

TEST REPORT

Title 47-Telecommunication

Chapter I - Federal Communications Commission

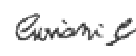
Subchapter A - General

Part 15 - Radio Frequency Devices

Subpart B - Unintentional Radiators

Report Reference No.: 326494-5TRFFCC

Tested by
(name, function and signature).....: P. Barbieri (project handler) 

Approved by
(name, function and signature).....: G. Curioni (verifier) 

Date of issue: 2017-03-22

Testing Laboratory: **Nemko Spa**

Address.....: Via del Carroccio, 4 – 20853 Biassono (MB) – Italy

Testing location: Nemko Spa

Address.....: Via del Carroccio, 4 – 20853 Biassono (MB) – Italy

Registration number:: 481407

Applicant's name: **Paradox Engineering SA**

Address.....: Via Passeggiata, 7 – CH-6883 Novazzano – Switzerland

Test specification:

Standard: FCC CFR 47 Part 15 Subpart B

§15.107 – Conducted limits

§15.109 – Radiated emission limits

Test procedure.....: Nemko WM L0077, WM L0177 and WM L1002

Test Report Form No.: FCCTRF


TRF Originator: Nemko Spa

Master TRF.....: 2014-03

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Test item description : **Gateway**

Trade Mark: 

Manufacturer.....: Paradox Engineering SA

Address of manufacturer: Via Passeggiata, 7 – CH-6883 Novazzano – Switzerland

Model: PE.AMI-GW920

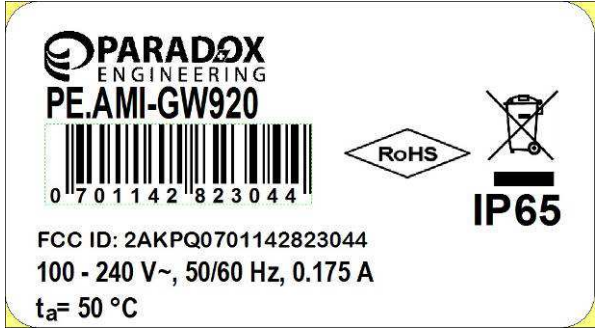
Ratings.....: 100-240 V ~ 50/60 Hz

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The test report merely corresponds to the tested sample.

The phase of sampling / collection of equipment under test is carried out by the customer.

Test Report No. : 326494-5TRFFCC	2017-03-22 Date of issue
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Short description of the EuT	Copy of marking plate
<p>The EUT is a gateway equipped with following radio modules:</p> <ol style="list-style-type: none"> 1) ELB-PED-0077 (radio narrowband 902-928 MHz) 2) WLE600VX (Wi-Fi cards 2412-2472 MHz and 5745-5825 MHz) <p>The EUT is also provided with the following antennas:</p> <ol style="list-style-type: none"> 1) MEGWX-1551SAAX-920 (902-928 MHz) 2) OM24580703 (2412-2472 MHz) 3) MT-485001 (5745-5825 MHz) 	

Number of tested samples:	1
Serial number:	1704PE000030
Internal operating frequency:	< 1 GHz with the Wi-Fi module switched off
Class:	B
Device type:	Pale Mounting
Accessories and detachable parts included:	The EUT is composed by a single unit with three antennas
Other options included:	-

Testing	
Date of receipt of test sample:	2017-03-17
Testing commenced on:	2017-03-20
Testing concluded on:	2017-03-22

Possible test case verdicts:	
test case does not apply to the test object:	N (Not applicable)
test object does meet the requirement:	P (Pass)
test object does not meet the requirement:	F (Fail)

Symbols used in this test report	
<input checked="" type="checkbox"/>	The crossed square indicates that the listed condition or equipment is applicable for this report.
<input type="checkbox"/>	The empty square indicates that the listed condition or equipment is not applicable for this report.

The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.

Verdict according to the standards listed at page 5:	Pass
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PROJECT HISTORY		
Report number	Modification to the report / comments	Date
326494-5TRFFCC	First release	2017-03-22
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REMARKS		

PRODUCT VARIANTS		
Variant model	Difference against the main model	Additional test performed
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REMARKS		

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1 TEST STANDARDS

The tests were performed according to following standards and procedures.

NEMKO WM L0177: General routines for using instruments at Nemko

NEMKO WM L1002: Measurement Uncertainty - Policy and Statement

NEMKO WM L0077: General routines to perform EMC tests

FCC CFR 47 Part 15 Subpart B

Code of Federal Regulations – Title 47 – Part 15 Radio Frequency Devices – Subpart B Unintentional radiation

The main standard above contains references to other standards, which are listed below.

ANSI C63.4 (2014)

American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

2 SUMMARY OF TEST RESULTS

FCC Part 15 Subpart B requirements			
Part	Test description	Frequency range	Verdict
§15.107	Conducted emission	150 kHz to 30 MHz	P
§15.109	Radiated emission	30 MHz to 5000 MHz	P
GENERAL REMARKS			

