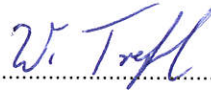


RADIO REPORT FCC 47 CFR Part 15C ISED Canada RSS-210 ISED Canada RSS-Gen Operation within the 13.110 – 14.010 MHz band	
Report Reference No	G0M-1904-8167-TFC225RI-V02
Testing Laboratory	Eurofins Product Service GmbH
Address	Storkower Str. 38c 15526 Reichenwalde Germany
Accreditation	    DAkks - Registration number : D-PL-12092-01-03 (ISED) ISED Testing Laboratory site: 3470A-2 DAkks - Registration number : D-PL-12092-01-04 (FCC) FCC Filed Test Laboratory, Reg.-No.: 96970
Applicant	W.O.M. WORLD OF MEDICINE GmbH
Address	Salzufer 8 10587 Berlin GERMANY
Test Specification	According to FCC/ISED rules
Standard	FCC 47 CFR Part 15C ISED RSS-210, Issue 9, 2016-08 ISED RSS-Gen, Issue 5, Amendment 1, 2019-03
Non-Standard Test Method	None
Equipment under Test (EUT):	
Product Description	customized Read / Write RFID module
Model(s)	TS-HW42
Additional Model(s)	None
Brand Name(s)	None
Hardware Version(s)	1430
Software Version(s)	PRV100
FCC-ID	2AS5K-TSHW42
IC	25004-TSHW42A
Test Result	PASSED

Test Report No.: G0M-1904-8167-TFC225RI-V02

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

Possible test case verdicts:		
required by standard but not tested	N/T	
not required by standard	N/R	
not applicable to EUT	N/A	
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	2019-04-10	
Report:		
Compiled by	Wilfried Treffke	
Tested by (+ signature) (Responsible for Test)	Christian Weber	
Approved by (+ signature) (Test Lab Engineer)	Wilfried Treffke	
Date of Issue	2019-07-11	
Total number of pages	31	
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 History			
Version	Issue Date	Remarks	Revised By
01	2019-05-09	Initial Release	
02	2019-07-11	Replaced document G0M-1904-8167-TFC225RI-V01 Replaced by G0M-1904-8167-TFC225RI-V02 Reason – Serial number added – Editorial corrections	C. Weber

ABBREVIATIONS AND ACRONYMS

Acronyms	
Acronym	Description
EUT	Equipment Under Test
FCC	Federal Communications Commission
ISED	Innovation, Science and Economic Development Canada
RBW	Resolution bandwidth
RFID	Radio Frequency Identification
RMS	Root mean square
VBW	Video bandwidth
V _{NOM}	Nominal supply voltage

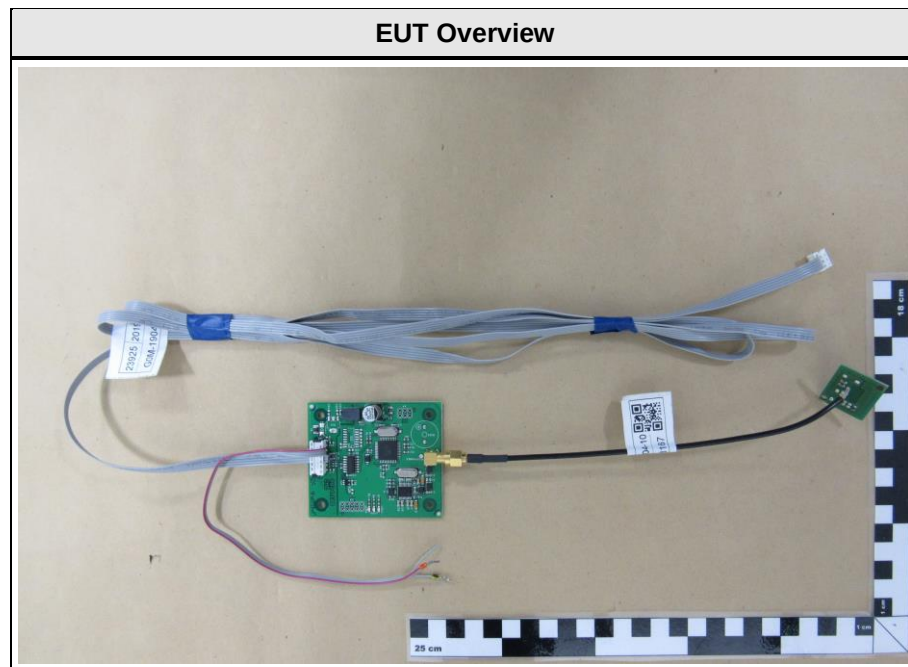
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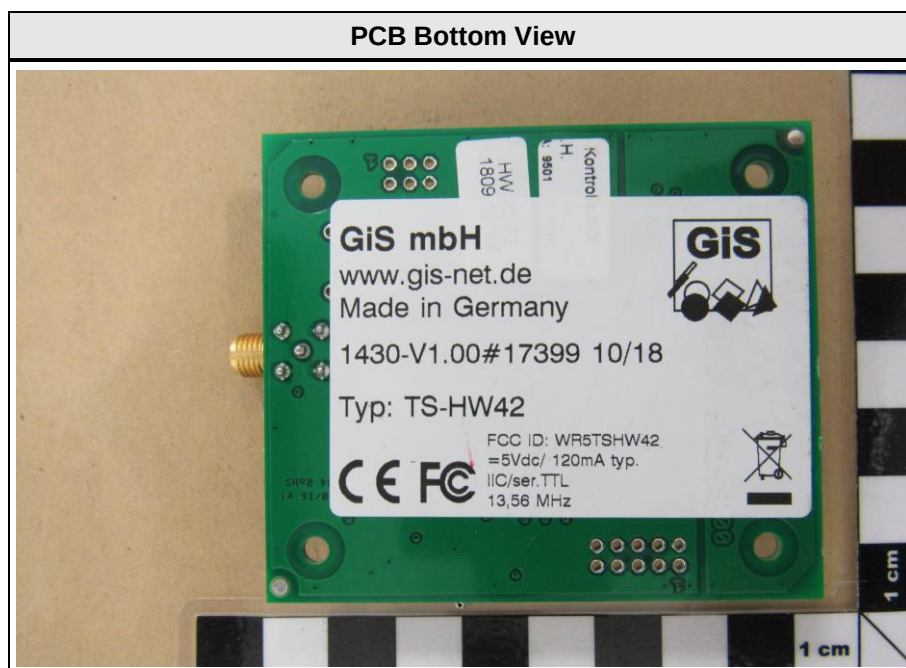
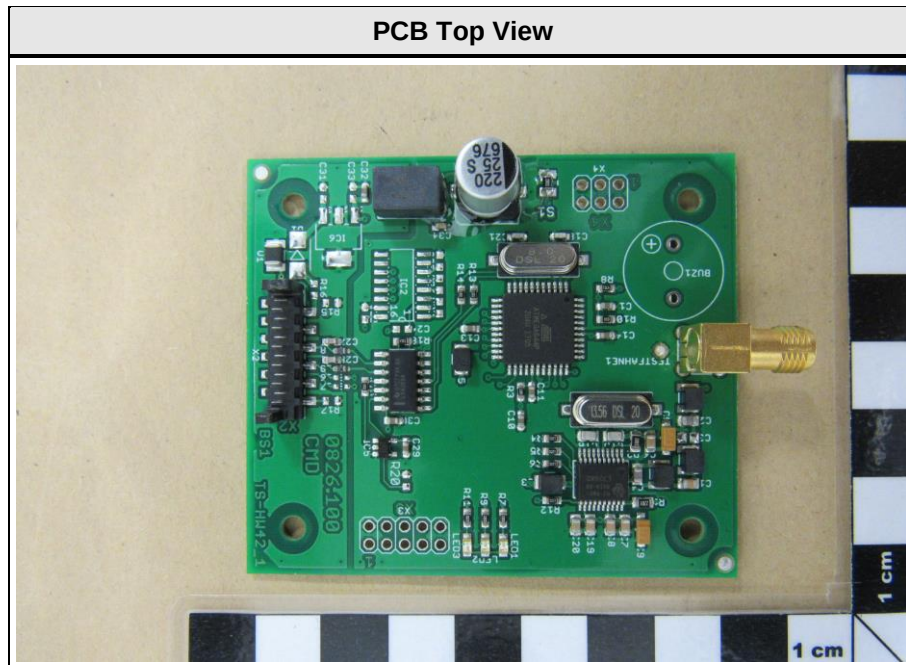
1 Equipment (Test Item) Under Test

