

TEST REPORT

No.: TR-15-1-0006302-03a

According to
FCC Regulations:
 Part 1.1310, Part 2.1091

for
 peiker acoustic GmbH & Co. KG

GSM/E-GPRS/W-CDMA/LTE Wireless Module
 V1140-104-1

FCC-ID: QWY-V1140-104-1

Laboratory Accreditation and Listings			
 Deutsche Akkreditierungsstelle D-PL-12047-01-01	 FEDERAL COMMUNICATIONS COMMISSION USA 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	 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.

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. This test report shows results for W-CDMA technologies only. Other implemented wireless technologies were not considered within this test report.

The presented EUT is a variant of already approved wireless module of type V1140-104 with FCC ID: QWY-V1140-104 and IC no. 6588A-V1140104. Pls. compare also official documents showing main differences. Delta tests apply in order to verify the compliance, however a new certification is intended.

Following tests have been performed to show compliance with applicable FCC Part 2.1091 and FCC Part 1.1310 of the FCC CFR 47 Rules..

1.1. TX mode, tests overview FCC Part 2.1091

No. of Diagram group	Test Cases	Port	References & Limits		EUT set-up	EUT op-mode	Result
			FCC Standard	Test limits			
--	RF Power (conducted)	Antenna terminal (conducted)	§2.1046	N/A	1	1 to 7	passed Remark 1
--	RF Power (radiated)	Cabinet	§2.1046 §22.913(a)(2)	< 7 Watt ERP	1	1 to 7	passed Remark 2
			§24.232(c)	< 2Watt (EIRP)			
			§27.50(h)(2)	< 2 Watt (EIRP)			
--	Radio frequency Exposure Evaluation (MPE)	Cabinet	§1.1310 §2.1091	FCC: §1.1310 Table 1, Limits for General Population	2	1 to 7	Passed, Remark 3

Remarks:

- 1.) See separate test reports 1-0438_15-01-02, 1-0438_15-01-04 and 1-0438_15-01-05 and corresponding annexes 1-0438_15-01-01 A and C
- 2.) Calculated only (with known antenna gain)
- 3.) Based on info delivered by applicant, see annex 5



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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. R. 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. Christian Lorenz
Receipt of EUT:	2015-02-27
Date(s) of test:	2015-09-03 to 2015-09-15
Date of report:	2016-01-29

Version of template:	13.02

2.4. Applicant's details

Applicant's name:	peiker acoustic 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 GSM/W-CDMA OF MAIN EUT DECLARED BY APPLICANT

Main function	LTE-NAD Wireless-Module
Type	V1140-104-1
TX-frequency range	☒ GSM / GPRS / EGPRS Band 850: 824.2 – 848.8 MHz (Uplink), 869.2-1893.8 MHz (Downlink) ☒ GSM / GPRS / EGPRS Band 1900: 1850.2 – 1909.8 MHz (Uplink), 1930.2-1989.8 MHz (Downlink) ☐ UMTS Band II: 1852.4 – 1907.6 MHz (Uplink), 1932.4-1987.6 MHz (Downlink) ☒ UMTS Band V: 826.4 – 846.6 MHz (Uplink), 871.4-891.6 MHz (Downlink)
Type of modulation	☒ GSM / GPRS / EGPRS Band 850: GMSK/8PSK ☒ GSM / GPRS / EGPRS Band 1900: GMSK/8PSK ☐ UMTS Band II: QPSK ☒ UMTS Band V: QPSK
Number of channels	☒ GSM / GPRS / EGPRS Band 850: 128 – 192 – 251 ☒ GSM / GPRS / EGPRS Band 1900: 512 – 661 – 810 ☐ UMTS Band II: UARFCN range 9262 – 9400 – 9538 ☒ UMTS Band V: UARFCN range 4132 – 4183 – 4233
UMTS-HSPA connectivity	☒ Uplink speed: 5.76 Mb/s (category 6)
Emission designator(s)	Values taken from certified module (FCC ID :) GSM / GPRS Band 850: 246KGXW E-GPRS Band 850: 241KG7W GSM / GPRS Band 1900: 246KGXW E-GPRS Band 1900: 242KG7W UMTS Band V: 4M15F9W
Antenna Type	☐ Integrated (enclosure) ☐ External - dedicated, no RF- connector ☒ External, separate RF-connector
Antenna Gain TX (main) Pls. see separate documents	☒ Value: (Data sheet for Fender antenna Fender Type 920325-102): max. 1dBi (-1.15dBd) ☒ Value: (Data sheet for External Antenna Model no. 64159, ECE-4G): GSM850/FDD/LTE Band 5: max. 3.7dBi (1.55dBd) GSM1900: max. 3.4 dBi LTE Band 7: max. 4.2 dBi ☒ Value: (Data sheet for Internal Antenna Roof-Version): GSM850/FDD/LTE Band 5: max. 1.3dBi (-0.85dBd) GSM1900: max. 2.0 dBi LTE Band 7: max. 4.3 dBi
Antenna Gain Dx (diversity)	☐ Not applicable ☒ Value: (Data sheet) lower then TX (main) ☐ No information from customer

MAX PEAK Output Power: Radiated	PK-Values taken from FCC Part 22/24 reports:		
GSM / GPRS Band 850	32.63 dBm (PK) + 1.55dBd = 34.18 dBm ERP (PK)		
E-GPRS Band 850	26.04 dBm (PK) + 1.55 dBd = 27.59 dBm ERP (PK)		
GSM / GPRS Band 1900	29.41 dBm (PK) + 3.4 dBi = 32.81 dBm EIRP (PK)		
E-GPRS Band 1900	28.19 dBm (PK) + 3.4 dBi = 31.59 dBm EIRP (PK)		
UMTS_FDD Band V	27.16 dBm (PK) + 1.55 dBd = 28.71 dBm ERP (PK)		
MAX PEAK Output Power: Conducted	PK-Values taken from FCC Part 22/24 reports:		
GSM / GPRS Band 850	1.832 W (PK)		
E-GPRS Band 850	0.401 W (PK)		
GSM / GPRS Band 1900	0.872 W (PK)		
E-GPRS Band 1900	0.659 W (PK)		
UMTS_FDD Band V	0.519 W (PK)		
Power supply	☒ DC power only: 3.5 Volt to 4.0 V DC by external power supply		
Special EMI components	--		
Does EUT contain devices susceptible to magnetic fields, e.g. Hall elements, electrodynamics microphones, etc.?	☐ yes ☒ no		
EUT sample type	☐ Production	☒ Pre-Production	☐ Engineering
FCC label attached	☐ yes	☒ no	

