P A R T I A L T E S T R E P O R T
No.: 2-20842790-15-9b

According to:
FCC Regulations
Part 15.407, Part 15.207

IC-Regulations
RSS-Gen, Issue 4
RSS-247, Issue 1

for

Datalogic ADC S.r.l.

JOYA TOUCH
Type: P00AN04HL0HT0W7-GR0

FCC-ID: U4GJNGWB
IC: 3862E-JNGWB
PMN: JOYA TOUCH
HVIN: JNG P HH

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

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Table of contents

Table of annex

The listed attachments are an integral part of this report — **Total pages**

Annex 1: Test result diagrams (separate document) **TR2-20842790-15-9b-A1**	52
Annex 2: External photographs of EUT (separate document) **TR2-20842790-15-9b-A2**	5
Annex 3: Internal photographs of EUT (separate document) **TR2-20842790-15-9b-A3**	13
Annex 4: Test set-up photographs (separate document) **TR2-20842790-15-9b-A4**	12
Tune-up procedure for SSD45_JOYA TOUCH Plus_rev20160621(supplied by applicant)	3
JOYANG_TEST-TOOLS_QUICK_START_INSTRUCTIONS_REV20160530 (supplied by applicant)	41
JOYANG_ WLAN Antenna Final Report (22-Feb-2016) (supplied by applicant)	11
Operational Description_JOYA TOUCH_20160530_rev05 (supplied by applicant)	10

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.
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 presented Equipment Under Test (in this report, hereinafter referred as EUT) supports radiofrequency technologies with WLAN technology and operating frequency range at 5150 to 5850 GHz according to IEEE 802.11 a/ac. Other implemented wireless technologies were not considered within this test report.
The build-in W-LAN module is already approved with FCC ID: SQG-SSD45N and IC:3147A-SSD45N.

Following test cases have been performed to show compliance with valid Part 15.209/15.407 of the FCC CFR Title 47 Rules, Edition 4th November 2015 and IC RSS-247 Issue 1/RSS-Gen Issue 4 standards.

1.1. Tests measurement overview according of US CFR Title 47, Subpart 15C and Canada RSS-Standards:

Test cases	Port	References and Limits			EUT set-up	EUT op. mode	Result
		FCC Standard	RSS-Standard	Test limit			
TX-Mode							
99% occupied bandwidth	Antenna terminal (conducted)	2.1049(h)	RSS-Gen, Issue 4	99% Power bandwidth	--	--	Remark 1.)
Duty-Cycle	Antenna terminal (conducted)	--	--	No pass/fail criteria To be reported accord. KDB789033 or ANSI C63.10:2013	2	1	Remark 4.)
Maximum output power	Antenna terminal (conducted)	§15.407(a) (1)(2)(3)	RSS-247, Issue 1 chapter 6.2.1(1) 6.2.2(1) 6.2.3(1) 6.2.4(1)	(1) lesser of 200mW or 10dBm+10logB (2): lesser of 250mW or 11dBm+10logB (3): lesser of 250mW or 11dBm+10logB	2	1	Pass Remark 4.)
Peak Power Spectral density	Antenna terminal (conducted)	§15.407(a) (1)(2)(3)	RSS-247, Issue 1 chapter 6.2.1(1) 6.2.2(1) 6.2.3(1) 6.2.4(1)	(1): 10dBm/MHz (2): 11dBm/MHz (3): 11dBm/MHz	2	1	Pass Remark 4.)
Antenna gain information	Antenna terminal (conducted)	§15.407(a) (1)(2)(3)	RSS-247, Issue 1 chapter 6.2.1(1) 6.2.2(1) 6.2.3(1) 6.2.4(1)	< 6dBi or reduction of power/power density	--	--	See Applicant's declaration

General field strength emissions within restricted bands	Enclosure + Inter-connecting cables (radiated)	§15.407(6) §15.407(b) §15.205 §15.209	RSS-247, Issue 1 chapter 6.2.1(2) 6.2.2(2) 6.2.3(2) 6.2.4(2) RSS-Gen., Issue 4	FCC/IC: Emissions in restricted bands must meet the general field-strength radiated limits IC: Chapter 8.9 Table 4+5+6	1	1	Pass
Band-Edge compliance radiated	Enclosure + Inter-connecting cables (radiated)	§15.205 §15.209		Emissions in restricted bands must meet the general field-strength radiated limits chapter 8.9 Table 6	1	1	Pass
		§15.407(b)		Out-of-band emission EIRP < -27dBm/MHz or -17dBm/MHz	1	1	Pass
				If applicable (EIRP>200mW): Elevation Mask of radiation pattern			
Dynamic frequency selection (DFS)	Antenna terminal (conducted)	§15.407	RSS-247, Issue 1 chapter 6.3	IC: A9.3 (a) General (b) Operational requirements --	--	--	Remark 2.)
AC-Power Lines Conducted Emissions	AC-Power lines	§15.207	RSS-Gen, Issue 4: Chapter 8.8, Table 3	FCC §15.107 class B limits §15.207 limits IC: Table 3	--	--	Remark 3.)

Remark: 1.) Please refer integrated SSD45N W-LAN Module's reports
FCC ID: SQG-SSD45N Report No.FR442904-01AN Version Rev.01, issued Sep. 15, 2015
Report No.FR442904-01AI Version Rev.01, issued Sep. 15, 2015
IC:3147A-SSD45N Report No.CR442904-02AN Version Rev.01, issued Nov. 03, 2015
2.) Please refer separate Report No.1-1858_16-02-03 issued on 25.05.2016
3.) Please refer separate test report TR2-20842790-15-10d and corresponding annexes
4.) Conducted Tests performed only on Worst-Case JOYA TOUCH Variant Type: P00AN04HL0GT0W7-GRR
(see test report TR2-20842790-15-10b)

RF-Exposure Evaluation (separation distance user to RF-radiating element greater 20cm)							
Test cases	**Port**	**References & Limits**			**EUT set-up**	**EUT opera-ting mode**	**Result**
		FCC Standard	**RSS Section**	**Test Limit**			
Radio frequency radiation exposure requirements	Cabinet + Inter-connecting cables (radiated)	§1.1310(b) §2.1091 §2.1093	RSS-102 Issue 5	**RF-Field Strength Limits: FCC:** "general population/ uncontrolled" environment Table 1 **IC:** Table 4	1	1	See separate test report 1-1858_16-01-05

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.

Digital unterschrieben von Rachid Acharkaoui
DN: cn=Rachid Acharkaoui, o=CETECOM GmbH, ou=RC&EMC, email=rachid.acharkaoui@cetecom.com, c=DE
Datum: 2016.10.28 15:37:49 +02'00'

Dipl.-Ing. Rachid Acharkaoui
Responsible for test section

Digitally signed by christian.lorenz@cetecom.com
DN: cn=christian.lorenz@cetecom.com
Date: 2016.10.28 15:20:53 +02'00'

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:	Dipl.-Ing. Rachid Acharkaoui
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

2.3. Organizational items

Responsible for test report :	Dipl.-Ing. Christian Lorenz
Project leader:	Dipl.-Ing. V. Krueger
Receipt of EUT:	2016-02-29
Date(s) of test:	2016-03-02 to 2016-10-10
Date of report:	2016-10-12
Version of template: 13.02	

2.4. Applicant's details

Applicant's name:	Datalogic ADC S.r.l.
Address:	Via S. Vitalino, 13 40012, Lippo di Calderara di Reno (BO) ITALY
Contact person:	Mr. Eucarpio Guarisco

2.5. Manufacturer's details

Manufacturer's name:	please see Applicant's details
Address:	please see Applicant's details

