EMC TEST REPORT

FCC 47 CFR Part 15B
Industry Canada ICES-003

Electromagnetic compatibility - Unintentional radiators

Report Reference No. ..... :	G0M-1507-4918-EF0115B-V01
Testing Laboratory ..... :	Eurofins Product Service GmbH
Address ..... :	Storkower Str. 38c 15526 Reichenwalde Germany
Accreditation ..... :	A2LA Accredited Testing Laboratory, Certificate No.: 1983.01 FCC Filed Test Laboratory, Reg.-No.: 96970 IC OATS Filing assigned code: 3470A
Applicant's name ..... :	ABB Oy, Drives and Controls
Address ..... :	Hiomotie 13 00380 Helsinki FINLAND
Test specification:	
Standard..... :	47 CFR Part 15 Subpart B ICES-003, Issue 5:2012 ANSI C63.4:2014
Equipment under test (EUT):	
Product description	Assistant control panel with Bluetooth interface
Model No.	ACS-AP-W
Product description	HVAC assistant control panel with Bluetooth interface
Additional Models	ACH-AP-W
Hardware version	C
Firmware / Software version	v 4.90
Contains	FCC-ID: 2AFNGAPWSERIES IC: 20555-APWSERIES
Test result	**Passed**

Possible test case verdicts:

- not applicable to test object ..... : N/A
- test object does meet the requirement..... : P (Pass)
- test object does not meet the requirement..... : F (Fail)

Testing:

Date of receipt of test item ..... : 2015-07-22

Date (s) of performance of tests ..... : 2015-10-02 – 2015-10-07

Compiled by ..... : Marcus Klein

Tested by (+ signature) ..... : Yu Yu / Andreas Pflug

Approved by (+ signature) ..... : Marcus Klein
Head of Lab

Date of issue ..... : 2015-10-20

Total number of pages ..... : 32

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.

Additional comments:

Main model: ACS-AP-W

Additional model: ACH-AP-W

The additional variant is called "HVAC assistant control panel with Bluetooth interface". The most important difference is that HVAC markets require different start-stop logic for controlling the frequency converter. In HVAC variant, the logic is Hand – Auto – Off, while normal industrial modes have only On – Off.

The Bluetooth part and PCBA are exactly similar:

- layout : no changes - schematic: no changes
- RF part: no changes
- Bluetooth profiles, QDID: no changes
- plastic covers: different printings on push-buttons, different colors of plastics

Full Test was performed on the version ACS-AP-W

Version History

Version	Issue Date	Remarks	Revised by
V01	2015-10-20	Initial Release	

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

REPORT INDEX

1	**EQUIPMENT (TEST ITEM) DESCRIPTION**	**5**
1.1	Photos – Equipment external	6
1.2	Photos – Equipment internal	8
1.3	Photos – Test setup	10
1.4	Supporting Equipment Used During Testing	12
1.5	Input / Output Ports	12
1.6	Operating Modes and Configurations	13
1.7	Test Equipment Used During Testing	14
1.8	Sample emission level calculation	15
2	**RESULT SUMMARY**	**16**
3	**TEST CONDITIONS AND RESULTS**	**17**
3.1	Test Conditions and Results – Radiated emissions	17
3.2	Test Conditions and Results – AC power line conducted emissions	29

1 Equipment (Test item) Description

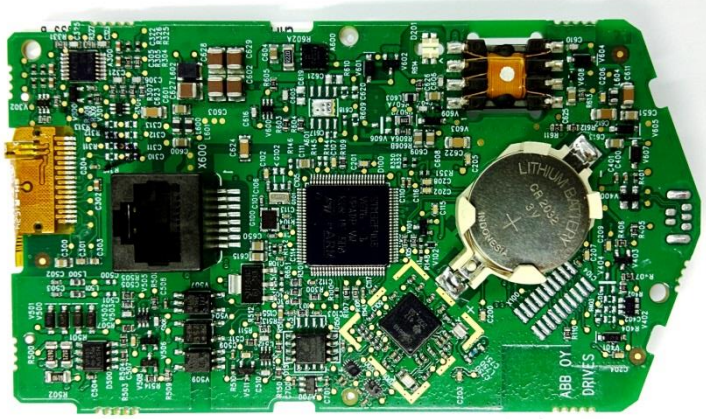
Description	Assistant control panel with Bluetooth interface	
Model	ACS-AP-W	
Description	HVAC assistant control panel with Bluetooth interface	
Additional Models	ACH-AP-W	
Serial number	A5300136EL	
Hardware version	C	
Software / Firmware version	v 4.90	
Power supply	24 VDC	
Radio module	Type	Bluetooth Module
	Model	CC2564B
	Manufacturer	Texas Instruments
Manufacturer	ABB Oy, Drives and Controls Hiomotie 13 00380 Helsinki FINLAND	
Highest emission frequency	Fmax [MHz] = 2480	
Device classification	Class B	
Equipment type	Tabletop	
Number of tested samples	1	

