

**TEST REPORT**  
 No.: 6-0147-12-14-5c

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






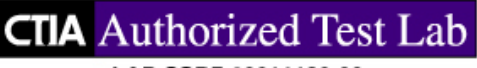
**IC-Regulations**  
 RSS-132 Issue 3, RSS-133 Issue 6,  
 RSS-139 Issue 2, RSS-Gen Issue 3

for

**Gemalto M2M GmbH**

**Wireless Module ALS1-US**  
**(LTE-Mode)**

FCC-ID: QIPALS1-US  
 IC: 7830A-ALS1US

Laboratory Accreditation and Listings			
 Deutsche Akkreditierungsstelle D-PL-12047-01-01	 Reg. No.: 736496 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-2665, R-2666 C-2914, T-1967, G-301
 <b>AUTHORIZED            RF LABORATORY</b>	 <b>LAB CODE 20011130-00</b>		
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 Equipment Under Test (in this report, hereinafter referred as EUT) supports radiofrequency technologies. This test report shows results for LTE technologies only for LTE Bands II, IV,V and XVII. Other implemented wireless technologies were not considered within this test report.

Following tests have been performed to show compliance with applicable FCC Part 2, Part 22, Subpart H and Part 24, Subpart E (Broadband PCS) of the FCC CFR 47 Rules, Edition 1<sup>st</sup> October 2012 and Canada RSS-132 Issue 3, RSS-133 Issue 6, RSS-139 Issue 2 and RSS-Gen Issue 3 standards.

## 1.1. TX mode, tests overview according FCC and Canadian RSS Standards


No. of Diagram group	Test case	Port	References & Limits			EUT set-up	EUT op-mode	Result
			FCC Standard	RSS Section	Test limit			
1	AC-Power Lines Emissions Conducted (0,15 - 30 MHz)	AC-Power lines (conducted)	§15.207	RSS-Gen, Issue 3: Chapter 7.2.4	§15.207 limits  IC: Table 4, Chapter 7.2.4	--	--	Remark 1.)
2	General field strength emissions (9 kHz - 30 MHz)	Cabinet + inter-connecting cables  (radiated)	§15.209(a)	RSS-Gen, Issue 3: Chapter 4.11 Chapter 7.2.5, Table 5+6	2400/F(kHz) µV/m 24000/F(kHz) µV/m 30 µV/m	--	--	Remark 1.)
7	RF-Power (ERP/EIRP)		§2.1046 §22.913(a)(2)	RSS-132: 5.4 SRSP-503: 5.1.3	< 7 Watt (ERP)	1	1+2+3 +4	passed
			§24.232(c)	RSS-133:4.1/6.4 SRSP-510: 5.1.2	< 2 Watt (EIRP)			
			§27.50 (d)(4)(5)(6)	RSS-139: 6.4	< 1 Watt (EIRP)			
			§27.50(c)(10)	--	< 3 Watt (ERP)			
8	Spurious emissions		§2.1053(a) §2.1057 §22.917(a)(b) §24.238(a)(b) §27.53(h)(3) (ii)(iii)	RSS-132: 4.5.1 & 4.5.2  RSS-133: 6.5.1(a)(b)  RSS-139: Issue 2 Chapter 6.5 (i) (ii)	43+10log(P) dBc	1	1+2+3 +4	passed
9	Band-Edge compliance		§27.53(g)	--		5	4	


30	RF Power	Antenna terminal (conducted)	§2.1046	--	N/A	3	1+2+3 +4	passed
						4	4	
34	26dB Emission bandwidth		§2.202 §2.1049 §22.917(a) §24.238(a) §27.53(h)(3)	RSS-Gen:4.6.1	99% Power	2	1+2+3 +4	For information only
35	99% Occupied bandwidth							
36	Spurious emissions		§2.1051 §2.1057 §22.917(a)(b) §24.238(a)(b) §27.53(h)(3) (ii)(iii)	RSS-132: 5.5(i)(ii)	43+10log(P) dBc	2	1+2+3 +4	passed
37	Band-Edge compliance		§27.53(g)	--				
38	Frequency stability		§22.355, table C-1 §24.235 §2.1055(a)(2) §27.54	RSS-132: 5.3	< ±2.5ppm	2	1+2+3 +4	passed
				RSS-133: 6.3				


Remarks: 1.) see separate test report TR6-0147-12-14-5d for tests according FCC Part15C

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

### 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:	2013-02-18
Date(s) of test:	2013-02-19 to 2013-07-26
Date of report:	2013-07-26
-----	
Version of template:	12.11

### 2.4. Applicant’s details

Applicant’s name:	Gemalto M2M GmbH
Address:	Siemensdamm 50 13629 Berlin  Germany
Contact person:	Mr. Thorsten Liebig

### 2.5. Manufacturer’s details

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

### 3. Equipment under test (EUT)

#### 3.1. TECHNICAL DATA OF MAIN EUT DECLARED BY APPLICANT

Main function	GSM/GPRS/E-GPRS/W-CDMA/LTE Wireless Module		
Type	ALS1-US		
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 (only for use in USA)	See Note about channels not to be used depending on channel bandwidths	
Emission designator(s) (Worst-Case, max. bandwidth stated here)	Channel bandwidth	QPSK Modulation:	16-QAM Modulation
	1.4 MHz 3 MHz 5 MHz 10 MHz 15 MHz 20 MHz	1M09G7W 2M70G7D 4M47G7D 8M93G7D 13M4G7D 17M8G7D	1M09W7D 2M69W7D 4M47W7D 8M93W7D 13M4W7D 17M9W7D
Antenna Type	<input type="checkbox"/> Integrated <input type="checkbox"/> External, no RF- connector <input checked="" type="checkbox"/> External, separate RF-connector: main TX + secondary RX connector		
Antenna Gain	max. 0dBd gain		
MAX PEAK Output Power: Radiated	LTE-Mode 2 LTE-Mode 4 LTE-Mode 5 LTE-Mode 17	28.8 dBm 26.4 dBm 24.3 dBm 19.6 dBm	
MAX PEAK Output Power: Conducted	LTE-Mode 2 LTE-Mode 4 LTE-Mode 5 LTE-Mode 17	22.76 dBm 22.97 dBm 22.99 dBm 22.5 dBm	
FCC-ID	QIPALS1-US		
IC	7830A-ALS1US		
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)		
Power supply	<input checked="" type="checkbox"/> DC power only: 9-12 Volt on DSB75-Adapter Converted to voltage range of 3.3 V to 4.2 V by DSB75-Adapter board		
Special EMI components	--		
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	

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

Short description*)	EUT	Type	S/N serial number	HW hardware status	SW software status
EUT A	Wireless Module	ALS1-US	004401080900 562 (sample#21)	B2 (rev.3)	00.170
EUT B	Wireless Module	ALS1-US	004401080900 430 (sample#35)	B2 (Rev.3)	00.170
EUT C	Wireless Module	ALS1-US	004401080906 320	Rev.4.2	01.010

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

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

AE short description *)	Auxiliary Equipment	Type	S/N serial number	HW hardware status	SW software status
AE 1	SMARTEQ MiniMag. mount antenna 1	2.6m RG174, SMA-m 0dBd, 824-960 / 1710-2170MHz	59801B	1140.26 SMA	-
AE 2	SMARTEQ MiniMag. mount antenna 2	2.6m RG174, SMA-m 0dBd, 824-960 / 1710-2170MHz	59801B	1140.26 SMA	-
AE 3	RS232 cable	2 m	-	-	-
AE 4	DSB75-Adapter	DSB75	-	AH6-DSB75-1	-
AE 5	Handset Votronic	Telephone receiver with RJ11 connector	4017953211 311	HH-SI-30.3/V3.0/0	-
AE 6	USB cable	1m	-	-	-
AE 7	Notebook	DELL D610 D	CTC-PC3	-	Windows XP + Terminal Program
AE 8	Test adapter	For EUT A/B/C	--	--	--

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

### 3.4. EUT set-ups

EUT set-up no.*)	Combination of EUT and AE	Remarks
Set. 1	EUT A + AE1 + AE2 + AE3 + AE4 + AE5 + AE6 + AE 7 + AE 8	<b>Radiated</b> tests performed: AT commands set the device into operating mode conditions with help of AE7  AE6 is not connected to the EUT during tests
Set. 2	EUT A + AE3 + AE4 + AE5 + AE6 + AE 7 + AE 8	<b>Conducted</b> tests performed: AT commands set the device into operating mode conditions with help of AE7
Set. 3	EUT B + AE4 + AE6 + AE 7 + AE 8	<b>RF-Conducted Output power</b> tests performed: AT commands set the device into operating mode conditions with help of AE7
Set. 4	EUT C + AE4 + AE6 + AE 7 + AE 8	<b>RF-Conducted Output power</b> tests performed: AT commands set the device into operating mode conditions with help of AE7
Set. 5	EUT C + AE1 + AE2 + AE3 + AE4 + AE5 + AE6 + AE 7 + AE 8	<b>Radiated</b> tests performed: AT commands set the device into operating mode conditions with help of AE7  AE6 is not connected to the EUT during tests

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

### 3.5. EUT operating modes

EUT operating mode no.*)	Description of operating modes	Additional information
1	LTE-Band 2 RMC Mode	A communication link is established between the mobile station (UE) and the test simulator. The transmitter is operated on its maximum rated output power class: 23dBm nominal. The input signal to the receiver is modulated with normal test modulation: QPSK or 16-QAM Modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link.
2	LTE-Band 4 RMC Mode	A communication link is established between the mobile station (UE) and the test simulator. The transmitter is operated on its maximum rated output power class: 23dBm nominal. The input signal to the receiver is modulated with normal test modulation: QPSK or 16-QAM Modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link.
3	LTE-Band 5 RMC Mode	A communication link is established between the mobile station (UE) and the test simulator. The transmitter is operated on its maximum rated output power class: 23dBm nominal. The input signal to the receiver is modulated with normal test modulation: QPSK or 16-QAM Modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link.



4	LTE-Band 17  RMC Mode	A communication link is established between the mobile station (UE) and the test simulator. The transmitter is operated on its maximum rated output power class: 23dBm nominal. The input signal to the receiver is modulated with normal test modulation: QPSK or 16-QAM Modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link.
---	-----------------------------	--

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

### 3.6. Configuration of cables used for testing

Cable number	Item	Type	S/N serial number	HW hardware status	Cable length
Cable 1	RS232 Port	--	--	--	2.5 m
Cable 2	USB Port	--	--	--	1 m
Cable 3	RJ11 handset line	--	--	--	1.5 m
Cable 4	RF-antenna port 1 (main)	--	--	--	1.5 m
Cable 5	RF-antenna port 2 (secondary)	--	--	--	1.5 m

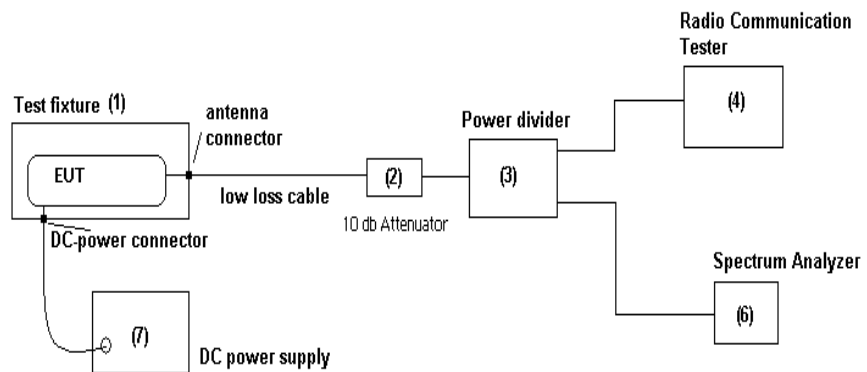
## 4. Description of test system set-up's

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

**Specification:** ANSI 63-10:2009

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

**Schematic:**

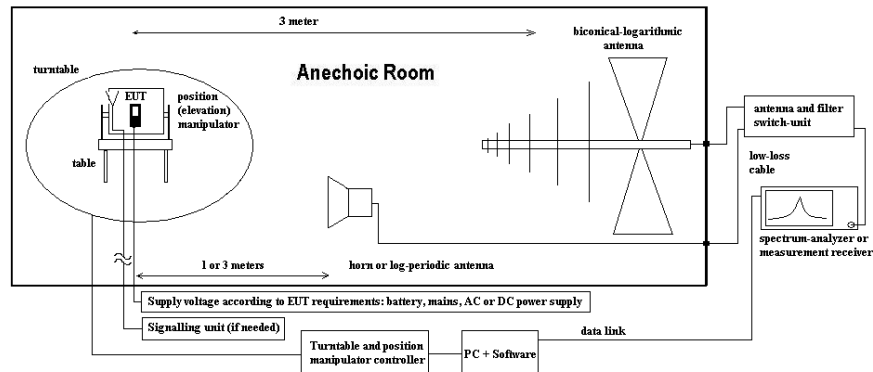


## 4.2. Test system set-up for radiated spurious emission measurements

**Specification:** ANSI C63.4-2009 chapter 8, ANSI C63.10-2009 chapter 6.5&6.6

**General Description:** Evaluating the field emissions have to be done first by an exploratory emissions measurement and a final measurement for most critical frequencies. The tests are performed in a CISPR 16-4 compliant fully anechoic room (FAR) recognized by the regulatory commission. The measurement distance was set to 3 meter for frequencies up to 20 GHz and 1 meter above 20 GHz. A logarithmic periodic antenna is used for the frequency range 30 MHz to 20 GHz. From 20 GHz to 40 GHz a horn antenna is used. The antennas are set to fixed antenna height of 1.55 m and the EUT aligned within 3 dB cone of radiation pattern.

**Schematic:**



**Testing method:**

### Exploratory, preliminary measurements

The EUT and its associated accessories are placed on a non-conductive position manipulator (tipping device) of 1.55 m height which is placed on the turntable. By rotating the turntable (range 0° to 360°, step 45°) and the EUT itself either on 3-orthogonal axis (portable equipment) or 2-orthogonal axis (defined operational position of EUT) the emission spectrum and its characteristics was recorded with an EMI-receiver, broadband antenna and software. The measurements are performed in horizontal and vertical polarization of the measurement antennas. The results are documented in a diagram. Critical frequencies (low margin to limit) are saved within a table for further investigations. If various operating modes are supported, further investigations are made to find the worst-case of them. Also the interconnection cables and equipment position were varied in order to maximize the emissions.

### Final measurement on critical frequencies

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

First a frequency zoom around the critical frequency is done to locate the frequency more precisely. After this step, for all identified critical frequencies, the maximum peak was determined. Following parameters were varied: the turntable angle continuously in the range 0 to 360 degree, the EUT itself either over 3-orthogonal axis (not defined usage position) or 2-orthogonal axis (defined usage position). The measurement antenna height is fixed to 1.55 m.

