RADIO TEST REPORT

No. 1613273STO-002, Ed. 1

RF Performance

EQUIPMENT UNDER TEST

Equipment:	RFID Card Reader
Type/Model:	AXIS A4010-E READER / ASSA Pando Mini RS485
Manufacturer:	ASSA AB
Tested by request of:	ASSA AB

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 (2014): General requirements of compliance of radio apparatus (2014).

RSS-210 Issue 9 Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment (2016) Section 2.5

For details, see clause 2 – 4.

Date of issue: 2016-11-07

Tested by: Daniel Nilsson

Approved by: Matti Virkki

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Revision History

Edition	Date	Description	Changes
1	2016-11-07	First release	

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1. CLIENT INFORMATION

The EUT has been tested by request of

Company	ASSA AB Förmansvägen 11 107 43 Stockholm Sweden
Name of contact	Kristofer Holst

2. EQUIPMENT UNDER TEST (EUT)

2.1 Identification of the EUT

Equipment:	RFID Card Reader	
Type/Model:	A4010-E READER / Pando Mini RS485	
Brand name:	AXIS / ASSA	
Serial number:	0x00000004 / 0x00000007	
Transmitter frequency range:	13,56 MHz	
Receiver frequency range:	13,56 MHz	
Frequency agile or hopping:	☐ Yes	☒ No
Antenna:	☒ Internal antenna	☐ External antenna
Antenna connector:	☒ None, internal antenna	☐ Yes
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: -30°C to +70°C	
Transmitter standby mode supported:	☐ Yes	☒ No

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2.2 Additional information about the EUT

The EUT consists of the following units:

Unit	Type	Serial number	Comment
RSIntCTX	Pando Mini RS485	0x00000004	Supports test mode continuous transmission.
RSExtCTX	Pando Mini RS485	0x00000007	Supports test mode continuous transmission. Modified with external antenna connector.

During the tests the EUT supported following software:

Software	Version	Comment
RFID on	PR300302_01_00_17_app_emc_rfid_on.hex	-

The EUT was tested with the following cables:

Port:	Type:	Length: [m]	Specifications:
DC and communication	4-core	3	-

2.3 Peripheral equipment

Peripheral equipment is equipment needed for correct operation of the EUT, but not included as part of the testing and evaluation of the EUT.

Equipment	Type / Model	Manufacturer	Serial no.
Central Unit	LCU9101	ASSA	-
AC adapter	04151V-240075	NORDIC POWER	-

2.4 Test signals

Continuous modulated transmission.

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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 9: Licence-exempt Radio Apparatus (All Frequency Bands):
Category I Equipment (2016)

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

3.2 Additions, deviations and exclusions from standards and accreditation

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

3.3 Test site

Measurements were performed at:

Intertek Semko AB.
Torshamnsgatan 43,
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

Powered by batteries (12V), test mode enabling continuous transmission of modulated carrier.

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4. TEST SUMMARY

The results in this report apply only to sample tested:

Standard	Description	Result
	Emission	
FCC Part 15.203	**Antenna requirement**	**PASS**
RSS-GEN 8.3	EUT has an integrated antenna which can't be removed without breaking the EUT	
FCC Part 15.207	**Conducted continuous emission in the frequency range 150 kHz to 30 MHz**	**PASS**
RSS-GEN 8.8 table 3	The EUT complies with the limits. The margin to the limit was at least 7.1 dB at 0.483 MHz See clause 5.4.	
FCC Part 15.209	**Radiated emission of electromagnetic fields in the frequency range 9 kHz - 30 MHz**	**PASS**
RSS-GEN, 8.9 RSS-210, A2 B.6	The EUT complies with the limits. The margin to the limit was at least 12.3 dB at 0.809 MHz See clause 6.5.	
FCC Part 15.209	**Radiated emission of electromagnetic fields in the frequency range 30 – 1000 MHz**	**PASS**
RSS-GEN, 8.9 RSS-210 A2 B.6	The EUT complies with the limits. The margin to the limit was at least 4.4 dB at 40.699 MHz See clause 6.5.	
FCC Part.209	**Radiated emission of electromagnetic fields in the frequency range above 1 GHz**	**PASS**
RSS-GEN, 8.9 RSS-210 A2 B.6	The EUT complies with the limits. The margin to the limit was at least 33.5 dB at 1037.9MHz See clause 6.6.	
RSS-GEN, 6.6	**Occupied bandwidth**	**-**
	RSS-GEN section 6.6 has no limit for 99% occupied band width	

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5. CONDUCTED CONTINUOUS DISTURBANCES IN THE FREQUENCY-RANGE 0.15 TO 30 MHZ

Date of test:	2016-10-13	**Test location:**	EMC Center
EUT Serial:	RSExtCTX	**Ambient temp:**	22 °C
Tested by:	DNI	**Relative humidity:**	32 %
Test result:	Pass	**Margin:**	7.08 dB

5.1 Test set-up and test procedure

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

The EUT was connected to the power via Artificial Mains Networks AMN.

The EUT was placed on an insulating support 0.8 m above the floor, 0.4 m from the vertical reference ground plane (RGP) and 0.8 m from the AMN/ISN.

Overview sweeps were performed for each lead.

During the tests the EUT was operated according to the mode of operation mentioned in clause 3.4.

5.2 Conducted emission requirements:

The EUT shall meet the limits for the standards.
Reference: 47 CFR §15.207
RSS-GEN, section 8.8 table 3

Limits for conducted emission

Frequency range [MHz]	Limits [dBµV]	
	Quasi-Peak	Average
0.15 – 0.50	66 – 56	56 – 46
0.50 – 5.00	56	46
5.00 – 30.0	60	50

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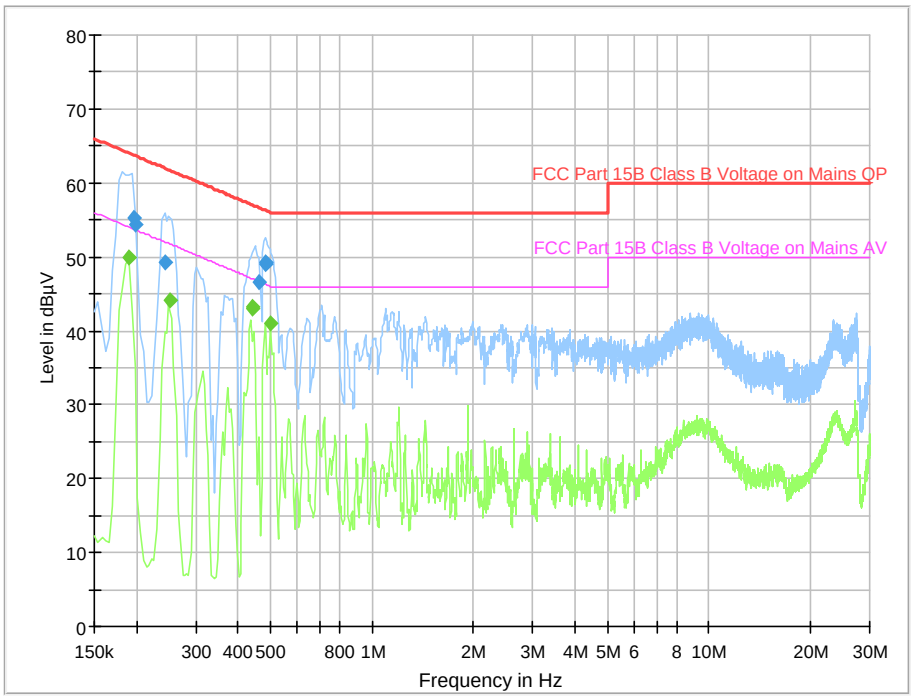
5.3 Test results: AC Power input port



Diagram, Peak and Average overview sweep

Measurement results, Quasi-peak

Frequency [MHz]	Level [dBµV]	Limit [dBµV]	Line L/N	Margin [dB]
0.197	55.34	63.74	L	8.40
0.198	54.29	63.69	L	9.40
0.242	49.19	62.03	L	12.84
0.462	46.54	56.66	L	10.12
0.483	49.21	56.29	L	7.08
0.484	49.11	56.27	L	7.16

Measurement results, Average

Frequency [MHz]	Level [dBµV]	Limit [dBµV]	Line L/N	Margin [dB]
0.191	49.94	53.99	L	4.05
0.251	44.18	51.72	L	7.54
0.441	43.22	47.04	L	3.82
0.442	43.07	47.02	L	3.95
41.04	41.04	46.00	L	4.96

Result [dBµV] = Analyser reading [dBµV] + cable loss [dB] + LISN insertion loss [dB]

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6. RADIATED RF EMISSION IN THE FREQUENCY-RANGE 0.009 MHZ TO 2 GHZ

Date of test:	2016-09-28, 2016-10-04	**Test location:**	Stora Hallen
EUT Serial:	RSIntCTX	**Ambient temp:**	21 °C
Tested by:	DNI	**Relative humidity:**	33 %
Test result:	Pass	**Margin:**	4.4 dB

6.1 Test set-up and test procedure.

The test method is in accordance with ANSI C63.10 < 1 GHz and ANSI C63.4 > 1 GHz.

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.

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

6.2 Test conditions

Test set-up: **9 kHz to 30 MHz**
Test receiver set-up:
Preview test: Peak, RBW 200 Hz / 9 kHz. VBW 30 kHz
Final test: Quasi-Peak, RBW 200 Hz / 9 kHz
Measuring distance: 10 m
Measuring angle: 0 – 359°
Antenna
- Height above ground plane: 1 m
- Orientation: 2 orthogonal axis
- Type: Loop

Test set-up: **30 MHz to 1000 MHz**
Test receiver set-up:
Preview test: Peak, RBW 120 kHz. VBW 1 MHz
Final test: Quasi-Peak, RBW 120 kHz
Measuring distance: 3 m
Measuring angle: 0 – 359°
Antenna
- Height above ground plane: 1 – 4 m
- Polarisation: Vertical and Horizontal
- Type: Bilog

Test set-up: **1 GHz – 2 GHz**
Test receiver set-up:
Preview test: Peak, RBW 1 MHz. VBW 3 MHz
Final test: Average, RBW 1 MHz
Peak, RBW 1 MHz
Measuring distance: 3 m
Measuring angle: 0 – 359°
Antenna
- Height above ground plane: 1 – 4 m
- Polarisation: Vertical and Horizontal
- Type: Horn
- Antenna tilt: Activated

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6.3 Radiated Emission requirements

The EUT shall meet the limits for the standards.
Reference: CFR 47 §15.209, RSS-Gen section 8.9

Limits for general radiated emission

Frequency range [MHz]	Field strength at 3 m (dBµV/m)	Field strength at 10 m (dBµV/m)	Detector (dBµV/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.

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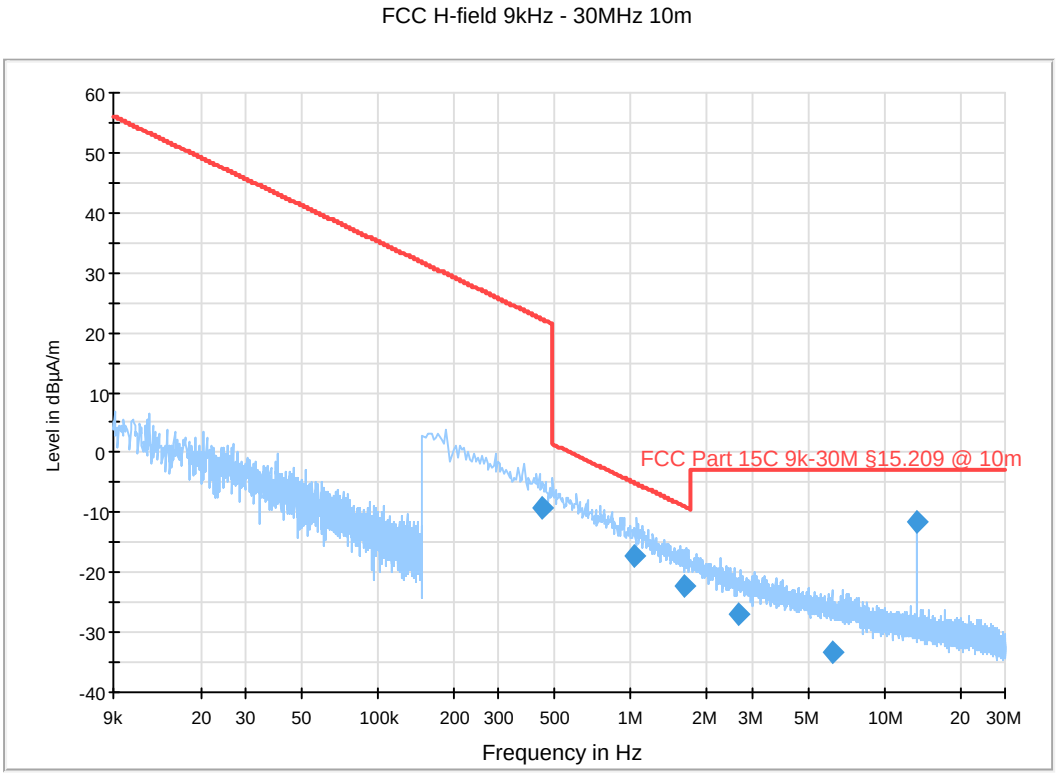
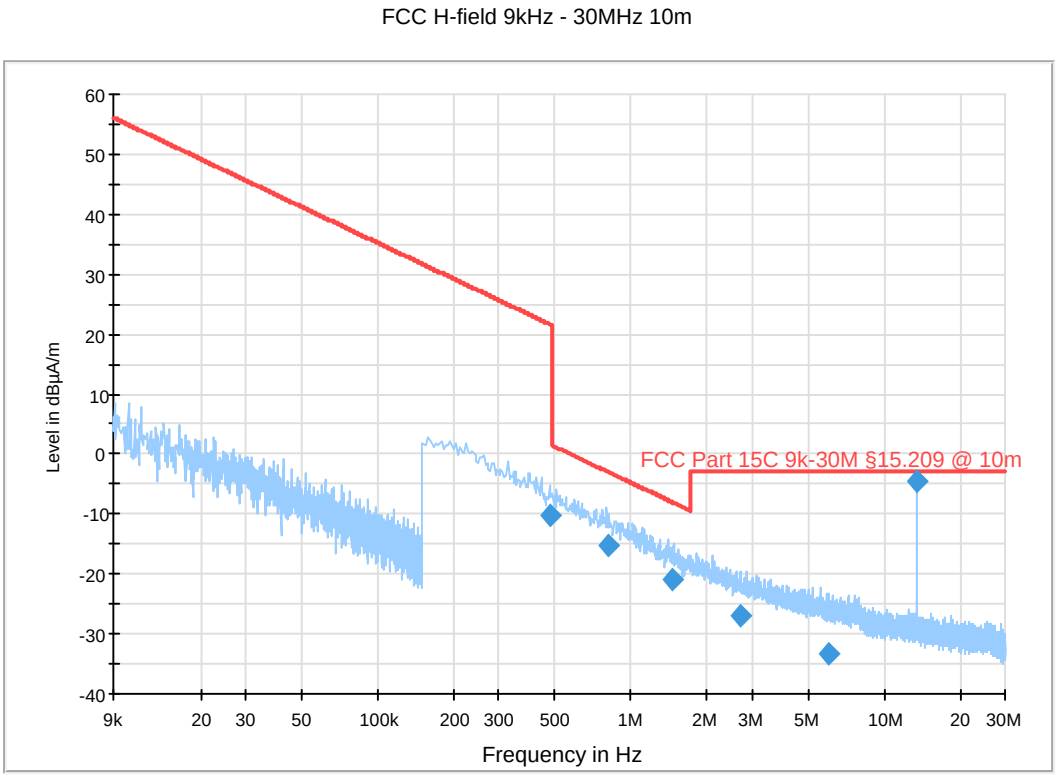
6.4 Test results 9 kHz – 30 MHz



Diagram, Peak overview sweep, 0.009 – 30 MHz at 10 m distance, x axis.



Diagram, Peak overview sweep, 0.009 – 30 MHz at 10 m distance, y axis.

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Measurement results, Quasi Peak

Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Position x/y	Margin [dB]
0.445	-9.4	22.2	x	31.6
1.021	-17.4	-5.0	x	12.4
1.617	-22.3	-8.9	x	13.3
2.677	-26.9	-2.9	x	24.0
6.225	-33.4	-2.9	x	30.5
13.561[1]	-11.7	-2.9	x	8.8
0.481	-10.2	21.6	y	31.8
0.809	-15.2	-2.9	y	12.3
1.443	-21.0	-8.0	y	13.1
2.729	-27.1	-2.9	y	24.2
5.997	-33.2	-2.9	y	30.3
13.561[1]	-4.4	-2.9	y	1.5

[1]Carrier

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

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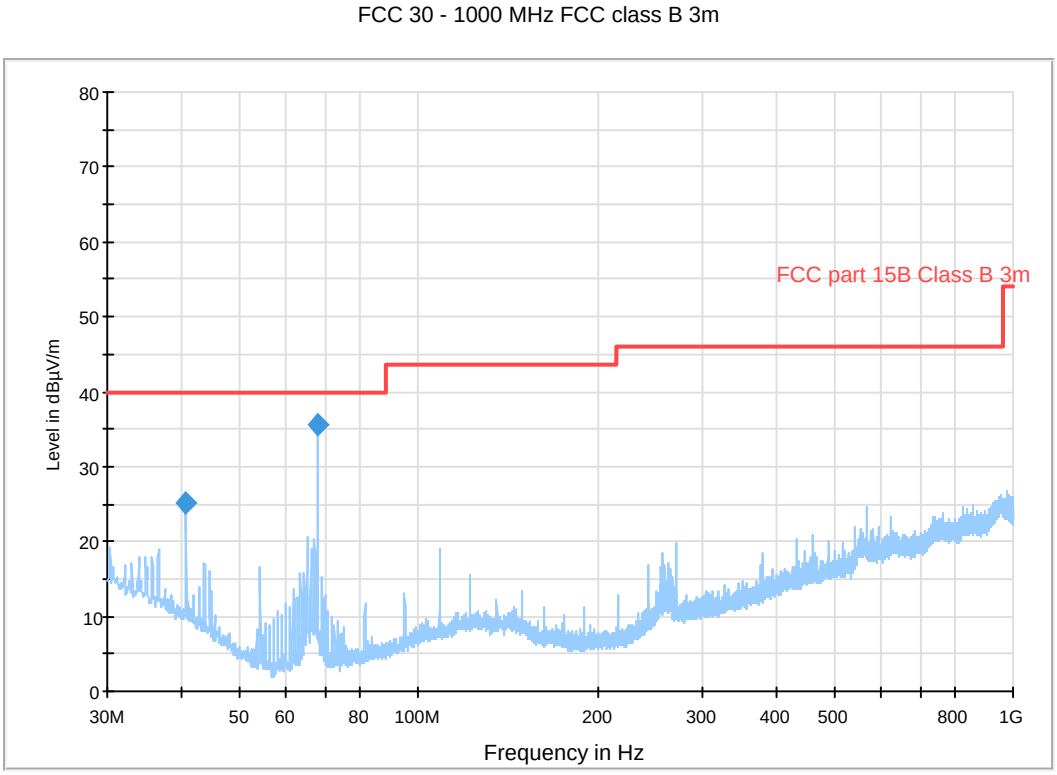
6.5 Test results 30 MHz – 1000 MHz



Diagram, Peak overview sweep, 30 – 1000 MHz at 3 m distance.

Measurement results, Quasi Peak

Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]
40.699	25.3	40.0	V	14.7
67.791	35.6	40.0	V	4.4

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

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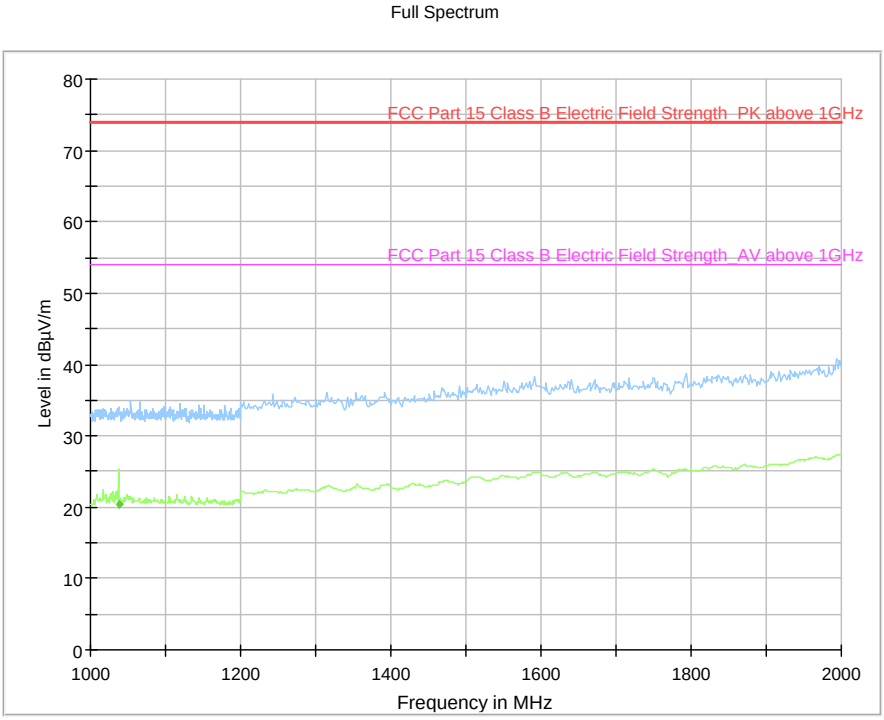
6.6 Test results 1 GHz – 2 GHz



Diagram, Peak overview sweep, 1 – 2 GHz at 3 m distance.

Measurement results, Peak / Average

Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]
1037.875351	- / 20.50	74 / 54	H	- / 33.50

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

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7. OCCUPIED BANDWIDTH

Date of test:	2016-10-06	**Test location:**	Wireless Center
EUT Serial:	RSExtCTX	**Ambient temp:**	22°C
Tested by:	DNI	**Relative humidity:**	52 %
Test result:	Pass	**Margin:**	-

7.1 Test set-up and test procedure.

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

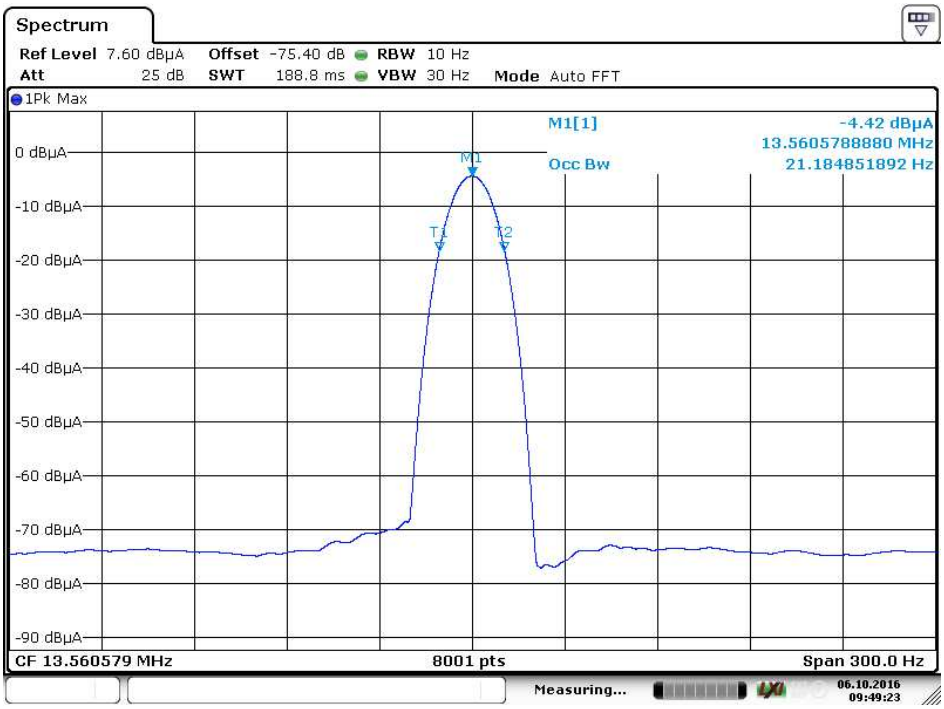
Spectrum analyser with occupied bandwidth measurement function is used to determine the occupied bandwidth.

7.2 Test conditions

Detector: Peak,
RBW: 1 – 5 % of span 300 Hz
VBV: 3 x RBW
Span: > OBW

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

7.3 Test results



Screenshot: Occupied bandwidth Measurement

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8. TEST EQUIPMENT

Conducted emission test site BUR 1

Equipment type	Manufacturer	Model	Inv. No.	Last Cal. date	Cal. interval
Measurement software	Rohde & Schwarz	EMC32 - 10.01	--	--	--
Receiver	Rohde & Schwarz	ESCI	12471	07-16	1 year
AMN / LISN	Rohde & Schwarz	ESH3-Z5	5875	07-16	1 year

Stora Hallen

Equipment type	Manufacturer	Model	Inv. No.	Last Cal. date	Cal. interval
Measurement software	Rohde & Schwarz	EMC32 - 8.51	--	--	--
Receiver	Rohde & Schwarz	ESU 8	12866	07-16	1 year
Loop antenna	Chase	EMCO 6502	8853	10-15	3 year
BiLog antenna	Chase	CBL6110A	971	07-15	3 year

Wireless Center and 3m FAC

Equipment type	Manufacturer	Model	Inv. No.	Last Cal. date	Cal. interval
Measurement software	Rohde & Schwarz	EMC32 - 9.21	--	--	--
Signal analyzer:	Rohde & Schwarz	FSV	32594	07-16	1 year
Signal analyzer:	Rohde & Schwarz	ESIB26	32288	07-16	1 year
BiLog antenna	Chase	CBL6110A	12474	04-16	3 year
Temperature chamber:	Vötsch	VC4018	12282	09-16	1 year
10 dB Attenuator:	Huber+Suhner	5910_N-50-010	32696	06-16	1 year

5M

Equipment type	**Manufacturer**	**Model**	**Inv. No.**	**Last Cal. date**	**Cal. interval**
Measurement software	Rohde & Schwarz	EMC32 – 9.12.10	--	--	--
Measurement receiver	Rohde & Schwarz	ESU40	13178	07-2016	1 year
Open switch and control platform	Rohde & Schwarz	OSP130	32298	07-2016	1 year
Open switch and control platform	Rohde & Schwarz	OSP-F7-B	32299	07-2016	1 year
Antenna ultralog	Rohde & Schwarz	HL562	32310	02-2016	1 year

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9. MEASUREMENT UNCERTAINTY

Continuous conducted disturbances with AMN in the frequency range 9 kHz to 30 MHz ± 3.7 dB

Measurement uncertainty for radiated disturbance

Uncertainty for the frequency range 0.09 to 30 MHz at 10 m	± 3.2 dB
Uncertainty for the frequency range 30 to 1000 MHz at 3 m	± 5.1 dB
Uncertainty for the frequency range 30 to 1000 MHz at 10 m	± 5.0 dB
Uncertainty for the frequency range 1.0 to 18 GHz at 3 m	± 4.7 dB
Uncertainty for the frequency range 18 to 26 GHz at 3 m	± 4.8 dB
Uncertainty for the frequency range 26 to 40 GHz at 3 m	± 5.7 dB

Measurement uncertainty is calculated in accordance with CISPR 16-4-2:2011.
The measurement uncertainty is given with a confidence of 95 %.

10. TEST SET UP AND EUT PHOTOS

EUT photos are in separate document 1613273STO-002 Annex 1.
Test set up photos are in separate document 1613273STO-002 Annex 2.

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