ACH-AP-W - Top


ACH-AP-W - Bottom

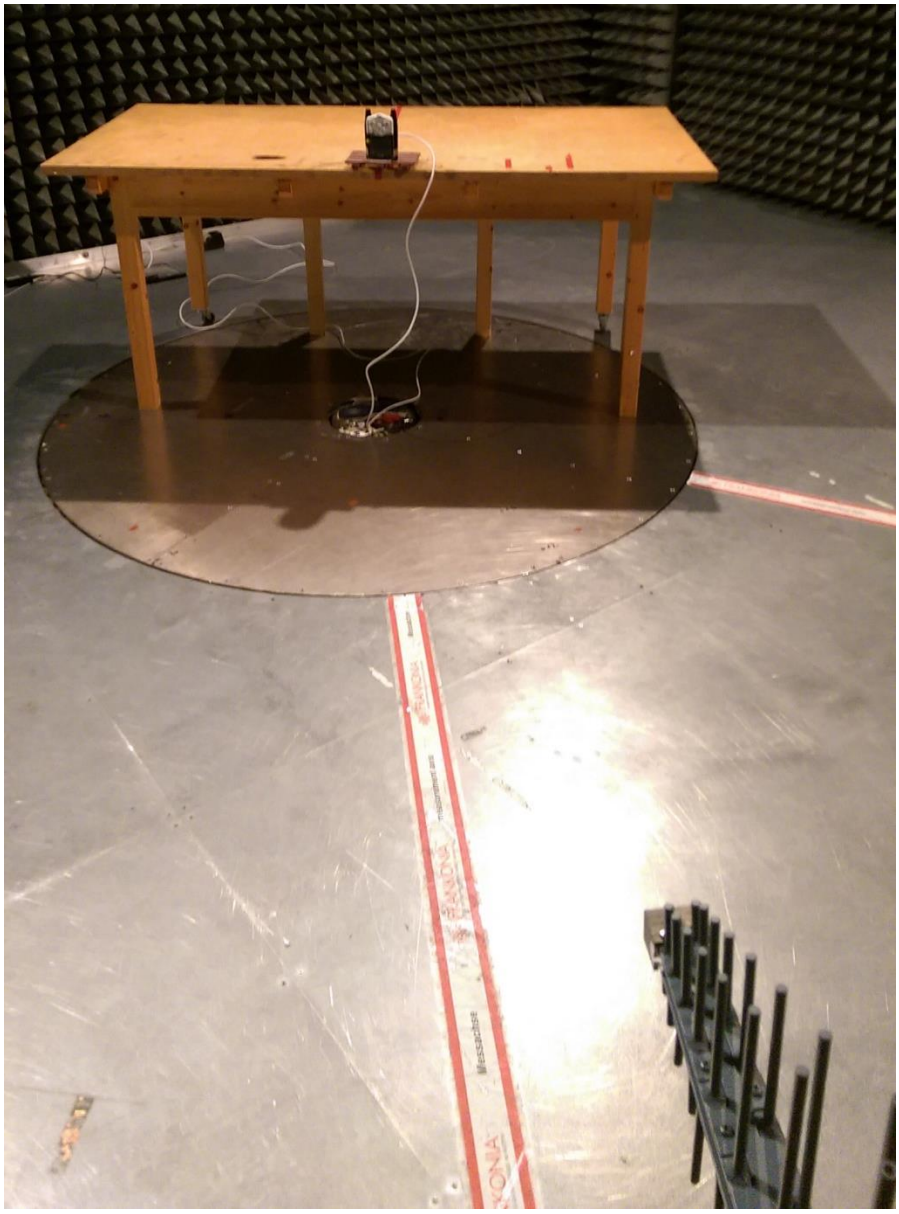

1.2 Photos – Equipment internal

ACS-AP-W - PCB BOTTOM


ACS-AP-W - PCB TOP


1.3 Photos – Test setup

Test Setup : Radiated Emissions



Test Setup : Conducted Emissions

1.4 Supporting Equipment Used During Testing

Product Type*	Device	Manufacturer	Model No.	Comments
AE	Notebook	DELL	Latitude	-
AE	Bluetooth 4.0 USB Adapter	ASUS	USB-BT400	-
AE	USB Serial Converter	MOXA	UPort 1150I	-

***Note:** Use the following abbreviations:

AE : Auxiliary/Associated Equipment, or

SIM : Simulator (Not Subjected to Test)

CABL : Connecting cables

1.5 Input / Output Ports

Port #	Name	Type*	Max. Cable Length	Cable Shielded	Comments
1	RS485	DC / I/O	>3m	Yes	-
2	USB	I/O	>3m	Yes	Service port only

***Note:** Use the following abbreviations:

AC : AC power port

DC : DC power port

N/E : Non electrical

I/O : Signal input or output port

TP : Telecommunication port

1.6 Operating Modes and Configurations

Mode #	Description
1	Bluetooth communication + Data transfer via RS485

Configuration #	EUT Configuration
1	Standard configuration without USB Cable connected (service only)

1.7 Test Equipment Used During Testing

Measurement Software			
Description	Manufacturer	Name	Version
EMC Test Software	Dare Instruments	Radimation	2014.1.15

Radiated emissions					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Biconical Antenna	R&S	HK 116	EF00012	2013-02	2016-02
LPD-Antenne	R&S	HL 223	EF00187	2014-03	2017-03
Horn antenna	Schwarzbeck	BBHA 9120D	EF00018	2013-09	2016-09
EMI Test Receiver	R&S	ESU26	EF00887	2015-01	2016-01

Conducted emissions					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
AMN	R&S	ESH2-Z5	EF00182	2014-11	2016-11
AMN	R&S	ESH3-Z5	EF00036	2014-12	2016-12
EMI Test Receiver	R&S	ESCS 30	EF00295	2014-10	2015-10

1.8 Sample emission level calculation

The following is a description of terms and a sample calculation, as appears in the radiated emissions data table. The numbers used in the calculation are for example only. There is no direct correlation to the specific data taken for the product described in this document:

Reading:

This is the reading obtained on the spectrum analyzer in dBµV. Any external preamplifiers used are taken into account through internal analyzer settings.

A.F.:

This is the antenna factor for the receiving antenna. It is a conversion factor, which converts electric fields strengths to voltages, which can be measured directly on the spectrum analyzer. It is treated as a loss in dB. Cable losses have been included with the A.F. to simplify the calculations. The antenna factor is used in calculations as follows:

Reading on Analyzer (dBµV) + A.F. (dB) = Net field strength (dBµV/m)

Net:

This is the net field strength measurement (as shown above).

Limit:

This is the FCC Class B radiated emission limit (in units of dBµV/m). The FCC limits are given in units of µV/m. The following formula is used to convert the units of µV/m to dBµV/m:

Limit (dBµV/m) = 20*log (µV/m)

Margin:

This is the margin of compliance below the FCC limit. The units are given in dB. A negative margin indicates the emission was below the limit. A positive margin indicates that the emission exceeds the limit.

Example only:

Reading	+	AF	=	Net Reading	:	Net reading - FCC limit	= Margin
21.5 dBµV	+	26 dB	=	47.5 dBµV/m	:	47.5 dBµV/m - 57.0 dBµV/m	= -9.5 dB

2 Result Summary

FCC 47 CFR Part 15B, Industry Canada ICES-003				
Product Specific Standard	**Requirement – Test**	**Reference Method**	**Result**	**Remarks**
47 CFR 15.109 ICES-003 Item 6.2	Radiated emissions	ANSI C 63.4	PASS	
47 CFR 15.107 ICES-003 Item 6.1	AC power line conducted emissions	ANSI C63.4	PASS	
Remarks:				

3 Test Conditions and Results

3.1 Test Conditions and Results – Radiated emissions

Radiated emissions acc. FCC 47 CFR 15.109 / ICES-003						**Verdict: PASS**
Laboratory Parameters:	Required prior to the test		During the test			
Ambient Temperature	15 to 35 °C		27°C			
Relative Humidity	30 to 60 %		40%			
Test according referenced standards	Reference Method					
	ANSI C63.4					
Sample is tested with respect to the requirements of the equipment class	Equipment class					
	Class B					
Test frequency range determined from highest emission frequency	Highest emission frequency					
	Fmax [MHz] = 2480					
Fully configured sample scanned over the following frequency range	Frequency range					
	30 MHz to 14 GHz					
Operating mode	1					
Configuration	1					
Limits and results Class B						
Frequency [MHz]	Quasi-Peak [dBµV/m]	Result	Average [dBµV/m]	Result	Peak [dBµV/m]	Result
30 – 88	40	PASS	-		-	-
88 – 216	43.5	PASS	-		-	-
216 – 960	46	PASS	-		-	-
960 – 1000	54	PASS	-		-	-
> 1000	-	-	54	PASS	74	PASS
Comments:						

Test Procedure:

The test site is in accordance with ANSI C63-4:2009 requirements and is listed by FCC.
The measurement procedure is as follows:

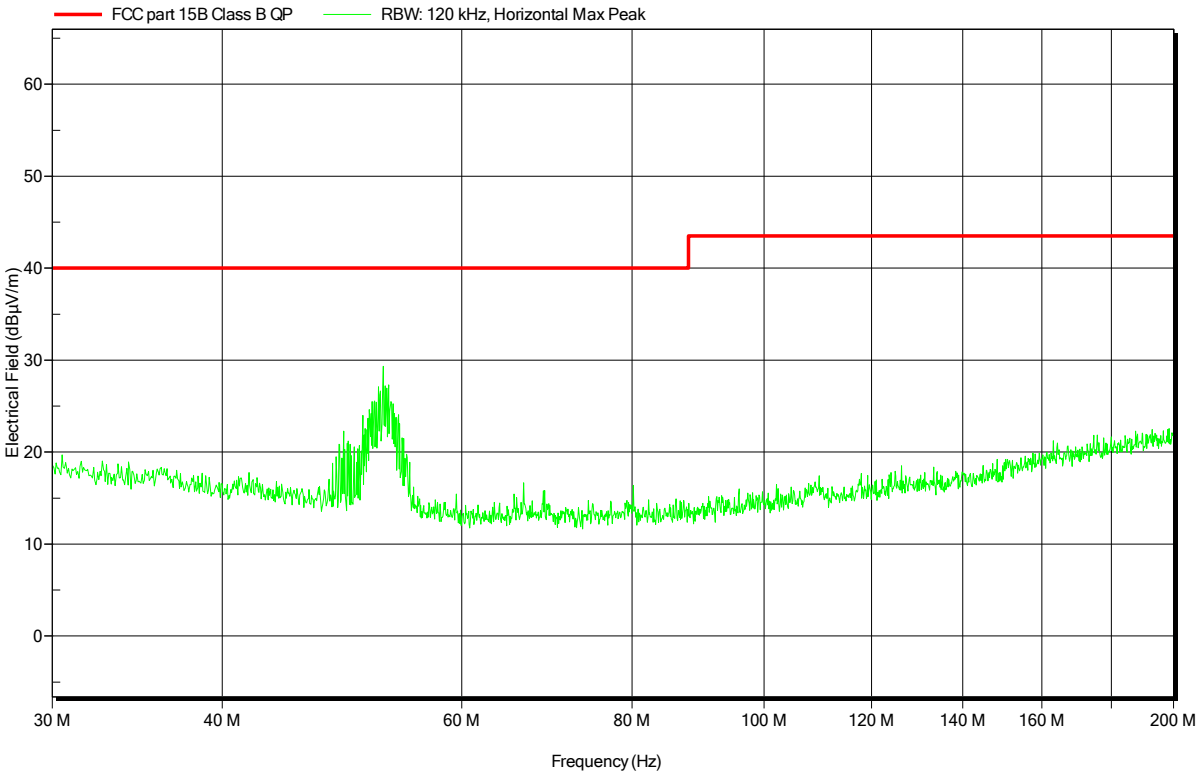
1) The EUT was placed on a 0.8 m non conductive table at a 3 m distance from the receive antenna (ANSI C63.4: 2009 item 6.2)
2) The antenna output was connected to the measurement receiver
3) A biconical antenna was used for the frequency range 30 – 200 MHz, a logarithmic periodical antenna was used for the frequency range from 200 – 1000 MHz. Above one 1 GHz a Double Ridged Broadband Horn antenna was used. The antenna was placed on an adjustable height antenna mast
4) Emissions were maximized at each frequency by rotating the EUT and adjusting the receive antenna height and polarization. The maximum values were recorded.

Spurious emissions under normal conditions according to FCC 15B

Project number: G0M-1507-4918

Applicant:	ABB Oy, Drives and Controls
EUT Name:	Assistant control panel with Bluetooth interface
Model:	ACS-AP-W
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Yu
Test Conditions:	Tnom: 27°C, Unom: 24VDC
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement distance:	3m
Mode:	1
Test Date:	2015-10-02
Note:	

Index 8

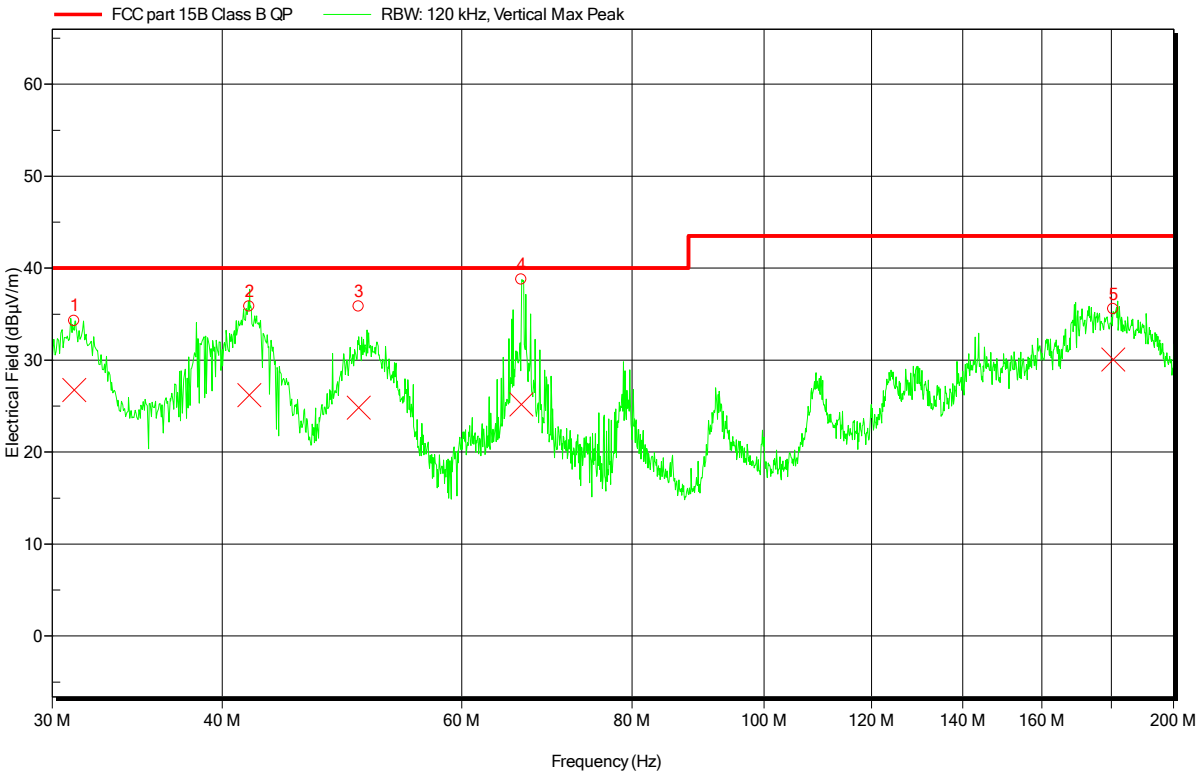


Spurious emissions under normal conditions according to FCC 15B

Project number: G0M-1507-4918

Applicant:	ABB Oy, Drives and Controls
EUT Name:	Assistant control panel with Bluetooth interface
Model:	ACS-AP-W
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Yu
Test Conditions:	Tnom: 27°C, Unom: 24VDC
Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement distance:	3m
Mode:	1
Test Date:	2015-10-02
Note:	

Index 7



Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status
180,6 MHz	30,08 dBµV/m	43,5 dBµV/m	-13,42 dB	Pass
31,14 MHz	26,74 dBµV/m	40 dBµV/m	-13,26 dB	Pass
41,88 MHz	26,19 dBµV/m	40 dBµV/m	-13,81 dB	Pass
50,4 MHz	24,83 dBµV/m	40 dBµV/m	-15,17 dB	Pass
66,36 MHz	25,18 dBµV/m	40 dBµV/m	-14,82 dB	Pass

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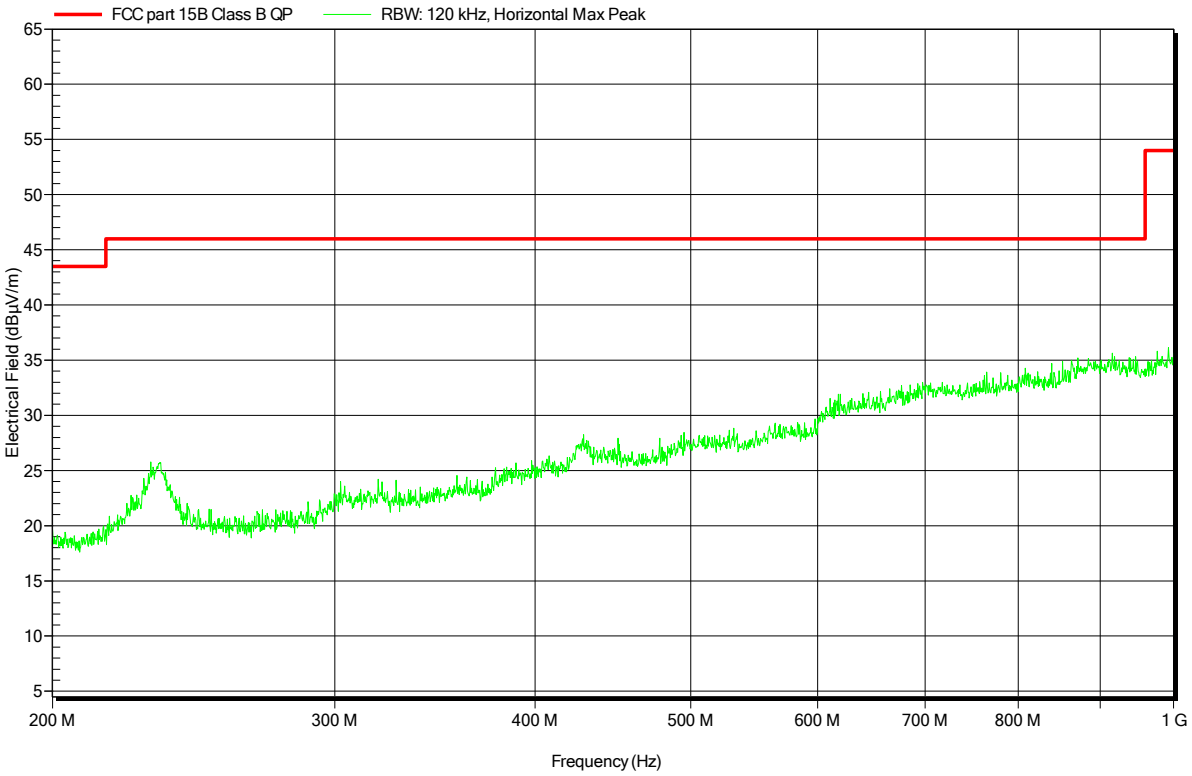
Model:	ACS-AP-W
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Yu
Test Conditions:	Tnom: 27°C, Unom: 24VDC
Antenna:	Rohde & Schwarz HL 223, Horizontal
Measurement distance:	3m
Mode:	1
Test Date:	2015-10-02
Note:	

Index 5



Spurious emissions under normal conditions according to FCC 15B

Project number: G0M-1507-4918

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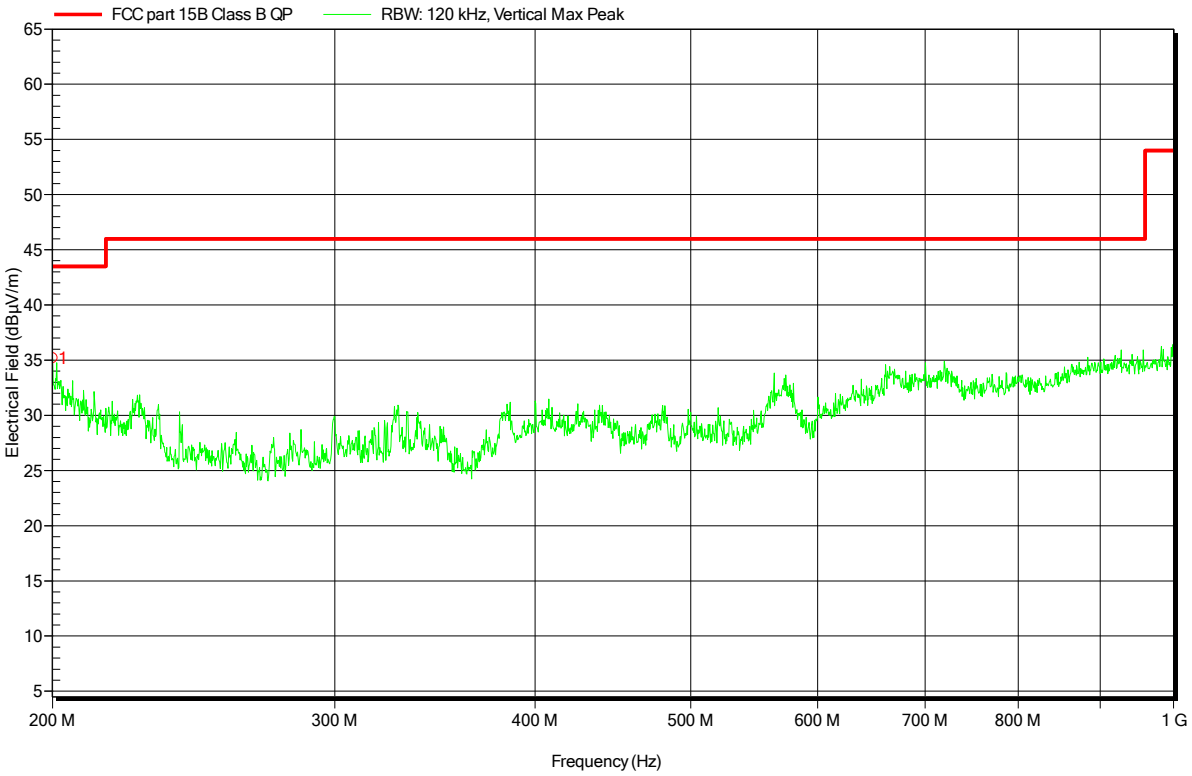
EUT Name:	Assistant control panel with Bluetooth interface
Model:	ACS-AP-W
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Yu
Test Conditions:	Tnom: 27°C, Unom: 24VDC
Antenna:	Rohde & Schwarz HL 223, Vertical
Measurement distance:	3m
Mode:	1
Test Date:	2015-10-02
Note:	