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 radiated

#### 5.1.1. Test location and equipment (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 type="checkbox"/> 574 BTA-L	<input type="checkbox"/> 133 EMCO3115	<input type="checkbox"/> 302 BBHA9170
signalling	<input type="checkbox"/> 392 MT8820A	<input type="checkbox"/> 436 CMU	<input checked="" type="checkbox"/> 546 CMU
otherwise	<input type="checkbox"/> 400 FTC40x15E	<input type="checkbox"/> 401 FTC40x15E	<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
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"/> 620 ESU 26
			<input type="checkbox"/> 482 Filter Matrix
			<input type="checkbox"/> 378 RadiSense
			<input type="checkbox"/> 494 AG6632A
			<input type="checkbox"/> 498 NGPE 40

#### 5.1.2. Requirements and limits

<b>FCC</b>	§2.1046(a), §22.913, § 24.232(c); §27.50(d)(4), §27.50( c)(10)
<b>IC</b>	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 2: 6.4 + PAR PK-AV ≤ 13 dB
<b>Limit</b>	Maximum Power Output of the mobile phone should be determined while measured radiated E(IRP).
	Limit FDD Band 5: 7 Watt ERP (38.4 dBm)
	Limit FDD Band 2: 2 Watt EIRP (33.0 dBm)
	Limit FDD Band 4: 1 Watt EIRP (30.0 dBm)

#### 5.1.3. 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±3°C)		Rel. humidity: (40±20)%
Test system set-up		Please see chapter "Test system set-up for radiated spurious emission measurements up to 20 GHz"		
Spectrum Analyzer Settings	<b>Parameter:</b>	Spectrum analyser mode		
	Scan Mode Span RBW VBW Sweep time Sweep mode Detector	100 MHz 10 MHz 10 MHz Coupled repetitive Peak		
Measurement method	<p>The measurements were performed by using the <b>substitution method</b> (ANSI/TIA/EIA 603C/D) with a spectrum-analyzer. This method can be described like follows:</p> <ol style="list-style-type: none"> <li>choosing of suitable spectrum-analyzer settings for performing the measurements. This settings of the spectrum analyzer must be maintained for both stages of the measurements: EUT emission measurements and also for measurements of the substituted level.</li> <li>The maximum level of the peak power was recorded, while the emissions were maximized by rotating the EUT in three orthogonal axes, which was situated on a non-conductive turntable of 1.55 m height (<math>P_{MEAS,1}</math>). This was performed for both measuring antenna polarisations (vertical/horizontal), the maximum of both values is used for further measurements and final substitution (<math>P_{MEAS,1,MAX}</math>).</li> <li>As the maximum emission is recorded, the EUT is replaced by a frequency dependant suitable antenna, which is connected to a RF-signal generator, which is transmitting on the determined worst-case frequency as determined in step 2.</li> <li>The RF-signal level of the signal generator is adjusted as long the same worst-case level determined first step is measured at the spectrum analyzer (<math>P_{SMHU}=P_{MEAS,1,MAX}</math>)</li> <li>Than the RF-signal cable is disconnected from the antenna and connected to a power-level meter. The level is determined (<math>P_{MEAS,2}</math>).</li> <li>The final result is calculated by adding the ERP/EIRP gain of the antenna which substitutes the EUT. <math>P_{EUT,SUBST} = P_{MEAS,2} + G_{ANTENNA}</math></li> </ol>			
Mobile phone settings	<p>A call was established on highest power transmit conditions in RMC mode. MPR was deactivated.</p> <p>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.</p>			

**5.1.4. Results**

Worst-Case channel, Signal bandwidth and resource block configuration from conducted tests cases, re-tested in order to have ERP. and EIRP values.

EUT			Set-up 1, Op.Mode 1				
Operating Mode	Channel		Peak Output Power [dBm]			Antenna Polarisation for maximum Power	Result
	Range	No.	PK	AV			
LTE Band 2	Low	18615	27.3	1.)	EIRP-Value	V	passed
	Middle	18900	<b>28.8</b>				
	High	19100	28.1				

Remark: 1.) see conducted measurements for PAR factor

EUT			Set-up 1, Op.Mode 2				
Operating Mode	Channel		Peak Output Power [dBm]			Antenna Polarisation for maximum Power	Result
	Range	No.	PK	AV			
LTE Band 4	Low	20025	24.2	1.)	EIRP-Value	V	passed
	Middle	20175	<b>26.4</b>				
	High	20325	23.6				

Remark: 1.) see conducted measurements for PAR factor

EUT			Set-up 1, Op.Mode 3				
Operating Mode	Channel		Peak Output Power [dBm]			Antenna Polarisation for maximum Power	Result
	Range	No.	PK	AV			
LTE Band 5	Low	20525	21.2	1.)	ERP-Value	H	passed
	Middle	20635	<b>24.3</b>				
	High	20415	20.8				

Remark: 1.) see conducted measurements for PAR factor

EUT			Set-up 1, Op.Mode 4				
Operating Mode	Channel		Peak Output Power [dBm]			Antenna Polarisation for maximum Power	Result
	Range	No.	PK	AV			
LTE Band 17	Low	23780	18.9	1.)	ERP-Value	H	passed
	Middle	23790	17.1				
	High	23825	<b>19.6</b>				

Remark: 1.) see conducted measurements for PAR factor

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

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

test location	<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"/> 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 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

### 5.2.2. Requirements and limits

<b>FCC</b>	§2.1053(a)-radiated , §2.1057(a)(a) , §22.917(a)(b) ; §24.238(a)(b) ; §27.53(h)(1)(3)(i)(ii)(iii) §27.53(g)
<b>IC</b>	RSS-132, Issue 2: 4.5.1.2, RSS-133, Issue 4: 6.5.1(a)(i)&(b), RSS-139, Issue 2: 6.5 (i)(ii)
<b>Limit</b>	„the power of emissions shall be attenuated below the transmitter output power (p) by at least 43+10Log(P) dB“ -> Resulting limits for all power levels of the Mobile Phone: -13dBm

### 5.2.3. Test condition and test set-up

link to test system (if used):	<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±3°C)		Rel. humidity: (40±20)%
Test system set-up	Please see chapter “Test system set-up for radiated spurious emission measurements up to 20 GHz”		
Spectrum Analyzer Settings	<b>Parameter:</b> Scan Mode RBW VBW Sweep time Sweep mode Detector	Spectrum analyser mode 1 MHz 10 MHz Coupled 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 block-edge where a AVERAGE detector applied when results are critical (low margin or limit exceed). Tests have been performed in various settings for the device regarding allocated ressource blocks and channels in order to find worst-case configuration. Due to very big amount of possible combinations only certain combinations have been tested.		
Mobile phone settings	A call was established on highest power transmit conditions in RMC mode. MPR was deactivated.  The measurements were made at the low, middle and high carrier frequencies of each of the supported operating band within the designated range within the allowed channel bandwidths. Choosing three TX-carrier frequencies of the mobile phone, should be sufficient to demonstrate compliance.		

**Spectrum-Analyzer settings for LTE band 2**

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

**Spectrum-analyzer settings for FDD Band 4**

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

**Spectrum-analyzer settings for LTE Band 5**

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

**Spectrum-analyzer settings for LTE Band 17**

	Start freq. MHz	Stop freq. MHz	R-BW 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	9000	1	1	160	10	MaxH-PK
Sweep 2a (Block-Edge)	703	704	0.05	0.5	30	35	MaxH-PK
Sweep 2b (Block-Edge)	703	704	0.05	0.5	30	35	MaxH-AV
Sweep 3a (Block-Edge)	716	717	0.05	0.5	30	35	MaxH-PK
Sweep 3b (Block-Edge)	716	717	0.05	0.5	30	35	MaxH-AV

**5.2.4. Results**

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

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

Diagram no.	Carrier Channel		Frequency range	OP-mode no.	Remark	Used detector			Result
	Range	No.				PK	AV	QP	
8.20a	Low	18607	30 MHz to 20 GHz	1	Carrier visible on diagram. Not relevant for results QPSK modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
8.20b	Low	18607	30 MHz to 20 GHz	1	Carrier visible on diagram. Not relevant for results 16-QAM modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.24a	Low	18615	1849 – 1850 MHz	1	Band-Edge compliance QPSK modulation Remark 1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
9.24b	Low	18615	1849 – 1850 MHz	1	Band-Edge compliance QAM modulation Remark 1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
8.21	Middle	18900	30 MHz to 20 GHz	1	Carrier visible on diagram. Not relevant for results	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
8.22	High	19100	30 MHz to 20 GHz	1	Carrier visible on diagram. Not relevant for results	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.26a	High	19185	1910 – 1911 MHz	1	Band-Edge compliance QPSK modulation Remark 1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
9.26b	High	19185	1910 – 1911 MHz	1	Band-Edge compliance QAM modulation Remark 1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed

Remark1: LTE EUT channel bandwidth of 3MHz was chosen as worst-case as determined within conducted band-edge measurements

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

Diagram no.	Carrier Channel		Frequency range	OP-mode no.	Remark	Used detector			Result
	Range	No.				PK	AV	QP	
8.40	Low	19957	30 MHz to 20 GHz	2	Carrier visible on diagram. Not relevant for results	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.44a	Low	19965	1709 - 1710 MHz	2	Band Edge Compliance QPSK modulation, remark 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.44b	Low	19965	1709 - 1710 MHz	2	Band Edge Compliance 16-QAM modulation, remark1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
8.41	Middle	20175	30 MHz to 20 GHz	2	Carrier visible on diagram. Not relevant for results	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
8.42	High	20300	30 MHz to 20 GHz	2	Carrier visible on diagram. Not relevant for results	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.46a	High	20385	1755 – 1756 MHz	2	Band Edge Compliance QPSK modulation, remark 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.46b	High	20385	1755 – 1756 MHz	2	Band Edge Compliance 16-QAM modulation remark 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed

Remark1: LTE EUT channel bandwidth of 3MHz was chosen as worst-case as determined within conducted band-edge measurements



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

Diagram no.	Carrier Channel		Frequency range	OP-mode no.	Remark	Used detector			Result
	Range	No.				PK	AV	QP	
8.50	Low	20407	30 MHz to 9 GHz	3	Carrier visible on diagram. Not relevant for results	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.504a	Low	20415	823 – 824 MHz	3	Band Edge Compliance QPSK modulation, remark 2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
9.504b	Low	20415	823 – 824 MHz	3	Band Edge Compliance 16-QAM modulation remark 2	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
8.51	Middle	20525	30 MHz to 9 GHz	3	Carrier visible on diagram. Not relevant for results	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
8.52	High	20600	30 MHz to 9 GHz	3	Carrier visible on diagram. Not relevant for results	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.502a	Low	20643	849 - 850 MHz	3	Band Edge Compliance QPSK modulation, remark 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.502b	Low	20643	849 - 850 MHz	3	Band Edge Compliance 16-QAM modulation remark 1+2	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed

Remark: 1.) LTE EUT channel bandwidth of 1.4 MHz used for measurements (correction factor of  $10\log(\text{measurement BW}=20\text{kHz}/14\text{kHz})= 1.54 \text{ dB}$ )  
 2.) LTE EUT Signal bandwidth of 3MHz was chosen as worst-case as determined within conducted band-edge measurements

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

Diagram no.	Carrier Channel		Frequency range	OP-mode no.	Remark	Used detector			Result
	Range	No.				PK	AV	QP	
8.1701 a	Low	23755	30 MHz to 1 GHz	4	Carrier visible on diagram. Not relevant for results	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
8.1701 b	Low	23755	1 GHz to 9GHz	4	--	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.1701 a	Low	23755	703 - 704 MHz	4	Band Edge Compliance QPSK modulation Remark 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.1701 b	Low	23755	703 - 704 MHz	4	Band Edge Compliance 16-QAM modulation remark 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
8.1702	Middle	23790	30 MHz to 9 GHz	4	Carrier visible on diagram. Not relevant for results	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
8.1703	High	23800	30 MHz to 9 GHz	4	Carrier visible on diagram. Not relevant for results	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.1703 a	High	23825	716 – 717 MHz	4	Band Edge Compliance QPSK modulation Remark 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.1703 b	High	23825	716 – 717 MHz	4	Band Edge Compliance 16-QAM modulation remark 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed

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

**5.2.4.5. LTE Band 17: Op. Mode 4, Set-up 5**

Dia-gram no.	Carrier Channel		Frequency range	OP-mode no.	Remark	Used detector			Result
	Range	No.				PK	AV	QP	
--	Low	--	--	--	--	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	--
8.1704	Middle	23790	30 MHz to 9 GHz	5	Carrier visible on diagram. Not relevant for results	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
--	High	--	--	--	--	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	--

Remark: 1.) LTE EUT channel bandwidth of 5MHz used for measurements as worst-case as determined within conducted band-edge measurements  
 Due to non critical results only 1 channel re-tested

### 5.3. RF-Parameter - RF Peak power output conducted

#### 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				
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 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	<input checked="" type="checkbox"/> 611 E3632A
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

<b>FCC</b>	§2.1046
<b>IC</b>	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 2: 6.4 + PAR PK-AV ≤ 13 dB
<b>Limit</b>	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±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&amp;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 and band.</p>	
Mobile phone settings	<p>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)</p> <p>Tests have been performed in different EUT bandwidth settings and various settings for allocated RBs.</p> <p>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.</p>	

### 5.3.4. Measurement Results

#### 5.3.4.1. LTE Band 2 Results

LTE-Band 2/Set-up 3				QPSK-Modulation			16-QAM-Modulation			max- modulation	max. channel	absolute max. value
channel bandwidth	ARFCN ch. no.	ARFCN-Frequency [MHz]	Resource block allocation	Peak detektor [dBm]	RMS detektor [dBm]	PAR Faktor [dB]	Peak detektor [dBm]	RMS detektor [dBm]	PAR Faktor [dB]			
1.4 MHz	18607	1850,7	1 RB low	27,27	22,66	4,61	26,51	21,61	4,9	27,44	28,03	
			1 RB high	27,34	22,74	4,6	26,52	21,64	4,88			
			50% RB mid	27,44	22,55	4,89	N/A	N/A	--			
			100% RB	27,31	21,56	5,75	27,33	20,49	6,84			
	18900	1880	1 RB low	27,44	22,33	5,11	26,83	21,6	5,23	28,03		
			1 RB high	27,52	22,54	4,98	26,89	21,65	5,24			
			50% RB mid	28,03	22,57	5,46	N/A	N/A	--			
			100% RB	27,78	21,79	5,99	27,45	20,49	6,96			
	19193	1909,3	1 RB low	26,41	22,37	4,04	25,98	21,35	4,63	26,8		
			1 RB high	26,02	22,15	3,87	25,64	21,27	4,37			
			50% RB mid	26,36	22,01	4,35	N/A	N/A	--			
			100% RB	26,67	21,26	5,41	26,8	20,25	6,55			
3 MHz	18615	1851,5	1 RB low	27,1	22,39	4,71	26,59	21,48	5,11	28,31	28,31	28,39
			1 RB high	27,22	22,29	4,93	26,75	21,5	5,25			
			50% RB mid	27,13	21,38	5,75	27,73	22,03	5,7			
			100% RB	28,31	21,31	7	27,7	20,56	7,14			
	18900	1880	1 RB low	27,53	22,58	4,95	26,61	21,47	5,14	28,11		
			1 RB high	27,62	22,52	5,1	26,54	21,3	5,24			
			50% RB mid	27,33	21,63	5,7	28,11	21,89	6,22			
			100% RB	27,87	21,52	6,35	28,01	20,47	7,54			
	19185	1908,5	1 RB low	26,66	22,37	4,29	27,01	22,16	4,85	27,34		
			1 RB high	25,84	21,89	3,95	26,14	21,84	4,3			
			50% RB mid	26,51	21,32	5,19	26,66	21,63	5,03			
			100% RB	27,05	21,12	5,93	27,34	20,33	7,01			
5 MHz	18625	1852,5	1 RB low	27,12	22,75	4,37	27,29	22,18	5,11	27,88	28,39	28,39
			1 RB high	27,26	22,75	4,51	27,52	22,25	5,27			
			50% RB mid	27,76	21,51	6,25	27,77	21,73	6,04			
			100% RB	27,68	21,39	6,29	27,88	20,44	7,44			
	18900	1880	1 RB low	27,69	22,42	5,27	27,81	21,7	6,11	28,39		
			1 RB high	27,89	22,76	5,13	27,99	21,91	6,08			
			50% RB mid	27,67	21,45	6,22	28,25	21,66	6,59			
			100% RB	28,33	21,41	6,92	28,39	20,53	7,86			
	19175	1907,5	1 RB low	26,81	22,35	4,46	27,07	21,81	5,26	27,51		
			1 RB high	25,9	22,21	3,69	26,05	21,6	4,45			
			50% RB mid	27,41	21,32	6,09	27,51	21,49	6,02			
			100% RB	27,27	21,19	6,08	27,25	20,12	7,13			

