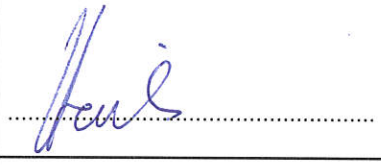
EMC TEST REPORT

FCC 47 CFR Part 15B, ISED ICES-003 Issue 6

Report Reference No	G0M-2002-8868-EF0115B-V01
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	Kamstrup A/S
Address	Industrivej 28 8660 Skanderborg DENMARK
Test Specification Standard(s)	47 CFR Part 15 Subpart B ISED ICES-003 Issue 6 ANSI C63.4:2014+A1:2017
Non-Standard Test Method	None
Equipment under Test (EUT):	
Product Description	Meter Transmit Unit
Model(s)	Ready MTU
Additional Model(s)	None
Brand Name(s)	Kamstrup
Hardware Version(s)	Assembly: 5915611, rev 00; PCB BOM: 55501820, rev E1
Software Version(s)	Software: 50981561, rev B1; Initiation file: 55141891, rev A1
FCC-ID	OUY-READYMTU
IC	22376-READYMTU
Test Result	**PASSED**

Possible test case verdicts:		
required by standard but not tested	N/T	
not required by standard	N/R	
required by standard but not appl. 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	2020-04-07	
Report:		
Compiled by	Matthias Handrik	
Tested by (+ signature) (Responsible for Test)	Matthias Handrik	
Approved by (+ signature) (Deputy Head of Lab)	Jens Marquardt	
Date of Issue	2020-06-05	
Total number of pages	39	
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:		

ABBREVIATIONS AND ACRONYMS

Acronyms	
Acronym	Description
EUT	Equipment Under Test
FCC	Federal Communications Commission
ISED	Innovation, Science and Economic Development Canada
T_{NOM}	Nominal operating temperature
V_{NOM}	Nominal supply voltage

VERSION HISTORY

Version History			
Version	Issue Date	Remarks	Revised By
01	2020-06-05	Initial Release	-

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1 Equipment (Test Item) Under Test

1.1 Equipment Ports

Name	Type	Attributes	Comment
Sensus UI-1203	IO	Count: 1 Direction: IO Service only: No	Interface consisting of three wires

Description:	
AC	AC mains power input/output port
DC	DC power input/output port
BAT	DC power input port connected to external battery
IO	Input/Output port
TP	Telecommunication port
NE	Non-electrical port

1.4 Support Equipment

Product Type	Device	Manufacturer	Model	Comment
AE	laptop	lenovo	Think Pad X250	
AE	USB to 3 wire interface	Kamstrup	55501457+5915413+ 5000491	
AE	Honywell meter	Honywell/ Kamstrup	VS282018105005+ 5000-491	Typical load for 3 wire interface
AE	Helix antenna	Kamstrup	165094	
AE	Wall antenna	Kamstrup	6699490	
AE	Pit antenna	Kamstrup	6697916	
Description:				
AE	Auxiliary Equipment			
SIM	Simulator			
MON	Monitoring Equipment			
CBL	Connecting Cable			
Comment:				

1.5 Operational Modes

Mode #	Description
1	LMR-PMR transmission on 460MHz
2	SRD transmission on 915MHz
Comment:	

1.6 EUT Configuration

Configuration #	Description
1	EUT battery is replaced during test with laboratory power supply. EUT operational mode is controlled by laptop via USB interface. EUT is set in test mode, USB interface is removing and honywell meter is connected instead of USB interface. Helix antenna is connected to EUT.
2	EUT battery is replaced during test with laboratory power supply. EUT operational mode is controlled by laptop via USB interface. EUT is set in test mode, USB interface is removing and honywell meter is connected instead of USB interface. Wall antenna is connected to EUT.
3	EUT battery is replaced during test with laboratory power supply. EUT operational mode is controlled by laptop via USB interface. EUT is set in test mode, USB interface is removing and honywell meter is connected instead of USB interface. Pit antenna is connected to EUT.
Comment:	

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 analyser in dBµV. Any external preamplifiers used are taken into account through internal analyser 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 analyser. 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 Analyser (dBµV) + A.F. (dB/m) = 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/m	= 47.5 dBµV/m	:	47.5 dBµV/m - 57.0 dBµV/m	= -9.5 dB

2 Result Summary

FCC 47 CFR Part 15B, ISED ICES-003 Issue 6				
Reference	**Requirement**	**Reference Method**	**Result**	**Remarks**
Emission				
FCC 15.109 ICES-003, 6.2	Radiated emissions	ANSI C63.4:2014 +A1:2017	PASS	-
FCC 15.107 ICES-003, 6.1	AC power line conducted emissions	ANSI C63.4:2014 +A1:2017	N/R	No relevant port
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

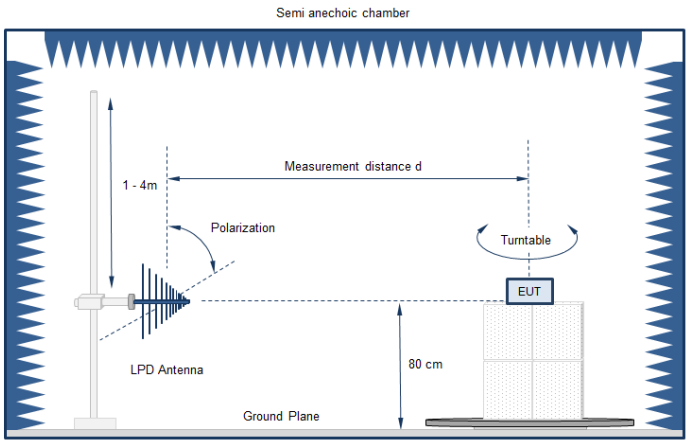
2.1 Test Conditions and Results - Radiated emissions acc. to ANSI C63.4

2.1.1 Information

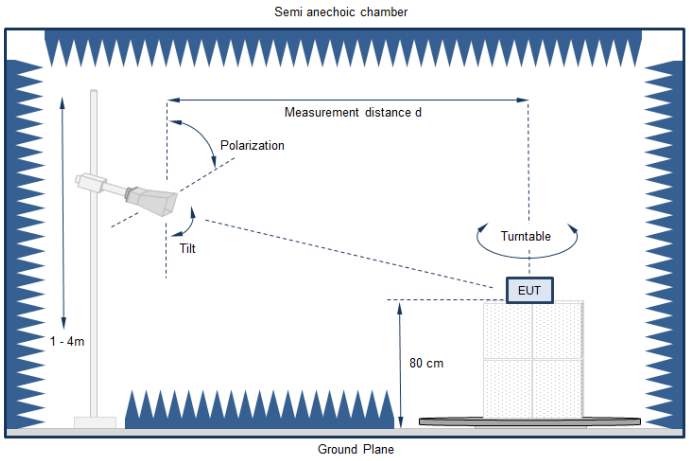
Test Information	
Reference	FCC 15.109, ICES-003, 6.2
Reference method	ANSI C63.4:2014+A1:2017 Section 8
Equipment class	Class B
Equipment type	Table top
Highest internal frequency [MHz]	3759.9
Measurement range	30 MHz to 18799.5 MHz
Temperature [°C]	20 - 21
Humidity [%]	30
Operator	Matthias Handrik
Date	2020-05-12

