
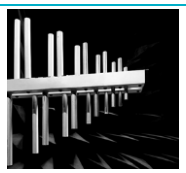
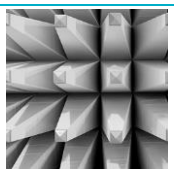

CTC advanced
member of RWTÜV group

Bundesnetzagentur

BNetzA-CAB-02/21-102

TEST REPORT

Test report no.: 1-9547/19-01-02

DAkkS Deutsche Akkreditierungsstelle D-PL-12076-01-03

Testing laboratory

CTC advanced GmbH
Untertuerkheimer Strasse 6 – 10
66117 Saarbruecken / Germany
Phone: + 49 681 5 98 - 0
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Accredited Testing Laboratory:
The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2005) by the Deutsche Akkreditierungsstelle GmbH (DAkkS)
The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12076-01-03

Applicant

Thrane & Thrane A/S
Lundtoftegaardsvej 93D
2800 Kgs. Lyngby / DENMARK
Phone: +45 39 55 88 00
Fax: +45 3955 8888
Contact: Hansen Christian
e-mail: christian.hansen@cobham.com
Phone: +45 3955 8725

Manufacturer

Thrane & Thrane A/S
trading as Cobham Aerospace Communications
Lundtoftegaardsvej 93D
2800 Kgs. Lyngby / DENMARK

Test standard/s

47 CFR Part 25	Title 47 of the Code of Federal Regulations; Chapter I; Part 25 - Satellite Communications
47 CFR Part 87	Title 47 of the Code of Federal Regulations; Chapter I; Part 87 - Aviation Services
RSS - 170 Issue 3	Mobile Earth Stations (MESs) and Ancillary Terrestrial Component (ATC) Equipment Operating in the Mobile-Satellite Service (MSS) Bands

For further applied test standards please refer to section 3 of this test report.

Test Item

Kind of test item:	**Aeronautical Satellite Terminal**
Model name:	**AVIATOR 200S**
FCC ID	**ROJ-AVIATOR200S**
IC	**6200B-AVIATOR200S**
Frequency:	RX: 1525.0 MHz – 1559.0 MHz TX: 1626.5 MHz – 1660.5 MHz
Antenna:	LGA External Antenna
Power supply:	115 V AC / 400 Hz
Temperature range:	-30°C to +70°C

This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

Test report authorized:

M. Walla
cn=Meheza Walla, o=CTC advanced GmbH, ou=WAL-200806, email=meheza.walla@ctcadvanced.com, c=DE
2021.11.16 15:40:30 +01'00'

Meheza Walla
Lab Manager
Radio Communications & EMC

Test performed:

Thomas Vogler
cn=Thomas Vogler, o=CTC advanced GmbH, ou=VOG-161125, email=thomas.vogler@ctcadvanced.com, c=DE
2021.11.16 15:10:59 +01'00'

Thomas Vogler
Lab Manager
Radio Communications & EMC

1 Table of contents

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2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. CTC advanced GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.
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2.2 Application details

Date of receipt of order:	2020-02-02
Date of receipt of test item:	2020-04-24
Start of test:	2020-04-29
End of test:	2020-06-19
Person(s) present during the test:	--

2.3 Test laboratories sub-contracted

None

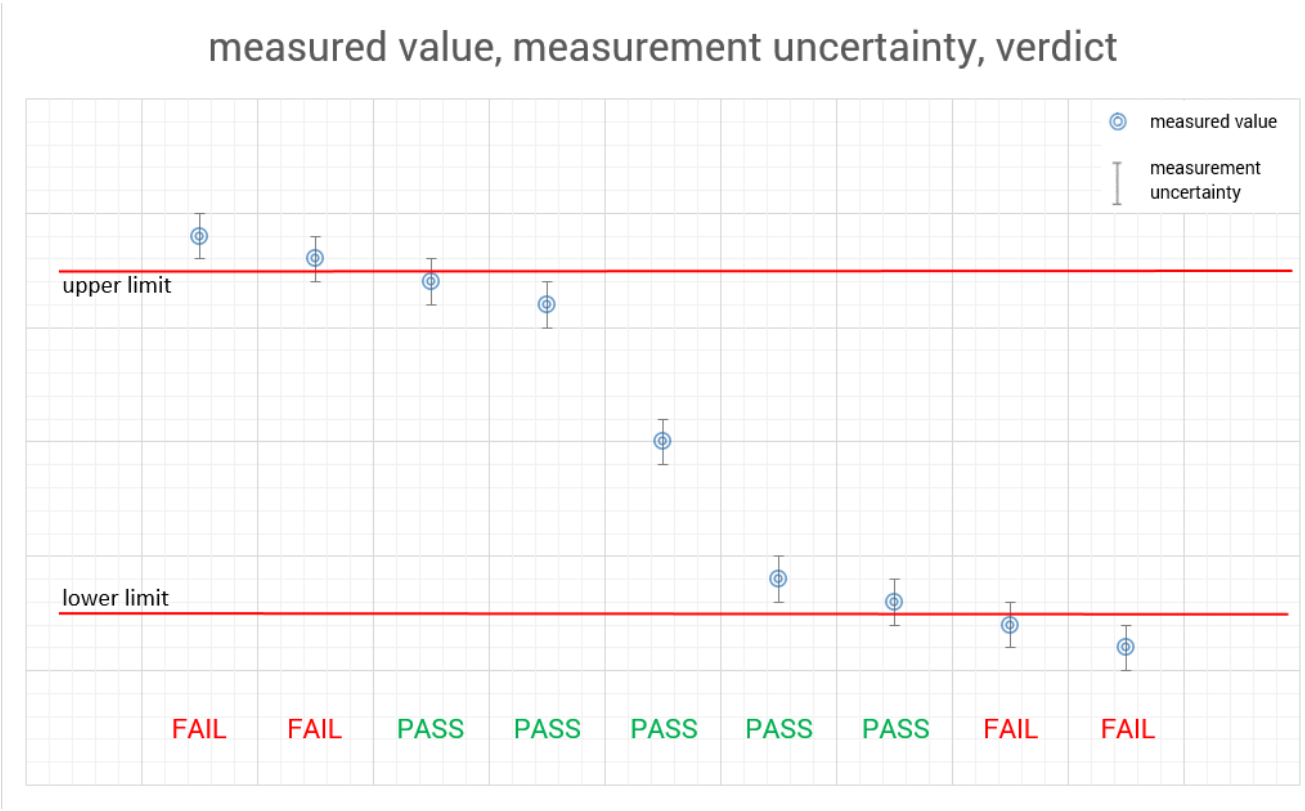
3 Test standard/s and references

Test standard	Date	Description
47 CFR Part 25		Title 47 of the Code of Federal Regulations; Chapter I; Part 25 - Satellite Communications
47 CFR Part 87		Title 47 of the Code of Federal Regulations; Chapter I; Part 87 - Aviation Services
RSS - 170 Issue 3	07-2015	Mobile Earth Stations (MESs) and Ancillary Terrestrial Component (ATC) Equipment Operating in the Mobile-Satellite Service (MSS) Bands

Guidance	Version	Description
ANSI C63.4-2014	-/-	American national standard for methods of measurement of radio-noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz
ANSI C63.10-2013	-/-	American national standard of procedures for compliance testing of unlicensed wireless devices

3.1 Reporting statements of conformity – decision rule

Only the measured values related to their corresponding limits will be used to decide whether the equipment under test meets the requirements of the test standards listed in chapter 3.
The measurement uncertainty is mentioned in this test report, but is not taken into account - neither to the limits nor to the measurement results. Measurement results with a smaller margin to the corresponding limits than the measurement uncertainty have a potential risk of more than 5% that the decision might be wrong."



4 Test environment

Temperature	:	T_{nom} T_{max} T_{min}	+22 °C during room temperature tests +70 °C during high temperature tests -30 °C during low temperature tests
Relative humidity content	:		55 %
Barometric pressure	:		1021 hpa
Power supply	:	V_{nom} V_{max} V_{min}	115 V AC / 400 Hz 126.5 V 103.5 V

5 Test item

5.1 General description

Kind of test item:	**Aeronautical Satellite Terminal**
Type identification:	**AVIATOR 200S**
HMN:	-/-
PMN:	AVIATOR 200S
HVIN:	AVIATOR 200S
FVIN:	-/-
S/N serial number:	Refer to 5.2
hardware status:	Refer to 5.2
software status:	Refer to 5.2
Frequency band:	RX: 1525.0 MHz – 1559.0 MHz TX: 1626.5 MHz – 1660.5 MHz
TX output power cond.:	37.9 dBm (measured value)
TX output power rad. (EIRP):	41.7 dBm (calculated value)
Type of modulation:	QPSK, 64 QAM, 32 QAM, 16 QAM
Channel Bandwidth:	21 ~ 190 kHz
Type of radio transmission:	G1W, D1W
Antenna:	LGA External Antenna
Power supply:	115 V AC / 400 Hz
Temperature range:	-30°C to +70°C

5.2 List of components

No.	Equipment	Manufacturer	(Part number / version / model)	Serial number	Software version	tested (Y/N)
1	Compact Satellite Data Unit (CSDU) SDU-5045	Thrane & Thrane	405045 – 00000H	18433417	1.10	Y
2	SDU Configuration module SCM-5055	Thrane & Thrane	405055 – 00000E	81256696	n.a.	Y
3	HPA Enhanced Low Gain Antenna (HELGA) LGA-5005	Thrane & Thrane	677 - A0213	DEV#044	2.04	Y

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5.3 Antenna system(s)

Description	Polarization	Gain	Datasheet / pattern / test report
LGA-5005	Right hand circular	3.8 dBiC over 90% of the Inmarsat Hemisphere	--
		(see antenna test report for spherical antenna gain	

Note:
Verification of Antenna pattern or antenna test reports is not part of this test report.
Above listed antennas should be compliant to test standard(s) listed under section 3!

5.4 Operating conditions

Operating condition 1: A200S: 1643.5 MHz (=fm, 1626.6 MHz=fl, 1660.4 MHz=fh), ACD RM Class 4 LDR *

Operating condition 2: carrier-off

Operation condition 3: Continuous wave (for frequency stability tests (see section 8.2 VI.)

* fl and fh varying due to different bearer types (see table below)

Note: fl = lowest operating frequency, fm = middle of the band, fh = highest operating frequency

#	Bearer Identifier	Systems designator	Min [MHz]	Max [MHz]
1	R5T1XD	50K0D1W	1626.625	1660.475
2	R5T2XD	100KD1W	1626.65	1660.45
3	R5T4.5XD	200KD1W	1626.8	1660.375
4	R20T1XD	50K0D1W	1626.625	1660.475
5	R20T2XD	100KD1W	1626.65	1660.45
6	R20T4.5XD	200KD1W	1626.8	1660.375
7	R5T2QD	100KG1W	1626.65	1660.45
8	R5T4.5QD	200KG1W	1626.8	1660.375
9	R20T0.5QD	25K0G1W	1626.6125	1660.4875
10	R20T1QD	50K0G1W	1626.625	1660.475
11	R20T2QD	100KG1W	1626.65	1660.45
12	R20T4.5QD	200KG1W	1626.8	1660.375
13	R80T0.5Q	25K0G1W	1626.6125	1660.4875
14	R80T1Q	50K0G1W	1626.625	1660.475
15	FR80T2.5X4	100KD1W	1626.65	1660.45
16	FR80T2.5X16	100KD1W	1626.65	1660.45

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5.5 Additional information

EUT external photos are included in test report:	1-9547/20-01-01_AnnexA
EUT internal photos are included in test report:	1-9547/20-01-01_AnnexB
Test setup photos are included in test report:	1-9547/20-01-01_AnnexC
Measurement results are included in test report	1-9547/20-01-0_AnnexD

6 Sequence of testing

6.1 Sequence of testing radiated spurious 30 MHz to 1 GHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 10 m or 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 m to 3 m.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximize the peaks by changing turntable position ± 45° and antenna height between 1 and 4 m.
- The final measurement is done with quasi-peak detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

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6.2 Sequence of testing radiated spurious 1 GHz to 18 GHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a 2-axis positioner with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height is 1.5 m.
- At each turntable position and antenna polarization the analyzer sweeps with positive peak detector to find the maximum of all emissions.

Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximizes the peaks by rotating the turntable from 0° to 360°. This measurement is repeated for different EUT-table positions (0° to 150° in 30°-steps) and for both antenna polarizations.
- The final measurement is done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and RMS detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

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7 Description of the test setup

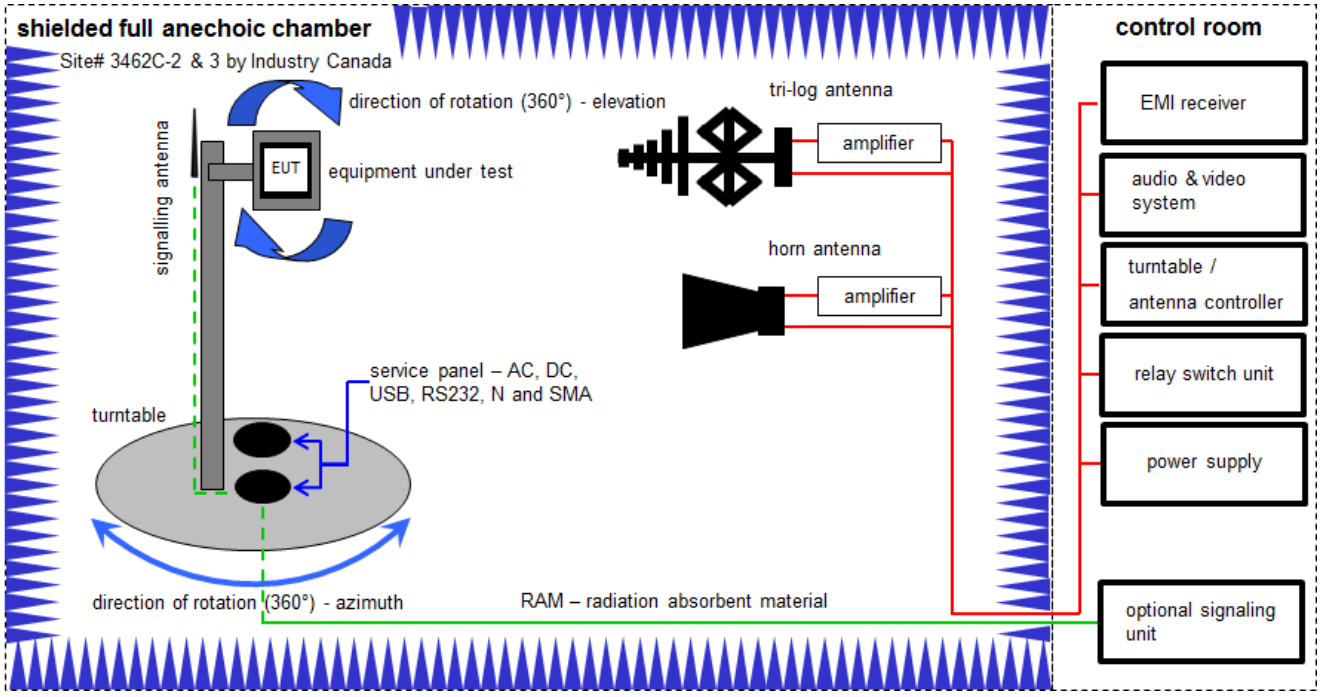
Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, RF generating and signaling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

Agenda: Kind of Calibration

k	calibration / calibrated	EK	limited calibration
ne	not required (k, ev, izw, zw not required)	zw	cyclical maintenance (external cyclical maintenance)
ev	periodic self verification	izw	internal cyclical maintenance
Ve	long-term stability recognized	g	blocked for accredited testing
vlkl!	Attention: extended calibration interval		
NK!	Attention: not calibrated	*)	next calibration ordered / currently in progress

7.1 Shielded fully anechoic chamber



Measurement distance: tri-log antenna and horn antenna 3 meter

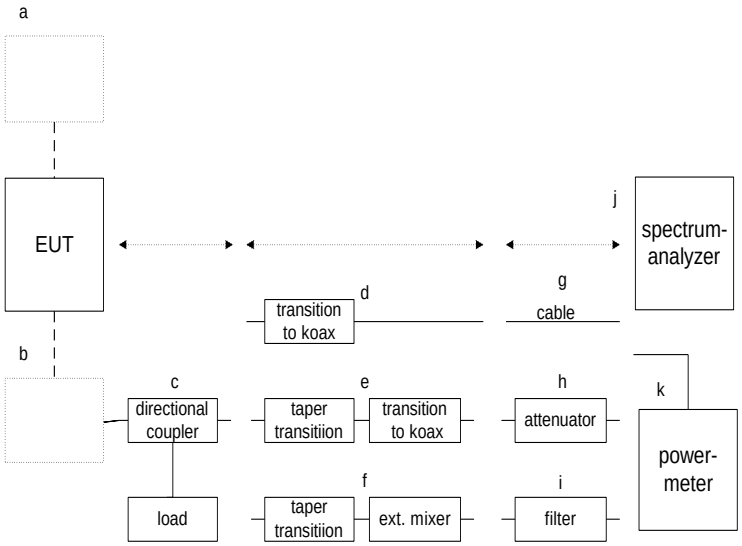
OP = AV + D - G + CA
(OP-radiated output power; AV-analyzer value; D-free field attenuation of measurement distance; G-antenna gain+amplifier gain; CA-loss signal path)

Example calculation:
OP [dBm] = -65.0 [dBm] + 50 [dB] - 20 [dBi] + 5 [dB] = -30 [dBm] (1 µW)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
2	19	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	9107-3697	300001605	vIKI!	27.02.2019	26.02.2021
3	n. a.	Switch / Control Unit	3488A	HP	*	300000199	ne	-/-	-/-
4	n. a.	Highpass Filter	WHKX2.9/18G-12SS	Wainwright	1	300003492	ev	-/-	-/-
5	n. a.	EMI Test Receiver 20Hz- 26,5GHz	ESU26	R&S	100037	300003555	k	11.12.2019	10.12.2020
6	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck Mess - Elektronik	295	300003787	vIKI!	19.02.2019	18.02.2021
7	n. a.	Broadband Amplifier 0.5-18 GHz	CBLU5184540	CERNEX	22049	300004481	ev	-/-	-/-
8	n. a.	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne	-/-	-/-
9	n. a.	NEXIO EMV-Software	BAT EMC V3.19.1.21	EMCO		300004682	ne	-/-	-/-
10	n. a.	PC	ExOne	F+W		300004703	ne	-/-	-/-
11	n. a.	RF-Amplifier	AMF-6F06001800-30-10P-R	NARDA-MITEQ Inc	2011572	300005241	ev	-/-	-/-

7.2 Conducted measurements (RF-Laboratory)



Setup 1.1 x..x

For inband measurements: hgj + hgk
(20 dB + 10 dB attenuation, power splitter, cable and analyzer or power meter)

For out-of-band and spurious measurements: higj
(10 dB attenuation + bandstop filter + cable + analyzer)

For spurious measurements > 3 GHz: higj:
(20 dB attenuation + high pass filter + cable + analyzer)

RF-Laboratory Equipment:

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No	Kind of Calibration	Last Calibration	Next Calibration
1	C220	HF-Cable	SUCOFLEX 101	Huber&Suhner	3054/1		ev	-/-	-/-
2	U311	High Power Attenuator 10 dB	WA-91-10-34	Weinschel	A244	300004265	ev	-/-	-/-
3	U312	High Power Attenuator 20 dB	WA-91-20-43	Weinschel	A514	300004824	ev	-/-	-/-
4	n. a.	Power Meter	438A	HP	2804U01015	300000357	vIKI!	12.12.2019	11.12.2021
5	n. a.	Power Sensor, 10 MHz to 26.5 GHz, -30 to +20 dBm	8485A	HP	2238A00798	300000511	vIKI!	18.12.2018	17.12.2020
6	R001	Spectrum Analyzer 20 Hz - 50 GHz	FSU50	R&S	200012	300003443	k	19.02.2019	18.02.2021
7	n. a.	Temperature and Climatic Test Chamber	VT4011	Voetsch	58566230600010	300005363	ev	08.05.2020	07.05.2022
8	HPF	High Pass Filter	HPM50110	MICRO-TRONICS	083	property of Thrane & Thrane	ev	-/-	-/-
9	BNCo	Band Stop filter	XN 3796	BSC FILTERS	836501	property of Thrane & Thrane	ev	-/-	-/-
10	n.a.	Power Splitter	11667B	HP	00875	---	ev	-/-	-/-

8 Measurement results

8.1 Summary

☒	**No deviations from the technical specifications were ascertained**
☐	There were deviations from the technical specifications ascertained
☐	This test report is only a partial test report. The content and verdict of the performed test cases are listed below.

TC identifier	Description	verdict	date	Remark
RF-Testing	CFR 47 Part 25 CFR 47 Part 87	see below	2021-11-16	-/-

Test Specification Clause	Test Case	Pass	Fail	N/A	N/P	Results
§2.1046 §25.204 §87.131 RSS-170, 5.3.2	RF power output Power limits	X				11.7 dBW (EIRP)
§2.1049 §87.139 (i)(3)	Emissions masks	X				complies
§2.1049 §87.135 RSS-170, 5.1	Occupied bandwidth	X				171.2 kHz
§2.1051 §25.202 §87.139 (a) §87.139 (i)(1) RSS-170, 5.4.3.1	Spurious emissions at antenna terminals Emission limitations (conducted emissions)	X				complies
§2.1053 §25.202	Field strength of spurious radiation Emission limitations (radiated emissions)	X				complies
§2.1055 §25.202 §87.133 (a) RSS-170, 5.2	Frequency stability Frequency tolerances	X				complies
§15.107	Unintentional Radiators: AC conducted limits	X				n/a (400 Hz aircraft system)
§15.109	Unintentional Radiators: Radiated emission limits	X				Refer to 1-9547_19-01-03.pdf

Note:
N/A = Not applicable; N/P = Not performed

8.2 Overview

I. RF power output / Power limits

Test setup(s): section 7.2, setup 1.1hgk

The power is measured at the transmitter output terminals and the type of power is determined according to the emission designator as follows:

(i) Mean power (pY) for amplitude modulated emissions and transmitting both sidebands using unmodulated full carrier.

(ii) Peak envelope power (pX) for all emission designators other than those referred to in paragraph (i) of this note.

Limits: **§87.131**

Class of Station	Frequency	Authorized emissions	Maximum power
Aircraft earth	UHF	G1D, G1E, G1W	60W

Power may not exceed 60 watts per carrier, as measured at the input of the antenna subsystem, including any installed diplexer. The maximum EIRP may not exceed 2000W per carrier.

Limits: **RSS-170 5.3.2**

The application for MES certification shall state the MES e.i.r.p. that is necessary for satisfactory communication. The maximum permissible e.i.r.p. will be the stated e.i.r.p. plus a 2 dB margin. If a detachable antenna is used, the certification application shall state the recommended antenna type and manufacturer, the antenna gain and the maximum transmitter output power at the antenna terminal.

Note: The measurement was performed at the antenna amplifier output.

Result: The measurement is passed.

Output Power Conducted with Power meter (measured)

Modulation Scheme	max. Bandwidth	Transmitter conducted output power [dBm]			Transmitter radiated output power / EIRP [dBm]		
		f_{low}	f_{mid}	f_{high}	f_{low}	f_{mid}	f_{high}
R5T1X	42 kHz	36.7	36.6	36.6	40.5	40.4	40.4
R5T2X	84 kHz	36.5	36.6	36.3	40.3	40.4	40.1
R5T45X	189 kHz	36.6	36.6	36.3	40.4	40.4	40.1
R20T1X	42 kHz	35.9	36	35.7	39.7	39.8	39.5
R20T2X	84 kHz	36.4	36.5	36.2	40.2	40.3	40
R20T45X	189 kHz	36.4	36.4	36.1	40.2	40.2	39.9
R5T2Q	84 kHz	36.6	36.6	36.3	40.4	40.4	40.1
R5T45Q	189 kHz	36.6	36.6	36.3	40.4	40.4	40.1
R20T05Q	21 kHz	**36.9**	36.8	36.3	**40.7**	40.6	40.1
R20T1Q	42 kHz	36.5	36.4	36.2	40.3	40.2	40
R20T2Q	84 kHz	36.6	36.3	36	40.4	40.1	39.8
R20T45Q	189 kHz	36.3	36.3	36	40.1	40.1	39.8
R80T05Q	21 kHz	35.7	35.5	35.3	39.5	39.3	39.1
R80T1Q	42 kHz	36	36	35.7	39.8	39.8	39.5
FR80T2.5X4	95 kHz	36	35.9	35.6	39.8	39.7	39.4
FR80T2.5X16	95 kHz	36.2	36.1	35.9	40	39.9	39.7

Summary:

Maximum conducted output power:

36.9 dBm = 6.9 dBW = **4.9 W** at amplifier output including connection cable between CSDU and amplifier input (attenuation 1.3 dB), 1 dB diplexer attenuation respected.

Maximum radiated output power (EIRP):

36.9 dBm + 3.8 dBiC = 40.7 dBm = 10.7 dBW = **11.75 W** including connection cable between CSDU and amplifier input (attenuation 1.3 dB), 1 dB diplexer attenuation respected.

Nominal radiated output power (EIRP) as declared by the manufacturer:

7.2 dBW – 1 dB attenuation + 3.8 dBiC antenna gain = 10 dbW = **10 W**

maximum tune-up tolerance +/- 1 dB

II. Emission masks

Test setup(s): section 7.2, setup 1.1hgj

Limits: **§87.131 (i)(3)**

While transmitting a single modulated signal at the rated output power of the transmitter, the emissions must be attenuated below the maximum emission level by at least:

Frequency Offset (normalized to SR)	Attenuation (dB)
±0.75 × SR	0
±1.40 × SR	20
±2.95 × SR	40

Where:

SR = Symbol Rate,

SR = 1 × channel rate for BPSK,

SR = 0.5 × channel rate for QPSK.

The mask shall be defined by drawing straight lines through the above points.

Plots:

See Annex D / 2, plots 65 to 73, 91 to 99, 124 to 132.

Result: The measurement is passed.

III. Occupied bandwidth

Test setup(s): section 7.2, setup 1.1hgj

(a) Occupied bandwidth is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to 0.5 percent of the total mean power of a given emission.

(b) The authorized bandwidth is the maximum occupied bandwidth authorized to be used by a station.

(c) The necessary bandwidth for a given class of emission is the width of the frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions.

Modulation Scheme	Occupied Bandwidth (99%)			Limit [kHz]
	f_{low}	f_{mid}	f_{high}	
R5T1X	39.5	39	39.5	42 kHz
R5T2X	76	75	76	84 kHz
R5T45X	170	168	170	189 kHz
R20T1X	39.5	39	39	42 kHz
R20T2X	75.4	75	75.5	84 kHz
R20T45X	170	168	**171.2**	189 kHz
R5T2Q	75.4	75	75.6	84 kHz
R5T45Q	170	167.4	169.3	189 kHz
R20T05Q	19.2	19.3	19	21 kHz
R20T1Q	39.3	39	39	42 kHz
R20T2Q	75.4	75	75.6	84 kHz
R20T45Q	169.4	166	170	189 kHz
R80T05Q	19	18.9	19	21 kHz
R80T1Q	39	38.7	38.8	42 kHz
FR80T2.5X4	89	88.2	89	95 kHz
FR80T2.5X16	89	88.2	88.5	95 kHz

Limits: **§87.135**

Limits: **RSS-170 5.1**

Frequency range	f(lowest) > 1625.5 MHz	f(highest) < 1660.5 MHz

Plots:

See Annex D / 2, plots 1 to 48

Result: **The measurement is passed.**

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IV. Emissions limitations (conducted emissions)

Test setup(s): section 7.2, setup 1.1higj

In case of conflict with other provisions of §87.139, the provisions of this paragraph shall govern for aircraft earth stations. When using G1D, G1E, or G1W emissions in the 1646.5-1660.5 MHz frequency band, the emissions must be attenuated as shown below.

At rated output power, while transmitting a modulated single carrier, the composite spurious and noise output shall be attenuated by at least:

Limits: **§87.139 (i)(1)**

Frequency (MHz)	Attenuation (dB)[1]
0.01 to 1525	−135 dB/4 kHz
1525 to 1559	−203 dB/4 kHz
1559 to 1585	−155 dB/MHz
1585 to 1605	−143 dB/MHz
1605 to 1610	−117 dB/MHz
1610 to 1610.6	−95 dB/MHz
1610.6 to 1613.8	−80 dBW/MHz[3]
1613.8 to 1614	−95 dB/MHz
1614 to 1626.5	−70 dB/4 kHz
1626.5 to 1660	−70 dB/4 kHz[2 3 4]
1660 to 1670	−49.5 dBW/20 kHz[2 3 4]
1670 to 1735	−60 dB/4 kHz
1735 to 12000	−105 dB/4 kHz
12000 to 18000	−70 dB/4 kHz

[1]These values are expressed in dB referenced to the carrier for the bandwidth indicated, and relative to the maximum emission envelope level, except where the attenuation is shown in dBW, the attenuation is expressed in terms of absolute power referenced to the bandwidth indicated.

[2]Attenuation measured within the transmit band excludes the band ±35 kHz of the carrier frequency.

[3]This level is not applicable for intermodulation products.

[4]The upper limit for the excess power for any narrow-band spurious emission (excluding intermodulation products within a 30 kHz measurement bandwidth) shall be 10 dB above the power limit in this table.

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Note:

Frequency response of filter as declared by the manufacturer:

2.6 DUPLEX FILTER RESPONSE

The AVIATOR 200S HELGA consist of a HPA, Duplex Filter and an Antenna Element in the transmission path. The duplex filter is by-passed in the modified HELGA, and the output is derived directly from the HPA. The duplex filter response is defined in Table 2.7 below:

Table 2.7: HELGA Duplex Filter Response

TX Path Frequency [MHz]	Attenuation [dB]
1518 – 1559	50
1559 – 1585	40
1585 – 1605	15
1605 – 1610	8
1626.5 – 1675	1
2400 – 2500	40
3253 – 3350	30
4879 – 5025	12

Filter response data delivered by the customer were also used as correction data during the measurements.

Plots:

See Annex D / 2, plots 74, 100 to 107, 133.

Limits: **§87.139 (a) / RSS-170 5.3.4.1**

The average power of unwanted emissions shall be attenuated below the average output power, P (dBW), of the transmitter, as specified below:

(1) 25 dB in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 50%, up to and including 100% of the occupied bandwidth or necessary bandwidth, whichever is greater;

(2) 35 dB in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 100%, up to and including 250% of the occupied bandwidth or necessary bandwidth, whichever is greater; and

(3) 43 + 10 log p (watts) in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 250% of the occupied bandwidth or necessary bandwidth, whichever is greater.

Plots:

See Annex D / 2, plots 49 to 64, 75 – 90, 108 to 123.

Result: **The measurement is passed.**

V. Emissions limits (radiated emissions)

Test setup(s): section 7.1

Limits: **§2.1053**

(a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of §2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

(b) The measurements specified in paragraph (a) of this section shall be made for the following equipment:

(1) Those in which the spurious emissions are required to be 60 dB or more below the mean power of the transmitter.

(2) All equipment operating on frequencies higher than 25 MHz.

(3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.

(4) Other types of equipment as required, when deemed necessary by the Commission.

Measurement results:

Radiated Spurious Emissions [dBm]								
Low frequency			Middle frequency			High channel		
F [GHz]	Detector	Level [dBm]	F [GHz]	Detector	Level [dBm]	F [GHz]	Detector	Level [dBm]
No critical peaks detected.			No critical peaks detected.			No critical peaks detected.		
Measurement uncertainty			± 3 dB					

Plots:

see also Annex D / 3, plots 1 to 3.

Result: **The measurement is passed.**

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VI. Transmitter frequency tolerance

Test setup(s): section 7.2, setup 1.1hgj

Limits: **§87.133 (a)**

Frequency band-470 to 2450 MHz (lower limit exclusive, upper limit inclusive), and categories of stations:	Tolerance[1]	Tolerance[2]
Aeronautical stations	100	20
Aircraft stations	100	20
Aircraft earth station		320 Hz[3]

[1]This tolerance is the maximum permitted until January 1, 1990, for transmitters installed before January 2, 1985, and used at the same installation. Tolerance is indicated in parts in 10^6 unless shown as Hertz (Hz).

[2]This tolerance is the maximum permitted after January 1, 1985 for new and replacement transmitters and to all transmitters after January 1, 1990. Tolerance is indicated in parts in 10^6 unless shown as Hertz (Hz).

[3]For purposes of certification, a tolerance of 160 Hz applies to the reference oscillator of the AES transmitter. This is a bench test.

Limits: **RSS-170 5.2**

For mobile earth station equipment, the carrier frequency shall not depart from the reference frequency by more than ±10 ppm.

Measurement results:

Temperature [°C]	Voltage [V DC]	Reference Frequency [MHz]	Measured Frequency [MHz]	Deviation [ppm]
-30	115	1626.600535	1626.599599	-0.58
-20	115	1626.600535	1626.599963	-0.35
-10	115	1626.600535	1626.600102	-0.27
0	115	1626.600535	1626.600830	0.18
10	115	1626.600535	1626.601076	0.33
20	103.5	1626.600460	1626.600458	0.00
20	115	1626.600460	1626.600462	0.00
20	126.5	1626.600460	1626.600470	0.01
30	115	1626.600535	1626.600273	-0.16
40	115	1626.600535	1626.600337	-0.12
50	115	1626.600535	1626.601046	0.31
55	115	1626.600535	1626.601445	0.56
59	115	1626.600535	1626.601720	0.73

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Temperature [°C]	Voltage [V DC]	Reference Frequency [MHz]	Measured Frequency [MHz]	Deviation [ppm]
-30	115	1643.500787	1643.499855	-0.57
-20	115	1643.500787	1643.500214	-0.35
-10	115	1643.500787	1643.500616	-0.10
0	115	1643.500787	1643.501090	0.18
10	115	1643.500787	1643.501341	0.34
20	103.5	1643.500730	1643.500728	0.00
20	115	1643.500730	1643.500731	0.00
20	126.5	1643.500730	1643.500733	0.00
30	115	1643.500787	1643.500540	-0.15
40	115	1643.500787	1643.500600	-0.11
50	115	1643.500787	1643.501386	0.36
55	115	1643.500787	1643.501704	0.56
59	115	1643.500787	1643.502002	0.74

Temperature [°C]	Voltage [V DC]	Reference Frequency [MHz]	Measured Frequency [MHz]	Deviation [ppm]
-30	115	1660.401036	1660.400114	-0.56
-20	115	1660.401036	1660.400468	-0.34
-10	115	1660.401036	1660.400636	-0.24
0	115	1660.401036	1660.401353	0.19
10	115	1660.401036	1660.401616	0.35
20	103.5	1660.401995	1660.401990	0.00
20	115	1660.401995	1660.401996	0.00
20	126.5	1660.401995	1660.402005	0.01
30	115	1660.401036	1660.400810	-0.14
40	115	1660.401036	1660.400865	-0.10
50	115	1660.401036	1660.401567	0.32
55	115	1660.401036	1660.401988	0.57
59	115	1660.401036	1660.402281	0.75

Note:

The EUT was set to a continuous wave mode during this test.
The marker frequency counter function of the spectrum analyzer was used for reading frequency values before and after temperature and voltage changes.
The 10 MHz reference frequency of the spectrum analyzer was locked to a GPS reference signal.

59°C is equivalent to ARINC600 air coolant with ambient temperature of 70°

Result: The measurement is passed.

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9 Glossary

EUT	Equipment under test
DUT	Device under test
GUE	GNSS User Equipment
ETSI	European Telecommunications Standards Institute
EN	European Standard
FCC	Federal Communications Commission
FCC ID	Company Identifier at FCC
IC	Industry Canada
PMN	Product marketing name
HMN	Host marketing name
HVIN	Hardware version identification number
FVIN	Firmware version identification number
EMC	Electromagnetic Compatibility
HW	Hardware
SW	Software
Inv. No.	Inventory number
S/N or SN	Serial number
C	Compliant
NC	Not compliant
NA	Not applicable
NP	Not performed
PP	Positive peak
QP	Quasi peak
AVG	Average
OC	Operating channel
OCW	Operating channel bandwidth
OBW	Occupied bandwidth
OOB	Out of band
DFS	Dynamic frequency selection
CAC	Channel availability check
OP	Occupancy period
NOP	Non occupancy period
DC	Duty cycle
PER	Packet error rate
CW	Clean wave
MC	Modulated carrier
WLAN	Wireless local area network
RLAN	Radio local area network
DSSS	Dynamic sequence spread spectrum
OFDM	Orthogonal frequency division multiplexing
FHSS	Frequency hopping spread spectrum
GNSS	Global Navigation Satellite System
C/N_0	Carrier to noise-density ratio, expressed in dB-Hz

10 Document history

Version	Applied changes	Date of release
-/-	DRAFT	2020-06-26
-/-	DRAFT2	2020-07-02
-/-	DRAFT3	2020-07-14
-/-	DRAFT4	2020-08-11
-/-	DRAFT5	2021-08-24
	Initial Release	2021-11-12

11 Accreditation Certificate – D-PL-12076-01-04

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DAkkS Deutsche Akkreditierungsstelle

Deutsche Akkreditierungsstelle GmbH

Entrusted according to Section 8 subsection 1 AkkStelleG in connection with Section 1 subsection 1 AkkStelleGBV
Signatory to the Multilateral Agreements of EA, ILAC and IAF for Mutual Recognition

Accreditation

The Deutsche Akkreditierungsstelle GmbH attests that the testing laboratory

CTC advanced GmbH
Untertürkheimer Straße 6-10, 66117 Saarbrücken

is competent under the terms of DIN EN ISO/IEC 17025:2005 to carry out tests in the following fields:

Telecommunication (TC) and Electromagnetic Compatibility (EMC) for Canadian Standards

The accreditation certificate shall only apply in connection with the notice of accreditation of 11.01.2019 with the accreditation number D-PL-12076-01 and is valid until 21.04.2021. It comprises the cover sheet, the reverse side of the cover sheet and the following annex with a total of 7 pages.

Registration number of the certificate: **D-PL-12076-01-04**

Frankfurt am Main, 11.01.2019

Dipl. Biol. Uwe Zimmermann
Head of Division

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ILAC: www.ilac.org
IAF: www.iaf.nu

Note: The current certificate annex is published on the website (link see below) of the Accreditation Body DAkkS or may be received by CTC advanced GmbH on request

https://www.dakks.de/as/ast/d/D-PL-12076-01-04.pdf

12 Accreditation Certificate – D-PL-12076-01-05

first page	last page
	

DAkkS Deutsche Akkreditierungsstelle

Deutsche Akkreditierungsstelle GmbH

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Untertürkheimer Straße 6-10, 66117 Saarbrücken

is competent under the terms of DIN EN ISO/IEC 17025:2005 to carry out tests in the following fields:

Telecommunication (FCC Requirements)

The accreditation certificate shall only apply in connection with the notice of accreditation of 11.01.2019 with the accreditation number D-PL-12076-01 and is valid until 21.04.2021. It comprises the cover sheet, the reverse side of the cover sheet and the following annex with a total of 5 pages.

Registration number of the certificate: **D-PL-12076-01-05**

Frankfurt am Main, 11.01.2019

Dipl.-Biol. Uwe Zimmermann
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See notes overleaf.

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https://www.dakks.de/as/ast/d/D-PL-12076-01-05.pdf