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FCC TEST REPORT

FCC 47 CFR Part 15C
Industry Canada RSS-210

Operation within the 13.110 – 14.010 MHz band

Report Reference No. ..... :	G0M-1510-5134-TFC225RI-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 ..... :	EMKA Beschlagteile GmbH & Co. KG
Address ..... :	Langenberger Straße 32 42551 Velbert GERMANY
Test specification:	
Standard..... :	47 CFR Part 15C RSS-210, Issue 8, 2010-12 RSS-Gen, Issue 4, 2014-11 ANSI C63.4:2014
Test scope…….. ..... :	complete Radio compliance test
Equipment under test (EUT):	
Product description	AgentE USA/SGP
Model No.	3000-U902-4X
Additional Model(s)	None
Brand Name(s)	EMKA
Hardware version	901.343B001
Firmware / Software version	350000091
	FCC-ID: 2AGCT-U9024X 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 ..... : 2015-10-27

Date (s) of performance of tests ..... : 2015-10-28

Compiled by ..... : Burkhard Pudell

Tested by (+ signature) ..... : Burkhard Pudell ..... B. Pudell .....
(Responsible for Test)

Approved by (+ signature) ..... : Christian Weber ..... C. Weber .....
(Head of Lab)

Date of issue ..... : 2015-11-18

Total number of pages ..... : 29

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	2015-11-18	Initial Release	

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1 Equipment (Test item) Description

Description	AgentE USA/SGP	
Model	3000-U902-4X	
Additional Model(s)	None	
Brand Name(s)	EMKA	
Serial number	None	
Hardware version	901.343B001	
Software / Firmware version	350000091	
FCC-ID	2AGCT-U9024X	
IC	N/A	
Equipment type	End product	
Radio type	Transceiver	
Radio technology	13.56 MHz RFID	
Operating frequency range	13.56 MHz	
Assigned frequency band	13.110 - 14.010 MHz	
Frequency range	F_{MID}	13.56 MHz
Spreading	None	
Modulations	ASK	
Number of channels	1	
Channel spacing	None	
Number of antennas	1	
Antenna	Type	integrated
	Model	printed loop antenna
	Manufacturer	In-circuit
Manufacturer	EMKA Beschlagteile GmbH & Co. KG Langenberger Straße 32 42551 Velbert GERMANY	
Power supply	V_{NOM}	3.0 V DC
	V_{MIN}	2.4 V DC
	V_{MAX}	3.2 V DC
Temperatures	T_{NOM}	20 °C
	T_{MIN}	5 °C
	T_{MAX}	50 °C
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
None				

***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 - CW	General conditions:	EUT powered by battery
	Radio conditions:	Mode = standalone transmit Modulation = none Power level = Maximum
Single	General conditions:	EUT powered by battery
	Radio conditions:	Mode = standalone transmit Modulation = ASK 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

Occupied Bandwidth					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSP 30	EF00312	2015-02	2016-02

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
Loop Antenna	R&S	HFH2-Z2	EF00184	2014-11	2016-11
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	2015-10	2018-10

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:

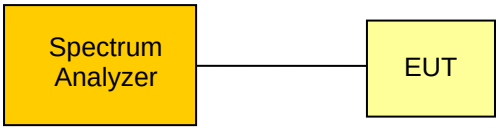
Reading	+	AF	=	Net Reading	:	Net reading - FCC limit = Margin
21.5 dBµV	+	26 dB	=	47.5 dBµV/m	:	47.5 dBµV/m - 57.0 dBµV/m = -9.5 dB

2 Result Summary

FCC 47 CFR Part 15C, IC RSS-210				
Product Specific Standard Section	**Requirement – Test**	**Reference Method**	**Result**	**Remarks**
RSS-Gen 6.6	Occupied Bandwidth	RSS-Gen 6.6	N/R	Informational only
FCC 15.225(a-c) IC RSS-210 A2.6(a-c)	Fundamental in-band field strength emissions	ANSI C63.4	PASS	
FCC 15.225(d) FCC 15.209 IC RSS-210 A2.6(d)	Emission radiated outside the specified frequency band	ANSI C63.4	PASS	
FCC 15.225(e) IC RSS-210 A2.6	Frequency stability	ANSI C63.4	PASS	
IC RSS-Gen 4.10 IC RSS-Gen 7.1	Receiver radiated spurious emissions	ANSI C 63.4	N/R	
47 CFR 15.207 RSS-Gen 8.8	AC power line conducted emissions	ANSI C63.4	N/R	EUT exclusively battery powered
Remarks:				

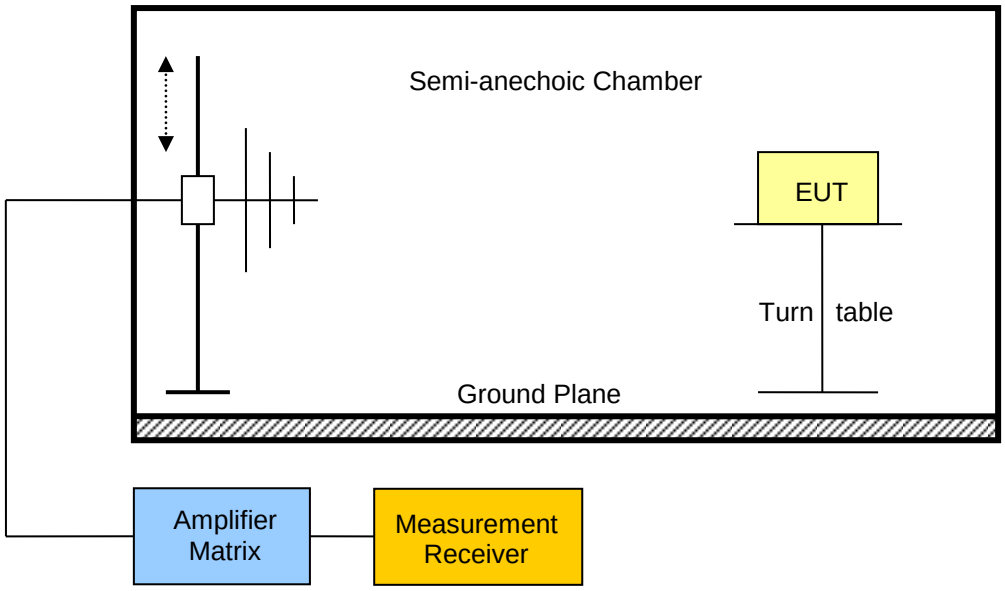
3 Test Conditions and Results

3.1 Test Conditions and Results – Occupied Bandwidth

Occupied Bandwidth acc. to IC RSS-Gen		**Verdict: PASS**
Test according to measurement reference	Reference Method	
	RSS-Gen 6.6	
Test frequency range	Tested frequencies	
	F_{MID}	
EUT test mode	Single	
Limits		
None (Informational only)		
Test setup		
		
Test procedure		
1. EUT set to test mode (Communication tester is used if needed) 2. Span set to at least twice the emission spectrum 3. Resolution bandwidth set to 1 % of span 4. Occupied Bandwidth (99 %) measurement with spectrum analyzer built in measurement function		
Test results		
Channel	Frequency [MHz]	Occupied Bandwidth [kHz]
F_{MID}	13.56	627
Comments: Measurement is applicable to all variants		

3.2 Test Conditions and Results – Fundamental in-band field strength emissions

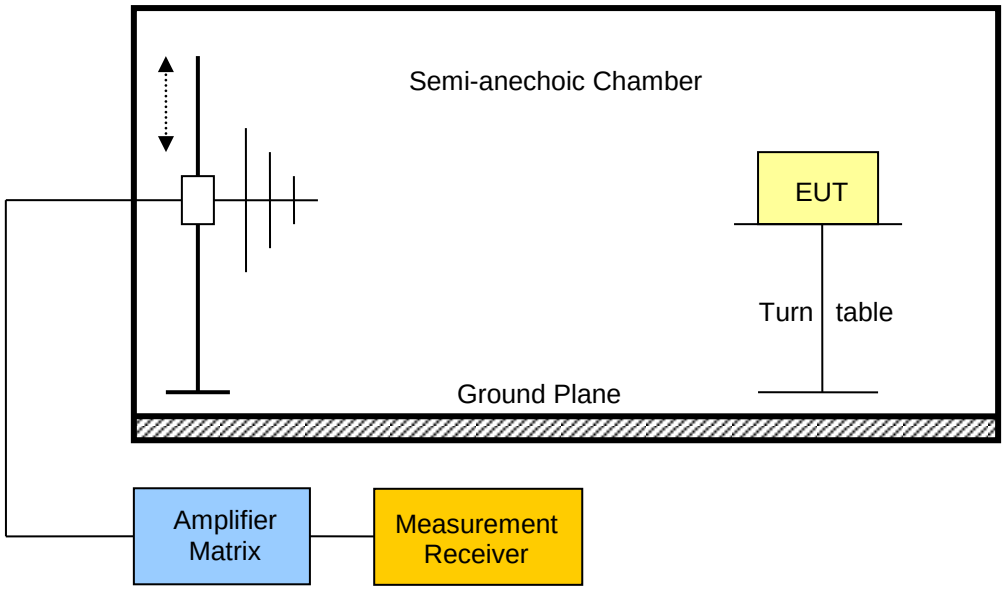
Field strength emissions acc. to FCC 47 CFR 15.225 / IC RSS-210			Verdict: PASS
Test according referenced standards	Reference Method		
	FCC 15.225(a-c) / IC RSS-210 A2.6(a-c)		
Test according to measurement reference	Reference Method		
	ANSI C63.4		
Test frequency range	Tested frequencies		
	F_{MID}		
EUT test mode	Single		
Limits			
Frequency range [MHz]	Limit [µV/m]	Limit [dBµV/m]	Limit Distance [m]
13.553 – 13.567	15848	84	30
13.410 – 13.553 13.567 – 13.710	334	50.5	30
13.110 – 13.410 13.710 – 14.010	106	40.5	30
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 4. Below 30MHz and extrapolation factor of 40dB/decade is used and at 30MHz and above an extrapolation factor of 20dB/decade is used (47 CRF 15.31(f)).							
Test results							
Channel	Frequency [MHz]	Emission [MHz]	Level @ 30m [dbµV/m]	Det.	Limit @ 30m [dbµV/m]	Measurement distance [m]*	Margin [dB]
F_{MID}	13.56	13.558	13.5	pk	84	3	-70.5
Comments: * Physical distance between EUT and measurement antenna. See Annex							

3.3 Test Conditions and Results – Emissions radiated outside the specified frequency band

Radiated out-of-band band emissions acc. to FCC 47 CFR 15.225 / IC RSS-210				**Verdict: PASS**
Test according referenced standards		Reference Method		
		FCC 15.225(d) / IC RSS-210 A2.6(d)		
Test according to measurement reference		Reference Method		
		ANSI C63.4		
Test frequency range		Tested frequencies		
		9 kHz – 216 MHz		
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 – 2.97	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
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

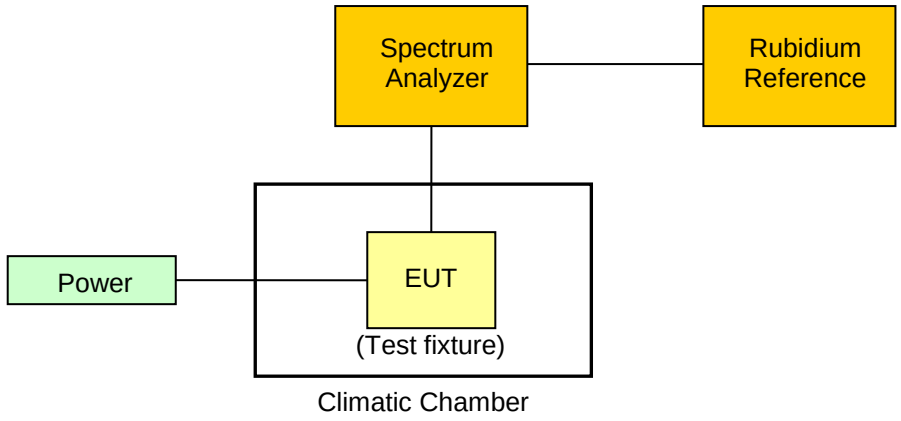
Test results

Channel	Frequency [MHz]	Emission [MHz]	Level [dbµV/m]	Detector	Pol.	Limit [dbµV/m]	Limit distance [m]*	Margin [dB]
F_{MID}	13.56	4.308	14.4	pk	ver	29.5	3	-15.1
F_{MID}	13.56	71.820	28.9	pk	ver	40.0	3	-11.1
F_{MID}	13.56	167.838	33.6	pk	ver	43.5	3	- 9.9

Comments: * Physical distance between EUT and measurement antenna.

3.4 Test Conditions and Results – Frequency stability

Frequency stability acc. to FCC 15.225 / IC RSS-210	**Verdict: PASS**
Test according referenced standards	Reference Method
	FCC 15.225(e) / IC RSS-210 A2.6
Test according to measurement reference	Reference Method
	ANSI C63.4
Test frequency range	Tested frequencies
	F_{MID}
EUT test mode	Single CW
Limits	
Frequency error limit	
±0.01% (±100ppm)	
Test setup	



Test procedure
1. EUT set to test mode 2. The ambient temperature and supply voltage is set according to measurement conditions 3. Span is set to capture fundamental emission 4. Frequency error is measured with frequency counter measurement function

Test results					
Channel	Frequency [MHz]	Temp.	Voltage	Measured Frequency [MHz]	Error [ppm]
F_{MID}	13.56	T_{min} = 5 °C	V_{nom} = 3.0 V DC	13.5598	-14.75
F_{MID}	13.56	$T_{min + 5}$ = 10 °C	V_{nom} = 3.0 V DC	13.5598	-14.75
F_{MID}	13.56	T_{nom} = 20 °C	V_{nom} = 3.0 V DC	13.5597	-22.12
F_{MID}	13.56	T_{nom} = 20 °C	V_{min} = 2.4 V DC	13.5597	-22.12
F_{MID}	13.56	T_{max-20} = 30 °C	V_{nom} = 3.0 V DC	13.5597	-22.12
F_{MID}	13.56	T_{max-10} = 40 °C	V_{nom} = 3.0 V DC	13.5597	-22.12
F_{MID}	13.56	T_{max} = 50 °C	V_{nom} = 3.0 V DC	13.5597	-22.12
Comments:					

ANNEX A Transmitter in-band emissions

Spurious emissions according to FCC 15.225

Project number: G0M-1510-5134

Applicant:	In-Circuit GmbH
EUT Name:	AgentE USA/SGP
Model:	3000-U902-4X
Test Site:	Eurofins Product Service GmbH
Operator:	Pudell
Test Conditions:	Tnom: 24°C, Vnom: 3.0 V DC
Antenna:	Rohde & Schwarz HFH 2-Z2
Measurement distance:	3 m converted to 30 m
Mode:	TX; RFID; 13.56 MHz
Test Date:	2015-10-28
Note:	EUT vertical, measured without Tag continuously reading

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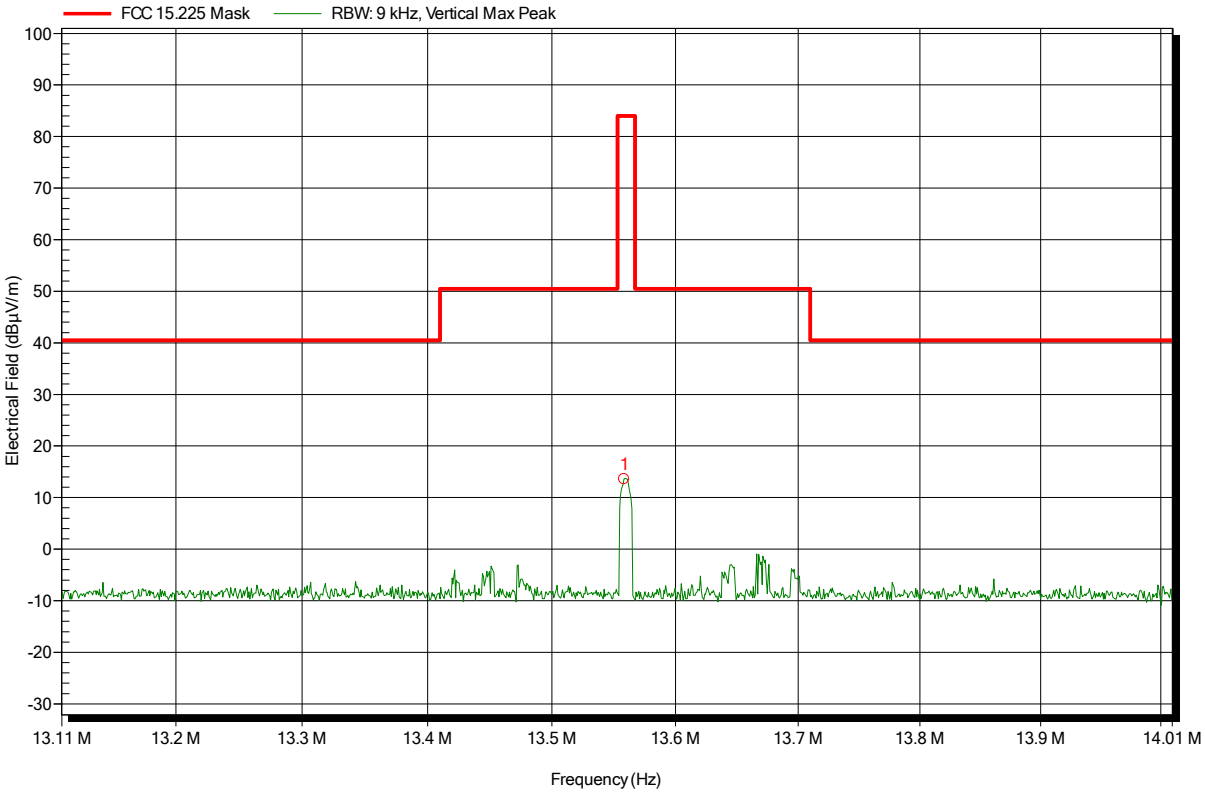

Frequency	Peak
13.558 MHz	13.5 dBµV/m

ANNEX B Transmitter radiated spurious emissions

Spurious emissions according to FCC 15.225

Project number: G0M-1510-5134

Applicant:	In-Circuit GmbH
EUT Name:	AgentE USA/SGP
Model:	3000-U902-4X
Test Site:	Eurofins Product Service GmbH
Operator:	Pudell
Test Conditions:	Tnom: 24°C, Vnom: 3.0 V DC
Antenna:	Rohde & Schwarz HFH 2-Z2
Measurement distance:	3 m converted to 300 m
Mode:	TX; RFID; 13.56 MHz
Test Date:	2015-10-28
Note:	EUT vertical, measured without Tag continuously reading

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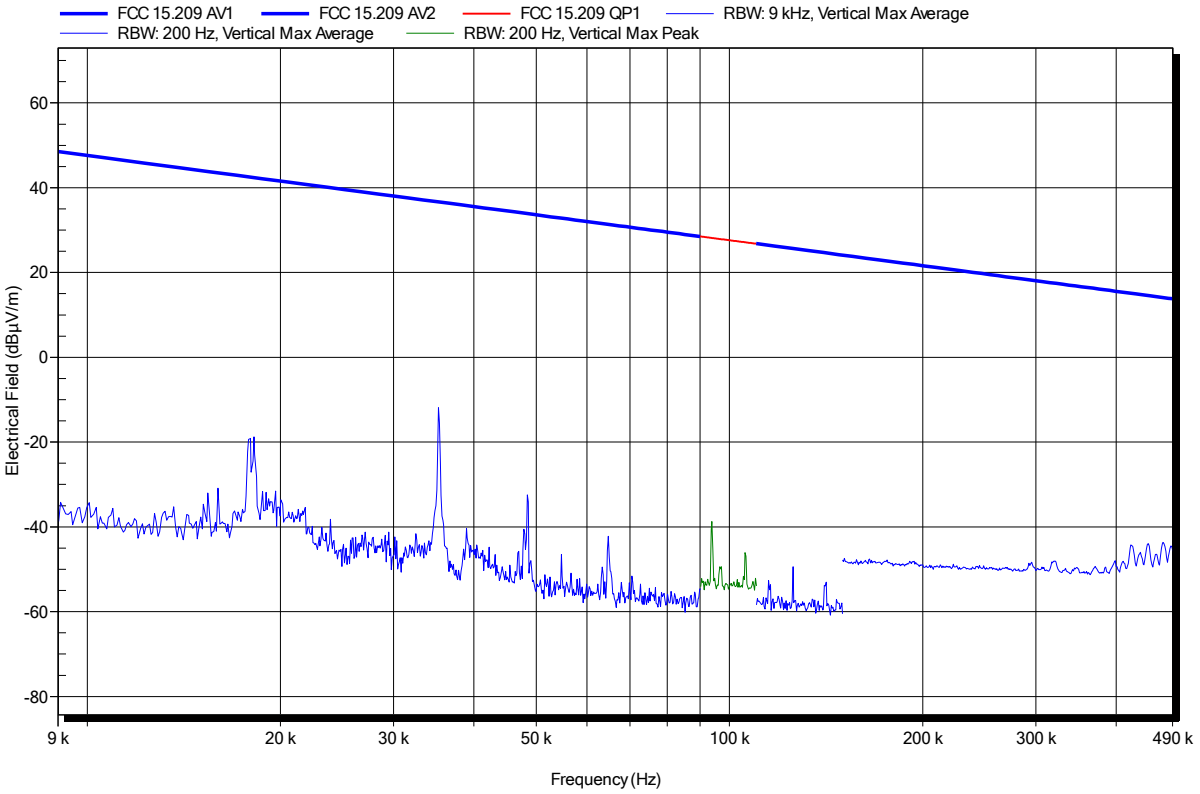

Spurious emissions according to FCC 15.225

Project number: G0M-1510-5134

Applicant:	In-Circuit GmbH
EUT Name:	AgentE USA/SGP
Model:	3000-U902-4X
Test Site:	Eurofins Product Service GmbH
Operator:	Pudell
Test Conditions:	Tnom: 24°C, Vnom: 3.0 V DC
Antenna:	Rohde & Schwarz HFH 2-Z2
Measurement distance:	3 m converted to 30 m
Mode:	TX; RFID; 13.56 MHz
Test Date:	2015-10-28
Note:	EUT vertical, measured without Tag continuously reading

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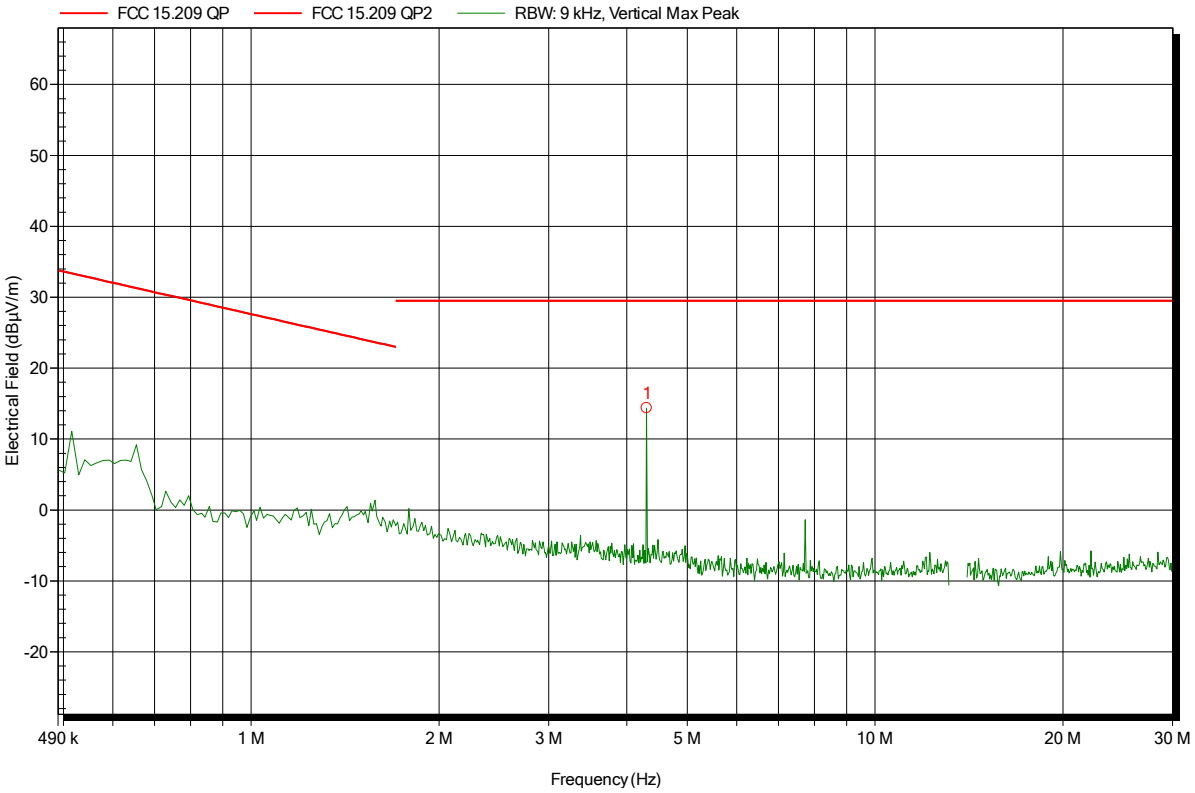

Frequency	Peak	Peak Limit	Peak Difference	Peak Status
4.308 MHz	14.4 dBµV/m	29.5 dBµV/m	-15.13 dB	Pass

Spurious emissions according to FCC 15.225

Project number: G0M-1510-5134

Applicant:	In-Circuit GmbH
EUT Name:	AgentE USA/SGP
Model:	3000-U902-4X
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Pudell
Test Conditions:	Tnom: 24°C, Vnom: 3.0 V DC
Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement distance:	3 m
Mode:	TX; RFID; 13.56 MHz
Test Date:	2015-10-28
Note:	EUT vertical, measured without Tag continuously reading

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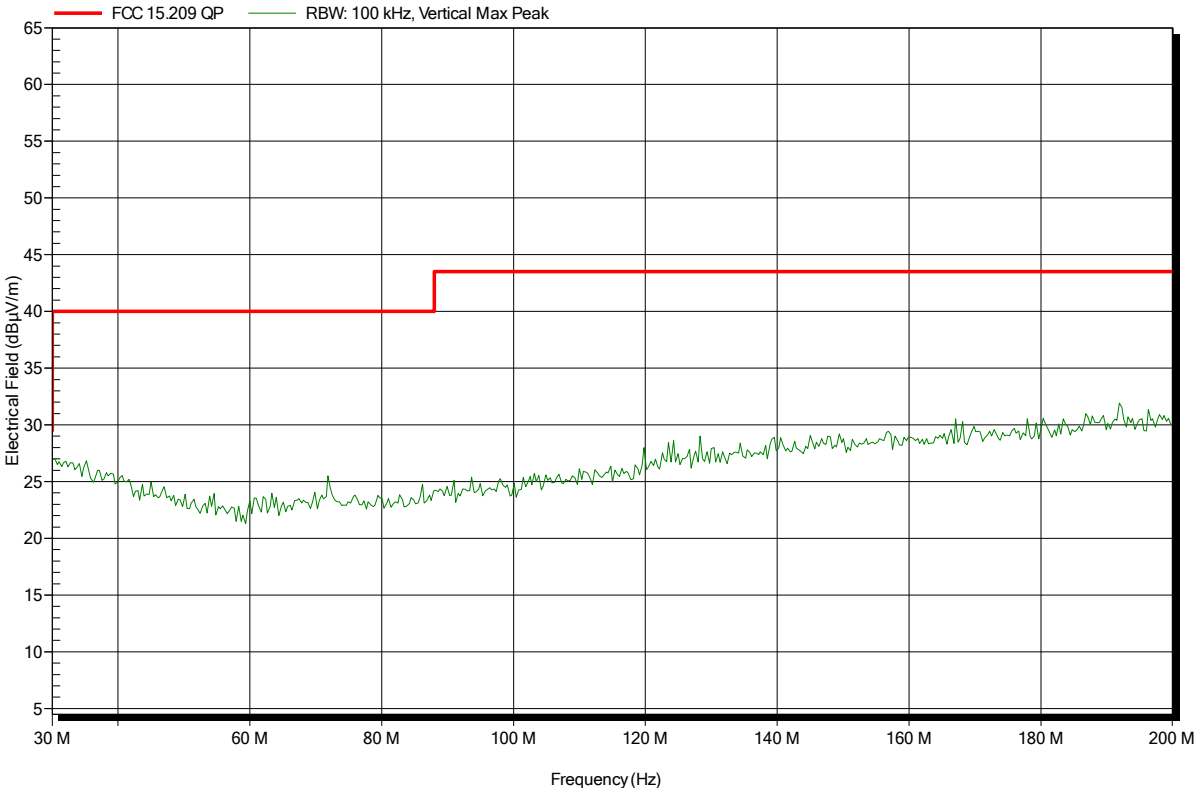

Spurious emissions according to FCC 15.225

Project number: G0M-1510-5134

Applicant:	In-Circuit GmbH
EUT Name:	AgentE USA/SGP
Model:	3000-U902-4X
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Pudell
Test Conditions:	Tnom: 24°C, Vnom: 3.0 V DC
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement distance:	3 m
Mode:	TX; RFID; 13.56 MHz
Test Date:	2015-10-28
Note:	EUT vertical, measured without Tag continuously reading

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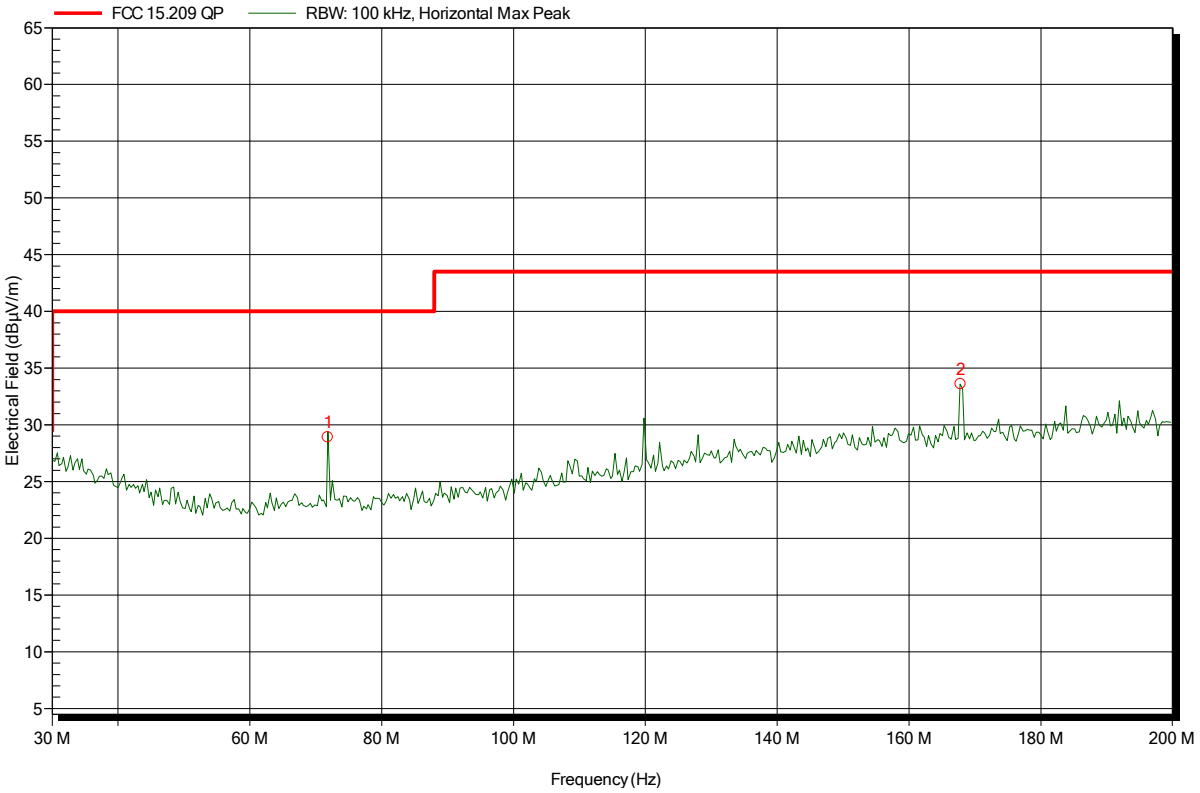

Frequency	Peak	Peak Limit	Peak Difference	Status
71.82 MHz	28.89 dBµV/m	40 dBµV/m	-11.11 dB	Pass
167.838 MHz	33.61 dBµV/m	43.5 dBµV/m	-9.89 dB	Pass