DAkkS Deutsche Akkreditierungsstelle D-PL-21375-01-00

LENHARDT WORLDWIDE | TESTING | CERTIFICATION

Bundesnetzagentur BNetzA-CAB-21/21-21

Test Report

Test report no.: 22057332-40764-0
Date of issue: 2024-06-05

Test result: The test item **- passed - and complies** with below listed standards.

Applicant
BURY GmbH & Co. KG

Manufacturer
BURY GmbH & Co. KG

Test Item
MB-WMI2024

RF-Spectrum Testing according to:

FCC 47 CFR Part 15
Radio Frequency Devices (Subpart C)

Tested by (name, function, signature)	*Piotr Sardyko* *Deputy Head of Laboratory RF*	signature
Approved by (name, function, signature)	*Andreas Bender* *Deputy Managing Director*	signature

Applicant and Test item details	
Applicant	BURY GmbH & Co. KG Robert-Koch Str. 1-7 32584 Löhne Germany
Manufacturer	BURY GmbH & Co. KG Robert-Koch Str. 1-7 32584 Löhne Germany
Test item description	Wireless Charger with NFC
Model/Type reference	MB-WMI2024
FCC ID	QZ9-WMI
Frequency	127.8 kHz
Technology	Wireless charger
Antenna	integrated antenna (ferrite coil)
Power supply (function)	Vehicle Battery (Vnom: 12; Vmax: 16; Vmin: 6)
Temperature range	-40 °C - +80 °C

Disclaimer and Notes

Within this test report, a ☒ point / ☐ comma is used as a decimal separator.
If otherwise, a detailed note is added adjected to its use.

Decision rule:
Decision rule based on simple acceptance without guard bands, binary statement, based on mutually agreed uncertainty tolerances with expansion factor k=2.

1 TABLE OF CONTENTS

2 GENERAL INFORMATION

2.1 Administrative details

Testing laboratory	**IBL-Lab GmbH** Heinrich-Hertz-Allee 7 66386 St. Ingbert / Germany Fon: +49 6894 38938-0 Fax: +49 6894 38938-99 URL: https://ib-lenhardt.com/ E-Mail: info@ib-lenhardt.com
Accreditation / Designation	The testing laboratory is accredited by Deutsche Akkreditierungsstelle GmbH (DAkkS) in compliance with DIN EN ISO/IEC 17025:2018. Scope of testing and registration number: • Attachment to the accreditation certificate D-PL-21375-01-00 ○ Electronics ○ Electromagnetic Compatibility ○ Radio ○ Electromagnetic Compatibility and Telecommunication (FCC requirements) ○ Telecommunication (TC) and Electromagnetic Compatibility (EMC) for Canadian Standards ○ Automotive EMC Website DAkkS: https://www.dakks.de/ The Deutsche Akkreditierungsstelle GmbH (DAkkS) is also a signatory to the ILAC Mutual Recognition Arrangement. • Designations ○ FCC Testing Laboratory Designation No. DE0024 ○ ISED Company Number 27156 Testing Laboratory CAB Identifier DE0020 ○ Kraftfahrt-Bundesamt KBA-P 00120-23
Testing location	**IBL-Lab GmbH** Heinrich-Hertz-Allee 7 66386 St. Ingbert / Germany
Date of receipt of test samples	2024-01-22
Start – End of tests	2024-01-25 – 2024-01-29

2.2 Possible test case verdicts

Test sample meets the requirements	P (PASS)
Test sample does not meet the requirements	F (FAIL)
Test case does not apply to the test sample	N/A (Not applicable)
Test case not performed	N/P (Not performed)

2.3 Observations

No additional observations other than the reported observations within this test report have been made.

2.4 Opinions and interpretations

No appropriate opinions or interpretations according ISO/IEC 17025:2017 clause 7.8.7 are within this test report.

2.5 Revision history

-0 Initial Version

2.6 Further documents

List of further applicable documents belonging to the present test report:

EUT photographs:	22057332-40764-0_Annex A
Test setup photographs:	22057332-40764-0_Annex B

3 ENVIRONMENTAL & TEST CONDITIONS

3.1 Environmental conditions of lab

Temperature	20°C ± 5°C
Relative humidity	25-75% r.H.
Barometric Pressure	860-1060 mbar

3.2 Normal and extreme test conditions

	minimum	normal	maximum
Temperature	-	20 °C	-
Relative humidity	-	45 % r.h.	-
Power supply	-	12 V DC	-

4 TEST STANDARDS AND REFERENCES

Test standard (accredited)	**Description**
FCC 47 CFR Part 15	Radio Frequency Devices (Subpart C)

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

5 EQUIPMENT UNDER TEST (EUT)

5.1 Product description

Wireless Charger with NFC.

*: as declared by applicant

5.2 Technical data of test item

Operational frequency*	127.8 kHz
Number of channels*	1
Channel bandwidth*	-/-
Channel spacing*	-/-
Antenna*	integrated antenna (ferrite coil)
Power supply*	Vehicle Battery (Vnom: 12; Vmax: 16; Vmin: 6)
Temperature range*	-40 °C - +80 °C

*: as declared by applicant

5.3 Test Item (Equipment Under Test) Description*

Short designation	EUT Model	EUT Description	ID	Hardware status	Software status
EUT A	MB-WMI2024	Wireless Charger with NFC	324000657958	23/50.00	24/03.05 E000.3

*: as declared by applicant

5.4 AE (Auxiliary equipment) Description*

Short designation	EUT Model	EUT Description	Serial number/ ID	Hardware status	Software/Firmware status
AE 1	-	Cable harness (see photos in Annex A)	-	-	AE 1
AE 2	-	EMC receiver	-	-	AE 2
AE 3	-	CanSimulator	-	-	AE 3
AE 4	Can Simulator GUI	SW	-	3.01.0	AE 4

*: declared by the applicant

5.5 Test Item Operating Modes Description*

EUT operating mode no.	Description of operating modes	Additional information
op. 1	Continuous modulated mode	-

*: declared by the applicant

5.6 Test Item Set-ups Description

set. 1	EUT A + AE 1 - 4

5.7 Test Conditions

Temperatur, [°C]		Voltage, [V]	
Tnom	20 ± 5	Vnom	Input AE 1: 12 V

5.8 Additional Information

Test items differences	-
Additional application considerations to test a component or sub-assembly	The EUT is tested together with EMC receiver.

6 SUMMARY OF TEST RESULTS

Test specification
FCC 47 CFR Part 15

Clause	Requirement / Test case	Test Conditions	Result / Remark	Verdict
§15.207	Conducted limits	Normal	< limit	N/A*
§15.209	Radiated emission limits	Normal	< limit	P

Notes
* the EUT is using a car battery for voltage supply

Comments and observations
– none –

7 TEST RESULTS

7.1 Field strength of emissions

Description / Limits

§15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency	Field Strength	Measurement distance
0.009 – 0.490 MHz	2400/F[kHz] µV/m	300 m
0.490 – 1.705 MHz	24000/F[kHz] µV/m	30 m
1.705 – 30.0 MHz	30.0 µV/m / 29.5 dBµV/m	30 m
30 – 88 MHz	100 µV/m / 40.0 dBµV/m	3 m
88 – 216 MHz	150 µV/m / 43.5 dBµV/m	3 m
216 – 960 MHz	200 µV/m / 46.0 dBµV/m	3 m
960 – 100 000 MHz	500 µV/m / 54.0 dBµV/m	3 m

§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

§15.209 (c) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other sections within this part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.

§15.209 (d) The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

Test procedure

§15.31 (m) Measurements on intentional radiators or receivers, other than TV broadcast receivers, shall be performed and, if required, reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table:

Frequency range	Number of frequencies	Location
< 1MHz bandwidth	1	middle
1 – 10 MHz bandwidth	2	1 near bottom and 1 near top
> 10 MHz bandwidth	3	1 near bottom / middle / top

§15.35 (a) On any frequency or frequencies below or equal to 1000 MHz, the limits shown are based on measuring equipment employing a CISPR quasi-peak detector function and related measurement bandwidths, unless otherwise specified. The specifications for the measuring instrumentation using the CISPR quasi-peak detector can be found in ANSI C63.4-2014, clause 4 (incorporated by reference, see §15.38). As an alternative to CISPR quasi-peak measurements, the responsible party, at its option, may demonstrate compliance with the emission limits using measuring equipment employing a peak detector function as long at the same bandwidth as indicated for CISPR quasi-peak measurements are employed.

Typical test distances
Up to 18 GHz: 3.00 m

Test setup: see 8.2

Test results*:

Channel frequency [kHz]	Frequency [MHz]	Detector	Test distance [m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]
125	*See plots*	QP	3	*See plots*	*See plots*	*See plots*

* Testing was performed with a test mode comparable to normal operation mode.

Note
Radiated field strength was measured with the 3 m distance between loop antenna and EUT without correction factor for 30 m/ 300 m measurement. The correction factor should be used to get a value corresponded for the 30 m / 300 m measurement.

30 m explanation:
ANSI C63.10-2013 6.4.4.2 says:
If field strength is measured at only a single point, then that point shall be at the radial from the EUT that produces the maximum emission at the frequency being measured, as described in 5.4. If that point is closer to the EUT than λ/2π and the limit distance is greater than λ/2π, the measurement shall be extrapolated to the limit distance by conservatively presuming that the field strength decreases at a 40 dB/decade of distance rate to the λ/2π distance, and at a 20 dB/decade of distance rate beyond λ/2π. This shall be accomplished using Equation:

$$FS_{\text{limit}} = FS_{\text{max}} - 40\log\left(\frac{d_{\text{near field}}}{d_{\text{measure}}}\right) - 20\log\left(\frac{d_{\text{limit}}}{d_{\text{near field}}}\right)$$

where
FS_{limit} is the calculation of field strength at the limit distance, expressed in dBµV/m
FS_{max} is the measured field strength, expressed in dBµV/m
d_{near} field is the λ/2π distance
$d_{measure}$ is the distance of the measurement point from the EUT
d_{limit} is the reference limit distance
*Here: [d_{near}(f=13.56MHz)=λ/2π=3.52m] > [$d_{measure}$=3m] AND [d_{limit}=30 m] > [d_{near}] => the Equation above can be used: $FS_{limit@30m}$=FS_{max}-**21.4 dB***

300 m explanation:
ANSI C63.10-2013 6.4.4.6 says:
*On frequencies for which **all measurement points and the limit distance are equal to or closer than λ/2π**, the methods described in 6.4.4.4 or 6.4.4.5 may be used.*
…
If only one point is measured inside the λ/2π boundary, then this result shall be extrapolated to a distance of λ/2π using the assumption of a decay of 40 dB/decade of distance. This shall be determined using Equation (6):

$$FS_{\text{near field}} = FS_{\text{measure}} - 40\log\left(\frac{d_{\text{measure}}}{d_{\text{near field}}}\right)$$

where

$FS_{\text{near field}}$	is the estimated field strength at the λ/2π boundary
FS_{measure}	is the value measured at the measurement point
d_{measure}	is the distance of the measurement point from the EUT
$d_{\text{near field}}$	is the distance of the λ/2π boundary

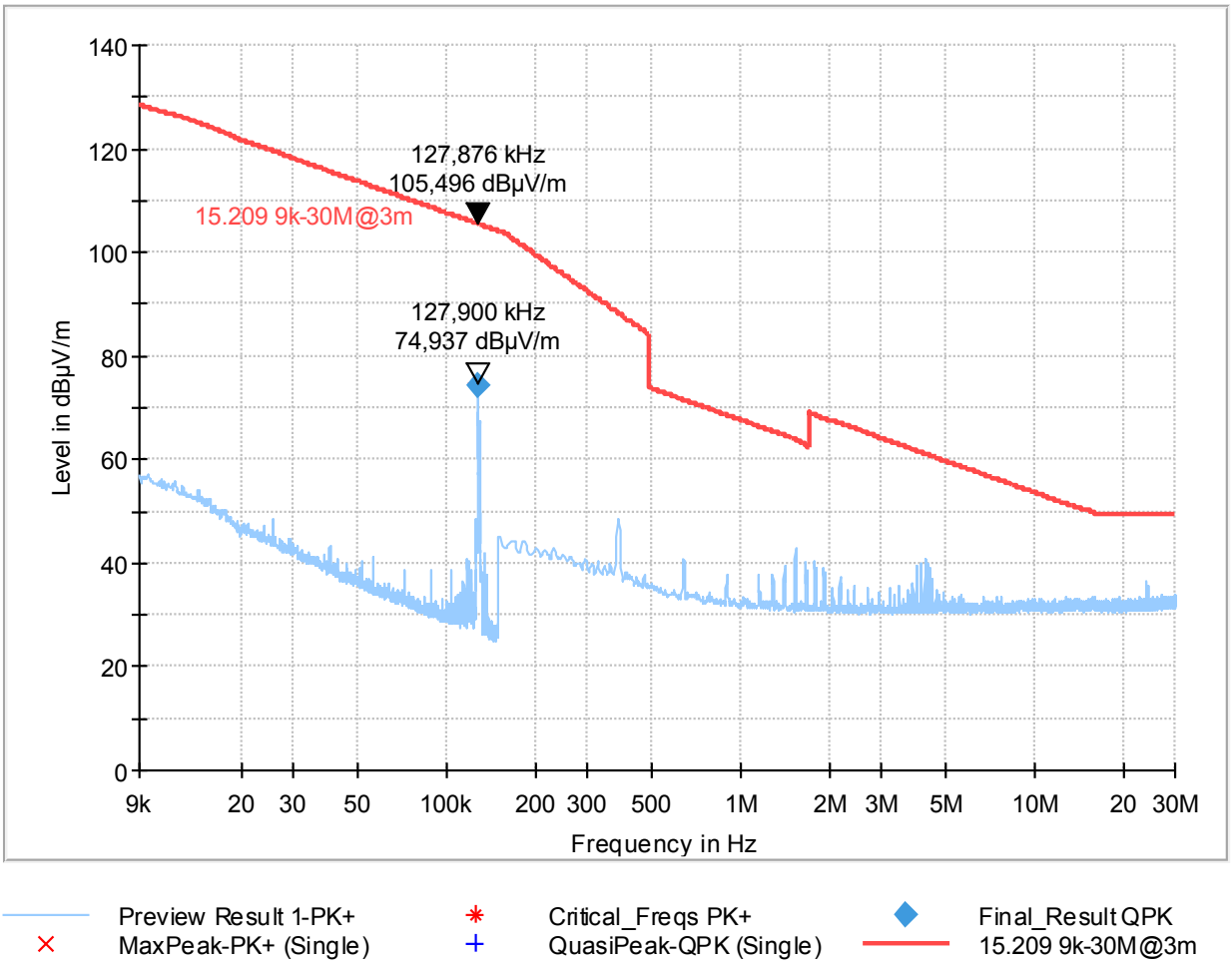
*Here: [d_{near}(f=127.8kHz)=λ/2π=373.3m] > [$d_{measure}$=3m] AND [d_{limit}=300 m] < [d_{near}] => the Equation above can be used: $FS_{near\ field@30m}$=$FS_{measure}$-**80 dB***

Formula for term conversion, dBµV to dBµA:

dBuV to dBuA $$dB\mu A = dB\mu V - 20\log(Z)$$

Z here is 377 Ω.
Thus, here: **dBµA = dBµV – 51.52.**

Plot no. 1: radiated emissions 9 kHz – 30 MHz, EUT lying (see photos 5 and 6 in annex B for EUT position clarification)



Final_Result

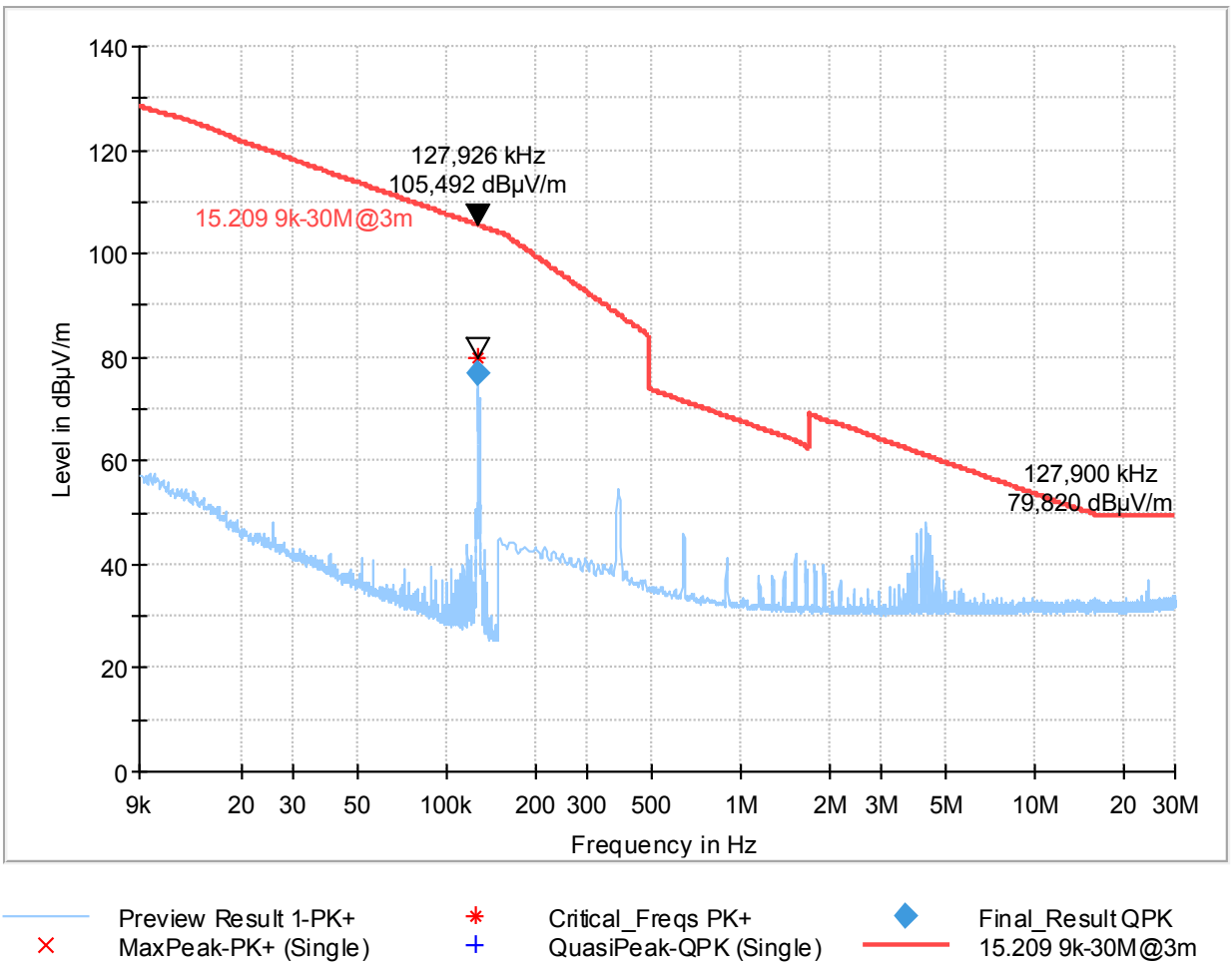
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)
0.1279	74.29	105.496	31.206	100	0.2	V	291	20.5

Final Result for measurement distance 300m/30m (recalculated) in dBµV:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)
0.1279	-5.71	25.496	31.206	100	0.2	V	291	20.5

* Please see Note in chapter 7.2. for the explanation respective correction factor.

Plot no. 2: radiated emissions 9 kHz – 30 MHz, EUT standing (see photos 5 and 6 in annex B for EUT position clarification)



Final_Result

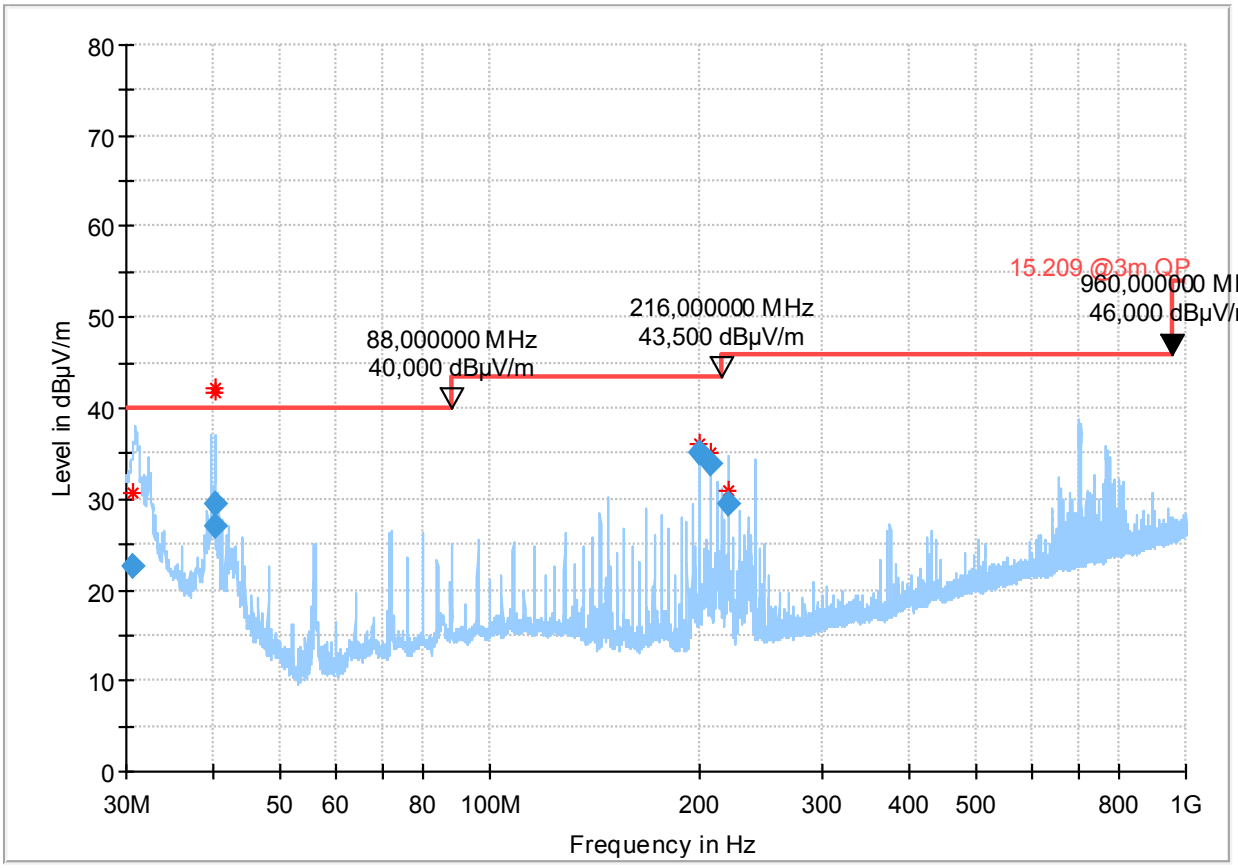
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)
0.127900	77.01	105.492	28.482	100.0	0.200	V	156.0	20.5

Final Result for measurement distance 300m/30m (recalculated) in dBµV:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)
0.1279	-2.99	25.492	28.482	100	0.2	V	156	20.5

* Please see Note in chapter 7.2. for the explanation respective correction factor.

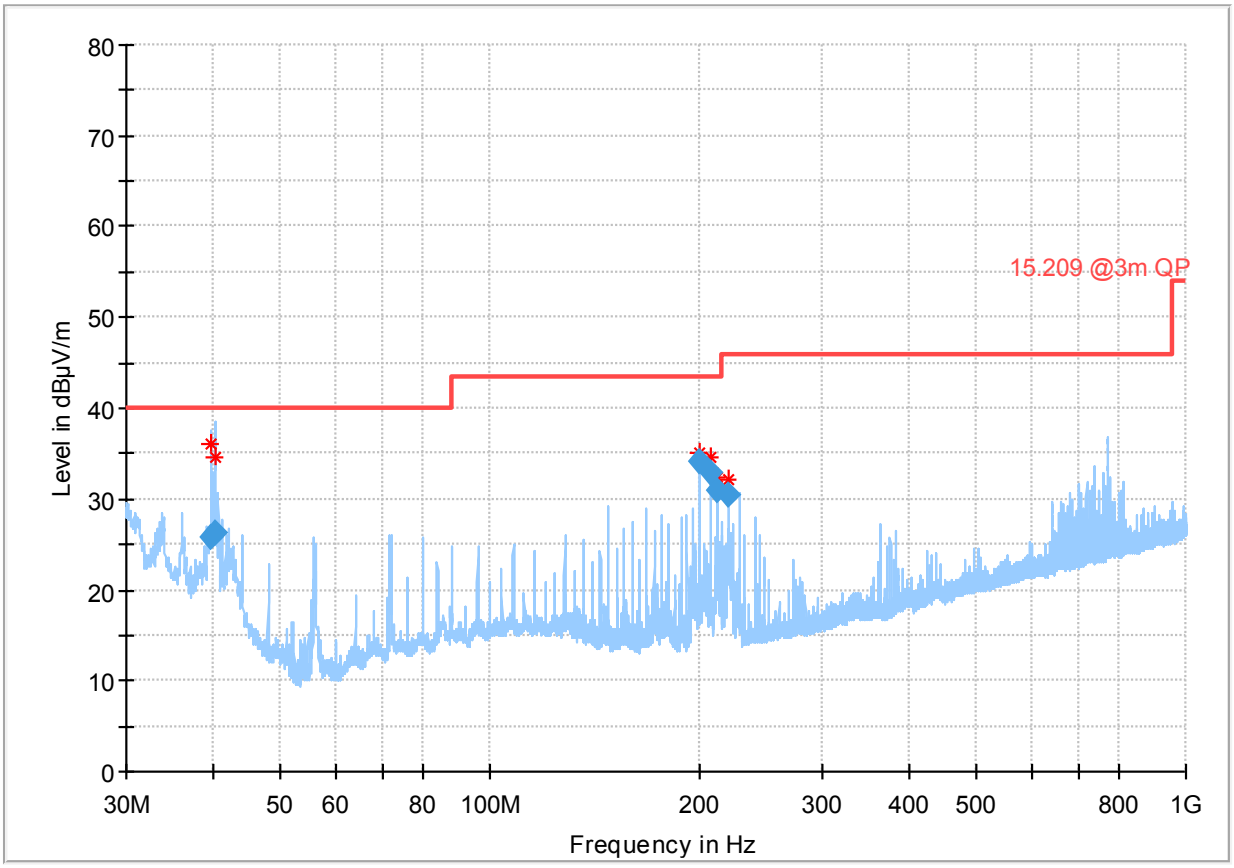
Plot no. 3: radiated emissions 30 MHz – 1 GHz, EUT lying



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
30.620000	22.54	40	17.46	100.0	120.000	104.0	V	90.0
40.220000	29.47	40	10.53	100.0	120.000	167.0	V	23.0
40.230000	26.92	40	13.08	100.0	120.000	159.0	V	127.0
200.000000	34.97	43.5	8.53	100.0	120.000	117.0	H	7.0
208.000000	33.79	43.5	9.71	100.0	120.000	100.0	V	56.0
220.000000	29.36	46	16.64	100.0	120.000	104.0	H	135.0

Plot no. 4: radiated emissions 30 MHz – 1 GHz, EUT standing



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
39.800000	25.67	40	14.33	100.0	120.000	175.0	V	49.0
40.200000	26.34	40	13.66	100.0	120.000	193.0	V	246.0
200.000000	34.05	40	5.95	100.0	120.000	138.0	H	4.0
208.000000	32.91	43.5	10.59	100.0	120.000	128.0	V	64.0
212.000000	30.95	43.5	12.55	100.0	120.000	103.0	V	71.0
220.000000	30.51	46	15.49	100.0	120.000	138.0	H	335.0

8 Test Setup Description

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. Cyclic chamber inspections and range calibrations are performed. Where possible, RF generating and signalling equipment as well as measuring receivers and analysers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

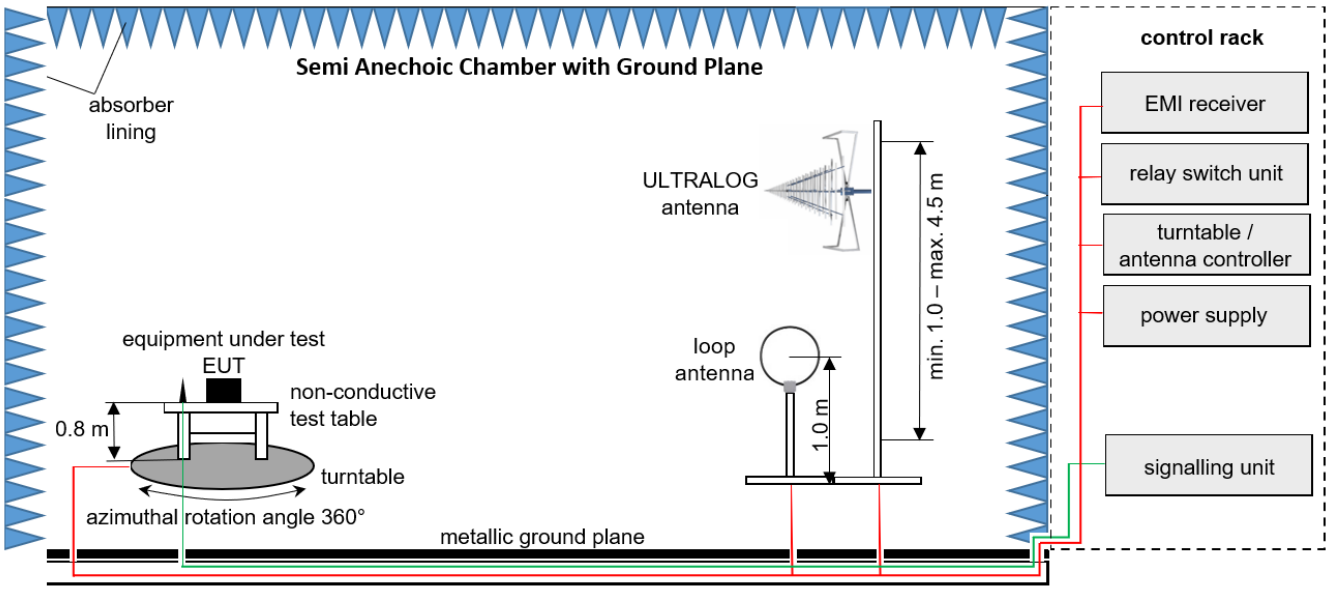
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

Kind of calibration (abbreviations):

C = calibrated
CM = cyclic maintenance
NR = not required
L = locked

8.1 Semi anechoic chamber with ground plane

Radiated measurements are performed in vertical and horizontal plane in the frequency range 30 MHz to 1 GHz in a Semi Anechoic Chamber with a metallic ground plane. The EUT is positioned on a non-conductive test table with a height of 0.80 m above the metallic ground plane that covers the whole chamber. The receiving antennas conform to specification ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices. These antennas can be moved over the height range between 1.0 m and 4.5 m in order to search for maximum field strength emitted from the EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by a spectrum analyzer where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.

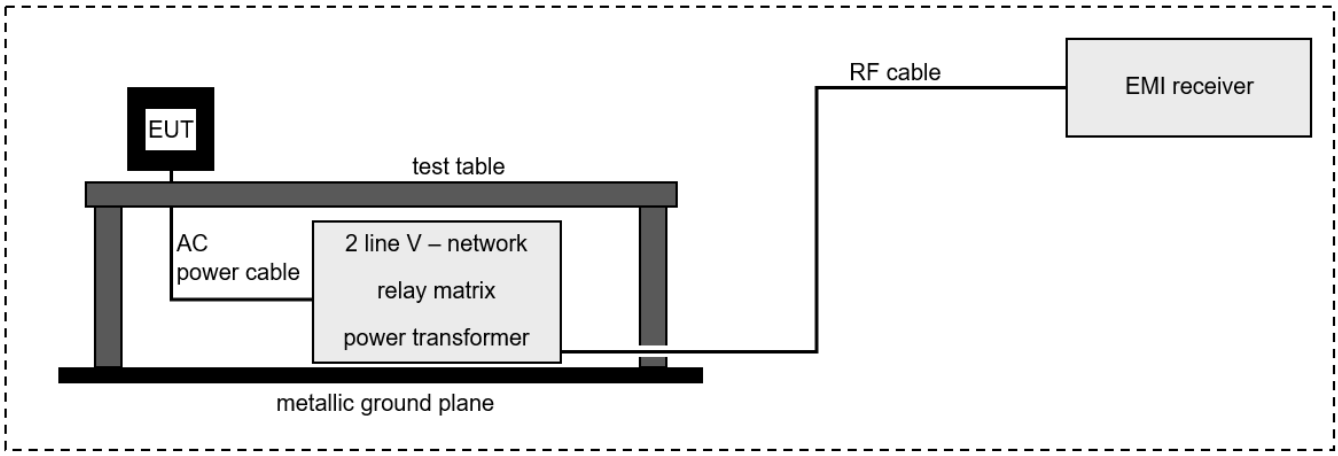


Measurement distance: ULTRALOG antenna at 3 m; loop antenna at 3 m
EMC32 software version: 11.20.00

FS = UR + CL + AF
(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

Example calculation:
FS [dBµV/m] = 12.35 [dBµV/m] + 1.90 [dB] + 16.80 [dB/m] = 31.05 [dBµV/m] (35.69 µV/m)

8.2 Conducted emission



EMC32 software version: 11.10.00

FS = UR + CL + AF
(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

Example calculation:
FS [dBµV] = 12.35 [dBµV] + 1.90 [dB] + 16.80 [dB] = 31.05 [dBµV (35.69 µV)

9 MEASUREMENT PROCEDURES

9.1 Radiated spurious emissions from 9 kHz to 30 MHz

Test setup

- The EUT is set up according to its intended use, as described in the user manual or as defined by the manufacturer.
- In case of floor standing equipment, it is placed in the middle of the turn table.
  In case of tabletop equipment it is placed on a non-conductive table with a height of 80 cm.
- Additional equipment, cables, … necessary for testing, are positioned like under normal operation.
- Interface cables, e.g. power supply, network, … are connected to the connection box in the turn table.
- EUT is powered on and set into operation.

Pre-scan

- Turntable performs an azimuthal rotation from 0° to 315° in 45° steps.
- For each turntable step the EMI-receiver/spectrum analyser performs a positive-peak/max-hold sweep (=worst-case). Data is transferred to EMI-software and recorded. EMI-software will show the maximum level of all single sweeps as the final result for the pre-scan.

Final measurement

- Significant emissions found during the pre-scan will be maximized by the EMI-software by rotating the turntable from 0° to 360°.
- Loop antenna is rotated with special 3D adapter set to find maximum level of emissions.
- Plot of the pre-scan with frequencies of identified emissions including levels, correction factors, turn table position and settings of measuring equipment is recorded.

Distance correction (extrapolation)

- When performing measurements on test distances other than defined in the rules, the results shall be extrapolated to the specified distance by conservatively presuming that the field strength decays at 40 dB/decade of distance in the region closer than λ in m divided by 2π (i.e., λ/2π), and at 20 dB/decade of distance beyond that, using the measurement of a single point at the radial angle that produces the maximum emission.
  This correction is already included in the limit line of corresponding measurement plots.

Detailed requirements can be found in e.g. ANSI C63.4 / C63.10

9.2 Radiated spurious emissions from 30 MHz to 1 GHz

Test setup

- The EUT is set up according to its intended use, as described in the user manual or as defined by the manufacturer.
- In case of floor standing equipment, it is placed in the middle of the turn table.
  In case of tabletop equipment it is placed on a non-conductive table with a height of 80 cm.
- Additional equipment, cables, … necessary for testing, are positioned like under normal operation.
- Interface cables, e.g. power supply, network, … are connected to the connection box in the turn table.
- EUT is powered on and set into operation.

Pre-scan

- Turntable performs an azimuthal rotation from 0° to 315° in 45° steps.
- Antenna polarisation is changed (H-V / V-H) and antenna height is changed from 1 meter to 4 meters.
- For each turntable step / antenna polarisation / antenna height the EMI-receiver/spectrum analyser performs a positive-peak/max-hold sweep (=worst-case). Data is transferred to EMI-software and recorded. EMI-software will show the maximum level of all single sweeps as the final result for the pre-scan.

Final measurement

- Significant emissions found during the pre-scan will be maximized by the EMI-software based on evaluated data during the pre-scan by rotating the turntable and changing antenna height and polarisation.
- Final measurement will be performed with measuring equipment settings as defined in the applicable test standards (e.g. ANSI C6.4).
- Plot of the pre-scan with frequencies of identified emissions including levels, correction factors, turn table position, antenna polarisation and settings of measuring equipment is recorded.

Distance correction (extrapolation)

- When performing measurements on test distances other than defined in the rules, the results shall be extrapolated to the specified distance by conservatively presuming that the field strength decays at 20 dB/decade of distance beyond the region λ in m divided by 2π (i.e., λ/2π), using the measurement of a single point at the radial angle that produces the maximum emission.
  This correction is already included in the corresponding measurement plots.

Detailed requirements can be found in e.g. ANSI C63.4 / C63.10

9.3 Conducted emission

Test setup

- The EUT is set up according to its intended use, as described in the user manual or as defined by the manufacturer.
- In case of floor standing equipment, it is placed in the middle of the turn table.
  In case of tabletop equipment it is placed on a non-conductive table with a hight of 80 cm.
- Additional equipment, cables, … necessary for testing, are positioned like under normal operation.
- Interface cables, e.g. power supply, network, … are connected to the connection box in the turn table.
- EUT is powered on and set into operation.

Pre-scan

- The EMI-receiver/spectrum analyser performs a positive-peak/max-hold sweep (=worst-case). Data is transferred to EMI-software and recorded. EMI-software will show the maximum level of all single sweeps as the final result for the pre-scan.

Final measurement

- Significant emissions found during the pre-scan will be maximized by the EMI-software based on evaluated data during the pre-scan.
- Final measurement will be performed with measuring equipment settings as defined in the applicable test standards (e.g. ANSI C63.4).
- Plot of the pre-scan with frequencies of identified emissions including levels, correction factors, and settings of measuring equipment is recorded.

Detailed requirements can be found in e.g. ANSI C63.4

10 MEASUREMENT EQUIPMENT

No	Equipment	Type	Manufacturer	Serial No.	Int. No.	Last Calibration	Next Calibration
Antennas (**A**):							
1.	Active Loop Antenna	HFH2-Z2E	Rohde & Schwarz	100108	LAB000108	2023-05-05	2026-05-05
2.	Ultrabroadband antenna	HL562E	Rohde & Schwarz	102005	LAB000150	2022-12-22	2025-12-22
3.	Double-Ridged Waveguide Horn Antenna	HF-907	Rohde & Schwarz	102899	LAB000151	2023-05-05	2026-05-05
4.	Rod Antenna	-	-	-	LAB000290	-	-
5.	Horn Antenna (2.6 GHz – 3.95 GHz)	PE9863/SF-10	Pasternack	-	LAB000312	2021-01-13	-
6.	Horn Antenna (3.95 GHz – 5.85 GHz)	PE9861/SF-10	Pasternack	-	LAB000264	2020-09-29	-
7.	Horn Antenna (10 GHz – 15 GHz)	PE9855 SF-20	Pasternack	-	LAB000263	2020-09-29	-
8.	Horn Antenna (12.4 GHz – 18 GHz)	62-HA20-A-SMF	TTE Europe	-	LAB000282	2020-09-29	-
9.	Horn Antenna (17.6 GHz – 26.7 GHz)	20240-20	Flann Microwave Ltd	266402	LAB000127	2020-06-29	-
10.	Horn Antenna (26.4 GHz – 40.1 GHz)	22240-20	Flann Microwave Ltd	270447	LAB000129	2020-06-29	-
11.	Horn Antenna (33 GHz – 50.1 GHz)	23240-20	Flann Microwave Ltd	273430	LAB000132	2020-07-01	-
12.	Horn Antenna (49.9 GHz – 75.8 GHz)	25240-20	Flann Microwave Ltd	272860	LAB000133	2020-07-01	-
13.	Horn Antenna (60.5 GHz – 91.5 GHz)	26240-20	Flann Microwave Ltd	273417	LAB000135	2020-07-01	-
14.	Horn Antenna (73.8 GHz – 114 GHz)	27240-20	Flann Microwave Ltd	273368	LAB000138	2020-07-01	-
15.	Horn Antenna (114 GHz – 173 GHz)	29240-20	Flann Microwave Ltd	273382	LAB000139	2020-07-01	-
16.	Horn Antenna (145 GHz – 220 GHz)	30240-20	Flann Microwave Ltd	273390	LAB000178	2020-08-01	-
17.	Horn Antenna (217 GHz – 330 GHz)	32240-20	Flann Microwave Ltd	273469	LAB000152	2020-08-01	-
18.	Horn Antenna (49.9 GHz – 75.8 GHz)	25240-20	Flann Microwave Ltd	272861	LAB000134	2020-07-01	-
19.	Horn Antenna (60.5 GHz – 91.5 GHz)	26240-20	Flann Microwave Ltd	273418	LAB000136	2020-08-01	-
Amplifiers (**Amp**)*:							
1.	Pre-Amplifier	BBV 9718 C	Schwarzbeck Mess-Elektronik OHG	84	LAB000169	-	-
2.	Low noise amplifier	BZ-01000900-111550-202320	B&Z Technologies	24336	LAB000296	-	-
3.	Low noise amplifier	BZ-08001800-180855-202020	B&Z Technologies	22105	LAB000297	-	-
4.	Low noise amplifier	BZ-18004000-270845-252525	B&Z Technologies	22449	LAB000298	-	-
Attenuator (**Att**)*:							
1.	Attenuator	25081-20 (49.9 GHz - 75.8 GHz)	Flann Microwave Ltd	234411	LAB000229	-	-
2.	Attenuator	27081-20	Flann Microwave Ltd	270004	LAB000230	-	-

		(73.8 GHz – 112 GHz)					
RF Cables (Cab)*:							
1.	Coaxial cable	LU7-022-1000	Rosenberger	33	LAB000153	-	-
2.	Coaxial cable	LU7-022-1000	Rosenberger	34	LAB000153	-	-
3.	Coaxial cable	SF101/1.5m	Huber & Suhner	503987/1	LAB000165	-	-
Chambers (C):							
1.	Semi/Fully Anecoic Chamber	SAC5	Albatross Projects GmbH	20168.PRB	LAB000235	2022-01-31	2025-01-31
2.	Climatic chamber	T-65/50	CTS GmbH	204002	LAB000110	2023-05-11	2024-05-11
3.	Shielding Cover	CMU-Z11	Rohde & Schwarz	100876	LAB000039	-	-
4.	Climatic chamber	T-70/350	CTS GmbH	194027	LAB000066	2023-06-30	2024-06-30
5.	Shielded room	Sputnik 1 (Schirmkabine)	Albatross Projects GmbH	-	LAB000257	-	-
Corner Reflector (CR):							
1.	Trihedral Corner Reflector	SAJ-080-S1	ERAVANT	04756-01	LAB000201	-	-
Directional coupler (DC):							
1.	Directional coupler	CPL-5230-10-SMA-79	Midwest Microwave	-	LAB000672	-	-
Distance meter (DM):							
1.	Laser distance meter	GLM 50 C	Bosch	-	-	-	-
2.	Laser distance meter	GLM 120 C	Bosch	-	-	-	-
Filter (F)*:							
1.	High-pass filter (84 GHz – 110 GHz)	10-WHPF-84.5-UG387	TTE	-	LAB000299	-	-
2.	High-pass filter (7 GHz – 23 GHz)	HPF 7-23	AtlantRF	-	LAB000444	-	-
3.	High-pass filter (3.3 GHz – 12.75 GHz)	HPF 3.3-11	AtlantRF	-	LAB000382	-	-
4.	High-pass filter (1.3 GHz – 12.75 GHz)	H1G713G1	Microwave Circuits Inc	46291	LAB000443	-	-
5.	High-pass filter (1.3 GHz – 12.75 GHz)	H1G713G1	Microwave Circuits Inc	1896-01	LAB000670	-	-
6.	Bandstop filter (30MHz – 3GHz for 900 MHz Band)	WRCG876/960-847/989-50/8SS	Wainwright Instruments GmbH	-	LAB000671	-	-
Harmonic mixers (H):							
1.	Harmonic Mixer	FS-Z60	Rohde & Schwarz	101350	LAB000375	2023-04-13	2024-04-13
2.	Harmonic Mixer	FS-Z75	Rohde & Schwarz	102015	LAB000112	2023-05-03	2024-05-03
3.	Harmonic Mixer	FS-Z90	Rohde & Schwarz	102020	LAB000113	2023-04-06	2024-04-06
4.	Harmonic Mixer	FS-Z110	Rohde & Schwarz	102000	LAB000114	2023-05-02	2024-05-02
5.	Harmonic Mixer	FS-Z170	Rohde & Schwarz	100996	LAB000126	2023-04-26	2024-04-26
6.	Harmonic Mixer	FS-Z220	Rohde & Schwarz	101039	LAB000116	2023-04-16	2024-04-06
7.	Harmonic Mixer	FS-Z325	Rohde & Schwarz	101015	LAB000117	2023-04-11	2024-04-11
LISN (L):							
1.	Two-line V-Network	ENV216	Rohde & Schwarz	102597	LAB000220	-	2024-09-07
2.	Two-line V-Network	ENV216	Rohde & Schwarz	102598	LAB000217	2023-06-01	2024-06-01
Multimeters (M):							
1.	Multimeter	U1242B	Keysight	MY59240021	LAB000187	2022-06-20	2024-06-20
2.	Multimeter	U1242B	Keysight	MY59160026	LAB000018	2023-09-20	2024-09-20
Multipliers (Mp):							
1.	Multiplier	SMZ75	Rohde & Schwarz	101307	-	2018-03-15	-
2.	Multiplier	SMZ110	Rohde & Schwarz	100001	-	2020-05-09	-
Power Supply (P):							
1.	Power Supply	PS 2042-10 B	Elektro-Automatic GmbH	2878350263	LAB000190	-	-
2.	Power Supply	PS 2042-10 B	Elektro-Automatic GmbH	2878350322	LAB000192	-	-

3.	Power Supply	E3640A	Agilent	MY40005693	LAB000036	-	-
Power meters (PM):							
1.	Power meter	NRP-Z81	Rohde & Schwarz	106194	LAB000120	2023-05-10	2024-05-10
2.	Power meter	NRP110T	Rohde & Schwarz	101151	LAB000119	2023-06-05	2024-06-05
Receivers and Spectrumanalyzers (R):							
1.	Test Receiver, SAC5	ESW-26	Rohde & Schwarz	101517	LAB000363	2024-01-22	2025-01-22
2.	Test Receiver	ESW-26	Rohde & Schwarz	101481	LAB000236	-	-
3.	Spectrum Analyzer 1 Hz – 50 GHz	FSW-50	Rohde & Schwarz	101450	LAB000111	2023-07-26	2024-07-26
4.	Spectrum Analyzer 2 Hz – 43 GHz	FSW-43	Rohde & Schwarz	101391	LAB000289	2023-06-02	2024-06-02
Signal Generators (SG):							
1.	Signal generator 8 kHz – 50 GHz	SMA100B	Rohde & Schwarz	103838	LAB000118	2021-06-30	2024-06-30
2.	Vector Signal Generator	SMW200A	Rohde & Schwarz	109775	LAB000870	2023-10-18	2026-10-18
Software (SW):							
No	Type	Name	Manufacturer	Version	Int. No.	Build	Rev
1.	Software	R&S Power Viewer	Rohde & Schwarz	11.3, 3.2.2020	-	7338	3230
2.	Software	R&S EMC32	Rohde & Schwarz	11.20	-	-	-
3.	Software	R&S Elektra EMC test software	Rohde & Schwarz	13.00	-	-	-

* The gain values of Amp and attenuation values of Cab and Att are remeasured annually internal.

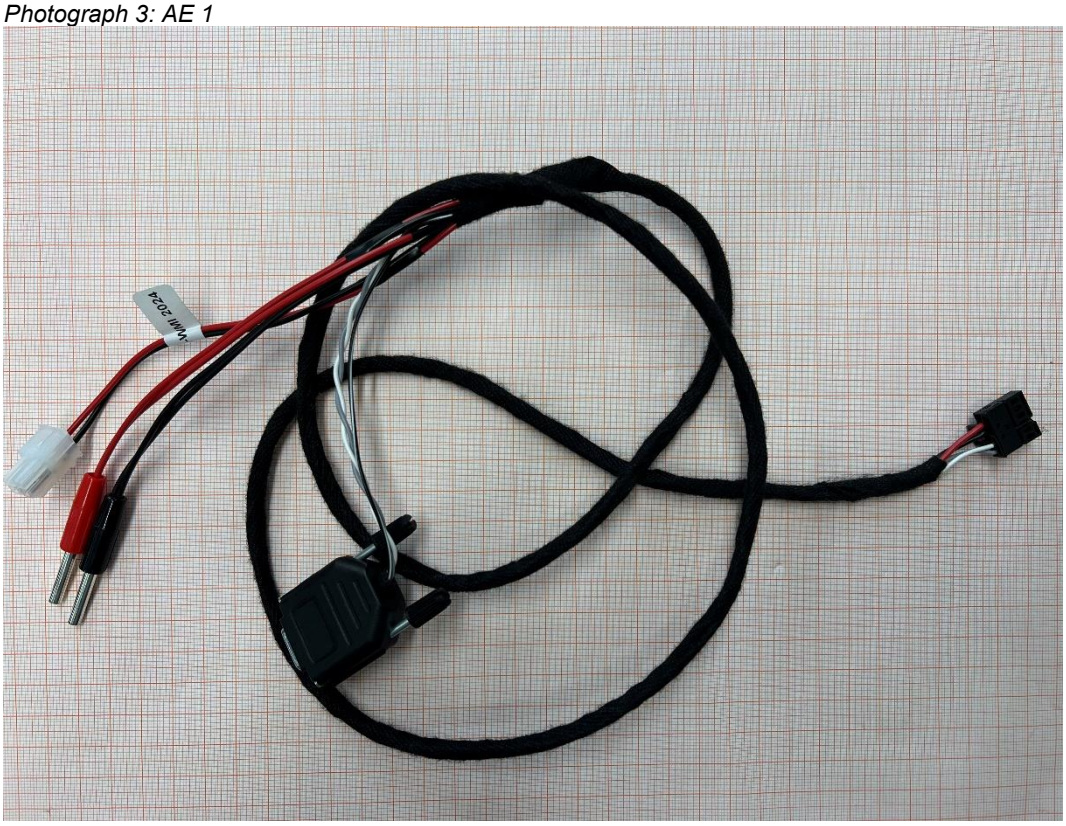
11 MEASUREMENT UNCERTAINTIES

Radio frequency	≤ ± 10 ppm
Radiated emission	≤ ± 6 dB
Temperature	≤ ± 1 °C
Humidity	≤ ± 5 %
DC and low frequency voltages	≤ ± 3 %
Conducted emissions	2.21 dB

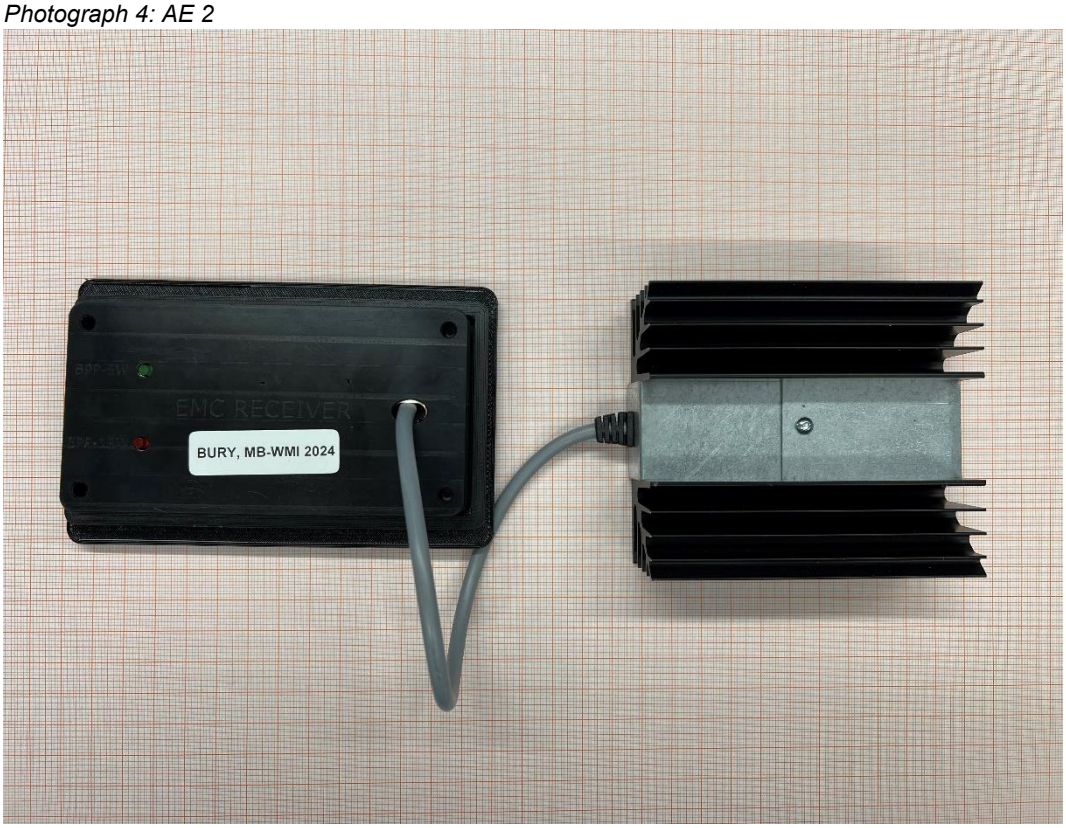
The indicated expanded measurement uncertainty corresponds to the standard measurement uncertainty for the measurement results multiplied by the coverage factor k = 2. It was determined in accordance with EA-4/01 m:2013. The true value is located in the corresponding interval with a probability of 95 %.

End of Test Report

Photograph 3: AE 1



Photograph 4: AE 2



Photograph 5: AE 3

Photograph 6: AE 3