



## TEST REPORT

BNetzA-CAB-02/21-102

Test report no.: 1-9477/19-01-02-A

### Testing laboratory

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### Manufacturer

**Sennheiser electronic GmbH & Co. KG**  
Am Labor 1  
30900 Wedemark / GERMANY

### Test standard/s

FCC - Title 47 CFR Part 74      FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 74 - Experimental radio, auxiliary, special broadcast and other program distributional services  
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:** UHF Wireless Microphones – Bodypack Transmitter  
**Model name:** SK 300 G4 / SK 500 G4 / SK 100 G4  
**FCC ID:** DMOSK1574  
**IC:** 2099A-SK1574  
**Frequency:** 470 MHz to 608 MHz  
**Technology tested:** proprietary  
**Antenna:** external antenna  
**Power supply:** 2.55 V to 3.45 V DC by 2 x AA battery  
**Temperature range:** -30°C to +50°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:

Christoph Schneider  
Lab Manager  
Radio Communications

### Test performed:

Tobias Wittenmeier  
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## 2 General information

### 2.1 Notes and disclaimer

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

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**This test report replaces the test report with the number 1-9477/19-01-02-A and dated 2020-04-06.**

### 2.2 Application details

Date of receipt of order:	2020-01-08
Date of receipt of test item:	2020-02-06
Start of test:	2020-02-06
End of test:	2020-02-10
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 74		FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 74 - Experimental radio, auxiliary, special broadcast and other program distributional services
RSS - 210 Issue 10	December 2019	Spectrum Management and Telecommunications Radio Standards Specification - Licence-Exempt Radio Apparatus: Category I Equipment
ETSI EN 300 422-1 V1.4.2	2011-08	Electromagnetic compatibility and Radio spectrum Matters (ERM); Wireless microphones in the 25 MHz to 3 GHz frequency range; Part 1: Technical characteristics and methods of measurement
ETSI EN 300 422-1 V2.1.2	2017-01	Wireless Microphones; Audio PMSE up to 3 GHz; Part 1: Class A Receivers; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU

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-12076-01-05	Telecommunication FCC requirements <a href="https://www.dakks.de/as/ast/d/D-PL-12076-01-05.pdf">https://www.dakks.de/as/ast/d/D-PL-12076-01-05.pdf</a>



## 4 Test environment

Temperature	:	$T_{nom}$ +20 °C during room temperature tests $T_{max}$ +50 °C during high temperature tests $T_{min}$ -30 °C during low temperature tests
Relative humidity content	:	55 %
Barometric pressure	:	1021 hpa
Power supply	:	$V_{nom}$ 3.00 V DC by 2 x AA battery $V_{max}$ 3.45 V $V_{min}$ 2.55 V

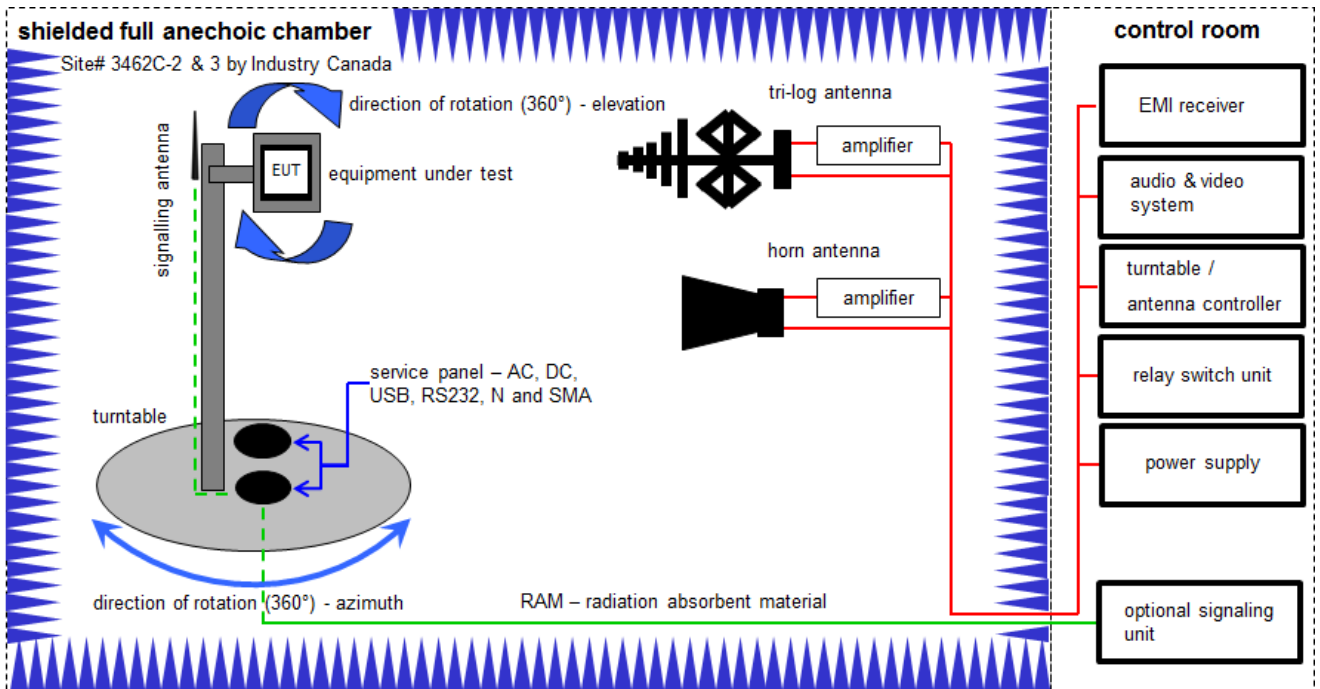
## 5 Test item

### 5.1 General description

Kind of test item	:	UHF Wireless Microphones – Bodypack Transmitter
Model name	:	SK 300 G4 / SK 500 G4 / SK 100 G4
HMN	:	-/-
PMN	:	ewG4
HVIN	:	SK 300 G4, SK 500 G4, SK 100 G4
FVIN	:	1.2.0
S/N serial number	:	Rad. Aw+: 1509011865 Gw1: 1509002710 Cond. Aw+: 1509011859 Gw1: 1509002717
Hardware status	:	525479_23
Software status	:	1.2.0
Firmware status	:	-/-
Frequency band	:	470 MHz to 608 MHz Band Aw+: 470 MHz to 558 MHz also available as sub-bands A1: 470 MHz to 516 MHz A: 516 MHz to 558 MHz AS: 520 MHz to 558 MHz Band Gw1: 558 MHz to 608 MHz also available as sub-band G: 566 MHz to 608 MHz
Type of radio transmission	:	modulated carrier
Use of frequency spectrum	:	
Type of modulation	:	Analog FM
Number of channels	:	-/-
Antenna	:	external antenna
Power supply	:	2.55 V to 3.45 V DC by 2 x AA battery
Temperature range	:	-30°C to +50°C



## 6.1 Shielded fully anechoic chamber



Measurement distance: tri-log antenna and horn antenna 3 meter

$$OP = AV + D - G + CA$$

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

Example calculation:

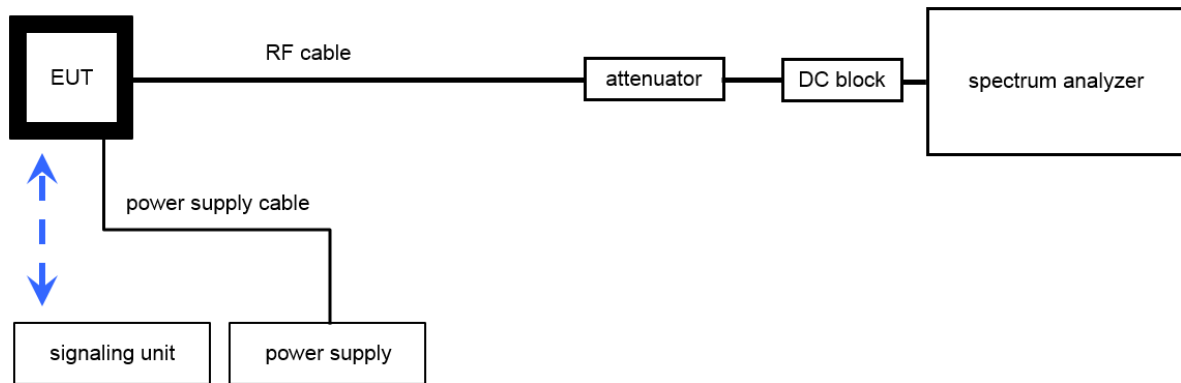
$$OP [dBm] = -65.0 [dBm] + 50 [dB] - 20 [dBi] + 5 [dB] = -30 [dBm] (1 \mu W)$$

**Equipment table:**

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A / B	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
2	A	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	9107-3697	300001605	vIKI!	27.02.2019	26.02.2021
3	A / B	Switch / Control Unit	3488A	HP	*	300000199	ne	-/-	-/-
4	A / B	EMI Test Receiver 20Hz- 26,5GHz	ESU26	R&S	100037	300003555	k	11.12.2019	10.12.2020
5	A	Highpass Filter	WHK1.1/15G-10SS	Wainwright	3	300003255	ev	-/-	-/-
6	B	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck Mess - Elektronik	295	300003787	vIKI!	19.02.2019	18.02.2021
7	A / 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 V3.19.1.9	EMCO		300004682	ne	-/-	-/-
10	A / B	PC	ExOne	F+W		300004703	ne	-/-	-/-

