

TEST REPORT

Test report no.: 1-4276/12-04-02-B



Deutsche
Akkreditierungsstelle
D-PL-12076-01-01

Testing laboratory

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Accredited Testing Laboratory:

The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2005) by the Deutsche Akkreditierungsstelle GmbH (DAkkS). The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12076-01-01
Area of Testing: Radio/Satellite Communications

Applicant

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Manufacturer

SMA Solar Technology AG
Sonnenallee 1
34266 Niestetal / GERMANY

Test standard/s

47 CFR Part 15	Title 47 of the Code of Federal Regulations; Chapter I Part 15 - Radio frequency devices
RSS - 210 Issue 8	Spectrum Management and Telecommunications - Radio Standards Specification Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment

For further applied test standards please refer to section 3 of this test report.

Test Item

Kind of test item:	Zigbee-Modul
Model name:	SB5GCOM31
FCC ID:	SVF-SCOM31
IC:	9440A-SCOM31
Frequency:	ISM band 2400 MHz to 2483.5 MHz lowest channel: 2405 MHz; highest channel: 2480 MHz
Technology tested:	ZigBee
Antenna:	External antenna
Power Supply:	12 V DC by external power supply
Temperature Range:	-20°C to +55 °C



This test report is electronically signed and valid without handwriting signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

Test report authorised:

Stefan BöS
Senior Testing Manager

Test performed:

Andreas Luckenbill

1 Table of contents

1	Table of contents	2
2	General information	3
2.1	Notes and disclaimer	3
2.2	Application details.....	3
3	Test standard/s	3
4	Test environment.....	4
5	Test item	4
6	Test laboratories sub-contracted	4
7	Summary of measurement results	5
8	RF measurements	6
8.1	Description of test setup	6
8.1.1	Radiated measurements.....	6
8.1.2	Conducted measurements.....	7
8.2	Additional comments	7
8.3	RSP100 test report cover sheet / performance test data	8
9	Measurement results.....	9
9.1	Maximum output power	9
9.2	Antenna gain	10
9.3	Power spectral density	11
9.4	Spectrum bandwidth – 6 dB bandwidth	14
9.5	Spectrum bandwidth – 20 dB bandwidth	17
9.6	Band edge compliance conducted	20
9.7	Band edge compliance radiated	23
9.8	TX spurious emissions conducted	26
9.9	TX spurious emissions radiated	32
9.10	RX spurious emissions radiated	47
9.11	TX spurious emissions radiated < 30 MHz	52
9.12	TX spurious emissions conducted < 30 MHz.....	54
10	Test equipment and ancillaries used for tests	57
11	Observations	58
Annex A	Photographs of the test setup	59
Annex B	External photographs of the EUT	64
Annex C	Internal photographs of the EUT	65
Annex D	Document history	72
Annex E	Further information.....	72
Annex F	Accreditation Certificate	73

2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

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2.2 Application details

Date of receipt of order:	2012-07-19
Date of receipt of test item:	2012-08-07
Start of test:	2012-08-07
End of test:	2012-10-12
Person(s) present during the test:	-/-

3 Test standard/s

Test standard	Date	Test standard description
47 CFR Part 15	2010-10	Title 47 of the Code of Federal Regulations; Chapter I Part 15 - Radio frequency devices
RSS - 210 Issue 8	2010-12	Spectrum Management and Telecommunications - Radio Standards Specification Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment

4 Test environment

Temperature:	T_{nom}	+22 °C during room temperature tests
	T_{max}	+55 °C during high temperature tests
	T_{min}	-20 °C during low temperature tests
Relative humidity content:		54 %
Barometric pressure:		not relevant for this kind of testing
Power supply:	V_{nom}	12 V DC by external power supply
	V_{max}	-/- V
	V_{min}	-/- V

5 Test item

Kind of test item	:	Zigbee-Modul
Type identification	:	SB5GCOM31
S/N serial number	:	not available!
HW hardware status	:	P3
SW software status	:	not available!
Frequency band [MHz]	:	ISM band 2400 MHz to 2483.5 MHz lowest channel: 2405 MHz; highest channel: 2480 MHz
Type of radio transmission	:	DSSS
Use of frequency spectrum	:	
Type of modulation	:	QPSK
Number of channels	:	16
Antenna	:	External antenna (see pictures)
Power supply	:	12 V DC by external power supply
Temperature range	:	-20°C to +55 °C

6 Test laboratories sub-contracted

None

7 Summary of measurement results



No deviations from the technical specifications were ascertained



There were deviations from the technical specifications ascertained

TC Identifier	Description	Verdict	Date	Remark
RF-Testing	CFR Part 15 RSS 210, Issue 8, Annex 8	Passed	2012-11-16	-/-

Test specification clause	Test case	Temperature conditions	Power source voltages	Pass	Fail	NA	NP	Results (max.)
§15.247(b)(4) RSS 210 / A8.4(2)	Antenna gain	Nominal	Nominal	☒	☐	☐	☐	complies
§15.247(e) RSS 210 / A8.2(b)	Power spectral density	Nominal	Nominal	☒	☐	☐	☐	complies
§15.247(a)(2) RSS 210 / A8.2(a)	Spectrum bandwidth 6dB bandwidth	Nominal	Nominal	☒	☐	☐	☐	complies
§15.247(a)(2) RSS 210 / A8.2(a)	Spectrum bandwidth 20dB bandwidth	Nominal	Nominal	☒	☐	☐	☐	complies
§15.247(b)(3) RSS-210 / A8.4(4)	Maximum output power	Nominal	Nominal	☒	☐	☐	☐	complies
§15.247(d) RSS-210 / A8.5	Band edge compliance conducted	Nominal	Nominal	☒	☐	☐	☐	complies
§15.205 RSS-210 / A8.5	Band edge compliance radiated	Nominal	Nominal	☒	☐	☐	☐	complies
§15.247(d) RSS-210 / A8.5	TX spurious emissions conducted	Nominal	Nominal	☒	☐	☐	☐	complies
§15.247(d) RSS-210 / A8.5	TX spurious emissions radiated	Nominal	Nominal	☒	☐	☐	☐	complies
§15.109 RSS-Gen.	RX spurious emissions radiated	Nominal	Nominal	☒	☐	☐	☐	complies
§15.209(a) RSS-Gen	TX spurious emissions radiated < 30 MHz	Nominal	Nominal	☒	☐	☐	☐	complies
§15.107(a)	Conducted emissions < 30 MHz	Nominal	Nominal	☒	☐	☐	☐	complies

Note: NA = Not Applicable; NP = Not Performed

8 RF measurements

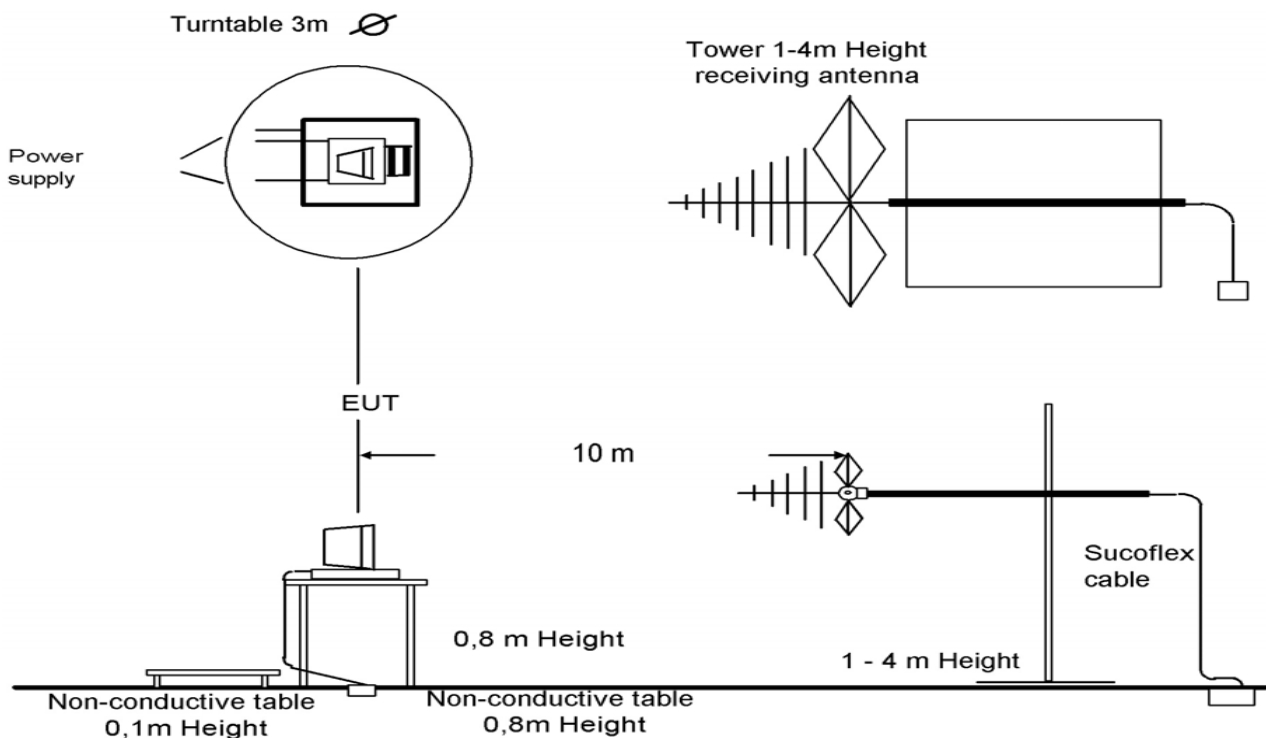
8.1 Description of test setup

8.1.1 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 C63.4-2009 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 C63-4-2009 clause 4.2.

Antennas are confirmed with ANSI C63.2-1996 item 15.

Semi anechoic chamber



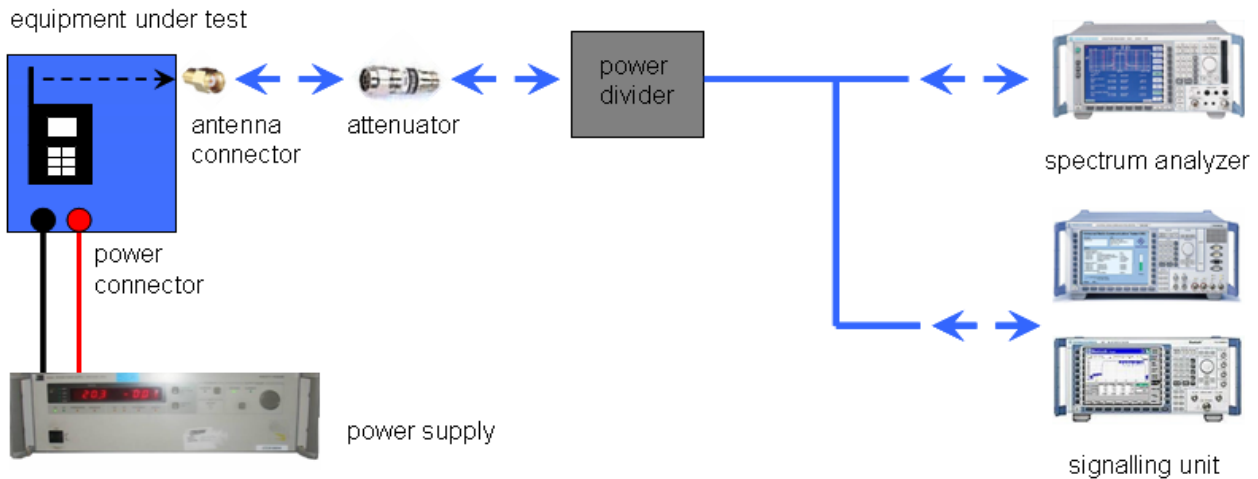
Picture 1: Diagram radiated measurements

9 kHz - 30 MHz:	active loop antenna
30 MHz – 1 GHz:	tri-log antenna
> 1 GHz:	horn antenna

The EUT is powered by an external power supply with nominal voltage

8.1.2 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.



Picture 2: Diagram conducted measurements

8.2 Additional comments

Reference documents: None

Special test descriptions: None

Configuration descriptions: None

Test mode:

- ☐ No test mode available.
- ☒ Special software is used.
EUT is transmitting pseudo random data by itself

Tested channels:

- Channel 11, low channel, 2405 MHz
- Channel 18, mid channel, 2440 MHz
- Channel 25, high channel, 2475 MHz
- Channel 26, additional channel, 2480 MHz

8.3 RSP100 test report cover sheet / performance test data

Test report number	:	1-4276/12-04-02-B
Equipment model number	:	SB5GCOM31
Certification number	:	9440A-SCOM31
Manufacturer (complete address)	:	SMA Solar Technology AG Sonnenallee 1 34266 Niestetal / GERMANY
Tested to radio standards specification no.	:	RSS 210, Issue 8, Annex 8
Open area test site IC No.	:	IC 3462C-1
Frequency range	:	Lowest channel: 2405 MHz; highest channel 2480 MHz
RF-power [W] (max.)	:	cond.: 15.7 dBm EIRP: 8.0 dBm
Occupied bandwidth (99%-BW) [kHz]	:	2460 kHz
Type of modulation	:	DSSS
Emission designator (TRC-43)	:	2M46FXD
Antenna information	:	External antenna connector (see pictures)
Transmitter spurious (worst case)[dBμV/m @ 3m]:		52 dBμV/m @ 4880 MHz
Receiver spurious (worst case) [dBμV/m @ 3m] :		48 dBμV/m (noise floor)

ATTESTATION:

DECLARATION OF COMPLIANCE:

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

Laboratory manager:

2012-11-16

Date

Andreas Luckenbill

Name



Signature

9 Measurement results

9.1 Maximum output power

Description:

Measurement of the maximum output power conducted and radiated

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Video bandwidth:	3 MHz
Resolution bandwidth:	3 MHz
Span:	3 MHz
Trace-Mode:	Max Hold

Result:

Modulation Channel	Maximum output power conducted [dBm]			
	Lowest	Middle	Highest	Additional
	15.7	14.8	12.2	-4.9
Measurement uncertainty	± 1 dB			

Modulation Channel	Maximum output power radiated - EIRP [dBm]			
	Lowest	Middle	Highest	Additional
	7.6	8.0	5.9	-11.1
Measurement uncertainty	± 1 dB			

Result: **Passed**

9.2 Antenna gain

Measurement:

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

Measurement parameters:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Video bandwidth:	3 MHz
Resolution bandwidth:	3 MHz
Span:	3 MHz
Trace-Mode:	Max hold

Limits:

FCC	IC
Antenna Gain	
6 dBi	

Results:

T _{nom}	V _{nom}	lowest channel	middle channel	highest channel	additional channel, 2480 MHz
Conducted power [dBm] Measured		15.7	14.8	12.2	-4.9
Radiated power [dBm] Measured		7.6	8.0	5.9	-11.1
Gain [dBi] Calculated		-8.1	-6.8	-6.3	-6.2

Result: **Passed**

9.3 Power spectral density

Description:

Measurement of the power spectral density of a digital modulated system. The measurement is repeated at the lowest, middle and highest channel.

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	2.5 s
Video bandwidth:	300 kHz
Resolution bandwidth:	100 kHz
Span:	2 MHz
Trace-Mode:	Max Hold
Bandwidth correction:	$10 \log (3\text{kHz} / 100\text{kHz}) = -15.2 \text{ dB}$

Limits:

FCC	IC
Power Spectral Density	
The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission or over 1.0 second if the transmission exceeds 1.0-second duration.	

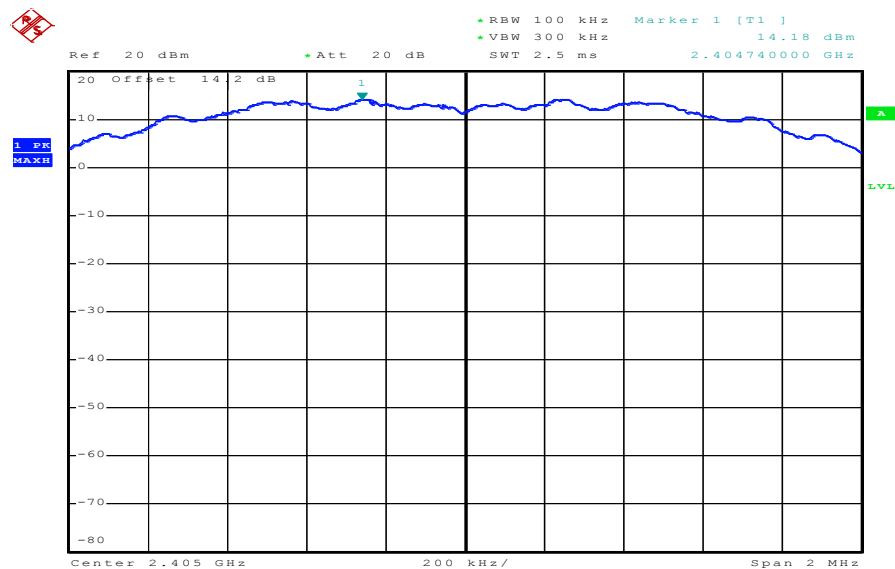
Results:

Modulation Channel	Power Spectral density [dBm/3kHz]			
	Lowest	Middle	Highest	Additional
	-1.0	-1.7	-4.32	-21.7
Measurement uncertainty	$\pm 1.5 \text{ dB}$			

Result: Passed

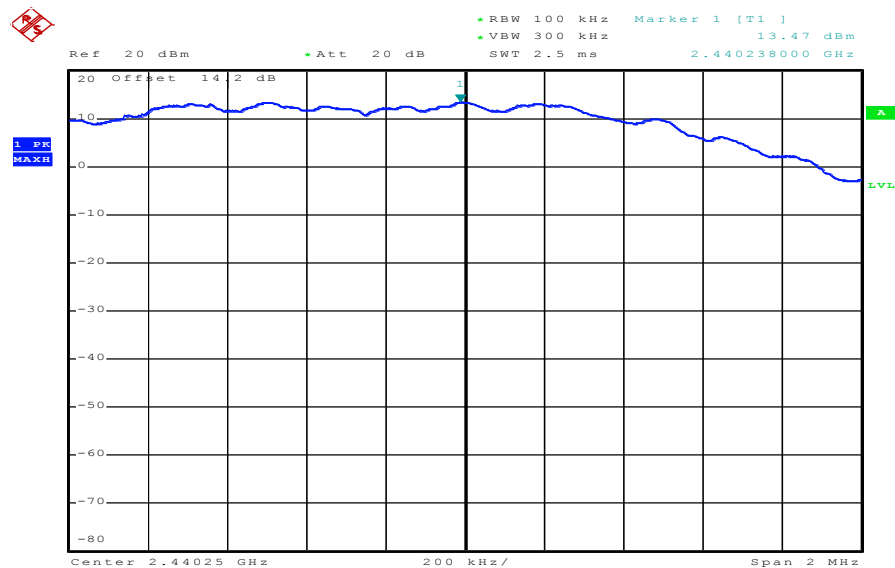
Plots:

Plot 1: lowest channel, 2405 MHz



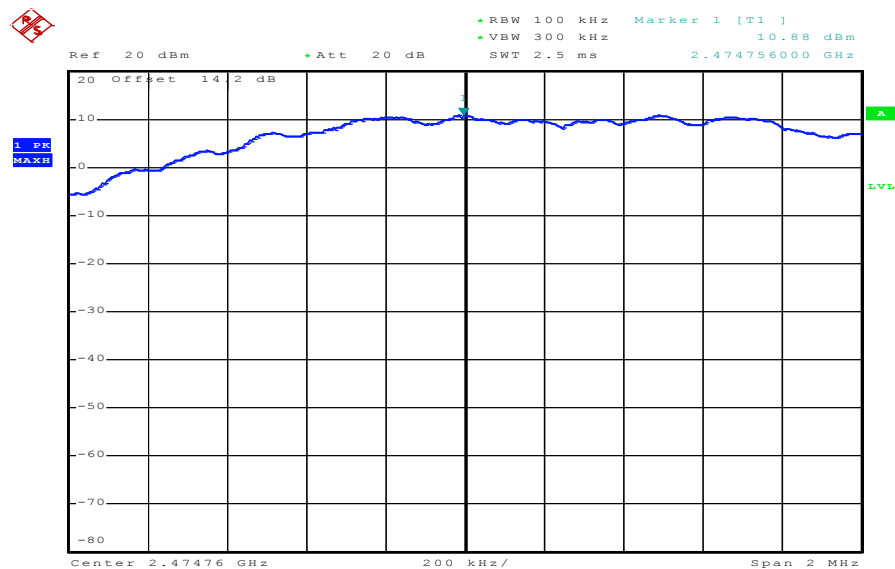
Date: 7.AUG.2012 13:07:07

Plot 2: middle channel, 2440 MHz



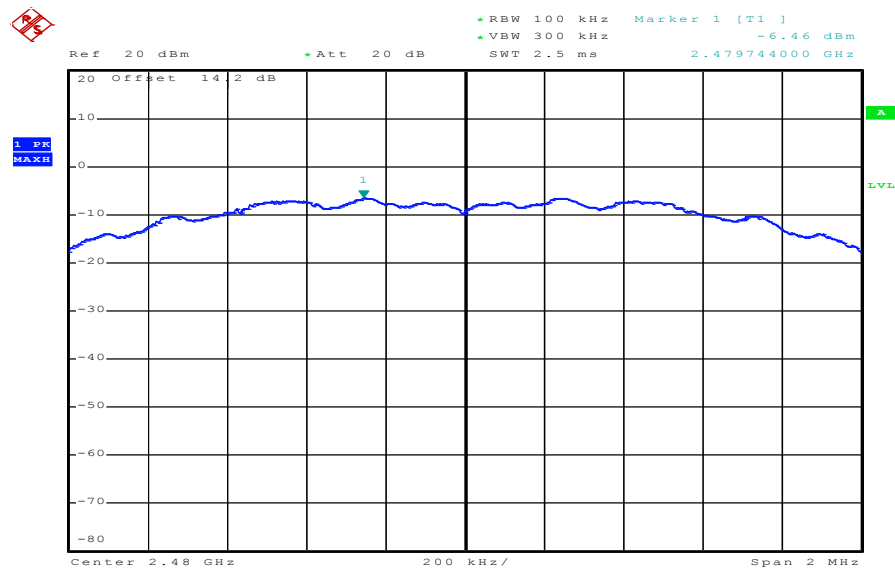
Date: 7.AUG.2012 12:29:32

Plot 3: highest channel, 2475 MHz



Date: 7.AUG.2012 12:30:42

Plot 4: additional channel, 2480 MHz



Date: 7.AUG.2012 13:06:18

9.4 Spectrum bandwidth – 6 dB bandwidth

Description:

Measurement of the 6 dB bandwidth of the modulated signal.

