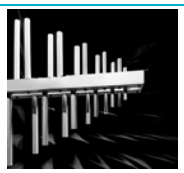
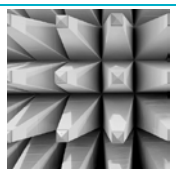




CTC advanced
member of RWTÜV group

Bundesnetzagentur

BNetzA-CAB-02/21-102

TEST REPORT

Test report no.: 1-8392/19-02-10-B

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: http://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

Sennheiser electronic GmbH & Co. KG
Am Labor 1
30900 Wedemark / GERMANY
Phone: +49 5130 600-0
Contact: Nils Knauer
e-mail: Nils.Knauer@sennheiser.com
Phone: +49 5130/600-9524

Manufacturer

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

Test standard/s

FCC - Title 47 CFR Part 15	FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part Part 15 - Radio frequency devices

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

Test Item

Test item description:	**Handheld Transmitter**
Model No.:	**EW-D SKM-S**
FCC ID:	**DMOSKMSEWD**
Operating Frequency:	470.2 MHz – 607.8 MHz
Technology:	Digital Audio Transmission
Antenna:	internal monopole antenna
Power ratings:	2.00 V to 4.35 V DC by battery Li-Ion BA 70 or 2 x AA type 1.50 V DC
Operating temperature range:	-10°C to +55°C

This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

Test report authorized:

p.o. cn=Andreas Luckenbill, o=CTC advanced GmbH, ou=LUC-180217, email=andreas.luckenbill@ctcadvanced.com, c=DE
2020.08.31 10:34:48 +02'00'

Christoph Schneider
Lab Manager
Radio Communications

Test performed:

p.o. cn=Mihail Dorongovskij, o=CTC advanced GmbH, ou=DOR-200803, email=mihail.dorongovskij@ctcadvanced.com, c=DE
2020.08.31 10:34:11 +02'00'

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.
The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CTC advanced GmbH.
The testing service provided by CTC advanced GmbH has been rendered under the current "General Terms and Conditions for CTC advanced GmbH".
CTC advanced GmbH will not be liable for any loss or damage resulting from false, inaccurate, inappropriate or incomplete product information provided by the customer.
Under no circumstances does the CTC advanced GmbH test report include any endorsement or warranty regarding the functionality, quality or performance of any other product or service provided.
Under no circumstances does the CTC advanced GmbH test report include or imply any product or service warranties from CTC advanced GmbH, including, without limitation, any implied warranties of merchantability, fitness for purpose, or non-infringement, all of which are expressly disclaimed by CTC advanced GmbH.
All rights and remedies regarding vendor's products and services for which CTC advanced GmbH has prepared this test report shall be provided by the party offering such products or services and not by CTC advanced GmbH.
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.

This test report replaces the test report with the number 1-8392/19-02-10-A and dated 2020-07-28

2.2 Application details

Date of receipt of order:	2020-04-16
Date of receipt of test item:	2020-06-15
Start of test:	2020-06-15
End of test:	2020-07-13
Person(s) present during the test:	-/-

2.3 Test laboratories sub-contracted

None

3 Test standard/s, references and accreditations

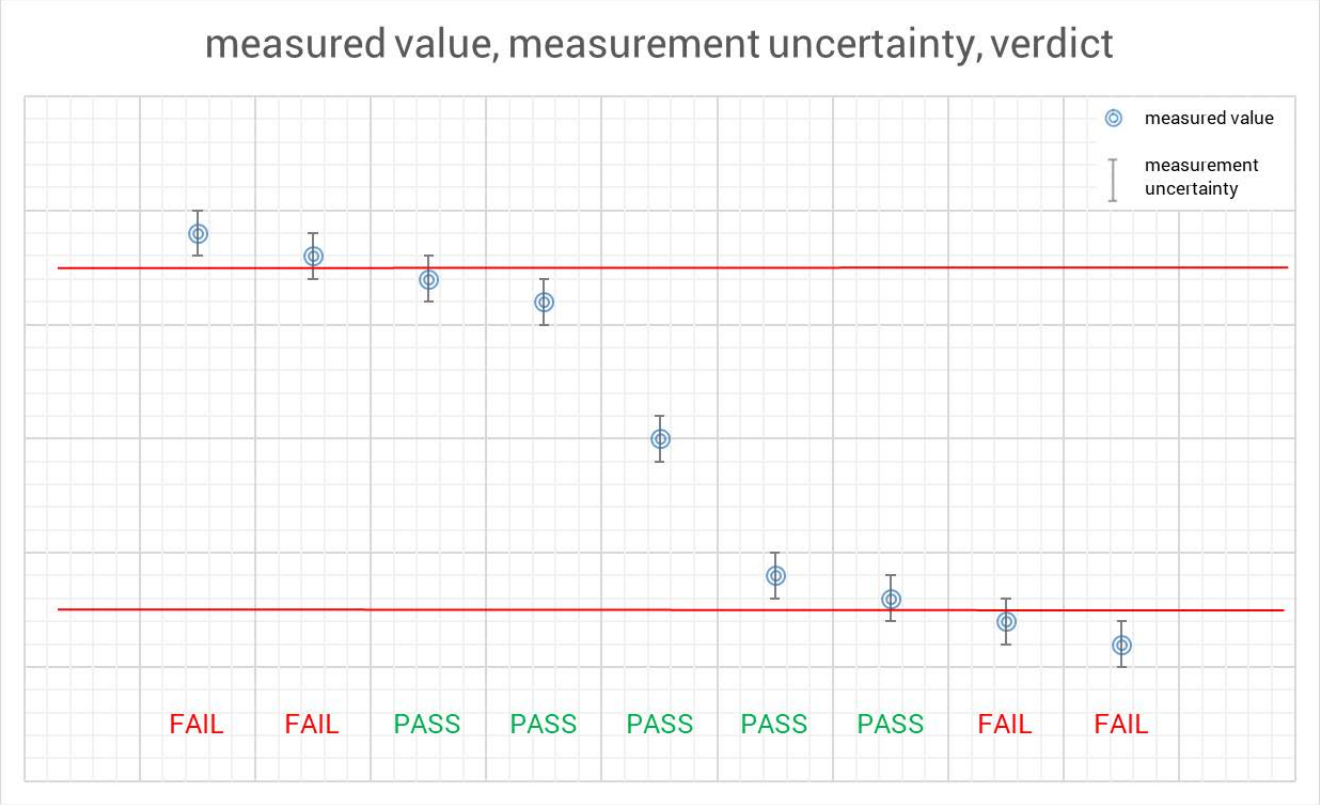
Test standard	Date	Description
FCC - Title 47 CFR Part 15	-/-	FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part Part 15 - Radio frequency devices
ETSI EN 300 422-1 V1.4.2	2011-08	Electromagnetic compatibility and Radio spectrum Matters (ERM); Wireless microphones in the 25 MHz to 3 GHz 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
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 https://www.dakks.de/as/ast/d/D-PL-12076-01-05.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 8, 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}	+20 °C during room temperature tests +50 °C during high temperature tests -30 °C during low temperature tests
Relative humidity content	:		55 %
Barometric pressure	:		1021 hpa
Power ratings	:	V_{nom} V_{max} V_{min}	3.80 V DC by battery Li-Ion BA 70 or 2 x AA type 1.50 V DC 4.35 V 2.00 V

6 Test item

6.1 General description

Test item description	:	Handheld Transmitter
Model No.	:	EW-D SKM-S
Brand name	:	SENNHEISER
Product name	:	Evolution Wireless Digital
HMN	:	-/-
PMN	:	EW-D SKM-S
HVIN	:	EW-D SKM-S
FVIN	:	1.0.0
S/N serial number	:	Radiated: Q1-6 1220000405 R1-6 1220000433 R4-9 1220000401 Conducted Q1-6 1220000408 R1-6 1220000436 R4-9 1220000405
Hardware version	:	583750_07
Software version	:	-/-
Firmware version	:	1.0.0
Operating frequency	:	470.2 MHz – 607.8 MHz
Type of radio transmission Use of frequency spectrum	: :	modulated carrier
Modulation type	:	PI/4 DQPSK
Number of channels	:	tuning step size 25 kHz
Antenna	:	internal monopole antenna
Maximum transmit power	:	12.53 dBm e.i.r.p.
Power ratings	:	2.00 V to 4.35 V DC by battery Li-Ion BA 70 or 2 x AA type 1.50 V DC
Operating temperature range	:	-10°C to +55°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: 1-8392/19-02-09_AnnexA
1-8392/19-02-01_AnnexB
1-8392/19-02-01_AnnexC

7 Description of the test setup

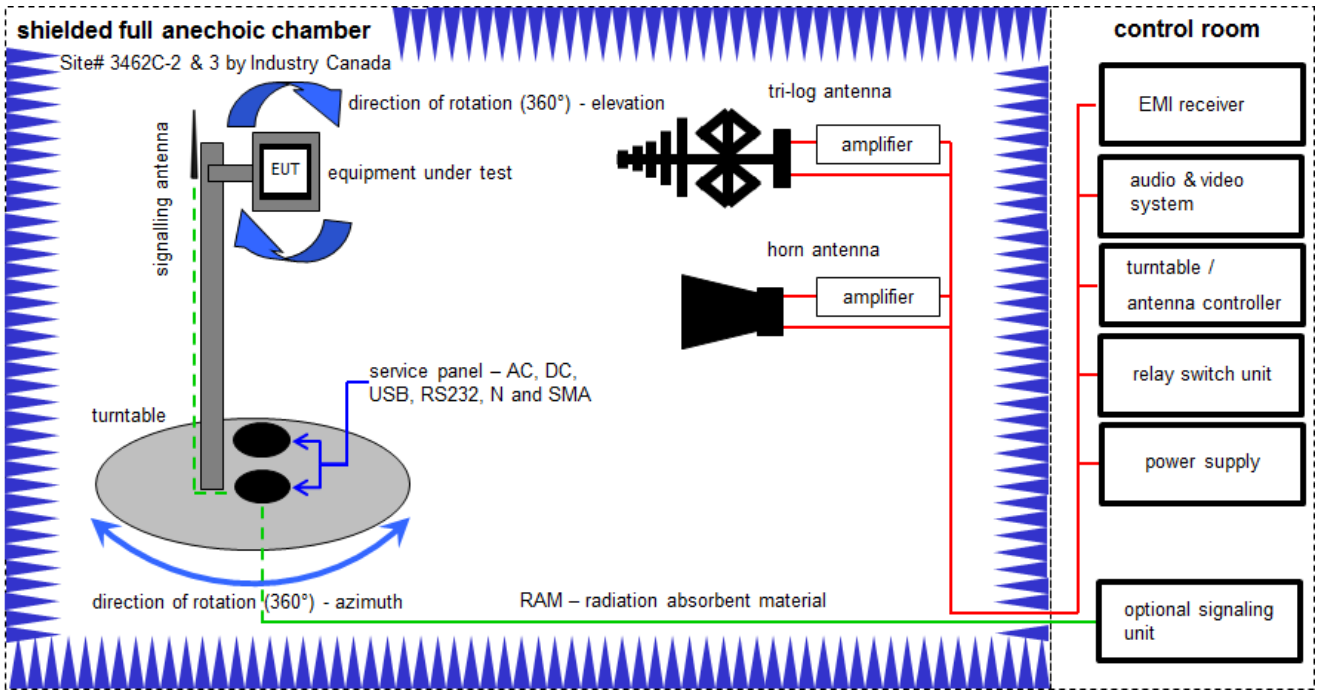
Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements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

