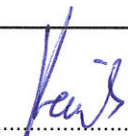


EMC TEST REPORT FCC 47 CFR Part 15B, ISED ICES-003 Issue 6	
Report Reference No	G0M-1912-8648-EF0115B-V02
Testing Laboratory	Eurofins Product Service GmbH
Address	Storkower Str. 38c 15526 Reichenwalde Germany
Accreditation	    DAKKS - Registration number : D-PL-12092-01-03 (ISED) ISED Testing Laboratory site: 3470A-2 DAKKS - Registration number : D-PL-12092-01-04 (FCC) FCC Filed Test Laboratory, Reg.-No.: 96970
Applicant	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
Non-Standard Test Method	None
Equipment under Test (EUT):	
Product Description	wireless mbus US radio module with pulse input for MULTICAL
Model(s)	wireless mbus US radio module with pulse input for MULTICAL
Additional Model(s)	None
Brand Name(s)	None
Hardware Version(s)	5550 1868 A3 (5536 1731C1 layout)
Software Version(s)	50981586 C1 / 5514 2007 C1
FCC-ID	OUY-HC-003-34
IC	22376-HC00334
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	2020-01-13	
Report:		
Compiled by	Stephan Liebich	
Tested by (+ signature) (Responsible for Test)	Matthias Handrik	
	Stephan Liebich	
Approved by (+ signature) (Deputy Head of Lab)	Jens Marquardt	
Date of Issue	2020-02-20	
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:		

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	2020-01-20	Initial Release	
02	2020-02-20	Replaced document: G0M-1912-8648-EF0115B-V01 Replaced by: G0M-1912-8648-EF0115B-V02 Changes: • IC ID	St. Liebich

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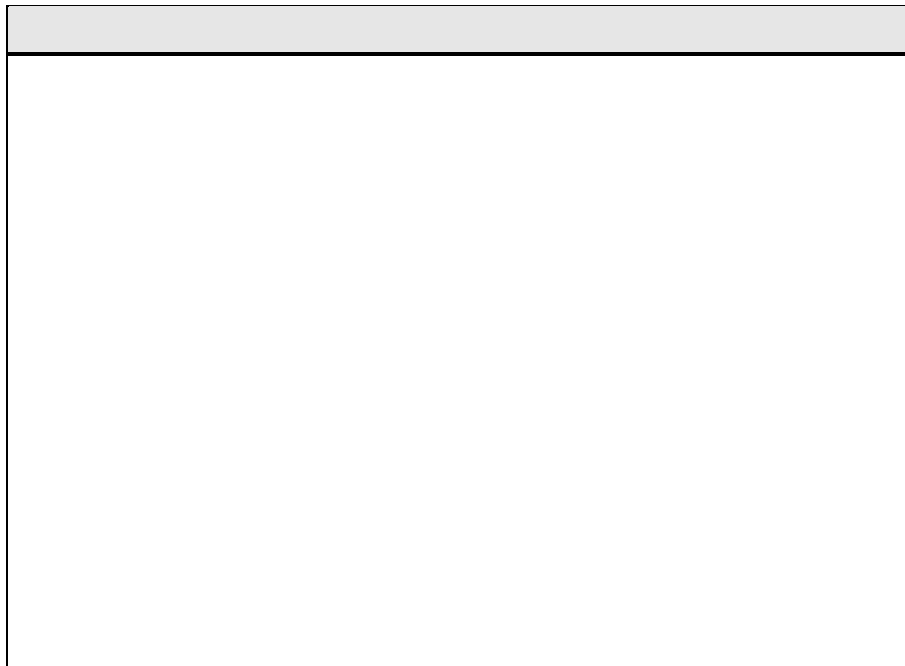
1 Equipment (Test Item) Under Test

Description	wireless mbus US radio module with pulse input for MULTICAL	
Model	wireless mbus US radio module with pulse input for MULTICAL	
Additional Model(s)	None	
Brand Name(s)	None	
Serial Number(s)	Unspecified	
Hardware Version(s)	5550 1868 A3 (5536 1731C1 layout)	
Software Version(s)	50981586 C1 / 5514 2007 C1	
FCC-ID	OUI-HC-003-34	
IC	22376-HC00334	
Class	Class B	
Equipment type	Table top	
Highest internal frequency [MHz]	3760	
Radio Module	Type	Short Range Device (SRD)
	Model	55501868 A3
	Manufacturer	Kamstrup A/S
	FCC-ID	OUI-HC-003-34
	IC	22376-HC00334
Supply Voltage	V _{NOM}	3.6 V DC
AC/DC-Adaptor	Model	60200004000000 A4
	Vendor	Kamstrup A/S
	Input	24 V AC
	Output	3.6 V DC
Manufacturer	Kamstrup A/S Industrivej 28 8660 Skanderborg DENMARK	

1.1 Equipment Ports

Name	Type	Attributes	Comment
POWER	BAT/DC	Count: 1 Direction: In Service only: No	-
ANTENNA	IO	Count: 1 Direction: IO Service only: No	-
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		

1.2 Equipment Photos





1.3 Support Equipment

Product Type	Device	Manufacturer	Model	Comment
AE	Internal antenna	Kamstrup A/S	6699482 B3	-
Description:				
AE	Auxiliary Equipment			
SIM	Simulator			
MON	Monitoring Equipment			
CBL	Connecting Cable			
Comment:				

1.4 Operational Modes

Mode #	Description
1	SRD Tx (EUT sends permanently status information via SRD 915 MHz connection)
Comment:	

1.5 EUT Configuration

Configuration #	Description
1	EUT is powered up and powered with 3.6 V DC external battery. EUT sends permanently status information via SRD 915 MHz connection.
2	EUT is powered up and powered with 24 V / 60 Hz via AC/DC-Adaptor. EUT sends permanently status information via SRD 915 MHz connection.
Comment:	

1.6 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:

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

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 15B, ISED ICES-003 Issue 6				
Reference	Requirement	Reference Method	Result	Remarks
Emission				
FCC 15.109 ICES-003, 8, 6.1	Radiated emissions	ANSI C63.4:2014	PASS	1
FCC 15.107 ICES-003, 8, 6.2	AC power line conducted emissions	ANSI C63.4:2014	PASS	-
Comment: 1 -> The test data of the worst-case conditions were recorded and shown on the next pages.				

