PARTIAL Test Report
18-1-0173201T48a-C3

Number of pages:	24	**Date of Report:**	2020-Jan-05
Testing company:	CETECOM GmbH Im Teelbruch 116 45219 Essen Germany Tel. + 49 (0) 20 54 / 95 19-0 Fax: + 49 (0) 20 54 / 95 19-150	**Applicant:**	Actia Nordic AB
Test Object / Tested Device(s):	Telematics Device / 103250101		
FCC ID:	2AGKK103250101		
Testing has been carried out in accordance with:	**Title 47 CFR, Chapter I** **FCC Regulations, Subchapter B** **Part 22 Subpart H, Part 24 Subpart E, Part 27 Subpart C** Deviations, modifications or clarifications (if any) to above mentioned documents are written in each section under "Test method and limit".		
Tested Technology:	UTRA FDD (W-CDMA)		
Test Results:	**☒ The EUT complies with the requirements in respect of selected parameters subject to the test.** The test results relate only to devices specified in this document		
	The current version of the Test Report CETECOM_TR18_1_0173201T48a_C3 replaces the Test Report CETECOM_TR18_1_0173201T48a_C2 dated 2020-Dec-21. The replaced test report is herewith invalid.		

Signatures:

Ninovic Perez
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Digital unterschrieben von B.Sc. Mohamed Ahmed
DN: cn=B.Sc. Mohamed Ahmed, o=Cetecom GmbH, ou=RC/EMC, email=mohamed.ahmed@cetecom.com, c=DE
Datum: 2021.01.07 11:26:56 +01'00'

Dipl.-Ing. Ninovic Perez	B.Sc. Mohamed Ahmed
Test Lab Manager	Test manager
Authorization of test report	Responsible of test report

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1 General information

1.1 Disclaimer and Notes

The test results of this test report relate exclusively to the test item specified in this test report as specified in chapter 2.7. CETECOM does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.
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Also we refer on special conditions which the applicant should fulfill according §2.927 to §2.948, special focus regarding modification of the equipment and availability of sample equipment for market surveillance tests.

1.1. Summary of Test Results

Test case in W-CDMA2	Reference Clause FCC ☒	Reference Clause ISED ☐	Page	Remark	Result
AC-Power Lines Conducted Emissions	§15.207(a)	RSS-Gen, Issue 5:§8.8	--	NA	--
Conducted RF output power	§2.1046(a)	RSS-133:4.1/6.4 + SRSP-510:5.1.2	13	--	PASSED
Radiated RF output power	§24.232(c), §2.1046(a)	RSS-133:6.4 + SRSP-510:5.1.2	--	NP	--
Occupied Channel Bandwidth 99%	§24.238(b), §2.1049(h)	RSS-Gen, Issue 5:§6.6	--	NP	*1)
26dB Emission bandwidth	§24.238(b), §2.1049(h)	RSS-Gen, Issue 5:§6.6	--	NP	*1)
Radiated Band Edge	§24.238(a)(b), §2.1053(a), §2.1057(a)	RSS-133, Issue 6: §6.5.1(i)(ii)	21	--	PASSED
Conducted RF Band Edge	§24.238(a)(b), §2.1051	RSS-133, Issue 6: §6.5.1(i)(ii)	--	NP	*1)
Peak to Average ratio (PAPR)	§2.1046(a)	RSS-133:4.1/6.4 + SRSP-510:5.1.2	14	--	PASSED
Radiated field strength emissions below 30 MHz	§15.205, §15.209	RSS-Gen: Issue 5: §8.9 Table 6	18	--	PASSED
Spurious emissions at antenna terminals	§24.238(a)(b), §2.1051	RSS-133, Issue 6: §6.5.1(i)(ii)	--	NP	*1)
Radiated spurious emissions	§24.238(a)(b), §2.1053(a)	RSS-133, Issue 6: §6.5.1(i)(ii)	20	--	PASSED
Frequency stability, temperature variation	§24.235, §2.1055(a)(1)	RSS-133: 6.3	--	NP	*1)
Frequency stability, voltage variation	§15.207(a)	RSS-Gen, Issue 5:§8.8	--	NP	*1)
Test case in W-CDMA4	**Reference Clause FCC**	**Reference Clause ISED**	**Page**	**Remark**	**Result**
AC-Power Lines Conducted Emissions	§15.207(a)	RSS-Gen, Issue 5:§8.8	--	NA	
Conducted RF output power	§27.50(d)(4), §2.1046	RSS-139, Issue 3:§6.5	13	--	PASSED
Radiated RF output power	§27.50(d)(4), §2.1046(a)	RSS-139, Issue 3: 6.5 + SRSP-513	--	NP	--
Occupied Channel Bandwidth 99%	§27.53(h)(3), §2.202(a)	RSS-Gen, Issue 5:§6.6	--	NP	*1)
26dB Emission bandwidth	§27.53(h)(3), §2.202(a)	RSS-Gen, Issue 5:§6.6	--	NP	*1)
Radiated Band Edge	§27.53(h), §2.1053(a) §2.1057(a)	RSS-139, Issue 3: 6.6 (i)(ii)	21	--	PASSED
Conducted RF Band Edge	§27.53(h), §2.1051	RSS-139, Issue 3: §6.6 (i)(ii)	--	NP	*1)
Peak to Average ratio (PAPR)	§27.50(d)(4), §2.1046	RSS-139, Issue 3:§6.5	14	--	PASSED
Radiated field strength emissions below 30 MHz	§15.205, §15.209	RSS-Gen: Issue 5: §8.9 Table 6	18	--	PASSED
Spurious emissions at antenna terminals	§27.53(h), §2.1051	RSS-139, Issue 3: §6.6 (i)(ii)	--	NP	*1)
Radiated spurious emissions	§27.53(h), §2.1053(a)	RSS-139, Issue 3: §6.6 (i)(ii)	20	--	PASSED
Frequency stability, temperature variation	§27.54, §2.1055(a)(1)	RSS-139, Issue 3:§6.4	--	NP	*1)
Frequency stability, voltage variation	§15.207(a)	RSS-Gen, Issue 5:§8.8	--	NP	*1)

