

# Test Report



## INTENTIONAL RADIATOR TESTS ACCORDING TO FCC PART 15 C

Equipment Under Test: Aqsens Q-system Time-Resolved-Fluorescence Analyzer

Model: AQ-QS01

Manufacturer /  
Customer: Aqsens Oy

Kaivokatu 8b  
00100 Helsinki  
FINLAND

FCC CFR 47 Part: 15.207: 2014  
15.225: 2014

Date: 7 September 2015

Issued by:

Niko Kotsalo  
Testing Engineer

Date: 7 September 2015

Checked by:

Pekka Kälviäinen  
Testing Engineer

**Table of Contents**

---

PRODUCT DESCRIPTION .....	3
Equipment Under Test (EUT).....	3
Type of the EUT.....	3
Peripherals .....	3
Ratings and declarations.....	4
Power Supply.....	4
GENERAL REMARKS .....	5
Disclaimer.....	5
SUMMARY OF TESTING .....	6
EUT Test Conditions during Testing .....	6
TEST RESULTS .....	7
Conducted Emissions In The Frequency Range 150 kHz to 30 MHz.....	7
Transmitter Radiated Spurious Emissions 9 kHz to 1 GHz.....	10
Receiver Radiated Radiated Emissions 9 kHz to 1 GHz .....	14
Frequency Stability.....	16
TEST EQUIPMENT .....	17

## **Equipment Under Test (EUT)**

TRF analyzer

Model: AQ-QS01  
Serial no: -  
Software Version: 1.00  
Hardware Version: 1.05  
FCC ID: 2AGFC – CAG01

The Aqsens Q System is a TRF analyzer with RFID reader. Aqsens Q system has a mixer that is used to mix a water sample with test reagents and an analyzer that makes actual measurements. The measurements are transferred to the laptop for saving and visualization. Key components of analyzer electronics are a led light source for excitation of the sample and photomultiplier tube to count the photons emitted by the sample. The analyzer has also an inbuilt 13.57 MHz RFID reader for reading an RFID tag attached to the cassette. Information read from the tag is used to check the authenticity of the test kit.

## **Type of the EUT**

The EUT will be tested as a tabletop unit.

## **Classification of the device**

Fixed device	<input type="checkbox"/>
Mobile Device (Human body distance > 20cm)	<input checked="" type="checkbox"/>
Portable Device (Human body distance < 20cm)	<input type="checkbox"/>

## **Modifications Incorporated in the EUT**

No modifications were applied to the EUT during testing

## **Peripherals**

- Laptop PC Acer V3-111 series (S/N NXMNTED019428121907612)
- Logitech USB mouse (connected to the laptop via USB cable)
- 3Com Etherlink III Network card (connected to the laptop via Ethernet cable)

## Ratings and declarations

Operating Frequency Range (OFR): 13.56 MHz  
Channels: 1  
Modulation: ASK

## Power Supply

The EUT is powered with 12V AC/DC power supply.

Manufacturer: XP Power  
Model: VEP24US12  
S/N: 1408-01478  
Rated voltage: AC 100-240 VAC (tested with 115 VAC, 60 Hz)  
Rated current: ~0.6 A max  
Rated frequency: 50/60 Hz  
Output voltage: +12 VDC  
Output current: 2.0 A

**Disclaimer**

*This document is issued by the Company under its General Conditions of service accessible at [http://www.sgs.com/terms\\_and\\_conditions.htm](http://www.sgs.com/terms_and_conditions.htm). attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.*

*Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.*

*Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only. This document cannot be reproduced except in full, without prior approval of the Company.*

## SUMMARY OF TESTING

Test Specification	Description of Test	Result
§15.225 (a) - (d)	Radiated Emissions 9 kHz to 1 GHz	<b>PASS</b>
§15.207	Conducted Emissions 150 kHz – 30 MHz	<b>PASS</b>
§15.225 (e)	Frequency Stability, Temperature Variation	<b>PASS</b>
§15.225 (e)	Frequency Stability, Voltage Variation	<b>PASS</b>

According to the standard the measurement results have been compared directly with the limits without considering measurement uncertainties.

### Explanations:

PASS The EUT passed that particular test.  
FAIL The EUT failed that particular test.  
N/A Not Applicable  
N/T Not Tested

## EUT Test Conditions during Testing

Configuration of the EUT system was made to correspond to actual assembling conditions as far as possible.

TRF analyzer was connected to the laptop with USB cable. Analyzer was connected to AC mains with AD/DC converter. During the tests RFID radio was set to read RFID tag continuously. Manufacturer's computer software was running in the laptop. Peripherals (USB mouse and a network card) were connected to the laptop.

