

EMC TEST REPORT

FCC 47 CFR Part 15B
Industry Canada ICES-003

Electromagnetic compatibility - Unintentional radiators

Report Reference No. : G0M-1601-5302-EF0115B-V01

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 : lesswire GmbH

Address : Rudower Chaussee 30
12489 Berlin
GERMANY

Test specification:

Standard..... : 47 CFR Part 15 Subpart B
ICES-003, Issue 5:2012
ANSI C63.4:2014

Equipment under test (EUT):

Product description	WLAN-LTE-Router	
Model No.	CCU5	
Additional Models	None	
Hardware version	C/BWIA3	
Firmware / Software version	1.0.119	
IDs	FCC-ID: 2AHHACCU5	IC: N/A
Test result	Passed	

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Eurofins Product Service GmbH
Storkower Str. 38c, D-15526 Reichenwalde, Germany

Possible test case verdicts:

- 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:

Date of receipt of test item: 2016-01-06

Date (s) of performance of tests: 2016-02-18 - 2016-02-25

Compiled by: Yu Yu

Tested by (+ signature).....: Yu Yu 

Approved by (+ signature): Marcus Klein 

Head of Lab

Date of issue: 2016-03-30

Total number of pages: 25

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 requirements:

Version History

Version	Issue Date	Remarks	Revised by
V01	2016-03-30	Initial Release	

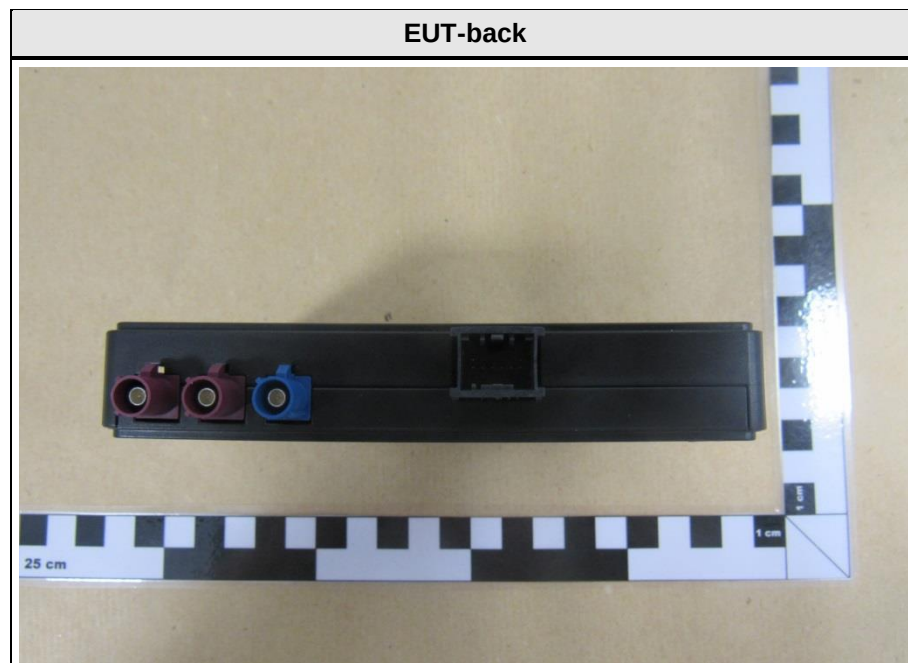
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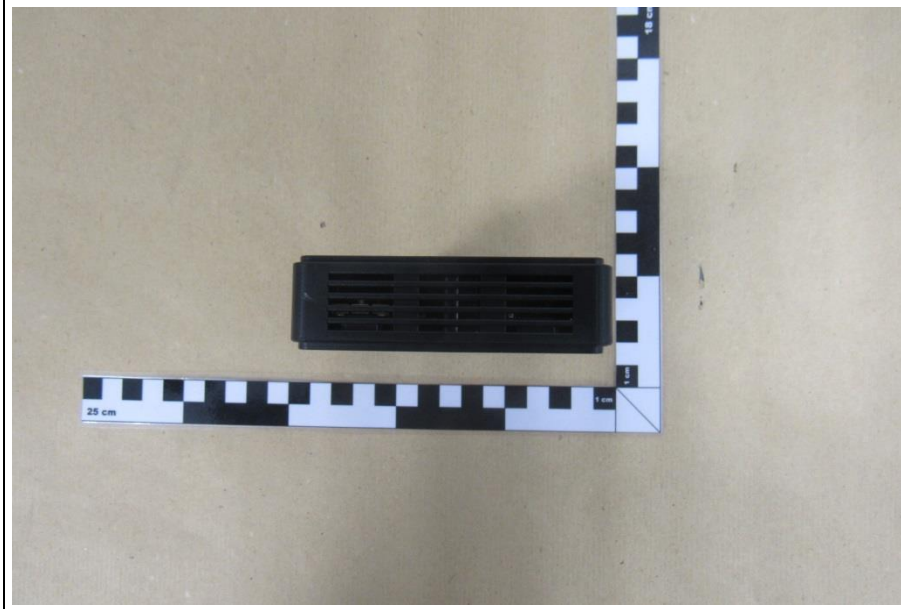
1 Equipment (Test item) Description

Description	WLAN-LTE-Router
Model	CCU5
Additional Models	None
Serial number	None
Hardware version	C/BWIA3
Software / Firmware version	1.0.119
FCC-ID	2AHHACCU5
IC	N/A
Power supply	12V DC via vehicular battery
Manufacturer	lesswire GmbH Rudower Chaussee 30 12489 Berlin GERMANY
Highest emission frequency	Fmax=2480MHz
Device classification	Class B
Equipment type	Tabletop
Number of tested samples	1

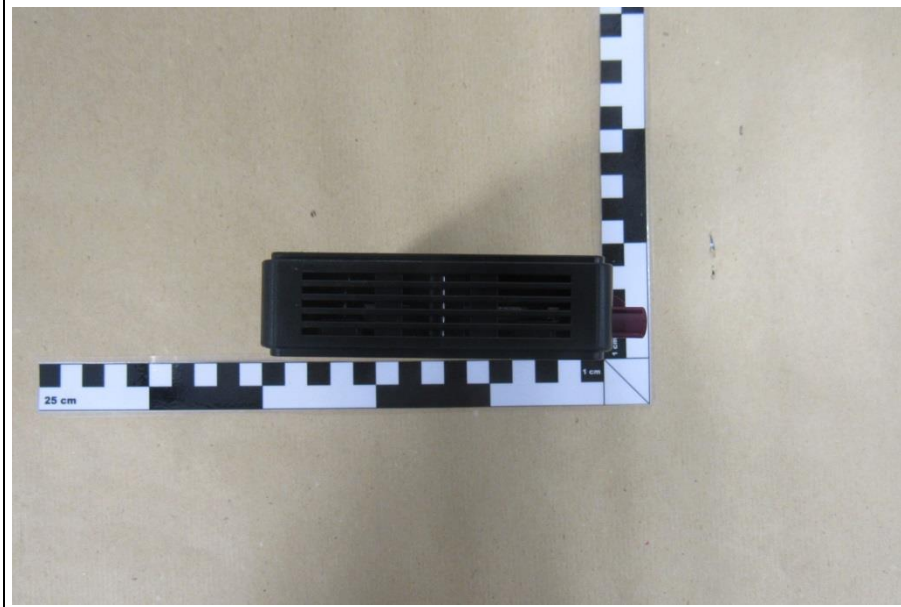
1.1 Photos – Equipment external



EUT-left side



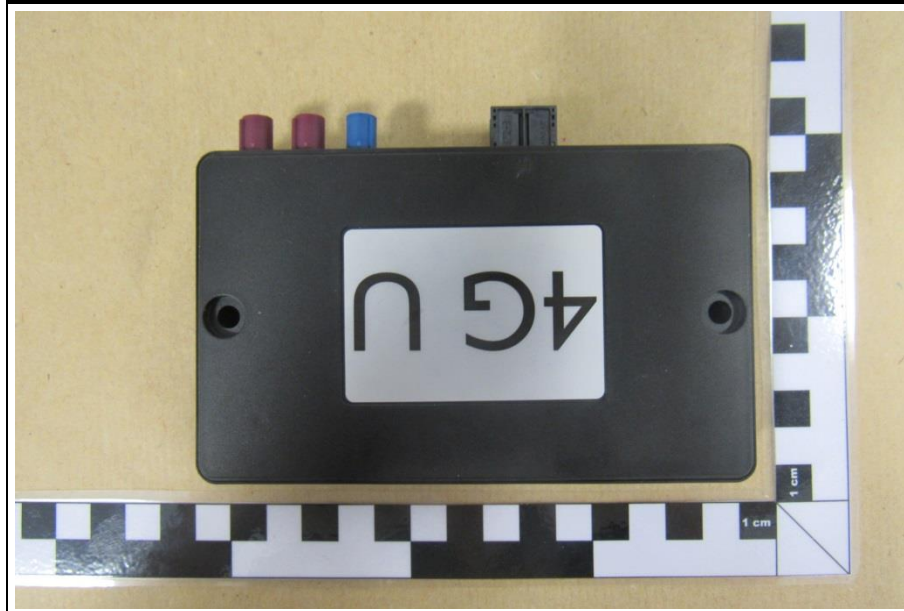
EUT-right side



EUT-top

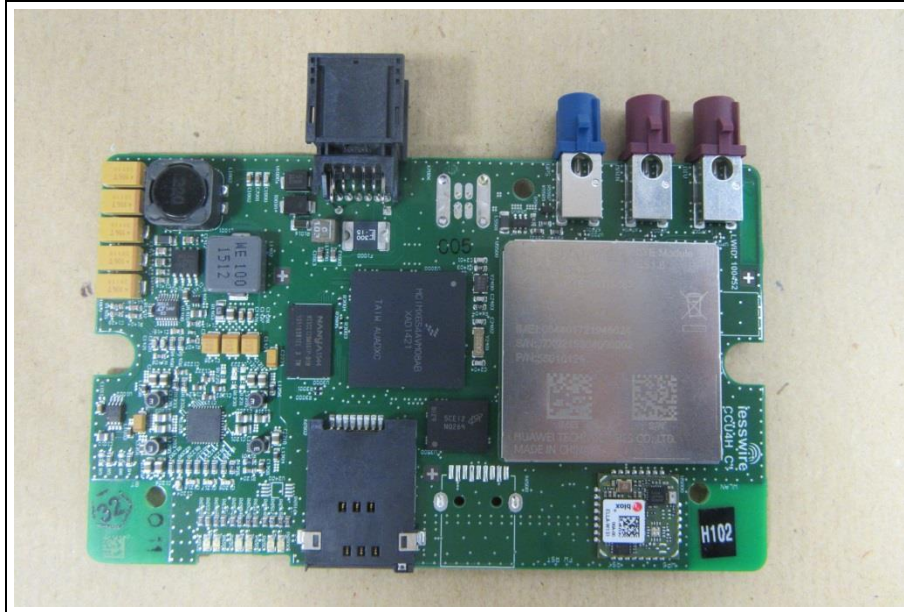


EUT-bottom

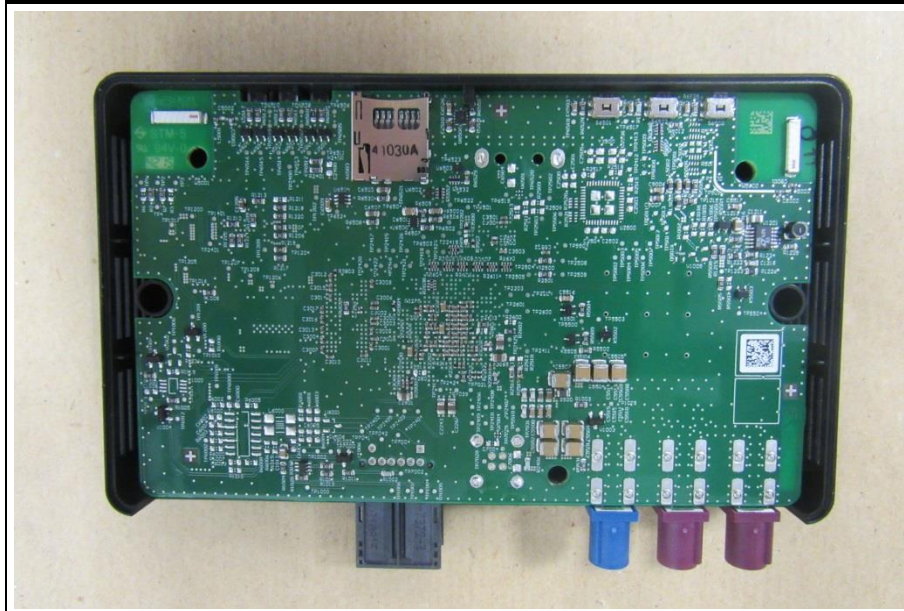


1.2 Photos – Equipment internal

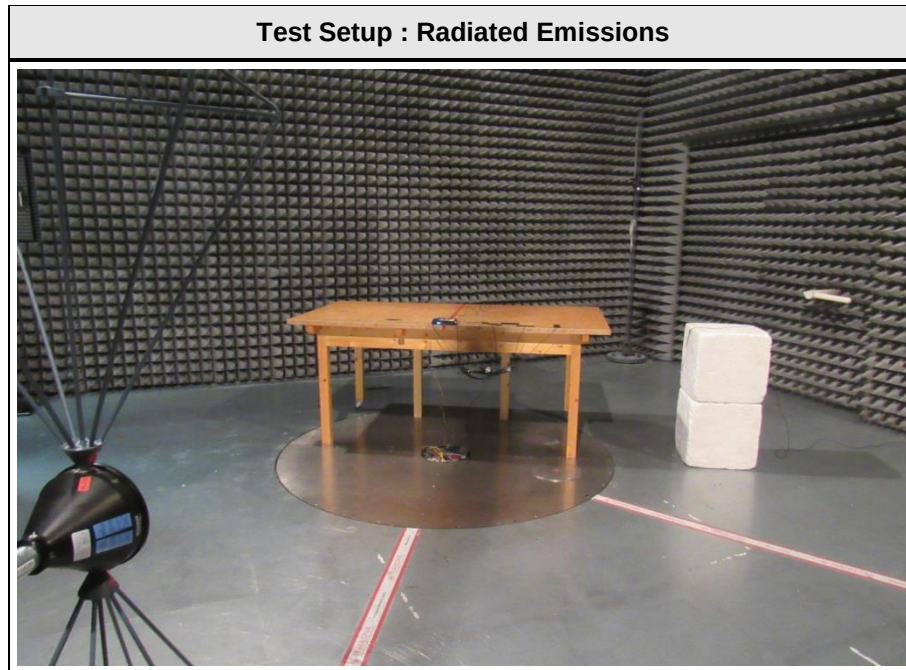
PCB-front



PCB-back; And inside of the case



1.3 Photos – Test setup



1.4 Supporting Equipment Used During Testing

Product Type*	Device	Manufacturer	Model No.	Comments (e.g. serial no.)
AE	LTE Antenna	Techship	AN00899758	X2
AE	GPS Antenna	SANAV	MA-25	
AE	MicroSD card	Transcend	9161BA 4G 07SS2	
AE	Laptop	DELL	Latitude E6420	
SIM	Universal radio communication tester	R&S	CMU200	
*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 (e.g. Cat. of Cable)
1	Power	DC	>3m	No	
2	LTE Antenna	I/O	3m	Yes	
3	GPS Antenna	I/O	3m	Yes	
4	MicroSD	I/O	-	-	
5	SIM Card	I/O	-	-	
*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	GSM850 communication with the CMU200 WLAN access point active and being pinged by the laptop GPS receiving

Configuration #	EUT Configuration
1	EUT fully assembled

1.7 Test Equipment Used During Testing

Measurement Software			
Description	Manufacturer	Name	Version
EMC Test Software	Dare Instruments	Radimation	2015.1.12

Radiated emissions – 3m Chamber					
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	2016-01	2017-01
RF Cable			-	System Cal.	System Cal
RF Cable			-	System Cal.	System Cal

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 dBμV. 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:

$$\text{Reading on Analyzer (dB}\mu\text{V)} + \text{A.F. (dB)} = \text{Net field strength (dB}\mu\text{V/m)}$$

Net:

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

Limit:

This is the FCC Class B radiated emission limit (in units of dBμV/m). The FCC limits are given in units of μV/m. The following formula is used to convert the units of μV/m to dBμV/m:

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

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 dBμV	+	26 dB	=	47.5 dBμV/m	:	47.5 dBμV/m - 57.0 dBμV/m	=	-9.5 dB

2 Result Summary

FCC 47 CFR Part 15B, Industry Canada ICES-003				
Product Specific Standard	Requirement – Test	Reference Method	Result	Remarks
47 CFR 15.109 ICES-003 Item 6.2	Radiated emissions	ANSI C 63.4	PASS	
47 CFR 15.107 ICES-003 Item 6.1	AC power line conducted emissions	ANSI C63.4	N/A	only battery powered
Remarks:				

3 Test Conditions and Results

3.1 Test Conditions and Results – Radiated emissions

Radiated emissions acc. FCC 47 CFR 15.109 / ICES-003					Verdict: PASS		
Laboratory Parameters:		Required prior to the test			During the test		
Ambient Temperature		15 to 35 °C			23°C		
Relative Humidity		30 to 60 %			40%		
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					
		2480MHz					
Fully configured sample scanned over the following frequency range		Frequency range					
		30 MHz to 14 GHz					
Operating mode		1					
Configuration		1					
Limits and results Class B							
Frequency [MHz]	Quasi-Peak [dBµV/m]	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	-		-	-	
Comments:							

Test Procedure:

The test site is in accordance with ANSI C63-4:2014 requirements and is listed by FCC.
The measurement procedure is as follows:

Exploratory measurement:

- The EUT was placed on a non-conductive table at a height of 0.8m.
- The EUT and support equipment, if needed, were set up to simulate typical usage.
- Cables, of type and length specified by the manufacturer, were connected to at least one port of each type and were terminated by a device or simulating load of actual usage.
- The antenna was placed at a distance of 3 or 10 m.
- The received signal was monitored at the measurement receiver.
 - Cables not bundled were manipulated within the range of likely arrangements to produce the highest emission amplitude
 - To maximize the suspected emissions the EUT is rotated 360 degrees. If the signal exceeds the previous amplitude, go back to the corresponding azimuth and manipulate the cables again for maximizing the emissions if possible.
 - Move the antenna from 1 to 4m to maximize the suspected highest amplitude signal.
- This procedure has to be performed in both antenna polarizations, horizontal and vertical.
- The arrangement of the equipment with the maximum emission level is shown on the setup picture at item 1.3.

Final measurement:

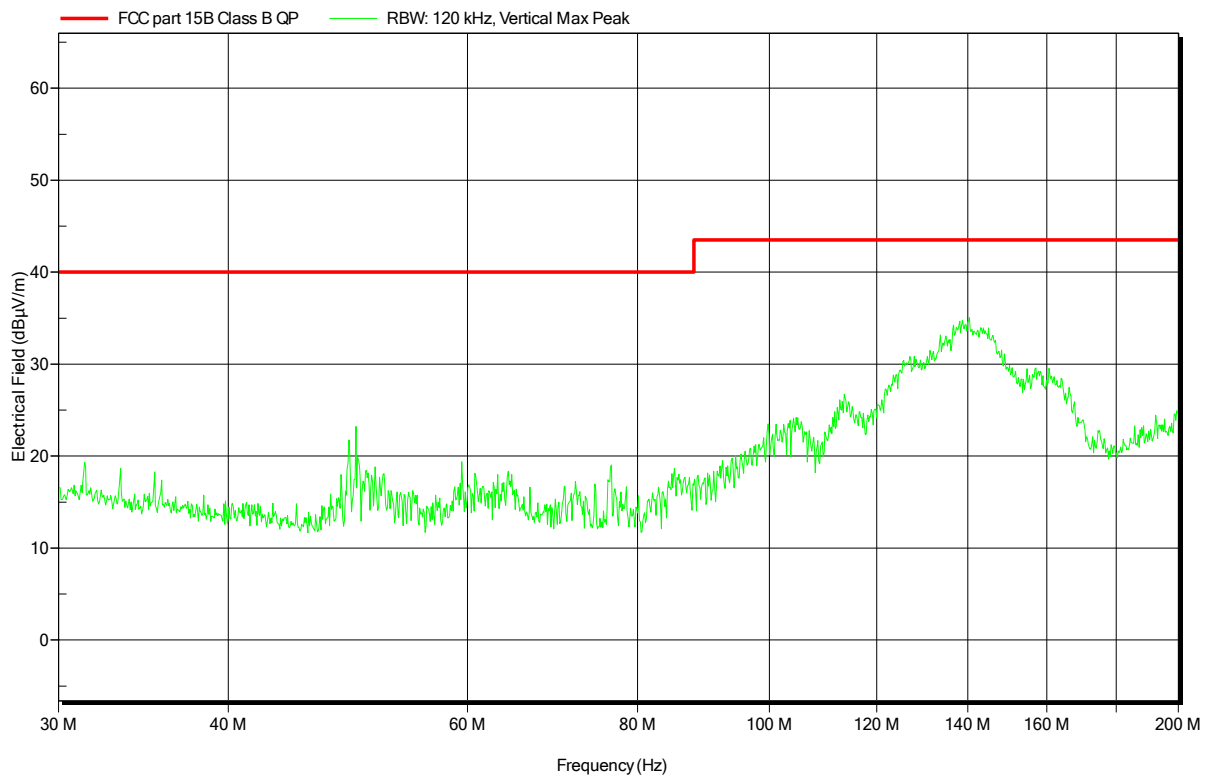
- The EUT was placed on a 0.8 m non-conductive table at a 3 m distance from the receive antenna. The antenna output was connected to the measurement receiver
- A biconical antenna was used for the frequency range 30 – 200 MHz, a logarithmic periodical antenna was used for the frequency range from 200 – 1000 MHz. Above one 1 GHz a Double Ridged Broadband Horn antenna was used. The antenna was placed on an adjustable height antenna mast
- The EUT and cable arrangement were based on the exploratory measurement results
- Emissions were maximized at each frequency by rotating the EUT and adjusting the receive antenna height and polarization. The maximum values were recorded.
- The test data of the worst-case conditions were recorded and shown on the next pages.

Spurious emissions under normal conditions according to FCC Part 15b

Project number: G0M-1601-5302

Applicant:	lesswire GmbH
EUT Name:	WLAN-LTE-Router
Model:	CCU5
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Yu
Test Conditions:	Tnom: 23°C, Unom: 12V DC
Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement distance:	3m
Mode:	1
Test Date:	2016-02-24
Note:	

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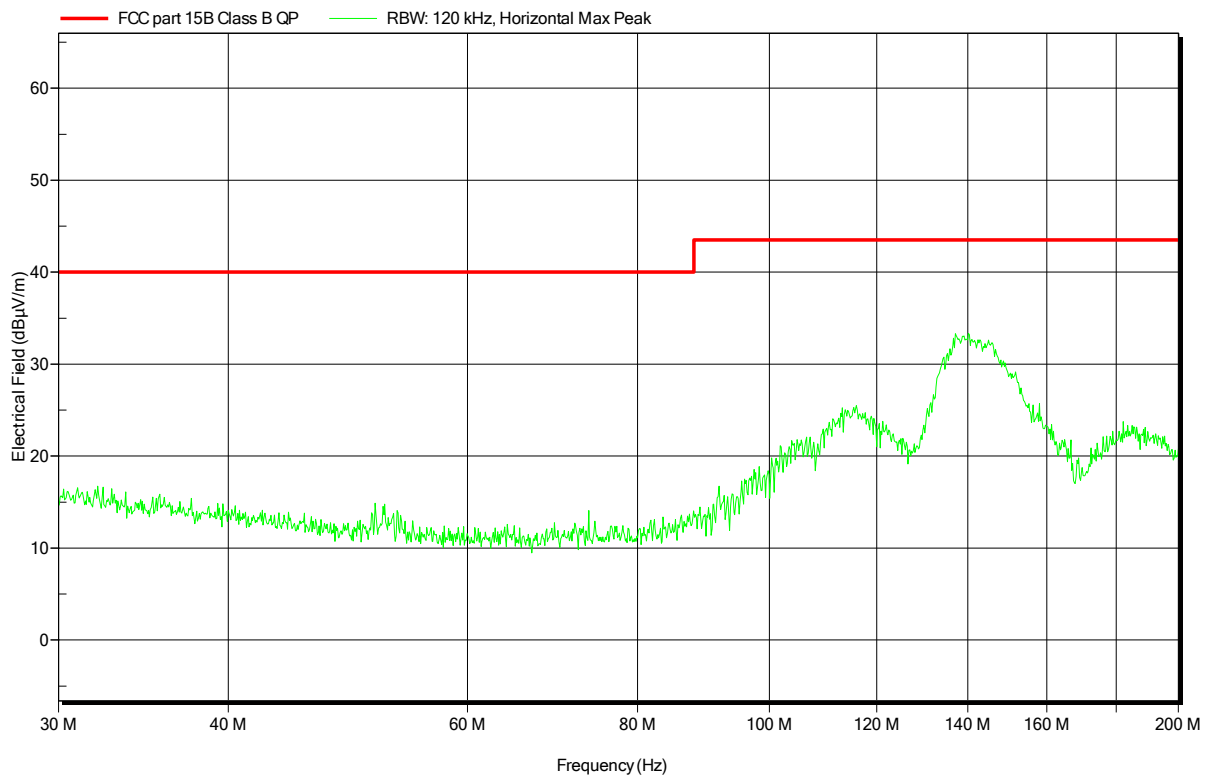


Spurious emissions under normal conditions according to FCC Part 15b

Project number: G0M-1601-5302

Applicant:	lesswire GmbH
EUT Name:	WLAN-LTE-Router
Model:	CCU5
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Yu
Test Conditions:	Tnom: 23°C, Unom: 12V DC
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement distance:	3m
Mode:	1
Test Date:	2016-02-24
Note:	

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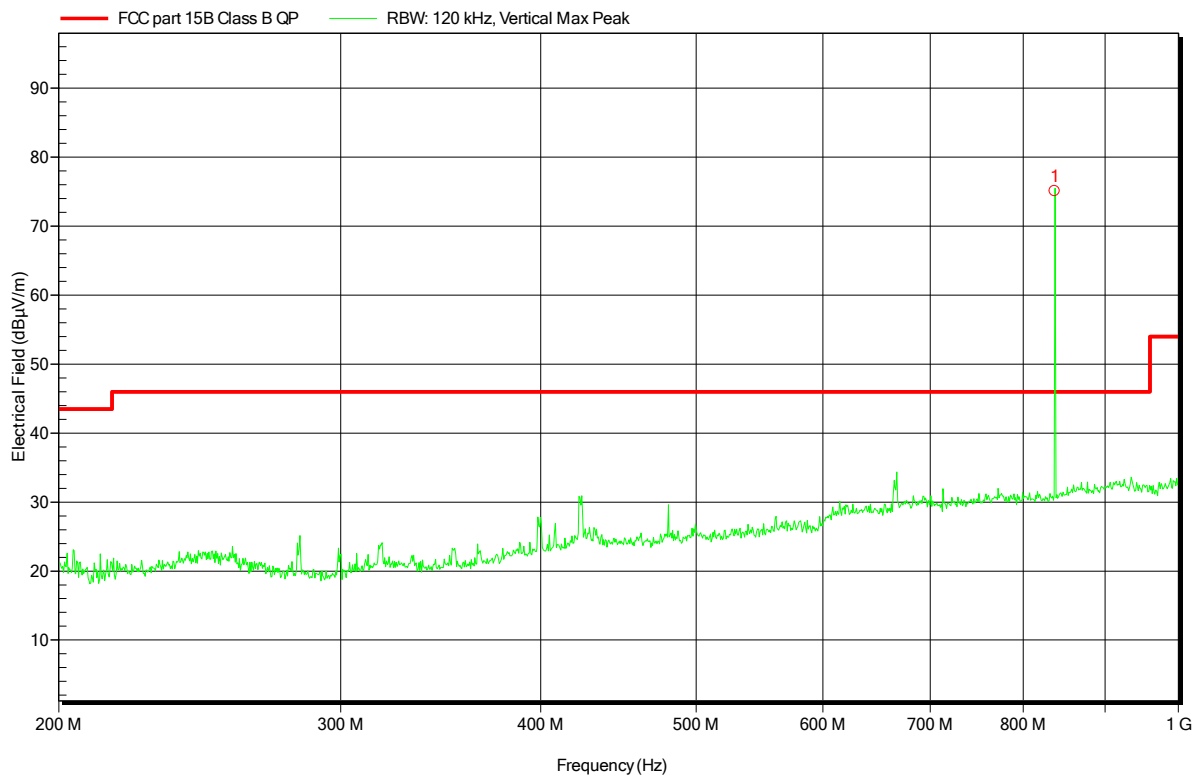


Spurious emissions under normal conditions according to FCC Part 15b

Project number: G0M-1601-5302

Applicant: lesswire GmbH
 EUT Name: WLAN-LTE-Router
 Model: CCU5
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Yu
 Test Conditions: Tnom: 23°C, Unom: 12V DC
 Antenna: Rohde & Schwarz HL 223, Vertical
 Measurement distance: 3m
 Mode: 1
 Test Date: 2016-02-24
 Note:

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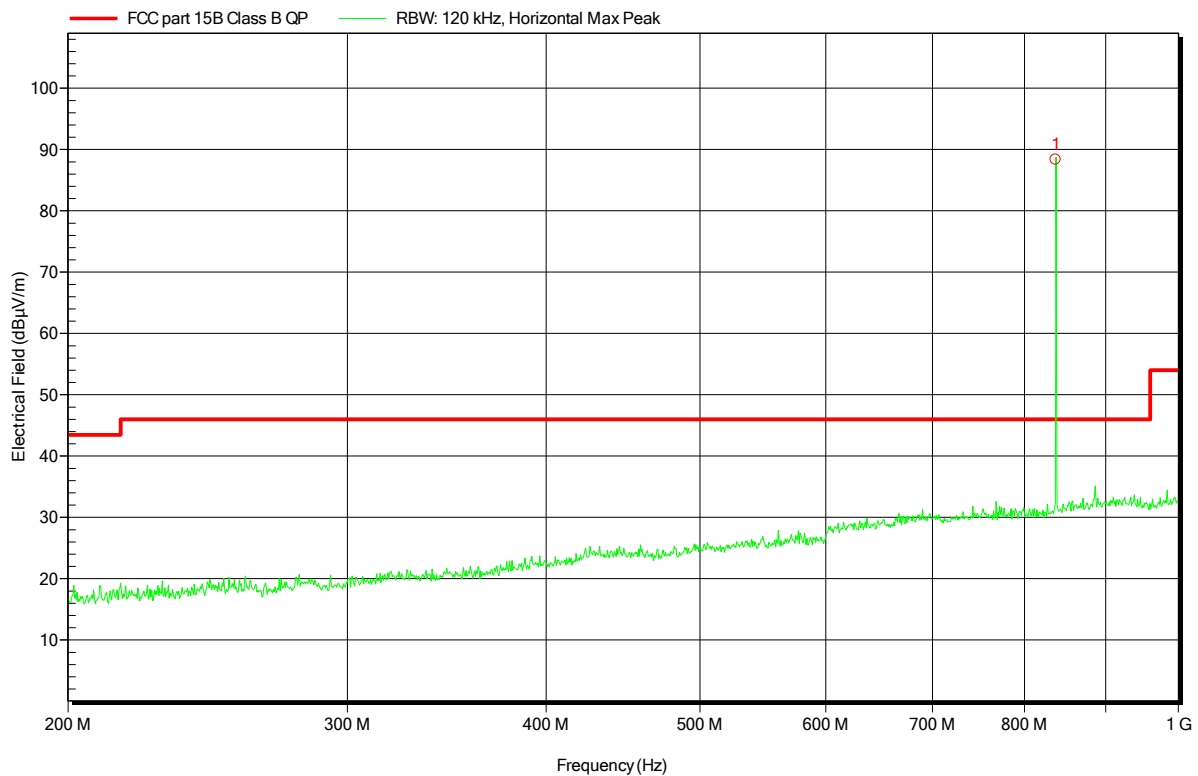
Peak Number	Frequency
1	837.02 MHz GSM850 carrier

Spurious emissions under normal conditions according to FCC Part 15b

Project number: G0M-1601-5302

Applicant: lesswire GmbH
 EUT Name: WLAN-LTE-Router
 Model: CCU5
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Yu
 Test Conditions: Tnom: 23°C, Unom: 12V DC
 Antenna: Rohde & Schwarz HL 223, Horizontal
 Measurement distance: 3m
 Mode: 1
 Test Date: 2016-02-24
 Note:

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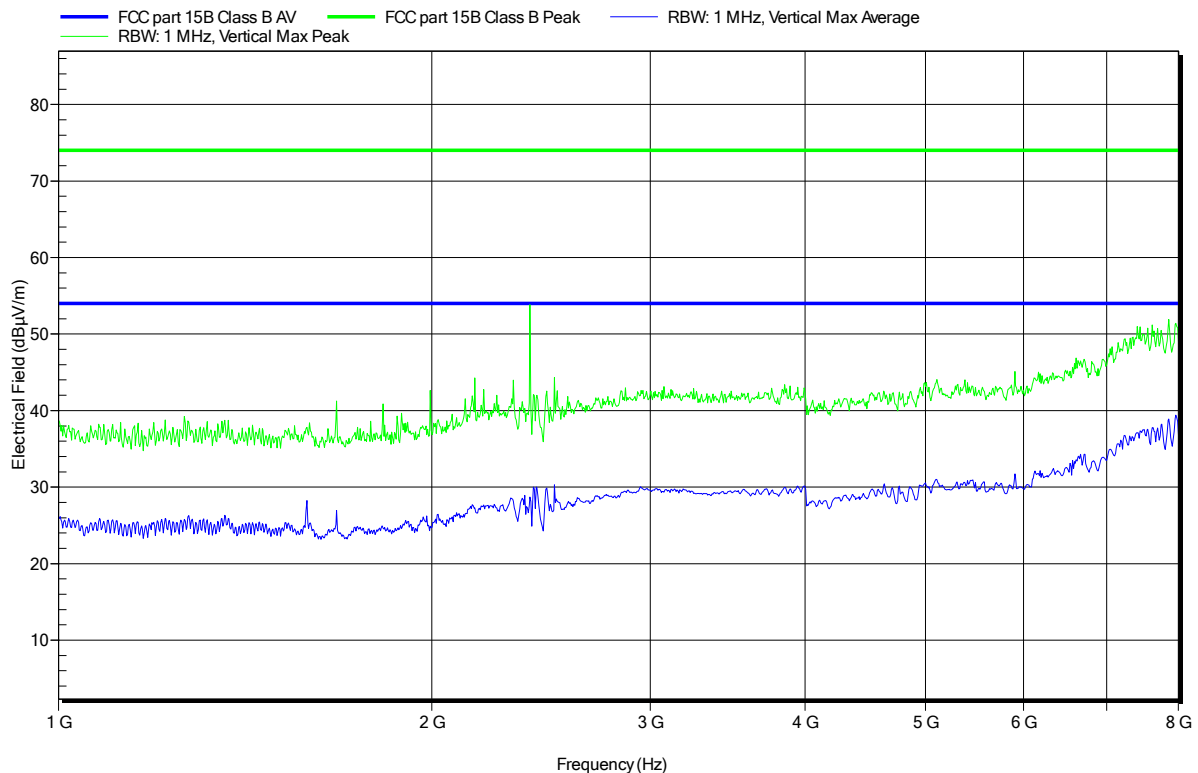
Peak Number	Frequency
1	837.02 MHz GSM850 carrier

Spurious emissions under normal conditions according to FCC Part 15b

Project number: G0M-1601-5302

Applicant: lesswire GmbH
 EUT Name: WLAN-LTE-Router
 Model: CCU5
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Yu
 Test Conditions: Tnom: 23°C, Unom: 12V DC
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement distance: 3m
 Mode: 1
 Test Date: 2016-02-24
 Note:

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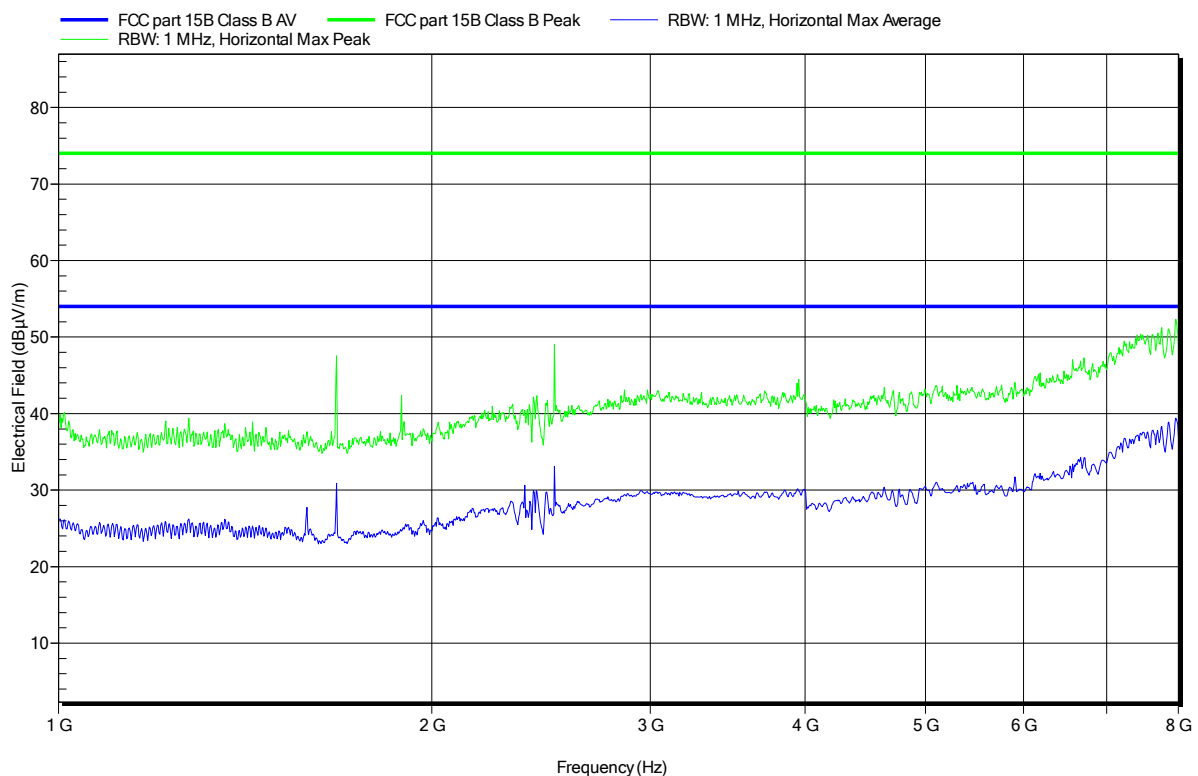


Spurious emissions under normal conditions according to FCC Part 15b

Project number: G0M-1601-5302

Applicant: lesswire GmbH
 EUT Name: WLAN-LTE-Router
 Model: CCU5
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Yu
 Test Conditions: Tnom: 23°C, Unom: 12V DC
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 3m
 Mode: 1
 Test Date: 2016-02-24
 Note:

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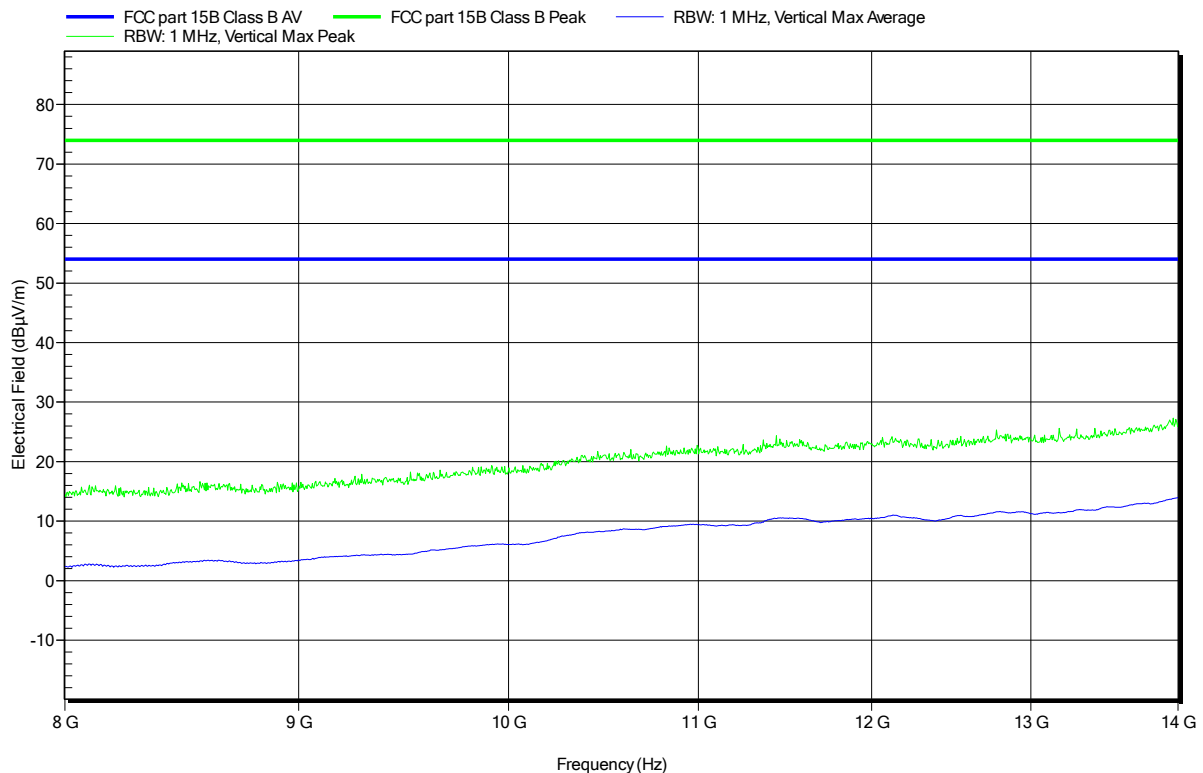


Spurious emissions under normal conditions according to FCC Part 15b

Project number: G0M-1601-5302

Applicant: lesswire GmbH
 EUT Name: WLAN-LTE-Router
 Model: CCU5
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Yu
 Test Conditions: Tnom: 23°C, Unom: 12V DC
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement distance: 3m
 Mode: 1
 Test Date: 2016-02-24
 Note:

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Spurious emissions under normal conditions according to FCC Part 15b

Project number: G0M-1601-5302

Applicant: lesswire GmbH
 EUT Name: WLAN-LTE-Router
 Model: CCU5
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Yu
 Test Conditions: Tnom: 23°C, Unom: 12V DC
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 3m
 Mode: 1
 Test Date: 2016-02-24
 Note:

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