



<b>FCC TEST REPORT</b> <b>FCC 47 CFR Part 90</b> <b>Private Land Mobile Radio Services (PMR)</b>	
<b>Report Reference No.</b> .....	G0M-1707-6700-TFC90PMR-V01
<b>Testing Laboratory</b> .....	Eurofins Product Service GmbH
Address .....	Storkower Str. 38c 15526 Reichenwalde Germany
Accreditation .....	<div style="display: flex; align-items: center; justify-content: center;">   </div> <p>A2LA Accredited Testing Laboratory, Certificate No.: 1983.01            FCC Test Firm Designation Number: DE0008            IC OATS Filing assigned code: 3470A-2</p>
<b>Applicant's name</b> .....	Kamstrup A/S
Address .....	Industrivej 28 8660 Skanderborg DENMARK
<b>Test specification:</b>	
Standard.....	47 CFR Part 90I
<b>Equipment under test (EUT):</b>	
Product description	Ultrasonic water meter
Model No.	FlowIQ 2250
Additional Model(s)	FlowIQ 3250 HW: 620220101 rev 00 / RF board 55501605 rev D1
Brand Name(s)	Kamstrup
Hardware version	620120101 rev A1 / RF board 55501605 rev D1
Firmware / Software version	50981336 rev E1 / 55141470 rev C1
	FCC-ID: OUY-FLOWX250    IC: N/A
<b>Test result</b>	<b>Passed</b>

**Possible test case verdicts:**

- neither assessed nor tested ..... : N/N
- required by standard but not appl. to test object ..... : N/A
- required by standard but not tested ..... : N/T
- not required by standard for the test object ..... : N/R
- test object does meet the requirement ..... : P (Pass)
- test object does not meet the requirement ..... : F (Fail)

**Testing:**


Test Lab Temperature ..... : 20 – 23 °C


Test Lab Humidity ..... : 32 – 38 %

Date of receipt of test item ..... : 2017-08-21

Date (s) of performance of tests ..... : 2017-08-21 – 2017-08-25

Compiled by ..... : Toralf Jahn

Tested by (+ signature) ..... : Toralf Jahn  
 (Responsible for Test) 

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

Date of issue ..... : 2017-09-14

Total number of pages ..... : 54

**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:**

The following models are additional models to the series. They were neither tested nor assessed nor evaluated.

FlowIQ 2250 HW:620120102 rev A1 / RF board 55501605 rev D1  
 FlowIQ 2250 HW:620120103 rev A1 / RF board 55501605 rev D1  
 FlowIQ 3250 HW:620220102 rev 00 / RF board 55501605 rev D1  
 FlowIQ 3250 HW:620220103 rev 00 / RF board 55501605 rev D1  
 FlowIQ 3250 HW:620220104 rev 00 / RF board 55501605 rev D1  
 FlowIQ 3250 HW:620220105 rev 00 / RF board 55501605 rev D1

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## Version History

Version	Issue Date	Remarks	Revised by
01	2017-09-14	Initial Release	

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## 1 Equipment (Test item) Description

<b>Description</b>	Ultrasonic water meter	
<b>Model</b>	FlowIQ 2250	
<b>Additional Model(s)</b>	FlowIQ 3250 HW: 620220101 rev 00 / RF board 55501605 rev D1	
<b>Brand Name(s)</b>	Kamstrup	
<b>Serial number</b>	None	
<b>Hardware version</b>	620120101 rev A1 / RF board 55501605 rev D1	
<b>Software / Firmware version</b>	50981336 rev E1 / 55141470 rev C1	
<b>PMN</b>	None	
<b>HVIN</b>	None	
<b>FVIN</b>	None	
<b>HMN</b>	None	
<b>FCC-ID</b>	OUY-FLOWX250	
<b>IC</b>	N/A	
<b>Equipment type</b>	End Product	
<b>Radio type</b>	PMR	
<b>Number of Radios</b>	1	
<b>Operating frequency range</b>	450.025 – 469.9875 MHz	
<b>Assigned frequency band</b>	421 – 512 MHz	
<b>Main test frequencies</b>	F <sub>LOW</sub>	450.025 MHz
	F <sub>MID</sub>	460.11875 MHz
	F <sub>HIGH</sub>	469.9875 MHz
<b>Modulations</b>	4-GFSK	
<b>Emission designator</b>	F1D	
<b>Channel bandwidth</b>	12.5 kHz	
<b>Authorized bandwidth</b>	11.25 kHz	
<b>Channel spacing</b>	6.25 kHz	
<b>Number of antennas</b>	3	

<b>Antenna 1</b>	Type	External
	Model	1653094
	Manufacturer	Kamstrup A/S
	Gain	-0.6 dBi
<b>Antenna 2</b>	Type	External
	Model	6699490
	Manufacturer	Kamstrup A/S
	Gain	0.5 dBi
<b>Antenna 3</b>	Type	External
	Model	6697902
	Manufacturer	Kamstrup A/S
	Gain	0.0 dBi
<b>Manufacturer</b>	Kamstrup A/S Industrivej 28 8660 Skanderborg DENMARK	
<b>Power supply</b>	V <sub>NOM</sub>	3.6 VDC (lithium battery)
	V <sub>MIN</sub>	3.0
	V <sub>MAX</sub>	3.6
<b>AC/DC-Adaptor</b>	Model	none
	Vendor	none
	Input	none
	Output	none
<b>Temperature</b>	T <sub>NOM</sub>	20°C
	T <sub>MIN</sub>	-30°C
	T <sub>MAX</sub>	65°C

**Additional information:**

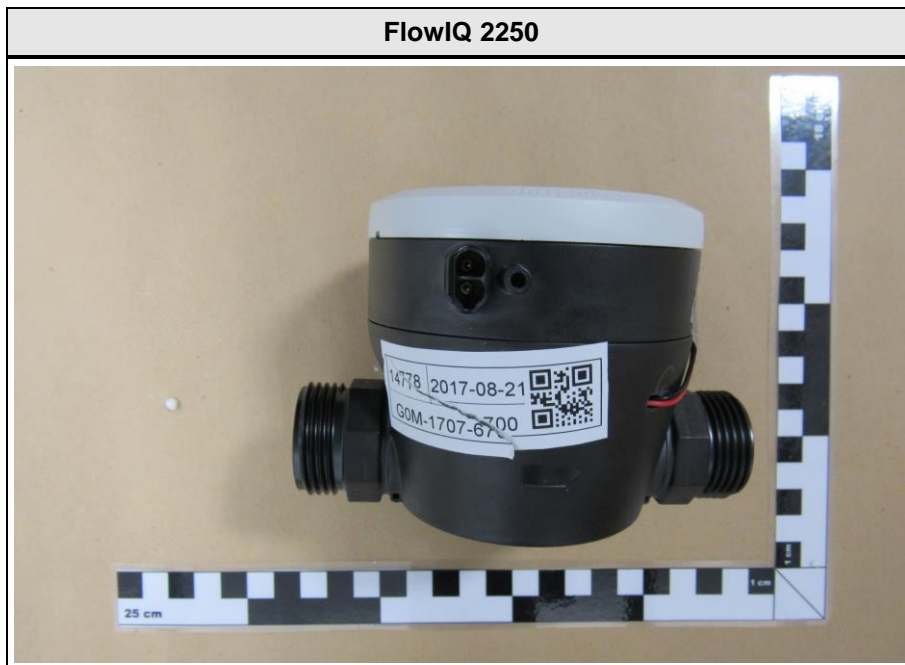
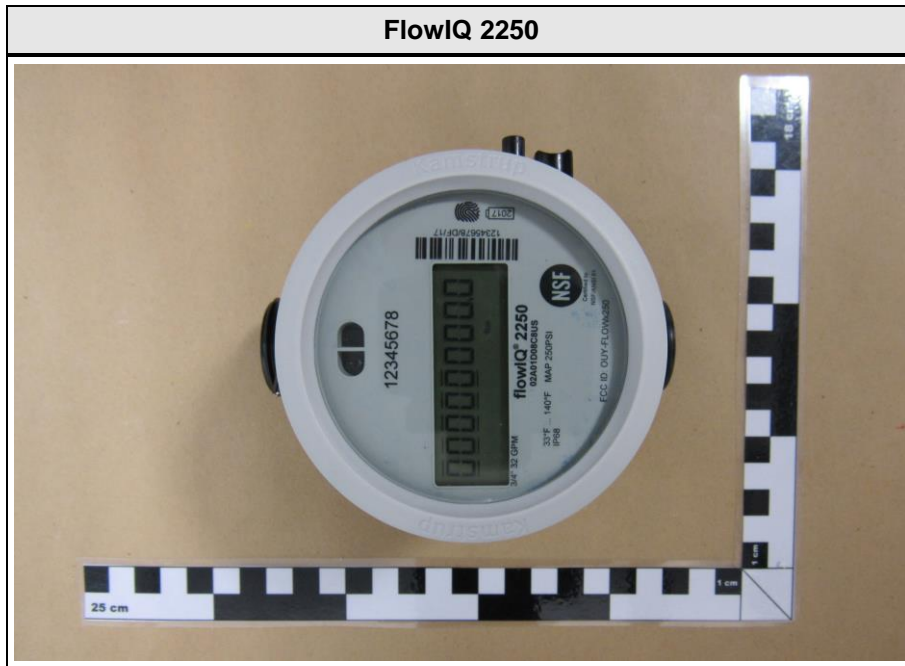
Antenna 2 and 3 each come in two versions. The difference between the two version are the length of the cable.

The data listed above belongs to the versions with the shortest cables and hence highest gain.

For Antenna 2 the data is presented for the wall mounted antenna version 6699490 which has a 2 meter long cable. The second version is called 6699491. This version features the same antenna as 6699490, but it has a cable up to 20 meters.

For Antenna 3 the data is presented for the pit antenna version 6697902, which has a 2 meter cable. The second version is called 6697903. This features the same antenna as 6697902, but it has a cable up to 7.5 meters.

