

Test Report

20-1-0094901T09a



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

Number of pages: 20 **Date of Report:** 2021-Sep-06

Testing company: CETECOM GmbH
Im Teelbruch 116
45219 Essen Germany
Tel. + 49 (0) 20 54 / 95 19-0
Fax: + 49 (0) 20 54 / 95 19-150

Applicant: Prodrive Technologies BV

Product: RFID Reader
Model: RFID Reader

FCC ID: Y2IRFIDR **IC:** 9389A-RFIDR

Testing has been carried out in accordance with:

Title 47 CFR, Chapter I
FCC Regulations, Subchapter A
Part 15, Subpart C: §15.209

RSS-Gen, Issue 5 + Amendment 1
General Requirements for Compliance of Radio Apparatus **FCC 15.209**

Deviations, modifications or clarifications (if any) to above mentioned documents are written in each section under "Test method and limit".

Tested Technology: RFID

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

Signatures:

Dipl.-Ing. Ninovic Perez Test Lab Manager Authorization of test report	M.Sc. Guangcheng Huang Test manager Responsible of test report
--	--

Table of Contents

Table of Annex.....	3
1 General information	4
1.1 Disclaimer and Notes.....	4
1.2 Attestation.....	4
1.3 Summary of Test Results	5
1.4 Summary of Test Methods	5
2 Administrative Data	6
2.1 Identification of the Testing Laboratory	6
2.2 General limits for environmental conditions.....	6
2.3 Test Laboratories sub-contracted.....	6
2.4 Organizational Items	6
2.5 Applicant's details	6
2.6 Manufacturer's details	6
2.7 EUT: Type, S/N etc. and short descriptions used in this test report	7
2.8 Auxiliary Equipment (AE): Type, S/N etc. and short descriptions.....	7
2.9 Connected cables	7
2.10 Software.....	7
2.11 EUT set-ups	7
2.12 EUT operation modes.....	7
3 Equipment under test (EUT)	8
3.1 General Data of Main EUT as Declared by Applicant.....	8
3.2 Detailed Technical data of Main EUT as Declared by Applicant	9
3.3 Modifications on Test sample.....	9
4 Measurements.....	10
4.1 Occupied Channel Bandwidth 99%.....	10
4.2 Radiated field strength emissions below 30 MHz	11
4.3 Radiated field strength emissions 30 MHz – 1 GHz	15
4.4 Results from external laboratory.....	17
4.5 Opinions and interpretations	17
4.6 List of abbreviations	17
5 Equipment lists	18
6 Measurement Uncertainty valid for conducted/radiated measurements	19
7 Versions of test reports (change history)	20

Table of Annex			
Annex No.	Contents	Reference Description	Total Pages
Annex 1	Test result diagrams	CETECOM_TR20-1-0094901T09a_A1	13
Annex 2	Internal photographs of EUT	--	--
Annex 3	External photographs of EUT	CETECOM_TR20-1-0094901T09a_A3	5
Annex 4	Test set-up photographs	CETECOM_TR20-1-0094901T09a_A4	9
The listed attachments are separate documents.			

1 General information

1.1 Disclaimer and Notes

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

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

The testing service provided by CETECOM has been rendered under the current "General Terms and Conditions for CETECOM". CETECOM will not be liable for any loss or damage resulting from false, inaccurate, inappropriate or incomplete product information provided by the customer.

Under no circumstances does the CETECOM test report include any endorsement or warranty regarding the functionality, quality or performance of any other product or service provided.

Under no circumstances does the CETECOM test report include or imply any product or service warranties from CETECOM, including, without limitation, any implied warranties of merchantability, fitness for purpose, or non-infringement, all of which are expressly disclaimed by CETECOM.

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

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

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

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

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

The EUT integrates a 2.4 GHz W-LAN transmitter. Other implemented wireless technologies were not considered within this test report.

Test case	Reference Clause FCC ☒	Reference Clause ISSED ☒	Page	Remark	Result
Occupied Channel Bandwidth 99%	2.1049(h)	RSS-Gen Issue 5, § 6.7	10	--	PASSED
Radiated field strength emissions below 30 MHz	§15.205(a) §15.209(a)	RSS-Gen: Issue 5 §8.9 Table 6	14	--	PASSED
Radiated field strength emissions 30 MHz – 1GHz	§15.209	RSS-Gen: Issue 5 §8.9 Table 5	16	--	PASSED

PASSED

The EUT complies with the essential requirements in the standard.