3 EQUIPMENT UNDER TEST

3.1 Power supply system utilised

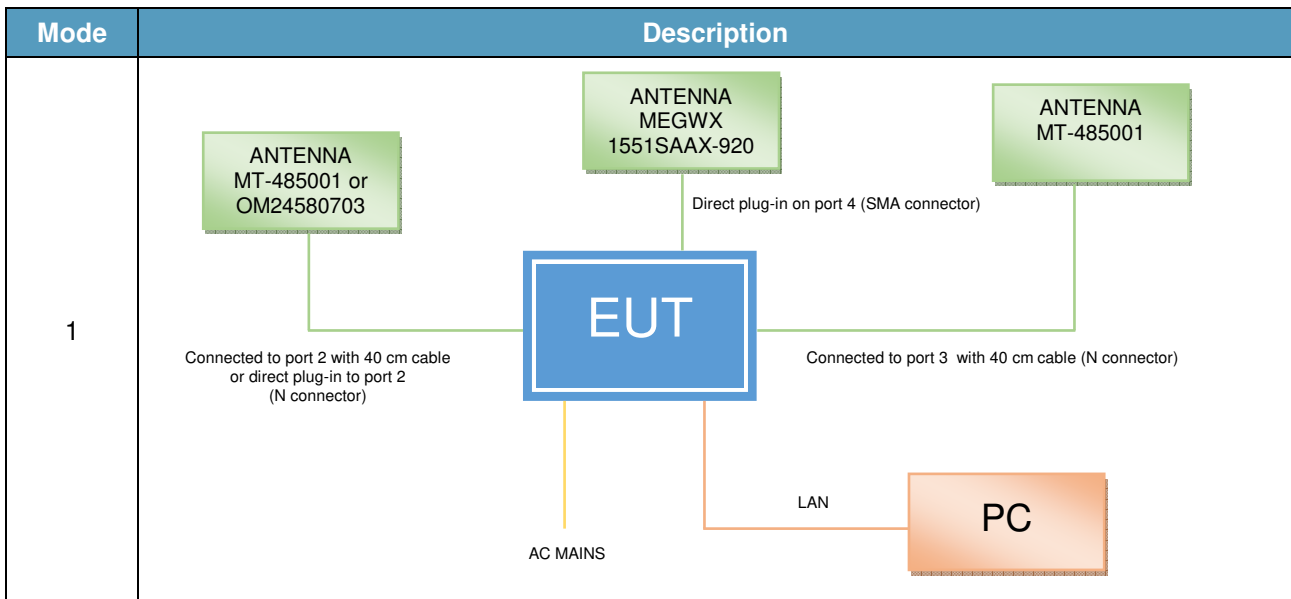
Power supply voltage:	<input type="checkbox"/>	230V/50 Hz / 1 ϕ	<input checked="" type="checkbox"/>	115V/60Hz / 1 ϕ
	<input type="checkbox"/>	400V/50 Hz 3PE	<input type="checkbox"/>	400V/50 Hz 3NPE
	<input type="checkbox"/>	12 VDC	<input type="checkbox"/>	24 VDC

3.2 EuT operation modes

Mode	Description
1	Normal working with the radio modules switched off and with traffic on Ethernet line

3.3 EuT configuration modes

The EuT was configured to measure its highest possible radiation level. The test modes selected are according to EuT instruction manual.



3.4 Input/Output Ports

Port	Name	Type*	Cable Max. >3m	Cable Shielded	Description
0	ENCLOSURE	N/E	—	—	—
1	AC MAINS	AC	<input type="checkbox"/>	<input type="checkbox"/>	Three wires cable
2	LAN	TP	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Standard cable with RJ 45 connector
3	ANTENNA PORT 2	ANT	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Coaxial cable or direct plug-in (N connector)
4	ANTENNA PORT 3	ANT	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Coaxial cable (N connector)
5	ANTENNA PORT 4	ANT	<input type="checkbox"/>	<input type="checkbox"/>	Direct plug-in (SMA connector)

*Note:

AC = AC Power Port DC = DC Power Port N/E = Non-Electrical
 I/O = Signal/Control Input or Output Port TP = Telecommunication Port ANT = Antenna Port

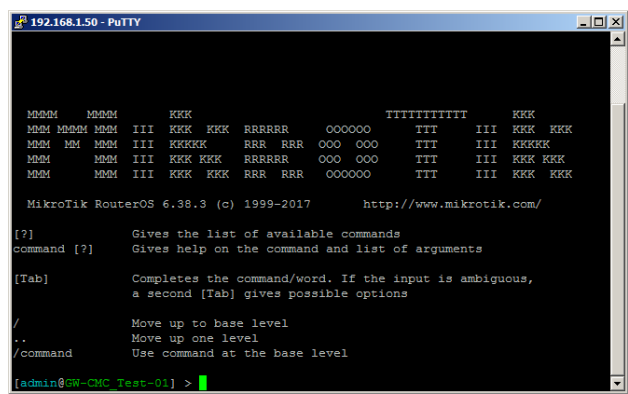
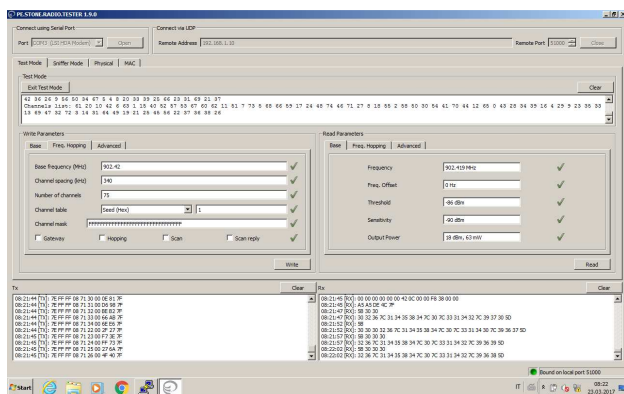
3.5 Equipment Used During Test

Use*	Product Type	Manufacturer	Model	Comments
AE	PC	HP	Compaq 6510b	—

Note: * Use

- EUT - Equipment Under Test
- AE - Auxiliary/Associated Equipment (Not Subjected to Test)
- SIM - Simulator (Not Subjected to Test)

3.6 Software Used During Test



The tx power parameter has been set to 18 for ELB-PED-0077 radio module, to 18 for WLE600VX radio module at 5 GHz and to 23 for radio module at 2.4 GHz, according to applicant's request.

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

Nemko Spa
Via del Carroccio, 4
20853 Biassono (MB) - Italy

Tests site/benches are in accordance with applicable standard/s, and have been utilized by Nemko Spa testing engineer(s).

4.2 Environmental conditions

Unless different values are declared in the test case, following ambient conditions apply for the tests:

Ambient temperature: 18÷33 °C

Relative Humidity: 30÷60 %

Atmospheric pressure: 980÷1060 hPa

4.3 Test equipment used for the monitoring of the environmental conditions

Equipment	Manufacturer	Model	Serial N°	Due Date
Thermohygrometer data loggers	Testo	175-H2	20012380/305	2018-12
Barometer	MSR	MSR145B	330080	2018-03

4.4 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report according to CISPR 16-4-2 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements” and is documented in the Nemko Spa Technical Procedure WML1002. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device. Hereafter the best measurement capability for Nemko Spa laboratory is reported:

Test	Range	Measurement Uncertainty	Notes
Radiated Disturbance 3m, 10m Chamber	Antenna distance 1m, 3m, 10m (30÷200) MHz	5.0 dB	(1)
	Antenna distance 1m, 3m, 10m (0.2÷6) GHz	5.2 dB	(1)
	Antenna distance 1m, 3m (6÷18) GHz	5.8 dB	(1)
	Antenna distance 1m, 3m (18÷40) GHz	7.2 dB	(1)
Conducted Disturbance	9 kHz ÷ 150 kHz with AMN	3.8 dB	(1)
	150 kHz ÷ 30 MHz with AMN	3.4 dB	(1)
	150 kHz ÷ 30 MHz with AAN	4.6 dB	(1)
	9 kHz ÷ 30 MHz with voltage probe	2.9 dB	(1)
	9 kHz ÷ 30 MHz with current probe	2.9 dB	(1)

NOTES:

(1) The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2$ which has been derived from the assumed normal probability distribution with infinite degrees of freedom and for a coverage probability of 95 %;

5 TEST CONDITIONS AND RESULTS

5.1 Clause 15.107 – Conducted limits

5.1.1 Photo documentation of the test set-up



5.1.2 Test method

Measurements were made on a ground plane that extends 1-meter minimum beyond all sides of the system under test. All power was connected to the system through Line Impedance Stabilization Networks (LISN). Conducted voltage measurements on mains lines were made at the output of the LISN.

5.1.3 Limits for AC mains port

Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-Peak	Average
0.15 to 0.50	66 to 56*	59 to 46*
0.50 to 5	56	46
5 to 30	60	50

*The limits decrease linearly with the logarithm of the frequency

For a Class A digital device that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms LISN. Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-Peak	Average
0.15 to 0.50	79	66
0.50 to 30	73	60

5.1.4 Test result

Verdict:	<input checked="" type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> N
Frequency range:	0.15MHz - 30MHz
Kind of test site:	Shielded room
Remarks:	

5.1.5 Test equipment used

Equipment	Manufacturer	Model	Serial N°	Due Date
EMI receiver 20 Hz ÷ 8 GHz	R&S	ESU8	100202	2017-09
LISN 9 kHz ÷ 30 MHz	R&S	ESH2-Z5	872 460/041	2017-11
Shielded room	Siemens	Conducted emission test room	1862	NCR

NCR = no calibration required

5.1.6 Test protocol

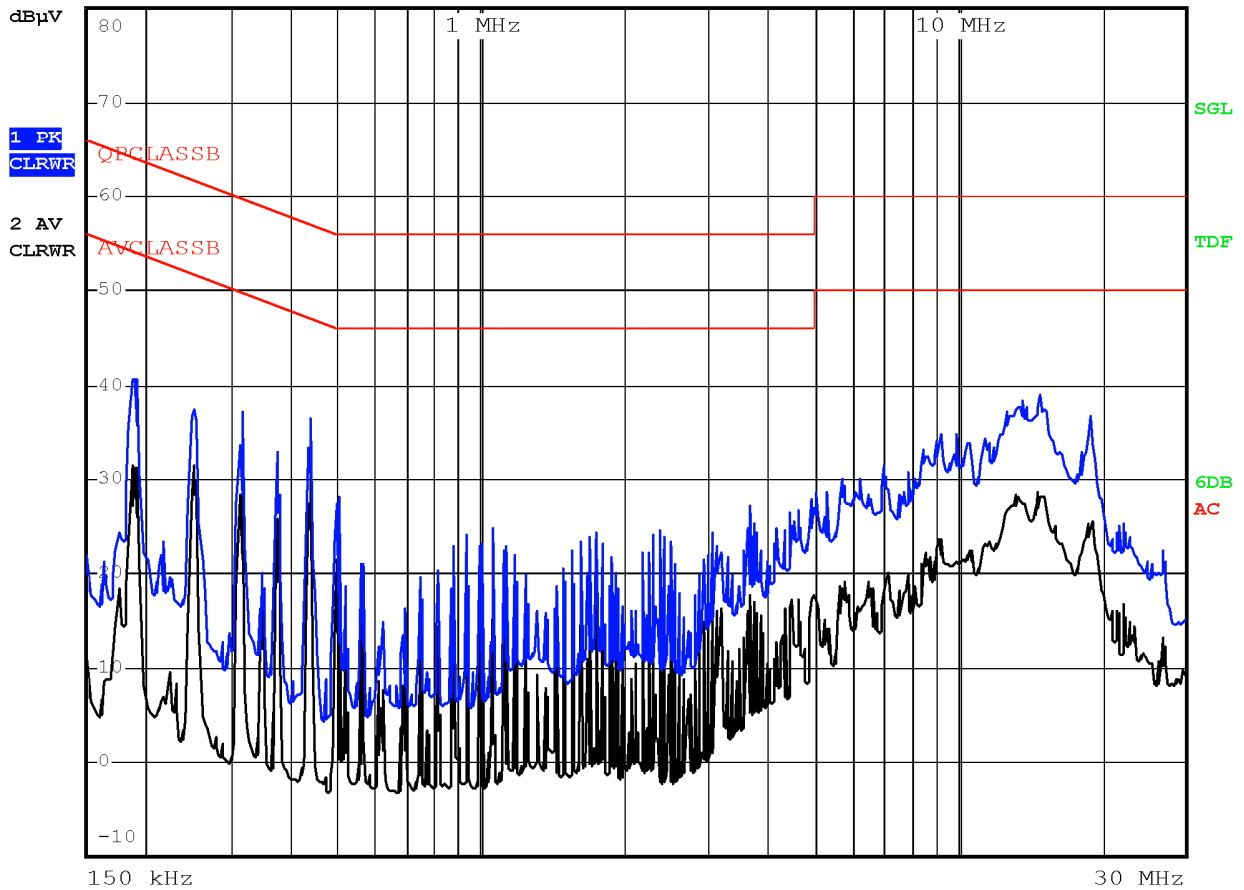
Test point: Phase line
 Operation mode: 1
 Configuration mode: 1
 Remarks: -

Verdict: Pass



RBW 9 kHz
 MT 1 s
 PREAMP OFF

Att 0 dB AUTO



Test point: Neutral line
Operation mode: 1
Configuration mode: 1
Remarks: -

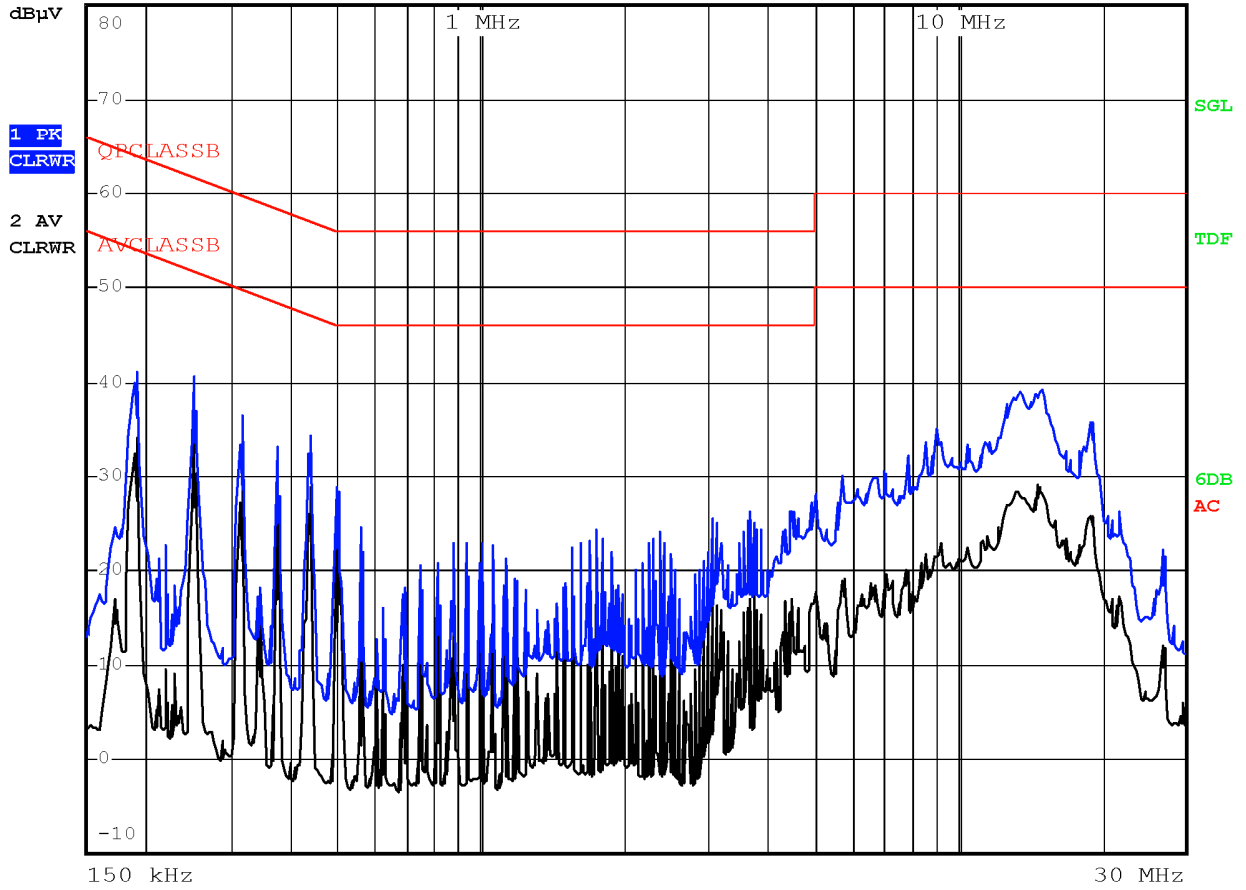
Verdict: Pass



RBW 9 kHz

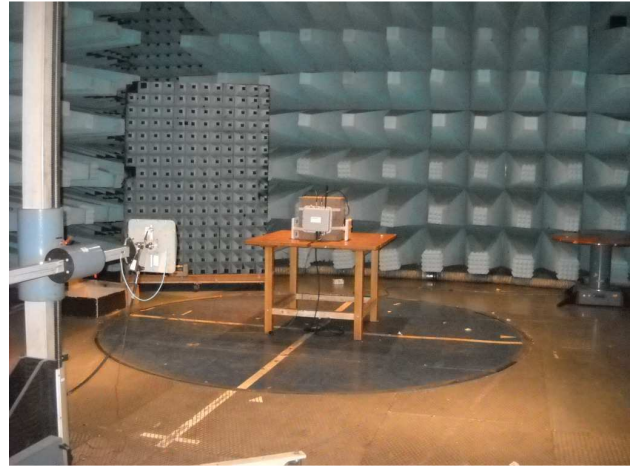
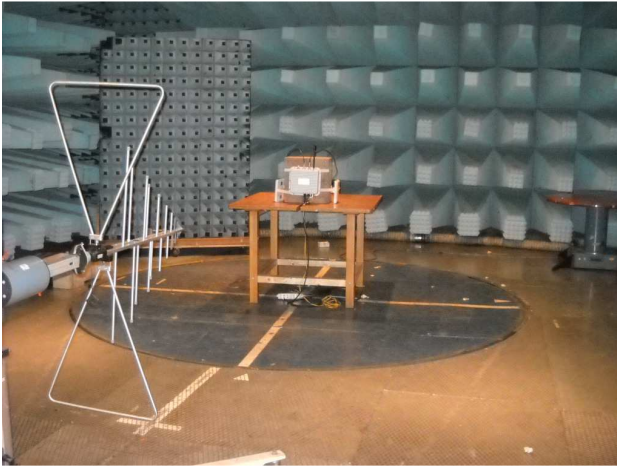
MT 1 s

Att 0 dB AUTO PREAMP OFF



5.2 Clause 15.109 – Radiated emissions limit

5.2.1 Photo documentation of the test set-up



5.2.2 Test method

Measurements were made on a semi anechoic chamber. Preliminary measurements were performed at an antenna to EUT separation distance of 3 or 10 meters with the receive antenna located at a fixed height (from 1 to 4 meter) in both horizontal and vertical polarities. Final measurements were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4 meters. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.

5.2.3 Limits for enclosure

Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency of emission (MHz)	Field strength ($\mu\text{V/m}$)	Field strength ($\text{dB}\mu\text{V/m}$)
30–88	100	40.0
88–216	150	43.5
216–960	200	46.0
Above 960	500	54.0

The field strength of radiated emissions from a Class A digital device, as determined at a distance of 10 meters, shall not exceed the following:

Frequency of emission (MHz)	Field strength ($\mu\text{V/m}$)	Field strength ($\text{dB}\mu\text{V/m}$)
30–88	90	39.0
88–216	150	43.5
216–960	210	46.4
Above 960	300	49.5

5.2.4 Test result

Verdict:	<input checked="" type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> N
Frequency range:	30MHz - 5000MHz
Kind of test site:	Semi anechoic chamber
Measurement distance:	3 m
<p>Remarks: for an unintentional radiator, including a digital device, the spectrum shall be investigated from the lowest radio frequency signal generated or used in the device, without going below the lowest frequency for which a radiated emission limit is specified, up to the frequency shown as follow:</p> <p>If the intentional radiator operates at frequency upper than 1.705 MHz and lowers than 108 MHz the upper frequency of measurement range is 1000 MHz.</p> <p>If the intentional radiator operates at frequency upper than 108 MHz and lowers than 500 MHz the upper frequency of measurement range is 2000 MHz.</p> <p>If the intentional radiator operates at frequency upper than 500 MHz and lowers than 1000 MHz the upper frequency of measurement range is 5000 MHz.</p> <p>If the intentional radiator operates at frequency above 1000 MHz the upper frequency of measurement range is 5th harmonic of the highest frequency or 40 GHz, whichever is lower.</p> <p>If the intentional radiator operates at or above 10 GHz and below 30 GHz to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.</p> <p>If the intentional radiator operates at or above 30 GHz to the fifth harmonic of the highest fundamental frequency or to 200 GHz, whichever is lower, unless specified otherwise elsewhere in the rules.</p>	

5.2.5 Test equipment used

Equipment	Manufacturer	Model	Serial N°	Due Date
Trilog Broadband Antenna 25 ÷ 8000 MHz	Schwarzbeck	VULB 9162	9162-025	2018-07
Bilog antenna 1 ÷ 18 GHz	Schwarzbeck	STLP 9148-123	123	2018-06
Broadband preamplifier	Schwarzbeck	BBV 9718	9718-137	2017-12
EMI receiver 20 Hz ÷ 8 GHz	R&S	ESU8	100202	2017-09
Hydraulic revolving platform	Nemko	RTPL 01	4.233	NCR
Antenna mast	R&S	HCM	836 529/05	NCR
Controller	R&S	HCC	836 620/7	NCR
Semi-anechoic chamber	Nemko	10m semi-anechoic chamber	530	2018-10
Shielded room	Siemens	10m control room	1947	NCR

NCR = no calibration required

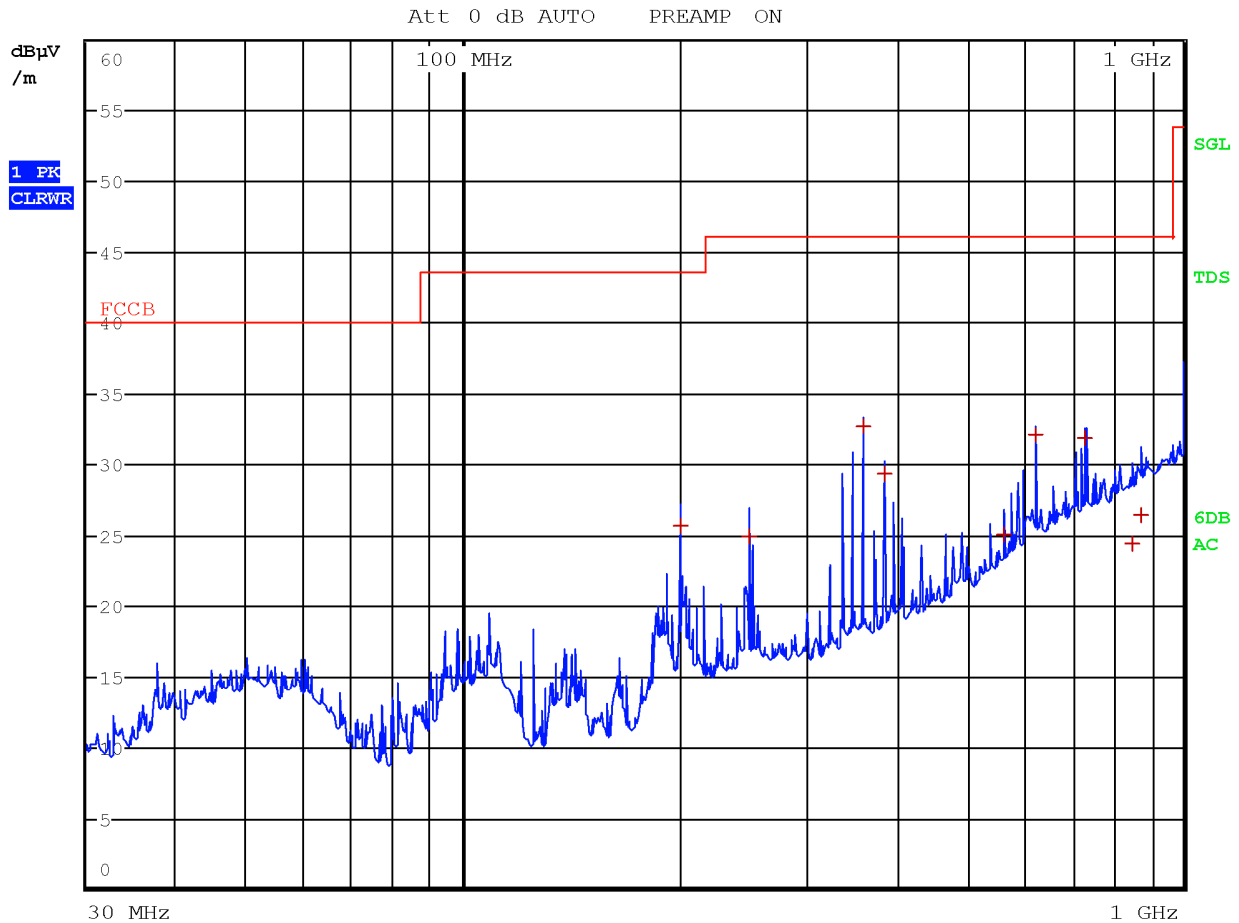
5.2.6 Test protocol

Antenna polarization: Horizontal
 Operation mode: 1
 Configuration mode: 1
 Remarks: Frequency range: 30 to 1000 MHz

Verdict: Pass



RBW 120 kHz
 MT 1 s
 PREAMP ON



Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
199.9800	25.7	43.5	-17.8	QP
250.0200	24.9	46.0	-21.1	QP
360.0000	32.7	46.0	-13.4	QP
384.0300	29.3	46.0	-16.7	QP
564.0000	25.0	46.0	-21.0	QP
624.9900	32.1	46.0	-13.9	QP
732.0300	31.8	46.0	-14.2	QP
849.9300	24.4	46.0	-21.6	QP
875.0100	26.4	46.0	-19.6	QP

Antenna polarization: Vertical
 Operation mode: 1
 Configuration mode: 1
 Remarks: Frequency range: 30 to 1000 MHz

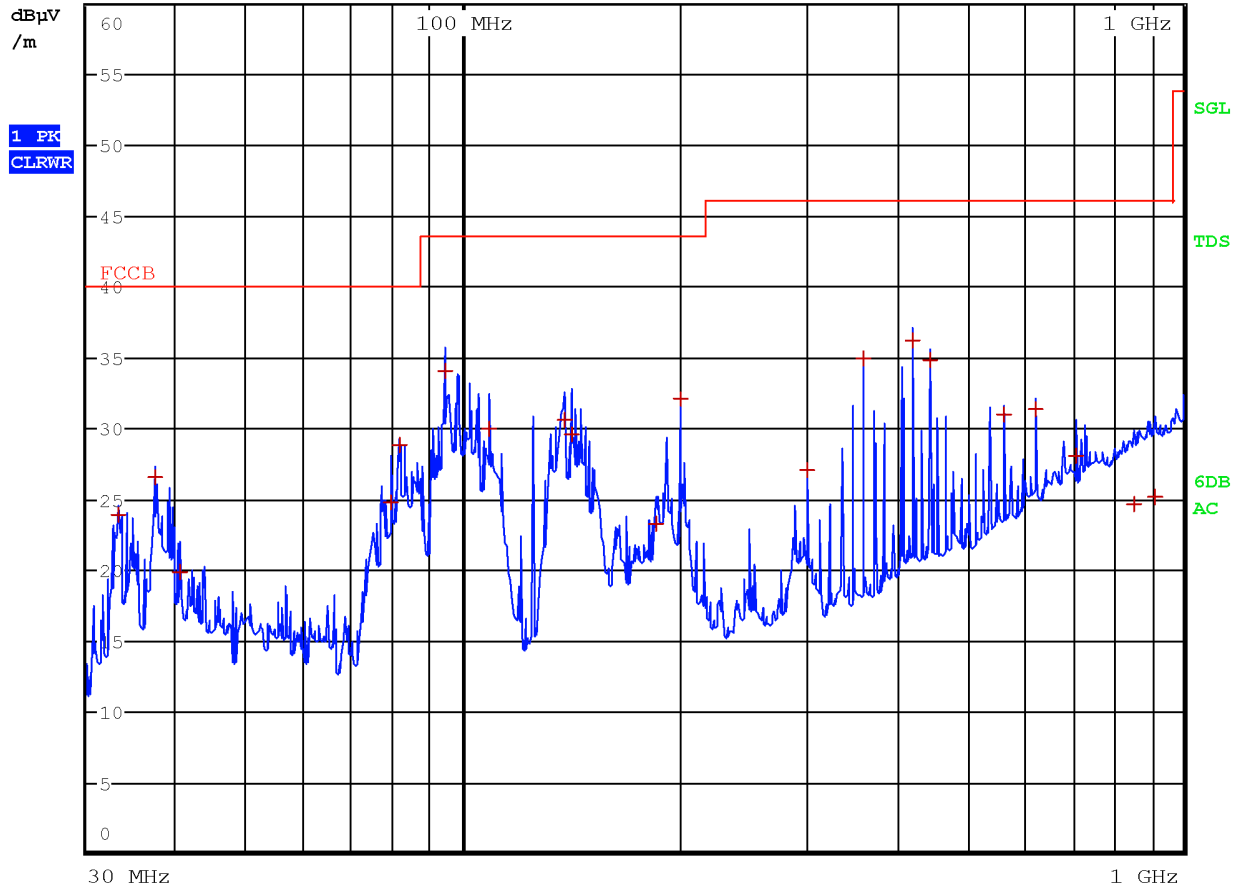
Verdict: Pass



RBW 120 kHz

MT 1 s

Att 0 dB AUTO PREAMP ON



Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Detector
33.1800	23.9	40.0	-16.1	QP
37.3800	26.6	40.0	-13.4	QP
40.3500	19.9	40.0	-20.1	QP
79.2600	24.8	40.0	-15.2	QP
81.4800	28.8	40.0	-11.2	QP
94.3800	34.1	43.5	-9.4	QP
108.8100	29.9	43.5	-13.6	QP
138.4200	30.6	43.5	-12.9	QP
141.1800	29.6	43.5	-13.9	QP
185.2500	23.2	43.5	-20.3	QP
199.9800	32.1	43.5	-11.4	QP
300.0000	27.1	46.0	-18.9	QP
360.0300	35.0	46.0	-11.0	QP
420.0300	36.2	46.0	-9.8	QP
444.0300	34.9	46.0	-11.1	QP
564.0300	31.0	46.0	-15.1	QP
624.9900	31.3	46.0	-14.7	QP
708.0600	28.1	46.0	-17.9	QP
854.9700	24.6	46.0	-21.4	QP
914.4000	25.2	46.0	-20.9	QP

Antenna polarization: Horizontal
 Operation mode: 1
 Configuration mode: 1
 Remarks: Frequency range: 1000 to 5000 MHz

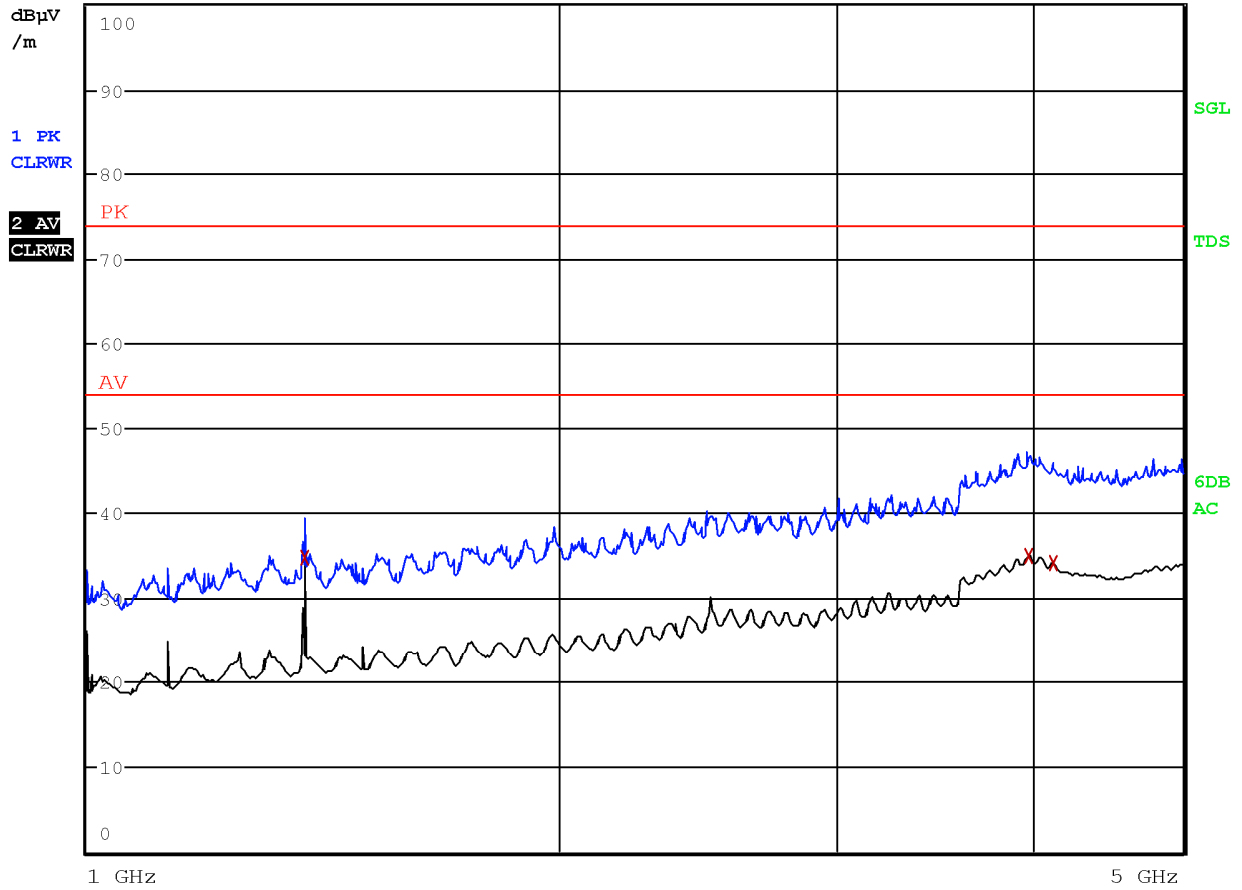
Verdict: Pass



RBW 1 MHz

MT 1 s

Att 0 dB AUTO PREAMP OFF



Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1375.0000	34.8	54.0	-19.2	AV
3981.5000	35.0	54.0	-19.0	AV
4131.0000	34.1	54.0	-19.9	AV

Antenna polarization: Vertical
 Operation mode: 1
 Configuration mode: 1
 Remarks: Frequency range: 1000 to 5000 MHz

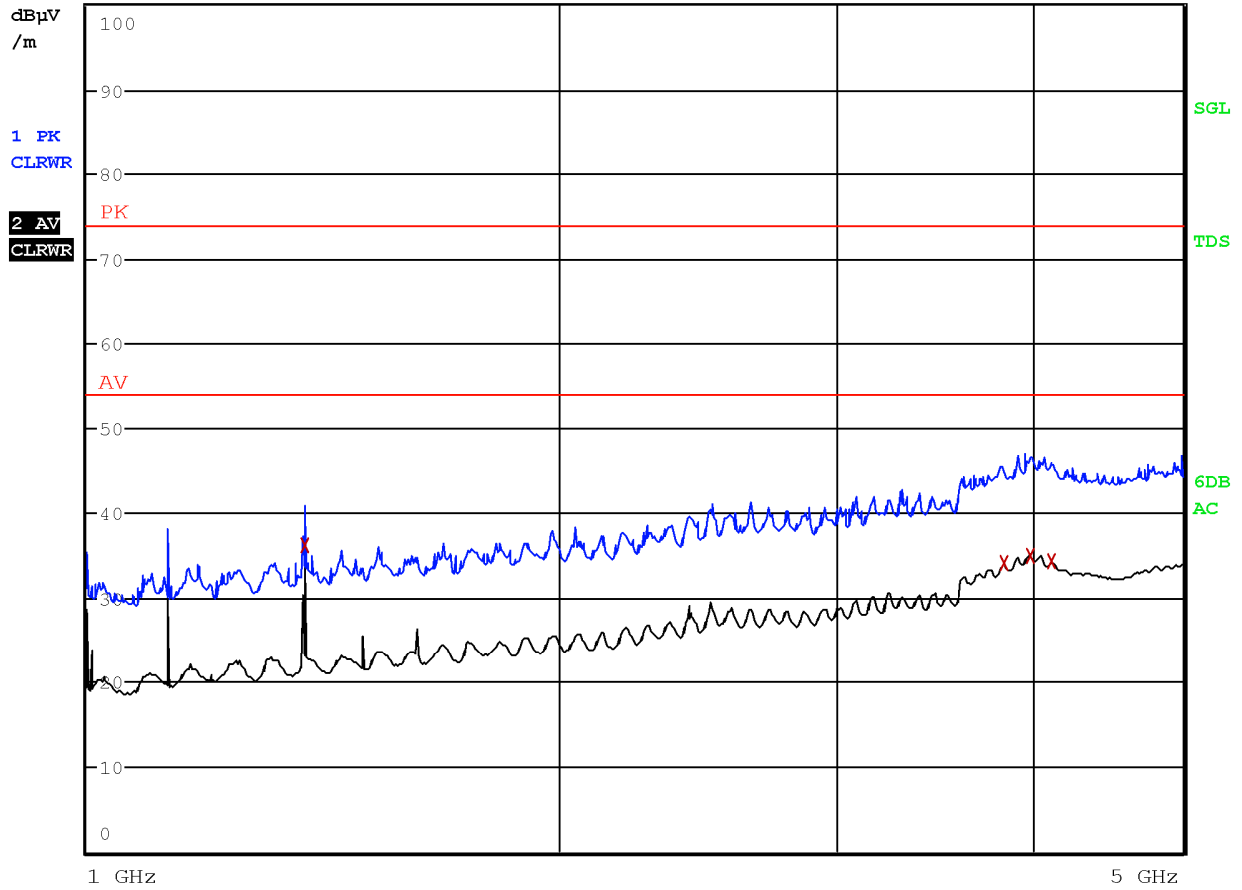
Verdict: Pass



RBW 1 MHz

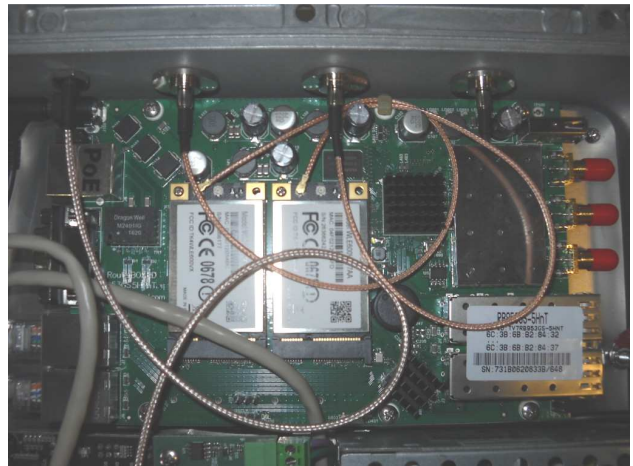
MT 1 s

Att 0 dB AUTO PREAMP OFF



Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1375.0000	36.3	54.0	-17.7	AV
3839.5000	34.0	54.0	-20.0	AV
3991.0000	34.9	54.0	-19.1	AV
4125.0000	34.3	54.0	-19.7	AV

6 EUT PHOTOS



End of report