
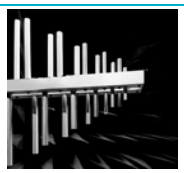
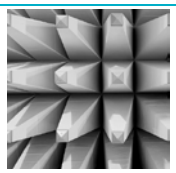

CTC advanced
member of RWTÜV group

Bundesnetzagentur

BNetzA-CAB-02/21-102

TEST REPORT

Test report no.: 1-1697/20-01-03

Testing laboratory

CTC advanced GmbH
Untertuerkheimer Strasse 6 – 10
66117 Saarbruecken / Germany
Phone: + 49 681 5 98 - 0
Fax: + 49 681 5 98 - 9075
Internet: https://www.ctcadvanced.com
e-mail: mail@ctcadvanced.com

Accredited Testing Laboratory:
The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (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.

Applicant

ROBERT BOSCH GmbH
Daimlerstr. 6
71229 Leonberg / GERMANY
Phone: +49 711 811-0
Contact: Zsolt Szentannai
e-mail: zsolt.szentannai@hu.bosch.com

Manufacturer

ROBERT BOSCH GmbH
Daimlerstr. 6
71229 Leonberg / GERMANY

Test standard/s

FCC - Title 47 CFR Part 15	FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 210 Issue 10	Spectrum Management and Telecommunications Radio Standards Specification - Licence-Exempt Radio Apparatus: Category I Equipment

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

Test Item

Kind of test item:	**BCM Body Computer Module**
Model name:	**BR21**
FCC ID:	**2AAJCBR21**
IC:	**24305-BR21**
Frequency:	433.46 MHz to 434.42 MHz
Technology tested:	proprietary
Antenna:	Integrated antenna
Power supply:	9 V to 16 V DC by car battery
Temperature range:	-40°C to + 80°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:

cn=Christoph Schneider, o=CTC advanced GmbH, ou=SND-161128, email=Christoph.Schneider@ctcadvanced.com, c=DE
2021.03.02 13:28:25 +01'00'

Christoph Schneider
Lab Manager
Radio Communications

Test performed:

cn=Wolsdorfer Hans-Joachim, o=CTC advanced GmbH, ou=WLD-200810, email=joachim.wolsdorfer@ctcadvanced.com, c=DE
2021.03.02 13:27:37 +01'00'

Hans-Joachim Wolsdorfer
Lab Manager
Radio Communications

1 Table of contents

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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In no case this test report can be considered as a Letter of Approval.

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:	2021-01-19
Date of receipt of test item:	2021-01-19
Start of test:*	2021-01-20
End of test:*	2021-01-28
Person(s) present during the test:	- / -

*Date of each measurement, if not shown in the plot, can be requested. Dates are stored in the measurement software.

2.3 Test laboratories sub-contracted

None

3 Test standard/s, references and accreditations

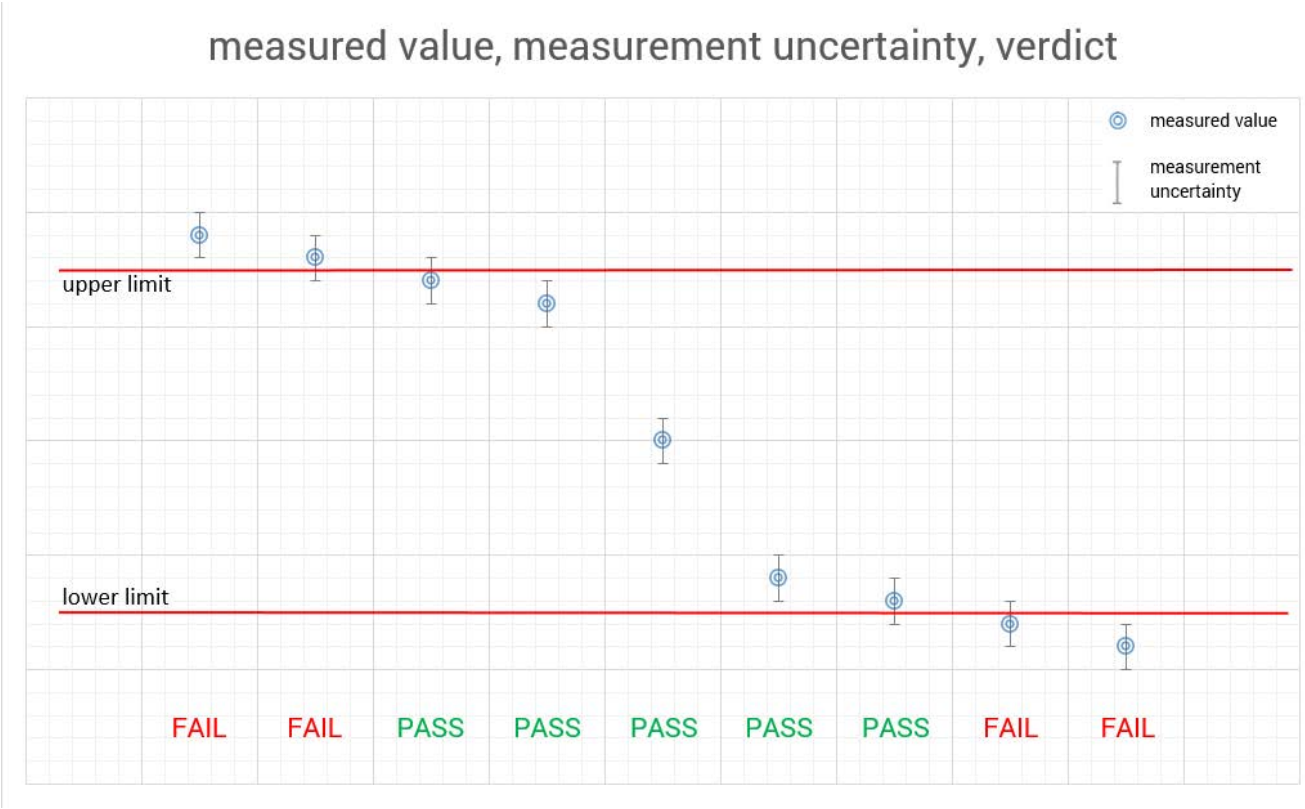
Test standard	Date	Description
FCC - Title 47 CFR Part 15		FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 210 Issue 10	December 2019	Spectrum Management and Telecommunications Radio Standards Specification - Licence-Exempt Radio Apparatus: Category I Equipment
RSS - Gen Issue 5 incl. Amendment 1	March 2019	Spectrum Management and Telecommunications Radio Standards Specification - General Requirements for Compliance of Radio Apparatus

Guidance	Version	Description
ANSI C63.4-2014	-/-	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10-2013	-/-	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

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

4 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, see chapter 7, 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."



5 Test environment

Temperature	:	T_{nom} T_{max} T_{min}	+22 °C during room temperature tests +80 °C all tests performed with room temperature -40 °C all tests performed with room temperature
Relative humidity content	:		55 %
Barometric pressure	:		1021 hpa
Power supply	:	V_{nom} V_{max} V_{min}	12 V DC by car battery 16 V 9 V

6 Test item

6.1 General description

Kind of test item	:	BCM Body Computer Module
Model name	:	BR21
HMN	:	-/-
PMN	:	MQB37W
HVIN	:	BR21
FVIN	:	-/-
S/N serial number	:	Rad. BXJ-53F17.12.2094060030 Cond. BXJ-53F17.12.2094060027
Hardware status	:	HW24
Software status	:	0171
Firmware status	:	-/-
Frequency band	:	433.46 MHz to 434.42 MHz
Type of radio transmission Use of frequency spectrum	: :	modulated carrier
Type of modulation	:	FSK ASK
Number of channels	:	RX 3 channels; TX 2 channels
Antenna	:	Integrated antenna
Power supply	:	9 V to 16 V DC by car battery
Temperature range	:	-40°C to +80°C

6.2 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.

Test setup and EUT photos are included in test report: 1-1697/20-01-01_AnnexA
1-1697/20-01-01_AnnexB
1-1697/20-01-01_AnnexD

7 Description of the test setup

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

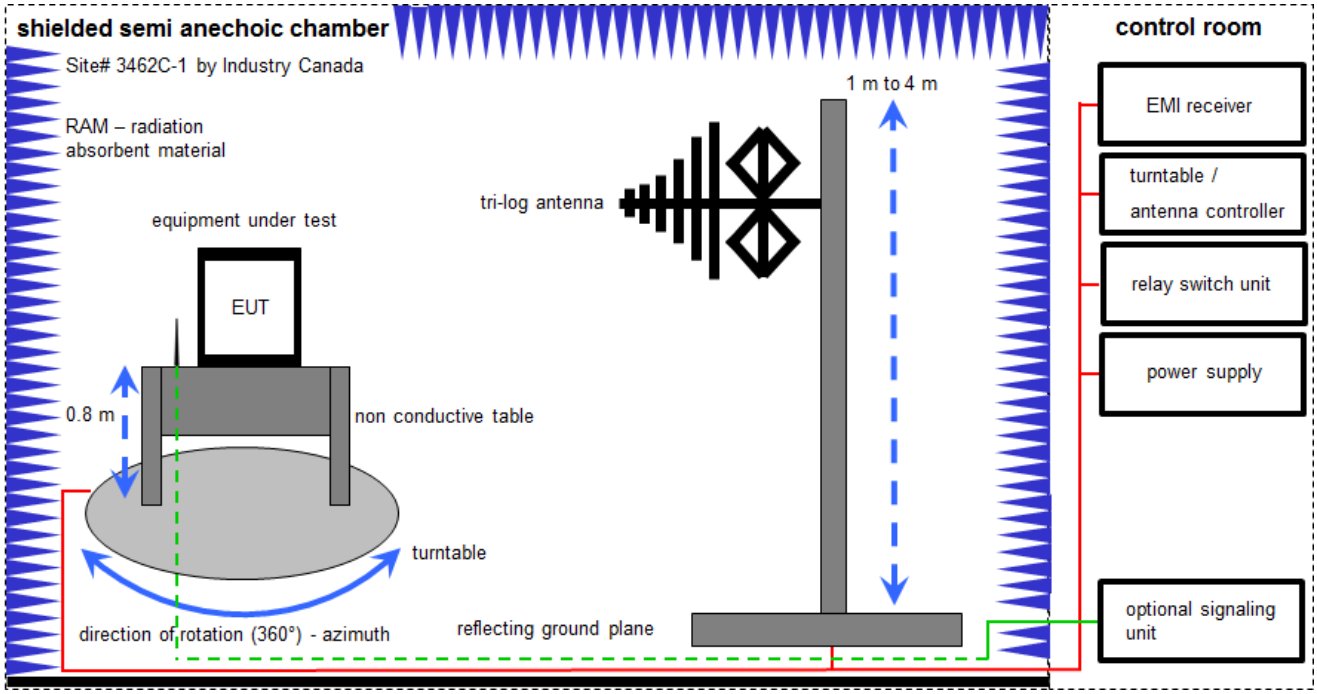
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

Agenda: Kind of Calibration

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

7.1 Shielded semi anechoic chamber

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 30 MHz 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 conform to 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
EMC32 software version: 10.59.00

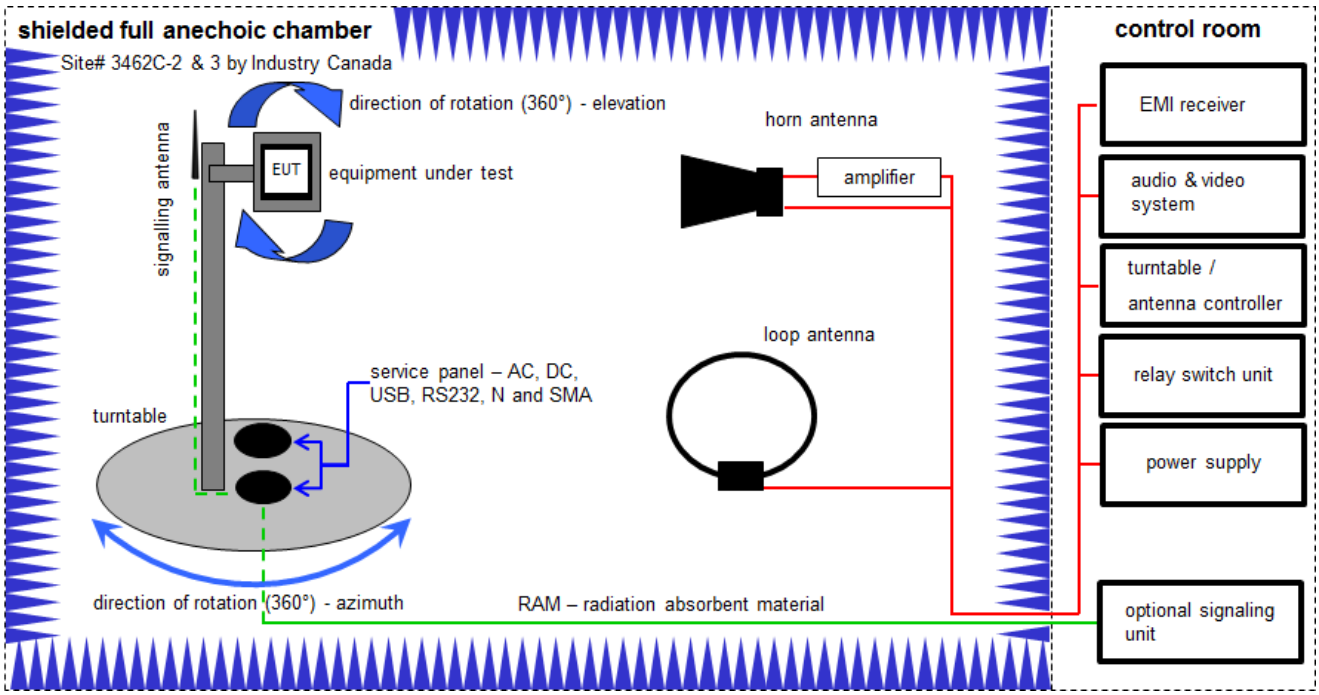
FS = UR + CL + AF
(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

Example calculation:
FS [dBµV/m] = 12.35 [dBµV/m] + 1.90 [dB] + 16.80 [dB/m] = 31.05 [dBµV/m] (35.69 µV/m)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2920A04466	300000580	ne	-/-	-/-
2	A	Semi anechoic chamber	3000023	MWB AG		300000551	ne	-/-	-/-
3	A	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw	-/-	-/-
4	A	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw	-/-	-/-
5	A	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw	-/-	-/-
6	A	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck Mess - Elektronik	295	300003787	vlKl!	19.02.2019	18.02.2021
7	A	Turntable	2089-4.0	EMCO		300004394	ne	-/-	-/-
8	A	PC	TecLine	F+W		300004388	ne	-/-	-/-
9	A	EMI Test Receiver	ESR3	Rohde & Schwarz	102587	300005771	k	10.12.2020	09.06.2022

7.2 Shielded fully anechoic chamber



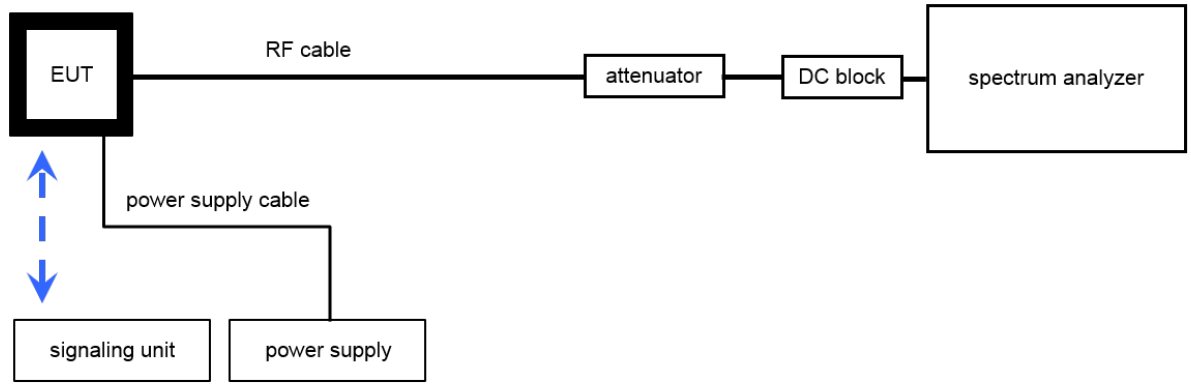
Measurement distance: horn antenna 3 meter; loop antenna 3 meter
FS = UR + CA + AF
(FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)
Example calculation:
FS [dBµV/m] = 40.0 [dBµV/m] + (-35.8) [dB] + 32.9 [dB/m] = 37.1 [dBµV/m] (71.61 µV/m)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A, B	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2818A03450	300001040	vlKl!	09.12.2020	08.12.2023
2	A	Active Loop Antenna 9 kHz to 30 MHz	6502	EMCO	2210	300001015	vlKl!	13.06.2019	12.06.2021
3	A, B	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
4	B	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	9107-3697	300001605	vlKl!	27.02.2019	26.02.2021
5	A, B	Switch / Control Unit	3488A	HP	*	300000199	ne	-/-	-/-
6	A, B	EMI Test Receiver 20Hz- 26,5GHz	ESU26	R&S	100037	300003555	k	11.12.2020	10.12.2021
7	B	Broadband Amplifier 0.5-18 GHz	CBLU5184540	CERNEX	22049	300004481	ev	-/-	-/-
8	A, B	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne	-/-	-/-
9	A, B	NEXIO EMV-Software	BAT EMC V3.20.0.13	EMCO		300004682	ne	-/-	-/-
10	A, B	PC	ExOne	F+W		300004703	ne	-/-	-/-

7.3 Conducted measurements

Conducted measurements normal conditions



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	A	RF-Cable SRD021 No. 1	Enviroflex 316 D	Huber & Suhner	-/-	400001311	ev	-/-	-/-
2	A	Spectrum Analyzer	FSV30	Rohde & Schwarz	104365	300005923	k	16.12.2020	15.03.2022
3	A	Power Supply	HMP2020	Rohde & Schwarz	101961	300006102	k	04.08.2020	03.08.2022

8 Sequence of testing

8.1 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.

8.2 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.

8.3 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.

9 Measurement uncertainty

Measurement uncertainty	
Test case	**Uncertainty**
Occupied bandwidth	± used RBW
Field strength of the fundamental	± 3 dB
Field strength of the harmonics and spurious	± 3 dB
Receiver spurious emissions and cabinet radiations	± 3 dB
Conducted limits	± 2.6 dB

10 Summary of measurement results

☒	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 Part 15 RSS 210, Issue 10 RSS-Gen, Issue 5	See table!	2021-03-02	-/-

Test specification clause	Test case	Temperature conditions	Power source voltages	C	NC	NA	NP	Remark
§ 15.35 (c) RSS-Gen, Issue 5	Timing of the transmitter (Duty cycle correction factor)	Nominal	Nominal					
§ 15.231 (a) (1) RSS-210 Issue 10	Switch off time	Nominal	Nominal	☐	☐	☒	☐	-/-
§ 15.231 (b) (3) (c) RSS-210 Issue 10	Emission bandwidth	Nominal	Nominal	☒	☐	☐	☐	-/-
§ 15.231 (b) RSS-210 Issue 10	Fieldstrength of Fundamental	Nominal	Nominal	☒	☐	☐	☐	-/-
§ 15.209 RSS-210 Issue 10	Fieldstrength of harmonics and spurious	Nominal	Nominal	☒	☐	☐	☐	-/-
§ 15.209 RSS-Gen, Issue 5	Receiver spurious emissions (radiated)	Nominal	Nominal	☒	☐	☐	☐	-/-

Note: C = Compliant; NC = Not compliant; NA = Not applicable; NP = Not performed

10.1 Additional comments

Reference documents: Short_Range_Devices__SRD_Radio__v1.pdf
Basic_Questions_to_Equipment_Under_Test__EUT__v1

Special test descriptions: Homologation_SW_User_Guide.docx

Configuration descriptions: Homologation_SW_Config.xlsx

11 Measurement results

11.1 Timing of the transmitter

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	300mS
Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Span:	Zero
Trace-Mode:	Single sweep
Test setup	7.3 A

Limits:

FCC	IC
(c) Unless otherwise specified, e.g. Section 15.255(b), when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification or shall be retained in the measurement data file for equipment subject to notification or verification.	

Result:

according to customers declaration the maximum transmission time is 11.25mS in a 100mS timewindow

max. Transmit time (Tx on) = 11.25mS
Tx on + Tx off = 100mS

The peak-to-average correction factor is calculated with 20Log [Tx on/(Tx on + Tx off)].
Hereby the peak-to-average correction factor is -18.97dB

11.2 Emission bandwidth

Measurement:

Measurement of the 99 % bandwidth of the modulated signal

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1% to 5% of the OBW
Video bandwidth:	3 x RBW
Span:	500kHz
Trace-Mode:	Max. hold

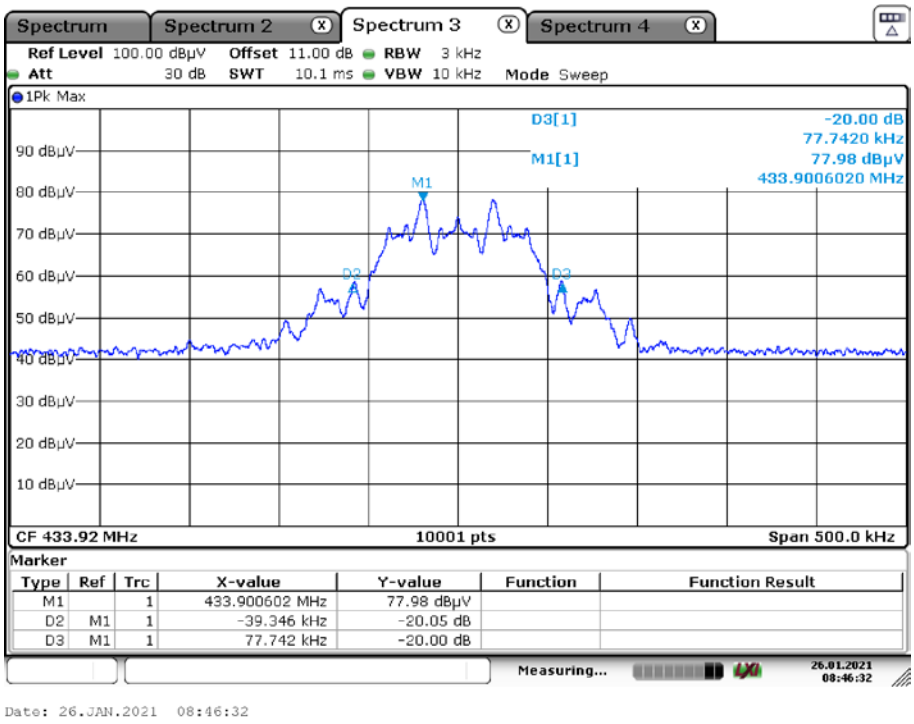
Limits:

FCC	IC
The OBW shall not be wider than 0.25% of the centre frequency, here maximum 1008.5 kHz.	

Result:

Center Frequency	Test conditions		Signal bandwidth / kHz	
	Mode		OBW 99%	20 dB-bandwidth
433.92 MHz	T_{nom}	V_{nom}	140.48	117.08
434.36 MHz	T_{nom}	V_{nom}	137.23	115.63

Plot 1: Emissions bandwidth – low channel



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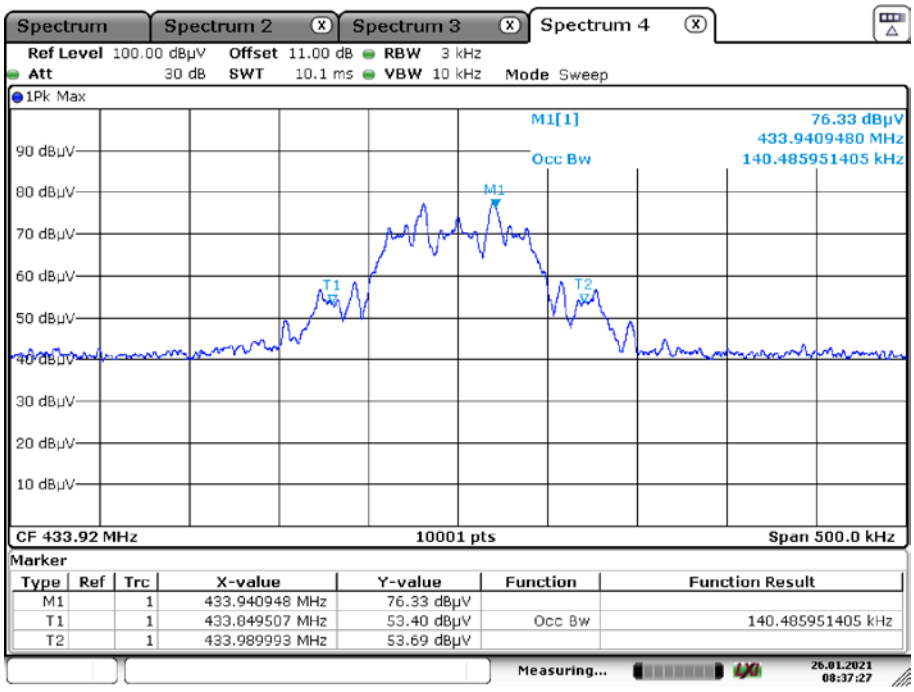
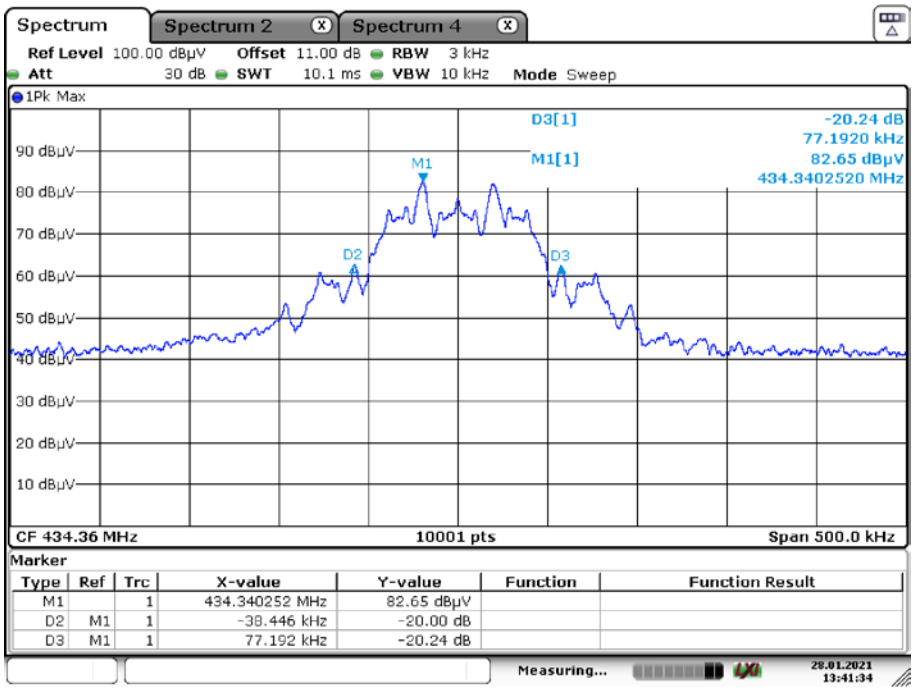
Plot 2: 99 % emission bandwidth – low channel



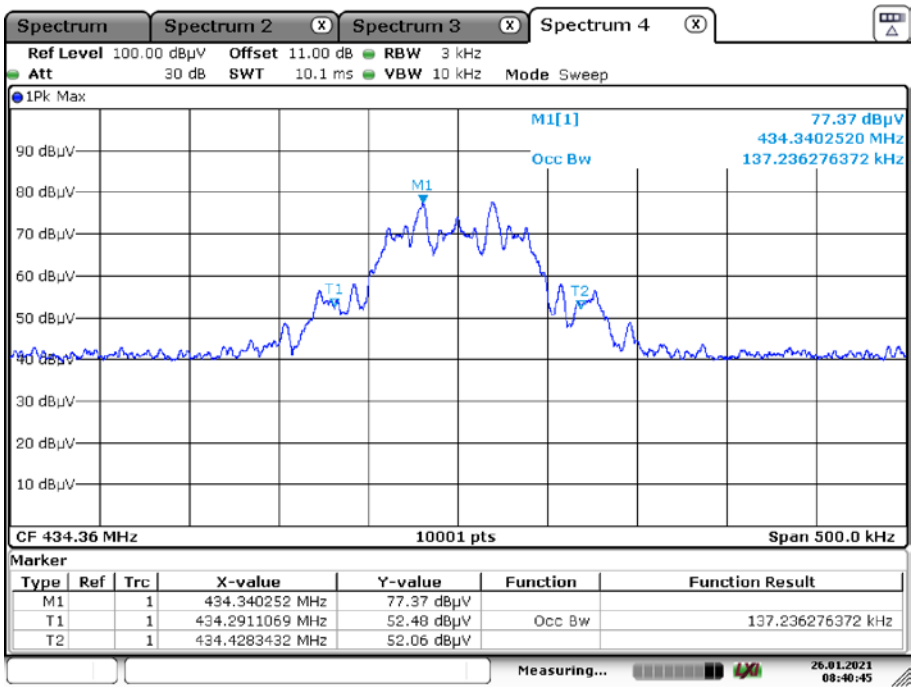
Date: 26.JAN.2021 08:37:27

Plot 3: Emissions bandwidth – high channel



Date: 28.JAN.2021 13:41:34

Plot 4: 99 % emission bandwidth – high channel



Date: 26.JAN.2021 08:40:45

11.3 Field strength of the fundamental

Measurement:

Measurement parameter	
Detector:	Peak / pulse averaging / quasi peak
Sweep time:	Auto
Resolution bandwidth:	120 kHz
Video bandwidth:	3 x RBW
Span:	Depends on the signal
Trace-Mode:	Max. hold
Test setup	7.1 A
Measurement uncertainty	chapter 9

Limits:

FCC		IC
Field strength of the fundamental. In addition to the provisions of Section 15.205, the field strength of emissions from intentional radiators operated under this Section shall not exceed the following:		
Fundamental Frequency (MHz)	**Field strength of Fundamental (µV/m)**	**Measurement distance (m)**
40.66 – 40.70	2,250	3
70-130	1,250	3
130-174	1,250 to 3,750	3
174-260	3,750	3
260-470	3,750 to 12,500	3
Above 470	12,500	3

Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows:

- for the band 130-174 MHz, µV/m at 3 meters = 56.81818(F) - 6136.3636;
- for the band 260-470 MHz, µV/m at 3 meters = 41.6667(F) - 7083.3333.

Result:

	MAXIMUM POWER (dBµV/m at 3 m distance)		Limit (dBµV/m at 3 m distance)
Center frequency	Peak *	Average **	Average
433.92 MHz	88.83	69.86	80.8
434.36 MHz	81.91	62.94	80.8

* Calculated from 10 meter to 3 meter with 10.46 dB
** Value recalculated from Peak-to-Average correction factor described in 11.1

11.4 Field strength of the harmonics and spurious

Measurement:

Measurement parameter	
Detector:	Peak / average / quasi peak
Sweep time:	Auto
Resolution bandwidth:	200 Hz / 9 kHz / 120 kHz
Video bandwidth:	3 x RBW
Span:	See plots
Trace-Mode:	Max. hold
Test setup	7.1A, 7.2A, 7.2B
Measurement uncertainty	chapter 9

Limits: Part 15.231

In addition to the provisions of Section 15.205, the field strength of emissions from intentional radiators operated under this Section shall not exceed the following:

FCC		IC
FCC Part 15.231		
Fundamental Frequency (MHz)	Field strength of spurious (µV/m)	Measurement distance (m)
40.66 – 40.70	225	3
70-130	125	3
130-174	125 to 375	3
174-260	375	3
260-470	375 to 1,250	3
Above 470	1,250	3

Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in Section 15.209, whichever limit permits a higher field strength.

FCC		IC
FCC Part 15.209		
Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30 – 88	100	3
88 – 216	150	3
216 – 960	200	3
above 960	500	3

Results: Spurious emissions within the restricted bands (Part15.205 & 15.209)

Fundamental Frequency	Spurious Frequency	Detector	Limit max. allowed [dBµV/m]	Amplitude of emission [dBµV/m]
433.92 MHz	1301.2 MHz	Peak	74	45.40
		AVG	54	42.11
	- / -	Peak	74	- / -
		AVG	54	- / -
434.37 MHz	1303.0 MHz	Peak	74	47.73
		AVG	54	45.56
	2171.8 MHz	Peak	74	39.75
		AVG	54	28.25

For emissions below 1 GHz, see table below the plots.

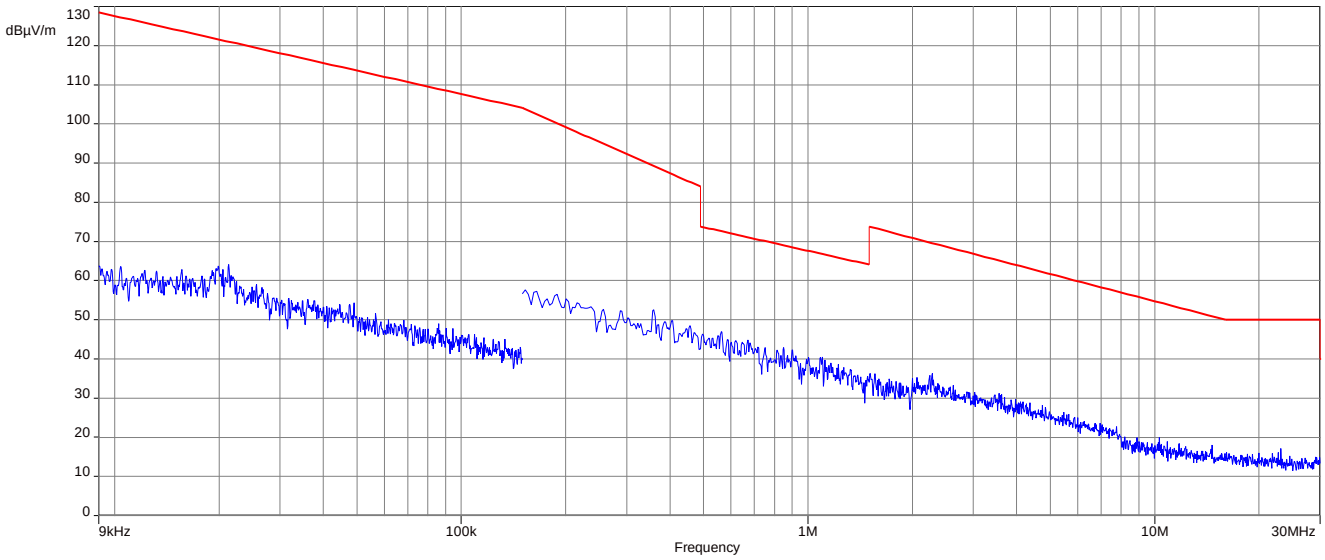
Results: Spurious emissions outside the restricted bands (Part15.231)

Fundamental Frequency	Spurious Frequency	Detector	Limit max. allowed [dBµV/m]	Amplitude of emission [dBµV/m]
433.92 MHz	2169.4	Peak	-/-	- / -
		AVG	62	55.10
	2634.4	Peak	-/-	- / -
		AVG	62	29.72
434.37 MHz	2171.8 MHz	Peak	-/-	-/-
		AVG	62	28.25

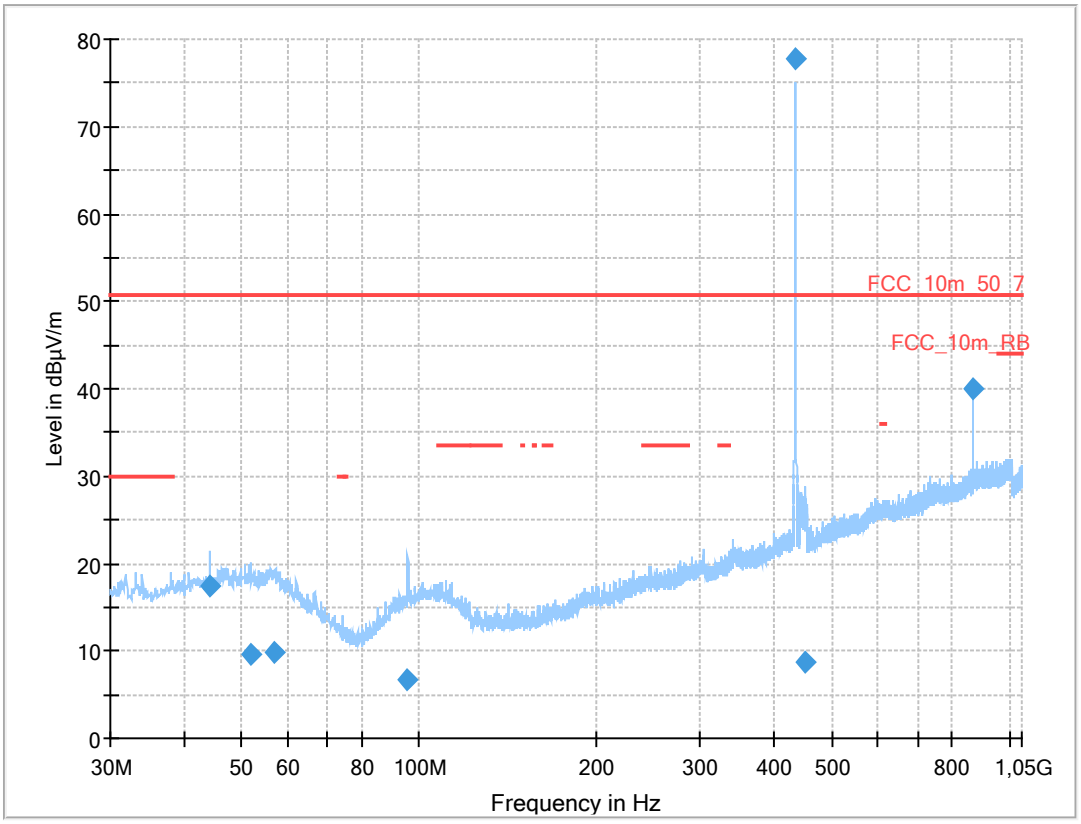
For emissions below 1 GHz, see table below the plots.

Plots:

Plot 1: 9 kHz to 30 MHz low channel



Plot 2: 30 MHz to 1000 MHz, vertical & horizontal polarisation low channel

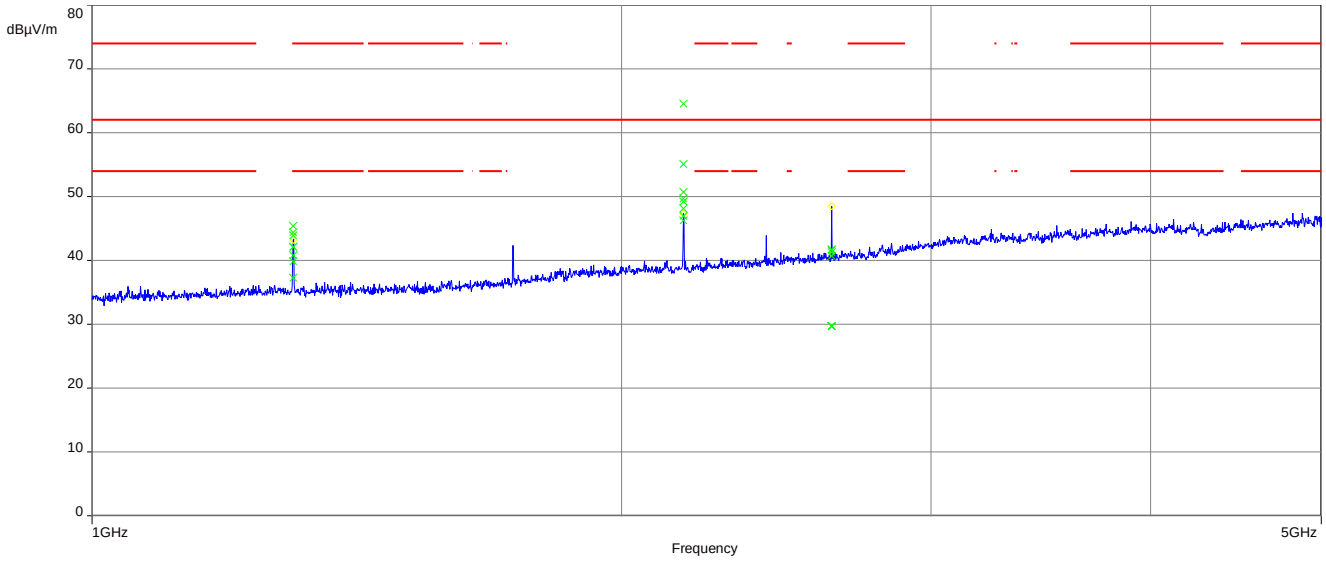


Final_Result:

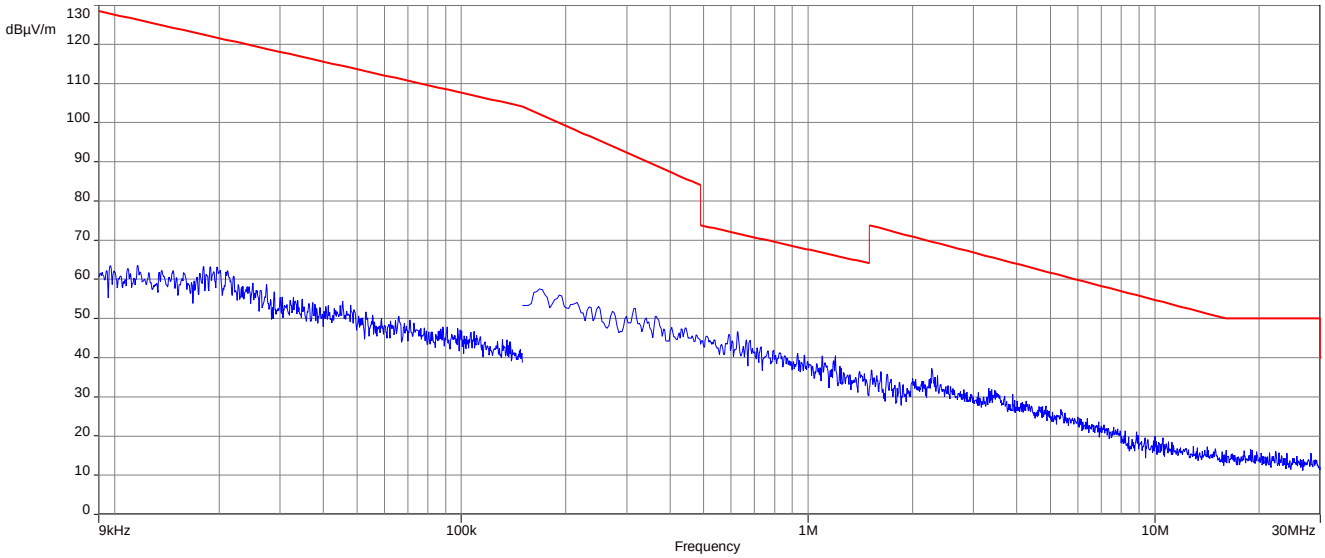
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
44.252	17.42	50.7	33.3	1000	120.0	100.0	V	184	14
51.987	9.72	50.7	41.0	1000	120.0	144.0	V	275	14
56.798	9.83	50.7	40.9	1000	120.0	173.0	V	225	15
95.198	6.62	50.7	44.1	1000	120.0	400.0	V	285	12
433.892	w a n t e d s i g n a l								
449.557	8.70	50.7	42.0	1000	120.0	171.0	H	64	17
867.828	39.90	50.7	10.8	1000	120.0	179.0	H	0	24

In addition to the limit according to Part 15.209 shown in the plot, the limit according to Part 15.231 also applies!

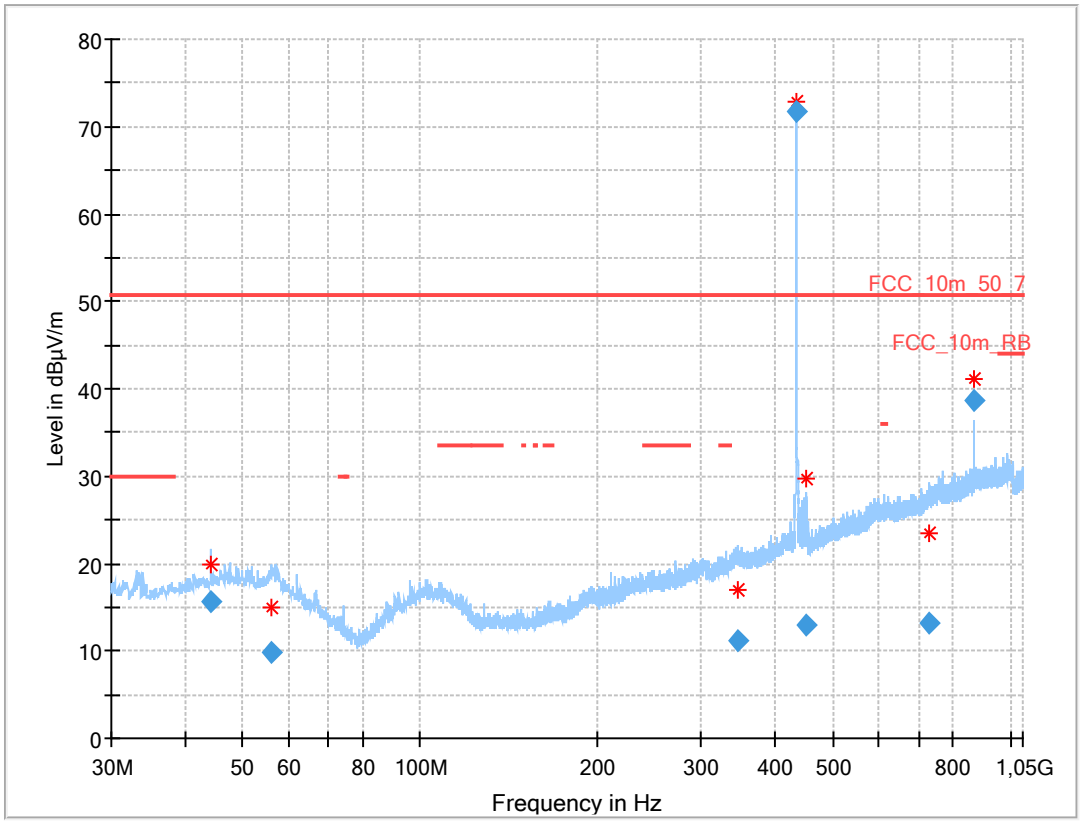
Plot 3: 1000 MHz to 5000 MHz, vertical & horizontal polarisation low channel



Plot 4: 9 kHz to 30 MHz high channel



Plot 5: 30 MHz to 1000 MHz, vertical & horizontal polarisation high channel

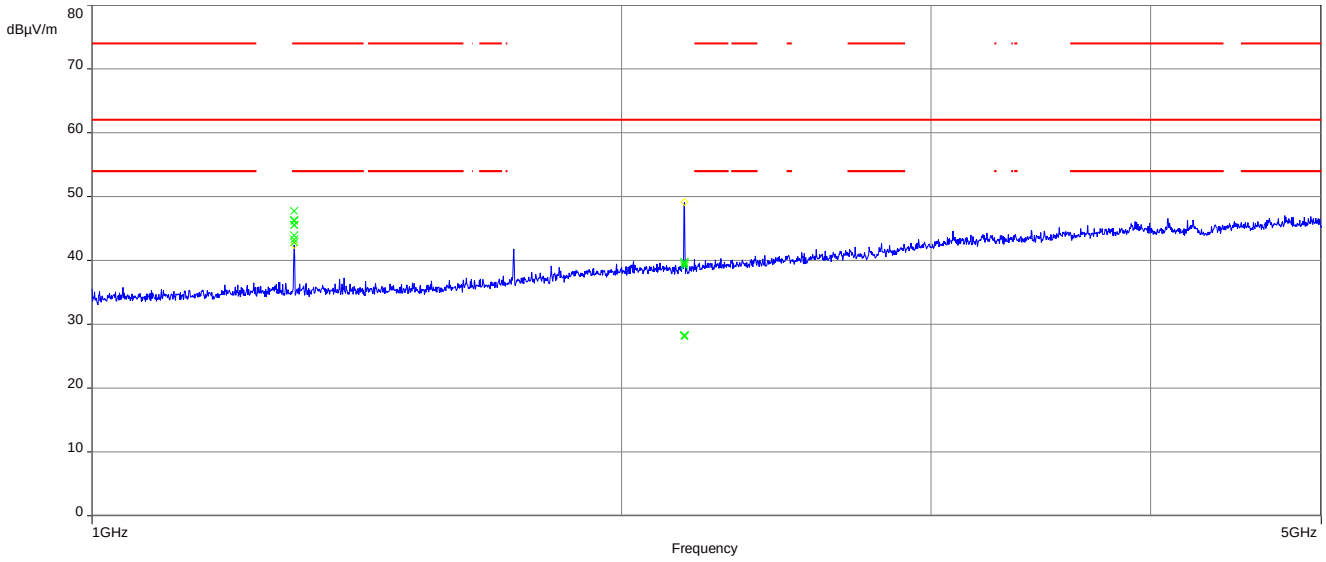


Final_Result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
44.235	15.69	50.7	35.0	1000	120.0	103.0	V	107	14
55.816	9.91	50.7	40.8	1000	120.0	126.0	V	45	15
344.513	11.22	50.7	39.5	1000	120.0	145.0	V	235	16
434.343	w a n t e d s i g n a l								
450.734	13.00	50.7	37.7	1000	120.0	149.0	H	38	17
727.133	13.12	50.7	37.6	1000	120.0	200.0	V	180	21
868.682	38.77	50.7	11.9	1000	120.0	242.0	V	90	23

In addition to the limit according to Part 15.209 shown in the plot, the limit according to Part 15.231 also applies!

Plot 6: 1000 MHz to 5000 MHz, vertical & horizontal polarisation high channel



11.5 Receiver spurious emission

Measurement:

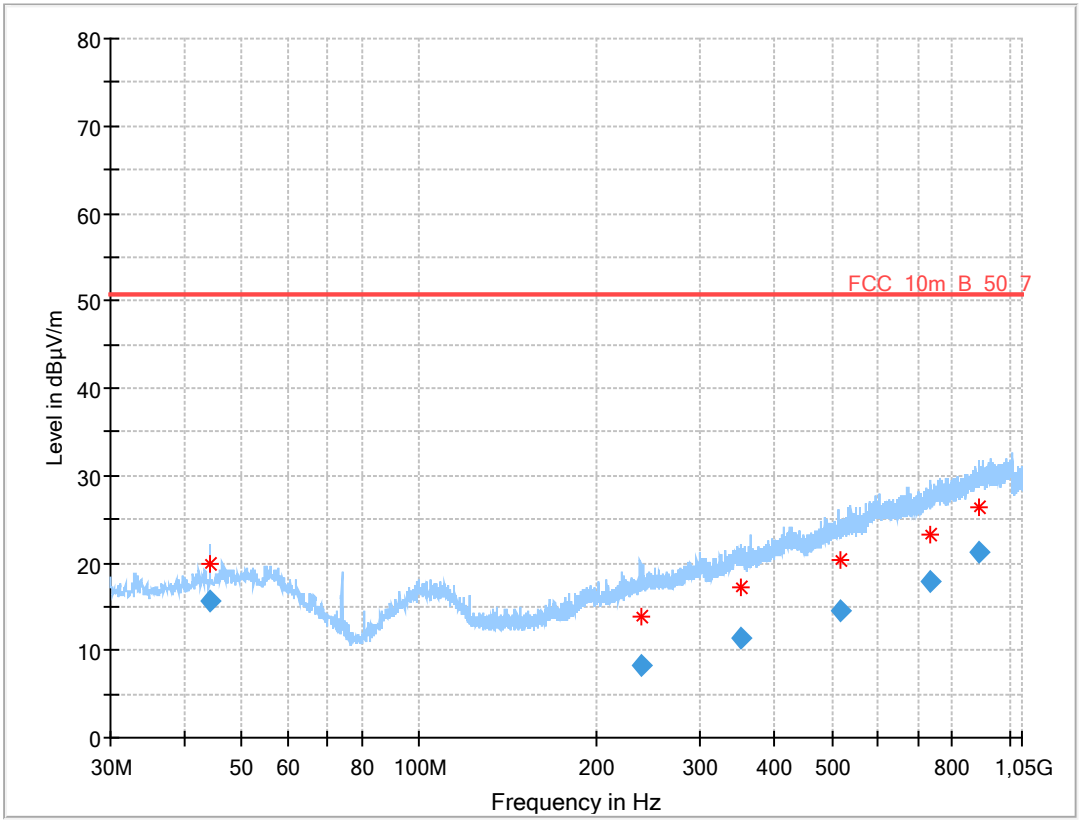
Measurement parameter	
Detector:	Peak / average / quasi peak
Sweep time:	Auto
Resolution bandwidth:	120 kHz
Video bandwidth:	3 x RBW
Span:	See plots
Trace mode:	Max. hold
Test setup	7.1A, 7.2B
Measurement uncertainty	chapter 9

Limits:

FCC		IC
Frequency (MHz)	**Field strength (µV/m)**	**Measurement distance (m)**
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
above 960	500	3

Plots:

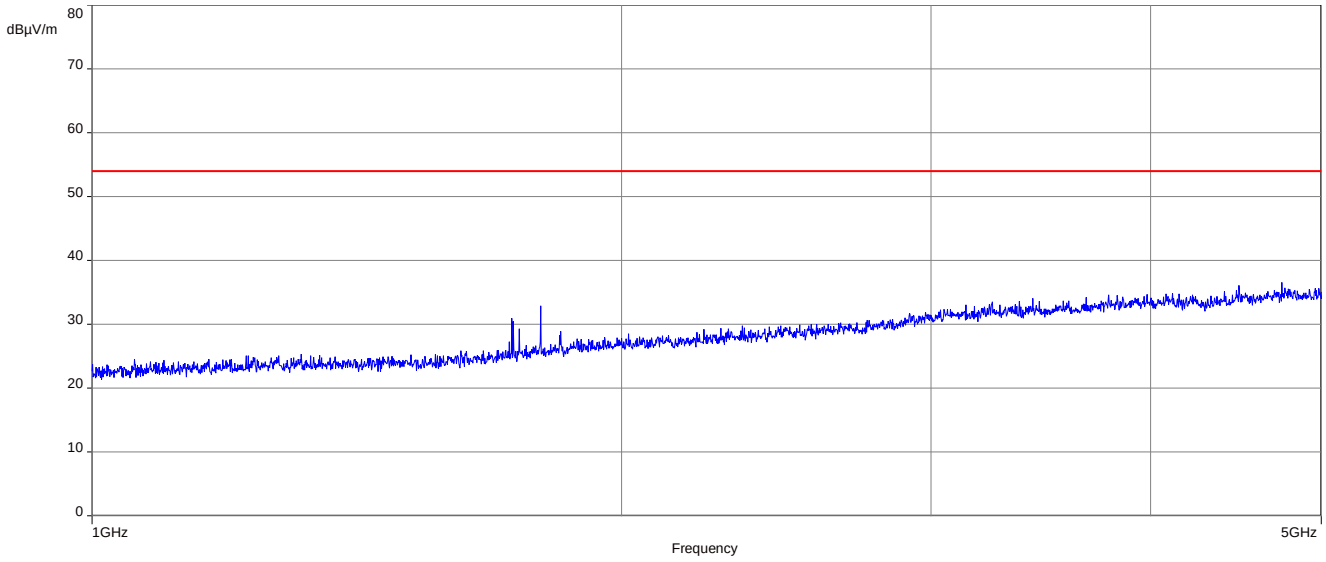
Plot 1: 30 MHz to 1000 MHz, vertical & horizontal polarisation



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
44.246	15.61	50.7	35.1	1000	120.0	122.0	V	174	14
237.128	8.16	50.7	42.5	1000	120.0	200.0	V	270	13
351.613	11.30	50.7	39.4	1000	120.0	141.0	V	298	16
515.683	14.51	50.7	36.2	1000	120.0	400.0	H	81	19
733.766	17.89	50.7	32.8	1000	120.0	183.0	H	117	22
886.890	21.31	50.7	29.4	1000	120.0	200.0	H	270	24

Plot 2: 1000 MHz to 5000 MHz, vertical & horizontal polarisation



12 Observations

No observations except those reported with the single test cases have been made.

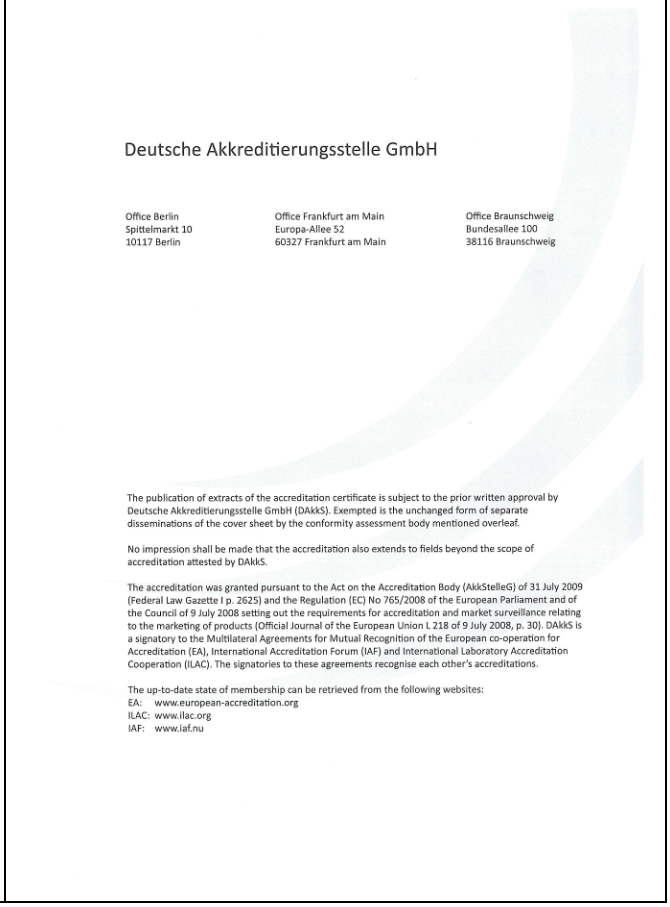
13 Glossary

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

14 Document history

Version	Applied changes	Date of release
-/-	Initial release	2021-03-02

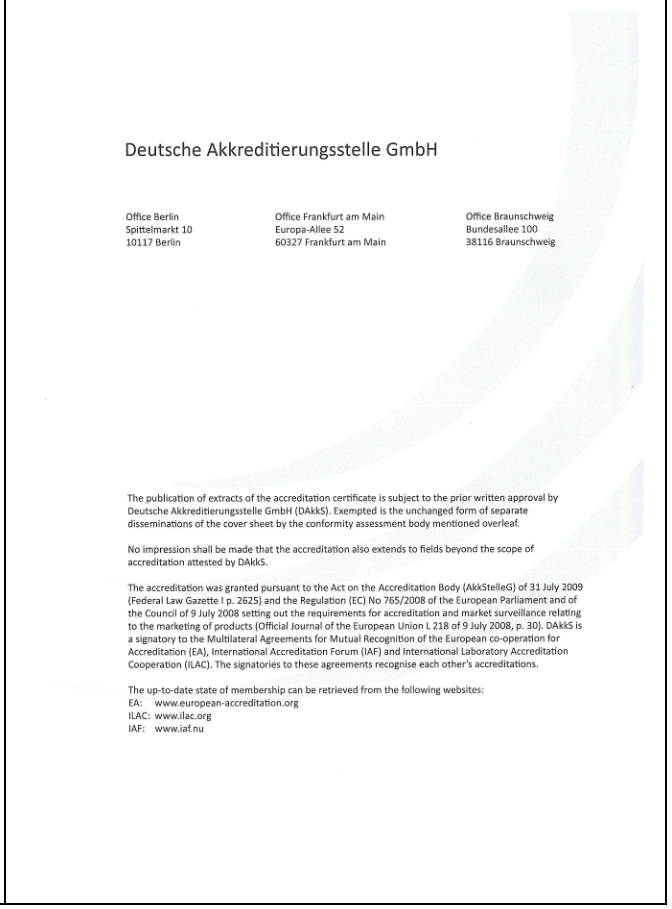
15 Accreditation Certificate – D-PL-12076-01-04

first page	last page
	

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

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

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

first page	last 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 17025:2018 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 overleaf.

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