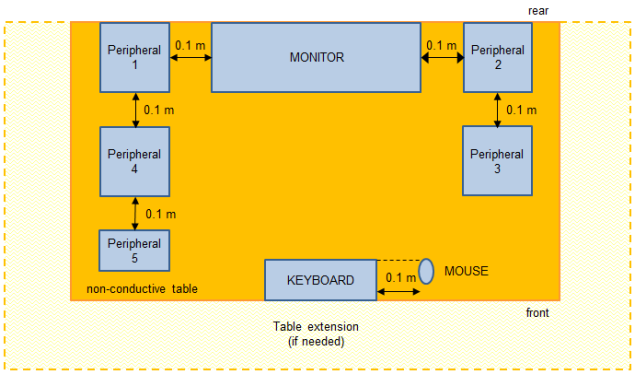
2.1.2 Setup

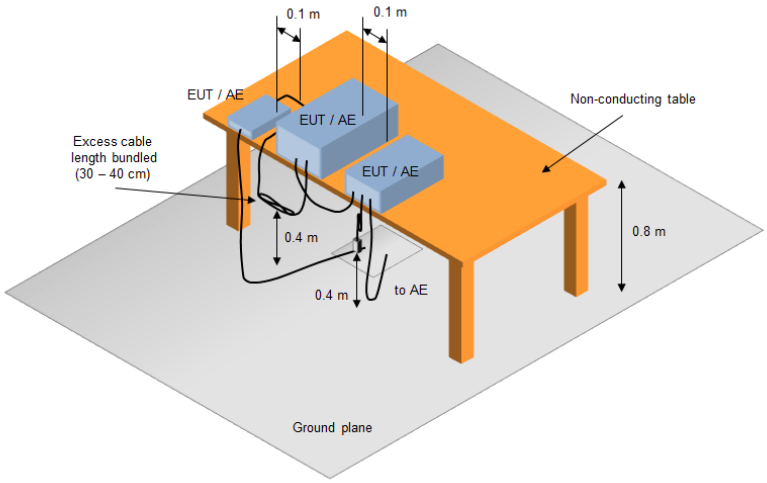
Measurement up to 1 GHz



Measurement above 1 GHz



Equipment placement - Table top


Test Setup


2.1.3 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
Anechoic chamber	Frankonia	AC1	EF00062	2018-07	2021-07
EMI Test Receiver	Keysight	N9038A-526/WXP	EF01070	2019-09	2020-09
Biconical Antenna	R&S	HK 116	EF00030	2019-04	2022-04
LPD Antenna	R&S	HL 223	EF00187	2019-05	2022-05
Horn Antenna	Schwarzbeck	BBHA9120D	EF00018	2019-10	2022-10
40GHz High Gain Antenna	Amplifier Research	AT4560	EF00302	2019-05	2020-05
Climatic Sensor	Embedded Data Systems, LLC.	2800100000254 17E	EF01054	2019-05	2020-05

2.1.4 Procedure

Exploratory measurement
1. The EUT was placed on a non-conductive table at a height of 0.8m. 2. The EUT and support equipment, if needed, were set up to simulate typical usage. 3. 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. 4. The antenna was placed at a distance of 3 or 10 m. 5. The received signal was monitored at the measurement receiver. 6. This procedure has to be performed in both antenna polarizations, horizontal and vertical. 7. The arrangement of the equipment with the maximum emission level is shown on the setup picture at item 1.3

Final measurement
1. 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. 2. 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. 3. The EUT and cable arrangement were based on the exploratory measurement results. 4. Emissions were maximized at each frequency by rotating the EUT and adjusting the receive antenna height and polarization. The maximum values were recorded. 5. The test data of the worst-case conditions were recorded and shown on the next pages.

2.1.5 Limits

Class B @ 3 m		
Frequency [MHz]	Detector	Limit [dBµV/m]
30 - 88	Quasi-peak	40
88 - 216	Quasi-peak	43.5
216 - 960	Quasi-peak	46
960 - 1000	Quasi-peak	54
> 1000	Peak Average	74 54

2.1.6 Results

Test Results			
Operational mode	EUT Configuration	Verdict	Remark
1	3	PASS	1
1	1	PASS	2
2	2	PASS	1
2	1	PASS	2
Comment: After investigation of worst case configuration, measurements were performed in this configuration. Only the worst case configuration is documented in this test report. 1 - measurement from 30-200MHz 2 - measurement from 200-19000MHz			

2.1.8 Records

Radiated emissions according to FCC part 15B

Project Number:	G0M-2002-8868
Applicant:	Kamstrup A/S
Model Description:	Meter Transmit Unit
Model:	Ready MTU
Test Sample ID:	28927
Test Site:	Eurofins Product Service Germany
Operator:	Mr. Handrik
Test Date:	2020-05-13
Operating Conditions:	ambient temperature: 21°C power input: 3.6V DC
Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement Distance:	3m
Mode:	1
Note 1:	

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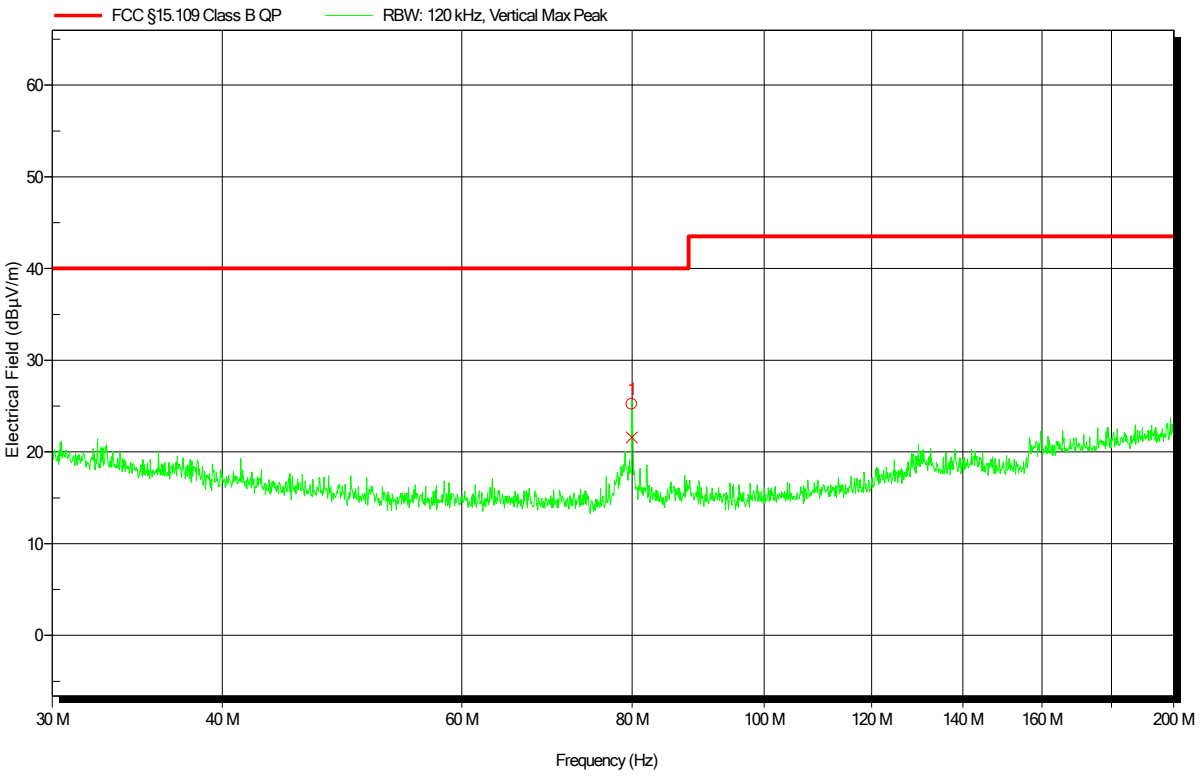

Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height
1	79.975 MHz	21.59 dBµV/m	40 dBµV/m	-18.41 dB	Pass	-108 Degree	1 m

