




RADIO REPORT FCC 47 CFR Part 90I ISED Canada RSS-119 Issue 12, Amendment 1	
Report Reference No	G0M-2211-1783-TFC090PMR-V01
Testing Laboratory	Eurofins Product Service GmbH
Address	Storkower Str. 38c 15526 Reichenwalde Germany
Accreditation	 <p> 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 </p>
Applicant	Kamstrup A/S
Address	Industrivej 28 8660 Skanderborg DENMARK
Test Specification	47 CFR Part 90I ISED RSS-119, Issue 12, Amendment 1: 2022-04
Non-Standard Test Method	None
Equipment under Test (EUT):	
Product Description	Ultrasonic water meter
Model(s)	KW2220
Additional Model(s)	None
Brand Name(s)	Kamstrup
Hardware Version(s)	Unit: 620-210-04; RF PCB BOM: 5550-2066; Flow PCB BOM: 5550-2080
Software Version(s)	RF: 50981789; meter: 50981812; Flow: 50981813
FCC-ID	OUY-KWMX220
IC	22376-KWMX220
Test Result	PASSED

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 °C – 23 °C	
Test Lab Humidity	32 % – 38 %	
Date of receipt of test item	2023-02-20	
Report:		
Compiled by	Odai Qawasmeh	
Tested by (+ signature) (Responsible for Test)	Odai Qawasmeh	
Approved by (+ signature) (Test Lab Engineer)	Dr.-Ing. Dhamia Almozani	
Date of Issue	2023-03-14	
Total number of pages	49	
General Remarks:		
<p>The test results presented in this report relate only to the object tested.</p> <p>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.</p> <p>This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.</p>		
Additional Comments:		

ADDITIONAL VARIANTS

Additional Variants (not tested and not evaluated variants)		
Not-tested Variant	Description	
1	Product Type Description	Ultrasonic water meter
	Model name	KWM2220
	Brand name	Kamstrup
	Hardware Version	Unit: 6201-210-01 RF PCB BOM: 5550-2066 Flow PCB BOM: 5550-2080
	Software Version	RF: 50981789 Meter: 50981812 Flow: 50981813
2	Product Type Description	Ultrasonic water meter
	Model name	KWM2220
	Brand name	Kamstrup
	Hardware Version	Unit: 6201-210-02 RF PCB BOM: 5550-2066 Flow PCB BOM: 5550-2080
	Software Version	RF: 50981789 Meter: 50981812 Flow: 50981813
3	Product Type Description	Ultrasonic water meter
	Model name	KWM2220
	Brand name	Kamstrup
	Hardware Version	Unit: 6201-210-03 RF PCB BOM: 5550-2066 Flow PCB BOM: 5550-2080
	Software Version	RF: 50981789 Meter: 50981812 Flow: 50981813
4	Product Type Description	Ultrasonic water meter
	Model name	KWM3220
	Brand name	Kamstrup
	Hardware Version	Unit: 6201-204-01 RF PCB BOM: 5550-2066 Flow PCB BOM: 5550-2094
	Software Version	RF: 50981789 Meter: 50981812 Flow: 50981813
5	Product Type Description	Ultrasonic water meter
	Model name	KWM3220
	Brand name	Kamstrup
	Hardware Version	Unit: 6201-205-01 RF PCB BOM: 5550-2066 Flow PCB BOM: 5550-2094
	Software Version	RF: 50981789 Meter: 50981812 Flow: 50981813

6	Product Type Description	Ultrasonic water meter
	Model name	KWM3220
	Brand name	Kamstrup
	Hardware Version	Unit: 6201-204-02 RF PCB BOM: 5550-2066 Flow PCB BOM: 5550-2094
	Software Version	RF: 50981789 Meter: 50981812 Flow: 50981813
7	Product Type Description	Ultrasonic water meter
	Model name	KWM3220
	Brand name	Kamstrup
	Hardware Version	Unit: 6201-204-03 RF PCB BOM: 5550-2066 Flow PCB BOM: 5550-2094
	Software Version	RF: 50981789 Meter: 50981812 Flow: 50981813
8	Product Type Description	Ultrasonic water meter
	Model name	KWM3220
	Brand name	Kamstrup
	Hardware Version	Unit: 6201-204-04 RF PCB BOM: 5550-2066 Flow PCB BOM: 5550-2094
	Software Version	RF: 50981789 Meter: 50981812 Flow: 50981813
9	Product Type Description	Ultrasonic water meter
	Model name	KWM3220
	Brand name	Kamstrup
	Hardware Version	Unit: 6201-204-05 RF PCB BOM: 5550-2066 Flow PCB BOM: 5550-2094
	Software Version	RF: 50981789 Meter: 50981812 Flow: 50981813
10	Product Type Description	Ultrasonic water meter
	Model name	KWM3220
	Brand name	Kamstrup
	Hardware Version	Unit: 6201-204-06 RF PCB BOM: 5550-2066 Flow PCB BOM: 5550-2094
	Software Version	RF: 50981789 Meter: 50981812 Flow: 50981813
11	Product Type Description	Ultrasonic water meter
	Model name	KWM3220
	Brand name	Kamstrup
	Hardware Version	Unit: 6201-204-07 RF PCB BOM: 5550-2066 Flow PCB BOM: 5550-2094
	Software Version	RF: 50981789 Meter: 50981812 Flow: 50981813

12	Product Type Description	Ultrasonic water meter
	Model name	KWM3220
	Brand name	Kamstrup
	Hardware Version	Unit: 6201-204-08 RF PCB BOM: 5550-2066 Flow PCB BOM: 5550-2094
	Software Version	RF: 50981789 Meter: 50981812 Flow: 50981813
<p>Comment: Those named additional variants above have not been tested. Those additional variants of the series have been declared by the manufacturer. The test report explicitly states that those variants were neither tested nor assessed nor evaluated.</p>		

VERSION HISTORY

Version History			
Version	Issue Date	Remarks	Revised By
01	2023-03-14	Initial Release	

ABBREVIATIONS AND ACRONYMS

Acronyms	
Acronym	Description
EUT	Equipment Under Test
FCC	Federal Communications Commission
ISED	Innovation, Science and Economic Development Canada
RBW	Resolution bandwidth
RMS	Root mean square
VBW	Video bandwidth
V _{NOM}	Nominal supply voltage
V _{MIN}	Miminal supply voltage
V _{MAX}	Maximal supply voltage
T _{NOM}	Nominal temperature
T _{MIN}	Miminal temperature
T _{MAX}	Maximal temperature
N/A	Not Applicable

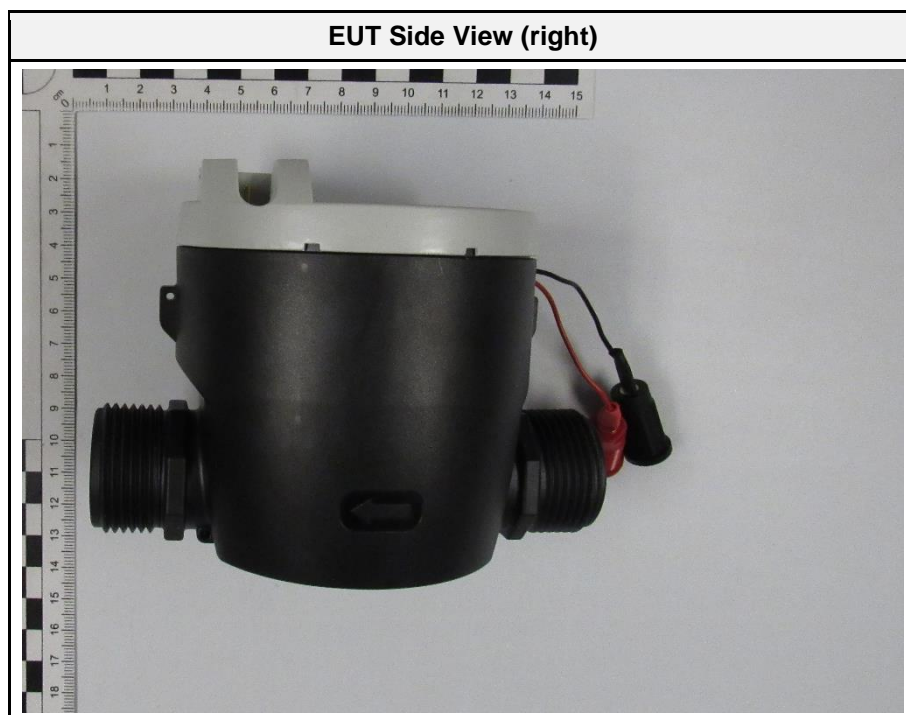
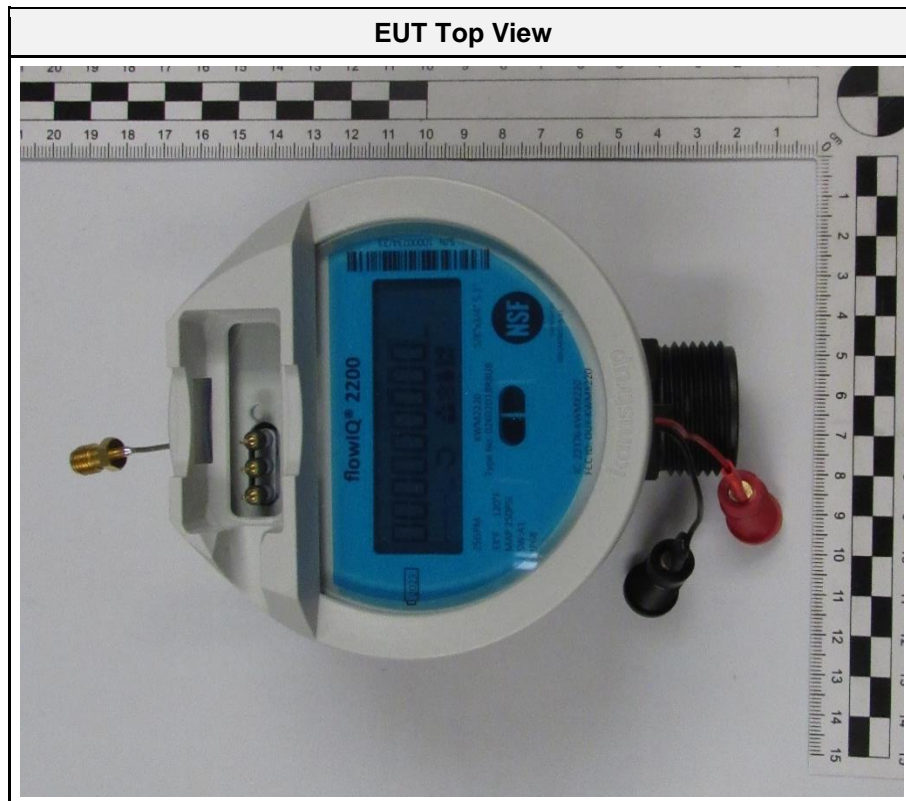
REPORT INDEX

1	Equipment (Test Item) Under Test.....	9
1.1	Photos – Equipment External.....	10
1.2	Photos – Equipment Internal.....	13
1.3	Support Equipment.....	17
1.4	Test Modes.....	18
1.5	Test Frequencies.....	19
1.6	Sample emission level calculation.....	20
2	Result Summary.....	21
3	Test Conditions and Results.....	22
3.1	Test Conditions and Results - Power.....	22
3.2	Test Conditions and Results - Emission mask and authorized bandwidth.....	24
3.3	Test Conditions and Results - Spurious emissions at antenna terminal.....	27
3.4	Test Conditions and Results - Transmitter radiated emissions.....	29
3.5	Test Conditions and Results - Receiver spurious emissions.....	34
ANNEX A	Transmitter conducted emissions.....	40
ANNEX B	Transmitter radiated emissions.....	42
ANNEX C	Receiver radiated emissions.....	46

1 Equipment (Test Item) Under Test

Description	Ultrasonic water meter	
Model	KW2220	
Additional Model(s)	None	
Brand Name(s)	Kamstrup	
Serial Number(s)	10000235/23	
Test Sample Id(s)	43142	
Hardware Version(s)	Unit: 620-210-04; RF PCB BOM: 5550-2066; Flow PCB BOM: 5550-2080	
Software Version(s)	RF: 50981789; meter: 50981812; Flow: 50981813	
PMN	KWM2220	
HVIN	02K02D18R8UB	
FVIN	50981789	
HMN	N/A	
IC	22376-KWMX220	
FCC-ID	OUY-KWMX220	
Equipment type	End Product	
Radio type	Transceiver	
Radio technologies	PMR	
Assigned frequency band	450 - 470 MHz	
Operating frequency range	450.25 - 469.9875 MHz	
Channel	450.25 MHz	
Modulation(s)	Unmodulated	
Channel bandwidth	12.5 kHz	
Authorized bandwidth	11.25 kHz	
Channel spacing	11.25 kHz	
Number of antenna ports	1	
Supply Voltage	V _{NOM}	3.66 V
Operating Temperature	T _{NOM}	25 °C
AC/DC-Adaptor	None	
Manufacturer	Kamstrup A/S Industrivej 28 8660 Skanderborg DENMARK	

