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FCC TEST REPORT

FCC 47 CFR Part 15C
Industry Canada RSS-247

Digital transmission systems operating within the 2400 – 2483.5 MHz band

Report Reference No. ..... :	G0M-1507-4918-TFC247BL-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 15C RSS-247, Issue 1, 2015-05 RSS-Gen, Issue 4, 2014-11 ANSI C63.10:2013 ANSI C63.4:2014
Test scope…….. ..... :	complete Radio compliance test
Equipment under test (EUT):	
Product description	Assistant control panel with Bluetooth interface
Model No.	ACS-AP-W
Additional Model(s)	ACH-AP-W
Brand Name(s)	ABB
Hardware version	C
Firmware / Software version	v 4.90
	FCC-ID: 2AFNGAPWSERIES IC: 20555-APWSERIES
Test result	**Passed**

Possible test case verdicts:	
- neither assessed nor tested	N/N
- required by standard but not appl. to test object	N/A
- required by standard but not tested	N/T
- not required by standard for the test object	N/R
- test object does meet the requirement	P (Pass)
- test object does not meet the requirement	F (Fail)

Testing:		
Test Lab Temperature	20 – 23 °C	
Test Lab Humidity	32 – 38 %	
Date of receipt of test item	2015-06-24	
Date (s) of performance of tests	2015-07-16 – 2015-07-27	
Compiled by	Wilfried Treffke	
Tested by (+ signature) (Responsible for Test)	Wilfried Treffke	W. Treffke
Approved by (+ signature) (Head of Lab)	Christian Weber	C. Weber
Date of issue	2015-10-23	
Total number of pages	43	

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:

"First" model: ACS-AP-W

"Second" model: ACH-AP-W

The "second" 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 PCB 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
01	2015-10-23	Initial Release	

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1 Equipment (Test item) Description

Description	Assistant control panel with Bluetooth interface	
Model	ACS-AP-W	
Additional Model(s)	ACH-AP-W	
Brand Name(s)	ABB	
Serial number	None	
Hardware version	C	
Software / Firmware version	v 4.90	
FCC-ID	2AFNGAPWSERIES	
IC	20555-APWSERIES	
Equipment type	End product	
Radio type	Transceiver	
Radio technology	Bluetooth 4.0 Low Energy	
Operating frequency range	2402 - 2480 MHz	
Assigned frequency band	2400 - 2483.5 MHz	
Main test frequencies	F_{LOW}	2402 MHz
	F_{MID}	2440 MHz
	F_{HIGH}	2480 MHz
Spreading	Frequency Hopping	
Modulations	GFSK	
Number of channels	40	
Channel spacing	2MHz	
Number of antennas	1	
Antenna	Type	integrated
	Model	PCB F-antenna
	Manufacturer	unspecified
	Gain	1.7
Manufacturer	ABB Oy, Drives and Controls Hiomotie 13 00380 Helsinki FINLAND	
Power supply	V_{NOM}	24.0 VDC
	V_{MIN}	15.0 VDC
	V_{MAX}	26.4 VDC
AC/DC-Adaptor	Model	NONE
	Vendor	NONE
	Input	NONE
	Output	NONE

1.4 Supporting Equipment Used During Testing

Product Type*	Device	Manufacturer	Model No.	Comments
AE	Laptop	Dell	Latitude E6420	Funk2

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

AE : Auxiliary/Associated Equipment, or

SIM : Simulator (Not Subjected to Test)

CABL : Connecting cables

1.5 Test Modes

Mode #	Description	
Transmit	General conditions:	EUT powered by laboratory power supply.
	Radio conditions:	Mode = standalone transmit Spreading = Hopping stopped (single hopping channel) Modulation = GFSK Data rate = 1 Mbps Bandwidth = 2 MHz Duty cycle = 100 % Power level = Maximum
Receive	General conditions:	EUT powered by laboratory power supply.
	Radio conditions:	Mode = standalone receive (scan mode) Spreading = On Modulation = GFSK
AC-Powerline	General conditions:	EUT powered by AC/DC adaptor
	Radio conditions:	Mode = Transmit Spreading = On

1.6 Test Equipment Used During Testing

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

Occupied Bandwidth					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSP 30	EF00312	2015-02	2016-02

6dB Bandwidth					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSP 30	EF00312	2015-02	2016-02

Maximum peak conducted power					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSP 30	EF00312	2015-02	2016-02

Power spectral density					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSP 30	EF00312	2015-02	2016-02

Band edge compliance					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSP 30	EF00312	2015-02	2016-02

Conducted spurious emissions					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSP 30	EF00312	2015-02	2016-02

Radiated spurious emissions					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Semi-anechoic chamber	Frankonia	AC 1	EF00062	-	-
Spectrum Analyzer	R&S	FSIQ26	EF00242	2015-04	2016-04
Biconical Antenna	R&S	HK 116	EF00012	2013-02	2016-02
LPD Antenna	R&S	HL 223	EF00187	2014-03	2017-03
LPD Antenna	R&S	HL 025	EF00327	2013-02	2016-02

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

1.7 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 15C, IC RSS-247				
Product Specific Standard Section	**Requirement – Test**	**Reference Method**	**Result**	**Remarks**
RSS-Gen 6.6	Occupied Bandwidth	ANSI C63.10	N/R	Informational only
FCC § 15.247(a)(2) IC RSS-247 § 5.2	6dB Bandwidth	ANSI C63.10	PASS	
FCC § 15.247(b)(3) IC RSS-247 § 5.4	Maximum peak conducted power	ANSI C63.10	PASS	
FCC § 15.247(e) IC RSS-247 § 5.2	Power spectral density	ANSI C63.10	PASS	
47 CFR 15.207 IC RSS-247 § 3.1	AC power line conducted emissions	ANSI C63.4	PASS	
FCC § 15.247(d) IC RSS-247 § 5.5	Band edge compliance	ANSI C63.10	PASS	
FCC § 15.247(d) IC RSS-247 § 5.5	Conducted spurious emissions	ANSI C63.10	PASS	
FCC § 15.247(d) FCC § 15.209 IC RSS-247 § 5.5	Transmitter radiated spurious emissions	ANSI C63.10	PASS	
IC RSS-247 § 3.1	Receiver radiated spurious emissions	ANSI C63.10	PASS	
Remarks:				

3 Test Conditions and Results

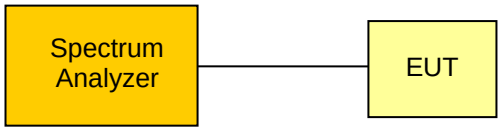
3.1 Test Conditions and Results – Occupied Bandwidth

Occupied Bandwidth acc. to IC RSS-Gen	**Verdict: PASS**
Test according to measurement reference	Reference Method
	ANSI C63.10
Test frequency range	Tested frequencies
	F_{LOW} / F_{MID} / F_{HIGH}

Limits

None (Informational only)

Test setup



Test procedure

1. EUT set to test mode (Communication tester is used if needed)
2. Span set to at least twice the emission spectrum
3. Resolution bandwidth set to 1 % of span
4. Occupied Bandwidth (99 %) measurement with spectrum analyzer built in measurement function

Test results

Channel	Frequency [MHz]	Mode	Occupied Bandwidth [kHz]
F_{LOW}	2402	Transmit	1016
F_{MID}	2442	Transmit	1015
F_{HIGH}	2480	Transmit	1016

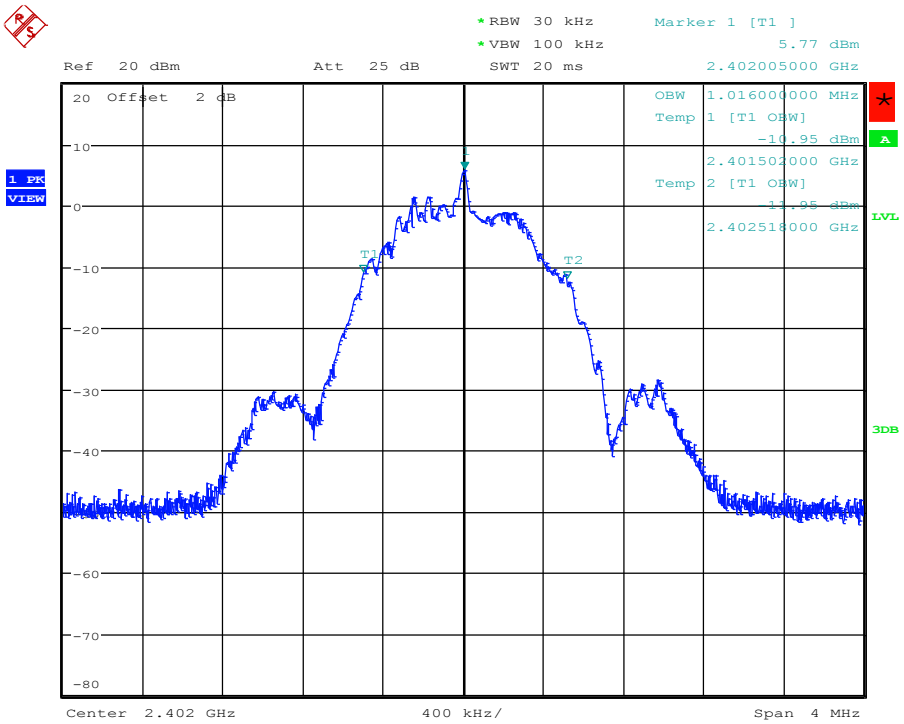
Comments:

Occupied Bandwidth – F_{LOW}

Occupied Bandwidth acc. to RSS-Gen

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:	Wilfried Treffke
Test Conditions:	Tnom / Vnom
Mode:	Tx, BT-LE, 2402 MHz
Test Date:	2015-07-27
Verdict:	NONE (INFORMATION ONLY)
Note 1:	A spectrum analyzer with an integrated 99% power bandwidth function is used
Note 2:	OBW= 1.016 MHz



Occupied bandwidth: 1016 KHz

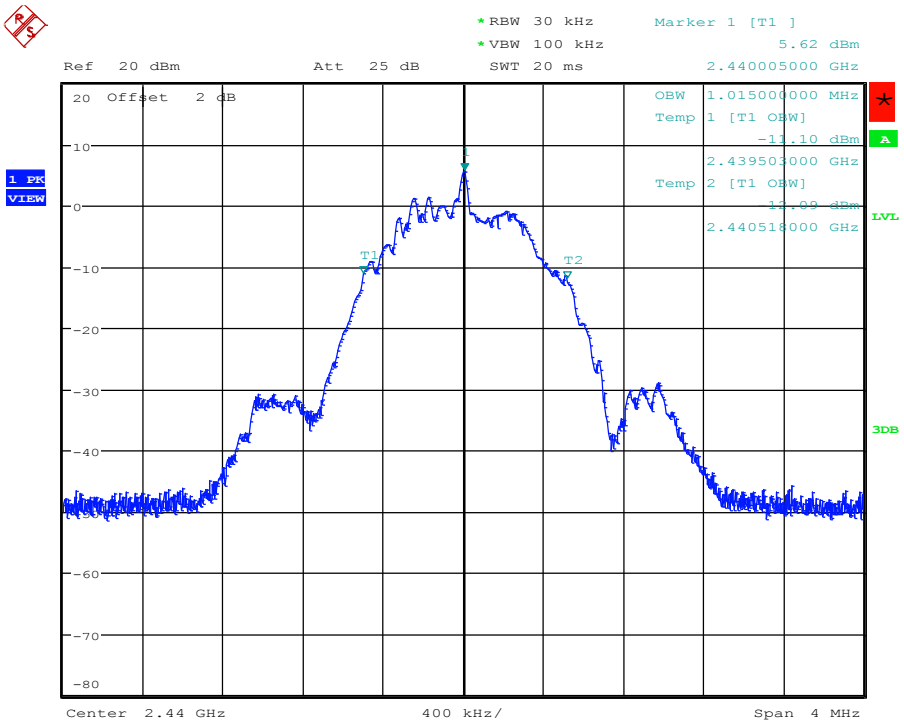
Date: 27.JUL.2015 08:50:49

Occupied Bandwidth – F_{MID}

Occupied Bandwidth acc. to RSS-Gen

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:	Wilfried Treffke
Test Conditions:	Tnom / Vnom
Mode:	Tx, BT-LE, 2440 MHz
Test Date:	2015-07-27
Verdict:	NONE (INFORMATION ONLY)
Note 1:	A spectrum analyzer with an integrated 99% power bandwidth function is used
Note 2:	OBW= 1.015 MHz



Occupied bandwidth: 1015 KHz

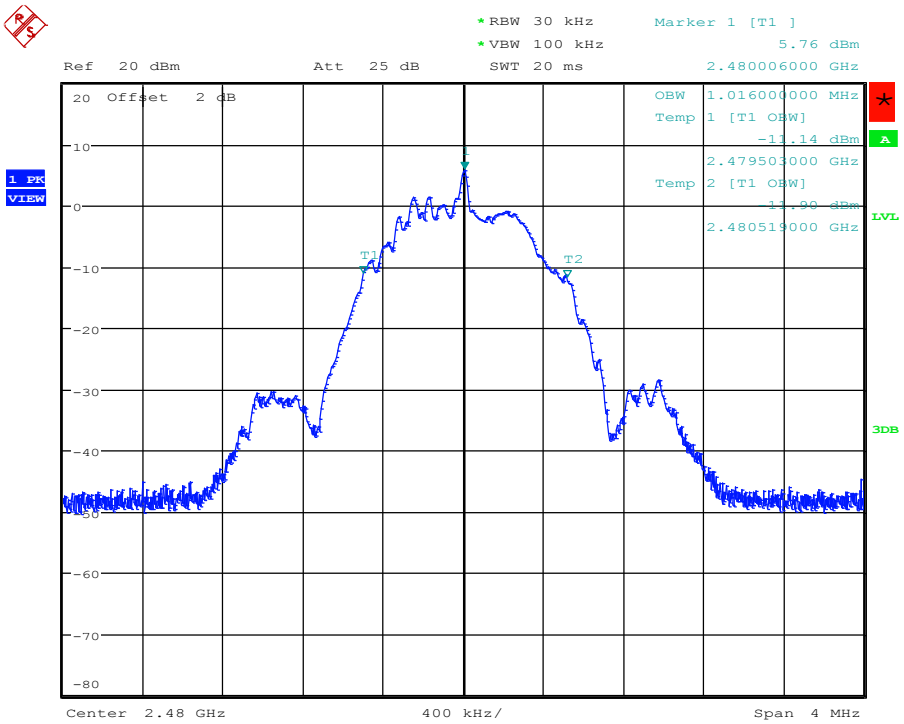
Date: 27.JUL.2015 08:59:04

Occupied Bandwidth – F_{HIGH}

Occupied Bandwidth acc. to RSS-Gen

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:	Wilfried Treffke
Test Conditions:	Tnom / Vnom
Mode:	Tx, BT-LE, 2480 MHz
Test Date:	2015-07-27
Verdict:	NONE (INFORMATION ONLY)
Note 1:	A spectrum analyzer with an integrated 99% power bandwidth function is used
Note 2:	OBW= 1.016 MHz