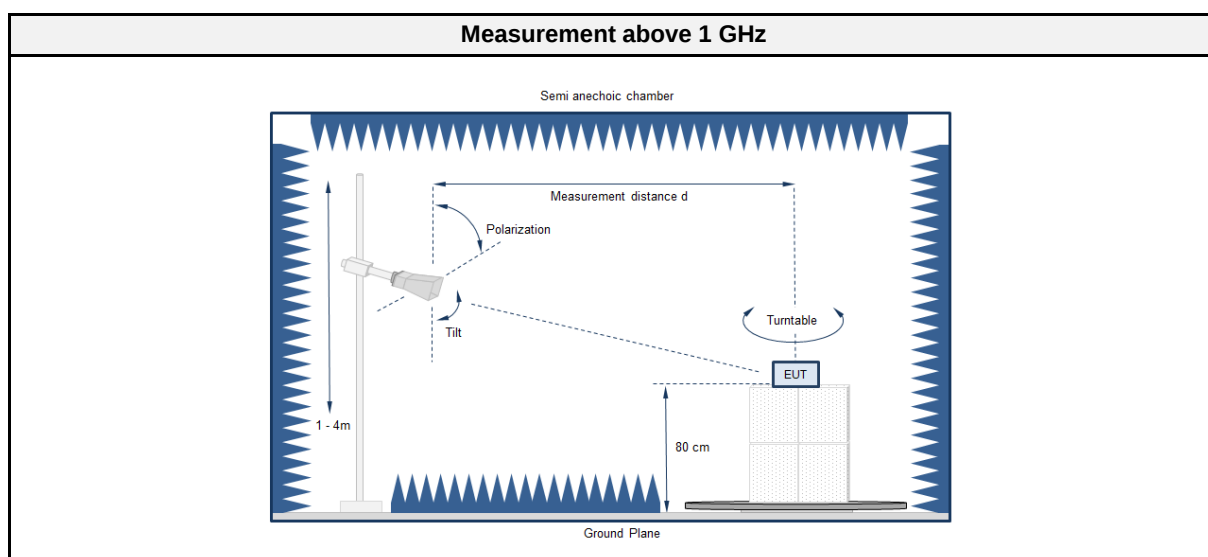
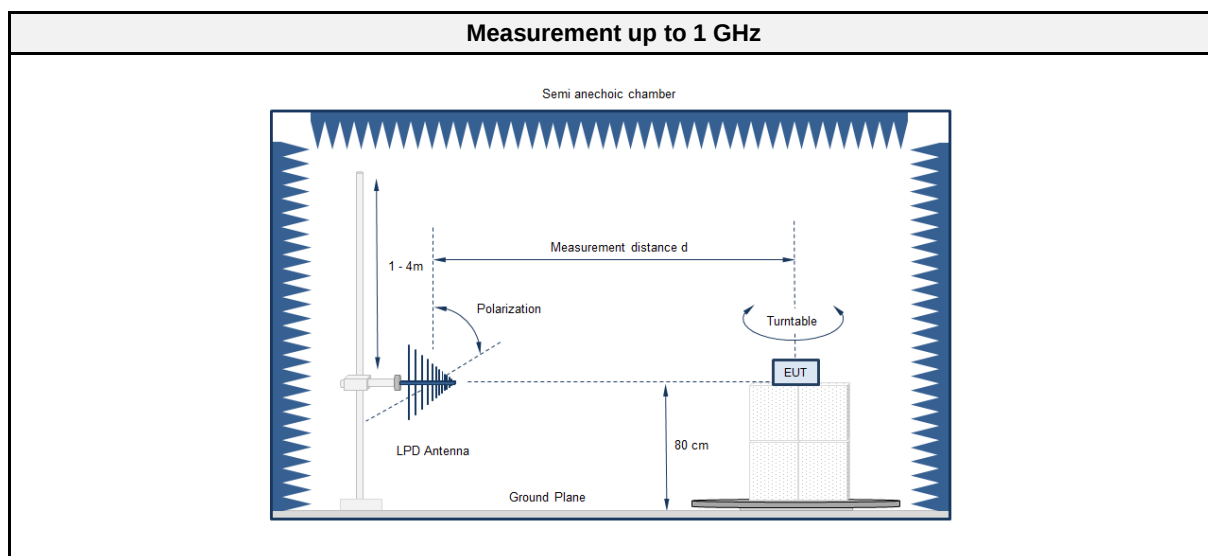
Possible Test Case Verdicts	
PASS	Test object does meet the requirements
FAIL	Test object does not meet the requirements
N/T	Required by standard but not tested
N/R	Not required by standard for the test object

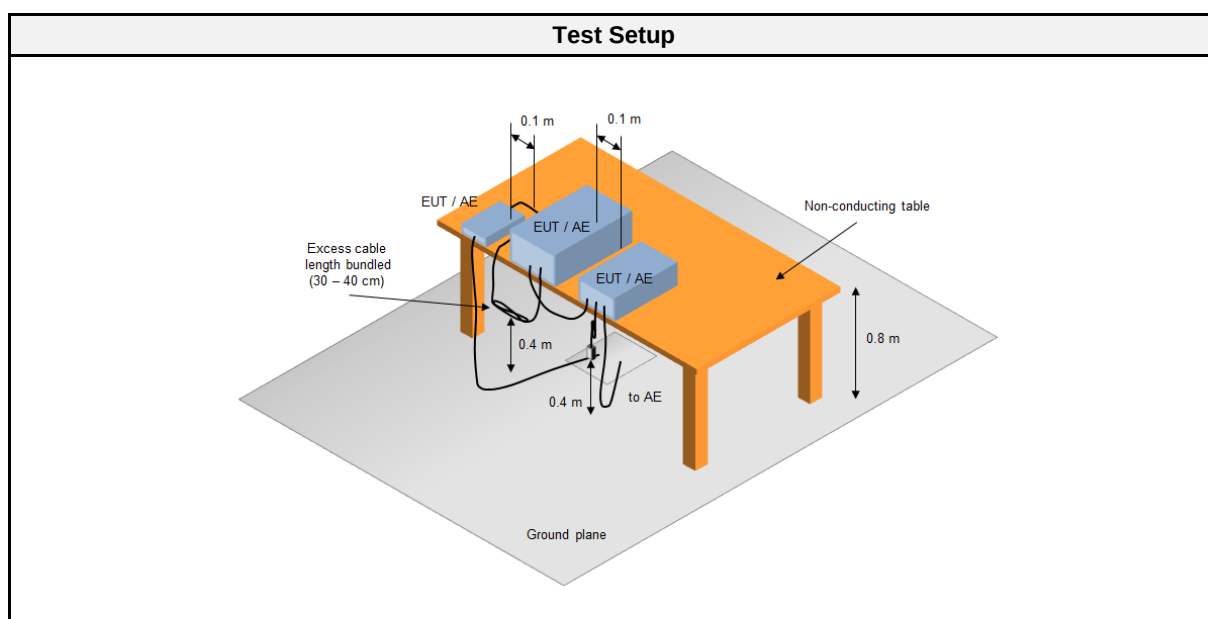
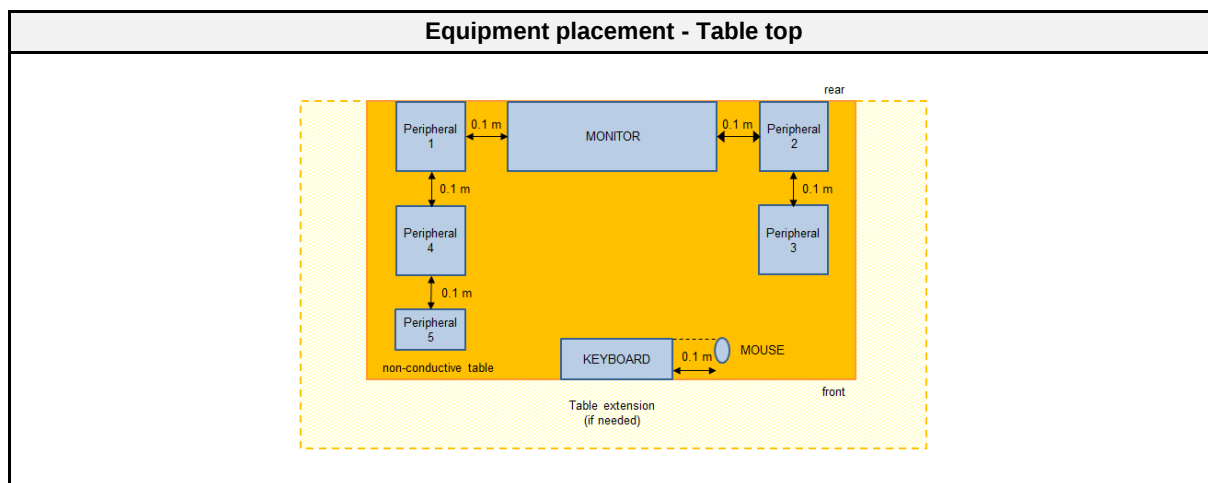
2.1 Test Conditions and Results - Radiated emissions acc. to ANSI C63.4

2.1.1 Information

Test Information	
Reference	FCC 15.109, ICES-003, 8, 6.1
Reference method	ANSI C63.4:2014 Section 8
Equipment class	Class B
Equipment type	Table top
Highest internal frequency [MHz]	3760
Measurement range	30 MHz to 18800 MHz
Temperature [°C]	21
Humidity [%]	32
Operator	Stephan Liebich
Date	2020-01-13

2.1.2 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
Spectrum analyzer	Rohde & Schwarz Vertriebs GmbH	FSW43	EF00896	2019-07	2020-07
Horn antenna	Schwarzbeck	BBHA 9120D (1-18GHz)	EF00018	2019-10	2022-10
40GHz High Gain Antenna	Amplifier Research	AT4560	EF00302	2019-05	2020-05
Biconical Antenna	R&S	HK 116	EF00030	2019-04	2022-04
LPD Antenna	R&S	HL 223	EF00187	2019-05	2022-05
Climatic Sensor	Embedded Data Systems	280010000025417E	EF01054	2019-05	2020-05

Test Report No.: G0M-1912-8648-EF0115B-V02

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

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 [dB μ V/m]
30 - 88	Quasi-peak	40
88 - 216	Quasi-peak	43.5
216 - 960	Quasi-peak	46
960 - 1000	Quasi-peak	54
> 1000	Peak	74
	Average	54

Class A @ 10 m		
Frequency [MHz]	Detector	Limit [dB μ V/m]
30 - 88	Quasi-peak	39
88 - 216	Quasi-peak	43.5
216 - 960	Quasi-peak	46.5
960 - 1000	Quasi-peak	49.5
> 1000	Peak	69.5
	Average	49.5

2.1.6 Results

Test Results			
Operational mode	EUT Configuration	Verdict	Remark
1	1	PASS	1
1 → The test data of the worst-case conditions from 30 MHz to 17 GHz were recorded and shown on the next pages. No relevant peaks were detected above 17 GHz with Spectrum analyzer.			

2.1.7 Setup Photos

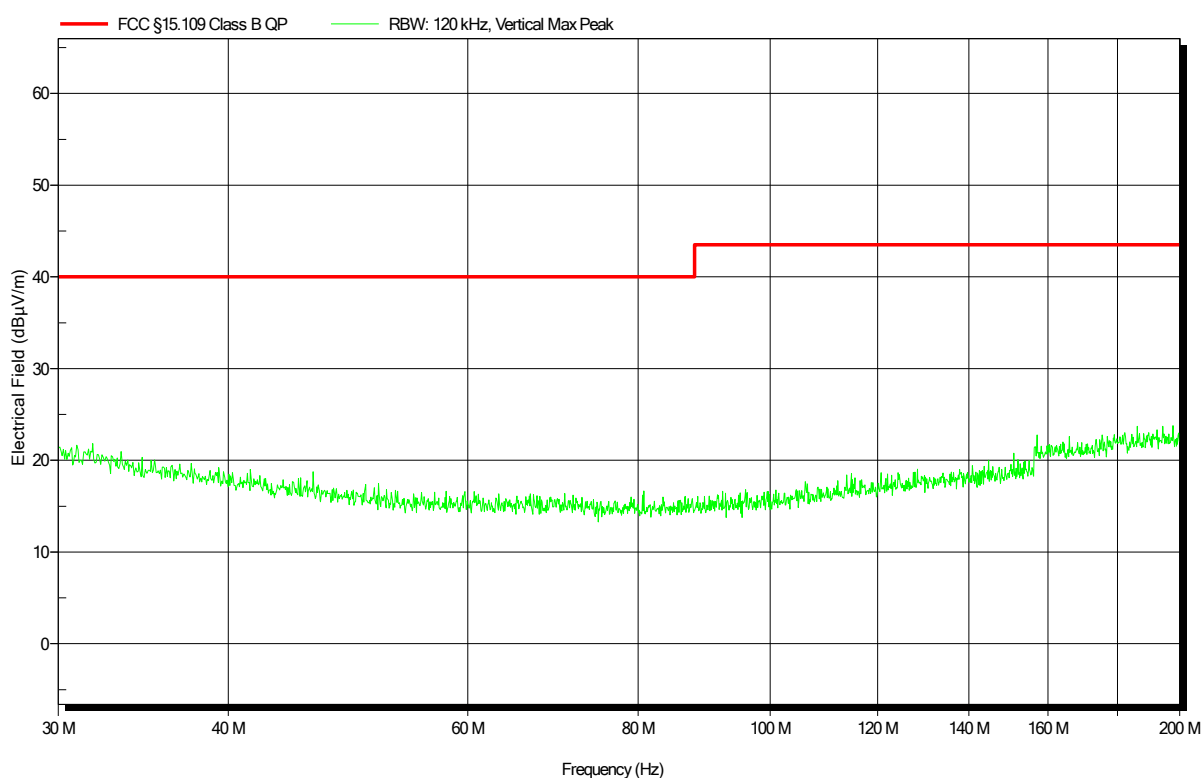


2.1.8 Records

Radiated emissions according to FCC part 15B

Project Number: G0M-1912-8648
 Applicant: Kamstrup A/S
 Model Description: wireless mbus US radio module with pulse input for MULTICAL
 Model: wireless mbus US radio module with pulse input for MULTICAL
 Test Sample ID: unspecified
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Liebich
 Test Date: 2020-01-13
 Operating Conditions: ambient temperature: 21 °C
 power input: 3.6 V DC (external power supply)
 Antenna: Rohde & Schwarz HK 116, Vertical
 Measurement Distance: 3 m
 Mode: 1
 Note 1:

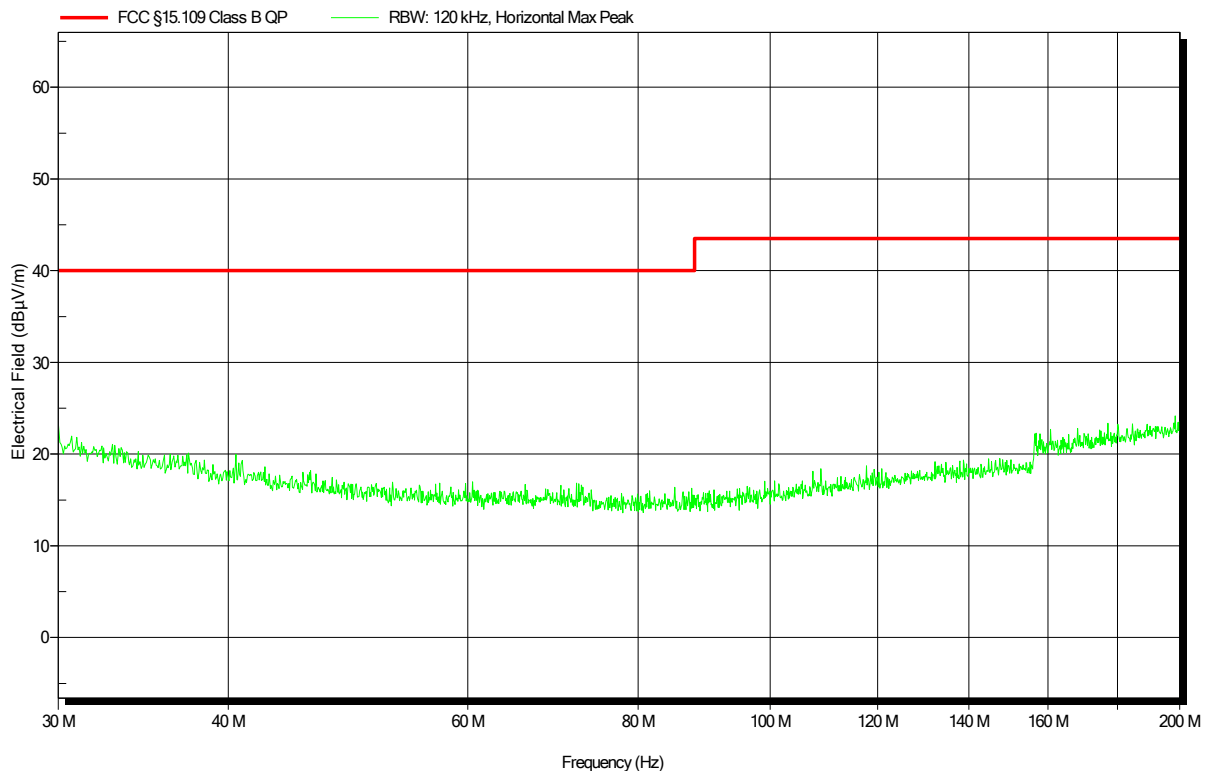
Index 13



Radiated emissions according to FCC part 15B

Project Number: G0M-1912-8648
Applicant: Kamstrup A/S
Model Description: wireless mbus US radio module with pulse input for MULTICAL
Model: wireless mbus US radio module with pulse input for MULTICAL
Test Sample ID: unspecified
Test Site: Eurofins Product Service GmbH
Operator: Mr. Liebich
Test Date: 2020-01-13
Operating Conditions: ambient temperature: 21 °C
power input: 3.6 V DC (external power supply)
Antenna: Rohde & Schwarz HK 116, Horizontal
Measurement Distance: 3 m
Mode: 1
Note 1:

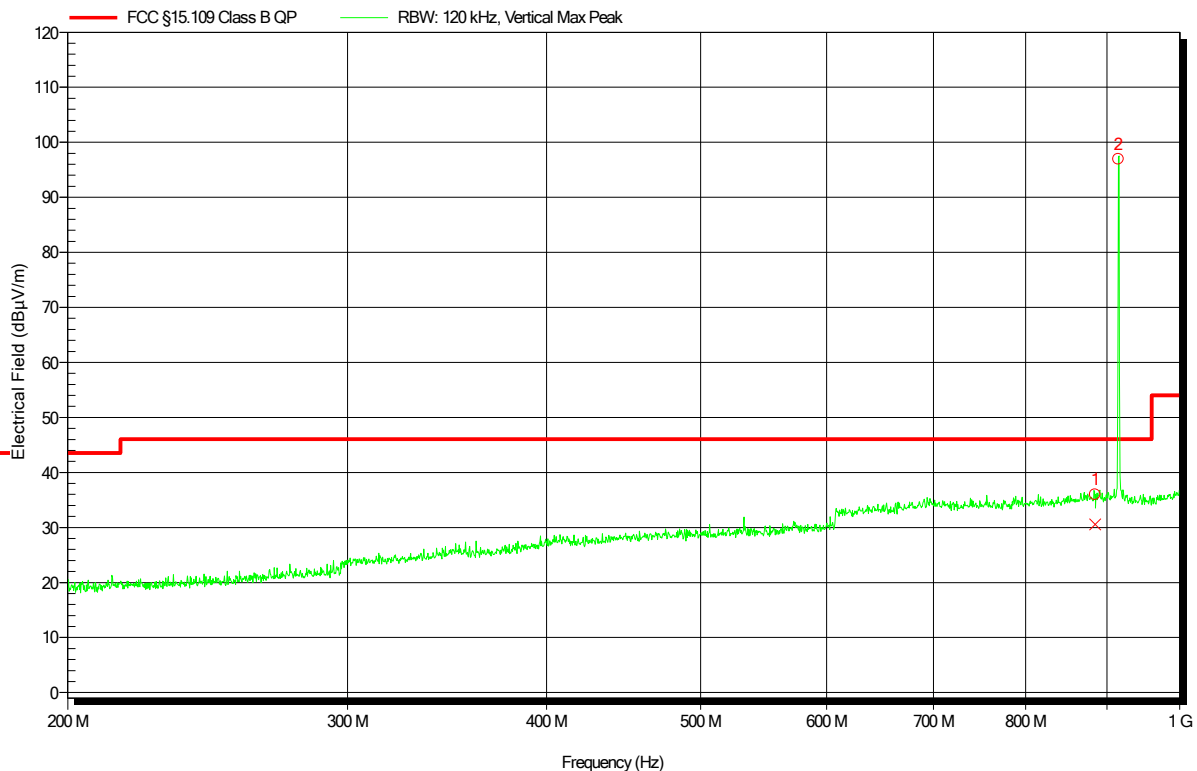
Index 14



Radiated emissions according to FCC part 15B

Project Number: G0M-1912-8648
Applicant: Kamstrup A/S
Model Description: wireless mbus US radio module with pulse input for MULTICAL
Model: wireless mbus US radio module with pulse input for MULTICAL
Test Sample ID: unspecified
Test Site: Eurofins Product Service GmbH
Operator: Mr. Liebich
Test Date: 2020-01-13
Operating Conditions: ambient temperature: 21 °C
power input: 3.6 V DC (external power supply)
Antenna: Rohde & Schwarz HL 223, Vertical
Measurement Distance: 3 m
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	884.833 MHz	30.57 dBµV/m	46.02 dBµV/m	-15.45 dB	Pass	0 Degree	1 m
2	915.161 MHz		SRD-Carrier			0 Degree	1 m

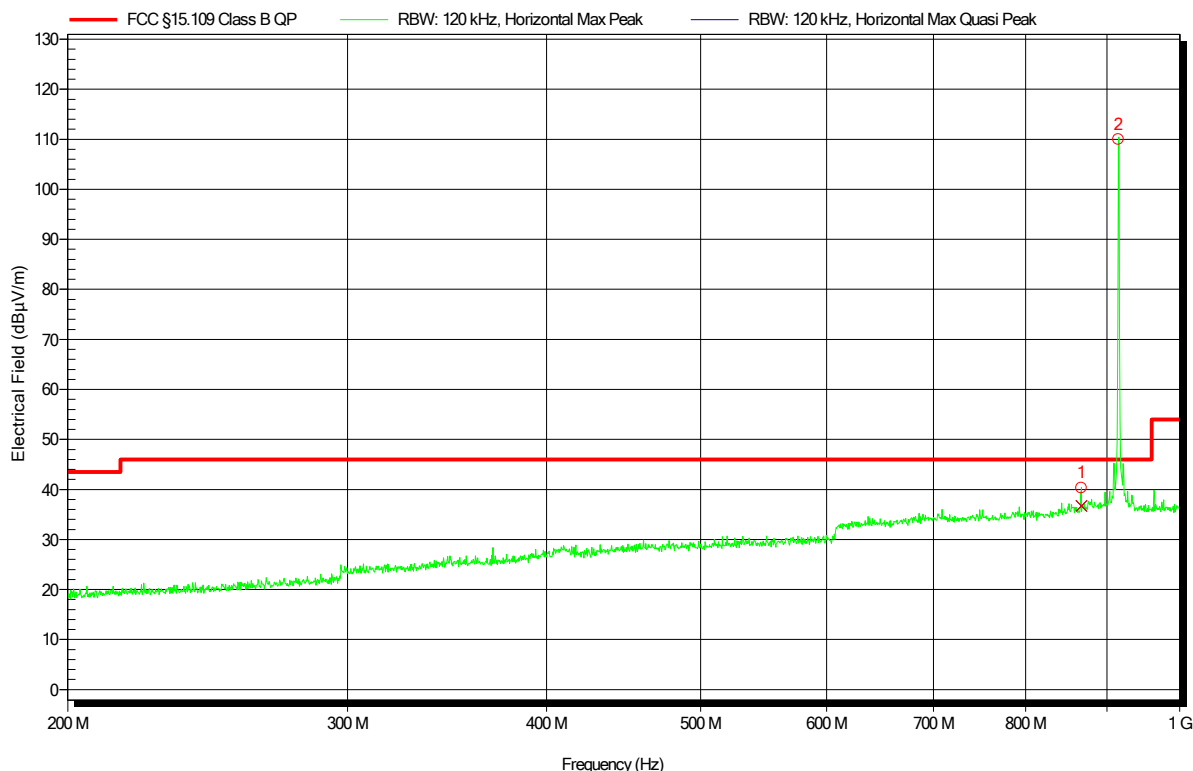
Test Report No.: G0M-1912-8648-EF0115B-V02

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

Radiated emissions according to FCC part 15B

Project Number: G0M-1912-8648
 Applicant: Kamstrup A/S
 Model Description: wireless mbus US radio module with pulse input for MULTICAL
 Model: wireless mbus US radio module with pulse input for MULTICAL
 Test Sample ID: unspecified
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Liebich
 Test Date: 2020-01-13
 Operating Conditions: ambient temperature: 21 °C
 power input: 3.6 V DC (external power supply)
 Antenna: Rohde & Schwarz HL 223, Horizontal
 Measurement Distance: 3 m
 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	867.235 MHz	36.71 dBµV/m	46.02 dBµV/m	-9.31 dB	Pass	0 Degree	1 m
2	915.161 MHz		SRD-Carrier			0 Degree	1 m

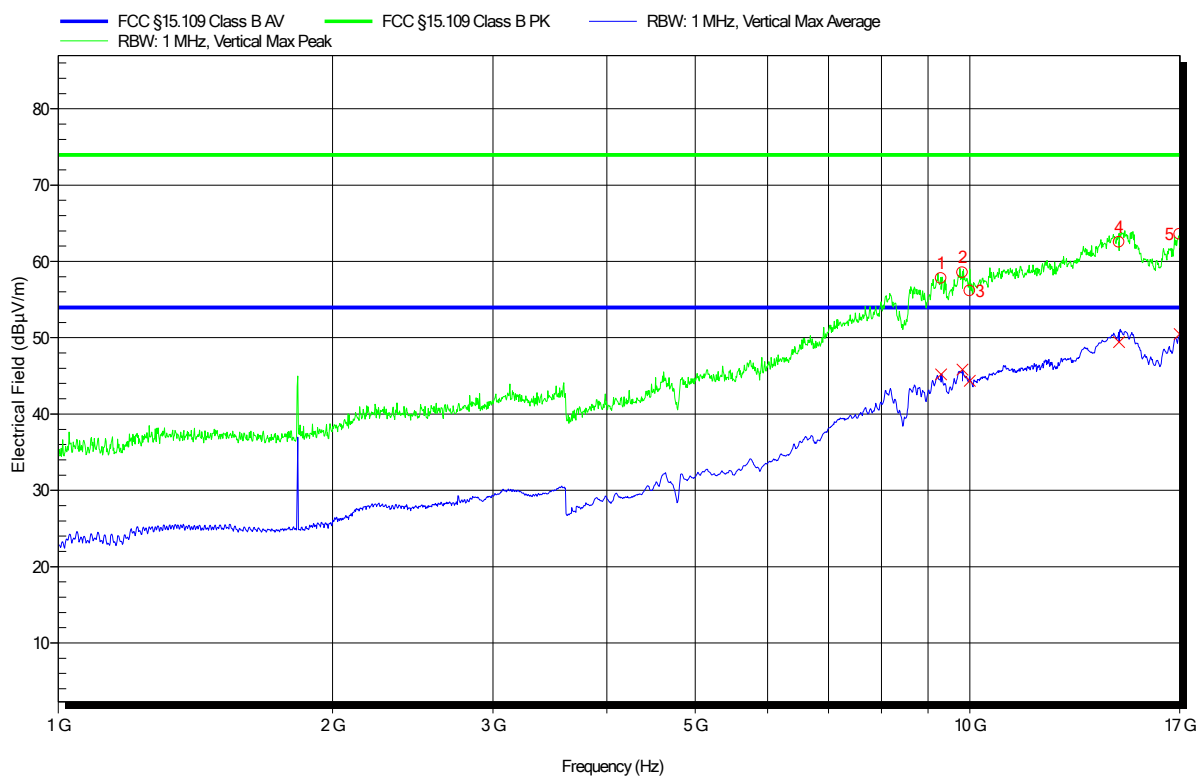
Test Report No.: G0M-1912-8648-EF0115B-V02

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

Radiated emissions according to FCC part 15B

Project Number: G0M-1912-8648
 Applicant: Kamstrup A/S
 Model Description: wireless mbus US radio module with pulse input for MULTICAL
 Model: wireless mbus US radio module with pulse input for MULTICAL
 Test Sample ID: unspecified
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Liebich
 Test Date: 2020-01-13
 Operating Conditions: ambient temperature: 21 °C
 power input: 3.6 V DC (external power supply)
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement Distance: 3 m
 Mode: 1

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Peak Number	Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Angle	Height
1	9.305 GHz	57.78 dBμV/m	73.98 dBμV/m	-16.2 dB	Pass	0 Degree	1 m
2	9.817 GHz	58.55 dBμV/m	73.98 dBμV/m	-15.43 dB	Pass	0 Degree	1 m
3	10.001 GHz	56.15 dBμV/m	73.98 dBμV/m	-17.83 dB	Pass	0 Degree	1 m
4	14.583 GHz	62.53 dBμV/m	73.98 dBμV/m	-11.45 dB	Pass	0 Degree	1 m
5	16.993 GHz	63.58 dBμV/m	73.98 dBμV/m	-10.4 dB	Pass	0 Degree	1 m

Test Report No.: G0M-1912-8648-EF0115B-V02

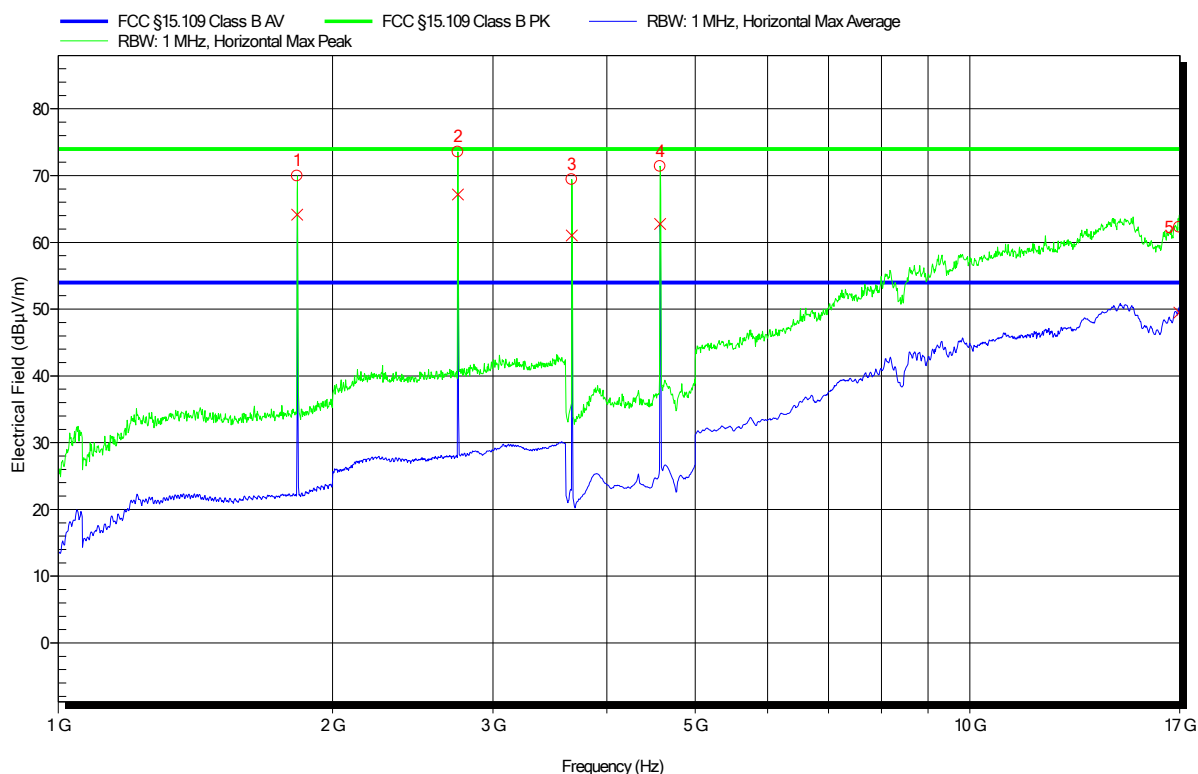
Eurofins Product Service GmbH
 Storkower Str. 38c, D-15526 Reichenwalde, Germany

Peak Number	Frequency	Average	Average Limit	Average Difference	Average Status	Angle	Height
1	9.305 GHz	45.2 dB μ V/m	53.98 dB μ V/m	-8.78 dB	Pass	0 Degree	1 m
2	9.817 GHz	45.81 dB μ V/m	53.98 dB μ V/m	-8.17 dB	Pass	0 Degree	1 m
3	10.001 GHz	44.35 dB μ V/m	53.98 dB μ V/m	-9.63 dB	Pass	0 Degree	1 m
4	14.583 GHz	49.45 dB μ V/m	53.98 dB μ V/m	-4.53 dB	Pass	0 Degree	1 m
5	16.993 GHz	50.49 dB μ V/m	53.98 dB μ V/m	-3.49 dB	Pass	0 Degree	1 m

Radiated emissions according to FCC part 15B

Project Number: G0M-1912-8648
 Applicant: Kamstrup A/S
 Model Description: wireless mbus US radio module with pulse input for MULTICAL
 Model: wireless mbus US radio module with pulse input for MULTICAL
 Test Sample ID: unspecified
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Liebich
 Test Date: 2020-01-13
 Operating Conditions: ambient temperature: 21 °C
 power input: 3.6 V DC (external power supply)
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement Distance: 3 m
 Mode: 1

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Peak Number	Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Angle	Height
1	1.829 GHz		2. Harmonic of SRD-Carrier			0 Degree	1 m
2	2.746 GHz		3. Harmonic of SRD-Carrier			0 Degree	1 m
3	3.659 GHz		4. Harmonic of SRD-Carrier			0 Degree	1 m
4	4.576 GHz		5. Harmonic of SRD-Carrier			0 Degree	1 m
5	16.975 GHz	62.3 dBµV/m	73.98 dBµV/m	-11.68 dB	Pass	0 Degree	1 m

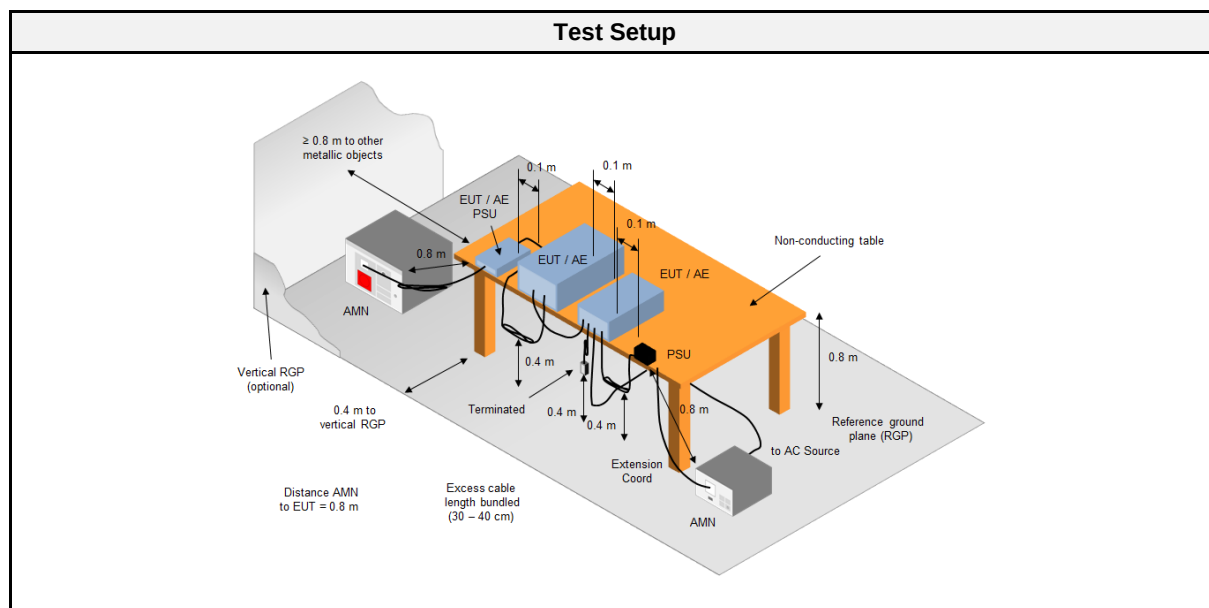
Test Report No.: G0M-1912-8648-EF0115B-V02

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

Peak Number	Frequency	Average	Average Limit	Average Difference	Average Status	Angle	Height
1	1.829 GHz			2. Harmonic of SRD-Carrier		0 Degree	1 m
2	2.746 GHz			3. Harmonic of SRD-Carrier		0 Degree	1 m
3	3.659 GHz			4. Harmonic of SRD-Carrier		0 Degree	1 m
4	4.576 GHz			5. Harmonic of SRD-Carrier		0 Degree	1 m
5	16.975 GHz	49.46 dBµV/m	53.98 dBµV/m	-4.52 dB	Pass	0 Degree	1 m

2.2.1 Information

2.2.2 Setup



2.2.3 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
AMN	R&S	ESH3-Z5	EF00036	2019-07	2021-07
Pulse Limiter	R&S	ESH3-Z2	EF01063	2019-07	2020-07
EMI Test Receiver	R&S	ESR 7	EF00943	2019-10	2020-10
Climatic Sensor	Embedded Data Systems, LLC.	2800100000254 17E	EF01054	2019-05	2020-05

2.2.4 Procedure

Exploratory measurement	
1.	The EUT was placed on a non conductive table 0.8 m above the reference ground plane and 0.4 m away from the vertical conducting plane (ANSI C63.4: 2014 item 7.3.1)
2.	The power cord that is normally supplied or recommended by the manufacturer was connected to the LISN.
3.	The distance between the outer edge of the EUT and the LISN shall be set to 0.8 m. A longer power cord shall be bundled to this length (bundling shall not exceed 40 cm in length).
4.	The LISN measurement port was connected to a measurement receiver
5.	I/O cables were bundled not longer than 0.4 m
6.	Measurement was performed in the frequency range 0.15 – 30MHz on each current-carrying conductor
7.	To maximize the emissions the cable positions were manipulated
8.	The worst configuration of EUT and cables is shown on a test setup picture at item 1.3

Final measurement	
1.	The EUT was placed on a non conductive table 0.8 m above the reference ground plane and 0.4 m away from the vertical conducting plane (ANSI C63.4: 2014 item 7.3.1)
2.	The power cord that is normally supplied or recommended by the manufacturer was connected to the LISN.
3.	The distance between the outer edge of the EUT and the LISN shall be set to 0.8 m. A longer power cord shall be bundled to this length (bundling shall not exceed 40 cm in length).
4.	The LISN measurement port was connected to a measurement receiver
5.	The EUT and cable arrangement were based on the exploratory measurement results
6.	The test data of the worst-case conditions were recorded and shown on the next pages

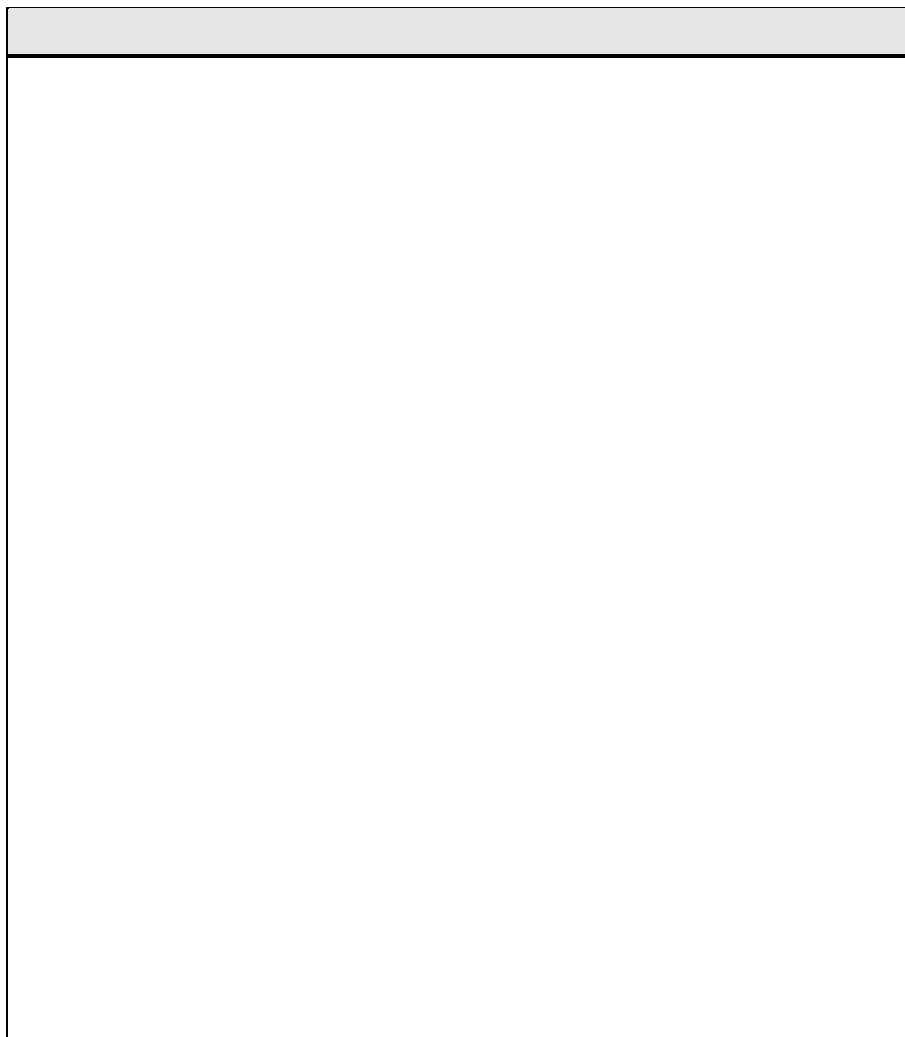
2.2.5 Limits

Class B		
Frequency [MHz]	Quasi-peak Limit [dBμV]	Average Limit [dBμV]
0.15 - 0.5	66 - 56 *	56 - 46 *
0.5 - 5	56	46
5 - 30	60	50
* Decreases with the logarithm of the frequency		

2.2.6 Results

AC power line conducted emissions					
Port	Coupling	Operational mode	EUT Configuration	Verdict	Remark
POWER	AMN	1	2	PASS	-

2.2.7 Setup Photos



2.2.8 Records

Conducted emissions at the mains power port according to FCC part 15B

Project Number: G0M-1912-8648
 Applicant: Kamstrup A/S
 Model Description: wireless mbus US radio module with pulse input for MULTICAL
 Model: wireless mbus US radio module with pulse input for MULTICAL
 Test Sample ID: unspecified
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Liebich
 Test Date: 2020-01-14
 Operating Conditions: ambient temperature: 22 °C
 power input: 24 V / 60 Hz via AC/DC-Adaptor
 LISN: Rohde & Schwarz ESH3-Z5
 Mode: 1
 Applied to Port: POWER
 Note 1:

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