




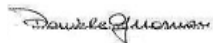
TEST REPORT

Title 47-Telecommunication

Chapter I - Federal Communications Commission

Subchapter A - General

Part 15 - Radio Frequency Devices Subpart B - Unintentional Radiators

Report Reference No.	354297-3TRFFCC		
Tested by (name, function and signature):	U Crippa	(project handler)	
Approved by (name, function and signature):	D. Guarnone	(verifier)	
Date of issue:	2018-06-22		
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	Novasis ingegneria Srl		
Address.....	Via Orbessano, 2/A – 10048 Vinovo (TO) – Italy		
Test specification:			
Standard	FCC CFR 47 Part 15 Subpart B		
	§15.107 – Conducted limits	<input checked="" type="checkbox"/>	
	§15.109 – Radiated emission limits	<input checked="" type="checkbox"/>	
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	Single Board Computer		
Trade Mark	Novasom		
Manufacturer.....	Novasis ingegneria Srl		
Address of manufacturer	Via Orbessano, 2/A – 10048 Vinovo (TO) – Italy		
Model N°	Novasom U 5		
Type	-		
Ratings.....	Input: 100–240V~1.0A, 50-60Hz (AC Adapter) I=0.5 A / 12VDC / P=6W (Board)		

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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. : 354297-3TRFFCC	2018-06-22 Date of issue
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Short description of the EuT
The appliance is a Single Board Computer

Copy of marking plate



Number of tested samples:	1
Serial number:	NEMKO ID 354297-3 (number assigned by Nemko Spa)
Internal operating frequency:	933MHz
Class:	B
Device type:	Table top/ Rack
Accessories and detachable parts included:	The E.U.T. is composed by two units: -Single Board Computer -AC Adapter -
Other options included:	-

Testing	
Date of receipt of test sample:	2018-06-19
Testing commenced on:	2018-06-19
Testing concluded on:	2018-06-22

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
354297-3TRFFCC	First release	2018-06-22
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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)

'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 6000 MHz	P
unintentional radiator operates at frequency lower than 1000 MHz			
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(see note1)	<input type="checkbox"/>	24 VDC

3.2 EuT operation modes

Mode	Description
1	Eut linked to a PC with RS232

3.3 EuT configuration modes

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

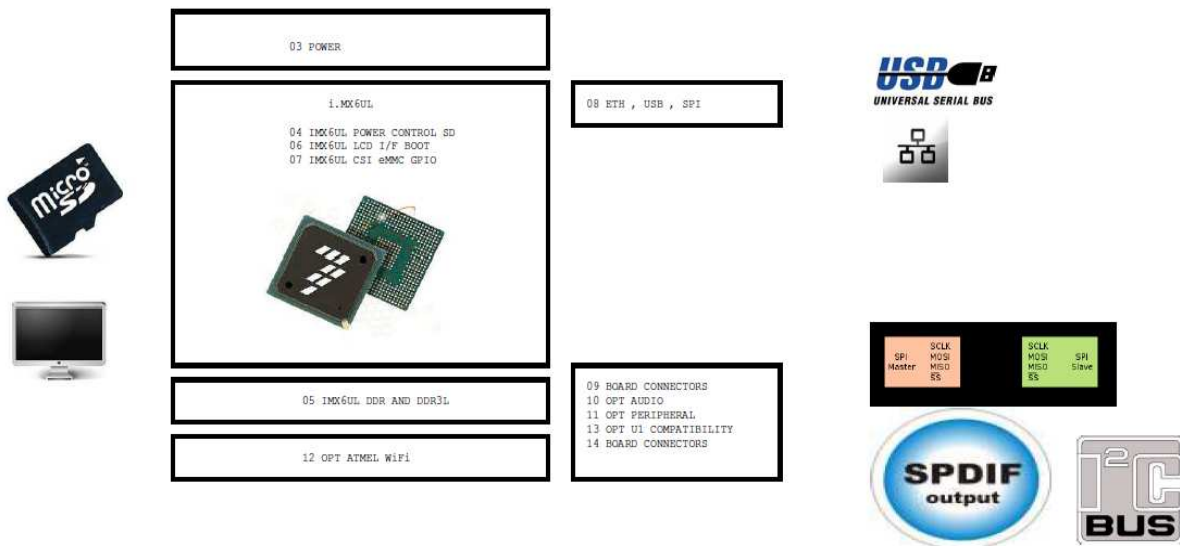
Immunity: the EuT was configured to have its highest possible susceptibility against tested phenomena. The test modes selected are according to EuT instruction manual.

Mode	Description
1	Normal configuration powered by a dedicated AC Adapter

3.4 Input/Output Ports

Port	Name	Type*	Cable Max. >3m	Cable Shielded	Description
--	Enclosure	N/E	—	—	—
0	Mains	AC	<input type="checkbox"/>	<input type="checkbox"/>	—
1	Ethernet LAN	TP	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Ethernet RJ45 connector for LAN communications
2	RS232	TP	<input type="checkbox"/>	<input type="checkbox"/>	Only for configuration
<p>Note: All other ports on the board have not been connected according to customer's declaration</p> <p>AC = AC Power Port DC = DC Power Port N/E = Non-Electrical</p> <p>I/O = Signal/Control Input or Output Port TP = Telecommunication Ports</p>					

Core processor



On Board:

- 1 x RaspBerryPiX compatible connector
- 1 x USB OTG on dedicated connector
- 1 x RGB Channel (up to 1366x768@24 bit) with current PWM brightness control and integrated resistive touch for 4.3" immediate connection
- 1 x Remote IR input connector (Option)
- 1 x Power led
- 1 x User Driven led

On dedicated STRIP:

- 1 x OTG USB **
- 1 x RS232 **
- 1 x RS485/422 **

- 25 x GPIO , shared with the following functions :
- 1 x SPI with 1 Slave Select, shared with WiFi
- 1 x I2C
- 1 x Full UART @ 3.3V (TX ; RX ; RTS ; CTS)
- 2 x UART @ 3.3V (TX ; RX)
- 1 x 4 bit uSD card
- 1 x PWM

3.5 Equipment Used During Test

Use*	Product Type	Manufacturer	Model	Comments
EUT	AC Adapter	EDACPOWER ELEC.	EA101SG-1E	—
AE	Single Board Computer (Ethernet load)	Novasis	U5	—
AE	PC	—	—	Provided by applicant

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

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°
Thermohygrometer data loggers	Testo	175-H2	20012380/305
Thermohygrometer data loggers	Testo	175-H2	38203337/307
Barometer	MSR	MSR145B	330080

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:	

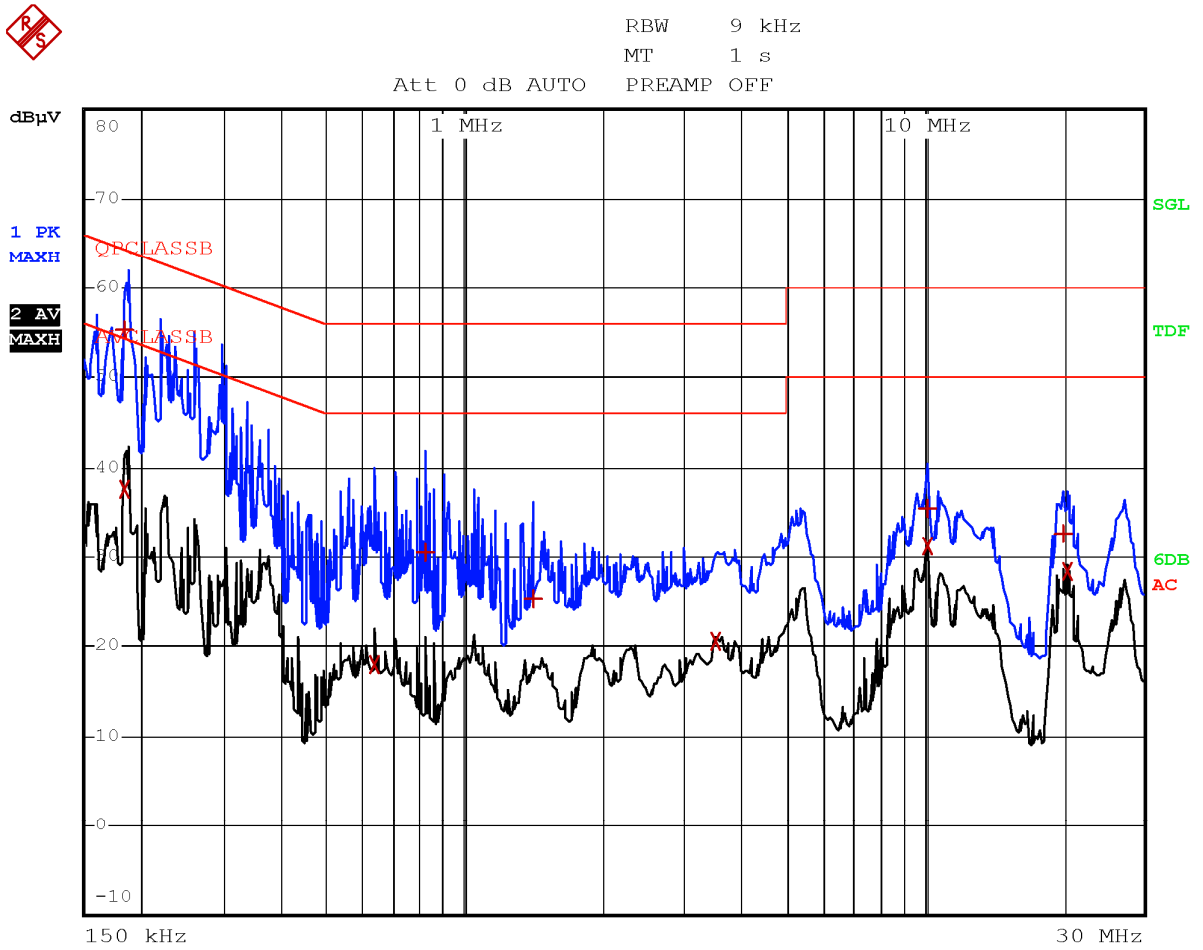
5.1.5 Test equipment used

Equipment	Manufacturer	Model	Serial N°	Cal. Date	Cal. Due
EMI receiver 20 Hz ÷ 8 GHz	R&S	ESU8	100202	2018/04/30	2019/04/30
LISN 9 kHz ÷ 30 MHz	R&S	ESH2-Z5	872 460/041	2017/11/21	2018/11/30
Shielded room	Siemens	Conducted emission test room	1862	—	—

5.1.6 Test protocol

Test point: Phase line
 Operation mode: 1
 Configuration mode: 1
 Remarks: 115 Vac, 60 Hz

Verdict: Pass



Date: 19.JUN.2018 17:55:10

Frequency (MHz)	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Detector
0.1860	55.4	64.2	-8.8	QP
0.1860	37.7	54.2	-16.5	AV
0.6340	17.9	46.0	-28.1	AV
0.8260	30.4	56.0	-25.6	QP
1.4140	25.4	56.0	-30.6	QP
3.5220	20.6	46.0	-25.4	AV
10.2020	35.6	60.0	-24.4	QP
10.2100	31.3	50.0	-18.7	AV
20.0340	32.7	60.0	-27.3	QP
20.5220	28.3	50.0	-21.7	AV

Test point: Neutral line
 Operation mode: 1
 Configuration mode: 1
 Remarks: 115 Vac, 60 Hz

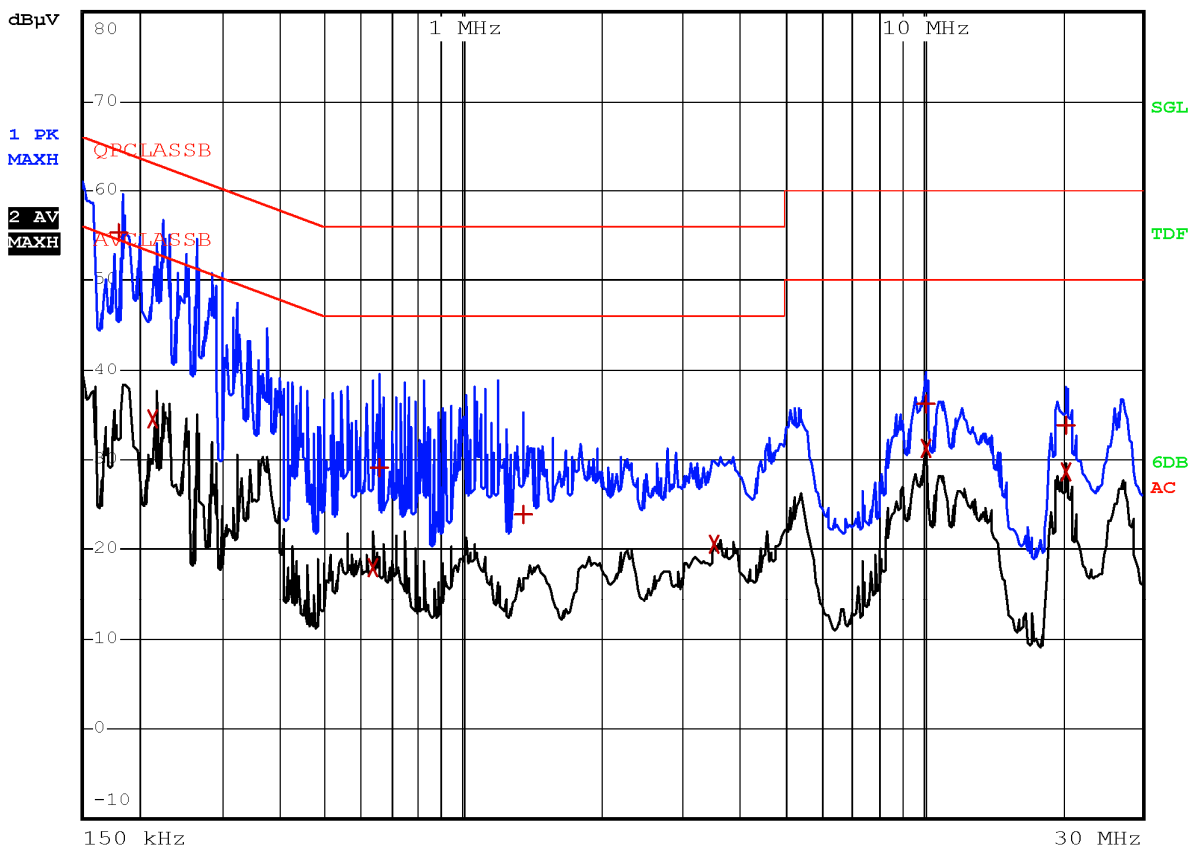
Verdict: Pass



RBW 9 kHz

MT 1 s

Att 0 dB AUTO PREAMP OFF

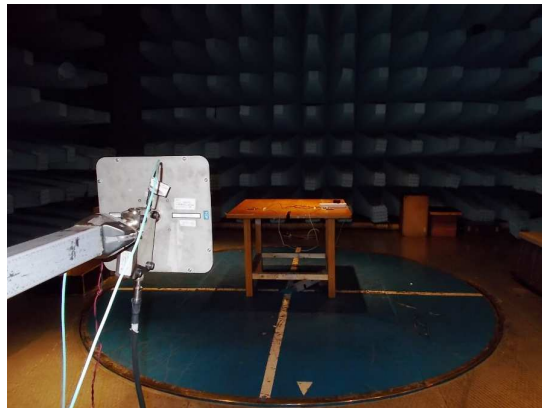
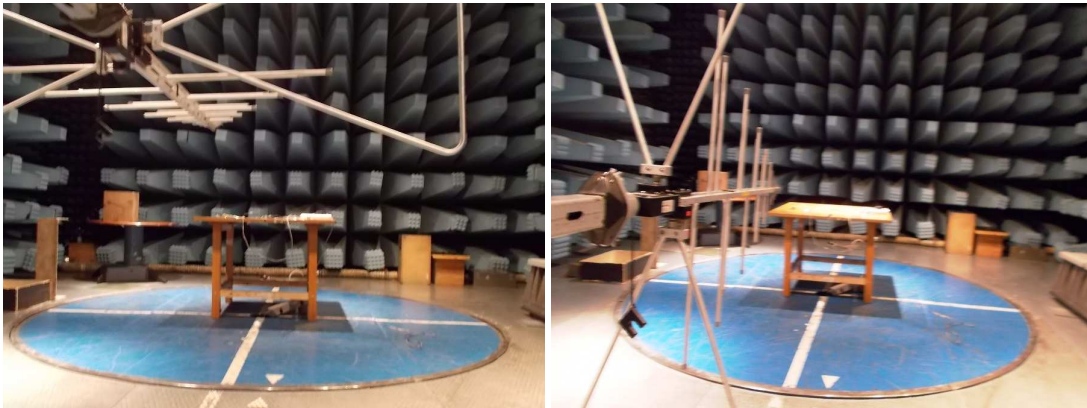
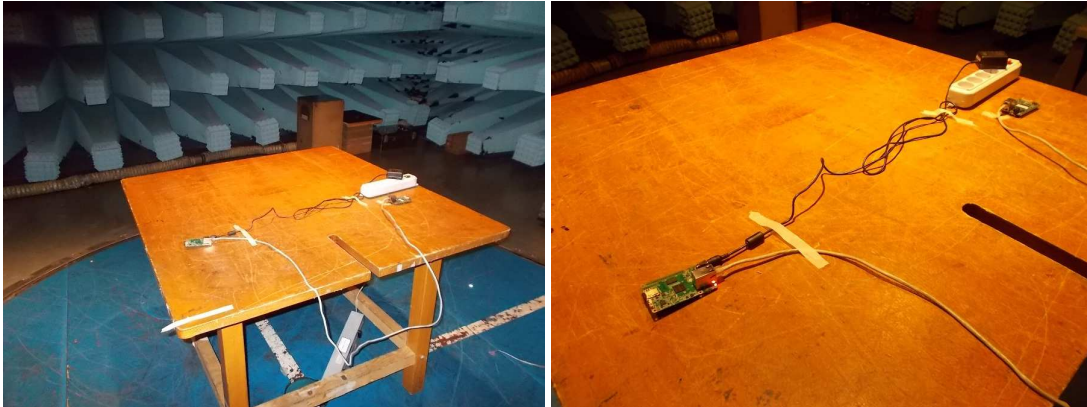


Date: 19.JUN.2018 17:58:01

Frequency (MHz)	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Detector
0.1820	55.3	64.4	-9.1	QP
0.2140	34.5	53.0	-18.5	AV
0.6340	17.9	46.0	-28.1	AV
0.6580	29.0	56.0	-27.0	QP
1.3500	23.9	56.0	-32.1	QP
3.5220	20.5	46.0	-25.5	AV
10.2060	36.2	60.0	-23.8	QP
10.2100	31.2	50.0	-18.8	AV
20.5260	33.7	60.0	-26.3	QP
20.5260	28.5	50.0	-21.5	AV

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 (peak) 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 (quasi-peak) 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 - 6000MHz												
Kind of test site:	Semi anechoic chamber												
Measurement distance:	3m												
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 in the following table:													
<table border="1"> <thead> <tr> <th>Highest frequency generated or used in the device or on which the device operates or tunes (MHz)</th> <th>Upper frequency of measurement range (MHz)</th> </tr> </thead> <tbody> <tr> <td>Below 1.705</td> <td>30.</td> </tr> <tr> <td>1.705-108</td> <td>1000.</td> </tr> <tr> <td>108-500</td> <td>2000.</td> </tr> <tr> <td>500-1000</td> <td>5000.</td> </tr> <tr> <td>Above 1000</td> <td>5th harmonic of the highest frequency or 40 GHz, whichever is lower.</td> </tr> </tbody> </table>		Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)	Below 1.705	30.	1.705-108	1000.	108-500	2000.	500-1000	5000.	Above 1000	5th harmonic of the highest frequency or 40 GHz, whichever is lower.
Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)												
Below 1.705	30.												
1.705-108	1000.												
108-500	2000.												
500-1000	5000.												
Above 1000	5th harmonic of the highest frequency or 40 GHz, whichever is lower.												

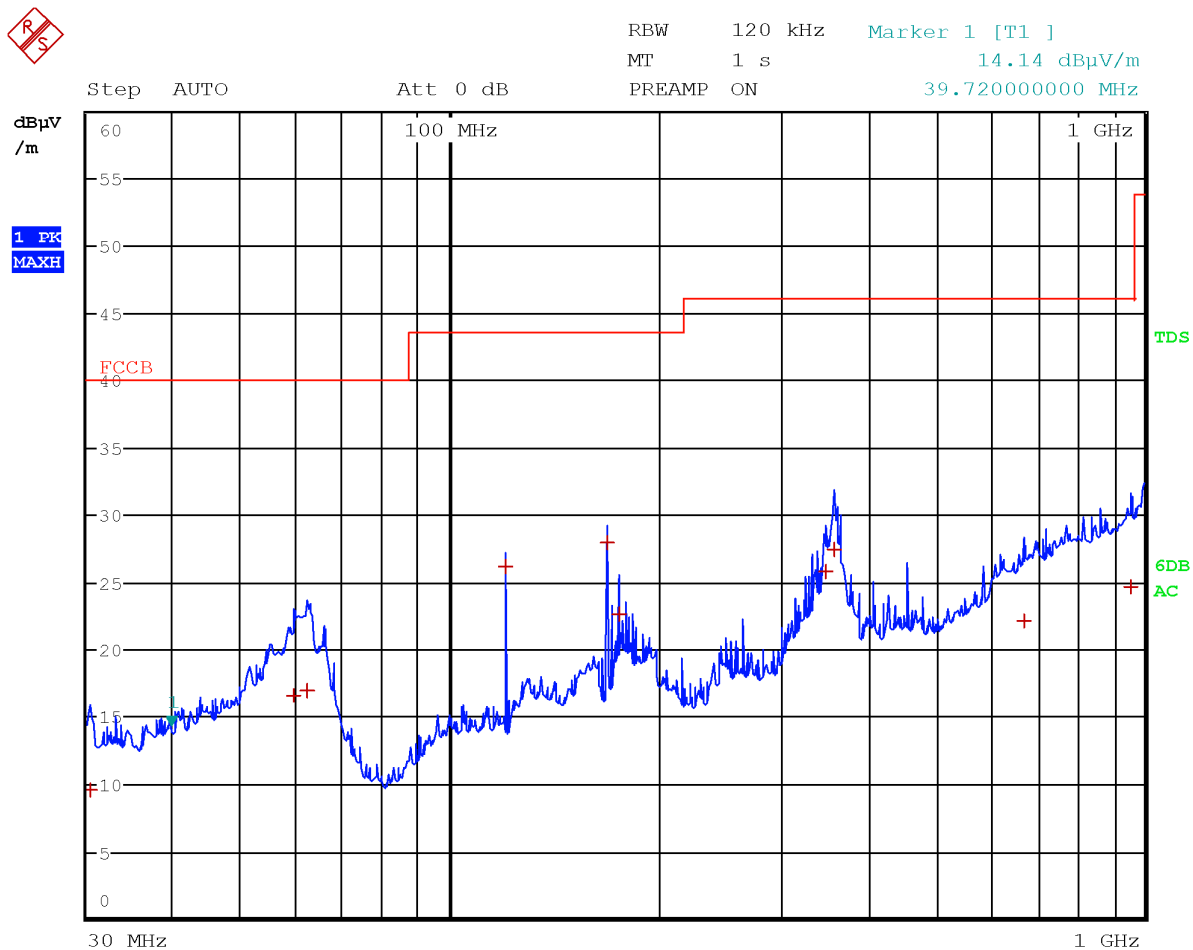
5.2.5 Test equipment used

Equipment	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Trilog Broadband Antenna	Schwarzbeck	VULB 9162	9162-025	2015/07	2018/07
Antenna 1-18GHz	Schwarzbeck	STLP9148	STLP9148-123	2016/06	2018/06
Broadband preamplifier	Schwarzbeck	BBV 9718	9718-137	2017/12	2018/12
EMI receiver 20 Hz ÷ 8 GHz	R&S	ESU8	100202	2018/04	2019/04
Hydraulic revolving platform	Nemko	RTPL 01	4.233	–	–
Antenna mast	R&S	HCM	836 529/05	–	–
Controller	R&S	HCC	836 620/7	–	–
Semi-anechoic chamber	Nemko	10m semi-anechoic chamber	530	–	–
Shielded room	Siemens	10m control room	1947	–	–

5.2.6 Test protocol

Antenna polarization: Horizontal
 Operation mode: 1
 Configuration mode: 1
 Remarks:

Verdict: Pass



Date: 20.JUN.2018 16:58:40

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Detector
30.3600	9.5	40.0	-30.5	QP
59.4400	16.5	40.0	-23.5	QP
62.2800	17.0	40.0	-23.0	QP
120.0000	26.2	43.5	-17.3	QP
168.0000	27.9	43.5	-15.6	QP
175.4000	22.7	43.5	-20.8	QP
346.7200	25.8	46.0	-20.2	QP
357.0400	27.5	46.0	-18.5	QP
671.9200	22.2	46.0	-23.8	QP
956.5600	24.6	46.0	-21.4	QP

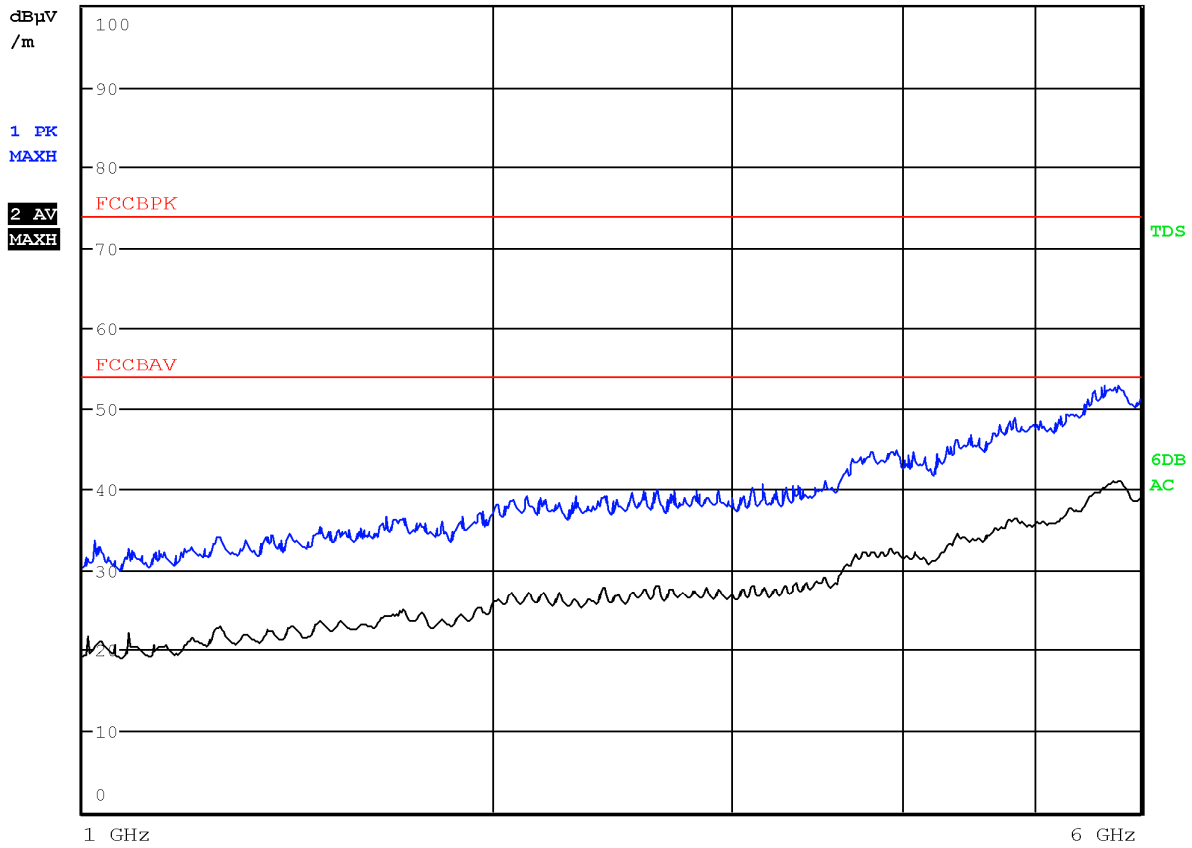
Antenna polarization: Horizontal
 Operation mode: 1
 Configuration mode: 1
 Remarks: 1GHz÷6GHz

Verdict: Pass



RBW 1 MHz
 MT 1 ms
 PREAMP OFF

Step AUTO Att 0 dB

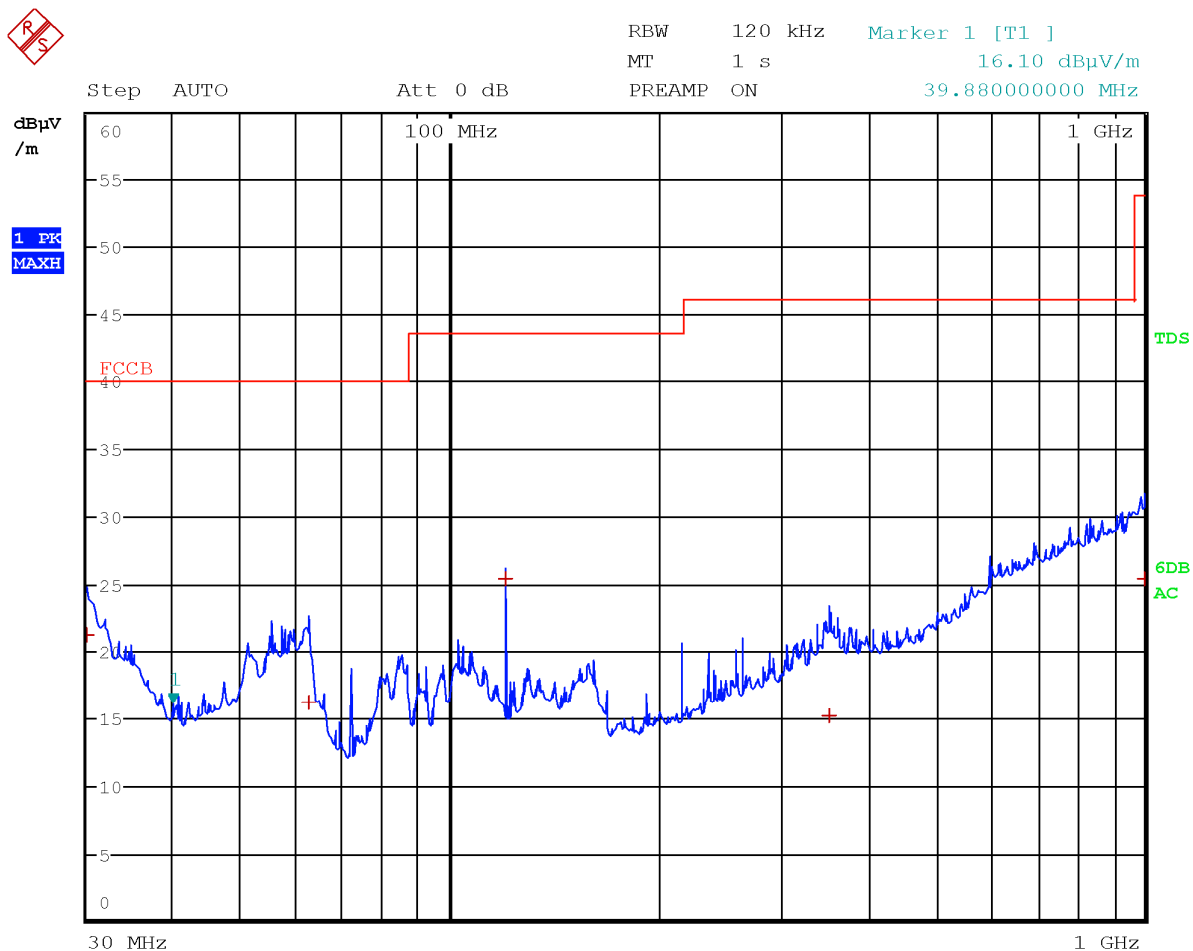


Date: 20.JUN.2018 17:06:03

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
-	-	-	-	-

Antenna polarization: Vertical
 Operation mode: 1
 Configuration mode: 1
 Remarks: 30MHz÷1000MHz

Verdict: Pass



Date: 20.JUN.2018 16:52:56

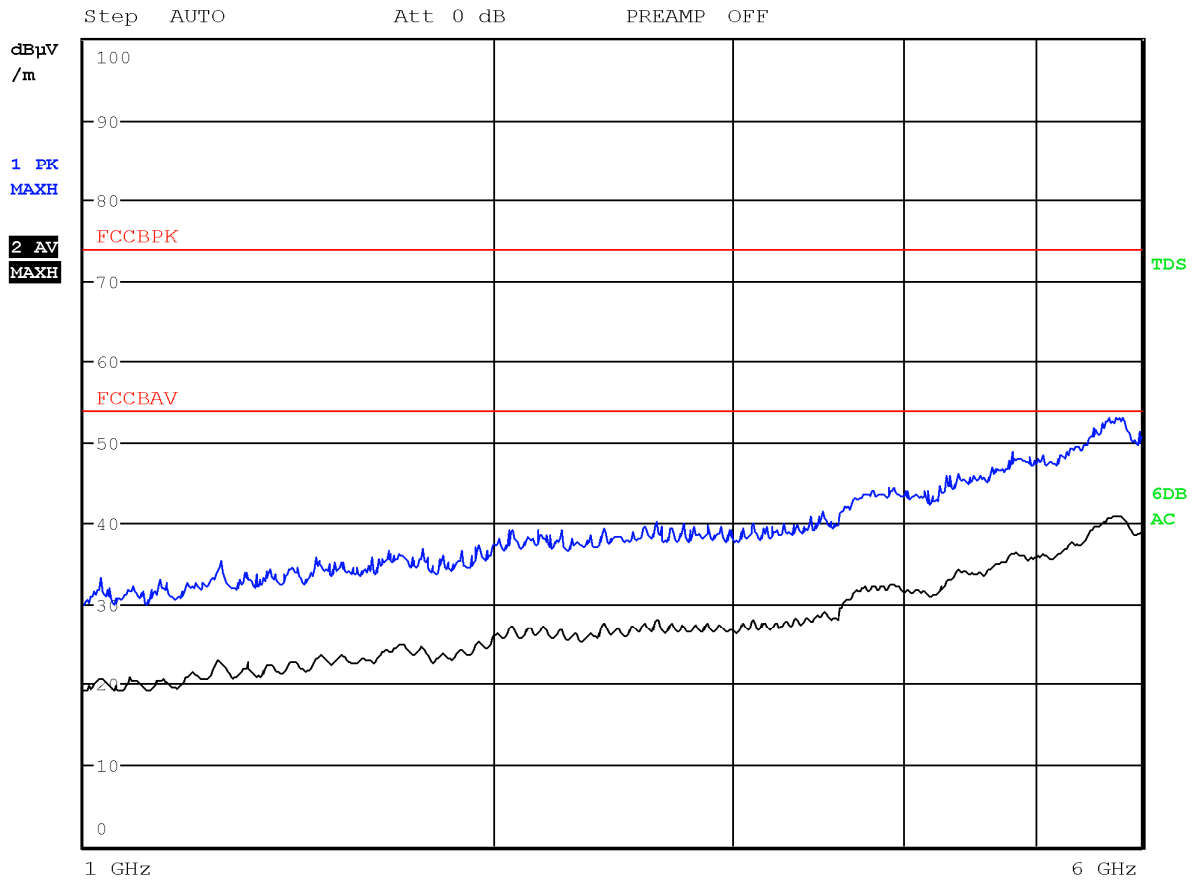
Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Detector
30.0000	21.2	40.0	-18.8	QP
62.6000	16.2	40.0	-23.8	QP
120.0000	25.3	43.5	-18.2	QP
352.5200	15.2	46.0	-30.8	QP
998.8000	25.4	54.0	-28.6	QP

Antenna polarization: Vertical
 Operation mode: 1
 Configuration mode: 1
 Remarks: 1GHz÷6GHz

Verdict: Pass



RBW 1 MHz
 MT 1 ms
 PREAMP OFF



Date: 20.JUN.2018 17:07:26

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
-	-	-	-29.5	-

6 EUT PHOTOS





End of report