

# TEST REPORT

**Test Report Reference: E40302fcc2 Edition 2**

**Equipment under Test: cB-0702-01**

**Serial number: 0035-04-001653**

**Applicant: Phoenix Contact GmbH & Co. KG**

**Manufacturer: ConnectBlue AB**

**Test Laboratory  
(CAB)  
accredited by  
DATEch e.V.  
in compliance with DIN EN ISO/IEC 17025  
under the  
Reg. No. TTI-P-G071/94-11  
and listed by  
FCC 31040/SIT1300F2**

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## 1 IDENTIFICATION

### 1.1 APPLICANT

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Country:	Germany
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### 1.2 MANUFACTURER

Name:	ConnectBlue AB
Address:	Isbergs Gata 3 SE-211 19 Malmö
Country:	Sweden
Name for contact purposes:	Mr. Rolf NIELSSON
Tel:	+ 46 40 6307102
Fax:	+ 46 40 237137
e-mail address:	rolf.nilsson@connectblue.se

### 1.3 DATES

Date of receipt of test sample:	23 September 2004
Start of test:	04 October 2004
Finish of test:	06 October 2004

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## 1.4 TEST LABORATORY

The tests were carried out at: **PHOENIX TESTLAB GmbH**  
**Königswinkel 10**  
**D-32825 Blomberg** Phone: **+49 (0) 52 35 / 95 00-0**  
**Germany** Fax: **+49 (0) 52 35 / 95 00-10**

Test engineer: Thomas KÜHN  
Name Signature Date  
22 October 2004

Test report checked: Bernd STEINER  
Name Signature Date  
22 October 2004

**PHOENIX TESTLAB GmbH**  
**Königswinkel 10**  
**32825 Blomberg**  
Tel. 0 52 35 / 95 00-0  
Fax 0 52 35 / 95 00-10

Stamp

## 1.5 RESERVATION

This test report is only valid in its original form.

Any reproduction of its contents without written permission of the accredited test laboratory  
PHOENIX TESTLAB GmbH is prohibited.

The test results herein refer only to the tested sample. PHOENIX TESTLAB GmbH is not responsible for any generalisations or conclusions drawn from these test results concerning further samples. Any modification of the tested samples is prohibited and leads to the invalidity of this test report. Each page necessarily contains the PHOENIX TESTLAB Logo and the TEST REPORT REFERENCE.

## 1.6 NORMATIVE REFERENCES

- [1] **ANSI C63.4-2003** American National Standard for Methods of Measuring of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
- [2] **FCC 47 CFR Part 15 (July 2004)** Radio Frequency Devices

## 1.7 TEST RESULTS

The requirements of this test document are fulfilled by the equipment under test. The complete test results are presented in the following.

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## 2 TECHNICAL DATA OF EQUIPMENT

### 2.1 DEVICE UNDER TEST

Type of equipment:	Bluetooth transceiver module
Type designation:	CB-0702-01
Serial No.:	0035-04-001653
Highest operating frequency:	2.483 GHz
FCC ID:	PVH070201

The following external I/O cables were used:

Cable	Length	Shielding	Connector
DC-input	2 m	No	Customised
RF in / out	1 m	Yes	U.FL (EUT) SMA (antenna)
-	-	-	-

### 2.2 PERIPHERY DEVICES

- None.

### 2.3 MODIFICATIONS

- None

### 2.4 NEW ANTENNAS

The cB-0702-01 is intended to operate with the following new antennas:

- RAD-ISM-2400-ANT-OMNI-2-1,
- RAD-ISM-2400-ANT-PAN-8-0.

## 3 ADDITIONAL INFORMATION

The EUT is already certified under FCC-ID PVH070201. Reason for this test report is that new antenna types shall be added to the grant. Pre-tests with both antenna types listed in clause 2.4 have shown that the radiated emissions produced by the EUT in combination with the antenna RAD-ISM-2400-ANT-PAN-8-0 (antenna gain of 8 dBi) represents the worst-case emissions. Therefore all measurements documented in this testreport were carried out with this 8dBi antenna.

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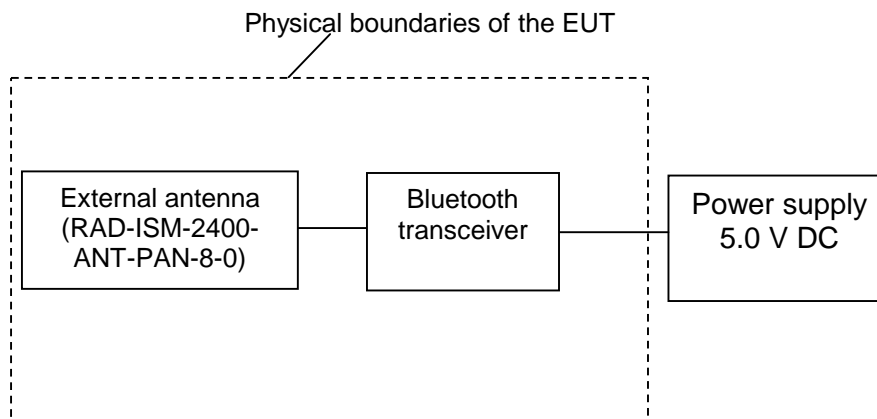
## 4 OPERATIONAL STATES AND PHYSICAL BOUNDARIES

### Radiated emission tests:

The following operation modes were used during the tests:

Operation mode	Description of the operation mode
1	Continuous transmitting on 2402 MHz and continuous receiving on 2402 MHz
2	Continuous transmitting on 2441 MHz and continuous receiving on 2441 MHz
3	Continuous transmitting on 2480 MHz and continuous receiving on 2480 MHz
4	Continuous transmitting on 2441 MHz and continuous receiving on 2480 MHz
5	Continuous receiving on 2441 MHz

The physical boundaries of the Equipment Under Test are shown below.



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## 5 TESTOVERVIEW

### 5.1 EMISSION

Conducted emissions FCC 47 CFR Part 15 section 15.207 (a)[2]					
Application	Frequency range	Limits [dB $\mu$ V]	Reference standard	Remark	Status
On DC supply line	0.15 to 0.5 MHz	66 to 56 (QP) *	ANSI C63.4 (2003)		Passed
	0.5 to 5 MHz	56 to 46 (AV) *			
		56 (QP)			
	5 to 30 MHz	46 (AV)			
		60 (QP)			
		50 (AV)			
*: Decreases with the logarithm of the frequency					
Radiated emissions FCC 47 CFR Part 15 section 15.247 (c)[2]					
Radiated emissions	30 – 25,000 MHz	In any 100 kHz bandwidth outside the frequency band at least 20 dBc. In restricted bands see 15.209 (a)[2].	ANSI C63.4 (2003);	15.205 (a) 15.209 (a)	Passed
Radiated emissions FCC 47 CFR Part 15 section 15.209 (a)[2]					
Application	Frequency range	Limits in 3 m distance	Reference standard	Remark	Status
Radiated emissions	30 – 88 MHz	40 dB $\mu$ V/m	ANSI C63.4 (2003);	15.209 (a)	Passed
	88 – 216 MHz	43.5 dB $\mu$ V/m			
	216 – 960 MHz	46 dB $\mu$ V/m			
	above 960 MHz	54 dB $\mu$ V/m			

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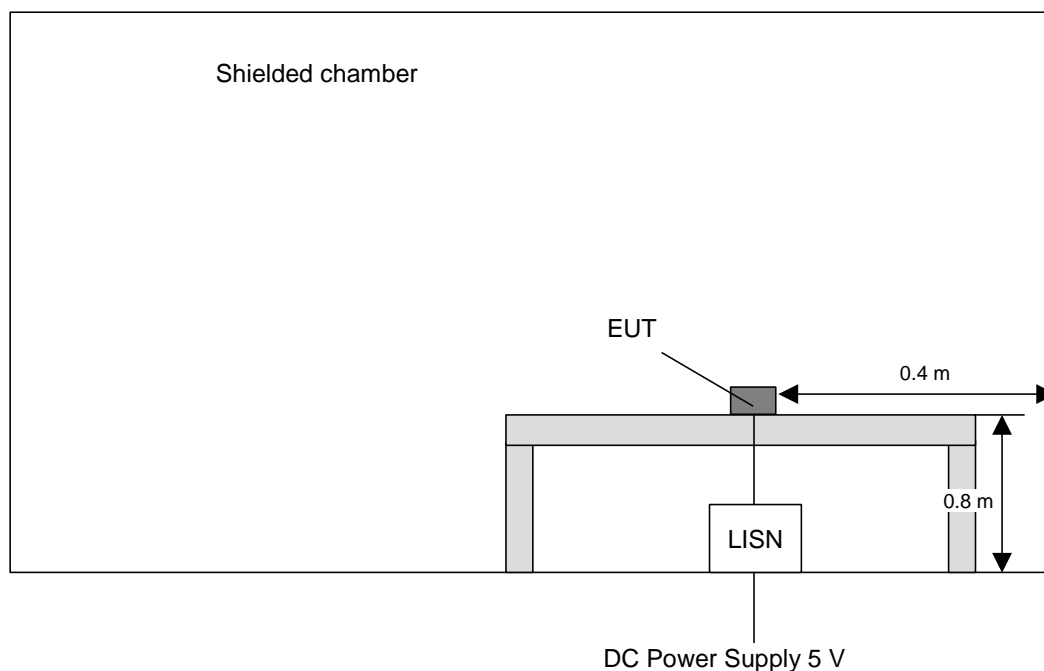
## 6 METHOD OF MEASUREMENT

### 6.1 CONDUCTED EMISSIONS ON DC POWER SUPPL LINES (150 kHz to 30 MHz)

This test will be carried out in a shielded chamber. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm above the ground plane. Floor-standing devices will be placed directly on the ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4-2003 [1].

The frequency range 150 kHz to 30 MHz will be measured with an EMI Receiver set to MAX Hold mode with peak and average detector and a resolution bandwidth of 9 kHz. A scan will be carried out on the phase (or plus pole in case of DC powered devices) of the AC mains network. If levels detected 10 dB below the appropriable limit, this emission will be measured with the average and quasi-peak detector on all lines.

Frequency range	Resolution bandwidth
150 kHz to 30 MHz	9 kHz





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## 6.2 METHOD OF MEASUREMENT (RADIATED EMISSIONS)

The radiated emission measurement is subdivided into two stages.

- A preliminary measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 9 kHz to 1 GHz.
- A final measurement carried out on an outdoor test site without reflecting ground plane and fixed antenna height in the frequency range 9 kHz to 30 MHz
- A final measurement carried out on an open area test site with reflecting ground plane and various antenna height in the frequency range 30 MHz to 1 GHz.
- A final measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 1 GHz to 25 GHz.

All measurements will be carried out with the EUT working on the middle and upper and lower edge of the assigned frequency band. For this reason the hopping function of the EUT has to be disabled.

### 6.2.1 RADIATED EMISSIONS 9 kHz to 30 MHz

The radiated emission measurement is divided into two stages.