Test case in W-CDMA5	Reference Clause FCC	Reference Clause ISED	Page	Remark	Result
AC-Power Lines Conducted Emissions	§15.207(a)	RSS-Gen, Issue 5:§8.8	--	NA	--
Conducted RF output power	§22.913(a)(5), §2.1046	RSS-132:5.4 + SRSP 503:5.1.3	13	--	PASSED
Radiated RF output power	§22.913, §2.1046(a)	RSS-132: 5.4 + SRSP 503:5.1.3	--	NP	--
Occupied Channel Bandwidth 99%	§22.917(b), §2.1049(h)	RSS-Gen, Issue 5:§6.6	--	NP	*1)
26dB Emission bandwidth	§22.917(b), §2.1049(h)	RSS-Gen, Issue 5:§6.6	--	NP	*1)
Radiated Band Edge	§22.917(a)(b), §2.1053(a), §2.1057(a)	RSS-132, Issue 3: §5.5(i)(ii)	21	--	PASSED
Conducted RF Band Edge	§22.917(a)(b), §2.1051	RSS-132, Issue 3: §5.5(i)(ii)	--	NP	*1)
Peak to Average ratio (PAPR)	§22.913(a)(5), §2.1046	RSS-132:5.4 + SRSP 503:5.1.3	14	--	PASSED
Radiated field strength emissions below 30 MHz	§15.205, §15.209	RSS-Gen: Issue 5: §8.9 Table 6	18	--	PASSED
Spurious emissions at antenna terminals	§22.917(a)(b), §2.1051	RSS-132, Issue 3: §5.5(i)(ii)	--	NP	*1)
Radiated spurious emissions	§22.917(a)(b), §2.1053(a)	RSS-132, Issue 3: §5.5(i)(ii)	20	--	PASSED
Frequency stability, temperature variation	§22.355, §2.1055(a)(1)	RSS-132: 5.3	--	NP	*1)
Frequency stability, voltage variation	§22.355, §2.1055(a)(1)	RSS-132: 5.3	--	NP	*1)

*1) please refer to module test report no: **I20D00079-SRD26, FCC ID:QIPPLS62-W1**

PASSED	The EUT complies with the essential requirements in the standard.
FAILED	The EUT does not comply with the essential requirements in the standard.
NP	The test was not performed by the CETECOM Laboratory.
NA	Not Applicable

*The calculation of the measurement uncertainty shows compliance with the "maximum measurement uncertainties" of the tested standard and therefore for result evaluation the stated uncertainties will not be additionally added to the measured results.

1.2. Summary of Test methods

Test case	Test method
AC-Power Lines Conducted Emissions	ANSI C63.4-2014 § 7, ANSI C63.10-2013 § 6.2
Conducted RF output power	ANSI C63.26:2015, §5.2, KDB 971168 D01 v03r01
Radiated RF output power	ANSI C63.26:2015, §5.2.7, KDB 971168 D01 v03r01
Occupied Channel Bandwidth 99%	ANSI C63.26:2015, §5.4.4, KDB 971168 D01 v03r01
26dB Emission bandwidth	ANSI C63.26:2015, §5.4.3, KDB 971168 D01 v03r01
Modulation characteristics	ANSI C63.26:2015, §5.3
Radiated Band Edge	ANSI C63.26:2015, §5.5, KDB 971168 D01 v03r01
Conducted RF Band Edge	ANSI C63.26:2015, §5.7, KDB 971168 D01 v03r01
Peak to Average ratio (PAPR)	ANSI C63.26:2015, §5.2.6 Result calculated with measured conducted RF-power value and stated/measured antenna gain for band of interest
Radiated field strength emissions below 30 MHz	ANSI C63.4-2014 §5.3, §8.2.1, §8.3.1.1+§8.3.2.1
Spurious emissions at antenna terminals	ANSI C63.26:2015, §5.7, KDB 971168 D01 v03r01
Radiated spurious emissions	ANSI C63.26:2015, §5.5, KDB 971168 D01 v03r01
Frequency stability, temperature variation	ANSI C63.26:2015, §5.6, KDB 971168 D01 v03r01

