Prüfbericht-Nr.: *Test Report No.:*	60338060-001	**Auftrags-Nr.:** *Order No.:* 23870191	Seite 1 von 17 *Page 1 of 17*
Kunden Referenz-Nr.: Client Reference No.:	1005969	**Auftragsdatum** *Order date:*	2019-09-18
Auftraggeber: *Client:*	ANTICIMEX INNOVATION CENTER A/S Skovgaardsvej 25 DK-3200 Helsinge Denmark	Mr. Rasmus Skou Bjerre Email: rasmus.skou.bjerre@anticimex.com Phone: +45 26799509	
Prüfgegenstand: *Test item:*	Smart Connect Mini		
Bezeichnung / Typ-Nr.: *Identification / Type No.:*	FCC ID: 2AOFP-300110		
Auftrags-Inhalt: *Order content:*	FCC verification testing – Simultaneous transmission (worst case LTE + Sub GHz radio)		
Prüfgrundlage: *Test specification:*	FCC Part 15.209 ANSI C63.10-2013		
Wareneingangsdatum: *Date of receipt:*	2019-09-18		
Prüfmuster-Nr.: *Test sample No.:*	A000231818-003		
Prüfzeitraum: *Testing period:*	2020-01-21		
Ort der Prüfung: *Place of testing:*	Lund, Sweden		
Prüflaboratorium: *Testing laboratory:*	TÜV Rheinland Sweden		
Prüfergebnis: *Test results:*	Pass		

Geprüft von *Tested by:*	Fariborz Abasi Test Engineer		**Kontrolliert von** *Reviewed by:*	Per Isacsson Lab Manager	
2020-01-21			2020-01-21		
Datum *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*	**Datum** *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*

Sontiges */Other:*

Only Radiated Emissions, FCC Rule part 15.209 is covered in this report

Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden.
This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts.

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Revisions ***Revisions***			
Revision Revision	**Datum** Date	**Anmerkung** Remark	**Verfasser** Author
001	2020-01-21	First release	Fariborz Abasi
Note: Latest revision report will replace all previous reports			

Summary of Test Results

FCC Rule Part	Test item	Result	Remarks
§ 15.209 (a) (f)	Radiated Emission	PASS	

Possible test case verdicts:

- test case does not apply to the test object ....: N/A
- test object does meet the requirement .....: PASS
- test object does not meet the requirement ....: FAIL
- test case not performed on the test object ....: n.p.

Table of contents

1 TEST SITES

Testing facility

TÜV Rheinland Sweden AB
Mobilvägen 10
223 62 Lund
Sweden

FCC Test Firm Registration Number: 517458

2 PRODUCT INFORMATION

2.1 General description

Model name:	Smart Connect Mini
Manufacturer:	Anticimex Innovation Center A/S
Model number:	300110
FCC ID:	FCC ID: 2AOFP-300110
Description:	Cellular and sub-GHz gateway for the smart Connect system
Supported Radio Technologies:	GPRS: 850; 1900 LTE B2; B4; B5; B12; B13 Proprietary radio channels: 917 MHz 921 MHz 922 MHz 926 MHz
Highest internal frequency	1910 MHz
Supply Voltage to Product	5V from power adaptor
Ancillary Equipment:	AC/DC Power adapter

2.2 Wireless Technologies and Frequency Bands supported by the DUT

Technology	Band	Frequency Range (Tx)	Evaluation Performed *
GSM (GPRS)	850	824.2 MHz – 848.8 MHz	NO
GSM (GPRS)	900	880.2 MHz – 914.8 MHz	NO
GSM (GPRS)	1800	1710.2 MHz – 1784.8 MHz	NO
GSM (GPRS)	1900	1850.2 MHz – 1909.8 MHz	NO
LTE CAT-M1	B1	1920 MHz – 1980 MHz	NO
LTE CAT-M1	B2	1850 MHz – 1910 MHz	NO
LTE CAT-M1	B3	1710 MHz – 1785 MHz	NO
LTE CAT-M1	B4	1710 MHz – 1755 MHz	YES
LTE CAT-M1	B5	824 MHz – 849 MHz	NO
LTE CAT-M1	B8	880 MHz – 915 MHz	NO
LTE CAT-M1	B12	699 MHz – 716 MHz	NO
LTE CAT-M1	B13	777 MHz – 787 MHz	NO
LTE CAT-M1	B20	832 MHz – 862 MHz	NO
LTE CAT-M1	B28	703 MHz – 748 MHz	NO
'Sub GHz' Proprietary	868.3 MHz	868.3 MHz	NO
'Sub GHz' Proprietary	917-926 MHz	917 MHz – 926 MHz	YES

* Only worst-case combination for simultaneous transmission has been verified in this test report.

2.3 Equipment Under Test (EUT) identification

TÜV Rheinland ID	S/N	HW	SW
A000231818-003	-	A	Mesh_Splinter_20190527_1114

2.4 Ancillary equipment identification

TÜV Rheinland ID	Type	Model	Manufacturer	S/N
A000231818-005	AC/DC Power adapter	SK02G-0500300Z	Starwell Technology CO. Ltd	N/A

3 TEST METHODS AND OPERATION MODES

3.1 Test Methods

The following standards/references has been considered for the testing

Reference Standards	
Standard	**Description**
FCC Part 15 (Subpart C)	15.209 Radiated emission limits; general requirements, intentional radiators
ANSI C63.4:2014	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10:2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
KDB 558074 v05r02	Guidance for compliance measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System and Hybrid System Devices operating under section 15.247 of the FCC rules.
KDB996369 D04	Modular transmitter integration guide – Guidance for host product manufacturers

3.2 Worst case considerations and Operation modes/Tested Channels

Testing was performed with the EUT operating with both the cellular radio module and the Sub GHz proprietary radio module transmitting at the same time.
Worst case has been identified as simultaneous transmission with LTE Band 4 at highest channel (1755 MHz) and Sub GHz frequency 926 MHz in transmission mode.

4 TEST METHODOLOGY

4.1 Radiated Emission Test

The radiated emission measurement was performed according to the procedures in ANSI C63.10-2013. The equipment under test (EUT) was placed at the middle of the turntable on an 80cm high table for below 1 GHz & 1.5 m height for above 1 GHz measurement, for frequencies up to 18GHz the EUT is 3 meters far from the measuring antenna, above 18GHz the distance is 1 meter. The turntable was rotated 360° for obtaining the maximum emission. The height of the measuring antennas was scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Repeat the measurement steps until the maximum emissions were obtained. The measurements above 1000 MHz was performed by 3 different horn antennas, the measurement below 30 MHz was performed by loop antenna and measurement from 30 MHz to 1 GHz was performed by Log-Periodic Antenna.

Test Setup Configuration

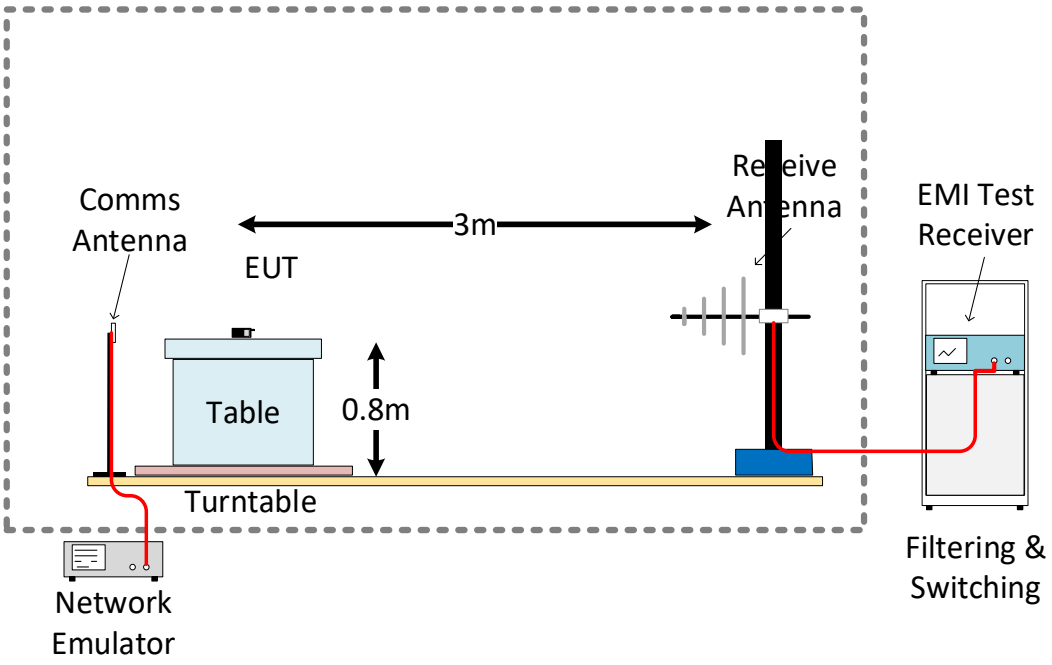


Figure 1: Frequency range 30 MHz – 1 GHz

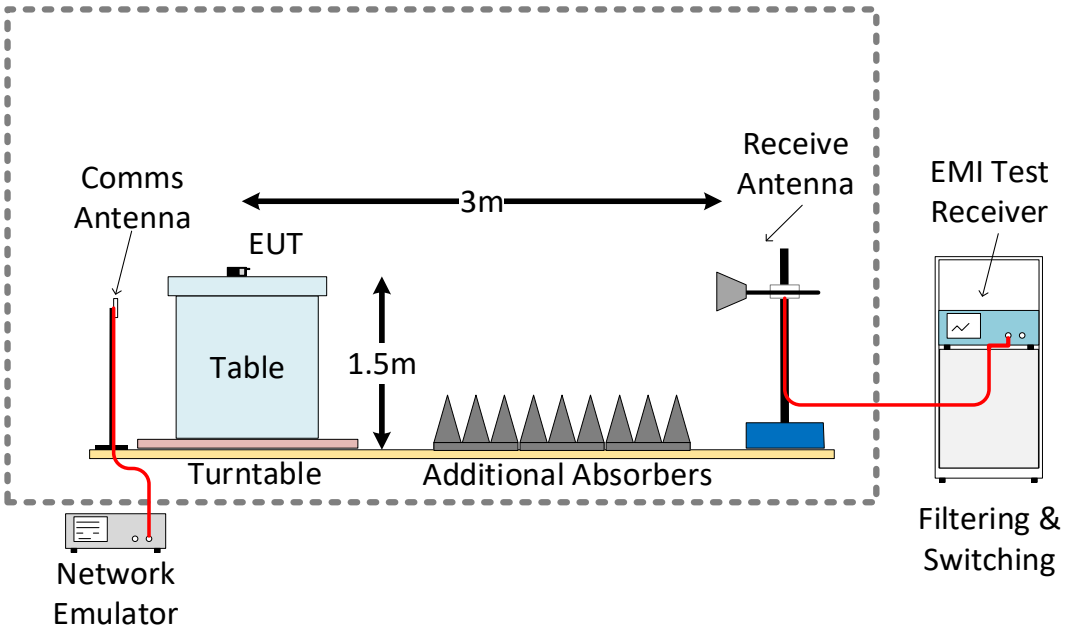


Figure 2: Frequency range 1 GHz – 18 GHz

5 TEST RESULTS – RADIATED EMISSIONS

5.1 Summary - Radiated emissions

Result	Pass
Test period	2020-01-21
Test Engineer	Fariborz Abasi
Test Specification	FCC part 15 Subpart C Section 15.209
Test Method	ANSI C63.10 – 2013
Measurement Location	Semi Anechoic Chamber
Measuring Distance	3 m for 30 MHz to 18 GHz
Detector	Quasi-peak, except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz where an Average detector is used.
Requirement	As per the limits mentioned in the below table
Environmental conditions	Temperature: + 18 - 20 °C Relative Humidity: 20 - 40 %

Frequency (MHz)	Field strength (µV/m)	Field strength (dBµV/m)	Distance of Measurement (m)
0.009 – 0.490	2400/F(kHz)	48.50 – 13.80	300*
0.490 – 1.705	24000/F(kHz)	33.80 – 23.00	30*
1.705 -30	30	29.54	30*
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Remark: * The limit shows in the table above of frequency range 0.009 – 0.490, 0.490 – 1.705 MHz and 1.705-30MHz is at 300 meter, 30 meter and 3 meter range respectively, which corresponds to 128.51 – 93.80, 73.80 – 62.96 and 69.54 dBµV/m at 3m range by extrapolation calculation and the measurement of loop antenna.

The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz Radiated emission limits in these three bands are based on measurements employing an average detector.

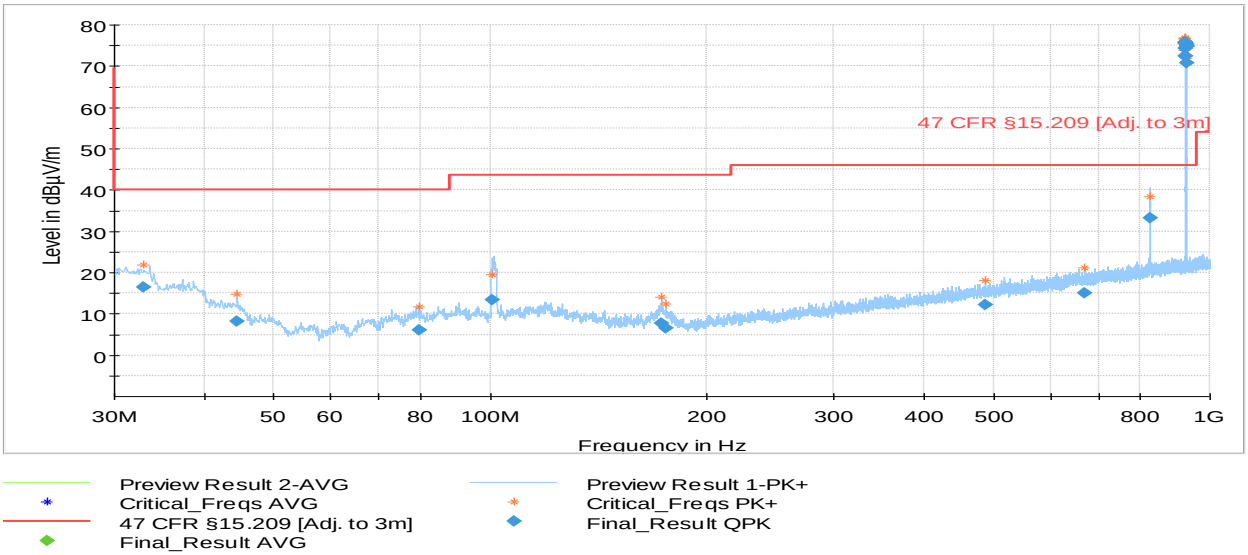
5.2 Test setups

Test	Constellation	EUT Radio	Result
1	Smart connect mini (EUT)	LTE Band 4 adjusted to highest channel (1755 MHz) + Sub GHz proprietary radio (926 MHz)	PASS

5.3 Detailed Test results - Radiated Emission

5.3.1 LTE Band 4 and 926 MHz proprietary radio frequency

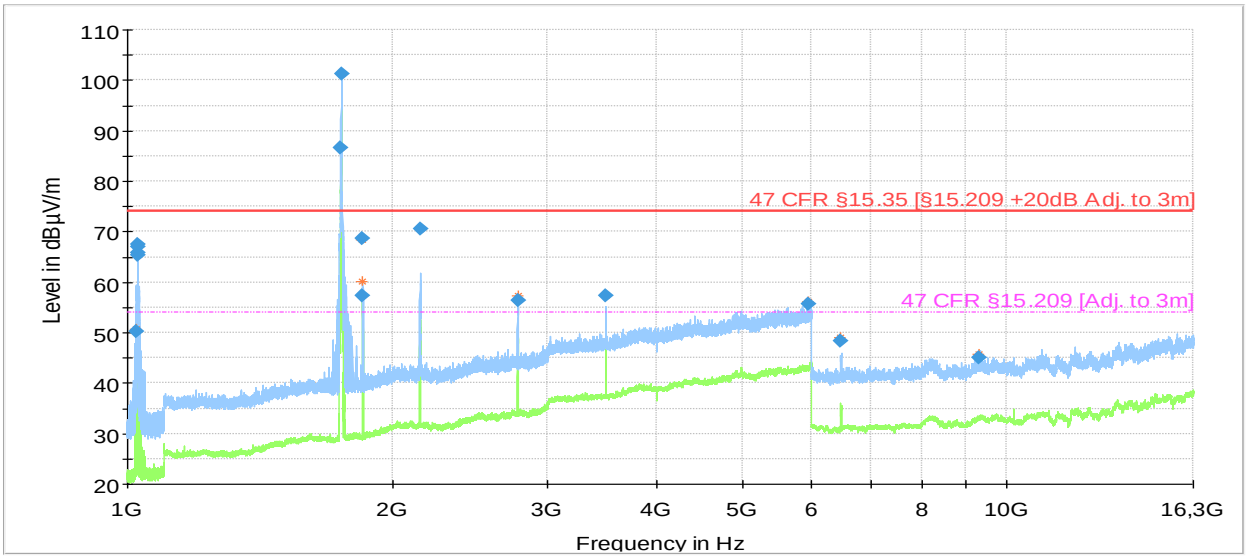
Test mode condition	Traffic (TX)	
Antenna orientation	Horizontal and Vertical	
Channel frequency	LTE Band 4 and 926 MHz proprietary radio	
Sweep frequency	30 MHz – 1 GHz	
Standard	CFR 47 - FCC Part 15 (C) § 15.209	
EUT	A000231818-003	
Ancillary Equipment	Ancillary devices inside the chamber: - A000231818-005 Charger / Power supply - Shielded Ethernet cable	
Test Engineer	Fariborz Abasi	Date: 2020-01-21
Environmental conditions	Temperature: 21,2 ^{0}C	Humidity: 36,2 %
Chamber details	Chamber: SAC 5	



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
925.817400*	75.72	46.02	-29.70	1000.0	120.000	125.0	V	26.0
925.814280*	75.69	46.02	-29.67	1000.0	120.000	125.0	V	26.0
824.893360	33.24	46.02	12.78	1000.0	120.000	279.0	V	202.0
32.992600	16.40	40.00	23.60	1000.0	120.000	225.0	H	19.0
100.574160	13.34	43.52	30.18	1000.0	120.000	129.0	V	191.0
668.281800	15.11	46.02	30.91	1000.0	120.000	325.0	H	202.0
44.334800	8.17	40.00	31.83	1000.0	120.000	152.0	H	41.0
79.657320	6.17	40.00	33.83	1000.0	120.000	375.0	H	280.0

Remark: Frequencies which are highlighted with * in above table are corresponded to unlicensed radio frequency (926 MHz) supported by DUT.

Test mode condition	Traffic (TX)	
Antenna orientation	Horizontal and Vertical	
Channel frequency	LTE Band 4 and 926 MHz proprietary radio	
Sweep frequency	1 GHz – 18 GHz	
Standard	CFR 47 - FCC Part 15 (C) § 15.209	
EUT	A000231818-003	
Ancillary Equipment	Ancillary devices inside the chamber: - A000231818-005 Charger / Power supply - Shielded Ethernet cable	
Test Engineer	Fariborz Abasi	Date: 2020-01-21
Environmental conditions	Temperature: 21,2 ^{0}C	Humidity: 36,2 %
Chamber details	Chamber: SAC 5	



Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
1751.072000 *	101.33	---	73.98	-27.35	1000.0	1000.000	148.0	V	220.0
1748.498000 *	86.70	---	73.98	-12.72	1000.0	1000.000	102.0	V	144.0
2154.439000	70.55	---	73.98	3.43	1000.0	1000.000	175.0	V	292.0
1851.898000	68.71	---	73.98	5.27	1000.0	1000.000	102.0	V	174.0
1026.906000	67.48	---	73.98	6.50	1000.0	1000.000	127.0	V	275.0
1028.042000	66.95	---	73.98	7.03	1000.0	1000.000	150.0	H	85.0
1028.373000	65.75	---	73.98	8.23	1000.0	1000.000	159.0	V	231.0
1028.553000	65.47	---	73.98	8.51	1000.0	1000.000	188.0	V	84.0

Remark: Frequencies which are highlighted with * in above table are corresponded to LTE B4 high channel.

6 TEST EQUIPMENT LIST

SAC 5 – Radiated emissions						
Type:	**Manufacturer**	**Model**	**Serial Number**	**GTEM ID**	**Calibration date**	**Calibration Due:**
EMI Test Receiver	Rohde & Schwarz	ESU26	100359	2703557	03.07.2019	03.07.2020
Ultra Broadband Antenna	Rohde & Schwarz	HL562E	100988	2823181	23.07.2019	23.07.2021
Double Ridged Waveguide Horn Antenna	Rohde & Schwarz	HF907	102678	2823164	15.07.2019	15.07.2021
Control device	Maturo	NCD	NCD/393/2372.01	2884216	N/A	N/A
Open Switch & Control Unit	Rohde & Schwarz	OSP150	100081	2884198	01.04.2019	01.04.2020
Open Switch & Control Unit	Rohde & Schwarz	OSP120	100084	2761253	01.04.2019	01.04.2020
Shielded Filter Unit	Rohde & Schwarz	OSP-F Extension 1	101333	2761265	01.04.2019	01.04.2020
Shielded Filter Unit	Rohde & Schwarz	OSP-F Extension 2	101335	2761266	01.04.2019	01.04.2020
Shielded Filter Unit	Rohde & Schwarz	OSP-F Base Unit	101330	2761262	01.04.2019	01.04.2020
Humidity Temperature Probe	Rotronic	HF532-DG1XX21X	0061829280	2926379	14.08.2018	14.08.2020

7 MEASUREMENT UNCERTAINTY

Measurement Uncertainty for Radiated Emission (Coverage Factor k=2)	
Parameter	**Uncertainty**
Field Strength 10 Hz -9 kHz	3,38 dB
Field Strength 9 kHz -30 MHz	3,38 dB
Field Strength 30 MHz -1000 MHz	3,38 dB
Field Strength 1 GHz -18 GHz	4,88 dB
Field Strength 18 GHz - 40 GHz	5,14 dB

8 APPENDIX 1 – TEST SETUP PHOTOS

See report 60338060-001 Appendix 1