## Test Facility

<input type="checkbox"/> Testing Location / address: FCC registration number: <b>90598</b>	SGS Fimko Ltd Särkiniementie 3 FI-00210, HELSINKI FINLAND
<input checked="" type="checkbox"/> Testing Location / address: FCC registration number: <b>178986</b> Industry Canada registration number: <b>8708A-2</b>	SGS Fimko Ltd Karakaarenkuja 4 FI-02610, ESPOO FINLAND

**Conducted Emissions In The Frequency Range 150 kHz to 30 MHz.**

**Standard:** ANSI C63.10 (2009)  
**Tested by:** NKO  
**Date:** 16.7.2015  
**Temperature:** 20 °C  
**Humidity:** 40 % RH  
**Measurement uncertainty:** ± 2.9 dB      Level of confidence 95 % (k = 2)

**FCC Rule: 15.207 (a)**

Conducted disturbance voltage was measured with an artificial main network from 150 kHz to 30 MHz with 4.5 kHz steps and a resolution bandwidth of 9 kHz. Measurements were carried out with peak and average detectors.

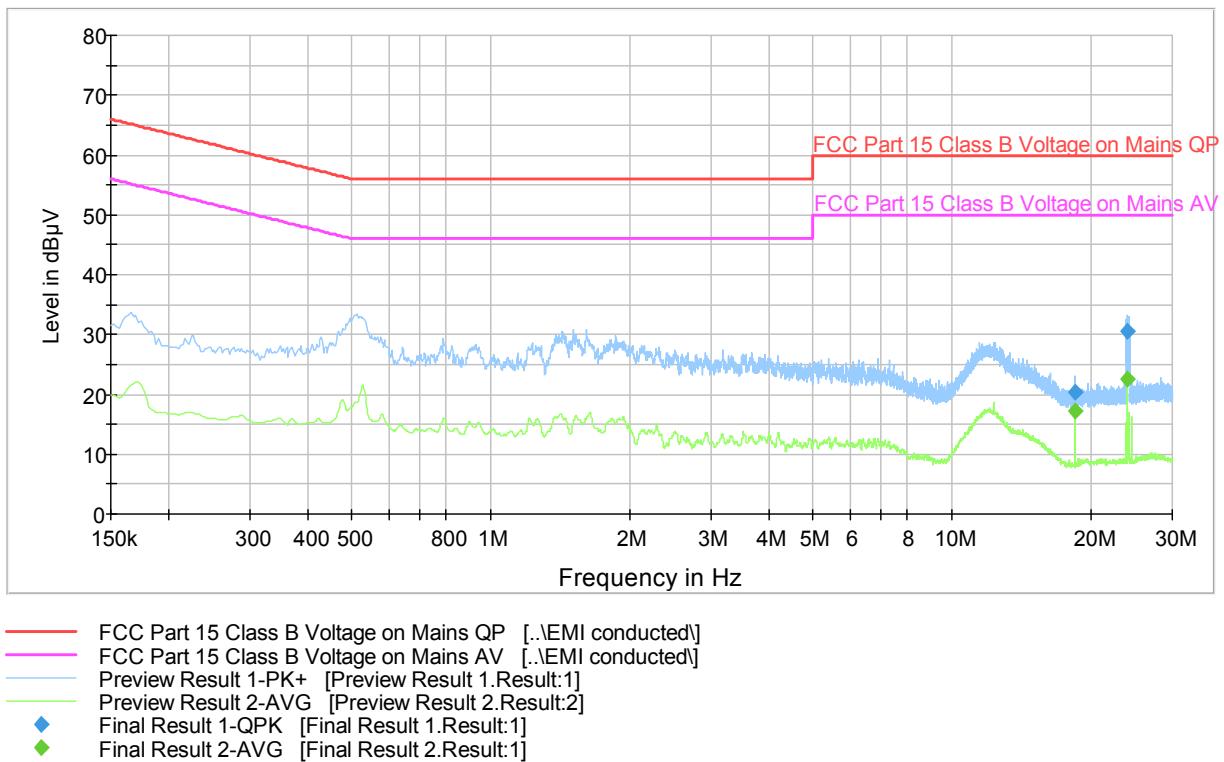
During the test the EUT was powered from the separate power supply (115VAC / 60 Hz) through the LISN.

<b>Frequency of emission (MHz)</b>	<b>Conducted limit (dB<math>\mu</math>V)</b>	
	<b>Quasi-peak</b>	<b>Average</b>
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

\*Decreases with the logarithm of the frequency.

## Conducted Emissions In The Frequency Range 150 kHz to 30 MHz

Conducted Emission Mains FCC Part 15 Class B with ESH3-Z5 8019

**Figure 1.** The measured curves with peak- and average detector from the AC input of the EUT.**Table 1.** The final quasi-peak measurements from the worst frequencies.

