PARTIAL TEST REPORT
No.: 6_0009_11_6_2a

According to:
FCC Regulations
FCC Part 22H/24E
FCC Part 15.207C
FCC Part 15.209C
&
IC Regulations
RSS-132, Issue 2
RSS-133, Issue 5
RSS-Gen, Issue 3

for

Cinterion Wireless Modules GmbH

Quad-Band GSM/GPRS Module BGS2-W
(HW B2.2)
FCC-ID: QIPBGS2
IC: 7830A-BGS2

Laboratory Accreditation and Listings			
D-PL-12047-01-01	Reg. No.: 736496 MRA US-EU 0003	Industry Canada Reg. No.: 3462D-1 3462D-2	Reg. No.: R-2665, R-2666 C-2914, T-1967 G-301
CTIA Authorized Test Lab LAB CODE 20011130-00		Wi Fi ALLIANCE AUTHORIZED RF LABORATORY	
accredited according to DIN EN ISO/IEC 17025			

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

Table of contents

Table of annex

	Total pages
SEPARATE DOCUMENT B_6_0009_11_6_2a_A1.PDF: DIAGRAMS OF TESTING	32
SEPARATE DOCUMENT B_6_0009_11_6_2a_A2.PDF: PHOTOS OF EUT	6
SEPARATE DOCUMENT B_6_0009_11_6_2a_A3.PDF: PHOTOS OF SET-UP	4

1. Summary of test results

The presented GSM 850/900/1800/1900 Module can be build inside host applications and extends their capability by wireless GSM technology. Data transmissions or voice applications are possible field applications.

In order to verify the compliance with applicable rules, a representative configuration consisting of representative auxiliary equipment was chosen. Embedded in this configuration, the GSM Module can be tested. Pls. refer to set-up description and photos for more details.

Due to some PCB modifications (pls. consult applicants technical documents) radiated spurious emission and radiated power (erp&eirp) tests have been performed again, for a permissive change class 2.

Regarding spurious emissions the most critical channel of the two operational bands has been re-tested and in addition also the band-edge compliance. The radiated power has been re-tested for all three channels: low, middle and high of both operational bands.

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 and RSS-132, RSS-133 and RSS-Gen.

The test results apply exclusively to the test samples as presented in chapter 3.1. 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.

1.1. TESTS OVERVIEW FCC Part 15/22/24 and Canada IC Standards (RSS)

TEST CASES	PORT	REFERENCES & LIMITS			EUT set-up	EUT opera-ting mode	Result
		FCC Standard	RSS Section	TEST LIMIT			
TX-Mode							
RF POWER (conducted)	Antenna terminal (conducted)	§2.1046	--	N/A	--	--	Not tested 1.)
RF-POWER radiated (ERP/EIRP)	Cabinet	§2.1046 §22.913(a)(2) §24.232(c)	RSS-132: 4.4 SRSP-503: 5.1.3 RSS-133:4.1/6.4 SRSP-510: 5.1.2	FCC: < 7 Watt (ERP) IC: < 6.3 Watt (ERP) < 2 Watt (EIRP)	1	1+2	Passed
SPURIOUS EMISSIONS (conducted)	Antenna terminal (conducted)	§2.1051 §22.917(a)(b) §24.238(a)(b)	RSS-132: 4.5.1.1 RSS-133: 6.5.1(a)(i)	43+10log(P) dBc	--	--	Not tested 1.)
99% OCCUPIED BANDWIDTH	Antenna terminal (conducted)	§2.202 §2.1049	RSS-Gen:4.6.1	99% Power	--	--	Not tested 1.)
SPURIOUS EMISSIONS (radiated)	Cabinet+ Interconnecting cables (radiated)	§15.209(a)	RSS-Gen: 4.11+ 7.2.5., Table 6	2400/F(kHz) µV/m 24000/F(kHz) µV/m 30 µV/m	--	--	Not tested 1.)
		§2.1053(a) §2.1057(a)(1) §22.917(a)(b) §24.238(a)(b)	RSS-132: 4.5.1.1 RSS-133: 6.5.1(a)(i) 6.5.1(b)	43+10log(P) dBc	1	1+2	Passed

FREQUENCY STABILITY	Antenna terminal (conducted)	§22.355, table C-1 §24.235 §2.1055(a)(1)	RSS-132: 4.3 RSS-133: 6.3 RSS-Gen, Issue 3: Chapter 4.7	< 2.5ppm <0.1 ppm	--	--	Not tested 1.)
AC-Power lines Conducted emissions	AC-mains	§15.207	RSS-Gen, Issue 3, Chapter 7.2.4	FCC §15.207, limits IC: Table 4, Chapter 7.2.4	--	--	Not tested 1.)

Remark: 1.) see initial test report 2_20795542b/11 and corresponding annexes

RX Mode							
AC-Power Lines Conducted Emissions	AC-Power lines	§15.107	RSS-Gen, Issue 3: Chapter 7.2.4	FCC §15.107 class B limits §15.207 limits IC: Table 4, Chapter 7.2.4	Remark 1	Remark 1	Not tested Remark 1
RECEIVER Radiated emissions	Cabinet + Interconnecting cables (radiated)	§15.109 §15.33 §15.35	RSS-132, Issue 2: Chapter 4.6 RSS-Gen, Issue 3: Chapter 6.1 RSS-133, Issue 5: 6.6	FCC 15.109 class B limits IC-limits: Table 2, Chapter 6.1	Remark 1	Remark 1	Not tested Remark 1
RECEIVER Conducted emissions	Antenna terminal (conducted)	§2.1051 §15.111(a)	RSS-Gen, Issue 3: Chapter 6.2 RSS-132, Issue 2: Chapter 4.6 RSS-133, Issue 5: Chapter 6.6	43+10log(P) dBc IC: < 2 nW/4kHz (30<f<1000MHz) < 5nW/4kHz (f> 1GHz)	Remark 1	Remark 1	Not tested Remark 1

Remark:

1.) See initial separate test report 2_20795542c/11 and corresponding annexes A1/A2 for measurements according Part 15, Subpart B.

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.

W. Richter

.....

Dipl.-Ing. W. Richter
Responsible for testsection

CETECOM GmbH
Im Teelbruch 116
45219 Essen
Tel.: + 49 (0) 20 54 / 95 19 - 0
Fax: + 49 (0) 20 54 / 95 19 - 997

.....

Dipl.-Ing. C. Lorenz
Responsible for test report

2. Administrative Data

2.1. Identification of the testing laboratory

Company name: Address:	CETECOM GmbH Im Teelbruch 116 45219 Essen - Kettwig Germany
Laboratory accreditations/Listings:	DAkkS-Registration No. D-PL-12047-01-01 FCC-Registration No.: 736496, MRA US-EU 0003 IC-Registration No. 3462D-1, 3462D-2 VCCI Registration No. R-2665,R-2666,C-2914,T-339
Responsible for testing laboratory:	Dipl.-Ing. W. Richter
Deputies:	Dipl.-Ing. J.Schmitt

2.2. Test location

2.2.1. Test laboratory "CTC"

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

2.3. Organizational items

Order No.:	6_0009_11_6_2
Responsible for test report and project leader:	Dipl.-Ing. C. Lorenz
Receipt of EUT:	2011-05-06
Date(s) of test:	2011-05-06
Date of report:	2011-05-11
---	---
Version of template: 09.06 _All.Dotm	

2.4. Applicant's details

Applicant's name:	Cinterion Wireless Modules GmbH
Address:	Siemensdamm 50 13629 Berlin Germany
Contact person:	Mr. Stefan Ludwig

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. Additional declaration and description of main EUT

Main function	GSM/GPRS Quad-Band Module	
Type	BGS2-W	
GSM Frequency range (USA/Canada bands)	GSM 850: 824 – 849MHZ (Uplink), 869-894MHz (Downlink) GSM1900: 1850-1910MHz (Uplink), 1930-1990MHz (Downlink)	
Type of modulation	GMSK	
Number of channels (USA/Canada bands)	GSM 850: 128 – 251, 125 channels GSM1900: 512 – 810, 300 channels	
EMISSION DESIGNATOR(S)	245KGXW	
Antenna Type: External magnet mount antenna for vehicular use	☐ Integrated ☐ External, no RF- connector ☒ External, separate RF-connector	Frequency range: GSM 850: 824 – 894 MHz GSM 1900: 1850-1990 MHz
Antenna Gain	☒ radiated: Max. 2 dBi gain at GSM1900	
MAX PEAK Output Power: Radiated ERP GSM850 Radiated EIRP GSM1900	 27.83 dBm (Burst PK) 27.61 dBm (Burst PK)	
MAX PEAK Output Power: Conducted GSM 850 Conducted GSM1900	 32.40 dBm (PK), see initial tests on Hardware B2.1 29.89 dBm (PK), see initial tests on Hardware B2.1	
FCC-ID	QIPBGS2	
IC	7830A-BGS2	
Installed option	☒ GSM900 and GSM1800 Bands	
Special EMI components	--	
Power supply	Internally supplied and controller by the DSB75 Board for tests: V_{MIN}=3.3V to V_{MAX}=4.5V DSB75 Box was DC supplied with 9V external power supply	
EUT sample type	☐ Production	☒ Pre-Production ☐ Engineering

3.2. Configuration of cables used for testing

Cable number	Item	Type	S/N serial number	HW hardware status	Cable length
Cable 1	RS232	unshielded	CTC	--	1.8m
Cable 2	USB cable	shielded	CTC	--	1.5m

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

Short description*)	EUT	Type	S/N serial number	HW hardware status	SW software status
EUT A	Quad-Band GSM/GPRS Module	BGS2-W	IMEI: 356496040024333	B2.2	01.301
EUT B	Magnetic Mount antenna	MAR-C3G-2F	CTC#1	2dBi Gain	--
EUT C	Handset Votronic	For M20T, MC35T, TC35T, DSB35	4017953211304	HH-SI-30.3/V2.0/0	--
EUT D	Adapter Board for BGS2-W	Ven_60/80_0035	#1	--	--
EUT E	DSB Board + flat ribbon connection+ Adapter BG2_PH8_Ada_0207	DSB75	0911007 ICM-100012-03	B1.1	--

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

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

AE short description *)	Auxiliary Equipment	Type	S/N serial number	HW hardware status	SW software status
AE 1	Notebook	Dell D610D	CTC PC3	--	Windows XP + Terminal program

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

3.5. EUT set-ups

EUT set-up no.*)	Combination of EUT and AE	Remarks
Set. 1	EUT A + EUT B+ EUT C + EUT D + EUT E + AE1	set-up used for tests: radiated AE1 connectedduring tests but switched-off

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

3.6. EUT operating modes

EUT operating mode no.*)	Description of operating modes	Additional information
op. 1	GSM 850 TCH mode TCH=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	GSM 1900 TCH mode TCH=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

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

3.7. 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 / 681 / 810	--
maximum power level (PCL)	GSM 850: PCL = 5 (2 Watt) GSM 1900: PCL = 0 (1 Watt)	--
Modulation	GSM: GMSK-Modulation Scheme EDGE: 8-PSK Modulation Scheme	--
DTX	off	--
Bitstream	PRBS 2E9-1 (pseudo-random-sequence) – CCITT 0.153	
Timeslot	3	
Hopping	off	
Timeslot (slot mode)	GSM-Mode: single GPRS-Mode: maximum allowed uplink slots no. according MS class	
MS slot class	Class 10	
Maximum data transmission rate, single time slot	GSM: 17,6 kBit/s Slot EDGE: 59,2 kBit/s Slot	
Speech transcoding (Traffic Mode)	Full rate Version 1	
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
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

4. DESCRIPTION OF TEST SET-UP's

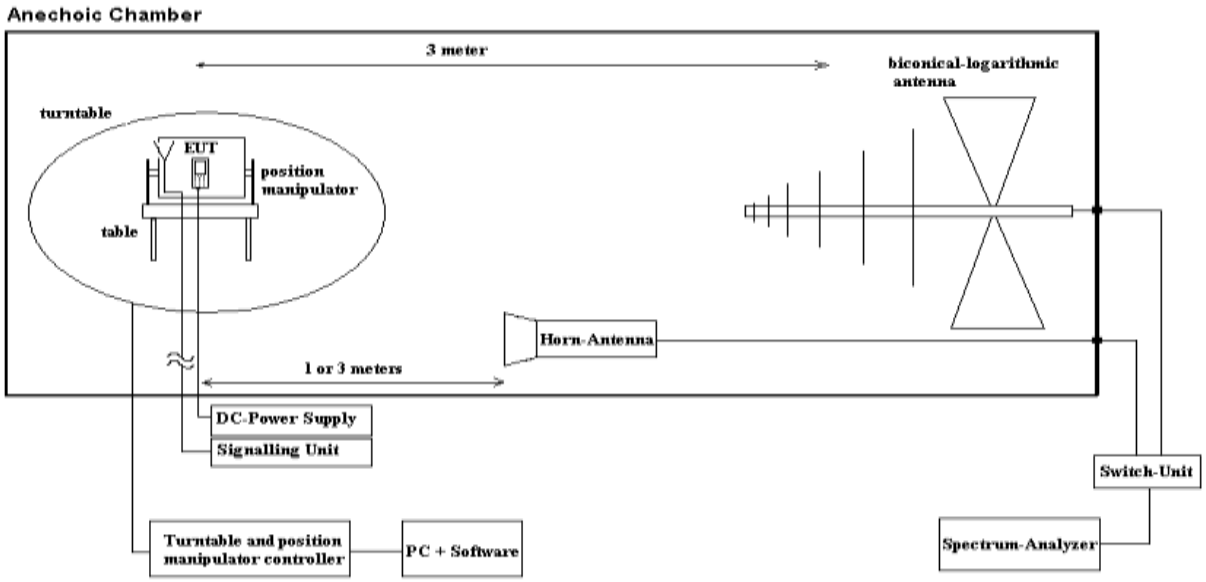
4.1. Test set-up for radiated measurements

The radiated emissions from the test device are measured first as exploratory measurement in a FCC recognized semi anechoic chamber or fully anechoic chamber with the dimensions of 8.05m x 6.85m x 5.48m. Very critical frequencies within a defined range, can be re-checked on CETECOM's Open Area Test side, recognized by the FCC to be compliant with ANSI 63.4: 2003.

The EUT and accessories are placed on a non-conducting tipping table of 0.8 meter height (semi-anechoic chamber) or 1.55m height (fully-anechoic chamber) which is situated in the middle of the turntable. The turntable can rotate the device under test 360 degree, the tipping table can rotate the device from laid to standing position. This way the device under test can be rotated in all three orthogonal planes in order to maximize the detected emissions. The turn- and tipping table are controlled by a controller unit. All positions manipulations are software controlled from a operator PC.
The measurements are performed for both receiving antenna polarisations: vertical and horizontal.

Up to 18GHz a measurement distance of 3 meters is used, above 18GHz the distance is 1 meter. A biconical-logarithmic antenna up to 1 GHz and a horn antenna for frequencies above 1 GHz used. (see equipment list)

The EUT is powered either by a external DC-supply with nominal voltage or a AC/DC power supply as accessory. The communication signalling is performed from outside the chamber with a communication test simulator (CMU200 from Rohde&Schwarz) by airlink.



Schematic: radiated measurements test set-up

5. Measurements

5.1. RF power output (Conducted and Radiated)

REFERENCES

FCC: §2.1046 (conducted), §22.913(a)(2), § 24.232(c)
IC: RSS-132:4.4 + SRSP 503:5.1.3 for GSM 850; RSS-133:4.1/6.4 + SRSP-510:5.1.2 for GSM 1900

MOBILE PHONE SETTINGS

- according 3.7

BASE STATION SETTING

- according 3.7

5.1.1. Radiated RF-Power

TEST METHOD

The measurements were made at the upper, center, and lower carrier traffic frequencies of each of the supported operating band. Choosing three TX-carrier frequencies of the mobile phone, should be sufficient to demonstrate compliance.
The measurements were performed by using the **substitution method** (ANSI/TIA/EIA 603) with a spectrum-analyzer. This method can be described like follows:

1.) 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.

Parameter	Setting for GSM measurements	Settings for UTRA/FDD measurements
RBW	3 MHz	10 MHz
VBW	10 MHz	10 MHz
Span	8 MHz	8 MHz
Detector Mode	Positive max-hold	Positive max-hold
Average	off	off
Sweep Time	coupled	coupled

2.) 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 ($P_{MEAS,\ 1,\ MAX}$).
3.) 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.
4.) 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 ($P_{SMHU}=P_{MEAS,1,\ MAX}$)
5.) Than the RF-signal cable is disconnected from the antenna and connected to a power-level meter. The level is determined ($P_{MEAS,2}$).
6.) The final result is calculated by adding the ERP/EIRP gain of the antenna which substitutes the EUT. $P_{EUT,SUBST} = P_{MEAS,2} + G_{Antenna}$

GSM RESULTS (RADIATED):

OP. MODE 1, SET-UP 1

Channel/ Frequency (MHz)		Peak Output Power (dBm)			Antenna Polarisation for maximum Power	Verdict
		PK	AV			
GSM 850	Channel 128/ 824.2 MHz	25.47	1.)	ERP-Value	V/H	Passed
	Channel 192/ 837.0 MHz	27.83				
	Channel 251/ 848.8 MHz	23.41				
E-GPRS 850	Channel 128/ 824.2 MHz	Not supported mode		ERP-Value	V/H	--
	Channel 192/ 837.0 MHz					
	Channel 251/ 848.8 MHz					

Remark: -
1.) PAR factor can be used from conducted measurement and subtracted from radiated ERP PK-value.

Op. Mode 2, Set-up 1

Channel/ Frequency (MHz)		Peak Output Power (dBm)			Antenna Polarisation for maximum Power	Verdict
		PK	AV			
GSM 1900	Channel 512/ 1850.2 MHz	27.40	1.)	EIRP-Value	V/H	Passed
	Channel 661/ 1880.0 MHz	27.22				
	Channel 810/ 1909.8 MHz	27.61				
E-GPRS 1900	Channel 512/ 1850.2 MHz	Not supported mode		EIRP-Value	V/H	--
	Channel 661/ 1880.0 MHz					
	Channel 810/ 1909.8 MHz					

Remark: -
1.) PAR factor can be used from conducted measurement and subtracted from radiated EIRP PK-value.

AMBIENT ENVIRONMENTAL CONDITIONS

Temperature	24.9 °C
Relative Humidity	29 %
Air pressure	1004 hPa

TEST EQUIPMENT

Used equipment at FAR system[Ref. No.443] (see reference in the annex)
549, 443, 439, 264, 460

5.2. Emission limits (Spurious emission conducted/radiated)

REFERENCES

FCC: §2.1051-conducted, §2.1053(a)-radiated, §22.917(a)(b); §24.238(a)(b),§2.1057(a)(1)

IC: RSS-132: 4.5.1.1, RSS-133: 6.5.1(a)(i) - TX-mode

„the power of emissions shall be attenuated below the transmitter output power (p) by at least least 43+10Log(P) dB“

FREQUENCY RANGE

TX: The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment. The detector used was Peak.

Limit TX: The specification that all emissions shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB, translates in the relevant power range of the mobile phone (1 to 0.001 W) to a constant limit of -13 dBm.

DESCRIPTION OF SET-UP

- see conducted set-up in chapter 4.1
- see radiated set-up in chapter 4.2

SETTINGS ON MOBILE PHONE

- The measurements in TX-mode were made at the upper, middle, and lower carrier frequencies of the operating band. Choosing three representative TX-carrier frequencies of the mobile phone within each operable GSM band, should be sufficient to demonstrate compliance with the emissions limits outside and adjacent to the frequency blocks.
- The measurements in RX-Mode were made at the middle tuning range of the receiver.
- The individual settings on base station and mobile phone were made according chapter 3.7

TEST METHOD RADIATED:

By rotating the EUT in three orthogonal planes, the emissions were recorded with Peak-Detector and Hold-Max function of the spectrum-analyzer. If the harmonic could not be detected above the noise floor, the ambient level was recorded. Measurement distance is 3m for frequencies up to 18GHz and 1m for frequencies greater then 18GHz. The readings on the spectrum analyzer are corrected with annually performed chamber path calibration values (see chapter 7), 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.

SETTINGS OF SPECTRUM-ANALYSER

Frequency range	RBW (resolution bandwidth)	VBW (video bandwidth)
BAND-EDGE compliance: 1MHz immediately adjacent to the frequency blocks	1% from applicants stated/measured emission bandwidth	3..10 times the RBW
More than 1 MHz outside and adjacent the frequency blocks	1 MHz	3..10 MHz

RESULTS (CONDUCTED)

No tested, see initial tests and test report for results.

RESULTS (RADIATED)

5.2.1. GSM 850 Mode: Set-up 1, Op. Mode 1

Lowest channel: 128 (only band-edge tests and harmonic range tested)

Transmitting channel/ frequency: TX = 824.2 MHz							
Sweep frequency range: [MHz]	Diagram numbers	Remarkable highest peak found at [MHz]	Worst-Antenna Polarisation	Transducer	Result [dBm]	Limit [dBm]	Verdict
Sweep 1	--	--	--	--	--	-13.0	--[4.)]
Sweep 2	8.03/8.04	823.98	H	--	<-23.19		Passed [3.)]
Sweep 4	--	--	V	--	--		--[4.)]
Sweep 5	8.11/8.12	--	H/V	--	<-30.0		Passed [1.)]

Remarks: see diagrams enclosed in annex A1, only worst-case polarisation mentioned
1.) only results near 20dB to the limit are referenced or noise level
3.) Band-Edge compliance
4.) Compare initial test for results

Middle channel: 192

Transmitting channel/ frequency: TX = 837 MHz							
Sweep frequency range: [MHz]	Diagram numbers	Remarkable highest peak found at [MHz]	Worst-Antenna Polarisation	Transducer	Result [dBm]	Limit [dBm]	Verdict
Sweep 1	8.01/8.02	--	H/V	--	<-28.0	-13.0	Passed [1.)]
Sweep 4	8.07/8.08	2251.7 2428.5	H V	--	-22.89 -21.62		Passed
Sweep 5	8.09/ 8.10	3334.6	HV	--	<-43.14		Passed [1.)]

Remarks: see diagrams enclosed in annex A1, only worst-case polarisation mentioned
1.) only results near 20dB to the limit are referenced or noise level

Highest channel: 251 (only band-edge tests and harmonic range tested)

Transmitting channel/ frequency: TX = 849.8 MHz							
Sweep frequency range: [MHz]	Diagram numbers	Remarkable highest peak found at [MHz]	Worst-Antenna Polarisation	Transducer	Result [dBm]	Limit [dBm]	Verdict
Sweep 1	--	--	--	--	--	-13.0	--[4.)]
Sweep 3	8.05/8.06	849.02	H	-	< -18.46		Passed [3.)]
Sweep 4	--	--	--	--	--		--
Sweep 5	8.13/8.14	--	H/V	--	<-30.0		Passed [1.)+4.)]

Remarks: see diagrams enclosed in annex A1, only worst-case polarisation mentioned
1.) only results near 20dB to the limit are referenced or noise level
3.) Band-Edge compliance
4.) Compare initial test for results

5.2.0.1. GSM 1900 Mode: Set-up 1, Op. Mode 2

Lowest channel: 512 (only band-edge tests and harmonics tested)

Transmitting channel/ frequency: TX = 1850,2 MHz							
Sweep frequency range: [MHz]	Diagram numbers	Remarkable highest peak found at [MHz]	Worst-Antenna Polarisation	Transducer factor [dB]	Result [dBm]	Limit [dBm]	Verdict
Sweep 1	--	--	--	--	--	-13	-- 6.)
Sweep 2 2.)	--	--	--	--	--		-- 6.)
Sweep 3 4.)	8.19/8.20	1.850	V	--	-32.76		Passed 4.)
Sweep 5	--	--	--	--	--		-- 6.)
Sweep 6	8.27/8.28	3684.9	V	--	-42.78		Passed
Sweep 7 5.)	--	--	--	--	--		-- 6.)

Remark: see diagrams in annex 1 for more details, only worst-case polarisation mentioned

1.) only results near 20dB to the limit are referenced or noise level
2.) TX-carrier on diagram
4.) Band-Edge compliance
5.) overview measurement only
6.) compare initial test report for results

Middle channel: 661

Transmitting channel/ frequency: TX = 1880,0 MHz							
Sweep frequency range: [MHz]	Diagram numbers	Remarkable highest peak found at [MHz]	Worst-Antenna Polarisation	Transducer factor [dB]	Result [dBm]	Limit [dBm]	Verdict
Sweep 1	8.15/8.16	743.41	H/V	--	< -30	-13	Passed 1.)
Sweep 2	8.17/8.18	2424.8	V	--	-19.32		Passed 2.)
Sweep 5	8.23/8.24	3758.5	V	--	-40.74		Passed
Sweep 6	8.25/8.26	17435.0	V	--	< -23.50		Passed 1.)
Sweep 7 5.)	--	--	--	--	--		-- 6.)

Remark: see diagrams in annex 1 for more details, only worst-case polarisation mentioned

1.) only results near 20dB to the limit are referenced or noise level
2.) TX-carrier on diagram
5.) overview measurement only
6.) compare initial test report for results

Highest channel: 810 (only band-edge tests and harmonics tested)

Transmitting channel/ frequency: TX = 1908,8 MHz							
Sweep frequency range: [MHz]	Diagram numbers	Remarkable highest peak found at [MHz]	Worst-Antenna Polarisation	Transducer factor [dB]	Result [dBm]	Limit [dBm]	Verdict
Sweep 1	--	--	--	--	--	-13	-- 6.)
Sweep 2	--	--	--	--	--		-- 6.)
Sweep 4	8.21/8.22	1910.0	H	--	-29.58		Passed 4.)
Sweep 5	--	--	--	--	--		-- 6.)
Sweep 6	8.29/8.30	3814.0	V	--	-39.49		Passed
Sweep 7 5.)	--	--	--	--	--		-- 6.)

Remark: see diagrams in annex 1 for more details, only worst-case polarisation mentioned

1.) only results near 20dB to the limit are referenced or noise level
2.) TX-carrier on diagram
4.) Band-Edge compliance
5.) overview measurement only
6.) compare initial test report for results

AMBIENT ENVIRONMENTAL CONDITIONS

Temperature	24,9 °C
Relative Humidity	29 %
Air pressure	1004 hPa

TEST EQUIPMENT

Used equipment at FAR system [ref. no. 443] (see reference in the annex)
549, 087, 264 , 439

6. Calibration method of anechoic chamber

For non-critical frequencies a pre-calibration method was used for determining the relevant radiated field-strength of radiated spurious in the anechoic chamber.

Generally the measured value is influenced by the characteristics of the used cables, filters, antenna, but also by the characteristic of the anechoic chamber.
By defining a ***transducer*** value, which include all characteristics of the signal propagation path (used equipment, cables, properties of anechoic chamber, etc..) from the source of radiation to the final reading equipment (spectrum-analyzer), the measured value can be corrected in order to get the real value of the device under test.

The method resumes as follows:

1.) determination of the path-loss of all cables used on the TX- and RX-side, which are used for the radiated measurement in the specific set-up for 1 meter and 3 meter distance.
2.) connection of the cables to the relevant antennas used for calibration.
3.) determination of the ***space attenuation loss*** *(G)* in the anechoic-chamber for both horizontal and vertical antenna polarisations:

   A signal generator connected to the TX-antenna sweeps the frequency range of interest (30 MHz to 19.5 GHz) with a level of –30dBm - the readings on the RX-side on the spectrum analyzer gives the ***space attenuation loss.*** The distance between RX- and TX-antenna is 3 meter for frequencies below 18 GHz, and 1 meter for frequencies above 18 GHz.

4.) Mathematical determination of the frequency dependant transducer values ($TD_{H/V}$):

$$TD_{H/V} = G_{H/V} + B_{H/V} - 10 \cdot \log_{10}(1{,}64) + D + E - F$$

Abreviations:

$TD_{H/V}$ = λ/2 transducer values for horizontal /vertical antenna polarisations
$G_{H/V}$ = space attenuation loss horizontal/ vertical
$B_{H/V}$ = Gain of TX-antenna

$10*\text{Log}_{10}(1.64)$ = Gain in dB of λ/2 Dipole relative to isotropic radiator

D = insertion losses of RX cable
E = Loss of filters in signal path (not used for FCC measurements)
F = Gain of pre-amplifiers in signal path

5.) The transducer values are recorded for horizontal and vertical polarisations in two reference distances to the measurement antenna (1 meter and 3 meter). EIRP can be calculated from ERP by adding the gain of the lambda/2 dipole EIRP = ERP + 2.14 dBi
6.) The specific transducer tables are loaded in the spectrum analyzer after each measurement. The readings on the spectrum-analyzer are automatically corrected by this values and can directly be compared with the limits as given in the relevant standards. The loaded values are displayed in each diagram and can be compared to internal calibration documents annually performed.

Used equiment for calibration (3 meter distance)

Used equipment (see reference)
264, 549, 020, 140, 484, 439,

Used equiment for calibration (1 meter distance)

Used equipment (see reference)
302, 303, 140, 264

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.

Measurement	Frequency range	Calculated uncertainty based on a confidence level of 95%	Remarks:
RF-Power Output conducted	9 kHz .. 20 GHz	1.0 dB	--
RF-Power Output radiated	30 MHz .. 4 GHz	3.17 dB	Substitution method
Conducted RF-emissions on antenna ports	9 kHz .. 20 GHz	1.0 dB	--
Radiated RF-emissions enclosure	150 kHz .. 30 MHz	5.0 dB	Magnetic field
	30 MHz .. 1 GHz	4.2 dB	E-Field
	1 GHz .. 18GHz	4.8 dB	E-Field
	1 GHz .. 20 GHz	3.17 dB	Substitution method
Occupied bandwidth	9 kHz .. 4 GHz	0.1272 ppm (Delta Marker method)	Frequency error
		1 dB	Power
Emission bandwidth	9 kHz .. 4 GHz	0.1272 ppm (Delta Marker method)	Frequency error
		1 dB	Power
Frequency stability	9 kHz .. 20 GHz	0.0636 ppm	--
Conducted emissions on AC-mains port (U_{CISPR})	9 kHz .. 150 kHz	4.0 dB	--
	150 kHz .. 30 MHz	3.6 dB	

Table : measurement uncertainties, valid for conducted/radiated measurements

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	Communication Tester	CMD 60 M	844365/014	Firmware = V 3.52 .22.01.99, DECT Firmware D2.87
053	audio analyzer	UPA3	860612/022	Firm. V 4.3
119	RT harmonics analyser/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,
298	Univ. Radio Communication Tester	CMU 200	832221/091	R&S Test Firmware =3.53 /3.54 (current Testsoftw. f.
323	Communication Tester	CMD 055	825878/0034	Firm.= 3.52 .22.01.99
331	climatic test chamber -40/+80 Grad	HC 4055	43146	TSI 1.53
335	System-CTC-EMS-Conducted	System EMS Conducted	-	EMS-K1 Immunity Test-Software 1.20SR10
340	Univ. Communication 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
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,
441	System CTC-SAR-EMI Cable Loss	System EMI field (SAR)	-	EMC 32 Version 8.40
442	System CTC-SAR-EMS	System EMS field (SAR)	-	EMC 32 Version 8.40
443	System CTC-FAR-EMI-Spuri	System CTC-FAR-EMI-	-	Spuri 7.2.5
444	System CTC_FAR-EMS	System EMS-Field (FAR)	-	EMS-K1 Immunity-Software 1.20SR10
460	Univ. Radio Communication Tester	CMU 200	108901	R&S Test Firmware Base=5.14/Messsoftware=
489	emi test receiver	ESU40	1000-30	Firmware=4.43 SP3, Bios=V5.1-16-3,
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
547	Univ. Radio Communikation Tester	CMU 200	835390/014	R&S Test Firmware Base=V5.1403 (current Testsoftw.
584	Spectrum Analyzer	FSU 8	100248	2.82_SP3
594	Communikation 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 /Messsoftware=
598	Spectrum Analyser	FSEM 30 (Reserve)	831259/013	Firmware Bios 3.40 , Analyzer 3.40 Sp 2

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	-	31.03.2012
005	AC - LISN (50 Ohm/50µH, test site 1)	ESH2-Z5	861741/005	Rohde & Schwarz	24/12 M	-	31.03.2012
007	DC - LISN (50 Ohm/5µH)	ESH3-Z6	892563/002	Rohde & Schwarz	24/12 M	-	31.03.2012
009	power meter (EMS-radiated)	NRV	863056/017	Rohde & Schwarz	24 M	-	31.03.2013
016	line impedance simulating network	Op. 24-D	B6366	Spitzenberger+Spies	36 M	-	31.03.2013
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	-	31.03.2013
030	loop antenna (H-field)	HFH-Z2	879604/026	Rohde & Schwarz	36 M	-	31.03.2012
033	RF-current probe (100kHz-30MHz)	ESH2-Z1	879581/18	Rohde & Schwarz	24 M	-	31.03.2013
060	power amplifier (DC-2kHz)	PAS 5000	B6363	Spitzenberger+Spies	-	3	
066	notch filter (WCDMA; FDD1)	WRCT 1900/2200-5/40-	5	Wainwright GmbH	12 M	-	30.05.2011
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	pre-m	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	-	31.03.2012
100	passive voltage probe	Probe TK 9416	without	Schwarzbeck	36 M	-	31.03.2012
110	USB-LWL-Converter	OLS-1	-	Extreme USB	-	4	
119	RT harmonics analyser/dig. flickermeter	B10	G60547	BOCONSULT	36 M	-	31.03.2013
134	horn antenna 18 GHz (Subst 2)	3115	9005-3414	EMCO	12 M	-	31.03.2012
136	adjustable dipole antenna (Dipole 1)	3121C-DB4	9105-0697	EMCO	12 M	-	31.03.2012
140	signal generator	SMHU	831314/006	Rohde & Schwarz	24 M	-	31.03.2012
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	24/12 M	-	31.03.2012
262	power meter	NRV-S	825770/0010	Rohde & Schwarz	24 M	-	31.03.2012
263	signal generator	SMP 04	826190/0007	Rohde & Schwarz	36 M	-	31.03.2013
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	-	31.03.2012
266	peak power sensor	NRV-Z31, Model 04	843383/016	Rohde & Schwarz	24 M	-	31.03.2012
268	AC/DC power supply	EA 3050-A	9823636	-	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	-	30.05.2011
291	high pass filter GSM 850/900	WHJ 2200-4EE	14	Wainwright GmbH	12 M	-	30.05.2011
298	Univ. Radio Communication Tester	CMU 200	832221/091	Rohde & Schwarz	pre-m	-	
300	AC LISN (50 Ohm/50µH, 1-phase)	ESH3-Z5	892 239/020	Rohde & Schwarz	24/12 M	-	31.03.2012
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	-	30.11.2012
341	digital multimeter	Fluke 112	81650455	Fluke	24 M	-	31.03.2012
342	digital multimeter	Voltcraft M-4660A	IB 255466	Voltcraft	24 M	-	31.03.2013
347	laboratory site	radio lab.	-	-	-	3	
348	laboratory site	EMI conducted	-	-	-	3	
354	DC - power supply 40A	NGPE 40/40	448	Rohde & Schwarz	pre-m	-	
355	power meter	URV 5	891310/027	Rohde & Schwarz	24 M	-	31.03.2012
356	power sensor	NRV-Z1	882322/014	Rohde & Schwarz	24 M	-	31.03.2013
357	power sensor	NRV-Z1	861761/002	Rohde & Schwarz	24 M	-	31.03.2013
373	V-Network 5µH/50 Ohm	ESH3-Z6	100535	Rohde & Schwarz	24/12 M	-	31.03.2012
376	horn antenna 6 GHz	BBHA9120 E	BBHA 9120 E 179	Schwarzbeck	12 M	-	31.03.2012
377	emi test receiver	ESCS 30	100160	Rohde & Schwarz	12 M	-	31.03.2012
389	digital multimeter	Keithley 2000	0583926	Keithley	24 M	-	31.03.2013
392	Radio Communication Tester	MT8820A	6K00000788	Anritsu	12 M	-	31.03.2012
431	Model 7405	Near-Field Probe Set	9305-2457	EMCO	-	4	
439	UltraLog-Antenna	HL 562	100248	Rohde & Schwarz	12 M	-	30.05.2011
441	System CTC-SAR-EMI Cable Loss	System EMI field (SAR)	-	ETS	12 M	5	31.08.2011
443	System CTC-FAR-EMI-Spuri	System CTC-FAR-EMI-	-	ETS-Lindgren/Cetecom	12 M	5	30.06.2011
448	notch filter WCDMA_FDD II	WRCT 1850.0/2170.0-	5	Wainwright Instruments	12 M	1c	30.05.2011
449	notch filter WCDMA FDD V	WRCT 824.0/894.0-5/40-	1	Wainwright Instruments	12 M	1c	30.05.2011