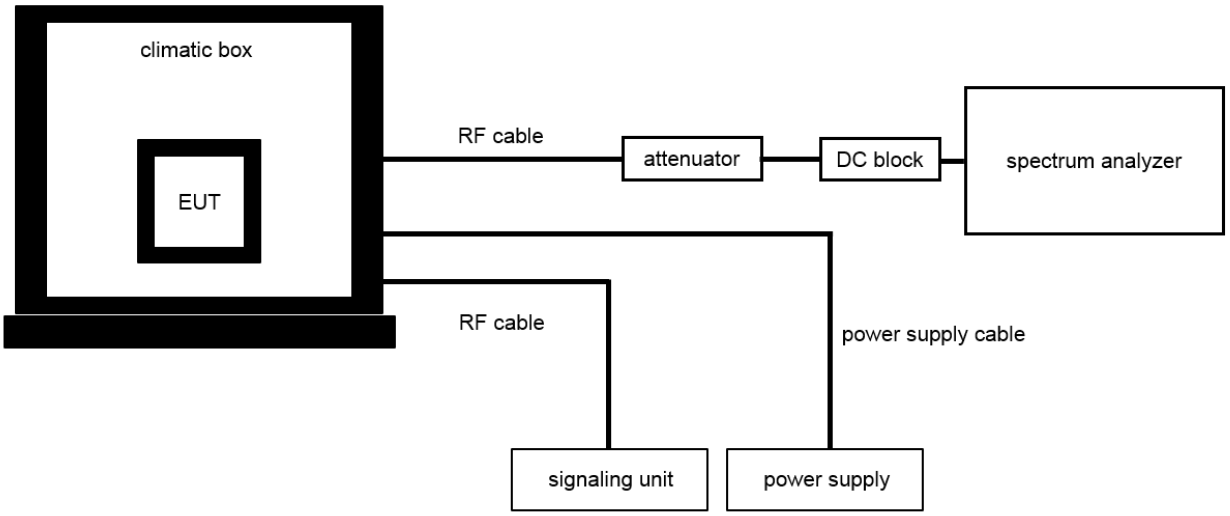
Example calculation:
OP [dBm] = -65.0 [dBm] + 50 [dB] - 20 [dBi] + 5 [dB] = -30 [dBm] (1 µW)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	B	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	9107-3696	300001604	vIKl!	27.02.2019	26.02.2021
2	B	Highpass Filter	WHK1.1/15G-10SS	Wainwright	37	400000148	ne	-/-	-/-
3	A, B	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000032	300004510	ne	-/-	-/-
4	A, B	Computer	Intel Core i3 3220/3,3 GHz, Prozessor		2V2403033A5421	300004591	ne	-/-	-/-
5	A, B	NEXIO EMV-Software	BAT EMC V3.19.1.21	EMCO		300004682	ne	-/-	-/-
6	A, B	Anechoic chamber		TDK		300003726	ne	-/-	-/-
7	A, B	EMI Test Receiver 9kHz-26,5GHz	ESR26	R&S	101376	300005063	k	10.12.2019	09.12.2020
8	B	RF-Amplifier	AMF-6F06001800-30-10P-R	NARDA-MITEQ Inc	2011571	300005240	ev	-/-	-/-
9	A	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck Mess - Elektronik	01029	300005379	vIKl!	02.07.2019	01.07.2021

7.2 Conducted measurements normal and extreme conditions

Conducted measurements normal & 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	B	DC Power Supply 0 – 32V	1108-32	Heiden Elektronik	001802	300001383	NK!	-/-	-/-
2	B	Temperature Test Chamber	VT 4011	Voetsch Industrietechnik	585662306000 10	300005363	ev	08.05.2020	07.05.2022
3	B	Signal- and Spectrum Analyzer 2 Hz - 26 GHz	FSW26	R&S	101455	300004528	k	12.12.2019	11.12.2020
4	A	Spectrum Analyzer	FSV30	Rohde & Schwarz	104365	300005923	k	17.10.2019	16.01.2021
5	A, B	Arbitrary Function Generator	33220A	Agilent Technologies	MY44051717	300004164	vlKl!	09.12.2019	08.12.2021

8 Measurement uncertainty

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

9 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	FCC Part 15	See table!	2020-08-31	-/-

Test specification clause	Test case	Temperature conditions	Voltage conditions	C	NC	NA	NP	Remark
FCC Part 15.236 (d)(1) FCC Part 15.236 (d)(2)	Transmitter output power	Nominal	Nominal	☒	☐	☐	☐	-/-
FCC Part 15.236 (f)(2)	Occupied bandwidth	Nominal	Nominal	☒	☐	☐	☐	-/-
FCC Part 15.236 (f)(3)	Transmitter frequency stability	Nominal	Nominal	☒	☐	☐	☐	-/-
		Extreme	Extreme	☒	☐	☐	☐	
FCC Part 15.236 (g) ETSI EN 300 422-1 v1.4.2 (2011-08)	Transmitter unwanted emissions (radiated or conducted)	Nominal	Nominal	☒	☐	☐	☐	-/-
FCC Part 15.236 (g)	Necessary bandwidth (BN)	Nominal	Nominal	☒	☐	☐	☐	-/-
FCC Part 15.236 (g)	Receiver spurious emissions	Nominal	Nominal	☐	☐	☒	☐	No receiver integrated!
FCC Part 15.107(a) FCC Part 15.207	Conducted emissions < 30 MHz	Nominal	Nominal	☐	☐	☒	☐	-/-

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

10 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.

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 ± 75 kHz, or to produce 50% of the manufacturer's rated deviation, whichever is less.
Test setup:	See sub clause 7.2 – A
Measurement uncertainty:	See sub clause 9

Limits:

Frequency range	FCC Part 15.236(d)(1)
470 MHz to 608 MHz	50 mW EIRP (17 dBm EIRP)

Result:

Transmitter output power e.i.r.p.						
Channels	**Q1-6**			**R1-6**		
	470.2 MHz	**498.1 MHz**	**526.0 MHz**	**520.0 MHz**	**548.0 MHz**	**576.0 MHz**
Peak	14.95 dBm	15.32 dBm	16.01 dBm	14.59 dBm	14.27 dBm	15.18 dBm
Average	11.41 dBm	11.76 dBm	12.53 dBm	11.07 dBm	10.85 dBm	11.64 dBm
Channels	**R4-9**					
	552.0 MHz		**579.9 MHz**		**607.8 MHz**	
Peak	15.06 dBm		15.58 dBm		15.65 dBm	
Average	11.86 dBm		12.19 dBm		12.26 dBm	

11.2 Occupied bandwidth

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1 % to 5 % of the occupied bandwidth
Video bandwidth:	3 x resolution bandwidth
Span:	2 x emission bandwidth
Trace mode:	Max. hold
Analyzer function:	99% power occupied bandwidth function
EUT:	Modulated signal with max. frequency deviation
Test setup:	See sub clause 7.2 - A
Measurement uncertainty:	See sub clause 9

Limits:

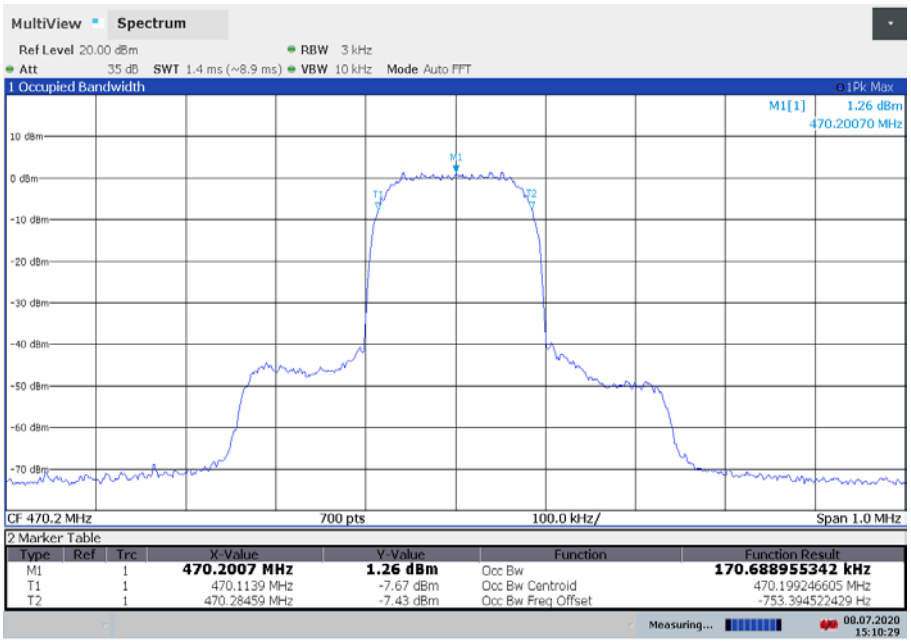
FCC
470 MHz to 608 MHz 200 kHz
Occupied bandwidth 99%. Other than single sideband or independent sideband transmitters - when modulated by a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation. The input level shall be established at the frequency of maximum response of the audio modulating circuit.

Result:

Occupied bandwidth						
Channels	**Q1-6**			**R1-6**		
	470.2 MHz	**498.1 MHz**	**526.0 MHz**	**520.0 MHz**	**548.0 MHz**	**576.0 MHz**
	170.68 kHz	169.87 kHz	170.31 kHz	170.14 kHz	170.49 kHz	170.82 kHz
Channels	**R4-9**					
	552.0 MHz		**579.9 MHz**		**607.8 MHz**	
	171.48 kHz		170.52		171.14	

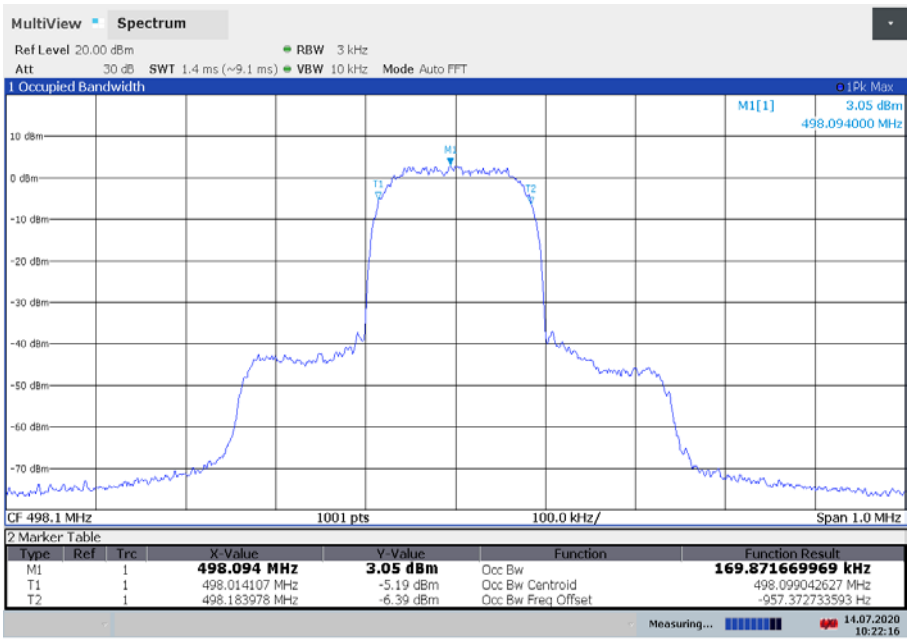
Plots: Q1-6

Plot 1: 470.2 MHz



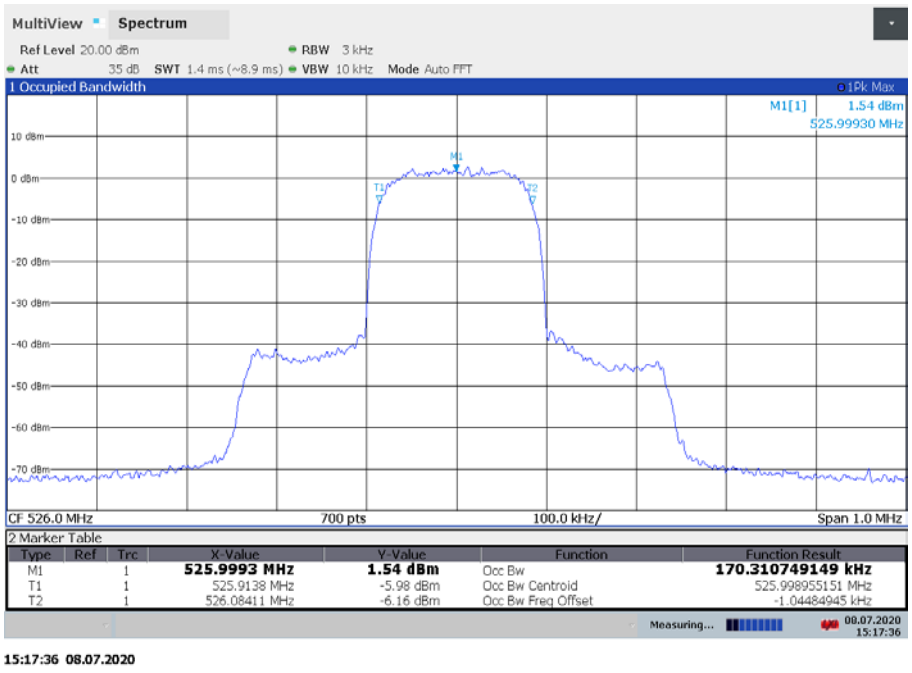
15:10:29 08.07.2020

Plot 2: 498.1 MHz



10:22:17 14.07.2020

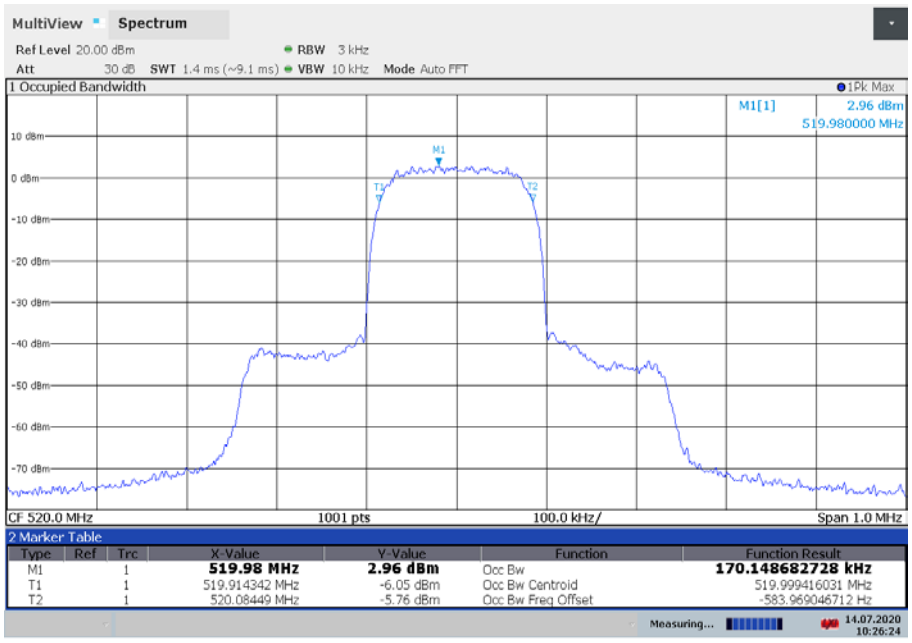
Plot 3: 526.0 MHz



15:17:36 08.07.2020

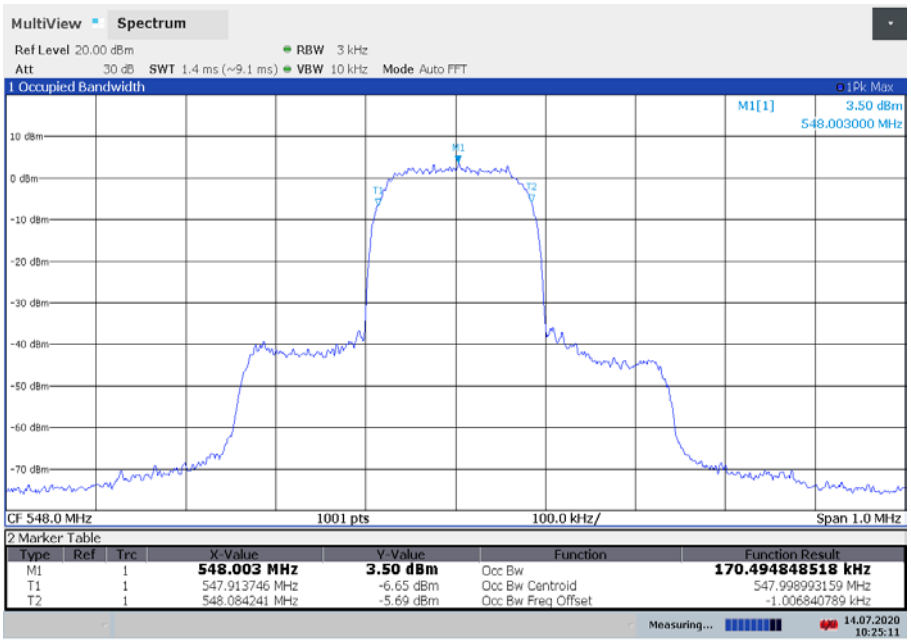
Plots: R1-6

Plot 1: 520.0 MHz



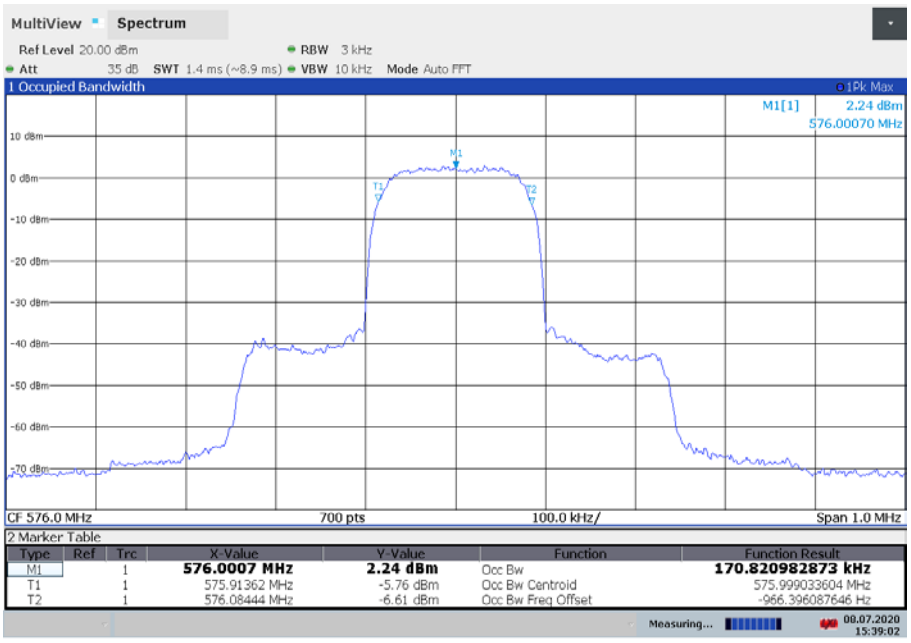
10:26:24 14.07.2020

Plot 2: 548.0 MHz



10:25:12 14.07.2020

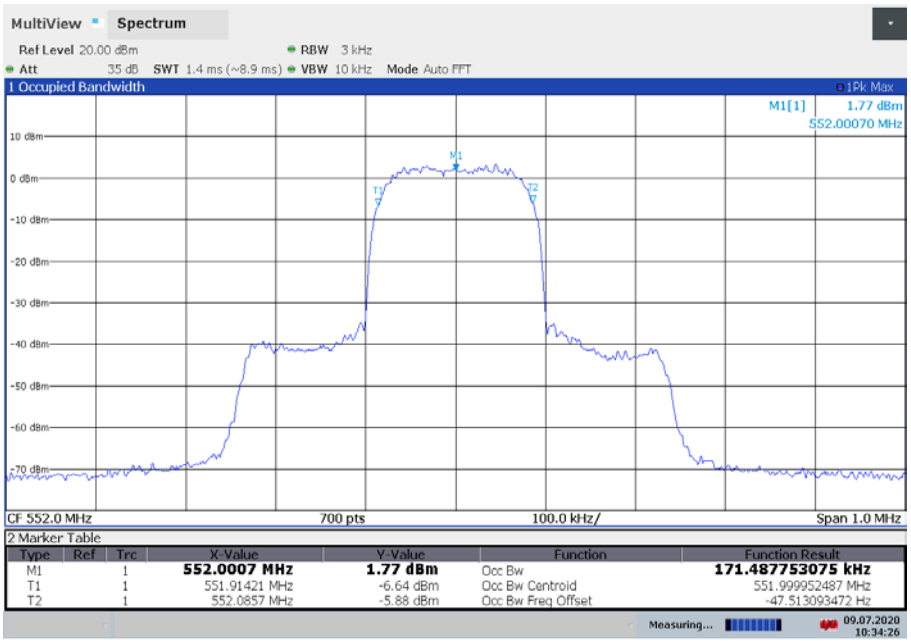
Plot 3: 576.0 MHz



15:39:03 08.07.2020

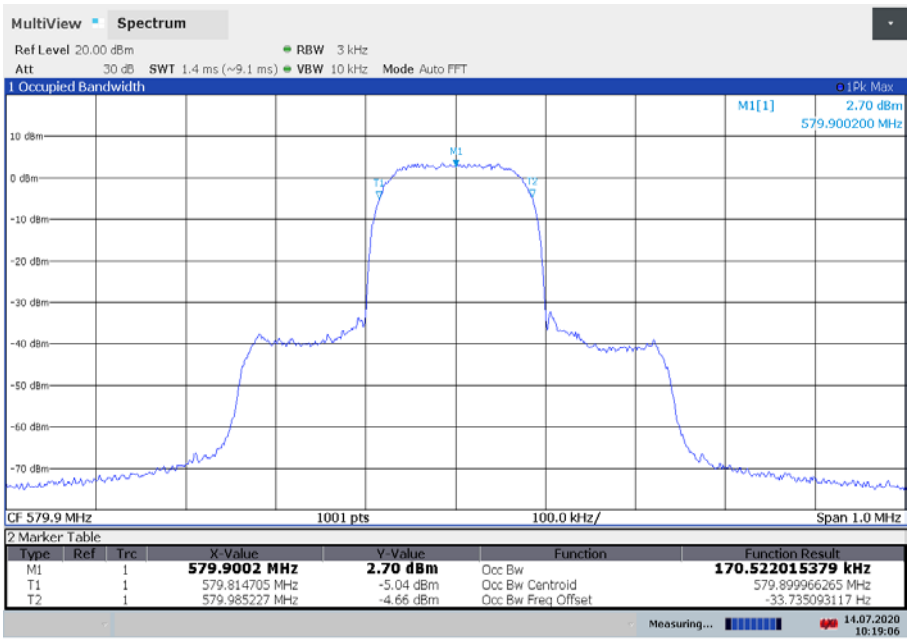
Plots: R4-9

Plot 1: 552.0 MHz



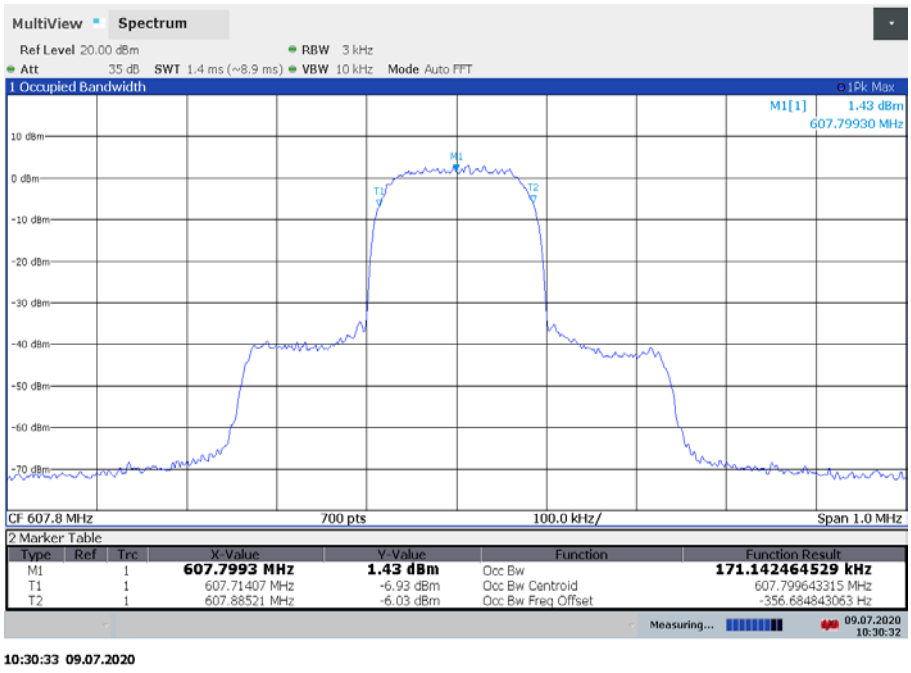
10:34:27 09.07.2020

Plot 2: 579.9 MHz



10:19:06 14.07.2020

Plot 3: 607.8 MHz



11.3 Transmitter frequency stability

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	10 Hz
Video bandwidth:	3 x resolution bandwidth
Span:	wide enough to follow the frequency drift
Trace mode:	clear/write/view
EUT:	CW signal or MC with measurement method description
Test setup:	See sub clause 7.2 - B
Measurement uncertainty:	See sub clause 9

Limits:

FCC
470 MHz to 608 MHz ± 50 ppm

Results:

Q1-6 - 470.2 MHz			
Temperature / Voltage	**Frequency**	**Deviation (kHz)**	**Deviation (ppm)**
-30 °C / V_{nom}	470.199487 MHz	-0.513	-1.09
-20 °C / V_{nom}	470.199522 MHz	-0.478	-1.02
-10 °C / V_{nom}	470.199387 MHz	-0.613	-1.30
0 °C / V_{nom}	470.199391 MHz	-0.609	-1.30
+10 °C / V_{nom}	470.199350 MHz	-0.650	-1.38
+20 °C / V_{nom}	470.199339 MHz	-0.661	-1.41
+30 °C / V_{nom}	470.199404 MHz	-0.596	-1.27
+40 °C / V_{nom}	470.199272 MHz	-0.728	-1.55
+50 °C / V_{nom}	470.199391 MHz	-0.609	-1.30
+20 °C / V_{nom} - 15%	470,199413 MHz	-0.587	-1,25
+20 °C / V_{nom}	470.199339 MHz	-0.661	-1.41