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Video bandwidth:	100 kHz
Resolution bandwidth:	100 kHz
Span:	See plots
Trace-Mode:	Max Hold

Limits:

FCC	IC
Spectrum Bandwidth – 6 dB Bandwidth	
Systems using digital modulation techniques may operate in the 2400–2483.5 MHz band. The minimum 6 dB bandwidth shall be at least 500 kHz.	

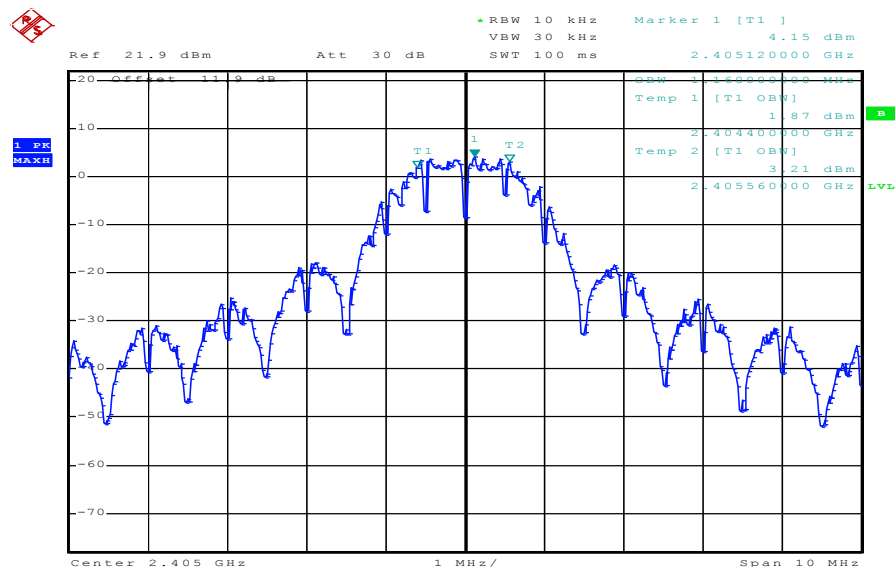
Results:

Modulation Channel	6 dB BANDWIDTH [MHz]			
	Lowest	Middle	Highest	Additional
	1.16	1.16	1.14	1.12
Measurement uncertainty	± 1.5 dB			

Result: **Passed**

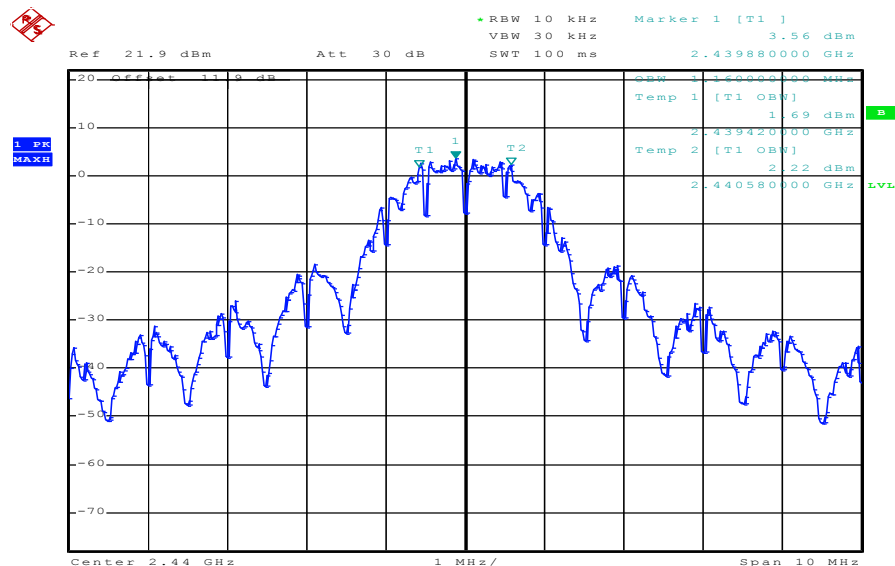
Plots:

Plot 1: lowest channel



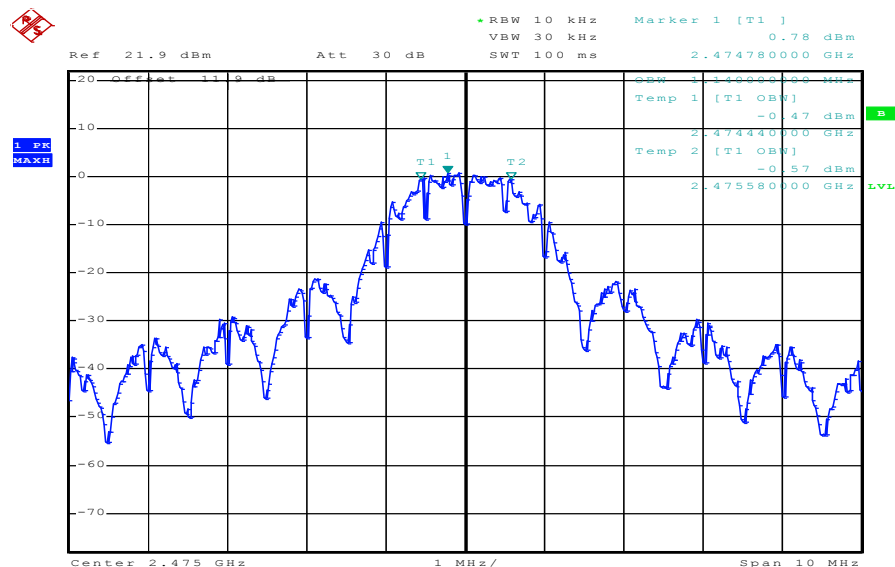
Date: 7.AUG.2012 11:55:05

Plot 2: middle channel



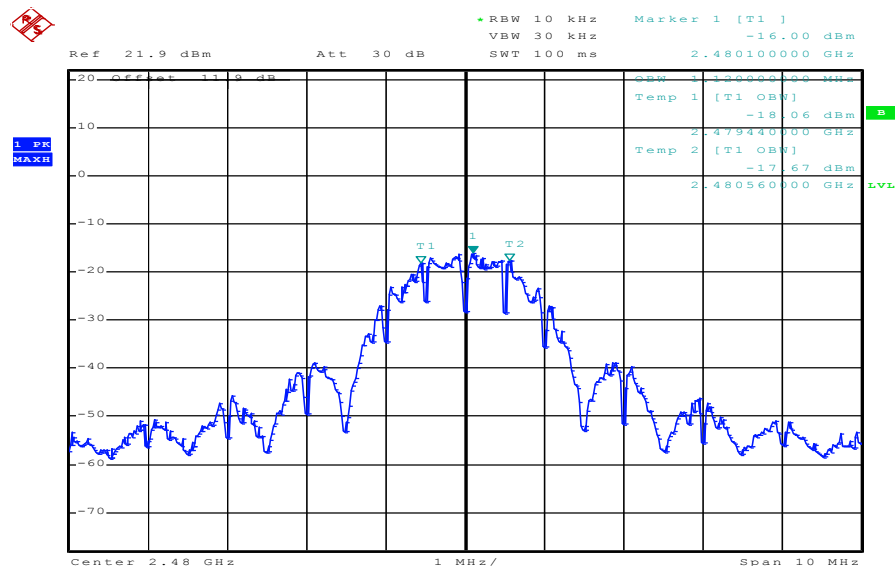
Date: 7.AUG.2012 11:59:16

Plot 3: highest channel



Date: 7.AUG.2012 11:59:57

Plot 4: additional channel, 2480 MHz



Date: 7.AUG.2012 12:03:48

9.5 Spectrum bandwidth – 20 dB bandwidth

Description:

Measurement of the 20 dB bandwidth of the modulated signal.

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Video bandwidth:	100 kHz
Resolution bandwidth:	100 kHz
Span:	8 MHz
Trace-Mode:	Max Hold

Limits:

FCC	IC
Spectrum Bandwidth – 20 dB Bandwidth	
Systems using digital modulation techniques may operate in the 2400–2483.5 MHz band. The minimum 6 dB bandwidth shall be at least 500 kHz.	

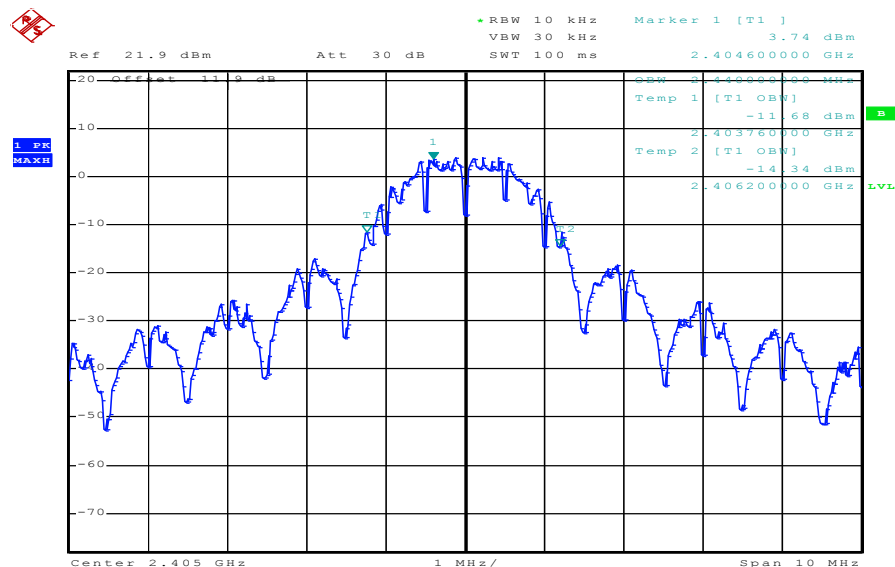
Results:

Modulation Channel	20 dB BANDWIDTH [MHz]			
	Lowest	Middle	Highest	Additional
	2.44	2.44	2.44	2.46
Measurement uncertainty	± 1.5 dB			

Result: **Passed**

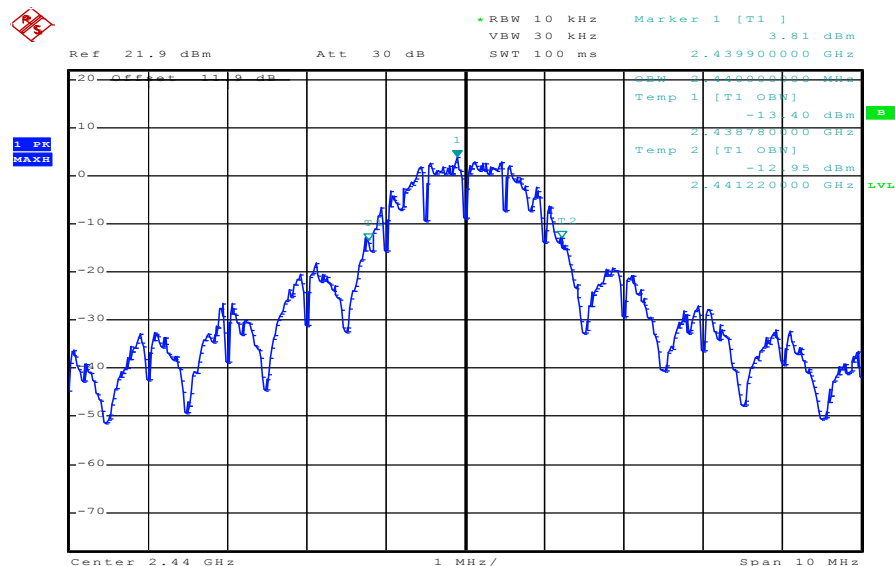
Plots:

Plot 1: lowest channel



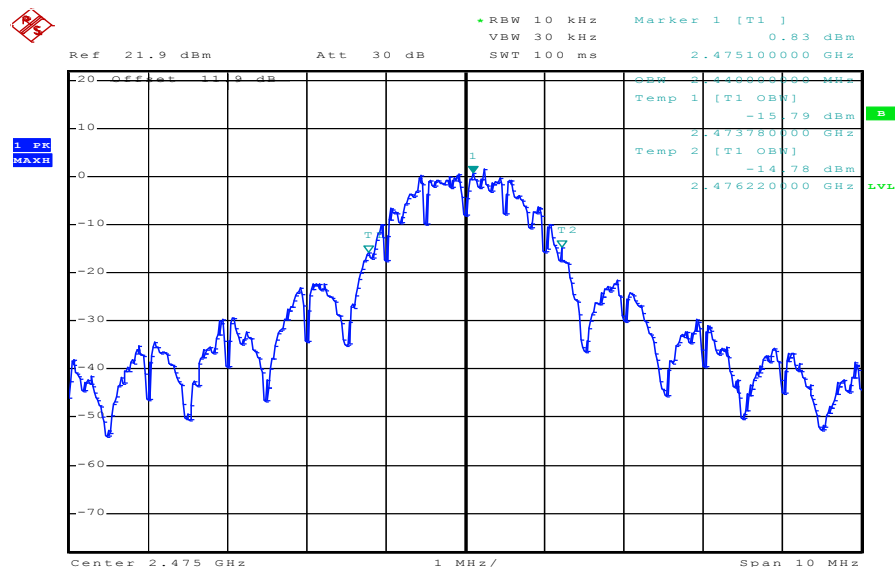
Date: 7.AUG.2012 11:55:58

Plot 2: middle channel



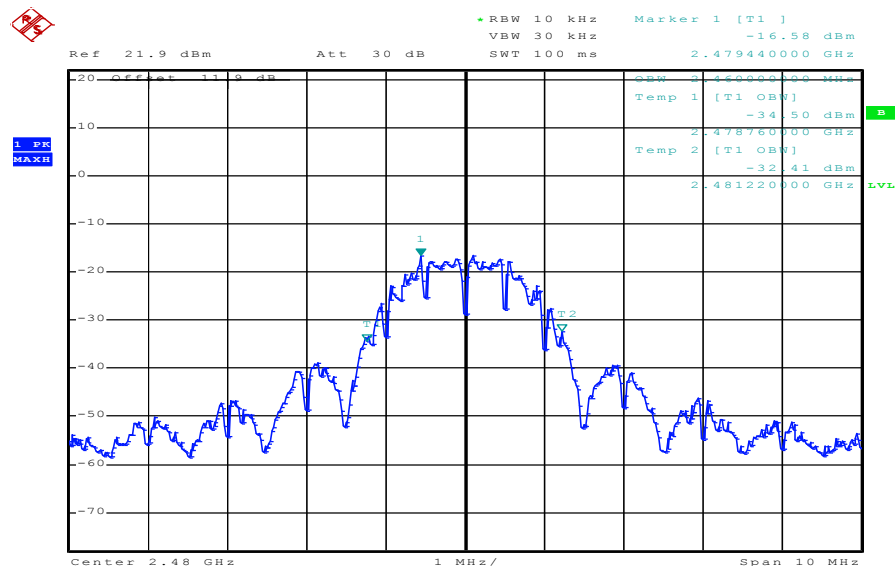
Date: 7.AUG.2012 11:58:44

Plot 3: highest channel



Date: 7.AUG.2012 12:00:24

Plot 4: additional channel, 2480 MHz



Date: 7.AUG.2012 12:03:10

9.6 Band edge compliance conducted

Description:

Measurement of the conducted band edge compliance. EUT is measured at the lower and upper band edge.

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Video bandwidth:	100 kHz
Resolution bandwidth:	100 kHz
Span:	See plots
Trace-Mode:	Max Hold

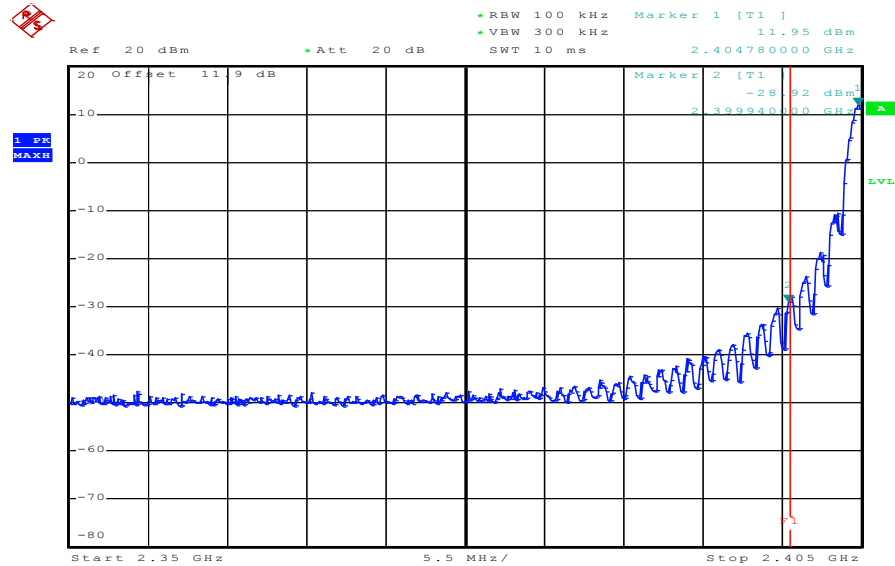
Limits:

FCC	IC
Band Edge Compliance Conducted	
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.	

