

TEST REPORT

Test report no.: 1-1739/21-01-07

Testing laboratory

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Accredited Testing Laboratory:

The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2018-03) 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.

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Manufacturer

Hiber B.V.

Moermanskkade 600

1013 BC Amsterdam / NETHERLANDS

Test standard/s

FCC - Title 47 CFR
Part 25

FCC - Title 47 of the Code of Federal Regulations; Chapter I; 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 3 of this test report.

Test Item

Kind of test item: Industrial IoT device

Model name: Easypulse Edge Station

FCC ID: 2ASDVEDGE1

IC: 24744-EDGE1

Frequency: 1626.5 – 1660.5 MHz

Technology tested: Mobile Earth Station (MES)

Antenna: Integrated patch antenna

Power supply: 21.6 V DC by integrated battery

Temperature range: -30°C to +65°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.

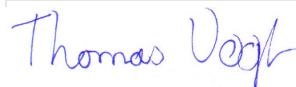
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2 General information

2.1 Notes and disclaimer

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

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2.2 Application details

Date of receipt of order:	2021-07-28
Date of receipt of test item:	2021-08-16
Start of test:	2021-08-18
End of test:	2021-08-23
Person(s) present during the test:	---

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

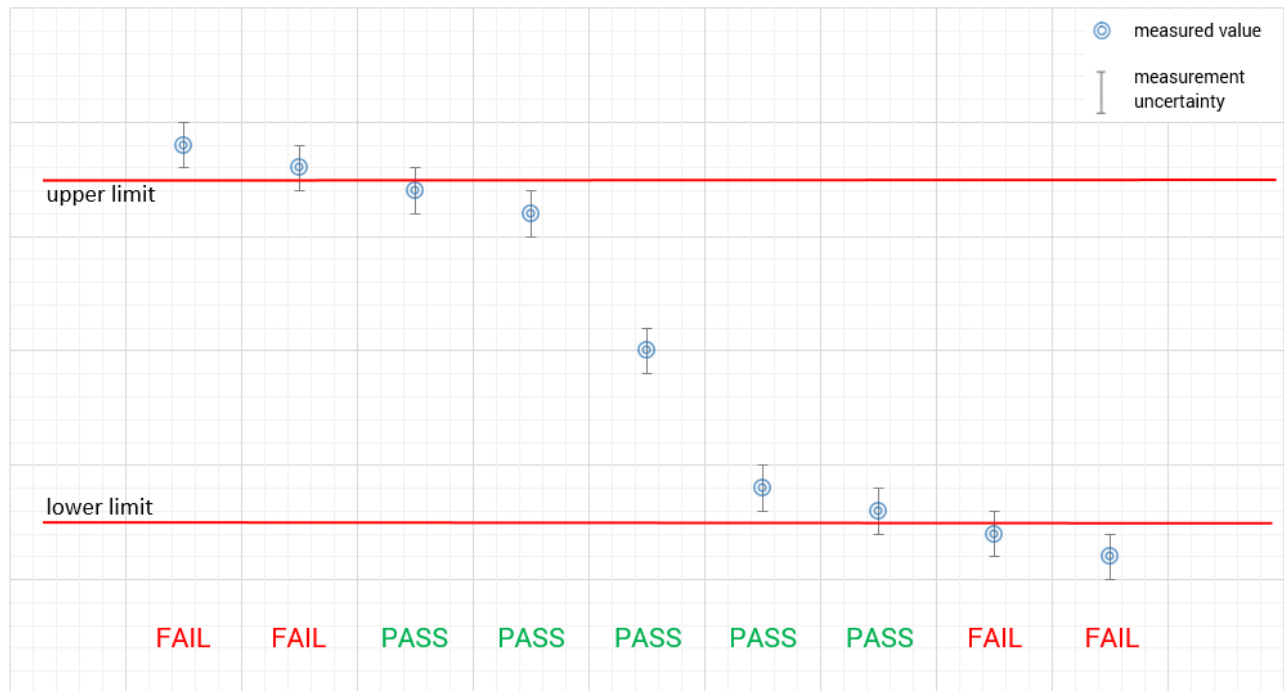
Accreditation	Description	
D-PL-12076-01-04	Telecommunication and EMC Canada https://www.dakks.de/as/ast/d/D-PL-12076-01-04.pdf	  Deutsche Akkreditierungsstelle D-PL-12076-01-04
D-PL-12076-01-05	Telecommunication FCC requirements https://www.dakks.de/as/ast/d/D-PL-12076-01-05.pdf	  Deutsche Akkreditierungsstelle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

3.1 Reporting statements of conformity – decision rule

Only the measured values related to their corresponding limits will be used to decide whether the equipment under test meets the requirements of the test standards listed in chapter 3.

The measurement uncertainty is mentioned in this test report, but is not taken into account - neither to the limits nor to the measurement results. Measurement results with a smaller margin to the corresponding limits than the measurement uncertainty have a potential risk of more than 5% that the decision might be wrong."

measured value, measurement uncertainty, verdict



4 Test environment

Temperature	:	T_{nom} T_{max} T_{min}	+22 °C during room temperature tests +65 °C during high temperature tests -30 °C during low temperature tests
Relative humidity content	:		45 %
Barometric pressure	:		not relevant for this kind of testing
Power supply	:	V_{nom} V_{min} V_{max}	21.6 V 18.4 V DC by integrated battery/external power supply 24.8 V
Power supply	:	V_{nom}	8.2 V DC by external power supply (during continuous Tx test)

5 Test item

5.1 General description

Kind of test item	:	Industrial IoT device
Model name	:	Easypulse Edge Station
S/N serial number	:	AB21J000001
HMN	:	-/-
PMN	:	Easypulse Edge Station
HVIN	:	Edge Station v1
FVIN	:	-/-
Hardware status	:	v1
Firmware status	:	v1
TX Frequency band	:	1626.5 – 1660.5 MHz
RX Frequency band	:	1525.0 – 1559.0 MHz
TX output power cond.	:	30.1 dBm (measured value)
TX output power rad.	:	37.1 dBm (measured value, with 7dBi nominal antenna gain)
Bandwidth	:	25 kHz
Type of modulation	:	OQPSK
ITU Emission Designator	:	25K0G1D
Antenna	:	Integrated patch antenna P/N: 1002789 Ethertronix AVX L-band and GPS antenna (1518 – 1675 MHz)
Power supply	:	21.6 V (13 – 23 V) DC by battery 8.2 V V DC by external power supply (during continuous Tx test)
Temperature range	:	-30°C to +65°C

Note: The Tx properties described above represent the settings of the used test mode.

5.2 Operating conditions

Operating condition 1: $f_{\text{low}} = 1626.75 \text{ MHz}$, $f_{\text{mid}} = 1643.5 \text{ MHz}$, $f_{\text{high}} = 1660.25 \text{ MHz}$

Operating condition 2: carrier off state

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.

Photos and plots are included in following documents:

- 1-1739/21-01-01_AnnexA
- 1-1739/21-01-01_AnnexB
- 1-1739/21-01-01_AnnexF
- 1-1739/21-01-01_AnnexG

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, 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.

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 $\pm 45^\circ$ 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.

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.

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).

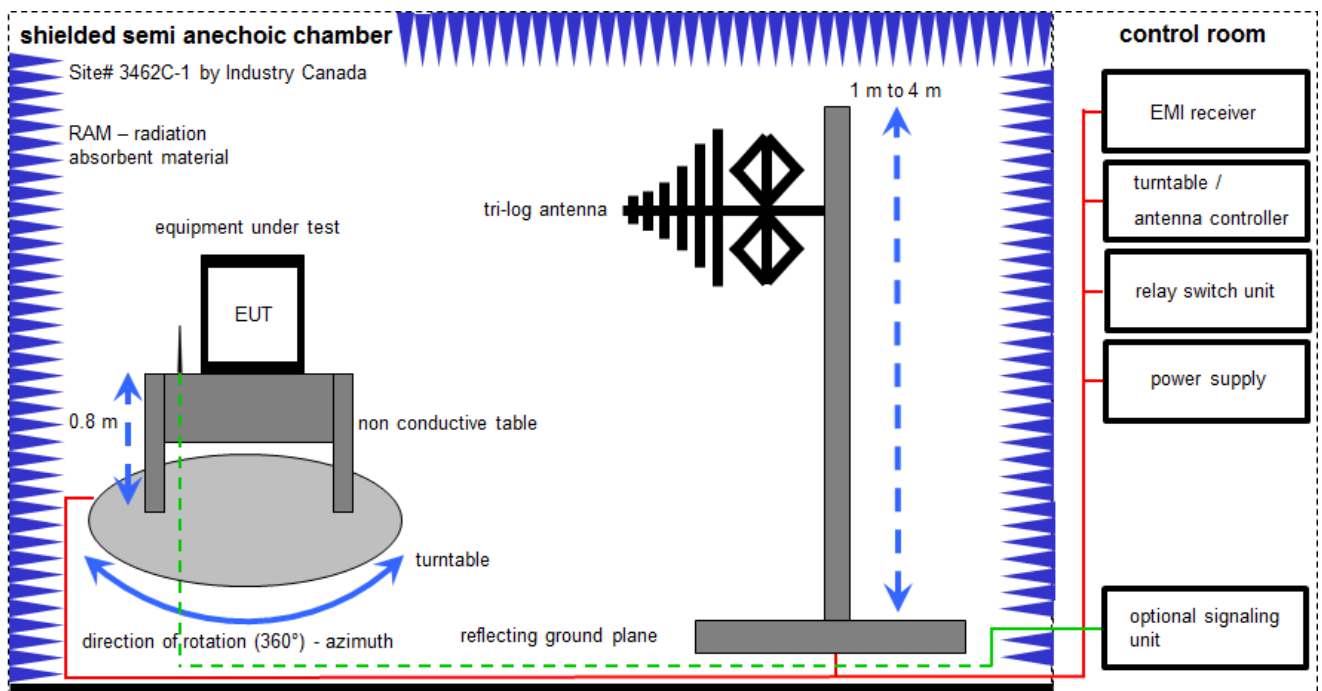
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

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
vkl!	Attention: extended calibration interval			
NK!	Attention: not calibrated		*)	next calibration ordered / currently in progress

7.1 Shielded semi anechoic chamber

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 1 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are confirmed with specifications ANSI C63. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analyzers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.

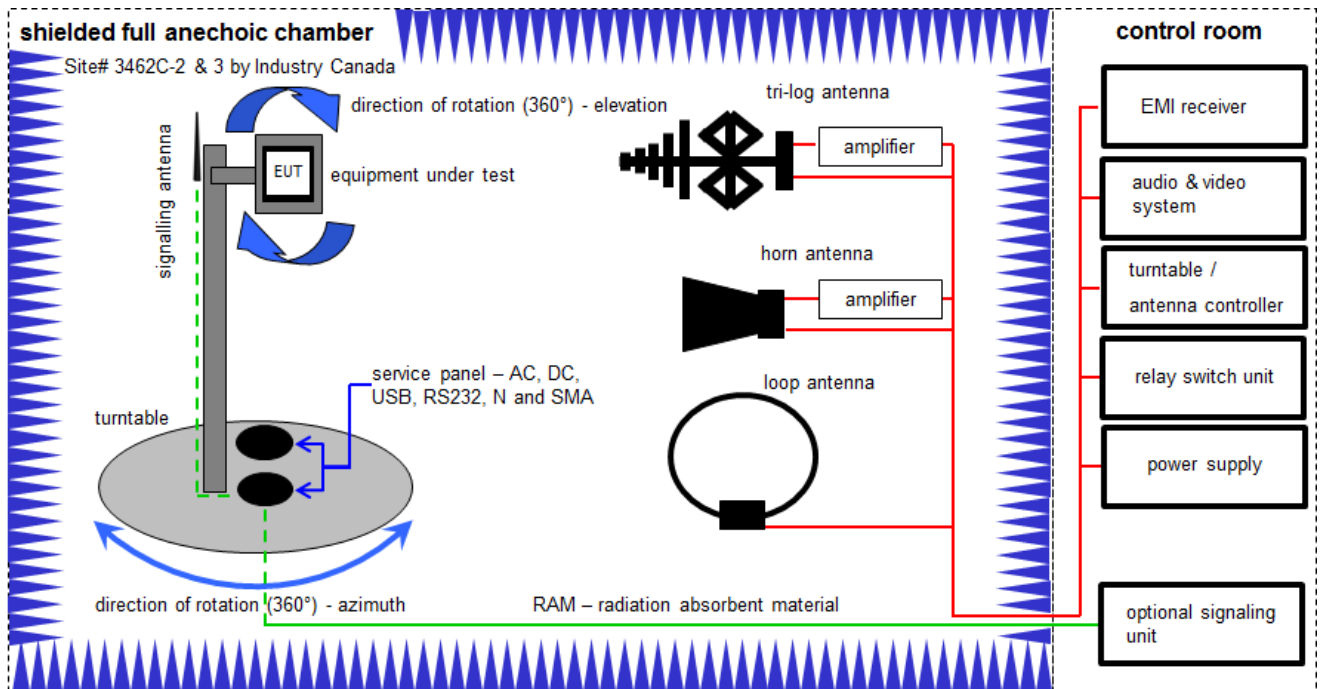


Measurement distance: tri-log antenna 10 meter

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	Switch-Unit	3488A	HP	2719A14505	300000368	ev	-/-	-/-
2	n. a.	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2920A04466	300000580	ne	-/-	-/-
3	n. a.	Meßkabine 1	HF-Absorberhalle	MWB AG 300023		300000551	ne	-/-	-/-
4	n. a.	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	09.12.2021	31.12.2022
5	n. a.	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw	-/-	-/-
6	n. a.	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw	-/-	-/-
7	n. a.	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw	-/-	-/-
8	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck Mess - Elektronik	01029	300005379	vKII	14.01.2020	31.01.2022
9	n. a.	Switch-Unit	3488A	HP	2719A14505	300000368	ev	-/-	-/-
10	n. a.	EMI Test Receiver	ESR3	Rohde & Schwarz	102587	300005771	k	08.12.2021	31.12.2022

7.2 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)

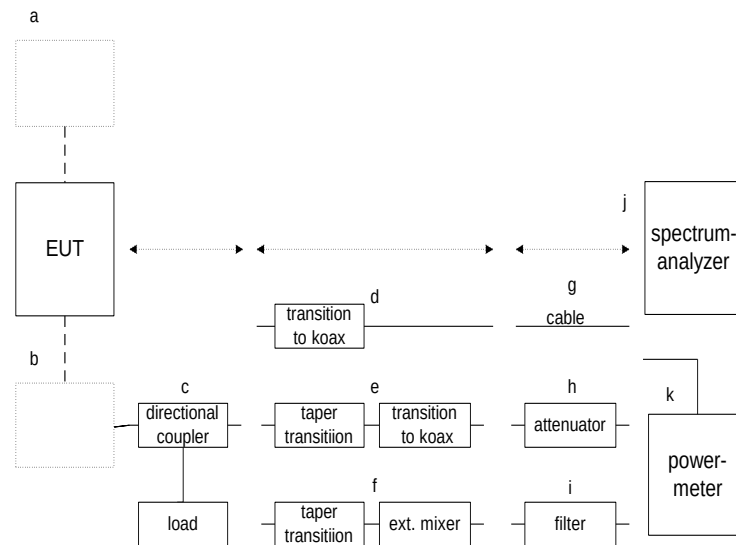
Example calculation:

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

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	VKII	09.12.2020	08.12.2023
2	n. a.	Active Loop Antenna 9 kHz to 30 MHz	6502	EMCO	2210	300001015	VKII	01.07.2021	30.06.2023
3	n. a.	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
4	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck Mess - Elektronik	371	300003854	VKII	14.01.2020	13.01.2022
5	n. a.	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	9709-5289	300000213	VKII	14.07.2020	13.07.2022
6	n. a.	Switch / Control Unit	3488A	HP	*	300000199	ne	-/-	-/-
7	n. a.	Variable isolating transformer	MPL IEC625 Bus Variable isolating transformer	Erfi	91350	300001155	ne	-/-	-/-
8	n. a.	EMI Test Receiver 20Hz- 26,5GHz	ESU26	R&S	100037	300003555	k	11.12.2020	10.12.2021
9	n. a.	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	19	300003790	ne	-/-	-/-
10	n. a.	Broadband Amplifier 0.5-18 GHz	CBLU5184540	CERNEX	22049	300004481	ev	-/-	-/-
11	n. a.	Broadband Amplifier 5-13 GHz	CBLU5135235	CERNEX	22010	300004491	ev	-/-	-/-
12	n. a.	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne	-/-	-/-
13	n. a.	NEXIO EMV-Software	BAT EMC V3.16.0.49	EMCO		300004682	ne	-/-	-/-
14	n. a.	PC	ExOne	F+W		300004703	ne	-/-	-/-
15	n. a.	RF-Amplifier	AMF-6F06001800-30-10P-R	NARDA-MITEQ Inc	2011572	300005241	ev	-/-	-/-

7.3 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	n. a.	Power Sensor, 10 MHz to 18 GHz, -30 to +20 dBm	8485A	HP	2238A00849	300001668	vKI!	15.12.2020	14.12.2022
2	n. a.	Power Supply	NGSM 32/10	Rohde & Schwarz	3939	400000192	k	11.12.2019	10.12.2022
3	R011	Dual-channel power meter with GPIB	438A	HP	2730U00683	300000852	vKI!	08.12.2020	07.12.2022
4	R001	Signal- and Spectrum Analyzer 3 Hz - 50 GHz	PXA N9030A	Agilent Technologies	US51350267	300004338	k	03.04.2019	02.04.2020
5	U312	Fixed Coaxial Attenuator, 20dB 100W DC-18GHz	WA91-20-43	Weinschel Ass	A514	300004824	ev	-/-	-/-
6	C220	1.5m / 2.4mm coaxial cable	SF101	Huber&Suhner	5183/1	-/-	ev	-/-	-/-
7	n. a.	Temperature Test Chamber	T-40/50	CTS GmbH	064023	300003540	ev	07.05.2018	06.05.2020

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	2022-02-11	-/-

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 RSS-170, 5.1 RSS-Gen 6.7	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.

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.

Test setup(s): 7.2hgk

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}
	30.0	30.1	30.1	37.0	37.1	37.1

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).

RSS-Gen 6.7 Occupied Bandwidth

The occupied bandwidth or the "99% emission bandwidth" is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

Test setup(s): 7.2hgj

Measurement results:

Modulation Scheme	Nominated bandwidth (Bn)		
	f_{low}	f_{mid}	f_{high}
OOPSK	14 kHz	14 kHz	14 kHz

Limits:

RSS-170 5.1

Frequency range	$f(\text{lowest}) > 1625.5 \text{ MHz}$	$f(\text{highest}) < 1660.5 \text{ MHz}$
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Plots:

see document 1-1739/21-01-01_AnnexF, chapter 2, plot 1 - 6

8.4 Emission limitations (RF spectrum mask)

Description / Limit:

§25.202 Frequencies, frequency tolerance and emission limitations / RSS-170 5.4.3.1

(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): 7.2hgj

Measurement results:

see document 1-1739/21-01-01_AnnexF, chapter 2

Mode	see following plots
Tx-mode, f_{low}	7, 8
Tx-mode, f_{mid}	15, 16
Tx-mode, f_{high}	21, 22

8.5 Emissions limitations (conducted emissions)

Description / Limit:

§25.202 Frequencies, frequency tolerance and emission limitations / RSS-170 5.4.3.1

(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): 7.2hgj

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

Plots:

see document 1-1739/21-01-01_AnnexF, chapter 2, plot 9 – 14, 17 - 20

8.6 Emissions limits (radiated emissions)

Description / Limit:

§25.202 Frequencies, frequency tolerance and emission limitations / RSS-170 5.4.3.1

(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): 7.1

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

Plots:

see document 1-1739/21-01-01_AnnexF, chapter 3, plot 1 - 3

8.7 Emissions limitations (conducted emissions)

Description / Limit:

§ 25.216 Limits on emissions from mobile earth stations for protection of aeronautical radionavigation-satellite service. / RSS 170 5.4.3.2.2

(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.

§ 25.216 Limits on emissions from mobile earth stations for protection of aeronautical radionavigation-satellite service. / RSS 170 5.4.4

(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): 7.2hgj

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 1-1739/21-01-01_AnnexF, chapter 2, plot 28 - 31

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 (10 ppm) of the reference frequency.

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.

Test setup: 7.2hgj

Measurement results:

Temperature [°C]	Voltage [V DC]	Reference Frequency [MHz]	Measured Frequency [MHz]	Deviation [Hz]	Deviation [ppm]
-30	V _{nom}	1643.5	1643.499780	-220	-0.13
-20	V _{nom}	1643.5	1643.499784	-216	-0.13
-10	V _{nom}	1643.5	1643.499730	-270	-0.16
0	V _{nom}	1643.5	1643.499707	-293	-0.18
10	V _{nom}	1643.5	1643.499748	-252	-0.15
20	V _{min}	1643.5	1643.499730	-270	-0.16
20	V _{nom}	1643.5	1643.499755	-245	-0.15
20	V _{max}	1643.5	1643.499730	-270	-0.16
30	V _{nom}	1643.5	1643.499764	-236	-0.14
40	V _{nom}	1643.5	1643.499570	-430	-0.26
50	V _{nom}	1643.5	1643.499670	-330	-0.20
60	V _{nom}	1643.5	1643.499591	-409	-0.25
65	V _{nom}	1643.5	1643.499547	-453	-0.28

Temperature [°C]	Voltage [V DC]	Reference Frequency [MHz]	Measured Frequency [MHz]	Deviation [Hz]	Deviation [ppm]
-30	V _{nom}	1626.75	1626.749770	-230	-0.14
-20	V _{nom}	1626.75	1626.749774	-226	-0.14
-10	V _{nom}	1626.75	1626.749750	-250	-0.15
0	V _{nom}	1626.75	1626.749700	-300	-0.18
10	V _{nom}	1626.75	1626.749742	-258	-0.16
20	V _{min}	1626.75	1626.749734	-266	-0.16
20	V _{nom}	1626.75	1626.749750	-250	-0.15
20	V _{max}	1626.75	1626.749733	-267	-0.16
30	V _{nom}	1626.75	1626.749762	-238	-0.15
40	V _{nom}	1626.75	1626.749690	-310	-0.19
50	V _{nom}	1626.75	1626.749650	-350	-0.22
60	V _{nom}	1626.75	1626.749580	-420	-0.26
65	V _{nom}	1626.75	1626.749530	-470	-0.29

Temperature [°C]	Voltage [V DC]	Reference Frequency [MHz]	Measured Frequency [MHz]	Deviation [Hz]	Deviation [ppm]
-30	V _{nom}	1660.25	1660.249789	-211	-0.13
-20	V _{nom}	1660.25	1660.249782	-218	-0.13
-10	V _{nom}	1660.25	1660.249733	-267	-0.16
0	V _{nom}	1660.25	1660.249750	-250	-0.15
10	V _{nom}	1660.25	1660.249738	-262	-0.16
20	V _{min}	1660.25	1660.249755	-245	-0.15
20	V _{nom}	1660.25	1660.249765	-235	-0.14
20	V _{max}	1660.25	1660.249760	-240	-0.14
30	V _{nom}	1660.25	1660.249766	-234	-0.14
40	V _{nom}	1660.25	1660.249620	-380	-0.23
50	V _{nom}	1660.25	1660.249670	-330	-0.20
60	V _{nom}	1660.25	1660.249571	-429	-0.26
65	V _{nom}	1660.25	1660.249560	-440	-0.27

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	2021-10-20
-/-	Initial release	2022-02-11

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 17025:2018 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 09.06.2020 with the accreditation number D-PL-12076-01. It comprises the cover sheet, the reverse side of the cover sheet and the following annex with a total of 07 pages. Registration number of the certificate: D-PL-12076-01-04 Frankfurt am Main, 09.06.2020 by order:  Head of Division The certificate together with its annex reflects the status at the time of the date of issue. The current status of the scope of accreditation can be found in the database of accredited bodies of Deutsche Akkreditierungsstelle GmbH. https://www.dakks.de/en/content/accredited-bodies-dakks See notes overleaf.	Deutsche Akkreditierungsstelle GmbH Office Berlin Spittelmarkt 10 10117 Berlin Office Frankfurt am Main Europa-Allee 52 60327 Frankfurt am Main Office Braunschweig Bundesallee 100 38116 Braunschweig 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 websites (link see below).

<https://www.dakks.de/files/data/as/pdf/D-PL-12076-01-04e.pdf>

or

https://ctcadvanced.com/app/uploads/2020/06/D-PL-12076-01-04_Canada_TCEMC.pdf

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

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 17025:2018 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 09.06.2020 with the accreditation number D-PL-12076-01. It comprises the cover sheet, the reverse side of the cover sheet and the following annex with a total of 05 pages. Registration number of the certificate: D-PL-12076-01-05 Frankfurt am Main, 09.06.2020  by order/ Dipl.-Ing. (FH) Ralf Egner Head of Division The certificate together with its annex reflects the status at the time of the date of issue. The current status of the scope of accreditation can be found in the database of accredited bodies of Deutsche Akkreditierungsstelle GmbH. https://www.dakks.de/en/content/accredited-bodies-dakks See notes enclosed.	Deutsche Akkreditierungsstelle GmbH Office Berlin Spittelmarkt 10 10117 Berlin Office Frankfurt am Main Europa-Allee 52 60327 Frankfurt am Main Office Braunschweig Bundesallee 100 38116 Braunschweig 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 websites (link see below).

<https://www.dakks.de/files/data/as/pdf/D-PL-12076-01-05e.pdf>

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END OF TEST REPORT