

## TEST REPORT

Test report no.: 1-7203/18-01-03



### Testing laboratory

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**Accredited Testing Laboratory:**

The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2005) by the Deutsche Akkreditierungsstelle GmbH (DAkkS)

The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12076-01-03

### Applicant

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Am Labor 1

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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 9

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:** Wireless Microphone  
**Model name:** SKM 9000 / SKM 6000  
**FCC ID:** DMOSKM9000  
**IC:** 2099A-SKM9000  
**Frequency:** 470.200 MHz – 607.800 MHz  
**Technology tested:** Digital Audio Transmission  
**Antenna:** Integrated antenna  
**Power supply:** 3.0 V DC by 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 & EMC

### Test performed:

p.o.  
Sumit Kumar  
Testing Manager  
Radio Communications & EMC

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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 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:	2018-10-30
Date of receipt of test item:	2018-10-29
Start of test:	2018-11-10
End of test:	2018-12-12
Person(s) present during the test:	-/-

### 2.3 Test laboratories sub-contracted

None

### 3 Test standard/s

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 9	August 2016	Spectrum Management and Telecommunications Radio Standards Specification - Licence-Exempt Radio Apparatus: Category I Equipment
RSS - Gen Issue 5	April 2018	Spectrum Management and Telecommunications Radio Standards Specification - General Requirements for Compliance of Radio Apparatus
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

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

## 4 Test environment

Temperature	:	T <sub>nom</sub> T <sub>max</sub> T <sub>min</sub>	+22 °C during room temperature tests +50 °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 <sub>nom</sub> V <sub>max</sub> V <sub>min</sub>	3.0 V DC by battery 3.45 V 2.65 V

## 5 Test item

### 5.1 General description

Kind of test item	:	Wireless Microphone
Type identification	:	SKM 9000 / SKM 6000
HVIN	:	SKM 6000; SKM 9000
PMN	:	SKM 6000; SKM 9000
S/N serial number	:	A1-A4: 1516000014 A5-A8 US: 1496000015
FVIN	:	SKM 6000: 1.1.29 SKM 9000: 1.0.146
Hardware status	:	572022
Software status	:	001.001.018
Firmware status	:	-/-
Frequency band	:	470.200 MHz – 607.800 MHz Frequency range: A1 - A4: 470.2 MHz, 514.0 MHz, 558.0 MHz A5 - A8 US: 550.0 MHz, 579.0 MHz, 607.8 MHz
Type of radio transmission	:	modulated carrier
Use of frequency spectrum	:	
Type of modulation	:	FM
Antenna	:	Integrated antenna
Power supply	:	3.0 V DC by battery
Temperature range	:	-30°C to +50°C

### 5.2 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:

- 1-7203/18-01-01\_AnnexA
- 1-7203/18-01-01\_AnnexB
- 1-7203/18-01-01\_AnnexC

## 6 Description of the test setup

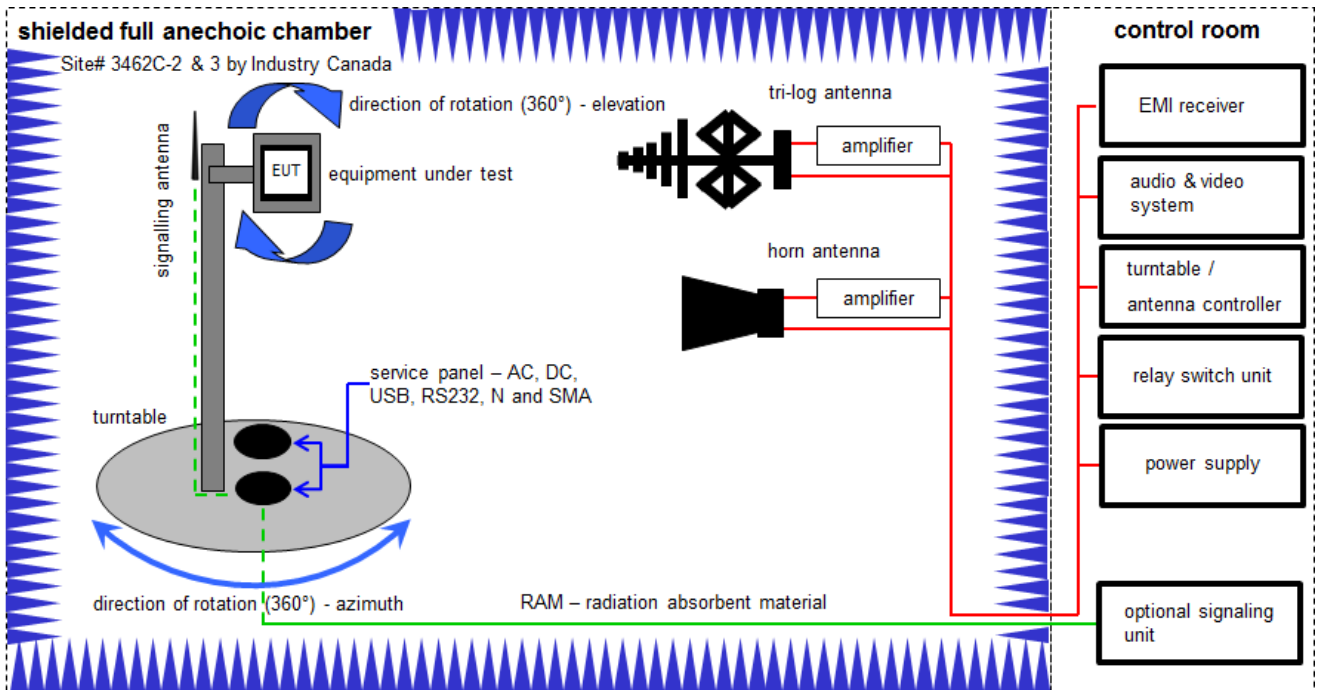
Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements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

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

### **Agenda:** Kind of Calibration

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

## 6.1 Shielded fully anechoic chamber



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

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

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

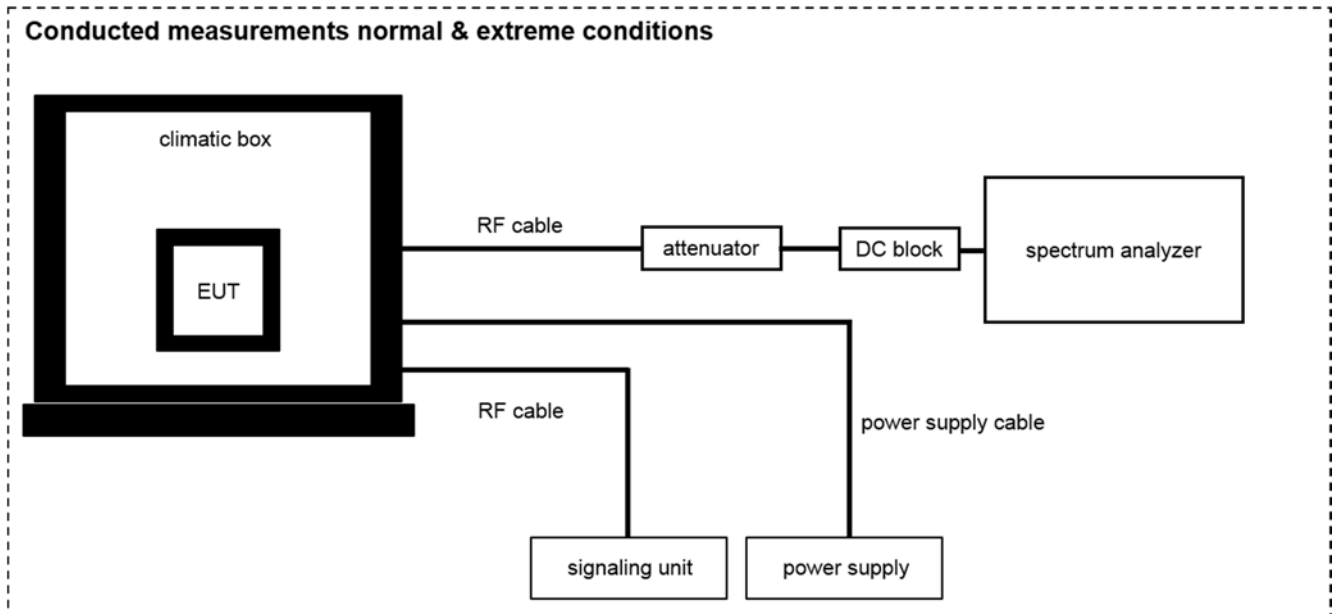
Example calculation:

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

**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	B	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	9107-3697	300001605	vKI!	14.02.2017	13.02.2019
3	A, B	Switch / Control Unit	3488A	HP	-/-	300000199	ne	-/-	-/-
4	B	Highpass Filter	WHK1.1/15G-10SS	Wainwright	3	300003255	ev	-/-	-/-
5	A	TRILOG Broadband Test-Antenna	VULB9163	Schwarzbeck Mess Elektronik	01029	300005379	k	07.04.2017	06.04.2020
6	B	Broadband Amplifier 0.5-18 GHz	CBLU5184540	CERNEX	22049	300004481	ev	-/-	-/-
7	A, B	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne	-/-	-/-
8	A, B	NEXIO EMV-Software	BAT EMC V3.16.0.49	EMCO	-/-	300004682	ne	-/-	-/-
9	A, B	PC	ExOne	F+W	-/-	300004703	ne	-/-	-/-
10	A,B	EMI Test Receiver 20Hz- 26,5GHz	ESU26	R&S	100037	300003555	k	20.12.2017	19.12.2018

## 6.2 Conducted measurements normal and extreme 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	Power Supply 0-20V; 0-5A	6632B	HP	US37478366	400000117	vKI!	25.01.2017	24.01.2019
2	A, B	Signal- and Spectrum Analyzer	FSW26	R&S	101455	300004528	k	20.12.2017	19.12.2018



## 7 Measurement uncertainty

Measurement uncertainty	
Test case	Uncertainty
Transmitter output power	$\pm 3$ dB
Occupied bandwidth	$\pm 3$ 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

## 8 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!	2018-12-13	-/-

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 type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" 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 digital system	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input 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 checked="" type="checkbox"/>	<input 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"/>	-/-
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

## 9 Additional comments

Reference documents: None

Special test descriptions: None

Configuration descriptions: EUT tested with a sensitivity setting of -30 dB – pre-setting from manufacturer.

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.*

## 10 Measurement results

### 10.1 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 7

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:

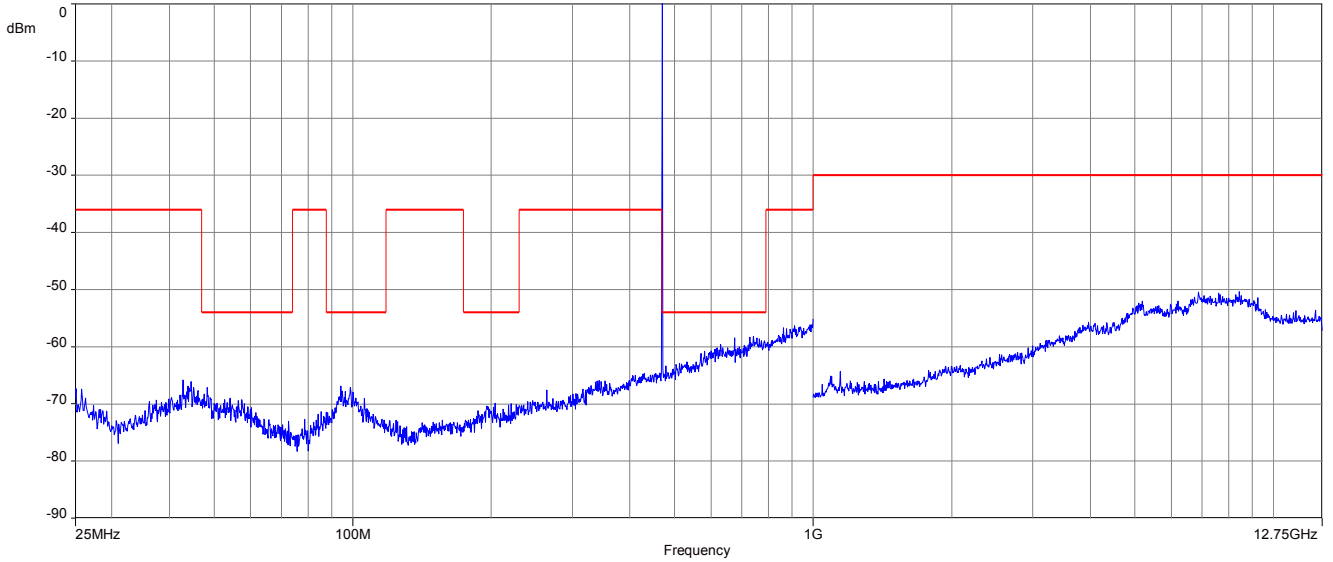
FCC & IC (according to ETSI EN 300 422-1 v1.4.2 (2011-08))			
State	Max. spurious level		
	47 MHz to 74 MHz 87.5 MHz to 118 MHz 174 MHz to 230 MHz 470 MHz to 862 MHz	Other frequencies ≤ 1000 MHz	All frequencies > 1000 MHz
Operating	4.0 nW	250 nW	1.00 µW
Standby	2.0 nW	2.0 nW	20.0 nW

#### Results:

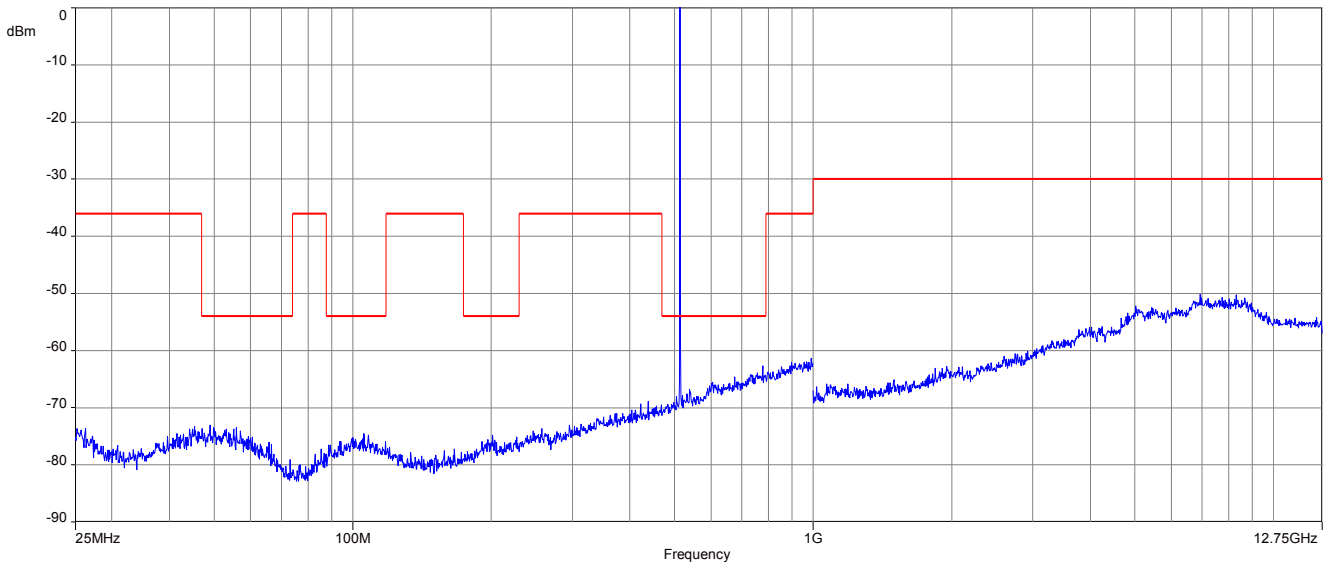
carrier frequency	unwanted emission frequency (MHz)	Limit (dBm)	level (dB) / (dBm) or remark
470.2 MHz			All peaks are more than 20 dB from the limit line.
514.0 MHz			
558.0 MHz			
550.0 MHz			
579.0 MHz			
607.8 MHz			

**Plots:** radiated

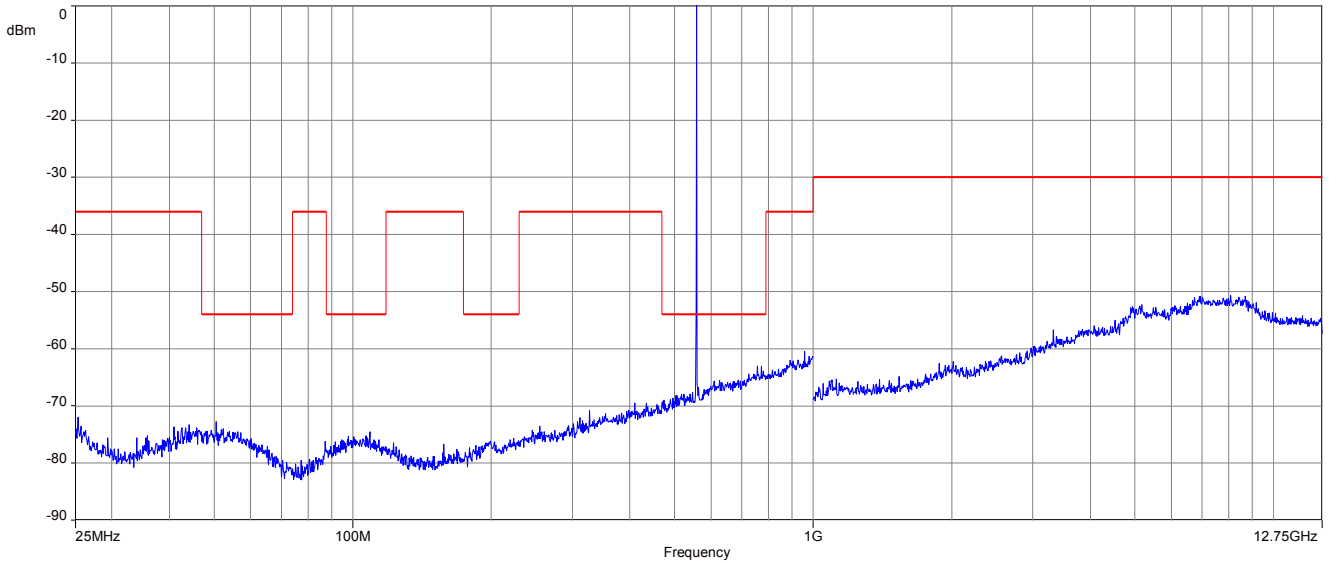
**Plot 1:** 470.2 MHz, spurious emissions, 25 MHz – 12.75 GHz



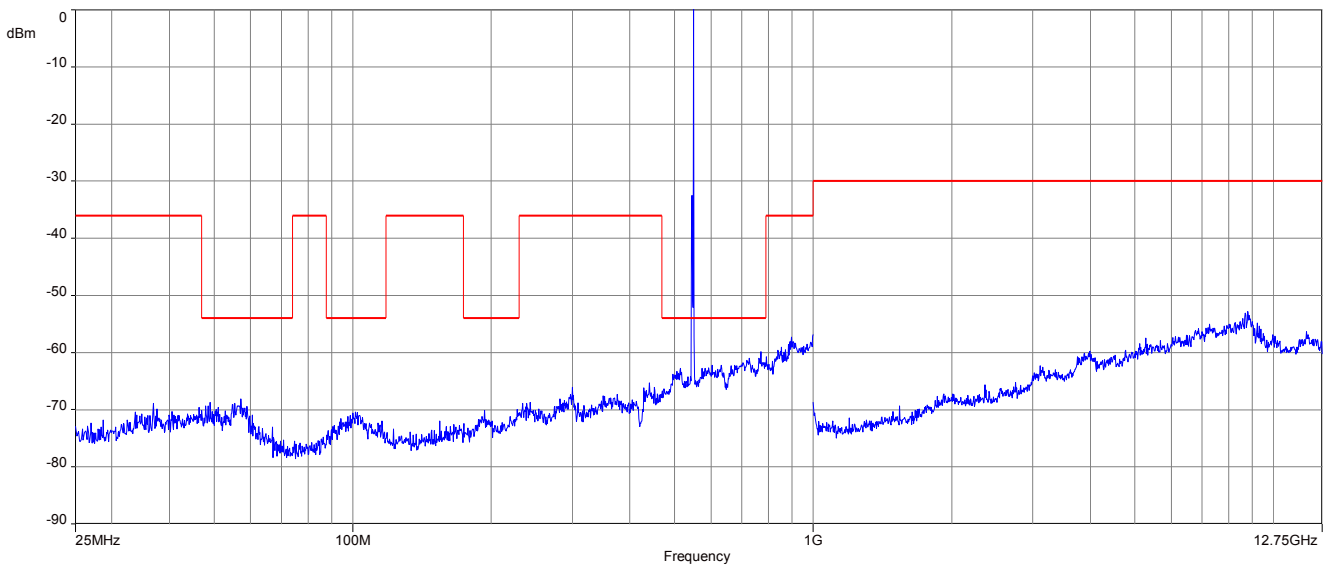
**Plot 2:** 514.0 MHz, spurious emissions, 25 MHz – 12.75 GHz



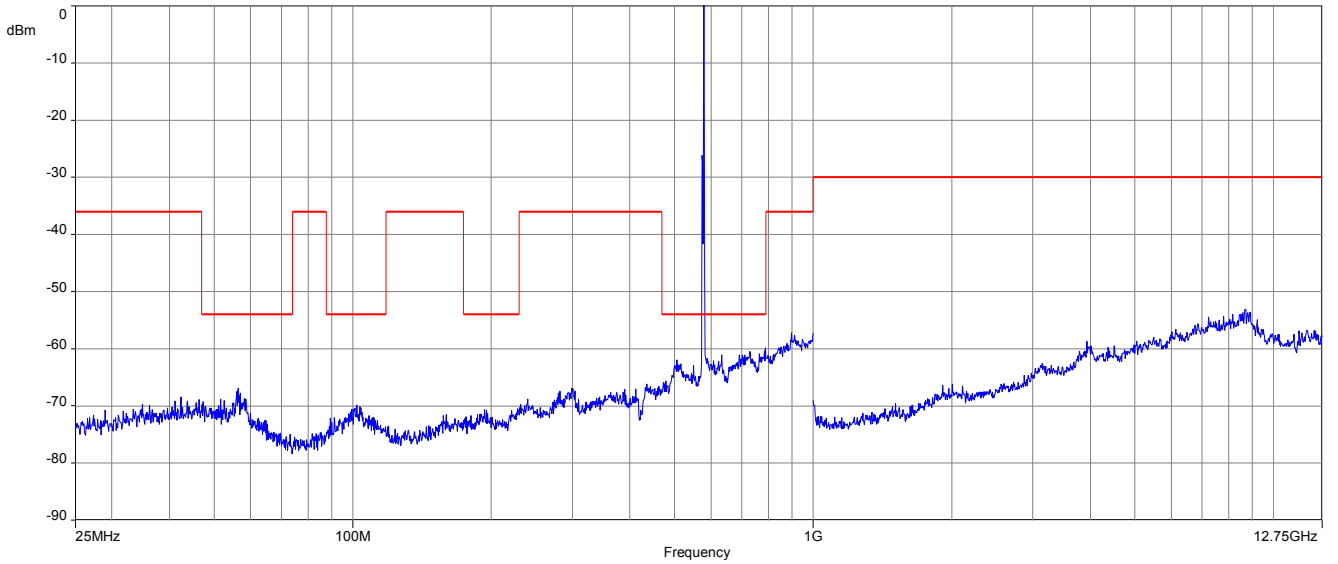
**Plot 3: 558.0 MHz, spurious emissions, 25 MHz – 12.75 GHz**



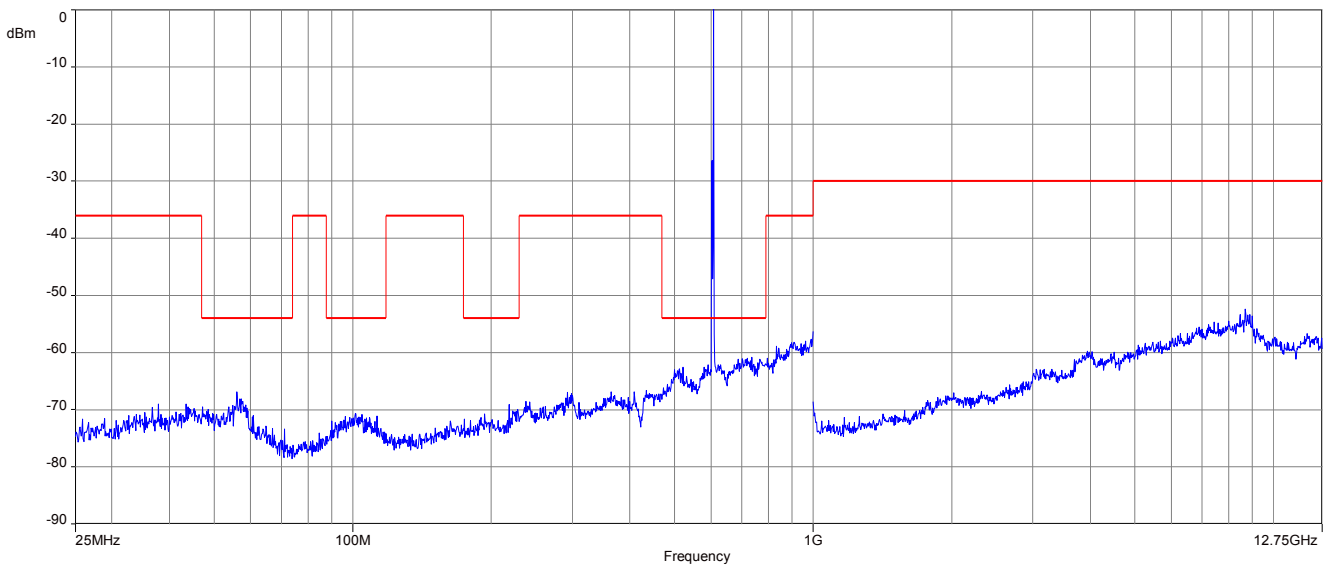
**Plot 4: 550.0 MHz, spurious emissions, 25 MHz – 12.75 GHz**



**Plot 5:** 579.0 MHz, spurious emissions, 25 MHz – 12.75 GHz



**Plot 6:** 607.8 MHz, spurious emissions, 25 MHz – 12.75 GHz



## 10.2 Necessary bandwidth (BN)

### Digital systems:

### Measurement:

Measurement parameters	Carrier Power	Maximum relative level (dBc)	Transmitter wide band noise floor
Detector:	RMS	RMS	RMS
Centre frequency:	$f_c$	$f_c$	
Sweep time:	$\geq 2s$	$\geq 2s$	$\geq 2s$
Video bandwidth:			
Resolution bandwidth:			
Span:	Zero span	$\geq 5 \times B$	
Trace-Mode:	Average	Peak Hold	Average
RBW&VBW	$5 \times B$	1 kHz	1 kHz

Frequency	below 1GHz	above 1 GHz
Start:	$f_c + 1.75B$ and $f_c - 1 \text{ MHz}$	$f_c + B$ and $f_c - 1 \text{ MHz}$
Stop:	$f_c + 1 \text{ MHz}$ and $f_c - 1.75B$	$f_c + 1 \text{ MHz}$ and $f_c - B$

### Limits:

### Subclause 8.3.2.2

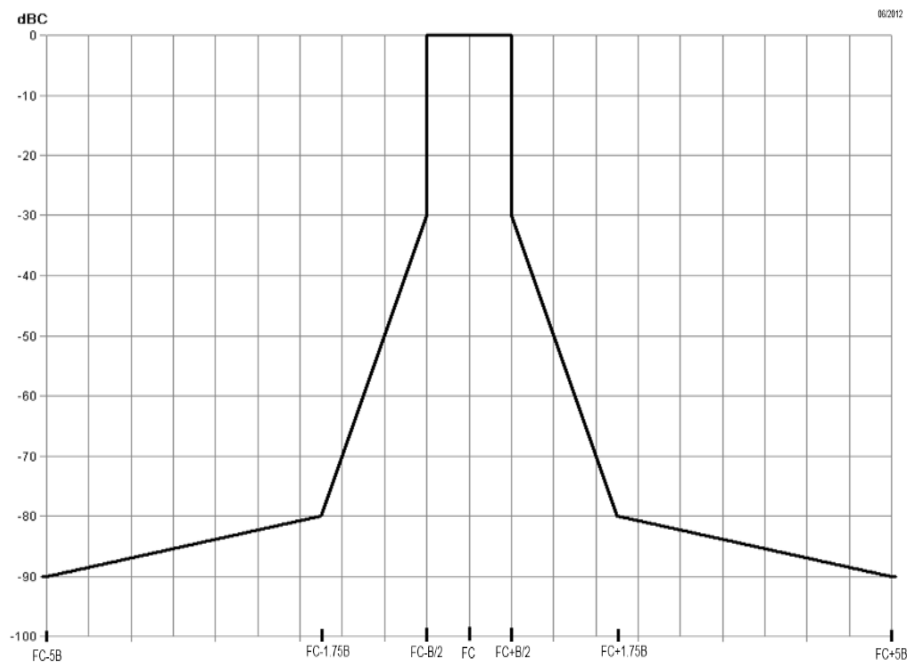
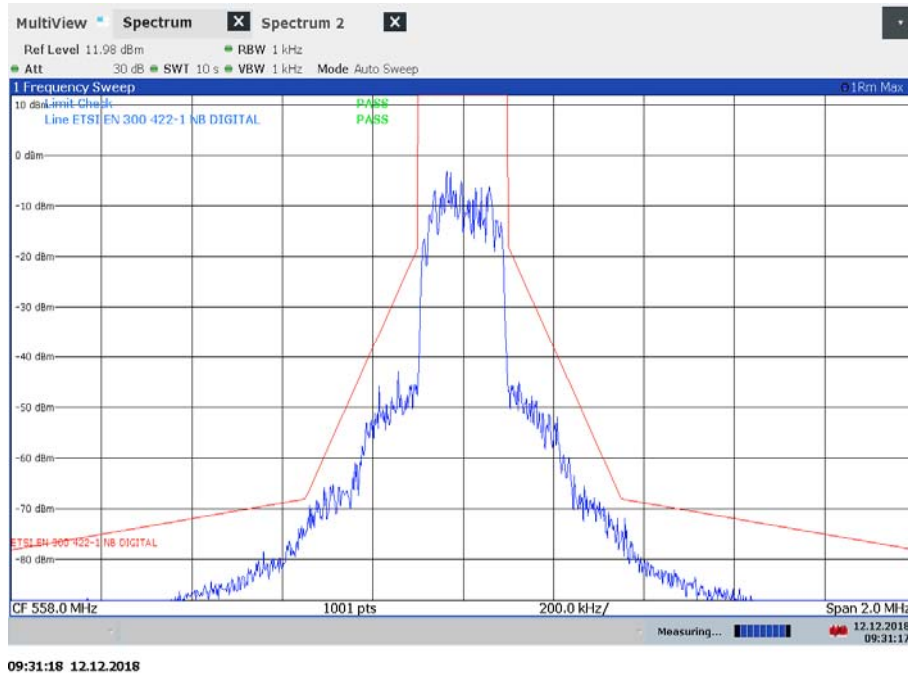


Figure 1: Spectrum mask for digital systems below 2 GHz

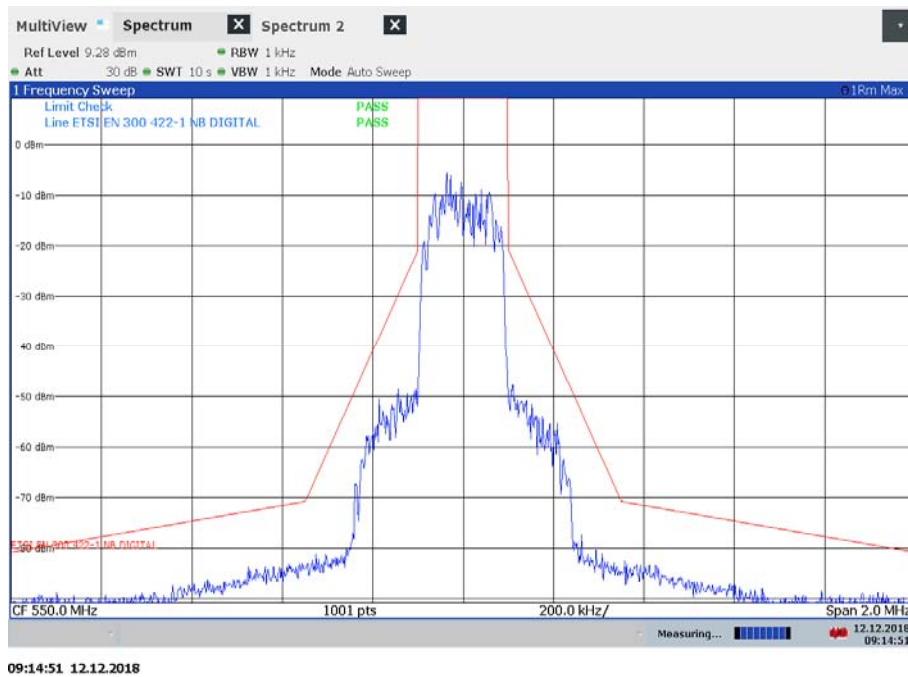




Plot 3: Modulated carrier with the weighted noise source, 558.0 MHz



Plot 4: Modulated carrier with the weighted noise source, 550.0 MHz





## 11 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	2018-12-13

**Annex C Accreditation Certificate**

first page	last page
 <p>The first page of the accreditation certificate includes the DAKKS logo (Deutsche Akkreditierungsstelle), the company name Deutsche Akkreditierungsstelle GmbH, and accreditation details for CTC advanced GmbH. It states that the company is entrusted according to Section 8 subsection 1 of the AkkStelleG in connection with Section 1 subsection 1 of the AkkStelleGBV, signatory to the Multilateral Agreements of EA, ILAC, and IAF for Mutual Recognition. The accreditation is for the field of Telecommunication. The certificate is valid until 21.04.2021 and includes the registration number D-PL-12076-01-03. It is signed by Dipl.-Ing. (FH) Ralf Peter, Head of Division, in Frankfurt on 02.06.2017.</p>	 <p>The last page of the accreditation certificate provides contact information for DAKKS offices: Berlin (Spittelmarkt 10), Frankfurt am Main (Europa-Allee 52), and Braunschweig (Bundesallee 100). It includes legal disclaimers regarding the publication of extracts and the scope of accreditation. It also mentions that the accreditation was granted pursuant to the Act on the Accreditation Body (AkkStelleG) of 31 July 2009 and the Regulation (EC) No 765/2008 of the European Parliament. The up-to-date state of membership can be retrieved from the websites: EA: www.european-accreditation.org, ILAC: www.ilac.org, and IAF: www.iaf.nu.</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-12076-01-03e.pdf>

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