
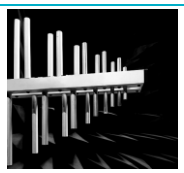
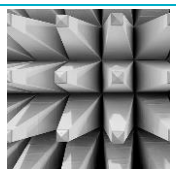

CTC advanced
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Bundesnetzagentur

BNetzA-CAB-02/21-102

TEST REPORT

Test report no.: 1-0716/15-01-04-B

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
Fax: + 49 681 5 98 - 9075
Internet: http://www.ctcadvanced.com
e-mail: mail@ctcadvanced.com

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: Morten Becker Saul
e-mail: morten.saul@cobham.com
Phone: +45 3955 8209

Manufacturer

Thrane & Thrane A/S
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 200; AVIATOR 300; AVIATOR 350**
FCC ID	**ROJ-AVIATOR**
IC	**6200B-AVIATOR**
Frequency:	RX: 1525.0 MHz – 1559.0 MHz TX: 1626.5 MHz – 1660.5 MHz
Antenna:	LGA / IGA / HGA External Antenna
Power supply:	20 V to 36 V DC
Temperature range:	-30°C to +55°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:

Geraldy Karsten

DN: cn=Karsten Geraldy, o=CTC advanced GmbH, ou=GER-2017-03-14, email=Karsten.Geraldy@ctcadvanced.com, c=DE
Datum: 2018.06.23 22:22:08 +02'00'

Geraldy Karsten
Lab Manager
Radio Communications & EMC

Test performed:

M. Walla

cn=Walla Meheza, o=ctcadvanced GmbH, ou=WAL-161220, email=meheza.walla@ctcadvanced.com, c=DE
2018.06.23 18:21:10 +02'00'

Meheza Walla
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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This test report replaces the test report with the number 1-0716/15-01-04-A and dated 2018-06-21

2.2 Application details

Date of receipt of order:	2016-05-31
Date of receipt of test item:	2017-11-01
Start of test:	2017-11-06
End of test:	2017-11-24
Person(s) present during the test:	Mr. Becker Mr. Pederson

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

4 Test environment

Temperature	:	T_{nom} T_{max} T_{min}	+22 °C during room temperature tests +55 °C during high temperature tests -30 °C during low temperature tests
Relative humidity content	:		55 %
Barometric pressure	:		1021 hpa
Power supply	:	V_{nom}	28.0 V DC

5 Test item

5.1 General description

Kind of test item:	**Aeronautical Satellite Terminal**
Type identification:	**AVIATOR 200; AVIATOR 300; AVIATOR 350**
HMN:	-/-
PMN:	AVIATOR 200; AVIATOR 300; AVIATOR 350
HVIN:	AVIATOR200/300/350
FVIN:	-/-
S/N serial number:	Refer to 5.2
HW hardware status:	G.01
SW software status:	1.05
Frequency band:	RX: 1525.0 MHz – 1559.0 MHz TX: 1626.5 MHz – 1660.5 MHz
TX output power cond.:	39.4 dBm (measured value)
TX output power rad. (EIRP):	51.4 dBm (calculated value)
Type of modulation:	QPSK, 64 QAM, 32 QAM, 16 QAM
Channel Bandwidth:	200 kHz
Type of radio transmission:	G7W, D7W
Antenna:	LGA / IGA / HGA External Antenna
Power supply:	20 V to 36 V DC
Temperature range:	-30°C to +55°C

5.2 List of components

No.	Equipment	Manufacturer	(Part number / version / model)	Serial number	Note	tested (Y/N)
1	TT-5040 SBU	Thrane & Thrane	405035A – 001 T19 Rev.: F	99402243		Y
2	TT-5016 HPA LNA Diplexer	Thrane & Thrane	405016A – Rev.: I	81186928		Y

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5.3 Antenna system(s)

Description	Polarization	Gain	Datasheet / pattern / test report
LGA-3000	Right hand circular	Nominal antenna gain: 2.5 dBic	677-A0205_PS_iss1.1
IGA-5001	Right hand circular	> 6 dBic over 90% of the Inmarsat service hemisphere > 2 dBic over 99% of the same hemisphere	677-A0181_PS_iss1.7
HGA-7001	Right hand circular	12 dBi to 16 dBi over 90% of the Inmarsat Hemisphere	677-A0173_PS_iss1.3

