

# TEST REPORT

No.: 17-1-0172601T20a-C2

According to:  
**FCC Regulations**  
Part 15.109, Class B

**ISED-Regulations**  
ICES-003, Issue 6

for

Robert Bosch Tool Corporation

**GPS 25-4**  
With integrated SARA-R410M LTE Cat-M1 Module

**FCC ID: TXTGPS25-4**  
**ISED: 909H-GPS254**

## Laboratory Accreditation



accredited according to DIN EN ISO/IEC 17025

### **CETECOM GmbH**

Laboratory Radio Communications & Electromagnetic Compatibility  
Im Teelbruch 116 • 45219 Essen • Germany  
Registered in Essen, Germany, Reg. No.: HRB Essen 8984  
Tel.: + 49 (0) 20 54 / 95 19-954 • Fax: + 49 (0) 20 54 / 95 19-964  
E-mail: [info@cetecom.com](mailto:info@cetecom.com) • Internet: [www.cetecom.com](http://www.cetecom.com)

## Table of contents

<b>1. SUMMARY OF TEST RESULTS.....</b>	<b>3</b>
1.1. RX mode, tests overview according FCC Part 15B and Canadian ISSED (RSS) Standards .....	3
<b>2. ADMINISTRATIVE DATA .....</b>	<b>4</b>
2.1. Identification of the testing laboratory .....	4
2.2. Test location .....	4
2.3. Organizational items .....	4
2.4. Applicant's details .....	4
2.5. Customer's details .....	4
2.6. Manufacturer's details .....	4
<b>3. EQUIPMENT UNDER TEST (EUT) .....</b>	<b>5</b>
3.1. EUT: Type, S/N etc. and short descriptions used in this test report .....	5
3.2. Auxiliary Equipment (AE): Type, S/N etc. and short descriptions .....	5
3.3. EUT set-ups .....	5
3.4. EUT operating modes .....	6
<b>4. DESCRIPTION OF TEST SYSTEM SET-UP'S .....</b>	<b>7</b>
4.1. Test system set-up for AC power-line conducted emission measurements .....	7
4.2. Test system set-up for radiated electric field measurement 30 MHz to 1 GHz .....	8
4.3. Test system set-up for radiated electric field measurement above 1 GHz .....	9
<b>5. MEASUREMENTS .....</b>	<b>10</b>
5.1. General Limit - Radiated field strength emissions, 30 MHz - 1 GHz.....	11
5.2. General Limit - Radiated emissions, above 1 GHz.....	12
5.3. Measurement uncertainties .....	13
<b>6. ABBREVIATIONS USED IN THIS REPORT .....</b>	<b>14</b>
<b>7. ACCREDITATION DETAILS OF CETECOM'S LABORATORIES AND TEST SITES .....</b>	<b>14</b>
<b>8. INSTRUMENTS AND ANCILLARY.....</b>	<b>15</b>
8.1. Test software and firmware of equipment .....	15
8.2. Legend .....	20
<b>9. VERSIONS OF TEST REPORTS (CHANGE HISTORY) .....</b>	<b>20</b>
<b>10. MEASUREMENT DIAGRAMS.....</b>	<b>21</b>
10.1. EMI-AC mains .....	21
10.2. Radiated emissions in the frequency range 30 to 1000MHz.....	22
10.3. Radiated emissions in the frequency range above 1000MHz .....	24

Table of annex	[ggf. löschen oder aktivieren!]	Total pages
Annex 1: Measurement diagrams (included in this report)		24
Annex 2: Internal photographs, separate document CETECOM_TR17_1_0172601T21a_C2_A2		5
Annex 3: External photographs, separate document CETECOM_TR17_1_0172601T21a_C2_A3		4
Annex 4: Test set-up photographs, separate document CETECOM_TR17_1_0172601T21a_C2_A4		3

The listed attachments are an integral part of this report.

## 1. Summary of test results

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

The Equipment Under Test (in this report, hereinafter referred as EUT) is a digital device with support of radiofrequency technologies including UMTS/LTE. A typical operation mode was set-up as described in chapter 3.4 according applicants instructions.

Following tests have been performed to show compliance with applicable FCC Part 15, Subpart B (Unintentional Radiators) of the CFR 47 Rules, Edition 2017.

### 1.1. RX mode, tests overview according FCC Part 15B and Canadian ISSED (RSS) Standards

No. of Diagram group	Test case	Port	References & Limits			EUT set-up	EUT op-mode	Result
			FCC Standard	RSS Section	Test limit			
4	Receiver radiated emissions	Cabinet + Interconnecting cables	§ 15.109 § 15.33 § 15.35	ICES-003, Issue 6	FCC 15.109 class B limits  ICES-003: Class B; Table 2, 5, 7	1	1	Passed

Remark:

### 1.2. Attestation:

I declare that all measurements were performed by me or under my supervision and that all measurements have been performed and are correct to my best knowledge and belief to Industry Canada standards. All requirements as shown in above table are met in accordance with enumerated standards.

The current version of the Test Report CETECOM\_TR17\_1\_0172601T20a\_C2 replaces the Test Report CETECOM\_TR17\_1\_0172601T20a\_C1 dated 2018-11-05. The replaced test report is herewith invalid.

.....  
Dipl.-Ing. Niels Jeß  
Responsible for test section

.....  
Dipl.-Ing. N. Perez  
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. 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

Project Leader:	B.Sc. Al-Amin Hossain
Responsible for test report:	Dipl.-Ing. Ninovic Perez
Receipt of EUT:	2018-07-05
Date(s) of test:	2018-07-02 and 2018-07-03
Date of report:	2019-04-29

### 2.4. Applicant's details

Applicant's name:	Robert Bosch Tool Corporation
Address:	1800 W, Central Road Mount Prospect IL, 60056 USA
Contact person:	Mr. Gerard Pasciak

### 2.5. Customer's details

Customer's name:	Rosenberger Hochfrequenztechnik GmbH & Co.KG
Address:	Hauptstr.1 83413, Fridolfing Germany
Contact person:	Mr. Matthias Rappl

### 2.6. Manufacturer's details

Manufacturer's name:	Robert Bosch Power Tools GmbH.
Address:	70538, Stuttgart Germany
Contact person:	Mr. Thomas Moser

### 3. Equipment under test (EUT)

#### 3.1. 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 S03	GPS25-4	Retrofit Tracker_US	IMEI-No: 352753090098 185	PCB-R2802 #200	Doberman- Retrofit-US- 1.0.0

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

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

AE short description *)	Auxiliary Equipment	Type	S/N serial number	HW hardware status	SW software status
AE 1	EUT Battery	ABI-L18650-1S1P	ABI 170815000528	--	--

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

#### 3.3. EUT set-ups

EUT set-up no. *)	Combination of EUT and AE	Remarks
set. 1	EUT A + AE 1	--

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

### 3.4. EUT operating modes

EUT operating mode no. *)	Description of operating modes	Description of operating modes
op. 1	>EUT Power On >Processor Running >GNSS receiving	---

\*) 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 AC power-line conducted emission measurements

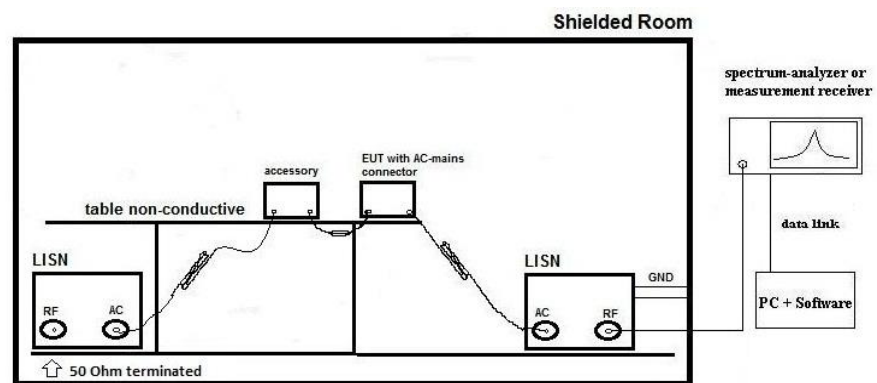
**Specification:** ANSI C63.4-2014 chapter 7, ANSI C63.10-2013 chapter 6.2

**General Description:** The radio frequency voltage conducted back into the AC power line in the frequency range 150 kHz to 30 MHz has to be investigated. Compliance should be tested by measuring the radio frequency voltage between each power line and ground at the power terminals in the stated frequency range.

A 50 Ohm / 50  $\mu$ H line impedance stabilization network (LISN) is used coupling the interface to the measurement equipment. The EUT power input leads are connected through the LISN to the AC-power source. The LISN enclosure is electrically connected to the ground plane. The measuring instrument is connected to the coaxial output of the LISN.

Tabletop devices were set-up on a 80 cm height above reference ground plane, floor standing equipment 10 cm raised above ground plane. Measurements have been performed on each phase line and neutral line of the devices AC-power lines. The EUT was power supplied with 120 V/60 Hz. The EUT was tested in the defined operating mode and installed (connected) to accessory equipment according the general description of use given by the applicant.

**Schematic:**



Only schematic view, we refer to figure 6, 7 and 8 of ANSI C63.4-2009 for more details.

**Testing method:**

**Exploratory, preliminary measurements** as a first step, determines the worst-case phase line (neutral or phase) as well as the most critical operating mode of the equipment. A complete frequency-sweep with PK-Detector is performed on each current-carrying conductor.

**Final testing** for power phases and critical frequencies (Margin to AV- or QP limit lower than 3 dB) as a second step includes measurements with receivers detector set to Quasi-Peak and Average.

**Formula:**

$$V_C = V_R + C_L \quad (1)$$

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

$V_C$  = measured Voltage –corrected value

$V_R$  = Receiver reading

$C_L$  = Cable loss

$M$  = Margin

$L_T$  = Limit

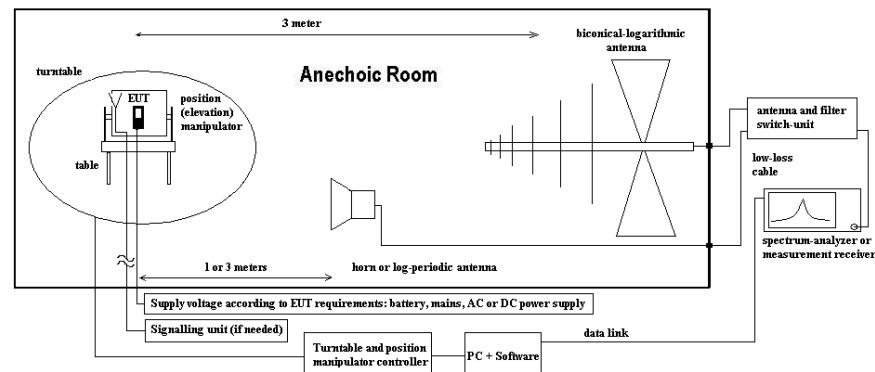
Values are in dB, positive margin means value is below limit.

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

**Specification:** ANSI C63.4-2014 chapter 8, 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.

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<sub>L</sub> = Cable loss

D<sub>F</sub> = Distance correction factor (if used)

E<sub>C</sub> = Electrical field – corrected value

E<sub>R</sub> = Receiver reading

G<sub>A</sub> = Gain of pre-amplifier (if used)

L<sub>T</sub> = Limit

M = Margin

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

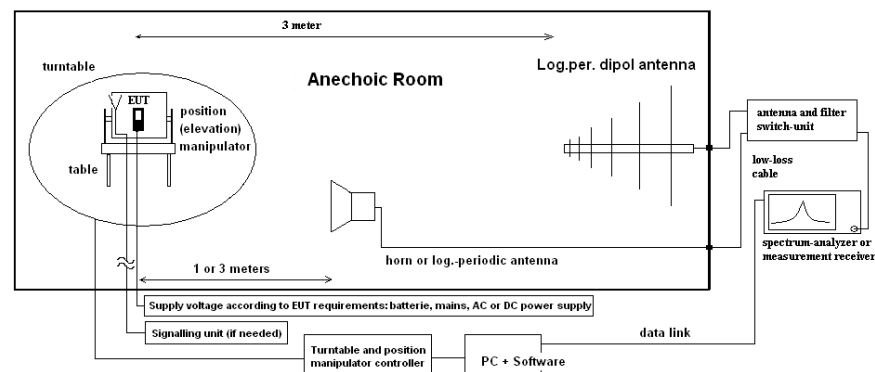


### 4.3. Test system set-up for radiated electric field measurement above 1 GHz

**Specification:** ANSI C63.4-2014 chapter 8, ANSI C63.10-2013 chapter 6.6

**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 CISPR 16-4 compliant fully anechoic room (FAR) recognized by the regulatory commissions. The measurement distance was set to 3 meter for frequencies up to 18 GHz and 2 meter above 18 GHz. A bicon-log or horn antenna is used for frequency range 1 GHz to 40 GHz. Due to use of a fully anechoic room the measurement antennas are set to fixed antenna height of 1.55 m and the site validation criteria accord. CISPR 16-1-4:2010, Chapter 8.3 is fulfilled. The EUT is aligned within 3 dB beamwidth of the measurement antenna, on big EUTs several surface measurements are performed.

**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 its characteristics was recorded with an EMI-receiver, broadband antenna and software.

The measurements are performed in horizontal and vertical polarization of the measurement antennas. The results are documented in a diagram. Critical frequencies (low margin to limit) are saved within a table for further investigations. If various operating modes are supported, further investigations are made to find the worst-case of them. Also the interconnection cables and equipment position were varied in order to maximize the emissions.

#### Final measurement on critical frequencies

Based on the exploratory measurements, the most critical frequencies are re-measured by 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). The measurement antenna height is fixed to 1.55 m.

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

**Formula:**

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

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

$E_C$  = 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. General Limit - Conducted emissions on AC-Power lines

#### 5.0.1. 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 type="checkbox"/> 333 EMI field	<input checked="" type="checkbox"/> 348 EMI cond.	
receiver	<input type="checkbox"/> 001 ESS	<input checked="" type="checkbox"/> 377 ESCS 30	<input type="checkbox"/> 489 ESU 40
LISN	<input checked="" type="checkbox"/> 005 ESH2-Z5	<input type="checkbox"/> 007 ESH3-Z6	<input type="checkbox"/> 300 ESH3-Z5 & 50Ω used for AE
signalling	<input type="checkbox"/> 392 MT8820A	<input type="checkbox"/> 436 CMU	<input type="checkbox"/> 547 CMU
line voltage	<input type="checkbox"/> 230 V 50 Hz via public mains	<input checked="" type="checkbox"/> 060 120 V 60 Hz via PAS 5000	<input type="checkbox"/> 594 CMW

#### 5.0.2. Requirements Un-Intentional EUT

<b>FCC</b>	Part 15, Subpart B, §15.107				
<b>IC</b>	RSS-Gen Issue 4, Chapter 8.8, Table 3				
<b>ANSI</b>	C63.4-2014, § 5.2, 6, 7				
<b>Limit</b>	Frequency [MHz]	<input checked="" type="checkbox"/> Conducted limit Class B		<input type="checkbox"/> Conducted limit Class A	
		QUASI-Peak [dBμV]	AVERAGE [dBμV]	QUASI-Peak [dBμV]	AVERAGE [dBμV]
	0.15 – 0.5	66 to 56*	56 to 46*	79	66
	0.5 – 5	56	46	73	60
	5 – 30	60	50	73	60
Remark: * decreases with the logarithm of the frequency					

