T E S T R E P O R T
No.: 16-1-0190801T03a

According to:

FCC Regulations
Part 15.205, Part 15.209, Part 15.247

ISED-Regulations
RSS-Gen, Issue 4, RSS-247, Issue 2

for

Intel Corporation

RCM24G Radio Control Module 2.4 GHz
+
PRESTTA Antenna + Intel FA5 Antenna Ports 1 & 5

FCC-ID: 2AJ2A-RCM24G
IC: 1000B-RCM24G
PMN:RCM24G
HVIN:D
FVIN: RCM24G_12017USCN

Laboratory Accreditation and Listings			
DAkkS Deutsche Akkreditierungsstelle D-PL-12047-01-01	MRA US-EU 0003	Industry Canada Reg. No.: 3462D-1 Reg. No.: 3462D-2 Reg. No.: 3462D-3	Voluntary Controls for Electromagnetic Emissions Reg. No.: R-2666 C-2914, T-1967, G-301
Wi Fi ALLIANCE AUTHORIZED RF LABORATORY	ctia Authorized™ Test Lab Lab Code: 20011130-00		
accredited according to DIN EN ISO/IEC 17025			

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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.

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 FCC: §2.927 to §2.948 & ISED: RSP-100, Issue 11, 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) integrates a Proprietary 2.4 GHz RF Transceiver (Hopping Mode).

Following test cases have been performed to show compliance with valid Part 15.205/15.209/15.247 of the FCC CFR Title 47 Rules, Edition 4th November 2016 & ISED RSS-247 Issue 2/ RSS-Gen Issue 4 standards.

1.1. Tests overview of US (FCC) and Canada ISED(RSS) Standards

Test cases	Port	References and Limits			EUT set-up	EUT op. mode	Result
		FCC Standard	RSS Section	Test limit			
TX-Mode							
20 dB bandwidth	Antenna terminal (conducted)	§15.247 (a)(1)	RSS-247, Issue 2: Chapter 5.1 a (1)	At least 25 kHz or 2/3 of 20 dB bandwith	4	1	Pass
Channel carrier frequency separation			RSS-247, Issue 2: Chapter 5.1 b		4	2	
99% occupied bandwidth	Antenna terminal (conducted)	2.1049(h)	RSS-Gen, Issue 4: Chapter 6.6	99% Power bandwidth	4	1	Tested for Information
Number of Hopping Channels	Antenna terminal (conducted)	§15.247 (a)(1) (iii)	RSS-247, Issue 2: Chapter 5.1 d	At least 15 Hopping Channels	4	2	Pass
Channel average Occupancy time and number of channels	Antenna terminal (conducted)	§15.247 (a)(1) (iii)	RSS-247, Issue 2: Chapter 5.1 d	0.4 seconds	4	2	Pass
Transmitter Peak output power	Antenna terminal (conducted)	§15.247 (b)(1)	RSS-247, Issue 2: Chapter 5.1 b	< 125 mW	4	1	Pass
Transmitter frequency stability	Antenna terminal (conducted)	--	RSS-Gen, Chapter 4.7	Operation within designated operational band	--	--	Not tested
Transmitter Peak output power radiated	Enclosure (radiated)	§15.247 (b)(4)	RSS-247, Issue 2: 5.1 (2)	< 125 mW (EIRP) for antenna with directional gain less 6 dBi	--	--	Pass
Out-Of-Band RF- emissions	Antenna terminal (conducted)	§15.247 (d)	RSS-247, Issue 2, Chapter 5.5	20 dBc Conducted Emissions in restricted bands	4	1 + 2	Pass
Band-Edge emissions	Enclosure (radiated)	§15.247 (d)	RSS-247, Issue 2, Chapter 5.5 RSS-Gen: Issue 4: §8.9 Table 4+5+6	Emissions in restricted bands must meet the general field strength radiated limits	1 + 2 + 3	1 + 2	Pass

General field strength emissions + restricted bands	Enclosure + Interconnecting cables (radiated)	§15.247 (d) §15.205 §15.209	RSS-247, Issue 2, Chapter 5.5 RSS-Gen: Issue 4: §8.9 Table 4+5+6	Emissions in restricted bands must meet the general field-strength radiated limits	1 + 2 + 3	1	Pass
AC-Power Lines Conducted Emissions	AC-Power lines	§15.207	RSS-Gen, Issue 4: Chapter 8.8 Table 3	FCC §15.107 class B limits §15.207 limits ISED: Table 3, Chapter 8.8	--	--	N/A *(Remark 1)
RX Mode							
RECEIVER Radiated emissions	Enclosure+ Inter-connecting cables (radiated)	§15.109 §15.33 §15.35	RSS-Gen, Issue 4: Chapter 7.1	FCC 15.109 class B limits ISED-limits: Table 2, Chapter 7.1.2	--	--	No tested within this test report*

Remark 1) : Not applicable as EUT employ only battery power for operations & which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines.

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)	§2.1091 §2.1093	RSS-102 Issue 5	**RF-Field Strength Limits:** **FCC:** "general population/ uncontrolled" environment Table 1	1 + 2 + 3	1 + 2	See separate test report CETECOM_1-16-10188601T05a

Digital unterschrieben von Ajit Phadtare
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Datum: 2017.04.24 15:55:05 +02'00'

Dipl.-Ing. Rachid Acharkaoui
Responsible for test section

M.Sc. Ajit Phadtare
Responsible for test report

2. Administrative Data

2.1. Identification of the testing laboratory

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

2.2. Test location

2.2.1. Test laboratory "CTC"

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

2.3. Organizational items

Responsible for test report and Project leader:	M.Sc. Ajit Phadtare
Receipt of EUT:	2017-01-12
Date(s) of test:	2017-02-01 o 2017-03-17
Date of report:	2017-04-11
Version of template: 13.02	

2.4. Applicant's details

Applicant's name:	Intel Corporation
Address:	2200 Mission College Boulevard Santa Clara, CA 95054 USA
Contact:	+1 408-765-8080

2.5. Manufacturer's details

Manufacturer's name:	Intel Deutschland GmbH
Address:	Konrad-Zuse-Bogen 4, 82152 Krailling, GERMANY

3. Equipment under test (EUT)

3.1. Certification data of main EUT declared by applicant

Module	**RCM24G**
Module Type	**RCM24G (Radio Control Module 2.4 GHz)**
Antenna 1	**PRESTTA Antenna** (for further details refer Chapter 3.2)
Antenna 2	**Intel FA5 Antenna Port 1** (for further details refer Chapter 3.3)
Antenna 3	**Intel FA5 Antenna Port 5** (for further details refer Chapter 3.4)
FCC Certification	
FCC ID	**2AJ2A-RCM24G**
FCC Filing Type:	**Original Modular Certification**
IC Certification	
IC	**1000B-RCM24G**
ISED	**1000B**
PMN	**RCM24G**
UPN	**RCM24G**
HVIN	**D**
FVIN	**RCM24G_12017USCN**
Canada Representative	**Intel Canada Ltd. ISED Company Number: 1000T 200 Ronson Drive, Ste 401, Toronto, Ontario, Canada, M9W 5Z9**
Contact Name	**Elaine Mah**
Email	**Elaine.mah@intel.com**
Telephone No	**+1 647-259-0114**
FAX	**+1 647-259-0195**

3.2. Technical data of RCM24G + PRESTTA Antenna declared by applicant

Module	**RCM24G**			
Module Type	**RCM24G (Radio Control Module 2.4 GHz)**			
Main Function	Proprietary 2.4 GHz RF Transceiver (Hopping Mode)			
Frequency Band	2.4 GHz ISM Band (2400-2483.5 MHz)			
Frequency Channels (Range)	**Channel 0: 2402.5 MHz to Channel 69: 2471.5 MHz**			
Number of Channels	**70 Frequency Hopping Channels**			
Channel Bandwidth	1 MHz			
Channels Power Settings	According to Applicant's declaration (Max. Typical Power Values)			
	Channel Range	**Channel Power**	**Channel Range**	**Channel Power**
	Channel 0-3	**12 dBm**	**Channel 40-43**	**20 dBm**
	Channel 4-7	**13 dBm**	**Channel 44-48**	**19 dBm**
	Channel 8-10	**14 dBm**	**Channel 49-52**	**18 dBm**
	Channel 11-14	**16 dBm**	**Channel 53-57**	**16 dBm**
	Channel 15-17	**18 dBm**	**Channel 58-61**	**14 dBm**
	Channel 18-21	**19 dBm**	**Channel 62-66**	**13 dBm**
	Channel 22-24	**20 dBm**	**Channel 67-69**	**12 dBm**
	Channel 25-39	**21 dBm**	--	--
Type of Modulation	MSK (Minimum Shift Keying)			
Supported Data Rates	50 Kbps | 100 Kbps | 250 Kbps | 500 Kbps			
Hopping Sequence	Pseudo Random Sequence based on RCM24G Module's S/N number. Hence every **RCM24G module has unique Hopping sequence**			
Antenna Connections	☒ External, separate 1 RF Transceiver Port			
Antenna Details	**PRESTTA Antenna**			
Antenna Type	PRESTTA WLAN Embedded Antenna-1000418			
Antenna Ports Number |Type	1		2.4 GHz only	
Antenna Gain (Peak)	**2.5 dBi** (According to Applicant's declaration)			
Total Number of Antennas	**1**			
Test Mode. Settings	RCM24G TestTool_V3_70Channels Software			
MAX Field Strength (Radiated@3m)	**PRESTTA Antenna**			
	Peak Value (dBµV/m)		Average Value (dBµV/m)	
	110.30		109.23	
Other Installed Options	None			
Power Supply	☒ DC power only: 3.6 V DC using Laboratory Power Supply			
Special EMI Components	--			
EUT Sample Type	☒ Production	☐ Pre-Production	☐ Engineering	
Firmware	☐ for normal use		☒ Special version for test execution	
FCC / IC labels attached	☐ Yes	☒ No		

3.3. Technical data of RCM24G + Intel FA5 Antenna Port1 & Port 5 declared by applicant

Module	**RCM24G**			
Module Type	**RCM24G (Radio Control Module 2.4 GHz)**			
Main Function	Proprietary 2.4 GHz RF Transceiver (Hopping Mode)			
Frequency Band	2.4 GHz ISM Band (2400-2483.5 MHz)			
Frequency Channels (Range)	**Channel 0: 2402.5 MHz** to **Channel 69: 2471.5 MHz**			
Number of Channels	**70**			
Channel Bandwidth	1 MHz			
Channels Power Settings	According to Applicant's declaration (Max. Typical Power Values)			
	Channel Range	**Channel Power**	**Channel Range**	**Channel Power**
	Channel 0-3	**12 dBm**	**Channel 40-43**	**20 dBm**
	Channel 4-7	**13 dBm**	**Channel 44-48**	**19 dBm**
	Channel 8-10	**14 dBm**	**Channel 49-52**	**18 dBm**
	Channel 11-14	**16 dBm**	**Channel 53-57**	**16 dBm**
	Channel 15-17	**18 dBm**	**Channel 58-61**	**14 dBm**
	Channel 18-21	**19 dBm**	**Channel 62-66**	**13 dBm**
	Channel 22-24	**20 dBm**	**Channel 67-69**	**12 dBm**
	Channel 25-39	**21 dBm**	--	--
Type of Modulation	MSK (Minimum Shift Keying)			
Supported Data Rates	50 Kbps | 100 Kbps | 250 Kbps | 500 Kbps			
Hopping Sequence	Pseudo Random Sequence based on RCM24G Module's S/N number. Hence every **RCM24G module has unique Hopping sequence**			
Antenna Details	**Intel FA5 Antenna**			
Antenna Ports Number |Type	5	Port 1 & Port 5: 2.4 GHz	Port 2 | Port 3| Port 4: 5 GHz	
Antenna Type	Monopole Antenna (2.4 GHz)		Circularly Polarized Patch Antenna(5GHz)	
Antenna Connections	☒ External, separate 2 RF 2.4 GHz Transceiver Ports			
2.4 GHz Antenna Ports Antenna Gain (Peak)	**Port 1: 3.19 dBi | Port 5: 4.86 dBi** (According to Applicant's declaration)			
5 GHz Antenna Ports Antenna Gain (Peak)	**Test are carried out by terminating 5 GHz ports with 50 Ω terminations**			
	Frequency Band	Port 2 : RX	Port 3 : TX	Port 4 : RX
	U-NII 1: (5150-5250MHz)	7.98 dBi	6.15 dBi	9.37 dBi
	U-NII2A: (5250-5350MHz)	7.98 dBi	6.15 dBi	9.37 dBi
	U-NII 2C (5470-5725MHz)	11.08 dBi	8.02 dBi	11.18 dBi
	U-NII-3 (5725 -5850 MHz)	11.08 dBi	8.02 dBi	11.18 dBi
Total Number of Antennas	**1**			
Test Mode. Settings	RCM24G TestTool_V3_70Channels Software			
MAX Field Strength (Radiated@3m)	**Intel FA5 Antenna Port 1**		**Intel FA5 Antenna Port 5**	
	Peak Value (dBµV/m)	Average Value (dBµV/m)	Peak Value (dBµV/m)	Average Value (dBµV/m)
	112.47	108.78	115.34	114.14
Installed Options	None			
Power Supply	☒ DC power only: 3.6 V DC using Laboratory Power Supply			
Special EMI Components	--			
EUT Sample Type	☒ Production	☐ Pre-Production	☐ Engineering	
Firmware	☐ for normal use		☒ Special version for test execution	
FCC label attached	☐ Yes	☒ No		

3.4. 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	RCM24G Radio Control Module 2.4 GHz RCM24G	Radio Control Module 2.4GHz	PCB ID 3526	D	RCM24G_12017USCN Bootloader Version3.6
EUT B	PRESTTA Antenna	PRESTTA WLAN Embedded Antenna-1000418	N/A	Antenna Cable Length : 20 cm	--
EUT C	RCM24G Radio Control Module 2.4 GHz RCM24G	Radio Control Module 2.4GHz	PCB ID 3518	D	RCM24G_12017USCN Bootloader Version3.6
EUT D	Intel FA5 Antenna	Monopole Antenna Port 1 Monopole Antenna Port 5	N/A	Antenna-002 Antenna Cable Length : 40 cm	--

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

3.5. 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	Test Tablet	Inari 8.3” AAVmobile	--	Intel® Atom™ CPU Z3795 RAM: 4 GB Full Touch Support	Windows Embedded 8.1 Industry Pro 64 bit + RCM24G TestTool_V3_70Channels Software
AE 2	Programming USB Cable	AscTec USB	4716	WMD	--

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

3.6. EUT set-ups

EUT set-up no.*)	Combination of EUT and AE	Description
set. 1	EUT A + EUT B + Cable 6 + (AE 1 +AE2) [AE 1 + AE 2: were only used to activate test mode & kept outside test chamber]	**RCM24G + PRESTTA Antenna Radiated Measurements**
set. 2	EUT C + EUT D + Cable 1 + Cable 2 + Cable 3 + Cable 4 + Cable 5 + (AE 1 + AE 2) [AE 1 + AE 2 : were only used to activate test mode & kept outside test chamber] [Unused 5 GHz Ports of EUT D were terminated with 50 Ω terminations]	**RCM24G + Intel FA5 Antenna Port 1 Radiated Measurements**
set. 3	EUT C + EUT D + Cable 1 + Cable 2 + Cable 3 + Cable 4 + Cable 5 + (AE 1 + AE 2) [AE 1 + AE 2 : were only used to activate test mode & kept outside test chamber] [Unused 5 GHz Ports of EUT D were terminated with 50 Ω terminations]	**RCM24G + Intel FA5 Antenna Port 5 Radiated Measurements**
set. 4	EUT A + Cable 7 + (AE 1 + AE 2) [AE 1 + AE 2 : were only used to activate test mode]	**RCM24G Conducted Measurements**

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

3.7. EUT operating modes

EUT operating mode no.*)	Description of operating modes	Additional information
op. 1	TX-Fixed Channel (Modulated)- Mode	The EUT was put to **Fixed Channel (Modulated) Continuous transmissions mode** with help of RCM24G TestTool_V3_70Channels Software installed on Test Tablet (AE 1) and **Firmware Files (Frequency | Data Rate & Power Settings)** for **Lowest Channel : 0 : 2402.5 MHz | Power : +12 dBm** **Middle Channel :34: 2436.5 MHz | Power : +21dBm** **Highest Channel :69: 2471.5 MHz | Power : +12 dBm**
op. 2	TX-Hopping Channels (Modulated)- Mode	The EUT was put to **all Channels Hopping (Modulated) Continuous transmissions mode** with help of RCM24G TestTool_V3_70Channels Software installed on Test Tablet (AE 1) and **Firmware Files (Hopping Mode| Data Rate & Power Settings)** **Hopping Channels: 0 : 2402.5 MHz to 69 : 2471.5 MHz**

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

3.8. Configuration of cables used for testing

Cable number	Item	Connections	Cable length
Cable 1	MCX to uUFL Cable	Intel FA5 Antenna Test Port to RCM24G	40 cm
Cable 2	MCX to SMA Cable	Intel FA5 Antenna unused port to 50 Ω termination	40 cm
Cable 3	MCX to SMA Cable	Intel FA5 Antenna to 50 Ω termination	40 cm
Cable 4	MCX to SMA Cable	Intel FA5 Antenna to 50 Ω termination	40 cm
Cable 5	MCX to SMA Cable	Intel FA5 Antenna to 50 Ω termination	40 cm
Cable 6	uUFL to uUFL Cable	PRESTTA Antenna to RCM24G	20 cm
Cable 7	uUFL to SMA Cable	RCM24G to Spectrum Analyzer	10 cm

4. Description of test system set-up's

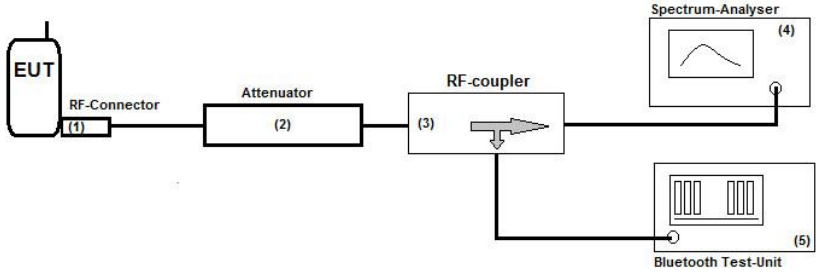
4.1. Test system set-up for conducted measurements on antenna port

Bluetooth conducted RF-Setup 1 (BT1 Set-up)

General description:

The EUT's RF-signal is coupled out by a suitable antenna coupling connector (1). The signal is first attenuated (2) then on the RF-coupler the coupled RF-path is connected to a Bluetooth test unit communication tester (5). The direct RF-path is connected to the spectrum – analyzer (4) for specific RF-measurements. The specific attenuation losses for both signal paths/branches are determined prior to the measurement within a set-up calibration. These are then taken into account by correcting the measurement readings on the spectrum-analyzer.

Schematic:



Testing method: ANSI C63.10:2013, KDB 971168 D01 v02r02

Used Equipment

Passive Elements	Test Equipment	Remark:
☒ 10 dB Attenuator	☒ CBT32 Communication Test-Unit for Bluetooth	See List of equipment under each test case and chapter 8 for calibration info
☒ Low loss RF-cables	☒ DC-Power Supply	
☒ RF-Coupler	☒ Spectrum-Analyser	

Measurement uncertainty See chapter 5.12

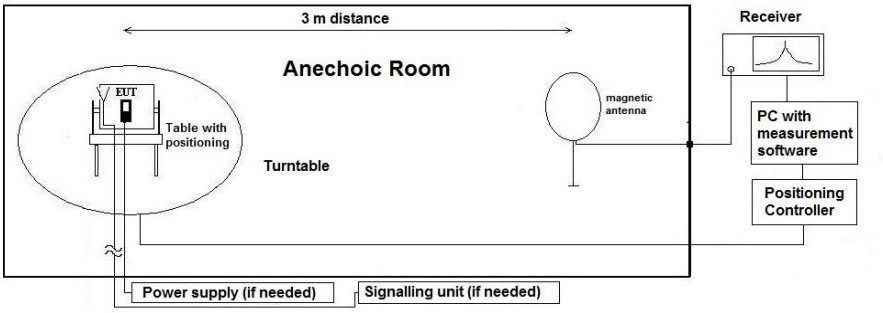
4.2. Test system set-up for radiated magnetic field measurements below 30 MHz

Specification: ANSI C63.10-2013 chapter 6.4 (§6.4.4.2)

General Description: Evaluating the radiated field emissions are done first by an exploratory emission measurement and a final measurement for most critical frequencies determined.

The loop antenna was placed at 1 m height above ground plane and 3 m measurement distance from set-up for investigations. Because of reduced measurement distance, correction data were applied, as stated in chapter "General Limit - Radiated field strength emissions below 30 MHz". The tests are performed in the semi anechoic room recognized by the regulatory commission.

Schematic:



Testing method:

Exploratory, preliminary measurement
The EUT and it's associated accessories are placed on a non-conductive position manipulator (tipping device) of 0.8 m height which is placed on the turntable. By rotating the turntable (step 90°, range 0°to 360°) and the EUT itself either on 3-orthogonal axis (portable equipment) or 2-orthogonal axis (defined operational position of EUT), the emission spectrum was recorded. The loop antenna was moved at least to 2-perpendicular axes (antenna vector in direction of EUT and parallel to EUT) in order to maximize the emissions. The results are documented in a diagram. Critical frequencies (low margin to limit) are saved within a data reduction table for further investigations. If various operating modes are supported, further investigations are made to find the worst-case. Also the interconnection cables and equipment position were varied in order to maximize the emissions.

Final measurement on critical frequencies
Based on the exploratory measurements, the most critical frequencies are re-measured by maintaining the EUT's worst-case operation mode, cable position, etc.

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

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

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

Formula:

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

$M = L_T - E_C$

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

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

Distance correction:

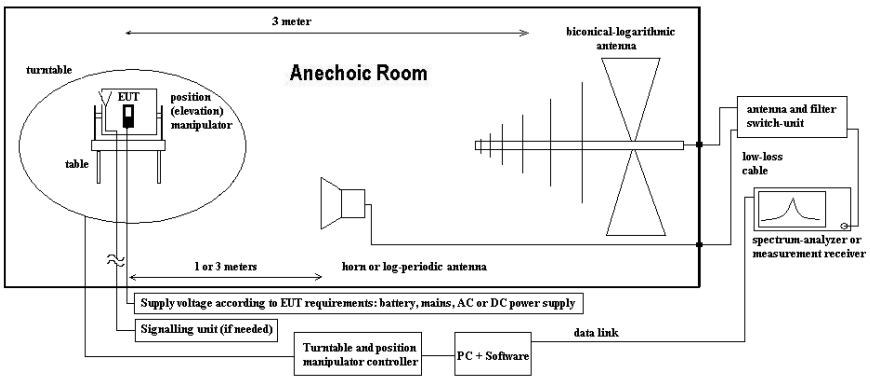
Reference for applied correction (extrapolating) factors due to reduced measurement distance:
ANSI C63.10:2013, §6.4.4.2 - Equations (2) + (3) + (4)

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

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

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

Schematic:



Testing method:

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

Measurement antenna: horizontal and vertical, heights: 1,0 m and 1,82 m as worst-case determined by an exploratory emission measurements. The results are documented in a diagram. Critical frequencies (low margin to limit) are saved within a table for further investigations. If various operating modes are supported, further investigations are made to find the worst-case of them. Also the interconnection cables and equipment position were varied in order to maximize the emissions.

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

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

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

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

Formula:

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

$M = L_T - E_C$ (2)

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

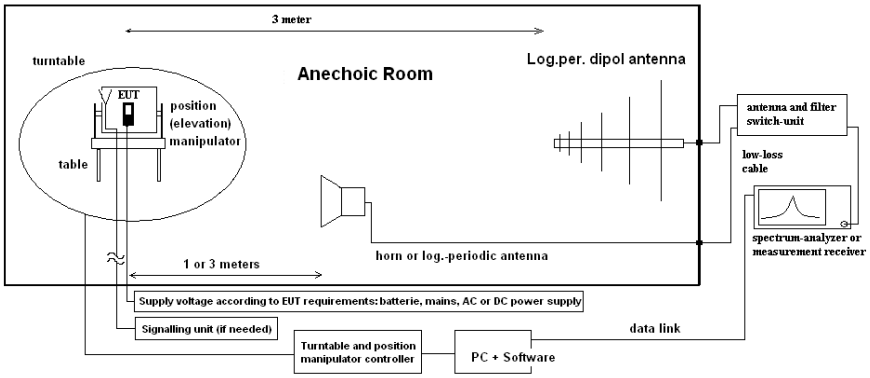
All units are dB-units, positive margin means value is below limit.

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

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

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

Schematic:



Testing method:

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

Final measurement on critical frequencies
Based on the exploratory measurements, the most critical frequencies are re-measured by maintaining the EUT's worst-case operation mode, cable position, etc.

First a frequency zoom around the critical frequency is done to locate the frequency more precisely. After this step, for all identified critical frequencies, the maximum peak was determined. Following parameters were varied: the turntable angle continuously in the range 0 to 360 degree, the EUT itself over 3-orthogonal axis and the height for EUT with large dimensions.

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

Formula:

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

$M = L_T - E_C$ (2)

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

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

5. Measurements

5.1. RF-Parameter – RF Power conducted

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

test location	☒ CETECOM Essen (Chapter. 2.2.1)		☐ 443 System CTC-FAR-EMI-		☐ Please see Chapter. 2.2.3	
test site	☐ 441 EMI SAR	☐ 487 SAR NSA	☐ 337 OATS	☒ 347 Radio.lab.	☐	☐
receiver	☐ 377 ESCS30	☐ 001 ESS	☒ 683 FSU 26	☐	☐	☐
spectr. analys.	☐ 489 ESU	☐ 120 FSEM	☐ 264 FSEK	☐	☐	☐
power supply	☐ 456 EA 3013A	☐ 457 EA 3013A	☐ 459 EA 2032-50	☐ 268 EA- 3050	☐ 494 AG6632A	☒ 354 NGPE 40
otherwise	☒ 510 10dB Attenuator		☒ cable K4	☐ Directional Coupler 1539R-10		

5.1.2. Requirements:

FCC	☒ §15.247 (b) (1)
ISED	☒ RSS-247, Issue 2. Chapter 5.1, b
ANSI	☒ C63.10-2013 Chapter 6.101

5.1.3. Reference: EUT antenna characteristics:
☒ Directional Gain < 6 dBi (measured: difference between measured conducted and radiated eirp. power)
☐ Directional Gain > 6 dBi (measured / applicant's declaration) -> conducted power reduction necessary

5.1.4. EUT settings:
For FHHS-systems hopping mode was switched-off so three fixed modulated channels could be measured. The EUT was instructed to send with maximum power (if adjustable) according applicants instructions. Different modulation characteristics have been checked, e.g. data rates which EUT can operate.

5.1.5. Measurement method:
The measurement was performed in non-hopping transmission mode with the carrier set to lowest, middle and highest channel. The power was also checked for different data rates, modulation scheme or packet types if applicable.