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
18.430750	20.5	1000.0	9.000	GN	N	11.6	39.5	60.0	
24.001750	30.4	1000.0	9.000	GN	N	11.9	29.6	60.0	

**Table 2.** The final average measurements from the worst frequencies.

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
18.433000	17.2	1000.0	9.000	GN	N	11.6	32.8	50.0	
23.997250	22.6	1000.0	9.000	GN	N	11.9	27.4	50.0	

## Conducted Emissions In The Frequency Range 150 kHz to 30 MHz

Conducted Emission Mains FCC Part 15 Class B with ESH3-Z5 8019

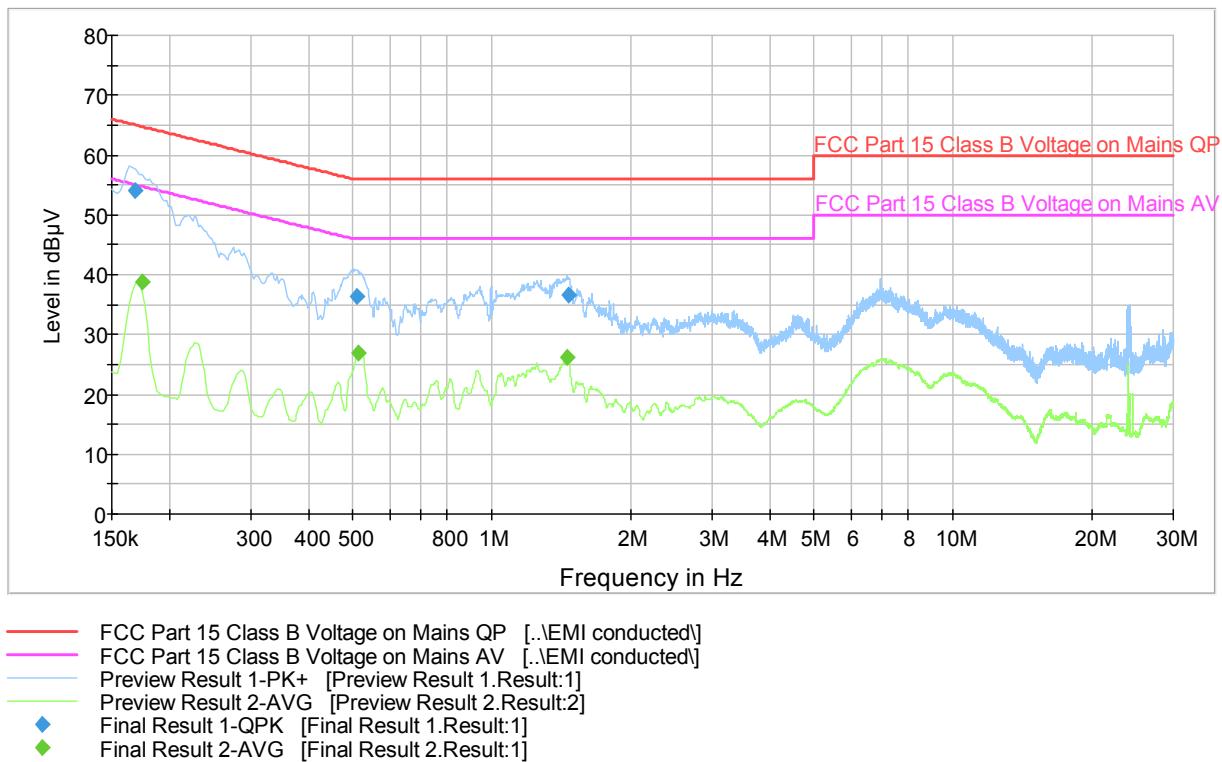


Figure 2. The measured curves with peak- and average detector from the AC input of a Laptop computer.

Table 3. The final quasi-peak measurements from the worst frequencies.

Frequency (MHz)	QuasiPeak (dB $\mu$ V)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V)	Comment
0.168000	54.1	1000.0	9.000	GN	L1	10.8	11.0	65.1	
0.510000	36.3	1000.0	9.000	GN	N	10.1	19.7	56.0	
1.461250	36.7	1000.0	9.000	GN	N	10.2	19.3	56.0	

Table 4. The Final average measurements from the worst frequencies.

Frequency (MHz)	Average (dB $\mu$ V)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V)	Comment
0.174750	38.8	1000.0	9.000	GN	N	10.8	15.9	54.7	
0.514500	27.0	1000.0	9.000	GN	L1	10.1	19.0	46.0	
1.459000	26.2	1000.0	9.000	GN	L1	10.2	19.8	46.0	

The correction factor in the final result table contains the sum of the transducers (antenna + cables + distance). The result value is the measured value corrected with the correction factor.

