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)

Test report no.	**:**	**1-1225-01-02/09**
Type identification	**:**	**E-4448-I**
Applicant	**:**	**Steute Schaltgeräte GmbH**
FCC ID	**:**	**XK5-SW100AMBINT**
IC Certification No	**:**	**5158A-SW100AMBINT E-4448-I**
Test standards	**:**	**47 CFR Part 15**
		RSS - 210 Issue 7

Table of contents

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:

2009-07-08	**Daniel Muyunga**	
Date	Name	Signature

Technical responsibility for area of testing:

2009-07-08	**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:	**Steute Schaltgeräte GmbH**
Street:	**Brückenstraße 91**
Town:	**32584 Löhne**
Country:	**GERMANY**
Telephone:	
Fax:	**+49 5731 745 6217**
Contact:	**Marc Schmidt**
E-mail:	**m.schmidt@steute.com**
Telephone:	**+49 5731 745 217**

1.4 Application details

Date of receipt of order:	**2009-05-14**
Date of receipt of test item:	**2009-06-09**
Date of start test:	**2009-06-09**
Date of end test	**2009-07-06**
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:	**Steute Schaltgeräte GmbH**
Street:	**Brückenstraße 91**
Town:	**32584 Löhne**
Country:	**GERMANY**

3.1.1 Test item

Kind of test item	:	**Wireless Modul 2,4 GHz ISM**
Type identification	:	**E-4448-I**
S/N serial number	:	**-/-**
HW hardware status	:	**-/-**
SW software status	:	**-/-**
Frequency Band [MHz]	:	**ISM 2.400 - 2.483,5**
Type of Modulation	:	**FHSS**
Number of channels	:	**32**
Antenna	:	**Internal antenna**
Power Supply	:	**7 V DC by power supply**
Temperature Range	:	**-20 °C to +55 °C**

Max. power conducted: -0.59 dBm
Max. power radiated: -1.60 dBm (Internal antenna)

FCC ID : XK5-SW100AMBINT
IC Certification No : 5158A-SW100AMBINT E-4448-I

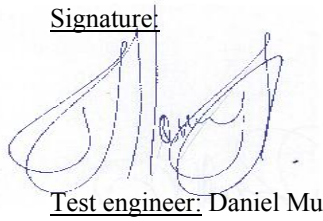
3.1.2 Additional EUT information For IC Canada (appendix 2)

IC Registration Number:	**5158A**
Model Name:	**E-4448-I**
Manufacturer (complete Address):	**Steute Schaltgeräte GmbH** **Brückenstraße 91** **32584 Löhne** **GERMANY**
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]:	**2400 – 2483.5 MHz**
RF: Power [W] (max):	**Rad. EIRP: 0.7 mW (Internal antenna)** **Conducted : 0.873 mW**
Antenna Type:	**Internal antenna**
Field Strength [dBµV/m in 3m]:	**105.07**
Occupied Bandwidth (99% BW) [kHz]:	**721.44**
Type of Modulation:	**FSK**
Emission Designator (TRC-43):	**722KFXD**
Transmitter Spurious (worst case) [µV/m in 3m]:	**481.4**
Receiver Spurious (worst case) [µV/m in 3m]:	**91.2**

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: 2009-07-08

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:

2. MODEL NUMBER:

3. MANUFACTURER:

4. TYPE OF EVALUATION: **N/A**

- Evaluated against exposure limits: General Public Use ☐ Controlled Use ☐
- Duty cycle used in evaluation: %
- Standard used for evaluation: RSS-102 Issue 2 (2005-11)
- Measurement distance: 0.20 m
- RF value: N/A V/m □ A/m □ W/m^2 ☐

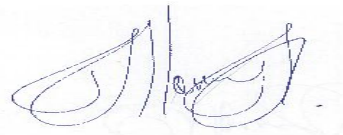
Measured ☐ Computed ☐ Calculated ☐

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}	%	**50**
Nominal Power Source	V_{nom}	V	**7**

Type of power source: **DC by power supply**

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	2009-07-08	-/-

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 Bandwith	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

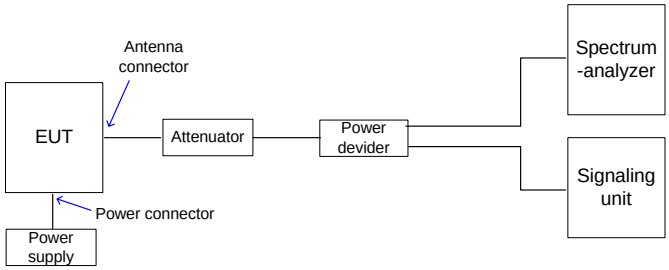
The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 25 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas 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

General

The Steute Wireless SW100 is a 2.4 GHz radio module that is designated to be installed in other host devices. The Steute Wireless SW100 uses a FHSS proprietary wireless protocol, which chops up the data being sent and transmits chunks of it on 32 frequencies. In its basic mode, the modulation is Minimum shift keying (MSK).

For testing purposes and in accordance with requirements for evaluating a device for modular approvals, the EUT was wired to an extender board that was connected to a PC, see pictures. The EUT was outside the PCs enclosure.

Six samples were provided by the manufacturer. One of four samples equipped with koax-cable with Reverse-SMA antenna connector was used for antenna port measurements and radiated spurious emissions with the Rubber external antenna (see pictures). Additional radiated spurious emissions evaluations were carried out with one of the two samples with internal antenna.

Functional description

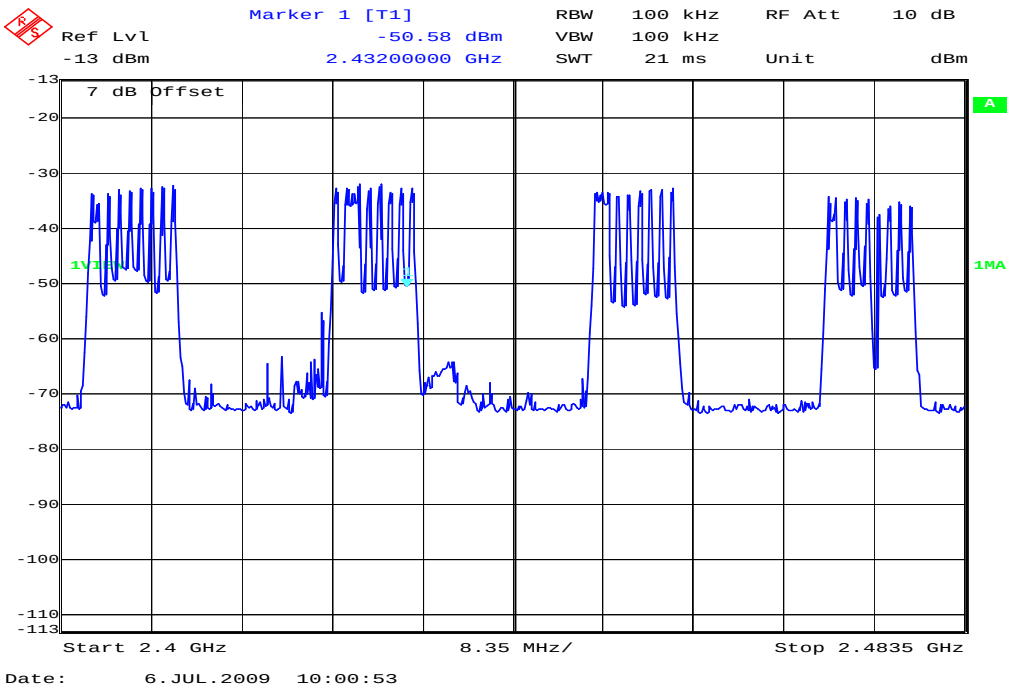
The system uses two different hopping schemes: the first scheme is used during scanning period while trying to find a partner for the connection. The second scheme is used during the communication once connected.

During the scanning period the transmitter hops on 4 channels in a 5 ms rhythm while transmitting only during <2.5 ms. The remaining 2.5 ms are left for a possible partner reply. The 4 connection channels used are located into each of the following 4 Sub-bands:
2403 to 2413 MHz
2427 to 2437 MHz
2450 to 2460 MHz and
2471 to 2480 MHz
These channels can be user-defined and the device always uses only one channel per sub-band for the connection.

After the scanning i.e. during the connection the system randomly changes the channel every 5ms according to a table of 32 channels. These 32 channels can not be changed by the user and are located in 4 sub-bands:
2403.5 to 2410.5 MHz
2425.5 to 2432.5 MHz
2449.5 to 2456.5 MHz and
2471.5 to 2478.5 MHz (see plot 1 below)

Summing up the frequencies during the scan and in after connection, the system transmits only between:
2403 to 2413 MHz
2425.5 to 2437 MHz
2449.5 to 2460 MHz and
2471 to 2480 MHz
Where the transmit frequencies in both modes are 500 KHz shifted.

Plot 1: Hopping scheme, connected



5.4 Antenna gain

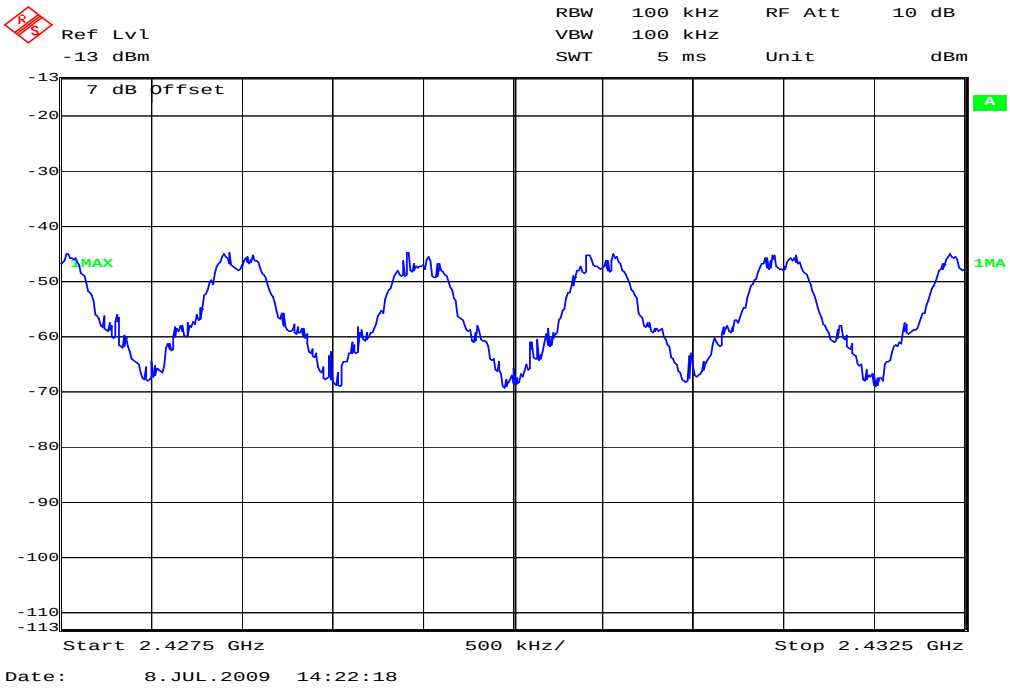
The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module.

Internal Antenna

	low channel 2403 MHz	mid channel 2453.5 MHz	high channel 2480 MHz
Conducted power [dBm] Measured, MSK modulation	-0.59	-0.96	-1.37
Radiated power [dBm] Measured, MSK modulation	-1.91	-1.60	-2.38
Gain [dBi] Calculated	-1.32	-0.64	-1.01

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

Plot 1 of 2:

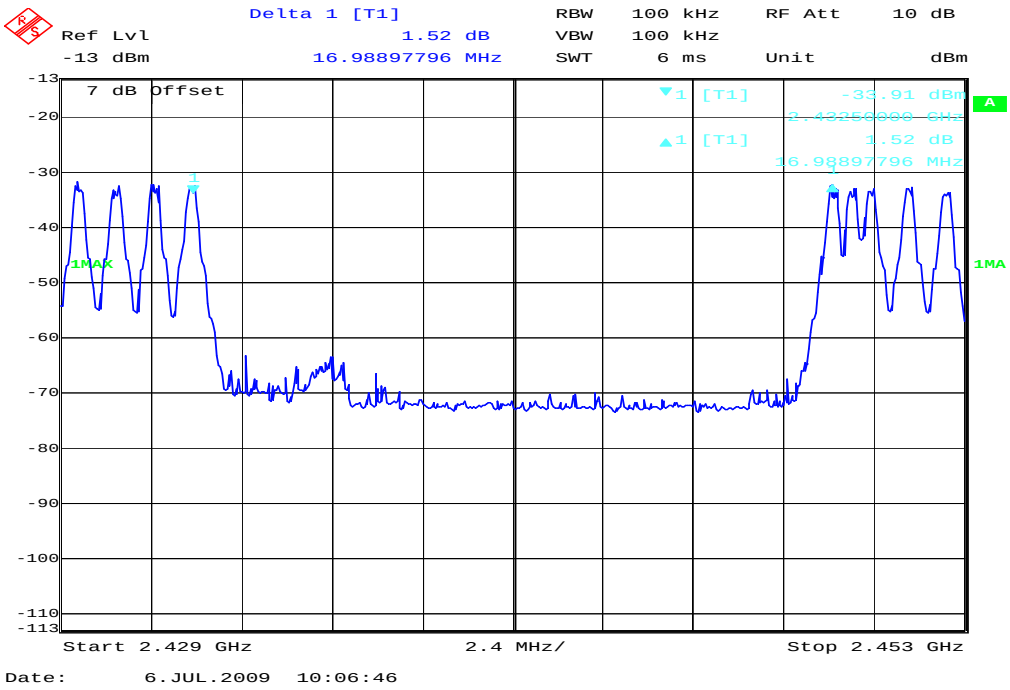


Result: Channel separation is: ~ 1 MHz

Limits:

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

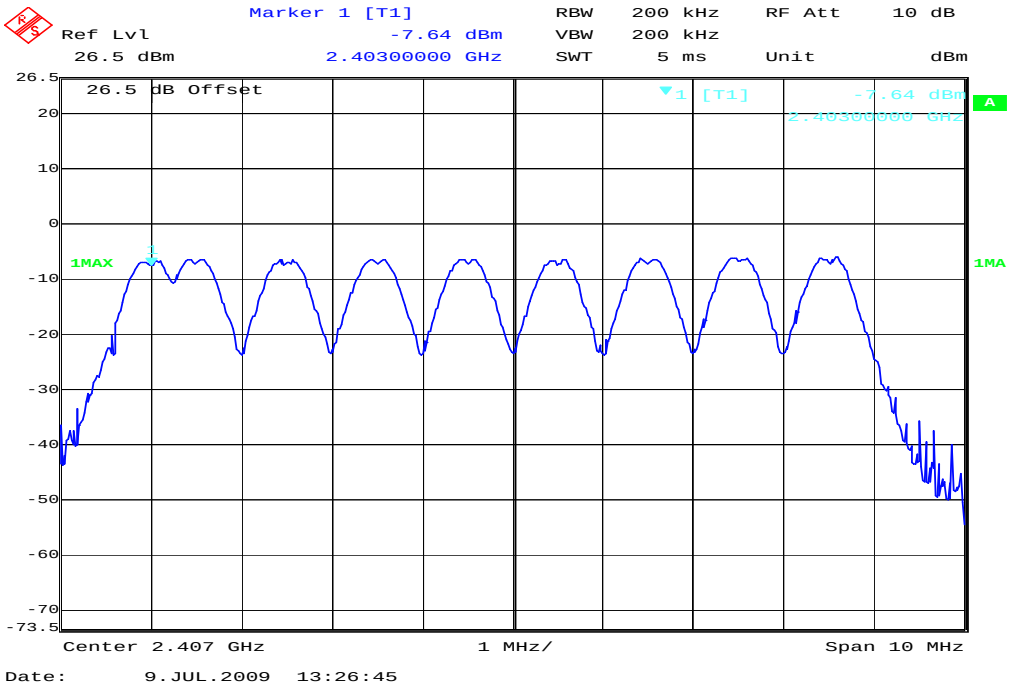
Plot 2 of 2:



Result: Sub-band separation is: ~ 17 MHz

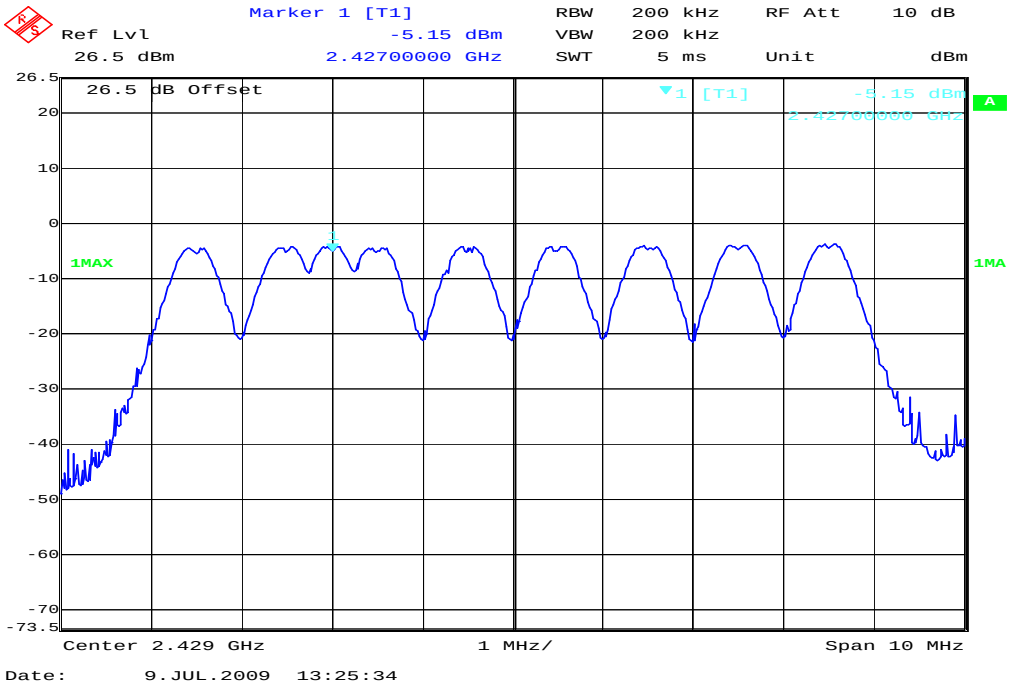
5.6. Number of hopping channels §15.247(a)(1)

Plot 1 of 4:



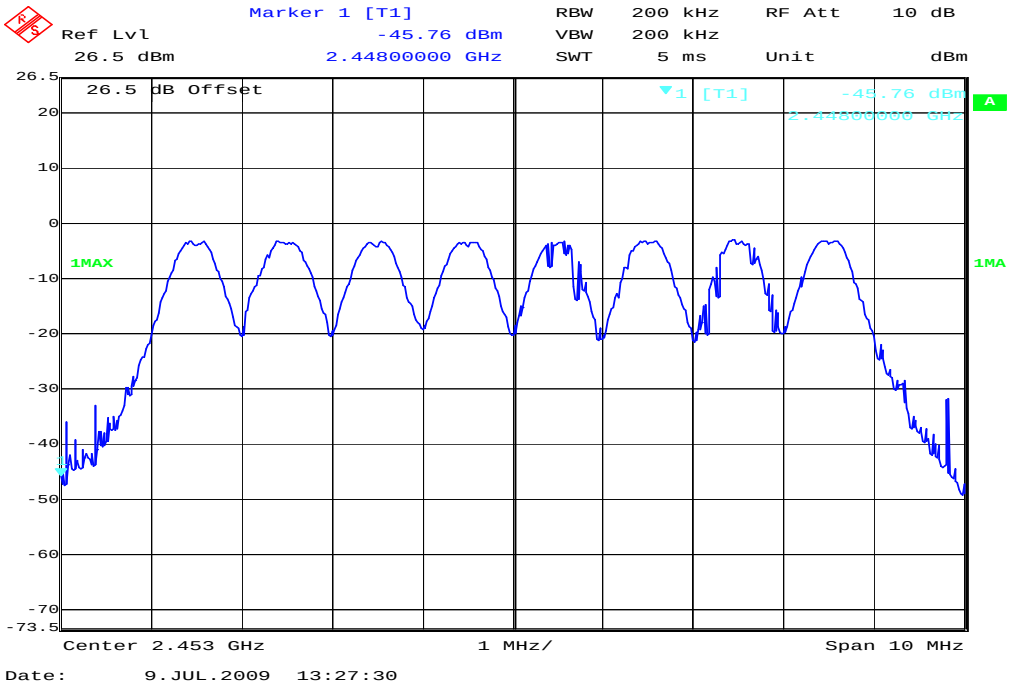
The 9th channel at 2403 MHz is the connection frequency. Due to the test application this channel can not be disabled after connection and

Plot 2 of 4:

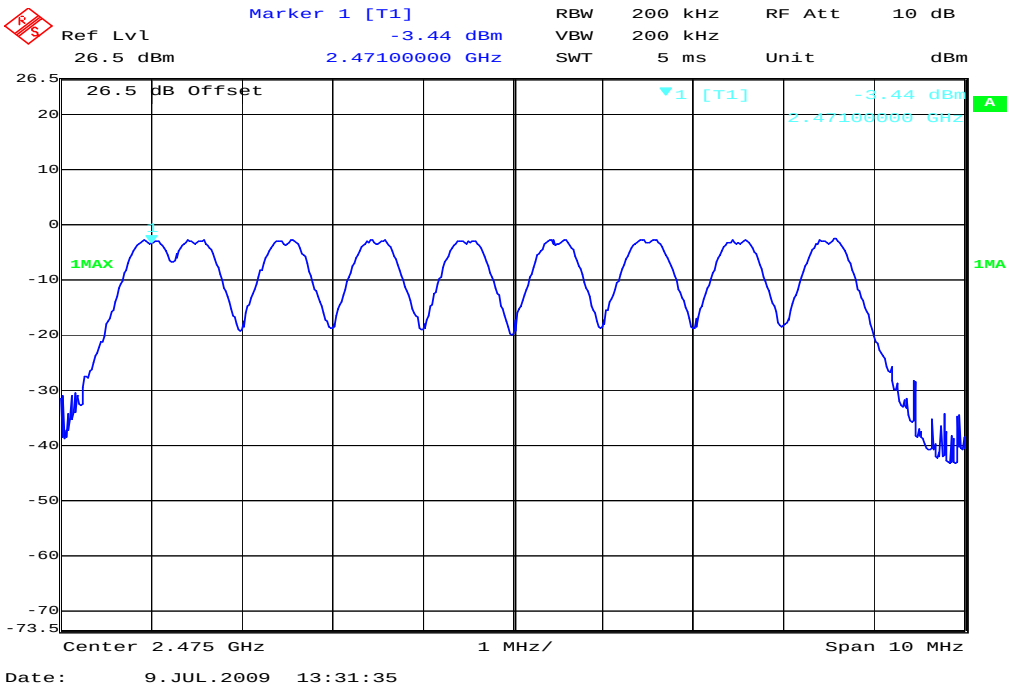


The 9th channel at 2427 MHz is a connection frequency. Due to the test application this channel can not be disabled after connection.

Plot 3 of 4:



Plot 4 of 4:



The 9th channel at 2471 MHz is a connection frequency. Due to the test application this channel can not be disabled after connection.

Result: The number of hopping channels is: 32

Limits:

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

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 Steute wireless SW100:

The dwell time of 0.4 s within a 12.8 second period in data mode is independent from the packet type (packet length). The calculation for a 12.8 second period is a follows:

Dwell time = time slot length * hop rate / number of hopping channels *12.8 s

Dwell time = 5 ms * 200 1/s / 32 * 12.8 s = 0.4 s (in a 12.8 s period)

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

Not applicable

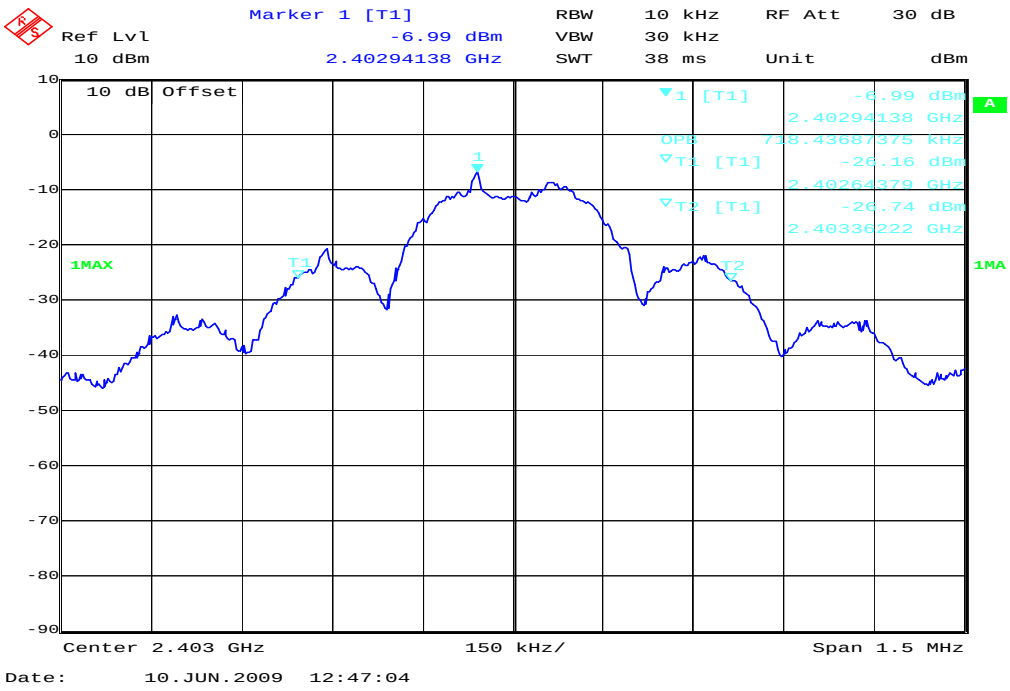
Result: Power density: - dBm/Hz = - dBm / 3 kHz

Limits:

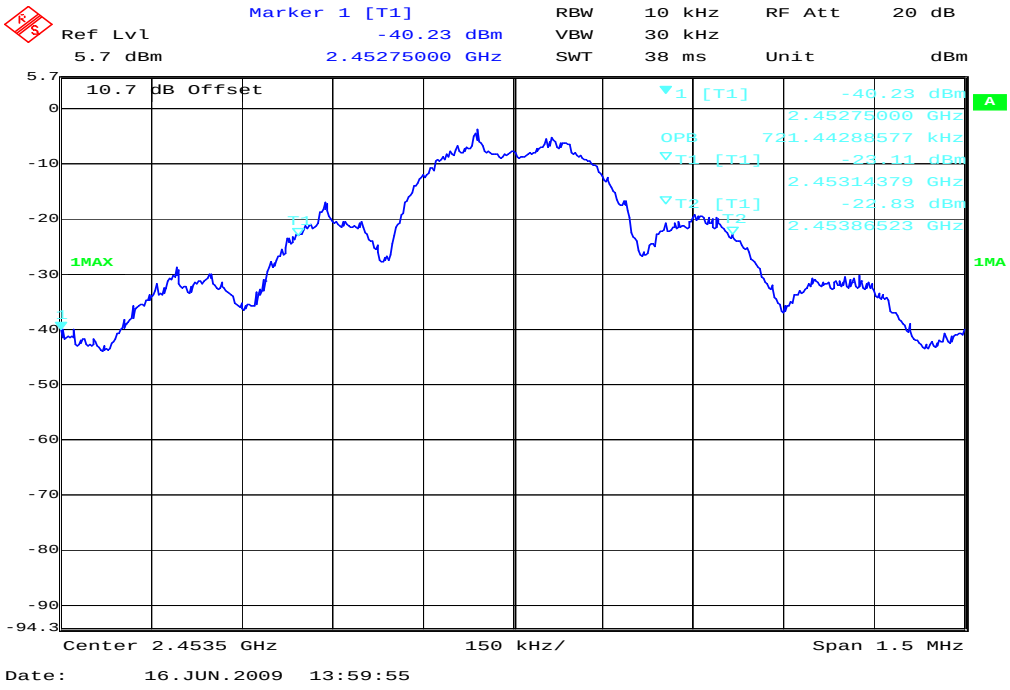
Under normal test conditions only	For digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission

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

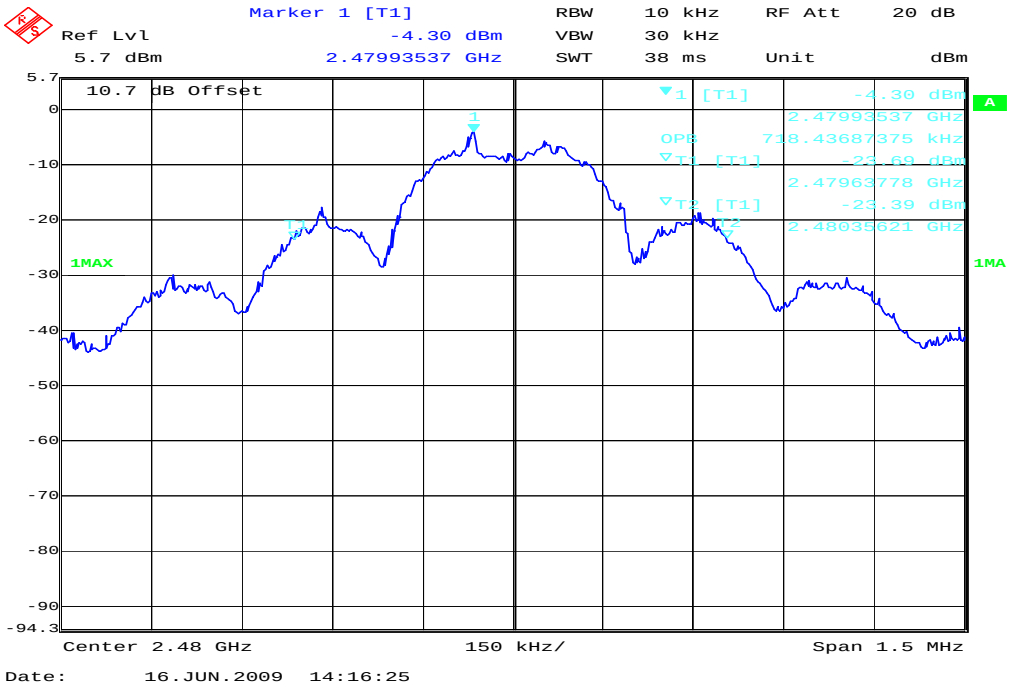
Plot 1 of 3



Plot 2 of 3



Plot 3 of 3



Result:

Test conditions		20 dB BANDWIDTH [kHz]		
Frequency [MHz]		2403	2453.5	2480
T_{nom}	V_{nom}	718.43	721.44	718.43
Measurement uncertainty		± 10 kHz		

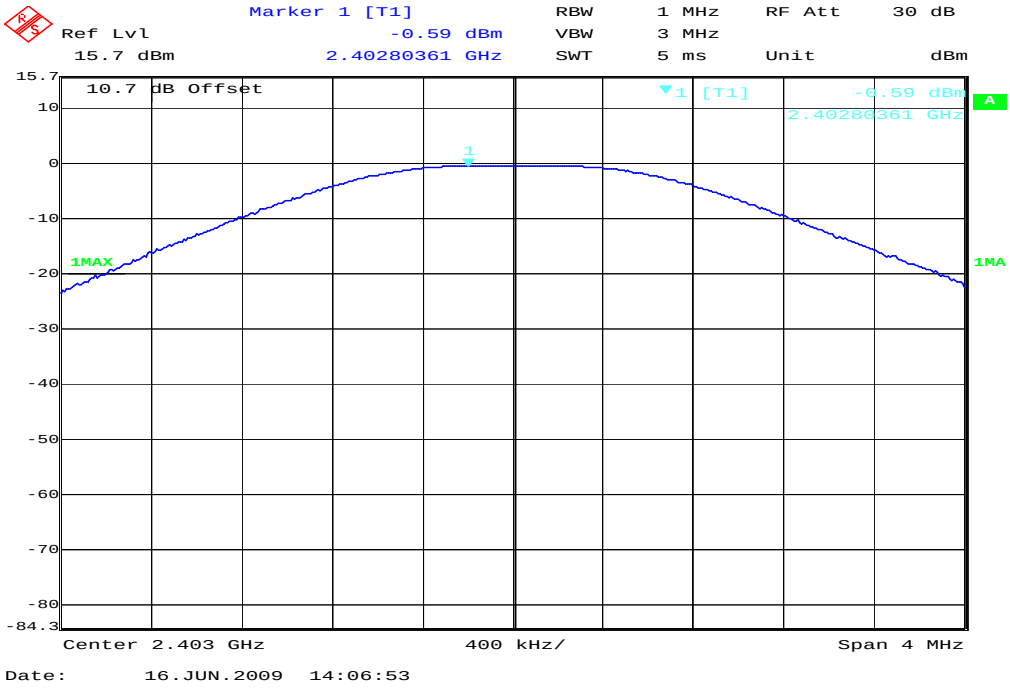
RBW / VBW as provided in the „Measurement Guidelines“ (DA 00-705, March 30, 2000)
RBW: 10 kHz / VBW 30 kHz

Limits:

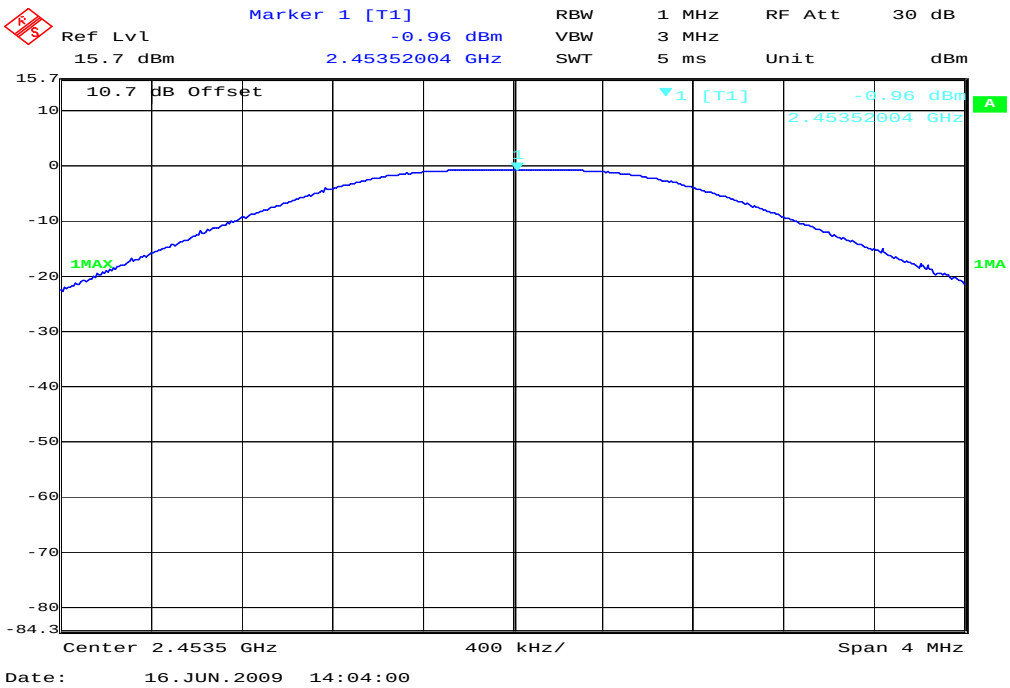
Under normal test conditions only	< 1000 kHz

5.10 Maximum output power (conducted) § 15.247 (b)(1)

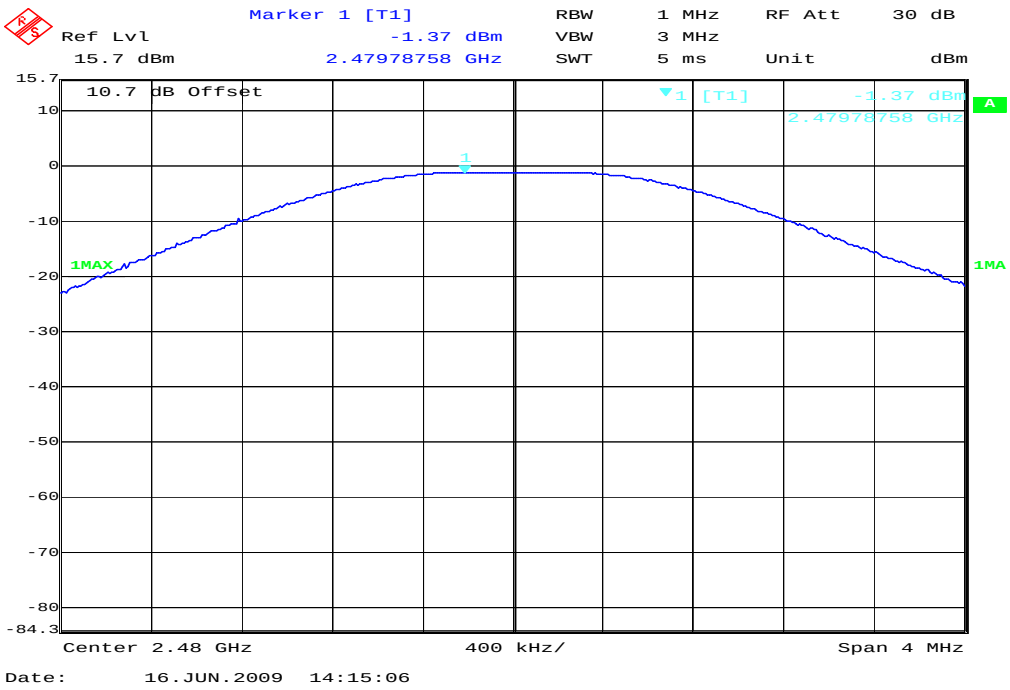
Plot 1 of 3



Plot 2 of 3



Plot 3 of 3



Results:

Test conditions		Max. peak output power [dBm]					
Frequency [MHz]		2403		2453.5		2480	
T_{nom}	V_{nom}	PK	-0.59	PK	-0.96	PK	-1.37
Measurement uncertainty		±3dB					

RBW / VBW: 1/3 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)

Internal antenna

Results:

Test conditions		Max. peak output power EIRP [dBm]		
Frequency [MHz]		2403	2453.5	2480
T_{nom}	V_{nom}	-1.91	-1.60	-2.38
Measurement uncertainty		±3dB		

RBW / VBW: 1/3 MHz

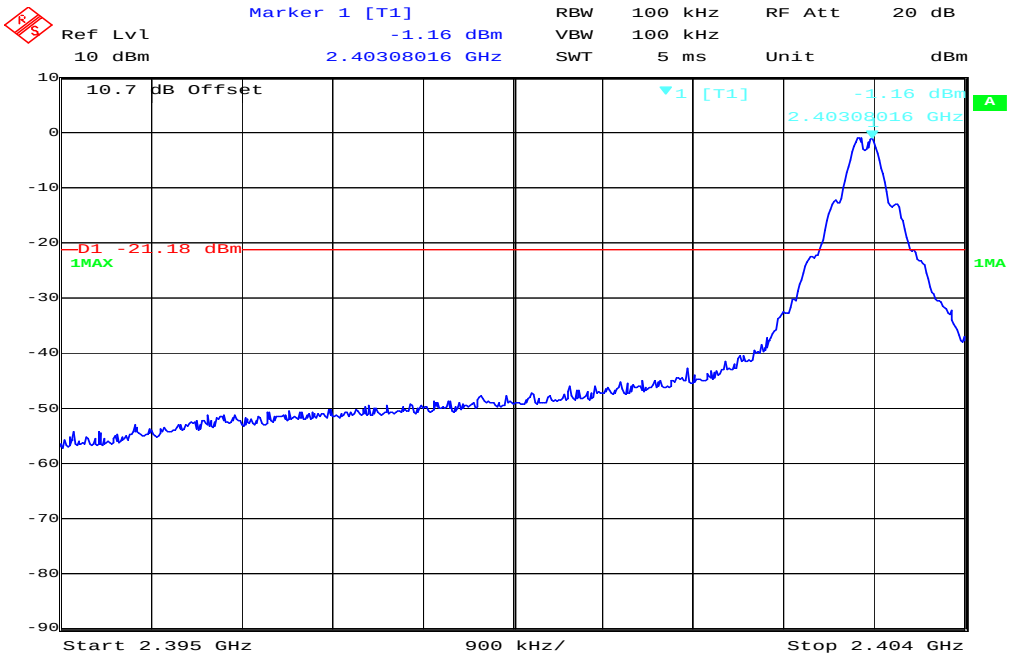
Limits:

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)

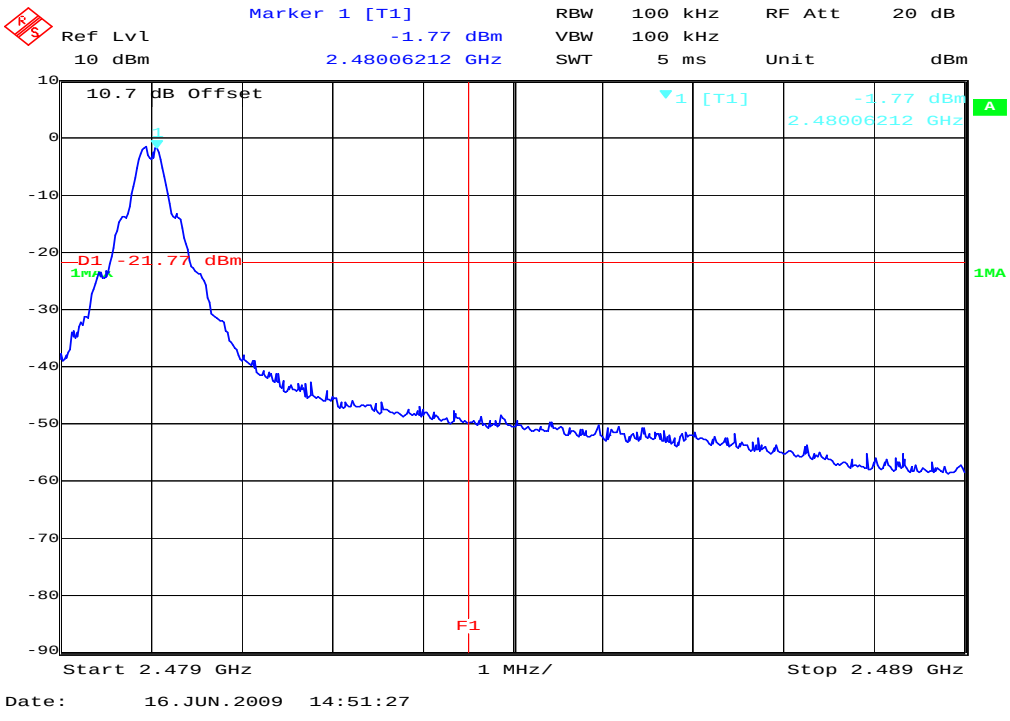
Plot 1 of 2 (hopping off, lowest frequency): also valid for hopping mode

The first hopping frequency (2403.5 MHz) is 500 kHz more distant from the band edge than the first non-hopping frequency.



Plot 2 of 2 (hopping off, lowest frequency): also valid for hopping mode.

The last hopping frequency (2478.5 MHz) is 500 kHz more distant from the band edge than the last non-hopping frequency.



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

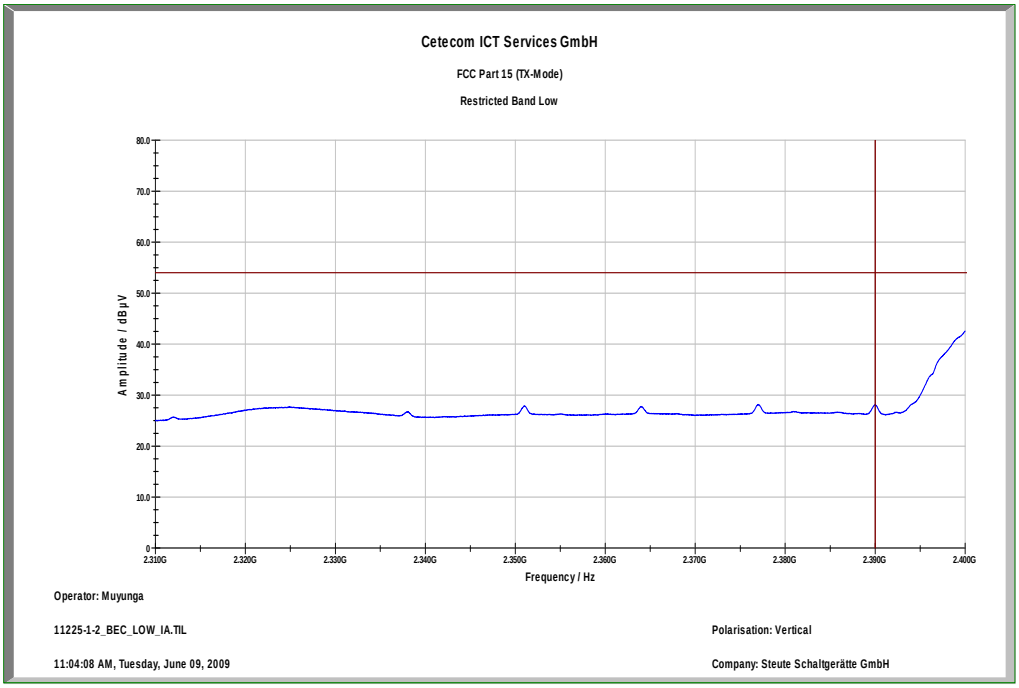
Limits:

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)).

5.13 Band-edge compliance of radiated emissions §15.205

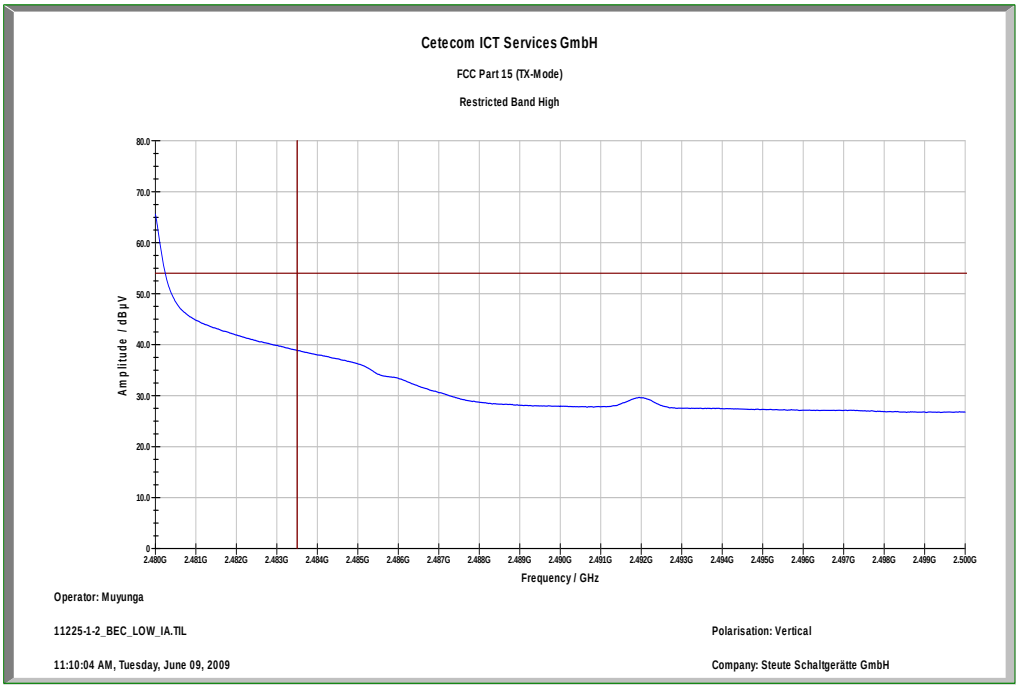
Plot 1: Restricted Bands low, (hopping off, lowest frequency): also valid for hopping mode

The first hopping frequency (2403.5 MHz) is 500 kHz more distant from the band edge than the first non-hopping frequency



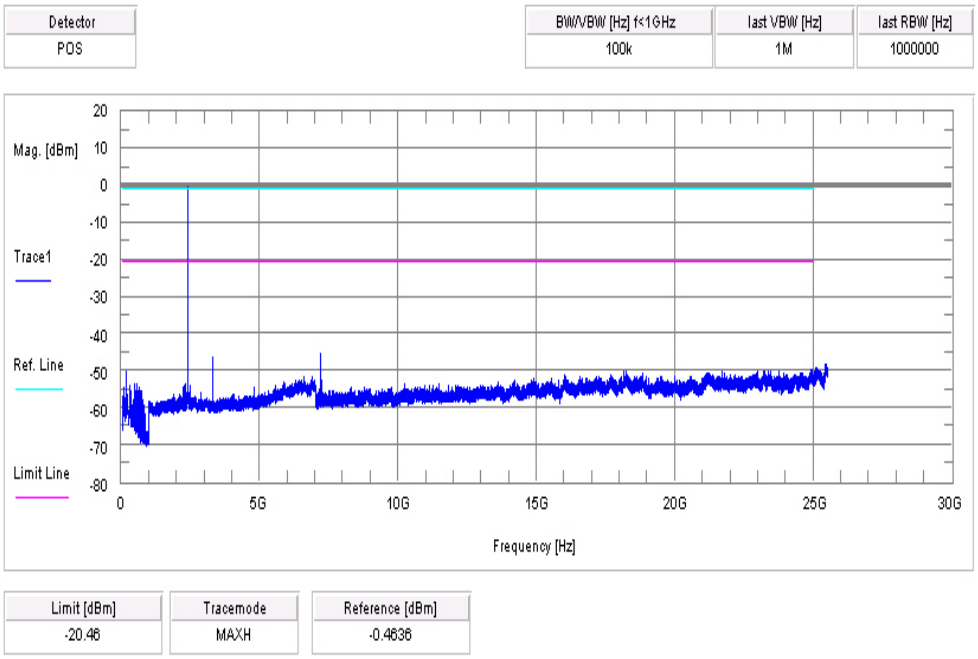
Plot 2: Restricted Bands high, (hopping off, lowest frequency): also valid for hopping mode

The last hopping frequency (2478.5 MHz) is 500 kHz more distant from the band edge than the last non-hopping frequency.

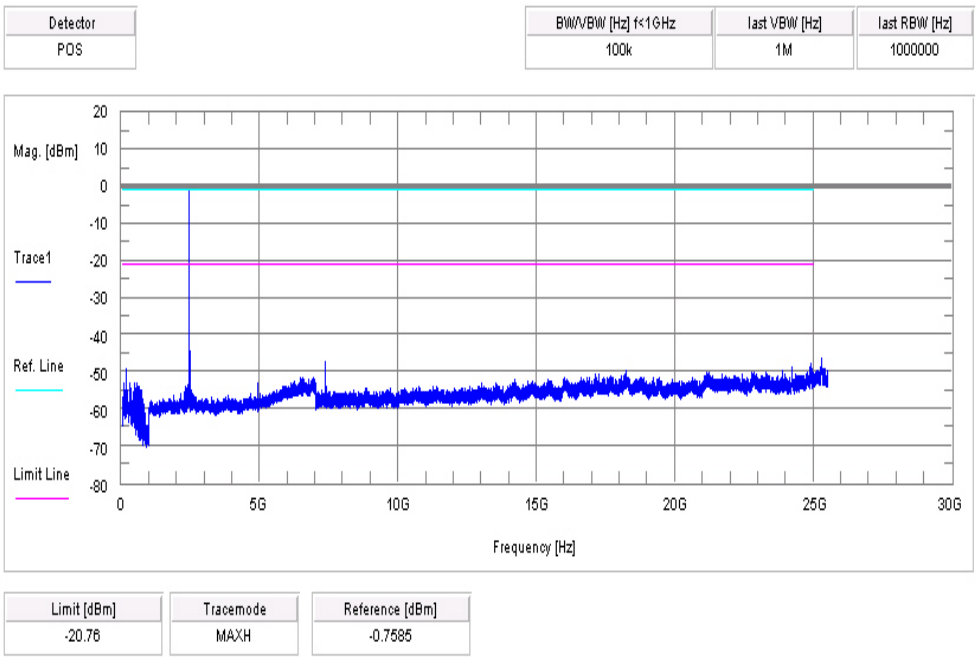


5.14 Spurious Emissions - conducted (Transmitter) § 15.247 (c)(1)

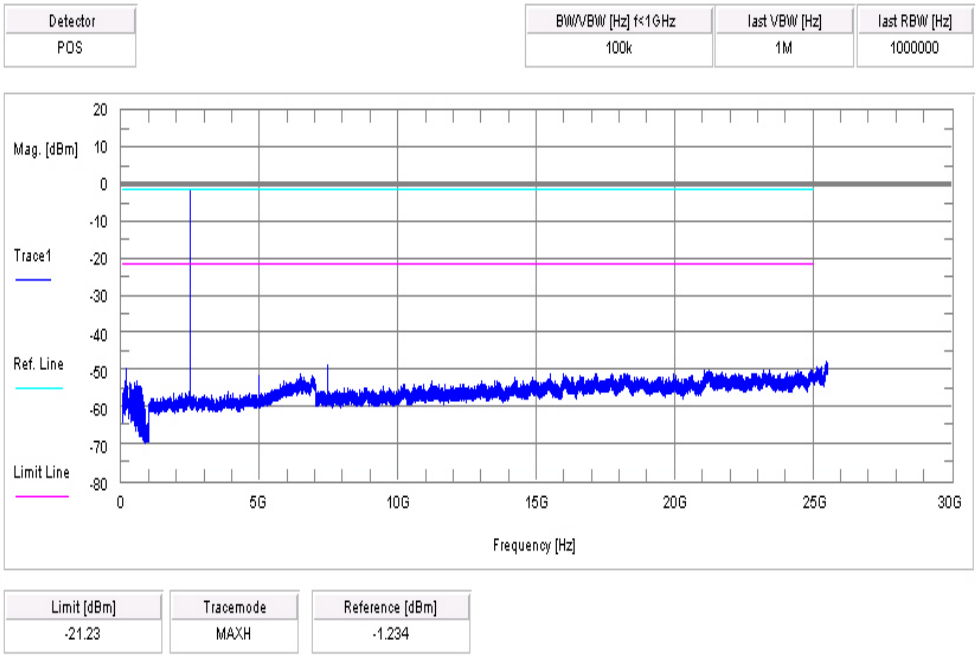
Plot 1 of 3: lowest channel



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		-0.46	30 dBm		Operating frequency
No critical peaks detected			-20 dBc		**Complies**
2453.5		-0.75	30 dBm		Operating frequency
No critical peaks detected			-20 dBc		**Complies**
2480		-1.23	30 dBm		Operating frequency
No critical peaks detected			-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)

Internal antenna

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

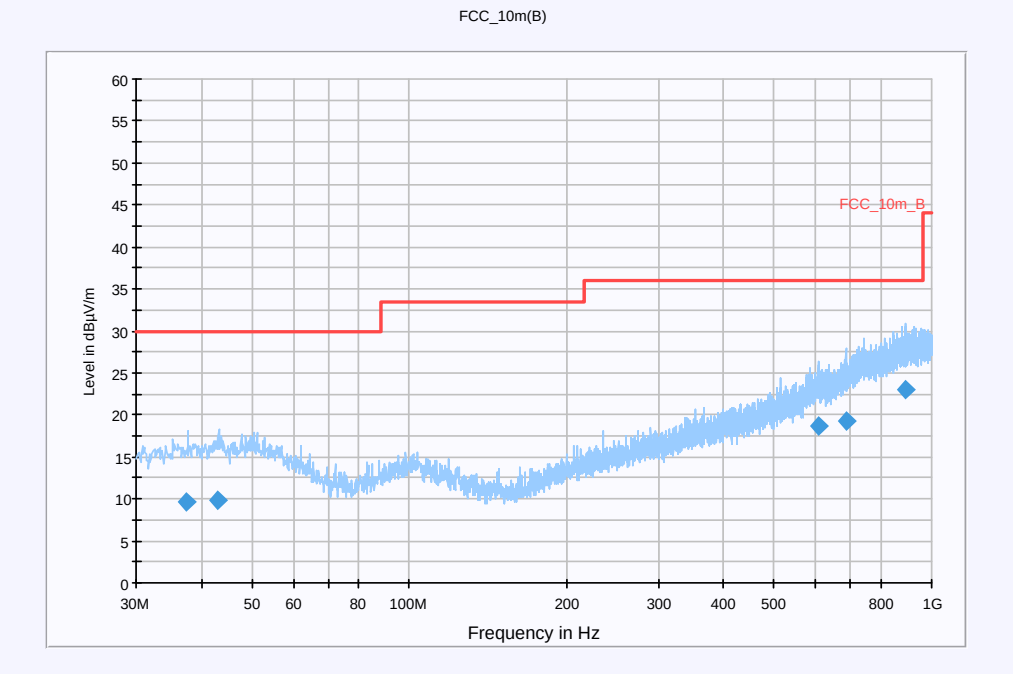
Common Information

EUT:	SW100
Serial Number:	sample 1
Test Description:	FCC Part 15 B Class B
Operating Conditions:	Tx 2,403 GHz
Operator Name:	LANGER
Comment:	Powerd with AC/DC Adaptor (115 V AC to 7 V DC)

Scan Setup: STAN_Fin [EMI radiated]

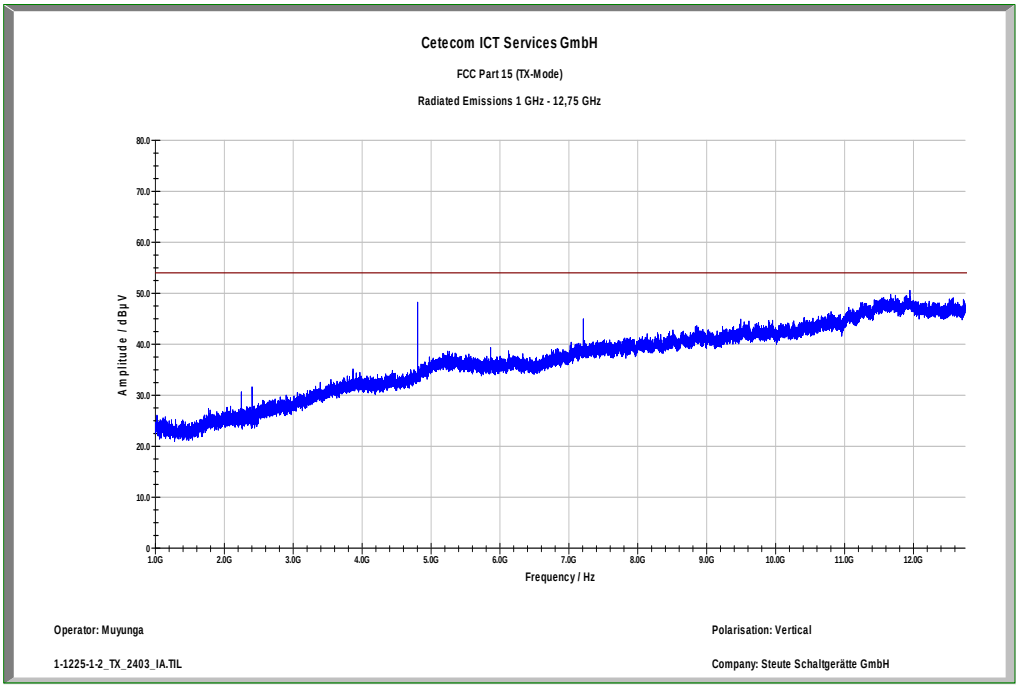
Hardware Setup:	Electric Field (NOS)
Level Unit:	dBµV/m

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



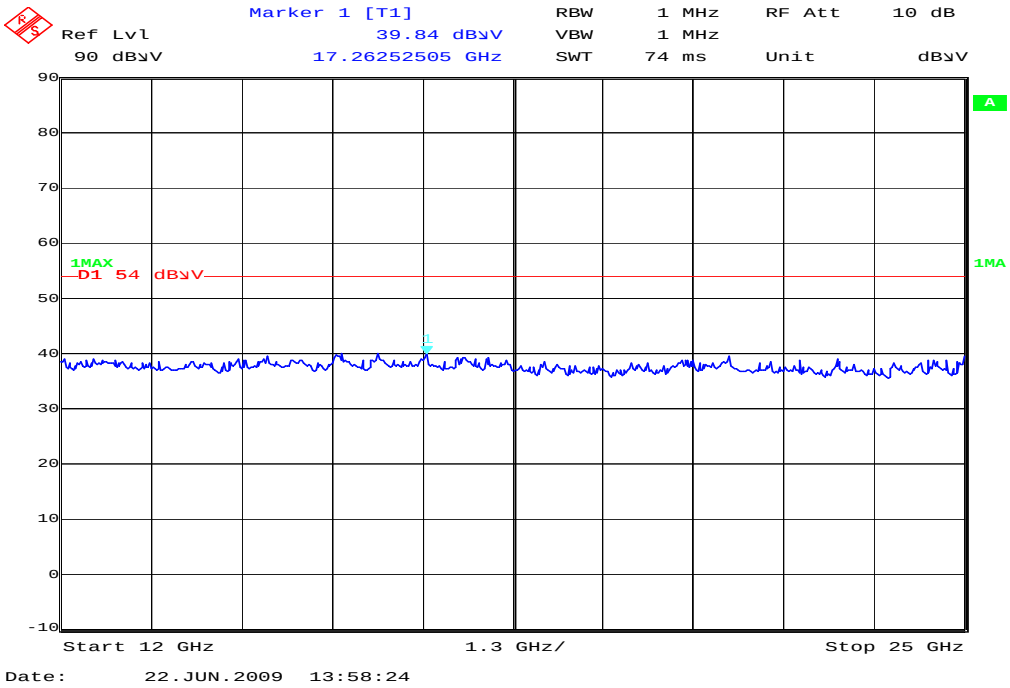
Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
37.563200	9.7	15000.000	120.000	400.0	H	73.0	13.4	20.3	30.0
42.944300	9.9	15000.000	120.000	198.0	V	190.0	13.5	20.1	30.0
606.987100	18.8	15000.000	120.000	198.0	V	202.0	21.4	17.2	36.0
684.666850	19.3	15000.000	120.000	198.0	H	307.0	22.6	16.7	36.0
889.930350	22.9	15000.000	120.000	400.0	H	39.0	25.6	13.1	36.0

Plot 2: 1 - 12 GHz vertical worst case (lowest channel)



Signal suppressed with a 2.4 GHz band-reject filter

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



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

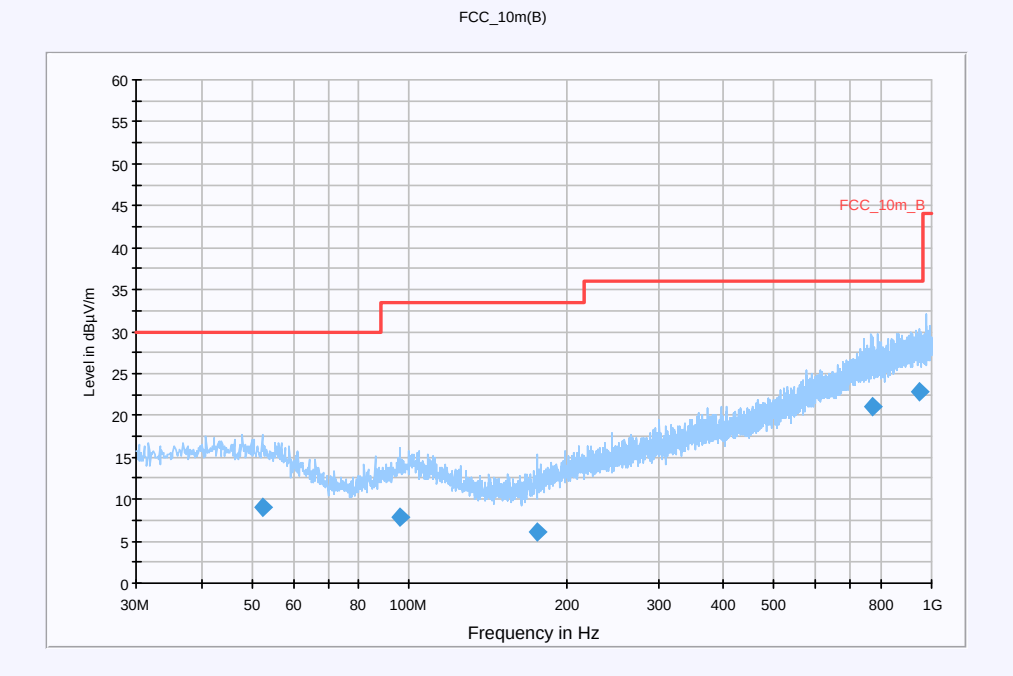
Common Information

EUT:	SW100
Serial Number:	sample 1
Test Description:	FCC Part 15 B Class B
Operating Conditions:	Tx 2,4535 GHz
Operator Name:	LANGER
Comment:	Powerd with AC/DC Adaptor (115 V AC to 7 V DC)

Scan Setup: STAN_Fin [EMI radiated]

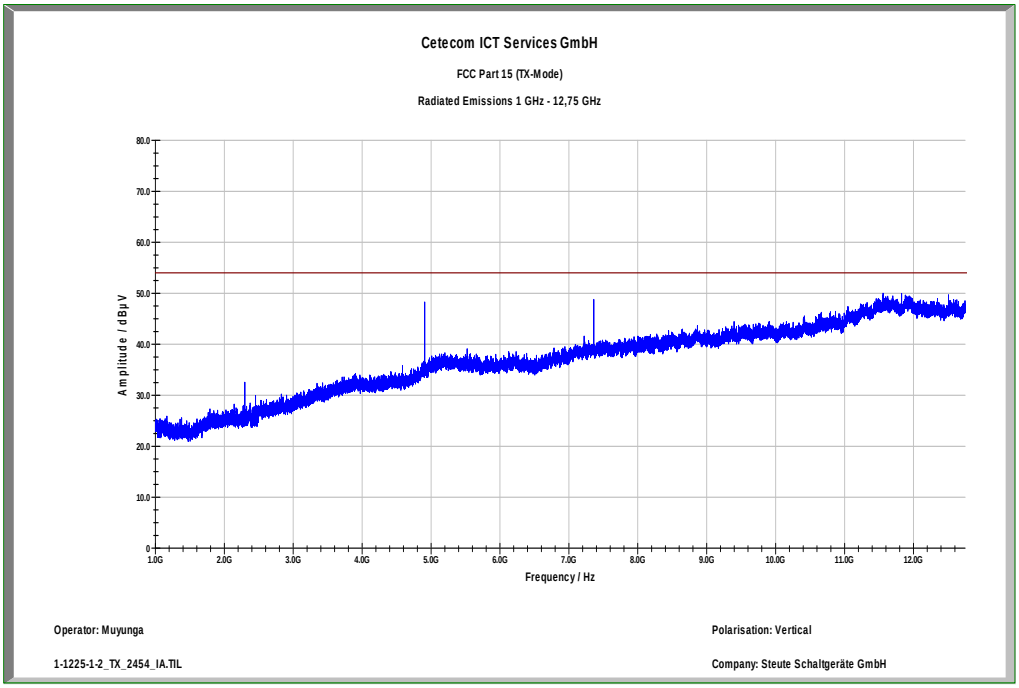
Hardware Setup:	Electric Field (NOS)
Level Unit:	dBµV/m

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



Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
52.288100	9.0	15000.000	120.000	317.0	V	244.0	13.3	21.0	30.0
95.756750	7.9	15000.000	120.000	400.0	V	233.0	11.7	25.6	33.5
175.872750	6.1	15000.000	120.000	198.0	V	234.0	10.4	27.4	33.5
768.305900	21.1	15000.000	120.000	300.0	H	175.0	24.2	14.9	36.0
948.314200	22.9	15000.000	120.000	225.0	H	16.0	25.8	13.1	36.0

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



Signal suppressed with a 2.4 GHz band-reject filter

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

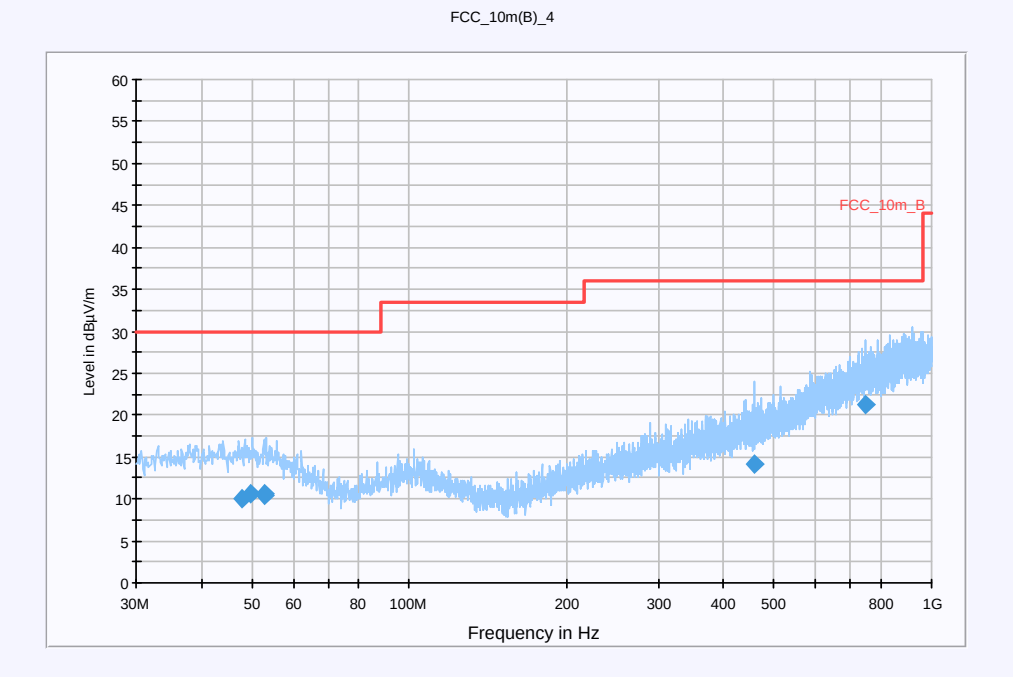
Common Information

EUT:	SW100
Serial Number:	sample 1
Test Description:	FCC Part 15 B Class B
Operating Conditions:	Tx 2,48 GHz
Operator Name:	LANGER
Comment:	Powerd with AC/DC Adaptor (115 V AC to 7 V DC)

Scan Setup: STAN_Fin [EMI radiated]

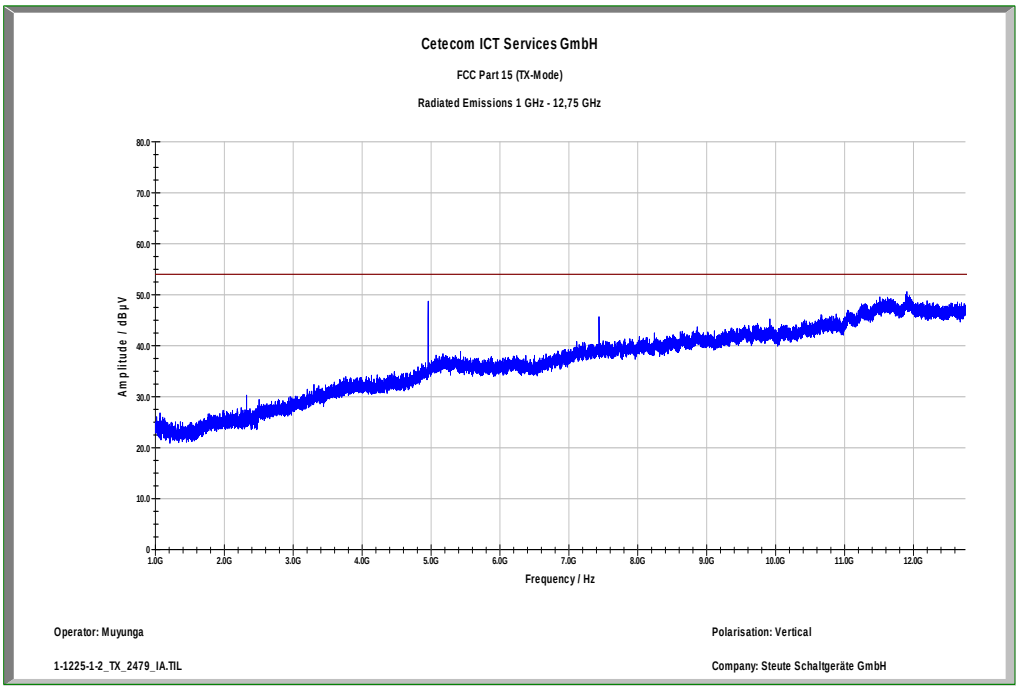
Hardware Setup:	Electric Field (NOS)
Level Unit:	dBµV/m

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



Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
48.015550	10.0	15000.000	120.000	158.0	V	323.0	13.5	20.0	30.0
49.554200	10.7	15000.000	120.000	213.0	V	205.0	13.5	19.3	30.0
52.956300	10.5	15000.000	120.000	105.0	V	224.0	13.3	19.5	30.0
52.970600	10.6	15000.000	120.000	220.0	V	145.0	13.3	19.4	30.0
457.789650	14.2	15000.000	120.000	190.0	H	288.0	18.2	21.8	36.0
747.018500	21.2	15000.000	120.000	220.0	V	0.0	24.1	14.8	36.0

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



Signal suppressed with a 2.4 GHz band-reject filter

Results:

SPURIOUS EMISSIONS LEVEL (dBµV/m)								
2403 MHz			2453.5 MHz			2480 MHz		
F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]
4806	peak	53.34	4907	peak	53.01	4960	Peak	52.56
7209	peak	46.63	7360.5	peak	45.98	7440	Peak	45.66
Measurement uncertainty			±3 dB					

f < 1 GHz : RBW/VBW: 100 kHz f ≥ 1GHz : 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 [µV/m]	Measurement distance (m)
30 - 88	100 (40 dBµV/m)	3
88 - 216	150 (43.5 dBµV/m)	3
216 - 960	200 (46 dBµV/m)	3
above 960	500 (54 dBµV/m)	3

5.16 Spurious Emissions - radiated (Receiver) § 15.109

Internal antenna

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

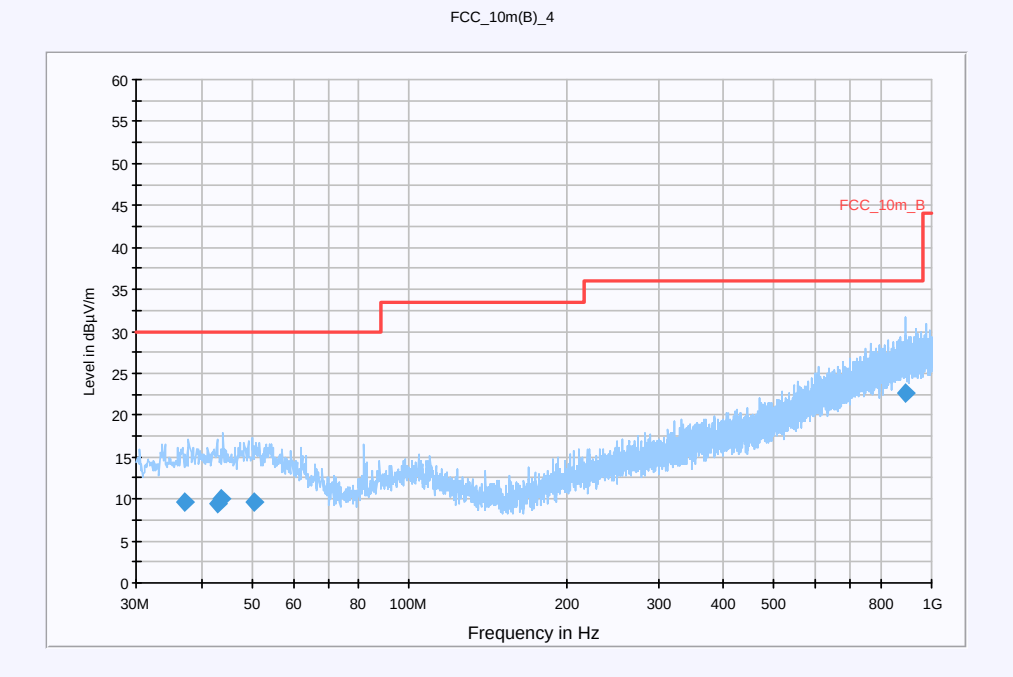
Common Information

EUT:	SW100
Serial Number:	sample 1
Test Description:	FCC part 15 B Class B
Operating Conditions:	idle
Operator Name:	Lang
Comment:	Powerd with AC/DC Adaptor (115 V AC to 7 V DC)

Scan Setup: STAN_Fin [EMI radiated]

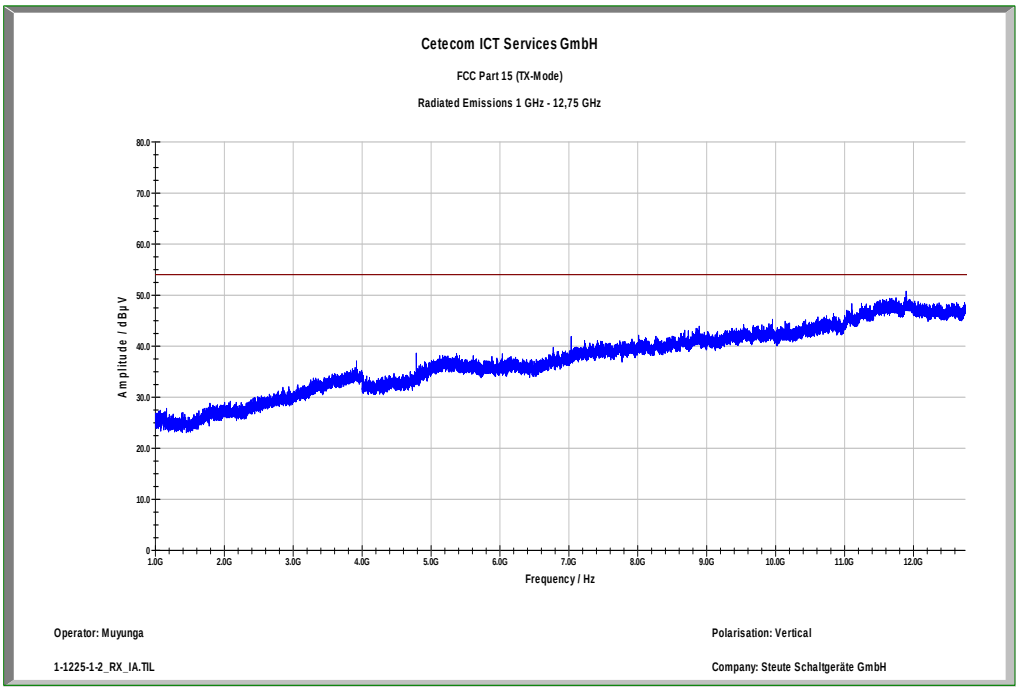
Hardware Setup:	Electric Field (NOS)
Level Unit:	dBµV/m

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



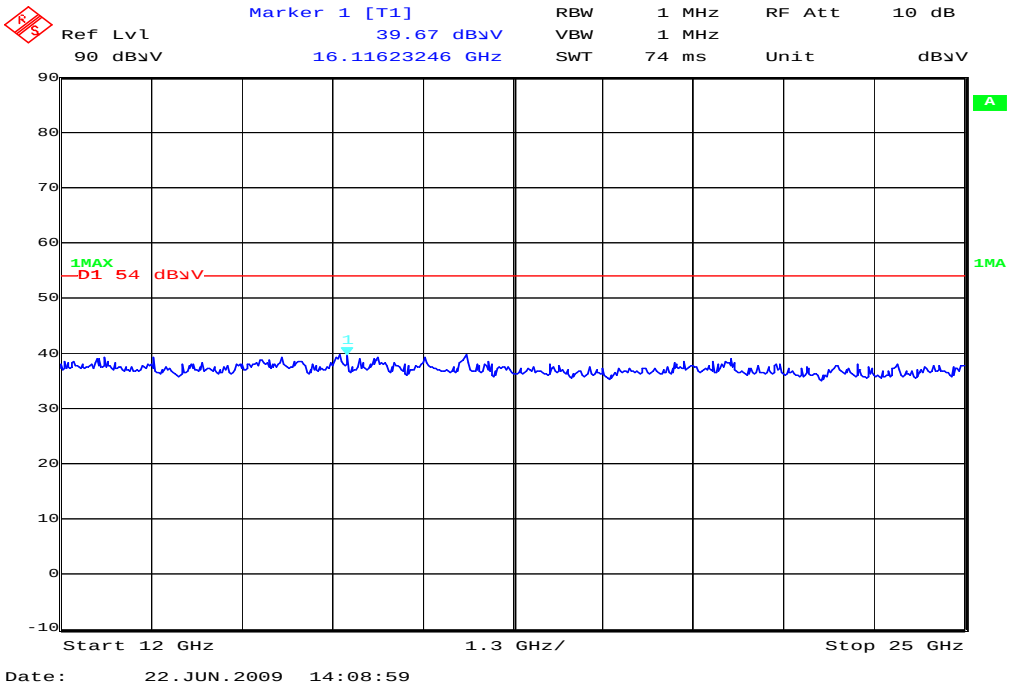
Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
37.299550	9.6	15000.000	120.000	220.0	V	261.0	13.4	20.4	30.0
43.096700	9.4	15000.000	120.000	220.0	H	39.0	13.5	20.6	30.0
43.776850	10.1	15000.000	120.000	186.0	V	300.0	13.5	19.9	30.0
50.463950	9.7	15000.000	120.000	206.0	H	26.0	13.5	20.3	30.0
893.569850	22.7	15000.000	120.000	220.0	V	119.0	25.6	13.3	36.0

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



Signal suppressed with a 2.4 GHz band-reject filter

Plot 3: 12 - 25 GHz vertical/horizontal (receiver)



Spurious Emissisons level [dBµV/m]		
f[MHz]	Detector	Level [dBµV/m]
No critical peaks detected		
Measurement uncertainty	±3 dB	

f < 1 GHz: RBW/VBW: 100 kHz f ≥ 1GHz : RBW/VBW: 1 MHz
See above plots

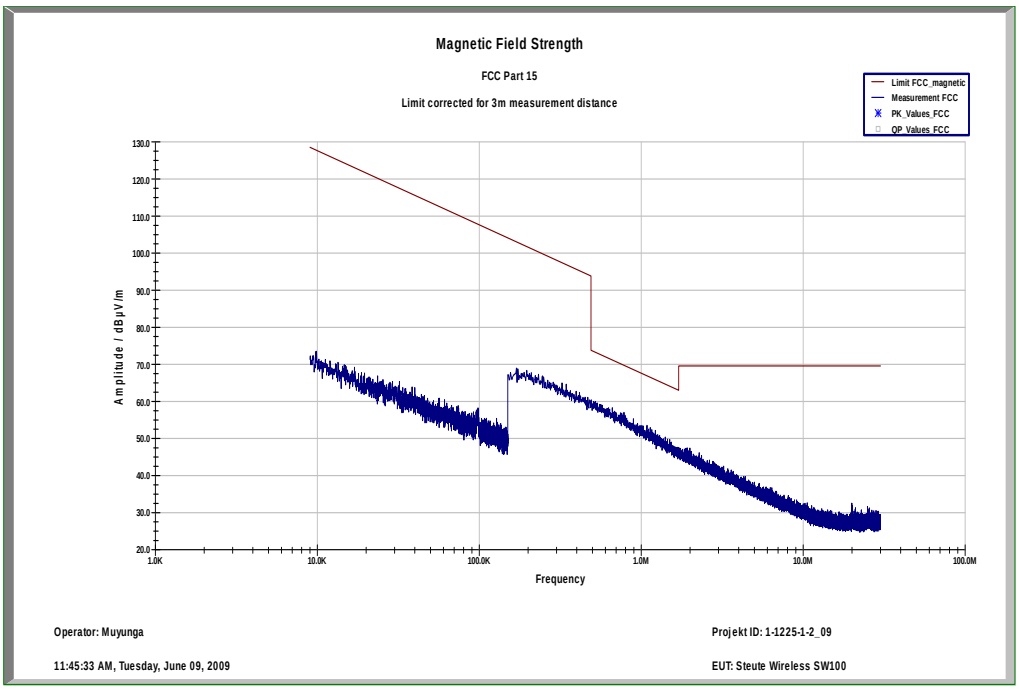
Measurement distance see table

Limits: § 15.109

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

5.17 Spurious Emissions < 30 MHz - Transmitter radiated § 15.209

Plot 1: Internal anrtenna

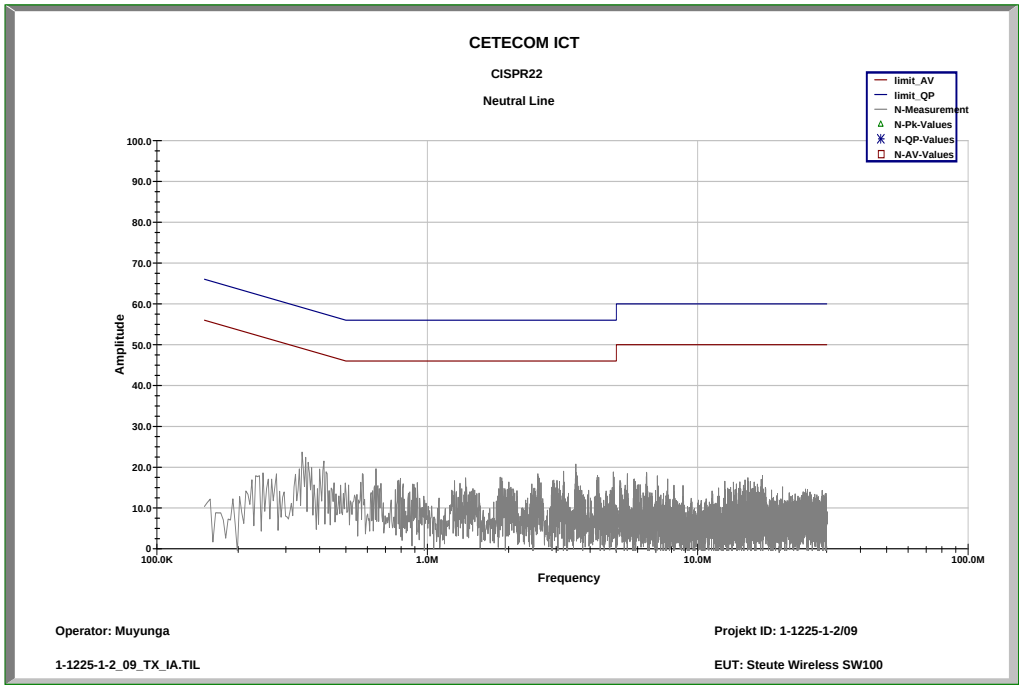


Limits:

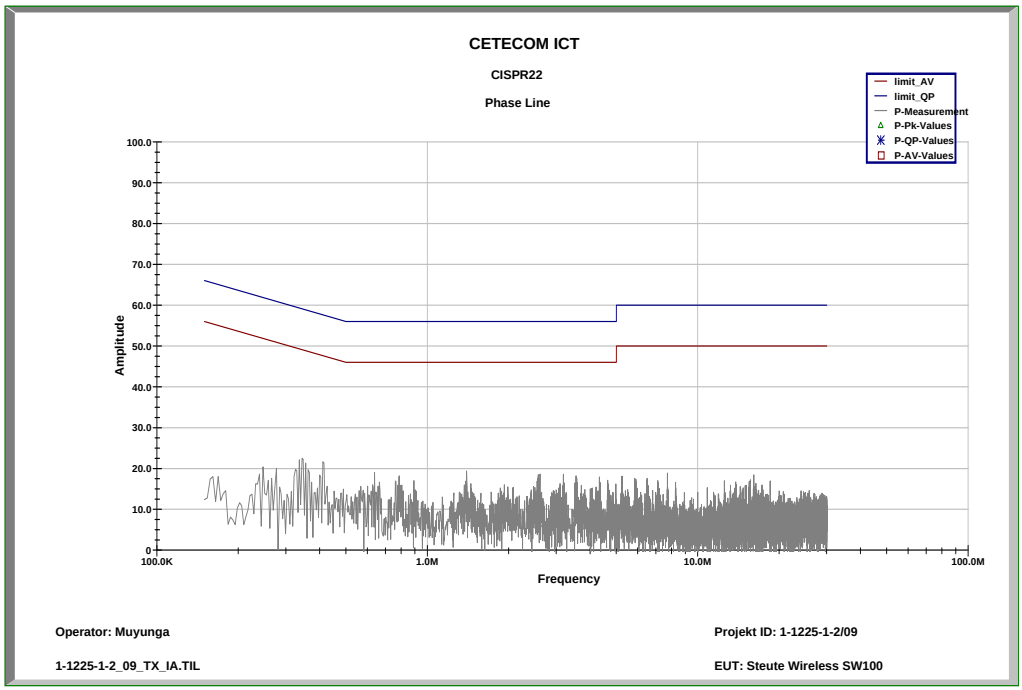
Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30 / 29.5 dBµV/m	30

5.18 Conducted Emissions <30 MHz § 15.107/207

Plot 1: Neutral Line



Plot 2: Phase Line



Limits:

Under normal test conditions only	See plots

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	PSA-Spektrumanalysator 3 Hz - 26.5 GHz (E4440A)	Agilent	MY48250080	300003812	05.08.2008	24	05.08.2010
5	EMI Preselector 9 kHz - 1 GHz (N9039A)	Agilent	MY48260003	300003825	19.08.2008	24	19.08.2010
6	Microwave Analog Signal Generator (N5183A)	Agilent	MY47420220	300003813	06.08.2008	24	06.08.2010
7	PC	F+W			n.a.		
8	TILE	TILE			n.a.		
9	TRILOG Super Broadband Antenna (VULB9163)	Schwarzbeck	371	300003854	Monthly verification (System cal.)		
10	Double Ridged Antenna 3115	EMCO	3088	300001032	Monthly verification (System cal.)		
11	Active Loop Antenna 6502	EMCO	2210	300001015	Monthly verification (System cal.)		
12	Switch / Control Unit 3488A	HP	2719A15013	300001156	n.a.		
13	Power Supply 6032A	HP	2818A03450	300001040	08.01.2009	36	08.01.2012
14	Busisolator	Kontron		300001056	n.a.		
15	Leitungsteiler 11850C	HP		300000997	Monthly verification (System cal.)		
16	Power attenuator 8325	Byrd	1530	300001595	Monthly verification (System cal.)		
17	Band reject filter WRCG1855/1910	Wainwright	7	300003350	Monthly verification (System cal.)		
18	Band reject filter WRCG2400/2483	Wainwright	11	300003351	Monthly verification (System cal.)		
19	Hochpassfilter WHK1.1/15G-10SS	Wainwright	3	300003255	Monthly verification (System cal.)		
20	Hochpassfilter WHKX2.9/18G-12SS	Wainwright	1	300003492	Monthly verification (System cal.)		
21	Hochpassfilter WHKX7.0/18G-8SS	Wainwright	18	300003789	Monthly verification (System cal.)		
22	Switch / Control Unit 3488A	HP	2605e08770	300001443	n.a.		
23	Trenntrafo RT5A	Grundig	9242	300001263	n.a.		
24	Relais Matrix PSU	R&S	890167/024	300001168	n.a.		
25	Netznachbildung ESH3-Z5	R&S	828576/020	300001210	n.a.		

System Rack Room 005:

No	Equipment/Type	Manuf.	Serial Nr.	Inv. No. Cetecom	Last Calibration	Frequency (months)	Next Calibration
1	FSP 30	R&S	100886	300003575	25.08.2008	24	25.08.2010
2	CBT	R&S	100313	300003516	03.09.2008	24	03.09.2010
3	Switch Matrix	HP		300000929	n.a.		
4	Power Supply 6625A	HP	3041A00544	300002270	13.05.2007	36	13.05.2010
5	Signal Generator SMIQ03B	R&S	836206/0092	300002680	30.05.2007	36	30.05.2010

Climatic Box:

No	Equipment/Type	Manuf.	Serial Nr.	Inv. No. Cetecom	Last Calibration	Frequency (months)	Next Calibration
1	Climatic box VT 4002	Heraeus Vötsch	58566046820010	300003019	28.05.2009	24	28.05.2011
2	Climatic box CTS T-40/50	CTS	064023	300003540	04.06.2009	24	04.06.2011

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	300002681-00xx	n.a.		
2	Memory Extension PSM-K10	R&S	To 1	300002681	n.a.		
3	Operating Software PSM-B2	R&S	To 1	300002681	n.a.		
4	19'' Monitor		22759020-ED	300002681	n.a.		
5	Mouse		LZE 0095/6639	300002681	n.a.		
6	Keyboard		G00013834L461	300002681	n.a.		
7	Spectrum Analyser FSIQ 26	R&S	835540/018	300002681-0005	10.01.2008	24	10.01.2010
8	Tracking Generator FSIQ-B10	R&S	835107/015	300002681	s.No.7		
10	RF-Generator SMIQ03 (B1 Signal)	R&S	835541/056	300002681-0002	26.08.2008	36	26.08.2011
11	Modulation Coder SMIQ-B20	R&S	To 10	300002681	s.No.10		
12	Data Generator SMIQ-B11	R&S	To 10	300002681	s.No.10		
13	RF Rear Connection SMIQ-B19	R&S	To 10	300002681	s.No.10		
14	Broadband horn antenna (1-18 GHz)	EMCO	9107-3696	300001604	16.04.2008	24	16.04.2010
15	Broadband horn antenna (1-18 GHz)	EMCO	9107-3697	300001605	21.08.2008	24	21.08.2010
16	Std gain horn antenna (18-26.5 GHz)	Narda	Model no. 638	300000486	n.a.		
17	Std gain horn antenna (18-26.5 GHz)	Narda	Model no. 638	300000487	n.a.		
18	Sleeve dipole antenna Model 3126-880	ETS-Lindgren	00040887	3000000	n.a.		
19	Fast CPU SM-B50	R&S	To 10	300002681	s.No.10		
20	FM Modulator SM-B5	R&S	835676/033	300002681	s.No.10		
21	RF-Generator SMIQ03 (B2 Signal)	R&S	835541/055	300002681-0001	25.08.2008	36	25.08.2011
22	Modulation Coder SMIQ-B20	R&S	To 21	300002681	s.No.21		
23	Data Generator SMIQ-B11	R&S	To 21	300002681	s.No.21		
24	RF Rear Connection SMIQ-B19	R&S	To 21	300002681	s.No.21		
25	Fast CPU SM-B50	R&S	To 21	300002681	s.No.21		
26	FM Modulator SM-B5	R&S	836061/022	300002681	s.No.21		
27	RF-Generator SMP03 (B3 Signal)	R&S	835133/011	300002681-0003	26.08.2008	36	26.08.2011
28	Attenuator SMP-B15	R&S	835136/014	300002681	S.No.27		
29	RF Rear Connection SMP-B19	R&S	834745/007	300002681	S.No.27		
30	Power Meter NRVD	R&S	835430/044	300002681-0004	26.08.2008	24	26.08.2010
31	Power Sensor NRVD-Z1	R&S	833894/012	300002681-0013	26.08.2008	24	26.08.2010
32	Power Sensor NRVD-Z1	R&S	833894/011	300002681-0010	26.08.2008	24	26.08.2010
33	Rubidium Standard RUB	R&S		300002681-0009	27.08.2008	24	27.08.2010
34	Switching and Signal Conditioning Unit SSCU	R&S	338864/003	300002681-0006	Verified with path compensation		
35	Laser Printer HP Deskjet 2100	HP	N/A	300002681-0011	n.a.		
36	19'' Rack	R&S	11138363000004	300002681	n.a.		
37	RF-cable set	R&S	N/A	300002681	n.a.		
39	IEEE-cables	R&S	N/A	300002681	n.a.		
40	Sampling System FSIQ-B70	R&S	835355/009	300002681	s.No.7		
41	RSP programmable attenuator	R&S	834500/010	300002681-0007	26.08.2008	24	26.08.2010
42	Signalling Unit	R&S	838312/011	300002681	n.a.		
43	NGPE programmable Power Supply for EUT	R&S	192.033.41	300002681			
44	Power Splitter 6005-3	Inmet Corp.	none	300002841	n.a.		
45	SMA Cables SPS-1151-985-SPS	Insulated Wire	different	different	n.a.		
46	CBT32 with EDR Signaling Unit	R&S					

47	Coupling unit	Narda	N/A	--	n.a.		
48	2xSwitch Matrix PSU	R&S	872584/021	300001329	n.a.		
49	RF-cable set	R&S	N/A	different	n.a.		
50	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 VULB 9163	Schwarzbeck	295	300003787	01.04.2008	24	01.04.2010
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: Internal antenna

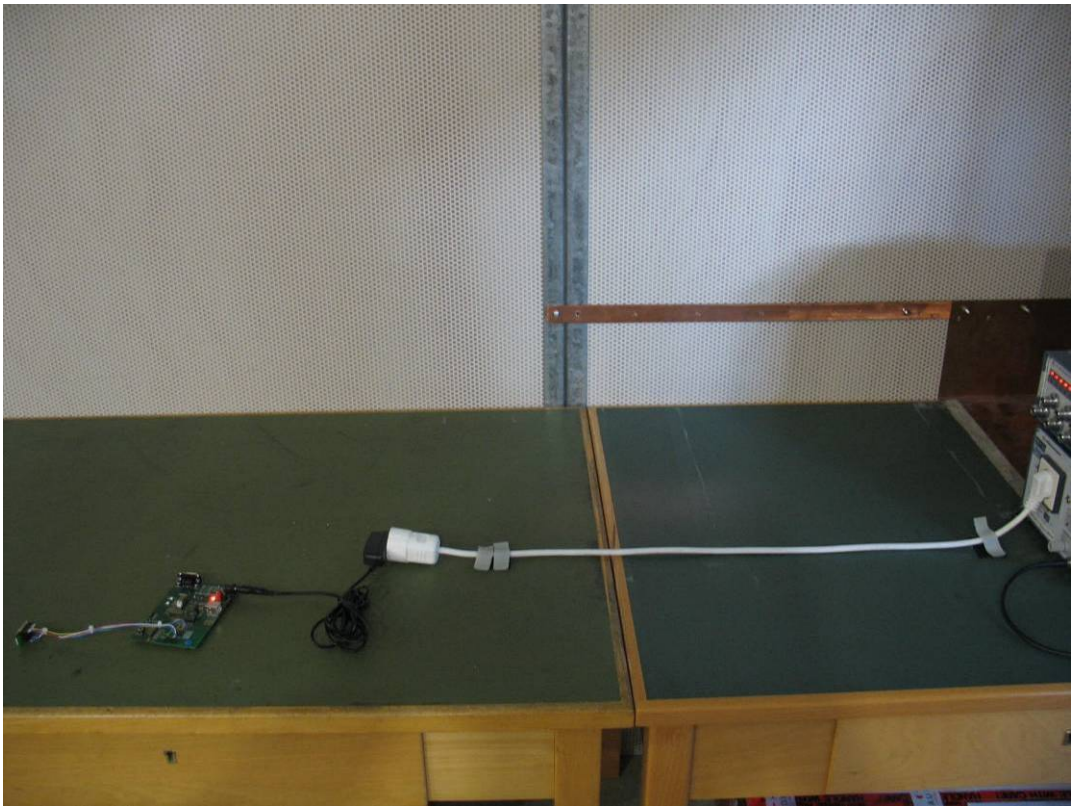


Photo 2: Internal antenna

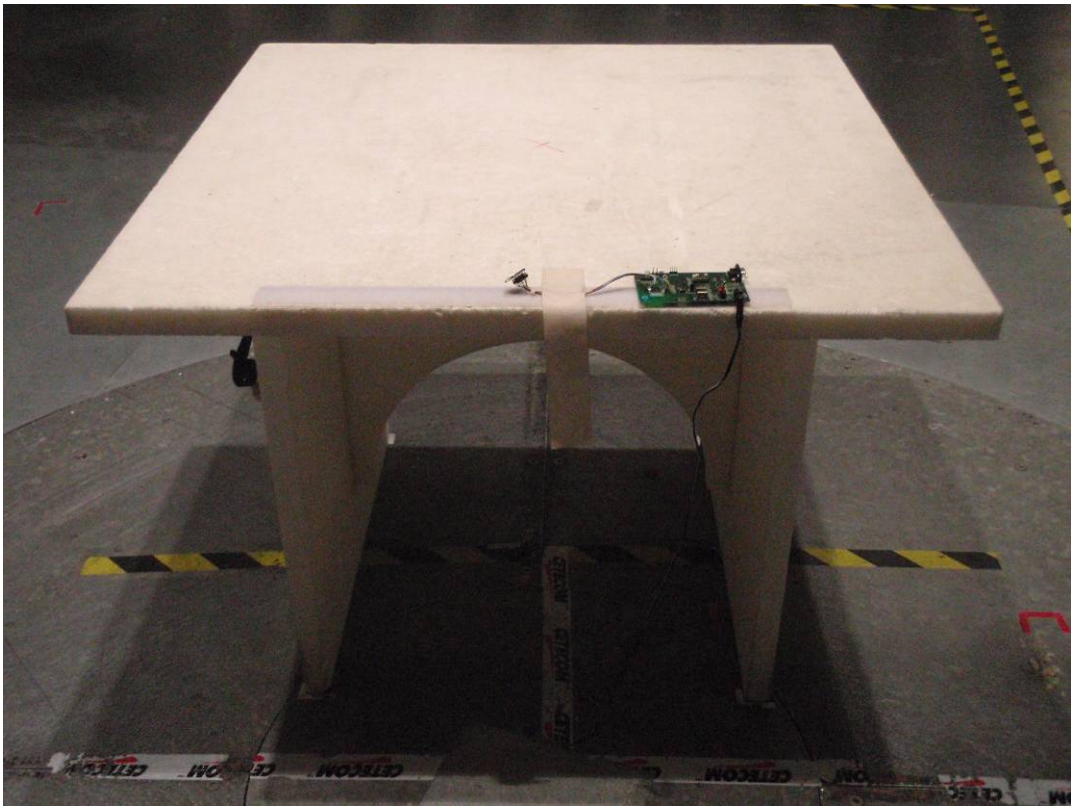


Photo 3: Internal antenna

8 Photographs of the EUT

Photo 4: EUT

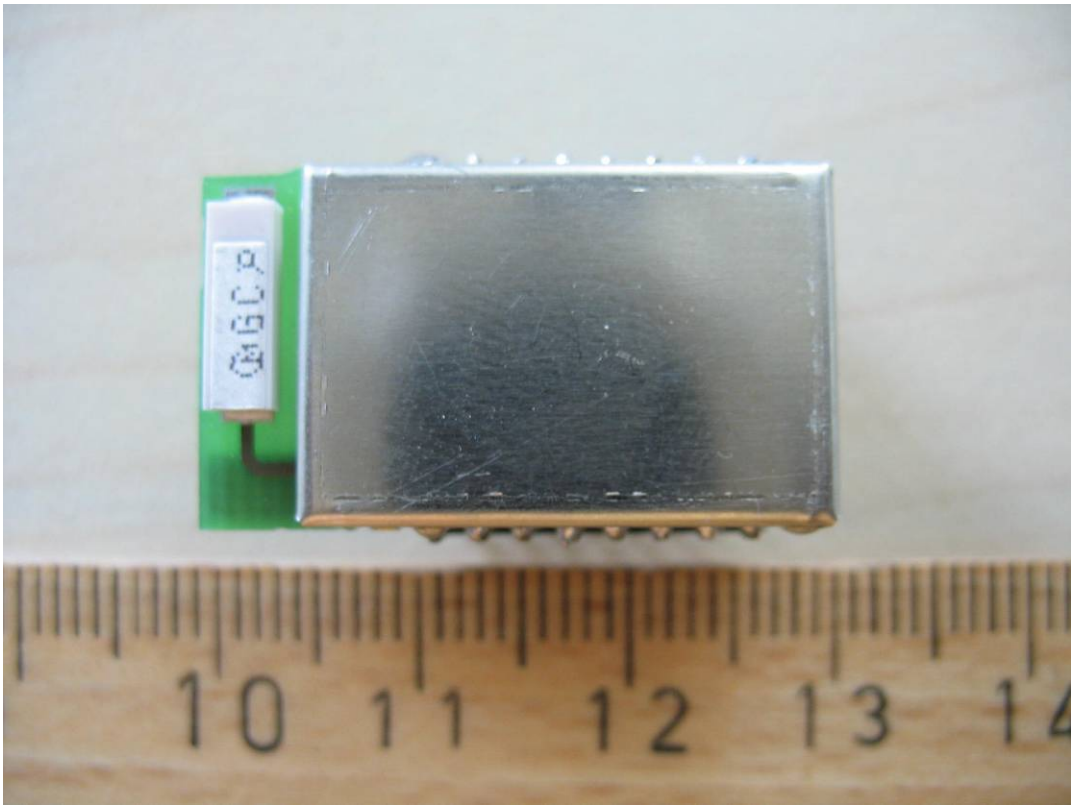


Photo 5: EUT

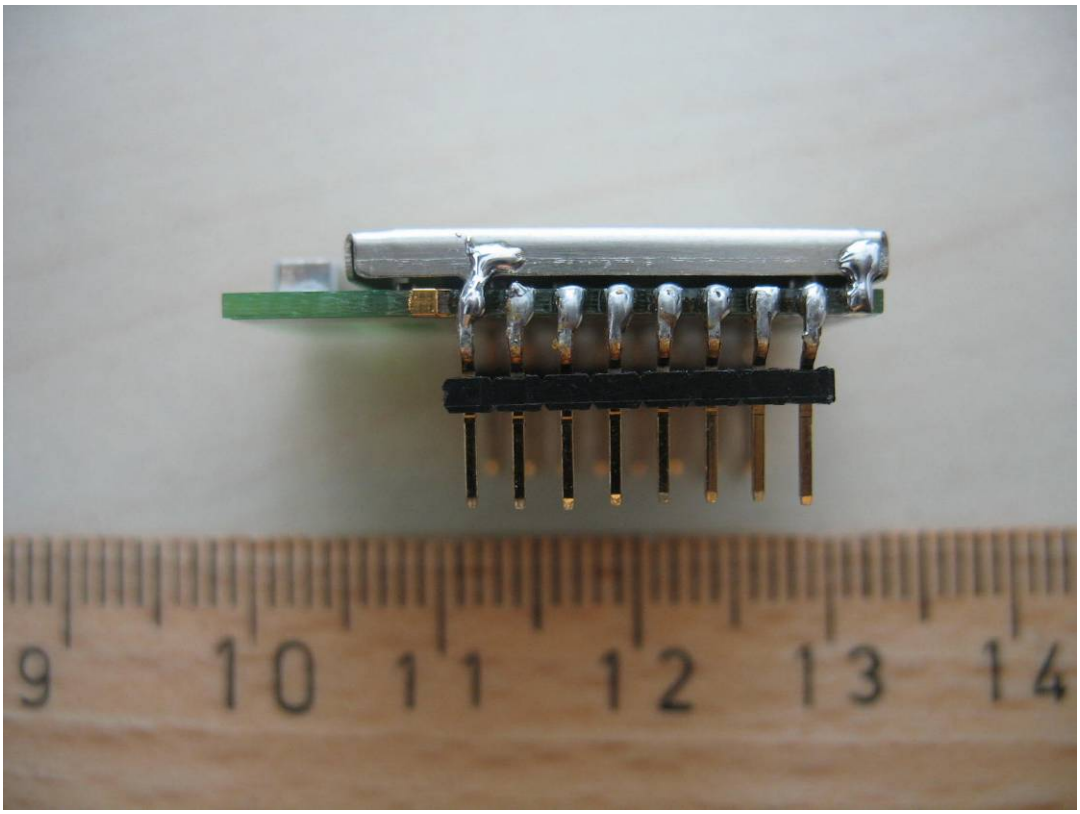


Photo 6: EUT

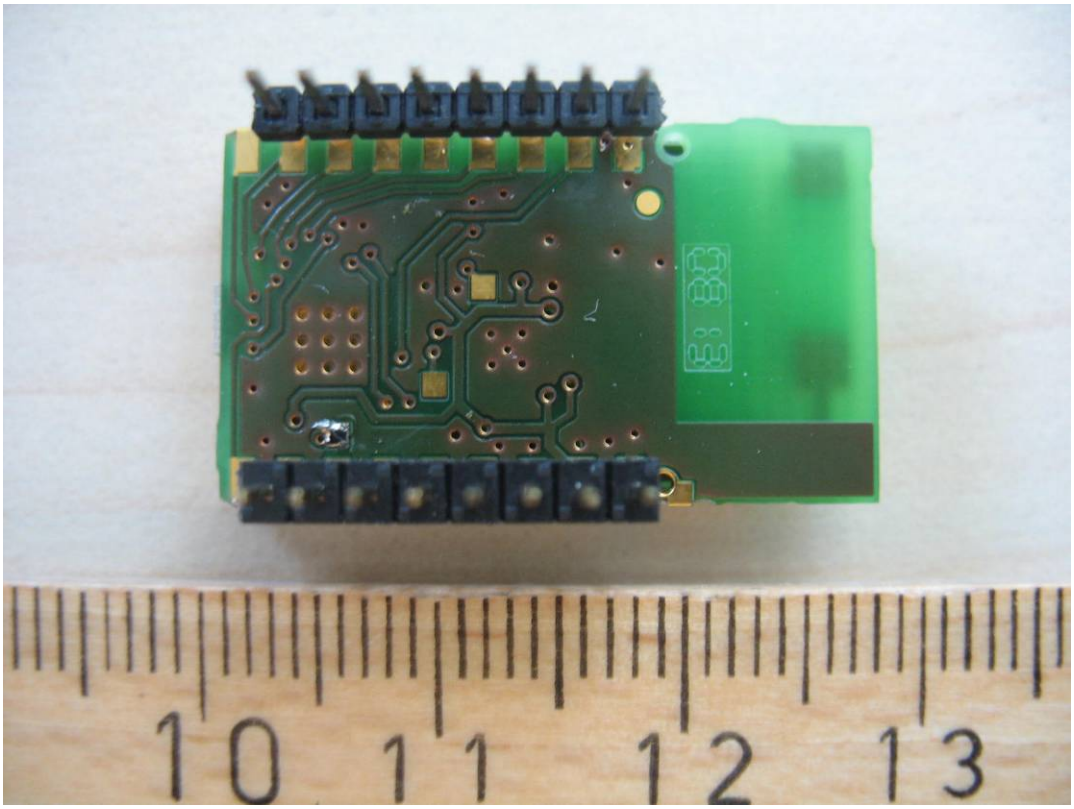


Photo 7: EUT

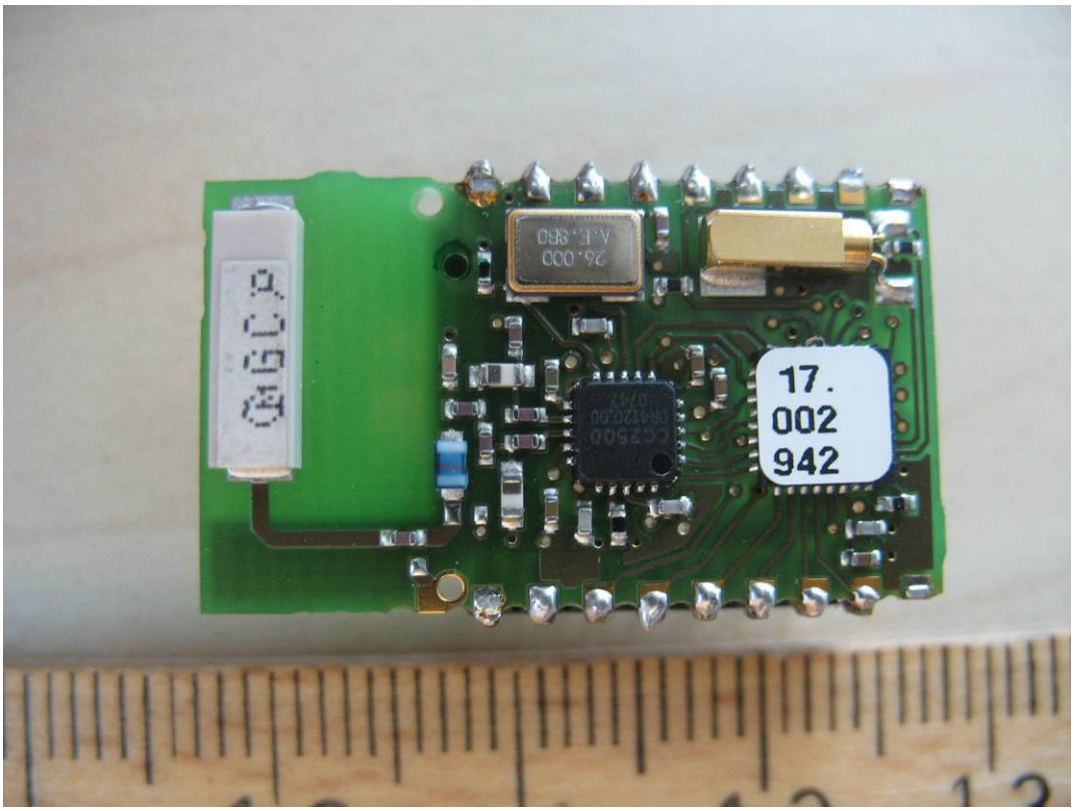


Photo 8: Extender board

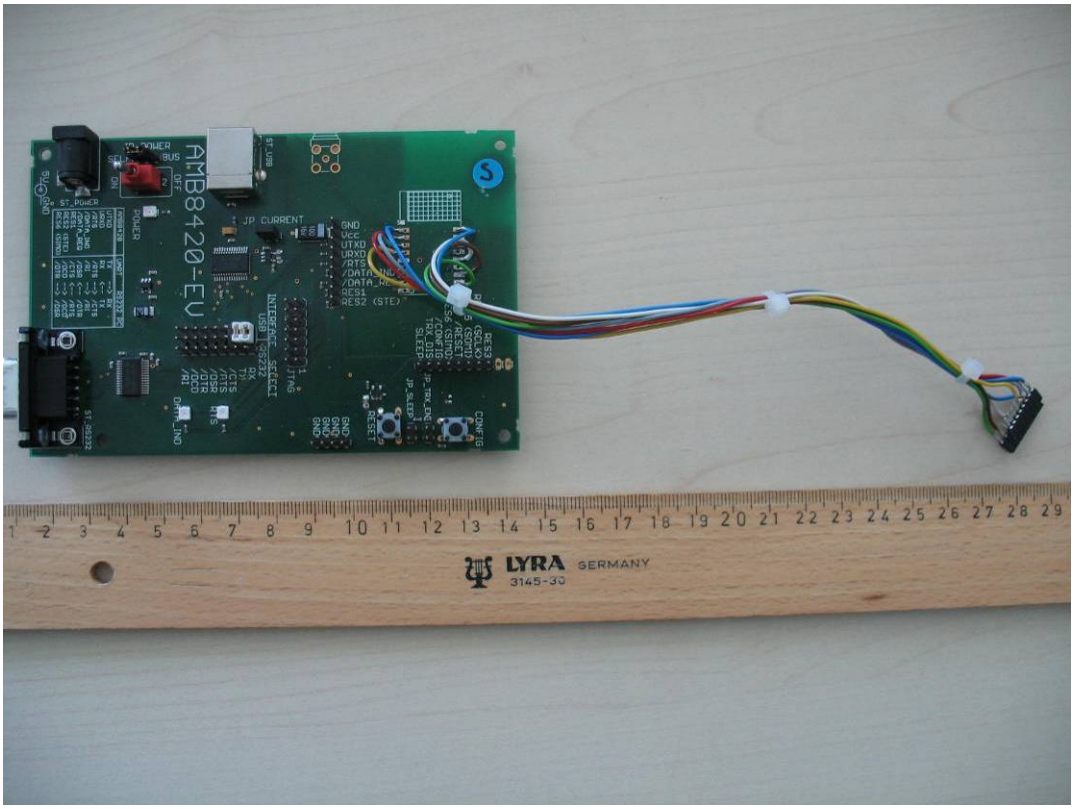


Photo 9: Extender board and EUT (+ conducted sample)

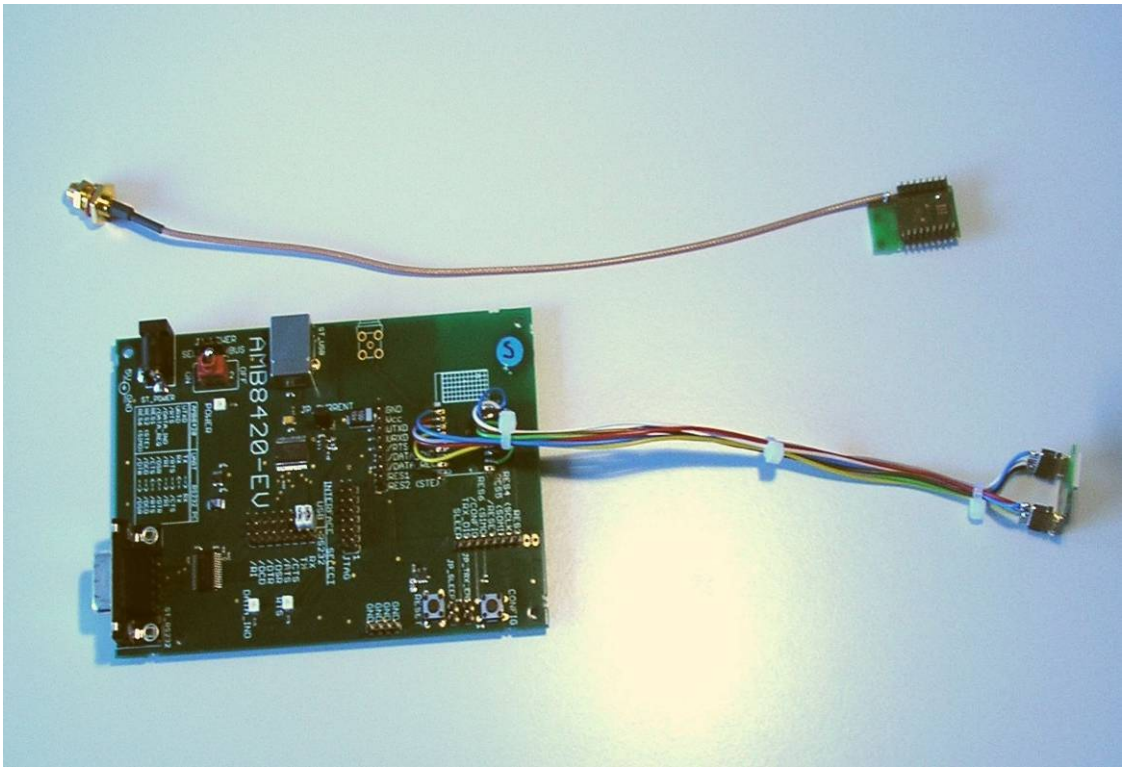


Photo 10: EUT

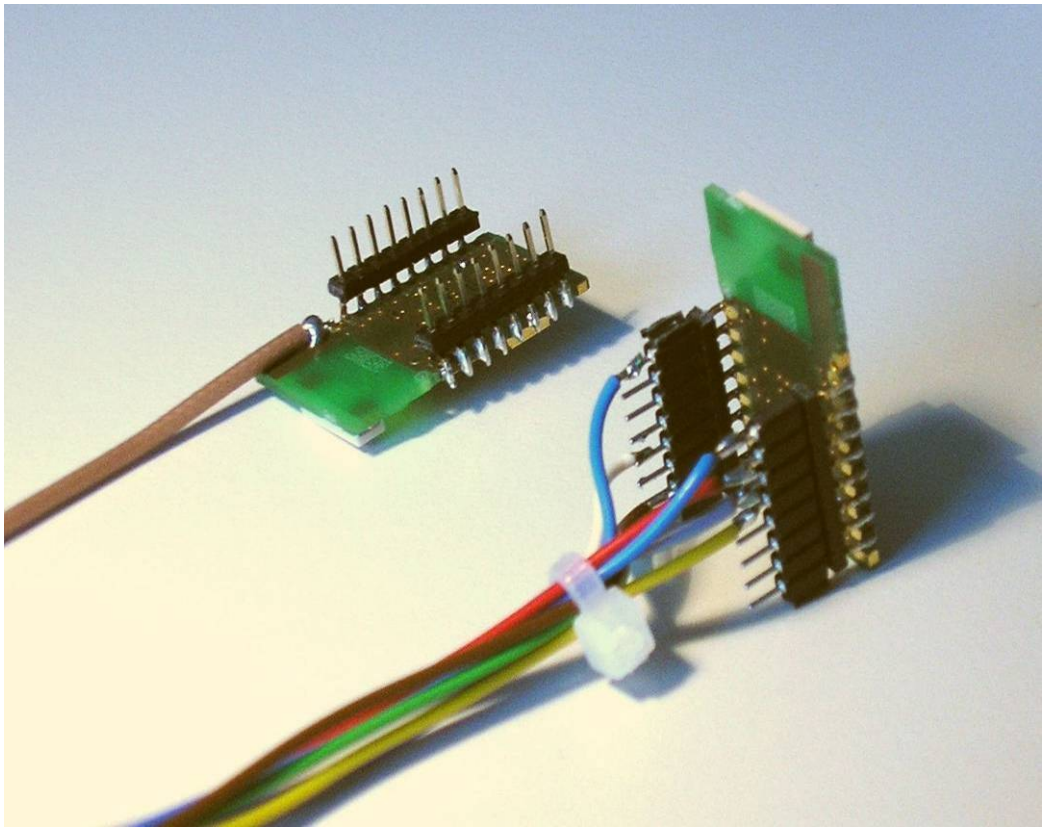


Photo 11: Extender board

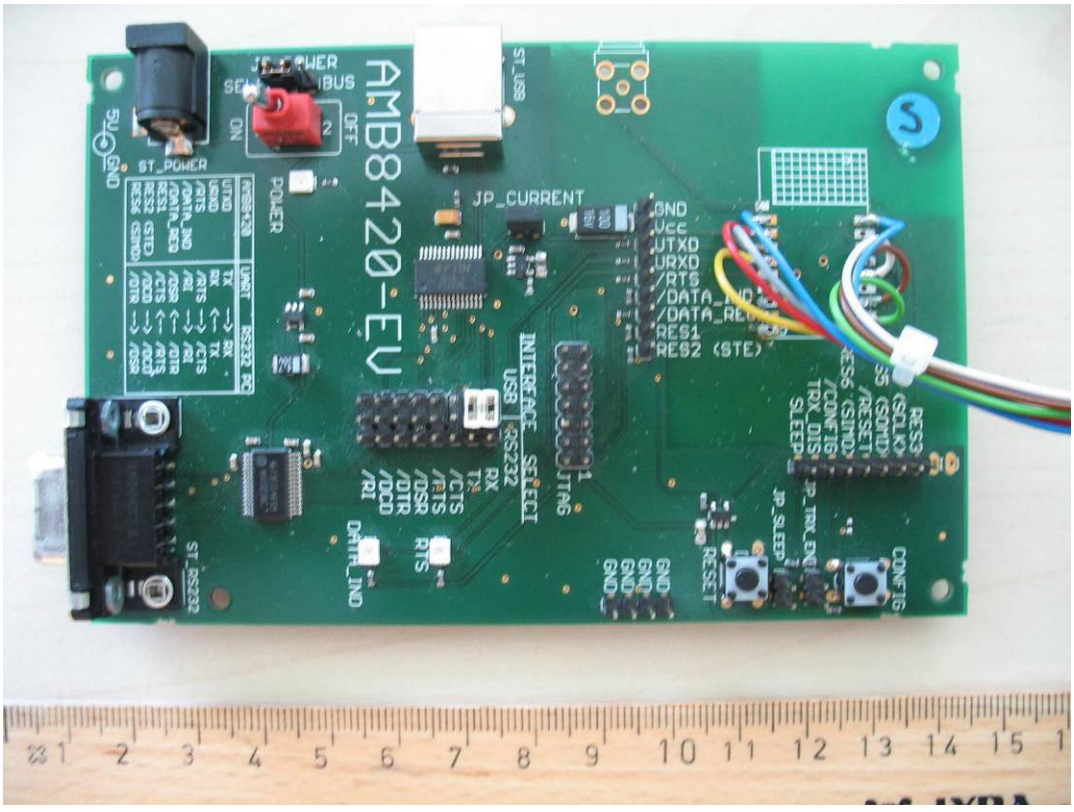


Photo 12: