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FCC TEST REPORT

FCC 47 CFR Part 15C
Industry Canada RSS-310

License exempt radio equipment

Report Reference No.....:	G0M-1502-4516-TFC209LP-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.....:	Roth & Rau - Ortner GmbH
Address.....:	Manfred-von-Ardenne-Ring 7 01099 Dresden GERMANY
Test specification:	
Standard.....:	47 CFR Part 15C RSS-310, Issue 3, 2010-12 RSS-Gen, Issue 4, 2014-11 ANSI C63.4:2014
Equipment under test (EUT):	
Product description	RFID reader with CAN interface
Model No.	LF-CAN-M
Additional Model(s)	None
Brand Name(s)	None
Hardware version	v3.1
Firmware / Software version	UNIreader Slave V2.7.hex
	FCC-ID: YTV-LF-134-CAN IC: N/A
Test result	**Passed**

Possible test case verdicts:	
- neither assessed nor tested ..... :	N/N
- required by standard but not appl. to test object..... :	N/A
- required by standard but not tested..... :	N/T
- not required by standard for the test object ..... :	N/R
- test object does meet the requirement..... :	P (Pass)
- test object does not meet the requirement..... :	F (Fail)

Testing:		
Test Lab Temperature ..... :	20 – 23 °C	
Test Lab Humidity ..... :	32 – 38 %	
Date of receipt of test item ..... :	2015-05-21	
Date (s) of performance of tests ..... :	2015-05-21	
Compiled by ..... :	Christian Weber	
Tested by (+ signature)..... : (Responsible for Test)	Wilfried Treffke	W. Treffke
Approved by (+ signature) ..... :	Christian Weber	C. Weber
Date of issue ..... :	2015-08-31	
Total number of pages ..... :	27	

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
01	2015-08-31	Initial Release	

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1 Equipment (Test item) Description

Description	RFID reader with CAN interface	
Model	LF-CAN-M	
Additional Model(s)	None	
Brand Name(s)	None	
Serial number	RRO2xxxxx	
Hardware version	v3.1	
Software / Firmware version	UNIreader Slave V2.7.hex	
FCC-ID	YTV-LF-134-CAN	
IC	N/A	
Equipment type	End product	
Radio type	Transceiver	
Radio technology	custom	
Operating frequency range	134 kHz + 124 kHz	
Frequency range	F_{MID}	124 kHz
	F_{MID}	134 kHz
Modulations	FSK	
Number of channels	1	
Channel spacing	None	
Number of antennas	1	
Antenna Variant	Type	external dedicated
	Model	RRO2101953
	Manufacturer	Roth & Rau - Ortner GmbH
Antenna Variant	Type	external dedicated
	Model	RRO2400007
	Manufacturer	Roth & Rau - Ortner GmbH
Manufacturer	Roth & Rau - Ortner GmbH Manfred-von-Ardenne-Ring 7 01099 Dresden GERMANY	
Power supply	V_{NOM}	3.0 VDC (Lithium-Battery)
	V_{MIN}	N/A
	V_{MIN}	N/A
AC/DC-Adaptor	Model	N/A
	Vendor	N/A
	Input	N/A
	Output	N/A

1.4 Supporting Equipment Used During Testing

Product Type*	Device	Manufacturer	Model No.	Comments
AE	Laptop	Lenovo	R61	EUT control
AE	Can Converter	Roth & Rau	CAN2WEB	

***Note:** Use the following abbreviations:

AE : Auxiliary/Associated Equipment, or

SIM : Simulator (Not Subjected to Test)

CABL : Connecting cables

1.5 Test Modes

Mode #	Description	
Single	General conditions:	EUT powered over CAN interface
	Radio conditions:	Mode = standalone transmit Modulation = FSK Power level = Maximum

1.6 Test Equipment Used During Testing

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

Field strength emissions					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Semi-anechoic chamber	Frankonia	AC 1	EF00062	-	-
Spectrum Analyzer	R&S	FSIQ26	EF00242	2015-04	2016-04
Biconical Antenna	R&S	HK 116	EF00012	2013-02	2016-02
LPD Antenna	R&S	HL 223	EF00187	2014-03	2017-03
LPD Antenna	R&S	HL 025	EF00327	2013-02	2016-02

AC power line 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

1.7 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:

Reading on Analyzer (dBµV) + A.F. (dB) = Net field strength (dBµV/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:

Limit (dBµV/m) = 20*log (µV/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 15C, IC RSS-310				
Product Specific Standard Section	**Requirement – Test**	**Reference Method**	**Result**	**Remarks**
RSS-Gen 6.6	Occupied Bandwidth	RSS-Gen 6.6	N/T	Informational only
47 CFR 15.207 RSS-Gen 8.8	AC power line conducted emissions	ANSI C63.4	PASS	
FCC 15.201(a), FCC 15.209 IC RSS-310 3.7	Field strength emissions	ANSI C63.4	PASS	
IC RSS-310 2.3 IC RSS-Gen 7.1	Receiver radiated spurious emissions	ANSI C63.4	N/T	
Remarks:				

3 Test Conditions and Results

3.1 Test Conditions and Results – AC power line conducted emissions

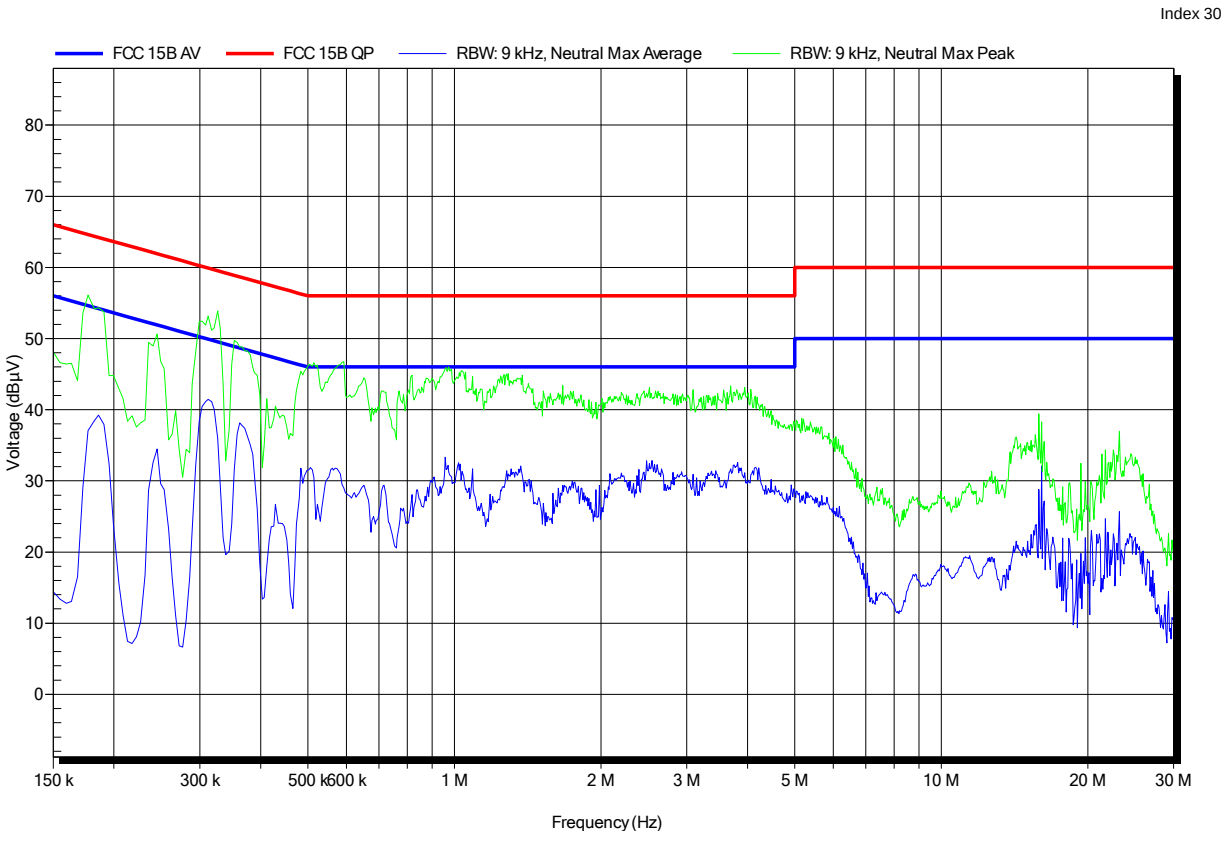
Power line conducted emissions acc. to FCC 47 CFR 15.207 / IC RSS-Gen				**Verdict: PASS**
Test according referenced standards	Reference Method			
	ANSI C63.4			
Fully configured sample scanned over the following frequency range	Frequency range			
	0.15 MHz to 30 MHz			
Points of Application	Application Interface			
AC Mains	LISN			
EUT test mode	AC-Powerline			
Limits and results				
Frequency [MHz]	Quasi-Peak [dBµV]	Result	Average [dBµV]	Result
0.15 to 5	66 to 56*	PASS	56 to 46*	PASS
0.5 to 5	56	PASS	46	PASS
5 to 30	60	PASS	50	PASS
Comments: * Limit decreases linearly with the logarithm of the frequency.				

Conducted Emissions 1

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

Project number: G0M-1502-4516

Applicant:	Roth & Rau - Ortner GmbH
EUT Name:	RFID reader with CAN interface
Model:	LF-134-CAN
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Pflug
Test Conditions:	Tnom: 23°C, Unom:120VAC(AC/DC-adap.model-SYS1308-2424-W2E)
LISN:	ESH2-Z5 N
Mode:	CAN-link with RRO2400007-antenna (ø 20mm)
Test Date:	2015-03-13
Note:	

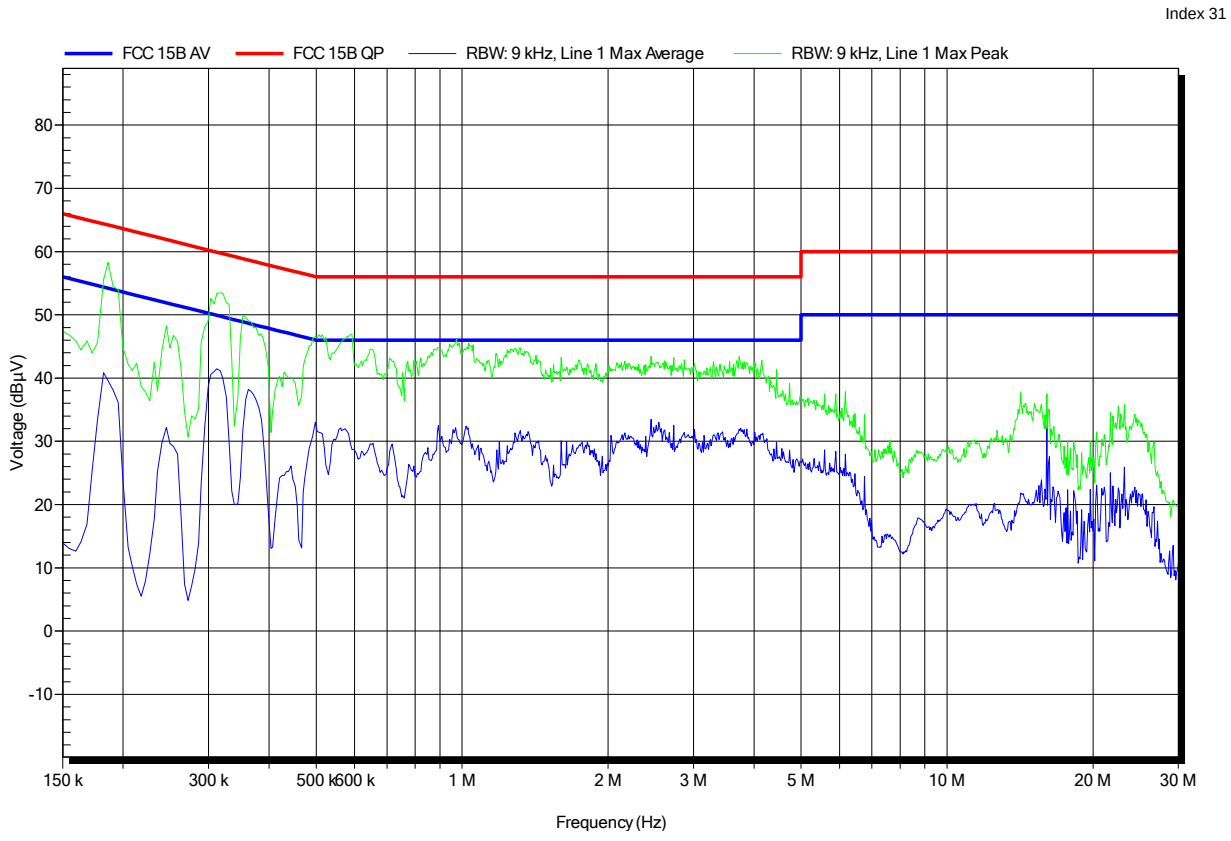


Conducted Emissions 2

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

Project number: G0M-1502-4516

Applicant:	Roth & Rau - Ortner GmbH
EUT Name:	RFID reader with CAN interface
Model:	LF-134-CAN
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Pflug
Test Conditions:	Tnom: 23°C, Unom:120VAC(AC/DC-adap.model-SYS1308-2424-W2E)
LISN:	ESH2-Z5 L
Mode:	CAN-link with RRO2400007-antenna (ø 20mm)
Test Date:	2015-03-13
Note:	



Conducted Emissions 3

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

Project number: G0M-1502-4516

Applicant:	Roth & Rau - Ortner GmbH
EUT Name:	RFID reader with CAN interface
Model:	LF-134-CAN
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Pflug
Test Conditions:	Tnom: 23°C, Unom:120VAC(AC/DC-adap.model-SYS1308-2424-W2E)
LISN:	ESH2-Z5 N
Mode:	CAN-link with RRO2101953-antenna (ø 12mm)
Test Date:	2015-03-13
Note:	

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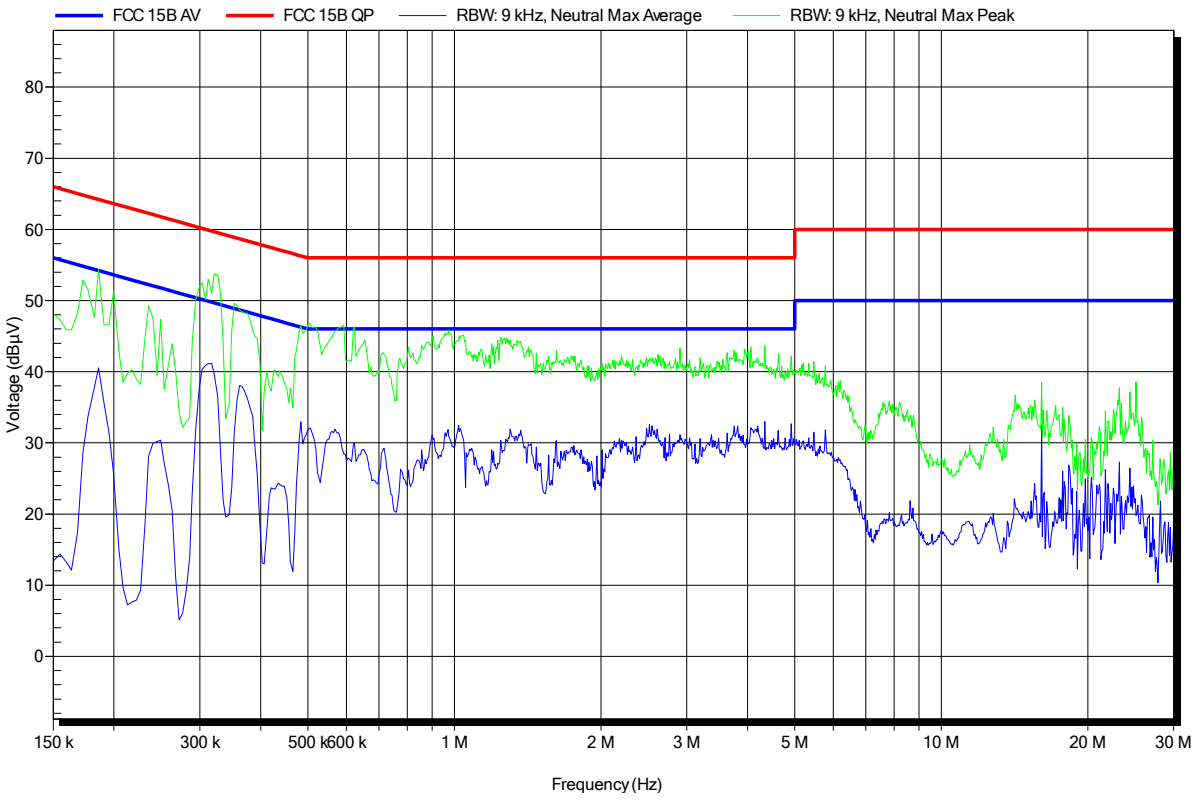
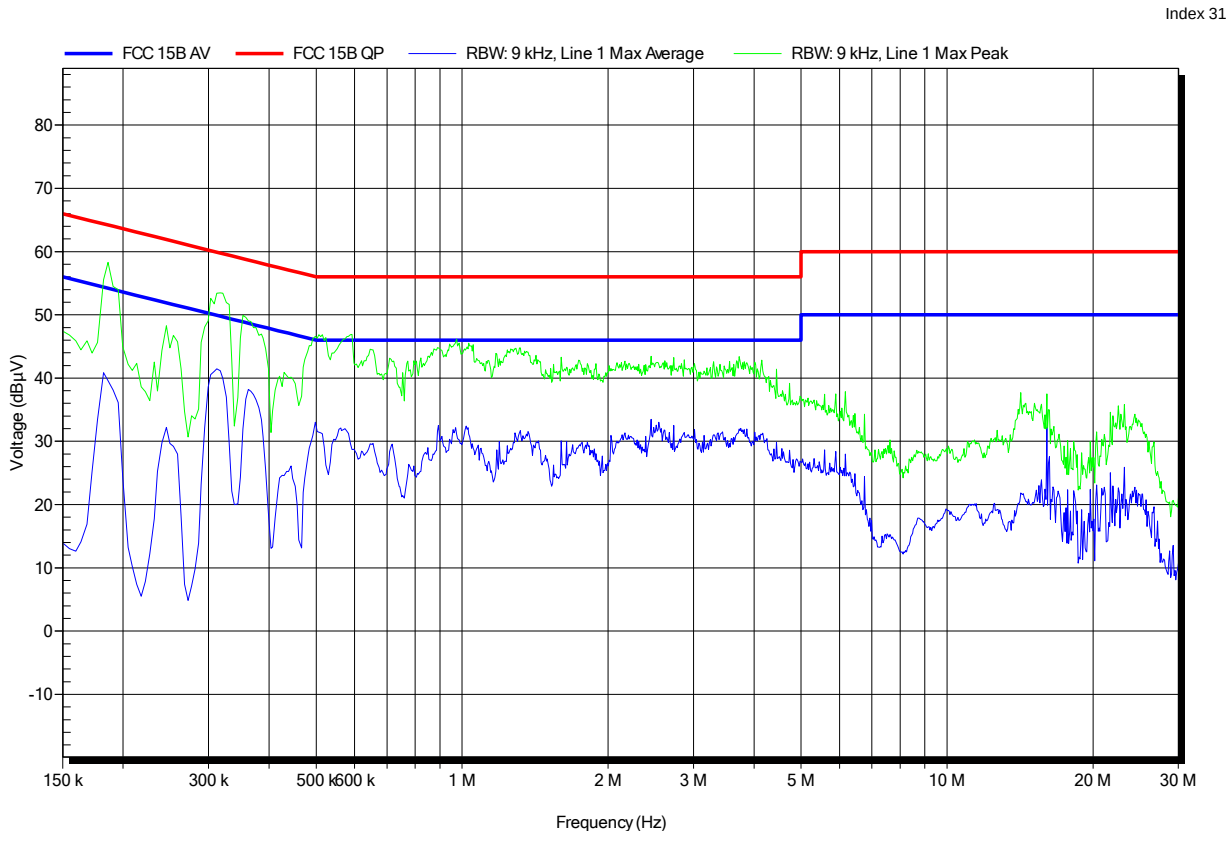


Conducted Emissions 4

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

Project number: G0M-1502-4516

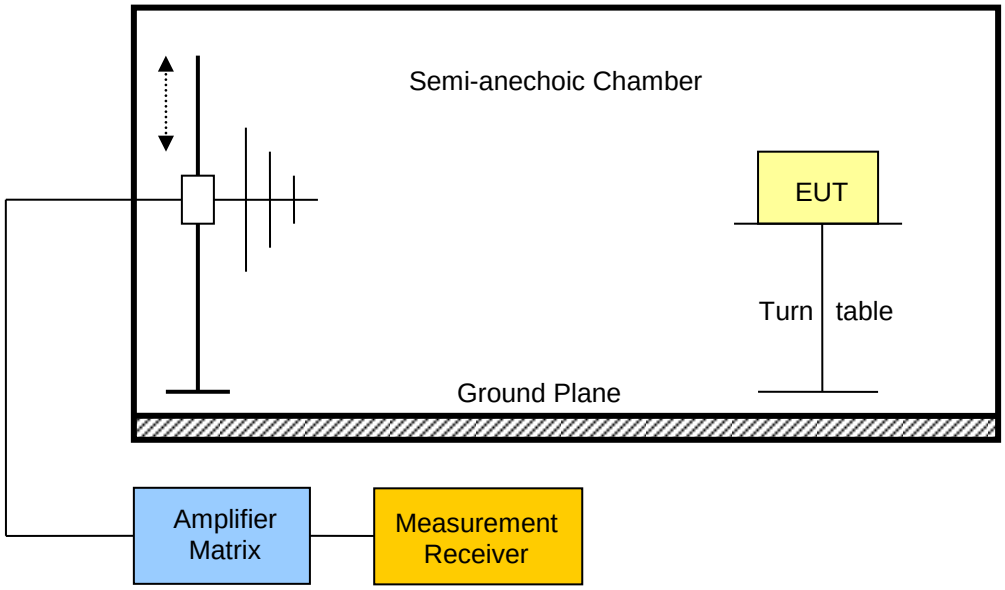
Applicant:	Roth & Rau - Ortner GmbH
EUT Name:	RFID reader with CAN interface
Model:	LF-134-CAN
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Pflug
Test Conditions:	Tnom: 23°C, Unom:120VAC(AC/DC-adap.model-SYS1308-2424-W2E)
LISN:	ESH2-Z5 L
Mode:	CAN-link with RRO2101953-antenna (ø 12mm)
Test Date:	2015-03-13
Note:	



3.2 Test Conditions and Results – Fundamental field strength emissions

Field strength emissions acc. FCC 47 CFR 15.201 / IC RSS-310				**Verdict: PASS**
Test according referenced standards		Reference Method		
		FCC 15.201(a) + 15.209 / IC RSS-310 3.7		
Test according to measurement reference		Reference Method		
		ANSI C63.4		
Test frequency range		Tested frequencies		
		9 kHz – 10th Harmonic		
EUT test mode		Single		
Limits				
Frequency range [MHz]	Detector	Limit [µV/m]	Limit [dBµV/m]	Limit Distance [m]
0.009 – 0.490	Quasi-Peak	2400/F[kHz]	48.5 – 13.8	300
0.490 – 1.705	Quasi-Peak	2400/F[kHz]	13.8 – 1.4	30
1.705 – 30	Quasi-Peak	30	29.5	30
30 – 88	Quasi-Peak	100	40	3
88 – 216	Quasi-Peak	150	43.5	3
216 – 960	Quasi-Peak	200	46	3
960 – 1000	Quasi-Peak	500	54	3
> 1000	Average	500	54	3
The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.				

Test setup



Test procedure

1. EUT set to test mode
2. Span it set according to measurement range
3. Resolution bandwidth below 1 GHz is set according to CISPR 16 with peak/quasi-peak detector and RBW of 1 MHz with peak/average detector is used above 1 GHz
4. Markers are set to maximum emission levels

Test results – Antenna RRO2101953

Channel	Frequency [kHz]	Emission [kHz]	Level [dbµV/m]	Detector	Pol.	Limit [dbµV/m]	Limit distance [m]*	Margin [dB]
F_{MID}	134	134.32	-23.10	avg	N/A	25.10	300	-48.18
F_{MID}	134	268.048	-33.40	avg	N/A	19.00	300	-52.49
F_{MID}	134	402.416	-43.60	avg	N/A	15.50	300	-59.09

Test results – Antenna RRO2400007

Channel	Frequency [kHz]	Emission [kHz]	Level [dbµV/m]	Detector	Pol.	Limit [dbµV/m]	Limit distance [m]*	Margin [dB]
F_{MID}	134	134.064	-13.90	avg	N/A	25.10	300	-38.97
F_{MID}	134	262.064	-38.20	avg	N/A	19.20	300	-57.45
F_{MID}	134	398.608	-41.10	avg	N/A	15.60	300	-56.66

Comments: * Physical distance between EUT and measurement antenna.

ANNEX A Transmitter radiated spurious emissions

Spurious emissions according to FCC 15.209

Project number: G0M-1502-4516

Applicant:	Roth & Rau - Ortner GmbH
EUT Name:	RFID reader with CAN interface
Model:	LF-CAN-M
Test Site:	Eurofins Product Service GmbH
Operator:	C. Weber
Test Conditions:	Tnom: 24°C, Vnom: 24 VDC (via dedicated AC/DC-adaptor)
Antenna:	Rohde & Schwarz HFH 2-Z2
Measurement distance:	3 m converted to 300 m
Mode:	TX; RFID 134 kHz
Test Date:	2015-05-21
Note:	Antenna RRO2101953, Antenna vertical, EUT horizontal, measured with Tag next to Antenna, continuously reading

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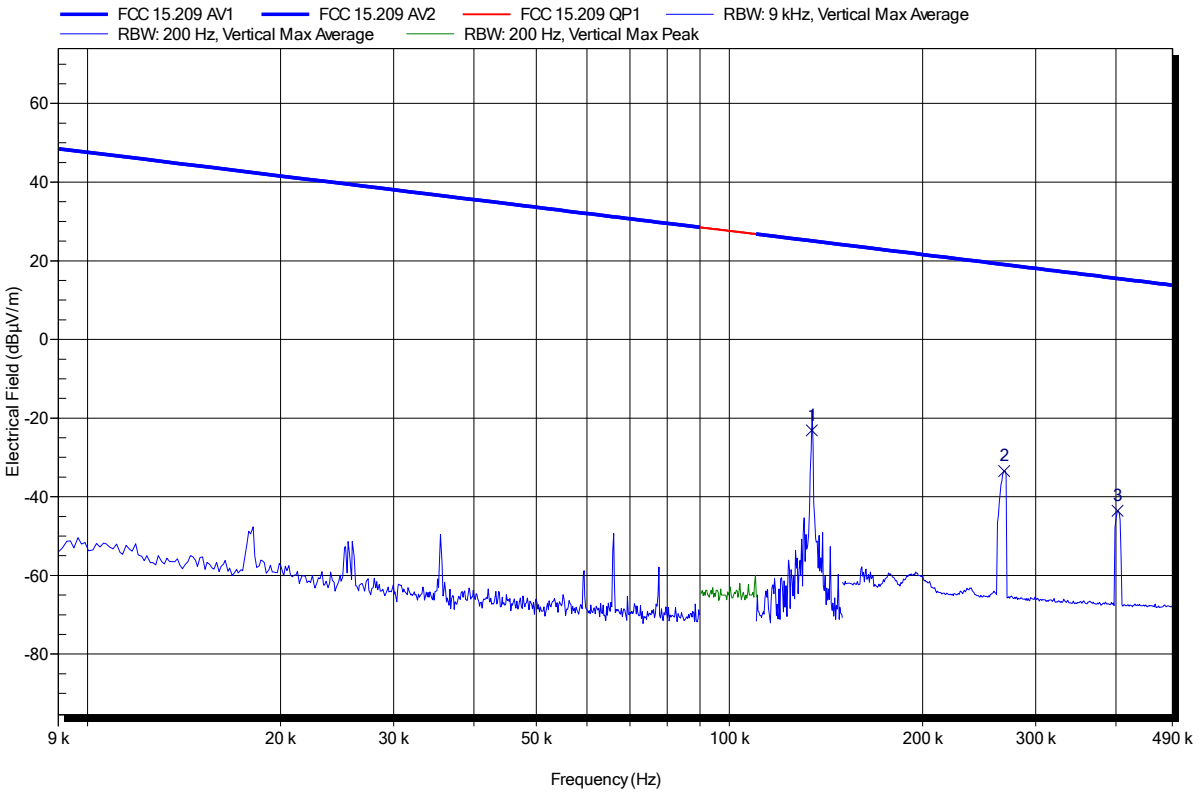

Frequency	Average	Average Limit	Average Difference	Average Status
134.32 kHz	-23.1 dBµV/m	25.1 dBµV/m	-48.18 dB	Pass
268.048 kHz	-33.4 dBµV/m	19 dBµV/m	-52.49 dB	Pass
402.416 kHz	-43.6 dBµV/m	15.5 dBµV/m	-59.09 dB	Pass

Spurious emissions according to FCC 15.209

Project number: G0M-1502-4516

Applicant:	Roth & Rau - Ortner GmbH
EUT Name:	RFID reader with CAN interface
Model:	LF-CAN-M
Test Site:	Eurofins Product Service GmbH
Operator:	C. Weber
Test Conditions:	Tnom: 24°C, Vnom: 24 VDC (via dedicated AC/DC-adaptor)
Antenna:	Rohde & Schwarz HFH 2-Z2
Measurement distance:	3 m converted to 30 m
Mode:	TX; RFID 134 kHz
Test Date:	2015-05-21
Note:	Antenna RRO2101953, Antenna vertical, EUT horizontal, measured with Tag next to Antenna, continuously reading

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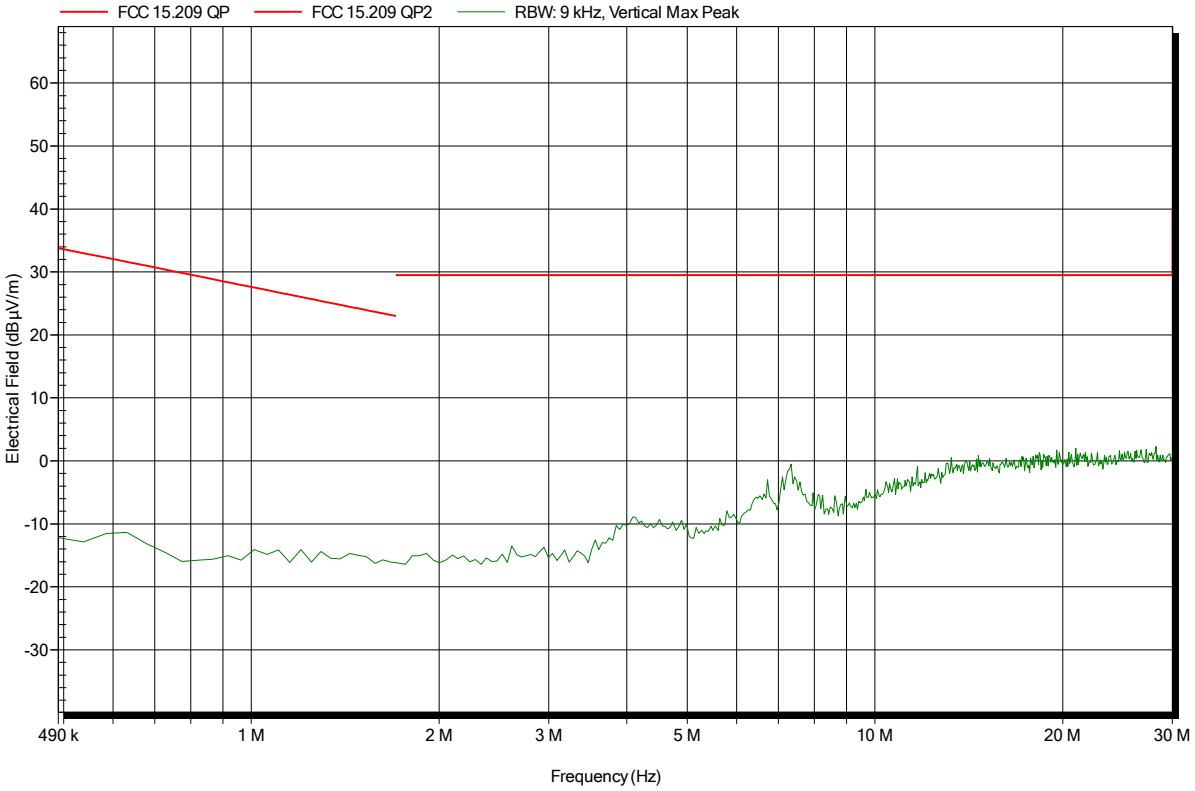

Spurious emissions according to FCC 15.209

Project number: G0M-1502-4516

Applicant:	Roth & Rau - Ortner GmbH
EUT Name:	RFID reader with CAN interface
Model:	LF-CAN-M
Test Site:	Eurofins Product Service GmbH
Operator:	C. Weber
Test Conditions:	Tnom: 24°C, Vnom: 24 VDC (via dedicated AC/DC-adaptor)
Antenna:	Rohde & Schwarz HFH 2-Z2
Measurement distance:	3 m converted to 300 m
Mode:	TX; RFID 134 kHz
Test Date:	2015-05-21
Note:	Antenna RRO2400007, Antenna vertical, EUT horizontal, measured with Tag next to Antenna, continuously reading

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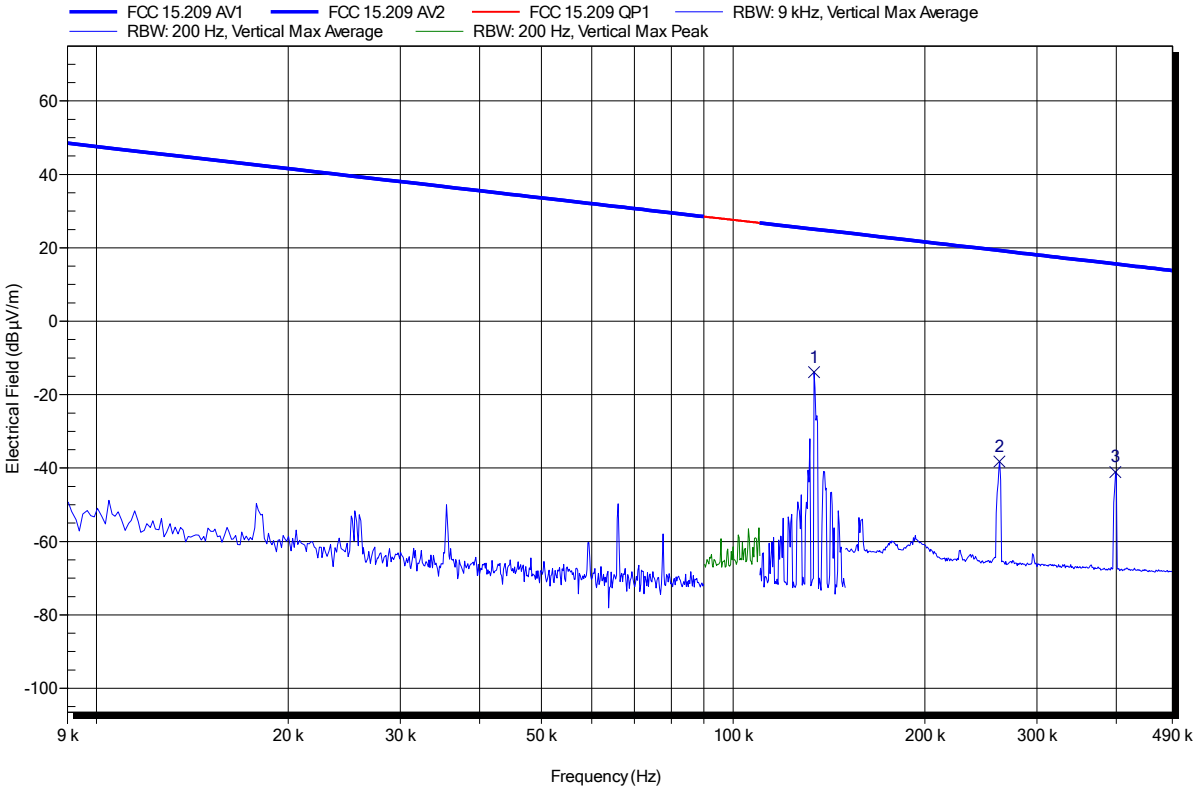

Frequency	Average	Average Limit	Average Difference	Average Status
134.064 kHz	-13.9 dBµV/m	25.1 dBµV/m	-38.97 dB	Pass
262.064 kHz	-38.2 dBµV/m	19.2 dBµV/m	-57.45 dB	Pass
398.608 kHz	-41.1 dBµV/m	15.6 dBµV/m	-56.66 dB	Pass

Spurious emissions according to FCC 15.209

Project number: G0M-1502-4516

Applicant:	Roth & Rau - Ortner GmbH
EUT Name:	RFID reader with CAN interface
Model:	LF-CAN-M
Test Site:	Eurofins Product Service GmbH
Operator:	C. Weber
Test Conditions:	Tnom: 24°C, Vnom: 24 VDC (via dedicated AC/DC-adaptor)
Antenna:	Rohde & Schwarz HFH 2-Z2
Measurement distance:	3 m converted to 30 m
Mode:	TX; RFID 134 kHz
Test Date:	2015-05-21
Note:	Antenna RRO2400007, Antenna vertical, EUT horizontal, measured with Tag next to Antenna, continuously reading

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