

TEST REPORT

No.: 18-1-0248302T03a

According to:

CFR Title 47, Part 15, Subpart E
§15.407 (U-NII)

ISED-Regulations
RSS-Gen, Issue 5
RSS-247, Issue 2

for

Robert Bosch Car Multimedia GmbH

AIVIV10
Multimedia device with Bluetooth and WLAN

FCC ID: YBN-AIVIV20
ISED: 9595A-AIVIV20



Laboratory Accreditation
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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 presented Equipment Under Test (in this report, hereinafter referred as EUT) supports radiofrequency technologies with WLAN technology and operating frequency range at 5.150 to 5.850 GHz according to IEE 802.11ac. This test report handles dynamic frequency selection (DFS) testing only. Other implemented wireless technologies were not considered within this test report.

Following test cases have been performed to show compliance with valid Part 15.407/15.209 of the FCC CFR Title 47 Rules, Edition 2017 and ISED RSS-247 Issue 2/RSS-Gen Issue 4 standards.

1.1. Tests measurement overview according to US CFR Title 47, Subpart 15C & RSS-247

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 5 Chapter 6.6	99% Power bandwidth	--	--	Remark 1)
26 dB bandwidth	Antenna terminal (conducted)	§15.303 + §15.407(a)(2)(5)	RSS-Gen, Issue 5 Chapter 6.6	26 dB spectral density bandwidth	--	--	Remark 1)
Duty-Cycle	Antenna terminal (conducted)	KDB789033 + ANSI C63.10:2013	KDB789033 + ANSI C63.10:2013	No Limit Criteria	--	--	Remark 1)
Transmitter frequency stability	Antenna terminal (conducted)	§ 2.1055 + §15.407(g)	RSS-Gen, Issue 5: Chapter 6.11	Operation within designated operational band	--	--	Remark 1)

Maximum output power	Antenna terminal (conducted)	<p>§15.407(a)</p> <p>(1)(iv) 5.15-5.25 GHz Client devices</p> <p>(2) 5.25-5.35 GHz & 5.47-5.725 GHz</p> <p>(3) 5.725-5.85 GHz</p>	<p>RSS-247, Issue 2 Chapter</p> <p>6.2.1.1</p> <p>6.2.2.1</p> <p>6.2.3.1 6.2.4.1</p>	<p>Power Limits (if Antenna Gain < 6 dBi)</p> <p>250 mW</p> <p>lesser of 250mW or 11dBm+10logB</p> <p>1 W</p>	--	--	Remark 1)
Peak Power Spectral density	Antenna terminal (conducted)	<p>§15.407(a)</p> <p>(1)(iv) 5.15-5.25 GHz Client devices</p> <p>(2) 5.25-5.35 GHz & 5.47-5.725 GHz</p> <p>(3) 5.725-5.85 GHz</p>	<p>RSS-247, Issue 2 Chapter</p> <p>6.2.1.1</p> <p>6.2.2.1</p> <p>6.2.3.1 6.2.4.1</p>	<p>Power Spectral Density Limits (if Antenna Gain < 6 dBi)</p> <p>11dBm/MHz</p> <p>11dBm/MHz</p> <p>30dBm/500kHz</p>	--	--	Remark 1)
Maximum e.i.r.p. power	Antenna terminal (conducted) + Antenna Gain	<p>§15.407(a)</p> <p>(1)(iv) 5.15-5.25 GHz Client devices</p> <p>(2) 5.25-5.35 GHz & 5.47-5.725 GHz</p> <p>(3) 5.725-5.85 GHz</p>	<p>RSS-247, Issue 2 Chapter</p> <p>6.2.1.1</p> <p>6.2.2.1</p> <p>6.2.3.1 6.2.4.1</p>	<p>e.i.r.p. Limits (if Antenna Gain < 6 dBi)</p> <p>250 mW + 6 dBi</p> <p>lesser of 250mW or 11dBm+10logB + 6 dBi</p> <p>1 W + 6 dBi</p>	--	--	Remark 1)
Antenna gain information	Antenna terminal (conducted)	<p>§15.407(a) (1)(2)(3)</p>	<p>RSS-247, Issue 2 chapter 6.2.1.1 6.2.2.1 6.2.3.1 6.2.4.1</p>	<p>< 6dBi or if Antenna directional Gain > 6dBi reduction of Max. power & power spectral density by the amount in dB that the directional gain of the antenna exceeds 6 dBi</p>	--	--	Measured Antenna Gain.

General field strength emissions within restricted bands + Band-Edge compliance radiated	Enclosure + Inter-connecting cables (radiated)	§ 15.407(b) (1)(2)(3)(4)(5)(6) (7)(8) § 15.205 + § 15.209	RSS-Gen., Issue 5 + RSS-247, Issue 2 Chapter 6.2.1.2 , 6.2.2.2 6.2.3.2, + 6.2.4.2 RSS-Gen., Issue 5 + RSS-247, Issue 2 Chapter 6.2.1.2 , 6.2.2.2 6.2.3.2, + 6.2.4.2	5150-5250 MHz 5250-5350 MHz 5470-5725 MHz all emissions outside operating band shall not exceed -27 dBm/MHz e.i.r.p. 5725-5850 MHz Spectrum Mask acc. to (4)(i) Restricted band limits + General field strength limits	--	--	Remark 1)
Transmit power control + Dynamic frequency selection (DFS)	Antenna terminal (conducted)	§ 15.407 (h1)(h2)	RSS-Gen., Issue 5 + RSS-247, Issue 2 Chapter 6.3	Requirements: Client without radar detection	1	1	Pass
Discontinuous transmissions + Device security	FIRMWARE	§ 15.407(c) + § 15.407(i)	RSS-247, Issue 2 Chapter 6.4 a + b + c	No transmissions in case of either absence of information to transmit or operational failure + Protection of firmware by unauthorized parties	--	--	Not tested Applicants declaration of implementation
AC-Power Lines Conducted Emissions	AC-Power lines or Battery Charger	§ 15.207(a)	RSS-Gen, Issue 5: Chapter 8.8 Table 3	AC Power line conducted limits	--	--	Not applicable

Remark 1) Please refer to separate FCC RF Test Report CETECOM_18-1-0248301T06a

RF-Exposure Evaluation (separation distance user to RF-radiating element greater 20cm)							
Test cases	Port	References & Limits			EUT set-up	EUT Op 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	SAR-Limits FCC: 1.1310(b)	--	--	See separate test reports CETECOM_TR 18-1-0248301T09a
				RF-Field Strength Limits: FCC: “general population/uncontrolled” environment Table 1 ISED: Table 4	--	--	

1.2. Attestation:

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

.....
Dipl.-Ing. Ch. Lorenz
Responsible for test section

.....
M.Sc. P. Marzotko
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 Volker Wittmann
Deputy:	Dipl.-Ing. Niels Jeß

2.2. Test location

2.2.1. Test laboratory "CTC"

Company name:	see chapter 2.1. Identification of the testing laboratory
Receipt of EUT:	2019-04-29
Date(s) of test:	2019-04-29 - 2019-08-30

2.3. Organizational items

Responsible for test report:	M.Sc. P. Marzotko
Project leader:	Dipl.-Ing. N. Perez
Receipt of EUT:	2019-06-20
Date(s) of test:	2019-07-30
Date of report:	2019-10-25

Version of template:	13.02

2.4. Applicant's details

Applicant's name:	Robert Bosch Car Multimedia GmbH
Address:	Robert-Bosch-Straße 200 31139 Hildesheim Germany
Contact :	Mr. Dirk Zamow