5.1.6. Settings on Spectrum-Analyzer:

Center Frequency	Nominal channel frequency
Span	8 MHz
Resolution Bandwidth (RBW)	3 MHz > 20dB-Bandwidth of the signal
Video Bandwidth (VBW)	3 times the resolution bandwidth = 10MHz
Sweep time	coupled
Detector	Peak, Max hold mode
Sweep Mode	Repetitive mode

5.1.7. Conducted Power Results:

Antenna Details	Maximum Declared Antenna Gain [isotropical]
PRESTTA Antenna	2.5 dBi
Intel FA5 Antenna Port 1	3.19 dBi
Intel FA5 Antenna Port 5	4.49 dBi

Conducted Output Power Measurements					
Temperature :+21 °C	Voltage Supply 3.6 V DC		Setup: 4	Op. Mode: 1	
Modulation : MSK			Frequency Hopping OFF		
Data Rate	Channel	Frequency	Max. Peak Output Power (Conducted)		Plot No.
[Kbps]	[Number]	[MHz]	[dBm]	[mW]	Remark 1
50	0	2402.5	**10.19**	**10.44**	**Plot 1**
50	34	2436.5	**19.93**	**98.40**	**Plot 2**
50	69	2471.5	**9.32**	**8.55**	**Plot 3**
100	0	2402.5	**10.20**	**10.47**	**Plot 4**
100	34	2436.5	**19.89**	**97.49**	**Plot 5**
100	69	2471.5	**9.39**	**8.69**	**Plot 6**
250	0	2402.5	**10.19**	**10.45**	**Plot 7**
250	34	2436.5	**19.78**	**95.06**	**Plot 8**
250	69	2471.5	**9.40**	**8.71**	**Plot 9**
500	0	2402.5	**10.26**	**10.62**	**Plot 10**
500	34	2436.5	**19.92**	**98.17**	**Plot 11**
500	69	2471.5	**9.42**	**8.74**	**Plot 12**
Conducted Output Power Limits- FCC 15.247			**20.97 dBm**	**125 mW**	
Conducted Output Power Limits - RSS-247, Issue 2					
Remark 1: For further details please refer → Annex 1: Test results - **CETECOM_TR16-1-0190801T03a-A1**					

5.1.8. Conducted Peak Output Power Verdict: Pass

5.2. RF-Parameter – 99% Occupied Bandwidth

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

test location	☒ CETECOM Essen (Chapter. 2.2.1)		☐ 443 System CTC-FAR-EMI-		☐ Please see Chapter. 2.2.3	
test site	☐ 441 EMI SAR	☐ 487 SAR NSA	☐ 337 OATS	☒ 347 Radio.lab.	☐	☐
receiver	☐ 377 ESCS30	☐ 001 ESS	☒ 683 FSU 26	☐	☐	☐
spectr. analys.	☐ 489 ESU	☐ 120 FSEM	☐ 264 FSEK	☐	☐	☐
power supply	☐ 456 EA 3013A	☐ 457 EA 3013A	☐ 459 EA 2032-50	☐ 268 EA- 3050	☐ 494 AG6632A	☒ 354 NGPE 40
otherwise	☒ 530 10dB Attenuator	☒ cable K4	☐ Directional Coupler 1539R-10			

5.2.2. Requirements:

FCC	☒ 2.1049(h) ☒ FCC 2.202 for information
ISED	☒ RSS-Gen, Issue4 , Chapter 6.6
Remark	The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

5.2.3. EUT settings

For FHSS-systems hopping mode was switched-off so fixed three different channels could be measured. The EUT was instructed to send with maximum power (if adjustable) according applicants instructions. Different modulation characteristics have been checked, e.g. data rates which EUT can operate.

5.2.4. Measurement method

The measurement was performed with the RBW set to 10kHz. The span was set to cover the complete carrier. Three carrier frequencies (low/middle/high) were used for showing the compliance with this requirement. A 99% OBW measurement function was used to measure the bandwidth compared 99% of the highest In-Band power. The operating modes have been varied (e.g. data rate, modulation scheme, etc.). The hopping-mode is switched off.

5.2.5. Spectrum-Analyzer Settings

Span	Set as to fully display the emissions and approximate 20dB below the PEAK level
Resolution Bandwidth (RBW)	Set to approx. 1% …3% of the emission width
Video Bandwidth (VBW)	3 times the resolution bandwidth
Sweep time	Coupled and low enough to have no gaps within power envelope
Detector	Sample (if bin width: Span/no. of frequency points SA < 0.5*RBW SA otherwise Peak detector)
Sweep mode	Repetitive Mode, Max hold

5.2.6. 99% Occupied Bandwidth Results:

99% Occupied Bandwidth Measurements				
Temperature :+21 °C	**Voltage Supply 3.6 V DC**		**Setup: 4**	**Op. Mode: 1**
Modulation : MSK			**Frequency Hopping OFF**	
Data Rate	**Channel**	**Frequency**	**99 % Occupied Bandwidth**	**Plot No.**
[Kbps]	**[Number]**	**[MHz]**	**[MHz]**	Remark 1
50	0	2402.5	**1.370192**	**Plot 13**
50	34	2436.5	**1.355769**	**Plot 14**
50	69	2471.5	**1.423077**	**Plot 15**
100	0	2402.5	**1.355769**	**Plot 16**
100	34	2436.5	**1.322115**	**Plot 17**
100	69	2471.5	**1.432692**	**Plot 18**
250	0	2402.5	**1.259615**	**Plot 19**
250	34	2436.5	**1.322115**	**Plot 20**
250	69	2471.5	**1.293269**	**Plot 21**
500	0	2402.5	**1.399038**	**Plot 22**
500	34	2436.5	**1.350961**	**Plot 23**
500	69	2471.5	**1.307692**	**Plot 24**
Remark 1: For further details please refer → Annex 1: Test results - **CETECOM_TR16-1-0190801T03a-A1**				

5.2.7. 99% Occupied Bandwidth Verdict: For Information only

5.3. RF-Parameter - 20 dB Bandwith

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

test location	☒ CETECOM Essen (Chapter. 2.2.1)		☐ 443 System CTC-FAR-EMI-		☐ Please see Chapter. 2.2.3	
test site	☐ 441 EMI SAR	☐ 487 SAR NSA	☐ 337 OATS	☒ 347 Radio.lab.	☐	☐
receiver	☐ 377 ESCS30	☐ 001 ESS	☒ 683 FSU 26	☐	☐	☐
spectr. analys.	☐ 489 ESU	☐ 120 FSEM	☐ 264 FSEK	☐	☐	☐
power supply	☐ 456 EA 3013A	☐ 457 EA 3013A	☐ 459 EA 2032-50	☐ 268 EA- 3050	☐ 494 AG6632A	☒ 354 NGPE 40
otherwise	☒ 530 10dB Attenuator	☒ cable K4	☐ Directional Coupler 1539R-10			

5.3.2. Requirements:

FCC	☒ §15.247 (a) (1)
ISED	☒ RSS-247, Issue 2, Chapter 5.1,a
Remark	The bandwidth of a frequency hopping channel is the 20 dB emission bandwidth, measured with the hopping stopped.

5.3.3. EUT settings

For FHSS-systems hopping mode was switched-off so fixed three different channels could be measured.
The EUT was instructed to send with maximum power (if adjustable) according applicants instructions.
Different modulation characteristics have been checked, e.g. data rates which EUT can operate.

5.3.4. Measurement method

The measurement was performed with the RBW set to 10kHz. The span was set to cover the complete carrier. Three carrier frequencies (low/middle/high) were used for showing the compliance with this requirement. A DELTA Marker method was set to measure the bandwidth compared to the highest In-Band power. The operating modes have been varied (e.g. data rate, modulation scheme, etc.). The hopping-mode is switched off.

5.3.5. Spectrum-Analyzer Settings

Span	Set as to fully display the emissions and approximate 20dB below the PEAK level
Resolution Bandwidth (RBW)	Set to approx. 1% …3% of the emission width
Video Bandwidth (VBW)	3 times the resolution bandwidth
Sweep time	Coupled and low enough to have no gaps within power envelope
Detector	Sample (if bin width: Span/no. of frequency points SA < 0.5*RBW SA otherwise Peak detector)
Sweep mode	Repetitive Mode, Max hold

5.3.6. 20 dB Bandwidth Results:

20 dB Bandwidth Measurements				
Temperature :+21 °C	**Voltage Supply 3.6 V DC**		**Setup: 4**	**Op. Mode: 1**
Modulation : MSK			**Frequency Hopping OFF**	
Data Rate	**Channel**	**Frequency**	**20 dB Bandwidth**	**Plot No.**
[Kbps]	**[Number]**	**[MHz]**	**[MHz]**	Remark 1
50	0	2402.5	**0.596153**	**Plot 25**
50	34	2436.5	**0.692307**	**Plot 26**
50	69	2471.5	**0.576923**	**Plot 27**
100	0	2402.5	**0.889423**	**Plot 28**
100	34	2436.5	**0.879807**	**Plot 29**
100	69	2471.5	**0.889423**	**Plot 30**
250	0	2402.5	**1.067307**	**Plot 31**
250	34	2436.5	**1.182692**	**Plot 32**
250	69	2471.5	**0.990384**	**Plot 33**
500	0	2402.5	**1.447115**	**Plot 34**
500	34	2436.5	**1.437500**	**Plot 35**
500	69	2471.5	**1.389423**	**Plot 36**
Remark 1: For further details please refer → Annex 1: Test results - **CETECOM_TR16-1-0190801T03a-A1**				

5.3.7. 20 dB Bandwidth Verdict: Pass

5.4. RF-Parameter - Channel Carrier Frequency Separation for FHSS-systems

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

test location	☒ CETECOM Essen (Chapter. 2.2.1)		☐ 443 System CTC-FAR-EMI-		☐ Please see Chapter. 2.2.3	
test site	☐ 441 EMI SAR	☐ 487 SAR NSA	☐ 337 OATS	☒ 347 Radio.lab.	☐	☐
receiver	☐ 377 ESCS30	☐ 001 ESS	☒ 683 FSU 26	☐	☐	☐
spectr. analys.	☐ 489 ESU	☐ 120 FSEM	☐ 264 FSEK	☐	☐	☐
power supply	☐ 456 EA 3013A	☐ 457 EA 3013A	☐ 459 EA 2032-50	☐ 268 EA- 3050	☐ 494 AG6632A	☒ 354 NGPE 40
otherwise	☒ 530 10dB Attenuator		☒ cable K4	☐ Directional Coupler 1539R-10		

5.4.2. Requirements:

FCC	☒ §15.247 (a) (1)
ISED	☒ RSS-247, Issue 2, Chapter 5.1,b
Remark	Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals..

5.4.3. EUT settings

For FHSS-systems hopping mode was switched-on so that adjacent Frequency Hopping channels could be measured. The EUT was instructed to send with maximum power (if adjustable) according applicants instructions. Different modulation characteristics have been checked, e.g. data rates which EUT can operate.

5.4.4. Measurement method

The measurement to prove this requirement was performed with a low RBW of 100kHz, peak detector and trace Hold-Max function in order to resolve each frequency carrier separately.

The span of the frequency analyzer was set to cover the carrier investigated as well as its neighbour channels. A frequency DELTA Marker method was set to measure the frequency separation between the channels.

5.4.5. Channel Carrier Frequency Separation Results:

Channel Carrier Frequency Separation Measurements					
Temperature :+21 °C	**Voltage Supply 3.6 V DC**		**Setup: 4**	**Op. Mode: 2**	
Modulation : MSK		**Frequency Hopping ON**			
Data Rate	**Neighboring Channels**	**Carrier Frequency Separation**	**Carrier Frequency Separation**	**2/3 20 dB B.W.**	**Plot No.**
[Kbps]	**[Number]**	**[MHz]**	**[MHz]**	**[MHz]**	Remark 1
50	0-1-2	**1.0048** [Ch 0-1]	**1.0000** [Ch 1-2]	**0,397435**	**Plot 37**
50	33-34-35	**1.0000** [Ch 33- 34]	**1.0096** [Ch 34-35]	**0,461538**	**Plot 38**
50	67-68-69	**1.0000** [Ch 67- 68]	**1.0000** [Ch 68-69]	**0,384615**	**Plot 39**
100	0-1-2	**1.0000** [Ch 0-1]	**1.0048** [Ch 1-2]	**0,592949**	**Plot 40**
100	33-34-35	**1.0000** [Ch 33- 34]	**1.0048** [Ch 34-35]	**0,586538**	**Plot 41**
100	67-68-69	**1.0048** [Ch 67- 68]	**1.0000** [Ch 68-69]	**0,592949**	**Plot 42**
250	0-1-2	**1.0048** [Ch 0-1]	**0.9951** [Ch 1-2]	**0,711538**	**Plot 43**
250	33-34-35	**1.0000** [Ch 33- 34]	**1.0048** [Ch 34-35]	**0,788461**	**Plot 44**
250	67-68-69	**1.0048** [Ch 67- 68]	**1.0000** [Ch 68-69]	**0,660256**	**Plot 45**
500	0-1-2	**1.0048** [Ch 0-1]	**1.0000** [Ch 1-2]	**0,964743**	**Plot 46**
500	33-34-35	**0.9951** [Ch 33- 34]	**1.0096** [Ch 34-35]	**0,958333**	**Plot 47**
500	67-68-69	**1.0000** [Ch 67- 68]	**1.0048** [Ch 68-69]	**0,926282**	**Plot 48**
Hopping Channel Carrier Frequencies Separation Limits- FCC 15.247				**Two thirds of the 20 dB B.W.**	
Hopping Channel Carrier Frequencies Separation Limits - RSS-247, Issue 2					
Remark 1: For further details please refer → Annex 1: Test results - **CETECOM_TR16-1-0190801T03a-A1**					

5.4.6. Hopping Channel Carrier Frequencies Separation Verdict: Pass

5.5. RF-Parameter – Number of Hopping Channels for FHSS-systems

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

test location	☒ CETECOM Essen (Chapter. 2.2.1)		☐ 443 System CTC-FAR-EMI-		☐ Please see Chapter. 2.2.3	
test site	☐ 441 EMI SAR	☐ 487 SAR NSA	☐ 337 OATS	☒ 347 Radio.lab.	☐	☐
receiver	☐ 377 ESCS30	☐ 001 ESS	☒ 683 FSU 26	☐	☐	☐
spectr. analys.	☐ 489 ESU	☐ 120 FSEM	☐ 264 FSEK	☐	☐	☐
power supply	☐ 456 EA 3013A	☐ 457 EA 3013A	☐ 459 EA 2032-50	☐ 268 EA- 3050	☐ 494 AG6632A	☒ 354 NGPE 40
otherwise	☒ 530 10dB Attenuator	☒ cable K4	☐ Directional Coupler 1539R-10			

5.5.2. Requirements:

FCC	☒ §15.247 (a) (1) (iii)
ISED	☒ RSS-247, Issue 2, Chapter 5.1,d
Remark	Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. Transmissions on particular hopping frequencies may be avoided or suppressed provided that at least 15 hopping channels are used.

5.5.3. EUT settings

For FHSS-systems hopping mode was switched-on so that adjacent Frequency Hopping channels could be measured. The EUT was instructed to send with maximum power (if adjustable) according applicants instructions. Different modulation characteristics have been checked, e.g. data rates which EUT can operate.

5.5.4. Measurement method

The measurement to prove this requirement was performed with a low RBW of 100kHz, peak detector and trace Hold-Max function in order to resolve each frequency carrier separately.

The span of the frequency analyzer was set to cover the Hopping channels in two parts namely 2.4 GHz Lower spectrum and 2.4 GHz Upper spectrum. On extreme right & left channels Markers were set to indicate the corresponding channel frequency.

5.5.5. Number of Hopping Channels Results:

Number of Hopping Channels Measurements				
Temperature :+21 °C	**Voltage Supply 3.6 V DC**		**Setup: 4**	**Op. Mode: 2**
Modulation: MSK		**Frequency Hopping ON**		
Data Rate	**Channels** 2.4 GHz Lower Spectrum	**Channels** 2.4 GHz Upper Spectrum	**Total Channels** 2.4 GHz Spectrum	**Plot No.**
[Kbps]	**[Number]**	**[Number]**	**[Number]**	Remark 1
50	40	30	**70**	49 | 50
100	40	30	**70**	51 | 52
250	40	30	**70**	53 | 54
500	40	30	**70**	55 | 56
Minimum Number of Hopping Channels Limits- FCC 15.247			**15**	
Minimum Number of Hopping Channels Limits - RSS-247, Issue 2				
Remark 1: For further details please refer → Annex 1: Test results - **CETECOM_TR16-1-0190801T03a-A1**				

5.5.6. Minimum Number of Hopping Channels Verdict: Pass

5.6. RF-Parameter – Average Time of Occupancy for FHSS systems

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

test location	☒ CETECOM Essen (Chapter. 2.2.1)		☐ 443 System CTC-FAR-EMI-		☐ Please see Chapter. 2.2.3	
test site	☐ 441 EMI SAR	☐ 487 SAR NSA	☐ 337 OATS	☒ 347 Radio.lab.	☐	☐
receiver	☐ 377 ESCS30	☐ 001 ESS	☒ 683 FSU 26	☐	☐	☐
spectr. analys.	☐ 489 ESU	☐ 120 FSEM	☐ 264 FSEK	☐	☐	☐
power supply	☐ 456 EA 3013A	☐ 457 EA 3013A	☐ 459 EA 2032-50	☐ 268 EA- 3050	☐ 494 AG6632A	☒ 354 NGPE 40
otherwise	☒ 530 10dB Attenuator	☒ cable K4	☐ Directional Coupler 1539R-10			

5.6.2. Requirements:

FCC	☒ §15.247 (a) (1) (iii)
ISED	☒ RSS-247, Issue 2, Chapter 5.1,d
Remark	The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

5.6.3. EUT settings

For FHSS-systems hopping mode was switched-on so that occupancy time of Frequency Hopping channels could be measured. The EUT was instructed to send with maximum power (if adjustable) according applicants instructions. Different modulation characteristics have been checked, e.g. data rates which EUT can operate.

5.6.4. Measurement method:

The measurement was performed with a spectrum analyzer set to ZERO span. The device was set to work within the defined specification with frequency Hopping Mode ON. The spectrum-analyzer was set the MAX-Hold positive peak detector mode. The sweep time set as long as necessary to capture the full signal burst per hopping channel. The burst on-period is captured by setting appropriate markers in the rising and falling edges.

5.6.5. Average occupancy time calculations:

Formula for calculating the dwell time (pseudo-hopping sequence over all channels assumed):

$$\text{Average Dwell Time} = Timeslot\ length \cdot \frac{Hop\ rate}{number\ of\ hopping\ channels} \cdot time\ period$$

The EUT employs Proprietary 2.4 GHz RF Transceiver Frequency Hopping system with total 70 channels. The maximum staying time of 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. = 0.4 seconds X 70 = 28 Seconds.

That means the average time of occupancy on any channel shall not be greater than 0.4 seconds within 28 seconds.

5.6.6. Average occupancy time Results:

Average Occupancy Time Measurements					
Temperature :+21 °C		**Voltage Supply 3.6 V DC**		**Setup: 4**	**Op. Mode: 2**
Modulation : MSK			**Frequency Hopping ON**		
Data Rate	**Channel**	**Single Transmission Time**	**Number of Transmissions in 28 Seconds**	**Average Occupancy Time in 28 Seconds**	**Plot No.**
[Kbps]	**[Number]**	**[milliseconds]**	**[Number]**	**[milliseconds]**	Remark 1
50	0	23.123	7	161.861	57 | 58
50	34	23.123	7	161.861	59 | 60
50	69	23.123	7	161.861	61 | 62
100	0	11.614	13	150.982	63 | 64
100	34	11.614	13	150.982	65 | 66
100	69	11.638	13	151.294	67 | 68
250	0	4.643	27	125.361	69 | 70
250	34	4.643	28	130.004	71 | 72
250	69	4.681	27	126.387	73 | 74
500	0	2.322	36	83.592	75 | 76
500	34	2.322	36	83.592	77 | 78
500	69	2.322	36	83.592	79 | 80
Average Occupancy Time Limits- FCC 15.247				**≤ 400 milliseconds**	
Average Occupancy Time Limits - RSS-247. Issue 2					
Remark 1: For further details please refer → Annex 1: Test results - **CETECOM_TR16-1-0190801T03a-A1**					

5.6.7. Average Occupancy Time Verdict: Pass

5.7. RF-Parameter – Out-of-Band 20 dBc Conducted Emissions for FHSS systems

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

test location	☒ CETECOM Essen (Chapter. 2.2.1)		☐ 443 System CTC-FAR-EMI-		☐ Please see Chapter. 2.2.3	
test site	☐ 441 EMI SAR	☐ 487 SAR NSA	☐ 337 OATS	☒ 347 Radio.lab.	☐	☐
receiver	☐ 377 ESCS30	☐ 001 ESS	☒ 683 FSU 26	☐	☐	☐
spectr. analys.	☐ 489 ESU	☐ 120 FSEM	☐ 264 FSEK	☐	☐	☐
power supply	☐ 456 EA 3013A	☐ 457 EA 3013A	☐ 459 EA 2032-50	☐ 268 EA- 3050	☐ 494 AG6632A	☒ 354 NGPE 40
otherwise	☒ 530 10dB Attenuator	☒ cable K4	☐ Directional Coupler 1539R-10			

5.7.2. Requirements:

FCC	☒ §15.247 (d)
ISED	☒ RSS-247. Issue 2. Chapter 5.5
Remark	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating. the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. based on either an RF conducted or a radiated measurement. provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval. as permitted under FCC15.247 paragraph (b)(3) / RSS-247section 5.4(d). the attenuation required shall be 30 dB instead of 20 dB

5.7.3. EUT settings

Fixed Channel Mode:
For FHSS-systems Hopping mode was switched-off so fixed three different channels could be measured.
The EUT was instructed to send with maximum power (if adjustable) according applicants instructions.
Different modulation characteristics have been checked. e.g. data rates which EUT can operate.

Hopping Mode:
For FHSS-systems Hopping mode was switched- ON so emissions from hopping channels could be measured.
The EUT was instructed to send with maximum power (if adjustable) according applicants instructions.
Different modulation characteristics have been checked. e.g. data rates which EUT can operate.

5.7.4. Measurement Method:

The measurements were performed with the RBW set to 100kHz & maximum carrier level was indicated with MAX-Hold positive peak detector using markers. Then a frequency line was set 20 dB below this measured maximum carrier level.

Then using RBW 100 kHz & spectrum analyzer span from 150 kHz to 25 GHz in three steps spurious emissions were measured with MAX-Hold positive peak detector.

The sweep time set as long as necessary to capture the full signal burst per hopping channel. The burst on-period is captured by setting appropriate markers in the rising and falling edges.

5.7.5. Out-of-Band 20 dBc Conducted Emissions Results:

Out-of-Band 20 dBc Conducted Emissions Measurements					
Temperature :+21 °C	**Voltage Supply 3.6 V DC**		**Setup: 4**	**Op. Mode: 1**	
Modulation : MSK		**Frequency Hopping OFF**			
Data Rate	**Channel**	**Minimum Margin 0.15 MHz -30 MHz**	**Minimum Margin 30 MHz -2.8 GHz**	**Minimum Margin 2.8 GHz - 25 GHz**	**Plot No.**
[Kbps]	**[Number]**	**[dBc]**	**[dBc]**	**[dBc]**	Remark 1
50	0	**46.23**	**45.31**	**43.29**	81 | 82 , 83 | 84
50	34	**56.60**	**55.07**	**52.28**	85 | 86 , 87 | 88
50	69	**45.19**	**43.97**	**41.91**	89 | 90 , 91 | 92
100	0	**46.50**	**44.96**	**43.17**	97 | 98 , 99 | 100
100	34	**55.77**	**54.62**	**53.04**	101 | 102 , 103 | 104
100	69	**46.20**	**44.46**	**43.51**	105 | 106 , 107 | 108
250	0	**45.81**	**47.45**	**43.01**	113 | 114 , 115 | 116
250	34	**56.11**	**55.15**	**53.82**	117 | 118 , 119 | 120
250	69	**45.00**	**44.22**	**41.34**	121 | 122 , 123 | 124
500	0	**45.40**	**45.34**	**42.26**	129 | 130 , 131 | 132
500	34	**56.06**	**55.02**	**52.3**	133 | 134 , 135 | 136
500	69	**46.29**	**43.61**	**41.42**	137 | 138 , 139 | 140
Out-of-Band 20 dBc Conducted Emissions Limits- FCC 15.247				**≥ 20 dBc**	
Out-of-Band 20 dBc Conducted Emissions Limits - RSS-247. Issue 2					
Remark 1: For further details please refer → Annex 1: Test results - **CETECOM_TR16-1-0190801T03a-A1**					

5.7.6. Out-of-Band 20 dBc Conducted Emissions- Hopping Mode OFF Verdict: Pass

Out-of-Band 20 dBc Conducted Emissions Measurements					
Temperature :+21 °C		**Voltage Supply 3.6 V DC**		**Setup: 4**	**Op. Mode: 2**
Modulation : MSK			**Frequency Hopping ON**		
Data Rate	**Hopping Channel**	**Minimum Margin 0.15 MHz -30 MHz**	**Minimum Margin 30 MHz -2.8 GHz**	**Minimum Margin 2.8 GHz - 25 GHz**	**Plot No.**
[Kbps]	**[Number]**	**[dBc]**	**[dBc]**	**[dBc]**	Remark 1
50	0 - 69	**57.21**	**54.12**	**52.63**	93 | 94 , 95 | 96
100	0 - 69	**56.12**	**54.83**	**52.71**	109 | 110 , 111 | 112
250	0 - 69	**59.77**	**54.73**	**52.72**	125 | 126 , 127 | 128
500	0 - 69	**55.81**	**54.65**	**50.26**	141 | 142 , 143 | 144
Out-of-Band 20 dBc Conducted Emissions Limits- FCC 15.247				**≥ 20 dBc**	
Out-of-Band 20 dBc Conducted Emissions Limits - RSS-247. Issue 2					
Remark 1: For further details please refer → Annex 1: Test results - **CETECOM_TR16-1-0190801T03a-A1**					

5.7.7. Out-of-Band 20 dBc Conducted Emissions- Hopping Mode ON Verdict: Pass

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

5.8.1. Test location and equipment

test location	☒ CETECOM Essen (Chapter. 2.2.1)		☐ Please see Chapter. 2.2.2		☐ Please see Chapter. 2.2.3	
test site	☒ 441 EMI SAR	☐ 487 SAR NSA	☐ 347 Radio.lab.		☐	☐
receiver	☐ 377 ESCS30	☒ 001 ESS	☐	☐	☐	☐
spectr. analys.	☐ 584 FSU	☐ 120 FSEM	☐ 264 FSEK	☐	☐	☐
antenna	☐ 574 BTA-L	☐ 133 EMCO3115	☐ 302 BBHA9170	☐ 289 CBL 6141	☒ 030 HFH-Z2	☐ 477 GPS
signaling	☐ 392 MT8820A	☐ 371 CBT32	☐ 547 CMU	☐ 594 CMW		
otherwise	☐ 400 FTC40x15E	☐ 401 FTC40x15E	☐ 110 USB LWL	☐ 482 Filter Matrix	☐ 378 RadiSense	
DC power	☒ 671 EA-3013S	☐ 457 EA 3013A	☐ 459 EA 2032-50	☐ 268 EA- 3050	☐ 494 AG6632A	☐ 498 NGPE 40
line voltage	☐ 230 V 50 Hz via public mains		☒ 060 120 V 60 Hz via PAS 5000			

5.8.2. Requirements

FCC	Part 15. Subpart C. §15.205 & §15.209		☒ Part 15.247 (d)	
ISED	RSS-Gen: Issue 4: §8.9 Table 5 RSS-247, Issue 2, Chapter 5.5			
ANSI	C63.10-2013			
Frequency [MHz]	Field strength limit [µV/m]	[dBµV/m]	Distance [m]	Remarks
0.009 – 0.490	2400/f (kHz)	67.6 – 20Log(f) (kHz)	300	Correction factor used due to measurement distance of 3 m
0.490 – 1.705	24000/f (kHz)	87.6 – 20Log(f) (kHz)	30	Correction factor used due to measurement distance of 3 m
1.705 – 30	30	29.5	30	Correction factor used due to measurement distance of 3 m

5.8.3. Test condition and test set-up

Signal link to test system (if used):		☐ air link	☐ cable connection	☐ none
EUT-grounding		☒ none	☐ with power supply	☐ additional connection
Equipment set up		☒ table top		☐ floor standing
Climatic conditions		Temperature: (22±3°C)		Rel. humidity: (40±20)%
EMI-Receiver or Analyzer Settings	Scan data	☒ 9 – 150 kHz RBW/VBW = 200 Hz Scan step = 80 Hz ☒ 150 kHz – 30 MHz RBW/VBW = 9 kHz Scan step = 4 kHz ☐ other:		
	Scan-Mode Detector Mode: Sweep-Time	☒ 6 dB EMI-Receiver Mode ☐ 3dB Spectrum analyser Mode Peak (pre-measurement) and Quasi-PK/Average (final if applicable) Repetitive-Scan. max-hold Coupled – calibrated display if continuous signal otherwise adapted to EUT's individual transmission duty-cycle		
General measurement procedures		Please see chapter "Test system set-up radiated magnetic field measurements below 30 MHz"		

5.8.4. Radiated Field Strength Emissions – 9 kHz to 30 MHz Results

Radiated Field Strength Emissions – 9 kHz to 30 MHz										
Temperature :+21 °C			**Voltage Supply 3.6 V DC**		**Modulation : MSK**		**Frequency Hopping OFF**			
Diagram No. (Remark 1)	**Carrier Channel**		**Channel Data Rate | Power**	**Set-up no.**	**OP-mode no.**	**Other Remarks**	**Used detector**			**Verdict**
	Range	**No.**					**PK**	**AV**	**QP**	
RCM24G + PRESTTA Antenna										
2.01	Low	0	50 Kbps | +12 dBm	1	1	--	☒	☐	☐	**Pass**
2.02	High	69	100 Kbps | +12 dBm	1	1	--	☒	☐	☐	**Pass**
2.03	Low	0	250 Kbps | +12 dBm	1	1	--	☒	☐	☐	**Pass**
2.04	Middle	34	500 Kbps | +21dBm	1	1	--	☒	☐	☐	**Pass**
RCM24G + Intel FA5 Antenna Port 1										
2.11	Low	0	50 Kbps | +12 dBm	2	1	--	☒	☐	☐	**Pass**
2.12	High	69	100 Kbps | +12 dBm	2	1	--	☒	☐	☐	**Pass**
2.13	Low	0	250 Kbps | +12 dBm	2	1	--	☒	☐	☐	**Pass**
2.14	Middle	34	500 Kbps | +21dBm	2	1	--	☒	☐	☐	**Pass**
RCM24G + Intel FA5 Antenna Port 5										
2.21	Low	0	50 Kbps | +12 dBm	3	1	--	☒	☐	☐	**Pass**
2.22	High	69	100 Kbps | +12 dBm	3	1	--	☒	☐	☐	**Pass**
2.23	Low	0	250 Kbps | +12 dBm	3	1	--	☒	☐	☐	**Pass**
2.24	Middle	34	500 Kbps | +21dBm	3	1	--	☒	☐	☐	**Pass**
Remark 1: For further details please refer → Annex 1: Test results - **CETECOM_TR16-1-0190801T03a-A1**										

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

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

Frequency -Range	f [kHz/MHz]	Lambda [m]	Far-Field Point [m]	Distance Limit accord. 15.209 [m]	1st Condition (dmeas< $D_{near-field}$)	2'te Condition (Limit distance bigger $d_{near-field}$)	Distance Correction accord. Formula
kHz	9,00E+03	33333,33	5305,17	300	fullfilled	not fullfilled	-80,00
	1,00E+04	30000,00	4774,65		fullfilled	not fullfilled	-80,00
	2,00E+04	15000,00	2387,33		fullfilled	not fullfilled	-80,00
	3,00E+04	10000,00	1591,55		fullfilled	not fullfilled	-80,00
	4,00E+04	7500,00	1193,66		fullfilled	not fullfilled	-80,00
	5,00E+04	6000,00	954,93		fullfilled	not fullfilled	-80,00
	6,00E+04	5000,00	795,78		fullfilled	not fullfilled	-80,00
	7,00E+04	4285,71	682,09		fullfilled	not fullfilled	-80,00
	8,00E+04	3750,00	596,83		fullfilled	not fullfilled	-80,00
	9,00E+04	3333,33	530,52		fullfilled	not fullfilled	-80,00
	1,00E+05	3000,00	477,47		fullfilled	not fullfilled	-80,00
	1,25E+05	2400,00	381,97		fullfilled	not fullfilled	-80,00
	2,00E+05	1500,00	238,73		fullfilled	fullfilled	-78,02
	3,00E+05	1000,00	159,16		fullfilled	fullfilled	-74,49
	4,00E+05	750,00	119,37		fullfilled	fullfilled	-72,00
	4,90E+05	612,24	97,44		fullfilled	fullfilled	-70,23
	5,00E+05	600,00	95,49	30	fullfilled	not fullfilled	-40,00
	6,00E+05	500,00	79,58		fullfilled	not fullfilled	-40,00
	7,00E+05	428,57	68,21		fullfilled	not fullfilled	-40,00
	8,00E+05	375,00	59,68		fullfilled	not fullfilled	-40,00
	9,00E+05	333,33	53,05		fullfilled	not fullfilled	-40,00
MHz	1,00	300,00	47,75		fullfilled	not fullfilled	-40,00
	1,59	188,50	30,00		fullfilled	not fullfilled	-40,00
	2,00	150,00	23,87		fullfilled	fullfilled	-38,02
	3,00	100,00	15,92		fullfilled	fullfilled	-34,49
	4,00	75,00	11,94		fullfilled	fullfilled	-32,00
	5,00	60,00	9,55		fullfilled	fullfilled	-30,06
	6,00	50,00	7,96		fullfilled	fullfilled	-28,47
	7,00	42,86	6,82		fullfilled	fullfilled	-27,13
	8,00	37,50	5,97		fullfilled	fullfilled	-25,97
	9,00	33,33	5,31		fullfilled	fullfilled	-24,95
	10,00	30,00	4,77		fullfilled	fullfilled	-24,04
	10,60	28,30	4,50		fullfilled	fullfilled	-23,53
	11,00	27,27	4,34		fullfilled	fullfilled	-23,21
	12,00	25,00	3,98		fullfilled	fullfilled	-22,45
	13,56	22,12	3,52		fullfilled	fullfilled	-21,39
	15,00	20,00	3,18		fullfilled	fullfilled	-20,51
	15,92	18,85	3,00		fullfilled	fullfilled	-20,00
	17,00	17,65	2,81		not fullfilled	fullfilled	-20,00
	18,00	16,67	2,65		not fullfilled	fullfilled	-20,00
	20,00	15,00	2,39		not fullfilled	fullfilled	-20,00
	21,00	14,29	2,27		not fullfilled	fullfilled	-20,00
	23,00	13,04	2,08		not fullfilled	fullfilled	-20,00
	25,00	12,00	1,91		not fullfilled	fullfilled	-20,00
	27,00	11,11	1,77		not fullfilled	fullfilled	-20,00
	29,00	10,34	1,65		not fullfilled	fullfilled	-20,00
	30,00	10,00	1,59		not fullfilled	fullfilled	-20,00

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

5.9.1. Test location and equipment

test location	☒ CETECOM Essen (Chapter. 2.2.1)		☐ Please see Chapter. 2.2.2		☐ Please see Chapter. 2.2.3	
test site	☒ 441 EMI SAR	☒ 487 SAR NSA				
receiver	☐ 377 ESCS30	☒ 001 ESS	☐ 489 ESU 40	☐ 620 ESU 26		
spectr. analys.	☐ 584 FSU	☐ 120 FSEM	☐ 264 FSEK			
antenna	☒ 574 BTA-L	☐ 133 EMCO3115	☐ 302 BBHA9170	☐ 289 CBL 6141	☐ 030 HFH-Z2	☐ 477 GPS
signaling	☐ 392 MT8820A	☐ 371 CBT32	☐ 547 CMU	☐ 594 CMW		
otherwise	☐ 400 FTC40x15E	☐ 401 FTC40x15E	☐ 110 USB LWL	☒ 482 Filter Matrix		
DC power	☒ 671 EA-3013S	☐ 457 EA 3013A	☐ 459 EA 2032-50	☐ 268 EA- 3050	☐ 494 AG6632A	☐ 498 NGPE
line voltage	☐ 230 V 50 Hz via public mains		☒ 060 120 V 60 Hz via PAS 5000			

5.9.2. Requirements/Limits

FCC		☐ Part 15 Subpart B. §15.109. class B ☒ Part 15 Subpart C. §15.209 @ frequencies defined in §15.205 ☒ Part 15.247 (d)	
ISED		☒ RSS-Gen.. Issue 4. Chapter 8.9. Table 4+6 (licence-exempt radio apparatus) ☐ RSS-Gen.. Issue 4. Chapter 7.1.2. Table 2 (receiver) ☐ ICES-003. Issue 6. Table 5 (Class B) ☒ RSS-247. Issue 2. Chapter 5	
ANSI		☐ C63.4-2014 ☒ C63.10-2013	
Limit	Frequency [MHz]	Radiated emissions limits. 3 meters	
		QUASI Peak [µV/m]	QUASI-Peak [dBµV/m]
	30 - 88	100	40.0
	88 - 216	150	43.5
	216 - 960	200	46.0
	above 960	500	54.0

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

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

5.9.4. Test condition and measurement test set-up

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

5.9.5. Radiated Field Strength Emissions – 30 MHz to 1 GHz Results

Radiated Field Strength Emissions – 30 MHz to 1 GHz

Temperature :+21 °C	Voltage Supply 3.6 V DC	Modulation : MSK	Frequency Hopping OFF

Diagram No. (Remark 1)	Carrier Channel		Channel Data Rate | Power	Set-up no.	OP-mode no.	Other Remarks	Used detector			Verdict
	Range	No.					PK	AV	QP	
RCM24G + PRESTTA Antenna										
3.01	Low	0	50 Kbps | +12 dBm	1	1	--	☒	☐	☒	**Pass**
3.02	High	69	100 Kbps | +12 dBm	1	1	--	☒	☐	☒	**Pass**
3.03	Low	0	250 Kbps | +12 dBm	1	1	--	☒	☐	☒	**Pass**
3.04	Middle	34	500 Kbps | +21dBm	1	1	--	☒	☐	☒	**Pass**
RCM24G + Intel FA5 Antenna Port 1										
3.11	Low	0	50 Kbps | +12 dBm	2	1	--	☒	☐	☒	**Pass**
3.12	High	69	100 Kbps | +12 dBm	2	1	--	☒	☐	☒	**Pass**
3.13	Low	0	250 Kbps | +12 dBm	2	1	--	☒	☐	☒	**Pass**
3.14	Middle	34	500 Kbps | +21dBm	2	1	--	☒	☐	☒	**Pass**
RCM24G + Intel FA5 Antenna Port 5										
3.21	Low	0	50 Kbps | +12 dBm	3	1	--	☒	☐	☒	**Pass**
3.22	High	69	100 Kbps | +12 dBm	3	1	--	☒	☐	☒	**Pass**
3.23	Low	0	250 Kbps | +12 dBm	3	1	--	☒	☐	☒	**Pass**
3.24	Middle	34	500 Kbps | +21dBm	3	1	--	☒	☐	☒	**Pass**

Remark 1: For further details please refer → Annex 1: Test results - **CETECOM_TR16-1-0190801T03a-A1**

5.10. General Limit - Radiated emissions. above 1 GHz

5.10.1. Test location and equipment FAR

test site	☐441 EMI SAR	☐348 EMI cond.	☒443 EMI FAR	☐347 Radio.lab.	☐337 OATS	☐
spectr. analys.	☐584 FSU	☐120 FSEM	☐264 FSEK	☒489 ESU 40	☐	☐
antenna meas	☐574 BTA-L	☐289 CBL 6141	☐608 HL 562	☒549 HL025	☒302 BBHA9170	☐477 GPS
antenna meas	☐123 HUF-Z2	☐132 HUF-Z3	☐030 HFH-Z2	☒376 BBHA9120E		☐
antenna subst	☐071 HUF-Z2	☐020 EMCO3115	☐063 LP 3146	☐303 BBHA9170	☐	☐
multimeter	☐341 Fluke 112	☐	☐	☐	☐	☐
signaling	☐392 MT8820A	☐371 CBT32	☐547 CMU	☐594 CMW		
DCpower	☒611 E3632A	☐087 EA3013	☐354 NGPE 40	☐349 car battery	☐350 Car battery	☐
line voltage	☐ 230 V 50 Hz via public mains		☒060 120 V 60 Hz via PAS 5000			

5.10.2. Requirements/Limits (CLASS B equipment)

FCC	☐ Part 15 Subpart B. §15.109 class B ☒ Part 15 Subpart C. §15.209 for frequencies defined in §15.205 ☒ Part 15.247 (d)			
ISED	☒ RSS-Gen.. Issue 4. Chapter 8.9. Table 4+6 (transmitter licence excempt) ☐ RSS-Gen.. Issue 4. Chapter 8.9. Table 2 (receiver) ☐ ICES-003. Issue 6. Chapter 6.2.2. Table 7 (class B) ☒ RSS-247. Issue 2. Chapter 5			
ANSI	☐ C63.4-2014 ☒ C63.10-2013			
Frequency [MHz]	Limits			
	AV [µV/m]	AV [dBµV/m]	Peak [µV/m]	Peak [dBµV/m] or [dBm/MHz]
above 1 GHz for frequencies as defined in §15.205 or RSS-Gen.. Issue 4. §8.10 - Table 6	500	54.0	5000	74.0 dBµV/m

5.10.3. Test condition and measurement test set-up

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

5.10.4. Radiated Field Strength Emissions – 1 GHz to 18 GHz Results

Radiated Field Strength Emissions – 1 GHz to 18 GHz										
Temperature :+21 °C			Voltage Supply 3.6 V DC		Modulation : MSK		Frequency Hopping OFF			
Diagram No. (Remark 1)	Carrier Channel		Channel Data Rate | Power	Set-up no.	OP-mode no.	Other Remarks	Used detector			Verdict
	Range	No.					PK	AV	QP	
RCM24G + PRESTTA Antenna										
4.01	Low	0	50 Kbps | +12 dBm	1	1	--	☒	☒	☐	**Pass**
4.02	High	69	100 Kbps | +12 dBm	1	1	--	☒	☒	☐	**Pass**
4.03	Low	0	250 Kbps | +12 dBm	1	1	--	☒	☒	☐	**Pass**
4.04	Middle	34	500 Kbps | +21dBm	1	1	--	☒	☒	☐	**Pass**
RCM24G + Intel FA5 Antenna Port 1										
4.11	Low	0	50 Kbps | +12 dBm	2	1	--	☒	☒	☐	**Pass**
4.12	High	69	100 Kbps | +12 dBm	2	1	--	☒	☒	☐	**Pass**
4.13	Low	0	250 Kbps | +12 dBm	2	1	--	☒	☒	☐	**Pass**
4.14	Middle	34	500 Kbps | +21dBm	2	1	--	☒	☒	☐	**Pass**
RCM24G + Intel FA5 Antenna Port 5										
4.21	Low	0	50 Kbps | +12 dBm	3	1	--	☒	☒	☐	**Pass**
4.22	High	69	100 Kbps | +12 dBm	3	1	--	☒	☒	☐	**Pass**
4.23	Low	0	250 Kbps | +12 dBm	3	1	--	☒	☒	☐	**Pass**
4.24	Middle	34	500 Kbps | +21dBm	3	1	--	☒	☒	☐	**Pass**
Remark 1: For further details please refer → Annex 1: Test results - **CETECOM_TR16-1-0190801T03a-A1**										

5.10.5. Radiated Field Strength Emissions – 18 GHz to 25 GHz Results

Radiated Field Strength Emissions – 18 GHz to 25 GHz										
Temperature :+21 °C			Voltage Supply 3.6 V DC		Modulation : MSK		Frequency Hopping OFF			
Diagram No. (Remark 1)	Carrier Channel		Channel Data Rate | Power	Set-up no.	OP-mode no.	Other Remarks	Used detector			Verdict
	Range	No.					PK	AV	QP	
RCM24G + PRESTTA Antenna										
4.01a	Low	0	50 Kbps | +12 dBm	1	1	--	☒	☒	☐	**Pass**
4.02a	High	69	100 Kbps | +12 dBm	1	1	--	☒	☒	☐	**Pass**
4.03a	Low	0	250 Kbps | +12 dBm	1	1	--	☒	☒	☐	**Pass**
4.04a	Middle	34	500 Kbps | +21dBm	1	1	--	☒	☒	☐	**Pass**
RCM24G + Intel FA5 Antenna Port 1										
4.11a	Low	0	50 Kbps | +12 dBm	2	1	--	☒	☒	☐	**Pass**
4.12a	High	69	100 Kbps | +12 dBm	2	1	--	☒	☒	☐	**Pass**
4.13a	Low	0	250 Kbps | +12 dBm	2	1	--	☒	☒	☐	**Pass**
4.14a	Middle	34	500 Kbps | +21dBm	2	1	--	☒	☒	☐	**Pass**
RCM24G + Intel FA5 Antenna Port 5										
4.21a	Low	0	50 Kbps | +12 dBm	3	1	--	☒	☒	☐	**Pass**
4.22a	High	69	100 Kbps | +12 dBm	3	1	--	☒	☒	☐	**Pass**
4.23a	Low	0	250 Kbps | +12 dBm	3	1	--	☒	☒	☐	**Pass**
4.24a	Middle	34	500 Kbps | +21dBm	3	1	--	☒	☒	☐	**Pass**
Remark 1: For further details please refer → Annex 1: Test results - **CETECOM_TR16-1-0190801T03a-A1**										

5.11. RF-Parameter - Radiated Band Edge compliance measurements

5.11.1. Test location and equipment FAR

test site	☐441 EMI SAR	☐348 EMI cond.	☒443 EMI FAR	☐347 Radio.lab.	☐337 OATS	☐
spectr. analys.	☐584 FSU	☐120 FSEM	☐264 FSEK	☒489 ESU 40	☐	☐
antenna meas	☐574 BTA-L	☐289 CBL 6141	☐608 HL 562	☒549 HL025	☒302 BBHA9170	☐477 GPS
antenna meas	☐123 HUF-Z2	☐132 HUF-Z3	☐030 HFH-Z2	☒376 BBHA9120E		☐
antenna subst	☐071 HUF-Z2	☐020 EMCO3115	☐063 LP 3146	☐303 BBHA9170	☐	☐
multimeter	☐341 Fluke 112	☐	☐	☐	☐	☐
signaling	☐392 MT8820A	☐371 CBT32	☐547 CMU	☐594 CMW		
DCpower	☒611 E3632A	☐087 EA3013	☐354 NGPE 40	☐349 car battery	☐350 Car battery	☐
line voltage	☐ 230 V 50 Hz via public mains		☒060 120 V 60 Hz via PAS 5000			

5.11.2. Requirements/Limits

FCC	☐ Part 15 Subpart B. §15.109 class B ☒ Part 15 subpart C. §15.209 @ frequencies defined in §15.205 ☒ Part 15.247 (d)
ISED	☒ RSS-247. Issue 2. Chapter 5 ☒ RSS-Gen: Issue 4: §8.9 Table 4+5+6
ANSI	☐ C63.4-2009 ☐ C63.4-2014 ☐ C63.10-2009 ☒ C63.10-2013. Chapter 6.10.6

5.11.3. Test condition and measurement test set-up

Signal ink to test system (if used):		☐ air link	☐ cable connection	☒ none
EUT-grounding		☒ none	☐ with power supply	☐ additional connection
Equipment set up		☒ table top 1.5m height		☐ floor standing
Climatic conditions		Temperature: (22±3°C)		Rel. humidity: (40±20)%
Spectrum-Analyzer settings	Scan frequency range: Scan-Mode Detector RBW/VBW Mode: Scan step Sweep-Time	☐ 1 – 18 GHz ☐ 18 – 25 GHz ☐ 18 – 40 GHz ☒ other: see diagrams ☐ 6 dB EMI-Receiver Mode ☒ 3 dB Spectrum analyser Mode Peak and Average Left band-edge: 100kHz/300kHz Right band-edge: 1 MHz / 3 MHz Repetitive-Scan. max-hold 40kHz or 400 kHz Coupled – calibrated display if CW signal otherwise adapted to EUT's individual duty-cycle		
General measurement procedures		Please see chapter "Test system set-up for radiated electric field measurements above 1 GHz" for general measurements procedures in anechoic chamber.		

5.11.4. Measurement Method

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

For critical results a Marker-Delta marker method was used for showing compliance to restricted bands. The method is according ANSI C63.10:2013. Chapter 6.10.6 "Marker-Delta method".. The method consists of three independent steps:

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

2. Step: Second step consist of finding the relative attenuation between the fundamental emission and the maximum local out-of-band emission (within 2 MHz range around the band edge either on the band-edge directly or some modulation product if the level is greater than that on the band-edge) when measured with lower resolution bandwidth.

3. Step: The delta value recorded in step 2 will be subtracted from value recorded in step 1. thus giving the required field strength at the band-edge. This value must fulfil the requirements for radiated spurious emissions in restricted bands in FCC §15.205 or RSS-Gen. Issue 4. Chapter 8.10. Table 6 with the general limits of FCC §15.209 or RSS-Gen. Issue 4 Chapter 8.9. Table 4.

5.11.5. EUT settings

The EUT was set in Hopping OFF as well as in Hopping ON modes with maximum power (if adjustable) according to applicants instructions.

5.11.6. Results: for non-restricted bands near-by

5.11.6.1. Non-restricted bands near-by - limits according FCC §15.247 and RSS-247. Issue 1. Chapter 5.5

Set-up No.:	1 + 2+3
Op. Mode:	2

Diagram No.	Channel No.	Restricted band ?	Fundamental Value [dBuV/m]		Peak-Value at Band-Edge [dBuV/m]	Difference [dB]	Limit [dBc]	Margin [dB]	Verdict	Remark: Data Rate | Channels | Hopping ?
			Peak-Value	Average-Value						
9.09a	Hopping	NO	103,367	102,132	68,885	34,482	20	14,482	PASS	500 Kbps | Ch 0-69 | Hopping ON (RCM24G + PRESTTA Antenna)
9.10a	Hopping	NO	106,51	101,386	68,9	37,605	20	17,605	PASS	250 Kbps | Ch 0-69 | Hopping ON (RCM24G + PRESTTA Antenna)

Diagram No.	Channel No.	Restricted band ?	Fundamental Value [dBuV/m]		Peak-Value at Band-Edge [dBuV/m]	Difference [dB]	Limit [dBc]	Margin [dB]	Verdict	Remark: Data Rate | Channels | Hopping ?
			Peak-Value	Average-Value						
9.19a	Hopping	NO	109,833	108,787	69,971	39,862	20	19,862	PASS	500 Kbps | Ch 0-69 | Hopping ON (RCM24G + Intel FA5 Antenna Port1)
9.20a	Hopping	NO	112,47	108,363	69,751	42,719	20	22,719	PASS	250 Kbps | Ch 0-69 | Hopping ON (RCM24G + Intel FA5 Antenna Port1)

Diagram No.	Channel No.	Restricted band ?	Fundamental Value [dBuV/m]		Peak-Value at Band-Edge [dBuV/m]	Difference [dB]	Limit [dBc]	Margin [dB]	Verdict	Remark: Data Rate | Channels | Hopping ?
			Peak-Value	Average-Value						
9.29a	Hopping	NO	115,337	114,141	69,731	45,606	20	25,606	PASS	500 Kbps | Ch 0-69 | Hopping ON (RCM24G + Intel FA5 Antenna Port5)
9.30a	Hopping	NO	113,71	112,003	68,959	44,751	20	24,751	PASS	250 Kbps | Ch 0-69 | Hopping ON (RCM24G + Intel FA5 Antenna Port5)

Remark 1: For further details please refer → Annex 1: Test results - **CETECOM_TR16-1-0190801T03a-A1**

Set-up No.:	1 + 2+3
Op. Mode:	1

Diagram No.	Channel No.	Restricted band ?	Fundamental Value [dBuV/m]		Peak-Value at Band-Edge [dBuV/m]	Difference [dB]	Limit [dBc]	Margin [dB]	Verdict	Remark: Data Rate | Power | Hopping ?
			Peak-Value	Average-Value						
9.01	0	NO	110,294	109,233	75,4	34,894	20	14,894	PASS	50 Kbps | +12 dBm | Hopping OFF (RCM24G + PRESTTA Antenna)
9.03	0	NO	108,728	106,896	73,292	35,436	20	15,436	PASS	100 Kbps | +12 dBm | Hopping OFF (RCM24G + PRESTTA Antenna)
9.05	0	NO	108,85	103,472	72,031	36,818	20	16,818	PASS	250 Kbps | +12 dBm | Hopping OFF (RCM24G + PRESTTA Antenna)
9.07	0	NO	109,41	102,046	72,076	37,334	20	17,334	PASS	500 Kbps | +12 dBm | Hopping OFF (RCM24G + PRESTTA Antenna)

Diagram No.	Channel No.	Restricted band ?	Fundamental Value [dBuV/m]		Peak-Value at Band-Edge [dBuV/m]	Difference [dB]	Limit [dBc]	Margin [dB]	Verdict	Remark: Data Rate | Power | Hopping ?
			Peak-Value	Average-Value						
9.11	0	NO	108,821	107,721	74,1	34,721	20	14,721	PASS	50 Kbps | +12 dBm | Hopping OFF (RCM24G + Intel FA5 Antenna Port1)
9.13	0	NO	108,171	106,308	73,577	34,594	20	14,594	PASS	100 Kbps | +12 dBm | Hopping OFF (RCM24G + Intel FA5 Antenna Port1)
9.15	0	NO	109,204	103,568	72,8	36,404	20	16,404	PASS	250 Kbps| +12 dBm | Hopping OFF RCM24G + Intel FA5 Antenna Port1)
9.17	0	NO	109,014	101,557	71,794	37,22	20	17,22	PASS	500 Kbps | +12 dBm | Hopping OFF (RCM24G + Intel FA5 Antenna Port1)

Diagram No.	Channel No.	Restricted band ?	Fundamental Value [dBuV/m]		Peak-Value at Band-Edge [dBuV/m]	Difference [dB]	Limit [dBc]	Margin [dB]	Verdict	Remark: Data Rate | Power | Hopping ?
			Peak-Value	Average-Value						
9.21	0	NO	111,183	110,026	66,3	44,883	20	24,883	PASS	50 Kbps | +12 dBm | Hopping OFF (RCM24G + Intel FA5 Antenna Port5)
9.23	0	NO	110,373	108,565	75,433	34,94	20	14,94	PASS	100 Kbps | +12 dBm | Hopping OFF (RCM24G + Intel FA5 Antenna Port5)
9.25	0	NO	111,017	106,223	75,4	35,617	20	15,617	PASS	250 Kbps | +12 dBm | Hopping OFF RCM24G + Intel FA5 Antenna Port5)
9.27	0	NO	111,284	104,089	73,824	37,46	20	17,46	PASS	500 Kbps | +12 dBm | Hopping OFF (RCM24G + Intel FA5 Antenna Port5)

Remark 1: For further details please refer → Annex 1: Test results - **CETECOM_TR16-1-0190801T03a-A1**

5.11.6.2. Restricted bands near-by
(§15.205 with limits accord. FCC §15.209) and (RSS-Gen. Issue4. Chapter 8.10)

Set-up No.:	1 + 2+3
Op. Mode:	2

Diagram No.	Channel no.	Restricted band ?	Fundamental Value [dBuV/m]		Value at Band-Edge [dBuV/m]		Limits [dBuV/m]		Margin [dB]		Verdict	Remark:
			Peak-Value	Average-Value	Peak -Value	Average -Value	Peak -Value	Average -Value	Peak	Average		Data Rate | Channels | Hopping ?
9.09b	Hopping	YES	--	--	67,55	45,901	74	54	6,45	8,099	PASS	500 Kbps | Ch 0-69 | Hopping ON (RCM24G + PRESTTA Antenna)
9.10b	Hopping	YES	--	--	67,6	48,634	74	54	6,4	5,366	PASS	250 Kbps | Ch 0-69 | Hopping ON (RCM24G + PRESTTA Antenna)

Diagram No.	Channel no.	Restricted band ?	Fundamental Value [dBuV/m]		Value at Band-Edge [dBuV/m]		Limits [dBuV/m]		Margin [dB]		Verdict	Remark:
			Peak-Value	Average-Value	Peak -Value	Average -Value	Peak -Value	Average -Value	Peak	Average		Data Rate | Channels | Hopping ?
9.19b	Hopping	YES	--	--	52,693	41,135	74	54	21,307	12,87	PASS	500 Kbps | Ch 0-69 | Hopping ON (RCM24G + Intel FA5 Antenna Port1)
9.20b	Hopping	YES	--	--	52,859	41,136	74	54	21,141	12,86	PASS	250 Kbps | Ch 0-69 | Hopping ON (RCM24G + Intel FA5 Antenna Port1)

Diagram No.	Channel no.	Restricted band ?	Fundamental Value [dBuV/m]		Value at Band-Edge [dBuV/m]		Limits [dBuV/m]		Margin [dB]		Verdict	Remark:
			Peak-Value	Average-Value	Peak -Value	Average -Value	Peak -Value	Average -Value	Peak	Average		Data Rate | Channels | Hopping ?
9.29b	Hopping	YES	--	--	66,3	48,117	74	54	7,7	5,883	PASS	500 Kbps | Ch 0-69 | Hopping ON (RCM24G + Intel FA5 Antenna Port5)
9.30b	Hopping	YES	--	--	52,992	41,158	74	54	21,008	12,84	PASS	250 Kbps | Ch 0-69 | Hopping ON (RCM24G + Intel FA5 Antenna Port5)

Remark 1: For further details please refer → Annex 1: Test results - **CETECOM_TR16-1-0190801T03a-A1**
Remark 2: No Duty-cycle correction factors are necessary

Set-up No.:	1 + 2+3
Op. Mode:	1

Diagram No.	Channel no.	Restricted band ?	Fundamental Value [dBuV/m]		Value at Band-Edge [dBuV/m]		Limits [dBuV/m]		Margin [dB]		Verdict	Remark: Data Rate | Power | Hopping ?
			Peak-Value	Average-Value	Peak -Value	Average -Value	Peak -Value	Average -Value	Peak	Average		
9.02	69	YES	--	--	53,4	42,426	74	54	20,6	11,57	PASS	50 Kbps | +21 dBm | Hopping OFF (RCM24G + PRESTTA Antenna)
9.04	69	YES	--	--	53,453	42,256	74	54	20,55	11,74	PASS	100 Kbps | +21 dBm | Hopping OFF (RCM24G + PRESTTA Antenna)
9.06	69	YES	--	--	54,028	42,455	74	54	19,97	11,55	PASS	250 Kbps | +21 dBm | Hopping OFF (RCM24G + PRESTTA Antenna)
9.08	69	YES	--	--	53,3	42,416	74	54	20,7	11,58	PASS	500 Kbps | +21 dBm | Hopping OFF (RCM24G + PRESTTA Antenna)

Diagram No.	Channel no.	Restricted band ?	Fundamental Value [dBuV/m]		Value at Band-Edge [dBuV/m]		Limits [dBuV/m]		Margin [dB]		Verdict	Remark: Data Rate | Power | Hopping ?
			Peak-Value	Average-Value	Peak -Value	Average -Value	Peak -Value	Average -Value	Peak	Average		
9.12	69	YES	--	--	52,639	41,185	74	54	21,361	12,82	PASS	50 Kbps | +12 dBm | Hopping OFF (RCM24G + Intel FA5 Antenna Port1)
9.14	69	YES	--	--	53,272	41,6	74	54	20,728	12,4	PASS	100 Kbps | +12 dBm | Hopping OFF (RCM24G + Intel FA5 Antenna Port1)
9.16	69	YES	--	--	53,3	41,1	74	54	20,7	12,9	PASS	250 Kbps | +12 dBm | Hopping OFF RCM24G + Intel FA5 Antenna Port1)
9.18	69	YES	--	--	53,021	41,121	74	54	20,979	12,88	PASS	500 Kbps | +12 dBm | Hopping OFF (RCM24G + Intel FA5 Antenna Port1)

Diagram No.	Channel no.	Restricted band ?	Fundamental Value [dBuV/m]		Value at Band-Edge [dBuV/m]		Limits [dBuV/m]		Margin [dB]		Verdict	Remark: Data Rate | Power | Hopping ?
			Peak-Value	Average-Value	Peak -Value	Average -Value	Peak -Value	Average -Value	Peak	Average		
9.22	69	YES	--	--	57,122	46,644	74	54	16,88	7,356	PASS	50 Kbps | +12 dBm | Hopping OFF (RCM24G + Intel FA5 Antenna Port5)
9.24	69	YES	--	--	56,728	46,684	74	54	17,27	7,316	PASS	100 Kbps | +12 dBm | Hopping OFF (RCM24G + Intel FA5 Antenna Port5)
9.26	69	YES	--	--	57,042	46,488	74	54	16,96	7,512	PASS	250 Kbps | +12 dBm | Hopping OFF RCM24G + Intel FA5 Antenna Port5)
9.28	69	YES	--	--	57,2	46,453	74	54	16,8	7,547	PASS	500 Kbps | +12 dBm | Hopping OFF (RCM24G + Intel FA5 Antenna Port5)

Remark 1: For further details please refer → Annex 1: Test results - **CETECOM_TR16-1-0190801T03a-A1**
Remark 2: No Duty-cycle correction factors are necessary

5.12. Measurement uncertainties

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

Following table shows expectable uncertainties for each measurement type performed.

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

Table: measurement uncertainties. valid for conducted/radiated measurements

6. Abbreviations used in this report

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

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

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

8. Instruments and Ancillary

21. Jun. 16
TC"
The "Ref.-No" in the left column of the following tables allows the clear identification of the laboratory equipment.

8.1.1. Test software and firmware of equipment

Ref.-No.	Equipment	Type	Serial-No.	Version of Firmware or Software during the test
001	EMI Test Receiver	ESS	825132/017	Firm.= 1.21 . OTP=2.0. GRA=2.0
012	Signal Generator (EMS-cond.)	SMY 01	839069/027	Firm.= V 2.02
013	Power Meter (EMS cond.)	NRVD	839111/003	Firm.= V 1.51
017	Digital Radiocommunication Tester	CMD 60 M	844365/014	Firmware = V 3.52 .22.01.99. DECT = D2.87 13.01.99
053	Audio Analyzer	UPA3	860612/022	Firm. V 4.3
119	RT Harmonics Analyzer dig. Flickermeter	B10	G60547	Firm.= V 3.1DHG
140	Signal Generator	SMHU	831314/006	Firm.= 3.21
261	Thermal Power Sensor	NRV-Z55	825083/0008	EPROM-Datum 02.12.04. SE EE 1 B
262	Power Meter	NRV-S	825770/0010	Firm.= 2.6
263	Signal Generator	SMP 04	826190/0007	Firm.=3.21
295	Racal Digital Radio Test Set	6103	1572	UNIT Firmware= 4.04. SW-Main=4.04. SW-BBP=1.04. SW-DSP=1.02. Hardboot=1.02. Softboot=2.02
298	Univ. Radio Communication Tester	CMU 200	832221/091	R&S Test Firmware =3.53 /3.54 (current Testsoftw. f. all band used
323	Digital Radiocommunication Tester	CMD 55	825878/0034	Firm.= 3.52 .22.01.99
335	CTC-EMS-Conducted	System EMS Conducted	-	EMC 32 V 8.52
340	Digital Radiocommunication Tester	CMD 55	849709/037	Firm.= 3.52 .22.01.99
355	Power Meter	URV 5	891310/027	Firm.= 1.31
365	10V Insertion Unit 50 Ohm	URV5-Z2	100880	Eprom Data = 31.03.08
366	Ultra Compact Simulator	UCS 500 M4	V0531100594	Firm. UCS 500=001925/3.06a02. rc=ISMIEC 4.10
371	Bluetooth Tester	CBT32	100153	CBT V5.30+ SW-Option K55. K57
377	EMI Test Receiver	ESCS 30	100160	Firm.= 2.30. OTP= 02.01. GRA= 02.36
378	Broadband RF Field Monitor	RadiSense III	03D00013SNO-08	Firm.= V.03D13
389	Digital Multimeter	Keithley 2000	0583926	Firm. = A13 (Mainboard) A02 (Display)
392	Radio Communication Tester	MT8820A	6K00000788	Firm.= 4.50 #005. IPL=4.01#001.OS=4.02#001. GSM=4.41#013. W-CDMA= 4.54#004. scenario= 4.52#002
436	Univ. Radio Communication Tester	CMU 200	103083	R&S Test Firmware Base=5.14. Mess-Software= GSM:5.14 WCDMA:5.14 (current Testsoftw. F. all band
441	CTC-SAR-EMI Cable Loss	System EMI field (SAR)	-	EMC 32 Version 8.52
442	CTC-SAR-EMS	System EMS field (SAR)	-	EMC 32 Version 8.40
443	CTC-FAR-EMI-RSE	System CTC-FAR-EMI-RSE	-	Spuri 7.2.5 or EMC 32 Ver. 9.15.00
444	CTC-FAR-EMS field	System-EMS-Field (FAR)	-	EMC 32 Version 9.15.00
460	Univ. Radio Communication Tester	CMU 200	108901	R&S Test Firmware Base=5.14. GSM=5.14 WCDMA=5.14 (current Testsoftw..f. all band to be used.
489	EMI Test Receiver	ESU40	1000-30	Firmware=4.43 SP3. Bios=V5.1-16-3. Spec. =01.00
491	ESD Simulator dito	ESD dito	dito307022	V 2.30
524	Voltage Drop Simulator	VDS 200	0196-16	Software Nr: 000037 Version V4.20a01
526	Burst Generator	EFT 200 A	0496-06	Software Nr. 000034 Version V2.32
527	Micro Pulse Generator	MPG 200 B	0496-05	Software-Nr. 000030 Version V2.43
528	Load Dump Simulator	LD 200B	0496-06	Software-Nr. 000031 Version V2.35a01
546	Univ. Radio Communication Tester	CMU 200	106436	R&S Test Firmware Base=5.14. GSM=5.14 WCDMA=5.14 (current Testsoftw..f. all band to be used
547	Univ. Radio Communication Tester	CMU 200	835390/014	R&S Test Firmware Base=V5.1403 (current Testsoftw.. f. all band used. GSM = 5.14 WCDMA: = 5.14
584	Spectrum Analyzer	FSU 8	100248	2.82_SP3
597	Univ. Radio Communication Tester	CMU 200	100347	R&S Test Firmware Base=5.01. GSM=5.02 WCDMA= not installed. Mainboard= µP1=V.850
598	Spectrum Analyzer	FSEM 30 (Reserve)	831259/013	Firmware Bios 3.40 . Analyzer 3.40 Sp 2
620	EMI Test Receiver	ESU 26	100362	4.43_SP3
642	Wideband Radio Communication Tester	CMW 500	126089	Setup V03.26. Test programm component V03.02.20
670	Univ. Radio Communication Tester	CMU 200	106833	µP1 =V8.50. Firmware = V.20
689	Vector Signal Generator	SMU200	100970	02.20.360.142
692	Bluetooth Tester	CBT 32	100236	CBT V 5.40. FW: V.2.41 (FPGA Digital. V. 3.09 FPGA RF)

8.1.2. Single instruments and test systems

Ref.-No.	Equipment	Type	Serial-No.	Manufacturer	Interval of calibration	Remark	Cal due
001	EMI Test Receiver	ESS	825132/017	Rohde & Schwarz	12 M	-	30.05.2017
005	AC - LISN (50 Ohm/50µH, test site 1)	ESH2-Z5	861741/005	Rohde & Schwarz	12 M	-	30.05.2017
007	Single-Line V-Network (50 Ohm/5µH)	ESH3-Z6	892563/002	Rohde & Schwarz	12 M	-	30.05.2017
009	Power Meter (EMS-radiated)	NRV	863056/017	Rohde & Schwarz	24 M	-	30.04.2017
016	Line Impedance Simulating Network	Op. 24-D	B6366	Spitzenberger+Spies	36 M	-	30.05.2019
020	Horn Antenna 18 GHz (Subst 1)	3115	9107-3699	EMCO	36/12 M	-	31.03.2017
021	Loop Antenna (H-Field)	6502	9206-2770	EMCO	36 M	-	30.04.2018
030	Loop Antenna (H-field)	HFH-Z2	879604/026	Rohde & Schwarz	36 M	-	30.04.2018
033	RF-current probe (100kHz-30MHz)	ESH2-Z1	879581/18	Rohde & Schwarz	24 M	-	30.04.2017
057	relay-switch-unit (EMS system)	RSU	494440/002	Rohde & Schwarz	pre-m	1a	
060	power amplifier (DC-2kHz)	PAS 5000	B6363	Spitzenberger+Spies	-	3	
066	notch filter (WCDMA; FDD1)	WRCT 1900/2200-5/40-10EEK	5	Wainwright GmbH	12 M	1g	30.06.2017
086	DC - power supply, 0 -10 A	LNG 50-10	-	Heinzinger Electronic	pre-m	2	
087	DC - power supply, 0 -5 A	EA-3013 S	-	Elektro Automatik	pre-m	2	
091	USB-LWL-Converter	OLS-1	007/2006	Ing. Büro Scheiba	-	4	
099	passive voltage probe	ESH2-Z3	299.7810.52	Rohde & Schwarz	36 M	-	30.04.2018
100	passive voltage probe	Probe TK 9416	without	Schwarzbeck	36 M	-	30.04.2018
110	USB-LWL-Converter	OLS-1	-	Ing. Büro Scheiba	-	4	
119	RT Harmonics Analyzer dig. Flickermeter	B10	G60547	BOCONSULT	36 M	-	30.05.2019
136	adjustable dipole antenna (Dipole 1)	3121C-DB4	9105-0697	EMCO	36 M	-	30.04.2018
140	Signal Generator	SMHU	831314/006	Rohde & Schwarz	24 M	-	30.05.2018
248	attenuator	SMA 6dB 2W	-	Radiall	pre-m	2	
249	attenuator	SMA 10dB 10W	-	Radiall	pre-m	2	
252	attenuator	N 6dB 12W	-	Radiall	pre-m	2	
256	attenuator	SMA 3dB 2W	-	Radiall	pre-m	2	
257	hybrid	4031C	04491	Narda	pre-m	2	
260	hybrid coupler	4032C	11342	Narda	pre-m	2	
261	Thermal Power Sensor	NRV-Z55	825083/0008	Rohde & Schwarz	24 M	-	30.05.2018
262	Power Meter	NRV-S	825770/0010	Rohde & Schwarz	24 M	-	30.05.2018
263	Signal Generator	SMP 04	826190/0007	Rohde & Schwarz	36 M	-	30.05.2019
265	peak power sensor	NRV-Z33, Model 04	840414/009	Rohde & Schwarz	24 M	-	30.05.2018
266	Peak Power Sensor	NRV-Z31, Model 04	843383/016	Rohde & Schwarz	24 M	-	30.05.2018
267	notch filter GSM 850	WRCA 800/960-6EEK	9	Wainwright GmbH	pre-m	2	
270	termination	1418 N	BB6935	Weinschel	pre-m	2	
271	termination	1418 N	BE6384	Weinschel	pre-m	2	
272	attenuator (20 dB) 50 W	Model 47	BF6239	Weinschel	pre-m	2	
273	attenuator (10 dB) 100 W	Model 48	BF9229	Weinschel	pre-m	2	
274	attenuator (10 dB) 50 W	Model 47 (10 dB) 50 W	BG0321	Weinschel	pre-m	2	
275	DC-Block	Model 7003 (N)	C5129	Weinschel	pre-m	2	
276	DC-Block	Model 7006 (SMA)	C7061	Weinschel	pre-m	2	
279	power divider	1515 (SMA)	LH855	Weinschel	pre-m	2	
287	pre-amplifier 25MHz - 4GHz	AMF-2D-100M4G-35-10P	379418	Miteq	12 M	1c	30.06.2017
291	high pass filter GSM 850/900	WHJ 2200-4EE	14	Wainwright GmbH	12 M	1c	30.06.2017
298	Univ. Radio Communication Tester	CMU 200	832221/091	Rohde & Schwarz	pre-m	3	
300	AC LISN (50 Ohm/50µH, 1-phase)	ESH3-Z5	892 239/020	Rohde & Schwarz	12 M	-	30.05.2017
301	attenuator (20 dB) 50W, 18GHz	47-20-33	AW0272	Lucas Weinschel	pre-m	2	
302	horn antenna 40 GHz (Meas 1)	BBHA9170	155	Schwarzbeck	36 M	-	31.03.2017
303	horn antenna 40 GHz (Subst 1)	BBHA9170	156	Schwarzbeck	36 M	-	31.03.2017
331	Climatic Test Chamber -40/+80 Grad	HC 4055	43146	Heraeus Vötsch	24 M	-	30.10.2018
341	Digital Multimeter	Fluke 112	81650455	Fluke	24 M	-	30.05.2018
342	Digital Multimeter	Voltcraft M-4660A	IB 255466	Voltcraft	24 M	-	30.04.2017
347	laboratory site	radio lab.	-	-	-	5	
348	laboratory site	EMI conducted	-	-	-	5	
354	DC - Power Supply 40A	NGPE 40/40	448	Rohde & Schwarz	pre-m	2	
355	Power Meter	URV 5	891310/027	Rohde & Schwarz	24 M	-	30.05.2018
357	power sensor	NRV-Z1	861761/002	Rohde & Schwarz	24 M	-	30.04.2017
371	Bluetooth Tester	CBT32	100153	R&S	36 M	-	30.05.2019
373	Single-Line V-Network (50 Ohm/5µH)	ESH3-Z6	100535	Rohde & Schwarz	12 M	-	30.05.2017
377	EMI Test Receiver	ESCS 30	100160	Rohde & Schwarz	12 M	-	30.05.2017
389	Digital Multimeter	Keithley 2000	0583926	Keithley	24 M	-	30.04.2017
392	Radio Communication Tester	MT8820A	6K00000788	Anritsu	12 M	-	30.05.2017
431	Model 7405	Near-Field Probe Set	9305-2457	EMCO	-	4	
436	Univ. Radio Communication Tester	CMU 200	103083	Rohde & Schwarz	12 M	-	30.04.2017
439	UltraLog-Antenna	HL 562	100248	Rohde & Schwarz	36 M	-	31.03.2017
441	CTC-SAR-EMI Cable Loss	System EMI field (SAR) Cable	-	CETECOM	12 M	5	05.06.2017
443	CTC-FAR-EMI-RSE	System CTC-FAR-EMI-RSE	-	ETS-Lindgren / CETECOM	12 M	5	30.06.2017
448	notch filter WCDMA_FDD II	WRCT 1850.0/2170.0-5/40-	5	Wainwright Instruments GmbH	12 M	1c	30.06.2017

Ref.-No.	Equipment	Type	Serial-No.	Manufacturer	Interval of calibration	Remark	Cal due
449	notch filter WCDMA FDD V	WRCT 824.0/894.0-5/40-8SSK	1	Wainwright	12 M	1c	30.06.2017
454	Oscilloscope	HM 205-3	9210 P 29661	Hameg	-	4	
456	DC-Power supply 0-5 A	EA 3013 S	207810	Elektro Automatik	pre-m	2	
459	DC -Power supply 0-5 A , 0-32 V	EA-PS 2032-50	910722	Elektro Automatik	pre-m	2	
460	Univ. Radio Communication Tester	CMU 200	108901	Rohde & Schwarz	12 M	-	30.04.2017
463	Universal source	HP3245A	2831A03472	Agilent	-	4	
466	Digital Multimeter	Fluke 112	89210157	Fluke USA	24 M	-	30.05.2018
467	Digital Multimeter	Fluke 112	89680306	Fluke USA	36 M	-	30.04.2018
468	Digital Multimeter	Fluke 112	90090455	Fluke USA	36 M	-	30.04.2018
477	ReRadiating GPS-System	AS-47	-	Automotive Cons. Fink	-	3	
480	power meter (Fula)	NRVS	838392/031	Rohde & Schwarz	24 M	-	30.04.2017
482	filter matrix	Filter matrix SAR 1	-	CETECOM (Brl)	-	1d	
484	pre-amplifier 2,5 - 18 GHz	AMF-5D-02501800-25-10P	1244554	Miteq	12 M	-	30.07.2017
487	System CTC NSA-Verification SAR-EMI	System EMI field (SAR) NSA	-	ETS Lindgren / CETECOM	24 M	-	31.07.2017
489	EMI Test Receiver	ESU40	1000-30	Rohde & Schwarz	12 M	-	30.05.2017
502	band reject filter	WRCG 1709/1786-1699/1796-	SN 9	Wainwright	pre-m	2	
503	band reject filter	WRCG 824/849-814/859-	SN 5	Wainwright	pre-m	2	
512	notch filter GSM 850	WRCA 800/960-02/40-6EEK	SN 24	Wainwrght	12 M	1c	30.06.2017
517	relais switch matrix	HF Relais Box Keithley	SE 04	Keithley	pre-m	2	
523	Digital Multimeter	L4411A	MY46000154	Agilent	24 M	-	30.04.2017
529	6 dB Broadband resistive power divider	Model 1515	LH 855	Weinschel	pre-m	2	
530	10 dB Broadband resistive power divider	R 416110000	LOT 9828	-	pre-m	2	
546	Univ. Radio Communication Tester	CMU 200	106436	R&S	12 M	-	30.05.2017
547	Univ. Radio Communication Tester	CMU 200	835390/014	Rohde & Schwarz	12 M	-	30.04.2017
549	Log.Per-Antenna	HL025	1000060	Rohde & Schwarz	36/12 M	-	31.07.2018
550	System CTC S-VSWR Verification SAR-EMI	System EMI Field SAR S-VSWR	-	ETS Lindgren/CETECOM	24 M	-	31.07.2017
552	high pass filter 2,8-18GHz	WHKX 2.8/18G-10SS	4	Wainwright	12 M	1c	30.06.2017
557	System CTC-OTA-2	R&S TS8991	-	Rohde & Schwarz	12 M	5	30.09.2016
558	System CTC FAR S-VSWR	System CTC FAR S-VSWR	-	CTC	24 M	-	31.07.2017
574	Biconilog Hybrid Antenna	BTA-L	980026L	Frankonia	36/12 M	-	31.03.2019
584	Spectrum Analyzer	FSU 8	100248	Rohde & Schwarz	pre-m	-	
594	Wideband Radio Communication Tester	CMW 500	101757	Rohde & Schwarz	12 M	-	30.04.2017
597	Univ. Radio Communication Tester	CMU 200	100347	Rohde & Schwarz	pre-m	-	
598	Spectrum Analyzer	FSEM 30 (Reserve)	831259/013	Rohde & Schwarz	24 M	-	30.04.2017
600	power meter	NRVD (Reserve)	834501/018	Rohde & Schwarz	24 M	-	30.04.2017
601	medium-sensitivity diode sensor	NRV-Z5 (Reserve)	8435323/003	Rohde & Schwarz	24 M	-	30.04.2017
602	peak power sensor	NRV-Z32 (Reserve)	835080	Rohde & Schwarz	24 M	-	
611	DC power supply	E3632A	KR 75305854	Agilent	pre-m	2	
612	DC power supply	E3632A	MY 40001321	Agilent	pre-m	2	
613	Attenuator	R416120000 20dB 10W	Lot. 9828	Radiall	pre-m	2	
616	Digital multimeter	Fluke 177	88900339	Fluke	24 M	-	30.05.2018
617	Power Splitter/Combiner	ZFSC-2-2-S+	S F987001108	Mini Circuits	-	2	
618	Power Splitter/Combiner	50PD-634	600994	JFW Industries USA	-	2	
619	Power Splitter/Combiner	50PD-634	600995	JFW Industries, USA	-	3	
620	EMI Test Receiver	ESU 26	100362	Rohde-Schwarz	12 M	-	30.05.2017
621	Step Attenuator 0-139 dB	RSP	100017	Rohde & Schwarz	pre-m	2	
625	Generic Test Load USB	Generic Test Load USB	-	CETECOM	-	2	
627	data logger	OPUS 1	201.0999.9302.6.4.1.43	G. Lufft GmbH	24 M	-	30.04.2017
634	Spectrum Analyzer	FSM (HF-Unit)	826188/010	Rohde & Schwarz	pre-m	2	
637	High Speed HDMI with Ethernet 1m	HDMI cable with Ethernet 1m	-	KogiLink	-	2	
638	HDMI Kabel with Ethernet 1,5 m flach	HDMI cable with Ethernet	-	Reichelt	-	2	
640	HDMI cable 2m rund	HDMI cable 2m rund	-	Reichelt	-	2	
641	HDMI cable with Ethernet	Certified HDMI cable with	-	PureLink	-	2	
642	Wideband Radio Communication Tester	CMW 500	126089	Rohde&Schwarz	12 M	-	07.07.2017
644	Amplifier	ZX60-2534M+	SN865701299	Mini-Circuits	-	-	
670	Univ. Radio Communication Tester	CMU 200	106833	Rohde & Schwarz	24 M	-	30.05.2018
671	DC-power supply 0-5 A	EA-3013S	-	Elektro Automatik	pre-m	2	
678	Power Meter	NRP	101638	Rohde&Schwarz	pre-m	-	
683	Spectrum Analyzer	FSU 26	200571	Rohde & Schwarz	12 M	-	30.05.2017
686	Field Analyzer	EHP-200A	160WX30702	Narda Safety Test Solutions	24 M	-	30.04.2017
687	Signal Generator	SMF 100A	102073	Rohde&Schwarz	12 M	-	30.05.2017
688	Pre Amp	JS-18004000-40-8P	1750117	Miteq	pre-m	-	
690	Spectrum Analyzer	FSU	100302/026	Rohde&Schwarz	12 M	-	30.05.2017

Ref.-No.	Equipment	Type	Serial-No.	Manufacturer	Interval of calibration	Remark	Cal due
692	Bluetooth Tester	CBT 32	100236	Rohde & Schwarz	36 M	-	31.03.2017
693	TS8997	CTC-Radio Lab 1_TS8997	-	Rohde&Schwarz	12 M	5	06.06.2017
697	Power Splitter	ZN4PD-642W-S+	165001445	Mini-Circuits	-	2	
701	CMW500 wide. Radio Comm.	CMW500	158150	Rohde & Schwarz	12 M	-	01.05.2017
703	INNCO Antennen Mast	MA 4010-KT080-XPET-ZSS3	MA4170-KT100-XPET-	INNCO	pre-m	-	
704	INNCON Controller	CO 3000-4port	CO3000/933/38410516/L	INNCO Systems GmBh	pre-m	-	

8.1.3. Legend

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

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

9. Versions of test reports (change history)

Version	Applied changes	Date of release
--	Inital release	2017-04-11
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