1.1 Photos - Equipment external

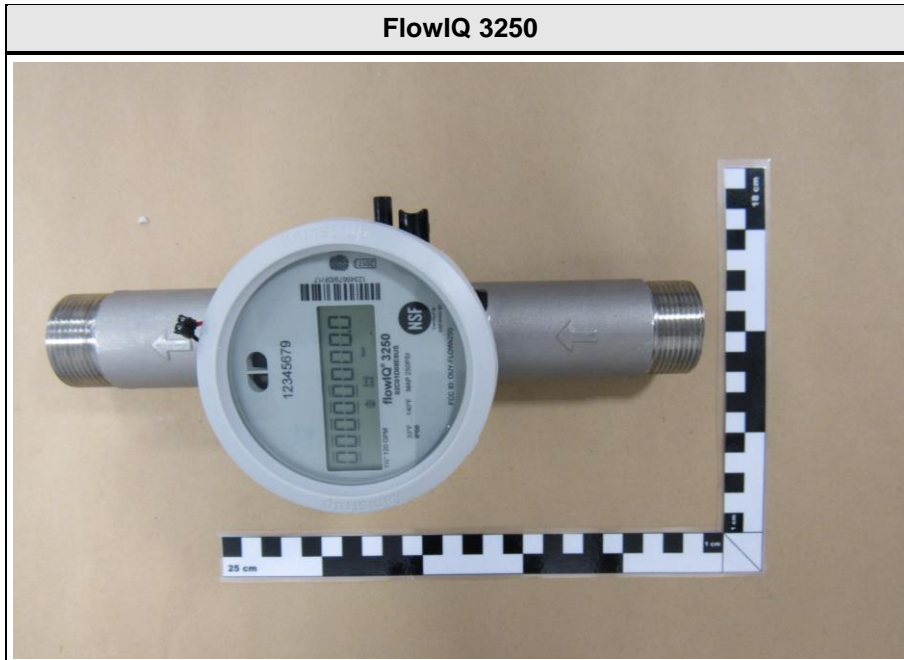




FlowIQ 2250

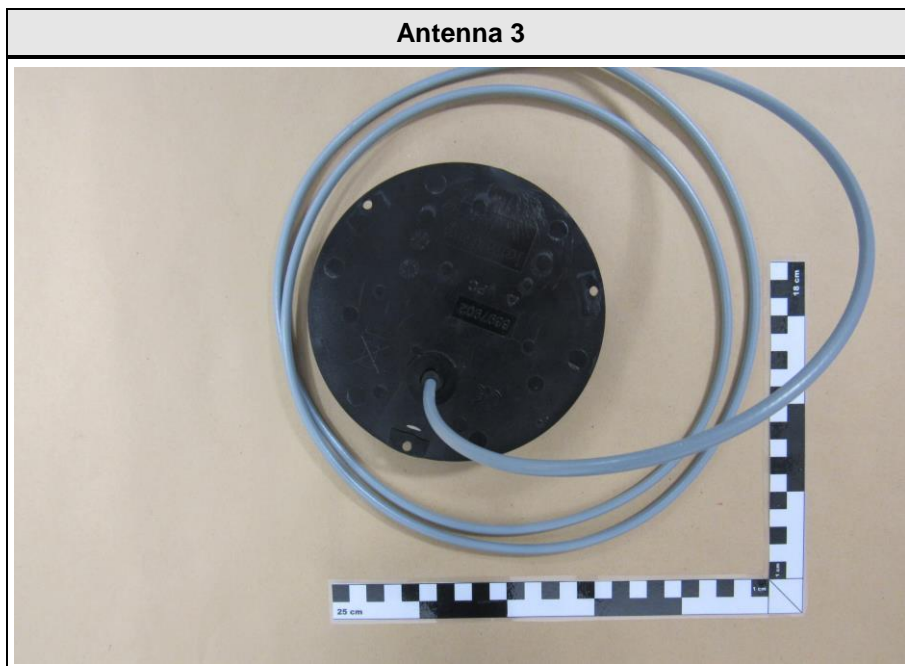


FlowIQ 3250







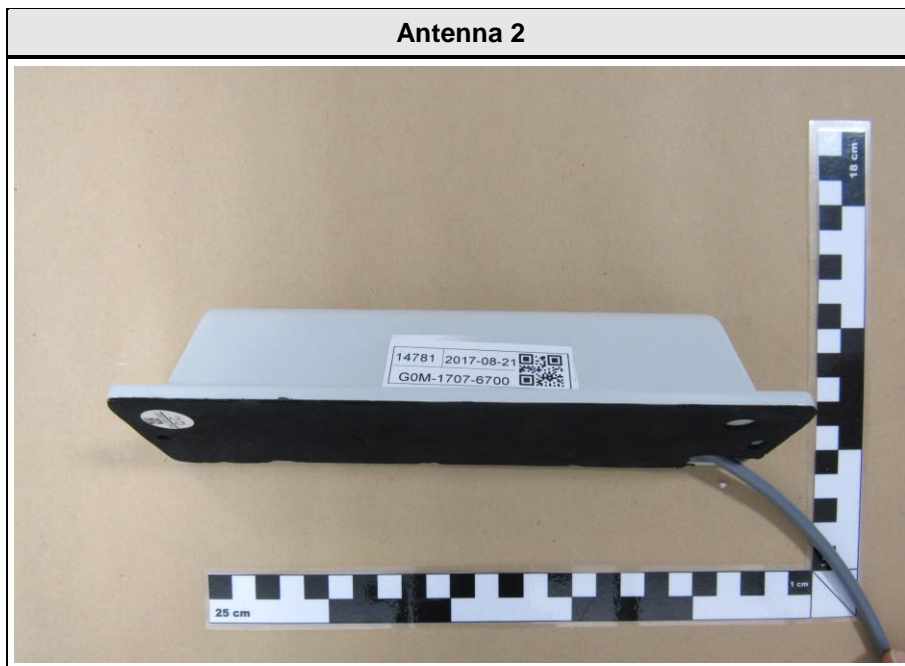


Antenna 3

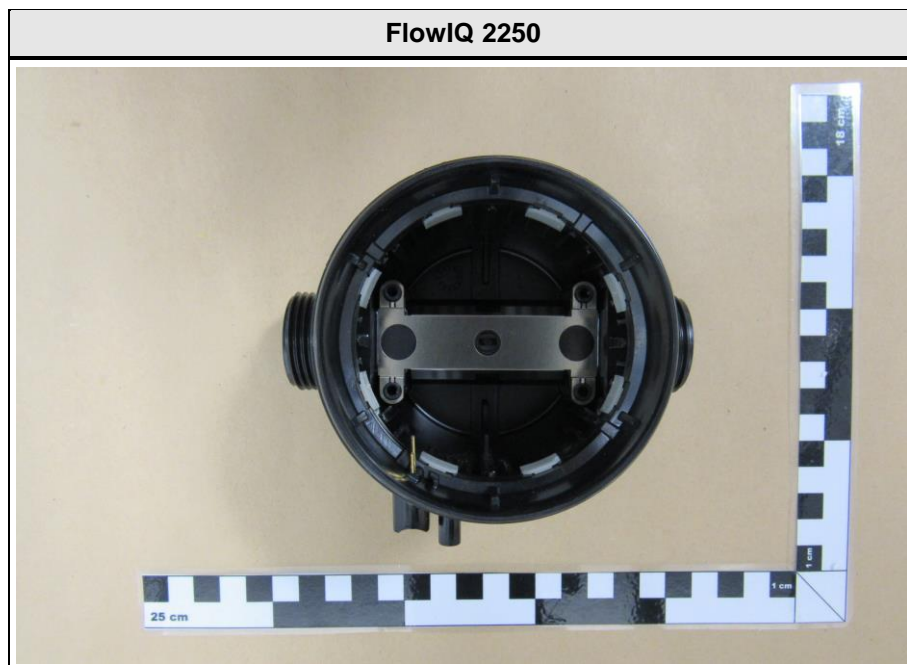
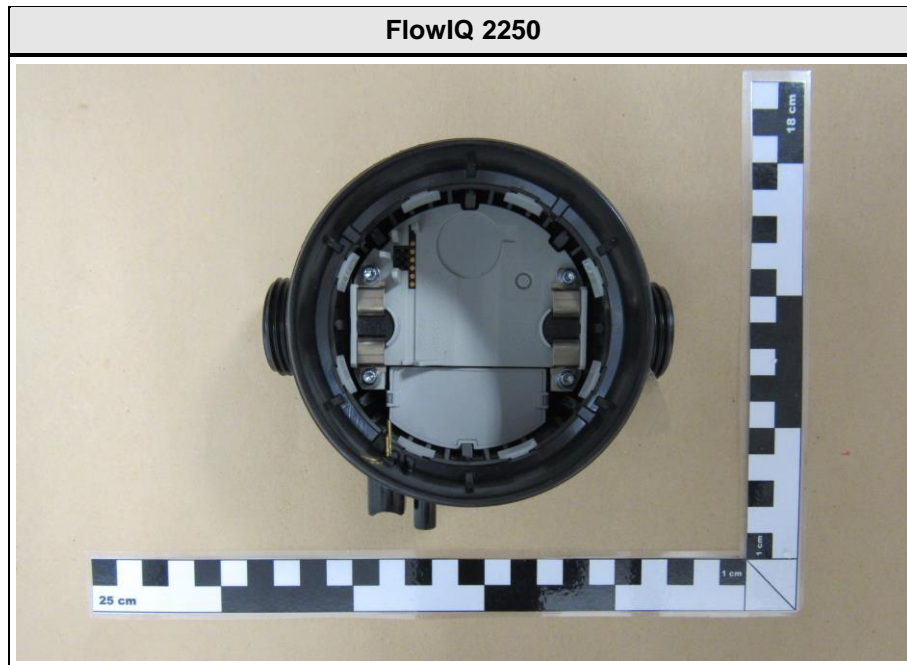


Antenna 2

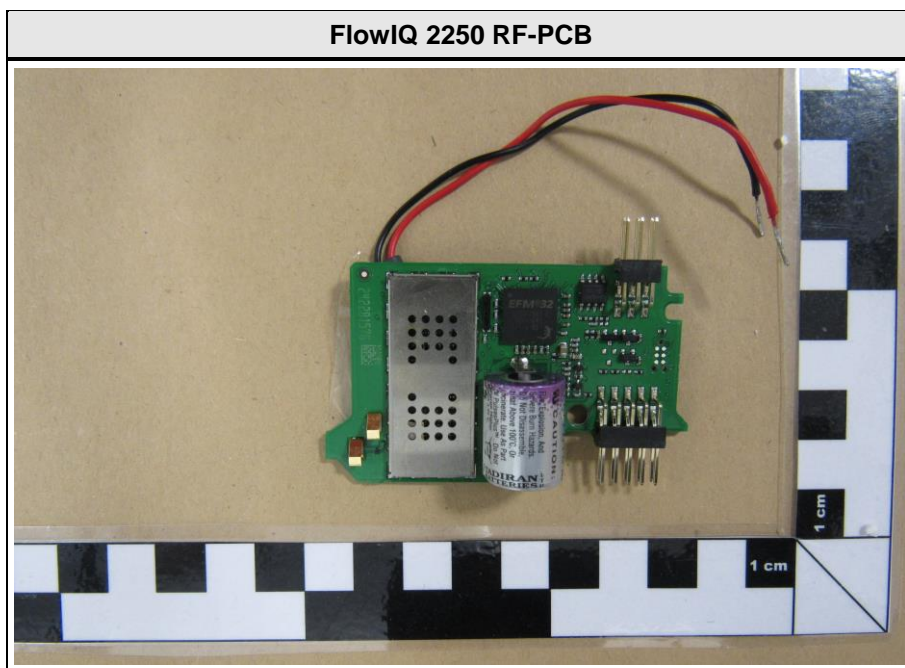
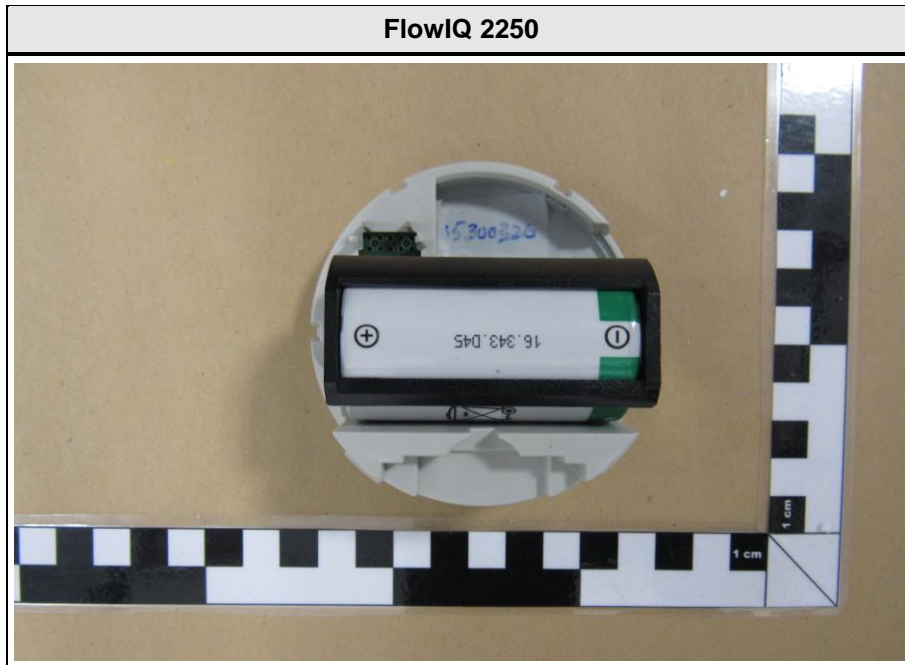


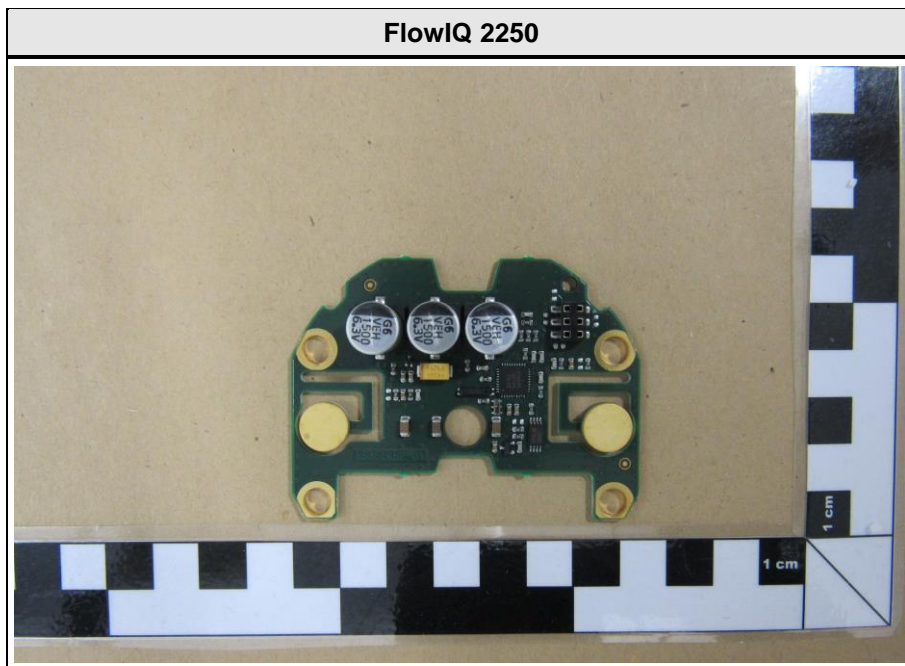
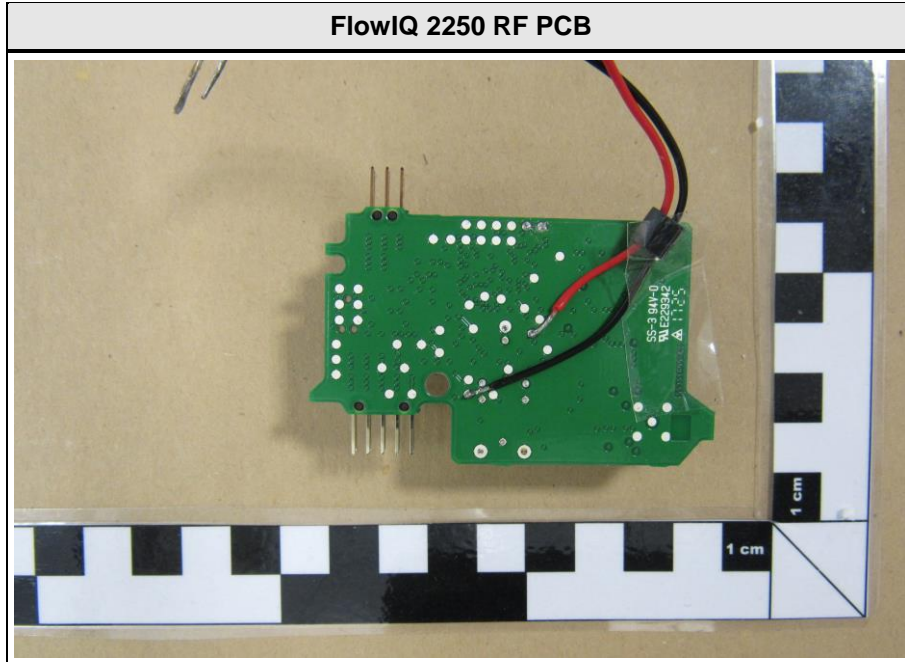


1.2 Photos - Equipment internal

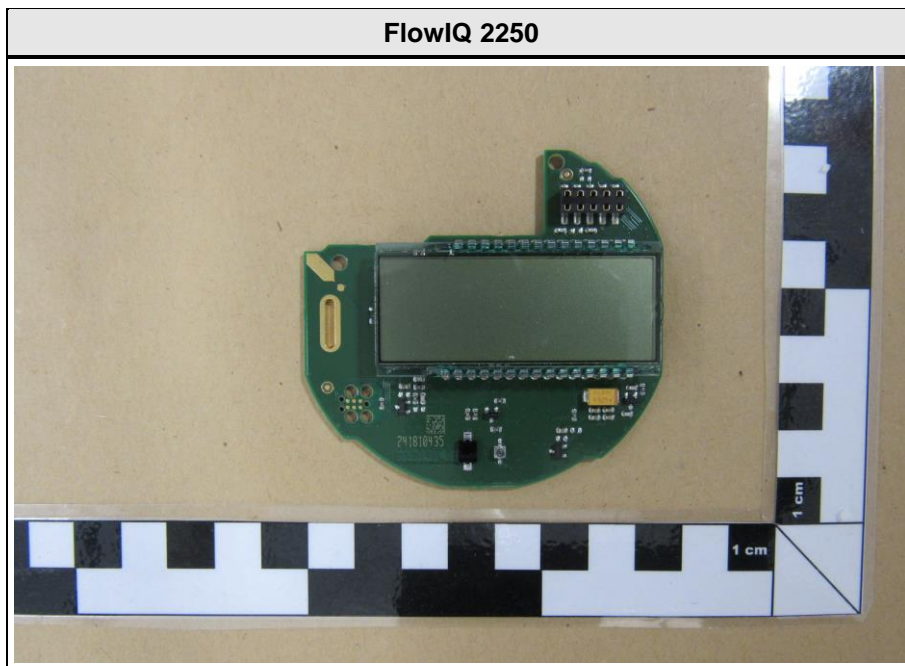
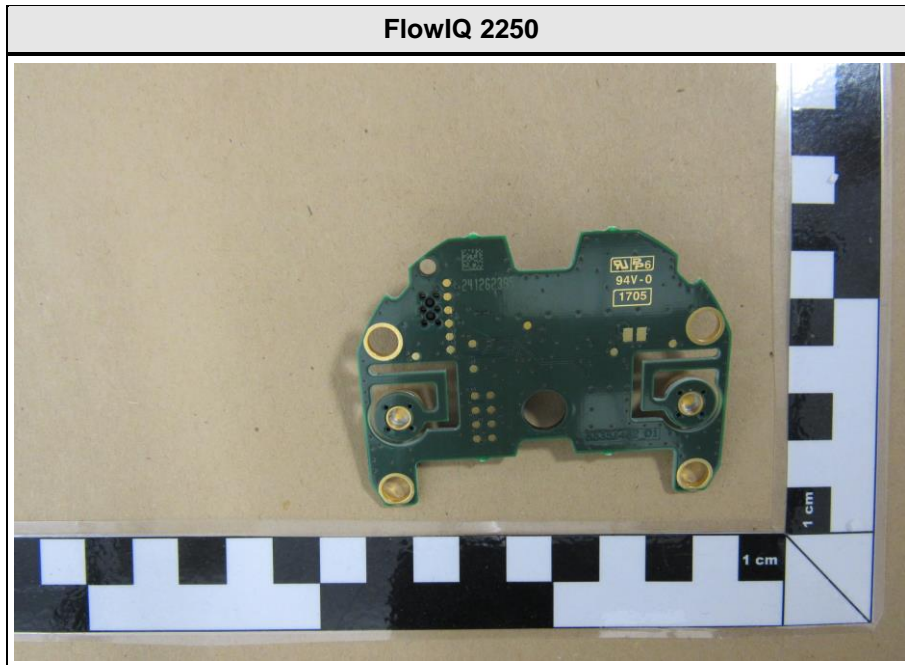


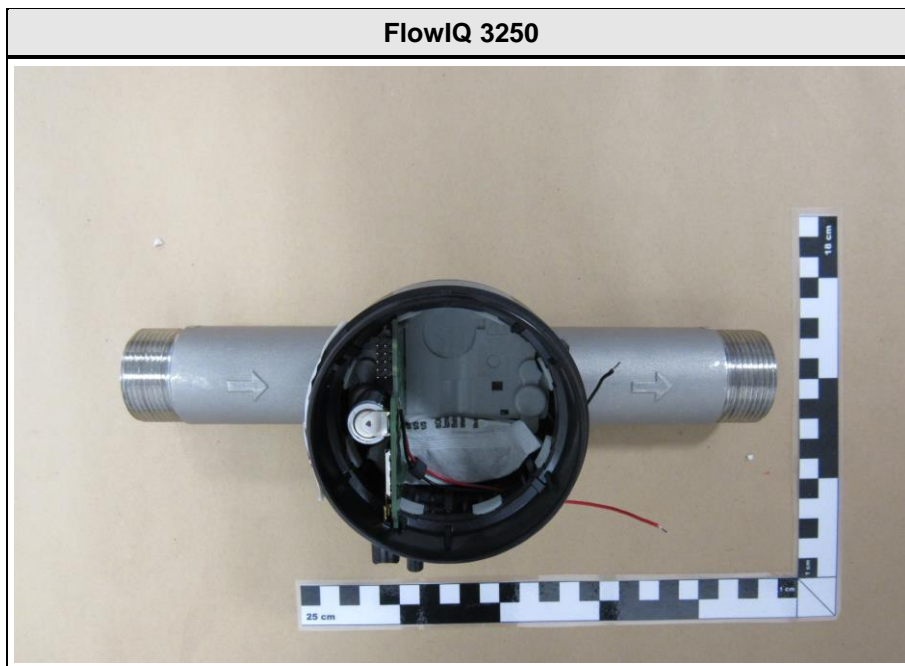
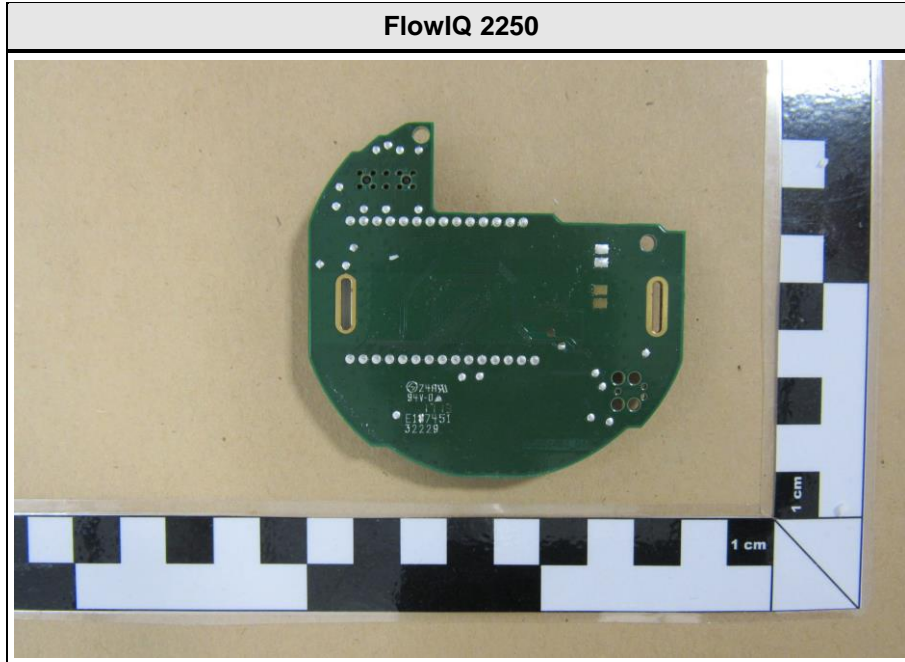


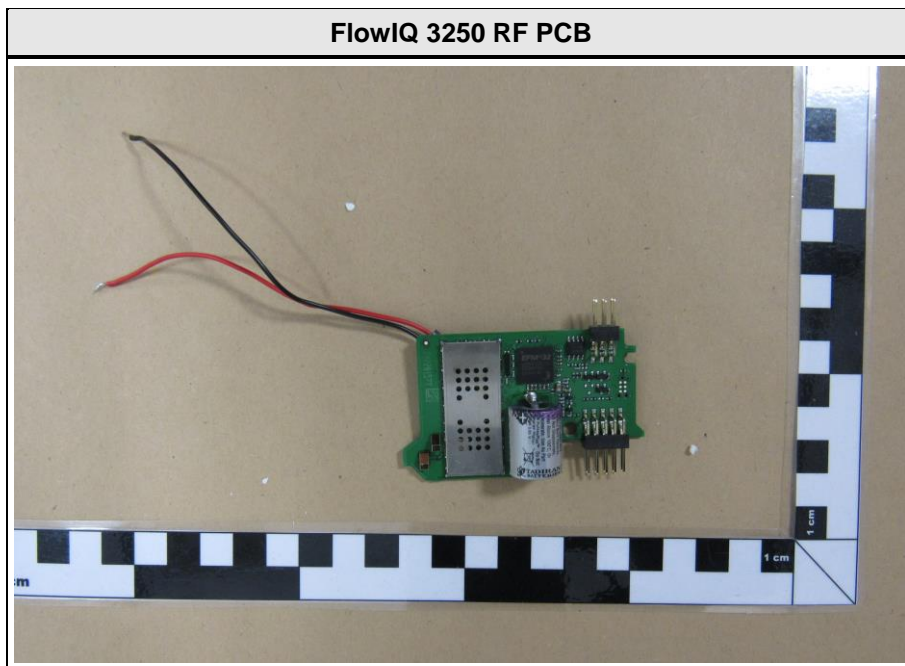
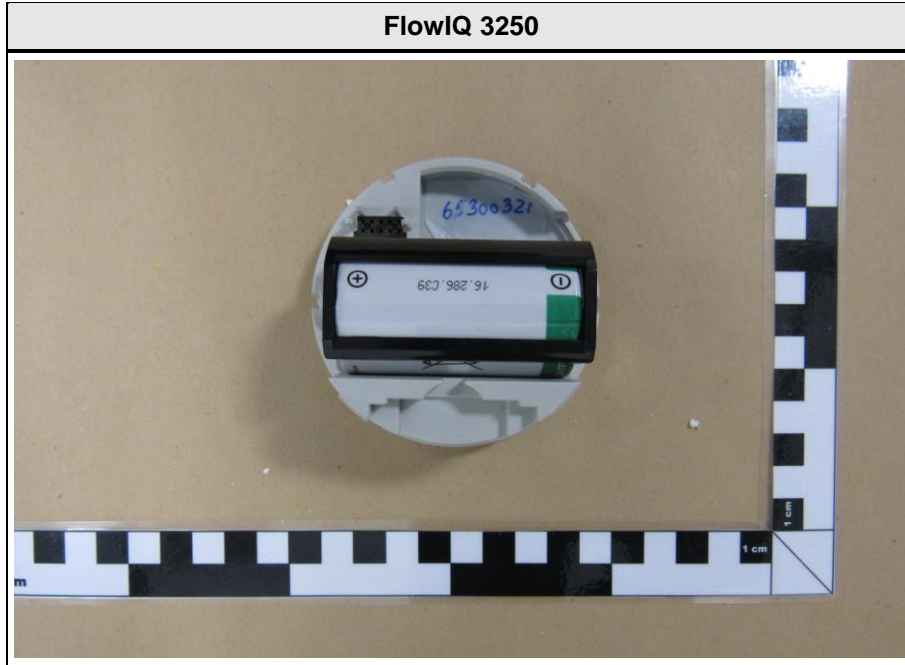




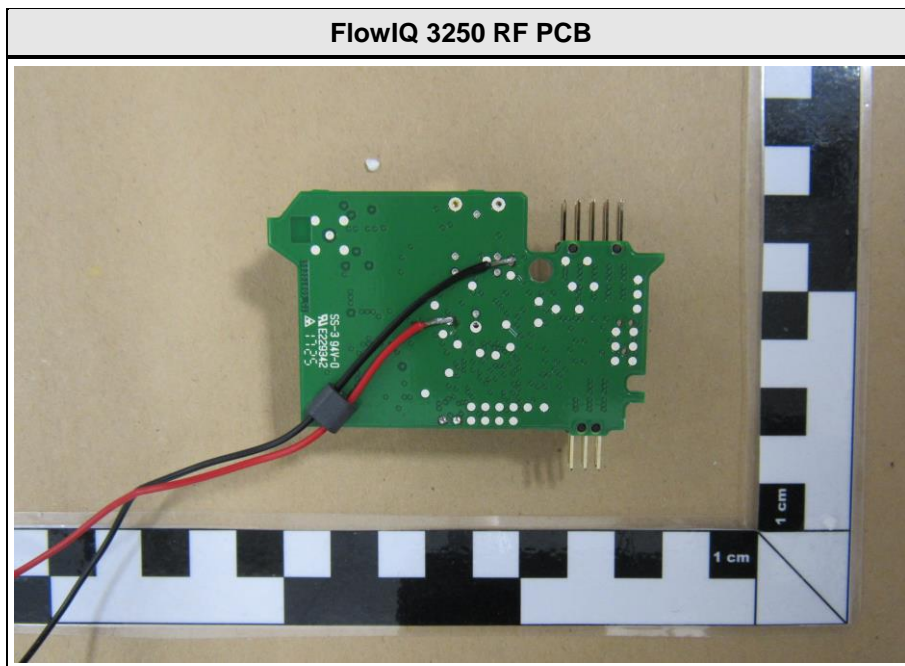
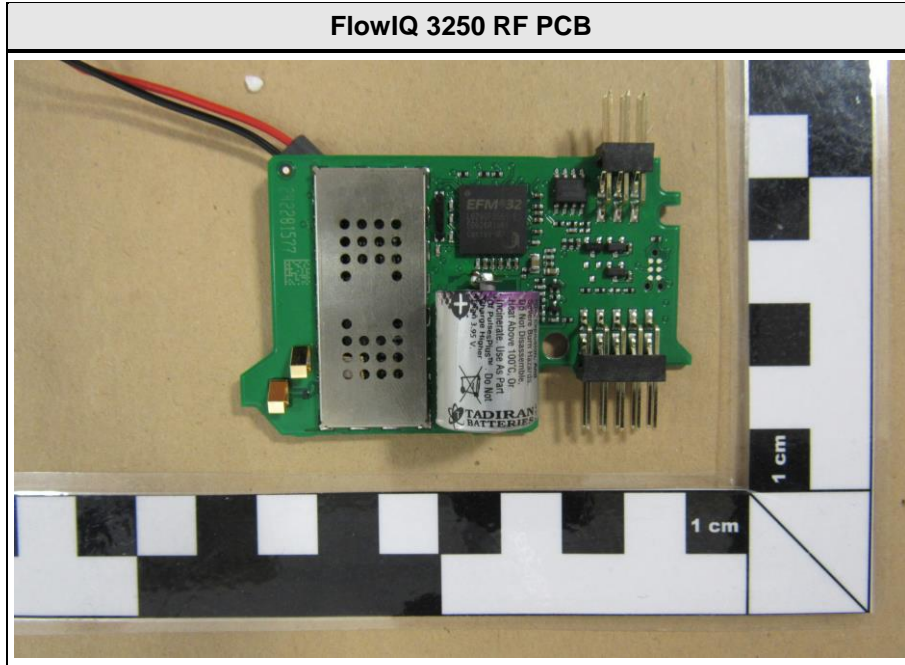


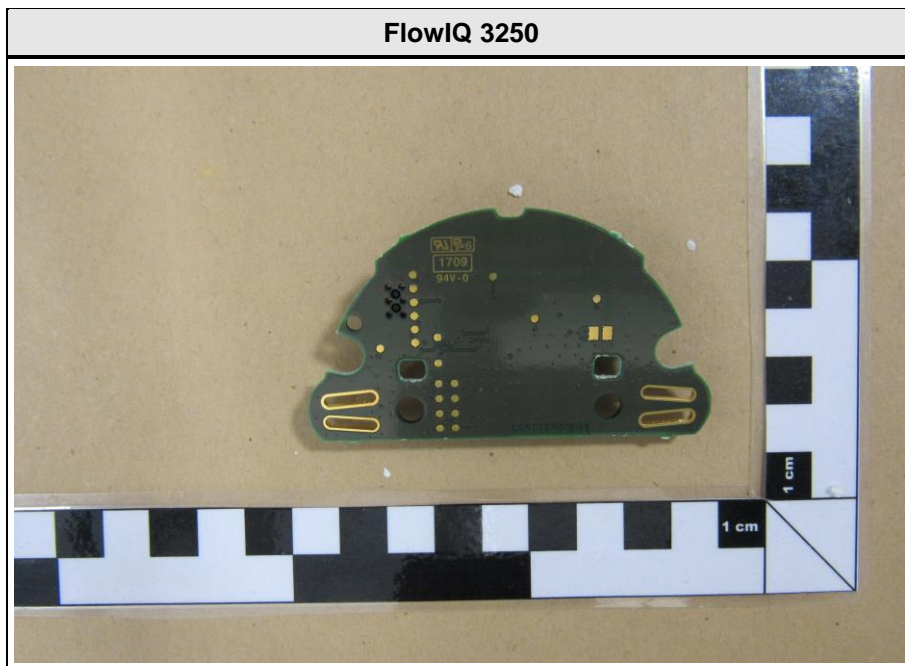
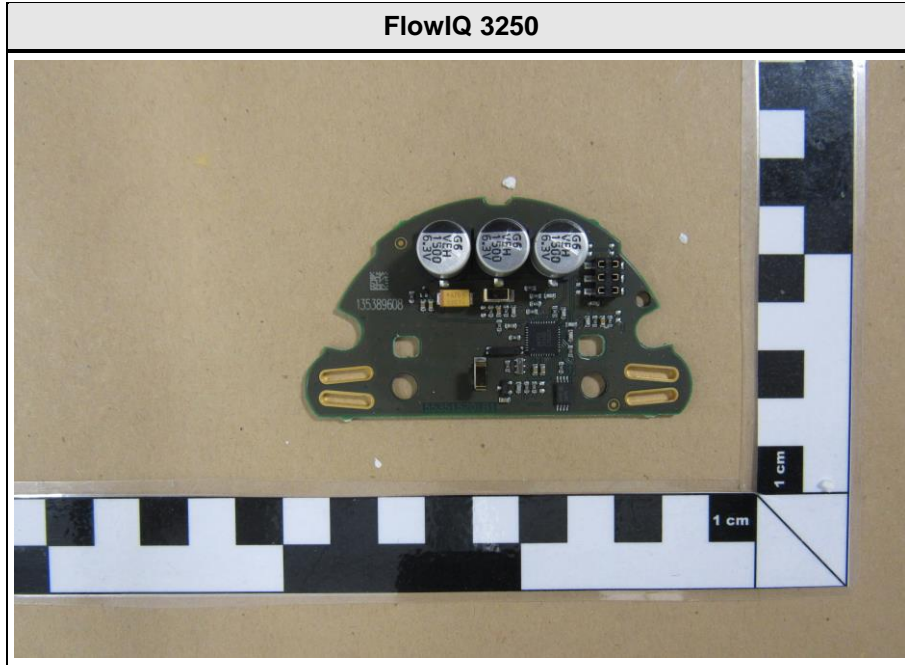


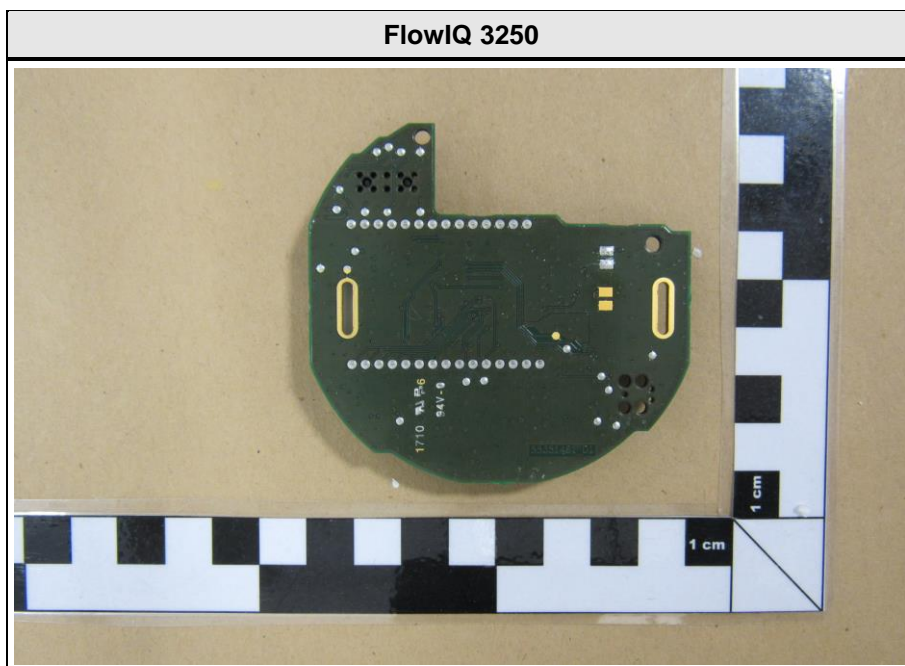
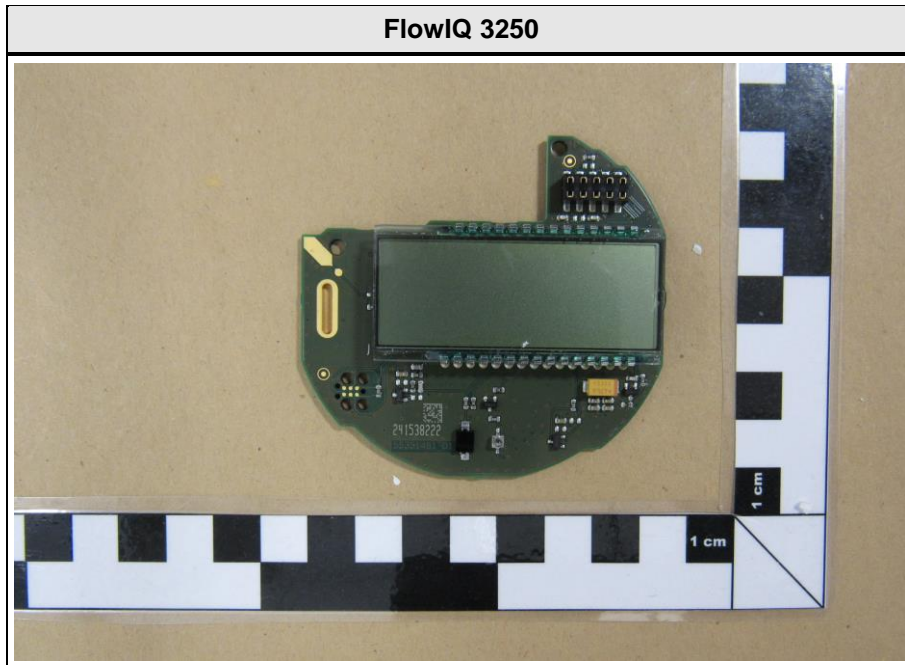






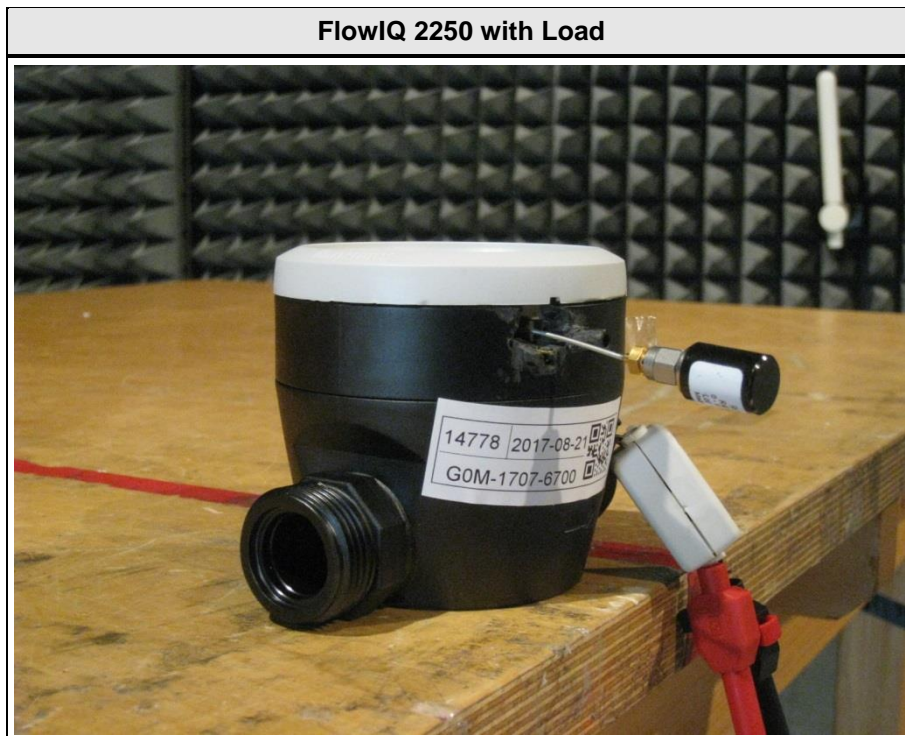
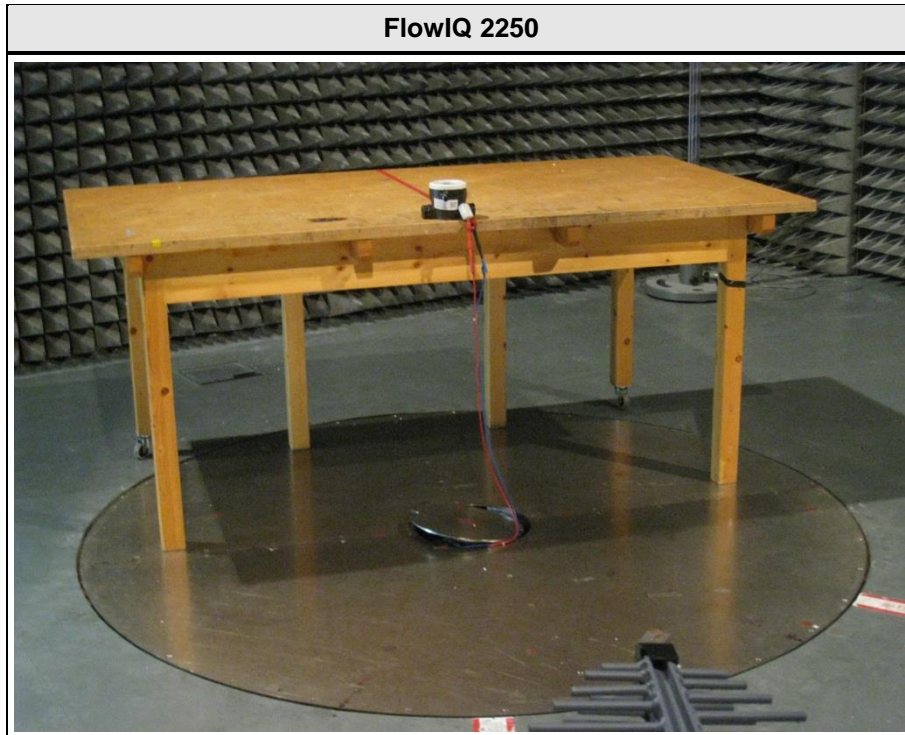




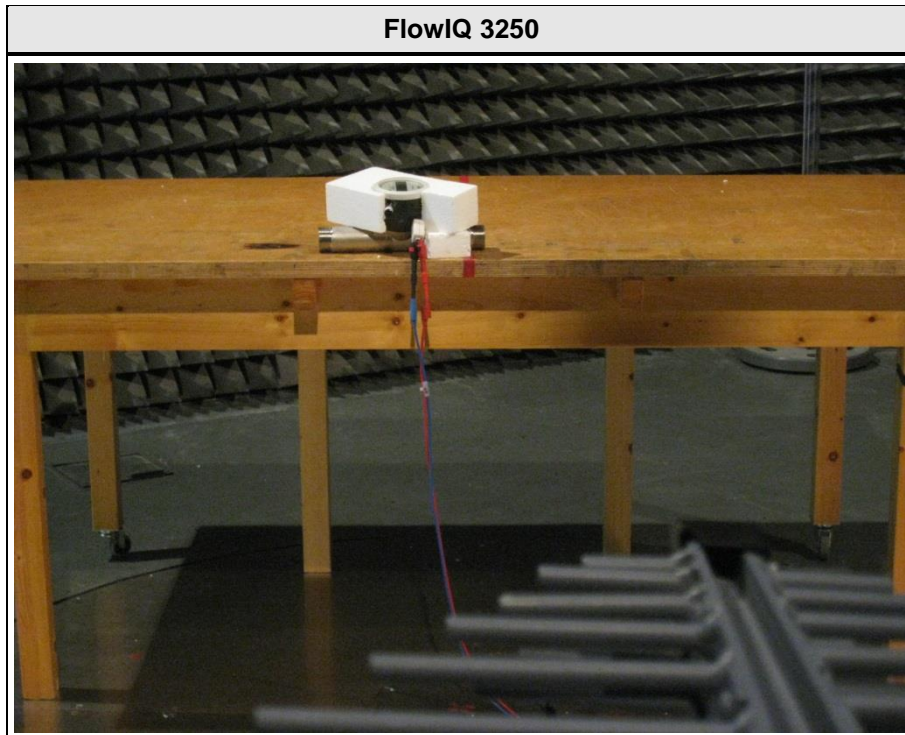




1.3 Photos – Test setup







#### 1.4 Supporting Equipment Used During Testing

Product Type*	Device	Manufacturer	Model No.	Comments
AE	Laboratory power supply	Statron	2224.2	The EUT battery does not last to perform the tests. Therefore an external power supply was necessary.
CBL	Auxillary cable			To connect EUT and power supply.
<p><b>*Note:</b> Use the following abbreviations:</p> <p>AE : Auxiliary/Associated Equipment, or</p> <p>SIM : Simulator (Not Subjected to Test)</p> <p>CABL : Connecting cables</p>				

#### 1.5 Test Modes

Mode #	Description	
Transmit modulated	General conditions:	EUT powered by laboratory power supply.
	Radio conditions:	Mode = standalone mode Modulation = 4-GFSK Duty cycle = 100% Power level = maximum
Transmit unmodulated	General conditions:	EUT powered by laboratory power supply.
	Radio conditions:	Mode = standalone mode Modulation = none Duty cycle = 100% Power level = maximum

**1.6 Test Equipment Used During Testing**

<b>Measurement Software</b>			
Description	Manufacturer	Name	Version
EMC Test Software	Dare Instruments	Radimation	2015.2.4

<b>Conducted</b>					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSW 43	EF00896	2017-07	2018-07
Modulation Domain Analyzer	R&S	FSIQ 26	EF00151	2016-03	2017-03
Rubidium Frequency Standard	EFRATOM	MFS	EF00308	2013-05	2018-05

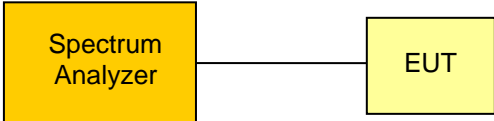
<b>Radiated spurious emissions</b>					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Semi-anechoic chamber	Frankonia	AC 1	EF00062	2017-02	2020-02
EMI Test Receiver	R&S	ESR7	EF00943	2016-10	2017-10
Spectrum Analyzer	R&S	FSIQ26	EF00151	2017-03	2018-03
Antenna	R&S	HK 116	EF00030	2016-04	2019-04
Antenna	R&S	HL 223	EF00187	2016-05	2019-05
Antenna	R&S	BBHA 9120D	EF00018	2016-09	2019-09
Antenna	Amplifier Research	AT4560	EF01152	2016-09	2017-09

## 2 Result Summary


FCC 47 CFR Part 90I				
Product Specific Standard Section	Requirement – Test	Reference Method	Result	Remarks
FCC 90.205 FCC 2.1046	Power	TIA-603-D 2.2.17.2	PASS	
FCC 90.209 FCC 90.210 FCC 2.1049	Authorized bandwidth Emission masks Occupied bandwidth	FCC 90.210	PASS	
FCC 90.210 FCC 2.1051	Spurious emissions at antenna terminal	FCC 90.210 TIA-603-D 2.2.13	PASS	
FCC 90.210 FCC 2.1053	Spurious emissions radiated	FCC 90.210 TIA-603-D 2.2.12	PASS	
FCC 90.213 FCC 2.1055	Frequency stability	TIA-603-D 2.2.2	PASS	
FCC 90.214	Transient frequency behavior	TIA-603-D 2.2.19.2	PASS	
<b>Remarks:</b>				

### 3 Test Conditions and Results

#### 3.1 Power

Maximum peak conducted power acc. to FCC 90.205				Verdict: PASS	
EUT requirement rule parts and clause	Reference				
	FCC 90.205, FCC 2.1046				
Test according to measurement reference	Reference Method				
	TIA-603-D 2.2.17.2				
Test frequency range	Tested frequencies				
	$F_{LOW} / F_{MID} / F_{HIGH}$				
EUT test mode	Transmit unmodulated				
Maximum antenna gain	0.5 dBi				
<b>Limit</b>					
2 W (33 dBm) ERP					
<b>Test setup</b>					
					
<b>Test procedure</b>					
<ul style="list-style-type: none"> <li>• EUT set to transmit mode</li> <li>• Center frequency set to test channel center frequency</li> <li>• Span set to twice the 20 dB bandwidth and detector to peak and max hold</li> <li>• Resolution bandwidth is set to 3 MHz</li> <li>• Peak conducted power is determined from peak of spectrum envelope</li> </ul>					
<b>ERP calculation</b>					
<ul style="list-style-type: none"> <li>• <math>EIRP [dBm] = \text{Conducted power [dBm]} + \text{Max EUT antenna gain [dBi]}</math></li> <li>• <math>ERP [dBm] = EIRP [dBm] - 2.15 \text{ dB}</math></li> </ul>					
<b>Test results</b>					
Channel	Conducted peak power [dbm]	ERP peak power [dbm]	ERP peak power [W]	ERP Limit [dBm]	Margin [dB]
$F_{LOW}$	29.4	27.8	0.603	33	-2.2
$F_{MID}$	29.3	27.7	0.589	33	-2.3
$F_{HIGH}$	29.2	27.6	0.575	33	-2.4
Comments:					

**3.2 Emission Mask and authorized bandwidth**

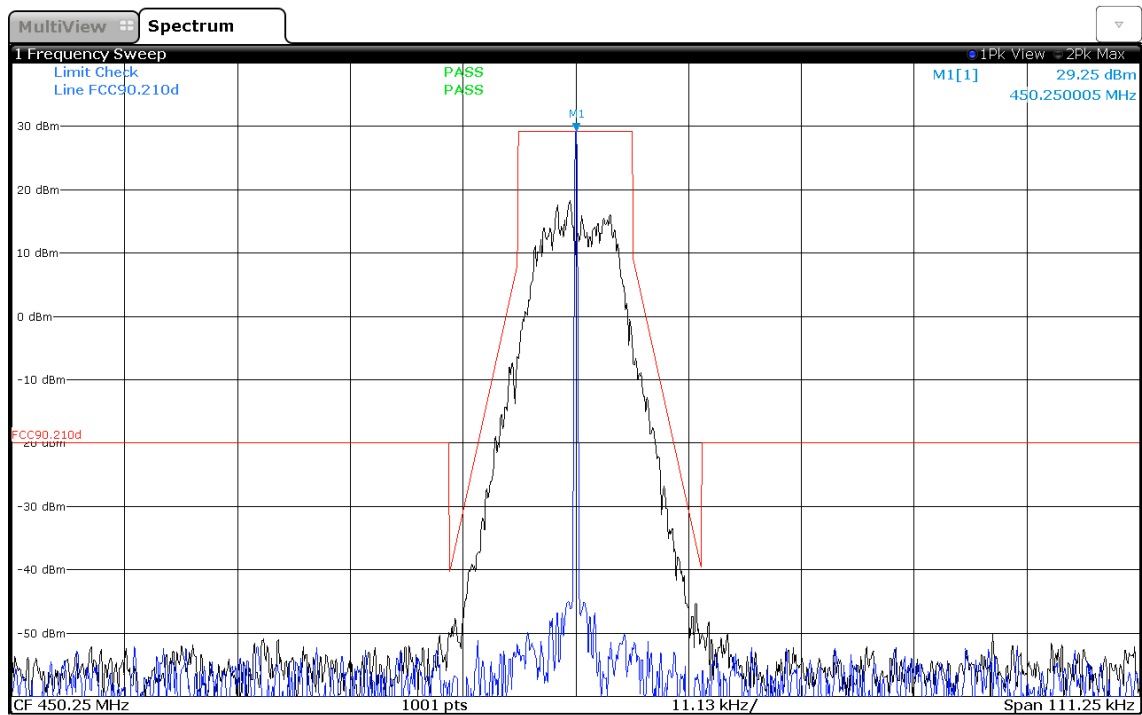
<b>Emission mask acc. to FCC 90.209, FCC 90.210</b>		<b>Verdict: PASS</b>
EUT requirement rule parts and clause	Reference	
	FCC 90.209(b), FCC 90.210 (d), FCC 2.1049	
Test according to measurement reference	Reference Method	
	FCC 90.210	
Test frequency range	Tested frequencies	
	$F_{LOW} / F_{MID} / F_{HIGH}$	
EUT test mode	Transmit modulated	
<b>Limits</b>		
<p>Operations using equipment designed to operate with a 12.5 kHz channel bandwidth will be authorized a 11.25 kHz bandwidth.</p> <p>Emission Mask D—12.5 kHz channel bandwidth equipment.</p> <p>For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:</p> <p>(1) On any frequency from the center of the authorized bandwidth <math>f_0</math> to 5.625 kHz removed from <math>f_0</math>: Zero dB.</p> <p>(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (<math>f_d</math> in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least <math>7.27(f_d - 2.88 \text{ kHz})</math> dB.</p> <p>(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (<math>f_d</math> in kHz) of more than 12.5 kHz: At least <math>50 + 10 \log(P)</math> dB or 70 dB, whichever is the lesser attenuation.</p>		
<b>Test setup</b>		
 <pre> graph LR     EUT[EUT] --- SA[Spectrum Analyzer]     SA --- RR[Rubidium Reference]             </pre>		
<b>Test procedure</b>		
<ul style="list-style-type: none"> <li>• EUT set to transmit mode</li> <li>• Center frequency set to test channel center frequency and the highest emission is determined</li> <li>• Resolution bandwidth is set to 100 Hz and detector to peak and max hold.</li> <li>• As for the authorized bandwidth the 99% power bandwidth is measured.</li> </ul>		

Test results emission mask			
Channel	Verdict		
F <sub>LOW</sub>	PASS		
F <sub>MID</sub>	PASS		
F <sub>HIGH</sub>	PASS		
Test results authorized bandwidth			
Channel	Authorized bandwidth [kHz]	Limit [kHz]	Verdict
F <sub>LOW</sub>	9.6	11.25	PASS
F <sub>MID</sub>	9.7	11.25	PASS
F <sub>HIGH</sub>	9.7	11.25	PASS
Comments:			



**Emission Mask**

Project Number:	G0M-1707-6700
Applicant	Kamstrup A/S
Model Description	Ultrasonic water meter
Model:	FlowIQ 2250
Test Sample ID:	14778
Operator:	T. Jahn
Test Site:	Eurofins Product Service GmbH
Test Date:	2017-08-22
Note 1:	Channel Low
Note 2:	Pass



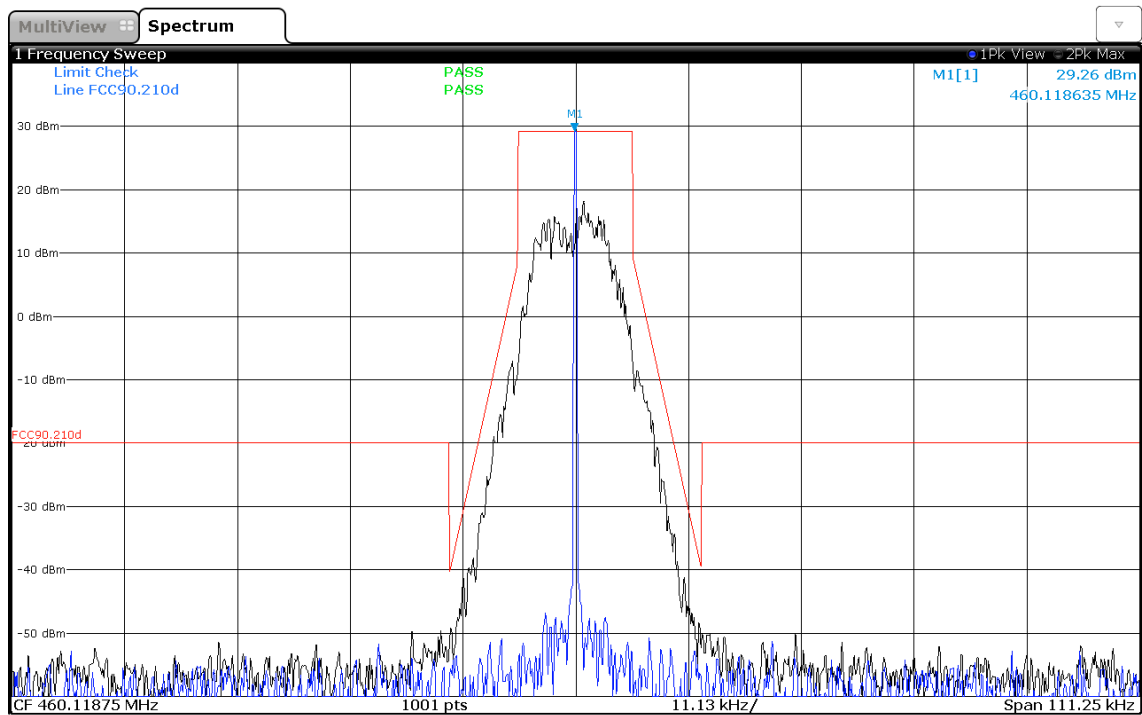
16:23:36 22.08.2017

Test Report No.: G0M-1707-6700-TFC90PMR-V01

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

**Emission Mask**

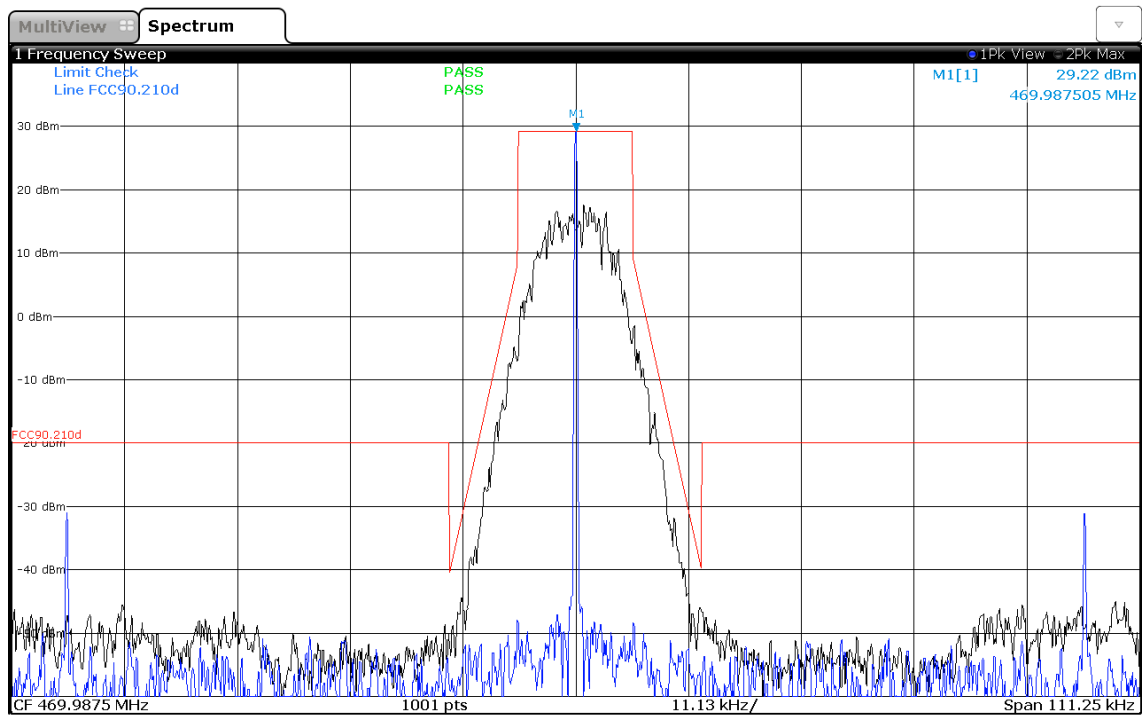
Project Number:	G0M-1707-6700
Applicant	Kamstrup A/S
Model Description	Ultrasonic water meter
Model:	FlowIQ 2250
Test Sample ID:	14778
Operator:	T. Jahn
Test Site:	Eurofins Product Service GmbH
Test Date:	2017-08-22
Note 1:	Channel Mid
Note 2:	Pass



16:27:51 22.08.2017

**Emission Mask**

Project Number:	G0M-1707-6700
Applicant	Kamstrup A/S
Model Description	Ultrasonic water meter
Model:	FlowIQ 2250
Test Sample ID:	14778
Operator:	T. Jahn
Test Site:	Eurofins Product Service GmbH
Test Date:	2017-08-22
Note 1:	Channel High
Note 2:	Pass



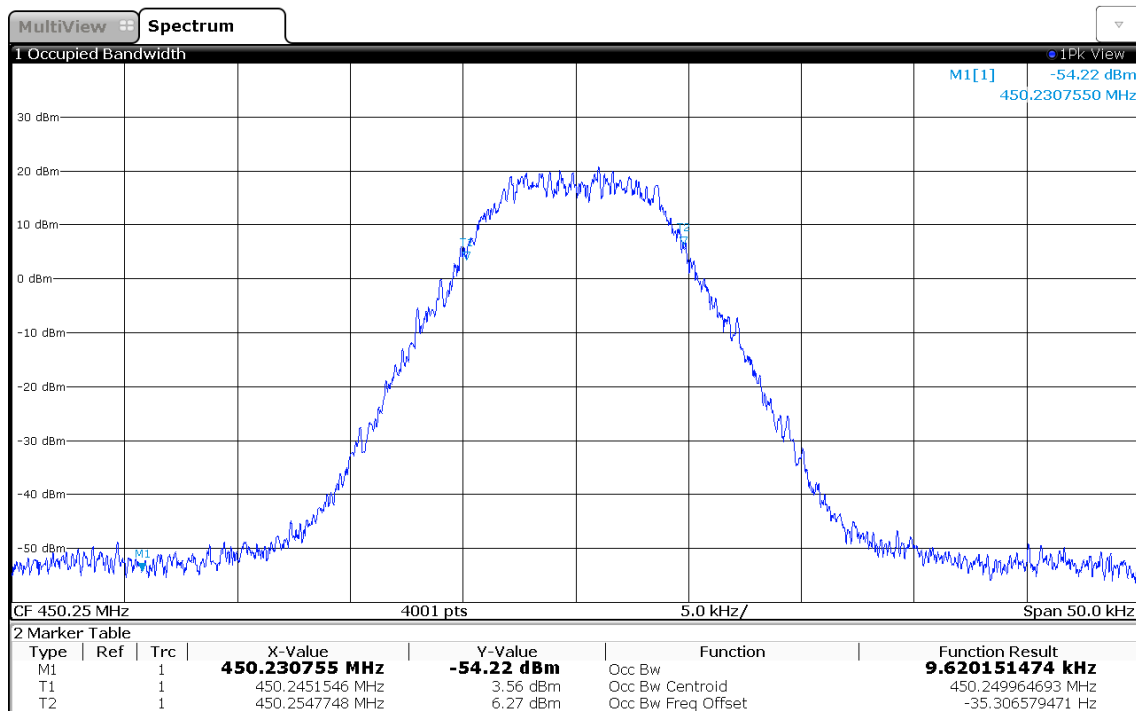
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Test Report No.: G0M-1707-6700-TFC90PMR-V01

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

### Authorized Bandwidth

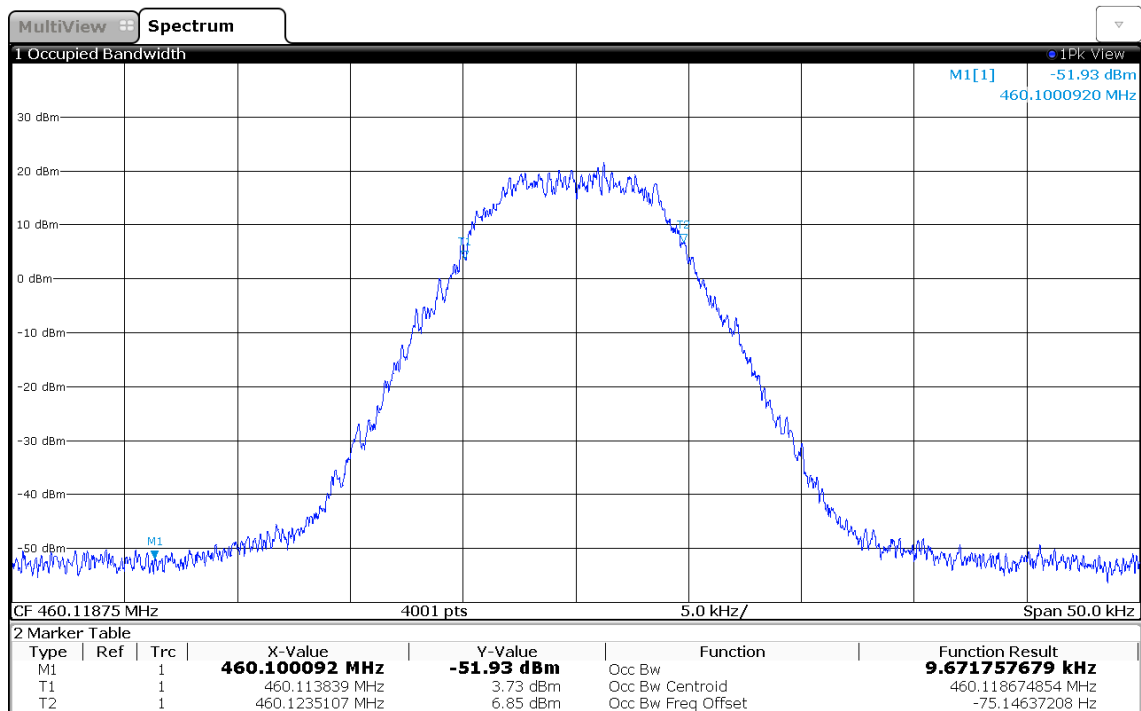
Project Number: G0M-1707-6700  
 Applicant: Kamstrup A/S  
 Model Description: Ultrasonic water meter  
 Model: FlowIQ 2250  
 Test Sample ID: 14778  
 Operator: T. Jahn  
 Test Site: Eurofins Product Service GmbH  
 Test Date: 2017-08-22  
 Note 1: Channel Low  
 Note 2: Pass



16:17:40 22.08.2017

**Authorized Bandwidth**

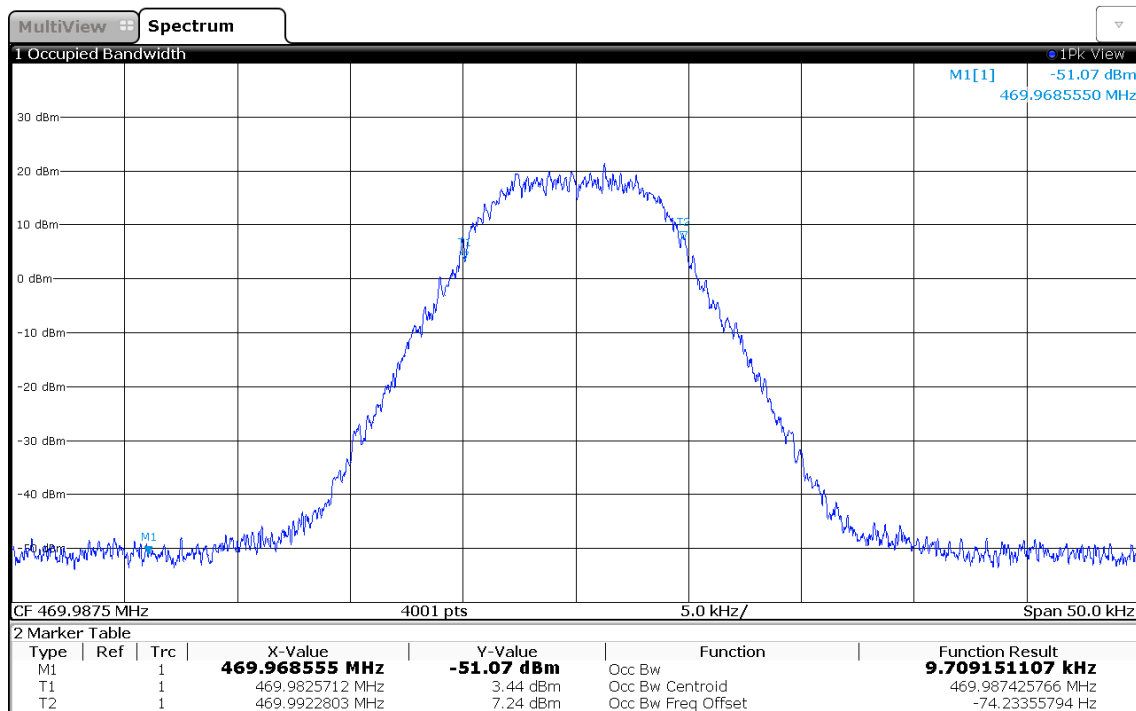
Project Number: G0M-1707-6700  
 Applicant: Kamstrup A/S  
 Model Description: Ultrasonic water meter  
 Model: FlowIQ 2250  
 Test Sample ID: 14778  
 Operator: T. Jahn  
 Test Site: Eurofins Product Service GmbH  
 Test Date: 2017-08-22  
 Note 1: Channel Mid  
 Note 2: Pass



16:30:12 22.08.2017


### Authorized Bandwidth

Project Number: G0M-1707-6700  
 Applicant: Kamstrup A/S  
 Model Description: Ultrasonic water meter  
 Model: FlowIQ 2250  
 Test Sample ID: 14778  
 Operator: T. Jahn  
 Test Site: Eurofins Product Service GmbH  
 Test Date: 2017-08-22  
 Note 1: Channel High  
 Note 2: Pass



16:37:11 22.08.2017

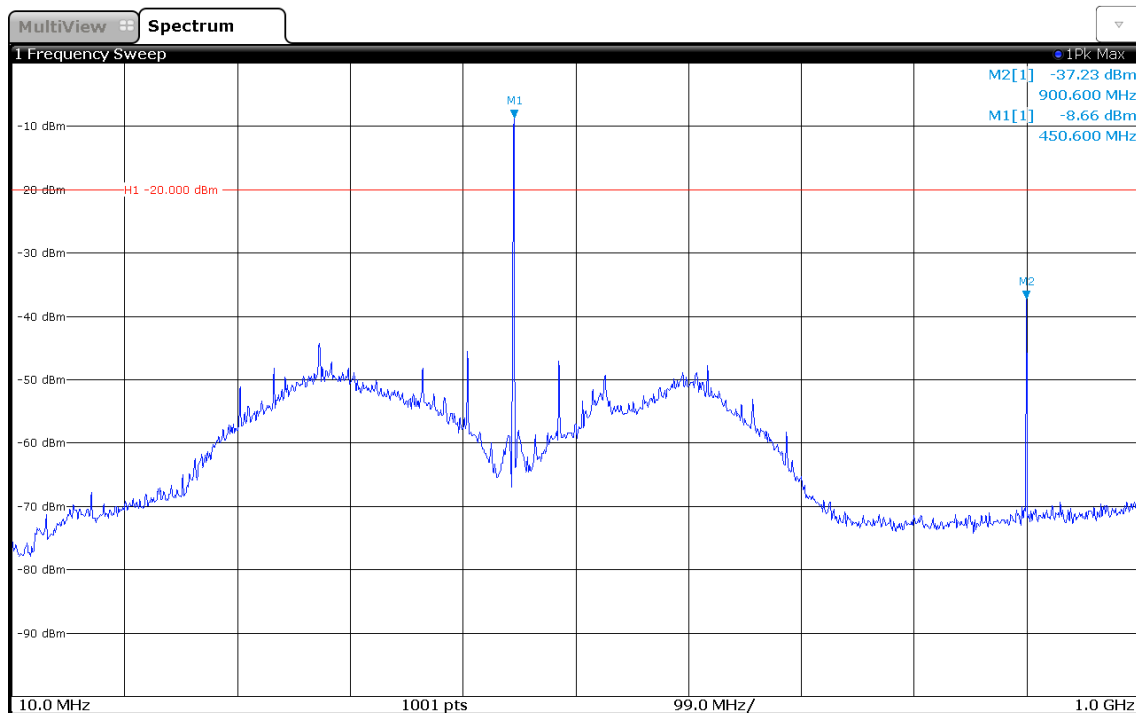
**3.3 Spurious emission at antenna terminal**

<b>Spurious emission at antenna terminal acc. to FCC 90.210</b>		<b>Verdict: PASS</b>
EUT requirement rule parts and clause	Reference	
	FCC 90.210 (d), FCC 2.1051	
Test according to measurement reference	Reference Method	
	FCC 90.210, TIA-603-D 2.2.13	
Test frequency range	Tested frequencies	
	10 MHz – 10 <sup>th</sup> Harmonic	
EUT test mode	Transmit unmodulated	
<b>Limits</b>		
On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 12.5 kHz: At least 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation.		
<b>Test setup</b>		
 <pre> graph LR     EUT[EUT] --- SA[Spectrum Analyzer]             </pre>		
<b>Test procedure</b>		
<ul style="list-style-type: none"> <li>• EUT set to transmit mode</li> <li>• Center frequency set to test channel center frequency</li> <li>• Below 1 GHz the carrier is suppressed with a notch filter. Above 1 GHz the carrier is suppressed with a high pass filter.</li> <li>• The detector is set to peak and max hold</li> <li>• Below 1 GHz the resolution bandwidth is set to 100 kHz. Above 1 GHz the resolution bandwidth is set to 1 MHz.</li> </ul>		
<b>Test results</b>		
Channel	Limit [dBm]	Verdict
F <sub>LOW</sub>	-20	PASS
F <sub>MID</sub>	-20	PASS
F <sub>HIGH</sub>	-20	PASS
Comments:		



**Conducted spurious emissions**

Project Number:	G0M-1707-6700
Applicant	Kamstrup A/S
Model Description	Ultrasonic water meter
Model:	FlowIQ 2250
Test Sample ID:	14778
Operator:	T. Jahn
Test Site:	Eurofins Product Service GmbH
Test Date:	2017-08-24
Note 1:	Channel Low
Note 2:	Pass



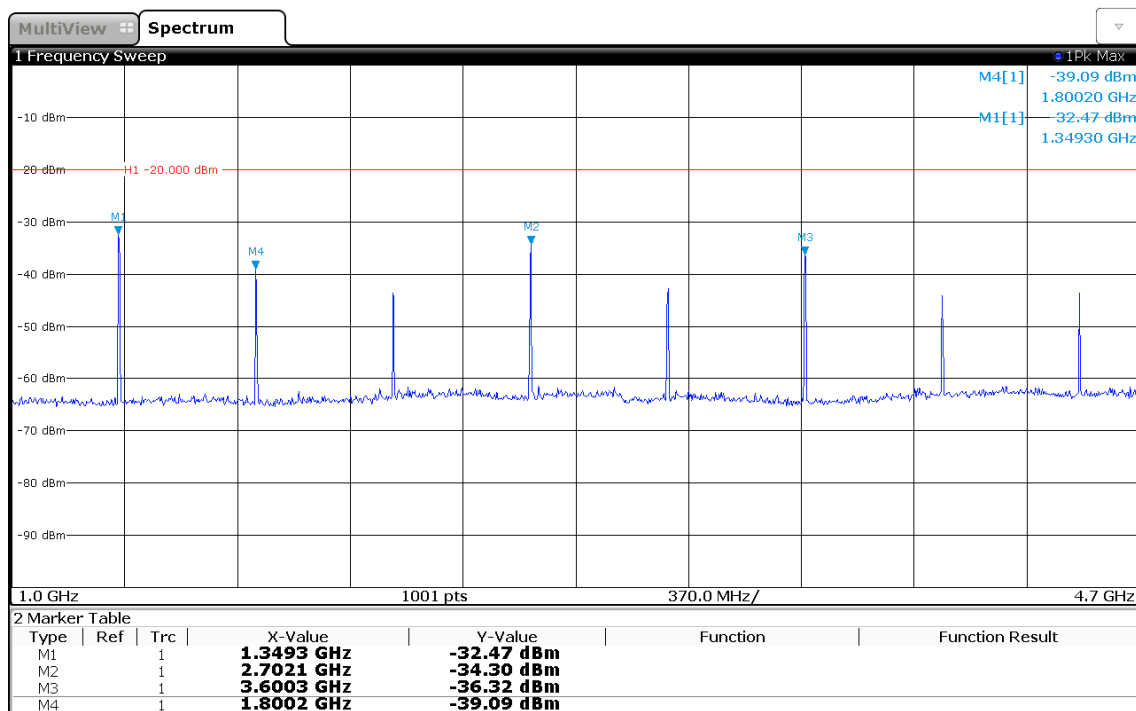
09:31:34 24.08.2017

Test Report No.: G0M-1707-6700-TFC90PMR-V01

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

### Conducted spurious emissions

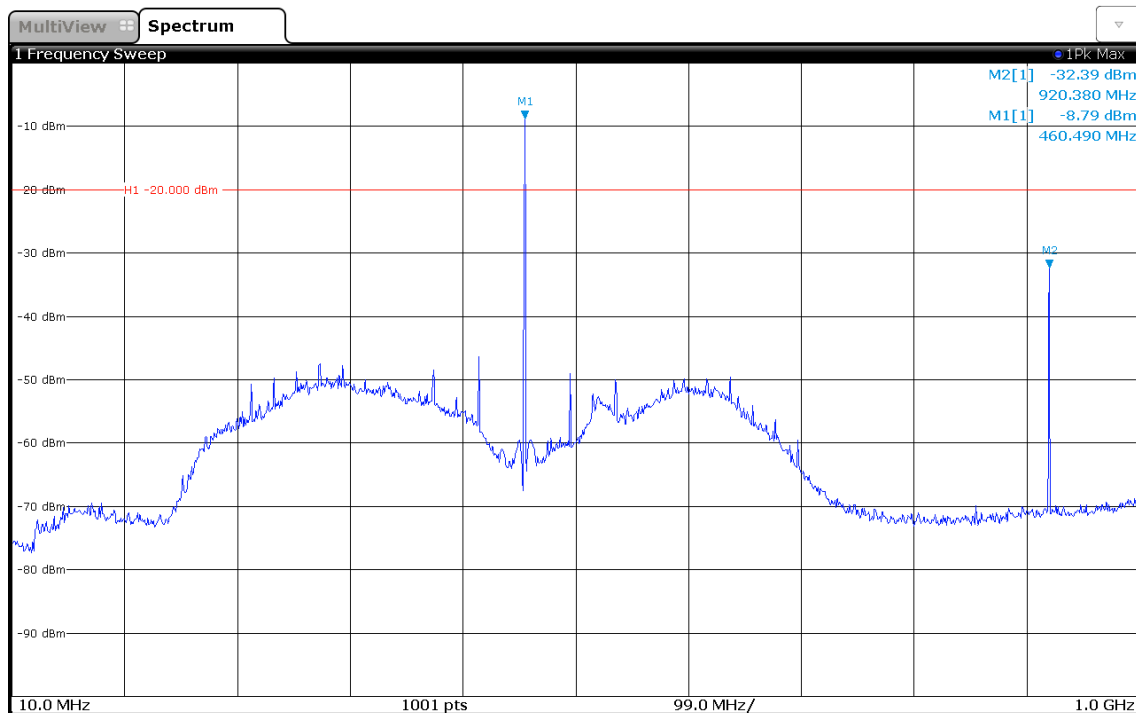
Project Number: G0M-1707-6700  
 Applicant: Kamstrup A/S  
 Model Description: Ultrasonic water meter  
 Model: FlowIQ 2250  
 Test Sample ID: 14778  
 Operator: T. Jahn  
 Test Site: Eurofins Product Service GmbH  
 Test Date: 2017-08-24  
 Note 1: Channel Low  
 Note 2: Pass



09:54:14 24.08.2017

**Conducted spurious emissions**

Project Number:	G0M-1707-6700
Applicant	Kamstrup A/S
Model Description	Ultrasonic water meter
Model:	FlowIQ 2250
Test Sample ID:	14778
Operator:	T. Jahn
Test Site:	Eurofins Product Service GmbH
Test Date:	2017-08-24
Note 1:	Channel Mid
Note 2:	Pass



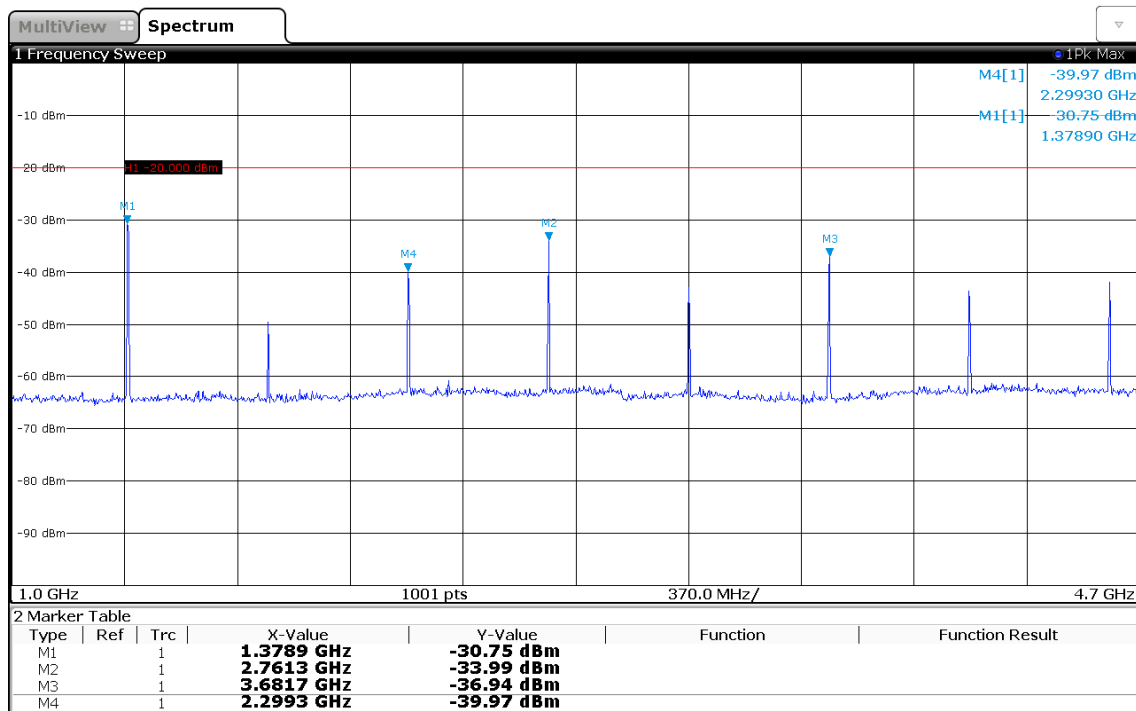
09:35:50 24.08.2017

Test Report No.: G0M-1707-6700-TFC90PMR-V01

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

### Conducted spurious emissions

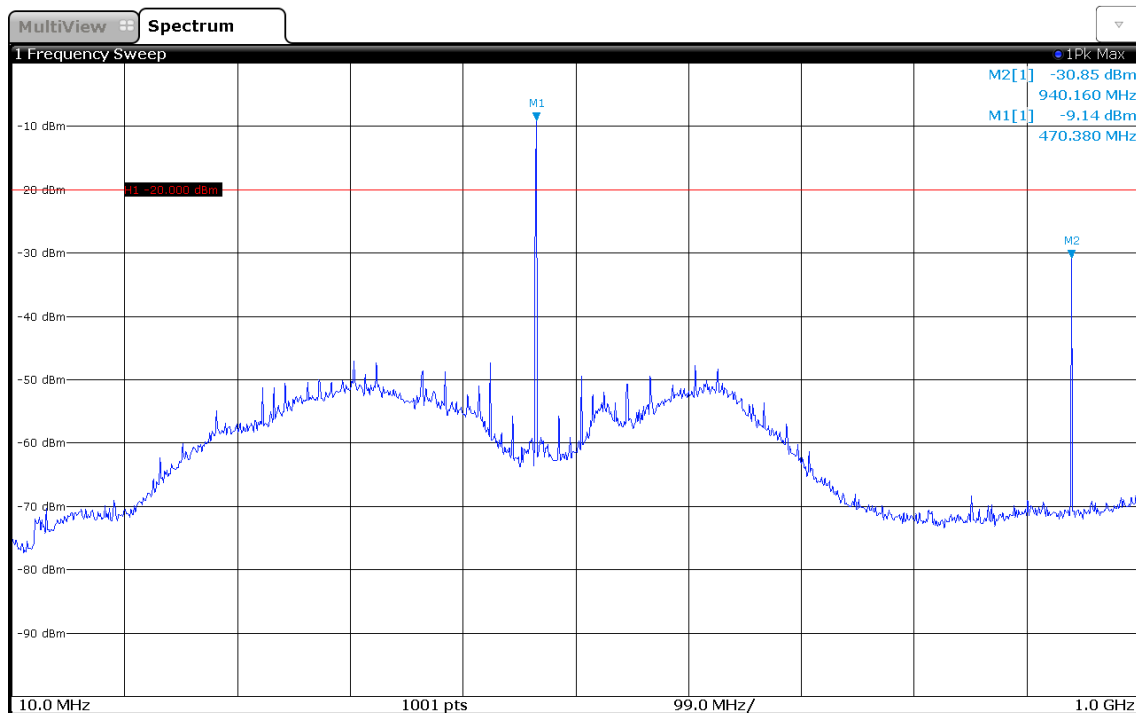
Project Number: G0M-1707-6700  
 Applicant: Kamstrup A/S  
 Model Description: Ultrasonic water meter  
 Model: FlowIQ 2250  
 Test Sample ID: 14778  
 Operator: T. Jahn  
 Test Site: Eurofins Product Service GmbH  
 Test Date: 2017-08-24  
 Note 1: Channel Mid  
 Note 2: Pass



09:52:31 24.08.2017

**Conducted spurious emissions**

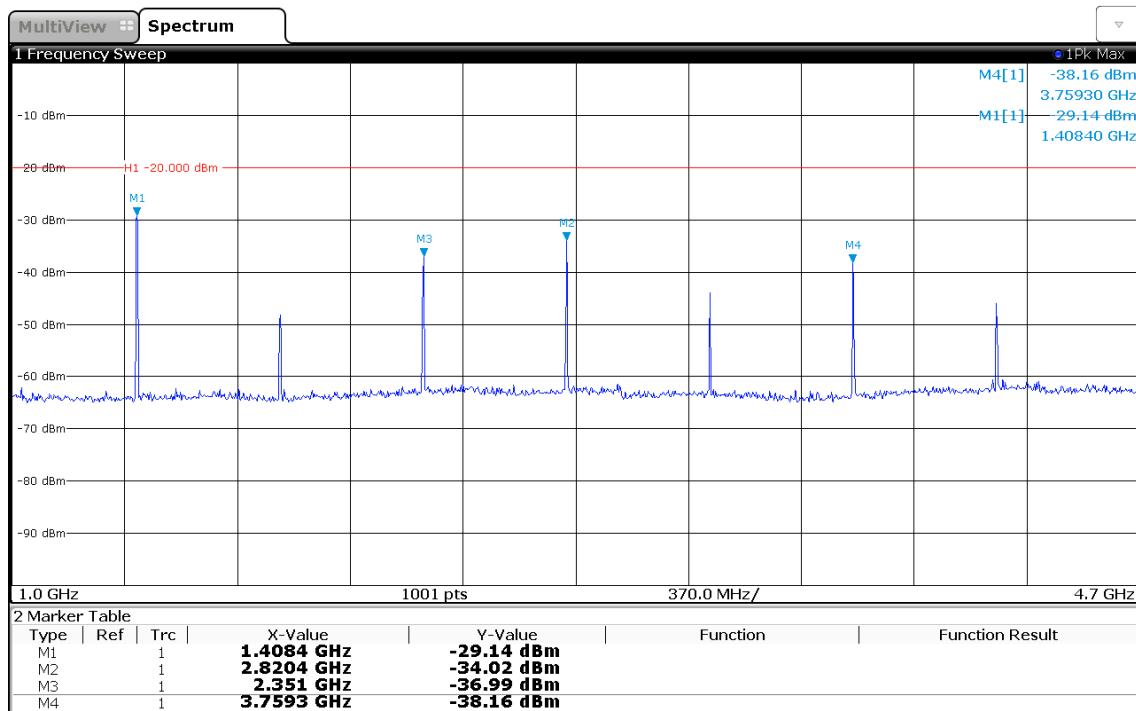
Project Number:	G0M-1707-6700
Applicant	Kamstrup A/S
Model Description	Ultrasonic water meter
Model:	FlowIQ 2250
Test Sample ID:	14778
Operator:	T. Jahn
Test Site:	Eurofins Product Service GmbH
Test Date:	2017-08-24
Note 1:	Channel High
Note 2:	Pass



09:41:40 24.08.2017

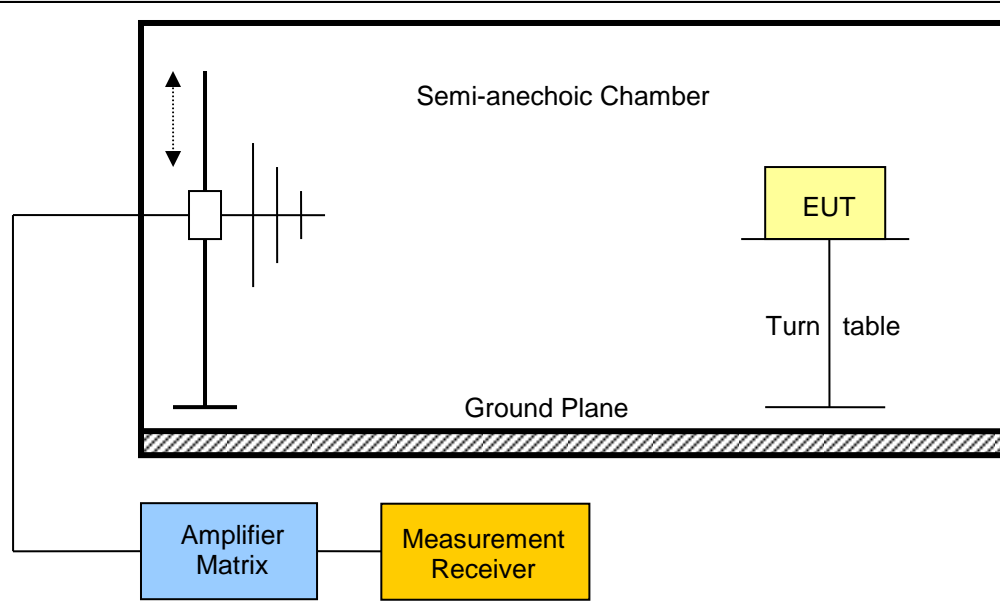
### Conducted spurious emissions

Project Number: G0M-1707-6700  
 Applicant: Kamstrup A/S  
 Model Description: Ultrasonic water meter  
 Model: FlowIQ 2250  
 Test Sample ID: 14778  
 Operator: T. Jahn  
 Test Site: Eurofins Product Service GmbH  
 Test Date: 2017-08-24  
 Note 1: Channel High  
 Note 2: Pass



09:47:53 24.08.2017

**3.4 Spurious emissions radiated**


<b>Spurious emissions radiated acc. to FCC 90.210</b>		<b>Verdict: PASS</b>
Test according referenced standards	Reference Method	
	FCC 15.210(d), FCC 2.1053	
Test according to measurement reference	Reference Method	
	FCC 90.210, TIA-603-D 2.2.12	
Test frequency range	Tested frequencies	
	30 MHz – 10 <sup>th</sup> Harmonic	
EUT test mode	Transmit unmodulated	
<b>Limits</b>		
On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 12.5 kHz: At least 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation..		
<b>Test setup</b>		
		
<b>Test procedure</b>		
<ol style="list-style-type: none"> <li>1. EUT antenna output connected to 50 Ohm load.</li> <li>2. EUT set to transmit mode</li> <li>3. Maximum emission level is measured by rotating the EUT and adjusting the antenna height for vertical polarization</li> <li>4. The EUT is replaced by a substitution antenna and generator</li> <li>5. The power level is set to obtain the same power reading</li> <li>6. Measurement is repeated for horizontal polarization</li> </ol>		

Test results FlowIQ 2250					
Channel	Emission [MHz]	Level [dbm]	Pol.	Limit [dBm]	Margin [dB]
F <sub>LOW</sub>	1348	-36.50	hor	-20.00	-16.52
F <sub>MID</sub>	1378	-38.10	hor	-20.00	-18.07
F <sub>HIGH</sub>	1408	-38.30	hor	-20.00	-18.28
Comments:					

Test results FlowIQ 3250					
Channel	Emission [MHz]	Level [dbm]	Pol.	Limit [dBm]	Margin [dB]
Flow	1348	-36.60	hor	-20.00	-16.65
Flow	1348	-39.90	ver	-20.00	-19.94
Fmid	1380	-35.90	hor	-20.00	-15.94
Fmid	1380	-38.90	ver	-20.00	-18.94
Fhigh	1410	-37.20	hor	-20.00	-17.17



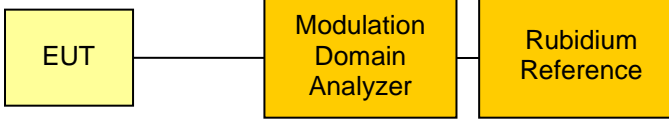
**3.5 Frequency Stability**

<b>Frequency stability acc. to FCC 90.213</b>		<b>Verdict: PASS</b>
EUT requirement rule parts and clause	Reference	
	FCC 90.213, FCC 2.1055	
Test according to measurement reference	Reference Method	
	TIA-603-D 2.2.2	
Test frequency range	Tested frequencies	
	$F_{MID}$	
EUT test mode	Transmit unmodulated	
<b>Limits</b>		
<p>In the 421-512 MHz band, fixed and base stations with a 12.5 kHz channel bandwidth must have a frequency stability of 1.5 ppm. Fixed and base stations with a 6.25 kHz channel bandwidth must have a frequency stability of 0.5 ppm.</p> <p>In the 421-512 MHz band, mobile stations designed to operate with a 12.5 kHz channel bandwidth must have a frequency stability of 2.5 ppm. Mobile stations designed to operate with a 6.25 kHz channel bandwidth must have a frequency stability of 1.0 ppm.</p>		
<b>Test setup</b>		
 <pre> graph LR     EUT[EUT] --- SA[Spectrum Analyzer]     SA --- RR[Rubidium Reference]             </pre>		
<b>Test procedure</b>		
<ul style="list-style-type: none"> <li>• The EUT is placed in a climatic chamber</li> <li>• EUT set to transmit mode</li> <li>• The frequency counter function of the spectrum analyzer is used</li> <li>• The frequency stability measurements are repeated within temperature and voltage range</li> </ul>		

<b>Test results</b>				
Voltage	Temperature	Frequency Error [ppm]	Limit [ppm]	Verdict
3.0 VDC	20°C	-0.18	± 2.5	PASS
3.6 VDC	20°C	-0.22	± 2.5	PASS
3.6 VDC	-30°C	0.00	± 2.5	PASS
3.6 VDC	-20°C	0.12	± 2.5	PASS
3.6 VDC	-10°C	0.18	± 2.5	PASS
3.6 VDC	0°C	0.05	± 2.5	PASS
3.6 VDC	10°C	0.01	± 2.5	PASS
3.6 VDC	20°C	0.02	± 2.5	PASS
3.6 VDC	30°C	-0.17	± 2.5	PASS
3.6 VDC	40°C	-0.22	± 2.5	PASS
3.6 VDC	50°C	-0.24	± 2.5	PASS
3.6 VDC	60°C	-0.10	± 2.5	PASS
3.6 VDC	65°C	-0.12	± 2.5	PASS

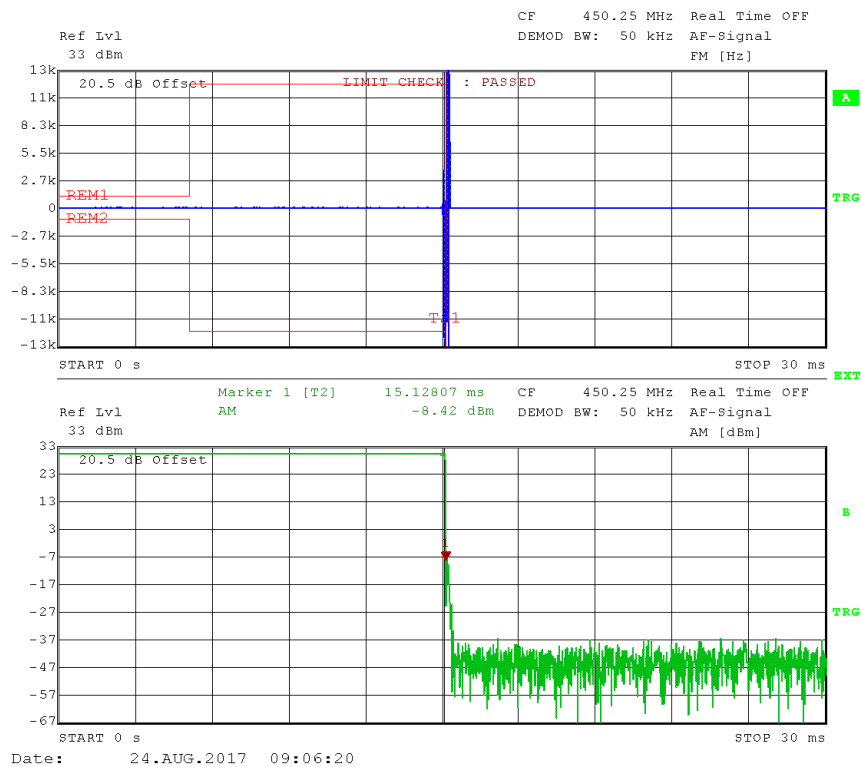
**3.6 Transient Frequency Behavior**

Frequency stability acc. to FCC 90.214		Verdict: PASS	
EUT requirement rule parts and clause	Reference		
	FCC 90.214		
Test according to measurement reference	Reference Method		
	TIA-603-D 2.2.19.2		
Test frequency range	Tested frequencies		
	$F_{LOW}$ , $F_{MID}$ , $F_{HIGH}$		
EUT test mode	Transmit unmodulated		
Limits			
Time intervals <sup>1, 2</sup>	Maximum frequency difference <sup>3</sup>	All equipment <sup>4</sup>	
		150 to 174 MHz	421 to 512 MHz
Transient Frequency Behavior for Equipment Designed to Operate on 25 kHz Channels			
$t_{1, 4}$	$\pm 25.0$ kHz	5.0 ms	10.0 ms
$t_{2, 4}$	$\pm 12.5$ kHz	20.0 ms	25.0 ms
$t_{3, 4}$	$\pm 25.0$ kHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 12.5 kHz Channels			
$t_{1, 4}$	$\pm 12.5$ kHz	5.0 ms	10.0 ms
$t_{2, 4}$	$\pm 6.25$ kHz	20.0 ms	25.0 ms
$t_{3, 4}$	$\pm 12.5$ kHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 6.25 kHz Channels			
$t_{1, 4}$	$\pm 6.25$ kHz	5.0 ms	10.0 ms
$t_{2, 4}$	$\pm 3.125$ kHz	20.0 ms	25.0 ms
$t_{3, 4}$	$\pm 6.25$ kHz	5.0 ms	10.0 ms
<sup>1</sup> $t_{on}$ is the instant when a 1 kHz test signal is completely suppressed, including any capture time due to phasing. ¶ <sup>2</sup> $t_{1, 4}$ is the time period immediately following $t_{on}$ . ¶ <sup>3</sup> $t_{2, 4}$ is the time period immediately following $t_{1, 4}$ . ¶ <sup>4</sup> $t_{3, 4}$ is the time period from the instant when the transmitter is turned off until $t_{off}$ . ¶ <sup>5</sup> $t_{off}$ is the instant when the 1 kHz test signal starts to rise. ¶ <sup>6</sup> During the time from the end of $t_{2, 4}$ to the beginning of $t_{3, 4}$ , the frequency difference must not exceed the limits specified in §90.213. ¶ <sup>7</sup> Difference between the actual transmitter frequency and the assigned transmitter frequency. ¶ <sup>8</sup> If the transmitter carrier output power rating is 6 watts or less, the frequency difference during this time period may exceed the maximum frequency difference for this time period. ¶			

Test setup		
		
Test procedure		
<ul style="list-style-type: none"> <li>• EUT set to transmit mode</li> <li>• Center frequency set to test channel center frequency</li> <li>• The transient behavior is captured during switching the transmitter on and off</li> </ul>		
Test results		
Channel	State	Verdict
F <sub>LOW</sub>	Tx off	PASS
F <sub>MID</sub>	Tx off	PASS
F <sub>HIGH</sub>	Tx off	PASS
F <sub>LOW</sub>	Tx on	PASS
F <sub>MID</sub>	Tx on	PASS
F <sub>HIGH</sub>	Tx on	PASS
Comments:		

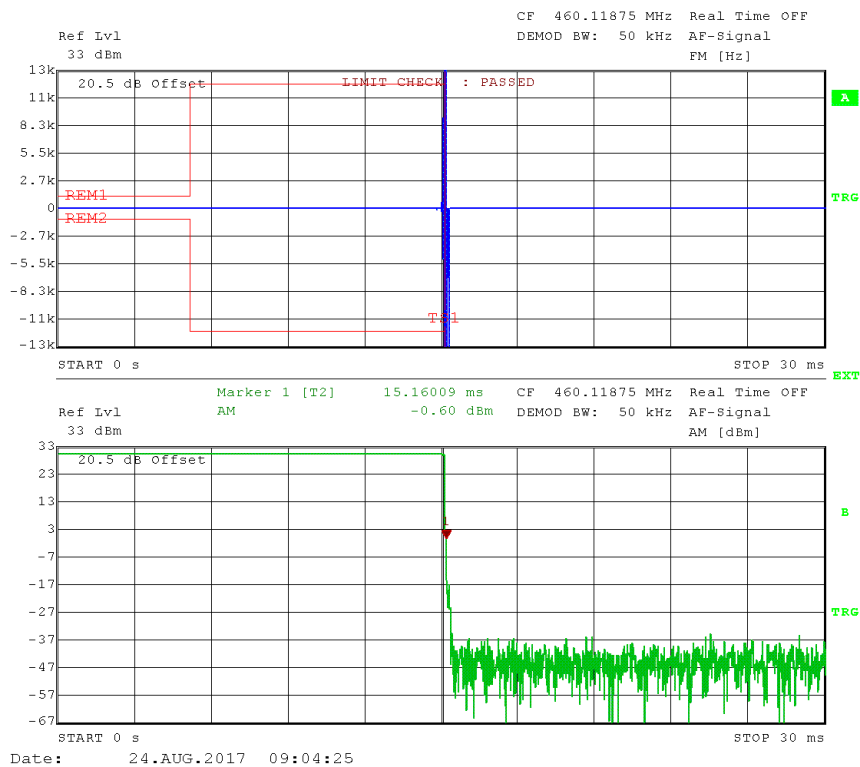
**Transient stability Tx off**

Project Number:	G0M-1707-6700
Applicant	Kamstrup A/S
Model Description	Ultrasonic water meter
Model:	FlowIQ 2250
Test Sample ID:	14778
Operator:	T. Jahn
Test Site:	Eurofins Product Service GmbH
Test Date:	2017-08-24
Note 1:	Channel Low
Note 2:	Pass



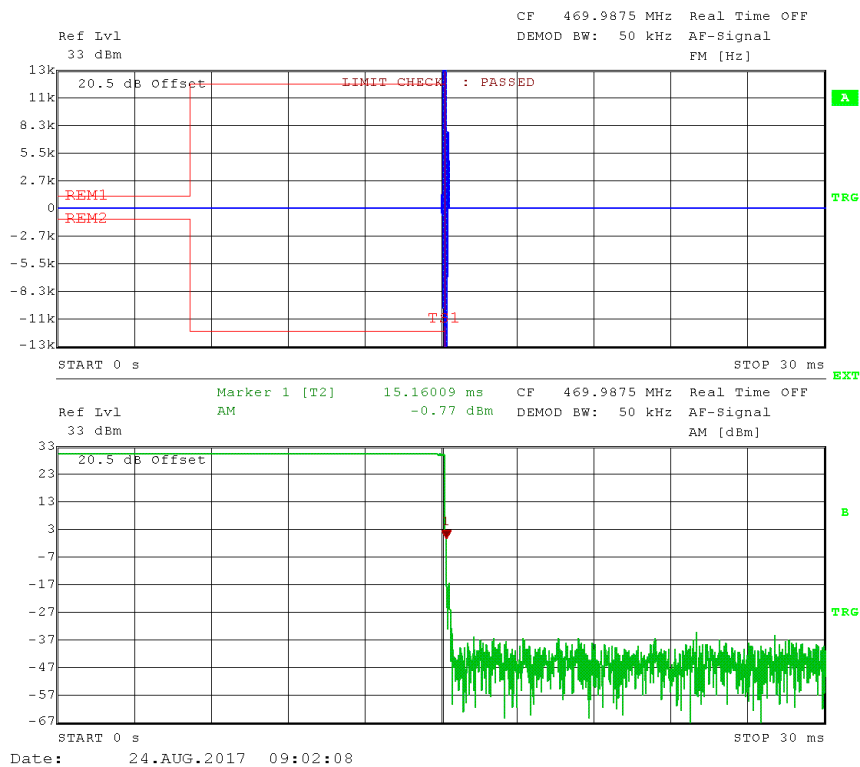
**Transient stability Tx off**

Project Number:	G0M-1707-6700
Applicant	Kamstrup A/S
Model Description	Ultrasonic water meter
Model:	FlowIQ 2250
Test Sample ID:	14778
Operator:	T. Jahn
Test Site:	Eurofins Product Service GmbH
Test Date:	2017-08-24
Note 1:	Channel Mid
Note 2:	Pass



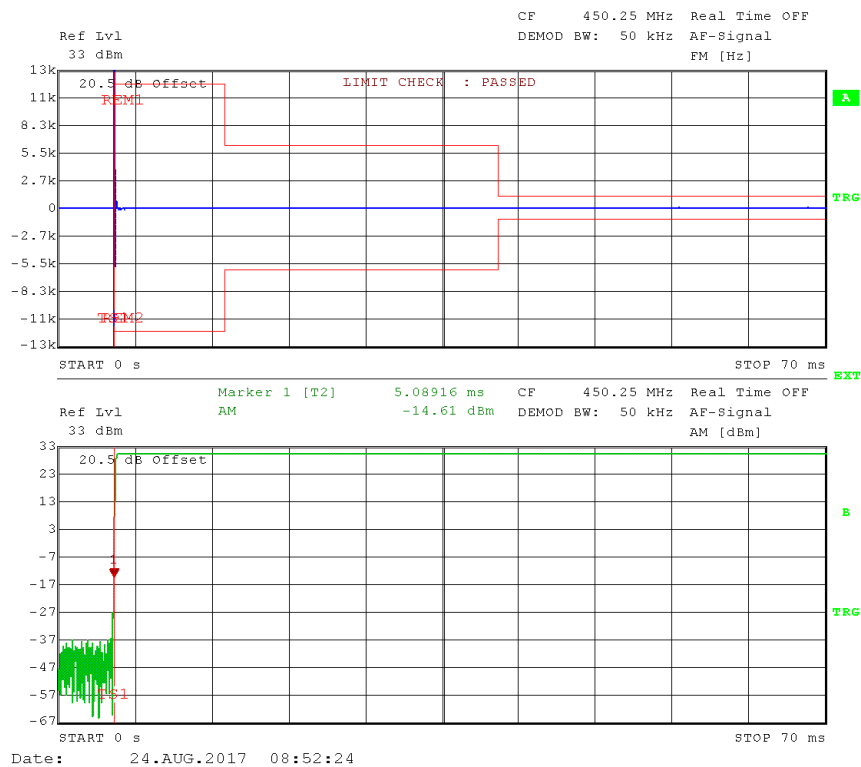
**Transient stability Tx off**

Project Number:	G0M-1707-6700
Applicant	Kamstrup A/S
Model Description	Ultrasonic water meter
Model:	FlowIQ 2250
Test Sample ID:	14778
Operator:	T. Jahn
Test Site:	Eurofins Product Service GmbH
Test Date:	2017-08-24
Note 1:	Channel High
Note 2:	Pass



**Transient stability Tx on**

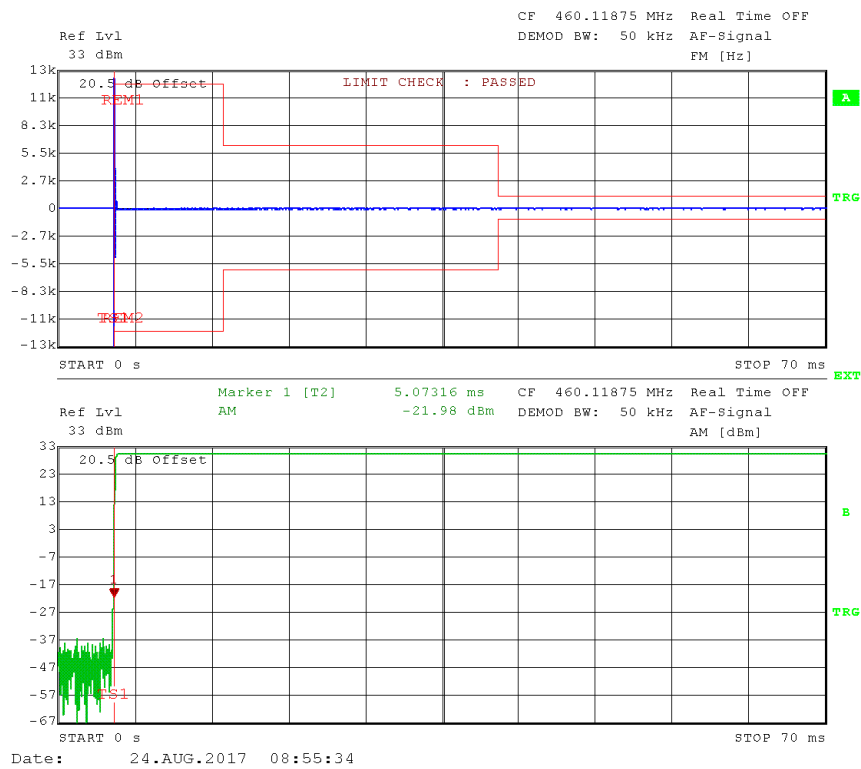
Project Number:	G0M-1707-6700
Applicant	Kamstrup A/S
Model Description	Ultrasonic water meter
Model:	FlowIQ 2250
Test Sample ID:	14778
Operator:	T. Jahn
Test Site:	Eurofins Product Service GmbH
Test Date:	2017-08-24
Note 1:	Channel Low
Note 2:	Pass





### Transient stability Tx on

Project Number: G0M-1707-6700  
 Applicant: Kamstrup A/S  
 Model Description: Ultrasonic water meter  
 Model: FlowIQ 2250  
 Test Sample ID: 14778  
 Operator: T. Jahn  
 Test Site: Eurofins Product Service GmbH  
 Test Date: 2017-08-24  
 Note 1: Channel Mid  
 Note 2: Pass



**Transient stability Tx on**

Project Number:	G0M-1707-6700
Applicant	Kamstrup A/S
Model Description	Ultrasonic water meter
Model:	FlowIQ 2250
Test Sample ID:	14778
Operator:	T. Jahn
Test Site:	Eurofins Product Service GmbH
Test Date:	2017-08-24
Note 1:	Channel High
Note 2:	Pass