2.5. Manufacturer's details

Manufacturer's name:	see applicant's details
Address:	see applicant's details

3. Equipment under test (EUT)

3.1. Certification Data of Main EUT declared by Applicant

Model Nr.	AIVIV10		
Type	Multimedia device with Bluetooth and WLAN		
FCC ID	YBN-AIVIV10		
ISED	9595A-AIVIV10		
Type of modulation	See chapter 3.2		
Antenna Type	<input checked="" type="checkbox"/> Integrated <input type="checkbox"/> External, no RF- connector <input type="checkbox"/> External, separate RF-connector		
Antenna Model	PCB Antenna		
Antenna Gain	U-NII-1	2.8 dBi	
	U-NII-2A	3.7 dBi	
	U-NII-2C	-0.8 dBi	
	U-NII-3	0.7 dBi	
Installed options	<input checked="" type="checkbox"/> 802.11 a/n/ac <input checked="" type="checkbox"/> 802.11 b/g/n (not tested within this report) <input checked="" type="checkbox"/> Bluetooth LE (not tested within this report) <input checked="" type="checkbox"/> Bluetooth EDR (not tested within this report)		
Power supply	<input type="checkbox"/> Internal battery Li-Io, range 3.5V to 4.1V <input type="checkbox"/> over AC/DC adapter: 110V/60 Hz <input checked="" type="checkbox"/> Nominal Test Voltage : 13.5 V DC with external power supply		
Special EMI components	--		
EUT sample type	<input type="checkbox"/> Production	<input checked="" type="checkbox"/> Pre-Production	<input type="checkbox"/> Engineering
FCC label attached	<input type="checkbox"/> yes	<input checked="" type="checkbox"/> no	
ISED certification number attached	<input type="checkbox"/> yes	<input checked="" type="checkbox"/> no	

Remark:

3.2. WLAN 5 GHz 802.11a/n Technical Data Of Main EUT as Declared by Applicant

Firmware Version	--
Frequency Channel B.W. (USA bands only)**	U-NII 1: 5150-5250 MHz
	<input checked="" type="checkbox"/> Ch. 36 40 44 48
	<input checked="" type="checkbox"/> Bandwidth 20 MHz
	<input checked="" type="checkbox"/> Ch. 38 46
	<input checked="" type="checkbox"/> Bandwidth 40 MHz
	<input checked="" type="checkbox"/> Ch. 42
	<input checked="" type="checkbox"/> Bandwidth 80 MHz
	U-NII2A: 5250-5350 MHz
	<input checked="" type="checkbox"/> Ch 52 56 60 64
	<input checked="" type="checkbox"/> Bandwidth 20 MHz
	<input checked="" type="checkbox"/> Ch. 54 62
	<input checked="" type="checkbox"/> Bandwidth 40 MHz
	<input checked="" type="checkbox"/> Ch. 58
	<input checked="" type="checkbox"/> Bandwidth 80 MHz
	U-NII 2C: 5470-5725 MHz
	<input checked="" type="checkbox"/> Ch 100 104 108
	<input checked="" type="checkbox"/> Ch 112 116 120
	<input checked="" type="checkbox"/> Ch 124 128 132
	<input checked="" type="checkbox"/> Ch 136 140
	<input checked="" type="checkbox"/> Bandwidth 20 MHz
	<input checked="" type="checkbox"/> Ch. 102 110 118
	<input checked="" type="checkbox"/> Bandwidth 40 MHz
	<input checked="" type="checkbox"/> Ch 126 134
	<input checked="" type="checkbox"/> Bandwidth 80 MHz
	<input checked="" type="checkbox"/> Ch 106 122
	<input checked="" type="checkbox"/> Bandwidth 80 MHz
	U-NII 3: 5725 -5850 MHz
	<input checked="" type="checkbox"/> Ch 149 153 157
	<input checked="" type="checkbox"/> Bandwidth 20 MHz
	<input checked="" type="checkbox"/> Ch 161 165
	<input checked="" type="checkbox"/> Bandwidth 40 MHz
	<input checked="" type="checkbox"/> Ch 151 159
	<input checked="" type="checkbox"/> Bandwidth 40 MHz
	<input checked="" type="checkbox"/> Ch 155
	<input checked="" type="checkbox"/> Bandwidth 80 MHz
Canada Only RSS 247 - Section 6.2.3	*) Until further notice, devices subject to this section shall not be capable of transmitting in the band 5600-5650 MHz.
802.11a – Mode OFDM Modulation Data Rates	<input checked="" type="checkbox"/> BPSK 6 Mbps / 9 Mbps <input checked="" type="checkbox"/> QPSK 12 Mbps / 18 Mbps <input checked="" type="checkbox"/> 16-QAM 24 Mbps / 36 Mbps <input checked="" type="checkbox"/> 64-QAM 48 Mbps / 54 Mbps
802.11n – Mode OFDM Modulation Data Rates	<input checked="" type="checkbox"/> HT20 (MCS0 – MCS7) 7.2/14.4/21.7/28.9/43.3/57.8/65/72.2 Mbps <input checked="" type="checkbox"/> HT40 (MCS0 – MCS7) 15/30/45/60/90/120/135/150 Mbps
802.11ac – Mode OFDM Modulation Data Rates	<input checked="" type="checkbox"/> HT20 (MCS0 – MCS9) 7.2/14.4/21.7/28.9/43.3/57.8/65/72.2 Mbps <input checked="" type="checkbox"/> HT40 (MCS0 – MCS9) 15/30/45/60/90/120/135/150 Mbps <input checked="" type="checkbox"/> HT80 (MCS0 – MCS9) 7.2/14.4/21.7/28.9/43.3/57.8/65/72.2 Mbps
Power Supply	<input checked="" type="checkbox"/> Nominal Test Voltage : 13.5V DC with external power supply
DFS equipment type	<input type="checkbox"/> Master <input type="checkbox"/> Client with DFS-capability <input checked="" type="checkbox"/> Client without DFS-capability
Hot spot capability	<input checked="" type="checkbox"/> Supports Hot-Spots in U-NII-1 and U-NII-3 band <input type="checkbox"/> No support
Description of Medium access protocol	<input checked="" type="checkbox"/> IEEE802.11n (2012) <input checked="" type="checkbox"/> IEEE 802.11ac (2014) <input type="checkbox"/> applicant specific

3.3. 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 S04	AIVIV10	Multimedia device with Bluetooth and WLAN	0005015	001	1049

*) 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 description *)	Auxiliary Equipment	Type	S/N serial number	HW hardware status	SW software status
AE 1	USB-cable (Dongle)	0.38m	S7291GC000379	Version-D1	--
AE 2	Power Supply Cable	--	--	--	--
AE 3	Notebook	Lenovo X200S	LVZT1DG	--	--
AE 4	WLAN Router	Nighthawk ® X4S	5K5188590067B	R7800	V1.0.2.46

*) 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	Description
set. 1	EUT A + AE 1 + AE 2 + AE 3 + AE 4	Conducted measurement 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

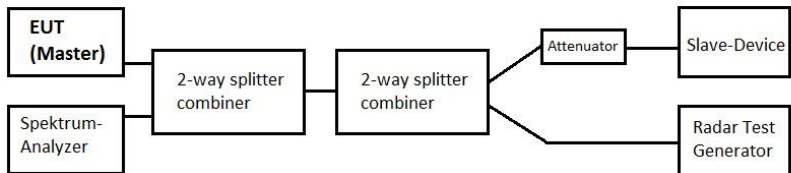
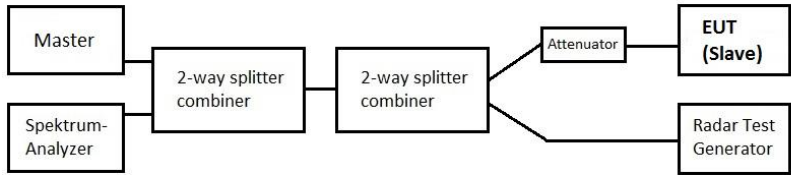
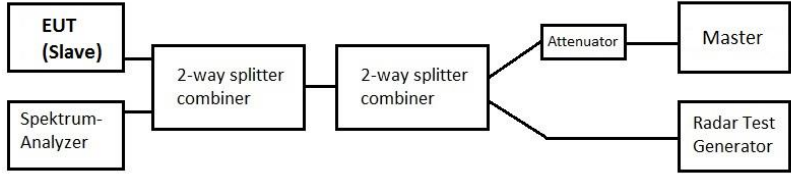
EUT operating mode no. *)	Description of operating modes	Additional information
op. 1	Normal mode	EUT was connected to AE4. Continuous Traffic was generated via iperf on Channel 58 (5290 MHz ; BW 80MHz)

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

*2) Please refer to document “Instructions_RadioTypeApproval_9_6_2017” dated 2017-06-09 for additional information regarding operating mode setup and output power levels.

