

TEST REPORT
No.: 6-0592-14-2-9a

According to:
FCC Regulations
Part 22, Part 24

for

ASCOM AB

Cellular/Wi-Fi Smartphone
SH1-ACAA

FCC ID: BXZSH1C







Laboratory Accreditation and Listings			
 DAkks Deutsche Akkreditierungsstelle D-PL-12047-01-01	 FEDERAL COMMUNICATIONS COMMISSION USA 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-2666 C-2914, T-1967, G-301
 AUTHORIZED RF LABORATORY	 LAB CODE 20011130-00		
accredited according to DIN EN ISO/IEC 17025			
<p>CETECOM GmbH Laboratory Radio Communications & Electromagnetic Compatibility Im Teelbruch 116 • 45219 Essen • Germany Registered in Essen, Germany, Reg. No.: HRB Essen 8984 Tel.: + 49 (0) 20 54 / 95 19-954 • Fax: + 49 (0) 20 54 / 95 19-964 E-mail: info@cetecom.com • Internet: www.cetecom.com</p>			

Table of contents

1. SUMMARY OF TEST RESULTS	3
1.1. TX mode, tests overview of FCC Standards Standards	3
2. ADMINISTRATIVE DATA	5
2.1. Identification of the testing laboratory	5
2.2. Test location	5
2.3. Organizational items	5
2.4. Applicant’s details	5
2.5. Manufacturer’s details	5
3. EQUIPMENT UNDER TEST (EUT)	6
3.1. TECHNICAL DATA OF MAIN EUT DECLARED BY APPLICANT	6
3.2. EUT: Type, S/N etc. and short descriptions used in this test report	8
3.3. Auxiliary Equipment (AE): Type, S/N etc. and short descriptions	8
3.4. EUT set-ups	8
3.5. EUT operating modes	9
3.6. Parameter Settings on mobile phone and base station CMU200	11
3.7. Test system set-up for AC power-line conducted emission measurements	11
3.8. Test system set-up for radiated magnetic field measurements below 30 MHz	13
3.9. Test system set-up for radiated electric field measurement 30 MHz to 1 GHz	14
3.10. Test system set-up for radiated electric field measurement above 1 GHz	15
4. MEASUREMENTS	16
4.1. General Limit - Conducted emissions on AC-Power lines	16
4.2. General Limit - Radiated field strength emissions below 30 MHz	17
4.3. RF-Parameter GSM - RF Peak power output radiated	19
4.4. RF-Parameter W-CDMA - RF Peak power output radiated	21
4.5. RF-Parameter GSM - Radiated out of Band RF emissions and Band Edge	23
4.6. RF-Parameter W-CDMA - Radiated out of Band RF emissions	25
5. INSTRUMENTS AND ANCILLARY	27
5.1. Used equipment “CTC”	27
6. VERSIONS OF TEST REPORTS (CHANGE HISTORY)	30

Table of annex

Total pages

Annex 1: External photographs of EUT - separate document TR6-0592-14-2-9a-A1	4
Annex 2: Internal photographs of EUT - separate document TR6-0592-14-2-9a -A2	4
Annex 3: Test set-up photographs - separate document TR6-0592-14-2-9a -A3	5
Annex 4: Measurement diagrams - separate document TR6-0592-14-2-9a -A4	47

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.

Following tests have been performed to show compliance with applicable FCC Part 2, Part 22, Subpart H, Part 27, Subpart C and Part 24, Subpart E (Broadband PCS) of the FCC CFR 47 Rules, Edition 1st October 2013.

1.1. TX mode, tests overview of FCC Standards Standards

No. of Diagram group	Test case	Port	References & Limits		EUT set-up	EUT op-mode	Result
			FCC Standard	Test limit			
1	AC- Power Lines Emissions Conducted (0,15 - 30 MHz)	AC- Power lines (conducted)	§15.207	§15.207 limits IC: Table 4, Chapter 7.2.4	2	3+5+7	passed
2	General field strength emissions (9 kHz - 30 MHz)	Cabinet + inter- connecting cables (radiated)	§15.209(a)	2400/F(kHz) μ V/m 24000/F(kHz) μ V/m 30 μ V/m	2	3+5+7	passed
7	RF-Power (ERP/EIRP)		§2.1046 §22.913(a)(2)	< 7 Watt (ERP)	1	1+2+3 +4+5+ 6+7	passed
			§24.232(c)	< 2 Watt (EIRP)			
8	Spurious emissions		§2.1053(a)(b) §2.1057(a)(1) (b)(c)	43+10log(P) dBc	1	3+5+7	passed
9	Band-Edge compliance		§22.917(a)(b) §24.238(a)(b)		1	3+5+7	passed

30	RF Power	Antenna terminal (conducted)	§2.1046	N/A	--	--	Not performed (remark1)
34	26dB Emission bandwidth		§2.202 §2.1049 §22.917(a) §24.238(a)	99% Power	--	--	Not performed (remark1)
35	99% Occupied bandwidth				--	--	
36	Spurious emissions		§2.1051 §2.1057 §22.917(a)(b) §24.238(a)(b)	43+10log(P) dBc	--	--	Not performed (remark1)
37	Band-Edge compliance				--	--	Not performed (remark1)
38	Frequency stability		§22.355, table C-1 §24.235 §2.1055(a)(2)	< ±2.5ppm <±0.1 ppm	--	--	Not performed (remark1)

Remark: 1.) see separate report 1-9110_14-01-10

.....
Dipl.-Ing. Rachid Acharkaoui
Responsible for test section

.....
Dipl.-Ing N. Perez
Responsible for test report

2. Administrative Data

2.1. Identification of the testing laboratory

Company name:	CETECOM GmbH
Address:	Im Teelbruch 116 45219 Essen - Kettwig Germany
Responsible for testing laboratory:	Dipl.-Ing. Rachid Acharkaoui
Deputy:	Dipl.-Ing. Niels Jeß

2.2. Test location

2.2.1. Test laboratory "CTC"

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

Project leader:	Dipl.-Ing C. Obert
Responsible for test report:	Dipl.-Ing N. Perez
Receipt of EUT:	2014-12-12
Date(s) of test:	2014-12-18, 2015-02-13
Date of report:	2015-04-20

Version of template:	13.02

2.4. Applicant's details

Applicant's name:	ASCOM AB
Address:	Grimbodalen 2 SE-402 76 Göteborg Sweden
Contact person:	Lena Kindmark

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

GSM

Main function	Cellular/Wi-Fi Smartphone		
Type	SH1-ACAA		
FCC-ID	BXZSH1C		
IC	3724B-SH1C		
GSM Frequency range (US/Canada -bands)	GSM 850: 824 – 849 MHz (Uplink), 869-894 MHz (Downlink) GSM1900: 1850-1910 MHz (Uplink), 1930-1990 MHz (Downlink)		
Type of modulation	GSM,GPRS, GMSK E-GPRS-Mode: 8-PSK		
MS Class	GSM/GPRS/E-GPRS 850: 4/12/E2 GSM/GPRS/E-GPRS 1900: 1/12/E2		
Number of channels (USA/Canada -bands)	GSM/E-GPRS 850 MHz Band: Channel 128/192/251 GSM/E-GPRS 1900 MHz Band: Channel 512/661/810		
Test Channel frequencies	GSM/E-GPRS 850 MHz Band: Channel 128/192/251 GSM/E-GPRS 1900 MHz Band: Channel 512/661/810		
Emission designator(s)	GSM850: 247KGXW EDGE850: 245KG7W GSM1900: 245KGXW EDGE1900: 245KG7W		
Antenna Type	<input checked="" type="checkbox"/> Integrated <input type="checkbox"/> External, no RF- connector <input type="checkbox"/> External, separate RF-connector: main TX + secondary RX connector + GPS		
Antenna Gain Tx (main)	<input checked="" type="checkbox"/> Value: 4dBi (850Mhz), 0dBi (1900MHz) <input type="checkbox"/> No information from customer		
Installed options	<input checked="" type="checkbox"/> GSM 900/1800 Bands and UMTS FDDI/VIII (not usable in USA/Canada) <input checked="" type="checkbox"/> GPS		
Power supply	<input checked="" type="checkbox"/> 3.7 V DC (normal battery power)		
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		

