

TEST REPORT

Test report no.: 1-6428/18-01-11

Testing laboratory

CTC advanced GmbH

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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 starting with the registration number: D-PL-12076-01.

Applicant

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Manufacturer

Thrane & Thrane A/S trading as Cobham SATCOM

Lundtoftegaardsvej 93D

2800 Kgs. Lyngby / DENMARK

Test standard/s

FCC - Title 47 CFR
Part 25

RSS-170

FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 25 - Satellite Communications

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: Inmarsat landmobile terminal

Model name: EXPLORER 323

FCC ID: ROJ-3723A

IC: 6200B-3723A

Frequency: 1626.5 – 1660.5 MHz

Technology tested: Mobile Earth Station (MES)

Antenna: Integrated patch antenna system consisting of 7 antenna patches

Power supply: 12 to 24 V DC by battery

Temperature range: -25°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:

Meheza Walla
Lab Manager
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Test performed:

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1 Table of contents

1	Table of contents	2
2	General information	3
2.1	Notes and disclaimer	3
2.2	Application details	3
2.3	Test laboratories sub-contracted	3
3	Test standard/s, references and accreditations	4
	Mobile Earth Stations (MESS) and Ancillary Terrestrial Component (ATC) Equipment Operating in the Mobile-Satellite Service (MSS) Bands	4
4	Test environment	4
5	Test item	5
5.1	General description	5
5.2	Operating conditions	5
5.3	Additional information	6
6	Description of the test setup	7
6.1	Shielded fully anechoic chamber	8
6.2	Conducted measurements	10
7	Sequence of testing	11
7.1	Sequence of testing radiated spurious 9 kHz to 30 MHz	11
7.2	Sequence of testing radiated spurious 30 MHz to 1 GHz	12
7.3	Sequence of testing radiated spurious 1 GHz to 18 GHz	13
8	Measurement results	14
8.1	Summary	14
8.2	RF power output / Power limits	15
8.3	Occupied bandwidth	16
8.4	Emission limitations (RF spectrum mask)	17
8.5	Emissions limitations (conducted emissions)	18
8.6	Emissions limits (radiated emissions)	19
8.7	Emissions limitations (conducted emissions)	20
8.8	Transmitter frequency tolerance	21
9	Glossary	22
10	Document history	23
11	Accreditation Certificate – D-PL-12076-01-04	23
12	Accreditation Certificate – D-PL-12076-01-05	24

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

2.2 Application details

Date of receipt of order:	2019-07-09
Date of receipt of test item:	2019-11-25
Start of test:	2019-11-25
End of test:	2019-12-06
Person(s) present during the test:	Mr. Molander, Mr. Maaloe, Mr. Olsen

2.3 Test laboratories sub-contracted

None

3 Test standard/s, references and accreditations

Test standard	Date	Description
FCC - Title 47 CFR Part 25	2019-10	FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 25 - Satellite Communications
RSS-170	2015-07	Mobile Earth Stations (MESs) and Ancillary Terrestrial Component (ATC) Equipment Operating in the Mobile-Satellite Service (MSS) Bands

Guidance	Date	Description
ANSI C63.4-2014	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	2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
ANSI C63.26-2015	2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services

Accreditation	Description	
D-PL-12076-01-04	Telecommunication and EMC Canada https://www.dakks.de/as/ast/d/D-PL-12076-01-04.pdf	  Deutsche Akkreditierungsstelle D-PL-12076-01-04
D-PL-12076-01-05	Telecommunication FCC requirements https://www.dakks.de/as/ast/d/D-PL-12076-01-05.pdf	  Deutsche Akkreditierungsstelle D-PL-12076-01-05

4 Test environment

Temperature	:	T_{nom} T_{max} T_{min}	+22 °C during room temperature tests +55 °C during high temperature tests -25 °C during low temperature tests
Relative humidity content	:		45 %
Barometric pressure	:		not relevant for this kind of testing
Power supply	:	V_{nom} V_{max} V_{min}	24.0 V DC 24 V 12 V