3. Equipment under test (EUT)

3.1. Technical 5GHz W-LAN data of main EUT declared by applicant

Frequency range and channels	U-NII 1 (5150-5250MHz)	☒ Ch. 36 to Ch. 48 (Nominal 20MHz signal bandwidth) ☐ Ch. 38 to Ch. 46 (Nominal 40MHz signal bandwidth)		
	U-NII2A (5250-5350MHz)	☒ Ch. 52 to Ch. 64 (Nominal 20MHz signal bandwidth) ☐ Ch. 54 to Ch. 62 (Nominal 40MHz signal bandwidth)		
	U-NII 2C (5470-5725MHz)	☒ Ch. 100 to 140 (Nominal 20MHz signal bandwidth) ☐ Ch. 102 to 134 (Nominal 40MHz signal bandwidth)		
	U-NII-3	☒ Ch. 149 to 165 (Nominal 20MHz signal bandwidth) ☐ Ch. 151 to 159 (Nominal 40MHz signal bandwidth)		
Type of modulation (packet types)		☒ BPSK ☒ QPSK ☒ 16-QAM ☒ 64-QAM ☒ 256-QAM		
Number of channels (USA/Canada -bands)		☒ 20MHz bandwidth: 36/40/44/48/52/56/60/64/100/104/108/112/116 132/136/138/140/149/153/157/161/165 ☐ 40MHz bandwidth: 38/46/54/62/102/110/118/134/151/159		
Antenna Type		☒ Integrated ☐ External, no RF- connector ☐ External, separate RF-connector		
Antenna Gain		According to Applicant's declaration 5150 to 5250 MHz: 5.83 dBi 5250 to 5350 MHz: 5.83 dBi 5470 to 5700 MHz: 5.83 dBi 5725 to 5850 MHz: 5.83 dBi		
Installed options		☒ W-LAN 2.4 GHz(not tested within this test report) ☒ Bluetooth©(not tested within this test report) ☒ NFC (not tested within this test report) ☒ battery charging option (WPC) (not tested within this test report)		
Power supply		☒ Internal battery Li-Io 3.41V DC to 4.35 V DC (nominal 3.75 V DC) ☐ over AC/DC adapter: 120V/60 Hz ☐ DC power only:		
Special EMI components		--		
EUT sample type		☐ Production	☒ Pre-Production	☐ Engineering
Firmware		☐ for normal use		☒ Special version for test execution
FCC label attached		☒ yes	☐ no	

Please refer Applicants declaration for further details

3.2. IEEE 802.11 OVERVIEW: MODULATION AND DATA RATES

The modulations and data rates defined for 802.11 a/n transmitters are identified in the table below. Also it shows which operational mode is possible for the device under test (EUT) according applicant's information.

802.11a-Mode (OFDM system)		
Brutto data rate [MBps]	Modulation type of subcarriers	Supported by EUT
6 / 9	BPSK	Yes
12 /18	QPSK	Yes
24 / 36	16-QAM	Yes
48 / 54	64-QAM	Yes

Remark: 52 sub-carriers which can be modulated at different data-rates.

802.11n-Mode (OFDM)		
Brutto data rate [MBps]	Modulation type	Supported by EUT
7.2/14.4/21.7/28.9/43.3/57.8/65/72.2 Mbps	HT20 (MCS0..MCS7)	Yes
14.444/28.889/43.333/57.778/86.667/ 115.556/130/144.444 Mbps	HT20 (MCS8..MCS15)	No
15/30/45/60/90/120/135/150 Mbps	HT40 (MCS0..MCS7)	No
30/60 Mbps	HT40 (MCS8..MCS9)	No
90/120/180/240/270/300 Mbps	HT40 (MCS10..MCS15)	No

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

Short descrip-tion*)	EUT	Type	S/N serial number	HW hardware status	SW software status
EUT A	JOYA TOUCH	P00AN04HL0HT0 W7-GR0	Z16P00043	Beta HW Version P/N: 911350015	SW Version:WEC7 Firmware Version: 2.16

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

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

AE short descrip-tion *)	Auxiliary Equipment	Type	S/N serial number	HW hardware status	SW software status
AE 1	--	--	--	--	--

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

3.5. EUT set-ups

EUT set-up no.*)	Combination of EUT and AE	Remarks
set. 1	EUT A	Radiated measurements Set-up
set. 2	EUT A + Cable 1	Conducted measurements Set-up

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

3.6. EUT operating modes

EUT operating mode no.*)	Description of operating modes	Additional information
op. 1	TX- Mode	With help of installed Datalogic test firmware version 2.16 a continuous TX-a/n (HT20) Mode can be established on -desired channels, modulation data rates in LRU Application -maximum 90% power level in LMU application.

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

3.7. EUT power level configurations

EUT operating mode no.*)	Description of operating modes	Power level information
op. 1	TX- Mode	With help of installed Datalogic test firmware version 2.16 maximum 90% power level in LMU application is configured for all measurements included in this report. This Power level will now be considered as a Nominal Power level throughout this report & shall be used for compliance purposes.

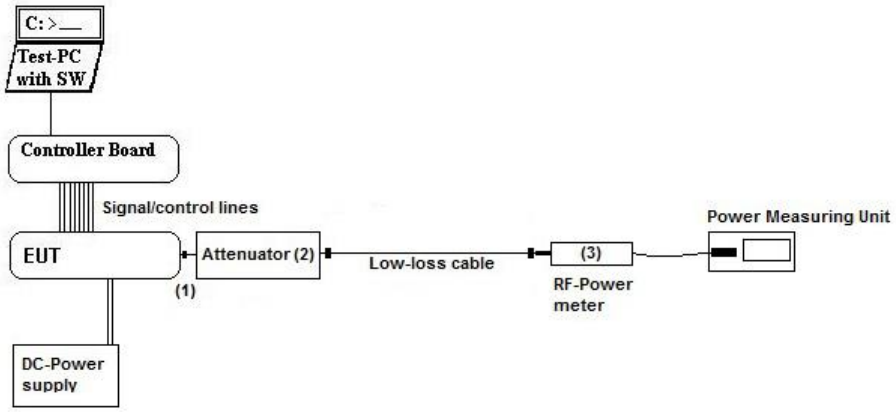
3.8. Configuration of cables used for testing

Cable number	Item	Type	S/N serial number	HW hardware status	Cable length
Cable 1	RF –SMA Cable	--	--	--	--

4. Description of test system set-up's

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

Conducted Set-up W1

W-LAN conducted RF-Setup 1 (W1 Set-up)	
General description:	The EUT's RF-signal is coupled out by a suitable antenna coupling connector (1). The signal is first attenuated (2) then connected to the power meter (3) for conducted power measurements. The specific attenuation loss is determined prior to the measurement within a set-up attenuation measurement. These are then taken into account by correcting the measurement readings.
Schematic:	
Testing method:	ANSI C63.10: 2013 Chapter 12.3.3.1+ FCC KDB 789033v01r03

Used Equipment	Passive Elements	Test Equipment	Remark:
	☒ 20 dB Attenuator ☒ Low loss RF-cables	☒ Power Meter ☒ DC-Power Supply ☒ Spectrum-Analyser	See List of equipment under each test case and chapter 8 for calibration info

Measurement uncertainty	See chapter 5.8

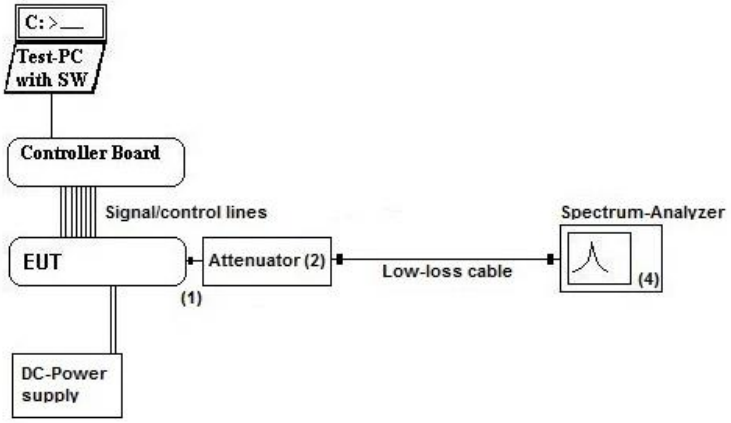
Conducted Set-up W2

W-LAN conducted RF-Setup 2 (W2 Set-up)

General description:

The EUT‘s RF-signal is coupled out by a suitable antenna coupling connector (1). The signal is first attenuated (2) then connected to spectrum-analyzer (4) for RF-conducted measurements. The specific attenuation loss is determined prior to the measurement within a set-up attenuation measurement. These are then taken into account by correcting the measurement readings of the spectrum-analyzer.

Schematic:



Testing method:

ANSI C63.10:2013, FCC KDB 789033v01r03

Used Equipment

Passive Elements	Test Equipment	Remark:
☒ 20 dB Attenuator ☒ Low loss RF-cables	☒ Power Meter ☒ DC-Power Supply ☒ Spectrum-Analyser	See List of equipment under each test case and chapter 8 for calibration info

Measurement uncertainty

See chapter 5.8

Testing method for DTS-devices:

ANSI C63.10: 2013 Chapter 11.9.2.3.1+ FCC KDB 789033v01r03

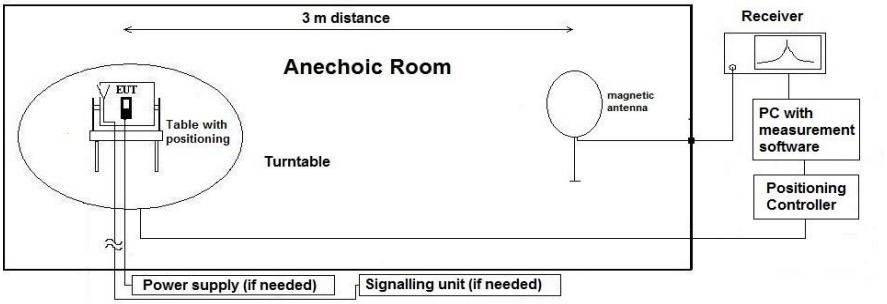
4.2. Test system set-up for radiated magnetic field measurements below 30 MHz

Specification: 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 it's 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:

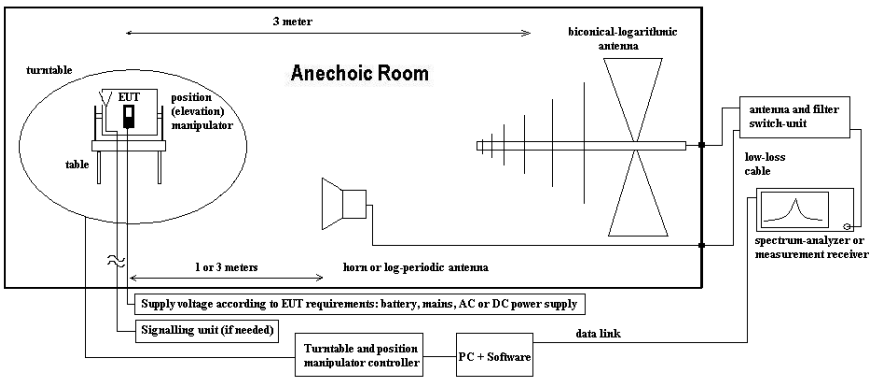
Reference for applied correction (extrapolating) factors due to reduced measurement distance:
ANSI C63.10:2013, §6.4.4.2 - Equations (2) + (3) + (4)

4.3. 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 it's 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:

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

$M = L_T - E_C$ (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

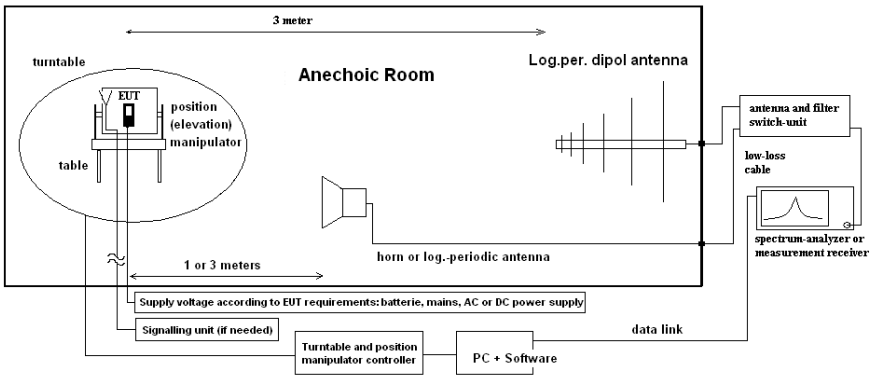
All units are dB-units, positive margin means value is below limit.

4.4. Test system set-up for radiated electric field measurement above 1 GHz

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

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

Schematic:



Testing method:

Exploratory, preliminary measurements
The EUT and its associated accessories are placed on a non-conductive position manipulator (tipping device) of 1.55 m height which is placed on the turntable. By rotating the turntable (range 0° to 360°, step 15°) and the EUT itself either on 3-orthogonal axis (portable equipment) or 2-orthogonal axis (defined operational position of EUT) the emission spectrum and it's characteristics was recorded with an EMI-receiver, broadband antenna and software.
The measurements are performed in horizontal and vertical polarization of the measurement antennas. The results are documented in a diagram. Critical frequencies (low margin to limit) are saved within a table for further investigations. If various operating modes are supported, further investigations are made to find the worst-case of them. Also the interconnection cables and equipment position were varied in order to maximize the emissions.

Final measurement on critical frequencies
Based on the exploratory measurements, the most critical frequencies are re-measured by 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 over 3-orthogonal axis and the height for EUT with large dimensions.

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

Formula:

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

$M = L_T - E_C$ (2)

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

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

5. Measurements

5.1. Duty-Cycle

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

Ambient Climatic conditions			Temperature: (22±2)°C	Rel. humidity: (45±15)%		
test site	☐ 441 EMI SAR	☐ 348 EMI cond.	☐ 443 EMI FAR	☒ 347 Radio.lab.	☐ 337 OATS	☐
equipment	☐ 331 HC 4055	☐	☐	☐	☐	☐
spectr. analys.	☒ 683 FSU26	☐ 120 FSEM	☐ 264 FSEK	☐	☐	☐
power meter	☐ 262 NRV-S	☐ 266 NRV-Z31	☐ 265 NRV-Z33	☐ 261 NRV-Z55	☐ 356 NRV-Z1	☐
multimeter	☐ 341 Fluke 112	☐	☐	☐	☐	☐
DC power	☐ 086 LNG50-10	☐ 087 EA3013	☐ 354 NGPE 40	☐ 349 car battery	☐ 350 Car battery	☒ 463 HP3245A
line voltage	☐ 230 V 50 Hz via public mains		☒ 4.35 V DC (fully charged internal battery)			
otherwise	☒K4 Cable		☒ 530 Attenuator 10dB			

Method of measurement: ☒ conducted
☐ radiated

A special firmware program is used for test purposes. In opposite to normal operating mode a higher duty-cycle is set in order to facilitate the measurements. This is maximized at the extent possible.

The necessary duty-cycle correction factor is determined on nominal conditions on middle channel only. It is assumed that no noticeable changes occur when tested on other channels or climatic conditions. The Duty-Cycle was constant, means without variations. Minimum and maximum modulation index was tested, the duty cycle is to be found therefore between a minimum and maximum values.

Results:

DUTY-CYCLE Measurement						
WLAN Channel 36 Modulation	Marker 1 [RX ON] ms	Marker 2 [BTS ON'] ms	TX on ms	TX off ms	Converted to DC (%)	Correction-Factor: 100log(1/DC) (dB)
Ch36 / n-Mode						
MCS0	1.741026	1.769231	1.74103	0.02821	98.41	0.07
MCS1	0.604167	0.633013	0.60417	0.02885	95.44	0.20
MCS3	0.463141	0.491987	0.46314	0.02885	94.14	0.26
MCS4	0.320513	0.349359	0.32051	0.02885	91.74	0.37
MCS5	0.247596	0.276442	0.24760	0.02885	89.57	0.48
MCS6	0.226763	0.254808	0.22676	0.02804	88.99	0.51
MCS7	0.207532	0.236378	0.20753	0.02885	87.80	0.57
Ch 36 / (a-Mode)						
6MBit	2.062821	2.094712	2.06282	0.03189	98.48%	0.07
9MBit	1.381731	1.413622	1.38173	0.03189	97.74%	0.10
12MBit	1.041186	1.073077	1.04119	0.03189	97.03%	0.13
18MBit	0.706730	0.735577	0.70673	0.02885	96.08%	0.17
24MBit	0.533654	0.562500	0.53365	0.02885	94.87%	0.23
36MBit	0.365384	0.394230	0.36538	0.02885	92.68%	0.33
48MBit	0.275961	0.303846	0.27596	0.02789	90.82%	0.42
54MBit	0.247115	0.276923	0.24712	0.02981	89.24%	0.49

Calculated with following formulas:

Duty cycle:	$x = \frac{Tx_{on}}{Tx_{on} + Tx_{off}}$	Duty cycle factor [dB]:	$10\log\left(\frac{1}{x}\right)$

The results were corrected in order to evaluate for worst-case result each time when average values are necessary for example average radiated emissions or similar.

