

EMC TEST REPORT

FCC 47 CFR Part 15B Industry Canada RSS-Gen

Electromagnetic compatibility - Unintentional radiators

Testing Laboratory: Eurofins Product Service GmbH

Address: Storkower Str. 38c

15526 Reichenwalde

Germany

Accreditation:



A2LA Accredited Testing Laboratory, Certificate No.: 1983.01

FCC Filed Test Laboratory, Reg.-No.: 96970 IC OATS Filing assigned code: 3470A

Applicant's name: AED Engineering

Address: Taunusstraße 51

80807 München GERMANY

Test specification:

Standard.....: 47 CFR Part 15 Subpart B

RSS-Gen, Issue 3, 2010-12

ANSI C63.4:2009

Equipment under test (EUT):

Product description CAN-WLAN Gateway RH

Model No. GN1001A

Additional Models None

Hardware version B0

Firmware / Software version None

FCC-ID: 2AELE-GN1001A IC: 20129-GN1001A

Test result Passed



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- not applicable to test object N/A

- test object does meet the requirement...... P (Pass)

- test object does not meet the requirement...... F (Fail)

Testing:

Compiled by: Marcus Klein

Tested by (+ signature)...... Andreas Pflug / Marco Belz

Approved by (+ signature) Marcus Klein

Date of issue 2015-08-28

Total number of pages: 35

General remarks:

The test results presented in this report relate only to the object tested.

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.

This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.

Additional comments:



Version History

Version	Issue Date	Remarks	Revised by
V01	2015-08-28	Initial Release	



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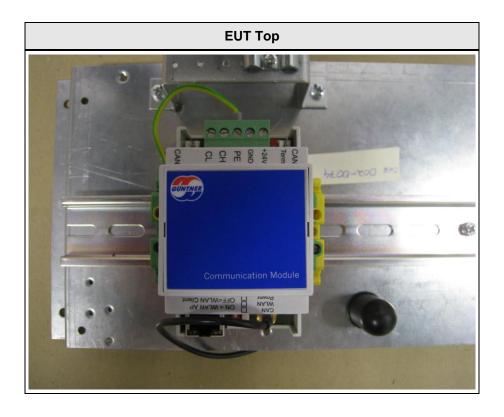


1 Equipment (Test item) Description

Description	CAN-WLAN Gateway RH		
Model	GN1001A		
Additional Models	None		
Serial number	None		
Hardware version	В0		
Software / Firmware version	None		
FCC-ID	2AELE-GN1001A		
IC	20129-GN1001A		
Power supply	24 VDC		
AC/DC-Adaptor	None		
	Type Model	WLAN Module	
	Manufacturer	WL18 MODG B Texas Instruments	
Radio module	HW Version	WL1801	
Naulo moudie	SW Version	None	
	FCC-ID	Z64-WL18SBMOD	
	IC	451I-WL18SBMOD	
Manufacturer	AED Engineering Taunusstraße 51 80807 München GERMANY		
Highest emission frequency	Fmax [MHz] = 2400		
Device classification	Class B		
Equipment type	Tabletop		
Number of tested samples	1		

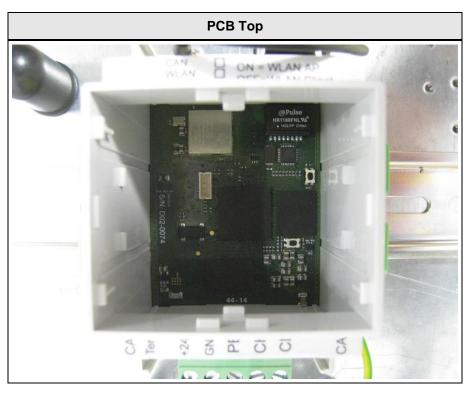


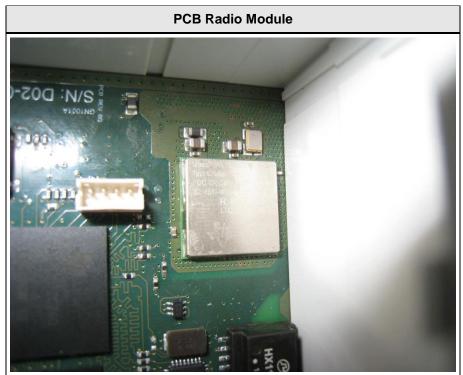
1.1 Photos – Equipment external





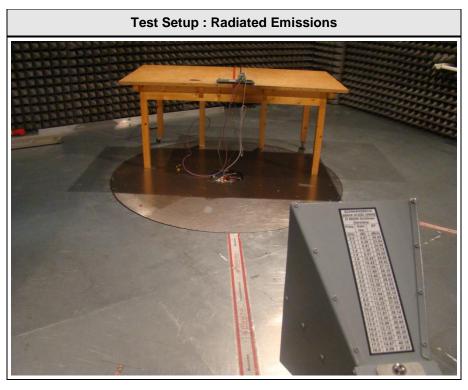
1.2 Photos – Equipment internal

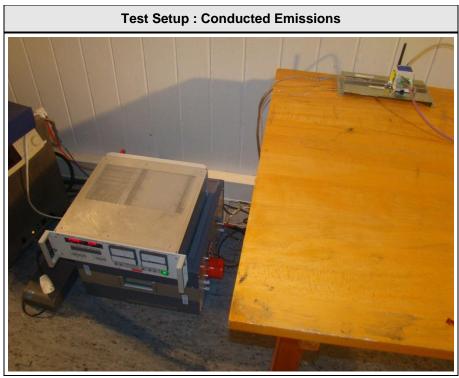






1.3 Photos - Test setup







1.4 Supporting Equipment Used During Testing

Product Type*	Device	Manufacturer	Model No.	Comments
AE	Notebook	Lenovo	R61	
AE	WiFi Router	SITECOM	WLR-5100	
AE	SENSOR	GÜNTNER GmbH	GTF201	
AE	STEP Controller	GÜNTNER GmbH	GRCS.1	
AE	Bus Cable	HEUKABEL	-	
AE	Power Supply	Mean Well	MDR-20-24	

*Note: Use the following abbreviations:

AE: Auxiliary/Associated Equipment, or SIM: Simulator (Not Subjected to Test)

CABL: Connecting cables

1.5 Input / Output Ports

Port #	Name	Type*	Max. Cable Length	Cable Shielded	Comments
1	DC Power	DC	>3m	No	
2	Ethernet	TP	2m	Yes	
3	CAN	I/O	2m	Yes	3x

*Note: Use the following abbreviations:

AC : AC power port
DC : DC power port
N/E : Non electrical

I/O : Signal input or output port

TP : Telecommunication port



1.6 Operating Modes and Configurations

Mode #	Description
1	EUT powered with 24 VDC. Ethernet link to Notebook established.
2	EUT powered with 24 VDC. WLAN link to Notebook established.
3	EUT powered with 24 VDC from external AC Power Supply which is powered with 120 VAC. Ethernet and WLAN link to Notebook established.

Configuration #	EUT Configuration
1	EUT equipped with external antenna.



1.7 Test Equipment Used During Testing

Measurement Software					
Description	Manufacturer	Name	Version		
EMC Test Software	Dare Instruments	Radimation	2014.1.15		

Radiated emissions					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Biconical Antenna	R&S	HK 116	EF00012	2013-02	2016-02
LPD-Antenne	R&S	HL 223	EF00187	2014-03	2017-03
Horn antenna	Schwarzbeck	BBHA 9120D	EF00018	2013-09	2016-09
EMI Test Receiver	R&S	ESU26	EF00887	2015-01	2016-01

Conducted emissions					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
AMN	R&S	ESH2-Z5	EF00182	2014-11	2016-11
AMN	R&S	ESH3-Z5	EF00036	2014-12	2016-12
EMI Test Receiver	R&S	ESCS 30	EF00295	2014-10	2015-10



1.8 Sample emission level calculation

The following is a description of terms and a sample calculation, as appears in the radiated emissions data table. The numbers used in the calculation are for example only. There is no direct correlation to the specific data taken for the product described in this document:

Reading:

This is the reading obtained on the spectrum analyzer in $dB\mu V$. Any external preamplifiers used are taken into account through internal analyzer settings.

A.F.:

This is the antenna factor for the receiving antenna. It is a conversion factor, which converts electric fields strengths to voltages, which can be measured directly on the spectrum analyzer. It is treated as a loss in dB. Cable losses have been included with the A.F. to simplify the calculations. The antenna factor is used in calculations as follows:

Reading on Analyzer (dB μ V) + A.F. (dB) = Net field strength (dB μ V/m)

Net:

This is the net field strength measurement (as shown above).

Limit:

This is the FCC Class B radiated emission limit (in units of $dB\mu V/m$). The FCC limits are given in units of $\mu V/m$. The following formula is used to convert the units of $\mu V/m$ to $dB\mu V/m$:

Limit $(dB\mu V/m) = 20*log (\mu V/m)$

Margin:

This is the margin of compliance below the FCC limit. The units are given in dB. A negative margin indicates the emission was below the limit. A positive margin indicates that the emission exceeds the limit.

Example only:

Reading + AF = Net Reading : Net reading - FCC limit = Margin 21.5 dB μ V + 26 dB = 47.5 dB μ V/m : 47.5 dB μ V/m - 57.0 dB μ V/m = -9.5 dB



2 Result Summary

FCC 47 CFR Part 15B, Industry Canada RSS-Gen					
Requirement – Test	Reference Method	Result	Remarks		
Radiated emissions	ANSI C 63.4	PASS			
AC power line conducted emissions	ANSI C63.4	PASS			
	Requirement – Test Radiated emissions	Requirement – Test Reference Method Radiated emissions ANSI C 63.4	Requirement – Test Reference Method Radiated emissions ANSI C 63.4 PASS		



3 Test Conditions and Results

3.1 Test Conditions and Results - Radiated emissions

Radiated emission	ons acc. FCC 47 C	FR 15.109	9 / IC RSS-Gen		Verdict:	PASS			
Laboratory Parameters:		Requir	ed prior to the test	During the test					
Ambient Temperature			15 to 35 °C	23°C					
Relative Humidity			30 to 60 %	32%					
Test according referenced standards		Reference Method							
		ANSI C63.4							
Sample is tested with respect to the requirements of the equipment class		Equipment class							
		Class B							
Test frequency range determined from highest emission frequency		Highest emission frequency							
		Fmax [MHz] = 2400							
Fully configured sample scanned over the following frequency range		Frequency range							
		30 MHz to 12 GHz							
Operating mode		1/2							
Configuration		1							
	L	imits and	results Class B						
Frequency [MHz]	Quasi-Peak [dBµV/r	n] Result	Average [dBµV/m]	Result	Peak [dBµV/m]	Result			
30 – 88	40	PASS	-		-	-			
88 – 216	43.5	PASS	-		-	-			
216 – 960	46	PASS	-		-	-			
960 – 1000	54	PASS	-		-	-			
> 1000	-	-	54	PASS	74	PASS			
Comments:				_					



Test Procedure:

The test site is in accordance with ANSI C63-4:2009 requirements and is listed by FCC. The measurement procedure is as follows:

- 1) The EUT was placed on a 0.8 m non conductive table at a 3 m distance from the receive antenna (ANSI C63.4: 2009 item 6.2)
- 2) The antenna output was connected to the measurement receiver
- 3) A biconical antenna was used for the frequency range 30 200 MHz, a logarithmic periodical antenna was used for the frequency range from 200 1000 MHz. Above one 1 GHz a Double Ridged Broadband Horn antenna was used. The antenna was placed on an adjustable height antenna mast
- 4) Emissions were maximized at each frequency by rotating the EUT and adjusting the receive antenna height and polarization. The maximum values were recorded.



Project number: G0M-1411-4293

Manufacturer: AED Engineering

EUT Name: CAN-WLAN Gateway RH

Model: GN1001A

Test Site: Eurofins Product Service GmbH

Operator: Mr. Belz

Test Conditions: Tnom: 23°C, Unom: + 24 VDC
Antenna: Rohde & Schwarz HK 116, Vertical

Measurement distance: 3m

Mode: WLAN aktiv Test Date: 2015-03-24

Note:

Index 29 FCC part 15B Class B QP RBW: 120 kHz, Vertical Max Peak 60 Electrical Field (dBµV/m) 10 60 M 100 M 120 M 30 M 40 M 80 M 140 M 160 M 200 M Frequency (Hz)



Project number: G0M-1411-4293

Manufacturer: AED Engineering

EUT Name: CAN-WLAN Gateway RH

Model: GN1001A

Test Site: Eurofins Product Service GmbH

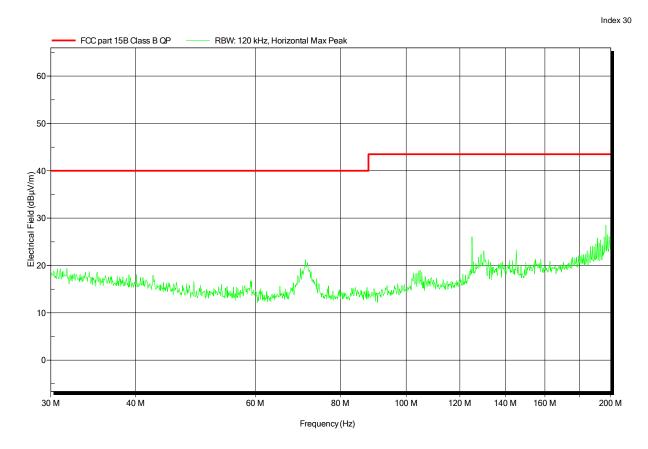
Operator: Mr. Belz

Test Conditions: Tnom: 23°C, Unom: + 24 VDC

Antenna: Rohde & Schwarz HK 116, Horizontal

Measurement distance: 3m

Mode: WLAN aktiv Test Date: 2015-03-24





Project number: G0M-1411-4293

Manufacturer: AED Engineering

EUT Name: CAN-WLAN Gateway RH

Model: GN1001A

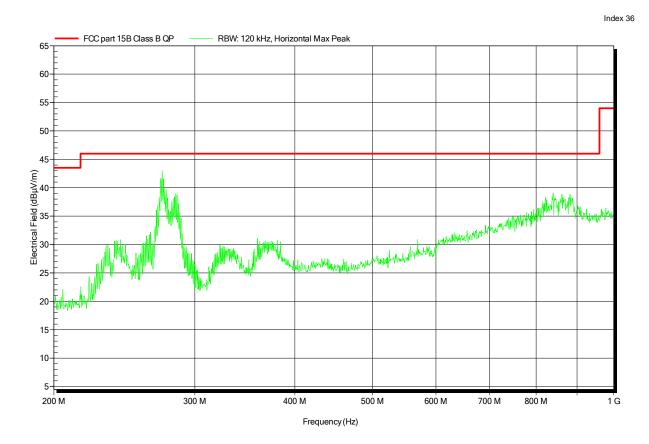
Test Site: Eurofins Product Service GmbH

Operator: Mr. Belz

Test Conditions: Tnom: 23°C, Unom: + 24 VDC
Antenna: Rohde & Schwarz HL 223, Horizontal

Measurement distance: 3m

Mode: WLAN aktiv Test Date: 2015-03-24





Project number: G0M-1411-4293

Manufacturer: AED Engineering

EUT Name: CAN-WLAN Gateway RH

Model: GN1001A

Test Site: Eurofins Product Service GmbH

Operator: Mr. Belz

Test Conditions: Tnom: 23°C, Unom: + 24 VDC
Antenna: Rohde & Schwarz HL 223, Vertical

Measurement distance: 3m

Mode: WLAN aktiv Test Date: 2015-03-24

Note:

Index 37 RBW: 120 kHz, Vertical Max Peak FCC part 15B Class B QP 60 55 50-45 Electrical Field (dBµV/m) 0. 55 0. -c5 0. 15 10 300 M 400 M 500 M 600 M 700 M 800 M 200 M Frequency (Hz)



Project number: G0M-1411-4293

Manufacturer: AED Engineering

EUT Name: CAN-WLAN Gateway RH

Model: GN1001A

Test Site: Eurofins Product Service GmbH

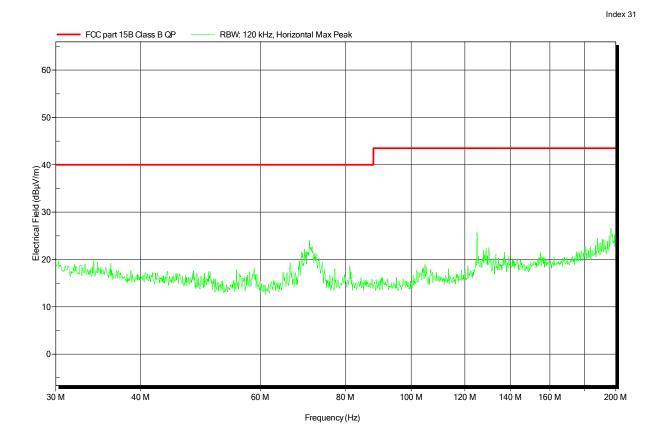
Operator: Mr. Belz

Test Conditions: Tnom: 23°C, Unom: + 24 VDC

Antenna: Rohde & Schwarz HK 116, Horizontal

Measurement distance: 3m

Mode: LAN aktiv Test Date: 2015-03-24





Project number: G0M-1411-4293

Manufacturer: AED Engineering

EUT Name: CAN-WLAN Gateway RH

Model: GN1001A

Test Site: Eurofins Product Service GmbH

Operator: Mr. Belz

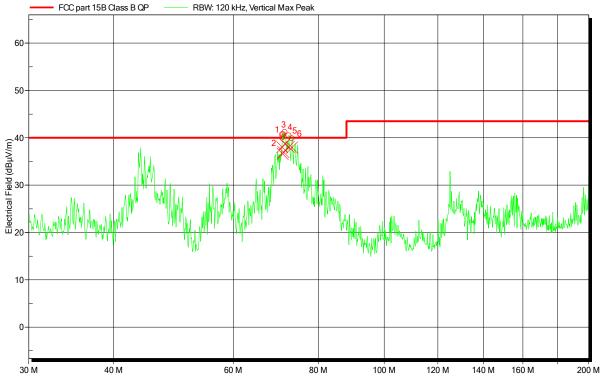
Test Conditions: Tnom: 23°C, Unom: + 24 VDC
Antenna: Rohde & Schwarz HK 116, Vertical

Measurement distance: 3m

Mode: LAN aktiv Test Date: 2015-03-24

Note:

Index 32



Frequency (Hz)

Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status
70.818 MHz	38 dBµV/m	40 dBμV/m	-2 dB	Pass
70.92 MHz	36.63 dBµV/m	40 dBμV/m	-3.37 dB	Pass
71.1 MHz	37 dBµV/m	40 dBµV/m	-3 dB	Pass
71.436 MHz	38.71 dBµV/m	40 dBμV/m	-1.29 dB	Pass
72.39 MHz	38.07 dBµV/m	40 dBµV/m	-1.93 dB	Pass
73.188 MHz	37.95 dBµV/m	40 dBµV/m	-2.05 dB	Pass



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EUT Name: CAN-WLAN Gateway RH

Model: GN1001A

Test Site: Eurofins Product Service GmbH

Operator: Mr. Belz

Test Conditions: Tnom: 23°C, Unom: + 24 VDC
Antenna: Rohde & Schwarz HL 223, Vertical

Measurement distance: 3m

Mode: LAN aktiv Test Date: 2015-03-24

Note:

Index 33 RBW: 120 kHz, Vertical Max Peak FCC part 15B Class B QP 60 55 50-45 Electrical Field (dBµV/m) 0. 55 0. -c5 0. Marking process of a popular property of the different of the second her harmond harmond 15 10 300 M 400 M 500 M 600 M 700 M 800 M 200 M Frequency (Hz)



Project number: G0M-1411-4293

Manufacturer: AED Engineering

EUT Name: CAN-WLAN Gateway RH

Model: GN1001A

Test Site: Eurofins Product Service GmbH

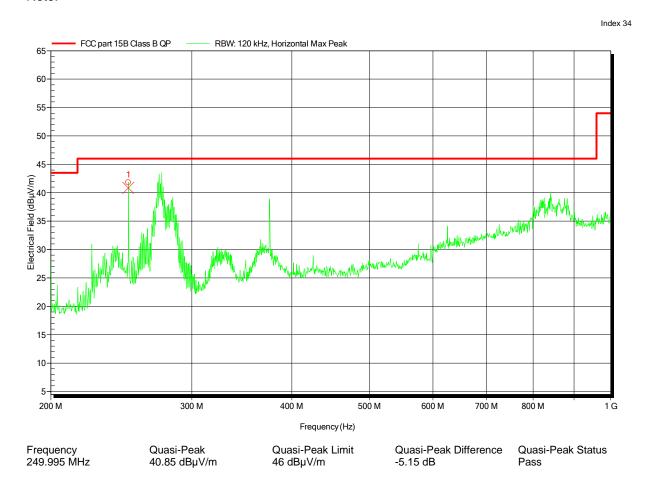
Operator: Mr. Belz

Test Conditions: Tnom: 23°C, Unom: + 24 VDC
Antenna: Rohde & Schwarz HL 223, Horizontal

Measurement distance: 3m

Mode: LAN aktiv Test Date: 2015-03-24

Note:





Project number: G0M-1411-4293

Manufacturer: AED Engineering

EUT Name: CAN-WLAN Gateway RH

Model: GN1001A

Test Site: Eurofins Product Service GmbH

Operator: Mr. Belz

Test Conditions: Tnom: 23°C, Unom: + 24 VDC
Antenna: Schwarzbeck BBHA 9120D, Vertical

Measurement distance: 3m

Mode: LAN aktiv Test Date: 2015-03-20

Note:

Index 25 FCC part 15B Class B Peak FCC part 15B Class B AV RBW: 1 MHz. Vertical Max Average RBW: 1 MHz, Vertical Max Peak 80 70 Electrical Field (dBµV/m) 2 G 3 G 4 G 5 G 1 G 6 G 8 G Frequency (Hz)



Project number: G0M-1411-4293

Manufacturer: AED Engineering

EUT Name: CAN-WLAN Gateway RH

Model: GN1001A

Test Site: Eurofins Product Service GmbH

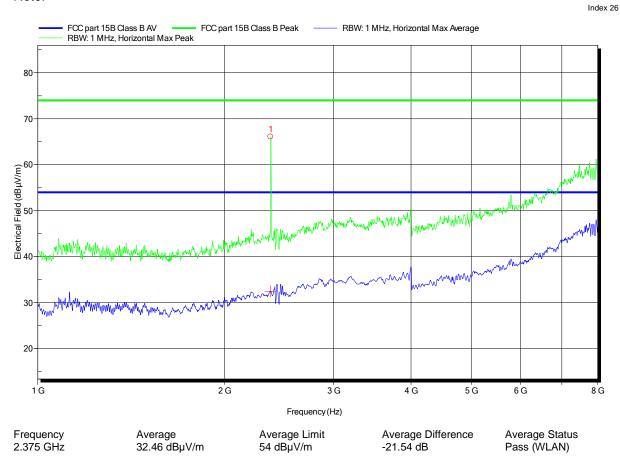
Operator: Mr. Belz

Test Conditions: Tnom: 23°C, Unom: + 24 VDC

Antenna: Schwarzbeck BBHA 9120D, Horizontal

Measurement distance: 3m

Mode: LAN aktiv Test Date: 2015-03-20





Project number: G0M-1411-4293

Manufacturer: AED Engineering

EUT Name: CAN-WLAN Gateway RH

Model: GN1001A

Test Site: Eurofins Product Service GmbH

Operator: Mr. Belz

Test Conditions: Tnom: 23°C, Unom: + 24 VDC
Antenna: Schwarzbeck BBHA 9120D, Vertical

Measurement distance: 3m

Mode: LAN aktiv Test Date: 2015-03-20

Note:

Index 21 FCC part 15B Class B AV RBW: 1 MHz, Vertical Max Peak FCC part 15B Class B Peak - RBW: 1 MHz. Vertical Max Average 80 70 60 Electrical Field (dBμV/m) 10 0 -10 10 G 11 G 12 G 13 G 8 G 9 G 14 G Frequency (Hz)



Project number: G0M-1411-4293

Manufacturer: AED Engineering

EUT Name: CAN-WLAN Gateway RH

Model: GN1001A

Test Site: Eurofins Product Service GmbH

Operator: Mr. Belz

Test Conditions: Tnom: 23°C, Unom: + 24 VDC

Antenna: Schwarzbeck BBHA 9120D, Horizontal

Measurement distance: 3m

Mode: LAN aktiv Test Date: 2015-03-20

Note:

Index 23 FCC part 15B Class B Peak -FCC part 15B Class B AV RBW: 1 MHz. Horizontal Max Average RBW: 1 MHz, Horizontal Max Peak 80 70 60 Electrical Field (dBμV/m) 10 0 -10 10 G 11 G 12 G 13 G 8 G 9 G 14 G Frequency (Hz)



Project number: G0M-1411-4293

Manufacturer: AED Engineering

EUT Name: CAN-WLAN Gateway RH

Model: GN1001A

Test Site: Eurofins Product Service GmbH

Operator: Mr. Belz

Test Conditions: Tnom: 23°C, Unom: + 24 VDC

Antenna: Schwarzbeck BBHA 9120D, Horizontal

Measurement distance: 3m

Mode: WLAN aktiv Test Date: 2015-03-20

Note:

Index 27 FCC part 15B Class B Peak RBW: 1 MHz, Horizontal Max Average FCC part 15B Class B AV RBW: 1 MHz, Horizontal Max Peak 80 70 Electrical Field (dBµV/m) 2 G 3 G 5 G 1 G 4 G 6 G 8 G Frequency (Hz)



Project number: G0M-1411-4293

Manufacturer: AED Engineering

EUT Name: CAN-WLAN Gateway RH

Model: GN1001A

Test Site: Eurofins Product Service GmbH

Operator: Mr. Belz

Test Conditions: Tnom: 23°C, Unom: + 24 VDC
Antenna: Schwarzbeck BBHA 9120D, Vertical

Measurement distance: 3m

Mode: WLAN aktiv Test Date: 2015-03-20

Note:

Frequency (Hz)



Project number: G0M-1411-4293

Manufacturer: AED Engineering

EUT Name: CAN-WLAN Gateway RH

Model: GN1001A

Test Site: Eurofins Product Service GmbH

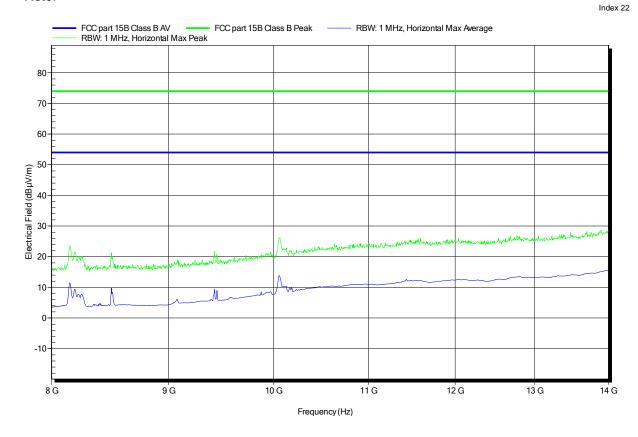
Operator: Mr. Belz

Test Conditions: Tnom: 23°C, Unom: + 24 VDC

Antenna: Schwarzbeck BBHA 9120D, Horizontal

Measurement distance: 3m

Mode: WLAN aktiv Test Date: 2015-03-20





Project number: G0M-1411-4293

Manufacturer: AED Engineering

EUT Name: CAN-WLAN Gateway RH

Model: GN1001A

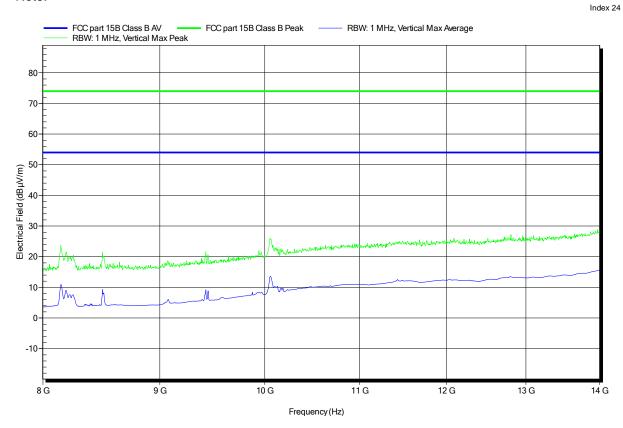
Test Site: Eurofins Product Service GmbH

Operator: Mr. Belz

Test Conditions: Tnom: 23°C, Unom: + 24 VDC
Antenna: Schwarzbeck BBHA 9120D, Vertical

Measurement distance: 3m

Mode: WLAN aktiv Test Date: 2015-03-20





3.2 Test Conditions and Results – AC power line conducted emissions

Conducted emissio	ns acc. FCC 47	CFR 15.	107 / IC RSS-G	en		Verdict: PASS	
Laboratory Para	ameters:	Req	uired prior to the t	test	During the test		
Ambient Temp	erature		15 to 35 °C 23°C		23°C		
Relative Hur	Relative Humidity		30 to 60 %		32%		
Test according referenced standards		Reference Method					
		ANSI C63.4					
Fully configured sample scanned over the following frequency range		Frequency range					
		0.15 MHz to 30 MHz					
Sample is tested with respect to the requirements of the equipment class		Equipment class					
		Class B					
Points of Application		Application Interface					
AC Mains		LISN					
Operating mode		3					
Configuration		1					
	L	imits and	l results Class B	}			
Frequency [MHz]	Quasi-Peak [dBµV]	Result	Avera	age [dBµV]	Result	
0.15 to 5	66 to 56	*	PASS	56	6 to 46*	PASS	
0.5 to 5	56		PASS		46	PASS	
5 to 30	60		PASS		50	PASS	

^{*} Limit decreases linearly with the logarithm of the frequency.



Test Procedure:

- 1) The EUT was placed on a non conductive table 0.8 m above the reference ground plane and 0.4 m away from the vertical conducting plane (ANSI C63.4: 2009 item 7.3.1)
- 2) The power cord that is normally supplied or recommended by the manufacturer was connected to the LISN.
- 3) The distance between the outer edge of the EUT and the LISN shall be set to 0.8 m. A longer power cord shall be bundled to this length (bundling shall not exceed 40 cm in length).
- 4) The LISN measurement port was connected to a measurement receiver
- 5) I/O cables were bundled not longer than 0.4 m
- 6) Measurement was performed in the frequency range 0.15 30MHz on each current-carrying conductor



EMI voltage test in the ac-mains according to FCC 15B

Project number: G0M-1411-4293

Manufacturer: AED Engineering

EUT Name: CAN-WLAN Gateway RH

Model: GN1001A

Test Site: Eurofins Product Service GmbH

Operator: Mr. Belz

Test Conditions: Tnom: 23°C, Unom: 24 VDC (from 120 VAC PS)

LISN: ESH2-Z5 N Mode: WLAN, LAN aktiv Test Date: 2015-03-16

Note:

Index 3 FCC 15B AV Class B RBW: 9 kHz, Neutral Max Average FCC 15B QP Class B RBW: 9 kHz, Neutral Max Peak 80 70 60 50 40 Voltage (dBµV) 30 20 10 0 -10 -20 -30 300 k 500 k600 k 1 M 2 M 5 M 10 M 20 M 30 M 150 k Frequency (Hz) Frequency Quasi-Peak Quasi-Peak Limit Quasi-Peak Difference Quasi-Peak Status 45.85 dBµV 417.75 kHz $57.49 \; dB\mu V$ -11.64 dB Pass Frequency Average Average Limit Average Difference Average Status 43.62 dBµV 47.49 dBµV -3.87 dB 417.75 kHz Pass



EMI voltage test in the ac-mains according to FCC 15B

Project number: G0M-1411-4293

Manufacturer: AED Engineering

EUT Name: CAN-WLAN Gateway RH

Model: GN1001A

Test Site: Eurofins Product Service GmbH

Operator: Mr. Belz

Test Conditions: Tnom: 23°C, Unom: 24 VDC (from 120 VAC PS)

LISN: ESH2-Z5 L Mode: WLAN, LAN aktiv Test Date: 2015-03-16