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: 1643.5 MHz (=fm, 1626.6 MHz=fl, 1660.4 MHz=fh)
A200/A300/A350 – SDU 405040A

5.5 Additional information

EUT external photos are included in test report: 1-0716/17-01-04_AnnexA

EUT internal photos are included in test report: 1-0716/17-01-04_AnnexB

Test setup photos are included in test report: 1-0716/17-01-04_AnnexC

Measurement results are included in test report 1-0716/17-01-04_AnnexD

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6 Sequence of testing

6.1 Sequence of testing radiated spurious 9 kHz to 30 MHz

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.

Note: According to ANSI C63.4 a test site with no reference ground plane shall take precedence to show the compliance with the standard. In contrast to a semi-anechoic chamber with conductive ground, the EUT distance to the ground in a fully anechoic chamber is irrelevant because it is a reflection-reduced environment at any distance to the ground structure, so in this case a height of 1.5 m was used.

Premeasurement

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

Final measurement

- Identified emissions during the premeasurement are maximized by the software by rotating the turntable from 0° to 360°. In case of the 2-axis positioner is used the elevation axis is also rotated from 0° to 360°.
- The final measurement is done in the position (turntable and elevation) causing the highest emissions with quasi-peak (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. A plot with the graph of the premeasurement and the limit is stored.

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6.2 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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6.3 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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6.4 Sequence of testing radiated spurious above 18 GHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- 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.
- The measurement distance is as appropriate (e.g. 0.5 m).
- The EUT is set into operation.

Premeasurement

- The test antenna is handheld and moved carefully over the EUT to cover the EUT's whole sphere and different polarizations of the antenna.

Final measurement

- The final measurement is performed at the position and antenna orientation causing the highest emissions with Peak and RMS detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement and the limit is stored.

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7 Description of the test setup

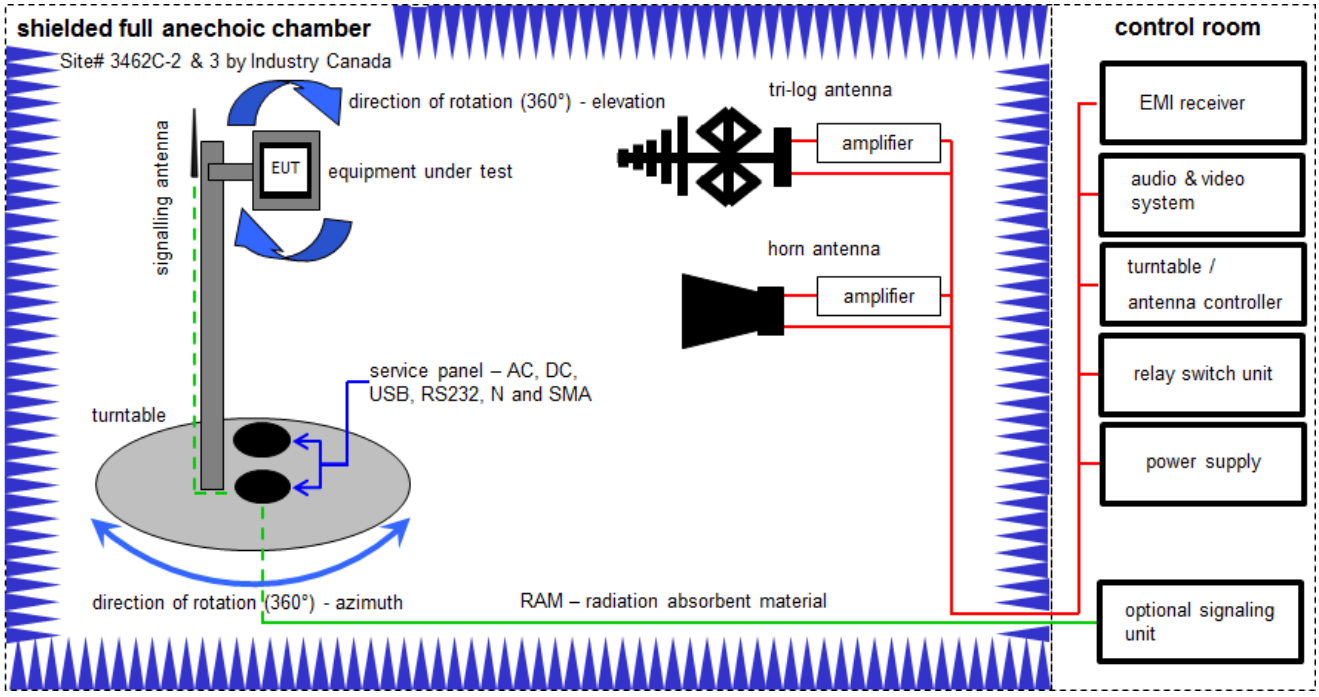
Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements 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

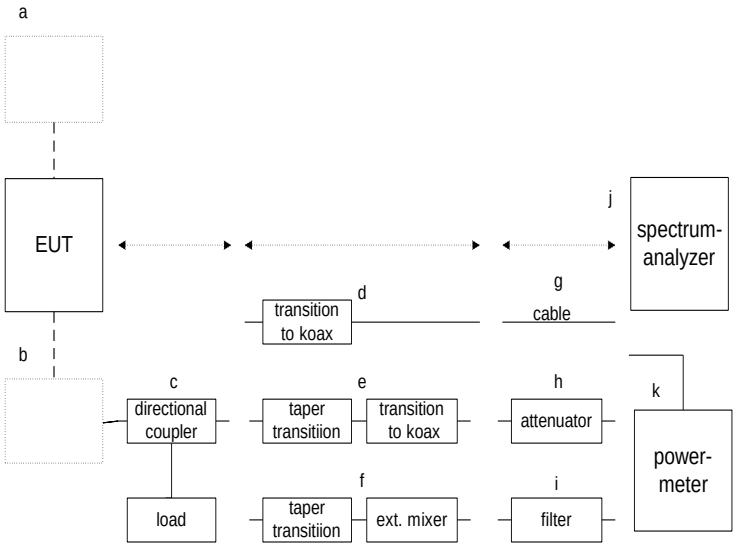
OP = AV + D - G + CA
(OP-radiated output power; AV-analyzer value; D-free field attenuation of measurement distance; G-antenna gain+amplifier gain; CA-loss signal path)

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.	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	vIKI!	14.02.2017	13.02.2019
2	n. a.	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
3	n. a.	Switch / Control Unit	3488A	HP	*	300000199	ne	-/-	-/-
4	n. a.	EMI Test Receiver 20Hz- 26,5GHz	ESU26	R&S	100037	300003555	k	31.01.2017	30.01.2018
5	n. a.	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	19	300003790	ne	-/-	-/-
6	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	371	300003854	vIKI!	29.10.2014	29.10.2017
7	n. a.	Broadband Amplifier 0.5-18 GHz	CBLU5184540	CERNEX	22049	300004481	ev	-/-	-/-
8	n. a.	Broadband Amplifier 5-13 GHz	CBLU5135235	CERNEX	22010	300004491	ev	-/-	-/-
9	n. a.	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne	-/-	-/-
10	n. a.	NEXIO EMV-Software	BAT EMC V3.16.0.49	EMCO		300004682	ne	-/-	-/-
11	n. a.	PC	ExOne	F+W		300004703	ne	-/-	-/-
12	n. a.	RF-Amplifier	AMF-6F06001800-30-10P-R	NARDA-MITEQ Inc	2011572	300005241	ev	-/-	-/-

7.2 Conducted measurements (RF-Laboratory)



Setup 1.2 x...x

RF-Laboratory Equipment:

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	HF-Cable	SUCOFLEX 101	Huber&Suhner	3054/1		ev		
2	n. a.	High Power Attenuator 30 dB	9498A	HP	2702A04550	300002403	ev		
3	n. a.	Power Sensor, 10 MHz to 18 GHz, -30 to +20 dBm	8481A	HP	2702A65984	300001197	Ve	26.01.2016	26.01.2018
4	n. a.	Spectrum Analyzer 20 Hz - 50 GHz	FSU50	R&S	200012	300003443	k	28.10.2016	27.10.2018
5	n. a.	Temperature and Climatic Test Chamber	VUK04/500	Heraeus Voetsch	32678	300000297	ev	30.09.2015	29.09.2018
6	n. a.	30 dB High Power Attenuator 150W	769-30	Narda	07662	property of Thrane & Thrane	-/-	-/-	-/-
7	n. a.	3 dB Bi-direct. Attenuator 50W	46-3-34	Weinschel Corp	BM0455	property of Thrane & Thrane	-/-	-/-	-/-
8	n. a.	6 dB Bi-direct. Attenuator 50W	46-6-34	Weinschel Corp	BM6859	property of Thrane & Thrane	-/-	-/-	-/-
9	n. a.	High Pass Filter	HPM50110	MICRO-TRONICS	083	property of Thrane & Thrane	-/-	-/-	-/-
10	n. a.	Diplexer Low Noise Amplifier	XN 3796	BSC FILTERS	836501	property of Thrane & Thrane	-/-	-/-	-/-

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	2018-06-23	-/-

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				21.4 dBW (EIRP)
§2.1049 §87.139 (i)(3)	Emissions masks	X				complies
§2.1049 §87.135 RSS-170, 5.1	Occupied bandwidth	X				170 kHz
§2.1051 §25.202 §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				**Refer to 1-0716_15-01-05.pdf**
§15.109	Unintentional Radiators: Radiated emission limits	X				**Refer to 1-0716_15-01-05.pdf**

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

8.2 Overview

I. RF power output / Power limits

Test setup(s): 1.2hgl

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.

Result: **The measurement is passed.**

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Output Power Conducted with Power meter (measured)

EUT	Modulation	CS	fLow	fMiddle	fHigh
SBU 405040A	QPSK	21 kHz	**39.1 dBm 9.1 dBW 8.1 W**	**39.2 dBm 9.2 dBW 8.3 W**	**39.1 dBm 9.1 dBW 8.1 W**
		42 kHz	**39.2 dBm 9.2 dBW 8.3 W**	**39.2 dBm 9.2 dBW 8.3 W**	**39.1 dBm 9.1 dBW 8.1 W**
		84 kHz	**39.2 dBm 9.2 dBW 8.3 W**	**39.4 dBm 9.4 dBW 8.7 W**	**39.2 dBm 9.2 dBW 8.3 W**
		189 kHz	**39.1 dBm 9.1 dBW 8.1 W**	**39.2 dBm 9.2 dBW 8.3 W**	**39.1 dBm 9.1 dBW 8.1 W**
	16QAM	42 kHz	**39.3 dBm 9.3 dBW 8.5 W**	**39.4 dBm 9.4 dBW 8.7 W**	**39.2 dBm 9.2 dBW 8.3 W**
		84 kHz	**39.2 dBm 9.2 dBW 8.3 W**	**39.3 dBm 9.3 dBW 8.5 W**	**39.1 dBm 9.1 dBW 8.1 W**
		189 kHz	**39.2 dBm 9.2 dBW 8.3 W**	**39.3 dBm 9.3 dBW 8.5 W**	**39.1 dBm 9.1 dBW 8.1 W**

Output Power radiated @ LGA-3000 @ 2.5 dBi (calculated in dBm)

EUT	Modulation	CS	fLow	fMiddle	fHigh
SBU 405040A	QPSK	21 kHz	**41.6 dBm 11.6 dBW**	**41.7 dBm 11.7 dBW**	**41.6 dBm 11.6 dBW**
		42 kHz	**41.7 dBm 11.7 dBW**	**41.7 dBm 11.7 dBW**	**41.6 dBm 11.6 dBW**
		84 kHz	**41.7 dBm 11.7 dBW**	**41.9 dBm 11.9 dBW**	**41.7 dBm 11.7 dBW**
		189 kHz	**41.6 dBm 11.6 dBW**	**41.7 dBm 11.7 dBW**	**41.6 dBm 11.6 dBW**
	16QAM	42 kHz	**41.8 dBm 11.8 dBW**	**41.9 dBm 11.9 dBW**	**41.7 dBm 11.7 dBW**
		84 kHz	**41.7 dBm 11.7 dBW**	**41.8 dBm 11.8 dBW**	**41.6 dBm 11.6 dBW**
		189 kHz	**41.7 dBm 11.7 dBW**	**41.8 dBm 11.8 dBW**	**41.6 dBm 11.6 dBW**

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Output Power radiated @ IGA-5001 @ 6 dBi (calculated in dBm)

EUT	Modulation	CS	fLow	fMiddle	fHigh
SBU 405040A	QPSK	21 kHz	**45.1 dBm** **15.1 dBW**	**45.2 dBm** **15.2 dBW**	**45.1 dBm** **15.1 dBW**
		42 kHz	**45.2 dBm** **15.2 dBW**	**45.2 dBm** **15.2 dBW**	**45.1 dBm** **15.1 dBW**
		84 kHz	**45.2 dBm** **15.2 dBW**	**45.4 dBm** **15.4 dBW**	**45.2 dBm** **15.2 dBW**
		189 kHz	**45.1 dBm** **15.1 dBW**	**45.2 dBm** **15.2 dBW**	**45.1 dBm** **15.1 dBW**
	16QAM	42 kHz	**45.3 dBm** **15.3 dBW**	**45.4 dBm** **15.4 dBW**	**45.2 dBm** **15.2 dBW**
		84 kHz	**45.2 dBm** **15.2 dBW**	**45.3 dBm** **15.3 dBW**	**45.1 dBm** **15.1 dBW**
		189 kHz	**45.2 dBm** **15.2 dBW**	**45.3 dBm** **15.3 dBW**	**45.1 dBm** **15.1 dBW**

Output Power radiated @ HGA-7001 @ 12 dBi (calculated in dBm)

EUT	Modulation	CS	fLow	fMiddle	fHigh
SBU 405040A	QPSK	21 kHz	**51.1 dBm** **21.1 dBW**	**51.2 dBm** **21.2 dBW**	**51.1 dBm** **21.1 dBW**
		42 kHz	**51.2 dBm** **21.2 dBW**	**51.2 dBm** **21.2 dBW**	**51.1 dBm** **21.1 dBW**
		84 kHz	**51.2 dBm** **21.2 dBW**	**51.4 dBm** **21.4 dBW**	**51.2 dBm** **21.2 dBW**
		189 kHz	**51.1 dBm** **21.1 dBW**	**51.2 dBm** **21.2 dBW**	**51.1 dBm** **21.1 dBW**
	16QAM	42 kHz	**51.3 dBm** **21.3 dBW**	**51.4 dBm** **21.4 dBW**	**51.2 dBm** **21.2 dBW**
		84 kHz	**51.2 dBm** **21.2 dBW**	**51.3 dBm** **21.3 dBW**	**51.1 dBm** **21.1 dBW**
		189 kHz	**51.2 dBm** **21.2 dBW**	**51.3 dBm** **21.3 dBW**	**51.1 dBm** **21.1 dBW**

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II. Emission masks

Test setup(s): 1.2hgl

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 22 to 35, 44 to 50.

Result: The measurement is passed.

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III. Occupied bandwidth

Test setup(s): 1.2hgl

(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.

EUT	Modulation	CS	fLow	fMiddle	fHigh
SBU 405040A	QPSK	21 kHz	**19 kHz**	**19 kHz**	**19 kHz**
		42 kHz	**40 kHz**	**40 kHz**	**40 kHz**
		84 kHz	**76 kHz**	**76 kHz**	**76 kHz**
		189 kHz	**170 kHz**	**170 kHz**	**170 kHz**
	16QAM	42 kHz	**40 kHz**	**40 kHz**	**40 kHz**
		84 kHz	**77 kHz**	**78 kHz**	**78 kHz**
		189 kHz	**170 kHz**	**170 kHz**	**170 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 21.

Result: **The measurement is passed.**

IV. Emissions limitations (conducted emissions)

Test setup(s): 1.2hgl

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: **§87.131 (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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Limits: **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.

Note:

Frequency response of filter as declared by the manufacturer:

DLNA 405013A

405013A DLNA(Diplexer Low Noise Amplifier) is compliant to:

MARK 3 AVIATION SATELLITE COMMUNICATION SYSTEMS ARINC CHARACTERISTIC 781-6

2.2.4.3.2.2 Type F - Transmit Port to Antenna Port

The path from the transmit port to the antenna port should have the following characteristics:

Frequency (MHz)			Rejection
0.0	to	1525.0	> 80 dB
1525.0	to	1559.0	> 120 dB
1559.0	to	1585.0	> 111 dB
1585.0	to	1605.0	> 95 dB
1605.0	to	1610.0	> 62 dB
1610.0	to	1614.0	> 40 dB
1614.0	to	1620.0	> 30 dB
1620.0	to	1624.5	> 20 dB
1624.5	to	1625.5	> 10 dB
1625.5	to	1626.5	Decreases
1626.5	to	1633.0	Insertion loss < 1.3 dB
1633.0	to	1660.5	Insertion loss < 0.8 dB
1660.5	to	1735.0	Increases
1735.0	to	1865.0	> 50 dB
1865.0	to	3250.0	> 20 dB
3250.0	to	3330.0	> 50 dB
3330.0	to	4000.0	> 40 dB
4000.0	to	12000.0	> 50 dB
12000.0	to	18000.0	> 15 dB

DLNA 405012A

405012A DLNA(Diplexer Low Noise Amplifier) is compliant to:

AVIATION SATELLITE COMMUNICATION SYSTEM PART 1 AIRCRAFT INSTALLATION PROVISIONS ARINC CHARACTERISTIC 741P1-14

2.2.4.3.3 Modified Type A Diplexer/LNA - For Protection of GPS and GLONASS

Transmit Port to Antenna Port

The path from the transmit port to the antenna port should have the following characteristics:

Frequency (MHz)	Rejection
0.0 to 1525.0	> 80 dB
1525.0 to 1559.0	> 120 dB
1559.0 to 1585.0	> 100 dB
1585.0 to 1605.0	> 88 dB
1605.0 to 1610.0	> 62 dB
1610.0 to 1614.0	> 40 dB
1614.0 to 1626.5	> Decreases
1626.5 to 1631.5	Insertion loss < 2.3 dB
1631.5 to 1660.5	Insertion loss < 0.8 dB
1660.5 to 1735.0	Increases
1735.0 to 12000.0	> 50 dB
12000.0 to 18000.0	> 15 dB

Plots:

See Annex D / 2, plots 36 to 43.

Result: The measurement is passed.

V. Emissions limits (radiated emissions)

Test setup(s): 2.0 - 2.5

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.**

VI. Transmitter frequency tolerance

Test setup(s): 1.2hgl

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	28	1626.5	1626.501 034	PASS
-20	28		1626.501 011	
-10	28		1626.500 768	
0	28		1626.498 856	
10	28		1626.499 969	
20	28		1626.499 988	
20	36		1626.499 972	
20	20		1626.499 982	
30	36		1626.499 706	
40	28		1626.499 619	
50	28		1626.499 595	

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Temperature [°C]	Voltage [V DC]	Reference Frequency [MHz]	Measured Frequency [MHz]	Deviation [ppm]
-30	28	1643.5	1643.500 950	PASS
-20	28		1643.501 020	
-10	28		1643.500 768	
0	28		1643.500 162	
10	28		1643.499 968	
20	28		1643. 499 875	
20	36		1643. 499 880	
20	20		1643. 499 860	
30	36		1643. 499 705	
40	28		1643. 499 615	
50	28		1643. 499 560	

Temperature [°C]	Voltage [V DC]	Reference Frequency [MHz]	Measured Frequency [MHz]	Deviation [ppm]
-30	28	1660.5	1660.500 950	PASS
-20	28		1660.501 030	
-10	28		1660.500 770	
0	28		1660.500 160	
10	28		1660.499 970	
20	28		1660.499 875	
20	36		1660.499 880	
20	20		1660.499 872	
30	36		1660.499 705	
40	28		1660.499 615	
50	28		1660.499 604	

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	2018-01-23
	minor editorial changes	2018-03-20
-A	minor editorial changes (HMN / PMN / HVIN)	2018-06-21
-B	minor editorial changes	2018-06-23

11 Accreditation Certificate

first page	last page
	

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

http://www.dakks.de/as/ast/d/D-PL-12076-01-03.pdf