

TEST REPORT
No.: 19-1-0066701T07a

According to:
FCC Regulations, Title 47, Subpart C
§15.225

ISED-Regulations
RSS-Gen, Issue 5
RSS-210, Issue 9

for

Continental Automotive GmbH

D-WMI2020A
Wireless Power Charger

FCC ID: KR5DWMI2020A
ISED ID: 7812D-DWMI2020A

Laboratory Accreditation



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) incorporates an NFC-Transceiver working at 13.56 MHz nominal frequency **with external and internal** NFC antenna. Also co-located test case with wireless charging technology was investigated.

Following tests have been performed to show compliance with applicable FCC Part 15, Subpart C (Unintentional Radiators) of the CFR 47 Rules, Edition 2018 and Canadian RSS-210: Issue 9, RSS-Gen., Issue 5 standards.

1.1. TEST OVERVIEW FCC 15.225 AND ISED RSS-210, ISSUE 9

TX-Mode							
TEST CASES	PORT	REFERENCES & LIMITS			EUT set-up	EUT operating mode	Result
		FCC Standard	RSS Section	Test limit			
Radiated field strength in 30m measurement distance) & emission mask	Cabinet	§2.1046 §15.225(a)(b)(c)(d)	RSS-210, Issue 9, Chapter B.6(a)(b)(c)(d)	84dBµV/m 13.553-13.567 MHz 50.5dBµV/m 13.410-13.553 MHz 13.567-13.710 MHz 40.5 dBµV/m 1.110-13.410 MHz 13.710-14.010 MHz 29.5dBµV/m outside the band 13.110-14.010 MHz	1+2+3	1	passed
99% Occupied bandwidth	Antenna coupling (radiated)	§2.202(a) §2.1049	RSS Gen, Issue 5, Chapter 6.7	99% Power	4+5	1	Only for information
General field strength emissions (radiated - (9 kHz to 30 MHz)	Cabinet + inter-connecting cables (radiated)	§15.209(a)	RSS-Gen, Issue 5 Chapter 8.9 Table 6	2400/F(kHz) µV/m 24000/F(kHz) µV/m 30 µV/m	1+2+3+6	1+2	passed
General field strength emissions + restricted bands (30 MHz to 1000 MHz)	Cabinet + inter-connecting cables (radiated)	§15.209	RSS-Gen, Issue 5 Chapter 8.9 Table 5+7	Emissions in restricted bands must meet the general field-strength radiated limits	1+2+3+6	1+2	passed
Frequency stability	Antenna port (conducted)	§2.1055 §15.225(e)	RSS-210, Issue 9, Chapter B.6	±100ppm	4+5	1	passed
Conducted Emissions	AC-Power lines	§15.207	RSS-Gen, Issue 5: Chapter 8.8, Table 4	FCC §15.207 limits	--	--	Not applicable
				ISED: Table 4			

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.

.....
Dipl.-Ing. Markus Ridder
Responsible for test section

.....
Dipl.-Ing. Christian 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 for testing laboratory:	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 / project:	Dipl.-Ing. C. Lorenz
Receipt of EUT:	2019-05-07
Date(s) of test:	2019-05-17 to 2019-06-28
Date of report:	2019-09-12

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
	Davalgonių g. 12 LT-54462 Sergeičikai I, Kaunas region Lithuania
2 nd Plant:	
Manufacturer's name:	Continental Automotive Lithuania UAB
Address:	Davalgonių g. 12 LT-54462 Sergeičikai I, Kaunas region Lithuania

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)		13.553 - 13.567 MHz	
Type of modulation (packet types)		2-ASK (Amplitude Shift Keying)	
Occupied bandwidth		High version, Internal antenna: 642.6282 kHz High version, External antenna: 572.1154 kHz	
Number of channels (USA/Canada -bands)		1 nominal channel at 13.56 MHz	
Antenna Type		<input checked="" type="checkbox"/> Internal(Integrated) <input type="checkbox"/> External, no RF- connector <input checked="" type="checkbox"/> External, separate RF-connector	
Antenna Gain (NFC Internal Antenna)		-50.8 dBi @ 13.56 MHz	
Antenna Gain (NFC External Antenna)		-53.3 dBi @ 13.56 MHz	
MAX Field strength (radiated):	Internal antenna:	High version: 52.84 dB μ V/m@30 m distance Low version: 53.52 dB μ V/m@30 m distance	
	External antenna:	High version: 43.89 dB μ V/m@30 m distance	
Installed options (not tested within this test report)		<input checked="" type="checkbox"/> battery charging option / wireless power transmission (not tested within this test report)	
Power supply		<input checked="" type="checkbox"/> DC power only: 13.5 Volt	
Special EMI components		--	
EUT sample type		<input type="checkbox"/> Production	<input checked="" type="checkbox"/> Pre-Production
Firmware		<input type="checkbox"/> for normal use	<input checked="" type="checkbox"/> Special version for test execution
FCC label attached		<input type="checkbox"/> yes	<input checked="" type="checkbox"/> no

Remarks:.

