

Test Report

22-1-0131901T005a-C01



Deutsche
 Akkreditierungsstelle
 D-PL-12047-01-01
 D-PL-12047-01-03
 D-PL-12047-01-04

Number of pages: 18 **Date of Report:** 2023-Mar-10

Testing company: cetecom advanced GmbH
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 45219 Essen Germany
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Applicant: BBC Bircher AG

Product: Wireless Transmission System
Model: XRF-R.2

FCC ID: TBZ-XRFR29 **IC:** 5904A-XRFR29

Testing has been carried out in accordance with:

FCC Regulations
 Title 47 CFR, Chapter I, Subchapter A, Part 15
 Subpart B Unintentional Radiators
 § 15.107 Conducted limits
 § 15.109 Radiated emission limits

ISED-Regulations
 Radio Standards Specification
 RSS-Gen, Issue 5
 General Requirements for Compliance of Radio Apparatus

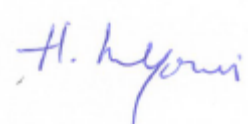
ICES-003, Issue 7
 Information Technology Equipment (including Digital Apparatus)

Test Results: ☒ **The EUT complies with the requirements in respect of all parameters subject to the test.**
 The test results relate only to devices specified in this document
 The current version of Test Report 22-1-0131901T005a-C01 replaces the test report 22-1-0131901T005a dated 2023-Jan-24. The replaced test report is herewith invalid.

Signatures:



Dipl.-Ing. Ninovic Perez
 Test Lab Manager
 Authorization of test report



Hicham Laayouni
 Test Manager
 Responsible of test report

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The listed attachments are separate documents.			

1 General information

1.1 Disclaimer and Notes

The test results of this test report relate exclusively to the test item specified in this test report as specified in chapter 2.7. cetecom advanced does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of cetecom advanced.

The testing service provided by cetecom advanced has been rendered under the current "General Terms and Conditions for cetecom advanced".

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All rights and remedies regarding vendor's products and services for which cetecom advanced has prepared this test report shall be provided by the party offering such products or services and not by cetecom advanced.

In no case this test report can be considered as a Letter of Approval.

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

The test report must always be reproduced in full; reproduction of an excerpt only is subject to written approval of the testing laboratory. The documentation of the testing performed on the tested devices is archived for 10 years at cetecom advanced.

Also we refer on special conditions which the applicant should fulfill according §2.927 to §2.948, special focus regarding modification of the equipment and availability of sample equipment for market surveillance tests.

1.2 Attestation

I declare that all measurements were performed by me or under my supervision and that all measurements have been performed and are correct to my best knowledge and belief to Industry Canada standards. All of the above requirements are met in accordance with enumerated standards.

1.3 Summary of Test Results

Test case	Reference in FCC ☒	Reference in ISED ☒	Reference in RSS-GEN ☒	Page	Remark	Result
AC-Power Lines Conducted Emissions	§15.107	ICES-003, Issue 7	RSS Gen, Issue 5, Chapter 8.8	9	--	Passed
Radiated field strength emissions 30 MHz – 1 GHz	§15.109 §15.33 §15.35	ICES-003, Issue 7	RSS-Gen., Issue 5 Chapter 8.9, Chapter 7.3	10	--	Passed
Radiated field strength emissions above 1 GHz	§15.109 §15.33 §15.35	ICES-003, Issue 7	RSS-Gen., Issue 5 Chapter 8.9, Chapter 7.3	13	--	Passed

PASSED

The EUT complies with the essential requirements in the standard.

FAILED

The EUT does not comply with the essential requirements in the standard.

N/A

Test case does not apply to the test object.

NP

The test was not performed by the cetecom advanced Laboratory.

Decision Rule: cetecom advanced GmbH follows [ILAC G8:2019 chapter 4.2.1 \(Simple Acceptance Rule\)](#).

1.4 Summary of Test Methods

Test case	Test method
AC-Power Lines Conducted Emissions	ANSI C63.4-2014 chapter 7
Radiated field strength emissions 30 MHz – 1 GHz	ANSI C63.4-2014 chapter 8.2.3
Radiated field strength emissions above 1 GHz	ANSI C63.4-2014 chapter 8.3

2 Administrative Data

2.1 Identification of the Testing Laboratory

Company name:	cetecom advanced GmbH
Address:	Im Teelbruch 116 45219 Essen - Kettwig Germany
Responsible for testing laboratory:	Dipl.-Ing. Ninovic Perez
Accreditation scope:	DAkkS Webpage: FCC ISED
IC Lab company No. / CAB ID:	3462D / DE0005
Test location:	cetecom advanced GmbH; Im Teelbruch 116; 45219 Essen

2.2 General limits for environmental conditions

Temperature:	19.0 °C to 21.0 °C
Relative. humidity:	41.0 %rH to 41.0 %rH

2.3 Test Laboratories sub-contracted

Company name:	--
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2.4 Organizational Items

Responsible test manager:	Hicham Laayouni
Receipt of EUT:	2022-Dec-16
Date(s) of test:	2022-Dec-21 to 2022-Dec-21
Version of template:	22.1201

2.5 Applicant's details

Applicant's name:	BBC Bircher AG
Address:	Wiesengasse 20 8222 Beringen Switzerland
Contact Person:	Milos Kostic
Contact Person's Email:	milos.kostic@bircher.com

2.6 Manufacturer's details

Manufacturer's name:	BBC Bircher AG
Address:	Wiesengasse 20 8222 Beringen Switzerland

2.7 Equipment under Test (EUT)

EUT No. *)	Sample No.	Product	Model	Type	SN	HW	SW
EUT 1	22-1-01319S05_C01	Wireless Transmission System	XRF-R.2	XRF-R.2.9	N/A	395476D	2.4.2906.2945

*) EUT short description is used to simplify the identification of the EUT in this test report.

2.8 Untested Variant (VAR)

VAR No. *)	Sample No.	Product	Model	Type	SN	HW	SW
------------	------------	---------	-------	------	----	----	----

*) The listed additional untested model variant(s) (VAR) is/are not object of evaluation of compliance. For further information please see Annex 5: Declaration of applicant of model differences.

If the table above does not show any other line than the headline, no untested variants are available.

2.9 Auxiliary Equipment (AE)

AE No. *)	Sample No.	Auxiliary Equipment	Model	SN	HW	SW
-----------	------------	---------------------	-------	----	----	----

*) AE short description is used to simplify the identification of the auxiliary equipment in this test report. If the table above does not show any other line than the headline, no AE was used during testing nor was taken into account for evaluation

2.10 Connected cables (CAB)

CAB No. *)	Sample No.	Cable Type	Connectors / Details	Length
CAB 1	22-1-01319S08_C01	Cable	-	200 cm

*) CAB short description is used to simplify the identification of the connected cables in this test report. If the table above does not show any other line than the headline, no cable was used during testing nor was taken into account for evaluation

2.11 Software (SW)

SW No. *)	Sample No.	SW Name	Description	SW Status
-----------	------------	---------	-------------	-----------

*) SW short description is used to simplify the identification of the used software in this test report. If the table above does not show any other line than the headline, no SW was used during testing nor was taken into account for evaluation.

2.12 EUT set-ups

set-up no. *)	Combination of EUT and AE	Description
1	EUT1 + CAB 1	--

*) EUT set-up no. is used to simplify the identification of the EUT set-up in this test report.

2.13 EUT operation modes

EUT operating mode no. *)	Operating modes	Additional information
	RX mode	RX mode was active during the Measurements

*) EUT operating mode no. is used to simplify the test report.

3 Equipment under test (EUT)

3.1 General Data of Main EUT as Declared by Applicant

Firmware	☐ for normal use	☒ Special version for test execution	
Power supply	☐ AC Mains	--	
	☒ DC Mains	12 V DC via car battery Connector	
	☐ Battery	--	
Operational conditions	T _{nom} =-- °C	T _{min} =-- °C	T _{max} =-- °C
EUT sample type	Engineering Samples		
Weight	0.100 kg		
Size [LxWxH]	11.5 cm x 7.5 cm x 3.0 cm		
Interfaces/Ports	--		
For further details refer Applicants Declaration & following technical documents			

3.2 Modifications on Test sample

Additions/deviations or exclusions	--
---	----

4 Measurements

Measurement No.	P1M1
Environmental conditions	Temperature: 19.0 °C Humidity: 41.0% rH
Test date	2022-Dec-21
Operator	Ahmed Ben Cheikh
EuT power supply:	DC +12.0 V
Operating mode	01
Setup	01
Remarks	

Diagram	Detector	Tested line(s)	Additional (scan-) information or remarks	Result
1.01	☒ Peak (pre-scan) ☐ CAV (pre-scan) ☐ CAV (final) ☐ QP (final)	N, L1	Margin > 10dB final measurement not performed	PASS

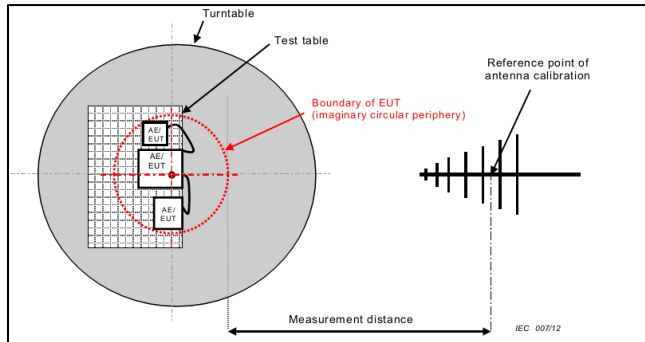
Remark: for more information and graphical plot see annex A1 **TR22-1-0131901T005a-C01_A1**

4.1 Radiated field strength emissions 30 MHz – 1 GHz

4.1.1 Description of the general test setup and methodology, see below example:

Test site: Measurements between 30 MHz and 1 GHz are performed in the NSA compliant Semi Anechoic Chamber (SAC) according to EMC basic standard. The test site is compliant to CISPR 16-1-4:2019 chap. 5.3 and ANSI C63.4:2014 chap. 5.4.2 to 5.4.4.

Schematic below 1 GHz:



Testing method below 1 GHz:

Step 1:

Pre-measurement, variation of turntable positions: The EUT is set in the worst case operating mode determined. The tests are also carried out as a pre-measurement with peak detector (PK), repetitive scan and max-hold mode. Azimuth step of turntable = 90°, antenna heights = 1.0 m & 1.82 m, both polarisations (H/V). If the mounting/usual operating position is defined, the under and the top side of the EUT/test set-up will not be measured. The results are documented in a diagram. The peak values shown in this graphic are not finally maximized. Peak values closer than 6 dB to the limit line are displayed explicitly in a table. If no critical frequencies are found (margin to limit >6 dB) the final measurement will be omitted.

Step 2:

Based on the exploratory measurements, the most critical frequencies are re-measured by main-taining the EUT's worst-case operation mode, cable position, etc. either on 10 m OATS or 5 m or 3 m semi-anechoic room.

Final measurement: For the critical frequencies a maximum search is done with PK and CISPR QP detectors: First a frequency zoom within +/- 1.2 MHz (= 10*IF-BW) of the critical frequencies, then the EUT/test set-up is rotated continuously (if applicable, the EUT orientation will be changed to measure the under and the top side) and the antenna height changed between 1 m & 4 m in order to find the worst case position. The final measurement with the QP detector is carried out in this position and the values are stored in the final result table, which can be found after the diagram.

Formula:

$$E_C = E_R + AF + C_L + D_F - G_A \quad (1)$$

$$M = L_T - E_C \quad (2)$$

AF = Antenna factor

C_L = Cable loss

D_F = Distance correction factor (if used)

E_C = Electrical field – corrected value

E_R = Receiver reading

G_A = Gain of pre-amplifier (if used)

L_T = Limit

M = Margin

All units are dB-units, positive margin means value is below limit.

4.1.2 Test receiver settings

Detector	Peak	Quasi peak
Min. attenuation	0 dB	0 dB
Resolution bandwidth	120 kHz	120 kHz
Dector Meas-time	10 ms	1 s
Step size	40 kHz	Selected frequencies
Preamp	Off	Off

4.1.3 Measurement Protocol(s)

Measurement No.	P2M1
Environmental conditions	Temperature: 21.0 °C Humidity: 41.0% rH
Test date	2022-Dec-21
Operator	Ahmed Ben Cheikh
EuT power supply:	DC +12.0 V
Operating mode	01
Setup	01
Remarks	Test with car battery

Diagram	Measurement Details		Result
3.01	EUT position	☒ standing ☐ laying ☒ Mounting position / usual operating position is defined (under and top side of EUT are not measured) ☐ Mounting position / usual operating position undefined (under and top side of EUT are measured)	PASS
		☐ no, margin to limit > 10 dB (only Step 1 carried out) ☒ yes, final measurement (Step 2 carried out)	
	Critical frequencies found:		

Remark: for more information and graphical plot see annex A1 **TR22-1-0131901T005a-C01_A1**

4.1.4 Limits

Frequency Range [MHz]	Class B ☒ (3 meters)		Class A ☐ (10 meters)	
	Limit [μV/m]	Limit [dBμV/m]	Limit [μV/m]	Limit [dBμV/m]
30 - 88	100	40.0	90	39.0
88 - 216	150	43.5	150	43.5
216 - 960	200	46.0	210	46.4
960 - 1000	500	54.0	300	49.5

4.1.5 Result

Test case	Reference in FCC ☒	Reference in ISSED ☒	Reference in RSS-GEN ☒	Remark	Result
Radiated field strength emissions 30 MHz – 1 GHz	§15.109 §15.33 §15.35	ICES-003, Issue 7	RSS-Gen., Issue 5 Chapter 8.9, Chapter 7.3	--	Pass / OK

4.1.6 Measurement Location and Equipment list

ID	Description	Manufacturer	SerNo	CheckType	Last Check	Interval	Next Check
	225911 - SAC5 - Radiated Emission <1GHz			calchk	cal: 2016-Apr-05 chk: 2021-Jan-20	cal: 120M chk: 12M	cal: 2026-Apr-05 chk: 2022-Jan-20
25348	Test Receiver ESR7	Rohde & Schwarz Messgerätebau GmbH / Memmingen	101600	cal	cal: 2021-Aug-09	cal: 24M	cal: 2023-Aug-09
25352	Open Switch and control Platform OSP120	Rohde & Schwarz Messgerätebau GmbH	101542-rV	cpu			
25357	Ultrabroadband Antenna H1562E	Rohde & Schwarz Messgerätebau GmbH	100824	cal	cal: 2020-Oct-09	cal: 36M	cal: 2023-Oct-09
25358	Semi Anechoic Chamber SAC5	Albatross Projects GmbH / Nattheim	P27281-016	cal	cal: 2022-Aug-12	cal: 10Y	cal: 2032-Aug-12
25360	Antenna Mast BAM 4.5-P	mature GmbH / Pfreimd	BAM 4.5-P/091/17791115	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
25361	Controller NCD	mature GmbH	NCD/202/17791115	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
25376	Measurement Software EMC32 [SAC5]	Rohde & Schwarz Messgerätebau GmbH	v10.60.10	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -

Tools used in 'P2M1'

4.1.7 Legend

Note / remarks	Interval of calibration & Verification
2W	2 weeks
12M	12 months
24M	24 months
36M	36 months
10Y	10 Years

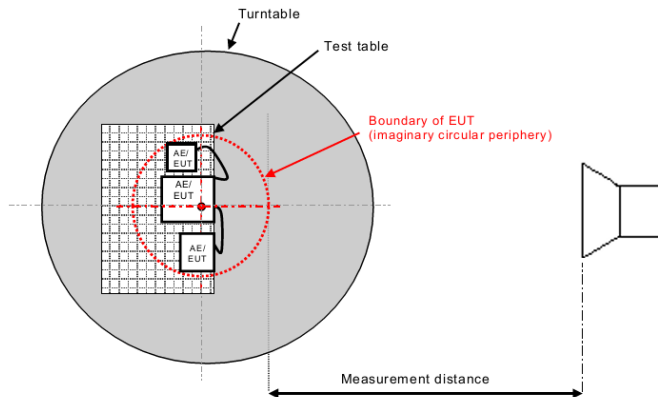
Abbreviation Check Type	Description
cnn	Calibration and verification not necessary
cal	Calibration
calchk	Calibration plus intermediate Verification
chk	Verification
cpu	Verification before usage

4.2 Radiated field strength emissions above 1 GHz

4.2.1 Description of the general test setup and methodology, see below example:

Measurements above 1 GHz are performed in the Semi Anechoic Chamber (SAC) with additional floor absorber (=> FAC). This site is compliant to CISPR 16-1-4:2019 and ANSI (IEEE) C63.4a:2017. Measurement distance $d = 3$ m.

Schematic:



Testing method above 1 GHz:

Step 1:

Pre-measurement, variation of turntable positions: The EUT is set in the determined worst case operating mode. The tests are carried out as a pre-measurement with PK and CISPR AV detector, repetitive scan and max-hold mode, azimuth step of turntable = 15° , antenna height = 1.0 m & 1.82 m, both polarisations (H/V). If the mounting/usual operating position is defined, the under and the top side of the EUT/test set-up will not be measured. If required, a height scan of the RX-Antenna is also performed (Step size = $0.8 \times$ smallest applicable w) while aimed to the EUT. The results are documented in a diagram with separate traces for each detector, upper trace = PK, lower trace = CISPR AV. The values shown in this graphic are not finally maximized. Values closer than 10 dB to the corresponding limit line are displayed explicitly in a table. If no critical frequencies are found (margin to limit >10 dB for PK, 3 dB for CISPR AV) the final measurement will be omitted.

Step 2:

Final measurement: For the critical frequencies a maximum search is done with the PK and CISPR AV detectors: First a frequency zoom within ± 10 MHz ($=10 \times \text{IF-BW}$) of the critical frequencies, then the EUT/test set-up will be rotated continuously within $\pm 15^\circ$ of the detected critical turntable position, (if applicable, the EUT orientation will be changed to measure the under and the top side) and the antenna height changed between 1 m & 4 m while aimed to the EUT in order to find the worst case position. The final measurements with PK and CISPR AV detectors are carried out in this position and the values are stored in the final result table, which can be found after the diagram.

Formula:

$$E_C = E_R + A_F + C_L + D_F - G_A \quad (1)$$

$$M = L_T - E_C \quad (2)$$

E_C = Electrical field – corrected value

E_R = Receiver reading

M = Margin

L_T = Limit

A_F = Antenna factor

C_L = Cable loss

D_F = Distance correction factor (if used)

G_A = Gain of pre-amplifier (if used)

All units are dB-units, positive margin means value is below limit.

4.2.2 Test receiver / spectrum analyzer settings

Detector	Peak	Average
Min. attenuation	10 dB	10 dB
Resolution bandwidth	1 MHz	1 MHz
Dector Meas-time	Pre-measurement 10 ms Final measurement 1 s	Pre-measurement 10 ms Final measurement 1 s
Step size	Pre-measurement: 400 kHz Final measurement: selected frequencies	Pre-measurement: 400 kHz Final measurement: selected frequencies
Preamp	Off below 6 GHz 30 dB above 6 GHz	Off below 6 GHz 30 dB above 6 GHz

4.2.1 Measurement Protocol(s)

Measurement No.	P3M1
Environmental conditions	Temperature: 21.0 °C Humidity: 41.0% rH
Test date	2022-Dec-21
Operator	Ahmed Ben Cheikh
EuT power supply:	DC +12.0 V
Operating mode	01
Setup	01
Remarks	Test with car battery

Diagram	Measurement Details		Result
4.01	EUT position	☒ standing ☐ laying ☒ Mounting position / usual operating position is defined (under and top side of EUT are not measured) ☐ Mounting position / usual operating position undefined (under and top side of EUT are measured)	PASS
	Critical frequencies found:	☐ no, margin to limit > 10 dB (only Step 1 carried out) ☐ yes, final measurement (Step 2 carried out)	

Remark: for more information and graphical plot see annex A1 **TR22-1-0131901T005a-C01_A1**

4.2.2 Limits

Frequency Range [MHz]	Class B ☒ (3 meters)		Class A ☐ (3 meters)		Detector
	Limit [μV/m]	Limit [dBμV/m]	Limit [μV/m]	Limit [dBμV/m]	
Above 1000	500	54	950	59.5	Average
Above 1000	5000	74	9500	79.5	Peak

4.2.3 Result

Test case	Reference in FCC ☒	Reference in ISCED ☒	Reference in RSS-GEN ☒	Remark	Result
Radiated field strength emissions above 1 GHz	\$15.109 \$15.33 \$15.35	ICES-003, Issue 7	RSS-Gen., Issue 5 Chapter 8.9, Chapter 7.3	--	Pass / OK

4.2.4 Measurement Location and Equipment list

ID	Description	Manufacturer	SerNo	CheckType	Last Check	Interval	Next Check
	225912 - SACS - Radiated Emission >1GHz			calchk	cal: 2016-May-04 chk: 2021-May-19	cal: 120M chk: 12M	cal: 2026-May-04 chk: 2022-May-19
25310	Double-Ridged Horn Antenna HF 907	Rohde & Schwarz Messgerätebau GmbH	100334	cal	cal: 2021-Oct-04	cal: 36M	cal: 2024-Oct-04
25348	Test Receiver ESR7	Rohde & Schwarz Messgerätebau GmbH / Memmingen	101600	cal	cal: 2021-Aug-09	cal: 24M	cal: 2023-Aug-09
25352	Open Switch and control Platform OSP120	Rohde & Schwarz Messgerätebau GmbH	101542-rV	cpu			
25358	Semi Anechoic Chamber SACS	Albatross Projects GmbH / Nattheim	P27281-016	cal	cal: 2022-Aug-12	cal: 10Y	cal: 2032-Aug-12
25360	Antenna Mast BAM 4.5-P	matur GmbH / Pfreimd	BAM 4.5-P/091/17791115	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
25361	Controller NCD	matur GmbH	NCD/202/17791115	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
25376	Measurement Software EMC32 [SACS]	Rohde & Schwarz Messgerätebau GmbH	v10.60.10	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -

Tools used in 'P3M1'

4.2.5 Legend

Note / remarks	Interval of calibration & Verification
2W	2 weeks
12M	12 months
24M	24 months
36M	36 months
10Y	10 Years

Abbreviation Check Type	Description
cnn	Calibration and verification not necessary
cal	Calibration
calchk	Calibration plus intermediate Verification
chk	Verification
cpu	Verification before usage

5 Results from external laboratory

None

-

6 Opinions and interpretations

None

-

7 List of abbreviations

None

-

8 Measurement Uncertainty valid for conducted/radiated measurements

The reported uncertainties are calculated based on the standard uncertainty multiplied with the appropriate coverage factor **k**, such that a confidence level of approximately 95% is achieved. For uncertainty determination, each component used in the concrete measurement set-up was taken in account and its contribution to the overall uncertainty according its statistical distribution calculated.

Measurement type	Frequency range of measurement		Calculated Uncertainty based on confidence level of 95.54%	Remarks
	Start [MHz]	Stop [MHz]		
Magnetic field strength	0.009	30	4.86	Magnetic loop antenna, Pre-amp on
RF-Output power (eirp) Unwanted emissions (eirp) [dB]	30	100	4.57	without Pre-Amp
	30	100	4.91	with PreAmp
	100	1000	4.02	without Pre-Amp
	100	1000	4.26	with PreAmp
	1000	18000	4.36	without Pre-Amp
	1000	18000	5.23	with PreAmp
	18000	33000	4.92	Schwarzbeck BBHA9170 (#20302) Antenna set-up non-waveguide antenna)
	33000	50000	4.17	Set-up for Q-Band (WR-22), non-wave guide antenna
	40000	60000	4.69	Set-up U-Band (WR-19), non-waveguide antenna
	50000	75000	4.06	External Mixer set-up V-Band (WR-15)
	75000	110000	4.17	External Mixer set-up W-Band (WR-6)
	90000	140000	5.49	External Mixer set-up F-Band (WR-8)
	140000	225000	6.22	External Mixer set-up G-Band (WR-5)
	225000	325000	7.04	External Mixer set-up (WR-3)
	325000	500000	8.84	External Mixer set-up (WR-2.2)
Radiated Blocking [dB]	1000	18000	2.85	Typical set-up with microwave generator and antenna, value for 7GHz calculated
	18000	33000	4.66	Typical set-up with microwave generator and antenna
	33000	50000	3.48	WR-22 set-up
	50000	75000	3.73	WR-15 set-up
	75000	110000	4.26	WR-6 set-up
Frequency Error [kHz]	40000	77000	276.19	calculated for 77 GHz (FMCW) carrier
	6000	7000	33.92	calculated for 6.5GHz UWB Ch.5
TS 8997 conducted Parameters	30	6000	1.11	1. Power measurement with Fast-sampling-detector
	30	6000	1.20	2. Power measurement with Spectrum-Analyzer
	30	6000	1.20	3. Power Spectrum-Density measurement
	30	7500	1.20	4. Conducted Spurious emissions:
	0.009	30	2.56	5. Conducted Spurious emissions:
	2.4	2.48	1.95 ppm	6a. Bandwidth / 2-Marker Method for 2.4GHz ISM
	5.18	5.825	7.180 ppm	6b. Bandwidth / 2-Marker Method for 5GHz WLAN
	5.18	5.825	1.099 ppm	7 Frequency (Marker method) for 5GHz WLAN
	30	6000	0.11561µs	8 Medium-Utilization factor / Timing
	30	6000	1.85	9 Blocking-Level of companion device
	30	6000	1.62	9 Blocking Generator level
Conducted emissions	0.009	30	3.57	

9 Versions of test reports (change history)

Version	Applied changes	Date of release
--	Initial release	2023-Jan-25
C1	FCC ID update	2023-Mar-10
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End Of Test Report