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Operator:	Mr. Handrik
Test Date:	2020-05-13
Operating Conditions:	ambient temperature: 21°C power input: 3.6V DC
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement Distance:	3m
Mode:	1
Note 1:	

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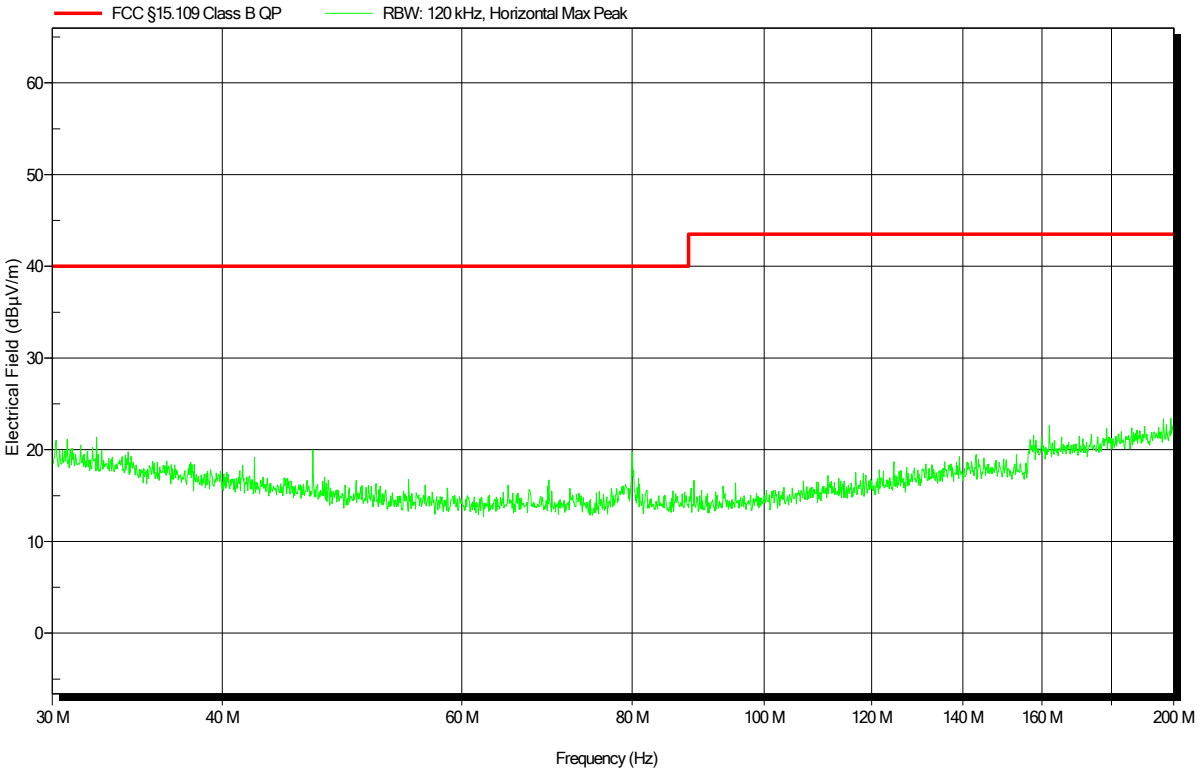

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Operator:	Mr. Handrik
Test Date:	2020-05-13
Operating Conditions:	ambient temperature: 21°C power input: 3.6V DC
Antenna:	Rohde & Schwarz HL 223, Vertical
Measurement Distance:	3m
Mode:	1
Note 1:	

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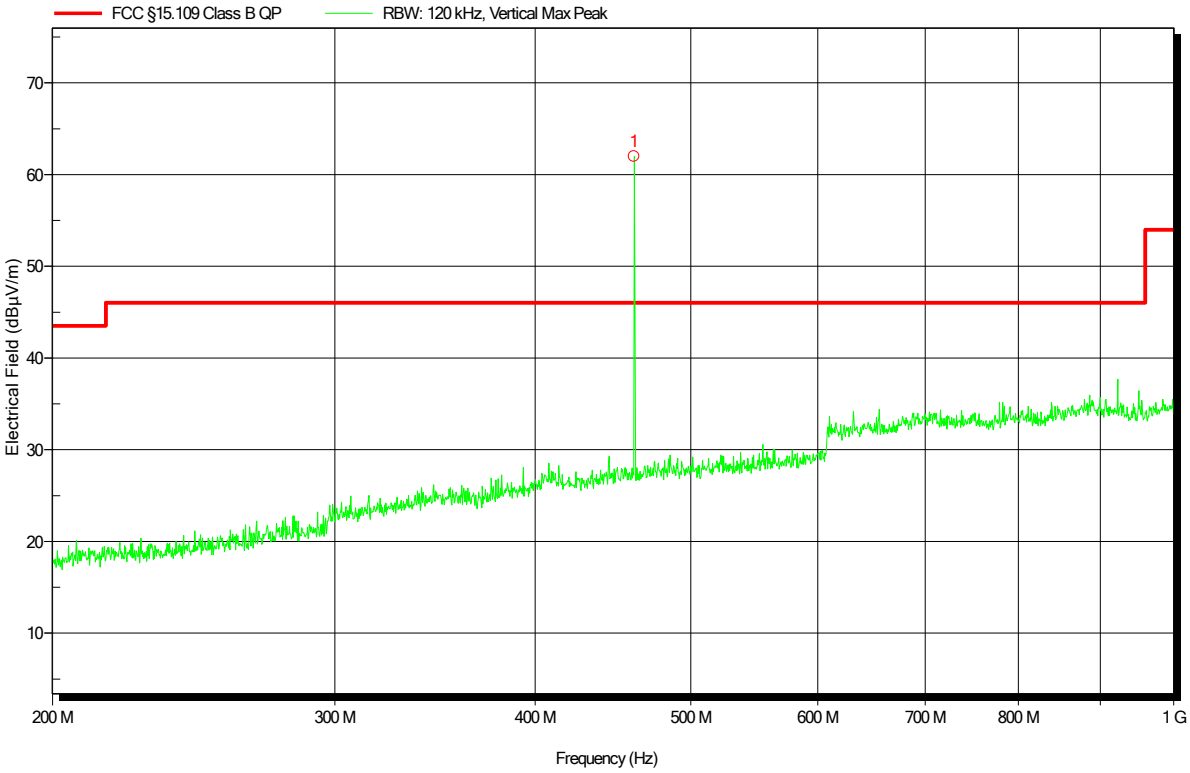

Peak Number	Frequency	
1	461 MHz	carrier

Radiated emissions according to FCC part 15B

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Test Site:	Eurofins Product Service Germany
Operator:	Mr. Handrik
Test Date:	2020-05-13
Operating Conditions:	ambient temperature: 21°C power input: 3.6V DC
Antenna:	Rohde & Schwarz HL 223, Horizontal
Measurement Distance:	3m
Mode:	1
Note 1:	