For more information of EUT Antenna Gain please see the Customer provided

Document(Operational_Description-1554998668)\cetecom.de\essen\CETECOMPMT\Archive\2019\19-1-00667\3_Documentation\04_TCF\02_Technical_Description

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 S24	D-WMI2020A	D-WMI2020A NFC External Antenna, High version	A3C01728002 00 19 04 01 0037	C2	19.09.30
EUT B S22	D-WMI2020A	D-WMI2020A NFC Internal Antenna, High version	A3C01728002 00 19 04 01 0048	C2	19.09.30
EUT C S18	D-WMI2020A	D-WMI2020A NFC Internal Antenna, Low version	A2C1662885 00 19 04 10 0027	C2	19.09.30
EUT D S26	D-WMI2020A	D-WMI2020A NFC External Antenna + WPC, High version	A3C01728002 00 19 04 01 0047	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	Comment
AE 1 S07	NFC External Antenna	NFC Ext.1	A2139053605	27 18	--	
AE 2 S19	Main Harness	With LED	--	--	--	
AE 3	NFC Tag	NCF3340EHN	--	--	--	
AE 4	Cable with Fakra connector (Cellular)	HUBER+SUHNER ENVIROFLEX 400	E111025 AWM 522787	--	--	
AE 5 S04	WPC 15W	Continental WPC 15W receiver	WS1806180074	--	FW: 0001.0429	
AE 6	NFC External Antenna	NFC Ext.2	A2139052312	27 18	-	Not tested
AE 7	NFC External Antenna	NFC Ext.3	A2139052412	27 18	-	Not tested

*) 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	WMI4 + NFC External Antenna, High Version ➤ Used for Radiated Measurements
set. 2	EUT B + AE 2 + AE 3 + AE 4	WMI3 + NFC Internal Antenna, High version ➤ Used for Radiated Measurements
set. 3	EUT C + AE 2 + AE 3 + AE 4	WMI3 + NFC Internal Antenna, Low version ➤ Used for Radiated Measurements
set. 4	EUT A + AE 1 + AE 2 + AE 3	WMI4 + NFC External Antenna, High Version ➤ Used for Conducted Measurements
set. 5	EUT B + AE 2 + AE 3	WMI3 + NFC Internal Antenna, High version ➤ Used for Conducted Measurements
set. 6	EUT D + AE 1 + AE 2 + AE 3 + AE 4 + AE 5	WMI5 + NFC External Antenna + WPC ➤ Used for Radiated Co-Location Measurements ➤ NFC on + WPC Charging

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

Remarks:.. For more information of EUT setup please see the Customer provided below Documents.

- (Sample setup description)\cetecom.de/essen/CETECOMPMT/Archive/2019/19-1-00667/3_Documentation/04_TCF/10_Test_Setup
- (D-WMI2020A_Homologation Test Setup)\cetecom.de/essen/CETECOMPMT/Archive/2019/19-1-00667/3_Documentation/04_TCF/10_Test_Setup
- (Operational_Description-1554998668)\cetecom.de/essen/CETECOMPMT/Archive/2019/19-1-00667/3_Documentation/04_TCF/02_Technical_Description

3.5. EUT operating modes

EUT operating mode no. *)	Description of operating modes	Additional information
op. 1	TX / RX Mode (NFC module)	Continuous Transmitting. and Receiving
op. 2	TX / RX Mode (NFC module)	Continuous Transmitting. and Receiving + WPC Charging

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

4. Description of test system set-up's

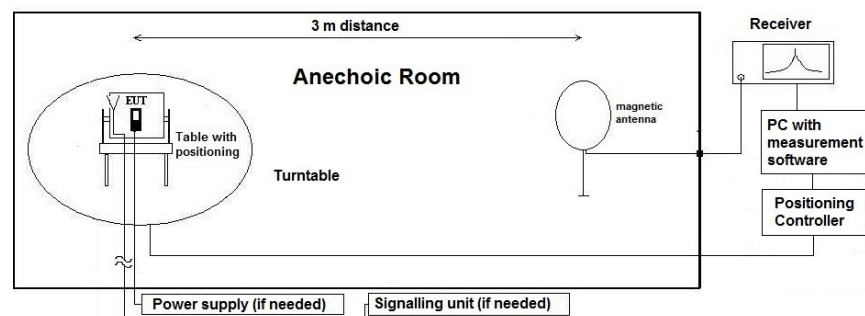
4.1. Test system set-up for radiated magnetic field measurements below 30 MHz

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:

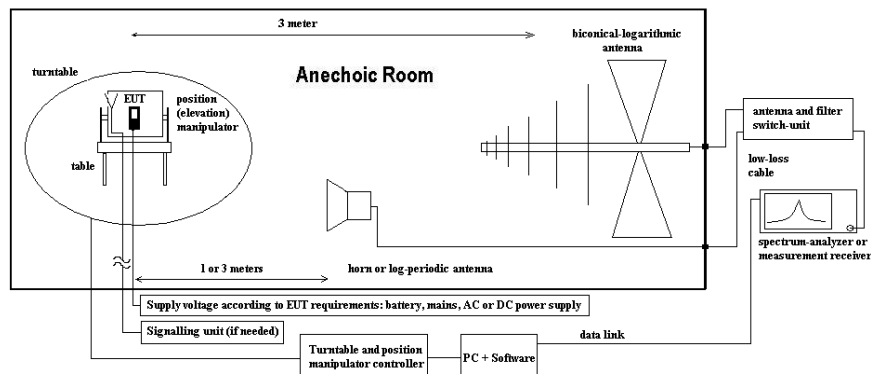
Reference for applied correction (extrapolating) factors due to reduced measurement distance:
ANSI C63.10:2013, §6.4.4.2 - Equations (2) + (3) + (4)

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 10m 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. Radiated field strength emission and mask at 13.110-14.010MHz §15.225(1)(2)(3)(4)

5.1.1. TEST LOCATION AND EQUIPMENT (for reference numbers please see chapter 'List of test equipment')

test location	<input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1)	<input type="checkbox"/> Please see Chapter. 2.2.2		<input type="checkbox"/> Please see Chapter. 2.2.3		
test site	<input checked="" type="checkbox"/> 441 EMI SAR	<input type="checkbox"/> 487 SAR NSA	<input type="checkbox"/> 337 OATS	<input type="checkbox"/> 347 Radio.lab.	<input type="checkbox"/>	
receiver	<input type="checkbox"/> 377 ESCS30	<input type="checkbox"/> 001 ESS	<input checked="" type="checkbox"/> 620 ESU26	<input type="checkbox"/>	<input type="checkbox"/>	
spectr. analys.	<input type="checkbox"/> 120 FSEM	<input type="checkbox"/> 264 FSEK	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
antenna	<input type="checkbox"/> 048 EMCO3143	<input type="checkbox"/> 133 EMCO3115	<input type="checkbox"/> 302 BBHA9170	<input type="checkbox"/> 289 CBL 6141	<input type="checkbox"/> 030 HFH-Z2	<input checked="" type="checkbox"/> 021 EMCO6502
power supply	<input type="checkbox"/> 456 EA 3013A	<input checked="" 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 40
otherwise	<input type="checkbox"/> 400 FTC40x15E	<input type="checkbox"/> 401 FTC40x15E	<input type="checkbox"/> 110 USB LWL	<input type="checkbox"/> 482 Filter Matrix	<input type="checkbox"/> 477 GPS	<input type="checkbox"/>

5.1.2. STANDARDS AND LIMITS: CFR 47, §15.225(a)(b)(c)(d), RSS-210, Issue 9, Chapter B.6

Frequency [MHz]	Field strength		Measurement distance [meters]	Remarks
	[µV/m]	[dBuV/m]		
13.553 -13.567 (allocated band)	15.848	84.00	30	Correction factor used due to measurement distance of 3 m
13.410-13.710	334	50.47	30	
13.110-14.010	106	40.50	30	
Outside band 13.110-14.010	30	29.5	30	

5.1.3. TEST CONDITION AND MEASUREMENT TEST SET-UP

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
EMI-Receiver (Analyzer) Settings	Span/Range: 9 kHz to 150 kHz; 150 kHz to 30 MHz RBW/VBW: 200 Hz/auto; 10 kHz/ auto (ANSI63.10/CISPR#16) Detector/ Mode: PEAK, TRACE max-hold mode, repetitive scan for exploratory measurements Quasi-Peak, for final measurement on critical frequencies (f<1 GHz)		

5.1.4. GENERAL MEASUREMENT PROCEDURES:

The measurement test set-up and test procedure are in accordance with the provisions described in ANSI 63.10: 2013

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

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

According the standard the compliance should be checked in 30m measurement distance. Therefore a additional extrapolation factor was used in order to normalize the measurement data. The frequency dependent extrapolation factor used for this reduced measurement distance, can be found in the chapter 5.1.7.

5.1.5. MEASUREMENT RESULTS: CARRIER FIELD STRENGTH (EMISSION MASK)

Table of measurement results:

Diagram No. / Sub-Chapter	Carrier Channel		Frequency range	Set-up no.	OP-mode no.	Remark	Used detector			Result
	Range	No.					PK	AV	QP	
3	nominal	1	12 - 15 MHz	1	1	High version External NFC antenna activated, with NFC card, standing position(worst case)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	passed
4	nominal	1	12 - 15 MHz	2	1	High version Internal NFC antenna activated, with NFC card, standing position(worst case)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	passed
5	nominal	1	12 - 15 MHz	3	1	Low version Internal NFC antenna activated, with NFC card, standing position(worst case)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	passed

Remarks:

- EUT standing Position found as worst case
- see diagrams enclosed in annex 1 for details

5.1.6. MEASUREMENT RESULTS: RADIATED FIELD STRENGTH (SPURIOUS) – NFC ONLY

Table of measurement results:

Diagram No. / Sub-Chapter	Carrier Channel		Frequency range	Set-up no.	OP-mode no.	Remark	Used detector			Result
	Range	No.					PK	AV	QP	
6	Nominal	1	9 kHz - 30 MHz	1	1	Carrier frequency component in diagram at 13.56 MHz-> not relevant for results	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	passed
7	Nominal	1	9 kHz - 30 MHz	2	1	Carrier frequency component in diagram at 13.56 MHz-> not relevant for results	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed
8	Nominal	1	9 kHz - 30 MHz	3	1	Carrier frequency component in diagram at 13.56 MHz-> not relevant for results	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	passed

Remark: see diagrams enclosed in annex 1 for details

5.1.7. MEASUREMENT RESULTS: RADIATED FIELD STRENGTH (SPURIOUS) – NFC + WPC CHARGING

Table of measurement results:

9	nominal	1	9 kHz - 30 MHz	6	2	Carrier frequency component in diagram at 13.56 MHz-> not relevant	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	passed
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Remark: see diagrams enclosed in annex 1 for details

5.1.8. 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 (d _{meas} < 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	fulfilled	not fulfilled	-80.00
	1.00E+04	30000.00	4774.65		fulfilled	not fulfilled	-80.00
	2.00E+04	15000.00	2387.33		fulfilled	not fulfilled	-80.00
	3.00E+04	10000.00	1591.55		fulfilled	not fulfilled	-80.00
	4.00E+04	7500.00	1193.66		fulfilled	not fulfilled	-80.00
	5.00E+04	6000.00	954.93		fulfilled	not fulfilled	-80.00
	6.00E+04	5000.00	795.78		fulfilled	not fulfilled	-80.00
	7.00E+04	4285.71	682.09		fulfilled	not fulfilled	-80.00
	8.00E+04	3750.00	596.83		fulfilled	not fulfilled	-80.00
	9.00E+04	3333.33	530.52		fulfilled	not fulfilled	-80.00
	1.00E+05	3000.00	477.47		fulfilled	not fulfilled	-80.00
	1.25E+05	2400.00	381.97		fulfilled	not fulfilled	-80.00
	2.00E+05	1500.00	238.73		fulfilled	fulfilled	-78.02
	3.00E+05	1000.00	159.16		fulfilled	fulfilled	-74.49
	4.00E+05	750.00	119.37		fulfilled	fulfilled	-72.00
	4.90E+05	612.24	97.44		fulfilled	fulfilled	-70.23
	5.00E+05	600.00	95.49		fulfilled	not fulfilled	-40.00
	6.00E+05	500.00	79.58		fulfilled	not fulfilled	-40.00
	7.00E+05	428.57	68.21		fulfilled	not fulfilled	-40.00
8.00E+05	375.00	59.68	fulfilled	not fulfilled	-40.00		
9.00E+05	333.33	53.05	fulfilled	not fulfilled	-40.00		
MHz	1.00	300.00	47.75	30	fulfilled	not fulfilled	-40.00
	1.59	188.50	30.00		fulfilled	not fulfilled	-40.00
	2.00	150.00	23.87		fulfilled	fulfilled	-38.02
	3.00	100.00	15.92		fulfilled	fulfilled	-34.49
	4.00	75.00	11.94		fulfilled	fulfilled	-32.00
	5.00	60.00	9.55		fulfilled	fulfilled	-30.06
	6.00	50.00	7.96		fulfilled	fulfilled	-28.47
	7.00	42.86	6.82		fulfilled	fulfilled	-27.13
	8.00	37.50	5.97		fulfilled	fulfilled	-25.97
	9.00	33.33	5.31		fulfilled	fulfilled	-24.95
	10.00	30.00	4.77		fulfilled	fulfilled	-24.04
	10.60	28.30	4.50		fulfilled	fulfilled	-23.53
	11.00	27.27	4.34		fulfilled	fulfilled	-23.21
	12.00	25.00	3.98		fulfilled	fulfilled	-22.45
	13.56	22.12	3.52		fulfilled	fulfilled	-21.39
	15.00	20.00	3.18		fulfilled	fulfilled	-20.51
	15.92	18.85	3.00		fulfilled	fulfilled	-20.00
	17.00	17.65	2.81		fulfilled	fulfilled	-20.00
	18.00	16.67	2.65		fulfilled	fulfilled	-20.00
	20.00	15.00	2.39		fulfilled	fulfilled	-20.00
	21.00	14.29	2.27		fulfilled	fulfilled	-20.00
23.00	13.04	2.08	fulfilled	fulfilled	-20.00		
25.00	12.00	1.91	fulfilled	fulfilled	-20.00		
27.00	11.11	1.77	fulfilled	fulfilled	-20.00		
29.00	10.34	1.65	fulfilled	fulfilled	-20.00		
30.00	10.00	1.59	fulfilled	fulfilled	-20.00		

5.1.9. VERDICT: Limits according §15.225(a)(b)(c)(d) and RSS-210, Issue 9, Chapter B.6 – 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 checked="" type="checkbox"/> 001 ESVS30	<input type="checkbox"/> 001 ESS	<input type="checkbox"/> 489 ESU 40	<input 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
signalling	<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 type="checkbox"/> 456 EA 3013A	<input checked="" 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

FCC		<input type="checkbox"/> Part 15 Subpart B, §15.109, class B <input checked="" type="checkbox"/> Part 15 Subpart C, §15.209	
ISED (IC)		<input checked="" type="checkbox"/> RSS-Gen., Issue 5, Chapter 8.9, Table 5+7 (licence-exempt radio apparatus) <input checked="" type="checkbox"/> RSS-210., Issue 9, Chapter B.6 <input type="checkbox"/> RSS-Gen., Issue 4, Chapter 7.1.2, Table 2 (receiver) <input type="checkbox"/> ICES-003, Issue 6, Table 5 (Class B) <input type="checkbox"/> RSS-247, Issue 1, Chapter 5	
ANSI		<input type="checkbox"/> C63.4-2014 <input checked="" type="checkbox"/> C63.10-2013	
Limit	Frequency [MHz]	Radiated emissions limits, 3 meters	
		QUASI Peak [μ V/m]	QUASI-Peak [$\text{dB}\mu\text{V/m}$]
	30 - 88	100	40.0
	88 - 216	150	43.5
	216 - 960	200	46.0
above 960	500	54.0	

5.2.3. Restricted bands of operation (FCC §15.205/ RSS-Gen, Issue 5, Chapter 8.10, Table 7)

MHz	MHz	GHz
0.090-0.110	156.7-156.9	9.0-9.2
0.495-0.505	162.0125-167.17	9.3-9.5
2.1735-2.1905	167.72-173.2	10.6-12.7
3.020-3.026 (Canada only)	240-285	13.25-13.4
4.125-4.128	322-335.4	14.47-14.5
4.17725 - 4.17775	399.9-410	15.35-16.2
4.20725-4.20775	608-614	17.7-21.4
5.677 - 5.683 (Canada only)	960-1240	22.01-23.12
6.215-6.218	1300-1427	23.6-24.0
6.26775-6.26825	960-1427 (only Canada)	31.2-31.8
6.31175-6.31225	1435-1626.5	36.43-36.5
8.291-8.294	1645.5-1646.5	Above 38.6
8.362-8.366	1660-1710	--
8.37625-8.38675	1718.8-1722.2	--
8.41425-8.41475	2200-2300	--
12.29-12.293	2310-2390	--
12.51975-12.52025	2483.5-2500	--
12.57675-12.57725	2690-2900	--
13.36-13.41	2655-2900 (only Canada)	--
16.42-16.423	3260-3267	--
16.69475-16.69525	3332-3339	--
16.80425-16.80475	3345.8-3358	--
25.5-25.67	3500-4400 (only Canada)	--
37.5-38.25	3600-4400	--
73-74.6	4500-5150	--
74.8-75.2	5350-5460	--
108-121.94	7250-7750	--
123-138	8025-8500	--
108-138 (only Canada)	--	--
149.9-150.05	--	--
156.52475-156.52525	--	--

Remark: only spurious emissions are allowed within these frequency bands not exceeding the limits per §15.209/RSS-Gen.

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 0.8m 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: NFC ONLY

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

Diagram No. / Sub-Chapter	Frequency range	Set-up no.	OP-mode no.	Remark	Used detector			Result
					PK	AV	QP	
10	30 MHz – 1 GHz	1	1	High version, External NFC antenna activated, with NFC card, laying position	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	passed
11	30 MHz – 1 GHz	1	1	High version, External NFC antenna activated, with NFC card, standing position	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	passed
12	30 MHz – 1 GHz	2	1	High version, Internal NFC antenna activated, with NFC card, laying position	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	passed
13	30 MHz – 1 GHz	2	1	High version, Internal NFC antenna activated, with NFC card, standing position	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	passed
14	30 MHz – 1 GHz	3	1	Low version, Internal NFC antenna activated, with NFC card, laying position	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	passed
15	30 MHz – 1 GHz	3	1	Low version, Internal NFC antenna activated, with NFC card, standing position	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	passed

Remark: see diagrams in annex 1 for more details

5.2.6. MEASUREMENT RESULTS: NFC + QI CHARGING WIRELESS TECHNOLOGY (CO-LOCATION)

16	30 MHz – 1 GHz	6	2	High version, External NFC antenna activated, with NFC card, laying position	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	passed
17	30 MHz – 1 GHz	6	2	High version, External NFC antenna activated, with NFC card, standing position	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	passed

Remark: see diagrams in annex 1 for more details

5.2.7. VERDICT: PASS

5.3. Frequency error (tolerance)

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

test location	<input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1)	<input type="checkbox"/> Please see Chapter. 2.2.2	<input type="checkbox"/> Please see Chapter. 2.2.3
test site	<input type="checkbox"/> 441 EMI SAR	<input type="checkbox"/> 487 SAR NSA	<input type="checkbox"/> 337 OATS
receiver	<input type="checkbox"/> 377 ESCS30	<input type="checkbox"/> 001 ESS	<input type="checkbox"/> 347 Radio.lab
spectr. analys.	<input type="checkbox"/> 489 ESU40	<input checked="" type="checkbox"/> 683 FSU26	<input type="checkbox"/>
antenna	<input type="checkbox"/> 048 EMCO3143	<input type="checkbox"/> 133 EMCO3115	<input type="checkbox"/> 302 BBHA9170
signaling	<input type="checkbox"/> 298 CMU	<input type="checkbox"/> 460 CMU	<input type="checkbox"/> 295 RACAL
power supply	<input checked="" type="checkbox"/> 456 EA 3013A	<input type="checkbox"/> 457 EA 3013A	<input type="checkbox"/> 459 EA 2032-50
otherwise	<input type="checkbox"/> 400 FTC40x15E	<input type="checkbox"/> 401 FTC40x15E	<input type="checkbox"/> 110 USB LWL
			<input type="checkbox"/> 289 CBL 6141
			<input type="checkbox"/> 030 HFH-Z2
			<input checked="" type="checkbox"/> 431 Model 7405
			<input type="checkbox"/> 392 MT8820A
			<input type="checkbox"/> 268 EA- 3050
			<input type="checkbox"/> 494 AG6632A
			<input type="checkbox"/> 498 NGPE 40
			<input type="checkbox"/> 482 Filter Matrix
			<input type="checkbox"/> 477 GPS

5.3.1. Standards and Limits: CFR 47, §15.225, RSS-210, Issue 9, B.6

Frequency [MHz]	Frequency tolerance			Remarks
	[%]	[ppm]	[Hz]	
13.553 -13.567	±0.01	±100	±1356.7	--

5.3.2. Test condition and measurement test set-up

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: between potential equalization connector (EUT) and GND with a lab wire 1.2 m)
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
EMI-Receiver (Analyzer) Settings	Span/Range: 9 kHz to 150 kHz; 150 kHz to 30 MHz RBW/VBW: 200Hz/auto; 10 kHz/ auto (ANSI63.10/CISPR#16) Detector/ Mode: PEAK, TRACE max-hold mode, repetitive scan for exploratory measurements		

5.3.1. TEST SET-UP

A sniffer antenna acts like a coupling antenna for measuring the fundamental frequency. This is placed at about 20cm away from the equipment. Also connecting cables at the equipment are avoided on the extent possible in order not to degrade the resonance frequency of the equipment and integral antenna.

5.3.2. EQUIPMENT SETTINGS

The measurements is made on nominal carrier frequency within operational band.

5.3.3. TEST METHOD

If the equipment is capable of producing an un-modulated carrier then a trace with max-hold function was recorded. The maximum peak within the span was found, then the frequency deviation was recorded with the build-in frequency counter within the spectrum-analyzer. The maximum resolution was chosen on the settings.

The frequency deviation was recorded at switching on point of the equipment and on 2 minutes, 5minutes and 10 minutes after at in accordance with ANSI 63.10: 2013, Chapter 6.8

All measurements data are enclosed in annex measurements. Here only maximum frequency error is reported.

5.3.3.1. Frequency shift of carrier against voltage range at constant nominal temperature of 21° Celsius

- 1.) determine the carrier frequency for the lowest and highest channel at room temperature [21° C] and nominal voltage after a long run of the device equipment (EUT). This frequency is taken as reference for all other measured frequencies.
- 2.) loaded batteries with specified voltage are prepared and used in the equipment specified range of the battery and equipment declared voltage.