4. Description of test system set-up's

Three theoretical set-ups for coupling the signals into the EUT are shown below, depending from the intended use of the equipment.

Figure	Set-up Designation
	<p>Set-up A:</p> <p><u>EUT is Master</u> with DFS capability. The test signals are injected into the R-LAN EUT during a communication link connection to a SLAVE device.</p>
	<p>Set-up B:</p> <p><u>EUT is slave</u> with or without DFS capability. The test signals are injected into the MASTER R-LAN device during a communication link connection to the SLAVE device.</p>
	<p>Set-up C:</p> <p><u>EUT is slave</u> with DFS capability. The test signals are injected into the Slave during a communication link connection to a RLAN device working as MASTER.</p>

The Set-up is realized by the OSP-Unit from R&S Testsystem TS8997, RF-Output Port 1 is connected to EUT's DFS Measurement port. Any path losses are calibrated out, so the test signal is on the threshold level as stated by the standard in Table D.2.

The companion device is a Netgear Nighthawk X4S AC2600 Smart WiFi Router, Model R7800 (S/N 5K5188590067B). This is a DFS Master device with **FCC-ID PY315100319**

5. U-NII DFS Rule Requirement

Applicability of DFS requirements prior to use a channel

Requirement	Operation Mode		
	Master	Client without radar detection	Client with radar detection
Non-Occupancy Period	X	X	X
DFS Detection Threshold	X	Not required	X
Channel Availability Check Time	X	Not required	Not required
Uniform Spreading	X	Not required	Not required
U-NII Detection Bandwidth	X	Not required	X

Applicability of DFS requirements during normal operation

Requirement	Operation Mode		
	Master	Client without radar detection	Client with radar detection
DFS Detection Threshold	X	Not required	X
Channel Closing Transmission Time	X	X	X
Channel Move Time	X	X	X
U-NII Detection Bandwidth	X	Not required	X

Additional requirements for devices with multiple bandwidth modes	Master Device or Client with Radar Detection	Client without Radar Detection
U-NII Detection Bandwidth and Statistical Performance Check	All BW modes must be tested	Not required
Channel Move Time and Channel Closing Transmission Time	Test using widest BW available	Test using the widest BW mode available for the link
All other tests	Any single BW mode	Not required
Note: Frequencies selected for statistical performance check should include several frequencies within the radar detection bandwidth and frequencies near the edge of the radar detection bandwidth. For 802.11 devices it is suggested to select frequencies in each of the bonded 20MHz channel and the channel center frequencies.		

6. Measurements

6.1. Dynamic frequency selection (DFS)

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

test location	<input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1)	<input type="checkbox"/> 443 System CTC-FAR-EMI-	<input type="checkbox"/> Please see Chapter. 2.2.3
test site	<input type="checkbox"/> 441 EMI SAR	<input type="checkbox"/> 487 SAR NSA	<input checked="" type="checkbox"/> 347 Radio.lab.
receiver	<input type="checkbox"/> 377 ESCS30	<input type="checkbox"/> 001 ESS	<input type="checkbox"/> 489 ESU 40
spectr. analys.	<input type="checkbox"/> 584 FSU	<input type="checkbox"/> 120 FSEM	<input type="checkbox"/> 264 FSEK
antenna	<input type="checkbox"/> 574 BTA-L	<input type="checkbox"/> 133 EMCO3115	<input type="checkbox"/> 302 BBHA9170
signaling	<input type="checkbox"/> 392 MT8820A	<input checked="" type="checkbox"/> 687 SMF100A	<input type="checkbox"/> 547 CMU
otherwise	<input type="checkbox"/> 266 NRV-Z31	<input type="checkbox"/> 600 NRVD	<input type="checkbox"/> 110 USB LWL
DC power	<input checked="" type="checkbox"/> 671 EA-3013S	<input type="checkbox"/> 463 HP3245A	<input type="checkbox"/> 459 EA 2032-50
otherwise	<input checked="" type="checkbox"/> 341 Fluke 112	<input type="checkbox"/> 248 6 dB Attenuator	<input type="checkbox"/> 529 Power divider
	<input type="checkbox"/> 530 10dB Attenuator	<input type="checkbox"/> K 4 Cable kit	<input checked="" type="checkbox"/> - cable OTA20
Supply voltage	<input checked="" type="checkbox"/> 13.5V DC	<input type="checkbox"/> 060 110 V 60 Hz via PAS 5000	

6.1.2. Reference

FCC	<input checked="" type="checkbox"/> Part 15 Subpart C, §15.407(a)(1)(2)(3)(4)
ISED	<input checked="" type="checkbox"/> RSS-247, Issue 2 <input checked="" type="checkbox"/> RSS-Gen, Issue 5
ANSI	<input checked="" type="checkbox"/> C63.10-2013
KDB Guidance no.	<input checked="" type="checkbox"/> UNII: KDB 789033 D02 v02r01 <input checked="" type="checkbox"/> UNII: KDB 905462 D03 v01r02 <input checked="" type="checkbox"/> UNII: KDB 905462 D04 v01

Guidelines for Compliance Testing
Client Without DFS New Rules
Operational Modes for DFS Testing New Rules

6.1.3. EUT settings:

The EUT was connected to a router. With help of iperf a continuous transmission was set.

6.1.4. Test condition and measurement test set-up

Signal link to test system (if used):	<input type="checkbox"/> air link	<input checked="" 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	<input type="checkbox"/> 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" (W1 Set-up)		

6.1.5. Test Results summary:

Clause	Test Parameter	Remarks	Pass/Fail
15.407 & RSS-247	DFS Detection Threshold	Not applicable	N/A
15.407 & RSS-247	Channel Availability Check Time	Not applicable	N/A
15.407 & RSS-247	Channel Move Time	Applicable	Pass
15.407 & RSS-247	Channel Closing Transmission Time	Applicable	Pass
15.407 & RSS-247	Non-Occupancy Period	Applicable	Pass
15.407 & RSS-247	Uniform Spreading	Not applicable	N/A
15.407 & RSS-247	U-NII Detection Bandwidth	Not applicable	N/A

Remark: Widest supported BW of EUT is 80MHz.

6.2. Parameters of DFS test signals

6.2.1. DFS Detection Threshold for Master Devices as well as Client Devices With Radar Detection

Maximum Transmit Power EIRP	Value (see note)
$\geq 200\text{mW}$	-64 dBm
$< 200\text{mW}$ and power spectral density $< 10\text{dBm/MHz}$	-62 dBm
$< 200\text{mW}$ and that do not meet the power spectral density $< 10\text{dBm/MHz}$	-64 dBm
<p>Note 1: This is the level at the input if the receiver assuming a 0 dBi receive antenna.</p> <p>Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response.</p> <p>Note 3: EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.</p>	

6.2.2. DFS Response Requirement Values

Parameter	Value
Non-occupancy period	Minimum 30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds (see Note 1)
Channel Closing Transmission Time	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 seconds period (See Notes 1 and 2)
U-NII Detection Bandwidth	Minimum 100% of the U-NII 99% transmission power bandwidth (See Note 3)
<p>Note 1: Channel Move Time and the Channel Closing Transmission Time should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst.</p> <p>Note 2: The Channel Closing Time plus any additional intermittent control signals required to facilitate a Channel move (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of the control signals will not count quiet periods in between transmissions.</p> <p>Note 3: During the U-NII Detection Bandwidth detection test, radar type 0 should be used. For each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.</p>	

6.2.3. Radar Test Waveforms

Short Pulse Radar Test Waveforms

Radar Type	Pulse Width (μsec)	PRI (μsec)	Number of Pulses	Minimum Percentage of Successful Detection	Minimum Number of Trials
0	1	1428	18	See Note 1	See Note 1
1	1	Test A: 15 unique PRI values randomly selected from the list of 23 PRI values in Table 5a	Roundup $\left\{ \left(\frac{1}{360} \right) * \left(\frac{19 * 10^6}{PRI_{\mu sec}} \right) \right\}$	60%	30
		Test B: 15 unique PRI values randomly selected within the range of 518-3066 μsec, with a minimum increment of 1 μsec, excluding PRI values selected in Test A			
2	1-5	150-230	23-29	60%	30
3	6-10	200-500	16-18	60%	30
4	11-20	200-500	12-16	60%	30
Aggregate (Radar Types 1-4)				80%	120
Note 1: Short Pulse Radar Type 0 should be used for the detection bandwidth test, channel move time, and channel closing time tests.					

A minimum of 30 unique waveforms are required for each of the Short Pulse Radar Types 2 through 4.

Long Pulse Radar Test Waveforms

Radar Type	Pulse Width (μsec)	Chirp Width (MHz)	PRI (μsec)	Number of Pulses per Burst	Number pf Bursts	Minimum Percentage of Successful Detection	Minimum Number of Trails
5	50-100	5-20	1000 – 2000	1-3	8-20	80%	30

The parameters for this waveform are randomly chosen. Thirty unique waveforms are required for the Long Pulse Radar Type waveforms. If more than 30 waveforms are used for the Long Pulse Type waveforms, the each additional waveform must also be unique and not repeated from the previous waveforms.

Frequency Hopping Radar Test Waveform

Radar Type	Pulse Width (μsec)	Chirp Width (MHz)	PRI (μsec)	Number of Pulses per Burst	Number pf Bursts	Minimum Percentage of Successful Detection	Minimum Number of Trails
6	1	333	9	0.333	300	70%	30

6.3. Test results

DFS In-Service Monitoring (5290 MHz; 11,000 dBm; 80 MHz)

Measurement Summary

DUT Frequency (MHz)	Radar Type No.	Type of Measurement value	Overall Result
5290.000000	0	First of all Transmit Test	---
5290.000000	0	Channel Move Time	PASS
5290.000000	0	Channel Closing Transmission Time	PASS
5290.000000	0	Non-occupancy period	PASS

(continuation of the "Measurement Summary" table from column 4 ...)

DUT Frequency (MHz)	Overall Comment
5290.000000	not performed / not finished
5290.000000	
5290.000000	
5290.000000	

Channel Move Time Detailed Results

DUT Frequency (MHz)	Radar Type No.	CMT Tx Time (s)	CMT Limit (s)	CMT Result
5290.000000	0	0.280	10.000	PASS

(continuation of the "Channel Move Time Detailed Results" table from column 5 ...)

DUT Frequency (MHz)	CMT Comment
5290.000000	Tx Time value is last trailing edge found within sweep. See Note 1.

Channel Closing Transmission Time Detailed Results

DUT Frequency (MHz)	Radar Type No.	CCTT Type of Value	CCTT No. of Pulses found	CCTT Tx Time (ms)
5290.000000	0	first 200 ms	17	0.676
5290.000000	0	remaining 10.0 second(s) period	8	0.316

(continuation of the "Channel Closing Transmission Time Detailed Results" table from column 5 ...)

DUT Frequency (MHz)	CCTT Tx Time Limit (ms)	CCTT Result	CCTT Comment
5290.000000	200.000	PASS	See Note 1.
5290.000000	60.000	PASS	See Note 1.

Non-occupancy period Detailed Results

DUT Frequency (MHz)	Radar Type No.	NOP No. of Pulses found	NOP No. of Pulses Limit	NOP Tx Time (s)	NOP Tx Time Limit (s)
5290.000000	0	0	0	0.000	0.000

(continuation of the "Non-occupancy period Detailed Results" table from column 6 ...)

DUT Frequency (MHz)	NOP Result
5290.000000	PASS

Transmitting Test Detailed Results

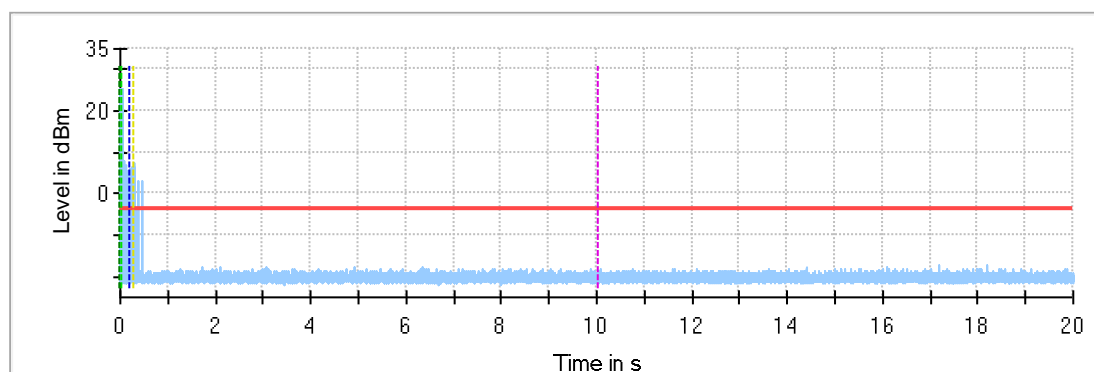
DUT Frequency (MHz)	Tx-Test Result	Tx-Test Comment
5290.000000	---	not performed / not finished

Radar level verification

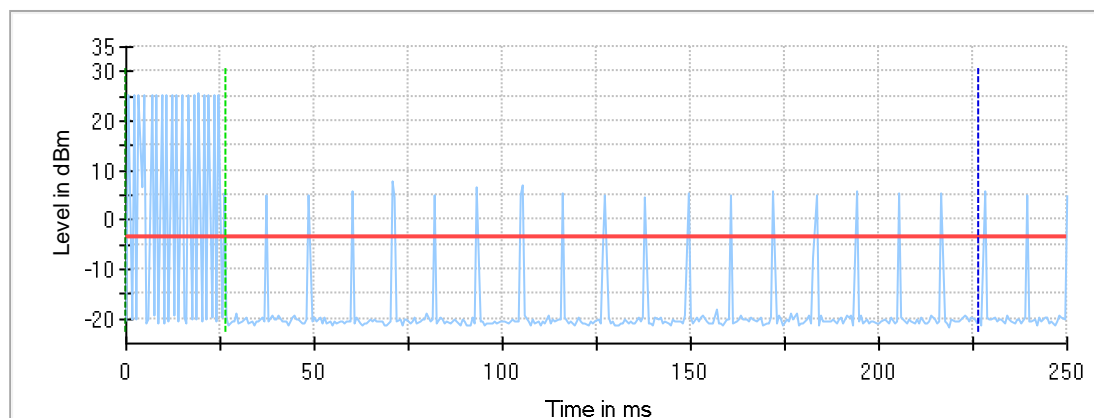
Description	Value	Unit
IF(({DFS Mode(0/1/2)}=0)or({DFS Mode(0/1/2)}=1) , IF((dBm2W({Nominal Power[dBm]}>0.2) , -64 , IF(({Configured PSD[dBm]}<10) , -62 , -64))+ {Attenuation Vector Generator to DUT[dB]} , -50+ {Attenuation Vector Generator to COMP[dB]}))+ {Radar Signal Level Offset[dB]}	Given setting / formula to calculate Vector Generator level	--
Configured DUT EIRP:	12.59	mW
Configured DUT PSD:	-3.00	dBm/MHz
Requirement of the Detection threshold value for this given values acc. to FCC clause 5.2 / Table 3	-62	dBm
Vector Generator level setting	1.60	dBm
Configured overall pathloss from Vector Generator RF out to DUT connector of 'DUT to OSP'-cable	58.03	dB
Given additional level added to the amplitude of the waveform to account for variations in measurement equipment acc. to FCC clause 5.2 / Table 3 / Note 2	1.00	dB
This results in the following radar signal level at the DUT	-56.43	dBm

Additional Information

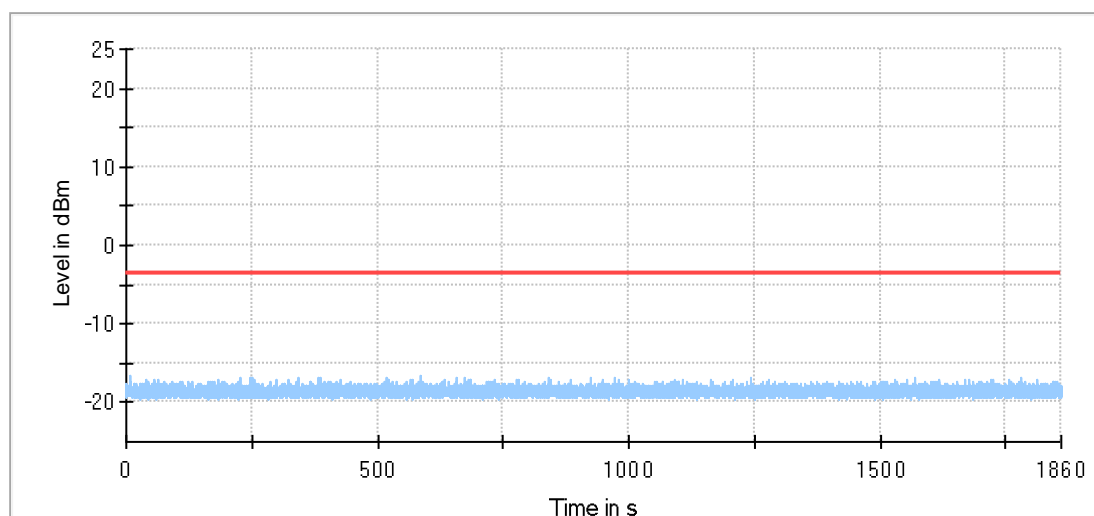
Note	Description
Note 1:	Because of the radar pulse event at the beginning, the investigation of the trace begins with an offset of 26.7 ms conforming to the end of the Radar burst.
Note 2:	Channel move time (CMT) / channel closing transmission time (CCTT) measurement was made with hi resolution video sweep using OSP DAQ channel
Note 3:	Because of the substantially higher sampling rate of the video signal the results for CCTT and CMT are more accurate than in the graphics visible. Reached timing accuracy of the video trace: approx 4 μ s
Note 4:	The Non-Occupancy Period trace starts at the end of the Channel move time trace (20.000 secs.) Labeling of the x-axis (time) is relative to its beginning (0 secs.)



- In-Service Monitoring Channel Move Time
- Threshold
- Start of Radar
- Trigger at end of Radar
- First 200ms of Channel Closing Tx Time
- 10sec Channel Move Time Limit
- Last measured edge of Channel Closing Tx Time



- In-Service Monitoring Channel Move Time first 200ms
- Threshold
- Start of Radar
- Trigger at end of Radar
- First 200ms of Channel Closing Tx Time



- In-Service Monitoring Non-occupancy period
- Threshold

Channel Move Time; Channel Closing Transmission Time

Setting	Instrument Value	Target Value
Center Frequency	5.29000 GHz	5.29000 GHz
Span	ZeroSpan	ZeroSpan
RBW	3.000 MHz	>= 3.000 MHz
VBW	3.000 MHz	>= 3.000 MHz
SweepPoints	30001	~ 30001
SweepTime	20.000 s	20.000 s
Reference Level	5.000 dBm	AUTO
Attenuation	0.000 dB	0.000 dB
Detector	MaxPeak	MaxPeak
SweepCount	1	1
Filter	3 dB	3 dB
Trace Mode	Clear Write	Clear Write
SweepType	Sweep	AUTO
Preamp	off	off
Trigger	External	External
Trigger Offset	0.000 s	0.000 s

Non-occupancy period

Setting	Instrument Value	Target Value
Center Frequency	5.29000 GHz	5.29000 GHz
Span	ZeroSpan	ZeroSpan
RBW	3.000 MHz	>= 3.000 MHz
VBW	3.000 MHz	>= 3.000 MHz
SweepPoints	30001	~ 30001
SweepTime	1.860 ks	1.860 ks
Reference Level	5.000 dBm	AUTO
Attenuation	0.000 dB	0.000 dB
Detector	MaxPeak	MaxPeak
SweepCount	1	1
Filter	3 dB	3 dB
Trace Mode	Clear Write	Clear Write
SweepType	Sweep	AUTO
Preamp	off	off

OSP Video Detector

Setting	Instrument Value	Target Value
Measurement Time	20.000 s	20.000 s
Samplerate	2500 kHz	2500 kHz
Tracepoints	50000000	50000000
Time resolution	4.000 µs	4.000 µs
Detector	Peak	Peak

6.4. Measurement uncertainties

The reported uncertainties are calculated based on the standard uncertainty multiplied with the appropriate coverage factor **k**, such that a confidence level of approximately 95% is achieved.

For uncertainty determination, each component used in the concrete measurement set-up was taken in account and 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	5.0 dB							Magnetic field E-field Substitution
		30 MHz - 1 GHz	4.2 dB							
		1 GHz - 20 GHz	3.17 dB							

Table: measurement uncertainties, valid for conducted/radiated measurements

7. Abbreviations used in this report

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

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

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

9. Instruments and Ancillary

9.1. Used equipment “CTC”

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

9.1.1. Test software and firmware of equipment

Ref.-No.	Equipment	Type	Serial-No.	Version of Firmware or Software during the test
012	Signal Generator (EMS-cond.)	SMY 01	839069/027	Firm.= V 2.02
013	Power Meter (EMS cond.)	NRVD	839111/003	Firm.= V 1.51
017	Digital Radiocommunication Tester	CMD 60 M	844365/014	Firmware = V 3.52 .22.01.99, DECT = D2.87 13.01.99
119	RT Harmonics Analyzer dig. Flickermeter	B10	G60547	Firm.= V 3.1DHG
261	Thermal Power Sensor	NRV-Z55	825083/0008	EPROM-Datum 02.12.04, SE EE 1 B
262	Power Meter	NRV-S	825770/0010	Firm.= 2.6
295	Racal Digital Radio Test Set	6103	1572	UNIT Firmware= 4.04, SW-Main=4.04, SW-BBP=1.04, SW-DSP=1.02, Hardboot=1.02, Softboot=2.02
298	Univ. Radio Communication Tester	CMU 200	832221/091	R&S Test Firmware =3.53 /3.54 (current Testsoftw. f. all band used
323	Digital Radiocommunication Tester	CMD 55	825878/0034	Firm.= 3.52 .22.01.99
335	CTC-EMS-Conducted	System EMS Conducted	-	EMC 32 V 8.52
340	Digital Radiocommunication Tester	CMD 55	849709/037	Firm.= 3.52 .22.01.99
366	Ultra Compact Simulator	UCS 500 M4	V0531100594	Firm. UCS 500=001925/3.06a02, rc=ISMIEC 4.10
371	Bluetooth Tester	CBT32	100153	CBT V5.30+ SW-Option K55, K57
377	EMI Test Receiver	ESCS 30	100160	Firm.= 2.30, OTP= 02.01, GRA= 02.36
378	Broadband RF Field Monitor	RadiSense III	03D00013SNO-08	Firm.= V.03D13
389	Digital Multimeter	Keithley 2000	0583926	Firm. = A13 (Mainboard) A02 (Display)
392	Radio Communication Tester	MT8820A	6K00000788	Firm.= 4.50 #005, IPL=4.01#001, OS=4.02#001, GSM=4.41#013, W-CDMA= 4.54#004, scenario=
436	Univ. Radio Communication Tester	CMU 200	103083	R&S Test Firmware Base=5.14, Mess-Software= GSM:5.14 WCDMA:5.14 (current Testsoftw. F. all band
441	CTC-SAR-EMI Cable Loss	System EMI field (SAR)	-	EMC 32 Version 8.52
442	CTC-SAR-EMS	System EMS field (SAR)	-	EMC 32 Version 8.40
443	CTC-FAR-EMI-RSE	System CTC-FAR-EMI-RSE	-	Spuri 7.2.5 or EMC 32 Ver. 9.15.00
444	CTC-FAR-EMS field	System-EMS-Field (FAR)	-	EMC 32 Version 9.15.00
460	Univ. Radio Communication Tester	CMU 200	108901	R&S Test Firmware Base=5.14, GSM=5.14 WCDMA=5.14 (current Testsoftw..f. all band to be used,
489	EMI Test Receiver	ESU40	1000-30	Firmware=4.43 SP3, Bios=V5.1-16-3, Spec. =01.00
491	ESD Simulator dito	ESD dito	dito307022	V 2.30
524	Voltage Drop Simulator	VDS 200	0196-16	Software Nr: 000037 Version V4.20a01
526	Burst Generator	EFT 200 A	0496-06	Software Nr. 000034 Version V2.32
527	Micro Pulse Generator	MPG 200 B	0496-05	Software-Nr. 000030 Version V2.43
528	Load Dump Simulator	LD 200B	0496-06	Software-Nr. 000031 Version V2.35a01
546	Univ. Radio Communication Tester	CMU 200	106436	R&S Test Firmware Base=5.14, GSM=5.14 WCDMA=5.14 (current Testsoftw..f. all band to be used
547	Univ. Radio Communication Tester	CMU 200	835390/014	R&S Test Firmware Base=V5.1403 (current Testsoftw., f. all band used, GSM = 5.14 WCDMA: = 5.14
584	Spectrum Analyzer	FSU 8	100248	2.82_SP3
597	Univ. Radio Communication Tester	CMU 200	100347	R&S Test Firmware Base=5.01, GSM=5.02 WCDMA= not installed, Mainboard= µP1=V.850
607	Signal Generator	SMR 20	832033/011	V1.25
620	EMI Test Receiver	ESU 26	100362	4.43_SP3
642	Wideband Radio Communication Tester	CMW 500	126089	Setup V03.26, Test programm component V03.02.20
670	Univ. Radio Communication Tester	CMU 200	106833	µP1 =V8.50, Firmware = V.20
689	Vector Signal Generator	SMU200	100970	02.20.360.142
692	Bluetooth Tester	CBT 32	100236	CBT V 5.40, FW: V.2.41 (FPGA Digital, V. 3.09 FPGA RF)
693	Test System	TS8997	--	SW: EMC32/WMS32 version 10.50.00 HW: _OSP120 Base unit (S/N=106833) ; FSU26 (Ref. Nr. 683) ; SMU 200 (Ref. Nr. 689) ; SMF 100A (Ref. Nr. 687)
699	Audio Analyzer	UPL16	833494/005	3.06

