

TEST REPORT
No.: 19-1-0067201T05a

According to:
FCC Regulations Title 47, Subpart 18
§18.305

ISED-Regulations
RSS-216, Issue 2
ICES-001, Issue 4

for

Continental Automotive GmbH

D-WMI2020B
Wireless Power Charger

FCC-ID: KR5DWMI2020B
ISED: 7812D-DWMI2020B

Laboratory Accreditation and Listings



Accredited EMC-Test Laboratory

accredited according to DIN EN ISO/IEC 17025

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The listed attachments are an integral part of this report.

1. Summary of test results

The test results apply exclusively to the test samples as presented in this Report. The CETECOM GmbH does not assume responsibility for any conclusions and generalizations taken in conjunction with other specimens or samples of the type of the item presented to tests.

Also we refer on special conditions which the applicant should fulfill 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) is an Wireless-Power Qi Transmitter operating at nominal 127 kHz. A typical operating mode (one or more) as used in the real usage was tested or a special test program simulating this was used. Pls. see chapter Operating-Mode for more details.

Following tests have been performed to show compliance with applicable FCC Part 18 of the CFR 47 Rules, Edition 1st October 2018 or RSS-216, Issue 2 regarding Canadian regulations.

1.1. Tests overview according CFR47, §2 & §18

No. of Diagram group	Test Cases	Port	References, Standards & Limits		EUT set-up	EUT op-mode	Result
			FCC	Limits			
1	Radiated emissions 9 kHz-30 MHz	Cabinet + inter-connecting cables (radiated)	§18.305	25 μ V/m (ISM Frequency) 15 μ V/m (non ISM Frequency)	1+2+3	1+3/4	Pass
2	Radiated emissions 30 MHz-1 GHz	Cabinet + inter-connecting cables (radiated)	§18.305	25 μ V/m (ISM Frequency) 15 μ V/m (non ISM Frequency)	1+2+3	1+3/4	Pass
3	99% Occupied bandwidth	Antenna coupling (radiated)	§2.202(a)	99% Power	1+2+3	1+3/4	For information only

1.2. Tests overview according RSS-216, Issue 2 / ICES-001, Issue 4

No. of Diagram group	Test Cases	Port	References, Standards & Limits		EUT set-up	EUT op-mode	Result
			RSS	Limits			
1	Radiated emissions 9 kHz-30 MHz	Cabinet + inter-connecting cables (radiated)	ICES-001, Issue 4	CAN/CSA-CEI/CISPR 11-04 (Table 3b – induction cooking appliances)	1+2+3	1+3/4	Pass
2	Radiated emissions 30 MHz-1 GHz	Cabinet + inter-connecting cables (radiated)	ICES-001, Issue 4	CAN/CSA-CEI/CISPR 11-04 (class B, group 2 limits)	1+2+3	1+3/4	Pass
3	99% Occupied bandwidth	Antenna coupling (radiated)	RSS-Gen, Issue 4	99% Power	1+2+3	1+3/4	For information only

1.3. 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. Markus Ridder
 Responsible for test section

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

2. Administrative Data

2.1. Identification of the testing laboratory

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

2.2. Test location

2.2.1. Test laboratory "CTC"

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

Responsible for test report and project leader:	Dipl.-Ing. C. Lorenz
Receipt of EUT:	2019-05-13
Date(s) of test:	2019-05-20 to 2019-06-24
Date of report:	2019-09-13

2.4. Applicant's details

Applicant's name:	Continental Automotive GmbH
Address:	Siemensstrasse 12 93055 Regensburg Germany
Contact person:	Ms. Qian Liu

2.5. Manufacturer's details

Manufacturer's name:	Continental Automotive Lithuania UAB
Address:	Davalgonių g. 12 LT-54462 Sergeičikai I, Kaunas region
2 nd plant:	
Manufacturer's name:	Continental Automotive Systems (Tianjin) Co. Ltd.
Address:	No. 2 Bohai Road 300457 TEDA Tianjin P.R. China

2.6. Customer's details

Customer's name:	IB-Lenhardt AG
Address:	Heinrich-Hertz-Allee 7 66386, St. Ingbert Germany
Contact person:	Mr. Philipp Gräf

3. Equipment under test (EUT)

3.1. Technical data of main EUT declared by applicant

Frequency range and channels (US/Canada -bands)	127.64 kHz		
Type of modulation (packet types)	2-ASK (Amplitude Shift Keying)		
Occupied bandwidth	Ping-Mode: 0.36858 kHz		
	Charge-Mode: 1.594551 kHz (High variant)		
	Charge-Mode: 1.538461 kHz (Low variant)		
Number of channels (USA/Canada -bands)	<input checked="" type="checkbox"/> 1 nominal channel at 127.64 kHz		<input type="checkbox"/> range:
Antenna Type	<input checked="" type="checkbox"/> Integrated <input type="checkbox"/> External, no RF- connector <input type="checkbox"/> External, separate RF-connector		
Antenna Gain	No information from applicant		
USA: Max.-Field strength (radiated), accord. §18.305	1.14 dBµV/m Peak@300 m distance		
Canada: Max.-Field strength (radiated), accord. §18.305	29.64 dBµA/m Peak@3 m distance		
Installed options (not tested within this test report)	<input checked="" type="checkbox"/> NFC transmitter (not tested within this test report)		
Power supply			
Special EMI components	--		
EUT sample type	<input type="checkbox"/> Production	<input checked="" type="checkbox"/> Pre-Production	<input type="checkbox"/> Engineering
Firmware		<input type="checkbox"/> for normal use	<input checked="" type="checkbox"/> Special version for test execution
FCC/ISED label attached	<input type="checkbox"/> yes	<input checked="" type="checkbox"/> no	

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

Short description*)	EUT	Type	S/N serial number	HW hardware status	SW software status
EUT A S12	Wireless Power Charger	Charging Mode High version	A2C16629105 00 19 04 10 0028	C2	19.09.30
EUT B S10	Wireless Power Charger	Ping Mode High version	A2C16629105 00 19 04 10 0030	C2	19.09.30
EUT C S08	Wireless Power Charger	Charging Mode Low version	A2C16629105 00 19 04 10 0026	C2	19.09.30

*) 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 S15	Main Harness	without LED	--	--	--
AE 2 S02	WPC 15W	Continental WPC 15 W receiver	WS1806180023	--	--

*) 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	High Version Charging Mode ➤ Used for radiated measurement and climatic measurement
set. 2	EUT B + AE 1	High Versioning Mode ➤ Used for radiated measurement and climatic measurement
set. 3	EUT C + AE 1 + AE 2	Low Version Charging Mode ➤ Used for radiated measurement and climatic measurement

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

3.5. EUT operating modes (Wireless power transfer)

EUT operating mode no. *)	Description of operating modes	Additional information
op. 1	Stand-by, Idle	Ping mode (No Qi receiver placed on EUT)
op. 3/4	Operating	Charging mode (working at 15 Watt nominal setting (power transfer), optimal coupling between Qi-transmitter and Qi-receiver.)

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

3.6. Additional declaration and description of EUT

(Applicant's declaration, = not selected, = selected)

EUT A, EUT B, EUT C		<input type="checkbox"/> table-top <input type="checkbox"/> floor-standing <input type="checkbox"/> wall-mounted <input checked="" type="checkbox"/> not defined	typical use <input type="checkbox"/> portable use <input type="checkbox"/> fixed use <input checked="" type="checkbox"/> vehicular use	typical operating cycle of EUT. <input checked="" type="checkbox"/> < 0.5 sec. <input type="checkbox"/> :
Place of use		<input type="checkbox"/> Residential, commercial and light industry <input type="checkbox"/> Industrial environment <input checked="" type="checkbox"/> vehicular use		
Highest frequency generated or used in the device or on which the device operates or tunes		<input checked="" type="checkbox"/> below 1.705 MHz -> up to 30 MHz <input checked="" type="checkbox"/> 1.705 MHz – 108 MHz -> up to 1 GHz <input type="checkbox"/> 108 MHz -500 MHz -> up to 2 GHz <input type="checkbox"/> 500 MHz 1000 MHz -> up to 5 GHz <input type="checkbox"/> Above 1000 MHz -> 5 th harmonic or 40 GHz		
Power line: <input type="checkbox"/> AC <input checked="" type="checkbox"/> DC		EUT-grounding: <input checked="" type="checkbox"/> none <input type="checkbox"/> with power supply <input type="checkbox"/> additional:		
<input type="checkbox"/> L1, <input type="checkbox"/> L2, <input type="checkbox"/> L3, <input type="checkbox"/> N <input checked="" type="checkbox"/> 12V, <input type="checkbox"/> 24V, <input type="checkbox"/> 230V, <input type="checkbox"/> 400V		(in case of deviation during tests the single details are described on chapter 4)		
Other Ports/Cable (description of interconnecting cables)		possible total cable length	shielding	connected during test
1. Power cable	Banana	<input checked="" type="checkbox"/> < 3 m <input type="checkbox"/> > 3 m <input type="checkbox"/> : other	<input type="checkbox"/> screened <input checked="" type="checkbox"/> unscreened	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
2. RF-Cable	FAKRA	<input checked="" type="checkbox"/> < 3 m <input type="checkbox"/> > 3 m <input type="checkbox"/> : other	<input checked="" type="checkbox"/> screened <input type="checkbox"/> unscreened	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
3. NFC Cable to NFC antenna	specific	<input checked="" type="checkbox"/> < 3 m <input type="checkbox"/> > 3 m <input type="checkbox"/> : other	<input checked="" type="checkbox"/> screened <input type="checkbox"/> unscreened	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
Does EUT contain devices susceptible to magnetic fields, e.g. Hall elements, electrodynamics microphones, etc.?				<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
Is mounting position / usual operating position defined?				<input type="checkbox"/> yes <input checked="" type="checkbox"/> no

3.7. Configuration of cables used for testing

Cable number	Item	Type	S/N serial number	HW hardware status	Cable length
Cable 1	Power cable	With banana connector	--	--	1.2m
Cable 2	RF-Cable	FAKRA	--	--	1.5m
Cable 3	EUT to NFC antenna	specific	--	--	30cm

4. Description of test system set-up's

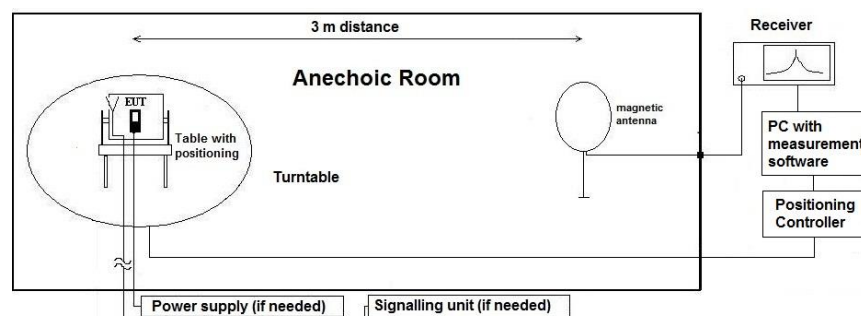
4.1. Test system set-up for radiated magnetic field measurements below 30 MHz

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 maintaining the EUT's worst-case operation mode, cable position, etc.

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

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

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

Formula:

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

$$M = L_T - E_C$$

AF = Antenna factor

C_L = Cable loss

D_F = Distance correction factor

E_C = Electrical field – corrected value

E_R = Receiver reading

G_A = Gain of pre-amplifier (if used)

L_T = Limit

M = Margin

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

Distance correction:

Reference for applied correction (extrapolating) factors due to reduced measurement distance:

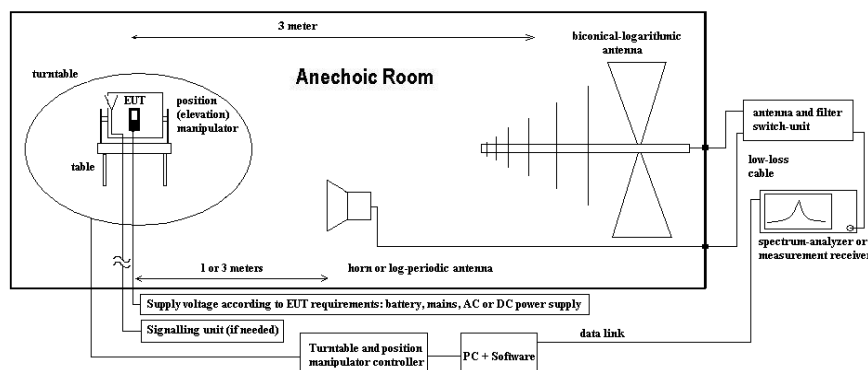
ANSI C63.10:2013, §6.4.4.2 - Equations (2) + (3) + (4)

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

Specification: ANSI C63.4-2014 chapter 8.2.3, ANSI C63.10-2013 chapter 6.5

General Description: Evaluating the field emissions have to be done first by an exploratory emissions measurement and a final measurement for most critical frequencies. The tests are performed in a NSA-compliant semi anechoic room (SAR) recognized by the regulatory commissions.

Schematic:



Testing method:

Exploratory, preliminary measurements

The EUT and its associated accessories are placed on a non-conductive position manipulator (tipping device) of 0.8 m height which is placed on the turntable. By rotating the turntable (range 0° to 360°, step 90°) and the EUT itself either on 3-orthogonal axis (portable equipment) or 2-orthogonal axis (defined operational position of EUT) the emission spectrum and its characteristics was recorded with an EMI-receiver, broadband antenna and software.

Measurement antenna: horizontal and vertical, heights: 1.0 m and 1.82 m as worst-case determined by an exploratory emission measurements. The results are documented in a diagram. Critical frequencies (low margin to limit) are saved within a table for further investigations. If various operating modes are supported, further investigations are made to find the worst-case of them. Also the interconnection cables and equipment position were varied in order to maximize the emissions.

Final measurement on critical frequencies

Based on the exploratory measurements, the most critical frequencies are re-measured by maintaining the EUT's worst-case operation mode, cable position, etc. either on 10 m OATS or 3m semi-anechoic room.

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

Following parameters were varied: the turntable angle continuously in the range 0 to 360 degree, the EUT itself either over 3-orthogonal axis (not defined usage position) or 2-orthogonal axis (defined usage position). The measurement antenna height between 1 m and 4 m.

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

Formula:

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

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

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

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

5. Measurements

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

5.1.1. Test location and equipment

test location	<input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1)	<input type="checkbox"/> Please see Chapter. 2.2.2	<input type="checkbox"/> Please see Chapter. 2.2.3
test site	<input checked="" type="checkbox"/> 441 EMI SAR	<input type="checkbox"/> 487 SAR NSA	<input type="checkbox"/> 347 Radio.lab.
receiver	<input type="checkbox"/> 377 ESCS30	<input type="checkbox"/> 001 ESS	<input checked="" type="checkbox"/> 620 ESU 26
spectr. analys.	<input type="checkbox"/> 584 FSU	<input type="checkbox"/> 120 FSEM	<input type="checkbox"/> 264 FSEK
antenna	<input type="checkbox"/> 574 BTA-L	<input type="checkbox"/> 133 EMCO3115	<input type="checkbox"/> 302 BBHA9170
signaling	<input type="checkbox"/> 757 CMW500	<input type="checkbox"/> 371 CBT32	<input type="checkbox"/> 547 CMU
otherwise	<input type="checkbox"/> 400 FTC40x15E	<input type="checkbox"/> 401 FTC40x15E	<input type="checkbox"/> 110 USB LWL
DC power	<input checked="" type="checkbox"/> 456 EA 3013A	<input type="checkbox"/> 457 EA 3013A	<input type="checkbox"/> 459 EA 2032-50
line voltage	<input type="checkbox"/> 230 V 50 Hz via public mains	<input type="checkbox"/> 060 120 V 60 Hz via PAS 5000	<input type="checkbox"/> 289 CBL 6141
			<input type="checkbox"/> 594 CMW500
			<input type="checkbox"/> 030 HFH-Z2
			<input checked="" type="checkbox"/> 021 EMCO6502
			<input type="checkbox"/> 378 RadiSense
			<input type="checkbox"/> 494 AG6632A
			<input type="checkbox"/> 498 NGPE 40

5.1.2. Requirements for USA/FCC:

FCC	Part 18.305 /FCC/OST MP-05			Remarks
Frequency [MHz]	Field strength limit		Distance [m]	
	[μ V/m]	[dB μ V/m]		
Any ISM frequency	25 (P<500 W) 25xSQRT(P/500)	27.95 (P<500 W) --	300	Correction factor used due to measurement distance of 3 m
Any non-ISM frequency	15 (P<500 W) 15xSQRT(P/500)	23.52 (P<500 W) --	300	Correction factor used due to measurement distance of 3 m

5.1.3. Requirements for Canada:

ISED	<input type="checkbox"/> RSS-Gen: Issue 4: §8.9 Table 5 <input checked="" type="checkbox"/> ICES-001, Issue 4 / CISPR11 (Table 3b – induction cooking appliances) <input checked="" type="checkbox"/> CAN/CSA-CEI/IEC CISPR 11-04
Frequency Range	Limits in dBμA/m in 3 m measurement distance (QP-Detector)
0.009-0.070 MHz	69 dB μ A/m
0.070-0.1485 MHz	69 dB μ A/m decreasing linearly with logarithm of frequency to 39 dB μ A/m
0.1485-4.0 MHz	39 dB μ A/m decreasing linearly with logarithm of frequency to 3 dB μ A/m
4.0-30 MHz	3 dB μ A/m

5.1.4. Test condition and test set-up

Signal link to test system (if used):	<input type="checkbox"/> air link	<input type="checkbox"/> cable connection	<input checked="" type="checkbox"/> none
EUT-grounding	<input checked="" type="checkbox"/> none	<input type="checkbox"/> with power supply	<input type="checkbox"/> additional connection
Equipment set up	<input checked="" type="checkbox"/> table top	<input type="checkbox"/> floor standing	
Climatic conditions	Temperature: (22 \pm 3 $^{\circ}$ C)		Rel. humidity: (40 \pm 20)% rH
EMI-Receiver or Analyzer Settings	Scan data	<input checked="" type="checkbox"/> 9 – 150 kHz RBW/VBW = 200 Hz Scan step = 80 Hz <input checked="" type="checkbox"/> 150 kHz – 30 MHz RBW/VBW = 9 kHz Scan step = 4 kHz <input type="checkbox"/> other:	
	Scan-Mode Detector Mode: Sweep-Time	<input checked="" type="checkbox"/> 6 dB EMI-Receiver Mode <input type="checkbox"/> 3dB Spectrum 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"		

5.1.5. Measurement Results

The results are presented below in summary form only. For more information please consult the diagrams included in annex 1 (USA, §18.305) or annex 2 (RSS-216).

The EUT is put on operation on nominal channel.

Table of measurement results: **(FCC 18.305)**

Diagram No.	Carrier Channel		Frequency range	Set-up no.	OP-mode no.	Remark	Used detector			Result
	No.	Freq.					PK	AV	QP	
2.03a	nominal	127.64 kHz	Carrier only	2	1 (Ping)	-13.01 dBµV/m EUT laying position	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
2.03b			Carrier only			-1.94 dBµV/m EUT standing position	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
2.04	nominal	127.64 kHz	9 kHz-30 MHz			EUT standing position (Worst-case position)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
2.05	nominal	128.2 kHz	Carrier only	1	3/4 (Charge)	1.14 dBµV/m EUT standing position	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
2.06	nominal		Carrier only			-4.89 dBµV/m EUT laying position	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
2.07	nominal	128.2 kHz	9 kHz-30 MHz			EUT laying position	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
2.08						EUT standing position (Worst-case position)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
2.01	nominal	127.40 kHz	Carrier only	3	3/4 (Charge)	-2.00 dBµV/m EUT standing position (Worst-case position)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
2.02	nominal	127.48 kHz	9 kHz-30 MHz			EUT standing position (Worst-case position)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed

Remark: see diagrams in **annex 1** for more details

Table of measurement results: **(RSS-216, Issue 2)**

Diagram No.	Carrier Channel		Frequency range	Set-up no.	OP-mode no.	Remark	Used detector			Result
	Range	No.					PK	AV	QP	
2.03a	nominal	127.64 kHz	109.96 to 210 kHz	2	1 (Ping)	15.49 dB μ A/m EUT laying position	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
2.03b	nominal	127.56 kHz				26.55 dB μ A/m EUT standing position	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
2.04	nominal		9 kHz to 30MHz			EUT standing position (Worst-case position)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
2.05	nominal	128.2 kHz	109.96 to 210 kHz	1	3/4 (charge)	29.64 dB μ A/m EUT standing position	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
2.06						24.31 dB μ A/m EUT laying position	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
2.07a			9 kHz to 30MHz			EUT laying position	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
2.07b						EUT standing position	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
2.01	nominal	127.40 kHz	Carrier only	3	3/4 (Charge)	25.169 dB μ A/m EUT standing position	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
2.02	nominal	127.48 kHz	9 kHz-30 MHz			EUT standing position	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed

Remark: see diagrams in **annex 2** for more details

5.1.6. Correction factors for FCC Part 18 (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 [kHz]	Correction factor [dB]	Frequency [kHz]	Correction factor [dB]
9	-80	1000	-64.04
10	-80	1100	-63.21
20	-80	1200	-62.46
30	-80	1300	-61.76
40	-80	1400	-61.12
50	-80	1500	-60.52
60	-80	1600	-59.96
70	-80	1700	-59.43
80	-80	1800	-58.94
90	-80	1900	-58.47
100	-80	2000	-58.02
110	-80	2100	-57.6
125	-80	2200	-57.19
130	-80	2300	-56.81
140	-80	2350	-56.62
150	-80	2400	-56.44
155	-80	2500	-56.08
160	-79.96	2600	-55.74
165	-79.69	2700	-55.41
170	-79.43	2850	-54.94
180	-78.94	3000	-54.5
190	-78.47	3300	-53.67
200	-78.02	3500	-53.16
210	-77.6	3800	-52.45
220	-77.19	4000	-52
230	-76.81	4200	-51.58
240	-76.44	4500	-50.98
250	-76.08	4800	-50.42
260	-75.74	5000	-50.06
270	-75.41	5200	-49.72
280	-75.1	5500	-49.23
290	-74.79	5800	-48.77
300	-74.5	6000	-48.48
310	-74.21	6500	-47.78
320	-73.94	7000	-47.14
330	-73.67	8000	-45.98
340	-73.41	9000	-44.96
350	-73.16	10000	-44.04
360	-72.91	11000	-43.21
370	-72.68	12000	-42.46
380	-72.45	13000	-41.76
390	-72.22	13560	-41.4
400	-72	14000	-41.12
435	-71.27	15000	-40.52
450	-70.98	15500	-40.23
475	-70.51	15750	-40.1
480	-70.42	15920	-40
490	-70.24	16000	-40
490.1	-70.23	17000	-40
491	-70.22	18000	-40
493	-70.18	19000	-40
495	-70.15	20000	-40
500	-70.06	21000	-40
550	-69.23	22000	-40
600	-68.48	23000	-40
650	-67.78	24000	-40
700	-67.14	25000	-40
750	-66.54	26000	-40
800	-65.98	27000	-40
850	-65.45	28000	-40
900	-64.96	29000	-40
950	-64.49	30000	-40

5.1.7. Verdict: Pass

5.2. General Limit - Radiated field strength emissions, 30 MHz - 1 GHz

5.2.1. Test location and equipment

test location	<input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1)	<input type="checkbox"/> Please see Chapter. 2.2.2	<input type="checkbox"/> Please see Chapter. 2.2.3
test site	<input checked="" type="checkbox"/> 441 EMI SAR	<input checked="" type="checkbox"/> 487 SAR NSA	
receiver	<input type="checkbox"/> 377 ESCS30	<input type="checkbox"/> 001 ESS	<input type="checkbox"/> 489 ESU 40 <input checked="" type="checkbox"/> 620 ESU 26
spectr. analys.	<input type="checkbox"/> 584 FSU	<input type="checkbox"/> 120 FSEM	<input type="checkbox"/> 264 FSEK
antenna	<input checked="" type="checkbox"/> 574 BTA-L	<input type="checkbox"/> 133 EMCO3115	<input type="checkbox"/> 302 BBHA9170 <input type="checkbox"/> 289 CBL 6141 <input type="checkbox"/> 030 HFH-Z2 <input type="checkbox"/> 477 GPS
signaling	<input type="checkbox"/> 392 MT8820A	<input type="checkbox"/> 371 CBT32	<input type="checkbox"/> 547 CMU <input type="checkbox"/> 594 CMW
otherwise	<input type="checkbox"/> 400 FTC40x15E	<input type="checkbox"/> 401 FTC40x15E	<input type="checkbox"/> 110 USB LWL <input checked="" type="checkbox"/> 482 Filter Matrix
DC power	<input checked="" type="checkbox"/> 456 EA 3013A	<input type="checkbox"/> 457 EA 3013A	<input type="checkbox"/> 459 EA 2032-50 <input type="checkbox"/> 268 EA- 3050 <input type="checkbox"/> 494 AG6632A <input type="checkbox"/> 498 NGPE
line voltage	<input type="checkbox"/> 230 V 50 Hz via public mains	<input type="checkbox"/> 060 120 V 60 Hz via PAS 5000	

5.2.2. Requirements/Limits Part 18.305

FCC	Part 18.305 /FCC/OST MP-05			
Frequency [MHz]	Field strength limit		Distance [m]	Remarks
	[μV/m]	[dBμV/m]		
Any ISM frequency	25 (P<500 W) 25xSQRT(P/500)	27.95 (P<500 W) --	300	Correction factor used due to measurement distance of 3 m: 40dB due two 20dB/Dec (67.95 dBμV/m)
Any non-ISM frequency	15 (P<500 W) 15xSQRT(P/500)	23.52 (P<500 W) --	300	Correction factor used due to measurement distance of 3 m: 40dB due two 20dB/Dec (63.52 dBμV/m)

5.2.3. Requirements/Limits RSS-216/RSS-001

ISED (ISED)		<input type="checkbox"/> RSS-Gen., Issue 5, Chapter 8.9, Table 5+6+7 (licence-exempt radio apparatus) <input type="checkbox"/> RSS-Gen., Issue 5, Chapter 7.1.2, Table 2 (receiver) <input checked="" type="checkbox"/> ICES-001, Issue 4 / CISPR 11, Table 11 <input type="checkbox"/> RSS-247, Issue 2, Chapter 5.5 <input type="checkbox"/> RSS-247, Issue 2, Chapter 6.2
Other (ANSI)		<input type="checkbox"/> OST MP-05 <input type="checkbox"/> C63.4-2014 <input type="checkbox"/> C63.10-2013
Limits	Frequency [MHz]	Radiated emissions limits, 3 meters
		QUASI-Peak [dBμV/m]
	30 – 80.872	40
	80.872 – 81.848	60
	81.848 – 134.786	40
	134.786 – 136.414	60
	136.414 - 230	40
230-1000	47	

5.2.4. Test condition and measurement test set-up

Signal link to test system (if used):	<input type="checkbox"/> air link	<input type="checkbox"/> cable connection	<input checked="" type="checkbox"/> none
EUT-grounding	<input checked="" type="checkbox"/> none	<input type="checkbox"/> with power supply	<input type="checkbox"/> additional connection
Equipment set up	<input checked="" type="checkbox"/> table top 0.8 m height <input type="checkbox"/> floor standing		
Climatic conditions	Temperature: (22±3° C)		Rel. humidity: (40±20)% rH
EMI-Receiver (Analyzer) Settings	Scan frequency range:	<input checked="" type="checkbox"/> 30 – 1000 MHz <input type="checkbox"/> other:	
	Scan-Mode	<input checked="" type="checkbox"/> 6 dB EMI-Receiver Mode <input type="checkbox"/> 3 dB spectrum analyzer mode	
	Detector	Peak / Quasi-peak	
	RBW/VBW	100 kHz/300 kHz	
	Mode:	Repetitive-Scan, max-hold	
	Scan step	80 kHz	
	Sweep-Time	Coupled – calibrated display if continuous TX-signal otherwise adapted to EUT's individual duty-cycle	
General measurement procedures	Please see chapter "Test system set-up for electric field measurement in the range 30 MHz to 1 GHz"		

5.2.5. MEASUREMENT RESULTS

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

Table of measurement results (FCC Part 18.305):

Diagram no.	Carrier Channel		Frequency range	Set-up no.	OP-mode no.	Remark	Used detector			Result
	Range	No.					PK	AV	QP	
3.02a	Nominal	127.64 kHz	30 MHz – 1 GHz	2	1 (Ping)	EUT laying	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	passed
3.02b	Nominal		30 MHz – 1 GHz	2		EUT standing	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	passed
3.03	Nominal	128.2 kHz	30 MHz – 1 GHz	1	3/4 (Charge)	EUT standing	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	passed
3.04	Nominal		30 MHz – 1 GHz	1		EUT laying	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	passed
3.01a	Nominal	127.4 kHz	30 MHz – 1 GHz	3	3/4 (Charge)	EUT laying	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	passed
3.01b	Nominal		30 MHz – 1 GHz	3		EUT standing	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	passed

Remark: see diagrams in annex 1 for more details

Table of measurement results (RSS-216, Issue 2):

Diagram no.	Carrier Channel		Frequency range	Set-up no.	OP-mode no.	Remark	Used detector			Result
	Range	No.					PK	AV	QP	
3.01a	Nominal		30 MHz – 1 GHz	3	3/4 (Charging)	EUT laying position Sample08	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	passed
3.01b						EUT standing position Sample08	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	passed
3.02a	Nominal		30 MHz – 1 GHz	2	1 (Ping)	EUT laying position Sample10	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	passed
3.02b						EUT standing position Sample10	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	passed
3.03	Nominal		30 MHz – 1 GHz	1	3/4 (Charging)	EUT standing position Sample12	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	passed
3.04						EUT laying position Sample12	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	passed

Remark: see diagrams in annex 2 for more details

5.2.6. Verdict: Pass

5.3. RF-Parameter: 99% Occupied bandwidth

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

test site	<input type="checkbox"/> 441 EMI SAR	<input type="checkbox"/> 348 EMI cond.	<input type="checkbox"/> 443 EMI FAR	<input checked="" type="checkbox"/> 347 Radio lab.	<input type="checkbox"/> 337 OATS	<input type="checkbox"/>
spectr. analys.	<input type="checkbox"/> 584 FSU	<input type="checkbox"/> 120 FSEM	<input type="checkbox"/> 264 FSEK	<input type="checkbox"/> 489 ESU	<input checked="" type="checkbox"/> 683 FSU26	<input type="checkbox"/>
attenuator	<input type="checkbox"/> 530 10 dB	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
signaling	<input type="checkbox"/> 392 MT8820A	<input type="checkbox"/> 436 CMU	<input type="checkbox"/> 547 CMU			
DC power	<input checked="" type="checkbox"/> 463 HP3245A	<input type="checkbox"/> 087 EA3013	<input type="checkbox"/> 354 NGPE 40	<input type="checkbox"/> 086 LNG50-10	<input type="checkbox"/>	<input type="checkbox"/>
Power supply voltage	<input checked="" type="checkbox"/> 12 V DC		<input type="checkbox"/> 060 110 V 60 Hz via PAS 5000			
Others	<input type="checkbox"/> 613 20dB Attenuator		<input type="checkbox"/> cable K5			

5.3.2. References of occupied and emission bandwidth

§15.202(a) / RSS-GEN, ISSUE 5

(a) Occupied bandwidth. The frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission. In some cases, for example multichannel frequency-division systems, the percentage of 0.5 percent may lead to certain difficulties in the practical application of the definitions of occupied and necessary bandwidth; in such cases a different percentage may prove useful.

5.3.3. Test condition and measurement test set-up

Signal link to test system (if used):	<input type="checkbox"/> air link	<input type="checkbox"/> cable connection	<input checked="" type="checkbox"/> none
EUT-grounding	<input checked="" type="checkbox"/> none	<input type="checkbox"/> with power supply	<input type="checkbox"/> additional connection
Equipment set up	<input checked="" type="checkbox"/> table top		<input type="checkbox"/> floor standing
Climatic conditions	Temperature: (22±3° C)		Rel. humidity: (40±20)% rH
General measurement procedures	Please see chapter "Test system set-up for conducted RF-measurement at antenna Port" (W2 Set-up)		

5.3.4. EUT Settings:

The EUT was instructed to send with maximum power (if adjustable) according applicants instructions. Different modulation characteristics have been checked, e.g. data rates which EUT can operate.

5.3.5. Measurement method:

The **99% emission bandwidth** was measured. Two markers are placed on frequency points such that left to lower f-marker and right to higher f-marker only 1% of the TX-power is contained. Between the markers, 99% of the power is laying. The RBW value is readjusted and the measurement repeated until the RBW/EBW ratio is around 1%.

5.3.6. Spectrum-Analyzer settings:

Span	Set as to fully display the emissions + 30%
Scale y display	approximate 30dB below the maximum PEAK level
Resolution Bandwidth (RBW)	<input checked="" type="checkbox"/> ANSI 63.10:2013 Set to initial value approx. 1% to 5% of the emission bandwidth, re-adjust and proof that RBW/EBW is between 1% and 5%
Video Bandwidth (VBW)	Minimum 3 times the resolution bandwidth
Sweep time	Auto -coupled
Detector	Peak detector
Sweep mode	Repetitive Mode, MAX-HOLD, trace stabilization

5.3.7. Results:

99% OCCUPIED BANDWIDTH:

Set-up no.: 1+2+3	99% Bandwidth	
T _{NOM} = 21°C, V _{NOM} = 13.5 VDC		
Channel 127.7 kHz	Set. 1, op. 3/4	1594.55 Hz (Diagram 2)
	Set. 2, op. 1	368.6 Hz (Diagram 1)
	Set. 3, op. 3/4	1538.46 Hz (Diagram 3)

Remark: Please find measurement diagram in section 1 of Annex 1 & 2.

VERDICT: for information only.

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 it's 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	4.0 dB						-
		150 kHz - 30 MHz	3.6 dB						
Radiated emissions Enclosure	CISPR 16-2-3	30 MHz - 1 GHz	4.2 dB						E-Field
		1 GHz - 18 GHz	5.1 dB						
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 - 26.5 GHz	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 – 18 GHz	1.81	N/A	1.83	N/A	1.77	--	
		18 GHz - 26.5 GHz	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	5.0 dB						Magnetic field E-field Substitution
		30 MHz - 1 GHz	4.2 dB						
		1 GHz - 20 GHz	3.17 dB						

Table: measurement uncertainties, valid for conducted/radiated measurements

6. Abbreviations used in this report

The abbreviations	
ANSI	American National Standards Institute
AV , AVG, CAV	Average detector
EIRP	Equivalent isotropic 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 Measur.	FCC, Federal Communications Commission Laboratory Division, USA
337 487 550 558	-- 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 Measur.	VCCI, Voluntary Control Council for Interference by Information Technology Equipment, Japan
OATS = Open Area Test Site, SAR = Semi Anechoic Room, FAR = Fully Anechoic Room			

8. Instruments and Ancillary

8.1. Used equipment “CTC”

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

8.1.1. Test software and firmware of equipment

Ref.-No.	Equipment	Type	Serial-No.	Version of Firmware or Software during the test
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
642	Wideband Radio Communication Tester	CMW 500	126089	Setup V03.26, Test programm component V03.02.20
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

8.1.2. 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	1a	
060	power amplifier (DC-2kHz)	PAS 5000	B6363	Spitzenberger+Spies	-	3	
066	notch filter (WCDMA; FDD1)	WRCT 1900/2200-5/40-10EEK	5	Wainwright GmbH	12 M	1g	16.11.2019
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	1c	10.03.2020
134	horn antenna 18 GHz (Subst 2)	3115	9005-3414	EMCO	36 M	-	10.03.2020
136	adjustable dipole antenna (Dipole 1)	3121C-DB4	9105-0697	EMCO	36 M	-	30.04.2020
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	1c	16.11.2019
291	high pass filter GSM 850/900	WHJ 2200-4EE	14	Wainwright GmbH	12 M	1c	16.11.2019
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
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
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-	-	ETS-Lindgren /	12 M	5	16.11.2019

Ref.-No.	Equipment	Type	Serial-No.	Manufacturer	Interval of calibration	Remark	Cal due
		RSE		CETECOM			
448	notch filter WCDMA_FDD II	WRCT 1850.0/2170.0-5/40-10SSK	5	Wainwright Instruments GmbH	12 M	1c	16.11.2019
449	notch filter WCDMA FDD V	WRCT 824.0/894.0-5/40-8SSK	1	Wainwright	12 M	1c	16.11.2019
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)	-	1d	
484	pre-amplifier 2,5 - 18 GHz	AMF-5D-02501800-25-10P	1244554	Miteq	12 M	-	16.11.2019
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	Wainwright	12 M	1c	16.11.2019
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	
549	Log.Per-Antenna	HL025	1000060	Rohde & Schwarz	36/12 M	-	31.07.2021
552	high pass filter 2,8-18GHz	WHKX 2.8/18G-10SS	4	Wainwright	12 M	1c	16.11.2019
557	System CTC-OTA-2	R&S TS8991	-	Rohde & Schwarz	12 M	5	24.01.2020
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	
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	24 M	-	29.09.2019
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

Ref.-No.	Equipment	Type	Serial-No.	Manufacturer	Interval of calibration	Remark	Cal due
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	24 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
748	Pickett-Potter Horn Antenna	FH-PP 4060	010001	Radiometer Physics	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	-	11.10.2019
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 Laboratories	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.	-	-	

8.1.3. Legend

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

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

9. Versions of test reports (change history)

Version	Applied changes	Date of release
--	Initial release	2019-09-13

----- End of the Test Report -----