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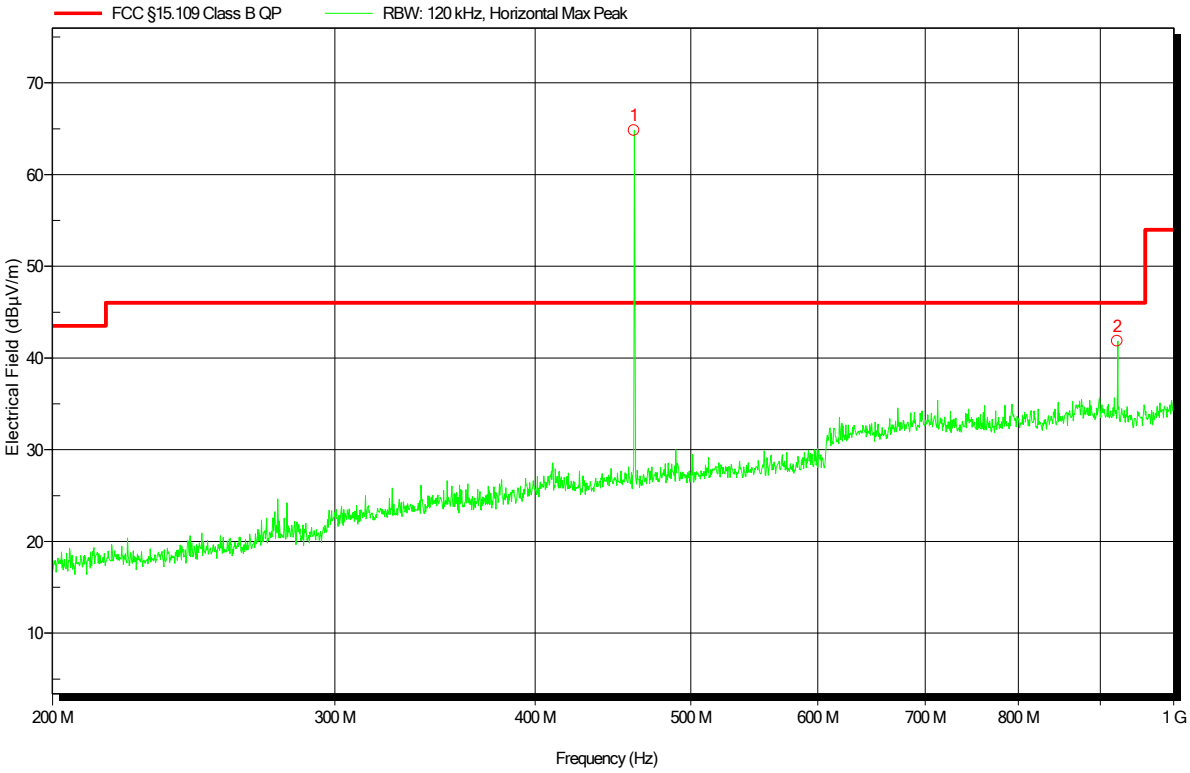

Peak Number	Frequency	Angle	Height
1	461 MHz	Carrier	
2	922 MHz	2nd harmonic	

Radiated emissions according to FCC part 15B

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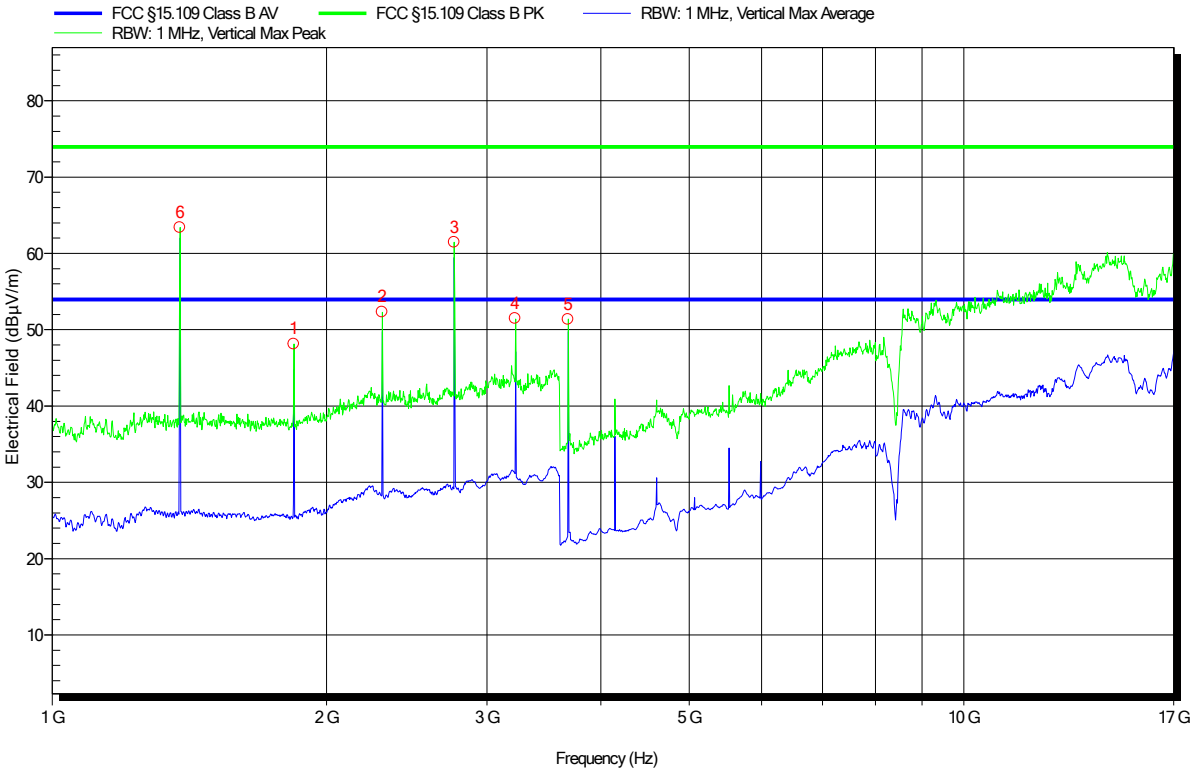
Model Description:	Meter Transmit Unit
Model:	Ready MTU
Test Sample ID:	28927
Test Site:	Eurofins Product Service Germany
Operator:	Mr. Handrik
Test Date:	2020-05-12
Operating Conditions:	ambient temperature: 20°C power input: 3.6V DC
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement Distance:	3m
Mode:	PMR
Note 1:	

Index 1



Peak Number	Frequency	Angle	Height
1	1.841 GHz	4th harmonic	
2	2.301 GHz	5th harmonic	
3	2.761 GHz	6th harmonic	
4	3.221 GHz	7th harmonic	
5	3.681 GHz	8th harmonic	
6	1.381 GHz	3rd harmonic	

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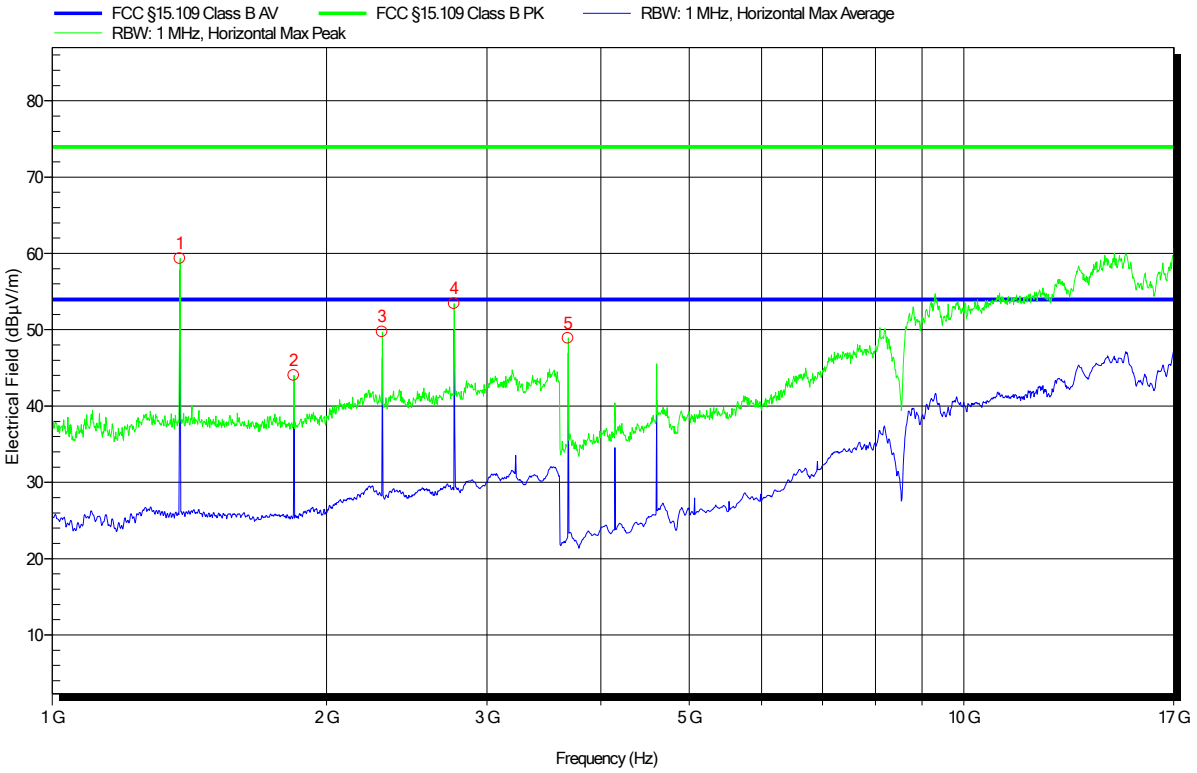
Test Date:	2020-05-12
Operating Conditions:	ambient temperature: 20°C power input: 3.6V DC
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement Distance:	3m
Mode:	1
Note 1:	

Index 2



Peak Number	Frequency	Angle	Height
1	1.381 GHz	3rd harmonic	
2	1.841 GHz	4th harmonic	
3	2.301 GHz	5th harmonic	
4	2.761 GHz	6th harmonic	
5	3.681 GHz	8th harmonic	

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Test Site:	Eurofins Product Service Germany
Operator:	Mr. Handrik
Test Date:	2020-05-12
Operating Conditions:	ambient temperature: 20°C power input: 3.6V DC
Antenna:	AT4560, Vertical
Measurement Distance:	3m
Mode:	1
Note 1:	

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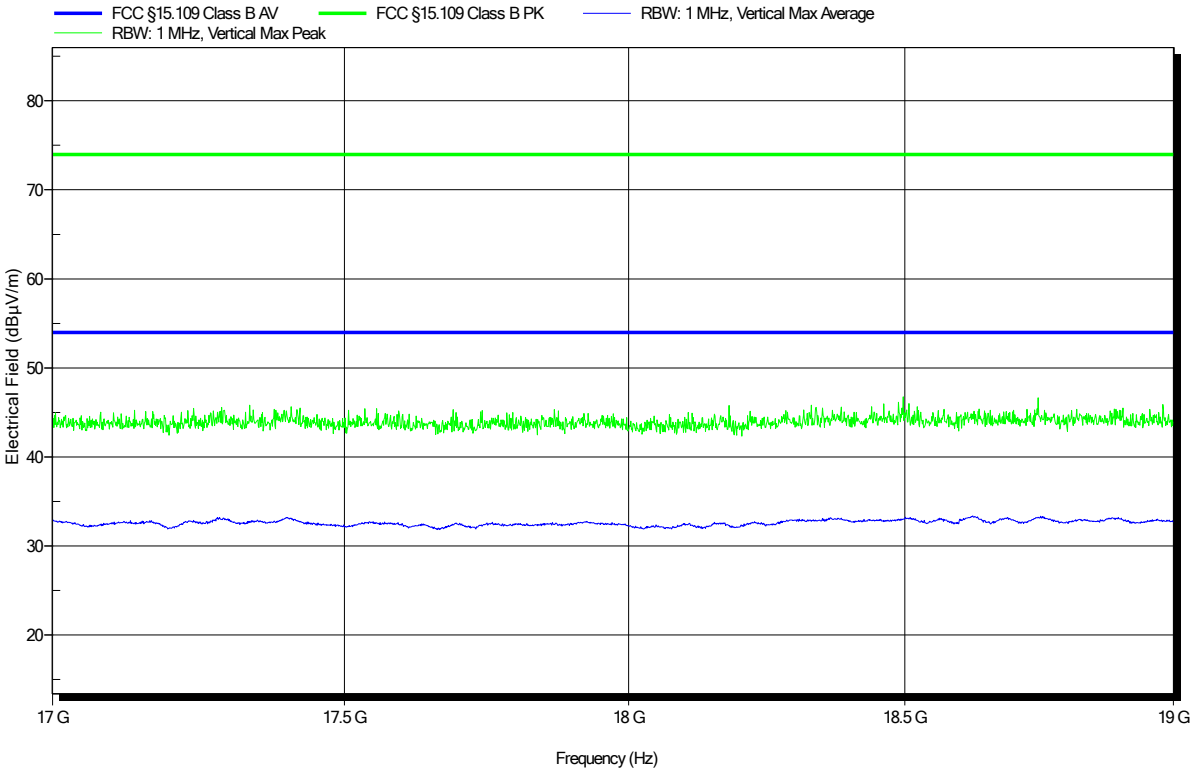

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Antenna:	AT4560, Horizontal
Measurement Distance:	3m
Mode:	1
Note 1:	

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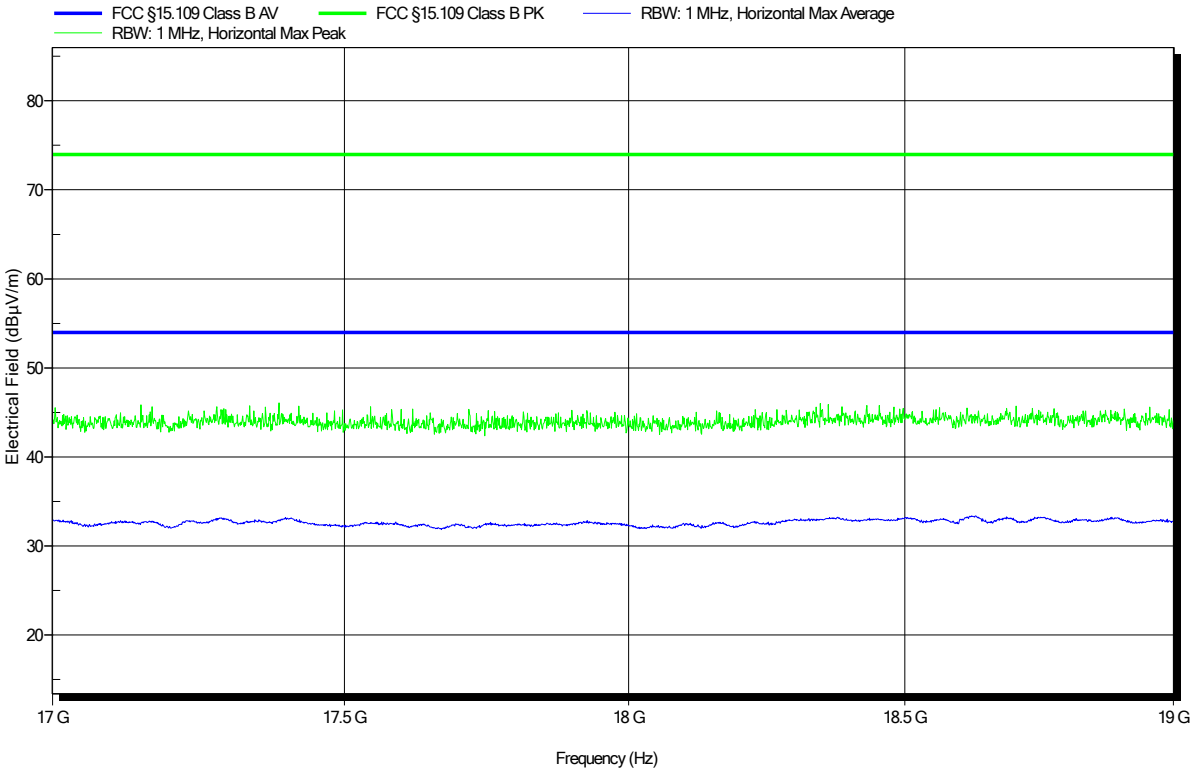

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Test Date:	2020-05-13
Operating Conditions:	ambient temperature: 21°C power input: 3.6V DC
Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement Distance:	3m
Mode:	2
Note 1:	

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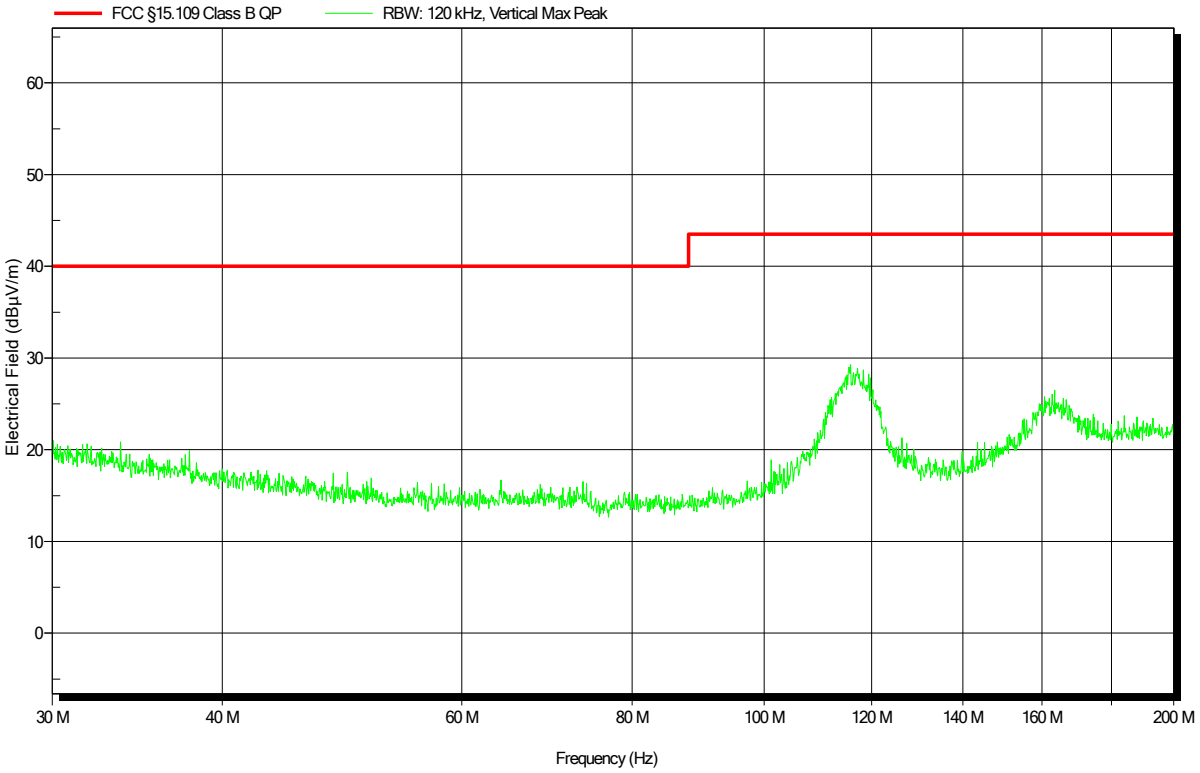

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Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement Distance:	3m
Mode:	2
Note 1:	

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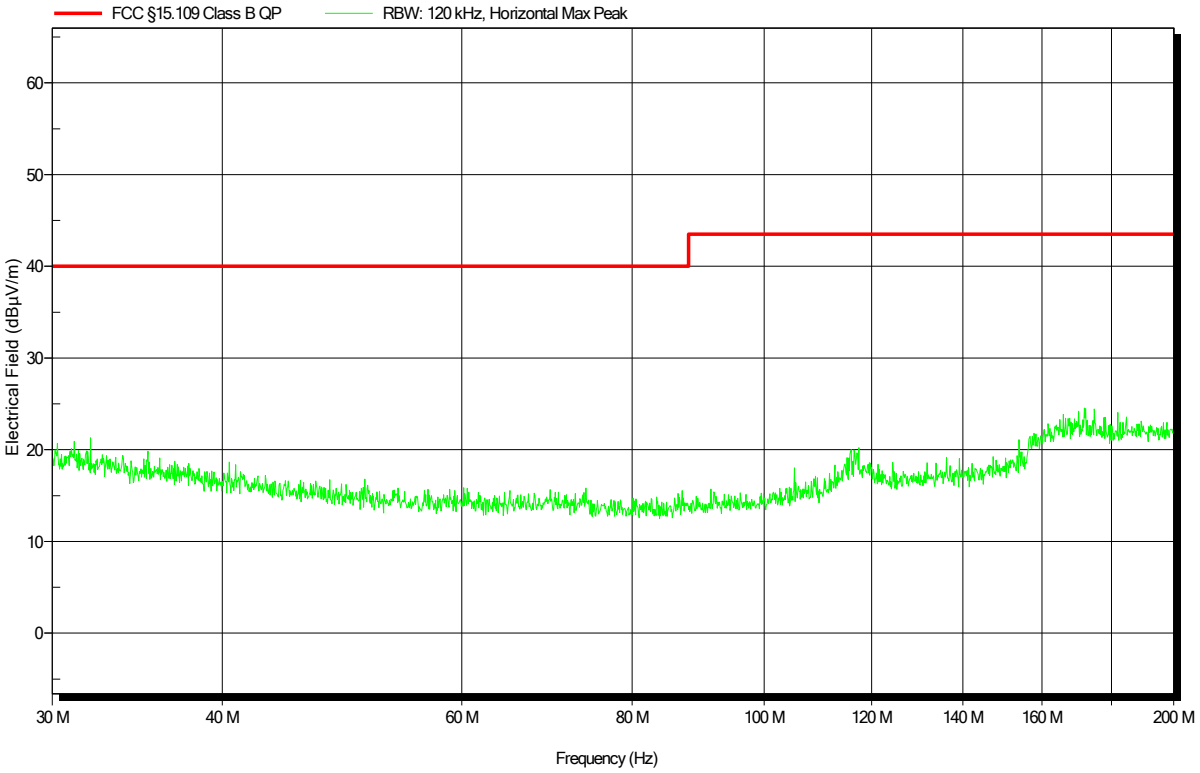

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Operating Conditions:	ambient temperature: 21°C power input: 3.6V DC
Antenna:	Rohde & Schwarz HL 223, Vertical
Measurement Distance:	3m
Mode:	SRD
Note 1:	

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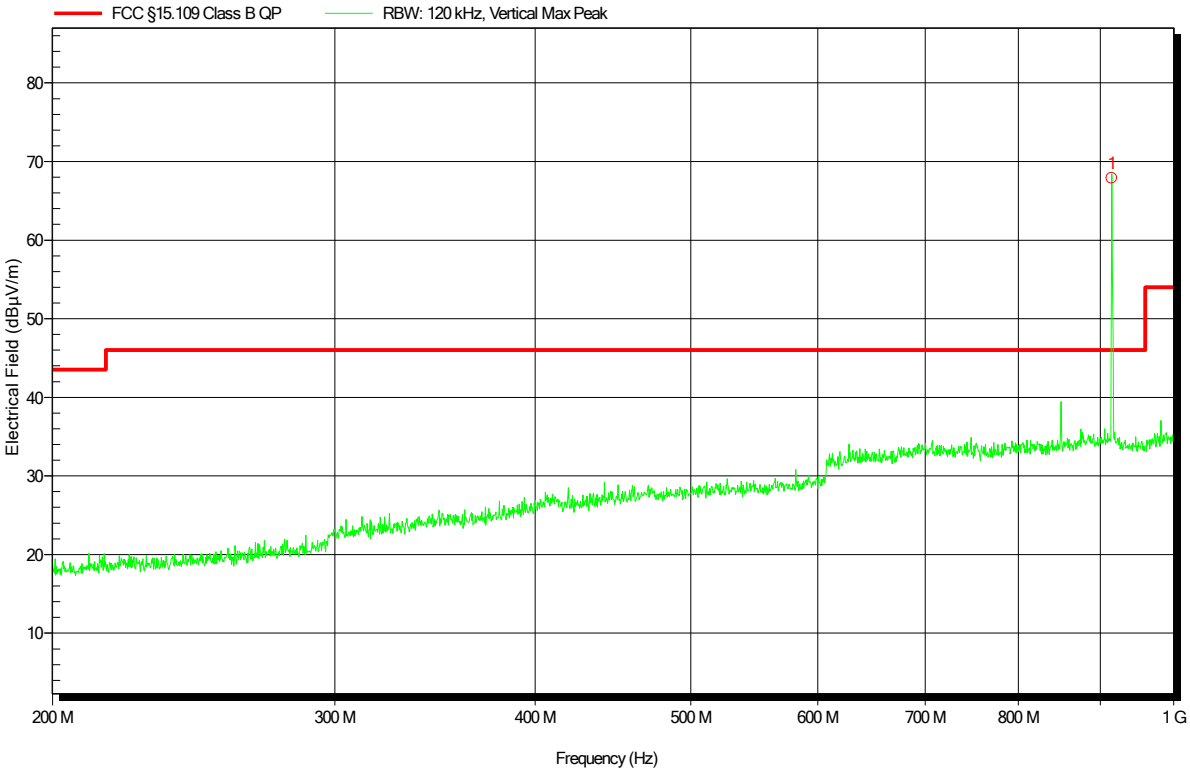

Peak Number	Frequency	Angle	Height
1	914.76 MHz	carrier	

Radiated emissions
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Antenna:	Rohde & Schwarz HL 223, Horizontal
Measurement Distance:	3m
Mode:	2
Note 1:	

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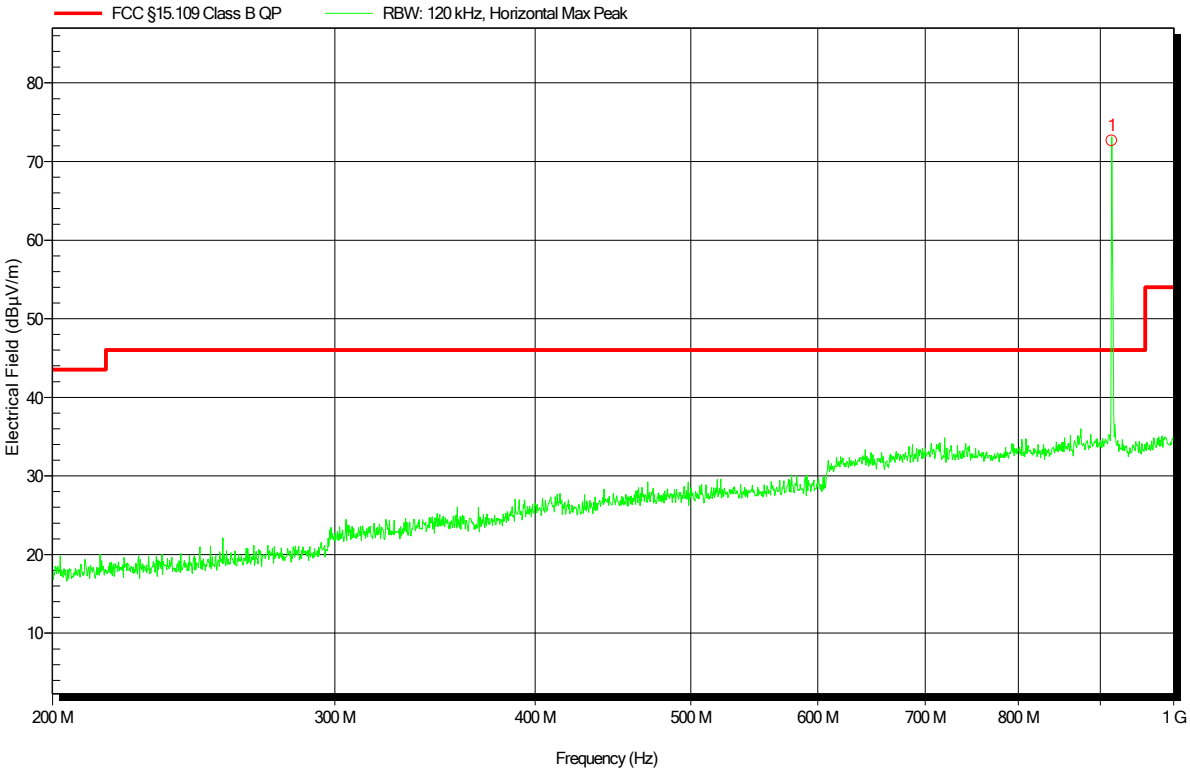

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Measurement Distance:	3m
Mode:	2
Note 1:	

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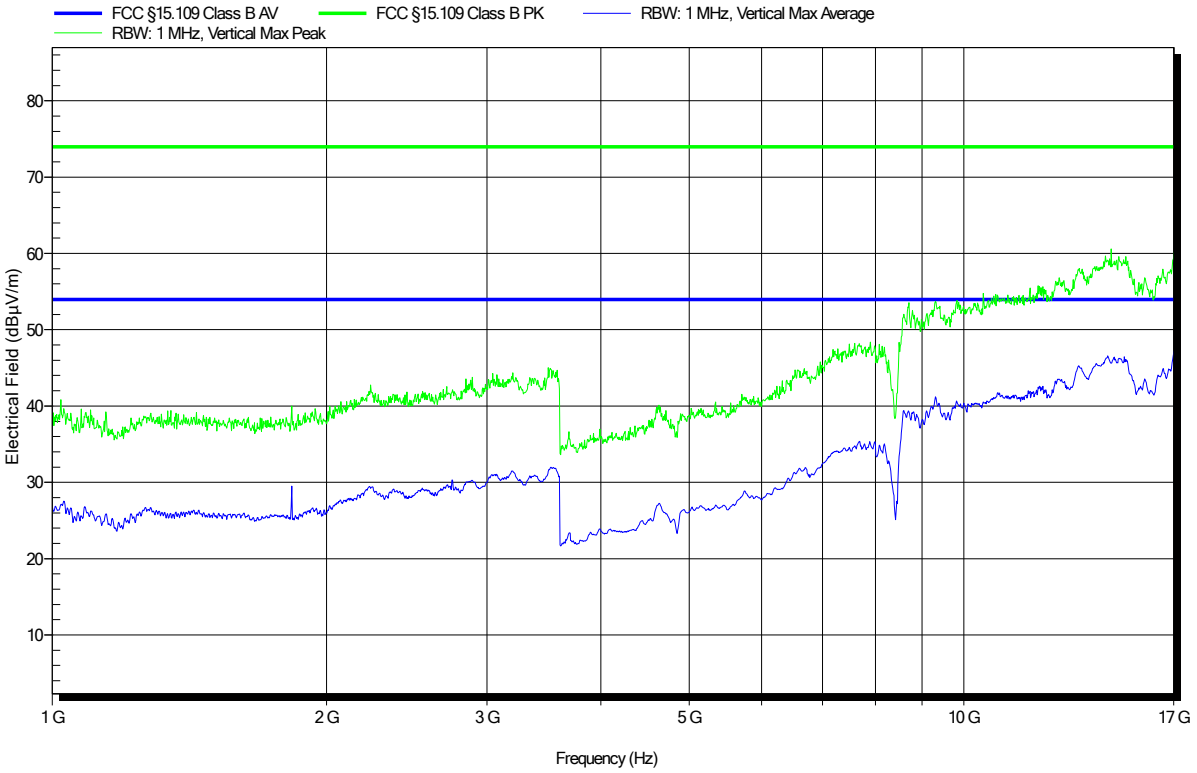

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Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement Distance:	3m
Mode:	2
Note 1:	

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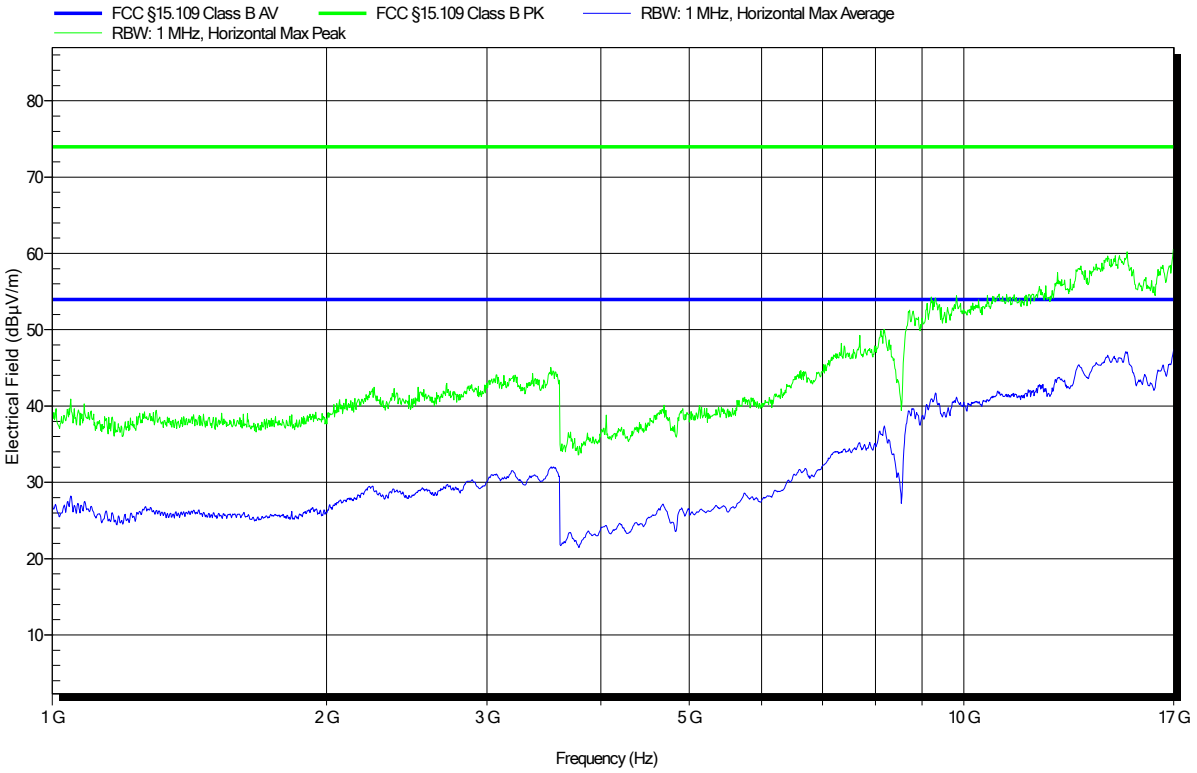

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Test Sample ID:	28927
Test Site:	Eurofins Product Service Germany
Operator:	Mr. Handrik
Test Date:	2020-05-12
Operating Conditions:	ambient temperature: 20°C power input: 3.6V DC
Antenna:	AT4560, Vertical
Measurement Distance:	3m
Mode:	2
Note 1:	

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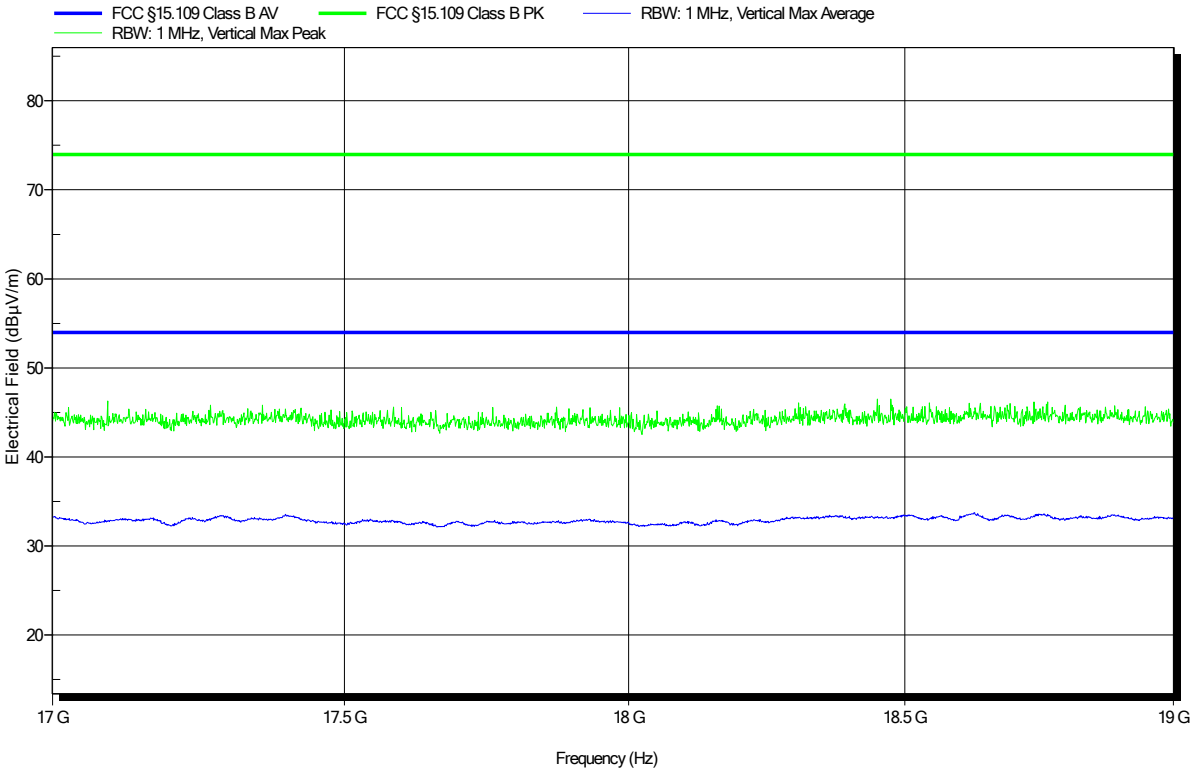

Radiated emissions according to FCC part 15B

Project Number:	G0M-2002-8868
Applicant:	Kamstrup A/S
Model Description:	Meter Transmit Unit
Model:	Ready MTU
Test Sample ID:	28927
Test Site:	Eurofins Product Service Germany
Operator:	Mr. Handrik
Test Date:	2020-05-12
Operating Conditions:	ambient temperature: 20°C power input: 3.6V DC
Antenna:	AT4560, Horizontal
Measurement Distance:	3m
Mode:	2
Note 1:	

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