T E S T R E P O R T
No.: 6-0754/15-1-3c

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

IC-Regulations
RSS-132 Issue 3, RSS-133 Issue 6,
RSS-139 Issue 3, RSS-Gen Issue 4

for

peiker acustic GmbH & Co. KG

Advanced Telecommunication Module
ATM-01 T1-US-4GW

FCC-ID: QWY-ATM-T-522
IC: 6588A-ATMT522
PMN: ATM trunk version
HVIN ATM-01 T1-US-4GW

Laboratory Accreditation and Listings			
DAkkS Deutsche Akkreditierungsstelle D-PL-12047-01-01	MRA US-EU 0003	Industry Canada Reg. No.: 3462D-1 Reg. No.: 3462D-2 Reg. No.: 3462D-3	Voluntary Controls for Electromagnetic Emissions Reg. No.: R-2666 C-2914, T-1967, G-301
Wi Fi ALLIANCE AUTHORIZED RF LABORATORY	CTIA Authorized Test Lab LAB CODE 20011130-00		
accredited according to DIN EN ISO/IEC 17025			

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The test results relate only to the individual items which have been tested. This report shall not be reproduced in parts without the written approval of the testing laboratory © Copyright: All rights reserved by CETECOM

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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 fulfill according §2.927 to §2.948, special focus regarding modification of the equipment and availability of sample equipment for market surveilance tests.

The Equipment Under Test (in this report, hereinafter referred as EUT) supports radiofrequency technologies. This test report shows results for FDD LTE technologies only. Other implemented wireless technologies were not considered within this test report.

The device incorporates an allready approved wireless module of type V1140-101 with FCC ID: QWY-V1140-101 and IC no. 6588A-V1140101. Delta tests apply in order to verify the compliance to adapted host equipment, however a new certification is intended.

Following tests have been performed to show compliance with applicable FCC Part 2, Part 22, Subpart H, Part 24, Subpart E (Broadband PCS) and Part 27, Subpart C of the FCC CFR Title 47 Rules, Edition 4th November 2014 and Canada RSS-130, Issue 1, RSS-132 Issue 3, RSS-133 Issue 6, RSS-139, Issue 3 and RSS-Gen Issue 4 standards.

1.1. TX mode, Test overview of FCC and Canada IC (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 IC: 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	--	--	Remark 2.)
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)	1	1+2+3+4	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	< 2 Watt (EIRP)			
8	Spurious emissions		§2.1053(a) §2.1057 §22.917(a)(b) §24.238(a)(b) §27.53(h)(1)(3)(i)(ii)(iii) §27.53(g)	RSS-132: Chapter 5.5(i)(ii) RSS-133: Chapter 6.5.1(i)(ii) RSS-139: Issue 3 Chapter 6.6 (i) (ii) RSS-130: Issue 1 Chapter 4.6 (i) (ii)	43+10log(P) dBc	1	1+2+3+4	Passed
9	Band-Edge compliance					1	1+2+3+4	Passed

30	RF Power	Antenna terminal (conducted)	§2.1046	--	N/A	2	1+2+3 +4	passed
34	26dB Emission bandwidth		§2.1049(h)	RSS-Gen, Issue 4, Chapter 6.6	26dBc Emissions BW 99% Power	--	--	Remark 2.)
35	99% Occupied bandwidth							
36	Spurious emissions		§2.1051 §2.1057 §22.917(a)(b) §24.238(a)(b) §27.53(h)	RSS-132, Issue 3: 5.5(i)(ii) RSS-133, Issue 6: 6.5.1(i)(ii) RSS-130: Issue 1 Chapter 4.6 (i) (ii) RSS-139, Issue 3 Chapt. 6.6 (i) (ii)	43+10log(P) dBc			
37	Band-Edge compliance							
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			

Remarks:
1.) EUT DC powered only, not applicable
2.) Pls. see original reports module's certification TR6-0315-13-1-3c and corresponding annexes A1 to A4
3.) No measurements, calculated with antenna gain and conducted power values

1.2. Attestation:

I declare that all measurements were performed by me or under my supervision and that all measurements have been performed and are correct to my best knowledge and belief to Industry Canada standards. All requirements as shown in above table are met in accordance with enumerated standards.

Dipl.-Ing. Rachid Acharkaoui
Responsible for test section

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45219 Essen
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Fax: + 49 (0) 20 54 / 95 19 - 997

Dipl.-Ing. C. Lorenz
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. C. Lorenz
Receipt of EUT:	2015-08-01
Date(s) of test:	2015-08-01 to 2015-09-01
Date of report:	2015-09-22
Version of template: 13.02	

2.4. Applicant's details

Applicant's name:	peiker acustic GmbH & Co. KG
Address:	Max-Planck-Straße 32 61381 Friedrichsdorf Germany
Contact person:	Mr. Martin Fleckenstein

2.5. Manufacturer's details

Manufacturer's name:	please see Applicant's details
Address:	please see Applicant's details

3. Equipment under test (EUT)

3.1. 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 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 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 initial modules's certification	
Antenna Type	☐ Integrated ☐ External, no RF- connector ☒ External, separate RF-connector TX-Main + Secondary		
Antenna Gain Tx (main)	☒ Value: 1 dBi / -1.15dBd (Data sheet) ☐ No information from customer		
Antenna Gain RX (diversity)	☒ Value: -2 dBi (Data sheet) ☐ No information from customer		
MAX PEAK Output Power: Radiated LTE-Mode 2 LTE-Mode 4 LTE-Mode 5 LTE-Mode 17	**(Calculations)** 28.76dBm (max. RF-conducted power) +1 dBi (max. Gain Antenna) = 29.76 dBm eirp 28.48dBm (max. RF-conducted power) +1 dBi (max. Gain Antenna) = 29.48 dBm eirp 29.31dBm (max. RF-conducted power) - 1.15 dBd (max. Gain Antenna) = 28.16 dBm erp 28.88dBm (max. RF-conducted power) - 1.15 dBd (max. Gain Antenna) = 27.73 dBm erp		
MAX PEAK Output Power (QPSK modulation): Conducted LTE-Mode 2 LTE-Mode 4 LTE-Mode 5 LTE-Mode 17	28.46 dBm(PK) / 24.05 dBm (AV) 28.29 dBm (PK) / 23.04 dBm (AV) 28.83dBm (PK) / 22.67 dBm (AV) 28.88 dBm (PK) / 22.52 dBm (PK)		
MAX PEAK Output Power (16-QAM modulation): Conducted LTE-Mode 2 LTE-Mode 4 LTE-Mode 5 LTE-Mode 17	28.76 dBm (PK / 23.50 dBm (AV) 28.48 dBm (PK) / 22.56 dBm (AV) 29.31 dBm (PK) / 22.33 dBm (AV) 28.73 dBm (PK) / 22.08 dBm (AV)		
Installed option	☒ GSM 900 and GSM 1800 Bands (not usable in USA/Canada) ☒ W-LAN wireless technologies (not tested within this test report)☒ GPS (not tested within this test report)		
Power supply	☒ DC power only: 14 V DC Nominal		
Special EMI components	--		
EUT sample type	☐ Production	☒ Pre-Production	☐ Engineering
FCC label attached	☒ yes	☐ no	

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

Short descrip-tion*)	EUT	Type	S/N serial number	HW hardware status	SW software status
EUT A	ATM-01 T1-US-4GW	Advanced Telecommunication Module	595569	212.007.007	001.018.103

*) 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 descrip-tion *)	Auxiliary Equipment	Type	S/N serial number	HW hardware status	SW software status
AE 1	Loudspeaker	KL3 / 4-Ohm	--	--	--
AE 2	Microphone	ME 39	--	--	--
AE 3	Antenna TRX mounted on a ground plane	Fender antenna from *Hirschmann* 920325-102	--	--	--
AE 4	Antenna DRX mounted on a ground plane	Bumper telephone antenna from *Hirschmann* 920337-101	--	--	--
AE 5	Antenna GPS mounted on a ground plane	Navilock NL-69AT	--	--	--
AE 6	Cable harness	Testing & Debugging	#1	See chapter 3.1 of Annex 5	--
AE 7	Reduced cable harness	Testing	#2	See chapter 3.1.1 of Annex 5	
AE 8	Notebook	Dell D2120	#RSE	--	Windows 7

*) 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 + AE 1+ AE 2 + AE 3 + AE 4 + AE 5+ AE 6 + (AE 8)	Main antenna radiated tests. AE 8 used temporary for seting up the operating mode.
set. 2	EUT A + AE 7 + (AE 8)	Main Antenna Conducted tests. SMA Adapter used. AE 8 used temporary for seting up the operating mode.

*) 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
1	LTE-Band 2 RMC Mode	A communication link is established between the mobile station (UE) and the test simulator. The transmitter is operated on its maximum rated output power class: 23dBm nominal. The input signal to the receiver is modulated with normal test modulation: QPSK or 16-QAM Modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link. NS_01 Network signalling value was used, no A-MPR was used therefore for this band.
2	LTE-Band 4 RMC Mode	A communication link is established between the mobile station (UE) and the test simulator. The transmitter is operated on its maximum rated output power class: 23dBm nominal. The input signal to the receiver is modulated with normal test modulation: QPSK or 16-QAM Modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link. NS_01 Network signalling value was used, no A-MPR was used therefore for this band.
3	LTE-Band 5 RMC Mode	A communication link is established between the mobile station (UE) and the test simulator. The transmitter is operated on its maximum rated output power class: 23dBm nominal. The input signal to the receiver is modulated with normal test modulation: QPSK or 16-QAM Modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link. NS_01 Network signalling value was used, no A-MPR was used therefore for this band.
5	LTE-Band 17 RMC Mode	A communication link is established between the mobile station (UE) and the test simulator. The transmitter is operated on its maximum rated output power class: 23dBm nominal. The input signal to the receiver is modulated with normal test modulation: QPSK or 16-QAM Modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link. NS_01 Network signalling value was used, no A-MPR was used therefore for this band.

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

3.6. Configuration of cables used for testing

Cable number	Item	Type	S/N serial number	HW hardware status	Cable length
Cable 1	CAN 9-pol D-SUB	--	--	--	About 1.5m
Cable 2	GND & BATT +12V	--	--	--	
Cable 3	BCBR	--	--	--	
Cable 4	KL.31 & K.30F	--	--	--	
Cable 5	AIRBAG-IF	--	--	--	
Cable 6	EXT-BUB	--	--	--	
Cable 7	Loudspeakers	--	--	--	
Cable 8	E-Call button	--	--	--	
Cable 9	MIC-OUT	--	--	--	
Cable 10	ME39	--	--	--	
Cable 11	CAN-uC	--	--	--	
Cable 12	NAD	--	--	--	
Cable 13	TRX-Antenna cable	--	--	--	1.5m
Cable 14	DRX antenna cable	--	--	--	2m
Cable 15	GPS Antenna	--	--	--	3m

Remark: pls. consult Annex 5 for further details.

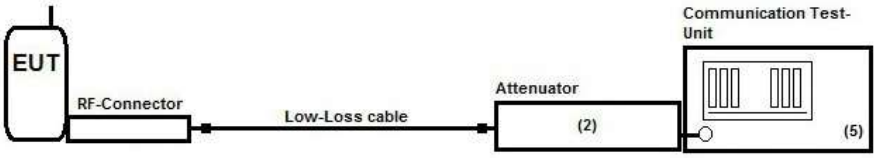
4. Description of test system set-up's

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

Cellular Conducted RF-Setup 2 (C2 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 a suitable 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:
☒ 10 dB Attenuator	☒ CMU200 Communication Test-Unit for GSM/W-CDMA	See List of equipment under each test case and chapter 8 for calibration info
☒ Low loss RF-cables	☒ DC-Power Supply	

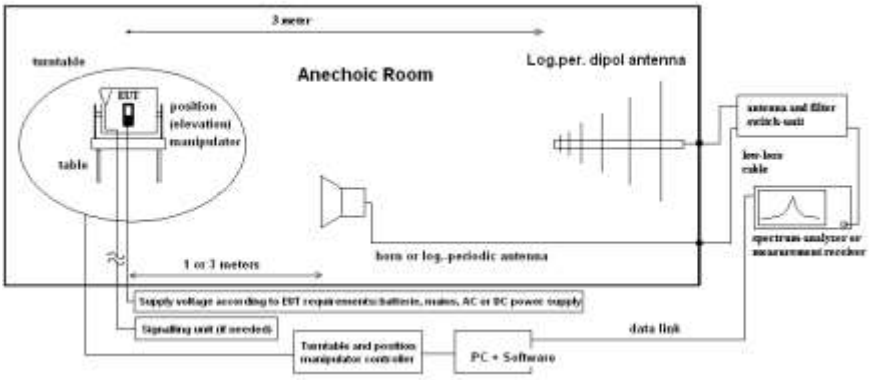
Measurement uncertainty See chapter 5.3

4.2. 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

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
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
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 17: 3 Watt ERP (34.7dBm)

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 CMU200 from Rohde&Schwarz company. In this way spectrum-analyzers instrument limitations can be avoided or minimized. Instead, CMU manufacturers declared measurement error can be considered for this measurement. The attenuation (insertion loss) at the RF Inputs/Outputs of CMU 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					
channel bandwidth	ARFCN ch. no.	ARFCN-Frequency [MHz]	Resource block allocation	Peak detektor [dBm]	RMS detektor [dBm]	Peak detektor [dBm]	RMS detektor [dBm]	max- modulation QPSK	max. modulation 16QAM	max. bandwidth	absolute max. value channels/bandwidths
1.4 MHz	18607	1850,7	1 RB low	27,03	23,57	26,78	22,65	23,57	22,65	23,57	24,05
			1 RB high	27,2	23,48	26,96	22,63				
			50% RB mid	27,06	23,38	26,81	22,56				
			100% RB	27,65	22,11	27,64	22,09				
	18900	1880	1 RB low	27,28	22,84	26,57	21,72	22,85	21,79		
			1 RB high	27,23	22,85	26,49	21,79				
			50% RB mid	27,19	22,81	26,5	21,77				
			100% RB	27,32	21,82	27,49	20,8				
	19193	1909,3	1 RB low	25,87	22,71	25,7	22	22,71	22		
			1 RB high	25,67	22,55	25,48	21,86				
			50% RB mid	25,77	22,62	25,54	21,9				
			100% RB	26,46	21,49	26,24	20,67				
3 MHz	18615	1851,5	1 RB low	26,8	23,13	26,24	22,15	23,32	22,39	23,47	
			1 RB high	27,32	23,32	26,63	22,24				
			50% RB mid	27,01	23,21	26,44	22,39				
			100% RB	27,88	23,13	27,94	22,24				
	18900	1880	1 RB low	27,03	22,62	27,44	22,35	23,47	23,13		
			1 RB high	27,27	23,47	27,59	23,13				
			50% RB mid	26,98	22,7	27,42	22,39				
			100% RB	27,47	21,74	27,93	20,86				
	19185	1908,5	1 RB low	26,29	22,96	25,88	21,97	22,96	21,97		
			1 RB high	25,69	22,49	25,35	21,49				
			50% RB mid	25,9	22,7	25,56	21,9				
			100% RB	26,69	21,67	26,66	20,81				
5 MHz	18625	1852,5	1 RB low	26,78	23,07	26,69	22,22	23,39	22,6	23,51	
			1 RB high	27,57	23,39	27,43	22,54				
			50% RB mid	27,21	23,32	27,1	22,6				
			100% RB	28,35	23,04	28,62	22,18				
	18900	1880	1 RB low	27,5	23,51	27,18	21,54	23,51	22,41		
			1 RB high	27,45	23,28	27,46	22,41				
			50% RB mid	27,2	22,72	27,11	21,64				
			100% RB	27,65	21,71	27,99	20,81				
	19175	1907,5	1 RB low	28,36	22,83	26,31	22,12	22,91	22,2		
			1 RB high	25,7	22,48	25,61	21,64				
			50% RB mid	26,15	22,91	26,1	22,2				
			100% RB	27,22	21,7	27,42	20,78				

10 MHz	18650	1855	1 RB low	27,00	23,98	27,19	23,5	23,98	23,5	23,98	
			1 RB high	27,68	23,24	28,29	23,01				
			50% RB mid	27,42	23,41	27,83	22,98				
			100% RB	28,45	23,17	28,76	22,26				
	18900	1880	1 RB low	27,43	23,34	26,41	21,52	23,66	22,2		
			1 RB high	27,29	23,06	26,73	22,2				
			50% RB mid	27,42	23,66	26,32	21,7				
			100% RB	27,8	21,67	27,48	20,76				
	19150	1905	1 RB low	26,11	22,83	25,58	21,26	22,9	22,24		
			1 RB high	25,69	22,38	25,4	21,31				
			50% RB mid	26,24	22,9	26,01	22,24				
			100% RB	26,9	21,62	27,06	20,7				
15 MHz	18675	1857,5	1 RB low	27,08	23,96	27,02	22,36	23,96	23,27	23,96	
			1 RB high	27,25	22,72	27,75	22,27				
			50% RB mid	27,74	23,61	28,27	23,27				
			100% RB	28,46	22,1	28,08	21,16				
	18900	1880	1 RB low	27,0	22,42	26,3	21,33	23,05	22,25		
			1 RB high	26,97	23,05	26,59	22,25				
			50% RB mid	27,0	22,63	26,32	21,64				
			100% RB	27,97	21,54	27,75	20,58				
	19125	1902,5	1 RB low	25,93	22,17	25,37	21,03	23,26	21,41		
			1 RB high	25,79	22,49	25,32	21,35				
			50% RB mid	26,33	23,26	25,57	21,41				
			100% RB	27,17	21,25	27,06	20,31				
20 MHz	18700	1860	1 RB low	27,21	23,94	26,8	22,13	24,05	23,39	24,05	
			1 RB high	27,4	23,1	27,33	22,42				
			50% RB mid	28,12	24,05	28,06	23,39				
			100% RB	28,08	22,12	28,56	21,11				
	18900	1880	1 RB low	26,99	22,33	27,23	21,33	22,76	21,89		
			1 RB high	26,62	22,45	26,84	21,66				
			50% RB mid	27,01	22,76	27,26	21,89				
			100% RB	27,79	21,52	27,66	20,63				
	19100	1900	1 RB low	26,49	22,36	26,43	21,99	22,42	22,07		
			1 RB high	25,87	22,42	25,85	22,07				
			50% RB mid	25,9	22,16	25,91	21,86				
			100% RB	27,07	21,42	27,08	20,38				

5.1.4.2. LTE Band 4 Results

LTE-Band 4				QPSK-Modulation		16-QAM-Modulation		max- modulation QPSK	max. modualtion 16-QAM	max. channel	absolute max. value
channel bandwidth	ARFCN ch. no.	ARFCN-Frequency [MHz]	Resource block allocation	Peak detektor [dBm]	RMS detektor [dBm]	Peak detektor [dBm]	RMS detektor [dBm]				
1.4 MHz	19957	1710,7	1 RB low	26,68	22,53	26,41	21,78	22,62	21,78	22,62	**23,04**
			1 RB high	26,88	22,62	26,58	21,72				
			50% RB mid	26,8	22,6	26,49	21,69				
			100% RB	27,13	21,56	27,23	20,52				
	20175	1732,5	1 RB low	27,23	21,78	26,01	20,64	21,78	20,71		
			1 RB high	27,16	21,72	26,04	20,71				
			50% RB mid	27,01	21,66	25,9	20,66				
			100% RB	26,78	20,71	26,89	19,74				
	20393	1754,3	1 RB low	27,11	21,76	26,19	20,66	21,8	20,76		
			1 RB high	27,17	21,8	26,22	20,7				
			50% RB mid	27,07	21,79	26,17	20,76				
			100% RB	26,96	20,81	27,2	20,09				
3 MHz	19965	1711,5	1 RB low	26,47	22,44	26,78	22,07	22,66	22,18	22,66	
			1 RB high	26,88	22,66	27,24	22,18				
			50% RB mid	26,64	22,59	26,99	22,14				
			100% RB	27,1	21,52	27,19	20,62				
	20175	1732,5	1 RB low	27,18	21,68	25,96	20,62	21,79	20,72		
			1 RB high	27,15	21,79	26,06	20,72				
			50% RB mid	27,09	21,62	25,79	20,53				
			100% RB	27,4	20,7	27,37	19,89				
	20385	1753,5	1 RB low	26,97	21,73	26,24	20,77	21,76	20,78		
			1 RB high	27,04	21,72	26,2	20,76				
			50% RB mid	26,96	21,76	26,19	20,78				
			100% RB	28,12	20,79	27,59	20				
5 MHz	19975	1712,5	1 RB low	26,92	22,66	26,41	21,5	22,79	21,69	22,79	
			1 RB high	27,7	22,79	27,01	21,69				
			50% RB mid	27,34	22,77	26,72	21,68				
			100% RB	27,57	21,53	27,47	20,65				
	20175	1732,5	1 RB low	27,33	21,87	26,94	20,79	22,04	20,96		
			1 RB high	27,18	22,04	26,89	20,96				
			50% RB mid	26,98	21,66	26,77	20,87				
			100% RB	27,49	20,71	28,11	19,77				
	20375	1752,5	1 RB low	27,24	21,92	26,73	20,97	22,37	20,97		
			1 RB high	28,0	22,37	26,83	20,84				
			50% RB mid	27,63	21,84	26,66	20,85				
			100% RB	27,24	20,86	27,79	19,92				

10 MHz	20000	1715	1 RB low	27,1	22,74	26,92	21,75	23,01	22,13	23,01	
			1 RB high	27,64	23,01	27,47	22,13				
			50% RB mid	27,28	22,8	27,12	22,0				
			100% RB	27,96	21,7	28,48	20,88				
	20175	1732,5	1 RB low	27,47	21,83	27,26	20,59	21,96	20,69		
			1 RB high	27,31	21,96	27,15	20,69				
			50% RB mid	27,21	21,72	27,07	20,58				
			100% RB	27,17	20,73	27,73	19,76				
	20350	1750	1 RB low	27,32	21,92	26,62	20,98	21,94	20,98		
			1 RB high	27,56	21,78	26,7	20,8				
			50% RB mid	27,47	21,94	26,61	20,88				
			100% RB	27,33	20,8	27,58	19,97				
15 MHz	20025	1717,5	1 RB low	26,63	22,55	26,95	22,11	22,93	22,56	22,93	
			1 RB high	27,25	22,15	26,93	22,18				
			50% RB mid	27,45	22,93	27,95	22,56				
			100% RB	28,29	21,63	27,79	20,69				
	20175	1732,5	1 RB low	27,46	21,94	26,12	20,85	21,94	20,85		
			1 RB high	26,92	21,81	25,97	20,79				
			50% RB mid	27,15	21,72	25,79	20,64				
			100% RB	27,63	20,68	27,4	19,82				
	20325	1747,5	1 RB low	26,84	21,87	26,52	21,51	21,92	21,64		
			1 RB high	26,99	21,92	26,75	21,64				
			50% RB mid	26,58	21,83	26,3	21,36				
			100% RB	27,61	20,86	27,4	19,9				
20 MHz	20050	1720	1 RB low	26,87	22,77	26,73	21,94	23,04	21,94	23,04	
			1 RB high	27,37	21,92	27,11	21,01				
			50% RB mid	27,82	23,04	27,39	21,8				
			100% RB	27,85	21,46	28,46	20,53				
	20175	1732,5	1 RB low	27,67	22,33	27,86	21,43	22,33	21,43		
			1 RB high	26,95	21,89	26,87	21,19				
			50% RB mid	27,04	21,61	26,86	20,85				
			100% RB	27,35	20,84	27,94	19,88				
	20300	1745	1 RB low	26,98	22,04	27,35	21,13	22,14	21,34		
			1 RB high	27,2	22,13	27,68	21,34				
			50% RB mid	26,82	22,14	27,12	21,13				
			100% RB	27,52	20,88	27,55	19,91				

Remark: marked cell is showing max. Average conducted power value

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]	Peak detektor [dBm]	RMS detektor [dBm]				
1.4 MHz	20407	824.7	1 RB low	28,24	22,38	27,62	21,36	22,38	21,40	22,48	**22,67**
			1 RB high	28,21	22,27	27,6	21,4				
			50% RB mid	28,18	22,32	27,51	21,32				
			100% RB	28,34	21,53	28,34	20,55				
	20525	836.5	1 RB low	28,46	22,48	26,86	21,34	22,48	21,34		
			1 RB high	28,26	22,31	26,76	21,3				
			50% RB mid	28,22	22,31	26,72	21,31				
			100% RB	27,72	21,48	27,95	20,52				
	20643	848.3	1 RB low	28,05	22,38	27,07	21,44	22,38	0,00		
			1 RB high	27,9	22,18	26,98	21,35				
			50% RB mid	27,96	22,28	26,95	21,35				
			100% RB	27,89	21,5	28,1	20,64				
3 MHz	20415	825.5	1 RB low	27,55	22,19	28,36	22,12	22,38	22,16	22,49	
			1 RB high	27,74	22,38	28,58	22,16				
			50% RB mid	27,58	22,2	28,41	22,16				
			100% RB	27,68	21,4	27,38	20,58				
	20525	836.5	1 RB low	27,86	22,27	28,99	22,32	22,27	22,32		
			1 RB high	27,76	22,22	28,88	22,18				
			50% RB mid	27,82	22,27	28,85	22,21				
			100% RB	28,44	21,5	27,91	20,68				
	20635	847.5	1 RB low	28,3	22,49	26,9	21,48	22,49	21,48		
			1 RB high	28,19	22,33	26,77	21,31				
			50% RB mid	28,27	22,49	26,71	21,38				
			100% RB	27,3	21,44	28,19	20,64				
5 MHz	20425	826.5	1 RB low	28,46	22,39	27,44	21,42	22,49	21,56	22,67	
			1 RB high	28,45	22,37	27,75	21,56				
			50% RB mid	28,83	22,49	27,57	21,49				
			100% RB	28,1	21,39	28,45	20,55				
	20525	836.5	1 RB low	28,34	22,45	28,11	21,68	22,45	21,68		
			1 RB high	28,24	22,45	27,93	21,63				
			50% RB mid	28,16	22,33	27,92	21,58				
			100% RB	28,44	21,44	29,31	20,56				
	20625	846.5	1 RB low	28,44	22,45	28,34	21,33	22,67	21,33		
			1 RB high	28,5	22,67	28,2	21,17				
			50% RB mid	28,4	22,45	28,2	21,25				
			100% RB	27,99	21,4	28,78	20,51				

10 MHz	20450	829	1 RB low	27,68	22,3	28,44	22,15	22,43	22,33	22,46	
			1 RB high	28,03	22,43	29,12	22,33				
			50% RB mid	27,74	22,35	28,76	22,22				
			100% RB	28,18	21,41	28,7	20,48				
	20525	836.5	1 RB low	28,5	22,46	26,89	21,46	22,46	21,46		
			1 RB high	28,28	22,25	26,62	21,16				
			50% RB mid	28,28	22,36	26,57	21,29				
			100% RB	28,3	21,41	28,36	20,5				
	20600	844	1 RB low	28,1	22,25	27,05	21,37	22,32	21,37		
			1 RB high	28,08	22,28	27,03	21,34				
			50% RB mid	28,0	22,32	26,94	21,37				
			100% RB	28,11	21,36	28,68	20,44				

Remark: marked cell is showing max. Average conducted power value

5.1.4.4. LTE Band 17 Results

LTE-Band 17				QPSK-Modulation		16-QAM-Modulation		max- modulation QPSK	max. modulation 16QAM	max. channel	absolute max. value
channel bandwidth	ARFCN ch. no.	ARFCN-Frequency [MHz]	Resource block allocation	Peak detektor [dBm]	RMS detektor [dBm]	Peak detektor [dBm]	RMS detektor [dBm]				
5 MHz	23755	706,5	1 RB low	28,77	22,43	27,71	21,45	22,43	21,45	**22,52**	**22,52**
			1 RB high	28,79	22,21	27,6	21,29				
			50% RB mid	28,88	22,14	27,7	21,29				
			100% RB	28,1	21,11	28,19	20,26				
	23790	710	1 RB low	28,15	22,16	27,94	21,4	22,29	21,5		
			1 RB high	27,85	22,29	27,63	21,5				
			50% RB mid	27,78	22,24	27,51	21,44				
			100% RB	28,31	21,17	27,67	20,19				
	23825	713,5	1 RB low	28,49	22,29	27,3	21,31	22,52	21,48		
			1 RB high	28,35	22,19	27,56	21,36				
			50% RB mid	28,52	22,52	27,55	21,48				
			100% RB	28,19	21,37	28,52	20,38				
10 MHz	23780	709	1 RB low	27,76	22,11	28,73	22,08	22,29	22,08	**22,43**	
			1 RB high	27,7	22,29	28,42	22,03				
			50% RB mid	27,55	22,16	28,56	21,93				
			100% RB	28,13	21,15	28,35	**20,19**				
	23790	710	1 RB low	28,37	22,2	26,88	21,16	22,43	21,34		
			1 RB high	28,16	22,43	26,86	21,34				
			50% RB mid	27,93	22,27	26,35	21,11				
			100% RB	28,27	21,11	28,3	20,26				
	23800	711	1 RB low	28,08	22,06	27,1	21,2	22,2	21,2		
			1 RB high	27,84	22,2	26,89	21,12				
			50% RB mid	27,55	22,13	26,55	21,13				
			100% RB	28,02	21,12	28,45	20,13				

Remark: marked cell is showing max. Average conducted power value

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 CMU 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.	

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		
Signal-Bandwidth / [MHz]	Max. PAPR Max. PAPR level with 0.1% probability / [dB]	
	QPSK Modulation	16-QAM Modulation
1.4	4.96	6.09
3.0	4.17	6.18
5.0	6.09	7.21
10	7.21	7.87
15	7.82	**8.06**
20	7.92	7.96

Remark: pls. see annex 1 for graphical plots

LTE Band 4		
Signal-Bandwidth / [MHz]	Max. PAPR level with 0.1% probability / [dB]	
	QPSK Modulation	16-QAM Modulation
1.4	5.53	6.46
3.0	4.17	6.18
5.0	6.04	7.21
10	7.26	7.87
15	7.78	**8.01**
20	7.73	7.92

Remark: pls. see annex 1 for graphical plots

LTE Band 5		
Signal-Bandwidth / [MHz]	Max. PAPR level with 0.1% probability / [dB]	
	QPSK Modulation	16-QAM Modulation
1.4	5.48	6.56
3.0	4.12	6.32
5.0	7.26	7.21
10	7.21	**7.64**

Remark: pls. see annex 1 for graphical plots

LTE Band 17		
Signal-Bandwidth / [MHz]	Max. PAPR level with 0.1% probability / [dB]	
	QPSK Modulation	16-QAM Modulation
5.0	6.09	7.07
10	7.31	**8.57**

Remark: pls. see annex 1 for graphical plots

5.1.5.2. Conclusion

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

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

5.2.1. 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		☒ 060 110 V/ 60 Hz via PAS 5000			

5.2.2. Requirements and limits

FCC	§2.1053(a)-radiated , §2.1057(a) , §22.917(a)(b) ; §24.238(a)(b) ; §27.53(h)(1)(3)(i)(ii)(iii) §27.53(g)
IC	RSS-130, Issue 1: 4.6.1 RSS-132, Issue 3: 5.5(i)(ii) RSS-133, Issue 6: 6.5.1(i)(ii) RSS-139, Issue 3: 6.6 (i)(ii)
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

5.2.3. 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	19000	1	10	60	10	MaxH-PK
Sweep 2a (Band-Edge)	1849	1850	0.02	0.2	1	35	MaxH-PK
Sweep 3a (Band-Edge)	1910	1911	0.02	0.2	1	35	MaxH-PK

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	0.02	0.2	1	35	MaxH-PK
Sweep 3a (Band-Edge)	1755	1756	0.02	0.2	1	35	MaxH-PK

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	1	35	MaxH-PK
Sweep 3a (Band-Edge)	850	851	0.02	0.2	1	35	MaxH-PK

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	200	1	35	MaxH-PK, Signal-BW=5MHz
Sweep 3a (Band-Edge)	716	717	50	200	1	35	MaxH-PK, Signal-BW=5MHz

5.2.4. Results

The results are presented below in summary form only. For more information please see the diagrams enclosed in annex 4.

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

Dia-gram no.	Carrier Channel		Frequency range	OP-mode no.	Remark	Used detector			Result
	Range	No.				PK	AV	QP	
8.20a	Low	18607	30 MHz to 19 GHz	1	Carrier visible on diagram. Not relevant for results QPSK modulation	☒	☐	☐	passed
9.20a	Low	18607	1849 – 1850 MHz	1	Band-Edge compliance QPSK modulation Remark 1 1RB low set-up	☒	☐	☐	passed
9.21a					Band-Edge compliance 16-QAM modulation Remark 1 Full RBs Set-up (6RBs)				
9.20b					Band-Edge compliance QAM modulation Remark 1 1RB low set-up	☒	☐	☐	passed
9.21b					Band-Edge compliance 16-QAM modulation Remark 1 Full RBs Set-up (6RBs)				
9.22a	High	19193	1910 – 1911 MHz	1	Band-Edge compliance QPSK modulation Remark 1 1RB high set-up	☒	☐	☐	passed
9.23a					Band-Edge compliance QPSK modulation Remark 1 Full RBs Set-up (6RBs)				
9.22b					Band-Edge compliance 16-QAM modulation Remark 1 1RB high set-up	☒	☐	☐	passed
9.23b					Band-Edge compliance 16-QAM modulation Remark 1 Full RBs Set-up (6RBs)				

Remark1:
LTE EUT channel bandwidth of 1.4MHz was chosen as worst-case from module's initial certification

5.2.4.2. LTE Band 4: Op. Mode 2, Set-up 1

Dia-gram no.	Carrier Channel		Frequency range	OP-mode no.	Remark	Used detector			Result
	Range	No.				PK	AV	QP	
8.40	Low	19957	30 MHz to 18 GHz	2	Carrier visible on diagram. Not relevant for results	☒	☐	☐	passed
9.40a	Low	19957	1709 - 1710 MHz	2	Band Edge Compliance QPSK modulation, remark 1 1RB low set-up	☒	☐	☐	passed
9.41a					Band Edge Compliance QPSK modulation, remark 1 Full RBs Set-up (6RBs)	☒	☐	☐	passed
9.40b					Band Edge Compliance 16-QAM modulation, remark1, 1RB low set-up	☒	☐	☐	passed
9.41b					Band Edge Compliance 16-QAM modulation, remark 1 Full RBs Set-up (6RBs)	☒	☐	☐	passed
9.42a	High	20393	1755 – 1756 MHz	2	Band Edge Compliance QPSK modulation, remark 1 1RB low set-up	☒	☐	☐	passed
9.42b					Band Edge Compliance 16-QAM modulation, remark 1 1RB low set-up	☒	☐	☐	passed
9.43a					Band Edge Compliance QPSK modulation, remark 1 Full RBs Set-up (6RBs)	☒	☐	☐	passed
9.43b					Band Edge Compliance 16-QAM modulation remark 1 Full RBs Set-up (6RBs)	☒	☐	☐	passed

Remark1: LTE EUT channel bandwidth of 1.4MHz was chosen as worst-case from module's initial certification

5.2.4.3. LTE Band 5: Op. Mode 3, Set-up 1

Dia-gram no.	Carrier Channel		Frequency range	OP-mode no.	Remark	Used detector			Result
	Range	No.				PK	AV	QP	
8.50	Low	20407	30 MHz to 9 GHz	3	Carrier visible on diagram. Not relevant for results	☒	☐	☐	passed
9.500a	Low	20407	823 – 824 MHz	3	Band Edge Compliance QPSK modulation, remark 2, 1RB low set-up	☒	☒	☐	passed
9.500b					Band Edge Compliance 16-QAM modulation remark 2, 1RB low set-up	☒	☐	☐	passed
9.501a					Band Edge Compliance QPSK modulation, remark 2, Full RBs Set-up (6RBs)	☒	☐	☐	passed
9.501b					Band Edge Compliance 16-QAM modulation remark 2, Full RBs Set-up (6RBs)	☒	☐	☐	passed
9.502a	High	20643	849 - 850 MHz	3	Band Edge Compliance QPSK modulation, remark 2, 1RB high set-up	☒	☐	☐	passed
9.502b					Band Edge Compliance 16-QAM modulation remark 2, 1RB high set-up	☒	☐	☐	passed
9.503a					Band Edge Compliance QPSK modulation, remark 2, Full RBs Set-up (6RBs)	☒	☐	☐	passed
9.503b					Band Edge Compliance 16-QAM modulation remark 2, Full RBs Set-up (6RBs)	☒	☐	☐	passed

Remark: LTE EUT Signal bandwidth of 1.4MHz was chosen as worst-case from module's initial certification

5.2.4.4. LTE Band 17: Op. Mode 4 Set-up 1

Dia-gram no.	Carrier Channel		Frequency range	OP-mode no.	Remark	Used detector			Result
	Range	No.				PK	AV	QP	
9.1701 a	Low	23755	703 - 704 MHz	4	Band Edge Compliance QPSK modulation Remark 1, 1RB low set-up	☒	☐	☐	passed
9.1701 b					Band Edge Compliance 16-QAM modulation remark 1, 1RB low set-up	☒	☐	☐	passed
9.1702 a					Band Edge Compliance QPSK modulation Remark 1, Full RBs Set-up (25RBs)	☒	☐	☐	passed
9.1702 b					Band Edge Compliance 16-QAM modulation remark 1, Full RBs Set-up (25RBs)	☒	☐	☐	passed
8.172	Middle	23790	30 MHz to 9 GHz	4	Carrier visible on diagram. Not relevant for results	☒	☐	☐	passed
9.1703 a	High	23825	716 – 717 MHz	4	Band Edge Compliance QPSK modulation Remark 1, 1RB high set-up	☒	☐	☐	passed
9.1703 b					Band Edge Compliance 16-QAM modulation remark 1, 1RB high set-up	☒	☐	☐	passed
9.1704 a					Band Edge Compliance QPSK modulation Remark 1, Full RBs Set-up (25RBs)	☒	☐	☐	passed
9.1704 b					Band Edge Compliance 16-QAM modulation remark 1, Full RBs Set-up (25RBs)	☒	☐	☐	passed

Remark: 1.) LTE EUT channel bandwidth of 5MHz was chosen as worst-case from module's initial certification

5.3. 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	--	
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	736496	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 (MRA US-EU 0003)
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-2666 G-301 C-2914 T-1967	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
264	Spectrum Analyzer	FSEK 30	826939/005	Bios=2.1, Analyzer= 3.20
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
331	Climatic Test Chamber -40/+80 Grad	HC 4055	43146	TSI 1.53
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	-	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
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
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	-	30.04.2016
005	AC - LISN (50 Ohm/50µH, test site 1)	ESH2-Z5	861741/005	Rohde & Schwarz	12 M	-	30.04.2016
007	Single-Line V-Network (50 Ohm/5µH)	ESH3-Z6	892563/002	Rohde & Schwarz	12 M	-	30.04.2016
009	Power Meter (EMS-radiated)	NRV	863056/017	Rohde & Schwarz	24 M	-	30.04.2017
016	Line Impedance Simulating Network	Op. 24-D	B6366	Spitzenberger+Spies	36 M	-	31.03.2016
020	Horn Antenna 18 GHz (Subst 1)	3115	9107-3699	EMCO	36/12 M	-	31.03.2017
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	-	30.04.2017
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	30.09.2015
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	
090	Helmholtz coil: 2x10 coils in series	Helmholtz coil: 2x10 coils in	-	RWTÜV	24 M	4	31.03.2016
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	-	31.03.2016
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	-	31.03.2016
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	-	31.03.2016
262	Power Meter	NRV-S	825770/0010	Rohde & Schwarz	24 M	-	31.03.2016
263	Signal Generator	SMP 04	826190/0007	Rohde & Schwarz	36 M	-	31.03.2016
264	Spectrum Analyzer	FSEK 30	826939/005	Rohde & Schwarz	12 M	-	30.04.2016
265	peak power sensor	NRV-Z33, Model 04	840414/009	Rohde & Schwarz	24 M	-	31.03.2016
266	Peak Power Sensor	NRV-Z31, Model 04	843383/016	Rohde & Schwarz	24 M	-	31.03.2016
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	30.09.2015
291	high pass filter GSM 850/900	WHJ 2200-4EE	14	Wainwright GmbH	12 M	1c	30.09.2015
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	-	30.04.2016
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	-	31.03.2017
303	horn antenna 40 GHz (Subst 1)	BBHA9170	156	Schwarzbeck	36 M	-	31.03.2017
331	Climatic Test Chamber -40/+80 Grad	HC 4055	43146	Heraeus Vötsch	24 M	-	30.12.2016
341	Digital Multimeter	Fluke 112	81650455	Fluke	24 M	-	31.03.2016
342	Digital Multimeter	Voltcraft M-4660A	IB 255466	Voltcraft	24 M	-	30.04.2017
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	-	31.03.2016
356	power sensor	NRV-Z1	882322/014	Rohde & Schwarz	24 M	-	31.03.2015
357	power sensor	NRV-Z1	861761/002	Rohde & Schwarz	24 M	-	30.04.2017
371	Bluetooth Tester	CBT32	100153	R&S	24 M	-	31.03.2016
373	Single-Line V-Network (50 Ohm/5µH)	ESH3-Z6	100535	Rohde & Schwarz	24 M	-	30.04.2017
377	EMI Test Receiver	ESCS 30	100160	Rohde & Schwarz	12 M	-	30.04.2016
389	Digital Multimeter	Keithley 2000	0583926	Keithley	24 M	-	30.04.2017
392	Radio Communication Tester	MT8820A	6K00000788	Anritsu	12 M	-	30.04.2016
431	Model 7405	Near-Field Probe Set	9305-2457	EMCO	-	4	
436	Univ. Radio Communication Tester	CMU 200	103083	Rohde & Schwarz	12 M	-	30.04.2016
439	UltraLog-Antenna	HL 562	100248	Rohde & Schwarz	36 M	-	31.03.2017
441	CTC-SAR-EMI Cable Loss	System EMI field (SAR) Cable	-	CETECOM	12 M	5	30.01.2016
443	CTC-FAR-EMI-RSE	System CTC-FAR-EMI-	-	ETS-Lindgren /	12 M	5	30.09.2015

Ref.-No.	Equipment	Type	Serial-No.	Manufacturer	Interval of calibration	Remark	Cal due
		RSE		CETECOM			
448	notch filter WCDMA_FDD II	WRCT 1850.0/2170.0-5/40-	5	Wainwright Instruments GmbH	12 M	1c	30.09.2015
449	notch filter WCDMA FDD V	WRCT 824.0/894.0-5/40-8SSK	1	Wainwright	12 M	1c	30.09.2015
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	-	30.04.2016
463	Universal source	HP3245A	2831A03472	Agilent	-	4	
466	Digital Multimeter	Fluke 112	89210157	Fluke USA	24 M	-	31.03.2016
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	-	30.04.2017
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	-	30.09.2015
487	System CTC NSA-Verification SAR-EMI	System EMI field (SAR) NSA	-	ETS Lindgren / CETECOM	24 M	-	31.07.2017
489	EMI Test Receiver	ESU40	1000-30	Rohde & Schwarz	12 M	-	30.04.2016
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	30.09.2015
517	relais switch matrix	HF Relais Box Keithley	SE 04	Keithley	pre-m	2	
523	Digital Multimeter	L4411A	MY46000154	Agilent	24 M	-	30.04.2017
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	-	30.04.2016
547	Univ. Radio Communication Tester	CMU 200	835390/014	Rohde & Schwarz	12 M	-	30.04.2016
548	Digital-Barometer	GBP 2300	without	Greisinger GmbH	-	-	
549	Log.Per-Antenna	HL025	1000060	Rohde & Schwarz	36 M	-	31.07.2018
552	high pass filter 2,8-18GHz	WHKX 2.8/18G-10SS	4	Wainwright	12 M	1c	30.09.2015
557	System CTC-OTA-2	R&S TS8991	-	Rohde & Schwarz	12 M	5	30.09.2015
558	System CTC FAR S-VSWR	System CTC FAR S-VSWR	-	CTC	24 M	-	30.09.2015
574	Biconilog Hybrid Antenna	BTA-L	980026L	Frankonia	36/12 M	-	31.03.2016
584	Spectrum Analyzer	FSU 8	100248	Rohde & Schwarz	pre-m	-	
594	Wideband Radio Communication Tester	CMW 500	101757	Rohde & Schwarz	12 M	-	30.04.2016
597	Univ. Radio Communication Tester	CMU 200	100347	Rohde & Schwarz	36 M	-	31.03.2016
598	Spectrum Analyzer	FSEM 30 (Reserve)	831259/013	Rohde & Schwarz	24 M	-	30.04.2017
600	power meter	NRVD (Reserve)	834501/018	Rohde & Schwarz	24 M	-	30.04.2017
601	medium-sensitivity diode sensor	NRV-Z5 (Reserve)	8435323/003	Rohde & Schwarz	24 M	-	30.04.2017
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	-	31.03.2016
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	-	01.12.2015
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	-	30.04.2017
634	Spectrum Analyzer	FSM (HF-Unit)	826188/010	Rohde & Schwarz	pre-m	2	
636	Thermal Imaging camera	Ti32	Ti32-12060213	Fluke Corporation	36 M	-	31.07.2015
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	-	30.04.2016
644	Amplifierer	ZX60-2534M+	SN865701299	Mini-Circuits	-	-	
670	Univ. Radio Communication Tester	CMU 200	106833	Rohde & Schwarz	24 M	-	31.03.2016
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	-	30.04.2016
686	Field Analyzer	EHP-200A	160WX30702	Narda Safety Test Solutions	24 M	-	30.04.2017
687	Signal Generator	SMF 100A	102073	Rohde&Schwarz	12 M	-	30.04.2016
688	Pre Amp	JS-18004000-40-8P	1750117	Miteq	pre-m	-	

Ref.-No.	Equipment	Type	Serial-No.	Manufacturer	Interval of calibration	Remark	Cal due
692	Bluetooth Tester	CBT 32	100236	Rohde & Schwarz	24 M	-	31.03.2016
693	TS8997	CTC-Radio Lab 1_TS8997	-	Rohde&Schwarz	12 M	5	01.05.2015
697	Power Splitter	ZN4PD-642W-S+	165001445	Mini-Circuits	-	2	

8.0.3. 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

9. Versions of test reports (change history)

Version	Applied changes	Date of release
--	Initial release	2015-09-22
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