FAILED

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

NP

The test was not performed by the CETECOM Laboratory.

N/A

Not applicable

*The calculation of the measurement uncertainty shows compliance with the "maximum measurement uncertainties" of the tested standard and therefore for result evaluation the stated uncertainties will not be additionally added to the measured results.

1.4 Summary of Test Methods

Test case	Test method
Occupied Channel Bandwidth 99%	ANSI C63.10:2013, §6.9.3
Radiated field strength emissions below 30 MHz	ANSI C63.10-2013 §6.3, §6.4
Radiated field strength emissions 30 MHz- 1 GHz	ANSI C63.4-2014 §8.2.3, ANSI C63.10-2013 §6.3, §6.5
Radiated field strength emissions above 1 GHz	ANSI C63.4-2014 §8.3, ANSI C63.10-2013 §6.3, §6.6

And reference also to Test methods in KDB558074

2 Administrative Data

2.1 Identification of the Testing Laboratory

Company name:	CETECOM GmbH
Address:	Im Teelbruch 116 45219 Essen - Kettwig Germany
Responsible for testing laboratory:	Dipl.-Ing. Ninovic Perez
Accreditation scope:	DAkkS Webpage: FCC ISED
Test location:	CETECOM GmbH; Im Teelbruch 116; 45219 Essen - Kettwig

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 test manager:	M.Sc. Guangcheng Huang
Receipt of EUT:	2021-Jun-24
Date(s) of test:	2021-Jul-20 – 2021-Sep-03
Version of template:	14.7

2.5 Applicant's details

Applicant's name:	Prodrive Technologies BV
Address:	Science Park Eindhoven 5501 5692 EM Son The Netherlands
Contact Person:	Free Claessens
Contact Person's Email:	free.claessens@prodrive-technologies.com

2.6 Manufacturer's details

Manufacturer's name:	Prodrive Technologies BV
Address:	Science Park Eindhoven 5501 5692 EM Son The Netherlands

2.7 EUT: Type, S/N etc. and short descriptions used in this test report

Short description*)	PMT Sample No.	Product	Model	Type	S/N	HW status	SW status
EUT 01	20-1-00949S04_C02	RFID Reader	RFID Reader	N/A	2110A18CFL	R05	R01
EUT 02	20-1-00949S03_C02	RFID Reader	RFID Reader	N/A	2110A18CHG	R05	R01

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

2.8 Auxiliary Equipment (AE): Type, S/N etc. and short descriptions

Short description*)	PMT Sample No.	Auxiliary Equipment	Type	S/N	HW status	SW status
AE 01	20-1-00949S06_C01	125 kHz RFID tag	--	--	--	--
AE 02	--	Laptop	Latitude E6420	--	Intel core i5	Windows 7 Enterprise

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

2.9 Connected cables

Short description*)	PMT Sample No.	Cable type	Connectors	Length
CAB 01	20-1-00949S07_C01	USB cable	Power, RS232, USB, 4-pin	120 cm
CAB 02	20-1-00949S09_C01	Power + RS232 cable	USB-A to mini-USB	20 cm

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

2.10 Software

Short description*)	PMT Sample No.	Software	Type	S/N	HW status	SW status
SW 01	20-1-00949S10_C01	Termite 3.4	--	--	--	--

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

2.11 EUT set-ups

set-up no. *)	Combination of EUT and AE	Description
1	EUT 1 + AE 2 + CAB 1 + CAB 2 + SW 1	Used for Radiated measurements. Test mode without RFID tag. AE 02 + SW 01 was used for set-up configuration.
2	EUT 1 + AE 1 + AE 2 + CAB 1 + CAB 2 + SW 1	Used for Radiated measurements. Test mode with RFID tag. AE 02 + SW 01 was used for set-up configuration.
3	EUT 2 + AE 2 + CAB 1 + CAB 2 + SW 1	Used for Radiated measurements. Test mode without RFID tag. AE 02 + SW 01 was used for set-up configuration.
4	EUT 2 + AE 1 + AE 2 + CAB 1 + CAB 2 + SW 1	Used for Radiated measurements. Test mode with RFID tag. AE 02 + SW 01 was used for set-up configuration.

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

2.12 EUT operation modes

EUT operating mode no. *)	Operating modes	Additional information
op. 1	TX-Mode	EUT intermittent transmission searching for counterpart.
op. 2	TXRX-Mode	EUT intermittent communication to 125 kHz AE 1.

*) 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

Product name	RFID Reader		
Kind of product	RFID Reader at 13.56 MHz and 125 kHz (13.56 MHz not tested within this report)		
Firmware	☐ for normal use	☒ Special version for test execution	
	☐ AC Mains	Wählen Sie ein Element aus.	
	☒ DC Mains	13.5 V DC	
	☐ Battery	Wählen Sie ein Element aus.	
Operational conditions	$T_{nom} = 21\text{ °C}$	$T_{min} = -30\text{ °C}$	$T_{max} = 75\text{ °C}$
EUT sample type	Engineering Samples		
Weight	0.1 kg		
Size [LxWxH]	7.5x5x2 cm		
Interfaces/Ports	USB		
For further details refer Applicants Declaration & following technical documents			
For further details regarding radio parameters, please refer to IEEE802.11 Specification			

3.2 Detailed Technical data of Main EUT as Declared by Applicant

Frequencies	Ch1 = 125 kHz RFID/NFC operating frequency Ch2 = 13.56 MHz (not tested in this report)	
Number of Channels (USA/Canada -bands)	2	
Measured Channel Bandwidth	Ch1: 14.759615 kHz Ch2: not tested within this report	
Type of Modulation Data Rate	☒ ASK 1 Mbit / s ☐ $\pi/4$ DQPSK 2 Mbit / s ☐ 8DPSK 3 Mbit / s	
Other installed options	☒ RFID 13.56 MHz (not tested within this test report)	
Max. Conducted Output Power	--	
EIRP Power	9.36 dB μ V/m @125 kHz (related 300m measurement distance)	
Antenna Type(s)	PCB coil antenna	
Antenna Gain(s)	--	
FCC label attached	No	
Test firmware / software and storage location	EUT A	
For further details refer Applicants Declaration & following technical documents		
Description of Reference Document (supplied by applicant)	Version	Total Pages
M2001226324_manualRFID	-	4

3.3 Modifications on Test sample

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

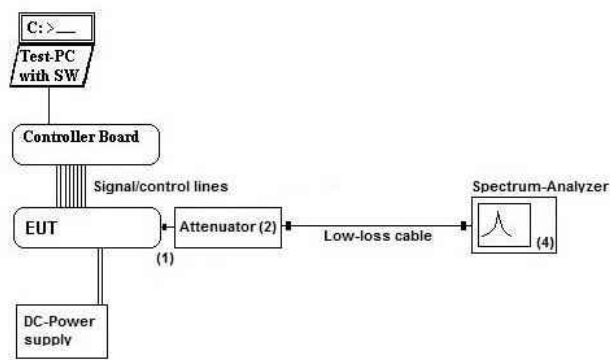
4 Measurements

4.1 Occupied Channel Bandwidth 99%

4.1.1 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 *Summary of Test Results* and *Summary of Test Methods* on page 5)

Measurement is made using Rohde & Schwarz TS8997 test system.

4.1.2 Measurement Location

Test site	120910 - Radio Laboratory 1 (TS 8997)
-----------	---------------------------------------

4.1.3 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.

4.1.4 Result

Mode	Channel	Frequency [kHz]	99% Occupied bandwidth [kHz]
TX	125 kHz	125.048077	14.759615
TXRX	125 kHz	125.048077	2.788462

Remark: for more information and graphical plot see annex A1 CETECOM_TR20-1-0094901T09a_A1

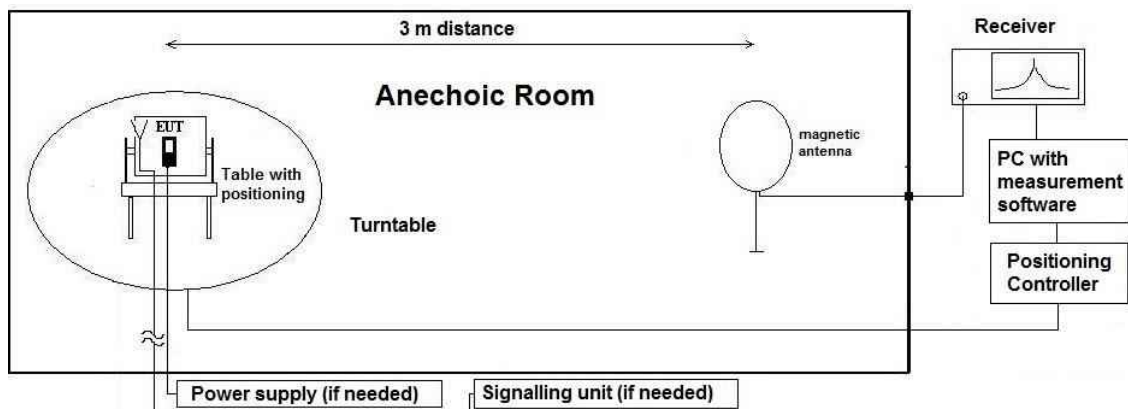
4.2 Radiated field strength emissions below 30 MHz

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 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.

4.2.2 Measurement Location

Test site	120901 - SAC - Radiated Emission <1GHz
-----------	--

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 $0.625 \times \text{Lambda}$. 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	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 Limit

Radiated emissions limits (3 meters)					
Frequency Range [MHz]	Limit [$\mu\text{V}/\text{m}$]	Limit [$\text{dB}\mu\text{V}/\text{m}$]	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

4.2.5 Result

Diagram	Remark	Set-up	Mode	Maximum Level [$\text{dB}\mu\text{V}/\text{m}$] Frequency Range 125 kHz MHz	Result
Pretest to determine worst case orientation of EUT					
2.01	EUT standing	1	1	11.237	n/a
2.02	EUT lying	1	1	-0.064	n/a
2.03	EUT standing	1	2	8.209	n/a
2.04	EUT lying	1	2	-4.560	n/a
Diagram	Remark	Set-up	Mode	Maximum Level [$\text{dB}\mu\text{V}/\text{m}$] Frequency Range 0.009 – 30 MHz	Result
2.05	EUT standing	1	1	No peaks found	Passed
2.06	EUT standing	1	2	No peaks found	Passed

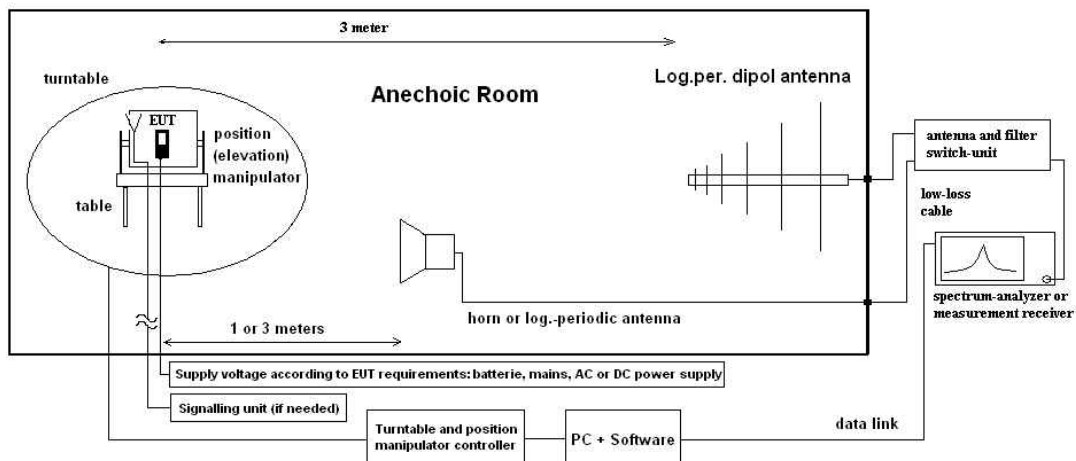
Remark: for more information and graphical plot see annex A1 **CETECOM_TR20-1-0094901T09a_A1**

4.3 Radiated field strength emissions 30 MHz – 1 GHz

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 semi anechoic room (SAR) and 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 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 was 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 measurements. 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 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). 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 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.

4.3.2 Measurement Location

Test site	120901 - SAC - Radiated Emission <1GHz
-----------	--

4.3.3 Limit

Radiated emissions limits (3 meters)				
Frequency Range [MHz]	Limit [$\mu\text{V/m}$]	Limit [$\text{dB}\mu\text{V/m}$]	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

4.3.4 Result

Diagram	Remark	Set-Up	Mode	Maximum Level [$\text{dB}\mu\text{V/m}$] Frequency Range 30 – 1000 MHz	Result
3.01	EUT standing	1	1	No peaks found, only noise 34 $\text{dB}\mu\text{V/m}$	Passed
3.02	EUT lying	1	1	No peaks found, only noise 34 $\text{dB}\mu\text{V/m}$	Passed
3.03	EUT standing	1	2	No peaks found, only noise 34 $\text{dB}\mu\text{V/m}$	Passed
3.04	EUT lying	1	2	No peaks found, only noise 34 $\text{dB}\mu\text{V/m}$	Passed

Remark: for more information and graphical plot see annex A1 **CETECOM_TR20-1-0094901T09a_A1**

4.4 Results from external laboratory

None	-
------	---

4.5 Opinions and interpretations

None	-
------	---

4.6 List of abbreviations

None	-
------	---

5 Equipment lists

ID	Description	Manufacturer	SerNo	Cal due date
	120901 - SAC - Radiated Emission <1GHz			2025-Jul-21
20574	Biconilog Hybrid Antenna BTA-L	Frankonia GmbH	980026L	2022-May-03
20487	CETECOM Semi Anechoic Chamber < 1GHz	ETS-Lindgren GmbH	-	2025-Jul-15
20341	Digital Multimeter Fluke 112	Fluke Deutschland GmbH	81650455	2022-May-25
20620	EMI Test Receiver ESU26	Rohde & Schwarz Messgerätebau GmbH	100362	2022-May-21
20482	filter matrix Filter matrix SAR 1	CETECOM GmbH	-	*1a
25038	Loop Antenna HFH2-Z2	Rohde & Schwarz Messgerätebau GmbH	879824/13	2022-Apr-07
20885	Power Supply EA3632A	Agilent Technologies Deutschland GmbH	75305850	-Pre-m
	120911 - Radio Laboratory 2			n/a
20457	DC-Power supply, 0-5A EA-3013 S	EA Elektro-Automatik GmbH & Co. KG	9624680	Pre-m
20468	Digital Multimeter Fluke 112	Fluke Deutschland GmbH	90090455	2024-Jun-01
20431	Model 7405 Near-Field Probe Set	EMCO Elektronik GmbH	9305-2457	Pre-m
20690	Spectrum Analyzer FSU	Rohde & Schwarz Messgerätebau GmbH	100302/026	2023-May-20
20869	VT4002 Klimaschrank	Vötsch Industrietechnik GmbH, a schunk company	521/79152	2021-Oct-06

Remarks: *1a: calibrated with system 120901 - SAC
 *1b: calibrated with system 120904 - FAC1
 *1c: calibrated with system 120907 – FAC2
 Pre-m: Check before starting the measurement

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.

RF-Measurement	Reference	Frequency range	Calculated uncertainty based on a confidence level of 95%							Remarks
Conducted emissions (U _{CISPR})	-	9 kHz - 150 kHz 150 kHz - 30 MHz	4.0 dB 3.6 dB							-
Power Output radiated	-	30 MHz - 4 GHz	3.17 dB							Substitution method
Power Output conducted	-	Set-up No.	Cel-C1	Cel-C2	BT1	W1	W2	--	-	
		9 kHz - 12.75 GHz	N/A	0.60	0.7	0.25	N/A	--		
		12.75 GHz - 26.5 GHz	N/A	0.82	--	N/A	N/A	--		
Conducted emissions on RF-port	-	9 kHz - 2.8 GHz	0.70	N/A	0.70	N/A	0.69	--	N/A - not applicable	
		2.8 GHz - 12.75 GHz	1.48	N/A	1.51	N/A	1.43	--		
		12.75 GHz – 18 GHz	1.81	N/A	1.83	N/A	1.77	--		
		18 GHz - 26.5 GHz	1.83	N/A	1.85	N/A	1.79	--		
Occupied bandwidth	-	9 kHz - 4 GHz	0.1272 ppm (Delta Marker)							Frequency error
			1.0 dB							Power
Emission bandwidth	-	9 kHz - 4 GHz	0.1272 ppm (Delta Marker)							Frequency error
	-		See above: 0.70 dB							Power
Frequency stability	-	9 kHz - 20 GHz	0.0636 ppm							-
Radiated emissions Enclosure	-	150 kHz - 30 MHz	5.01dB							Magnetic field strength
		30 MHz - 1 GHz	5.83 dB							Electrical Field strength
		1 GHz - 18 GHz	4.91 dB							
		18-26.5 GHz	5.06 dB							

7 Versions of test reports (change history)

Version	Applied changes	Date of release
--	Initial release	2021-Sep-06
--	--	--
--	--	--

End Of Test Report