W-CDMA

TX-frequency range		FDD Band 5: 826.4-846.6 MHz (Uplink), 869-894 MHz (Downlink)	
Type of modulation		FDD-Mode Release99: QPSK FDD Mode Release 5+6: 16QAM additional	
Number of channels		FDD Band 5: UARFCN range 4132 – 4183 – 4233	
UMTS-HSPA connectivity		<input checked="" type="checkbox"/> Uplink speed: 5.76 Mb/s (category 6) <input type="checkbox"/> Uplink speed:	
Test Channels	Band V	Channel 4132/4183/4233	
Emission designator(s)		Band V: 4M17F9W	
Antenna Gain Tx (main)		<input checked="" type="checkbox"/> Value: 4dBi <input type="checkbox"/> No information from customer	
Power supply		<input checked="" type="checkbox"/> 3.7 V DC (normal battery power)	
Special EMI components		--	
EUT sample type		<input type="checkbox"/> Production	<input checked="" type="checkbox"/> Pre-Production
			<input type="checkbox"/> Engineering

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	Cellular/Wi-Fi Smartphone	SH1-ACAA	T26105EB77	PF	myco-eng 4.4.2 daily_2014-12-11_eng daily_379_214-12-11 dev-keys
EUT B	Cellular/Wi-Fi Smartphone	SH1-ACAA	T26105EA0D	PF	myco-eng 4.4.2 daily_2014-12-11_eng daily_379_214-12-11 dev-keys

*) 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	UNIFIVE AC/DC charger	UBX305-0510	E11-0087739	--	--
AE 2	USB cable	Highspeed USB 2.0 Type LL87003	--	--	--

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

3.4. EUT set-ups

EUT set-up no. *)	Combination of EUT and AE	Remarks
set. 1	EUT A+ AE 1 + AE 2	
set. 2	EUT B+ AE 1 + AE 2	

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

3.5. EUT operating modes

3.5.1. EUT operating modes GSM

EUT operating mode no. *)	Description of operating modes	Additional information:
op. 1	GSM 850-Voice Traffic channels = 128/192/251	A communication link is established between the mobile station and the test simulator. The transmitter is operated at its maximum rated output power: 33 dBm (power class 4; power control level 5). The input signal to the receiver is modulated with normal test modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link.
op. 2	GPRS 850 Data Traffic channels = 128/192/251	A communication link is established between the mobile station and the test simulator. The transmitter is operated at its maximum rated output power: 33 dBm (power class 4; power control level 5). USF_Duty CYCLE set to 100%, coding scheme CS-1 for GMSK modulation, slot 3 active, uplink gamma: 3 (33 dBm). The input signal to the receiver is modulated with normal test modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link.
op. 3	E-GPRS 850 Data Traffic channels = 128/192/251	A communication link is established between the mobile station and the test simulator. The transmitter is operated at its maximum rated output power: 33 dBm (power class 4; power control level 5). USF_Duty CYCLE set to 100%, coding scheme MCS-5 for 8PSK modulation, slot 3 active, uplink gamma: 6 (27dBm). The input signal to the receiver is modulated with normal test modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link.
op. 4	GSM1900-Voice Traffic channels = 512/661/810	A communication link is established between the mobile station and the test simulator. The transmitter is operated at its maximum rated output power: 30 dBm (power class 1; power control level 0). The input signal to the receiver is modulated with normal test modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link
op. 5	GPRS 1900 Data Traffic channels = 512/661/810	A communication link is established between the mobile station and the test simulator. The transmitter is operated at its maximum rated output power: 30 dBm (power class 1; power control level 0). USF_Duty CYCLE set to 100%, coding scheme CS-1 for GMSK modulation, slot 3 active, uplink gamma: 3 (30 dBm). The input signal to the receiver is modulated with normal test modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link
op. 6	E-GPRS 1900 Data traffic channels = 512/661/810	A communication link is established between the mobile station and the test simulator. The transmitter is operated at its maximum rated output power: 30 dBm (power class 1; power control level 0). USF_Duty CYCLE set to 100%, coding scheme MCS-5 for 8-PSK modulation, slot 3 active, uplink gamma: 5 (26 dBm). The input signal to the receiver is modulated with normal test modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link.

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

3.5.2. EUT operating modes W-CDMA

EUT operating mode no. *)	Description of operating modes:	Additional information:
op. 7	FDD-Band 5 12.2 kbps RMC	A communication link is established between the mobile station (UE) and the test simulator. The transmitter is operated on its maximum rated output power class: 24dBm nominal. The input signal to the receiver is modulated with normal test modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link according Table E5.1/Table E5.1A as described in 3GPP TS34.121, Annex E.

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

3.6. Parameter Settings on mobile phone and base station CMU200

Following settings apply to the MS during the measurements in **GSM/(E)GPRS-Mode** only:

Parameter	Traffic Mode	Idle Mode
Traffic Channels mobile station (EUT)	GSM 850: TCH _{MS} = 128/ 192 /251 GSM 1900: TCH _{MS} = 512 / 661 / 810	--
maximum power level (PCL)	GSM 850: PCL = 5 (2 Watt) GSM 1900: PCL = 0 (1 Watt)	--
Modulation	GSM/GPRS: GMSK-Modulation Scheme EDGE: 8-PSK Modulation Scheme	--
DTX	off	--
Bitstream	PRBS 2E9-1 (pseudo-random-sequence) – CCITT 0.153	
Timeslot(s) in Uplink	3	
Hopping	off	
Timeslot (slot mode)	GSM-Mode: single GPRS-Mode: slots no.3 according MS class	
MS slot class	Class 12	
Maximum data transmission rate, single time slot	GSM: 9,6 kbit/s Slot GPRS: 17,6 kbit/s Slot EDGE: 59,2 kBit/s Slot	
Speech transcoding (Traffic Mode)	Full rate Version 1	
Speed rate	130 Kb/s	
Mode	BCCH and TCH	
BCCH – base station (CMU,CMD)	GSM 850: 182 GSM 1900: 651	
TCH – base station (CMD, CMU)	auto	
Power level TCH – base station (used timeslot level)	- 70 dBm	
Power level BCCH – base station (control channel level)	- 80 dBm	
External attenuation RF/AF-Input/Output	Accord. calibration prior to measurements	
Mobile Country Code	310	310
Domain	CS	
BS_AG_BLKS_RES	Not applicable	0
Paging reorganisation		Off (0)
Signalling channel		SDCCH
Location Update		Auto
Cell access		Disabled (barred)

Settings for CMU (general)

Repetition	Continuous	
Stop condition	None	
Display mode	Max./Min	
Statistic Count	1000 Bursts	
Decoder	Standard	

Additional settings on the base stations CMU200 for frequency stability measurements