## 6.2 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 / ItemA	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	RF-Cable SRD021 No. 7	Enviroflex 316 D	Huber & Suhner		400001317	ev	-/-	-/-
2	A	Radio Test Set	CMA180	Rohde & Schwarz	101381	300005590	k	20.12.2019	19.12.2021



## 7 Sequence of testing

### 7.1 Sequence of testing radiated spurious 25 MHz to 12.75 GHz

#### Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a 2-axis positioner with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

#### Premeasurement

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

#### Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximizes the peaks by rotating the turntable from 0° to 360°. This measurement is repeated for different EUT-table positions (0° to 150° in 30°-steps) and for both antenna polarizations.
- The final measurement is done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and RMS detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

## 8 Measurement uncertainty

Measurement uncertainty	
Test case	Uncertainty
Transmitter output power	$\pm 3$ dB
<b>Occupied bandwidth</b>	$\pm 3$ kHz to 10 kHz (depends on the used RBW)
Transmitter frequency stability	$\pm 1$ Hz to 1 kHz (depends on the used RBW)
Transmitter unwanted emissions (radiated or conducted)	Radiated: $\pm 3$ dB Conducted: $\pm 0.5$ dB
Modulation characteristics	-/-
Necessary bandwidth (BN) for analogue systems	$\pm 1$ kHz (depends on the used RBW)
Frequency modulation	$\pm 3$ kHz (depends on the used RBW)
Spurious emissions conducted below 30 MHz (AC conducted)	$\pm 2.6$ dB

## 9 Summary of measurement results

<input type="checkbox"/>	No deviations from the technical specifications were ascertained
<input type="checkbox"/>	There were deviations from the technical specifications ascertained
<input checked="" type="checkbox"/>	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	FCC Part 74 RSS - 210, Issue 9 RSS-Gen Issue 4	See table!	2020-04-24	-/-

Test specification clause	Test case	Temperature conditions	Voltage conditions	C	NC	NA	NP	Remark
FCC Part 74.861 (e)(1)(ii) FCC Part 2.1046 RSS-210 – G.3.1 RSS-Gen – 6.12	Transmitter output power	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
FCC Part 74.861 (e)(5) FCC Part 2.1049 RSS-210 – G.3.2 RSS-Gen – 6.6	Occupied bandwidth	Nominal	Nominal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	-/-
FCC Part 74.861 (e)(4) FCC Part 2.1055 RSS-210 – G.3.3 RSS-Gen – 6.11	Transmitter frequency stability	Nominal	Nominal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	-/-
		Extreme	Extreme	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
FCC Part 74.861 (e)(6) FCC Part 74.861 (e)(7) RSS-210 – G.3.4 ETSI EN 300 422-1 v1.4.2 (2011-08)	Transmitter unwanted emissions (radiated or conducted)	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
FCC Part 2.1047	Modulation characteristics	Nominal	Nominal	-/-				-/-
FCC Part 74.861 (e)(7) ETSI EN 300 422-1 v1.4.2 (2011-08)	Necessary bandwidth (BN) for analogue systems	Nominal	Nominal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	-/-
FCC Part 74.861 (e)(3) RSS-210 – G.3.5.2	Frequency modulation	Nominal	Nominal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	-/-
FCC Part 74.861 (e)(7) RSS-210 – G.3.4	Receiver spurious emissions	Nominal	Nominal	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	No receiver integrated!
FCC Part 15.107(a) FCC Part 15.207	Conducted emissions < 30 MHz	Nominal	Nominal	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	-/-

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

## 10 Additional comments

Reference documents: None

Special test descriptions: None

Configuration descriptions: None

Test mode:  No test mode available.  
Test signal is applied to the transmitter.

Special software is used.  
EUT is transmitting pseudo random data by itself

Antennas and transmit operating modes:  **Operating mode 1 (single antenna)**

- *Equipment with 1 antenna,*
- *Equipment with 2 diversity antennas operating in switched diversity mode by which at any moment in time only 1 antenna is used,*
- *Smart antenna system with 2 or more transmit/receive chains, but operating in a mode where only 1 transmit/receive chain is used)*

**Operating mode 2 (multiple antennas, no beamforming)**

- *Equipment operating in this mode contains a smart antenna system using two or more transmit/receive chains simultaneously but without beamforming.*

**Operating mode 3 (multiple antennas, with beamforming)**

- *Equipment operating in this mode contains a smart antenna system using two or more transmit/receive chains simultaneously with beamforming. In addition to the antenna assembly gain (G), the beamforming gain (Y) may have to be taken into account when performing the measurements.*

## 11 Measurement results

### 11.1 Transmitter output power

**Measurement:**

Measurement parameter	
Detector:	Peak (worst case) / Average (RMS)
Sweep time:	Auto / 20s
Resolution bandwidth:	> emission bandwidth
Video bandwidth:	> resolution bandwidth
Span:	> 2 times emissions bandwidth
Trace mode:	Max. hold
EUT configuration:	Peak: Unmodulated carrier RMS: Modulate the transmitter with a 2.5 kHz tone at a level 16 dB higher than that required to produce a frequency deviation of $\pm 75$ kHz, or to produce 50% of the manufacturer's rated deviation, whichever is less.
Test setup:	See sub clause 6.1 A / 6.2 A
Measurement uncertainty:	See sub clause 8

**Limits:**

FCC & IC
470 MHz to 608 MHz 250 mW (average) / 24 dBm (average)

**Result:**

Transmitter conducted output power					
Aw+			Gw1		
Frequency	Peak	Average	Frequency	Peak	Average
470.1 MHz	15.63 dBm	15.57 dBm	558.0 MHz	16.34 dBm	15.96 dBm
516.1 MHz	15.97 dBm	15.63 dBm	583.0 MHz	16.38 dBm	15.76 dBm
558.0 MHz	16.37 dBm	15.94 dBm	607.9 MHz	16.52 dBm	16.14 dBm

Transmitter output power e.i.r.p.					
Aw+			Gw1		
Frequency	Peak	Average	Frequency	Peak	Average
470.1 MHz	13.90 dBm	13.90 dBm	558.0 MHz	13.77 dBm	13.76 dBm
516.1 MHz	15.63 dBm	15.62 dBm	583.0 MHz	15.47 dBm	15.46 dBm
558.0 MHz	15.18 dBm	15.17 dBm	607.9 MHz	15.96 dBm	15.96 dBm

## 11.2 Transmitter unwanted emissions (radiated)

### Measurement:

Measurement parameter	
Detector:	Peak (prescan) / RMS
Sweep time:	Auto
Resolution bandwidth:	See table below!
Video bandwidth:	See table below!
Span:	100 MHz steps!
Trace-Mode:	Max. hold
EUT:	MC with max frequency deviation
Used equipment:	See chapter 6.1- A / B
Measurement uncertainty:	See chapter 8
Frequency being measured	Measuring receiver bandwidth
25 MHz to 30 MHz	9 kHz to 10 kHz
30 MHz to 1 000 MHz	100 kHz
> 1 000 MHz	1 MHz

### Limits:

FCC & IC (according to ETSI EN 300 422-1)			
State	Max. spurious level		
	47 MHz to 74 MHz 87.5 MHz to 137 MHz 174 MHz to 230 MHz 470 MHz to 862 MHz	Other frequencies ≤ 1000 MHz	All frequencies > 1000 MHz
Operating	4.0 nW	250 nW	1.00 µW
Standby	2.0 nW	2.0 nW	20.0 nW

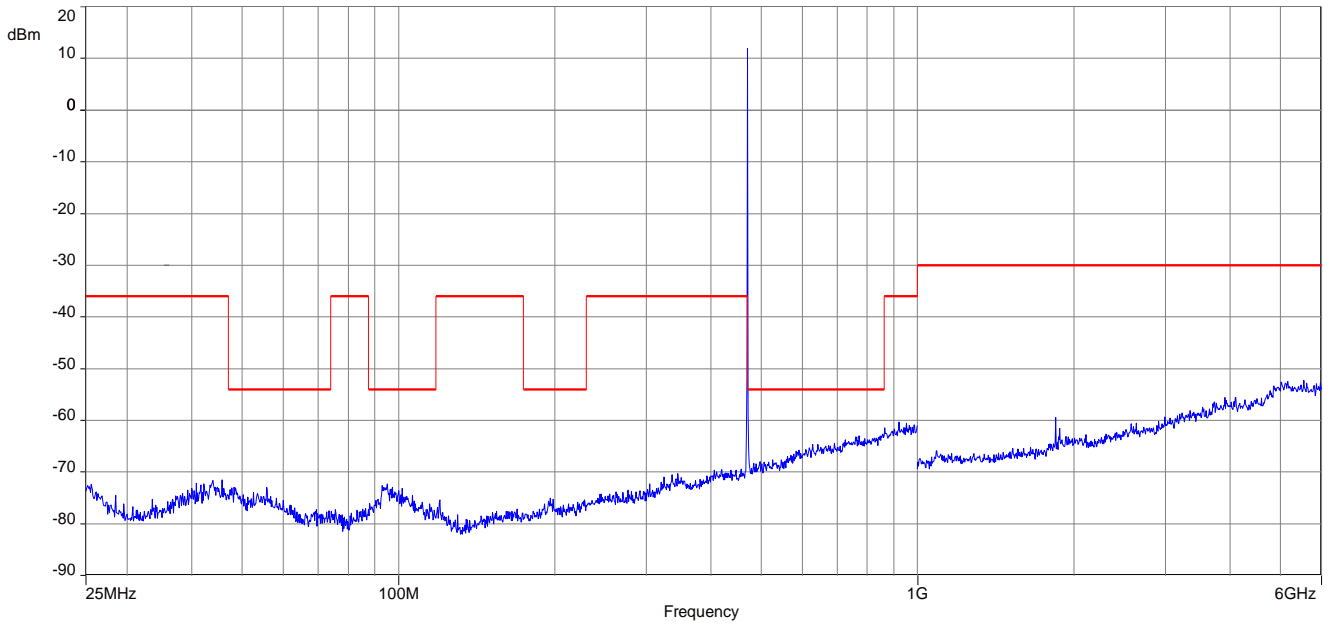
FCC & IC	
The mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:	
On any frequency removed from the operating frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: at least	25 dB
On any frequency removed from the operating frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth	35 dB
On any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth: at least	43 + 10log <sub>10</sub> (mean output power in watts) dB

### Results:

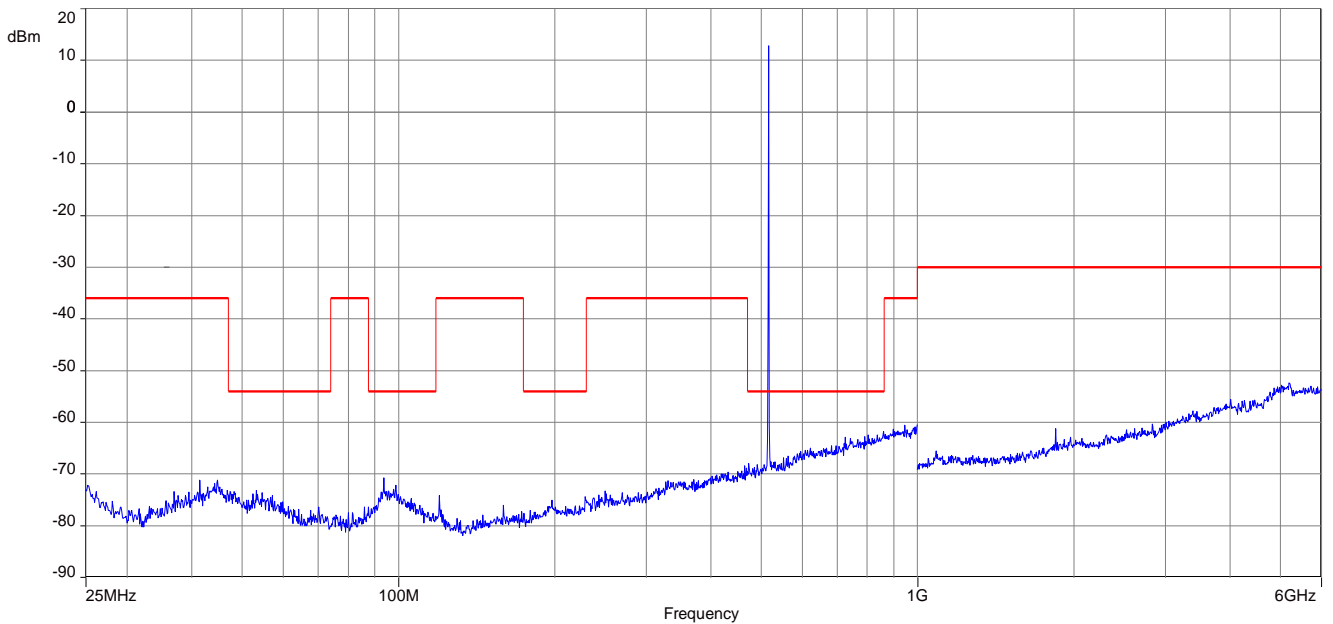
carrier frequency	unwanted emission frequency	Limit	Level or remark
All detected emissions are more than 20 dB below the limit.			

**Plots:** radiated Aw+

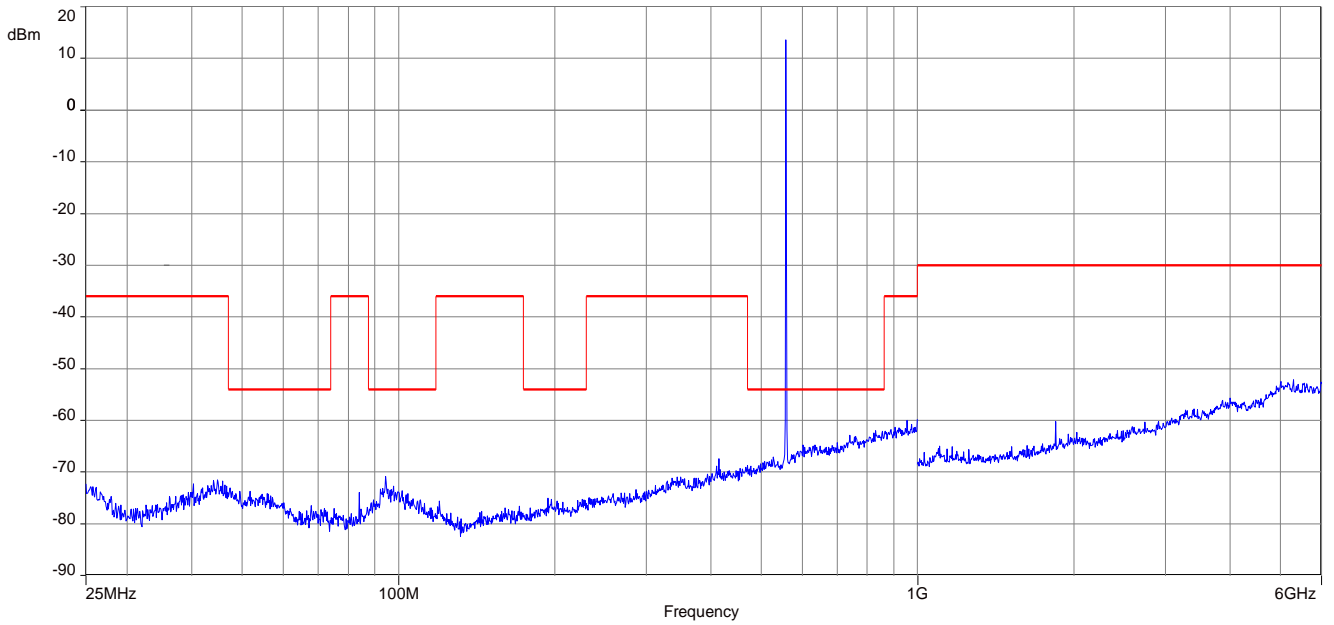
**Plot 1: 470.1 MHz, spurious emissions, 25 MHz – 6 GHz**



**Plot 2: 516.1 MHz, spurious emissions, 25 MHz – 6 GHz**

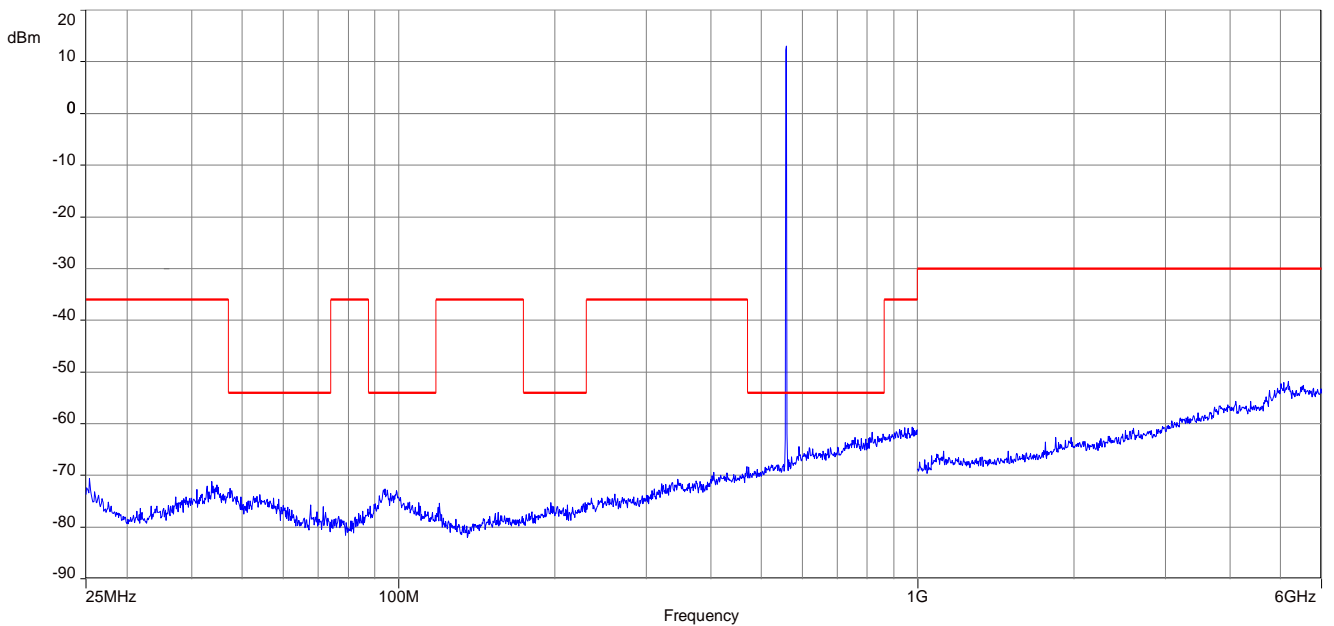


**Plot 3: 558.0 MHz, spurious emissions, 25 MHz – 6 GHz**



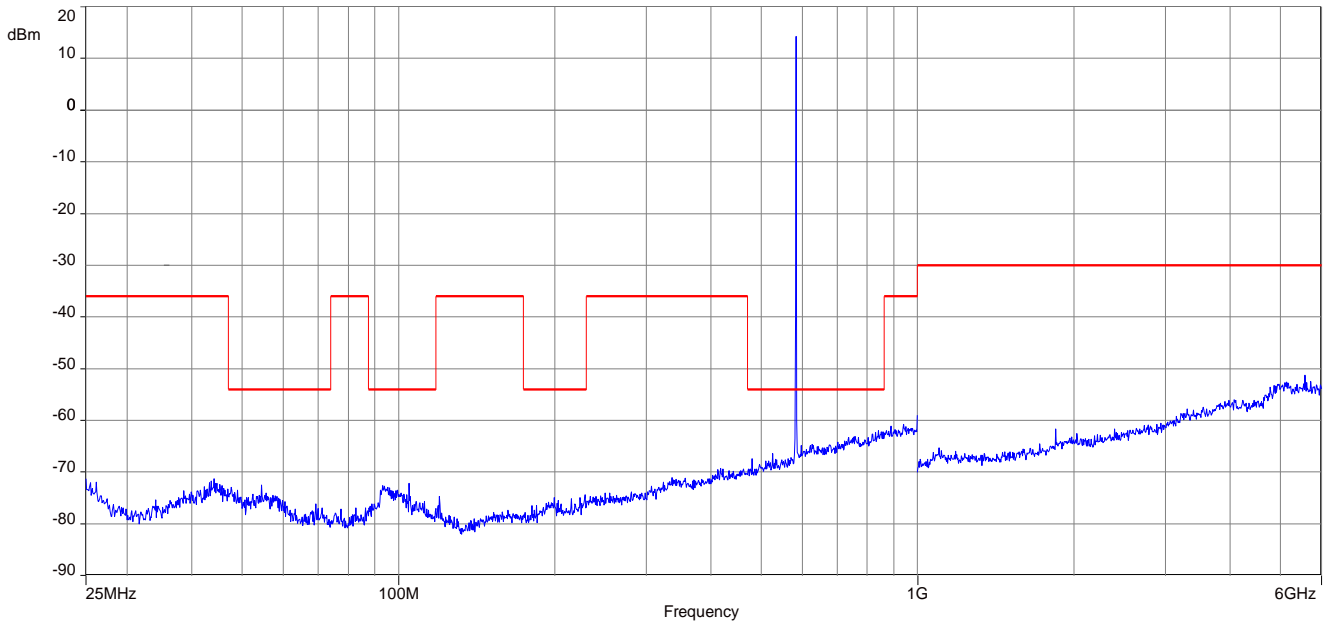
**Plots: radiated Gw1**

**Plot 1: 558.0 MHz, spurious emissions, 25 MHz – 6 GHz**

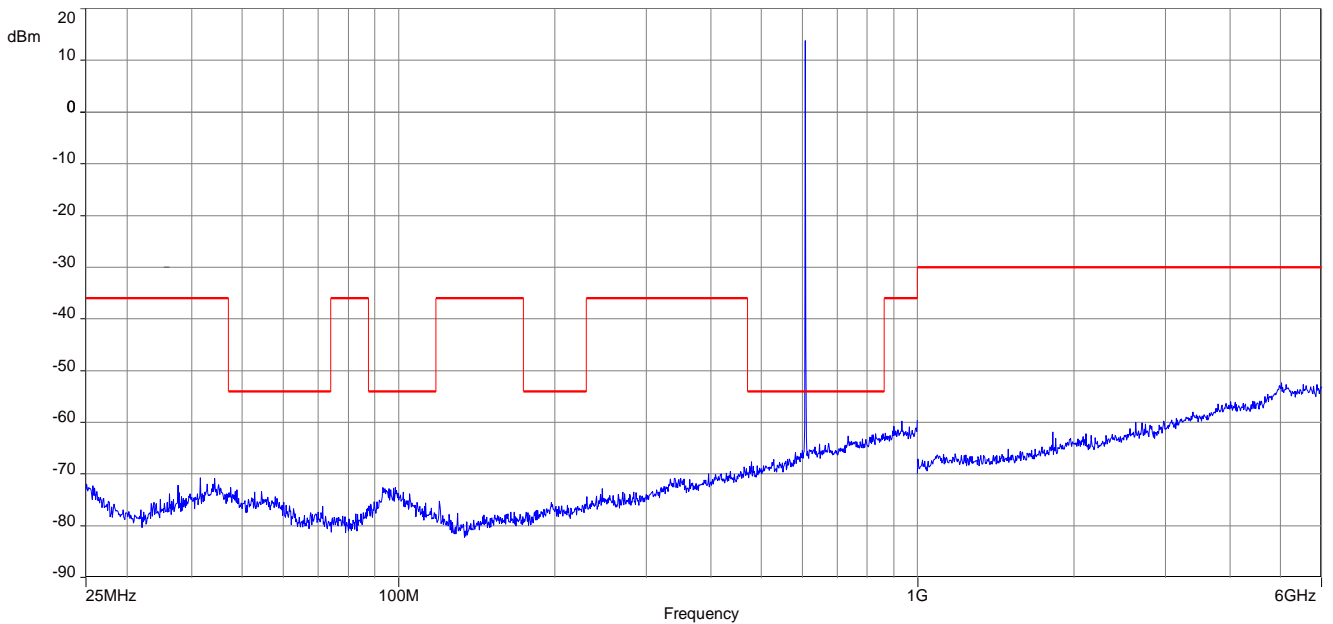




**Plot 2: 583.0 MHz, spurious emissions, 25 MHz – 6 GHz**



**Plot 3: 607.9 MHz, spurious emissions, 25 MHz – 6 GHz**



## 12 Observations

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

## Annex A Glossary

<b>EUT</b>	Equipment under test
<b>DUT</b>	Device under test
<b>UUT</b>	Unit under test
<b>GUE</b>	GNSS User Equipment
<b>ETSI</b>	European Telecommunications Standards Institute
<b>EN</b>	European Standard
<b>FCC</b>	Federal Communications Commission
<b>FCC ID</b>	Company Identifier at FCC
<b>IC</b>	Industry Canada
<b>PMN</b>	Product marketing name
<b>HMN</b>	Host marketing name
<b>HVIN</b>	Hardware version identification number
<b>FVIN</b>	Firmware version identification number
<b>EMC</b>	Electromagnetic Compatibility
<b>HW</b>	Hardware
<b>SW</b>	Software
<b>Inv. No.</b>	Inventory number
<b>S/N or SN</b>	Serial number
<b>C</b>	Compliant
<b>NC</b>	Not compliant
<b>NA</b>	Not applicable
<b>NP</b>	Not performed
<b>PP</b>	Positive peak
<b>QP</b>	Quasi peak
<b>AVG</b>	Average
<b>OC</b>	Operating channel
<b>OCW</b>	Operating channel bandwidth
<b>OBW</b>	Occupied bandwidth
<b>OOB</b>	Out of band
<b>DFS</b>	Dynamic frequency selection
<b>CAC</b>	Channel availability check
<b>OP</b>	Occupancy period
<b>NOP</b>	Non occupancy period
<b>DC</b>	Duty cycle
<b>PER</b>	Packet error rate
<b>CW</b>	Clean wave
<b>MC</b>	Modulated carrier
<b>WLAN</b>	Wireless local area network
<b>RLAN</b>	Radio local area network
<b>DSSS</b>	Dynamic sequence spread spectrum
<b>OFDM</b>	Orthogonal frequency division multiplexing
<b>FHSS</b>	Frequency hopping spread spectrum
<b>GNSS</b>	Global Navigation Satellite System
<b>C/N<sub>0</sub></b>	Carrier to noise-density ratio, expressed in dB-Hz

**Annex B Document history**

Version	Applied changes	Date of release
-/-	Initial release	2020-04-06
A	Editorial changes	2020-04-24

**Annex C Accreditation Certificate – D-PL-12076-01-05**

first page	last page
 <p>The first page of the accreditation certificate includes the DAkkS logo, the name 'Deutsche Akkreditierungsstelle GmbH', and details of the accreditation for CTC advanced GmbH. It states that the laboratory is competent under DIN EN ISO/IEC 17025:2005 for telecommunication (FCC Requirements). The certificate is signed by Uwe Zimmermann, Head of Division, on 11.01.2019.</p>	 <p>The last page of the certificate lists three office locations: Berlin, Frankfurt am Main, and Braunschweig. It also contains a disclaimer about the publication of extracts and provides information on where to find the up-to-date state of membership.</p>

**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-12076-01-05.pdf>

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