#### Preliminary measurement:

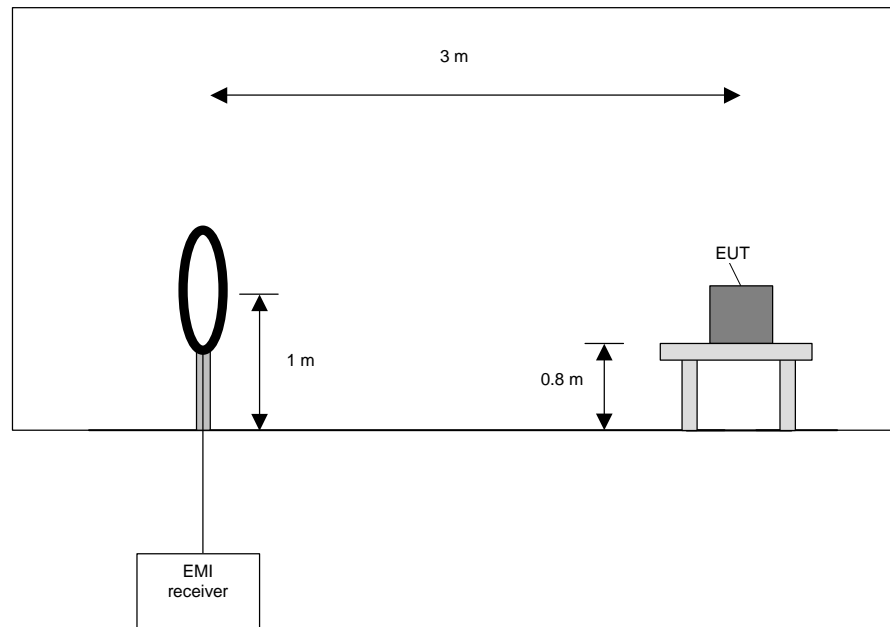
In the first stage a preliminary measurement will be performed in a shielded room with a measuring distance of 3 meters. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices will be placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4-2003 [1].

The frequency range 9 kHz to 30 MHz will be monitored with a spectrum analyser while the system and its cables will be manipulated to find out the configuration with the maximum emission levels if applicable. The EMI Receiver will be set to MAX Hold mode. The EUT and the measuring antenna will be rotated around their vertical axis to found the maximum emissions.

The resolution bandwidth of the spectrum analyser will be set to the following values:

Frequency range	Resolution bandwidth
9 kHz to 150 kHz	200 Hz
150 kHz to 30 MHz	10 kHz

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**Preliminary measurement procedure:**

Prescans were performed in the frequency range 9 kHz to 150 kHz and 150 kHz to 30 MHz.

The following procedure will be used:

- 1) Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
- 2) Manipulate the system cables within the range to produce the maximum level of emission.
- 3) Rotate the EUT by 360 ° to maximize the detected signals.
- 4) Make a hardcopy of the spectrum.
- 5) Measure the frequencies of highest detected emission with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
- 6) Repeat steps 1) to 4) with the other orthogonal axes of the EUT.
- 7) Rotate the measuring antenna and repeat steps 1) to 5).

**Final measurement:**

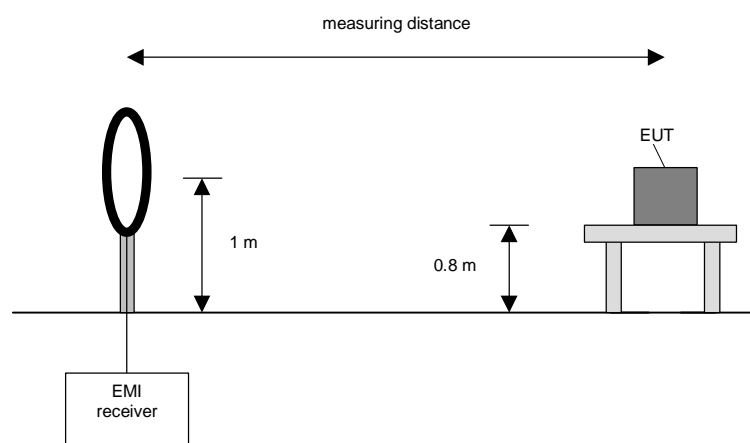
In the second stage a final measurement will be performed on an open area test site with no conducting ground plane in a measuring distances of 3 m, 10 m and 30 m. In the case where larger measuring distances are required the results will be extrapolated based on the values measured on the closer distances according to Section 15.31 (f) (2) [2]. The final measurement will be performed with a EMI Receiver set to Quasi Peak detector except for the frequency bands 9 kHz to 90 kHz and 110 kHz to 490 kHz where an average detector will be used according Section 15.209 (d) [2].

On the during the preliminary measurement detected frequencies the final measurement will be performed while rotating the EUT and the measuring antenna in the range of 0 ° to 360 ° around their vertical axis until the maximum value is found.

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The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
9 kHz to 150 kHz	200 Hz
150 kHz to 30 MHz	9 kHz



#### Final measurement procedure:

The following procedure will be used:

- 1) Monitor the frequency range with the measuring antenna at vertical orientation parallel to the EUT at an azimuth of 0 °.
- 2) Rotate the EUT by 360 ° to maximize the detected signals and note the azimuth and orientation.
- 3) Rotate the measuring antenna to find the maximum and note the value.
- 4) Rotate the measuring antenna and repeat steps 1) to 3) until the maximum value is found.
- 5) Repeat steps 1) to 4) with the other orthogonal axes of the EUT if applicable (handheld equipment).

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## 6.2.2 RADIATED EMISSIONS 30 MHz to 1 GHZ

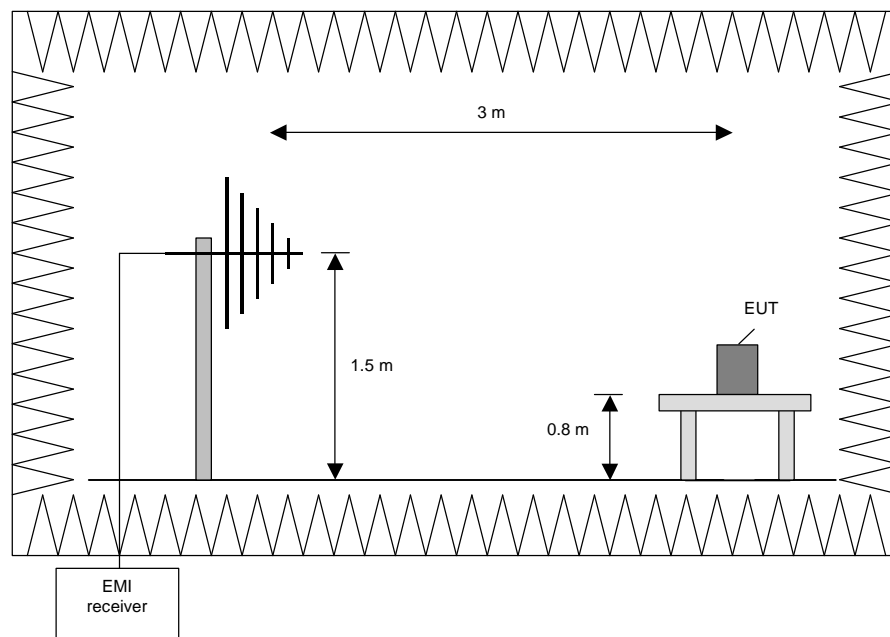
### Preliminary measurement

In the first stage a preliminary measurement will be performed in a fully anechoic chamber with a measuring distance of 3 meter. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices will be placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4-2003 [1].

The frequency range 30 MHz to 1 GHz will be measured with an EMI Receiver set to MAX Hold mode and a resolution bandwidth of 100 kHz. The measurement will be performed in horizontal and vertical polarisation of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 ° to 360 °.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
30 MHz to 230 MHz	100 kHz
230 MHz to 1 GHz	100 kHz



### Procedure preliminary measurement:

Prescans were performed in the frequency range 30 MHz to 230 MHz and 230 MHz to 1 GHz. The following procedure will be used:

1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Manipulate the system cables within the range to produce the maximum level of emission.
3. Rotate the EUT by 360 ° to maximize the detected signals.
4. Make a hardcopy of the spectrum.
5. Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
6. Repeat 1) to 4) with the other orthogonal axes of the EUT if handheld equipment.
7. Repeat 1) to 5) with the vertical polarisation of the measuring antenna.

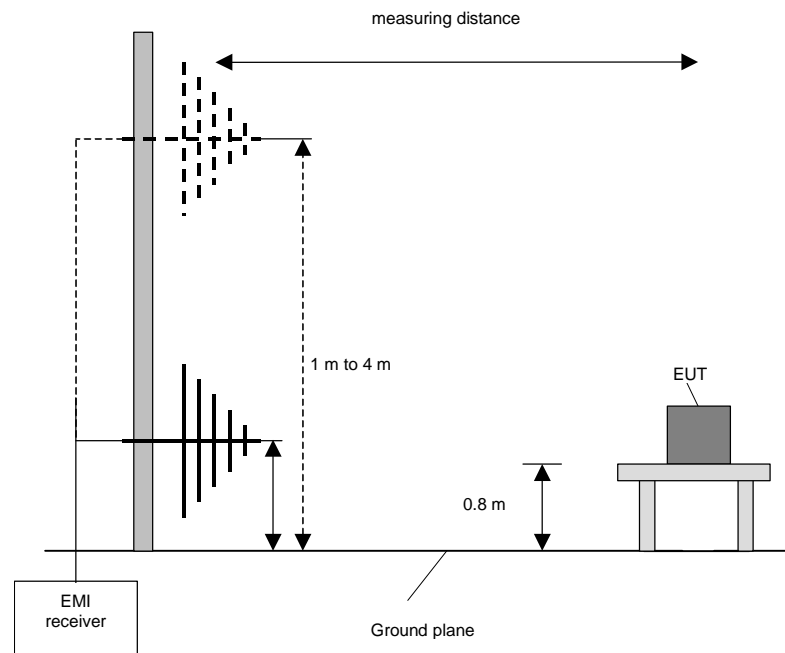
TEST REPORT REFERENCE: E40302fcc2 Edition 2

### **Final measurement (30 MHz to 1 GHz)**

A final measurement on an open area test site will be performed on selected frequencies found in the preliminary measurement. During this test the EUT will be rotated in the range of  $0^\circ$  to  $360^\circ$ , the measuring antenna will be set to horizontal and vertical polarisation and raised and lowered in the range from 1 m to 4 m to find the maximum level of emissions.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
30 MHz to 1 GHz	120 kHz



### **Procedure final measurement:**

The following procedure will be used:

- 1) Measure on the selected frequencies at an antenna height of 1 m and a EUT azimuth of  $23^\circ$ .
- 2) Move the antenna from 1 m to 4 m and note the maximum value at each frequency.
- 3) Rotate the EUT by  $45^\circ$  and repeat 2) until an azimuth of  $337^\circ$  is reached.
- 4) Repeat 1) to 3) for the other orthogonal antenna polarization.
- 5) Move the antenna and the turntable to the position where the maximum value is detected.
- 6) Measure while moving the antenna slowly  $\pm 1$  m.
- 7) Set the antenna to the position where the maximum value is found.
- 8) Measure while moving the turntable  $\pm 45^\circ$ .
- 9) Set the turntable to the azimuth where the maximum value is found.
- 10) Measure with Final detector (QP and AV) and note the value.
- 11) Repeat 5) to 10) for each frequency.
- 12) Repeat 1) to 11) for each orthogonal axes of the EUT if handheld equipment.

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### **6.2.3 RADIATED EMISSIONS 1 GHz to 25 GHz**

This measurement will be performed in a fully anechoic chamber with a measuring distance of 3 meter. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices will be placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4-2003 [1].

#### **Preliminary measurement (1 GHz to 25 GHz)**

The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The EMI Receiver set to MAX Hold mode and a resolution bandwidth of 100 kHz. The measurement will be performed in horizontal and vertical polarisation of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 ° to 360 °. If the EUT is larger than the antenna beamwidth, the antenna will be moved to various positions, to cover the whole surface of the EUT. It might be possible to shorter the measuring distance to higher the measurement sensitivity.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
1 GHz to 4 GHz	100 kHz
4 GHz to 12 GHz	100 kHz
12 GHz to 18 GHz	100 kHz
18 GHz to 25 GHz	100 kHz

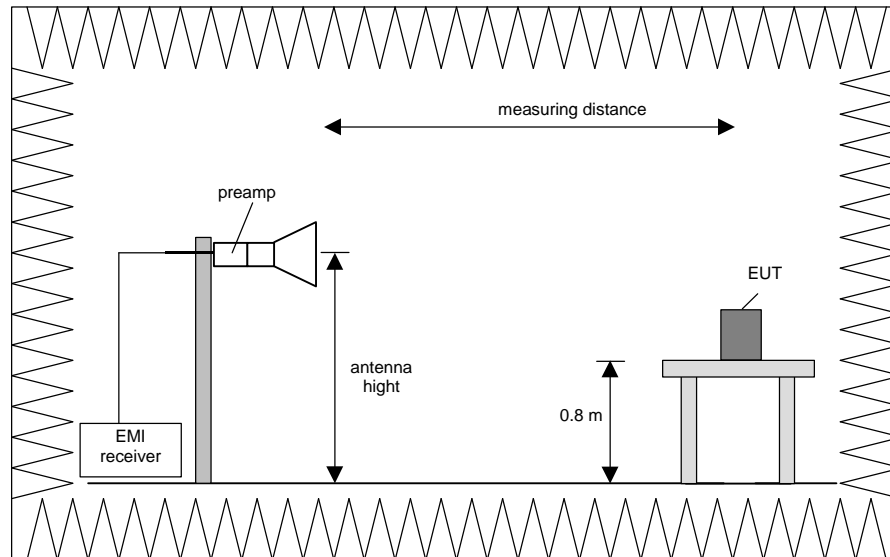
#### **Final measurement (1 GHz to 25 GHz)**

The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The EMI Receiver set to MAX Hold mode and a resolution bandwidth of 1 MHz. The measurement will be performed in horizontal and vertical polarisation of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 ° to 360 °. If the EUT is larger than the antenna beamwidth, the antenna will be moved to various positions, to cover the whole surface of the EUT. It might be possible to shorter the measuring distance to higher the measurement sensitivity.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
1 GHz to 4 GHz	1 MHz
4 GHz to 12 GHz	1 MHz
12 GHz to 18 GHz	1 MHz
18 GHz to 25 GHz	1 MHz

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#### Procedure of measurement:

The measurements were performed in the frequency range 1 GHz to 4 GHz, 4 GHz to 12 GHz, 12 GHz to 18 GHz and 18 GHz to 25 GHz.

The following procedure will be used:

- 1) Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
- 2) Rotate the EUT by 360 ° to maximize the detected signals.
- 3) Change the antenna polarisation.
- 4) Rotate the EUT by 360 ° to maximize the detected signals.
- 5) Make a hardcopy of the spectrum.
- 6) Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
- 7) Measure the level of the detected frequency with the correct resolution bandwidth, with the antenna polarisation and azimuth and the peak and average detector, which causes the maximum emission.
- 8) Repeat steps 1) to 7) with the other orthogonal axes of the EUT if handheld equipment.
- 9) Repeat steps 1) to 8) for the next antenna spot if the EUT is larger than the antenna beamwidth.

Step 1) to 6) are defined as preliminary measurement.

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## 7 TEST RESULTS

### 7.1 CONDUCTED EMISSION MEASUREMENT ON DC POWER SUPPLY LINES

Ambient temperature	20 °C	Relative humidity	35 %
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Position of EUT: The EUT was set-up on a wooden table of a height of 0.8 m.

Cable guide: All cables of the EUT were fixed on the wooden table. For further information of the cable guide refer to the pictures in annex C of this test report.

Test record: The test was carried out in EUT operation mode as described in clause 4 of this test report. All results are shown in the following.

Power supply: During this test the EUT was powered by a DC power supply 24V.

Title: DC Powerline Conducted Emission Test with protective ground conductor simulating network

EUT: cB-0702-01

Manufacturer: connectBlue AB

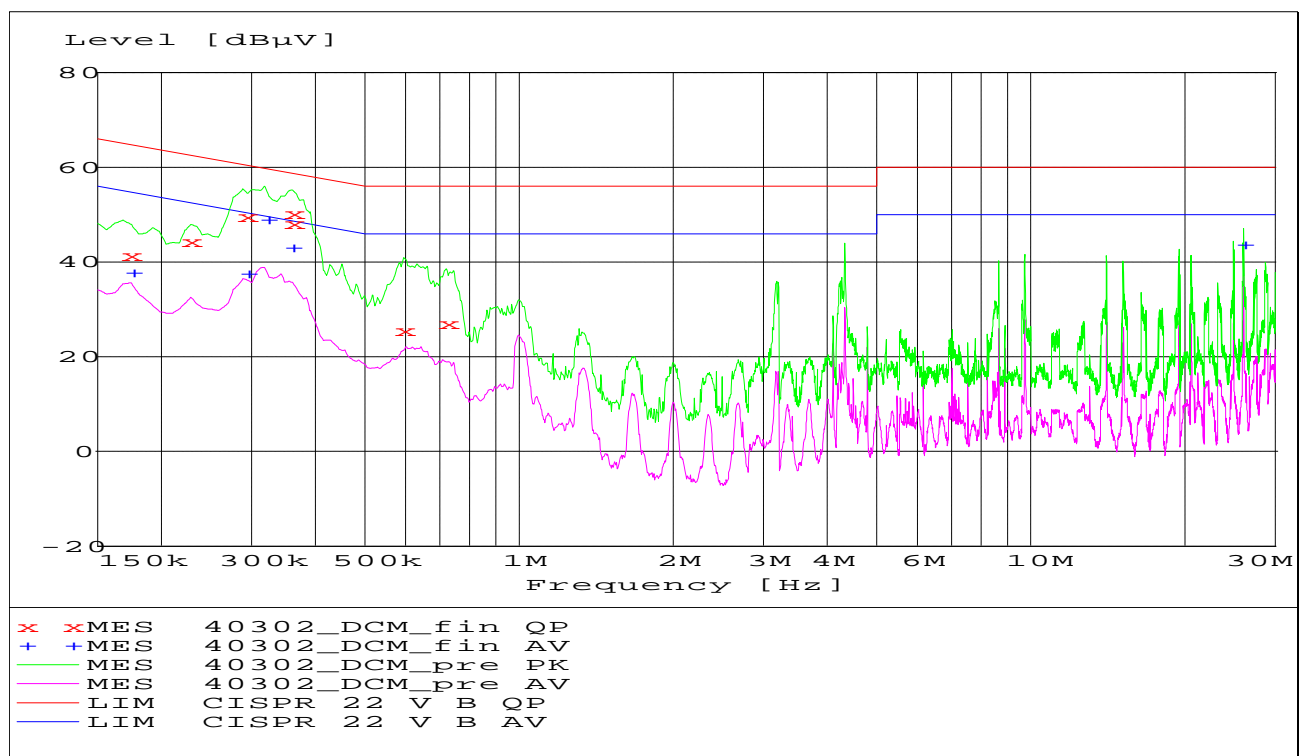
Operating Condition: Transmit and receive on channel 39

Test site: PHOENIX TEST-LAB Blomberg M4

Operator: Th. KÜHN

Test Specification:

Comment:



Data record name: 40302\_DCM



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**Result measured with the quasi-peak detector:**

(These values are marked in the above diagram by x)

Frequency MHz	Level dB $\mu$ V	Transducer dB	Limit dB $\mu$ V	Margin dB	Line	PE
0.173400	41.30	1.3	64.8	23.5	Minus	GND
0.227400	44.40	1.1	62.5	18.2	Minus	GND
0.292200	49.60	0.8	60.5	10.8	Minus	FLO
0.359700	48.10	0.9	58.7	10.7	Minus	FLO
0.360600	50.20	0.9	58.7	8.5	Minus	FLO
0.592800	25.50	0.8	56.0	30.5	Minus	FLO
0.722400	26.90	0.8	56.0	29.1	Plus	GND

Data record name: 40302\_DCM\_fin QP

**Result measured with the average detector:**

(These values are marked in the above diagram by +)

Frequency MHz	Level dB $\mu$ V	Transducer DB	Limit dB $\mu$ V	Margin dB	Line	PE
0.175200	37.80	1.2	54.7	16.9	Plus	FLO
0.294000	37.50	0.8	50.4	12.9	Plus	FLO
0.321900	49.00	0.8	49.7	0.7	Minus	FLO
0.358800	43.10	0.9	48.8	5.6	Plus	FLO
25.999800	43.80	2.9	50.0	6.2	Plus	FLO

Data record name: 40302\_DCM\_fin AV

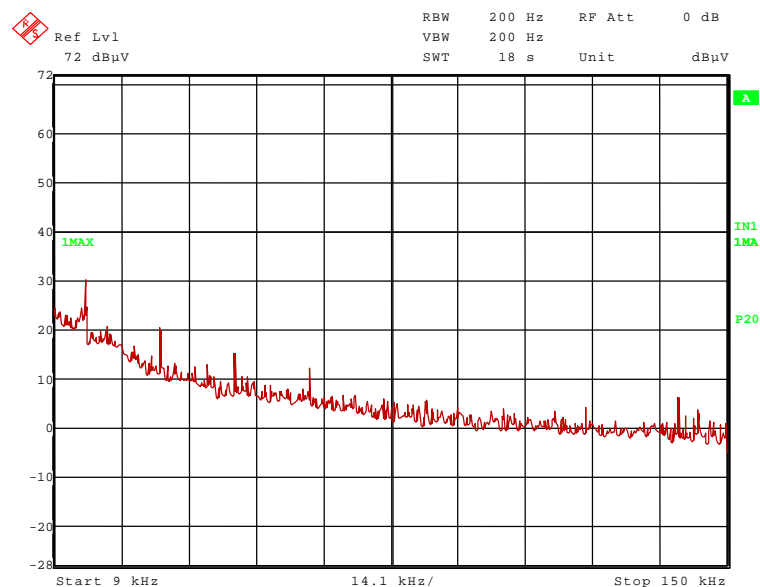
TEST REPORT REFERENCE: E40302fcc2 Edition 2

## 7.2 RADIATED EMISSION TEST (9 kHz to 30 MHz)

Ambient temperature	20 °C	Relative humidity	32 %
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Position of EUT:	The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m (preliminary measurement) and 10 m (final measurement).
Cable guide:	The cables of the EUT were fixed on the non-conducting table. For further information of the cable guide refer to the pictures in annex A of this test report.
Test record:	The test was carried out in the worst case operation mode as detected in advance. This worst case test mode was transmit on channel 39 (2.442 GHz) and receive on channel 79 (2.480 GHz) and defined as operation mode 4 (refer also clause 4 of this test report). All results are shown in the following.
Supply voltage:	During all measurements the EUT was supplied with 5.0 V DC.
Remark:	The emissions found around 16 kHz, 32 kHz, 48 and 62 kHz caused by the measuring system and not from the EUT.

40302tx14: Spurious emissions from 9 kHz to 150 kHz, TX = 2.441 GHz, RX = 2.48 GHz (operation mode 4):

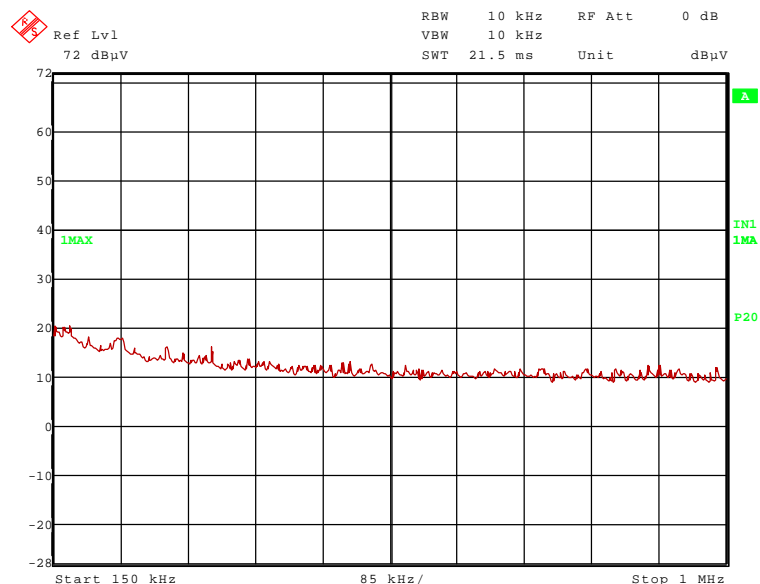


TEST EQUIPMENT USED THE TEST:

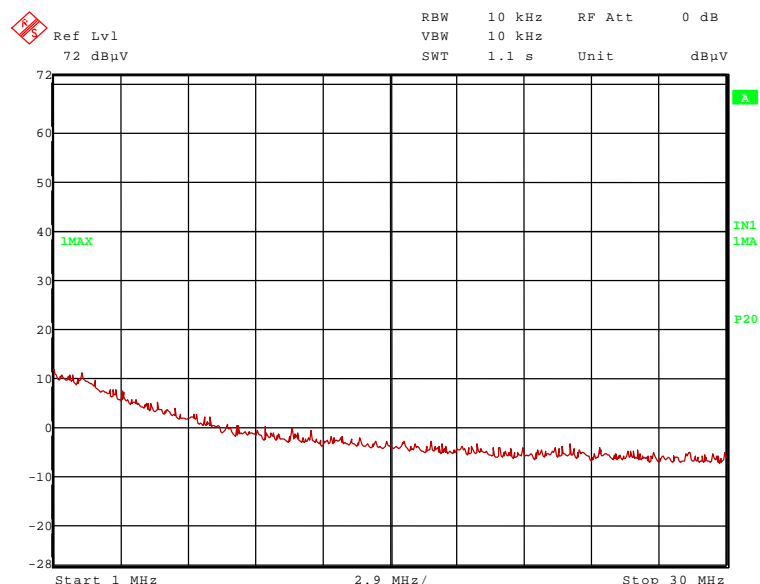
29, 31 – 33, 56, 68
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40302tx15: Spurious emissions from 150 kHz to 1 MHz, TX = 2.441 GHz, RX = 2.48 GHz (operation mode 4):



40302tx16: Spurious emissions from 1 MHz to 30 MHz, TX = 2.441 GHz, RX = 2.48 GHz (operation mode 4):



No significant frequencies above the noise floor of the system were found during the preliminary radiated emission test, so no measurements were carried out on the outdoor test site.

Test: Passed.

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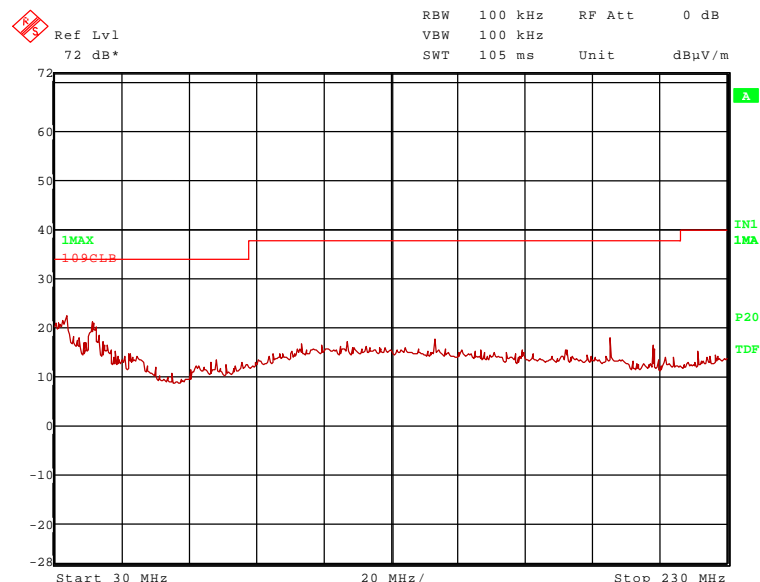
### 7.3 TEST RESULTS (RADIATED EMISSIONS UP TO 1 GHz)

Ambient temperature	20 °C	Relative humidity	32 %
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- Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m (preliminary measurement) and 10 m (final measurement).
- Cable guide: The cables of the EUT were fixed on the non-conducting table. For further information of the cable guide refer to the pictures in annex A of this test report.
- Test record: The test was carried out in the worst case operation mode as detected in advance. This worst case test mode was transmit on channel 39 (2.442 GHz) and receive on channel 79 (2.480 GHz) and defined as operation mode 4 (refer also clause 4 of this test report). All results are shown in the following.
- Supply voltage: During all measurements the EUT was supplied with 5.0 V DC.

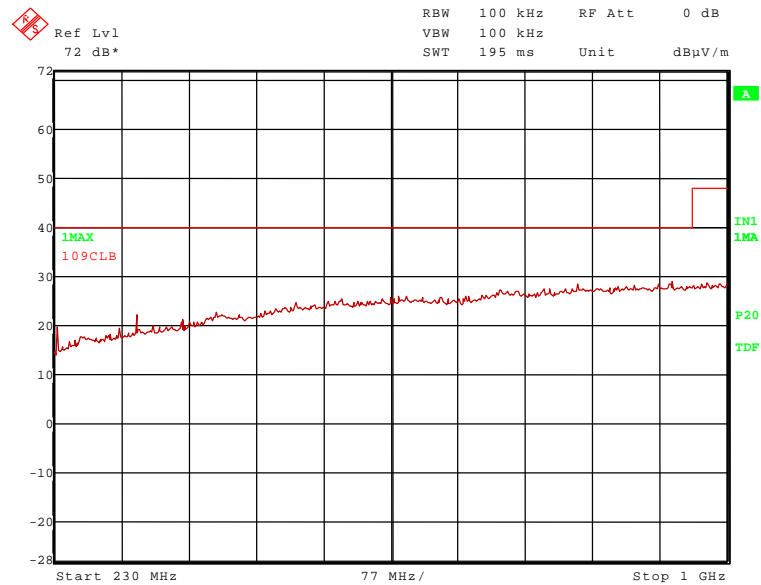
#### Preliminary measurement

40302t12: Spurious emissions from 30 MHz to 230 MHz, TX = 2.441 GHz, RX = 2.48 GHz (operation mode 4):



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40302t13: Spurious emissions from 230 MHz to 1 GHz, TX = 2.441 GHz, RX = 2.48 GHz (operation mode 4):



No significant frequencies above the noise floor of the system were found during the preliminary radiated emission test, so no measurements were carried out on the open area test site.

Test: Passed

TEST EQUIPMENT USED:

29, 31 – 35, 37, 56

TEST REPORT REFERENCE: E40302fcc2 Edition 2

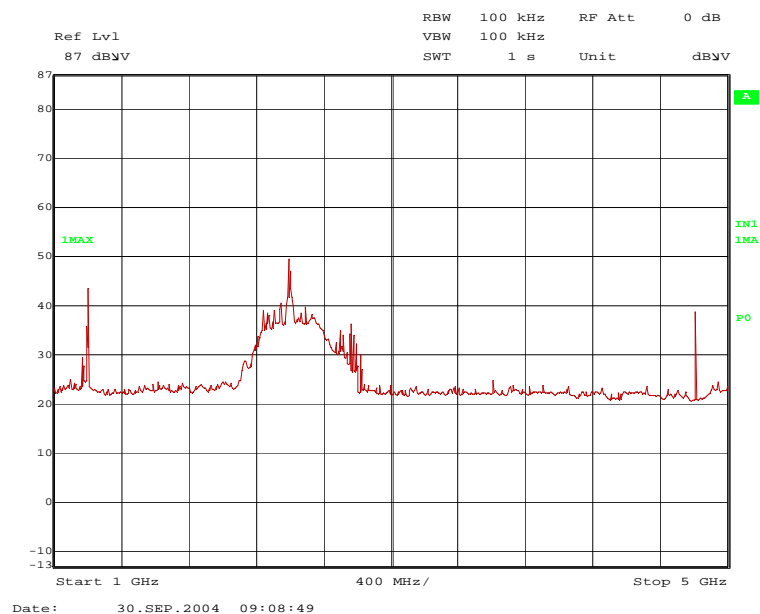
## 7.4 TEST RESULTS (RADIATED TRANSMITTER EMISSIONS ABOVE 1 GHz)

Ambient temperature	21 °C	Relative humidity	59 %
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- Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.
- Cable guide: The cable of the EUT was fixed on the non-conducting table. For further information of the cable guide refer to the pictures in annex A of this test report.
- Test record: All results are shown in the following.
- Supply voltage: During all measurements the EUT was supplied with 5.0 V DC.

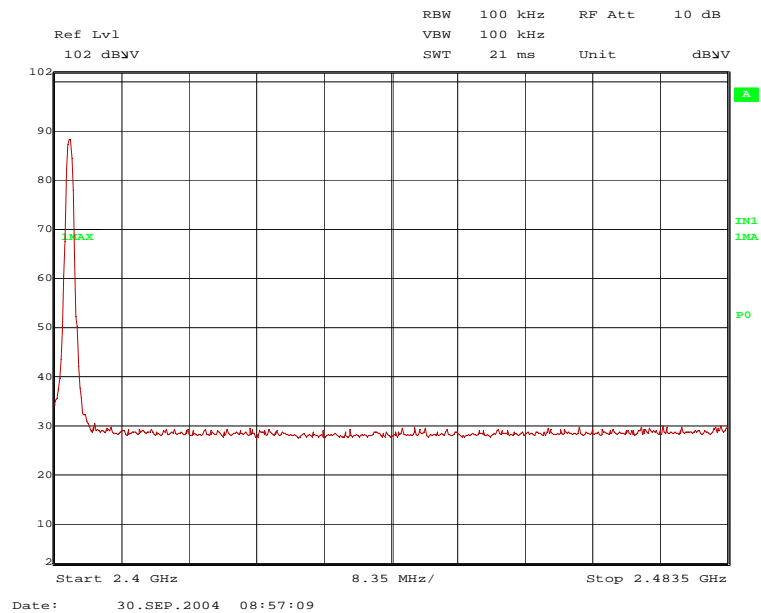
### Transmitter operates at the lower band of the assigned frequency band

40302t7: Spurious emissions from 1 GHz to 5 GHz, TX = 2.402 GHz, RX = 2.402 GHz (operation mode 1):

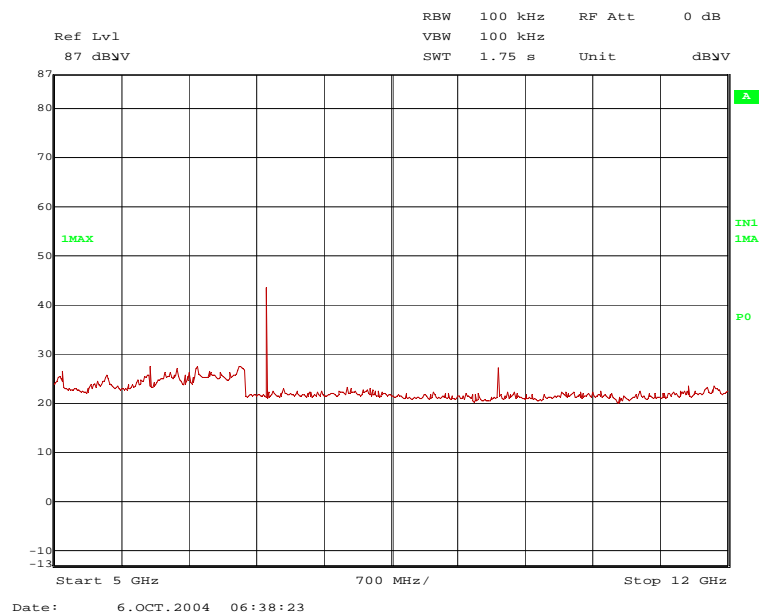


TEST REPORT REFERENCE: E40302fcc2 Edition 2

40302t8: Transmitter spurious emissions from 2.4 GHz to 2.4835 GHz, TX = 2.402 GHz, RX = 2.402 GHz  
(operation mode 1):

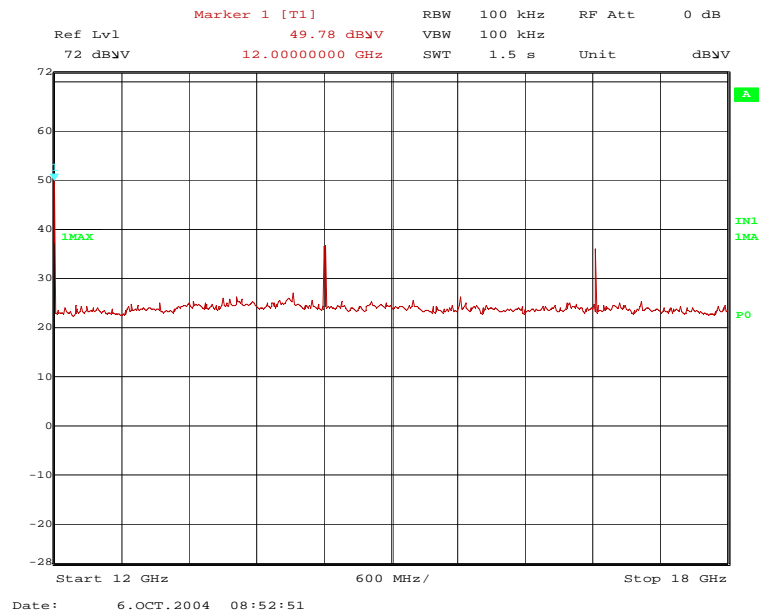


40302t10: Transmitter spurious emissions from 5 GHz to 12 GHz, TX = 2.402 GHz, RX = 2.402 GHz  
(operation mode 1):

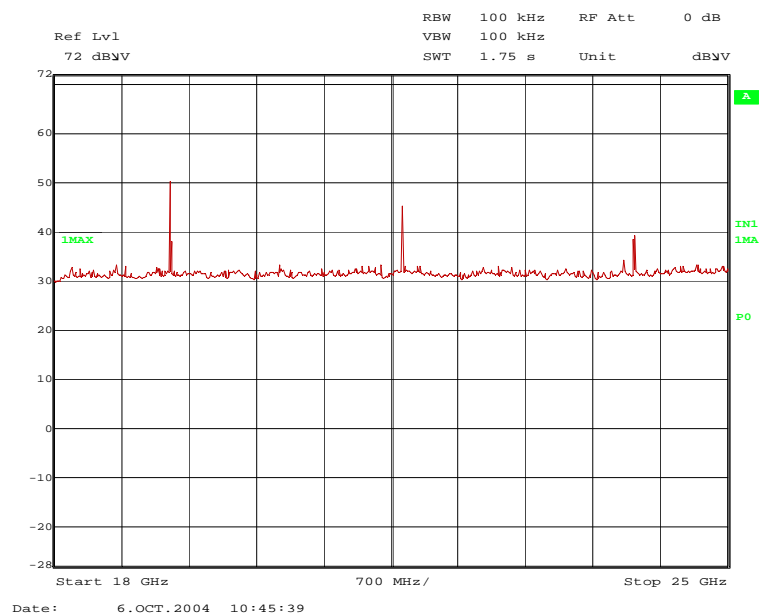


TEST REPORT REFERENCE: E40302fcc2 Edition 2

40302t13: Transmitter spurious emissions from 12 GHz to 18 GHz, TX = 2.402 GHz, RX = 2.402 GHz  
(operation mode 1):



40302t17: Transmitter spurious emissions from 18 GHz to 25 GHz, TX = 2.402 GHz, RX = 2.402 GHz  
(operation mode 1):





TEST REPORT REFERENCE: E40302fcc2 Edition 2

**Results measured with the peak detector:**

Transmitter operates at the lower edge of the assigned frequency band										
Frequency GHz	Corr. value dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
1.2010	46.6	74.0	27.4	45.1	24.9	26.0	2.6	150	Vert.	Yes
2.4020	120.6	-	-	88.7	28.5	-	3.4	150	Vert.	-
2.7663	52.3	74.0	21.7	43.6	31.0	26.0	3.7	150	Vert.	Yes
2.7793	51.5	74.0	22.5	42.8	31.0	26.0	3.7	150	Vert.	Yes
4.8040	61.7	74.0	12.3	41.4	33.5	26.0	12.8	150	Vert.	Yes
7.2058	65.9	100.6	34.7	47.7	37.0	24.7	5.9	150	Vert.	No
9.6097	62.2	100.6	38.4	41.0	38.4	23.9	6.7	150	Vert.	No
12.0094	62.1	74.0	11.9	53.4	33.6	25.9	1.0	80	Vert.	Yes
14.4113	49.2	100.6	51.4	41.1	33.7	26.6	1.0	80	Vert.	No
16.8131	49.0	100.6	51.6	41.7	33.8	27.5	1.0	80	Vert.	No
19.2161	51.8	74.0	22.2	51.8	37.1	38.2	1.1	80	Vert.	Yes
21.6175	51.5	100.6	49.1	51.5	37.2	38.3	1.1	80	Hor.	No
24.0201	45.1	100.6	55.5	45.6	37.2	38.8	1.1	80	Vert.	No

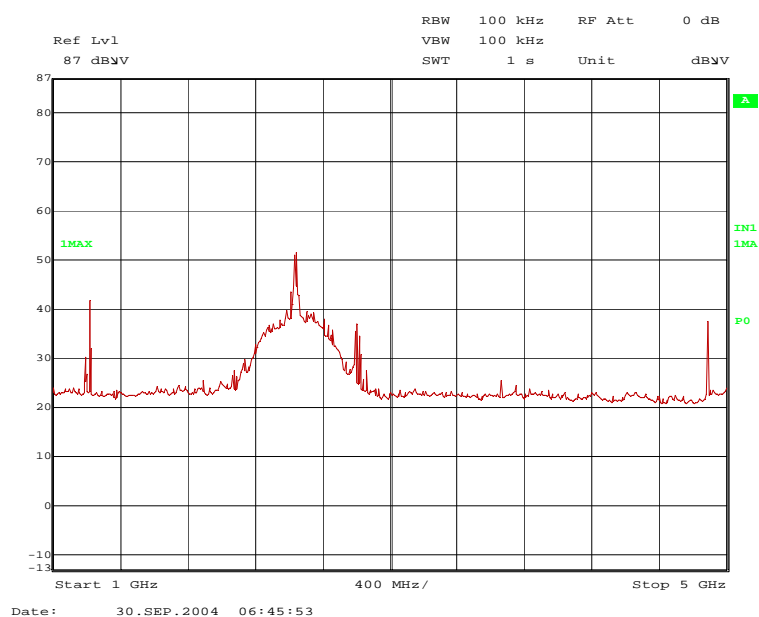
**Results measured with the average detector:**

Transmitter operates at the lower edge of the assigned frequency band										
Frequency GHz	Corr. value dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
1.2010	39.3	54.0	14.7	37.8	24.9	26.0	2.6	150	Vert.	Yes
2.4020	111.0	-	-	79.1	28.5	-	3.4	150	Vert.	-
2.7663	31.3	54.0	22.7	22.6	31.0	26.0	3.7	150	Vert.	Yes
2.7793	30.0	54.0	14.0	21.3	31.0	26.0	3.7	150	Vert.	Yes
4.8040	50.3	54.0	3.7	30.0	33.5	26.0	12.8	150	Vert.	Yes
7.2058	51.4	91.0	39.6	33.2	37.0	24.7	5.9	150	Vert.	No
9.6097	38.4	91.0	52.6	17.2	38.4	23.9	6.7	150	Vert.	No
12.0094	47.0	54.0	7.0	38.3	33.6	25.9	1.0	80	Vert.	Yes
14.4113	34.5	91.0	56.5	26.4	33.7	26.6	1.0	80	Vert.	No
16.8131	33.9	91.0	57.1	26.6	33.8	27.5	1.0	80	Vert.	No
19.2161	31.2	54.0	22.8	31.2	37.1	38.2	1.1	80	Vert.	Yes
21.6175	33.8	91.0	57.2	33.8	37.2	38.3	1.1	80	Hor.	No
24.0201	29.1	91.0	61.9	29.6	37.2	38.8	1.1	80	Vert.	No

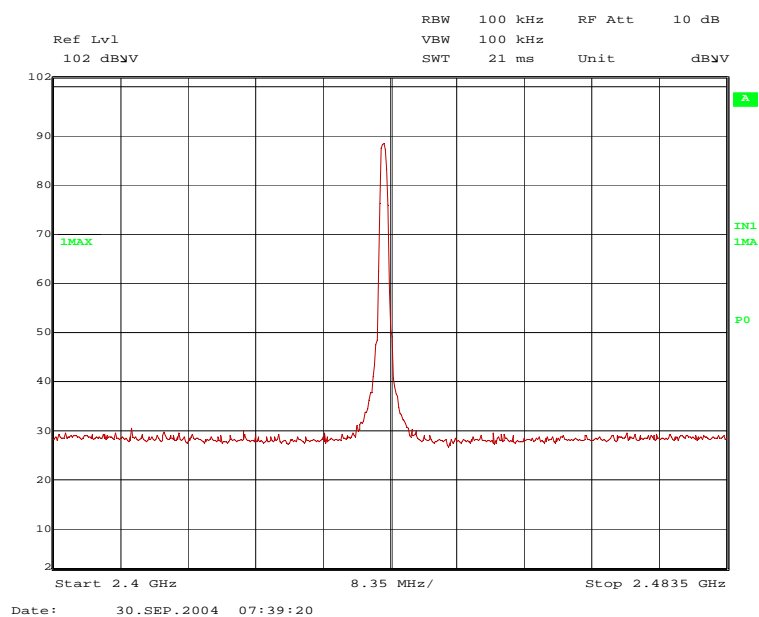
TEST REPORT REFERENCE: E40302fcc2 Edition 2

## Transmitter operates at the middle of the assigned frequency band

40302t3: Spurious emissions from 1 GHz to 5 GHz, TX = 2.441 GHz, RX = 2.441 GHz (operation mode 2):

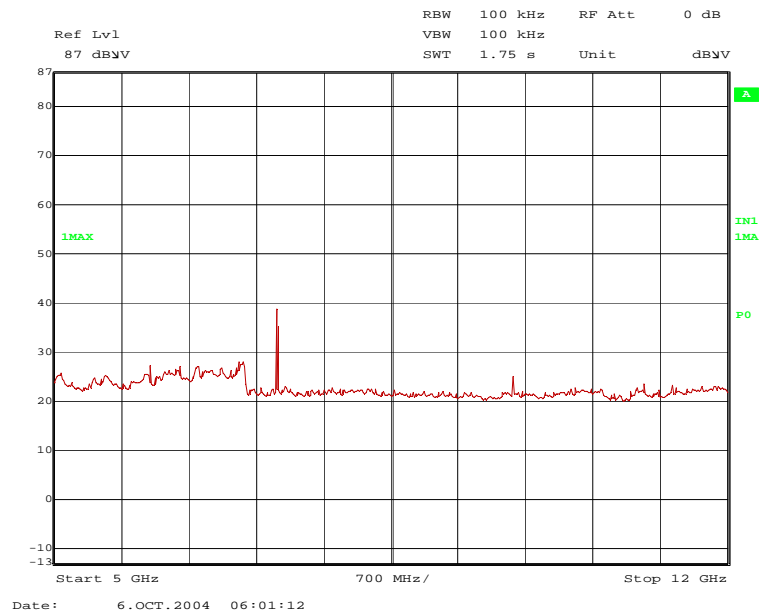


40302t4: Transmitter spurious emissions from 2.4 GHz to 2.4835 GHz, TX = 2.441 GHz, RX = 2.441 GHz (operation mode 2):

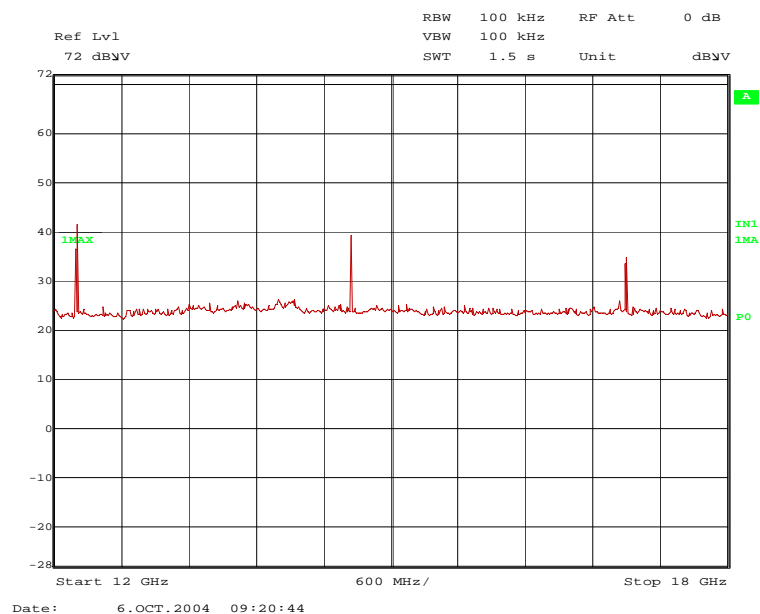


TEST REPORT REFERENCE: E40302fcc2 Edition 2

40302t9: Transmitter spurious emissions from 5 GHz to 12 GHz, TX = 2.441 GHz, RX = 2.441 GHz  
(operation mode 2):

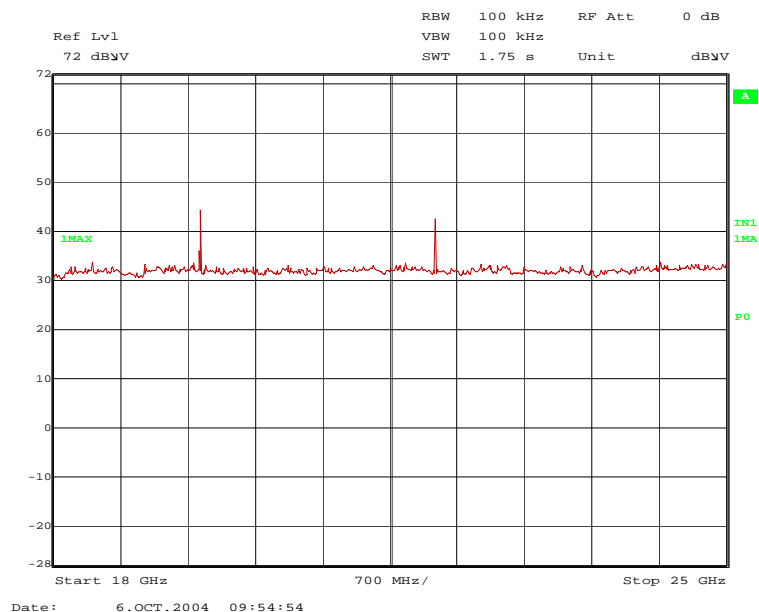


40302t14: Transmitter spurious emissions from 12 GHz to 18 GHz, TX = 2.441 GHz, RX = 2.441 GHz  
(operation mode 2):



TEST REPORT REFERENCE: E40302fcc2 Edition 2

40302t15: Transmitter spurious emissions from 18 GHz to 25 GHz, TX = 2.441 GHz, RX = 2.441 GHz  
(operation mode 2):



Results measured with the peak detector:

Transmitter operates at the middle of the assigned frequency band										
Frequency GHz	Corr. value dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
1.1989	45.2	74.0	28.8	43.7	24.9	26.0	2.6	150	Vert.	Yes
1.2204	45.1	74.0	28.9	43.6	24.9	26.0	2.6	150	Vert.	Yes
2.441	120.6	-	-	88.7	28.5	-	3.4	150	Vert.	-
2.8054	52.9	74.0	21.1	44.2	31.0	26.0	3.7	150	Vert.	Yes
2.8184	51.1	74.0	22.9	42.4	31.0	26.0	3.7	150	Vert.	Yes
4.882	62.1	74.0	11.9	41.8	33.5	26.0	12.8	150	Hor.	Yes
7.323	70.0	74.0	4.0	51.3	37.8	25.0	5.9	150	Vert.	Yes
9.764	61.1	100.6	39.5	40.0	38.4	24.0	6.7	150	Vert.	No
12.205	56.2	74.0	17.8	45.6	33.6	24.0	1.0	80	Vert.	Yes
14.646	52.2	100.6	47.8	44.1	33.7	26.6	1.0	80	Hor.	No
17.087	57.1	100.6	43.5	49.8	33.8	27.5	1.0	80	Hor.	No
19.528	55.7	74.0	18.3	55.7	37.1	38.2	1.1	80	Vert.	Yes
21.969	48.7	100.6	51.9	48.7	37.2	38.3	1.1	80	Vert.	No

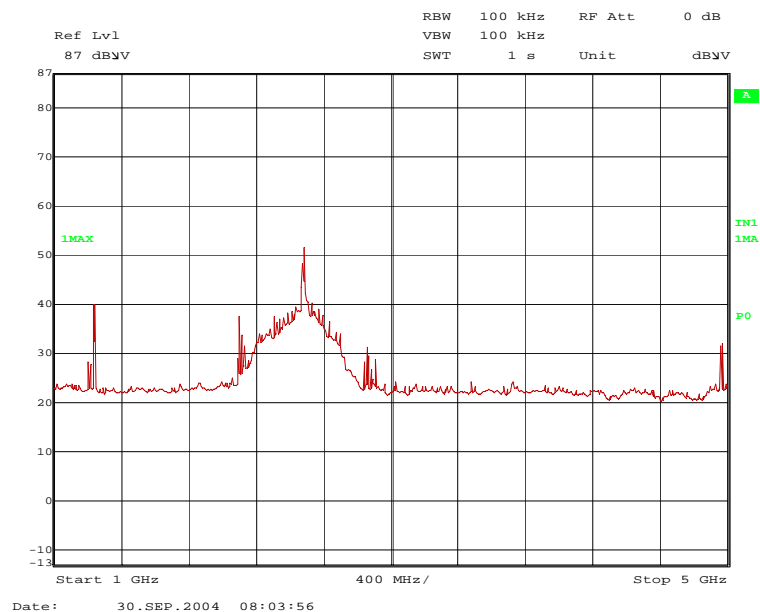
TEST REPORT REFERENCE: E40302fcc2 Edition 2

**Results measured with the average detector:**

Frequency GHz	Corr. value dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
1.1989	19.4	54.0	34.6	17.9	24.9	26.0	2.6	150	Vert.	Yes
1.2204	37.7	54.0	16.3	36.2	24.9	26.0	2.6	150	Vert.	Yes
2.441	110.9	-	-	79.0	28.5	-	3.4	150	Vert.	-
2.8054	28.1	54.0	25.9	19.4	31.0	26.0	3.7	150	Vert.	Yes
2.8184	27.8	54.0	26.2	19.1	31.0	26.0	3.7	150	Vert.	Yes
4.882	50.7	54.0	3.3	30.4	33.5	26.0	12.8	150	Hor.	Yes
7.323	41.2	54.0	12.8	22.5	37.8	25.0	5.9	150	Vert.	Yes
9.764	38.9	90.9	52	17.8	38.4	24.0	6.7	150	Vert.	No
12.205	38.3	54.0	15.7	29.5	33.6	25.8	1.0	80	Vert.	Yes
14.646	35.4	90.9	55.5	27.3	33.7	26.6	1.0	80	Hor.	No
17.087	28.3	90.9	62.6	21.0	33.8	27.5	1.0	80	Hor.	No
19.528	28.6	54.0	25.4	28.6	37.1	38.2	1.1	80	Vert.	Yes
21.969	29.9	90.9	61.0	29.9	37.2	38.3	1.1	80	Vert.	No

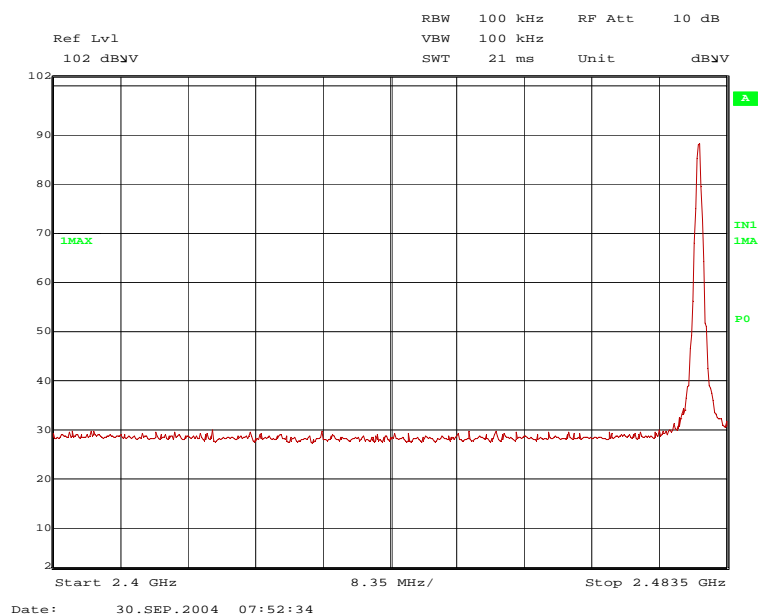
Transmitter operates at the upper band of the assigned frequency band

40302t5: Spurious emissions from 1 GHz to 5 GHz, TX = 2.480 GHz, RX = 2.480 GHz (operation mode 3):

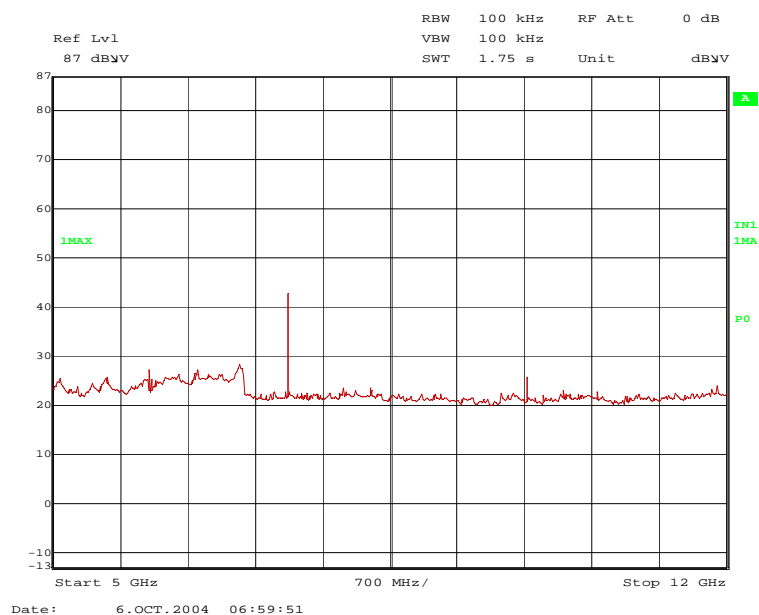


TEST REPORT REFERENCE: E40302fcc2 Edition 2

40302t6: Transmitter spurious emissions from 2.4 GHz to 2.4835 GHz, TX = 2.480 GHz, RX = 2.480 GHz (operation mode 3):

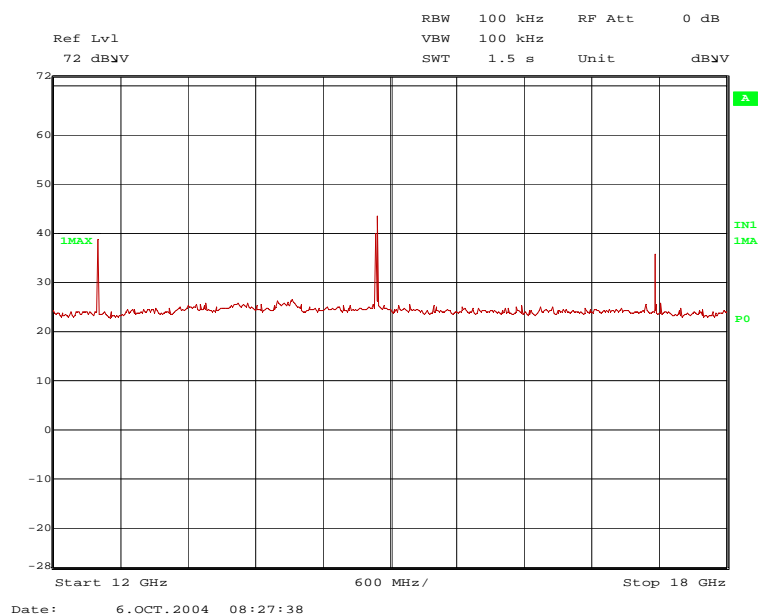


40302t11: Transmitter spurious emissions from 5 GHz to 12 GHz, TX = 2.480 GHz, RX = 2.480 GHz (operation mode 3):

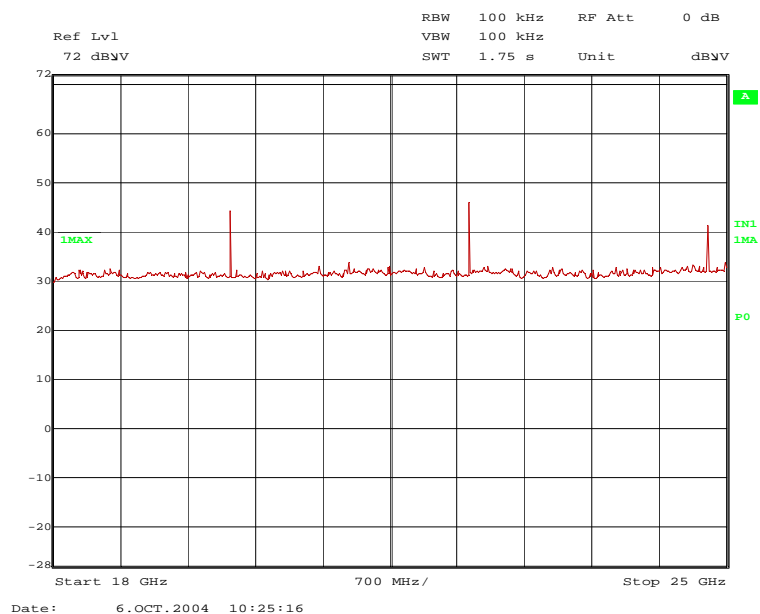


TEST REPORT REFERENCE: E40302fcc2 Edition 2

40302t12: Transmitter spurious emissions from 12 GHz to 18 GHz, TX = 2.480 GHz, RX = 2.480 GHz  
(operation mode 1):



40302t16: Transmitter spurious emissions from 18 GHz to 25 GHz, TX = 2.480 GHz, RX = 2.480 GHz  
(operation mode 3):



TEST REPORT REFERENCE: E40302fcc2 Edition 2

**Result measured with the peak detector:**

Transmitter operates at the upper edge of the assigned frequency band										
Frequency GHz	Corr. value dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
1.2400	44.2	74.0	29.8	42.7	24.9	26.0	2.6	150	Vert.	Yes
2.1030	51.7	100.3	48.6	46.4	28.4	26.4	3.3	150	Vert.	No
2.1160	52.0	100.3	48.3	46.7	28.4	26.4	3.3	150	Vert.	No
2.4800	120.3	-	-	88.4	28.5	-	3.4	150	Vert.	-
2.8569	50.7	74.0	23.3	42.0	31.0	26.0	3.7	150	Vert.	Yes
4.9600	60.9	74.0	13.1	40.4	33.5	25.8	12.8	150	Vert.	Yes
7.4398	58.4	74.0	15.6	51.5	37.8	25.0	5.9	150	Vert.	Yes
9.9198	61.5	100.3	38.8	40.1	38.5	24.0	6.9	150	Vert.	No
12.3996	59.4	74.0	14.6	50.5	33.7	25.8	1.0	80	Vert.	Yes
14.8801	52.9	100.3	47.4	45.1	33.7	26.9	1.0	80	Hor.	No
17.3596	58.8	100.3	41.2	51.1	33.9	27.2	1.0	80	Hor.	No
19.8395	54.1	100.3	46.2	54.4	37.0	38.3	1.0	80	Vert.	No
22.3194	53.4	74.0	20.6	53.4	37.2	38.3	1.1	80	Vert.	Yes
24.7993	47.5	100.3	52.8	48.1	37.3	39.0	1.1	80	Vert.	No

**Result measured with the average detector:**

Transmitter operates at the upper edge of the assigned frequency band										
Frequency GHz	Corr. value dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
1.2400	36.8	54.0	17.2	35.3	24.9	26.0	2.6	150	Vert.	Yes
2.1030	26.2	90.6	64.4	20.9	28.4	26.4	3.3	150	Vert.	No
2.1160	28.1	90.6	62.5	22.8	28.4	26.4	3.3	150	Vert.	No
2.4800	110.6	-	-	78.7	28.5	-	3.4	150	Vert.	-
2.8569	27.6	54.0	26.4	18.9	31.0	26.0	3.7	150	Vert.	Yes
4.9600	45.5	54.0	8.5	25.0	33.5	25.8	12.8	150	Vert.	Yes
7.4398	51.6	54.0	2.4	32.9	37.8	25.0	5.9	150	Vert.	Yes
9.9198	42.7	90.6	47.9	21.3	38.5	24.0	6.9	150	Vert.	No
12.3996	42.4	54.0	11.6	33.5	33.7	25.8	1.0	80	Vert.	Yes
14.8801	36.0	90.6	54.6	28.2	33.7	26.9	1.0	80	Hor.	No
17.3596	33.8	90.6	56.8	26.1	33.9	27.2	1.0	80	Hor.	No
19.8395	29.3	90.6	61.3	29.6	37.0	38.3	1.0	80	Vert.	No
22.3194	30.8	54.0	23.2	30.8	37.2	38.3	1.1	80	Vert.	Yes
24.7993	29.3	90.6	61.3	29.9	37.3	39.0	1.1	80	Vert.	No

Test: Passed

**TEST EQUIPMENT USED FOR THE TEST:**

29, 31 – 34, 36, 40, 42, 46 - 48, 50, 56 – 58, 66, 67



TEST REPORT REFERENCE: E40302fcc2 Edition 2

## 7.5 TEST RESULTS (RADIATED RECEIVER EMISSIONS ABOVE 1 GHz)

Ambient temperature	21 °C	Relative humidity	59 %
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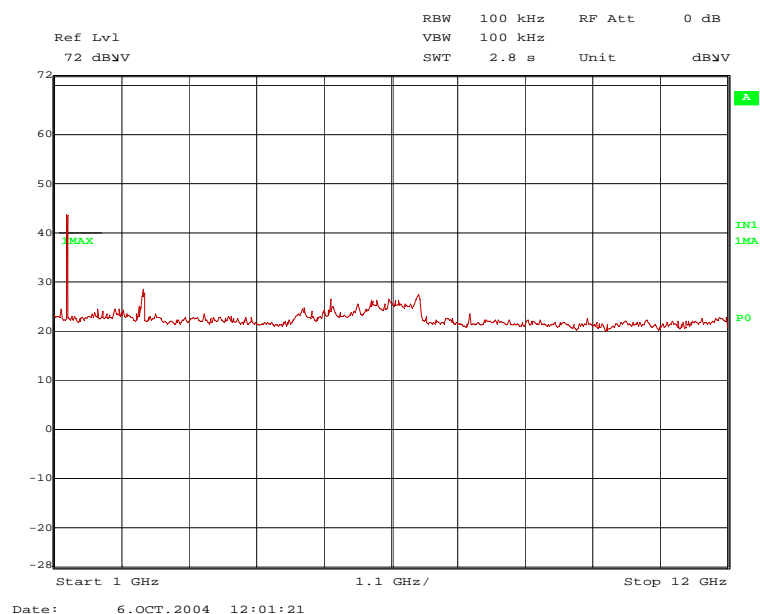
Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.

Cable guide: The cables of the EUT were fixed on the non-conducting table. For further information of the cable guide refer to the pictures in annex A of this test report.

Test record: All results are shown in the following.

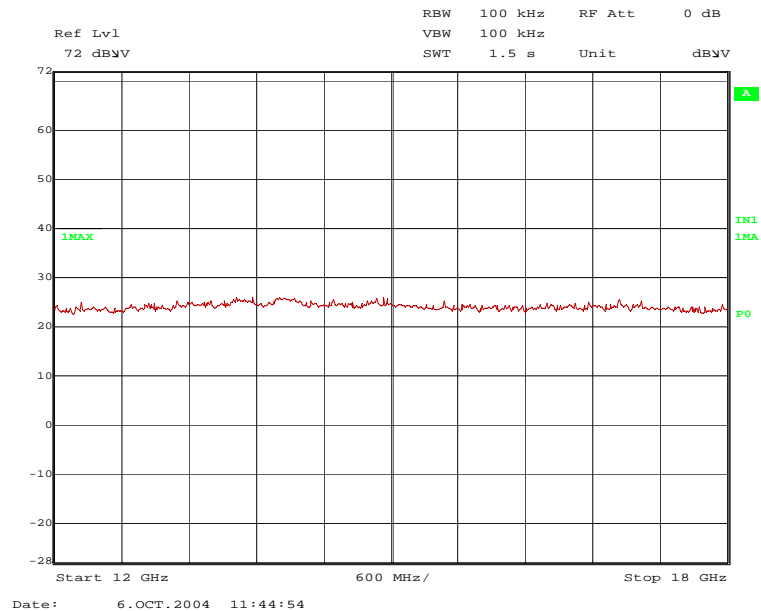
Supply voltage: During all measurements the EUT was supplied with 24.0 V DC.

40302r3: Receiver emissions from 1 GHz to 12 GHz, RX = 2.441 GHz (operation mode 5):

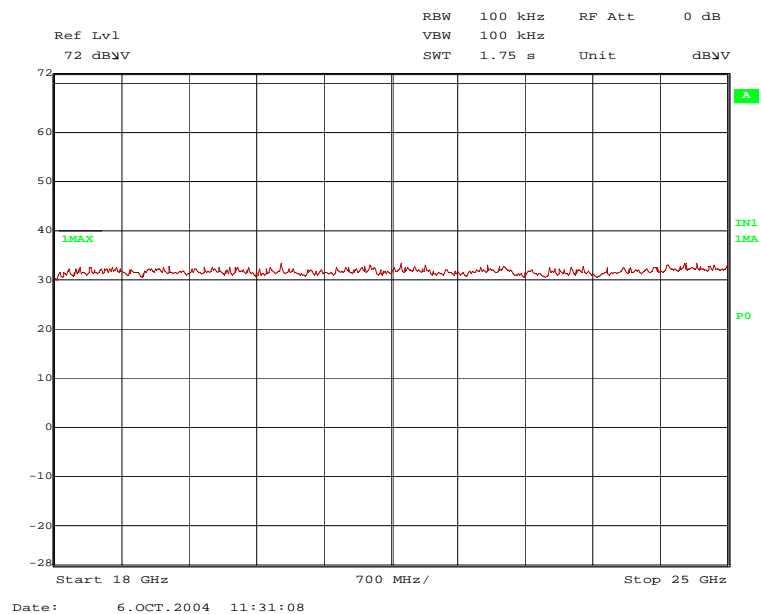


TEST REPORT REFERENCE: E40302fcc2 Edition 2

40302r4: Receiver spurious emissions from 12 GHz to 18 GHz, RX = 2.441 GHz (operation mode 5):



40302r5: Receiver spurious emissions from 18 GHz to 25 GHz, RX = 2.441 GHz (operation mode 5):



TEST REPORT REFERENCE: E40302fcc2 Edition 2

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Receiver operates in the middle of the assigned frequency band									
Frequency GHz	Corr. Value dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.
1.2026	43.0	54.0	11.0	41.5	24.9	26.0	2.6	150	Vert.
2.4340	29.2	54.0	24.8	23.3	28.5	26.0	3.4	150	Hor..

Test:        Passed

TEST EQUIPMENT USED FOR THE TEST:

29, 31 – 34, 36, 38, 40, 42, 46 - 48, 50, 56, 66, 67
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TEST REPORT REFERENCE: E40302fcc2 Edition 2

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## **8 TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS**

TEST REPORT REFERENCE: E40302fcc2 Edition 2

Emission measurement at AC mains and DC in / out ports at M4					
No.	Test equipment	Type	Manufacturer	Serial No.	PM-No
1	Shielded chamber M4	-	Siemens	B83117S1-X158	480088
2	Measuring receiver	ESAI	Rohde & Schwarz	831953/001 833181/018	480025 480026
3	LISN	NSLK8128	Schwarzbeck	8128155	480058
4	DC-filter	B84266-A21-E13	Siemens	940164525	480099
5	AC-filter	B84299-D87-E3	Siemens	930262292	480097
6	EMI-Software	ES-K1	Rohde & Schwarz	-	480111

Radiated emission measurement at M5					
No.	Test equipment	Type	Manufacturer	Serial No.	PM-No
7	Fully anechoic chamber M5	-	Siemens	B83177-S1-X156	480073
8	Measuring receiver	ESVS30	Rohde & Schwarz	829673/012	480024
9	Controller	HD100	Deisel	100/324	480067
10	Antenna support	MA240	Deisel	228/314	480069
11	Turntable	DS412	Deisel	412/317	480070
12	Antenna	CBL6112C	Chase	2689	480327
13	EMI Software	ES-K1	Rohde & Schwarz	-	480111

Radiated emission measurement at M6					
No.	Test equipment	Type	Manufacturer	Serial No.	PM-No
14	Open area test site	-	Phoenix Test-Lab	-	480085
15	Measuring receiver	ESVS30	Rohde & Schwarz	829673/012	480024
16	Controller	HD100	Deisel	100/670	480139
17	Turntable	DS420HE	Deisel	420/620/80	480087
18	Antenna support	AS615P	Deisel	615/310	480086
19	Antenna	CBL6111 A	Chase	1643	480147
20	EMI Software	ES-K1	Rohde & Schwarz	-	480111

TEST REPORT REFERENCE: E40302fcc2 Edition 2

Radiated emission measurement at M8					
No.	Test equipment	Type	Manufacturer	Serial No.	PM-No
21	Fully anechoic chamber M8	-	Siemens	B83117-E7019-T231	480190
22	Measuring receiver	ESMI	Rohde & Schwarz	843977/001 843530/018	480179 480180
23	Measuring receiver	ESCS 30	Rohde & Schwarz	828985/014	480270
24	Controller	HD100	Deisel	100/427	480181
25	Turntable	DS420	Deisel	420/435/97	480186
26	Antenna support	AS615P	Deisel	615/310	480187
27	Antenna	CBL6112 A	Chase	2034	480185
28	EMI Software	ES-K1	Rohde & Schwarz	-	480111

Radiated emission measurement at M20					
No.	Test equipment	Type	Manufacturer	Serial No.	PM-No
29	Fully anechoic chamber M20	-	Albatross Projects	B83107-E2439-T232	480303
30	Measuring receiver	ESMI	Rohde & Schwarz	843977/001 843530/018	480179 480180
31	Measuring receiver	ESI 40	Rohde & Schwarz	100064	480355
32	Controller	HD100	Deisel	100/670	480326
33	Turntable	DS420HE	Deisel	420/620/80	480315
34	Antenna support	AS615P	Deisel	615/310	480187
35	Antenna	CBL6112 B	Chase	2688	480328
36	Antenna	3115 A	EMCO	9609-4918	480183
37	RF-cable No. 30	RTK 081	Rosenberger	-	410141
38	EMI Software	ES-K1	Rohde & Schwarz	-	480111
39	RF-cable No. 5	RTK 081	Rosenberger		410097

Microwave Test equipment					
No.	Test equipment	Type	Manufacturer	Serial No.	PM-No
40	Standard Gain Horn 11.9 GHz – 18 GHz	18240-20	Flann Microwave	483	480294
41	Standard Gain Horn 11.9 GHz – 18 GHz	18240-20	Flann Microwave	482	480295

TEST REPORT REFERENCE: E40302fcc2 Edition 2

No.	Test equipment	Type	Manufacturer	Serial No.	PM-No
42	Standard Gain Horn 17.9 GHz – 26.7 GHz	20240-20	Flann Microwave	411	480297
43	Standard Gain Horn 17.9 GHz – 26.7 GHz	20240-20	Flann Microwave	410	480296
44	Standard Gain Horn 26.4 GHz – 40.1 GHz	22240-20	Flann Microwave	469	480299
45	Standard Gain Horn 26.4 GHz – 40.1 GHz	22240-20	Flann Microwave	468	480298
46	Preamplifier	JS3- 00101200- 23-5A	Miteq	681851	480337
47	Preamplifier	JS3- 12001800- 16-5A	Miteq	571667	480343
48	Preamplifier	JS3- 18002600- 20-5A	Miteq	658697	480342
49	Preamplifier	JS3- 26004000- 25-5A	Miteq	563593	480344
50	RF-cable 1m	KPS-1533- 400-KPS	Insulated Wire	-	480300
51	RF-cable 1m	KPS-1533- 400-KPS	Insulated Wire	-	480301
52	RF-cable 2m	KPS-1533- 400-KPS	Insulated Wire	-	480302
53	Detector	8473D	Hewlett Packard	3614A01788	480320
54	Power Meter	NRVD	Rohde & Schwarz	828110/026	480267
55	Thermal Power Sensor	NRV-Z51	Rohde & Schwarz	825489/004	480247

Ancillary equipment used for testing					
No.	Test equipment	Type	Manufacturer	Serial No.	PM-No
56	Power supply	TOE 8752	Toellner	31566	480010
57	High Pass Filter	HP 4000	Dirk Fischer Elektronik	-	480445
58	Tuneable Notch Filter	WRCT2300/ 2650-5/40- 10EEK	Wainwright Instruments GmbH	1	480446
59	Power supply	TOE 8852	Toellner	51786	490001
60	RF-cable No. 1	RTK 081	Rosenberger	-	410093

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No.	Test equipment	Type	Manufacturer	Serial No.	PM-No
61	RF-cable No. 31	RTK 081	Rosenberger	-	410142
62	Variable Attenuator 0 -11 dB	8494B	Hewlett Packard	3308A38264	480264
63	Variable Attenuator 0 - 110 dB	8496B	Hewlett Packard	3308A71365	480265
64	Signal generator	SMHU	Rohde & Schwarz	844170/017	480266
65	LISN	NSLK8128	Schwarzbeck	8128161	480138
66	RF-cable No. 3	RTK 081	Rosenberger	-	410095
67	RF-cable No. 4	RTK 081	Rosenberger	-	410096
68	Loop antenna	HFH2-Z2	Rohde & Schwarz	832609/014	480059

All used measurement equipment was calibrated (if necessary). The calibration intervals and the calibration history will be given out on request.



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## 9 LIST OF ANNEXES

<b>ANNEX A</b>	<b>INTERNAL PHOTOGRAPHS OF THE TEST SAMPLE:</b>	<b>2 pages</b>
	PCB, top view	40302eutfcc1.JPG
	PCB, bottom view	40302eutfcc2.JPG
<b>ANNEX B</b>	<b>EXTERNAL PHOTOGRAPHS OF THE TEST SAMPLE:</b>	<b>- pages</b>
	Because the EUT has no housing, no external photographs can be shown.	
<b>ANNEX C</b>	<b>PHOTOGRAPHS OF THE TEST SET-UPS:</b>	<b>4 pages</b>
	Test set-up radiated emission measurement anechoic chamber	40302emi5.JPG
		40302emi6.JPG
		40302emi4.JPG
		40302emi7.JPG
	Test set up conducted emission measurement	40302emi8.JPG