+20 °C / V_{nom} + 15%	470,199386 MHz	-0.614	-1.31

Q1-6 - 498.1 MHz			
Temperature / Voltage	**Frequency**	**Deviation (kHz)**	**Deviation (ppm)**
-30 °C / V_{nom}	498.099608 MHz	-0.392	-0.79
-20 °C / V_{nom}	498.099304 MHz	-0.696	-1.40
-10 °C / V_{nom}	498.099224 MHz	-0.776	-1.56
0 °C / V_{nom}	498.099353 MHz	-0.647	-1.30
+10 °C / V_{nom}	498.099351 MHz	-0.649	-1.30
+20 °C / V_{nom}	498.099257 MHz	-0.743	-1.49
+30 °C / V_{nom}	498.099316 MHz	-0.684	-1.37
+40 °C / V_{nom}	498.099286 MHz	-0.714	-1.43
+50 °C / V_{nom}	498.099238 MHz	-0.762	-1.53
+20 °C / V_{nom} - 15%	498,099382 MHz	-0.618	-1.24
+20 °C / V_{nom}	498.099257 MHz	-0.743	-1.49
+20 °C / V_{nom} + 15%	498,099182 MHz	-8,818	-1.64

Q1-6 - 526.0 MHz			
Temperature / Voltage	**Frequency**	**Deviation (kHz)**	**Deviation (ppm)**
-30 °C / V_{nom}	525.999630 MHz	-0.370	-0.70
-20 °C / V_{nom}	525.999292 MHz	-0.708	-1.35
-10 °C / V_{nom}	525.999307 MHz	-0.693	-1.32
0 °C / V_{nom}	525.999222 MHz	-0.778	-1.48
+10 °C / V_{nom}	525.999337 MHz	-0.663	-1.26
+20 °C / V_{nom}	525.999198 MHz	-0.802	-1.52
+30 °C / V_{nom}	525.999155 MHz	-0.845	-1.61
+40 °C / V_{nom}	525.999163 MHz	-0.837	-1.59
+50 °C / V_{nom}	525.999253 MHz	-0.747	-1.42
+20 °C / V_{nom} - 15%	525.999104 MHz	-0.896	-1.7
+20 °C / V_{nom}	525.999198 MHz	-0.802	-1.52
+20 °C / V_{nom} + 15%	525.999463 MHz	-0.537	-1.02

R1-6 - 520.0 MHz			
Temperature / Voltage	**Frequency**	**Deviation (kHz)**	**Deviation (ppm)**
-30 °C / V_{nom}	519.999377 MHz	-0.623	-1.20
-20 °C / V_{nom}	519.999412 MHz	-0.588	-1.13
-10 °C / V_{nom}	519.999440 MHz	-0.560	-1.08
0 °C / V_{nom}	519.999531 MHz	-0.469	-0.90
+10 °C / V_{nom}	519.999526 MHz	-0.474	-0.91
+20 °C / V_{nom}	519.999405 MHz	-0.595	-1.14
+30 °C / V_{nom}	519.999281 MHz	-0.719	-1.38
+40 °C / V_{nom}	519.999225 MHz	-0.775	-1.49
+50 °C / V_{nom}	519.999241 MHz	-0.759	-1.46
+20 °C / V_{nom} - 15%	519.999255 MHz	-0.745	-1.43
+20 °C / V_{nom}	519.999405 MHz	-0.595	-1.14
+20 °C / V_{nom} + 15%	519.999289 MHz	-0.711	-1.37