**Transmitter Radiated Spurious Emissions 9 kHz to 1 GHz**

**Standard:** ANSI C63.10 (2009)  
**Tested by:** NKO  
**Date:** 27.5.2015  
**Temperature:** 22 °C  
**Humidity:** 40 % RH  
**Measurement uncertainty:** ± 5.25 dB      Level of confidence 95 % (k = 2)

**FCC Rule: 15.225 (d), 15.209**

The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100 **	3
88-216	150 **	3
216-960	200 **	3
Above 960	500	3

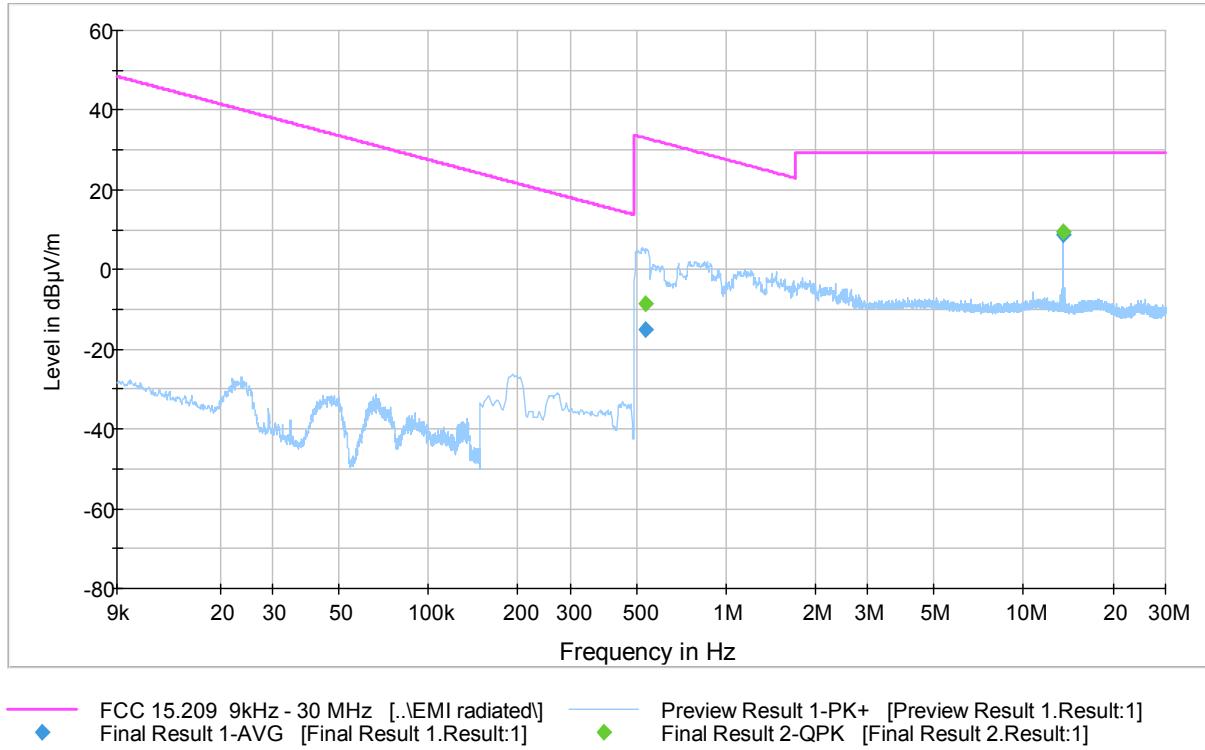
The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

According to ANSI C63.10 (clause 5.3.2) and RSS-Gen (Clause 4.11) the measurements below 30 MHz can be performed at a closer distance than the EUT limit distance, the results shall be extrapolated to shorter distance by using the square of an inverse linear distance extrapolation factor (40 dB/ decade). This method was used when performing measurements at a distance of 3 m instead of limit distances 300 m or 30 m.

The correction factor in the final result table contains the sum of the transducers (antenna + cables + distance). The result value is the measured value corrected with the correction factor.

**Test results**

FCC Part 15 Class B (15.209) Spurious Emission 9 kHz - 30 MHz 3m

**Figure 3.** Transmitter radiated spurious emissions 9 kHz to 30MHz.**Final measurements from the worst frequencies****Table 5.** The final results with average detector.

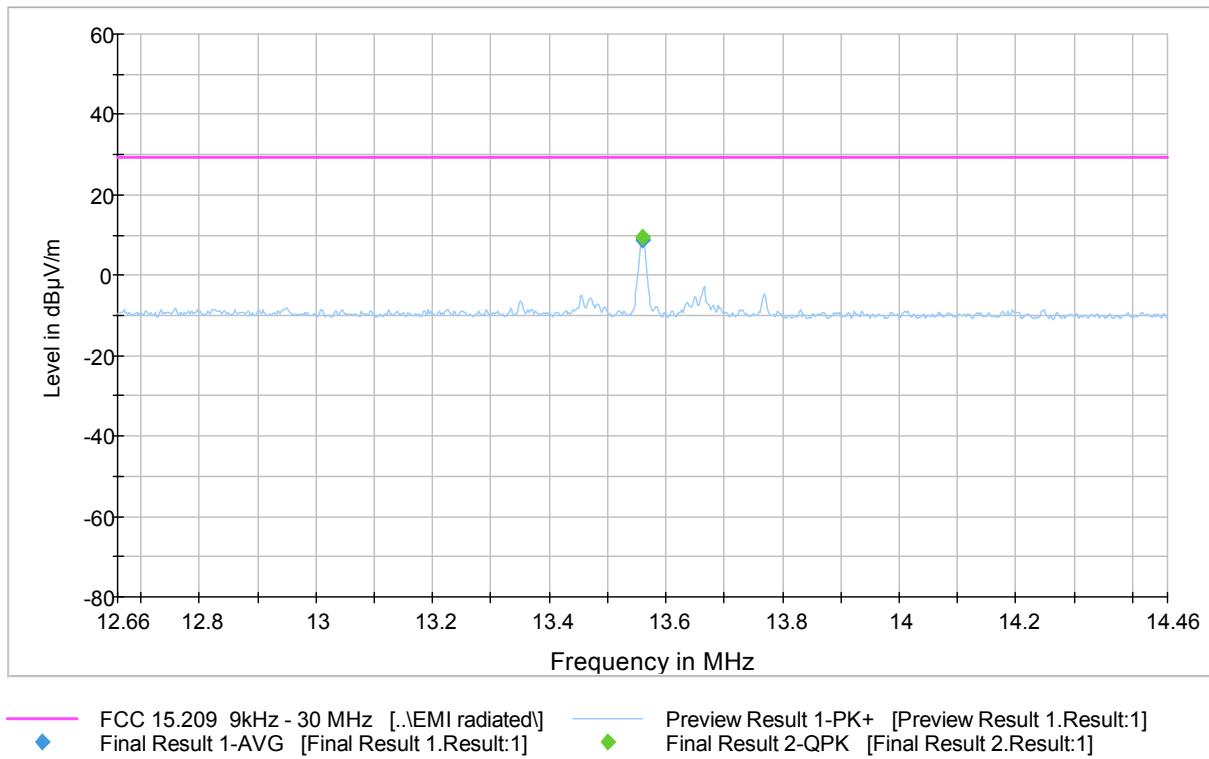
c	Average (dB $\mu$ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna (deg)	Azimuth (deg)	Corr (dB)	Margin (dB)	Limit (dB $\mu$ V/m)	Comment
0.537750	-15.2	1000.0	9.000	0.0	235.0	-20.0	48.2	33.0	
13.559000	8.8	1000.0	9.000	90.0	155.0	-19.7	20.7	29.5	Carrier

**Table 6.** The final results with quasi-peak detector.

Frequency (MHz)	QuasiPeak (dB $\mu$ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna (deg)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V/m)	Comment
0.537750	-8.6	1000.0	9.000	0.0	235.0	-20.0	41.6	33.0	
13.559000	9.5	1000.0	9.000	90.0	155.0	-19.7	20.0	29.5	Carrier

## Transmitter Radiated Spurious Emissions 9 kHz to 1 GHz

FCC Part 15 Class B (15.209) Spurious Emission 9 kHz - 30 MHz 3m

**Figure 4.** Tx Radiated spurious emissions 12.66 MHz – 14.46 MHz.**Final measurements from the worst frequencies****Table 7.** The final results with average detector.

Frequency (MHz)	Average (dB $\mu$ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna (deg)	Azimuth (deg)	Corr (dB)	Margin (dB)	Limit (dB $\mu$ V/m)	Comment
13.559000	8.8	1000.0	9.000	90.0	155.0	-19.7	20.7	29.5	Carrier

**Table 8.** The final results with quasi-peak detector.

Frequency (MHz)	QuasiPeak (dB $\mu$ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna (deg)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V/m)	Comment
13.559000	9.5	1000.0	9.000	90.0	155.0	-19.7	20.0	29.5	Carrier

## Transmitter Radiated Spurious Emissions 9 kHz to 1 GHz

FCC Part 15 Class B Spurious Emission 30-1000MHz 3m

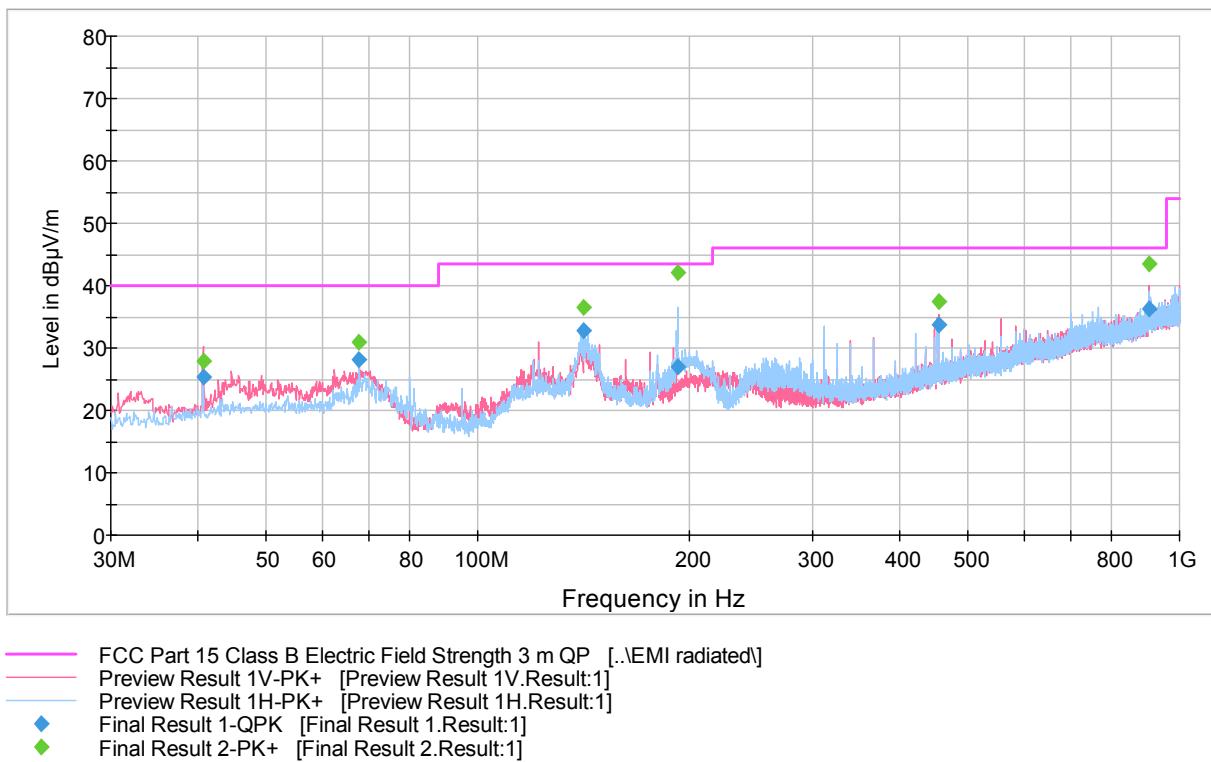


Figure 5. Transmitter radiated emission 30 MHz to 1000 MHz.

## Final measurements from the worst frequencies

Table 9. The final results with quasi-peak detector.

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
40.690000	25.3	1000.0	120.000	158.0	V	164.0	14.1	14.7	40.0	
67.790000	28.0	1000.0	120.000	100.0	V	185.0	12.7	12.0	40.0	
141.570000	32.9	1000.0	120.000	215.0	H	89.0	14.1	10.6	43.5	
192.392000	26.9	1000.0	120.000	122.0	H	253.0	11.7	16.6	43.5	
453.502000	33.7	1000.0	120.000	100.0	V	200.0	19.1	12.3	46.0	
903.254000	36.4	1000.0	120.000	100.0	V	157.0	26.8	9.6	46.0	

Table 10. The final results with max peak detector.

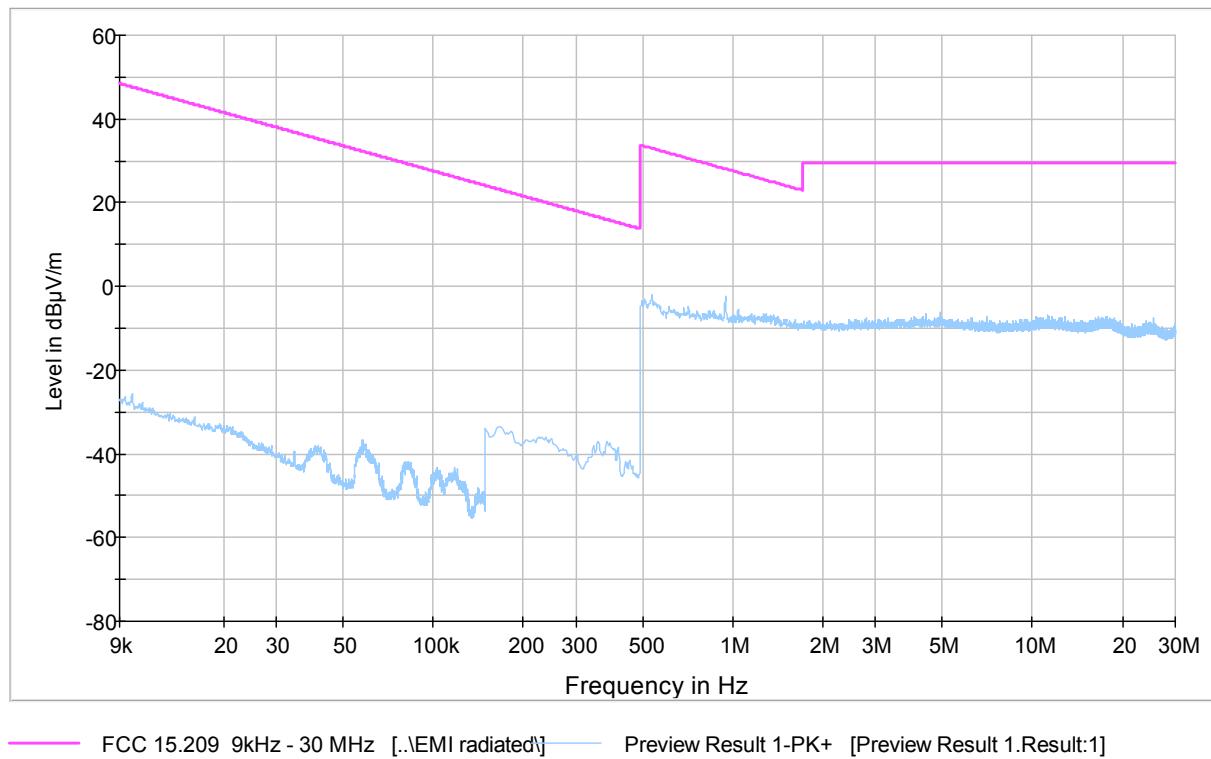
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
40.690000	27.8	1000.0	120.000	158.0	V	164.0	14.1	12.2	40.0	
67.790000	31.0	1000.0	120.000	100.0	V	185.0	12.7	9.0	40.0	
141.570000	36.5	1000.0	120.000	215.0	H	89.0	14.1	7.0	43.5	
192.392000	42.1	1000.0	120.000	122.0	H	253.0	11.7	1.4	43.5	
453.502000	37.4	1000.0	120.000	100.0	V	200.0	19.1	8.6	46.0	
903.254000	43.6	1000.0	120.000	100.0	V	157.0	26.8	2.4	46.0	

**Receiver Radiated Emissions 9 kHz to 1 GHz**

**Standard:** ANSI C63.10 (2009)  
**Tested by:** NKO  
**Date:** 30.5.2015  
**Temperature:** 22 °C  
**Humidity:** 40 % RH  
**Measurement uncertainty:**  $\pm 5.25$  dB      **Level of confidence 95 % (k = 2)**

**Test Results**

FCC Part 15 Class B (15.209) Spurious Emission 9 kHz - 30 MHz 3m

**Figure 6.** Receiver radiated spurious emissions 9 kHz to 30MHz.**Final measurements from the worst frequencies**

No final measurements were made due to the low emission level.

## Receiver Radiated Spurious Emissions 9kHz to 1 GHz

FCC Part 15 Class B Spurious Emission 30-1000MHz 3m

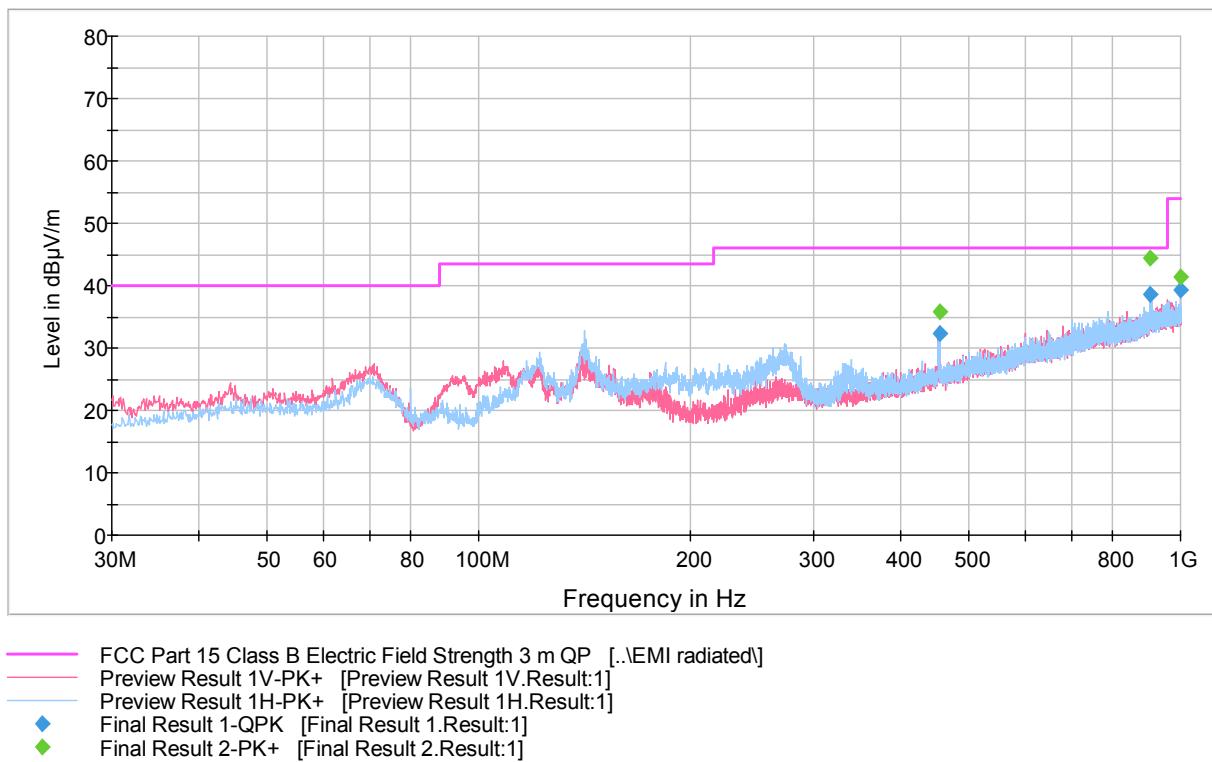


Figure 7. Receiver radiated spurious emissions 9 kHz to 30 MHz.

## Final measurements from the worst frequencies

Table 11. The final results with quasi-peak detector.

Frequency (MHz)	QuasiPeak (dB $\mu$ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V/m)	Comment
453.502000	32.2	1000.0	120.000	100.0	V	149.0	19.1	13.8	46.0	
903.234000	38.5	1000.0	120.000	152.0	H	75.0	26.8	7.5	46.0	
999.980000	39.2	1000.0	120.000	100.0	V	85.0	27.9	14.7	53.9	

Table 12. The final results with max peak detector.

Frequency (MHz)	MaxPeak (dB $\mu$ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V/m)	Comment
453.502000	35.8	1000.0	120.000	100.0	V	149.0	19.1	10.2	46.0	
903.234000	44.4	1000.0	120.000	152.0	H	75.0	26.8	1.6	46.0	
999.980000	41.3	1000.0	120.000	100.0	V	85.0	27.9	12.6	53.9	

The correction factor in the final result tables contains the sum of the transducers (antenna + amplifier + cables). The Max Peak and Quasi-peak values are measured values corrected with the correction factor.

## Frequency Stability

**Standard:** ANSI C63.10 (2009)  
**Tested by:** NKO  
**Date:** 29.5.2015  
**Temperature:** 22 °C  
**Humidity:** 40 % RH

**Measurement uncertainty:** ± 26Hz      Level of confidence 95 % (k = 2).

### FCC § 15.225 (e)

The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency over a temperature variation of -20°C to + 50°C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20°C.

The EUT was placed in the environmental temperature chamber near to near field probe. The temperature of the chamber was set to 50°C. After the temperature was stabilized the transmitter was turned on and the measurements were done by using R&S FSV 40 spectrum analyzer and its frequency counter function. After measuring the temperature value of the chamber was lowered 10°C and the measurement procedure was repeated after the temperature of the temperature chamber and the EUT were stabilized.

**Table 13.** Test results for temperature variation

Voltage (VAC)	Temperature (°C)	Frequency (MHz)	Deviation (MHz)	Deviation (%)	Result
115	50	13.5600017	0.0000017	0.000012537	PASS
115	40	13.5600323	0.0000323	0.000238201	PASS
115	30	13.5600415	0.0000415	0.000306047	PASS
115	20	13.5600419	0.0000419	0.000308997	PASS
115	10	13.5601034	0.0001034	0.000762500	PASS
115	0	13.5600148	0.0000148	0.000109000	PASS
115	-10	13.5602327	0.0002327	0.001700000	PASS
115	-20	13.5601179	0.0001179	0.000869469	PASS

**Table 14.** Test results for voltage variation

Voltage (VAC)	Temperature (°C)	Frequency (MHz)	Deviation (MHz)	Deviation (%)	Result
97.5	20	13.5600410	0.0000410	0.000302359	PASS
132.5	20	13.5600621	0.0000621	0.000045796	PASS

**TEST EQUIPMENT**

Manufacturer	Type	Serial no	Cal. date	Cal. due
<b>ROHDE &amp; SCHWARZ</b>				
EMI Test receiver	ESU 26	100185	01.07.2015	01.07.2015
Spectrum Analyzer	FSV40	101068	01.07.2015	01.07.2015
Test software	EMC32	Ver. 8.30.0	-	-
LISN	ESH2-Z5	863794/013	14.10.2014	14.10.2015
LISN	ESH2-Z5	863794/014	14.10.2014	14.10.2015
Transient limiter	ESH3-Z2	#1	24.10.2014	24.10.2015
Antenna (9 kHz - 30 MHz)	HFH2-Z2	860004/016	18.08.2014	18.08.2016
E- Field Probe	HZ-14	839184/004	-	-
<b>C &amp; O</b>				
Thermometer	-	8376	11.02.2015	11.02.2016
<b>SCHWARZBECK</b>				
Antenna (30 MHz - 1 GHz)	VULB9168	9168-503	04.11.2014	04.05.2016
<b>DEISEL</b>				
Antenna mast	MA 240 T	240/394/96	-	-
Tilt option	KE 220	220/307/96	-	-
Controller	HD 100	100/413/96	-	-
Turntable	DS 420	420/420/96	-	-
<b>CALIFORNIA INSTRUMENTS</b>				
Power Supply	5001 iX Series II	58209	-	-