



Accredited testing-laboratory

DAR registration number: DAT-P-176/94-D1

**Federal Motor Transport Authority (KBA)
DAR registration number: KBA-P 00070-97**

Recognized by the Federal Communications Commission

Anechoic chamber registration no.: 90462 (FCC)

Anechoic chamber registration no.: 3463A-1 (IC)

Certification ID: DE 0001

Accreditation ID: DE 0002

Accredited Bluetooth® Test Facility (BQTF)

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Test report no. : 1-0931-01-03/08
Type identification : WIOP208
Applicant : ABB Stotz-Kontakt GmbH
FCC ID : R4T-WISARF02
IC Certification No : 5082A-WISARF02
Test standards : 47 CFR Part 15
RSS – 210 Issue 7

Table of contents

1	General information.....	3
1.1	Notes	3
1.2	Testing laboratory	4
1.3	Details of applicant	4
1.4	Application details	4
2	Test standard/s:.....	5
3	Technical tests	6
3.1	Details of manufacturer.....	6
3.1.1	Test item.....	6
3.1.2	Additional EUT information For IC Canada (appendix 2).....	7
3.1.3	RF Technical Brief Cover Sheet acc. To RSS-102	8
3.1.4	EUT operating modes.....	9
3.1.5	Extreme conditions testing values.....	9
4	Summary of Measurement Results and list of all performed test cases	10
5	RF measurement testing	11
5.1	Description of test set-up.....	11
5.1.1	Radiated measurements.....	11
5.1.2	Conducted measurements.....	11
5.2	Referenced documents	12
5.3	Additional comments	12
5.4	Antenna gain	12
5.5	Carrier frequency separation §15.247(a)(1)	13
5.6	Number of hopping channels §15.247(a)(1)	14
5.7	Time of occupancy (dwell time) §15.247(a)(1)(iii).....	15
5.8	Power Spectral density (Hybrid system in Inquiry mode/Page scan) §15.247(e)	16
5.9	Spectrum Bandwidth of a FHSS System / 20dB Bandwidth §15.247(a)(1).....	17
5.10	Maximum output power (conducted) § 15.247 (b)(1).....	19
5.11	Max. peak output power (radiated) § 15.247 (b)(1)	21
5.12	Band-edge compliance of conducted emissions §15.247 (d)	22
5.13	Band-edge compliance of radiated emissions §15.205	24
5.14	Spurious Emissions - conducted (Transmitter) § 15.247 (c)(1)	28
5.15	Spurious Emissions > 30 MHz- radiated (Transmitter) § 15.247 (c)(1).....	30
5.16	Spurious Emissions - radiated (Receiver) § 15.109	39
5.17	Spurious Emissions < 30 MHz - Transmitter radiated § 15.209	43
5.18	Conducted Emissions <30 MHz § 15.107/207.....	44
6	Test equipment and ancillaries used for tests.....	47
7	Photographs of the Test Set-up.....	50
8	Photographs of the EUT	52

1 General information

1.1 Notes

The test results of this test report relate exclusively to the test item specified in 3.1.1. The CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalisations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of the CETECOM ICT Services GmbH.

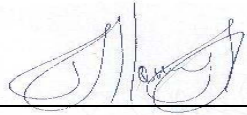
Test laboratory manager:

2008-12-04 **Daniel Muyunga**

Date

Name

Signature



2008-12-04 **Jakob Reschke**

Date

Name

Signature



Technical responsibility for area of testing:

2008-12-04 **Stefan Bös**

Date

Name

Signature



1.2 Testing laboratory

CETECOM ICT Services GmbH

Untertürkheimer Straße 6 - 10

66117 Saarbrücken

Germany

Phone: + 49 681 5 98 - 0

Fax: + 49 681 5 98 - 9075

e-mail: info@ICT.cetecom.de

Internet: <http://www.cetecom-ict.de>

State of accreditation: The test laboratory (area of testing) is accredited according to
DIN EN ISO/IEC 17025
DAR registration number: DAT-P-176/94-D1

Accredited by: Federal Motor Transport Authority (KBA)
DAR registration number: KBA-P 00070-97

Testing location, if different from CETECOM ICT Services GmbH:

Name :
Street :
Town :
Country :
Phone :
Fax :

1.3 Details of applicant

Name:	ABB Stotz-Kontakt GmbH
Street:	Eppelheimer Str. 82
Town:	69123 Heidelberg
Country:	Germany
Telephone:	
Fax:	+49 (0) 6221 701-1344
Contact:	Herr Roland Wiebe
E-mail:	roland.wiebe@de.abb.com
Telephone:	+49 (0) 6221 701-1430

1.4 Application details

Date of receipt of order:	2008-11-19
Date of receipt of test item:	2008-12-03
Date of start test:	2008-12-03
Date of end test	2008-12-04
Persons(s) who have been present during the test:	Ralph Schelling, Dipl.-Ing. (FH) Hardware und Software-Entwicklung ABB STOTZ-KONTAKT GmbH

2 Test standard/s:

47 CFR Part 15	2008-07	Title 47 of the Code of Federal Regulations; Chapter I- Federal Communications Commission subchapter A - general, Part 15-Radio frequency devices
RSS - 210 Issue 7	2007-06	Spectrum Management and Telecommunications - Radio Standards Specification Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment

3 Technical tests

3.1 Details of manufacturer

Name:	ABB Stotz-Kontakt GmbH
Street:	Eppelheimer Str. 82
Town:	69123 Heidelberg
Country:	Germany

3.1.1 Test item

Kind of test item	:	FHSS System
Type identification	:	WIOP208
S/N serial number	:	-/-
HW hardware status	:	1SAF975120P0002
SW software status	:	081002_CCU2_M8 (IMA [I am alive] Interval 50ms / 10 ms)
Frequency Band [MHz]	:	ISM 2.400 - 2.483,5
Type of Modulation	:	FHSS
Number of channels	:	77
Antenna	:	Integrated antenna
Power Supply	:	24 V DC
Temperature Range	:	-20 °C to +55 °C

Max. power radiated: -1.07 dBm

Max. power conducted: 2.47 dBm

FCC ID: **R4T-WISARF02**

IC: **5082A-WISARF02**

3.1.2 Additional EUT information For IC Canada (appendix 2)

IC Registration Number:	5082A-WISARF02
Model Name:	WIOP208
Manufacturer (complete Address):	ABB Stotz-Kontakt GmbH Eppelheimer Str. 82 69123 Heidelberg Germany
Tested to Radio Standards Specification (RSS) No.:	RSS-210 Issue 7
Open Area Test Site Industry Canada Number:	IC 3463A-1
Frequency Range (or fixed frequency) [MHz]:	2403 – 2479 MHz
RF: Power [W] (max):	Rad. EIRP: 0.78 mW Conducted : 1.35 mW
Antenna Type:	Integrated antenna
Field Strength [dB μ V/m in 3m]:	91.70
Occupied Bandwidth (99% BW) [kHz]:	1062
Type of Modulation:	GFSK
Emission Designator (TRC-43):	1M06FXD
Transmitter Spurious (worst case) [dBm]:	-42.85
Receiver Spurious (worst case) [dB μ V/m in 10m]:	22.9

ATTESTATION:

I attest that the testing was performed or supervised by me; that the test measurements were made in accordance with the above-mentioned departmental standard(s), and that the radio equipment identified in this application has been subject to all applicable test conditions specified in the departmental standards and all of the requirements of the standards have been met.

Signature:



Test engineer: Daniel Muyunga

Date: 2008-12-05

3.1.3 RF Technical Brief Cover Sheet acc. To RSS-102

All Fields must be completed with the requested information or the following codes: N/A for Not Applicable, N/P for Not Performed or N/V for Not Available. Where applicable, check appropriate box.

1. COMPANY NUMBER: **5082A**
2. MODEL NUMBER: **WIOP208**
3. MANUFACTURER: **ABB Stotz-Kontakt GmbH**
4. TYPE OF EVALUATION: **(c) RF Evaluation**

- Evaluated against exposure limits: General Public Use ☒ Controlled Use ☐
 - Duty cycle used in evaluation: 100 %
 - Standard used for evaluation: RSS-102 Issue 2 (2005-11)
 - Measurement distance: 0.20 m
 - RF value: 0.0015 V/m ☐ A/m ☐ W/m² ☒
- Measured ☐ Computed ☐ Calculated ☒

Declaration of RF Exposure Compliance

ATTESTATION:

I attest that the information provided in this test report are correct; that a Technical Brief was prepared and the information it contains is correct; that the device evaluation was performed or supervised by me; that applicable measurement methods and evaluation methodologies have been followed and that the device meets the SAR and/or RF exposure limits of RSS-102.

Name: Daniel K. Muyunga
Title: Engineer
Company: Cetecom ICT Services GmbH

3.1.4 EUT operating modes

EUT operating mode no. *)	Description of operating modes	Additional information
Op. 0	Normal mode	Normal temperature and power source conditions
Op. 1		low temperature, low power source conditions
Op. 2		low temperature, high power source conditions
Op. 3		high temperature, low power source conditions
Op. 4		high temperature, high power source conditions

*) EUT operating mode no. is used to simplify the test plan

3.1.5 Extreme conditions testing values

Description	Shortcut	Unit	Value
Nominal Temperature	T _{nom}	°C	+23
Nominal Humidity	H _{nom}	%	43
Nominal Power Source	V _{nom}	V	24

Type of power source: **DC**

Deviations from these values are reported in chapter 2

4 Summary of Measurement Results and list of all performed test cases

- ☒ No deviations from the technical specifications were ascertained
☐ There were deviations from the technical specifications ascertained

TC identifier	Description	verdict	date	Remark
RF-Testing	FCC Part 15 §15.247 - CANADA RSS-210	Pass	2008-12-05	-/-

Test Specification Clause	Test Case	Pass	Fail	Not applicable	Not performed
None	Antenna Gain	Yes			
§15.247(a1)	Carrier frequency separation	Yes			
§15.247(a1)	Number of hopping channels	Yes			
§15.247(a)(1)(iii)	Time of occupancy (dwell time)	Yes			
§15.247(e)	Power Spectral density (Hybrid system in Inquiry mode/Page scan)			Yes	
§15.247(a)(1)	Spectrum Bandwidth of a FHSS System / 20dB Bandwidth	Yes			
§ 15.247 (b)(1)	Maximum output power (conducted)	Yes			
§ 15.247 (b)(1)	Max. peak output power (radiated)	Yes			
§ 15.247 (d)	Band-edge compliance of conducted emissions	Yes			
§ 15.205	Band-edge compliance of radiated emissions	Yes			
§ 15.247 (d)	Spurious Emission - conducted (Transmitter)	Yes			
§ 15.247 (d)	Spurious Emission - radiated (Transmitter) >30 MHz	Yes			
§ 15.109	Spurious Emissions - radiated (Receiver)	Yes			
§ 15.209	Spurious Emissions - radiated (Transmitter) < 30 MHz	Yes			
§ 15.107/207	Conducted Emissions <30 MHz	Yes			

5 RF measurement testing

5.1 Description of test set-up

5.1.1 Radiated measurements

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 25 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are confirmed with specifications ANSI C63.2-1996 clause 15 and ANSI C63.4-2003 clause 4.1.5. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analysers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63-4-2003 clause 4.2. Antennas are confirmed with ANSI C63.2-1996 item 15.

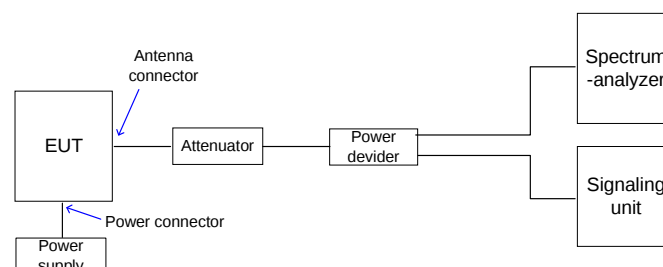
9 kHz - 150 kHz: Quasi Peak measurement, 200 Hz Bandwidth, passive loop antenna.
150 kHz - 30 MHz: Quasi Peak measurement, 9 kHz Bandwidth, passive loop antenna.
30 MHz - 200 MHz: Quasi Peak measurement, 120 kHz Bandwidth, bi-conical antenna
200MHz - 1GHz: Quasi Peak measurement, 120 kHz Bandwidth, log periodic antenna
>1GHz: Average, RBW 1MHz, VBW 10 Hz, waveguide horn

All measurements are done in accordance with the Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems DA 00-705 and Appendix A "BLUETOOTH APPROVALS"

The EUT is powered by an external power supply with nominal voltage. The signalling is performed from outside the chamber with a signalling unit (CMU200 or other) by air link using signalling antenna.

5.1.2 Conducted measurements

The EUT's RF signal is coupled out by the antenna connector which is supplied by the manufacturer. The signal is first 10dB attenuated before it is power divided (~6dB loss per branch). One of the signal paths is connected to the communication base Station (CMU200 or other), the other one is connected to the spectrum analyzer. The specific losses for both signal paths are first checked within a calibration. The measurement readings on the signalling unit/spectrum analyzer are corrected by the specific test set-up loss. The attenuator, power divider, signalling unit and the spectrum analyzer are impedance matched on 50 Ohm.



5.2 Referenced documents

None

5.3 Additional comments

None

5.4 Antenna gain

The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module.

	low channel 2403 MHz	mid channel 2440 MHz	high channel 2479 MHz
Conducted power [dBm] Measured, GFSK modulation	1.27	1.32	1.21
Radiated power [dBm] Measured, GFSK modulation	-1.74	-1.14	-1.07
Gain [dBi] Calculated	-3.01	-2.46	-2.28

5.5 Carrier frequency separation §15.247(a)(1)

Plot 1 of 1:



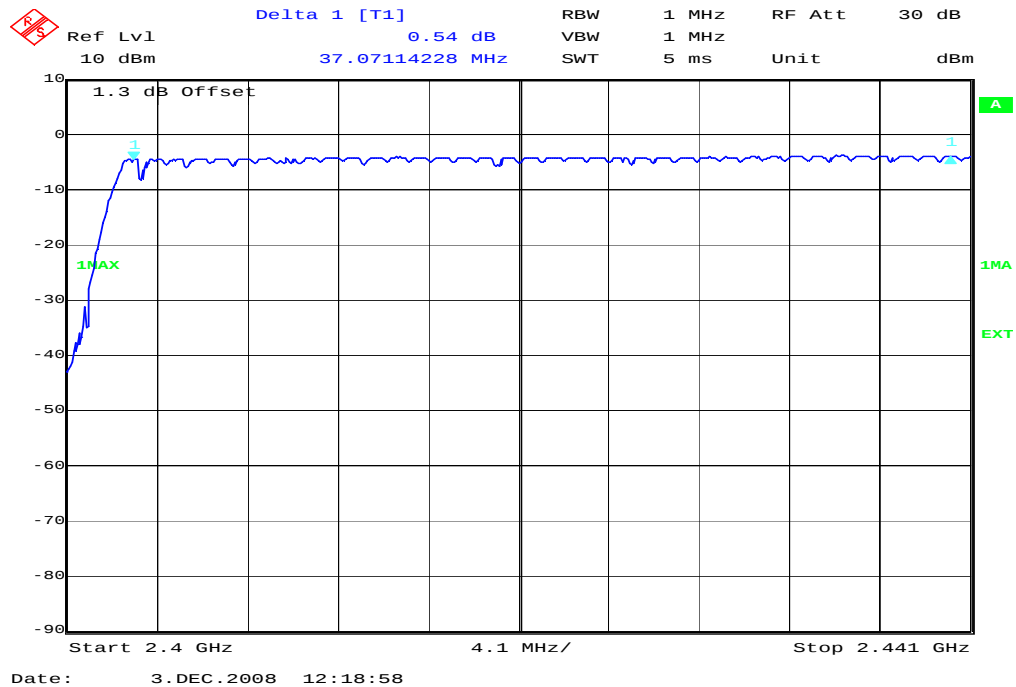
Result: Channel separation is: ~ 1 MHz

Limits:

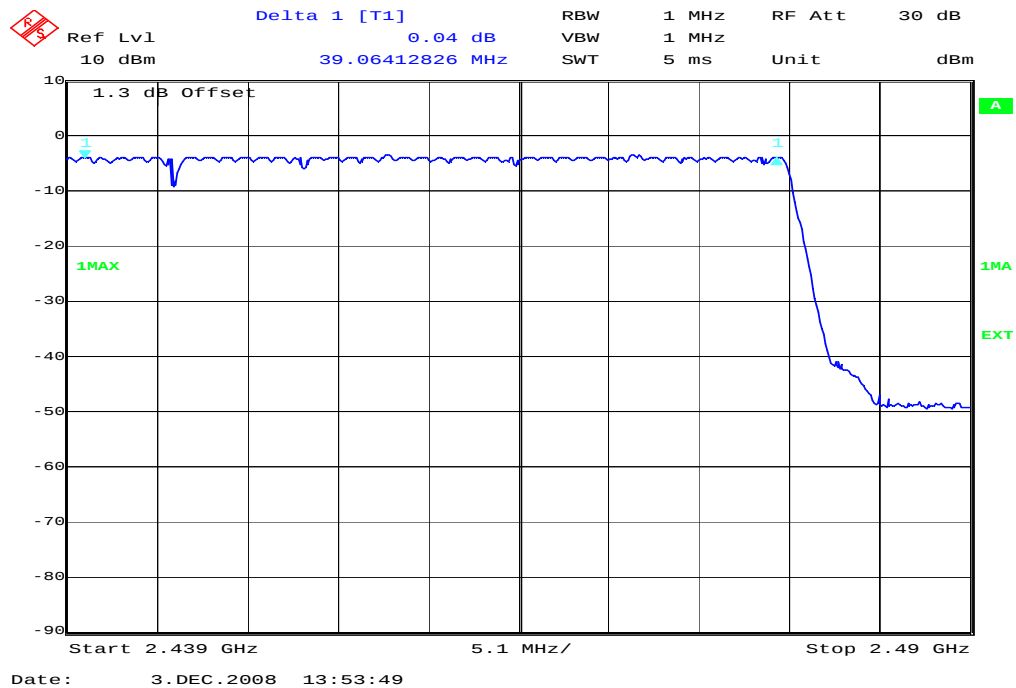
Under normal test conditions only	Minimum 25 kHz or 20 dB Bandwidth of the hopping system
-----------------------------------	---

5.6 Number of hopping channels §15.247(a)(1)

Plot 1 of 2:



Plot 2 of 2:



Result: The number of hopping channels is: 77

Limits:

Under normal test conditions only	at least 15 non-overlapping channels
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5.7 Time of occupancy (dwell time) §15.247(a)(1)(iii)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

For the present device:

The dwell time of 0.4 s within a 30.8 second period in data mode is independent from the packet type (packet length). The calculation for a 30.8 second period is as follows:

Dwell time = time slot length * hop rate / number of hopping channels * 30.8 s

Dwell time = $2,048 \mu\text{s} * 488 \text{ 1/s} / 77 * 30.8 \text{ s} = 0.4 \text{ s}$ (in a 30.8 s period)

**5.8 Power Spectral density (Hybrid system in Inquiry mode/Page scan)
§15.247(e)**

Not applicable

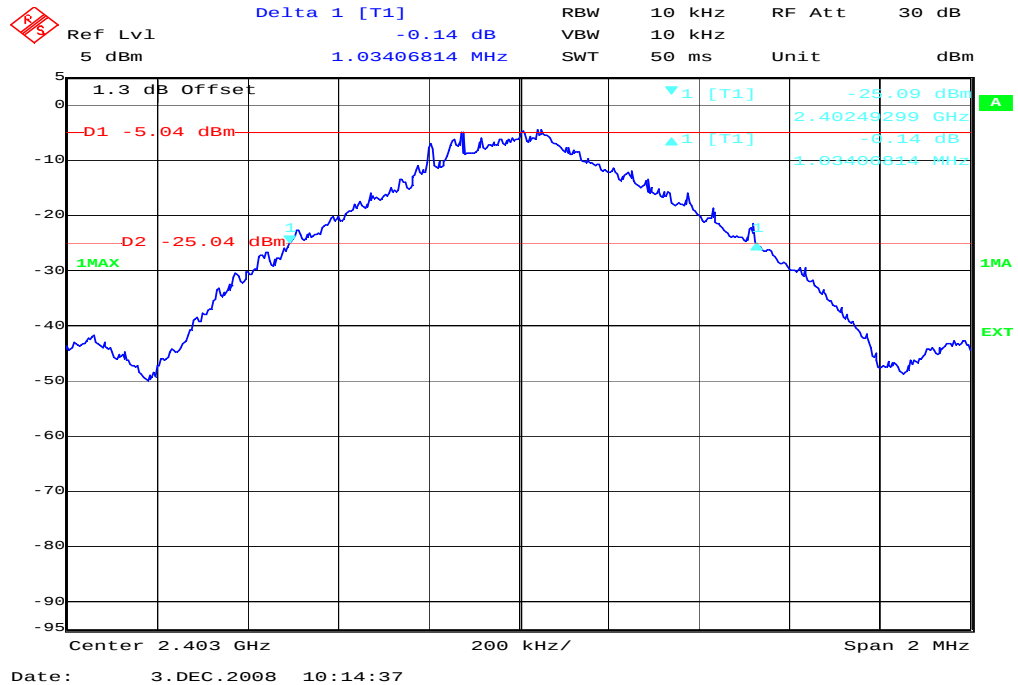
Result: Power density: - dBm/Hz = - dBm / 3 kHz
Correction factor from dBm/Hz to dBm / 3 kHz is +34,8 dB

Limits:

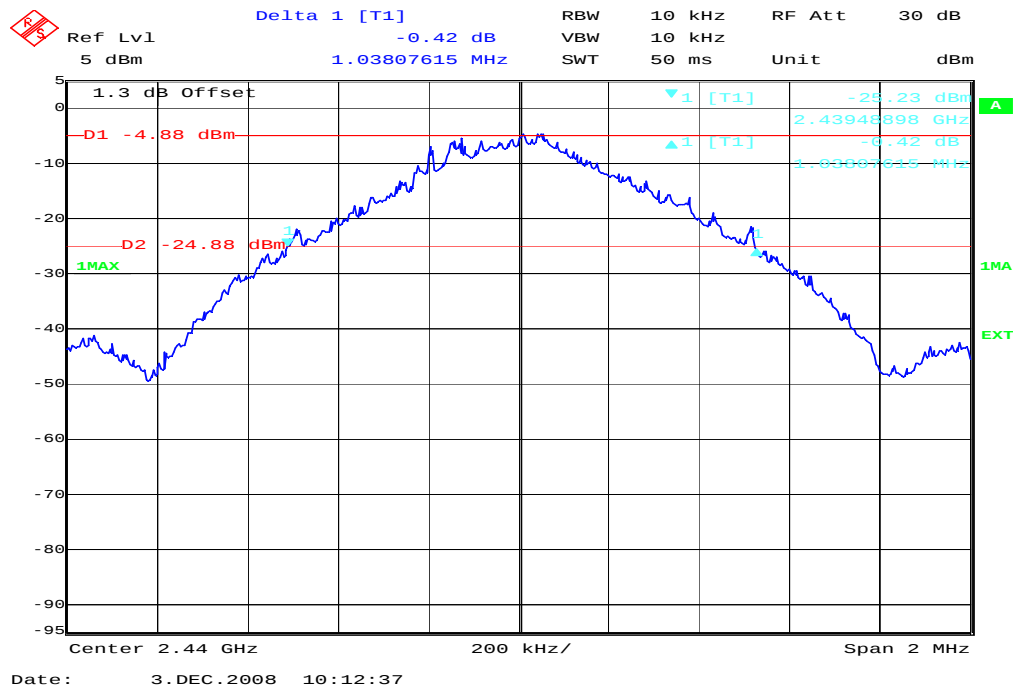
Under normal test conditions only	For digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission
-----------------------------------	---

5.9 Spectrum Bandwidth of a FHSS System / 20dB Bandwidth §15.247(a)(1)

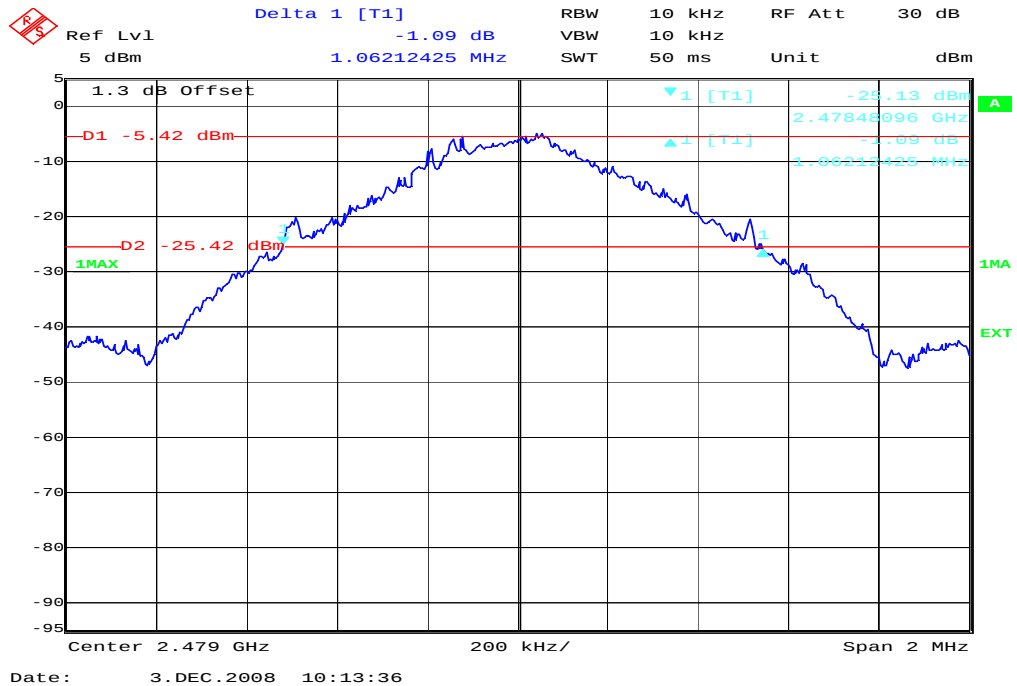
Plot 1 of 3



Plot 2 of 3



Plot 3 of 3



Result:

Test conditions		20 dB BANDWIDTH [kHz]		
Frequency [MHz]		2402	2441	2480
T _{nom}	V _{nom}	1034	1038	1062
Measurement uncertainty		±10 kHz		

RBW / VBW as provided in the „Measurement Guidelines“ (DA 00-705, March 30, 2000)

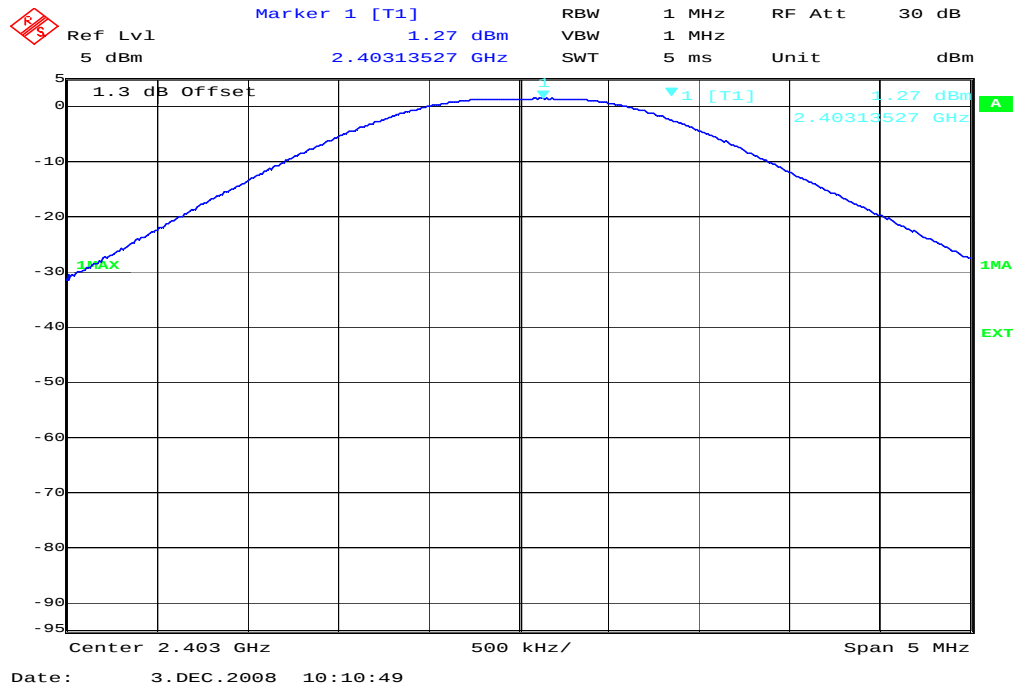
RBW: 10 kHz / VBW 10 kHz

Limits:

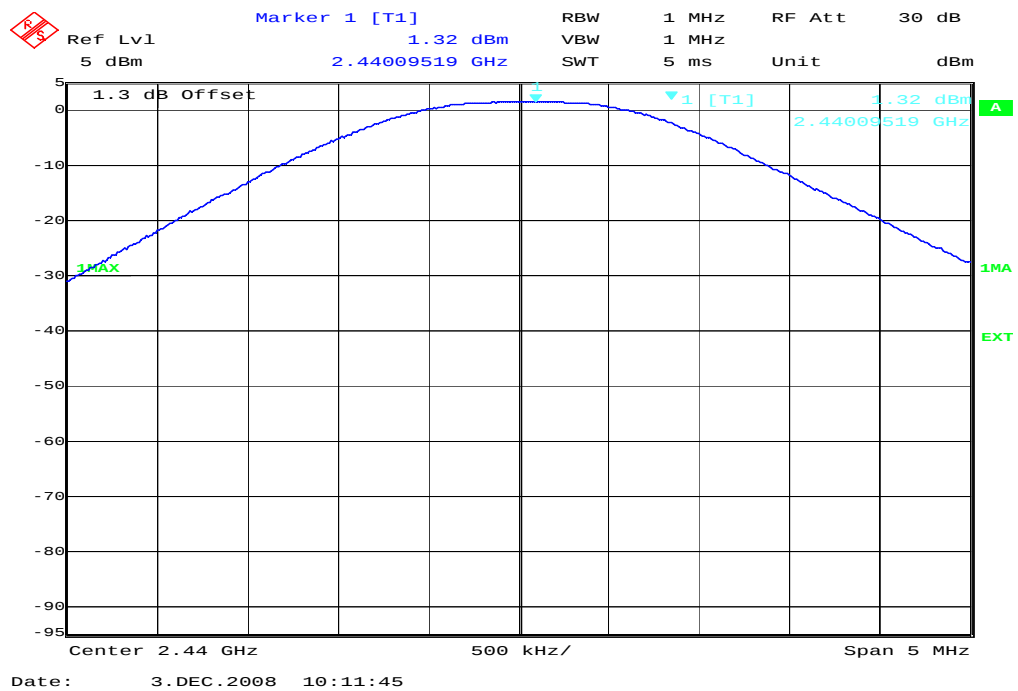
Under normal test conditions only	< 1000 kHz
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5.10 Maximum output power (conducted) § 15.247 (b)(1)

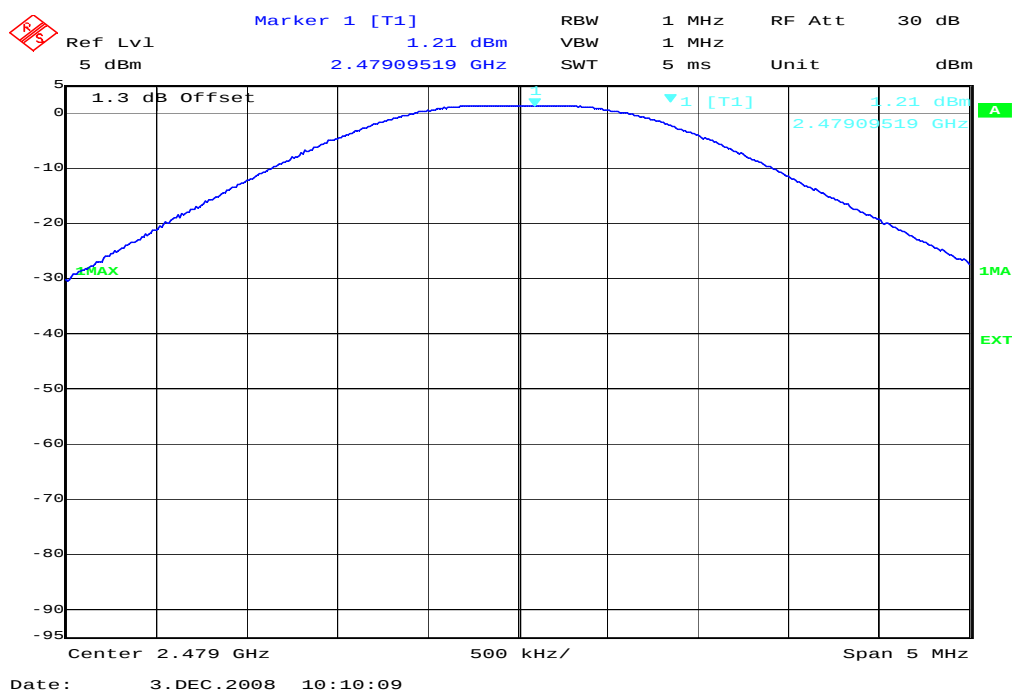
Plot 1 of 3



Plot 2 of 3



Plot 3 of 3



Results:

Test conditions		Max. peak output power [dBm]					
		2403		2440		2479	
Frequency [MHz]							
T _{nom}	V _{nom}	PK	1.27	PK	1.32	PK	1.21
Measurement uncertainty		±3dB					

RBW / VBW: 1 MHz

Limits:

Under normal test conditions only, for frequency range 2400-2483.5 MHz	Max. 1.0 Watt
--	---------------

5.11 Max. peak output power (radiated) § 15.247 (b)(1)Results:

Test conditions		Max. peak output power EIRP [dBm]		
Frequency [MHz]		2403	2440	2479
T _{nom}	V _{nom}	-1.74	-1.14	-1.07
Measurement uncertainty		±3dB		

RBW / VBW: 3 MHz

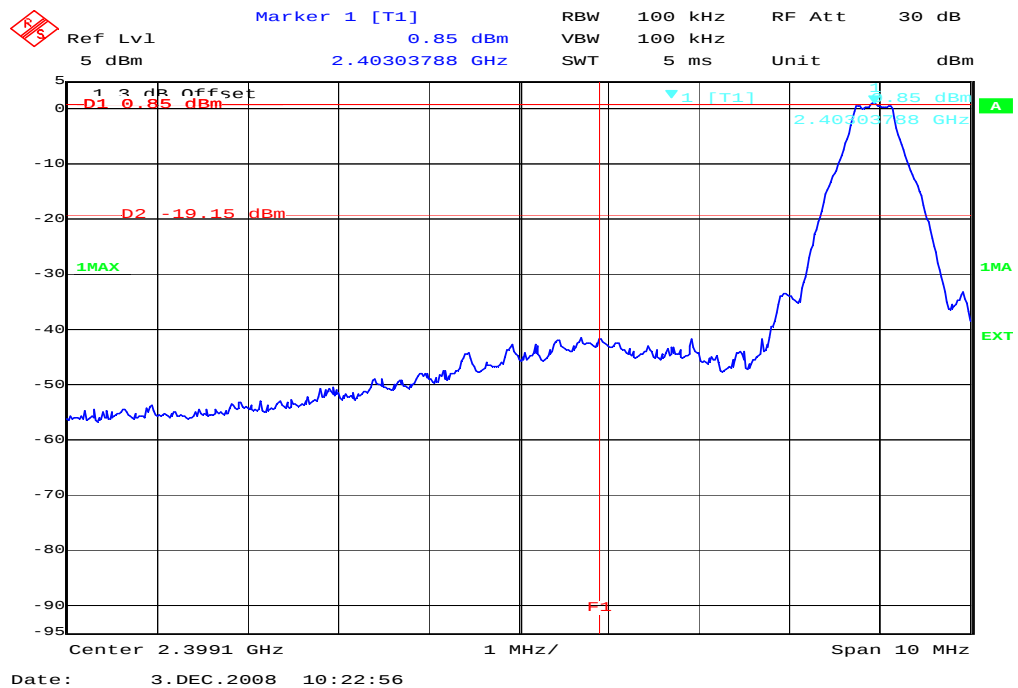
Measured at a distance of 3m

Limits:

Under normal test conditions only, for frequency range 2400-2483.5 MHz	Max. 1.0 Watt
--	---------------

5.12 Band-edge compliance of conducted emissions §15.247 (d)

Plot 1 of 4 (lowest frequency, valid for hopping off and hopping on):



Plot 2 of 4 (highest frequency, valid for hopping off and hopping on):



Results:

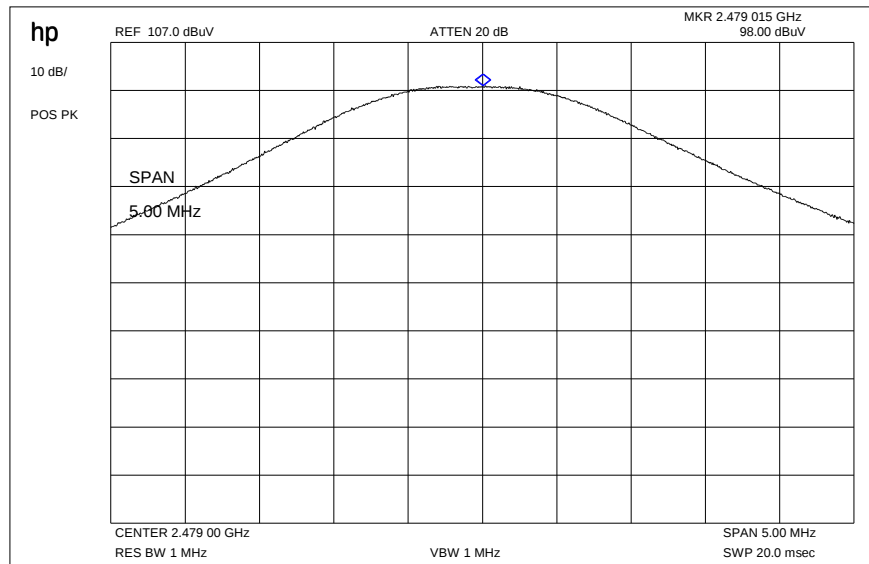
SZENARIO	DELTA VALUE [DB]
hopping off, lowest frequency	> 20 dB
hopping on, lowest frequency	> 20 dB
hopping off, highest frequency	> 20 dB
hopping on, highest frequency	> 20 dB
Measurement uncertainty	±1,5dB

Limits:

Under normal test conditions only	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, 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 5.205(c)).
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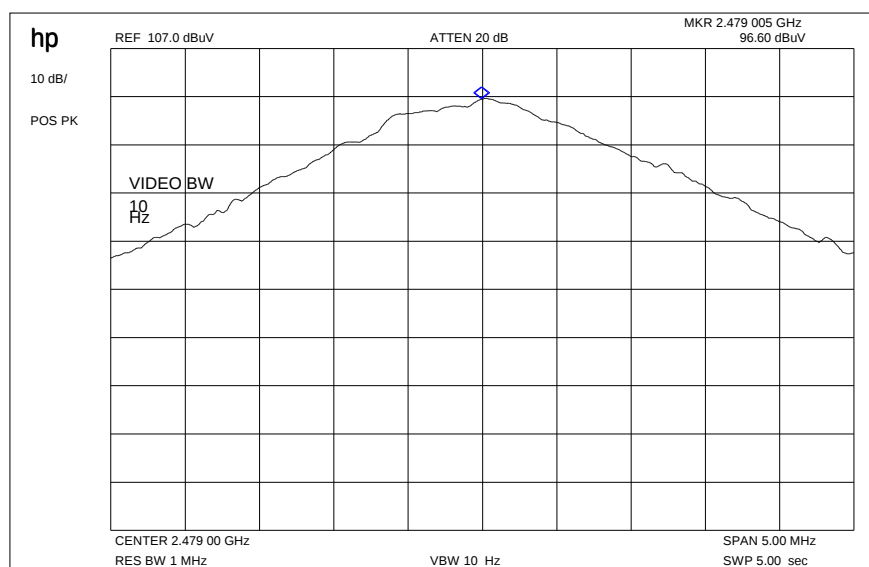
5.13 Band-edge compliance of radiated emissions §15.205

Plot 1: Max field strength in 3m distance (single frequency)



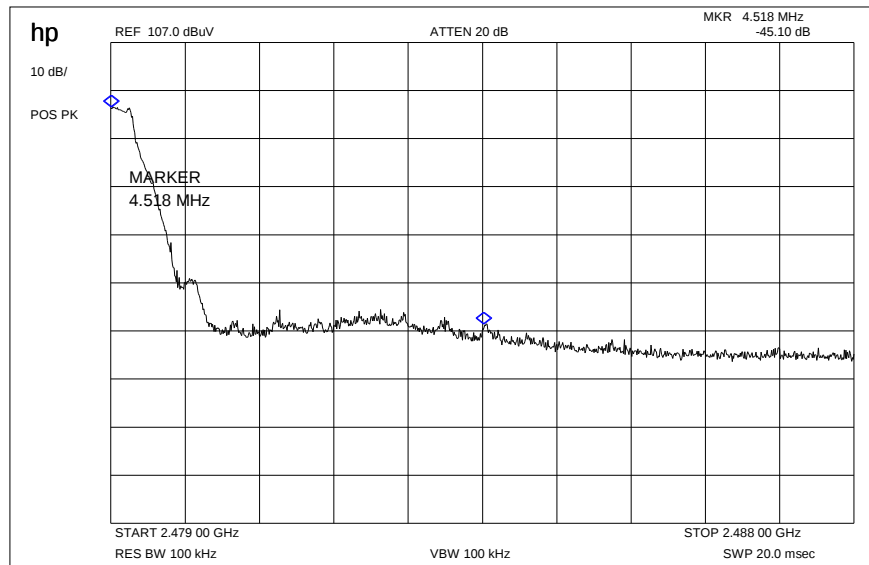
Result: 98 dB μ V/m

Plot 2: Max field strength in 3m distance (single frequency) average



Result: 96.60 dB μ V/m

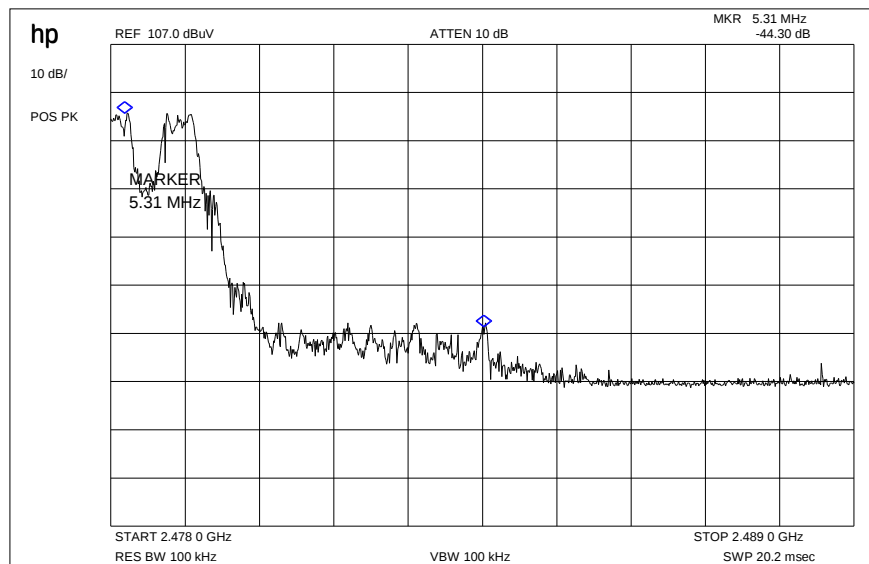
Plot 3: Marker-Delta Method (single carrier)



Marker-Delta-Value: 45.10 dB

This measurement was made to show that the behaviour of the system is conform to FCC 15.205 (restricted bands)

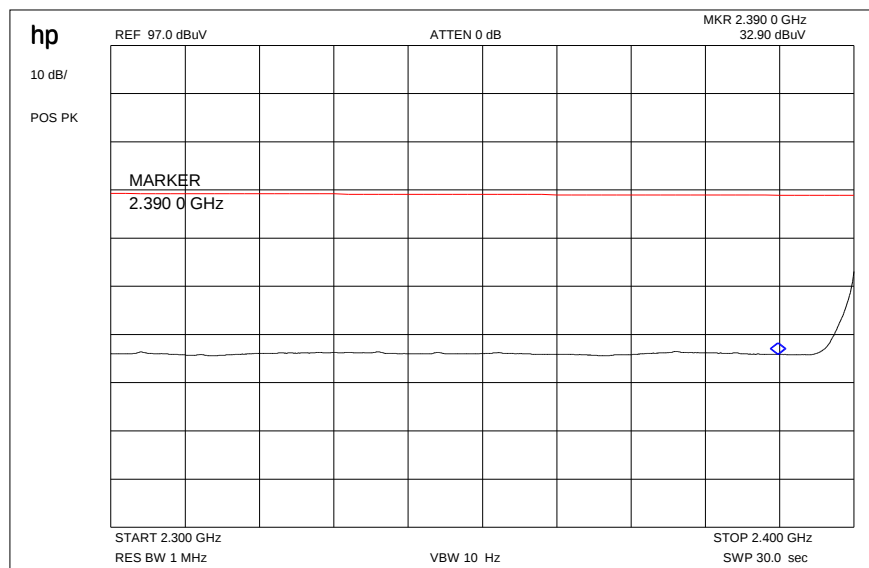
Plot 4: Marker-Delta Method (hopping)



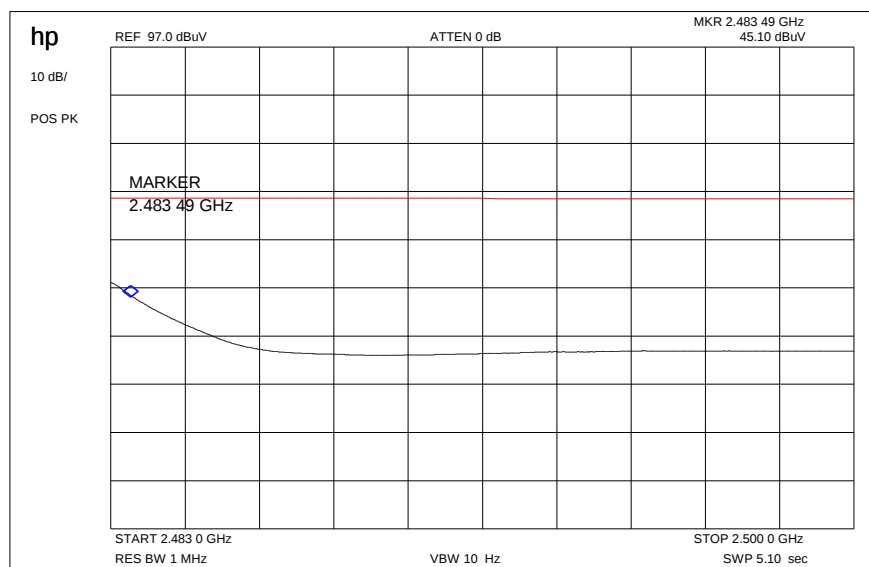
Marker-Delta-Value: 44.30 dB

This measurement was made to show that the behaviour of the system is conform to FCC 15.205 (restricted bands)

Plot 6: Restricted Bands low



Plot 6: Restricted Bands high



Results & Limits:

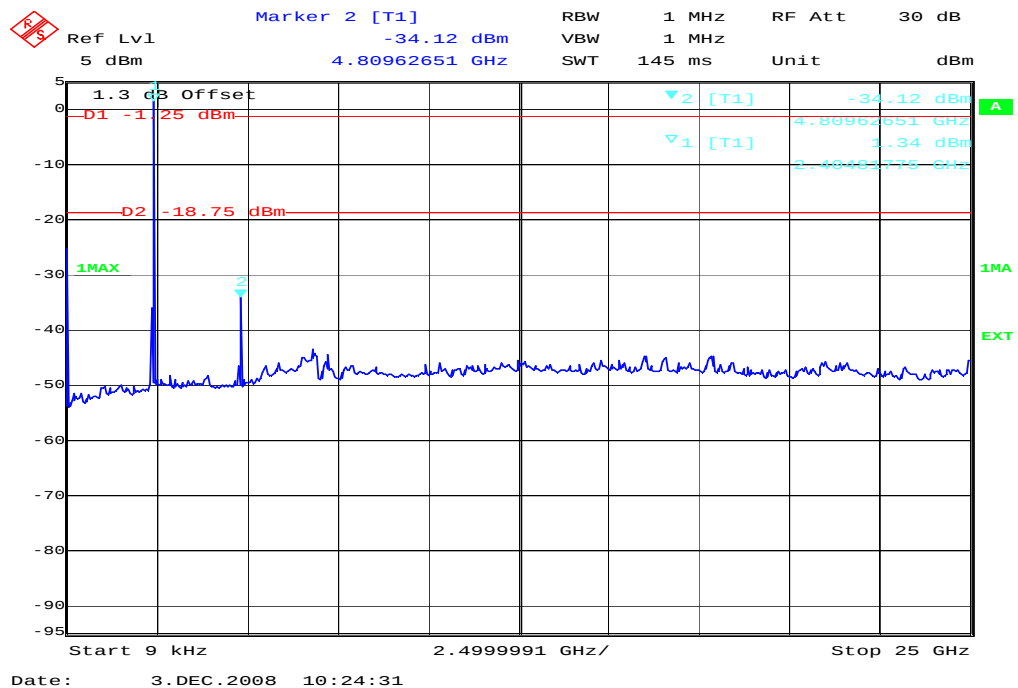
Radiated field strength

The field strength was measured with an EMI measuring receiver and 1 MHz RBW / VBW for peak and with 1MHz RBW / 10Hz VBW for average at a distance of 3m.

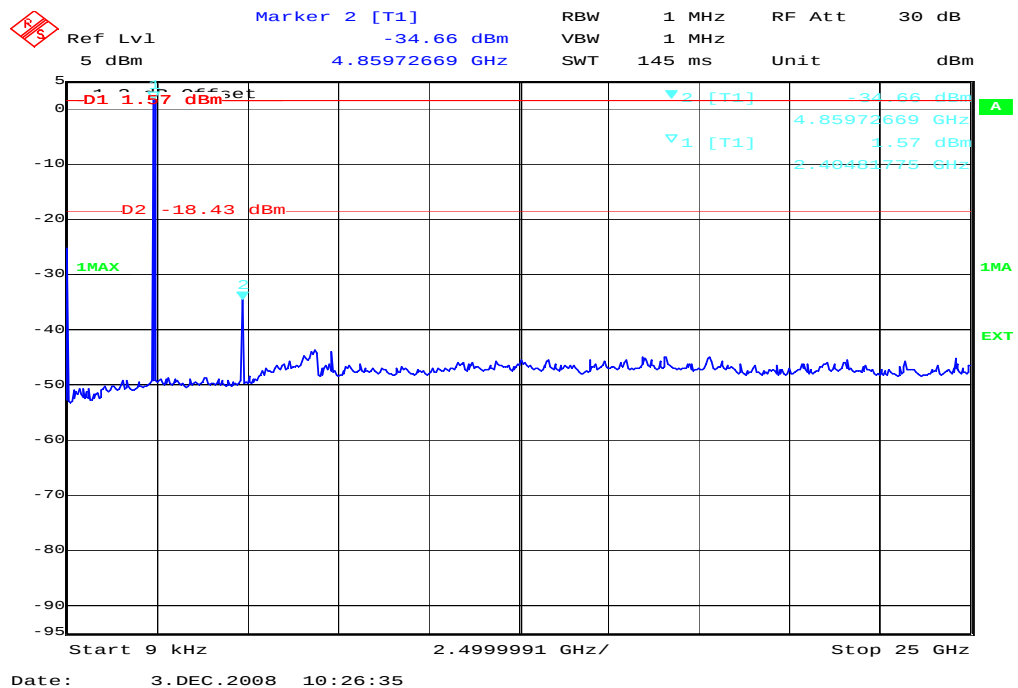
high channel	setup	measured value (3m)	correction factor (3m)	calculated value (3m)
Max. peak value	1 MHz RBW 1 MHz VBW	98.00 dB μ V/m	-6.3 dB	91.70 dB μ V/m
Max. average value	1 MHz RBW 10 Hz VBW	96.60 dB μ V/m	-6.3 dB	90.30 dB μ V/m
Delta value	Peak 100 kHz RBW/VBW	45.10 dB (single carrier) 44.30 dB (hopping mode)	-	-
Value at band edge	limit 54 dB μ V/m			45.20 dB μ V/m (single carrier) 46.00 dB μ V/m (hopping mode)
Statement:				Complies

5.14 Spurious Emissions - conducted (Transmitter) § 15.247 (c)(1)

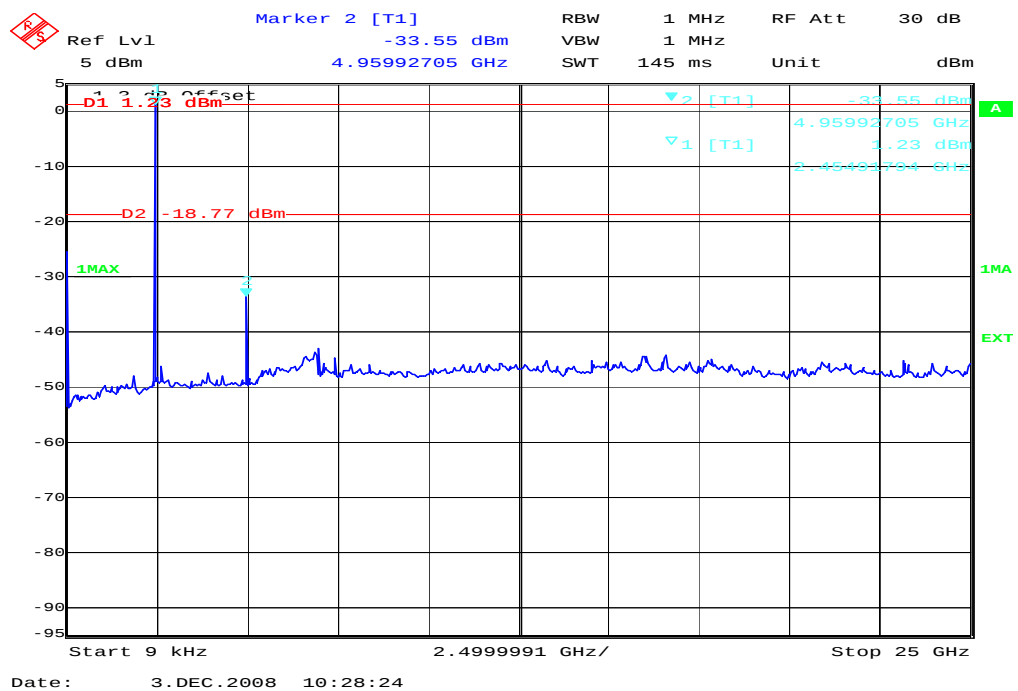
Plot 1 of 3: lowest channel



Plot 2 of 3: middle channel



Plot 3 of 3: highest channel



Result & Limits:

Emission Limitation					
f [MHz]		amplitude of emission [dBm]	limit max. allowed emission power	actual attenuation below frequency of operation [dB]	results
2403		1.34	30 dBm		Operating frequency
4806		-34.12	-20 dBc		complies
2440		1.57	30 dBm		Operating frequency
4880		-34.66	-20 dBc		complies
2479		1.23	30 dBm		Operating frequency
4958		-33.55	-20 dBc		Complies
Measurement uncertainty			± 3dB		

F < 1 GHz: RBW: 100 kHz VBW: 100 kHz
F > 1 GHz: RBW: 1 MHz VBW: 1 MHz

Under normal test conditions only	In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).
-----------------------------------	--

Note: For emissions that fall into restricted bands you find the radiated emissions later in the report.

5.15 Spurious Emissions > 30 MHz- radiated (Transmitter) § 15.247 (c)(1)

Plot 1: 0.03 - 1 GHz vertical worst case (lowest channel)

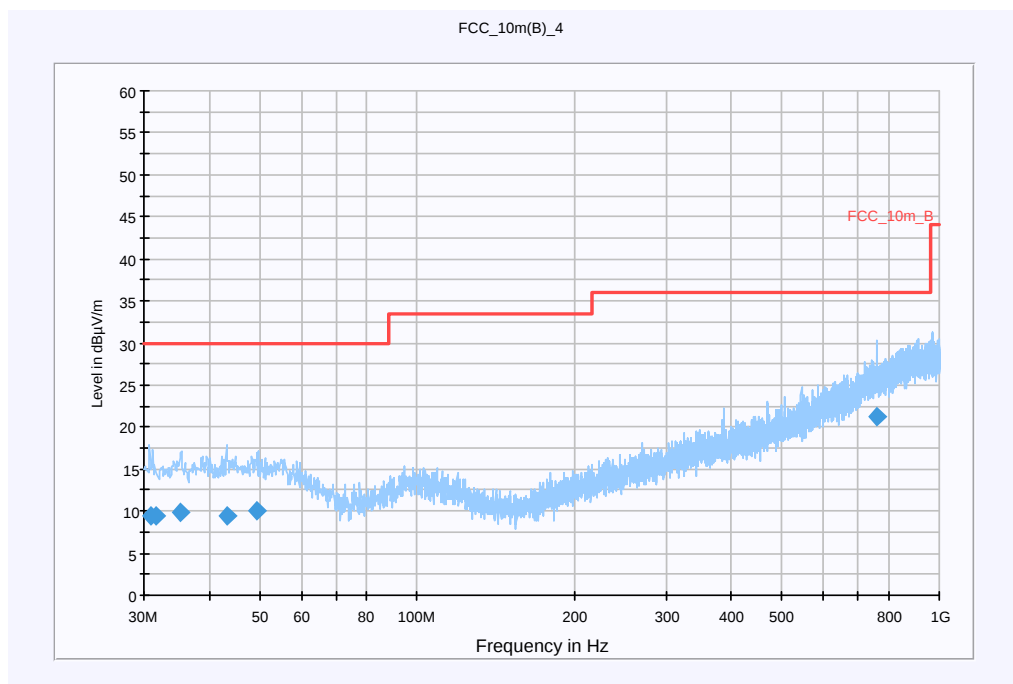
Information

EUT:	WIOP208
Serial Number:	28
Test Description:	FCC @ 10 m
Operating Conditions:	Tx bottom frequency (2403 MHz)
Operator Name:	Folz
Comment:	Powered with DC 24 V

Scan Setup: FCC_Fin [EMI radiated]

Hardware Setup:	Electric Field (NOS)
Level Unit:	dB μ V/m

Subrange	Detectors	IF Bandwidth	Meas. Time	Receiver
30 MHz - 1 GHz	QuasiPeak	120 kHz	15 s	Receiver



Final Result

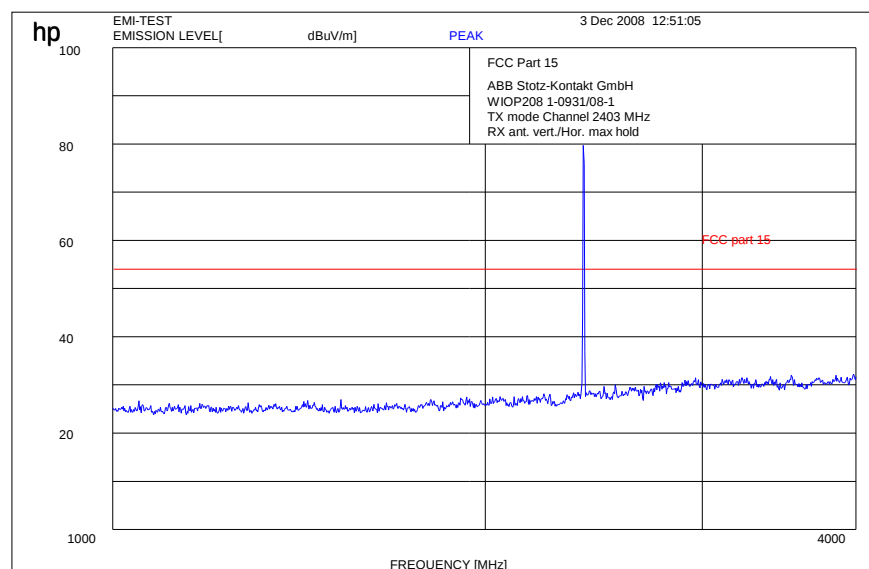
Frequency (MHz)	QuasiPeak (dB μ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)
30.892500	9.5	15000.000	120.000	220.0	V	50.0	12.7	20.5	30.0
31.611950	9.4	15000.000	120.000	220.0	V	36.0	12.8	20.6	30.0
35.285700	9.9	15000.000	120.000	200.0	H	311.0	13.2	20.1	30.0
43.188650	9.5	15000.000	120.000	220.0	H	186.0	13.5	20.5	30.0
49.167350	10.1	15000.000	120.000	220.0	V	131.0	13.5	19.9	30.0
760.204250	21.2	15000.000	120.000	171.0	V	269.0	24.0	14.8	36.0

Hardware Setup: EMI radiated\Electric Field (NOS) - [EMI radiated]

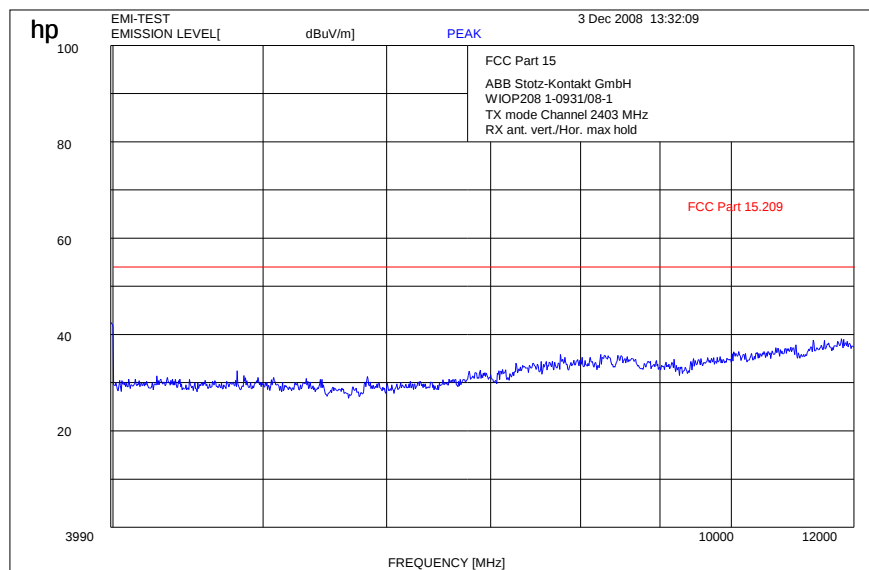
Subrange 1	
Frequency Range:	30 MHz - 2 GHz
Receiver:	Receiver [ESCI 3] @ GPIB0 (ADR 20), SN 100083/003, FW 3.32, CAL 07.01.2009
Signal Path:	without Notch FW 1.0
Antenna:	VULB 9163 SN 9163-295, FW ---, CAL 08.04.2010 Correction Table (vertical): VULP6113 Correction Table (horizontal): VULP6113 Correction Table: Cabel with switch (0908)
Antenna Tower:	Tower [EMCO 2090 Antenna Tower] @ GPIB0 (ADR 8), FW REV 3.12
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12

EMC 32 Version 6.30.10 + Service Pack 2

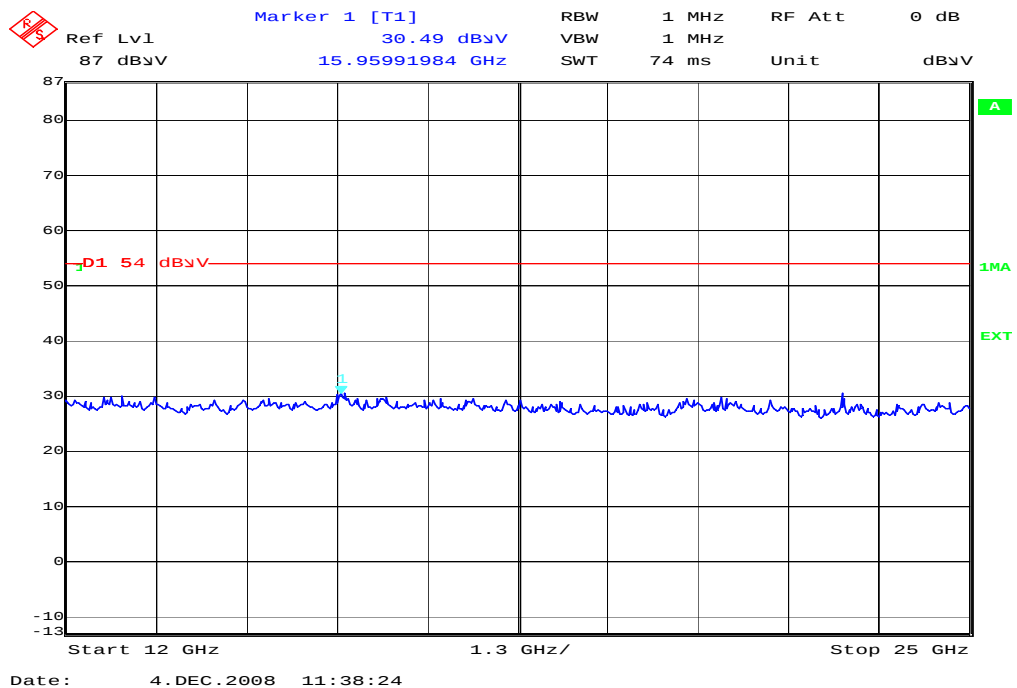
Plot 2: 1 - 4 GHz vertical worst case (lowest channel)



Plot 3: 4 - 12 GHz vertical worst case (lowest channel)



Plot 4: 12 - 25 GHz vertical/horizontal (valid for all channels)



Plot 5: 0.03 - 1 GHz vertical/horizontal (middle channel)

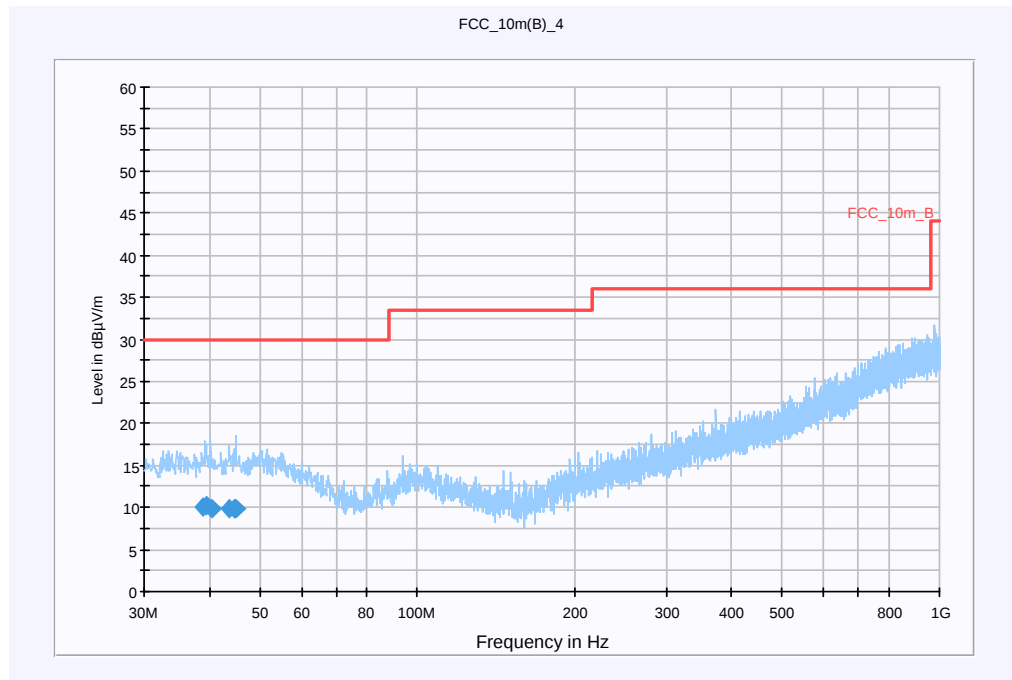
Information

EUT:	WIOP208
Serial Number:	28
Test Description:	FCC @ 10 m
Operating Conditions:	Tx mid frequency (2440 MHz)
Operator Name:	Folz
Comment:	Powered with DC 24 V

Scan Setup: FCC_Fin [EMI radiated]

Hardware Setup:	Electric Field (NOS)
Level Unit:	dB μ V/m

Subrange	Detectors	IF Bandwidth	Meas. Time	Receiver
30 MHz - 1 GHz	QuasiPeak	120 kHz	15 s	Receiver

**Final Result**

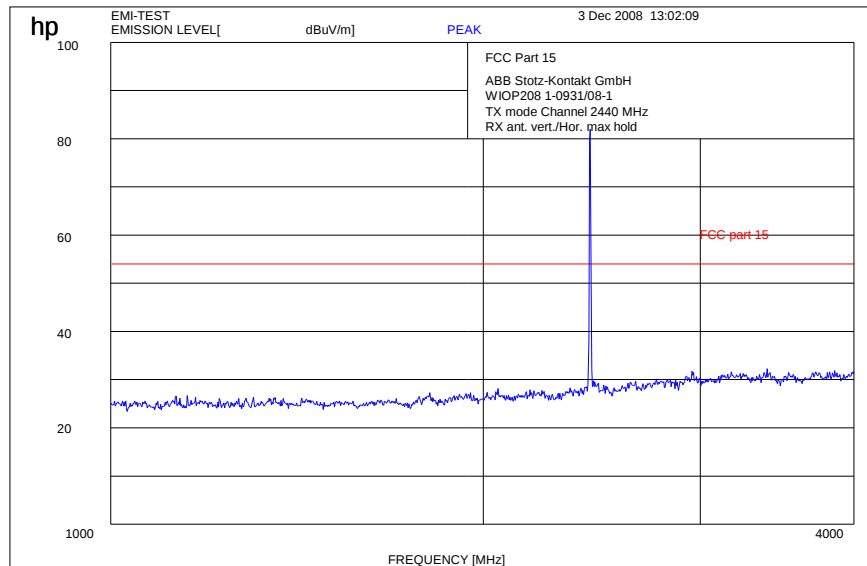
Frequency (MHz)	QuasiPeak (dB μ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)
38.933100	10.0	15000.000	120.000	220.0	V	0.0	13.5	20.0	30.0
39.618950	10.3	15000.000	120.000	204.0	H	107.0	13.6	19.7	30.0
40.476450	9.8	15000.000	120.000	220.0	V	71.0	13.6	20.2	30.0
43.758850	9.9	15000.000	120.000	220.0	V	245.0	13.5	20.1	30.0
44.834600	9.8	15000.000	120.000	220.0	H	13.0	13.4	20.2	30.0
45.007850	9.8	15000.000	120.000	187.0	H	143.0	13.4	20.2	30.0

Hardware Setup: EMI radiated\Electric Field (NOS) - [EMI radiated]

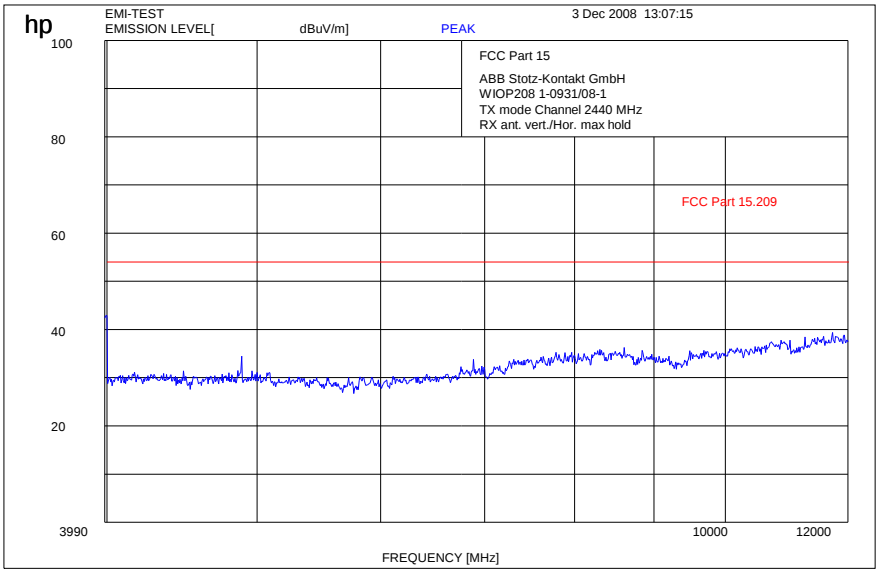
Subrange 1	
Frequency Range:	30 MHz - 2 GHz
Receiver:	Receiver [ESCI 3] @ GPIB0 (ADR 20), SN 100083/003, FW 3.32, CAL 07.01.2009
Signal Path:	without Notch FW 1.0
Antenna:	VULB 9163 SN 9163-295, FW ---, CAL 08.04.2010 Correction Table (vertical): VULP6113 Correction Table (horizontal): VULP6113 Correction Table: Cabel with switch (0908)
Antenna Tower:	Tower [EMCO 2090 Antenna Tower] @ GPIB0 (ADR 8), FW REV 3.12
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12

EMC 32 Version 6.30.10 + Service Pack 2

Plot 6: 1 - 4 GHz vertical/horizontal (middle channel)



Plot 7: 4 - 12 GHz vertical/horizontal (middle channel)



Plot 8: 0.03 - 1 GHz vertical/horizontal (highest channel)

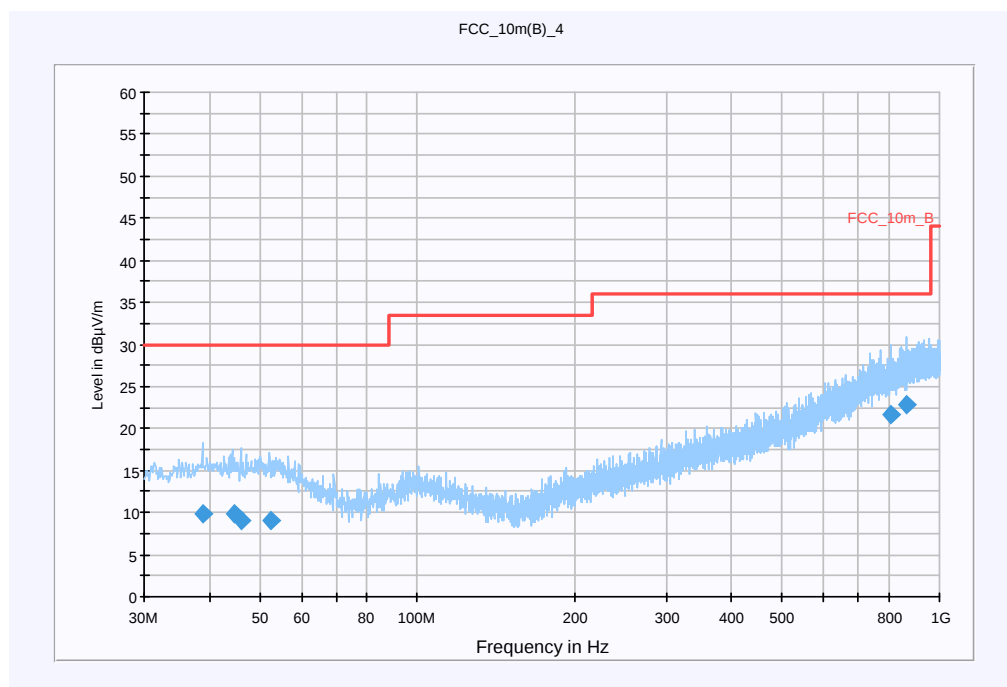
Information

EUT:	WIOP208
Serial Number:	28
Test Description:	FCC @ 10 m
Operating Conditions:	Tx top frequency (2479 MHz)
Operator Name:	Folz
Comment:	Powered with DC 24 V

Scan Setup: FCC_Fin [EMI radiated]

Hardware Setup:	Electric Field (NOS)
Level Unit:	dB μ V/m

Subrange	Detectors	IF Bandwidth	Meas. Time	Receiver
30 MHz - 1 GHz	QuasiPeak	120 kHz	15 s	Receiver

**Final Result**

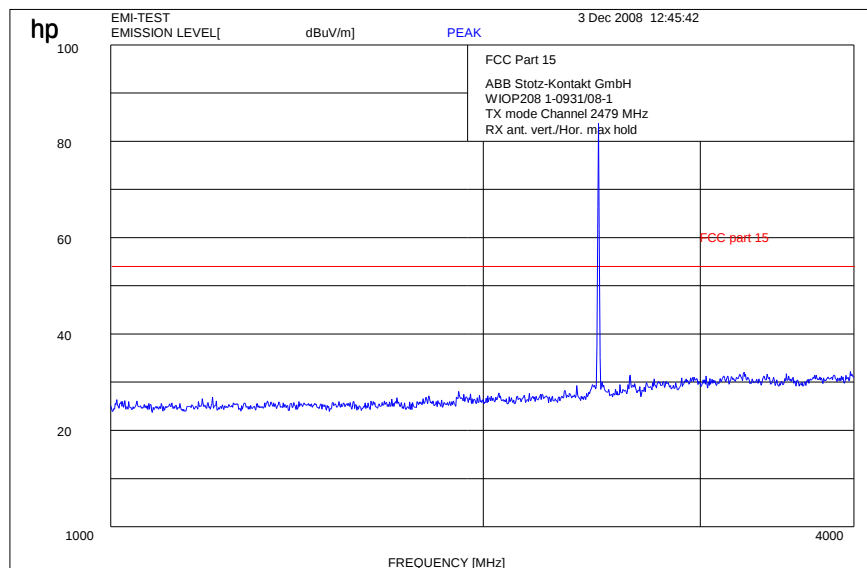
Frequency (MHz)	QuasiPeak (dB μ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)
38.775350	9.9	15000.000	120.000	220.0	H	143.0	13.5	20.1	30.0
44.633700	9.9	15000.000	120.000	144.0	H	72.0	13.4	20.1	30.0
46.079550	9.1	15000.000	120.000	126.0	V	143.0	13.4	20.9	30.0
52.444350	9.0	15000.000	120.000	100.0	H	131.0	13.3	21.0	30.0
804.399600	21.6	15000.000	120.000	220.0	V	35.0	24.4	14.4	36.0
867.021250	22.8	15000.000	120.000	192.0	V	220.0	25.3	13.2	36.0

Hardware Setup: EMI radiated\Electric Field (NOS) - [EMI radiated]

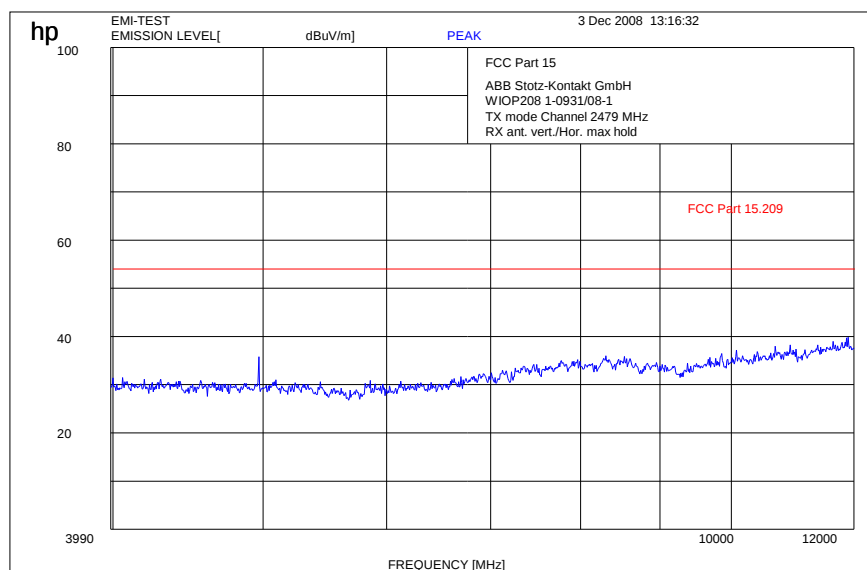
Subrange 1	
Frequency Range:	30 MHz - 2 GHz
Receiver:	Receiver [ESCI 3] @ GPIB0 (ADR 20), SN 100083/003, FW 3.32, CAL 07.01.2009
Signal Path:	without Notch FW 1.0
Antenna:	VULB 9163 SN 9163-295, FW ---, CAL 08.04.2010 Correction Table (vertical): VULP6113 Correction Table (horizontal): VULP6113 Correction Table: Cabel with switch (0908)
Antenna Tower:	Tower [EMCO 2090 Antenna Tower] @ GPIB0 (ADR 8), FW REV 3.12
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12

EMC 32 Version 6.30.10 + Service Pack 2

Plot 9: 1 - 4 GHz vertical/horizontal (highest channel)



Plot 10: 4 - 12 GHz vertical/horizontal (highest channel)



Results:

SPURIOUS EMISSIONS LEVEL (dB μ V/m)								
2403 MHz			2440 MHz			2479 MHz		
F [MHz]	Detector	Level [dB μ V/m]	F [MHz]	Detector	Level [dBm]	F [MHz]	Detector	Level [dBm]
-	-	-	4880	peak	-44.04	4958	peak	-42.85
For measurement results of the frequency range from 30 MHz up to 1GHz, also see tables below plots.								
Measurement uncertainty			± 3 dB					

$f < 1$ GHz : RBW/VBW: 100 kHz

$f \geq 1$ GHz : RBW/VBW: 1 MHz

Limits: § 15.247 (c)

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Limits: § 15.209

Frequency [MHz]	Field strength [μ V/m]	Measurement distance (m)
30 - 88	100 (40 dB μ V/m)	3
88 - 216	150 (43.5 dB μ V/m)	3
216 - 960	200 (46 dB μ V/m)	3
above 960	500 (54 dB μ V/m)	3

5.16 Spurious Emissions - radiated (Receiver) § 15.109

Plot 1: 0.03 - 1 GHz vertical/horizontal (receiver)

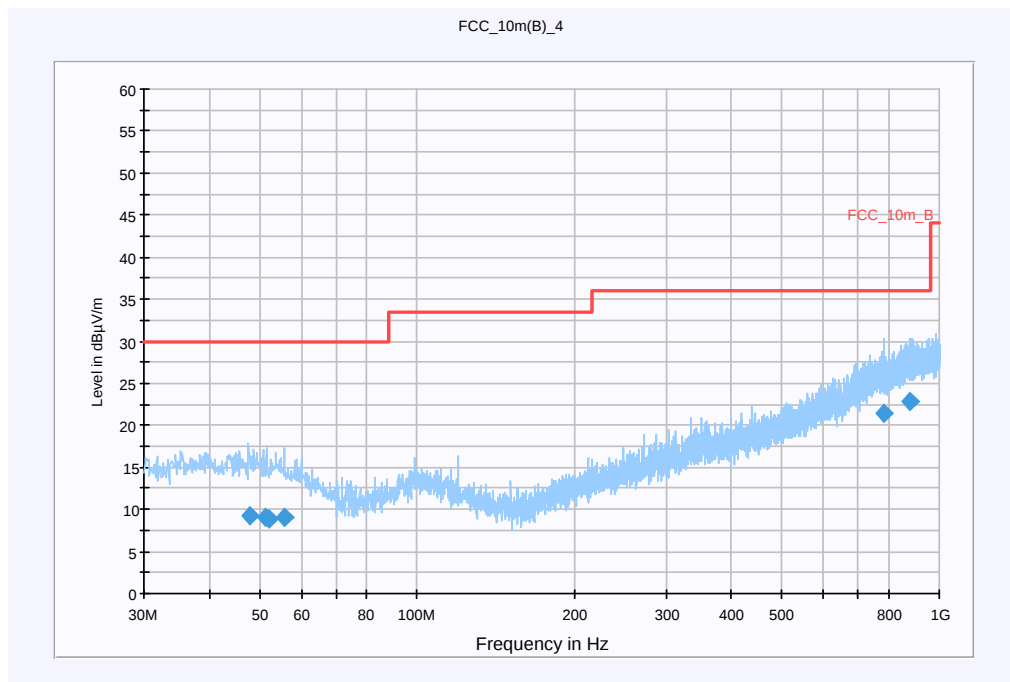
Information

EUT:	WIOP208
Serial Number:	28
Test Description:	FCC @ 10 m
Operating Conditions:	Rx
Operator Name:	Folz
Comment:	Powered with DC 24 V

Scan Setup: FCC_Fin [EMI radiated]

Hardware Setup:	Electric Field (NOS)
Level Unit:	dB μ V/m

Subrange	Detectors	IF Bandwidth	Meas. Time	Receiver
30 MHz - 1 GHz	QuasiPeak	120 kHz	15 s	Receiver



Final Result 1

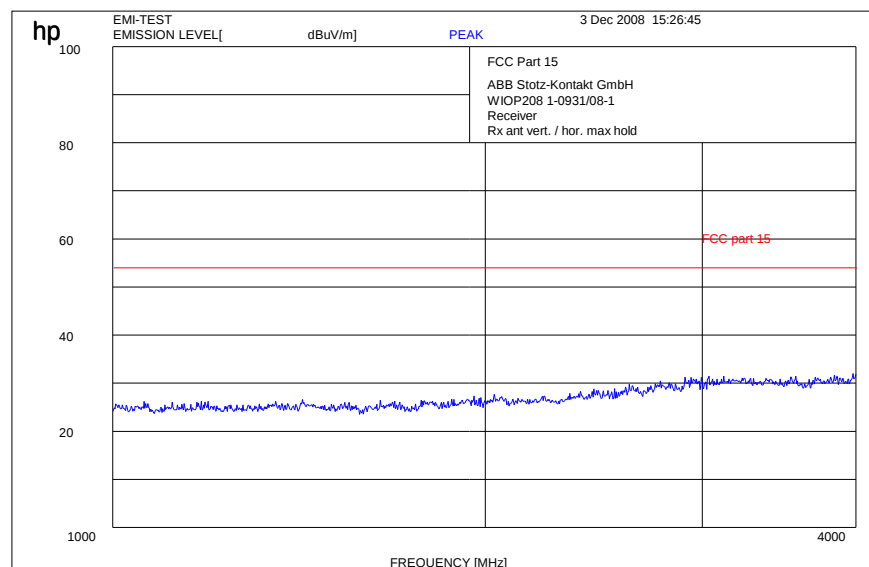
Frequency (MHz)	QuasiPeak (dB μ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)
47.842100	9.2	15000.000	120.000	220.0	H	233.0	13.5	20.8	30.0
51.246600	9.1	15000.000	120.000	220.0	H	323.0	13.4	20.9	30.0
52.035650	8.8	15000.000	120.000	100.0	H	173.0	13.3	21.2	30.0
55.799250	9.0	15000.000	120.000	220.0	V	50.0	12.9	21.0	30.0
781.506700	21.4	15000.000	120.000	220.0	V	225.0	24.2	14.6	36.0
880.491800	22.9	15000.000	120.000	220.0	H	27.0	25.5	13.1	36.0

Hardware Setup: EMI radiated\Electric Field (NOS) - [EMI radiated]

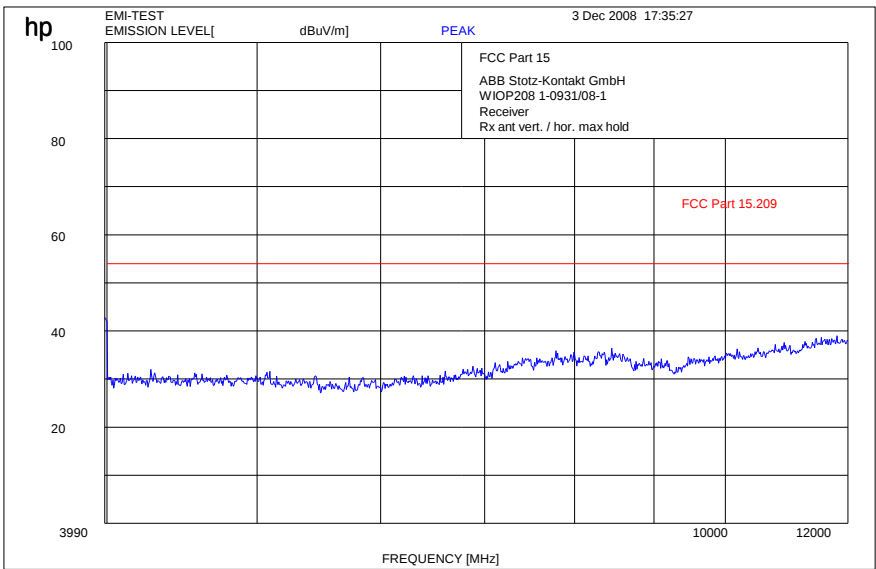
Subrange 1	
Frequency Range:	30 MHz - 2 GHz
Receiver:	Receiver [ESCI 3] @ GPIB0 (ADR 20), SN 100083/003, FW 3.32, CAL 07.01.2009
Signal Path:	without Notch FW 1.0
Antenna:	VULB 9163 SN 9163-295, FW ---, CAL 08.04.2010 Correction Table (vertical): VULP6113 Correction Table (horizontal): VULP6113 Correction Table: Cabel with switch (0908)
Antenna Tower:	Tower [EMCO 2090 Antenna Tower] @ GPIB0 (ADR 8), FW REV 3.12
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12

EMC 32 Version 6.30.10 + Service Pack 2

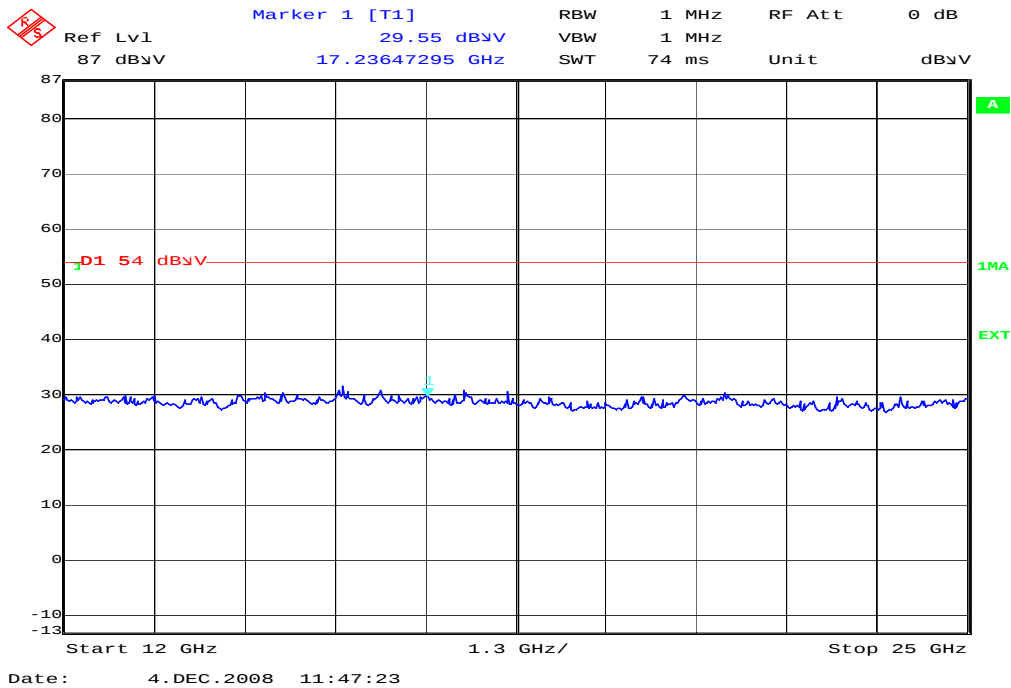
Plot 2:1 - 4 GHz vertical/horizontal (receiver)



Plot 3: 4 - 12 GHz vertical/horizontal (receiver)



Plot 4: 12 - 25 GHz vertical/horizontal (receiver)



Results

Spurious Emissions level [dB μ V/m]		
f[MHz]	Detector	Level [dB μ V/m]
No peaks detected		
For measurement results of the frequency range from 30 MHz up to 1GHz, also see tables below plots.		
Measurement uncertainty		± 3 dB

f < 1 GHz: RBW/VBW: 100 kHz

f $\geq$ 1GHz : RBW/VBW: 1 MHz

See above plots

Measurement distance see table

Limits: § 15.109

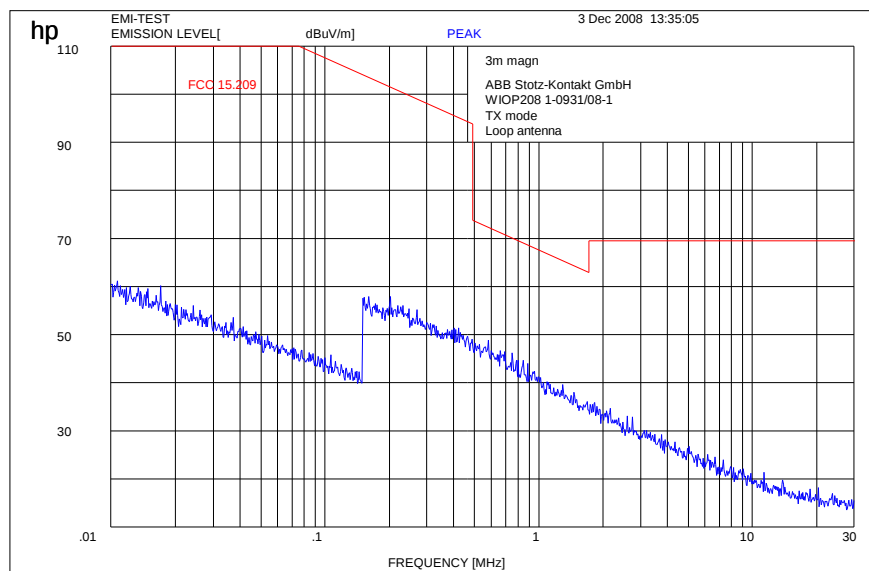
Frequency (MHz)	Field strength (μ V/m)	Measurement distance (m)
30 - 88	100 (40 dB μ V/m)	3
88 - 216	150 (43.5 dB μ V/m)	3
216 - 960	200 (46 dB μ V/m)	3
above 960	500 (54 dB μ V/m)	3

5.17 Spurious Emissions < 30 MHz - Transmitter radiated § 15.209

Measured at 10 m distance.

Values recalculated with 40 dB/decade according to FCC rules.

Plot 1:



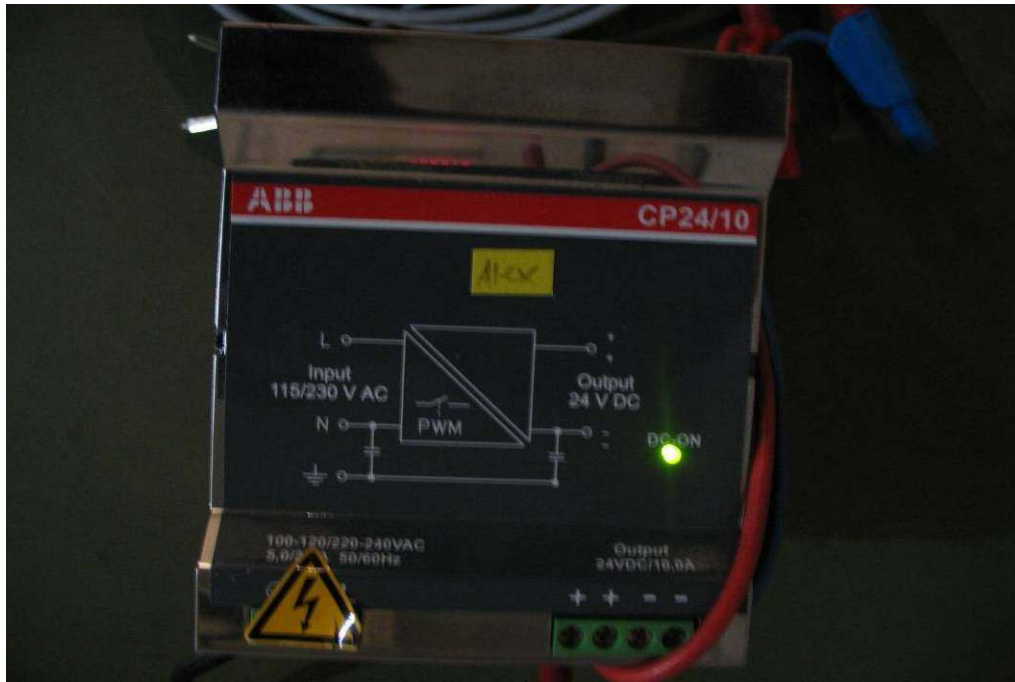
Limits:

Frequency (MHz)	Field strength ($\mu\text{V/m}$)	Measurement distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30 / 29.5 dB $\mu\text{V/m}$	30

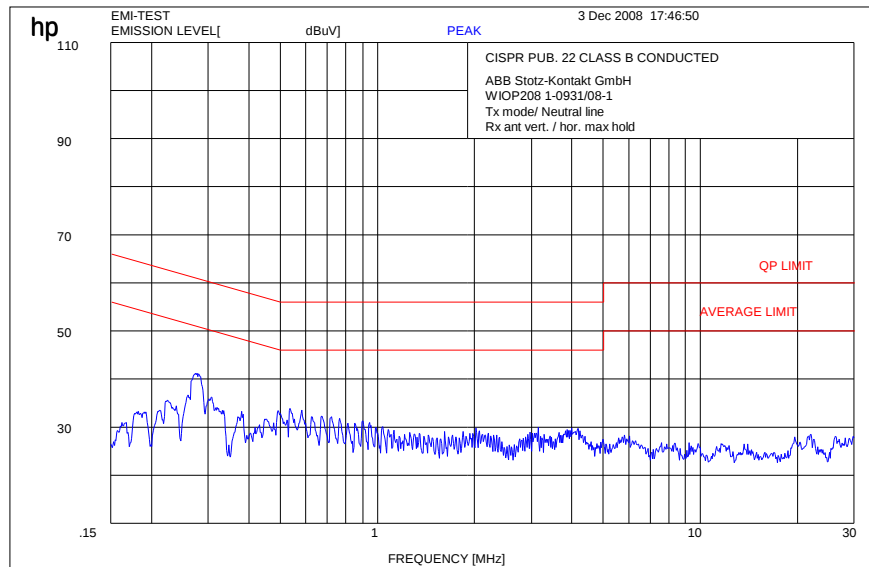
5.18 Conducted Emissions <30 MHz § 15.107/207

Tests carried out with the AC adapter provided by the manufacturer, see picture 1 below.

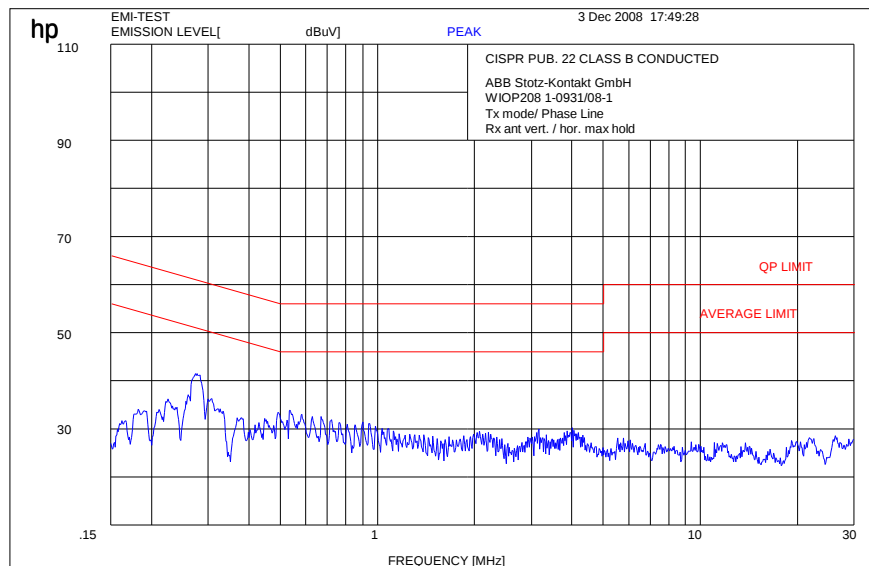
Picture 1



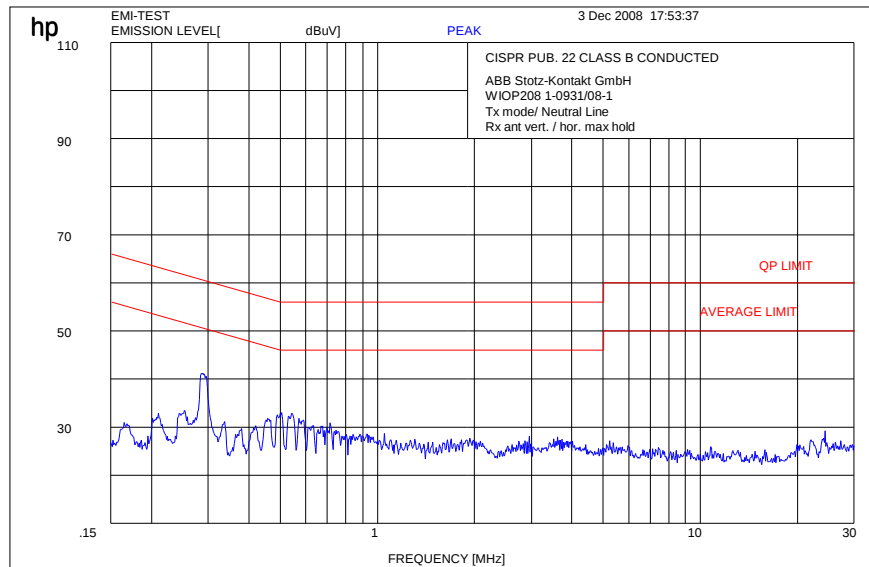
Plot 1: Tx mode, Neutral Line



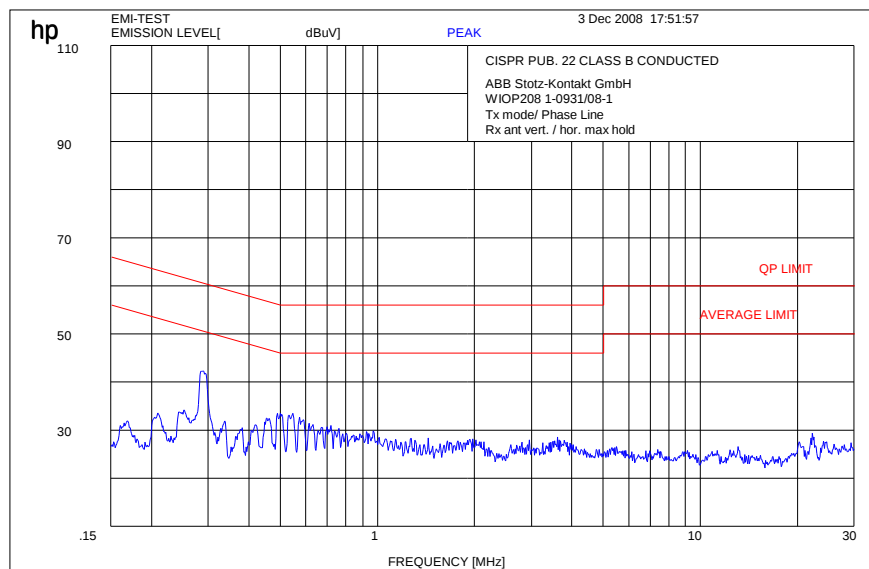
Plot 2: Tx Mode, Phase Line



Plot 3: Rx Mode, Neutral Line



Plot 4: Rx Mode, Phase Line



Limits:

Under normal test conditions only	See plots
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6 Test equipment and ancillaries used for tests

To simplify the identification on each page of the test equipment used, on each page of the test report, each item of test equipment and ancillaries such as cables are identified (numbered) by the Test Laboratory, below.

All reported calibration intervals are calibrations according to the EN/ISO/IEC 17025 standard. These calibrations were performed from an accredited external calibration laboratory.

Additional to these calibrations the laboratory performed comparison measurements with other calibrated systems and performed a weekly chamber inspection.

All used devices are connected with a 10 MHz external reference.

According to the manufacturers' instruction is it possible to establish a calibration interval for the FSP unit of 24 month, if the device has an external 10 MHz reference.

Anechoic chamber C:

No	Equipment/Type	Manuf.	Serial Nr.	Inv. No. Cetecom	Last Calibration	Frequency (months)	Next Calibration
1	Anechoic chamber	MWB	87400/02	300000996	Monthly verification		
2	System-Rack 85900	HP I.V.	*	300000222	n.a.		
3	Measurement System 1						
4	Spektrum Analyzer 8566B	HP	3138A07614	300001207	13.12.2007	24	13.12.2009
5	Spektrum Analyzer Display 85662A	HP	3144A28627	300001208	13.12.2007	24	13.12.2009
6	Quasi-Peak-Adapter 85650A	HP	2811A01204	300002308	13.12.2007	24	13.12.2009
7	RF-Preselector 85685A	HP	2837A00778	300002448	13.12.2007	24	13.12.2009
8	PC Vectra VL	HP		300001688	n.a.		
9	Software EMI	HP		300000983	n.a.		
10	Measurement System 2						
11	FSP 30	R&S	100886	300003575	25.08.2008	24	25.08.2010
12	PC	F+W			n.a.		
13	TILE	TILE			n.a.		
14	Biconical antenna	EMCO	S/N: 860 942/003		Monthly verification (System cal.)		
15	Log. Period. Antenna 3146	EMCO	2130	300001603	Monthly verification (System cal.)		
16	Double Ridged Antenna HP 3115P	EMCO	3088	300001032	Monthly verification (System cal.)		
17	Active Loop Antenna 6502	EMCO	2210	300001015	Monthly verification (System cal.)		
18	Power Supply 6032A	HP	2818A03450	300001040	12.05.2007	36	12.05.2010
19	Busisolator	Kontron		300001056	n.a.		
20	Leitungsteiler 11850C	HP		300000997	Monthly verification (System cal.)		
21	Power attenuator 8325	Byrd	1530	300001595	Monthly verification (System cal.)		
22	Band reject filter WRCG1855/1910	Wainwright	7	300003350	Monthly verification (System cal.)		
23	Band reject filter WRCG2400/2483	Wainwright	11	300003351	Monthly verification (System cal.)		

SRD Laboratory Room 002:

No	Equipment/Type	Manuf.	Serial Nr.	Inv. No. Cetecom	Last Calibration	Frequency (months)	Next Calibration
1	System Controller PSM 12	R&S	835259/007	3000002681-00xx	n.a.		
2	Memory Extension PSM-K10	R&S	To 1	3000002681	n.a.		
3	Operating Software PSM-B2	R&S	To 1	3000002681	n.a.		
4	19" Monitor		22759020-ED	3000002681	n.a.		
5	Mouse		LZE 0095/6639	3000002681	n.a.		
6	Keyboard		G00013834L461	3000002681	n.a.		
7	Spectrum Analyser FSIQ 26	R&S	835540/018	3000002681-0005	10.01.2008	24	10.01.2010
8	Tracking Generator FSIQ-B10	R&S	835107/015	3000002681	s.No.7		
10	RF-Generator SMIQ03 (B1 Signal)	R&S	835541/056	3000002681-0002	26.08.2008	36	26.08.2011
11	Modulation Coder SMIQ-B20	R&S	To 10	3000002681	s.No.10		
12	Data Generator SMIQ-B11	R&S	To 10	3000002681	s.No.10		
13	RF Rear Connection SMIQ-B19	R&S	To 10	3000002681	s.No.10		
14	Fast CPU SM-B50	R&S	To 10	3000002681	s.No.10		
15	FM Modulator SM-B5	R&S	835676/033	3000002681	s.No.10		
16	RF-Generator SMIQ03 (B2 Signal)	R&S	835541/055	3000002681-0001	25.08.2008	36	25.08.2011
17	Modulation Coder SMIQ-B20	R&S	To 16	3000002681	s.No.16		
18	Data Generator SMIQ-B11	R&S	To 16	3000002681	s.No.16		
19	RF Rear Connection SMIQ-B19	R&S	To 16	3000002681	s.No.16		
20	Fast CPU SM-B50	R&S	To 16	3000002681	s.No.16		
21	FM Modulator SM-B5	R&S	836061/022	3000002681	s.No.16		
22	RF-Generator SMP03 (B3 Signal)	R&S	835133/011	3000002681-0003	26.08.2008	36	26.08.2011
23	Attenuator SMP-B15	R&S	835136/014	3000002681	S.No.22		
24	RF Rear Connection SMP-B19	R&S	834745/007	3000002681	S.No.22		
25	Power Meter NRVD	R&S	835430/044	3000002681-0004	26.08.2008	24	26.08.2010
26	Power Sensor NRVD-Z1	R&S	833894/012	3000002681-0013	26.08.2008	24	26.08.2010
27	Power Sensor NRVD-Z1	R&S	833894/011	3000002681-0010	26.08.2008	24	26.08.2010
28	Rubidium Standard RUB	R&S		3000002681-0009	27.08.2008	24	27.08.2010
29	Switching and Signal Conditioning Unit SSCU	R&S	338864/003	3000002681-0006	Verified with path compensation		
30	Laser Printer HP Deskjet 2100	HP	N/A	3000002681-0011	n.a.		
31	19" Rack	R&S	11138363000004	3000002681	n.a.		
32	RF-cable set	R&S	N/A	3000002681	n.a.		
33	IEEE-cables	R&S	N/A	3000002681	n.a.		
34	Sampling System FSIQ-B70	R&S	835355/009	3000002681	s.No.7		
35	RSP programmable attenuator	R&S	834500/010	3000002681-0007	26.08.2008	24	26.08.2010
36	Signalling Unit	R&S	838312/011	3000002681	n.a.		
37	NGPE programmable Power Supply for EUT	R&S	192.033.41	3000002681			
39	Power Splitter 6005-3	Inmet Corp.	none	300002841	23.12.2006	24	23.12.2008
40	SMA Cables SPS-1151-985-SPS	Insulated Wire	different	different	n.a.		
41	CBT32 with EDR Signaling Unit	R&S					
42	Coupling unit	Narda	N/A	--	n.a.		
43	2xSwitch Matrix PSU	R&S	872584/021	300001329	n.a.		
44	RF-cable set	R&S	N/A	different	n.a.		
45	IEEE-cables	R&S	N/A	--	n.a.		

Note: 3000002681-00xx inventoried as a system

Anechoic chamber F:

No	Equipment/Type	Manuf.	Serial Nr.	Inv. No. Cetecom	Last Calibration	Frequency (months)	Next Calibration
1	Control Computer	F+W	FW0502032	300003303	-/-	-/-	-/-
2	Trilog Antenna	9163-295	-/-	-/-	30.04.2008	24	30.04.2010
3	Amplifier - 0518C-138	Veritech Micro-wave Inc.	-/-	-/-	-/-	-/-	-/-
4	Switch - 3488A	HP		300000368	-/-	-/-	-/-
5	EMI Test receiver - ESCI	R&S	100083	300003312	31.01.2007	24	31.01.2009
6	Turntable Controller - 1061 3M	EMCO	1218	300000661	-/-	-/-	-/-
7	Tower Controller 1051 Controller	EMCO	1262	300000625	-/-	-/-	-/-
8	Tower - 1051	EMCO	1262	300000625	-/-	-/-	-/-
10	Ultra Notch-Filter Rejected band Ch. 62	WRCD	9	-/-	-/-	-/-	-/-

7 Photographs of the Test Set-up

Photo documentation

Photo 1:



Photo 2:



Photo 3:



8 Photographs of the EUT

Photo documentation

Photo 4:

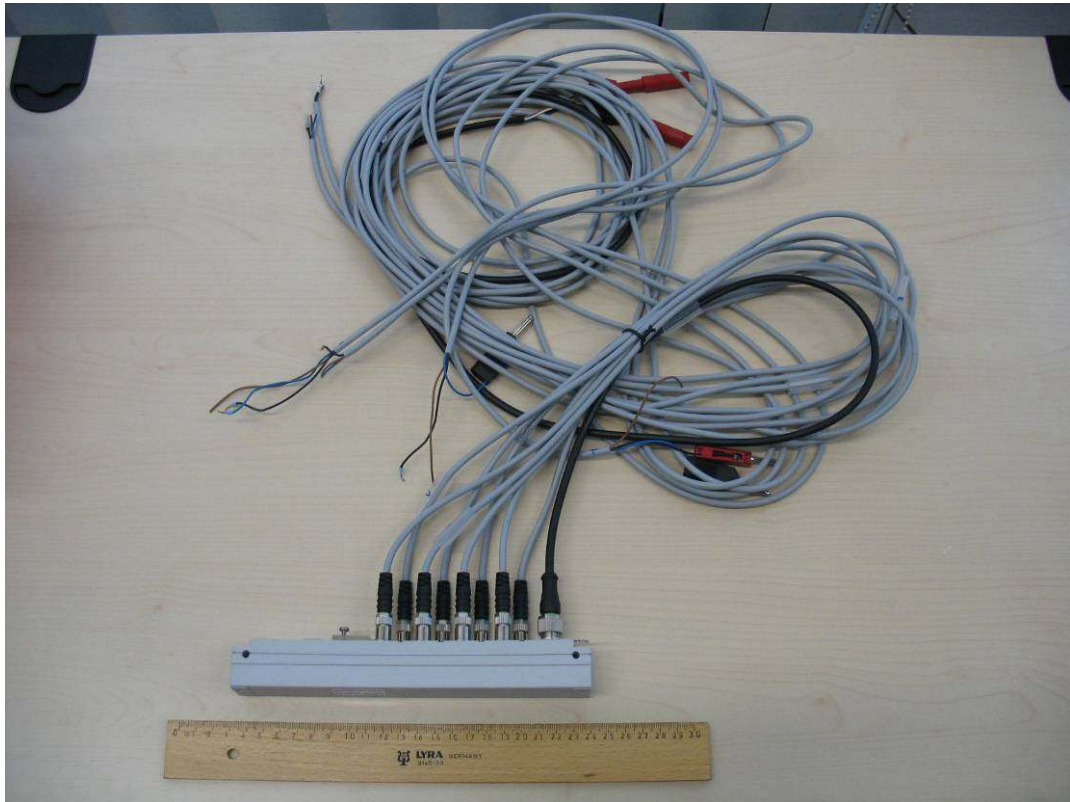


Photo 5:



Photo 6:



Photo 7:



Photo 8:



Photo 9:



Photo 10:

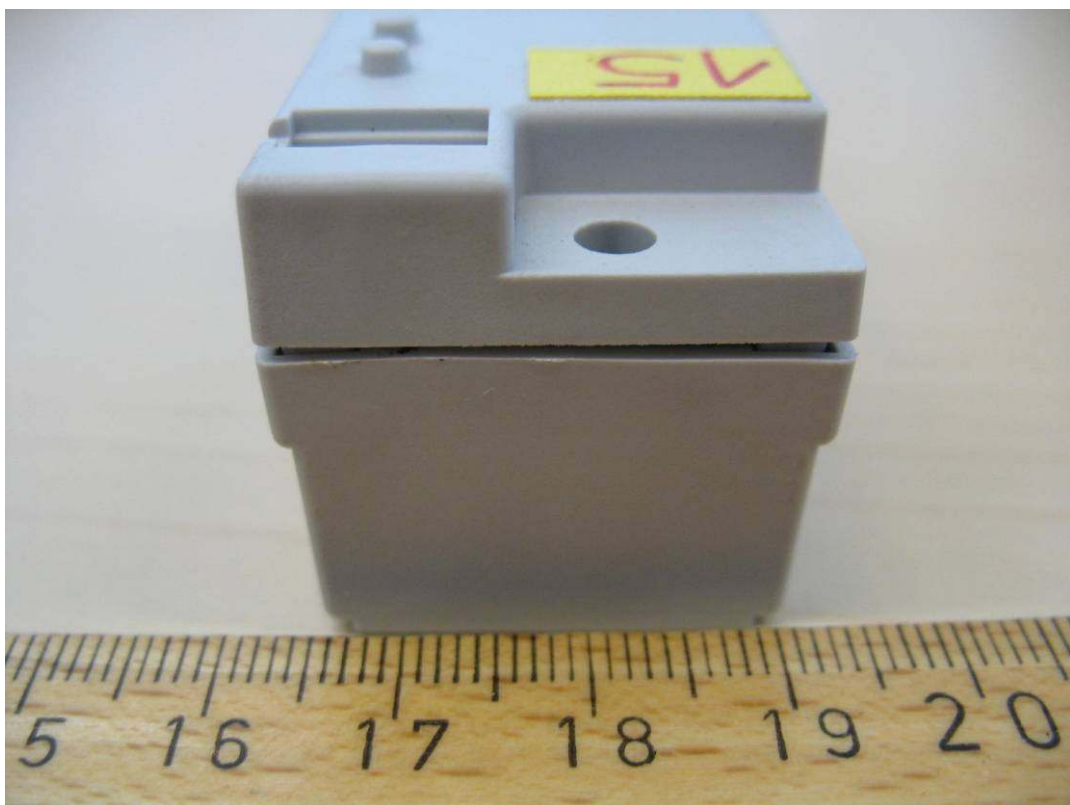


Photo 11:

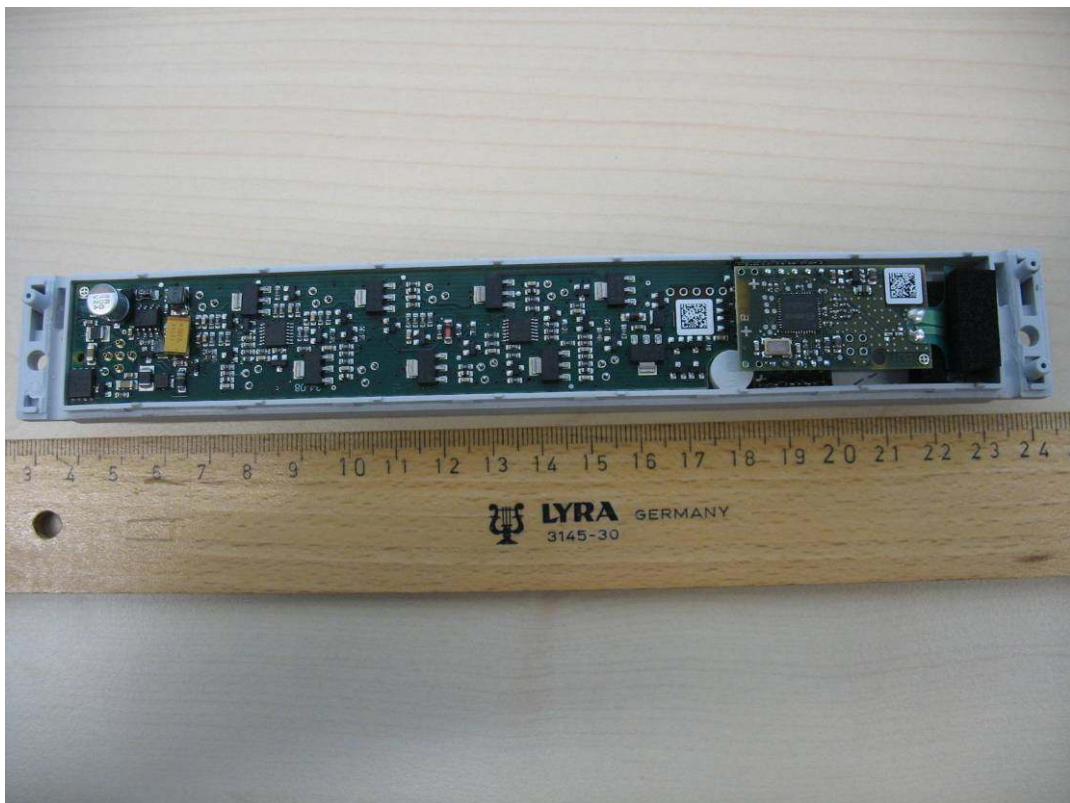


Photo 12:

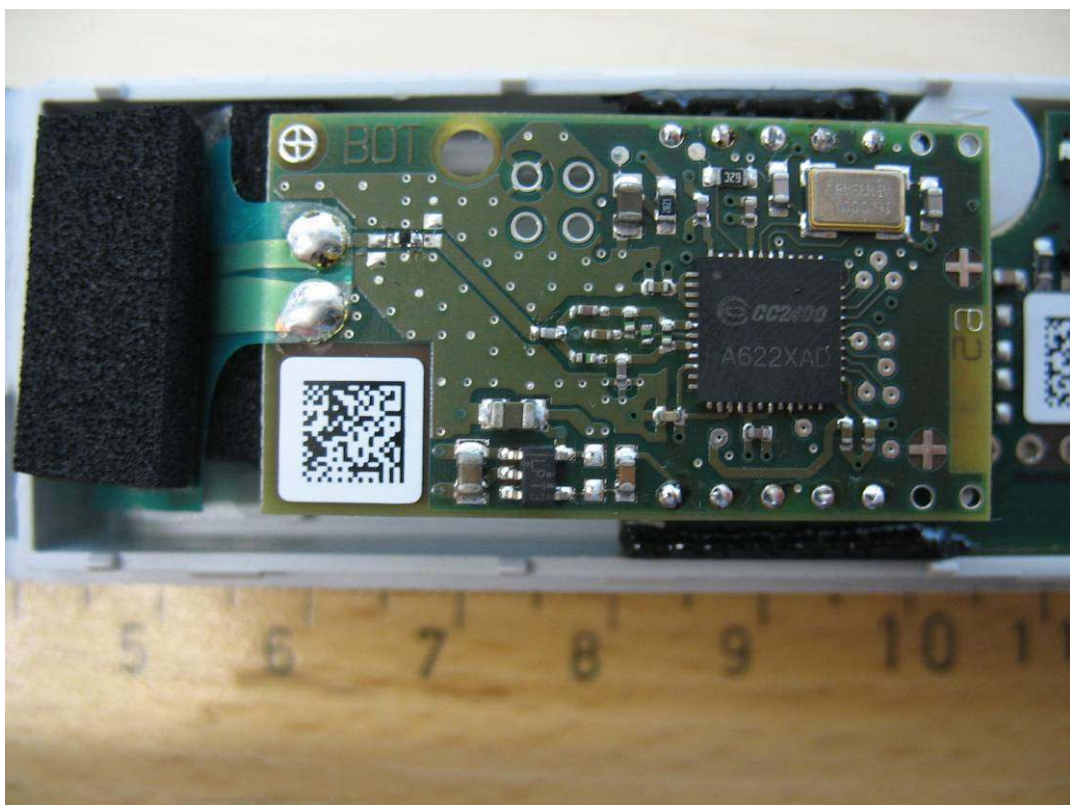


Photo 13:

