	0.4 %	Passed
Search result	161.970 MHz	0.0 %	Passed
Search result	162.080 MHz	0.0 %	Passed
Measurement uncertainty		+ 0.8 dB / - 0.9 dB	

Limit: Subclause 11.2.5.6 [1]

At any frequency separated from the nominal frequency of the receiver by two channels or more, the spurious responses shall not result in a PER of greater than 20 %.

Test equipment used (refer clause 6):

6, 7, 10, 14, 15

5.5 Intermodulation Response Rejection

Subclause 11.2.6 [1]

Ambient temperature	22 °C	Relative humidity	43 %
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Wanted signal A: P = -101 dBm

Unwanted signal B: Unmodulated, P = -36 dBm

Unwanted signal C: Modulated with 400 Hz / 3 kHz-deviation, P = -36 dBm

Frequencies of the (un)wanted signals			Packet Error Rate PER	Result
Generator A	Generator B	Generator C		
156.025 MHz	156.075 MHz	156.125 MHz	11.0 %	Passed
	155.975 MHz	155.925 MHz	5.7 %	Passed
Measurement uncertainty:			+ 0.8 dB / - 0.9 dB	

Wanted signal A: P = -101 dBm

Unwanted signal B: Unmodulated, P = -36 dBm

Unwanted signal C: Modulated with 400 Hz / 3 kHz-deviation, P = -36 dBm

Frequencies of the (un)wanted signals			Packet Error Rate PER	Result
Generator A	Generator B	Generator C		
162.025 MHz	162.075 MHz	162.125 MHz	6.6 %	Passed
	161.975 MHz	161.925 MHz	8.8 %	Passed
Measurement uncertainty:			+ 0.8 dB / - 0.9 dB	

Limit: Subclause 11.2.6.3 [1]

The PER shall not exceed 20 %.

Test equipment used (refer clause 6):

6 - 15

5.6 Blocking Or Desensitisation

Subclause 11.2.7 [1]

Ambient temperature	22 °C	Relative humidity	43 %
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Operation mode: Receive on 156.025 MHz

Wanted signal A: P = -101 dBm

Unwanted signal B: Unmodulated, P = -23 dBm (for frequency settings < 5 MHz)

Unmodulated, P = -15 dBm (for frequency settings ³ ±5 MHz, marked with *)

Frequencies of the unwanted signal		Packet Error Rate PER	Result
-10 MHz	146.025 MHz*	1.3 %	Passed
-5 MHz	151.025 MHz*	3.1 %	Passed
-2 MHz	154.025 MHz	2.6 %	Passed
-1 MHz	155.025 MHz	0.0 %	Passed
-500 kHz	155.525 MHz	1.7 %	Passed
+500 kHz	156.525 MHz	0.9 %	Passed
+1 MHz	157.025 MHz	1.7 %	Passed
+2 MHz	158.025 MHz	0.9 %	Passed
+5 MHz	161.025 MHz*	1.3 %	Passed
+10 MHz	166.025 MHz*	3.5 %	Passed
Measurement uncertainty		+ 0.8 dB / - 0.9 dB	

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Blocking or desensitisation (Continued):

Operation mode: Receive on 162.025 MHz
 Wanted signal A: P = -101 dBm
 Unwanted signal B: Unmodulated, P = -23 dBm (for frequency settings < 5 MHz)
 Unmodulated, P = -15 dBm (for frequency settings ³ ±5 MHz, marked with *)

Frequencies of the unwanted signal		Packet Error Rate PER	Result
-10 MHz	152.025 MHz*	3.9 %	Passed
-5 MHz	157.025 MHz*	2.6 %	Passed
-2 MHz	160.025 MHz	0.0 %	Passed
-1 MHz	161.025 MHz	0.0 %	Passed
-500 kHz	161.525 MHz	2.6 %	Passed
+500 kHz	162.525 MHz	0.0 %	Passed
+1 MHz	163.025 MHz	0.0 %	Passed
+2 MHz	164.025 MHz	0.0 %	Passed
+5 MHz	167.025 MHz*	0.4 %	Passed
+10 MHz	172.025 MHz*	0.4 %	Passed
Measurement uncertainty		+ 0.8 dB / - 0.9 dB	

Limit: Subclause 11.2.7.3 [1]

The maximum packet error rate shall not exceed 20 %.

Test equipment used (refer clause 6):

6, 7, 10, 14, 15

5.7 Spurious Emissions From The Receiver

Subclause 11.3.1 [1]

Ambient temperature	22 °C	Relative humidity	43 %
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Operation mode: Receiver A: $f = 156.025$ MHz, AIS-mode
 Receiver B: $f = 162.025$ MHz, AIS-mode

RS232 connected via mk RS232 to fibre optics converter

Spurious emissions level (conducted)					
f	Level	Bandwidth	Limit	Margin	Result
306.047 kHz	-68.5 dBm	10 kHz	-57.0 dBm	11.5 dB	Passed
2.063 MHz	-77.4 dBm	10 kHz	-57.0 dBm	20.4 dB	Passed
2.533 MHz	-75.2 dBm	10 kHz	-57.0 dBm	18.2 dB	Passed
4.293 MHz	-78.6 dBm	10 kHz	-57.0 dBm	21.6 dB	Passed
335.887 MHz	-77.2 dBm	100 kHz	-57.0 dBm	20.2 dB	Passed
383.997 MHz	-68.3 dBm	100 kHz	-57.0 dBm	11.3 dB	Passed
479.996 MHz	-77.4 dBm	100 kHz	-57.0 dBm	20.4 dB	Passed
Measurement uncertainty		+0.66 dB / -0.72 dB			

Remark: This measurement includes the spurious emission results of both integrated receivers (receiver A: 156.025 MHz and receiver B: 162.025 MHz).
 The emission around 70 kHz is caused by the measurement system and not by the EUT.

Limit: Subclause 11.3.1.3 [1]

The power of any spurious emission in the specified range at the antenna terminal shall not exceed -57.0 dBm (2 nW) in the frequency range 9 kHz to 1 GHz and -47.0 dBm (20 nW) in the frequency range 1 GHz to 4 GHz.

Test equipment used (refer clause 6):

3, 5, 14, 15, 21, 22

5.8 Spurious Emissions From The Transmitter

Subclause 11.3.2 [1]

Ambient temperature	22 °C	Relative humidity	43 %
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Operation mode: Transmit continuously without modulation (CW), $f = 156.025$ MHz

Spurious emissions level (conducted)					
f	Level	Bandwidth	Limit	Margin	Result
306.047 kHz	-68.5 dBm	10 kHz	-57.0 dBm	11.5 dB	Passed
134.625 MHz	-43.3 dBm	10 kHz	-36.0 dBm	7.3 dB	Passed
154.749 MHz	-47.8 dBm	100 kHz	-36.0 dBm	11.8 dB	Passed
155.387 MHz	-42.4 dBm	50 kHz	-36.0 dBm	6.4 dB	Passed
156.663 MHz	-42.9 dBm	50 kHz	-36.0 dBm	6.9 dB	Passed
157.300 MHz	-47.1 dBm	100 kHz	-36.0 dBm	11.1 dB	Passed
177.424 MHz	-48.3 dBm	50 kHz	-36.0 dBm	12.3 dB	Passed
312.050 MHz	-44.8 dBm	100 kHz	-36.0 dBm	8.8 dB	Passed
468.075 MHz	-58.5 dBm	50 kHz	-36.0 dBm	22.5 dB	Passed
624.100 MHz	-60.7 dBm	100 kHz	-36.0 dBm	24.7 dB	Passed
1092.175 MHz	-56.1 dBm	300 kHz	-30.0 dBm	26.1 dB	Passed
1560.250 MHz	-56.8 dBm	300 kHz	-30.0 dBm	26.8 dB	Passed
Measurement uncertainty		+ 0.66 dB / - 0.72 dB			

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Spurious emissions from the transmitter (continued):

Operation mode: Transmit continuously without modulation (CW), $f = 162.025$ MHz

Spurious emissions level (conducted)					
f	Level	Bandwidth	Limit	Margin	Result
306.047 kHz	-68.5 dBm	10 kHz	-57.0 dBm	11.5 dB	Passed
140.625 MHz	-42.4 dBm	10 kHz	-36.0 dBm	6.4 dB	Passed
156.663 MHz	-50.8 dBm	20 kHz	-36.0 dBm	14.8 dB	Passed
183.424 MHz	-50.5 dBm	100 kHz	-36.0 dBm	14.5 dB	Passed
324.050 MHz	-39.7 dBm	100 kHz	-36.0 dBm	3.7 dB	Passed
972.150 MHz	-59.4 dBm	50 kHz	-36.0 dBm	23.4 dB	Passed
1134.175 MHz	-55.8 dBm	300 kHz	-30.0 dBm	25.8 dB	Passed
Measurement uncertainty		+ 0.66 dB / - 0.72 dB			

Limit: Subclause 11.3.2.3 [1]

The power of any spurious emission on any discrete frequency shall not exceed 0.25 μ W (-36 dBm) in the frequency range 9 kHz to 1 GHz and 1 μ W (-30 dBm) in the frequency range 1 GHz to 4 GHz.

Test equipment used (refer clause 6):

3, 4, 14 – 18, 21, 22

6 Test Equipment Used For Tests

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal Due
1	Shielded chamber M21-1	B83117-B1232-T162	Albatross Projects	26491	481967	Calibration not necessary	
2	Shielded chamber M21	B83117-B1232-T162	Albatross Projects	26491	481966	Calibration not necessary	
3	Spectrum Analyser	FSU46	Rohde & Schwarz	200125	480956	31.10.2018	10.2019
4	Attenuator / 20 dB / 10 W	WA8 / 18-20-34	Weinschel	WA8 / 18-20-34	481451	Calibration not necessary	
5	Attenuator / 10 dB / 10 W	WA8 / 18-10-34	Weinschel	-	481449	Calibration not necessary	
6	Signal generator	SMHU 58	Rohde & Schwarz	844170/017	480266	28.02.2018	02.2020
7	Signal Generator	SMBV100A	Rohde & Schwarz	255092	481326	04.04.2019	04.2020
8	Signal generator	SMG	Rohde & Schwarz	833449/030	480013	07.03.2018	03.2020
9	Combiner	ZFSC-2-11	Mini Circuits	-	410169	Calibration not necessary	
10	Combiner	ZFSC-2-11	Mini Circuits	-	410170	Calibration not necessary	
11	Circulator	156-162MHz	DFE	-	410163	Calibration not necessary	
12	Circulator	156-162MHz	DFE	-	410164	Calibration not necessary	
13	Circulator	156-162MHz	DFE	-	410165	Calibration not necessary	
14	Power supply	TOE8852	Toellner	51704	480591	Calibration not necessary	
15	Multimeter	971A	Hewlett Packard	JP39009358	480721	19.02.2019	02.2020
16	200 MHz High pass filter	WHJ9-167-200-2000-60EF	Wainwright Instruments	1	481811	Calibration not necessary	
17	1 GHz High pass filter	WHJS1000C11/60 EF	Wainwright Instruments	1	480413	Calibration not necessary	
18	Tunable Notch Filter	WTRCD5-150-165-0.05-0.61-40EEK	Wainwright Instruments	1	481810	Calibration not necessary	
19	Dynamic temperature chamber	MK 240	WTB Binder Labortechnik GmbH	05-79022	480462	02.07.2018	07.2019
20	Signal & Spectrum Analyzer	FSW43	Rohde & Schwarz	100586 & 100926	481720	15.03.2018	03.2020
21	Digital Optical Transceiver System	optoRS232	MK Messtechnik	16-006651	482206	Calibration not necessary	
22	Digital Optical Transceiver System	optoRS232	MK Messtechnik	16-006652	482207	Calibration not necessary	

7 Report History

Report Number	Date	Comment
F190015E1	23.07.2019	Initial Test Report
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-	-	-
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8 List Of Annexes

Annex A	Photographs	17 pages
Annex B	Measurement results	8 pages