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DELTA Test Report



TEST Reg. no. 19

Test of flowIQ2100 according to FCC requirements

Performed for Kamstrup A/S

DANAK-19/12504 Rev. A

Project no.: T203210-1

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30 October 2012

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Title Test of flowIQ2100 according to FCC requirements

Test object flowIQ2100

Report no. DANAK-19/12504 Rev. A

Project no. T203210-1

Test period 24 September to 02 October 2012

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Manufacturer Kamstrup A/S

Specifications 47 CFR Part 15, Subpart C (Specific rule part §15.247)

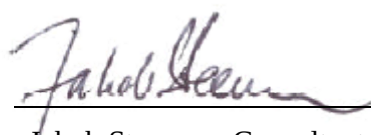
Results The test objects were found to be in compliance with the specifications, as listed in Section 1

Test personnel Claus Momme Thomsen

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Date 20 October 2012

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This test report replaces previously issued test report DANAK-19/12504 dated 22 October 2012. The changes in this report are:

Section 6: Information about calibration has been added.

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1. Summary of tests

The authorization procedure for the flowIQ2100 is:

Certification by FCC Part 15 C.

Test case ID	Description	Specification	Test methods	Results
2.3	6 dB Bandwidth	47 CFR Part 15C Subpart 15.247(a)(2)	ANSI C63.10-2009	Passed
2.5	Radiated limits; general requirements	47 CFR Part 15C Subpart 15.209	ANSI C63.10-2009	Passed
2.6	Antenna Conducted Emission	47 CFR Part 15C Subpart 15.247(b)(3)	ANSI C63.10-2009	Passed
2.7	Occupied Bandwidth & Band Edge Compliance	47 CFR Part 15C Subpart 15.247(c)	ANSI C63.10-2009	Passed
2.8	Power Spectral Density	47 CFR Part 15C Subpart 15.247(e)	ANSI C63.10-2009	Passed

The given result is based on a shared risk principle with respect to the measurement uncertainty.

Conclusion

The test objects mentioned in this report meet the requirements of the rule part stated below.

- 47 CFR Part 15, Subpart C (Specific rule part §15.247).

The test results relate only to the objects tested.



2. Test objects



Photo 2.1.1 Test object.

2.1 Test objects

Test object 2.1.1

Name of test object	flowIQ2100
Model / type	flowIQ2100
Part no.	-
Serial no.	SN:001
FCC ID	OUY-FLOW2100
Manufacturer	Kamstrup A/S
Supply voltage	3.7 VDC
Software version	Test software ver 001
Hardware version	-
Cycle time	0.1 msec
Highest frequency generated or used	915.0 MHz
Comment	Used for radiated measurements



Test object 2.1.2

Name of test object	flowIQ2100
Model / type	flowIQ2100
Part no.	-
Serial no.	SN:002
FCC ID	OUY-FLOW2100
Manufacturer	Kamstrup A/S
Supply voltage	3.7 VDC
Software version	Test software ver 001
Hardware version	-
Cycle time	0.1 msec
Highest frequency generated or used	915.0 MHz
Comment	Used for conducted measurements

2.2 Auxiliary equipment

Auxiliary equipment 2.2.1

Name of auxiliary equipment	Optical Readout head with USB
Model / type	6699-099
Part no.	-
Serial no.	Batch:123456.1
FCC ID	-
Manufacturer	Kamstrup A/S
Supply voltage	USB 5.0 VDC
Highest frequency generated or used	-
Comment	The aux equipment is supplied by the client, who also has the responsibility for its correct function and set up. The aux equipment is only used for test object configuration prior to testing. Not present during testing.



3. General test conditions

3.1 Test setup during test

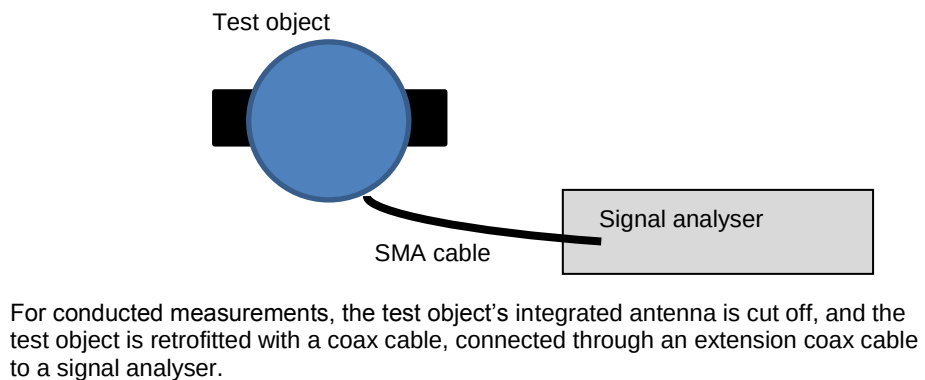
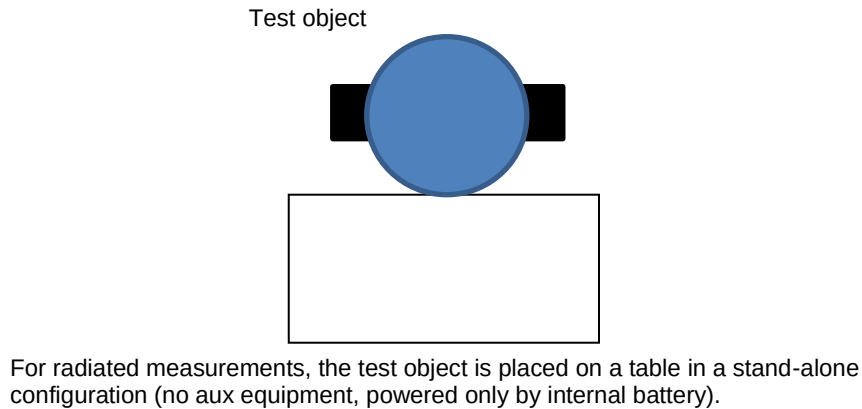


Figure 3.1 Block diagram of test objects with cables and auxiliary equipment.

The flowIQ2100 is powered by battery and put into continuous Tx mode. The test object is measured completely stand alone.

A separate device with the internal antenna replaced with a SMA connector is supplied for conducted tests.

3.1.1 Description and intended use of test object

The flowIQ2100 is used for measurement of cold water consumption in households as well as in industrial and commercial buildings.

Ultrasonic flow measurement is utilized for exact measuring accuracy and longevity.

The flowIQ2100 is power supplied by battery. Battery lifetime is up to 16 years.

All measurements, references, readings, events and calculations are stored in a data logger for billing and analysis.

The water meter has a readable display.

Remote meter reading is possible by handheld devices and by integration in smart metering networks.

The remote data communication is handled in either of two ways:

- By broadband wireless communication in the 902-928 MHz band, with output power of approximately 10 mW.
- By low power, very low proximity infrared communication.

For the purpose of testing, only option 1 is used.

3.1.2 Test modes during emission tests

All test objects were running special test software.

Tests were performed at the following fundamental frequency of the radio transmitter: 915.0 MHz.

For all the emission tests, all relevant functions are activated in order to maximize emissions and to monitor that the radio is active. The presence of an active radio is checked both prior to and after each test.

The test object is put into constant, modulated Tx operating mode with a modulation cycle no higher than 0.1 msec, so that each measurement sample completely covers a cycle.



3.2 Radio specification

Radio	Proprietary 915 MHz radio
Fundamental operating frequency (f _{center})	915.0 MHz
Maximum measured field strength @ 3m	98.3 dBuV/m
Antenna type	Integral antenna
Equipment Type	I: Transfer of messages (digital or analogue signals)
Equipment intended for fixed use?	Yes
Equipment intended for vehicular or mobile use?	No
Equipment intended for portable use? (<20cm from user)	No
Transmit mode available	Yes
Receive mode available	Yes
Environment	General population
User proximity by FCC definition	Fixed use (more than 20 cm from user during normal operation)
Frequency band	902-928 MHz
Maximum permissible output power in the band	1 W from ant connector (127.38 dBuV/m @ 3m)
Number of power levels	1
Number of channels	1
Modulation forms	FSK (digital modulation)
Maximum Data Rate [kbps]	250
Manufacturer stated band width (20 dB) [kHz]	1000
Manufacturer stated band width (6 dB) [kHz]	520
Channel spacing	One channel only
Maximum Duty Cycle during normal use	1 %



4. Test results

4.1 Test ID 2.5: Radiated limits below 1 GHz

Test object	flowIQ2100	Sheet	RE_Spur-1
Type	flowIQ2100	Project no.	T203210-1
Serial no.	SN:001	Date	24 Sep 2012
Client	Kamstrup A/S	Initials	CMT
Specification	See Section 1, Summary of tests	Frequency	30-1000 MHz

Test method	ANSI C63.10:2009			Temperature	23 °C			
Characteristics	Peak search ant. at 3 m, height: 1-4 m, v/h pol.			Humidity	41 % RH			
Detector	Peak and Quasi peak			Bandwidth	120 kHz			
Test equipm.	EMI room Hørsholm	49600	29861	29727	29301	49421	Uncertainty	4.9 dB

Final max (Quasi peak):

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
34.440000	16.30	18.5	40.0	23.7	131.0	45.00	VERTICAL
232.110000	18.70	13.8	46.0	27.3	101.0	358.00	HORIZONTAL
335.220000	16.10	17.8	46.0	29.9	132.0	147.00	VERTICAL
625.860000	24.70	24.5	46.0	21.3	271.0	48.00	HORIZONTAL
914.770000	97.80	29.3	127.4	29.6	142.0	25.00	HORIZONTAL
915.220000	98.30	29.3	127.4	29.1	142.0	26.00	HORIZONTAL
951.960000	30.70	30.1	46.0	15.3	128.0	59.00	HORIZONTAL

Test result The measured field strengths were below the limit

Polarization Vertical and horizontal

Test Port Enclosure

Test frequency Tx @ 915 MHz

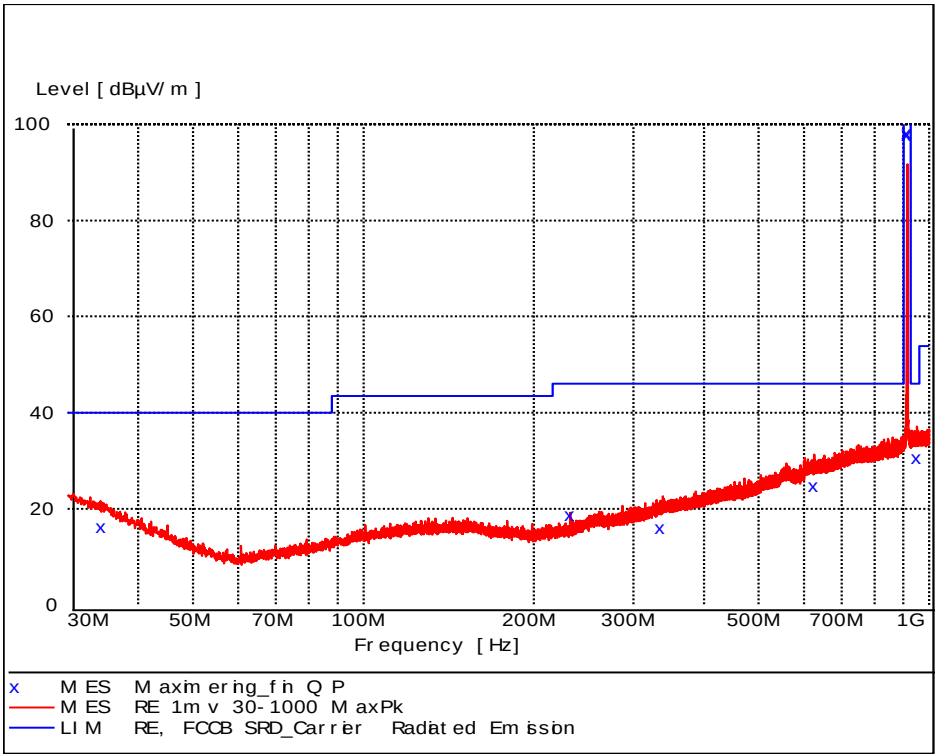
Test mode Continuous Tx - normal modulation

Condition Normal

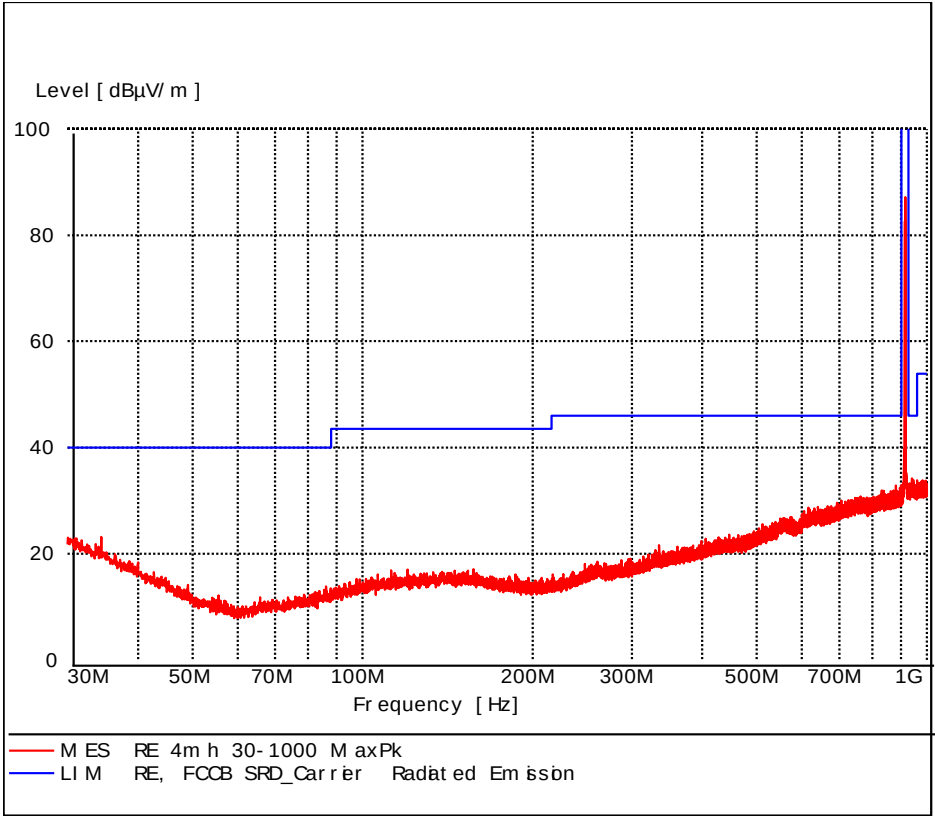
Compliant Yes

Comments Prescan and final maximal measurements by variation of turntable azimuth, antenna height, and antenna polarisation





Pre-scan, Antenna at 3 m, 1 m height, vert. pol. Peak detector.



Pre-scan, Antenna at 3 m, 4 m height, hor. pol. Peak detector.



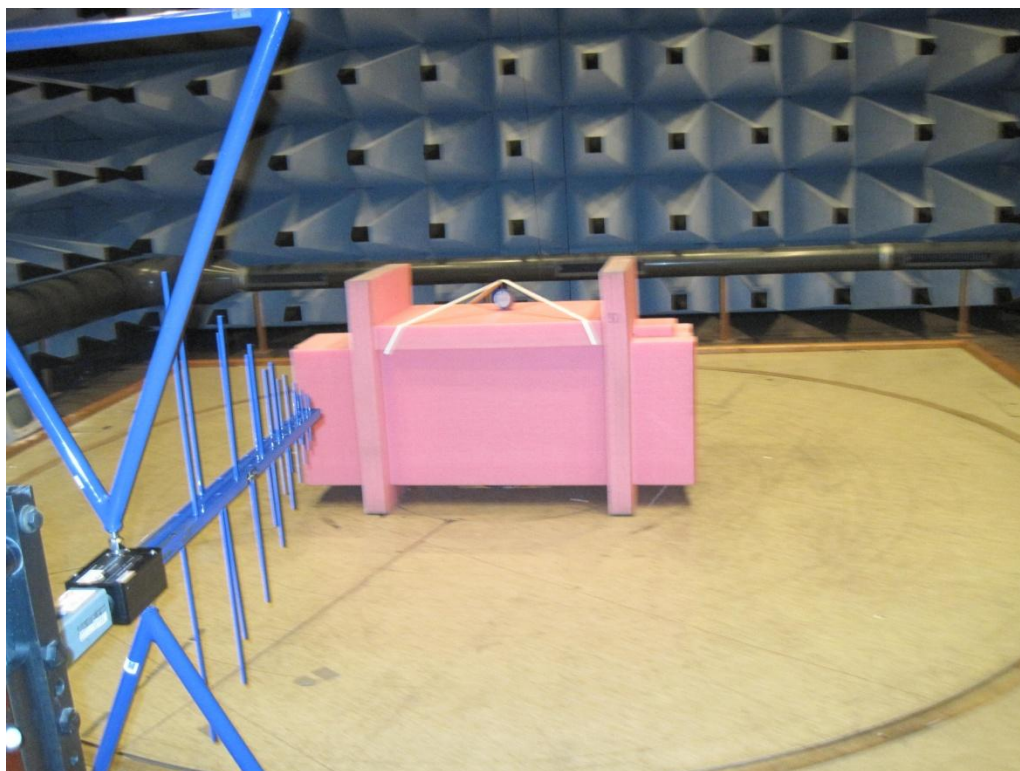


Photo 4.1.1 Test setup regarding measurement Radiated limits below 1 GHz.

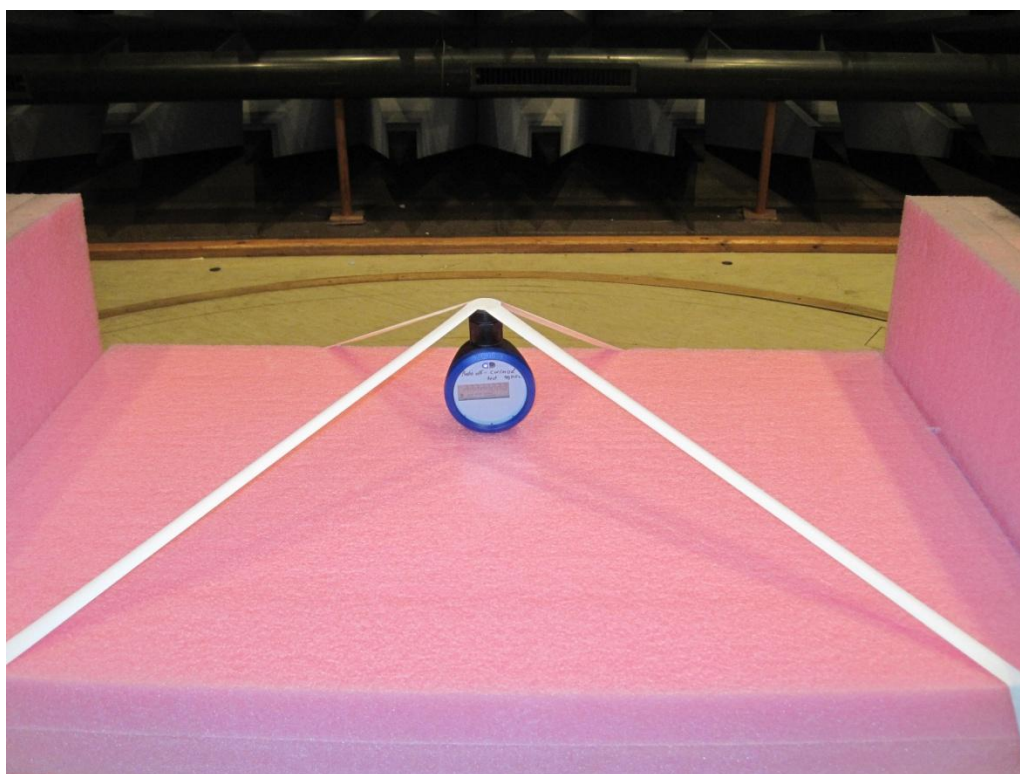


Photo 4.1.2 Test setup regarding measurement Radiated limits below 1 GHz.



4.2 Test ID 2.5: Radiated limits above 1 GHz

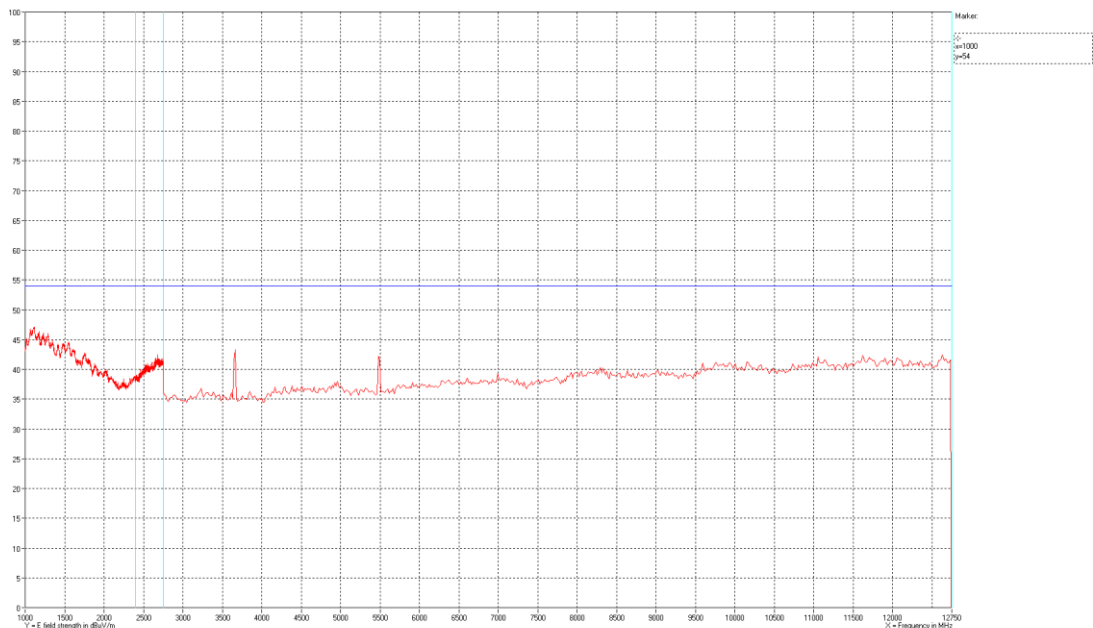
Test object	flowIQ2100	Sheet	RE_Spur-2
Type	flowIQ2100	Project no.	T203210
Serial no.	SN:001	Date	24 Sep 2012
Client	Kamstrup A/S	Initials	CMT
Specification	See Section 1, Summary of tests	Frequency	1-12.75 GHz

Test method	ANSI C63.10:2009	Temperature	23 °C
Characteristics	Complete search, antenna distance 3 m	Humidity	41 % RH
Detector	Peak	Bandwidth	1 MHz
Test equipm.	EMI room Hørsholm 49600 49712 49625	Uncertainty	4.9 dB

Final max (Peak) :

Frequency MHz	Level dBµV/m	Peak Limit dBµV/m	AV Limit dBµV/m	Margin to AV dB	Polarisation
3665.20000	43.3	74.0	54.0	10.7	Complete search
5479.20000	42.3	74.0	54.0	11.7	Complete search

Test result	The measured field strengths were below the limit
Test Port	Enclosure
Test frequency	Tx @ 915 MHz
Test mode	Continuous Tx - normal modulation
Condition	Normal
Compliant	Yes
Comments	Prescan and final maximal measurements by variation of turntable azimuth, antenna height and antenna polarization



Polarization	Vertical and horizontal peak measurements
Comments	All measurements are performed with a peak detector. All peak measurements were below average limit.



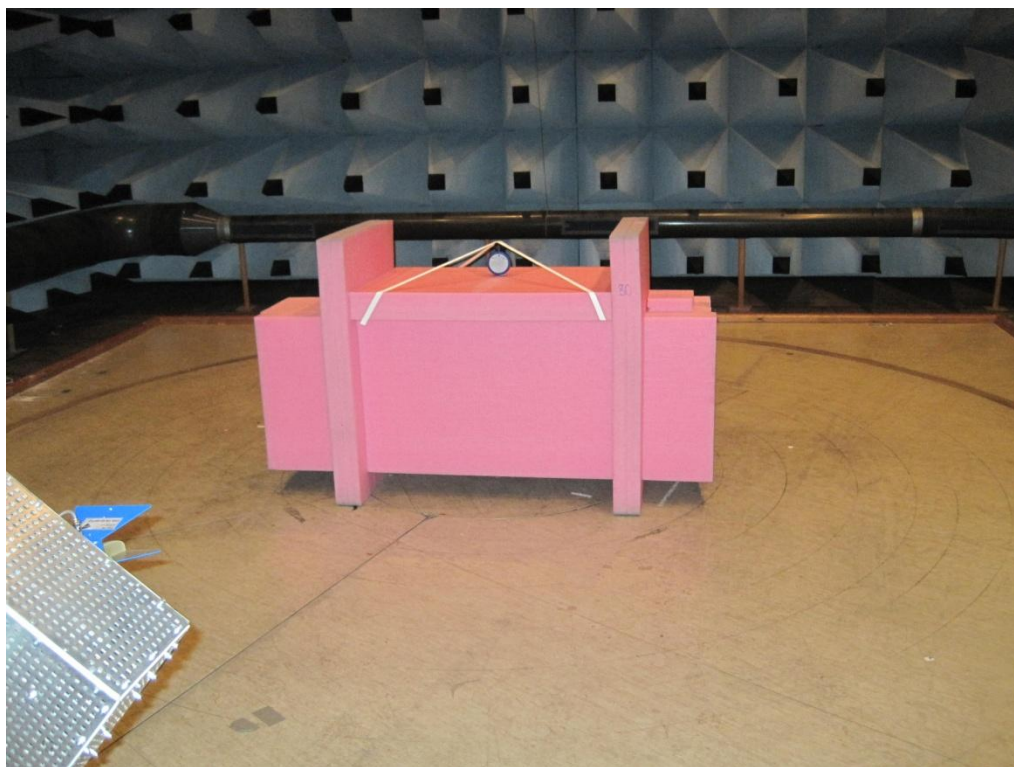


Photo 4.2.1 Test setup regarding measurement Radiated limits above 1 GHz.

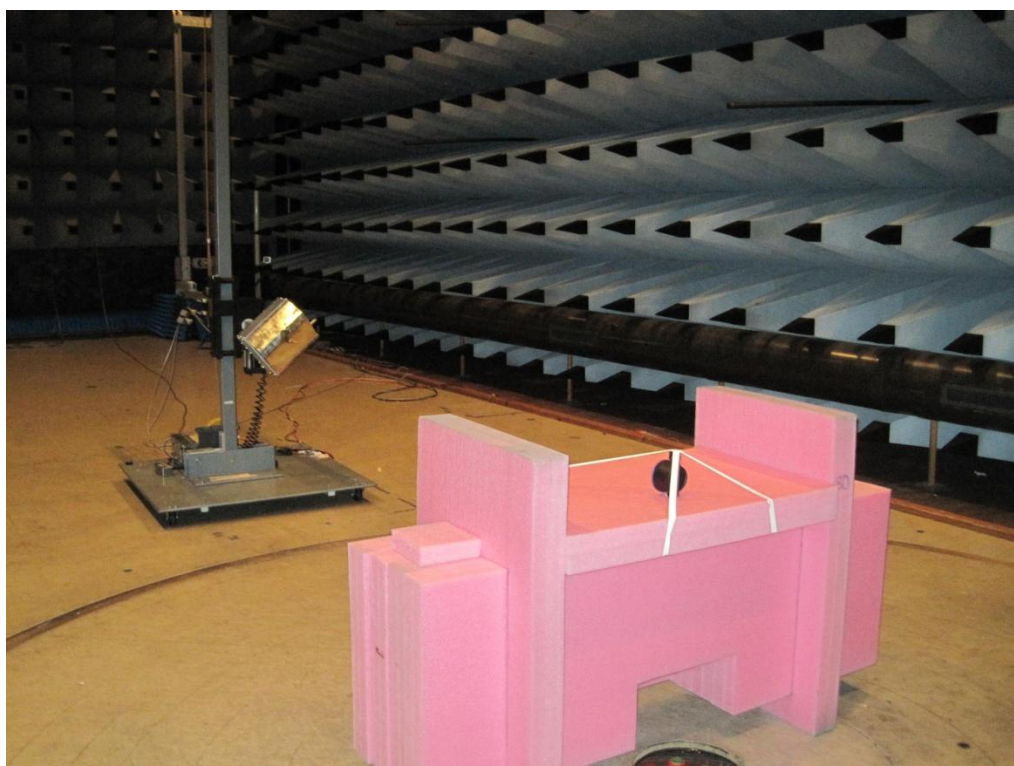


Photo 4.2.2 Test setup regarding measurement Radiated limits above 1 GHz.



4.3 Test ID 2.6: Antenna conducted emission

Test object	flowIQ2100	Sheet	RE_Con-1
Type	flowIQ2100	Project no.	T203210
Serial no.	SN:002	Date	02 Oct 2012
Client	Kamstrup A/S	Initials	CMT
Specification	See Section 1, Summary of tests	Frequency	915 MHz

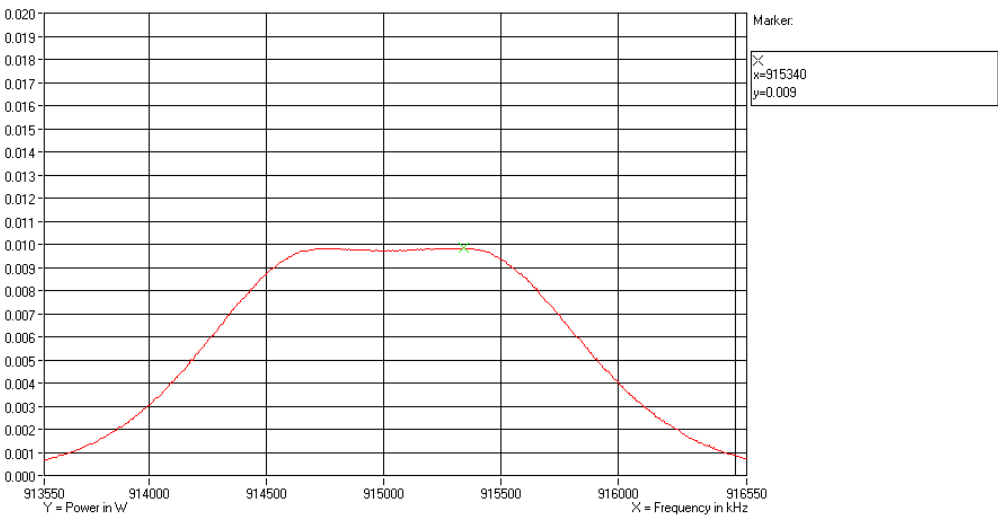
Test method	ANSI C63.10:2009	Temperature	21 °C
Characteristics	Conducted measurement @ antenna port	Humidity	42 % RH
Span	3 MHz	RBW	1 MHz
Sweep	Auto	VBW	3 MHz
Detector	Peak	Trace	Max hold
Test equipm.	Outside EMC room Hørsholm 49184 49550 49299	Uncertainty	1.1 dB

Final max (Peak) :

Frequency MHz	Level dBm	Level mW	Limit dBm @ 3m	Limit mW	Margin dB	(Max ant gain) (dB)
915.34000	9.93	9.84	30.00	1000.0	20.07	(-8.29)

Test result	The measured power was below the limit
Test Port	Antenna connector
Test frequency	915.34 MHz
Test mode	Continuous Tx - normal modulation
Condition	Normal
Compliant	Yes
Comments	The limit of 1000.0 mW applies to transmitters with antenna gain up to 6 dBi. The test object incorporates an integrated PCB antenna with a maximum gain of -8.29 dBi. Measurements are corrected for cable losses.





Polarization	Not applicable
Comments	Conducted measurement of antenna emission



4.4 Test ID 2.3: 6 dB bandwidth

Test object	flowIQ2100	Sheet	RE_Con-2
Type	flowIQ2100	Project no.	T203210
Serial no.	SN:002	Date	02 Oct 2012
Client	Kamstrup A/S	Initials	CMT
Specification	See Section 1, Summary of tests	Frequency	915 MHz

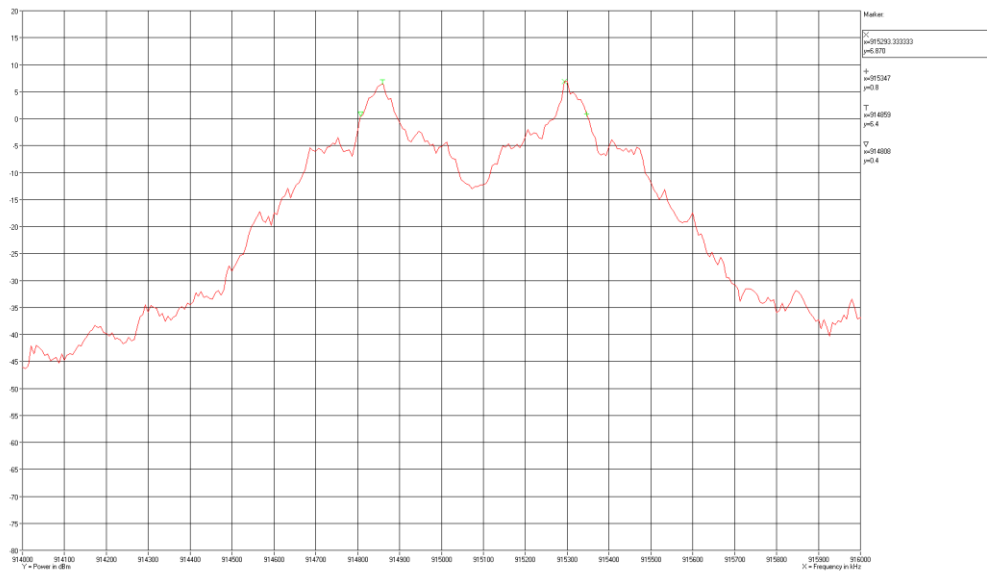
Test method	ANSI C63.10:2009	Temperature	21 °C
Characteristics	Conducted measurement @ antenna port	Humidity	42 % RH
Span	2 MHz	RBW	10 kHz
Sweep	Auto	VBW	30 kHz
Detector	Peak	Trace	Max hold
Test equipm.	Outside EMC room Hørsholm 49184 49550 49299	Uncertainty	1.1 dB

Final max (Peak) :

Frequency Peak 1 MHz	Frequency 6 dB Delta 1 MHz	Frequency Peak 2 MHz	Frequency 6 dB Delta 2 MHz	6 dB BW Delta 2 - Delta 1 MHz
914.859	914.808	915.293	915.347	000.539

Test result	The measured bandwidth was within the limit
Test Port	Antenna connector
Test frequency	Fundamental frequency is set at 915 MHz
Test mode	Continuous Tx - normal modulation
Condition	Normal
Compliant	Yes
Comments	The 6 dB BW lower limit is 500 kHz. The test object has a 6 dB BW of 539 kHz. Measurements are corrected for cable losses.





Polarization	Not applicable
Comments	Conducted measurement of 6 dB BW



4.5 Test ID 2.7: Occupied bandwidth & band edge compliance

Test object	flowIQ2100	Sheet	RE_Con-3
Type	flowIQ2100	Project no.	T203210
Serial no.	SN:002	Date	02 Oct 2012
Client	Kamstrup A/S	Initials	CMT
Specification	See Section 1, Summary of tests	Frequency	915 MHz

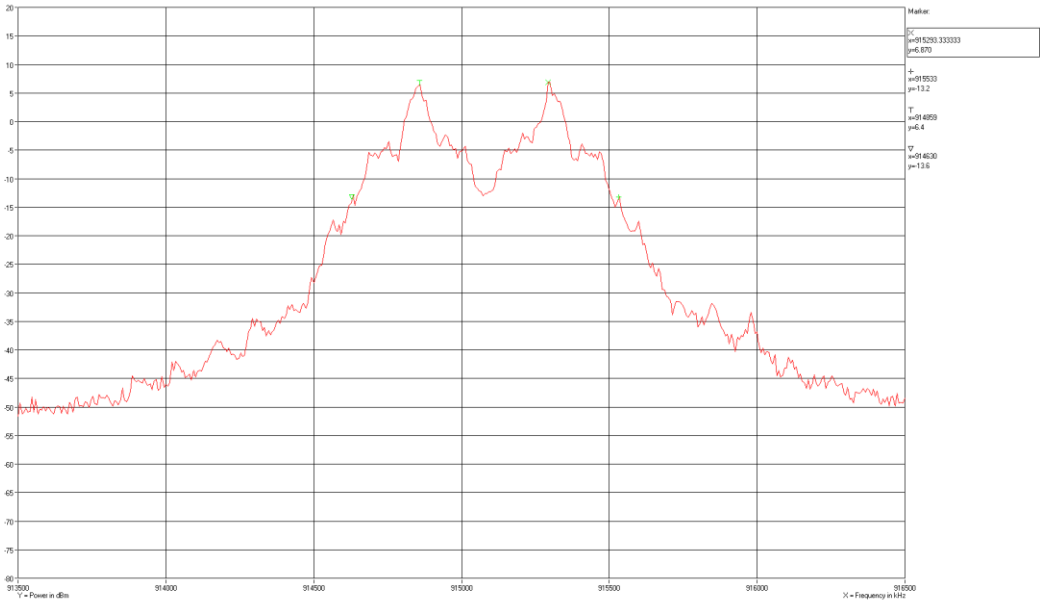
Test method	ANSI C63.10:2009	Temperature	21 °C
Characteristics	Conducted measurement @ antenna port	Humidity	42 % RH
Span	3 MHz	RBW	10 kHz
Sweep	Auto	VBW	30 kHz
Detector	Peak	Trace	Max hold
Test equipm.	Outside EMC room Hørsholm 49184 49550 49299	Uncertainty	1.1 dB

Final max (Peak):

Frequency Peak 1 MHz	20 dB Delta 1 MHz	Frequency Peak 2 MHz	20 dB Delta 2 MHz	20 dB OBW Delta 2 - Delta 1 MHz
914.859	914.630	915.293	915.533	000.903
Band Edge MHz	20 dB OBW frequency MHz	Margin MHz		
902.000	914.630	12.630		
928.000	915.533	12.467		

Test result	The measured occupied bandwidth was within the limit. Band edges are respected.
Test Port	Antenna connector
Test frequency	Fundamental frequency is set at 915 MHz
Test mode	Continuous Tx - normal modulation
Condition	Normal
Compliant	Yes
Comments	The measured 20 dB OBW is 903 kHz. The 20 dB bandwidth of the emission is contained within the frequency band designated in the rule section under which the equipment is operated (15.247).





Polarization	Not applicable
Comments	Conducted measurement of 20 dB Occupied BW



4.6 Test ID 2.8: Power Spectral Density

Test object	flowIQ2100	Sheet	RE_Con-4
Type	flowIQ2100	Project no.	T203210
Serial no.	SN:002	Date	02 Oct 2012
Client	Kamstrup A/S	Initials	CMT
Specification	See Section 1, Summary of tests	Frequency	915 MHz

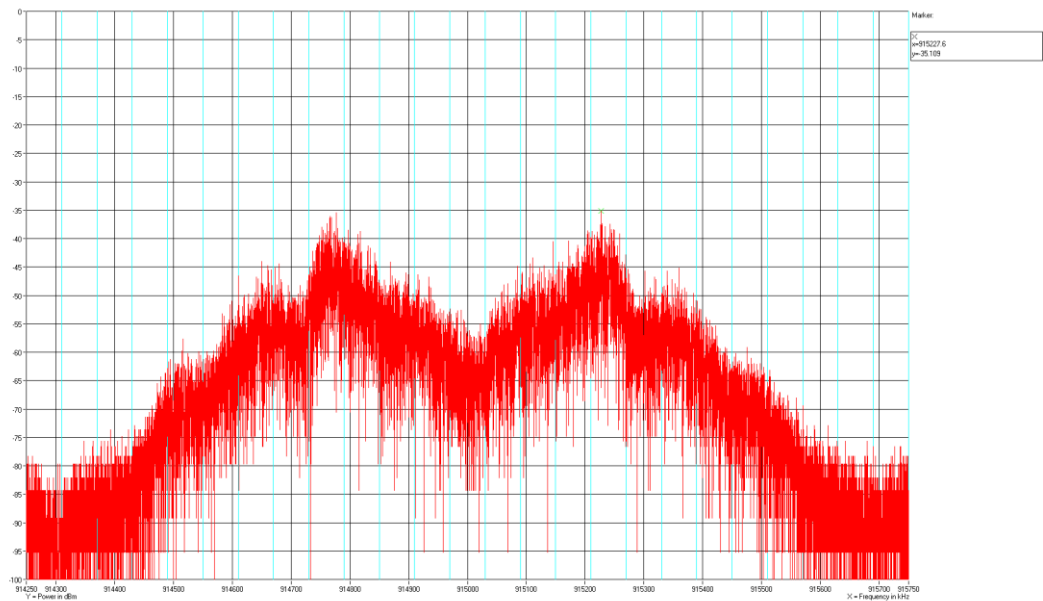
Test method	ANSI C63.10:2009	Temperature	21 °C
Characteristics	Conducted measurement @ antenna port	Humidity	42 % RH
Span	1.5 MHz	RBW	3 kHz
Sweep	Auto	VBW	10 kHz
Detector	Peak	Trace	Max hold
Test equipm.	Outside EMC room Hørsholm 49184 49550 49299	Uncertainty	1.1 dB

Final max (Peak):
 Max peak value in any 3 kHz band

Frequency MHz	Level dBm	Limit dBm	Margin dB
915.228	-35.11	8.00	43.11

Test result	The measured power spectral density was within the limit.
Test Port	Antenna connector
Test frequency	Fundamental frequency is set at 915 MHz
Test mode	Continuous Tx - normal modulation
Condition	Normal
Compliant	Yes
Comments	The maximum output power is -35.11 dBm within any 3 kHz band. Measurements are corrected for cable losses.





Polarization	Not applicable
Comments	Conducted measurement of power spectral density



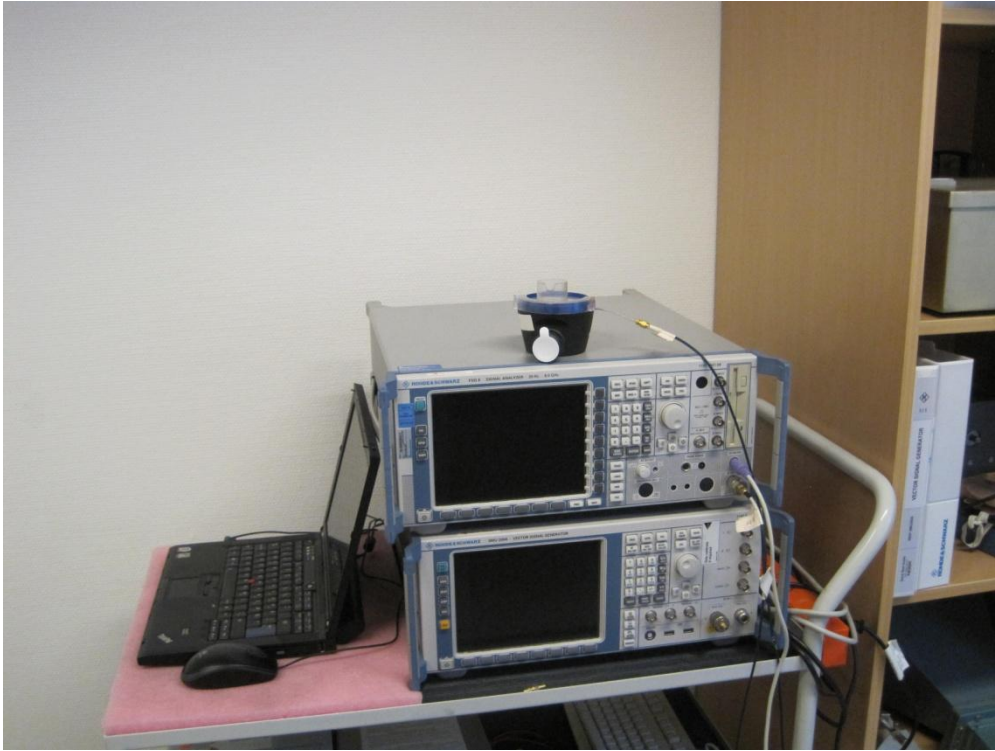


Photo 4.6.1 Test setup for all conducted measurements:
Antenna conducted emission
6 dB bandwidth
Occupied bandwidth & band edge compliance
Power spectral density

5. National registrations and accreditations

5.1 DANAK Accreditation

Organization: Danish Accreditation and Metrology Fund - DANAK, see www.danak.dk and www.ilac.org

Registration Number: 19

Area Number: C

DANAK is part of ILAC (International Laboratory Accreditation Cooperation) including its MRA (Mutual Recognition Arrangement). The MRA includes the Australian NATA and Canadian SCC.

CISPR 22 is equivalent to AS/NZS CISPR 22, and therefore this report can be used for applying the **Australian C-Tick mark** for IT equipment, when this test has been passed.

CISPR 22:2002 is equivalent to ICES-003:2004, and therefore this report can be used for approval in Canada for IT equipment, when this test has been passed.

5.2 FCC Registrations

Organization: Federal Communications Commission, USA

Registration Number: 90529

Facilities: EMC room 2 Hørsholm (EMC-2)
EMC room 3 Hørsholm (EMC-3)
EMC room 4 Hørsholm (EMC-4)
EMI room Hørsholm (EMC-5)

5.3 VCCI Registrations

Organization: Voluntary Control Council for Interference by Information Technology, Japan

Member Number: 910

Facilities: EMC room 2 Hørsholm (EMC-2): C-707, T-246 and T-1547
EMC room 3 Hørsholm (EMC-3): C-2532, T-247 and T-1548
EMC room 4 Hørsholm (EMC-4): C-2533, T-248 and T1549
EMI room Hørsholm (EMC-5): R-1180, C-706 and
T-1550, G-470

5.4 IC Registrations

Organization: Industry Canada, Certification and Engineering Bureau

Registration Number: IC4187A-5

Facilities: EMI room Hørsholm (EMC-5)



6. List of instruments

No.	Description	Manufacturer	Type No.	Cal date	Cal exp
29301	ARTIFICIAL MAINS NETWORK	ROHDE & SCHWARZ	ESH2-Z5	2011-12-21	2012-12-21
29861	EMI-SOFTWARE VER. 1.60	ROHDE & SCHWARZ	ES-K1, PART: 1026.6790.02	-	-
49086	REMI EMISSION SOFTWARE PACKAGE v. 2.133, ROOM 5	NeWeTec	REMI	-	-
49421	IMPULSE VOLTAGE LIMITER (BNC)	ROHDE & SCHWARZ	ESH3/Z2	2012-06-21	2013-06-21
49550	SIGNAL ANALYZER	ROHDE & SCHWARZ	FSQ8	2012-02-28	2013-02-28
49600	SPECTRUM ANALYZER / MEASUREMENT RECEIVER	ROHDE & SCHWARZ	ESU40	2011-12-16	2012-12-16
49624	DUAL RIDGE HORN ANTENNA – 1 GHz – 26 GHz (2 GHz – 32 GHz)	SATIMO	SH2000	2011-09-19	2014-09-19
49625	SRD COAX SWITCH MATRIX USED IN 1GHZ TO 26 GHz SRD ANTENNASYSTEM	DELTA	COAX SWITCH MATRIX	2012-05-11	2013-05-11