3.7. Test system set-up for AC power-line conducted emission measurements

Specification: ANSI C63.4-2009 chapter 7, ANSI C63.10-2009 chapter 6.2

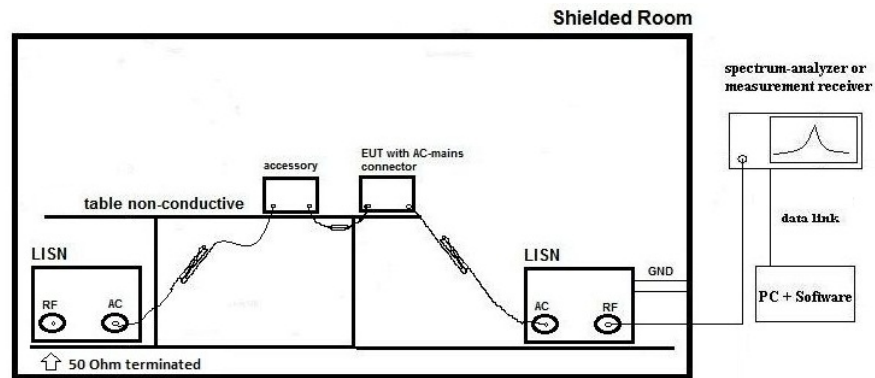
General Description: The radio frequency voltage conducted back into the AC power line in the

frequency range 150 kHz to 30 MHz has to be investigated. Compliance should be tested by measuring the radio frequency voltage between each power line and ground at the power terminals in the stated frequency range.

A 50 Ohm / 50 μH line impedance stabilization network (LISN) is used coupling the interface to the measurement equipment. The EUT power input leads are connected through the LISN to the AC-power source. The LISN enclosure is electrically connected to the ground plane. The measuring instrument is connected to the coaxial output of the LISN.

Tabletop devices were set-up on a 80 cm height above reference ground plane, floor standing equipment 10 cm raised above ground plane. Measurements have been performed on each phase line and neutral line of the devices AC-power lines. The EUT was power supplied with 110 V/60 Hz. The EUT was tested in the defined operating mode and installed (connected) to accessory equipment according the general description of use given by the applicant.

Schematic:



Only schematic view, we refer to figure 6, 7 and 8 of ANSI C63.4-2009 for more details.

Testing method:

Exploratory, preliminary measurements as a first step, determines the worst-case phase line (neutral or phase) as well as the most critical operating mode of the equipment. A complete frequency-sweep with PK-Detector is performed on each current-carrying conductor.

Final testing for power phases and critical frequencies (Margin to AV- or QP limit lower than 3 dB) as a second step includes measurements with receivers detector set to Quasi-Peak and Average.

Formula:

$$V_C = V_R + C_L \quad (1)$$

$$M = L_T - V_C \quad (2)$$

V_C = measured Voltage –corrected value
 V_R = Receiver reading
 C_L = Cable loss
 M = Margin
 L_T = Limit

Values are in dB, positive margin means value is below limit.

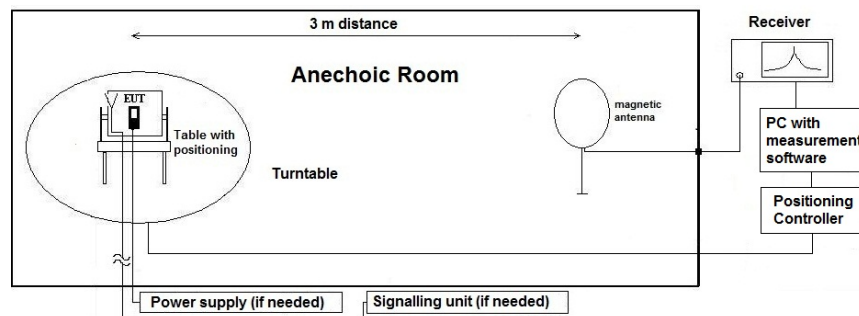
3.8. Test system set-up for radiated magnetic field measurements below 30 MHz

Specification: ANSI C63.4-2009 chapter 8.2.1, ANSI C63.10-2009 chapter 6.4

General Description: Evaluating the radiated field emissions are done first by an exploratory emission measurement and a final measurement for most critical frequencies determined.

The loop antenna was placed at 1 m height above ground plane and 3 m measurement distance from set-up for investigations. Because of reduced measurement distance, correction data were applied, as stated in chapter “General Limit - Radiated field strength emissions below 30 MHz“. The tests are performed in the semi anechoic room recognized by the regulatory commission.

Schematic:



Testing method:

Exploratory, preliminary measurement

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

Final measurement on critical frequencies

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

First a frequency zoom around the critical frequency is done to locate the frequency more precisely. After this step, for all identified critical frequencies, the maximum peak was determined.

Following parameters were varied: the turntable angle continuously in the range 0 to 360 degree, the EUT itself either over 3-orthogonal axis (not defined usage position) or 2-orthogonal axis (defined usage position).

On the determined worst-case position, a final measurement with necessary bandwidth and detector according standard has been carried out.

Formula:

$$E_C = E_R + AF + C_L + D_F - G_A$$

$$M = L_T - E_C$$

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

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

Distance correction:

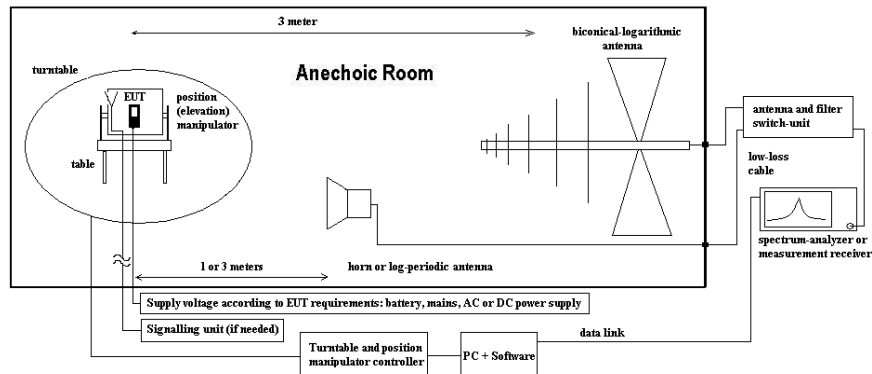
Reference for applied correction (extrapolating) factors:
 IEEC Transaction EMC, Vol. 47, No. 3 , Aug. 2005, Journal Paper
 “Extrapolating Near-field emissions of low frequency loop transmitters”.

3.9. Test system set-up for radiated electric field measurement 30 MHz to 1 GHz

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

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 NSA-compliant semi anechoic room (SAR) recognized by the regulatory commissions.

Schematic:



Testing method:

Exploratory, preliminary measurements

The EUT and its associated accessories are placed on a non-conductive position manipulator (tipping device) of 0.8 m height which is placed on the turntable. By rotating the turntable (range 0° to 360°, step 90°) 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.

Measurement antenna: horizontal and vertical, heights: 1,0 m and 1,82 m as worst-case determined by an exploratory emission measurements. 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 between 1 m and 4 m.

On the determined worst-case position, a final measurement with necessary bandwidth and detector according standard has been carried out.

Formula:

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

$$M = L_T - E_C \quad (2)$$

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

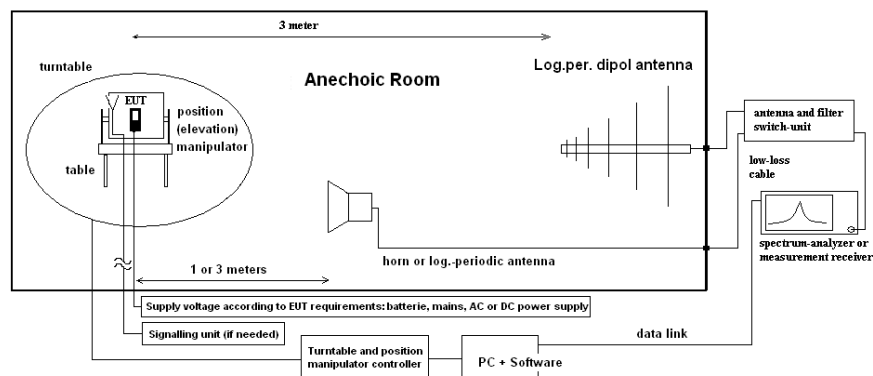
All units are dB-units, positive margin means value is below limit.

3.10. Test system set-up for radiated electric field measurement above 1 GHz

Specification: ANSI C63.4-2009 chapter 8, ANSI C63.10-2009 chapter 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 commissions. The measurement distance was set to 3 meter for frequencies up to 18 GHz and 2 meter above 18 GHz. A bicon-log or horn antenna is used for frequency range 1 GHz to 40 GHz. Due to use of a fully anechoic room the measurement antennas are set to fixed antenna height of 1.55 m and the site validation criteria accord. CISPR 16-1-4:2010, Chapter 8.3 is fulfilled. The EUT is aligned within 3 dB beamwidth of the measurement antenna, on big EUTs several surface measurements are performed.

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 15°) 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.

Formula:

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

$$M = L_T - E_C \quad (2)$$

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)

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

4. Measurements

4.1. General Limit - Conducted emissions on AC-Power lines

4.1.1. Test location and 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"/> 333 EMI field	<input checked="" type="checkbox"/> 348 EMI cond.	
receiver	<input type="checkbox"/> 001 ESS	<input checked="" type="checkbox"/> 377 ESCS 30	<input type="checkbox"/> 489 ESU 40 <input type="checkbox"/> 620 ESU 26
LISN	<input checked="" type="checkbox"/> 005 ESH2-Z5	<input type="checkbox"/> 007 ESH3-Z6	<input type="checkbox"/> 300 ESH3-Z5 & 50Ω used for AE <input type="checkbox"/> no LISN for AE
signaling	<input type="checkbox"/> 392 MT8820A	<input type="checkbox"/> 436 CMU	<input checked="" type="checkbox"/> 547 CMU <input type="checkbox"/> 594 CMW
line voltage	<input type="checkbox"/> 230 V 50 Hz via public mains <input checked="" type="checkbox"/> 060 120 V 60 Hz via PAS 5000		

4.1.2. Requirements

FCC		Part 15, Subpart B, §15.207	
ANSI		C63.10-2009	
Limit	Frequency [MHz]	QUASI-Peak [dBμV]	AVERAGE [dBμV]
	0.15 – 0.5	66 to 56*	56 to 46*
	0.5 – 5	56	46
	5 – 30	60	50
Remark: * decreases with the logarithm of the frequency			

4.1.3. Test condition and test set-up

Signal 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 (40 cm distance to reference ground plane (wall))		<input type="checkbox"/> floor standing EUT stands isolated on reference ground plane (floor)
Climatic conditions		Temperature: (22±3°C)		Rel. humidity: (40±20)%
EMI-Receiver or Analyzer settings	Scan data	<input type="checkbox"/> 9 – 150 kHz, RBW = 200 Hz, Step = 61 Hz <input checked="" type="checkbox"/> 150 kHz – 30 MHz RBW = 9 kHz, Step = 4 kHz <input type="checkbox"/> other:		
	Scan-Mode	6 dB EMI-Receiver Mode		
	Pre-measurement Final measurement	Peak detector, Repetitive-Scan, max-hold, sweep-time 50 μs per frequency point Average & Quasi-peak detector at critical frequencies		
General measurement procedures		Please see chapter “Test system set-up for AC power line conducted emissions measurements”		

4.1.4. Measurement results

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

EUT set-up no.:2					
Diagram No.	EUT operating mode no. or comment	Used Detector	Power line	Additional (scan-) information or remarks	Result
1.01	EUT operating mode	<input checked="" type="checkbox"/> Peak (pre-scan) <input checked="" type="checkbox"/> CAV (final) <input checked="" type="checkbox"/> QP (final)	L1/ N	-	passed
1.02	EUT operating mode	<input checked="" type="checkbox"/> Peak (pre-scan) <input checked="" type="checkbox"/> CAV (final) <input checked="" type="checkbox"/> QP (final)	L1/ N	-	passed
1.03	EUT operating mode	<input checked="" type="checkbox"/> Peak (pre-scan) <input checked="" type="checkbox"/> CAV (final) <input checked="" type="checkbox"/> QP (final)	L1/ N	-	passed

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

4.2.1. Test location and 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 checked="" type="checkbox"/> 441 EMI SAR	<input type="checkbox"/> 487 SAR NSA	<input type="checkbox"/> 347 Radio.lab.
receiver	<input type="checkbox"/> 377 ESCS30	<input checked="" type="checkbox"/> 001 ESS	<input type="checkbox"/>
spectr. analys.	<input type="checkbox"/> 584 FSU	<input type="checkbox"/> 120 FSEM	<input type="checkbox"/> 264 FSEK
antenna	<input type="checkbox"/> 574 BTA-L	<input type="checkbox"/> 133 EMCO3115	<input type="checkbox"/> 302 BBHA9170
signaling	<input type="checkbox"/> 392 MT8820A	<input type="checkbox"/> 371 CBT32	<input type="checkbox"/> 547 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 type="checkbox"/> 457 EA 3013A	<input type="checkbox"/> 459 EA 2032-50
line voltage	<input type="checkbox"/> 230 V 50 Hz via public mains	<input checked="" type="checkbox"/> 060 120 V 60 Hz	via PAS 5000

4.2.2. Requirements

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

4.2.3. Test condition and test set-up

Signal link to test system (if used):	<input checked="" type="checkbox"/> air link	<input type="checkbox"/> cable connection	<input type="checkbox"/> none
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)%
EMI-Receiver or Analyzer Settings	Scan data	<input checked="" type="checkbox"/> 9 – 150 kHz RBW/VBW = 200 Hz Scan step = 80 Hz <input checked="" type="checkbox"/> 150 kHz – 30 MHz RBW/VBW = 9 kHz Scan step = 4 kHz <input type="checkbox"/> other:	
	Scan-Mode Detector Mode: Sweep-Time	<input checked="" type="checkbox"/> 6 dB EMI-Receiver Mode <input type="checkbox"/> 3dB Spectrum analyser Mode Peak (pre-measurement) and Quasi-PK/Average (final if applicable) Repetitive-Scan, max-hold Coupled – calibrated display if continuous signal otherwise adapted to EUT’s individual transmission duty-cycle	
General measurement procedures	Please see chapter “Test system set-up radiated magnetic field measurements below 30 MHz”		

4.2.4. Measurement Results

The results are presented below in summary form only. The EUT is put on operation on middle channel only. If critical peaks are found (Margin <10 dB) the lowest and highest channels will be performed too. For more information please see the diagrams.