5.3.3.2. Frequency shift of carrier against temperature at constant power supply voltage

- 1.) Use a full loaded battery for tests according this chapter
- 2.) determine the carrier frequency at room temperature and nominal voltage [21°C] after a long run of the device equipment (EUT). This frequency is taken as reference for all other measured frequencies.
- 3.) Perform the carrier frequencies measurements in 10°C increments from 85°C down to -40°C as required by the standards. The stabilization period was about 1 hour after thermal reach of the required temperature.

5.3.4. Results for voltage variations

Nominal conditions	Frequency measured			
Vnom = 13.5 V Thom = 21°C	13.5604962	Limit-> 100ppm:	1356.04962	Hz

Extreme conditions				
Voltage	Frequency measured	Values for Frequency Error		
		[Hz]	[%]	[ppm]
16	13.5605268	-30.6000000	-0.0002257	-2.26
15.3	13.5605523	-56.1000000	-0.0004137	-4.14
14.6	13.5605455	-49.3000000	-0.000364	-3.64
13.9	13.5605440	-47.8000000	-0.000352	-3.53
13.2	13.5605417	-45.5000000	-0.000336	-3.36
12.5	13.5605366	-40.4000000	-0.000298	-2.98
11.8	13.5605367	-40.5000000	-0.000299	-2.99
11.1	13.5605362	-40.0000000	-0.000571	-2.95
10.4	13.5605350	-38.8000000	-0.000286	-2.86
9.7	13.5605330	-36.8000000	-0.000271	-2.71
9.0	13.5604883	7.9000000	0.000058	0.58

5.3.5. Results for temperature variations

Nominal conditions					
Vnom = 13.5V (DC Supply) Tnom = 21°C	Reference frequency [MHz]	13.5604962	Limit-> 100 ppm:	1356.04962	Hz

Extreme conditions								
Temperature	Measurement period after power-up the EUT	Frequency measured	Values for Frequency Error			Abs. Maximum Value	Absolute Maximum value	Verdict
			[Hz]	[%]	[ppm]			
Tmax=85°C	on StartUp	13.5605013	5.1000000	0.00038	0.38	7.47	21.27	Pass
	2 Minutes	13.5605365	40.3000000	0.00297	2.97			
	5 Minutes	13.5605599	63.7000000	0.00470	4.70			
	10 Minutes	13.5605975	101.3000000	0.00747	7.47			
Tmax=70°C	on StartUp	13.5606093	113.1000000	0.00834	8.34	8.34		
	2 Minutes	13.5604491	-47.1000000	-0.00347	-3.47			
	5 Minutes	13.5604596	-36.6000000	-0.00270	-2.70			
	10 Minutes	13.5604723	-23.9000000	-0.00176	-1.76			
Tmax=60°C	on StartUp	13.5604324	-63.8000000	-0.00470	-4.71	7.57		
	2 Minutes	13.5605988	102.6000000	0.00757	7.57			
	5 Minutes	13.5604287	-67.5000000	-0.00498	-4.98			
	10 Minutes	13.5604320	-64.2000000	-0.00473	-4.73			
Tmax=50°C	on StartUp	13.5604736	-22.6000000	-0.00167	-1.67	7.90		
	2 Minutes	13.5604627	-33.5000000	-0.00247	-2.47			
	5 Minutes	13.5604505	-45.7000000	-0.00337	-3.37			
	10 Minutes	13.5606033	107.1000000	0.00790	7.90			
T=40°C	on StartUp	13.5605777	81.5000000	0.00601	6.01	6.01		
	2 Minutes	13.5605534	57.2000000	0.00422	4.22			
	5 Minutes	13.5605299	33.7000000	0.00249	2.49			
	10 Minutes	13.5604925	-3.7000000	-0.00027	-0.27			
T=30°C	on StartUp	13.5605285	32.3000000	0.00238	2.38	6.50		
	2 Minutes	13.5605511	54.9000000	0.00405	4.05			
	5 Minutes	13.5604962	0.0000000	0.00000	0.00			
	10 Minutes	13.5605843	88.1000000	0.00650	6.50			
T=10°C	on StartUp	13.5605700	73.8000000	0.00544	5.44	12.43		
	2 Minutes	13.5606488	152.6000000	0.01125	11.25			
	5 Minutes	13.5605619	65.7000000	0.00484	4.84			
	10 Minutes	13.5606648	168.6000000	0.01243	12.43			
T=0°C	StartUp	13.5606634	167.2000000	0.01233	12.33	12.65		
	2 Minutes	13.5606548	158.6000000	0.01170	11.70			
	5 Minutes	13.5606451	148.9000000	0.01098	10.98			
	10 Minutes	13.5606677	171.5000000	0.01265	12.65			
T=-10°C	StartUp	13.5606754	179.2000000	0.01321	13.21	15.85		
	2 Minutes	13.5606718	175.6000000	0.01295	12.95			
	5 Minutes	13.5607111	214.9000000	0.01585	15.85			
	10 Minutes	13.5606575	161.3000000	0.01189	11.89			
T=-20°C	StartUp	13.5606669	170.7000000	0.01259	12.59	21.27		
	2 Minutes	13.5607846	288.4000000	0.02127	21.27			
	5 Minutes	13.5606801	183.9000000	0.01356	13.56			
	10 Minutes	13.5606823	186.1000000	0.01372	13.72			
T=-30°C	StartUp	13.5606833	187.1000000	0.01380	13.80	19.31		
	2 Minutes	13.5607360	239.8000000	0.01768	17.68			
	5 Minutes	13.5607580	261.8000000	0.01931	19.31			
	10 Minutes	13.5606916	195.4000000	0.01441	14.41			
T=-40°C	StartUp	13.5605701	73.9000000	0.00545	5.45	10.66		
	2 Minutes	13.5606073	111.1000000	0.00819	8.19			
	5 Minutes	13.5606222	126.0000000	0.00929	9.29			
	10 Minutes	13.5606407	144.5000000	0.01066	10.66			

VERDICT: Limits according §15.225(e) and RSS-210, Issue 9, Chapter B.6 - Pass

5.4. RF-Parameter - 99% occupied Bandwidth

5.4.1. 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"/> 620 ESU26	<input checked="" type="checkbox"/> 683 FSU26	<input type="checkbox"/>
attenuator	<input checked="" type="checkbox"/> 530 10 dB	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
other	<input checked="" type="checkbox"/> 431 EMCO Model 7405					
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"/> 13.5 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				

5.4.2. References of bandwidth measurements

§15.215(C), RSS-Gen, Issue 5: Chapter 6.7

(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. In the case of intentional radiators operating under the provisions of subpart E, the emission bandwidth may span across multiple contiguous frequency bands identified in that subpart. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

5.4.3. 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)		

5.4.4. 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.

5.4.5. Measurement method:

Three carrier frequencies (low/middle/high) were used for showing the compliance with this requirement. The operating modes have been varied (e.g. data rate, modulation scheme, etc.). If applicable the hopping-mode is switched off.

The **99% 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%.

5.4.6. 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% <input type="checkbox"/> KDB558074v04
Video Bandwidth (VBW)	Minimum 3 times the resolution bandwidth
Sweep time	Auto -coupled
Detector	Peak detector
Sweep mode	Repetitive Mode, MAX-HOLD, trace stabilization

5.4.7. Results:

For graphical results pls. see annex 1 to this test report.

99% OCCUPIED BANDWIDTH:

Set-up no.: 1 Op. Mode: 1	99% Bandwidth [kHz]		
$T_{NOM}=21^{\circ}\text{C}$, $V_{NOM}=3\text{V}$	Nominal channel (13.56 MHz)	Remark:	
Measured value: Set-up 1, External Antenna	572.115384	Diagram 1	
Measured Level Set-up 2, Internal antenna	642.628205	Diagram 2	--

Remark: For graphical results pls. see annex 1 to this test report.

VERDICT: pass

5.5. 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 - 12.75 GHz	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 - 2.8 GHz	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 isotropically radiated power, determined within a separate measurement
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)	IC, 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
001	EMI Test Receiver	ESVS 30	829007/001	Firm.= V11.08.06, V 1.18
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	-	30.04.2018
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	-	30.04.2018
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
371	Bluetooth Tester	CBT32	100153	R&S	36 M	-	30.05.2019
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	-	30.03.2019
431	Model 7405	Near-Field Probe Set	9205-2457	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

Ref.-No.	Equipment	Type	Serial-No.	Manufacturer	Interval of calibration	Remark	Cal due
441	CTC-SAR-EMI Cable Loss	System EMI field (SAR) Cable	-	CETECOM	12 M	5	05.06.2017
443	CTC-FAR-EMI-RSE	System CTC-FAR-EMI-RSE	-	ETS-Lindgren / CETECOM	12 M	5	16.11.2019
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	
546	Univ. Radio Communication Tester	CMU 200	106436	R&S	12 M	-	30.07.2019
547	Univ. Radio Communication Tester	CMU 200	835390/014	Rohde & Schwarz	12 M	-	30.07.2019
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	-	30.08.2019
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
558	System CTC FAR S-VSWR	System CTC FAR S-VSWR	-	CTC	24 M	-	08.08.2019
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	

Ref.-No.	Equipment	Type	Serial-No.	Manufacturer	Interval of calibration	Remark	Cal due
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
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
747	Spectrum Analyzer	FSU 26	200152	Rohde & Schwarz	12 M	-	30.05.2019
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	Elektro-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	Antenal 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

8.1.4. 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	2019-09-12

End Of Test Report