Frequency stability, voltage variation	ANSI C63.26:2015, §5.6, KDB 971168 D01 v03r01

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. Ninovic Perez
Accreditation scope:	DAkkS Webpage
Test location:	CETECOM GmbH; Im Teelbruch 116; 45219 Essen - Kettwig

2.2 General limits for environmental conditions

Temperature:	22±2 °C
Relative. humidity:	45±15% rH

2.3 Test Laboratories sub-contracted

Company name:	--

2.4 Organizational Items

Order No.:	IA4370
Responsible test manager:	B.Sc. Al-Amin Hossain
Receipt of EUT:	2019-Jun-13
Date(s) of test:	2020-Sep-08 – 2020-Sep-14
Version of template:	14.2

2.5 Applicant's details

Applicant's name:	Actia Nordic AB
Address:	Hammarbacken 4A, 3tr 191 49 Sollentuna Sweden
Contact Person:	Salah Alazawi
Contact Person's Email:	salah.alazawi@actia.se

2.6 Manufacturer's details

Manufacturer's name:	Same as Applicant's details.
Address:	Same as Applicant's details.

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

Short description*)	PMT Sample No.	Model Name	Type	S/N	HW status	SW status
EUT 01	18-1-01732S32_C01	103250101	Telematics Device	--	H1	1

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

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

Short description*)	PMT Sample No.	Auxiliary Equipment	Type	S/N	HW status	SW status
AE 01	18-1-01732S17_C01	Jinchang Electronic, GNSS+LTE Combination Antenna	1570718**)	--	--	--
AE 02	--	LAPTOP	DELL	CTC 522013	--	Windows 7

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

**)157071x: This is the part number depending on cable length as stated below.

→0.2 m cable: 1570718, 1.05 m cable: 1570719, 1.7 m cable: 1570720, 3.5 m cable: 1570721,

4.3 m cable: 1570722, 5 m cable: 1570723

2.9 Connected cables

Short description*)	PMT Sample No.	Cable type	Connectors	Lenght
CAB 01	18-1-01732S06_C01	Cable Harness	--	< 3 meter
CAB 02	18-1-01732S89_C01	USB Cable	--	< 3 meter

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

2.10 Softwares

Short description*)	PMT Sample No.	Software	Type	S/N	HW status	SW status
--	--	--	--	--	--	--

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

2.11 EUT set-ups

set-up no.*)	Combination of EUT and AE	Description
set 01	EUT 01 +AE 01 + AE 02 + CAB 01 + CAB 02	➢ Used for Radiated measurements ➢ AE 02 has been used to activate the Cellular mode before start the measurements
set 02	EUT 01 + AE 02 + CAB 01 + CAB 02	➢ Used for Conducted measurements ➢ AE 02 has been used to activate the Cellular mode before start the measurements

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

*) AE 02 and a software(provided by Customer) has been used to activate the Cellular mode.

*) Please check chapter 3.2 for customer provided software information.

2.12 EUT operation modes

EUT operating mode no.*)	Operating modes	Additional information
1	WCDMA Band II	WCDMA Band II Traffic mode ➢ Uplink Channel: 9263, ➢ Uplink frequency: 1852.60 MHz A Communication link has been established between Radio Communication Tester CMU200 and EUT
2	WCDMA Band IV	WCDMA Band IV Traffic mode ➢ Uplink Channel: 1413, ➢ Uplink frequency: 1732.60 MHz A Communication link has been established between Radio Communication Tester CMU200 and EUT
3	WCDMA Band V	WCDMA Band V Traffic mode ➢ Uplink Channel: 4133, ➢ Uplink frequency: 826.60 MHz A Communication link has been established between Radio Communication Tester CMU200 and EUT

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

3 Equipment under test (EUT)

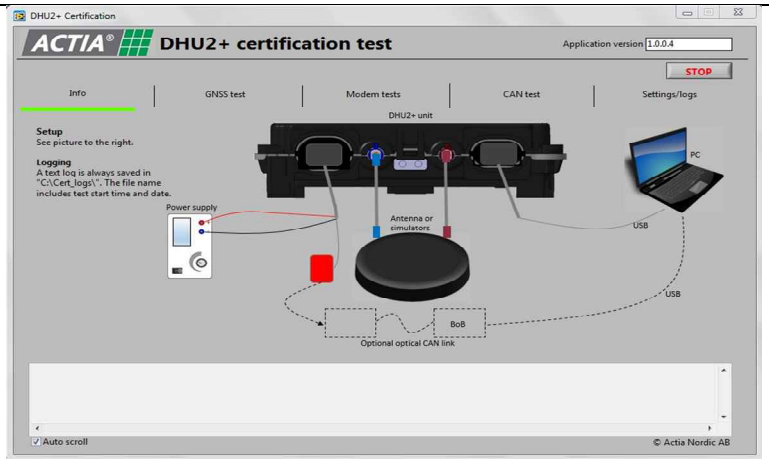
3.1 General Data of Main EUT as Declared by Applicant

Product name	103250101	
Kind of product	Telematics Device	
Firmware	☒ for normal use	☐ Special version for test execution
Power Supply	☐ AC Mains	--
	☒ DC Mains	**12** V DC
	☐ Battery	--
EUT sample type	Pre-Production	
Weight	please check the document "5586_40030_RFQ ACU-C Certification_1.0"	
Size	please check the document" ACU-C updated version for North America 20190321"	
Interfaces/Ports	please check the document" ACU-C updated version for North America 20190321"	

For further details refer Applicants Declaration & following technical documents

- ACU-C updated version for North America 20190321
- 5586_40030_RFQ ACU-C Certification_1.0
- 1032-501-01 User Manual_ver1.1
- Product Information - Model 103250101

3.2 Detailed Technical data of Main EUT as Declared by Applicant

TX Frequency range	☒ UMTS-FDD band 2	1850 - 1910 MHz (Uplink), 1930 - 1990 MHz (Downlink)
	☒ UMTS-FDD band 4	1710 - 1755 MHz (Uplink), 2110 - 2155 MHz (Downlink)
	☒ UMTS-FDD band 5	824 - 849 MHz (Uplink), 869 -894 MHz (Downlink)
Number of channels	☒ UMTS-FDD band 2	UARFCN range 9262 - 9538
	☒ UMTS-FDD band 4	UARFCN range 1312 - 1513
	☒ UMTS-FDD band 5	UARFCN range 4132 - 4233
Type of modulation		
Emission designator	Nominal CBW	See initial certification of the module:
		FCC ID:QIPPLS62-W1
Antenna Type	☐ Integrated	
	☐ External, no RF- connector	
	☒ External, separate RF-connector	
Maximum antenna gain(s)	UMTS-FDD band 2 **3.27** dBi	
	UMTS-FDD band 4: **1.64** dBi	
	UMTS-FDD band 5: **-0.44** dBi	
Test firmware / software and storage location		
For further details refer Applicants Declaration & following technical documents ➢ ACU-C updated version for North America 20190321 ➢ 5586_40030_RFQ ACU-C Certification_1.0 ➢ 1032-501-01 User Manual_ver1.1 ➢ DHU2+ MPE Information Requirements - v3 Product Information - Model 103250101		

3.3 Worst case identification

WCDMA mode	Data rate
WCDMA Band II	Uplink channel: 9263
WCDMA Band IV	Uplink channel: 1413
WCDMA Band V	Uplink channel: 4133

Remarks:

➢ Worst case has been found from Conducted Power verification Measurements.

3.4 Modifications on Test sample

Additions/deviations or exclusions	--

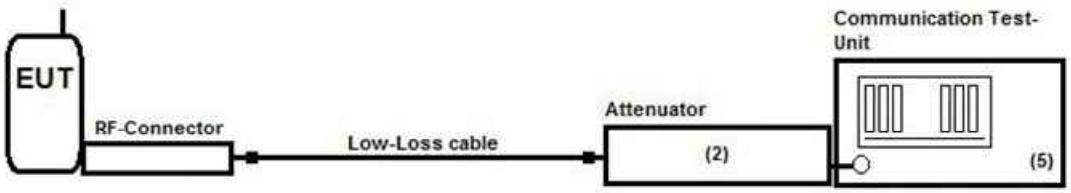
4 Measurements

4.1 Conducted RF output power

4.1.1 Description of the general test setup and methodology, see below example:

Following modified test set-up apply for tests performed inside the climatic chamber (frequency stability) or conducted RF-carrier power-measurement. The EUT RF-Signal is directly connected over suitable RF-connector over low-loss cable and an attenuator (2) to the cellular radio communication test-unit. (5).
The measurements were performed with the integrated power measurement function of the communication test-unit. (5).

Schematic:



Testing method:

The measurement is made according to relevant reference clauses:
(See Tables *Summary of Test Results* and *Summary of Test Methods* on page 5)

EUT settings
The EUT was instructed to send with maximum power (if adjustable) according applicants instructions.
The measurements were made at the low, middle and high carrier frequencies of each of the supported operating band within the designated range within the allowed channel bandwidths. Choosing three TX-carrier frequencies of the mobile phone, should be sufficient to demonstrate compliance

4.1.2 Measurement Location

Test site	Fula 1

4.1.3 Limit

Frequency Range [MHz]	Limit [W]	Limit [dBm]
824 – 849	7 ERP	38.5
1710 – 1755	1 EiRP	30
1850 – 1910	2 EiRP	33

4.1.4 Result

Fehler! Keine gültige Verknüpfung.

Conclusion conducted power verification:

All measured power values are below the values of the modular report I20D00079-SRD26 with FCC ID QIPPlS62-W1 dated 2020-08-10 => ERP/ EIRP calculation are based on values measured within this verification.

WCDMA Band	Channel	Frequency [MHz]	cond. Peak Power [dBm]	Antenna Gain [dBi]	Ext. Path Loss to antenna (external cables) [dB]	EIRP [dBm]	ERP [dBm]
2	9263	1852.60	22.50	2.07	2.36	22.21	--
	9400	1880.00	22.62	2.79	2.36	23.05	--
	9537	1907.40	22.79	3.27	2.36	23.70	--
4	1312	1712.40	23.15	1.53	2.29	22.39	--
	1413	1732.60	23.05	1.64	2.29	22.40	--
	1513	1752.60	22.96	0.86	2.29	21.53	--
5	4133	826.60	24.05	-1.78	1.88	--	18.24
	4175	835.00	23.96	-1.28	1.88	--	18.65
	4233	846.40	23.92	-0.44	1.88	--	19.45
EIRP = Peak Power + Antenna Gain - Ext. Path Loss to antenna (external cables)							
ERP = EIRP - 2.15							

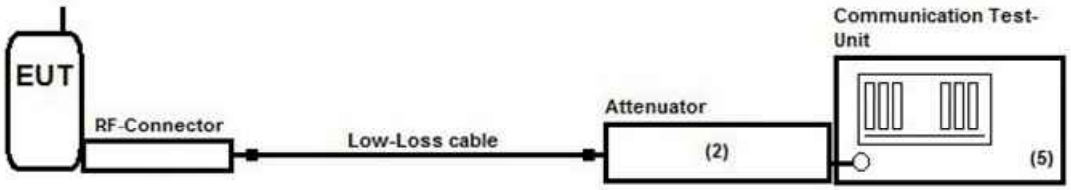
Band	Limit [W]	Limit [dBm]	Verdict
WCDMA Band 5	7 ERP	38.5	Passed
WCDMA Band 4	1 EiRP	30	Passed
WCDMA Band 2	2 EiRP	33	Passed

4.2 Peak to Average ratio (PAPR)

4.2.1 Description of the general test setup and methodology, see below example:

Following modified test set-up apply for tests performed inside the climatic chamber (frequency stability) or conducted RF-carrier power-measurement. The EUT RF-Signal is directly connected over suitable RF-connector over low-loss cable and an attenuator (2) to the cellular radio communication test-unit. (5).
The measurements were performed with the integrated power measurement function of the communication test-unit. (5).

Schematic:



Testing method:

The measurement is made according to relevant reference clauses:
(See Tables *Summary of Test Results* and *Summary of Test Methods* on page 5)

EUT settings
The EUT was set to highest transmit power condition.

4.2.2 Measurement Location

Test site	Fula 1

4.2.3 Limit

Peak to average power ratio [dB]
≤ 13

4.2.4 Result

Band	Mode	PAPR [dB]	Result
UMTS 2	1	0.25	Passed
UMTS 4	2	0.11	Passed
UMTS 5	3	0.10	Passed

According KDB 971168D01 v03r01 two method are allowed.
☐ Chapter 5.7.2 Sub clause 5.2.3.4 of ANSI C63.26-2015 CCDF-Method (0.1% probability)
☒ Chapter 5.7.3 Sub clause 5.2.6 of ANSI C63.26-2015 [PAPR (dB)=$\mathbf{P}_{PK}$ (dBm or dBW) – $\mathbf{P}_{Avg}$ (dBm or dBW)]

Remark: for more informations see chapter 4.1.4

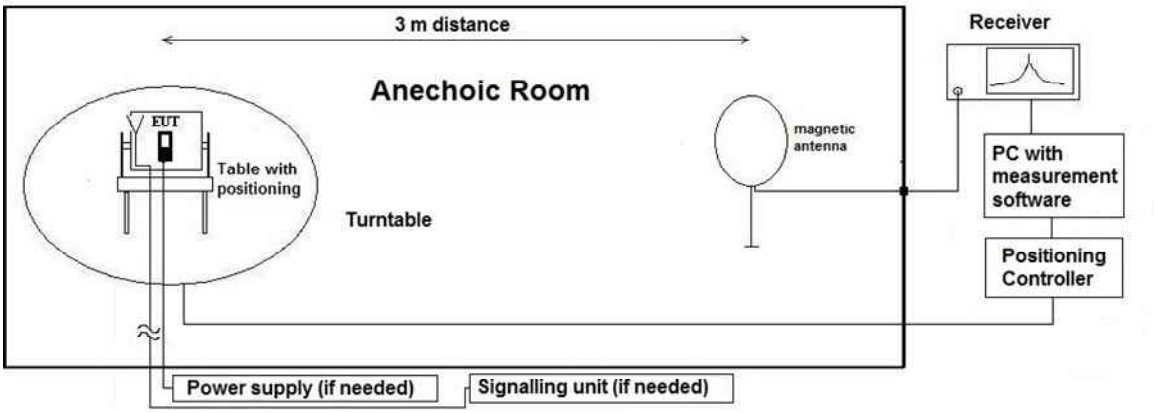
4.3 Radiated field strength emissions below 30 MHz

4.3.1 Description of the general test setup and methodology, see below example:

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:

The measurement is made according to relevant reference clauses:
(See Tables *Summary of Test Results* and *Summary of Test Methods* on page 5)

Exploratory, preliminary measurements
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 main-taining 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 (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.

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< Dnear-field)	2'te Condition (Limit distance bigger dnear-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

4.3.2 Measurement Location

Test site	SAC 1

4.3.3 Limit

Radiated emissions limits, 3 meters					
Frequency Range [MHz]	Limit [µV/m]	Limit [dBµV/m]	Distance [m]	Detector	RBW [kHz]
0.009 – 0.09	2400 / f [kHz]	67.6 – 20Log(f) (kHz)	300	Pk & Avg	0.2
0.09 – 0.11	2400 / f [kHz]	67.6 – 20Log(f) (kHz)	300	Quasi peak	0.2
0.11 – 0.15	2400 / f [kHz]	67.6 – 20Log(f) (kHz)	300	Pk & Avg	0.2
0.15 – 0.49	2400 / f [kHz]	67.6 – 20Log(f) (kHz)	300	Pk & Avg	9
0.49 – 1.705	24000 / f [kHz]	87.6 – 20Log(f) (kHz)	30	Quasi peak	9
1.705 - 30	30	29.5	30	Quasi peak	9

*Remark: In Canada same limits apply, just unit reference is different

4.3.4 Result

Diagram	Band	Operation Mode	Maximum Level [dBµV/m] Frequency Range 0.009 – 30 MHz	Result
2.01	UMTS II	1 + EUT elevation 0°	No critical frequency found	Passed
2.02	UMTS II	1 + EUT elevation 90°	No critical frequency found	Passed
2.03	UMTS IV	2 + EUT elevation 0°	No critical frequency found	Passed
2.04	UMTS IV	2 + EUT elevation 90°	No critical frequency found	Passed
2.05	UMTS V	3 + EUT elevation 0°	No critical frequency found	Passed
2.06	UMTS V	3 + EUT elevation 90°	No critical frequency found	Passed

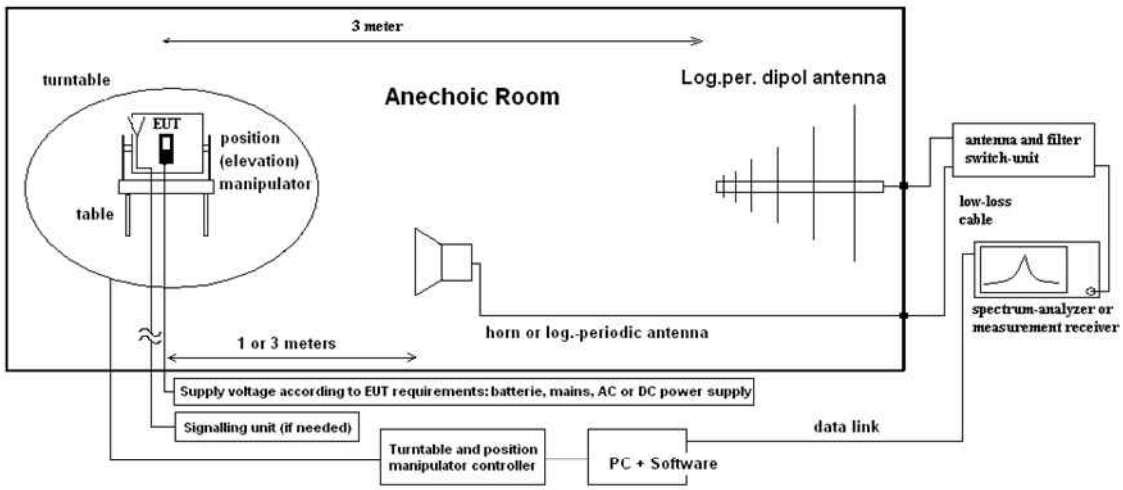
Remark: for more informations and graphical plot see annex A1

4.4 Radiated spurious emissions

4.4.1 Description of the general test setup and methodology, see below example:

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:

The measurement is made according to relevant reference clauses:
(See Tables *Summary of Test Results* and *Summary of Test Methods* on page 5)

Exploratory, preliminary measurements

The EUT and its associated accessories are placed on a non-conductive position manipulator (tipping device) of 1.50 m height which is placed on the turntable. By rotating the turntable (range 0° to 360°, step 45°) and the EUT itself on 3-orthogonal axis (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 main-taining 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.
The readings on the spectrum analyzer are corrected with conversion value between field strength and E(I)RP, so the readings shown are equivalent to ERP/EIRP values. Critical measurements near the limit are re-measured with a substitution method accord. ANSI/TIA/EIA 603 C/D

Formula:

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

$EcE(I)RP = Ec - 95.2\ dB$

$M = L_T - EcE(I)RP$

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

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

4.4.2 Measurement Location

Test site	FAC 1

4.4.3 Limit

Frequency Range [MHz]	Limit [dBm]	Detector [MaxHold]	RBW / VBW [MHz]
30 - 8500	-13	Peak	0.1/0.3
30 - 17500	-13	Peak	1 / 3
30 - 19100	-13	Peak	1 / 3

4.4.4 Result

Diagram	Band	Mode	30 to 1000 MHz	1 to 2.8 GHz	2.8 to 10th Harmonics	Stop Freq [MHz]	Result
8.01	UMTS II	1	No critical frequency found	No critical frequency found	No critical frequency found	20 GHz	Passed
8.02	UMTS IV	2	No critical frequency found	No critical frequency found	No critical frequency found	20 GHz	Passed
8.03	UMTS V	3	No critical frequency found	No critical frequency found	No critical frequency found	9 GHz	Passed

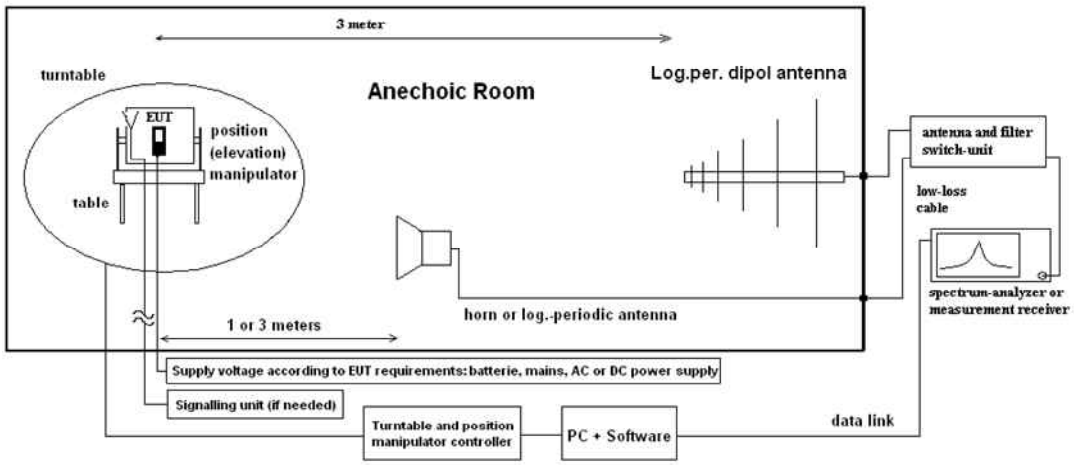
Remark: for more informations and graphical plot see annex A1

4.5 Radiated Band Edge

4.5.1 Description of the general test setup and methodology, see below example:

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:

The measurement is made according to relevant reference clauses:
(See Tables *Summary of Test Results* and *Summary of Test Methods* on page 5)
See chapter Radiated Spurious Emission forTest method.

4.5.2 Measurement Location

Test site	FAC 1

4.5.3 Limit

Frequency Range [MHz]	Limit [dBm]	Detector [MaxHold]	RBW / VBW [kHz]
Below 824 and above 849	-13	Peak	3 / 9
Below 1710 and above 1755	-13	Peak	3 / 9
Below 1850 and above 1910	-13	Peak	3 / 9

4.5.4 Result

Diagram	Band	Mode	Edge [Low / High]	Value [dBm]	Result
9.201	UMTS II	UMTS Band II_low channel_9262	Low	-32.30	Passed
9.202	UMTS II	UMTS Band II_high channel_9538	High	-22.62	Passed
9.401	UMTS IV	UMTS Band IV_low channel_1312	Low	-32.13	Passed
9.402	UMTS IV	UMTS Band IV_high channel_1513	High	-30.82	Passed
9.501	UMTS V	UMTS Band V_low channel_4132	Low	-30.16	Passed
9.502	UMTS V	UMTS Band V_high channel_4233	High	-28.20	Passed

Remark: for more informations and graphical plot see annex A1

4.6 Results from external laboratory

None	--

4.7 Opinions and interpretations

None	--

4.8 List of abbreviations

None	--

5 Equipment lists

ID	Description	Manufacturer	SerNo	Last cal date	Cal due date
120904 - FAC1 - Radiated Emissions					
20720	EMC32 [FAC]	Rohde & Schwarz Messgerätebau GmbH	V10.50.00	--	--
20254	High Pass Filter 5HC 2600/12750-1.5KK (GSM1800/1900/DECT)	Trilithic	23042	20.03.2020	20.03.2021
20868	High Pass Filter AFH-07000	AtlanTecRF	16071300004	20.03.2020	20.03.2021
20291	High Pass Filter WHJ 2200-4EE (GSM 850/900)	Wainwright Instruments GmbH	14	20.03.2020	20.03.2021
20020	Horn Antenna 3115 (Subst 1)	EMCO Elektronik GmbH	9107-3699	19.07.2018	19.07.2021
20549	Log.Per-Antenna HL025	Rohde & Schwarz Messgerätebau GmbH	1000060	31.07.2018	31.07.2021
20700	PC ctc662012 [FAC]	Dell Inc.	--	--	--
20338	Pre-Amplifier 100MHz - 26GHz JS4-00102600-38-5P	Miteq Inc.	838697	20.03.2020	20.03.2021
20484	Pre-Amplifier 2,5GHz - 18GHz AMF-5D-02501800-25-10P	Miteq Inc.	1244554	20.03.2020	20.03.2021
20287	Pre-Amplifier 25MHz - 4GHz AMF-2D-100M4G-35-10P	Miteq Inc.	379418	20.03.2020	20.03.2021
20690	Spectrum Analyzer FSU	Rohde & Schwarz Messgerätebau GmbH	100302/026	23.05.2019	23.05.2021
20341	Digital Multimeter Fluke 112	Fluke Deutschland GmbH	81650455	25.05.2020	25.05.2022
20885	Power Supply EA3632A	Agilent Technologies Deutschland GmbH	75305850	--	--
20670	Radio Communication Tester CMU200	Rohde & Schwarz Messgerätebau GmbH	106833	16.06.2020	16.06.2022
120901 - SAC - Radiated Emission <30MHz					
20620	EMI Test Receiver ESU26	Rohde & Schwarz Messgerätebau GmbH	100362	13.05.2020	13.05.2021
20341	Digital Multimeter Fluke 112	Fluke Deutschland GmbH	81650455	25.05.2020	25.05.2022
25038	Loop Antenna HFH2-Z2	Rohde & Schwarz Messgerätebau GmbH	879824/13	07.04.2020	07.04.2022

6 Measurement Uncertainty valid for conducted/radiated measurements

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 contribution to the overall uncertainty according its statistical distribution calculated.

RF-Measurement	Reference	Frequency range	Calculated uncertainty based on a confidence level of 95%						Remarks
Conducted emissions (U_{CISPR})	-	9 kHz - 150 kHz 150 kHz - 30 MHz	4.0 dB 3.6 dB						-
Power Output radiated	-	30 MHz - 4 GHz	3.17 dB						Substitution method
Power Output conducted	-	Set-up No.	Cel-C1	Cel-C2	BT1	W1	W2	--	
		9 kHz - 12.75 GHz	N/A	0.60	0.7	0.25	N/A	--	-
		12.75 - 26.5 GHz	N/A	0.82	--	N/A	N/A	--	
Conducted emissions on RF-port	-	9 kHz - 2.8 GHz	0.70	N/A	0.70	N/A	0.69	--	N/A - not applicable
		2.8 GHz - 12.75 GHz	1.48	N/A	1.51	N/A	1.43	--	
		12.75 GHz – 18 GHz	1.81	N/A	1.83	N/A	1.77	--	
		18 GHz - 26.5 GHz	1.83	N/A	1.85	N/A	1.79	--	
Occupied bandwidth	-	9 kHz - 4 GHz	0.1272 ppm (Delta Marker)						Frequency error
			1.0 dB						Power
Emission bandwidth	-	9 kHz - 4 GHz	0.1272 ppm (Delta Marker)						Frequency error
	-		See above: 0.70 dB						Power
Frequency stability	-	9 kHz - 20 GHz	0.0636 ppm						-
Radiated emissions Enclosure	-	150 kHz - 30 MHz	5.01dB						Magnetic field strength
		30 MHz - 1 GHz 1 GHz - 18 GHz 18-26.5 GHz	5.83 dB 4.91 dB 5.06 dB						Electrical Field strength

7 Versions of test reports (change history)

Version	Applied changes	Date of release
--	Initial release	2020-Oct-29
C1	Calculated EIRP and ERP values added	2020-Nov-11
C2	Updated “Conducted RF output power” results, based on the updated antenna gain due to the internal loss between modem and antenna connector	2020-Dez-21
C3	Conclusion conducted power verification and clarification for ERP/ EIRP calculation added, last cal date added to equipment list	2020-Jan-05

End of Test Report