Table of measurement results:

Diagram No.	Carrier Channel		Frequency range	Set-up no.	OP-mode no.	Remark	Used detector			Result
	Range	No.					PK	AV	QP	
02.01	Low	128	9 kHz-30 MHz	2	3		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
02.05	Middle	192	9 kHz-30 MHz	2	3		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
02.06	High	251	9 kHz-30 MHz	2	3		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
02.07	Low	4133	9 kHz-30 MHz	2	7		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
02.09	Middle	4185	9 kHz-30 MHz	2	7		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
02.10	High	4232	9 kHz-30 MHz	2	7		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
02.11	Low	512	9 kHz-30 MHz	2	5		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
02.12	Middle	661	9 kHz-30 MHz	2	5		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
02.13	High	810	9 kHz-30 MHz	2	5		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed

Remark: Optimized test plan applied, only worst case modulation

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

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

Frequency Range	f [kHz/MHz]	Lambda [m]	Far-Field Point [m]	Distance Limit accord. 15.209 [m]	1st Condition (dmeas < D _{near-field})	2'te Condition (Limit distance bigger d _{near-field})	Distance Correction accord. Formula
MHz	9.00E+03	33333.33	5305.17	300	fulfilled	not fulfilled	-80.00
	1.00E+04	30000.00	4774.85		fulfilled	not fulfilled	-80.00
	2.00E+04	15000.00	2387.33		fulfilled	not fulfilled	-80.00
	3.00E+04	10000.00	1591.55		fulfilled	not fulfilled	-80.00
	4.00E+04	7500.00	1193.66		fulfilled	not fulfilled	-80.00
	5.00E+04	6000.00	954.93		fulfilled	not fulfilled	-80.00
	6.00E+04	5000.00	795.76		fulfilled	not fulfilled	-80.00
	7.00E+04	4285.71	682.09		fulfilled	not fulfilled	-80.00
	8.00E+04	3750.00	595.63		fulfilled	not fulfilled	-80.00
	9.00E+04	3333.33	530.52		fulfilled	not fulfilled	-80.00
	1.00E+05	3000.00	477.47		fulfilled	not fulfilled	-80.00
	1.25E+05	2400.00	381.97		fulfilled	not fulfilled	-80.00
	2.00E+05	1500.00	238.73		fulfilled	fulfilled	-79.02
	3.00E+05	1000.00	159.16		fulfilled	fulfilled	-74.49
	4.00E+05	750.00	119.37		fulfilled	fulfilled	-72.00
	4.90E+05	612.24	97.44		fulfilled	fulfilled	-70.23
	5.00E+05	600.00	95.49		fulfilled	not fulfilled	-40.00
	6.00E+05	500.00	79.59		fulfilled	not fulfilled	-40.00
	7.00E+05	428.57	68.21		fulfilled	not fulfilled	-40.00
	8.00E+05	375.00	59.58		fulfilled	not fulfilled	-40.00
9.00E+05	333.33	53.05	fulfilled	not fulfilled	-40.00		
MHz	1.00	300.00	47.75	30	fulfilled	not fulfilled	-40.00
	1.59	188.50	30.00		fulfilled	not fulfilled	-40.00
	2.00	150.00	23.87		fulfilled	fulfilled	-38.02
	3.00	100.00	15.92		fulfilled	fulfilled	-34.49
	4.00	75.00	11.94		fulfilled	fulfilled	-32.00
	5.00	60.00	9.55		fulfilled	fulfilled	-30.08
	6.00	50.00	7.95		fulfilled	fulfilled	-28.47
	7.00	42.86	6.82		fulfilled	fulfilled	-27.13
	8.00	37.50	5.97		fulfilled	fulfilled	-25.97
	9.00	33.33	5.31		fulfilled	fulfilled	-24.95
	10.00	30.00	4.77		fulfilled	fulfilled	-24.04
	10.60	28.30	4.50		fulfilled	fulfilled	-23.53
	11.00	27.27	4.34		fulfilled	fulfilled	-23.21
	12.00	25.00	3.98		fulfilled	fulfilled	-22.45
	13.58	22.12	3.52		fulfilled	fulfilled	-21.39
	15.00	20.00	3.18		fulfilled	fulfilled	-20.51
	15.92	18.85	3.00		fulfilled	fulfilled	-20.00
	17.00	17.65	2.81		not fulfilled	fulfilled	-20.00
	18.00	16.67	2.65		not fulfilled	fulfilled	-20.00
	20.00	15.00	2.39		not fulfilled	fulfilled	-20.00
21.00	14.29	2.27	not fulfilled	fulfilled	-20.00		
23.00	13.04	2.08	not fulfilled	fulfilled	-20.00		
25.00	12.00	1.91	not fulfilled	fulfilled	-20.00		
27.00	11.11	1.77	not fulfilled	fulfilled	-20.00		
28.00	10.34	1.65	not fulfilled	fulfilled	-20.00		
30.00	10.00	1.59	not fulfilled	fulfilled	-20.00		

4.3. RF-Parameter GSM - RF Peak power output radiated

4.3.1. 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
signaling	<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 type="checkbox"/> 463 HP3245A	<input type="checkbox"/> 459 EA 2032-50
line voltage	<input type="checkbox"/> 230 V 50 Hz via public mains	<input checked="" type="checkbox"/> 060 120 V/ 60 Hz via PAS 5000	<input type="checkbox"/> 482 Filter Matrix
			<input type="checkbox"/> 378 RadiSense
			<input type="checkbox"/> 494 AG6632A
			<input type="checkbox"/> 498 NGPE 40

4.3.2. Requirements and limits

FCC	§2.1046(a)
Limit	Maximum E(I)RP of the mobile phone should be determined.
	Limit GSM850: 7 Watt ERP (38.4 dBm)
	Limit GSM1900: 2 Watt EIRP (33.0 dBm)

4.3.3. 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	Parameter: Scan Mode Span RBW VBW Sweep time Sweep mode Detector	Spectrum analyser mode 20 MHz 3 MHz 10 MHz Coupled repetitive Peak	
Measurement method	<p>The measurements were performed by using the substitution method (ANSI/TIA/EIA 603) with a spectrum-analyzer. This method can be described like follows:</p> <ol style="list-style-type: none"> 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. 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 ($P_{MEAS,1}$). This was performed for both measuring antenna polarisations (vertical/horizontal), the maximum of both values is used for further measurements and final substitution ($P_{MEAS,1,MAX}$). 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. 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 ($P_{SMHU}=P_{MEAS,1,MAX}$) Then the RF-signal cable is disconnected from the antenna and connected to a power-level meter. The level is determined ($P_{MEAS,2}$). The final result is calculated by adding the ERP/EIRP gain of the antenna which substitutes the EUT. $P_{EUT,SUBST} = P_{MEAS,2} + G_{ANTENNA}$ 		
EUT settings	<p>A call was established with settings according chapter "Parameter settings on mobile phone and base station CMU200"</p> <p>UE Power should be set to maximum, continuous transmission. DTX or other power saving techniques have been disabled</p> <p>The measurements were made at the low, middle and high carrier frequencies of each of the supported operating band. Choosing three TX-carrier frequencies of the wireless device, should be sufficient to demonstrate compliance.</p>		

4.3.4. Measurement results

4.3.4.1. GSM 850 results

Operating Mode	Carrier Channel		Peak Output Power [dBm]			Antenna Polarisation for maximum Power	Result
	Range	No.	PK	AV	ERP-Value		
GSM 850	Low	128	29.4	1.)	ERP-Value	V/H	passed
	Middle	192	29.1				
	High	251	29.3				
GPRS 850	Low	128	30.0	1.)	ERP-Value	V/H	passed
	Middle	192	27.0				
	High	251	29.1				
E-GPRS 850	Low	128	27.8	1.)	ERP-Value	V/H	passed
	Middle	192	30.2				
	High	251	28.9				

Remark: 1.) see conducted measurements for PAR factor

4.3.4.2. GSM 1900 results

Operating Mode	Carrier Channel		Peak Output Power [dBm]			Antenna Polarisation for maximum Power	Result
	Range	No.	PK	AV	EIRP-Value		
GSM 1900	Low	512	29.2	1.)	EIRP-Value	V/H	passed
	Middle	661	29.3				
	High	810	27.1				
GPRS 1900	Low	512	29.3	1.)	EIRP-Value	V/H	passed
	Middle	661	29.5				
	High	810	27.1				
E-GPRS 1900	Low	512	29.1	1.)	EIRP-Value	V/H	passed
	Middle	661	29.3				
	High	810	27.2				

Remark: 1.) see conducted measurements for PAR factor

4.4. RF-Parameter W-CDMA - RF Peak power output radiated

4.4.1. 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"/> 611 E3636A	<input type="checkbox"/> 463 HP3245A	<input type="checkbox"/> 459 EA 2032-50
line voltage	<input type="checkbox"/> 230 V 50 Hz via public mains	<input checked="" type="checkbox"/> 060 110 V/ 60 Hz via PAS 5000	<input type="checkbox"/> 482 Filter Matrix
			<input type="checkbox"/> 378 RadiSense
			<input type="checkbox"/> 494 AG6632A
			<input type="checkbox"/> 498 NGPE 40

4.4.2. Requirements and limits

FCC	§2.1046(a), §22.913, § 24.232(c); §27.50(d)(4)
Limit	Maximum Power Output of the wireless device should be determined while measured radiated E(I)RP.
	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)

4.4.3. Test condition and test set-up

link to test system (if used):	<input checked="" type="checkbox"/> air link	<input type="checkbox"/> cable connection	<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	Parameter:	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 substitution method (ANSI/TIA/EIA 603C/D) with a spectrum-analyzer. This method can be described like follows:</p> <ol style="list-style-type: none"> 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. 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 ($P_{MEAS,1}$). This was performed for both measuring antenna polarisations (vertical/horizontal), the maximum of both values is used for further measurements and final substitution ($P_{MEAS,1,MAX}$). 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. 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 ($P_{SMHU}=P_{MEAS,1,MAX}$). Than the RF-signal cable is disconnected from the antenna and connected to a power-level meter. The level is determined ($P_{MEAS,2}$). The final result is calculated by adding the ERP/EIRP gain of the antenna which substitutes the EUT. $P_{EUT,SUBST} = P_{MEAS,2} + G_{ANTENNA}$ 		
EUT settings	<p>A call was established on highest power transmit conditions in RMC99 mode.</p> <p>The measurements were made at the low, middle and high carrier frequencies of each of the supported operating band. Choosing three TX-carrier frequencies of the wireless device, should be sufficient to demonstrate compliance.</p>		

4.4.4. Results

EUT				Set-up 1, Op.Mode 1				
Operating Mode	Channel			Peak Output Power [dBm]			Antenna Polarisation for maximum Power	Result
	Range	No.	Nominal frequency [MHz]	PK	AV			
FDD Band 5	Low	4132	1852.4	25.9	1.)	ERP-Value	H/V	passed
	Middle	4183	1880.0	26.5				
	High	4233	1907.6	25.6				

Remark: 1.) see conducted measurements for PAR factor

4.5. RF-Parameter GSM - Radiated out of Band RF emissions and Band Edge

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

test location	<input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1)	<input type="checkbox"/> Please see Chapter. 2.2.2	<input type="checkbox"/> Please see Chapter. 2.2.3
test site	<input type="checkbox"/> 441 EMI SAR	<input type="checkbox"/> 487 SAR NSA	<input checked="" type="checkbox"/> 443 FAR
receiver	<input type="checkbox"/> 377 ESCS30	<input type="checkbox"/> 001 ESS	<input type="checkbox"/> 489 ESU 40
spectr. analys.	<input type="checkbox"/> 584 FSU	<input type="checkbox"/> 120 FSEM	<input checked="" type="checkbox"/> 264 FSEK
antenna	<input checked="" type="checkbox"/> 439 HL 562	<input checked="" type="checkbox"/> 549 HL 025	<input type="checkbox"/> 302 BBHA9170
signaling	<input type="checkbox"/> 017 CMD 65	<input type="checkbox"/> 323 CMD 55	<input type="checkbox"/> 340 CMD 55
signaling	<input type="checkbox"/> 392 MT8820A	<input checked="" type="checkbox"/> 546 CMU	<input type="checkbox"/> 547 CMU
power supply	<input checked="" type="checkbox"/> 463 HP3245A	<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"/> 060 120 V/ 60 Hz via PAS 5000

4.5.2. Requirements and limits (Variante RF-Parameter)

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

4.5.3. Test condition and test set-up

link to test system (if used):	<input checked="" type="checkbox"/> air link	<input type="checkbox"/> cable connection
EUT-grounding	<input checked="" type="checkbox"/> none	<input type="checkbox"/> with power supply
Equipment set up	<input checked="" type="checkbox"/> table top	<input type="checkbox"/> floor standing
Climatic conditions	Temperature: (22±3°C)	Rel. humidity: (40±20)%
Test system set-up	Please see chapter “Test system set-up for radiated spurious emission measurements up to 20 GHz”	
Measurement method	<p>“§ 2.1057 Frequency spectrum to be investigated. (a) In all of the measurements set forth in § 2.1051 and 2.1053, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz”</p> <p>The spectrum was scanned from 9 kHz (depend on the equipment, s. §2.1057) to the 10th harmonic of the highest frequency generated within the equipment. A PEAK detector was used except measurements near the block-edge where a AVERAGE detector applied.</p> <p>According chapter “Test system set-up for electric field measurement in the range 30-1000MHz and 1 to 40GHz” and additionally: the readings on the spectrum analyzer are corrected with annually performed chamber path calibration values so the readings shown are equivalent to ERP/EIRP values. Critical measurements near the limit are re-measured with a substitution method accord. ANSI/TIA/EIA 603.</p>	
EUT settings	<p>A call was established with settings according chapter “Parameter settings on mobile phone and base station CMU200”</p> <p>The UE and used accessories (if any used) were set to work according their intended use/specification stated as by the applicant</p> <p>The measurements were made at the low, middle and high carrier frequencies of each of the supported operating band. Choosing three TX-carrier frequencies of the wireless device, should be sufficient to demonstrate compliance.</p>	

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

Sweep no.	Start freq. MHz	Stop freq. MHz	R-BW MHz	V-BW MHz	Sweep time sec.	Att. [dB]	Detector
Sweep 1 (subrange 1)	30	1000	1	1	10	10	MaxH-PK
Sweep 2 (subrange 2)	1000	2800	1	1	15	10	MaxH-PK
Sweep 3 (subrange 3)	2800	9000	1	1	60	10	MaxH-PK
Sweep 4a (Band-Edge)	823	824	0.003	0.01	30	10	MaxH-PK
Sweep 4b (Band-Edge)	849	850	0.003	0.01	30	10	MaxH-PK

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

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

4.5.4. Measurement results

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

4.5.4.1. EGPRS 850: Set-up 1

Diagram no.	Carrier Channel		Frequency range	OP-mode no.	Remark	Used detector			Result
	Range	No.				PK	AV	QP	
8.04	Low	128	30 MHz – 9 GHz	2	Carrier on diagram, not relevant for results	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.01	Low		823 – 824 MHz		Band Edge Compliance	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
8.05	Middle	192	30 MHz – 9 GHz		Carrier on diagram, not relevant for results	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
8.06	High	251	30 MHz – 9 GHz		Carrier on diagram, not relevant for results	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.02	High		849 – 850 MHz		Band-Edge compliance	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed

Remark: Optimized test plan applied, only worst case modulation

4.5.4.2. GPRS 1900: Set-up 1

Diagram no.	Carrier Channel		Frequency range	OP-mode no.	Remark	Used detector			Result
	Range	No.				PK	AV	QP	
8.01	Low	512	30 MHz – 20 GHz	4	Carrier on diagram, not relevant for results	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.05	Low		1849 – 1850 MHz		Band Edge Compliance	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
8.02	Middle	661	30 MHz – 20 GHz		Carrier on diagram, not relevant for results	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
8.03	High	810	30 MHz – 20 GHz		Carrier on diagram, not relevant for results	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.06	High		1910 – 1911 MHz		Band-Edge compliance	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed

Remark: Optimized test plan applied, only worst case modulation

4.6. RF-Parameter W-CDMA - Radiated out of Band RF emissions

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

test location	<input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1)	<input type="checkbox"/> Please see Chapter. 2.2.2	<input type="checkbox"/> Please see Chapter. 2.2.3
test site	<input type="checkbox"/> 441 EMI SAR	<input type="checkbox"/> 487 SAR NSA	<input checked="" type="checkbox"/> 443 FAR
receiver	<input type="checkbox"/> 377 ESCS30	<input type="checkbox"/> 001 ESS	<input type="checkbox"/> 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 checked="" type="checkbox"/> 546 CMU	<input type="checkbox"/> 547 CMU
power supply	<input checked="" type="checkbox"/> 611 E3636A	<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 type="checkbox"/> 060 110 V/ 60 Hz via PAS 5000

4.6.2. Requirements and limits

FCC	<input checked="" type="checkbox"/> §2.1053(a)(b) , §2.1057(a)(1)(b)(c) <input checked="" type="checkbox"/> §22.917(a)(b) <input checked="" type="checkbox"/> §24.238(a)(b)
Limit	„the power of emissions shall be attenuated below the transmitter output power (p) by at least 43+10Log(P) dB“ -> Resulting limits for all power levels of the Mobile Phone: -13dBm

4.6.3. Test condition and test set-up

link to test system (if used):	<input checked="" type="checkbox"/> air link	<input type="checkbox"/> cable connection	<input type="checkbox"/>
EUT-grounding	<input checked="" type="checkbox"/> none	<input type="checkbox"/> with power supply	<input type="checkbox"/> additional connection
Equipment set up	<input checked="" type="checkbox"/> table top	<input type="checkbox"/> floor standing	
Climatic conditions	Temperature: (22±3°C)		Rel. humidity: (40±20)%
Test system set-up	Please see chapter “Test system set-up for radiated spurious emission measurements up to 20 GHz”		
Spectrum Analyzer Settings	Parameter: Scan Mode Span RBW VBW Sweep time Sweep mode Detector	Spectrum analyser mode 20 MHz 3 MHz 10 MHz Coupled repetitive Peak	
Measurement method	<p>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 for critical measurements.</p> <p>According chapter 4.2</p> <p>Valid for band-edge compliance: Due to not available exact 1% RBW of the measurement equipment, the lower available RBW was used for the FDD measurements.</p> <p>An additional correction factor of 10 Log (RBW1/ RBW2) to the result was added. RBW1 is the narrower measurement resolution bandwidth (used RBW) and RBW2 is either the 1% emissions bandwidth or 1 MHz (KDB890810).</p> <p>Formula: Band-Edge compliance correction factor for FDD bands 10log(30 kHz/50 kHz) to be used= -2.22 dB</p>		
Mobile phone settings	<p>A call was established on highest power transmit conditions in RMC99 mode.</p> <p>The measurements were made middle carrier frequencies of each of the supported operating band.</p>		

Spectrum-Analyzer settings for FDD band 2

	Start freq. MHz	Stop freq. MHz	R-BW MHz	V-BW MHz	Sweep time sec.	Att. [dB]	Detector
Sweep 1 (subrange 1)	30	1000	1	1	10	10	MaxH-PK
Sweep 1 (subrange 2)	1000	2800	1	1	15	0	MaxH-PK
Sweep 1 (subrange 3)	2800	20000	1	1	60	10	MaxH-PK

Spectrum-analyzer settings for FDD Band 5

	Start freq. MHz	Stop freq. MHz	R-BW MHz	V-BW MHz	Sweep time sec.	Att.	Detector
Sweep 1 (subrange 1)	30	1000	1	1	10	10	MaxH-PK
Sweep 1 (subrange 2)	1000	2800	1	1	15	0	MaxH-PK
Sweep 1 (subrange 3)	2800	12000	1	1	160	10	MaxH-PK

4.6.4. Results

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

4.6.4.1. FDD Band 5: Op. Mode 7, Set-up 1

Diagram no.	Carrier Channel		Frequency range	OP-mode no.	Remark	Used detector			Result
	Range	No.				PK	AV	QP	
8.07	Low	4132	30 MHz to 12 GHz	7	Carrier visible on diagram. Not relevant for results	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.03	Low		823 – 824 MHz		Band Edge Compliance Correction of 2.22dB apply: + 2.22 =dBm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
8.08	Middle	4185	30 MHz to 12 GHz		Carrier visible on diagram. Not relevant for results	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
8.09	High	4233	30 MHz to 12 GHz		Carrier visible on diagram. Not relevant for results	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
9.04	High		849 – 850 MHz		Band-Edge compliance Correction of 2.22dB apply: + 2.22 =dBm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed

Remark: a mathematical correction of used RBW=30kHz for measurements to required 1% RBW of EBW was used
Optimized test plan applied, only worst case modulation

5. Instruments and Ancillary

5.1. Used equipment “CTC”

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

5.1.1. 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
597	Univ. Radio Communication Tester	CMU 200	100347	R&S Test Firmware Base=5.01, GSM=5.02 WCDMA= not installed, Mainboard= µP1=V.850
598	Spectrum Analyzer	FSEM 30 (Reserve)	831259/013	Firmware Bios 3.40 , Analyzer 3.40 Sp 2
620	EMI Test Receiver	ESU 26	100362	4.43 SP3
642	Wideband Radio Communication Tester	CMW 500	126089	Setup V03.26, Test programm component V03.02.20
692	Bluetooth Tester	CBT 32	100236	CBT V 5.40, FW: V.2.41 (FPGA Digital, V. 3.09 FPGA RF)

5.1.2. 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	-	31.03.2015
005	AC - LISN (50 Ohm/50µH, test site 1)	ESH2-Z5	861741/005	Rohde & Schwarz	12 M	-	31.03.2015
007	Single-Line V-Network (50 Ohm/5µH)	ESH3-Z6	892563/002	Rohde & Schwarz	12 M	-	31.03.2015
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	-	31.03.2015
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	30.06.2014
086	DC - power supply, 0 -10 A	LNG 50-10	-	Heinzinger Electronic	pre-m	2	
087	DC - power supply, 0 -5 A	EA-3013 S	-	Elektro Automatik	pre-m	2	
090	Helmholtz coil: 2x10 coils in series	Helmholtz coil: 2x10 coils in	-	RWTÜV	12 M	4	31.03.2015
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
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	-	31.03.2016
248	attenuator	SMA 6dB 2W	-	Radiall	pre-m	2	
249	attenuator	SMA 10dB 10W	-	Radiall	pre-m	2	
252	attenuator	N 6dB 12W	-	Radiall	pre-m	2	
256	attenuator	SMA 3dB 2W	-	Radiall	pre-m	2	
257	hybrid	4031C	04491	Narda	pre-m	2	
260	hybrid coupler	4032C	11342	Narda	pre-m	2	
261	Thermal Power Sensor	NRV-Z55	825083/0008	Rohde & Schwarz	24 M	-	31.03.2016
262	Power Meter	NRV-S	825770/0010	Rohde & Schwarz	24 M	-	31.03.2016
263	Signal Generator	SMP 04	826190/0007	Rohde & Schwarz	36 M	-	31.03.2016
264	Spectrum Analyzer	FSEK 30	826939/005	Rohde & Schwarz	12 M	-	31.03.2015
265	peak power sensor	NRV-Z33, Model 04	840414/009	Rohde & Schwarz	24 M	-	31.03.2016
266	Peak Power Sensor	NRV-Z31, Model 04	843383/016	Rohde & Schwarz	24 M	-	31.03.2016
267	notch filter GSM 850	WRCA 800/960-GEEK	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	30.06.2014
291	high pass filter GSM 850/900	WHJ 2200-4EE	14	Wainwright GmbH	12 M	1c	30.06.2014
298	Univ. Radio Communication Tester	CMU 200	832221/091	Rohde & Schwarz	pre-m	3	
300	AC LISN (50 Ohm/50µH, 1-phase)	ESH3-Z5	892 239/020	Rohde & Schwarz	12 M	-	31.03.2015
301	attenuator (20 dB) 50W, 18GHz	47-20-33	AW0272	Lucas Weinschel	pre-m	2	
302	horn antenna 40 GHz (Meas 1)	BBHA9170	155	Schwarzbeck	36 M	-	31.03.2017
303	horn antenna 40 GHz (Subst 1)	BBHA9170	156	Schwarzbeck	36 M	-	31.03.2017
331	Climatic Test Chamber -40/+80 Grad	HC 4055	43146	Heraeus Vötsch	24 M	-	30.11.2014
341	Digital Multimeter	Fluke 112	81650455	Fluke	24 M	-	31.03.2016
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	-	31.03.2016
356	power sensor	NRV-Z1	882322/014	Rohde & Schwarz	24 M	-	31.03.2015
357	power sensor	NRV-Z1	861761/002	Rohde & Schwarz	24 M	-	31.03.2015
371	Bluetooth Tester	CBT32	100153	R&S	24 M	-	31.03.2016
373	Single-Line V-Network (50 Ohm/5µH)	ESH3-Z6	100535	Rohde & Schwarz	24 M	-	31.03.2016
376	Horn Antenna 6 GHz	BBHA9120 E	BBHA 9120 E 179	Schwarzbeck	12 M	-	31.03.2015
377	EMI Test Receiver	ESCS 30	100160	Rohde & Schwarz	12 M	-	31.03.2015
389	Digital Multimeter	Keithley 2000	0583926	Keithley	24 M	-	31.03.2015
392	Radio Communication Tester	MT8820A	6K00000788	Anritsu	12 M	-	31.03.2015
431	Model 7405	Near-Field Probe Set	9305-2457	EMCO	-	4	
436	Univ. Radio Communication Tester	CMU 200	103083	Rohde & Schwarz	12 M	-	31.03.2015
439	UltraLog-Antenna	HL 562	100248	Rohde & Schwarz	36 M	-	31.03.2017

Ref.-No.	Equipment	Type	Serial-No.	Manufacturer	Interval of calibration	Remark	Cal due
441	CTC-SAR-EMI Cable Loss	System EMI field (SAR) Cable	-	CETECOM	12 M	5	31.10.2014
443	CTC-FAR-EMI-RSE	System CTC-FAR-EMI-RSE	-	ETS-Lindgren / CETECOM	12 M	5	15.07.2014
448	notch filter WCDMA_FDD II	WRCT 1850.0/2170.0-5/40-	5	Wainwright Instruments GmbH	12 M	1c	30.06.2014
449	notch filter WCDMA_FDD V	WRCT 824.0/894.0-5/40-8SSK	1	Wainwright	12 M	1c	30.06.2014
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	-	31.03.2015
463	Universal source	HP3245A	2831A03472	Agilent	-	4	
466	Digital Multimeter	Fluke 112	89210157	Fluke USA	24 M	-	31.03.2016
467	Digital Multimeter	Fluke 112	89680306	Fluke USA	36 M	-	31.03.2015
468	Digital Multimeter	Fluke 112	90090455	Fluke USA	36 M	-	31.03.2015
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	-	30.06.2014
487	System CTC NSA-Verification SAR-EMI	System EMI field (SAR) NSA	-	ETS Lindgren / CETECOM	24 M	-	30.06.2015
489	EMI Test Receiver	ESU40	1000-30	Rohde & Schwarz	12 M	-	31.03.2015
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	30.06.2014
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	-	12.02.2015
547	Univ. Radio Communication Tester	CMU 200	835390/014	Rohde & Schwarz	12 M	-	31.03.2015
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	30.06.2014
558	System CTC FAR S-VSWR	System CTC FAR S-VSWR	-	CTC	24 M	-	31.07.2015
574	Biconilog Hybrid Antenna	BTA-L	980026L	Frankonia	36/12 M	-	31.03.2016
584	Spectrum Analyzer	FSU 8	100248	Rohde & Schwarz	pre-m	-	
597	Univ. Radio Communication Tester	CMU 200	100347	Rohde & Schwarz	36 M	-	31.03.2016
598	Spectrum Analyzer	FSEM 30 (Reserve)	831259/013	Rohde & Schwarz	24 M	-	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
611	DC power supply	E3632A	KR 75305854	Agilent	pre-m	2	
612	DC power supply	E3632A	MY 40001321	Agilent	pre-m	2	
613	Attenuator	R416120000 20dB 10W	Lot. 9828	Radiall	pre-m	2	
616	Digitalmultimeter	Fluke 177	88900339	Fluke	24 M	-	31.03.2016
617	Power Splitter/Combiner	ZFSC-2-2-S+	S F987001108	Mini Circuits	-	2	
618	Power Splitter/Combiner	50PD-634	600994	JFW Industries USA	-	2	
619	Power Splitter/Combiner	50PD-634	600995	JFW Industries, USA	-	3	
620	EMI Test Receiver	ESU 26	100362	Rohde-Schwarz	12 M	-	31.03.2015
621	Step Attenuator 0-139 dB	RSP	100017	Rohde & Schwarz	pre-m	2	
625	Generic Test Load USB	Generic Test Load USB	-	CETECOM	-	2	
627	data logger	OPUS 1	201.0999.9302.6.4.1.4 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	12 M	-	31.03.2015
644	Amplifierer	ZX60-2534M+	SN865701299	Mini-Circuits	-	-	
670	Univ. Radio Communication Tester	CMU 200	106833	Rohde & Schwarz	12 M	-	31.03.2015
671	DC-power supply 0-5 A	EA-3013S	-	Elektro Automatik	pre-m	2	
678	Power Meter	NRP	101638	Rohde&Schwarz	pre-m	-	
683	Spectrum Analyzer	FSU 26	200571	Rohde & Schwarz	12 M	-	26.11.2014
686	Field Analyzer	EHP-200A	160WX30702	Narda Safety Test Solutions	24 M	-	18.07.2015
687	Signal Generator	SMF 100A	102073	Rohde&Schwarz	12 M	-	27.11.2014
688	Pre Amp	JS-18004000-40-8P	1750117	Miteq	pre-m	-	

Ref.-No.	Equipment	Type	Serial-No.	Manufacturer	Interval of calibration	Remark	Cal due
692	Bluetooth Tester	CBT 32	100236	Rohde & Schwarz	12 M	-	31.03.2015
693	TS8997	CTC-Radio Lab 1 TS8997	-	Rohde&Schwarz	12 M	5	30.11.2014

5.1.3. 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

6. Versions of test reports (change history)

Version	Applied changes	Date of release
1.0	Initial release	2015-04-20