TEST REPORT

Test report no.: 1-6662/18-01-02

D-PL-12076-01-03

Testing laboratory

CTC advanced GmbH
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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

Dialog Semiconductor BV
Het Zuiderkruis 53
5215 MV 's Hertogenbosch / Netherlands
Phone: -/-
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e-mail: Laura.Dimitropoulou@diasemi.com
Phone: +30 2610 462406

Manufacturer

Dialog Semiconductor BV
Het Zuiderkruis 53
5215 MV 's Hertogenbosch / Netherlands

Test standard/s

ETSI EN 300 328 V2.1.1	Wideband transmission systems; Data transmission equipment operating in the 2.4 GHz ISM band and using wide band modulation techniques; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU

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

Test Item

Kind of test item:	**Bluetooth LE SoC**
Model name:	**DA1469x**
Frequency:	ISM band 2400 MHz to 2483.5 MHz
Technology tested:	Bluetooth® LE
Antenna:	Integrated printed inverted F antenna
Power supply:	3.0 V DC by external power supply
Temperature range:	-40°C to +85°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:

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Test performed:

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Mihail Dorongovskij
Lab Manager
Radio Communications & EMC

1 Table of contents

2 General information

2.1 Notes and disclaimer

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2.2 Application details

Date of receipt of order:	2018-06-21
Date of receipt of test item:	2018-07-16
Start of test:	2018-07-16
End of test:	2018-07-17
Person(s) present during the test:	Mr. Kai Lewandowski

2.3 Test laboratories sub-contracted

None

3 Test standard/s

Test standard	Date	Description
ETSI EN 300 328 V2.1.1	2016-11	Wideband transmission systems; Data transmission equipment operating in the 2.4 GHz ISM band and using wide band modulation techniques; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU

4 Test environment

Temperature	:	T_{nom} T_{max} T_{min}	+22 °C during room temperature tests +85 °C during high temperature tests -40 °C during low temperature tests
Relative humidity content	:		55 %
Barometric pressure	:		not relevant for this kind of testing
Power supply	:	V_{nom} V_{max} V_{min}	3.0 V DC by external power supply No tests under extreme voltage conditions required. No tests under extreme voltage conditions required.

5 Test item

5.1 General description

Kind of test item	:	Bluetooth LE SoC
Type identification	:	DA1469x
S/N serial number	:	Rad. 1825_000_29 Cond. 1825_000_27
HW hardware status	:	AA
SW software status	:	A8F138
Firmware status		10.0.1.32 and later
Frequency band	:	ISM band 2400 MHz to 2483.5 MHz
Type of radio transmission **Use of frequency spectrum**	: :	Other than FHSS
Type of modulation	:	GFSK
Number of channels	:	40
Channel bandwidth (B)	:	Approx. 1 MHz for 1 Msps Approx. 2.3 MHz for 2 Msps
Channel spacing	:	2 MHz
Receiver category	:	2
Antenna	:	Integrated printed inverted F antenna
Power supply	:	3.0 V DC by external power supply
Temperature range	:	-40°C to +85°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: 1-6662/18-01-01_AnnexB
1-6662/18-01-01_AnnexC

6 Description of the test setup

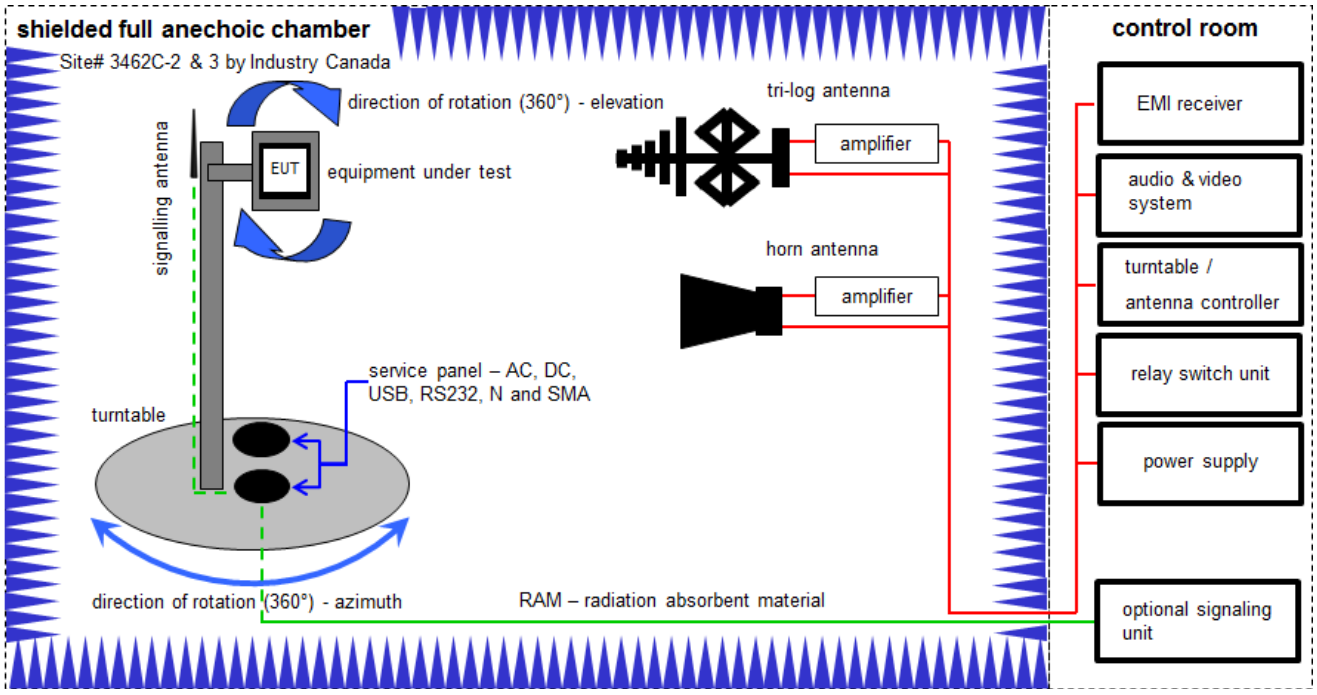
Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements 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
vlkl!	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
BAT-EMC software version: 3.16.0.49

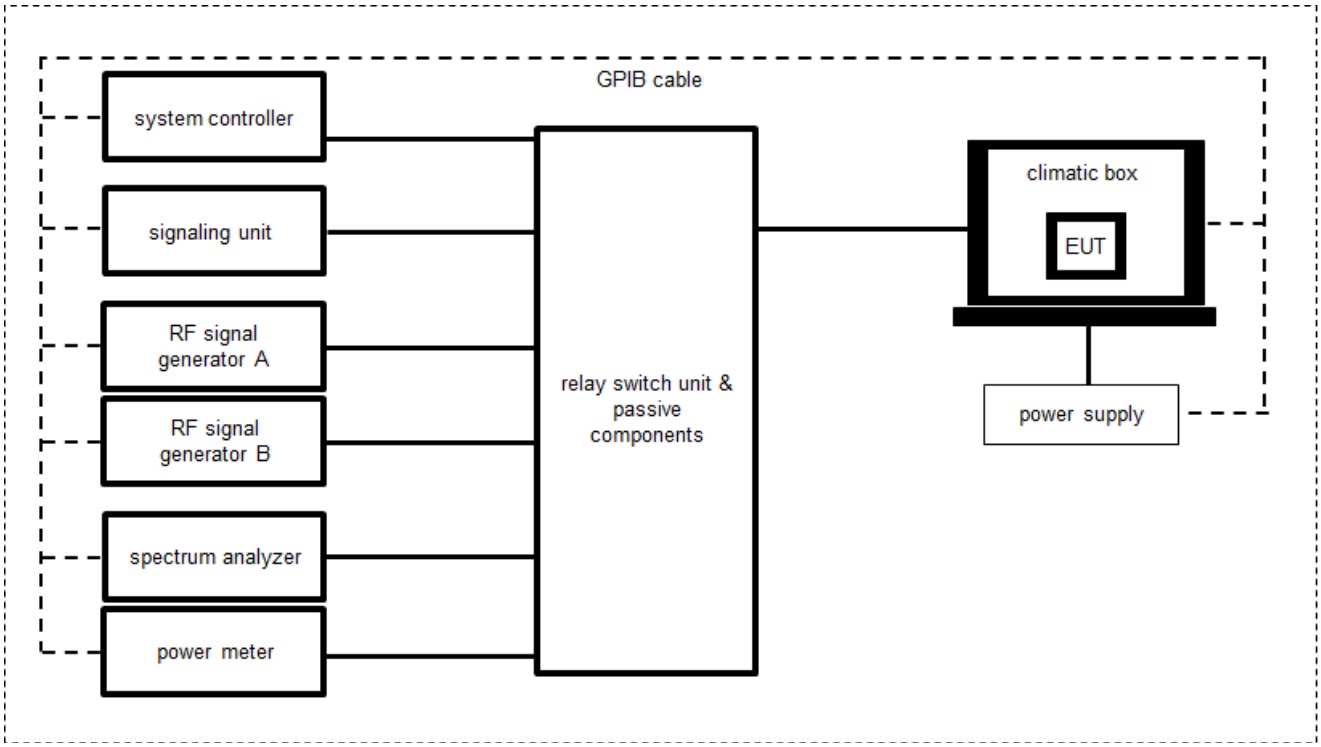
OP = AV + D - G + CA
(OP-radiated output power; AV-analyzer value; D-free field attenuation of measurement distance; G-antenna gain+amplifier gain; CA-loss signal path)

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	A	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	vIKI!	07.07.2017	06.07.2019
2	A	Highpass Filter	WHK1.1/15G-10SS	Wainwright	37	400000148	ne	-/-	-/-
3	A	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	18	300003789	ne	-/-	-/-
4	A	Band Reject Filter	WRCG2400/2483-2375/2505-50/10SS	Wainwright	26	300003792	ne	-/-	-/-
5	A	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck Mess - Elektronik	318	300003696	vIKI!	23.05.2017	22.05.2020
6	A	Broadband Amplifier 0.5-18 GHz	CBLU5184540	CERNEX	22051	300004483	ev	-/-	-/-
7	A	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000032	300004510	ne	-/-	-/-
8	A	Anechoic chamber		TDK		300003726	ne	-/-	-/-
9	A, B	EMI Test Receiver 9kHz-26,5GHz	ESR26	R&S	101376	300005063	k	14.12.2017	13.12.2018
10	A, B	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2818A03450	300001040	vIKI!	12.12.2017	11.12.2020

6.2 Conducted measurements Bluetooth system



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	Climatic Box	VT 4011	Voetsch Industrietechnik	585662306000 10	300005363	ev	01.06.2017	31.05.2019
2	A, C	USB/GPIB interface	82357B	Agilent Technologies	MY52103346	300004390	ne	-/-	-/-
3	A, B, C	PC	Exone	F+W		300004179	ne	-/-	-/-
4	A, B, C	Wireless Connectivity Tester	CMW270	Rohde & Schwarz	100683	300005133	k	03.01.2018	02.01.2020
5	A	Spectrum Analyzer	FSV30	Rohde & Schwarz	103809	300005359	k	04.04.2017	03.04.2019
6	C	Signal Generator	SMB100A	Rohde & Schwarz	180587	300005462	k	01.01.2018	31.12.2019
7	A, B, C	Relay Switch Matrix	RSM-1	CTC	1	400001355	ev	07.02.2018	06.02.2019
8	B	Peak And Average Power Sensor	U2042XA	Keysight	MY58020014	300005547	k	12.02.2018	11.02.2019

7 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	ETSI EN 300 328 V2.1.1 (2016-11)	See table!	2018-07-20	-/-

Test specification clause	Test case	temperature conditions	power source voltages	Mode	C	NC	NA	NP	Remark
5.4.2	RF output power	Nominal	Nominal	1 Msps 2 Msps	☒	☐	☐	☐	-/-
		Low	Nominal	1 Msps 2 Msps	☒	☐	☐	☐	
		High	Nominal	1 Msps 2 Msps	☒	☐	☐	☐	
5.4.2	Duty cycle, Tx-sequence, Tx-gap, medium utilization	Nominal	Nominal	-/-	☐	☐	☒	☐	-/-
5.4.3	Power spectral density	Nominal	Nominal	1 Msps 2 Msps	☒	☐	☐	☐	-/-
5.4.4	Accumulated transmit time, freq. occupation and hopping sequence	Nominal	Nominal	-/-	☐	☐	☒	☐	-/-
5.4.5	Hopping frequency separation	Nominal	Nominal	-/-	☐	☐	☒	☐	-/-
5.4.6	Adaptivity	Nominal	Nominal	-/-	☐	☐	☒	☐	-/-
5.4.7	Occupied channel bandwidth	Nominal	Nominal	1 Msps 2 Msps	☒	☐	☐	☐	-/-
5.4.8	Transmitter unwanted emissions in the out-of-band domain	Nominal	Nominal	1 Msps 2 Msps	☒	☐	☐	☐	-/-
5.4.9	Transmitter unwanted emissions in the spurious domain (cond. + rad.)	Nominal	Nominal	1 Msps 2 Msps	☒	☐	☐	☐	-/-
5.4.10	Receiver spurious emissions (cond. + rad.)	Nominal	Nominal	1 Msps	☒	☐	☐	☐	-/-
5.4.11	Receiver blocking	Nominal	Nominal	1 Msps 2 Msps	☒	☐	☐	☐	-/-

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

8 Additional comments

The Bluetooth® word mark and logos are owned by the Bluetooth SIG Inc. and any use of such marks by CTC advanced GmbH is under license.

Reference documents: Bluetooth® Core Specification 5.0
1-6662_18-01-02_log1_conducted.pdf

Note: 0 dBi antenna gain assumed in log1 conducted tests

Special test descriptions: None

Configuration descriptions:

Bluetooth Low Energy	
Longest Supported payload (37 – 255 Byte)	Tx: 255, RX: 255
LE 1M PHY supported	Yes
LE 2M PHY supported	Yes
Stable Modulation Index supported (SMI)	No
LE Coded PHY supported (S=2)	No
LE Coded PHY supported (S=8)	No

Test mode:

☒ Bluetooth direct test mode enabled
(EUT is controlled via CBT/CMW)

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

9 EUT classification

Type of equipment:

- ☒ stand alone equipment
- ☐ plug in radio equipment
- ☐ combined equipment

Modulation types:

- ☒ Wide band modulation (none hopping – e.g. DSSS, OFDM)
- ☐ Frequency hopping spread spectrum (FHSS)

Adaptive equipment:

- ☐ Yes, LBT-based
- ☒ Yes, non-LBT-based
- ☐ Yes (but can be disabled)
- ☐ No

Antennas and transmission 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 Antenna gain

Measurement:

The antenna gain of the system is calculated by the difference of radiated power in EIRP and the conducted power of the module.

Measurement parameters (radiated)	
Detector	Peak
Sweep time	Auto
Resolution bandwidth	3 MHz
Video bandwidth	3 MHz
Trace mode	Max hold
Additional EUT parameters:	Longest supported packet Pattern: PRBS 9
Test setup	See sub clause 6.1 - B
Measurement uncertainty	See sub clause 11

Measurement parameters (conducted)	
External result file	-/-
Test setup	See sub clause 6.2 - A
Measurement uncertainty	See sub clause 11

Limits:

No restriction!

Results:

	Low channel (2402 MHz)	Mid channel (2440 MHz)	High channel (2480 MHz)
Conducted power [dBm] Measured with GFSK modulation (1 Msps)	5.9	5.6	5.3
Radiated power [dBm] Measured with GFSK modulation (1 Msps)	5.9	5.7	3.6
Gain [dBi] Calculated	0.0	0.1	-1.7

10.2 RF output power

Measurement:

The Output power measurement is used to detect the maximum power of a device under test. The measurement is performed according to the EN specification 5.4.2.

Measurement parameters:

Instrument: Power Meter measuring average burst Power of a least 10 packets

External result file	1-6662_18-01-02_log1_conducted.pdf Chapter EN300328 RF Output Power etc
Test setup	See sub clause 6.2 – B
Measurement uncertainty	See sub clause 11

Performed: ☒ Conducted

☐ Radiated (only if no conducted sample is provided)

Limits:

For adaptive equipment	20 dBm
For non-adaptive equipment	Declared by the supplier and shall not exceed 20 dBm

Results: 1 Msps

Test conditions		Maximum conducted burst power in 10 measured bursts [dBm]		
		low channel	mid channel	high channel
T_{nom}	V_{nom}	5.8	5.6	5.3
T_{min}	V_{nom}	5.2	4.9	4.5
T_{max}	V_{nom}	6.4	6.2	5.8

P = max cond. burst power (A) + antenna gain (G) + beamforming gain (Y)

With:

Beamforming gain (Y) = 0 (SISO)

Result P [dBm] E.I.R.P (Low channel):	6.4 dBm + 0.0 dBi = 6.4 dBm
Result P [dBm] E.I.R.P (Mid channel):	6.2 dBm + 0.1 dBi = 6.3 dBm
Result P [dBm] E.I.R.P (High channel):	5.8 dBm - 1.7 dBi = 4.1 dBm

Results: 2 Msps

Test conditions		Maximum conducted burst power in 10 measured bursts [dBm]		
		low channel	mid channel	high channel
T_{nom}	V_{nom}	5.8	5.6	5.2
T_{min}	V_{nom}	5.2	4.9	4.5
T_{max}	V_{nom}	6.4	6.2	5.8

P = max cond. burst power (A) + antenna gain (G) + beamforming gain (Y)

With:

Beamforming gain (Y) = 0 (SISO)

Result P [dBm] E.I.R.P (Low channel):	6.4 dBm + 0.0 dBi = 6.4 dBm
Result P [dBm] E.I.R.P (Mid channel):	6.2 dBm + 0.1 dBi = 6.3 dBm
Result P [dBm] E.I.R.P (High channel):	5.8 dBm - 1.7 dBi = 4.1 dBm

10.3 Power spectral density

Description:

The power spectral density is the mean equivalent isotropically radiated power (E.I.R.P.) density during a transmission burst.

Measurement parameters	
External result file	1-6662_18-01-02_log1_conducted.pdf Chapter EN300328 Power Spectral Density
Test setup	See sub clause 6.2 - A
Measurement uncertainty	See sub clause 11

Performed: ☒ Conducted

☐ Radiated (only if no conducted sample is provided)

Limits:

Under normal test conditions only (including antenna gain)	-20 dBW / 1 MHz 10 dBm / 1 MHz

Results: 1 Msps

ID	Measurement	Unit	Low channel	Mid channel	High channel
1	P (Tnom) *(from chapter RF Output power)*	dBm E.I.R.P.	5.8	5.5	3.6
2	Psum of all raw points	dBm	4.4	4.2	4.2
3	PSD max uncorrected	dBm/1MHz	4.3	4.2	4.1
4	C-corr = Psum-Peirp (1-2)	dB	1.4	1.3	-0.6
	PSD max corrected (3+4)	dBm/1MHz E.I.R.P.	5.7	5.5	3.5

Results: **2 Msps**

ID	Measurement	Unit	Low channel	Mid channel	High channel
1	P (Tnom) *(from chapter RF Output power)*	dBm E.I.R.P.	5.8	5.5	3.5
2	Psum of all raw points	dBm	2.9	2.8	2.8
3	PSD max uncorrected	dBm/1MHz	1.7	1.6	1.6
4	C-corr = Psum-Peirp (1-2)	dB	1.9	1.7	0.7
	PSD max corrected (3+4)	dBm/1MHz E.I.R.P.	3.6	3.3	2.3

10.4 Occupied channel bandwidth

Measurement:

The occupied channel bandwidth is the bandwidth that contains 99 % of the power of the signal.

Measurement parameters	
External result file	1-6662_18-01-02_log1_conducted.pdf Chapter EN300328 Occupied Channel Bandwidth
Test setup	See sub clause 6.2 - A
Measurement uncertainty	See sub clause 11

Performed: ☒ Conducted

☐ Radiated (only if no conducted sample is provided)

Limits:

The occupied channel bandwidth shall fall completely within the band. For non-adaptive systems using wide band modulations other than FHSS and with e.i.r.p greater than 10 dBm, the occupied channel bandwidth shall be less than 20 MHz.

Results:

99% bandwidth [kHz]		
	Low channel	High channel
1 Msps	1031	1033
2 Msps	2073	2073

10.5 Transmitter unwanted emissions in the out-of-band domain

Description:

Transmitter unwanted emissions in the out-of-band domain are emissions when the equipment is in transmit mode, on frequencies immediately outside the necessary bandwidth which results from the modulation process, but excluding spurious.

Measurement parameters	
External result file	1-6662_18-01-02_log1_conducted.pdf Chapter EN300328 TX Unwanted Emissions In The OOB Domain
Test setup	See sub clause 6.2 - A
Measurement uncertainty	See sub clause 11

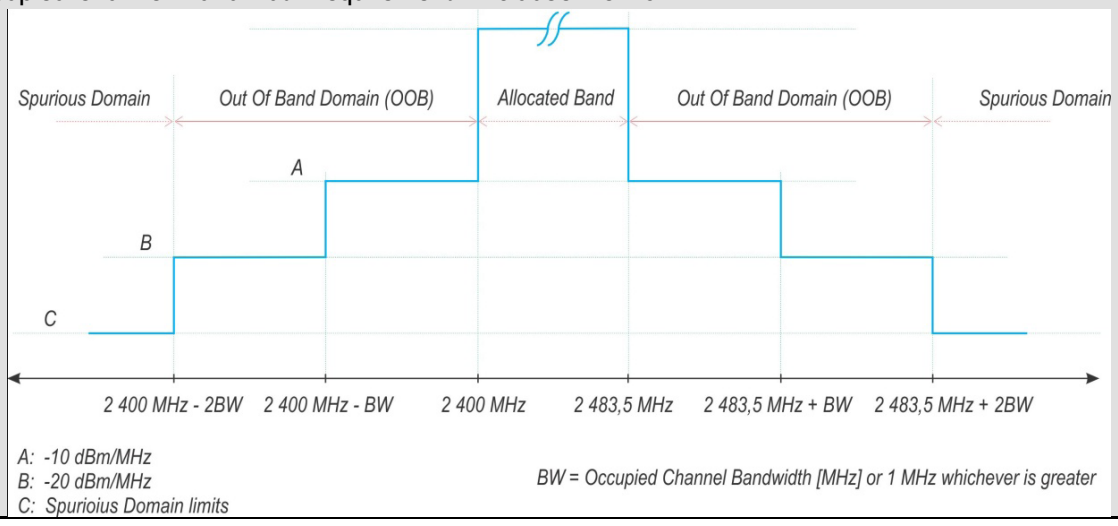
Performed: ☒ Conducted

☐ Radiated (only if no conducted sample is provided)

Limits:

The transmitter unwanted emissions in the out-of-band domain but outside the allocated band, shall not exceed the values provided by the mask.

NOTE: Within the 2400 MHz to 2483.5 MHz band, the Out-of-band emissions are fulfilled by compliance with the Occupied Channel Bandwidth requirement in clause 4.3.2.6.



Results

Unwanted emissions [dBm] (including antenna gain)	
1 Msps, channel BW see plots	
2400 MHz - 2BW to 2400 MHz – BW Limit:< -20dBm/MHz	compliant
2400 MHz - BW to 2400 MHz Limit:< -10dBm/MHz	compliant
2483.5 MHz to 2483.5 MHz + BW Limit:< -10dBm/MHz	compliant
2483.5 MHz + BW to 2483.5 MHz + 2BW Limit:< -20dBm/MHz	compliant

Unwanted emissions [dBm] (including antenna gain)	
2 Msps, channel BW see plots	
2400 MHz - 2BW to 2400 MHz – BW Limit:< -20dBm/MHz	compliant
2400 MHz - BW to 2400 MHz Limit:< -10dBm/MHz	compliant
2483.5 MHz to 2483.5 MHz + BW Limit:< -10dBm/MHz	compliant
2483.5 MHz + BW to 2483.5 MHz + 2BW Limit:< -20dBm/MHz	compliant

10.6 Transmitter unwanted emissions in the spurious domain

Description:

Transmitter unwanted emissions in the spurious domain are emissions outside the allocated band and outside the out-of-band domain when the equipment is in transmit mode.

Pre-scan:

Measurement parameters (radiated)	
Detector	Peak
Sweep time	1s
Resolution bandwidth	Below 1 GHz: 100 kHz / above 1MHz
Video bandwidth	Below 1 GHz: 300 kHz / above 3MHz
Detector	Peak
Test setup	See sub clause 6.1 - A
Measurement uncertainty	See sub clause 11

Measurement parameters (conducted)	
External result file	1-6662_18-01-02_log1_conducted.pdf EN300328 Unwanted Emissions in spurious domain
Test setup	See sub clause 6.2 - A
Measurement uncertainty	See sub clause 11

Any emissions identified during the sweeps in the pre-scan and that fall within the 6 dB range below the applicable limit, shall be individually measured using the procedure "retest".

Retest:

Measurement parameters (radiated)	
Detector	RMS
Measurement mode	Time domain power
Sweep time	30 ms
Resolution bandwidth	Below 1 GHz: 100 kHz / above 1MHz
Video bandwidth	Below 1 GHz: 300 kHz / above 3MHz
Span	Zero span
Trace mode	Single sweep
Test setup	See sub clause 6.1 - A
Measurement uncertainty	See sub clause 11

Measurement parameters (conducted)	
External result file	1-6662_18-01-02_log1_conducted.pdf EN300328 Unwanted Emissions in spurious domain
Test setup	See sub clause 6.2 - A
Measurement uncertainty	See sub clause 11

Performed: ☒ Conducted
☒ Radiated

Limits:

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 (-54 dBm)	250 nW (-36 dBm)	1.00 µW (-30 dBm)
Receiver / Idle	2.0 nW (-57 dBm)	2.0 nW (-57 dBm)	20.0 nW (-47 dBm)

Results: conducted, 1 Msps

Low channel			High channel		
f [MHz]	Detector Peak/RMS	Level [dBm]	f [MHz]	Detector Peak/RMS	Level [dBm]
All detected peaks are more than 6 dB below the limit			All detected peaks are more than 6 dB below the limit		

Results: conducted, 2 Msps

Low channel			High channel		
f [MHz]	Detector Peak/RMS	Level [dBm]	f [MHz]	Detector Peak/RMS	Level [dBm]
All detected peaks are more than 6 dB below the limit			All detected peaks are more than 6 dB below the limit		

Results: radiated, 1 Msps

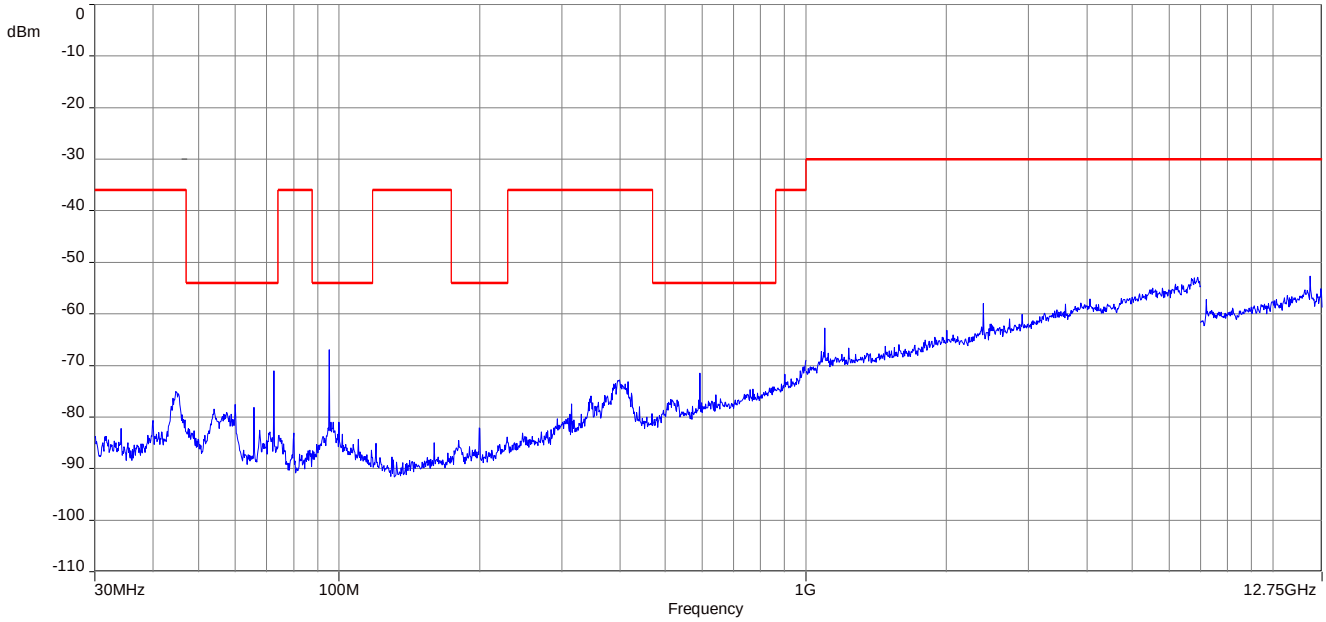
Low channel			High channel		
f [MHz]	Detector Peak/RMS	Level [dBm]	f [MHz]	Detector Peak/RMS	Level [dBm]
All detected peaks are more than 6 dB below the limit			All detected peaks are more than 6 dB below the limit		

Results: radiated, 2 Msps

Low channel			High channel		
f [MHz]	Detector Peak/RMS	Level [dBm]	f [MHz]	Detector Peak/RMS	Level [dBm]
All detected peaks are more than 6 dB below the limit			All detected peaks are more than 6 dB below the limit		

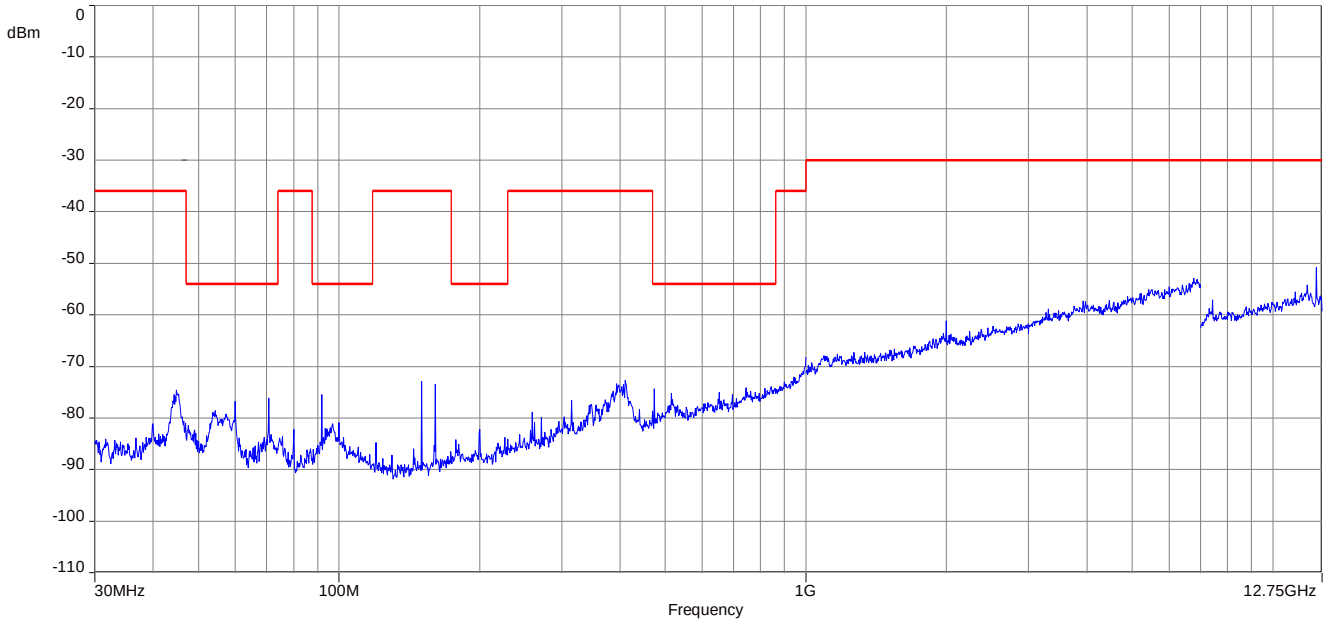
Plots: Radiated

Plot 1: 30 MHz to 12.75 GHz, Low channel, 1 Msps



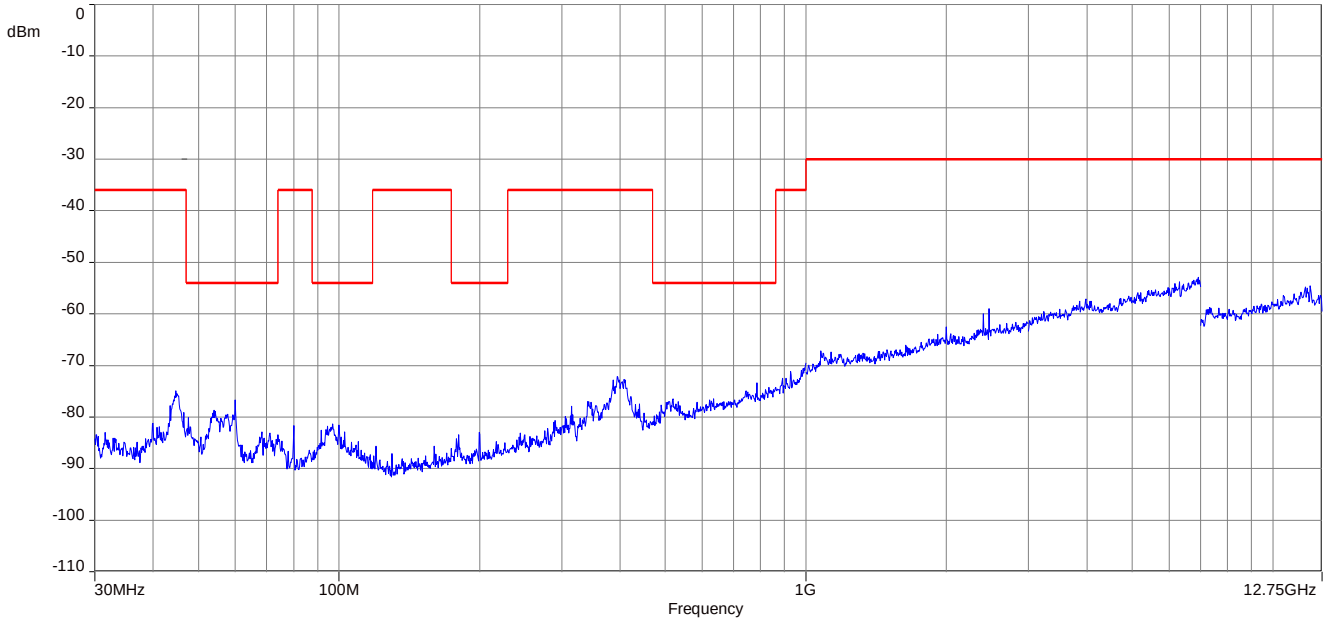
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 2: 30 MHz to 12.75 GHz, High channel, 1 Msps



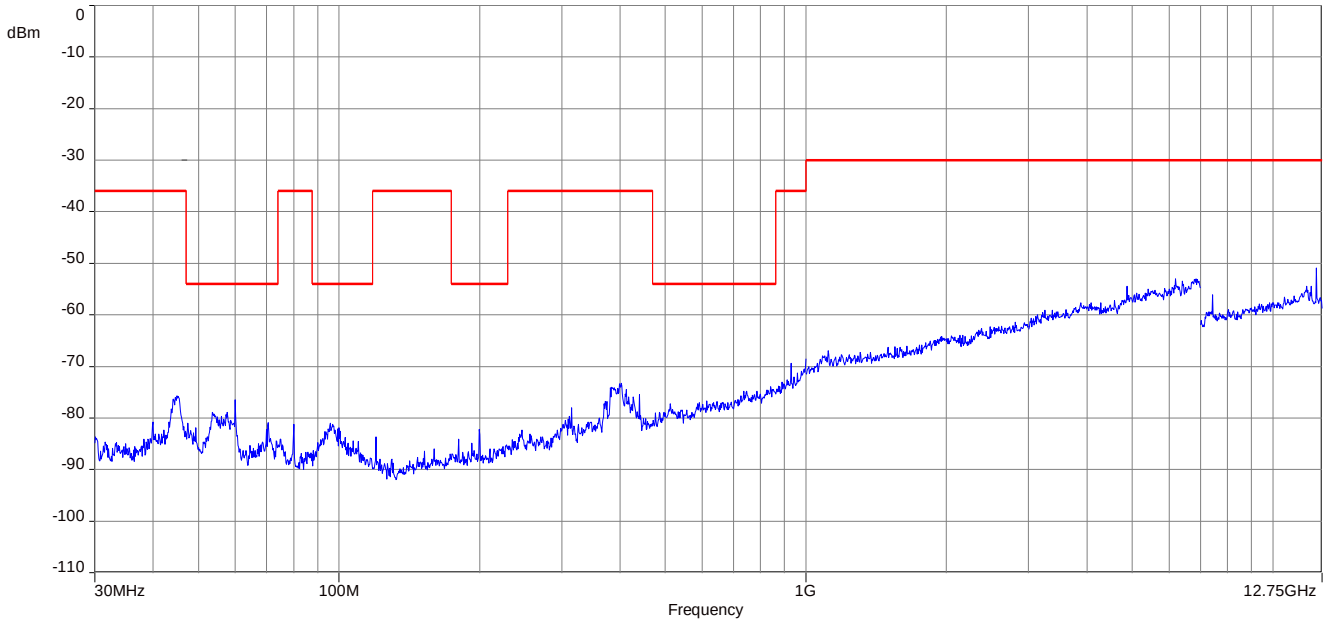
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 3: 30 MHz to 12.75 GHz, Low channel, 2 Msps



The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 4: 30 MHz to 12.75 GHz, High channel, 2 Msps



The carrier signal is notched with a 2.4 GHz band rejection filter.

10.7 Receiver spurious emissions

Description:

Receiver/idle unwanted emissions in the spurious domain are emissions outside the allocated band and outside the out-of-band domain when the equipment is in receiver/idle mode.

Pre-scan:

Measurement parameters (radiated)	
Detector	Peak
Sweep time	1s
Resolution bandwidth	Below 1 GHz: 100 kHz / above 1MHz
Video bandwidth	Below 1 GHz: 300 kHz / above 3MHz
Detector	Peak
Test setup	See sub clause 6.1 - A
Measurement uncertainty	See sub clause 11
Measurement parameters (conducted)	
External result file	1-6662_18-01-02_log1_conducted.pdf EN300328 Unwanted Emissions in spurious domain RX
Test setup	See sub clause 6.2 - A
Measurement uncertainty	See sub clause 11

Any emissions identified during the sweeps in the pre-scan and that fall within the 6 dB range below the applicable limit, shall be individually measured using the procedure "retest".

Retest:

Measurement parameters (radiated)	
Detector	RMS
Measurement mode	Time domain power
Sweep time	30 ms
Resolution bandwidth	Below 1 GHz: 100 kHz / above 1MHz
Video bandwidth	Below 1 GHz: 300 kHz / above 3MHz
Span	Zero span
Trace mode	Single sweep
Test setup	See sub clause 6.1 - A
Measurement uncertainty	See sub clause 11
Measurement parameters (conducted)	
External result file	1-6662_18-01-02_log1_conducted.pdf EN300328 Unwanted Emissions in spurious domain RX
Test setup	See sub clause 6.2 - A
Measurement uncertainty	See sub clause 11

Performed: ☒ Conducted
☒ Radiated

Limits:

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 (-54 dBm)	250 nW (-36 dBm)	1.00 µW (-30 dBm)
Receiver/idle	2.0 nW (-57 dBm)	2.0 nW (-57 dBm)	20.0 nW (-47 dBm)

Results: conducted, 1 Msps

Low channel			High channel		
f [MHz]	Detector Peak/RMS	Level [dBm]	f [MHz]	Detector Peak/RMS	Level [dBm]
All detected peaks are more than 6 dB below the limit			All detected peaks are more than 6 dB below the limit		

Results: conducted, 2 Msps

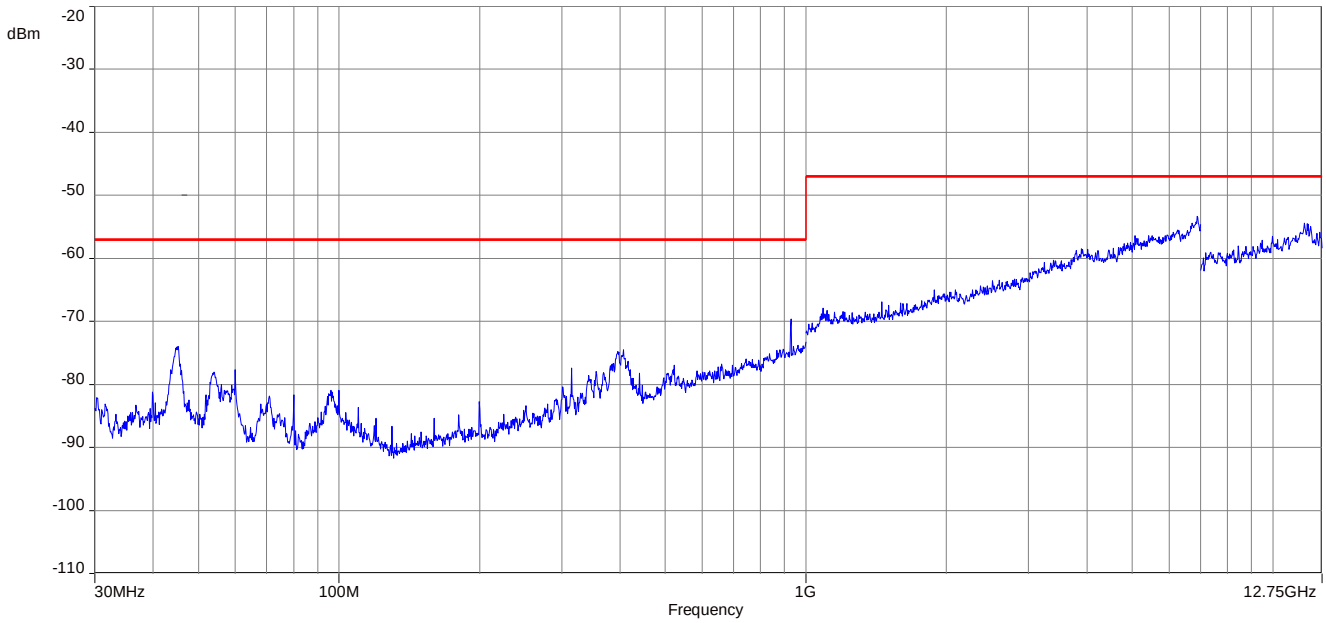
Low channel			High channel		
f [MHz]	Detector Peak/RMS	Level [dBm]	f [MHz]	Detector Peak/RMS	Level [dBm]
All detected peaks are more than 6 dB below the limit			All detected peaks are more than 6 dB below the limit		

Results: radiated, 1 Msps

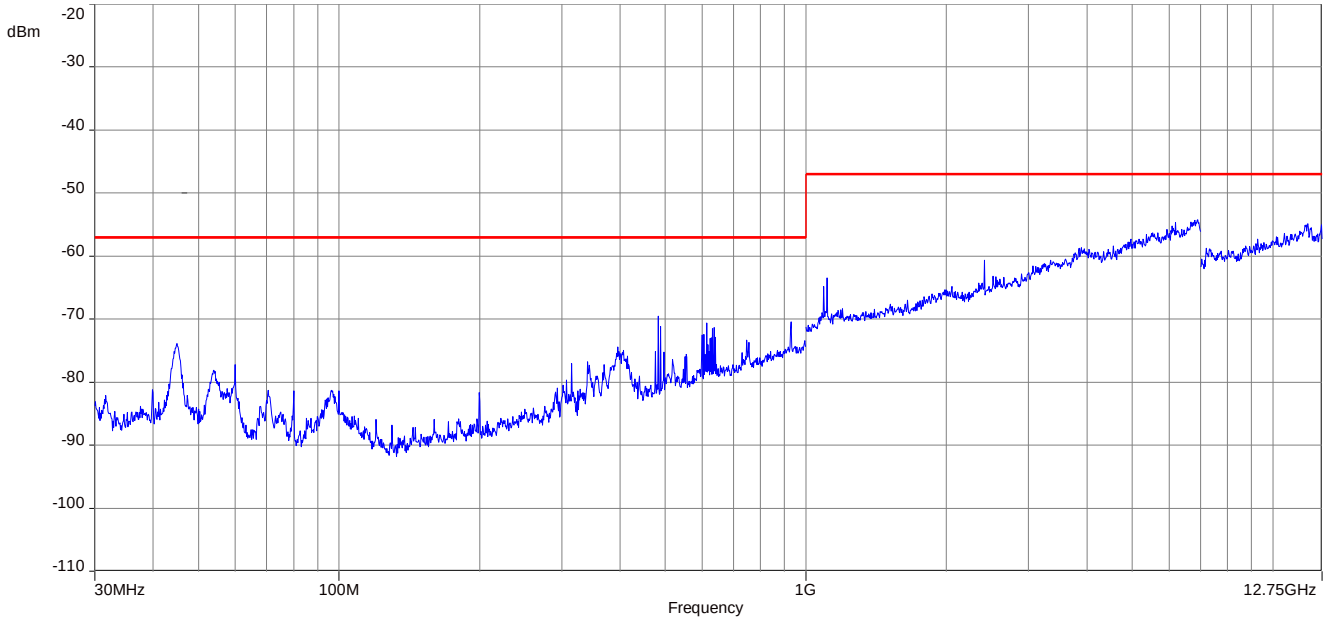
Low channel			High channel		
f [MHz]	Detector Peak/RMS	Level [dBm]	f [MHz]	Detector Peak/RMS	Level [dBm]
All detected peaks are more than 6 dB below the limit			All detected peaks are more than 6 dB below the limit		

Plots: Radiated

Plot 1: Receiver, 30 MHz to 12.75 GHz, Low channel, 1 Msps



Plot 2: Receiver, 30 MHz to 12.75 GHz, High channel, 1 Msps



10.8 Receiver blocking

Description:

Receiver blocking is a measure of the ability of the equipment to receive a wanted signal on its operating channel without exceeding a given degradation in the presence of an unwanted signal (blocking signal) on frequencies other than those of the operating band.

The CBT is used as the signaling unit. Starting at a typical high signaling level (e.g. -70.0 dBm) the CMW is sending packets to the EUT. The PER is logged and the signaling level gets reduced in 1 dB steps until the PER is higher than 10%. This is the Pmin value which is used as described in tables 1-3 depending on the receiver category of the EUT.

Measurement parameters	
External result file	1-6662_18-01-02_log1_conducted.pdf Chapter EN300328 RX Receiver Blocking
Test setup	See sub clause 6.2 – C
Measurement uncertainty	See sub clause 11

Performed: ☒ Conducted

☐ Radiated

Table 1: Receiver blocking parameters for receiver category 1 equipment:

Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 2)	Type of blocking signal
P_{min} + 6 dB	2 380.0 2 503.5	-53	CW
P_{min} + 6 dB	2 300.0 2 330.0 2 360.0	-47	CW
P_{min} + 6 dB	2 523.5 2 553.5 2 583.5 2 613.5 2 643.5 2 673.5	-47	CW
NOTE 1:	P_{min} is the minimum level of wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.		
NOTE 2:	The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.		

Table 2: Receiver blocking parameters for receiver category 2 equipment:

Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 2)	Type of blocking signal
P_{min} + 6 dB	2 380.0 2 503.5	-57	CW
P_{min} + 6 dB	2 300.0 2 583.5	-47	CW
NOTE 1:	P_{min} is the minimum level of wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.		
NOTE 2:	The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.		

Table 3: Receiver blocking parameters for receiver category 3 equipment:

Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 2)	Type of blocking signal
P_{min} + 12 dB	2 380.0 2 503.5	-57	CW
P_{min} + 12 dB	2 300.0 2 583.5	-47	CW
NOTE 1:	P_{min} is the minimum level of wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.		
NOTE 2:	The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.		

Limits:

	Channel	
	Low channel	High channel
Packet error rate limit	10% PER*	

*The manufacturer may declare alternative performance criteria as long as that is appropriate for the intended use of the equipment

Result: Compliant (See log file for details)

11 Measurement uncertainty

Measurement uncertainty	
Occupied channel bandwidth	±5 %
RF output power, conducted	±1.5 dB
Power spectral density, conducted	±3 dB
Unwanted emissions, conducted	±3 dB
All emissions, radiated	±3 dB
Temperature	±1 °C
Humidity	±5 %
DC and low frequency voltages	±3 %
Time	±5 %
Duty cycle	±5 %

Annex A 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

Annex B Document history

Version	Applied changes	Date of release
-/-	Initial release	2018-07-20

Annex C Accreditation Certificate

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-12076-01-03e.pdf

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