5.2. RF-Parameter - Transmitter Peak output power (conducted and radiated)

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

test location	☒ CETECOM Essen (Chapter. 2.2.1)		☒ 443 System CTC-FAR-EMI-		☐ Please see Chapter. 2.2.3	
test site	☐ 441 EMI SAR	☐ 487 SAR NSA	☐ 337 OATS	☒ 347 Radio.lab.	☐	☐
receiver	☐ 377 ESCS30	☐ 001 ESS	☐ 489 ESU 40	☐ 620 ESU 26	☐	☐
otherwise	☒ 600 NRVD	☒ 357 NRV-Z1	☒ 693 TS8997			
spectr. analys.	☐ 215 FSU	☐ 120 FSEM	☐ 264 FSEK	☐	☐	☐
power supply	☐ 456 EA 3013A	☐ 457 EA 3013A	☐ 459 EA 2032-50	☐ 268 EA- 3050	☐ 494 AG6632A	☒ 498 NGPE 40
otherwise	☐ 693 TS8997	☐ 248 6 dB Attenuator	☐ 529 Power divider	☐ - cable OTA20	☒ 613 20dB Attenuator	☐ K5 Cable
line voltage	☒ 4.35 V DC (fully charged internal battery)					

5.2.2. Reference:

FCC	☒ Part 15 Subpart C, §15.407(a)(1)(2)(3)
IC	☒ RSS-247, Issue 1
ANSI	☒ C63.10-2013
KDB Guidance no.	☒ 789033 D02 General UNII test procedures v01r03: Subchapter E, **Method PM (3)(a)**
Limits	☒ U-NII 1: 5.15-5.25 GHz: **FCC Outdoor access point:** 1W + antenna gain max. 6dBi + Elevation > 30° 21 dBm EIRP **FCC Indoor Access Point:** 1W + antenna gain max. 6dBi **FCC Mobile & Portable client:** 250mW + antenna gain max. 6dBi **IC:** E.I.R.P. max. 200mW or $10+10\log_{10}(B)$ whichever power less
	☒ U-NII2: 5.25-5.35 GHz: **FCC:** 250mW or $11dBm+10\log_{10}(B)$ **IC:** 250mW or $11dBm+10\log_{10}(B)$ + EIRP Elevation Mask requierements if max. EIRP>200mW Max. EIRP 1Watt or $17+10\log_{10}(B)$ whichever power less
	☒ U-NII2extension: 5.470-5.725 GHz: **FCC/IC:** Lesser of: 250mW or $11dBm+10\log_{10}(B)$ whichever power less Max. EIRP 1Watt or $17+10\log_{10}(B)$ whichever power less
	☒ U-NII3 : 5.475-5.85 GHz: **FCC/IC:** Max. EIRP 1Watt

5.2.3. Antenna characteristics:

According §15.407(a)(1)(2):
☒ directional gain < 6 dBi (measured: difference between measured conducted and radiated eirp. power)
☐ directional gain > 6 dBi (measured / applicant's declaration) -> conducted power reduction necessary

- Maximum declared antenna gain [isotropic]: 5.83 dBi

5.2.4. 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.
Different frequencies within each operating band have been selected.

5.2.5. Measurement method:

The power was also checked for different data rates, modulation scheme or packet types if applicable.

5.2.6. Conducted power measurement and EIRP calculation

Duty-Cycle Correction applicable according. to KDB 789033v01r03

Max. Peak Power (conducted) [dBm]				
Set-up no: 2 Op-Mode: 1	U-NII 1 (5150-5250MHz)	U-NII-A (5250-5350MHz)	U-NII2C (5470-5725MHz)	U-NII-3 (5725-5825MHz)
Measured Level a-Mode	14.46	13.88	12.13	12.82
Measured Level n(HT20)-Mode	14.46	13.74	12.15	12.77
Measured Max. Level	**14.46**	**13.88**	**12.15**	**12.82**
Conducted Limit [dBm]:	23.98 (Outdoor use 21.0 dBm e.i.r.p. for azimuth angles > 30° over horizon)	23.98	23.98	30.0

Remark:

1.) Only maximum values among all data rates and modulations are given above.
For other data rates please refer measurement table in separate annex A1

2.) Above values are inclusive Duty cycle correction factors.
For further details please refer measurement table in separate annex A1

3.) Conducted Tests performed only on Worst-Case JOYA TOUCH Variant Type: P00AN04HL0GT0W7-GRR
(see test report TR2-20842790-15-10b)

5.2.7. Verdict: Pass

5.3. RF-Parameter - Power Spectral Density

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

test location	☒ CETECOM Essen (Chapter. 2.2.1)		☐ Please see Chapter. 2.2.2		☐ Please see Chapter. 2.2.3	
test site	☐ 441 EMI SAR	☐ 487 SAR NSA	☐ 337 OATS	☒ 347 Radio.lab.	☐	☐
receiver	☐ 377 ESCS30	☐ 001 ESS	☐ 489 ESU	☒ 683 FSU26	☐	☐
spectr. analys.	☐ 489 ESU	☐ 120 FSEM	☐ 264 FSEK	☐	☐	☐
power supply	☒ 463 HP3245A	☐ 457 EA 3013A	☐ 463	☐ 268 EA- 3050	☐ 494 AG6632A	☐ 498 NGPE 40
	☒ 4.35 V DC (fully charged internal battery)			☐ 060 110 V 60 Hz via PAS 5000		
otherwise	☒530 10dB Attenuator			☒ cable K4		

5.3.2. REFERENCES: §15.247(e), RSS-247, Chapter 5.2(2)

(e) *For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.*

5.3.3. TEST CONDITION AND MEASUREMENT TEST SET-UP

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

Measurement Method	☐ ANSI 63.10:2009	☒ PKPSD-Method ☐ AVGPSD Method
	☒ FCC KDB 789033v01r03	
Center Frequency	Nominal channel frequency	
Span	5..30% higher than the EBW measured before	
Resolution Bandwidth (RBW)	> 3 kHz (at least 3 times RBW) - pls. see diagram	
Video Bandwidth (VBW)	> 10 kHz - pls. see diagram	
Sweep time	coupled	
Detector	Peak, Max hold mode for method PKPSD or RMS method AVGPSD	
Sweep Mode	Repetitive mode, allow trace to stabilize (PKPSD) or single (AVGPSD)	
Addition of correction factors	external measuring set-up path-loss	

Remarks:--

5.3.6. RESULTS

Power Spectral Density												
Test conditions	Set-up no: 2						Op-Mode: 1					
RBW Units	**dBm/1MHz**									**dBm/500kHz**		
Operating Bands	U-NII 1 (5150-5250MHz)			U-NII-A (5250-5350MHz)			U-NII2C (5470-5725MHz)			U-NII-3 (5725-5825MHz)		
Channel Number	36	40	48	52	56	64	100	116	140	149	157	165
Channel Frequency (MHz)	5180	5200	5240	5260	5280	5320	5500	5580	5700	5745	5785	5825
a-Mode Measured Conducted (dBm)	3.01	2.21	2.24	2.17	1.33	1.22	0.68	0.86	-0.32	-2.78	-1.78	-1.89
n(HT20)-Mode Measured Conducted (dBm)	2.65	2.68	2.37	1.99	1.95	1.02	0.45	0.43	-0.53	-2.83	-1.90	-2.05
Max. Conducted Value (dBm)	**3.01**			**2.17**			**0.86**			**-1.78**		
Conducted Limits (dBm)	**11**			**11**			**11**			**30**		
Antenna Gain (dBi)	5.83			5.83			5.83			5.83		
Max. E.I.R.P. Calculated(dBm)	**8.84**			**8.00**			**6.69**			**4.05**		
Limits (dBm)	**11 + Antenna Gain (< 6 dBi)**			**17**			**17**			**30**		

Remarks:

1.) Measurements are performed only for modes with relevant data rates and modulations having maximum conducted power values among available a / n(HT20) modes, other data rates and modulations.
For further details & other data rates please refer diagrams in separate annex A1

2.) Conducted Tests performed only on Worst-Case JOYA TOUCH Variant Type: P00AN04HL0GT0W7-GRR (see test report TR2-20842790-15-10b)

3.) Max. E.I.R.P. Calculated(dBm) = Max. Conducted Value (dBm) + Applicant's declared Antenna Gain (dBi)

5.3.7. VERDICT: Pass

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

5.4.1. Test location and equipment

test location	☒ CETECOM Essen (Chapter. 2.2.1)		☐ Please see Chapter. 2.2.2		☐ Please see Chapter. 2.2.3	
test site	☒ 441 EMI SAR	☐ 487 SAR NSA	☐ 347 Radio.lab.		☐	☐
receiver	☐ 377 ESCS30	☒ 001 ESS	☐	☐	☐	☐
spectr. analys.	☐ 584 FSU	☐ 120 FSEM	☐ 264 FSEK	☐	☐	☐
antenna	☐ 574 BTA-L	☐ 133 EMCO3115	☐ 302 BBHA9170	☐ 289 CBL 6141	☒ 030 HFH-Z2	☐ 477 GPS
signaling	☐ 392 MT8820A	☐ 371 CBT32	☐ 547 CMU	☐ 594 CMW		
otherwise	☐ 400 FTC40x15E	☐ 401 FTC40x15E	☐ 110 USB LWL	☐ 482 Filter Matrix	☐ 378 RadiSense	
DC power	☐ 456 EA 3013A	☐ 457 EA 3013A	☐ 459 EA 2032-50	☐ 268 EA- 3050	☐ 494 AG6632A	☐ 498 NGPE 40
line voltage	☒ 4.35 V DC (fully charged internal battery)					

5.4.2. Requirements

FCC	Part 15, Subpart C, §15.205 & §15.209			
IC	RSS-Gen: Issue 4: §8.9 Table 5			
ANSI	C63.10-2013			
Frequency [MHz]	Field strength limit [µV/m]	[dBµV/m]	Distance [m]	Remarks
0.009 – 0.490	2400/f (kHz)	67.6 – 20Log(f) (kHz)	300	Correction factor used due to measurement distance of 3 m
0.490 – 1.705	24000/f (kHz)	87.6 – 20Log(f) (kHz)	30	Correction factor used due to measurement distance of 3 m
1.705 – 30	30	29.5	30	Correction factor used due to measurement distance of 3 m

5.4.3. Test condition and test set-up

Signal link to test system (if used):		☐ air link	☐ cable connection	☒ none
EUT-grounding		☒ none	☐ with power supply	☐ additional connection
Equipment set up		☒ table top		☐ floor standing
Climatic conditions		Temperature: (22±3°C)		Rel. humidity: (40±20)%
EMI-Receiver or Analyzer Settings	Scan data	☒ 9 – 150 kHz RBW/VBW = 200 Hz Scan step = 80 Hz ☒ 150 kHz – 30 MHz RBW/VBW = 9 kHz Scan step = 4 kHz ☐ other:		
	Scan-Mode Detector Mode: Sweep-Time	☒ 6 dB EMI-Receiver Mode ☐ 3dB Spectrum analyser 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"		

5.4.4. Measurement Results

The results are presented below in summary form only. For more information please consult the diagrams included in annex 1.
The EUT is put on operation on middle channel only. If critical peaks are found (Margin <10 dB) the lowest and highest channels will be performed too.For more information please see the diagrams.

Table of measurement results:

Diagram No.	Carrier Channel		Frequency range	Set-up no.	OP-mode no.	Remark	Used detector			Result
	Range	No.					PK	AV	QP	
2.09	Low	100	9 kHz-30 MHz	1	1	n(HT20) Mode, MCS0, Ch100	☒	☐	☒	Pass

Remark: 1.) For further details please refer diagrams in separate annex A1
2.) Tests performed only on Worst-Case Channels of JOYA TOUCH Variant Type: P00AN04HL0GT0W7-GRR (see test report TR2-20842790-15-10b)

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

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

Frequency -Range	f [kHz/MHz]	Lambda [m]	Far-Field Point [m]	Distance Limit accord. 15.209 [m]	1st Condition (dmeas< $D_{near-field}$)	2'te Condition (Limit distance bigger $d_{near-field}$)	Distance Correction accord. Formula
kHz	9,00E+03	33333,33	5305,17	300	fulfilled	not fullfilled	-80,00
	1,00E+04	30000,00	4774,65		fulfilled	not fullfilled	-80,00
	2,00E+04	15000,00	2387,33		fulfilled	not fullfilled	-80,00
	3,00E+04	10000,00	1591,55		fulfilled	not fullfilled	-80,00
	4,00E+04	7500,00	1193,66		fulfilled	not fullfilled	-80,00
	5,00E+04	6000,00	954,93		fulfilled	not fullfilled	-80,00
	6,00E+04	5000,00	795,78		fulfilled	not fullfilled	-80,00
	7,00E+04	4285,71	682,09		fulfilled	not fullfilled	-80,00
	8,00E+04	3750,00	596,83		fulfilled	not fullfilled	-80,00
	9,00E+04	3333,33	530,52		fulfilled	not fullfilled	-80,00
	1,00E+05	3000,00	477,47		fulfilled	not fullfilled	-80,00
	1,25E+05	2400,00	381,97		fulfilled	not fullfilled	-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	30	fulfilled	not fullfilled	-40,00
	6,00E+05	500,00	79,58		fulfilled	not fullfilled	-40,00
	7,00E+05	428,57	68,21		fulfilled	not fullfilled	-40,00
	8,00E+05	375,00	59,68		fulfilled	not fullfilled	-40,00
	9,00E+05	333,33	53,05		fulfilled	not fullfilled	-40,00
MHz	1,00	300,00	47,75		fulfilled	not fullfilled	-40,00
	1,59	188,50	30,00		fulfilled	not fullfilled	-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		not fullfilled	fulfilled	-20,00
	18,00	16,67	2,65		not fullfilled	fulfilled	-20,00
	20,00	15,00	2,39		not fullfilled	fulfilled	-20,00
	21,00	14,29	2,27		not fullfilled	fulfilled	-20,00
	23,00	13,04	2,08		not fullfilled	fulfilled	-20,00
	25,00	12,00	1,91		not fullfilled	fulfilled	-20,00
	27,00	11,11	1,77		not fullfilled	fulfilled	-20,00
	29,00	10,34	1,65		not fullfilled	fulfilled	-20,00
	30,00	10,00	1,59		not fullfilled	fulfilled	-20,00

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

5.5.1. Test location and equipment

test location	☒ CETECOM Essen (Chapter. 2.2.1)		☐ Please see Chapter. 2.2.2		☐ Please see Chapter. 2.2.3	
test site	☒ 441 EMI SAR	☒ 487 SAR NSA				
receiver	☐ 377 ESCS30	☒ 001 ESS	☐ 489 ESU 40	☐ 620 ESU 26		
spectr. analys.	☐ 584 FSU	☐ 120 FSEM	☐ 264 FSEK			
antenna	☒ 574 BTA-L	☐ 133 EMCO3115	☐ 302 BBHA9170	☐ 289 CBL 6141	☐ 030 HFH-Z2	☐ 477 GPS
signaling	☐ 392 MT8820A	☐ 371 CBT32	☐ 547 CMU	☐ 594 CMW		
otherwise	☐ 400 FTC40x15E	☐ 401 FTC40x15E	☐ 110 USB LWL	☒ 482 Filter Matrix		
DC power	☐ 456 EA 3013A	☐ 457 EA 3013A	☐ 459 EA 2032-50	☐ 268 EA- 3050	☐ 494 AG6632A	☐ 498 NGPE
line voltage	☒ 4.35 V DC (fully charged internal battery)					

5.5.2. Requirements/Limits

FCC		☐ Part 15 Subpart B, §15.109, class B ☒ Part 15 Subpart C, §15.209 @ frequencies defined in §15.205	
IC		☒ RSS-Gen., Issue 4, Chapter 8.9, Table 4+6 (licence-exempt radio apparatus) ☐ RSS-Gen., Issue 4, Chapter 7.1.2, Table 2 (receiver) ☐ ICES-003, Issue 6, Table 5 (Class B) ☐ RSS-247, Issue 1, Chapter 5	
ANSI		☐ C63.4-2014 ☒ C63.10-2013	
Limit	Frequency [MHz]	Radiated emissions limits, 3 meters	
		QUASI Peak [µV/m]	QUASI-Peak [dBµV/m]
	30 - 88	100	40.0
	88 - 216	150	43.5
	216 - 960	200	46.0
	above 960	500	54.0

5.5.3. Restricted bands of operation (FCC §15.205/ RSS-Gen, Issue 4 Chapter 8.9, Table 4)

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.20725-4.20775	37.5-38.25	1645.5-1646.5	9.3-9.5
6.215-6.218	73-74.6	1660-1710	10.6-12.7
6.26775-6.26825	74.8-75.2	1718.8-1722.2	13.25-13.4
6.31175-6.31225	108-121.94	2200-2300	14.47-14.5
8.291-8.294	123-138	2310-2390	15.35-16.2
8.362-8.366	149.9-150.05	2483.5-2500	17.7-21.4
8.37625-8.38675	156.52475-156.52525	2690-2900	22.01-23.12
8.41425-8.41475	156.7-156.9	3260-3267	23.6-24.0
12.29-12.293	162.0125-167.17	3332-3339	31.2-31.8
12.51975-12.52025	167.72-173.2	3345.8-3358	36.43-36.5
12.57675-12.57725	240-285	3600-4400	--
13.36-13.41	322-335.4	--	--
Remark: only spurious emissions are allowed within these frequency bands not exceeding the limits per §15.209			

5.5.4. Test condition and measurement test set-up

Signal link to test system (if used):		☐ air link	☐ cable connection	☐ none
EUT-grounding		☒ none	☐ with power supply	☐ additional connection
Equipment set up		☒ table top 0.8m height		☐ floor standing
Climatic conditions		Temperature: (22±3°C)		Rel. humidity: (40±20)%
EMI-Receiver (Analyzer) Settings	Scan frequency range:	☒ 30 – 1000 MHz ☐ other:		
	Scan-Mode	☒ 6 dB EMI-Receiver Mode ☐ 3 dB spectrum analyser 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"		

5.5.5. 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:

Dia-gram no.	Carrier Channel		Frequency range	Set-up no.	OP-mode no.	Remark	Used detector			Result
	Range	No.					PK	AV	QP	
3.09	Low	100	30 MHz – 1 GHz	1	1	n(HT20) Mode, MCS0, Ch100	☒	☐	☒	Pass

Remark: 1.) For further details please refer diagrams in separate annex A1
2.) Tests performed only on Worst-Case Channels of JOYA TOUCH Variant Type: P00AN04HL0GT0W7-GRR (see test report TR2-20842790-15-10b)

5.6. General Limit - Radiated emissions, above 1 GHz

5.6.1. Test location and equipment FAR

test site	☐441 EMI SAR	☐348 EMI cond.	☒443 EMI FAR	☐347 Radio.lab.	☐337 OATS	☐
spectr. analys.	☐584 FSU	☐120 FSEM	☐264 FSEK	☒489 ESU 40	☐	☐
antenna meas	☐574 BTA-L	☐289 CBL 6141	☐608 HL 562	☒549 HL025	☒302 BBHA9170	☐477 GPS
antenna meas	☐123 HUF-Z2	☐132 HUF-Z3	☐030 HFH-Z2	☐376 BBHA9120E		☐
antenna subst	☐071 HUF-Z2	☐020 EMCO3115	☐063 LP 3146	☐303 BBHA9170	☐	☐
multimeter	☐341 Fluke 112	☐	☐	☐	☐	☐
signaling	☐392 MT8820A	☐371 CBT32	☐547 CMU	☐594 CMW		
DCpower	☐086 LNG50-10	☐087 EA3013	☐354 NGPE 40	☐349 car battery	☐350 Car battery	☐
line voltage	☒ 4.35 V DC (fully charged internal battery)					

5.6.2. Requirements/Limits (CLASS B equipment)

FCC	☐ Part 15 Subpart B, §15.109 class B ☒ Part 15 Subpart C, §15.209 for frequencies defined in §15.205 ☒ Part 15 Subpart C, §15.407(b)(1)(2)(3) 9			
IC	☒ RSS-Gen., Issue 4, Chapter 8.9, Table 4+6 (transmitter licence excempt) ☐ RSS-Gen., Issue 4, Chapter 8.9, Table 2 (receiver) ☐ ICES-003, Issue 6, Chapter 6.2.2, Table 7 (class B) ☒ RSS-247, Issue 1, Chapter 6			
ANSI	☐ C63.4-2014 ☒ C63.10-2013			
Frequency [MHz]	Limits			
	AV [µV/m]	AV [dBµV/m]	Peak [µV/m]	Peak [dBµV/m] or [dBm/MHz]
above 1 GHz for frequencies as defined in §15.205 or RSS-Gen., Issue 4, §8.10 - Table 6	500	54.0	5000	74.0 dBµV/m
§15.407(b) Or RSS-247, Issue 1	--	--	--	-27dBm/MHz (68.5 dBµV/m) or -17dBm/MHz (78.5 dBµV/m)

5.6.3. Test condition and measurement test set-up

Signal link to test system (if used):		☐ air link	☐ cable connection	☒ none
EUT-grounding		☒ none	☐ with power supply	☐ additional connection
Equipment set up		☒ table top 1.5m height		☐ floor standing
Climatic conditions		Temperature: (22±3°C)		Rel. humidity: (40±20)%
Spectrum-Analyzer settings	Scan frequency range:	☒ 1 – 18 GHz ☐ 18 – 25 GHz ☒ 18 – 40 GHz ☐ other:		
	Scan-Mode	☒ 6 dB EMI-Receiver Mode ☐ 3 dB Spectrum analyser Mode		
	Detector	Peak and Average		
	RBW/VBW	1 MHz / 3 MHz		
	Mode:	Repetitive-Scan, max-hold		
	Scan step	400 kHz		
	Sweep-Time	Coupled – calibrated display if CW signal otherwise adapted to EUT's individual duty-cycle		
General measurement procedures		Please see chapter "Test system set-up for radiated electric field measurements above 1 GHz"		

5.6.4. Measurement Results

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

Dia-gram no.	Carrier Channel		Frequency range	Set-up no.	OP-mode no.	Remark	Used detector			Result
	Range	No.					PK	AV	QP	
4.09	Low	100	1-7GHz	1	1	n(HT20) Mode, MCS0, Ch100	☒	☒	☐	Pass
4.09a	Low	100	7-18GHz	1	1	n(HT20) Mode, MCS0, Ch100	☒	☒	☐	Pass
4.09b	Low	100	18-40GHz	1	1	n(HT20) Mode, MCS0, Ch100	☒	☒	☐	Pass

Remark: 1.) For further details please refer diagrams in separate annex A1
2.) Tests performed only on Worst-Case Channels of JOYA TOUCH Variant Type: P00AN04HL0GT0W7-GRR (see test report TR2-20842790-15-10b)

5.7. General Limit - Band-edge compliance measurements

5.7.1. Test location and equipment FAR

test site	☐441 EMI SAR	☐348 EMI cond.	☒443 EMI FAR	☐347 Radio.lab.	☐337 OATS	☐
spectr. analys.	☐584 FSU	☐120 FSEM	☐264 FSEK	☒489 ESU 40	☐	☐
antenna meas	☐574 BTA-L	☐289 CBL 6141	☐608 HL 562	☒549 HL025	☐302 BBHA9170	☐477 GPS
antenna meas	☐123 HUF-Z2	☐132 HUF-Z3	☐030 HFH-Z2	☐	☐	☐
antenna subst	☐071 HUF-Z2	☐020 EMCO3115	☐063 LP 3146	☐303 BBHA9170	☐	☐
multimeter	☐341 Fluke 112	☐	☐	☐	☐	☐
signaling	☐392 MT8820A	☐371 CBT32	☐547 CMU	☐594 CMW		
DC power	☐086 LNG50-10	☐087 EA3013	☐354 NGPE 40	☐349 car battery	☐350 Car battery	☐
line voltage	☒ 4.35 V DC (fully charged internal battery)					

5.7.2. Test condition and measurement test set-up

Signal ink to test system (if used):		☐ air link	☐ cable connection	☒ none
EUT-grounding		☒ none	☐ with power supply	☐ additional connection
Equipment set up		☒ table top 1.5m height		☐ floor standing
Climatic conditions		Temperature: (22±3°C)		Rel. humidity: (40±20)%
Spectrum-Analyzer settings	Scan frequency range: Scan-Mode Detector RBW/VBW Mode: Scan step Sweep-Time	☐ 1 – 18 GHz ☐ 18 – 25 GHz ☐ 18 – 40 GHz ☒ other: see diagrams ☐ 6 dB EMI-Receiver Mode ☒ 3 dB Spectrum analyser Mode Peak and Average Band-edge: 1 MHz / 3 MHz Repetitive-Scan, max-hold 40kHz or 400 kHz Coupled – calibrated display if CW signal otherwise adapted to EUT's individual duty-cycle		
General measurement procedures		Please see chapter "Test system set-up for radiated electric field measurements above 1 GHz" for general measurements procedures in anechoic chamber.		

5.7.3. Requirements/ Limits

FCC		☒ Part 15 Subpart C, §15.407(b)(1)(2)(3) ☒ Part 15 subpart C, §15.209 @ frequencies defined in §15.205	
IC		☒ RSS-247, Issue 1, Chapter 5.5; RSS-Gen: Issue 4: §8.9 Table 4+5+6 ☒ RSS-Gen: Issue 4: §8.9, Table 4+6	
ANSI		☐ C63.10-2009 for TX-mode ☒ C63.10-2013, Chapter 6.10.6	
KDB Guidance no.		☒ 789033 D01 General UNII test procedures v01r03': G(2)(c)(d), G(3)(d)	
Limits accord. §15.205	Above 1GHz	AV [dBµV/m]	Peak [dBµV/m]
		54.0	74.0
Limits accord. §15.407	Carrier operating frequency band [MHz]	EIRP – limit for outside operating frequency band	
		Peak [dBm] 30 MHz to 40 GHz	Peak [dBµV/m][1.)] 30 MHz to 40 GHz@3m
	5.15 – 5.25 GHz	-27.0	68.2
	5.25 – 5.35 GHz	-27.0	68.2
	5.47 – 5.725 GHz	-27.0	68.2
	5.725 – 5.825 GHz	-27.0 (10 MHz greater above/below band edge) -17.0 (within 10 MHz offset to band-edge)	68.2 (10 MHz greater above/below band edge) 78.2 (within 10 MHz offset to band-edge)

Remark: 1.) Conversion formula between EIRP and field strength used (Please read measurement method).

5.7.4. Measurement method

For uncritical results where a measurement bandwidth of 1MHz can clearly show the compliance without influencing the results, a field strength measurement was performed only.

For critical results a Marker-Delta marker method was used for showing compliance to restricted bands according §15.205. The method is according ANSI 63.10:2013 "Marker-Delta method", §6.9.3. The method consists of three independent steps:

1. Step: Prior to the measurement the fundamental radiated In-Band field strength was performed. The determined value is used as reference value.

2. Step: Second step consist of finding the relative attenuation between the fundamental emission and the maximum local out-of-band emission (within 2 MHz range around the band edge either on the band-edge directly or some modulation product if the level is greater than that on the band-edge) when measured with lower resolution bandwidth.
3. Step: The delta value recorded in step 2 will be subtracted from value recorded in step 1, thus giving the required field strength at the band-edge. This value must fulfil the requirements for radiated spurious emissions in restricted bands in §15.205 with the general limits of §15.209.

The formula EIRP[dBm] = E [dBµV/m] - 95.2 for radiated measurements, which used field strength at 3 meters to convert the value in dBm.

5.7.5. EUT settings

The EUT was instructed to send with maximum intended power levels according to applicants instructions.

5.7.6. Results:

5.7.6.1. Non-restricted bands near-by - limits according FCC §15.407 and RSS-247, Issue 1, Chapter 5.5

Diagram No.	Channel No.	Restricted band ?	Fundamental Value [dBuV/m]		Peak-Value at Band-Edge [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Verdict	Remark:
			Peak-Value	Average-Value					
9.15	100	No	105.57	98.22	58.01	68.2	10.19	Pass	a mode, 6 Mbps, CH100,
9.19	100	No	106.96	97.32	57.83	68.2	10.37	Pass	n(HT20) mode, MCS0, CH100
9.16	140	No	104.17	97.12	58.03	68.2	10.17	Pass	a mode, 6 Mbps, CH140
9.20	140	No	106.19	97.21	58.62	68.2	9.58	Pass	n(HT20) mode, MCS0, CH140
9.21	149	No	105.86	96.61	65.95	78.2	12.25	Pass	n(HT20) mode, MCS0, CH149
9.22	165	No	106.72	97.81	60.73	78.2	17.47	Pass	n(HT20) mode, MCS0, CH165

5.7.6.2. Restricted bands near-by
(§15.205 with limits accord. FCC §15.209) and (RSS-Gen, Issue 4, Chapter 8.10)

Diagram No.	Channel No.	Restricted band ?	Fundamental Value [dBuV/m]		Value of Band-Edge [dBuV/m]		Limits [dBuV/m]		Margin [dB]		Verdict:	Remark:
			Peak-Value	Average-Value	Peak-Value	Average-Value	Peak-Value	Average-Value	Peak-Value	Average-Value		
9.13	36	Yes	105.44	98.24	57.08	45.50	74	54	16.92	8.50	Pass	a mode, 6 Mbps, CH36,
9.17	36	Yes	108.62	99.98	58.80	46.80	74	54	15.20	7.20	Pass	n(HT20) mode, MCS0, CH36
9.14	64	Yes	104.34	97.12	54.14	44.2	74	54	19.86	9.8	Pass	a mode, 6 Mbps, CH64
9.18	64	Yes	107.14	97.58	54.73	44.92	74	54	19.27	9.08	Pass	n(HT20) mode, MCS0, CH64

Remark: Please refer chapter 5.1 for applicable duty-cycle correction factor

5.7.7. Verdict: Pass

5.8. Measurement uncertainties

The reported uncertainties are calculated based on the standard uncertainty multiplied with the appropriate coverage factor **k**, such that a confidence level of approximately 95% is achieved.
For uncertainty determination, each component used in the concrete measurement set-up was taken in account and it's contribution to the overall uncertainty according it's statistical distribution calculated.

Following table shows expectable uncertainties for each measurement type performed.

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

Table: measurement uncertainties, valid for conducted/radiated measurements

6. Abbreviations used in this report

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

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

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

8. Instruments and Ancillary

8.1. Used equipment "CTC"

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

8.1.1. Test software and firmware of equipment

Ref.-No.	Equipment	Type	Serial-No.	Version of Firmware or Software during the test
001	EMI Test Receiver	ESS	825132/017	Firm.= 1.21 , OTP=2.0, GRA=2.0
012	Signal Generator (EMS-cond.)	SMY 01	839069/027	Firm.= V 2.02
013	Power Meter (EMS cond.)	NRVD	839111/003	Firm.= V 1.51
017	Digital Radiocommunication Tester	CMD 60 M	844365/014	Firmware = V 3.52 .22.01.99, DECT = D2.87 13.01.99
053	Audio Analyzer	UPA3	860612/022	Firm. V 4.3
119	RT Harmonics Analyzer dig. Flickermeter	B10	G60547	Firm.= V 3.1DHG
140	Signal Generator	SMHU	831314/006	Firm.= 3.21
261	Thermal Power Sensor	NRV-Z55	825083/0008	EPROM-Datum 02.12.04, SE EE 1 B
262	Power Meter	NRV-S	825770/0010	Firm.= 2.6
263	Signal Generator	SMP 04	826190/0007	Firm.=3.21
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
355	Power Meter	URV 5	891310/027	Firm.= 1.31
365	10V Insertion Unit 50 Ohm	URV5-Z2	100880	Eprom Data = 31.03.08
366	Ultra Compact Simulator	UCS 500 M4	V0531100594	Firm. UCS 500=001925/3.06a02, rc=ISMIEC 4.10
371	Bluetooth Tester	CBT32	100153	CBT V5,30+ SW-Option K55, 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= 4.52#002
436	Univ. Radio Communication Tester	CMU 200	103083	R&S Test Firmware Base=5.14, Mess-Software= GSM:5.14 WCDMA:5.14 (current Testsoftw. F. all band
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
598	Spectrum Analyzer	FSEM 30 (Reserve)	831259/013	Firmware Bios 3.40 , Analyzer 3.40 Sp 2
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)

8.1.2. Single instruments and test systems

Ref.-No.	Equipment	Type	Serial-No.	Manufacturer	Interval of calibration	Remark	Cal due
001	EMI Test Receiver	ESS	825132/017	Rohde & Schwarz	12 M	-	30.05.2017
005	AC - LISN (50 Ohm/50µH, test site 1)	ESH2-Z5	861741/005	Rohde & Schwarz	12 M	-	30.05.2017
007	Single-Line V-Network (50 Ohm/5µH)	ESH3-Z6	892563/002	Rohde & Schwarz	12 M	-	30.05.2017
009	Power Meter (EMS-radiated)	NRV	863056/017	Rohde & Schwarz	24 M	-	30.04.2017
016	Line Impedance Simulating Network	Op. 24-D	B6366	Spitzenberger+Spies	36 M	-	30.05.2019
020	Horn Antenna 18 GHz (Subst 1)	3115	9107-3699	EMCO	36/12 M	-	31.03.2017
021	Loop Antenna (H-Field)	6502	9206-2770	EMCO	36 M	-	30.04.2018
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	-	30.04.2017
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	30.06.2016
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	-	30.04.2018
100	passive voltage probe	Probe TK 9416	without	Schwarzbeck	36 M	-	30.04.2018
110	USB-LWL-Converter	OLS-1	-	Ing. Büro Scheiba	-	4	
119	RT Harmonics Analyzer dig. Flickermeter	B10	G60547	BOCONSULT	36 M	-	30.05.2019
136	adjustable dipole antenna (Dipole 1)	3121C-DB4	9105-0697	EMCO	36 M	-	30.04.2018
140	Signal Generator	SMHU	831314/006	Rohde & Schwarz	24 M	-	30.05.2018
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	-	30.05.2018
262	Power Meter	NRV-S	825770/0010	Rohde & Schwarz	24 M	-	30.05.2018
263	Signal Generator	SMP 04	826190/0007	Rohde & Schwarz	36 M	-	30.05.2019
265	peak power sensor	NRV-Z33, Model 04	840414/009	Rohde & Schwarz	24 M	-	30.05.2018
266	Peak Power Sensor	NRV-Z31, Model 04	843383/016	Rohde & Schwarz	24 M	-	30.05.2018
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	30.06.2017
291	high pass filter GSM 850/900	WHJ 2200-4EE	14	Wainwright GmbH	12 M	1c	30.06.2017
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	-	30.05.2017
301	attenuator (20 dB) 50W, 18GHz	47-20-33	AW0272	Lucas Weinschel	pre-m	2	
302	horn antenna 40 GHz (Meas 1)	BBHA9170	155	Schwarzbeck	36 M	-	31.03.2017
303	horn antenna 40 GHz (Subst 1)	BBHA9170	156	Schwarzbeck	36 M	-	31.03.2017
331	Climatic Test Chamber -40/+80 Grad	HC 4055	43146	Heraeus Vötsch	Pre-m	2	
341	Digital Multimeter	Fluke 112	81650455	Fluke	24 M	-	30.05.2018
342	Digital Multimeter	Voltcraft M-4660A	IB 255466	Voltcraft	24 M	-	30.04.2017
347	laboratory site	radio lab.	-	-	-	5	
348	laboratory site	EMI conducted	-	-	-	5	
354	DC - Power Supply 40A	NGPE 40/40	448	Rohde & Schwarz	pre-m	2	
355	Power Meter	URV 5	891310/027	Rohde & Schwarz	24 M	-	30.05.2018
357	power sensor	NRV-Z1	861761/002	Rohde & Schwarz	24 M	-	30.04.2017
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	-	30.05.2017
377	EMI Test Receiver	ESCS 30	100160	Rohde & Schwarz	12 M	-	30.05.2017
389	Digital Multimeter	Keithley 2000	0583926	Keithley	24 M	-	30.04.2017
392	Radio Communication Tester	MT8820A	6K00000788	Anritsu	12 M	-	30.05.2017
431	Model 7405	Near-Field Probe Set	9305-2457	EMCO	-	4	
436	Univ. Radio Communication Tester	CMU 200	103083	Rohde & Schwarz	12 M	-	30.04.2017
439	UltraLog-Antenna	HL 562	100248	Rohde & Schwarz	36 M	-	31.03.2017
443	CTC-FAR-EMI-RSE	System CTC-FAR-EMI-RSE	-	ETS-Lindgren / CETECOM	12 M	5	30.06.2017
448	notch filter WCDMA_FDD II	WRCT 1850.0/2170.0-5/40-	5	Wainwright Instruments GmbH	12 M	1c	30.06.2017

Ref.-No.	Equipment	Type	Serial-No.	Manufacturer	Interval of calibration	Remark	Cal due
449	notch filter WCDMA FDD V	WRCT 824.0/894.0-5/40-8SSK	1	Wainwright	12 M	1c	30.06.2017
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	-	30.04.2017
463	Universal source	HP3245A	2831A03472	Agilent	-	4	
466	Digital Multimeter	Fluke 112	89210157	Fluke USA	24 M	-	30.05.2018
467	Digital Multimeter	Fluke 112	89680306	Fluke USA	36 M	-	30.04.2018
468	Digital Multimeter	Fluke 112	90090455	Fluke USA	36 M	-	30.04.2018
477	ReRadiating GPS-System	AS-47	-	Automotive Cons. Fink	-	3	
480	power meter (Fula)	NRVS	838392/031	Rohde & Schwarz	24 M	-	30.04.2017
482	filter matrix	Filter matrix SAR 1	-	CETECOM (Brl)	-	1d	
484	pre-amplifier 2,5 - 18 GHz	AMF-5D-02501800-25-10P	1244554	Miteq	12 M	-	30.06.2017
487	System CTC NSA-Verification SAR-EMI	System EMI field (SAR) NSA	-	ETS Lindgren / CETECOM	24 M	-	31.07.2017
489	EMI Test Receiver	ESU40	1000-30	Rohde & Schwarz	12 M	-	30.05.2017
502	band reject filter	WRCG 1709/1786-1699/1796-	SN 9	Wainwright	pre-m	2	
503	band reject filter	WRCG 824/849-814/859-	SN 5	Wainwright	pre-m	2	
512	notch filter GSM 850	WRCA 800/960-02/40-6EEK	SN 24	Wainwrght	12 M	1c	30.06.2017
517	relais switch matrix	HF Relais Box Keithley	SE 04	Keithley	pre-m	2	
523	Digital Multimeter	L4411A	MY46000154	Agilent	24 M	-	30.04.2017
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	-	30.05.2017
547	Univ. Radio Communication Tester	CMU 200	835390/014	Rohde & Schwarz	12 M	-	30.04.2017
549	Log.Per-Antenna	HL025	1000060	Rohde & Schwarz	36/12 M	-	31.07.2018
550	System CTC S-VSWR Verification SAR-EMI	System EMI Field SAR S-VSWR	-	ETS Lindgren/CETECOM	24 M	-	31.07.2017
552	high pass filter 2,8-18GHz	WHKX 2.8/18G-10SS	4	Wainwright	12 M	1c	30.06.2017
557	System CTC-OTA-2	R&S TS8991	-	Rohde & Schwarz	12 M	5	30.09.2016
558	System CTC FAR S-VSWR	System CTC FAR S-VSWR	-	CTC	24 M	-	19.04.2017
574	Biconilog Hybrid Antenna	BTA-L	980026L	Frankonia	36/12 M	-	31.03.2019
584	Spectrum Analyzer	FSU 8	100248	Rohde & Schwarz	pre-m	-	
594	Wideband Radio Communication Tester	CMW 500	101757	Rohde & Schwarz	12 M	-	30.04.2017
597	Univ. Radio Communication Tester	CMU 200	100347	Rohde & Schwarz	pre-m	-	
598	Spectrum Analyzer	FSEM 30 (Reserve)	831259/013	Rohde & Schwarz	24 M	-	30.04.2017
600	power meter	NRVD (Reserve)	834501/018	Rohde & Schwarz	24 M	-	30.04.2017
601	medium-sensitivity diode sensor	NRV-Z5 (Reserve)	8435323/003	Rohde & Schwarz	24 M	-	30.04.2017
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	-	30.05.2018
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	-	30.05.2017
621	Step Attenuator 0-139 dB	RSP	100017	Rohde & Schwarz	pre-m	2	
625	Generic Test Load USB	Generic Test Load USB	-	CETECOM	-	2	
627	data logger	OPUS 1	201.0999.9302.6.4.1.43	G. Lufft GmbH	24 M	-	30.04.2017
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	-	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	-	30.05.2018
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	-	30.05.2017
686	Field Analyzer	EHP-200A	160WX30702	Narda Safety Test Solutions	24 M	-	30.04.2017
687	Signal Generator	SMF 100A	102073	Rohde&Schwarz	12 M	-	30.05.2017
688	Pre Amp	JS-18004000-40-8P	1750117	Miteq	pre-m	-	
690	Spectrum Analyzer	FSU	100302/026	Rohde&Schwarz	12 M	-	30.05.2017
692	Bluetooth Tester	CBT 32	100236	Rohde & Schwarz	36 M	-	31.03.2017

Ref.-No.	Equipment	Type	Serial-No.	Manufacturer	Interval of calibration	Remark	Cal due
697	Power Splitter	ZN4PD-642W-S+	165001445	Mini-Circuits	-	2	

8.1.3. Legend

Note / remarks		Calibrated during system calibration:
	1a	System CTC-SAR-EMS (Ref.-No. 442)
	1b	System-CTC-EMS-Conducted (Ref.-No. 335)
	1c	System CTC-FAR-EMI-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	2016-10-12
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