PARTIAL TEST REPORT
No.: 6-0082-11-1-2b

According to:
FCC-Regulations
Part 22 & Part 24
IC-Regulations
RSS-132 Issue 2, RSS-133 Issue 5 &
RSS-Gen Issue 3

for

u-blox AG

RF Data-Module LISA-U200
FCC-ID: XPYLISAU200
IC: 8595A-LISAU200

Laboratory Accreditation and Listings			
DAkkS Deutsche Akkreditierungsstelle D-PL-12047-01-01	FCC Reg. No.: 736496 MRA US-EU 0003	Industry Canada Reg. No.: 3462D-1 Reg. No.: 3462D-2 Reg. No.: 3462D-3	VCCI Voluntary Controls for Electromagnetic Emissions Reg. No.: R-2665, R-2666 C-2914, T-1967, G-301
Wi Fi ALLIANCE AUTHORIZED RF LABORATORY	CTIA Authorized Test Lab LAB CODE 20011130-00		
accredited according to DIN EN ISO/IEC 17025			

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1. Summary of test results

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.

The presented RF-Data module includes GPRS/(E)GPRS and W-CDMA Band II and V technologies. This test report shows results for W-CDMA technologies only.

Following tests have been performed to show compliance with applicable FCC Part 2, Part 22, Subpart H and Part 24, Subpart E (Broadband PCS) of the FCC CFR 47 Rules, Edition 1st October 2010 and Canada RSS-132, RSS-133 and RSS-Gen standards.

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

TEST CASES	PORT	REFERENCES & LIMITS			EUT set-up	EUT op-mode	Result
		FCC Standard	RSS Section	TEST LIMIT			
Emissions AC-Power Lines 0,15-30 MHz conducted	AC-Power lines	§15.207	RSS-Gen, Issue 3: Chapter 7.2.4	FCC §15.107 class B limits §15.207 limits IC: tb. 4, Chpt.7.2.4	3	1 + 2	Passed
Electrical field strength emission <30 MHz radiated	Cabinet + Interco-necting cables	§15.209(a)	RSS-Gen: 4.11	2400/F(kHz) µV/m 24000/F(kHz) µV/m 30 µV/m	3	1 + 2	Passed
RF POWER (conducted)	Antenna terminal (conducted)	§2.1046	--	N/A	2	1 + 2	Passed
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	< 7 Watt (ERP) < 2 Watt (EIRP)	1	1 + 2	Passed
Radio frequency Exposure EVALUATION (MPE)	Antenna terminal	§1.1310 §2.1091	RSS-102, Issue 2	FCC: §1.1310 Table 1, Limits for General:IC chpt. 4.2 RF-Limits	2	1 + 2	Passed
SPURIOUS EMISSIONS (conducted)	Antenna terminal (conducted)	§2.1051 §2.1057 §22.917(a)(b) §24.238(a)(b)	RSS-132: 4.5.1 RSS 133: 6.5.1(a)(b) RSS-139: Issue 2, chpt. 6.5(i)(ii)	43+10log(P) dBc	2	1 + 2	Passed
EMISSION BANDWIDTH & 99%OCCUPIED BANDWIDTH	Antenna terminal (conducted)	§2.202 §2.1049 §22.917(a) §24.238(a)	RSS Gen:4.6.1	99% Power	2	1 + 2	Passed
SPURIOUS EMISSIONS (radiated)	Cabinet + Interconnecting cables (radiated)	§15.209(a)	RSS-Gen: 4.11	2400/F(kHz) µV/m 24000/F(kHz) µV/m 30 µV/m	3	1 + 2	Passed
		§2.1053(a) §2.1057 §22.917(a)(b) §24.238(a)(b)	RSS-132: 4.5.1 & 4.5.2 RSS-133: 6.5.1(a)(b)	43+10log(P) dBc	1	1 +2	Passed
FREQUENCY STABILITY	Antenna terminal (conducted)	§22.355, table C-1 §24.235 §2.1055(a)(2)	RSS-132: 4.3 RSS-133: 6.3	<±2.5 ppm <±0.1 ppm	2	1 + 2	Passed

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

TEST CASES	PORT	REFERENCES & LIMITS			EUT set-up	EUT op-mode	Result
		FCC Standard	RSS Section	TEST LIMIT			
AC-Power Lines Conducted Emissions	AC-Power lines	§15.107 §15.207	RSS-Gen, Issue 3: Chapter 7.2.4	FCC §15.107 class B limits §15.207 limits IC: Table 4, Chapter 7.2.4	--	--	Passed Remark 1
RECEIVER Radiated emissions	Cabinet + Interconnecting cables (radiated)	§15.109 §15.33 §15.35	RSS-132, Issue 2: 4.6 RSS-Gen, Issue 3: 6.1 RSS 133, Issue 5: 6.6	FCC 15.109 class B limits IC-limits: Table 1, Chapter 6	--	--	Passed Remark 1
RECEIVER Conducted emissions	Antenna terminal (conducted)	§2.1051	RSS-Gen: 6.2 RSS132: 4.6 RSS133: 6.7(b)	43+10log(P) dBc IC: < 2 nW/4kHz (30<f<1000MHz) < 5nW/4kHz (f> 1GHz)	--	--	Passed Remark 1

Remark: 1.) See separate test report TR6-0082-11-1-2c for measurements according Part 15 B/ RSS- Gen.

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.

.....
Dipl.-Ing. Ch. Lorenz
Responsible for test section

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.....
Dipl.-Ing. B. Taslica
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
Responsible for testing laboratory:	Dipl.-Ing. W. Richter
Deputy:	Dipl.-Ing. J. Schmitt
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, 3462D-3 VCCI Reg. No. R-2665, R-2666, C-2914, T-1967, G-301

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.:	E600082001
Responsible for test report and project leader:	Dipl.-Ing. B. Taslica
Receipt of EUT:	2011-10-26
Date(s) of test:	2011-10-26- 2011-11-15
Date of report:	2011-11-27
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Version of template: 11.05	

2.4. Applicant's details

Applicant's name:	u-blox AG
Address:	Zürcherstrasse 68 8800 Thalwil Switzerland
Contact person:	Mr. Andreas Thiel

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	E-GPRS/UMTS RF Module		
Type	RF data module		
TX-frequency range	GSM 850: 824 – 849MHz (Uplink), 869-894MHz (Downlink) GSM1900: 1850-1910MHz (Uplink), 1930-1990MHz (Downlink) FDD Band 2: 1852.4–1907.6 MHz (Uplink), 1930-1990MHz (Downlink) FDD Band 5: 826.4-846.6 MHz (Uplink), 869-894MHz (Downlink)		
Type of modulation	GSM-mode: GMSK GPRS-Mode: 8-PSK FDD-Mode Release99: QPSK FDD Mode Release 5+6: DL: 16QAM, UL: BPSK		
Number of channels	GSM 850: 128 – 251, 125 channels GSM1900: 512 – 810, 300 channels FDD Band 2: UARFCN range 9262 – 9400 – 9538 FDD Band 5: UARFCN range 4132 – 4183 – 4233		
EMISSION DESIGNATOR(S)	4M15F9D (FDD 2) 4M15F9D (FDD 5)		
Antenna Type	☐ Integrated ☐ External, no RF- connector ☒ External, separate RF-connector	Frequency range of antenna: 800MHz to 2200MHz	
Antenna Gain	☒radiated: Max. 2.6 dBi gain at FDD 5 (free space) ☒ radiated: Max. -2.1 dBi gain at FDD 2 (free space)		
MAX PEAK Output Power: Radiated FDD-Mode 2 FDD_Mode 5	 27.3 dBm (PK) 20.9 dBm (PK)		
MAX PEAK Output Power: Conducted FDD-Mode 2 FDD-Mode 5	 27.61 dBm (PK) / 23.73 dBm (AV) 26.60 dBm (PK) / 23.15 dBm (AV)		
FCC-ID	XPYLISAU200		
IC	8959-LISAU200		
Installed option	☒ GSM900, G850, DCS1800 and PCS1900 Bands. ☒ W-CDMA Band I and Band VI (not usable in USA/Canada)		
Special EMI components	--		
Lowest radio frequency signal	Master clock 26 MHz		
Voltage settings	3.8 V DC (nominal), 3.3 V DC (minimum) and 4.4 V DC (maximum)		
EUT sample type	☐ Production	☒ Pre-Production	☐ 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	RF Data-Module	LISA-U200 LISA-U200-00S-00	IMEI: 35890104000 1353	146001	21.03.00
EUT B	RF Data-Module	LISA-U200 LISA-U200-00S-00	IMEI: 35890104000 1734	146001	21.03.00
EUT C	Adapter Board	LISA-U200 FAE	SN095	IP02_HW_CS_150000	--
EUT D	Magnetic Mount Antenna	Taoglas GA.107	#1	--	--

*) 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	AC/DC adaptor (AC 110V/60Hz, DC 12 V)	0055 (Power supply connected on EUT B)	# 1	--	--

*) 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 + EUT C + EUT D+ AE 1	Used for radiated tests
Set. 2	EUT A + EUT C	Used for conducted tests (power supply cables at EUT B for nominal, high and low voltage)
Set. 3	EUT B + EUT C+ EUT D+ AE 1	Used for radiated tests

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

3.5. EUT operating modes

EUT operating mode no.*)	Description of operating modes	Additional information
op. 1	FDD Mode 2 RMC99-Mode	A communication link is established between the mobile station (UE) and the test simulator. The transmitter is operated on its maximum rated output power class: 24dBm. 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. Chosen settings: 12.2kbps RMC + HSPA 34.108 This setting was chosen for all Release 6 mobile equipment.
op. 2	FDD Mode 5 RMC99-Mode	

*) 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 UE (EUT) during the measurements in **FDD-Mode** only:

Parameter	Traffic Mode	Idle Mode
UARFCN UE Uplink (EUT) (according TS34.108)	FDD 2 = 9262/ 9400/ 9538 FDD 5 = 4132/ 4182/ 4233	--
UARFCN Node B (downlink) (according TS34.108)	FDD 2 = 9663/ 9800/ 9937 FDD 5 = 4358/ 4040/ 4457	
UE power class	Class 3 (+24dBm)	
HSDPA UE category/ HSUPA category	14/6	
Maximum power	FDD 2/5 12.2kbps RMC99 -> all TPC bits up ("1") HSDPA-mode = accord. Subtests 1,2,3,4 defined in 3GPP TS34.121 HSUPA mode = accord. Subtests 1,2,3,4,5 defined in 3GPP TS34.121	--
Modulation	12.2kbps RMC99-mode: QPSK-Modulation Scheme HSDPA/HSUPA = QPSK, BPSK and 16 QAM Modulation Scheme is applicable	--
Compression mode	Off	--
Bitstream	PRBS 2E9-1 (pseudo-random-sequence) – CCITT 0.153	
Maximum data transmission rate:	GPRS: 20.0 kbps/ Slot EDGE: 59.2 kbps/ Slot FDD: 12.2 kbps	
Node B Downlink physical channels settings	According Table E.5.1/E.5.1A in 3GPP TS34.121	
External attenuation RF/AF-Input/Output	Accord. Set-up calibration prior to measurements	

For additional FDD/HSDPA/HSUPA-mode settings pls. consult chapter 9

Settings for CMU (general)

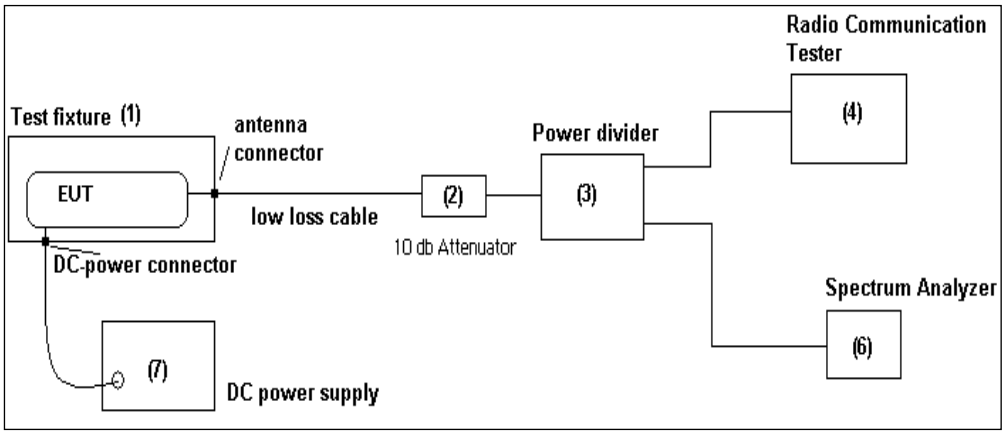
Repetition	Continuous	
Stop condition	None	
Display mode	Max./Min	
Statistic Count	1000 Bursts	
Decoder	Standard	

Additional settings on the base stations CMU200 for frequency stability measurements

4. DESCRIPTION OF TEST SET-UP's

4.1. Test Set-up for conducted measurements

The EUT's RF-signal is coupled out by a suitable antenna coupling connector (1). The signal is first 10 dB attenuated (2) before it is 0° divided by a power divider (3). One of the signal path is connected to the communication base station (4), other branch is connected to the spectrum – analyzer (5). The specific attenuation losses for both signal paths/branches are determined prior to the measurement within a set-up calibration. These are then taken into account by correcting the measurement readings on the spectrum-analyzer.



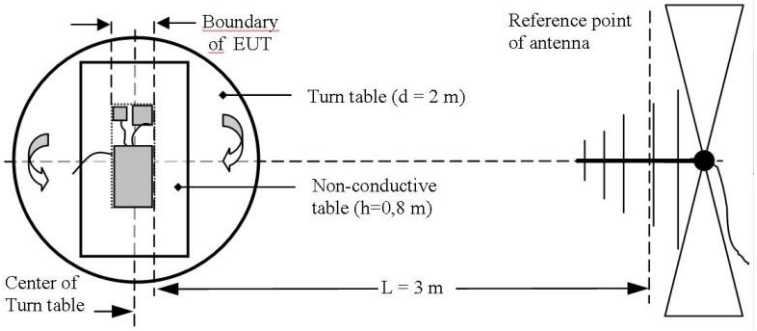
Schematic: Test set-up conducted

4.2. Test set-up for radiated measurements

Please see below description and schematic for radiated measurements used set-up.

MEASUREMENT METHOD (30 MHz<f <1 GHz):

A EMI analyzer together with a broadband antenna was used in order to identify the emissions from the EUT by positioning the antenna close to the EUT surfaces. The interconnecting cables and equipment position were vari

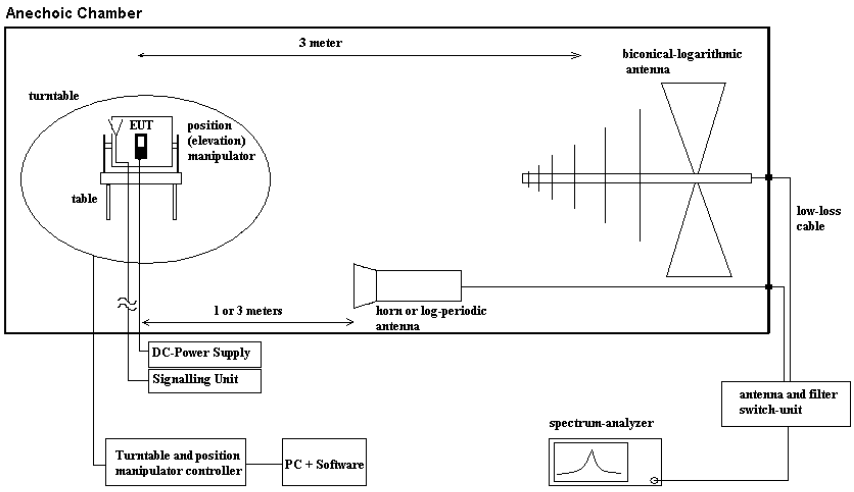


ed in order to maximize the emissions. Then most critical frequencies are recorded for further investigations. Based on the exploratory measurements, the most critical frequencies are re-measured by maintaining the EUT's operating mode, cable position, etc. The EUT was placed on a non-conductive support of 0.8 m height. By rotating the turntable angle 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) and the measurement antenna height from 1 meter to 4 meters, the maximized emissions are recorded. The measurements are performed for both polarizations of the measuring antenna: horizontal and vertical.

MEASUREMENT METHOD (1 GHz<f <26.5 GHz):

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 18 GHz a measurement distance of 3 meters is used, above 18 GHz the distance is 1 meter. A biconical-logarithmic antenna up to 1 GHz and a logarithmic-periodic antenna for frequencies above 1 GHz up to 26.5 GHz is used. For frequencies above 26.5 GHz a horn antenna is used, pls. compare the equipment list for more details.



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

Schematic: radiated measurements test set-up

5. Measurements

5.1. Conducted emissions on AC-Power lines

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

test location	☒ CETECOM Essen (Chapter 2.2.1)		☐ Please see Chapter 2.2.2		☐ Please see Chapter 2.2.3	
test site	☐ 333 EMI field	☒ 348 EMI cond.				
receiver	☐ 001 ESS	☒ 377 ESCS 30				
LISN	☒ 005 ESH2-Z5	☐ 007 ESH3-Z6	☐ 300 ESH3-Z5 & 50Ω used for AE		☐ no LISN for AE	
signaling	☐ 392 MT8820A	☐ 436 CMU	☐ 547 CMU			
line voltage	☐ 230 V 50 Hz via public mains		☒060 110 V 60 Hz via PAS 5000			

TEST CONDITION AND MEASUREMENT PROCEDURES TEST SET-UP

link to test system (if used):	☐ air link	☐ cable connection	☐
EUT-grounding	☐ none	☐ with power supply	☐ additional connection
Equipment set up	☒ table top (40 cm distance to reference ground plane (wall)		☐ floor standing EUT stands isolated on reference ground plane (floor)
Climatic conditions	Temperature: (22±3°C)		Rel. humidity: (40±20)%
EMI-Receiver (Analyzer) Settings	Frequency Range: 150 kHz to 30 MHz RBW: 9 kHz		

Devices which can be connected to the public AC-power network, should be tested against the radio frequency voltage conducted back into the AC-power line in the frequency range 150kHz to 30 MHz. 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 50Ohm/50µH line impedance stabilization network (LISN) is used therefore. The EUT power input leads are connected through the LISN to the AC-power source. The LISN enclosure is electrically connected to the GND-plane. The measuring instrument is connected to the coaxial output of the LISN.
Tabletop devices were set-up on a 80 cm height over 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/60Hz.
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.

Preliminary testing as a first step, determines the worst-case phase line (neutral or phase) as well as the most critical amplitude by changing the operating mode. A complete frequency-sweep is performed with PK-Detector.

Final testing for power phases and critical frequencies (Margin to AV- or QP limit lower than 3dB) as a second step includes measurements either on discrete frequency components with receivers detector set to Quasi-Peak and Average per frequency component or a complete frequency sweep with corresponding detector according to ANSI 63.4, CISPR 16.

Measurement results

EUT Type and S/N or EUT set-up no.		EUT set-up 3				
Diagram No.	EUT operating mode no. or commend	Used Detector	Power line	Limit Class	Additional (scan-) information	Result
b_1.1	EUT operating mode 1 (UARFCN 9262)	☐ Peak ☒ CAV ☒ QP	L1/ N	☐ A ☒ B	The Diagram shows QP/CAV detector measurements on L1 and N with maxhold mode.	passed
b_1.2	EUT operating mode 1 (UARFCN 9400)	☐ Peak ☒ CAV ☒ QP	L1/ N	☐ A ☒ B	The Diagram shows QP/CAV detector measurements on L1 and N with maxhold mode.	passed
b_1.3	EUT operating mode 1 (UARFCN 9538)	☐ Peak ☒ CAV ☒ QP	L1/ N	☐ A ☒ B	The Diagram shows QP/CAV detector measurements on L1 and N with maxhold mode.	passed
b_1.4	EUT operating mode 2 (UARFCN 4132)	☐ Peak ☒ CAV ☒ QP	L1/ N	☐ A ☒ B	The Diagram shows QP/CAV detector measurements on L1 and N with maxhold mode. Final measurement QP and AV was carried out on at least one frequency	passed
b_1.5	EUT operating mode 2 (UARFCN 4182)	☐ Peak ☒ CAV ☒ QP	L1/ N	☐ A ☒ B	The Diagram shows QP/CAV detector measurements on L1 and N with maxhold mode. Final measurement QP and AV was carried out on at least one frequency	passed
b_1.6	EUT operating mode 2 (UARFCN 4233)	☐ Peak ☒ CAV ☒ QP	L1/ N	☐ A ☒ B	The Diagram shows QP/CAV detector measurements on L1 and N with maxhold mode. Final measurement QP and AV was carried out on at least one frequency	Passed

Remarks:
For more information please see diagrams enclosed in the annex to this Report.
Positive margin means passed result.

Margin to Limit for verdict: $M = L_T - R_R + C_{Loss}$

Abbreviations used:
- R_R : Receiver readings in dBµV
- C_{Loss}: cable loss
- L_T : Limit in dBµV

Verdict

Summary of measurement results for conducted emissions on AC-Power lines: Passed

5.2. Radiated field strength emissions below 30 MHz

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

test location	☒ CETECOM Essen (Chapter. 2.2.1)		☐ Please see Chapter. 2.2.2		☐ Please see Chapter. 2.2.3	
test site	☒ 441 EMI SAR	☐ 487 SAR NSA	☐ 347 Radio.lab.		☐	☐
receiver	☐ 377 ESCS30	☒ 001 ESS	☐	☐	☐	☐
spectr. analys.	☐ 584 FSU	☐ 120 FSEM	☐ 264 FSEK	☐	☐	☐
antenna	☐ 574 BTA-L	☐ 133 EMCO3115	☐ 302 BBHA9170	☐ 289 CBL 6141	☒ 030 HFH-Z2	☐ 477 GPS
signaling	☐ 392 MT8820A	☐ 436 CMU	☐ 547 CMU			
otherwise	☐ 400 FTC40x15E	☐ 401 FTC40x15E	☐ 110 USB LWL	☐ 482 Filter Matrix	☐ 378 RadiSense	
DC power	☐ 456 EA 3013A	☐ 457 EA 3013A	☐ 459 EA 2032-50	☐ 268 EA- 3050	☐ 494 AG6632A	☐ 498 NGPE 40
line voltage	☐ 230 V 50 Hz via public mains		☒ 060 110 V 60 Hz via PAS 5000 bei Bedarf andere Werte einsetzen			

Standards and Limits: **CFR 47, §15.205, §15.209, RSS-Gen**

Frequency [MHz]	Field strength [µV/m]	[dBuV/m]	Measurement distance [meters]	Remarks
0.009 – 0.490	2400/f (kHz)	67.6 – 20Log(f) (kHz)	300	Correction factor used due to measurement distance of 3m
0.490 – 1.705	24000/f (kHz)	87.6 – 20 Log(f) (kHz)	30	Correction factor used due to measurement distance of 3m
1.705 – 30	30	29.54	30	Correction factor used due to measurement distance of 3m
Remark: * decreases with the logarithm of the frequency				

Test condition and measurement test set-up

link to test system (if used):	☒ air link	☐ cable connection	☐
EUT-grounding	☐ none	☐ with power supply	☐ additional connection
Equipment set up	☒ table top		☐ floor standing
Climatic conditions	Temperature: (22±3°C)		Rel. humidity: (40±20)%
EMI-Receiver (Analyzer) Settings	Span/Range: 9kHz to 150kHz; 150 kHz to 30 MHz RBW/VBW: 200Hz/auto; 10 kHz/ auto (ANSI63.10/CISPR#16) Detector/ Mode: PEAK, TRACE max-hold mode, repetitive scan for exploratory measurements Quasi-Peak, for final measurement on critical frequencies (f<1GHz)		

General measurement procedures:

The measurement test set-up and test procedure are in accordance with the provisions described in ANSI 63.10: 2009

The **Equipment under Test** (EUT) was set-up to defined operating mode and installed (connected) to accessory equipment according the general description of use given by the applicant.

The measurement loop antenna was situated in 3m distance to the EUT. Between EUT and measurement antenna absorbers are covering the GND-Plane. With these absorbers the chamber fulfills CIPR16-1-4 site VSWR-criteria. Radiated magnetic emission measurements were made with the antenna situated in 1 meter height. 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 EUT itself either over 3-orthogonal axes (no defined usage position) or 2-orthogonal axis (defined usage position) by the position manipulator.

According the standard the compliance should be checked in 30m and 300m measurement distance. Therefore a additional extrapolation factor was used in order to normalize the measurement data. The frequency dependent extrapolation factor used for this reduced measurement distance, can be found on page 16.

Measurement Results

Set-up No.		3								
Operating Mode		1								
Diagram no.	Frequency (MHz)	MaxPeak (dBµV/m)	Meas Time (ms)	Bandwidth (kHz)	Ant. height (cm)	Polarity	Turntable position (deg)	Corr. (dB) (C_F)	Margin (dB) (M)	Limit (dBµV/m) (L_T)
b_3.02 (mid. ch.) b_3.03 (high ch.)	Same settings (see below)	See diagram		Same settings (see below)				Same settings (see below)	See diagram	
b_3.01 (low channel)	0.009 to 0.150	<-55	10	0.2	100	--	0°..360°	300 to 3m	>20	See diagram
	0.150 to 0.5	<-60		10				300 to 3m	>20	
	0.5 to 30	17.84		10				300 to 3m 30 to 3m	11.7	29.54

Remark: Selected worst-case measurement to the closest limit of RMC99 mode. Please see the other measured channels as diagrams in the separate annex.

Set-up No.		3								
Operating Mode		2								
Diagram no.	Frequency (MHz)	MaxPeak (dBµV/m)	Meas Time (ms)	Bandwidth (kHz)	Ant. Height (cm)	Polarity	Turntable position (deg)	Corr. (dB) (C_F)	Margin (dB) (M)	Limit (dBµV/m) (L_T)
b_3.05 (mid. ch) b_3.06 (high ch)	Same settings (see below)	See diagram		Same settings (see below)				Same settings (see below)	See diagram	
b_3.04 (low channel)	0.009 to 0.150	<-55	10	0.2	100	--	0°..360°	300 to 3m	>20	See diagram
	0.150 to 0.5	<-60		10				300 to 3m	>20	
	0.5 to 30	19.04		10				300 to 3m 30 to 3m	10.5	29.54

Remark: Selected worst-case measurement to the closest limit of RMC99 mode. Please see the other measured channels as diagrams in the separate annex.

Margin to Limit:

$$M = L_T - R_R + C_F + D_F$$
$$= L_T - R_R + \left(AF_{ANTENNA} + Cable_{LOSS}\right) + D_F$$

Verdict: Summary of measurement results for radiated frequencies below 30 MHz - Passed

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

The used correction factors when the measurement distance is reduced, are taken from IEEC Transaction EMC, Vol 47, No.3, Aug. 2005, Journal Paper *"EXTRAPOLATING NEAR-FIELD EMISSIONS OF LOW-FREQUENCY LOOP TRANSMITTERS".*

Used Transducer factors (f < 30 MHz)					
1	2	3	4	5	6
					=2+3+4+5
Frequency	Antenna factor	Corection factor		Cable loss	Transducer factor
		300m to 3m	30m to 3m		
kHz	dB µV/m	dB	dB	dB	dB µV/m
9.0	20.0	-116.7		0.0	-96.7
10.6	20.0	-116.7		0.0	-96.7
12.6	20.0	-116.7		0.0	-96.7
14.8	20.0	-116.7		0.0	-96.7
17.5	20.0	-116.6		0.0	-96.6
20.7	20.0	-116.6		0.0	-96.6
24.4	20.0	-116.6		0.0	-96.6
28.9	20.0	-116.6		0.0	-96.6
34.1	20.0	-116.5		0.0	-96.5
40.3	20.0	-116.4		0.0	-96.4
47.6	20.0	-116.3		0.0	-96.3
56.2	20.0	-116.2		0.0	-96.2
66.4	20.0	-116.0		0.0	-96.0
78.4	20.0	-115.8		0.0	-95.8
92.7	20.0	-115.4		0.0	-95.4
109.4	20.0	-115.0		0.0	-95.0
129.3	20.0	-114.5		0.0	-94.5
152.7	20.0	-113.9		0.0	-93.9
180.4	20.0	-113.1		0.0	-93.1
213.1	20.0	-112.2		0.0	-92.2
251.7	20.0	-111.3		0.0	-91.3
297.3	20.0	-108.3		0.0	-88.3
351.2	20.0	-105.2		0.0	-85.2
414.8	20.0	-102.1		0.0	-82.1
490.0	20.0	-99.1		0.0	-79.1
490.0	20.0		-56.4	0.1	-36.3
582.0	20.0		-56.2	0.1	-36.1
690.0	20.0		-56.0	0.2	-35.8
820.0	20.0		-55.7	0.2	-35.5
973.0	20.0		-55.4	0.2	-35.2
1,155.0	20.0		-54.9	0.3	-34.6
1,371.0	20.0		-54.4	0.3	-34.1
1,627.0	20.0		-53.7	0.3	-33.4
1,931.0	20.0		-52.9	0.4	-32.5
2,292.0	20.0		-52.0	0.4	-31.6
2,721.0	20.0		-49.8	0.5	-29.3
3,230.0	20.0		-46.6	0.5	-26.1
3,834.0	20.0		-43.3	0.6	-22.7
4,551.0	20.0		-40.1	0.6	-19.5
5,402.0	20.0		-36.8	0.7	-16.1
6,412.0	20.0		-33.5	0.7	-12.8
7,612.0	20.0		-30.3	0.8	-9.5
9,035.0	20.0		-27.0	0.8	-6.2
10,725.0	20.0		-23.9	0.9	-3.0
12,730.0	20.0		-21.2	0.9	-0.3
15,111.0	20.0		-19.3	1.0	1.7
17,937.0	20.0		-18.4	1.0	2.6
21,292.0	20.0		-18.2	1.1	2.9
25,274.0	20.0		-18.3	1.1	2.8
30,000.0	20.0		-18.4	1.2	2.8

5.3. RF Peak power output conducted

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

test site	☐ 441 EMI SAR	☐ 348 EMI cond.	☐ 443 EMI FAR	☒ 420 OTA	☐ 337 OATS	☐
spectr. analys.	☐ 584 FSU	☐ 120 FSEM	☐ 264 FSEK	☐ 489 ESU	☐	☐
power meter	☐ 009 NRV	☐ 010 URV5-Z2	☐ 011 URV5-Z2	☐	☐	☐
signalgener.	☐ 008 SMG	☐ 140 SMHU	☐ 263 SMP04	☐	☐	☐
power meter	☐ 262 NRV-S	☐ 266 NRV-Z31	☐ 265 NRV-Z33	☐ 261 NRV-Z55	☐ MC-TRX	☐
multimeter	☐ 341 Fluke 112	☐	☐	☐	☐	☐
signaling	☐ 392 MT8820A	☒ 436 CMU		☒ 248 6 dB Att. +cable OTA20		

5.3.2.Test condition and measurement test set-up

link to test system (if used):	☐ air link	☒ cable connection	☐
EUT-grounding	☐ none	☐ with power supply	☐ additional connection
Equipment set up	☒ table top 1.5m height		☐ floor standing
Climatic conditions	Temperature: (22±3°C)		Rel. humidity: (40±20)%

5.3.3.Requirement

- Maximum Power Output of the mobile phone should be determined while measured conducted and radiated way
- Regulatory Limit for GSM850/FDD5 mobile equipment: 7 Watt
- Regulatory Limit for GSM1900/FDD2 mobile equipment: 2 Watt

5.3.4.Measurement conditions and procedure

- conducted set-up usedUE is set TX mode, highest transmit power conditions. UE set to low, middle, and high nominal operating frequency within the operating range

5.3.5.Measurement procedure

- The UE was set to work according its nominal specification as stated by the applicant.
- The measurements were performed with the integrated power measurement capability of the CMU200 base simulator. Specific loss due to the measurement set-up was determined prior to the measurement and the measurement values correlated with this correction values.
- The power values have been recorded for Peak- and also Average values where possible

5.3.6. Results

The test results do not covered the HSDPA/HSUPA power values for portable application and should be reported in later certification of each product based on this RF module.

W-CDMA BAND 2

EUT		Set-up 2, Op. Mode 1						
Test case	Mode	Power[dBm]						Remarks
		UARFCN no. 9262		UARFCN no. 9400		UARFCN no. 9538		
		PK	AV	PK	AV	PK	AV	
HSUPA, Release 6	RMC99	27.58	**23.73**	**27.61**	23.58	26.94	23.51	PAR factor <13dB

Remark: --

W-CDMA BAND 5

EUT		Set-up 2, Op. Mode 2						
Test case	Mode	Power[dBm]						Remarks
		UARFCN no. 4132		UARFCN no. 4183		UARFCN no. 4233		
		PK	AV	PK	AV	PK	AV	
HSUPA, Release 6	RMC99	**26.60**	**23.15**	26.42	23.06	26.49	23.14	PAR factor <13dB

Remark: --

5.4. RF power output (radiated) ERP/EIRP

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

test site	☐ 441 EMI SAR	☐ 348 EMI cond.	☒ 443 EMI FAR	☐ 347 Radio.lab.	☐ 337 OATS	☐
spectr. analys.	☐ 584 FSU	☐ 120 FSEM	☐ 264 FSEK	☒ 489 ESU	☐	☐
antenna	☒ 540 HL 025	☒ 608 HL 562				
multimeter	☐ 341 Fluke 112	☐	☐	☐	☐	☐
signaling	☐ 392 MT8820A	☐ 436 CMU	☒ 546 CMU			
DCpower	☐ 086 LNG50-10	☐ 087 EA3013	☐ 354 NGPE 40	☐ 349 car battery	☐ 350 Car battery	☐
line voltage	☐ 230 V 50 Hz via public mains		☒060 110 V 60 Hz via PAS 5000			

5.4.2.Test condition and measurement test set-up

link to test system (if used):	☒ air link	☐ cable connection	☐
EUT-grounding	☒ none	☐ with power supply	☐ additional connection
Equipment set up	☒ table top 1.5m height		☐ floor standing
Climatic conditions	Temperature: (22±3°C)		Rel. humidity: (40±20)%

5.4.3. Requirement

- Regulatory Limit for GSM850/FDD5 mobile equipment: 7 Watt
- Regulatory Limit for GSM1900/FDD2 mobile equipment: 2 Watt

5.4.4. Measurement conditions

- radiated set-up, see chapter 4
- UE is set TX mode, highest transmit power conditions UE set to low, middle, and high nominal operating frequency within the operating range
- Compare chapter 4 for details of test configuration and settings chosen on the EUT and base system simulator

5.4.5. Measurement procedure

The measurements were made at the upper, center, and lower carrier traffic frequencies of the 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.

2.)

Parameter	Settings
RBW	10 MHz
VBW	10 MHz
Span	100 MHz
Detector Mode	Positive max-hold
Average	off
Sweep Time	coupled

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

5.4.6. Results

EUT		Set-up 1, Op. Mode 1				
Band	**Channel No.**	**Frequency**	**Maximum PK value (EIRP)**	**Limit**	**Result**	**Remarks**
2	UARFCN no. 9262	1852.4	24.7	2 Watt	Passed	--
	UARFCN no. 9400	1880	24.8			
	UARFCN no. 9538	1907.6	27.3			

EUT		Set-up 1, Op. Mode 2				
Band	**Channel No.**	**Frequency**	**Maximum PK value (ERP)**	**Limit**	**Result**	**Remarks**
5	UARFCN no. 4132	826.4	20.1	7 Watt	Passed	--
	UARFCN no. 4182	837	20.2			
	UARFCN no. 4233	846.6	20.9			

5.5. Radio Frequency Exposure Evaluation

The calculation of RF Exposure exist also as separate MPE test report no. 'TR-6-0082-11-1-2e'.

References:
FCC: §1.1310, § 2.1091
IC: RSS-102, Issue 4

The criteria used for the evaluation of human exposure to radio frequency radiation is table 1 according FCC §1.1310 and table chapter 4.2 of RSS-102 standard and it is subject for evaluation of the RF exposure prior to equipment authorization.

§2.1091: Further information on evaluating compliance with these limits can be found in the FCC's OST/OET Bulletin Number 65, ''Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to Radiofrequency Radiation.''

For purposes of these requirements mobile devices are defined by the FCC as transmitters designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between radiating structures and the body of the user or nearby persons. These devices are normally evaluated for exposure potential with relation to the MPE limits given in Table 1 of Appendix A.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
30–300	61.4	0.163	1.0	6
300–1500	.....	.....	f/300	6
1500–100,000	.....	.....	5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f^2)	30
30–300	27.5	0.073	0.2	30
300–1500	.....	.....	f/1500	30
1500–100,000	.....	.....	1.0	30

f = frequency in MHz

Table 1: LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

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

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

Abbreviations:

S: Power density (unit: mW/cm^2)
P: Power Input to the antenna
G: Gain of the antenna relative to an isotropic radiator,
EIRP: Equivalent isotropically radiated power, determined within a separate measurement (unit: mW)
R: distance to the center of the radiation of the antenna (unit: cm)

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

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

General Limits:

§1.1307
Cellular Radiotelephone Service (subpart H of part 22)
Non-building-mounted antennas: height above ground level to lowest point of antenna < 10 m and total power of all channels > 1000 W ERP (1640 W EIRP)

§1.1307
Personal Communications Services (part 24)
Broadband PCS (subpart E): non-building-mounted antennas: height above ground level to lowest point of antenna < 10 m and total power of all channels > 2000 W ERP (3280 W EIRP)

§1.1310 LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)
Table 1(B) Limits for General Population/Uncontrolled Exposure
300–1500 MHz: f/1500 mW/cm²
1500–100,000 MHz: 1.0 mW/cm²

§2.1091
Subject to routine evaluation is required when the device operate at frequencies of 1.5 GHz or below and their effective radiated power (ERP) is 1.5 watts or more, or if they operate at frequencies above 1.5 GHz and their ERP is 3 watts or more.

§24.232
(a) Base stations are limited to 1640 watts peak equivalent isotropically radiated power (e.i.r.p.) with an antenna height up to 300 meters HAAT.
b) Mobile/portable stations are limited to 2 watts e.i.r.p. peak power, …

§22.913
(a) Maximum ERP. The effective radiated power (ERP) of base transmitters and cellular repeaters must not exceed 500 Watts. The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

RSS-102
Standard requires the RF-exposure value in W/m^2 unit:, therefore the value determined in mW/cm^2 unit should be multiplied by 10 to have the required unit.

METHOD: The RF-exposure values were derived from the measured conducted Peak Power with assumed antenna gain of 0dBi. The gain does not include path losses of interconnecting cables between RF-delivering output port and antenna gain. Typical path losses are 0.7 to 1.5 dB per meter depending of cable quality.

The power was checked on 3 frequencies (lowest/middle/highest) within each operable FDD-band. Please refer to chapter 4.1 for the measurement set-up. Also a transmitter duty cycle of 100% was assumed.

5.5.1. General result for fixed FDD operations with assumed 0dBi antenna gain

Band	Channel no.	Channel Frequency	Peak value (Unit dBm)	EIRP-Value (Unit: mWatt)	MPE-Value (Unit: mWatt/cm^2)	MPE-Limit	Margin to limit	Maximum admissible antenna gain at 20 cm distance (Unit: dBi)
FDD Band 5	4132	826.4	26.6	457.09	0.0909	0.5509	0.4600	7.8236
	4185	837	26.42	438.53	0.0872	0.5580	0.4708	8.0589
	4233	846.6	26.49	445.66	0.0887	0.5644	0.4757	8.0384
FDD Band 2	9262	1852.4	27.58	572.80	0.1140	1.0000	0.8860	9.4326
	9400	1880	27.61	576.77	0.1147	1.0000	0.8853	9.4026
	9538	1907.6	26.94	494.31	0.0983	1.0000	0.9017	10.0726

Canadian RSS-102 standard requires the RF-exposure value in W/m^2 unit:, therefore the value determined in mW/cm^2 unit, should be multiplied by 10 to have the required unit.

Conclusion:

For the actual project a commercial available magnetic antenna (EUT D) with the highest antenna gain of 2.6 dBi was used. Measuring the conducted e.i.r.p. power shows at the value of 26.6 dBm in the FDD 5 Band within the maximum admissible antenna gain.

5.5.2. Results for mobile operations

Prediction for Part 22 (max antenna gain for mobile operations)
Maximum conducted peak power: 26.60 dBm on U-ARFCN 4132.

Highest admissible antenna gain for **FDD 5 mobile operations (@20cm)** where no routine evaluation is required according § 2.1091 (c) for P= 1.5W ERP

G = 10 log 1500mW [ERP] – 26.60 dBm + 2.15 dB = **7.31 dBi**

Prediction for Part 24 (max antenna gain for mobile operations)
Maximum conducted peak power: 27.61 dBm on U-ARFCN 9400.

Highest admissible antenna gain for **FDD 2 mobile operations (@20cm)** where no routine evaluation is required accord. §2.1091 (c) and §24.232 for P= 2W EIRP

G = 10 log 2000mW [EIRP] – 27.61 dBm = **5.39 dBi**

5.6. Occupied bandwidth and emission bandwidth

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

test site	☐ 441 EMI SAR	☐ 348 EMI cond.	☐ 443 EMI FAR	☒ 347 Radio.lab.	☐ 337 OATS	☐
equipment	☐ 331 HC 4055	☐	☐	☐	☐	☐
spectr. analys.	☐ 584 FSU	☐ 120 FSEM	☐ 264 FSEK	☒ 489 ESU	☐	☐
power and components	☒ 463 Power source	☒ 530 10 dB attenuator	☒ 529 6dB Power divider	☐	☐	☐
Signalling	☐ 392 MT8820A	☐ 436 CMU	☒ 547 CMU			
DCpower	☐ 086 LNG50-10	☐ 087 EA3013	☒ 354 NGPE 40	☐ 349 car battery	☐ 350 Car battery	☐
line voltage	☐ 230 V 50 Hz via public mains		☐060 110 V 60 Hz via PAS 5000			

5.6.2.Test condition and measurement test set-up

link to test system (if used):	☐ air link	☒ cable connection	☐
Climatic conditions	Temperature: (22±3°C)		Rel. humidity: (40±20)%

5.6.3. Requirements:

the UE occupied channel bandwidth containing 99% of the total integrated power should be less than 5 MHz, based on a chip rate of 3.84Mcps

5.6.4. Measurement conditions

- conducted set-up, see chapter 4.1
- UE set to low, middle, and high nominal operating frequency within the operating range
- UE Power is set to maximum; continuous transmission in RMC99 mode

5.6.5. Measurement procedure

Following settings were chosen on the spectrum analyzer:

Measure-ment	Center Frequency	Span	RBW	VBW	Sweep Time	Sweep Mode	Detector
26dB BW	Nominal carrier frequency	10 MHz	3 kHz	30 kHz	coupled	Repetitive, max-hold	PK
99% OBW	Nominal carrier frequency	10 MHz	200 kHz	2 MHz	coupled	Repetitive, max-hold	RMS

The used spectrum analyzer FSE/ESU from Rohde&Schwarz contains an integrated function to calculate the *Occupied bandwidth* automatically. From left and right display margin, the upper and lower frequency points where the accumulated power becomes 0.5% of the total power, are calculated. Subtracting the previous determined two frequency points, yields the *Occupied bandwidth.*

Also the 26dB emission bandwidth was measured, defined as a bandwidth between 2 markers which are 26dBc compared to highest In-Band Peak Emission.

5.6.6. Results

EUT		Set-up 2, Op. Mode 1		
Test case	**Channel**	**Occupied bandwidth [MHz]**	**Emission bandwidth [MHz]**	**Remarks**
RMC99 Mode	9262	4.134	4.663	diagram see annex A1
RMC99 Mode	9400	4.134	4.583	
RMC99 Mode	9538	4.151	4.631	
EUT		**Set-up 2, Op. Mode 2**		
Test case	**Channel**	**Occupied bandwidth [MHz]**	**Emission bandwidth [MHz]**	**Remarks**
RMC99 Mode	4132	4.135	4.583	diagram see annex A1
RMC99 Mode	4182	4.135	4.583	
RMC99 Mode	4233	4.151	4.583	

5.7. Spurious emission measurements at antenna terminals (conducted)

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

test site	☐ 441 EMI SAR	☐ 348 EMI cond.	☐ 443 EMI FAR	☒ 347 Radio.lab.	☐ 337 OATS	☐
equipment	☐ 331 HC 4055	☐	☐	☐	☐	☐
spectr. analys.	☐ 584 FSU	☐ 120 FSEM	☐ 264 FSEK	☒ 489 ESU	☐	☐
power	☐ 463 Power source	☒ 530 10 dB attenuator	☒ 529 6dB power divider	☐	☐	☐
signaling	☐ 392 MT8820A	☐ 436 CMU	☒ 547 CMU			
DCpower	☐ 086 LNG50-10	☐ 087 EA3013	☒ 354 NGPE 40	☐ 349 car battery	☐ 350 Car battery	☐
line voltage	☐ 230 V 50 Hz via public mains		☐060 110 V 60 Hz via PAS 5000			

5.7.2.Test condition and measurement test set-up

link to test system (if used):	☐ air link	☒ cable connection	☐
EUT-grounding	☐ none	☐ with power supply	☐ additional connection
Equipment set up	☐ table top 1.5m height		☒ floor standing
Climatic conditions	Temperature: (22±3°C)		Rel. humidity: (40±20)%

5.7.3. Requirement

Part 22.917(a) & Part24.238(a):
(a) *Out of band emissions. 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*

§27.53(g):
For operations in the 1710–1755 MHz and 2110–2155 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least 43 + 10 log10(P) dB..
However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.
(1) *Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.*

§ 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"

5.7.4. Measurement conditions

- Conducted set-up used, see chapter 4.1
- UE is set TX mode, highest transmit power conditions
- UE set to low, middle, and high nominal operating frequency within the operating range
- Tests have been done in 12.2 kbps RMC + HSPA operating mode

5.7.5. Measurement procedure

The spectrum was scanned up to 10th harmonic of the carrier frequency.

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.

Settings on spectrum analyzer for frequencies outside the frequency block:

Frequency range	RBW	VBW	Sweep Time	Sweep Mode	Detector
9 kHz .. 1 MHz	0.001 MHz	0.01 MHz	High enough to maintain necessary accuracy	Repetitive scan, Max-Hold mode	Max-Peak
1 MHz .. 30 MHz	0.1 MHz	1 MHz			
30 MHz .. 19.5 GHz	1 MHz	1 MHz			

Settings on spectrum analyzer for Block-Edge compliance measurements:

Band	Frequency range (uplink)	RBW	VBW	Sweep Time	Sweep Mode	Detector
5	823-824 MHz 849-850 MHz	30 kHz	300 kHz	High enough to maintain necessary accuracy	Repetitive scan, Max-Hold mode	Max-Peak
2	1849-1850 MHz 1910-1911 MHz					

Due to not available exact 1% RBW of the measurement equipment, the lower available RBW was used for these measurements.
An 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)**

5.7.6. Measurement results

5.7.7. Results FDD Band V Mode

EUT	Set-up 2, Op. Mode 2					
Diagram no.'s	**Spurious frequency [MHz]**	**Maximum value [dBm]**	**Limit [dBm]**	**Margin to limit [dB]**	**Result**	**Remarks**
b_4.09, b_4.10 & b_4.11	1.33 (Channel 4182)	-49.82	-13 dBm	>20	Passed	--
b_4.14, b_4.15 & b_4.16	--	<-30.0		>17	Passed	Carrier on diagrams
b_4.12	823.90 (Channel 4132)	-23.62 (PK) + 2.21 = -21.41		8.41	Passed	Block-Edge compliance Correction factor 10log(50kHz/30KHz) to be used=2.21dB
b_4.13	849.0 (Channel 4233)	-23.06 (PK) + 2.21 = -20.85		7.85	Passed	

Remark: Selected worst-case measurement to the closest limit of RMC99 mode. Please see the other measured channels as diagrams in the separate annex.

5.7.8. Results FDD Band II Mode

EUT	Set-up 2, Op. Mode 1					
Diagram no.'s	**Spurious frequency [MHz]**	**Maximum value [dBm]**	**Limit [dBm]**	**Margin to limit [dB]**	**Result**	**Remarks**
b_4.19, b_4.20 & b_4.21	--	-49.85	-13 dBm	>20	Passed	--
b_4.22, b_4.23 & b_4.24	--	<-28.0		>15	Passed	Carrier on diagrams
b_4.27	1910.33 (Channel 9262)	-23.69 (AV) + 2.21 = -21.48		8.48	Passed	Block-Edge compliance Correction factor 10log(50kHz/30KHz) to be used=2.21dB
b_4.28	1849.70 (Channel 9538)	-22.94 (AV) + 2.21 = -20.73		7.73	Passed	

Remark: Selected worst-case measurement to the closest limit of RMC99 mode. Please see the other measurement channels as diagrams in the separate annex.

5.8. Radiated spurious emission measurements outside the licensee's frequency block

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

test site	☐ 441 EMI SAR	☐ 348 EMI cond.	☒ 443 EMI FAR	☐ 347 Radio.lab.	☐ 337 OATS	☐
equipment	☐ 331 HC 4055	☐	☐	☐	☐	☐
spectr. analys.	☐ 584 FSU	☐ 120 FSEM	☐ 264 FSEK	☒ 489 ESU	☐	☐
antenna meas	☐ 574 BTA-L	☐ 289 CBL 6141	☒ 608 HL 562	☒ 549 HL025	☐ 302 BBHA9170	☐ 477 GPS
antenna meas	☐ 123 HUF-Z2	☐ 132 HUF-Z3	☐ 030 HFH-Z2	☐	☐	☐
antenna subst	☐ 071 HUF-Z2	☐ 020 EMCO3115	☐ 063 LP 3146	☐ 303 BBHA9170	☐	☐
power meter	☐ 009 NRV	☐ 010 URV5-Z2	☐ 011 URV5-Z2	☐	☐	☐
signalgener.	☐ 008 SMG	☐ 140 SMHU	☐ 263 SMP04	☐	☐	☐
power meter	☐ 262 NRV-S	☐ 266 NRV-Z31	☐ 265 NRV-Z33	☐ 261 NRV-Z55	☐ 356 NRV-Z1	☐
multimeter	☐ 341 Fluke 112	☐	☐	☐	☐	☐
signaling	☐ 392 MT8820A	☐ 436 CMU	☒ 546 CMU			
DCpower	☐ 086 LNG50-10	☐ 087 EA3013	☐ 354 NGPE 40	☐ 349 car battery	☐ 350 Car battery	☐
line voltage	☐ 230 V 50 Hz via public mains		☒ 060 110 V 60 Hz via PAS 5000			

5.8.2.Test condition and measurement test set-up

link to test system (if used):	☒ air link	☐ cable connection	☐
EUT-grounding	☒ none	☐ with power supply	☐ additional connection
Equipment set up	☒ table top 1.55m height		☐ floor standing
Climatic conditions	Temperature: (22±3°C)		Rel. humidity: (40±20)%

5.8.3. Requirement

Part 22.917(a) & Part24.238(a)
(a) Out of band emissions. 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

Part 27.53(g):
(g) For operations in the 1710–1755 MHz and 2110–2155 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least 43 + 10 log10(P) dB.

5.8.4. Measurement conditions

- radiated set-up, see chapter 4.2
- UE is set TX mode, highest transmit power conditions
- UE set to low, middle, and high nominal operating frequency within the operating range

5.8.5. Measurement procedure

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 antenna was set to horizontal plane (h) and vertical plane (v) for measuring the emissions. Measurement distance is 3m up to 18GHz, 1m from 18 to 25 GHz. Critical measurements near the limit are re-measured with a substitution method accord. TIA/EIA 603.

Settings on spectrum analyzer outside the frequency block:

Frequency range	RBW	VBW	Sweep Time	Sweep Mode	Detector
30 .. 20 GHz	1MHz	3 MHz	High enough to maintain necessary accuracy	Repetitive scan, Max-Hold mode	Max-Peak

Settings on spectrum analyzer for Band-Edge compliance measurements:

Band	Frequency range	RBW	VBW	Sweep Time	Sweep Mode	Detector
5	823-824 MHz 849-850 MHz	30kHz	300 kHz	High enough to maintain necessary accuracy	Repetitive scan, Max-Hold mode	Max-Peak and/or Average
2	1849-1850 MHz 1910-1911 MHz					

Due to not available exact 1% RBW of the measurement equipment, the lower available RBW was used for these measurements.
An an additional correction factor of 10 Log (RBW1/ RBW2) to the result was added to RBW1 is the narrower measurement resolution bandwidth (used RBW) and RBW2 is either the 1% emissions bandwidth or 1 MHz.

5.8.6. Results Band II Mode

EUT	Set-up 2, Op. Mode 1					
Diagram no.'s	**Spurious frequency [MHz]**	**Maximum value [dBm]**	**Limit [dBm]**	**Margin to limit [dB]**	**Results**	**Remarks**
b_5.14 & b_5.16	298.26 (Channel 9400)	-39.15	-13 dBm	>20	Passed	Peak above limit is due to wanted TX-carrier
b_5.14_BE	1849.90 (Channel 9262)	-19.41 (PK) + 2.21 = -17.2		4.2	Passed	Band-Edge compliance Correction factor 10log(50kHz/30KHz) to be used=2.21dB
b_5.16_BE	1910.31 (Channel 9538)	-17.66 (PK) + 2.21 = -15.45		2.45	Passed	

Remark: Selected worst-case measurement to the closest limit of HSUPA mode. Please see the other measurement channels as diagrams in the separate annex.

5.8.6.1. Results Band V Mode

EUT	Set-up 1, Op. Mode 2					
Diagram no.'s	**Spurious frequency [MHz]**	**Maximum value [dBm]**	**Limit [dBm]**	**Margin to limit [dB]**	**Results**	**Remarks**
b_5.11 & b_5.13	150.52 (Channel 4182)	-41.72	-13 dBm	>20	Passed	Peak above limit is due to wanted TX-carrier
b_5.11_BE	823.99 (Channel 4132)	-34.83 (PK) + 2.21 = -32.62		19.62	Passed	Band-Edge compliance Correction factor 10log(50kHz/30KHz) to be used=2.21dB
b_5.16_BE	849.01 (Channel 4233)	-33.05 (PK) + 2.21 = -30.84		17.84	Passed	

Remark: Selected worst-case measurement to the closest limit of HSUPA mode. Please see the other measurement channels as diagrams in the separate annex.

5.9. Frequency stability on temperature and voltage variations

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

test site	☐ 441 EMI SAR	☐ 348 EMI cond.	☐ 443 EMI FAR	☒ 347 Radio.lab.	☐ 337 OATS	☐
equipment	☐ 331 HC 4055	☐	☐	☒ 331 Climatic chamber	☐	☐
spectr. analys.	☐ 584 FSU	☐ 120 FSEM	☐ 264 FSEK	☒ 489 ESU	☐	☐
power	☐ 463 Power source	☒ 530 10 dB attenuator	☐ 529 6dB power divider	☐	☐	☐
signaling	☐ 392 MT8820A	☐ 436 CMU	☒ 547 CMU			
DCpower	☐ 086 LNG50-10	☐ 087 EA3013	☒ 354 NGPE 40	☐ 349 car battery	☐ 350 Car battery	☐
line voltage	☐ 230 V 50 Hz via public mains		☐060 110 V 60 Hz via PAS 5000			

5.9.2.Test condition and measurement test set-up

link to test system (if used):	☐ air link	☒ cable connection	☐
Climatic conditions	Temperature: (22±3°C)		Rel. humidity: (40±20)%

5.9.3. Requirement

§22.355:
..the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table C-1 of this section. Table C-1--Frequency Tolerance for Transmitters in the Public Mobile in the range 821 to 896MHz: 2.5ppm

§24.235:
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

§27.54:
The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

5.9.4. Limit

As the limit is not specified in detail for FDD Band II, it was fixed to an limit according 3GPP34.121 ($0.1xfx10^{-06}$) Hz (0.1ppm), where f the frequency [Hz] of the transmitting equipment

5.9.5. Measurement conditions

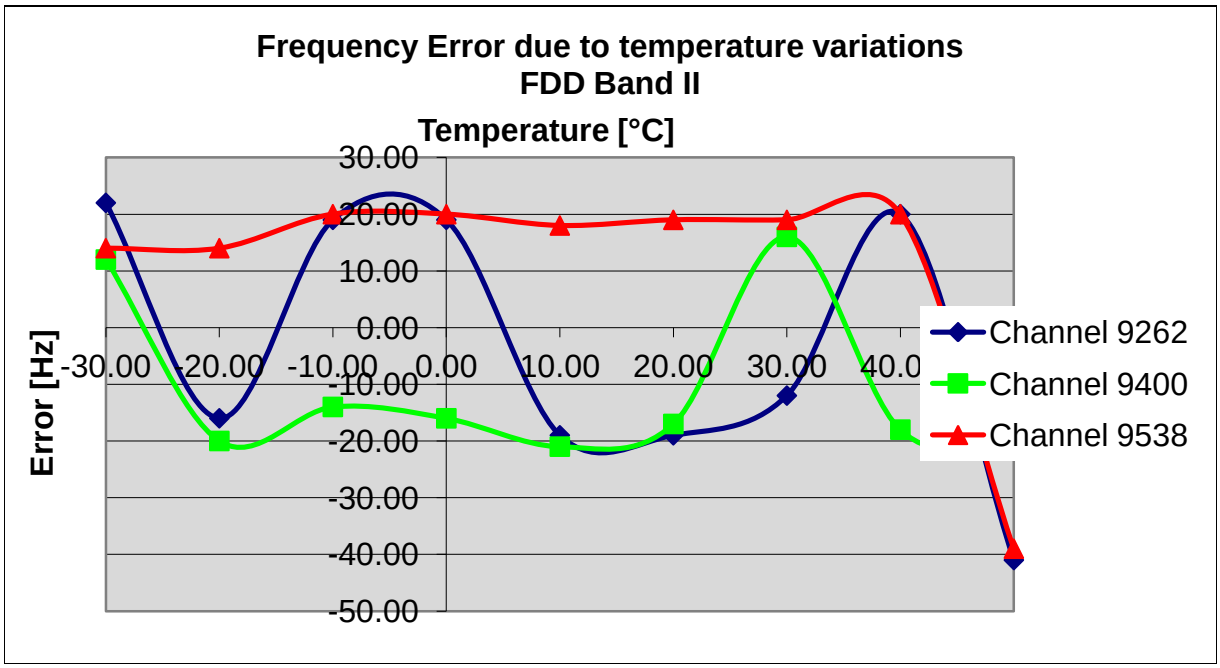
- conducted set-up used, see chapter 4.1
- UE set to low, middle, and high operating frequency within the operating range
- UE Power should be set to maximum, continuous transmission
- in order to maintain the voltage constant over the time period of the tests, a dummy battery was connected to a laboratory power supply. The level of the supplied voltage was controlled on the input of the power supply terminals of the EUT.
- the frequency error was recorded by the integrated possibility of the base station simulator.
- Tests have been done in 12.2 kbps RMC+ HSPA operating mode

5.9.6. Measurement procedures: Extreme temperature

1.) *determine the carrier frequency for the* lowest, middle *and* highest channel *at room temperature and nominal voltage [20°C]*
2.) *expose the mobile station to –30°C, wait sufficient time to have constant temperature.*
3.) *perform the carrier frequencies measurements in 10°C increments from –30°C to +50°C. For about half hour at the specified temperature the mobile was powered-off. After powering-on, the measurements were made within 2 minute for the channel lower channel, in order to prevent self-warming of the mobile.*

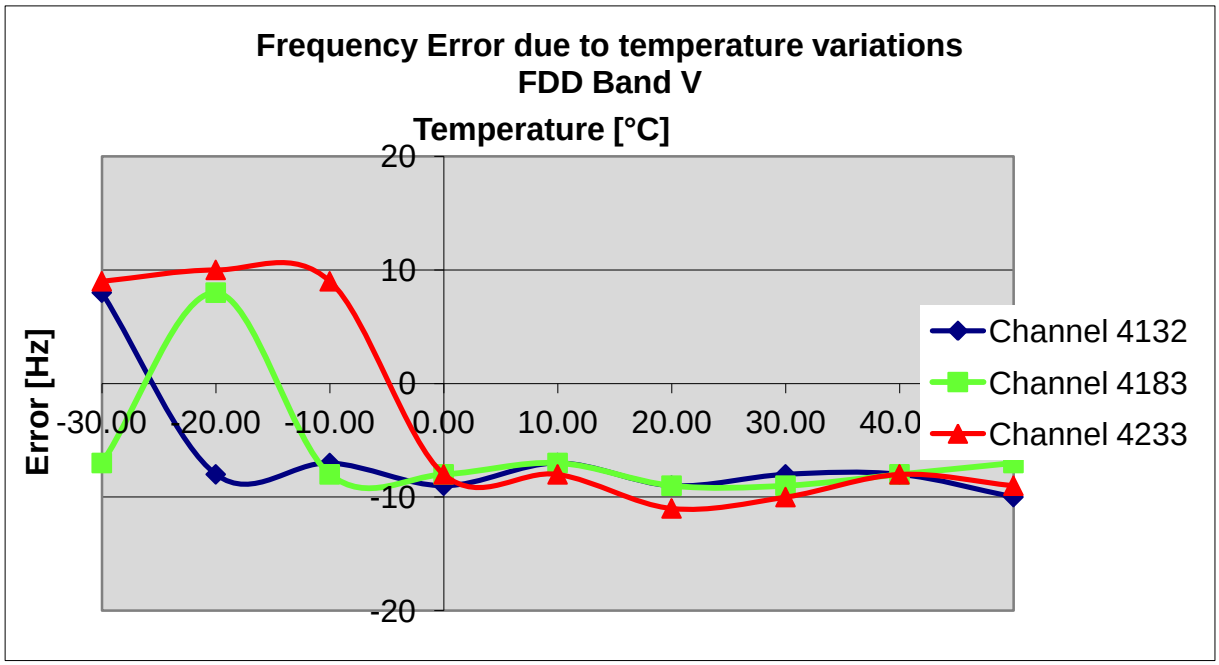
5.9.6.1. Results: Temperature variations for FDD II

Temperature	Maximum frequency error [Hz] Channel 9262	Channel 9400	Channel 9538	[ppm] Channel 9262	Channel 9400	Channel 9538	Verdict Limit= ±0.1ppm
-30	22	12	14	0.012	0.006	0.007	
-20	-16	-20	14	-0.009	-0.011	0.007	
-10	19	-14	20	0.010	-0.007	0.010	
0	19	-16	20	0.010	-0.009	0.010	
10	-19	-21	18	-0.010	-0.011	0.009	Passed
20	-19	-17	19	-0.010	-0.009	0.010	
30	-12	16	19	-0.006	0.009	0.010	
40	20	-18	20	0.011	-0.010	0.010	
50	-41	-21	-39	-0.022	-0.011	-0.020	



5.9.6.2. Results: Temperature variations for FDD V

	Maximum frequency error						Verdict
	Channel 4132	Channel 4183	Channel 4233	Channel 4132	Channel 4183	Channel 4233	
Temperature	[Hz]			[ppm]			Limit= ±2.5ppm
-30	8	-7	9	0.010	-0.008	0.011	
-20	-8	8	10	-0.010	0.010	0.012	
-10	-7	-8	9	-0.008	-0.010	0.011	
0	-9	-8	-8	-0.011	-0.010	-0.009	
10	-7	-7	-8	-0.008	-0.008	-0.009	Passed
20	-9	-9	-11	-0.011	-0.011	-0.013	
30	-8	-9	-10	-0.010	-0.011	-0.012	
40	-8	-8	-8	-0.010	-0.010	-0.009	
50	-10	-7	-9	-0.012	-0.008	-0.011	

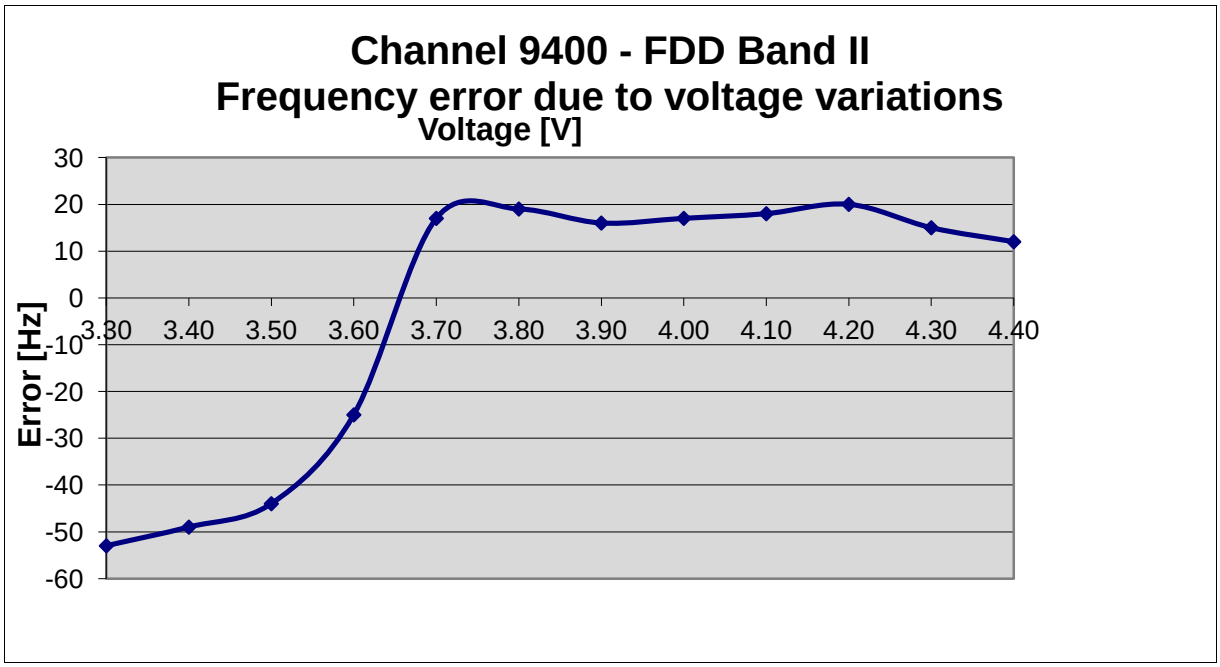


5.9.7. Measurement procedures: Extreme voltage Range at constant room reference temperature

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

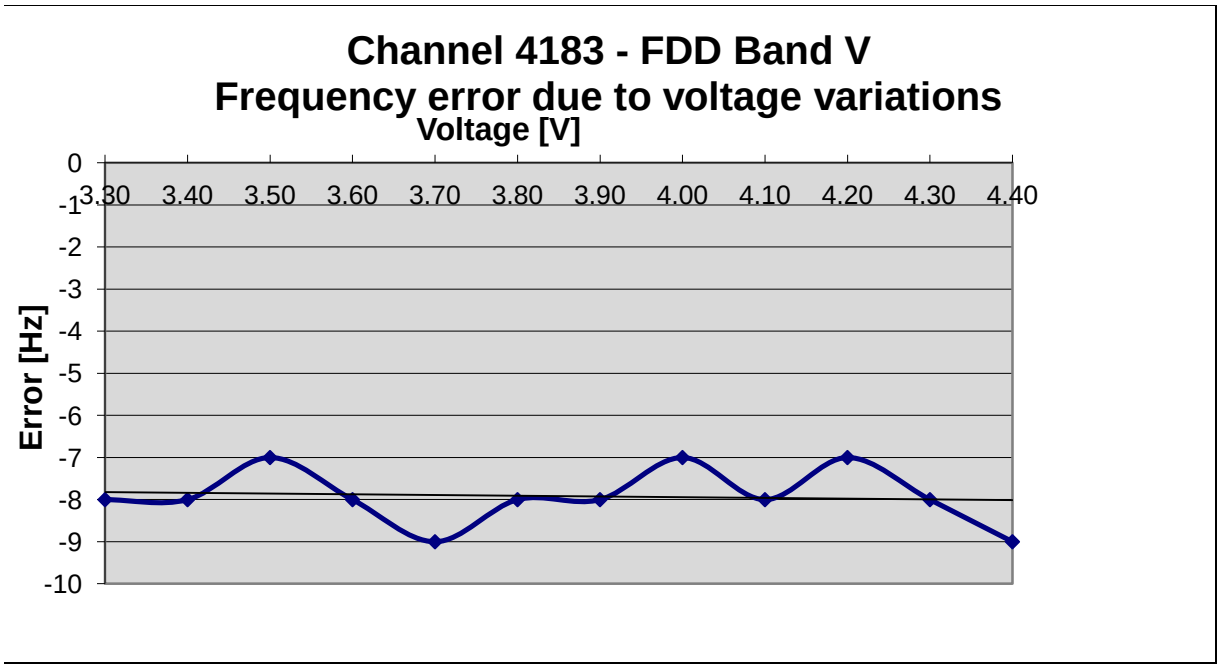
5.9.7.1. Results: Voltage variations for FDD II

Voltage [V]	Nominal Frequency [Hz]	Maximum frequency error		Verdict
		[Hz]	[ppm]	Limit=±0.1ppm
3.30	1880000000	-53	-0.028	Passed
3.40		-49	-0.026	
3.50		-44	-0.023	
3.60		-25	-0.013	
3.70		17	0.009	
3.80		19	0.010	
3.90		16	0.009	
4.00		17	0.009	
4.10		18	0.010	
4.20		20	0.011	
4.30		15	0.008	
4.40		12	0.006	



5.9.7.2. Results: Voltage variations for FDD V

Voltage [V]	Nominal Frequency [Hz]	Maximum frequency error		Verdict Limit=±2.5ppm
		[Hz]	[ppm]	
3.30	836400000	-8	-0.010	Passed
3.40		-8	-0.010	
3.50		-7	-0.008	
3.60		-8	-0.010	
3.70		-9	-0.011	
3.80		-8	-0.010	
3.90		-8	-0.010	
4.00		-7	-0.008	
4.10		-8	-0.010	
4.20		-7	-0.008	
4.30		-8	-0.010	
4.40		-9	-0.011	



5.10. 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

6. Accreditation details of CETECOM's laboratories and test sites

Ref.-No.	Accreditation Certificate	Valid for laboratory area or test site	Accreditation Body
-	D-PL-12047-01-01	All laboratories and test sites of CETECOM GmbH, Essen	DAkkS, Deutsche Akkreditierungsstelle GmbH
337 487 558 348 348	736496	Radiated Measurements 30 MHz to 1 GHz, 3m+10m OATS Radiated Measurements 30 MHz to 1 GHz, 3m SAR Radiated Measurements above 1 GHz, 3 m Fully Anechoic Chamber Mains Ports Conducted Interference Measurements Telecommunication Ports Conducted Interference Measurements	FCC, Federal Communications Commission Laboratory Division, USA (MRA US-EU 0003)
337 487 550 558	3462D-1 3462D-2 3462D-2 3462D-3	Radiated Measurements 30 MHz to 1 GHz, 3m + 10m OATS Radiated Measurements 30 MHz to 1 GHz, 3m SAR Radiated Measurements 1 GHz to 6 GHz, 3m SAR Radiated Measurements above 1 GHz ,3 m Fully Anechoic Chamber	IC, Industry Canada Certification and Engineering Bureau
337 487 550 348 348	R-2665 R-2666 G-301 C-2914 T-1967	Radiated Measurements 30 MHz to 1 GHz, 3m+10m OATS Radiated Measurements 30 MHz to 1GHz, 3m SAR Radiated Measurements 1GHz to 6 GHz, 3m SAR Mains Ports Conducted Interference Measurements Telecommunication Ports Conducted Interference Measurements	VCCI, Voluntary Control Council for Interference by Information Technology Equipment, Japan

7. Instruments and Ancillary

7.1. Used equipment "CTC"

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

7.1.1. 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	System-CTC-EMS-Conducted	System EMS Conducted	-	EMC 32 V 8.40
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
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 to be used ,
441	CTC-SAR-EMI Cable Loss	System EMI field (SAR) Cable	-	EMC 32 Version 8.40
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. 8.40
444	CTC-FAR-EMS field	System-EMS-Field (FAR)	-	EMC 32 Version 8.40
460	Univ. Radio Communication Tester	CMU 200	108901	R&S Test Firmware Base=5.14, GSM=5.14 WCDMA=5.14 (current Testsoftw.,f. all band to be used,
489	Emi Test Receiver	ESU40	1000-30	Firmware=4.43 SP3, Bios=V5.1-16-3, Spec. =01.00
491	ESD Simulator dito	ESD dito	dito307022	V 2.30
524	Voltage Drop Simulator	VDS 200	0196-16	Software Nr: 000037 Version V4.20a01
526	Burst Generator	EFT 200 A	0496-06	Software Nr. 000034 Version V2.32
527	Micro Pulse Generator	MPG 200 B	0496-05	Software-Nr. 000030 Version V2.43
528	Load Dump Simulator	LD 200B	0496-06	Software-Nr. 000031 Version V2.35a01
546	Univ. Radio Communication Tester	CMU 200	106436	R&S Test Firmware Base=5.14, GSM=5.14 WCDMA=5.14 (current Testsoftw.,f. all band to be used
547	Univ. Radio Communication Tester	CMU 200	835390/014	R&S Test Firmware Base=V5.1403 (current Testsoftw., f. all band used, GSM = 5.14 WCDMA: = 5.14
584	Spectrum Analyzer	FSU 8	100248	2.82_SP3
594	Univ. Radio Communication Tester	CMW500	101757	Firmware Base=2.0.20.9, LTE=2.0.20.8. CDMA= 2.0.10
597	Univ. Radio Communication Tester	CMU 200	100347	R&S Test Firmware Base=5.01, GSM=5.02 WCDMA= not installed, Mainboard= µP1=V.850
598	Spectrum Analyzer	FSEM 30 (Reserve)	831259/013	Firmware Bios 3.40 , Analyzer 3.40 Sp 2