454	Oscilloscope	HM 205-3	9210 P 29661	Hameg	-	4	
456	DC-Power supply 0-5A	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	-	31.03.2012
463	Universal source	HP3245A	2831A03472	Agilent	-	4	
466	digital multimeter	Fluke 112	89210157	Fluke USA	24 M	-	31.03.2012
467	digital multimeter	Fluke 112	89680306	Fluke USA	24 M	-	31.03.2012
468	digital multimeter	Fluke 112	90090455	Fluke USA	24 M	-	31.03.2012
477	ReRadiating GPS-System	AS-47	-	Automotive Cons. Fink	-	3	
480	power meter (Fula)	NRVS	838392/031	Rohde & Schwarz	24 M	-	31.03.2013
482	filtermatrix	FilterMatrix SAR 1	-	CETECOM (Brl)	-	1d	
484	pre-amplifier 2,5 - 18 GHz	AMF-5D-02501800-25-	1244554	Miteq	12 M	-	01.06.2011
487	System CTC NSA-Verification SAR-EMI	System EMI field (SAR)	-	ETS	12 M	-	30.09.2011
489	emi test receiver	ESU40	1000-30	Rohde & Schwarz	12 M	-	31.03.2012
502	band reject filter	WRCG 1709/1786-	SN 9	Wainwright	-	2	
503	band reject filter	WRCG 824/849-814/859-	SN 5	Wainwright	-	2	
517	relais switc matrix	HF Relais Box Keithley	SE 04	Keithley	-	2	
523	Digitalmultimeter	L4411A	MY46000154	Agilent	24 M	-	31.03.2013
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	
547	Univ. Radio Communikation Tester	CMU 200	835390/014	Rohde & Schwarz	12 M	-	31.03.2012
548	Digital-Barometer	GBP 2300	without	Greisinger GmbH	36/12 M	-	31.03.2012
549	Log.Per-Antenna	HL025	1000060	Rohde & Schwarz	36/12 M	-	31.03.2012
552	high pass filter 2,8-18GHz	WHKX 2.8/18G-10SS	4	Wainwright	12 M	-	30.06.2011
558	System CTC FAR S-VSWR	System CTC FAR S-	-	CTC	24 M	-	31.08.2011
574	Biconilog Hybrid Antenna	BTA-L	980026L	Frankonia	36/12 M	-	30.03.2013
584	Spectrum Analyzer	FSU 8	100248	Rohde & Schwarz	12 M	-	31.03.2012
594	Communikation Tester	CMW500	101757	Rohde & Schwarz	24 M	-	31.03.2012
597	Univ. Radio Communication Tester	CMU 200	100347	Rohde & Schwarz	12 M	-	31.03.2012
598	Spectrum Analyser	FSEM 30 (Reserve)	831259/013	Rohde & Schwarz	24 M	-	13.01.2013
600	power meter	NRVD (Reserve)	834501/018	Rohde & Schwarz	24 M	-	31.03.2013
601	medium-sensitivity diode sensor	NRV-Z5 (Reserve)	8435323/003	Rohde & Schwarz	24 M	-	12.01.2013
602	peak power sensor	NRV-Z32 (Reserve)	835080	Rohde & Schwarz	24 M	-	12.01.2013
608	UltraLog-Antenna	HL 562	830547/009	Rohde & Schwarz	36/12 M	-	31.05.2014
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	

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-spurious emission (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