



## TEST REPORT

BNetzA-CAB-02/21-102

Test report no.: 1-6002\_23-01-10

### Testing laboratory

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#### Accredited Testing Laboratory:

The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2018-03) by the Deutsche Akkreditierungsstelle GmbH (DAkkS).

The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12047-01-00.  
ISED Testing Laboratory Recognized Listing Number: DE0001  
FCC designation number: DE0002

### Applicant

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### 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 15 - Radio frequency devices

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

### Test Item

**Kind of test item:** Tablestand Transmitter  
**Model name:** EW-DX TS  
**FCC ID:** DMOTSEWDX  
**ISED certification number:** 2099A-TSEWDX  
**Frequency range:** 470 MHz to 608 MHz  
**Technology tested:** proprietary  
**Antenna:** Integrated monopole antenna  
**Power supply:** 2.00 V to 4.35 V DC by Li Ion battery  
**Temperature range:** -10°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 Labs

### Test performed:

Tobias Wittenmeier  
Testing Manager  
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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. cetecom 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:	2023-11-06
Date of receipt of test item:	2023-11-13
Start of test:*	2023-11-15
End of test:*	2023-11-24
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
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

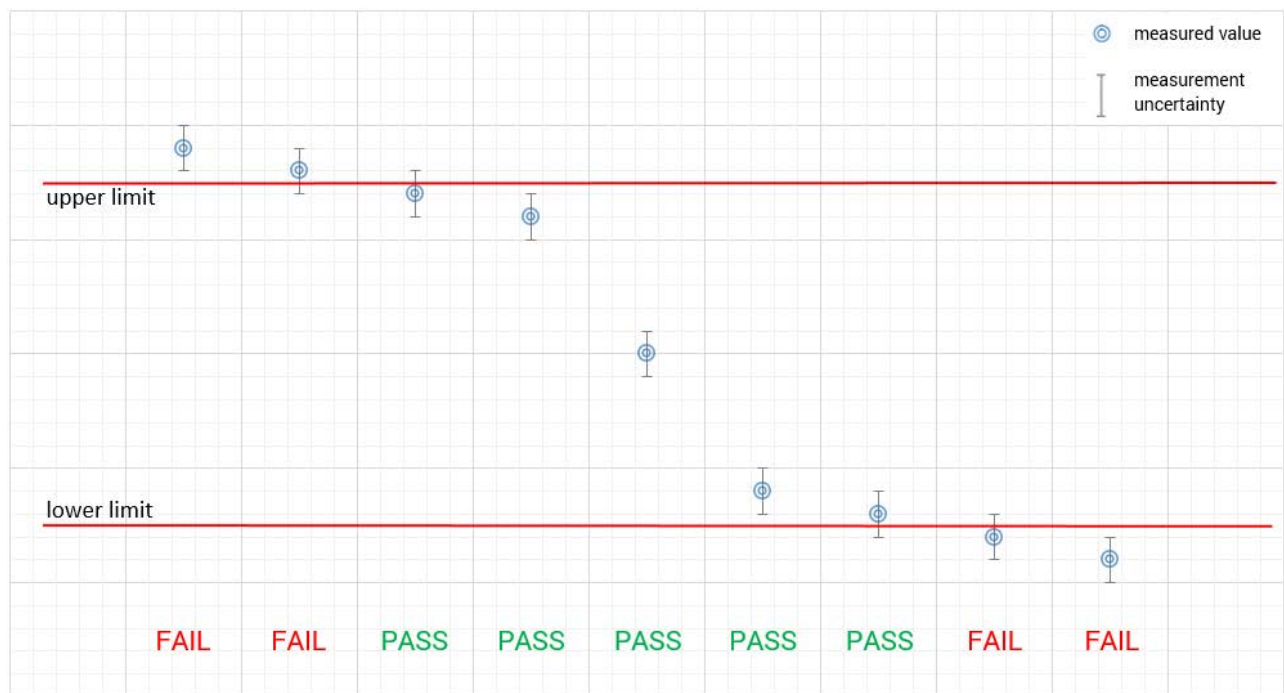
Guidance	Version	Description
ANSI C63.4-2014	-/-	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10-2013	-/-	American National Standard of Procedures for Compliance Testing of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

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

measured value, measurement uncertainty, verdict



## 5 Test environment

Temperature	:	$T_{nom}$ +22 °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	:	$V_{nom}$ 3.80 V DC by Li Ion battery $V_{max}$ 4.35 V $V_{min}$ 2.00 V

## 6 Test item

### 6.1 General description

Kind of test item	:	Tablestand Transmitter
Model name	:	EW-DX TS
Series	:	Evolution Wireless Digital
HMN	:	-/-
PMN	:	EW-DX TS
HVIN	:	EW-DX TS
FVIN	:	1v3
S/N serial number	:	Rad. 470 MHz – 550 MHz: 1433000053 520 MHz – 608 MHz: 1433000035  Cond. 470 MHz – 550 MHz: 1433000053 520 MHz – 608 MHz: 1433000035
Hardware status	:	593619
Software status	:	1v3
Firmware status	:	-/-
Frequency band	:	470 MHz to 608 MHz
Type of radio transmission	:	Modulated carrier
Use of frequency spectrum	:	
Type of modulation	:	Pi/4 DQPSK
Number of channels	:	Tuning step size: 25 kHz
Antenna	:	Integrated monopole antenna
Power supply	:	2.00 V to 4.35 V DC by Li Ion battery
Temperature range	:	-10°C to +50°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:

- 1-6002\_23-01-01\_AnnexA
- 1-6002\_23-01-01\_AnnexB
- 1-6002\_23-01-01\_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).

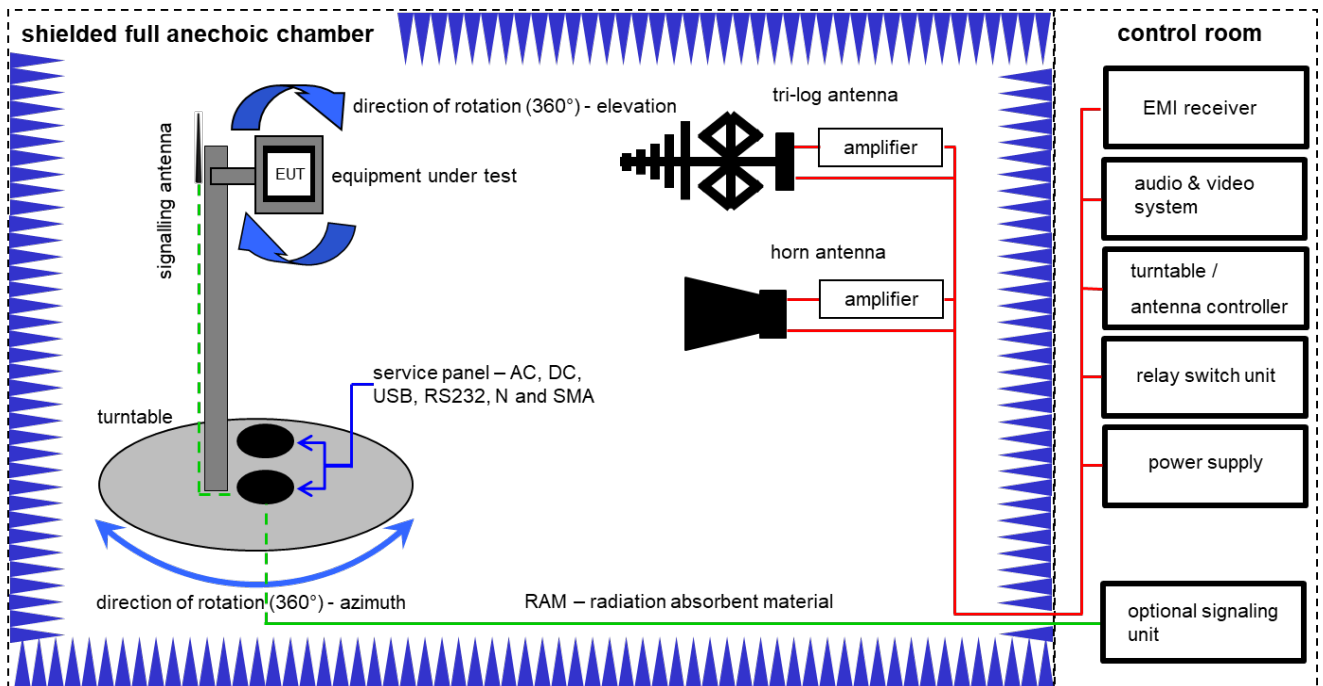
Each block diagram listed can contain several test setup configurations. All devices belonging to a test setup are identified with the same letter syntax. For example: Column Setup and all devices with an A.

### **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



## 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)

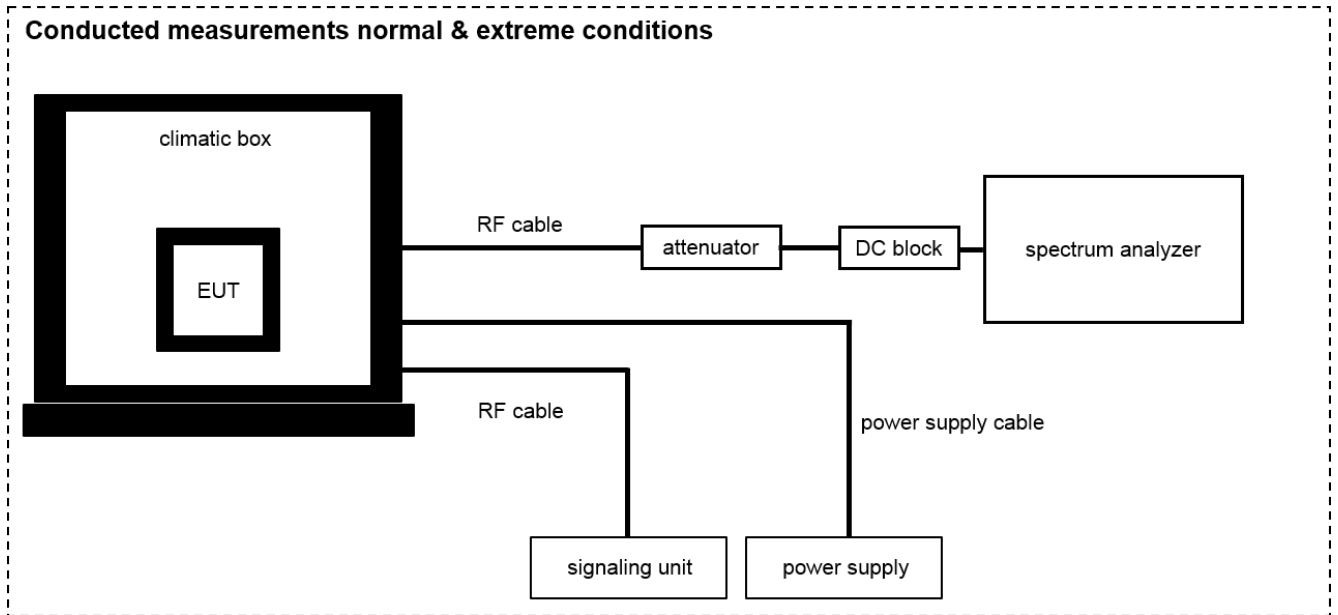
Example calculation:

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

**Equipment table:**

No.	Setup	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,B	Switch / Control Unit	3488A	HP	*	300000199	ne	-/-	-/-
3	B	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3089	300000307	vIKI!	11.02.2022	29.02.2024
4	B	Highpass Filter	WHKX2.9/18G-12SS	Wainwright	1	300003492	ev	-/-	-/-
5	A,B	EMI Test Receiver 20Hz- 26,5GHz	ESU26	R&S	100037	300003555	k	07.12.2022	31.12.2023
6	B	Highpass Filter	WHK1.1/15G-10SS	Wainwright	3	300003255	ev	-/-	-/-
7	B	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	19	300003790	ne	-/-	-/-
8	A	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck Mess - Elektronik	318	300003696	vIKI!	30.09.2023	29.09.2025
9	A,B	Broadband Amplifier 0.5-18 GHz	CBLU5184540	CERNEX	22049	300004481	ev	-/-	-/-
10	A,B	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne	-/-	-/-
11	A,B	NEXIO EMV-Software	BAT EMC V2022.0.32.0	Nexio		300004682	ne	-/-	-/-

## 7.2 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.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A,B	Signal analyzer	FSW26	Rohde&Schwarz	101455	300004528	k	07.12.2022	31.12.2023
2	A,B	RF-Cable SRD021 No. 1	Enviroflex 316 D	Huber & Suhner		400001311	ev	-/-	-/-
3	B	Temperature Test Chamber	VT 4011	Voetsch Industrietechnik	58566230600010	300005363	ev	09.05.2022	31.05.2024
4	B	Power Supply	HMP2020	Rohde & Schwarz	102219	300006192	k	15.12.2022	31.12.2024

## 8 Sequence of testing

### 8.1 Sequence of testing radiated spurious 30 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.

## 9 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

## 10 Summary of measurement results

<input checked="" type="checkbox"/>	No deviations from the technical specifications were ascertained
<input type="checkbox"/>	There were deviations from the technical specifications ascertained
<input 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 15 ETSI EN 300 422-1 v1.4.2	See table!	2024-01-03	-/-

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	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
FCC Part 15.236 (f)(2)	Occupied bandwidth	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
FCC Part 15.236 (f)(3)	Transmitter frequency stability	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
		Extreme	Extreme	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
FCC Part 15.236 (g)	Transmitter unwanted emissions (radiated or conducted)	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
FCC Part 15.236 (g)	Necessary bandwidth (BN) for digital systems	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
FCC Part 15.236 (g)	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

## 11 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.*

## 12 Measurement results

### 12.1 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 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 normal mode:**

Transmitter output power e.i.r.p. / dBm						
Channels	Q1-9			R1-9		
Frequencies / MHz	470.2	510.0	550.0	520.0	564.0	607.8
Peak	9.38 dBm	13.12 dBm	13.48 dBm	13.14 dBm	15.65 dBm	13.27 dBm
Average	5.74 dBm	9.39 dBm	9.81 dBm	9.19 dBm	11.78 dBm	9.46 dBm

**Result LD mode:**

Transmitter output power e.i.r.p. / dBm						
Channels	Q1-9			R1-9		
Frequencies / MHz	470.2	510.0	550.0	520.0	564.0	607.8
Peak	9.78 dBm	12.83 dBm	13.37 dBm	13.24 dBm	16.40 dBm	13.82 dBm
Average	6.11 dBm	9.11 dBm	9.71 dBm	9.30 dBm	12.57 dBm	10.01 dBm



## 12.2 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 & IC
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.

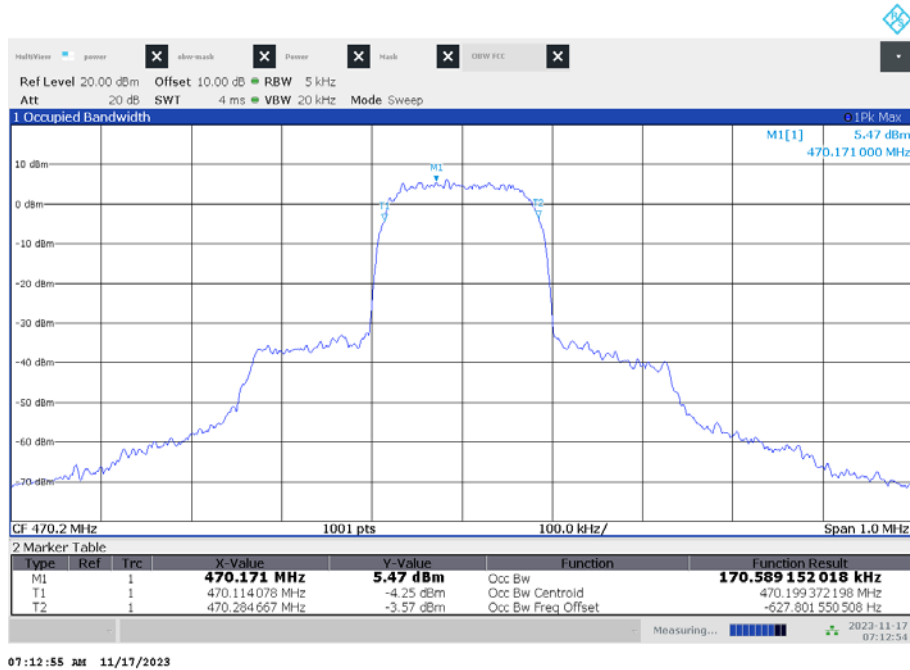
### Result:

Normal mode	
Centre frequency (fc)	OBW
470.200 MHz	170.589 kHz
510.000 MHz	171.768 kHz
550.000 MHz	170.933 kHz
520.000 MHz	170.798 kHz
564.000 MHz	170.044 kHz
607.800 MHz	170.985 kHz

LD-mode	
Centre frequency (fc)	OBW
470.200 MHz	142.837 kHz
510.000 MHz	143.806 kHz
550.000 MHz	143.846 kHz
520.000 MHz	142.924 kHz
564.000 MHz	143.419 kHz
607.800 MHz	143.270 kHz

**Plots normal mode:**

**Plot 1: 470.200 MHz, OBW**



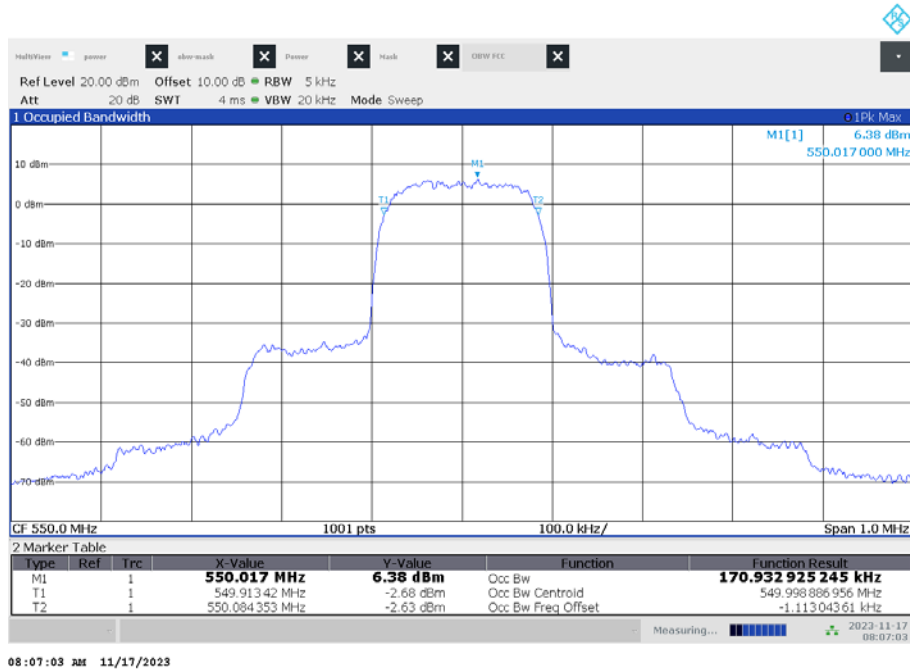
07:12:55 AM 11/17/2023

**Plot 2: 510.000 MHz, OBW**



08:30:12 AM 11/17/2023

Plot 3: 550.000 MHz, OBW



Plot 4: 520.000 MHz, OBW



Plot 5: 564.000 MHz, OBW



09:07:15 AM 11/17/2023

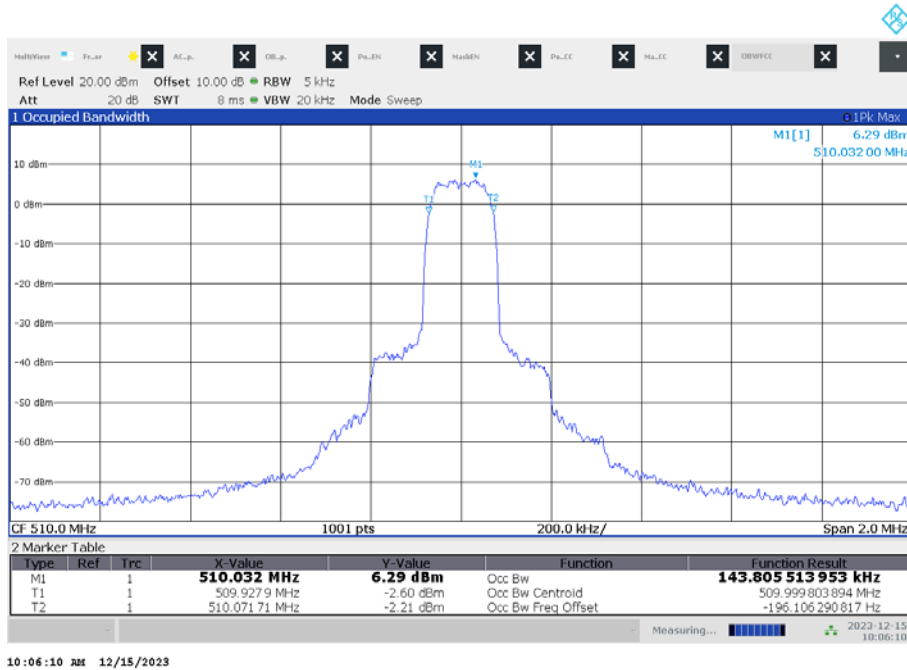
Plot 6: 607.800 MHz, OBW



09:17:24 AM 11/17/2023

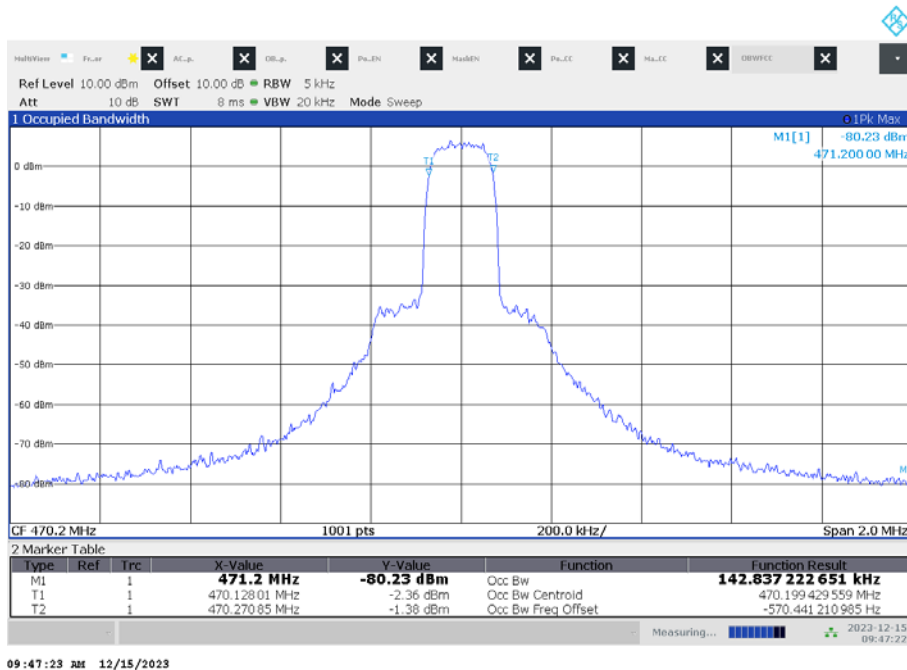
**Plots LD mode:**

**Plot 1: 470.200 MHz, OBW**



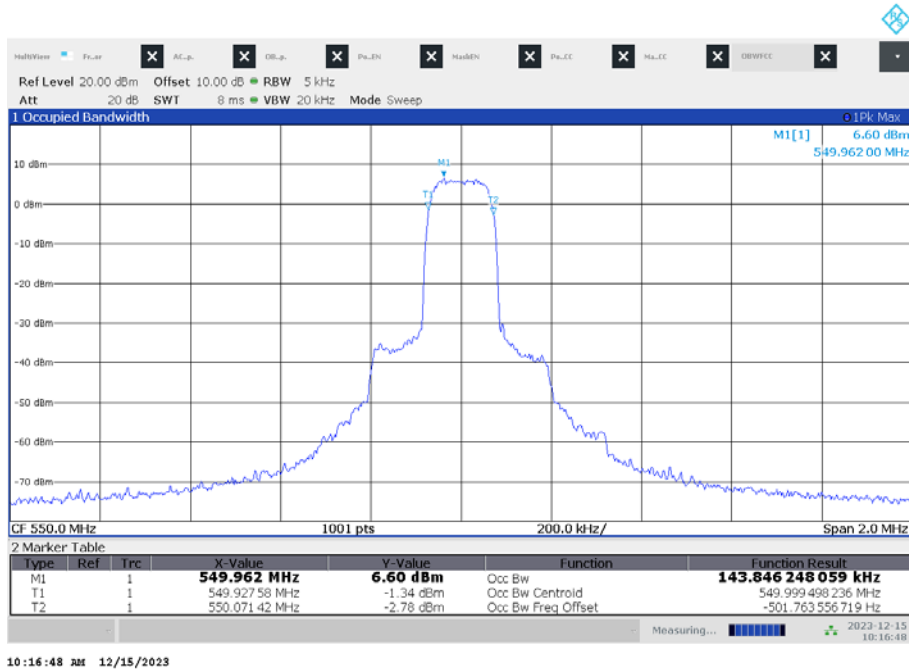
10:06:10 AM 12/15/2023

**Plot 2: 510.000 MHz, OBW**

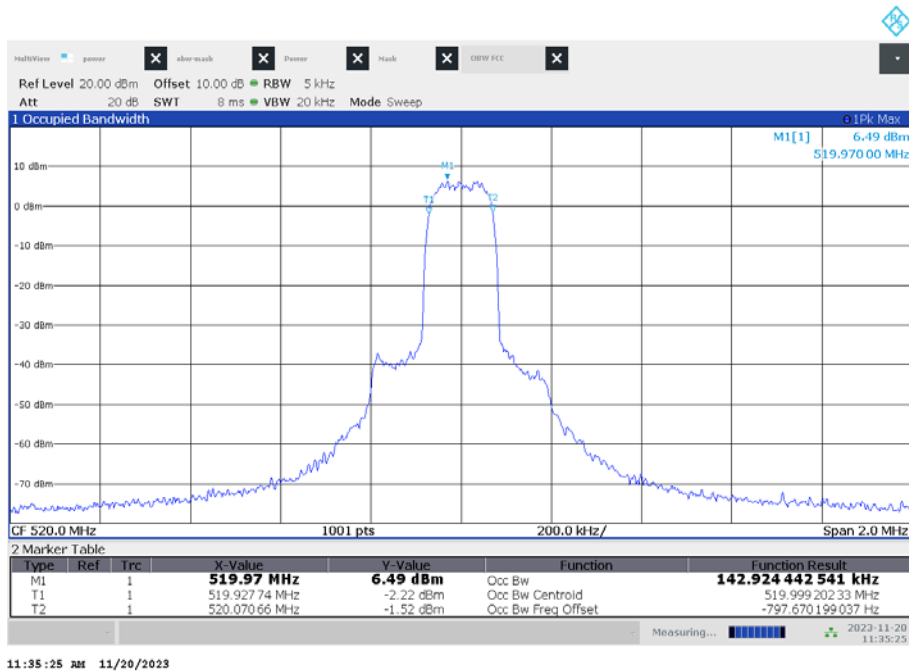


09:47:23 AM 12/15/2023

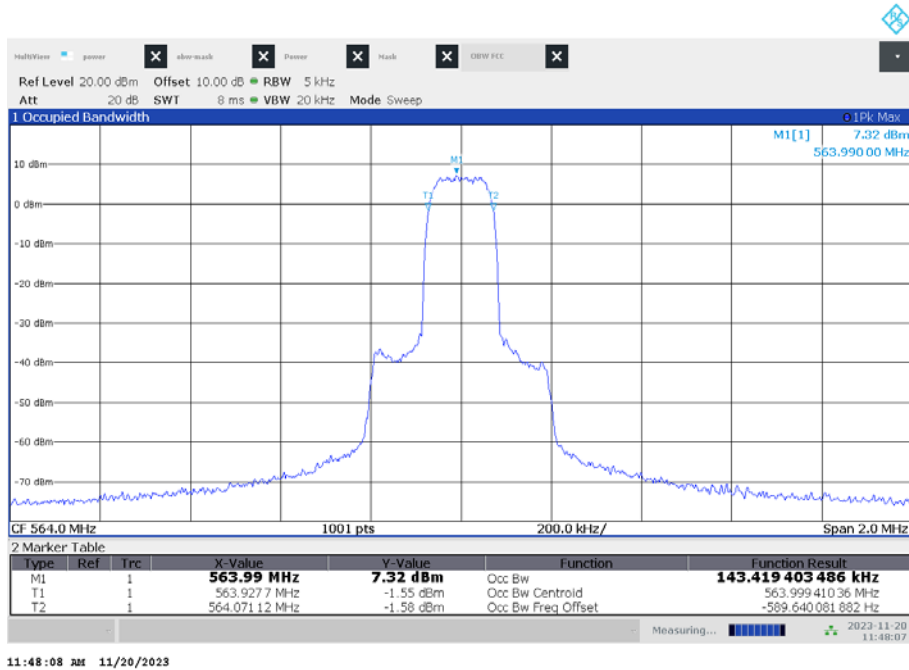
Plot 3: 550.000 MHz, OBW



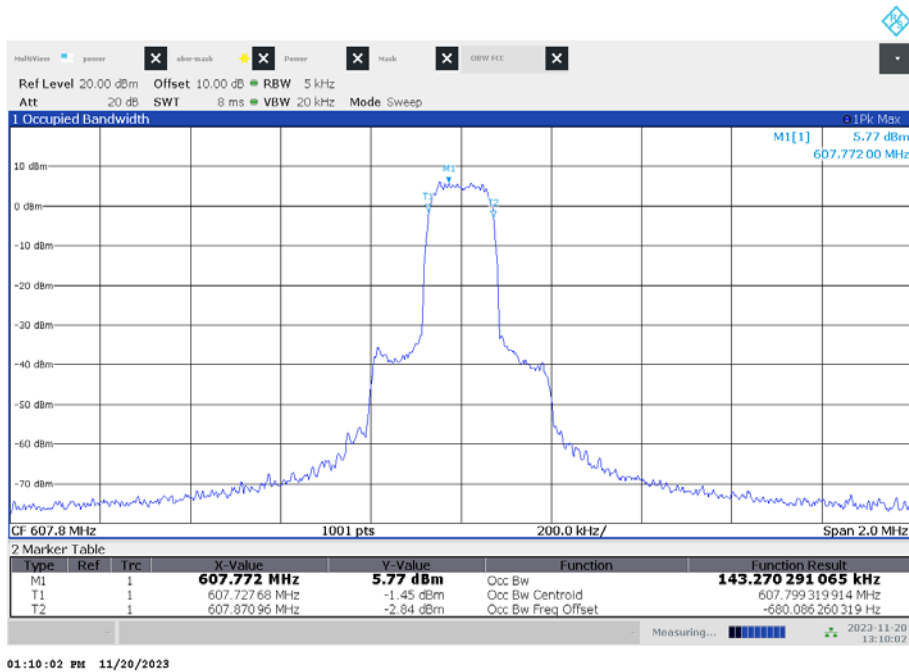
Plot 4: 520.000 MHz, OBW



Plot 5: 564.000 MHz, OBW



Plot 6: 607.800 MHz, OBW



## 12.3 Transmitter frequency stability

### Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1 Hz / 10 Hz / 100 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 & IC
470 MHz to 608 MHz ± 50 ppm

### Results: 470.200 MHz

Temperature / Voltage	Frequency (MHz)	Deviation (kHz / ppm)
-30 °C / V <sub>nom</sub>	470.199900	-0.100 / -0.21
-20 °C / V <sub>nom</sub>	470.199328	-0.672 / -1.43
-10 °C / V <sub>nom</sub>	470.199050	-0.950 / -2.02
0 °C / V <sub>nom</sub>	470.200009	0.009 / 0.02
+10 °C / V <sub>nom</sub>	470.200014	0.014 / 0.03
+20 °C / V <sub>nom</sub>	470.200249	0.249 / 0.53
+30 °C / V <sub>nom</sub>	470.199723	-0.277 / -0.59
+40 °C / V <sub>nom</sub>	470.200306	0.306 / 0.65
+50 °C / V <sub>nom</sub>	470.199610	-0.390 / -0.83
<b>Temperature / Voltage</b>		
+20 °C / V <sub>nom</sub> - 15%	470.199760	-0.239 / -0.51
+20 °C / V <sub>nom</sub>	470.199807	-0.192 / -0.41
+20 °C / V <sub>nom</sub> + 15%	470.199473	-0.524 / -1.12



**Results:** 510.000 MHz

Temperature / Voltage	Frequency (MHz)	Deviation (kHz / ppm)
-30 °C / V <sub>nom</sub>	509.999752	-0.248 / -0.49
-20 °C / V <sub>nom</sub>	509.999459	-0.541 / -1.06
-10 °C / V <sub>nom</sub>	509.999827	-0.173 / -0.34
0 °C / V <sub>nom</sub>	509.999954	-0.046 / -0.09
+10 °C / V <sub>nom</sub>	509.999567	-0.434 / -0.85
+20 °C / V <sub>nom</sub>	509.999516	-0.485 / -0.95
+30 °C / V <sub>nom</sub>	510.000051	0.051 / 0.10
+40 °C / V <sub>nom</sub>	510.000556	0.556 / 1.09
+50 °C / V <sub>nom</sub>	510.000342	0.342 / 0.67
+20 °C / V <sub>nom</sub> - 15%	509.999903	-0.097 / -0.19
+20 °C / V <sub>nom</sub>	510.000092	0.092 / 0.18
+20 °C / V <sub>nom</sub> + 15%	509.999755	-0.245 / -0.48

**Results:** 550.000 MHz

Temperature / Voltage	Frequency (MHz)	Deviation (kHz / ppm)
-30 °C / V <sub>nom</sub>	549.999956	-0.044 / -0.08
-20 °C / V <sub>nom</sub>	549.999588	-0.413 / -0.75
-10 °C / V <sub>nom</sub>	549.999489	-0.512 / -0.93
0 °C / V <sub>nom</sub>	549.999967	-0.033 / -0.06
+10 °C / V <sub>nom</sub>	550.000209	0.209 / 0.38
+20 °C / V <sub>nom</sub>	550.000319	0.319 / 0.58
+30 °C / V <sub>nom</sub>	550.000495	0.495 / 0.90
+40 °C / V <sub>nom</sub>	550.000154	0.154 / 0.28
+50 °C / V <sub>nom</sub>	550.000215	0.215 / 0.39
+20 °C / V <sub>nom</sub> - 15%	549.999769	-0.231 / -0.42
+20 °C / V <sub>nom</sub>	549.999544	-0.457 / -0.83
+20 °C / V <sub>nom</sub> + 15%	550.000319	0.319 / 0.58

**Results:** 520.000 MHz

Temperature / Voltage	Frequency (MHz)	Deviation (kHz / ppm)
-30 °C / V <sub>nom</sub>	519.999644	-0.356 / -0.68
-20 °C / V <sub>nom</sub>	519.999792	-0.208 / -0.40
-10 °C / V <sub>nom</sub>	519.999724	-0.276 / -0.53
0 °C / V <sub>nom</sub>	519.999220	-0.780 / -1.50
+10 °C / V <sub>nom</sub>	519.999542	-0.458 / -0.88
+20 °C / V <sub>nom</sub>	519.999740	-0.260 / -0.50
+30 °C / V <sub>nom</sub>	519.999589	-0.411 / -0.79
+40 °C / V <sub>nom</sub>	519.999797	-0.203 / -0.39
+50 °C / V <sub>nom</sub>	519.999808	-0.192 / -0.37
+20 °C / V <sub>nom</sub> - 15%	519.999350	-0.650 / -1.25
+20 °C / V <sub>nom</sub>	519.999984	-0.016 / -0.03
+20 °C / V <sub>nom</sub> + 15%	519.999782	-0.218 / -0.42

**Results:** 564.000 MHz

Temperature / Voltage	Frequency (MHz)	Deviation (kHz / ppm)
-30 °C / V <sub>nom</sub>	564.000220	0.220 / 0.39
-20 °C / V <sub>nom</sub>	563.999673	-0.327 / -0.58
-10 °C / V <sub>nom</sub>	563.999515	-0.485 / -0.86
0 °C / V <sub>nom</sub>	563.999594	-0.406 / -0.72
+10 °C / V <sub>nom</sub>	563.999752	-0.248 / -0.44
+20 °C / V <sub>nom</sub>	564.000259	0.259 / 0.46
+30 °C / V <sub>nom</sub>	563.999650	-0.350 / -0.62
+40 °C / V <sub>nom</sub>	564.000017	0.017 / 0.03
+50 °C / V <sub>nom</sub>	564.000045	0.045 / 0.08
+20 °C / V <sub>nom</sub> - 15%	564.000130	0.130 / 0.23
+20 °C / V <sub>nom</sub>	564.000034	0.034 / 0.06
+20 °C / V <sub>nom</sub> + 15%	563.999831	-0.169 / -0.30

**Results:** 607.8 MHz

Temperature / Voltage	Frequency (MHz)	Deviation (kHz / ppm)
-30 °C / V <sub>nom</sub>	607.799617	-0.383 / -0.63
-20 °C / V <sub>nom</sub>	607.799125	-0.875 / -1.44
-10 °C / V <sub>nom</sub>	607.799161	-0.839 / -1.38
0 °C / V <sub>nom</sub>	607.799708	-0.292 / -0.48
+10 °C / V <sub>nom</sub>	607.799301	-0.699 / -1.15
+20 °C / V <sub>nom</sub>	607.799550	-0.450 / -0.74
+30 °C / V <sub>nom</sub>	607.800024	0.024 / 0.04
+40 °C / V <sub>nom</sub>	607.799611	-0.389 / -0.64
+50 °C / V <sub>nom</sub>	607.799617	-0.383 / -0.63
+20 °C / V <sub>nom</sub> - 15%	607.799672	-0.328 / -0.54
+20 °C / V <sub>nom</sub>	607.799927	-0.073 / -0.12
+20 °C / V <sub>nom</sub> + 15%	607.799848	-0.152 / -0.25

## 12.4 Transmitter unwanted emissions (radiated)

### Measurement:

Measurement parameter							
Detector:	Peak (prescan) / RMS						
Sweep time:	Auto						
Resolution bandwidth:	<table border="0"> <tr> <td>25 MHz to 30 MHz</td> <td>9 kHz to 10 kHz</td> </tr> <tr> <td>30 MHz to 1 000 MHz</td> <td>100 kHz</td> </tr> <tr> <td>&gt; 1 000 MHz</td> <td>1 MHz</td> </tr> </table>	25 MHz to 30 MHz	9 kHz to 10 kHz	30 MHz to 1 000 MHz	100 kHz	> 1 000 MHz	1 MHz
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 & IC (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 & 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

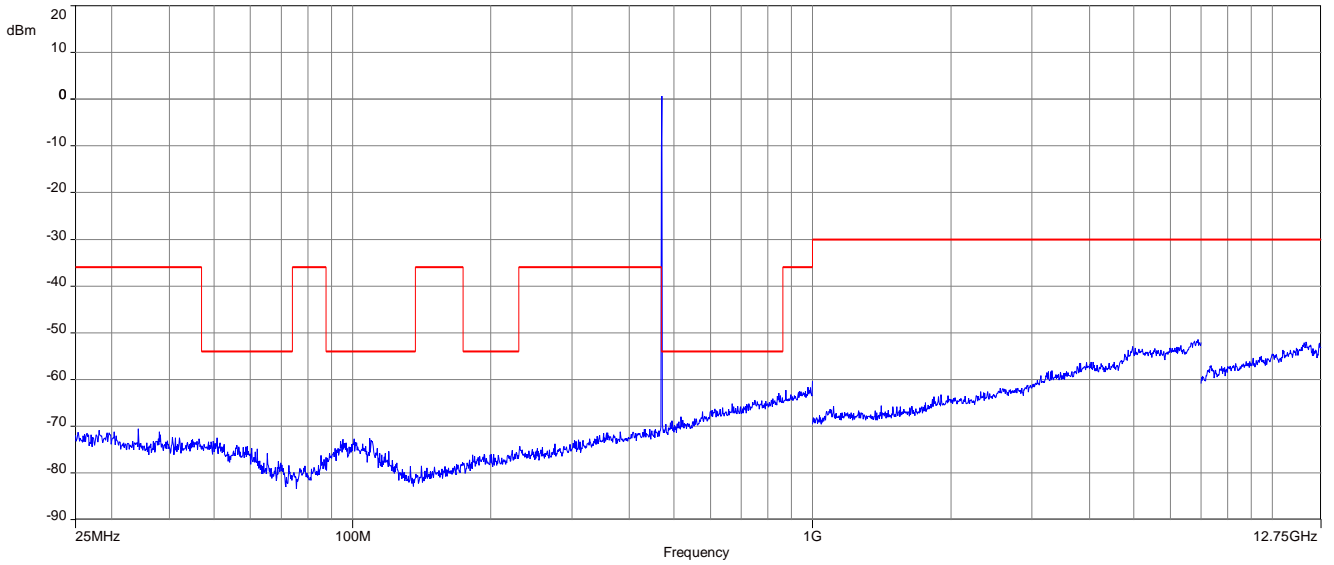
### Results:

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

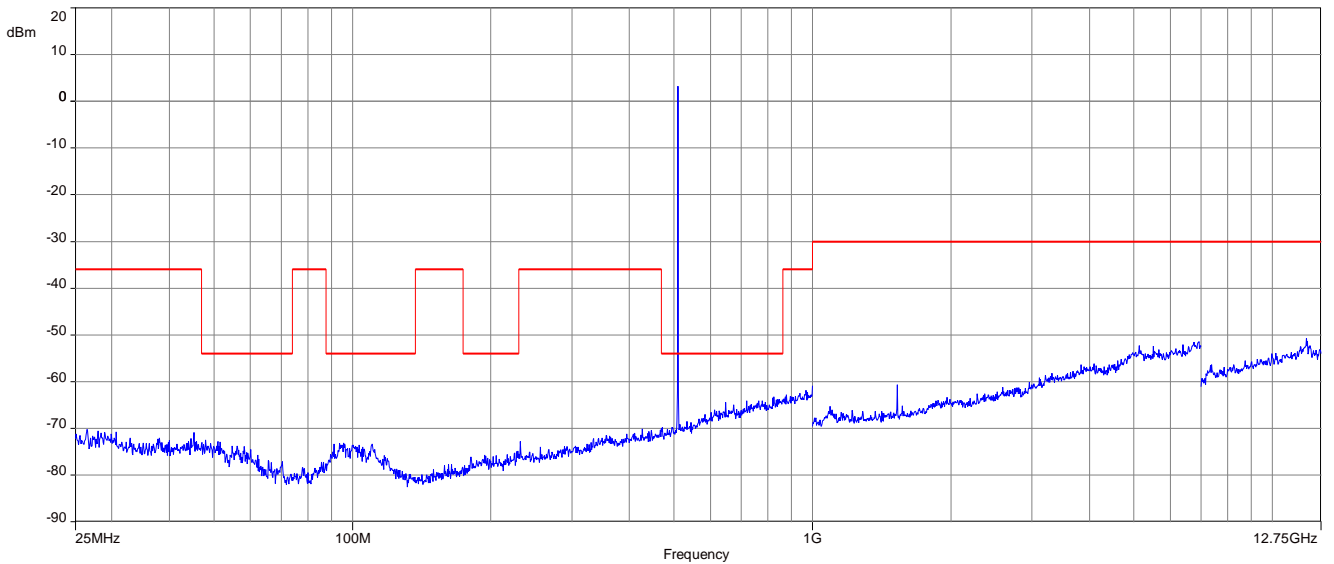
**Plots:** radiated

**normal mode:**

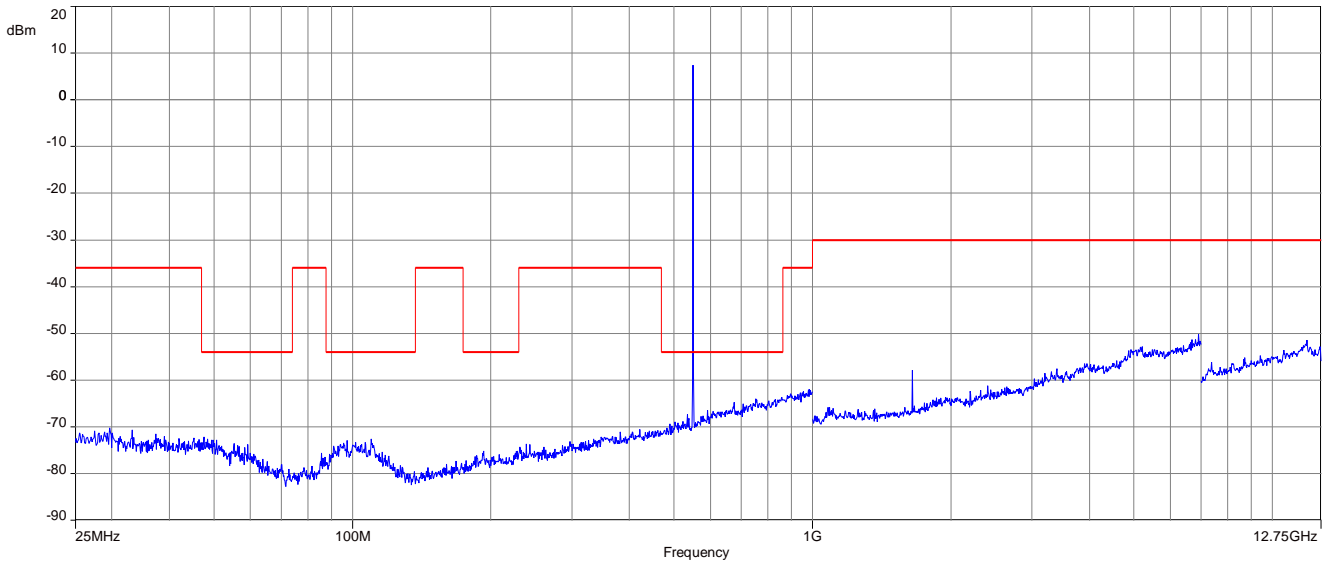
**Plot 1:** 470.200 MHz, 25 MHz – 12.75 GHz



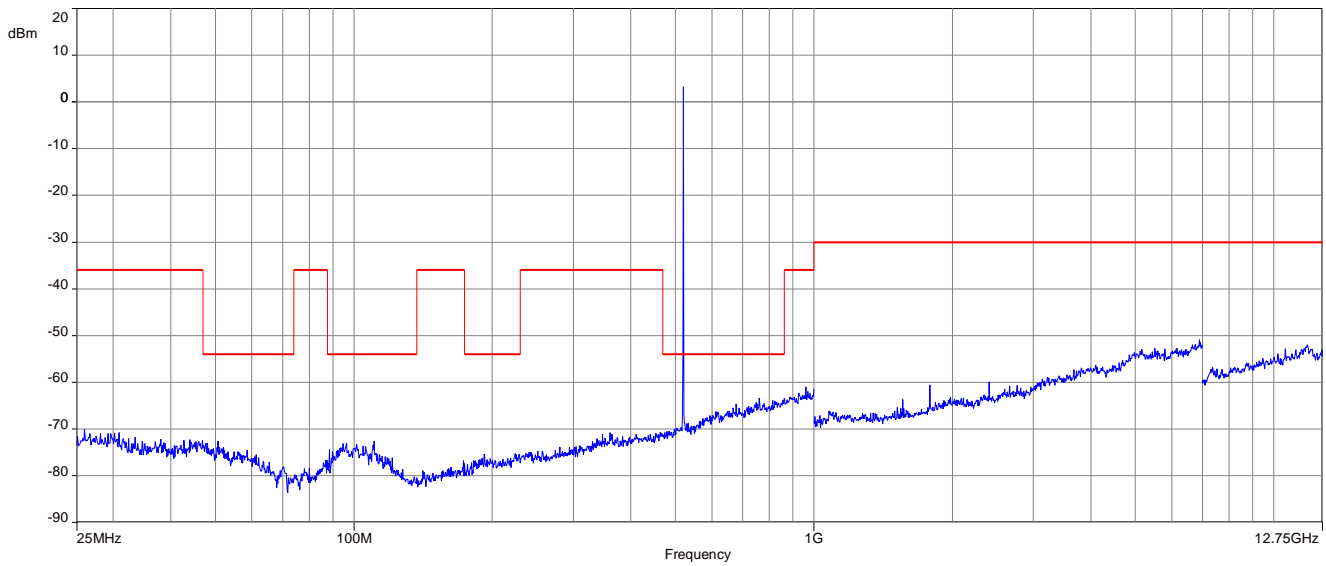
**Plot 2:** 510.000 MHz, 25 MHz – 12.75 GHz



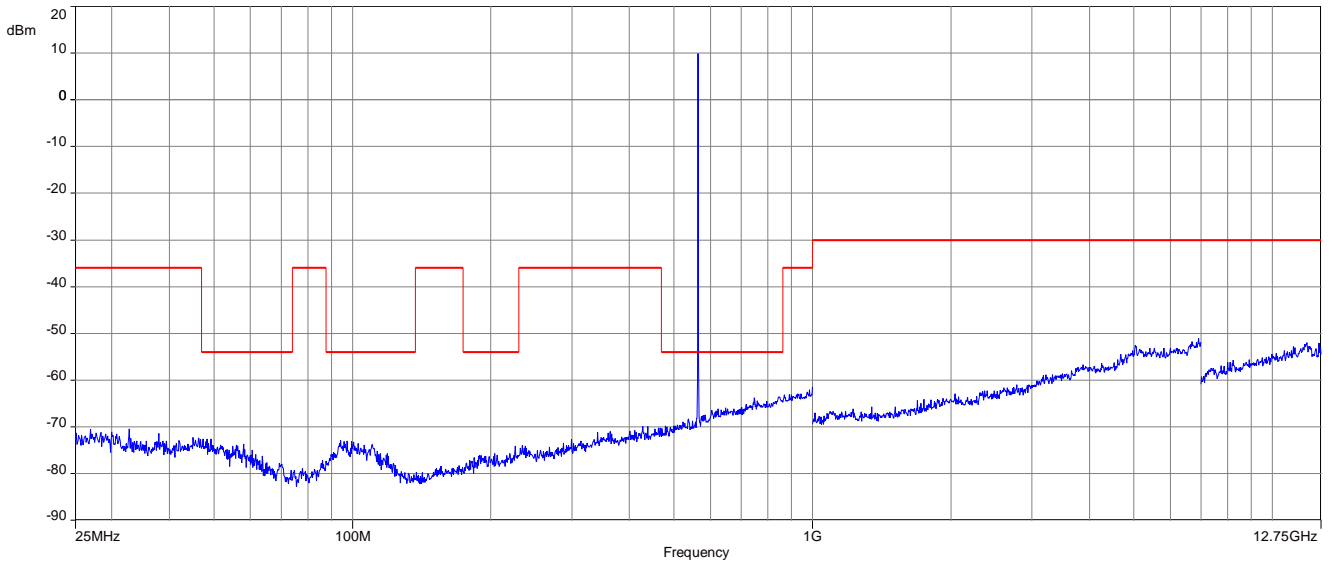
**Plot 3:** 550.000 MHz, 25 MHz – 12.75 GHz



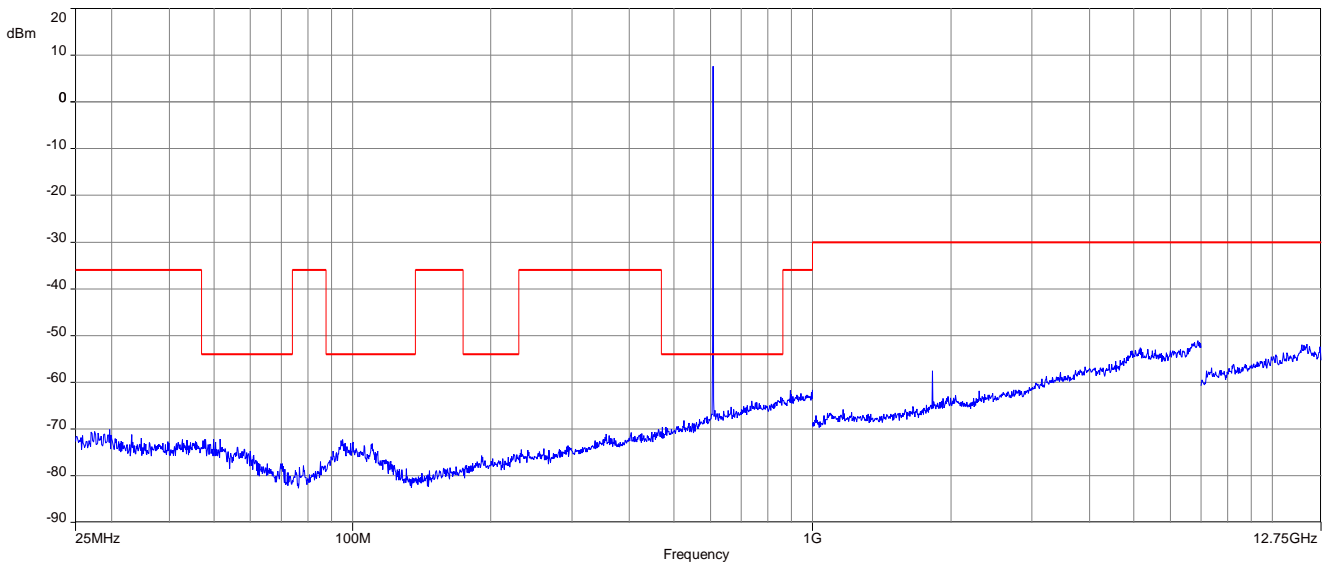
**Plot 4:** 520.000 MHz, 25 MHz – 12.75 GHz



**Plot 5:** 564.000 MHz, 25 MHz – 12.75 GHz

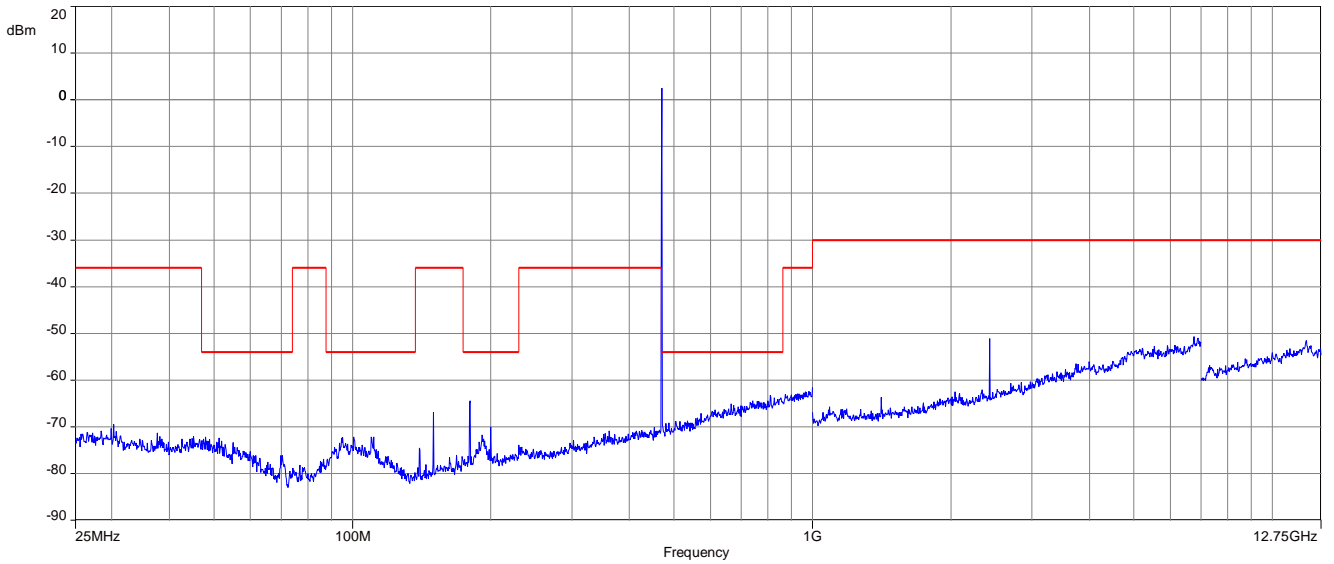


**Plot 6:** 607.800 MHz, 25 MHz – 12.75 GHz

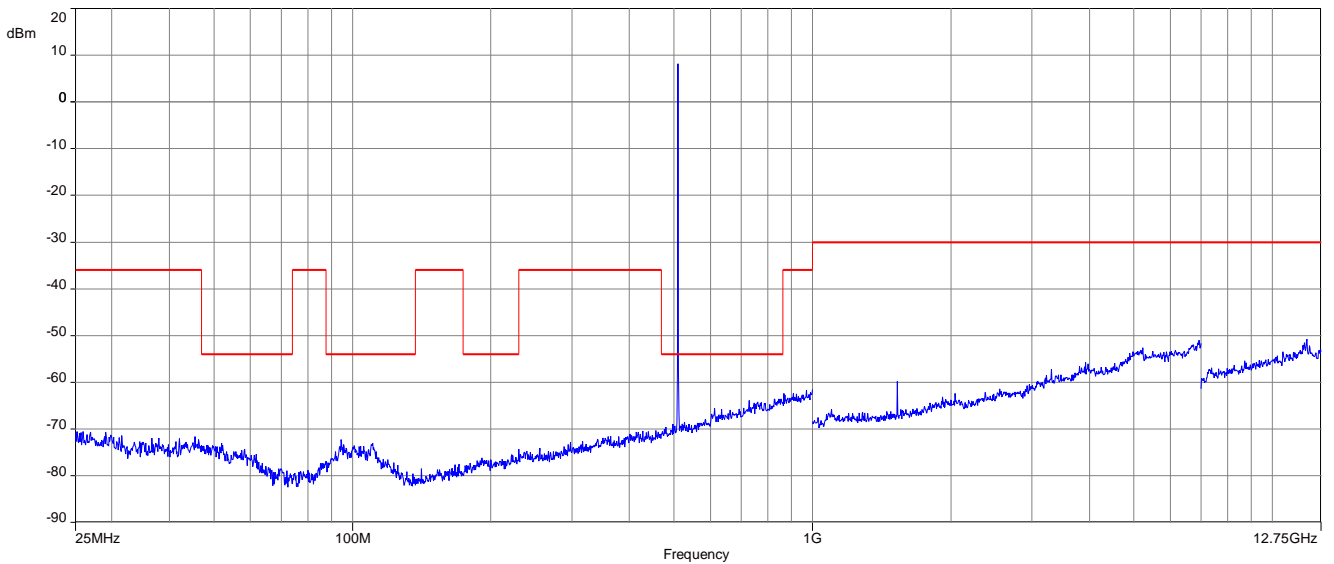


**LD mode:**

**Plot 1: 470.200 MHz, 25 MHz – 12.75 GHz**

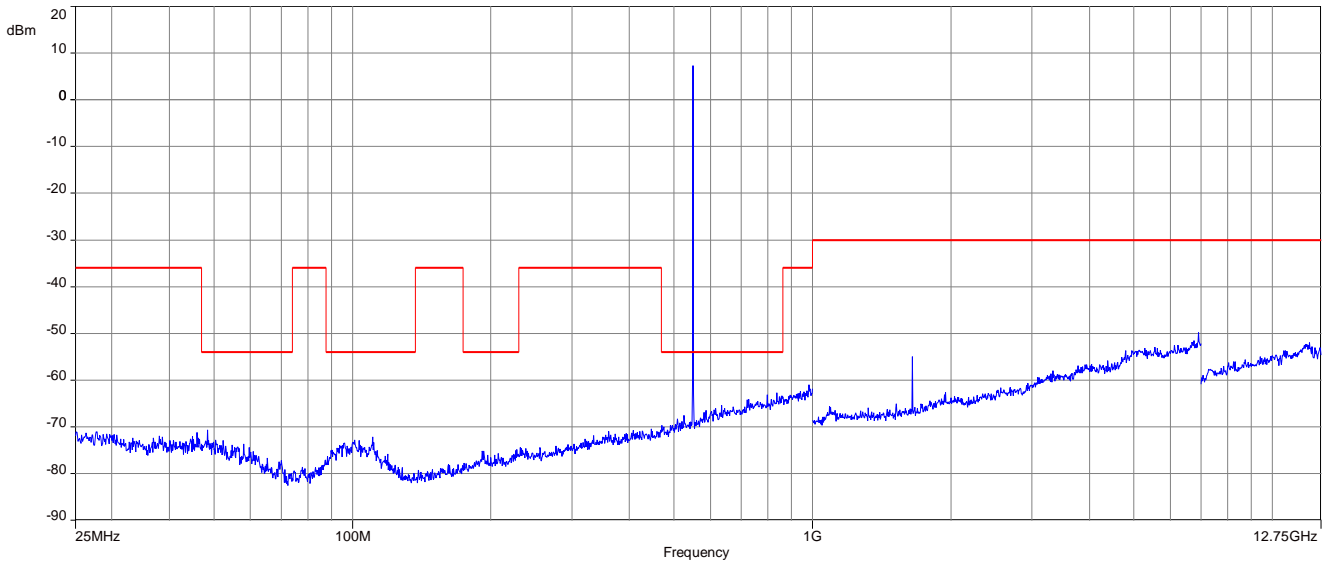


**Plot 2: 510.000 MHz, 25 MHz – 12.75 GHz**

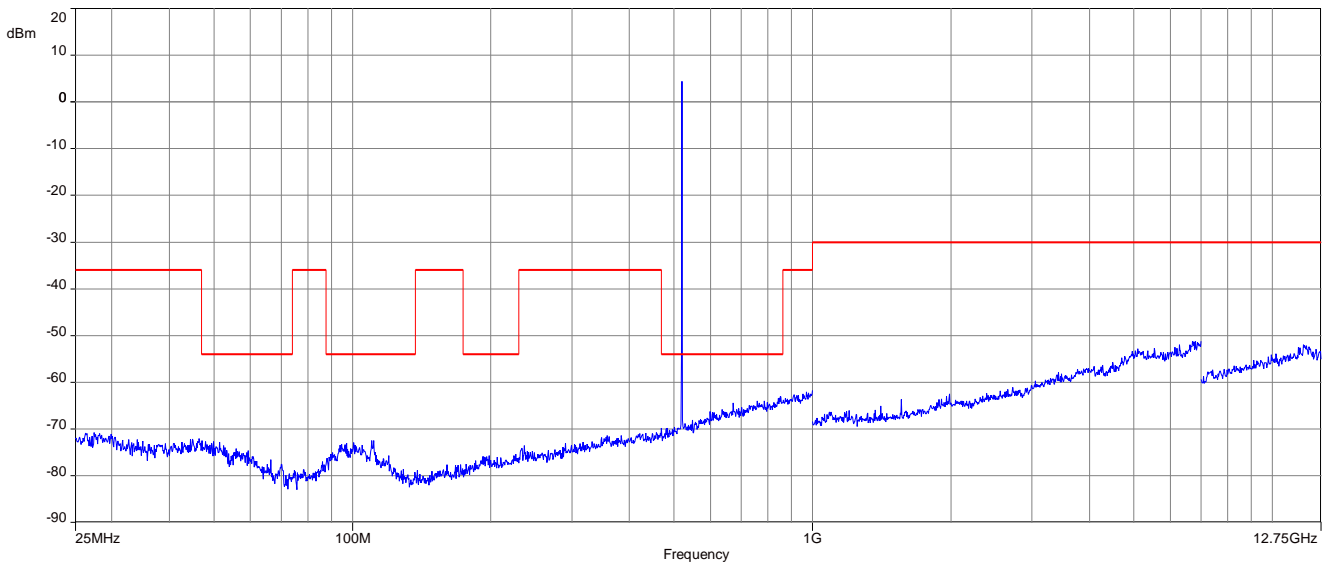




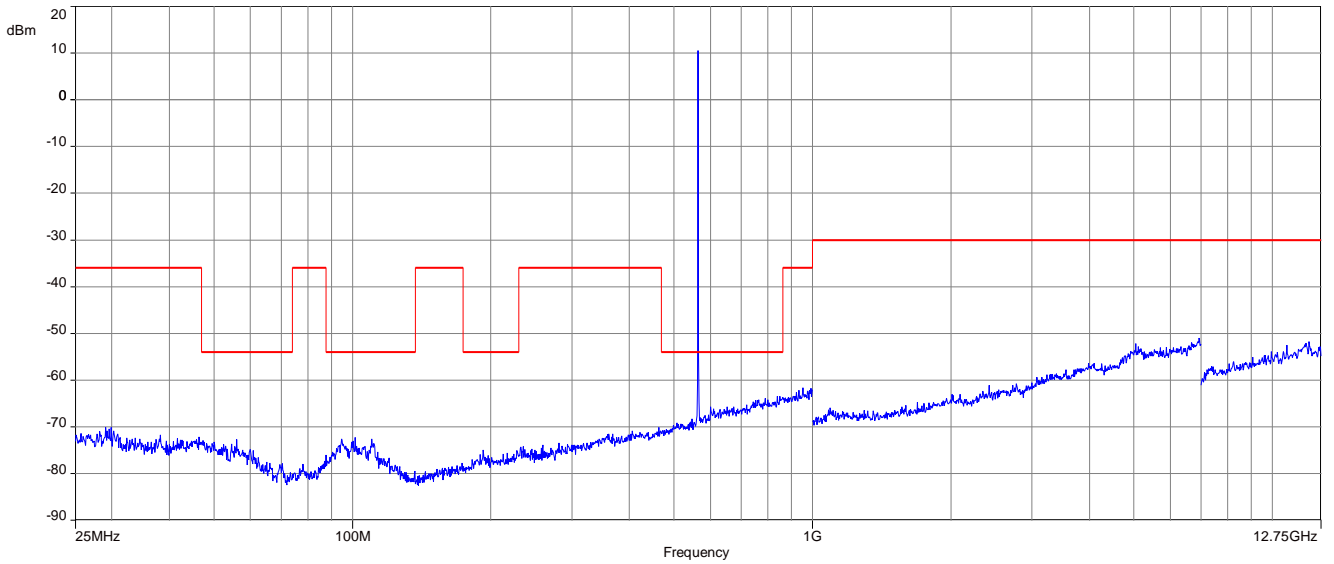
**Plot 3:** 550.000 MHz, 25 MHz – 12.75 GHz



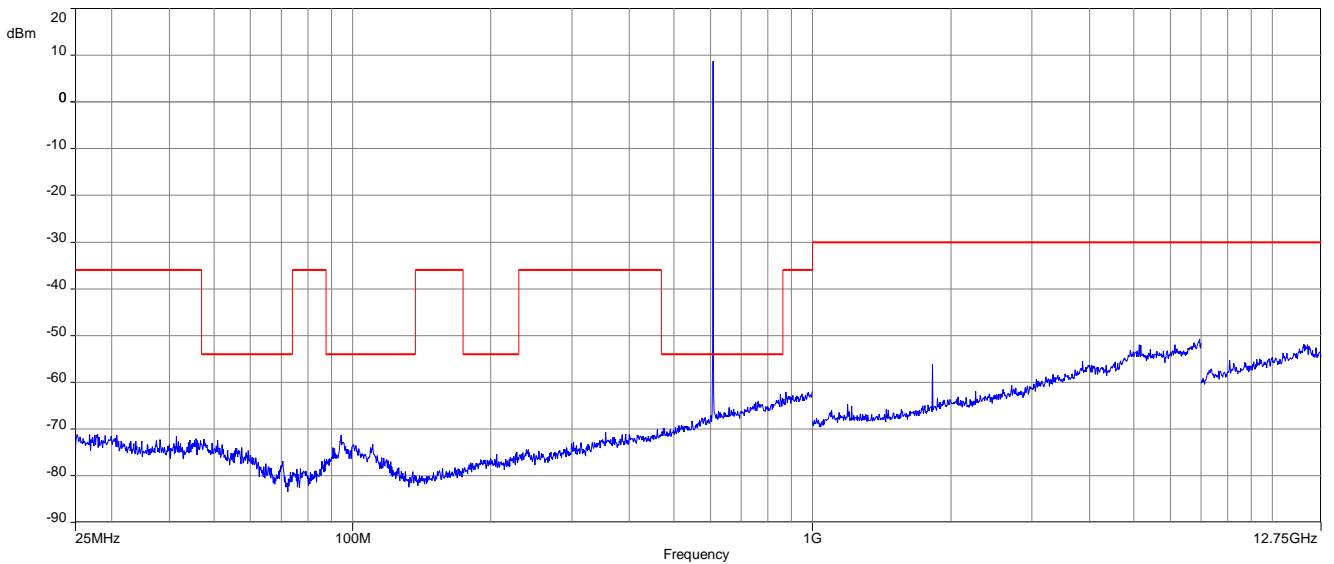
**Plot 4:** 520.000 MHz, 25 MHz – 12.75 GHz



**Plot 5:** 564.000 MHz, 25 MHz – 12.75 GHz



**Plot 6:** 607.800 MHz, 25 MHz – 12.75 GHz

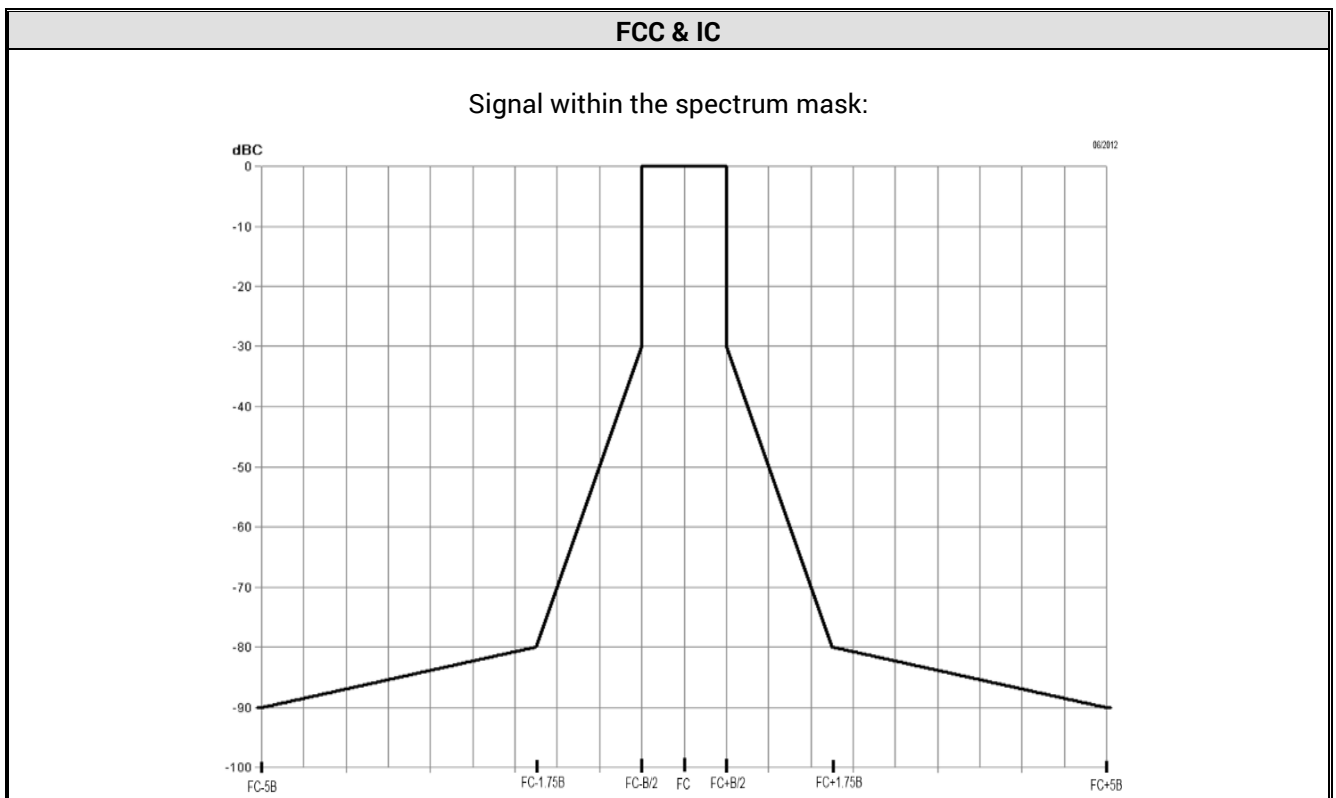


## 12.5 Necessary bandwidth (BN) for digital systems

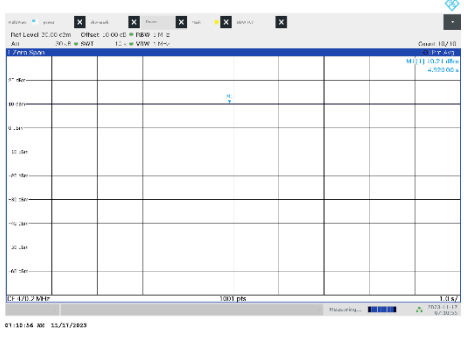
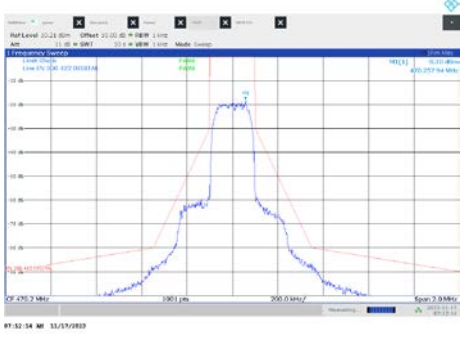
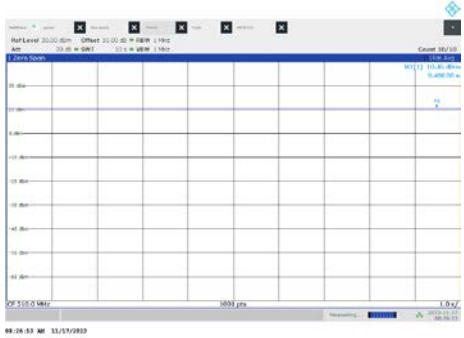
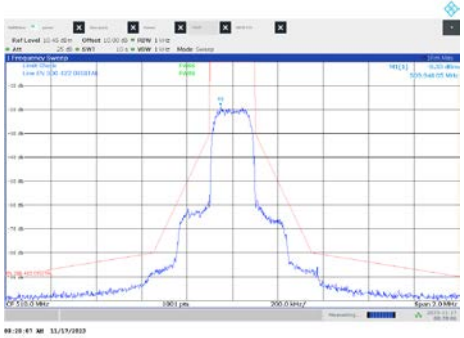
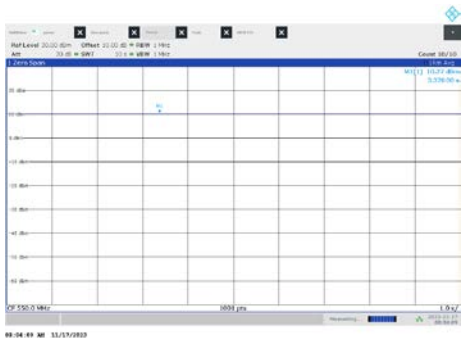
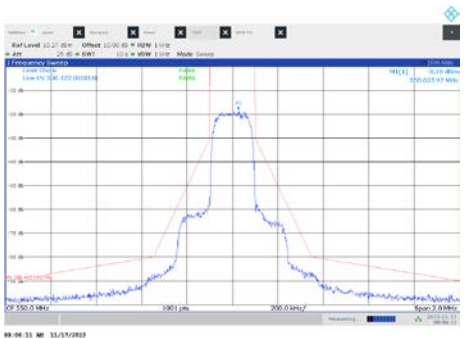
**Measurement:**

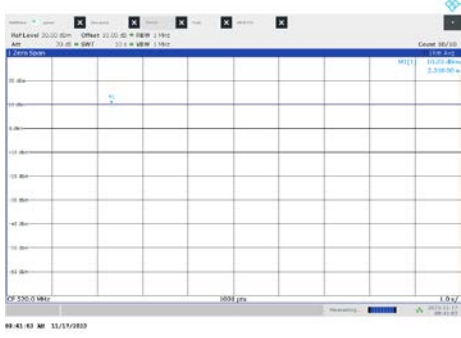
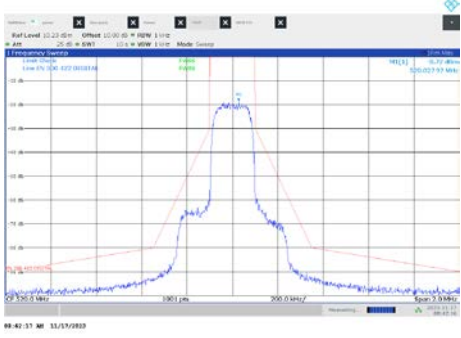
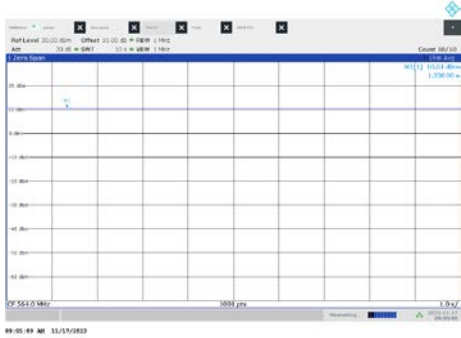
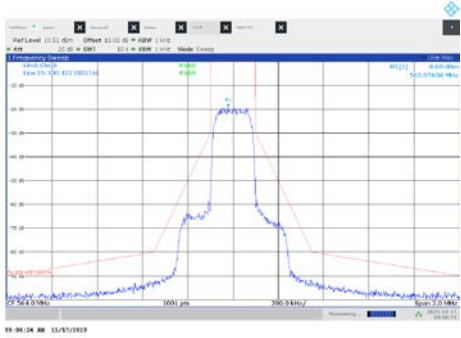
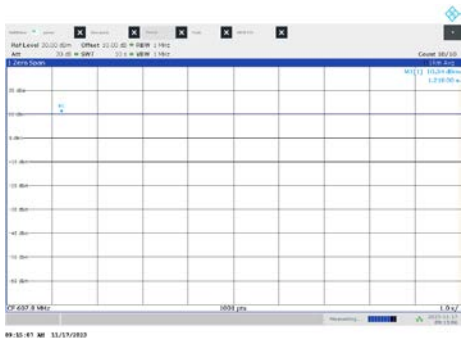
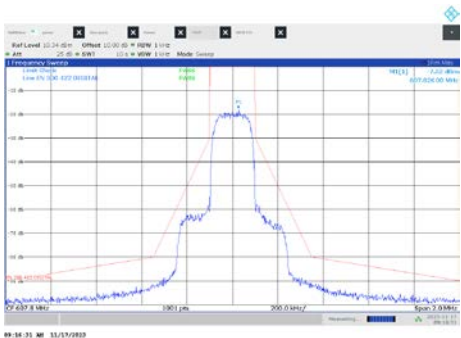
Measurement parameter	
Detector:	Peak / Average (-90 dBc point only)
Sweep time:	Auto
Resolution bandwidth:	1 kHz
Video bandwidth:	1 kHz
Span:	fc - 1 MHz to fc + 1 MHz (2 MHz)
Trace mode:	Max hold/view
EUT:	CW and MC
Test setup:	See sub clause 7.2 - D
Measurement uncertainty:	See sub clause 9

**Limits:** according to ETSI EN 300 422-1 v1.4.2

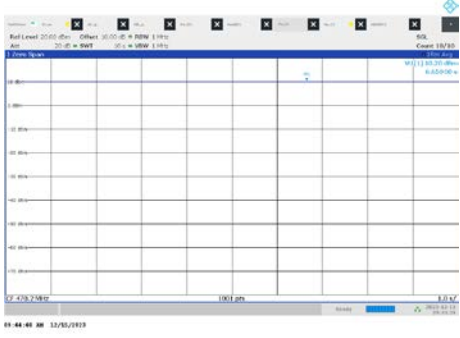
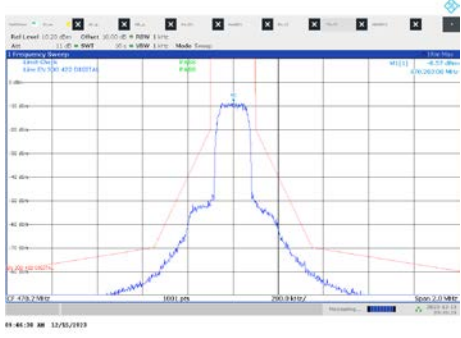
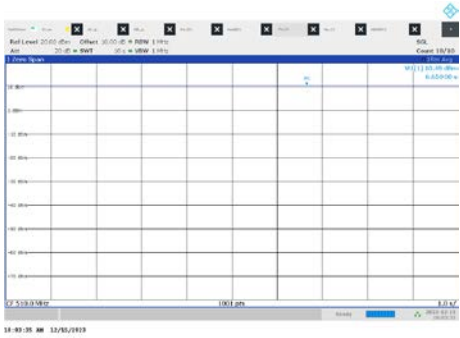
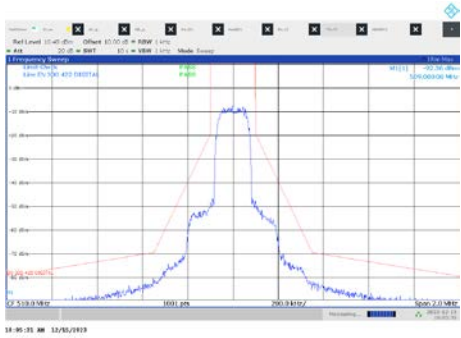
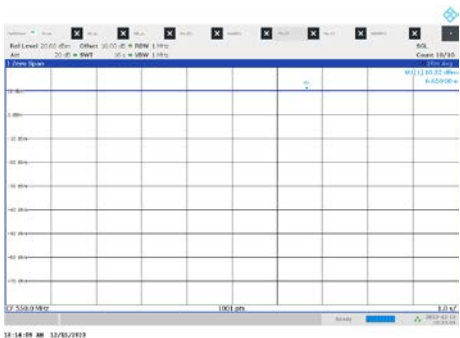
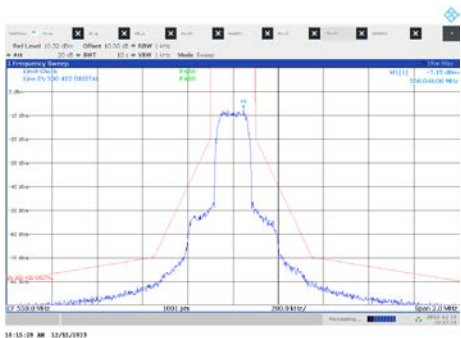


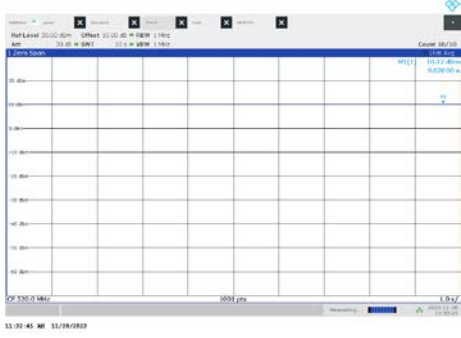
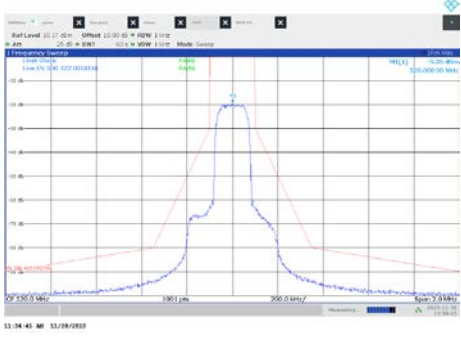
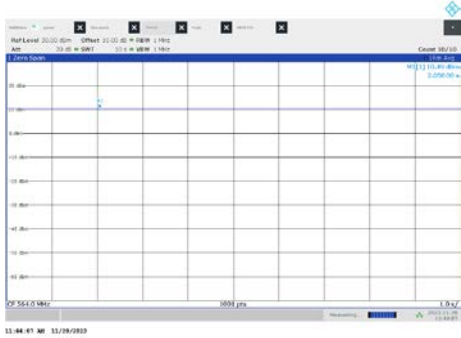
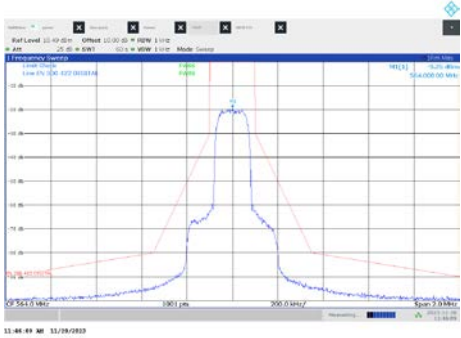
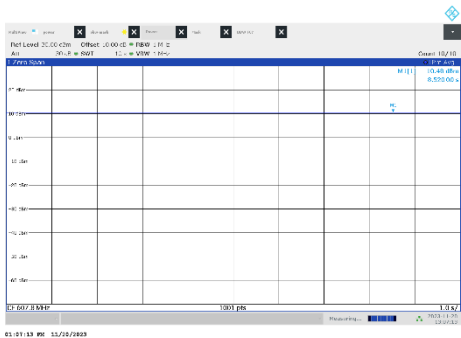
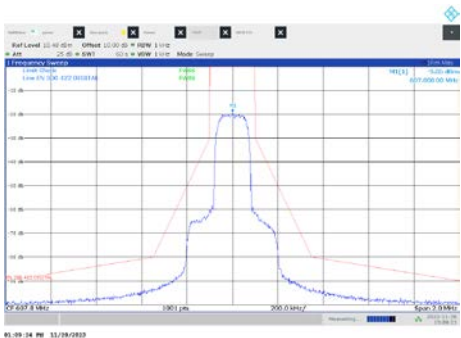
**Plots normal mode:**

Frequency	Carrier power	Modulated carrier with modulated carrier
470.2 MHz		
510.0 MHz		
550.0 MHz		

Frequency	Carrier power	Modulated carrier with modulated carrier
520.0 MHz	 <p>Carrier power spectrum plot at 520.0 MHz. The plot shows a single sharp peak at the center frequency. The y-axis represents power in dBm, ranging from -100 to 20. The x-axis represents frequency in MHz, ranging from 519.9 to 520.1. The peak power is approximately 15.00 dBm.</p>	 <p>Modulated carrier spectrum plot at 520.0 MHz. The plot shows a modulated carrier signal with sidebands. The y-axis represents power in dBm, ranging from -100 to 20. The x-axis represents frequency in MHz, ranging from 519.9 to 520.1. The main carrier peak is at 520.0 MHz with a power of approximately 15.00 dBm. Sidebands are visible on either side of the carrier.</p>
564.0 MHz	 <p>Carrier power spectrum plot at 564.0 MHz. The plot shows a single sharp peak at the center frequency. The y-axis represents power in dBm, ranging from -100 to 20. The x-axis represents frequency in MHz, ranging from 563.9 to 564.1. The peak power is approximately 15.00 dBm.</p>	 <p>Modulated carrier spectrum plot at 564.0 MHz. The plot shows a modulated carrier signal with sidebands. The y-axis represents power in dBm, ranging from -100 to 20. The x-axis represents frequency in MHz, ranging from 563.9 to 564.1. The main carrier peak is at 564.0 MHz with a power of approximately 15.00 dBm. Sidebands are visible on either side of the carrier.</p>
607.8 MHz	 <p>Carrier power spectrum plot at 607.8 MHz. The plot shows a single sharp peak at the center frequency. The y-axis represents power in dBm, ranging from -100 to 20. The x-axis represents frequency in MHz, ranging from 607.7 to 607.9. The peak power is approximately 15.00 dBm.</p>	 <p>Modulated carrier spectrum plot at 607.8 MHz. The plot shows a modulated carrier signal with sidebands. The y-axis represents power in dBm, ranging from -100 to 20. The x-axis represents frequency in MHz, ranging from 607.7 to 607.9. The main carrier peak is at 607.8 MHz with a power of approximately 15.00 dBm. Sidebands are visible on either side of the carrier.</p>

**Plots LD mode:**

Frequency	Carrier power	Modulated carrier with modulated carrier
470.0 MHz	 <p>Carrier power plot for 470.0 MHz. The plot shows a flat line at approximately -100 dBm across the frequency range from 469.7 MHz to 470.3 MHz. The y-axis represents power in dBm, ranging from -120 to 0. The x-axis represents frequency in MHz.</p>	 <p>Modulated carrier with modulated carrier plot for 470.0 MHz. The plot shows a clear signal peak centered at 470.0 MHz, with a bandwidth of approximately 200 kHz. The peak power is around -100 dBm. The plot includes a red trace for the signal and a blue trace for the noise floor. The y-axis represents power in dBm, ranging from -120 to 0. The x-axis represents frequency in MHz.</p>
510.0 MHz	 <p>Carrier power plot for 510.0 MHz. The plot shows a flat line at approximately -100 dBm across the frequency range from 509.7 MHz to 510.3 MHz. The y-axis represents power in dBm, ranging from -120 to 0. The x-axis represents frequency in MHz.</p>	 <p>Modulated carrier with modulated carrier plot for 510.0 MHz. The plot shows a clear signal peak centered at 510.0 MHz, with a bandwidth of approximately 200 kHz. The peak power is around -100 dBm. The plot includes a red trace for the signal and a blue trace for the noise floor. The y-axis represents power in dBm, ranging from -120 to 0. The x-axis represents frequency in MHz.</p>
550.0 MHz	 <p>Carrier power plot for 550.0 MHz. The plot shows a flat line at approximately -100 dBm across the frequency range from 549.7 MHz to 550.3 MHz. The y-axis represents power in dBm, ranging from -120 to 0. The x-axis represents frequency in MHz.</p>	 <p>Modulated carrier with modulated carrier plot for 550.0 MHz. The plot shows a clear signal peak centered at 550.0 MHz, with a bandwidth of approximately 200 kHz. The peak power is around -100 dBm. The plot includes a red trace for the signal and a blue trace for the noise floor. The y-axis represents power in dBm, ranging from -120 to 0. The x-axis represents frequency in MHz.</p>

Frequency	Carrier power	Modulated carrier with modulated carrier
520.0 MHz	 <p>Carrier power spectrum plot at 520.0 MHz. The plot shows a flat baseline with a noise floor around -130 dBm. A small peak is visible at the center frequency. The x-axis is labeled '3000 Hz' and the y-axis is labeled '1.0 V'.</p>	 <p>Modulated carrier spectrum plot at 520.0 MHz. The plot shows a clear signal with a peak at the center frequency. The signal is wider than the carrier power plot. The x-axis is labeled '3000 Hz' and the y-axis is labeled '1.0 V'.</p>
564.0 MHz	 <p>Carrier power spectrum plot at 564.0 MHz. The plot shows a flat baseline with a noise floor around -130 dBm. A small peak is visible at the center frequency. The x-axis is labeled '3000 Hz' and the y-axis is labeled '1.0 V'.</p>	 <p>Modulated carrier spectrum plot at 564.0 MHz. The plot shows a clear signal with a peak at the center frequency. The signal is wider than the carrier power plot. The x-axis is labeled '3000 Hz' and the y-axis is labeled '1.0 V'.</p>
607.8 MHz	 <p>Carrier power spectrum plot at 607.8 MHz. The plot shows a flat baseline with a noise floor around -130 dBm. A small peak is visible at the center frequency. The x-axis is labeled '3000 Hz' and the y-axis is labeled '1.0 V'.</p>	 <p>Modulated carrier spectrum plot at 607.8 MHz. The plot shows a clear signal with a peak at the center frequency. The signal is wider than the carrier power plot. The x-axis is labeled '3000 Hz' and the y-axis is labeled '1.0 V'.</p>

## 13 Observations

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



## 14 Glossary

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

## 15 Document history

Version	Applied changes	Date of release
-/-	Initial release	2024-01-03

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