Description	customized Read / Write RFID module	
Model	TS-HW42	
Additional Model(s)	None	
Brand Name(s)	None	
Serial Number(s)	1430-V1.00#17399 10/18	
Hardware Version(s)	1430	
Software Version(s)	PRV100	
PMN	TS-HW42	
HVIN	1430	
FVIN	-/-	
HMN	-/-	
FCC-ID	2AS5K-TSHW42	
IC	25004-TSHW42A	
Equipment type	Radio Module	
Radio type	Transceiver	
Assigned frequency bands	13.110 - 14.010 MHz	
Radio technology	RFID	
Modulation	ASK	
Antenna	Type	External dedicated
	Model	TS-AH20
	Manufacturer	GiS GmbH
	Gain	N/A
Supply Voltage	V _{NOM}	5.0 VDC
Operating Temperature	T _{NOM}	25 °C
AC/DC-Adaptor	Model	N/A
	Vendor	N/A
	Input	N/A
	Output	N/A
Manufacturer	GiS GmbH Höllochstrasse 1 73252 Lenningen Germany	

1.1 Photos – Equipment External



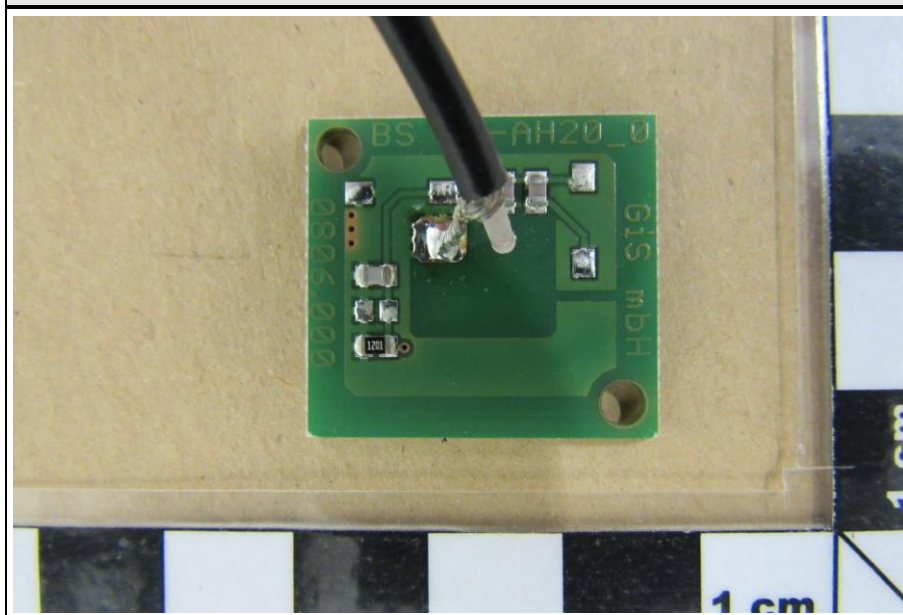
1.2 Photos – Equipment Internal



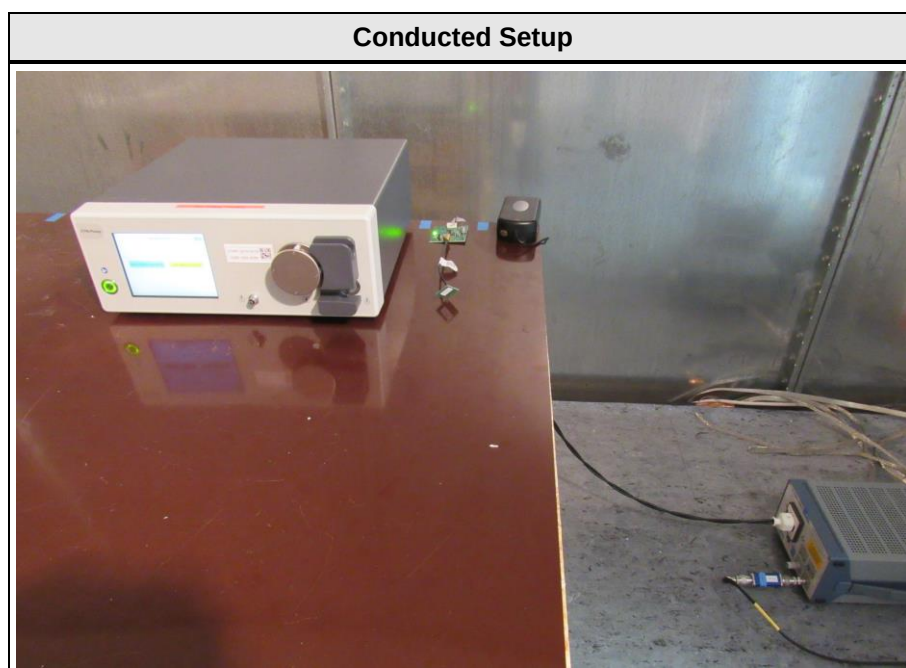
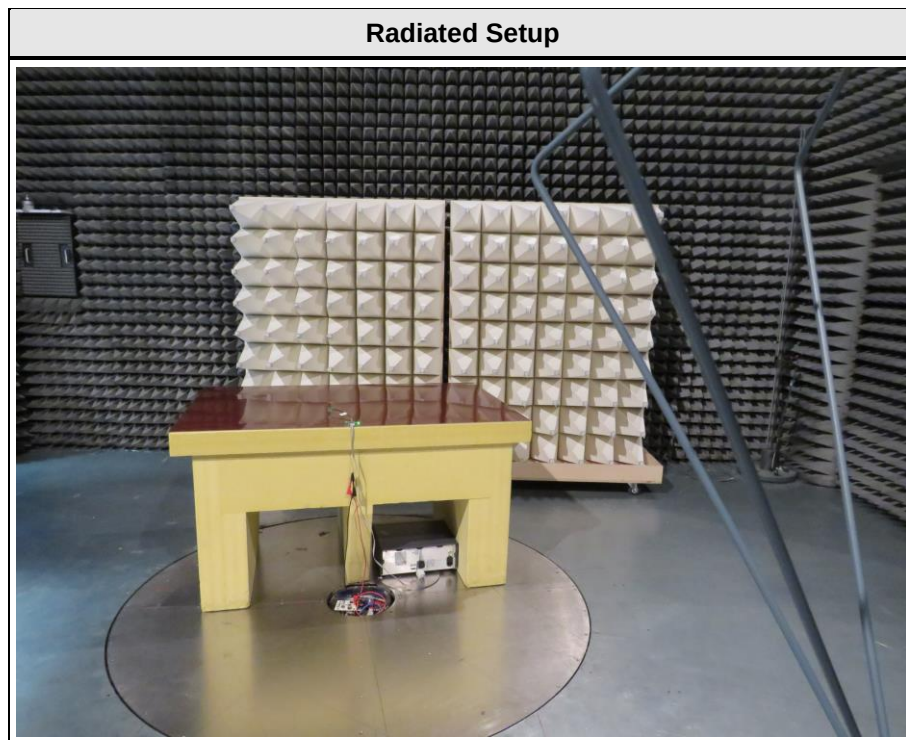
Antenna, PCB Top View



Antenna, PCB Bottom View



1.3 Photos – Test Setup



1.4 Support Equipment

Product Type	Device	Manufacturer	Model	Comment
AE	Irrigation Pump for HYS/LAP, Fluid Monitoring Module	W.O.M. WORLD OF MEDICINE GmbH	PH304	Used for radio module control
AE	Switching Power Supply	Revolt	PE-3747-675	Used for AC powerline conducted emissions
Description:				
AE	Auxiliary Equipment			
SIM	Simulator			
CBL	Connecting Cable			
SFT	Software			
Comment:				

1.5 Test Modes

Mode	Description
Transmit/Receive	Mode = Transmit Modulation = ASK
Comment:	

1.6 Test Frequencies

Designator	Mode	Channel	Frequency [MHz]
F1	Tx / Rx	0	13.5609

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:

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

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:

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

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

2 Result Summary

FCC 47 CFR Part 15C, ISED RSS-210, ISED RSS-Gen				
Product Standard Reference	Requirement	Reference Method	Result	Remarks
ISED RSS-Gen 6.7	Occupied Bandwidth	ANSI C63.10-2013	N/R	Informational only
FCC 47 CFR 15.225(a-c) ISED RSS-210 B.6(a)	Fundamental in-band field strength emissions	ANSI C63.10-2013	PASS	
FCC 47 CFR 15.225(d) FCC 47 CFR 15.209 ISED RSS-210 B.6(d)	Emission radiated outside the specified frequency band	ANSI C63.10-2013	PASS	
FCC 47 CFR 15.225(e) ISED RSS-210 B.6	Frequency stability	ANSI C63.10-2013	PASS	
ISED RSS-Gen 4.10 ISED RSS-Gen 7.1	Receiver radiated spurious emissions	ANSI C63.10-2013	N/R	Permanently co-located transmitter
FCC 47 CFR 15.207 ISED RSS-Gen 8.8	AC power line conducted emissions	ANSI C63.10-2013	PASS	
Comment:				

Possible Test Case Verdicts	
PASS	Test object does meet the requirements
FAIL	Test object does not meet the requirements
N/T	Required by standard but not tested
N/R	Not required by standard for the test object

3 Test Conditions and Results

3.1 Test Conditions and Results - Occupied bandwidth

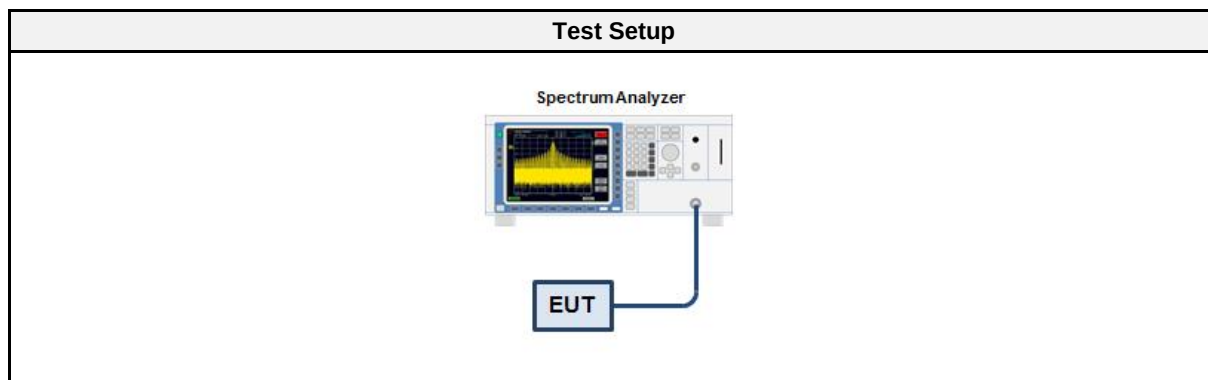
3.1.1 Information

Test Information	
Product Standard Reference	ISED RSS-Gen 6.7
Measurement Method	Conducted

3.1.2 Limits

Limits
None (Informational only)

3.1.3 Setup



3.1.4 Equipment

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSU 26	EF01407	2018-12	2019-12

3.1.5 Procedure

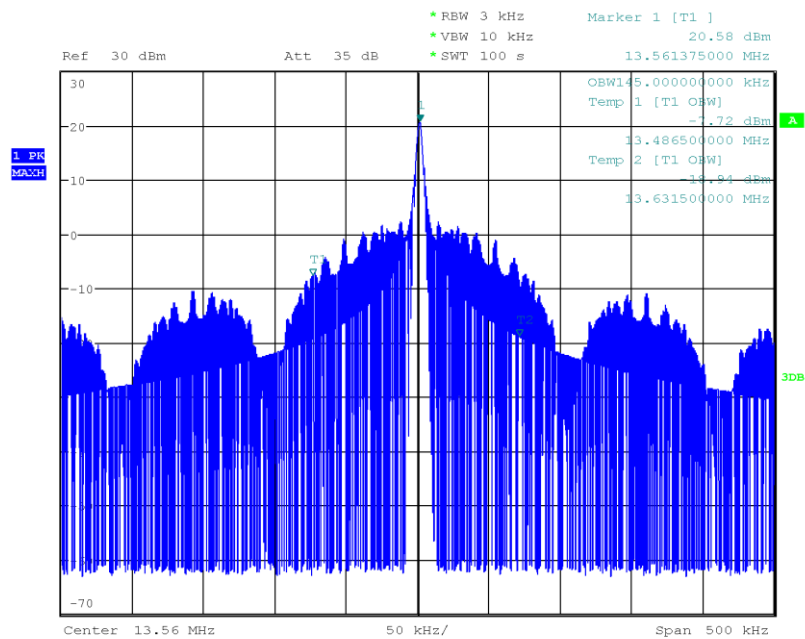
Test Procedure
1. EUT set to test mode (Communication tester is used if needed) 2. Span set to at least twice the emission spectrum 3. Resolution bandwidth set between 1 % to 5 % of OBW 4. Occupied Bandwidth (99 %) measurement with spectrum analyzer built in measurement function

3.1.6 Results

Test Results	
Channel [MHz]	Bandwidth [kHz]
13.5609	145

Occupied Bandwidth

Project Number: G0M-1904-8167
 Applicant: W.O.M. WORLD OF MEDICINE GmbH
 Model Description: customized Read / Write RFID module
 Model: TS-HW42
 Test Sample ID: 23664
 Operator: Wilfried Treffke
 Test Site: Eurofins Product Service GmbH
 Test Date: 2019-05-06
 Operating Conditions: Tnom/Vnom
 Reference Standards: ANSI C63.10:2013, Section 6.9.3
 Mode: ASK, Channel: 13.56 MHz
 Occupied Bandwidth [MHz]: 145 kHz



Date: 6.MAY.2019 08:59:32

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

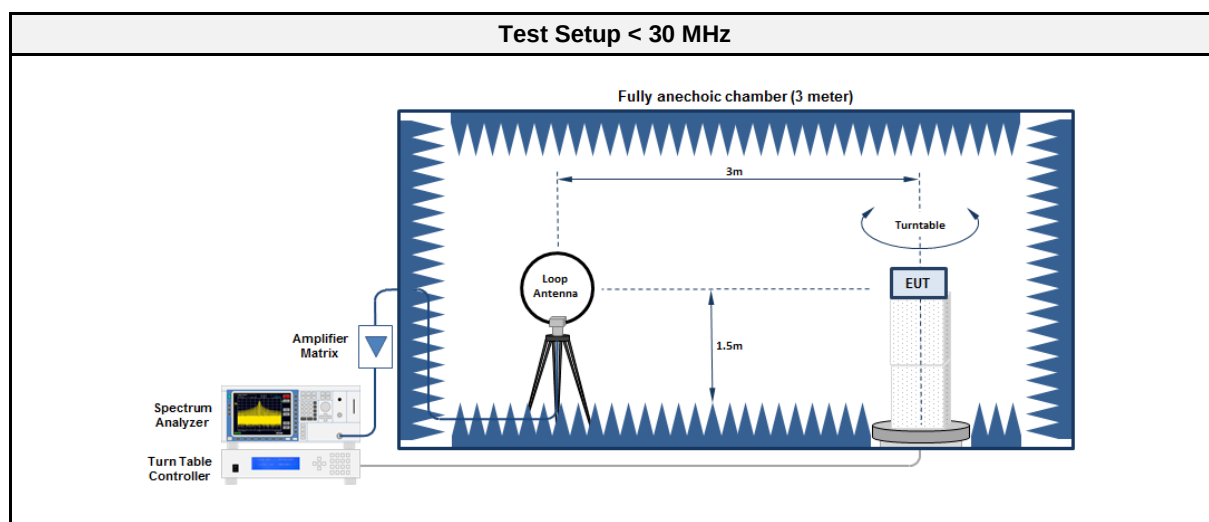
3.2.1 Information

Test Information	
Product Standard Reference	FCC 47 CFR 15.225(a-c) / ISSED RSS-210 B.6(a)
Measurement Method	Radiated
Operator	Christian Weber
Date	2019-05-03

3.2.2 Limits

Limits			
Frequency range [MHz]	Limit [$\mu\text{V/m}$]	Limit [$\text{dB}\mu\text{V/m}$]	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

3.2.3 Setup



3.2.4 Equipment

Test Software			
Description	Manufacturer	Name	Version
EMC Software	DARE Instruments	RadiMation	2015.2.4

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Semi-Anechoic Chamber	Frankonia	AC2	EF00196	-	-
Spectrum Analyzer	R&S	FSU 3	EF00241	2017-07	2019-07
Antenna	R&S	HFH2-Z2	EF00184	2017-12	2019-12

3.2.5 Procedure

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 an extrapolation according ANSI 63.10; 6.4.4.2 is used.

3.2.6 Results

Test Results						
Channel [MHz]	Emission [MHz]	Level @ 30 m [dBμV/m]	Detector	Polarization	Limit @ 30 m [dBμV/m]	Margin
13.5609	13.563	30.4	pk	ver	84	-53.60

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

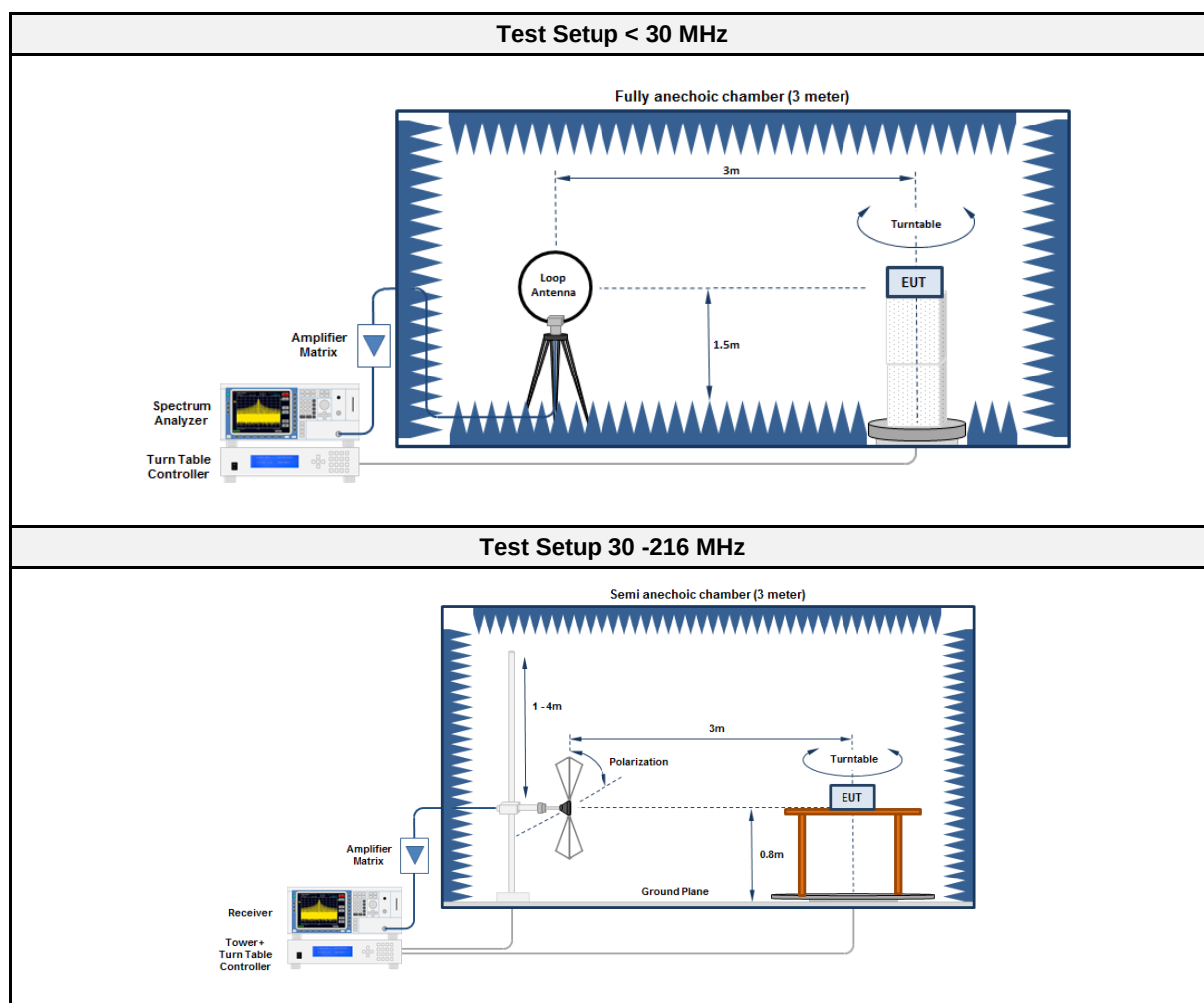
3.3.1 Information

Test Information	
Product Standard Reference	FCC 47 CFR 15.225(d) / ISED RSS-210 B.6(d)
Measurement Method	Radiated
Operator	Christian Weber
Date	2019-05-03

3.3.2 Limits

Limits				
Frequency range [MHz]	Detector	Limit [$\mu\text{V/m}$]	Limit [$\text{dB}\mu\text{V/m}$]	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

3.3.3 Setup



3.3.4 Equipment

Test Software			
Description	Manufacturer	Name	Version
EMC Software	DARE Instruments	RadiMation	2016.1.10

Test Equipment < 30 MHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC2	EF00196	-	-
Loop Antenna	R&S	HFH2-Z2	EF00184	2017-12	2019-12
Spectrum Analyzer	R&S	FSU 3	EF00241	2017-07	2019-07

Test Equipment 30 - 216 MHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC1	EF00062	2018-07	2021-07
Measurement Receiver	R&S	ESU 26	EF00887	2018-08	2019-08
Measurement Receiver	R&S	N9038A-526/WXP	EF01070	2018-08	2019-08
Antenna	R&S	HK116	EF00186	2018-03	2020-03

3.3.5 Procedure

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. Below 30MHz an extrapolation according ANSI 63.10; 6.4.4.2 is used. 5. Markers are set to maximum emission levels

3.3.6 Results

Test Results						
Channel [MHz]	Emission [MHz]	Level [dBμV/m]	Detector	Polarization	Limit [dBμV/m]	Margin [dB]
13.5609	0.065986	-38.90	avg	ver	31.20	-70.12

3.4 Test Conditions and Results - Frequency stability

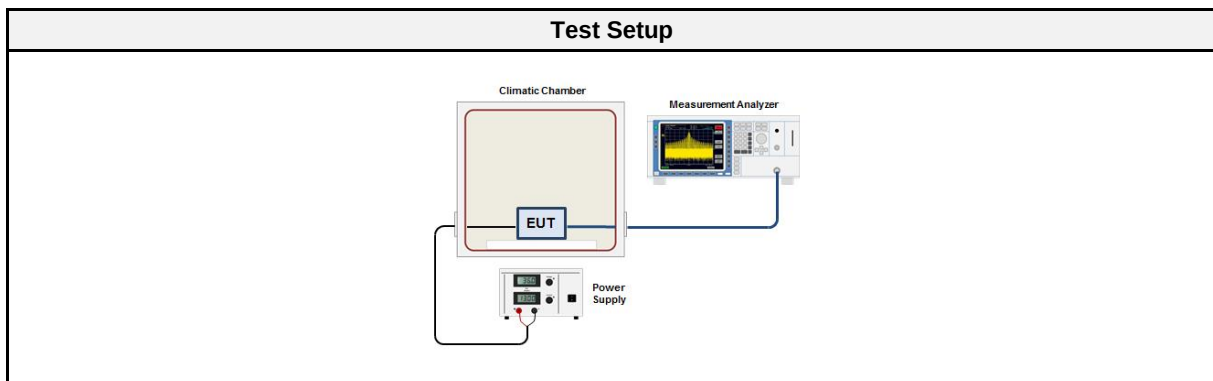
3.4.1 Information

Test Information	
Product Standard Reference	FCC 47 CFR 15.225(e) / ISED RSS-210 B.6
Measurement Method	Conducted
Operator	Wilfried Treffke
Date	2019-05-06

3.4.2 Limits

Limits
Frequency error limit
$\pm 0.01\%$ ($\pm 100\text{ppm}$)

3.4.3 Setup



3.4.4 Equipment

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSU 26	EF01407	2018-12	2019-12

3.4.5 Procedure

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

3.4.6 Results

Test Results				
Channel [MHz]	Temperatur [°C]	Voltage [V]	Measured Frequency [MHz]	Error [ppm]
13.5609	20	5.0	13.56135	33.18
13.5609	20	4.85	13.56137	34.66
13.5609	20	5.15	13.56137	34.66
13.5609	-20	5.0	13.56141	37.61
13.5609	-10	5.0	13.56144	39.82
13.5609	0	5.0	13.56141	37.61
13.5609	10	5.0	13.56140	36.87
13.5609	30	5.0	13.56136	33.92
13.5609	40	5.0	13.56134	32.45
13.5609	50	5.0	13.56133	31.71

3.5 Test Conditions and Results - AC powerline conducted emissions

3.5.1 Information

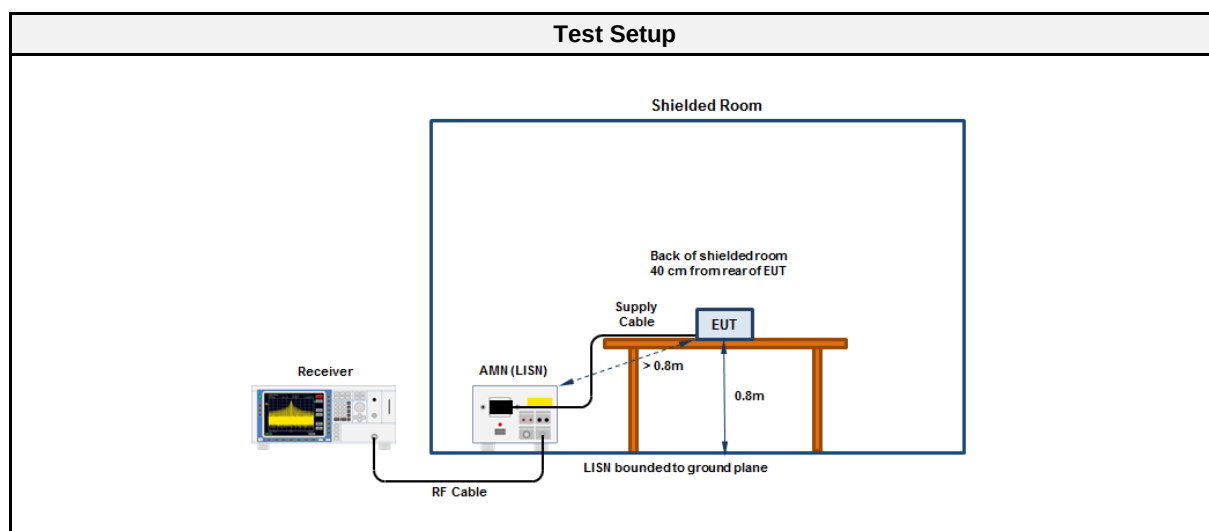
Test Information	
Reference	FCC 47 CFR 15.207; ISSED RSS-Gen, Issue 5
Measurement Method	ANSI C63.10 6.2
Operator	Wilfried Treffke
Date	2019-05-06

3.5.2 Limits

Limits		
Frequency [MHz]	Quasi-Peak [dBμV]	Average [dBμV]
0.15 - 0.5	66 - 56*	56 - 46*
0.5 - 5	56	46
5 - 30	60	50

* Limit decreases linearly with the logarithm of the frequency

3.5.3 Setup



3.5.4 Equipment

Test Software			
Description	Manufacturer	Name	Version
EMC Software	DARE Instruments	RadiMation	2016.1.10

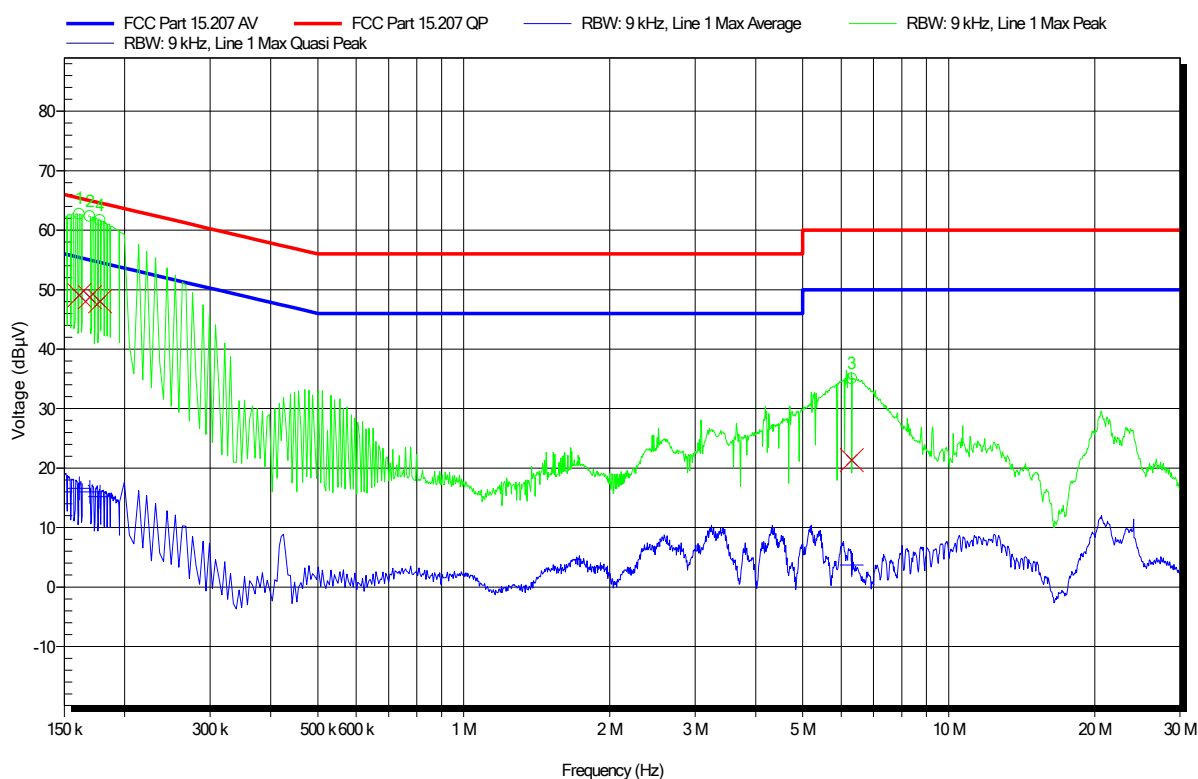
Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
EMI Receiver	R&S	ESU 26	EF00241	2017-07	2019-07
LISN	R&S	ESH3-Z5	EF00036	2017-01	2019-07

EMI voltage test in the ac-mains according to FCC 47 CFR 15 Subpart C, ISED RSS-Gen

Project number: G0M-1904-8167

Applicant: W.O.M. WORLD OF MEDICINE GmbH
 EUT Name: customized Read / Write RFID module
 Model: TS-HW42
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 22°C, Unom: 120 VAC
 LISN: ESH3-Z5 (N)
 Mode: Transmit
 Test Date: 2019-05-06
 Note:

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Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status
1	161.25 kHz	49.08 dBμV	65.4 dBμV	-16.32 dB	Pass
2	169.35 kHz	48.73 dBμV	64.99 dBμV	-16.26 dB	Pass
3	6.309 MHz	21.31 dBμV	60 dBμV	-38.69 dB	Pass
4	177.9 kHz	48.05 dBμV	64.58 dBμV	-16.53 dB	Pass

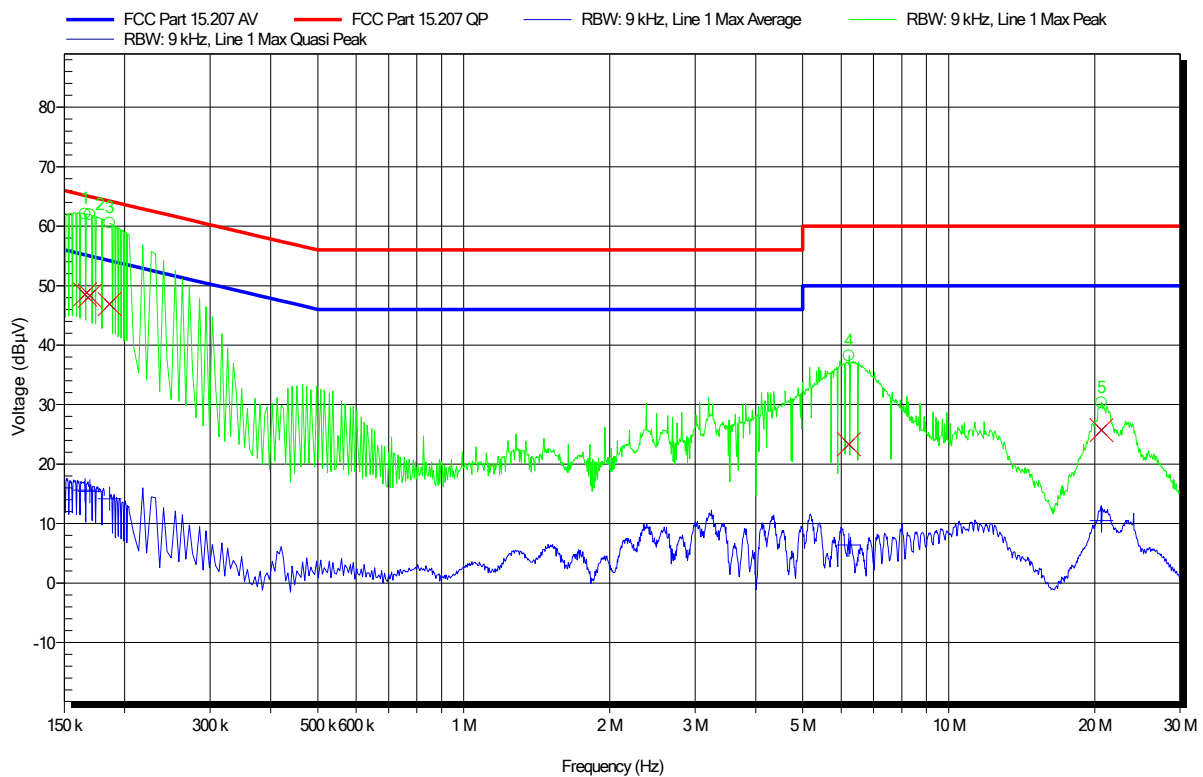
Peak Number	Frequency	Average	Average Limit	Average Difference	Average Status
1	161.25 kHz	16.59 dBμV	55.4 dBμV	-38.81 dB	Pass
2	169.35 kHz	16.02 dBμV	54.99 dBμV	-38.97 dB	Pass
3	6.309 MHz	3.69 dBμV	50 dBμV	-46.31 dB	Pass
4	177.9 kHz	15.16 dBμV	54.58 dBμV	-39.42 dB	Pass

EMI voltage test in the ac-mains according to FCC 47 CFR 15 Subpart C, ISED RSS-Gen

Project number: G0M-1904-8167

Applicant: W.O.M. WORLD OF MEDICINE GmbH
EUT Name: customized Read / Write RFID module
Model: TS-HW42
Test Site: Eurofins Product Service GmbH
Operator: Mr. Treffke
Test Conditions: Tnom: 22°C, Unom: 120 VAC
LISN: ESH3-Z5 (L)
Mode: Transmit
Test Date: 2019-05-06
Note:

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Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status
1	165.75 kHz	48.5 dBμV	65.17 dBμV	-16.67 dB	Pass
2	169.35 kHz	48.33 dBμV	64.99 dBμV	-16.66 dB	Pass
3	186 kHz	46.92 dBμV	64.21 dBμV	-17.29 dB	Pass
4	6.23 MHz	23.31 dBμV	60 dBμV	-36.69 dB	Pass
5	20.643 MHz	25.68 dBμV	60 dBμV	-34.32 dB	Pass

Peak Number	Frequency	Average	Average Limit	Average Difference	Average Status
1	165.75 kHz	15.64 dBμV	55.17 dBμV	-39.53 dB	Pass
2	169.35 kHz	15.4 dBμV	54.99 dBμV	-39.59 dB	Pass
3	186 kHz	14.14 dBμV	54.21 dBμV	-40.08 dB	Pass
4	6.23 MHz	6.39 dBμV	50 dBμV	-43.61 dB	Pass
5	20.643 MHz	10.51 dBμV	50 dBμV	-39.49 dB	Pass

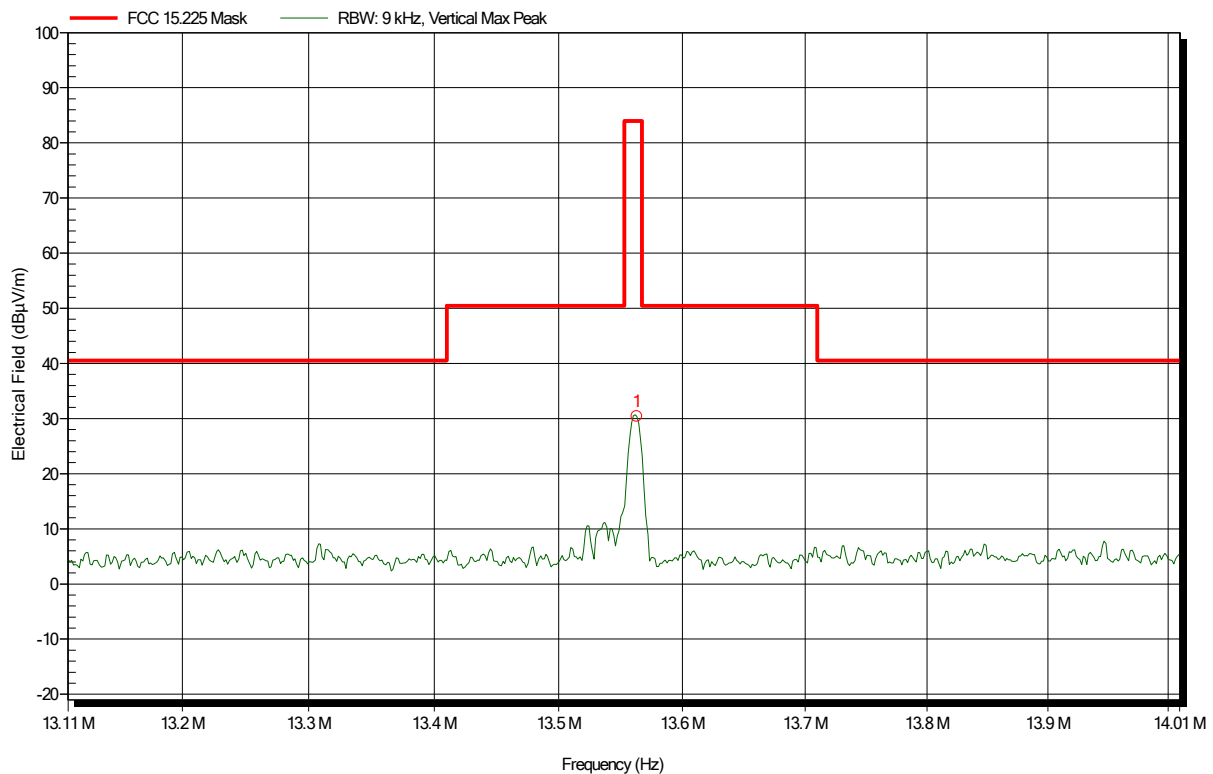
ANNEX A Transmitter in-band emissions

Radiated H-Field strength according to FCC 47 CFR 15.225, ISED RSS-210

Project number: G0M-1904-8167

Applicant: W.O.M. WORLD OF MEDICINE GmbH
EUT Name: customized Read / Write RFID module
Model: TS-HW42
Test Site: Eurofins Product Service GmbH
Operator: Mr. Weber
Test Conditions: Tnom: 23°C, Vnom: 5.0 VDC
Antenna: Rohde & Schwarz HFH 2-Z2
Measurement distance: 3 m converted to 30 m
Mode: TX; Transmit
Test Date: 2019-05-03
Note:

Index 1



Frequency
13.563 MHz

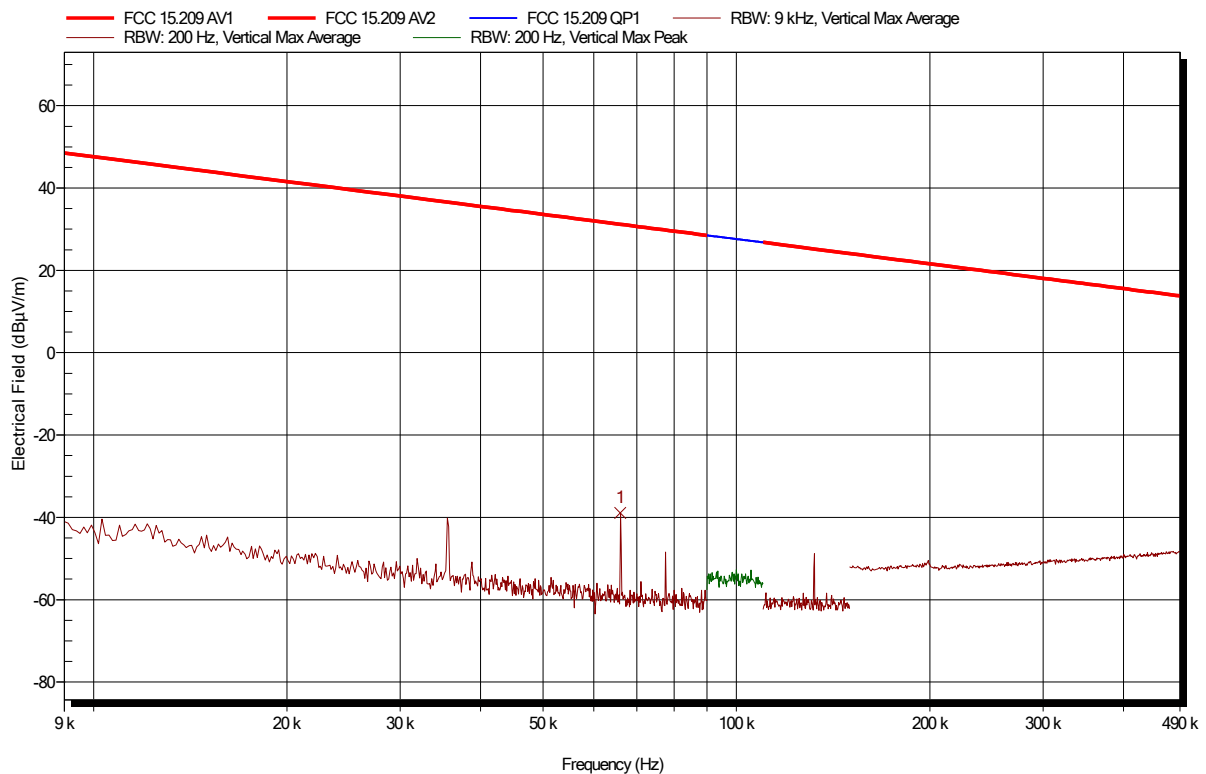
Peak
30.4 dBµV/m

ANNEX B Transmitter radiated spurious emissions

Spurious emissions according to FCC 47 CFR 15.225, ISED RSS-210

Project number: G0M-1904-8167
 Applicant: W.O.M. WORLD OF MEDICINE GmbH
 EUT Name: customized Read / Write RFID module
 Model: TS-HW42
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Weber
 Test Conditions: Tnom: 23°C, Vnom: 5.0 VDC
 Antenna: Rohde & Schwarz HFH 2-Z2
 Measurement distance: 3 m converted to 300 m
 Mode: TX; Transmit
 Test Date: 2019-05-03
 Note:

Index 2



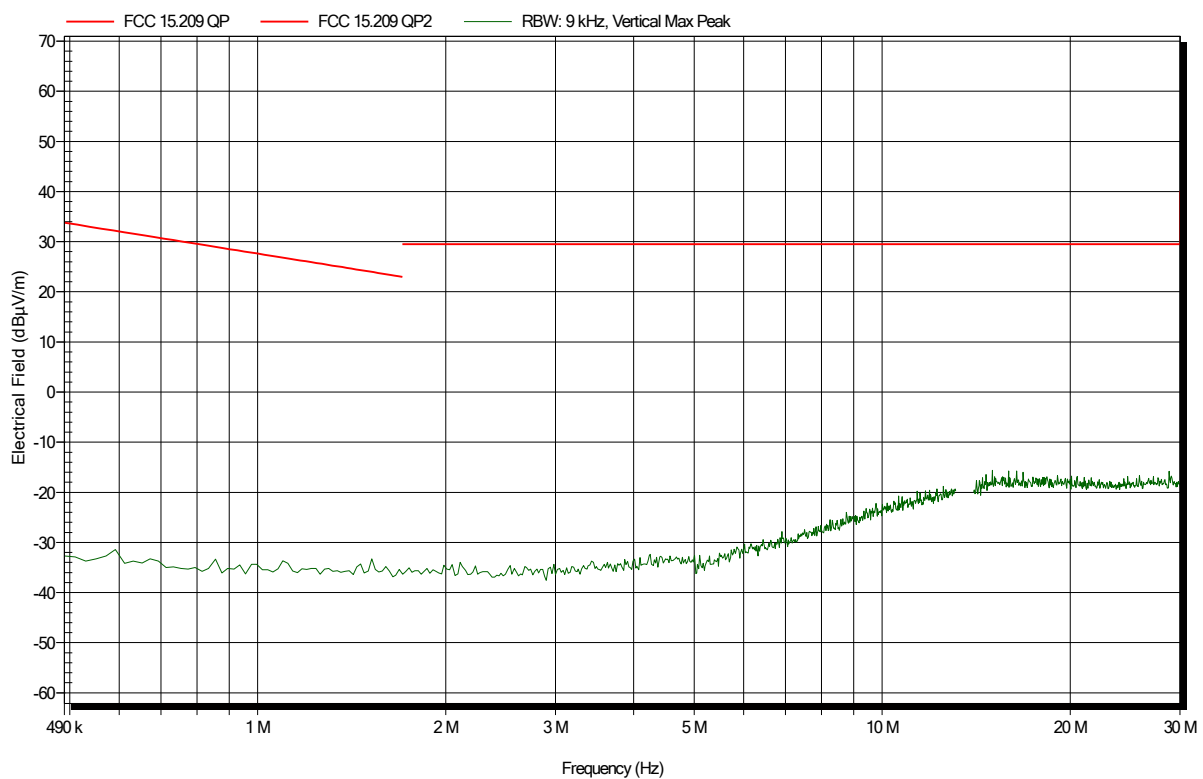
Frequency	Average	Average Limit	Average Difference	Average Status
65.986 kHz	-38.9 dBµV/m	31.2 dBµV/m	-70.12 dB	Pass

Spurious emissions according to FCC 47 CFR 15.225, ISED RSS-210

Project number: G0M-1904-8167

Applicant: W.O.M. WORLD OF MEDICINE GmbH
 EUT Name: customized Read / Write RFID module
 Model: TS-HW42
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Weber
 Test Conditions: Tnom: 23°C, Vnom: 5.0 VDC
 Antenna: Rohde & Schwarz HFH 2-Z2
 Measurement distance: 3 m converted to 30 m
 Mode: TX; Transmit
 Test Date: 2019-05-03
 Note: EUT vertical, measured without Tag continuously reading

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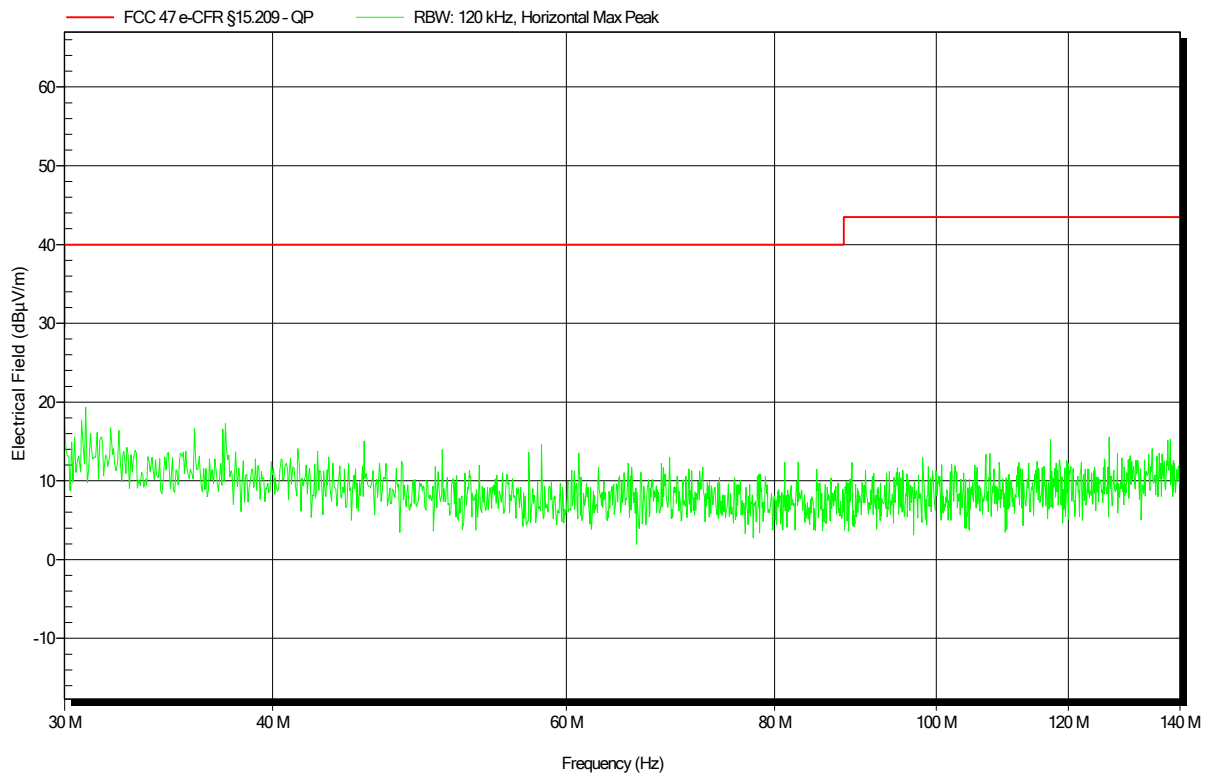


Radiated emissions under normal conditions according to FCC 47 CFR 15.225, ISED RSS-210

Project number: G0M-1904-8167

Applicant:	W.O.M. WORLD OF MEDICINE GmbH
EUT Name:	customized Read / Write RFID module
Model:	TS-HW42
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Weber
Test Conditions:	Tnom: 23°C, Unom: 5.0 VDC
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement distance:	3m
Mode:	Transmit
Test Date:	2019-05-03
Note:	

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Radiated emissions under normal conditions according to FCC 47 CFR 15.225, ISED RSS-210

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Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement distance:	3m
Mode:	Transmit
Test Date:	2019-05-03
Note:	

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