

RADIO TEST REPORT

No. 1515453STO-001, Ed. 1

RF Performance

EQUIPMENT UNDER TEST

Equipment: Mobile reader
Type/Model: 6GT2803-1BA00
Additional type/model*: 6GT2803-1BA10
Manufacturer: Nordic ID Oy
Tested by request of: Nordic ID Oy

*See clause 2.2

SUMMARY

Referring to the emission limits, and the operating mode during the tests specified in this report, the equipment complies with the requirements according to the following standards:

47 CFR Part 15 (2015): Subpart C: Intentional radiators. Section 15.209

RSS-GEN Issue 4: General requirements of compliance of radio apparatus (2014).

RSS-210 Issue 8 Licence-exempt Radio Apparatus (All Frequency Bands):
Category I Equipment (2010) Section 2.5

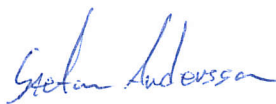
For details, see clause 2 – 4.

Date of issue: 2015-12-08

Tested by:


Matti Virkki

Approved by:


Stefan Andersson

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Edition	Date	Description	Changes
1	2015-12-08	First release	

Version 1.00

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1. CLIENT INFORMATION

The EUT has been tested by request of

Company Nordic ID Oy
Myllyojankatu 2a
FI-24100 Salo
Finland

Name of contact Hannu Heino

2. EQUIPMENT UNDER TEST (EUT)

2.1 Identification of the EUT

Equipment: Mobile reader
Model: 6GT2803-1BA00
Additional model: 6GT2803-1BA10
Brand name: Simatic RF350M
Serial number: No visible serial on EUT
Manufacturer: Nordic ID Oy

Transmitter frequency range: 13,56 MHz

Receiver frequency range: 13,56 MHz

Frequency agile or hopping: ☐ Yes ☒ No

Antenna: ☒ Internal antenna ☒ External antenna

Type of modulation: RF300, ISO15694

Temperature range: ☒ Category I (General): -20°C to +55°C
☐ Category II (Portable equipment): -10°C to +55°C
☐ Category III (Equipment for normal indoor use): +5°C to +35°C
☐ Other: <-20°C to +60°C

Power rating:

Transmitter standby mode supported: ☒ Yes ☐ No

2.2 Additional information about the EUT

The EUT consists of the following units:

Unit	Type	Serial number
Mobile reader	6GT2803-1BA00	
Mobile reader	6GT2803-1BA10	

The difference between models is that 6GT2803-1BA00 is equipped with integrated RFID antenna and 6GT2803-1BA10 has an external RFID antenna. Otherwise models are identical.

During the tests the EUT supported following software:

Software	Version	Comment
Simatic RF350M FW	3.5	
100_SiemensHFtest_1.pak	1	

2.3 Peripheral equipment

No peripheral equipment was used

2.4 Test signals

Continuous signal with ISO15694 modulation

2.5 Modifications made to improve EMC-characteristics

The following modifications were required to obtain the results presented in this report.

An rf-shield was installed on the RFID module to reduce transmitter harmonics.

No other modifications were made during the tests

3. TEST SPECIFICATIONS

3.1 Standards

Requirements:

47 CFR Part 15: Radio frequency device, Subpart C: Unintentional radiators (2015).

RSS-GEN Issue 4: General requirements of compliance of radio apparatus (2014).

RSS-210 Issue 8 Licence-exempt Radio Apparatus (All Frequency Bands):
Category I Equipment (2010)

Test methods:

ANSI C63.10-2013: American National Standard for testing Unlicensed Wireless Devices

3.2 Additions, deviations and exclusions from standards

No additions, deviations or exclusions have been made from standards.

3.3 Test site

Measurements were performed at:

Intertek Semko AB.
Torshamnsgatan 43,
P.O. Box 1103
SE-164 22 Kista

Intertek Semko AB is a FCC listed test site with site registration number 90913

Intertek Semko AB is a FCC accredited conformity assessment body with designation number SE0002

Intertek Semko AB is an Industry Canada listed test facility with IC assigned code 2042G

Measurement chambers

Measurement Chamber	Type of chamber	IC Site filing #
STORA HALLEN	Semi-anechoic 10 m and 3 m	2042G-2

3.4 Mode of operation during the test

The EUT was tested with fresh battery

The EUT was tested with continuous test signal.

4. TEST SUMMARY

The results in this report apply only to sample tested:

Standard	Description	Result
	Emission	
FCC Part 15.203 RSS-GEN 8.3	Antenna requirement EUT has an integrated antenna which can't be removed without breaking the EUT. The alternative model is equipped with unique connector which fits only manufacturer's own antenna.	PASS
FCC Part 15.207 RSS-GEN 8.8 table 3	Conducted continuous emission in the frequency range 150 kHz to 30 MHz, AC Power input port Battery powered	NT
FCC Part.209 RSS-GEN, 8.9 RSS-210, 2.5.1	Radiated emission of electromagnetic fields in the frequency range 9 kHz - 30 MHz The EUT complies with the limits. The margin to the limit was at least 2.4 dB at 13.56 MHz See clause 5.4.	PASS
FCC Part.209 RSS-GEN, 8.9 RSS-210 2.5.1	Radiated emission of electromagnetic fields in the frequency range 30 – 140 MHz The EUT complies with the limits. No emissions were found above noise floor. See clause 5.5.	PASS
RSS-GEN, 6.6	Occupied bandwidth RSS-GEN section 6.6 has no limit for 99% occupied band width	-

5. RADIATED RF EMISSION IN THE FREQUENCY-RANGE 0.009 - 140 MHZ

Date of test:	2015-10-12	Test location:	Stora Hallen
EUT Serial:	--	Ambient temp:	19 °C
Tested by:	MTV	Relative humidity:	28 %
Test result:	Pass	Margin:	2.4

5.1 Test set-up and test procedure.

The test method is in accordance with ANSI C63.10.

The EUT was set up in order to emit maximum disturbances.

The EUT was placed on an insulating support 0.8 m above the turntable which is part of the reference ground plane. Preliminary radiated emissions were measured in 3 different EUT positions. Final measurements were made in worst position(s).

Overview sweeps were performed with the measurement receiver in max-hold mode and the peak detector activated.

5.2 Test conditions**Test set-up:**

Test receiver set-up:

Preview test:

Final test:

Measuring distance:

Measuring angle:

Antenna

Height above ground plane:

orientation:

Type:

9 kHz to 30 MHz

Peak, RBW 200 Hz / 9 kHz. VBW 30 kHz

Quasi-Peak, RBW 200 Hz / 9 kHz

Average RBW 200 Hz / 9 kHz

10 m

0 – 359°

1 m

2 orthogonal axis

Loop

Test set-up:

Test receiver set-up:

Preview test:

Final test:

Measuring distance:

Measuring angle:

Antenna

Height above ground plane:

Polarisation:

Type:

30 MHz to 1000 MHz

Peak, RBW 120 kHz. VBW 1 MHz

Quasi-Peak, RBW 120 kHz

10 m

0 – 359°

1 – 4 m

Vertical and Horizontal

Bilog

5.3 Radiated Emission requirements

The EUT shall meet the limits for the standards.

Reference: 47 CFR §15.209

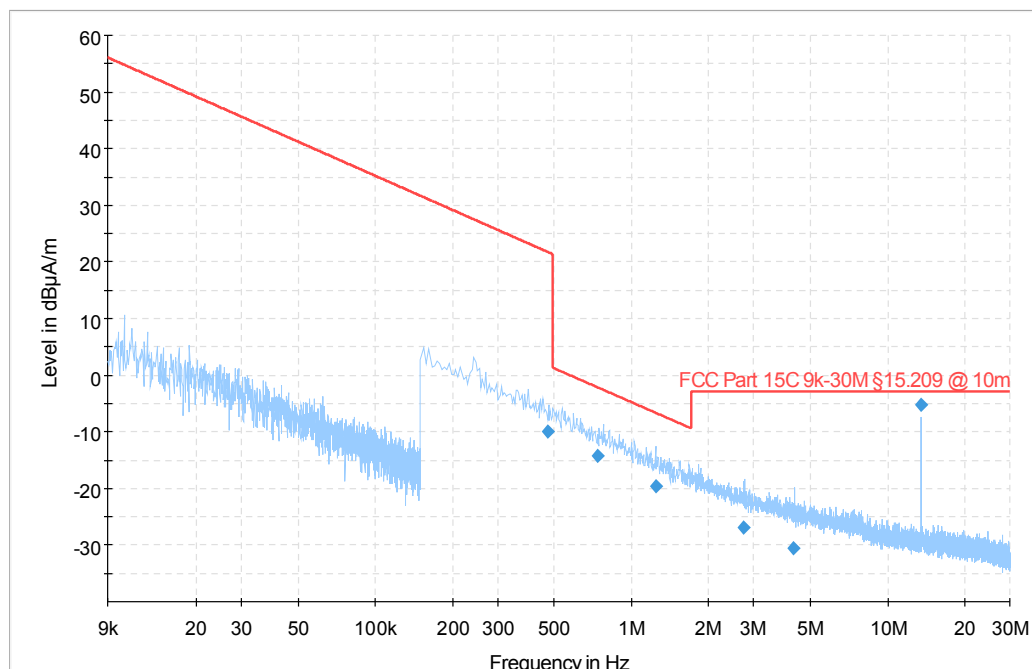
RSS-gen section 8.9 table 4

Limits for general radiated emission

Frequency range [MHz]	Field strength at 3 m (dB μ V/m)	Field strength at 10 m (dB μ V/m)	Detector (dB μ V/m)
0.009 – 0.09	-	107.6 – 87.6	Average
0.09 – 0.110	-	87.6 – 85.9	Quasi Peak
0.110 – 0.490	-	85.9 – 72.9	Average
0.490 – 1.705	-	68.1 – 42.1	Quasi Peak
1.735 – 30	30	49.1	Quasi Peak
30 – 88	40.0	29.5	Quasi Peak
88 – 216	43.5	33.0	Quasi Peak
216 – 960	46.0	35.5	Quasi Peak
960 – 1000	54.0	43.5	Quasi Peak
Above 1000	54.0 / 74.0	-	Average / Peak

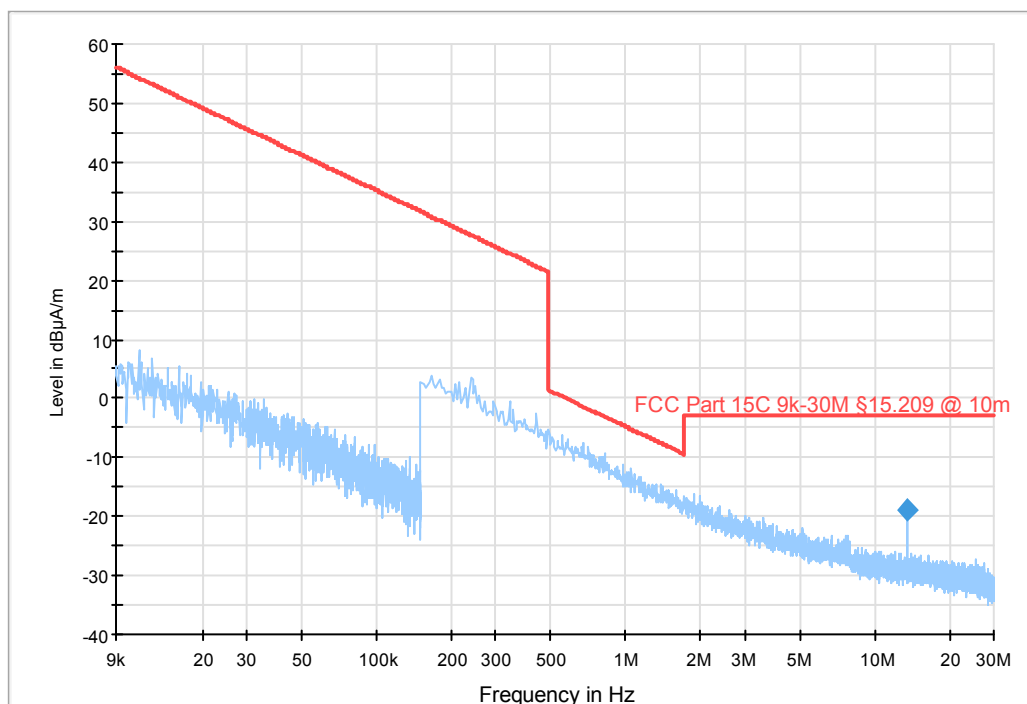
The values for each measurement distance are given using an extrapolation factor of 20 dB/decade above 30 MHz and 40 dB/decade below 30 MHz according to §15.31(f)(1), §15.31(f)(2) and RSS-GEN sections 6.4 and 6.5.

5.4 Test results 9 kHz – 30 MHz



Diagram, Peak overview sweep, 0.009 – 30 MHz at 10 m distance internal antenna.

FCC H-field 9kHz - 30MHz 10m



Diagram, Peak overview sweep, 0.009 – 30 MHz at 10 m distance external antenna.

Frequency [MHz]	Level [dBµA/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Comment
0.473	-9.9	41.6	73.2	31.6	Noise floor
0.737	-14.2	37.3	49.4	12.0	Noise floor
1.249	-19.6	31.9	44.8	12.9	Noise floor
2.749	-26.9	24.6	48.6	24.0	Noise floor
4.293	-30.6	20.9	48.6	27.7	Noise floor
13.561	-5.3	46.2	48.6	2.4	Carrier

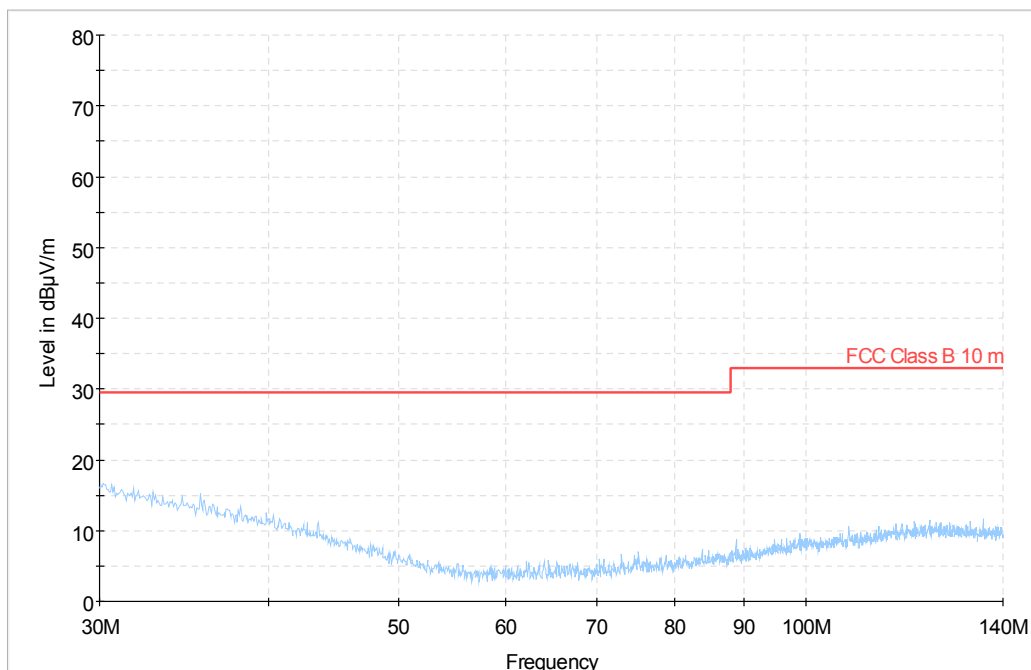
Measurement results internal antenna, Quasi Peak

Frequency [MHz]	Level [dBµA/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Comment
13.561	-19.0	32.5	48.6	16.1	Carrier

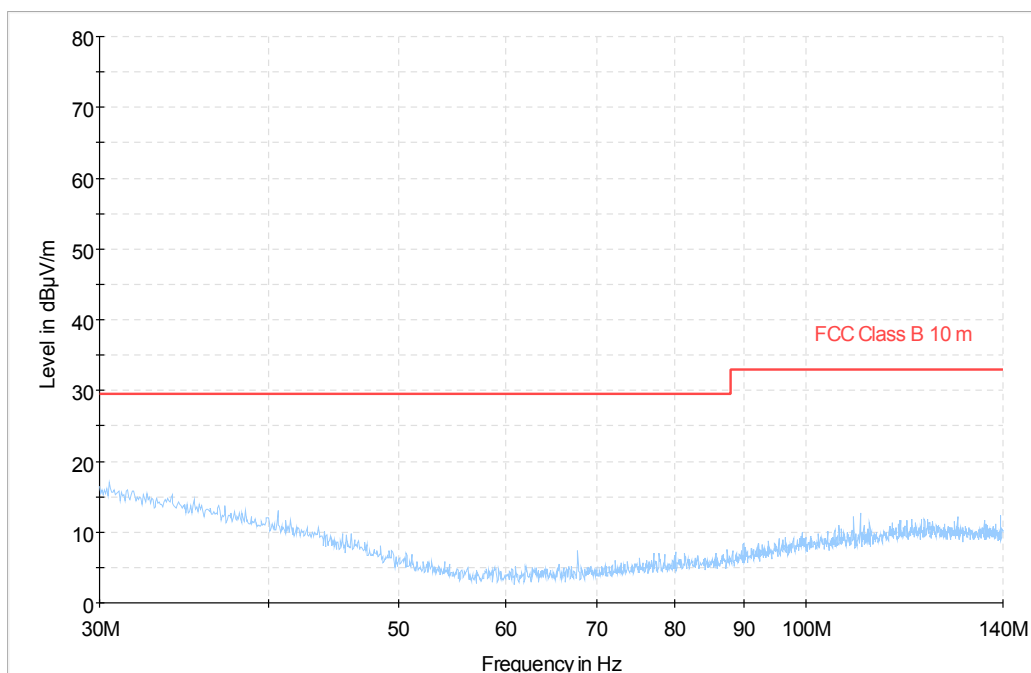
Measurement results external antenna, Quasi Peak

Result [dBµV/m] = Analyser reading [dBµA] + Antenna factor [1/m] - Amplifier gain [dB] + Cable loss [dB] + H-field to E-field conversion factor 51.5 dB

5.5 Test results 30 MHz – 140 MHz



Diagram, Peak overview sweep, 30 – 140 MHz at 10 m distance with internal antenna.



Diagram, Peak overview sweep, 30 – 140 MHz at 10 m distance with external antenna.

Measurement results, Quasi Peak

No emissions above noise floor were found.

Result [dBµV/m] = Analyser reading [dBµV] + Antenna factor [1/m] - Amplifier gain [dB] + Cable loss [dB]

6. OCCUPIED BANDWIDTH

Date of test:	2015-11-12	Test location:	Wireless Center
EUT Serial:	--	Ambient temp:	22°C
Tested by:	MTV	Relative humidity:	48%
Test result:	110.7 and 229.4 kHz	Margin:	--

6.1 Test set-up and test procedure.

The test method is in accordance with ANSI C63.10. and RSS-GEN

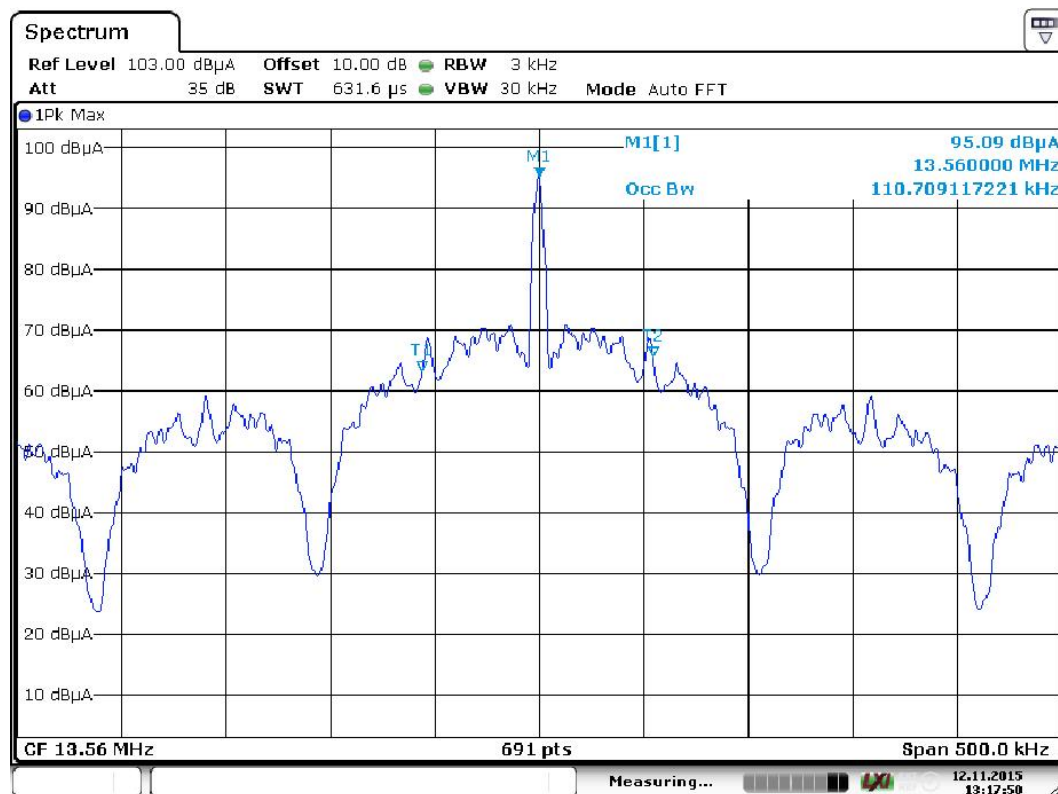
Spectrum analyser with occupied bandwidth measurement function is used to determine the occupied bandwidth.

6.2 Test conditions

Detector: Peak
 RBW 1 – 5 % of OBW
 VBW 3 x RBW
 Span > OBW

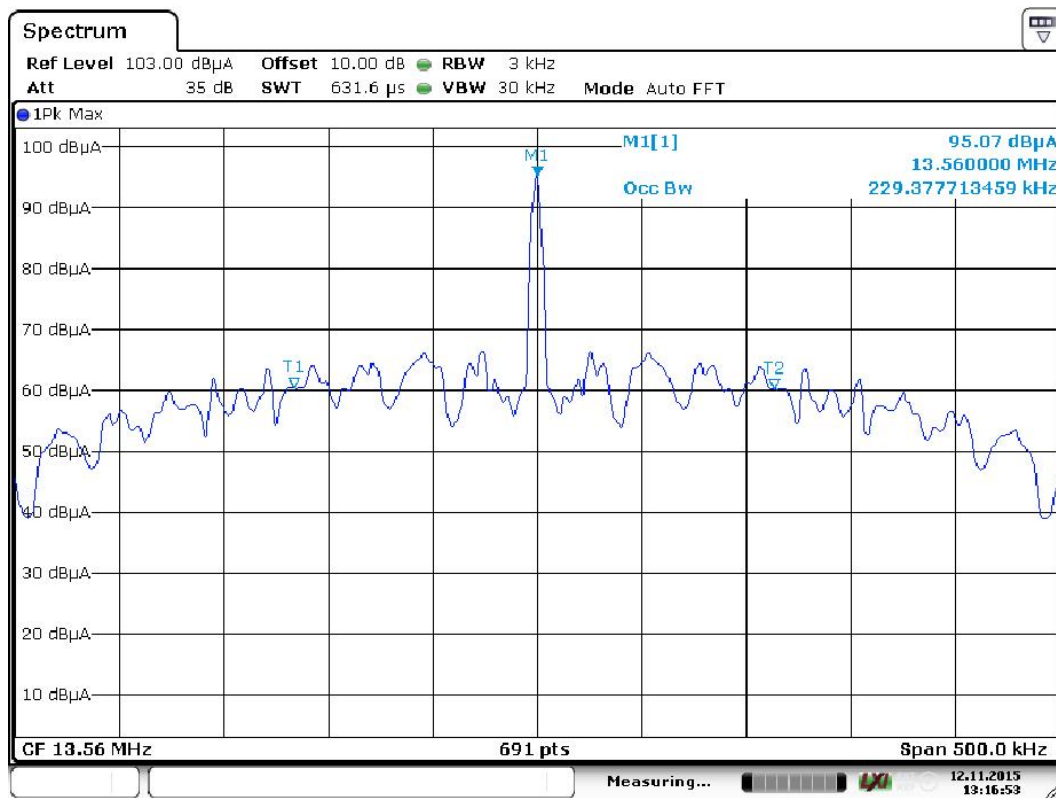
The EUT was set up in order to emit maximum disturbances.

6.3 Test results



Date: 12 NOV 2015 13:17:50

Screenshot: Occupied bandwidth Measurement ISO15693 modulation



Date:12 NOV 2015 13:16:53

Modulation type	99% Occupied band width
	[kHz]
ISO15693	110.7
RF300	229.4

7. TEST EQUIPMENT

Stora Hallen

Equipment type	Manufacturer	Model	Inv. No.	Last Cal. date	Cal. interval
Measurement software	Rohde & Schwarz	EMC32 - V8.51	--	--	--
Receiver	Rohde & Schwarz	ESU 8	12866	7 / 2015	1 year
Loop antenna	Chase	6502	8853	11 / 2012	3 years
BiLog antenna	Chase	CBL6110A	971	7 / 2015	3 years
Preamplifier	Semko	AM1331	7992	7 / 2015	1 year

Wireless Center

Equipment type	Manufacturer	Model	Inv. No.	Last Cal. date	Cal. interval
Signal analyzer:	Rohde & Schwarz	FSV	32594	7 / 2015	1 year
10 dB Attenuator:	Huber+Suhner	5910_N-50-010	32696	7 / 2015	1 year

8. MEASUREMENT UNCERTAINTY

Continuous conducted disturbances with AMN in the frequency range 9 kHz to 30 MHz ± 3.6 dB

Measurement uncertainty for radiated disturbance

Uncertainty for the frequency range 30 to 1000 MHz at 3 m	± 4.9 dB
Uncertainty for the frequency range 30 to 1000 MHz at 10 m	± 4.8 dB
Uncertainty for the frequency range 1.0 to 18 GHz at 3 m	± 5.4 dB
Uncertainty for the frequency range 18 to 26 GHz at 3 m	± 5.5 dB
Uncertainty for the frequency range 26 to 40 GHz at 3 m	± 5.6 dB

Measurement uncertainty is calculated in accordance with CISPR 16-4-2:2011.

The measurement uncertainty is given with a confidence of 95 %.

9. TEST SET UP AND EUT PHOTOS

Photos are in separate document 1515453STO-001, Ed. 1, Annex 1