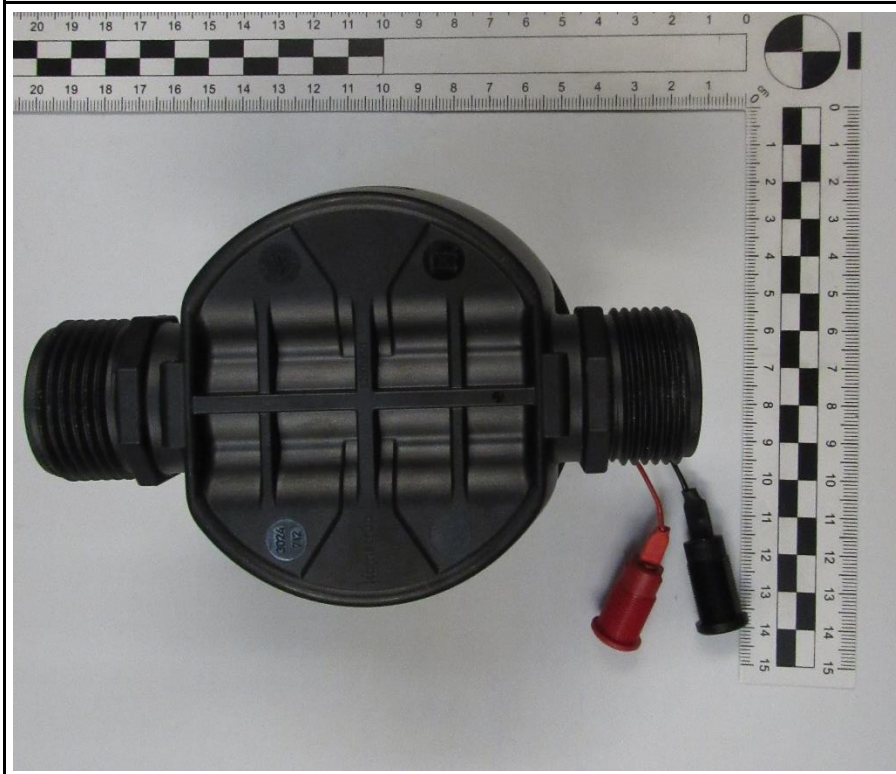
1.1 Photos – Equipment External



EUT Side View (left)



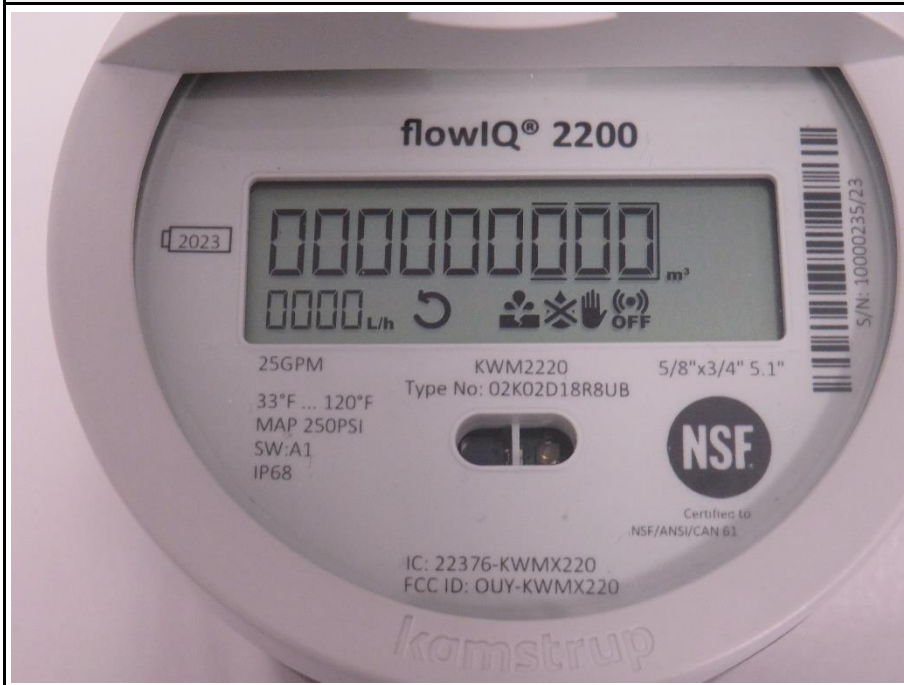
EUT Bottom View



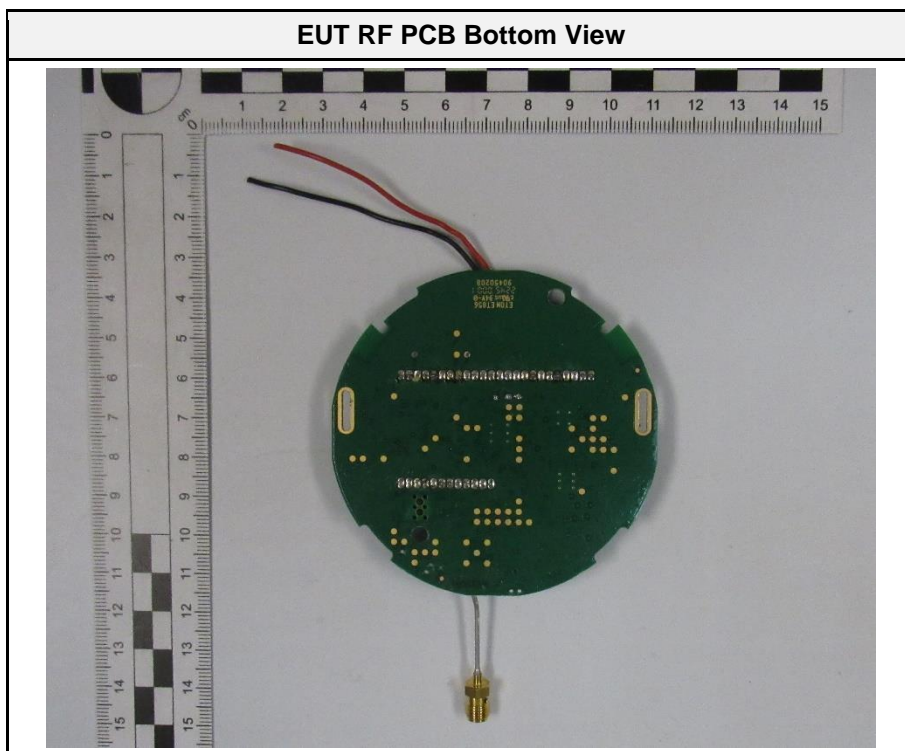
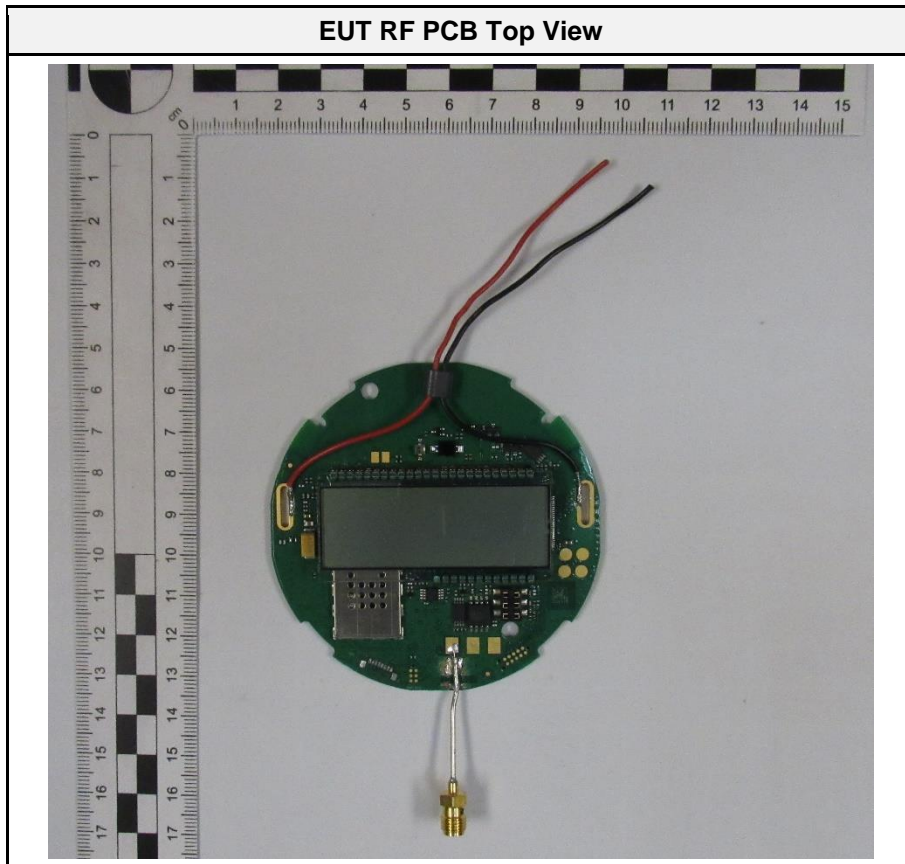
EUT Front View



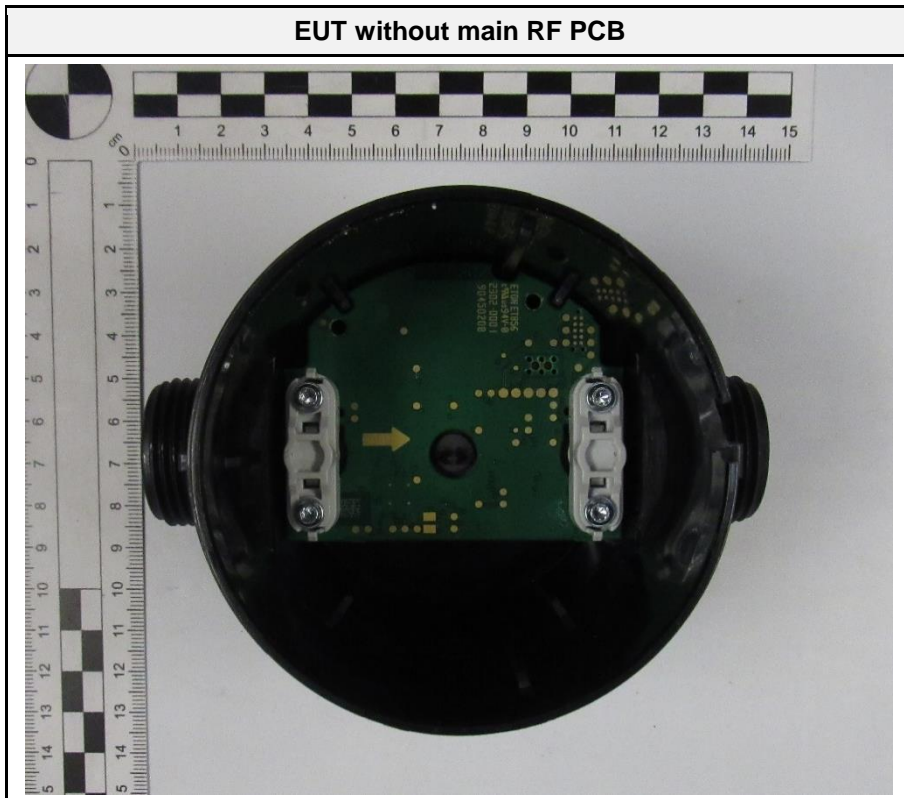
EUT Label



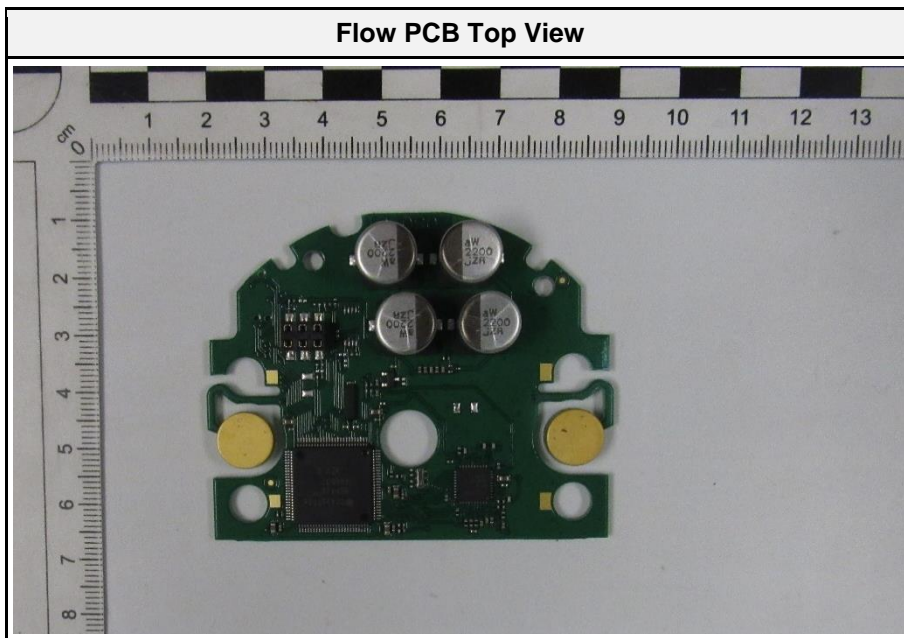
1.2 Photos – Equipment Internal

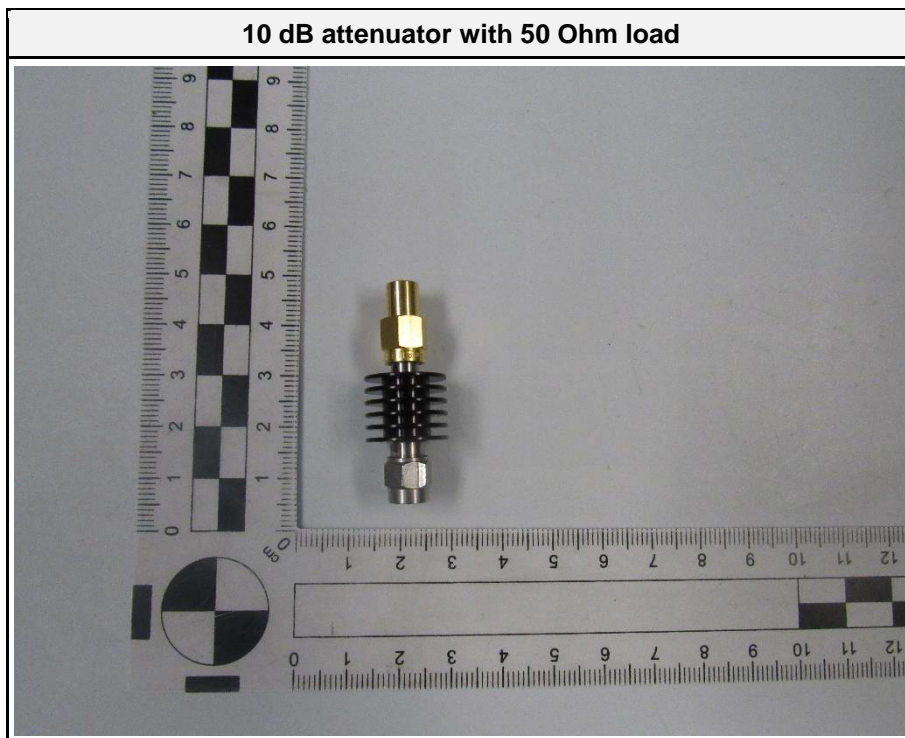


EUT without main RF PCB



Flow PCB Top View





1.3 Support Equipment

Product Type	Device	Manufacturer	Model	Comment
AE	Customer Notebook	---	---	For configuring test modes
AE	Optical readout head	Kamstrup	14071	Programming interface
AE	10 dB attenuator	---	---	---
AE	50 Ohm load	---	---	---
CBL	Banana plugs	---	---	To connect EUT to power supply.
SFT	Device Control Tool	Kamstrup	---	Tool for controlling RF module and parameters
Description:				
AE	Auxiliary Equipment			
SIM	Simulator			
CBL	Connecting Cable			
SFT	Software			
Comment:				

1.4 Test Modes

Mode	Description
Unmodulated	Tuned conducted power = 30 dBm Mode = Transmit Modulation = None Duty cycle = 100 %
Receive	Mode = Receive
Comment: Worst case was found in module test report number G0M-2002-8859-TFC090PMR-V02 issued by Eurofins Product Service GmbH on 2020-07-28.	

1.5 Test Frequencies

Designator	Mode	Frequency [MHz]
F1	Tx / Rx	450.25

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 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:

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

Net:

This is the net field strength measurement (as shown above).

Limit:

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

Radiated power:

$$\text{EIRP (dBm)} = \text{E (dB}\mu\text{V/m)} + 20\log(\text{D}) - 104.8 \quad (\text{D is the measurement distance in m})$$

$$\text{ERP (dBm)} = \text{EIRP (dBm)} - 2.15$$

2 Result Summary

Test Summary				
Product Standard Reference	Requirement	Reference Method	Result	Remarks
FCC 90.205 FCC 2.1046 RSS-119 5.4	Power	ANSI C63.26:2015 5.2	PASS	Note 1
FCC 90.209 FCC 90.210 FCC 2.1049 RSS-119 4.2,5.5,5.8	Authorized bandwidth Emission masks Occupied bandwidth	FCC 90.210 ANSI C63.26:2015 5.4	PASS	Note 1
FCC 90.210 FCC 2.1051 RSS-119 4.2 RSS-Gen 6.13	Spurious emissions at antenna terminal	FCC 90.210 ANSI C63.26:2015 5.7	PASS	Note 1
FCC 90.210 FCC 2.1053 RSS-119 4.2 RSS-Gen 6.13	Spurious emissions radiated	FCC 90.210 ANSI C63.26:2015 5.5	PASS	
RSS-Gen 7.3	Receiver spurious emissions	ANSI C63.4-2014	PASS	
FCC 90.213 FCC 2.1055 RSS-119 5.3	Frequency Stability	ANSI C63.26:2015 5.6	N/T	
FCC 90.214 RSS-119 5.9	Transient Frequency behavior	ANSI C63.26:2015 6.5	N/T	
Note 1: Due to the integration of a pre-certified module, only partial and spot check tests according RSS-119 were performed with reference to the original test report G0M-2002-8859-TFC090PMR-V02 issued by Eurofins Product Service GmbH on 2020-07-28.				
Comment: The Decision Rule is applied on the basis of ETSI TR 102 273 and ETSI TR 100 028. These standards provide guidance on how to calculate and apply measurement uncertainty whilst providing maximum uncertainties allowance. In all cases due consideration will be given to ILAC-G8:09/2019. Where a result is considered conditional in respect of its proximity to the limit line, the customer would be made aware of situation so that they can make an informed decision on how to proceed.				

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 - Power

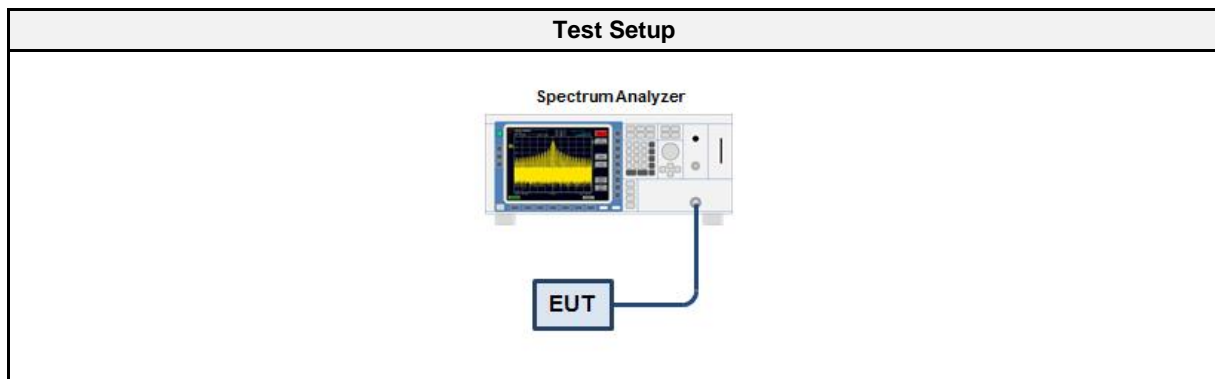
3.1.1 Information

Test Information	
Reference	FCC 90.205, FCC 90.2.1046 ISED RSS-119, Issue 12, Amendment 1 (Section 5.4)
Measurement Method	ANSI C63.26:2015 5.2
Test Method	Conducted
Test Mode	Unmodulated
Maximum antenna gain	1 dBi
Measurement Uncertainty:	± 1.77 dB
Operator	Toralf Jahn
Date	2020-06-03

3.1.2 Limits

Limits	
Device	Power
Base / Fixed / Mobile	± 1 dB of rated power
Base / Fixed	110 W ERP (50.41 dBm)
Mobile	60 W ERP (47.78 dBm)

3.1.3 Setup



3.1.4 Equipment

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum analyzer	R&S	FSU43	EF01631	2019-12	2020-12
Attenuator	Radiall GmbH	R416010000	EF01013	cal before use	
Cable	Gigalane	SMS111B	EF00779 CAAZ	cal before use	

3.1.5 Procedure

Test Procedure
1. EUT transmitter is activated in test mode under normal conditions
2. The spectrum analyzer is set to peak detection and maximum hold with a span twice the emission spectrum
3. The resolution bandwidth is set to 3 MHz
4. Peak power is determined from peak of spectrum envelope
5. EIRP power is calculated by adding the antenna gain in dBi
6. ERP power is calculated by subtracting 2.15 from EIRP power

3.1.6 Results

Test Results Rated Power					
Channel [MHz]	Conducted Power [dBm]	Rated Power [dBm]	Lower Limit [dBm]	Upper Limit [dBm]	Verdict
450.25	30.41	30	29	31	PASS

Test Results Maximum ERP					
Channel [MHz]	Conducted Power [dBm]	ERP Peak Power [dBm]	ERP Peak Power [W]	ERP Power Limit [dBm]	Margin [dB]
450.25	30.41	28.26	0.67	47.78	-19.52

3.2 Test Conditions and Results - Emission mask and authorized bandwidth

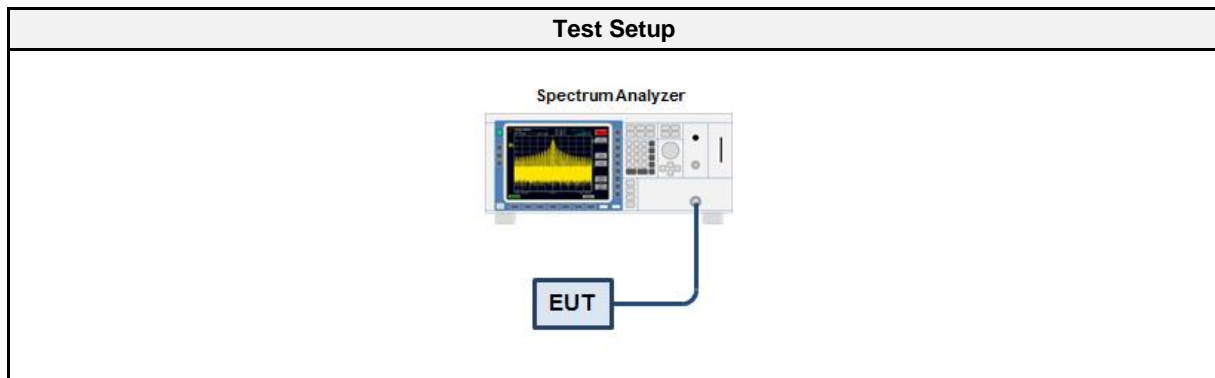
3.2.1 Information

Test Information	
Reference	FCC 90.209, FCC 90.210, FCC 2.1049 ISED RSS-119, Issue 12, Amendment 1 (Sections 4.2,5,5,5.8)
Measurement Method	FCC 90.210, ANSI C63.26:2015 5.4
Test Method	Conducted
Test Mode	Modulated
Measurement Uncertainty:	± 1.80 dB (Emission mask) ± 1.26 % (Authorized bandwidth)
Operator	Toralf Jahn
Date	2020-06-03

3.2.2 Limits

Limits
Emission Mask D
Necessary bandwidth (Occupied bandwidth) < 11.25 kHz (Authorized bandwidth)

3.2.3 Setup



3.2.4 Equipment

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum analyzer	R&S	FSU43	EF01631	2019-12	2020-12
Attenuator	Radiall GmbH	R416010000	EF01013	cal before use	
Cable	Gigalane	SMS111B	EF00779 CAAZ	cal before use	

3.2.5 Procedure

Test Procedure
<ol style="list-style-type: none"> 1. EUT set to test mode 2. Span set in order to cover the emission spectrum and emission mask 3. Resolution bandwidth set to 100 Hz and VBW to 300 Hz 4. Detector is set to peak max hold

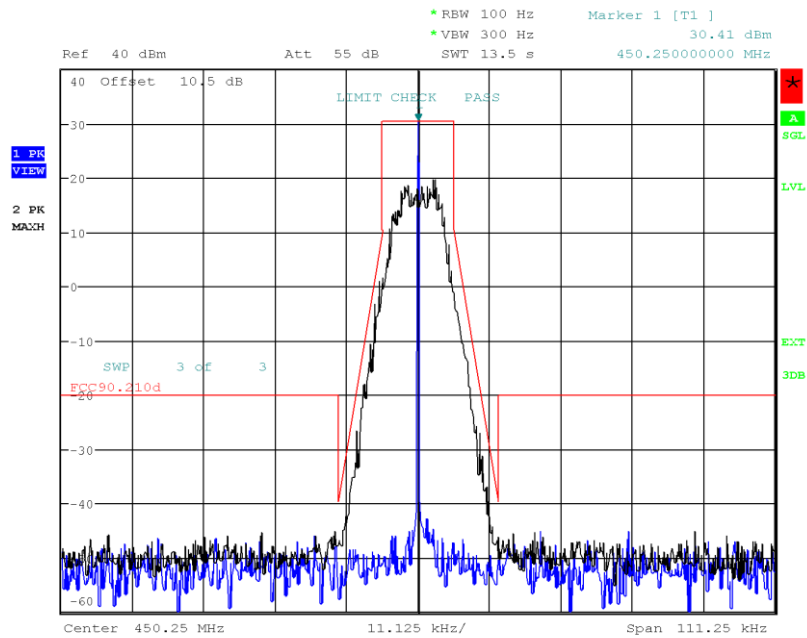
3.2.6 Results

Test Results - Emission Mask	
Channel [MHz]	Verdict
450.25	PASS

Test Results - Authorized bandwidth			
Channel [MHz]	Bandwidth [kHz]	Limit [kHz]	Verdict
450.25	9.660	11.25	PASS

Emission mask

Project Number: G0M-2002-8859
 Applicant: Kamstrup A/S
 Model Description: Ultrasonic water meter
 Model: KWM2220
 Test Sample ID: 29577
 Operator: Toralf Jahn
 Test Site: Eurofins Product Service GmbH
 Test Date: 2020-06-03
 Operating Conditions: Tnom/Vnom
 Mode: 450.25 MHz



Date: 3.JUN.2020 12:43:13

3.3 Test Conditions and Results - Spurious emissions at antenna terminal

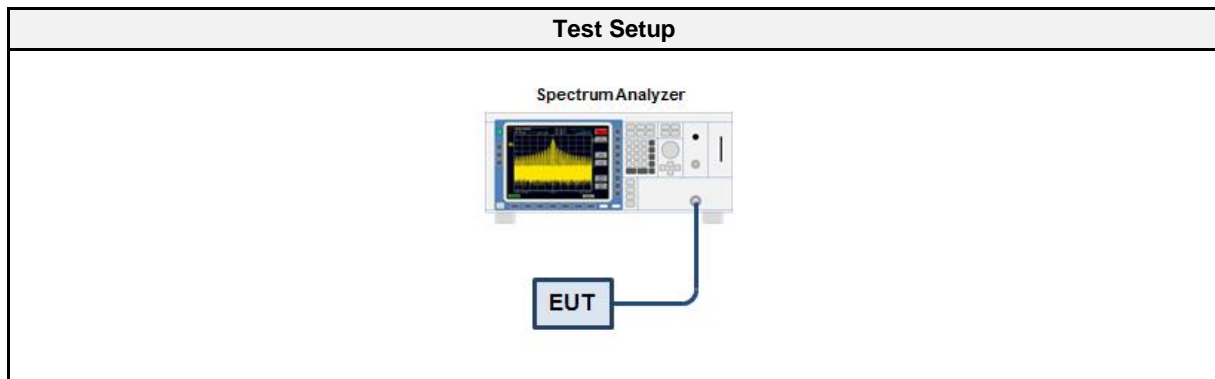
3.3.1 Information

Test Information	
Reference	FCC 90.210, FCC 2.1051 ISED RSS-119, Issue 12, Amendment 1 (Sections 4.2,6.13)
Measurement Method	FCC 90.210 ANSI C63.26:2015 5.7
Test Method	Conducted
Test Mode	Unmodulated
Test Range	10 MHz to 10th Harmonic
Measurement Uncertainty:	± 4.25 dB
Operator	Toralf Jahn
Date	2020-06-03

3.3.2 Limits

Limits
-20 dBm

3.3.3 Setup



3.3.4 Equipment

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum analyzer	R&S	FSU43	EF01631	2019-12	2020-12
Attenuator	Radial GmbH	R416010000	EF01013	cal before use	
Cable	Gigalane	SMS111B	EF00779 CAAZ	cal before use	

3.3.5 Procedure

Test Procedure	
<ol style="list-style-type: none"> 1. EUT set to test mode 2. Span is set according to measurement range 3. Resolution bandwidth is set to 100 kHz below 1 GHz and 1 MHz above 1 GHz 4. Detector is set to peak and trace mode to max hold 	

3.3.6 Results

Test Results	
Channel [MHz]	Verdict
450.25	PASS

3.4 Test Conditions and Results - Transmitter radiated emissions

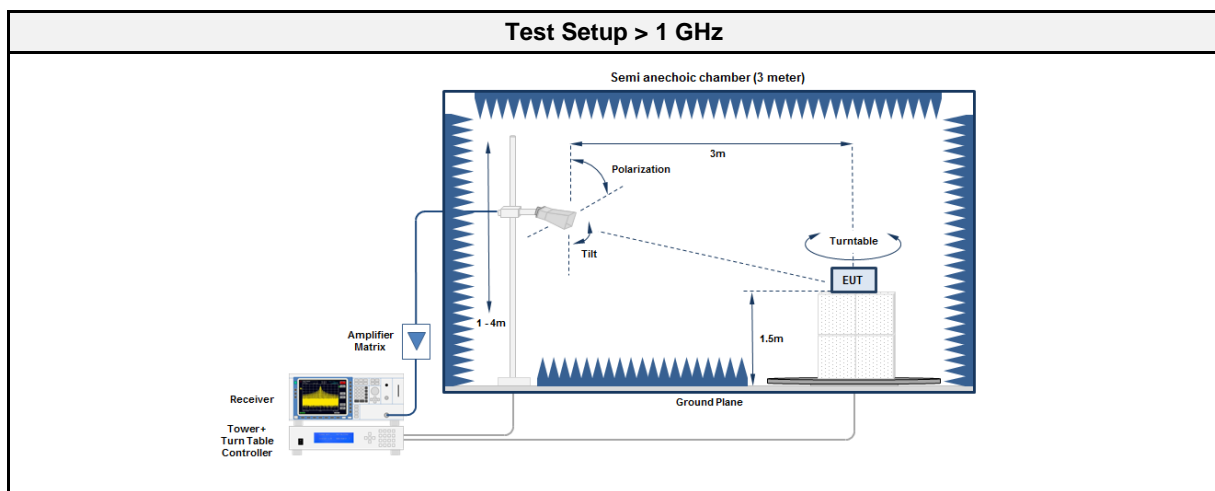
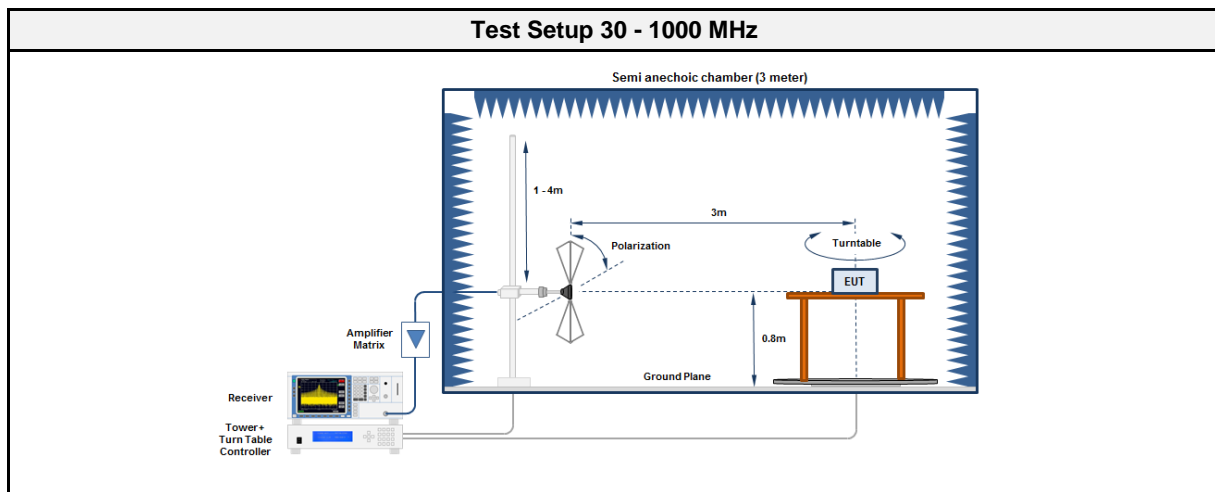
3.4.1 Information

Test Information	
Reference	FCC 90.210 FCC 2.1053 ISED RSS-119, Issue 12, Amendment 1 (Sections 4.2,6.13)
Measurement Method	FCC 90.210 ANSI C63.26:2015 5.7
Test Method	Radiated
Test Mode	Unmodulated
Test Range	30 MHz to 10th Harmonic
Measurement Uncertainty:	± 5.7 dB
Operator	Odai Qawasmeh
Date	2023-02-20 – 2023-02-21

3.4.2 Limits

Limits
-20 dBm

3.4.3 Setup



3.4.4 Equipment

Test Software			
Description	Manufacturer	Name	Version
EMC Software	DARE Instruments	RadiMation	2020.1.8

Test Equipment 30 MHz - 1000 MHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC1	EF00062	2022-11	2025-11
Antenna	Schwarzbeck	VULB 9168	EF01824	2022-10	2023-10
EMI Test Receiver	R&S	ESU8	EF00379	2022-10	2023-10

Test Equipment > 1 GHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC2	EF01616	2022-10	2023-10
Antenna	Schwarzbeck	BBHA 9120D	EF01678	2021-03	2024-03
Antenna	Schwarzbeck	HWRD 650	EF01679	2021-03	2024-03
Antenna	Amplifier Research	AT4560	EF00302	2021-06	2023-06
Spectrum analyzer	R&S	FSW43	EF00896	2022-08	2023-08

3.4.5 Procedure

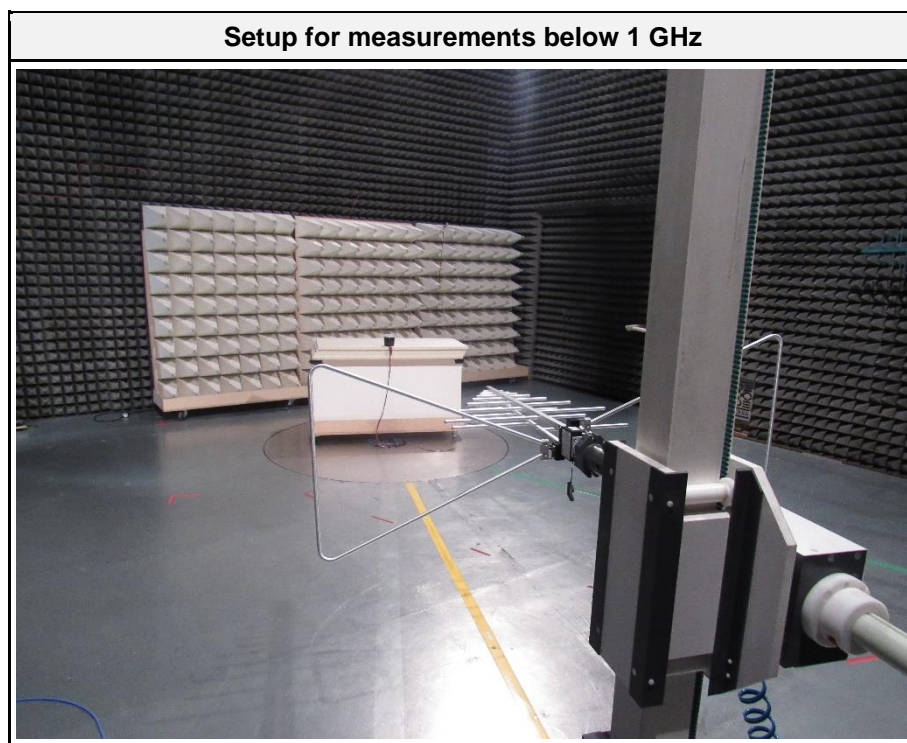
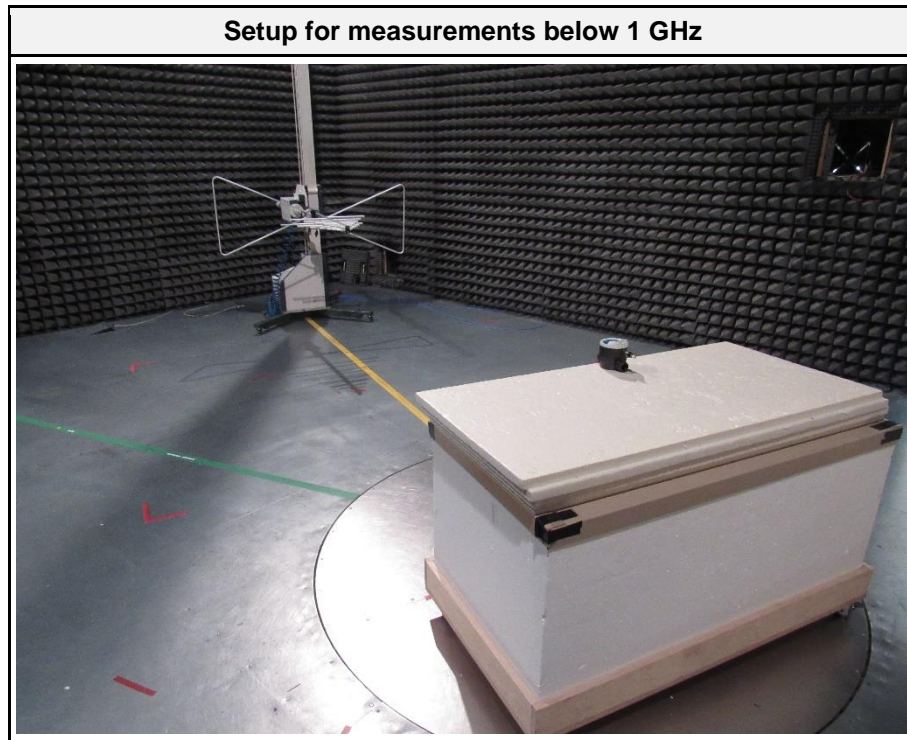
Test Procedure 30 - 1000 MHz
<ol style="list-style-type: none"> EUT is placed on a non conducting support at the center of a turn table 0.8 m above the ground EUT set to test mode The receiver is set to peak detection with max hold The EUT is rotated through 360° and the height of the antenna is varied from 1 m to 4 m All significant emissions are measured again using the corresponding final detector

Test Procedure > 1 GHz
<ol style="list-style-type: none"> EUT is placed on a non conducting support at the center of a turn table 1.5 m above the ground EUT set to test mode The receiver is set to peak detection with max hold The EUT is rotated through 360° and the height of the antenna is varied from 1 m to 4 m All significant emissions are measured again using the corresponding final detector

3.4.6 Results

Test Results						
Channel [MHz]	Emission [MHz]	Level [dBm]	Det.	Pol.	Limit [dBm]	Margin [dB]
450.25	450.236	-36.60	pk	ver	-20.00	-16.60
450.25	8752	-32.60	pk	ver	-20.00	-12.61

3.4.7 Setup Photos



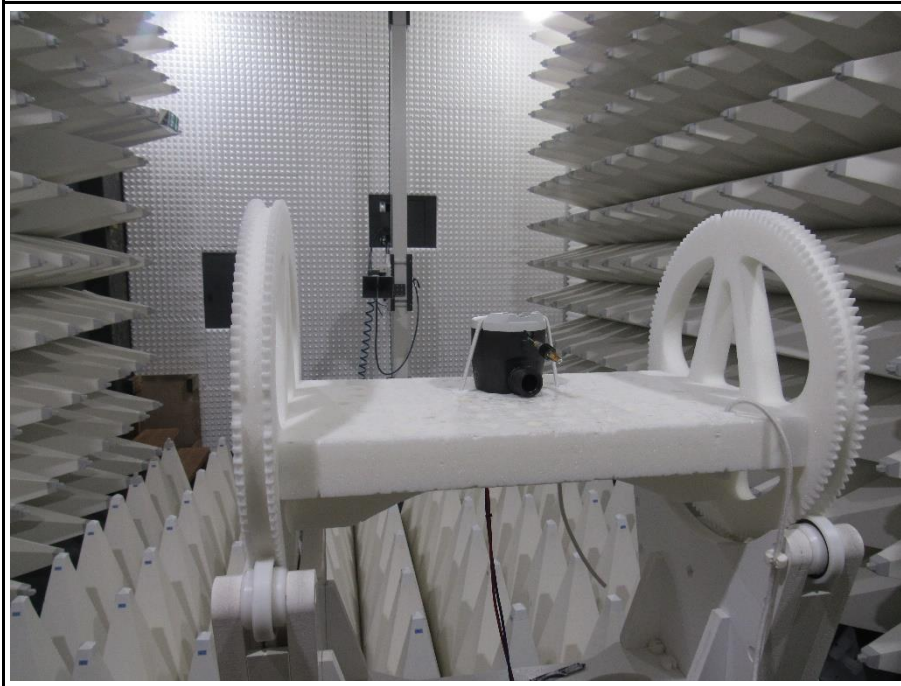
Test Setup with 10 dB attenuator and 50 Ohm load



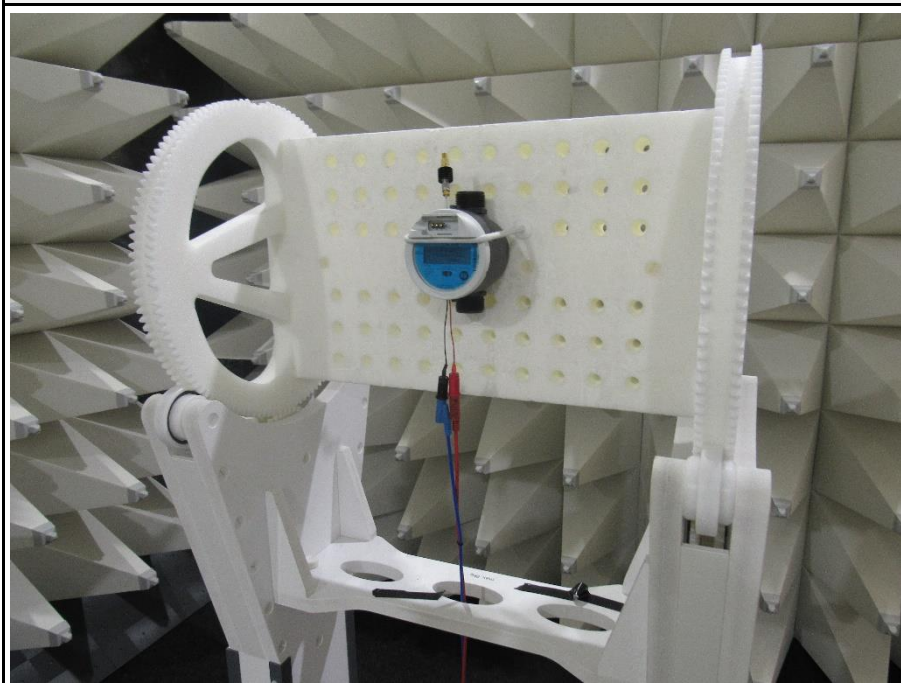
Setup for measurements above 1 GHz



Setup for measurements above 1 GHz



Test Setup with 10 dB attenuator and 50 Ohm load



3.5 Test Conditions and Results - Receiver spurious emissions

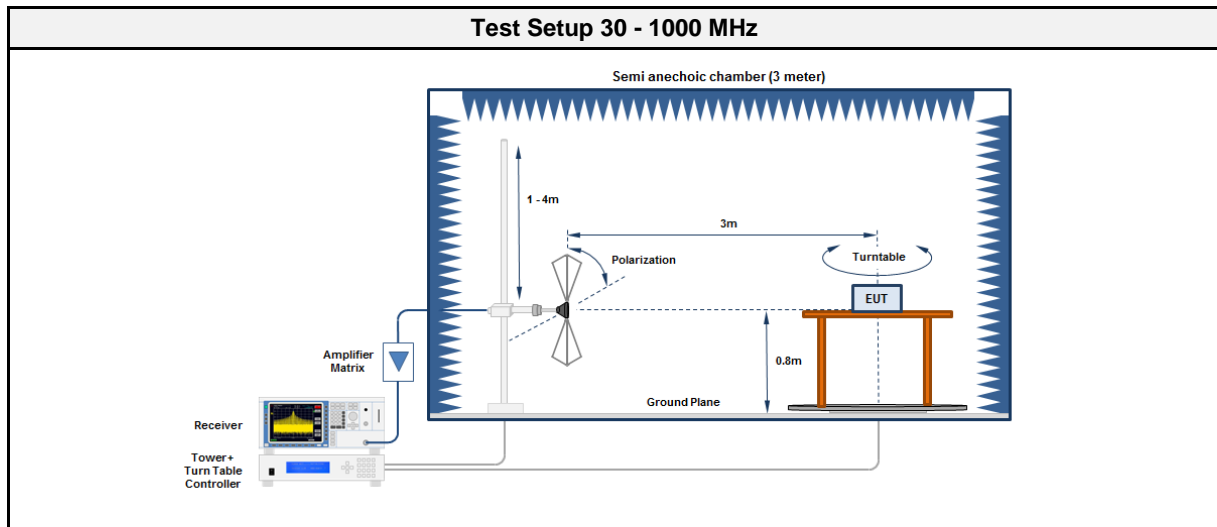
3.5.1 Information

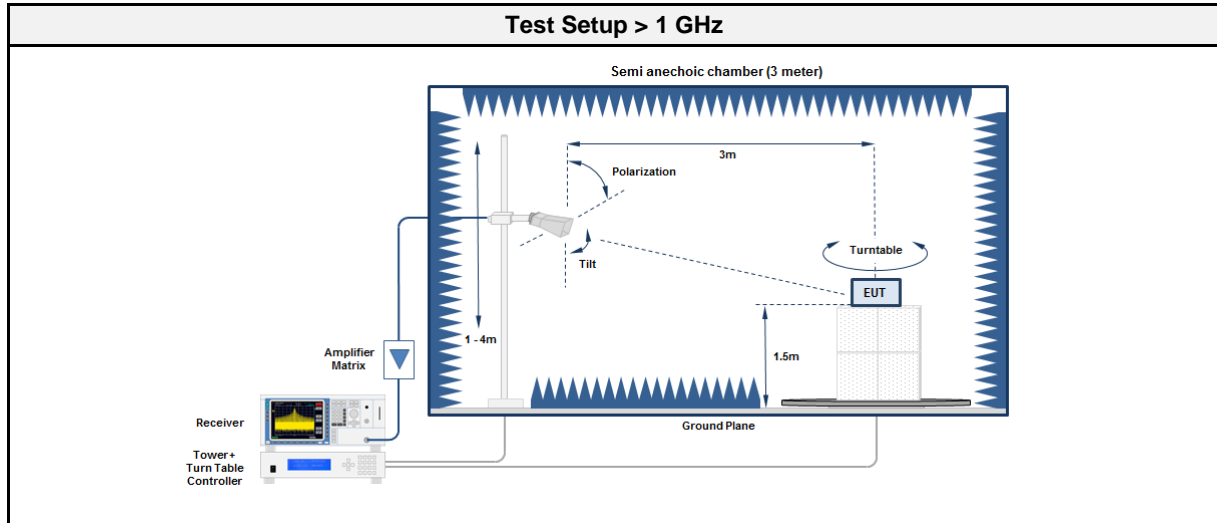
Test Information	
Reference	ISED RSS-Gen, Issue 5 (Sections 7.1)
Measurement Method	ANSI C63.26:2015 5.7
Test Method	Radiated
Test Mode	Receive
Test Range	30 MHz to 5th Harmonic
Measurement Uncertainty:	± 5.3 dB
Operator	Odai Qawasmeh
Date	2023-02-20 + 2023-02-21

3.5.2 Limits

Limits			
Frequency [MHz]	Detector	Field strength [$\mu\text{V}/\text{m}$]	Measurement distance [m]
30 - 88	Quasi-Peak	100	3
88 - 216	Quasi-Peak	150	3
216 - 960	Quasi-Peak	200	3
960 - 1000	Quasi-Peak	500	3
>1000	Average	500	3

3.5.3 Setup





3.5.4 Equipment

Test Software			
Description	Manufacturer	Name	Version
EMC Software	DARE Instruments	RadiMation	2020.1.8

Test Equipment 30 MHz - 1000 MHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC1	EF00062	2022-11	2025-11
Antenna	Schwarzbeck	VULB 9168	EF01824	2022-10	2023-10
EMI Test Receiver	R&S	ESU8	EF00379	2022-10	2023-10

Test Equipment > 1 GHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC1	EF01011	2022-11	2023-11
Antenna	Schwarzbeck	BBHA 9120D	EF01561	2021-11	2024-11
Antenna	Schwarzbeck	HWRD 650	EF01679	2021-03	2024-03
Antenna	Amplifier Research	AT4560	EF00302	2021-06	2023-06
Spectrum analyzer	R&S	FSU26	EF01407	2022-07	2023-07

3.5.5 Procedure

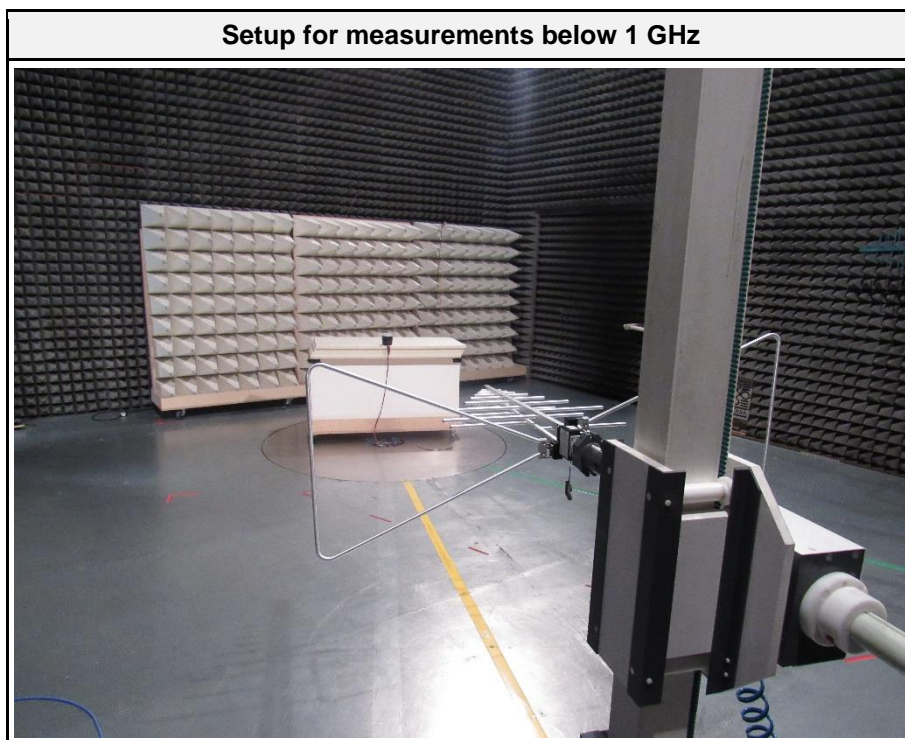
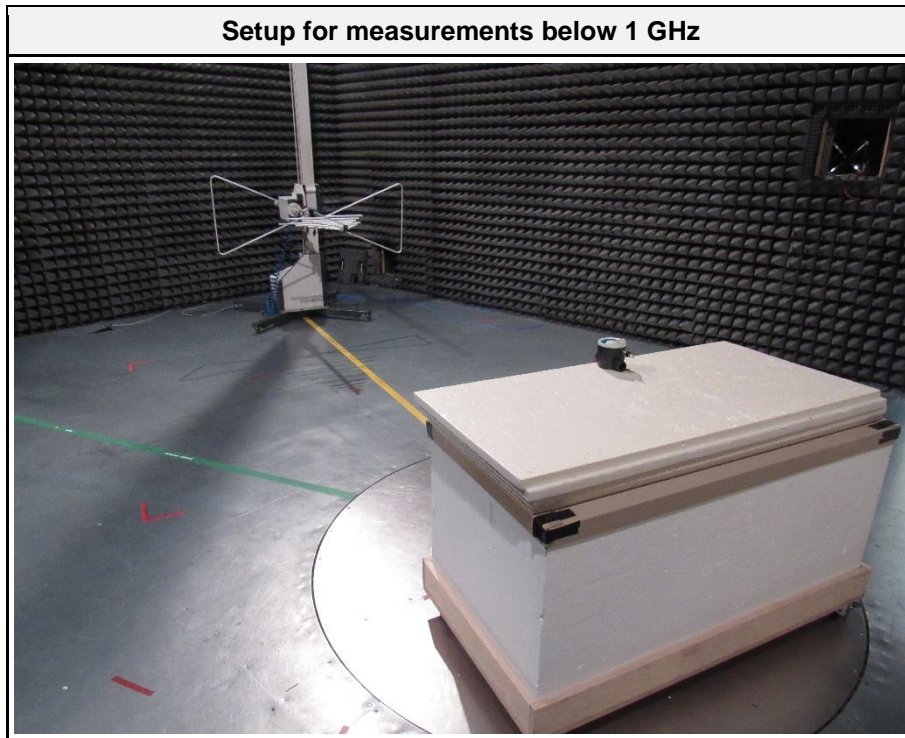
Test Procedure 30 - 1000 MHz
<ol style="list-style-type: none"> 1. EUT is placed on a non conducting support at the center of a turn table 0.8 m above the ground 2. EUT set to test mode 3. The receiver is set to peak detection with max hold 4. The EUT is rotated through 360° and the height of the antenna is varied from 1 m to 4 m 5. All significant emissions are measured again using the corresponding final detector