Index 6



Frequency
200 MHz

Spurious emissions under normal conditions according to FCC 15B

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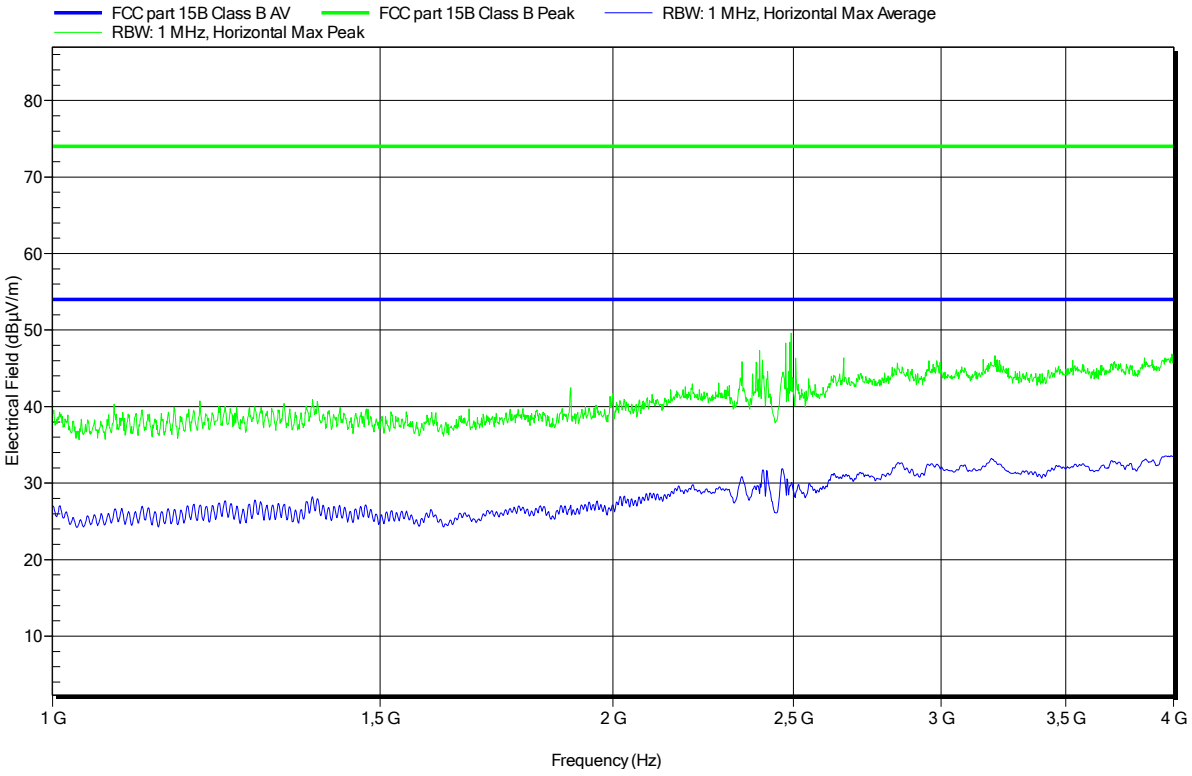
Applicant:	ABB Oy, Drives and Controls
EUT Name:	Assistant control panel with Bluetooth interface
Model:	ACS-AP-W
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Yu
Test Conditions:	Tnom: 27°C, Unom: 24VDC
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	3m
Mode:	1
Test Date:	2015-10-02
Note:	

Index 9



Spurious emissions under normal conditions according to FCC 15B

Project number: G0M-1507-4918

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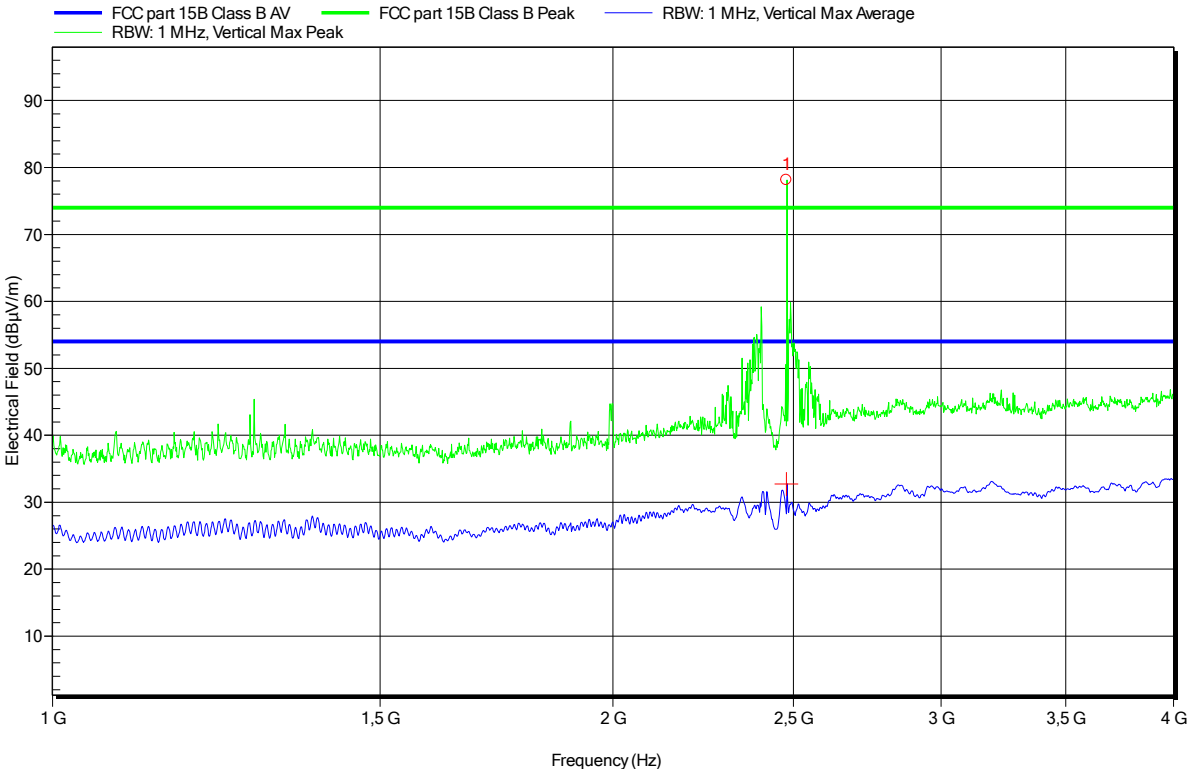
EUT Name:	Assistant control panel with Bluetooth interface
Model:	ACS-AP-W
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Yu
Test Conditions:	Tnom: 27°C, Unom: 24VDC
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	3m
Mode:	1
Test Date:	2015-10-02
Note:	