3.2. LTE TECHNICAL DATA OF MAIN EUT DECLARED BY APPLICANT

TX-frequency range (E-UTRA operating bands)	LTE Band 5: 824 - 849 MHz (Uplink), 869-894 MHz (Downlink) LTE Band 7: 2500 to 2570 MHz (Uplink), 2620 to 2690MHz (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 5: UARFCN range 20400 – 20649 LTE Band 7: UARFCN range 20750 – 21449		See Note about channels not to be used depending on channel bandwidths
Emission designator(s) (Max. Value across all operating bands)	Channel bandwidth	QPSK Modulation:	16-QAM Modulation
	1.4 MHz	1M32G7W (LTE Bd. 5)	1M32W7D (LTE Bd. 5)
	3 MHz	3M14G7D (LTE Bd. 5)	3M14W7D (LTE Bd. 5)
	5 MHz	5M13G7D (LTE Bd. 7)	5M13W7D (LTE Bd.5)
	10 MHz	10M1G7D (LTE Bd. 5)	10M2W7D (LTE Bd. 7)
	15 MHz	15M1G7D (LTE Bd. 7)	15M1W7D (LTE Bd. 7)
	20 MHz	20M0G7D (LTE Bd. 7)	20M0W7D (LTE Bd. 7)
Antenna Gain	☒ Values: LTE-Band 5: (Data sheet for External Antenna Model no. 64159, ECE-4G): GSM850/FDD/LTE Band 5: max. 3.7dBi (1.55dBd) LTE Band 7: max. 4.2 dBi External Antenna, max. 4.3dBi Internal Antenna		
MAX Output Power: Radiated	LTE-Band 5 LTE-Band 7	22.69 dBm (AV) + 1.55dBd = 24.24 dBm ERP (AV) 22.57 dBm (AV) + 4.3 dBi = 26.87 dBm EIRP (AV)	
MAX. Output Power: Conducted	LTE-Band 5 LTE Band 7	0.186 W (AV) 0.181 W (AV)	
Power supply	☒ DC power only: 3.5 Volt to 4.0 V DC by external power supply		
Special EMI components	--		
Does EUT contain devices susceptible to magnetic fields, e.g. Hall elements, electrodynamics microphones, etc.?	☐ yes ☒ no		
EUT sample type	☐ Production	☒ Pre-Production	☐ Engineering
FCC label attached	☐ yes	☒ no	

3.3. 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	NAD Module	V1140-104-1	--	V1140-104-1_Ver. 1	M9615A-CETWTDZM-6.3.100105
EUT B	Automotive Antenna 4G Roof-Pod	64154 ECE-4G Version	--	--	--
EUT C	Fender Antenna	920 325-102	--	LTE worldwide	--

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

3.4. 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	LTE-NAD Evaluation Board	Testboard	LP1307-1	--	--
AE 2	Microphone	KL1/B	9263744	--	--
AE 3	Loudspeaker	KL1/B	#1	4Ω/6Watt	--
AE 4	Small Ground-Plane	For EUT B 30cm diameter	--	--	--
AE 5	DC power cable	For AE 1	--	1m long	--
AE 6	Notebook Dell	Lattitude D2120	#Test PC6	--	Windows 7
AE 7	USB cable	Mini-USB	--	1m long	--

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

3.5. EUT set-ups

EUT set-up no. *)	Combination of EUT and AE	Remarks
set. 1	EUT A + AE1 + AE 5 + AE 6 + AE 7	Set-up for conducted RF-tests.
set. 2	EUT A + EUT B Set-up to be defined with ATM-01 R2-[xxx]-[yy] Product ID: 2609-07x-xxx-51	Roof antenna set-up: external antenna Based on document for Antenna Model no. 64159 (ECE-4G)
set. 3		Roof antenna set-up: internal antenna Based on document Advanced Telecommunication module (ATM) Roof-Version, Rev. 3.0, 09.12.2015
set. 4	EUT A + EUT C Set-up to be defined with ATM-01 T2-[xxx]-[yy] Product ID: 2609-07x-xxx-51	ATM Trunk Version set-up Based on document "Advanced Telecommunication Module (ATM) Trunk Version, Rev. 2.0, from 09.12.2015

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

3.6. EUT operating modes

EUT operating mode no.*)	Description of operating modes	Additional information
op. 1	GPRS 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-GPRS 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	GPRS 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-GPRS 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.
op. 5	UMTS FDD-Band V 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. The description of the settings performed can be found in chapter 3.5

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

3.7. LTE EUT operating modes

EUT operating mode no.*)	Description of operating modes	Additional information
op. 6	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 for QPSK Modulation scheme and 22dBm nominal for 16-QAM modulation scheme. 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.
op. 7	LTE-Band 7 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 for QPSK Modulation scheme and 22dBm nominal for 16-QAM modulation scheme. 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.

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

3.8. Configuration of cables used for testing

Cable number	Item	Type	S/N serial number	HW hardware status	Cable length
Cable 1	TRX-Antenna cable	--	--	--	1m
Cable 2	DRX antenna cable	--	--	--	1m
Cable 3	GPS Antenna	--	--	--	1m
Cable 4	DC power cable	--	--	--	1m
Cable 5	Loudspeaker cable	--	--	--	2m long

4. Measurements

4.1. Radio Frequency Exposure Evaluation §2.1091

4.1.1. Test location and equipment (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
	For Evaluation instruments are not needed. Results are determined by calculation based on applicants delivered Tune-Up procedure.		

4.1.2. Requirements

FCC: §1.1310	<i>The criteria used for the evaluation of human exposure to radio frequency radiation is table 1 according FCC §1.1310. As the mobile equipment is authorized under Part 22 (Subpart H) and Part 24 of the FCC Rules, it is subject for evaluation of the RF exposure prior to equipment authorization.</i>
FCC § 2.1091	<i>Further information on evaluating compliance with these limits can be found in the FCC's OST/OET Bulletin Number 65, 'Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to Radiofrequency Radiation.' For purposes of these requirements mobile devices are defined by the FCC as transmitters designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between radiating structures and the body of the user or nearby persons. These devices are normally evaluated for exposure potential with relation to the MPE limits given in Table 1 of Appendix A.</i>

4.1.2.1. Valid for FCC

Table 1: LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)				
Frequency range [MHz]	Electric field strength [V/m]	Magnetic field strength [A/m]	Power density [mW/cm ²]	Averaging time [minutes]
30 - 300	61.4	0.163	1.0	6
300 - 1500	-	-	f/300	6
1500 - 100,000	-	-	5	6
(B) Limits for General Population / Uncontrolled Exposure				
0.3 - 1.34	614	1.63	*(100)	30
1.34 - 30	824/f	2.19/f	*(180/f ²)	30
30 - 300	27.5	0.073	0.2	30
300 - 1500	-	-	f/1500	30
1500 - 100,0	-	-	1.0	30

For given Power density limit at a single frequency (accord. Table 1 Limits) the maximum antenna gain can be calculated.

The used equation to predict the power density in the far-field of one single radiating antenna can be made by following equation:

$$S = \frac{EIRP}{4\pi R^2} = \frac{P * G}{4\pi R^2}$$

$$G_{NUMERIC} = \frac{S * 4\pi R^2}{P}$$

4.1.3. General Limits:

FCC: §1.1307	Cellular Radiotelephone Service (subpart H of part 22) Non-building-mounted antennas: height above ground level to lowest point of antenna < 10 m and total power of all channels > 1000 W ERP (1640 W EIRP)
FCC §1.1307	Personal Communications Services (part 24) Broadband PCS (subpart E): non-building-mounted antennas: height above ground level to lowest point of antenna < 10 m and total power of all channels > 2000 W ERP (3280 W EIRP)
FCC §1.1310	LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE) Table 1(B) Limits for General Population/Uncontrolled Exposure 300–1500 MHz: $f/1500 \text{ mW/cm}^2$ 1500–100,000 MHz: 1.0 mW/cm^2
FCC §2.1091	Subject to routine evaluation is required when the device operate at frequencies of 1.5 GHz or below and their effective radiated power (ERP) is 1.5 watts or more, or if they operate at frequencies above 1.5 GHz and their ERP is 3 watts or more.
FCC §24.232	(a) Base stations are limited to 1640 watts peak equivalent isotropically radiated power (e.i.r.p.) with an antenna height up to 300 meters HAAT. b) Mobile/portable stations are limited to 2 watts e.i.r.p. peak power, ...
FCC §22.913	(a) Maximum ERP. The effective radiated power (ERP) of base transmitters and cellular repeaters must not exceed 500 Watts. The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.
FCC §27.50 (h)(2)	(h) The following power limits shall apply in the BRS and EBS: (2) Mobile and other user stations. Mobile stations are limited to 2.0 watts EIRP. All user stations are limited to 2.0 watts transmitter output power.
KDBs	No. 447498 D01 v05r02

4.1.4. Evaluation Method

Valid for GSM/GPRS/EDGE mode:

- Average burst power (slot power) and peak were measured (see separate report for GSM/GPRS/E-GPRS technology)
- Only one uplink slot (1 TX) was measured. 4 TX slots are maximum possible for this device and calculated as worst-case
- A duty-cycle correction factor of $10 \cdot \log_{10}$ (max. number of possible active slots / 8 slots) were applied

Please find in the following tables the calculations based on applicants tune-up information for the power values. Also the maximum admissible allowed antenna gain is calculated which is not exceeding the MPE limit for fixed and mobile operations.

Valid for W-CDMA/LTE operating modes:

- The power was checked on 3 frequencies (lowest/middle/highest) within each operable FDD-band (see separate report for W-CDMA technology) and the results compared to applicant's declared power values (tune-up info). A RMS detector was used.
- No duty-cycle correction factor is applicable

The calculations are based on applicants tune-up information, pls. see Annex 5.

4.2. Results for fixed and mobile operations

4.2.1. Results for operational band: GSM850, FDD band 5 and LTE FDD band 5

4.2.1.1. Max. Antenna Gain consideration, set-up 2

Distance	20	cm											
Operating Mode	Frequency on channel	Declared maximum conducted output power	Max. positive tolerance according manufacturer	Antenna Gain	Calculated maximum ERP (declared+ Tune-up+ antenna Gain) (dBm)	Duty cycle	Declared Maximum ERP	Equivalent ERP (maximum ERP x duty cycle)	MPE Limit accord. Table 1	MPE-Value	Margin to limit:	Fraction for Co-Location calculations	Max. Fraction-Value within Frequency-Band
	(MHz)	(dBm)	(dB)	(dBd)		%	(W)	(mW)	(mW/cm ²)	(mW/cm ²)	(mW/cm ²)		
GSM/GPRS (PK)	824,2	32,5	1,5	0	34,0	50%	2,512	1256	0,5495	0,4098	0,1397	0,7458	0,7458
	837	32,5	1,5	0	34,0		2,512	1256	0,5580	0,4098	0,1482	0,7344	
	848,8	32,5	1,5	0	34,0		2,512	1256	0,5659	0,4098	0,1561	0,7242	
EDGE (PK)	824,2	26,5	2,5	0	29,0	50%	0,794	397	0,5495	0,1296	0,4199	0,2358	0,2358
	837	26,5	2,5	0	29,0		0,794	397	0,5580	0,1296	0,4284	0,2322	
	848,8	26,5	2,5	0	29,0		0,794	397	0,5659	0,1296	0,4363	0,2290	
WCDMA FDD Band 5 (RMS-Value)	826,4	23,0	2,0	0	25,0	100%	0,316	316	0,5509	0,1032	0,4478	0,1873	0,1873
	836,4	23,0	2,0	0	25,0		0,316	316	0,5576	0,1032	0,4544	0,1850	
	846,6	23,0	2,0	0	25,0		0,316	316	0,5644	0,1032	0,4612	0,1828	
LTE Band 5 (QPSK, #RB=1, RMS-Value)	824,7	23,0	2,0	0	25,0	100%	0,316	316	0,5498	0,1032	0,4466	0,1877	0,1877
	836,5	23,0	2,0	0	25,0		0,316	316	0,5577	0,1032	0,4545	0,1850	
	848,3	23,0	2,0	0	25,0		0,316	316	0,5655	0,1032	0,4624	0,1824	
LTE Band 5 (16QAM, #RB=1, RMS-Value)	824,7	23,0	2,0	0	25,0	100%	0,316	316	0,5498	0,1032	0,4466	0,1877	0,1877
	836,5	23,0	2,0	0	25,0		0,316	316	0,5577	0,1032	0,4545	0,1850	
	848,3	23,0	2,0	0	25,0		0,316	316	0,5655	0,1032	0,4624	0,1824	

Maximum calculated MPE value:		
Lowest MPE-Limit in Frequency-Band:	0,5495	[mW/cm ²]
Highest MPE value in frequency-band:	0,4098	[mW/cm ²]
Lowest margin to limit in frequency band:	0,1397	[mW/cm ²]

Maximum antenna gain considerations for fixed/mobile operations for complying with limits:

P	Maximum power input to the antenna incl. Duty cycle [mW]: (Avg. Burst Power or RMS)	1256
R	Distance [cm]:	20
S	MPE limit acc. §1.1310 for uncontrolled exposure [mW/cm ²]: (FCC use mW/cm ²)	0,55
G ₁	Maximum Antenna gain to comply with MPE limit [dBi]:	3,42

(For G1 the low est measured channel to reach minimum ant. Gain selected)

ERP power limit according to §2.1091 [W]: (Avg. Burst Power or RMS)		1,50
G ₂	Max. Antenna gain to comply with limit incl. Duty cycle [dBi]:	2,92

(For G2 select the max. Avg. Burst Pow er or RMS value incl. Duty cycle)

ERP power limit according to §22.913 [W ERP]:		7,00
G ₃	Max. Antenna gain to comply with limit [dBi]:	6,60

(For G3 select the max. Average burst power value excluding Duty cycle)

G _{850 MHz band}	Min (G ₁ , G ₂ , G ₃) [dBi]	2,92
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Summarized results:	The max. ant. gain for mobile operation at 700/850MHz band to comply with MPE and ERP limits incl. path loss shall not exceed [dBi]:	2,92
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4.2.2. Results for operational band: GSM850, FDD band 5 and LTE FDD band 5 – Set-up 3 (Roof-Version , External antenna)

Distance	20	cm													
Operating Mode	Frequency on channel	Declared maximum conducted output power	Max. positive tolerance according manufacturer	External Antenna Gain	Path Loss Module to Ext. Antenna (MIMO1)	Uncertainty of Path-Loss	Calculated maximum ERP (declared+ Tune-up+ antenna Gain) (dBm)	Duty cycle	Declared Maximum ERP	Equivalent ERP (maximum ERP x duty cycle)	MPE Limit accord. Table 1	MPE-Value	Margin to limit:	Fraction for Co-Location calculations	Max. Fraction-Value within Frequency-Band
	(MHz)	(dBm)	(dB)	(dBd)	(dB)	(dB)		%	(W)	(mW)	(mW/cm ²)	(mW/cm ²)	(mW/cm ²)		
GSM/GPRS (PK)	824,2	32,5	1,5	1,55	2,8	0,25	33,0	50%	1,995	998	0,5495	0,3255	0,2240	0,5924	0,5924
	837	32,5	1,5	1,55	2,8	0,25	33,0		1,995	998	0,5580	0,3255	0,2325	0,5833	
	848,8	32,5	1,5	1,55	2,8	0,25	33,0		1,995	998	0,5659	0,3255	0,2404	0,5752	
EDGE (PK)	824,2	26,5	2,5	1,55	2,8	0,25	28,0	50%	0,631	315	0,5495	0,1029	0,4465	0,1873	0,1873
	837	26,5	2,5	1,55	2,8	0,25	28,0		0,631	315	0,5580	0,1029	0,4551	0,1845	
	848,8	26,5	2,5	1,55	2,8	0,25	28,0		0,631	315	0,5659	0,1029	0,4629	0,1819	
WCDMA FDD Band 5 (RMS-Value)	826,4	23,0	2,0	1,55	2,8	0,25	24,0	100%	0,251	251	0,5509	0,0820	0,4690	0,1488	0,1488
	836,4	23,0	2,0	1,55	2,8	0,25	24,0		0,251	251	0,5576	0,0820	0,4756	0,1470	
	846,6	23,0	2,0	1,55	2,8	0,25	24,0		0,251	251	0,5644	0,0820	0,4824	0,1452	
LTE Band 5 (QPSK, #RB=1, RMS-Value)	824,7	23,0	2,0	1,55	2,8	0,25	24,0	100%	0,251	251	0,5498	0,0820	0,4678	0,1491	0,1491
	836,5	23,0	2,0	1,55	2,8	0,25	24,0		0,251	251	0,5577	0,0820	0,4757	0,1470	
	848,3	23,0	2,0	1,55	2,8	0,25	24,0		0,251	251	0,5655	0,0820	0,4836	0,1449	
LTE Band 5 (16QAM, #RB=1, RMS-Value)	824,7	23,0	2,0	1,55	2,8	0,25	24,0	100%	0,251	251	0,5498	0,0820	0,4678	0,1491	0,1491
	836,5	23,0	2,0	1,55	2,8	0,25	24,0		0,251	251	0,5577	0,0820	0,4757	0,1470	
	848,3	23,0	2,0	1,55	2,8	0,25	24,0		0,251	251	0,5655	0,0820	0,4836	0,1449	

Maximum calculated MPE value:		
Lowest MPE Limit in Frequency-Band:	0,5495	[mW/cm ²]
Highest MPE value in frequency-band:	0,3255	[mW/cm ²]
Lowest margin to limit in frequency band:	0,2240	[mW/cm ²]

4.2.3. Results for operational band: GSM850, FDD band 5 and LTE FDD band 5 – Set-up 4 (Roof-Version , Internal antenna)

Distance	20	cm													
Operating Mode	Frequency on channel	Declared maximum conducted output power	Max. positive tolerance according manufacturer	Internal Antenna Gain	Path Loss Module to Ext. Antenna (MIMO1)	Uncertainty of Path-Loss	Calculated maximum ERP (declared+ Tune-up+ antenna Gain) (dBm)	Duty cycle	Declared Maximum ERP	Equivalent ERP (maximum ERP x duty cycle)	MPE Limit accord. Table 1	MPE-Value	Margin to limit:	Fraction for Co-Location calculations	Max. Fraction-Value within Frequency-Band
	(MHz)	(dBm)	(dB)	(dBd)	(dB)	(dB)		%	(W)	(mW)	(mW/cm ²)	(mW/cm ²)	(mW/cm ²)		
GSM/GPRS (PK)	824,2	32,5	1,5	-0,85	0,7	0,25	32,7	50%	1,862	931	0,5495	0,3038	0,2457	0,5528	0,5528
	837	32,5	1,5	-0,85	0,7	0,25	32,7		1,862	931	0,5580	0,3038	0,2542	0,5444	
	848,8	32,5	1,5	-0,85	0,7	0,25	32,7		1,862	931	0,5659	0,3038	0,2621	0,5368	
EDGE (PK)	824,2	26,5	2,5	-0,85	0,7	0,25	27,7	50%	0,589	294	0,5495	0,0961	0,4534	0,1748	0,1748
	837	26,5	2,5	-0,85	0,7	0,25	27,7		0,589	294	0,5580	0,0961	0,4619	0,1722	
	848,8	26,5	2,5	-0,85	0,7	0,25	27,7		0,589	294	0,5659	0,0961	0,4698	0,1698	
WCDMA FDD Band 5 (RMS-Value)	826,4	23,0	2,0	-0,85	0,7	0,25	23,7	100%	0,234	234	0,5509	0,0765	0,4744	0,1388	0,1388
	836,4	23,0	2,0	-0,85	0,7	0,25	23,7		0,234	234	0,5576	0,0765	0,4811	0,1372	
	846,6	23,0	2,0	-0,85	0,7	0,25	23,7		0,234	234	0,5644	0,0765	0,4879	0,1355	
LTE Band 5 (QPSK, #RB=1, RMS-Value)	824,7	23,0	2,0	-0,85	0,7	0,25	23,7	100%	0,234	234	0,5498	0,0765	0,4733	0,1391	0,1391
	836,5	23,0	2,0	-0,85	0,7	0,25	23,7		0,234	234	0,5577	0,0765	0,4812	0,1372	
	848,3	23,0	2,0	-0,85	0,7	0,25	23,7		0,234	234	0,5655	0,0765	0,4890	0,1352	
LTE Band 5 (16QAM, #RB=1, RMS-Value)	824,7	23,0	2,0	-0,85	0,7	0,25	23,7	100%	0,234	234	0,5498	0,0765	0,4733	0,1391	0,1391
	836,5	23,0	2,0	-0,85	0,7	0,25	23,7		0,234	234	0,5577	0,0765	0,4812	0,1372	
	848,3	23,0	2,0	-0,85	0,7	0,25	23,7		0,234	234	0,5655	0,0765	0,4890	0,1352	

Maximum calculated MPE value:		
Lowest MPE Limit in Frequency-Band:	0,5495	[mW/cm ²]
Highest MPE value in frequency-band:	0,3038	[mW/cm ²]
Lowest margin to limit in frequency band:	0,2457	[mW/cm ²]

4.2.4. Results for operational band: GSM850, FDD5 and LTE band 5 – Set-up 5 (Trunk-Version)

Distance	20	cm														
Operating Mode	Frequency on channel	Declared maximum conducted output power	Max. positive tolerance according manufacturer	External Antenna Gain	Path Loss Module to Ext. Antenna (MIMO)	Uncertainty of Path-Loss	Path Loss due cable loss to external antenna	Calculated maximum ERP (declared+ Tune-up+ antenna Gain)	Duty cycle	Declared Maximum ERP	Equivalent ERP (maximum ERP x duty cycle)	MPE Limit accord. Table 1	MPE-Value	Margin to limit:	Fraction for Co-Location calculations	Max. Fraction-Value within Frequency-Band
	(MHz)	(dBm)	(dB)	(dBd)	(dB)	(dB)	(dB)	(dBm)	%	(W)	(mW)	(mW/cm ²)	(mW/cm ²)	(mW/cm ²)		
GSM/GPRS (PK)	824,2	32,5	1,5	-1,15	0,65	0,25	1,2	31,3	50%	1,334	667	0,5495	0,2175	0,3319	0,3959	0,3959
	837	32,5	1,5	-1,15	0,65	0,25	1,2	31,3		1,334	667	0,5580	0,2175	0,3405	0,3899	
	848,8	32,5	1,5	-1,15	0,65	0,25	1,2	31,3		1,334	667	0,5659	0,2175	0,3483	0,3844	
EDGE (PK)	824,2	26,5	2,5	-1,15	0,65	0,25	1,2	26,3	50%	0,422	211	0,5495	0,0688	0,4807	0,1252	0,1252
	837	26,5	2,5	-1,15	0,65	0,25	1,2	26,3		0,422	211	0,5580	0,0688	0,4892	0,1233	
	848,8	26,5	2,5	-1,15	0,65	0,25	1,2	26,3		0,422	211	0,5659	0,0688	0,4971	0,1216	
WCDMA FDD Band 5 (RMS-Value)	826,4	23,0	2,0	-1,15	0,65	0,25	1,2	22,3	100%	0,168	168	0,5509	0,0548	0,4962	0,0994	0,0994
	836,4	23,0	2,0	-1,15	0,65	0,25	1,2	22,3		0,168	168	0,5576	0,0548	0,5028	0,0982	
	846,6	23,0	2,0	-1,15	0,65	0,25	1,2	22,3		0,168	168	0,5644	0,0548	0,5096	0,0970	
LTE Band 5 (QPSK, #RB=1, RMS-Value)	824,7	23,0	2,0	-1,15	0,65	0,25	1,2	22,3	100%	0,168	168	0,5498	0,0548	0,4950	0,0996	0,0996
	836,5	23,0	2,0	-1,15	0,65	0,25	1,2	22,3		0,168	168	0,5577	0,0548	0,5029	0,0982	
	848,3	23,0	2,0	-1,15	0,65	0,25	1,2	22,3		0,168	168	0,5655	0,0548	0,5108	0,0969	
LTE Band 5 (16QAM, #RB=1, RMS-Value)	824,7	23,0	2,0	-1,15	0,65	0,25	1,2	22,3	100%	0,168	168	0,5498	0,0548	0,4950	0,0996	0,0996
	836,5	23,0	2,0	-1,15	0,65	0,25	1,2	22,3		0,168	168	0,5577	0,0548	0,5029	0,0982	
	848,3	23,0	2,0	-1,15	0,65	0,25	1,2	22,3		0,168	168	0,5655	0,0548	0,5108	0,0969	

Maximum calculated MPE-value:		
Lowest MPE-Limit in Frequency-Band:	0,5495	[mW/cm ²]
Highest MPE value in frequency-band:	0,2175	[mW/cm ²]
Lowest margin to limit in frequency band:	0,3319	[mW/cm ²]

4.2.5. Results for upper operational band: GSM1900

4.2.5.1. Max. Antenna Gain considerations for set-up 1

Safety-Distance	20	cm											
Operation Mode	Frequency on channel (MHz)	Declared maximum conducted output power (dBm)	Max. positive tolerance according manufacturer (dB)	Antenna Gain (dB)	Declared maximum ERP (Measured+ Tune-up+ Antenna Gain) (dBm)	Duty cycle (%)	Declared Maximum ERP (W)	Equivalent ERP (maximum ERP x duty cycle) (mW)	MPE Limit accord. Table 1 (mW/cm ²)	MPE-Value (mW/cm ²)	Margin to limit: (W/m ²)	Fraction for Co-Location calculations	Max. Fraction-Value within Frequency-Band
GSM/GPRS (PK-Burst value)	1850,2	29,5	1,5	0,0	31,0	50%	1,259	629	1,0000	0,1252	0,8748	0,125228	0,1252276
	1880,0	29,5		0,0	31,0		1,259	629	1,0000	0,1252	0,8748	0,125228	
	1909,8	29,5		0,0	31,0		1,259	629	1,0000	0,1252	0,8748	0,125228	
EDGE (PK-Burst value)	1850,2	25,5	2,5	0,0	28,0	50%	0,631	315	1,0000	0,0628	0,9372	0,062762	0,0627625
	1880,0	25,5		0,0	28,0		0,631	315	1,0000	0,0628	0,9372	0,062762	
	1909,8	25,5		0,0	28,0		0,631	315	1,0000	0,0628	0,9372	0,062762	

Maximum calculated MPE value:		
Lowest MPE-Limit in frequency-band:	1,0000	[mW/cm ²]
Highest MPE value in frequency-band:	0,1252	[mW/cm ²]
Margin to limit in frequency-band:	0,8748	[mW/cm ²]

Maximum antenna gain considerations for fixed/mobile operations for complying with limits:					
P	Maximum power input to the antenna incl. Duty cycle (mW): (Avg. Burst Power or RMS)				629
R	Distance (cm):				20
S	MPE limit acc. §1.1310 for uncontrolled exposure (mW/cm ²): (FCC use mW/cm ²)				1,00
G ₁	Maximum Antenna gain to comply with MPE limit (dBi):				9,02

(For G1 the lowest measured channel to reach minimum ant. Gain selected)

ERP power limit according to §2.1091 [W]: (Avg. Burst Power or RMS)					
G ₂	Max. Antenna gain to comply with this limit incl. Duty cycle (dBi):				8,93

(For G2 select the max. Avg. Burst Power or RMS value incl. Duty cycle)

ERP power limit according to §24.232 [W]:					
G ₃	Max. Antenna gain to comply with this limit (dBi):				2,01

(For G3 select the max. Average burst power value excluding Duty cycle)

Min (G ₁ , G ₂ , G ₃) (dBi)					
					2,01

Summarized results:	The max. ant. gain for mobile operation at 1900 MHz band to comply with MPE and ERP limits incl. path loss shall not exceed (dBi):				2,01
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4.2.6. Results for operational band: GSM1900 – Set-up 2 (Roof-Version , External antenna)

Safety-Distance	20	cm													
Operation Mode	Frequency on channel	Declared maximum conducted output power	Max. positive tolerance according manufacturer	Antenna Gain	Path Loss Module to Ext. Antenna (MIMO1)	Uncertainty of Path-Loss	Declared maximum ERP (Measured+ Tune-up+ Antenna Gain)	Duty cycle	Declared Maximum ERP	Equivalent ERP (maximum ERP x duty cycle)	MPE Limit accord. Table 1	MPE-Value	Margin to limit:	Fraction for Co-Location calculations	Max. Fraction-Value within Frequency-Band
	(MHz)	(dBm)	(dB)	(dB)	(dB)	(dB)	(dBm)	%	(W)	(mW)	(mW/cm²)	(mW/cm²)	(W/m²)		
GSM/GPRS (PK-Burst value)	1850.2	29.5	1.50	3.40	5.00	0.25	29.65	50%	0.923	461	1.0000	0.0918	0,9082	0.091770	0,0917699
	1880.0	29.5		3.40	5.00	0.25	29.65		0.923	461	1.0000	0.0918	0,9082	0.091770	
	1909.8	29.5		3.40	5.00	0.25	29.65		0.923	461	1.0000	0.0918	0,9082	0.091770	
EDGE (PK-Burst value)	1850.2	25.5	2.50	3.40	5.00	0.25	26.65	50%	0.462	231	1.0000	0.0460	0,9540	0.045994	0,0459939
	1880.0	25.5		3.40	5.00	0.25	26.65		0.462	231	1.0000	0.0460	0,9540	0.045994	
	1909.8	25.5		3.40	5.00	0.25	26.65		0.462	231	1.0000	0.0460	0,9540	0.045994	
Maximum calculated MPE value:															
Lowest MPE-Limit in frequency-band:	1,0000	[mW/cm²]													
Highest MPE value in frequency-band:	0,0918	[mW/cm²]													
Margin to limit in frequency-band:	0,9082	[mW/cm²]													

4.2.7. Results for operational band: GSM1900 – Set-up 3 (Roof-Version , internal antenna)

Safety-Distance	20	cm													
Operation Mode	Frequency on channel	Declared maximum conducted output power	Max. positive tolerance according manufacturer	Antenna Gain	Path Loss Module to Ext. Antenna (MIMO1)	Uncertainty of Path-Loss	Declared maximum ERP (Measured+ Tune-up+ Antenna Gain)	Duty cycle	Declared Maximum ERP	Equivalent ERP (maximum ERP x duty cycle)	MPE Limit accord. Table 1	MPE-Value	Margin to limit:	Fraction for Co-Location calculations	Max. Fraction-Value within Frequency-Band
	(MHz)	(dBm)	(dB)	(dBi)	(dB)	(dB)	(dBm)	%	(W)	(mW)	(mW/cm^2)	(mW/cm^2)	(W/m^2)		
GSM/GPRS (PK-Burst value)	1850.2	29.5	1.50	2.0	1.1	0.25	32.15	50%	1.641	820	1.0000	0.1632	0,8368	0.163192	0,1631925
	1880.0	29.5		2.0	1.1	0.25	32.15		1.641	820	1.0000	0.1632	0,8368	0.163192	
	1909.8	29.5		2.0	1.1	0.25	32.15		1.641	820	1.0000	0.1632	0,8368	0.163192	
EDGE (PK-Burst value)	1850.2	25.5	2.50	2.0	1.1	0.25	29.15	50%	0.822	411	1.0000	0.0818	0,9182	0.081790	0,0817900
	1880.0	25.5		2.0	1.1	0.25	29.15		0.822	411	1.0000	0.0818	0,9182	0.081790	
	1909.8	25.5		2.0	1.1	0.25	29.15		0.822	411	1.0000	0.0818	0,9182	0.081790	
Maximum calculated MPE value:															
Lowest MPE-Limit in frequency-band:	1,0000	[mW/cm^2]													
Highest MPE value in frequency-band:	0,1632	[mW/cm^2]													
Margin to limit in frequency-band:	0,8368	[mW/cm^2]													

4.2.8. Results for operational band: GSM1900 – Set-up 4 (Trunk-Version)

Safety-Distance	20	cm														
Operation Mode	Frequency on channel	Declared maximum conducted output power	Max. positive tolerance according manufacturer	Antenna Gain	Path Loss Module to Ext. Antenna (MIMO1)	Uncertainty of Path-Loss	Path Loss due cable loss to external antenna	Declared maximum ERP (Measured+ Tune-up+ Antenna Gain)	Duty cycle	Declared Maximum ERP	Equivalent ERP (maximum ERP x duty cycle)	MPE Limit accord. Table 1	MPE-Value	Margin to limit:	Fraction for Co-Location calculations	Max. Fraction-Value within Frequency Band
	(MHz)	(dBm)	(dB)	(dBi)	(dB)	(dB)	(dB)	(dBm)	%	(W)	(m W)	(m W/cm ^2)	(mW/cm ^2)	(W/m ^2)		
GSM/GPRS (PK-Burst value)	1850.2	29.5	1.50	1.00	0.90	0.25	2.16	29.19	50%	0.830	415	1.0000	0.0825	0.9175	0.082547	0.0825468
	1880.0	29.5		1.00	0.90	0.25	2.16	29.19		0.830	415	1.0000	0.0825	0.9175	0.082547	
	1909.8	29.5		1.00	0.90	0.25	2.16	29.19		0.830	415	1.0000	0.0825	0.9175	0.082547	
EDGE (PK-Burst value)	1850.2	25.5	2.50	1.00	0.90	0.25	2.16	26.19	50%	0.416	208	1.0000	0.0414	0.9586	0.041371	0.0413714
	1880.0	25.5		1.00	0.90	0.25	2.16	26.19		0.416	208	1.0000	0.0414	0.9586	0.041371	
	1909.8	25.5		1.00	0.90	0.25	2.16	26.19		0.416	208	1.0000	0.0414	0.9586	0.041371	
Maximum calculated MPE value:																
Lowest MPE-Limit in frequency-band:	1.0000	[mW/cm ^2]														
Highest MPEvalue in frequency-band:	0.0825	[mWcm ^2]														
Margin to limit in frequency-band:	0.9175	[m Wcm ^2]														

4.2.9. Results for upper operational band: LTE Band 7

4.2.9.1. Max. Antenna Gain considerations for set-up 1

Safety-Distance	20	cm											
Operation Mode	Frequency on channel	Declared maximum conducted output power	Max. positive tolerance according manufacturer	Antenna Gain	Declared maximum ERP (Measured+ Tune-up+ Antenna Gain)	Duty cycle	Declared Maximum ERP	Equivalent ERP (maximum ERP x duty cycle)	MPE Limit accord. Table 1	MPE-Value	Margin to limit:	Fraction for Co-Location calculations	Max. Fraction-Value within Frequency-Band
	(MHz)	(dBm)	(dB)	(dBi)	(dBm)	%	(W)	(mW)	(mW/cm ²)	(mW/cm ²)	(W/m ²)		
LTE Band 7 (QPSK, #1RB, RMS-Value)	2500,7	23,0	2,0	0,0	25,0	100%	0,316	316	1,0000	0,0629	0,9371	0,062912	0,0629115
	2535,0	23,0		0,0	25,0		0,316	316	1,0000	0,0629	0,9371	0,062912	
	2569,3	23,0		0,0	25,0		0,316	316	1,0000	0,0629	0,9371	0,062912	
LTE Band 7 (16QAM, #1RB, RMS-Value)	2500,7	23,0	2,0	0,0	25,0	100%	0,316	316	1,0000	0,0629	0,9371	0,062912	0,0629115
	2535,0	23,0		0,0	25,0		0,316	316	1,0000	0,0629	0,9371	0,062912	
	2569,3	23,0		0,0	25,0		0,316	316	1,0000	0,0629	0,9371	0,062912	

Maximum calculated MPE value:		
Lowest MPE-Limit in frequency-band:	1,0000	[mW/cm ²]
Highest MPE value in frequency-band:	0,0629	[mW/cm ²]
Margin to limit in frequency-band:	0,9371	[mW/cm ²]

Maximum antenna gain considerations for fixed/mobile operations for complying with limits:					
P	Maximum power input to the antenna incl. Duty cycle (mW): (Avg. Burst Power or RMS)				316
R	Distance (cm):				20
S	MPE limit acc. §1.1310 for uncontrolled exposure (mW/cm ²): (FCC use mW/cm ²)				1,00
G ₁	Maximum Antenna gain to comply with MPE limit (dBi):				12,01

(For G1 the low est measured channel to reach minimum ant. Gain selected)

ERP power limit according to §2.1091 [W]: (Avg. Burst Power or RMS)					
G ₂	Max. Antenna gain to comply with this limit incl. Duty cycle (dBi):				11,92

(For G2 select the max. Avg. Burst Power or RMS value incl. Duty cycle)

ERP power limit according to §27.50(h)(2) [W]:					
G ₃	Max. Antenna gain to comply with this limit (dBi):				8,01

(For G3 select the max. Average burst power value excluding Duty cycle)

Min (G ₁ , G ₂ , G ₃) (dBi)					
					8,01

Summarized results:	The max. ant. gain for mobile operation at 1900 MHz band to comply with MPE and ERP limits incl. path loss shall not exceed (dBi):				8,01
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4.2.10. Results for operational band: LTE Band 7 – Set-up 2 (Roof-Version , External antenna)

Safety-Distance	20	cm													
Operation Mode	Frequency on channel	Declared maximum conducted output power	Max. positive tolerance according manufacturer	Antenna Gain	Path Loss Module to Ext. Antenna (MIMO1)	Uncertainty of Path-Loss	Declared maximum ERP (Measured+ Tune-up+ Antenna Gain) (dBm)	Duty cycle	Declared Maximum ERP	Equivalent ERP (maximum ERP x duty cycle)	MPE Limit accord. Table 1	MPE-Value	Margin to limit:	Fraction for Co-Location calculations	Max. Fraction-Value within Frequency Band
	(MHz)	(dBm)	(dB)	(dB)	(dB)	(dB)		%	(W)	(m W)	(m W/cm^2)	(m W/cm^2)	(W/m^2)		
LTE Band 7 (QPSK, #1RB, RMS-Value)	2500,7	23,0	2,00	4,20	5,20	0,25	24,25	100%	0,266	266	1,0000	0,0529	0,9471	0,052933	0,0529334
	2535,0	23,0		4,20	5,20	0,25	24,25		0,266	266	1,0000	0,0529	0,9471	0,052933	
	2569,3	23,0		4,20	5,20	0,25	24,25		0,266	266	1,0000	0,0529	0,9471	0,052933	
LTE Band 7 (16QAM, #1RB, RMS-Value)	2500,7	23,0	2,00	4,20	5,20	0,25	24,25	100%	0,266	266	1,0000	0,0529	0,9471	0,052933	0,0529700
	2535,0	23,0		4,20	5,20	0,25	24,25		0,266	266	1,0000	0,0529	0,9471	0,052933	
	2569,3	23,0		4,20	5,20	0,25	24,25		0,266	266	1,0000	0,0530	0,9470	0,052970	
Maximum calculated MPE value:															
Lowest MPE Limit in frequency-band:	1,0000	[m W/cm^2]													
Highest MPE value in frequency-band:	0,0530	[m W/cm^2]													
Margin to limit in frequency-band:	0,9470	[m W/cm^2]													

4.2.11. Results for operational band: LTE Band 7 – Set-up 3 (Roof-Version , Internal antenna)

Safety-Distance	20	cm													
Operation Mode	Frequency on channel	Declared maximum conducted output power	Max. positive tolerance according manufacturer	Antenna Gain	Path Loss Module to Ext. Antenna (MIMO1)	Uncertainty of Path-Loss	Declared maximum ERP (Measured+ Tune-up+ Antenna Gain) (dBm)	Duty cycle	Declared Maximum ERP	Equivalent BRP (maximum ERP x duty cycle)	MPE Limit accord. Table 1	MPE-Value	Margin to limit:	Fraction for Co-Location calculations	Max. Fraction-Value within Frequency Band
	(MHz)	(dBm)	(dB)	(dBi)	(dB)	(dB)		%	(W)	(mW)	(mW/cm^2)	(mW/cm^2)	(W/m^2)		
LTE Band 7 (QPSK, #1RB, RMS-Value)	2500,7	23,0	2,00	4,30	1,60	0,25	27,95	100%	0,624	624	1,0000	0,1241	0,8759	0,124088	0,1240881
	2535,0	23,0		4,30	1,60	0,25	27,95		0,624	624	1,0000	0,1241	0,8759	0,124088	
	2569,3	23,0		4,30	1,60	0,25	27,95		0,624	624	1,0000	0,1241	0,8759	0,124088	
LTE Band 7 (16QAM, #1RB, RMS-Value)	2500,7	23,0	2,00	4,30	1,60	0,25	27,95	100%	0,624	624	1,0000	0,1241	0,8759	0,124088	0,1241738
	2535,0	23,0		4,30	1,60	0,25	27,95		0,624	624	1,0000	0,1241	0,8759	0,124088	
	2569,3	23,0		4,30	1,60	0,25	27,95		0,624	624	1,0000	0,1242	0,8758	0,124174	
Maximum calculated MPE value:															
Lowest MPE Limit in frequency-band:	1,0000	[mW/cm^2]													
Highest MPE value in frequency-band:	0,1242	[mW/cm^2]													
Margin to limit in frequency-band:	0,8758	[mW/cm^2]													

4.2.12. Results for operational band: LTE Band 7 – Set-up 4 (Trunk-Version)

Safety-Distance	20	cm														
Operation Mode	Frequency on channel	Declared maximum conducted output power	Max. positive tolerance according manufacturer	Antenna Gain	Path Loss Module to Ext. Antenna (MIMO1)	Uncertainty of Path-Loss	Path Loss due cable loss to external antenna	Declared maximum ERP (Measured+ Tune-up+ Antenna Gain) (dBm)	Duty cycle	Declared Maximum ERP	Equivalent ERP (maximum ERP x duty cycle)	MPE Limit accord. Table 1	MPE-Value	Margin to limit:	Fraction for Co-Location calculations	Max. Fraction-Value within Frequency-Band
	(MHz)	(dBm)	(dB)	(dBi)	(dB)	(dB)	(dB)		%	(W)	(m W)	(m W/cm^2)	(m W/cm^2)	(W/m^2)		
LTE Band 7 (QPSK, #1RB, RMS-Value)	2500,7	23,0	2,00	1,0	1,1	0,25	2,16	22,99	100%	0,199	199	1,0000	0,0396	0,9604	0,039603	0,0396032
	2535,0	23,0		1,0	1,1	0,25	2,16	22,99		0,199	199	1,0000	0,0396	0,9604	0,039603	
	2569,3	23,0		1,0	1,1	0,25	2,16	22,99		0,199	199	1,0000	0,0396	0,9604	0,039603	
LTE Band 7 (16QAM, #1RB, RMS-Value)	2500,7	23,0	2,00	1,0	1,1	0,25	2,16	22,99	100%	0,199	199	1,0000	0,0396	0,9604	0,039603	0,0396306
	2535,0	23,0		1,0	1,1	0,25	2,16	22,99		0,199	199	1,0000	0,0396	0,9604	0,039603	
	2569,3	23,0		1,0	1,1	0,25	2,16	22,99		0,199	199	1,0000	0,0396	0,9604	0,039631	
Maximum calculated MPE value:																
Lowest MPE-Limit in frequency-band:	1,0000	[m W/cm^2]														
Highest MPE value in frequency-band:	0,0396	[m W/cm^2]														
Margin to limit in frequency-band:	0,9604	[m W/cm^2]														

4.3. 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	--	--	--			
		12.75 - 26.5GHz	N/A	0.82	--	--	--			
Conducted emissions on RF-port	-	9 kHz - 2.8 GHz	0.70	N/A	--	--	--		N/A - not applicable	
		2.8 GHz - 12.75GHz	1.48	N/A	--	--	--			
		12.75 GHz - 18GHz	1.81	N/A	--	--	--			
		18 GHz - 26.5GHz	1.83	N/A	--	--	--			
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

5. 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

6. 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 Measur.	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 Measur.	VCCI, Voluntary Control Council for Interference by Information Technology Equipment, Japan
OATS = Open Area Test Site, SAR = Semi Anechoic Room, FAR = Fully Anechoic Room			

7. Instruments and Ancillary

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

7.0.1. 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)

7.0.2. 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	
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	
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
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
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	-	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	
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	
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
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	
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	-	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	-	
692	Bluetooth Tester	CBT 32	100236	Rohde & Schwarz	24 M	-	31.03.2016
697	Power Splitter	ZN4PD-642W-S+	165001445	Mini-Circuits	-	2	

7.0.3. 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

8. Versions of test reports (change history)

Version	Applied changes	Date of release
--	Initial release	2016-01-29
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