10 MHz	18650	1855	1 RB low	27,7	21,36	6,34	26,49	21,49	5	27,72	28,05
			1 RB high	27,71	21,23	6,48	26,89	21,82	5,07		
			50% RB mid	27,49	21,3	6,19	27,28	20,65	6,63		
			100% RB	27,72	21,31	6,41	27,69	20,45	7,24		
	18900	1880	1 RB low	27,44	22,37	5,07	26,94	21,57	5,37	28,05	
			1 RB high	27,57	22,54	5,03	27	21,65	5,35		
			50% RB mid	27,99	21,44	6,55	27,87	20,61	7,26		
			100% RB	27,64	21,33	6,31	28,05	20,26	7,79		
	19150	1905	1 RB low	27,18	22,42	4,76	26,37	21,32	5,05	27,27	
			1 RB high	26,22	22,23	3,99	25,71	21,13	4,58		
			50% RB mid	27,1	21,04	6,06	27,13	20,44	6,69		
			100% RB	27,27	20,95	6,32	27,02	20,1	6,92		
15 MHz	18675	1857,5	1 RB low	27,3	22,62	4,68	26,59	21,61	4,98	28,09	
			1 RB high	27,67	22,67	5	26,82	21,73	5,09		
			50% RB mid	27,52	21,2	6,32	27,7	21,61	6,09		
			100% RB	28,09	21,27	6,82	27,75	20,3	7,45		
	18900	1880	1 RB low	27,39	22,52	4,87	27,07	22,02	5,05	28,21	
			1 RB high	27,41	22,54	4,87	27,23	22,28	4,95		
			50% RB mid	27,8	21,37	6,43	28,21	21,61	6,6		
			100% RB	28,09	21,13	6,96	27,79	20,26	7,53		
	19125	1902,5	1 RB low	27,1	22,38	4,72	26,28	21,23	5,05	27,82	
			1 RB high	26,17	22,12	4,05	25,66	21,01	4,65		
			50% RB mid	27,1	20,95	6,15	27,34	21,35	5,99		
			100% RB	27,82	20,93	6,89	27,64	19,97	7,67		
20 MHz	18700	1860	1 RB low	27,32	22,51	4,81	26,43	21,33	5,1	27,92	
			1 RB high	27,68	22,66	5,02	26,63	21,38	5,25		
			50% RB mid	27,49	21,21	6,28	27,85	21,45	6,4		
			100% RB	27,92	21,31	6,61	27,8	20,34	7,46		
	18900	1880	1 RB low	27,52	22,47	5,05	26,92	21,48	5,44	28,01	
			1 RB high	27,34	22,49	4,85	26,72	21,44	5,28		
			50% RB mid	27,51	21,2	6,31	28,01	21,45	6,56		
			100% RB	27,88	21,29	6,59	27,82	20,19	7,63		
	19100	1900	1 RB low	27,51	22,74	4,77	26,46	21,39	5,07	28,04	
			1 RB high	26,44	22,31	4,13	25,88	21,2	4,68		
			50% RB mid	27,22	21,1	6,12	27,63	21,49	6,14		
			100% RB	28,04	21,28	6,76	27,61	20,21	7,4		

Remark: 50% RB's not always applicable and to be set by the communication test center

5.3.4.2. LTE Band 4 Results

LTE-Band 4 / Set-up 3				QPSK-Modulation			16-QAM-Modulation			max- modulation	max. channel	absolute max. value
channel bandwidth	ARFCN ch. no.	ARFCN-Frequency [MHz]	Resource block allocation	Peak detektor [dBm]	RMS detektor [dBm]	PAR Faktor [dB]	Peak detektor [dBm]	RMS detektor [dBm]	PAR Faktor [dB]			
1.4 MHz	19957	1710,7	1 RB low	27,6	22,65	4,95	26,55	21,45	5,1	27,76	27,76	
			1 RB high	27,66	22,75	4,91	26,45	21,37	5,08			
			50% RB mid	27,76	22,47	5,29	N/A	N/A	-			
			100% RB	27,25	21,5	5,75	27,35	20,4	6,95			
	20175	1732,5	1 RB low	27,26	22,17	5,09	26,52	21,41	5,11	27,76		
			1 RB high	27,28	22,26	5,02	26,54	21,42	5,12			
			50% RB mid	27,76	22,35	5,41	N/A	N/A	-			
			100% RB	27,27	21,33	5,94	27,38	20,36	7,02			
	20393	1754,3	1 RB low	27,46	22,27	5,19	27,07	21,21	5,86	27,73		
			1 RB high	27,53	22,3	5,23	27,13	21,27	5,86			
			50% RB mid	27,73	22,2	5,53	N/A	N/A	-!			
			100% RB	27,58	21,21	6,37	27,58	20,24	7,34			
3 MHz	19965	1711,5	1 RB low	27,6	22,61	4,99	26,46	21,35	5,11	27,7		
			1 RB high	27,64	22,57	5,07	26,57	21,44	5,13			
			50% RB mid	27,25	21,57	5,68	27,59	21,72	5,87			
			100% RB	27,7	21,32	6,38	27,38	20,34	7,04			
	20175	1732,5	1 RB low	27,31	22,29	5,02	26,57	21,32	5,25	27,7		
			1 RB high	27,33	22,36	4,97	26,49	21,26	5,23			
			50% RB mid	27,1	21,28	5,82	27,46	21,43	6,03			
			100% RB	27,7	21,29	6,41	27,25	20,37	6,88			
	20385	1753,5	1 RB low	27,47	22,41	5,06	26,41	21,14	5,27	27,63		
			1 RB high	27,5	22,37	5,13	27,42	22,29	5,13			
			50% RB mid	27,09	21,32	5,77	27,61	21,51	6,1			
			100% RB	27,63	21,26	6,37	27,42	20,15	7,27			
5 MHz	19975	1712,5	1 RB low	27,36	22,71	4,65	27,61	22,01	5,6	27,85		
			1 RB high	27,31	22,53	4,78	27,71	21,99	5,72			
			50% RB mid	27,75	21,32	6,43	27,85	21,58	6,27			
			100% RB	27,65	21,3	6,35	27,74	20,18	7,56			
	20175	1732,5	1 RB low	27,63	22,52	5,11	27,44	21,59	5,85	28,04		
			1 RB high	27,55	22,45	5,1	27,34	21,59	5,75			
			50% RB mid	27,42	21,35	6,07	27,68	21,32	6,36			
			100% RB	28,04	21,21	6,83	27,89	20,2	7,69			
	20375	1752,5	1 RB low	27,16	22,45	4,71	27,44	21,87	5,57	27,75		
			1 RB high	27,31	22,85	4,46	27,55	22,3	5,25			
			50% RB mid	27,75	21,11	6,64	27,54	21,14	6,4			
			100% RB	27,35	21,07	6,28	27,61	20,05	7,56			

10 MHz	20000	1715	1 RB low	27,73	22,48	5,25	27,72	22,53	5,19	28,19	28,19
			1 RB high	27,82	22,43	5,39	27,83	22,52	5,31		
			50% RB mid	27,48	21,31	6,17	28,01	21,47	6,54		
			100% RB	28,19	21,31	6,88	28,13	20,35	7,78		
	20175	1732,5	1 RB low	27,33	22,3	5,03	26,52	21,2	5,32	27,87	
			1 RB high	27,27	22,31	4,96	26,5	21,32	5,18		
			50% RB mid	27,76	21,29	6,47	27,58	21,52	6,06		
			100% RB	27,87	21,13	6,74	27,62	20,36	7,26		
	20350	1750	1 RB low	27,14	22,43	4,71	27,42	21,78	5,64	27,77	
			1 RB high	27,05	22,27	4,78	27,44	21,75	5,69		
			50% RB mid	27,77	21,14	6,63	27,6	21,21	6,39		
			100% RB	27,53	20,99	6,54	27,53	20	7,53		
15 MHz	20025	1717,5	1 RB low	27,49	22,9	4,59	27,72	22,05	5,67	28,26	
			1 RB high	27,3	22,3	5	27,81	22,1	5,71		
			50% RB mid	27,59	21,21	6,38	27,98	21,43	6,55		
			100% RB	28,26	21,27	6,99	27,62	20,2	7,42		
	20175	1732,5	1 RB low	27,24	22,34	4,9	27	21,96	5,04	27,98	
			1 RB high	27,1	22,27	4,83	26,77	21,73	5,04		
			50% RB mid	27,26	21,02	6,24	27,98	21,43	6,55		
			100% RB	27,61	20,98	6,63	27,48	20,01	7,47		
	20325	1747,5	1 RB low	27,46	22,39	5,07	26,41	21,22	5,19	27,81	
			1 RB high	27,49	22,58	4,91	26,67	21,56	5,11		
			50% RB mid	27,44	21,08	6,36	27,6	21,32	6,28		
			100% RB	27,81	20,94	6,87	27,54	20,02	7,52		
20 MHz	20050	1720	1 RB low	27,68	22,97	4,71	26,45	21,3	5,15	27,94	
			1 RB high	27,49	22,54	4,95	26,56	21,38	5,18		
			50% RB mid	27,49	21,23	6,26	27,94	21,33	6,61		
			100% RB	27,73	21,14	6,59	27,54	20,1	7,44		
	20175	1732,5	1 RB low	27,42	22,3	5,12	26,71	21,27	5,44	27,9	
			1 RB high	27,38	22,72	4,66	26,53	21,11	5,42		
			50% RB mid	27,24	21,01	6,23	27,9	21,37	6,53		
			100% RB	27,52	21,12	6,4	27,44	20,05	7,39		
	20300	1745	1 RB low	27,35	22,42	4,93	26,44	21,29	5,15	27,79	
			1 RB high	27,35	22,27	5,08	26,54	21,37	5,17		
			50% RB mid	27,35	21,02	6,33	27,79	21,17	6,62		
			100% RB	27,63	20,99	6,64	27,35	20,02	7,33		

Remark: 50% RB's not always applicable and to be set by the communication test center

5.3.4.3. LTE Band 5 Results

LTE-Band 5 / Set-up 3				QPSK-Modulation			16-QAM-Modulation			max. modulation	max. channel	absolute max. value
channel bandwidth	ARFCN ch. no.	ARFCN-Frequency [MHz]	Resource block allocation	Peak detektor [dBm]	RMS detektor [dBm]	PAR Faktor [dB]	Peak detektor [dBm]	RMS detektor [dBm]	PAR Faktor [dB]			
1.4 MHz	20407	824.7	1 RB low	26,92	22,63	4,29	27,04	21,98	5,06	27,88	28,19	
			1 RB high	27,61	22,89	4,72	26,96	21,87	5,09			
			50% RB mid	27,86	22,90	4,96	N/A	N/A	--			
			100% RB	27,88	21,87	6,01	27,8	20,99	6,81			
	20525	836.5	1 RB low	28,11	22,9	5,21	27,69	22,01	5,68	28,19		
			1 RB high	28,06	22,83	5,23	27,65	22,01	5,64			
			50% RB mid	27,73	22,93	4,8	N/A	N/A	--			
			100% RB	27,51	21,77	5,74	28,19	20,76	7,43			
	20643	848.3	1 RB low	27,64	22,73	4,91	26,48	21,4	5,08	27,78		
			1 RB high	27,57	22,62	4,95	26,36	21,35	5,01			
			50% RB mid	27,78	22,4	5,38	N/A	N/A	--			
			100% RB	27,49	21,74	5,75	27,28	20,44	6,84			
3 MHz	20415	825.5	1 RB low	27,69	22,99	4,7	26,77	21,76	5,01	28,10		
			1 RB high	27,77	22,94	4,83	26,64	21,7	4,94			
			50% RB mid	27,35	21,87	5,48	27,83	22,09	5,74			
			100% RB	27,61	21,73	5,88	28,1	20,77	7,33			
	20525	836.5	1 RB low	27,74	22,69	5,05	26,84	21,59	5,25	28,77		
			1 RB high	27,7	22,76	4,94	27,02	21,84	5,18			
			50% RB mid	27,56	21,76	5,8	28,27	22,65	5,62			
			100% RB	28,77	21,63	7,14	28,15	20,74	7,41			
	20635	847.5	1 RB low	27,79	22,99	4,8	26,74	21,74	5	28,11		
			1 RB high	27,66	22,74	4,92	26,54	21,44	5,1			
			50% RB mid	27,21	21,55	5,66	27,81	21,97	5,84			
			100% RB	27,61	21,79	5,82	28,11	20,83	7,28			
5 MHz	20425	826.5	1 RB low	27,34	22,85	4,49	27,64	22,24	5,4	28,05		
			1 RB high	27,52	22,84	4,68	27,91	22,35	5,56			
			50% RB mid	27,95	21,7	6,25	27,81	21,88	5,93			
			100% RB	27,91	21,69	6,22	28,05	20,76	7,29			
	20525	836.5	1 RB low	28,07	22,72	5,35	28,05	21,83	6,22	28,40		
			1 RB high	27,91	22,91	5	27,9	22,01	5,89			
			50% RB mid	27,85	21,72	6,13	28,32	21,67	6,65			
			100% RB	28,4	21,61	6,79	28,29	20,6	7,69			
	20625	846.5	1 RB low	27,28	22,78	4,5	27,62	22,15	5,47	28,00		
			1 RB high	27,29	22,8	4,49	27,63	22,31	5,32			
			50% RB mid	28	21,77	6,23	27,74	21,6	6,14			
			100% RB	27,82	21,59	6,23	27,82	20,41	7,41			



10 MHz	20450	829	1 RB low	27,63	22,91	4,72	26,66	21,7	4,96	28,00	28,25
			1 RB high	27,97	22,79	5,18	26,81	21,73	5,08		
			50% RB mid	27,84	21,69	6,15	27,49	20,89	6,6		
			100% RB	28	21,58	6,42	27,92	20,63	7,29		
	20525	836.5	1 RB low	27,84	22,76	5,08	27,05	21,76	5,29	28,25	
			1 RB high	27,48	22,65	4,83	26,82	21,65	5,17		
			50% RB mid	28,25	21,69	6,56	27,97	20,88	7,09		
			100% RB	27,86	21,61	6,25	28,2	20,59	7,61		
	20600	844	1 RB low	27,71	22,82	4,89	26,59	21,55	5,04	27,75	
			1 RB high	27,64	22,84	4,8	26,86	21,92	4,94		
			50% RB mid	27,69	21,62	6,07	27,34	20,77	6,57		
			100% RB	27,75	21,42	6,33	27,61	20,47	7,14		

Remark: 50% RB's not always applicable and to be set by the communication test center

### 5.3.4.4. LTE Band 17 Results

LTE-Band 17 / Set-up 3				QPSK-Modulation			16-QAM-Modulation			max. modulation	max. channel	absolute max. value
channel bandwidth	ARFCN ch. no.	ARFCN-Frequency [MHz]	Resource block allocation	Peak detektor [dBm]	RMS detektor [dBm]	PAR Faktor [dB]	Peak detektor [dBm]	RMS detektor [dBm]	PAR Faktor [dB]			
5 MHz	23755	706,5	1 RB low	27,22	22,5	4,72	27,53	21,78	5,75	27,68	28,13	
			1 RB high	27,18	22,5	4,68	27,59	21,89	5,7			
			50% RB mid	27,68	21,19	6,49	27,68	21,2	6,48			
			100% RB	27,52	21,22	6,3	27,44	19,96	7,48			
	23790	710	1 RB low	27,49	22,16	5,33	27,53	21,58	5,95	28,1		
			1 RB high	28,1	22,24	5,86	28,03	21,4	6,63			
			50% RB mid	27,38	21,16	6,22	27,83	21,25	6,58			
			100% RB	27,84	20,99	6,85	28,02	20,13	7,89			
	23825	713,5	1 RB low	27,46	22,03	5,43	26,42	21,03	5,39	28,13		
			1 RB high	27,26	22,01	5,25	26,3	20,96	5,34			
			50% RB mid	28,02	21,07	6,95	28,03	21,3	6,73			
			100% RB	28,13	20,99	7,14	27,79	20,06	7,73			
10 MHz	23780	709	1 RB low	27,51	22,39	5,12	26,33	21,22	5,11	27,73	27,73	
			1 RB high	27,73	22,11	5,62	26,28	21,02	5,26			
			50% RB mid	27,39	20,99	6,4	27,05	20,21	6,84			
			100% RB	27,35	20,86	6,49	27,36	19,89	7,47			
	23790	710	1 RB low	27,15	22,04	5,11	26,43	21,12	5,31	27,67		
			1 RB high	27,51	22,06	5,45	26,46	20,99	5,47			
			50% RB mid	27,64	20,97	6,67	27,32	20,31	7,01			
			100% RB	27,21	20,86	6,35	27,67	19,94	7,73			
	23800	711	1 RB low	27,44	22,32	5,12	26,17	21,12	5,05	27,54		
			1 RB high	27,54	22,11	5,43	26,16	20,94	5,22			
			50% RB mid	27,48	20,19	7,29	27,08	20,33	6,75			
			100% RB	27,41	20,97	6,44	27,39	19,88	7,51			

### 5.4. RF-Parameter - Occupied bandwidth and emission bandwidth

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

test site	<input type="checkbox"/> 347 Radio.lab. 1	<input checked="" type="checkbox"/> Radio.lab. 2			
spectr. analys.	<input type="checkbox"/> 584 FSU8	<input type="checkbox"/> 489 ESU	<input checked="" type="checkbox"/> 620 ESU26	<input type="checkbox"/> 264 FSEK	
attenuator	<input checked="" type="checkbox"/> 530 10 dB	<input type="checkbox"/>	<input type="checkbox"/>		
signaling	<input type="checkbox"/> 392 MT8820A	<input type="checkbox"/> 436 CMU	<input type="checkbox"/> 547 CMU	<input checked="" type="checkbox"/> 594 CMW500	
DC Power	<input checked="" type="checkbox"/> 611 E3632A	<input type="checkbox"/> 087 EA3013	<input type="checkbox"/> 354 NGPE 40	<input type="checkbox"/> 086 LNG50-10	<input checked="" type="checkbox"/> 611 E3632A
otherwise	<input checked="" type="checkbox"/> 529 6dB divider				
line voltage	<input type="checkbox"/> 230 V 50 Hz via public mains		<input type="checkbox"/> 060 110 V/ 60 Hz via PAS 5000		

#### 5.4.2. Requirements and Limits

FCC	CFR47, §2.202(a), §2.1049, §22.917(b), §24.238(b), 27.53(h)(3)	„the <b>occupied bandwidth</b> is the frequency bandwidth, such that, below it lower and above it upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated”
IC	RSS-Gen, Issue 3: §4.6.1	
ANSI	C63.10-2009	

#### 5.4.3. 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 at antenna port”			
Spectrum Analyzer Settings	Parameter	Occupied bandwidth:	Emission bandwidth
	Scan Mode	Spectrum analyser mode	Spectrum analyser mode
	Span	1.8MHz/4MHz/6MHz /12MHz/17MHz/22MHz	2MHz/4MHz/7MHz /12MHz/17MHz/22MHz
	RBW	30kHz/50kHz/100kHz/	30kHz/50kHz/100kHz/
	VBW	500kHz/1MHz/	300 kHz/500kHz/1MHz/
	Sweep time	60 Sec	Coupled
	Sweep mode	Single max-hold	Repetitive, max-hold
	Detector	RMS	PK
Measurement method	The used spectrum analyzer FSE or ESU from Rohde & Schwarz contains an integrated function to calculate the occupied bandwidth automatically. From left and right display margin, the upper and lower frequency points where the accumulated power becomes 0.5% of the total power, are calculated. Subtracting the previous determined two frequency points, yields the occupied bandwidth.		Bandwidth defined between 2 markers with are 26dBc compared to highest In-Band Peak Emission.
Mobile phone settings	<p>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. All RBs as possible per EUT signal bandwidth have been allocated.</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>		

5.4.4. Results

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

Operational Band	Modulation	Signal bandwidth [MHz]	Channel no.		Occupied bandwidth		26 dB Bandwidth	
			Range	Channel no.	Diagram no.	Value [MHz]	Diagram no.	Value [MHz]
Band 2	QPSK	1.4	Low	18607	35.20	1.088	34.20	<b>1.3608</b>
			Mid	18900	--	--	34.21	1.3086
			High	19193	--	--	34.22	1.3338
		3	Low	18615	--	--	34.23	2.9800
			Mid	18900	35.24	2.692	34.24	<b>3.0200</b>
			High	19185	--	--	34.25	2.9880
		5	Low	18625	35.26	4.459	34.26	<b>5.0220</b>
			Mid	18900	--	--	34.27	4.9550
			High	19175	--	--	34.28	4.9980
		10	low	18650	35.29	8.196	34.29	<b>9.558</b>
			Mid	18900	--	--	34.30	9.540
			High	19150	--	--	34.31	9.516
		15	Low	18675	35.32	13.379	34.32	<b>14.569</b>
			Mid	18900	--	--	34.33	14.467
			High	19125	--	--	34.34	14.450
		20	Low	18700	35.35	17.842	34.35	<b>18.986</b>
			Mid	18900	--	--	34.36	18.964
			High	19100	--	--	34.37	18.942

Remark: see extract of diagrams with max. values in annex 4

Band 2	QAM	1.4	low	18607	--	--	34.38	1.3158
			mid	18900	35.39	1.086	34.39	<b>1.3482</b>
			high	19193	--	--	34.40	1.3374
		3	low	18615	--	--	34.41	2.9960
			mid	18900	--	--	34.42	2.9840
			high	19185	35.43	2.684	34.43	<b>3.0080</b>
		5	low	18625	35.44	4.466	34.44	<b>5.0280</b>
			mid	18900	--	--	34.45	4.9500
			high	19175	--	--	34.46	5.0160
		10	low	18650	35.47	8.916	34.47	<b>9.540</b>
			mid	18900	--	--	34.48	9.528
			high	19150	--	--	34.49	9.504
		15	low	18675	35.50	13.379	34.50	<b>14.484</b>
			Mid	18900	--	--	34.51	14.433
			High	19125	--	--	34.52	14.467
		20	low	18700	35.53	17.864	34.53	<b>19.338</b>
			Mid	18900	35.		34.54	18.854
			High	19100	35.		34.55	19.184

Remark: see extract of diagrams with max. values in annex 4

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

Operational Band	Modulation	Signal bandwidth [MHz]	Channel no.		Occupied bandwidth		26 dB Bandwidth	
			Range	Channel no.	Diagram no.	Value [MHz]	Diagram no.	Value [MHz]
Band 4	QPSK	1.4	Low	19957	35.401	--	34.401	1.320
			Mid	20175	35.402	--	34.402	1.326
			High	20393	35.403	1.088	34.403	<b>1.35</b>
		3	Low	19965	35.404	--	34.404	3.040
			Mid	20175	35.405	2.692	34.405	<b>3.052</b>
			High	20385	35.406	--	34.406	3.032
		5	Low	19975	35.407	4.466	34.407	<b>5.034</b>
			Mid	20175	35.408	--	34.408	4.956
			High	20375	35.409	4.459	34.409	<b>5.034</b>
		10	low	20000	35.410	8.928	34.410	<b>9.828</b>
			Mid	20175	35.411	--	34.411	9.804
			High	20350	35.412	--	34.412	9.804
		15	Low	20025	35.413	--	34.413	14.552
			Mid	20175	35.414	--	34.414	14.484
			High	20325	35.415	13.362	34.415	<b>14.569</b>
		20	Low	20050	35.416	--	34.416	19.052
			Mid	20175	35.417	--	34.417	18.898
			High	20300	35.418	17.82	34.418	<b>19.074</b>

Remark: see extract of diagrams with max. values in annex 4

Operational Band	Modulation	Signal bandwidth [MHz]	Channel no.		Occupied bandwidth		26 dB Bandwidth	
			Range	Channel no.	Diagram no.	Value [MHz]	Diagram no.	Value [MHz]
Band 4	16-QAM	1.4	Low	19957	35.419	1.086	34.419	<b>1.340</b>
			Mid	20175	35.420	--	34.420	1.334
			High	20393	35.421	--	34.421	1.296
		3	Low	19965	35.422	--	34.422	3.052
			Mid	20175	35.423	2.688	34.423	<b>3.064</b>
			High	20385	35.424	--	34.424	3.048
		5	Low	19975	35.425	--	34.425	5.022
			Mid	20175	35.426	--	34.426	4.962
			High	20375	35.427	4.466	34.427	<b>5.028</b>
		10	low	20000	35.428	8.904	34.428	<b>9.756</b>
			Mid	20175	35.429	--	34.429	9.732
			High	20350	35.430	--	34.430	9.744
		15	Low	20025	35.431	--	34.431	14.433
			Mid	20175	35.432	13.362	34.432	<b>14.450</b>
			High	20325	35.433	13.362	34.433	<b>14.450</b>
		20	Low	20050	35.434	--	34.434	18.986
			Mid	20175	35.435	17.82	34.435	<b>19.140</b>
			High	20300	35.436	--	34.436	18.876

Remark: see extract of diagrams with max. values in annex 4

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

Operational Band	Modulation	Signal bandwidth [MHz]	Channel no.		Occupied bandwidth		26 dB Bandwidth	
			Range	Channel no.	Diagram no.	Value [MHz]	Diagram no.	Value [MHz]
Band 5	QPSK	1.4	Low	20407	35.501	1.088	34.501	<b>1.3482</b>
			Mid	20525	35.502	--	34.502	1.3464
			High	20643	35.503	1.09	34.503	1.314
		3	Low	20415	35.504	--	34.504	2.976
			Mid	20525	35.505	2.688	34.505	<b>3.020</b>
			High	20635	35.506	--	34.506	2.964
		5	Low	20425	35.507	--	34.507	4.986
			Mid	20525	35.508	--	34.508	4.920
			High	20625	35.509	4.466	34.509	<b>4.992</b>
		10	low	20450	35.510	--	34.510	9.528
			Mid	20525	35.511	--	34.511	9.540
			High	20600	35.512	8.928	34.512	<b>9.588</b>

Remark: see extract of diagrams with max. values in annex 4

Operational Band	Modulation	Signal bandwidth [MHz]	Channel no.		Occupied bandwidth		26 dB Bandwidth	
			Range	Channel no.	Diagram no.	Value [MHz]	Diagram no.	Value [MHz]
Band 5	16-QAM	1.4	Low	20407	35.513	--	34.513	1.2996
			Mid	20525	35.514	--	34.514	1.2942
			High	20643	35.515	1.084	34.515	<b>1.3284</b>
		3	Low	20415	35.516	--	34.516	2.988
			Mid	20525	35.517	2.684	34.517	<b>2.996</b>
			High	20635	35.518	--	34.518	2.980
		5	Low	20425	35.519	--	34.519	4.980
			Mid	20525	35.520	--	34.520	4.932
			High	20625	35.521	4.459	34.521	<b>4.992</b>
		10	low	20450	35.522	--	34.522	9.528
			Mid	20525	35.523	--	34.523	9.540
			High	20600	35.524	8.928	34.524	<b>9.552</b>

Remark: see extract of diagrams with max. values in annex 4

**5.4.4.4. LTE Band 17: Op. Mode 4, Set-up 2**

Operational Band	Modulation	Signal bandwidth [MHz]	Channel no.		Occupied bandwidth		26 dB Bandwidth	
			Range	Channel no.	Diagram no.	Value [MHz]	Diagram no.	Value [MHz]
Band 17	QPSK	5	Low	23755	35.01	<b>4.47</b>	34.01	<b>5.024</b>
			Mid	23790	35.02	4.46	34.02	4.952
			High	23825	35.03	<b>4.47</b>	34.03	5.016
		10	low	23780	35.04	8.925	34.04	<b>9.594</b>
			Mid	23790	35.05	8.910	34.05	9.529
			High	23800	35.06	<b>8.925</b>	34.06	9.555
	QAM	5	Low	23755	35.07	<b>4.47</b>	34.07	<b>5.024</b>
			Mid	23790	35.08	4.46	34.08	4.968
			High	23825	35.09	<b>4.47</b>	34.09	4.992
		10	low	23780	35.10	8.925	34.10	<b>9.594</b>
			Mid	23790	35.11	8.910	34.11	9.555
			High	23800	35.12	8.895	34.12	9.568

Remark: pls. see extract of diagrams with max. values in annex 4

## 5.5. RF-Parameter - Conducted out of Band RF emissions and Band Edge

### 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"/> 347 Radio.lab. 1	<input checked="" type="checkbox"/> Radio.lab. 2	
spectr. analys.	<input type="checkbox"/> 584 FSU	<input type="checkbox"/> 120 FSEM	<input type="checkbox"/> 264 FSEK <input checked="" type="checkbox"/> 620 ESU26
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"/> 436 CMU	<input checked="" type="checkbox"/> 594 CMW500
power supply	<input checked="" type="checkbox"/> 611 E3632A	<input type="checkbox"/> 457 EA 3013A	<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 checked="" type="checkbox"/> 529 6dB divider	<input checked="" type="checkbox"/> 530 10dB Att.	<input type="checkbox"/> 431 Near field
line voltage	<input type="checkbox"/> 230 V 50 Hz via public mains <input type="checkbox"/> 060 110 V/ 60 Hz via PAS 5000		

### 5.5.2. Requirements and limits

<b>FCC</b>	§2.1051-conducted, §2.1057, §22.917(a)(b), §24.238(a)(b), §27.53(h)(3)(ii)(iii), §27.53(g)
<b>IC</b>	RSS-132, Issue 3: 6.5.1, RSS-133, Issue 4: 6.5.1(i)(ii), RSS-139, Issue 2: 6.5 (i)(ii)
<b>Limit</b>	„the power of emissions shall be attenuated below the transmitter output power (p) by at least 43+10Log(P) dB“

### 5.5.3. Test condition and test set-up

Climatic conditions	Temperature: (22±3°C)	Rel. humidity: (40±20)%
Test system set-up	Please see chapter “Test system set-up for conducted measurements on antenna port”	
Measurement method	The 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 block-edge where a AVERAGE detector applied.  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)	
Spectrum-Analyzer settings	See below tables	
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  Tests have been performed in various settings for the device regarding allocated ressource blocks and channels in order to find worst-case configuration. Due to very big amount of possible combinations only certain combinations have been tested.  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.	

### Spectrum-Analyzer settings for LTE Band 2

	Start freq. MHz	Stop freq. MHz	R-BW kHz	V-BW MHz	Sweep time sec.	Att. [dB]	Detector
Sweep 1 (subrange 1)	0.009	0.150	0.0001	-- <sup>1.)</sup>	10	25	MaxH-PK
Sweep 1 (subrange 2)	0.150	1	0.009	-- <sup>1.)</sup>	10	25	MaxH-PK
Sweep 1 (subrange 3)	1	30	0.1	-- <sup>1.)</sup>	5	25	MaxH-PK
Sweep 2 (subrange 1)	30	19500	1	-- <sup>1.)</sup>	>60	35	MaxH-PK
Sweep 3a (Block-Edge)	1849	1850	20 <sup>2.)</sup> to 200	-- <sup>1.)</sup>	30	35	MaxH-PK
Sweep 3b (Block-Edge)	1849	1850		-- <sup>1.)</sup>	30	35	MaxH-AV
Sweep 4a (Block-Edge)	1910	1911		-- <sup>1.)</sup>	30	35	MaxH-PK
Sweep 4b (Block-Edge)	1910	1911		-- <sup>1.)</sup>	30	35	MaxH-AV

Remark: 1.) EMI 6dB receiver mode used

2.) according rules approx. 1% of emission bandwidth depending of chosen signal bandwidth

### Spectrum-Analyzer Settings LTE Band 4

	Start freq. MHz	Stop freq. MHz	R-BW kHz	V-BW MHz	Sweep time sec.	Att.	Detector
Sweep 1 (subrange 1)	0.009	0.150	0.0001	-- <sup>1.)</sup>	10	25	MaxH-PK

Sweep 1 (subrange 2)	0.150	1	0.009	-- <sup>1.)</sup>	10	25	MaxH-PK
Sweep 1 (subrange 3)	1	30	0.1	-- <sup>1.)</sup>	5	25	MaxH-PK
Sweep 2 (subrange 1)	30	18000	1	-- <sup>1.)</sup>	>60	35	MaxH-PK
Sweep 3a (Block-Edge)	1709	1710	20 <sup>2.)</sup> to 200	-- <sup>1.)</sup>	30	35	MaxH-PK
Sweep 3b (Block-Edge)	1709	1710		-- <sup>1.)</sup>	30	35	MaxH-AV
Sweep 4a (Block-Edge)	1755	1756		-- <sup>1.)</sup>	30	35	MaxH-PK
Sweep 4b (Block-Edge)	1755	1756		-- <sup>1.)</sup>	30	35	MaxH-AV

Remark: 1.) EMI 6dB receiver mode used

2.) according rules approx. 1% of emission bandwidth depending of chosen signal bandwidth

### Spectrum-Analyzer Settings LTE Band 5

	Start freq. MHz	Stop freq. MHz	R-BW kHz	V-BW MHz	Sweep time sec.	Att.	Detector
Sweep 1 (subrange 1)	0.009	0.150	0.0001	-- <sup>1.)</sup>	10	25	MaxH-PK
Sweep 1 (subrange 2)	0.150	1	0.009	-- <sup>1.)</sup>	10	25	MaxH-PK
Sweep 1 (subrange 3)	1	30	0.1	-- <sup>1.)</sup>	5	25	MaxH-PK
Sweep 2 (subrange 1)	30	9000	1	-- <sup>1.)</sup>	>60	35	MaxH-PK
Sweep 3a (Block-Edge)	823	824	20 <sup>2.)</sup> to 100	-- <sup>1.)</sup>	30	35	MaxH-PK
Sweep 3b (Block-Edge)	823	824		-- <sup>1.)</sup>	30	35	MaxH-AV
Sweep 4a (Block-Edge)	850	851		-- <sup>1.)</sup>	30	35	MaxH-PK
Sweep 4b (Block-Edge)	850	851		-- <sup>1.)</sup>	30	35	MaxH-AV

Remark: 1.) EMI 6dB receiver mode used

2.) according rules approx. 1% of emission bandwidth depending of chosen signal bandwidth

### Spectrum-Analyzer Settings LTE Band 17

	Start freq. MHz	Stop freq. MHz	R-BW MHz	V-BW MHz	Sweep time sec.	Att.	Detector
Sweep 1 (subrange 1)	0.009	0.150	0.0001	-- <sup>1.)</sup>	10	25	MaxH-PK
Sweep 1 (subrange 2)	0.150	1	0.009	-- <sup>1.)</sup>	10	25	MaxH-PK
Sweep 1 (subrange 3)	1	30	0.1	-- <sup>1.)</sup>	5	25	MaxH-PK
Sweep 2 (subrange 1)	30	9000	1	-- <sup>1.)</sup>	>60	35	MaxH-PK
Sweep 3a (Block-Edge)	703	704	50 <sup>2.)</sup> to 100	-- <sup>1.)</sup>	30	35	MaxH-PK
Sweep 3b (Block-Edge)	703	704		-- <sup>1.)</sup>	30	35	MaxH-AV
Sweep 4a (Block-Edge)	716	717		-- <sup>1.)</sup>	30	35	MaxH-PK
Sweep 4b (Block-Edge)	716	717		-- <sup>1.)</sup>	30	35	MaxH-AV

Remark: 1.) EMI 6dB receiver mode used

2.) according rules approx. 1% of emission bandwidth depending of chosen signal bandwidth



**5.5.4. Results**

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

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

Diagram no.	Carrier Channel		Frequency range	OP-mode no.	Remark	Used detector			Result
	Range	No.				PK	AV	QP	
36.20a	Low	18607	9kHz to 30MHz	1	QPSK modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
36.20b	Low		9kHz to 30MHz		16QAM-Modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
36.21a	Low		30 MHz to 19.5MHz		Carrier visible on diagram, not relevant for results QPSK modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
36.21b	Low		30 MHz to 19.5MHz		Carrier visible on diagram, not relevant for results QPSK modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
37.203 a	Low	18607	1849 – 1850 MHz	1	Band Edge Compliance QPSK modulation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
37.203 b	Low	18607	1849 – 1850 MHz		Band Edge Compliance QAM modulation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
36.22a	Middle	18900	9kHz to 30MHz	1	QPSK modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
36.22b	Middle	18900	9kHz to 30MHz		16QAM-Modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
36.23a	Middle	18900	30 MHz to 19.5MHz	1	Carrier visible on diagram, not relevant for results QPSK modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
36.23b	Middle	18900	30 MHz to 19.5MHz		Carrier visible on diagram, not relevant for results QAM modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
36.24a	High	19100	9kHz to 30MHz		QPSK modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
36.25a	High		30 MHz to 19.5MHz		QPSK modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
36.26b	High	19193	9kHz to 30MHz		QAM modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
36.27b	High	19193	30 MHz to 19.5MHz		QAM modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
37.215 a	High	19185	1910 – 1911 MHz		Band-Edge compliance QPSK Modulation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
37.215 b	High	19185	1910 – 1911 MHz		Band-Edge compliance QAM Modulation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed

Remark:

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

Diagram no.	Carrier Channel		Frequency range	OP-mode no.	Remark	Used detector			Result
	Range	No.				PK	AV	QP	
36.401 a	Low	19957	9kHz to 30MHz	2	QPSK modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
36.402 a	Low		30 MHz to 18GHz		Carrier visible on diagram, not relevant for results QPSK modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
36.402 b	Low		30 MHz to 18GHz		Carrier visible on diagram, not relevant for results QAM modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
37.520 a	Low	19965	1709 -1710 MHz		Band Edge Compliance QPSK modulation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
37.520 b	Low	19965	1709 -1710 MHz		Band Edge Compliance QAM modulation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
36.403 a	Middle	20175	9kHz to 30MHz		QPSK modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
36.404 a	Middle	20175	30 MHz to 18GHz		Carrier visible on diagram, not relevant for results QPSK modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
36.404 b	Middle	20175	30 MHz to 18GHz		Carrier visible on diagram, not relevant for results QAM modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
36.405 a	High	20300	9kHz to 30MHz		QPSK modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
36.406 a	High		30 MHz to 19.5MHz		Carrier visible on diagram, not relevant for results QPSK modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
36.406 b	High		30 MHz to 19.5MHz		Carrier visible on diagram, not relevant for results QAM modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
37.532 a	High	20385	1755 - 1756 MHz		Band-Edge compliance QPSK modulation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
37.532 b	High	20385	1755 - 1756 MHz		Band-Edge compliance QAM modulation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed

Remark:

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

Diagram no.	Carrier Channel		Frequency range	OP-mode no.	Remark	Used detector			Result
	Range	No.				PK	AV	QP	
36.52a	Low	20407	9kHz to 30MHz	3	QPSK modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
36.53a	Low		30 MHz to 9GHz		Carrier visible on diagram, not relevant for results QPSK modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
36.53b	Low		30 MHz to 9GHz		Carrier visible on diagram, not relevant for results QAM modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
37.502 a	Low	20415	823 – 824 MHz		Band Edge Compliance QPSK modulation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
37.512 b	Low		823 – 824 MHz		Band Edge Compliance QPSK modulation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
36.54a	Middle	20525	9kHz to 30MHz		QPSK modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
36.55a	Middle		30 MHz to 9GHz		Carrier visible on diagram, not relevant for results QPSK modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
36.55b	Middle		30 MHz to 9GHz		Carrier visible on diagram, not relevant for results QAM modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
36.56a	High	20600	9kHz to 30MHz		QPSK modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
36.56b	High		9kHz to 30MHz		QAM modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
36.57a	High		30 MHz to 9GHz		Carrier visible on diagram, not relevant for results	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
36.57b	High		30 MHz to 9GHz		Carrier visible on diagram, not relevant for results	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
37.502 a	High	20643	849 – 850 MHz	Band Edge Compliance QPSK modulation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed	
37.502 b	High		849 – 850 MHz	Band Edge Compliance QAM modulation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed	

Remark:

**5.5.4.4. LTE Band 17: Op. Mode 4, Set-up 2**

Diagram no.	Carrier Channel		Frequency range	OP-mode no.	Remark	Used detector			Result
	Range	No.				PK	AV	QP	
36.170 a	Low	23755	9kHz to 30MHz	xxx	QPSK modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
36.171 a	Low		30 MHz to 9GHz		Carrier visible on diagram, not relevant for results QPSK modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
37.171 a	Low	23755	703 - 704 MHz		Band Edge Compliance QPSK modulation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
37.171 b	Low		703 - 704 MHz		Band Edge Compliance QAM modulation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
36.172 b	Middle	23790	9kHz to 30MHz		QAM modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
36.173 b	Middle		30 MHz to 9GHz		Carrier visible on diagram, not relevant for results QAM modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
36.174 a	High	23800	9kHz to 30MHz		QPSK Modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
36.175 a	High		30 MHz to 9GHz		Carrier visible on diagram, not relevant for results QPSK modulation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
37.175 a	High	23825	716 -717 MHz		Band-Edge compliance QPSK modulation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
37.175 b	High		716 -717 MHz		Band-Edge compliance QAM modulation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed

Remark:

## 5.6. RF-Parameter - Frequency stability on temperature and voltage variations

### 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"/> 347 Radio.lab.1	<input checked="" type="checkbox"/> Radio.lab.2	<input type="checkbox"/>
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 checked="" type="checkbox"/> 594 CMW500 <input type="checkbox"/> 594 CMW500
DC power	<input type="checkbox"/> 611 E3632A	<input type="checkbox"/> 457 EA 3013A	<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 checked="" type="checkbox"/> 529 6dB divider	<input checked="" type="checkbox"/> 530 10dB Att.	<input type="checkbox"/> 431 Near field
Climatic test chamber	<input checked="" type="checkbox"/> 331 HC 4055		
line voltage	<input type="checkbox"/> 230 V 50 Hz via public mains	<input type="checkbox"/> 060 110 V/ 60 Hz via PAS 5000	

### 5.6.2. Requirements and limits

<b>FCC</b>	§2.1055(a)(1) , §22.355, §24.235, §27.54
<b>IC</b>	RSS-132: 5.3, RSS-133: 6.3; RSS-139, Issue 2: 6.3
<b>Limit</b>	<i>“The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block”</i>

### 5.6.3. Test condition and test set-up

Test system set-up	Please see chapter “Test system set-up for conducted measurements on antenna port”  In order to maintain the voltage constant over the time period of the tests, a dummy battery was connected to a laboratory power supply. The power supply voltage was controlled on the input of the power supply terminals of the EUT.
Measurement method	The RF Channel spacing is 100 kHz according LTE-Spec, with a guard band depending of the TX signal bandwidth. Details can be found in standard 3GPP36.521. The aim of the EUT is to function under all extreme conditions within authorized sub-bands in regard to temperature and voltage variations. The frequency deviation was recorded with base station’s build in capability. (CMW500) for both modulations possible: QPSK and 16-QAM  As the standard requires that the fundamental emissions stays within the authorized band, a limit of ±0.1ppm is considered low enough to ensure this. However the standard required a more relaxed limit of ±2.5ppm
Mobile phone settings	UE is set TX mode, highest transmit power conditions (RMC-mode), power saving techniques have been disabled  Tests have been done in RMC operating mode ,maximum power at lowest per bandwidth allowed TX signal bandwidth: 1.4MHz or 5MHz. Both modulations have been tested: QPSK and 16-QAM.

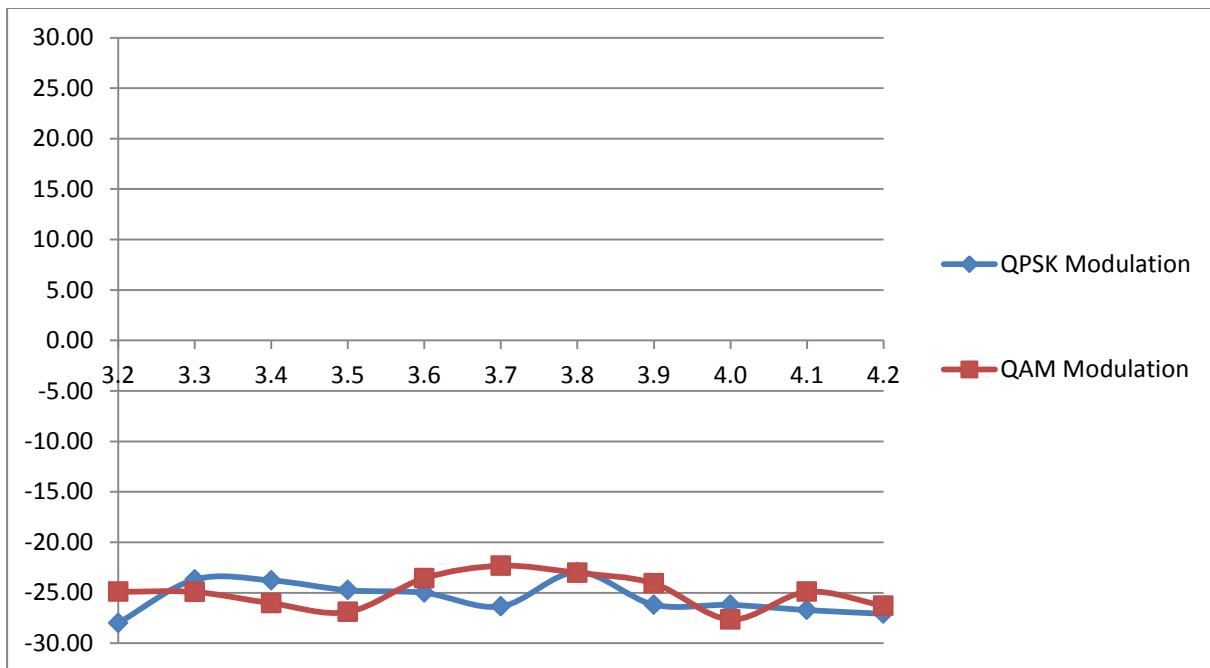
#### 5.6.3.1. Frequency shift of carrier against a voltage range at constant nominal temperature of 20° Celsius

- 1.) determine the carrier frequency for the lowest and highest channel at room temperature and nominal voltage [20°C]
- 2.) The voltage was reduced in 0.1 Volt steps to the lower end point, where the mobile phone stops working. (this shall be specified by the manufacturer) Record the carrier frequency shift within 2 minutes after powering on the mobile phone, to prevent for self heating effects.
- 3.) The voltage was increased in 0.1 Volt steps to the upper declared voltage of the battery. Record the carrier frequency shift within 2 minutes after powering on the mobile phone, to prevent for self heating effects.

**5.6.4. Measurement Results:**

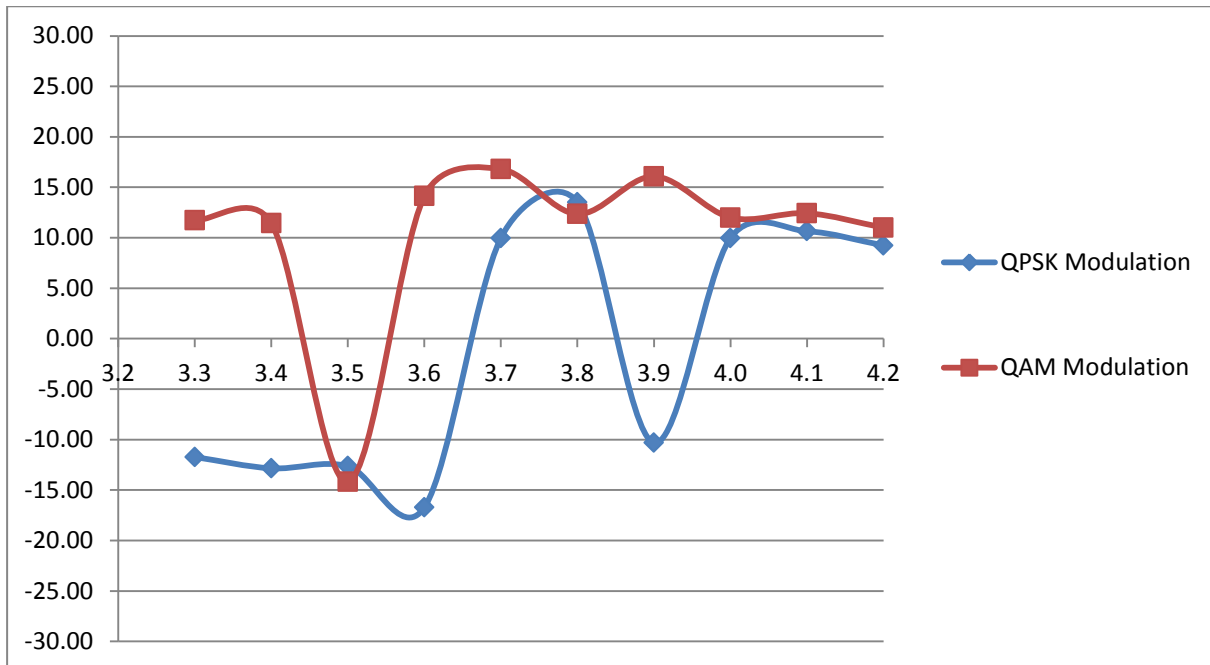
**5.6.4.1. LTE Band 2**

Voltage [V]	Nominal Frequency [MHz]	Frequency error [Hz]		Maximum Frequency error		Verdict
		QPSK Modulation	16-QAM Modulation	[ppm]	[ppm]	
3,2	1,8800E+09	-28,00	-24,91	-0,0149	-0,0133	passed
3,3		-23,70	-24,93	-0,0126	-0,0133	
3,4		-23,78	-26,04	-0,0126	-0,0139	
3,5		-24,75	-26,91	-0,0132	-0,0143	
3,6		-25,01	-23,56	-0,0133	-0,0125	
3,7		-26,36	-22,33	-0,0140	-0,0119	
3,8		-22,96	-23,03	-0,0122	-0,0123	
3,9		-26,19	-24,09	-0,0139	-0,0128	
4,0		-26,21	-27,65	-0,0139	-0,0147	
4,1		-26,72	-24,92	-0,0142	-0,0133	
4,2		-27,09	-26,29	-0,0144	-0,0140	



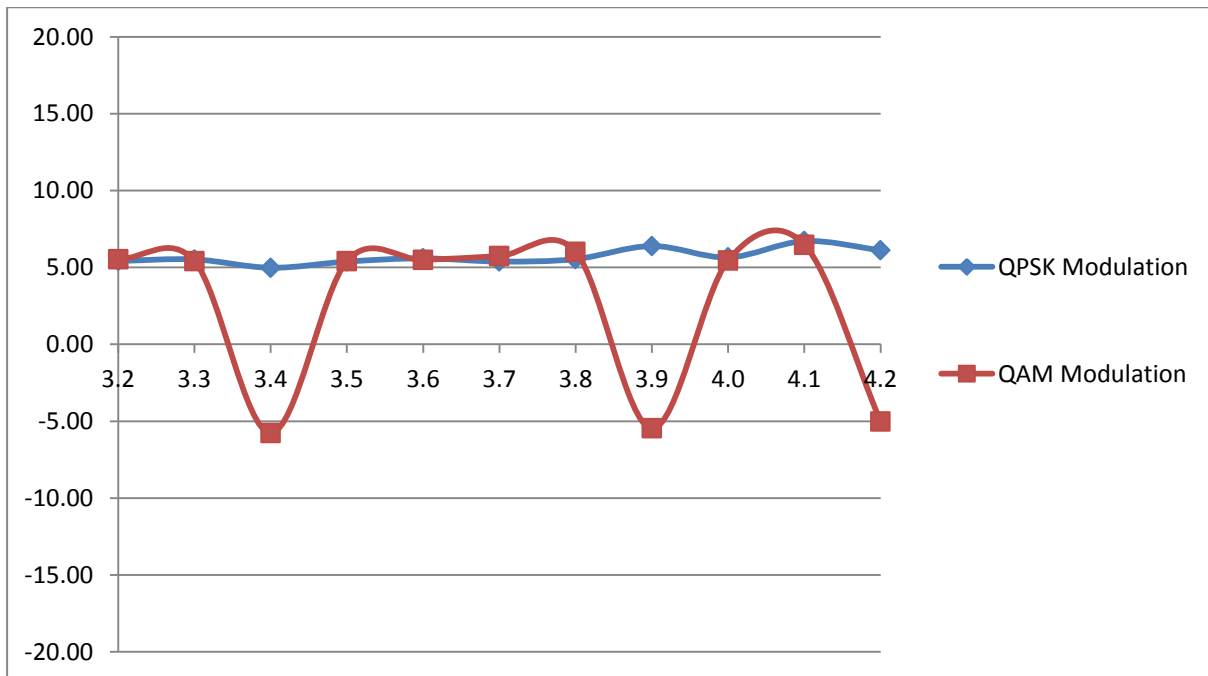
5.6.4.2. LTE Band 4

Voltage [V]	Nominal Frequency [MHz]	Frequency error [Hz]		Maximum Frequency error		Verdict
		QPSK Modulation	16-QAM Modulation	[ppm]	[ppm]	
3,3	1,7325E+09	-11,73	11,72	-0,0068	0,0068	passed
3,4		-12,85	11,44	-0,0074	0,0066	
3,5		-12,63	-14,18	-0,0073	-0,0082	
3,6		-16,72	14,13	-0,0097	0,0082	
3,7		9,97	16,80	0,0058	0,0097	
3,8		13,52	12,35	0,0078	0,0071	
3,9		-10,31	16,08	-0,0060	0,0093	
4,0		9,97	12,00	0,0058	0,0069	
4,1		10,64	12,43	0,0061	0,0072	
4,2		9,24	11,00	0,0053	0,0063	



5.6.4.3. LTE Band 5

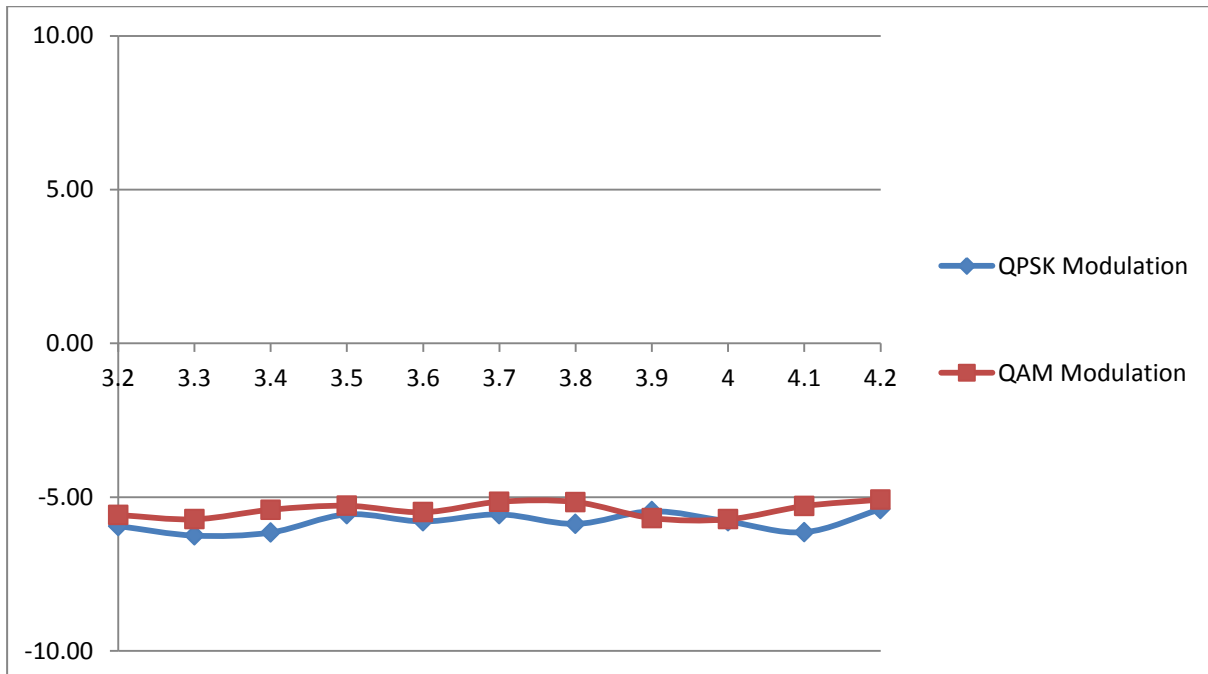
Voltage [V]	Nominal Frequency [MHz]	Frequency error [Hz]		Maximum Frequency error		Verdict
		QPSK Modulation	16-QAM Modulation	[ppm]	[ppm]	
3,2	8,3650E+08	5,42	5,54	0,0065	0,0066	passed
3,3		5,52	5,41	0,0066	0,0065	
3,4		4,98	-5,76	0,0060	-0,0069	
3,5		5,38	5,41	0,0064	0,0065	
3,6		5,59	5,49	0,0067	0,0066	
3,7		5,38	5,74	0,0064	0,0069	
3,8		5,54	6,01	0,0066	0,0072	
3,9		6,39	-5,46	0,0076	-0,0065	
4,0		5,65	5,45	0,0068	0,0065	
4,1		6,71	6,47	0,0080	0,0077	
4,2		6,12	-5,01	0,0073	-0,0060	





5.6.4.4. LTE Band 17

Voltage [V]	Nominal Frequency [MHz]	Frequency error [Hz]		Maximum Frequency error		Verdict
		QPSK Modulation	16-QAM Modulation	[ppm]	[ppm]	
3,2	7,1000E+08	-5,94	-5,58	-0,0084	-0,0079	passed
3,3		-6,25	-5,72	-0,0088	-0,0081	
3,4		-6,15	-5,41	-0,0087	-0,0076	
3,5		-5,56	-5,28	-0,0078	-0,0074	
3,60		-5,79	-5,49	-0,0082	-0,0077	
3,70		-5,56	-5,15	-0,0078	-0,0073	
3,80		-5,87	-5,16	-0,0083	-0,0073	
3,90		-5,46	-5,68	-0,0077	-0,0080	
4,00		-5,79	-5,72	-0,0082	-0,0081	
4,10		-6,14	-5,29	-0,0086	-0,0075	
4,20		-5,39	-5,08	-0,0076	-0,0072	

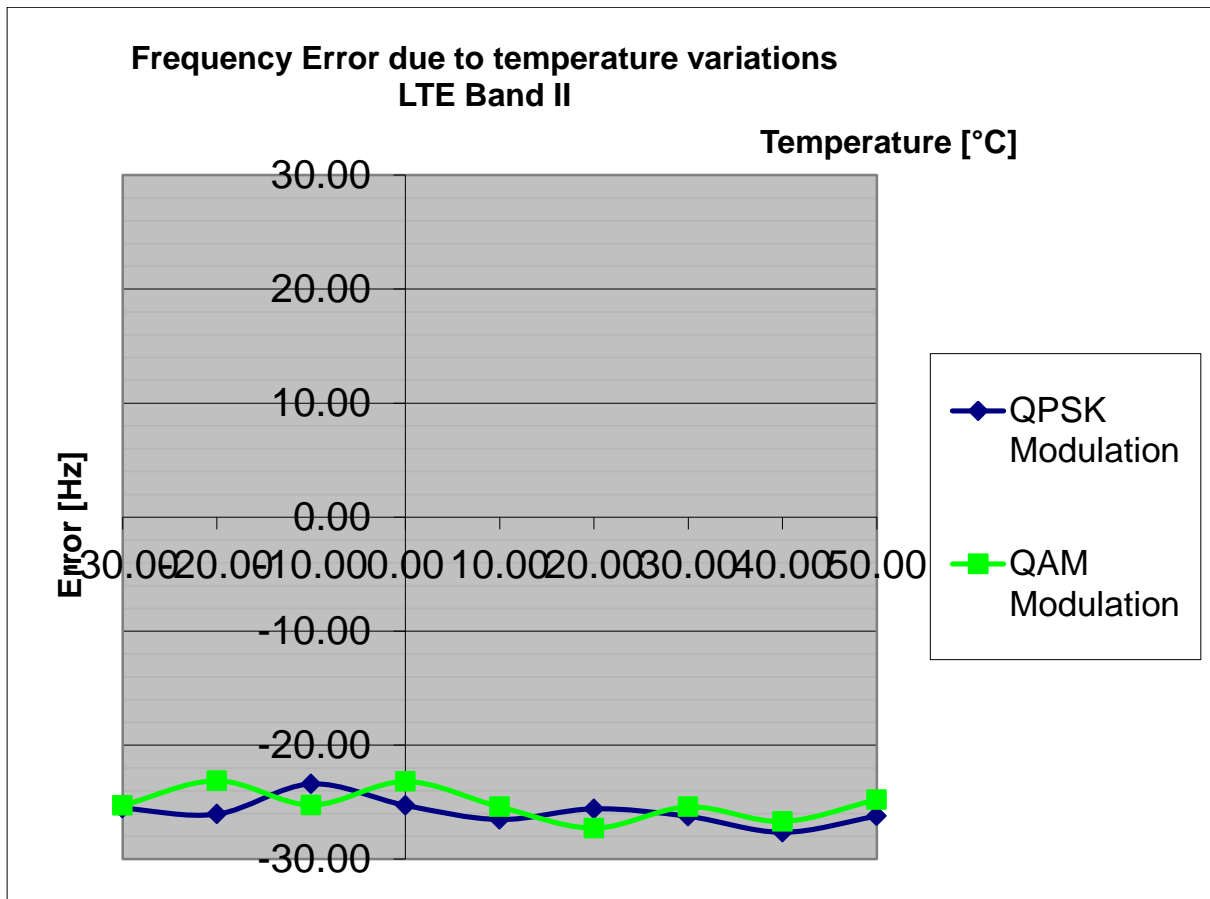


**5.6.4.5. Frequency shift of carrier against temperature at constant power supply voltage**

- 1.) determine the carrier frequency for the lowest, middle and highest channel at room temperature and nominal voltage [20°C]
- 2.) expose the mobile station to -30°C, wait sufficient time to have constant temperature.
- 3.) Perform the carrier frequencies measurements in 10°C increments from -30°C to +60°C. For about half hour at the specified temperature the mobile was powered-off. After powering-on, the measurements were made within 2 minute for the channel lower channel, in order to prevent self-warming of the mobile.

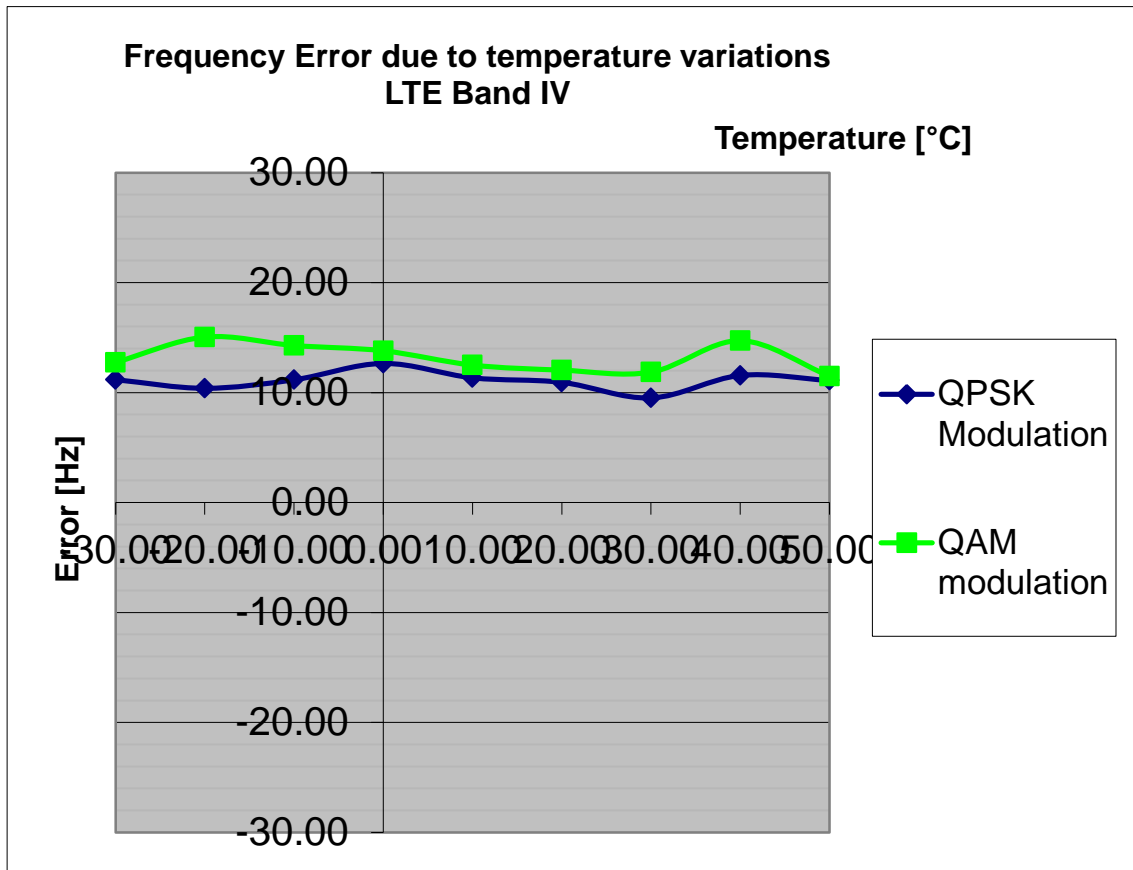
**5.6.4.6. LTE Band 2**

Temperature	Maximum frequency error				Verdict Limit=±0.1ppm
	Channel 18900/ BW=1.4 MHz				
	QPSK Modulation [Hz]	16-QAM Modulation [Hz]	QPSK Modulation [ppm]	16-QAM Modulation [ppm]	
-30°C	-25,53	-25,28	-0,014	-0,013	Passed
-20°C	-26,05	-23,12	-0,014	-0,012	
-10°C	-23,40	-25,25	-0,012	-0,013	
0°C	-25,28	-23,19	-0,013	-0,012	
10°C	-26,52	-25,41	-0,014	-0,014	
20°C	-25,58	-27,27	-0,014	-0,015	
30°C	-26,24	-25,41	-0,014	-0,014	
40°C	-27,64	-26,69	-0,015	-0,014	
50°C	-26,22	-24,78	-0,014	-0,013	



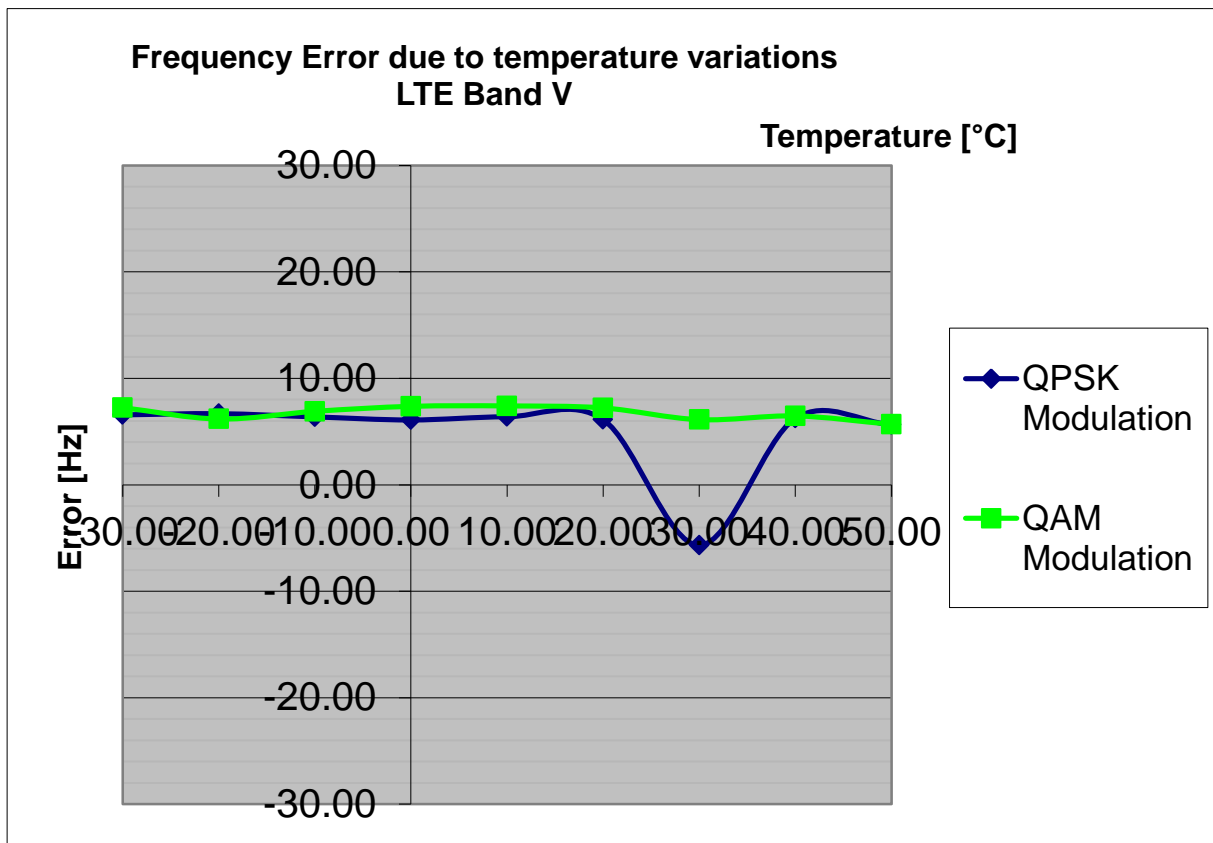
5.6.4.7. LTE Band 4

Maximum frequency error					
Temperature	Channel 20175/ BW= 1.4MHz				Verdict Limit=±0.1ppm
	QPSK Modulation [Hz]	16-QAM Modulation [Hz]	QPSK Modulation [ppm]	16-QAM Modulation [ppm]	
-30°C	11,17	12,75	0,006	0,007	Passed
-20°C	10,39	15,05	0,006	0,009	
-10°C	11,16	14,28	0,006	0,008	
0°C	12,65	13,80	0,007	0,008	
10°C	11,34	12,50	0,007	0,007	
20°C	10,93	12,04	0,006	0,007	
30°C	9,51	11,86	0,005	0,007	
40°C	11,56	14,72	0,007	0,008	
50°C	11,10	11,50	0,006	0,007	



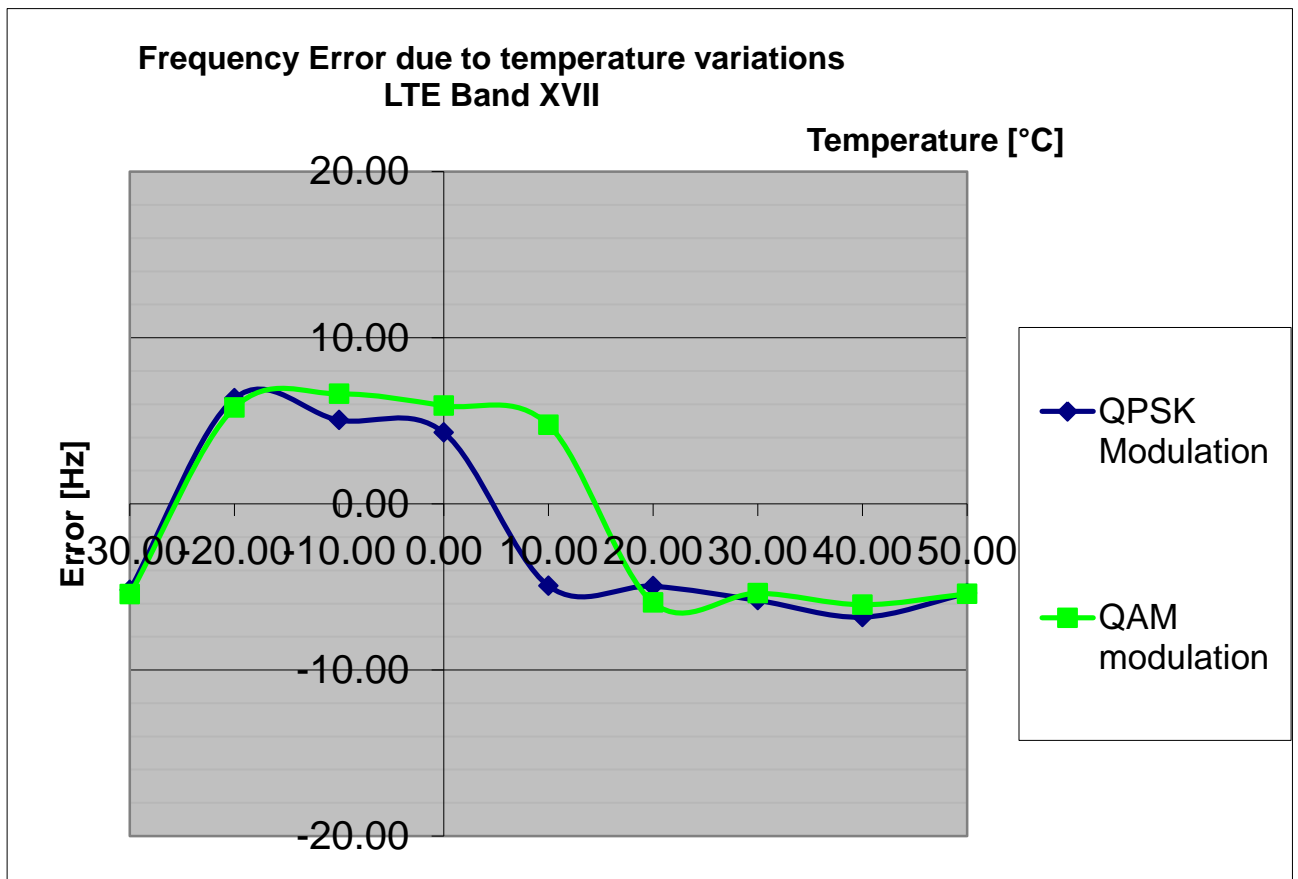
5.6.4.8. LTE Band 5

Maximum frequency error					
Temperature	Channel 20525/ BW= 1.4MHz				Verdict Limit=±0.1ppm
	QPSK Modulation [Hz]	16-QAM Modulation [Hz]	QPSK Modulation [ppm]	16-QAM Modulation [ppm]	
-30°C	6,57	7,25	0,008	0,009	Passed
-20°C	6,68	6,18	0,008	0,007	
-10°C	6,38	6,90	0,008	0,008	
0°C	6,09	7,37	0,007	0,009	
10°C	6,39	7,41	0,008	0,009	
20°C	6,12	7,22	0,007	0,009	
30°C	-5,68	6,12	-0,007	0,007	
40°C	6,24	6,47	0,007	0,008	
50°C	5,64	5,68	0,007	0,007	



5.6.4.9. LTE Band 17

Temperature	Maximum frequency error				Verdict Limit=±0.1ppm
	Channel 23790/ BW=5MHz				
	QPSK Modulation [Hz]	16-QAM Modulation [Hz]	QPSK Modulation [ppm]	16-QAM Modulation [ppm]	
-30°C	-5,19	-5,45	-0,007	-0,008	Passed
-20°C	6,35	5,79	0,009	0,008	
-10°C	5,04	6,62	0,007	0,009	
0°C	4,29	5,91	0,006	0,008	
10°C	-4,94	4,75	-0,007	0,007	
20°C	-4,96	-5,95	-0,007	-0,008	
30°C	-5,81	-5,38	-0,008	-0,008	
40°C	-6,82	-6,07	-0,010	-0,009	
50°C	-5,39	-5,42	-0,008	-0,008	



### 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	Frequency range	Calculated uncertainty based on a confidence level of 95%	Remarks:
Power Output conducted	9 kHz .. 20 GHz	1.0 dB	--
Power Output radiated	30 MHz .. 4 GHz	3.17 dB	Substitution method
Conducted emissions on antenna ports	9 kHz .. 20 GHz	1.0 dB	--
Radiated emissions enclosure	150 kHz .. 30 MHz	5.0 dB	Magnetic field
	30 MHz .. 1 GHz	4.2 dB	E-Field
	1 GHz .. 20 GHz	3.17 dB	Substitution method
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
		1.0 dB	Power
Frequency stability	9 kHz .. 20 GHz	0.0636 ppm	--
Conducted emissions on AC-mains port (U <sub>CISPR</sub> )	9 kHz .. 150 kHz	4.0 dB	--
	150 kHz .. 30 MHz	3.6 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	736496	Radiated Measurements 30 MHz to 1 GHz, 3 m / 10 m (OATS) Radiated Measurements 30 MHz to 1 GHz, 3 m (SAR) Radiated Measurements above 1 GHz, 3 m (FAR) Mains Ports Conducted Interference Measurements Telecommunication Ports Conducted Interference Measur.	FCC, Federal Communications Commission Laboratory Division, USA (MRA US-EU 0003)
337 487 550 558	3462D-1 3462D-2 3462D-2 3462D-3	Radiated Measurements 30 MHz to 1 GHz, 3 m / 10 m (OATS) Radiated Measurements 30 MHz to 1 GHz, 3 m (SAR) Radiated Measurements 1 GHz to 6 GHz, 3 m (SAR) Radiated Measurements above 1 GHz, 3 m (FAR)	IC, Industry Canada Certification and Engineering Bureau
337 487 550 348 348	R-2665 R-2666 G-301 C-2914 T-1967	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) 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			

## 8. Instruments and Ancillary

### 8.1. Used equipment “CTC”

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

#### 8.1.1. 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
383	Signal Generator	SME 03	842 828 /034	Firm.= 4.61
389	Digital Multimeter	Keithley 2000	0583926	Firm. = A13 (Mainboard) A02 (Display)
392	Radio Communication Tester	MT8820A	6K00000788	Firm.= 4.50 #005, IPL=4.01#001,OS=4.02#001, GSM=4.41#013, W-CDMA= 4.54#004, scenario= 4.52#002
436	Univ. Radio Communication Tester	CMU 200	103083	R&S Test Firmware Base=5.14, Mess-Software= GSM:5.14 WCDMA:5.14 (current Testsoftw. F. all band
441	CTC-SAR-EMI Cable Loss	System EMI field (SAR)	-	EMC 32 Version 8.52
442	CTC-SAR-EMS	System EMS field (SAR)	-	EMC 32 Version 8.40
443	CTC-FAR-EMI-RSE	System CTC-FAR-EMI-RSE	-	Spuri 7.2.5 or EMC 32 Ver. 8.53
444	CTC-FAR-EMS field	System-EMS-Field (FAR)	-	EMC 32 Version 8.40
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
594	Wideband Radio Communication Tester	CMW500	101757	Firmware Base=2.0.20.9, LTE=2.0.20.8. CDMA= 2.0.10
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 V02.12.01



### 8.1.2. 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	-	31.03.2014
005	AC - LISN (50 Ohm/50µH, test site 1)	ESH2-Z5	861741/005	Rohde & Schwarz	24/12 M	-	31.03.2014
007	Single-Line V-Network (50 Ohm/5µH)	ESH3-Z6	892563/002	Rohde & Schwarz	24/12 M	-	31.03.2014
009	Power Meter (EMS-radiated)	NRV	863056/017	Rohde & Schwarz	24 M	-	31.03.2015
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	-	31.03.2013
021	Loop Antenna (H-Field)	6502	9206-2770	EMCO	36 M	-	31.03.2015
030	Loop Antenna (H-field)	HFH-Z2	879604/026	Rohde & Schwarz	36 M	-	31.03.2015
033	RF-current probe (100kHz-30MHz)	ESH2-Z1	879581/18	Rohde & Schwarz	24 M	-	31.03.2015
057	relay-switch-unit (EMS system)	RSU	494440/002	Rohde & Schwarz	pre-m	1a	
060	power amplifier (DC-2kHz)	PAS 5000	B6363	Spitzenberger+Spies	-	3	
066	notch filter (WCDMA; FDD1)	WRCT 1900/2200-5/40-10EEK	5	Wainwright GmbH	12 M	1g	30.06.2013
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	-	-	RWTÜV	-	4	
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	-	31.03.2015
100	passive voltage probe	Probe TK 9416	without	Schwarzbeck	36 M	-	31.03.2015
110	USB-LWL-Converter	OLS-1	-	Ing. Büro Scheiba	-	4	
119	RT Harmonics Analyzer dig. Flickermeter	B10	G60547	BOCONSULT	36 M	-	31.03.2016
134	horn antenna 18 GHz (Subst 2)	3115	9005-3414	EMCO	12 M	-	31.03.2014
136	adjustable dipole antenna (Dipole 1)	3121C-DB4	9105-0697	EMCO	36 M	-	31.03.2015
140	Signal Generator	SMHU	831314/006	Rohde & Schwarz	24 M	-	31.03.2014
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	-	31.03.2014
262	Power Meter	NRV-S	825770/0010	Rohde & Schwarz	24 M	-	31.03.2014
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	-	31.03.2014
265	peak power sensor	NRV-Z33, Model 04	840414/009	Rohde & Schwarz	24 M	-	31.03.2014
266	peak power sensor	NRV-Z31, Model 04	843383/016	Rohde & Schwarz	24 M	-	31.03.2014
267	notch filter GSM 850	WRCA 800/960-6EEK	9	Wainwright GmbH	pre-m	2	
270	termination	1418 N	BB6935	Weinschel	pre-m	2	
271	termination	1418 N	BE6384	Weinschel	pre-m	2	
272	attenuator (20 dB) 50 W	Model 47	BF6239	Weinschel	pre-m	2	
273	attenuator (10 dB) 100 W	Model 48	BF9229	Weinschel	pre-m	2	
274	attenuator (10 dB) 50 W	Model 47 (10 dB) 50 W	BG0321	Weinschel	pre-m	2	
275	DC-Block	Model 7003 (N)	C5129	Weinschel	pre-m	2	
276	DC-Block	Model 7006 (SMA)	C7061	Weinschel	pre-m	2	
279	power divider	1515 (SMA)	LH855	Weinschel	pre-m	2	
287	pre-amplifier 25MHz - 4GHz	AMF-2D-100M4G-35-10P	379418	Miteq	12 M	1c	30.06.2013
291	high pass filter GSM 850/900	WHJ 2200-4EE	14	Wainwright GmbH	12 M	1c	30.06.2013
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	24/12 M	-	31.03.2014
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	-	31.03.2014
303	horn antenna 40 GHz (Subst 1)	BBHA9170	156	Schwarzbeck	36 M	-	31.03.2014
331	Climatic Test Chamber -40/+80 Grad	HC 4055	43146	Heraeus Vötsch	24 M	-	30.11.2014
341	Digital Multimeter	Fluke 112	81650455	Fluke	24 M	-	31.03.2014
342	Digital Multimeter	Voltcraft M-4660A	IB 255466	Voltcraft	24 M	-	31.03.2015
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	-	31.03.2014
356	power sensor	NRV-Z1	882322/014	Rohde & Schwarz	24 M	-	31.03.2015
357	power sensor	NRV-Z1	861761/002	Rohde & Schwarz	24 M	-	31.03.2015
371	Bluetooth Tester	CBT32	100153	R&S	24 M	-	31.03.2014
373	Single-Line V-Network (50 Ohm/5µH)	ESH3-Z6	100535	Rohde & Schwarz	24/12 M	-	31.03.2014
376	Horn Antenna 6 GHz	BBHA9120 E	BBHA 9120 E 179	Schwarzbeck	12 M	-	31.03.2014
377	EMI Test Receiver	ESCS 30	100160	Rohde & Schwarz	12 M	-	31.03.2014
389	Digital Multimeter	Keithley 2000	0583926	Keithley	24 M	-	31.03.2015
392	Radio Communication Tester	MT8820A	6K00000788	Anritsu	12 M	-	31.03.2014
431	Model 7405	Near-Field Probe Set	9305-2457	EMCO	-	4	
436	Univ. Radio Communication Tester	CMU 200	103083	Rohde & Schwarz	12 M	-	31.03.2014
441	CTC-SAR-EMI Cable Loss	System EMI field (SAR) Cable	-	CETECOM	12 M	5	31.10.2013

Ref.-No.	Equipment	Type	Serial-No.	Manufacturer	Interval of calibration	Remark	Cal due
443	CTC-FAR-EMI-RSE	System CTC-FAR-EMI-RSE	-	ETS-Lindgren / CETECOM	12 M	5	30.06.2013
448	notch filter WCDMA_FDD II	WRCT 1850.0/2170.0-5/40-	5	Wainwright Instruments GmbH	12 M	1c	30.06.2013
449	notch filter WCDMA FDD V	WRCT 824.0/894.0-5/40-8SSK	1	Wainwright	12 M	1c	30.06.2013
454	Oscilloscope	HM 205-3	9210 P 29661	Hameg	-	4	
456	DC-Power supply 0-5 A	EA 3013 S	207810	Elektro Automatik	pre-m	2	
459	DC -Power supply 0-5 A , 0-32 V	EA-PS 2032-50	910722	Elektro Automatik	pre-m	2	
460	Univ. Radio Communication Tester	CMU 200	108901	Rohde & Schwarz	12 M	-	31.03.2014
463	Universal source	HP3245A	2831A03472	Agilent	-	4	
466	Digital Multimeter	Fluke 112	89210157	Fluke USA	24 M	-	31.03.2014
467	Digital Multimeter	Fluke 112	89680306	Fluke USA	24 M	-	31.03.2014
468	Digital Multimeter	Fluke 112	90090455	Fluke USA	24 M	-	31.03.2014
477	ReRadiating GPS-System	AS-47	-	Automotive Cons. Fink	-	3	
480	power meter (Fula)	NRVS	838392/031	Rohde & Schwarz	24 M	-	31.03.2015
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	-	30.06.2013
487	System CTC NSA-Verification SAR-EMI	System EMI field (SAR) NSA	-	ETS Lindgren / CETECOM	24 M	-	30.09.2013
489	EMI Test Receiver	ESU40	1000-30	Rohde & Schwarz	12 M	-	31.03.2014
502	band reject filter	WRCG 1709/1786-1699/1796-	SN 9	Wainwright	pre-m	2	
503	band reject filter	WRCG 824/849-814/859-	SN 5	Wainwright	pre-m	2	
512	notch filter GSM 850	WRCA 800/960-02/40-6EEK	SN 24	Wainwright	12 M	1c	30.06.2013
517	relais switch matrix	HF Relais Box Keithley	SE 04	Keithley	pre-m	2	
523	Digital Multimeter	L4411A	MY46000154	Agilent	24 M	-	31.03.2015
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	-	31.03.2014
547	Univ. Radio Communication Tester	CMU 200	835390/014	Rohde & Schwarz	12 M	-	31.03.2014
548	Digital-Barometer	GBP 2300	without	Greisinger GmbH	36 M	-	30.06.2015
549	Log.Per-Antenna	HL025	1000060	Rohde & Schwarz	36/12 M	-	31.03.2015
552	high pass filter 2,8-18GHz	WHKX 2,8/18G-10SS	4	Wainwright	12 M	1c	30.06.2013
558	System CTC FAR S-VSWR	System CTC FAR S-VSWR	-	CTC	24 M	-	31.07.2013
574	Biconilog Hybrid Antenna	BTA-L	980026L	Frankonia	36/12 M	-	31.03.2016
584	Spectrum Analyzer	FSU 8	100248	Rohde & Schwarz	24 M	-	31.03.2014
594	Wideband Radio Communication Tester	CMW500	101757	Rohde & Schwarz	24 M	-	31.03.2014
597	Univ. Radio Communication Tester	CMU 200	100347	Rohde & Schwarz	12 M	-	31.03.2014
598	Spectrum Analyzer	FSEM 30 (Reserve)	831259/013	Rohde & Schwarz	24 M	-	13.01.2015
600	power meter	NRVD (Reserve)	834501/018	Rohde & Schwarz	24 M	-	31.03.2015
601	medium-sensitivity diode sensor	NRV-Z5 (Reserve)	8435323/003	Rohde & Schwarz	24 M	-	31.03.2015
602	peak power sensor	NRV-Z32 (Reserve)	835080	Rohde & Schwarz	24 M	-	31.03.2015
608	UltraLog-Antenna	HL 562	830547/009	Rohde & Schwarz	36/12 M	-	31.03.2014
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	-	31.03.2014
617	Power Splitter/Combiner	ZFSC-2-2-S+	S F987001108	Mini Circuits	-	2	
618	Power Splitter/Combiner	50PD-634	600994	JFW Industries USA	-	2	
619	Power Splitter/Combiner	50PD-634	600995	JFW Industries, USA	-	3	
620	EMI Test Receiver	ESU 26	100362	Rohde-Schwarz	12 M	-	01.03.2014
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	-	30.05.2014
634	Spectrum Analyzer	FSM (HF-Unit)	826188/010	Rohde & Schwarz	pre-m	2	
636	Thermal Imaging camera	Ti32	Ti32-12060213	Fluke Corporation	24 M	-	31.07.2014
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	24 M	-	31.03.2014
644	Amplifierer	ZX60-2534M+	SN865701299	Mini-Circuits	-	-	
670	Univ. Radio Communication Tester	CMU 200	106833	Rohde & Schwarz	12 M	-	31.03.2014

### 8.1.3. 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