Index 10



Frequency	
2,479 GHz	Bluetooth Carrier

Spurious emissions under normal conditions according to FCC 15B

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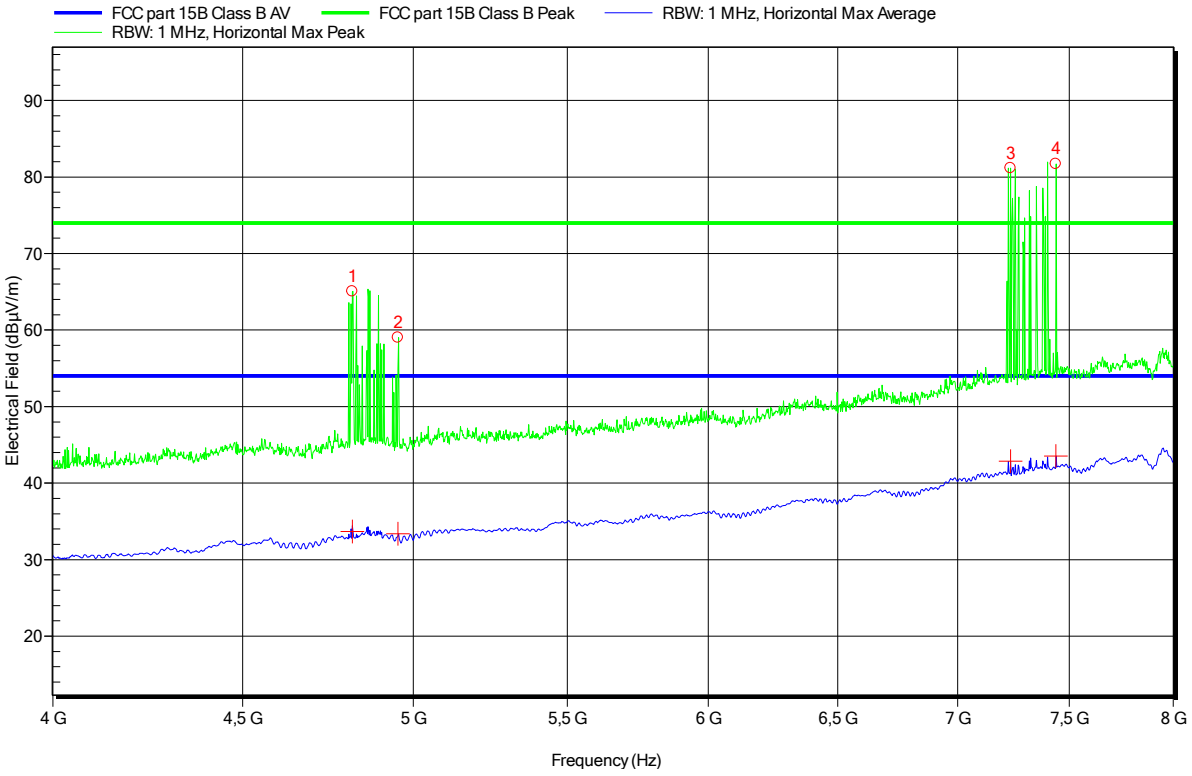
Model:	ACS-AP-W
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Yu
Test Conditions:	Tnom: 27°C, Unom: 24VDC
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	3m
Mode:	1
Test Date:	2015-10-02
Note:	

Index 12



Frequency	
4,816 GHz	Bluetooth Harmonic
4,954 GHz	Bluetooth Harmonic
7,233 GHz	Bluetooth Harmonic
7,438 GHz	Bluetooth Harmonic

Spurious emissions under normal conditions according to FCC 15B

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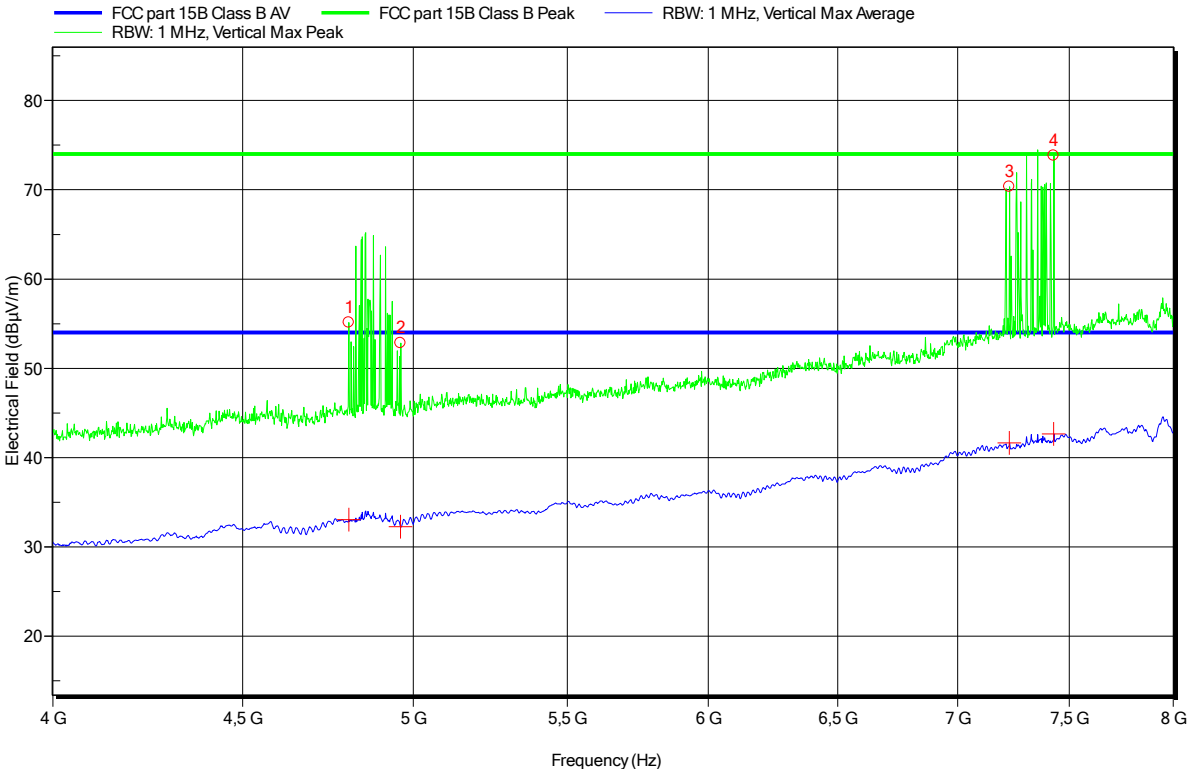
Model:	ACS-AP-W
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Yu
Test Conditions:	Tnom: 27°C, Unom: 24VDC
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	3m
Mode:	1
Test Date:	2015-10-02
Note:	

