PARTIAL Test Report

23-1-0014801T033_TR1-R02

Number of pages:	28	**Date of Report:**	2024-okt-17
Testing company:	cetecom advanced GmbH Untertuerkheimer Str. 6-10 66117 Saarbruecken GERMANY	**Applicant:**	VALEO Telematik und Akustik GmbH
Product:	**Antenna and Remote Telematics Integrated System**		
Model:	**ARTEMIS-NAR-01**		
FCC ID:	QWY-ARTEMIS-NAR01	**IC:**	6588A-ARTEMISNAR1
		PMN:	ARTEMIS-NAR-01
		HVIN:	ARTEMIS-NAR-01
		FVIN:	E20 R550

Testing has been carried out in accordance with:

FCC Regulations
Title 47 CFR, Chapter I, Subchapter A
Part 15, Subpart C Intentional Radiators; § 15.209 Radiated emission limits; general requirements
Title 47 CFR, Chapter I, Subchapter B
Part 22, Subpart H Cellular Radiotelephone Service
Part 24, Subpart E Paging and Radiotelephone Service
Part 27, Subpart C Miscellaneous Wireless Communications Services

ISED-Regulations, Radio Standards Specification
RSS-Gen, Issue 5
General Requirements for Compliance of Radio Apparatus
RSS-132, Issue 4
Cellular Telephone Systems Operating in the Bands 824-849 MHz and 869-894 MHz
RSS-133, Issue 7
2 GHz Personal Communications Services
RSS-139, Issue 4
Advanced Wireless Services (AWS) Equipment Operating in the Bands 1710-1780 MHz and 2110-2180 MHz

Tested Technology: UTRA FDD (W-CDMA)

Test Results: **☒ The EUT complies with the requirements in respect of selected parameters subject to the test.**
The test results relate only to devices specified in this document
The current version of Test Report 23-1-0014801T033_TR1-R02 replaces the test report 23-1-0014801T033_TR1-R01 dated 2024-Jun-27. The replaced test report is herewith invalid.

Signatures:

B.Eng. Martin Nunier	Timo Franke
Supervisor Radio Services	Testing Manager
Authorization of test report	Responsible of test report

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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.
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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 in W-CDMA2	Reference Clause FCC ☒	Reference Clause ISED ☒	Page	Remark	Result
AC-Power Lines Conducted Emissions	§15.207(a)	RSS-Gen, Issue 5: §8.8	--	--	N/A
Conducted RF output power	§2.1046(a)	RSS-133, Issue 7: §5.5 + SRSP-510, Issue 6: §6.3	14	--	PASSED
Radiated RF output power	§24.232(c), §2.1046(a)	RSS-133, Issue 7: §5.5 + SRSP-510, Issue 6: §6.3	--	--	NP
Occupied Channel Bandwidth 99%	§24.238(b), §2.1049(h)	RSS-Gen, Issue 5: §6.7	--	--	NP
26dB Emission bandwidth	§24.238(b), §2.1049(h)	RSS-Gen, Issue 5: §6.7	--	--	NP
Radiated Band Edge	§24.238(a)(b), §2.1053(a), §2.1057(a)	RSS-133, Issue 7: §5.6	23	--	PASSED
Conducted RF Band Edge	§24.238(a)(b), §2.1051	RSS-133, Issue 7: §5.6	--	--	NP
Peak to Average ratio (PAPR)	§2.1046(a)	RSS-133, Issue 7: §5.5	--	--	NP
Radiated field strength emissions below 30 MHz	§15.205, §15.209	RSS-Gen: Issue 5: §8.9	18	--	PASSED
Spurious emissions at antenna terminals	§24.238(a)(b), §2.1051	RSS-133, Issue 7: §5.6	--	--	NP
Radiated spurious emissions	§24.238(a)(b), §2.1053(a)	RSS-133, Issue 7: §5.6	21	--	PASSED
Frequency stability, temperature variation	§24.235, §2.1055(a)(1)	RSS-Gen, Issue 5: §6.11 RSS-133, Issue 7: §5.4	--	--	NP
Frequency stability, voltage variation	§15.207(a)	RSS-Gen, Issue 5: §6.11 RSS-133, Issue 7: §5.4	--	--	NP

Test case in W-CDMA4	Reference Clause FCC	Reference Clause ISED	Page	Remark	Result
AC-Power Lines Conducted Emissions	§15.207(a)	RSS-Gen Issue 5: §8.8	--	--	N/A
Conducted RF output power	§27.50(d)(4), §2.1046	RSS-139, Issue 4: §5.5	14	--	PASSED
Radiated RF output power	§27.50(d)(4), §2.1046(a)	RSS-139, Issue 4: §5.5	--	--	NP
Occupied Channel Bandwidth 99%	§27.53(h)(3), §2.202(a)	RSS-Gen, Issue 5: §6.7	--	--	NP
26dB Emission bandwidth	§27.53(h)(3), §2.202(a)	RSS-Gen, Issue 5: §6.7	--	--	NP
Radiated Band Edge	§27.53(h), §2.1053(a) §2.1057(a)	RSS-139, Issue 4: 5.6	23	--	PASSED
Conducted RF Band Edge	§27.53(h), §2.1051	RSS-139, Issue 4: 5.6	--	--	NP
Peak to Average ratio (PAPR)	§27.50(d)(4), §2.1046	RSS-139, Issue 4: 5.5	--	--	NP
Radiated field strength emissions below 30 MHz	§15.205, §15.209	RSS-Gen: Issue 5: §8.9	18	--	PASSED
Spurious emissions at antenna terminals	§27.53(h), §2.1051	RSS-139, Issue 4: 5.6	--	--	NP
Radiated spurious emissions	§27.53(h), §2.1053(a)	RSS-139, Issue 4: 5.6	21	--	PASSED
Frequency stability, temperature variation	§27.54, §2.1055(a)(1)	RSS-Gen, Issue 5: §6.11 RSS-139, Issue 4: 5.4	--	--	NP
Frequency stability, voltage variation	§15.207(a)	RSS-Gen, Issue 5: §6.11 RSS-139, Issue 4: 5.4	--	--	NP

Test case in W-CDMA5	Reference Clause FCC	Reference Clause ISED	Page	Remark	Result
AC-Power Lines Conducted Emissions	§15.207(a)	RSS-Gen, Issue 5: §8.8	--	--	N/A
Conducted RF output power	§22.913(a)(5), §2.1046	RSS-132, Issue 4: §5.4	14	--	PASSED
Radiated RF output power	§22.913, §2.1046(a)	RSS-132, Issue 4: §5.4	--	--	NP
Occupied Channel Bandwidth 99%	§22.917(b), §2.1049(h)	RSS-Gen, Issue 5: §6.7	--	--	NP
26dB Emission bandwidth	§22.917(b), §2.1049(h)	RSS-Gen, Issue 5: §6.7	--	--	NP
Radiated Band Edge	§22.917(a)(b), §2.1053(a), §2.1057(a)	RSS-132, Issue 4: §5.5(i)(ii)	23	--	PASSED
Conducted RF Band Edge	§22.917(a)(b), §2.1051	RSS-132, Issue 4: §5.5(i)(ii)	--	--	NP
Peak to Average ratio (PAPR)	§22.913(a)(5), §2.1046	RSS-132, Issue 4: §5.4	--	--	NP
Radiated field strength emissions below 30 MHz	§15.205, §15.209	RSS-Gen, Issue 5: §8.9	18	--	PASSED
Spurious emissions at antenna terminals	§22.917(a)(b), §2.1051	RSS-132, Issue 4: §5.5(i)(ii)	--	--	NP
Radiated spurious emissions	§22.917(a)(b), §2.1053(a)	RSS-132, Issue 4: §5.5(i)(ii)	21	--	PASSED
Frequency stability, temperature variation	§22.355, §2.1055(a)(1)	RSS-Gen, Issue 5: §6.11 RSS-132, Issue 4: §5.3	--	--	NP
Frequency stability, voltage variation	§22.355, §2.1055(a)(1)	RSS-Gen, Issue 5: §6.11 RSS-132, Issue 4: §5.3	--	--	NP

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).

Remarks:

- Please check the module report "FG370621-01A issued on 2023-Dec-01 and CG370621-01A issued on 2023-Dec-25 by Sporton International Inc. EMC & Wireless Communications Laboratory" for not performed measurements by the cetecom advanced laboratory.

1.4 Summary of Test Methods

Test case	Test method
AC-Power Lines Conducted Emissions	ANSI C63.4-2014, §7, ANSI C63.10-2013 § 6.2
Conducted RF output power	ANSI C63.26:2015, §5.2, KDB 971168 D01 v03r01
Radiated RF output power	ANSI C63.26:2015, §5.2.7, KDB 971168 D01 v03r01
Occupied Channel Bandwidth 99%	ANSI C63.26:2015, §5.4.4, KDB 971168 D01 v03r01
26dB Emission bandwidth	ANSI C63.26:2015, §5.4.3, KDB 971168 D01 v03r01
Modulation characteristics	ANSI C63.26:2015, §5.3
Radiated Band Edge	ANSI C63.26:2015, §5.5, KDB 971168 D01 v03r01
Conducted RF Band Edge	ANSI C63.26:2015, §5.7, KDB 971168 D01 v03r01
Peak to Average ratio (PAPR)	ANSI C63.26:2015, §5.2.6 Result calculated with measured conducted RF-power value and stated/measured antenna gain for band of interest
Radiated field strength emissions below 30 MHz	ANSI C63.4-2014 §5.3, §8.2.1, §8.3.1.1+§8.3.2.1
Spurious emissions at antenna terminals	ANSI C63.26:2015, §5.7, KDB 971168 D01 v03r01
Radiated spurious emissions	ANSI C63.26:2015, §5.5, KDB 971168 D01 v03r01, ANSI C63.26.1:2018
Frequency stability, temperature variation	ANSI C63.26:2015, §5.6, KDB 971168 D01 v03r01
Frequency stability, voltage variation	ANSI C63.26:2015, §5.6, KDB 971168 D01 v03r01

2 Administrative Data

2.1 Identification of the Testing Laboratory

Company name:	cetecom advanced GmbH
Address:	Untertuerkheimer Str. 6-10 66117 Saarbruecken Germany
Responsible for testing laboratory:	Dipl.-Ing. (FH) Andreas Luckenbill M.Sc.
Accreditation scope:	**DAkkS Webpage: FCC ISED**
IC Lab company No. / CAB ID:	3462D / DE0001
Test location 1:	Im Teelbruch 116; 45219 Essen
Test location 2:	--

2.2 General limits for environmental conditions

Temperature:	22±2 °C
Relative. humidity:	45±15% rH

2.3 Test Laboratories sub-contracted

Company name:	--

2.4 Organizational Items

Responsible testing manager:	Timo Franke
Receipt of EUT:	2023-Sep-13
Date(s) of test:	2023-Dec-04 to 2024-Apr-15
Version of template:	24.0301

2.5 Applicant's details

Applicant's name:	VALEO Telematik und Akustik GmbH
Address:	Max-Planck-Str. 28-32 61381 Friedrichsdorf Hesse Germany
Contact Person:	Martin Fleckenstein
Contact Person's Email:	martin.fleckenstein@valeo.com

2.6 Manufacturer's details

Manufacturer's name:	VALEO Telematik und Akustik GmbH
Address:	Max-Planck-Str. 28-32 61381 Friedrichsdorf Deutschland

2.7 Equipment under Test (EUT)

EUT No.*)	Sample No.	Product	Model	Type	SN	HW	SW
EUT 1	23-1-00148S177_C01	Antenna and Remote Telematics Integrated System	ARTEMIS -NAR-01	-	AT10NAFH24000 000052	D4	E20 R550
EUT 2	23-1-00148S178_C01	Antenna and Remote Telematics Integrated System	ARTEMIS -NAR-01	-	AT10NAFH24000 000051	D4	E20 R550

*) 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 1	23-1-00148S22_C01	Ethernet/USB Adapter	N/A	N/A	N/A	N/A
AE 2	23-1-00148S24_C01	Media Converter BCM	100Base-T1 Media Converter BCM	230230153	N/A	N/A
AE 3	23-1-00148S55_C01	Car roof	N/A	N/A	N/A	N/A
AE 4	23-1-00148S59_C01	EMC Load Box	N/A	N/A	N/A	N/A
AE 5	23-1-00148S63_C01	Evaluation KIT	VA6003	71012229012	N/A	N/A

*) 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	23-1-00148S28_C01	Power cable	-	150 cm
CAB 2	23-1-00148S60_C01	EMC cable harness	-	150 cm
CAB 3	23-1-00148S70_C01	Cable	SMA / UFL	15 cm
CAB 4	23-1-00148S27_C01	LAN cable	-	100 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	EUT 1 + AE 1 + AE 2 + AE 3 + AE 4 + AE 5 + CAB 2 + CAB 4	Used for radiated measurements
2	EUT 2 + CAB 1 + CAB 3	Used for conducted measurements

*) 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
Operating mode 1	W-CDMA FDD II Traffic	Frequency / channel range: UL:1852.4 to 1907.6 MHz, DL: 1932.4 to 1987.6 MHz, Channel: UL: 9262 to 9538, DL: 9662 to 9938. A Communication link has been established between Radio Communication Tester CMU200 and EUT
Operating mode 2	W-CDMA FDD IV Traffic	Frequency / channel range: UL:1712.40 to 1752.60 MHz, DL: 2112.4 to 2152.6 MHz, Channel: UL: 1312 to 1513, DL: 1537 to 1738. A Communication link has been established between Radio Communication Tester CMU200 and EUT
Operating mode 3	W-CDMA FDD V Traffic	Frequency / channel range: UL:826.4 to 846.6 MHz, DL: 871.4 to 891.6 MHz, Channel: UL: 4132 to 4233, DL: 4357 to 4458. A Communication link has been established between Radio Communication Tester CMU200 and EUT

*) 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	
	☐ Battery	-	
Operational conditions	T_{nom} = 21 °C	T_{min} = -35 °C	T_{max} = +75 °C
EUT sample type	**Engineering Samples**		
Weight	0.860 kg		
Size [LxWxH]	61.0 cm x 11.0 cm x 4.5 cm		
Interfaces/Ports	2x Fakra, 2x MQS, 1x MateNet		
For further details refer Applicants Declaration & following technical documents **Artemis Technical Description**			

3.2 Detailed Technical data of Main EUT as Declared by Applicant

TX Frequency range	☒ UMTS-FDD band 2	1850 - 1910 MHz (Uplink), 1930 - 1990 MHz (Downlink)	
	☒ UMTS-FDD band 4	1710 - 1755 MHz (Uplink), 2110 - 2155 MHz (Downlink)	
	☒ UMTS-FDD band 5	824 - 849 MHz (Uplink), 869 -894 MHz (Downlink)	
Number of channels	☒ UMTS-FDD band 2	UARFCN range 9262 - 9538	
	☒ UMTS-FDD band 4	UARFCN range 1312 - 1513	
	☒ UMTS-FDD band 5	UARFCN range 4132 - 4233	
Type of modulation	QPSK	BPSK	
	16-QAM	64-QAM	
Emission designator	Nominal CBW	See initial certification of the module:	
Antenna Type	☒ Integrated		
	☐ External, no RF- connector		
	☐ External, separate RF-connector		
Antenna gain	UMTS-FDD band 2 **9.5** dBi		
	UMTS-FDD band 4: **9.5** dBi		
	UMTS-FDD band 5: **5** dBi		
FCC label attached	No		
Test firmware / software and storage location	EUT		
For further details refer Applicants Declaration & following technical documents			
Description of Reference Document (supplied by applicant)	**Version**	**Total Pages**	
ARTEMIS_Tune-up-information_Rev_1.2	**Rev. 1.2**	**23**	

3.3 Worst case identification

UMTS mode	Data rate
WCDMA II	RMC ch Low 9262
WCDMA IV	RMC ch Mid 1413
WCDMA V	RMC ch Low 4132

3.4 Modifications on Test sample

Additions/deviations or exclusions	--

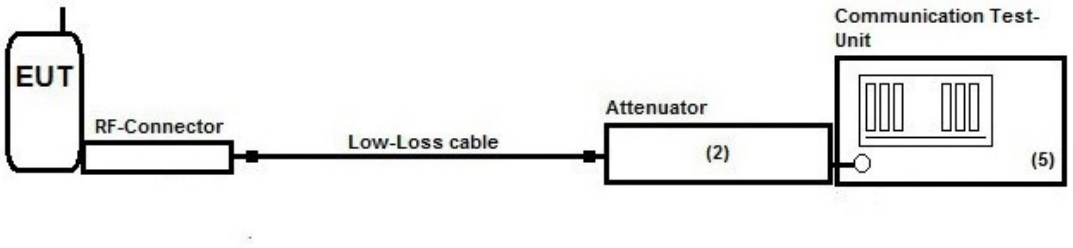
4 Measurements

4.1 Conducted RF output power

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

Following modified test set-up apply for tests performed inside the climatic chamber (frequency stability) or conducted RF-carrier power-measurement. The EUT RF-Signal is directly connected over suitable RF-connector over low-loss cable and an attenuator (2) to the cellular radio communication test-unit. (5).
The measurements were performed with the integrated power measurement function of the communication test-unit. (5).

Schematic:



Testing method:

The measurement is made according to relevant reference clauses:
(See Tables *Summary of Test Results* and *Summary of Test Methods* on page 5)

EUT settings
The EUT was instructed to send with maximum power (if adjustable) according applicants instructions.
The measurements were made at the low, middle and high carrier frequencies of each of the supported operating band within the designated range within the allowed channel bandwidths. Choosing three TX-carrier frequencies of the mobile phone, should be sufficient to demonstrate compliance

4.1.2 Measurement Location

Test site	120910 - Radio Laboratory 1 (TS 8997)

4.1.3 Limit

Frequency Range [MHz]	Limit [W]	Limit [dBm]
824 – 849	7 ERP	38.5
1710 – 1755	1 EiRP	30
1850 – 1910	2 EiRP	33

4.1.4 Result

WCDMA-Modulation Band 2														
	ARFCN-Frequency (MHz)	Average power at Antenna Port (dBm)	Maximum declared Antenna Gain(dBi)	Path loss to Antenna Connector	Path loss in Antenna Cable	EIRP in dBm	EIRP in Watt	ERP in dBm	ERP in Watt	FCC Limit(W), EIRP	FCC Limit (dBm), EIRP	ISED Limit(W), EIRP	ISED Limit (dBm), EIRP	Verdict
Channel 9262	1852.40	22.54	9.50	3.30		28.74	0.74817	26.59	0.45604	2.00	33.01	2.00	33.01	Passed
Channel 9400	1880.00	22.37	9.50	3.30		28.57	0.71945	26.42	0.43853	2.00	33.01	2.00	33.01	Passed
Channel 9538	1907.60	22.27	9.50	3.30		28.47	0.70307	26.32	0.42855	2.00	33.01	2.00	33.01	Passed

WCDMA-Modulation Band 4														
	ARFCN-Frequency (MHz)	Average power at Antenna Port (dBm)	Maximum declared Antenna Gain(dBi)	Path loss to Antenna Connector	Path loss in Antenna Cable	EIRP in dBm	EIRP in Watt	ERP in dBm	ERP in Watt	FCC Limit(W), EIRP	FCC Limit (dBm); EIRP	ISED Limit(W), EIRP	ISED Limit (dBm), EIRP	Verdict
Channel 1312	1712.40	22.18	9.50	3.50		28.18	0.65766	26.03	0.40087	1.00	30.00	1.00	30.00	Passed
Channel 1413	1732.60	22.47	9.50	3.50		28.47	0.70307	26.32	0.42855	1.00	30.00	1.00	30.00	Passed
Channel 1513	1752.60	22.45	9.50	3.50		28.45	0.69984	26.30	0.42658	1.00	30.00	1.00	30.00	Passed

WCDMA-Modulation Band 5														
	ARFCN-Frequency (MHz)	Average power at Antenna Port (dBm)	Maximum declared Antenna Gain(dBi)	Path loss to Antenna Connector	Path loss in Antenna Cable	EIRP in dBm	EIRP in Watt	ERP in dBm	ERP in Watt	FCC Limit(W), ERP	FCC Limit (dBm), ERP	ISED Limit(W), EIRP	ISED Limit (dBm), EIRP	Verdict
Channel 4132	826.40	23.03	5.00	3.50		24.53	0.28379	22.38	0.17298	7.00	38.45	11.50	40.61	Passed
Channel 4183	836.40	22.86	5.00	3.50		24.36	0.27290	22.21	0.16634	7.00	38.45	11.50	40.61	Passed
Channel 4233	846.60	22.44	5.00	3.50		23.94	0.24774	21.79	0.15101	7.00	38.45	11.50	40.61	Passed

EIRP= Average Power at Antenna Port + Maximum declared Antenna Gain - Path loss to Antenna Connector - Path loss in Antenna Cable

ERP = EIRP - 2.15

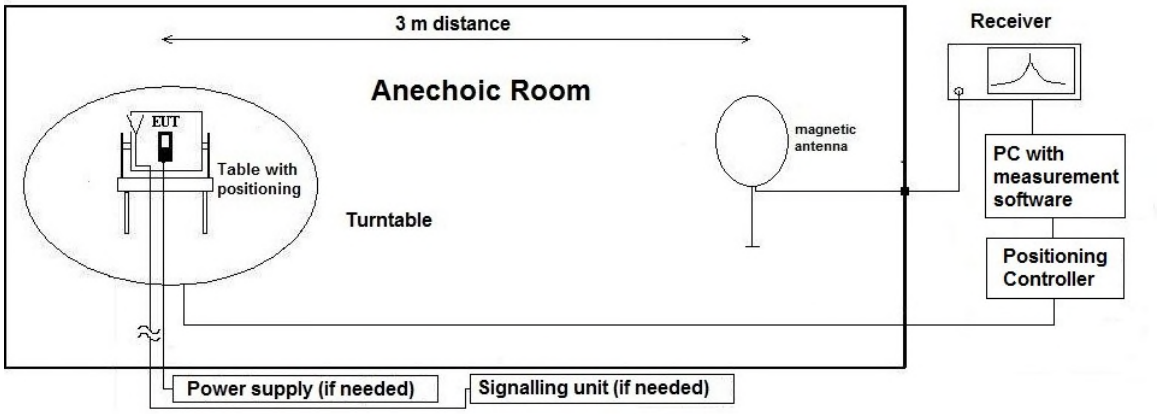
4.2 Radiated field strength emissions below 30 MHz

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

Evaluating the radiated field emissions are done first by an exploratory emission measurement and a final measurement for most critical frequencies determined.

The loop antenna was placed at 1 m height above ground plane and 3 m measurement distance from set-up for investigations. Because of reduced measurement distance, correction data were applied, as stated in chapter "General Limit - Radiated field strength emissions below 30 MHz". The tests are performed in the semi anechoic room recognized by the regulatory commission.

Schematic:



Testing method:

The measurement is made according to relevant reference clauses:
(See Tables *Summary of Test Results* and *Summary of Test Methods* on page 5)

Exploratory, preliminary measurements
The EUT and it's associated accessories are placed on a non-conductive position manipulator (tipping device) of 0.8 m height which is placed on the turntable. By rotating the turntable (step 90°, range 0°to 360°) and the EUT itself either on 3-orthogonal axis (portable equipment) or 2-orthogonal axis (defined operational position of EUT), the emission spectrum was recorded.

The loop antenna was moved at least to 2-perpendicular axes (antenna vector in direction of EUT and parallel to EUT) in order to maximize the emissions. The results are documented in a diagram. Critical frequencies (low margin to limit) are saved within a data reduction table for further investigations. If various operating modes are supported, further investigations are made to find the worst-case. Also the interconnection cables and equipment position were varied in order to maximize the emissions.

Final measurement on critical frequencies
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.

First a frequency zoom around the critical frequency is done to locate the frequency more precisely. After this step, for all identified critical frequencies, the maximum peak was determined.

Following parameters were varied: the turntable angle continuously in the range 0 to 360 degree, the EUT itself either over 3-orthogonal axis (not defined usage position) or 2-orthogonal axis (defined usage position).

On the determined worst-case position, a final measurement with necessary bandwidth and detector according standard has been carried out.

Formula:

$E_C = E_R + AF + C_L + D_F - G_A$

$M = L_T - E_C$

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.

4.2.2 Sample calculation

Raw-Value [dBuV/m]	Antenna factor	Distance Correction [dB]	Cable Loss	Preamplifier	Resulting correction value [dB]	Final result [dBuV/m]	Remarks
19.83	18.9	-70.75	0.18	--	-51.67	-31.83	30 to 3 m correction used according ANSI C63.10-2013

Remark: This calculation is based on an example value at 458 kHz

4.2.3 Correction factors due to reduced meas. distance (f < 30 MHz):

The used correction factors when the measurement distance is reduced compared to regulatory measurement distance, are calculated according Extrapolation formulas valid for EUT's with maximum dimension of 0.625xLambda. Formula 2+3+4 as presented in ANSI C63.10, Chapter 6.4.4 are used for the calculations of proper extrapolation factors

Frequency Range	f [kHz/MHz]	Lambda [m]	Far-Field Point [m]	Distance Limit accord. 15.209 [m]	1st Condition (dmeas < Dnear-field)	2nd Condition (Limit distance bigger dnear-field)	Distance Correction accord. Formula
kHz	9	33333.33	5305.17	300	fullfilled	not fullfilled	-80.00
	10	30000.00	4774.65		fullfilled	not fullfilled	-80.00
	20	15000.00	2387.33		fullfilled	not fullfilled	-80.00
	30	10000.00	1591.55		fullfilled	not fullfilled	-80.00
	40	7500.00	1193.66		fullfilled	not fullfilled	-80.00
	50	6000.00	954.93		fullfilled	not fullfilled	-80.00
	60	5000.00	795.78		fullfilled	not fullfilled	-80.00
	70	4285.71	682.09		fullfilled	not fullfilled	-80.00
	80	3750.00	596.83		fullfilled	not fullfilled	-80.00
	90	3333.33	530.52		fullfilled	not fullfilled	-80.00
	100	3000.00	477.47		fullfilled	not fullfilled	-80.00
	125	2400.00	381.97		fullfilled	not fullfilled	-80.00
	200	1500.00	238.73		fullfilled	fullfilled	-78.02
	300	1000.00	159.16		fullfilled	fullfilled	-74.49
	400	750.00	119.37		fullfilled	fullfilled	-72.00
	490	612.24	97.44		fullfilled	fullfilled	-70.23
	500	600.00	95.49	30	fullfilled	not fullfilled	-40.00
	600	500.00	79.58		fullfilled	not fullfilled	-40.00
	700	428.57	68.21		fullfilled	not fullfilled	-40.00
	800	375.00	59.68		fullfilled	not fullfilled	-40.00
	900	333.33	53.05		fullfilled	not fullfilled	-40.00
MHz	1.00	300.00	47.75		fullfilled	not fullfilled	-40.00
	1.59	188.50	**30.00**		fullfilled	not fullfilled	-40.00
	2.00	150.00	23.87		fullfilled	fullfilled	-38.02
	3.00	100.00	15.92		fullfilled	fullfilled	-34.49
	4.00	75.00	11.94		fullfilled	fullfilled	-32.00
	5.00	60.00	9.55		fullfilled	fullfilled	-30.06
	6.00	50.00	7.96		fullfilled	fullfilled	-28.47
	7.00	42.86	6.82		fullfilled	fullfilled	-27.13
	8.00	37.50	5.97		fullfilled	fullfilled	-25.97
	9.00	33.33	5.31		fullfilled	fullfilled	-24.95
	10.00	30.00	4.77		fullfilled	fullfilled	-24.04
	10.60	28.30	4.50		fullfilled	fullfilled	-23.53
	11.00	27.27	4.34		fullfilled	fullfilled	-23.21
	12.00	25.00	3.98		fullfilled	fullfilled	-22.45
	13.56	22.12	3.52		fullfilled	fullfilled	-21.39
	15.00	20.00	3.18		fullfilled	fullfilled	-20.51
	15.92	18.85	**3.00**		fullfilled	fullfilled	-20.00
	17.00	17.65	2.81		not fullfilled	fullfilled	-20.00
	18.00	16.67	2.65		not fullfilled	fullfilled	-20.00
	20.00	15.00	2.39		not fullfilled	fullfilled	-20.00
	21.00	14.29	2.27		not fullfilled	fullfilled	-20.00
	23.00	13.04	2.08		not fullfilled	fullfilled	-20.00
	25.00	12.00	1.91		not fullfilled	fullfilled	-20.00
	27.00	11.11	1.77		not fullfilled	fullfilled	-20.00
	29.00	10.34	1.65		not fullfilled	fullfilled	-20.00
	30.00	10.00	1.59		not fullfilled	fullfilled	-20.00

4.2.4 Measurement Location

Test site	120901 - SAC3 - Radiated Emission <1GHz

4.2.5 Limit

Radiated emissions limits, 3 meters					
Frequency Range [MHz]	Limit [µV/m]	Limit [dBµV/m]	Distance [m]	Detector	RBW [kHz]
0.009 – 0.09	2400 / f [kHz]	67.6 – 20Log(f) (kHz)	300	Pk & Avg	0.2
0.09 – 0.11	2400 / f [kHz]	67.6 – 20Log(f) (kHz)	300	Quasi peak	0.2
0.11 – 0.15	2400 / f [kHz]	67.6 – 20Log(f) (kHz)	300	Pk & Avg	0.2
0.15 – 0.49	2400 / f [kHz]	67.6 – 20Log(f) (kHz)	300	Pk & Avg	9
0.49 – 1.705	24000 / f [kHz]	87.6 – 20Log(f) (kHz)	30	Quasi peak	9
1.705 - 30	30	29.5	30	Quasi peak	9

*Remark: In Canada same limits apply, just unit reference is different

4.2.6 Result

Diagram	Band	Mode	Maximum Level [dBµV/m] Frequency Range 0.009 – 30 MHz	Result
2.201	II | standing	1	No peaks < 6dB margin found	Passed
2.202	II | lying	1	No peaks < 6dB margin found	Passed
2.401	IV	2	No peaks < 6dB margin found	Passed
2.501	V	3	No peaks < 6dB margin found	Passed

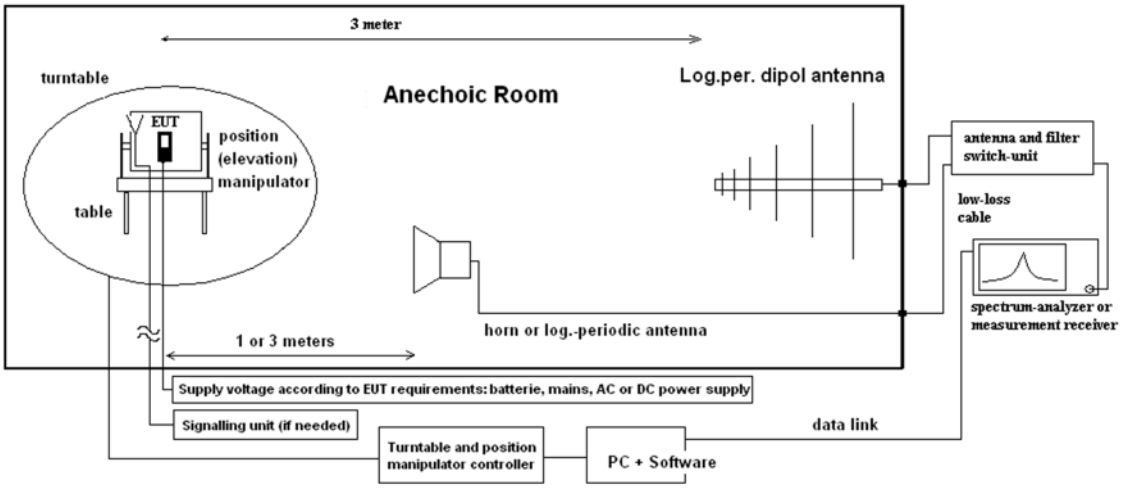
Remark: for more information and graphical plot see annex A1 **23-1-0014801T033_TR1-A201-R02**

4.3 Radiated spurious emissions

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

Evaluating the emissions have to be done first by an exploratory emissions measurement and a final measurement for most critical frequencies. The tests are performed in a CISPR 16-1-4:2010 compliant fully anechoic room (FAR) recognized by the regulatory commission. The measurement distance was set to 3 meter for frequencies up to 18 GHz and 2 meter above 18 GHz. A logarithmic periodic antenna is used for the frequency range 30 MHz to 1 GHz. Horn antennas are used for frequency range 1 GHz to 40 GHz. The EUT is aligned within 3 dB beam width of the measurement antenna with three orthogonal axis measurements on the EUT.

Schematic:



Testing method:

The measurement is made according to relevant reference clauses:
(See Tables *Summary of Test Results* and *Summary of Test Methods* on page 5)

Exploratory, preliminary measurements

The EUT and its associated accessories are placed on a non-conductive position manipulator (tipping device) of 1.50 m height which is placed on the turntable. By rotating the turntable (range 0° to 360°, step 45°) and the EUT itself on 3-orthogonal axis (the emission spectrum and it's characteristics was recorded with an EMI-receiver, broadband antenna and software.

The measurements are performed in horizontal and vertical polarization of the measurement antennas. The results are documented in a diagram. Critical frequencies (low margin to limit) are saved within a table for further investigations. If various operating modes are supported, further investigations are made to find the worst-case of them. Also the interconnection cables and equipment position were varied in order to maximize the emissions.

Final measurement on critical frequencies

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.

First a frequency zoom around the critical frequency is done to locate the frequency more precisely. After this step, for all identified critical frequencies, the maximum peak was determined.

Following parameters were varied: the turntable angle continuously in the range 0 to 360 degree, the EUT itself over 3-orthogonal axis and the height for EUT with large dimensions.

On the determined worst-case position, a final measurement with necessary bandwidth and detector according standard has been carried out.
The readings on the spectrum analyzer are corrected with conversion value between field strength and E(I)RP, so the readings shown are equivalent to ERP/EIRP values. Critical measurements near the limit are re-measured with a substitution method accord. ANSI/TIA/EIA 603 C/D

Formula:

$P_{EIRP} = P_{MEAS} + C_L + FSL - G_{PreA} - G_{ANT}$ (1)

P_{MEAS} = measured power at instrument
M = Margin
L_T = Limit

FSL = Free Space loss = Function(frequency, measurement distance)

$M = L_T - P_{EIRP}$

C_L= cable loss
G_{PreA} = Gain of pre-amplifier (if used)
G_{ANT} = Gain of antenna in [dBi]

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

4.3.2 Measurement Location

Test site	120904 - FAC1 - Radiated Emissions

4.3.3 Limit

Frequency Range [MHz]	Limit [dBm]	Detector [MaxHold]	RBW / VBW [MHz]
30 - 8500	-13	Peak	1 / 3
30 - 17500	-13	Peak	1 / 3
30 - 19100	-13	Peak	1 / 3

4.3.4 Result

Diagram	Band	Mode	30 MHz to 1000 MHz	1 GHz to 9 GHz	9 GHz to 10th Harmonics	Stop Freq [MHz]	Result
8.201a	II	1 Lying	No peaks < 6dB margin found	No peaks < 6dB margin found	-	19500	Passed
8.201a1	II	1 Lying	-	-	No peaks < 6dB margin found	19500	Passed
8.201b	II	1 standing	No peaks < 6dB margin found	No peaks < 6dB margin found	-	19500	Passed
8.201b1	II	1 standing	-	-	No peaks < 6dB margin found	19500	Passed
8.202_02	II	1 Ant V lying	-	-	No peaks < 6dB margin found	19500	Passed
8.202_02	II	1 Ant V standing	-	-	No peaks < 6dB margin found	19500	Passed
8.202_01	II	1 Ant H standing	-	-	No peaks < 6dB margin found	19500	Passed
8.202_01	II	1 Ant H lying	-	-	No peaks < 6dB margin found	19500	Passed
8.401a	IV	2 lying	No peaks < 6dB margin found	No peaks < 6dB margin found	-	18000	Passed
8.401a1	IV	2 lying	-	-	No peaks < 6dB margin found	18000	Passed
8.401b	IV	2 standing	No peaks < 6dB margin found	-	-	18000	Passed
8.401b1	IV	2 standing	-	No peaks < 6dB margin found	-	18000	Passed
8.401b2	IV	2 standing	-	-	No peaks < 6dB margin found	18000	Passed
8.501a	V	3 Lying	No peaks < 6dB margin found	No peaks < 6dB margin found	-	9000	Passed
8.501b	V	3 Standing	No peaks < 6dB margin found	No peaks < 6dB margin found	-	9000	Passed

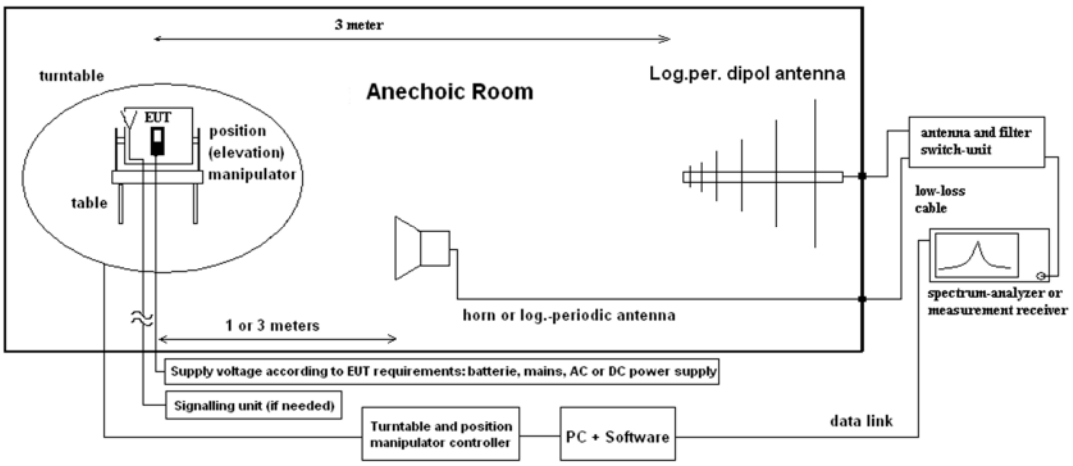
Remark: for more information and graphical plot see annex A1 **23-1-0014801T033_TR1-A201-R02**

4.4 Radiated Band Edge

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

Evaluating the emissions have to be done first by an exploratory emissions measurement and a final measurement for most critical frequencies. The tests are performed in a CISPR 16-1-4:2010 compliant fully anechoic room (FAR) recognized by the regulatory commission. The measurement distance was set to 3 meter for frequencies up to 18 GHz and 2 meter above 18 GHz. A logarithmic periodic antenna is used for the frequency range 30 MHz to 1 GHz. Horn antennas are used for frequency range 1 GHz to 40 GHz. The EUT is aligned within 3 dB beam width of the measurement antenna with three orthogonal axis measurements on the EUT

Schematic:



Testing method:

The measurement is made according to relevant reference clauses:
(See Tables *Summary of Test Results* and *Summary of Test Methods* on page 5)

See chapter Radiated Spurious Emission forTest method.

4.4.2 Measurement Location

Test site	120904 - FAC1 - Radiated Emissions

4.4.3 Limit

Frequency Range [MHz]	Limit [dBm]	Detector [MaxHold]	RBW / VBW [kHz]
Below 824 and above 849	-13	Peak	3 / 3
Below 1710 and above 1755	-13	Peak	3 / 3
Below 1850 and above 1910	-13	Peak	3 / 3

4.4.4 Result

Diagram	Band	Mode	Edge [Low / High]	Value [dBm]	Result
9.201	II	Bandedge_low_Channel_9262_UL_1852.4_laying	Low	-26.78	Passed
9.201	II	Bandedge_low_Channel_9262_UL_1852.4_standing	Low	~-22.5	Passed
9.202	II	Bandedge_high_Channel_9538_UL_1907.6_laying	High	~-22.5	Passed
9.202	II	Bandedge_high_Channel_9538_UL_1907.6_standing	High	~-20	Passed
9.401	IV	Bandedge_low_Channel_1312_UL_1712.6_laying	Low	-26.96	Passed
9.401	IV	Bandedge_low_Channel_1312_UL_1712.6_standing	Low	-21.24	Passed
9.402	IV	Bandedge_high_Channel_1513_UL_1752.4_laying	High	-26.93	Passed
9.402	IV	Bandedge_high_Channel_1513_UL_1752.4_standing	High	-19.69	Passed
9.501	V	Bandedge_low_Channel_4132_UL_826.4_laying	Low	~-29	Passed
9.501	V	Bandedge_low_Channel_4132_UL_826.4_standing	Low	~-25	Passed
9.502	V	Bandedge_high_Channel_4233_UL_846.6_laying	High	~-30	Passed
9.502	V	Bandedge_high_Channel_4233_UL_846.6_standing	High	~-27.5	Passed

Remark: for more information and graphical plot see annex A1 **23-1-0014801T033_TR1-A201-R02**

4.5 Equipment lists

ID	Description	Manufacturer	SerNo	CheckType	Last Check	Interval	Next Check
	120901 - SAC3 - Radiated Emission <1GHz			calchk	cal: 2015-Jul-21 chk: 2021-Jul-27	cal: 10Y chk: 12M	cal: 2025-Jul-21 chk: 2022-Jul-27
20341	Digital Multimeter Fluke 112	Fluke Deutschland GmbH / Glottertal	81650455	cal	cal: 2024-May-13	cal: 24M	cal: 2026-May-13
20442	Semi Anechoic Chamber	ETS-Lindgren Gmbh / Taufkirchen	without	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
20482	filter matrix Filter matrix SAR 1	cetecom advanced GmbH / Essen	without	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
20574	Biconilog Hybrid Antenna BTA-L	Frankonia GmbH / Heideck	980026L	cal	cal: 2022-Jun-15	cal: 36M	cal: 2025-Jun-15
20620	Test Receiver ESU26	Rohde & Schwarz Messgerätebau GmbH / Memmingen	100362	cal	cal: 2024-May-15	cal: 12M	cal: 2025-May-15
20885	Power Supply EA3632A	Agilent Technologies Deutschland GmbH	75305850	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
25038	Loop Antenna HFH2-Z2	Rohde & Schwarz Messgerätebau GmbH / Memmingen	879824/13	cal	cal: 2022-Jul-04	cal: 24M	cal: 2024-Jul-04
	120904 - FAC1 - Radiated Emissions			chk	chk: 2023-Aug-22	chk: 12M	chk: 2024-Aug-22
20020	Horn Antenna 3115 (Subst 1)	EMCO Elektronik GmbH	9107-3699	calchk	cal: 2021-Aug-17 chk: 2013-Apr-20	cal: 36M chk: 12M	cal: 2024-Aug-17
20066	Notch Filter WRCT 1900/2200-5/40-10EEK	Wainwright Instruments GmbH	5	chk	chk: 2023-Aug-22	chk: 12M	chk: 2024-Aug-22
20121	Notch Filter WRCB 1879,5/1880,5EE	Wainwright Instruments GmbH	15	chk	chk: 2023-Aug-22	chk: 12M	chk: 2024-Aug-22
20122	Notch Filter WRCB 1747/1748	Wainwright Instruments GmbH / Andechs	12	chk	chk: 2023-Aug-22	chk: 12M	chk: 2024-Aug-22
20254	High Pass Filter 5HC 2600/12750-1.5KK	Trilithic	23042	chk	chk: 2023-Aug-22	chk: 12M	chk: 2024-Aug-22
20287	Pre-Amplifier 25MHz - 4GHz AMF-2D-100M4G-35-10P	Miteq Inc.	379418	chk	chk: 2023-Aug-22	chk: 12M	chk: 2024-Aug-22
20290	Notch Filter WRCA 901,9/903,1SS	Wainwright Instruments GmbH	3RR	chk	chk: 2023-Aug-22	chk: 12M	chk: 2024-Aug-22
20291	High Pass Filter WHJ 2200-4EE	Wainwright Instruments GmbH	14	chk	chk: 2023-Aug-22	chk: 12M	chk: 2024-Aug-22
20338	Pre-Amplifier 100MHz - 26GHz JS4-00102600-38-5P	Miteq Inc.	838697	chk	chk: 2023-Aug-22	chk: 12M	chk: 2024-Aug-22
20448	Notch Filter WRCT 1850.0/2170.0-5/40-10SSK	Wainwright Instruments GmbH	5	chk	chk: 2023-Aug-22	chk: 12M	chk: 2024-Aug-22
20449	Notch Filter WRCT 824.0/894.0-5/40-8SSK	Wainwright Instruments GmbH	1	chk	chk: 2023-Aug-22	chk: 12M	chk: 2024-Aug-22
20484	Pre-Amplifier 2,5GHz - 18GHz AMF-5D-02501800-25-10P	Miteq Inc.	1244554	chk	chk: 2023-Aug-22	chk: 12M	chk: 2024-Aug-22
20489	Test Receiver ESU40	Rohde & Schwarz Messgerätebau GmbH / Memmingen	100030	cal	cal: 2024-May-15	cal: 12M	cal: 2025-May-15
20512	Notch Filter WRCA 800/960-02/40-6EEK (GSM 850)	Wainwright Instruments GmbH	24	chk	chk: 2023-Aug-22	chk: 12M	chk: 2024-Aug-22
20549	Log. Per. Antenna HL025	Rohde & Schwarz Messgerätebau GmbH	1000060	calchk	cal: 2021-Aug-18	cal: 36M chk: 12M	cal: 2024-Aug-18
20558	Fully Anechoic Chamber 1	ETS-Lindgren Gmbh / Taufkirchen	-	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
20608	Ultrabroadband-Antenna HL562	Rohde & Schwarz Messgerätebau GmbH / Memmingen	830547/009	cal	cal: 2023-Jul-04	cal: 36M	cal: 2026-Jul-04
20611	Power Supply E3632A	Agilent Technologies Deutschland GmbH	KR 75305854	cpu			
20690	Spectrum Analyzer FSU	Rohde & Schwarz Messgerätebau GmbH / Memmingen	100302/026	cal	cal: 2023-May-25	cal: 24M	cal: 2025-May-25
20720	Measurement Software EMC32 [FAC]	Rohde & Schwarz Messgerätebau GmbH	V10.xx	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
20868	High Pass Filter AFH-07000	AtlanTecRF	16071300004	chk	chk: 2023-Aug-22	chk: 12M	chk: 2024-Aug-22
20883	Open Switch and control Platform OSP-B200S2 Satellite	Rohde & Schwarz Messgerätebau GmbH / Memmingen	101432	chk	chk: 2023-Aug-22	chk: 12M	chk: 2024-Aug-22
20884	Open Switch and control Platform OSP320	Rohde & Schwarz Messgerätebau GmbH / Memmingen	101391	chk	chk: 2023-Aug-22	chk: 12M	chk: 2024-Aug-22
	120907 - FAC2 - Radiated Emissions			chk	chk: 2024-Mar-15	chk: 12M	chk: 2025-Mar-15
20005	AC - LISN 50 Ohm/50µH ESH2-Z5	Rohde & Schwarz Messgerätebau GmbH / Memmingen	861741/005	cal	cal: 2024-May-16	cal: 12M	cal: 2025-May-16
20133	Horn Antenna 3115 (Meas 1)	EMCO Elektronik GmbH / Gilching	9012-3629	cal	cal: 2023-May-22	cal: 36M	cal: 2026-May-22
20302	Horn Antenna BBHA9170 (Meas 1)	Schwarzbeck Mess-Elektronik OHG / Schönau	155	cpu	chk: 2020-Apr-15	chk: 12M	
20412	Fully Anechoic Chamber 2	ETS-Lindgren Gmbh / Taufkirchen	without	chk	chk: 2023-Apr-14	chk: 12M	chk: 2024-Apr-14
20729	FS-Z140	Rohde & Schwarz Messgerätebau GmbH / Memmingen	101004	cal	cal: 2023-Jun-16	cal: 36M	cal: 2026-Jun-16
20730	FS-Z110	Rohde & Schwarz Messgerätebau GmbH / Memmingen	101468	cal	cal: 2023-Jun-02	cal: 36M	cal: 2026-Jun-02
20731	FS-Z75	Rohde & Schwarz Messgerätebau GmbH / Memmingen	101022	cal	cal: 2022-May-18	cal: 36M	cal: 2025-May-18
20733	Harmonic Mixer FS-Z220	RPG-Radiometer Physics GmbH / Meckenheim	101009	cal	cal: 2024-May-24	cal: 36M	cal: 2027-May-24
20734	Harmonic Mixer FS-Z325	RPG-Radiometer Physics GmbH / Meckenheim	101005	cal	cal: 2024-May-24	cal: 36M	cal: 2027-May-24
20765	Pickett-Potter Horn Antenna FH-PP 40-60	RPG-Radiometer Physics GmbH / Meckenheim	010001	chk	chk: 2023-Oct-20	chk: 12M	chk: 2024-Oct-20
20767	Pickett-Potter Horn Antenna FH-PP 140-220	RPG-Radiometer Physics GmbH / Meckenheim	010011	chk	chk: 2023-Oct-20	chk: 12M	chk: 2024-Oct-20
20811	Horn Antenna ASY-SGH-124-SMA	Antenna Systems Solutions S.L	29F14182337	cal	cal: 2021-Oct-20	cal: 36M	cal: 2024-Oct-20
20812	Pickett-Potter Horn Antenna FH-PP-325	RPG-Radiometer Physics GmbH / Meckenheim	10024	chk	chk: 2023-Oct-20	chk: 12M	chk: 2024-Oct-20
20813	Pickett-Potter Horn Antenna FH-PP 075	RPG-Radiometer Physics GmbH / Meckenheim	10006	chk	chk: 2023-Oct-20	chk: 12M	chk: 2024-Oct-20

ID	Description	Manufacturer	SerNo	CheckType	Last Check	Interval	Next Check
20814	Pickett-Potter Horn Antenna FH-PP 140	RPG-Radiometer Physics GmbH / Meckenheim	10008	chk	chk: 2023-Oct-20	chk: 12M	chk: 2024-Oct-20
20815	Pickett-Potter Horn Antenna FH-PP 110	RPG-Radiometer Physics GmbH / Meckenheim	10014	chk	chk: 2023-Oct-20	chk: 12M	chk: 2024-Oct-20
20816	SGH Antenna SGH-26-WR10	Anteral S.L.	1144	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
20817	Waveguide Rectangular Horn Antenna SAR-2309-22-S2	ERAVANT / Torrance	13254-01	chk	chk: 2023-Oct-20	chk: 12M	chk: 2024-Oct-20
20836	1-18 GHz Amplifier	Wright Technologies, Inc., Inc. / Roseville	0001	chk		chk: 36M	
20877	JS42-08001800-16-8P Verstärker	Miteq Inc.	2079991 / 2079992	chk	chk: 2023-Feb-27	chk: 6M	chk: 2023-Aug-27
20907	Waveguide WR-15 attenuator STA-30-15-M2	SAGE Millimeter Inc.	13256-01	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
20908	Waveguide WR 10 attenuator STA-30-10-M2	SAGE Millimeter Inc.	13256-01	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
20909	Waveguide Horn Antenna PE9881-24	Pasternack Enterprises, Inc.	37/2016	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
20910	Frequency Multiplier 936VF-10/385	MI-Wave, Millimeter Wave Products Inc.	142	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
20911	Frequency Multiplier 938WF-10/387	MI-Wave, Millimeter Wave Products Inc.	141	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
20913	Phase Amplitude Stable Cable Assembly DC-40GHz	RF-Lambda Europe GmbH	AC19040001	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
25457	DRG Horn Antenna SAS-574	A.H. Systems, Inc. / Chatsworth	383	cal	cal: 2022-Mar-28	cal: 36M	cal: 2025-Mar-28
	120910 - Radio Laboratory 1 (TS 8997)			chk	chk: 2023-Jul-10	chk: 12M	chk: 2024-Jul-10
20559	Vector Signal Generator SMU200A	Rohde & Schwarz Messgerätebau GmbH / Memmingen	103736	cal	cal: 2023-May-25	cal: 24M	cal: 2025-May-25
20691	Open Switch and control Platform OSP157W 8 Port Plus	Rohde & Schwarz Messgerätebau GmbH / Memmingen	100950	cal	cal: 2023-Jun-30	cal: 36M	cal: 2026-Jun-30
20805	Open Switch and control Platform OSP B157WX 40GHz 8Port Switch	Rohde & Schwarz Messgerätebau GmbH / Memmingen	101264	cal	cal: 2023-May-26	cal: 36M	cal: 2026-May-26
20866	Signal Analyzer FSV3030	Rohde & Schwarz Messgerätebau GmbH / Memmingen	101247	cal	cal: 2023-Jun-14	cal: 12M	cal: 2024-Jun-14
20871	NRP-Z81	Rohde & Schwarz Messgerätebau GmbH / Memmingen	104631	cal	cal: 2024-May-15	cal: 12M	cal: 2025-May-15
20872	NRX Power Meter	Rohde & Schwarz Messgerätebau GmbH / Memmingen	101831	cal	cal: 2024-May-14	cal: 24M	cal: 2026-May-14
20904	Climatic Chamber ClimeEvent C/1000/70a/5	Weiss Umwelttechnik GmbH / Reiskirchen-Lindenstruth	58226223240010	cal	cal: 2022-Nov-29	cal: 24M	cal: 2024-Nov-29
20927	Signal Generator SMF 100A	Rohde & Schwarz Messgerätebau GmbH / Memmingen	102109	cal	cal: 2022-May-19	cal: 36M	cal: 2025-May-19
20902	Wideband Radio Communication Tester CMW500	Rohde & Schwarz Messgerätebau GmbH / Memmingen	168880	cal	cal: 2024-Jun-07	cal: 12M	cal: 2025-Jun-07

Tools used in 'P1M1'

4.5.1 Legend

Note / remarks	Interval of calibration & Verification
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 it contribution to the overall uncertainty according its statistical distribution calculated.

Issue No.	Measurement type	Reference	Frequency range of measurement		Calculated Uncertainty based on confidence level of 95.54%	Remarks
			Start [MHz]	Stop [MHz]		
1	Magnetic Field Strength	EN ,FCC, JP, IC	0.009	30	4.86	Magnetic loop antenna, Pre-Amp on
2	RF-Output Power (EIRP) Unwanted emissions (EIRP) [dB]	EN, FCC, JP, IC	30	100	4.57	without Pre-Amp
			30	100	4.91	with Pre-Amp
			100	1000	4.02	without Pre-Amp
			100	1000	4.26	with Pre-Amp
			1000	18000	4.36	without Pre-Amp
			1000	18000	5.23	with Pre-Amp
			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)
3	Radiated Blocking [dB]	EN	1000	18000	2.85	Typical set-up with microwave generator and antenna, value for 7 GHz 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
4	Frequency Error / UWB+FMCW [kHz]	EN, FCC, JP, ISED	40000	77000	276.19	calculated for 77 GHz (FMCW) carrier
			6000	7000	33.92	calculated for 6.5 GHz UWB Ch.5
	Frequency Error / NFC [Hz]	EN, FCC, JP, ISED	11.00	14.00	20.76	calculated for 13.56 MHz NFC carrier
5	TS 8997 Conducted Parameters	FCC15/18 / ISED	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 2.4 GHz ISM
			5.18	5.825	7.180 ppm	6b. Bandwidth / 2-Marker Method for 5 GHz WLAN
			5.18	5.825	1.099 ppm	7. Frequency (Marker method) for 5 GHz WLAN
			30	6000	0.11561 µs	8. Medium-Utilization factor / Timing
			30	6000	1.85	9a. Blocking-Level of companion device
			30	6000	1.62	9b. Blocking Generator level
6	Conducted Emissions	EN, FCC	0.009	30	3.57	general EMI-measurements on AC/DC ports

9 Versions of test reports (change history)

Version	Applied changes	Date of release
R01	Initial release	2024-Jun-27
R02	PMN, HVIN and FVIN for ISED corrected ISED references updated	2024-Oct-17
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End Of Test Report