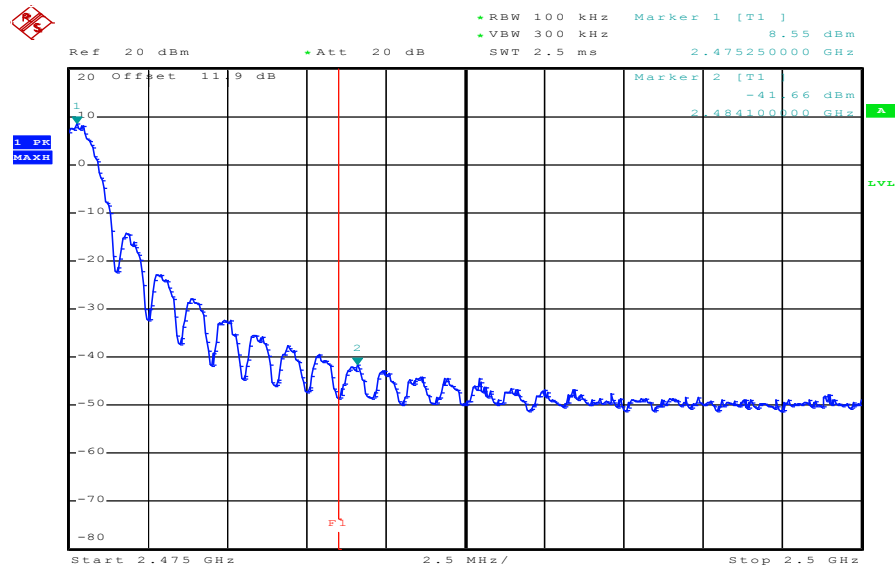
Result:

Scenario	Band Edge Compliance Conducted [dB]
Lower Band Edge	> 20 dB (see plot 1)
Upper Band Edge	> 20 dB (see plot 2)
Measurement uncertainty	± 1.5 dB

Result: The result of the measurement is passed.

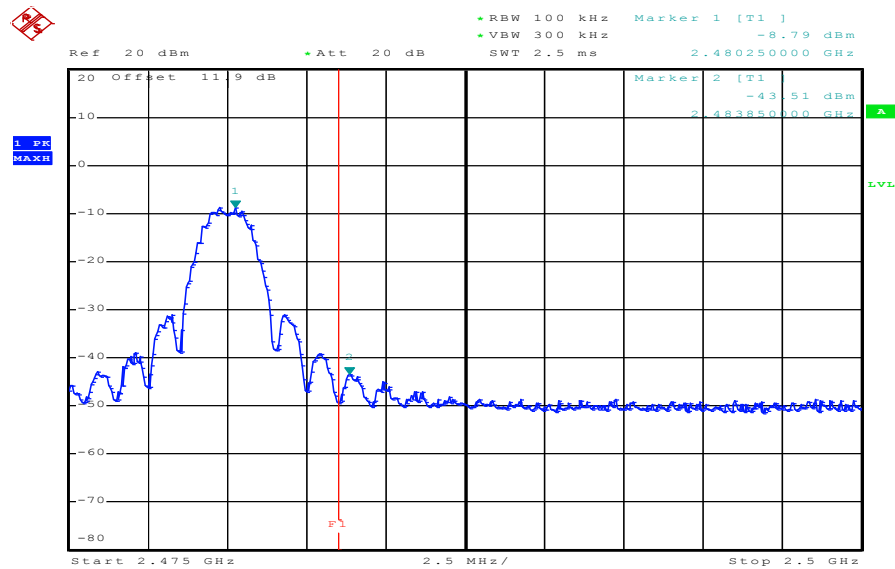
Plots:**Plot 1: lowest channel**

Date: 7.AUG.2012 11:57:47

Plot 2: highest channel

Date: 7.AUG.2012 12:01:35

Plot 3: additional channel, 2480 MHz



Date: 7.AUG.2012 12:02:29

9.7 Band edge compliance radiated

Description:

Measurement of the radiated band edge compliance. The EUT is turned in the position that results in the maximum level at the band edge. Then a sweep over the corresponding restricted band is performed. The EUT is set to the lowest channel for the lower restricted band and to the highest channel for the upper restricted band. Measurement distance is 3m.

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Video bandwidth:	10 Hz
Resolution bandwidth:	1 MHz
Span:	Lower Band: 2300 – 2400 MHz Upper Band: 2480 – 2500 MHz
Trace-Mode:	Max Hold

Limits:

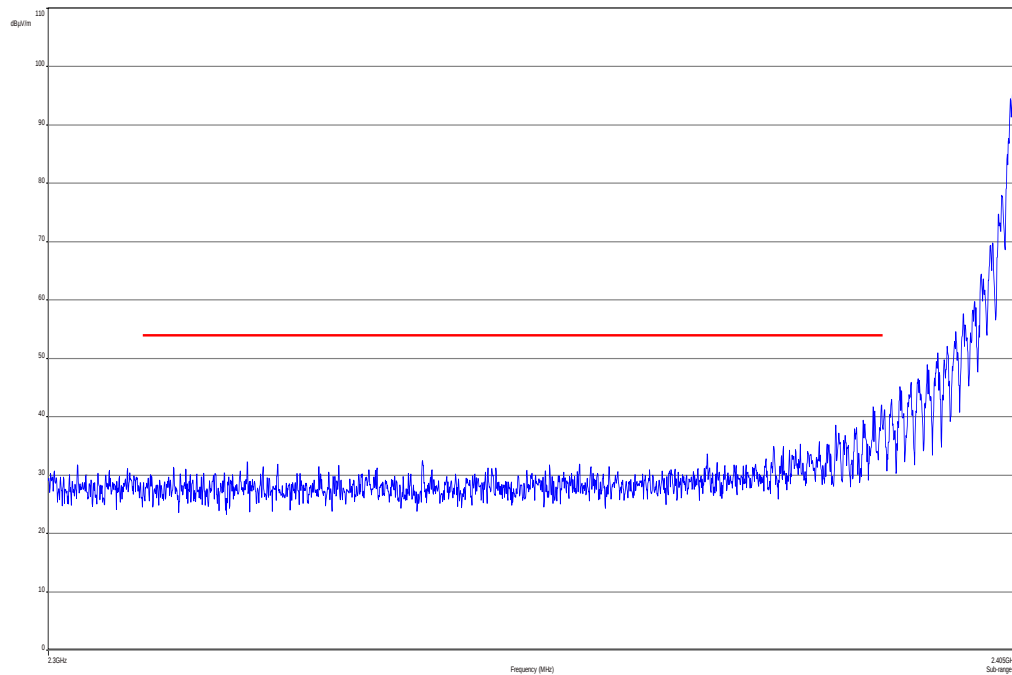
FCC	IC
Band Edge Compliance Radiated	
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth 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)).	
54 dB μ V/m AVG	

Result:

Scenario	Band Edge Compliance Radiated [dB μ V/m]
Lower Band Edge	< 54 dB μ V/m (see plots 1/3)
Upper Band Edge	< 54 dB μ V/m (see plot 2/4)
Measurement uncertainty	$\pm$ 3 dB

Plots:

Plot 1: lower band edge, vertical & horizontal polarization



Plot 2: upper band edge, vertical & horizontal polarization



Plot 3: additional channel, 2480 MHz, upper band edge, vertical & horizontal polarization



Result: Passed

9.8 TX spurious emissions conducted

Description:

Measurement of the conducted spurious emissions in transmit mode. The measurement is performed at lowest, middle and highest channel.

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Video bandwidth:	F < 1 GHz: 100 kHz F > 1 GHz: 100 kHz
Resolution bandwidth:	F < 1 GHz: 100 kHz F > 1 GHz: 100 kHz
Span:	9 kHz to 25 GHz
Trace-Mode:	Max Hold

Limits:

FCC	IC
TX Spurious Emissions Conducted	
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	

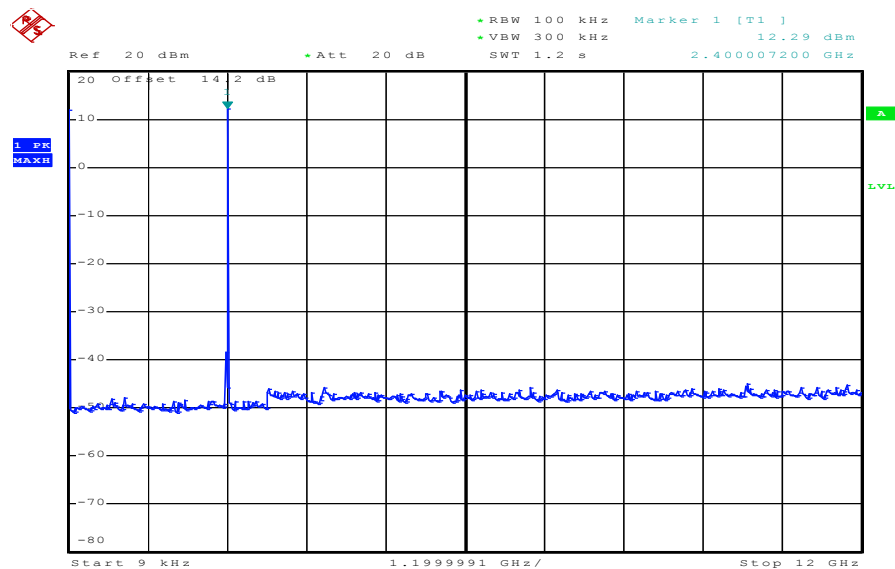
Results:

TX Spurious Emissions Conducted					
f [MHz]		amplitude of emission [dBm]	limit max. allowed emission power	actual attenuation below frequency of operation [dB]	results
Low		12.3	30 dBm		Operating frequency
No critical peaks found			-20 dBc		complies
Middle		11.7	30 dBm		Operating frequency
No critical peaks found			-20 dBc		complies
High		9.8	30 dBm		Operating frequency
No critical peaks found			-20 dBc		complies
Additional		-6.8	0 dBm		Operating frequency
No critical peaks found			-20 dBc		complies
Measurement uncertainty		± 3 dB			

Result: Passed

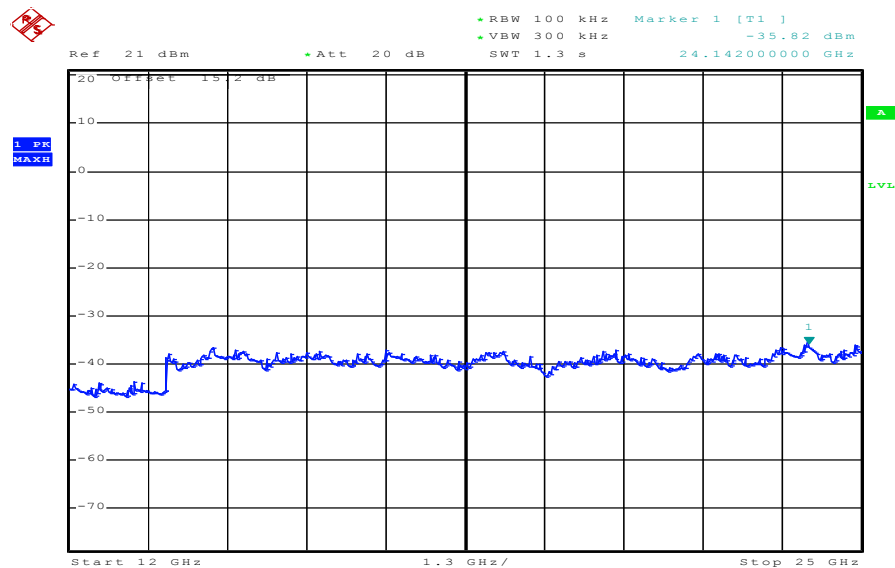
Plots:

Plot 1: lowest channel, 9 kHz to 12 GHz



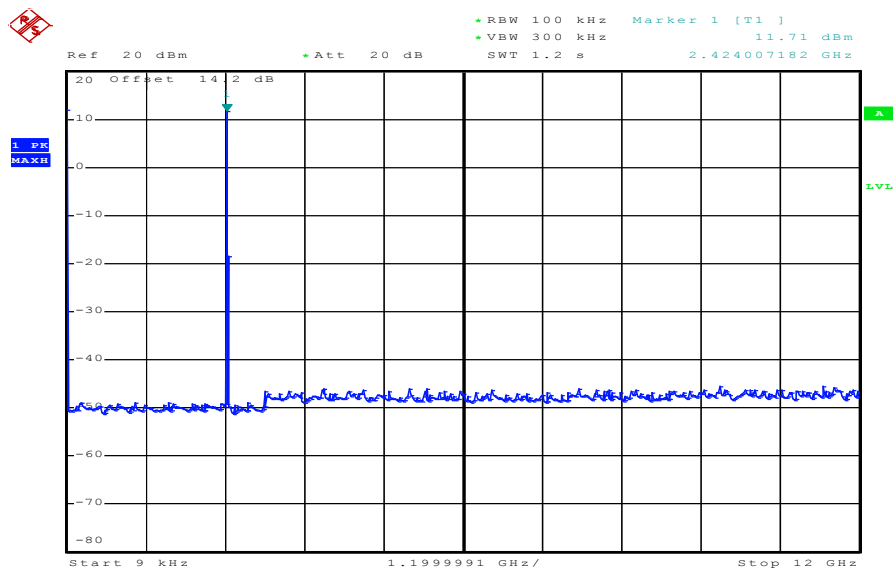
Date: 7.AUG.2012 12:11:37

Plot 2: lowest channel, 12 GHz to 25 GHz



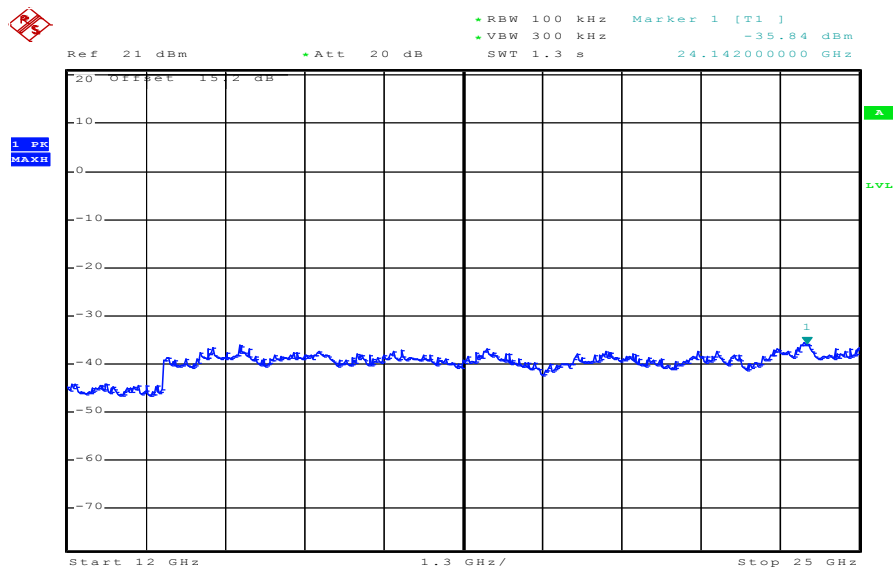
Date: 7.AUG.2012 12:14:57

Plot 3: middle channel, 9 kHz to 12 GHz



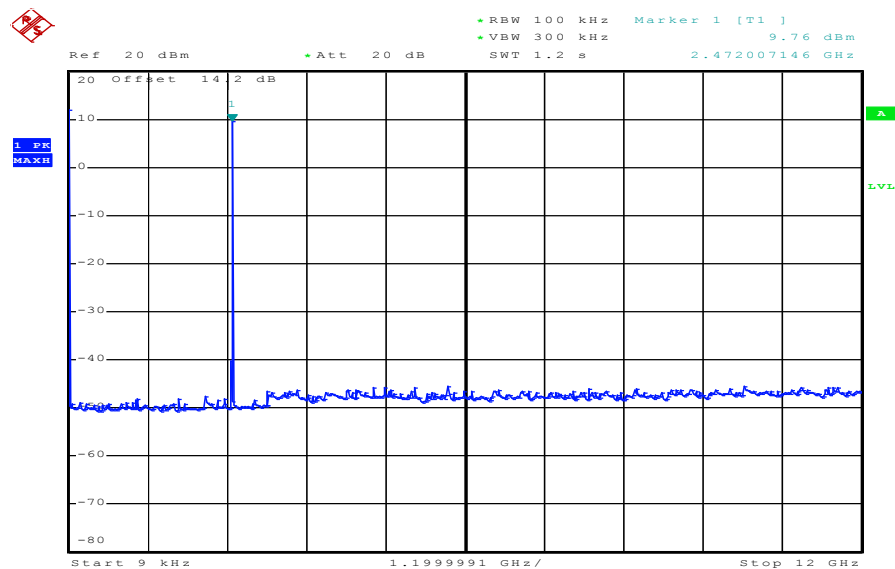
Date: 7.AUG.2012 12:11:58

Plot 4: middle channel, 12 GHz to 25 GHz



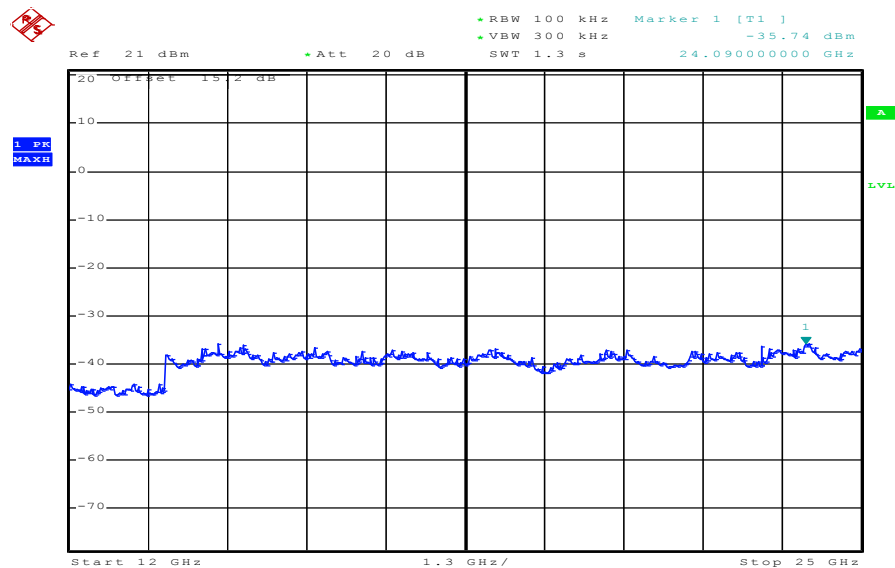
Date: 7.AUG.2012 12:15:49

Plot 5: highest channel, 9 kHz to 12 GHz



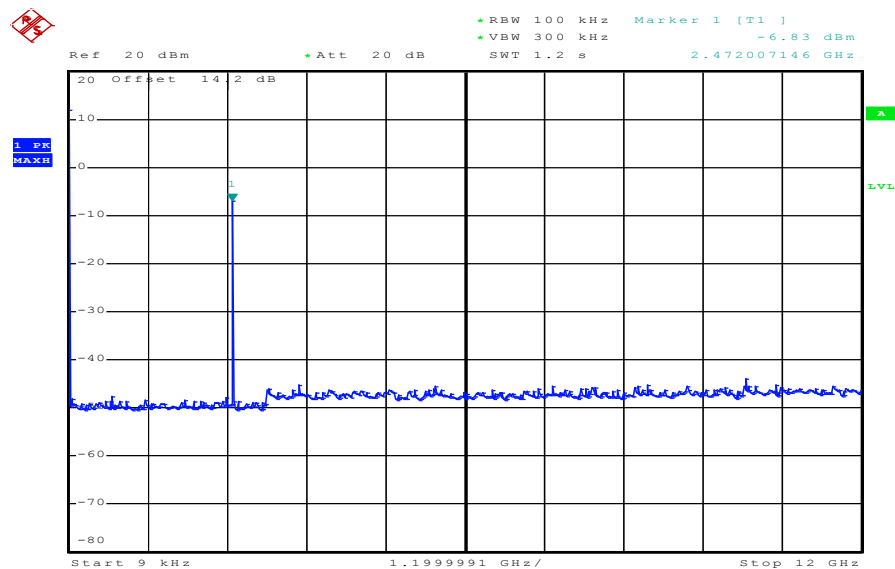
Date: 7.AUG.2012 12:12:41

Plot 6: highest channel, 12 GHz to 25 GHz



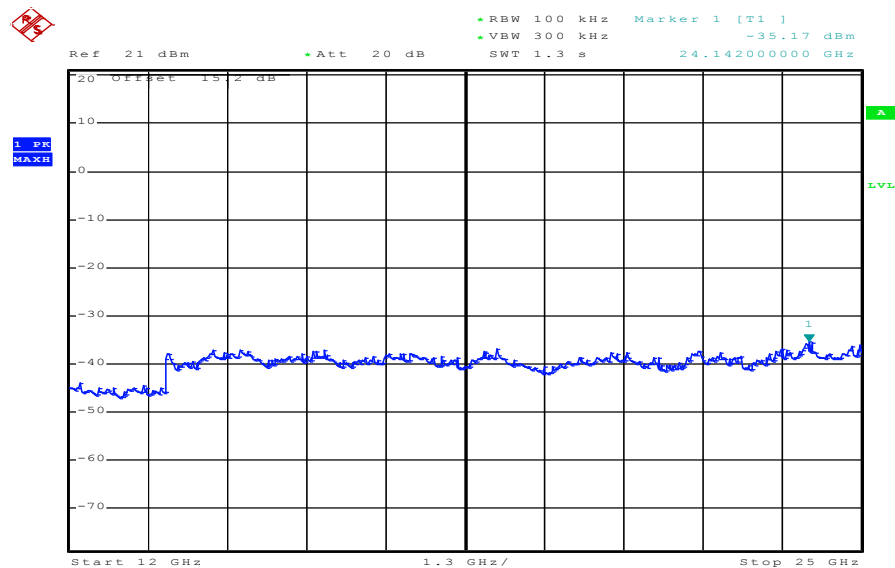
Date: 7.AUG.2012 12:13:43

Plot 7: additional channel, 2480 MHz, 9 kHz to 12 GHz



Date: 7.AUG.2012 12:10:48

Plot 8: additional channel, 2480 MHz, 12 GHz to 25 GHz



Date: 7.AUG.2012 12:14:14

9.9 TX spurious emissions radiated

Description:

Measurement of the radiated spurious emissions in transmit mode. The measurement is performed at lowest, middle and highest channel.

Measurement:

Measurement parameter	
Detector:	Peak / Quasi Peak
Sweep time:	Auto
Video bandwidth:	Sweep: 100 kHz Remeasurement: 10 Hz
Resolution bandwidth:	F < 1 GHz: 100 kHz F > 1 GHz: 1 MHz
Span:	30 MHz to 25 GHz
Trace-Mode:	Max Hold

Limits:

FCC		IC
TX Spurious Emissions Radiated		
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 §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).		
§15.209		
Frequency (MHz)	Field Strength (dBμV/m)	Measurement distance
30 - 88	30.0	10
88 – 216	33.5	10
216 – 960	36.0	10
Above 960	54.0	3

Results:

TX Spurious Emissions Radiated [dBμV/m]							
Lowest		Middle		Highest		Additional	
F [MHz]	Level [dBμV/m]	F [MHz]	Level [dBμV/m]	F [MHz]	Level [dBμV/m]	F [MHz]	Level [dBμV/m]
4880	52.0	4810	51.3	4950	47.5	-/-	-/-
7320	47.8			7425	44.0		
Measurement uncertainty		± 3 dB					

Result: Passed

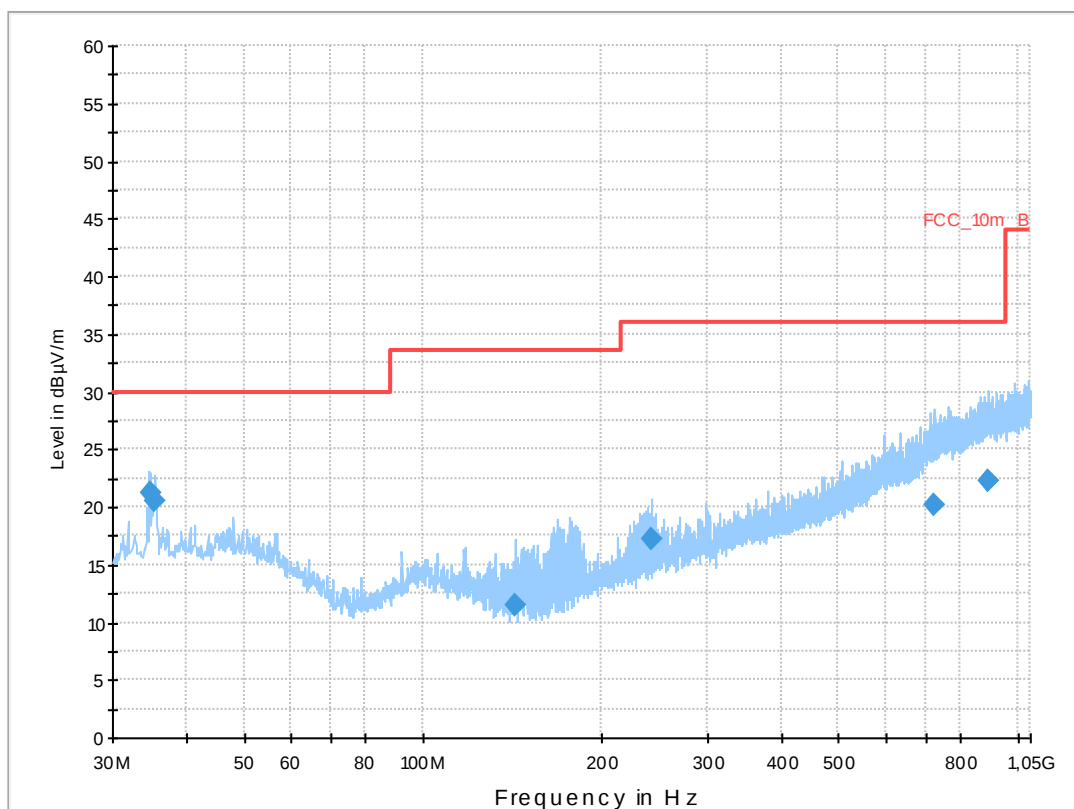
Plots:**Plot 1:** Lowest channel, 30 MHz to 1 GHz, vertical & horizontal polarization**Common Information**

EUT: SB5GCOM31.BG1
 Serial Number:
 Test Description: FCC part 15 C class B @ 10 m
 Operating Conditions: TX ch 11
 Operator Name: Wolsdorfer
 Comment: DC 12 V

Scan Setup: STAN_Fin [EMI radiated]

Hardware Setup: Electric Field (NOS)
 Receiver: [ESCI 3]
 Level Unit: dB μ V/m

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
30 MHz - 2 GHz	60 kHz	QPK	120 kHz	1 s	20 dB



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
34.693500	21.2	1000.0	120.000	100.0	V	275.0	13.0	8.8	30.0	
35.368800	20.5	1000.0	120.000	120.0	V	268.0	13.1	9.5	30.0	
142.695000	11.5	1000.0	120.000	100.0	V	234.0	8.7	22.0	33.5	
242.661900	17.1	1000.0	120.000	143.0	V	240.0	13.1	18.9	36.0	
725.921550	20.2	1000.0	120.000	213.0	H	131.0	23.1	15.8	36.0	
894.669000	22.3	1000.0	120.000	200.0	V	230.0	25.1	13.7	36.0	

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

Subrange 1

Frequency Range: 30 MHz - 2 GHz

Receiver: Receiver [ESCI 3]
@ GPIB0 (ADR 20), SN 100083/003, FW 4.42

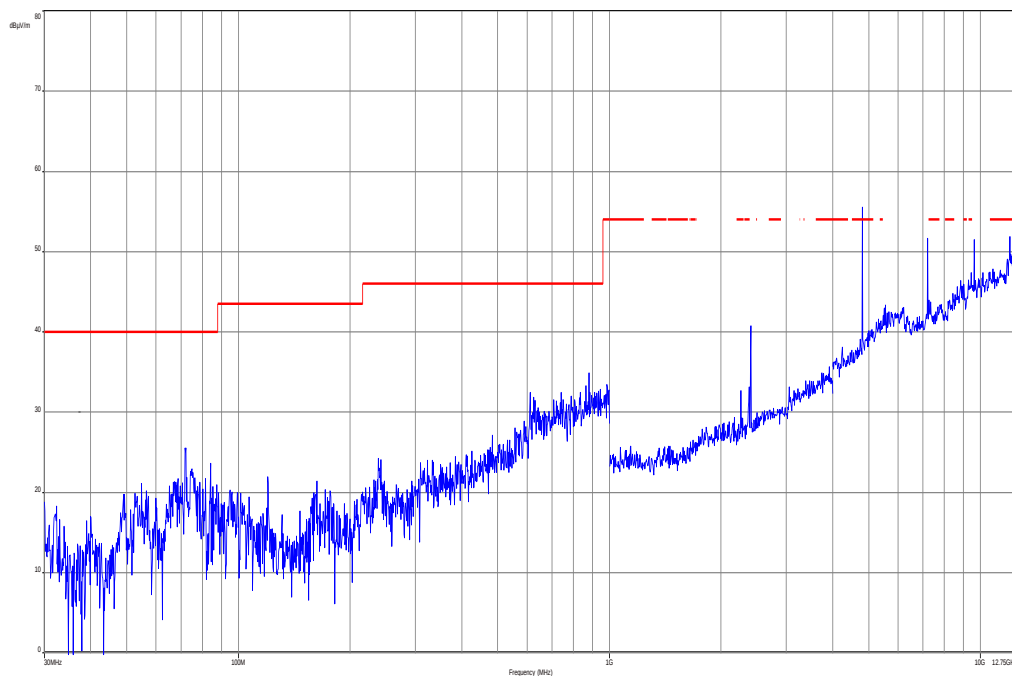
Signal Path: without Notch
FW 1.0

Antenna: VULB 9163
SN 9163-295, FW ---
Correction Table (vertical): VULP6113
Correction Table (horizontal): VULP6113
Correction Table (vertical): Cable_EN_1GHz (1005)
Correction Table (horizontal): Cable_EN_1GHz (1005)

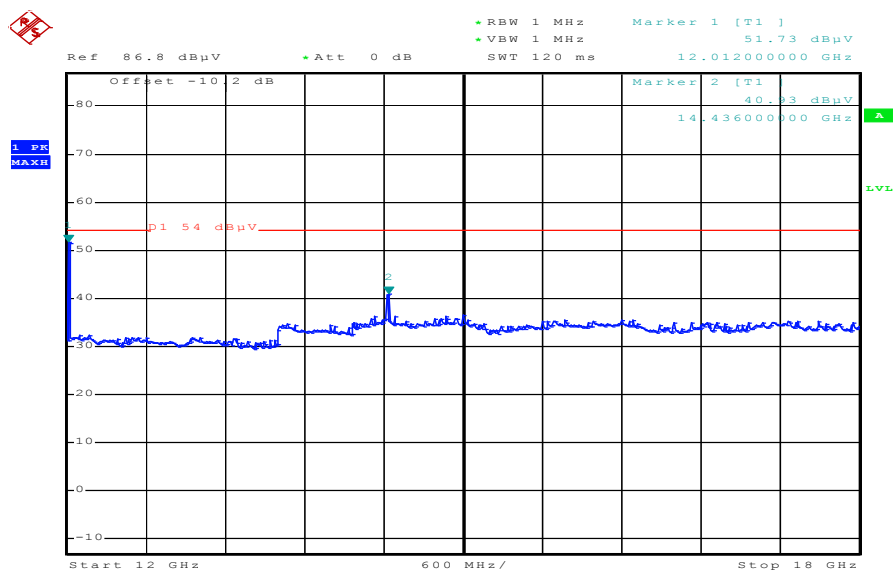
Antenna Tower: Tower [EMCO 2090 Antenna Tower]
@ GPIB0 (ADR 8), FW REV 3.12

Turntable: Turntable [EMCO Turntable]
@ GPIB0 (ADR 9), FW REV 3.12

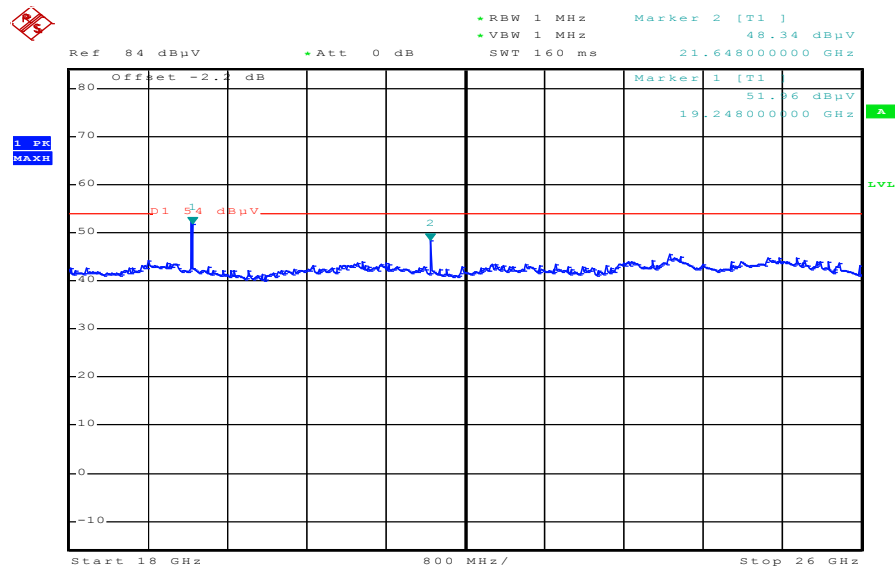
EMC 32 Version 8.52

Plot 2: 1 GHz to 12.75 GHz, vertical & horizontal polarization

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

Plot 3: Lowest channel, 12 GHz to 18 GHz (valid for all channels)

Date: 8.AUG.2012 11:26:28

Plot 4: Lowest channel, 18 GHz to 26 GHz (valid for all channels)

Date: 8.AUG.2012 11:32:15

Plot 4: Middle channel, 30 MHz to 1 GHz, vertical & horizontal polarization

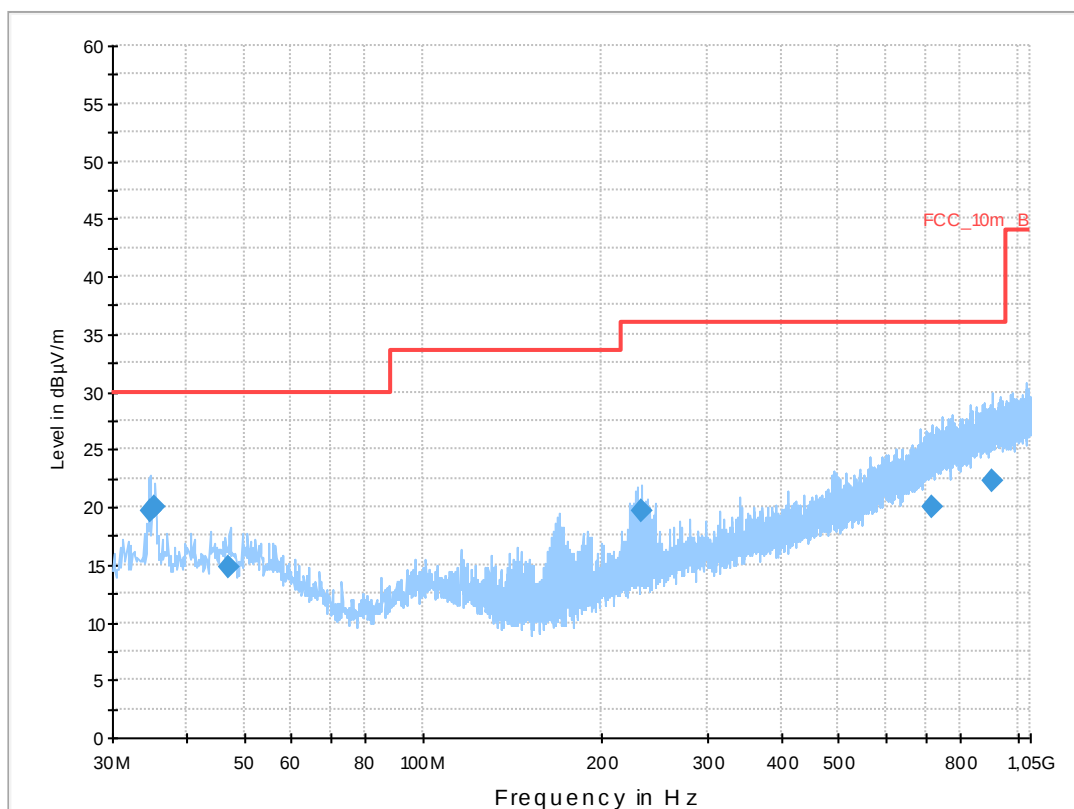
Common Information

EUT: SB5GCOM31.BG1
 Serial Number:
 Test Description: FCC part 15 C class B @ 10 m
 Operating Conditions: TX ch 18
 Operator Name: Hennemann
 Comment: DC 12 V

Scan Setup: STAN_Fin [EMI radiated]

Hardware Setup: Electric Field (NOS)
 Receiver: [ESC1 3]
 Level Unit: dB μ V/m

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamplifier
30 MHz - 2 GHz	60 kHz	QPK	120 kHz	1 s	20 dB



Final Result 1

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
34.720950	19.7	1000.0	120.000	152.0	V	175.0	13.0	10.3	30.0	
35.357250	20.1	1000.0	120.000	144.0	V	100.0	13.1	9.9	30.0	
47.243400	14.8	1000.0	120.000	98.0	V	80.0	13.3	15.2	30.0	
233.339400	19.7	1000.0	120.000	120.0	V	261.0	12.8	16.3	36.0	
718.676700	20.0	1000.0	120.000	170.0	V	10.0	22.9	16.0	36.0	
905.375250	22.3	1000.0	120.000	170.0	V	280.0	25.2	13.7	36.0	

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

Subrange 1

Frequency Range: 30 MHz - 2 GHz

Receiver: Receiver [ESCI 3]
@ GPIB0 (ADR 20), SN 100083/003, FW 4.42

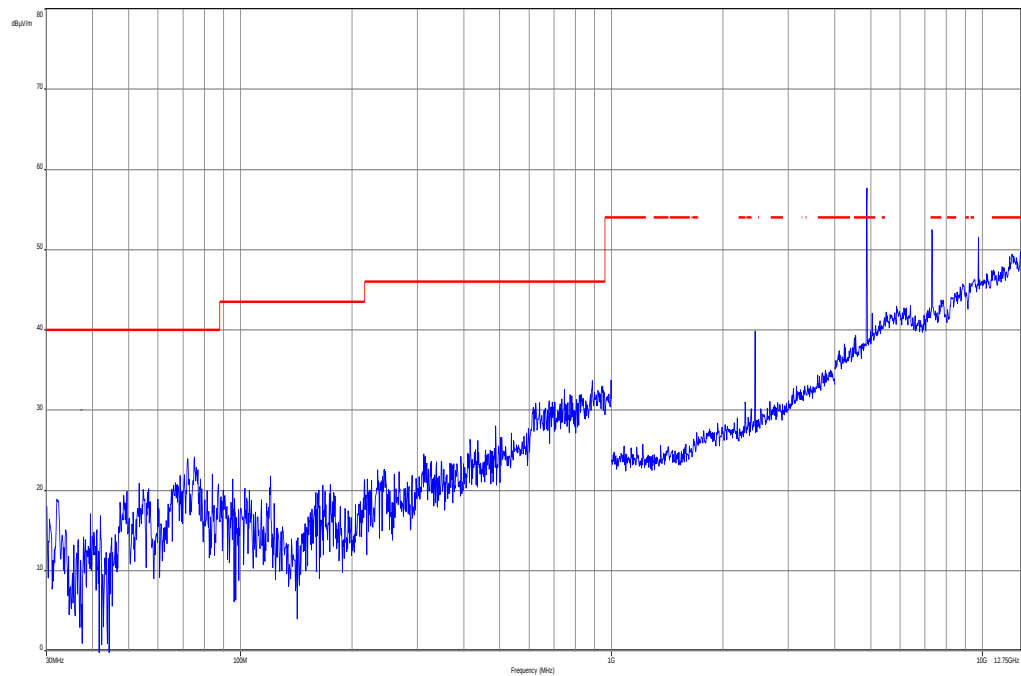
Signal Path: without Notch
FW 1.0

Antenna: VULB 9163
SN 9163-295, FW ---
Correction Table (vertical): VULP6113
Correction Table (horizontal): VULP6113
Correction Table (vertical): Cable_EN_1GHz (1005)
Correction Table (horizontal): Cable_EN_1GHz (1005)

Antenna Tower: Tower [EMCO 2090 Antenna Tower]
@ GPIB0 (ADR 8), FW REV 3.12

Turntable: Turntable [EMCO Turntable]
@ GPIB0 (ADR 9), FW REV 3.12

EMC 32 Version 8.52

Plot 5: Middle channel, 1 GHz to 12.75 GHz, vertical & horizontal polarization

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

Plot 6: Highest channel, 30 MHz to 1 GHz, vertical & horizontal polarization

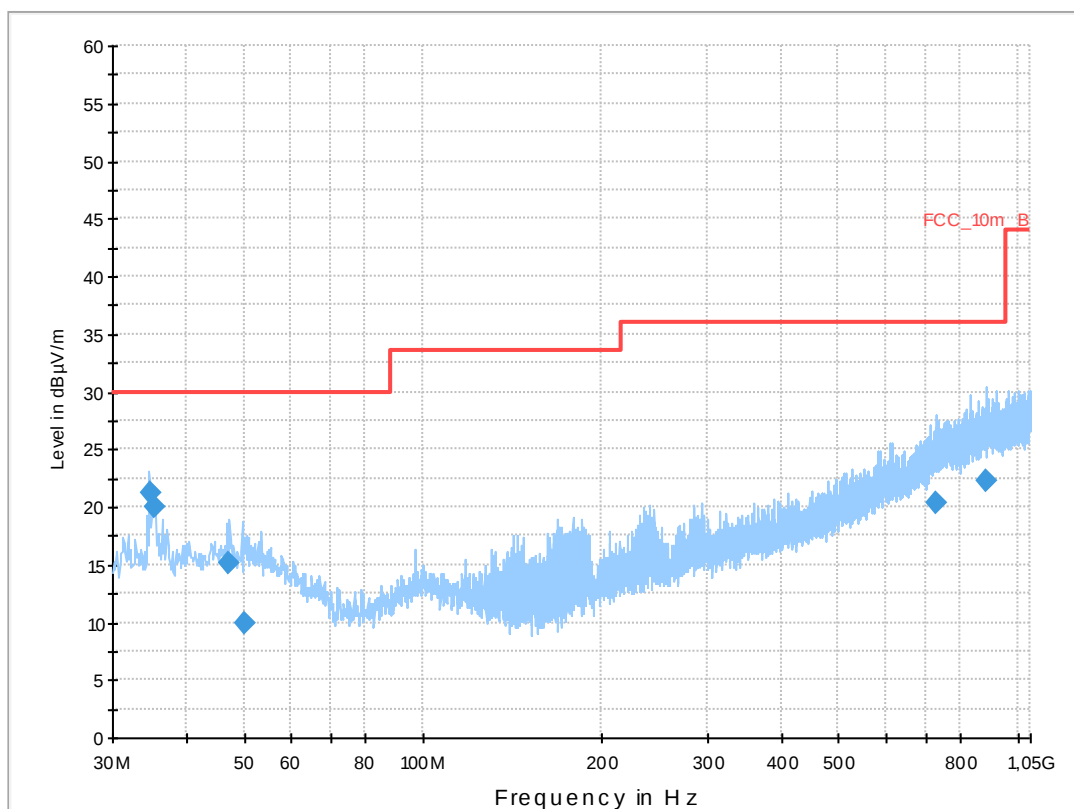
Common Information

EUT: SB5GCOM31.BG1
 Serial Number:
 Test Description: FCC part 15 C class B @ 10 m
 Operating Conditions: TX ch 25
 Operator Name: Hennemann
 Comment: DC 12 V

Scan Setup: STAN_Fin [EMI radiated]

Hardware Setup: Electric Field (NOS)
 Receiver: [ESCI 3]
 Level Unit: dB μ V/m

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamplifier
30 MHz - 2 GHz	60 kHz	QPK	120 kHz	1 s	20 dB



Final Result 1

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
34.686000	21.3	1000.0	120.000	98.0	V	80.0	13.0	8.7	30.0	
35.377350	20.0	1000.0	120.000	153.0	V	280.0	13.1	10.0	30.0	
47.234400	15.2	1000.0	120.000	170.0	V	-10.0	13.3	14.8	30.0	
50.040600	9.9	1000.0	120.000	104.0	H	10.0	13.4	20.1	30.0	
728.300850	20.3	1000.0	120.000	170.0	H	280.0	23.2	15.7	36.0	
884.889900	22.2	1000.0	120.000	170.0	V	175.0	25.0	13.8	36.0	

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

Subrange 1

Frequency Range: 30 MHz - 2 GHz

Receiver: Receiver [ESCI 3]
@ GPIB0 (ADR 20), SN 100083/003, FW 4.42

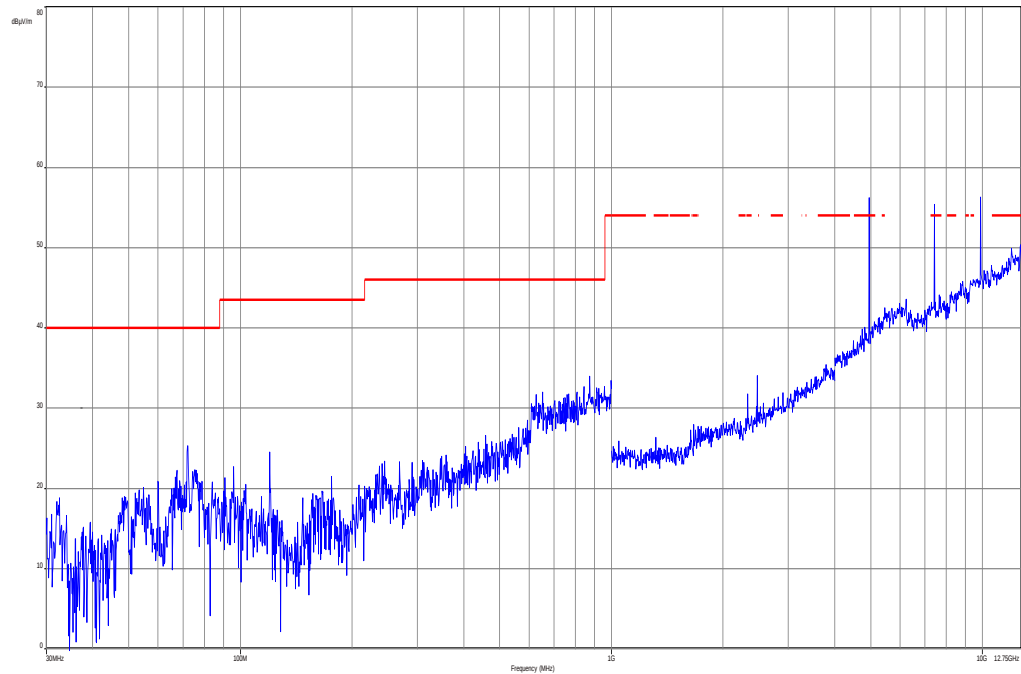
Signal Path: without Notch
FW 1.0

Antenna: VULB 9163
SN 9163-295, FW ---
Correction Table (vertical): VULP6113
Correction Table (horizontal): VULP6113
Correction Table (vertical): Cable_EN_1GHz (1005)
Correction Table (horizontal): Cable_EN_1GHz (1005)

Antenna Tower: Tower [EMCO 2090 Antenna Tower]
@ GPIB0 (ADR 8), FW REV 3.12

Turntable: Turntable [EMCO Turntable]
@ GPIB0 (ADR 9), FW REV 3.12

Plot 7: Highest channel, 1 GHz to 12.75 GHz, vertical & horizontal polarization



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

Plot 6: Additional channel, 30 MHz to 1 GHz, vertical & horizontal polarization

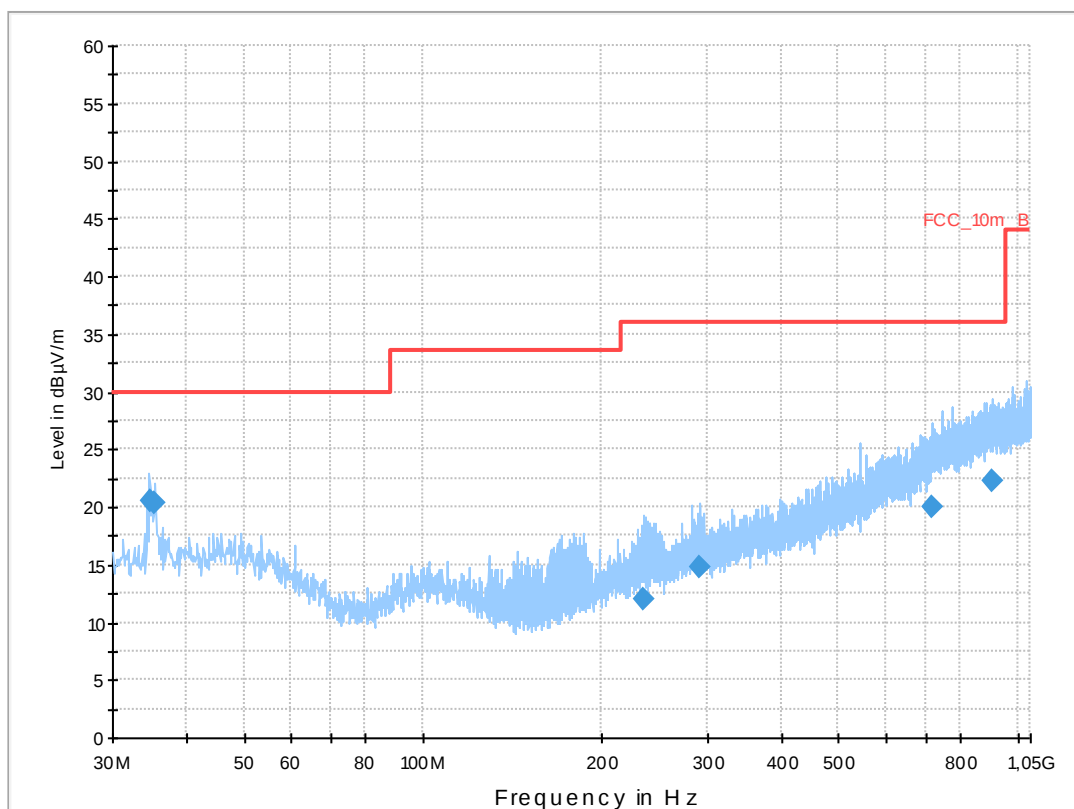
Common Information

EUT: SB5GCOM31.BG1
 Serial Number:
 Test Description: FCC part 15 C class B @ 10 m
 Operating Conditions: TX ch 26
 Operator Name: Hennemann
 Comment: DC 12 V

Scan Setup: STAN_Fin [EMI radiated]

Hardware Setup: Electric Field (NOS)
 Receiver: [ESCI 3]
 Level Unit: dB μ V/m

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamplifier
30 MHz - 2 GHz	60 kHz	QPK	120 kHz	1 s	20 dB



Final Result 1

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
34.693950	20.5	1000.0	120.000	170.0	V	190.0	13.0	9.5	30.0	
35.381550	20.4	1000.0	120.000	98.0	V	182.0	13.1	9.6	30.0	
234.097950	12.0	1000.0	120.000	98.0	V	190.0	12.8	24.0	36.0	
292.279650	14.7	1000.0	120.000	121.0	V	280.0	14.3	21.3	36.0	
716.447550	20.1	1000.0	120.000	170.0	H	260.0	22.9	15.9	36.0	
906.971700	22.3	1000.0	120.000	151.0	H	190.0	25.2	13.7	36.0	

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

Subrange 1

Frequency Range: 30 MHz - 2 GHz

Receiver: Receiver [ESCI 3]
@ GPIB0 (ADR 20), SN 100083/003, FW 4.42

Signal Path: without Notch
FW 1.0

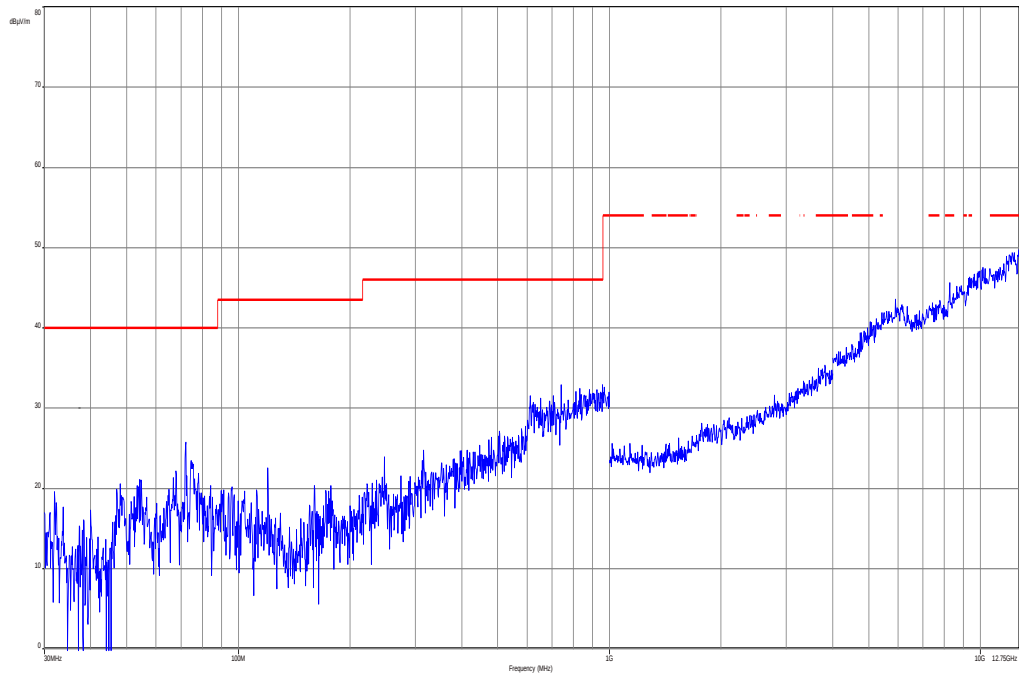
Antenna: VULB 9163
SN 9163-295, FW ---
Correction Table (vertical): VULP6113
Correction Table (horizontal): VULP6113
Correction Table (vertical): Cable_EN_1GHz (1005)
Correction Table (horizontal): Cable_EN_1GHz (1005)

Antenna Tower: Tower [EMCO 2090 Antenna Tower]
@ GPIB0 (ADR 8), FW REV 3.12

Turntable: Turntable [EMCO Turntable]
@ GPIB0 (ADR 9), FW REV 3.12

EMC 32 Version 8.52

Plot 7: Additional channel, 1 GHz to 12.75 GHz, vertical & horizontal polarization



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

9.10 RX spurious emissions radiated

Description:

Measurement of the radiated spurious emissions in idle/receive mode.

Measurement:

Measurement parameter	
Detector:	Peak / Quasi Peak
Sweep time:	Auto
Video bandwidth:	Sweep: 100 kHz Remeasurement: 10 Hz
Resolution bandwidth:	F < 1 GHz: 100 kHz F > 1 GHz: 1 MHz
Span:	30 MHz to 25 GHz
Trace-Mode:	Max Hold

Limits:

FCC		IC
RX Spurious Emissions Radiated		
Frequency (MHz)	Field Strength (dB μ V/m)	Measurement distance
30 - 88	30.0	10
88 – 216	33.5	10
216 – 960	36.0	10
Above 960	54.0	3

Results:

RX Spurious Emissions Radiated [dB μ V/m]		
F [MHz]	Detector	Level [dB μ V/m]
No critical peaks detected!		
Measurement uncertainty	± 3 dB	

Result: Passed

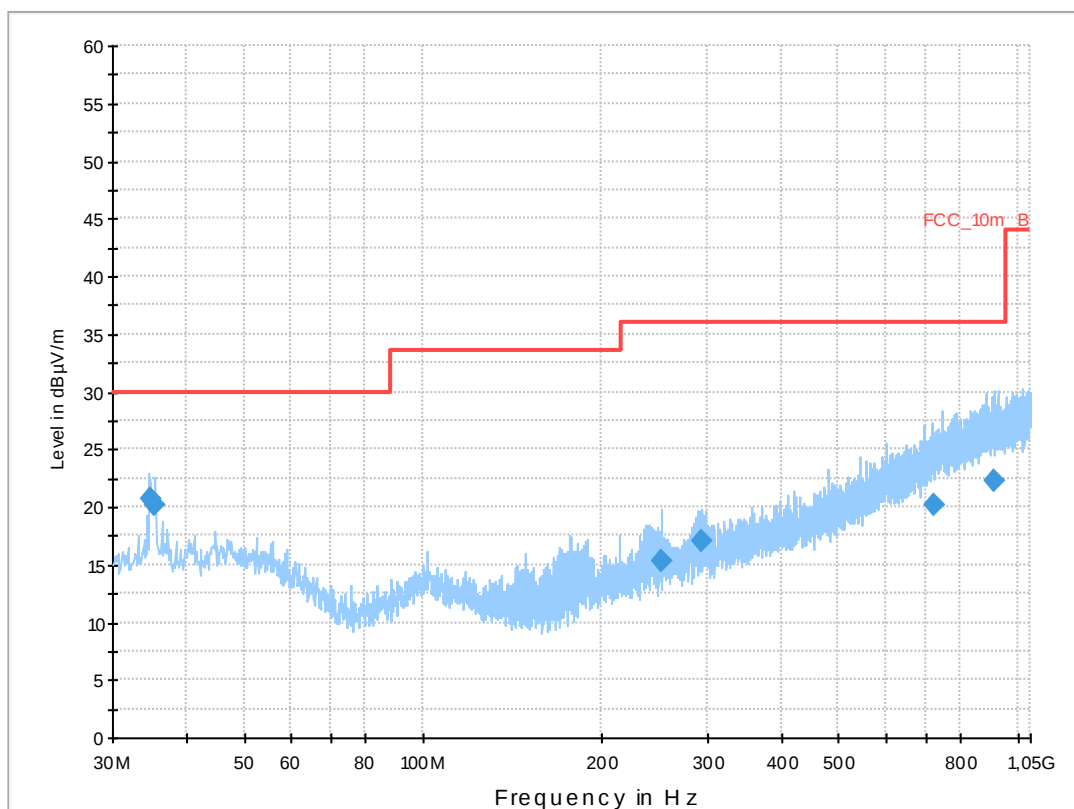
Plots: RX / Idle – mode**Plot 1:** 30 MHz to 1 GHz, vertical & horizontal polarization**Common Information**

EUT: SB5GCOM31.BG1
 Serial Number:
 Test Description: FCC part 15 C class B @ 10 m
 Operating Conditions: RX ch 18
 Operator Name: Hennemann
 Comment: DC 12 V

Scan Setup: STAN_Fin [EMI radiated]

Hardware Setup: Electric Field (NOS)
 Receiver: [ESCI 3]
 Level Unit: dB μ V/m

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
30 MHz - 2 GHz	60 kHz	QPK	120 kHz	1 s	20 dB



Final Result 1

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
34.699650	20.7	1000.0	120.000	170.0	V	182.0	13.0	9.3	30.0	
35.381550	20.1	1000.0	120.000	170.0	V	261.0	13.1	9.9	30.0	
251.297850	15.3	1000.0	120.000	98.0	V	100.0	13.3	20.7	36.0	
294.722700	17.0	1000.0	120.000	153.0	V	171.0	14.4	19.0	36.0	
720.596850	20.1	1000.0	120.000	170.0	H	10.0	23.0	15.9	36.0	
914.788200	22.2	1000.0	120.000	132.0	H	10.0	25.2	13.8	36.0	

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

Subrange 1

Frequency Range: 30 MHz - 2 GHz

Receiver: Receiver [ESCI 3]
@ GPIB0 (ADR 20), SN 100083/003, FW 4.42

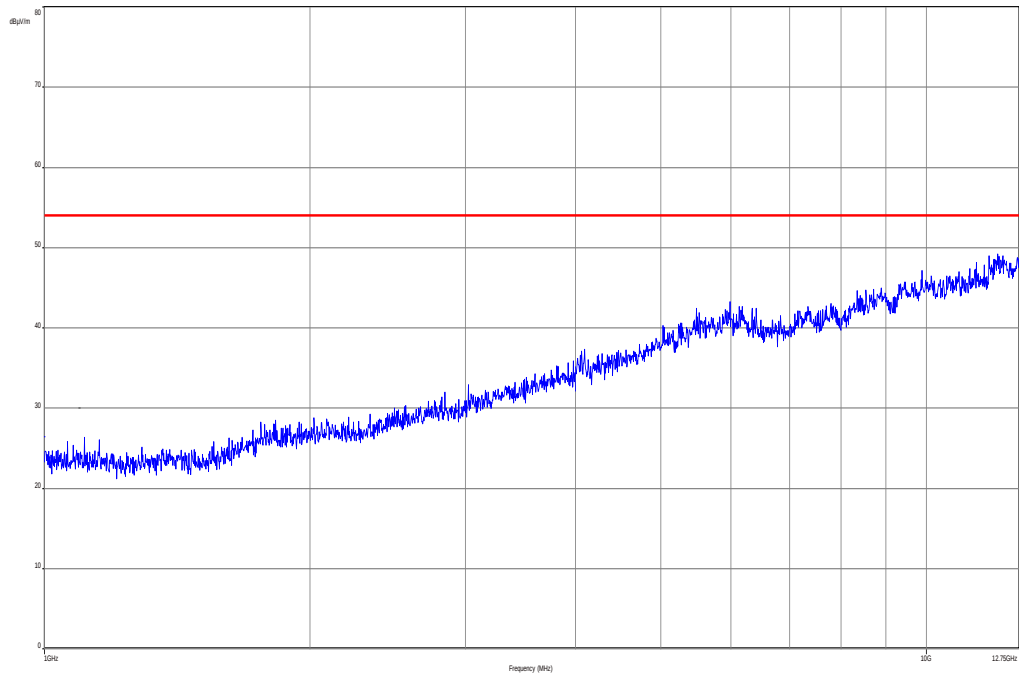
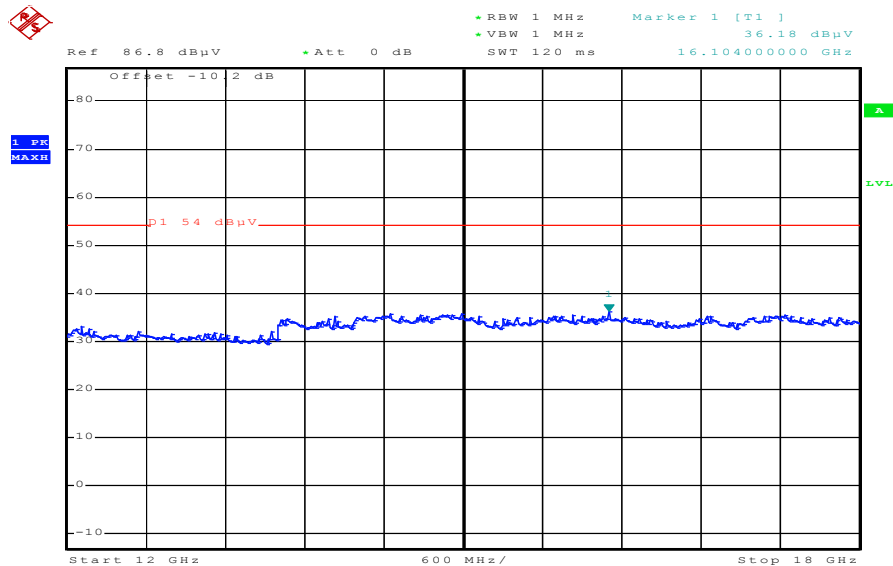
Signal Path: without Notch
FW 1.0

Antenna: VULB 9163
SN 9163-295, FW ---
Correction Table (vertical): VULP6113
Correction Table (horizontal): VULP6113
Correction Table (vertical): Cable_EN_1GHz (1005)
Correction Table (horizontal): Cable_EN_1GHz (1005)

Antenna Tower: Tower [EMCO 2090 Antenna Tower]
@ GPIB0 (ADR 8), FW REV 3.12

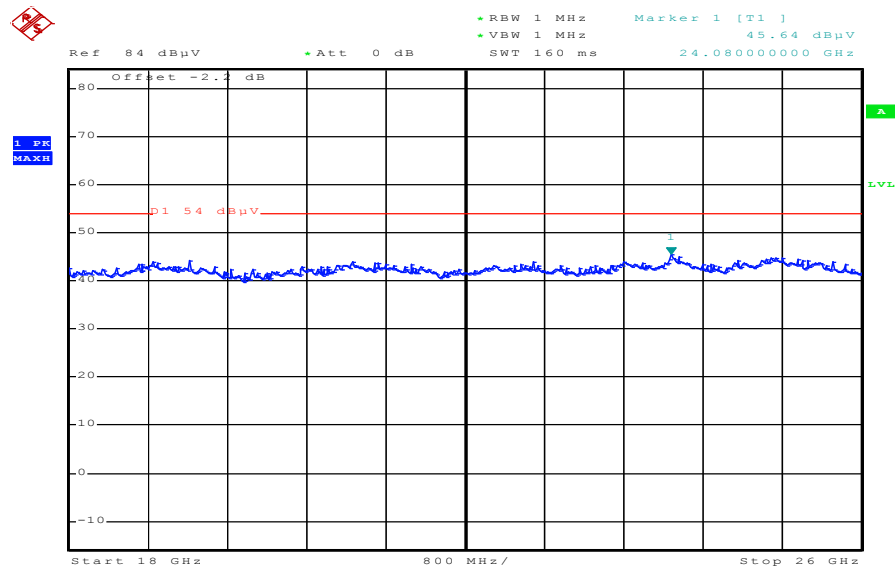
Turntable: Turntable [EMCO Turntable]
@ GPIB0 (ADR 9), FW REV 3.12

EMC 32 Version 8.52

Plot 2: 1 GHz to 12.75 GHz, vertical & horizontal polarization**Plot 3:** 12 GHz to 18 GHz, vertical & horizontal polarization

Date: 8.AUG.2012 11:24:34

Plot 4: 18 GHz to 26 GHz, vertical & horizontal polarization



Date: 8.AUG.2012 11:31:35

9.11 TX spurious emissions radiated < 30 MHz

Description:

Measurement of the radiated spurious emissions in transmit mode below 30 MHz. The EUT is set to channel 39. This measurement is representative for all channels and modes. If critical peaks are found channel 00 and channel 78 will be measured too. The limits are recalculated to a measurement distance of 3 m with 40 dB/decade according CFR Part 2.

Measurement:

Measurement parameter	
Detector:	Peak / Quasi Peak
Sweep time:	Auto
Video bandwidth:	F < 150 kHz: 200 Hz F > 150 kHz: 9 kHz
Resolution bandwidth:	F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz
Span:	9 kHz to 30 MHz
Trace-Mode:	Max Hold

Limits:

FCC		IC
TX Spurious Emissions Radiated < 30 MHz		
Frequency (MHz)	Field Strength (dB μ V/m)	Measurement distance
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30

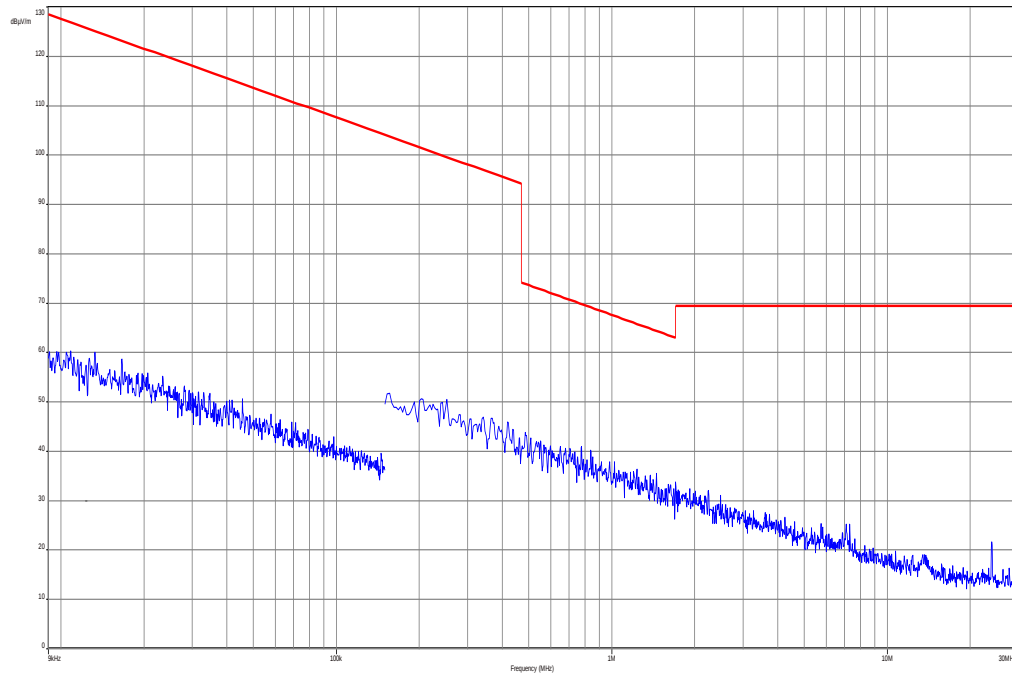
Results:

TX Spurious Emissions Radiated < 30 MHz [dB μ V/m]		
F [MHz]	Detector	Level [dB μ V/m]
No critical peaks detected!		
Measurement uncertainty	± 3 dB	

Result: Passed

Plot:

Plot 1: 9 kHz to 30 MHz



9.12 TX spurious emissions conducted < 30 MHz

Description:

Measurement of the conducted spurious emissions in transmit mode below 30 MHz. The EUT is set to channel 6. This measurement is repeated for DSSS and OFDM modulation. If critical peaks are found channel 1 and channel 11 will be measured too. The measurement is performed with the data rate producing the highest output power. Both power lines, phase and neutral line, are measured. Found peaks are remeasured with average and quasi peak detection to show compliance to the limits.

Measurement:

Measurement parameter	
Detector:	Peak - Quasi Peak / Average
Sweep time:	Auto
Video bandwidth:	F < 150 kHz: 200 Hz F > 150 kHz: 9 kHz
Resolution bandwidth:	F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz
Span:	9 kHz to 30 MHz
Trace-Mode:	Max Hold

Limits:

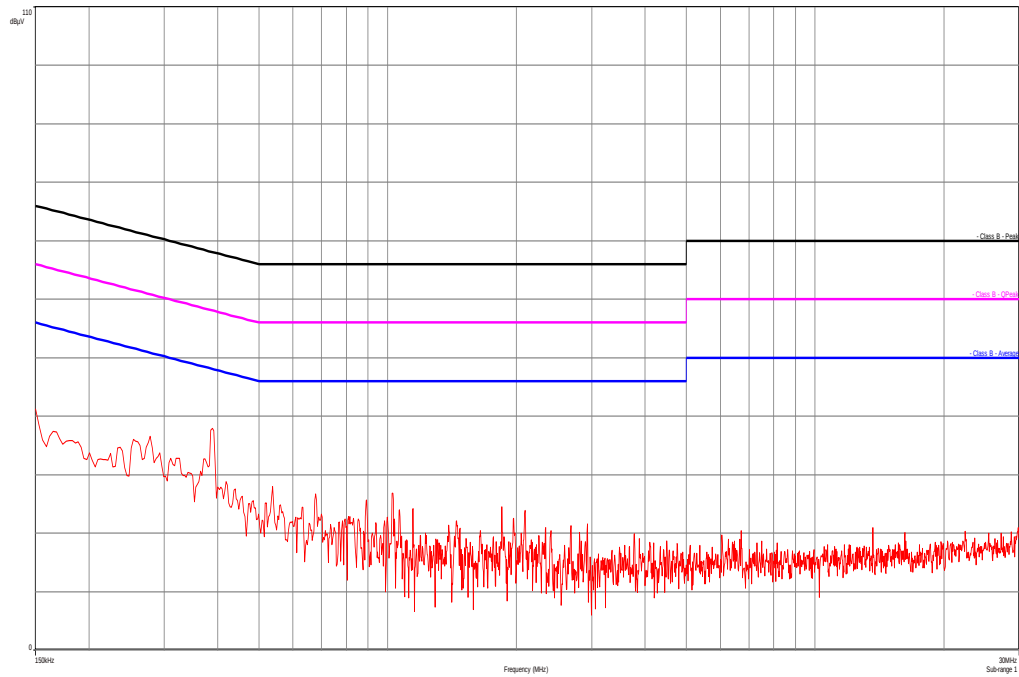
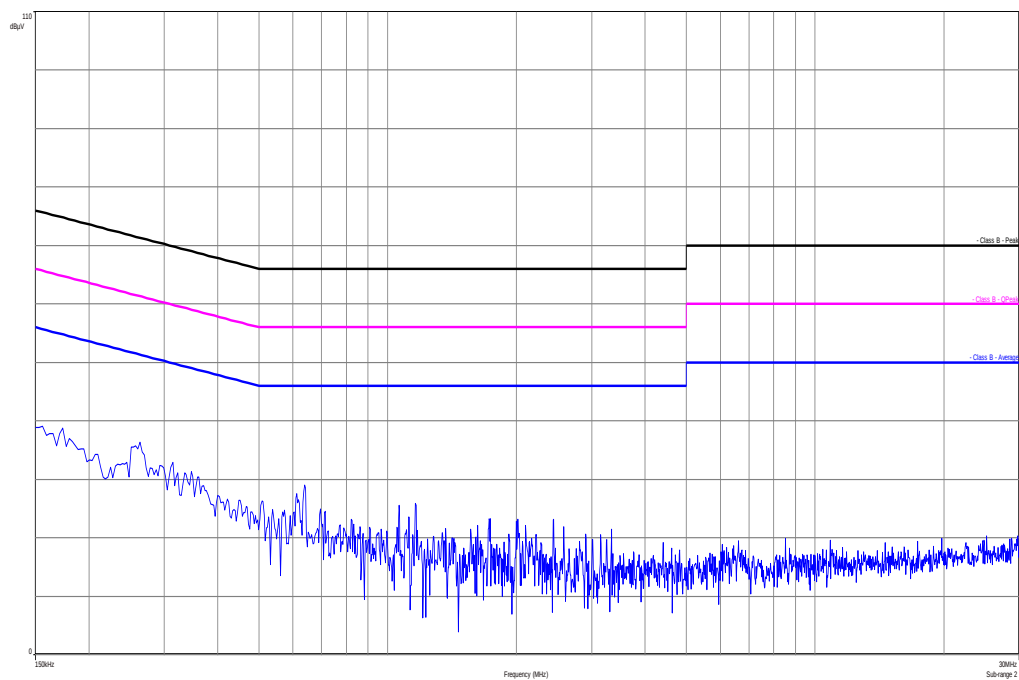
FCC		IC
CFR Part 15.107(a)		-/-
TX Spurious Emissions Conducted < 30 MHz		
Frequency (MHz)	Quasi-Peak (dBμV/m)	Average (dBμV/m)
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30.0	60	50

*Decreases with the logarithm of the frequency

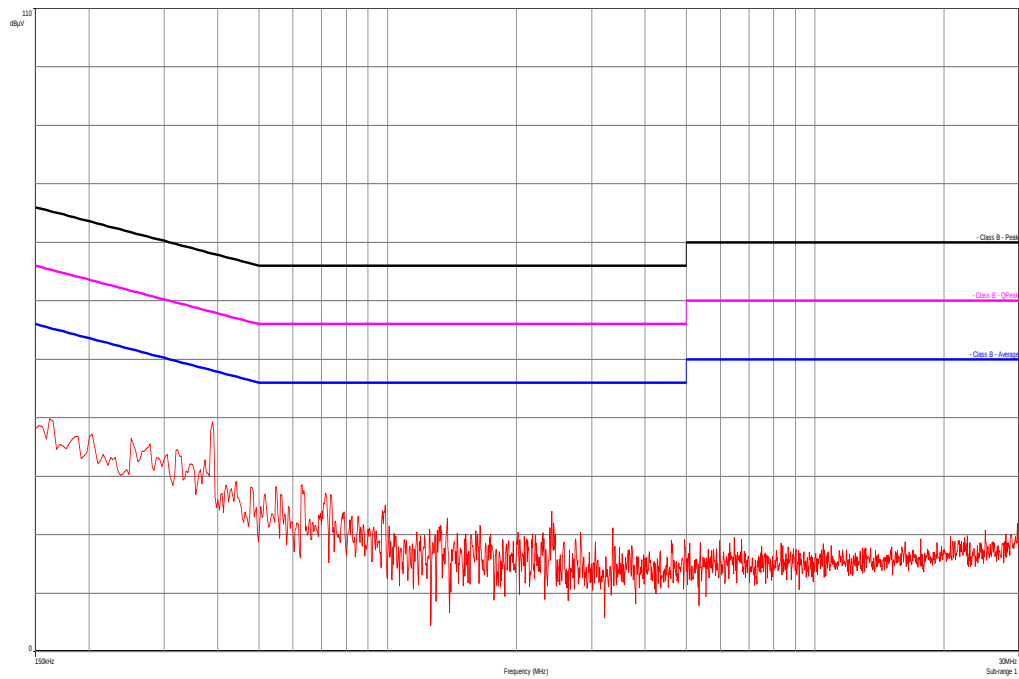
Results:

TX Spurious Emissions Conducted < 30 MHz [dBμV/m]		
F [MHz]	Detector	Level [dBμV/m]
No critical peaks detected		
Measurement uncertainty	± 3 dB	

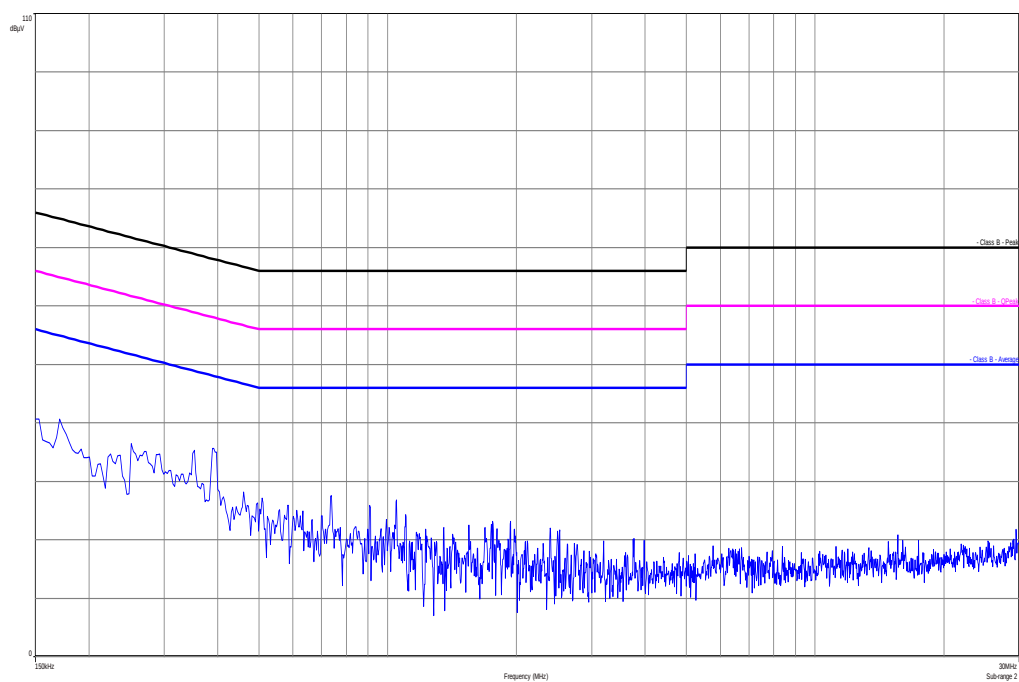
Result: Passed

Plots:**Plot 1:** TX mode, 9 kHz to 30 MHz, phase line**Plot 2:** TX mode, 9 kHz to 30 MHz, neutral line

Plot 3: RX / Idle – mode, 9 kHz to 30 MHz, phase line



Plot 4: RX / Idle – mode, 9 kHz to 30 MHz, neutral line



10 Test equipment and ancillaries used for tests

Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, rf-generating and signalling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Labor/Item).

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	vKI!	11.05.2011	11.05.2013
2	n. a.	Active Loop Antenna	6502	EMCO	2210	300001015	ne		
3	n. a.	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev		
4	n. a.	Relais Matrix	3488A	HP Meßtechnik	2719A15013	300001156	ne		
5	n. a.	Three-Way Power Splitter, 50 Ohm	11850C	HP Meßtechnik		300000997	ne		
6	n. a.	Switch / Control Unit	3488A	HP	2605e08770	300001443	ne		
7	n. a.	Amplifier	js42-00502650-28-5a	Parzich GMBH	928979	300003143	ne		
8	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	371	300003854	vKI!	14.10.2011	14.10.2014
9	n. a.	MXE EMI Receiver 20 Hz bis 26,5 GHz	N9038A	Agilent Technologies	MY51210197	300004405	k	19.12.2011	19.12.2012
10	45	Switch-Unit	3488A	HP Meßtechnik	2719A14505	300000368	g		
11	50	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP Meßtechnik	2920A04466	300000580	ne		
12	n. a.	software	SPS_PHE 1.4f	Spitzberger & Spieß	B5981; 5D1081; B5979	300000210	ne		
13	n. a.	EMI Test Receiver	ESCI 1166.5950.03	R&S	100083	300003312	k	04.01.2012	04.01.2013
14	n. a.	Analyzer-Reference-System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	k	14.07.2011	14.07.2013
15	n. a.	Amplifier	JS42-00502650-28-5A	MITEQ	1084532	300003379	ev		
16	n. a.	Antenna Tower	Model 2175	ETS-LINDGREN	64762	300003745	izw		
17	n. a.	Positioning Controller	Model 2090	ETS-LINDGREN	64672	300003746	izw		
18	n. a.	Turntable Interface-Box	Model 105637	ETS-LINDGREN	44583	300003747	izw		
19	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787	k	01.04.2010	
20	n. a.	Spectrum-Analyzer	FSU26	R&S	200809	300003874	k	06.01.2012	06.01.2014

Agenda: Kind of Calibration

k	calibration / calibrated	EK	limited calibration
ne	not required (k, ev, izw, zw not required)	zw	cyclical maintenance (external cyclical maintenance)
ev	periodic self verification	izw	internal cyclical maintenance
Ve	long-term stability recognized	g	blocked for accredited testing
vlk!	Attention: extended calibration interval		
NK!	Attention: not calibrated	*)	next calibration ordered / currently in progress

11 Observations

No observations exceeding those reported with the single test cases have been made.

Annex A Photographs of the test setup

Photo documentation:

Photo 1:

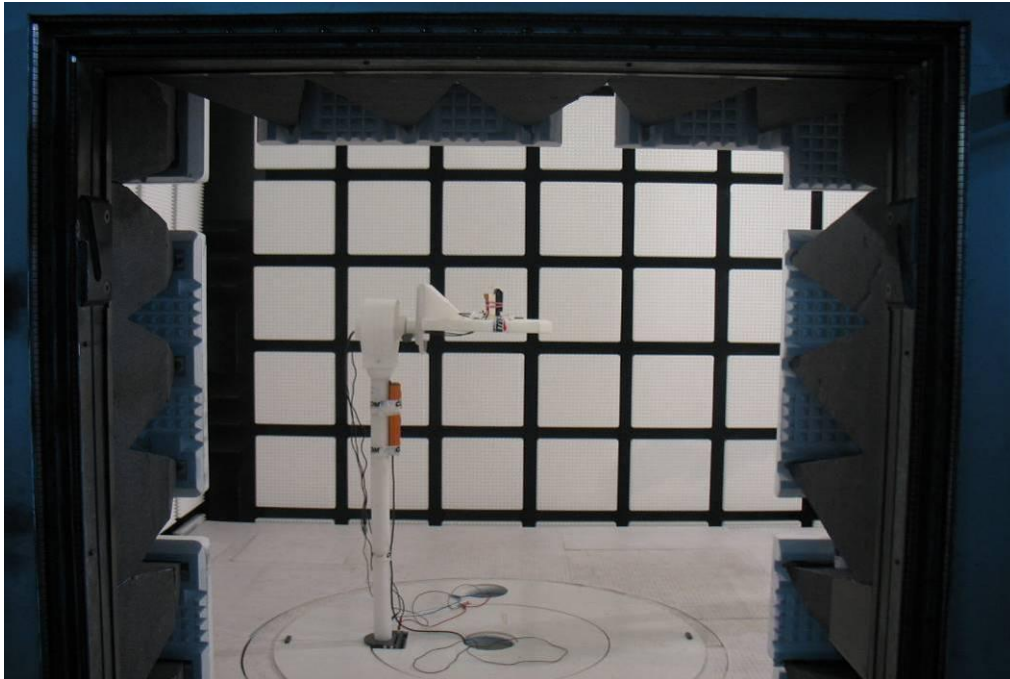


Photo 2:



Photo 3:



Photo 4:

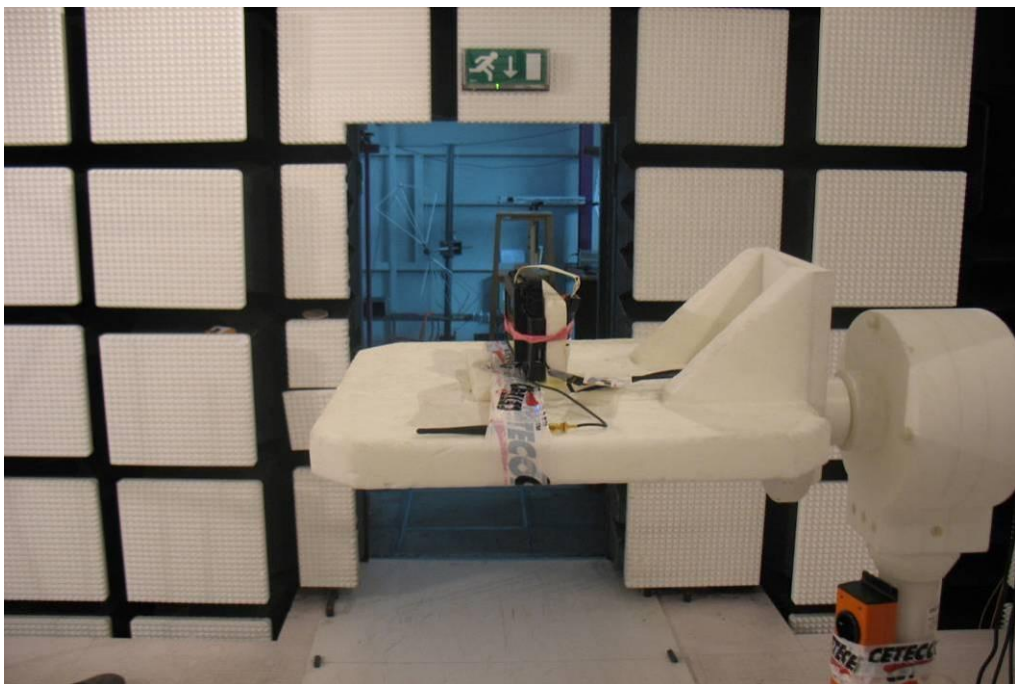


Photo 5:

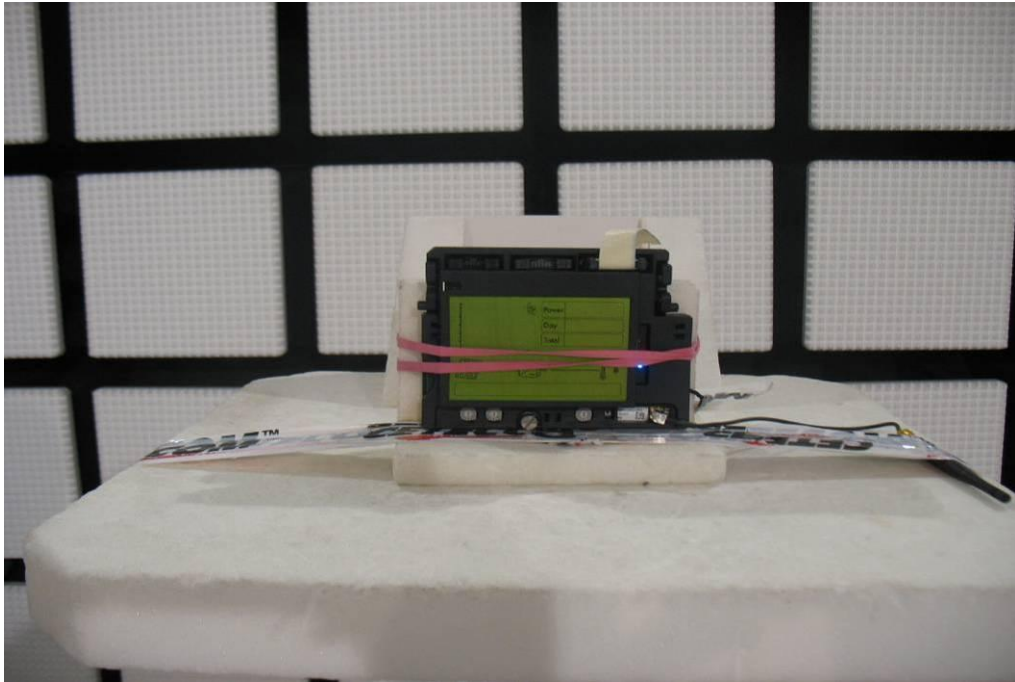


Photo 6:



Photo 7:

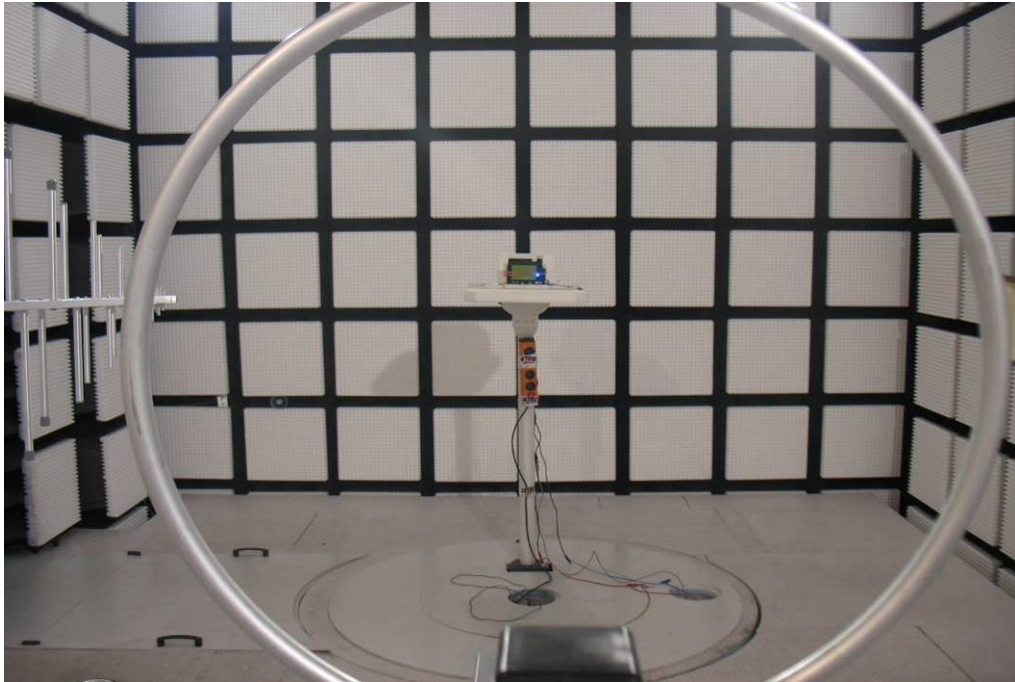


Photo 8:



Photo 9:

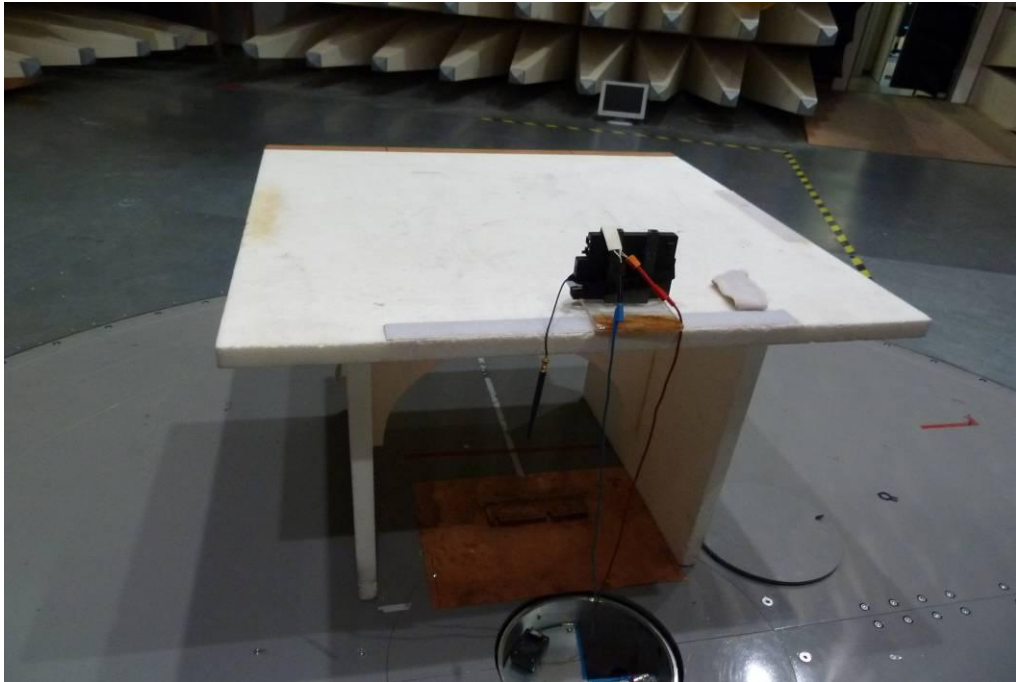


Photo 10:



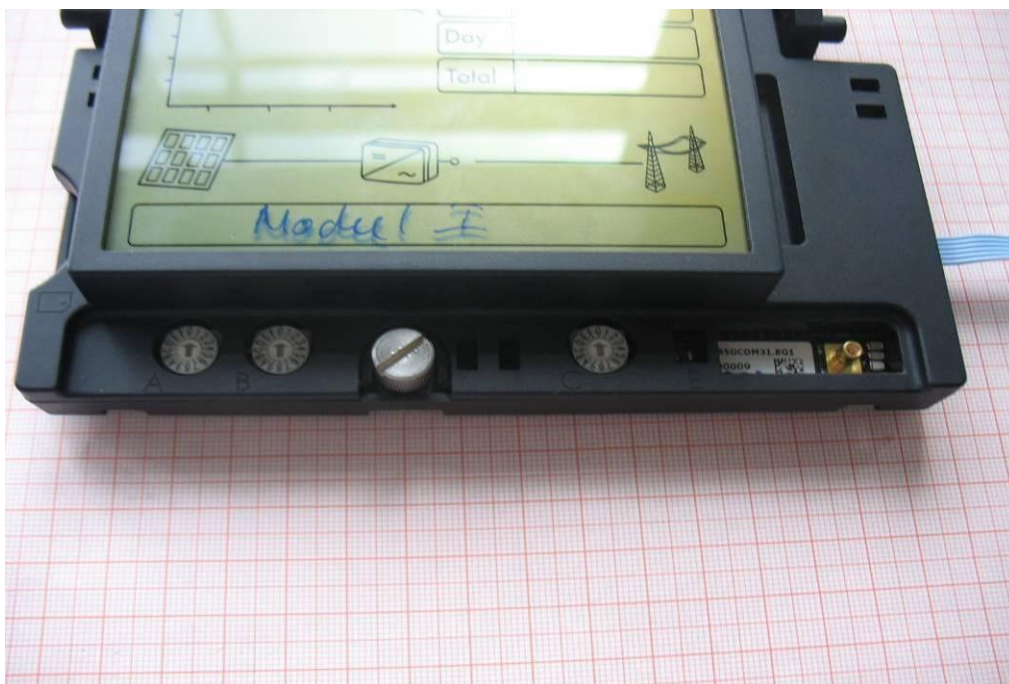
Annex B External photographs of the EUT

Photo documentation:

Photo 1:



Photo 2:



Annex C Internal photographs of the EUT

Photo documentation:

Photo 1:



Photo 2:

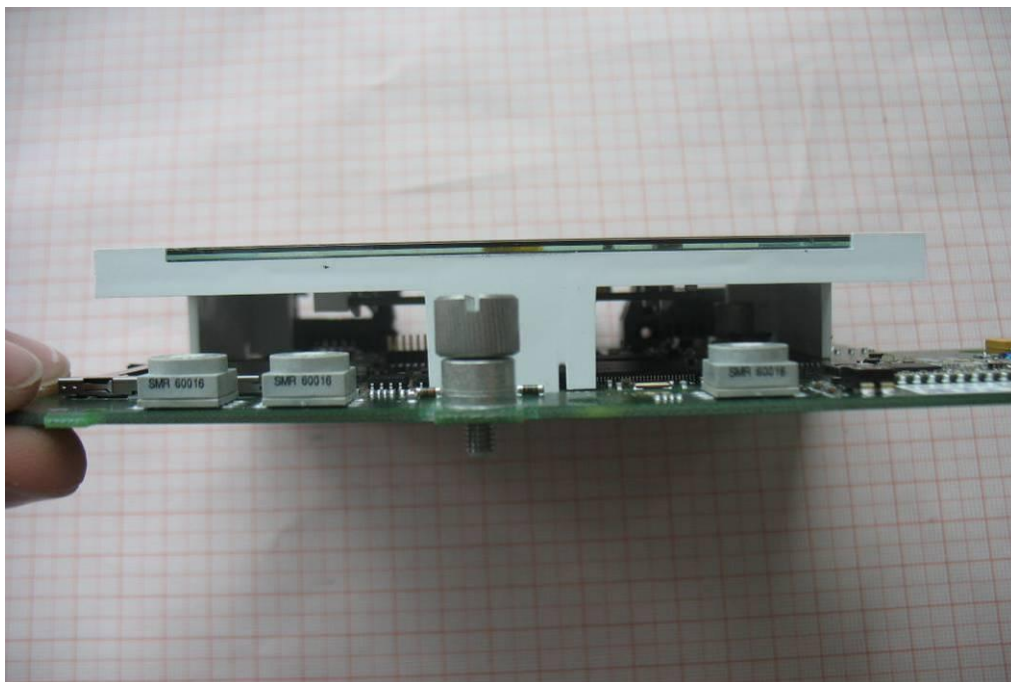


Photo 3:

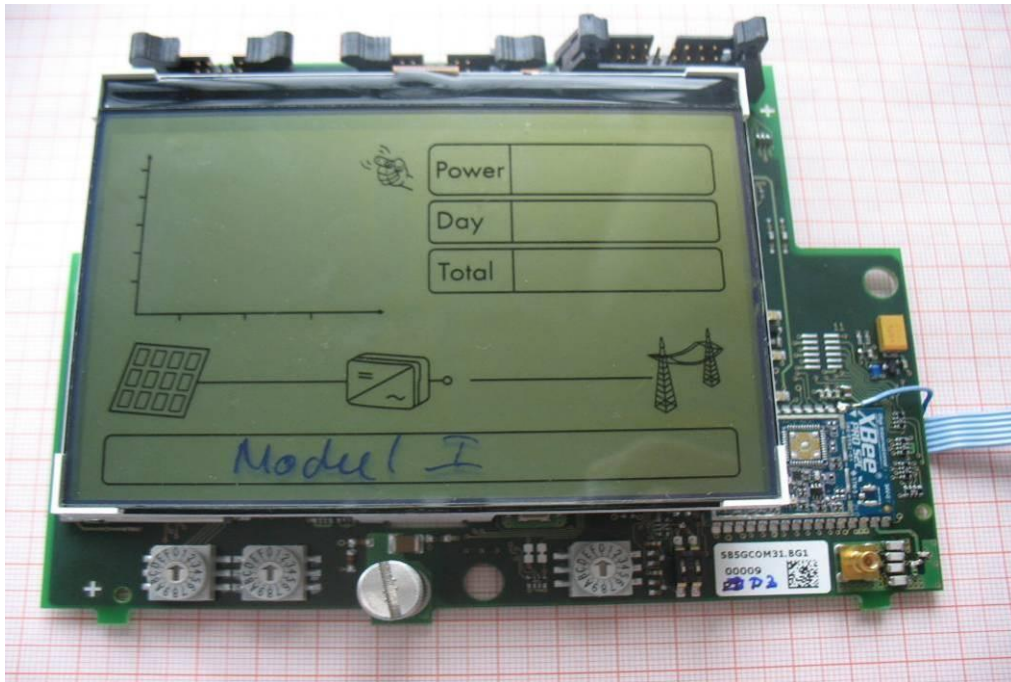


Photo 4:

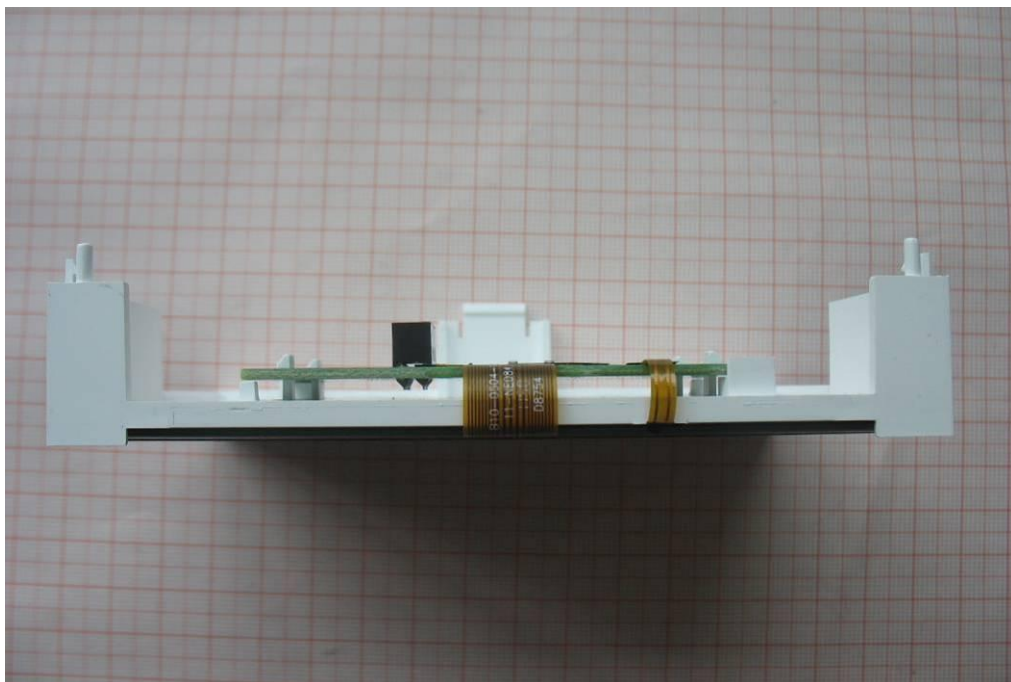


Photo 5:

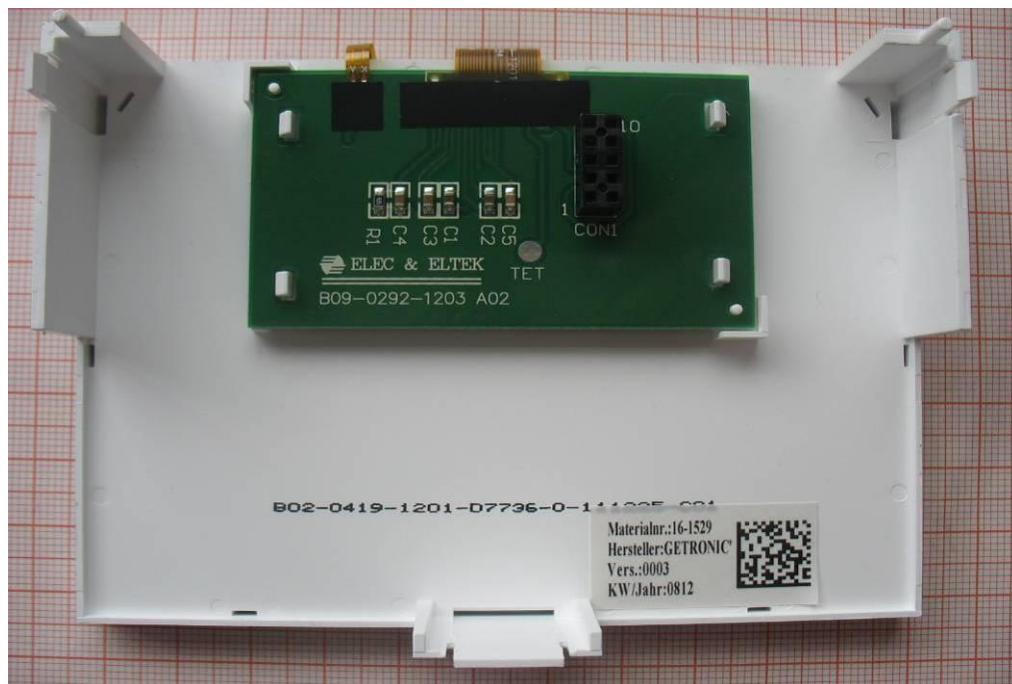


Photo 6:

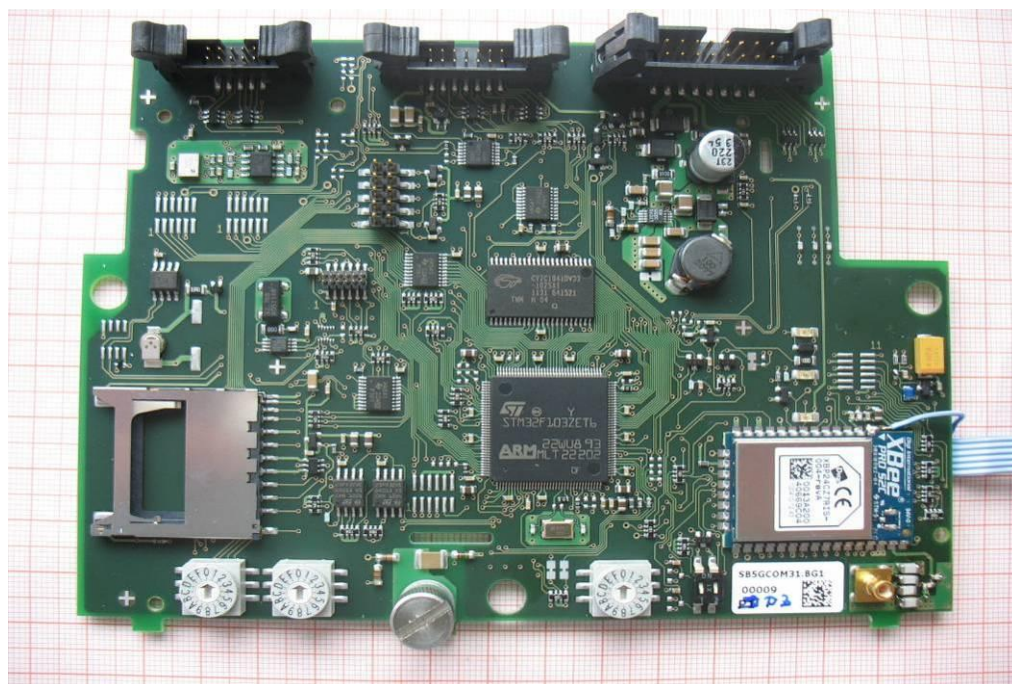


Photo 7:

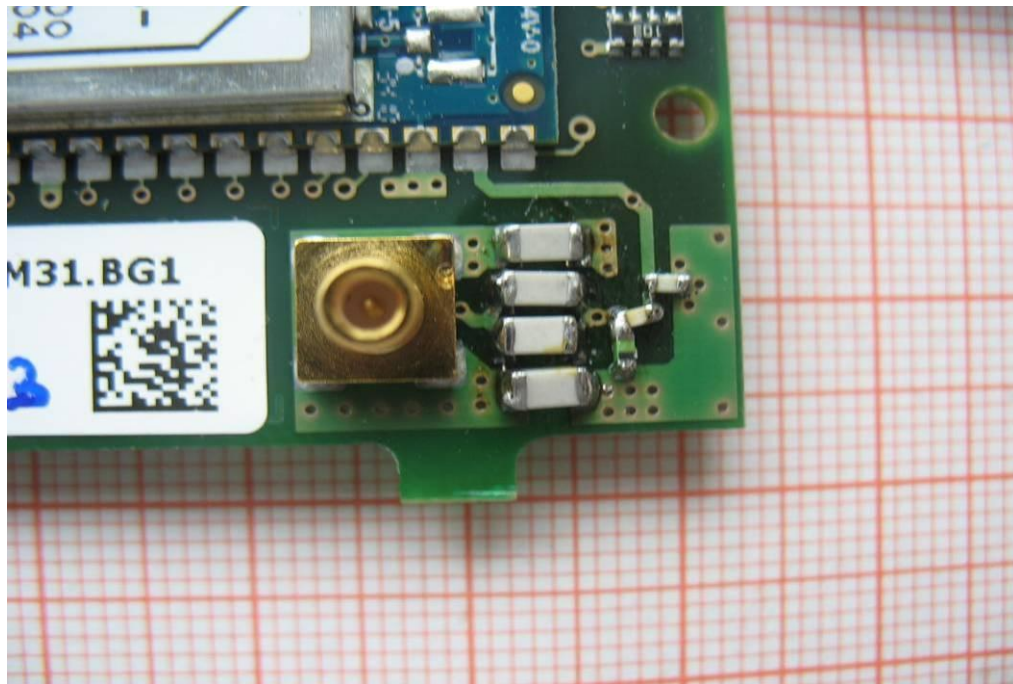


Photo 8:



Photo 9:

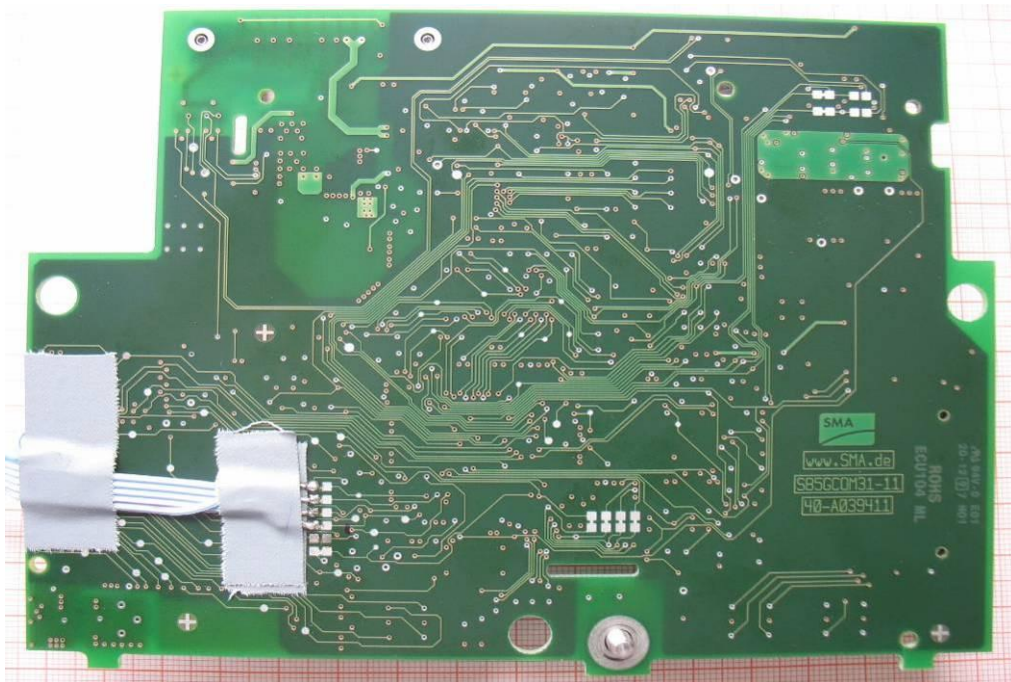


Photo 10:



Photo 11:



Photo 12:



Photo 13:

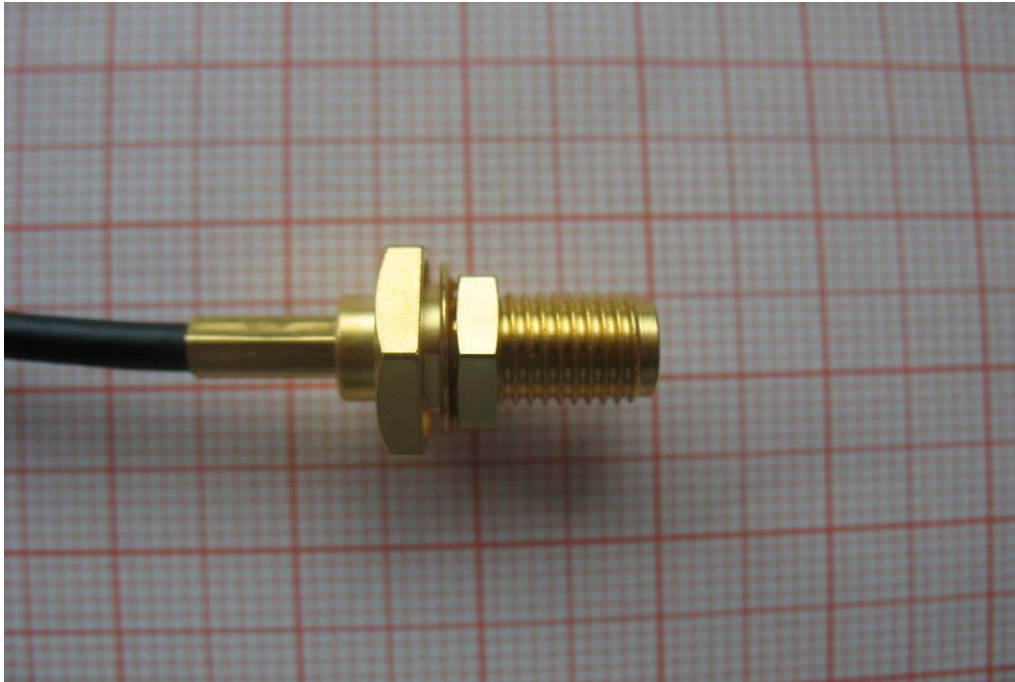


Photo 14:



Annex D Document history

Version	Applied changes	Date of release
1.0	Initial release	2012-09-06
-A	Add AC-conducted measurement	2012-10-12
-B	Changed model name	2012-11-16

Annex E Further information**Glossary**

AVG	-	Average
DUT	-	Device under test
EMC	-	Electromagnetic Compatibility
EN	-	European Standard
EUT	-	Equipment under test
ETSI	-	European Telecommunications Standard Institute
FCC	-	Federal Communication Commission
FCC ID	-	Company Identifier at FCC
HW	-	Hardware
IC	-	Industry Canada
Inv. No.	-	Inventory number
N/A	-	Not applicable
PP	-	Positive peak
QP	-	Quasi peak
S/N	-	Serial number
SW	-	Software

Annex F Accreditation Certificate



Deutsche Akkreditierungsstelle GmbH
German Accreditation Body

Entrusted according to Section 8 subsection 1 AkkStelleG in connection with Section 1 subsection 1 AkkStelleGBV
Signatory to the Multilateral Agreements of EA, ILAC and IAF for Mutual Recognition

Accreditation



The Deutsche Akkreditierungsstelle GmbH (German Accreditation Body) attests that the testing laboratory

CETECOM ICT Services GmbH
Untertürkheimer Straße 6-10
66117 Saarbrücken

is competent under the terms of DIN EN ISO/IEC 17025:2005 to carry out tests in the following fields:

Wired communications and DECT
Acoustic
Radio
Short Range Devices (SRD)
RFID
WiMax and Richtfunk
Mobile radio (GSM / DCS), Over the Air (OTA) Performance
Electromagnetic Compatibility (EMC) incl. Automotive
Product safety
SAR and Hearing Aid Compatibility (HAC)
Environmental simulation
Smart Card Terminals
Bluetooth
Wi-Fi-Services

The accreditation certificate shall only apply in connection with the notice of accreditation of 13.04.2011 with the accreditation number D-PL-12076-01 and is valid until 03.09.2014. It comprises the cover sheet, the reverse side of the cover sheet and the following annex with a total of 82 pages.

Registration number of the certificate: D-PL-12076-01-01

Frankfurt am Main, 13.04.2011

Dipl.-Ing. (FH) Rüdiger Eger
Head of Division 2

This document is a translation. The definitive version is the original German accreditation certificate.
See notes overleaf.

Front side of certificate

Deutsche Akkreditierungsstelle GmbH

Office Berlin
Spittelmarkt 10
10117 Berlin

Office Frankfurt am Main
Gartenstraße 6
60594 Frankfurt am Main

Office Braunschweig
Bundesallee 100
38116 Braunschweig

The publication of extracts of the accreditation certificate is subject to the prior written approval by Deutsche Akkreditierungsstelle GmbH (DAKKS). Exempted is the unchanged form of separate disseminations of the cover sheet by the conformity assessment body mentioned overleaf.

No impression shall be made that the accreditation also extends to fields beyond the scope of accreditation attested by DAKKS.

The accreditation was granted pursuant to the Act on the Accreditation Body (AkkStelleG) of 31 July 2009 (Federal Law Gazette I p. 2625) and the Regulation (EC) No 765/2008 of the European Parliament and of the Council of 9 July 2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products (Official Journal of the European Union L 218 of 9 July 2008, p. 30). DAKKS is a signatory to the Multilateral Agreements for Mutual Recognition of the European co-operation for Accreditation (EA), International Accreditation Forum (IAF) and International Laboratory Accreditation Cooperation (ILAC). The signatories to these agreements recognise each other's accreditations.

The up-to-date state of membership can be retrieved from the following websites:

EA: www.european-accreditation.org
ILAC: www.ilac.org
IAF: www.iaf.nu

Back side of certificate

Note:

The current certificate including annex is published on our website (see link below) or may be received from CETECOM ICT Services on request.

http://www.cetecom.com/fileadmin/de/CETECOM_D_Saarbruecken/accreditations_Jan_2010/DAKKS_Akkred_Urk_EN17025-En_incl_Annex.pdf