T E S T R E P O R T
No.: 17-1-0105501T04a-C1

According to:
FCC Regulations
Part 22, Part 24, Part 27

ISED-Regulations
RSS-132 Issue 3, RSS-133 Issue 6,
RSS-139 Issue 2, RSS-Gen Issue 4
RSS-130 Issue 1

for

Daimler Trucks North America

7 620 000 296
66-10777-001

FCC: 2AKC8CTP10777001
ISED: 22221-CTP10777001
PMN: CTPMIDDTNA
HVIN: CTPMIDDTNA
FVIN: 17.02.S.016

Laboratory Accreditation and Listings		
DAkkS Deutsche Akkreditierungsstelle D-PL-12047-01-01 Accredited EMC-Test Laboratory	Industry Canada Reg. No.: 3462D-1 Reg. No.: 3462D-2 Reg. No.: 3462D-3	Voluntary Controls for Electromagnetic Emissions Reg. No.: R-20013, C-20009, T-20006, G-20013
Wi Fi ALLIANCE AUTHORIZED RF LABORATORY	ctia Authorized™ Test Lab Lab Code: 20011130-00	FEDERAL COMMUNICATIONS COMMISSION USA MRA US-EU 0003
accredited according to DIN EN ISO/IEC 17025		

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Laboratory Accreditation and Listings

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The listed attachments are an integral part of this report.

1. Summary of test results

The test results apply exclusively to the test samples as presented in this Report. The CETECOM GmbH does not assume responsibility for any conclusions and generalizations taken in conjunction with other specimens or samples of the type of the item presented to tests.

The test results apply exclusively to the test samples as presented in this Report. The CETECOM GmbH does not assume responsibility for any conclusions and generalizations taken in conjunction with other specimens or samples of the type of the item presented to tests. Also we refer on special conditions which the applicant should fulfil according §2.927 to §2.948, special focus regarding modification of the equipment and availability of sample equipment for market surveillance tests.

The Equipment Under Test (in this report, hereinafter referred as EUT) supports radiofrequency technologies and use an already approved cellular module with FCC-ID: XPYTOBYL200 and ISED/ IC: 8595A-TOBYL200. This test report shows results for LTE technology only. Other implemented wireless technologies were not considered within this test report.

Following tests have been performed to show compliance with applicable FCC Part 2, Part 22, Subpart H, Part 24, Subpart E (Broadband PCS) and FCC Part 27, Subpart C, of the FCC CFR Title 47 Rules, Edition 4th November 2016 and Canada RSS-132 Issue 3, RSS-133 Issue 6 and RSS-Gen Issue 4 standards.

1.1. TX mode, Test overview of FCC and Canada IC/ISED (RSS) Standards

No. of Diagram group	Test case	Port	References & Limits			EUT set-up	EUT op-mode	Result
			FCC Standard	RSS Section	Test limit			
1	AC-Power Lines Emissions Conducted (0,15 - 30 MHz)	AC-Power lines (conducted)	§15.207	RSS-Gen, Issue 4: Chapter 8.8	§15.207 limits ISED: Table 3, Chapter 8.8	--	--	Remark 1.)
2	General field strength emissions (9 kHz - 30 MHz)	Cabinet + inter-connecting cables (radiated)	§15.209(a)	RSS-Gen, Issue 4: Chapter 8.9, Table 5+6	2400/F(kHz) µV/m 24000/F(kHz) µV/m 30 µV/m	2	1+2+3 +4+5	passed
7	RF-Power (ERP/EIRP)		§2.1046 §22.913(a)(2)	RSS-132, Issue 3: Chapter 5.4 SRSP-503: 5.1.3	< 7 Watt (ERP)	2	1+2+3 +4+5	Calculated passed
			§24.232(c)	RSS-133, Issue 6 Chapter 4.1/6.4 SRSP-510: 5.1.2	< 2 Watt (EIRP)			
			§27.50 (d)(4)	RSS-139: Issue 3 Chapter 6.5 SRSP-513: 5.1.2	< 1 Watt (EIRP)			
			§27.50(c)(10)	RSS-130, Issue 1, Chapter 4.4	< 3 Watt (ERP)			
8	Spurious emissions		§2.1053(a) §2.1057	RSS-Gen., Issue 4	43+10log(P) dBc	2	1+2+3 +4+5	passed
			§22.917(a)(b)	RSS-132: Chapter 5.5(i)(ii)				
9	Band-Edge compliance		§24.238(a)(b)	RSS-133: Chapter 6.5.1(i)(ii)		2	1+2+3 +4+5	passed
			§27.53(h)(1)(3) (i)(ii)(iii)	RSS-139: Issue 3 Chapter 6.6 (i) (ii)				
			§27.53(g)	RSS-130: Issue 1 Chapter 4.6.1				

30	RF Power	Antenna terminal (conducted)	§2.1046	--	N/A	1	1+2+3 +4+5	passed
34	26dB Emission bandwidth		§2.1049(h)	RSS-Gen, Issue 4, Chapter 6.6	26dBc Emissions BW 99% Power	--	--	Not performed see initial modules's certification *3)
35	99% Occupied bandwidth							
36	Spurious emissions		§2.1051 §2.1057 §22.917(a)(b) §24.238(a)(b) §27.53	RSS-132, Issue 3: 5.5(i)(ii) RSS-133, Issue 6: 6.5.1(i)(ii) RSS-139, Issue 3 Chapt. 6.6 (i) (ii)	43+10log(P) dBc			Not performed see initial modules's certification *3)
37	Band-Edge compliance			RSS-130, Issue 1 Chapt. 4.6.1 Chapt. 4.6.2				Not performed see initial modules's certification *3)
38	Frequency stability		§22.355, table C-1 §24.235 §2.1055(a)(2) §27.54	RSS-132, Issue 3: Chapter 5.3 RSS-133, Issue 6: Chapter 6.3 RSS-130, Issue 1: Chapter 4.3 RSS-139, Issue 3, Chapter 6.4	< ±2.5ppm			Not performed see initial modules's certification *3)

1.2. RX mode, tests overview according FCC Part 15B and Canadian RSS Standards

No. of Diagram group	Test case	Port	References & Limits			EUT set-up	EUT op-mode	Result
			FCC Standard	RSS Section	Test limit			
1	AC-Power Lines conducted Emissions	AC-Power lines	§15.107 §15.207	RSS-Gen, Issue 8: Chapter 8.8	FCC §15.107 class B limits §15.207 limits RSS-Gen: Table 3	--	--	Remark 1
3	Receiver radiated emissions	Cabinet + Interconnecting cables	§15.109 §15.33 §15.35	RSS-132, Issue 3: 6.6 RSS-Gen, Issue 4: 5.3 RSS 133, Issue 6: 6.6	FCC 15.109 class B limits RSS-Gen: Chapter 5.3+Chapter 7.1.2	--	--	Passed, Remark 2

Remark:
1.) not applicable since powered within car-environment
2.) See separate test report no. CETECOM_TR17-1-0105501T01a-C1 for measurements according Part 15, Subpart B / RSS-Gen (ICES-003)
3.) Please refer to modular test reports of FCC-ID: XPYTOBYL200

1.3. 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 requirements as shown in above table are met in accordance with enumerated standards.

The current version of the Test Report CETECOM_TR17-1-0105501T04a-C1 replaces the test report CETECOM_TR17-1-0105501T04a dated 2017-10-05. The replaced test report is herewith invalid.

Digital unterschrieben von Rachid Acharkaoui
DN: cn=Rachid Acharkaoui, o=CETECOM GmbH, ou=RC&EMC, email=rachid.acharkaoui@cetecom.com, c=DE
Datum: 2018.01.08 21:29:40 +01'00'

Ninovic Perez 2018.01.08 16:53:10 +01'00'

....

Dipl.-Ing. Rachid Acharkaoui
Responsible for test section

Dipl.-Ing N. Perez
Responsible for test report

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. Rachid Acharkaoui
Deputy:	Dipl.-Ing. Niels Jeß

2.2. Test location

2.2.1. Test laboratory "CTC"

Company name:	see chapter 2.1. Identification of the testing laboratory

2.3. Organizational items

Responsible for test report and project leader:	Dipl.-Ing N. Perez
Receipt of EUT:	2017-08-17
Date(s) of test:	2017-09-18 to 2017-10-02
Date of report:	2018-01-08
Version of template: 13.02	

2.4. Applicant's details

Applicant's name:	Daimler Trucks North America
Address:	4747 N. Channel Ave. Portland, OR 97217 U.S.A.
Contact person:	Mr. Jürgen Weber

2.5. Manufacturer's details

Manufacturer's name:	Robert Bosch Car Multimedia Portugal, S.A.
Address:	Rua Max Grundig 35 4705-820 Braga Portugal

3. Equipment under test (EUT)

3.1. SUMMARY OF RESULTS AND TECHNICAL DATA OF MAIN EUT DECLARED BY APPLICANT

TX-frequency range (E-UTRA operating bands)	☒ LTE Band 2: 1850 - 1910 MHz (Uplink), 1930-1990 MHz (Downlink) ☒ LTE Band 4: 1710 - 1755 MHz (Uplink), 2110 - 2155 MHz (Downlink) ☒ LTE Band 5: 824 - 849 MHz (Uplink), 869-894 MHz (Downlink) ☒ LTE Band 7: 824 - 849 MHz (Uplink), 869-894 MHz (Downlink) ☐ LTE Band 13: 777 - 787 MHz (Uplink), 746-756 MHz (Downlink) ☒ LTE Band 17: 704 - 716 MHz (Uplink), 734 - 746 MHz (Downlink)		
Type of modulation	QPSK, 16-QAM		
Data rates	Cat3, Downlink: max. 100Mbps, Uplink: max. 50Mbps		
Number of channels – Table 5.4.4-1 accord. 3GPP TS36.521-1 (See Note in 3GPP-Standard about channels not to be used depending on channel bandwidths)	☒ LTE Band 2: UARFCN range 18600 - 19199 ☒ LTE Band 4: UARFCN range 19950 - 20399 ☒ LTE Band 5: UARFCN range 20400 - 20649 ☒ LTE Band 7: UARFCN range 20750 - 21449 ☐ LTE Band 13: UARFCN range 23180 - 23279 ☒ LTE Band 17: UARFCN range 23730 - 23849		
Emission designator(s)	Nominal Channel bandwidth	QPSK Modulation:	16-QAM Modulation
	1.4 MHz 3 MHz 5 MHz 10 MHz 15 MHz 20 MHz	See original grant under: https://apps.fcc.gov/oetcf/tcb/reports/Tcb731GrantForm.cfm?mode=COPY&RequestTimeout=500&tcb_code=&application_id=fy%2FxVplxCthQV%2Bcew9PD2Q%3D%3D&fcc_id=XPYTOBYL200	See original grant under: https://apps.fcc.gov/oetcf/tcb/reports/Tcb731GrantForm.cfm?mode=COPY&RequestTimeout=500&tcb_code=&application_id=fy%2FxVplxCthQV%2Bcew9PD2Q%3D%3D&fcc_id=XPYTOBYL200
Antenna Type	☐ Integrated ☐ External, no RF- connector ☒ External, separate RF-connector		
Antenna Gain Tx *1)	☒ Values: 850MHz Band: 0dBi 1700MHz band: 0dBi 1900MHz Band: 0dBi		

MAX Average Output Power:				
Conducted	LTE-Mode 2	22.22 dBm (AV)		
	LTE-Mode 4	22.21 dBm (AV)		
	LTE-Mode 5	22.24 dBm (AV)		
	LTE-Mode 7	21.81 dBm (AV)		
	LTE-Mode 17	22.42 dBm (AV)		
EIRP		conducted output power + antenna gain		
	LTE-Mode 2	22.22 dBm + 0 dBi = 22.22 dBm		
	LTE-Mode 4	22.21 dBm + 0 dBi = 22.21 dBm		
	LTE-Mode 5	22.24 dBm + 0 dBi = 22.24 dBm		
	LTE-Mode 7	21.81 dBm + 0 dBi = 21.81 dBm		
	LTE-Mode 17	22.42 dBm + 0 dBi = 22.42 dBm		
ERP		EIRP – 2.15dBi		
	LTE-Mode 2	22.22 dBm – 2.15 dBi = 20.07 dBm		
	LTE-Mode 4	22.21 dBm – 2.15 dBi = 20.06 dBm		
	LTE-Mode 5	22.24 dBm – 2.15 dBi = 20.09 dBm		
	LTE-Mode 7	21.81 dBm – 2.15 dBi = 19.66 dBm		
	LTE-Mode 17	22.42 dBm – 2.15 dBi = 20.27 dBm		
Installed option		☒ GSM 900 and GSM 1800 Bands (not usable in USA/Canada) ☒ W-CDMA Band I and Band VIII (not usable in USA/Canada) ☒ W-LAN, Bluetooth©, ANT+ wireless technologies ☒ GPS (not tested within this test report)		
Power supply		☒ DC power only: 24 V DC Nominal		
Special EMI components		--		
EUT sample type		☐ Production	☒ Pre-Production	☐ Engineering
FCC label attached		☐ yes	☒ no	

Remark: *1)please refer to antenna data sheet “D126-0153A - HCEL-AG-0205A Installation Instruction Rev1”

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

Short description*)	EUT	Type	S/N serial number	HW hardware status	SW software status
EUT A	66-10777-001	7 620 000 296	2960006201	0601G01	17.02.S.016
EUT B	HCEL-AG-0205-01 / 955-180-001 (DTNA PN 66-03942-002)	4G LTE/GNSS Low Profile Adhesive Mount Antenna	--	--	--
EUT C	HWLN-AX-0115A-01	WiFi Low Profile Adhesive Mount Antenna	--	--	--

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

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

AE short description *)	Auxiliary Equipment	Type	S/N serial number	HW hardware status	SW software status
AE 1	Cable harness with loadbox	--	Harness#1	--	--
AE 2	Cable harness reduced	--	Harness#2	--	--

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

3.4. EUT set-ups

EUT set-up no.*)	Combination of EUT and AE	Remarks
set. 1	EUT A + EUT B + EUT C + AE 1	Radiated Set-up (main TX -antenna activated)
set. 2	EUT A + AE 2	Conducted measurement set-up

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

3.5. EUT operating modes

EUT operating mode no.*)	Description of operating modes	Additional information
op. 1	LTE Band2: Channel: 18606 and 19175	A communication link is established between the mobile station (UE) and the test simulator
op. 2	LTE FDD4 Channel: 19965 and 20300	A communication link is established between the mobile station (UE) and the test simulator
op. 3	LTE FDD5 Channel : 20425 and 20625	A communication link is established between the mobile station (UE) and the test simulator
op. 4	LTE FDD7 Channel : 20750 and 21449	A communication link is established between the mobile station (UE) and the test simulator
op. 5	LTE FDD 17 Channel: 23755 and 23800	A communication link is established between the mobile station (UE) and the test simulator

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

4. Description of test system set-up's

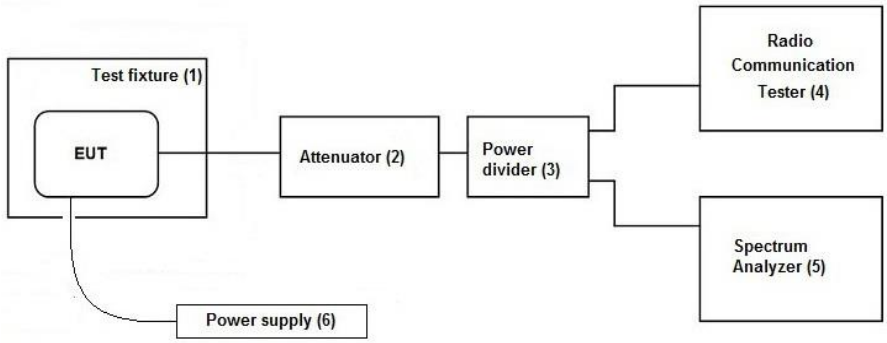
4.1. Test system set-up for conducted measurements on antenna port

Cellular Conducted RF-Setup 1 (Cel-1 Set-up)

Tests Specification: Conducted spurious emissions, Emission Bandwidth

General Description: The EUT's RF-signal is coupled out by a suitable antenna coupling connector (1). The signal is first attenuated (2) before it is 0° divided by a power divider (3). One of the RF-signal path is connected to the test unit communication tester (4), other RF-path is connected to the spectrum – analyzer (5) for specific RF-measurements. The specific attenuation losses for both signal paths/branches are determined prior to the measurement within a set-up calibration. These are then taken into account by correcting the measurement readings on the spectrum-analyzer.

Schematic:



Used Equipment:

Passive Elements	Test Equipment	Remark:
☒ 10 dB Attenuator (#530)	☒ CMW500	See List of equipment under each test case and chapter 8. for calibration info
☒ Low loss RF-cables	☒ DC-Power Supply	
☒ 6 dB resistive power divider/coupler (#529)	☒ Spectrum-Analyser	

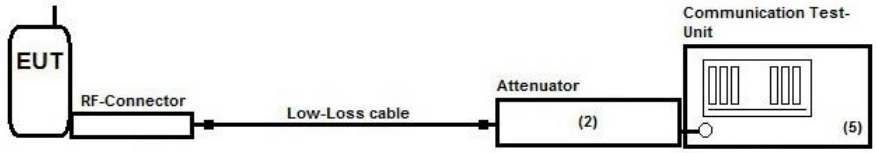
Testing method: ANSI C63.10:2013, KDB 971168 D01 v02r02

Measurement uncertainty: See chapter Measurement Uncertainties (Cel-1)

Cellular Conducted RF-Setup 2 (Cel-2 Set-up)

Tests Specification: Conducted Carrier power, Frequency Error

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



Testing method: ANSI C63.10:2013, KDB 971168 D01 v02r02

Used Equipment	Passive Elements	Test Equipment	Remark:
	☒ 20 dB Attenuator (#613)	☒ CMW500	See List of equipment under each test case and chapter 8. for calibration info
	☒ Low loss RF-cables	☒ DC-Power Supply	

Measurement uncertainty See chapter Measurement Uncertainties (Cel-2)

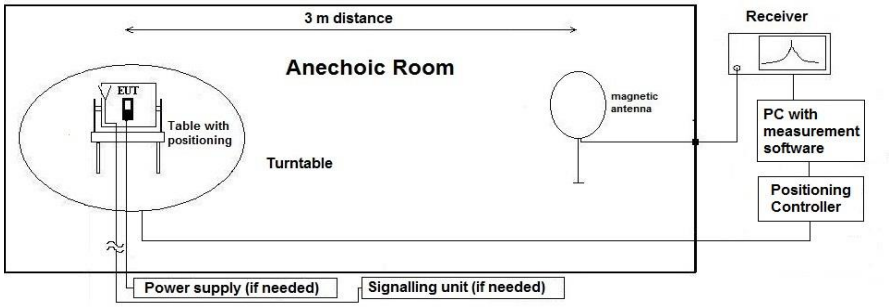
4.2. Test system set-up for radiated magnetic field measurements below 30 MHz

Specification: ANSI C63.4-2014 §5.3, §8.2.1, §8.3.1.1+§8.3.2.1 , ANSI C63.10-2013 chapter 6.4 (§6.4.4.2)

General Description: 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:

Exploratory, preliminary measurement
The EUT and it's associated accessories are placed on a non-conductive position manipulator (tipping device) of 0.8 m height which is placed on the turntable. By rotating the turntable (step 90°, range 0°to 360°) and the EUT itself either on 3-orthogonal axis (portable equipment) or 2-orthogonal axis (defined operational position of EUT), the emission spectrum was recorded. The loop antenna was moved at least to 2-perpendicular axes (antenna vector in direction of EUT and parallel to EUT) in order to maximize the emissions. The results are documented in a diagram. Critical frequencies (low margin to limit) are saved within a data reduction table for further investigations. If various operating modes are supported, further investigations are made to find the worst-case. Also the interconnection cables and equipment position were varied in order to maximize the emissions.

Final measurement on critical frequencies
Based on the exploratory measurements, the most critical frequencies are re-measured by 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
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.

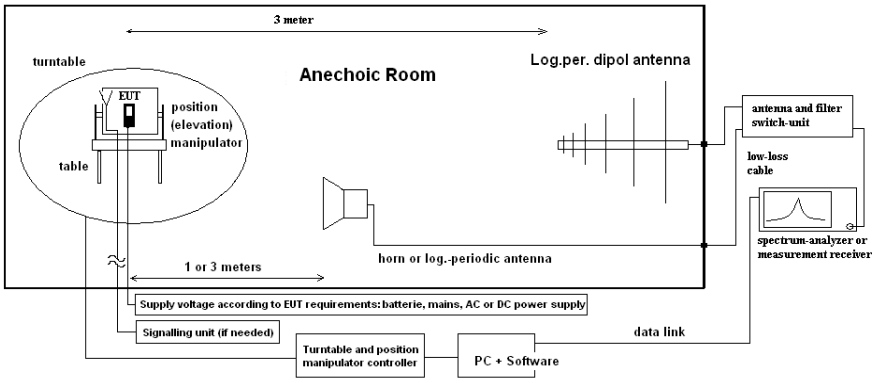
Distance correction: Reference for applied correction (extrapolating) factors due to reduced measurement distance:
ANSI C63.10:2013, §6.4.4.2 - Equations (2) + (3) + (4)

4.3. Test system set-up for radiated spurious emission measurements

Specification: ANSI C63.4-2014 chapter 8.3, ANSI C63.10-2013 chapter 6.6.3.3 & 6.6.4, ANSI C63.26-2015, Chapter 4.6.3.3

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

Schematic:



Testing method:

Exploratory, preliminary measurements
The EUT and its associated accessories are placed on a non-conductive position manipulator (tipping device) of 1.50 m height which is placed on the turntable. By rotating the turntable (range 0° to 360°, step 45°) and the EUT itself on 3-orthogonal axis (the emission spectrum and it's characteristics was recorded with an EMI-receiver, broadband antenna and software.
The measurements are performed in horizontal and vertical polarization of the measurement antennas. The results are documented in a diagram. Critical frequencies (low margin to limit) are saved within a table for further investigations. If various operating modes are supported, further investigations are made to find the worst-case of them. Also the interconnection cables and equipment position were varied in order to maximize the emissions.

Final measurement on critical frequencies
Based on the exploratory measurements, the most critical frequencies are re-measured by 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 over 3-orthogonal axis and the height for EUT with large dimensions.
On the determined worst-case position, a final measurement with necessary bandwidth and detector according standard has been carried out.
The readings on the spectrum analyzer are corrected with conversion value between field strength and E(I)RP, so the readings shown are equivalent to ERP/EIRP values. Critical measurements near the limit are re-measured with a substitution method accord. ANSI/TIA/EIA 603 C/D

Formula:

$E_C = E_R + AF + C_L + D_F - G_A$ (1)

$Ec_{E(I)RP} = Ec - 95.2\ dB$

$M = L_T - Ec_{E(I)RP}$

E_C = Electrical field – corrected value
E_R = Receiver reading
M = Margin
L_T = Limit
AF = Antenna factor
C_L = Cable loss
D_F = Distance correction factor (if used)
G_A = Gain of pre-amplifier (if used)
$Ec_{E(I)RP}$ = Electrical field corrected for E(I)RP

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

5. Measurements

5.1. RF-Parameter - RF Peak power output conducted and PAPR

5.1.1. Test location and equipments (for reference numbers please see chapter 'List of test equipment')

test location	☒ CETECOM Essen (Chapter. 2.2.1)		☐ Please see Chapter. 2.2.2			
test site	☐ 347 Radio.lab. 1	☒ Radio.lab. 2				
spectr. analys.	☐ 584 FSU	☐ 489 ESU 40	☐ 264 FSEK	☐ 620 ESU 26		
signaling	☐ 392 MT8820A	☐ 436 CMU	☐ 547 CMU	☒ 594 CMW500		
otherwise	☐ 400 FTC40x15E	☐ 401 FTC40x15E	☐ 110 USB LWL	☐ 482 Filter Matrix	☐ 378 RadiSense	
DC power	☐ 456 EA 3013A	☐ 463 HP3245A	☐ 459 EA 2032-50	☐ 268 EA- 3050	☐ 494 AG6632A	☒ 611 E3632A
otherwise	☐ 331 HC 4055	☐ 248 6 dB Att.	☐ 529 Power div.	☐ - cable OTA20		☒ 530 10 dB Att.
line voltage	☐ 230 V 50 Hz via public mains		☐ 060 110 V/ 60 Hz via PAS 5000			

5.1.2. Requirements and limits

FCC	§2.1046, §27.50
IC	RSS-132: 5.4 + SRSP 503:5.1.3 for FDD Band 5 RSS-133: 4.1/6.4 + SRSP-510:5.1.2 for FDD Band 2 RSS-139, Issue 3: 6.5 RSS-199: Issue 1, §4.4 + PAR PK-AV ≤ 13 dB RSS-130, Issue 1 + SRSP-518
Limit	Maximum Power Output of the mobile phone should be determined while measured conducted.
	Limit LTE Band 5: 7 Watt ERP (38.4 dBm)
	Limit LTE Band 2: 2 Watt EIRP (33.0 dBm)
	Limit LTE Band 4: 1 Watt EIRP (30.0 dBm)
	Limit LTE Band 7: 2 Watt EIRP (33.0 dBm)
	FCC: Limit LTE Band 12/13/17: 3 Watt ERP (34.7dBm)
FCC Limit	FCC: Limit LTE Band 12/13/17: 3 Watt ERP (34.7dBm)
ISED Limit	ISED Limit LTE Band 12: 5 Watt EIRP (37dBm)
	ISED Limit LTE Band 13: 5 Watt EIRP (37dBm)
	ISED-Limit LTE Band 17: 5 Watt EIRP (37dBm)

5.1.3. Test condition and test set-up

Climatic conditions	Temperature: (22±3°C)	Rel. humidity: (40±20)%
Test system set-up	Please see chapter "Test system set-up for conducted measurements on antenna port"	
Measurement method	The measurements were performed with the integrated power measurement function of the „radio communication tester CMW500 from Rohde&Schwarz company. In this way spectrum-analyzers instrument limitations can be avoided or minimized. Instead, CMW manufacturers declared measurement error can be considered for this measurement. The attenuation (insertion loss) at the RF Inputs/Outputs of CMW were set according the path loss of the test set-up, determined in a step before starting the measurements. A suitable artificial antenna or RF-connector is provided by the applicant in order to perform the conducted measurements. Any data provided with the artificial antenna or connector, have been taken in account in order to correct the measurement data. (typical 0.3dB for attenuation of antenna connector) Peak and Average Values have been recorded for each channel and band. The Peak-to -Average-Ratio is determined by comparing the total peak power to total average power for each measurement.	
Mobile phone settings	A call was established with a suitable communication test unit (CMW500). UE is set TX mode, highest transmit power conditions (RMC-mode), power saving techniques have been disabled (MPR-techniques) Tests have been performed in different EUT bandwidth settings and various settings for allocated RBs. The measurements were made at the low, middle and high carrier frequencies of each of the supported operating band within the designated range within the allowed channel bandwidths. Choosing three TX-carrier frequencies of the mobile phone, should be sufficient to demonstrate compliance.	

5.1.4. Power results

5.1.4.1. LTE Band 2 results

LTE-Band 2				QPSK-Modulation			16-QAM-Modulation			max- modulation QPSK	max. modulation 16QAM	max. bandwidth	absolute max. value channels/bandwidths
channel bandwidth	ARFCN ch. no.	ARFCN-Frequency [MHz]	Resource block allocation	Peak detektor [dBm]	RMS detektor [dBm]	PAR Faktor [dB]	Peak detektor [dBm]	RMS detektor [dBm]	PAR Faktor [dB]				
1.4 MHz	18607	1850,7	1 RB low	26,9512	**21,4049**	5,5463	26,4464	20,5594	5,887	21,4049	20,5594	22,0912	22,2207
			1 RB high	26,9479	21,3479	5,6	26,3421	20,465	5,8771				
			50% RB mid	26,8758	21,3554	5,5204	26,8752	20,4369	6,4383				
			100% RB	26,5619	20,3519	6,21	26,7958	19,4217	7,3741				
	18900	1880	1 RB low	27,0812	21,0383	6,0429	26,4464	20,5594	5,887	21,2259	20,5594		
			1 RB high	27,0508	21,2259	5,8249	25,4955	20,232	5,2635				
			50% RB mid	26,9759	21,1337	5,8422	26,9068	20,2057	6,7011				
			100% RB	26,6925	20,0855	6,607	26,2919	19,1619	7,13				
	19193	1909,3	1 RB low	27,4291	21,9481	5,481	26,488	21,0814	5,4066	22,0912	21,2218		
			1 RB high	27,2791	22,0912	5,1879	26,4106	21,2161	5,1945				
			50% RB mid	27,2462	21,9855	5,2607	27,3167	21,2218	6,0949				
			100% RB	27,3681	20,9676	6,4005	26,7085	20,0147	6,6938				
3 MHz	18615	1851,5	1 RB low	26,6165	21,3979	5,2186	25,5314	20,4411	5,0903	21,3979	20,4411	22,1133	
			1 RB high	26,6049	21,1839	5,421	25,3484	20,176	5,1724				
			50% RB mid	26,2121	20,2266	5,9855	26,6057	20,3672	6,2385				
			100% RB	26,3027	20,2753	6,0274	26,8743	19,3141	7,5602				
	18900	1880	1 RB low	26,3391	20,7658	5,5733	25,3796	19,8688	5,5108	21,2106	20,3756		
			1 RB high	26,5797	21,2106	5,3691	25,7039	20,3756	5,3283				
			50% RB mid	26,7314	20,1789	6,5525	27,2138	20,1686	7,0452				
			100% RB	26,3853	20,1011	6,2842	26,259	19,21	7,049				
	19185	1908,5	1 RB low	26,7765	21,5272	5,2493	27,3363	21,2813	6,055	22,1133	21,6988		
			1 RB high	26,8036	22,1133	4,6903	27,1379	21,6988	5,4391				
			50% RB mid	27,3168	20,9498	6,367	26,8754	21,0176	5,8578				
			100% RB	26,7884	20,9203	5,8681	26,8058	19,9291	6,8767				
5 MHz	18625	1852,5	1 RB low	26,71	21,5388	5,1712	26,5182	20,7604	5,7578	**21,5388**	20,7604	22,1228	
			1 RB high	26,477	21,0291	5,4479	26,1986	20,2762	5,9224				
			50% RB mid	27,1223	20,1814	6,9409	26,6248	20,2924	6,3324				
			100% RB	26,8056	20,2071	6,5985	27,4834	19,2248	8,2586				
	18900	1880	1 RB low	26,6121	21,0026	5,6095	26,644	20,0528	6,5912	21,3673	20,3369		
			1 RB high	26,9532	21,3673	5,5859	26,8579	20,3369	6,521				
			50% RB mid	27,1942	20,1641	7,0301	27,0917	20,2809	6,8108				
			100% RB	26,4354	20,1328	6,3026	27,1359	19,2007	7,9352				
	19175	1907,5	1 RB low	27,2234	21,0874	6,136	26,276	20,1454	6,1306	22,1228	21,1664		
			1 RB high	27,2298	22,1228	5,107	26,7329	21,1664	5,5665				
			50% RB mid	27,3693	20,763	6,6063	27,3109	20,7512	6,5597				
			100% RB	27,3251	20,7529	6,5722	27,3242	19,6265	7,6977				
10 MHz	18650	1855	1 RB low	26,7289	21,4882	5,2407	25,6499	**20,5687**	5,0812	**21,4882**	**20,5687**	**22,0708**	
			1 RB high	26,2008	20,4087	5,7921	24,7399	19,4626	5,2773				
			50% RB mid	26,215	19,8642	6,3508	26,7685	18,8616	7,9069				
			100% RB	26,2471	19,8822	6,3649	26,325	18,9234	7,4016				
	18900	1880	1 RB low	26,6559	21,2246	5,4313	25,9412	20,5443	5,3969	21,5062	20,7327		
			1 RB high	26,654	**21,5062**	5,1478	26,0098	20,7327	5,2771				
			50% RB mid	26,7848	20,1848	6,6	26,6576	19,2725	7,3851				
			100% RB	26,8732	20,2877	6,5855	27,1984	19,2479	7,9505				
	19150	1905	1 RB low	25,9343	20,4754	5,4589	26,6953	20,1337	6,5616	**22,0708**	21,7402		
			1 RB high	26,9645	**22,0708**	4,8937	27,1935	21,7402	5,4533				
			50% RB mid	26,8631	20,1681	6,695	26,4913	19,0386	7,4527				
			100% RB	26,9154	20,2297	6,6857	27,2288	19,1435	8,0853				

LTE-Band 2				QPSK-Modulation			16-QAM-Modulation						
channel bandwidth	ARFCN ch. no.	ARFCN-Frequency [MHz]	Resource block allocation	Peak detektor [dBm]	RMS detektor [dBm]	PAR Faktor [dB]	Peak detektor [dBm]	RMS detektor [dBm]	PAR Faktor [dB]	max- modulationQPSK	max. modulation16QAM	max. bandwidth	absolute max. value channels/bandwidths
15 MHz	18675	1857,5	1 RB low	26,5466	21,4677	5,0789	25,6939	20,5772	5,1167	21,4677	20,5772	22,0077	22,2207
			1 RB high	25,532	20,0241	5,5079	24,417	19,0968	5,3202				
			50% RB mid	26,7795	19,5936	7,1859	27,0312	19,373	7,6582				
			100% RB	26,8754	19,6827	7,1927	26,2991	18,726	7,5731				
	18900	1880	1 RB low	26,274	20,8592	5,4148	25,8809	20,5847	5,2962	21,1773	20,7184		
			1 RB high	26,4026	21,1773	5,2253	25,8875	20,7184	5,1691				
			50% RB mid	27,1679	20,1771	6,9908	27,3899	20,1982	7,1917				
			100% RB	27,4421	20,3147	7,1274	26,7281	19,2413	7,4868				
	19125	1902,5	1 RB low	26,1926	20,835	5,3576	26,7903	20,5003	6,29	22,0077	21,7692		
			1 RB high	26,9439	22,0077	4,9362	27,1852	21,7692	5,416				
			50% RB mid	27,0519	19,766	7,2859	26,8712	19,6254	7,2458				
			100% RB	27,5507	20,0607	7,49	26,5292	18,934	7,5952				
20 MHz	18700	1860	1 RB low	26,8408	21,5881	5,2527	27,044	20,8983	6,1457	**21,5881**	20,8983	**22,2207**	
			1 RB high	26,1095	**20,2887**	5,8208	26,5255	19,6184	6,9071				
			50% RB mid	26,3254	19,4404	6,885	26,6161	19,2278	7,3883				
			100% RB	26,2774	19,6241	6,6533	26,6802	18,6353	8,0449				
	18900	1880	1 RB low	26,3152	**20,5771**	5,7381	26,1265	20,0869	6,0396	20,6243	20,1969		
			1 RB high	26,2706	20,6243	5,6463	26,0277	20,0813	5,9464				
			50% RB mid	26,8481	20,2828	6,5653	27,1417	20,1969	6,9448				
			100% RB	26,8727	20,2113	6,6614	26,8565	19,1834	7,6731				
	19100	1900	1 RB low	26,3157	20,6699	5,6458	26,0826	19,9609	6,1217	22,2207	21,4838		
			1 RB high	27,1768	22,2207	4,9561	27,0237	21,4838	5,5399				
			50% RB mid	26,8065	19,7672	7,0393	26,4178	19,4853	6,9325				
			100% RB	27,0126	19,9018	7,1108	27,5244	18,7545	8,7699				

5.1.4.2. LTE Band 4 Results

LTE-Band 4				QPSK-Modulation			16-QAM-Modulation			max- modulationQPSK	max. modualtion16-QAM	max. channel	absolute max.value
channel bandwidth	ARFCN ch. no.	ARFCN-Frequency [MHz]	Resource block allocation	Peak detektor [dBm]	RMS detektor [dBm]	PAR Faktor [dB]	Peak detektor [dBm]	RMS detektor [dBm]	PAR Faktor [dB]				
1.4 MHz	19957	1710,7	1RB low	27,0448	21,4539	5,5909	26,3712	20,4334	5,9378	21,5035	20,5603	21,6737	22,218
			1RB high	26,9622	21,5035	5,4587	26,4014	20,5603	5,8411				
			50% RB mid	27,0093	21,4343	5,575	26,9931	20,5068	6,4863				
			100% RB	26,9706	20,4002	6,5704	26,7565	19,4282	7,3283				
	20175	1732,5	1RB low	27,2329	21,6737	5,5592	26,6266	20,7232	5,9034	21,6737	20,7578		
			1RB high	27,0311	21,6178	5,4133	26,5248	20,7578	5,767				
			50% RB mid	27,1772	21,6544	5,5228	27,1968	20,752	6,4448				
			100% RB	26,8768	20,629	6,2478	26,9473	19,683	7,2643				
	20393	1754,3	1RB low	26,4647	20,7939	5,6708	25,8556	19,9193	5,9363	20,856	19,963		
			1RB high	26,5334	20,856	5,6774	25,8638	19,9458	5,918				
			50% RB mid	26,4965	20,7566	5,7399	26,5241	19,963	6,5611				
			100% RB	26,3953	19,8545	6,5408	25,7696	18,6784	7,0912				
3 MHz	19965	1711,5	1RB low	26,5243	21,3984	5,1259	27,0072	21,076	5,9312	21,4444	21,1238	21,6312	
			1RB high	26,4498	21,4444	5,0054	26,9362	21,1238	5,8124				
			50% RB mid	27,0911	20,4476	6,6435	26,4668	20,5865	5,8803				
			100% RB	26,7241	20,4428	6,2813	26,5978	19,4978	7,1				
	20175	1732,5	1RB low	26,6322	21,5527	5,0795	27,1727	21,2275	5,9452	21,6312	21,3053		
			1RB high	26,6365	21,6312	5,0053	27,1478	21,3053	5,8425				
			50% RB mid	27,3051	20,6714	6,6337	26,6935	20,8043	5,8892				
			100% RB	27,2886	20,6366	6,652	27,0681	19,718	7,3501				
	20385	1753,5	1RB low	25,8303	20,6732	5,1571	26,4093	20,4419	5,9674	20,7963	20,5621		
			1RB high	25,9716	20,7963	5,1753	26,5739	20,5621	6,0118				
			50% RB mid	26,6082	19,88	6,7282	25,8765	19,9382	5,9383				
			100% RB	26,3819	19,8151	6,5668	25,4002	18,7128	6,6874				
5 MHz	19975	1712,5	1RB low	27,2815	21,4913	5,7902	26,3688	20,5056	5,8632	21,4913	20,5144	21,8185	
			1RB high	27,0857	21,4891	5,5966	26,213	20,5144	5,6986				
			50% RB mid	26,915	20,4626	6,4524	26,9016	20,4922	6,4094				
			100% RB	26,9161	20,4692	6,4469	26,5568	19,504	7,0528				
	20175	1732,5	1RB low	27,4099	21,6049	5,805	26,4932	20,6265	5,8667	21,8185	20,8279		
			1RB high	27,5519	21,8185	5,7334	26,5816	20,8279	5,7537				
			50% RB mid	27,3157	20,6797	6,636	27,119	20,7225	6,3965				
			100% RB	27,1506	20,6734	6,4772	27,2683	19,7142	7,5541				
	20375	1752,5	1RB low	26,6229	20,831	5,7919	25,7402	19,9406	5,7996	20,8874	19,9832		
			1RB high	26,8629	20,8874	5,9755	25,7856	19,9832	5,8024				
			50% RB mid	26,7849	19,849	6,9359	26,3894	19,874	6,5154				
			100% RB	26,3313	19,8345	6,4968	26,2775	18,7052	7,5723				
10 MHz	20000	1715	1RB low	26,5825	21,4951	5,0874	27,0688	21,1453	5,9235	21,4951	21,1453	22,0354	
			1RB high	26,3732	21,2707	5,1025	26,8247	20,939	5,8857				
			50% RB mid	26,8512	20,4665	6,3847	26,5324	19,5562	6,9762				
			100% RB	26,8928	20,449	6,4438	27,1034	19,4547	7,6487				
	20175	1732,5	1RB low	26,808	21,3578	5,4502	27,0689	21,0125	6,0564	**22,0354**	21,6435		
			1RB high	27,2263	**22,0354**	5,1909	27,4559	21,6435	5,8124				
			50% RB mid	27,0508	20,7063	6,3445	26,8112	19,7911	7,0201				
			100% RB	27,0807	20,7171	6,3636	27,5415	19,7289	7,8126				
	20350	1750	1RB low	26,2496	21,3142	4,9354	26,6558	20,9828	5,673	**21,3142**	20,9828		
			1RB high	26,0984	20,8641	5,2343	26,667	20,599	6,068				
			50% RB mid	26,3646	19,93	6,4343	25,8964	18,8689	7,0275				
			100% RB	26,505	20,0461	6,4589	26,5846	18,8912	7,6934				

LTE-Band 4				QPSK-Modulation			16-QAM-Modulation			max- modulationQPSK	max. modualtion16-QAM	max. channel	absolute max. value
channel bandwidth	ARFCN ch. no.	ARFCN-Frequency [MHz]	Resource block allocation	Peak detektor [dBm]	RMS detektor [dBm]	PAR Faktor [dB]	Peak detektor [dBm]	RMS detektor [dBm]	PAR Faktor [dB]				
15 MHz	20025	1717,5	1RB low	26,5878	21,4792	5,1086	27,0955	21,1903	5,9052	21,4792	21,1903	21,9609	22,218
			1RB high	26,3516	21,1858	5,1658	26,8798	20,8788	6,001				
			50% RB mid	26,9266	20,3555	6,5711	26,8546	20,3463	6,5083				
			100% RB	27,4239	20,3824	7,0415	26,8601	19,4243	7,4358				
	20175	1732,5	1RB low	26,494	21,3104	5,1836	25,6418	20,441	5,2008	21,9609	21,6191		
			1RB high	26,8952	21,9609	4,9343	27,3355	21,6191	5,7164				
			50% RB mid	27,3738	20,7185	6,6553	27,2721	20,7436	6,5285				
			100% RB	27,6227	20,7053	6,9174	27,2389	19,7646	7,4743				
	20325	1747,5	1RB low	26,6354	21,7151	4,9203	27,1134	21,4359	5,6775	21,7151	21,4359		
			1RB high	26,0619	20,8074	5,2545	25,2268	20,0139	5,2129				
			50% RB mid	26,6539	20,2346	6,4193	26,5687	20,2068	6,3619				
			100% RB	27,2188	20,279	6,9398	26,4068	19,1067	7,3001				
20 MHz	20050	1720	1RB low	26,931	**21,7496**	5,1814	26,8349	21,0201	5,8148	**21,7496**	21,0201	22,2175	
			1RB high	27,0694	21,6991	5,3703	26,8964	20,9726	5,9238				
			50% RB mid	26,7553	20,3275	6,4278	26,6933	20,3105	6,3828				
			100% RB	26,9742	20,425	6,5492	27,4553	19,4508	8,0045				
	20175	1732,5	1RB low	26,6881	21,4371	5,251	26,5627	20,7244	5,8383	21,9329	21,9841		
			1RB high	26,992	21,9329	5,0591	26,8277	21,207	5,6207				
			50% RB mid	27,2825	20,772	6,5105	27,1446	20,7643	6,3803				
			100% RB	27,2568	20,7327	6,5241	25,2052	21,9841	3,2211				
	20300	1745	1RB low	27,2931	22,2175	5,0756	27,1594	21,5225	5,6369	22,2175	21,5225		
			1RB high	26,447	21,0117	5,4353	26,2831	20,2941	5,989				
			50% RB mid	26,7293	20,5595	6,1698	26,7695	20,4601	6,3094				
			100% RB	26,8976	20,4943	6,4033	27,3418	19,4869	7,8549				

5.1.4.3. LTE Band 5 Results

LTE-Band 5				QPSK-Modulation			16-QAM-Modulation			max- modulation QPSK	max. modulation 16-QAM	max. channel	absolute max. value
channel bandwidth	ARFCN ch. no.	ARFCN-Frequency [MHz]	Resource block allocation	Peak detektor [dBm]	RMS detektor [dBm]	PAR Faktor [dB]	Peak detektor [dBm]	RMS detektor [dBm]	PAR Faktor [dB]				
14 MHz	20407	824.7	1RB low	27,3381	21,6406	5,6975	26,2249	20,8048	5,4201	21,88	20,92	21,88	22,24
			1RB high	27,2788	21,8805	5,3983	26,7237	20,9211	5,8026				
			50% RB mid	27,2948	21,7124	5,5824	27,2901	20,8365	6,4536				
			100% RB	27,2291	20,6629	6,5662	26,9533	19,6523	7,301				
	20525	**836.5**	1RB low	27,1495	21,1697	5,9798	26,4225	20,2026	6,2199	21,17	20,21		
			1RB high	27,2062	21,1701	6,0361	26,4194	20,21	6,2094				
			50% RB mid	27,12	21,0656	6,0498	27,1179	20,201	6,9169				
			100% RB	26,581	20,081	6,5	26,5774	19,0747	7,5027				
	20643	**848.3**	1RB low	26,3692	**21,8736**	4,4956	26,0225	20,9485	5,074	**21,87**	20,95		
			1RB high	26,2819	21,7141	4,5678	25,9433	20,8478	5,0955				
			50% RB mid	26,333	21,7375	4,5955	26,2926	20,9064	5,3862				
			100% RB	26,5134	20,7948	5,7186	26,3767	19,8417	6,535				
3 MHz	20415	825.5	1RB low	26,7334	21,4895	5,2439	27,369	21,2341	6,1349	22,11	21,81	22,11	
			1RB high	26,7731	22,1051	4,668	27,1669	21,8095	5,3574				
			50% RB mid	27,3248	20,9291	6,3957	26,7128	21,0584	5,6544				
			100% RB	27,3591	20,8772	6,4819	26,9998	19,881	7,1188				
	20525	**836.5**	1RB low	26,4792	21,158	5,3212	27,0685	20,8627	6,2058	21,16	20,86		
			1RB high	26,5698	21,1092	5,4606	27,4139	20,8362	6,5777				
			50% RB mid	27,3055	20,093	7,2125	26,4626	20,229	6,2336				
			100% RB	26,6282	20,1136	6,5146	26,7217	19,0853	7,6364				
	20635	847.5	1RB low	26,315	21,9303	4,3847	26,74	21,5848	5,1552	21,93	21,58		
			1RB high	26,0067	21,7285	4,2782	26,3487	21,3377	5,011				
			50% RB mid	26,4334	20,9362	5,4972	26,0578	20,9919	5,0659				
			100% RB	26,6144	20,9547	5,6597	26,2476	19,9947	6,2529				
5 MHz	20425	826.5	1RB low	27,7003	21,6996	6,0007	26,6709	20,7133	5,9576	22,24	21,27	**22,24**	
			1RB high	27,0633	**22,2385**	4,8248	26,4901	21,2713	5,2188				
			50% RB mid	27,387	21,0963	6,2907	26,9832	21,2051	5,7781				
			100% RB	27,1359	21,1031	6,0328	27,4316	20,0519	7,3797				
	20525	**836.5**	1RB low	27,1381	21,3532	5,7849	26,3066	20,3884	5,9182	**21,35**	20,39		
			1RB high	27,7935	21,14	6,6541	26,3047	20,1718	6,1329				
			50% RB mid	27,392	20,1274	7,2646	27,2538	20,168	7,0858				
			100% RB	26,846	20,1309	6,7151	27,0296	19,1245	7,9051				
	20625	846.5	1RB low	27,3892	21,8452	5,544	26,5132	20,8959	5,6173	21,85	21,09		
			1RB high	26,5215	21,7502	4,7713	25,9131	20,809	5,1041				
			50% RB mid	26,8806	21,0302	5,8504	26,6123	21,0886	5,5237				
			100% RB	26,9711	21,0241	5,947	26,5859	19,9773	6,6086				
10 MHz	20450	829	1RB low	26,8431	21,7001	5,143	27,4407	21,365	6,0757	21,70	21,37	21,85	
			1RB high	26,5115	21,5388	4,9727	26,8928	21,2116	5,6812				
			50% RB mid	26,7074	21,1757	5,5317	26,5704	20,2538	6,3166				
			100% RB	27,1939	21,0607	6,1332	27,5001	20,0339	7,4662				
	20525	**836.5**	1RB low	26,4021	**21,7693**	4,6328	26,7598	21,3964	5,3634	21,77	21,40		
			1RB high	26,8387	21,3199	5,5188	27,7285	21,0375	6,691				
			50% RB mid	26,9936	20,1484	6,8452	26,6523	19,2082	7,4441				
			100% RB	27,1224	20,3073	6,8151	26,4641	19,237	7,2271				
	20600	844	1RB low	26,7097	21,2089	5,5008	27,635	20,9156	6,7194	21,85	21,45		
			1RB high	26,2456	21,8492	4,3964	26,4358	21,4532	4,9826				
			50% RB mid	26,9882	20,9125	6,0757	26,795	19,8854	6,9096				
			100% RB	27,0261	20,825	6,2011	27,4849	19,7934	7,6915				

5.1.4.4. LTE Band 7 Results

LTE-Band 7				QPSK-Modulation			16-QAM-Modulation			max- modulation QPSK	max. modulation 16-QAM	max. channel	absolute max. value
channel bandwidth	ARFCN ch. no.	ARFCN-Frequency [MHz]	Resource block allocation	Peak detektor [dBm]	RMS detektor [dBm]	PAR Faktor [dB]	Peak detektor [dBm]	RMS detektor [dBm]	PAR Faktor [dB]				
5 MHz	20775	2502,5	1RB low	25,31	19,1304	6,18	23,814	18,1916	5,6224	19,13	18,378	21,73	21,81
			1RB high	25,136	19,1089	6,0272	23,9762	18,3783	5,5979				
			50%RB mid	25,163	18,1577	7,0052	24,965	18,2582	6,7068				
			100%RB	24,554	18,2072	6,3471	24,634	17,2534	7,3806				
	21100	2535	1RB low	24,89	20,5637	4,3267	24,4315	19,6922	4,7393	20,564	19,692		
			1RB high	25,007	20,1024	4,9044	24,4209	19,1796	5,2413				
			50%RB mid	25,141	19,3885	5,7521	24,683	19,5027	5,1803				
			100%RB	25,114	19,3859	5,7282	25,3437	18,6039	6,7398				
	21425	2567,5	1RB low	26,417	21,6235	4,7931	25,8519	20,7767	5,0752	21,735	20,966		
			1RB high	26,22	21,7348	4,4853	25,7912	20,8986	4,8926				
			50%RB mid	26,647	20,8834	5,7636	26,2341	20,966	5,2681				
			100%RB	26,245	20,568	5,677	26,7405	20,1103	6,6302				
10 MHz	20800	2505	1RB low	24,169	19,0268	5,1426	24,8593	19,135	5,7243	19,504	19,362	21,67	
			1RB high	24,403	19,5035	4,8994	25,2336	19,362	5,8716				
			50%RB mid	24,715	18,2393	6,476	24,4424	17,4047	7,0377				
			100%RB	25,014	18,2913	6,7225	25,147	17,4056	7,7414				
	21000	2535	1RB low	24,565	20,7785	3,786	24,7328	20,4163	4,3165	20,779	20,416		
			1RB high	24,543	19,7083	4,8343	24,9225	19,4464	5,4761				
			50%RB mid	24,989	19,4483	5,541	24,6332	18,6779	5,9553				
			100%RB	25,359	19,4841	5,8745	25,5765	18,6893	6,8872				
	21400	2565	1RB low	25,528	20,609	4,9193	26,2116	20,4391	5,7725	21,671	21,381		
			1RB high	25,915	21,6712	4,244	26,1239	21,381	4,7429				
			50%RB mid	26,447	20,6189	5,828	26,1491	19,9041	6,245				
			100%RB	26,59	20,5269	6,0631	27,0062	19,7535	7,2527				
15 MHz	20825	2507,5	1RB low	24,297	19,0816	5,2158	24,9709	18,8252	6,1457	20,354	20,1	21,67	
			1RB high	25,097	20,3541	4,7427	25,5797	20,1002	5,4795				
			50%RB mid	25,031	18,5908	6,4402	25,5029	18,5569	6,946				
			100%RB	25,579	18,7206	6,8579	25,0403	17,7004	7,3399				
	21100	2535	1RB low	25,234	20,9506	4,283	25,5513	20,5561	4,9952	20,951	20,556		
			1RB high	24,628	20,717	3,911	24,7803	20,3223	4,458				
			50%RB mid	24,991	20,2635	4,7271	25,161	20,2654	4,8956				
			100%RB	26,092	20,1927	5,8988	25,6771	19,3914	6,2857				
	21375	2562,5	1RB low	25,058	20,0115	5,0464	25,6411	19,6902	5,9509	21,671	21,332		
			1RB high	25,876	21,6711	4,2046	26,117	21,332	4,785				
			50%RB mid	26,295	20,3303	5,9644	26,52	20,3479	6,1721				
			100%RB	25,856	20,568	5,288	26,405	19,2824	7,1226				
20 MHz	20850	2510	1RB low	24,528	19,3205	5,2075	24,3695	18,6488	5,7207	21,113	20,433	21,81	
			1RB high	25,393	21,1128	4,28	25,2404	20,4334	4,807				
			50%RB mid	25,442	18,9496	6,4919	25,6396	18,8759	6,7637				
			100%RB	25,401	19,0048	6,3961	26,2309	18,1703	8,0606				
	21100	2535	1RB low	25,514	20,9285	4,5857	25,292	20,2642	5,0278	20,929	20,306		
			1RB high	24,735	20,5542	4,1808	24,6088	19,8842	4,7246				
			50%RB mid	25,193	20,297	4,8962	25,1605	20,3057	4,8548				
			100%RB	25,824	20,1387	5,6852	26,2247	19,3446	6,8801				
	21300	2555	1RB low	25,046	19,4518	5,5946	24,8269	18,8482	5,9787	21,811	21,271		
			1RB high	26,114	21,8109	4,3028	26,0749	21,2708	4,8041				
			50%RB mid	26,128	19,8047	6,3236	26,4861	19,8539	6,6322				
			100%RB	26,197	19,9056	6,2918	26,8748	19,0159	7,8589				

5.1.4.5. LTE Band 17 Results

LTE-Band 17				QPSK-Modulation			16-QAM-Modulation			max- modulatio	max. modulatio	max. channel	absolute max. value
channel bandwidth	ARFCN ch. no.	ARFCN-Frequency [MHz]	Resource block allocation	Peak detektor [dBm]	RMS detektor [dBm]	PAR Faktor [dB]	Peak detektor [dBm]	RMS detektor [dBm]	PAR Faktor [dB]				
5 MHz	23755	706,5	1RB low	27,726	22,0732	5,6527	26,8844	21,0836	5,801	22,307	21,297	22,31	22,42
			1RB high	27,713	22,3069	5,4064	26,9551	21,2971	5,658				
			50%RB mid	27,7	21,2113	6,4886	27,3303	21,2884	6,042				
			100%RB	27,532	21,1813	6,3504	27,4538	20,1825	7,271				
	23790	710	1RB low	27,582	22,2551	5,327	26,851	21,2344	5,617	22,255	21,234		
			1RB high	28,148	21,5688	6,5789	26,6385	20,5685	6,07				
			50%RB mid	27,5	21,0195	6,4803	27,7442	21,0449	6,699				
			100%RB	27,354	20,9976	6,356	27,219	19,9816	7,237				
	23825	713,5	1RB low	28,209	21,8198	6,389	26,7921	20,7959	5,996	21,873	20,955		
			1RB high	27,952	21,873	6,079	26,9238	20,9546	5,969				
			50%RB mid	27,571	20,5736	6,9974	27,8513	20,5686	7,283				
			100%RB	27,218	20,6491	6,5684	27,2954	19,6095	7,686				
10 MHz	23780	709	1RB low	27,144	22,1262	5,0178	27,5746	21,6843	5,89	22,126	21,684	22,42	
			1RB high	27,209	21,7171	5,4915	28,0042	21,3114	6,693				
			50%RB mid	27,427	21,1515	6,2759	27,1619	20,1873	6,975				
			100%RB	27,49	21,0113	6,479	27,9039	20,0023	7,902				
	23790	710	1RB low	27,196	22,3767	4,8189	27,4728	21,9071	5,566	22,377	21,907		
			1RB high	27,192	21,7265	5,4655	28,0059	21,3309	6,675				
			50%RB mid	27,413	21,0098	6,4036	27,304	20,0655	7,239				
			100%RB	27,501	21,0083	6,4922	27,9559	19,9594	7,997				
	23800	711	1RB low	27,146	22,4247	4,7217	27,4247	21,9594	5,465	22,425	21,959		
			1RB high	27,631	21,9158	5,7151	27,977	21,6641	6,313				
			50%RB mid	27,555	20,8767	6,6787	27,2518	19,881	7,371				
			100%RB	27,188	20,974	6,2138	27,8926	19,9097	7,983				

5.1.5. PAPR results

5.1.5.1. Test condition and test set-up

Climatic conditions	Temperature: (22±3°C)	Rel. humidity: (40±20)%
Test system set-up	Please see chapter "Test system set-up for conducted measurements on antenna port"	
Measurement method	The measurements were performed with the integrated power measurement function of the „radio communication tester CMW500 from Rohde&Schwarz company. The attenuation (insertion loss) at the RF Inputs/Outputs of CMW were set according the path loss of the test set-up, determined in a step before starting the measurements. A suitable artificial antenna or RF-connector is provided by the applicant in order to perform the conducted measurements. Any data provided with the artificial antenna or connector, have been taken in account in order to correct the measurement data. (typical 0.3dB for attenuation of antenna connector) The CCDF function of the measurement equipment as described in the operating manual was used (default settings). Futher details can be found in KDB 971168 D01 v02r02 chapter 5.7.1.	
Mobile phone settings	A call was established with a suitable communication test unit (CMW500). UE is set TX mode, highest transmit power conditions (RMC-mode), power saving techniques have been disabled (MPR-techniques) Tests have been performed in different EUT bandwidth settings and various settings for allocated RBs.	

5.1.5.2. PAPR-results

According KDB 5.7.1 two method are allowed.

☒ Chapter 5.7.2 for determining worst-case configuration (Signal bandwidth, modulation, RB allocation)
☒ Chapter 5.7.1 CCDF-Method (0.1% probability)

LTE Band 2		
	Max. PAPR Max. PAPR level with 0.1% probability / [dB]	
Signal-Bandwidth / [MHz]	QPSK Modulation	16-QAM Modulation
1.4	6.25	6.36
3.0	5.02	5.83
5.0	4.94	5.83
10	4.81	6.12
15	4.97	6.31
20	4.76	6.55

Remark: pls. see annex 1 for graphical plots

LTE Band 4		
	Max. PAPR level with 0.1% probability / [dB]	
Signal-Bandwidth / [MHz]	QPSK Modulation	16-QAM Modulation
1.4	5.26	5.83
3.0	5.16	5.95
5.0	5.00	6.03
10	5.26	5.26
15	5.38	5.43
20	4.71	7.23

Remark: pls. see annex 1 for graphical plots

LTE Band 5		
	Max. PAPR level with 0.1% probability / [dB]	
Signal-Bandwidth / [MHz]	QPSK Modulation	16-QAM Modulation
1.4	4.63	4.70
3.0	4.97	5.46
5.0	4.31	5.05
10	4.82	6.01

Remark: pls. see annex 1 for graphical plots

LTE Band 7		
	Max. PAPR level with 0.1% probability / [dB]	
Signal-Bandwidth / [MHz]	QPSK Modulation	16-QAM Modulation
5.0	4.41	5.02
10	4.19	4.90
15	4.25	5.05
20	4.90	4.90

Remark: pls. see annex 1 for graphical plots

LTE Band 17		
	Max. PAPR level with 0.1% probability / [dB]	
Signal-Bandwidth / [MHz]	QPSK Modulation	16-QAM Modulation
5.0	5.10	5.37
10	4.78	5.64

Remark: pls. see annex 1 for graphical plots

5.1.5.3. Conclusion

☒ Peak conducted output power - pass
☒ PAPR <13dB - pass

5.2. General Limit - Radiated field strength emissions below 30 MHz

5.2.1. Test location and equipment

test location	☒ CETECOM Essen (Chapter. 2.2.1)		☐ Please see Chapter. 2.2.2		☐ Please see Chapter. 2.2.3	
test site	☒ 441 EMI SAR	☐ 487 SAR NSA	☐ 347 Radio.lab.		☐	☐
receiver	☐ 377 ESCS30	☒ 001 ESS	☐	☐	☐	☐
spectr. analys.	☐ 584 FSU	☐ 120 FSEM	☐ 264 FSEK	☐	☐	☐
antenna	☐ 574 BTA-L	☐ 133 EMCO3115	☐ 302 BBHA9170	☐ 289 CBL 6141	☒ 030 HFH-Z2	☐ 477 GPS
signaling	☐ 392 MT8820A	☐ 371 CBT32	☐ 547 CMU	☐ 594 CMW		
otherwise	☐ 400 FTC40x15E	☐ 401 FTC40x15E	☐ 110 USB LWL	☐ 482 Filter Matrix	☐ 378 RadiSense	
DC power	☐ 456 EA 3013A	☐ 457 EA 3013A	☐ 459 EA 2032-50	☐ 268 EA- 3050	☐ 494 AG6632A	☐ 498 NGPE 40
line voltage	☐ 230 V 50 Hz via public mains		☒ 24V DC			

5.2.2. Requirements

FCC	Part 15, Subpart C, §15.205 & §15.209			
IC	RSS-Gen: Issue 4: §8.9 Table 5			
ANSI	C63.10-2013			
Frequency [MHz]	Field strength limit [µV/m]	[dBµV/m]	Distance [m]	Remarks
0.009 – 0.490	2400/f (kHz)	67.6 – 20Log(f) (kHz)	300	Correction factor used due to measurement distance of 3 m
0.490 – 1.705	24000/f (kHz)	87.6 – 20Log(f) (kHz)	30	Correction factor used due to measurement distance of 3 m
1.705 – 30	30	29.5	30	Correction factor used due to measurement distance of 3 m

5.2.3. Test condition and test set-up

Signal link to test system (if used):		☒ air link	☐ cable connection	☐ none
EUT-grounding		☒ none	☐ with power supply	☐ additional connection
Equipment set up		☒ table top		☐ floor standing
Climatic conditions		Temperature: (22±3°C)		Rel. humidity: (40±20)%
EMI-Receiver or Analyzer Settings	Scan data	☒ 9 – 150 kHz RBW/VBW = 200 Hz Scan step = 80 Hz ☒ 150 kHz – 30 MHz RBW/VBW = 9 kHz Scan step = 4 kHz ☐ other:		
	Scan-Mode Detector Mode: Sweep-Time	☒ 6 dB EMI-Receiver Mode ☐ 3dB Spectrum analyser Mode Peak (pre-measurement) and Quasi-PK/Average (final if applicable) Repetitive-Scan, max-hold Coupled – calibrated display if continuous signal otherwise adapted to EUT's individual transmission duty-cycle		
General measurement procedures		Please see chapter "Test system set-up radiated magnetic field measurements below 30 MHz"		

5.2.4. Measurement Results

The results are presented below in summary form only. For more information please consult the diagrams included in annex 1.

Table of measurement results:

Diagram No.	Carrier Channel		Frequency range	Set-up no.	OP-mode no.	Remark	Used detector			Result
	Range	No.					PK	AV	QP	
2.01	1 RB low	18607	9 kHz-30 MHz	1	1	Remark1	☒	☐	☐	passed
2.02	1RB high	18900	9 kHz-30 MHz	1	1	Remark1	☒	☐	☐	passed
2.03	1 RB high	19150	9 kHz-30 MHz	1	1	Remark1	☒	☐	☐	passed
2.11	1RB High	19965	9 kHz-30 MHz	1	2	Remark1	☒	☐	☐	passed
2.12	1RB high	20175	9 kHz-30 MHz	1	2	Remark1	☒	☐	☐	passed
2.13	1RB low	20300	9 kHz-30 MHz	1	2	Remark1	☒	☐	☐	passed
2.21	1 RB high	20425	9 kHz-30 MHz	1	3	Remark1	☒	☐	☐	passed
2.22	1 RB low	20525	9 kHz-30 MHz	1	3	Remark1	☒	☐	☐	passed
2.23	1 RB high	20643	9 kHz-30 MHz	1	3	Remark1	☒	☐	☐	passed
2.31	1 RB high	23755	9 kHz-30 MHz	1	4	Remark1	☒	☐	☐	passed
2.32	1 RB low	23790	9 kHz-30 MHz	1	4	Remark1	☒	☐	☐	passed
2.33	1 RB high	23800	9 kHz-30 MHz	1	4	Remark1	☒	☐	☐	passed
2.41	1 RB high	20850	9 kHz-30 MHz	1	5	Remark1	☒	☐	☐	passed
2.42	1 RB low	21100	9 kHz-30 MHz	1	5	Remark1	☒	☐	☐	passed
2.43	1 RB low	21425	9 kHz-30 MHz	1	5	Remark1	☒	☐	☐	passed

Remark 1: For further information see Annex A1

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

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

Frequency -Range	f [kHz/MHz]	Lambda [m]	Far-Field Point [m]	Distance Limit accord. 15.209 [m]	1st Condition (dmeas< $D_{near-field}$)	2'te Condition (Limit distance bigger $d_{near-field}$)	Distance Correction accord. Formula
kHz	9,00E+03	33333,33	5305,17	300	fullfilled	not fullfilled	-80,00
	1,00E+04	30000,00	4774,65		fullfilled	not fullfilled	-80,00
	2,00E+04	15000,00	2387,33		fullfilled	not fullfilled	-80,00
	3,00E+04	10000,00	1591,55		fullfilled	not fullfilled	-80,00
	4,00E+04	7500,00	1193,66		fullfilled	not fullfilled	-80,00
	5,00E+04	6000,00	954,93		fullfilled	not fullfilled	-80,00
	6,00E+04	5000,00	795,78		fullfilled	not fullfilled	-80,00
	7,00E+04	4285,71	682,09		fullfilled	not fullfilled	-80,00
	8,00E+04	3750,00	596,83		fullfilled	not fullfilled	-80,00
	9,00E+04	3333,33	530,52		fullfilled	not fullfilled	-80,00
	1,00E+05	3000,00	477,47		fullfilled	not fullfilled	-80,00
	1,25E+05	2400,00	381,97		fullfilled	not fullfilled	-80,00
	2,00E+05	1500,00	238,73		fullfilled	fullfilled	-78,02
	3,00E+05	1000,00	159,16		fullfilled	fullfilled	-74,49
	4,00E+05	750,00	119,37		fullfilled	fullfilled	-72,00
	4,90E+05	612,24	97,44		fullfilled	fullfilled	-70,23
	5,00E+05	600,00	95,49	30	fullfilled	not fullfilled	-40,00
	6,00E+05	500,00	79,58		fullfilled	not fullfilled	-40,00
	7,00E+05	428,57	68,21		fullfilled	not fullfilled	-40,00
	8,00E+05	375,00	59,68		fullfilled	not fullfilled	-40,00
	9,00E+05	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

5.3. RF-Parameter - Radiated out of Band RF emissions and Band Edge

5.3.1. Test location and equipments (for reference numbers please see chapter 'List of test equipment')

test location	☒ CETECOM Essen (Chapter. 2.2.1)		☐ Please see Chapter. 2.2.2		☐ Please see Chapter. 2.2.3	
test site	☐ 441 EMI SAR	☐ 487 SAR NSA	☒ 443 FAR	☐ 347 Radio.lab.1	☐ 347 Radio.lab.2	
receiver	☐ 377 ESCS30	☐ 001 ESS	☐ 489 ESU 40	☐ ESU 26		
spectr. analys.	☐ 584 FSU	☐ 120 FSEM	☒ 264 FSEK			
antenna	☒ 608 HL 562	☒ 549 HL 025	☐ 302 BBHA9170	☐ 289 CBL 6141	☐ 030 HFH-Z2	☐ 477 GPS
signaling	☐ 017 CMD 65	☐ 323 CMD 55	☐ 340 CMD 55			
signaling	☐ 392 MT8820A	☐ 546 CMU	☐ 547 CMU	☒ 642 CMW500		
power supply	☒ 611 E3632A	☐ 457 EA 3013A	☐ 459 EA 2032-50	☐ 268 EA- 3050	☐ 494 AG6632A	☐ 498 NGPE 40
otherwise	☐ 529 6dB divider	☐ 530 6dB Att.	☐ 110 USB LWL	☐ 482 Filter Matrix	☐ 431 Near field	
line voltage	☐ 230 V 50 Hz via public mains		☒ 24V DC			

5.3.2. Requirements and limits

FCC	General: §2.1053(a) , §2.1057(a) ☒ LTE Band 5: Part 22: §22.917(a)(b) ☒ LTE Band 2: Part 24: §24.238(a)(b) ☒ LTE Band 4: Part 27: §27.53(h) ☒ LTE Band 12: Part 27: §27.53(g)☐ LTE Band 13: Part 27: §27.53(c) , §27.53(f) ☒ LTE Band 17: Part 27: §27.53(g)
IC	☒ FDD Band 5: RSS-132, Issue 3: 5.5(i)(ii) ☒ FDD Band 2: RSS-133, Issue 6: 6.5.1(i)(ii) ☒ FDD Band 4: RSS-139, Issue 3: 6.6 (i)(ii) ☒ FDD Band 12: RSS-130, Issue 1: 4.6.1 ☐ FDD Band 13: RSS-130, Issue 1: 4.6.2(a)(i)(ii) + 4.6.2(b)☒ FDD Band 17: RSS-130, Issue 1: 4.6.1
Limit	„the power of emissions shall be attenuated below the transmitter output power (p) by at least 43+10Log(P) dB“ -> Resulting limits for all power levels of the Mobile Phone: -13dBm

5.3.3. Test condition and test set-up

link to test system (if used):		☒ air link	☐ cable connection	☐
EUT-grounding		☒ none	☐ with power supply	☐ additional connection
Equipment set up		☒ table top		☐ floor standing
Climatic conditions		Temperature: (22±3°C)		Rel. humidity: (40±20)%
Test system set-up		Please see chapter “Test system set-up for radiated spurious emission measurements up to 20 GHz”		
Spectrum Analyzer Settings	**Parameter:** Scan Mode RBW VBW Sweep time Sweep mode Detector	Spectrum analyser mode 1 MHz 10 MHz Coupled (Auto) repetitive Peak		
Measurement method		The spectrum was scanned from 9 kHz to the 10th harmonic of the highest frequency generated within the equipment. A PEAK detector was used except measurements near the Band-Edge where a AVERAGE detector applied when results are critical (low margin or limit exceed). Tests have been performed in various settings for the device regarding allocated ressource blocks and channels in order to find worst-case configuration. Due to very big amount of possible combinations only certain combinations have been tested.		
Mobile phone settings		A call was established on highest power transmit conditions in RMC mode. MPR was deactivated. The measurements were made at the low, middle and high carrier frequencies of each of the supported operating band within the designated range within the allowed channel bandwidths. Choosing three TX-carrier frequencies of the mobile phone, should be sufficient to demonstrate compliance.		

Spectrum-Analyzer settings for LTE band 2

	Start freq. MHz	Stop freq. MHz	R-BW MHz	V-BW MHz	Sweep time sec.	Att. [dB]	Detector
Sweep 1 (subrange 1)	30	1000	1	10	10	10	MaxH-PK
Sweep 1 (subrange 2)	1000	2800	1	10	15	0	MaxH-PK
Sweep 1 (subrange 3)	2800	20000	1	10	60	10	MaxH-PK
Sweep 2a (Band-Edge)	1849	1850	0.03	0.3	30	35	MaxH-PK
Sweep 2b (Band-Edge)	1849	1850	0.03	0.3	30	35	MaxH-AV
Sweep 3a (Band-Edge)	1910	1911	0.03	0.3	30	35	MaxH-PK
Sweep 3b (Band-Edge)	1910	1911	0.03	0.3	30	35	MaxH-AV

Spectrum-analyzer settings for FDD Band 4

	Start freq. MHz	Stop freq. MHz	R-BW MHz	V-BW MHz	Sweep time sec.	Att.	Detector
Sweep 1 (subrange 1)	30	1000	1	10	10	10	MaxH-PK
Sweep 1 (subrange 2)	1000	2800	1	10	15	0	MaxH-PK
Sweep 1 (subrange 3)	2800	18000	1	10	160	10	MaxH-PK
Sweep 2a (Band-Edge)	1709	1710	0.03	0.3	30	35	MaxH-PK
Sweep 2b (Band-Edge)	1709	1710	0.03	0.3	30	35	MaxH-AV
Sweep 3a (Band-Edge)	1755	1756	0.03	0.3	30	35	MaxH-PK
Sweep 3b (Band-Edge)	1755	1756	0.03	0.3	30	35	MaxH-AV

Spectrum-analyzer settings for LTE Band 5

	Start freq. MHz	Stop freq. MHz	R-BW MHz	V-BW MHz	Sweep time sec.	Att.	Detector
Sweep 1 (subrange 1)	30	1000	1	10	10	10	MaxH-PK
Sweep 1 (subrange 2)	1000	2800	1	10	15	0	MaxH-PK
Sweep 1 (subrange 3)	2800	9000	1	10	160	10	MaxH-PK
Sweep 2a (Band-Edge)	823	824	0.02	0.2	30	35	MaxH-PK
Sweep 2b (Band-Edge)	823	824	0.02	0.2	30	35	MaxH-AV
Sweep 3a (Band-Edge)	850	851	0.02	0.2	30	35	MaxH-PK
Sweep 3b (Band-Edge)	850	851	0.02	0.2	30	35	MaxH-AV

Spectrum-analyzer settings for LTE Band 17

	Start freq. MHz	Stop freq. MHz	R-BW kHz	V-BW kHz	Sweep time sec.	Att.	Detector
Sweep 1 (subrange 1)	30	1000	100	300	10	10	MaxH-PK
Sweep 1 (subrange 2)	1000	2800	100	300	15	0	MaxH-PK
Sweep 1 (subrange 3)	2800	9000	100	300	160	10	MaxH-PK
Sweep 2a (Band-Edge)	703	704	50	300	30	35	MaxH-PK, Signal-BW=5MHz
Sweep 2b (Band-Edge)	703	704	100	300	30	35	MaxH-PK, Signal-BW=10MHz
Sweep 3a (Band-Edge)	716	717	500	300	30	35	MaxH-PK, Signal-BW=5MHz
Sweep 3b (Band-Edge)	716	717	100	300	30	35	MaxH-PK, Signal-BW=10MHz

5.3.4. Results

The results are presented below in summary form only. For more information please see the diagrams enclosed in annex 1.

5.3.4.1. LTE Band 2: Op. Mode 1, Set-up 1

Diagram no.	Carrier Channel		Frequency range	OP-mode no.	Remark	Used detector			Result
	Range	No.				PK	AV	QP	
8.01_RSE_R_Ch18607_BW_1,4	1RB low	18607	30 MHz to 20 GHz	1	Carrier visible on diagram. Not relevant for results External antenna used QPSK modulation	☒	☐	☐	passed
8.02_RSE_R_Ch18900_BW_10	1RB high	18900	30 MHz to 20 GHz	1	Carrier visible on diagram. Not relevant for results Internal antenna used 16-QAM modulation	☒	☐	☐	passed
8.03_RSE_R_Ch19150_BW_10	1RB high	19175	30 MHz to 20 GHz	1	Carrier visible on diagram. Not relevant for results External antenna used QPSK modulation	☒	☐	☐	passed

Remark: Used channel bandwidth of 1.4MHZ (low channel) and 10MHz (mid and high channel) was chosen as worst-case as determined within power measurements

5.3.4.1.1. Band-Edge Low: 1849-1850 MHz

Diagram No.	Channel no.	Op.Mode	Number of RBs	Modulation scheme	Detector		Verdict
					PK	RMS	
9.01	18607	1	☒ 1RB low	☒ QPSK modulation	☒	☐	passed
9.06	18650	1	☒ full: 50	☒ QPSK modulation	☒	☐	passed
9.02	18607	1	☒ 1RB low	☒ 16-QAM modulation	☒	☐	passed
9.05	18650	1	☒ full: 50	☒ 16-QAM modulation	☒	☐	passed

Remark: Used channel bandwidth of 1.4MHZ and 10MHz was chosen as worst-case as determined within power measurements

5.3.4.1.2. Band-Edge High: 1910-1911MHz

Diagram No.	Channel no.	Op.Mode	Number of RBs	Modulation scheme	Detector		Verdict
					PK	RMS	
9.04	19193	1	☒ 1RB high	☒ QPSK modulation	☒	☐	passed
9.03	19193	1	☒ 1RB high	☒ QAM modulation	☒	☐	passed
9.07	19150	1	☒ full: 50	☒ QAM modulation	☒	☐	passed
9.08	19150	1	☒ full: 50	☒ QPSK modulation	☒	☐	Passed

Remark: Used channel bandwidth of 1.4MHZ and 10MHz was chosen as worst-case as determined within power measurements

5.3.4.2. LTE Band 4: Op. Mode 2, Set-up 2

Dia-gram no.	Carrier Channel		Frequency range	OP-mode no.	Remark	Used detector			Result
	Range	No.				PK	AV	QP	
8.11_RSE_R_Ch19965_BW_3	Low	19965	30 MHz to 18 GHz		Carrier visible on diagram. Not relevant for results Laying EUT position External antenna used	☒	☐	☐	passed
8.12_RSE_R_Ch20175_BW_10	Mid	20175	30 MHz to 18 GHz		Carrier visible on diagram. Not relevant for results Standing EUT position External antenna used	☒	☐	☐	passed
8.13_RSE_R_Ch20300_BW_20	High	20300	30 MHz to 18 GHz		Carrier visible on diagram. Not relevant for results Laying EUT position Internal antenna used	☒	☐	☐	passed

Remark1: LTE EUT channel bandwidth of 3MHz (Low Channel), 10Mhz (Mid channel) and 20MHz (High channel) was chosen as worst-case as determined within power measurements

5.3.4.2.1. Band-Edge Low: 1709-1710 MHz

Diagram No.	Channel no.	Op.Mode	Number of RBs	Modulation scheme	Detector		Verdict
					PK	RMS	
9.10	19965	2	☒ 1RB low	☒ QPSK modulation	☒	☐	passed
9.11	19965	2	☒ 1RB low	☒ 16-QAM modulation	☒	☐	passed
9.12	19965	2	☒ full: 15	☒ QPSK modulation	☒	☐	passed
9.13	19965	2	☒ full: 15	☒ 16-QAM modulation	☒	☐	passed

Remark:

1.) LTE EUT channel bandwidth of 3MHz used for measurements as worst-case as determined within power measurements

5.3.4.2.2. Band-Edge High: 1755-1756MHz

Diagram No.	Channel no.	Op.Mode	Number of RBs	Modulation scheme	Detector		Verdict
					PK	RMS	
9.14	20300	2	☒ 1RB high	☒ QPSK modulation	☒	☐	passed
9.15	20300	2	☒ 1RB high	☒ 16-QAM modulation	☒	☐	passed
9.16	20300	2	☒ full: 100	☒ QPSK modulation	☒	☐	passed
9.17	20300	2	☒ full: 100	☒ 16-QAM modulation	☒	☐	Passed

Remark: LTE EUT channel bandwidth of 20MHz used for measurements as worst-case as determined within power measurements

5.3.4.3. LTE Band 5: Op. Mode 3, Set-up 2

Diagram no.	Carrier Channel		Frequency range	OP-mode no.	Remark	Used detector			Result
	Range	No.				PK	AV	QP	
8.21_RSE_R_Ch20425_BW_5	Low	20425	30 MHz to 9 GHz	3	Carrier visible on diagram. Not relevant for results QPSK modulation External antenna used	☒	☐	☐	passed
8.22_RSE_R_Ch20525_BW_10	Mid	20525	30 MHz to 9 GHz	3	Carrier visible on diagram. Not relevant for results QPSK modulation External antenna used	☒	☐	☐	passed
8.23_RSE_R_Ch20643_BW_5	High	20643	30 MHz to 9 GHz	3	Carrier visible on diagram. Not relevant for results QPSK modulation Internal antenna used	☒	☐	☐	passed

Remark: LTE EUT channel bandwidth of 5MHz (Low Channel), 10Mhz (Mid channel) and 5MHz (High channel) was chosen as worst-case as determined within power measurements

5.3.4.3.1. Band-Edge Low: 823-824MHz

Diagram No.	Channel no.	Op.Mode	Number of RBs	Modulation scheme	Detector		Verdict
					PK	RMS	
9.21	20425	3	☒ 1RB low	☒ QPSK modulation	☒	☐	passed
9.22	20425	3	☒ 1RB low	☒ 16-QAM modulation	☒	☐	passed
9.23	20425	3	☒ full: 25	☒ QPSK modulation	☒	☐	passed
9.24	20425	3	☒ full: 25	☒ 16-QAM modulation	☒	☐	passed

Remark: LTE EUT channel bandwidth of 5MHz used for measurements as worst-case as determined within power measurements

5.3.4.3.2. Band-Edge High: 849-850MHz

Diagram No.	Channel no.	Op.Mode	Number of RBs	Modulation scheme	Detector		Verdict
					PK	RMS	
9.25	20625	3	☒ 1RB high	☒ QPSK modulation	☒	☐	passed
9.26	20625	3	☒ 1RB high	☒ 16-QAM modulation	☒	☐	passed
9.27	20625	3	☒ 25RB	☒ QPSK modulation	☒	☐	Passed
9.28	20625	3	☒ 25RB	☒ 16-QAM modulation	☒	☐	Passed

Remark:
1.) LTE EUT channel bandwidth of 5MHz used for measurements as worst-case as determined within power measurements

5.3.4.4. LTE Band 7: Op. Mode 4 Set-up 1

Radiated spurious emission measurements:

Diagram no.	Carrier Channel		Frequency range	OP-mode no.	Remark	Used detector			Result
	Range	No.				PK	AV	QP	
8.31_RSE_R_Ch20850_BW_20	Low	20850	30 MHz to 9 GHz	4	Carrier visible on diagram. Not relevant for results External antenna used QPSK Modulation Laying position	☒	☐	☐	passed
8.32_RSE_R_Ch21100_BW_15	Mid	21100	30 MHz to 9GHz	4	Carrier visible on diagram. Not relevant for results External antenna used QPSK Modulation Standing position	☒	☐	☐	passed
8.33_RSE_R_Ch21425_BW_5	High	21425	30 MHz to 9 GHz	4	Carrier visible on diagram. Not relevant for results Internal antenna used QPSK Modulation Laying position	☒	☐	☐	passed

Remark: LTE EUT channel bandwidth of 20MHz (Low Channel), 15Mhz (Mid channel) and 5MHz (High channel) was chosen as worst-case as determined within power measurements

Band-Edge Low: 2471-2496MHz

Diagram No.	Channel no.	Op.Mode	Number of RBs	Modulation scheme	Detector		Verdict
					PK	RMS	
9.30	20850	4	☒ 1RB low	☒ QPSK modulation	☐	☒	passed
9.31	20850	4	☒ 1RB low	☒ 16-QAM modulation	☐	☒	passed
9.32	20850	4	☒ full: 100	☒ QPSK modulation	☐	☒	passed
9.33	20850	4	☒ full: 100	☒ 16-QAM modulation	☐	☒	passed

Remark:
1.) LTE EUT channel bandwidth of 20MHz used for measurements as worst-case as determined within power measurements

Band-Edge High: 2572-2587MHz

Diagram No.	Channel no.	Op.Mode	Number of RBs	Modulation scheme	Detector		Verdict
					PK	RMS	
9.34	21425	4	☒ 1RB high	☒ QPSK modulation	☐	☒	passed
9.35	21425	4	☒ 1RB low	☒ 16-QAM modulation	☐	☒	passed
9.36	21425	4	☒ full: 25	☒ QPSK modulation	☐	☒	passed
9.37	21425	4	☒ full: 25	☒ 16-QAM modulation	☐	☒	passed

Remark:
1.) LTE EUT channel bandwidth of 5MHz used for measurements as worst-case as determined within power measurements

5.3.4.5. LTE Band 17: Op. Mode 5 Set-up 1

Radiated spurious emission measurements:

Diagram no.	Carrier Channel		Frequency range	OP-mode no.	Remark	Used detector			Result
	Range	No.				PK	AV	QP	
8.41_RSE_R_Ch23755_BW_5	Low	23755	30 MHz to 9 GHz	5	Carrier visible on diagram. Not relevant for results External antenna used QPSK Modulation Laying position	☒	☐	☐	passed
8.42_RSE_R_Ch23790_BW_10	Mid	23790	30 MHz to 9GHz	5	Carrier visible on diagram. Not relevant for results External antenna used QPSK Modulation Standing position	☒	☐	☐	passed
8.43_RSE_R_Ch23800_BW_10	High	23800	30 MHz to 9 GHz	5	Carrier visible on diagram. Not relevant for results Internal antenna used QPSK Modulation Laying position	☒	☐	☐	passed

Remark: LTE EUT channel bandwidth of 5MHz (Low Channel), 10Mhz (Mid channel) and 10MHz (High channel) was chosen as worst-case as determined within power measurements

Band-Edge Low: 703-704MHz

Diagram No.	Channel no.	Op.Mode	Number of RBs	Modulation scheme	Detector		Verdict
					PK	RMS	
9.40	23755	5	☒ 1RB low	☒ QPSK modulation	☐	☒	passed
9.41	23755	5	☒ 1RB low	☒ 16-QAM modulation	☐	☒	passed
9.42	23755	5	☒ full: 25	☒ QPSK modulation	☐	☒	passed
9.43	23755	5	☒ full: 25	☒ 16-QAM modulation	☐	☒	passed

Remark:
1.) LTE EUT channel bandwidth of 5MHz used for measurements as worst-case as determined within power measurements

Band-Edge High: 716-717MHz

Diagram No.	Channel no.	Op.Mode	Number of RBs	Modulation scheme	Detector		Verdict
					PK	RMS	
9.44	23800	5	☒ 1RB high	☒ QPSK modulation	☐	☒	passed
9.45	23800	5	☒ 1RB low	☒ 16-QAM modulation	☐	☒	passed
9.46	23800	5	☒ full: 50	☒ QPSK modulation	☐	☒	passed
9.47	23800	5	☒ full: 50	☒ 16-QAM modulation	☐	☒	passed

Remark:
1.) LTE EUT channel bandwidth of 10MHz used for measurements as worst-case as determined within power measurements

5.4. Measurement uncertainties

The reported uncertainties are calculated based on the standard uncertainty multiplied with the appropriate coverage factor **k**, such that a confidence level of approximately 95% is achieved.
For uncertainty determination, each component used in the concrete measurement set-up was taken in account and it's contribution to the overall uncertainty according it's statistical distribution calculated.

Following table shows expectable uncertainties for each measurement type performed.

RF-Measurement	Reference	Frequency range	Calculated uncertainty based on a confidence level of 95%						Remarks
Conducted emissions (U_{CISPR})	CISPR 16-2-1	9 kHz - 150 kHz 150 kHz - 30 MHz	4.0 dB 3.6 dB						-
Radiated emissions Enclosure	CISPR 16-2-3	30 MHz - 1 GHz 1 GHz - 18 GHz	4.2 dB 5.1 dB						E-Field
Disturbance power	CISPR 16-2-2	30 MHz - 300 MHz	-						-
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 - 26.5GHz	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 - 12.75GHz	1.48	N/A	1.51	N/A	1.43	--	
		12.75 GHz - 18GHz	1.81	N/A	1.83	N/A	1.77	--	
		18 GHz - 26.5GHz	1.83	N/A	1.85	N/A	1.79	--	
Power density	-	1 – 2.8GHz	1.40 dB						--
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 30 MHz - 1 GHz 1 GHz - 20 GHz	5.0 dB 4.2 dB 3.17 dB						Magnetic field E-field Substitution

Table: measurement uncertainties, valid for conducted/radiated measurements

6. Abbreviations used in this report

The abbreviations	
ANSI	American National Standards Institute
AV , AVG, CAV	Average detector
EIRP	Equivalent isotropically radiated power, determined within a separate measurement
EGPRS	Enhanced General Packet Radio Service
EUT	Equipment Under Test
FCC	Federal Communications Commission, USA
IC	Industry Canada
n.a.	not applicable
Op-Mode	Operating mode of the equipment
PK	Peak
RBW	resolution bandwidth
RF	Radio frequency
RSS	Radio Standards Specification, Dokuments from Industry Canada
Rx	Receiver
TCH	Traffic channel
Tx	Transmitter
QP	Quasi peak detector
VBW	Video bandwidth
ERP	Effective radiated power

7. Accreditation details of CETECOM's laboratories and test sites

Ref.-No.	Accreditation Certificate	Valid for laboratory area or test site	Accreditation Body
-	D-PL-12047-01-01	All laboratories and test sites of CETECOM GmbH, Essen	DAkkS, Deutsche Akkreditierungsstelle GmbH
337 487 558 348 348	(MRA US-EU 0003)	Radiated Measurements 30 MHz to 1 GHz, 3 m / 10 m (OATS) Radiated Measurements 30 MHz to 1 GHz, 3 m (SAR) Radiated Measurements above 1 GHz, 3 m (FAR) Mains Ports Conducted Interference Measurements Telecommunication Ports Conducted Interference Measurem.	FCC, Federal Communications Commission Laboratory Division, USA
337 487 550 558	3462D-1 3462D-2 3462D-2 3462D-3	Radiated Measurements 30 MHz to 1 GHz, 3 m / 10 m (OATS) Radiated Measurements 30 MHz to 1 GHz, 3 m (SAR) Radiated Measurements 1 GHz to 6 GHz, 3 m (SAR) Radiated Measurements above 1 GHz, 3 m (FAR)	IC, Industry Canada Certification and Engineering Bureau
487 550 348 348	R- 4452 G- 20013 C- 20009 T- 20006	Radiated Measurements 30 MHz to 1 GHz, 3 m (SAR) Radiated Measurements 1 GHz to 6 GHz, 3 m (SAR) Mains Ports Conducted Interference Measurements Telecommunication Ports Conducted Interference Measurem.	VCCI, Voluntary Control Council for Interference by Information Technology Equipment, Japan
OATS = Open Area Test Site, SAR = Semi Anechoic Room, FAR = Fully Anechoic Room			

8. Instruments and Ancillary

The “Ref.-No” in the left column of the following tables allows the clear identification of the laboratory equipment.

8.0.1. Test software and firmware of equipment

Ref.-No.	Equipment	Type	Serial-No.	Version of Firmware or Software during the test
001	EMI Test Receiver	ESS	825132/017	Firm.= 1.21 , OTP=2.0, GRA=2.0
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
053	Audio Analyzer	UPA3	860612/022	Firm. V 4.3
119	RT Harmonics Analyzer dig. Flickermeter	B10	G60547	Firm.= V 3.1DHG
140	Signal Generator	SMHU	831314/006	Firm.= 3.21
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
263	Signal Generator	SMP 04	826190/0007	Firm.=3.21
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
335	CTC-EMS-Conducted	System EMS Conducted	-	EMC 32 V 8.52
340	Digital Radiocommunication Tester	CMD 55	849709/037	Firm.= 3.52 .22.01.99
355	Power Meter	URV 5	891310/027	Firm.= 1.31
365	10V Insertion Unit 50 Ohm	URV5-Z2	100880	Eprom Data = 31.03.08
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= 4.52#002
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 8.52
442	CTC-SAR-EMS	System EMS field (SAR)	-	EMC 32 Version 8.40
443	CTC-FAR-EMI-RSE	System CTC-FAR-EMI-RSE	-	Spuri 7.2.5 or EMC 32 Ver. 9.15.00
444	CTC-FAR-EMS field	System-EMS-Field (FAR)	-	EMC 32 Version 9.15.00
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
491	ESD Simulator dito	ESD dito	dito307022	V 2.30
524	Voltage Drop Simulator	VDS 200	0196-16	Software Nr: 000037 Version V4.20a01
526	Burst Generator	EFT 200 A	0496-06	Software Nr. 000034 Version V2.32
527	Micro Pulse Generator	MPG 200 B	0496-05	Software-Nr. 000030 Version V2.43
528	Load Dump Simulator	LD 200B	0496-06	Software-Nr. 000031 Version V2.35a01
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
584	Spectrum Analyzer	FSU 8	100248	2.82_SP3
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
598	Spectrum Analyzer	FSEM 30 (Reserve)	831259/013	Firmware Bios 3.40 , Analyzer 3.40 Sp 2
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)

8.0.2. Single instruments and test systems

Ref.-No.	Equipment	Type	Serial-No.	Manufacturer	Interval of calibration	Remark	Cal due
001	EMI Test Receiver	ESS	825132/017	Rohde & Schwarz	12 M	-	16.05.2018
005	AC - LISN (50 Ohm/50µH, test site 1)	ESH2-Z5	861741/005	Rohde & Schwarz	12 M	-	15.05.2018
007	Single-Line V-Network (50 Ohm/5µH)	ESH3-Z6	892563/002	Rohde & Schwarz	12 M	-	17.05.2018
009	Power Meter (EMS-radiated)	NRV	863056/017	Rohde & Schwarz	24 M	-	15.05.2019
016	Line Impedance Simulating Network	Op. 24-D	B6366	Spitzenberger+Spies	36 M	-	30.05.2019
021	Loop Antenna (H-Field)	6502	9206-2770	EMCO	36 M	-	30.04.2018
030	Loop Antenna (H-field)	HFH-Z2	879604/026	Rohde & Schwarz	36 M	-	30.04.2018
033	RF-current probe (100kHz-30MHz)	ESH2-Z1	879581/18	Rohde & Schwarz	24 M	-	15.05.2019
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	
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	-	30.04.2018
100	passive voltage probe	Probe TK 9416	without	Schwarzbeck	36 M	-	30.04.2018
110	USB-LWL-Converter	OLS-1	-	Ing. Büro Scheiba	-	4	
119	RT Harmonics Analyzer dig. Flickermeter	B10	G60547	BOCONSULT	36 M	-	30.05.2019
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
136	adjustable dipole antenna (Dipole 1)	3121C-DB4	9105-0697	EMCO	36 M	-	30.04.2018
140	Signal Generator	SMHU	831314/006	Rohde & Schwarz	24 M	-	30.05.2018
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	-	30.05.2018
262	Power Meter	NRV-S	825770/0010	Rohde & Schwarz	24 M	-	30.05.2018
263	Signal Generator	SMP 04	826190/0007	Rohde & Schwarz	36 M	-	30.05.2019
265	peak power sensor	NRV-Z33, Model 04	840414/009	Rohde & Schwarz	24 M	-	30.05.2018
266	Peak Power Sensor	NRV-Z31, Model 04	843383/016	Rohde & Schwarz	24 M	-	30.05.2018
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	
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	-	17.05.2018
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	-	30.10.2018
341	Digital Multimeter	Fluke 112	81650455	Fluke	24 M	-	30.05.2018
342	Digital Multimeter	Voltcraft M-4660A	IB 255466	Voltcraft	24 M	-	17.05.2019
347	laboratory site	radio lab.	-	-	-	5	
348	laboratory site	EMI conducted	-	-	-	5	
354	DC - Power Supply 40A	NGPE 40/40	448	Rohde & Schwarz	pre-m	2	
355	Power Meter	URV 5	891310/027	Rohde & Schwarz	24 M	-	30.05.2018
357	power sensor	NRV-Z1	861761/002	Rohde & Schwarz	24 M	-	24.05.2019
371	Bluetooth Tester	CBT32	100153	R&S	36 M	-	30.05.2019
373	Single-Line V-Network (50 Ohm/5µH)	ESH3-Z6	100535	Rohde & Schwarz	12 M	-	17.05.2018
377	EMI Test Receiver	ESCS 30	100160	Rohde & Schwarz	12 M	-	15.05.2018
392	Radio Communication Tester	MT8820A	6K00000788	Anritsu	12 M	-	18.05.2018
405	Thermo-/Hygrometer	OPUS 10 THI	126.0604.0003.3.3.3.22	LUFFT Mess u. Regeltechnik	24 M	-	30.03.2019
431	Model 7405	Near-Field Probe Set	9305-2457	EMCO	-	4	
436	Univ. Radio Communication Tester	CMU 200	103083	Rohde & Schwarz	12 M	-	24.05.2018
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	30.09.2017
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	
463	Universal source	HP3245A	2831A03472	Agilent	-	4	
466	Digital Multimeter	Fluke 112	89210157	Fluke USA	24 M	-	30.05.2018

Ref.-No.	Equipment	Type	Serial-No.	Manufacturer	Interval of calibration	Remark	Cal due
467	Digital Multimeter	Fluke 112	89680306	Fluke USA	36 M	-	30.04.2018
468	Digital Multimeter	Fluke 112	90090455	Fluke USA	36 M	-	30.04.2018
477	ReRadiating GPS-System	AS-47	-	Automotive Cons. Fink	-	3	
480	power meter (Fula)	NRVS	838392/031	Rohde & Schwarz	24 M	-	16.05.2019
482	filter matrix	Filter matrix SAR 1	-	CETECOM (Brl)	-	1d	
487	System CTC NSA-Verification SAR-EMI	System EMI field (SAR) NSA	-	ETS Lindgren / CETECOM	24 M	-	31.09.2017
489	EMI Test Receiver	ESU40	1000-30	Rohde & Schwarz	12 M	-	18.05.2019
502	band reject filter	WRCG 1709/1786-1699/1796-	SN 9	Wainwright	pre-m	2	
503	band reject filter	WRCG 824/849-814/859-	SN 5	Wainwright	pre-m	2	
512	notch filter GSM 850	WRCA 800/960-02/40-6EEK	SN 24	Wainwrght	12 M	1c	30.06.2017
517	relais switch matrix	HF Relais Box Keithley	SE 04	Keithley	pre-m	2	
523	Digital Multimeter	L4411A	MY46000154	Agilent	24 M	-	18.05.2019
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	
546	Univ. Radio Communication Tester	CMU 200	106436	R&S	12 M	-	30.03.2018
547	Univ. Radio Communication Tester	CMU 200	835390/014	Rohde & Schwarz	12 M	-	30.04.2017
549	Log.Per-Antenna	HL025	1000060	Rohde & Schwarz	36/12 M	-	31.07.2018
550	System CTC S-VSWR Verification SAR-EMI	System EMI Field SAR S-VSWR	-	ETS Lindgren/CETECOM	24 M	-	31.07.2017
574	Biconilog Hybrid Antenna	BTA-L	980026L	Frankonia	36/12 M	-	31.03.2019
584	Spectrum Analyzer	FSU 8	100248	Rohde & Schwarz	pre-m	-	
597	Univ. Radio Communication Tester	CMU 200	100347	Rohde & Schwarz	pre-m	-	
600	power meter	NRVD (Reserve)	834501/018	Rohde & Schwarz	24 M	-	17.05.2019
601	medium-sensitivity diode sensor	NRV-Z5 (Reserve)	8435323/003	Rohde & Schwarz	24 M	-	15.05.2019
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	-	30.05.2018
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	-	16.05.2018
621	Step Attenuator 0-139 dB	RSP	100017	Rohde & Schwarz	pre-m	2	
625	Generic Test Load USB	Generic Test Load USB	-	CETECOM	-	2	
627	data logger	OPUS 1	201.0999.9302.6.4.1.43	G. Lufft GmbH	24 M	-	30.03.2019
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 Kabel with Ethernet 1,5 m flach	HDMI cable with Ethernet	-	Reichelt	-	2	
640	HDMI cable 2m rund	HDMI cable 2m rund	-	Reichelt	-	2	
641	HDMI cable with Ethernet	Certified HDMI cable with	-	PureLink	-	2	
642	Wideband Radio Communication Tester	CMW 500	126089	Rohde&Schwarz	12 M	-	24.05.2018
644	Amplifierer	ZX60-2534M+	SN865701299	Mini-Circuits	-	-	
670	Univ. Radio Communication Tester	CMU 200	106833	Rohde & Schwarz	24 M	-	30.05.2018
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	-	17.05.2018
686	Field Analyzer	EHP-200A	160WX30702	Narda Safety Test Solutions	24 M	-	29.03.2019
687	Signal Generator	SMF 100A	102073	Rohde&Schwarz	12 M	-	17.05.2018
688	Pre Amp	JS-18004000-40-8P	1750117	Miteq	pre-m	-	
690	Spectrum Analyzer	FSU	100302/026	Rohde&Schwarz	12 M	-	16.05.2018
691	OSP120 Base Unit	OSP120	101183	Rohde & Schwarz	12 M	-	22.05.2018
692	Bluetooth Tester	CBT 32	100236	Rohde & Schwarz	36 M	-	29.05.2020
697	Power Splitter	ZN4PD-642W-S+	165001445	Mini-Circuits	-	2	
703	INNCO Antennen Mast	MA 4010-KT080-XPET-ZSS3	MA4170-KT100-XPET-	INNCO	pre-m	-	
704	INNCON Controller	CO 3000-4port	CO3000/933/38410516/L	INNCO Systems GmBh	pre-m	-	
711	Harmonic Mixer 90 GHz - 140GHz	RPG FS-Z140	101004	RPG	12 M	-	22.02.2018
712	Harmonic Mixer 75 GHz - 110GHz	FS-Z110	101468	Rohde & Schwarz	12 M	-	22.02.2018
713	Harmonic Mixer, 50 GHz - 75GHz	FS-Z75	101022	Rohde & Schwarz	12 M	-	22.05.2018
714	Signal Analyzer 67GHz	FSW67	104023	Rohde & Schwarz	24 M	-	03.03.2019
715	Harmonic Mixer, 140 GHz - 220GHz	FS-Z220	101009	RPG Radiometer Physics	12 M	-	03.08.2018
716	Harmonic Mixer 220 GHz to 325 GHZ	FS-Z325	101005	RPG Radiometer Physics	12 M	-	13.02.2018
747	Spectrum Analyzer	FSU 26	200152	Rohde & Schwarz	12 M	-	18.05.2018
748	Pickett-Potter Horn Antenna	FH-PP 4060	010001	Radiometer Physiscs	-	-	
749	Pickett-potter Horn Antenna	FH-PP 60-90	010003	Radiometer Physics	-	-	
750	Pickett-Potter Horn Antenna	FH-PP 140-220	010011	Radiometer Physics	-	-	

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

9. Versions of test reports (change history)

Version	Applied changes	Date of release
--	Initial release	2017-10-06
C1	EUT identification changed	2018-01-08