Occupied bandwidth: 1016 KHz

Date: 27.JUL.2015 09:04:35

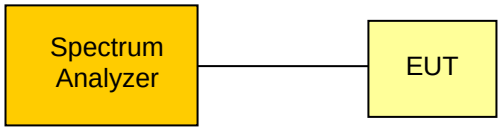
3.2 Test Conditions and Results – 6 dB Bandwidth

6dB Bandwidth acc. to FCC 15.247 / IC RSS-247	**Verdict: PASS**
EUT requirement rule parts and clause	Reference
	FCC 15.247(a)(2) / IC RSS-247 5.2
Test according to measurement reference	Reference Method
	ANSI C63.10
Test frequency range	Tested frequencies
	F_{LOW} / F_{MID} / F_{HIGH}

Limits

Limit
≥ 500kHz

Test setup



Test procedure

1. EUT set to test mode
2. Span set to at least twice the emission spectrum
3. Detector set to peak and max hold and RBW is set to 100 kHz
4. Envelope peak value of emission spectrum is selected
5. Marker on envelope of spectrum is set to level of -6 dB to the left of the peak
6. Marker on envelope of spectrum is set to level of -6 dB to the right of the peak
7. 6 dB Bandwidth is determined by marker frequency separation

Test results

Channel	Frequency [MHz]	Mode	6 dB Bandwidth [kHz]	Limit [kHz]	Result
F_{LOW}	2402	Transmit	687.2	500	PASS
F_{MID}	2442	Transmit	672.8	500	PASS
F_{HIGH}	2480	Transmit	682.5	500	PASS

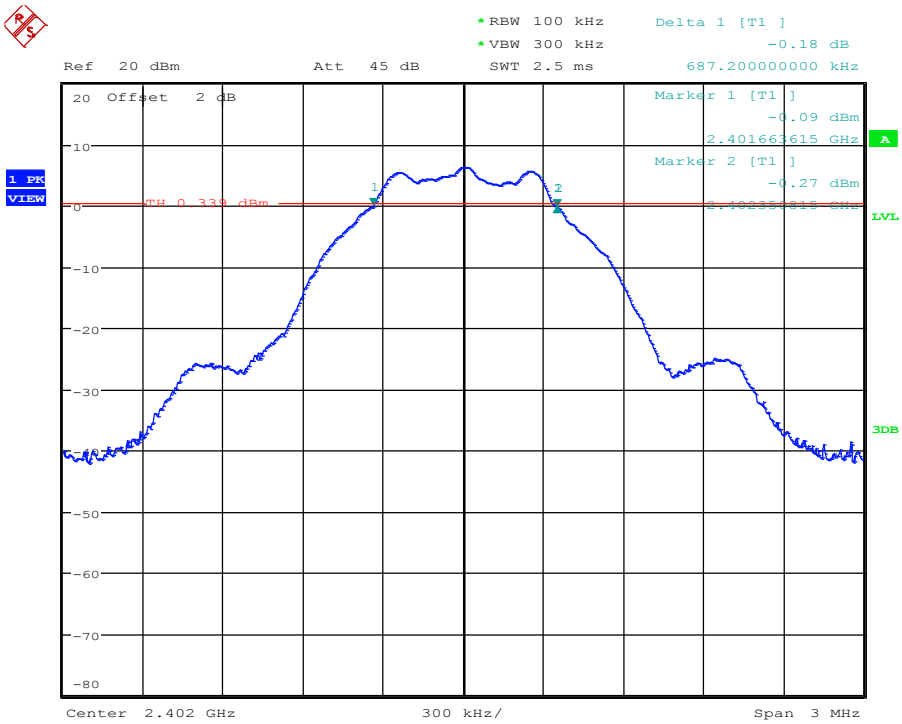
Comments:

6 dB Bandwidth – F_{LOW}

Minimum 6 dB Bandwidth acc. to FCC 15.247

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:	Wilfried Treffke
Test Conditions:	Tnom / Vnom
Mode:	Tx, BLE, 2402 MHz
Test Date:	2015-07-27
Verdict:	PASS
Note 1:	Procedure according to ANSI C63.10
Note 2:	Minimum 6 dB Bandwidth conducted



6 dB bandwidth: 687.2 KHz > 500 KHz

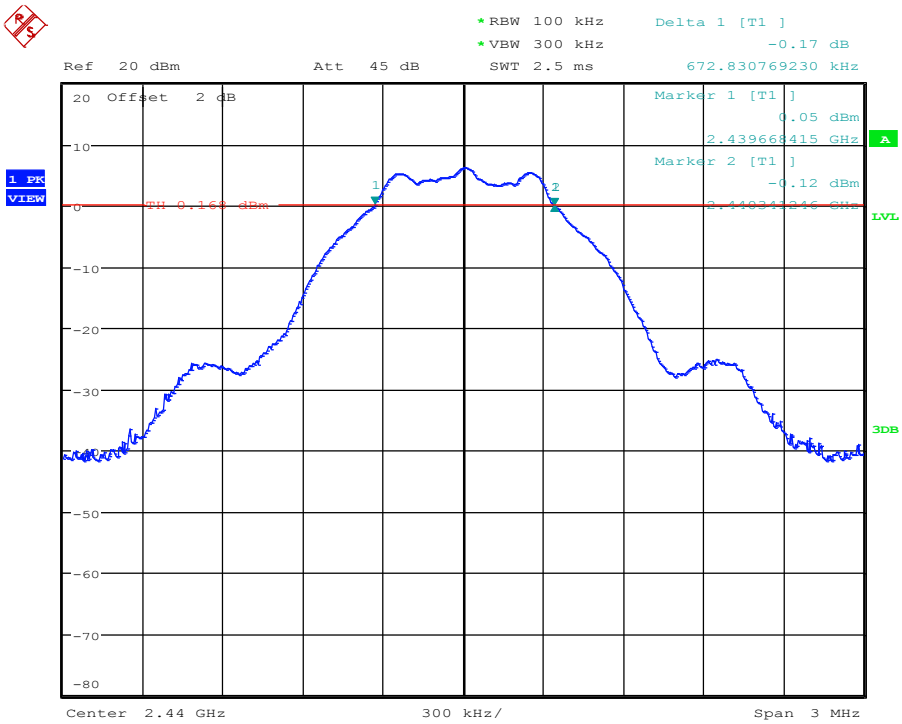
Date: 27.JUL.2015 09:22:54

6 dB Bandwidth – F_{MID}

Minimum 6 dB Bandwidth acc. to FCC 15.247

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:	Wilfried Treffke
Test Conditions:	Tnom / Vnom
Mode:	Tx, BLE, 2440 MHz
Test Date:	2015-07-27
Verdict:	PASS
Note 1:	Procedure according to ANSI C63.10
Note 2:	Minimum 6 dB Bandwidth conducted



