
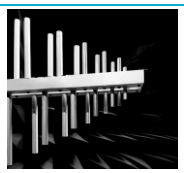
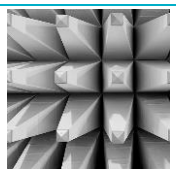

Bundesnetzagentur

BNetzA-CAB-02/21-102

TEST REPORT

Test report no.: 1-8774/19-01-06-A

Testing laboratory

CTC advanced GmbH
Untertuerkheimer Strasse 6 – 10
66117 Saarbruecken / Germany
Phone: + 49 681 5 98 - 0
Fax: + 49 681 5 98 - 9075
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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 starting with the registration number: D-PL-12076-01.

Applicant

Intellian Technologies, Inc.
18-7, Jinwisandan-ro, Jinwi-myeon (Chungho-ri),
Pyeongtaek-si, Gyeonggi-do 17709 Korea
Phone: +82 31 379 1000

Manufacturer

Intellian Technologies, Inc.
18-7, Jinwisandan-ro, Jinwi-myeon (Chungho-ri),
Pyeongtaek-si, Gyeonggi-do 17709 Korea

Test standard/s

CFR 47 Part 25	Satellite Communications
RSS-170	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 of this test report.

Test Item

Kind of test item:	**Iridium Certus Terminal**
Product name:	**Intellian C700**
Model name:	**C1-70-A00S**
FCC ID:	**XXZ-INTC700**
IC:	**26236-INTC700**
Frequency:	1610 – 1626.5 MHz (flow = 1616 MHz , fmid = 1621 MHz, fhigh = 1626 MHz)
Antenna:	Integrated patch antenna (electronically phased array)
Power supply:	10.8-30 V DC (120W) from power supply
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:

Thomas Vogler

cn=Thomas Vogler, o=CTC advanced GmbH, ou=VOG-161125, email=thomas.vogler@ctcadvanced.com, c=DE
2020.09.03 13:59:59 +02'00'

Thomas Vogler
Lab Manager
Radio Communications & EMC

Test performed:

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2020.09.03 13:53:06 +02'00'

Meheza Walla
Lab Manager
Radio Communications & EMC

1 Table of contents

2 General information

2.1 Notes and disclaimer

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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.

This test report replaces the test report with the number 1-8774_19-01-06 and dated 2020-08-07

2.2 Application details

Date of receipt of order:	2019-12-09
Date of receipt of test item:	2020-01-13
Start of test:	2020-01-20
End of test:	2020-06-29
Person(s) present during the test:	Mr. Choi, Mr. Byun, Mr. Yoon, Mr. Song

2.3 Test laboratories sub-contracted

None

3 Test standard/s, references and accreditations

Test standard	Date	Description
47 CFR Part 25		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

Reference	Version	Description
ANSI C63.10-2013	-/-	American national standard of procedures for compliance testing of unlicensed wireless devices
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 C63.26-2015	-/-	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	
D-PL-12076-01-05	Telecommunication FCC requirements https://www.dakks.de/as/ast/d/D-PL-12076-01-05.pdf	

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	:		55 %
Barometric pressure	:		not relevant for this kind of testing
Power supply	:	V_{nom}	10.8-30 V DC (120W) from power supply

5 Test item

5.1 General description

Kind of test item	**:**	**Iridium Certus Terminal**
Product name	**:**	**Intellian C700**
Model name	**:**	**C1-70-A00S**
Series mode name	**:**	**C1-70-A00R**
HMN:		-/-
PMN:		Intellian C700
HVIN1:		C1-70-A00S
HVIN2:		C1-70-A00R
FVIN:		-/-
S/N serial number	:	ADU 404352A C702004001 BDU 404338A B702004001
HW hardware status	:	-/-
SW software status	:	-/-
Frequency band	:	1610 – 1626.5 MHz (f_{low} = 1616 MHz , f_{mid} = 1621 MHz, f_{high} = 1626 MHz)
Type of modulation	:	16APSK, QPSK
TX output power cond.:		24.30 dBm (measured value at Powermeter) 39.37 dBm (measured Peak value at SA)
TX output power rad. (EIRP):		49.77 dBm (calculated value)
Number of channels		254
Channel spacing	:	666.666 kHz
Antenna	:	Integrated patch antenna (electronically phased array)
Power supply	:	10.8-30 V DC (120W) from power supply
Temperature range	:	-25 °C to +55 °C

5.2 Operating conditions

Operating condition 1: fl = f_{low} = 1616 MHz , fm = f_{mid} = 1621 MHz, fh = f_{high} = 1626 MHz
Operating condition 2: TX off, carrier off state

Modulation Scheme	Modulation	Symbole rate (ksps)	Bit rate (kbps)	Nominal bandwidth (kHz)
TCH_B1	DEQPSK	25	50	41.667
TCH_B8	DEQPSK x8	200	400	333.336
TCH_C1	QPSK	30	60	41.667
TCH_C2	QPSK x2	60	120	83.334
TCH_C8Q	QPSK x8	240	480	333.333
TCH_2C8Q	QPSK x8 (Dual Carriers)	480	960	666.666
TCH_C8A	16APSK x8	240	960	333.333
TCH_2C8A	16APSK x8 (Dual Carriers)	480	1920	666.666
TX off	-/-	-/-	-/-	-/-

For the radiatied measurements following settings were necessary: Power : 270
APV: 17

For the conducted measurements following settings were necessary: Power: 270
APV: 6

Additionally, on the page 6 and 7 more detail information about what APV representing for.

Rx Path A 1616 MHz

Rx APV number	Path	Theta (actual)	Phi (actual)	Gain	Directivity
0	A	50	40	31.1	10.1
1	A	50	52	31.2	10.1
2	A	65	13	29.8	9.6
3	A	74	24	30.7	9.7
4	A	82	31	30.1	9.3
5	A	79	335	29.6	9.2
6	A	79	349	29.5	9.3
7	A	82	4	30.7	9.4
8	A	48	105	31.0	9.8
9	A	48	118	31.4	9.7
10	A	66	73	30.5	9.8
11	A	74	89	30.3	9.7
12	A	82	90	29.8	9.3
13	A	80	39	29.2	8.8
14	A	84	40	29.5	8.7
15	A	92	71	28.6	8.9
16	A	45	139	31.1	10.0
17	A	46	155	31.3	9.9
18	A	56	129	30.7	9.7
19	A	68	137	31.5	9.9
20	A	73	146	31.1	9.6
21	A	83	91	29.4	8.8
22	A	87	108	29.4	9.1
23	A	88	123	30.3	9.2
24	A	45	214	30.8	10.0
25	A	47	227	31.2	10.2
26	A	56	189	30.8	9.5
27	A	70	202	31.2	9.9
28	A	76	208	30.8	9.9
29	A	89	155	29.4	8.9
30	A	86	166	30.5	9.1
31	A	87	182	29.5	8.6
32	A	49	286	31.6	9.8
33	A	49	300	30.4	8.9
34	A	70	257	31.0	10.2
35	A	77	268	31.3	9.7
36	A	84	275	30.1	8.8
37	A	83	223	29.6	8.9
38	A	84	240	29.9	8.8
39	A	85	253	30.7	8.9
40	A	39	310	30.3	9.6
41	A	41	332	30.7	9.7
42	A	50	305	31.6	9.6
43	A	59	321	31.4	9.9
44	A	68	327	31.1	10.0
45	A	79	270	28.8	8.5
46	A	80	281	30.2	8.3
47	A	81	299	29.3	8.6

Antenna data summary table from antenna report

APV No.	Element Odd patch No.	Element Even patch No.
1	1	2
2	1	2
3	1	8
4	1	8
5	1	8
6	7	8
7	7	8
8	7	8
9	3	2
10	3	2
11	9	2
12	9	2
13	9	2
14	9	8
15	9	8
16	9	8
17	3	4
18	3	4
19	3	10
20	3	10
21	3	10
22	9	10
23	9	10
24	9	10
25	5	4
26	5	4
27	11	4
28	11	4
29	11	4
30	11	10
31	11	10
32	11	10
33	5	6
34	5	6
35	5	12
36	5	12
37	5	12
38	11	12
39	11	12
40	11	12
41	1	6
42	1	6
43	7	6
44	7	6
45	7	6
46	7	12
47	7	12
48	7	12

Antenna combination information for each APV

"Gain" column from above figure represents 'Gain for each Rx/Tx path of matrix switch board + Antenna gain' and "Directivity" is actually refer to 'Antenna gain'.

Path A or B is for simulating the Iridium system and Path A is for satellite data communications and Path B is for looking for the satellite which is not communicating.

Please refer to peak gain summary as below.

Frequency	Path	Tx	Rx
1616 MHz	Path A	10.4	10.2
	Path B	-	10.2
1621 MHz	Path A	10.4	10.2
	Path B	-	10.2
1626.5 MHz	Path A	10.2	10.1
	Path B	-	10.2

Intellian C700 has total 12 antennas and any combinations of 2 antennas will be transmitting. And these 2 antennas must be right next to each other (combinations of separated far away antennas are excluded from the combinations).

APV is basically the number of these 2 antennas combinations and information of each APV number refer to below table.

Please note that there are duplicated odd and even patch combinations due to the different angle of phases.

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.

EUT external photos are included in test report: 1-8774/19-01-01_AnnexE

EUT internal photos are included in test report: 1-8774/19-01-01_AnnexF

Test setup photos are included in test report: 1-8774/19-01-01_AnnexG

Plots are included in test report: 1-8774/19-01-01_AnnexI

6 Description of the test setup

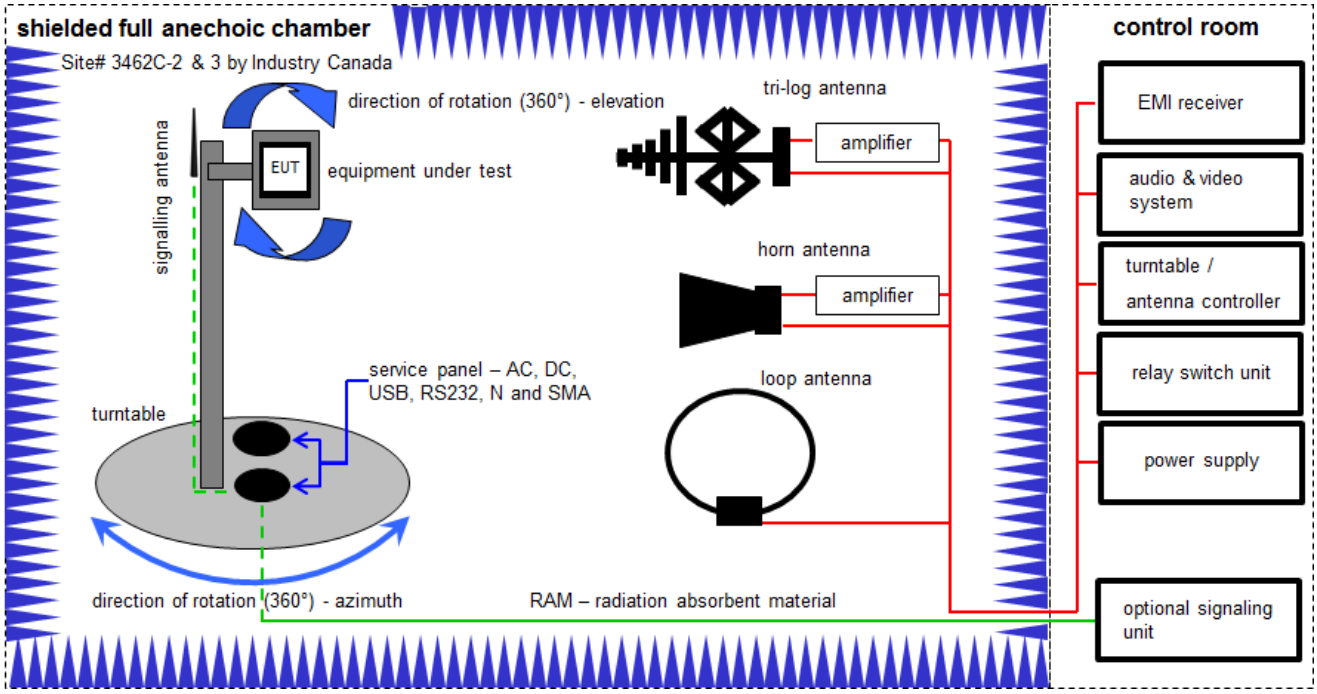
Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements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

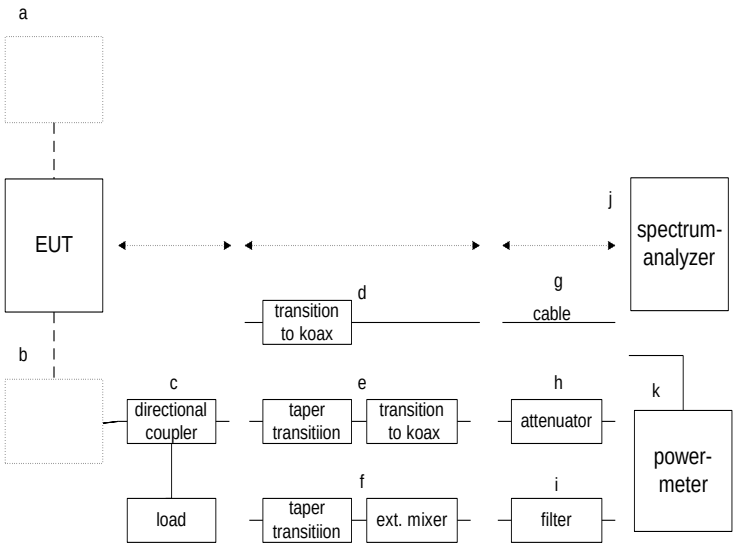
OP = AV + D - G + CA
(OP-radiated output power; AV-analyzer value; D-free field attenuation of measurement distance; G-antenna gain+amplifier gain; CA-loss signal path)

Example calculation:
OP [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.	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2818A03450	300001040	vIKI!	12.12.2017	11.12.2020
2	n. a.	Active Loop Antenna 9 kHz to 30 MHz	6502	EMCO	2210	300001015	vIKI!	13.06.2019	12.06.2021
3	n. a.	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
4	n. a.	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	9107-3697	300001605	vIKI!	27.02.2019	26.02.2021
5	n. a.	Switch / Control Unit	3488A	HP	*	300000199	ne	-/-	-/-
6	n. a.	Variable isolating transformer	MPL IEC625 Bus Variable isolating transformer	Erfi	91350	300001155	ne	-/-	-/-
7	n. a.	Active Loop Antenna 9 kHz to 30 MHz	6502	EMCO/2	8905-2342	300000256	vIKI!	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	vIKI!	19.02.2019	18.02.2021
15	n. a.	MXG Microwave Analog Signal Generator	N5183A	Agilent Technologies	MY47420220	300003813	vIKI!	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



Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	Power Sensor, 50 MHz to 26.5 GHz, -30 to +20 dBm	8485A	HP	2238A00798	300000511	vIKI!	18.12.2018	17.12.2020
2	n. a.	Power Supply	2X30V	Zentro	2010	300000505	NK!	-/-	-/-
3	n. a.	Dual-channel power meter with GPIB	438A	HP	2839U01315	300001186	vIKI!	13.12.2018	12.12.2020
4	n. a.	Fixed Coaxial Attenuator 10dB 100W DC-18GHz	WA91-10-34	Weinschel Ass	#A244	300004265	ne	-/-	-/-
5	R001	Spectrum Analyzer 2 Hz - 50 GHz	FSU50	R&S	200012	300003443	k	19.02.2019	18.02.2021
6	n. a.	Fixed Coaxial Attenuator, 20dB 100W DC-18GHz	WA91-20-43	Weinschel Ass	A514	300004824	ev	-/-	-/-
7	U005	High Power Attenuator 30 dB, DC	9498A	HP	2702A04550	300002403	ev	-/-	-/-
8	C220	HF-Cable	SUCOFLEX 101	Huber&Suhner	3054/1	-/-	ev	-/-	-/-
9	n. a.	26.5 GHz power splitter	11667B	HP	00616	300002421	ev	-/-	-/-
10	n. a.	Temperature Test Chamber	T-40/50	CTS GmbH	064023	300003540	ev	08.05.2020	07.05.2022
11	FHPF	High Pass Filter 2.5-18 GHz	HPM50110	Micro-Tronics	083	-/-	ev	-/-	-/-
12	n. a.	Band stop filter & 10 dB Attenuator	XN 6534 Mod 766-10	BSC Narda	2404101 -/-	-/-	ev	-/-	-/-

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, 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.

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 ± 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.

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.

7.4 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.

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	2020-09-03	-/-

Test Specification Clause	Test Case	C	NC	NA	NP	Remark
§2.1046 / §25.204/ RSS-170, 5.3.2	RF power output / Power limits	X				complies
§2.1049	Occupied bandwidth	X				complies
§2.1051/ §25.202/ RSS-170, 5.4.3.1	Spurious emissions at antenna terminals / Emission limitations (conducted emissions)	X				complies
§2.1053/ §25.202/ RSS-170, 5.4.3.1	Field strength of spurious radiation / Emission limitations (radiated emissions)	X				complies
§2.1055 / §25.202/ RSS-170, 5.2 RSS-Gen Issue 4 §6.11	Transmitter 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

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 $\theta \leq 0°$
+40 + 3 * θ dBW in any 4 kHz band for $0° < \theta \leq 5°$
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 / 6.2hgj

Measurement results:

Modulation Scheme	Transmitter conducted output power with Powermeter [dBm]		
	f_{low}	f_{mid}	f_{high}
TCH_B1	20.70	20.80	20.75
TCH_B8	21.00	21.30	21.10
TCH_C1	21.10	21.10	21.10
TCH_C2	21.20	21.20	21.20
TCH_C8Q	20.90	21.20	21.00
TCH_2C8Q	24.10	24.20	23.00
TCH_C8A	20.90	21.30	21.10
TCH_2C8A	24.00	24.30	23.00

Modulation Scheme	Transmitter conducted output power with PXA (RMS detector) [dBm]		
	f_{low}	f_{mid}	f_{high}
TCH_B1	20.17	20.74	20.22
TCH_B8	19.98	20.99	20.60
TCH_C1	20.89	20.96	21.00
TCH_C2	20.22	21.24	20.35
TCH_C8Q	20.21	20.41	20.14
TCH_2C8Q	22.97	23.08	21.98
TCH_C8A	20.52	20.16	20.55
TCH_2C8A	23.56	23.04	22.19

Modulation Scheme	Transmitter conducted output power with PXA (Peak detector) [dBm]		
	f_{low}	f_{mid}	f_{high}
TCH_B1	31.39	31.21	31.33
TCH_B8	38.24	39.13	38.56
TCH_C1	33.87	34.26	33.97
TCH_C2	34.32	34.44	34.29
TCH_C8Q	34.03	34.54	34.08
TCH_2C8Q	38.87	38.97	37.84
TCH_C8A	34.56	35.14	34.81
TCH_2C8A	39.22	39.37	38.39

Modulation Scheme	Transmitter radiated output power / EIRP [dBm]		
	f_{low}	f_{mid}	f_{high}
TCH_B1	41.79	41.61	41.53
TCH_B8	48.64	49.53	**48.76**
TCH_C1	44.27	44.66	44.17
TCH_C2	44.72	44.84	44.49
TCH_C8Q	44.43	44.94	44.28
TCH_2C8Q	49.27	49.37	48.04
TCH_C8A	44.96	45.54	45.01
TCH_2C8A	**49.62**	**49.77**	48.59

Note: The manufacturer declared an antenna gain of 10.4 dBi / 10.2 dBi

Please refer to peak gain summary as below.

Frequency	Path	Tx	Rx
1616 MHz	Path A	10.4	10.2
	Path B	-	10.2
1621 MHz	Path A	10.4	10.2
	Path B	-	10.2
1626.5 MHz	Path A	10.2	10.1
	Path B	-	10.2

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}
TCH_B1	-/-	32 kHz	-/-
TCH_B8	-/-	323 kHz	-/-
TCH_C1	-/-	33 kHz	-/-
TCH_C2	-/-	65 kHz	-/-
TCH_C8Q	-/-	260 kHz	-/-
TCH_2C8Q	-/-	596 kHz	-/-
TCH_C8A	-/-	260 kHz	-/-
TCH_2C8A	-/-	595 kHz	-/-

Plots:

See document 1-8774/19-01-01_AnnexI, plot 1 – 8.

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}	9
Tx-mode, f_{mid}	20, 21
Tx-mode, f_{high}	30, 31

Note:

Measurements are performed with most commonly used modulation scheme TCH_2C8A.

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 TCH_2C8A.

Plots:

See document 1-8774/19-01-01_AnnexI, plot 9 – 39.

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 TCH_2C8A.

Plots:

See document 1-8774/19-01-01_AnnexI, plot 48 – 59.

8.7 Emissions limitations (conducted emissions)

Description / Limit:

§ 25.216 Limits on emissions from mobile earth stations for protection of aeronautical radionavigation-satellite service.
(g) 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 1610–1626.5 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 -20 dBW at 1610 MHz, averaged over any 2 millisecond active transmission 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

Plots:

See document 1-8774/19-01-01_AnnexI, plot 40 – 47.

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.

(4)(i) The following frequencies are available for use by the 1.6 GHz Mobile-Satellite Service:
1610-1626.5 MHz: User-to-Satellite Link
1613.8-1626.5 MHz: Satellite-to-User Link (secondary)

(iii)(A) The following frequencies are available for use by the 1.6 GHz Mobile-Satellite Service:
1626.5-1660.5 MHz: Earth-to-space

RSS-Gen Issue 4 §6.11
In circumstances when the transmitter frequency stability is not stated in the applicable RSS or reference measurement method, the following applies:

Frequency stability is a measure of frequency drift due to temperature and supply voltage variations, with reference to the frequency measured at an appropriate reference temperature and the rated supply voltage. Unless specified otherwise in an RSS applicable to the device, the reference temperature for radio transmitters is +20°C (+68°F).

Test setup: 6.2hgj

Measurement results:

Temperature [°C]	Voltage [V DC]	Reference Frequency [MHz]	Measured Frequency [MHz]	Deviation [ppm]
-30	V_{nom}	fm: 1620. 978 270 979 (deviation based on 20 °C)	1620. 977 823 214	0.28
-20	V_{nom}		1620. 977 793 020	0.29
-10	V_{nom}		1620. 977.552 486	0.44
0	V_{nom}		1620. 977 540 859	0.45
+10	V_{nom}		1620. 977 971 665	0.18
+20	V_{min} - V_{max}		1620. 978 270 979	0.00
+30	V_{nom}		1620. 978 297.451	0.02
+40	V_{nom}		1620. 978 761 178	0.30
+50	V_{nom}		1620. 978 753 504	0.30
+55	V_{nom}		1620. 978 860 744	0.36

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/N_0	Carrier to noise-density ratio, expressed in dB-Hz

10 Document history

Version	Applied changes	Date of release
-/-	Initial release – DRAFT	2020-06-30
-/-	Editorial changes based on applicant´s remarks	2020-08-07
A	Editorial changes based on TCB remarks	2020-09-03

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

first page

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

See notes overleaf

last page

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

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

first page

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

Frankfurt am Main, 11.01.2019

Dipl.-Biol. Uwe Zimmermann
Head of Division

See notes overleaf.

last page

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########## END OF TEST REPORT ##########