5 Test item

5.1 General description

Kind of test item	:	Inmarsat landmobile terminal
Model name	:	EXPLORER 323
HMN	:	N/A
PMN	:	EXPLORER 323
HVIN	:	TT-3723A
FVIN	:	N/A
S/N serial number	:	T06 Sample A
Hardware status	:	A
Software status	:	0.06 build 1761
TX Frequency band	:	1626.5 – 1660.5 MHz
RX Frequency band	:	1525.0 – 1559.0 MHz
TX output power cond.	:	< 35 dBm (measured value)
TX output power rad.	:	< 41 dBm (measured value, with 6dBi nominal antenna gain)
Data rate	:	33.6 – 604.8 kbps
Type of modulation	:	QPSK-Pi/4, 16QAM
Antenna	:	Integrated patch antenna system consisting of 7 antenna patches
Power supply	:	12 V to 24 V DC
Temperature range	:	-25°C to +55°C

5.2 Operating conditions

Operating condition 1: $f_{\text{low}} = 1626.79 \text{ MHz}$, $f_{\text{mid}} = 1643.5 \text{ MHz}$, $f_{\text{high}} = 1660.33 \text{ MHz}$

Operating condition 2: carrier off state

Modulation Scheme	Modulation	Bitrate (kbps)
R5T1X	16QAM	134.4
R5T2X	16QAM	268.8
R5T45X	16QAM	604.8
R20T1X	16QAM	134.4
R20T2X	16QAM	268.8
R20T45X	16QAM	604.8
R5T2Q	QPSK-pi/4	134.4
R5T45Q	QPSK-pi/4	302.4
R20T05Q	QPSK-pi/4	33.6
R20T1Q	QPSK-pi/4	67.2
R20T2Q	QPSK-pi/4	134.4
R20T45Q	QPSK-pi/4	302.4

5.3 Additional information

The content of the following annexes is defined in the QA. It may be that not all of the listed annexes are necessary for this report, thus some values in between may be missing.

The content of the following annexes is defined in the QA. It may be that not all of the listed annexes are necessary for this report, thus some values in between may be missing.

Photos and plots are included in following documents:

- 1-6428/18-01-01_AnnexA
- 1-6428/18-01-01_AnnexB
- 1-6428/18-01-01_AnnexE
- 1-6428/18-01-01_AnnexL

More detailed pictures of DUT can also be found in applicant's document called
99-170223-A TT3723A Inside Outside Photos_v3.pdf

6 Description of the test setup

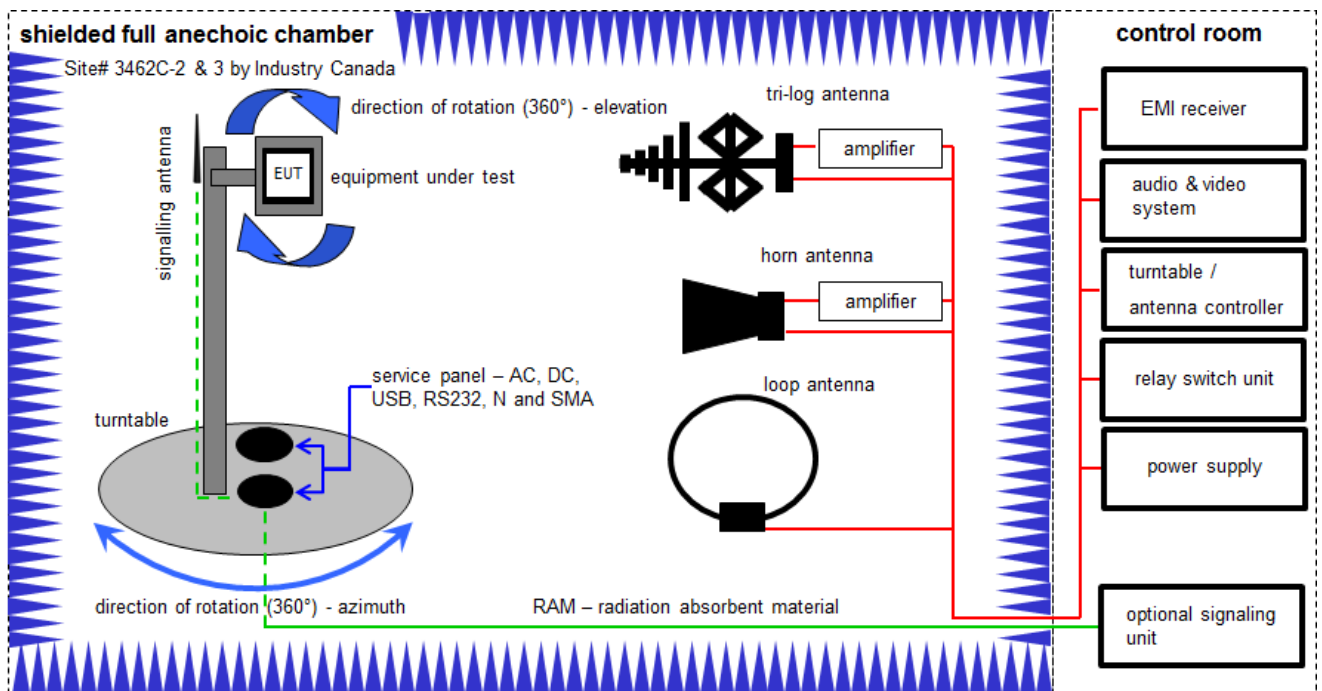
Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements 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
vkl!	Attention: extended calibration interval			
NK!	Attention: not calibrated		*)	next calibration ordered / currently in progress

6.1 Shielded fully anechoic chamber



Measurement distance: tri-log antenna and horn antenna 3 meter; loop antenna 3 meter / 1 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)

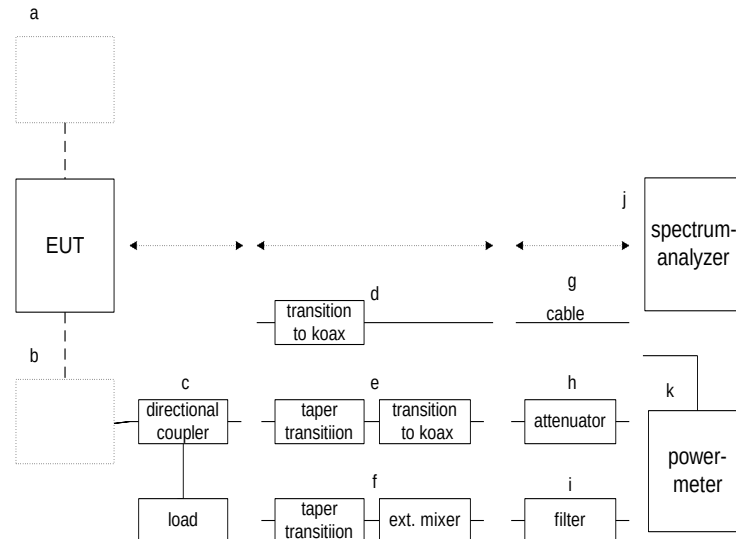
Example calculation:

$$OP \text{ [dBm]} = -65.0 \text{ [dBm]} + 50 \text{ [dB]} - 20 \text{ [dBi]} + 5 \text{ [dB]} = -30 \text{ [dBm]} \text{ (1 } \mu\text{W)}$$

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2818A03450	300001040	vKI!	12.12.2017	11.12.2020
2	n. a.	Active Loop Antenna 9 kHz to 30 MHz	6502	EMCO	2210	300001015	vKI!	13.06.2019	12.06.2021
3	n. a.	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
4	19	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	9107-3697	300001605	vKI!	27.02.2019	26.02.2021
5	n. a.	Switch / Control Unit	3488A	HP	*	300000199	ne	-/-	-/-
6	9	Variable isolating transformer	MPL IEC625 Bus Variable isolating transformer	Erli	91350	300001155	ne	-/-	-/-
7	90	Active Loop Antenna 9 kHz to 30 MHz	6502	EMCO/2	8905-2342	300000256	vKI!	11.04.2019	10.04.2021
8	n. a.	Band Reject filter	WRCG1850/1910-1835/1925-40/8SS	Wainwright	7	300003350	ev	-/-	-/-
9	n. a.	Band Reject filter	WRCG2400/2483-2375/2505-50/10SS	Wainwright	11	300003351	ev	-/-	-/-
10	n. a.	Highpass Filter	WHKX2.9/18G-12SS	Wainwright	1	300003492	ev	-/-	-/-
11	n. a.	EMI Test Receiver 20Hz- 26,5GHz	ESU26	R&S	100037	300003555	k	11.12.2019	10.03.2021
12	n. a.	Highpass Filter	WHK1.1/15G-10SS	Wainwright	3	300003255	ev	-/-	-/-
13	n. a.	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	19	300003790	ne	-/-	-/-
14	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck Mess - Elektronik	295	300003787	vKI!	19.02.2019	18.02.2021
15	n. a.	MXG Microwave Analog Signal Generator	N5183A	Agilent Technologies	MY47420220	300003813	vKI!	12.12.2019	11.12.2022
16	n. a.	High Pass Filter	VHF-3500+	Mini Circuits	-/-	400000193	ne	-/-	-/-
17	n. a.	Broadband Amplifier 0.5-18 GHz	CBLU5184540	CERNEX	22049	300004481	ev	-/-	-/-
18	n. a.	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne	-/-	-/-
19	n. a.	NEXIO EMV-Software	BAT EMC V3.19.1.9	EMCO		300004682	ne	-/-	-/-
20	n. a.	PC	ExOne	F+W		300004703	ne	-/-	-/-
21	n. a.	Highpass Filter (Chebyshev)	WHKX10-4432.5-4925-18000-40SS	Wainwright	1	300005028	ev	-/-	-/-
22	n. a.	Lowpass Filter (Chebyshev)	WLK12-5975-6333.5-18000-40SS	Wainwright	1	400001213	ev	-/-	-/-
23	n. a.	RF-Amplifier	AMF-6F06001800-30-10P-R	NARDA-MITEQ Inc	2011572	300005241	ev	-/-	-/-

6.2 Conducted measurements



OP = AV + CA
 (OP-output power; AV-analyzer value; CA-loss signal path)

Example calculation:

OP [dBm] = 6.0 [dBm] + 11.7 [dB] = 17.7 [dBm] (58.88 mW)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	R008	Power Sensor, 50 MHz to 26.5 GHz, -30 to +20 dBm	8485A	HP	2238A00798	300000511	vKI!	18.12.2018	17.12.2020
2	V002	Power Supply	2X30V	Zentro	2010	300000505	NK!	-/-	-/-
3	R004	Dual-channel power meter with GPIB	438A	HP	2839U01315	300001186	vKI!	13.12.2018	12.12.2020
4	U311	Fixed Coaxial Attenuator 10dB 100W DC-18GHz	WA91-10-34	Weinschel Ass	#A244	300004265	ne	-/-	-/-
5	R001	Signal- and Spectrum Analyzer 3 Hz - 50 GHz	PXA N9030A	Agilent Technologies	US51350267	300004338	k	03.04.2019	02.04.2020
6	U312	Fixed Coaxial Attenuator, 20dB 100W DC-18GHz	WA91-20-43	Weinschel Ass	A514	300004824	ev	-/-	-/-
7	C220	1.5m / 2.4mm coaxial cable	SF101	Huber&Suhner	5183/1	-/-	ev	-/-	-/-
8		26.5 GHz power splitter	11667B	HP	00616	300002421	ev	-/-	-/-
9	n. a.	Temperature Test Chamber	T-40/50	CTS GmbH	064023	300003540	ev	07.05.2018	06.05.2020
10	FHPF	High Pass Filter 2.5-18 GHz	HPM50110	Micro-Tronics	083	property of applicant			
11	FCob	Band stop filter & 10 dB Attenuator	XN 6534 Mod 766-10	BSC Narda	2404101 -/-	property of applicant			

7 Sequence of testing

7.1 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, it is placed on a table with 0.8 m height.
- 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 height is 1 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 pre-measurement are maximized by the software by rotating the turntable from 0° to 360°.
- Loop antenna is rotated about its vertical axis for maximum response at each azimuth about the EUT. (For certain applications, the loop antenna plane may also need to be positioned horizontally at the specified distance from the EUT)
- 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.

*)Note: The sequence will be repeated three times with different EUT orientations.

7.2 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 $\pm 45^\circ$ 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.

7.3 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.

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 / RSS-170	see table	2020-02-28	-/-

Test Specification Clause	Test Case	C	NC	NA	NP	Remark
§2.1046 / §25.204/ RSS-170, 5.3.2	Measurements required: RF power output / Power limits	X				complies
§2.1049	Measurements required: Occupied bandwidth	X				complies
§2.1051/ §25.202/ RSS-170, 5.4.3.1	Measurements required: Spurious emissions at antenna terminals / Emission limitations (conducted emissions)	X				complies
§2.1053/ §25.202/ RSS-170, 5.4.3.1	Measurements required: Field strength of spurious radiation / Emission limitations (radiated emissions)	X				complies
§2.1055 / §25.202/ RSS-170, 5.2	Measurements required: Frequency stability / Frequency tolerances	X				complies
§25.216/ RSS-170, 5.4.3.2 & 5.4.4	Limits on emissions from mobile earth stations for protection of aeronautical radionavigation-satellite service / Carrier-Off State Emissions	X				complies

Note:

C	Compliant	NC	Not compliant	NA	Not applicable	NP	Not performed
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8.2 RF power output / Power limits

Description / Limit:

§25.204 Power limits

(b) In bands shared coequally with terrestrial radiocommunication services, the equivalent isotropically radiated power transmitted in any direction towards the horizon by an earth station operating in frequency bands between 1 and 15 GHz shall not exceed the following limits except as provided for in paragraph (c) of this section:

+40 dBW in any 4 kHz band for $\theta \leq 0^\circ$

+40 + 3 * θ dBW in any 4 kHz band for $0^\circ < \theta \leq 5^\circ$

θ = elevation angle above horizon

(c) For angles of elevation of the horizon greater than 5° there shall be no restriction as to the equivalent isotropically radiated power transmitted by an earth station towards the horizon.

Test setup(s): 6.2hgk

Measurement results:

Modulation Scheme	Transmitter conducted output power [dBm]			Transmitter radiated output power / EIRP [dBm]		
	f _{low}	f _{mid}	f _{high}	f _{low}	f _{mid}	f _{high}
R5T1X	34.3	34.7	34.6	40.3	40.7	40.6
R5T2X	33.7	34.1	33.9	39.7	40.1	39.9
R5T45X	33.7	34.1	34.0	39.7	40.1	40.0
R20T1X	34.1	34.5	34.3	40.1	40.5	40.3
R20T2X	33.7	34.1	34.0	39.7	40.1	40.0
R20T45X	33.9	34.2	34.1	39.9	40.2	40.1
R5T2Q	33.3	33.7	33.6	39.3	39.7	39.6
R5T45Q	33.5	33.9	33.7	39.5	39.9	39.7
R20T05Q	33.7	34.1	33.9	39.7	40.1	39.9
R20T1Q	33.8	34.2	34.1	39.8	40.2	40.1
R20T2Q	33.6	34.0	33.9	39.6	40.0	39.9
R20T45Q	33.7	34.1	34.0	39.7	40.1	40.0

8.3 Occupied bandwidth

Description:

§2.1 Occupied Bandwidth

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 a specified percentage $b/2$ of the total mean power of a given emission.

NOTE: Unless otherwise specified in an ITU–R Recommendation for the appropriate class of emission, the value of $b/2$ should be taken as 0.5%. (RR).

Test setup(s): 6.2hgj

Measurement results:

Modulation Scheme	Occupied Bandwidth (99%)		
	f_{low}	f_{mid}	f_{high}
R5T1X	37.2 kHz	37.1 kHz	37.2 kHz
R5T2X	74.3 kHz	74.4 kHz	74.4 kHz
R5T45X	169.3 kHz	169.5 kHz	169.5 kHz
R20T1X	37.3 kHz	37.2 kHz	37.3 kHz
R20T2X	74.7 kHz	74.7 kHz	74.8 kHz
R20T45X	170.1 kHz	169.8 kHz	169.7 kHz
R5T2Q	75.0 kHz	74.4 kHz	74.5 kHz
R5T45Q	166.8 kHz	166.2 kHz	166.6 kHz
R20T05Q	18.5 kHz	18.6 kHz	18.5 kHz
R20T1Q	37.1 kHz	37.1 kHz	37.1 kHz
R20T2Q	74.3 kHz	74.4 kHz	74.2 kHz
R20T45Q	166.6 kHz	166.7 kHz	166.9 kHz

Plots:

see document 1-6428/18-01-01_AnnexL, plot 1 – 39

8.4 Emission limitations (RF spectrum mask)

Description / Limit:

§25.202 Frequencies, frequency tolerance and emission limitations

(f) Emission limitations. Except for SDARS terrestrial repeaters, the mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the schedule set forth in paragraphs (f)(1) through (f)(4) of this section.

(1) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: 25 dB;

(2) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: 35 dB;

(3) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 250 percent of the authorized bandwidth:

An amount equal to 43 dB plus 10 times the logarithm (to the base 10) of the transmitter power in watts;

(4) In any event, when an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in paragraphs (f) (1), (2) and (3) of this section.

Test setup(s): 6.2hgj

Measurement results:

Mode	see following plots
Tx-mode, f_{low}	40, 41
Tx-mode, f_{mid}	48, 49
Tx-mode, f_{high}	55, 56

Note:

Measurements are performed with most commonly used modulation scheme R20T45X.

8.5 Emissions limitations (conducted emissions)

Description / Limit:

§25.202 Frequencies, frequency tolerance and emission limitations

(f) Emission limitations. Except for SDARS terrestrial repeaters, the mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the schedule set forth in paragraphs (f)(1) through (f)(4) of this section.

(1) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: 25 dB;

(2) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: 35 dB;

(3) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 250 percent of the authorized bandwidth:

An amount equal to 43 dB plus 10 times the logarithm (to the base 10) of the transmitter power in watts;

(4) In any event, when an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in paragraphs (f) (1), (2) and (3) of this section.

Test setup(s): 6.2hgj

Measurement results:

Conducted Spurious Emissions [dBm]								
f _{low}			f _{mid}			f _{high}		
F [MHz]	Detector	Level [dBm]	F [GHz]	Detector	Level [dBm]	F [MHz]	Detector	Level [dBm]
no critical peaks found			no critical peaks found			no critical peaks found		
Measurement uncertainty			± 1.5 dB					

n.f. = nothing found

Note:

Measurements are performed with most commonly used modulation scheme R20T45X.

Plots:

see document 1-6428/18-01-01_AnnexL, plot 40 – 62

8.6 Emissions limits (radiated emissions)

Description / Limit:

§25.202 Frequencies, frequency tolerance and emission limitations

(f) Emission limitations. Except for SDARS terrestrial repeaters, the mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the schedule set forth in paragraphs (f)(1) through (f)(4) of this section.

(1) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: 25 dB;

(2) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: 35 dB;

(3) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 250 percent of the authorized bandwidth:

An amount equal to 43 dB plus 10 times the logarithm (to the base 10) of the transmitter power in watts;

(4) In any event, when an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in paragraphs (f) (1), (2) and (3) of this section.

Test setup(s): 6.1

Measurement results:

Radiated Spurious Emissions [dBm]								
f _{low}			f _{mid}			f _{high}		
F [MHz]	Detector	Level [dBm]	F [MHz]	Detector	Level [dBm]	F [MHz]	Detector	Level [dBm]
no critical peaks found			no critical peaks found			no critical peaks found		
Measurement uncertainty			± 3 dB					

n.f. = nothing found

v / h = vertical / horizontal

Note:

Measurements are performed with most commonly used modulation scheme R20T45X.

Plots:

see document 1-6428/18-01-01_AnnexL, plot 67 – 70

8.7 Emissions limitations (conducted emissions)

Description / Limit:

§ 25.216 Limits on emissions from mobile earth stations for protection of aeronautical radionavigation-satellite service.

(h) Mobile earth stations manufactured more than six months after FEDERAL REGISTER publication of the rule changes adopted in FCC 03–283 with assigned uplink frequencies in the 1626.5–1660.5 MHz band shall suppress the power density of emissions in the 1605–1610 MHz band-segment to an extent determined by linear interpolation from -70 dBW/MHz at 1605 MHz to -46 dBW/MHz at 1610 MHz, averaged over any 2 millisecond active transmission interval. The e.i.r.p of discrete emissions of less than 700 Hz bandwidth from such stations shall not exceed a level determined by linear interpolation from -80 dBW at 1605 MHz to -56 dBW at 1610 MHz, averaged over any 2 millisecond active transmission interval.

(i) The e.i.r.p density of carrier-off state emissions from mobile earth stations manufactured more than six months after FEDERAL REGISTER publication of the rule changes adopted in FCC 03–283 with assigned uplink frequencies between 1 and 3 GHz shall not exceed -80 dBW/MHz in the 1559–1610 MHz band averaged over any two millisecond interval.

Test setup(s): 6.2hgj

Measurement results:

Conducted Spurious Emissions [dBm]								
f _{low}			f _{mid}			f _{high}		
F [MHz]	Detector	Level [dBm]	F [MHz]	Detector	Level [dBm]	F [MHz]	Detector	Level [dBm]
no critical peaks found			no critical peaks found			no critical peaks found		
Measurement uncertainty			± 1.5 dB					

n.f. = nothing found

Note:

Measurements are performed with most commonly used modulation scheme R20T45X.

Plots:

see document 1-6428/18-01-01_AnnexL, plot 63 – 66

8.8 Transmitter frequency tolerance

Description / Limit:

§25.202 Frequencies, frequency tolerance and emission limitations

(d) Frequency tolerance, Earth stations.

The carrier frequency of each earth station transmitter authorized in these services shall be maintained within 0.001 percent of the reference frequency.

Test setup: 6.2hgj

Measurement results:

Temperature [°C]	Voltage [V DC]	Reference Frequency [MHz]	Measured Frequency [MHz]	Deviation [Hz]	Deviation [ppm]
-30	24.0	1643.5	1643.499824	-176	-0.11
-20	24.0	1643.5	1643.500066	66	0.04
-10	24.0	1643.5	1643.500213	213	0.13
0	24.0	1643.5	1643.500264	264	0.16
10	24.0	1643.5	1643.500236	236	0.14
20	24.0	1643.5	1643.500066	66	0.04
20	10.8	1643.5	1643.500066	66	0.04
20	31.2	1643.5	1643.500066	66	0.04
30	24.0	1643.5	1643.499972	-28	-0.02
40	24.0	1643.5	1643.499976	-24	-0.01
50	24.0	1643.5	1643.500117	117	0.07

Note:

Above values show the frequency deviation when operating in special test mode without receiving the forward link of satellite. Under normal operation the DUT's transmit frequency is locked to the forward link of satellite.

For testing purpose DUT's modulation is deactivated, CW carrier is activated.

Spectrum analyzer is connected to external GPS based 10 MHz reference signal.

Spectrum analyzer's internal frequency counter function is used.

9 Glossary

EUT	Equipment under test
DUT	Device under test
UUT	Unit 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/N₀	Carrier to noise-density ratio, expressed in dB-Hz

10 Document history

Version	Applied changes	Date of release
-/-	Initial release – DRAFT	2019-12-20
	editorial changes based on applicant's remarks	2020-02-28

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

first page

last page



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.-Ing. Uwe Zimmermann
 Head of Division

See notes overleaf

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The publication of extracts of the accreditation certificate is subject to the prior written approval by Deutsche Akkreditierungsstelle GmbH (DAkKS). Exempted is the unchanged form of separate disseminations of the cover sheet by the conformity assessment body mentioned overleaf.

No impression shall be made that the accreditation also extends to fields beyond the scope of accreditation attested by DAkKS.

The accreditation was granted pursuant to the Act on the Accreditation Body (AkkStelleG) of 31 July 2009 (Federal Law Gazette I p. 2625) and the Regulation (EC) No 765/2008 of the European Parliament and of the Council of 9 July 2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products (Official Journal of the European Union L 218 of 9 July 2008, p. 30). DAkKS is a signatory to the Multilateral Agreements for Mutual Recognition of the European co-operation for Accreditation (EA), International Accreditation Forum (IAF) and International Laboratory Accreditation Cooperation (ILAC). The signatories to these agreements recognise each other's accreditations.

The up-to-date state of membership can be retrieved from the following websites:

EA: www.european-accreditation.org
 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



Deutsche Akkreditierungsstelle GmbH

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Accreditation



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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 (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

Dr. Bodo Lueke
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END OF TEST REPORT