R1-6 - 548.0 MHz			
Temperature / Voltage	**Frequency (MHz)**	**Deviation (kHz)**	**Deviation (ppm)**
-30 °C / V_{nom}	547.999503 MHz	-0.497	-0.91
-20 °C / V_{nom}	547.999298 MHz	-0.702	-1.28
-10 °C / V_{nom}	547.999472 MHz	-0.528	-0.96
0 °C / V_{nom}	547.999452 MHz	-0.548	-1.00
+10 °C / V_{nom}	547.999426 MHz	-0.574	-1.05
+20 °C / V_{nom}	547.999249 MHz	-0.751	-1.37
+30 °C / V_{nom}	547.999180 MHz	-0.820	-1.50
+40 °C / V_{nom}	547.999100 MHz	-0.900	-1.64
+50 °C / V_{nom}	547.999016 MHz	-0.984	-1.80
+20 °C / V_{nom} - 15%	547.999288 MHz	-0.712	-1.30
+20 °C / V_{nom}	547.999249 MHz	-0.751	-1.37
+20 °C / V_{nom} + 15%	547.999370 MHz	-0.630	-1.50

R1-6 - 576.0 MHz			
Temperature / Voltage	**Frequency (MHz)**	**Deviation (kHz)**	**Deviation (ppm)**
-30 °C / V_{nom}	575.999483 MHz	-0.517	-0.90
-20 °C / V_{nom}	575.999366 MHz	-0.634	-1.10
-10 °C / V_{nom}	575.999480 MHz	-0.520	-0.90
0 °C / V_{nom}	575.999526 MHz	-0.474	-0.82
+10 °C / V_{nom}	575.999400 MHz	-0.600	-1.04
+20 °C / V_{nom}	575.999319 MHz	-0.681	-1.18
+30 °C / V_{nom}	575.999232 MHz	-0.768	-1.33
+40 °C / V_{nom}	575.999011 MHz	-0.989	-1.72
+50 °C / V_{nom}	575.999044 MHz	-0.956	-1.66
+20 °C / V_{nom} - 15%	575.999034 MHz	-0.966	-1.68
+20 °C / V_{nom}	575.999319 MHz	-0.681	-1.18
+20 °C / V_{nom} + 15%	575.999598 MHz	-0.402	-0.70

R4-9 - 552.0 MHz			
Temperature / Voltage	**Frequency (MHz)**	**Deviation (kHz)**	**Deviation (ppm)**
-30 °C / V_{nom}	551.999867 MHz	-0.133	-0.24
-20 °C / V_{nom}	551.999986 MHz	-0.014	-0.03
-10 °C / V_{nom}	551.999971 MHz	-0.029	-0.05
0 °C / V_{nom}	551.999973 MHz	-0.027	-0.05
+10 °C / V_{nom}	551.999942 MHz	-0.058	-0.11
+20 °C / V_{nom}	551.999823 MHz	-0.177	-0.32
+30 °C / V_{nom}	551.999789 MHz	-0.211	-0.38
+40 °C / V_{nom}	551.999767 MHz	-0.233	-0.42
+50 °C / V_{nom}	551.999826 MHz	-0.174	-0.32
+20 °C / V_{nom} - 15%	551.999777 MHz	-0.223	-0.40
+20 °C / V_{nom}	551.999823 MHz	-0.177	-0.32
+20 °C / V_{nom} + 15%	551.999828 MHz	-0.172	-0.31

R4-9 - 579.9 MHz			
Temperature / Voltage	**Frequency (MHz)**	**Deviation (kHz)**	**Deviation (ppm)**
-30 °C / V_{nom}	579.899745 MHz	-0.255	-0.44
-20 °C / V_{nom}	579.899817 MHz	-0.183	-0.32
-10 °C / V_{nom}	579.899825 MHz	-0.175	-0.30
0 °C / V_{nom}	579.899902 MHz	-0.098	-0.17
+10 °C / V_{nom}	579.899909 MHz	-0.091	-0.16
+20 °C / V_{nom}	579.899827 MHz	-0.173	-0.30
+30 °C / V_{nom}	579.899814 MHz	-0.186	-0.32
+40 °C / V_{nom}	579.899669 MHz	-0.331	-0.57
+50 °C / V_{nom}	579.899785 MHz	-0.215	-0.37
+20 °C / V_{nom} - 15%	579.89987 MHz	-0.130	-0.22
+20 °C / V_{nom}	579.899827 MHz	-0.173	-0.30
+20 °C / V_{nom} + 15%	579.899949 MHz	-0.051	-0.09

R4-9 - 607.8 MHz			
Temperature / Voltage	**Frequency (MHz)**	**Deviation (kHz)**	**Deviation (ppm)**
-30 °C / V_{nom}	607.799775 MHz	-0.225	-0.37
-20 °C / V_{nom}	607.799784 MHz	-0.216	-0.36
-10 °C / V_{nom}	607.799920 MHz	-0.080	-0.13
0 °C / V_{nom}	607.800032 MHz	0.032	0.05
+10 °C / V_{nom}	607.799952 MHz	-0.048	-0.08
+20 °C / V_{nom}	607.800843 MHz	0.843	1.39
+30 °C / V_{nom}	607.799738 MHz	-0.262	-0.43
+40 °C / V_{nom}	607.799752 MHz	-0.248	-0.41
+50 °C / V_{nom}	607.799804 MHz	-0.196	-0.32
+20 °C / V_{nom} - 15%	607,799838 MHz	-0.162	-0.27
+20 °C / V_{nom}	607.800843 MHz	0.843	1.39
+20 °C / V_{nom} + 15%	607,799812 MHz	-0.188	-0.31

11.4 Transmitter unwanted emissions

Measurement:

Measurement parameter	
Detector:	Peak (prescan) / RMS
Sweep time:	Auto
Resolution bandwidth:	25 MHz to 30 MHz 9 kHz to 10 kHz 30 MHz to 1 000 MHz 100 kHz > 1 000 MHz 1 MHz
Video bandwidth:	3 * RBW
Span:	100 MHz steps!
Trace-Mode:	Max. hold
EUT:	MC with max frequency deviation
Used equipment:	See chapter 7.1- A / B
Measurement uncertainty:	See chapter 8

Limits:

Max. spurious level FCC (according to ETSI EN 300 422-1 v1.4.2 (2011-08))			
State	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

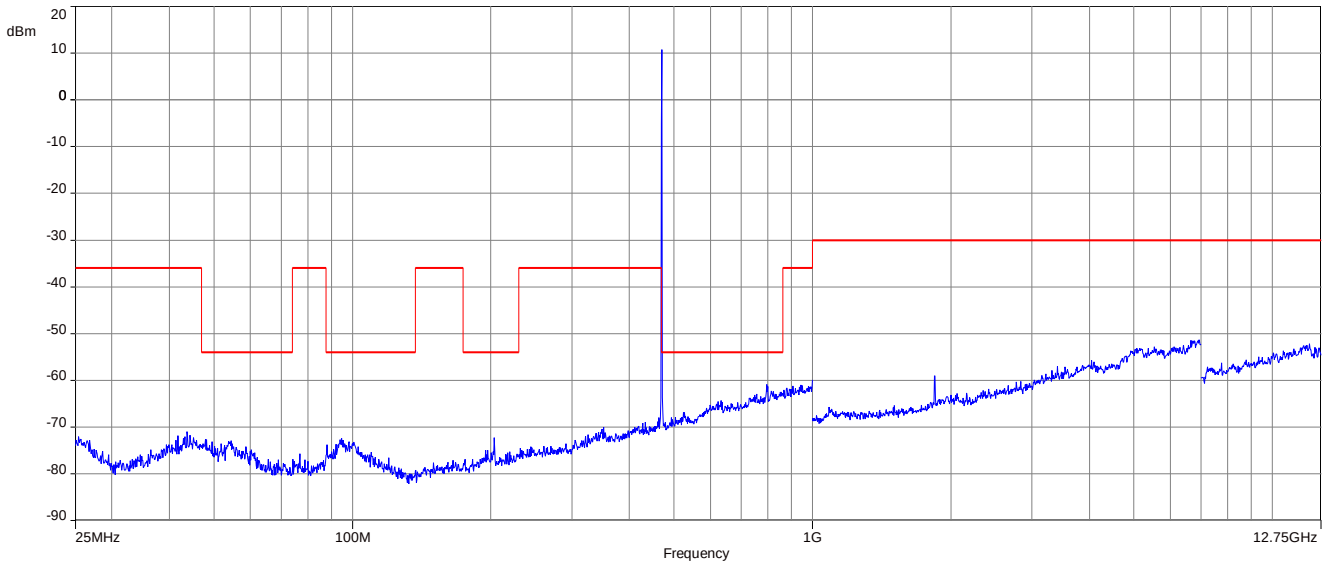
FCC	
The mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:	
On any frequency removed from the operating frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: at least	25 dB
On 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 + 10log10 (mean output power in watts) dB

Results:

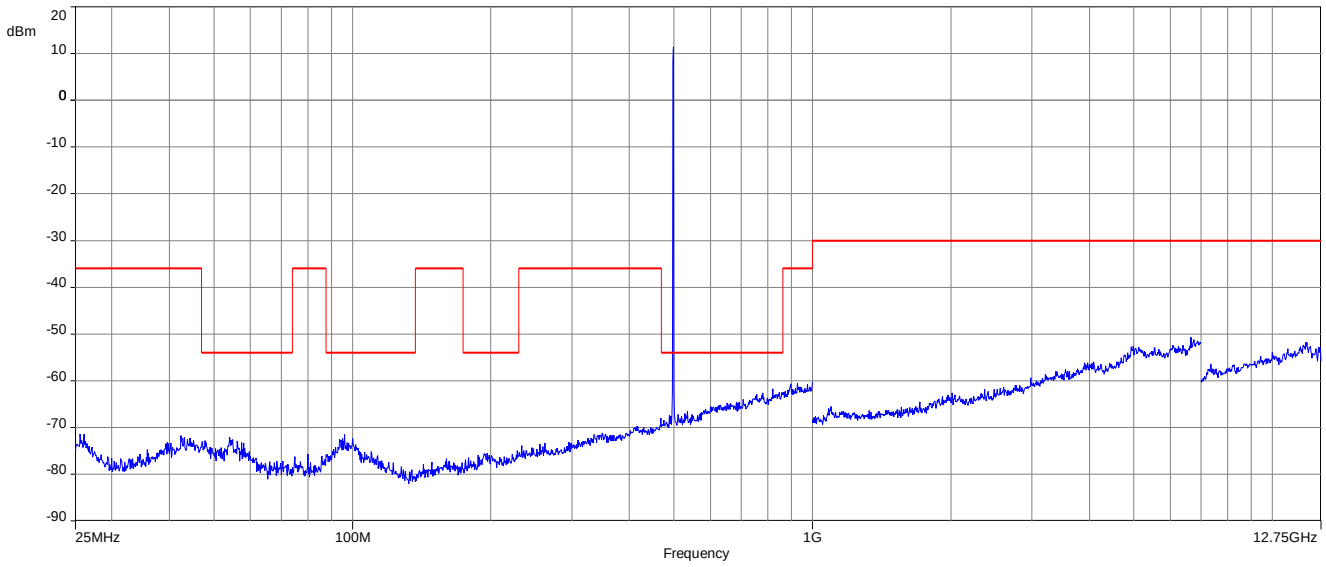
carrier frequency (MHz)	unwanted emission frequency (MHz)	Limit	level (dB) / (dBm) or remark
All detected emissions are more than 10 dB below the limit.			

Plots: Q1-6

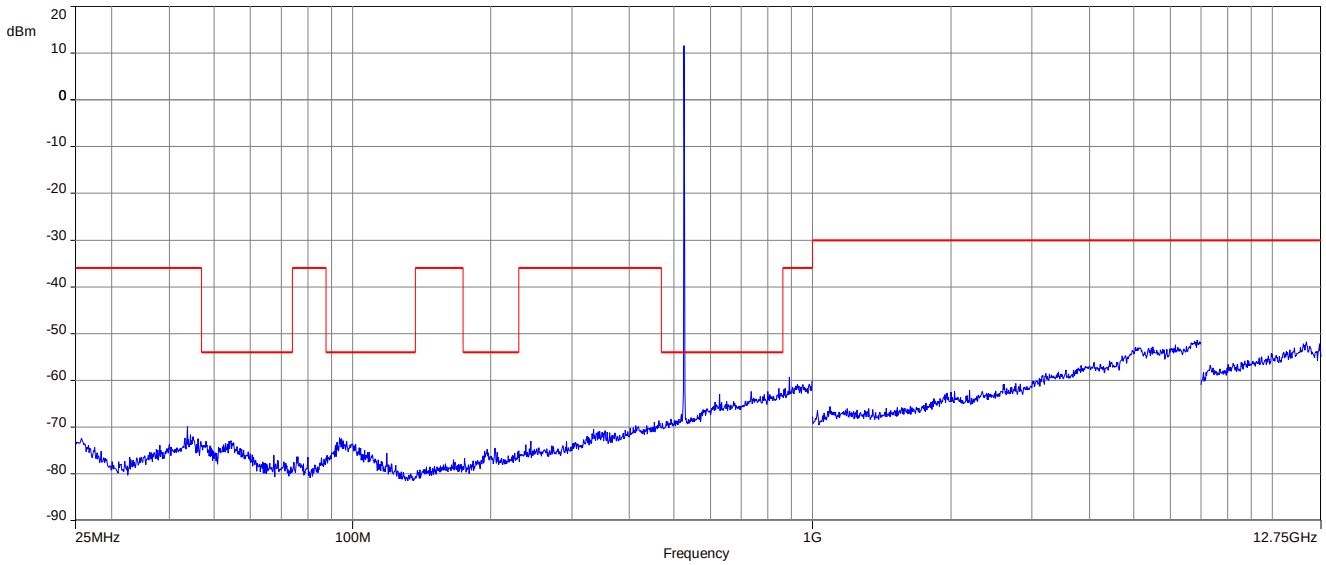
Plot 1: 470.2 MHz, 25 MHz – 12.75 GHz



Plot 2: 498.1 MHz, 25 MHz – 12.75 GHz

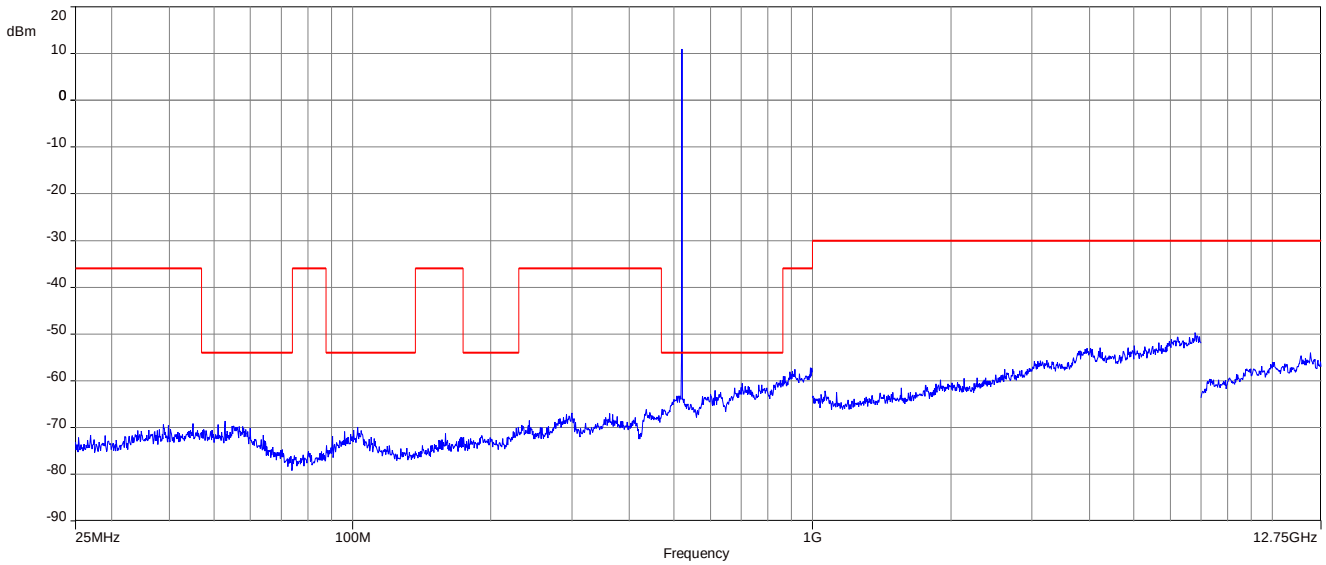


Plot 3: 526.0 MHz, 25 MHz – 12.75 GHz

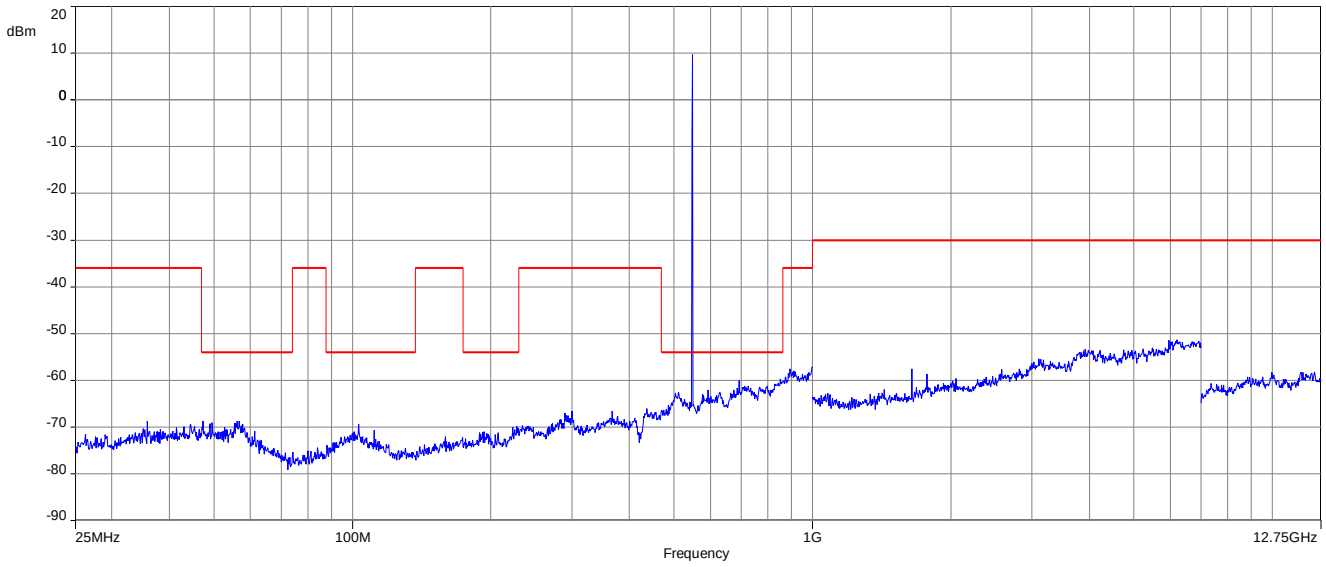


Plots: R1-6

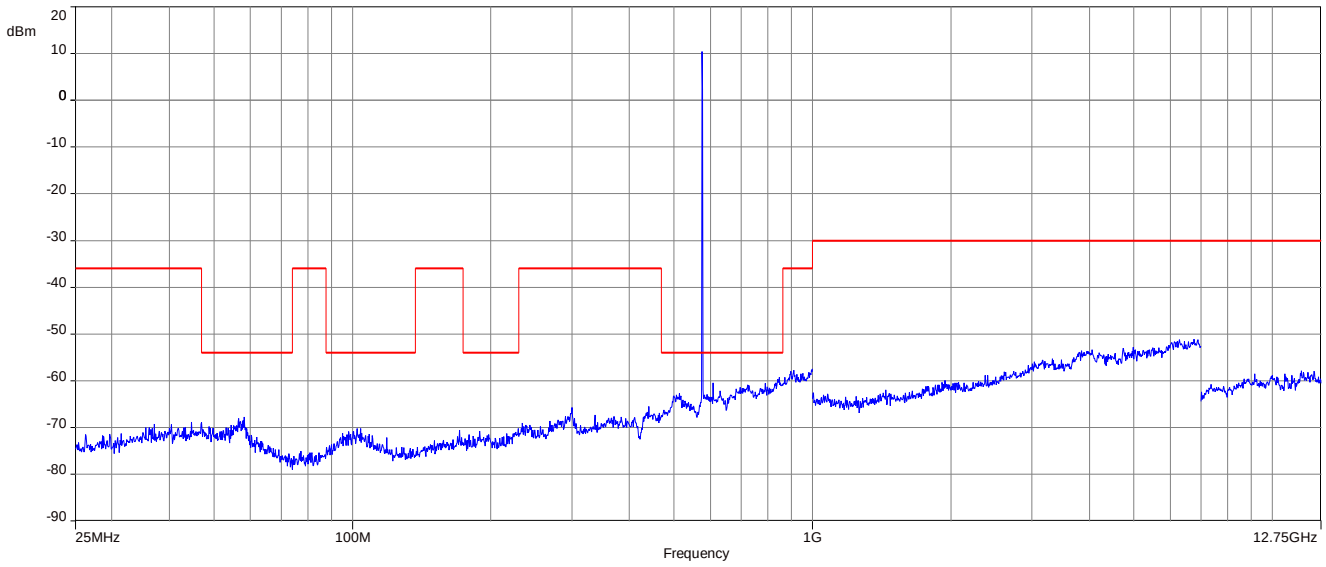
Plot 1: 520.0 MHz, 25 MHz – 12.75 GHz



Plot 2: 548.0 MHz, 25 MHz – 12.75 GHz

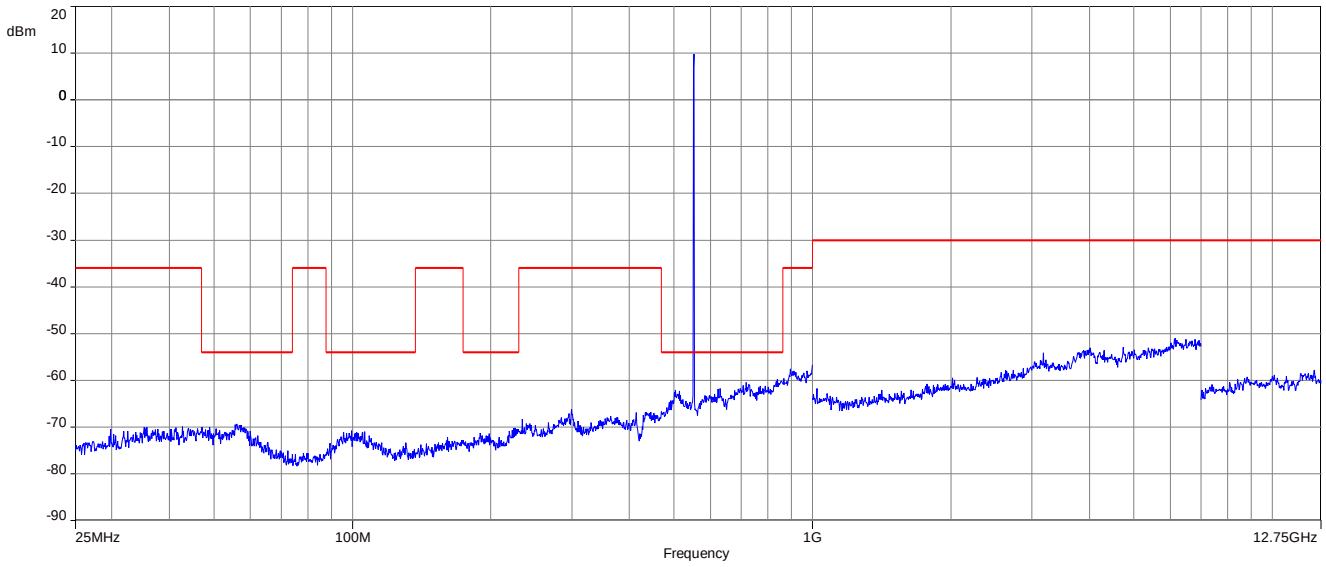


Plot 3: 576.0 MHz, 25 MHz – 12.75 GHz

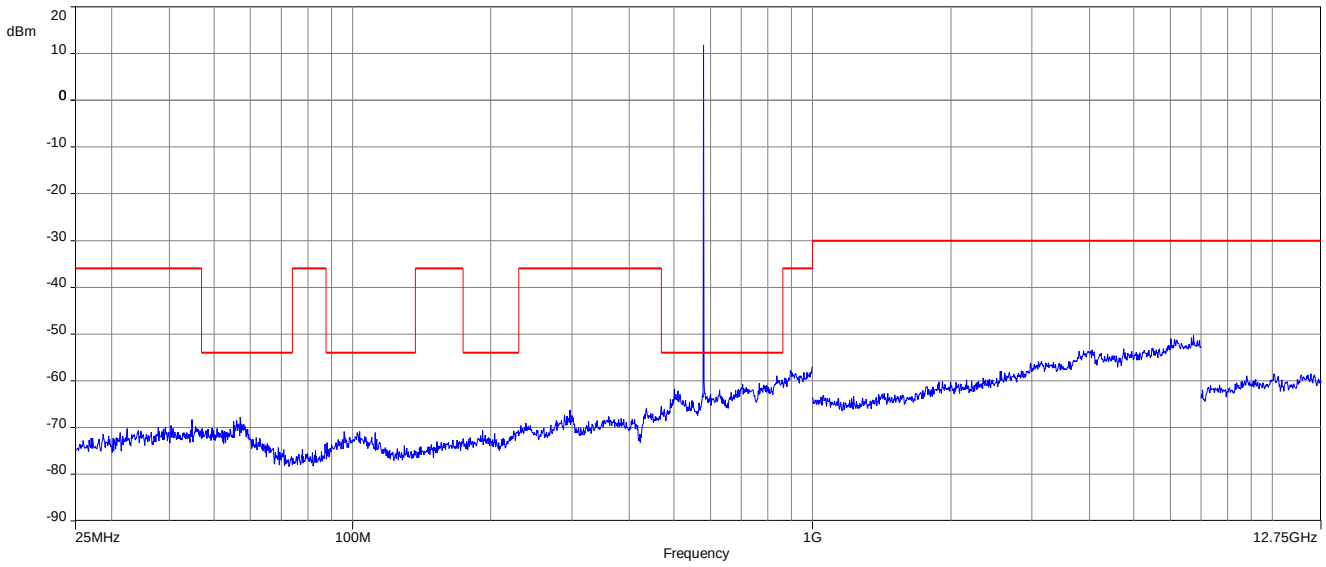


Plots: R4-9

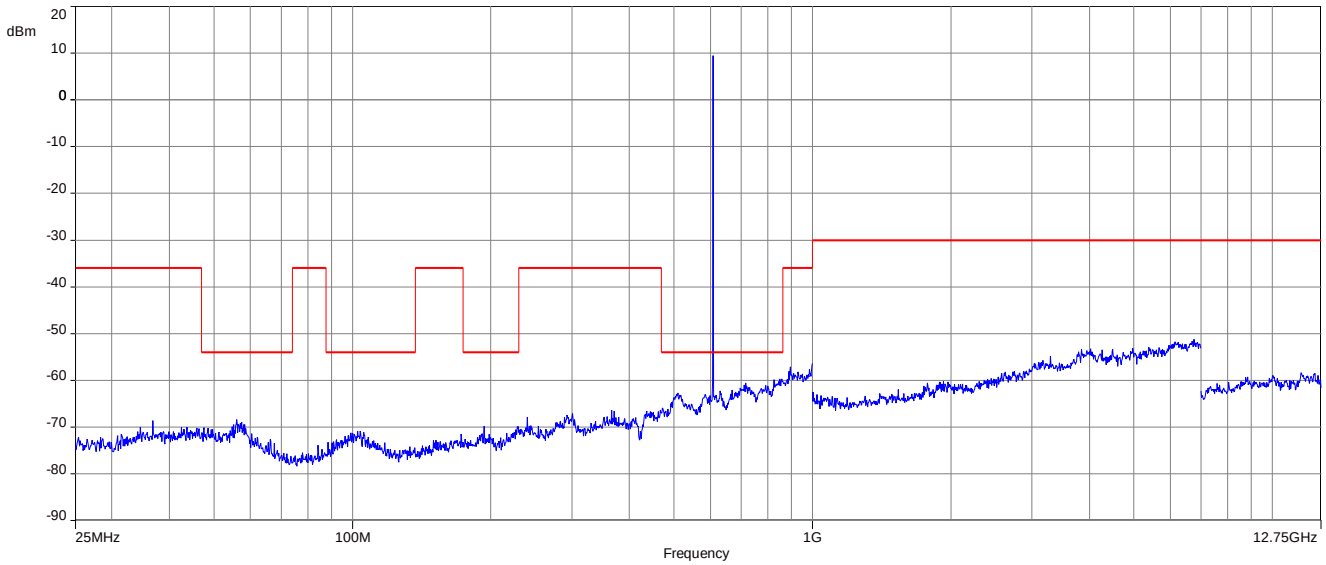
Plot 1: 552.0 MHz, 25 MHz – 12.75 GHz



Plot 2: 579.9 MHz, 25 MHz – 12.75 GHz



Plot 3: 607.8 MHz, 25 MHz – 12.75 GHz

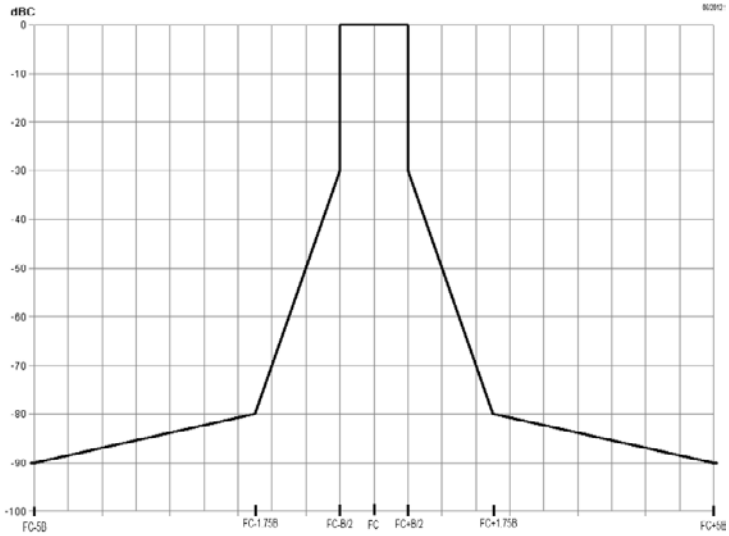


11.5 Necessary bandwidth (BN)

Measurement:

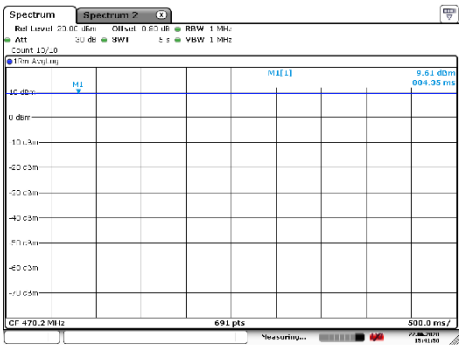
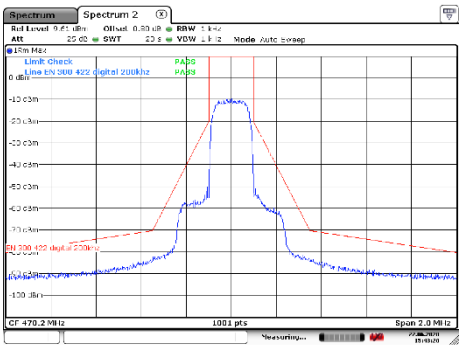
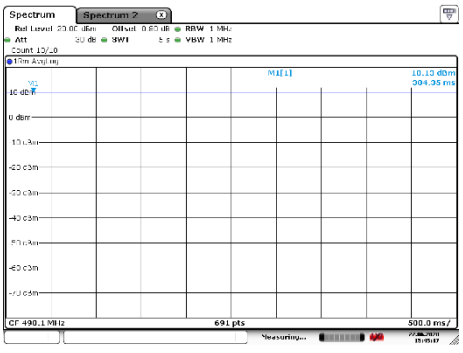
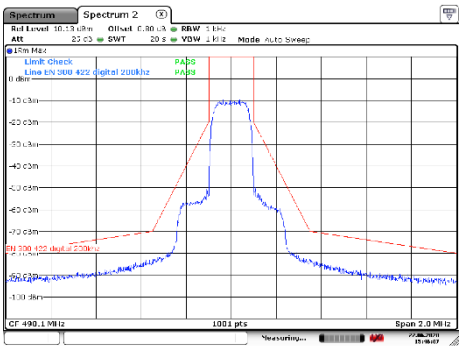
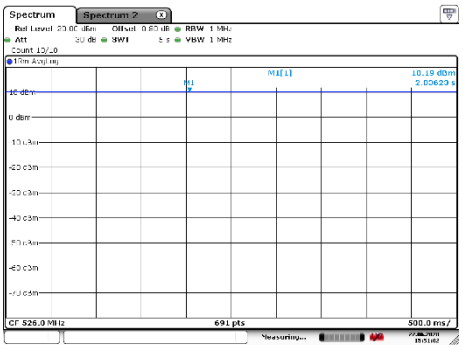
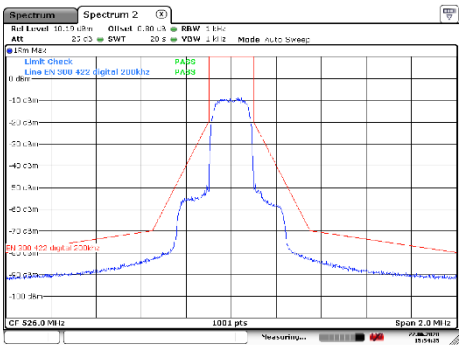
Measurement parameters	Carrier Power	Maximum relative level (dBc) / Transmitter wide band noise floor
Detector:	RMS	RMS
Centre frequency:	fc	fc
Sweep time:	≥ 2s	≥ 2s
Video bandwidth:	1 MHz	1 kHz
Resolution bandwidth:	1 MHz	1 kHz
Span:	Zero span	≥ 5 x B (2 MHz)
Trace-Mode:	Average	Peak Hold

Limits:

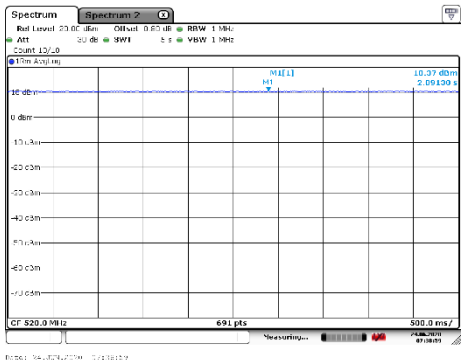
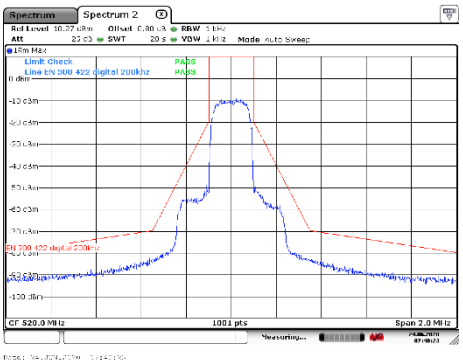
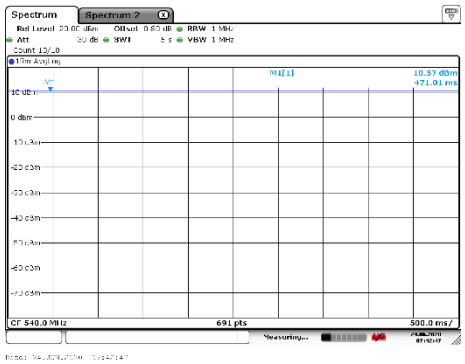
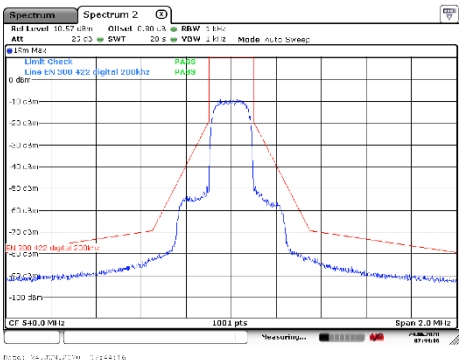
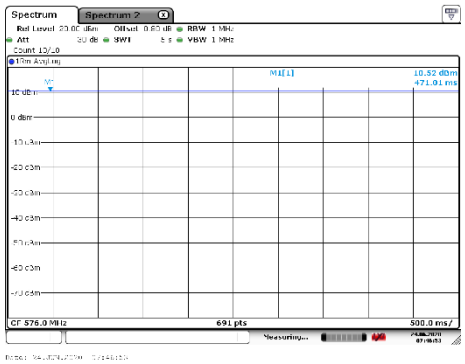
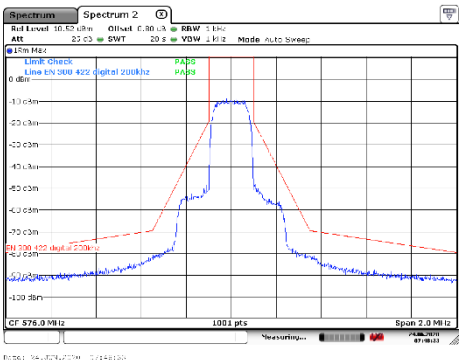
FCC (see also ETSI EN 300 422-1 V1.4.2)
Signal within the spectrum mask:    Figure .: Spectrum mask for digital systems below 2 GHz

Results: See plots!

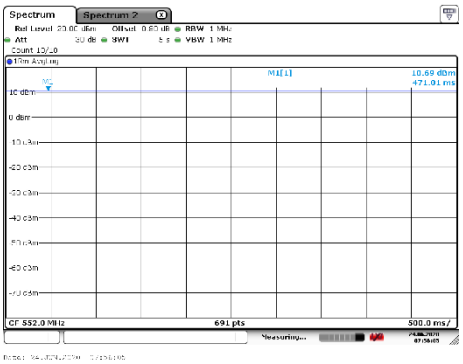
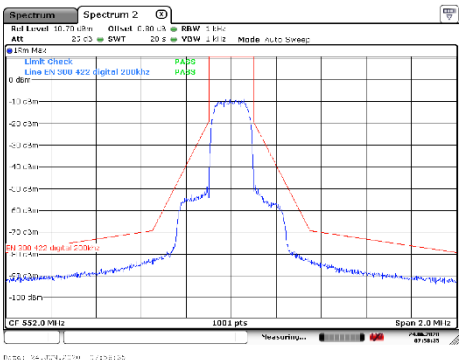
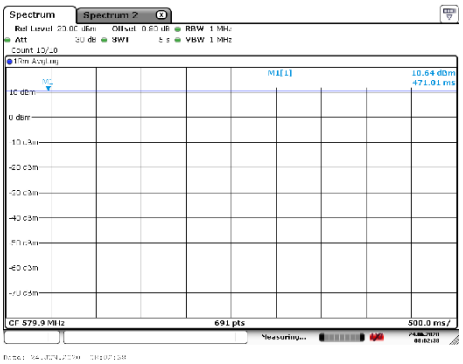
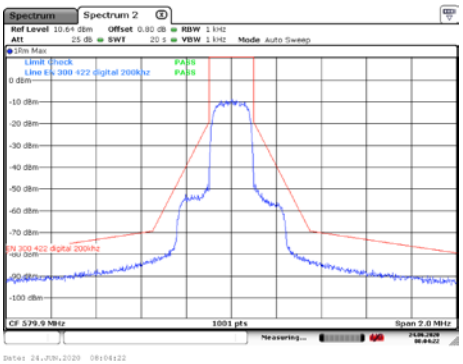
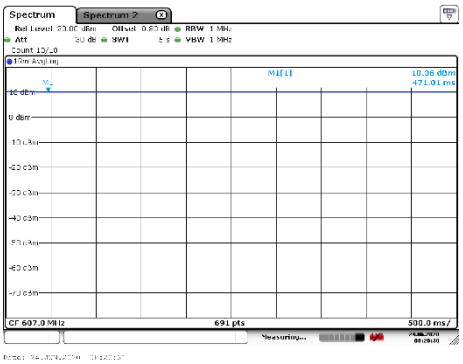
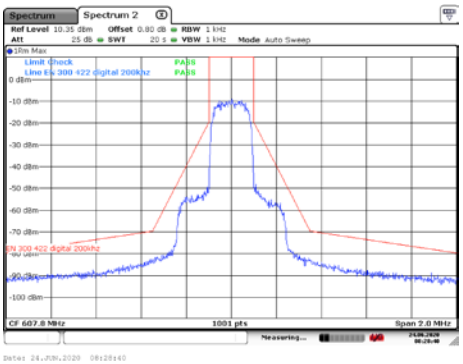
Plots: Frequency Range Q1-6

Frequency	Carrier power	Modulated carrier with the weighted noise source
470.2 MHz		
498.1 MHz		
526.0 MHz		

Plots: Frequency Range R1-6

Frequency	Carrier power	Modulated carrier with the weighted noise source
520.0 MHz		
548.0 MHz		
576.0 MHz		

Plots: Frequency Range R4-9

Frequency	Carrier power	Modulated carrier with the weighted noise source
552.0 MHz		
579.9 MHz		
607.8 MHz		

12 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

13 Document history

Version	Applied changes	Date of release
-/-	Initial release	2020-07-21
A	reference to external documents changed	2020-07-28
B	HW version changed	2020-08-27

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

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-12076-01-05.pdf

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