6 dB bandwidth: 672.8 KHz > 500 KHz

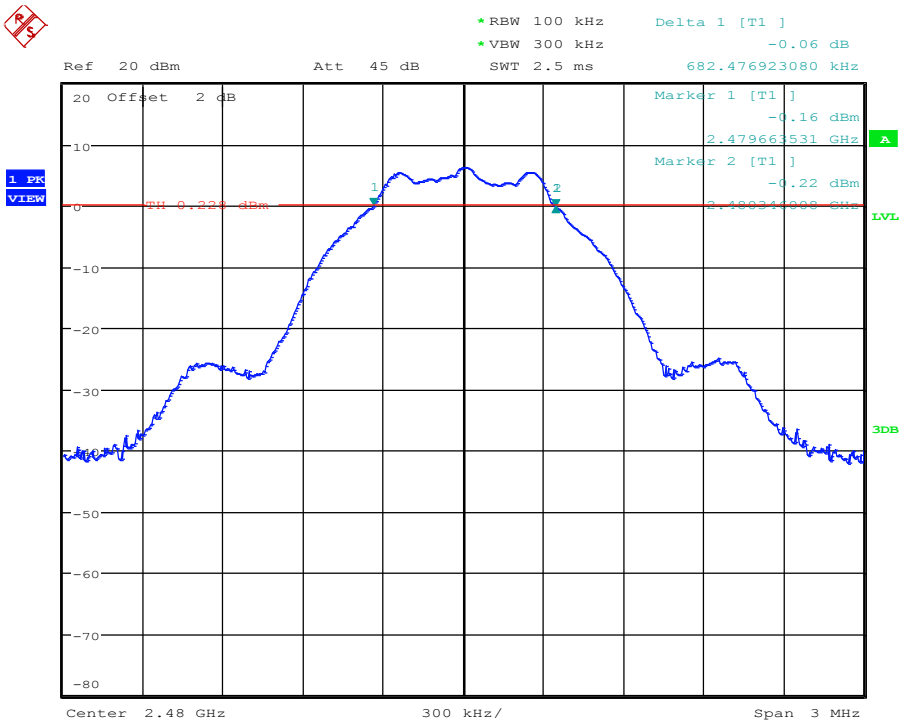
Date: 27.JUL.2015 09:19:58

6 dB Bandwidth – F_{HIGH}

Minimum 6 dB Bandwidth acc. to FCC 15.247

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:	Wilfried Treffke
Test Conditions:	Tnom / Vnom
Mode:	Tx, BLE, 2480 MHz
Test Date:	2015-07-27
Verdict:	PASS
Note 1:	Procedure according to ANSI C63.10
Note 2:	Minimum 6 dB Bandwidth conducted



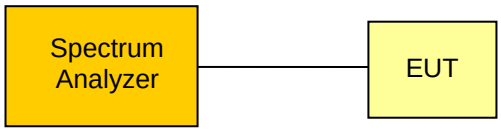
6 dB bandwidth: 682.5 KHz > 500 KHz

Date: 27.JUL.2015 09:17:18

3.3 Test Conditions and Results – Maximum peak conducted power

Maximum peak conducted power acc. to FCC 15.247 / IC RSS-247	**Verdict: PASS**
EUT requirement rule parts and clause	Reference
	FCC 15.247(b)(3) / IC RSS-247 5.4
Test according to measurement reference	Reference Method
	ANSI C63.10
Test frequency range	Tested frequencies
	F_{LOW} / F_{MID} / F_{HIGH}
Measurement mode	Peak
Maximum antenna gain	1.7 dBi ⇒ Limit correction = 0 dB

Limits
1 W (30 dBm)
The conducted output power limit specified above is based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in the table, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Test setup


Test procedure
1. EUT set to test mode (Communication tester is used if needed) 2. Center frequency set to test channel center frequency 3. Span set to twice the 20 dB bandwidth and detector to peak and max hold 4. Resolution bandwidth is set to 3 MHz 5. Peak conducted power is determined from peak of spectrum envelope

Test results							
Channel	Frequency [MHz]	Voltage	Mode	Peak power [dbm]	Peak power [W]	Limit [dBm]	Margin [dB]
F_{LOW}	2402	V_{nom} = 24VDC	Transmit	6.84	0.0048	30	-23.16
F_{MID}	2442	V_{nom} = 24VDC	Transmit	6.75	0.0047	30	-23.25
F_{HIGH}	2480	V_{nom} = 24VDC	Transmit	6.82	0.0048	30	-23.18
Comment:							

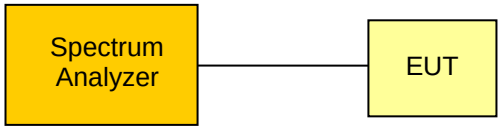
3.4 Test Conditions and Results – Power spectral density

Power spectral density acc. to FCC 15.247 / IC RSS-247	**Verdict: PASS**
EUT requirement rule parts and clause	Reference
	FCC 15.247(e) / IC RSS-247 5.2
Test according to measurement reference	Reference Method
	ANSI C63.10
Test frequency range	Tested frequencies
	F_{LOW} / F_{MID} / F_{HIGH}
Measurement mode	Peak

Limits

8 dBm / 3 kHz

Test setup



Test procedure

1. EUT set to test mode (Communication tester is used if needed)
2. Center frequency set to test channel center frequency
3. Span is set large enough to capture maximum emissions in passband, RBW is set to 3kHz
4. Peak power density is determined from peak emission of envelope

Test results

Channel	Frequency [MHz]	Test mode	Peak frequency [MHz]	Peak power density [dBm/kHz]	Limit [dBm/3kHz]	Margin [dB]
F_{LOW}	2402	Transmit	2402.005	6.38	8.0	-01.62
F_{MID}	2442	Transmit	2440.005	6.19	8.0	-01.81
F_{HIGH}	2480	Transmit	2480.005	6.26	8.0	-01.74

Comments:

3.5 Test Conditions and Results – AC power line conducted emissions

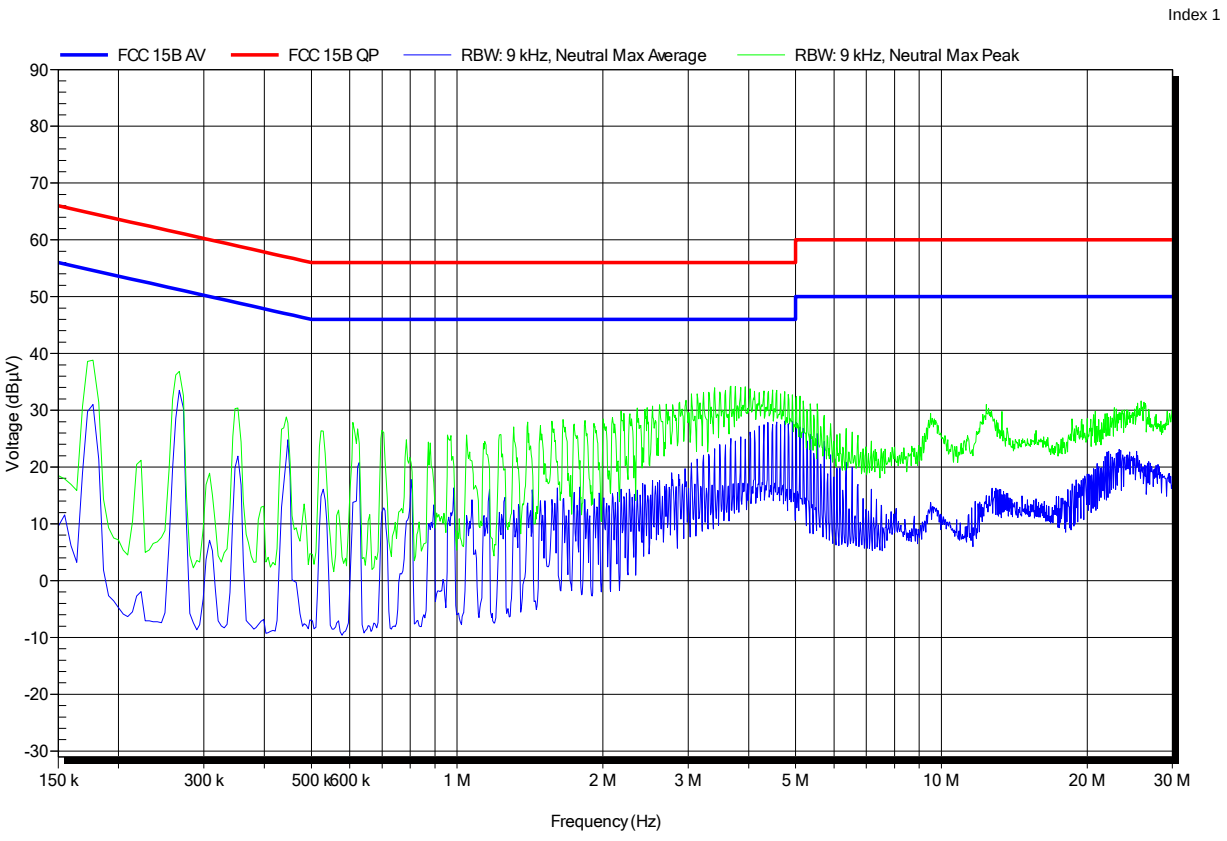
Power line conducted emissions acc. to FCC 47 CFR 15.207 / IC RSS-Gen				**Verdict: PASS**
Test according referenced standards	Reference Method			
	ANSI C63.4			
Fully configured sample scanned over the following frequency range	Frequency range			
	0.15 MHz to 30 MHz			
Points of Application	Application Interface			
AC Mains	LISN			
EUT test mode	AC power line			
Limits and results				
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.				

Conducted Emissions 1

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: 24VDC
LISN:	ESH2-Z5 N
Mode:	1
Test Date:	2015-10-02
Note:	

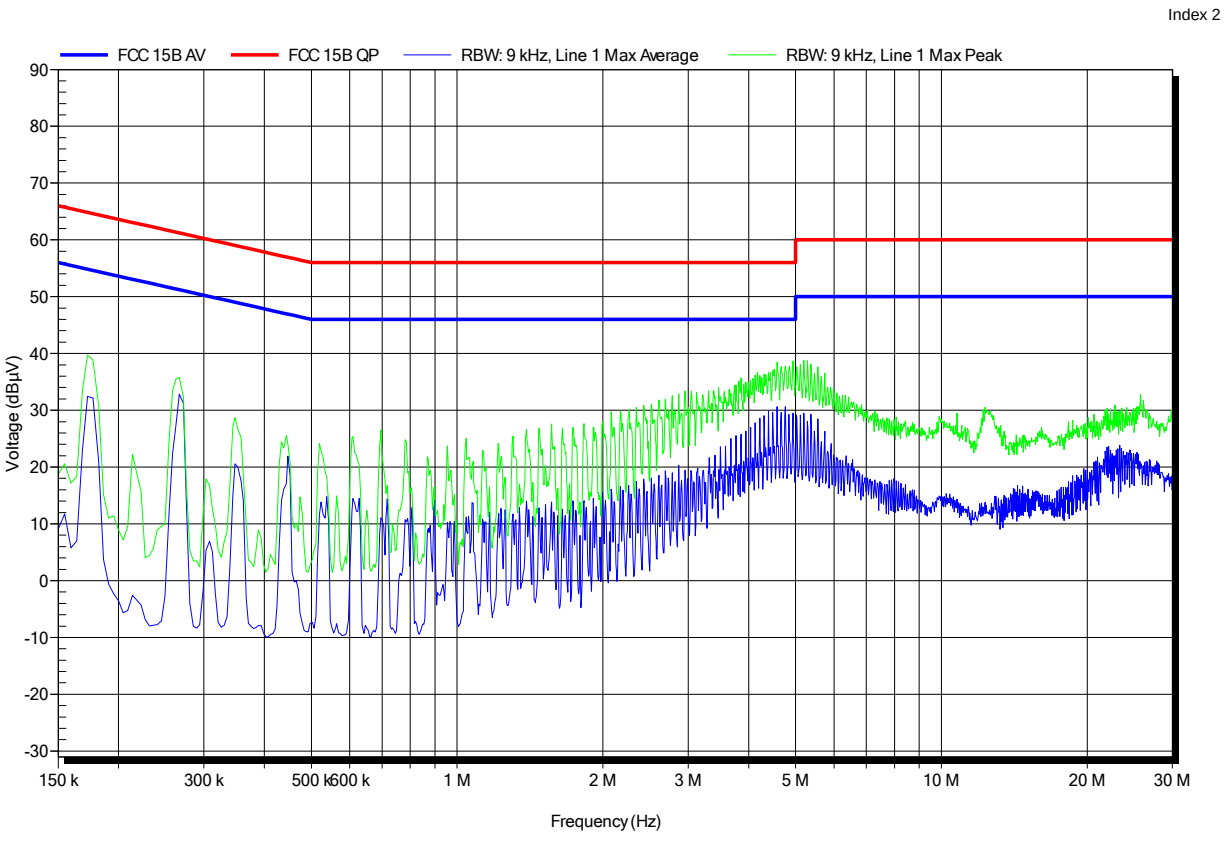


Conducted Emissions 2

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: 24VDC
LISN:	ESH2-Z5 L
Mode:	1
Test Date:	2015-10-02
Note:	



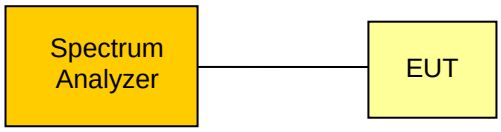
3.6 Test Conditions and Results – Band edge compliance

Band-edge compliance acc. to FCC 15.247 / IC RSS-247	**Verdict: PASS**
EUT requirement rule parts and clause	Reference
	FCC 15.247(d) / IC RSS-247 5.5
Test according to measurement reference	Reference Method
	ANSI C63.10
Test frequency range	Tested frequencies
	F_{LOW} / F_{HIGH}
Measurement mode	Peak

Limits

Limit	Condition
≤ -20 dB / 100 kHz	Peak power measurement detector = Peak
≤ -30 dB / 100 kHz	Peak power measurement detector = RMS

Test setup



Test procedure

1. EUT set to test mode (Communication tester is used if needed)
2. Span set around lower band edge and detector is set to peak and max hold
3. Resolution bandwidth is set to 100 kHz
4. Markers are set to peak emission levels within frequency band and outside frequency band
5. Band edge attenuation is determined from level difference

Test results

Channel	Frequency [MHz]	Mode	Level [dBc]	Limit [dBc]	Margin [dB]
F_{LOW}	2402	Transmit	-47.8	-20	-27.80
F_{HIGH}	2480	Transmit	-47.3	-20	-27.30

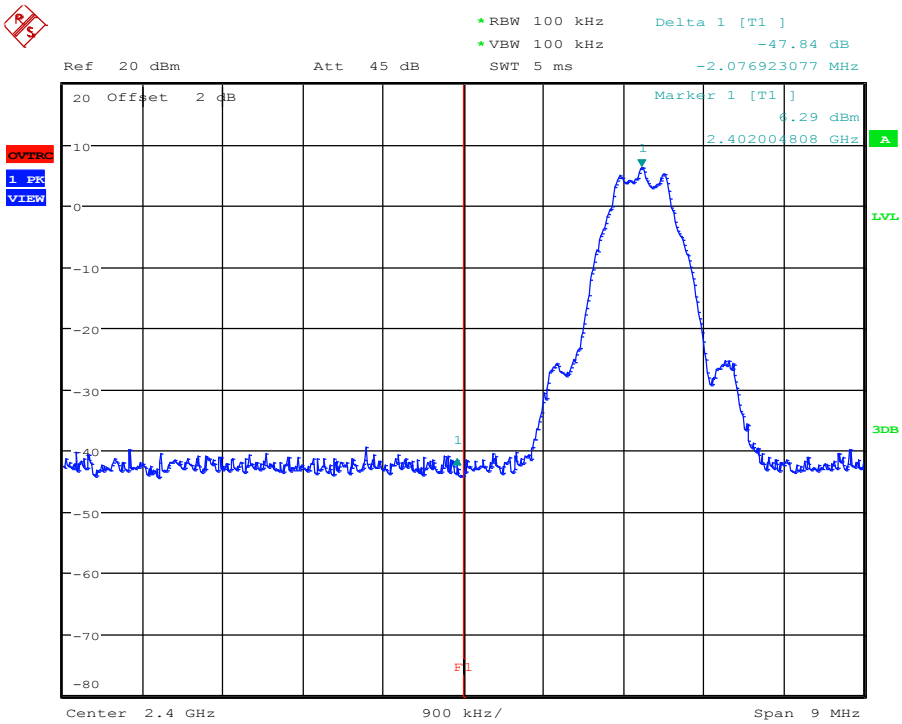
Comments:

Band-edge compliance – F_{LOW}

Band-edge compliance acc. to FCC 15.247

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:	Wilfried Treffke
Test Conditions:	Tnom / Vnom
Mode:	Tx, BLE, 2402 MHz, modulated
Test Date:	2015-07-27
Verdict:	PASS
Note 1:	Reference Method according to ANSI C63.10
Note 2:	lower Band-edge, conducted measurement



Limit: Marker Delta value >20 dB

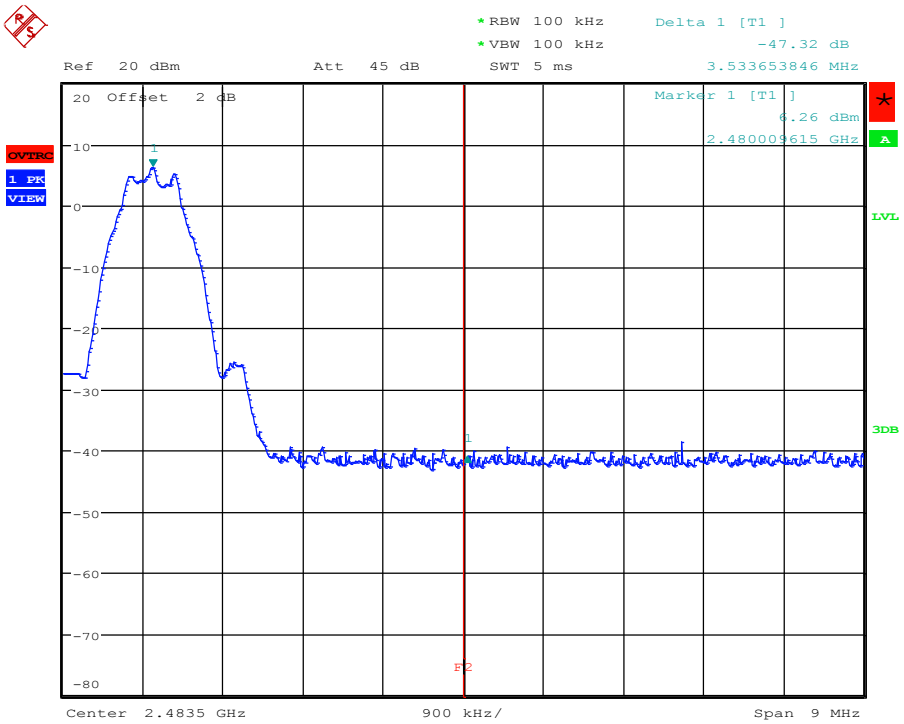
Date: 27.JUL.2015 10:06:33

Band-edge compliance – F_{HIGH}

Band-edge compliance acc. to FCC 15.247

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:	Wilfried Treffke
Test Conditions:	Tnom / Vnom
Mode:	Tx, BLE, 2480 MHz, modulated
Test Date:	2015-07-27
Verdict:	PASS
Note 1:	Reference Method according to ANSI C63.10
Note 2:	Upper Band-edge, conducted measurement



Limit: Marker Delta value >20 dB

Date: 27.JUL.2015 10:18:41

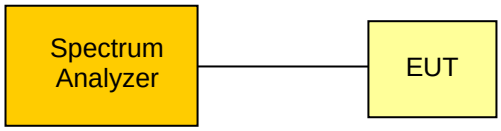
3.7 Test Conditions and Results – Conducted spurious emissions

Conducted spurious emissions acc. to FCC 15.247 / IC RSS-247	**Verdict: PASS**
EUT requirement rule parts and clause	Reference
	FCC 15.247(d) / IC RSS-247 5.5
Test according to measurement reference	Reference Method
	ANSI C63.10
Test frequency range	Tested frequencies
	10 MHz – 10th Harmonic
Measurement mode	Peak

Limits

Limit	Condition
≤ -20 dB / 100 kHz	Peak power measurement detector = Peak
≤ -30 dB /100 kHz	Peak power measurement detector = RMS

Test setup



Test procedure

1. EUT set to test mode (Communication tester is used if needed)
2. Span it set according to measurement range
3. Resolution bandwidth is set to 100 kHz and detector to peak and max hold
4. Markers are set to peak emission levels within frequency band
5. Emission level is determined by second marker on emission peak
6. Attenuation is determined from level difference

Test results

Channel	Frequency [MHz]	Mode	Emission [MHz]	Emission Level [dbm]	Peak power [dBm]	Limit [dBm]	Margin [dB]
F_{LOW}	2402	Transmit	4804.27	-52.7	5.1	-14.9	-37.80
F_{MID}	2440	Transmit	4880.28	-51.1	4.50	-15.5	-35.60
F_{HIGH}	2480	Transmit	4959.79	-48.7	6.1	-13.8	-34.90

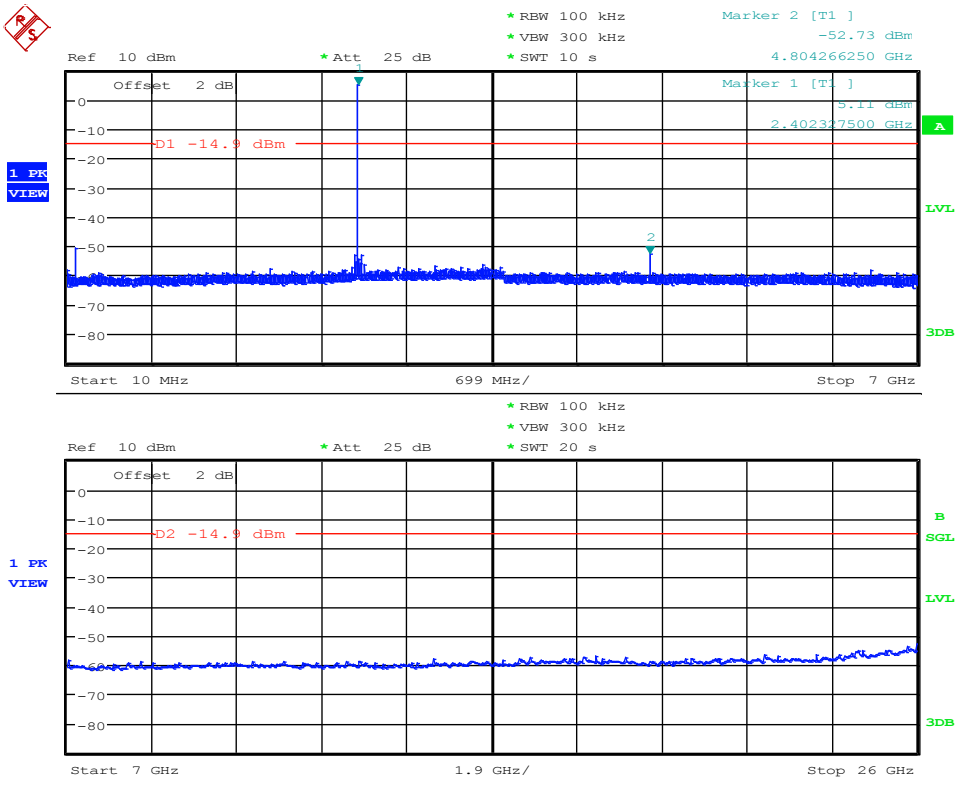
Comments:

Conducted spurious emissions – F_{LOW}

Spurious Emissions acc. to FCC 15.247

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:	Wilfried Treffke
Test Conditions:	Tnom / Vnom
Mode:	Tx, BLE, 2402 MHz, modulated
Test Date:	2015-07-27
Verdict:	PASS
Note 1:	Spurious in non-restricted frequency bands (ANSI C63.10)
Note 2:	conducted measurement



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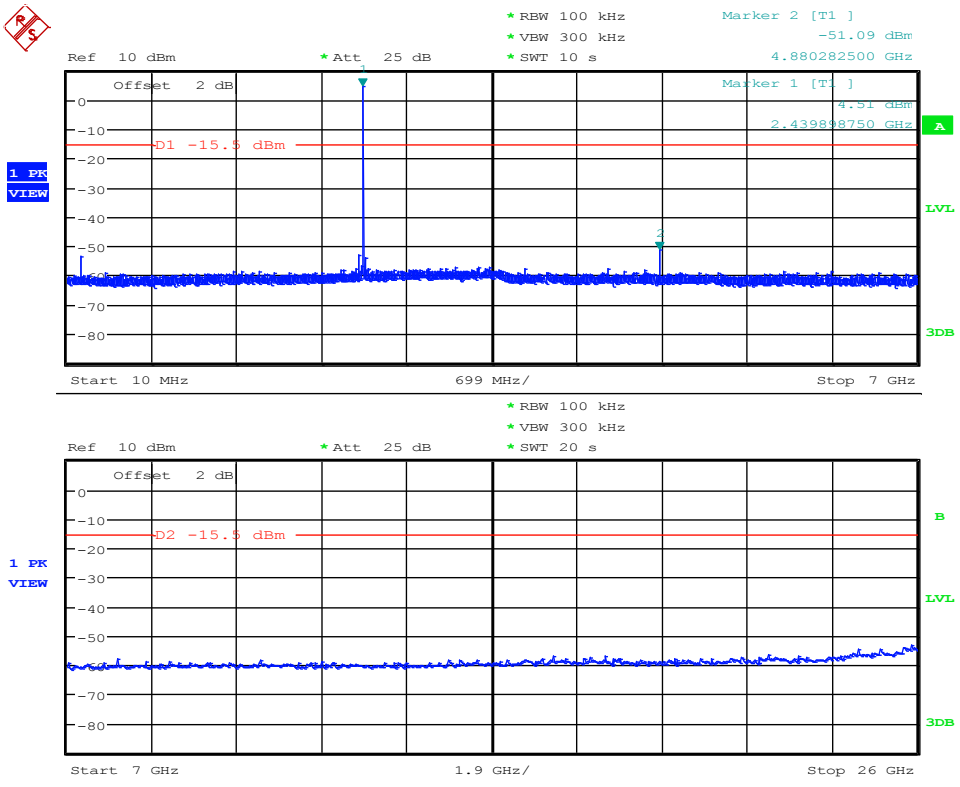
Conducted spurious emissions – F_{MID}

Spurious Emissions acc. to FCC 15.247

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:	Wilfried Treffke
Test Conditions:	Tnom / Vnom
Mode:	Tx, BLE, 2440 MHz, modulated
Test Date:	2015-07-27
Verdict:	PASS
Note 1:	Spurious in non-restricted frequency bands (ANSI C63.10)
Note 2:	conducted measurement



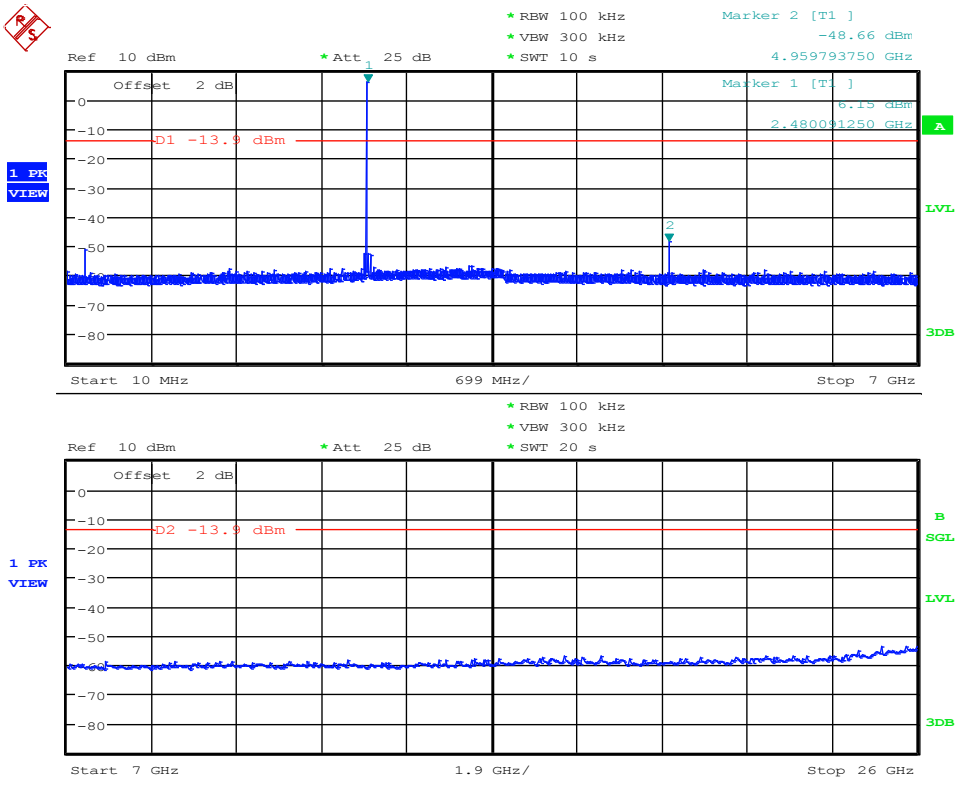
Date: 27.JUL.2015 10:48:09

Conducted spurious emissions – F_{HIGH}

Spurious Emissions acc. to FCC 15.247

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:	Wilfried Treffke
Test Conditions:	Tnom / Vnom
Mode:	Tx, BLE, 2480 MHz, modulated
Test Date:	2015-07-27
Verdict:	PASS
Note 1:	Spurious in non-restricted frequency bands (ANSI C63.10)
Note 2:	conducted measurement



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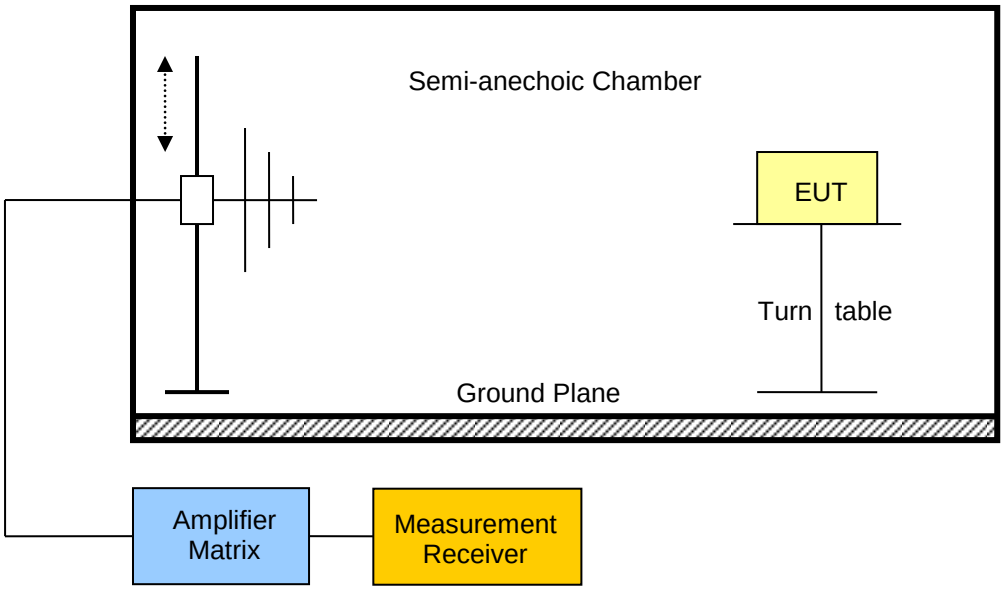
3.8 Test Conditions and Results – Transmitter radiated emissions

Transmitter radiated emissions acc. to FCC 47 CFR 15.247 / IC RSS-247				**Verdict: PASS**
Test according referenced standards	Reference Method			
	FCC 15.247(d) / IC RSS-247 5.5			
Test according to measurement reference	Reference Method			
	ANSI C63.10			
Test frequency range	Tested frequencies			
	30 MHz – 10th Harmonic			
Limits				
Frequency range [MHz]	Detector	Limit [µV/m]	Limit [dBµV/m]	Limit Distance [m]
30 – 88	Quasi-Peak	100	40	3
88 – 216	Quasi-Peak	150	43.5	3
216 – 960	Quasi-Peak	200	46	3
960 – 1000	Quasi-Peak	500	54	3
> 1000	Average	500	54	3
Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)). When average radiated emission measurements are specified, including average emission measurements below 1000 MHz, there also is a limit on the peak level of the radio frequency emissions. The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.				
Test setup				



Test procedure
1. EUT set to test mode (Communication tester is used if needed) 2. Span it set according to measurement range 3. Resolution bandwidth below 1 GHz is set according to CISPR 16 with peak/quasi-peak detector and RBW of 1 MHz with peak/average detector is used above 1 GHz 4. Markers are set to peak emission levels within restricted bands

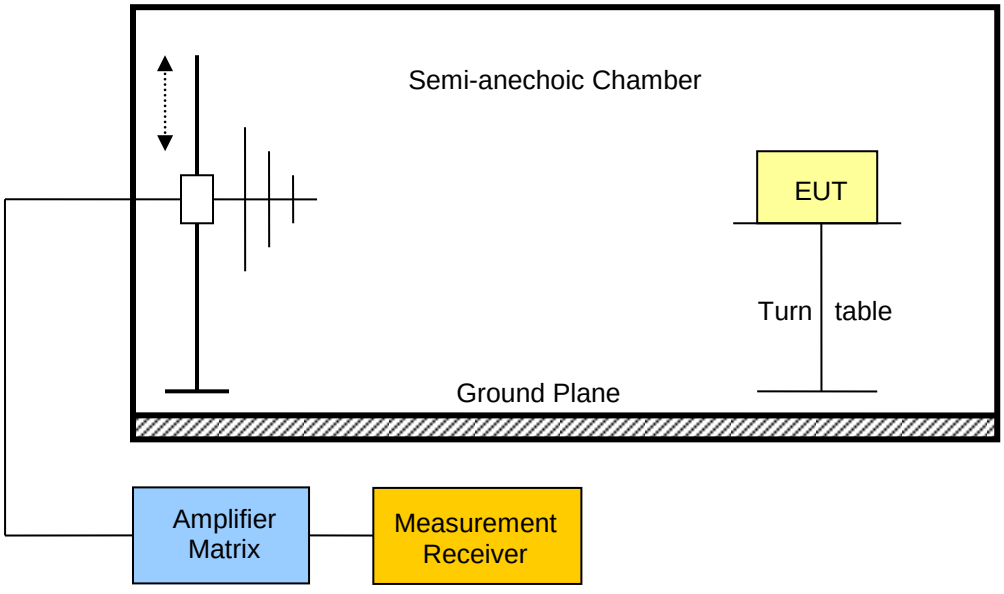
Test results

Channel	Frequency [MHz]	Mode	Emission [MHz]	Level [dbµV/m]	Det.	Pol.	Limit [dbµV/m]	Margin [dB]
F_{LOW}	2402	Transmit	2377	55.98	pk	hor	74.00	-18.02
F_{LOW}	2402	Transmit	2377	37.81	RMS	hor	54.00	-16.19
F_{LOW}	2402	Transmit	2377	53.23	pk	ver	74.00	-20.77
F_{LOW}	2402	Transmit	2377	36.89	RMS	ver	54.00	-17.11
F_{MID}	2442	Transmit	7319	56.56	pk	hor	74.00	-17.44
F_{MID}	2442	Transmit	7319	51.33	avg	hor	54.00	-02.67
F_{HIGH}	2480	Transmit	2483.5	57.36	pk	hor	74.00	-16.64
F_{HIGH}	2480	Transmit	2483.5	48.12	RMS	hor	54.00	-05.88
F_{HIGH}	2480	Transmit	2483.5	54.58	pk	ver	74.00	-19.42
F_{HIGH}	2480	Transmit	2483.5	45.24	RMS	ver	54.00	-08.76
F_{HIGH}	2480	Transmit	2503	54.75	pk	hor	95.00	-40.25
F_{HIGH}	2480	Transmit	7439	55.21	pk	hor	74.00	-18.79
F_{HIGH}	2480	Transmit	7439	49.64	avg	hor	54.00	-04.36

Comments:

3.9 Test Conditions and Results – Receiver radiated emissions

Receiver radiated emissions acc. to IC RSS-247				**Verdict: PASS**
Test according referenced standards	Reference Method			
	IC RSS-247 3.1			
Test according to measurement reference	Reference Method			
	ANSI C63.10			
Test frequency range	Tested frequencies			
	30 MHz – 5th Harmonic			
EUT test mode	Receive			
Limits				
Frequency range [MHz]	Detector	Limit [µV/m]	Limit [dBµV/m]	Limit Distance [m]
30 – 88	Quasi-Peak	100	40	3
88 – 216	Quasi-Peak	150	43.5	3
216 – 960	Quasi-Peak	200	46	3
960 – 1000	Quasi-Peak	500	54	3
> 1000	Average	500	54	3
Test setup				



Test procedure
1. EUT set to receive mode (Communication tester is used if needed) 2. Span it set according to measurement range 3. Resolution bandwidth below 1 GHz is set according to CISPR 16 with peak/quasi-peak detector and RBW of 1 MHz with peak/average detector is used above 1 GHz 4. Markers are set to peak emission levels

Test results

Channel	Frequency [MHz]	Emission [MHz]	Emission Level [dbµV/m]	Pol.	Det.	Limit [dBµV/m]	Margin [dB]
scan mode	2402 - 2480	430.4	23.11	ver	pk	46.00	-22.89
scan mode	2402 - 2480	883.2	25.78	ver	pk	46.00	-20.22
scan mode	2402 - 2480	3892	39.90	ver	pk	53.98	-14.08
scan mode	2402 - 2480	7560	48.36	hor	pk	53.98	-5.62
scan mode	2402 - 2480	7944	49.04	ver	pk	53.98	-4.94
scan mode	2402 - 2480	12365	42.75	hor	pk	53.98	-11.23

Comments: