PARTIAL T E S T R E P O R T
No.: 18-1-0097201T21a-C03

According to:
Title 47 CFR, Chapter I
FCC Regulations, Subchapter B
Part 22, Part 24

ISED-Regulations
RSS-132 Issue 3, RSS-133 Issue 6,
RSS-Gen Issue 5

for

Actia Nordic AB

103360002
Telematics Device

FCC-ID: 2AGKK103360002
ISED-ID: 20839-103360002

Laboratory Accreditation
ilac-MRA DAkkS Deutsche Akkreditierungsstelle D-PL-12047-01-01 D-PL-12047-01-03 D-PL-12047-01-04
accredited according to DIN EN ISO/IEC 17025:2018

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Table of contents

Table of Annex			
Annex No.	**Contents**	**Reference Description**	**Total Pages**
Annex 1	Test results	**CETECOM_TR18-1-0097201T21a-C03-A1**	29
Annex 2	External photographs of EUT	**CETECOM_TR18-1-0097201T19a-C03-A2**	13
Annex 3	Internal photographs of EUT	**CETECOM_TR18-1-0097201T19a-C03-A3**	05
Annex 4	Test set-up photographs	**CETECOM_TR18-1-0097201T19a-C03-A4**	06
The listed attachments are an integral part of this report.			

1. Summary of test results

The test results apply exclusively to the test samples as presented in this Report. The CETECOM GmbH does not assume responsibility for any conclusions and generalizations taken in conjunction with other specimens or samples of the type of the item presented to tests. Also we refer on special conditions which the applicant should fulfil according §2.927 to §2.948, special focus regarding modification of the equipment and availability of sample equipment for market surveillance tests.

The Equipment under Test (in this report, hereinafter referred as EUT) supports radiofrequency technologies. Delta tests apply to check for conformance against valid standards due already approved cellular wireless module **Cinterion ALAS5V-US** with **FCC-ID: QIPALAS5V-US**. Due to no modifications on the GSM Part of the module only radiated tests have been performed. In addition power verification tests have been performed too. This test report shows results for LTE technology only. Other implemented wireless technologies were not considered within this test report.

Following tests have been performed to show compliance with applicable FCC Part 2, Part 22, Subpart H, Part 24, Subpart E (Broadband PCS) of the FCC CFR Title 47 Rules, Edition 2018 and Canada RSS-132 Issue 3, RSS-133 Issue 6 and RSS-Gen Issue 5 standards.

1.1. TX mode, Test overview of FCC and Canada ISED (RSS) Standards

Test case in GSM850 band	Reference Clause FCC ☒	Reference Clause ISED ☐	Remark	Result
AC-Power Lines Conducted Emissions	§15.207(a)	RSS-Gen Issue 5:§8.8	NA	-
Conducted RF output power	§2.1046(a)	RSS-132: 5.4 + SRSP 503 :5.1.3	-	Passed
Radiated RF output power	§22.913(a)	4.4	-	Passed**
Occupied Channel Bandwidth 99%	§22.917(b), §2.202(a), §2.1049(h)	RSS-Gen, Issue 4: §6.7	NP	
26dB Emission bandwidth	§22.917(b), §2.202(a), §2.1049(h)	RSS-Gen, Issue 4: §6.7	NP	-
Radiated Band Edge	§2.1053(a), §2.1057(a)(1) §22.917(a)(b)	RSS-132, Issue 3: 5.5(i)(ii)	-	Passed
Conducted RF Band Edge	§22.917(a)(b)(c)(d) §2.1051, §2.1057(a)(1)	RSS-132, Issue 3: 5.5(i)(ii)	NP	-
Peak to Average ratio (PAPR)	§2.1046(a)	RSS-132: 5.4 + SRSP 503 :5.1.3	-	Passed
Radiated field strength emissions below 30 MHz	§15.205, §15.209	RSS-Gen: Issue 5:	-	Passed
Spurious emissions at antenna terminals	§22.917(a)(b)(c)(d) §2.1051, §2.1057(a)(1)	RSS-132, Issue 3: 5.5(i)(ii)	NP	-
Radiated spurious emissions	§2.1053(a), §2.1057(a)(1) §22.917(a)(b)	RSS-132, Issue 3: 5.5(i)(ii)	-	Passed
Frequency stability, temperature variation	§22.355, §2.1055(a)(1) (d)	RSS-Gen, Issue 5 RSS-132: 5.3	NP	-
Frequency stability, voltage variation	§22.355, §2.1055(a)(1) (d)	RSS-Gen, Issue 5 RSS-132: 5.3	NP	-

Remarks:

PASSED	The EUT complies with the essential requirements in the standard.
FAILED	The EUT does not comply with the essential requirements in the standard.
NP	The test was not performed by the CETECOM Laboratory.
Passed**	Radiated RF output power has been calculated based upon Conducted Power Verification.

For conducted and NP tests please check Initial Module Test Reports,
FCC ID: **QIPALAS5V-US**
ISED ID: **7830A-ALAS5VUS**

Test case in GSM1900 band	Reference Clause FCC	Reference Clause ISED	Remark	Result
AC-Power Lines Conducted Emissions	§15.207(a)	RSS-Gen Issue 5:§8.8	NA	-
Conducted RF output power	§2.1046(a)	RSS-133 4.1/6.4 + SRSP-510 :5.1.2	-	Passed
Radiated RF output power	§24.232(b)	6.4	-	Passed**
Occupied Channel Bandwidth 99%	§24.238(b), §2.202(a), §2.1049(h)	RSS-Gen, Issue 4: §6.7	NP	-
26dB Emission bandwidth	§24.238(b), §2.202(a), §2.1049(h)	RSS-Gen, Issue 4: §6.7	NP	-
Radiated Band Edge	§2.1053(a), §2.1057(a)(1) §24.238(a)(b)	RSS-133, Issue 6: 6.5.1(i)(ii)	-	Passed
Conducted RF Band Edge	§24.238(a)(b)(c)(d) §2.1051, §2.1057(a)(1)	RSS-133, Issue 6: 6.5.1(i)(ii)	NP	-
Peak to Average ratio (PAPR)	§2.1046(a)	RSS-133 4.1/6.4 + SRSP-510 :5.1.2	-	Passed
Radiated field strength emissions below 30 MHz	§15.205, §15.209	RSS-Gen: Issue 5:	-	Passed
Spurious emissions at antenna terminals	§24.238(a)(b)(c)(d) §2.1051, §2.1057(a)(1)	RSS-133, Issue 6: 6.5.1(i)(ii)	NP	-
Radiated spurious emissions	§2.1053(a), §2.1057(a)(1) §24.238(a)(b)	RSS-133, Issue 6: 6.5.1(i)(ii)	-	Passed
Frequency stability, temperature variation	§24.235, §2.1055(a)(1)(d)	RSS-Gen, Issue 5 RSS-133: 6.3	NP	-
Frequency stability, voltage variation	§24.235, §2.1055(a)(1)(d)	RSS-Gen, Issue 5 RSS-133: 6.3	NP	-

Remarks:

PASSED	The EUT complies with the essential requirements in the standard.
FAILED	The EUT does not comply with the essential requirements in the standard.
NP	The test was not performed by the CETECOM Laboratory.
Passed**	Radiated RF output power has been calculated based upon Conducted Power Verification.

For conducted and NP tests please check Initial Module Test Reports,
FCC ID: **QIPALAS5V-US**
ISED ID: **7830A-ALAS5VUS**

1.2. 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.

The current version of the Test Report TR18-1-0097201T21a-C03 replaces the Test Report TR18-1-0097201T21a-C02 dated 2021-08-17. The replaced Test Report is herewith invalid.

Ninovic Perez
2021.09.09
09:36:47 +
02'00'

.....
Dipl.-Ing. Ninovic Perez
Responsible for test section

Digitally signed by: Al-Amin
DN: CN = Al-Amin email = Al-Amin.Hossain@cetecom.com C = AD
Date: 2021.09.09 09:32:23 +02'00'

.....
B.Sc. Al-Amin Hossain
Responsible for test report

2. Administrative Data

2.1. Identification of the testing laboratory

Company name:	CETECOM GmbH
Address:	Im Teelbruch 116 45219 Essen - Kettwig Germany
Responsible for testing laboratory:	Dipl.-Ing. Ninovic Perez

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

Responsible for test and test report:	M.Sc. Patrick Marzotko
Project Leader:	Carsten Cleem
Receipt of EUT:	2019-11-27
Date(s) of test:	2020-01-09 to 2020-01-12
Date of report:	2021-07-19
Version of template:	13.02

2.4. Applicant's details

Applicant's name:	Actia Nordic AB
Address:	Hammarbacken 4A, 3tr 191 49 Sollentuna Sweden
Contact person:	Mr. Salah Alazawi

2.5. Manufacturer's details

Manufacturer's name:	please see Applicant's details.
Address:	please see Applicant's details.
Contact person:	please see Applicant's details.

3. Equipment under test (EUT)

3.1. SUMMARY OF RESULTS AND Technical data of main EUT declared by applicant

Module FCC ID	QIPALAS5V-US
Module ISED	7830A-ALAS5VUS
TX-frequency range (E-UTRA operating bands)	☒ GSM/E-GPRS 850 MHz Band: Channel 128/192/251 ☒ GSM/E-GPRS 1900 MHz Band: Channel 512/661/810
Type of modulation	☒ GSM,GPRS, GMSK ☒ EGPRS-Mode: 8-PSK
Number of channels – Table 5.4.4-1 accord. 3GPP TS36.521-1 (See Note in 3GPP-Standard about channels not to be used depending on channel bandwidths)	☒ GSM 850: 128 – 251, 125 channels ☒ GSM1900: 512 – 810, 300 channels
Emission designator(s)	See initial certification of the module FCC ID: QIPALAS5V-US ISED ID: 7830A-ALAS5VUS
Antenna Type	☒ Integrated ☒ External, separate RF-connector (Fakra)
Antenna Model	LTE Antenna 7680588
Antenna Gain Tx *1)	☒ Values: Internal Antenna Gain 698MHz-960MHz: 0,2 dBi 1710MHz-2690: 0,2 dBi External Antenna Gain: (GSM 850) 824MHz: 1,8 dBi (GSM 1900) 1850MHz: 3,2 dBi

Max. Output Power: Conducted GSM 850	31.7 dBm (RMS)		
Max. Output Power: Conducted GSM 1900	28.3 dBm (RMS)		
Peak EIRP(Internal Antenna) Conducted GSM 850	= Max Output Power + Antenna Gain - internal loss 31.7 dBm + 0.2 dBi – 0.6 dB = 31.3 dBm		
Peak EIRP(Internal Antenna) Conducted GSM 1900	= Max Output Power + Antenna Gain - internal loss 28.3 dBm + 0.2 dBi – 0.6 dB = 27.9 dBm		
Peak ERP(Internal Antenna) Conducted GSM 850	= EIRP – 2.15 31.3 dBm – 2.15 = 29.15 dBm		
Peak ERP(Internal Antenna) Conducted GSM 1900	= EIRP – 2.15 27.9 dBm – 2.15 = 25.75 dBm		
Peak EIRP(External Antenna) Conducted GSM 850	= Max Output Power + Antenna Gain - internal loss - cable loss 31.7 dBm + 1.8 dBi – 0.63 dB – 1,24 dB = 31.63 dBm		
Peak EIRP(External Antenna) Conducted GSM 1900	= Max Output Power + Antenna Gain - internal loss - cable loss 28.3 dBm + 3.2 dBi – 0.94 dB – 1,90 dB = 28.66 dBm		
Peak ERP(External Antenna) Conducted GSM 850	= EIRP – 2.15 31.63 dBm – 2.15 = 29.48 dBm		
Peak ERP(External Antenna) Conducted GSM 1900	= EIRP – 2.15 28.66 dBm – 2.15 = 26.51 dBm		
Power supply	☒ 13,8V DC power supply		
Special EMI components	--		
EUT sample type	☐ Production	☒ Pre-Production	☐ Engineering
FCC/ISED label attached	☒ yes	☐ no	

Remark: *1) :

- For Antenna Gain and Path Loss data sheet please check the document" **MPE Information Requirements NA_103360002_1.2**".
- In this Chapter ERP/EIRP has been calculated with respect to Conducted Power verification, for more information please check chapter 5.1.4

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

Short descrip-tion*)	EUT	Type	S/N serial number	HW hardware status	SW software status
EUT A S20	103360002	Telematics Device	AN10335010 2B160	H1	1
EUT B S17	103360002	Telematics Device	AN10335010 2B163	H1	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 descrip-tion *)	Auxiliary Equipment	Type	S/N serial number	HW hardware status	FW Firmware status
AE 1	Cellular Antenna	CALEARO LTE antenna	7680588	16MA800CP	N/A
AE 2	WLAN Antenna	CALEARO WiFi antenna	7750162	16MA439CP	N/A
AE 3	Bluetooth Antenna	--	--	N/A	N/A
AE 4	GNSS Antenna	CALEARO GNSS antenna	7750161	N/A	N/A
AE 5	Cable	Harness	--	--	--
AE 6	Cable	Ethernet + USB	--	--	--
AE 7	Cable(4 pcs)	FAKRA	--	--	--

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

3.4. EUT set-ups

EUT set-up no.*)	Combination of EUT and AE	Remarks
set. 1	EUT A + AE 1 + AE 2 + AE 3 + AE 4 + AE 5 + AE 6 + AE 7	➢ se-tup-1 considered for Radiated testing ➢ AE 3 is integrated in the Sample. ➢ EUT + External Antenna
set. 2	EUT A + AE 1 + AE 2 + AE 3 + AE 4 + AE 5 + AE 6 + AE 7	➢ se-tup-2 considered for Radiated testing ➢ AE 3 is integrated in the Sample. ➢ EUT + Internal Antenna
set. 3	EUT B + AE 5	➢ se-tup-1 considered for Conducted testing

*) 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	GPRS 850 Data Traffic channels = 128/192/251	A communication link is established between the mobile station and the test simulator. The transmitter is operated at its maximum rated output power: 33 dBm (power class 4; power control level 5). USF_Duty CYCLE set to 100%, coding scheme CS-1 for GMSK modulation, slot 3 active, uplink gamma: 3 (33 dBm). The input signal to the receiver is modulated with normal test modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link.
op. 2	GPRS 1900 Data Traffic channels = 512/661/810	A communication link is established between the mobile station and the test simulator. The transmitter is operated at its maximum rated output power: 30 dBm (power class 1; power control level 0). USF_Duty CYCLE set to 100%, coding scheme CS-1 for GMSK modulation, slot 3 active, uplink gamma: 3 (30 dBm). The input signal to the receiver is modulated with normal test modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link
op. 3	E-GPRS 850 Data Traffic channels = 128/192/251	A communication link is established between the mobile station and the test simulator. The transmitter is operated at its maximum rated output power: 33 dBm (power class 4; power control level 5). USF_Duty CYCLE set to 100%, coding scheme MCS-5 for 8PSK modulation, slot 3 active, uplink gamma: 6 (27dBm). The input signal to the receiver is modulated with normal test modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link.
op. 4	E-GPRS 1900 Data traffic channels = 512/661/810	A communication link is established between the mobile station and the test simulator. The transmitter is operated at its maximum rated output power: 30 dBm (power class 1; power control level 0). USF_Duty CYCLE set to 100%, coding scheme MCS-5 for 8-PSK modulation, slot 3 active, uplink gamma: 5 (26 dBm). The input signal to the receiver is modulated with normal test modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link.

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

3.6. Worst case selection

Configuration of bandwidth, modulation was extrapolated from the modular test report, for more information please check module report,
Module Test Report FCC ID: QIPALAS5V-US
Module Test Report IC ID: 7830A-ALAS5VUS

GPRS-Modulation 850MHz Band		CETECOM tested power_GSM850			Certified module power_GSM850
	ARFCN-Frequency [MHz]	Peak detector [dBm]	Average detector [dBm]	PAR Factor [dB]	Average detector [dBm]
Channel 128	824.2	31.9	31.7	0.2	32.37
Channel 190	836.6	31.8	31.6	0.2	32.32
Channel 251	848.8	31.6	31.4	0.2	32.19

E-GPRS/EDGE Modulation 850MHz Band		CETECOM tested power_GSM850			Certified module power_GSM850
	ARFCN-Frequency [MHz]	Peak detector [dBm]	Average detector [dBm]	PAR Factor [dB]	Average detector [dBm]
Channel 128	824.2	28.8	25.6	3.2	26.19
Channel 190	836.6	28.6	25.4	3.2	26.36
Channel 251	848.8	28.5	25.3	3.2	26.14

Worst Case found by GSM 850

- Channel 128
- Modulation GMSK

Conclusion conducted power verification:
All Conducted Power verification results are below the Initial module Power Value.
Therefore Conducted Output Power has been Passed.

GPRS-Modulation 1900MHz Band		CETECOM tested power_GSM1900			Certified module power_GSM1900
	ARFCN-Frequency [MHz]	Peak detector [dBm]	Average detector [dBm]	PAR Factor [dB]	Average detector [dBm]
Channel 512	1850.2	28.1	27.6	0.5	29.29
Channel 662	1880.0	28.4	28.0	0.4	29.34
Channel 810	1909.8	28.6	28.3	0.3	29.24

E-GPRS/EDGE Modulation 1900MHz Band		CETECOM tested power_GSM1900			Certified module power_GSM1900
	ARFCN-Frequency [MHz]	Peak detector [dBm]	Average detector [dBm]	PAR Factor [dB]	Average detector [dBm]
Channel 512	1850.2	26.7	23.1	3.6	25.44
Channel 662	1880.0	26.9	23.3	3.6	25.31
Channel 810	1909.8	27.2	23.7	3.5	25.35

Worst Case found by GSM 1900
- Channel 810
- Modulation GMSK

Conclusion conducted power verification:
All Conducted Power verification results are below the Initial module Power Value.

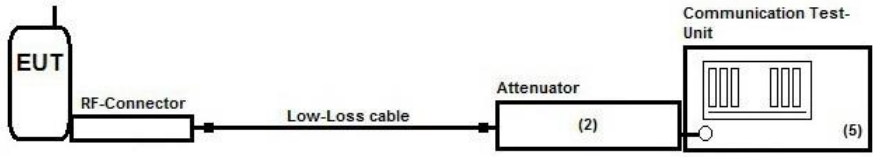
4. Description of test system set-up's

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

Cellular Conducted RF-Setup 2 (Cel-2 Set-up)

Tests Specification: Conducted Carrier power, Frequency Error

Schematic: Following modified test set-up apply for tests performed inside the climatic chamber (frequency stability) or conducted RF-carrier power-measurement. The EUT RF-Signal is directly connected over suitable RF-connector over low-loss cable and an attenuator (2) to the cellular radio communication test-unit. (5)



Testing method: ANSI C63.10:2013, KDB 971168 D01 v02r02

Used Equipment

Passive Elements	Test Equipment	Remark:
☒ 10 dB Attenuator (#DG3)	☒ CMU200	See List of equipment under each test case and chapter 8. for calibration info
☒ Low loss RF-cables(**0.3 to 0.5 dB**)	☒ DC-Power Supply	

Measurement uncertainty See chapter Measurement Uncertainties (Cel-2)

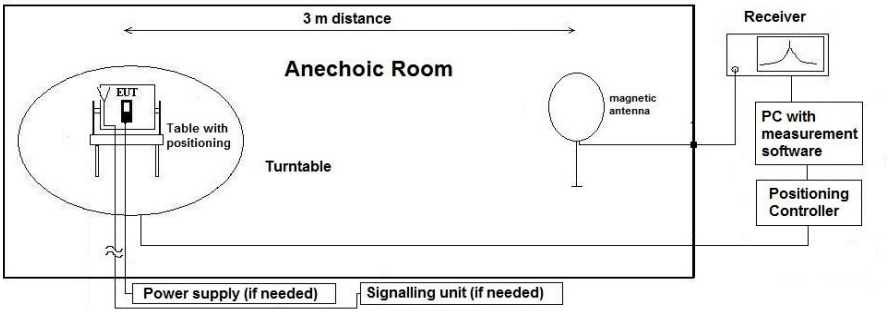
4.2. Test system set-up for radiated magnetic field measurements below 30 MHz

Specification: ANSI C63.4-2014 §5.3, §8.2.1, §8.3.1.1+§8.3.2.1 , ANSI C63.10-2013 chapter 6.4 (§6.4.4.2)

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

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

Schematic:



Testing method:

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

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

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

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

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

Formula:

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

$M = L_T - E_C$

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

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

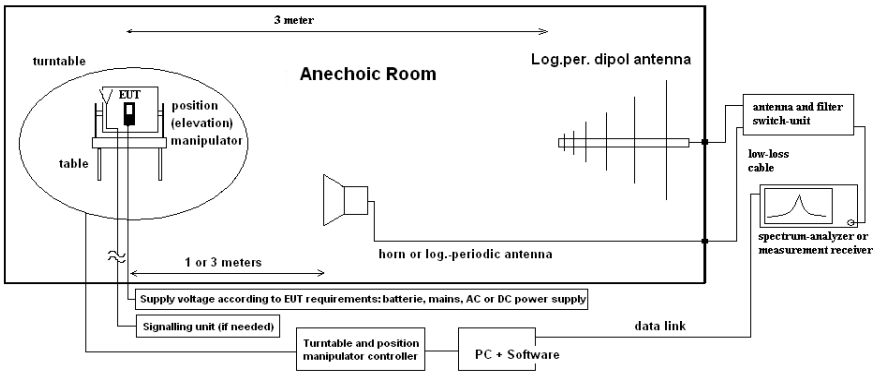
Distance correction: Reference for applied correction (extrapolating) factors due to reduced measurement distance:
ANSI C63.10:2013, §6.4.4.2 - Equations (2) + (3) + (4)

4.3. Test system set-up for radiated spurious emission measurements

Specification: ANSI C63.4-2014 chapter 8.3, ANSI C63.10-2013 chapter 6.6.3.3 & 6.6.4, ANSI C63.26-2015, Chapter 4.6.3.3

General Description: Evaluating the emissions have to be done first by an exploratory emissions measurement and a final measurement for most critical frequencies. The tests are performed in a CISPR 16-1-4:2010 compliant fully anechoic room (FAR) recognized by the regulatory commission. The measurement distance was set to 3 meter for frequencies up to 18 GHz and 2 meter above 18 GHz. A logarithmic periodic antenna is used for the frequency range 30 MHz to 1 GHz. Horn antennas are used for frequency range 1 GHz to 40 GHz. The EUT is aligned within 3 dB beam width of the measurement antenna with three orthogonal axis measurements on the EUT.

Schematic:



Testing method:

Exploratory, preliminary measurements
The EUT and its associated accessories are placed on a non-conductive position manipulator (tipping device) of 1.50 m height which is placed on the turntable. By rotating the turntable (range 0° to 360°, step 45°) and the EUT itself on 3-orthogonal axis (the emission spectrum and its characteristics was recorded with an EMI-receiver, broadband antenna and software.
The measurements are performed in horizontal and vertical polarization of the measurement antennas. The results are documented in a diagram. Critical frequencies (low margin to limit) are saved within a table for further investigations. If various operating modes are supported, further investigations are made to find the worst-case of them. Also the interconnection cables and equipment position were varied in order to maximize the emissions.

Final measurement on critical frequencies
Based on the exploratory measurements, the most critical frequencies are re-measured by main-training the EUT's worst-case operation mode, cable position, etc.
First a frequency zoom around the critical frequency is done to locate the frequency more precisely. After this step, for all identified critical frequencies, the maximum peak was determined.
Following parameters were varied: the turntable angle continuously in the range 0 to 360 degree, the EUT itself over 3-orthogonal axis and the height for EUT with large dimensions.
On the determined worst-case position, a final measurement with necessary bandwidth and detector according standard has been carried out.
The readings on the spectrum analyzer are corrected with conversion value between field strength and E (I) RP, so the readings shown are equivalent to ERP/EIRP values. Critical measurements near the limit are re-measured with a substitution method accord. ANSI/TIA/EIA 603 C/D

Formula:

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

$Ec_{E(I)RP} = Ec - 95.2\ dB$

$M = L_T - Ec_{E(I)RP}$

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

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

5. Measurements

5.1. RF-Parameter - RF Peak power output conducted and PAPR

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			
test site	☐ 347 Radio.lab. 1	☒ Radio.lab. 2				
spectr. analys.	☐ 584 FSU	☐ 489 ESU 40	☐ 264 FSEK	☐ 620 ESU 26		
signaling	☐ 392 MT8820A	☐ 436 CMU	☒ 546 CMU	☐ 757 CMW		
otherwise	☐ 400 FTC40x15E	☐ 401 FTC40x15E	☐ 110 USB LWL	☐ 482 Filter Matrix	☐ 378 RadiSense	
DC power	☒ 456 EA 3013A	☐ 463 HP3245A	☐ 459 EA 2032-50	☐ 268 EA- 3050	☐ 494 AG6632A	☐ 611 E3632A
otherwise	☐ 331 HC 4055	☐ 248 6 dB Att.	☐ 529 Power div.	☐ - cable OTA20		☐ 530 10 dB Att.
line voltage	☒ 13.8V DC		☐060 120 V/ 60 Hz via PAS 5000 (EUT Power supply: 5V DC USB over 120V AC via PAS 5000)			

5.1.2. Requirements and limits

FCC	§2.1046(a)
ISED	RSS-132 : 5.4 + SRSP 503 :5.1.3 for GSM 850 RSS-133 4.1/6.4 + SRSP-510 :5.1.2 for GSM 1900
ANSI	C63.26-2015
Limit	Maximum conducted output power of the transmitter should be determined while measured on RF output terminal.
	Limit GSM850: 7 Watt (38.4 dBm)
	Limit GSM1900: 2 Watt (33.0 dBm)
	PAPR≤13 dB

5.1.3. Test condition and test set-up

Climatic conditions	Temperature: (22±3°C)	Rel. humidity: (40±20)%
Test system set-up	Please see chapter “Test system set-up for conducted measurements on antenna port”	
Measurement method	The measurements were performed with the integrated power measurement function of the „radio communication tester CMU200 from Rohde&Schwarz company. In this way spectrum-analyzers instrument limitations can be avoided or minimized. Instead, CMU manufacturers declared measurement error can be considered for this measurement. The attenuation (insertion loss) at the RF Inputs/Outputs of CMU were set according the path loss of the test set-up, determined in a step before starting the measurements. A suitable artificial antenna or RF-connector is provided by the applicant in order to perform the conducted measurements. Any data provided with the artificial antenna or connector, have been taken in account in order to correct the measurement data. (typical 0.3dB for attenuation of antenna connector) Peak and Average Values have been recorded for each channel on test set-up Cel-2. The Peak-to - Average-Power Ratio is determined on test set-up Cel-1 with corresponding settings. (see plots). The guideline in ANSIC63.26-2016 is taken into account.	
Mobile phone settings	A call was established with settings according chapter “Parameter settings on mobile phone and base station CMU200” UE Power should be set to maximum, continuous transmission. DTX or other power saving techniques have been disabled The measurements were made at the low, middle and high carrier frequencies of each of the supported operating band. Choosing three TX-carrier frequencies of the mobile phone, should be sufficient to demonstrate compliance.	

5.1.4. Measurement results Radiated RF output power

ERP/EIRP: EUT External Antenna

GPRS-Modulation 850MHz Band														
	ARFCN-Frequency (MHz)	Average power at Antenna Port (dBm)	Maximum declared Antenna Gain(dBi)	Path loss to Antenna Connector	Path loss in Antenna Cable	EIRP in dBm	EIRP in Watt	ERP in dBm	ERP in Watt	FCC Limit(W), ERP	FCC Limit (dBm), ERP	ISED Limit(W), EIRP	ISED Limit (dBm), EIRP	Verdict
Channel 128	824.2	32.37	1.80	0.63	1.24	32.30	1.69824	30.15	1.03514	7.00	38.45	11.50	40.61	Passed
Channel 189	836.6	32.32	1.80	0.63	1.24	32.25	1.67880	30.10	1.02329	7.00	38.45	11.50	40.61	Passed
Channel 251	848.8	32.19	1.80	0.63	1.24	32.12	1.62930	29.97	0.99312	7.00	38.45	11.50	40.61	Passed
E-GPRS/EDGE Mode 850MHz Band														
Channel 128	824.2	26.19	1.80	0.63	1.24	26.12	0.40926	23.97	0.24946	7.00	38.45	11.50	40.61	Passed
Channel 189	836.6	26.36	1.80	0.63	1.24	26.29	0.42560	24.14	0.25942	7.00	38.45	11.50	40.61	Passed
Channel 251	848.8	26.14	1.80	0.63	1.24	26.07	0.40458	23.92	0.24660	7.00	38.45	11.50	40.61	Passed
GPRS-Modulation 1900MHz Band														
	ARFCN-Frequency (MHz)	Average power at Antenna Port (dBm)	Maximum declared Antenna Gain(dBi)	Path loss to Antenna Connector	Path loss in Antenna Cable	EIRP in dBm	EIRP in Watt			FCC Limit(W), EIRP	FCC Limit (dBm); EIRP	ISED Limit(W), EIRP	ISED Limit (dBm), EIRP	Verdict
Channel 512	1850.2	29.29	3.20	0.94	1.90	29.65	0.92257	x	x	2.00	33.01	2.00	33.01	Passed
Channel 661	1880.2	29.34	3.20	0.94	1.90	29.70	0.93325	x	x	2.00	33.01	2.00	33.01	Passed
Channel 810	1909.8	29.24	3.20	0.94	1.90	29.60	0.91201	x	x	2.00	33.01	2.00	33.01	Passed
E-GPRS/EDGE Mode 1900MHz Band														
Channel 512	1850.2	25.44	3.20	0.94	1.90	25.80	0.38019	x	x	2.00	33.01	2.00	33.01	Passed
Channel 661	1880.2	25.31	3.20	0.94	1.90	25.67	0.36898	x	x	2.00	33.01	2.00	33.01	Passed
Channel 810	1909.8	25.35	3.20	0.94	1.90	25.71	0.37239	x	x	2.00	33.01	2.00	33.01	Passed
EIRP= Average Power at Antenna Port + Maximum declared Antenna Gain - Path loss to Antenna Connector - Path loss in Antenna Cable														
ERP = EIRP - 2.15														

Remarks:

- Radiated RF output power has been calculated based upon Conducted Power Verification.
- Initial Module Conducted Power has been taken to calculate ERP and EIRP.
- For Antenna Gain and Path Loss data sheet please check the document" **MPE Information Requirements NA_103360002_1.2**".
- For Initial Module Conducted Power, please check the module Report,
  - Module Test Report FCC ID: QIPALAS5V-US
  - Module Test Report IC ID: 7830A-ALAS5VUS

ERP/EIRP: EUT Internal Antenna

GPRS-Modulation 850MHz Band														
	ARFCN-Frequency (MHz)	Average power at Antenna Port (dBm)	Maximum declared Antenna Gain(dBi)	Path loss to Antenna Connector	Path loss in Antenna Cable	EIRP in dBm	EIRP in Watt	ERP in dBm	ERP in Watt	FCC Limit(W), ERP	FCC Limit (dBm), ERP	ISED Limit(W), EIRP	ISED Limit (dBm), EIRP	Verdict
Channel 128	824.2	32.37	0.20	0.60	0.00	31.97	1.57398	29.82	0.95940	7.00	38.45	11.50	40.61	Passed
Channel 189	836.6	32.32	0.20	0.60	0.00	31.92	1.55597	29.77	0.94842	7.00	38.45	11.50	40.61	Passed
Channel 251	848.8	32.19	0.20	0.60	0.00	31.79	1.51008	29.64	0.92045	7.00	38.45	11.50	40.61	Passed
E-GPRS/EDGE Mode 850MHz Band														
Channel 128	824.2	26.19	0.20	0.60	0.00	25.79	0.37931	23.64	0.23121	7.00	38.45	11.50	40.61	Passed
Channel 189	836.6	26.36	0.20	0.60	0.00	25.96	0.39446	23.81	0.24044	7.00	38.45	11.50	40.61	Passed
Channel 251	848.8	26.14	0.20	0.60	0.00	25.74	0.37497	23.59	0.22856	7.00	38.45	11.50	40.61	Passed
GPRS-Modulation 1900MHz Band														
	ARFCN-Frequency (MHz)	Average power at Antenna Port (dBm)	Maximum declared Antenna Gain(dBi)	Path loss to Antenna Connector	Path loss in Antenna Cable	EIRP in dBm	EIRP in Watt			FCC Limit(W), EIRP	FCC Limit (dBm); EIRP	ISED Limit(W), EIRP	ISED Limit (dBm), EIRP	Verdict
Channel 512	1850.2	29.29	0.20	0.60	0.00	28.89	0.77446	x	x	2.00	33.00	2.00	33.01	Passed
Channel 661	1880.2	29.34	0.20	0.60	0.00	28.94	0.78343	x	x	2.00	33.00	2.00	33.01	Passed
Channel 810	1909.8	29.24	0.20	0.60	0.00	28.84	0.76560	x	x	2.00	33.00	2.00	33.01	Passed
E-GPRS/EDGE Mode 1900MHz Band														
Channel 512	1850.2	25.44	0.20	0.60	0.00	25.04	0.31915	x	x	2.00	33.00	2.00	33.01	Passed
Channel 661	1880.2	25.31	0.20	0.60	0.00	24.91	0.30974	x	x	2.00	33.00	2.00	33.01	Passed
Channel 810	1909.8	25.35	0.20	0.60	0.00	24.95	0.31261	x	x	2.00	33.00	2.00	33.01	Passed
EIRP= Average Power at Antenna Port + Maximum declared Antenna Gain - Path loss to Antenna Connector - Path loss in Antenna Cable														
ERP = EIRP - 2.15														

Remarks:

- Radiated RF output power has been calculated based upon Conducted Power Verification.
- Initial Module Conducted Power has been taken to calculate ERP and EIRP.
- For Antenna Gain and Path Loss data sheet please check the document" **MPE Information Requirements NA_103360002_1.2**".
- For Initial Module Conducted Power, please check the module Report,
  - Module Test Report FCC ID: QIPALAS5V-US
  - Module Test Report IC ID: 7830A-ALAS5VUS

Op. Mode 1, Set-up 3

Op. Mode	Carrier Channel		Peak Output Power [dBm]	Average Output Power [dBm]	PAPR-Ratio on 0.1% probability [dB]	Peak power Limit	PAPR-Limit	Result
	Range	No.				[dBm]	[dB]	
GSM 850	Low	128	31.9	31.7	0.2	31.9	13	Passed
	Middle	192	31.8	31.6	0.2			
	High	251	31.6	31.4	0.2			

Remark: --

Op. Mode 3, Set-up 3

Op. Mode	Carrier Channel		Peak Output Power [dBm]	Average Output Power [dBm]	PAPR-Ratio on 0.1% probability [dB]	Peak power Limit	PAPR-Limit	Result
	Range	No.				[dBm]	[dB]	
E-GPRS 850	Low	128	28.8	25.6	3.2	28.8	13	Passed
	Middle	192	28.6	25.4	3.2			
	High	251	28.5	25.3	3.2			

Remark: --

Op. Mode 2, Set-up 3

Op. Mode	Carrier Channel		Peak Output Power [dBm]	Average Output Power [dBm]	PAPR-Ratio on 0.1% probability [dB]	Peak power Limit	PAPR-Limit	Result
	Range	No.				[dBm]	[dB]	
GSM 1900	Low	512	28.1	27.6	0.5	28.6	13	Passed
	Middle	661	28.4	28.0	0.4			
	High	810	28.6	28.3	0.3			

Remark: --

Op. Mode 4, Set-up 3

Op. Mode	Carrier Channel		Peak Output Power [dBm]	Average Output Power [dBm]	PAPR-Ratio on 0.1% probability [dB]	Peak power Limit	PAPR-Limit	Result
	Range	No.				[dBm]	[dB]	
E-GPRS 1900	Low	512	26.7	23.1	3.6	27.2	13	Passed
	Middle	661	26.9	23.3	3.6			
	High	810	27.2	23.7	3.5			

Remark: --

5.1.5. Conducted Power Verification

5.1.6. PAPR-results

According KDB 971168D01 v03r01 two method are allowed.

☐ Chapter 5.7.2 Sub clause 5.2.3.4 of ANSI C63.26-2015 CCDF-Method (0.1% probability)

☒ Chapter 5.7.3: Sub clause 5.2.6 of ANSI C63.26-2015 [PAPR (dB)=$\mathbf{P}_{PK}$ (dBm or dBW) – $\mathbf{P}_{Avg}$ (dBm or dBW)]

5.1.6.1. Conclusion

☒ Conducted output power – pass

☒ Radiated output power – pass

☒ PAPR <13dB – pass

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

5.2.1. Test location and 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	☒ 021 EMCO 6502	☐ 477 GPS
signaling	☐ 392 MT8820A	☐ 371 CBT32	☐ 547 CMU	☒ 546 CMU 200		
otherwise	☐ 400 FTC40x15E	☐ 401 FTC40x15E	☐ 110 USB LWL	☐ 482 Filter Matrix	☐ 378 RadiSense	
Power supply	☒ 456 EA 3013A	☐ 457 EA 3013A	☐ 459 EA 2032-50	☐ 268 EA- 3050	☐ 494 AG6632A	☐ 498 NGPE 40
DC voltage	☒ 13.8 V DC		☐060 120 V/ 60 Hz via PAS 5000			

5.2.2. Requirements

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

5.2.3. Test condition and test set-up

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

5.2.4. Measurement Results

The results are presented below in summary form only. For more information please consult the diagrams included in annex 1.

Diagram No.	Carrier Channel		Frequency range	Set-up no.	OP-mode no.	Remark	Used detector			Result
	Band	No.					PK	AV	QP	
2.01	850	128	9 kHz-30 MHz	2	1	EUT Internal Antenna + EUT position Laying	☒	☐	☐	passed
2.02	850	128	9 kHz-30 MHz	2	1	EUT Internal Antenna + EUT position Standing	☒	☐	☐	passed
2.03	850	128	9 kHz-30 MHz	1	1	EUT External Antenna + EUT position Laying	☒	☐	☐	passed
2.04	850	128	9 kHz-30 MHz	1	1	EUT External Antenna + EUT position Laying	☒	☐	☐	passed
2.05	1900	810	9 kHz-30 MHz	2	2	EUT Internal Antenna + EUT Laying position	☒	☐	☐	passed
2.06	1900	810	9 kHz-30 MHz	2	2	EUT Internal Antenna + EUT Standing position	☒	☐	☐	passed
2.07	1900	810	9 kHz-30 MHz	1	2	EUT External Antenna + EUT Laying position	☒	☐	☐	passed
2.08	1900	810	9 kHz-30 MHz	1	2	EUT External Antenna + EUT Standing position	☒	☐	☐	passed

Remark 1: For measurements diagram, please see Annex A1(18-1-0097201T21a_C03_A1)

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

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

Frequency -Range	f [kHz/MHz]	Lambda [m]	Far-Field Point [m]	Distance Limit accord. 15.209 [m]	1st Condition (dmeas< $D_{near-field}$)	2'te Condition (Limit distance bigger $d_{near-field}$)	Distance Correction accord. Formula
kHz	9,00E+03	33333,33	5305,17	300	fullfilled	not fullfilled	-80,00
	1,00E+04	30000,00	4774,65		fullfilled	not fullfilled	-80,00
	2,00E+04	15000,00	2387,33		fullfilled	not fullfilled	-80,00
	3,00E+04	10000,00	1591,55		fullfilled	not fullfilled	-80,00
	4,00E+04	7500,00	1193,66		fullfilled	not fullfilled	-80,00
	5,00E+04	6000,00	954,93		fullfilled	not fullfilled	-80,00
	6,00E+04	5000,00	795,78		fullfilled	not fullfilled	-80,00
	7,00E+04	4285,71	682,09		fullfilled	not fullfilled	-80,00
	8,00E+04	3750,00	596,83		fullfilled	not fullfilled	-80,00
	9,00E+04	3333,33	530,52		fullfilled	not fullfilled	-80,00
	1,00E+05	3000,00	477,47		fullfilled	not fullfilled	-80,00
	1,25E+05	2400,00	381,97		fullfilled	not fullfilled	-80,00
	2,00E+05	1500,00	238,73		fullfilled	fullfilled	-78,02
	3,00E+05	1000,00	159,16		fullfilled	fullfilled	-74,49
	4,00E+05	750,00	119,37		fullfilled	fullfilled	-72,00
	4,90E+05	612,24	97,44		fullfilled	fullfilled	-70,23
	5,00E+05	600,00	95,49	30	fullfilled	not fullfilled	-40,00
	6,00E+05	500,00	79,58		fullfilled	not fullfilled	-40,00
	7,00E+05	428,57	68,21		fullfilled	not fullfilled	-40,00
	8,00E+05	375,00	59,68		fullfilled	not fullfilled	-40,00
	9,00E+05	333,33	53,05		fullfilled	not fullfilled	-40,00
MHz	1,00	300,00	47,75		fullfilled	not fullfilled	-40,00
	1,59	188,50	30,00		fullfilled	not fullfilled	-40,00
	2,00	150,00	23,87		fullfilled	fullfilled	-38,02
	3,00	100,00	15,92		fullfilled	fullfilled	-34,49
	4,00	75,00	11,94		fullfilled	fullfilled	-32,00
	5,00	60,00	9,55		fullfilled	fullfilled	-30,06
	6,00	50,00	7,96		fullfilled	fullfilled	-28,47
	7,00	42,86	6,82		fullfilled	fullfilled	-27,13
	8,00	37,50	5,97		fullfilled	fullfilled	-25,97
	9,00	33,33	5,31		fullfilled	fullfilled	-24,95
	10,00	30,00	4,77		fullfilled	fullfilled	-24,04
	10,60	28,30	4,50		fullfilled	fullfilled	-23,53
	11,00	27,27	4,34		fullfilled	fullfilled	-23,21
	12,00	25,00	3,98		fullfilled	fullfilled	-22,45
	13,56	22,12	3,52		fullfilled	fullfilled	-21,39
	15,00	20,00	3,18		fullfilled	fullfilled	-20,51
	15,92	18,85	3,00		fullfilled	fullfilled	-20,00
	17,00	17,65	2,81		not fullfilled	fullfilled	-20,00
	18,00	16,67	2,65		not fullfilled	fullfilled	-20,00
	20,00	15,00	2,39		not fullfilled	fullfilled	-20,00
	21,00	14,29	2,27		not fullfilled	fullfilled	-20,00
	23,00	13,04	2,08		not fullfilled	fullfilled	-20,00
	25,00	12,00	1,91		not fullfilled	fullfilled	-20,00
	27,00	11,11	1,77		not fullfilled	fullfilled	-20,00
	29,00	10,34	1,65		not fullfilled	fullfilled	-20,00
	30,00	10,00	1,59		not fullfilled	fullfilled	-20,00

5.3. RF-Parameter - Radiated out of Band RF emissions and Band Edge

5.3.1. 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	☒ 443 FAR	☐ 347 Radio.lab.1	☐ 347 Radio.lab.2	
receiver	☐ 377 ESCS30	☐ 001 ESS	☐ 489 ESU 40	☐ ESU 26		
spectr. analys.	☒ 584 FSU	☐ 120 FSEM	☐ 264 FSEK			
antenna	☒ 608 HL 562	☒ 549 HL 025	☐ 302 BBHA9170	☐ 289 CBL 6141	☐ 030 HFH-Z2	☐ 477 GPS
signaling	☐ 017 CMD 65	☐ 323 CMD 55	☐ 340 CMD 55			
signaling	☐ 392 MT8820A	☐ 546 CMU	☐ 547 CMU	☒ 546 CMU200		
power supply	☒ 611 E3632A	☐ 457 EA 3013A	☐ 459 EA 2032-50	☐ 268 EA- 3050	☐ 494 AG6632A	☐ 498 NGPE 40
otherwise	☐ 529 6dB divider	☐ 530 6dB Att.	☐ 110 USB LWL	☐ 482 Filter Matrix	☐ 431 Near field	
DC voltage	☒ 13.8 V DC		☐060 120 V/ 60 Hz via PAS 5000			

5.3.2. Requirements and limits

FCC	☒ Part 2.1053(a), Part2.1057(a)(1) ☒ Part 22 Subpart H, §22.917(a)(b) ☒ Part 24 Subpart E, §24.238(a)(b)
ISED	☒ RSS-132, Issue 3: 5.5(i)(ii) ☒ RSS-133, Issue 6: 6.5.1(i)(ii)
Limit	**§22.917(a) & §24.238(a):** "The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB" **Limit:** -13dBm for all Power Control Levels of the cellular equipment

5.3.3. Test condition and test set-up

link to test system (if used):	☐ air link	☐ cable connection	☒ none
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)%
Test system set-up	Please see chapter "Test system set-up for radiated spurious emission measurements up to 20 GHz"		
Measurement method	*"§ 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"* The spectrum was scanned from 9 kHz (depend on the equipment, s. §2.1057) to the 10th harmonic of the highest frequency generated within the equipment. A PEAK detector was used except measurements near the block-edge where a AVERAGE detector applied. According chapter "Test system set-up for electric field measurement in the range 30-1000MHz and 1 to 40GHz" and additionally: the readings on the spectrum analyzer are corrected with annually performed chamber path calibration values so the readings shown are equivalent to ERP/EIRP values. Critical measurements near the limit are re-measured with a substitution method accord. ANSI/TIA/EIA 603.		
EUT settings	A call was established with settings according chapter "Parameter settings on mobile phone and base station CMU200" The UE and used accessories (if any used) were set to work according their intended use/specification stated as by the applicant The measurements were made at the low, middle and high carrier frequencies of each of the supported operating band. Choosing three TX-carrier frequencies of the wireless device, should be sufficient to demonstrate compliance.		

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

Sweep no.	Start freq. MHz	Stop freq. MHz	R-BW MHz	V-BW MHz	Sweep time sec.	Att. [dB]	Detector
Sweep 1 (subrange 1)	30	1000	0.1	0.3	10	10	MaxH-PK
Sweep 2 (subrange 2)	1000	2800	0.1	0.3	15	10	MaxH-PK
Sweep 3 (subrange 3)	2800	9000	0.1	0.3	60	10	MaxH-PK
Sweep 4a (Band-Edge)	823	824	0.003	0.01	30	10	MaxH-PK
Sweep 4b (Band-Edge)	849	850	0.003	0.01	30	10	MaxH-PK

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

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

5.3.4. Measurement results

The results are presented below in summary form only. For more information please see each diagram enclosed in annex 1.

☒ EUT laying and standing position (hand-held device assumption)

☐ standing position only (defined position of operation according applicant's manual)

5.3.5. Spurious Results

The results are presented below in summary form only.
For more information please see the diagrams enclosed in annex 1. (18-1-0097201T21a_C03_A1)

5.3.5.1. GSM 850: Set-up 1 (EUT + External Antenna)

Diagram no.	Carrier Channel		Frequency range	OP-mode no.	Remark	Used detector			Result
	Range	No.				PK	AV	QP	
8.03a_RSE_R_Ch128_GSM_laying	Low	128	30 MHz – 1 GHz	1	Carrier on diagram, not relevant for results	☒	☐	☐	passed
8.03b_RSE_R_Ch128_GSM_laying	Low		1GHz – 9 GHz		--	☒	☐	☐	passed
8.04_RSE_R_Ch128_GSM_standing	Low		30 MHz – 9 GHz		Carrier on diagram, not relevant for results	☒	☐	☐	passed
9.1203a_RSE_R_Ch128_GSM_laying	Low	128	823 – 824 MHz		Band Edge Compliance	☒	☐	☐	passed
9.1203b_RSE_R_Ch128_GSM_standing	Low				Band Edge Compliance	☒	☐	☐	passed
9.1204a_RSE_R_Ch251_GSM_laying	High	251	849 – 850 MHz		Band Edge Compliance	☒	☐	☐	passed
9.1204b_RSE_R_Ch251_GSM_standing	High				Band Edge Compliance	☒	☐	☐	passed

Remark:--

5.3.5.2. GSM 850: Set-up 2 (EUT + Internal Antenna)

Diagram no.	Carrier Channel		Frequency range	OP-mode no.	Remark	Used detector			Result
	Range	No.				PK	AV	QP	
8.01_RSE_R_Ch128_GSM_laying	Low	128	30 MHz – 9 GHz	1	Carrier on diagram, not relevant for results	☒	☐	☐	passed
8.02_RSE_R_Ch128_GSM_standing	Low				Carrier on diagram, not relevant for results	☒	☐	☐	passed
9.1201a_RSE_R_Ch128_GSM_laying	Low	128	823 – 824 MHz		Band Edge Compliance	☒	☐	☐	passed
9.1201b_RSE_R_Ch128_GSM_standing	Low				Band Edge Compliance	☒	☐	☐	passed
9.1202a_RSE_R_Ch251_GSM_laying	High	251	849 – 850 MHz		Band Edge Compliance	☒	☐	☐	passed
9.1202b_RSE_R_Ch251_GSM_standing	High				Band Edge Compliance	☒	☐	☐	passed

Remark:--

5.3.5.3. GSM 1900: Set-up 1 (EUT + External Antenna)

Diagram no.	Carrier Channel		Frequency range	OP-mode no.	Remark	Used detector			Result
	Range	No.				PK	AV	QP	
8.07_RSE_R_Ch810_GSM_laying	High	810	30 MHz – 19.5 GHz	2	Carrier on diagram, not relevant for results	☒	☐	☐	passed
8.08_RSE_R_Ch810_GSM_standing	High				Carrier on diagram, not relevant for results	☒	☐	☐	passed
9.1207a_RSE_R_Ch512_GSM_laying	Low	512	1849 – 1850 MHz		Band Edge Compliance	☒	☐	☐	passed
9.1207b_RSE_R_Ch512_GSM_standing	Low				Band Edge Compliance	☒	☐	☐	passed
9.1208a_RSE_R_Ch810_GSM_laying	High	810	1910 – 1911 MHz		Band Edge Compliance	☒	☐	☐	passed
9.1208b_RSE_R_Ch810_GSM_standing	High				Band Edge Compliance	☒	☐	☐	passed

Remark:--

5.3.5.4. GSM 1900: Set-up 2 (EUT + Internal Antenna)

Diagram no.	Carrier Channel		Frequency range	OP-mode no.	Remark	Used detector			Result
	Range	No.				PK	AV	QP	
8.05_RSE_R_Ch810_GSM_laying	High	810	30 MHz – 19.5 GHz	2	Carrier on diagram, not relevant for results	☒	☐	☐	passed
8.06_RSE_R_Ch810_GSM_standing	High				Carrier on diagram, not relevant for results	☒	☐	☐	passed
9.1205a_RSE_R_Ch512_GSM_laying	Low	512	1849 – 1850 MHz		Band Edge Compliance	☒	☐	☐	passed
9.1205b_RSE_R_Ch512_GSM_standing	Low				Band Edge Compliance	☒	☐	☐	passed
9.1206a_RSE_R_Ch810_GSM_laying	High	810	1910 – 1911 MHz		Band Edge Compliance	☒	☐	☐	passed
9.1206b_RSE_R_Ch810_GSM_standing	High				Band Edge Compliance	☒	☐	☐	passed

Remark:--

5.4. 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 its contribution to the overall uncertainty according its statistical distribution calculated.

Following table shows expectable uncertainties for each measurement type performed.

RF-Measurement	Reference	Frequency range	Calculated uncertainty based on a confidence level of 95%						Remarks
Conducted emissions (U_{CISPR})	CISPR 16-2-1	9 kHz - 150 kHz 150 kHz - 30 MHz	4.0 dB 3.6 dB						-
Radiated emissions Enclosure	CISPR 16-2-3	30 MHz - 1 GHz 1 GHz - 18 GHz	4.2 dB 5.1 dB						E-Field
Disturbance power	CISPR 16-2-2	30 MHz - 300 MHz	-						-
Power Output radiated	-	30 MHz - 4 GHz	3.17 dB						Substitution method
Power Output conducted	-	Set-up No.	Cel-C1	Cel-C2	BT1	W1	W2	--	
		9 kHz - 12.75 GHz	N/A	0.60	0.7	0.25	N/A	--	-
		12.75 - 26.5GHz	N/A	0.82	--	N/A	N/A	--	
Conducted emissions on RF-port	-	9 kHz - 2.8 GHz	0.70	N/A	0.70	N/A	0.69	--	N/A - not applicable
		2.8 GHz - 12.75GHz	1.48	N/A	1.51	N/A	1.43	--	
		12.75 GHz - 18GHz	1.81	N/A	1.83	N/A	1.77	--	
		18 GHz - 26.5GHz	1.83	N/A	1.85	N/A	1.79	--	
Power density	-	1 – 2.8GHz	1.40 dB						--
Occupied bandwidth	-	9 kHz - 4 GHz	0.1272 ppm (Delta Marker)						Frequency error
			1.0 dB						Power
Emission bandwidth	- -	9 kHz - 4 GHz	0.1272 ppm (Delta Marker)						Frequency error
			See above: 0.70 dB						Power
Frequency stability	-	9 kHz - 20 GHz	0.0636 ppm						-
Radiated emissions Enclosure	-	150 kHz - 30 MHz 30 MHz - 1 GHz 1 GHz - 20 GHz	5.0 dB 4.2 dB 3.17 dB						Magnetic field E-field Substitution

Table: measurement uncertainties, valid for conducted/radiated measurements

6. Abbreviations used in this report

The abbreviations	
ANSI	American National Standards Institute
AV , AVG, CAV	Average detector
EIRP	Equivalent isotropically radiated power, determined within a separate measurement
EGPRS	Enhanced General Packet Radio Service
EUT	Equipment Under Test
FCC	Federal Communications Commission, USA
IC	Industry Canada
n.a.	not applicable
Op-Mode	Operating mode of the equipment
PK	Peak
RBW	resolution bandwidth
RF	Radio frequency
RSS	Radio Standards Specification, Documents from Industry Canada
Rx	Receiver
TCH	Traffic channel
Tx	Transmitter
QP	Quasi peak detector
VBW	Video bandwidth
ERP	Effective radiated power

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

Ref.-No.	Accreditation Certificate	Valid for laboratory area or test site	Accreditation Body
-	D-PL-12047-01-01	All laboratories and test sites of CETECOM GmbH, Essen	DAkkS, Deutsche Akkreditierungsstelle GmbH
337 487 558 348 348	(MRA US-EU 0003)	Radiated Measurements 30 MHz to 1 GHz, 3 m / 10 m (OATS) Radiated Measurements 30 MHz to 1 GHz, 3 m (SAR) Radiated Measurements above 1 GHz, 3 m (FAR) Mains Ports Conducted Interference Measurements Telecommunication Ports Conducted Interference Measurem.	FCC, Federal Communications Commission Laboratory Division, USA
337 487 550 558	3462D-1 3462D-2 3462D-2 3462D-3	Radiated Measurements 30 MHz to 1 GHz, 3 m / 10 m (OATS) Radiated Measurements 30 MHz to 1 GHz, 3 m (SAR) Radiated Measurements 1 GHz to 6 GHz, 3 m (SAR) Radiated Measurements above 1 GHz, 3 m (FAR)	ISED, Industry Canada Certification and Engineering Bureau
487 550 348 348	R- 4452 G- 20013 C- 20009 T- 20006	Radiated Measurements 30 MHz to 1 GHz, 3 m (SAR) Radiated Measurements 1 GHz to 6 GHz, 3 m (SAR) Mains Ports Conducted Interference Measurements Telecommunication Ports Conducted Interference Measurem.	VCCI, Voluntary Control Council for Interference by Information Technology Equipment, Japan
OATS = Open Area Test Site, SAR = Semi Anechoic Room, FAR = Fully Anechoic Room			

8. Instruments and Ancillary

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

8.0.1. Test software and firmware of equipment

Ref.-No.	Equipment	Type	Serial-No.	Version of Firmware or Software during the test
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
119	RT Harmonics Analyzer dig. Flickermeter	B10	G60547	Firm.= V 3.1DHG
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
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
335	CTC-EMS-Conducted	System EMS Conducted	-	EMC 32 V 8.52
340	Digital Radiocommunication Tester	CMD 55	849709/037	Firm.= 3.52 .22.01.99
366	Ultra Compact Simulator	UCS 500 M4	V0531100594	Firm. UCS 500=001925/3.06a02, rc=ISMIEC 4.10
371	Bluetooth Tester	CBT32	100153	CBT V5,30+ SW-Option K55, K57
377	EMI Test Receiver	ESCS 30	100160	Firm.= 2.30, OTP= 02.01, GRA= 02.36
378	Broadband RF Field Monitor	RadiSense III	03D00013SNO-08	Firm.= V.03D13
389	Digital Multimeter	Keithley 2000	0583926	Firm. = A13 (Mainboard) A02 (Display)
392	Radio Communication Tester	MT8820A	6K00000788	Firm.= 4.50 #005, IPL=4.01#001,OS=4.02#001, GSM=4.41#013, W-CDMA= 4.54#004, scenario=
436	Univ. Radio Communication Tester	CMU 200	103083	R&S Test Firmware Base=5.14, Mess-Software= GSM:5.14 WCDMA:5.14 (current Testsoftw. F. all band
441	CTC-SAR-EMI Cable Loss	System EMI field (SAR)	-	EMC 32 Version 8.52
442	CTC-SAR-EMS	System EMS field (SAR)	-	EMC 32 Version 8.40
443	CTC-FAR-EMI-RSE	System CTC-FAR-EMI-RSE	-	Spuri 7.2.5 or EMC 32 Ver. 9.15.00
444	CTC-FAR-EMS field	System-EMS-Field (FAR)	-	EMC 32 Version 9.15.00
460	Univ. Radio Communication Tester	CMU 200	108901	R&S Test Firmware Base=5.14, GSM=5.14 WCDMA=5.14 (current Testsoftw.,f. all band to be used,
489	EMI Test Receiver	ESU40	1000-30	Firmware=4.43 SP3, Bios=V5.1-16-3, Spec. =01.00
491	ESD Simulator dito	ESD dito	dito307022	V 2.30
524	Voltage Drop Simulator	VDS 200	0196-16	Software Nr: 000037 Version V4.20a01
526	Burst Generator	EFT 200 A	0496-06	Software Nr. 000034 Version V2.32
527	Micro Pulse Generator	MPG 200 B	0496-05	Software-Nr. 000030 Version V2.43
528	Load Dump Simulator	LD 200B	0496-06	Software-Nr. 000031 Version V2.35a01
546	Univ. Radio Communication Tester	CMU 200	106436	R&S Test Firmware Base=5.14, GSM=5.14 WCDMA=5.14 (current Testsoftw.,f. all band to be used
547	Univ. Radio Communication Tester	CMU 200	835390/014	R&S Test Firmware Base=V5.1403 (current Testsoftw., f. all band used, GSM = 5.14 WCDMA: = 5.14
584	Spectrum Analyzer	FSU 8	100248	2.82_SP3
597	Univ. Radio Communication Tester	CMU 200	100347	R&S Test Firmware Base=5.01, GSM=5.02 WCDMA= not installed, Mainboard= µP1=V.850
607	Signal Generator	SMR 20	832033/011	V1.25
620	EMI Test Receiver	ESU 26	100362	4.43_SP3
670	Univ. Radio Communication Tester	CMU 200	106833	µP1 =V8.50, Firmware = V.20
689	Vector Signal Generator	SMU200	100970	02.20.360.142
692	Bluetooth Tester	CBT 32	100236	CBT V 5.40, FW: V.2.41 (FPGA Digital, V. 3.09 FPGA RF)
699	Audio Analyzer	UPL16	833494/005	3.06

8.0.2. Single instruments and test systems

Ref.-No.	Equipment	Type	Serial-No.	Manufacturer	Interval of calibration	Remark	Cal due
005	AC - LISN (50 Ohm/50µH, test site 1)	ESH2-Z5	861741/005	Rohde & Schwarz	12 M	-	23.05.2020
007	Single-Line V-Network (50 Ohm/5µH)	ESH3-Z6	892563/002	Rohde & Schwarz	12 M	-	23.05.2020
009	Power Meter (EMS-radiated)	NRV	863056/017	Rohde & Schwarz	24 M	-	23.05.2021
016	Line Impedance Simulating Network	Op. 24-D	B6366	Spitzenberger+Spies	36 M	-	22.05.2022
020	Horn Antenna 18 GHz (Subst 1)	3115	9107-3699	EMCO	36/12 M	-	31.07.2021
021	Loop Antenna (H-Field)	6502	9206-2770	EMCO	36 M	-	30.05.2021
030	Loop Antenna (H-field)	HFH-Z2	879604/026	Rohde & Schwarz	36 M	-	30.04.2020
033	RF-current probe (100kHz-30MHz)	ESH2-Z1	879581/18	Rohde & Schwarz	24 M	-	23.05.2021
057	relay-switch-unit (EMS system)	RSU	494440/002	Rohde & Schwarz	pre-m	1 a	
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	1 g	16.11.2020
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	
091	USB-LWL-Converter	OLS-1	007/2006	Ing. Büro Scheiba	-	4	
099	passive voltage probe	ESH2-Z3	299.7810.52	Rohde & Schwarz	36 M	-	30.05.2021
100	passive voltage probe	Probe TK 9416	without	Schwarzbeck	36 M	-	30.05.2021
110	USB-LWL-Converter	OLS-1	-	Ing. Büro Scheiba	-	4	
119	RT Harmonics Analyzer dig. Flickermeter	B10	G60547	BOCONSULT	36 M	-	22.05.2022
133	horn antenna 18 GHz (Meas 1)	3115	9012-3629	EMCO	36 M	1 c	10.03.2020
134	horn antenna 18 GHz (Subst 2)	3115	9005-3414	EMCO	36 M	-	10.03.2020
248	attenuator	SMA 6dB 2W	-	Radiall	pre-m	2	
249	attenuator	SMA 10dB 10W	-	Radiall	pre-m	2	
252	attenuator	N 6dB 12W	-	Radiall	pre-m	2	
256	attenuator	SMA 3dB 2W	-	Radiall	pre-m	2	
257	hybrid	4031C	04491	Narda	pre-m	2	
260	hybrid coupler	4032C	11342	Narda	pre-m	2	
261	Thermal Power Sensor	NRV-Z55	825083/0008	Rohde & Schwarz	24 M	-	30.05.2020
262	Power Meter	NRV-S	825770/0010	Rohde & Schwarz	24 M	-	30.05.2020
265	peak power sensor	NRV-Z33, Model 04	840414/009	Rohde & Schwarz	24 M	-	30.05.2020
266	Peak Power Sensor	NRV-Z31, Model 04	843383/016	Rohde & Schwarz	24 M	-	30.05.2020
267	notch filter GSM 850	WRCA 800/960-6EEK	9	Wainwright GmbH	pre-m	2	
270	termination	1418 N	BB6935	Weinschel	pre-m	2	
271	termination	1418 N	BE6384	Weinschel	pre-m	2	
272	attenuator (20 dB) 50 W	Model 47	BF6239	Weinschel	pre-m	2	
273	attenuator (10 dB) 100 W	Model 48	BF9229	Weinschel	pre-m	2	
274	attenuator (10 dB) 50 W	Model 47 (10 dB) 50 W	BG0321	Weinschel	pre-m	2	
275	DC-Block	Model 7003 (N)	C5129	Weinschel	pre-m	2	
276	DC-Block	Model 7006 (SMA)	C7061	Weinschel	pre-m	2	
279	power divider	1515 (SMA)	LH855	Weinschel	pre-m	2	
287	pre-amplifier 25MHz - 4GHz	AMF-2D-100M4G-35-10P	379418	Miteq	12 M	1 c	16.11.2020
291	high pass filter GSM 850/900	WHJ 2200-4EE	14	Wainwright GmbH	12 M	1 c	16.11.2020
298	Univ. Radio Communication Tester	CMU 200	832221/091	Rohde & Schwarz	pre-m	3	
300	AC LISN (50 Ohm/50µH, 1-phase)	ESH3-Z5	892 239/020	Rohde & Schwarz	12 M	-	22.05.2020
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	-	14.03.2020
303	horn antenna 40 GHz (Subst 1)	BBHA9170	156	Schwarzbeck	36 M	-	20.03.2020
331	Climatic Test Chamber -40/+180 Grad	HC 4055	43146	Heraeus Vötsch	24 M	-	10.01.2021
341	Digital Multimeter	Fluke 112	81650455	Fluke	24 M	-	30.05.2020
342	Digital Multimeter	Voltcraft M-4660A	IB 255466	Voltcraft	24 M	-	23.05.2021
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	
357	power sensor	NRV-Z1	861761/002	Rohde & Schwarz	24 M	-	21.05.2021
371	Bluetooth Tester	CBT32	100153	R&S	36 M	-	30.05.2020
373	Single-Line V-Network (50 Ohm/5µH)	ESH3-Z6	100535	Rohde & Schwarz	12 M	-	22.05.2020
377	EMI Test Receiver	ESCS 30	100160	Rohde & Schwarz	12 M	-	22.05.2020
389	Digital Multimeter	Keithley 2000	0583926	Keithley	pre-m	-	
392	Radio Communication Tester	MT8820A	6K00000788	Anritsu	12 M	-	01.07.2020
396	Thermo/Hygrometer	Thermo/Hygrometer	-	Conrad	24 M	-	09.01.2021
405	Thermo-/Hygrometer	OPUS 10 THI	126.0604.0003.3.3.3.22	LUFFT Mess u. Regeltechnik GmbH	24 M	-	30.03.2020

Ref.-No.	Equipment	Type	Serial-No.	Manufacturer	Interval of calibration	Remark	Cal due
431	Model 7405	Near-Field Probe Set	9305-2457	EMCO	-	4	
436	Univ. Radio Communication Tester	CMU 200	103083	Rohde & Schwarz	12 M	-	25.05.2020
439	UltraLog-Antenna	HL 562	100248	Rohde & Schwarz	36 M	-	10.03.2020
441	CTC-SAR-EMI Cable Loss	System EMI field (SAR) Cable	-	CETECOM	12 M	5	05.06.2020
443	CTC-FAR-EMI-RSE	System CTC-FAR-EMI-RSE	-	ETS-Lindgren / CETECOM	12 M	5	16.11.2020
448	notch filter WCDMA_FDD II	WRCT 1850.0/2170.0-5/40-10SSK	5	Wainwright Instruments GmbH	12 M	1 c	16.11.2020
449	notch filter WCDMA FDD V	WRCT 824.0/894.0-5/40-8SSK	1	Wainwright	12 M	1 c	16.11.2020
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	-	30.05.2020
463	Universal source	HP3245A	2831A03472	Agilent	-	4	
466	Digital Multimeter	Fluke 112	89210157	Fluke USA	24 M	-	30.05.2020
467	Digital Multimeter	Fluke 112	89680306	Fluke USA	36 M	-	30.05.2021
468	Digital Multimeter	Fluke 112	90090455	Fluke USA	36 M	-	30.04.2021
477	ReRadiating GPS-System	AS-47	-	Automotive Cons. Fink	-	3	
480	power meter (Fula)	NRVS	838392/031	Rohde & Schwarz	24 M	-	30.05.2021
482	filter matrix	Filter matrix SAR 1	-	CETECOM (Brl)	-	1 d	
484	pre-amplifier 2,5 - 18 GHz	AMF-5D-02501800-25-10P	1244554	Miteq	12 M	-	16.11.2020
487	System CTC NSA-Verification SAR-EMI	System EMI field (SAR) NSA	-	ETS Lindgren / CETECOM	24 M	-	16.04.2021
489	EMI Test Receiver	ESU40	1000-30	Rohde & Schwarz	12 M	-	30.06.2020
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	1 c	16.11.2020
517	relais switch matrix	HF Relais Box Keithley System	SE 04	Keithley	pre-m	2	
523	Digital Multimeter	L4411A	MY46000154	Agilent	24 M	-	23.05.2021
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	-	05.08.2020
547	Univ. Radio Communication Tester	CMU 200	835390/014	Rohde & Schwarz	12 M	-	30.07.2020
549	Log.Per-Antenna	HL025	1000060	Rohde & Schwarz	36/12 M	-	31.07.2021
550	System CTC S-VSWR Verification SAR-EMI	System EMI Field SAR S-VSWR	-	ETS Lindgren/CETECOM	24 M	-	02.10.2021
552	high pass filter 2,8-18GHz	WHKX 2.8/18G-10SS	4	Wainwright	12 M	1 c	16.11.2020
557	System CTC-OTA-2	R&S TS8991	-	Rohde & Schwarz	12 M	5	24.01.2020
558	System CTC FAR S-VSWR	System CTC FAR S-VSWR	-	CTC	24 M	-	08.08.2020
574	Biconilog Hybrid Antenna	BTA-L	980026L	Frankonia	36/12 M	-	03.05.2022
584	Spectrum Analyzer	FSU 8	100248	Rohde & Schwarz	pre-m	-	
594	Wideband Radio Communication Tester	CMW 500	101757	Rohde & Schwarz	12 M	-	26.06.2020
597	Univ. Radio Communication Tester	CMU 200	100347	Rohde & Schwarz	pre-m	-	
600	power meter	NRVD (Reserve)	834501/018	Rohde & Schwarz	24 M	-	30.05.2021
602	peak power sensor	NRV-Z32 (Reserve)	835080	Rohde & Schwarz	24 M	-	
611	DC power supply	E3632A	KR 75305854	Agilent	pre-m	2	
612	DC power supply	E3632A	MY 40001321	Agilent	pre-m	2	
613	Attenuator	R416120000 20dB 10W	Lot. 9828	Radiall	pre-m	2	
616	Digitalmultimeter	Fluke 177	88900339	Fluke	24 M	-	30.05.2020
617	Power Splitter/Combiner	ZFSC-2-2-S+	S F987001108	Mini Circuits	-	2	
618	Power Splitter/Combiner	50PD-634	600994	JFW Industries USA	-	2	
619	Power Splitter/Combiner	50PD-634	600995	JFW Industries, USA	-	3	
620	EMI Test Receiver	ESU 26	100362	Rohde-Schwarz	12 M	-	30.05.2020
621	Step Attenuator 0-139 dB	RSP	100017	Rohde & Schwarz	pre-m	2	
625	Generic Test Load USB	Generic Test Load USB	-	CETECOM	-	2	
634	Spectrum Analyzer	FSM (HF-Unit)	826188/010	Rohde & Schwarz	pre-m	2	
637	High Speed HDMI with Ethernet 1m	HDMI cable with Ethernet 1m	-	KogiLink	-	2	
638	HDMI Kabel with Ethernet 1,5 m flach	HDMI cable with Ethernet 1,5m	-	Reichelt	-	2	
640	HDMI cable 2m rund	HDMI cable 2m rund	-	Reichelt	-	2	

Ref.-No.	Equipment	Type	Serial-No.	Manufacturer	Interval of calibration	Remark	Cal due
641	HDMI cable with Ethernet	Certified HDMI cable with	-	PureLink	-	2	
644	Amplifierer	ZX60-2534M+	SN865701299	Mini-Circuits	-	-	
670	Univ. Radio Communication Tester	CMU 200	106833	Rohde & Schwarz	24 M	-	30.05.2020
671	DC-power supply 0-5 A	EA-3013S	-	Elektro Automatik	pre-m	2	
678	Power Meter	NRP	101638	Rohde&Schwarz	pre-m	-	
683	Spectrum Analyzer	FSU 26	200571	Rohde & Schwarz	12 M	-	30.05.2020
686	Field Analyzer	EHP-200A	160WX30702	Narda Safety Test Solutions	-	-	
687	Signal Generator	SMF 100A	102073	Rohde&Schwarz	12 M	-	30.05.2020
688	Pre Amp	JS-18004000-40-8P	1750117	Miteq	pre-m	-	
690	Spectrum Analyzer	FSU	100302/026	Rohde&Schwarz	24 M	-	30.05.2021
691	OSP120 Base Unit	OSP120	106833	Rohde & Schwarz	12 M	-	30.05.2020
692	Bluetooth Tester	CBT 32	100236	Rohde & Schwarz	36 M	-	29.05.2020
693	TS8997	CTC-Radio Lab 1_TS8997	-	Rohde&Schwarz	12 M	5	07.01.2020
697	Power Splitter	ZN4PD-642W-S+	165001445	Mini-Circuits	-	2	
701	CMW500 wide. Radio Comm.	CMW500	158150	Rohde & Schwarz	12 M	-	30.07.2020
703	INNCO Antennen Mast	MA 4010-KT080-XPET-ZSS3	MA4170-KT100-XPET-ZSS3	INNCO	pre-m	-	
704	INNCON Controller	CO 3000-4port	CO3000/933/384105 16/L	INNCO Systems GmBh	pre-m	-	
711	Harmonic Mixer 90 GHz - 140GHz	RPG FS-Z140	101004	RPG	36 M	-	22.02.2020
712	Harmonic Mixer 75 GHz - 110GHz	FS-Z110	101468	Rohde & Schwarz	36 M	-	22.02.2020
713	Harmonic Mixer, 50 GHz - 75GHz	FS-Z75	101022	Rohde & Schwarz	24 M	-	05.07.2021
714	Signal Analyzer 67GHz	FSW67	104023	Rohde & Schwarz	24 M	-	04.07.2021
715	Harmonic Mixer, 140 GHz - 220GHz	FS-Z220	101009	RPG Radiometer Physics	36 M	-	03.08.2020
716	Harmonic Mixer 220 GHz to 325 GHZ	FS-Z325	101005	RPG Radiometer Physics	36 M	-	13.02.2020
727	SAR Probe	ES3DV3	3260	Speag	-	-	13.05.2020
747	Spectrum Analyzer	FSU 26	200152	Rohde & Schwarz	12 M	-	04.07.2020
748	Pickett-Potter Horn Antenna	FH-PP 4060	010001	Radiometer Physiscs	36 M	-	
750	Pickett-Potter Horn Antenna	FH-PP 220	010011	Radiometer Physics	36 M	-	
751	Digital Optical System	optoCAN-FD Transceiver	17-010416	mk-messtechnik GmbH	-	-	
752	Digital Optical System	optoCAN-FD Transceiver	17-010083	mk-messtechnik GmbH	-	-	
753	Digital Optical System	optoCAN-FD Transceiver	17-010084	mk-messtechnik GmbH	-	-	
754	Digital Optical System	optoCAN-FD Transceiver	17-010415	mk-messtechnik GmbH	-	-	
755	Digital Optical System	optoLAN-100-MAX Transceiver	17-010795	mk-messtechnik GmbH	-	-	
757	WIDEBAND RADIO COMMUNICATION	CMW500	163673	Rohde&Schwarz	12 M	-	30.05.2020
758	Signal Generator	SMU 200A	100754	Rohde & Schwarz	24 M	-	11.10.2020
781	Power Supply	PS 2042-10 B	2815450369	Elektro-Automatik GmbH &Co.KG	-	-	
782	Power Supply	PS 2042-10 B	2815450348	lektro-Automatik GmbH &Co.KG	-	-	
783	Spectrum Analyzer	FSU 26	100414	Rohde & Schwarz	12 M	-	30.05.2020
784	Power Supply	NGSM 32/10	00196	Rohde & Schwarz	12 M	-	
785	RSP	RF Step Attenuator 0…139.9dB	860712/012	Rohde & Schwarz	12 M	-	
786	SAR Probe	ES3DV3	3340	Speag	36 M	-	14.02.2021
787	OSP	OSP B157WX	101264	Rohde & Schwarz	24 M	-	30.05.2020
788	Precision Omnidirectional Dipole	POD 618	6182558/Q	Seibersdorf Labaratories	36 M	-	30.06.2021
789	Precision Omnidirectional Dipole	POD 16	162496/Q	Seibersdorf Laboratories	36 M	-	30.06.2021
790	Horn Antenna	ASY-SGH-124-SMA	29F14182337	Antenna System Solutions	36 M	-	08.10.2021
791	Pickett-Potter Horn Antenna	FH-PP-325	10024	Radiometer Physics	36 M	-	
792	Pickett-Potter Horn Antenna	FH-PP 075	10006	Radiometer Physics	36 M	-	
793	Pickett-Potter Horn Antenna	FH-PP 140	10008	Radiometer Physics	36 M	-	
794	Pickett-Potter Horn Antenna	FH-PP 110	10014	Radiometer Physics	36 M	-	
795	SGH Antenna	SGH-26-WR10	1144	Anteral S.L.	36 M	-	
798	WR-22 Rectangular Gain Horn	SAR-2309-22-S2	13254-01	SAGE Millimeter, Inc.	36 M	-	
799	Transceiver	optoLAN-Gb	18-014746	mk messtechnik	pre-m	-	
801	Spectrum Analyzer	FSP 13	100960	Rohde & Schwarz	24 M	-	14.01.2021
802	Exposure Level Tester	ELT-400	O-0026	NARDA Safety Solutions	24 M	-	30.01.2021
803	Probe	ELT probe 3cm²	O-0026	Narda Safety Test Solution	24 M	-	30.01.2021
805	Thermo-Hygrometer	Web-Thermo-Hygrometer	02749814	W&T	24 M	-	
806	AC2600 Smart Wifi Router	Netgear Nighthawk x4S	5K5188590067B	Netgear	-	-	
807	Direct Coupler	Direct Coupler C-05020-10	511	ET Industries	-	-	
808	Diode Power Sensor	NRV-Z1	829894/001	Rohde & Schwarz	24 M	-	24.05.2021
809	Standard gain Horn Antenna	WR-159 Horn Antenna	-	Pasternack Enterprises Inc.	-	-	
810	Horn Antenna WR90	90-HA20	J202064946	TACTRON Elektronik	-	-	

Ref.-No.	Equipment	Type	Serial-No.	Manufacturer	Interval of calibration	Remark	Cal due
				GmbH &			
811	Waveguide to Coax Adapter	ADP-WC-WR90-SMA-F-F	J504072436	TACTRON elektronik GmbH &	-	-	
812	1-18 GHz Amplifier	ASG18B-4010	-	Wright Technologies, Inc.	pre-m	-	
813	Band Reject Filter	WRCJV10-5855-5875-5905-5925-	10	Wainwright Instruments GmbH	pre-m	-	
814	Band Reject Filter	WRCJV10-5855-5875-5905-5925-	11	Wainwright Instruments GmbH	pre-m	-	
816	GPIB-USB-HS	187965G-01L	16AE772	National Instruments	-	-	
817	GBIP-USB-HS	187965G-01L	16AC1EE	National Instruments	-	-	
818	GPIB-USB-HS	187965G-01L	16AE8D0	Natinal Instruments	-	-	
819	GPIB-USB-HS	187965G-01L	16AB93C	National Instruments	-	-	
820	GPIB-USB-HS	187965G-01L	16AE294	National Instruments	-	-	
821	GPIB-USB-HS	187965G-01L	16ACB9C	National Instruments	-	-	
822	GPIB-USB-HS	187965G-01L	16AE5B2	National Instruments	-	-	
823	Broadband Field Meter	NBM-550	H-0929	NARDA Safety Test Solutions	36 M	-	19.07.2022
824	E-Field Probe	EF 0691	H-0851	Narda Safety Test Solutions	36 M	-	06.08.2022
825	H-Field Probe	HF 3061	D-0805	NARDA Safety Test Solutions	36 M	-	06.08.2022
826	Electric and magnetic Field Analyzer	EHP-50F	510WY90125	NARDA Safety Test Solutions	36 M	-	01.10.2022
827	Transceiver	optoUSB-2.0	19-017001	mk-messtechnik GmbH	-	-	
828	Transceiver	optoUSB-2.0	19-017002	mk-messtechnik GmbH	-	-	
829	Battery Pack BP-84	Battery Pack BP-84	19-017271	mk-messtechnik GmbH	-	-	
830	SIGNAL ANALYZER	FSV3030	101247	Rohde&Schwarz	12 M	-	02.10.2020
25038	Loop Antenna	HFH2-Z2	879824/13	Rohde&Schwarz	24 M	-	19.03.2020

8.0.3. Legend

Note / remarks		Calibrated during system calibration:
	1a	System CTC-SAR-EMS (Ref.-No. 442)
	1b	System-CTC-EMS-Conducted (Ref.-No. 335)
	1c	System CTC-FAR-EMI-RSE (Ref.-No . 443)
	1d	System CTC-SAR-EMI (Ref.-No . 441)
	1e	System CTC-OATS (EMI radiated) (Ref.-No. 337)
	1 f	System CTC-CTIA-OTA (Ref.-No . 420)
	1 g	System CTC-FAR-EMS (Ref.-No . 444)
	2	Calibration or equipment check immediately before measurement
	3	Regulatory maintained equipment for functional check or support purpose
	4	Ancillary equipment without calibration e.g. mechanical equipment or monitoring equipment
	5	Test System

Interval of calibration	12 M	12 month
	24 M	24 month
	36 M	36 month
	24/12 M	Calibration every 24 months, between this every 12 months internal validation
	36/12 M	Calibration every 36 months, between this every 12 months internal validation
	Pre-m	Check before starting the measurement
	-	Without calibration

9. Versions of test reports (change history)

Version	Applied changes	Date of release
--	Initial release	2020-04-08
C01	Added FCC ID and ISED ID below table Summary of test results	2021-07-16
C02	Added ERP and EIRP value for all Channels of GSM 850/1900	2021-08-17
C03	GSM 1900 Result table has been added to Chapter 5.3.5, Diagram 8.06 and 8.08 has been verified and updated in Annex-1	2021-09-01

End of Report