9.1.2. Single instruments and test systems

Ref.-No.	Equipment	Type	Serial-No.	Manufacturer	Interval of calibration	Remark	Cal due
005	AC - LISN (50 Ohm/50µH, test site 1)	ESH2-Z5	861741/005	Rohde & Schwarz	12 M	-	23.05.2020
007	Single-Line V-Network (50 Ohm/5µH)	ESH3-Z6	892563/002	Rohde & Schwarz	12 M	-	23.05.2020
009	Power Meter (EMS-radiated)	NRV	863056/017	Rohde & Schwarz	24 M	-	23.05.2021
016	Line Impedance Simulating Network	Op. 24-D	B6366	Spitzenberger+Spies	36 M	-	22.05.2022
020	Horn Antenna 18 GHz (Subst 1)	3115	9107-3699	EMCO	36/12 M	-	31.07.2021
021	Loop Antenna (H-Field)	6502	9206-2770	EMCO	36 M	-	30.05.2021
033	RF-current probe (100kHz-30MHz)	ESH2-Z1	879581/18	Rohde & Schwarz	24 M	-	23.05.2021
057	relay-switch-unit (EMS system)	RSU	494440/002	Rohde & Schwarz	pre-m	1a	
060	power amplifier (DC-2kHz)	PAS 5000	B6363	Spitzenberger+Spies	-	3	
066	notch filter (WCDMA; FDD1)	WRCT 1900/2200-5/40-10EEK	5	Wainwright GmbH	12 M	1g	16.11.2019
086	DC - power supply, 0 -10 A	LNG 50-10	-	Heinzinger Electronic	pre-m	2	
087	DC - power supply, 0 -5 A	EA-3013 S	-	Elektro Automatik	pre-m	2	
091	USB-LWL-Converter	OLS-1	007/2006	Ing. Büro Scheiba	-	4	
099	passive voltage probe	ESH2-Z3	299.7810.52	Rohde & Schwarz	36 M	-	30.05.2021
100	passive voltage probe	Probe TK 9416	without	Schwarzbeck	36 M	-	30.05.2021
110	USB-LWL-Converter	OLS-1	-	Ing. Büro Scheiba	-	4	
119	RT Harmonics Analyzer dig. Flickermeter	B10	G60547	BOCONSULT	36 M	-	22.05.2022
133	horn antenna 18 GHz (Meas 1)	3115	9012-3629	EMCO	36 M	1c	10.03.2020
134	horn antenna 18 GHz (Subst 2)	3115	9005-3414	EMCO	36 M	-	10.03.2020
248	attenuator	SMA 6dB 2W	-	Radiall	pre-m	2	
249	attenuator	SMA 10dB 10W	-	Radiall	pre-m	2	
252	attenuator	N 6dB 12W	-	Radiall	pre-m	2	
256	attenuator	SMA 3dB 2W	-	Radiall	pre-m	2	
257	hybrid	4031C	04491	Narda	pre-m	2	
260	hybrid coupler	4032C	11342	Narda	pre-m	2	
261	Thermal Power Sensor	NRV-Z55	825083/0008	Rohde & Schwarz	24 M	-	30.05.2020
262	Power Meter	NRV-S	825770/0010	Rohde & Schwarz	24 M	-	30.05.2020
265	peak power sensor	NRV-Z33, Model 04	840414/009	Rohde & Schwarz	24 M	-	30.05.2020
266	Peak Power Sensor	NRV-Z31, Model 04	843383/016	Rohde & Schwarz	24 M	-	30.05.2020
267	notch filter GSM 850	WRCA 800/960-6EEK	9	Wainwright GmbH	pre-m	2	
270	termination	1418 N	BB6935	Weinschel	pre-m	2	
271	termination	1418 N	BE6384	Weinschel	pre-m	2	
272	attenuator (20 dB) 50 W	Model 47	BF6239	Weinschel	pre-m	2	
273	attenuator (10 dB) 100 W	Model 48	BF9229	Weinschel	pre-m	2	
274	attenuator (10 dB) 50 W	Model 47 (10 dB) 50 W	BG0321	Weinschel	pre-m	2	
275	DC-Block	Model 7003 (N)	C5129	Weinschel	pre-m	2	
276	DC-Block	Model 7006 (SMA)	C7061	Weinschel	pre-m	2	
279	power divider	1515 (SMA)	LH855	Weinschel	pre-m	2	
287	pre-amplifier 25MHz - 4GHz	AMF-2D-100M4G-35-10P	379418	Miteq	12 M	1c	16.11.2019
291	high pass filter GSM 850/900	WHJ 2200-4EE	14	Wainwright GmbH	12 M	1c	16.11.2019
298	Univ. Radio Communication Tester	CMU 200	832221/091	Rohde & Schwarz	pre-m	3	
300	AC LISN (50 Ohm/50µH, 1-phase)	ESH3-Z5	892 239/020	Rohde & Schwarz	12 M	-	22.05.2020
301	attenuator (20 dB) 50W, 18GHz	47-20-33	AW0272	Lucas Weinschel	pre-m	2	
302	horn antenna 40 GHz (Meas 1)	BBHA9170	155	Schwarzbeck	36 M	-	14.03.2020
303	horn antenna 40 GHz (Subst 1)	BBHA9170	156	Schwarzbeck	36 M	-	20.03.2020
331	Climatic Test Chamber -40/+180 Grad	HC 4055	43146	Heraeus Vötsch	24 M	-	10.01.2021
341	Digital Multimeter	Fluke 112	81650455	Fluke	24 M	-	30.05.2020
342	Digital Multimeter	Voltcraft M-4660A	IB 255466	Voltcraft	24 M	-	23.05.2021
347	laboratory site	radio lab.	-	-	-	5	
348	laboratory site	EMI conducted	-	-	-	5	
354	DC - Power Supply 40A	NGPE 40/40	448	Rohde & Schwarz	pre-m	2	
357	power sensor	NRV-Z1	861761/002	Rohde & Schwarz	24 M	-	21.05.2021
373	Single-Line V-Network (50 Ohm/5µH)	ESH3-Z6	100535	Rohde & Schwarz	12 M	-	22.05.2020
377	EMI Test Receiver	ESCS 30	100160	Rohde & Schwarz	12 M	-	22.05.2020
389	Digital Multimeter	Keithley 2000	0583926	Keithley	pre-m	-	
392	Radio Communication Tester	MT8820A	6K00000788	Anritsu	12 M	-	01.07.2020
396	Thermo/Hygrometer	Thermo/Hygrometer	-	Conrad	24 M	-	09.01.2021
431	Model 7405	Near-Field Probe Set	9305-2457	EMCO	-	4	
436	Univ. Radio Communication Tester	CMU 200	103083	Rohde & Schwarz	12 M	-	25.05.2020
439	UltraLog-Antenna	HL 562	100248	Rohde & Schwarz	36 M	-	10.03.2020
443	CTC-FAR-EMI-RSE	System CTC-FAR-EMI-RSE	-	ETS-Lindgren / CETECOM	12 M	5	16.11.2019
448	notch filter WCDMA_FDD II	WRCT 1850.0/2170.0-5/40-10SSK	5	Wainwright Instruments GmbH	12 M	1c	16.11.2019
449	notch filter WCDMA FDD V	WRCT 824.0/894.0-5/40-8SSK	1	Wainwright	12 M	1c	16.11.2019
454	Oscilloscope	HM 205-3	9210 P 29661	Hameg	-	4	

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	-	30.05.2020
463	Universal source	HP3245A	2831A03472	Agilent	-	4	
466	Digital Multimeter	Fluke 112	89210157	Fluke USA	24 M	-	30.05.2020
467	Digital Multimeter	Fluke 112	89680306	Fluke USA	36 M	-	30.05.2021
468	Digital Multimeter	Fluke 112	90090455	Fluke USA	36 M	-	30.04.2021
477	ReRadiating GPS-System	AS-47	-	Automotive Cons. Fink	-	3	
480	power meter (Fula)	NRVS	838392/031	Rohde & Schwarz	24 M	-	30.05.2021
482	filter matrix	Filter matrix SAR 1	-	CETECOM (Brl)	-	1d	
484	pre-amplifier 2,5 - 18 GHz	AMF-5D-02501800-25-10P	1244554	Miteq	12 M	-	16.11.2019
487	System CTC NSA-Verification SAR-EMI	System EMI field (SAR) NSA	-	ETS Lindgren / CETECOM	24 M	-	16.04.2021
489	EMI Test Receiver	ESU40	1000-30	Rohde & Schwarz	12 M	-	30.06.2020
502	band reject filter	WRCG 1709/1786-1699/1796-	SN 9	Wainwright	pre-m	2	
503	band reject filter	WRCG 824/849-814/859-60/10SS	SN 5	Wainwright	pre-m	2	
512	notch filter GSM 850	WRCA 800/960-02/40-6EEK	SN 24	Wainwright	12 M	1c	16.11.2019
517	relais switch matrix	HF Relais Box Keithley System	SE 04	Keithley	pre-m	2	
523	Digital Multimeter	L4411A	MY46000154	Agilent	24 M	-	23.05.2021
529	6 dB Broadband resistive power divider	Model 1515	LH 855	Weinschel	pre-m	2	
530	10 dB Broadband resistive power divider	R 416110000	LOT 9828	-	pre-m	2	
549	Log.Per-Antenna	HL025	1000060	Rohde & Schwarz	36/12 M	-	31.07.2021
552	high pass filter 2,8-18GHz	WHKX 2.8/18G-10SS	4	Wainwright	12 M	1c	16.11.2019
557	System CTC-OTA-2	R&S TS8991	-	Rohde & Schwarz	12 M	5	24.01.2020
574	Biconilog Hybrid Antenna	BTA-L	980026L	Frankonia	36/12 M	-	03.05.2022
584	Spectrum Analyzer	FSU 8	100248	Rohde & Schwarz	pre-m	-	
594	Wideband Radio Communication Tester	CMW 500	101757	Rohde & Schwarz	12 M	-	26.06.2020
597	Univ. Radio Communication Tester	CMU 200	100347	Rohde & Schwarz	pre-m	-	
600	power meter	NRVD (Reserve)	834501/018	Rohde & Schwarz	24 M	-	30.05.2021
602	peak power sensor	NRV-Z32 (Reserve)	835080	Rohde & Schwarz	24 M	-	
611	DC power supply	E3632A	KR 75305854	Agilent	pre-m	2	
612	DC power supply	E3632A	MY 40001321	Agilent	pre-m	2	
613	Attenuator	R416120000 20dB 10W	Lot. 9828	Radiall	pre-m	2	
616	Digitalmultimeter	Fluke 177	88900339	Fluke	24 M	-	30.05.2020
617	Power Splitter/Combiner	ZFSC-2-2-S+	S F987001108	Mini Circuits	-	2	
618	Power Splitter/Combiner	50PD-634	600994	JFW Industries USA	-	2	
619	Power Splitter/Combiner	50PD-634	600995	JFW Industries, USA	-	3	
620	EMI Test Receiver	ESU 26	100362	Rohde-Schwarz	12 M	-	30.05.2020
621	Step Attenuator 0-139 dB	RSP	100017	Rohde & Schwarz	pre-m	2	
625	Generic Test Load USB	Generic Test Load USB	-	CETECOM	-	2	
634	Spectrum Analyzer	FSM (HF-Unit)	826188/010	Rohde & Schwarz	pre-m	2	
637	High Speed HDMI with Ethernet 1m	HDMI cable with Ethernet 1m	-	KogiLink	-	2	
638	HDMI Kabel with Ethernet 1,5 m flach	HDMI cable with Ethernet 1,5m	-	Reichelt	-	2	
640	HDMI cable 2m rund	HDMI cable 2m rund	-	Reichelt	-	2	
641	HDMI cable with Ethernet	Certified HDMI cable with	-	PureLink	-	2	
644	Amplifierer	ZX60-2534M+	SN865701299	Mini-Circuits	-	-	
670	Univ. Radio Communication Tester	CMU 200	106833	Rohde & Schwarz	24 M	-	30.05.2020
671	DC-power supply 0-5 A	EA-3013S	-	Elektro Automatik	pre-m	2	
678	Power Meter	NRP	101638	Rohde&Schwarz	pre-m	-	
683	Spectrum Analyzer	FSU 26	200571	Rohde & Schwarz	12 M	-	30.05.2020
687	Signal Generator	SMF 100A	102073	Rohde&Schwarz	12 M	-	30.05.2020
688	Pre Amp	JS-18004000-40-8P	1750117	Miteq	pre-m	-	
690	Spectrum Analyzer	FSU	100302/026	Rohde&Schwarz	24 M	-	30.05.2021
691	OSP120 Base Unit	OSP120	106833	Rohde & Schwarz	12 M	-	30.05.2020
692	Bluetooth Tester	CBT 32	100236	Rohde & Schwarz	36 M	-	29.05.2020
693	TS8997	CTC-Radio Lab 1_TS8997	-	Rohde&Schwarz	12 M	5	07.01.2020
697	Power Splitter	ZN4PD-642W-S+	165001445	Mini-Circuits	-	2	
701	CMW500 wide. Radio Comm.	CMW500	158150	Rohde & Schwarz	24 M	-	30.07.2020
703	INNCO Antennen Mast	MA 4010-KT080-XPET-ZSS3	MA4170-KT100-XPET-ZSS3	INNCO	pre-m	-	
704	INNCON Controller	CO 3000-4port	CO3000/933/384105 16/L	INNCO Systems GmBh	pre-m	-	

Ref.-No.	Equipment	Type	Serial-No.	Manufacturer	Interval of Calibration	Remark	Cal due
711	Harmonic Mixer 90 GHz - 140GHz	RPG FS-Z140	101004	RPG	36 M	-	22.02.2020
712	Harmonic Mixer 75 GHz - 110GHz	FS-Z110	101468	Rohde & Schwarz	36 M	-	22.02.2020
713	Harmonic Mixer, 50 GHz - 75GHz	FS-Z75	101022	Rohde & Schwarz	24 M	-	05.07.2021
714	Signal Analyzer 67GHz	FSW67	104023	Rohde & Schwarz	24 M	-	04.07.2021
715	Harmonic Mixer, 140 GHz - 220GHz	FS-Z220	101009	RPG Radiometer Physics	36 M	-	03.08.2020
716	Harmonic Mixer 220 GHz to 325 GHz	FS-Z325	101005	RPG Radiometer Physics	36 M	-	13.02.2020
747	Spectrum Analyzer	FSU 26	200152	Rohde & Schwarz	12 M	-	30.05.2020
748	Pickett-Potter Horn Antenna	FH-PP 4060	010001	Radiometer Physics	36 M	-	
750	Pickett-Potter Horn Antenna	FH-PP 220	010011	Radiometer Physics	36 M	-	
751	Digital Optical System	optoCAN-FD Transceiver	17-010416	mk-messtechnik GmbH	-	-	
752	Digital Optical System	optoCAN-FD Transceiver	17-010083	mk-messtechnik GmbH	-	-	
753	Digital Optical System	optoCAN-FD Transceiver	17-010084	mk-messtechnik GmbH	-	-	
754	Digital Optical System	optoCAN-FD Transceiver	17-010415	mk-messtechnik GmbH	-	-	
755	Digital Optical System	optoLAN-100-MAX Transceiver	17-010795	mk-messtechnik GmbH	-	-	
757	WIDEBAND RADIO COMMUNICATION	CMW500	163673	Rohde&Schwarz	12 M	-	30.05.2020
781	Power Supply	PS 2042-10 B	2815450369	Elektro-Automatik GmbH & Co.KG	-	-	
782	Power Supply	PS 2042-10 B	2815450348	Elektro-Automatik GmbH & Co.KG	-	-	
783	Spectrum Analyzer	FSU 26	100414	Rohde & Schwarz	12 M	-	30.05.2020
784	Power Supply	NGSM 32/10	00196	Rohde & Schwarz	12 M	-	
785	RSP	RF Step Attenuator 0...139.9dB	860712/012	Rohde & Schwarz	12 M	-	
786	SAR Probe	ES3DV3	3340	Speag	36 M	-	14.02.2021
787	OSP	OSP B157WX	101264	Rohde & Schwarz	24 M	-	30.05.2020
788	Precision Omnidirectional Dipole	POD 618	6182558/Q	Seibersdorf Laboratories	36 M	-	30.06.2021
789	Precision Omnidirectional Dipole	POD 16	162496/Q	Seibersdorf Laboratories	36 M	-	30.06.2021
790	Horn Antenna	ASY-SGH-124-SMA	29F14182337	Antenna System Solutions	36 M	-	08.10.2021
791	Pickett-Potter Horn Antenna	FH-PP-325	10024	Radiometer Physics	36 M	-	
792	Pickett-Potter Horn Antenna	FH-PP 075	10006	Radiometer Physics	36 M	-	
793	Pickett-Potter Horn Antenna	FH-PP 140	10008	Radiometer Physics	36 M	-	
794	Pickett-Potter Horn Antenna	FH-PP 110	10014	Radiometer Physics	36 M	-	
795	SGH Antenna	SGH-26-WR10	1144	Antenal S.L.	36 M	-	
798	WR-22 Rectangular Gain Horn	SAR-2309-22-S2	13254-01	SAGE Millimeter, Inc.	36 M	-	
799	Transceiver	optoLAN-Gb	18-014746	mk messtechnik	pre-m	-	
801	Spectrum Analyzer	FSP 13	100960	Rohde & Schwarz	24 M	-	14.01.2021
802	Exposure Level Tester	ELT-400	O-0026	NARDA Safety Solutions	24 M	-	30.01.2021
803	Probe	ELT probe 3cm²	O-0026	Narda Safety Test Solution	24 M	-	30.01.2021
805	Thermo-Hygrometer	Web-Thermo-Hygrometer	02749814	W&T	24 M	-	
806	AC2600 Smart Wifi Router	Netgear Nighthawk x4S	5K5188590067B	Netgear	-	-	
807	Direct Coupler	Direct Coupler C-05020-10	511	ET Industries	-	-	
808	Diode Power Sensor	NRV-Z1	829894/001	Rohde & Schwarz	24 M	-	24.05.2021
809	Standard gain Horn Antenna	WR-159 Horn Antenna	-	Pasternack Enterprises Inc.	-	-	

9.2. 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

10. Versions of test reports (change history)

Version	Applied changes	Date of release
--	Initial release	2019-10-25

END OF TEST REPORT