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1 General information

1.1 Disclaimer and Notes

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

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

1.1. Summary of Test Results

Test case	Reference in FCC ☑	Reference in ISED ☐	Reference in RSS-GEN ☐	Remark	Result
AC-Power Lines Conducted Emissions	§15.107	ICES-003, Issue 6	RSS Gen, Issue 5, Chapter 8.8	--	PASSED
Radiated field strength emissions 30 MHz – 1 GHz	§15.109 §15.33 §15.35	ICES-003, Issue 6	RSS-Gen., Issue 5 Chapter 8.9, Chapter 7.3	--	PASSED
Radiated field strength emissions above 1 GHz	§15.109 §15.33 §15.35	ICES-003, Issue 6	RSS-Gen., Issue 5 Chapter 8.9, Chapter 7.3	--	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.

*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.

Test report no. 18-1-0029001T02b-C1, dated 2020-05-27 replaces test report 18-1-0029001T02b, dated 2020-05-12. The substituted reports gets invalid herewith.

1.2. Summary of Test Methods

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

2 Administrative Data

2.1 Identification of the Testing Laboratory

Company name:	CETECOM GmbH
Address:	Im Teelbruch 116 45219 Essen - Kettwig Germany
Responsible for testing laboratory:	Volker Wittmann
Accreditation scope:	DAkS Webpage
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:	--
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2.4 Organizational Items

Order No.:	1
Responsible test manager:	Christian Lorenz
Receipt of EUT:	17.08.2018
Date(s) of test:	2018-Mar-22 – 2018-Oct-16
Version of template:	14.1

2.5 Applicant's details

Applicant's name:	ELOKON GmbH
Address:	Gärtnerweg 49 25436 Tornesch Schleswig-Holstein Deutschland
Contact Person:	Alexander Glasmacher
Contact Person's Email:	

2.6 Manufacturer's details

Manufacturer's name:	ELOKON GmbH
Address:	

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

Short description*)	PMT Sample No.	EUT	Type	S/N	HW status	SW status
EUT 12	18-1-00290512	Verification Unit	100874	17080002	1.1	1.1.0.4

*) 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
AE1	18-1-00290504	Pedestrian Badge	100587	18070565	1.1	1.1.0.5
CAB1	18-1-00290503	Cable USB	--	--	--	--
CAB2	--	CAN Bus cable	--	--	--	--
AE2	--	Dell notebook	Latitude E6430	CTC522013	--	Windows 7 + Customer application

*) 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	S/N	HW status	SW status
CAB1	18-1-00290503	Cable USB	--	--	--	--
CAB2	--	CAN Bus cable	--	--	--	--

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

2.10 Softwares

Short description*)	PMT Sample No.	Software	Type	S/N	HW status	SW status
	--	--	--	--	--	--

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

2.11 EUT set-ups

set-up no.*)	Combination of EUT and AE	Description
	EUT A + AE 1 + CAB1 + CAB 2 + AE2	Used for measurements. AE1 used for providing control UWB signal for EUT 12.

*) 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
Operating mode 1	Verification Panel - Relay On/Off - UWB Off (RX-Mode)	UWB transmissions switched-off. Relays are switched on/off due incoming control signals from AE1

*) 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	ELOshield system		
Kind of product	Pedestrian personal warning,checking and access control		
Firmware	<input checked="" type="checkbox"/> for normal use on AE2	<input type="checkbox"/> Special version for test execution	
Power supply	<input checked="" type="checkbox"/> AC Mains	single Line (L1/N) 120V 60 Hz	
	<input type="checkbox"/> DC Mains		
	<input type="checkbox"/> Battery	-	
Operational conditions	T _{nom} =21 °C	T _{min} =21 °C	T _{max} =21 °C
EUT sample type	Pre-Production		
Weight	--		
Size	--		
Interfaces/Ports	CAN Bus		
For further details refer Applicants Declaration & following technical documents			

3.2 Modifications on Test sample

Additions/deviations or exclusions	--
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4 Measurements

4.1 AC-Power Lines Conducted Emissions

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

The radio frequency voltage conducted back into the AC power line in the frequency range 150 kHz to 30 MHz has to be investigated.

Compliance should be tested by measuring the radio frequency voltage between each power line and ground at the power terminals in the stated frequency range.

A 50 Ohm / 50 μ H line impedance stabilization network (LISN) is used coupling the interface to the measurement equipment.

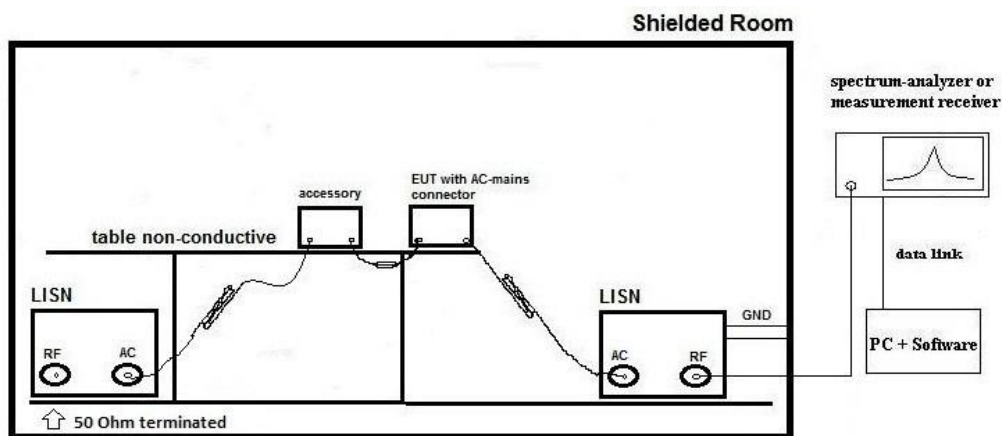
The EUT power input leads are connected through the LISN to the AC-power source. The LISN enclosure is electrically connected to the ground plane. The measuring instrument is connected to the coaxial output of the LISN.

Tabletop devices were set-up on an 80 cm height above reference ground plane, floor standing equipment 10 cm raised above ground plane.

Measurements have been performed on each phase line and neutral line of the devices AC-power lines.

The EUT was power supplied with 120 V/60 Hz. The EUT was tested in the defined operating mode and installed (connected) to accessory equipment according to the general description of use given by the applicant.

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

As a first step, determines the worst-case phase line (neutral or phase) as well as the most critical operating mode of the equipment. A complete frequency-sweep with PK-Detector is performed on each current-carrying conductor.

Final measurement on critical frequencies

For power phases and critical frequencies (Margin to AV- or QP limit lower than 3 dB) as a second step includes measurements with receivers detector set to Quasi-Peak and Average.

Formula:

$$V_C = V_R + C_L \quad (1)$$

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

V_C = measured Voltage –corrected value

V_R = Receiver reading

C_L = Cable loss

M = Margin

L_T = Limit

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

4.1.2 Measurement Location

Test site	120919 - Conducted Emission
-----------	-----------------------------

4.1.3 Limit

Frequency Range [MHz]	Class B <input checked="" type="checkbox"/>		Class A <input type="checkbox"/>	
	QUASI-Peak [dBμV]	AVERAGE [dBμV]	QUASI-Peak [dBμV]	AVERAGE [dBμV]
0.15 – 0.5	66 to 56*	56 to 46*	79	66
0.5 – 5	56	46	73	60
5 – 30	60	50	73	60

4.1.4 Result

Diagram	Mode	Power Line	Max [dBμV]	Detector	Result
1.08	Verification Panel - Relay On/Off - UWB Off	N/L1	44,51	Average	Pass

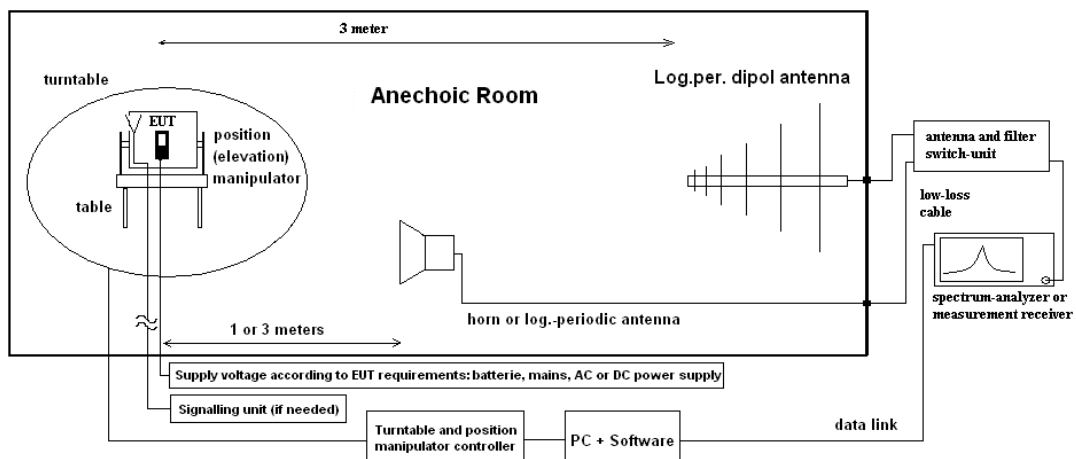
Remark: for more informations and graphical plot see annex A1 **18-1-0029001T02b-A1**

4.2 Radiated field strength emissions 30 MHz – 1 GHz

4.2.1 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 *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 main-taining 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.

4.2.2 Measurement Location

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

4.2.3 Limit

Frequency Range [MHz]	Class B <input checked="" type="checkbox"/> (3 meters)		Class A <input type="checkbox"/> (10 meters)		Detector	RBW / VBW [kHz]
	Limit [µV/m]	Limit [dBµV/m]	Limit [µV/m]	Limit [dBµV/m]		
30 - 88	100	40.0	90	39.0	Quasi peak	100 / 300
88 - 216	150	43.5	150	43.5	Quasi peak	100 / 300
216 - 960	200	46.0	210	46.4	Quasi peak	100 / 300
960 - 1000	500	54.0	300	49.5	Quasi peak	100 / 300

4.2.4 Result

Diagram	Channel	Mode	Maximum Level [dBµV/m] Frequency Range 30 – 1000 MHz	Result
3.01	--	Op.Mode1	17,03	Passed

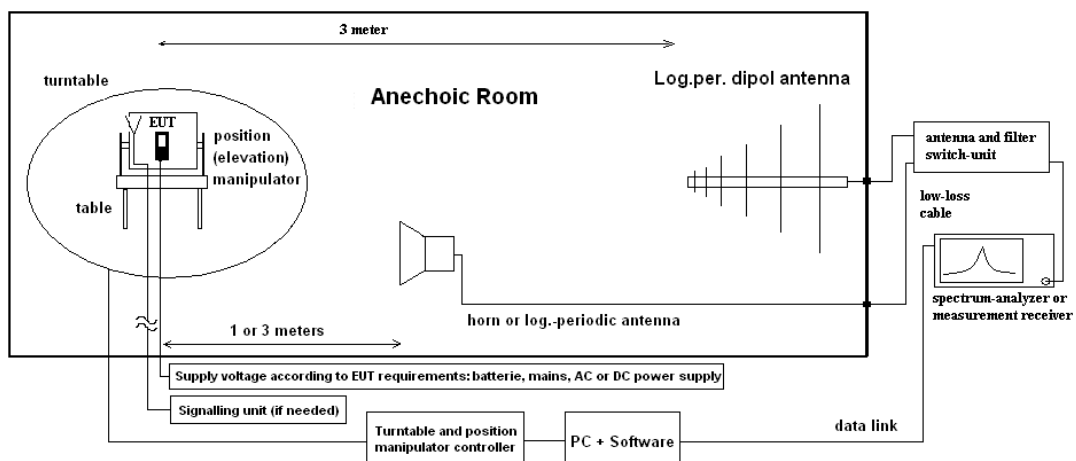
Remark: for more informations and graphical plot see annex A1 **18-1-0029001T02b-A1**

4.3 Radiated field strength emissions above 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 18-1-4:2010 compliant fully anechoic room (FAR) recognized by the regulatory commission. The measurement distance was set to 3 meter for frequencies up to 18 GHz and 2 meter above 18 GHz. A logarithmic periodic antenna is used for the frequency range 30 MHz to 1 GHz. Horn antennas are used for frequency range 1 GHz to 40 GHz. The EUT is aligned within 3 dB beam width of the measurement antenna with three orthogonal axis measurements on the EUT.

Schematic:



Testing method:

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

Exploratory, preliminary measurements

The EUT and its associated accessories are placed on a non-conductive position manipulator (tipping device) of 1.55 m height which is placed on the turntable. By rotating the turntable (range 0° to 360°, step 15°) 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.

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

Final measurement on critical frequencies

Based on the exploratory measurements, the most critical frequencies are re-measured by main-taining the EUT's worst-case operation mode, cable position, etc.

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

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

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

Formula:

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

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

E_C = Electrical field – corrected value

E_R = Receiver reading

M = Margin

L_T = Limit

A_F = Antenna factor

C_L = Cable loss

D_F = Distance correction factor (if used)

G_A = Gain of pre-amplifier (if used)

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

4.3.2 Measurement Location

Test site	120904 - FAC1 - Radiated Emissions
-----------	------------------------------------

4.3.3 Limit

Radiated emissions limits (3 meters)				
Frequency Range [MHz]	Limit [$\mu\text{V}/\text{m}$]	Limit [$\text{dB}\mu\text{V}/\text{m}$]	Detector	RBW / VBW [kHz]
Above 1000	500	54	Average	1000 / 3000
Above 1000	5000	74	Peak	1000 / 3000

4.3.4 Result

Diagram	Channel	Mode	Maximum Level [$\text{dB}\mu\text{V}/\text{m}$] Frequency Range 1 – 18 GHz	Result
4.01	--	--	49,85	Passed

Remark: for more informations and graphical plot see annex A1 **18-1-0029001T02b-A1**

4.4 Results from external laboratory

None

-

4.5 Opinions and interpretations

None

-

5 Equipment lists

5.1.1 At date of Test report writing

ID	Description	Manufacturer	SerNo	Cal due Date
120901 - SAC - Radiated Emission <1GHz				
2057 4	Biconilog Hybrid Antenna BTA-L	Frankonia GmbH	980026L	03.05.2022
2034 1	Digital Multimeter Fluke 112	Fluke Deutschland GmbH	81650455	16.05.2020
2062 0	EMI Test Receiver ESU26	Rohde & Schwarz Messgerätebau GmbH	100362	20.05.2020
2048 2	filter matrix Filter matrix SAR 1	CETECOM GmbH	--	--
2088 5	Power Supply EA3632A	Agilent Technologies Deutschland GmbH	75305850	--
2048 7	System CTC NSA-Verification SAR-EMI System EMI field (SAR) NSA	ETS-Lindgren GmbH	--	23.03.2021
120904 - FAC1 - Radiated Emissions (f>1GHz)				
2072 0	EMC32 [FAC]	Rohde & Schwarz Messgerätebau GmbH	V10.25.0	--
2054 9	Log.Per-Antenna HL025	Rohde & Schwarz Messgerätebau GmbH	1000060	31.07.2021
2048 4	Pre-Amplifier 2,5GHz - 18GHz AMF-5D-02501800- 25-10P	Miteq Inc.	1244554	--
2028 7	Pre-Amplifier 25MHz - 4GHz AMF-2D-100M4G-35-10P	Miteq Inc.	379418	--

ID	Description	Manufacturer	SerNo	Cal due Date
20690	Spectrum Analyzer FSU	Rohde & Schwarz Messgerätebau GmbH	100302/026	23.05.2021
120919 - Conducted Emission				
20005	AC - LISN 50 Ohm/50µH ESH2-Z5	Rohde & Schwarz Messgerätebau GmbH	861741/005	23.05.2020
20468	Digital Multimeter Fluke 112	Fluke Deutschland GmbH	90090455	16.05.2021
20377	EMI Test Receiver ESCS30	Rohde & Schwarz Messgerätebau GmbH	100160	22.05.2020
20556	Thermo-/Hygrometer WS-9400	Conrad Electronic GmbH	--	--

Tools used in 'P1M1'

5.1.2 Calibration data valid at date of performed tests

Ref.-No.	Equipment	Type	Serial-No.	Version of Firmware or Software during the test
012	Signal Generator (EMS-cond.)	SMY 01	839069/027	Firm.= V 2.02
013	Power Meter (EMS cond.)	NRVD	839111/003	Firm.= V 1.51
017	Digital Radiocommunication Tester	CMD 60 M	844365/014	Firmware = V 3.52 .22.01.99, DECT = D2.87 13.01.99
119	RT Harmonics Analyzer dig. Flickermeter	B10	G60547	Firm.= V 3.1.DHG
261	Thermal Power Sensor	NRV-Z55	825083/0008	EPROM-Datum 02.12.04, SE EE 1 B
262	Power Meter	NRV-S	825770/0010	Firm.= 2.6
295	Racal Digital Radio Test Set	6103	1572	UNIT Firmware= 4.04, SW-Main=4.04, SW-BBP=1.04, SW-DSP=1.02, Hardboot=1.02, Softboot=2.02
298	Univ. Radio Communication Tester	CMU 200	832221/091	R&S Test Firmware =3.53 /3.54 (current Testsoftw. f. all band used
323	Digital Radiocommunication Tester	CMD 55	825878/0034	Firm.= 3.52 .22.01.99
340	Digital Radiocommunication Tester	CMD 55	849709/037	Firm.= 3.52 .22.01.99
366	Ultra Compact Simulator	UCS 500 M4	V0531100594	Firm. UCS 500=001925/3.06a02, rc=ISMIEC 4.10
371	Bluetooth Tester	CBT32	100153	CBT V5,30+ SW-Option K55, K57
377	EMI Test Receiver	ESCS 30	100160	Firm.= 2.30, OTP= 02.01, GRA= 02.36
378	Broadband RF Field Monitor	RadiSense III	03D00013SNO-08	Firm.= V.03D13
389	Digital Multimeter	Keithley 2000	0583926	Firm. = A13 (Mainboard) A02 (Display)
392	Radio Communication Tester	MT8820A	6K00000788	Firm.= 4.50 #005, IPL=4.01#001, OS=4.02#001, GSM=4.41#013, W-CDMA= 4.54#004, scenario=
436	Univ. Radio Communication Tester	CMU 200	103083	R&S Test Firmware Base=5.14, Mess-Software= GSM:5.14 WCDMA:5.14 (current Testsoftw. F. all band
441	CTC-SAR-EMI Cable Loss	System EMI field (SAR)	-	EMC 32 Version 9.25.0
443	CTC-FAR-EMI-RSE	System CTC-FAR-EMI-RSE	-	EMC 32 Ver. 10.50.00
460	Univ. Radio Communication Tester	CMU 200	108901	R&S Test Firmware Base=5.14, GSM=5.14 WCDMA=5.14 (current Testsoftw.f. all band to be used,
489	EMI Test Receiver	ESU40	1000-30	Firmware=4.43 SP3, Bios=V5.1-16-3, Spec. =01.00
546	Univ. Radio Communication Tester	CMU 200	106436	R&S Test Firmware Base=5.14, GSM=5.14 WCDMA=5.14 (current Testsoftw.f. all band to be used
547	Univ. Radio Communication Tester	CMU 200	835390/014	R&S Test Firmware Base=V5.1403 (current Testsoftw., f. all band used, GSM = 5.14 WCDMA: = 5.14
597	Univ. Radio Communication Tester	CMU 200	100347	R&S Test Firmware Base=5.01, GSM=5.02 WCDMA= not installed, Mainboard= µP1=V.850

Ref.-No.	Equipment	Type	Serial-No.	Version of Firmware or Software during the test
607	Signal Generator	SMR 20	832033/011	V1.25
620	EMI Test Receiver	ESU 26	100362	4.43_SP3
642	Wideband Radio Communication Tester	CMW 500	126089	Setup V03.26, Test programm component V03.02.20
670	Univ. Radio Communication Tester	CMU 200	106833	µP1 = V8.50, Firmware = V.20
689	Vector Signal Generator	SMU200	100970	02.20.360.142
692	Bluetooth Tester	CBT 32	100236	CBT V 5.40, FW: V.2.41 (FPGA Digital, V. 3.09 FPGA RF)
699	Audio Analyzer	UPL16	833494/005	3.06

5.1.3 Single instruments and test systems

Extract of

Ref.-No.	Equipment	Type	Serial-No.	Manufacturer	Interval of calibration	Remark	Cal due
005	AC - LISN (50 Ohm/50µH, test site 1)	ESH2-Z5	861741/005	Rohde & Schwarz	12 M	-	23.05.2020
007	Single-Line V-Network (50 Ohm/5µH)	ESH3-Z6	892563/002	Rohde & Schwarz	12 M	-	23.05.2020
009	Power Meter (EMS-radiated)	NRV	863056/017	Rohde & Schwarz	24 M	-	23.05.2021
016	Line Impedance Simulating Network	Op. 24-D	B6366	Spitzenberger+Spies	36 M	-	22.05.2022
020	Horn Antenna 18 GHz (Subst 1)	3115	9107-3699	EMCO	36/12 M	-	31.07.2021
021	Loop Antenna (H-Field)	6502	9206-2770	EMCO	36 M	-	30.05.2021
033	RF-current probe (100kHz-30MHz)	ESH2-Z1	879581/18	Rohde & Schwarz	24 M	-	23.05.2021
057	relay-switch-unit (EMS system)	RSU	494440/002	Rohde & Schwarz	pre-m	1a	
060	power amplifier (DC-2kHz)	PAS 5000	B6363	Spitzenberger+Spies	-	3	
066	notch filter (WCDMA; FDD1)	WRCT 1900/2200-5/40-10EEK	5	Wainwright GmbH	12 M	1g	16.11.2019
086	DC - power supply, 0 -10 A	LNG 50-10	-	Heinzinger Electronic	pre-m	2	
087	DC - power supply, 0 -5 A	EA-3013 S	-	Elektro Automatik	pre-m	2	
091	USB-LWL-Converter	OLS-1	007/2006	Ing. Büro Scheiba	-	4	
099	passive voltage probe	ESH2-Z3	299.7810.52	Rohde & Schwarz	36 M	-	30.05.2021
100	passive voltage probe	Probe TK 9416	without	Schwarzbeck	36 M	-	30.05.2021
110	USB-LWL-Converter	OLS-1	-	Ing. Büro Scheiba	-	4	
119	RT Harmonics Analyzer dig. Flickermeter	B10	G60547	BOCONSULT	36 M	-	22.05.2022
133	horn antenna 18 GHz (Meas 1)	3115	9012-3629	EMCO	36 M	1c	10.03.2020
134	horn antenna 18 GHz (Subst 2)	3115	9005-3414	EMCO	36 M	-	10.03.2020
248	attenuator	SMA 6dB 2W	-	Radiall	pre-m	2	
249	attenuator	SMA 10dB 10W	-	Radiall	pre-m	2	
252	attenuator	N 6dB 12W	-	Radiall	pre-m	2	
256	attenuator	SMA 3dB 2W	-	Radiall	pre-m	2	
257	hybrid	4031C	04491	Narda	pre-m	2	
260	hybrid coupler	4032C	11342	Narda	pre-m	2	
261	Thermal Power Sensor	NRV-Z55	825083/0008	Rohde & Schwarz	24 M	-	30.05.2020
262	Power Meter	NRV-S	825770/0010	Rohde & Schwarz	24 M	-	30.05.2020
265	peak power sensor	NRV-Z33, Model 04	840414/009	Rohde & Schwarz	24 M	-	30.05.2020
266	Peak Power Sensor	NRV-Z31, Model 04	843383/016	Rohde & Schwarz	24 M	-	30.05.2020
267	notch filter GSM 850	WRCA 800/960-6EEK	9	Wainwright GmbH	pre-m	2	
270	termination	1418 N	BB6935	Weinschel	pre-m	2	
271	termination	1418 N	BE6384	Weinschel	pre-m	2	
272	attenuator (20 dB) 50 W	Model 47	BF6239	Weinschel	pre-m	2	
273	attenuator (10 dB) 100 W	Model 48	BF9229	Weinschel	pre-m	2	
274	attenuator (10 dB) 50 W	Model 47 (10 dB) 50 W	BG0321	Weinschel	pre-m	2	
275	DC-Block	Model 7003 (N)	C5129	Weinschel	pre-m	2	
276	DC-Block	Model 7006 (SMA)	C7061	Weinschel	pre-m	2	
279	power divider	1515 (SMA)	LH855	Weinschel	pre-m	2	
287	pre-amplifier 25MHz - 4GHz	AMF-2D-100M4G-35-10P	379418	Miteq	12 M	1c	16.11.2019
291	high pass filter GSM 850/900	WHJ 2200-4EE	14	Wainwright GmbH	12 M	1c	16.11.2019
298	Univ. Radio Communication Tester	CMU 200	832221/091	Rohde & Schwarz	pre-m	3	
300	AC LISN (50 Ohm/50µH, 1-phase)	ESH3-Z5	892 239/020	Rohde & Schwarz	12 M	-	22.05.2020
301	attenuator (20 dB) 50W, 18GHz	47-20-33	AW0272	Lucas Weinschel	pre-m	2	
302	horn antenna 40 GHz (Meas 1)	BBHA9170	155	Schwarzbeck	36 M	-	14.03.2020
303	horn antenna 40 GHz (Subst 1)	BBHA9170	156	Schwarzbeck	36 M	-	20.03.2020
331	Climatic Test Chamber -40/+180 Grad	HC 4055	43146	Heraeus Vötsch	24 M	-	10.01.2021
341	Digital Multimeter	Fluke 112	81650455	Fluke	24 M	-	30.05.2020
342	Digital Multimeter	Voltcraft M-4660A	IB 255466	Voltcraft	24 M	-	23.05.2021
347	laboratory site	radio lab.	-	-	-	5	

Ref.-No.	Equipment	Type	Serial-No.	Manufacturer	Interval of calibration	Remark	Cal due
348	laboratory site	EMI conducted	-	-	-	5	
354	DC - Power Supply 40A	NGPE 40/40	448	Rohde & Schwarz	pre-m	2	
357	power sensor	NRV-Z1	861761/002	Rohde & Schwarz	24 M	-	21.05.2021
373	Single-Line V-Network (50 Ohm/5µH)	ESH3-Z6	100535	Rohde & Schwarz	12 M	-	22.05.2020
377	EMI Test Receiver	ESCS 30	100160	Rohde & Schwarz	12 M	-	22.05.2020
389	Digital Multimeter	Keithley 2000	0583926	Keithley	pre-m	-	
392	Radio Communication Tester	MT8820A	6K00000788	Anritsu	12 M	-	01.07.2020
396	Thermo/Hygrometer	Thermo/Hygrometer	-	Conrad	24 M	-	09.01.2021
431	Model 7405	Near-Field Probe Set	9305-2457	EMCO	-	4	
436	Univ. Radio Communication Tester	CMU 200	103083	Rohde & Schwarz	12 M	-	25.05.2020
439	UltraLog-Antenna	HL 562	100248	Rohde & Schwarz	36 M	-	10.03.2020
443	CTC-FAR-EMI-RSE	System CTC-FAR-EMI-RSE	-	ETS-Lindgren / CETECOM	12 M	5	16.11.2019
448	notch filter WCDMA_FDD II	WRCT 1850.0/2170.0-5/40-10SSK	5	Wainwright Instruments GmbH	12 M	1c	16.11.2019
449	notch filter WCDMA FDD V	WRCT 824.0/894.0-5/40-8SSK	1	Wainwright	12 M	1c	16.11.2019
454	Oscilloscope	HM 205-3	9210 P 29661	Hameg	-	4	
456	DC-Power supply 0-5 A	EA 3013 S	207810	Elektro Automatik	pre-m	2	
459	DC -Power supply 0-5 A , 0-32 V	EA-PS 2032-50	910722	Elektro Automatik	pre-m	2	
460	Univ. Radio Communication Tester	CMU 200	108901	Rohde & Schwarz	12 M	-	30.05.2020
463	Universal source	HP3245A	2831A03472	Agilent	-	4	
466	Digital Multimeter	Fluke 112	89210157	Fluke USA	24 M	-	30.05.2020
467	Digital Multimeter	Fluke 112	89680306	Fluke USA	36 M	-	30.05.2021
468	Digital Multimeter	Fluke 112	90090455	Fluke USA	36 M	-	30.04.2021
477	ReRadiating GPS-System	AS-47	-	Automotive Cons. Fink	-	3	
480	power meter (Fula)	NRVS	838392/031	Rohde & Schwarz	24 M	-	30.05.2021
482	filter matrix	Filter matrix SAR 1	-	CETECOM (Brl)	-	1d	
484	pre-amplifier 2,5 - 18 GHz	AMF-5D-02501800-25-10P	1244554	Miteq	12 M	-	16.11.2019
487	System CTC NSA-Verification SAR-EMI	System EMI field (SAR) NSA	-	ETS Lindgren / CETECOM	24 M	-	16.04.2021
489	EMI Test Receiver	ESU40	1000-30	Rohde & Schwarz	12 M	-	30.06.2020
502	band reject filter	WRCG 1709/1786-1699/1796-	SN 9	Wainwright	pre-m	2	
503	band reject filter	WRCG 824/849-814/859-60/10SS	SN 5	Wainwright	pre-m	2	
512	notch filter GSM 850	WRCA 800/960-02/40-6EEK	SN 24	Wainwright	12 M	1c	16.11.2019
517	relais switch matrix	HF Relais Box Keithley System	SE 04	Keithley	pre-m	2	
523	Digital Multimeter	L4411A	MY46000154	Agilent	24 M	-	23.05.2021
529	6 dB Broadband resistive power divider	Model 1515	LH 855	Weinschel	pre-m	2	
530	10 dB Broadband resistive power divider	R 416110000	LOT 9828	-	pre-m	2	
549	Log.Per-Antenna	HL025	1000060	Rohde & Schwarz	36/12 M	-	31.07.2021
550	System CTC S-VSWR Verification SAR-EMI	System EMI Field SAR S-VSWR	-	ETS Lindgren/CETECOM	24 M	-	30.08.2019
552	high pass filter 2,8-18GHz	WHKX 2.8/18G-10SS	4	Wainwright	12 M	1c	16.11.2019
557	System CTC-OTA-2	R&S TS8991	-	Rohde & Schwarz	12 M	5	24.01.2020
574	Biconilog Hybrid Antenna	BTA-L	980026L	Frankonia	36/12 M	-	03.05.2022
584	Spectrum Analyzer	FSU 8	100248	Rohde & Schwarz	pre-m	-	
594	Wideband Radio Communication Tester	CMW 500	101757	Rohde & Schwarz	12 M	-	26.06.2020
597	Univ. Radio Communication Tester	CMU 200	100347	Rohde & Schwarz	pre-m	-	
600	power meter	NRVD (Reserve)	834501/018	Rohde & Schwarz	24 M	-	30.05.2021
602	peak power sensor	NRV-Z32 (Reserve)	835080	Rohde & Schwarz	24 M	-	
611	DC power supply	E3632A	KR 75305854	Agilent	pre-m	2	
612	DC power supply	E3632A	MY 40001321	Agilent	pre-m	2	
613	Attenuator	R416120000 20dB 10W	Lot. 9828	Radiall	pre-m	2	
616	Digitalmultimeter	Fluke 177	88900339	Fluke	24 M	-	30.05.2020
617	Power Splitter/Combiner	ZFSC-2-2-S+	S F987001108	Mini Circuits	-	2	
618	Power Splitter/Combiner	50PD-634	600994	JFW Industries USA	-	2	
619	Power Splitter/Combiner	50PD-634	600995	JFW Industries, USA	-	3	
620	EMI Test Receiver	ESU 26	100362	Rohde-Schwarz	12 M	-	30.05.2020
621	Step Attenuator 0-139 dB	RSP	100017	Rohde & Schwarz	pre-m	2	
625	Generic Test Load USB	Generic Test Load USB	-	CETECOM	-	2	
634	Spectrum Analyzer	FSM (HF-Unit)	826188/010	Rohde & Schwarz	pre-m	2	
637	High Speed HDMI with Ethernet 1m	HDMI cable with Ethernet 1m	-	Kogilink	-	2	
638	HDMI Cable with Ethernet 1.5 m flat	HDMI cable with Ethernet 1,5m	-	Reichelt	-	2	
640	HDMI cable 2m round	HDMI cable 2m round	-	Reichelt	-	2	

Ref.-No.	Equipment	Type	Serial-No.	Manufacturer	Interval of calibration	Remark	Cal due
641	HDMI cable with Ethernet	Certified HDMI cable with	-	PureLink	-	2	
644	Amplifierer	ZX60-2534M+	SN865701299	Mini-Circuits	-	-	
670	Univ. Radio Communication Tester	CMU 200	106833	Rohde & Schwarz	24 M	-	30.05.2020
671	DC-power supply 0-5 A	EA-3013S	-	Elektro Automatik	pre-m	2	
678	Power Meter	NRP	101638	Rohde&Schwarz	pre-m	-	
683	Spectrum Analyzer	FSU 26	200571	Rohde & Schwarz	12 M	-	30.05.2020
686	Field Analyzer	EHP-200A	160WX30702	Narda Safety Test Solutions	24 M	-	29.09.2019
687	Signal Generator	SMF 100A	102073	Rohde&Schwarz	12 M	-	30.05.2020
688	Pre Amp	JS-18004000-40-8P	1750117	Miteq	pre-m	-	
690	Spectrum Analyzer	FSU	100302/026	Rohde&Schwarz	24 M	-	30.05.2021
691	OSP120 Base Unit	OSP120	106833	Rohde & Schwarz	12 M	-	30.05.2020
692	Bluetooth Tester	CBT 32	100236	Rohde & Schwarz	36 M	-	29.05.2020
693	TS8997	CTC-Radio Lab 1_TS8997	-	Rohde&Schwarz	12 M	5	07.01.2020
697	Power Splitter	ZN4PD-642W-S+	165001445	Mini-Circuits	-	2	
701	CMW500 wide. Radio Comm.	CMW500	158150	Rohde & Schwarz	24 M	-	30.07.2020
703	INNCO Antennen Mast	MA 4010-KT080-XPET-ZSS3	MA4170-KT100-XPET-ZSS3	INNCO	pre-m	-	
704	INNCON Controller	CO 3000-4port	CO3000/933/384105 16/L	INNCO Systems GmbH	pre-m	-	
711	Harmonic Mixer 90 GHz - 140GHz	RPG FS-Z140	101004	RPG	36 M	-	22.02.2020
712	Harmonic Mixer 75 GHz - 110GHz	FS-Z110	101468	Rohde & Schwarz	36 M	-	22.02.2020
713	Harmonic Mixer, 50 GHz - 75GHz	FS-Z75	101022	Rohde & Schwarz	24 M	-	05.07.2021
714	Signal Analyzer 67GHz	FSW67	104023	Rohde & Schwarz	24 M	-	04.07.2021
715	Harmonic Mixer, 140 GHz - 220GHz	FS-Z220	101009	RPG Radiometer Physics	36 M	-	03.08.2020
716	Harmonic Mixer 220 GHz to 325 GHz	FS-Z325	101005	RPG Radiometer Physics	36 M	-	13.02.2020
748	Pickett-Potter Horn Antenna	FH-PP 4060	010001	Radiometer Physics	36 M	-	
750	Pickett-Potter Horn Antenna	FH-PP 220	010011	Radiometer Physics	36 M	-	
751	Digital Optical System	optoCAN-FD Transceiver	17-010416	mk-messtechnik GmbH	-	-	
752	Digital Optical System	optoCAN-FD Transceiver	17-010083	mk-messtechnik GmbH	-	-	
753	Digital Optical System	optoCAN-FD Transceiver	17-010084	mk-messtechnik GmbH	-	-	
754	Digital Optical System	optoCAN-FD Transceiver	17-010415	mk-messtechnik GmbH	-	-	
755	Digital Optical System	optoLAN-100-MAX Transceiver	17-010795	mk-messtechnik GmbH	-	-	
757	WIDEBAND RADIO COMMUNICATION	CMW500	163673	Rohde&Schwarz	12 M	-	30.05.2020
758	Signal Generator	SMU 200A	100754	Rohde & Schwarz	24 M	-	11.10.2019
781	Power Supply	PS 2042-10 B	2815450369	Elektro-Automatik GmbH & Co.KG	-	-	
782	Power Supply	PS 2042-10 B	2815450348	lektro-Automatik GmbH & Co.KG	-	-	
783	Spectrum Analyzer	FSU 26	100414	Rohde & Schwarz	12 M	-	30.05.2020
784	Power Supply	NGSM 32/10	00196	Rohde & Schwarz	12 M	-	
785	RSP	RF Step Attenuator 0...139.9dB	860712/012	Rohde & Schwarz	12 M	-	
786	SAR Probe	ES3DV3	3340	Speag	36 M	-	14.02.2021
787	OSP	OSP B157WX	101264	Rohde & Schwarz	24 M	-	30.05.2020
788	Precision Omnidirectional Dipole	POD 618	6182558/Q	Seibersdorf Laboratories	36 M	-	30.06.2021
789	Precision Omnidirectional Dipole	POD 16	162496/Q	Seibersdorf Laboratories	36 M	-	30.06.2021
790	Horn Antenna	ASY-SGH-124-SMA	29F14182337	Antenna System Solutions	36 M	-	08.10.2021
791	Pickett-Potter Horn Antenna	FH-PP-325	10024	Radiometer Physics	36 M	-	
792	Pickett-Potter Horn Antenna	FH-PP 075	10006	Radiometer Physics	36 M	-	
793	Pickett-Potter Horn Antenna	FH-PP 140	10008	Radiometer Physics	36 M	-	
794	Pickett-Potter Horn Antenna	FH-PP 110	10014	Radiometer Physics	36 M	-	
795	SGH Antenna	SGH-26-WR10	1144	Antenal S.L.	36 M	-	
798	WR-22 Rectangular Gain Horn	SAR-2309-22-S2	13254-01	SAGE Millimeter, Inc.	36 M	-	
799	Transceiver	optoLAN-Gb	18-014746	mk messtechnik	pre-m	-	
801	Spectrum Analyzer	FSP 13	100960	Rohde & Schwarz	24 M	-	14.01.2021
802	Exposure Level Tester	ELT-400	O-0026	NARDA Safety Solutions	24 M	-	30.01.2021
803	Probe	ELT probe 3cm²	O-0026	Narda Safety Test Solution	24 M	-	30.01.2021
805	Thermo-Hygrometer	Web-Thermo-Hygrometer	02749814	W&T	24 M	-	
806	AC2600 Smart Wifi Router	Netgear Nighthawk x4S	5K5188590067B	Netgear	-	-	
807	Direct Coupler	Direct Coupler C-05020- 10	511	ET Industries	-	-	
808	Diode Power Sensor	NRV-Z1	829894/001	Rohde & Schwarz	24 M	-	24.05.2021



Ref.-No.	Equipment	Type	Serial-No.	Manufacturer	Interval of calibration	Remark	Cal due
809	Standard gain Horn Antenna	WR-159 Horn Antenna	-	Pasternack Enterprises Inc.	-	-	

5.1.4 Legend

Note / remarks		Calibrated during system calibration:
	1a	System CTC-SAR-EMS (Ref.-No. 442)
	1b	System-CTC-EMS-Conducted (Ref.-No. 335)
	1c	System CTC-FAR-EMI-RSE (Ref.-No . 443)
	1d	System CTC-SAR-EMI (Ref.-No . 441)
	1e	System CTC-OATS (EMI radiated) (Ref.-No. 337)
	1 f	System CTC-CTIA-OTA (Ref.-No . 420)
	1 g	System CTC-FAR-EMS (Ref.-No . 444)
	2	Calibration or equipment check immediately before measurement
	3	Regulatory maintained equipment for functional check or support purpose
	4	Ancillary equipment without calibration e.g. mechanical equipment or monitoring equipment
	5	Test System

Interval of calibration	12 M	12 month
	24 M	24 month
	36 M	36 month
	24/12 M	Calibration every 24 months, between this every 12 months internal validation
	36/12 M	Calibration every 36 months, between this every 12 months internal validation
	Pre-m	Check before starting the measurement
	-	Without calibration

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	4.0 dB						-
		150 kHz - 30 MHz	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 - 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	2020-May-12
C1	Calibration dates new organized into date of tests and current status at date of test report writing	2020-May-27

End Of Test Report