Index 11



Frequency	
4,805 GHz	Bluetooth Harmonic
4,961 GHz	Bluetooth Harmonic
7,227 GHz	Bluetooth Harmonic
7,428 GHz	Bluetooth Harmonic

Spurious emissions under normal conditions according to FCC 15B

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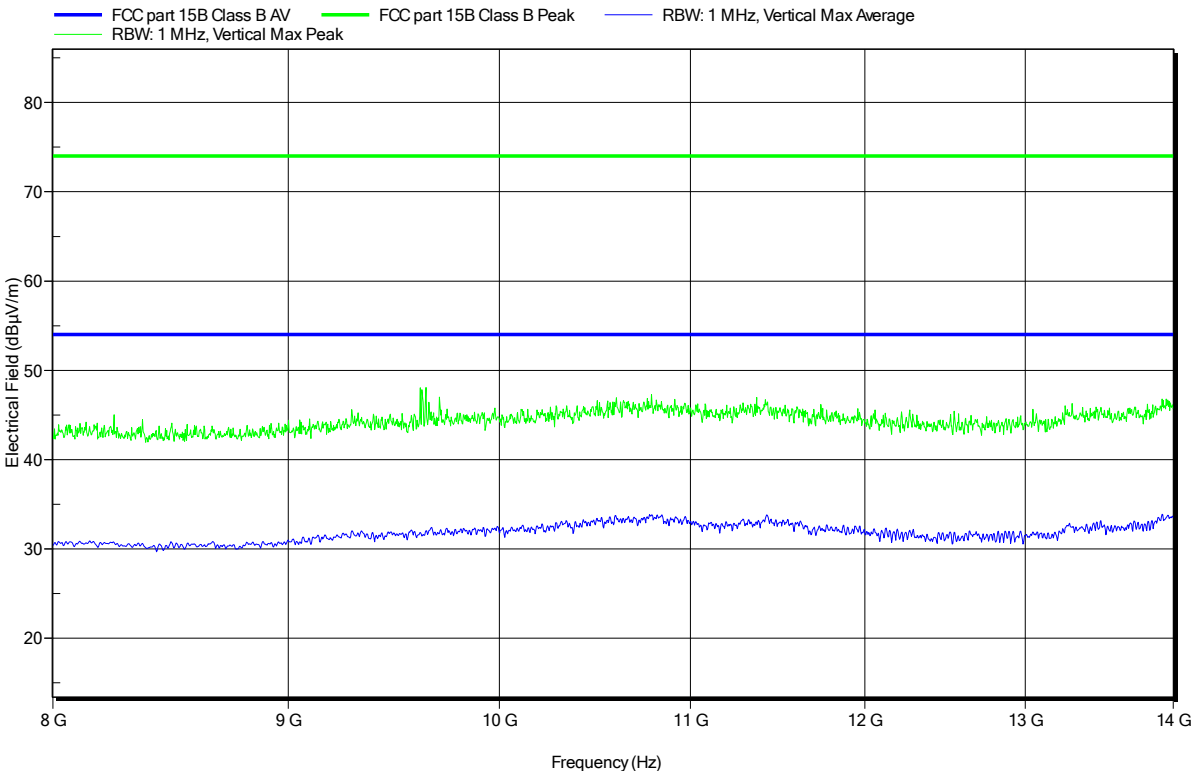
Model:	ACS-AP-W
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Yu
Test Conditions:	Tnom: 27°C, Unom: 24VDC
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	3m
Mode:	1
Test Date:	2015-10-02
Note:	

Index 4



Spurious emissions under normal conditions according to FCC 15B

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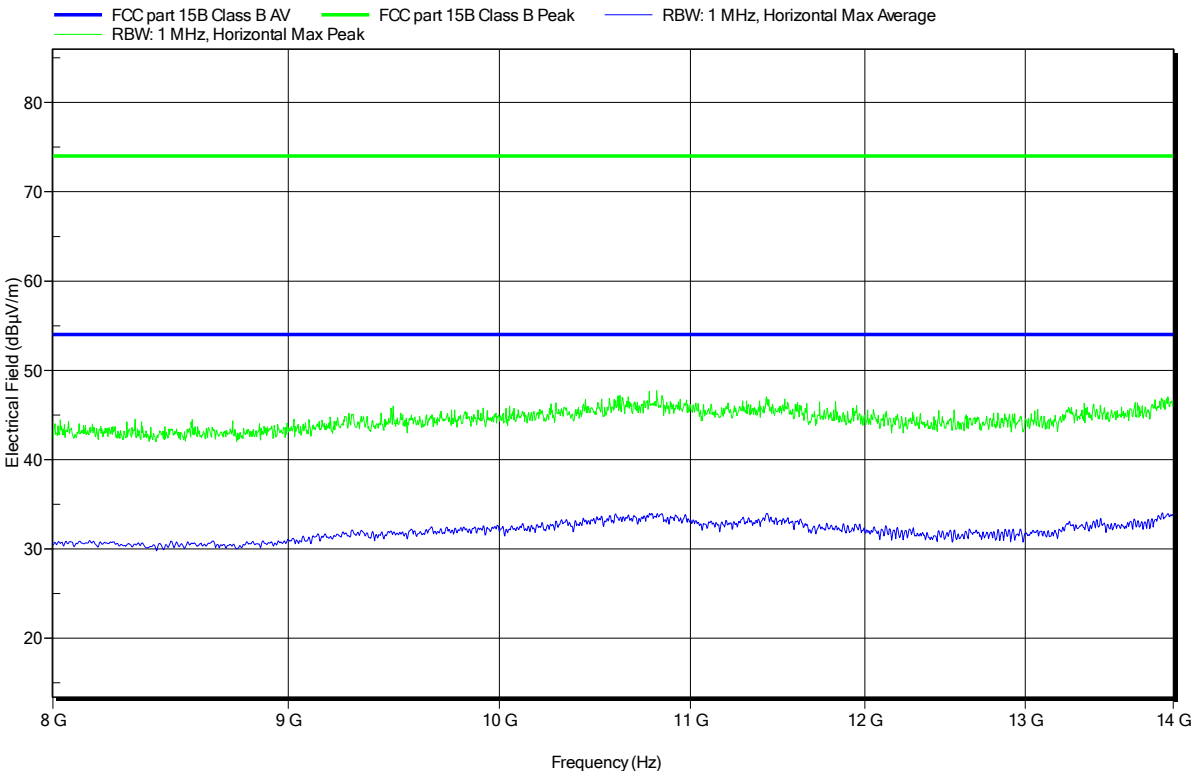
Model:	ACS-AP-W
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Yu
Test Conditions:	Tnom: 27°C, Unom: 24VDC
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	3m
Mode:	1
Test Date:	2015-10-02
Note:	

Index 3



3.2 Test Conditions and Results – AC power line conducted emissions

Conducted emissions acc. FCC 47 CFR 15.107 / ICES-003		**Verdict: PASS**
Laboratory Parameters:	Required prior to the test	During the test
Ambient Temperature	15 to 35 °C	27°C
Relative Humidity	30 to 60 %	40%
Test according referenced standards	Reference Method	
	ANSI C63.4	
Fully configured sample scanned over the following frequency range	Frequency range	
	0.15 MHz to 30 MHz	
Sample is tested with respect to the requirements of the equipment class	Equipment class	
	Class B	
Points of Application	Application Interface	
AC Mains	LISN	
Operating mode	1	
Configuration	1	

Limits and results Class B				
Frequency [MHz]	Quasi-Peak [dBµV]	Result	Average [dBµV]	Result
0.15 to 5	66 to 56*	PASS	56 to 46*	PASS
0.5 to 5	56	PASS	46	PASS
5 to 30	60	PASS	50	PASS

Comments:
* Limit decreases linearly with the logarithm of the frequency.

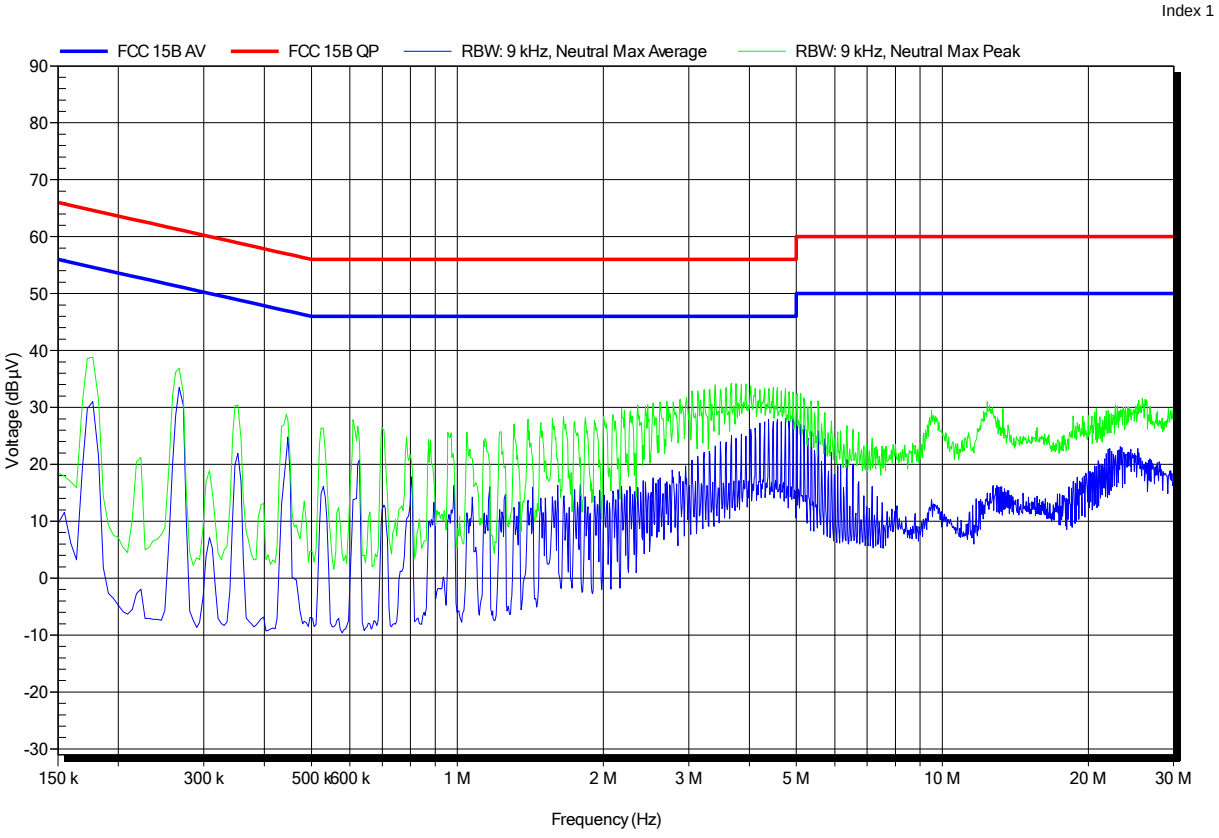
Test Procedure:

1) The EUT was placed on a non conductive table 0.8 m above the reference ground plane and 0.4 m away from the vertical conducting plane (ANSI C63.4: 2009 item 7.3.1)
2) The power cord that is normally supplied or recommended by the manufacturer was connected to the LISN.
3) The distance between the outer edge of the EUT and the LISN shall be set to 0.8 m. A longer power cord shall be bundled to this length (bundling shall not exceed 40 cm in length).
4) The LISN measurement port was connected to a measurement receiver
5) I/O cables were bundled not longer than 0.4 m
6) Measurement was performed in the frequency range 0.15 – 30MHz on each current-carrying conductor

EMI voltage test in the ac-mains according to FCC 15B

Project number: G0M-1507-4918

Applicant:	ABB Oy, Drives and Controls
EUT Name:	Assistant control panel with Bluetooth interface
Model:	ACS-AP-W
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Yu
Test Conditions:	Tnom: 27°C, Unom: 120VAC
LISN:	ESH2-Z5 N
Mode:	1
Test Date:	2015-10-02
Note:	



EMI voltage test in the ac-mains according to FCC 15B

Project number: G0M-1507-4918

Applicant:	ABB Oy, Drives and Controls
EUT Name:	Assistant control panel with Bluetooth interface
Model:	ACS-AP-W
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Yu
Test Conditions:	Tnom: 27°C, Unom: 120VAC
LISN:	ESH2-Z5 L
Mode:	1
Test Date:	2015-10-02
Note: