



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.: 3462C-1 (IC)

Certification ID: DE 0001

Accreditation ID: DE 0002

Accredited Bluetooth® Test Facility (BQTF)

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Test report no. : 1-0920-01-06/08-A
Type identification : 2.4 GHz radio modul
Applicant : Profoto AB
FCC ID : W4G-RMI
IC Certification No : 8167A-RMI
Test standards : 47 CFR Part 15
RSS - 210 Issue 7

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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:

2009-03-02

Date

Meheza K. Walla

Name



Signature


Technical responsibility for area of testing:

2009-03-02

Date

Michael Berg

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:	Profoto AB
Street:	Flygfältsgatan 4
Town:	12831 Skarpnäck
Country:	SWEDEN
Telephone:	+46-8-4475300
Fax:	
Contact:	Bo Dalenius
E-mail:	bo.dalenius@profoto.com
Telephone:	+46-8-4475300

1.4 Application details

Date of receipt of order:	2008-11-19
Date of receipt of test item:	2008-11-19
Date of start test:	2008-12-01
Date of end test	2009-03-02
Persons(s) who have been present during the test:	-/-

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:	Profoto AB
Street:	Flygfältsgatan 4
Town:	12831 Skarpnäck
Country:	SWEDEN

3.1.1 Test item

Kind of test item	:	2.4 GHz radio modul
Type identification	:	2.4 GHz radio modul
S/N serial number	:	-/-
HW hardware status	:	-/-
SW software status	:	-/-
Frequency Band [MHz]	:	ISM 2.400 - 2.483,5
Type of Modulation	:	MSK (diff. offset QPSK)
Number of channels	:	8 (2404, 2412, 2417, 2422, 2427, 2447, 2454, 2479)
Antenna	:	One integrated and one external antenna
Power Supply	:	3.3 V DC powered by power supply or battery
Temperature Range	:	-20 °C to +55 °C

Max. power radiated: 11.87 dBm

Max. power conducted: 13.78 dBm

FCC ID: W4G-RMI

IC: 8167A-RMI

3.1.2 Additional EUT information For IC Canada (appendix 2)

IC Registration Number:	8167A-RMI
Model Name:	2.4 GHz radio modul
Manufacturer (complete Address):	Profoto AB Flygfältsgatan 4 12831 Skarpnäck SWEDEN
Tested to Radio Standards Specification (RSS) No.:	RSS-210 Issue 7
Open Area Test Site Industry Canada Number:	IC 3462C-1
Frequency Range (or fixed frequency) [MHz]:	2404 – 2479 MHz
RF: Power [W] (max):	QPSK: Rad. EIRP: 15.38 mW Conducted : 23.88 mW
Antenna Type:	Integrated and External antenna
Field Strength [dBμV/m in 3m]:	107.1
Occupied Bandwidth (99% BW) [kHz]:	1322 (20 dB Bandwidth Measurement)
Type of Modulation:	QPSK
Emission Designator (TRC-43):	13M2G1D
Transmitter Spurious (worst case) [dBμV/m in 3m]:	32.9
Receiver Spurious (worst case) [dBμV/m in 3m]:	33.0

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: Meheza K. Walla

Date: 2009-03-02

3.1.3 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

3.1.4 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	3.3

Type of power source: **DC powered by power supply or battery**

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	2009-03-02	-/-

Test Specification Clause	Test Case	Modulation	Pass	Fail	N/A	Not performed
None	Antenna Gain	QPSK	Yes			
§15.247(a1)	Carrier frequency separation	QPSK			Yes	
§15.247(a1)	Number of hopping channels	QPSK			Yes	
§15.247(a)(1)(iii)	Time of occupancy (dwell time)	QPSK			Yes	
§15.247(e)	Power Spectral density (Hybrid system in Inquiry mode/Page scan)	QPSK	Yes			
§15.247(a)(1)	Spectrum Bandwidth of a FHSS System / 20dB Bandwidth	QPSK	Yes			
	6dB Bandwidth Measurement	QPSK	Yes			
§ 15.247 (b)(1)	Maximum output power (conducted)	QPSK	Yes			
§ 15.247 (b)(1)	Max. peak output power (radiated)	QPSK	Yes			
§ 15.247 (d)	Band-edge compliance of conducted emissions	QPSK	Yes			
§ 15.205	Band-edge compliance of radiated emissions	QPSK	Yes			
§ 15.247 (d)	Spurious Emission - conducted (Transmitter)	QPSK	Yes			
§ 15.247 (d)	Spurious Emission - radiated (Transmitter) >30 MHz	QPSK	Yes			
§ 15.109	Spurious Emissions - radiated (Receiver)	QPSK	Yes			
§ 15.209	Spurious Emissions - radiated (Transmitter) <30 MHz	QPSK	Yes			
§ 15.107/207	Conducted Emissions <30 MHz	QPSK	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 20 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 set-ups 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 MHz: 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, biconical antenna

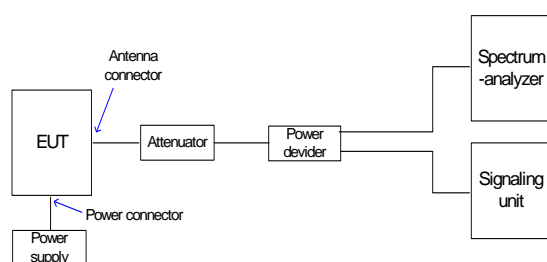
200MHz - 1GHz: Quasi Peak measurement, 120 kHz Bandwidth, log periodic antenna

>1GHz: Average, RBW 1MHz, VBW 10 Hz, wave guide horn

All measurement settings are according to FCC 15.209 and 15.207

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 connected to the spectrum analyzer. The specific losses for signal path are first checked within a calibration. The measurement readings on the 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.

Profoto 2.4 GHz Radio modul with an internal antenna

	low channel 2404 MHz	mid channel 2447 MHz	high channel 2479 MHz
Conducted power [dBm] (measured)	13.78	13.32	13.14
Radiated power [dBm] (measured)	11.87	11.09	11.23
Gain [dBi] (calculated)	-1.91	-2.23	-1.91

Profoto 2.4 GHz Radio modul with an external antenna

	low channel 2404 MHz	mid channel 2447 MHz	high channel 2479 MHz
Conducted power [dBm] (measured)	13.78	13.32	13.14
Radiated power [dBm] (measured)	10.17	10.23	10.09
Gain [dBi] (calculated)	-3.61	-3.09	-3.05

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

Not applicable!

Limits:

Under normal test conditions only	Minimum 25 kHz or 20 dB Bandwidth of the hopping system
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5.6 Number of hopping channels §15.247(a) (1)

Not applicable!

Limits:

Under normal test conditions only	at least 15 non-overlapping channels
-----------------------------------	--------------------------------------

5.7 Time of occupancy (dwell time) §15.247(a) (1) (iii)

Not applicable!

For Bluetooth devices:

The dwell time of 0.4 s within a 31.6 second period in data mode is independent from the packet type (packet length).
The calculation for a 31.6 second period is as follows:

Dwell time = time slot length * hop rate / number of hopping channels * 31.6 s

Example for a DH1 packet (with a maximum length of one time slot)

Dwell time = $625 \mu\text{s} * 1600 \text{ 1/s} / 79 * 31.6 \text{ s} = 0.4 \text{ s}$ (in a 31.6 s period)

For multi-slot packet the hopping is reduced according to the length of the packet.

Example for a DH5 packet (with a maximum length of five time slots)

Dwell time = $5 * 625 \mu\text{s} * 1600 * 1/5 * 1/s / 79 * 31.6 \text{ s} = 0.4 \text{ s}$ (in a 31.6 s period)

This is according to the Bluetooth Core Specification V 1.1 & V 1.2 & V2.0 (+ critical errata) for all Bluetooth devices.

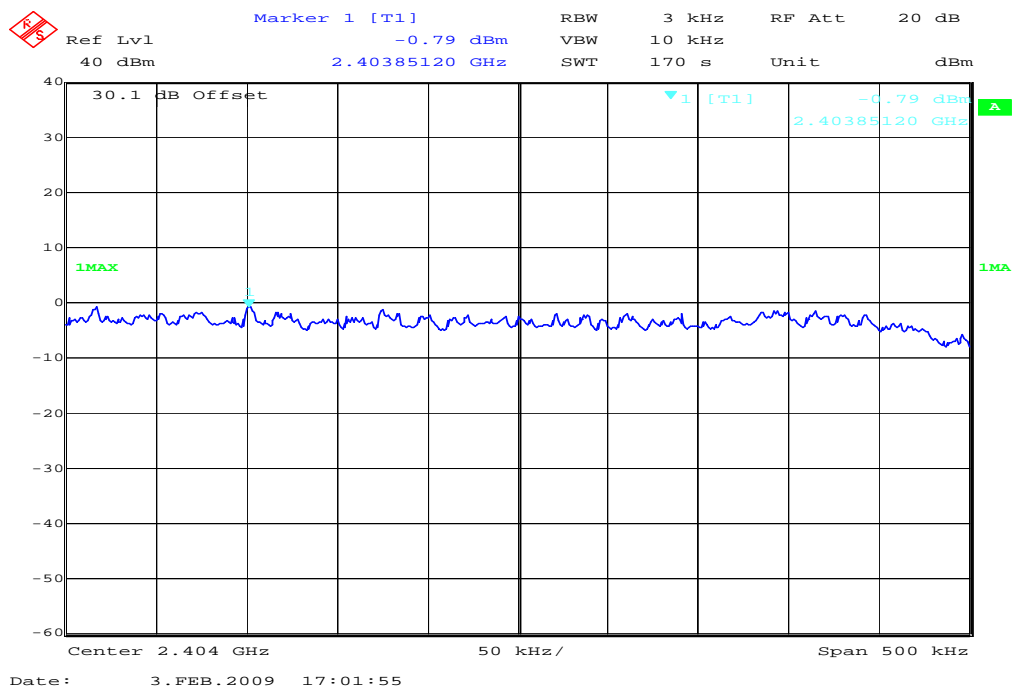
Therefore, all Bluetooth devices comply with the FCC dwell time requirement in the data mode.

This was checked during the Bluetooth Qualification tests.

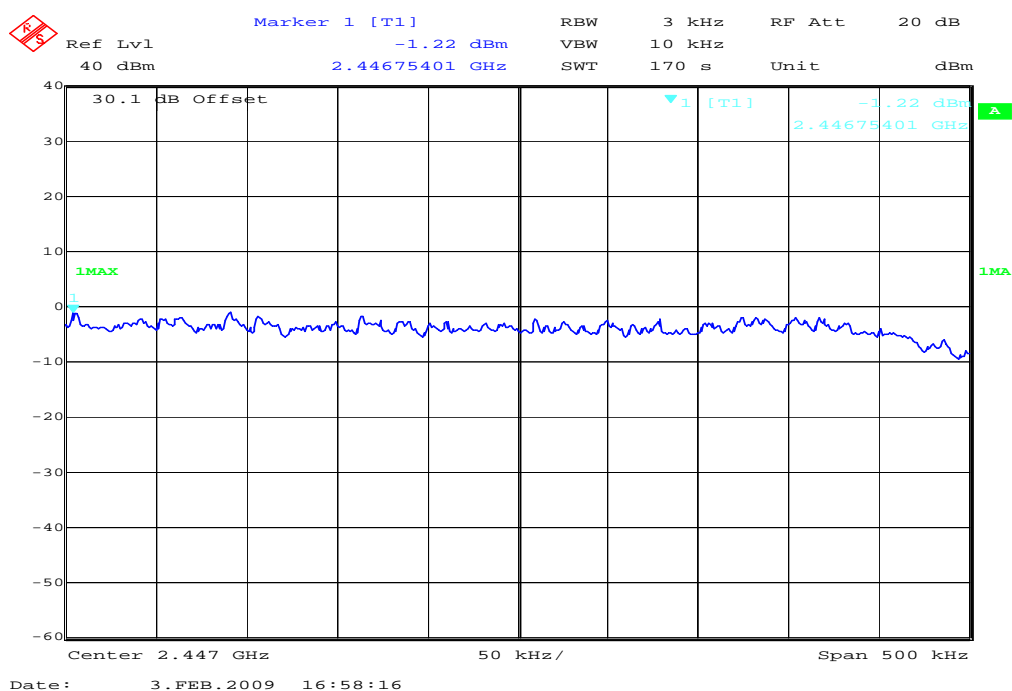
The Dwell time in hybrid mode is approximately 2.6 ms (in a 12.8s period)

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

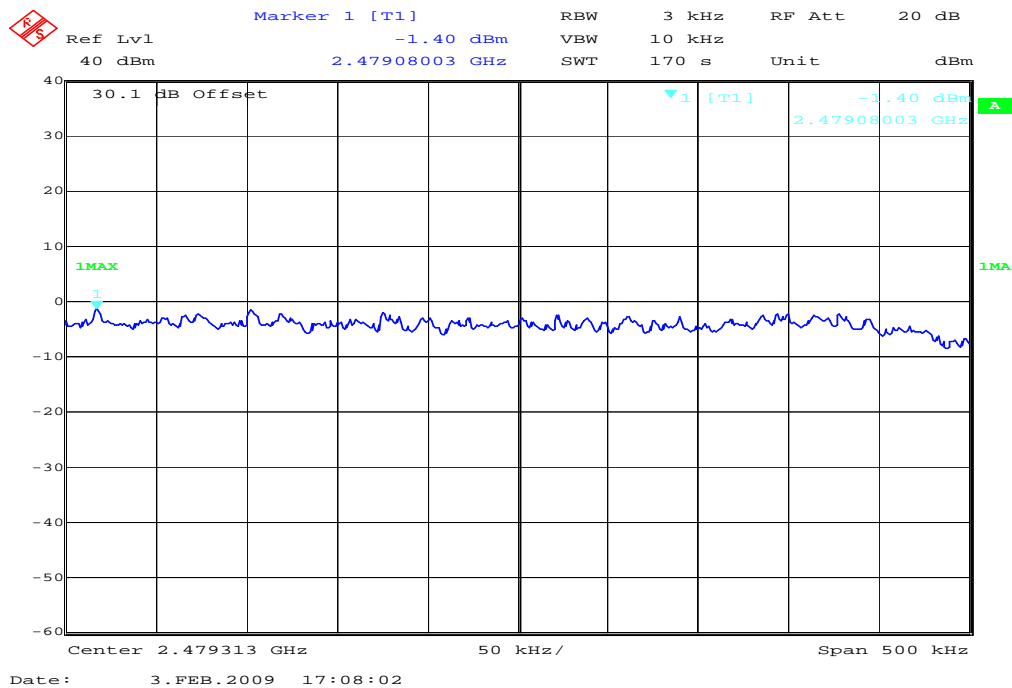
Plot 1:



Plot 2:



Plot 3:



Result:

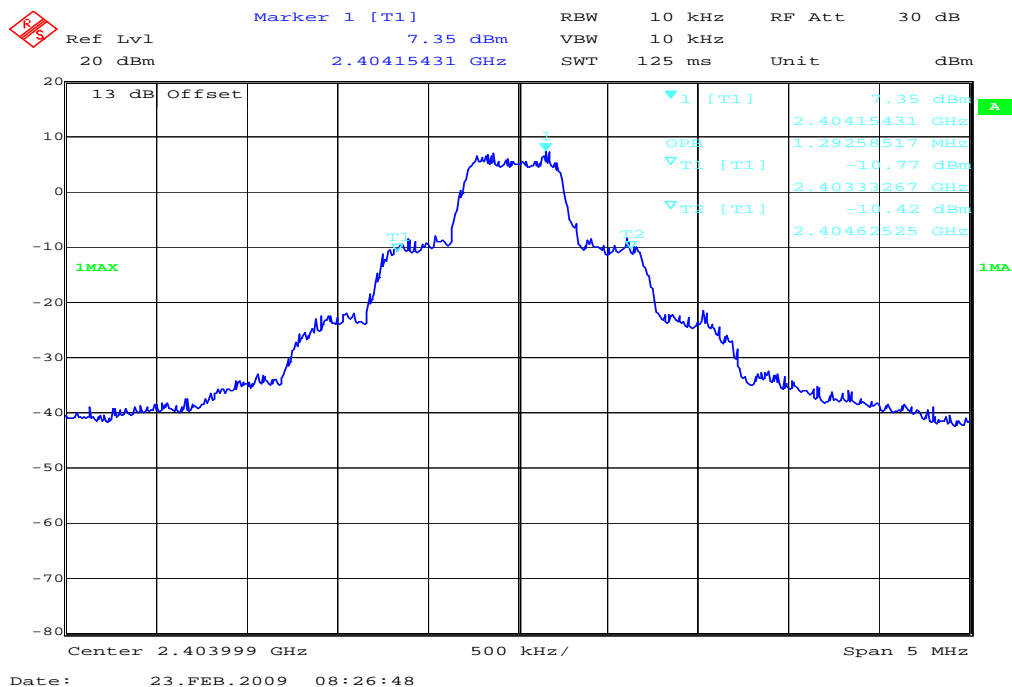
Plot 1: Power density = -0.79 dBm / 3 KHz
Plot 2: Power density = -1.22 dBm / 3 KHz
Plot 3: Power density = -1.40 dBm / 3 KHz

Limits:

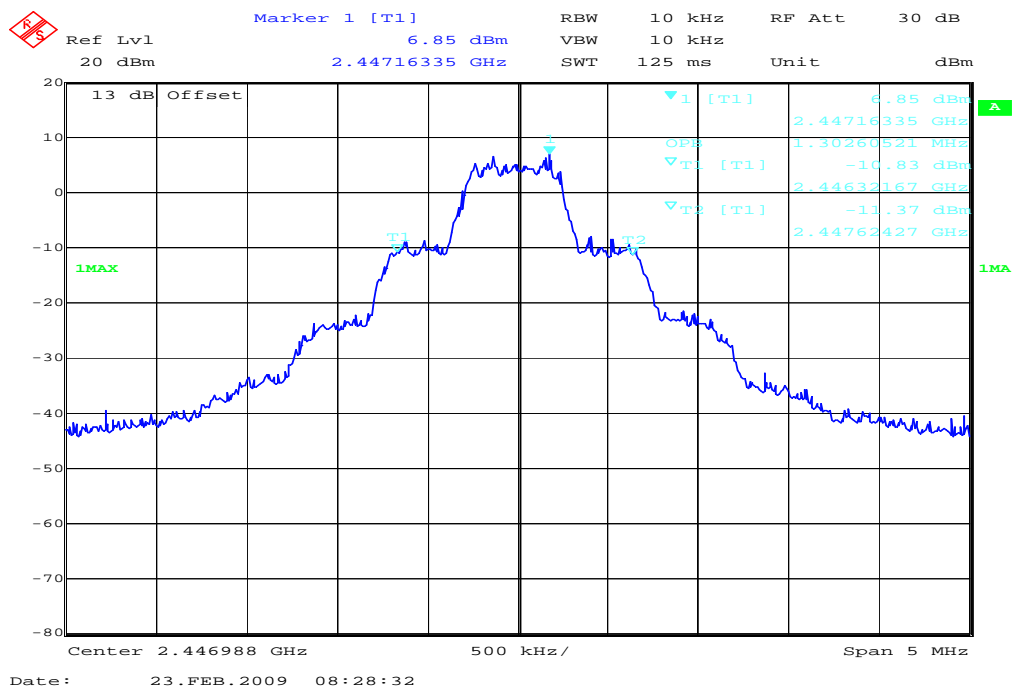
Under normal test conditions only	For digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission
-----------------------------------	---

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

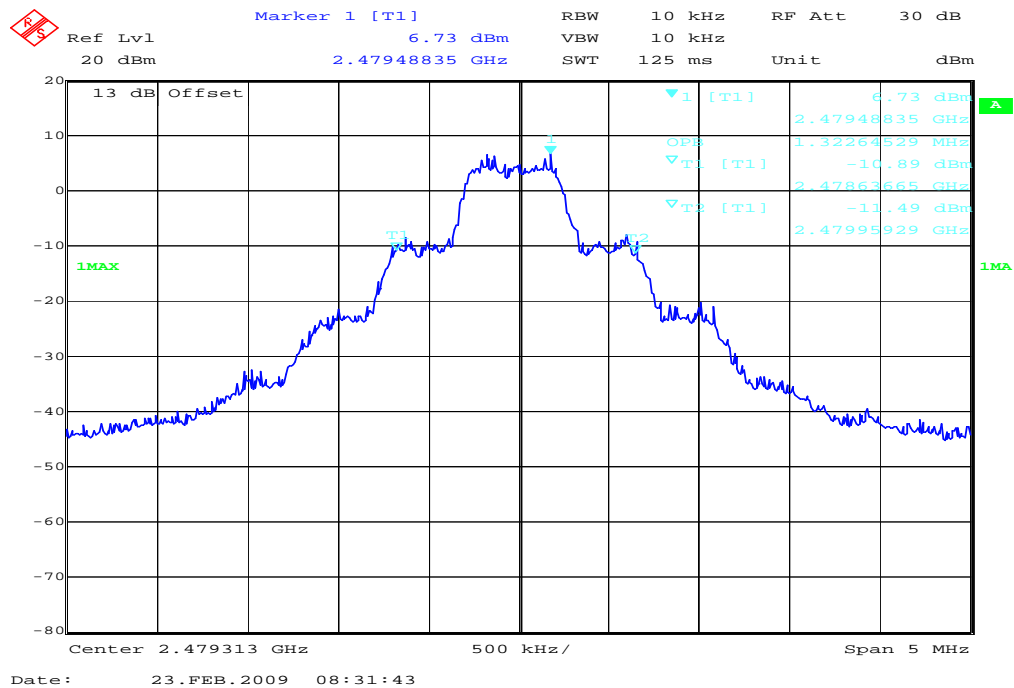
Plot 1: QPSK



Plot 2: QPSK



Plot 3: QPSK



Results:

Modulation	20 dB BANDWIDTH [kHz]		
Frequency [MHz]	2404	2447	2479
QPSK	1292	1302	1322
Measurement uncertainty	±1kHz		

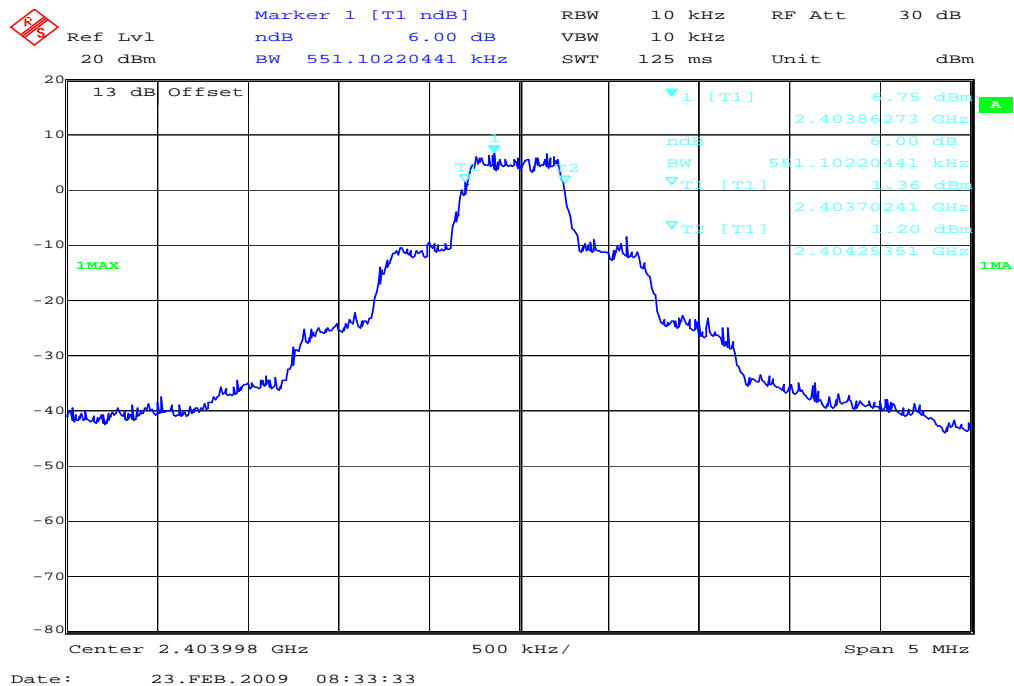
RBW: 10 kHz / VBW 10 kHz

Limits:

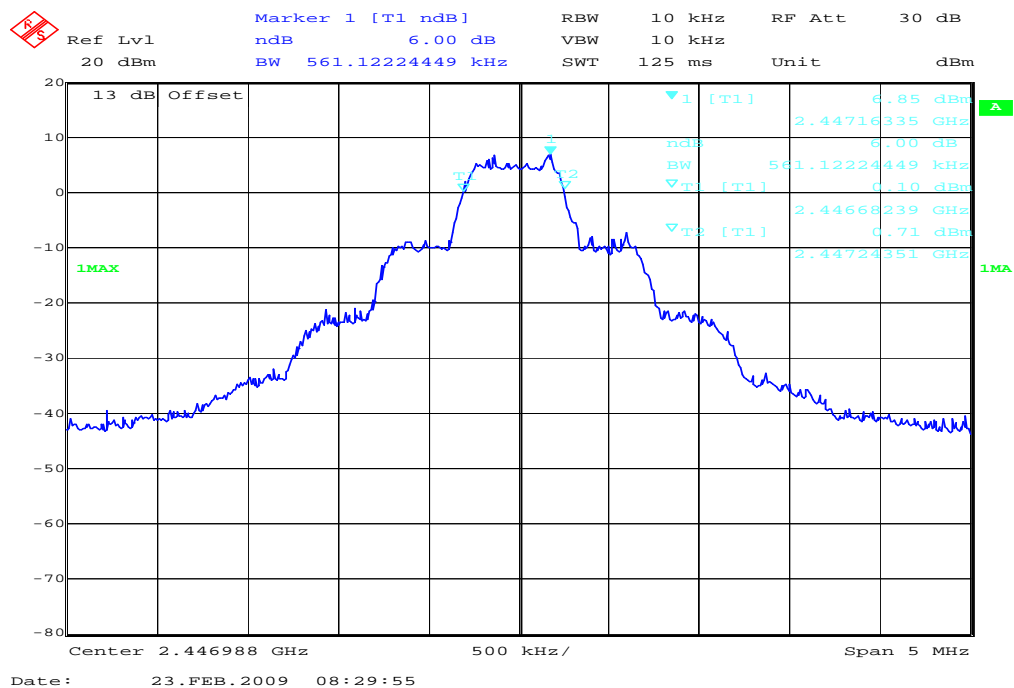
Under normal test conditions only	For devices operating above 900 MHz, the emission shall be no wider than 0.5 % of the centre frequency.
-----------------------------------	---

5.10 6 dB Bandwidth Measurement

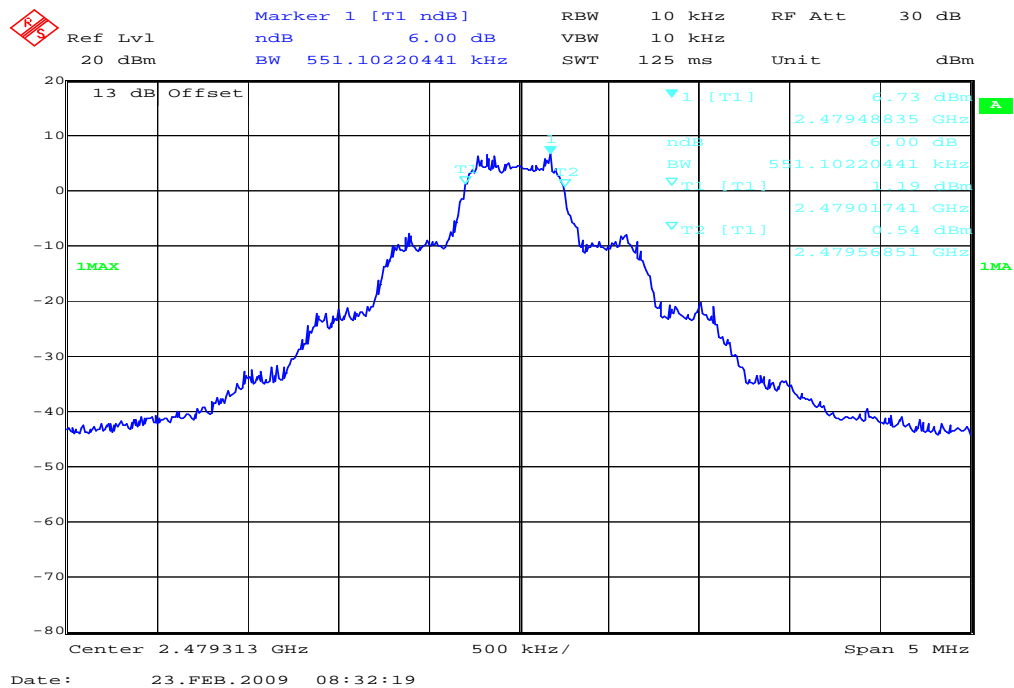
Plot 1: QPSK



Plot 2: QPSK



Plot 3: QPSK



Results:

Modulation	6 dB BANDWIDTH [kHz]		
Frequency [MHz]	2404	2447	2479
QPSK	551	561	551
Measurement uncertainty	±1kHz		

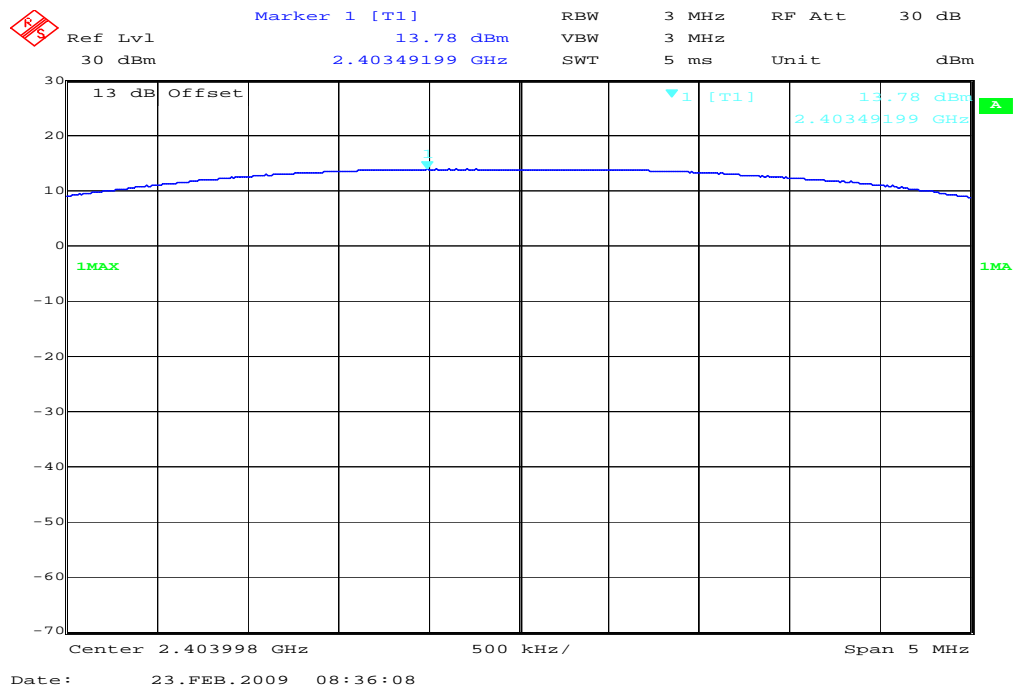
RBW: 10 kHz / VBW 10 kHz

Limits:

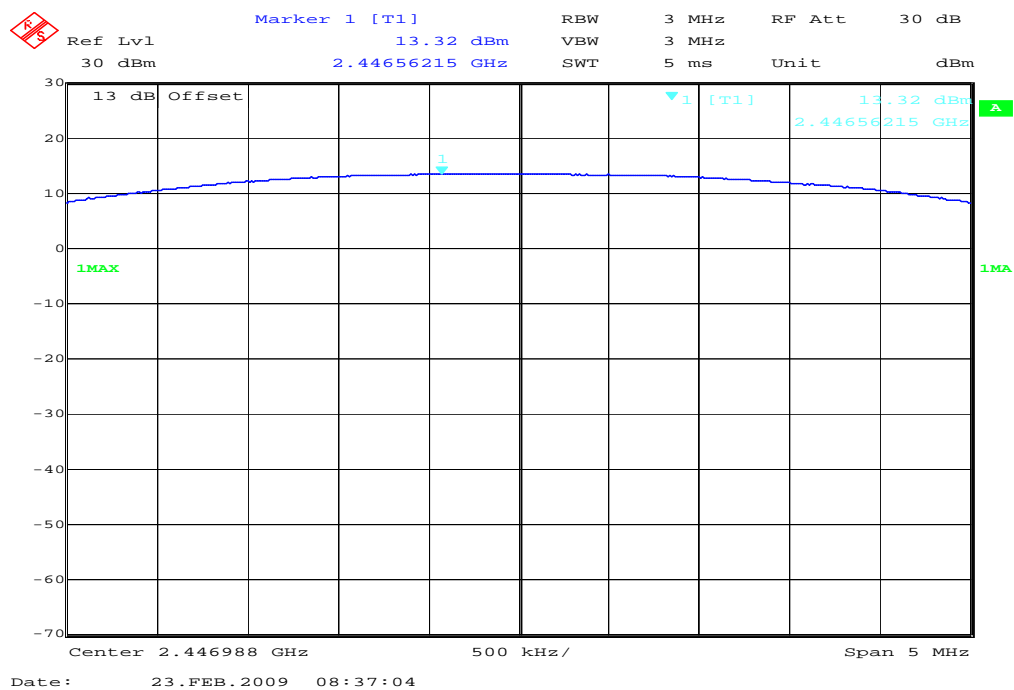
Under normal test conditions only	QPSK > 500 kHz
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5.11 Maximum output power (conducted) § 15.247 (b) (1)

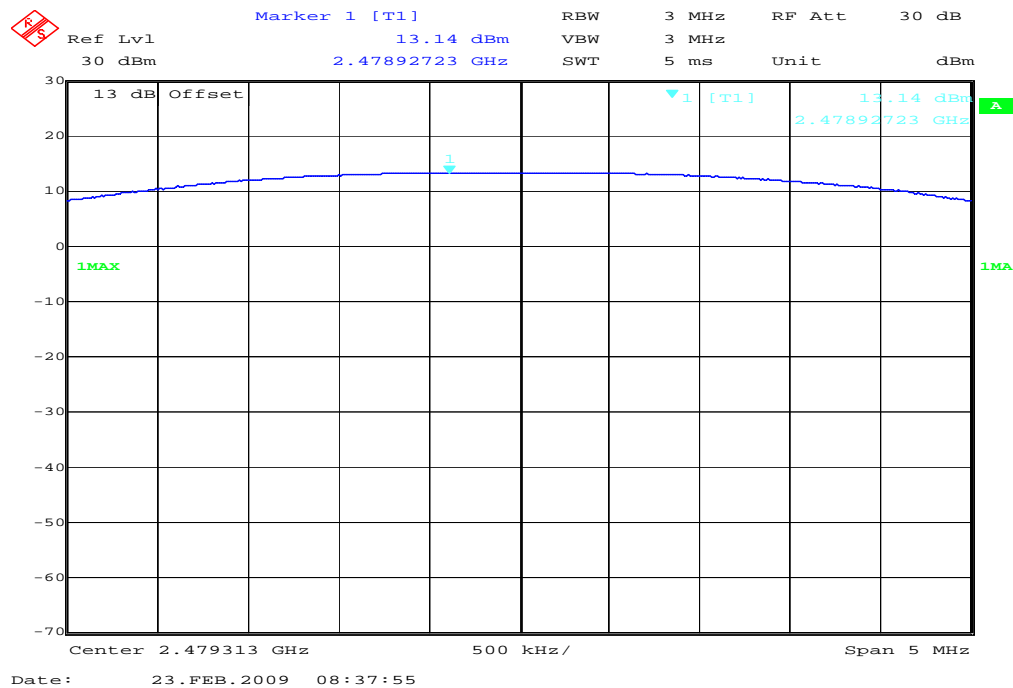
Plot 1: QPSK



Plot 2: QPSK



Plot 3: QPSK



Results:

Modulation	Max. peak output power [dBm]		
Frequency [MHz]	2404	2447	2479
QPSK	13.78	13.32	13.14
Measurement uncertainty	±2dB		

RBW / VBW: 3 MHz

Limits:

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

5.12 Max. peak output power (radiated) § 15.247 (b)(1)

Profoto 2.4 GHz Radio modul with an internal antenna

Modulation: QPSK

Results:

Test conditions		Max. peak output power EIRP [dBm]		
Frequency [MHz]		2404	2447	2479
T _{nom}	V _{nom}	11.87	11.09	11.23
Measurement uncertainty		±3dB		

RBW / VBW: 3 MHz

Measured at a distance of 3m

Profoto 2.4 GHz Radio modul with an external antenna

Modulation: QPSK

Results:

Test conditions		Max. peak output power EIRP [dBm]		
Frequency [MHz]		2404	2447	2479
T _{nom}	V _{nom}	10.17	10.23	10.09
Measurement uncertainty		±3dB		

RBW / VBW: 3 MHz

Measured at a distance of 3m

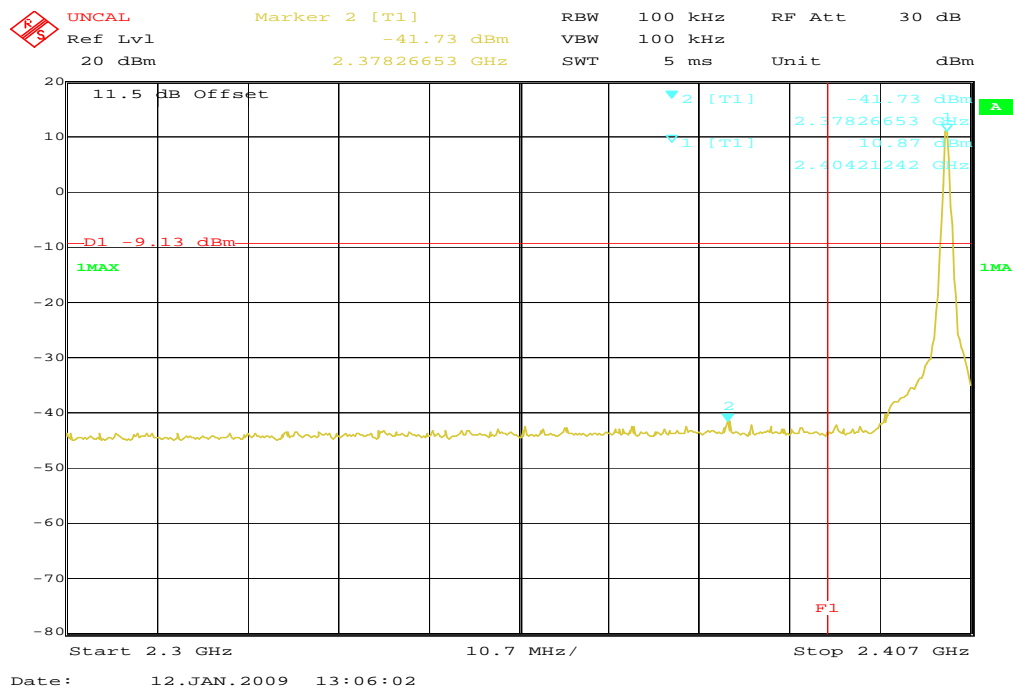
Limits:

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

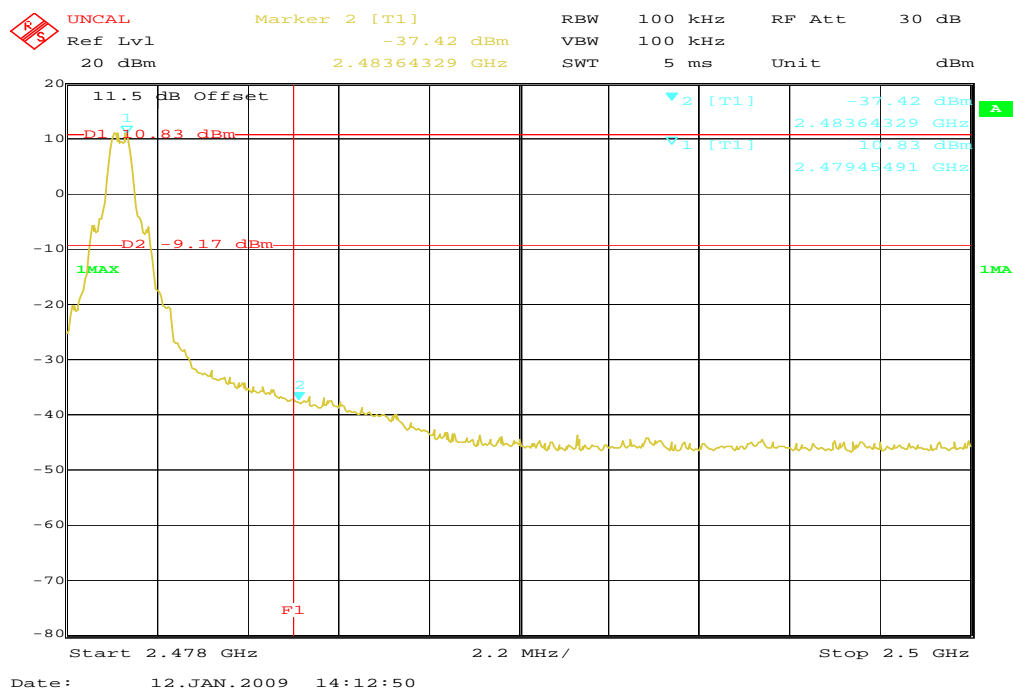
5.13 Band-edge compliance of conducted emissions §15.247 (d)

Modulation: QPSK

Plot 1 of 2 (lowest frequency):



Plot 2 of 2 (highest frequency):



Results:

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

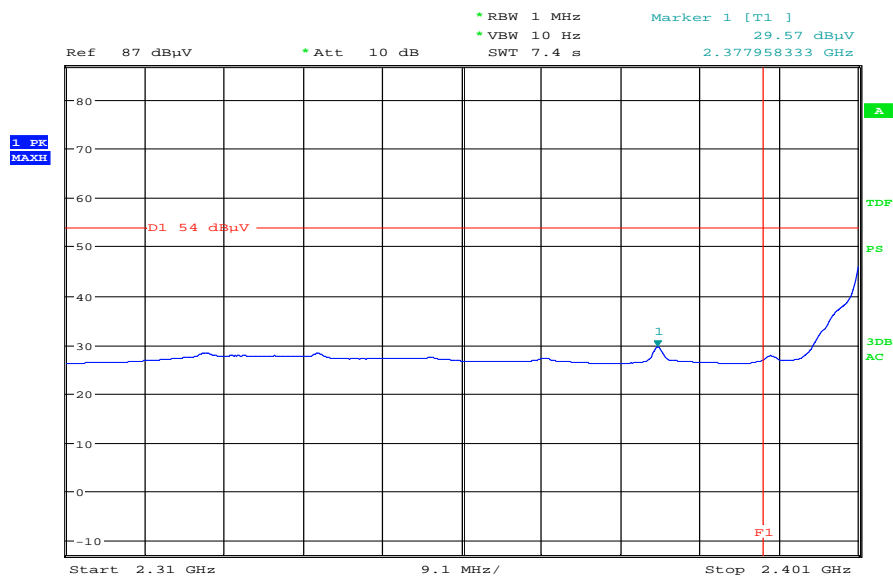
Limits:

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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5.14 Band-edge compliance of radiated emissions §15.205

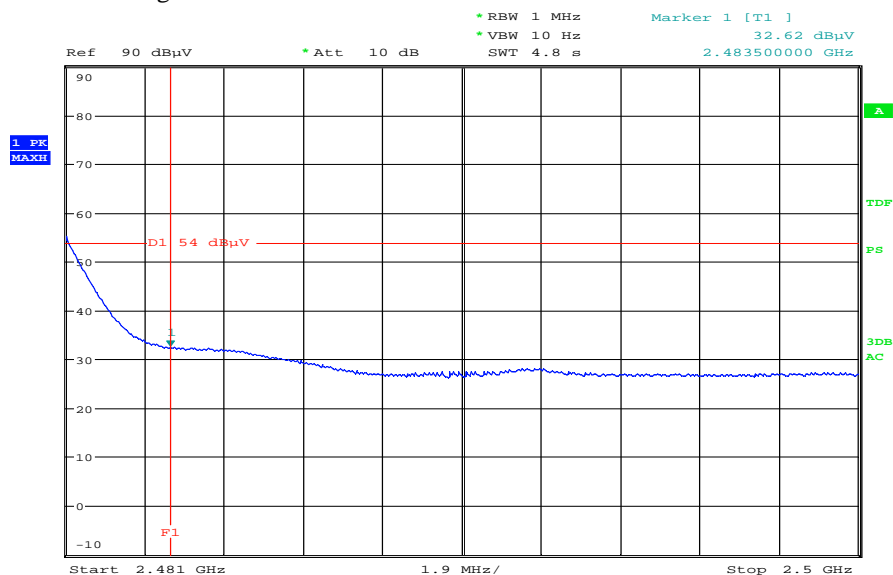
Modulation: QPSK

Plot 4: Restricted Bands low



Date: 4.FEB.2009 11:47:19

Plot 5: Restricted Bands high



Date: 4.FEB.2009 11:55:46

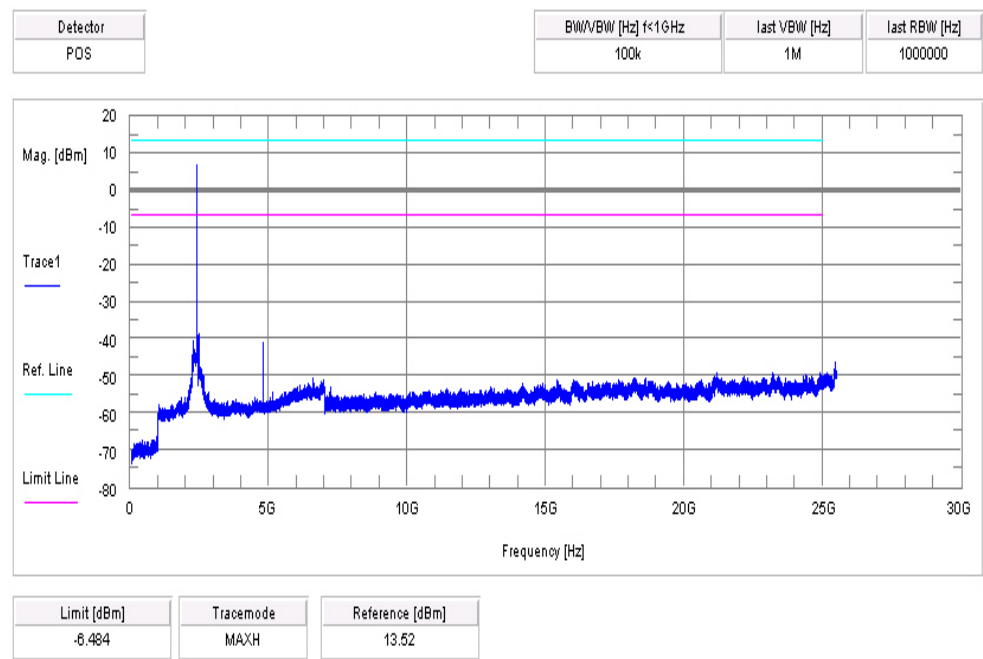
Limit: 54 dBμV/m

Verdict: Complies

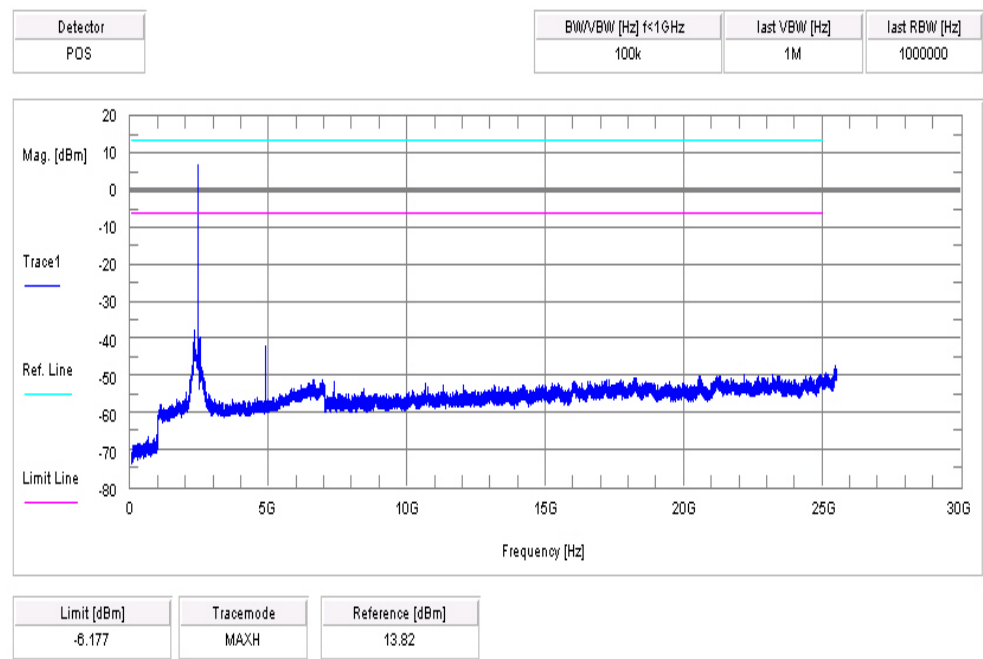
5.15 Spurious Emissions - conducted (Transmitter) § 15.247 (c) (1)

Modulation: QPSK

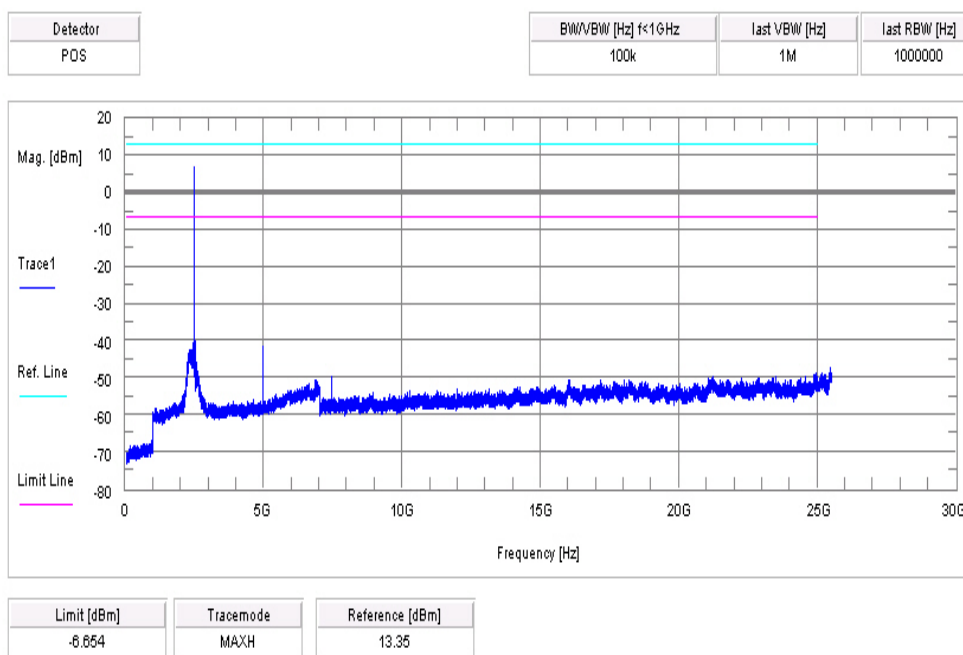
Plot 1 of 3: lowest channel



Plot 2 of 3: middle channel



Plot 3 of 3: highest channel



Result & Limits:

Emission Limitation					
Frequency [MHz]		amplitude of emission [dBm]	limit max. allowed emission power	actual attenuation below frequency of operation [dB]	results
2404		13.52	30 dBm		Operating frequency
No critical peaks found			-20 dBc		complies
					complies
2447		13.82	30 dBm		Operating frequency
No critical peaks found			-20 dBc		complies
					complies
2479		13.35	30 dBm		Operating frequency
No critical peaks found			-20 dBc		complies
					complies
Measurement uncertainty		± 3dB			

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

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

2.4 GHz radio modul with an internal antenna

Modulation: QPSK

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

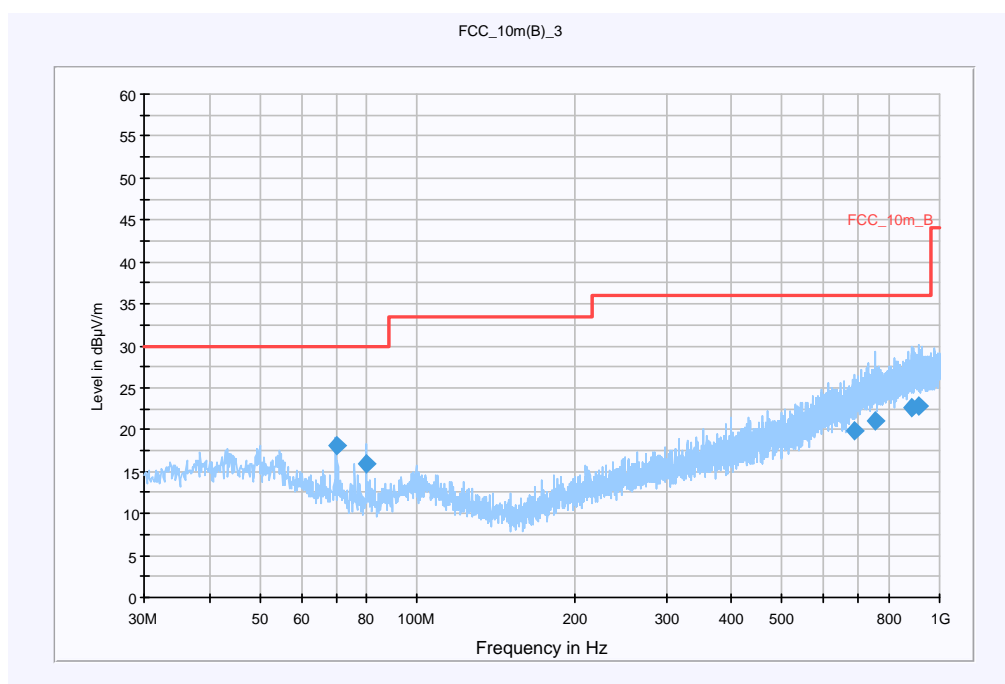
Information

EUT:	Profoto 2.4 GHz Radio modul with an internal antenna
Serial Number:	-/-
Test Description:	FCC Part 15B @ 10 m
Operating Conditions:	Low Channel
Operator Name:	LANGER
Comment:	Powered with DC 3.3 V

Scan Setup: STAN_Fin [EMI radiated]

Hardware Setup:	Electric Field (NOS)
Level Unit:	dBμV/m

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

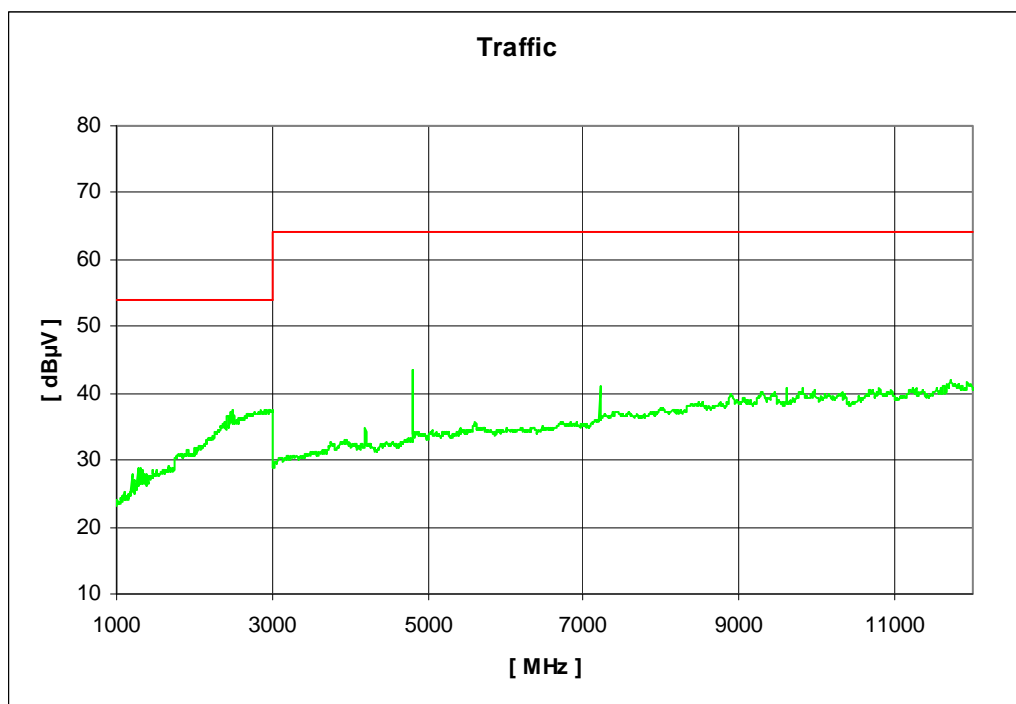


Final Result

Frequency [MHz]	QuasiPeak [dBμV/m]	Meas. Time [ms]	Bandwidth [kHz]	Antenna height [cm]	Polarity	Turntable position [deg]	Corr. [dB]	Margin [dB]	Limit [dBμV/m]	Comment
69.964450	18.1	15000.000	120.000	220.0	V	141.0	9.6	11.9	30.0	
79.971500	16.0	15000.000	120.000	220.0	V	164.0	9.4	14.0	30.0	
685.649650	19.8	15000.000	120.000	212.0	V	233.0	22.6	16.2	36.0	
751.679700	21.1	15000.000	120.000	220.0	V	315.0	24.2	14.9	36.0	
887.941000	22.6	15000.000	120.000	118.0	H	72.0	25.5	13.4	36.0	
914.899900	22.9	15000.000	120.000	220.0	H	27.0	25.7	13.1	36.0	

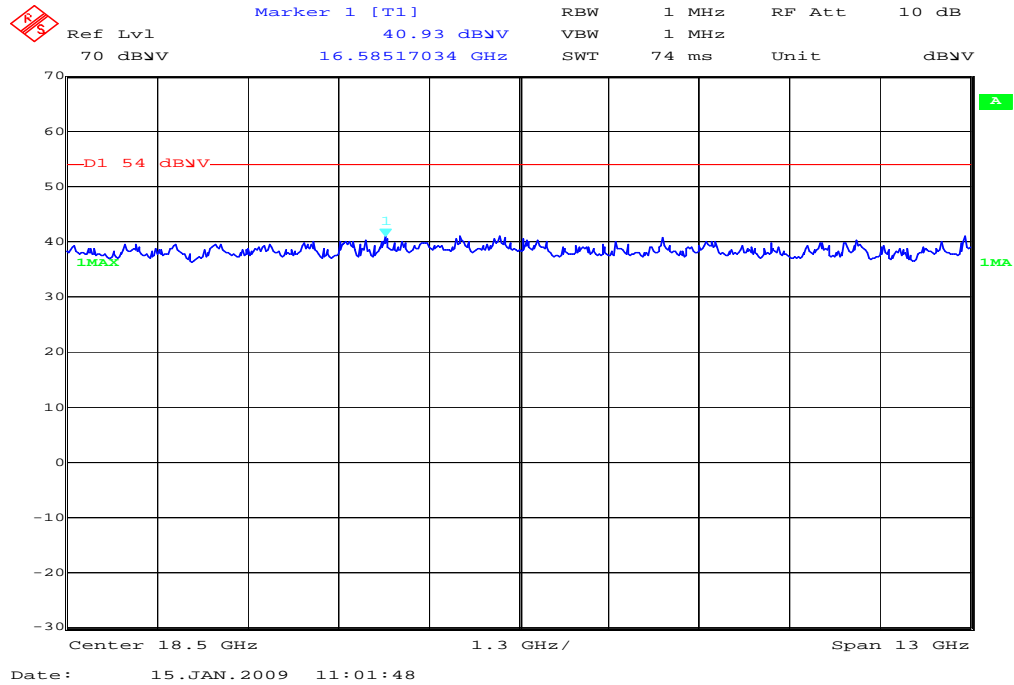
Plot 2: 1 - 12 GHz vertical/horizontal (lowest channel)

EUT:	2.4 GHz Radio modul	Polarisation:	Horizontal, Vertikal
Manufacturer:	Profoto	Battery:	AC/DC Power Supply
IMEI:	int ant, ch1	HW:	-/-
Operator:	WAL	SW:	-/-
Start of Test :	24.02.2009 07:54:56	Vmin:	-/-
Standard:	FCC_15_407_2400	Vnom:	3.3 V DC
Signalling Unit:	CMU200	Vmax:	-/-
Start Freq. [MHz]:	1000	Stop Freq. [MHz]	12000
Transducer-File:	C:\Spurious_neu\Messparameter\FCC_15_407_2400\Transducer_FCC_15_407_2400.xls		



The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 3: 12 - 25 GHz vertical/horizontal (valid for all channels)



Plot 4: 0.03 - 1 GHz vertical/horizontal (middle channel)

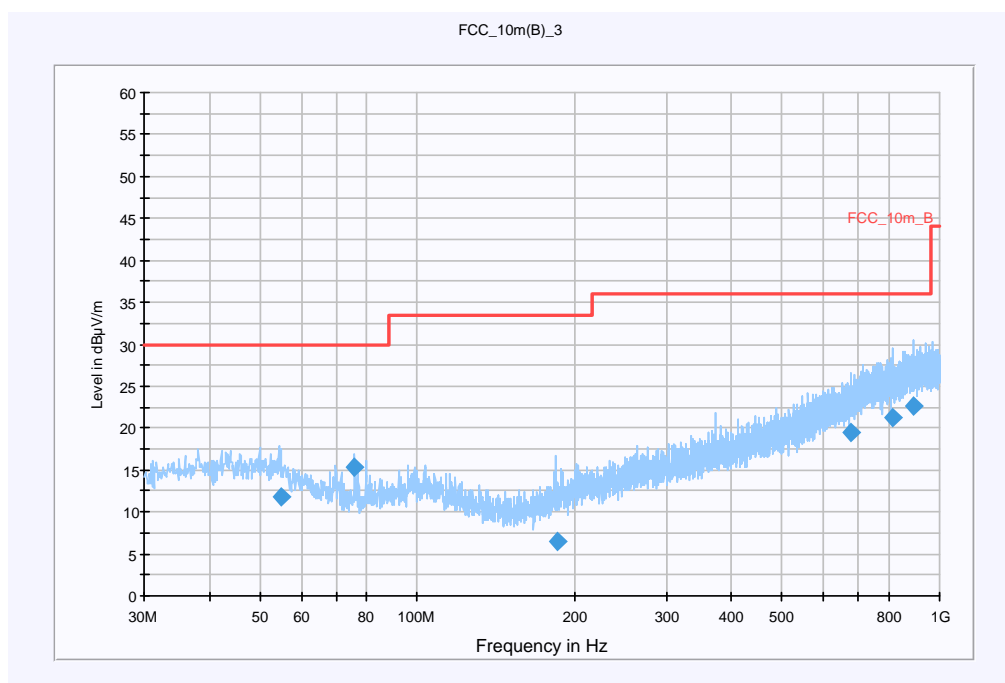
Information

EUT:	Profoto 2.4 GHz Radio modul with an internal antenna
Serial Number:	-/-
Test Description:	FCC Part 15B @ 10 m
Operating Conditions:	Middle Channel
Operator Name:	LANGER
Comment:	Powered with DC 3.3 V

Scan Setup: STAN_Fin [EMI radiated]

Hardware Setup:	Electric Field (NOS)
Level Unit:	dBμV/m

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

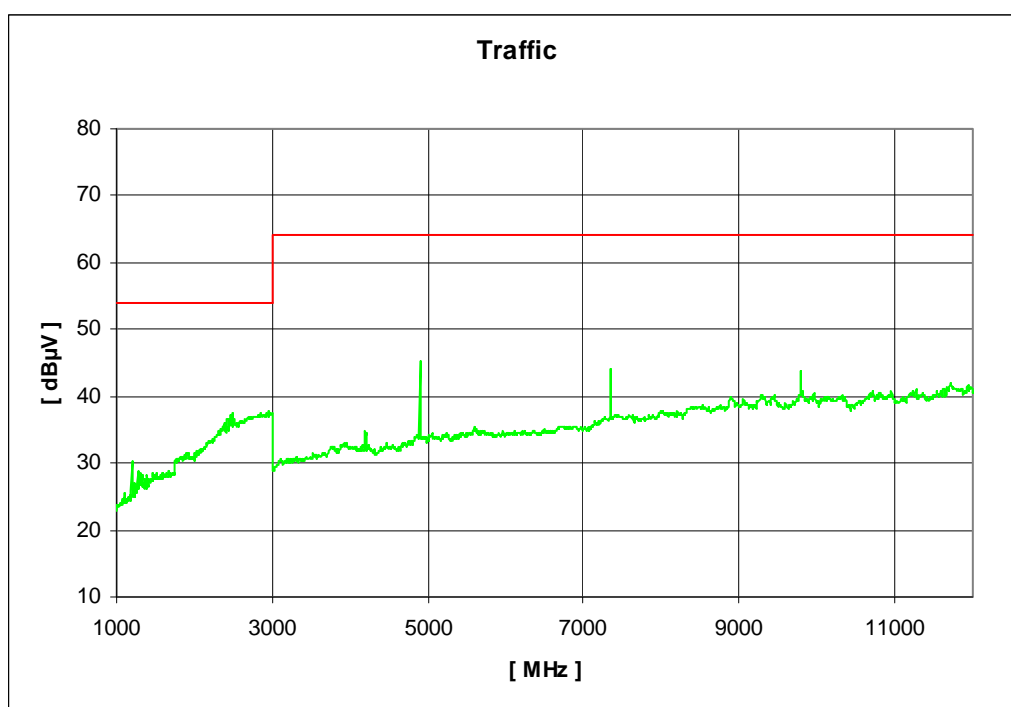


Final Result

Frequency [MHz]	QuasiPeak [dBμV/m]	Meas. Time [ms]	Bandwidth [kHz]	Antenna height [cm]	Polarity	Turntable position [deg]	Corr. [dB]	Margin [dB]	Limit [dBμV/m]	Comment
54.944250	11.7	15000.000	120.000	220.0	V	315.0	13.1	18.3	30.0	
76.021700	15.3	15000.000	120.000	220.0	V	78.0	9.4	14.7	30.0	
184.964200	6.5	15000.000	120.000	163.0	V	118.0	11.0	27.0	33.5	
675.929300	19.4	15000.000	120.000	220.0	H	323.0	22.4	16.6	36.0	
811.455500	21.3	15000.000	120.000	220.0	H	310.0	24.5	14.7	36.0	
889.002150	22.6	15000.000	120.000	210.0	H	235.0	25.6	13.4	36.0	

Plot 5: 1 - 12 GHz vertical/horizontal (middle channel)

EUT:	2.4 GHz Radio modul	Polarisation:	Horizontal, Vertikal
Manufacturer:	Profoto	Battery:	AC/DC Power Supply
IMEI:	int ant, ch6	HW:	-/-
Operator:	WAL	SW:	-/-
Start of Test :	24.02.2009 08:08:23	Vmin:	-/-
Standard:	FCC_15_407_2400	Vnom:	3.3 V DC
Signalling Unit:	CMU200	Vmax:	-/-
Start Freq. [MHz]:	1000	Stop Freq. [MHz]	12000
Transducer-File:	C:\Spurious_neu\Messparameter\FCC_15_407_2400\Transducer_FCC_15_407_2400.xls		



The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 6: 0.03 - 1 GHz vertical/horizontal (highest channel)

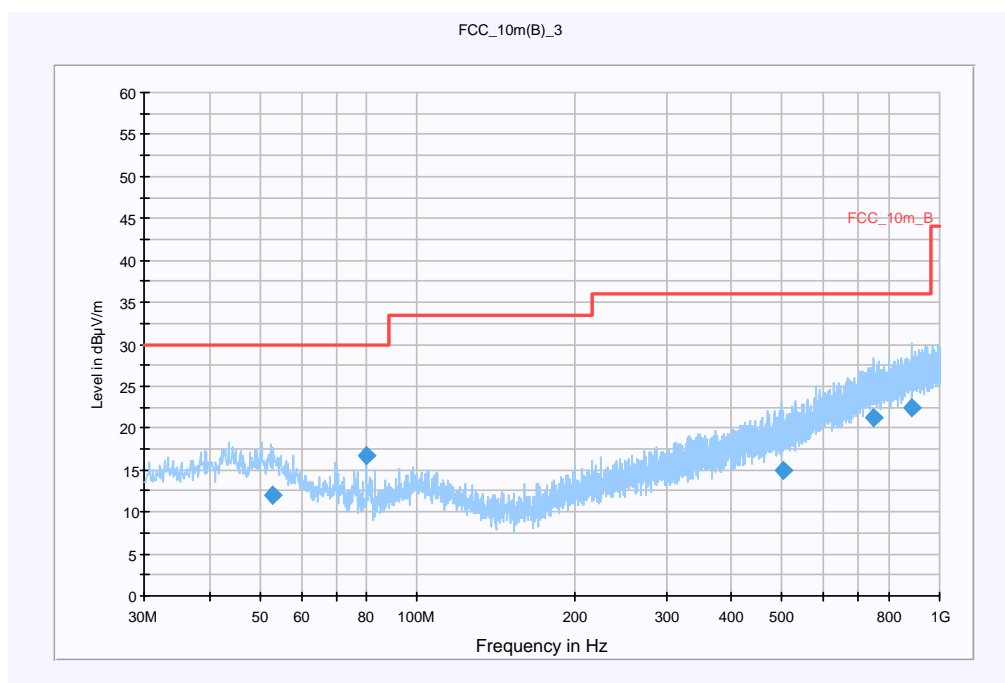
Information

EUT:	Profoto 2.4 GHz Radio modul with an internal antenna
Serial Number:	-/-
Test Description:	FCC Part 15B @ 10 m
Operating Conditions:	High Channel
Operator Name:	LANGER
Comment:	Powered with DC 3.3 V

Scan Setup: STAN_Fin [EMI radiated]

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

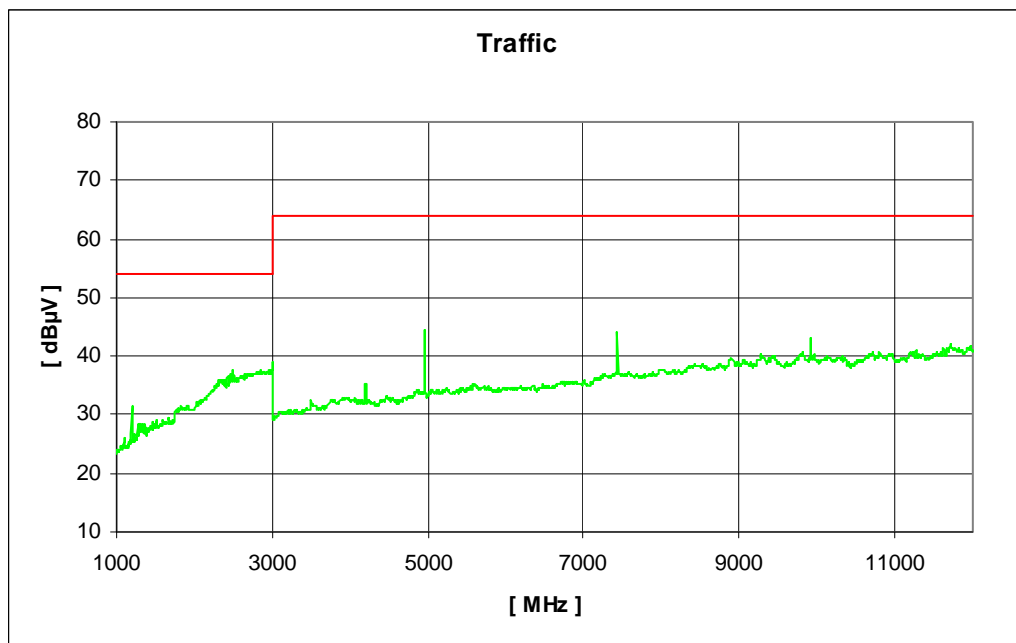
Subrange	Detectors	IF Bandwidth	Meas. Time	Receiver
30 MHz - 1 GHz	QuasiPeak	120 kHz	15 s	Receiver

**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]	Comment
52.708950	12.1	15000.000	120.000	114.0	V	141.0	13.3	18.0	30.0	
80.013500	16.8	15000.000	120.000	155.0	V	141.0	9.4	13.2	30.0	
501.910400	15.0	15000.000	120.000	173.0	H	128.0	19.1	21.0	36.0	
748.286150	21.2	15000.000	120.000	150.0	H	98.0	24.1	14.8	36.0	
885.560900	22.5	15000.000	120.000	220.0	V	182.0	25.5	13.5	36.0	

Plot 7: 1 - 12 GHz vertical/horizontal (highest channel)

EUT:	2.4 GHz Radio modul	Polarisation:	Horizontal, Vertikal
Manufacturer:	Profoto	Battery:	AC/DC Power Supply
IMEI:	int ant, ch8	HW:	-/-
Operator:	WAL	SW:	-/-
Start of Test :	24.02.2009 08:27:14	Vmin:	-/-
Standard:	FCC_15_407_2400	Vnom:	3.3 V DC
Signalling Unit:	CMU200	Vmax:	-/-
Start Freq. [MHz]:	1000	Stop Freq. [MHz]	12000
Transducer-File:	C:\Spurious_neu\Messparameter\FCC_15_407_2400\Transducer_FCC_15_407_2400.xls		



The carrier signal is notched with a 2.4 GHz band rejection filter.

Results:

SPURIOUS EMISSIONS LEVEL [dB μ V/m]								
2404 MHz			2447 MHz			2479 MHz		
Frequency [MHz]	Detector	Level [dB μ V/m]	Frequency [MHz]	Detector	Level [dB μ V/m]	Frequency [MHz]	Detector	Level [dB μ V/m]
4807.692	Peak	43.48	4894.230	Peak	45.40	4961.538	Peak	44.51
7211.538	Peak	40.96	7341.346	Peak	44.09	7437.500	Peak	44.02
			9788.461	Peak	43.65			
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: § 15.109

Frequency [MHz]	Field strength [dB μ V/m]	Measurement distance [m]
30 - 88	30.0	10
88 - 216	33.5	10
216 - 960	36.0	10
above 960	54.0	3

2.4 GHz radio modul with an external antennaModulation: QPSK

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

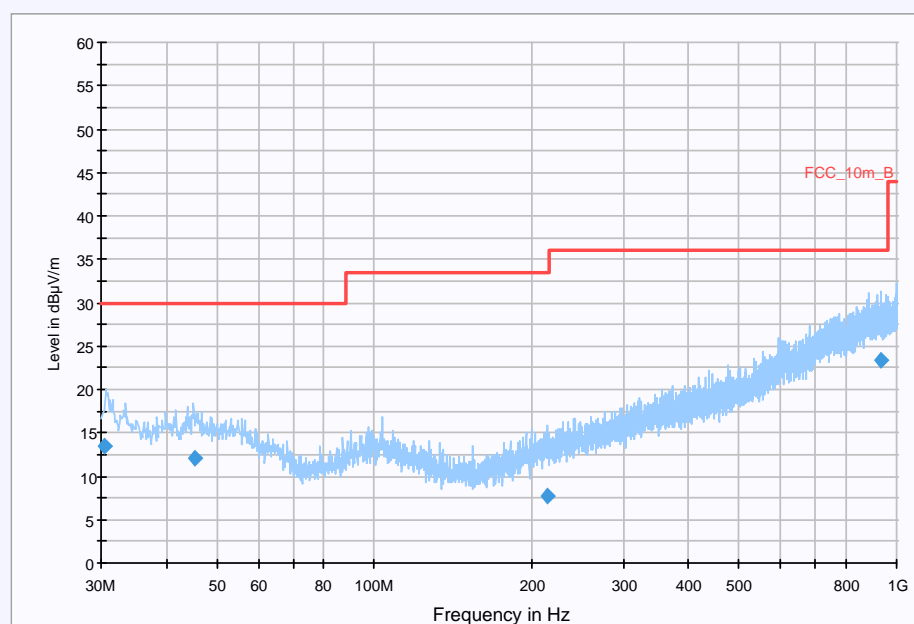
Information

EUT:	Profoto 2.4 GHz Radio modul with an external antenna
Serial Number:	-/-
Test Description:	FCC Part 15B @ 10 m
Operating Conditions:	Low Channel
Operator Name:	WAL
Comment:	Powered with DC 3.3 V

Scan Setup: STAN_Fin [EMI radiated]

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

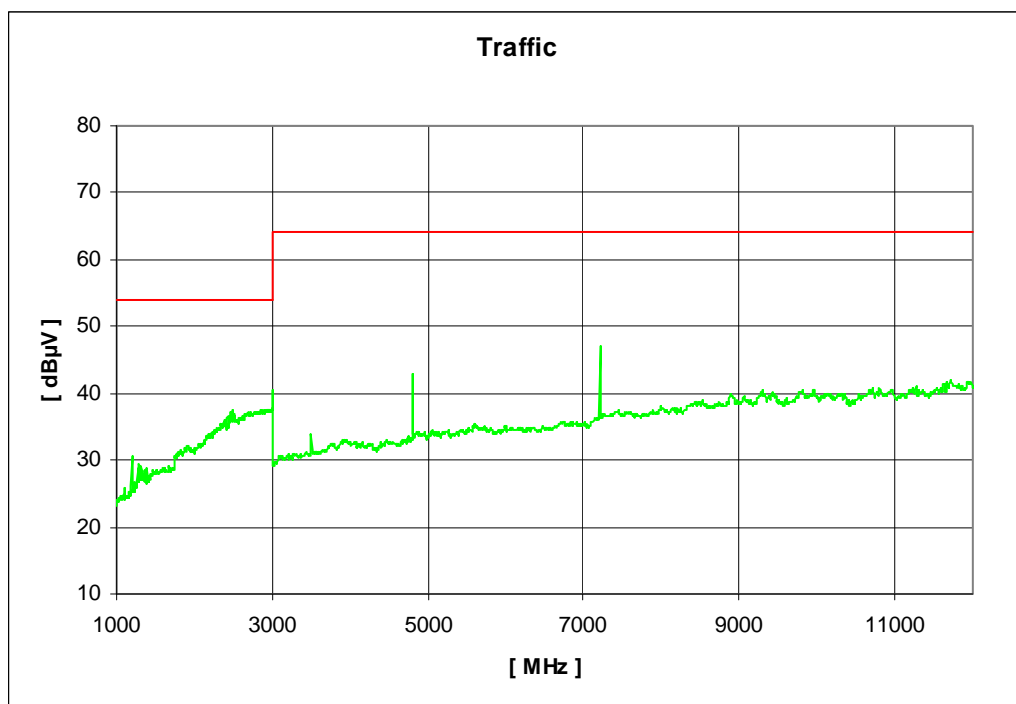
Subrange	Detectors	IF Bandwidth	Meas. Time	Receiver
30 MHz - 1 GHz	QuasiPeak	120 kHz	15 s	Receiver

**Final Result**

Frequency (MHz)	QuasiPeak (dB μ V/m)	Meas. Time	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)	Comment
30.443950	13.5	15000.000	120.000	176.0	V	143.0	12.7	16.5	30.0	
45.235900	12.0	15000.000	120.000	100.0	V	167.0	13.5	18.0	30.0	
214.417200	7.8	15000.000	120.000	201.0	H	-1.0	12.4	25.7	33.5	
930.297750	23.4	15000.000	120.000	139.0	H	31.0	26.3	12.6	36.0	

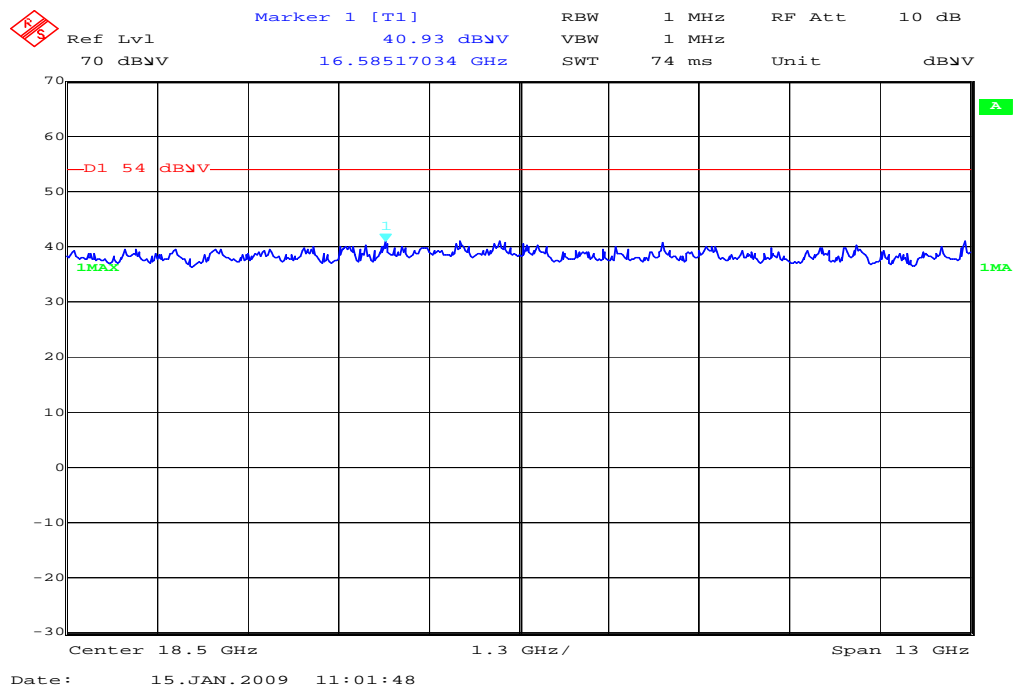
Plot 9: 1 - 12 GHz vertical/horizontal (lowest channel)

EUT:	2.4 GHz Radio modul	Polarisation:	Horizontal, Vertikal
Manufacturer:	Profoto	Battery:	AC/DC Power Supply
IMEI:	ext ant, chl	HW:	-/-
Operator:	WAL	SW:	-/-
Start of Test :	24.02.2009 07:06:31	Vmin:	-/-
Standard:	FCC_15_407_2400	Vnom:	3.3 V DC
Signalling Unit:	CMU200	Vmax:	-/-
Start Freq. [MHz]:	1000	Stop Freq. [MHz]	12000
Transducer-File:	C:\Spurious_neu\Messparameter\FCC_15_407_2400\Transducer_FCC_15_407_2400.xls		



The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 10: 12 - 25 GHz vertical/horizontal (valid for all channels)



Plot 11: 0.03 - 1 GHz vertical/horizontal (middle channel)

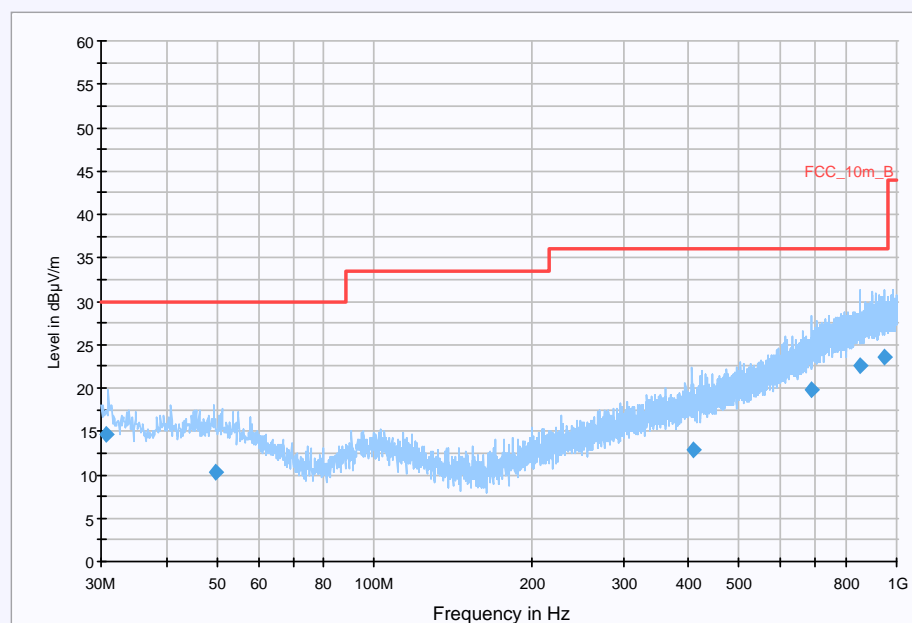
Information

EUT:	Profoto 2.4 GHz Radio modul with an external antenna
Serial Number:	-/-
Test Description:	FCC Part 15B @ 10 m
Operating Conditions:	Middle Channel
Operator Name:	WAL
Comment:	Powered with DC 3.3 V

Scan Setup: STAN_Fin [EMI radiated]

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

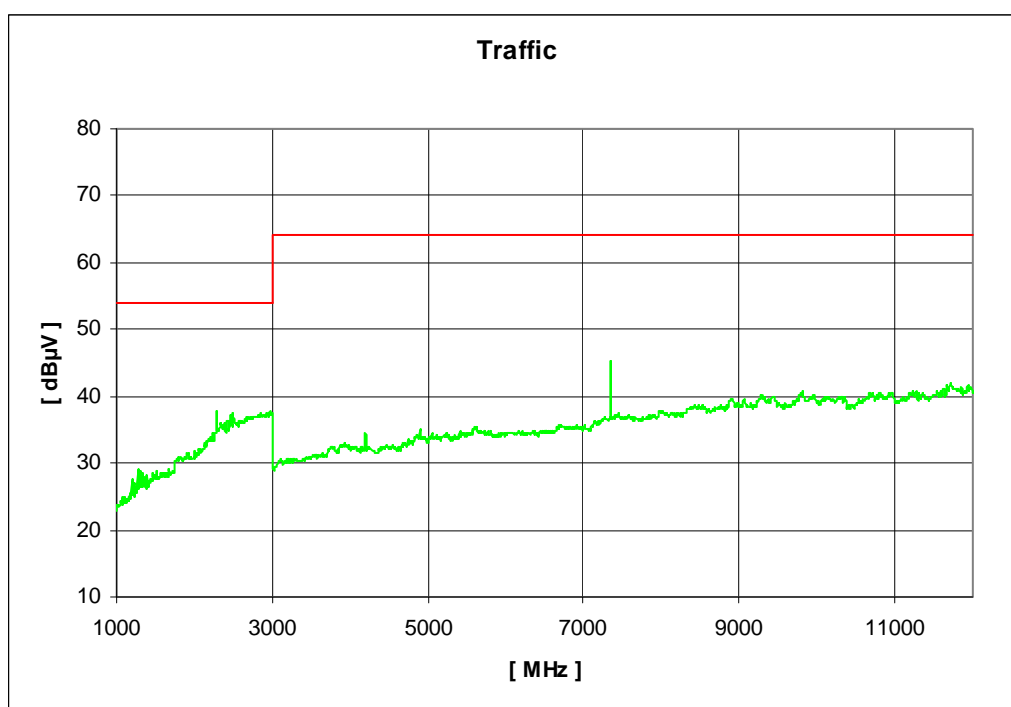
Subrange	Detectors	IF Bandwidth	Meas. Time	Receiver
30 MHz - 1 GHz	QuasiPeak	120 kHz	15 s	Receiver

**Final Result**

Frequency (MHz)	QuasiPeak (dB μ V/m)	Meas. Time	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)	Comment
30.698200	14.7	15000.000	120.000	202.0	V	220.0	12.7	15.3	30.0	
49.870200	10.4	15000.000	120.000	115.0	V	323.0	13.6	19.6	30.0	
407.217400	13.0	15000.000	120.000	126.0	H	5.0	17.1	23.0	36.0	
688.226400	19.8	15000.000	120.000	220.0	H	50.0	22.6	16.2	36.0	
853.670400	22.6	15000.000	120.000	220.0	H	150.0	25.4	13.4	36.0	
947.312800	23.6	15000.000	120.000	127.0	V	245.0	26.4	12.4	36.0	

Plot 12: 1 - 12 GHz vertical/horizontal (middle channel)

EUT:	2.4 GHz Radio modul	Polarisation:	Horizontal, Vertikal
Manufacturer:	Profoto	Battery:	AC/DC Power Supply
IMEI:	ext ant, ch6	HW:	-/-
Operator:	WAL	SW:	-/-
Start of Test :	24.02.2009 07:22:44	Vmin:	-/-
Standard:	FCC_15_407_2400	Vnom:	3.3 V DC
Signalling Unit:	CMU200	Vmax:	-/-
Start Freq. [MHz]:	1000	Stop Freq. [MHz]	12000
Transducer-File:	C:\Spurious_neu\Messparameter\FCC_15_407_2400\Transducer_FCC_15_407_2400.xls		



The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 13: 0.03 - 1 GHz vertical/horizontal (highest channel)

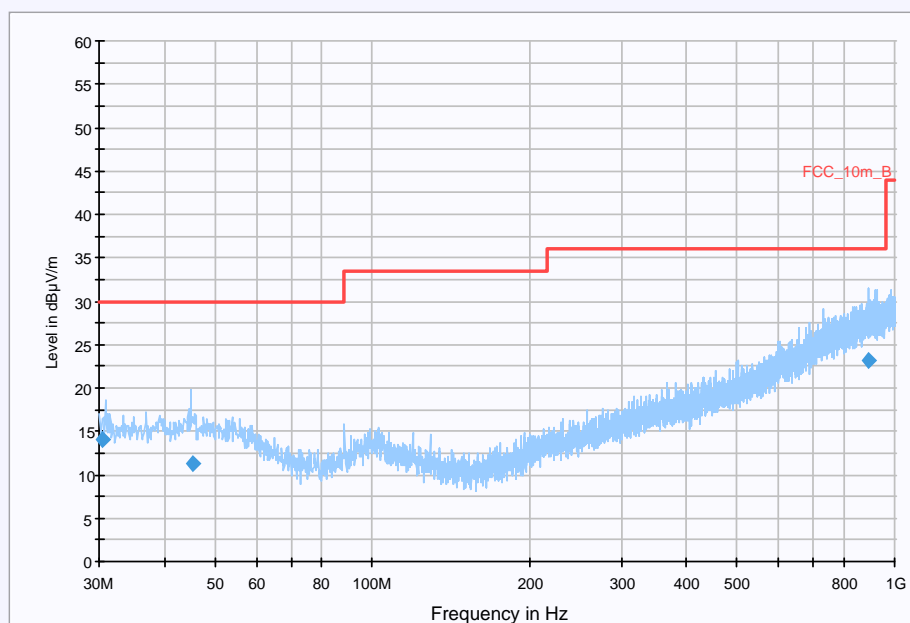
Information

EUT:	Profoto 2.4 GHz Radio modul with an external antenna
Serial Number:	-/-
Test Description:	FCC Part 15B @ 10 m
Operating Conditions:	High Channel
Operator Name:	WAL
Comment:	Powered with DC 3.3 V

Scan Setup: STAN_Fin [EMI radiated]

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

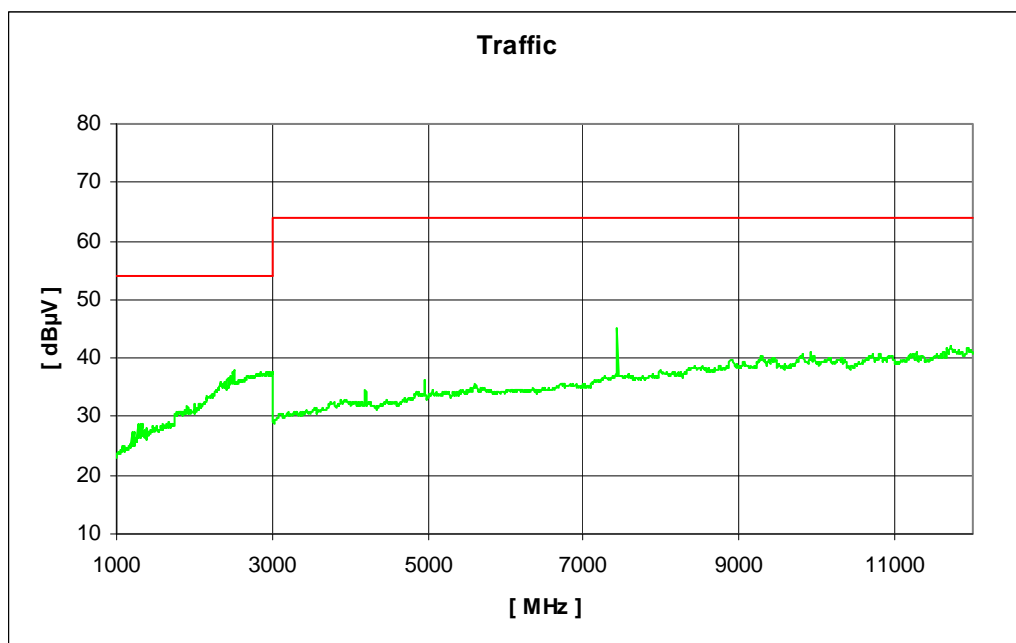
Subrange	Detectors	IF Bandwidth	Meas. Time	Receiver
30 MHz - 1 GHz	QuasiPeak	120 kHz	15 s	Receiver

**Final Result**

Frequency (MHz)	QuasiPeak (dB μ V/m)	Meas. Time	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)	Comment
30.557000	14.1	15000.000	120.000	114.0	V	254.0	12.7	15.9	30.0	
45.496550	11.4	15000.000	120.000	191.0	V	45.0	13.5	18.6	30.0	
893.794600	23.2	15000.000	120.000	149.0	V	159.0	26.0	12.8	36.0	

Plot 14: 1 - 12 GHz vertical/horizontal (highest channel)

EUT:	2.4 GHz Radio modul	Polarisation:	Horizontal, Vertikal
Manufacturer:	Profoto	Battery:	AC/DC Power Supply
IMEI:	ext ant, ch8	HW:	-/-
Operator:	WAL	SW:	-/-
Start of Test :	24.02.2009 07:33:54	Vmin:	-/-
Standard:	FCC_15_407_2400	Vnom:	3.3 V DC
Signalling Unit:	CMU200	Vmax:	-/-
Start Freq. [MHz]:	1000	Stop Freq. [MHz]	12000
Transducer-File:	C:\Spurious_neu\Messparameter\FCC_15_407_2400\Transducer_FCC_15_407_2400.xls		



The carrier signal is notched with a 2.4 GHz band rejection filter.

Results:

SPURIOUS EMISSIONS LEVEL [dB μ V/m]								
2404 MHz			2447 MHz			2479 MHz		
Frequency [MHz]	Detector	Level [dB μ V/m]	Frequency [MHz]	Detector	Level [dB μ V/m]	Frequency [MHz]	Detector	Level [dB μ V/m]
4807.692	Peak	42.94	7341.346	Peak	45.18	7437.500	Peak	45.05
7211.538	Peak	46.98						
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: § 15.109

Frequency [MHz]	Field strength [dB μ V/m]	Measurement distance [m]
30 - 88	30.0	10
88 - 216	33.5	10
216 - 960	36.0	10
above 960	54.0	3

5.17 Spurious Emissions - radiated (Receiver) § 15.109

Modulation: QPSK

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

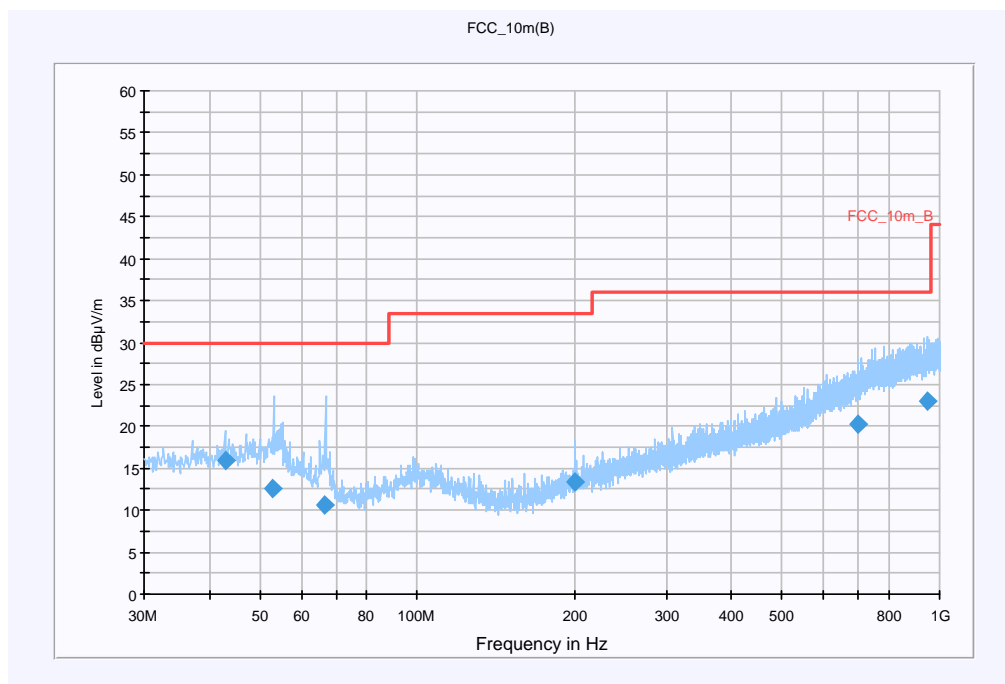
Information

EUT:	Profoto 2.4 GHz Radio modul
Serial Number:	-/-
Test Description:	FCC Part 15B @ 10 m
Operating Conditions:	Idle Mode
Operator Name:	LANGER
Comment:	Powered with DC 3.3 V

Scan Setup: STAN_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

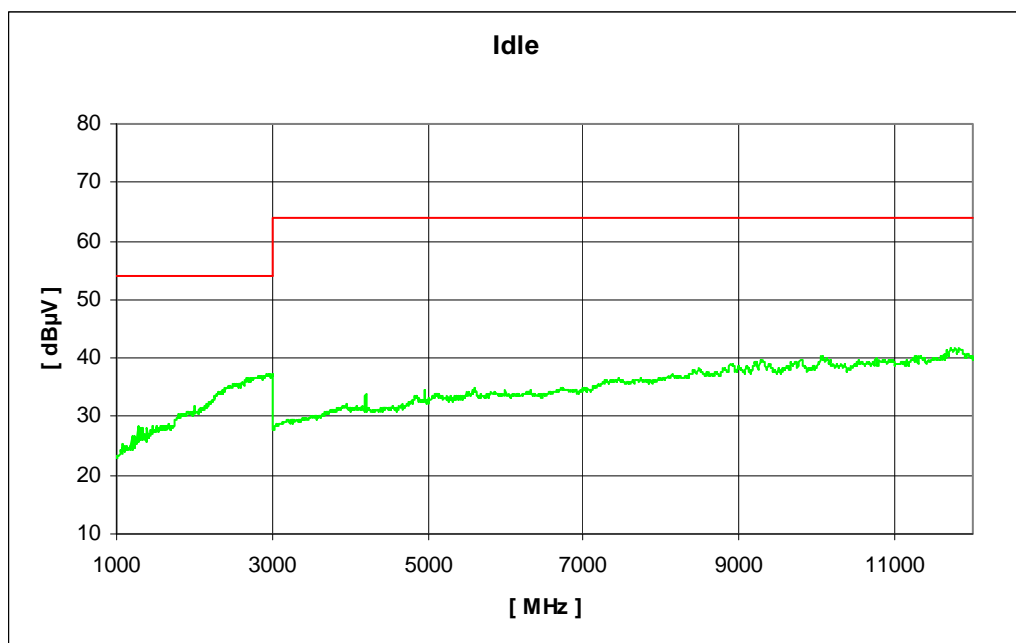


Final Result

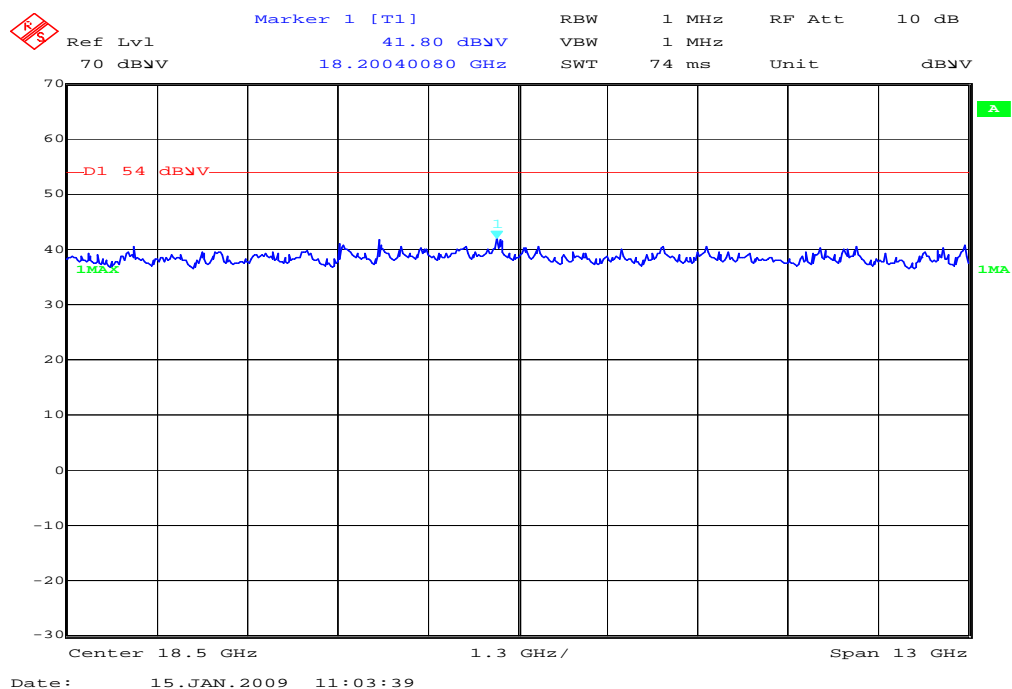
Frequency [MHz]	QuasiPeak [dB μ V/m]	Meas. Time [ms]	Bandwidth [kHz]	Antenna height [cm]	Polarity	Turntable position [deg]	Corr. [dB]	Margin [dB]	Limit [dB μ V/m]	Comment
43.002800	16.0	15000.000	120.000	107.0	V	71.0	13.5	14.0	30.0	
53.067700	12.5	15000.000	120.000	321.0	V	221.0	13.3	17.5	30.0	
66.346850	10.6	15000.000	120.000	323.0	V	60.0	10.3	19.4	30.0	
200.014550	13.4	15000.000	120.000	100.0	V	21.0	12.0	20.1	33.5	
698.394750	20.2	15000.000	120.000	200.0	V	190.0	23.0	15.8	36.0	
946.838000	23.0	15000.000	120.000	100.0	H	178.0	25.8	13.0	36.0	

Plot 2: 1 - 12 GHz vertical/horizontal (receiver)

EUT:	2.4 GHz Radio modul	Polarisation:	Horizontal, Vertikal
Manufacturer:	Profoto	Battery:	AC/DC Power Supply
IMEI:	Idle mode	HW:	-/-
Operator:	WAL	SW:	-/-
Start of Test :	24.02.2009 07:40:03	Vmin:	-/-
Standard:	FCC_15_407_2400	Vnom:	3.3 V DC
Signalling Unit:	CMU200	Vmax:	-/-
Start Freq. [MHz]:	1000	Stop Freq. [MHz]	12000
Transducer-File:	C:\Spurious_neu\Messparameter\FCC_15_407_2400\Transducer_FCC_15_407_2400.xls		



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

Results:

Spurious Emissions level [dBμV/m]		
Frequency [MHz]	Detector	Level [dBμV/m]
No critical peaks found		
Measurement uncertainty		±3 dB

f < 1 GHz: RBW/VBW: 100 kHz

f ≥ 1GHz : RBW/VBW: 1 MHz

See above plots

Measurement distance see table

Limits: § 15.109

Frequency [MHz]	Field strength [dBμV/m]	Measurement distance [m]
30 - 88	30.0	10
88 - 216	33.5	10
216 - 960	36.0	10
above 960	54.0	3

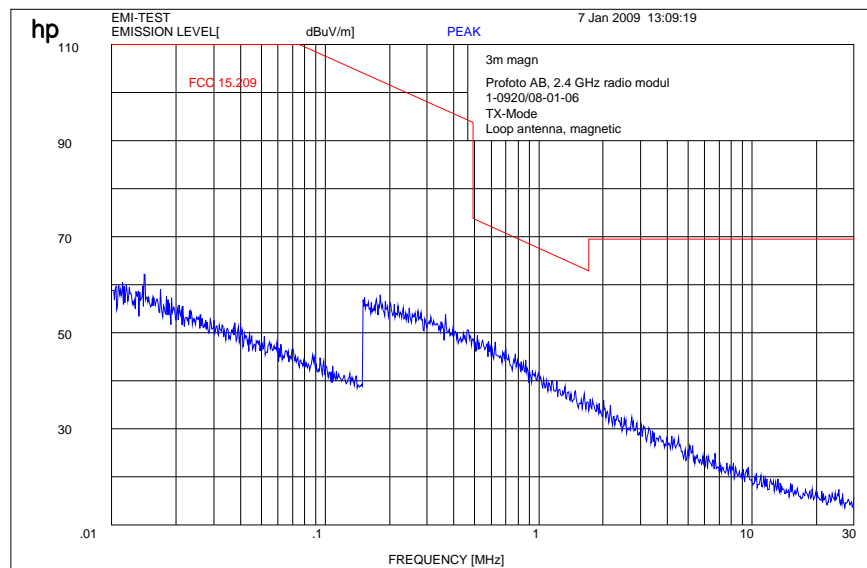
5.18 Spurious Emissions < 30 MHz - Transmitter radiated § 15.209

Modulation: QPSK

Measured at 3 m distance.

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

Plot 1:



Limits:

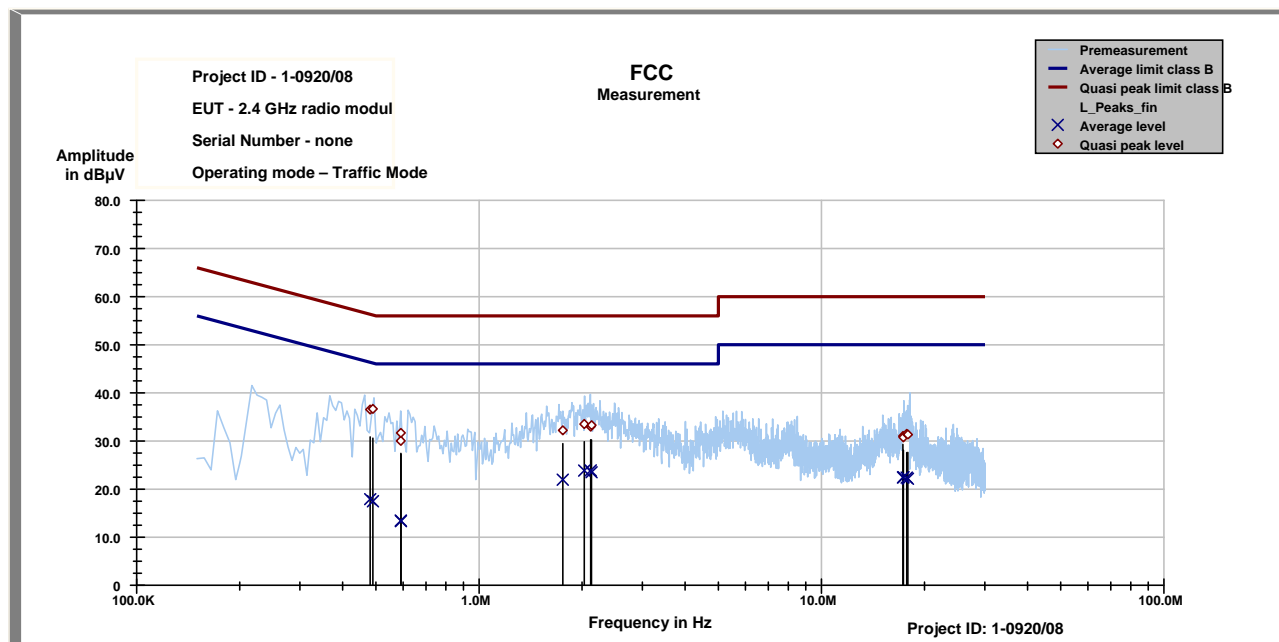
Frequency [MHz]	Field strength [$\mu\text{V/m}$]	Measurement distance [m]
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30 / 29.5 dB $\mu\text{V/m}$	30

5.19 Conducted Emissions <30 MHz § 15.107/207

Modulation: QPSK

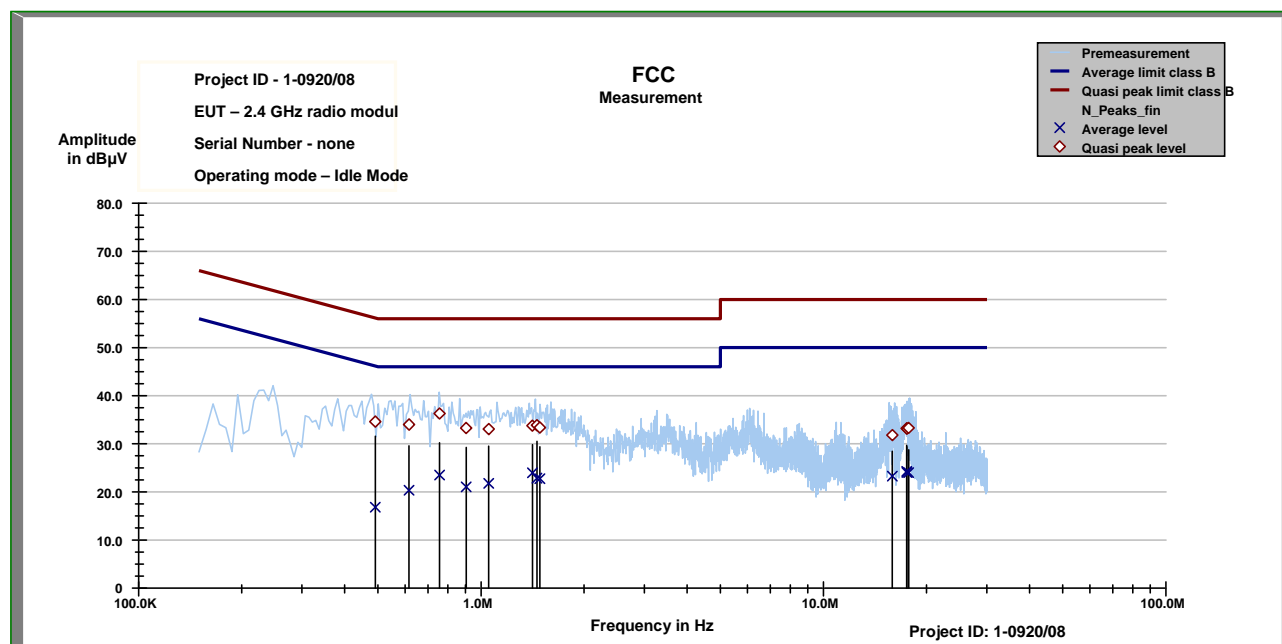
We measured in TX and RX mode, L1 and N floating and grounded, max value was hold.

Plot 1: CISPR 22 (Traffic Mode)



Frequency MHz	Quasi peak level dBμV	Margin quasi peak dBμV	Average level dBμV	Margin average dBμV
0.4809	36.55	19.77	17.91	28.64
0.4897	36.64	19.53	17.46	28.84
0.5907	30.01	25.99	13.44	32.56
0.5912	31.67	24.33	13.35	32.65
1.7564	32.21	23.79	21.93	24.07
2.0286	33.51	22.49	23.84	22.16
2.1173	32.98	23.02	23.87	22.13
2.1300	33.27	22.73	23.50	22.50
17.2882	31.02	28.98	22.41	27.59
17.3310	30.74	29.26	22.45	27.55
17.7247	31.46	28.54	22.37	27.63
17.8692	31.33	28.67	22.16	27.84

Plot 2: CISPR 22 (Idle Mode)



Frequency	Quasi peak level	Margin quasi peak	Average level	Margin average
MHz	dBµV	dBµV	dBµV	dBµV
0.4913	34.59	21.56	16.81	29.44
0.6161	33.98	22.02	20.31	25.69
0.7562	36.28	19.72	23.48	22.52
0.9042	33.26	22.74	21.05	24.95
1.0528	33.05	22.95	21.76	24.24
1.4120	33.74	22.26	23.96	22.04
1.4563	33.85	22.15	22.84	23.16
1.4844	33.38	22.62	22.74	23.26
15.8790	31.78	28.22	23.26	26.74
17.4982	33.18	26.82	24.26	25.74
17.5094	33.18	26.82	24.02	25.98
17.7201	33.28	26.72	24.00	26.00

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 A:

No.	Instrument/Ancillary	Manufacturer	Type	Serial-No.	Internal identification
Radiated emission in chamber A					
A-1	Spectrum Analyzer	Rohde & Schwarz	ESU26	100037	300003555
A-2	Signal Generator	Rohde & Schwarz	SMR20B11	1104.0002.20	300003593
A-3	RF System Panel	Rohde & Schwarz	TS RSP	---	300003556
A-4	Relais Matrix	Rohde & Schwarz	PSN	860673/009	300001385
A-5	Horn Antenna	EMCO	3115	9709-5290	300000212
A-6	Bilog.-Log. Antenna	Schwarzbeck	VULB 9163	02/00	300003696
A-7	Notch Filter GSM 900	Wainwright	WRCD 901.9/903.1EE	9	---
A-8	Notch Filter GSM 1800	Wainwright	WRCD 1747/1748-5EE	1	---
A-9	Notch Filter GSM 1900	Wainwright	WRCB 1879.5/1880.5EE	9	---
A-10	Notch Filter GSM 850	Wainwright	WRCT 837-0.2/50-8EE	1	---
A-11	Notch Filter UMTS	Wainwright	WRCD 1800/2000-0.2/40-5EEK	2	---
A-12	Notch Filter ISM 2400	Wainwright	WRCG 2400/ 2483-2375/ 2505-50/10SS	26	---
A-13	High Pass Filter 1.1 GHz	Wainwright	WHKX 1.1/15G-10SS	---	---
A-14	High Pass Filter 2.6 GHz	Wainwright	WHKX 2.6/18G-12SS	---	---
A-15	High Pass Filter 7 GHz	Wainwright	WHKX 7.0/18G-8SS	---	---
A-14	Amplifier	Miteq	AFS4-00201800-15-10P-6	US42-0050 2650-28-5A	300003204
A-16	Controller	Inn co	CO 2000	2020507	---
A-17	DC Power Supply	Hewlet Packard	HP6632A	---	300000924
A-18	Computer	F+W	---	---	300003303

SRD Laboratory Room 005:

No	Equipment/Type	Manuf.	Serial Nr.	Inv. No. Cetecom	Last Calibration	Frequency (months)	Next Calibration
1	Spektrum Analyzer 8566B	HP	2747A05275	300000219	18.01.2008	24	18.01.2010
2	Spektrum Analyzer Display 85662A	HP	2816A16497	300001690	23.01.2008	24	23.01.2010
3	Quasi-Peak-Adapter 85650A	HP	2811A01135	300000216	23.01.2008	24	23.01.2010
4	Power Supply	Heiden	003202	300001187	12.05.2007	36	12.05.2010
5	Power Supply	Heiden	1701	300001392	12.05.2007	36	12.05.2010

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	-/-	-/-	-/-	-/-

C.BER Bluetooth Rack Room AC2:

No	Equipment/Type	Manuf.	Inv. No. Cetecom	Last Calibration	Frequency (months)	Next Calibration
1	System Controller with XP Prof. & C.BER Control Software	F&W	300003580	na		
2	GPIO to USB Converter	Agilent	300003426	na		
3	Spectrum Analyser FSIQ26	R&S	300002681-005	10.01.2008	24	10.01.2010
	Sampling System FSIQ-B70	R&S	300002681-005	s.No.3		
	Tracking Generator FSIQ-B10 for FSIQ26	R&S	300002681-005	s.No.3		
4	RF-Generator SMIQ03 (Interferer Signal)	R&S	300002681-001	25.08.2008	36	25.08.2011
	Modulation Coder SMIQ-B20	R&S	300002681-001	s.No.4		
	Data Generator SMIQ-B11	R&S	300002681-001	s.No.4		
	RF Rear Connection SMIQ-B19	R&S	300002681-001	s.No.4		
	Fast CPU SM-B50	R&S	300002681-001	s.No.4		
	FM Modulator SM-B5	R&S	300002681-001	s.No.4		
5	Rubidium Standard RUB	R&S	300002681-009	27.08.2008	24	27.08.2010
6	Switching Unit 3488A including 2 44476A cards	HP	300000926	Verified with path compensation		
	44472A VHF switch	HP	300000926	Verified with path compensation		
7	Signalling Unit: CBT with EDR	R&S	300003416	27.08.2008	24	27.08.2010
8	RF-cable set	different	no	Verified with path compensation		
9	IEEE-cables	R&S	no	na		
10	NGPE programmable Power Supply for EUT	R&S	400000078	27.08.2008	24	27.08.2010
11	Coupling Unit 4324-2	Narda	no	Verified with path compensation		
12	Climatic Chamber VT4002	Voetch	300003019	11.05.2007	24	11.05.2009
13	6 dB Attenuator 1W	Narda	no	Verified with path compensation		
14	DCBlocker 30 MHz to 12.75 GHz 1W	Narda	no	Verified with path compensation		

7 Photographs of the Test Set-up

Photo 1:

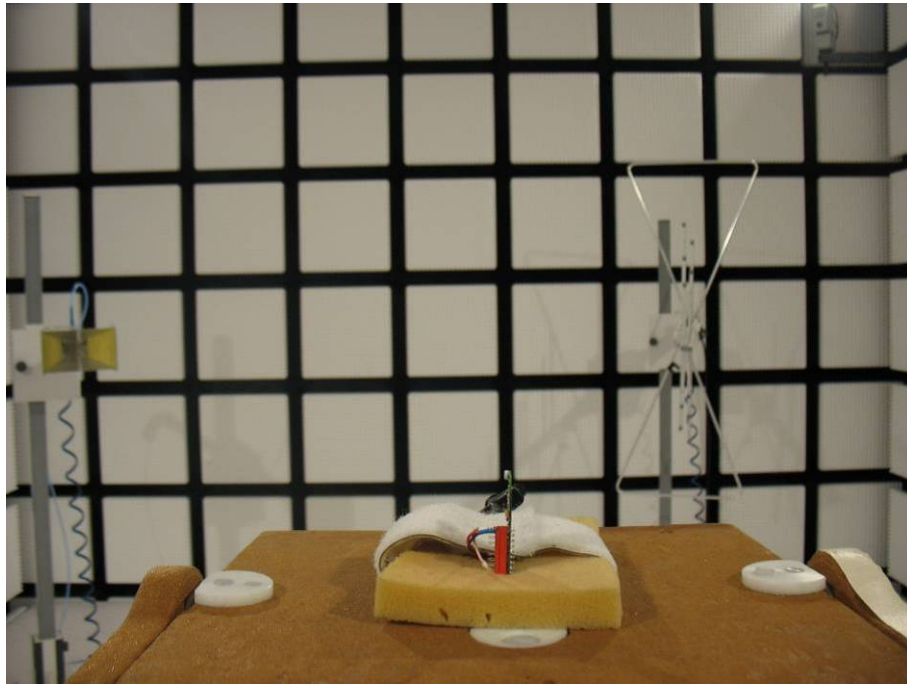


Photo 2:

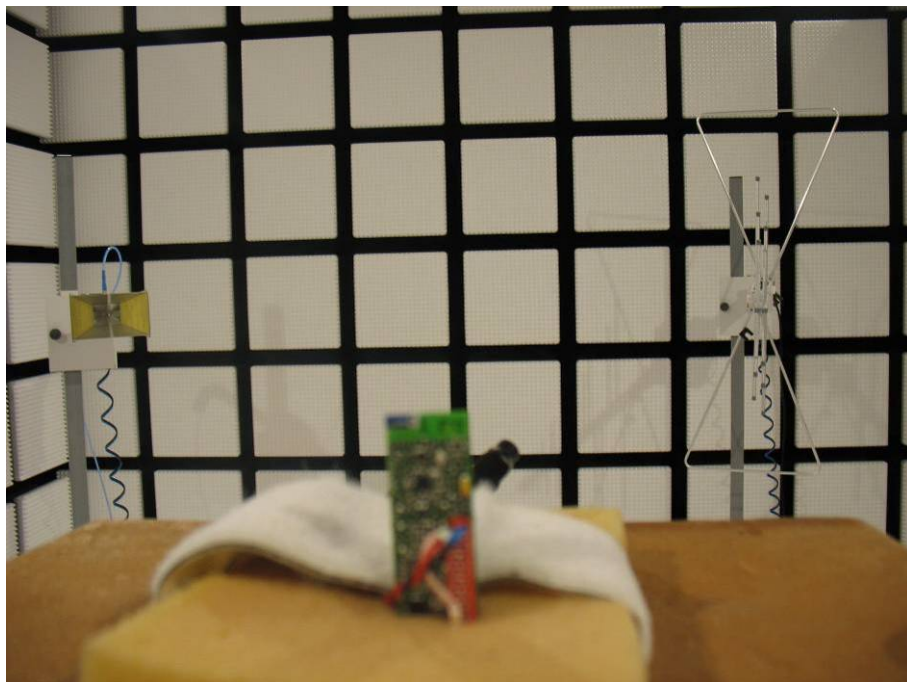
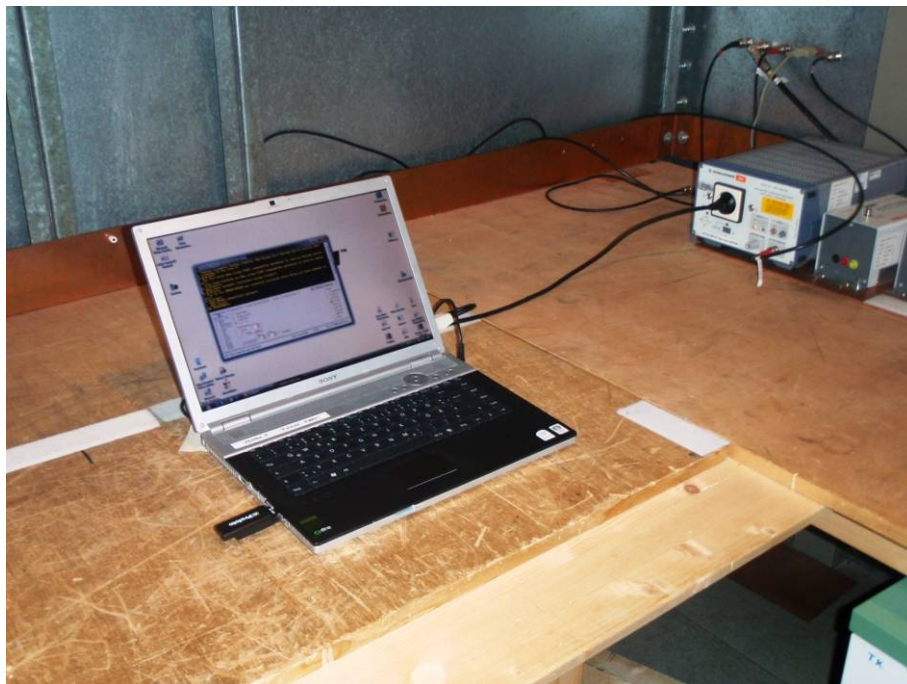


Photo 3:



Photo 4:



8 Photographs of the EUT

Photo 5:



Photo 6:



Photo 7:



Photo 8:

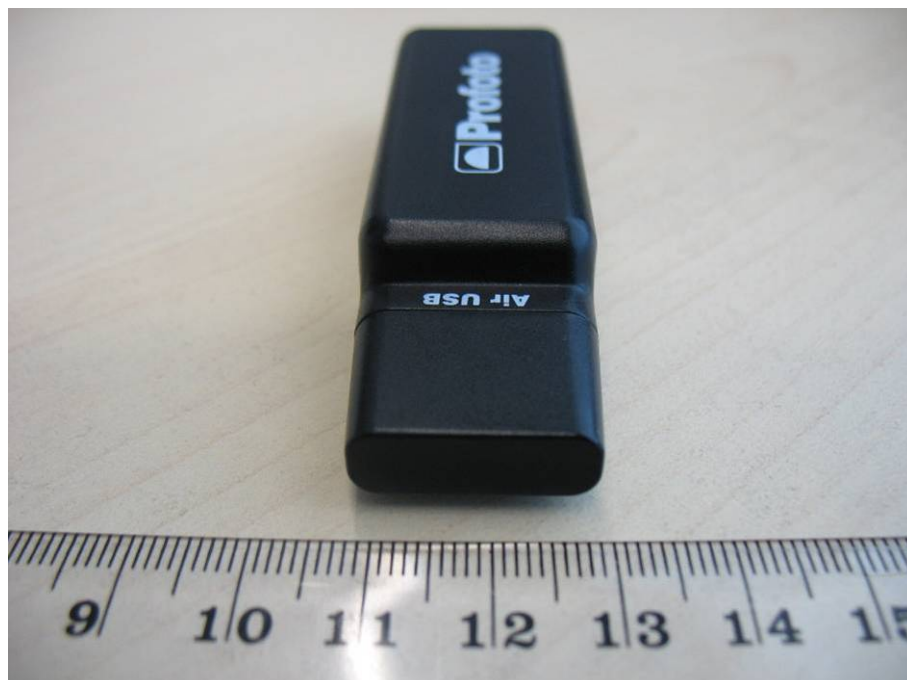


Photo 9:

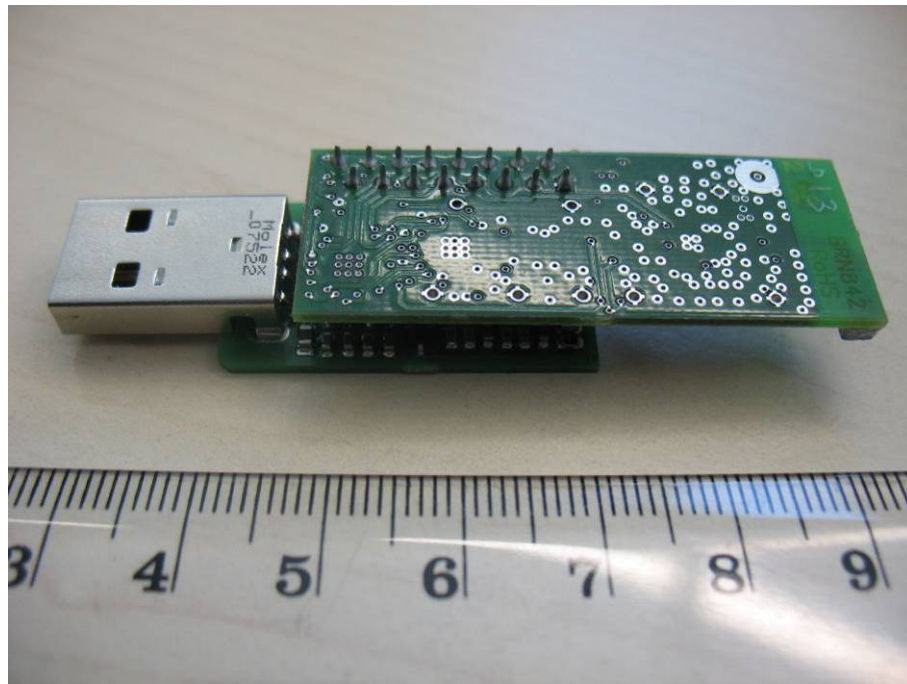


Photo 10:

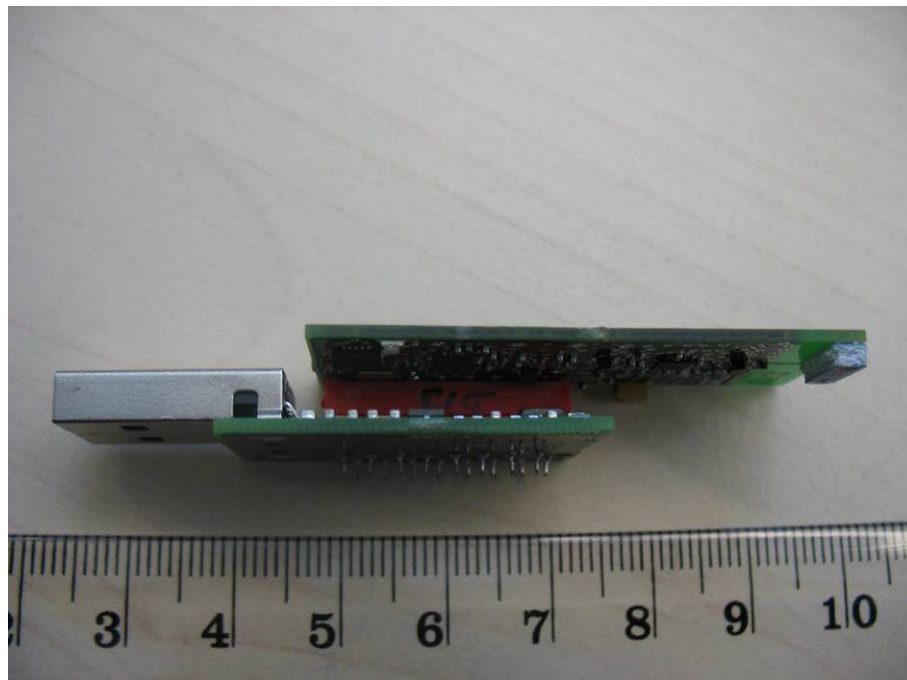


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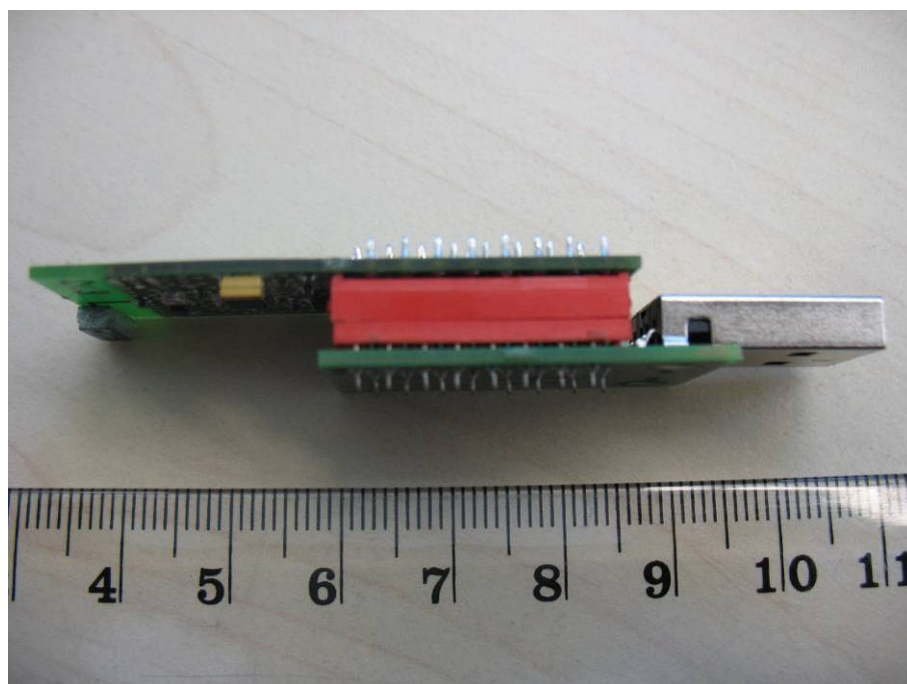


Photo 12:



Photo 13:

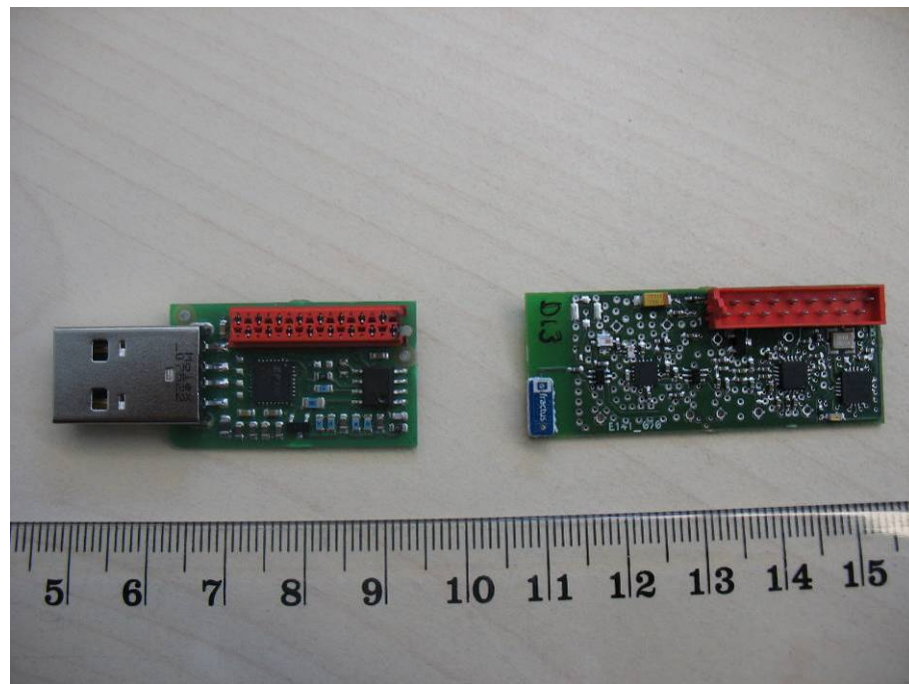


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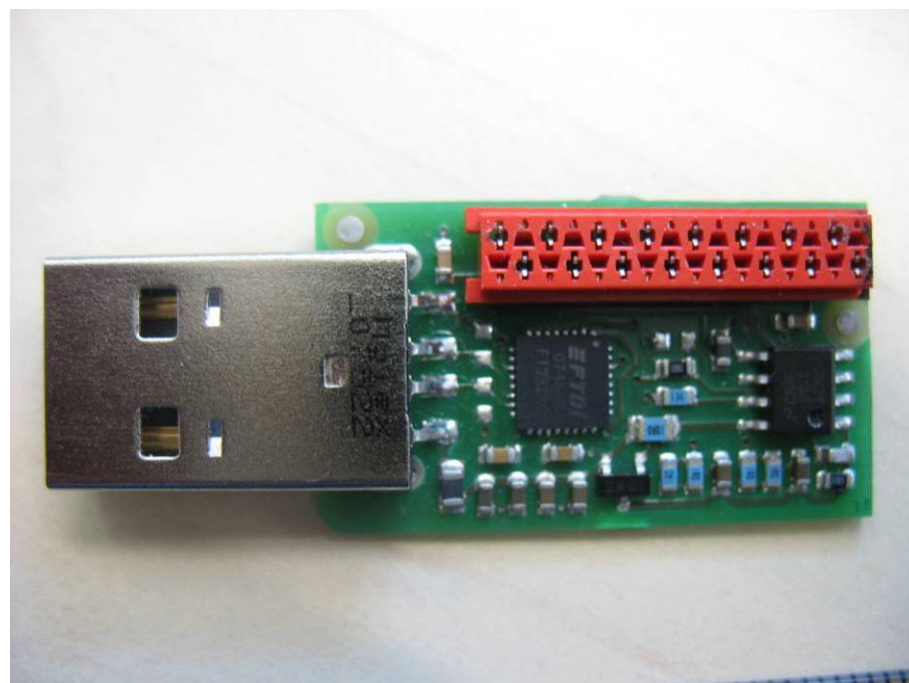


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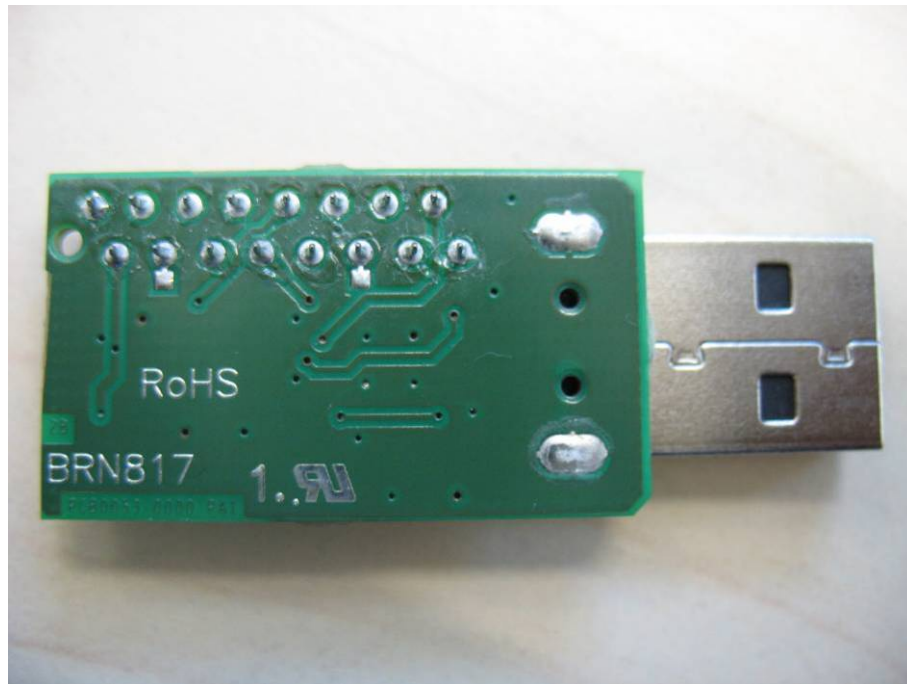


Photo 16:

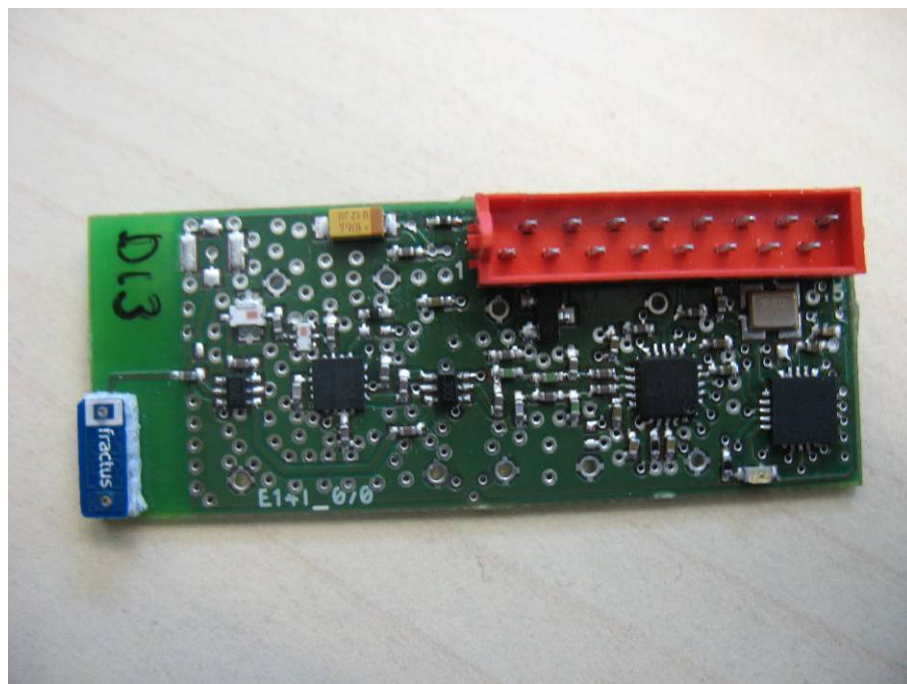


Photo 17:

