
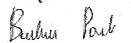




<b>TEST REPORT</b>	
<b>Title 47-Telecommunication</b>	
Chapter I - Federal Communications Commission	
Subchapter A – General Part 15 - Radio Frequency Devices	
Subpart B - Unintentional Radiators	
<b>Report Reference No.</b> .....	368276TRFFCC
Tested by (name, function and signature).....	D. Guarnone (project handler) 
Approved by (name, function and signature).....	P. Barbieri (verifier) 
Date of issue.....	2019-04-15
<b>Testing Laboratory</b> .....	<b>Nemko Spa</b>
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
<b>Applicant's name</b> .....	<b>Mikrotiks SIA</b>
Address.....	Brivibas gatve 214i LV-1039 Riga Latvia
<b>Test specification:</b>	
Standard .....	FCC CFR 47 Part 15 Subpart B, ICES-003
	§15.107 – Conducted emission <input checked="" type="checkbox"/>
	§15.109 – Radiated emission <input checked="" type="checkbox"/>
Test procedure.....	Nemko WM L0077, WM L0177 and WM L1002
<b>Test Report Form No.</b> .....	FCCTRF
TRF Originator .....	Nemko Spa
Master TRF.....	2014-03
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<b>Test item description</b> .....	<b>WLAN 802.11a/n/ac and 802.11b/g/n router</b>
Trade Mark .....	MikroTIK
Manufacturer.....	<b>Mikrotiks SIA</b>
Address of manufacturer .....	Brivibas gatve 214i LV-1039 Riga Latvia
Model .....	RBLHGG-5HPacD2HPnD-XL-US
Ratings.....	100 ÷ 240 V, 50/60 Hz with external power adapter (through PoE injector)


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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.*

This Test Report, when bearing the Nemko name and logo is only valid when issued by a Nemko laboratory, or by a laboratory having special agreement with Nemko.

<b>Test Report No. : 368276TRFFCC</b>	<b>2019-04-15</b> Date of issue
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Short description of the EuT	Copy of marking plate
The EUT is <b>WLAN 802.11a/n/ac and 802.11b/g/n router</b> with two 2 chains transmitters with integrated omni-directional antenna.	
Number of tested samples:	1
Serial number:	8517075EAC80/904
Internal operating frequency:	< 1.2 GHz
Class:	B
Device type:	Fixed
Accessories and detachable parts included:	The E.U.T. is composed by a single unit
Other options included:	--
<b>Testing</b>	
Date of receipt of test sample:	2019-02-21
Testing commenced on:	2019-03-13
Testing concluded on:	2019-04-01
<b>Possible test case verdicts:</b>	
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)
<b>Symbols used in this test report</b>	
<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.	
Throughout this report point is used as decimal separator.	
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.	

<b>Verdict</b> according to the standards listed at page 5:	<b>Pass</b>
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<b>PROJECT HISTORY</b>		
<b>Report number</b>	<b>Modification to the report / comments</b>	<b>Date</b>
368276TRFFCC	First release	2019-04-15
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<b>REMARKS</b>		

<b>PRODUCT VARIANTS</b>		
<b>Variant model</b>	<b>Difference against the main model</b>	<b>Additional test performed</b>
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<b>REMARKS</b>		

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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

**ICES-003 (2017)**

Information Technology Equipment (Including Digital Apparatus) — Limits and Methods of Measurement

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

<b>FCC Part 15 Subpart B requirements and ICES 003</b>			
Part	Test description	Frequency range	Verdict
§15.107, 6.1	Conducted emission	150 kHz to 30 MHz	P
§15.109, 6.2	Radiated emission	30 MHz to 1000 MHz	P
<b>GENERAL REMARKS</b>			

### 3 EQUIPMENT UNDER TEST

#### 3.1 Power supply system utilised


Power supply voltage:	<input type="checkbox"/>	230 V / 50 Hz / 1φ	<input checked="" type="checkbox"/>	115 V / 60 Hz / 1φ
	<input type="checkbox"/>	400 V / 50 Hz 3PE	<input type="checkbox"/>	400 V / 50 Hz 3NPE
	<input type="checkbox"/>	12 V DC	<input type="checkbox"/>	5 V DC

#### 3.2 EuT operation modes

Mode	Description
1	E.U.T. tested powered without RF carrier.

#### 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.

Mode	Description
1	The EUT has been tested supplied by an external DC external power adapter (through PoE injector) and connected to PC with dedicated software. (  )

#### 3.4 Input/Output Ports

Port	Name	Type*	Cable Max. >3m	Cable Shielded	Description
0	Enclosure	N/E	—	—	—
1	ETH1	DC+TP	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Power and signal from PoE
2	ETH2	I/O	<input checked="" type="checkbox"/>	<input type="checkbox"/>	with rubber plug

\*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	Notebook	--	--	—

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**

<b>Equipment</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial N°</b>
Thermohygrometer data loggers	Testo	175-H2	20012380/305
Baarometer	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 emission

#### 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 $\mu$ 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 $\mu$ 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  $\mu$ 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 $\mu$ 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:	

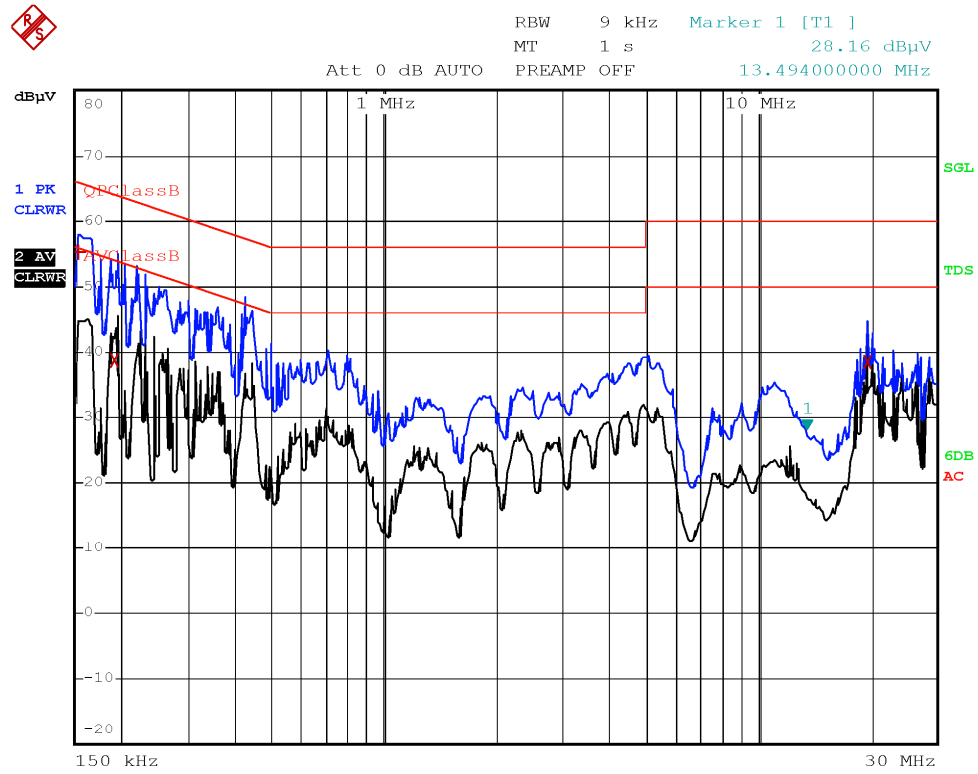
**5.1.5 Test equipment used**

Equipment	Manufacturer	Model	Serial N°	Cal Date	Due Date
EMI receiver 20 Hz ÷ 8 GHz	Rohde & Schwarz	ESU8	100202	2019/01	2020/01
LISN three phase 9 kHz to 30 MHz	Rohde & Schwarz	ESH2-Z5	872 460/041	2018/09	2019/09
Shielded room	Siemens	Conducted emission test room	1862	NSC	-

5.1.6 Test protocol

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

Verdict: Pass

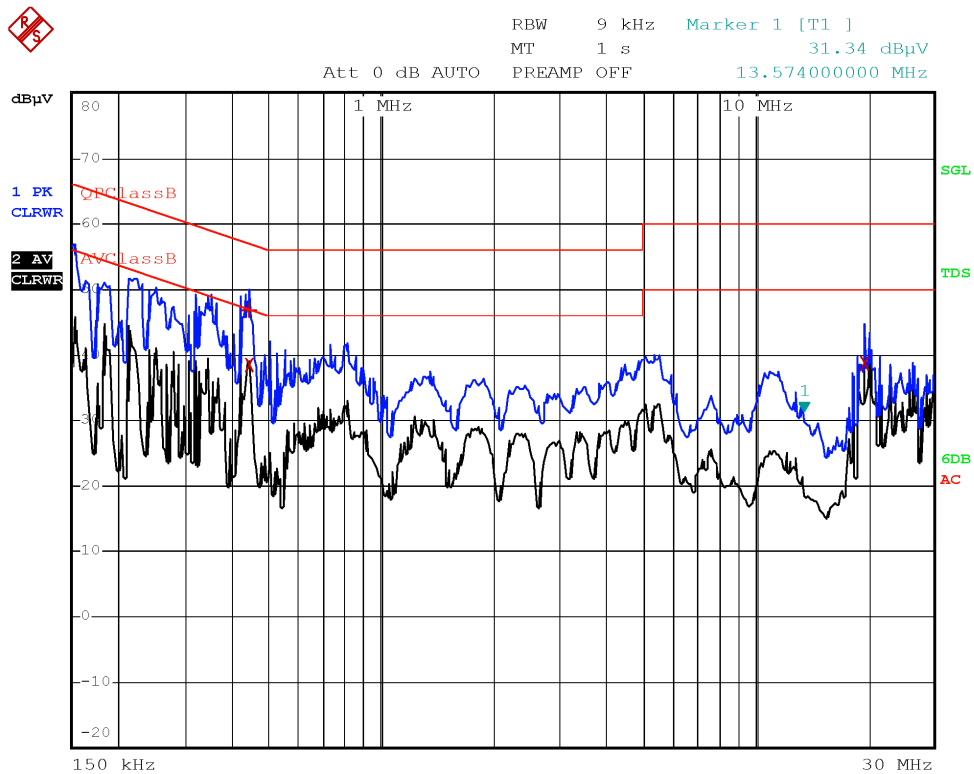


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Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
0.1540	55.3	65.8	-10.5	QP
0.1940	38.7	53.9	-15.2	Av
19.7100	38.6	50.0	-11.4	Av

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

Verdict: Pass



Date: 4.APR.2019 20:17:19

Plot 0-1: Conducted emissions on neutral line

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
0.1540	55.3	65.8	-10.5	QP
0.1940	38.7	53.9	-15.2	Av
19.7100	38.6	50.0	-11.4	Av

## 5.2 Clause 15.109 – Radiated emissions

### 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 - 1000MHz												
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.												

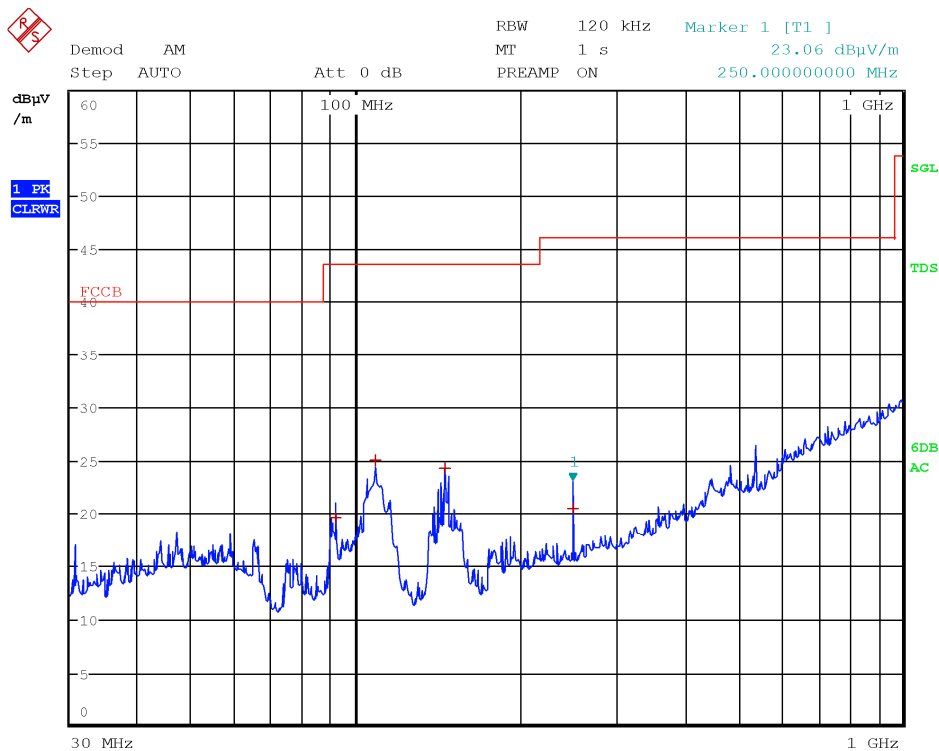
**5.2.5 Test equipment used**

Equipment	Manufacturer	Model	Serial N°	Cal Date	Due Date
Trilog Broadband Antenna	Schwarzbeck	VULB 9162	9162-025	2018/07	2019/07
Bilog antenna 1 ÷ 18 GHz	Schwarzbeck	STLP 9148-123	123	2018/07	2021/07
Broadband preamplifier 1 ÷ 18 GHz	Schwarzbeck	BBV 9718	9718-137	2018/08	2019/08
EMI receiver 20 Hz ÷ 8 GHz	Rohde & Schwarz	ESU8	100202		
Hydraulic revolving platform	Nemko	RTPL 01	4.233	NSC	-
Antenna mast	R&S	HCM	836 529/05	NSC	-
Controller	R&S	HCC	836 620/7	NSC	-
Semi-anechoic chamber	Nemko	10 m semi-anechoic chamber	530	2018-09	2021-09
Shielded room	Siemens	10 m control room	1947	NSC	-

### 5.2.6 Test protocol

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

Verdict: Pass



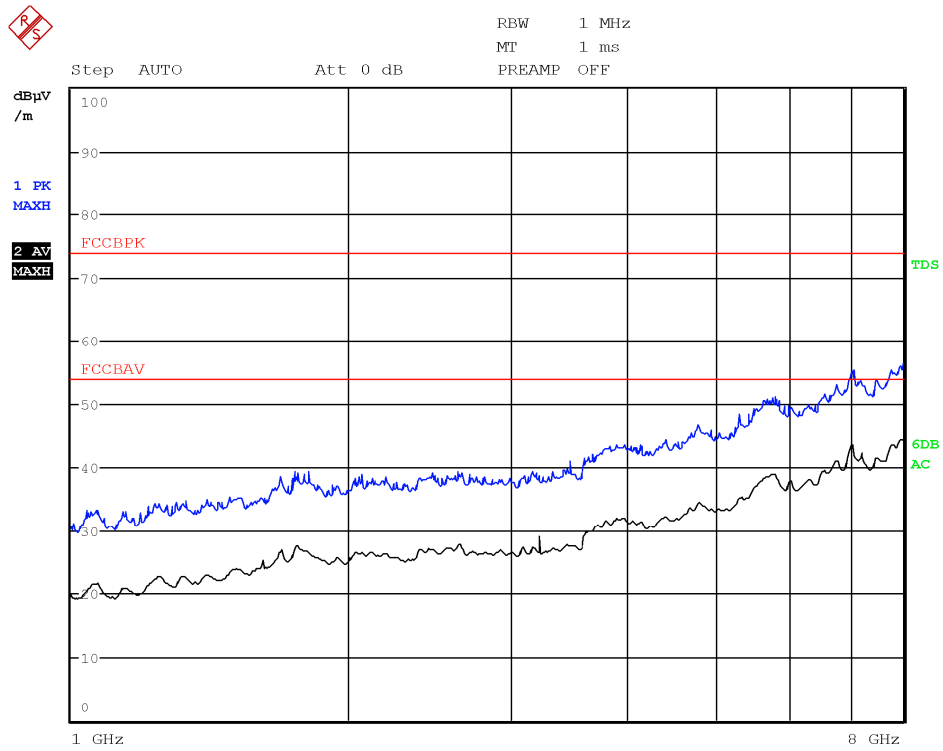
Date: 13.MAR.2019 16:22:47

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
91.5600	19.6	43.5	-23.9	QP
108.7200	25.1	43.5	-18.4	QP
145.2800	24.3	43.5	-19.2	QP
250.0000	20.5	46.0	-25.5	QP



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

Verdict: Pass

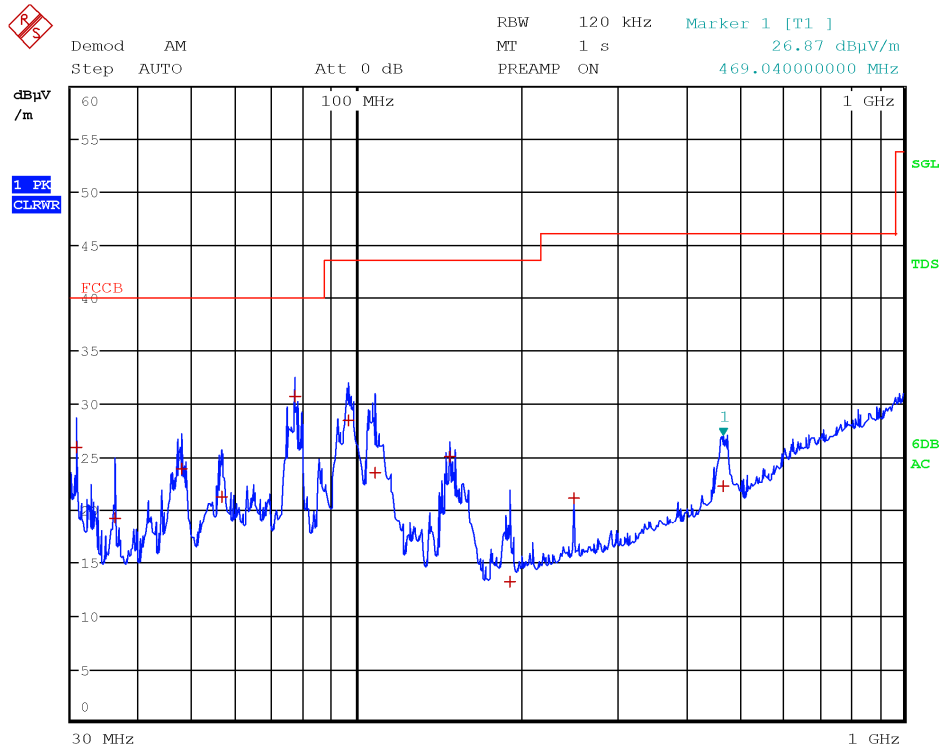


Date: 13.MAR.2019 19:14:35

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
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Antenna polarization: Vertical  
 Operation mode: 1  
 Configuration mode: 1  
 Remarks:

Verdict: Pass

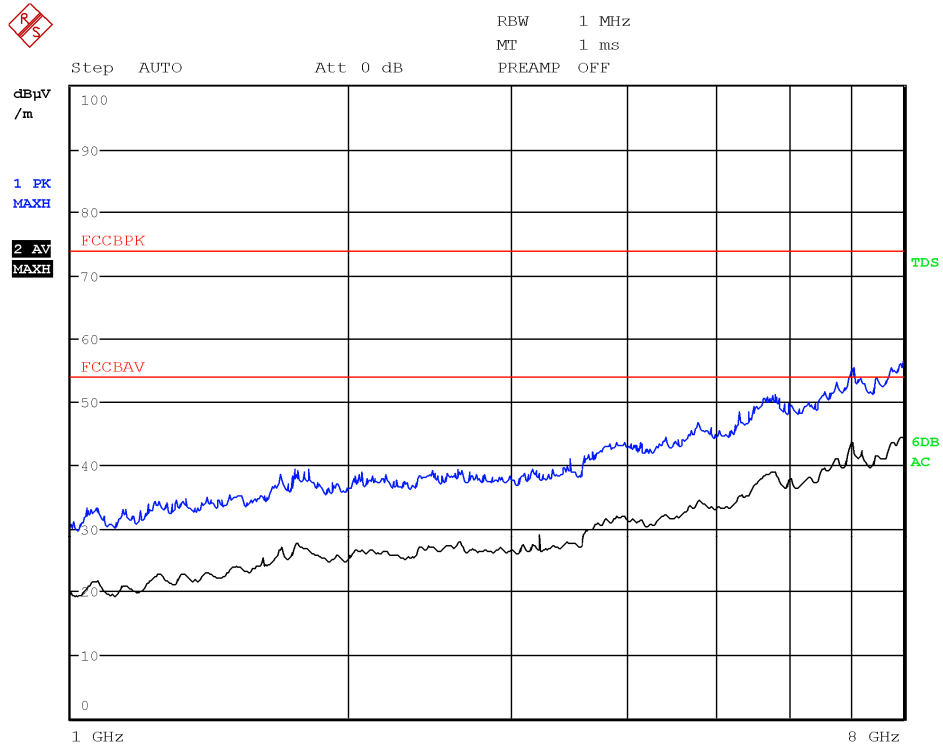


Date: 13.MAR.2019 16:11:08

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
30.6400	26.0	40.0	-14.0	QP
36.1200	19.2	40.0	-20.8	QP
47.8000	24.0	40.0	-16.0	QP
56.5200	21.3	40.0	-18.7	QP
77.2000	30.8	40.0	-9.2	QP
96.3600	28.5	43.5	-15.0	QP
107.8400	23.5	43.5	-20.0	QP
148.1200	25.0	43.5	-18.5	QP
190.7600	13.2	43.5	-30.3	QP
250.0000	21.2	46.0	-24.8	QP
469.0400	22.3	46.0	-23.7	QP

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

Verdict: Pass



Date: 13.MAR.2019 19:14:35

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

**6 EUT PHOTOS**



End of report