
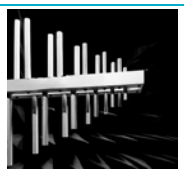
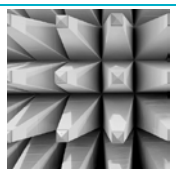

CTC advanced
member of RWTÜV group

TEST REPORT

Test report no.: 1-3925/22-01-02

DAkkS Deutsche Akkreditierungsstelle D-PL-12076-01-03

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: https://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 with the registration number: D-PL-12076-01-03

Applicant

Dialog Semiconductor BV
Het Zuiderkruis 53
5215 MV°s Hertogenbosch / NETHERLANDS
Phone: -/-
Contact: Laura Dimitropoulou
e-mail: Laura.Dimitropoulou@diasemi.com

Manufacturer

Dialog Semiconductor BV
Het Zuiderkruis 53
5215 MV°s Hertogenbosch / NETHERLANDS

Test standard/s

ETSI EN 300 328 V2.2.2	Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz band; Harmonised Standard for access to radio spectrum

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:	**DA1470x (DA14701, DA14705, DA14706, DA14708)**
Frequency:	2400 MHz to 2483.5 MHz
Technology tested:	Bluetooth® LE
Antenna:	Integrated 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:

cn=Joerg Warken, o=CTC advanced GmbH, ou=WAK-211130, email=joerg.warken@ctcadvanced.com, c=DE
2022.03.01 09:58:58 +01'00'

Joerg Warken
Lab Manager
Radio Communications

Test performed:

cn=Michael Dorongovski, o=CTC advanced GmbH, ou=DOR-210422, email=Michael.Dorongovski@ctcadvanced.com, c=DE
2022.03.01 09:02:38 +01'00'

Michael Dorongovski
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.
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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:	2022-02-08
Date of receipt of test item:	2022-02-10
Start of test:*	2022-02-10
End of test:*	2022-02-16
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

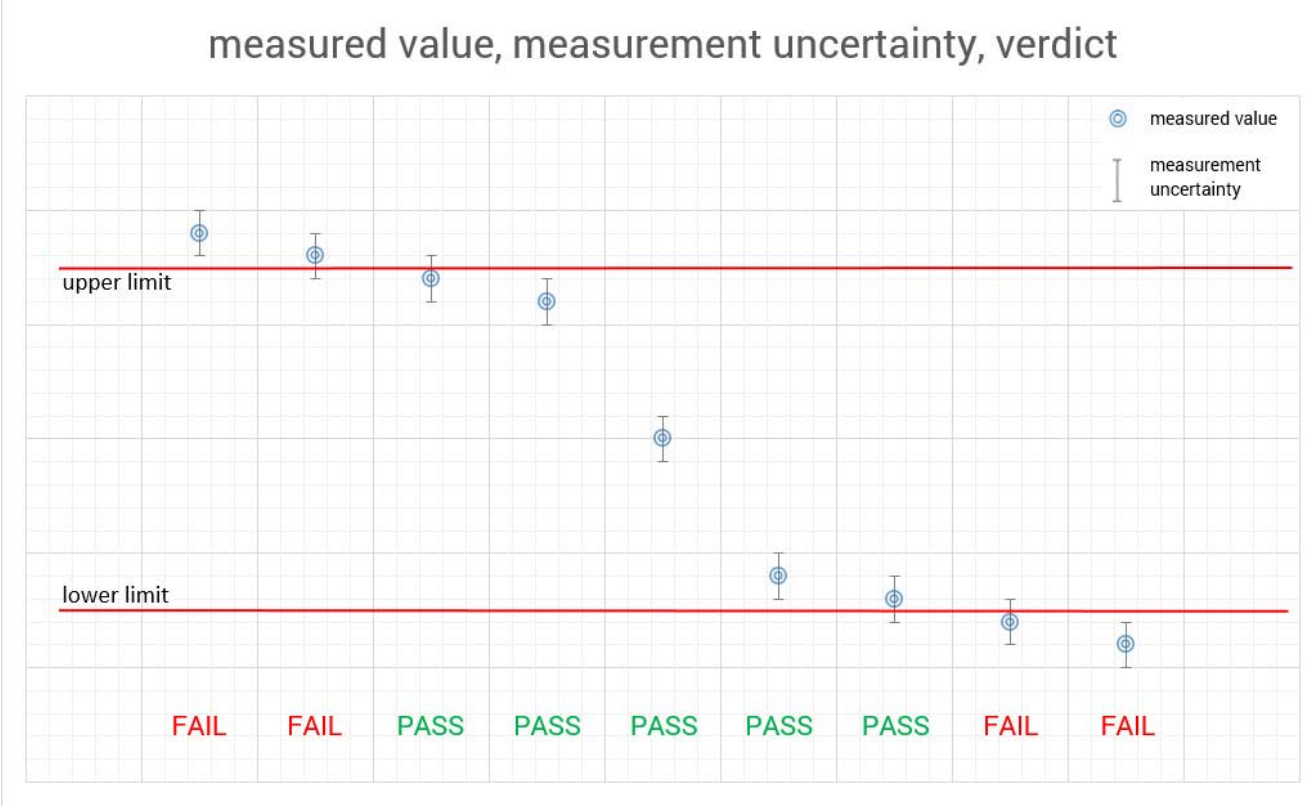
None

3 Test standard/s

Test standard	Date	Description
ETSI EN 300 328 V2.2.2	2019-07	Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz band; Harmonised Standard for access to radio spectrum

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 12, 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}	+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.

6 Test item

6.1 General description

Kind of test item	:	Bluetooth LE SoC
Model name:	:	DA1470x (DA14701, DA14705, DA14706, DA14708)
S/N serial number	:	2045 00019
Hardware status	:	500-06-B
Software status	:	SDK10.2.2.35
Firmware status	:	-/-
Frequency 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 (1 Msps) 37 (2 Msps, only data channels without advertising channels)
Channel bandwidth (B)	:	1 MHz
Channel spacing	:	2 MHz
Receiver category	:	2
Antenna	:	Integrated antenna
Power supply	:	3.0 V DC by external power supply
Temperature range	:	-40°C to +85°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: 1-3925/22-01-01_AnnexA
1-3925/22-01-01_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).

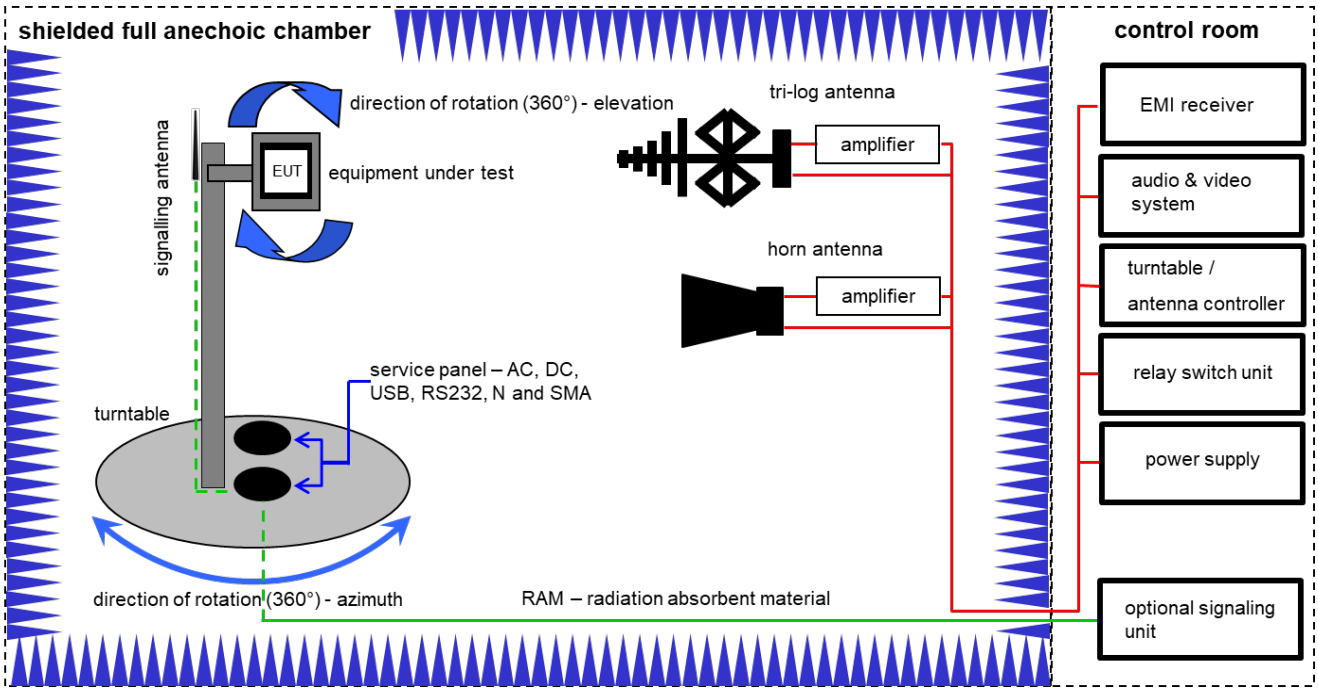
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

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
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

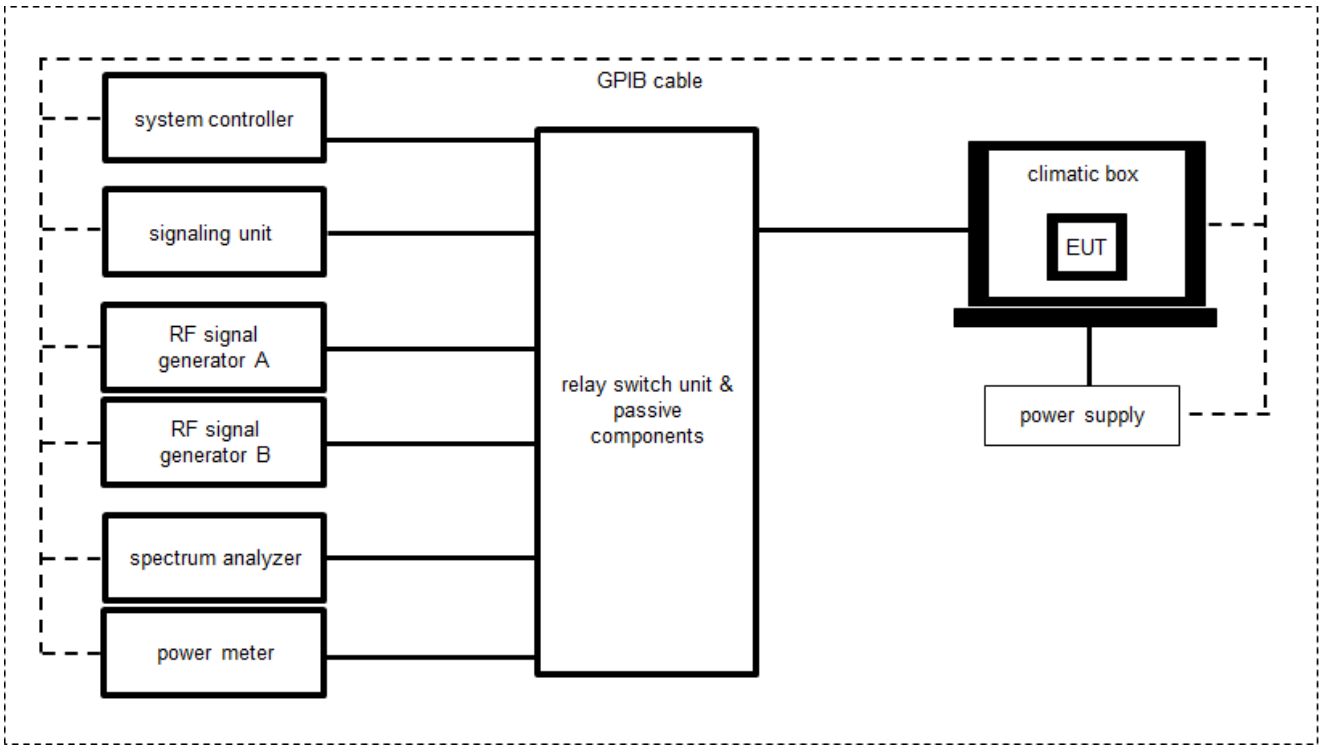
OP = AV + D - G + CA
(OP-radiated output power; AV-analyzer value; D-free field attenuation of measurement distance; G-antenna gain+amplifier gain; CA-loss signal path)

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

Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A, B	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2818A03450	300001040	vlKl!	09.12.2020	08.12.2023
2	A, B	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
3	A, B	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	9107-3697	300001605	vlKl!	12.03.2021	11.03.2023
4	A, B	Switch / Control Unit	3488A	HP	*	300000199	ne	-/-	-/-
5	B	Band Reject filter	WRCG2400/2483-2375/2505-50/10SS	Wainwright	11	300003351	ev	-/-	-/-
6	A, B	EMI Test Receiver 20Hz- 26,5GHz	ESU26	R&S	100037	300003555	k	09.12.2021	08.12.2022
7	A, B	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck Mess - Elektronik	371	300003854	vlKl!	14.01.2020	30.01.2022
8	A, B	High Pass Filter	VHF-3500+	Mini Circuits	-/-	400000193	ne	-/-	-/-
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 V3.21.0.27	EMCO	-/-	300004682	ne	-/-	-/-
12	A, B	RF-Amplifier	AMF-6F06001800-30-10P-R	NARDA-MITEQ Inc	2011572	300005241	ev	-/-	-/-

7.2 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.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A, B, C	Hygro-Thermometer	-/-, 5-45°C, 20-100%rF	Thies Clima	-/-	400000109	ev	13.08.2020	12.08.2022
2	A, B, C	Power supply	NGSM 32/10	Rohde & Schwarz	3939	400000192	vIKI!	11.12.2019	10.12.2022
3	A, B, C	USB/GPIB interface	82357B	Agilent Technologies	MY52103346	300004390	ne	-/-	-/-
4	A, B, C	PC Laboratory	Exone	Fröhlich + Walter	S2642279-03 / 10	300004179	ne	-/-	-/-
5	A	Signal analyzer	FSV30	Rohde&Schwarz	1321.3008K30/ 103809	300005359	vIKI!	08.12.2020	07.12.2022
6	A, B, C	Tester Software RadioStar (C.BER2 for BT Conformance)	Version 1.0.0.X	CTC advanced GmbH	0001	400001380	ne	-/-	-/-
7	B	Power Sensor	L2061XA	Keysight	MY58000020	300005803	k	14.12.2021	13.12.2022
8	A, B, C	Wideband Radio Communication Tester	CMW270	Rohde & Schwarz	102550	300006253	k	17.09.2021	16.09.2023
9	C	Signal Generator	SMB100A	Rohde & Schwarz	180587	300005462	vIKI!	22.10.2020	21.10.2023
10	B	Temperature Test Chamber	VT 4002	Heraeus Voetsch	585660468200 10	300003019	ev	08.05.2020	07.05.2022

8 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 V2.2.2 (2019-07)			See table		2022-03-01			-/-
Test specification clause	**Test case**	**temperature conditions**	**power source voltages**	**Mode**	**C**	**NC**	**NA**	**NP**	**Remark**
4.3.2.2 5.4.2	RF output power	Nominal	Nominal	1 Msps 2 Msps	☒	☐	☐	☐	-/-
		Low	Nominal	1 Msps 2 Msps	☒	☐	☐	☐	
		High	Nominal	1 Msps 2 Msps	☒	☐	☐	☐	
4.3.2.3 5.4.2	Power spectral density	Nominal	Nominal	1 Msps 2 Msps	☒	☐	☐	☐	-/-
4.3.2.4, 4.3.2.5 5.4.3	Duty cycle, Tx-sequence, Tx-gap, medium utilization	Nominal	Nominal	-/-	☐	☐	☒	☐	-/-
5.4.4	Accumulated transmit time, freq. occupation and hopping sequence	Nominal	Nominal	-/-	☐	☐	☒	☐	-/-
5.4.5	Hopping frequency separation	Nominal	Nominal	-/-	☐	☐	☒	☐	-/-
4.3.2.6 5.4.6	Adaptivity	Nominal	Nominal	-/-	☐	☐	☒	☐	-/-
4.3.2.7 5.4.7	Occupied channel bandwidth	Nominal	Nominal	1 Msps 2 Msps	☒	☐	☐	☐	-/-
4.3.2.8 5.4.8	Transmitter unwanted emissions in the out-of-band domain	Nominal	Nominal	1 Msps 2 Msps	☒	☐	☐	☐	-/-
4.3.2.9 5.4.9	Transmitter unwanted emissions in the spurious domain (cond. + rad.)	Nominal	Nominal	1 Msps 2 Msps	☒	☐	☐	☐	-/-
4.3.2.10 5.4.10	Receiver spurious emissions (cond. + rad.)	Nominal	Nominal	1 Msps	☒	☐	☐	☐	-/-
4.3.2.11 5.4.11	Receiver blocking	Nominal	Nominal	1 Msps 2 Msps	☒	☐	☐	☐	-/-
4.3.2.12	Geo-location	Nominal	Nominal	-/-	☐	☐	☒	☐	-/-

C	Compliant	NC	Not compliant
NA	Not applicable	NP	Not performed

9 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 5.1
1-3925_22-01-02_Annex_MR_A1.pdf

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

EUT selection:

☐ Only one device available

☐ Devices selected by the customer

☒ Devices selected by the laboratory (Randomly)

10 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.

11 Measurement results

11.1 Antenna gain

Limits:

No restriction!

Results:

	Low channel (2402 MHz)	Mid channel (2440 MHz)	High channel (2480 MHz)
Gain [dBi] Declared	2.5		

11.2 RF output power

Measurement parameters	
External result file	1-3925_22-01-02_Annex_MR_A1.pdf Chapter EN300328 RF Output Power and PSD + Chapter EN 300328 RF Output Power
Test setup	See sub clause 7.2 - B
Measurement uncertainty	See sub clause 12

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 burst power in 10 measured bursts [dBm] E.I.R.P.		
		low channel	mid channel	high channel
T_{nom}	V_{nom}	7.7	7.3	7.7
T_{min}	V_{nom}	9.8	9.0	7.7
T_{max}	V_{nom}	7.9	7.8	7.2

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

Results: 2 Msps

Test conditions		Maximum burst power in 10 measured bursts [dBm] E.I.R.P.		
		low channel	mid channel	high channel
T_{nom}	V_{nom}	7.7	7.3	7.8
T_{min}	V_{nom}	9.8	9.0	7.8
T_{max}	V_{nom}	7.9	7.7	7.2

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

With:

Beamforming gain (Y) = 0 (SISO)

11.3 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	1-3925_22-01-02_Annex_MR_A1.pdf Chapter EN300328 RF Output Power and PSD
Test setup	See sub clause 7.2 - A
Measurement uncertainty	See sub clause 12

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
	PSD max corrected (3+4)	dBm/1MHz E.I.R.P.	7.6	7.2	7.6

Results: 2 Msps

ID	Measurement	Unit	Low channel	Mid channel	High channel
	PSD max corrected (3+4)	dBm/1MHz E.I.R.P.	6.4	6.0	6.6

11.4 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	1-3925_22-01-02_Annex_MR_A1.pdf Chapter EN300328 Occupied Channel Bandwidth
Test setup	See sub clause 7.2 - A
Measurement uncertainty	See sub clause 12

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	1059	1065
2 Msps	2137	2132

11.5 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	1-3925_22-01-02_Annex_MR_A1.pdf Chapter EN300328 TX Unwanted Emissions In The OOB Domain
Test setup	See sub clause 7.2 - A
Measurement uncertainty	See sub clause 12

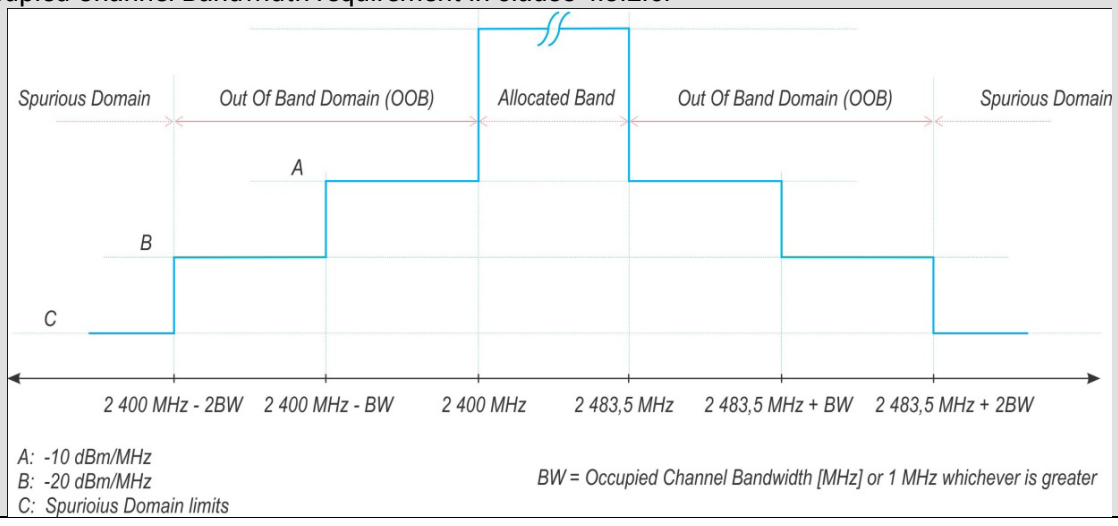
Performed: ☒ Conducted

☐ 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

11.6 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	5ms/MHz
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 7.1 - B
Measurement uncertainty	See sub clause 12
Measurement parameters (conducted)	
External result file	1-3925_22-01-02_Annex_MR_A1.pdf EN300328 Unwanted Emissions in spurious domain
Test setup	See sub clause 7.2 - A
Measurement uncertainty	See sub clause 12

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 7.1 - B
Measurement uncertainty	See sub clause 12
Measurement parameters (conducted)	
External result file	1-3925_22-01-02_Annex_MR_A1.pdf EN300328 Unwanted Emissions in spurious domain
Test setup	See sub clause 7.2 - A
Measurement uncertainty	See sub clause 12

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 694 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]
See log file			See log file		

Results: conducted, 2 Msps

Low channel			High channel		
f [MHz]	Detector Peak/RMS	Level [dBm]	f [MHz]	Detector Peak/RMS	Level [dBm]
See log file			See log file		

Results: radiated, 1 Msps

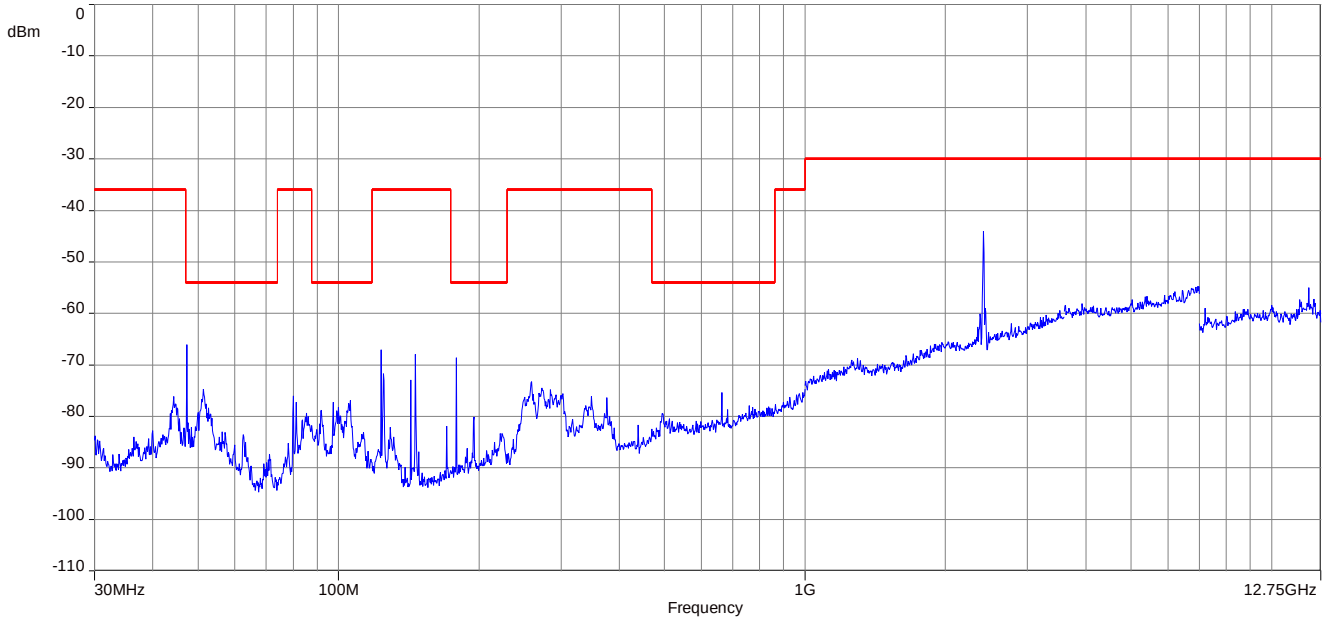
Low channel			High channel		
f [MHz]	Detector Peak/RMS	Level [dBm]	f [MHz]	Detector Peak/RMS	Level [dBm]
All detected peaks are more than 6 dB below the limit			All detected peaks are more than 6 dB below the limit		

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		

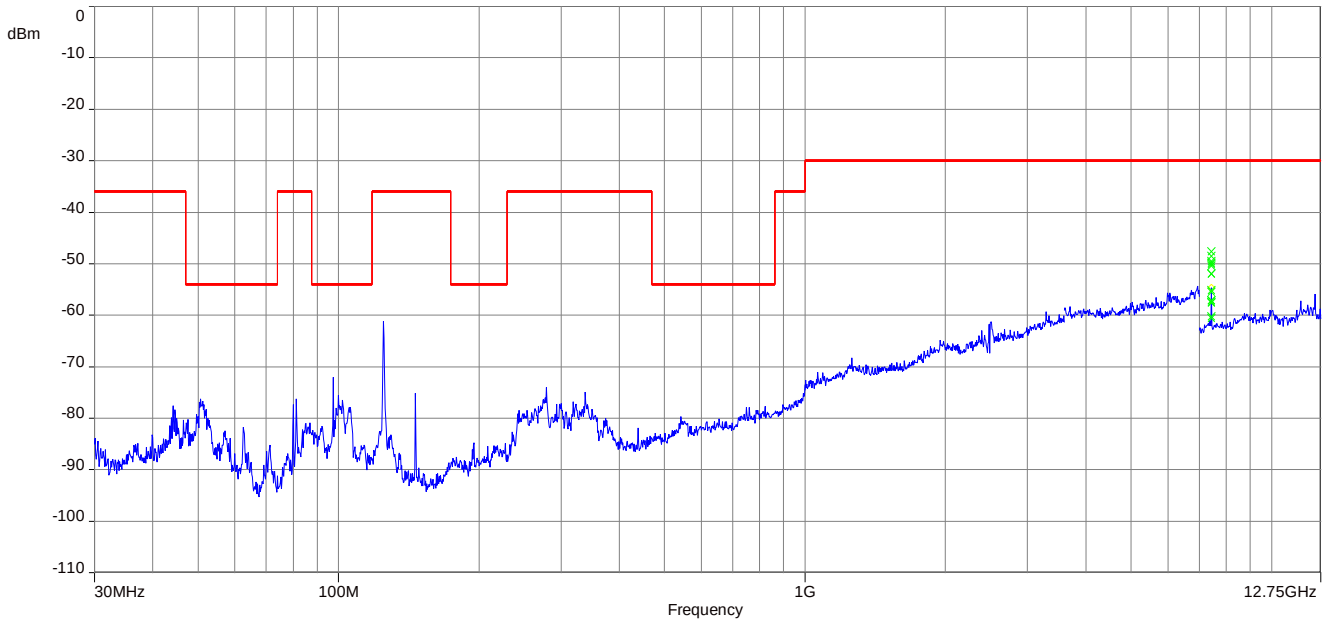
Plots: Radiated

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



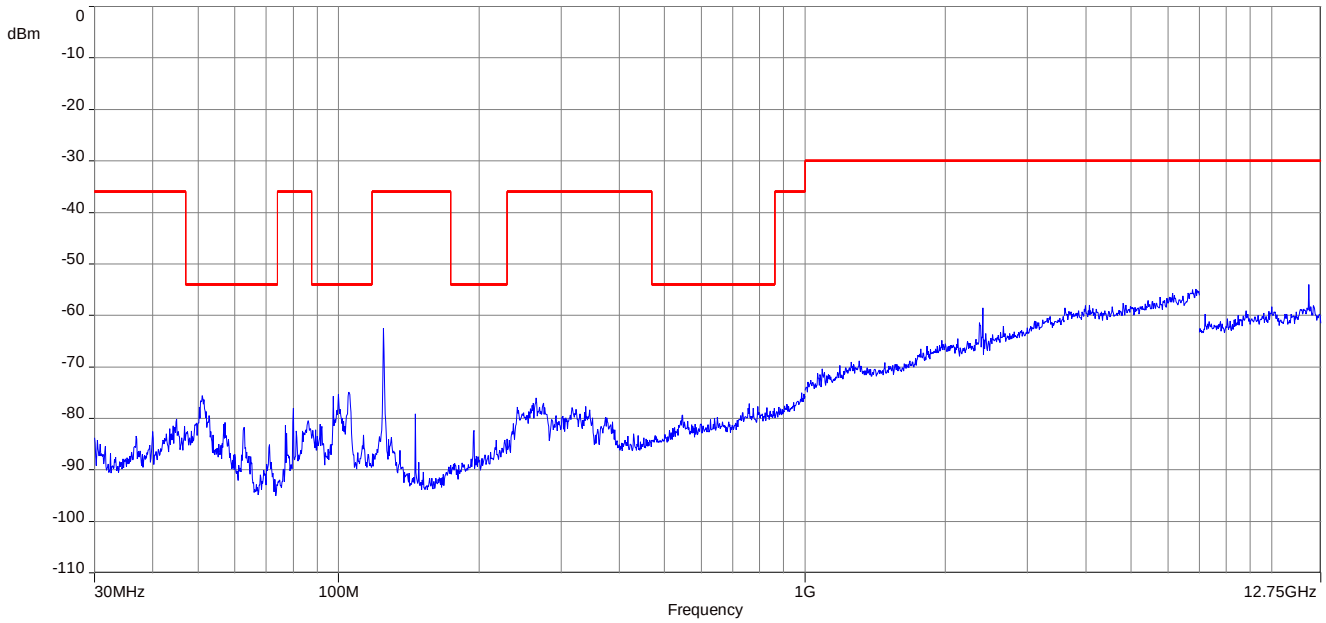
The carrier signal is notched with a 2.4 GHz band rejection filter.

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



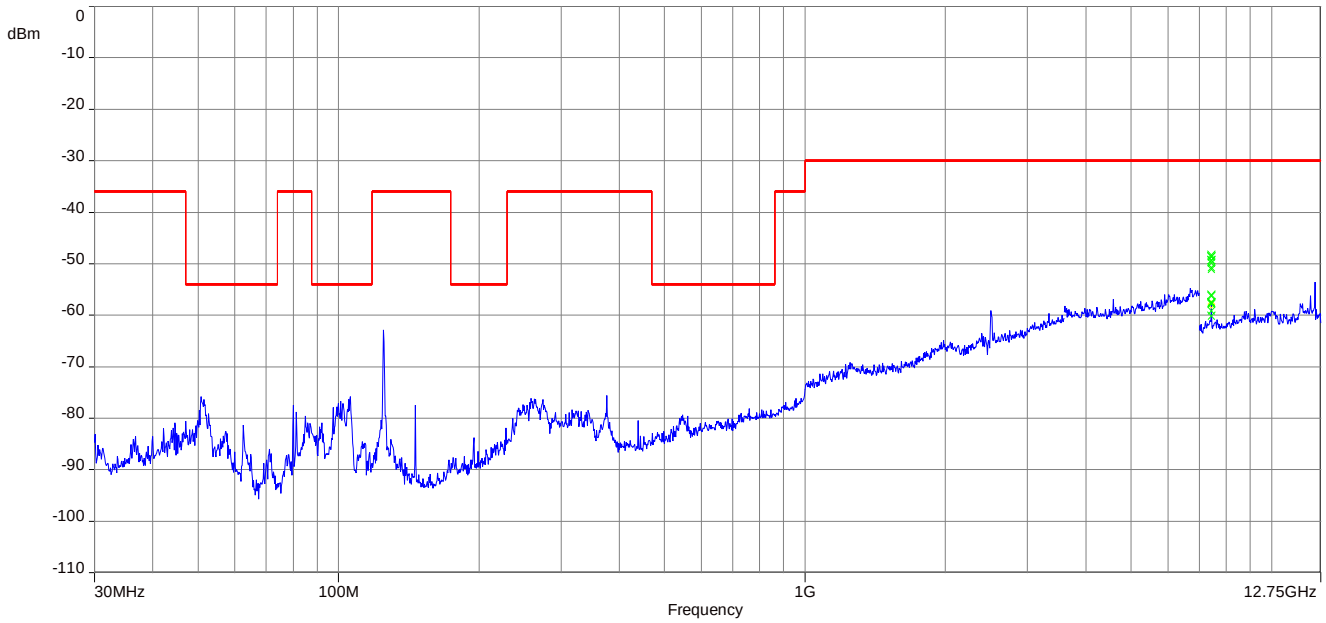
The carrier signal is notched with a 2.4 GHz band rejection filter.

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.

11.7 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	5ms/MHz
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 7.1 - A
Measurement uncertainty	See sub clause 12
Measurement parameters (conducted)	
External result file	1-3925_22-01-02_Annex_MR_A1.pdf EN300328 Unwanted Emissions in spurious domain RX
Test setup	See sub clause 7.2 - A
Measurement uncertainty	See sub clause 12

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 7.1 - A
Measurement uncertainty	See sub clause 12
Measurement parameters (conducted)	
External result file	1-3925_22-01-02_Annex_MR_A1.pdf EN300328 Unwanted Emissions in spurious domain RX
Test setup	See sub clause 7.2 - A
Measurement uncertainty	See sub clause 12

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 694 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

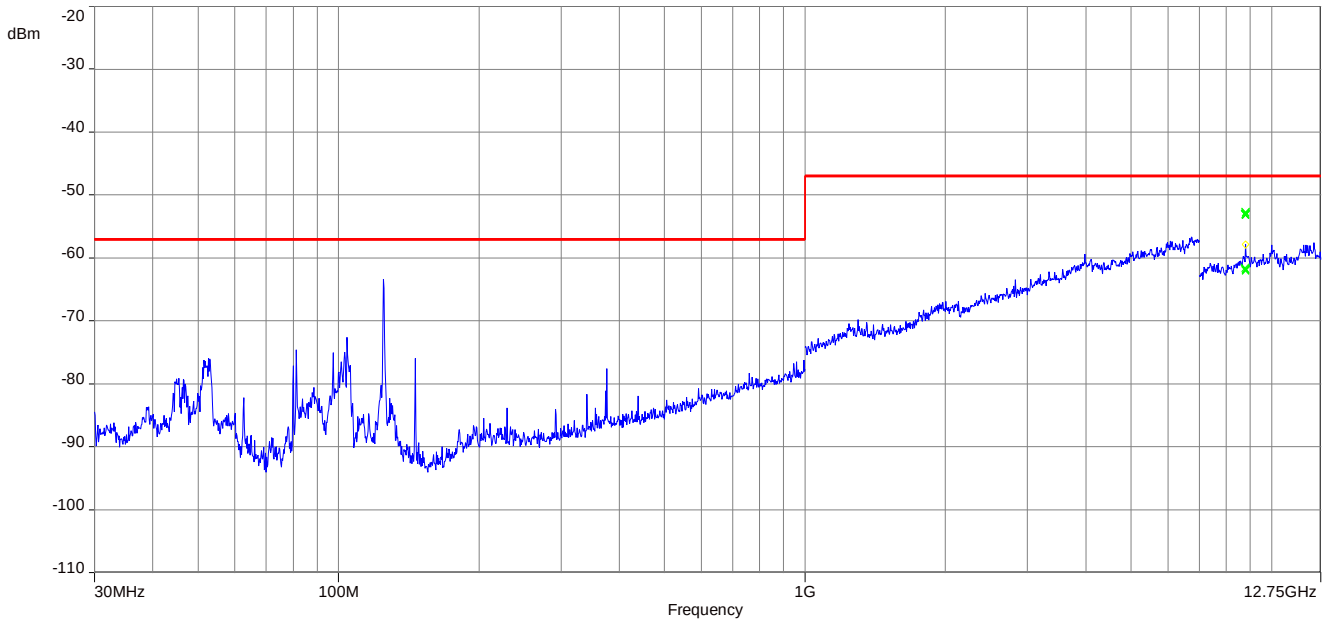
Low channel			High channel		
f [MHz]	Detector Peak/RMS	Level [dBm]	f [MHz]	Detector Peak/RMS	Level [dBm]
All detected peaks are more than 6 dB below the limit			All detected peaks are more than 6 dB below the limit		

Results: radiated, 1 Msps

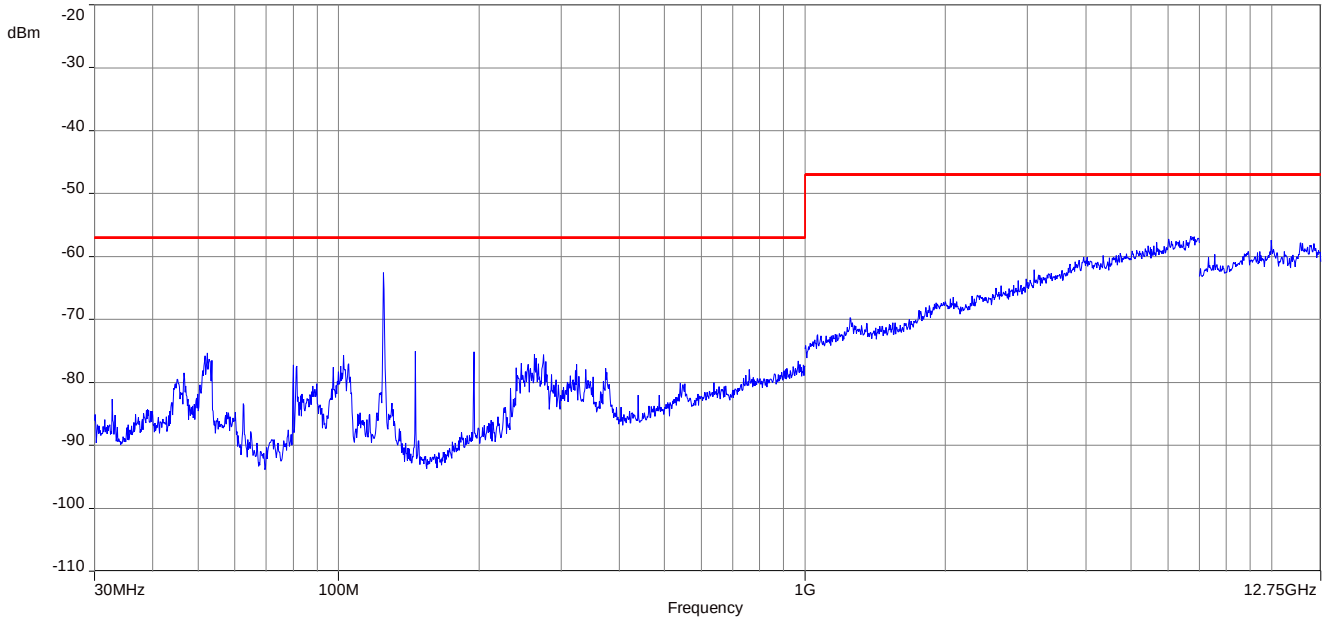
Low channel			High channel		
f [MHz]	Detector Peak/RMS	Level [dBm]	f [MHz]	Detector Peak/RMS	Level [dBm]
All detected peaks are more than 6 dB below the limit			All detected peaks are more than 6 dB below the limit		

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



11.8 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 due to the presence of an unwanted input signal (blocking signal) at frequencies other than those of the operating band and spurious responses.

Measurement parameters	
External result file	1-3925_22-01-02_Annex_MR_A1.pdf Chapter EN300328 RX Receiver Blocking
Test setup	See sub clause 7.2 – C
Measurement uncertainty	See sub clause 12

Performed: ☒ Conducted

☐ Radiated

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

Wanted signal mean power from companion device (dBm) (see notes 1 and 4)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 4)	Type of blocking signal
(-133 dBm + 10 × log10(OCBW)) or -68 dBm whichever is less (see note 2)	2 380 2 504	-34	CW
(-139 dBm + 10 × log10(OCBW)) or -74 dBm whichever is less (see note 3)	2 300 2 330 2 360 2 524 2 584 2 674		
NOTE 1:	OCBW is in Hz.		
NOTE 2:	In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to Pmin + 26 dB where Pmin is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.		
NOTE 3:	In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to Pmin + 20 dB where Pmin is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.		
NOTE 4:	The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.		

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

Wanted signal mean power from companion device (dBm) (see notes 1 and 3)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 3)	Type of blocking signal
(-139 dBm + 10 × log10(OCBW) + 10 dB) or (-74 dBm + 10 dB) whichever is less (see note 2)	2 380 2 504 2 300 2 584	-34	CW
NOTE 1:	OCBW is in Hz.		
NOTE 2:	In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to Pmin + 26 dB where Pmin is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.		
NOTE 3:	The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.		

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

Wanted signal mean power from companion device (dBm) (see notes 1 and 3)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 3)	Type of blocking signal
(-139 dBm + 10 × log10(OCBW) + 20 dB) or (-74 dBm + 20 dB) whichever is less (see note 2)	2 380 2 504 2 300 2 584	-34	CW
NOTE 1:	OCBW is in Hz.		
NOTE 2:	In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to Pmin + 30 dB where Pmin is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.		
NOTE 3:	The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.		

Limits:

	Channel	
	Low channel	High channel
Performance Criteria	10% PER or FER	

* For equipment that does not support a PER or a FER test to be performed, the minimum performance criterion shall be no loss of the wireless transmission function needed for the intended use of the equipment.

Result: Compliant (See log file for details)

12 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 %

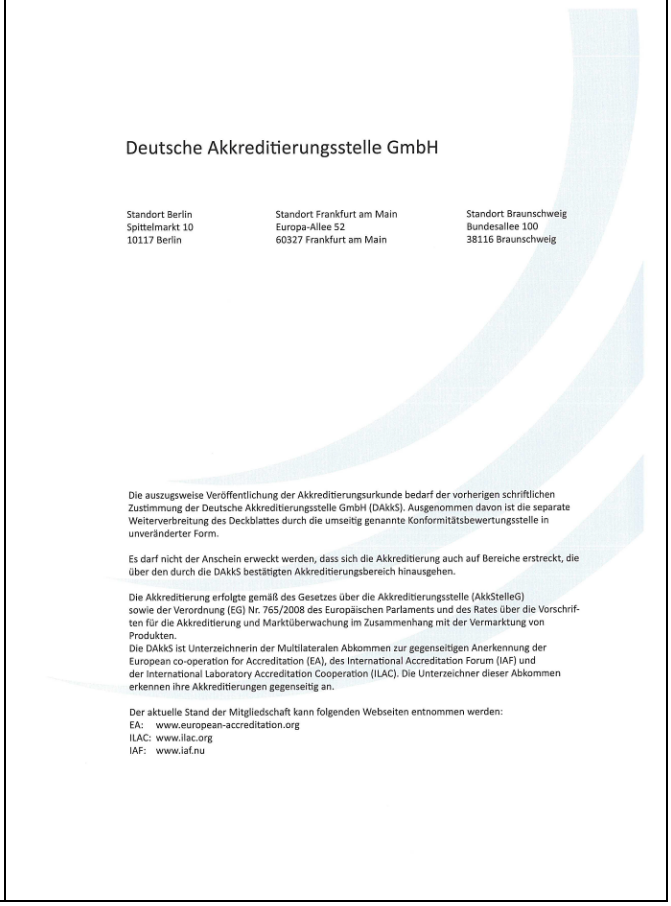
13 Glossary

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

14 Document history

Version	Applied changes	Date of release
-/-	Initial release	2022-03-01

15 Accreditation Certificate – D-PL-12076-01-03

first page	last page
	

Note: The current certificate annex is published on the websites (link see below).

https://www.dakks.de/files/data/as/pdf/D-PL-12076-01-03.pdf
or
https://ctcadvanced.com/app/uploads/2020/06/D-PL-12076-01-03_TK.pdf

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