Test Procedure > 1 GHz
<ol style="list-style-type: none"> 1. EUT is placed on a non conducting support at the center of a turn table 1.5 m above the ground 2. EUT set to test mode 3. The receiver is set to peak detection with max hold 4. The EUT is rotated through 360° and the height of the antenna is varied from 1 m to 4 m 5. All significant emissions are measured again using the corresponding final detector

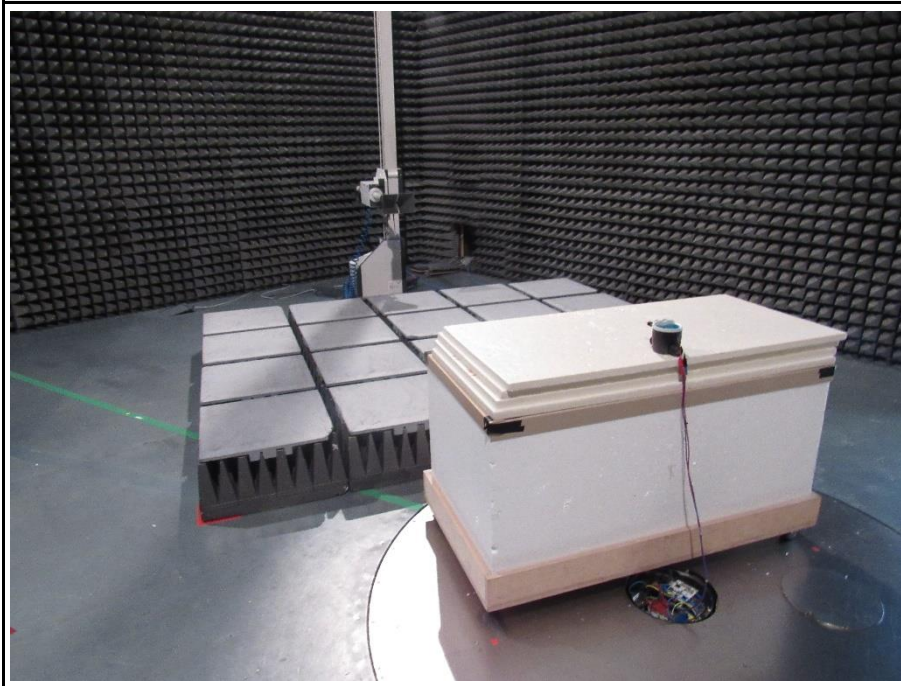
3.5.6 Results

Test Results						
Channel [MHz]	Emission [MHz]	Level [dBµV/m]	Det.	Pol.	Limit [dBµV/m]	Margin [dB]
450.25	624.125	33.60	pk	ver	46.00	-12.41
450.25	6028	49.02	pk	ver	74.00	-24.98
450.25	6028	36.80	avg	ver	53.98	-17.18
450.25	17849	42.74	pk	ver	74.00	-31.26
450.25	17849	31.47	avg	ver	53.98	-22.51
450.25	19567	46.80	pk	ver	74.00	-27.20

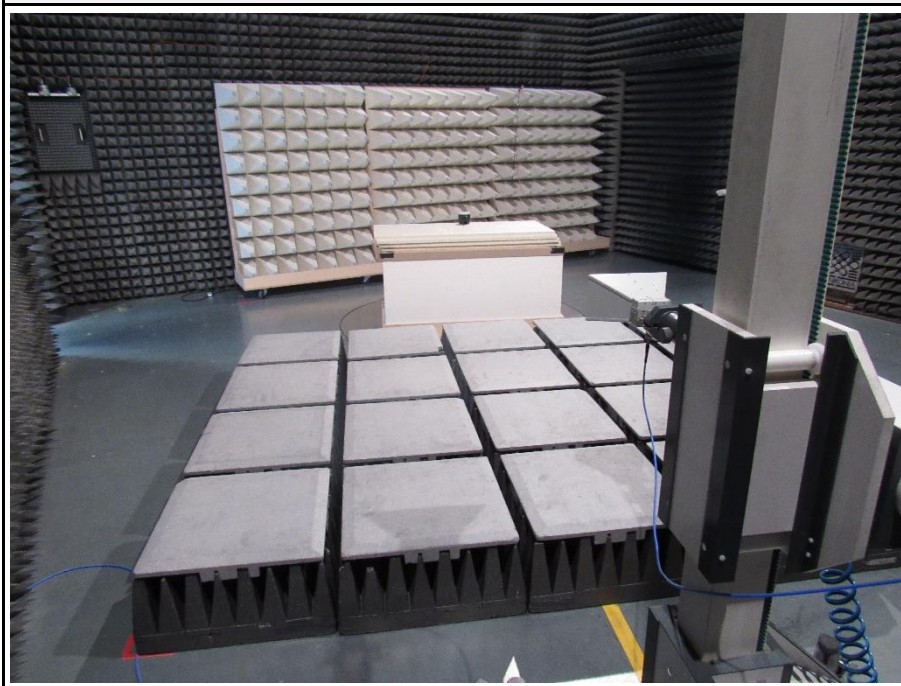
3.5.7 Setup Photos



Setup for measurements above 1 GHz



Setup for measurements above 1 GHz



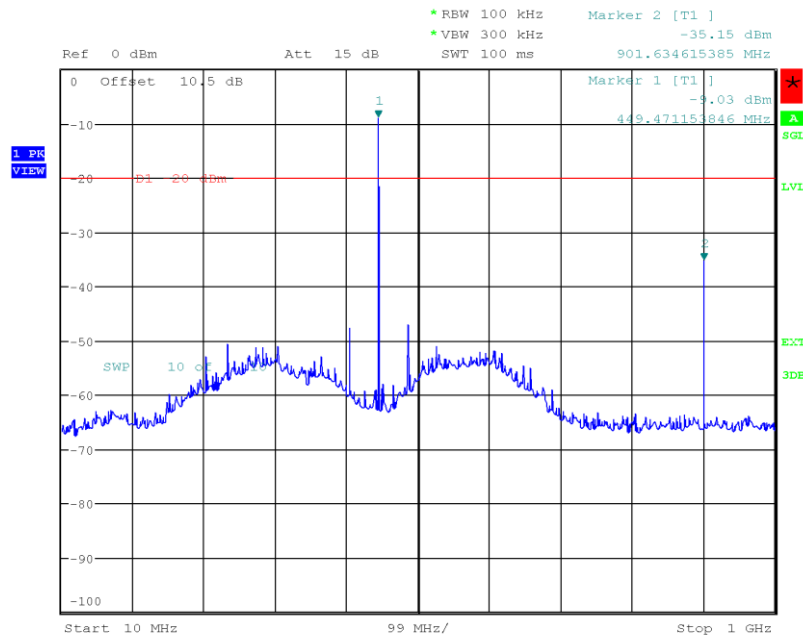
Test Setup with 10 dB attenuator and 50 Ohm load



ANNEX A Transmitter conducted emissions

Spurious emissions at antenna terminal

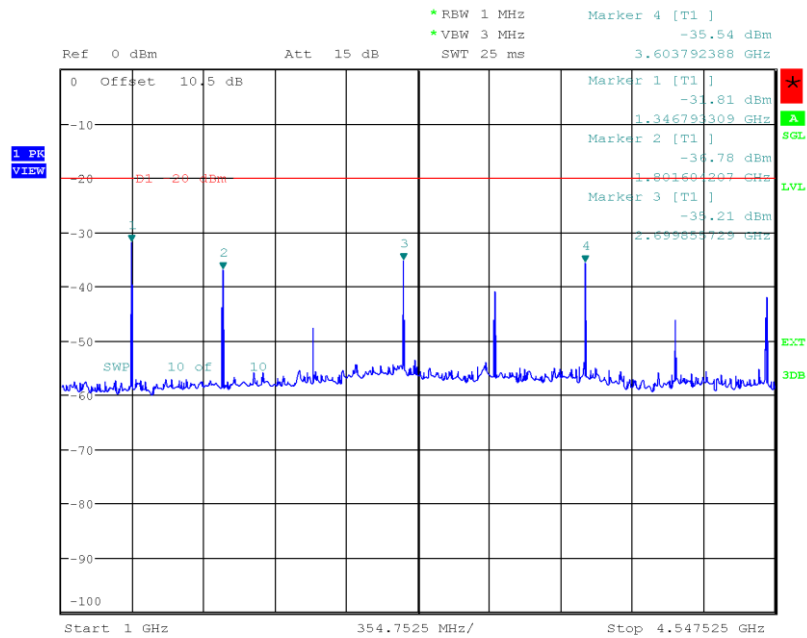
Project Number: G0M-2002-8859
 Applicant: Kamstrup A/S
 Model Description: Ultrasonic water meter
 Model: KWM2220
 Test Sample ID: 29577
 Operator: Toralf Jahn
 Test Site: Eurofins Product Service GmbH
 Test Date: 2020-06-03
 Operating Conditions: Tnom/Vnom
 Mode: 450.25 MHz



Date: 3.JUN.2020 13:24:39

Spurious emissions at antenna terminal

Project Number: G0M-2002-8859
 Applicant: Kamstrup A/S
 Model Description: Ultrasonic water meter
 Model: KWM2220
 Test Sample ID: 29577
 Operator: Toralf Jahn
 Test Site: Eurofins Product Service GmbH
 Test Date: 2020-06-03
 Operating Conditions: Tnom/Vnom
 Mode: 450.25 MHz

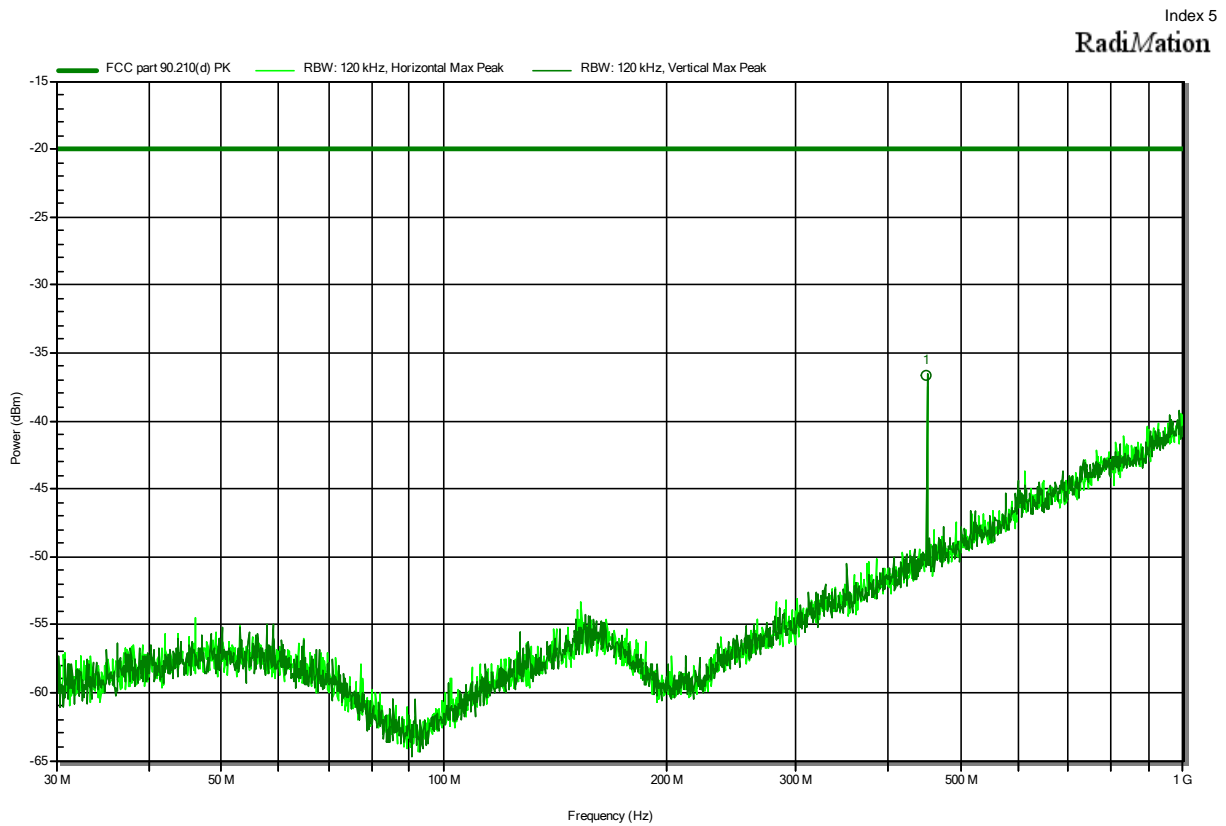


Date: 3.JUN.2020 13:34:08

ANNEX B Transmitter radiated emissions

Radiated Spurious Emissions according to RSS-119, Issue 12, 47 CFR Part 90 Subpart I

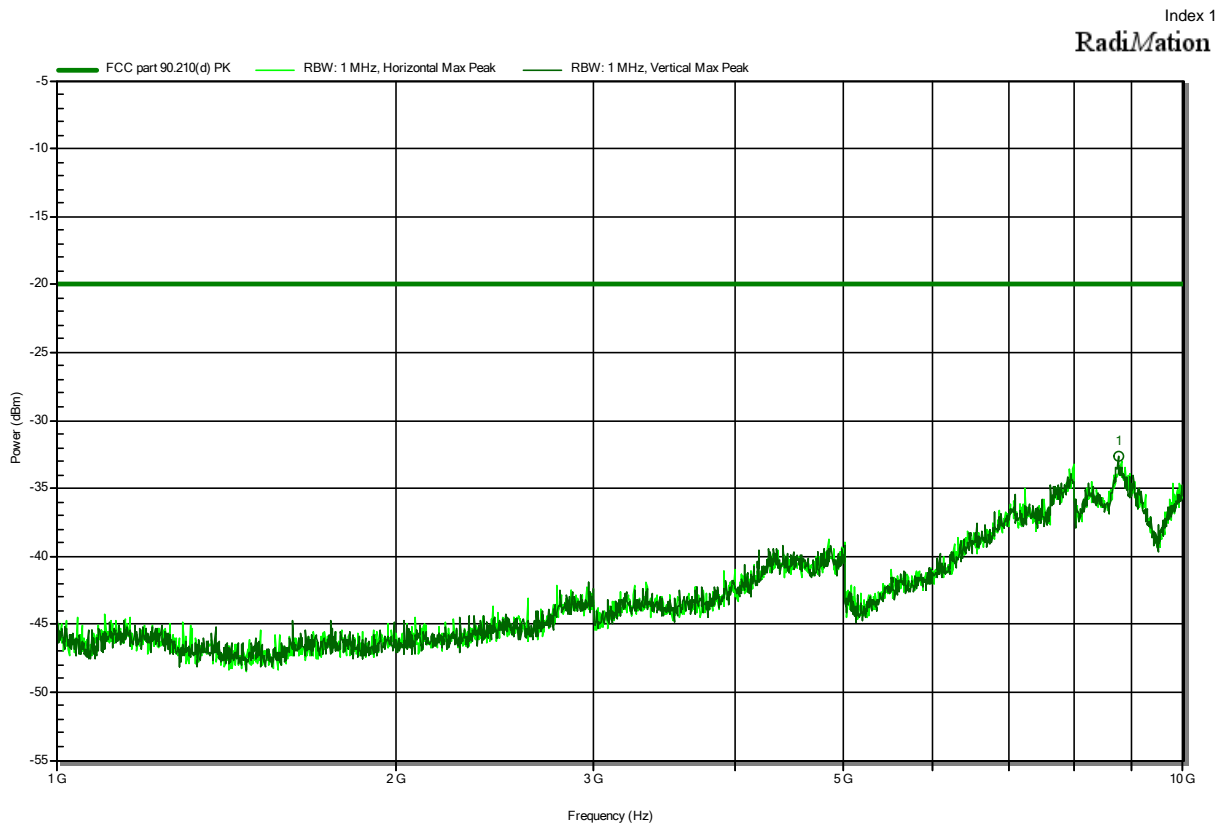
Project Number: G0M-2211-1783
 Applicant: Kamstrup A/S
 Model Description: Ultrasonic water meter
 Model: KW2220
 Test Sample ID: 43142
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Qawasmeh
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 21 °Celsius, Vnom: 3.6 VDC
 Antenna: Schwarzbeck VULB 9168
 Measurement distance: 3 m
 Mode: TX; 450.25 MHz, CW, 1 tone, 30 dBm output with 10 dB attenuation and 50 Ohm load
 Test Date: 2023-02-21
 Note:



Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Polarization
450.236 MHz	-36.6 dBm	---	---	Carrier	Vertical

Radiated Spurious Emissions according to RSS-119, Issue 12, 47 CFR Part 90 Subpart I

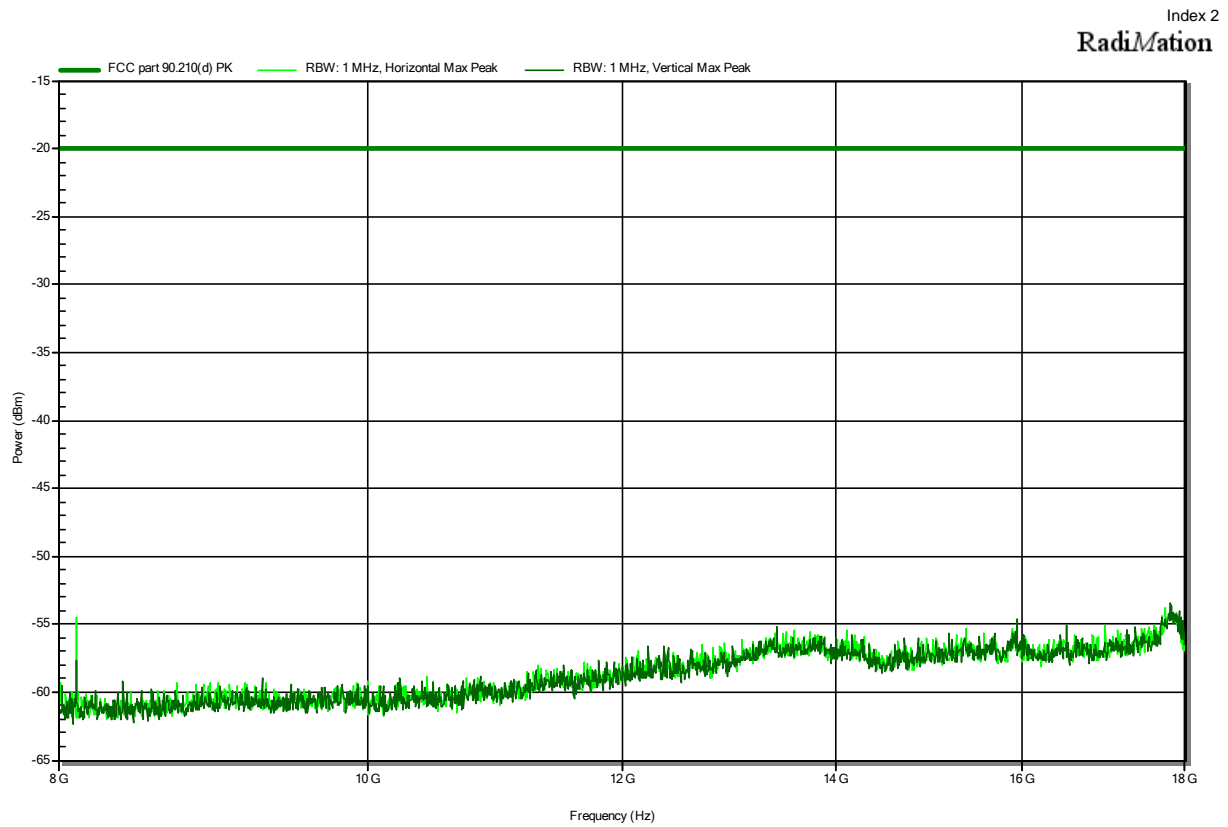
Project Number: G0M-2211-1783
 Applicant: Kamstrup A/S
 Model Description: Ultrasonic water meter
 Model: KW2220
 Test Sample ID: 43142
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Qawasmeh
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 24 °Celsius, Vnom: 3.6 VDC
 Antenna: Schwarzbeck BBHA 9120B
 Measurement distance: 3 m
 Mode: Tx; 450.25 MHz, CW, 1 tone, 30 dBm output with 10 dB attenuation and 50 Ohm load
 Test Date: 2023-02-20
 Note:



Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Polarization
8.752 GHz	-32.6 dBm	-20 dBm	-12.61 dB	Pass	Vertical

Radiated Spurious Emissions according to RSS-119, Issue 12, 47 CFR Part 90 Subpart I

Project Number: G0M-2211-1783
 Applicant: Kamstrup A/S
 Model Description: Ultrasonic water meter
 Model: KW2220
 Test Sample ID: 43142
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Qawasmeh
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 24 °Celsius, Vnom: 3.6 VDC
 Antenna: Schwarzbeck HWRD 650
 Measurement distance: 3 m
 Mode: Tx; 450.25 MHz, CW, 1 tone, 30 dBm output with 10 dB attenuation and 50 Ohm load
 Test Date: 2023-02-20
 Note:

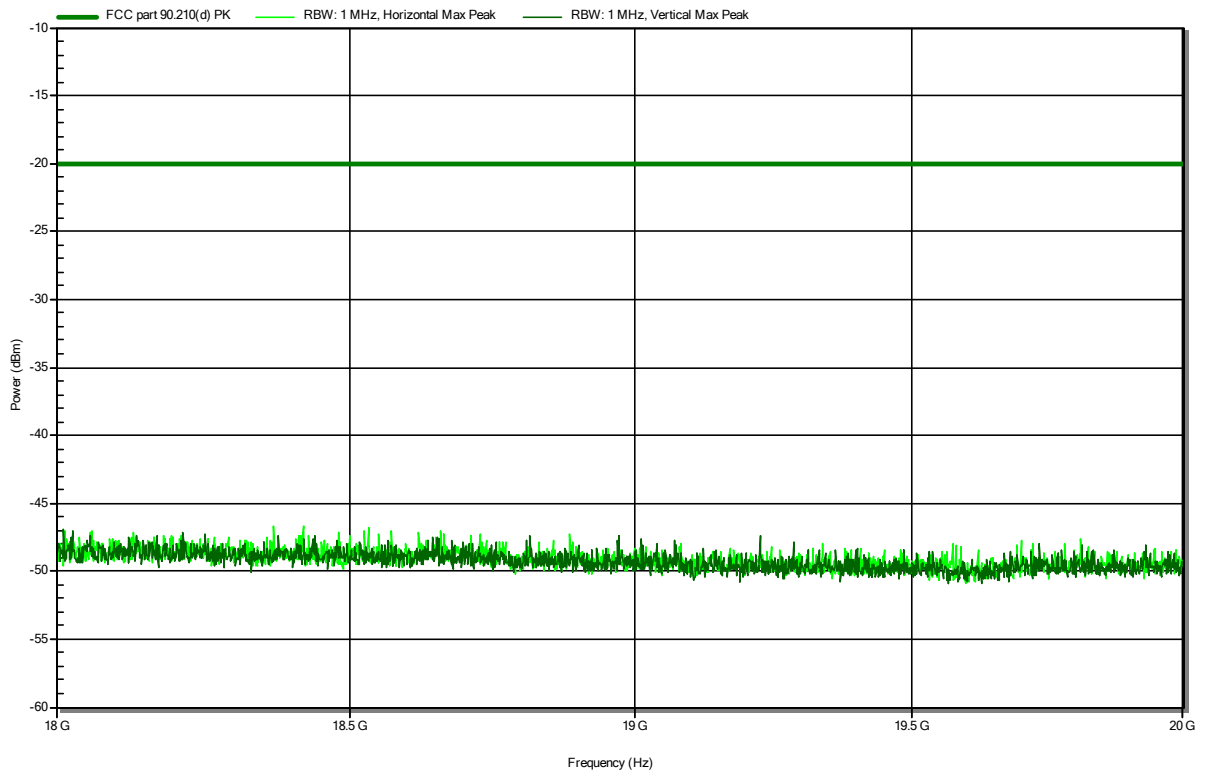


Radiated Spurious Emissions according to RSS-119, Issue 12, 47 CFR Part 90 Subpart I

Project Number: G0M-2211-1783
 Applicant: Kamstrup A/S
 Model Description: Ultrasonic water meter
 Model: KW2220
 Test Sample ID: 43142
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Qawasmeh
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 24 °Celsius, Vnom: 3.6 VDC
 Antenna: Amplifier Research AT4560
 Measurement distance: 3 m
 Mode: Tx; 450.25 MHz, CW, 1 tone, 30 dBm output with 10 dB attenuation and 50 Ohm load
 Test Date: 2023-02-20
 Note:

Index 4

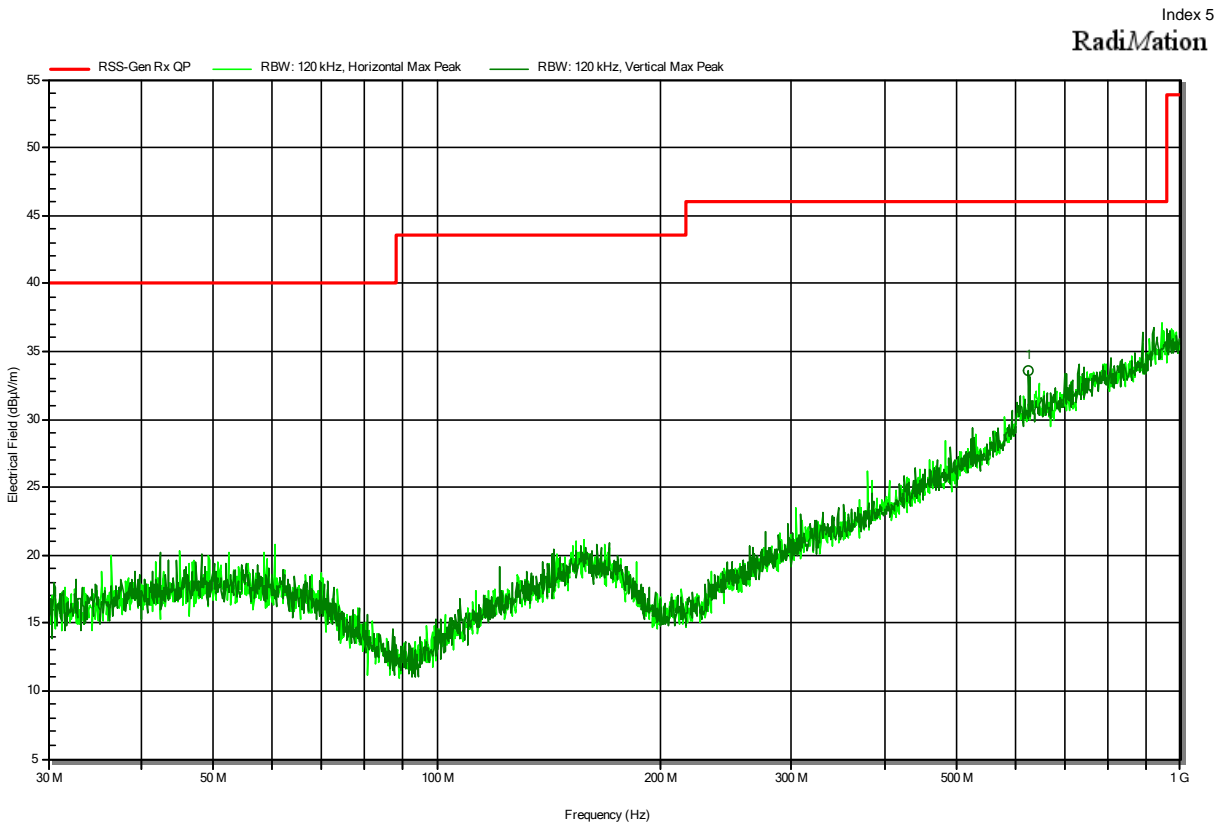
RadiMation



ANNEX C Receiver radiated emissions

Radiated Spurious Emissions according to RSS-119, Issue 12, RSS-Gen, Issue 5

Project Number: G0M-2211-1783
 Applicant: Kamstrup A/S
 Model Description: Ultrasonic water meter
 Model: KW2220
 Test Sample ID: 43142
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Qawasmeh
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 21 °Celsius, Vnom: 3.6 VDC
 Antenna: Schwarzbeck VULB 9168
 Measurement distance: 3 m
 Mode: Rx; 450.25 MHz with 10 dB attenuator and 50 Ohm load
 Test Date: 2023-02-21
 Note:



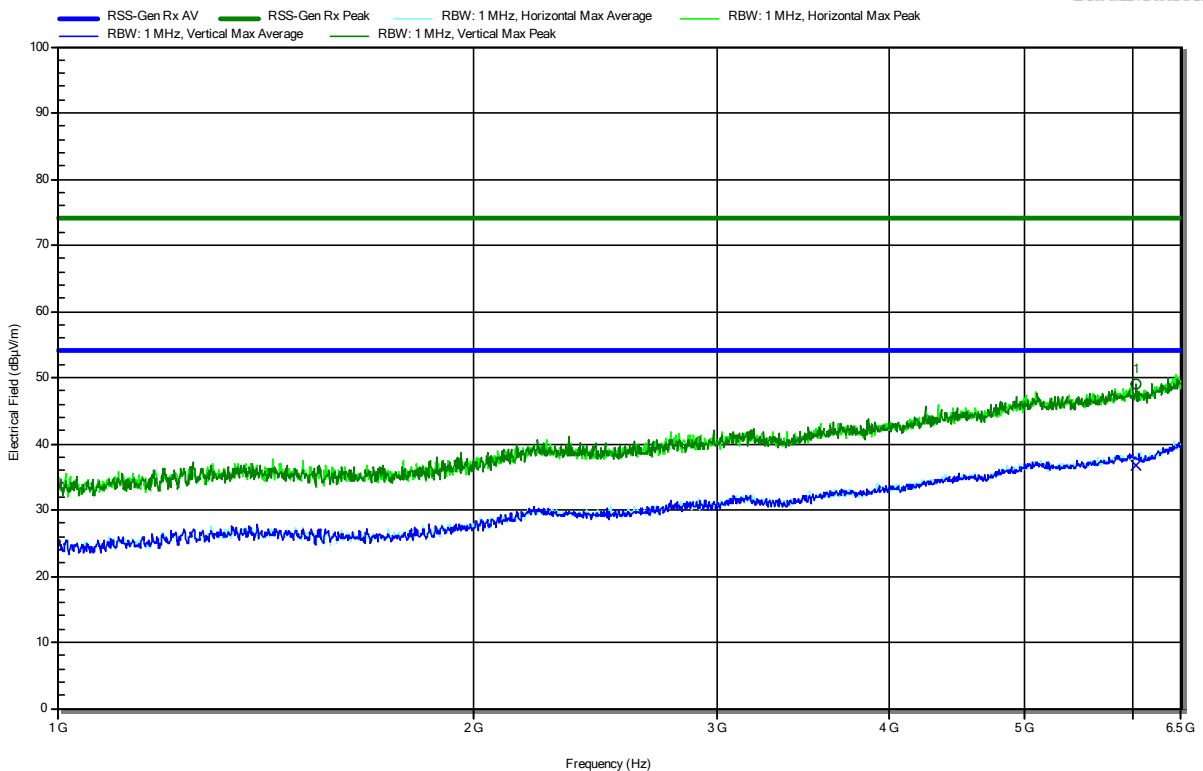
Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Polarization
624.125 MHz	33.6 dBµV/m	46 dBµV/m	-12.41 dB	Pass	Vertical

Radiated Spurious Emissions according to RSS-119, Issue 12, RSS-Gen, Issue 5

Project Number: G0M-2211-1783
 Applicant: Kamstrup A/S
 Model Description: Ultrasonic water meter
 Model: KW2220
 Test Sample ID: 43142
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Qawasmeh
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 21 °Celsius, Vnom: 3.6 VDC
 Antenna: Schwarzbeck BBHA 9120D
 Measurement distance: 3 m
 Mode: Rx; 450.25 MHz with 10 dB attenuator and 50 Ohm load
 Test Date: 2023-02-21
 Note:

Index 6

RadiMation



Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Polarization
6.028 GHz	49.02 dBµV/m	74 dBµV/m	-24.98 dB	Pass	Vertical
Frequency	Average	Average Limit	Average Difference	Average Status	Polarization
6.028 GHz	36.8 dBµV/m	53.98 dBµV/m	-17.18 dB	Pass	Vertical

Test Report No.: G0M-2211-1783-TFC090PMR-V01

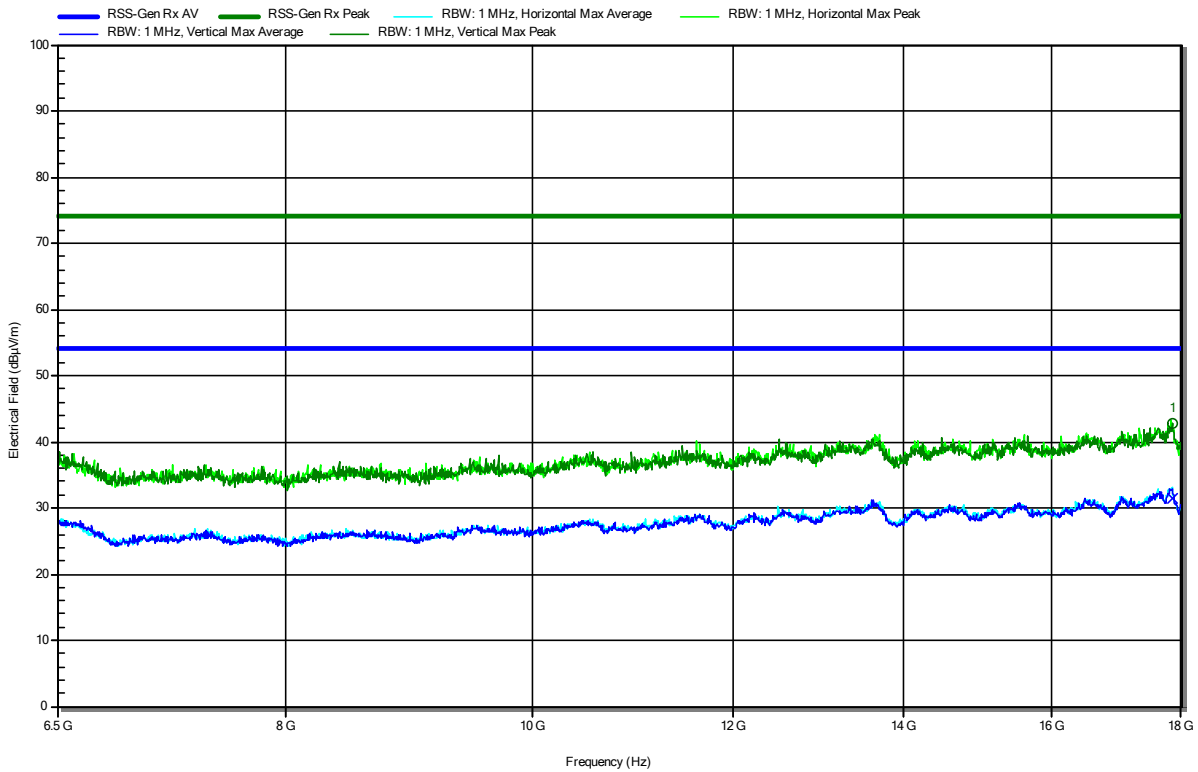
Eurofins Product Service GmbH
 Storkower Str. 38c, D-15526 Reichenwalde, Germany

Radiated Spurious Emissions according to RSS-119, Issue 12, RSS-Gen, Issue 5

Project Number: G0M-2211-1783
 Applicant: Kamstrup A/S
 Model Description: Ultrasonic water meter
 Model: KW2220
 Test Sample ID: 43142
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Qawasmeh
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 21 °Celsius, Vnom: 3.6 VDC
 Antenna: Schwarzbeck HWRD 650
 Measurement distance: 3 m
 Mode: Rx; 450.25 MHz with 10 dB attenuator and 50 Ohm load
 Test Date: 2023-02-21
 Note:

Index 10

RadiMation



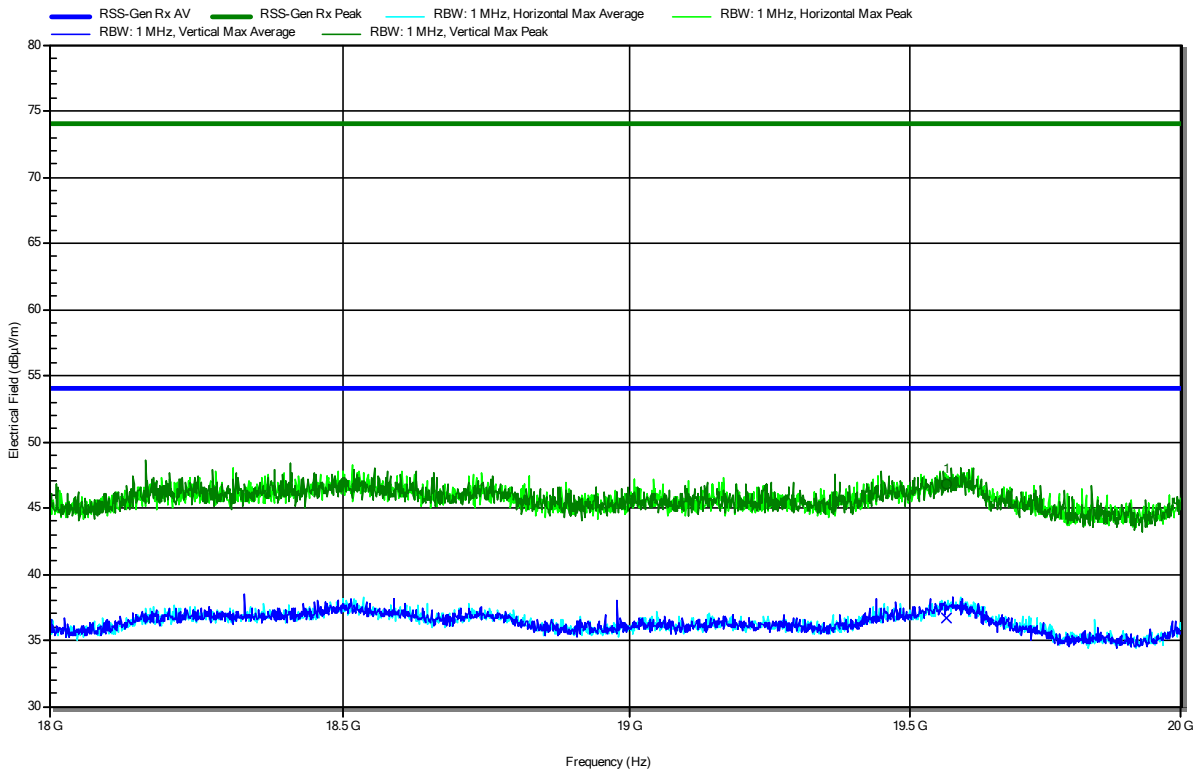
Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Polarization
17.849 GHz	42.74 dBµV/m	74 dBµV/m	-31.26 dB	Pass	Vertical
Frequency	Average	Average Limit	Average Difference	Average Status	Polarization
17.849 GHz	31.47 dBµV/m	53.98 dBµV/m	-22.51 dB	Pass	Vertical

Radiated Spurious Emissions according to RSS-119, Issue 12, RSS-Gen, Issue 5

Project Number: G0M-2211-1783
 Applicant: Kamstrup A/S
 Model Description: Ultrasonic water meter
 Model: KW2220
 Test Sample ID: 43142
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Qawasmeh
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 21 °Celsius, Vnom: 3.6 VDC
 Antenna: Amplifier Research AT4560
 Measurement distance: 3 m
 Mode: Rx; 450.25 MHz with 10 dB attenuator and 50 Ohm load
 Test Date: 2023-02-21
 Note:

Index 9

RadiMation



Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Polarization
19.567 GHz	46.8 dBµV/m	74 dBµV/m	-27.2 dB	Pass	Vertical
Frequency	Average	Average Limit	Average Difference	Average Status	Polarization
19.567 GHz	36.64 dBµV/m	53.98 dBµV/m	-17.34 dB	Pass	Vertical

=== END OF TEST REPORT ===