

Test Report

No. 1-0083-25-02-15_TR1-R02

April 13, 2026

Applicant	WITTE Velbert GmbH & Co KG
Product Model	Automotive NFC Outer Door Handle EHNFCB
FCC ID	V2T-EHNFCB
Tested Technology	NFC
Test Standard(s)	§15.225

Verdict ☒ **PASS:** All applicable Test(s) acc. to the standard(s) are PASS/complies

The test results relate only to devices specified in this document

This test report is electronically signed and valid without handwritten signature.

Public keys for verification of the electronic signatures can be requested at the testing laboratory.



authorized by	Paul Shin
	Testing manager Compliance Testing & Innovation



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1 Disclaimer

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

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

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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.

2 Related cetekom advanced documents

Document	Content	Reference	Total Pages
Annex 101	External photographs	1-0083-25-02-15_TR1-A101-R02	5
Annex 102	Internal photographs	-	-
Annex 103	Test set-up photographs	1-0083-25-02-15_TR1-A103-R01	7
Annex 201	Results / Diagrams Conducted	1-0083-25-02-15_TR1-A201-R01	18
Annex 202	Results / Diagrams Radiated	1-0083-25-02-15_TR1-A202-R01	10
Annex 301	Declaration of untested variant	-	-

3 Document history

3.1 Current release

Release No.:	R02
Date of release:	April 13, 2026
Applied changes:	Updated annex 101 name reference Updated limit table in chapter 8.3.1.4

3.2 Previous releases

Release No.	Applied changes	Date of release
R01	Initial release	April 01, 2026

4 Test laboratory

4.1 Contact information

cetecom advanced GmbH
 Untertuerkheimer Str. 6-10
 66117 Saarbruecken
 Germany

4.2 Involved test locations

☐	Saarbruecken lab	☒	Essen lab
	Untertuerkheimer Str. 6-10 66117 Saarbruecken Germany		Im Teelbruch 116 45219 Essen Germany

4.3 Subcontracted laboratories

None.

4.4 Laboratory listings and recognitions

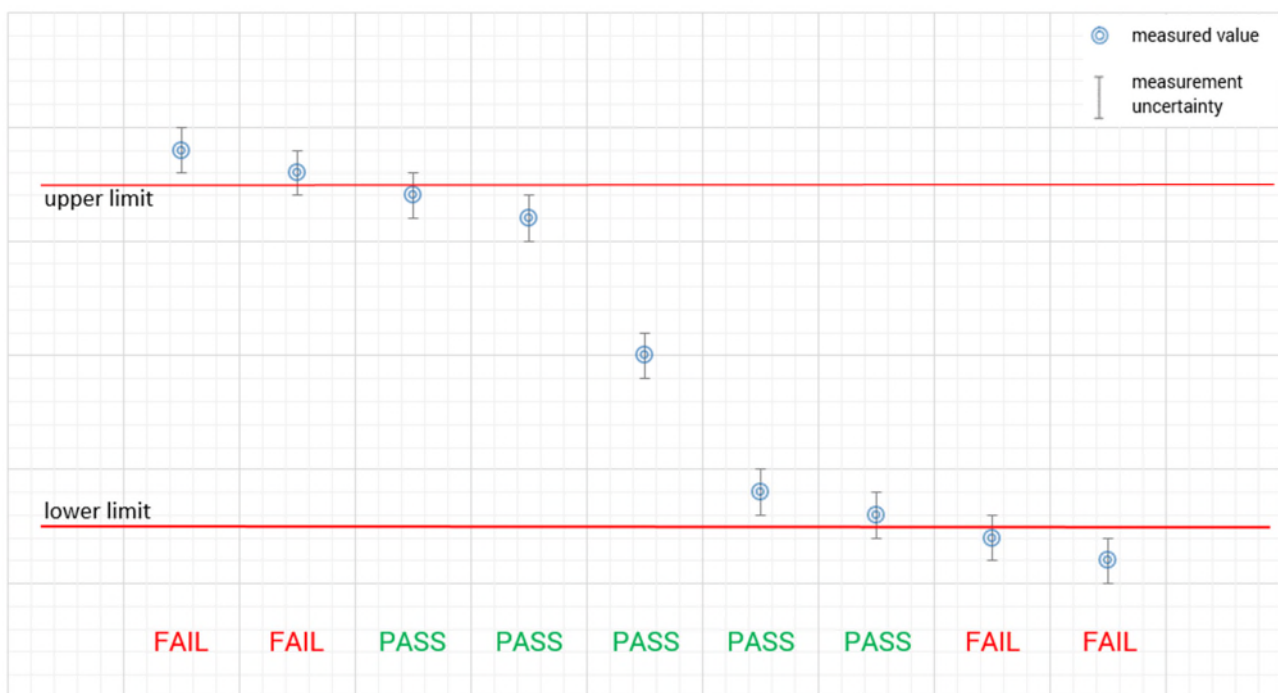
	Saarbruecken	Essen
FCC	DE0002	DE0003

4.5 Reporting statements of conformity – decision rule

Only the measured values related to their corresponding limits will be used to decide whether the equipment under test meets the requirements of the test standards listed in chapter 8.1.

The measurement uncertainty is mentioned in this test report, see chapter 4.6, but is not taken into account - neither to the limits nor to the measurement results. Measurement results with a smaller margin to the corresponding limits than the measurement uncertainty have a potential risk of more than 5% that the decision might be wrong."

measured value, measurement uncertainty, verdict



Decision Rule for emission testing:

cetecom advanced GmbH follows [ILAC G8:2019 chapter 4.2.1 \(Simple Acceptance Rule\)](#) according to CISPR 16-4-2: $U_{Lab} < U_{CISPR}$. Therefore, the uncertainty is not considered for the statement of conformity in this test report.

4.6 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.

For the determination of the measurement uncertainty, every component and influencing factor present in the measurement chain is considered and statistically evaluated.

Issue No.	Measurement type	References	Frequency range of measurement		Calculated Uncertainty based on confidence level of 95.54%	Remarks
			Start [MHz]	Stop [MHz]		
1	Magnetic field strength	EN/FCC/ISED/JP	0.009	30	4.86	Magnetic loop antenna, Pre-amp on
			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
2	RF-Output power (eirp) Unwanted emissions (eirp) [dB]	EN/FCC/ISED/JP	18000	33000	4.92	Schwarzbeck BBHA9170 (#20302) Antenna set-up non-mixer set-up)
			33000	50000	4.17	Set-up for Q-Band (WR-22), non-mixer set-up
			40000	60000	4.69	Set-up U-Band (WR-19), non-mixer set-up
			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)
			1000	18000	2.85	Typical set-up with microwave generator and antenna, value for 7GHz calculated
3	Radiated Blocking [dB]	EN	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
			116000	123000	279.87	Calculated for 123GHz carrier (FMCW)
4	Frequency Error UWB/FMCW [kHz]	EN/FCC/ISED/JP	40000	77000	276.19	calculated for 77 GHz (FMCW) carrier
			6000	7000	33.92	calculated for 6.5GHz UWB Ch.5
			11	14	20.76	calculated for 13.56MHz carrier
6	Conducted emissions AC-mains	EN/FCC/ISED	0.009	30	3.57	general EMI-measurements on AC/DC ports

5 Client information

5.1 Applicant

Name: WITTE Velbert GmbH & Co KG

Address: Höferstrasse 3-15
42551 Velbert
Germany

Contact Person: Mr. Kay Lackmann
Contact Person's Email: kay.lackmann@witte-automotive.de

5.2 Manufacturer

Name: WITTE Velbert GmbH & Co KG

Address: Höferstrasse 3-15
42551 Velbert
Germany

6 Test sample information

The data about the test samples is given/supplied by the customer and not under control by cetecom advanced GmbH.

6.1 Generic information sample

6.1.1 General data of main EUT as declared by applicant

Firmware	☐ Normal use			☒ Special version for test execution		
Power supply	☐ AC Mains					
	☒ DC Mains			12 V DC car battery		
	☐ Battery					
Operational conditions	T _{nom} = +21 °C		T _{min} = -40 °C		T _{max} = +80 °C	
Weight	0.5 kg					
Size [LxWxH]	240 mm x 140 mm x 50 mm					
Interfaces/Ports	-					

6.1.2 Detailed technical data of main EUT as declared by applicant

Frequency band	13.110 MHz – 14.010 MHz
Number of channels	1 at 13.56 MHz
Nominal channel bandwidth	n/a
Type of modulation	ASK
Max. conducted output power	n/a
Antenna Gain	n/a
Antenna type	Inductive loop
FCC label attached	No
Remarks	-

Reference documents	Version	Pages
-	-	-

6.2 Equipment under test

6.2.1 EUT

EUT no. *)	Sample no.	Product	Model	Type	SN	HW	SW
EUT 1	57.301	Automotive NFC Outer Door Handle	EHNFCB	EHNFCB	20260227_K03	V13.1	C2.1
EUT 2	57.300	Automotive NFC Outer Door Handle	EHNFCB	EHNFCB	20260227_K06	V13.1	C2.1

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

6.2.2 Untested variants

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.

6.2.3 Auxiliary equipment

AE no. *)	Sample no.	Auxiliary equipment	Model	SN	HW	SW
AE 1	57.304	NFC Card	n/a	n/a	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 considered for evaluation

6.2.4 Connected cables

CAB no. *)	Sample no.	Cable type	Connectors / Details	Length
CAB 1	59.052	Adapter Cable	Power 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 considered for evaluation

6.2.5 Software

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 considered for evaluation.

6.2.6 EUT set-ups

Set-Up no. *)	Combination of EUT and AE	Description
SET 1	EUT 1 + CAB 1	Used for radiated measurements
SET 2	EUT 2 + CAB 1 + AE 1	Used for radiated and extreme condition measurements

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

6.2.7 EUT operation mode

EUT operating mode no. *)	Operating mode	Additional information
OP 1	TX CW	Continuous wave at 13.56 MHz
OP 2	TXXR	Continuous modulated transmission in combination with AE 1 at 13.56 MHz

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

7 Application details

7.1 Scheduling

Date of sample reception: March 11, 2026
Date(s) of test: March 13, 2026 to March 23, 2025

7.2 Climatic data

Temperature: $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$
Relative. humidity: $50\%\text{rH} \pm 25\%\text{rH}$
Barometric pressure: $950\text{hPa} \pm 75\text{hPa}$

7.3 Opinions and interpretations

None.

8 Measurement details

8.1 Test methodology

The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2018-03) by the Deutsche Akkreditierungsstelle GmbH (DAkkS).

The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number D-PL-12047-01-00.

Applied test method, standard, rule	Description
Radiated field strength emissions and emission mask	ANSI C63.10:2020, chapter 6.4
Radiated field strength emissions below 30 MHz	ANSI C63.10-2020, chapter 6.4
Radiated field strength emissions 30 MHz- 1 GHz	ANSI C63.10-2020, chapter 6.5
Occupied Channel Bandwidth 99%	ANSI C63.10-2020, chapter 6.9 ANSI/USEMCSC C63.10a-2024, chapter 6.9
Frequency stability tests	ANSI C63.10-2020, chapter 6.8 ANSI/USEMCSC C63.10a-2024, chapter 6.8
AC-Power Lines Conducted Emissions	ANSI C63.10-2020, chapter 6.2

8.2 Test results summary

8.2.1 Conformance Requirements

Conformance Requirements	Reference Clause No	Remark	Result
Radiated field strength emissions and emission mask	§15.225 (a)(b)(c)(d)	-	PASSED
Radiated field strength emissions below 30 MHz	§15.209(a)	-	PASSED
Radiated field strength emissions 30 MHz to 1 GHz	§15.209	-	PASSED
Occupied Channel Bandwidth 99% 20 dB bandwidth	§2.202(a) §2.1049(h)	-	PASSED
Frequency stability	§2.1055 §15.225(e)	-	PASSED
AC-Power Lines Conducted Emissions	§15.207	-	N/A

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 GmbH laboratory.

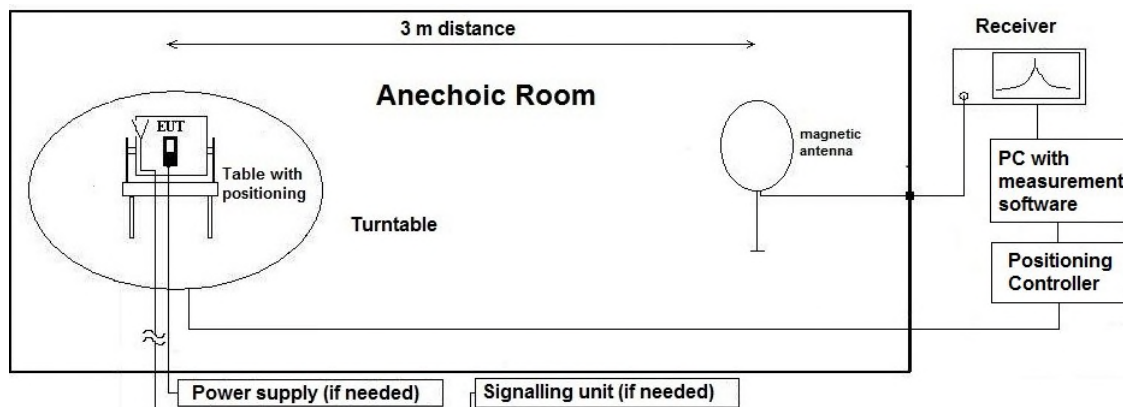
8.3 Measurements

8.3.1 Radiated field strength emissions and emission mask

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 Measurement details on page 12)

Exploratory, preliminary measurements

The EUT and its 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 maintaining 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.

8.3.1.1 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 C63.10-2020

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

8.3.1.2 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 $0.625 \times \text{Lambda}$. 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	fulfilled	not fulfilled	-80.00
	10	30000.00	4774.65		fulfilled	not fulfilled	-80.00
	20	15000.00	2387.33		fulfilled	not fulfilled	-80.00
	30	10000.00	1591.55		fulfilled	not fulfilled	-80.00
	40	7500.00	1193.66		fulfilled	not fulfilled	-80.00
	50	6000.00	954.93		fulfilled	not fulfilled	-80.00
	60	5000.00	795.78		fulfilled	not fulfilled	-80.00
	70	4285.71	682.09		fulfilled	not fulfilled	-80.00
	80	3750.00	596.83		fulfilled	not fulfilled	-80.00
	90	3333.33	530.52		fulfilled	not fulfilled	-80.00
	100	3000.00	477.47		fulfilled	not fulfilled	-80.00
	125	2400.00	381.97		fulfilled	not fulfilled	-80.00
	200	1500.00	238.73		fulfilled	fulfilled	-78.02
	300	1000.00	159.16		fulfilled	fulfilled	-74.49
	400	750.00	119.37		fulfilled	fulfilled	-72.00
	490	612.24	97.44		fulfilled	fulfilled	-70.23
	500	600.00	95.49		fulfilled	not fulfilled	-40.00
	600	500.00	79.58		fulfilled	not fulfilled	-40.00
	700	428.57	68.21		fulfilled	not fulfilled	-40.00
	800	375.00	59.68		fulfilled	not fulfilled	-40.00
MHz	900	333.33	53.05	30	fulfilled	not fulfilled	-40.00
	1.00	300.00	47.75		fulfilled	not fulfilled	-40.00
	1.59	188.50	30.00		fulfilled	not fulfilled	-40.00
	2.00	150.00	23.87		fulfilled	fulfilled	-38.02
	3.00	100.00	15.92		fulfilled	fulfilled	-34.49
	4.00	75.00	11.94		fulfilled	fulfilled	-32.00
	5.00	60.00	9.55		fulfilled	fulfilled	-30.06
	6.00	50.00	7.96		fulfilled	fulfilled	-28.47
	7.00	42.86	6.82		fulfilled	fulfilled	-27.13
	8.00	37.50	5.97		fulfilled	fulfilled	-25.97
	9.00	33.33	5.31		fulfilled	fulfilled	-24.95
	10.00	30.00	4.77		fulfilled	fulfilled	-24.04
	10.60	28.30	4.50		fulfilled	fulfilled	-23.53
	11.00	27.27	4.34		fulfilled	fulfilled	-23.21
	12.00	25.00	3.98		fulfilled	fulfilled	-22.45
	13.56	22.12	3.52		fulfilled	fulfilled	-21.39
	15.00	20.00	3.18		fulfilled	fulfilled	-20.51
	15.92	18.85	3.00		fulfilled	fulfilled	-20.00
	17.00	17.65	2.81		not fulfilled	fulfilled	-20.00
	18.00	16.67	2.65		not fulfilled	fulfilled	-20.00
	20.00	15.00	2.39		not fulfilled	fulfilled	-20.00
	21.00	14.29	2.27		not fulfilled	fulfilled	-20.00
	23.00	13.04	2.08		not fulfilled	fulfilled	-20.00
	25.00	12.00	1.91		not fulfilled	fulfilled	-20.00
	27.00	11.11	1.77		not fulfilled	fulfilled	-20.00
	29.00	10.34	1.65		not fulfilled	fulfilled	-20.00
	30.00	10.00	1.59		not fulfilled	fulfilled	-20.00

8.3.1.3 Measurement Location

Test site

120901 - ESS SAC3 - Radiated Emission <1GHz

8.3.1.4 Limit

Frequency Range [MHz]	Limit [μV/m]	Limit [dBμV/m] *	Detector	RBW [kHz]
13.553 – 13.567	15848 at 30 m	84	Pk	10
13.410 – 13.553 and 13.567 – 13.710	334 at 30 m	50.47		
13.110 – 13.410 and 13.710 – 14.010	106 at 30 m	40.5		
f ≤ 13.110 – 14.010 ≥ f		§15.209 general radiated emission limits		

8.3.1.5 Result

Diagram	Channel	Mode	Maximum Level [dB $\mu\text{V/m}$]	Result
2.01	1	SET 1 / OP 1	42.305	PASSED
2.03	1	SET 2 / OP 2	43.829	PASSED

Remark: for more information and graphical plot see annex A202

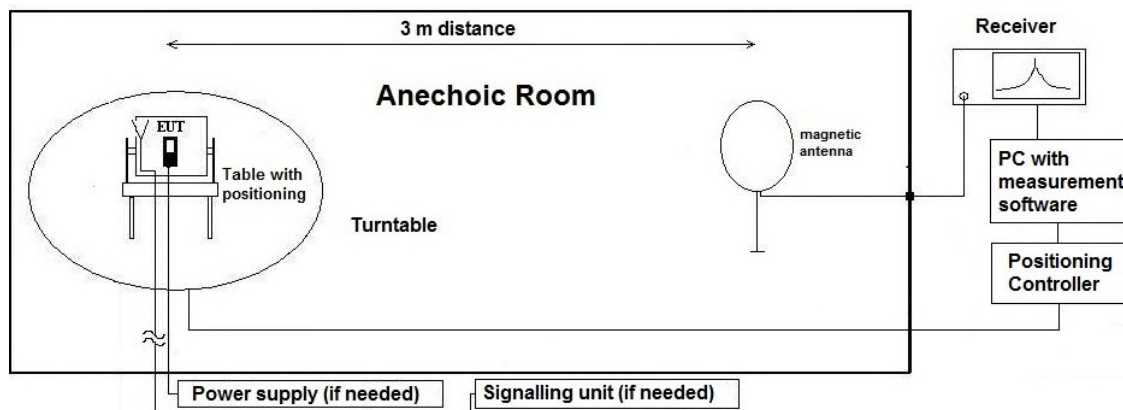
8.3.2 Radiated field strength emissions below 30 MHz

8.3.2.1 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 Measurement details on page 12)

Exploratory, preliminary measurements

The EUT and its 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 maintaining 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.

8.3.2.2 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 C63.10-2020

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

8.3.2.3 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 $0.625 \times \text{Lambda}$. 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	fulfilled	not fulfilled	-80.00
	10	30000.00	4774.65		fulfilled	not fulfilled	-80.00
	20	15000.00	2387.33		fulfilled	not fulfilled	-80.00
	30	10000.00	1591.55		fulfilled	not fulfilled	-80.00
	40	7500.00	1193.66		fulfilled	not fulfilled	-80.00
	50	6000.00	954.93		fulfilled	not fulfilled	-80.00
	60	5000.00	795.78		fulfilled	not fulfilled	-80.00
	70	4285.71	682.09		fulfilled	not fulfilled	-80.00
	80	3750.00	596.83		fulfilled	not fulfilled	-80.00
	90	3333.33	530.52		fulfilled	not fulfilled	-80.00
	100	3000.00	477.47		fulfilled	not fulfilled	-80.00
	125	2400.00	381.97		fulfilled	not fulfilled	-80.00
	200	1500.00	238.73		fulfilled	fulfilled	-78.02
	300	1000.00	159.16		fulfilled	fulfilled	-74.49
	400	750.00	119.37		fulfilled	fulfilled	-72.00
	490	612.24	97.44		fulfilled	fulfilled	-70.23
	500	600.00	95.49		fulfilled	not fulfilled	-40.00
	600	500.00	79.58		fulfilled	not fulfilled	-40.00
	700	428.57	68.21		fulfilled	not fulfilled	-40.00
	800	375.00	59.68		fulfilled	not fulfilled	-40.00
MHz	900	333.33	53.05	30	fulfilled	not fulfilled	-40.00
	1.00	300.00	47.75		fulfilled	not fulfilled	-40.00
	1.59	188.50	30.00		fulfilled	not fulfilled	-40.00
	2.00	150.00	23.87		fulfilled	fulfilled	-38.02
	3.00	100.00	15.92		fulfilled	fulfilled	-34.49
	4.00	75.00	11.94		fulfilled	fulfilled	-32.00
	5.00	60.00	9.55		fulfilled	fulfilled	-30.06
	6.00	50.00	7.96		fulfilled	fulfilled	-28.47
	7.00	42.86	6.82		fulfilled	fulfilled	-27.13
	8.00	37.50	5.97		fulfilled	fulfilled	-25.97
	9.00	33.33	5.31		fulfilled	fulfilled	-24.95
	10.00	30.00	4.77		fulfilled	fulfilled	-24.04
	10.60	28.30	4.50		fulfilled	fulfilled	-23.53
	11.00	27.27	4.34		fulfilled	fulfilled	-23.21
	12.00	25.00	3.98		fulfilled	fulfilled	-22.45
	13.56	22.12	3.52		fulfilled	fulfilled	-21.39
	15.00	20.00	3.18		fulfilled	fulfilled	-20.51
	15.92	18.85	3.00		fulfilled	fulfilled	-20.00
	17.00	17.65	2.81		not fulfilled	fulfilled	-20.00
	18.00	16.67	2.65		not fulfilled	fulfilled	-20.00
	20.00	15.00	2.39		not fulfilled	fulfilled	-20.00
	21.00	14.29	2.27		not fulfilled	fulfilled	-20.00
	23.00	13.04	2.08		not fulfilled	fulfilled	-20.00
	25.00	12.00	1.91		not fulfilled	fulfilled	-20.00
	27.00	11.11	1.77		not fulfilled	fulfilled	-20.00
	29.00	10.34	1.65		not fulfilled	fulfilled	-20.00
	30.00	10.00	1.59		not fulfilled	fulfilled	-20.00

8.3.2.4 Measurement Location

Test site

120901 - ESS SAC3 - Radiated Emission <1GHz

8.3.2.5 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

8.3.2.6 Result

Diagram	Channel	Mode	Maximum Level [dBμV/m]	Result
2.02	1	SET 1 / OP 1	No peaks <6 dB margin found	PASSED
2.04	1	SET 2 / OP 2	No peaks <6 dB margin found	PASSED

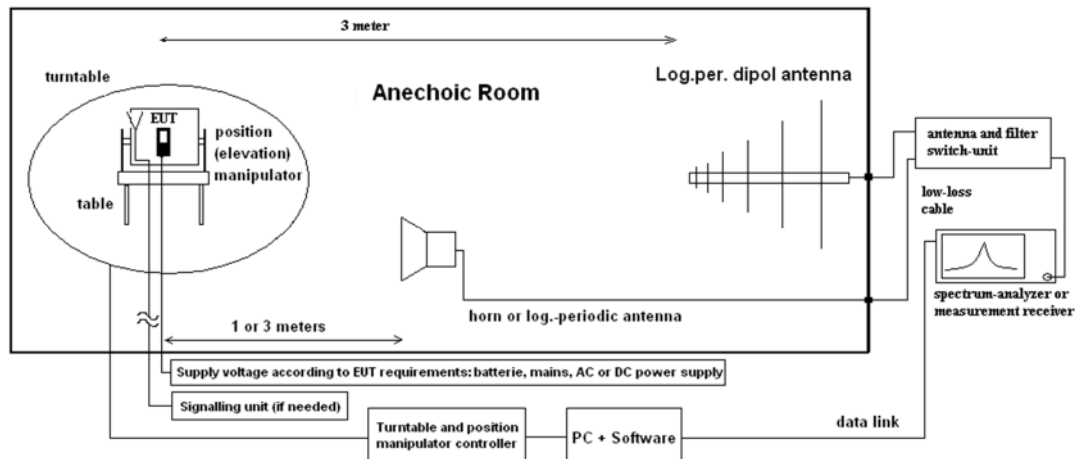
Remark: for more information and graphical plot see annex A202

8.3.3 Radiated field strength emissions 30 MHz – 1 GHz

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

Evaluating the field 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 NSA-compliant semi anechoic room (SAR) recognized by the regulatory commissions.

Schematic:



Testing method:

The measurement is made according to relevant reference clauses:
(See Tables Measurement details on page 12)

Exploratory, preliminary measurements

The EUT and its 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 (range 0° to 360°, step 90°) and the EUT itself either on 3-orthogonal axis (portable equipment) or 2-orthogonal axis (defined operational position of EUT) the emission spectrum and its characteristics were recorded with an EMI-receiver, broadband antenna and software.

Measurement antenna: horizontal and vertical, heights: 1,0 m and 1,82 m as worst case determined by an exploratory emission measurement. 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 carried out to find the worst case of them. Also, the interconnection cables and equipment position were varied to maximize the emissions.

Final measurement on critical frequencies

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

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) and the measurement antenna height between 1 m and 4 m.

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

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.

8.3.3.2 Sample calculation

Raw-Value [dBuV/m]	Antenna factor	Distance Correction [dB]	Cable Loss + Preamplifier	Resulting correction value [dB]	Final result [dBuV/m]	Remarks
29.37	41.20	--	24.28	16.92	46.3	CableLoss and PreAmp data in one data correction file

Remark: This calculation is based on an example value at 800.4MHz

8.3.3.3 Measurement Location

Test site

120901 - ESS SAC3 - Radiated Emission <1GHz

8.3.3.4 Limits

Radiated emissions limits, (3 meters)

Frequency Range [MHz]	Limit [μV/m]	Limit [dBμV/m]	Detector	RBW / VBW [kHz]
30 - 88	100	40.0	Quasi peak	100 / 300
88 - 216	150	43.5	Quasi peak	100 / 300
216 - 960	200	46.0	Quasi peak	100 / 300
960 - 1000	500	54.0	Quasi peak	100 / 300

8.3.3.5 Result

Diagram	Channel	Mode	Maximum Level [dBμV/m]	Result
3.01	1	SET 1 / OP 1	No peaks < 6 dB margin found	PASSED
3.02	1	SET 2 / OP 2	No peaks < 6 dB margin found	PASSED

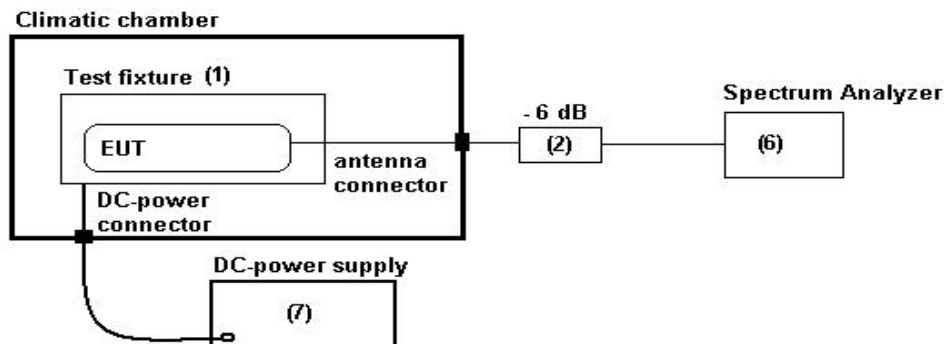
Remark: for more information and graphical plot see annex A202

8.3.4 20 dB bandwidth

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

The EUT's RF-signal is coupled out by a suitable antenna coupling connector (1). The signal is first attenuated (2) then connected to spectrum-analyzer (4) for RF-conducted measurements. The specific attenuation loss is determined prior to the measurement within a set-up attenuation measurement. These are then taken into account by correcting the measurement readings of the spectrum-analyzer.

Schematic:



Testing method:

The measurement is made according to relevant reference clauses:
(See Tables Measurement details on page 12)

8.3.4.2 Measurement Location

Test site

120928 - ESS RC8G Climatic Room 1

8.3.4.3 Limit

When the occupied bandwidth limit is not stated in the applicable reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

8.3.4.4 Result

Diagram	Channel	Mode	Bandwidth [kHz]	Result
TID001	1	SET 2 / OP 2	2.0	PASSED

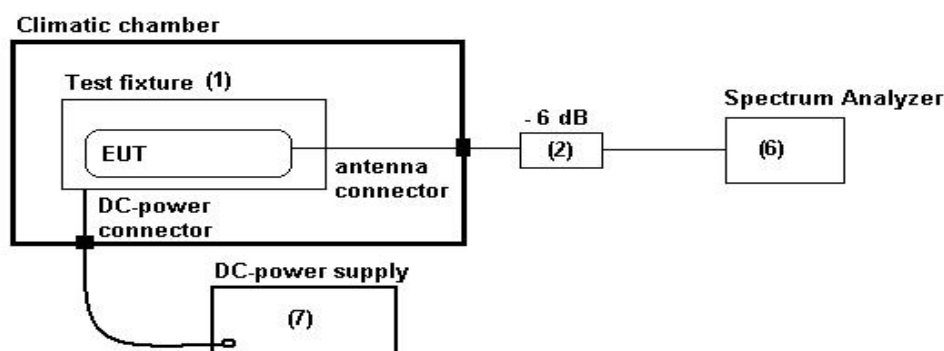
Remark: for more information and graphical plot see annex A202

8.3.5 Frequency stability

8.3.5.1 Description

A sniffer antenna acts like a coupling antenna for measuring the fundamental frequency. This is placed at about 20cm away from the equipment. Also connecting cables at the equipment are avoided on the extent possible in order not to degrade the resonance frequency of the equipment and integral antenna.

Schematic:



Testing method:

The measurement is made according to relevant reference clauses:
(See Tables Measurement details on page 12)

8.3.5.2 Measurement Location

Test site

120928 - ESS RC8G Climatic Room 1

8.3.5.3 Result

Frequency range [MHz]	Limit [%]	Limit [ppm]	Remarks	F _{offset max} (abs) [ppm]	Result
13.553 – 13.567	± 0.01	± 100	Voltage variation	20.69	PASSED
13.553 – 13.567	± 0.01	± 100	Temperature variation	28.96	PASSED

Remark: for more information and graphical plot see annex A201

8.3.6 Equipment list

ID	Description	Manufacturer	SerNo	CheckType	Last Check	Interval	Next Check
	120901 - ESS SAC3 - Radiated Emission <1GHz			chk	chk: 2025-Mar-29	chk: 12M	chk: 2026-Mar-29
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 SAC3	ETS-Lindgren GmbH / Taufkirchen	without	chk	chk: 2025-Sep-05	chk: 12M	chk: 2026-Sep-05
20482	Filter Matrix SAC3	cetecom advanced GmbH / Essen	without	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
20574	Biconilog Hybrid Antenna BTA-L	Frankonia GmbH / Heideck	980026L	cal	cal: 2025-Jun-06	cal: 36M	cal: 2028-Jun-06
20620	EMI Test Receiver ESU26	Rohde & Schwarz Messgerätebau GmbH / Memmingen	100362	cal	cal: 2025-May-06	cal: 12M	cal: 2026-May-06
20885	Power Supply EA3632A	Agilent Technologies Deutschland GmbH	75305850	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
20979	Loop Antenna HFH2-Z2	Rohde & Schwarz Messgerätebau GmbH / Memmingen	872096/61	cal	cal: 2024-Sep-16	cal: 36M	cal: 2027-Sep-16
	120928 - ESS RC8G Climatic Room 1			chk	chk: 2025-Jul-14	chk: 12M	chk: 2026-Jul-14
20866	Signal- and Spectrum Analyzer FSW50	Rohde & Schwarz Messgerätebau GmbH / Memmingen	101929	cal	cal: 2025-Mar-19	cal: 12M	cal: 2026-Mar-19
20904	Climatic Chamber ClimeEvent C/1000/70a/5	Weiss Umwelttechnik GmbH / Reiskirchen-Lindenstruth	58226223240010	cal	cal: 2025-Jan-23	cal: 24M	cal: 2027-Jan-23

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

8.4 Results from external laboratory

None -

8.5 Opinions and interpretations

None -

8.6 List of abbreviations

None -

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