7.1.2. 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
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	1c	30.06.2012
086	DC - power supply, 0 -10 A	LNG 50-10	-	Heinzinger Electronic	pre-m	2	
087	DC - power supply, 0 -5 A	EA-3013 S	-	Elektro Automatik	pre-m	2	
090	Helmholtz coil: 2x10 coils in series	-	-	RWTÜV	-	4	
091	USB-LWL-Converter	OLS-1	007/2006	Ing. Büro Scheiba	-	4	
099	passive voltage probe	ESH2-Z3	299.7810.52	Rohde & Schwarz	36 M	-	31.03.2012
100	passive voltage probe	Probe TK 9416	without	Schwarzbeck	36 M	-	31.03.2012
110	USB-LWL-Converter	OLS-1	-	Ing. Büro Scheiba	-	4	
119	RT Harmonics Analyzer 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
267	notch filter GSM 850	WRCA 800/960-6EEK	9	Wainwright GmbH	pre-m	2	
268	AC/DC power supply	EA 3050-A	9823636	Elektro Automatik	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	30.06.2012
291	high pass filter GSM 850/900	WHJ 2200-4EE	14	Wainwright GmbH	12 M	1c	30.06.2012
298	Univ. Radio Communication Tester	CMU 200	832221/091	Rohde & Schwarz	pre-m	3	
300	AC LISN (50 Ohm/50µH, 1-phase)	ESH3-Z5	892 239/020	Rohde & Schwarz	24/12 M	-	31.03.2012
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.	-	-	-	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	-	31.03.2012
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	
436	Univ. Radio Communication Tester	CMU 200	103083	Rohde & Schwarz	12 M	-	31.03.2012
441	CTC-SAR-EMI Cable Loss	System EMI field (SAR) Cable	-	CETECOM	12 M	5	31.08.2012

Ref.-No.	Equipment	Type	Serial-No.	Manufacturer	Interval of calibration	Remark	Cal due
443	CTC-FAR-EMI-RSE	System CTC-FAR-EMI-RSE	-	ETS-Lindgren/CETECOM	12 M	5	30.06.2012
448	notch filter WCDMA_FDD II	WRCT 1850.0/2170.0-5/40-10SSK	5	Wainwright Instruments GmbH	12 M	1c	30.06.2012
449	notch filter WCDMA FDD V	WRCT 824.0/894.0-5/40-8SSK	1	Wainwright	12 M	1c	30.06.2012
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	-	31.03.2012
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	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	-	30.07.2012
487	System CTC NSA-Verification SAR-EMI	System EMI field (SAR) NSA	-	ETS Lindgren/CETECOM	12 M	-	30.09.2012
489	Emi Test Receiver	ESU40	1000-30	Rohde & Schwarz	12 M	-	31.03.2012
502	band reject filter	WRCG 1709/1786-1699/1796-	SN 9	Wainwright	pre-m	2	
503	band reject filter	WRCG 824/849-814/859-60/10SS	SN 5	Wainwright	pre-m	2	
512	notch filter GSM 850	WRCA 800/960-02/40-6EEK	SN 24	Wainwrght	12 M	1c	30.06.2012
517	relais switch matrix	HF Relais Box Keithley System	SE 04	Keithley	pre-m	2	
523	Digital Multimeter	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	
546	Univ. Radio Communication Tester	CMU 200	106436	R&S	12 M	-	31.03.2012
547	Univ. Radio Communication 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	1c	30.07.2012
558	System CTC FAR S-VSWR	System CTC FAR S-VSWR	-	CTC	24 M	-	31.07.2013
574	Biconilog Hybrid Antenna	BTA-L	980026L	Frankonia	36/12 M	-	30.03.2013
584	Spectrum Analyzer	FSU 8	100248	Rohde & Schwarz	12 M	-	31.03.2012
594	Univ. Radio Communication 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 Analyzer	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	-	31.03.2014
611	DC power supply	E3632A	KR 75305854	Agilent	pre-m	2	
612	DC power supply	E3632A	MY 40001321	Agilent	pre-m	2	
613	Attenuator	R416120000 20dB 10W	Lot. 9828	Radiall	pre-m	2	

7.1.3. 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

8. RMC99, HSDPA and HSUPA FDD SETTINGS

Output power considerations for WCDMA mobile equipment

The maximum output power is verified for Low, Middle and High channels according the general descriptions in section 5.2 of 3GPP TS34.121. Following table shows the references to the relative chapter.

Test	Rel99	HSDPA		HSUPA
Max. Power	5.2	5.2A	5.2AA	5.2B

8.1. 3GPP Release 99

The default test configuration and radio link is 12.2 kbps Reference Measurement Channel configured in test loop mode 1. This RMC defines one code channel in I-branch (DPDCH) and one code channel on the Q-branch. (DPCCH). Compressed mode is switched off.

The uplink contains one DPCCH and up to 6 DPDCH channels. The radio link contain simultaneous data, voice, data, video and packet data and signalling. The nominal maximum output power are defined according to the power class of the EUT. All the parameters are defined using the UL reference measurement channel (12.2kbps), as specified in clause C2.1 of 3GPP TS34.121.

C.2.1 UL reference measurement channel (12,2 kbps)

The parameters for the 12,2 kbps UL reference measurement channel are specified in table C.2.1.1, table C 2.1.2, table C 2.1.3 and table C.2.1.4. The channel coding for information is shown in figure C.2.1

Table C.2.1.1: UL reference measurement channel physical parameters (12,2 kbps)

Parameter	Level	Unit
Information bit rate	12,2	kbps
DPDCH	60	kbps
DPCCH	15	kbps
DPCCH Slot Format #i	0	-
DPCCH/DPDCH power ratio	-5,46	dB
TFCI	On	-
Repetition	23	%
NOTE: Slot Format #2 is used for closed loop tests in clause 7.6.2. Slot Format #2 and #5 are used for site selection diversity transmission tests in subclause 7.6.3.		

Table C.2.1.2: UL reference measurement channel using RLC-TM for DTCH, transport channel parameters (12.2 kbps)

Higher Layer	RAB/Signalling RB		RAB	SRB
RLC	Logical channel type		DTCH	DCCH
	RLC mode		TM	UM/AM
	Payload sizes, bit		244	88/80
	Max data rate, bps		12200	2200/2000
	PDU header, bit		N/A	8/16
	TrD PDU header, bit		0	N/A
MAC	MAC header, bit		0	4
	MAC multiplexing		N/A	Yes
Layer 1	TrCH type		DCH	DCH
	Transport Channel Identity		1	5
	TB sizes, bit		244	100
	TFS	TF0, bits	0*244	0*100
		TF1, bits	1*244	1*100
	TTI, ms		20	40
	Coding type		Convolution Coding	Convolution Coding
	Coding Rate		1/3	1/3
	CRC, bit		16	12
	Max number of bits/TTI after channel coding		804	360
	Uplink: Max number of bits/radio frame before rate matching		402	90

	RM attribute	256	256

Table C.2.1.3: UL reference measurement channel, TFCS (12.2 kbps)

TFCS size	4
TFCS	(DTCH, DCCH)= (TF0, TF0), (TF1, TF0), (TF0, TF1), (TF1, TF1)

In order to measure the maximum output power the base station set and send continuously power control commands to the EUT. TPC bits were set all up ("1").

Physical channels during connection for non-HSDPA test cases

The following clauses describe the downlink Physical Channels that are transmitted during a connection i.e., when measurements are done. For these measurements the offset between DPCH and SCH shall be zero chips at base station meaning that SCH is overlapping with the first symbols in DPCH in the beginning of DPCH slot structure.

E.3.1 Measurement of Tx Characteristics

Table E.3.1 is applicable for measurements on the Transmitter Characteristics (clause 5) with the exception of clauses 5.3 (frequency error), 5.4.1, 5.4.4 and 5.5.2.

Table E.3.1: Downlink Physical Channels transmitted during a connection

Physical Channel	Power
Îor	–93 dBm / 3,84MHz
CPICH	CPICH_Ec / DPCH_Ec= 7 dB
P-CCPCH	P-CCPCH_Ec / DPCH_Ec= 5 dB
SCH	SCH_Ec / DPCH_Ec = 5 dB
PICH	PICH_Ec / DPCH_Ec= 2 dB
DPCH	–103,3 dBm / 3,84MHz

E.3.2 Measurement of Rx Characteristics

Table E.3.2.1 is applicable for measurements on the ***Receiver Characteristics*** (clause 6) including clauses 5.3 of 3GPP, Frequency Error.

Table E.3.2.2 describes the downlink Physical Channels that are required for the test of Spurious Emissions (clause 6.8). The UE is in the CELL_FACH state during the measurement.

Table E.3.2.2: Downlink Physical Channels transmitted during the RX Spurious Emissions test

Physical Channel	Power
CPICH	–86dBm / 3,84MHz
P-CCPCH	P-CCPCH_Ec/ CPICH_Ec= -2 dB
SCH	SCH_Ec / CPICH_Ec= -2 dB
PICH	PICH_Ec / CPICH_Ec= -5 dB
S-CCPCH	S-CCPCH_Ec / CPICH_Ec= -2 dB

8.2. 3GPP Release 5 (HSDPA Option)

HSDPA as evolution of WCDMA Rel. 99 are implementing new features like: fast scheduling principle, faster retransmission of data blocks, hybrid automatic-repeat-request (HARQ), adaptive modulation and coding (AMC), shorter transmit time interval and a shared channel concept. so a reduced transmission delay and a increased data rate up to 14 Mbit/s can be offered by the end user equipment.

In the downlink a new transport channel (HS-DSCH) and two physical channels (HS-PDSCH and HS-SCCH) are introduced.
In the uplink the signal quality is feedback by transmission of HARQ-ACK, and CQI.

According TS34.121, the maximum output power with HS-DPCCH activated is the UE power can transmit when HS-DPCCH is fully or partially transmitting during a DPCCH timeslot.

The total WCDMA power is the sum from all active physical channels. The power for each physical channel can be configured by BETA values, which define the respective physical channel above the DPCCH channel (Dedicated physical control channel) which is always active. For RF-testing all this BETA factors are well defined by the standard 3GPP TS 34.121.

HSDPA Rel. 5 is handled in section 5.2A of TS34.121
HSDPA Rel. 6 is handled in section 5.2AA of TS34.121

The most used radio bearer set-up for tests according TS34.121 is RMC12.2kbps + HSDPA
An HSDPA call is set-up according 3GPP TS34.108 clause 7.3.6 Baseline radio bearer combinations and set-up procedures for HSDPA-tests are described here.

The specific RF parameters are set-up accord. Table E5.1(QPSK-modulation) or Table E5.1A (16QAM-modulation) in Annex E of 3GPP34.121.

Table E.5.1: Downlink physical channels for HSDPA testing

Physical Channel	Parameter	Value	Note
P-CPICH	P-CPICH_Ec/Ior	-10dB	
P-CCPCH	P-CCPCH_Ec/Ior	-12dB	Mean power level is shared with SCH.
SCH	SCH_Ec/Ior	-12dB	Mean power level is shared with P-CCPCH – SCH includes P- and S-SCH, with power split between both. P-SCH code is S_dl,0 as per [14] S-SCH pattern is scrambling code group 0
PICH	PICH_Ec/Ior	-15dB	
DPCH	DPCH_Ec/Ior	Test-specific	12.2 kbps DL reference measurement channel as defined in Annex C.3.1
HS-SCCH-1	HS-SCCH_Ec/Ior	Test-specific	Specifies fraction of Node-B radiated power transmitted when TTI is active (i.e. due to minimum inter-TTI interval). During TTIs, in which the HS-SCCH is not allocated to the UE the HS-SCCH shall be transmitted continuously with constant power.
HS-SCCH-2	HS-SCCH_Ec/Ior	DTX'd	No signalling scheduled, or power radiated, on this HS-SCCH, but signalled to the UE as present.
HS-SCCH-3	HS-SCCH_Ec/Ior	DTX'd	As HS-SCCH-2.
HS-SCCH-4	HS-SCCH_Ec/Ior	DTX'd	As HS-SCCH-2.
HS-PDSCH	HS-PDSCH_Ec/Ior	Test-specific	.
OCNS		Necessary power so that total transmit power spectral density of Node B (Ior) adds to one1	OCNS interference consists of a number of dedicated data channels as specified in table E.5.5 and E.5.5A. Table E.5.5 specifies the OCNS setup for H-Set 1 to H-Set 6. Table E.5.5A specifies the OCNS setup for H-Set 8.
NOTE 1: For dynamic power correction required to compensate for the presence of transient channels, e.g. control channels, a subset of the OCNS DPCH channels may be used.			

Remark: Power values are relative to I_{OR}

Table E.5.10 is applicable for measurements on the Transmitter Characteristics with HSDPA in clauses ***5.2A, 5.2AA***, 5.2C, 5.7A, 5.9A, 5.10A, 5.13.1A, 5.13.1AA and 5.13.2A

Table E.5.10: Test specific downlink physical channels

Parameter	Unit	Test
DPCH	DPCH_Ec/Ior (dB)	-9
HS-SCCH_1	HS-SCCH_Ec/Ior (dB)	-8
HS-PDSCH	HS-PDSCH_Ec/Ior (dB)	-3
Note: The power levels are selected high enough to keep the DTX reporting ratio very small and to ensure that the radio link is maintained during the test.		

Release 6 contain 6 fixed reference channels (FRC), the so called H-Sets, which are describing the set-up of the HS-(P)DSCH for tests specified in the 3GPP TS34.121. For the tests FRC H-SET1 is used independent of the UE category. Inter TTI is set to 3.

Table: performance requirements of UE related to HS-DSCH category

HS-DSCH category	Corresponding requierement
Category 1	H-SET1
Category 2	H-SET1
Category 3	H-SET2
Category 4	H-SET2
Category 5	H-SET3
Category 6	H-SET3
Category 7	H-SET6 (Release 6)
Category 8	H-SET6 (Release 6)
Category 11	H-SET1 4
Category 12	H-SET1 5

Table C.10.1.1: UL reference measurement channel physical parameters (12.2 kbps) for HSDPA tests and E-DCH

Parameter	Level	Unit
DPCCH/DPDCH power ratio	-5.46 (Note 1)	dB
Note 1: The power ratio for transmitter characteristics testing with HS-DPCCH depends on the beta values given in table C.10.1.4. Note 2: With the exception of the DPCCH/DPDCH power ratio parameter in this table all other parameters are defined in UL reference measurement channel in clause C.2.1, table C.2.1.1.		

Table C.10.1.1 to C.10.1.4 are applicable for tests on Transmitter Characteristics with HSDPA in clauses **5.2A**, 5.2C, 5.2AA, 5.7A, 5.9A, 5.10A, 5.13.1A and 5.13.1AA.

Table C.10.1.2: UL reference measurement channel, transport channel parameters (12.2 kbps) for HSDPA

Higher Layer	RAB/Signalling RB	RAB\SRB
Note: As defined in UL reference measurement channel in clause C.2.1, table C.2.1.2.		

Table C.10.1.3: UL reference measurement channel, TFCS (12.2 kbps) for HSDPA

Note: As defined in UL reference measurement channel in clause C.2.1, table C.2.1.3.

The standard defines **four HSDPA test configurations**, named subtests. The settings for each subtests can be found in TS34.121, Table C.11.1.4 It is enclosed here for reference.

Table C.10.1.4: β values for transmitter characteristics tests with HS-DPCCH

Subtest	βc	βd	βd (SF)	βc/βd	β_{HS} (Note1, Note 2)	CM (dB) (Note 3)	MPR (dB) (Note 3)
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15 (Note 4)	15/15 (Note 4)	64	12/15 (Note 4)	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

Note 1: ΔACK, ΔNACK and ΔCQI = 30/15 with $\beta_{hs} = 30/15 * \beta_c$.
Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA, ΔACK and ΔNACK = 30/15 with $\beta_{hs} = 30/15 * \beta_c$, and ΔCQI = 24/15 with $\beta_{hs} = 24/15 * \beta_c$.
Note 3: CM = 1 for βc/βd =12/15, βhs/βc=24/15. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.
Note 4: For subtest 2 the βc/βd ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to βc = 11/15 and βd = 15/15.

Table C.10.1.4: β values for transmitter characteristics tests with HS-DPCCH

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1, Note 2)	CM (dB) (Note 3)	MPR (dB) (Note 3)
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15 (Note 4)	15/15 (Note 4)	64	12/15 (Note 4)	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with $\beta_{hs} = 30/15 * \beta_c$.

Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA, Δ_{ACK} and Δ_{NACK} = 30/15 with $\beta_{hs} = 30/15 * \beta_c$. and Δ_{CQI} = 24/15 with $\beta_{hs} = 24/15 * \beta_c$.

Note 3: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.

Note 4: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 11/15 and β_d = 15/15.

The general set-up procedure to measure the maximum power is according 3GPP 34.121, section 5.2A(A). It is reproduced here:

1. configure the desired subtest no., set the configurable $BETA_C$, $BETA_D$ and $BETA_{HS}$ to values required (Table C10.1.4)
2. build up a HSDPA data transfer
3. send continuously power up commands to UE
4. measure the mean and peak power. (mean power averaged at least over one slot)
5. repeat the tests for each combinations of configurable BETA values as given in each subtest.

8.3. 3GPP Release 6 (HSUPA Option)

HSUPA introduced in Release 6 of the 3GPP standards is an improved step for WCDMA standards. Its objective is to enhance the uplink data transmission rate, reduce overall delay in the system and to increase the cell capacity. A new transport channel E-DCH carries the data to physical layer.

The test requierements and procedures for testing all variations of WCDMA are described in 3GPP TS34.121

The general configuration consists of:

1. enable the packet switched data transmission
2. set the mode to HSUPA Test mode and activate the HSPA channels
3. configure the HSDPA channels
4. configure the general power settings

E.5A.0 Downlink Physical Channels for connection set-up

Table E.5A.0: Levels for connection setup

Parameter During Connection setup	Unit	Value
P-CPICH_Ec/Ior	dB	-10
P-CCPCH and SCH_Ec/Ior	dB	-12
PICH _Ec/Ior	dB	-15
HS-PDSCH	dB	off
HS-SCCH_1	dB	off
DPCH_Ec/Ior	dB	-5
E-HICH	dB	off
E-AGCH	dB	off
E-RGCH	dB	off
OCNS_Ec/Ior	dB	-3.1

E.5A.1 Downlink Physical Channels for measurement

Table E.5A.1 is applicable for tests in subclause 5.2B, 5.2D, 5.2E, 5.9B, 5.10B, 5.13.2B, and 5.13.2C. Table E.5A.2 is applicable for tests in subclause 10.2.1, 10.3.1, 10.4.1. and 10.4.1A. Table E.5A.3 is applicable for tests in subclause 10.2.2, 10.3.2 and 10.3.2A.

Table E.5A.1: Downlink Physical Channel parameters for E-DCH the Transmitter Characteristics tests

Parameter During Measurement	Unit	Value	Remark
P-CPICH_Ec/Ior	dB	-10	
P-CCPCH and SCH_Ec/Ior	dB	-12	
PICH _Ec/Ior	dB	-15	
HS-PDSCH	dB	-3	During TTIs, in which the HS-PDSCH is not allocated to the UE via HS-SCCH signalling, the HS-PDSCH shall be transmitted continuously with constant power
HS-SCCH_1	dB	-8	During TTIs, in which the HS-SCCH is not allocated to the UE the HS-SCCH shall be transmitted continuously with constant power.
DPCH_Ec/Ior	dB	-10	
E-AGCH	dB	-20	
E-HICH	dB	-20	
E-RGCH	dB	DTX'd	
OCNS_Ec/Ior	dB	Necessary power so that total transmit power spectral density of Node B (Ior) adds to one	OCNS interference consists of 6 dedicated data channels as specified in table E.5A.4
NOTE 1: For dynamic power correction required to compensate for the presence of transient channels, e.g. control channels, a subset of the OCNS DPCH channels may be used. NOTE 2: For 5.2B, 5.9B, 5.10B, the power levels are selected high enough to keep the DTX reporting ratio very small and to ensure that the radio link is maintained during the test.			

The standard defines five HSUPA test configurations, named subtests with different absolute grant (AG) DELTA_E_DPCCH and BETA values. Each sub-test has its own reference TFCI and gain settings. The settings

for each subtests can be found in TS34.121, Table C.11.1.3. In order to perform the test correctly these parameters must be set-up before tests for each sub-test.

Table C.11.1.3: β values for transmitter characteristics tests with HS-DPCCH and E-DCH

Sub-test	**βc**	**βd**	**βd (SF)**	**βc/βd**	βHS (Note 1)	βec	βed (Note 5) (Note 6)	βed (SF)	βed (Codes)	CM (dB) (Note 2)	MPR (dB) (Note 2)	**AG** Index (Note 6)	**E-TFCI**
1	11/15 (Note 3)	15/15 (Note 3)	64	11/15 (Note 3)	22/15	209/225	1309/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	βed1: 47/15 βed2: 47/15	4 4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 (Note 4)	15/15 (Note 4)	64	15/15 (Note 4)	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1: ΔACK, ΔNACK and ΔCQI = 30/15 with $\beta_{hs} = 30/15 * \beta_c$.
Note 2: CM = 1 for βc/βd =12/15, □hs/□c=24/15. For all other combinations of DPDCH, DPCCH, HS- DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.
Note 3: For subtest 1 the βc/βd ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to βc = 10/15 and βd = 15/15.
Note 4: For subtest 5 the βc/βd ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to βc = 14/15 and βd = 15/15.
Note 5: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.
Note 6: βed can not be set directly, it is set by Absolute Grant Value.

Table C.11.1.3: β values for transmitter characteristics tests with HS-DPCCH and E-DCH

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1)	β_{ec}	β_{ed} (Note 5) (Note 6)	β_{ed} (SF)	β_{ed} (Codes)	CM (dB) (Note 2)	MPR (dB) (Note 2)	AG Index (Note 6)	E-TFCI
1	11/15 (Note 3)	15/15 (Note 3)	64	11/15 (Note 3)	22/15	209/225	1309/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	$\beta_{ed}1$: 47/15 $\beta_{ed}2$: 47/15	4 4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 (Note 4)	15/15 (Note 4)	64	15/15 (Note 4)	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with $\beta_{hs} = 30/15 * \beta_c$.

Note 2: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH, HS- DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.

Note 3: For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 10/15 and β_d = 15/15.

Note 4: For subtest 5 the β_c/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 14/15 and β_d = 15/15.

Note 5: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.

Note 6: β_{ed} can not be set directly, it is set by Absolute Grant Value.

Table C.11.1.4: β values for transmitter characteristics tests with HS-DPCCH and E-DCH with 16QAM

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1)	β_{ec}	β_{ed} (Note 4) (Note 5)	β_{ed} (SF)	β_{ed} (Codes)	CM (dB) (Note 2)	MPR (dB) (Note 2)	Alt. AG Index (Note 5)	E-TFCI	E-TFCI (boost)
1	11/15 (Note 3)	15/15 (Note 3)	64	11/15 (Note 3)	22/15	209/225	1309/225	[4]	[1]	[1.0]	[0.0]	18	75	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	[4]	[1]	[3.0]	[2.0]	10	67	67
3	15/15	9/15	64	15/9	30/15	30/15	$\beta_{ed}1$: 47/15 $\beta_{ed}2$: 47/15	[4] [4]	[2]	[2.0]	[1.0]	13	92	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	[4]	[1]	[3.0]	[2.0]	15	71	71

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with $\beta_{hs} = 30/15 * \beta_c$.

Note 2: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH, HS- DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.

Note 3: For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 10/15 and β_d = 15/15.

Note 4: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.

Note 5: β_{ed} can not be set directly, it is set by Absolute Grant Value.

Requiered values for **DELTA E-DPCCH:**

Subtest	DELTA E DPCCH
1	6
2	8
3	8
4	5
5	7

Table C11.3.1 is also important for setting the ***UL-RLC SDU SIZE*** parameter. This should be for all E-DCH tests set to 2936bits.

The general set-up procedure to measure the maximum power is according 3GPP 34.121, section 5.2B. It is reproduced here:

6. configure the desired subtest no., set-up all necessary parameters
7. set the UE power lower (approx. 5dB) then maximum output power
8. build up a HSUPA call
9. monitor the E-TFCI parameter transmitted and compare it with the 3GPP requirements

Subtest	**1**	**2**	**3**	**4**	**5**
Expected E-TFCI	75	67	92	71	81

10. increase UE transmit power (TPC commands +1) until E-TFCI is reducing
11. reduce UE power 1 dB and check if the target E-TFCI is transmitted, if not reduce power again.
12. record the value as maximum power

References

1. SAR measurement procedures for 3G Devices CDMA2000/Ev-Do/WCDMA/HSDPA Rev. 2.0
2. 3GPP TS34.121: V.8.3.0; Terminal conformance specification, Radio Transmission and reception (FDD)
3. Application Note from Rohde&Schwarz “1CM62”
4. CMU operating manual; Software Options CMU-K61..K69