#### 5.0.3. Test condition and test set-up

Signal link to test system (if used):		<input type="checkbox"/> air link	<input type="checkbox"/> cable connection	<input checked="" type="checkbox"/> none
EUT-grounding		<input checked="" type="checkbox"/> none	<input type="checkbox"/> with power supply	<input type="checkbox"/> additional connection
Equipment set up		<input checked="" type="checkbox"/> table top (40 cm distance to reference ground plane (wall))		<input type="checkbox"/> floor standing EUT stands isolated on reference ground plane (floor)
Climatic conditions		Temperature: (22±3°C)		Rel. humidity: (40±20)%
EMI-Receiver or Analyzer settings	Scan data	<input type="checkbox"/> 9 – 150 kHz, RBW = 200 Hz, Step = 61 Hz <input checked="" type="checkbox"/> 150 kHz – 30 MHz RBW = 9 kHz, Step = 4 kHz <input type="checkbox"/> other:		
	Scan-Mode	6 dB EMI-Receiver Mode		
	Pre-measurement Final measurement	Peak detector, Repetitive-Scan, max-hold, sweep-time 50 µs per frequency point Average & Quasi-peak detector at critical frequencies		
General measurement procedures		Please see chapter “Test system set-up for AC power line conducted emissions measurements”		

#### 5.0.4. Measurement results

The results are presented below in summary form only. For more information please see the diagrams

EUT set-up no.:			set-up 1		
Diagram No.	EUT operating mode no. or commend	Used Detector	Power line	Additional (scan-) information or remarks	Result
1.01	EUT operating mode 1	<input checked="" type="checkbox"/> Peak (pre-scan) <input checked="" type="checkbox"/> AV (final) <input checked="" type="checkbox"/> QP (final)	L1/ N	--	passed

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

### 5.1.1. Test location and equipment

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

### 5.1.2. Requirements/Limits

FCC		<input checked="" type="checkbox"/> Part 15 Subpart B, §15.109, class B <input type="checkbox"/> Part 15 Subpart C, §15.209 @ frequencies defined in §15.205	
ANSI		<input checked="" type="checkbox"/> C63.4-2014 <input type="checkbox"/> C63.10-2013	
Limit	Frequency [MHz]	Radiated emissions limits, 3 meters	
		QUASI Peak [ $\mu\text{V/m}$ ]	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

### 5.1.3. 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 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 $\pm$ 3°C) Rel. humidity: (40 $\pm$ 20)%		
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 analyser mode		
	Detector	Peak / Quasi-peak		
	RBW/VBW	100 kHz/300 kHz		
	Mode:	Repetitive-Scan, max-hold		
General measurement procedures		Please see chapter “Test system set-up for electric field measurement in the range 30 MHz to 1 GHz”		

### 5.1.4. MEASUREMENT RESULTS

The results are presented below in summary form only. For more information please see diagrams.

Table of measurement results:

Dia-gram no.	Frequency range	Set-up no.	OP-mode no.	Remark	Used detector			Result
					PK	AV	QP	
3.01a	30 MHz – 1 GHz	Set. 1	Op. 1	EUT_Position_laying	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Passed
3.01b	30 MHz – 1 GHz	Set. 1	Op. 1	EUT_Position_standing	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Passed

Remark: --

## 5.2. General Limit - Radiated emissions, above 1 GHz

### 5.2.1. Test location and equipment FAR

test site	<input checked="" type="checkbox"/> 441 EMI SAR	<input type="checkbox"/> 348 EMI cond.	<input checked="" type="checkbox"/> 443 EMI FAR	<input type="checkbox"/> 347 Radio.lab.	<input type="checkbox"/> 337 OATS	<input type="checkbox"/>
spectr. analys.	<input checked="" type="checkbox"/> 747 FSU-26	<input type="checkbox"/> 120 FSEM	<input type="checkbox"/> 264 FSEK	<input type="checkbox"/> 489 ESU 40	<input type="checkbox"/>	<input type="checkbox"/>
antenna meas	<input type="checkbox"/> 574 BTA-L	<input type="checkbox"/> 289 CBL 6141	<input checked="" type="checkbox"/> 439 HL 562	<input checked="" type="checkbox"/> 549 HL025	<input type="checkbox"/> 302 BBHA9170	<input type="checkbox"/> 477 GPS
antenna meas	<input type="checkbox"/> 123 HUF-Z2	<input type="checkbox"/> 132 HUF-Z3	<input type="checkbox"/> 030 HFH-Z2	<input type="checkbox"/> 376 BBHA9120E	<input type="checkbox"/>	<input type="checkbox"/>
antenna subst	<input type="checkbox"/> 071 HUF-Z2	<input type="checkbox"/> 020 EMCO3115	<input type="checkbox"/> 063 LP 3146	<input type="checkbox"/> 303 BBHA9170	<input type="checkbox"/>	<input type="checkbox"/>
multimeter	<input type="checkbox"/> 341 Fluke 112	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
signaling	<input type="checkbox"/> 392 MT8820A	<input type="checkbox"/> 371 CBT32	<input type="checkbox"/> 547 CMU	<input type="checkbox"/> 594 CMW	<input type="checkbox"/>	<input type="checkbox"/>
DCpower	<input type="checkbox"/> 086 LNG50-10	<input checked="" type="checkbox"/> 087 EA3013	<input type="checkbox"/> 354 NGPE 40	<input type="checkbox"/> 349 car battery	<input type="checkbox"/> 350 Car battery	<input type="checkbox"/>
line voltage	<input type="checkbox"/> via laptop		<input type="checkbox"/> 060 120 V 60 Hz via PAS 5000			

### 5.2.2. Requirements/Limits

<b>FCC</b>	<input checked="" type="checkbox"/> Part 15 Subpart B, §15.109 class B <input type="checkbox"/> Part 15 Subpart C, §15.209 for frequencies defined in §15.205 <input type="checkbox"/> Part 15 Subpart C, §15.407(b)(1)(2)(3)(4)			
<b>ANSI</b>	<input checked="" type="checkbox"/> C63.4-2014 <input type="checkbox"/> 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

### 5.2.3. 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 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 1.5m height		
Climatic conditions	Temperature: (22±3°C)		
Spectrum-Analyzer settings	Rel. humidity: (40±20)% <input checked="" type="checkbox"/> 1 – 18 GHz <input type="checkbox"/> 18 – 25 GHz <input type="checkbox"/> 18 – 40 GHz <input type="checkbox"/> other: <input checked="" type="checkbox"/> 6 dB EMI-Receiver Mode <input type="checkbox"/> 3 dB Spectrum analyser Mode Peak and Average 1 MHz / 3 MHz Repetitive-Scan, max-hold 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"		

### 5.2.4. Measurement Results

The results are presented below in summary form only. For more information please see diagrams.

Dia-gram no.	Frequency range	Set-up no.	OP-mode no.	Remark	Used detector			Result
					PK	AV	QP	
4.01	1 - 18 GHz	Set. 1	Op. 1	--	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Passed

Remark: --

### 5.3. 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 <sub>CISPR</sub> )	CISPR 16-2-1	9 kHz - 150 kHz 150 kHz - 30 MHz	4.0 dB 3.6 dB							-
Radiated emissions Enclosure	CISPR 16-2-3	30 MHz - 1 GHz 1 GHz - 18 GHz	4.2 dB 5.1 dB							E-Field
Disturbance power	CISPR 16-2-2	30 MHz - 300 MHz	-							-
Power Output radiated	-	30 MHz - 4 GHz	3.17 dB							Substitution method
Power Output conducted	-	Set-up No.	Cel-C1	Cel-C2	BT1	W1	W2	--	-	
		9 kHz - 12.75 GHz	N/A	0.60	0.7	0.25	N/A	--		
		12.75 - 26.5GHz	N/A	0.82	--	N/A	N/A	--		
Conducted emissions on RF-port	-	9 kHz - 2.8 GHz	0.70	N/A	0.70	N/A	0.69	--	N/A - not applicable	
		2.8 GHz - 12.75GHz	1.48	N/A	1.51	N/A	1.43	--		
		12.75 GHz - 18GHz	1.81	N/A	1.83	N/A	1.77	--		
		18 GHz - 26.5GHz	1.83	N/A	1.85	N/A	1.79	--		
Power density	-	1 – 2.8GHz	1.40 dB							--
Occupied bandwidth	-	9 kHz - 4 GHz	0.1272 ppm (Delta Marker)							Frequency error
			1.0 dB							Power
Emission bandwidth	-	9 kHz - 4 GHz	0.1272 ppm (Delta Marker)							Frequency error
	-		See above: 0.70 dB							Power
Frequency stability	-	9 kHz - 20 GHz	0.0636 ppm							-
Radiated emissions Enclosure	-	150 kHz - 30 MHz	5.0 dB							Magnetic field
		30 MHz - 1 GHz	4.2 dB							E-field
		1 GHz - 20 GHz	3.17 dB							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 Measurment.	FCC, Federal Communications Commission Laboratory Division, USA
337 487 550 558	3462D-1 3462D-2 3462D-2 3462D-3	Radiated Measurements 30 MHz to 1 GHz, 3 m / 10 m (OATS) Radiated Measurements 30 MHz to 1 GHz, 3 m (SAR) Radiated Measurements 1 GHz to 6 GHz, 3 m (SAR) Radiated Measurements above 1 GHz, 3 m (FAR)	IC, Industry Canada Certification and Engineering Bureau
487 550 348 348	R-20013 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 Measurment.	VCCI, Voluntary Control Council for Interference by Information Technology Equipment, Japan

OATS = Open Area Test Site, SAR = Semi Anechoic Room, FAR = Fully Anechoic Room

## 8. Instruments and Ancillary

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

### 8.1. 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
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)



### 8.1.1. 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	-	16.05.2019
250	EMI Test Receiver	ESVS-30	829007/001	Rohde & Schwarz			
23	AC - LISN (50 Ohm/50µH, test site 1)	ESH2-Z5	861741/005	Rohde & Schwarz	12 M	-	16.05.2019
007	Single-Line V-Network (50 Ohm/5µH)	ESH3-Z6	892563/002	Rohde & Schwarz	12 M	-	16.05.2019
009	Power Meter (EMS-radiated)	NRV	863056/017	Rohde & Schwarz	24 M	-	15.05.2019
011	Insertion Unit (EMS-radiated)	URV5-Z2	864169/004	Rohde & Schwarz	24 M	-	
012	Signal Generator (EMS-cond.)	SMY 01	839069/027	Rohde & Schwarz	24 M	-	15.05.2019
013	Power Meter (EMS cond.)	NRVD	839111/003	Rohde & Schwarz	24 M	-	15.05.2019
014	Insertion Unit (EMS cond.)	URV5-Z2	838519/029	Rohde & Schwarz	24 M	-	15.05.2019
015	Insertion Unit (EMS cond.)	URV5-Z4	838570/024	Rohde & Schwarz	24 M	-	15.05.2019
016	Line Impedance Simulating Network	Op. 24-D	B6366	Spitzenberger+Spies	36 M	-	30.05.2019
017	Digital Radiocommunication Tester	CMD 60 M	844365/014	Rohde & Schwarz	pre-m	3	
020	Horn Antenna 18 GHz (Subst 1)	3115	9107-3699	EMCO	36/12 M	-	31.07.2017
021	Loop Antenna (H-Field)	6502	9206-2770	EMCO	36 M	-	30.04.2018
022	Audio Measurement Amplifier	2636C	1537643	Brüel & Kjaer	24 M	-	31.03.2016
030	Loop Antenna (H-field)	HFH-Z2	879604/026	Rohde & Schwarz	36 M	-	30.04.2018
031	Absorbing Clamp	MDS-21	863325/015	Rohde & Schwarz	36 M	-	30.04.2018
033	RF-current probe (100kHz-30MHz)	ESH2-Z1	879581/18	Rohde & Schwarz	24 M	-	15.05.2019
049	Current Clamp (injection)	F-120-2	48	FCC	24 M	-	30.05.2020
050	3-ph Coupling Decoupling Netw. (Burst)	CDN 300	176	Schaffner	36 M	-	30.05.2021
051	VHF-Current Probe 20-300 MHz	ESV-Z1	872421	Rohde & Schwarz	36 M	-	30.05.2021
052	Notch Filter DECT	WRCB 1887,82/1889,55SS	12	Wainwright Industries	pre-m	2	
057	relay-switch-unit (EMS system)	RSU	494440/002	Rohde & Schwarz	pre-m	1a	
058	capacitive clamp (Burst)	IP 4	99	Haefely	36 M	-	30.05.2021
060	power amplifier (DC-2kHz)	PAS 5000	B6363	Spitzenberger+Spies	-	3	
065	attenuator, (6 dB) 50 Ohm, 250W	AT 50-6-250	521057	BNOS Electronics	12 M	1b	30.09.2015
066	notch filter (WCDMA; FDD1)	WRCT 1900/2200-5/40-10EEK	5	Wainwright GmbH	12 M	1g	30.06.2017
067	coupling decoupling-network	CDN 801-M2/M3	272	Lüthi	36 M	-	15.05.2020
068	coupling decoupling-network	CDN 801-M5	95226	Lüthi	36 M	-	17.05.2020
069	EM - clamp	EM101	9535159	Lüthi	36 M	-	30.05.2019
072	coupling decoupling-network	CDN 801-M2/M3	276	Lüthi	36 M	-	17.05.2020
083	AC - power supply, 0-10 A	EAC/MT 27010	910502096	EURO TEST	pre-m	2	
084	AC - power supply, 0-5 A	ELABO-8-34214	-	ELABO	pre-m	2	
085	AC - power supply, 0-10 A	R250	-	Schunterm.&Benningh.	pre-m	2	
086	DC - power supply, 0 -10 A	LNG 50-10	-	Heinzinger Electronic	pre-m	2	
087	DC - power supply, 0 -5 A	EA-3013 S	-	Elektro Automatik	pre-m	2	
090	Helmholtz coil: 2x10 coils in series	Helmholtz coil: 2x10 coils in	-	RWTÜV	24 M	4	31.03.2016
091	USB-LWL-Converter	OLS-1	007/2006	Ing. Büro Scheiba	-	4	
094	artificial head (No.1)	4905	1566990	Brüel & Kjaer	pre-m	2	
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	-	30.05.2019
121	notch filter GSM 1900	WRCB 1879,5/1880,5EE	15	Wainwright GmbH	12 M	1d	30.06.2017
122	notch filter GSM 1800	WRCB 1747/1748	12	Wainwright GmbH	12 M	1c	30.06.2017
131	RF-Current Probe	F-52	19	FCC	36 M	-	17.05.2020
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
142	attenuator (6 dB) 2 W, 8 GHz	DGL N	-	Radiall	12 M	1b	30.09.2015
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	
254	high pass GSM1800/1900/DECT	SHC 2600/12750-1.5KK	23042	Trilithic	12 M	1c	30.06.2017
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	-	30.05.2019
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	-	30.05.2020
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	
268	AC/DC power supply	EA 3050-A	9823636	Elektro Automatik	pre-m	-	
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	



Ref.-No.	Equipment	Type	Serial-No.	Manufacturer	Interval of calibration	Remark	Cal due
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	
284	coupling decoupling network	CDN 801-M1	1661	Lüthi	36 M	-	17.05.2020
285	coupling decoupling network	CDN 801-S1	1642	Lüthi	36 M	-	17.05.2020
287	pre-amplifier 25MHz - 4GHz	AMF-2D-100M4G-35-10P	379418	Miteq	12 M	1c	30.06.2017
290	notch filter GSM 900	WRCA 901.9/903,1SS	3RR	Wainwright GmbH	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
295	Racal Digital Radio Test Set	6103	1572	Racal	pre-m	3	
296	audio measurement amplifier	2636C (Reserve)	R=316568/004 B=1537541	Brüel & Kjaer	pre-m	2	
298	Univ. Radio Communication Tester	CMU 200	832221/091	Rohde & Schwarz	pre-m	3	
299	audio microphone	134	-	Brüel & Kjaer	pre-m	2	
300	AC LISN (50 Ohm/50µH, 1-phase)	ESH3-Z5	892 239/020	Rohde & Schwarz	12 M	-	17.05.2019
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
304	fix dipole antenna 1,6 GHz	EMCO 3125-307	9907-1001	ETS	pre-m	-	
305	fix dipole antenna 1,8-2,0 GHz	EMCO 3125-306	9907-1001	ETS	pre-m	-	
306	fix dipole antenna 2,45 GHz	EMCO 3125-308	9907-1001	ETS	pre-m	-	
307	fix dipole antenna 3 GHz	EMCO 3125-309	9907-1001	ETS	pre-m	-	
317	1000 Hz calibrator 94 dB SPL	4230 94dB	1542286	Brüel & Kjaer	12 M	-	
323	Digital Radiocommunication Tester	CMD 55	825878/0034	Rohde & Schwarz	pre-m	3	
335	CTC-EMS-Conducted	System EMS Conducted	-	Rohde & Schwarz	12 M	5	30.09.2015
337	System CTC OATS NSA	System EMI OATS NSA	-	HD GmbH	24 M	5	12.04.2019
340	Digital Radiocommunication Tester	CMD 55	849709/037	Rohde & Schwarz	pre-m	3	
341	Digital Multimeter	Fluke 112	81650455	Fluke	24 M	-	30.05.2020
342	Digital Multimeter	Voltcraft M-4660A	IB 255466	Voltcraft	24 M	-	17.05.2019
344	adaptor 150/50 Ohm	150/50	-	Krohne	36 M	-	17.05.2020
345	adaptor 150/50 Ohm	150/50	-	Krohne	36 M	-	17.05.2020
347	laboratory site	radio lab.	-	-	-	5	
348	laboratory site	EMI conducted	-	-	-	5	
349	car battery 12 V	car battery 12 V	without	-	-	3	
350	car battery 12 V	car battery 12 V	without	-	-	3	
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	-	24.05.2019
363	Kalibrieradapter HF-uns.	CR 100 A	without	Lüthi	24 M	-	30.05.2020
364	Kalibrieradapter HF-uns.	CR 100 A	128	Lüthi	24 M	-	30.05.2020
366	Ultra Compact Simulator	UCS 500 M4	V0531100594	EM-Test	12 M	-	30.05.2019
368	ROD-Antenna	HFH 2-Z1	879283/31	Rohde & Schwarz	60 M	-	17.07.2019
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	-	17.05.2019
374	Power Amplifier 0,8-3 GHz	60S1G3	306528	Amplifier Research	12 M	1a	20.03.2018
375	Directional Coupler	DC7144M1	306498	Amplifier Research	12 M	1a	20.03.2018
376	Horn Antenna 6 GHz	BBHA9120 E	BBHA 9120 E 179	Schwarzbeck	36 M	-	28.02.2020
377	EMI Test Receiver	ESCS 30	100160	Rohde & Schwarz	12 M	-	30.05.2019
378	Broadband RF Field Monitor	RadiSense III	03D00013SNO-08	DARE B.V.	24 M	-	25.05.2016
386	Coupling Decoupling Network	CDN USB/p	19397	Schaffner	36 M	-	17.05.2020
387	Coupling Decoupling Network	CDN L-801 M2	2051	Lüthi	36 M	-	18.05.2020
388	Coupling Decoupling Network	CDN L-801 T2	1929	Lüthi	36 M	-	18.05.2020
389	Digital Multimeter	Keithley 2000	0583926	Keithley	pre-m	-	
390	Industry Acoustic System	MO 2000 Set	2127100123	Sennheiser	pre-m	2	
392	Radio Communication Tester	MT8820A	6K00000788	Anritsu	12 M	-	18.05.2018
394	Power Amplifier 80-1000 MHz	BLWA 0810-250/200	045610	Bonn-Elektronik	-	1a	20.03.2018
399	Sound Calibrator	Sound Calibrator 4231	2665101	Brüel & Kjaer	12 M	-	30.05.2019
431	Model 7405	Near-Field Probe Set	9305-2457	EMCO	-	4	
436	Univ. Radio Communication Tester	CMU 200	103083	Rohde & Schwarz	12 M	-	06.03.2019
439	UltraLog-Antenna	HL 562	100248	Rohde & Schwarz	36 M	-	10.03.2020
440	CDN for Datacable	CDN-UTP	CDN-UTP 029	EMC Partner AG, CH	36 M	-	30.05.2019
441	CTC-SAR-EMI Cable Loss	System EMI field (SAR) Cable	-	CETECOM	12 M	5	05.06.2017
442	CTC-SAR-EMS	System EMS field (SAR)	-	ETS-Lindgren / CETECOM	12 M	5	20.03.2018
443	CTC-FAR-EMI-RSE	System CTC-FAR-EMI-RSE	-	ETS-Lindgren / CETECOM	12 M	5	30.09.2017
444	CTC-FAR-EMS field	System-EMS-Field (FAR)	-	ETS Lindgren/CETECOM	12 M	5	30.09.2014
448	notch filter WCDMA_FDD II	WRCT 1850.0/2170.0-5/40-	5	Wainwright Instruments GmbH	12 M	1c	30.06.2017
449	notch filter WCDMA FDD V	WRCT 824.0/894.0-5/40-8SSK	1	Wainwright	12 M	1c	30.06.2017
450	6dB attenuator N/N	6806.17B 6dB	-	Huber & Suhner	12 M	-	20.05.2019
454	Oscilloscope	HM 205-3	9210 P 29661	Hameg	-	4	
455	Oscilloscope	HP 54602B	US 350 336 45	Hawlett Packard	-	4	

Ref.-No.	Equipment	Type	Serial-No.	Manufacturer	Interval of calibration	Remark	Cal due
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	-	30.05.2019
462	AF-Generator	MX-2020	-	Conrad	-	4	
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	-	30.05.2019
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	-	16.05.2019
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	-	
487	System CTC NSA-Verification SAR-EMI	System EMI field (SAR) NSA	-	ETS Lindgren / CETECOM	24 M	-	31.03.2019
489	EMI Test Receiver	ESU40	1000-30	Rohde & Schwarz	12 M	-	18.05.2018
491	ESD Simulator dito	ESD dito	dito307022	EM-Test	12 M	-	30.05.2019
498	Power Supply	NGPE 40/40	402	Rohde & Schwarz	pre-m	2	
500	Industry Acoustic System	MO 2000 Set	100048	Sennheiser	pre-m	2	
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	Wainwright	12 M	1c	
517	relais switch matrix	HF Relais Box Keithley	SE 04	Keithley	pre-m	2	
523	Digital Multimeter	L4411A	MY46000154	Agilent	24 M	-	18.05.2019
524	Voltage Drop Simulator	VDS 200	0196-16	EM Test	24 M	-	16.05.2019
525	CDN coupling network	CNA 200	1196-01	EM Test	24 M	-	16.05.2019
526	Burst Generator	EFT 200 A	0496-06	EM Test	24 M	-	16.05.2019
527	Micro Pulse Generator	MPG 200 B	0496-05	EM Test	24 M	-	16.05.2019
528	Load Dump Simulator	LD 200B	0496-06	EM Test	24 M	-	16.05.2019
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	
533	Impedance Stabilization Network	ISN T200A	25706	Teseq	36 M	-	18.05.2020
534	Impedance Stabilization Network	ISN T400A	24881	Teseq	36 M	-	18.05.2020
535	Impedance Stabilization Network	ISN T800	26321	Teseq	36 M	-	18.05.2020
536	Impedance Stabilization Network	ISN ST08	25867	Teseq	36 M	-	18.05.2020
541	Impedance Stabilization Network	ISN T8-Cat6	26373	Teseq Berlin	36 M	-	18.05.2020
546	Univ. Radio Communication Tester	CMU 200	106436	R&S	12 M	-	30.03.2018
547	Univ. Radio Communication Tester	CMU 200	835390/014	Rohde & Schwarz	12 M	-	05.07.2018
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	-	30.03.2019
552	high pass filter 2,8-18GHz	WHKX 2.8/18G-10SS	4	Wainwright	12 M	1c	
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	-	31.03.2019
584	Spectrum Analyzer	FSU 8	100248	Rohde & Schwarz	pre-m	-	
592	CDN-HDMI	CDN-HDMI	A3029004	Frankonia / Dr.Hubert	36 M	-	18.05.2020
595	Analog Adder	TS8910	-	Rohde & Schwarz	pre-m	2	
597	Univ. Radio Communication Tester	CMU 200	100347	Rohde & Schwarz	pre-m	-	
600	power meter	NRVD (Reserve)	834501/018	Rohde & Schwarz	24 M	-	17.05.2019
602	peak power sensor	NRV-Z32 (Reserve)	835080	Rohde & Schwarz	24 M	-	
607	Signal Generator	SMR 20	832033/011	Rohde & Schwarz	36 M	-	18.05.2020
609	Sleeve Dipole Antenna	3126-700	00123808	ETS-Lindgren	36/12 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	
615	Analog Adder	TS8920	-	Rohde & Schwarz	pre-m	2	
616	Digitalmultimeter	Fluke 177	88900339	Fluke	24 M	-	30.05.2020
620	EMI Test Receiver	ESU 26	100362	Rohde-Schwarz	12 M	-	30.05.2019
625	Generic Test Load USB	Generic Test Load USB	-	CETECOM	-	2	
627	data logger	OPUS 1	201.0999.9302.6.4.1.43	G. Luft GmbH	24 M	-	30.03.2019
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	
642	Wideband Radio Communication Tester	CMW 500	126089	Rohde&Schwarz	24 M	-	24.05.2019
644	Amplifierer	ZX60-2534M+	SN865701299	Mini-Circuits	-	-	
645	Power Amplifier	CBA 230M-080	T44236	TESEQ	-	1g	
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	
672	Digitalmultimeter	Keithley 2700	1182075	Keithley	pre-m	-	
673	Diditalmultimeter	Keithley 2700	1181408	Keithley	pre-m	-	
674	Digitalmultimeter	Keithley 2700	1182090	Keithley	pre-m	-	

Ref.-No.	Equipment	Type	Serial-No.	Manufacturer	Interval of calibration	Remark	Cal due
675	Digitalmultimeter	Keithley 2700	1162865	Keithley	pre-m	-	
676	Digitalmultimeter	Keithley 2700	1182092	Keithley	24 M	-	16.05.2019
677	Digitalmultimeter	Keithley 2700	1182089	Keithley	pre-m	-	
678	Power Meter	NRP	101638	Rohde&Schwarz	pre-m	-	
679	Power Supply	High Speed Power Supply	0783417	Keithley	pre-m	-	
680	Power Sensor	NRP-Z21	100622	Rohde & Schwarz	pre-m	-	
682	Vector Signal Generator	SMU 200A	101319	Rohde & Schwarz	pre-m	-	
683	Spectrum Analyzer	FSU 26	200571	Rohde & Schwarz	12 M	-	30.05.2019
684	Widerstand 100 Ohm	SL 403-403	72973	Teseq	pre-m	-	
685	Widerstand 100 OHM	SL 403-403	72974	Teseq	pre-m	-	
686	Field Analyzer	EHP-200A	160WX30702	Narda Safety Test Solutions	24 M	-	29.03.2019
687	Signal Generator	SMF 100A	102073	Rohde&Schwarz	12 M	-	30.05.2019
689	Vector Signal Generator	SMU200	100970	Rohde&Schwarz	24 M	-	30.06.2020
690	Spectrum Analyzer	FSU	100302/026	Rohde&Schwarz	24 M	-	16.05.2019
692	Bluetooth Tester	CBT 32	100236	Rohde & Schwarz	36 M	-	29.05.2020
695	ReRadiating GPS-System	AS-47	G1406003500001	Automotive Cons. Fink	-	3	
698	Sound Calibrator	Sound Calibrator 4231	2035208	Brüel & Kjaer	12 M	-	30.05.2019
699	Audio Analyzer	UPL16	833494/005	Rohde & Schwarz	12 M	-	30.05.2019
700	Audio Analyzer	UPL 16	830695/0016	Rohde&Schwarz	24 M	-	30.05.2020
701	CMW500 wide. Radio Comm.	CMW500	158150	Rohde & Schwarz	12 M	-	
705	NRV-Z1	Power Sensor	893350/020	Rohde & Schwarz	12 M	-	30.05.2019
706	NRV-Z1	Power Sensor	830961/001	Rohde & Schwarz	12 M	-	30.05.2019
707	RadiCentre	CTR-1004B	10100037SN038-1	D.A.R.E!! Instruments	24 M	-	
708	Laser powered Electrical Field Strength Probe	RadiSense 6	10100037SN038	D.A.R.E!! Instruments BV	24 M	-	31.03.2019
710	RF Power Amplifier	BLMA 2560-100	1610879	Bonn Elektronik	12 M	-	
711	Harmonic Mixer 90 GHz - 140GHz	RPG FS-Z140	101004	RPG	24 M	-	22.02.2019
712	Harmonic Mixer 75 GHz - 110GHz	FS-Z110	101468	Rohde & Schwarz	24 M	-	22.02.2019
713	Harmonic Mixer, 50 GHz - 75GHz	FS-Z75	101022	Rohde & Schwarz	24 M	-	22.05.2019
714	Signal Analyzer 67GHz	FSW67	104023	Rohde & Schwarz	24 M	-	28.02.2020
715	Harmonic Mixer, 140 GHz - 220GHz	FS-Z220	101009	RPG Radiometer Physics	24 M	-	03.08.2019
716	Harmonic Mixer 220 GHz to 325 GHZ	FS-Z325	101005	RPG Radiometer Physics	24 M	-	13.02.2019
717	Signal Generator	SMP02	830682/005	Rohde&Schwarz	36 M	-	
718	Robot	Dasy 5 / TX90	F11/5GM9A1/A/01	Stäubli	pre-m	-	
747	Spectrum Analyzer	FSU 26	200152	Rohde & Schwarz	12 M	-	30.05.2019
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	17-010795	mk-messtechnik GmbH	-	-	
757	WIDEBAND RADIO COMMUNICATION	CMW500	163673	Rohde&Schwarz	12 M	-	
758	Signal Generator	SMU 200A	100754	Rohde & Schwarz	24 M	-	11.10.2019
780	Spectrum Analyzer	FSH3	101726	Rohde & Schwarz	12 M	-	
781	Power Supply	PS 2042-10 B	2815450369	Elektro-Automatik GmbH	-	-	
782	Power Supply	PS 2042-10 B	2815450348	Elektro-Automatik GmbH & Co.KG	-	-	
783	Spectrum Analyzer	FSU 26	100414	Rohde & Schwarz	12 M	-	30.05.2019
784	Power Supply	NGSM 32/10	00196	Rohde & Schwarz	12 M	-	
785	RSP	RF Step Attenuator	860712/012	Rohde & Schwarz	12 M	-	

## 8.2. 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
V1	Initial release	2018-08-21
C1	Manufacturer and ISED changed	2018-11-05
C2	Applicant and coversheet logo changed	2019-04-29

## 10. Measurement diagrams

### 10.1. EMI-AC mains

#### 1.01

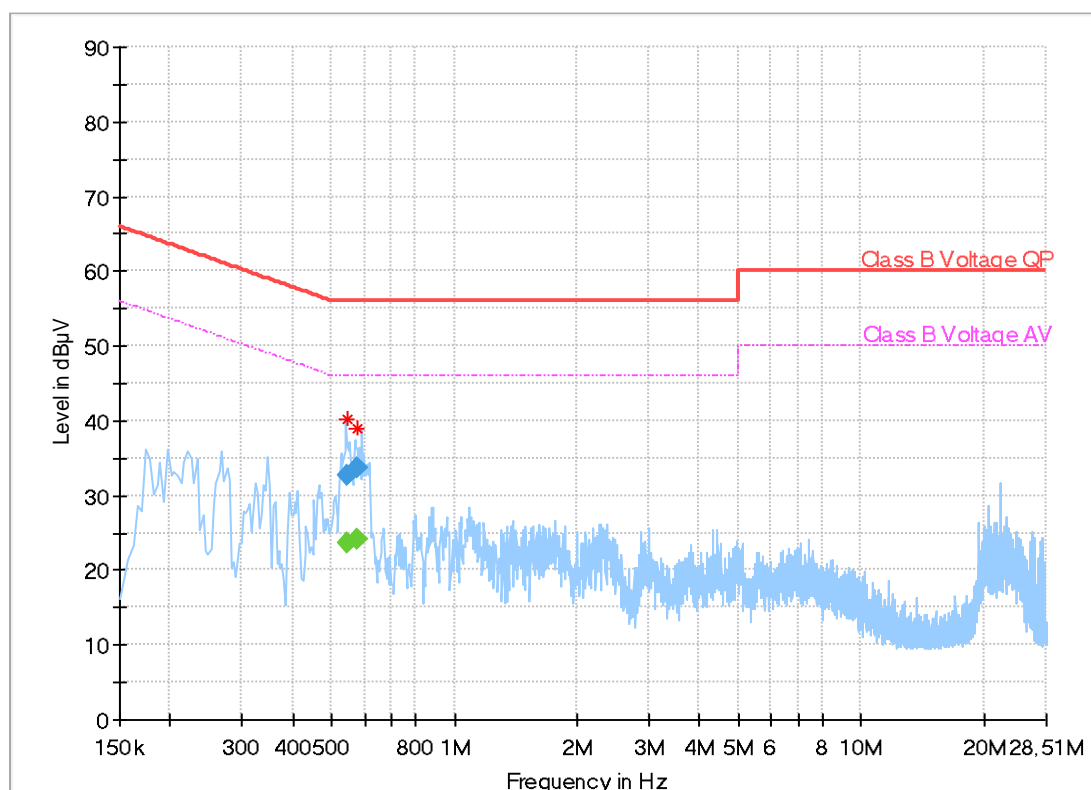
#### Common Information

Test Description:	Conducted Voltage Measurement Class B
Test Site & Location:	Conducted Emission, CETECOM GmbH Essen
Test Software:	R&S EMC32 v9.15
Test Specification:	FCC 15.107, FCC 15.207
Operating Mode:	Op 1
Measured on line:	N/L1
Diagram details:	Shows the peak values as a sum of measured ports in maxhold mode
Environmental Conditions:	Humidity: 42%rH; Temperature: 23°C
Operator:	Klv

#### EUT Information

Manufacturer:	Robert Bosch Power Tools GmbH
Type:	Retrofit Tracker
EUT:	GPS25-4
HW version: tbd	PCB-R2802 #200
SW version:	Doberman-Retrofit-US-1.0.0
Power Supply:	120V
Comments:	IMEI:352753090098185-

Full Spectrum



#### Final Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	PE
0.543125	---	23.55	46.00	22.45	1000.0	9.000	N	GN
0.543125	32.63	---	56.00	23.37	1000.0	9.000	N	GN
0.573906	---	24.21	46.00	21.79	1000.0	9.000	N	GN
0.573906	33.62	---	56.00	22.38	1000.0	9.000	N	GN

## 10.2. Radiated emissions in the frequency range 30 to 1000MHz

### 10.2.1. Part 15B

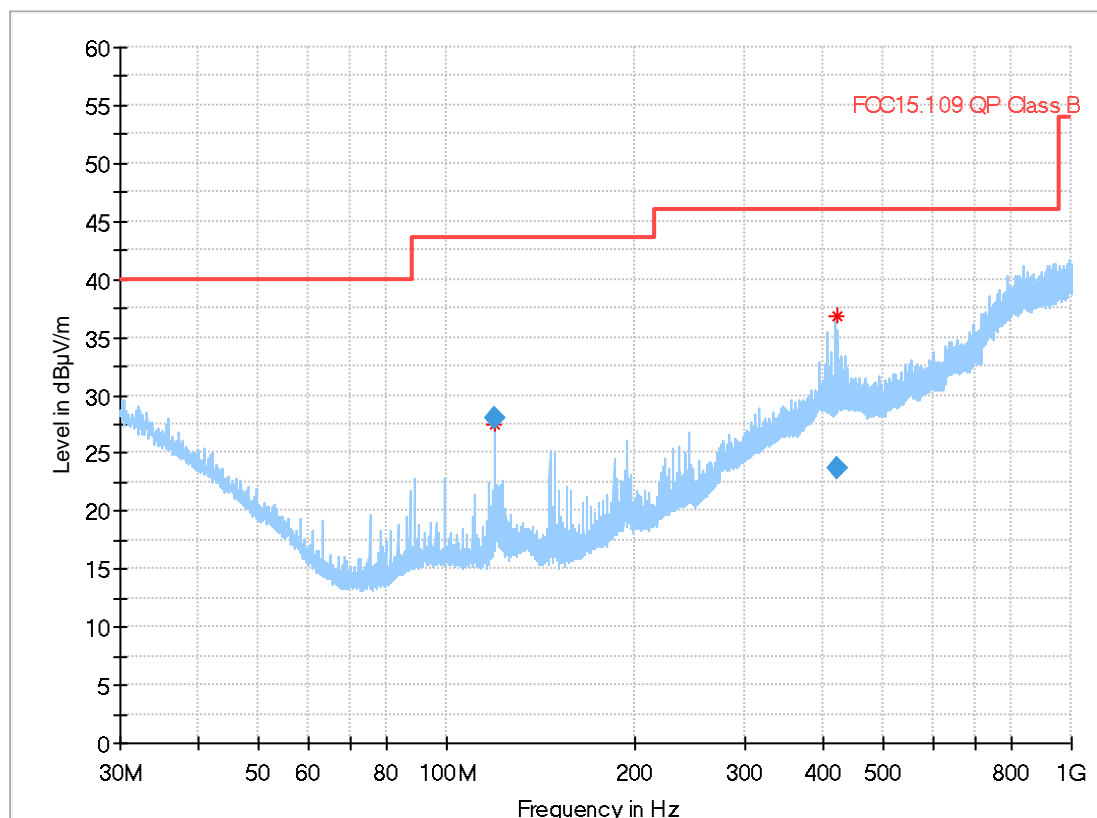
#### 3.01a\_laying

Test description:	Electric Field Strength Measurement
Test site and distance:	Ref.-Nr. 441 Semi Anechoic Room (SAR) with 3 m measurement distance
Version of Testsoftware:	EMC32 V9.25.0
Technical Data:	please see page 2 for detailed data of measurement setup
Test specification.:	FCC 15.109 Class B; RSS-Gen. Issue 4
Operating Mode	EUT Power on, Processor running
Operator:	TFra
Operating conditions:	Humidity: 35%rH; Temperature: 20°C
Power during tests:	AC 120V 60Hz

#### EUT Information

Please see Diagram Number 1.01

Full Spectrum



#### Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
119.340000	28.01	43.50	15.49	1000.0	120.000	160.0	H	340.0	7.9
420.060000	23.68	46.00	22.32	1000.0	120.000	283.0	V	200.0	18.8

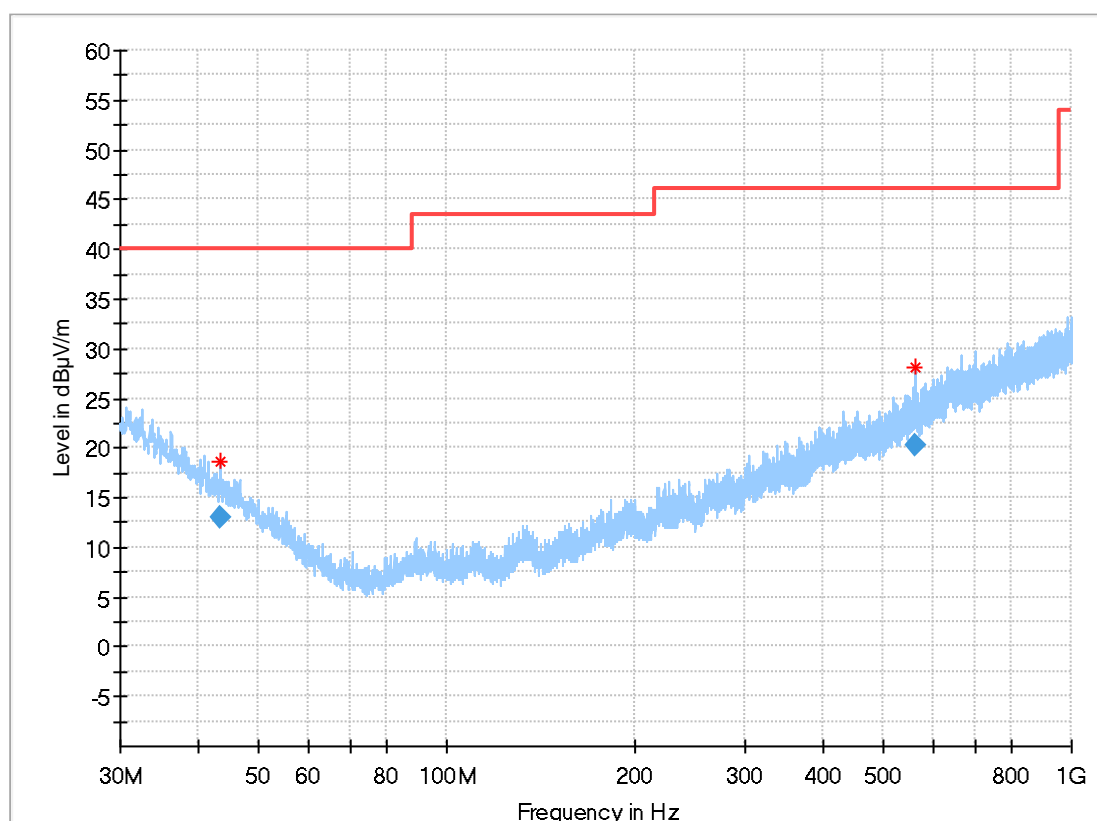
## 3.01b\_standing

Test description:	Electric Field Strength Measurement
Test site and distance:	Ref.-Nr. 441 Semi Anechoic Room (SAR) with 3 m measurement distance
Version of Testsoftware:	EMC32 V9.25.0
Technical Data:	please see page 2 for detailed data of measurement setup
Test specification.:	FCC 15.109 Class B; RSS-Gen. Issue 4
Operating Mode	EUT Power on, Processor running
Operator:	TFra
Operating conditions:	Humidity: 35%rH; Temperature: 20°C
Power during tests:	AC 120V 60Hz

### EUT Information

Please see Diagram Number 1.01

### Full Spectrum



### Final\_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)
43.353000	12.94	40.00	27.06	1000.0	120.000	105.0	H	198.0	0.0
561.625000	20.30	46.00	25.70	1000.0	120.000	105.0	H	0.0	0.0



### 10.3. Radiated emissions in the frequency range above 1000MHz

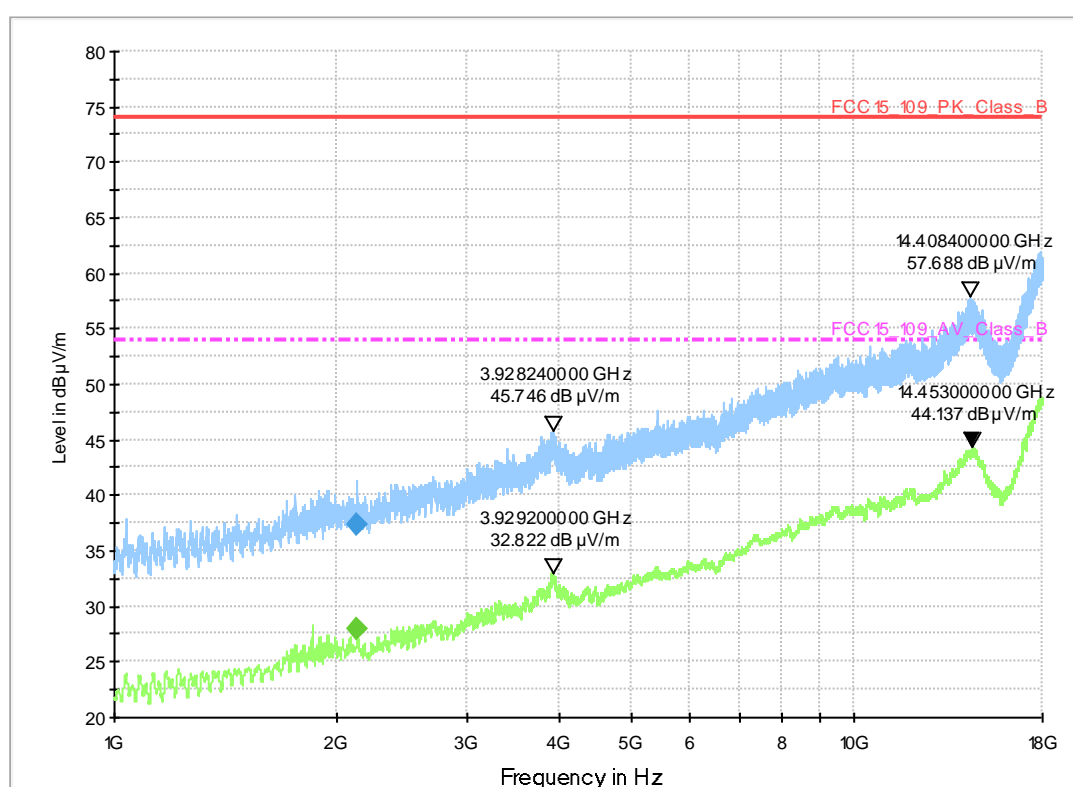
#### 10.3.1. Part 15B

#### 4.01

Test Description: Radiated Filed Strength Emission  
 Test Site Location: CETECOM GmbH Essen  
 Test Site: Fully Anechoic Room (FAR)  
 Test Standard: FCC Part 15.109, class B / RSS-Gen., Issue 4  
 Operating Mode: EUT Power on, Processor running  
 Equipment Class: Class B  
 Environmental Conditions: Humidity: 40%rH; Temperature: 25°C

#### EUT Information

Please see Diagram Number 1.01



#### Final Result 1

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Elevation (deg)	Margin (dB)
2131.118000	37.4	100.0	1000.000	155.0	H	12.0	0.0	36.6

(continuation of the "Final Result 1" table from column 10 ...)

Frequency (MHz)	Limit (dBµV/m)
2131.118000	74.0

End Of Test Report