

TEST REPORT
No.: 15-1-0017001T01a

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

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

for

peiker acustic GmbH & Co. KG

ATM-01 T2-US-4GW

FCC-ID: QWY-ATM-T-622

IC: 6588A-ATMT622

PMN: ATM trunk version

HVIN: ATM-01 T2-US-4GW

Laboratory Accreditation and Listings						
 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			
 AUTHORIZED RF LABORATORY	 ctia Authorized™ Test Lab Lab Code: 20011130-00					
accredited according to DIN EN ISO/IEC 17025						
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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 surveillance tests.

The Equipment Under Test (in this report, hereinafter referred as EUT) supports radiofrequency technologies. Delta tests apply to check for conformance against valid standards due allready approved cellular wireless module V1140-101-1 with FCC-ID: QWY-V1140-101-1 and IC 6588A-V11401011.

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 2015 and Canada RSS-132 Issue 3, RSS-133 Issue 6, RSS-130 Issue 1 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	--	--	Not applicable
2	General field strength emissions (9 kHz - 30 MHz)		§15.209(a)	RSS-Gen, Issue 4: Chapter 8.9, Table 5+6	2400/F(kHz) μ V/m 24000/F(kHz) μ V/m 30 μ V/m	--	--	Not performed, remark 1
7	RF-Power (ERP/EIRP)	Cabinet + inter-connecting cables (radiated)	§2.1046 §22.913(a)(2)	RSS-132, Issue 3: Chapter 5.4 SRSP-503: 5.1.3	< 7 Watt (ERP)	1	1 to 10	Passed calculated with new antenna gain
			§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 §22.917(a)(b)	RSS-Gen., Issue 4 RSS-132: Chapter 5.5(i)(ii)	43+10log(P) dBc	1	1 to 10	passed
9	Band-Edge compliance		§24.238(a)(b)	RSS-133: Chapter 6.5.1(i)(ii)				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	43+10log(P) dBc + Spectrum Mask			

30	RF Power	Antenna terminal (conducted)	§2.1046	--	N/A	2	1 to 10	passed
34	26dB Emission bandwidth		§2.1049(h)	RSS-Gen, Issue 4, Chapter 6.6	26dBc Emissions BW 99% Power			
35	99% Occupied bandwidth							
36	Spurious emissions		§2.1051 §2.1057 §22.917(a)(b) §24.238(a)(b) §27.53(h)	RSS-130, Issue 1, chapter 4.6.1 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	--	--	Remark 1
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			

Remark: 1.) EUT based on already certified cellular module, see original test reports

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.



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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
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2.3. Organizational items

Responsible for test report and project leader:	Dipl.-Ing. C. Lorenz
Receipt of EUT:	2016-01-06
Date(s) of test:	2016-01-07 to 2016-04-22
Date of report:	2016-04-25

Version of template:	13.02

2.4. Applicant's details

Applicant's name:	peiker acoustic GmbH & Co. KG
Address:	Max-Planck-Straße 28-32 61381 Friedrichsdorf Germany
Contact person:	Mr. Martin Fleckenstein

2.5. Manufacturer's details

Manufacturer's name:	see applicant
Address:	

3. Equipment under test (EUT)

3.1. TECHNICAL GSM/GPRS/E-GPRS DATA OF MAIN EUT DECLARED BY APPLICANT

GSM Frequency range (US/Canada -bands)	<input checked="" type="checkbox"/> GSM 850: 824 – 849 MHz (Uplink), 869-894 MHz (Downlink) <input checked="" type="checkbox"/> GSM1900: 1850-1910 MHz (Uplink), 1930-1990 MHz (Downlink)
Type of modulation	<input checked="" type="checkbox"/> GSM,GPRS, GMSK <input checked="" type="checkbox"/> EGPRS-Mode: 8-PSK
Number of channels (USA/Canada -bands)	<input checked="" type="checkbox"/> GSM 850: 128 – 251, 125 channels <input checked="" type="checkbox"/> GSM1900: 512 – 810, 300 channels
Test Channel frequencies	<input checked="" type="checkbox"/> GSM/E-GPRS 850 MHz Band: Channel 128/192/251 <input checked="" type="checkbox"/> GSM/E-GPRS 1900 MHz Band: Channel 512/661/810
Emission designator(s)	See original module's grant:
Antenna Type	<input type="checkbox"/> Integrated (enclosure) <input type="checkbox"/> External - dedicated, no RF- connector <input checked="" type="checkbox"/> External, separate RF-connector FAKRA type
Antenna Gain Tx (main)	<input checked="" type="checkbox"/> Value: +1 dBi / -1.15dB (from corresponding data sheet) <input type="checkbox"/> No information from customer
Antenna Gain Dx (diversity)	<input type="checkbox"/> Not applicable <input checked="" type="checkbox"/> Value: -2dBi (Data sheet from corresponding data sheet) <input type="checkbox"/> No information from customer
Cable loss due vehicle defined usage (2.4m)	704-849 MHz: 1.2dB minimum path loss 1710-1910MHz: 2.16dB minimum path loss
Measured Output Power [dBm]: Conducted GSM 850 Conducted EDGE850	32.0 (PK) 29.2 (PK)
Measured Output Power [dBm]: Radiated GSM 850 Radiated EDGE 850	32.0dBm - 1.15dBd - 1.2dB = 29.65 dBm erp 29.2dBm - 1.15 dBd – 1.2dB = 26.85 dBm erp
Measured Output Power [dBm]: Conducted GSM 1900 Conducted EDGE 1900	29.5 (PK) 28.6 (PK)
Measured Output Power [dBm]: Radiated GSM 1900 Radiated EDGE1900	29.5 dBm +1dBi - 2.16dB = 28.34 dBm eirp 28.6 dBm + 1dBi -2.16dB = 27.44 dBm eirp

3.2. TECHNICAL W-CDMA DATA OF MAIN EUT DECLARED BY APPLICANT

TX-frequency range	<input checked="" type="checkbox"/> FDD Band 2: 1852.4–1907.6 MHz (Uplink), 1930–1990 MHz (Downlink) <input checked="" type="checkbox"/> FDD Band 5: 826.4–846.6 MHz (Uplink), 869–894 MHz (Downlink)
Type of modulation	<input checked="" type="checkbox"/> FDD-Mode Release99: QPSK <input checked="" type="checkbox"/> FDD Mode Release 5+6: 16QAM additional
Number of channels	<input checked="" type="checkbox"/> FDD Band 2: UARFCN range 9262 – 9400 – 9538 <input checked="" type="checkbox"/> FDD Band 5: UARFCN range 4132 – 4183 – 4233
UMTS-HSPA connectivity	<input checked="" type="checkbox"/> Uplink speed: 5.76 Mb/s (category 6) <input type="checkbox"/> Uplink speed:
Emission designator(s)	See original module's grant:
Antenna Type	<input type="checkbox"/> Integrated (enclosure) <input type="checkbox"/> External - dedicated, no RF- connector <input checked="" type="checkbox"/> External, separate RF-connector FAKRA type
Antenna Gain Tx (main)	<input checked="" type="checkbox"/> Value: +1 dBi / -1.15dBd (from corresponding data sheet) <input type="checkbox"/> No information from customer
Antenna Gain Dx (diversity)	<input type="checkbox"/> Not applicable <input checked="" type="checkbox"/> Value: -2dBi (Data sheet from corresponding data sheet) <input type="checkbox"/> No information from customer
Cable loss due vehicle defined usage (2.4m)	704-849 MHz: 1.2dB minimum. Path loss 1710-1910MHz: 2.16dB minimum. Path loss
MAX PEAK Output Power: Radiated	FDD-Mode 2 23.83dBm + 1dBi -2.16 dB (Path Loss cable)= 22.67 dBm eirp FDD-Mode 5 23.24dBm – 1.15dBd - 1.2dB (Path Loss cable) = 20.89 dBm erp
MAX PEAK Output Power: Conducted	FDD-Mode 2 23.83 (AV) dBm FDD-Mode 5 23.24 (AV) dBm

3.3. TECHNICAL LTE 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	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) (Max. Value across all operating bands)	Channel bandwidth	QPSK Modulation:	16-QAM Modulation
	1.4 MHz 3 MHz 5 MHz 10 MHz 15 MHz 20 MHz	See original grant	See original grant
Antenna Gain main TX	<input checked="" type="checkbox"/> Value: +1dBi (-1.15dBd)		
Antenna Gain RX	<input checked="" type="checkbox"/> Value: -2dBi		
Cable loss due vehicle defined usage (2.4m)	704-849 MHz: 1.2dB minimum. Path loss 1710-1910MHz: 2.16dB minimum. Path loss		
MAX average Output Power: Conducted	LTE-Mode 2 LTE-Mode 4 LTE-Mode 5 LTE-Mode 17	Measured: 24.71 (AV) dBm 23.88 (AV) dBm 23.15 (AV) dBm 23.01 (AV) dBm	
MAX PEAK Output Power: radiated	LTE-Mode 2 LTE-Mode 4 LTE-Mode 5 LTE-Mode 17	24.71 dBm + 1.0dBi - 2.16dB = 23.55 dBm eirp 23.88 dBm + 1.0 dBi - 2.16dB = 22.72 dBm eirp 23.15 dBm - 1.15dBd - 1.2dB = 20.80 dBm erp 23.01 dBm - 1.15dBd - 1.2dB = 20.66 dBm erp	
Installed option	<input checked="" type="checkbox"/> GSM 900 and GSM 1800 Bands (not usable in USA/Canada) <input checked="" type="checkbox"/> W-CDMA Band I and Band VIII (not usable in USA/Canada) <input checked="" type="checkbox"/> GPS/GNSS (not tested within this test report)		
Power supply	<input checked="" type="checkbox"/> DC power only: 14.0 V		
Special EMI components	--		
Does EUT contain devices susceptible to magnetic fields, e.g. Hall elements, electrodynamics microphones, etc.?	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no		
EUT sample type	<input type="checkbox"/> Production	<input checked="" type="checkbox"/> Pre-Production	<input type="checkbox"/> Engineering
FCC label attached	<input type="checkbox"/> yes	<input checked="" type="checkbox"/> no	

3.4. 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	Advanced Telecommunication Module (ATM) Trunk Version	ATM-01 T2-US-4GW	IMEI: 35382407-000089-4 S/N: 748740	213.002.002	001.024.047
EUT B	Antenna TRX mounted on Ground plane	Fender antenna from HIRSCHMANN 920325-102 BMW: 9 308 114	--	--	--

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

3.5. 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	Loudspeaker	KL3/4-Ohm	--	--	--
AE 2	Microphone	ME39	--	--	--
AE 3	Antenna DRX	Bumper telephone antenna from Hirschmann 920337-101 BMW: 9 273 669	--	30cm length	--
AE 4	Antenna GPS	Navilock NL-69AT	--	3m length	--
AE 5	Reduced harness	Testing	#1	See chapter 3.1.1 of Annex 5	--
AE 6	RF connection cable	shielded	--	One branch 2.62m length other branch 4m length	--
AE 7	Notebook	Dell D2120	--	--	Windows 7
AE 8	FAKRA-SMA Adapter	--	--	--	--

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

3.6. EUT set-ups

EUT set-up no.*)	Combination of EUT and AE	Remarks
set. 1	EUT A + EUT B + AE1 +AE2 + AE3 + AE4+ AE5 +AE6 + AE7 + (AE8)	Radiated measurements
set. 2	EUT A + EUT B + AE 8 + AE 9	Conducted RF-measurements

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

3.7. GSM/GPRS/E-GPRS EUT operating modes

EUT operating mode no.*)	Description of operating modes	Additional information
op. 1	GRPS 850 Data Traffic channels = 128/192/251	A communication link is established between the mobile station and the test simulator. The transmitter is operated at its maximum rated output power: 33 dBm (power class 4; power control level 5). USF_Duty CYCLE set to 100%, coding scheme CS-1 for GMSK modulation, slot 3 active, uplink gamma: 3 (33 dBm). The input signal to the receiver is modulated with normal test 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.
op. 2	E-GRPS 850 Data Traffic channels = 128/192/251	A communication link is established between the mobile station and the test simulator. The transmitter is operated at its maximum rated output power: 33 dBm (power class 4; power control level 5). USF_Duty CYCLE set to 100%, coding scheme MCS-5 for 8PSK modulation, slot 3 active, uplink gamma: 6 (27dBm). The input signal to the receiver is modulated with normal test 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.
op. 3	GRPS 1900 Data Traffic channels = 512/661/810	A communication link is established between the mobile station and the test simulator. The transmitter is operated at its maximum rated output power: 30 dBm (power class 1; power control level 0). USF_Duty CYCLE set to 100%, coding scheme CS-1 for GMSK modulation, slot 3 active, uplink gamma: 3 (30 dBm). The input signal to the receiver is modulated with normal test 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
op. 4	E-GRPS 1900 Data traffic channels = 512/661/810	A communication link is established between the mobile station and the test simulator. The transmitter is operated at its maximum rated output power: 30 dBm (power class 1; power control level 0). USF_Duty CYCLE set to 100%, coding scheme MCS-5 for 8-PSK modulation, slot 3 active, uplink gamma: 5 (26 dBm). The input signal to the receiver is modulated with normal test 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.

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

3.8. W-CDMA EUT operating modes

EUT operating mode no.*)	Description of operating modes	Additional information
op. 5	FDD-Band 2 12.2 kbps RMC	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: 21 dBm or 24dBm nominal. The input signal to the receiver is modulated with normal test 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 according Table E5.1/Table E5.1A as described in 3GPP TS34.121, Annex E.
op. 6	FDD-Band 5 12.2 kbps RMC	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: 21 dBm or 24dBm nominal. The input signal to the receiver is modulated with normal test 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 according Table E5.1/Table E5.1A as described in 3GPP TS34.121, Annex E.

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

3.9. EUT LTE operating modes

EUT operating mode no.*)	Description of operating modes	Additional information
op. 7	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.
op. 8	LTE-Band 4 RMC Mode	The input signal to the receiver is modulated with normal test modulation: QPSK or 16-QAM Modulation.
op. 9	LTE-Band 5 RMC Mode	The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link.
op. 10	LTE-Band 17 RMC Mode	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.

3.10. Configuration of cables used for testing

Cable number	Item	Type	S/N serial number	HW hardware status	Cable length
Cable 1	Cable harness	--	--	--	2.62m
Cable 2	RF-connection cable	--	--	--	Max. 4m
Cable 3	Loudspeaker cable	--	--	--	1.5m
Cable 4	GPS cable	--	--	--	3m
Cable 5	DC-power cable	--	--	--	2m

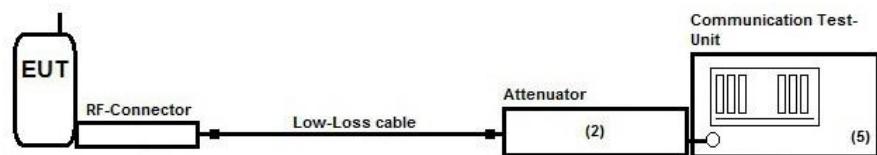
4. Description of test system set-up's

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

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

Tests Specification: Conducted Carrier power, Frequency Error

Schematic: Following test set-up applies 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:
	<input checked="" type="checkbox"/> 20 dB Attenuator (#613) <input checked="" type="checkbox"/> Low loss RF-cables	<input checked="" type="checkbox"/> CMU200 Communication Test-Unit for GSM/W-CDMA <input checked="" type="checkbox"/> DC-Power Supply	See List of equipment under each test case and chapter 8 for calibration info

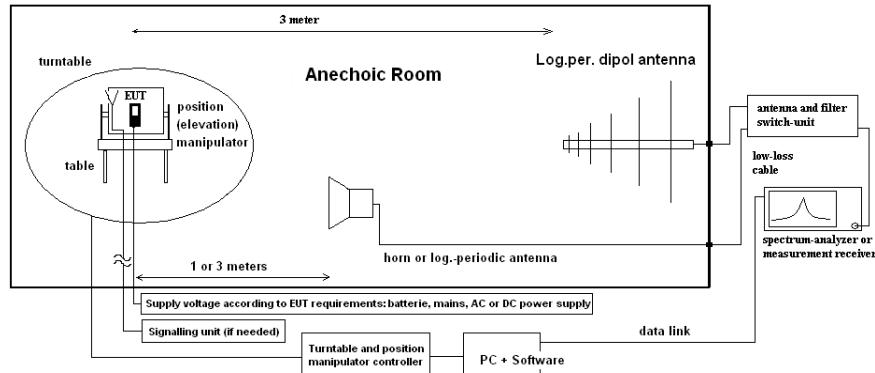
Measurement uncertainty See chapter Measurement Uncertainties (Cel-2)

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:

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

$$E_{C(E)RP} = E_C - 95.2 \text{ dB}$$

$$M = L_T - E_{C(E)RP}$$

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)

$E_{C(E)RP}$ = 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-value (GSM/GPRS/E-GPRS Mode)

5.1.1. Test location and equipments

test location	<input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1)	<input type="checkbox"/> Please see Chapter. 2.2.2			
test site	<input checked="" type="checkbox"/> 347 Radio.lab. 1	<input type="checkbox"/> Radio.lab. 2			
spectr. analys.	<input type="checkbox"/> 584 FSU	<input checked="" type="checkbox"/> 489 ESU 40	<input type="checkbox"/> 264 FSEK	<input type="checkbox"/> 620 ESU 26	
signaling	<input type="checkbox"/> 392 MT8820A	<input checked="" type="checkbox"/> 436 CMU	<input type="checkbox"/> 547 CMU		
otherwise	<input type="checkbox"/> 110 USB LWL				
DC power	<input type="checkbox"/> 456 EA 3013A	<input checked="" type="checkbox"/> 463 HP3245A	<input type="checkbox"/> 459 EA 2032-50	<input type="checkbox"/> 268 EA- 3050	<input type="checkbox"/> 494 AG6632A
otherwise	<input type="checkbox"/> 331 HC 4055	<input checked="" type="checkbox"/> 248 6 dB Att.	<input type="checkbox"/> 529 Power div.	<input checked="" type="checkbox"/> - cable OTA20	<input type="checkbox"/> 498 NGPE 40
line voltage	<input type="checkbox"/> 230 V 50 Hz via public mains		<input type="checkbox"/> 060 120 V/ 60 Hz via PAS 5000		

5.1.2. Requirements and limits

FCC	§2.1046(a)
IC	RSS-132 : 5.4 + SRSP 503 :5.1.3 for GSM 850 RSS-133 4.1/6.4 + SRSP-510 :5.1.2 for GSM 1900
Limit	Maximum conducted output power of the transmitter should be determined while measured on RF output terminal. Limit GSM850: 7 Watt (38.4 dBm) Limit GSM1900: 2 Watt (33.0 dBm) PAPR≤13 dB

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	<p>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.</p> <p>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)</p> <p>Peak and Average Values have been recorded for each channel on test set-up Cel-1. The Peak-to -Average-Power Ratio is determined by devices integrated CCDF capability with corresponding settings. (see annex 1 plots)</p>
Mobile phone settings	<p>A call was established with settings according chapter "Parameter settings on mobile phone and base station CMU200"</p> <p>UE Power should be set to maximum, continuous transmission. DTX or other power saving techniques have been disabled</p> <p>The measurements were made at the low, middle and high carrier frequencies of each of the supported operating band. Choosing three TX-carrier frequencies of the mobile phone, should be sufficient to demonstrate compliance.</p>

5.1.4. Measurement results

Op. Mode 1, Set-up 1

Op. Mode	Carrier Channel		Peak Output Power [dBm]	Average Output Power [dBm]	PAPR-Ratio on 0.1% probability [dB]	Peak power Limit [dBm]	PAPR-Limit [dB]	Result
	Range	No.						
GSM 850	Low	128	32.0	31.9	Remark 1	38.4	13	Passed
	Middle	192	31.9	31.8				
	High	251	31.7	31.6				

Remark: 1.) see original reports of Cellular Module

Op. Mode 2, Set-up 1

Op. Mode	Carrier Channel		Peak Output Power [dBm]	Average Output Power [dBm]	PAPR-Ratio on 0.1% probability [dB]	Peak power Limit [dBm]	PAPR-Limit [dB]	Result
	Range	No.						
E-GPRS 850	Low	128	29.2	26.0	Remark 1	38.4	13	Passed
	Middle	192	29.2	25.9				
	High	251	29.1	25.8				

Remark: 1.) see original reports of Cellular Module

Op. Mode 3, Set-up 1

Op. Mode	Carrier Channel		Peak Output Power [dBm]	Average Output Power [dBm]	PAPR-Ratio on 0.1% probability [dB]	Peak power Limit [dBm]	PAPR-Limit [dB]	Result
	Range	No.						
GSM 1900	Low	512	29.5	29.4	Remark 1	38.4	13	Passed
	Middle	661	29.3	29.2				
	High	810	29.5	29.4				

Remark: 1.) see original reports of Cellular Module

Op. Mode 4, Set-up 1

Op. Mode	Carrier Channel		Peak Output Power [dBm]	Average Output Power [dBm]	PAPR-Ratio on 0.1% probability [dB]	Peak power Limit [dBm]	PAPR-Limit [dB]	Result
	Range	No.						
E-GPRS 1900	Low	512	28.6	25.6	Remark 1	33.0	13	Passed
	Middle	661	28.5	25.4				
	High	810	28.5	25.3				

Remark: 1.) see original reports of Cellular Module

5.2. RF-Parameter - RF Peak power output conducted and PAPR-Value (W-CDMA Mode)

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

test location	<input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1)	<input type="checkbox"/> Please see Chapter. 2.2.2				
test site	<input type="checkbox"/> 347 Radio.lab. 1	<input checked="" type="checkbox"/> Radio.lab. 2				
spectr. analys.	<input type="checkbox"/> 584 FSU	<input type="checkbox"/> 489 ESU 40	<input type="checkbox"/> 264 FSEK	<input type="checkbox"/> 620 ESU 26		
signaling	<input type="checkbox"/> 392 MT8820A	<input type="checkbox"/> 436 CMU	<input type="checkbox"/> 547 CMU	<input type="checkbox"/> 460 CMU		
otherwise	<input type="checkbox"/> 400 FTC40x15E	<input type="checkbox"/> 401 FTC40x15E	<input type="checkbox"/> 110 USB LWL	<input type="checkbox"/> 482 Filter Matrix	<input type="checkbox"/> 378 RadiSense	
DC power	<input checked="" type="checkbox"/> 611 E3636A	<input type="checkbox"/> 463 HP3245A	<input type="checkbox"/> 459 EA 2032-50	<input type="checkbox"/> 268 EA- 3050	<input type="checkbox"/> 494 AG6632A	<input type="checkbox"/> 498 NGPE 40
otherwise	<input type="checkbox"/> 331 HC 4055	<input type="checkbox"/> 248 6 dB Att.	<input type="checkbox"/> 529 Power div.	<input type="checkbox"/> - cable OTA20		
line voltage	<input type="checkbox"/> 230 V 50 Hz via public mains		<input type="checkbox"/> 060 110 V/ 60 Hz via PAS 5000			

5.2.2. Requirements and limits

FCC	<input checked="" type="checkbox"/> § 2.1046 <input checked="" type="checkbox"/> §22.913(a)(2) <input checked="" type="checkbox"/> § 24.232(c) <input type="checkbox"/> § 27.50(d)(4)
IC	<input checked="" type="checkbox"/> RSS-132, Issue 3: 5.4 + SRSP 503:5.1.3 <input checked="" type="checkbox"/> RSS-133, Issue 6: 4.1/6.4 + SRSP-510:5.1.2 <input type="checkbox"/> RSS-139, Issue 3: 6.5
KDB	971168 D01 v02r02, October 2014
Limits	<p>Maximum Power Output of the wireless device should be determined while measured radiated E(I)RP</p> <p><input checked="" type="checkbox"/> Limit FDD Band 5: 7 Watt ERP (38.4 dBm)</p> <p><input checked="" type="checkbox"/> Limit FDD Band 2: 2 Watt EIRP (33.0 dBm)</p> <p><input type="checkbox"/> Limit FDD Band 4: 1 Watt EIRP (30.0 dBm)</p> <p>PAPR \leq 13dB</p>

5.2.3. Test condition and test set-up

Climatic conditions	Temperature: (22 \pm 3°C)	Rel. humidity: (40 \pm 20)%
Test system set-up	Please see chapter "Test system set-up for conducted measurements on antenna port" ANRITSU	
Measurement method	<p>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.</p> <p>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)</p> <p>Peak and Average Values have been recorded for each channel on test set-up Cel-1. The Peak-to -Average-Power Ratio is determined by devices integrated CCDF capability with corresponding settings. (see annex 1 plots)</p>	
EUT settings	<p>A call was established on highest power transmit conditions in GMSK and RMC99 mode.</p> <p>UE is set TX mode, highest transmit power conditions, DTX, MPR or other power saving techniques have been disabled</p> <p>The measurements were made at the low, middle and high carrier frequencies of each of the supported operating band. Choosing three TX-carrier frequencies of the wireless device, should be sufficient to demonstrate compliance.</p>	

5.2.4. Measurement Results

FDD Band 2								
EUT	Set-up 1, Op. Mode 1							
Test case	Power value [dBm]						Limit [dBm]	Result
	UARFCN no. 9262	UARFCN no. 9400	UARFCN no. 9538	PK	AV	PK		
	Release 99 12.2kbps RMC	27.18	23.83	26.98	23.54	26.56	23.60	33
Peak-to-Average power ratio on 0.1% probability [dB]	Remark 1						13	Passed

1.) Remark: see original reports of Cellular Module

FDD Band 5								
EUT	Set-up 1, Op. Mode 3							
Test case	Power value [dBm]						Limit [dBm]	Result
	UARFCN no. 4132	UARFCN no. 4183	UARFCN no. 4233	PK	AV	PK		
	Release 99 12.2kbps RMC	26.51	22.88	26.55	22.95	26.77	23.24	38.4
Peak-to Average ratio [dB]	Remark 1						13	Passed

2.) see original reports of Cellular Module

5.3. RF-Parameter - RF Peak power output conducted and PAPR (LTE – Mode)

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

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

5.3.2. 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 \leq 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)

5.3.3. Test condition and test set-up

Climatic conditions	Temperature: (22 \pm 3°C)	Rel. humidity: (40 \pm 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.	

5.3.4. Power results

5.3.4.1. LTE Band 2 Results

Signal-BW	LTE Band 2			
	QPSK		16-QAM	
	RMS	PEAK	RMS	PEAK
1.4	23,75	29,06	23,19	28,92
3	24,65	29,13	24,22	29,07
5	24,71	29,03	23,79	28,91
10	24,07	29,38	23,58	29,01
15	24,05	29,03	23,66	29,43
20	24,02	28,92	23,49	28,82

LTE Band 2			
QPSK		16-QAM	
RMS	PEAK	RMS	PEAK
24,71	29,38	24,22	29,43

5.3.4.2. LTE Band 4 Results

Signal-BW	LTE Band 4			
	QPSK		16-QAM	
	RMS	PEAK	RMS	PEAK
1.4	23,88	28,92	23,05	28,95
3	23,74	28,88	23,21	28,80
5	23,75	28,73	23,31	28,87
10	23,45	28,70	22,98	28,91
15	23,54	29,02	22,69	28,96
20	23,48	28,92	22,97	29,05

LTE Band 4			
QPSK		16-QAM	
RMS	PEAK	RMS	PEAK
23,88	29,02	23,31	29,05

5.3.4.3. LTE Band 5 Results

Signal-BW	LTE Band 5			
	QPSK		16-QAM	
	RMS	PEAK	RMS	PEAK
1.4	23,15	29,59	22,63	30,04
3	23,03	29,40	22,59	29,66
5	23,09	29,25	22,57	29,64
10	23,12	29,22	22,80	29,40

LTE Band 5			
QPSK		16-QAM	
RMS	PEAK	RMS	PEAK
23,15	29,59	22,80	30,04

5.3.4.4. LTE Band 17 Results

Signal-BW	LTE Band 17			
	QPSK		16-QAM	
	RMS	PEAK	RMS	PEAK
5	23,01	29,18	22,37	29,47
10	23,00	29,29	22,53	29,33

LTE Band 17			
QPSK		16-QAM	
RMS	PEAK	RMS	PEAK
23,01	29,29	22,53	29,47

5.3.5. PAPR results

5.3.5.1. 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	<p>The measurements were performed with the integrated power measurement function of the „radio communication tester CMW500 from Rohde&Schwarz company.</p> <p>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)</p> <p>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.</p>	
Mobile phone settings	<p>A call was established with a suitable communication test unit (CMW500).</p> <p>UE is set TX mode, highest transmit power conditions (RMC-mode), power saving techniques have been disabled (MPR-techniques)</p> <p>Tests have been performed in different EUT bandwidth settings and various settings for allocated RBs.</p>	

5.3.5.2. 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		
Signal-Bandwidth / [MHz]	Max. PAPR Max. PAPR level with 0.1% probability / [dB]	
	QPSK Modulation	16-QAM Modulation
1.4		
3.0		
5.0		
10		
15		
20		

see original reports of Cellular Module

Remark:

LTE Band 4		
Signal-Bandwidth / [MHz]	Max. PAPR level with 0.1% probability / [dB]	
	QPSK Modulation	16-QAM Modulation
1.4		
3.0		
5.0		
10		
15		
20		

see original reports of Cellular Module

Remark:

LTE Band 5			
Signal-Bandwidth / [MHz]	Max. PAPR level with 0.1% probability / [dB]		
	QPSK Modulation	16-QAM Modulation	
	1.4	see original reports of Cellular Module	
	3.0		
	5.0		
	10		

Remark:

LTE Band 17			
Signal-Bandwidth / [MHz]	Max. PAPR level with 0.1% probability / [dB]		
	QPSK Modulation	16-QAM Modulation	
	5.0	see original reports of Cellular Module	
	10		

Remark:

5.3.5.3. Conclusion

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

5.4. RF-Parameter - Radiated out of Band RF emissions and Band Edge (GSM/GPRS/E-GPRS Mode)

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

test location	<input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1)	<input type="checkbox"/> Please see Chapter. 2.2.2	<input type="checkbox"/> Please see Chapter. 2.2.3
test site	<input type="checkbox"/> 441 EMI SAR	<input checked="" type="checkbox"/> 487 SAR NSA	<input checked="" type="checkbox"/> 443 FAR
receiver	<input type="checkbox"/> 377 ESCS30	<input type="checkbox"/> 001 ESS	<input type="checkbox"/> 489 ESU 40
spectr. analys.	<input type="checkbox"/> 584 FSU	<input type="checkbox"/> 120 FSEM	<input checked="" type="checkbox"/> 264 FSEK
antenna	<input checked="" type="checkbox"/> 439 HL 562	<input checked="" type="checkbox"/> 549 HL 025	<input type="checkbox"/> 302 BBHA9170
signaling	<input type="checkbox"/> 017 CMD 65	<input type="checkbox"/> 323 CMD 55	<input type="checkbox"/> 340 CMD 55
signaling	<input type="checkbox"/> 392 MT8820A	<input checked="" type="checkbox"/> 546 CMU	<input type="checkbox"/> 547 CMU
power supply	<input type="checkbox"/> 463 HP3245A	<input checked="" type="checkbox"/> 457 EA 3013A	<input type="checkbox"/> 459 EA 2032-50
otherwise	<input type="checkbox"/> 529 6dB divider	<input type="checkbox"/> 530 6dB Att.	<input type="checkbox"/> 268 EA- 3050
line voltage	<input type="checkbox"/> 230 V 50 Hz via public mains	<input type="checkbox"/> 060 120 V/ 60 Hz via PAS 5000	<input type="checkbox"/> 494 AG6632A
			<input type="checkbox"/> 498 NGPE 40

5.4.2. Requirements and limits (Variante RF-Parameter)

FCC	<input checked="" type="checkbox"/> Part 2.1053(a), Part2.1057(a)(1) <input checked="" type="checkbox"/> Part 22 Subpart H, §22.917(a)(b) <input checked="" type="checkbox"/> Part 24 Subpart E, §24.238(a)(b)
IC	<input checked="" type="checkbox"/> RSS-132, Issue 3: 5.5(i)(ii) <input checked="" type="checkbox"/> RSS-133, Issue 6: 6.5.1(i)(ii)
Limit	§22.917(a) & §24.238(a): “The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB” Limit: -13dBm for all Power Control Levels of the cellular equipment

5.4.3. Test condition and test set-up

link to test system (if used):	<input checked="" type="checkbox"/> air link	<input type="checkbox"/> cable connection	
EUT-grounding	<input checked="" type="checkbox"/> none	<input type="checkbox"/> with power supply	<input type="checkbox"/> additional connection
Equipment set up	<input checked="" type="checkbox"/> table top	<input type="checkbox"/> 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”		
Measurement method	<p>“§ 2.1057 Frequency spectrum to be investigated. (a) In all of the measurements set forth in § 2.1051 and 2.1053, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz”</p> <p>The spectrum was scanned from 9 kHz (depend on the equipment, s. §2.1057) to the 10th harmonic of the highest frequency generated within the equipment. A PEAK detector was used except measurements near the block-edge where a AVERAGE detector applied.</p> <p>According chapter “Test system set-up for electric field measurement in the range 30-1000MHz and 1 to 40GHz” and additionally: the readings on the spectrum analyzer are corrected with annually performed chamber path calibration values 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.</p>		
EUT settings	<p>A call was established with settings according chapter “Parameter settings on mobile phone and base station CMU200”</p> <p>The UE and used accessories (if any used) were set to work according their intended use/specification stated as by the applicant</p> <p>The measurements were made at the low, middle and high carrier frequencies of each of the supported operating band. Choosing three TX-carrier frequencies of the wireless device, should be sufficient to demonstrate compliance.</p>		

Spectrum-Analyzer settings for GSM/GPRS/E-GPRS 850 Mode

Sweep no.	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	1	10	10	MaxH-PK
Sweep 2 (subrange 2)	1000	2800	1	1	15	10	MaxH-PK
Sweep 3 (subrange 3)	2800	9000	1	1	60	10	MaxH-PK
Sweep 4a (Band-Edge)	823	824	0.003	0.01	30	10	MaxH-PK
Sweep 4b (Band-Edge)	849	850	0.003	0.01	30	10	MaxH-PK

Spectrum-analyzer settings for GSM/GPRS/E-GPRS 1900 Mode

Sweep no.	Start freq. MHz	Stop freq. MHz	R-BW MHz	V-BW MHz	Sweep time sec.	Att.	Detector
Sweep 1 (subrange 1)	30	1000	1	1	10	10	MaxH-PK
Sweep 2 (subrange 2)	1000	2800	1	1	15	10	MaxH-PK
Sweep 3 (subrange 3)	2800	20000	1	1	160	10	MaxH-PK
Sweep 4a (Band-Edge)	1849	1850	0.003	0.01	30	10	MaxH-PK
Sweep 4b (Band-Edge)	1910	1911	0.003	0.01	30	10	MaxH-AV

5.4.4. Measurement results

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

5.4.4.1. Band 850 GRPS/GSM

Diagram no.	Carrier Channel		Frequency range	OP-mode no.	Remark	Used detector			Result
	Range	No.				PK	AV	QP	
8.04_Ch128	Low	128	30 MHz – 9 GHz	GPRS	Carrier on diagram, not relevant for result External antenna used	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.03_Ch128	Low		823 – 824 MHz		External antenna used	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
--	Middle	192	--	Voice	--	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	--
8.03_Ch251	High		30 MHz – 9 GHz		Carrier on diagram, not relevant for result Internal antenna used	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.02_Ch251	High	251	849 – 850 MHz	Voice	Internal antenna used	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed

Remark: Low and high channels tested, active antennas ex-changed between channels

5.4.4.2. GPRS 1900

Diagram no.	Carrier Channel		Frequency range	OP-mode no.	Remark	Used detector			Result
	Range	No.				PK	AV	QP	
8.13_Ch512	Low	512	30 MHz – 19.5 GHz	GPRS	Carrier on diagram, not relevant for result External antenna used	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.09_Ch810	Low		1849 – 1850 MHz	GPRS	External antenna used	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
--	Middle	--	30 MHz – 18 GHz	--	--	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	--
8.12a_Ch810	High	810	30 MHz – 2.8 GHz	Voice	Carrier on diagram, not relevant for result Internal antenna used	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
8.12b_Ch810			2.8 – 19.5 GHz	Voice	Internal antenna used				
9.08_Ch810	High		1910 – 1911 MHz	Voice	Internal antenna used	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed

Remark: Low and high channels tested, active antennas ex-changed between channels

5.5. RF-Parameter - Radiated out of Band RF emissions and Band Edge (W-CDMA – Mode)

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

test location	<input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1)	<input type="checkbox"/> Please see Chapter. 2.2.2	<input type="checkbox"/> Please see Chapter. 2.2.3
test site	<input type="checkbox"/> 441 EMI SAR	<input type="checkbox"/> 487 SAR NSA	<input checked="" type="checkbox"/> 443 FAR
receiver	<input type="checkbox"/> 377 ESCS30	<input type="checkbox"/> 001 ESS	<input type="checkbox"/> 489 ESU 40
spectr. analys.	<input type="checkbox"/> 584 FSU	<input type="checkbox"/> 120 FSEM	<input checked="" type="checkbox"/> 264 FSEK
antenna	<input checked="" type="checkbox"/> 439 HL 562	<input checked="" type="checkbox"/> 549 HL 025	<input type="checkbox"/> 302 BBHA9170
signaling	<input type="checkbox"/> 017 CMD 65	<input type="checkbox"/> 323 CMD 55	<input type="checkbox"/> 340 CMD 55
signaling	<input type="checkbox"/> 392 MT8820A	<input checked="" type="checkbox"/> 546 CMU	<input type="checkbox"/> 547 CMU
power supply	<input type="checkbox"/> 611 E3636A	<input checked="" type="checkbox"/> 457 EA 3013A	<input type="checkbox"/> 459 EA 2032-50
otherwise	<input type="checkbox"/> 529 6dB divider	<input type="checkbox"/> 530 6dB Att.	<input type="checkbox"/> 110 USB LWL
line voltage	<input type="checkbox"/> 230 V 50 Hz via public mains	<input type="checkbox"/> 060 110 V/ 60 Hz via PAS 5000	<input type="checkbox"/> 482 Filter Matrix
			<input type="checkbox"/> 494 AG6632A
			<input type="checkbox"/> 498 NGPE 40
			<input type="checkbox"/> 477 GPS
			<input type="checkbox"/> 030 HFH-Z2
			<input type="checkbox"/> 431 Near field

5.5.2. Requirements and limits

FCC	General: §2.1053(a) , §2.1057(a) <input checked="" type="checkbox"/> FDD Band 5: Part 22: §22.917(a)(b) <input checked="" type="checkbox"/> FDD Band 2: Part 24: §24.238(a)(b) <input type="checkbox"/> FDD Band 4: Part 27: §27.53(h)
IC	<input checked="" type="checkbox"/> FDD Band 5: RSS-132, Issue 3: 5.5(i)(ii) <input checked="" type="checkbox"/> FDD Band 2: RSS-133, Issue 6: 6.5.1(i)(ii) <input type="checkbox"/> FDD Band 4: 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

5.5.3. Test condition and test set-up

link to test system (if used):	<input checked="" type="checkbox"/> air link	<input type="checkbox"/> cable connection	<input type="checkbox"/>
EUT-grounding	<input checked="" type="checkbox"/> none	<input type="checkbox"/> with power supply	<input type="checkbox"/> additional connection
Equipment set up	<input checked="" type="checkbox"/> table top	<input type="checkbox"/>	<input type="checkbox"/> floor standing
Climatic conditions	Temperature: (22±3°C)		
Test system set-up	Please see chapter "Test system set-up for radiated spurious emission measurements up to 20 GHz"		
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 for critical measurements. According chapter 4.2		
EUT settings	A call was established on highest power transmit conditions in RMC99 mode. The measurements were made at the low, middle and high carrier frequencies of each of the supported operating band. Choosing three TX-carrier frequencies of the wireless device, should be sufficient to demonstrate compliance.		

Spectrum-Analyzer settings for FDD 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	1	10	10	MaxH-PK
Sweep 1 (subrange 2)	1000	2800	1	1	15	0	MaxH-PK
Sweep 1 (subrange 3)	2800	20000	1	1	60	10	MaxH-PK
Sweep 2a (Band-Edge)	1849	1850			30	35	MaxH-PK
Sweep 2b (Band-Edge)	1849	1850			30	35	MaxH-AV
Sweep 3a (Band-Edge)	1910	1911			30	35	MaxH-PK
Sweep 3b (Band-Edge)	1910	1911			30	35	MaxH-AV

Spectrum-analyzer settings for FDD 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	1	10	10	MaxH-PK
Sweep 1 (subrange 2)	1000	2800	1	1	15	0	MaxH-PK
Sweep 1 (subrange 3)	2800	12000	1	1	160	10	MaxH-PK
Sweep 2a (Band-Edge)	823	824			30	35	MaxH-PK
Sweep 2b (Band-Edge)	823	824			30	35	MaxH-AV
Sweep 3a (Band-Edge)	850	851			30	35	MaxH-PK
Sweep 3b (Band-Edge)	850	851			30	35	MaxH-AV

5.5.4. Results

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

5.5.4.1. FDD Band 2

Dia-gram no.	Carrier Channel		Frequency range	OP-mode no.	Remark	Used detector			Result
	Range	No.				PK	AV	QP	
8.23_Ch9262	Low	9262	30 MHz to 19.5 GHz	5	Carrier visible on diagram. Not relevant for results External antenna used	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
9.22_Ch9262	Low		1849 – 1850 MHz		External antenna used	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
--	Middle		30 MHz to 18 GHz		--	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	--
8.22_Ch9538	High		30 MHz to 20 GHz		Carrier visible on diagram. Not relevant for results Internal antenna used	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.21_Ch9538	High		1910 – 1911 MHz		Internal antenna used	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed

Remark: Low and high channels tested, active antennas ex-changed between channels

5.5.4.2. FDD Band 5

Dia-gram no.	Carrier Channel		Frequency range	OP-mode no.	Remark	Used detector			Result
	Range	No.				PK	AV	QP	
8.53_Ch4132	Low	4132	30 MHz to 9 GHz	6	Carrier visible on diagram. Not relevant for results External antenna used	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
9.52_Ch4132	Low		823 – 824 MHz		External antenna used	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
--	Middle		--		--	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	--
8.52_Ch4233	High		30 MHz to 9 GHz		Carrier visible on diagram. Not relevant for results Internal antenna used	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
9.51_Ch4233	High		849 – 850 MHz		Internal antenna used	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed

Remark: Low and high channels tested, active antennas ex-changed between channels

5.6. RF-Parameter - Radiated out of Band RF emissions and Band Edge (LTE - Mode)

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

test location	<input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1)	<input type="checkbox"/> Please see Chapter. 2.2.2	<input type="checkbox"/> Please see Chapter. 2.2.3
test site	<input type="checkbox"/> 441 EMI SAR	<input type="checkbox"/> 487 SAR NSA	<input checked="" type="checkbox"/> 443 FAR
receiver	<input type="checkbox"/> 377 ESCS30	<input type="checkbox"/> 001 ESS	<input type="checkbox"/> 347 Radio.lab.1
spectr. analys.	<input type="checkbox"/> 584 FSU	<input type="checkbox"/> 120 FSEM	<input checked="" type="checkbox"/> 264 FSEK
antenna	<input checked="" type="checkbox"/> 608 HL 562	<input checked="" type="checkbox"/> 549 HL 025	<input type="checkbox"/> 302 BBHA9170
signaling	<input type="checkbox"/> 017 CMD 65	<input type="checkbox"/> 323 CMD 55	<input type="checkbox"/> 340 CMD 55
signaling	<input type="checkbox"/> 392 MT8820A	<input type="checkbox"/> 546 CMU	<input checked="" type="checkbox"/> 547 CMU
power supply	<input checked="" type="checkbox"/> 611 E3632A	<input type="checkbox"/> 457 EA 3013A	<input type="checkbox"/> 459 EA 2032-50
otherwise	<input type="checkbox"/> 529 6dB divider	<input type="checkbox"/> 530 6dB Att.	<input type="checkbox"/> 110 USB LWL
line voltage	<input type="checkbox"/> 230 V 50 Hz via public mains	<input checked="" type="checkbox"/> 060 110 V/ 60 Hz via PAS 5000	<input type="checkbox"/> 482 Filter Matrix
			<input type="checkbox"/> 431 Near field

5.6.2. Requirements and limits

FCC	General: §2.1053(a) , §2.1057(a) <input checked="" type="checkbox"/> LTE Band 5: Part 22: §22.917(a)(b) <input checked="" type="checkbox"/> LTE Band 2: Part 24: §24.238(a)(b) <input checked="" type="checkbox"/> LTE Band 4: Part 27: §27.53(h) <input checked="" type="checkbox"/> LTE Band 17: Part 27: §27.53(g)
IC	<input checked="" type="checkbox"/> FDD Band 5: RSS-132, Issue 3: 5.5(i)(ii) <input checked="" type="checkbox"/> FDD Band 2: RSS-133, Issue 6: 6.5.1(i)(ii) <input checked="" type="checkbox"/> FDD Band 4: RSS-139, Issue 3: 6.6 (i)(ii) <input checked="" type="checkbox"/> 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 $43+10\log(P)$ dB“ -> Resulting limits for all power levels of the Mobile Phone: -13dBm

5.6.3. Test condition and test set-up

link to test system (if used):	<input checked="" type="checkbox"/> air link	<input type="checkbox"/> cable connection	<input type="checkbox"/>		
EUT-grounding	<input checked="" type="checkbox"/> none	<input type="checkbox"/> with power supply	<input type="checkbox"/> additional connection		
Equipment set up	<input checked="" type="checkbox"/> table top	<input type="checkbox"/> floor standing			
Climatic conditions	Temperature: $(22\pm3^\circ\text{C})$	Rel. humidity: $(40\pm20)\%$			
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 resource 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	0.2	1	30	35	MaxH-PK
Sweep 2b (Band-Edge)	1849	1850			30	35	MaxH-AV
Sweep 3a (Band-Edge)	1910	1911			30	35	MaxH-PK
Sweep 3b (Band-Edge)	1910	1911			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	0.2	0.3	30	35	MaxH-PK
Sweep 2b (Band-Edge)	1709	1710			30	35	MaxH-AV
Sweep 3a (Band-Edge)	1755	1756			30	35	MaxH-PK
Sweep 3b (Band-Edge)	1755	1756			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	0.1	0.3	30	35	MaxH-PK
Sweep 2b (Band-Edge)	823	824			30	35	MaxH-AV
Sweep 3a (Band-Edge)	850	851			30	35	MaxH-PK
Sweep 3b (Band-Edge)	850	851			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 3a (Band-Edge)	716	717	50	300	30	35	MaxH-PK, Signal- BW=5MHz

5.6.4. Results

The results are presented below in summary form only. Measurements have been performed with both possible modulations QPSK and 16-QAM. Also the allocated RB's were varied between minimum 1RB and 100%RBs over the LTE-signal bandwidth in order to search for worst-case mode.

For more information please see the diagrams enclosed in annex 1.

5.6.4.1. LTE Band 2

Dia-gram no.	Carrier Channel		Frequency range	OP-mode no.	Remark	Used detector			Result
	Range	No.				PK	AV	QP	
8.20_Ch18607	Low	18607	30 MHz to 19.5 GHz		Carrier visible on diagram. Not relevant for results external antenna used	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
9.20a_Ch18607	Low	18650	1849 – 1850 MHz		1RB low QPSK modulation external antenna used Worst-case value:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
9.20b_Ch18607	Low	18650	1849 – 1850 MHz		1RB low QAM modulation external antenna used Worst-case value:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
9.21a_Ch18607	Low	18650	1849 – 1850 MHz		6RBs QPSK modulation external antenna used Worst-case value:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
9.21b_Ch18607	Low	18650	1849 – 1850 MHz		6RBs QAM modulation external antenna used Worst-case value:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
--	Middle	18900	--	--	--	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	--
8.22	High	19193	30 MHz to 19.5 GHz		Carrier visible on diagram. Not relevant for results Internal antenna used	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
9.22a_Ch19193	High	19607	1910 – 1911 MHz		1RB low QPSK modulation internal antenna used	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.22b_Ch19193	High	19150	1910 – 1911 MHz		1RB low QAM modulation internal antenna used	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.23_Ch19193	High	19607	1910 – 1911 MHz		6RBs QPSK modulation internal antenna used	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.23b_Ch19193	High	19150	1910 – 1911 MHz		6RBs QAM modulation internal antenna used	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed

Remark1: A signal bandwidth of 1.4MHz was chosen for the tests

5.6.4.2. LTE Band 4

Dia-gram no.	Carrier Channel Range	Frequency range	OP-mode no.	Remark	Used detector			Result	
					PK	AV	QP		
8.40 Ch19957	Low	19957	30 MHz to 2.8 GHz		Carrier visible on diagram. Not relevant for results QPSK modulation	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
9.40 Ch19957		19957	1709 - 1710 MHz		1RB low, QPSK modulation External antenna Worst/Case value	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
9.40b Ch19957		19957	1709 - 1710 MHz		1RB low, 16-QAM modulation External antenna Worst/Case value	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
9.41a Ch19957		19957	1709 - 1710 MHz		6RBs, QPSK modulation, External antenna	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.41b Ch19957		19957	1709 - 1710 MHz		6RBs, QAM modulation, External antenna	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
--	Middle	20175	--	--	--	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	--
8.42	High	20393	30 MHz to 18 GHz		Carrier visible on diagram. Not relevant for results	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
9.42a Ch20393		20393	1709 - 1710 MHz		1RB high, QPSK modulation Internal antenna Worst/Case value	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
9.42b Ch20393		20393	1709 - 1710 MHz		1RB high, 16-QAM modulation Internal antenna Worst/Case value	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
9.43a Ch20393		20393	1709 - 1710 MHz		6RBs, QPSK modulation, Internal antenna	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.43b Ch20393		20393	1709 - 1710 MHz		6RBs, QAM modulation, Internal antenna	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed

Remark1: A signal bandwidth of 1.4MHz was chosen for the tests

5.6.4.3. LTE Band 5>

Dia-gram no.	Carrier Channel		Frequency range	OP-mode no.	Remark	Used detector			Result
	Range	No.				PK	AV	QP	
8.50 Ch20407	Low	20407	30 MHz to 9 GHz		Carrier visible on diagram. Not relevant for results External antenna	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
9.500a Ch20407	Low	20407	823 – 824 MHz		1RB low, QPSK modulation External antenna	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.500b Ch20407	Low	20407	823 – 824 MHz		1RB low 16-QAM modulation External antenna	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
9.501a Ch20407	Low	20407	823 – 824 MHz		6RBs, QPSK Modulation External antenna	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
9.501b Ch20407	Low	20407	823 – 824 MHz		6RBS, QAM modulation External antenna	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
--	Middle	20525	--	--	--	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	--
8.52 Ch20643	High	20643	30 MHz to 9 GHz		Carrier visible on diagram. Not relevant for results Internal antenna	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
9.502a Ch20643	High	20643	849 - 850 MHz		1RB high, QPSK modulation Internal antenna	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.502b Ch20643	High	20643	849 - 850 MHz		1RB high 16-QAM modulation Internal antenna	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.503a Ch20643	High	20643	849 - 850 MHz		6RBs, QPSK Modulation Internal antenna	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.503b Ch20643	High	20643	849 - 850 MHz		6RBS, QAM modulation Internal antenna	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed

Remark: A LTE signal bandwidth of 1.4MHz was chosen for the tests

5.6.4.4. LTE Band 17>

Dia-gram no.	Carrier Channel Range	No.	Frequency range	OP-mode no.	Remark	Used detector			Result
						PK	AV	QP	
8.171	Low	23737	30 MHz to 9 GHz		Carrier visible on diagram. Not relevant for results External antenna	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.1701a	Low	23755	703 - 704 MHz		Band Edge Compliance 1RB low, QPSK modulation External antenna	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.1701b	Low	23755	703 - 704 MHz		Band Edge Compliance 1RB low, 16-QAM modulation, External antenna	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.1702a	Low	23755	703 - 704 MHz		Band Edge Compliance 6RBs, QPSK modulation External antenna	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.1702b	Low	23755	703 - 704 MHz		Band Edge Compliance 6RBs, 16-QAM modulation, External antenna				
--	Middle	23790	--	--	--	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	--
8.173	High	23843	30 MHz to 9 GHz		Carrier visible on diagram. Not relevant for results	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.1704a	High	23825	716 – 717 MHz		Band Edge Compliance 1RB high, QPSK modulation Internal antenna	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.1704b	High	23825	716 – 717 MHz		Band Edge Compliance 1RB high, 16-QAM modulation Internal antenna	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.1704a	High	23825	716 – 717 MHz		Band Edge Compliance 6RBs, QPSK modulation Internal antenna	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.1704b	High	23825	716 – 717 MHz		Band Edge Compliance 6RBs, 16-QAM modulation Internal antenna	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed

Remark: A LTE signal bandwidth of 5MHz was chosen for the tests

5.7. 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	5.0 dB						Magnetic field E-field Substitution	
		30 MHz - 1 GHz	4.2 dB							
		1 GHz - 20 GHz	3.17 dB							

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-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	Eeprom 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= μ P1=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	-	31.05.2016
005	AC - LISN (50 Ohm/50µH, test site 1)	ESH2-Z5	861741/005	Rohde & Schwarz	12 M	-	31.05.2016
007	Single-Line V-Network (50 Ohm/5µH)	ESH3-Z6	892563/002	Rohde & Schwarz	12 M	-	31.05.2016
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	-	31.05.2016
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	
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	-	31.05.2016
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	-	31.05.2016
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	-	31.05.2016
262	Power Meter	NRV-S	825770/0010	Rohde & Schwarz	24 M	-	31.05.2016
263	Signal Generator	SMP 04	826190/0007	Rohde & Schwarz	36 M	-	31.05.2016
264	Spectrum Analyzer	FSEK 30	826939/005	Rohde & Schwarz	12 M	-	31.05.2016
265	peak power sensor	NRV-Z33, Model 04	840414/009	Rohde & Schwarz	24 M	-	31.05.2016
266	Peak Power Sensor	NRV-Z31, Model 04	843383/016	Rohde & Schwarz	24 M	-	31.05.2016
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	
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	-	31.05.2016
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	-	31.05.2016
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	-	31.05.2016
357	power sensor	NRV-Z1	861761/002	Rohde & Schwarz	24 M	-	30.04.2017
371	Bluetooth Tester	CBT32	100153	R&S	24 M	-	31.05.2016
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	-	31.05.2016
389	Digital Multimeter	Keithley 2000	0583926	Keithley	24 M	-	30.04.2017
392	Radio Communication Tester	MT8820A	6K00000788	Anritsu	12 M	-	31.05.2016
431	Model 7405	Near-Field Probe Set	9305-2457	EMCO	-	4	
436	Univ. Radio Communication Tester	CMU 200	103083	Rohde & Schwarz	12 M	-	31.05.2016
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	31.05.2016
443	CTC-FAR-EMI-RSE	System CTC-FAR-EMI-RSE	-	ETS-Lindgren / CETECOM	12 M	5	30.09.2016
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	

Ref.-No.	Equipment	Type	Serial-No.	Manufacturer	interval of calibration	Remark	Cal due
460	Univ. Radio Communication Tester	CMU 200	108901	Rohde & Schwarz	12 M	-	31.05.2016
463	Universal source	HP3245A	2831A03472	Agilent	-	4	
466	Digital Multimeter	Fluke 112	89210157	Fluke USA	24 M	-	31.05.2016
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	-	30.09.2016
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	-	31.05.2016
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	
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	-	31.05.2016
547	Univ. Radio Communication Tester	CMU 200	835390/014	Rohde & Schwarz	12 M	-	31.05.2016
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	30.09.2016
574	Biconilog Hybrid Antenna	BTA-L	980026L	Frankonia	36/12 M	-	31.05.2016
584	Spectrum Analyzer	FSU 8	100248	Rohde & Schwarz	pre-m	-	
594	Wideband Radio Communication Tester	CMW 500	101757	Rohde & Schwarz	12 M	-	31.05.2016
597	Univ. Radio Communication Tester	CMU 200	100347	Rohde & Schwarz	36 M	-	31.05.2016
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	-	31.05.2016
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	
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	201.0999.9302.6.4.1.4 3	G. Lufft GmbH	24 M	-	30.04.2017
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	-	31.05.2016
644	Amplifier	ZX60-2534M+	SN865701299	Mini-Circuits	-	-	
670	Univ. Radio Communication Tester	CMU 200	106833	Rohde & Schwarz	24 M	-	31.05.2016
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	-	31.05.2016
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	-	31.05.2016
688	Pre Amp	JS-18004000-40-8P	1750117	Miteq	pre-m	-	
692	Bluetooth Tester	CBT 32	100236	Rohde & Schwarz	24 M	-	31.05.2016
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	2016-04-25
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