

TEST REPORT

Test Report Reference: R51984_C Edition 1

Equipment under Test: cB-OWLAN211bx-02 / cB-OWLAN211bi-02

IC: 5325A-090402

Serial Number: none

Applicant: connectBlue AB

Manufacturer: connectBlue AB

**Test Laboratory
(CAB)
accredited by
DATech GmbH
in compliance with DIN EN ISO/IEC 17025
under the
Reg. No. DAT-P-105/99-21
and
Industry Canada Test site registration IC3469**

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1 IDENTIFICATION

1.1 APPLICANT

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	Malmö SE-211 19
Country:	Sweden
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Fax:	+ 46 40 23 71 37
e-mail address:	martin.engdahl@connectblue.se

1.2 MANUFACTURER

Name:	connectBlue AB
Address:	Norra Vallgatan 64 3V
	Malmö SE-211 19
Country:	Sweden
Name for contact purposes:	Mr. Martin Engdahl
Tel:	+ 46 40 63 07 100
Fax:	+ 46 40 23 71 37
e-mail address:	martin.engdahl@connectblue.se

1.3 DATES

Date of receipt of test sample:	13 July 2006
Start of test:	20 July 2006
End of test:	27 July 2006

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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**

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and Industry Canada Test site registration IC3469

Test engineer: Thomas KÜHN
Name

T. Li
Signature

30 August 2006
Date

Test report checked: Bernd STEINER
Name

B. Steiner

30 August 2006
Date

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.

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PHOENIX TEST-LAB GmbH is prohibited.

The test results herein refer only to the tested sample. PHOENIX TEST-LAB 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 TEST-LAB 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] **RSS-210 Issue 6 September 2005** Low power Licence-Exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment
- [3] **RSS-Gen Issue 1 September 2005** General Requirements and Information for the Certification of Radiocommunication Equipment

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: *	802.11b Wireless LAN module
Type designation: *	cB-OWLAN211bx-02 / cB-OWLAN211bi-02
IC: *	5325A-090402
Antenna type: *	External or internal
Antenna gain: *	Refer table below
Antenna connector: *	With internal antenna, no antenna connector is mounted. Using an external antenna, a UFL connector is used.
Power supply: *	3.3 V DC to 5.0 V DC
Type of modulation: *	DSSS (CCK and DQPSK, depends on data-rate)
Operating frequency range:*	2.412 to 2.462 GHz (11 channels with 5 MHz channel separation)
Data rate:*	1, 2, 5.5 and 11 MBit/s
Number of channels: *	11
Temperature range: *	-30 °C to +85 °C

*: declared by the applicant

Used antennas:

model name*	Antenna type	Rated Antenna gain*
NanoBlue-IP04	external	+2.0 dBi
MircoBlue CAP24235	external	+1.5 dBi
WCR-2400-IP04	external	+2.0 dBi
Notebookantenna NB-2400	external	+2.0 dBi
SPA 2400/75/8/0/V	external	+7.5 dBi
SOA 2400/360/5/0/V_C	external	+5.0 dBi
PSTG0-2400HS	external	0 dBi
IG-103	external	+8.5 dBi
2.4 GHz Mica SMD Antenna	internal	+2.7 dBi
2.4 GHz Flying Lead Straigth Antenna IHF-242	external	+2.0 dBi

*: declared by the applicant

The following external I/O cables were used:

Cable	Length	Shielding	Connector
DC in	2 m *	No	6.3 mm jack plug
SPI bus (not connected during test)	40 cm	No	20 pole terminal block

*: Length during the test if no other specified.

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2.2 PERIPHERY DEVICES

The following equipment was used as control unit and ancillary equipment:

- The EUT was connected to a carrier board (cB-0703-02), which was delivered by the applicant. The carrier board was supplied via an external power supply with 5.0 V DC.
- A personal computer (ACER TravelMate 525TXV, model No. 1904) with a configuration-software was used, connected temporary to the EUT via a Ethernet switch (NETGEAR ProSafe 5 Port 10/100 switch FS105 v2) and a EUT initiator (cB-0717-02), for setting the equipment into the necessary operation mode. During the measurement procedures the personal computer, the Ethernet switch and the EUT initiator were disconnected.

3 OPERATIONAL STATES AND PHYSICAL BOUNDARIES

The EUT is intended to be used in several WLAN applications. Because the EUT is a module, which will be implemented in a final application, it was mounted on a carrier board to change the operation modes of the EUT from a Laptop with test software. The tests were carried out with one unmodified sample with integral antenna and another unmodified sample with an antenna connector and external antennas. Because the antenna WRC2400-IP04 (with UFL connector) was not available at the moment of testing the identical antenna with a SMA connector (WRC2400-SMA) was used instead.

The EUT has a UFL connector, which is regarded to be unique.

During the tests the test sample was powered by an external power supply via the carrier board with 5.0 V DC. The emission measurement on AC mains was carried out by using a mascot power supply type 2121.

If not otherwise stated, for modulating the transmitter, a pseudo random bit sequence with a data rate of 11 MBit/s was used because pretests have shown that this is the operation mode, which causes the highest spurious emissions and occupies the largest bandwidth.

For selecting an operation mode, a personal computer with a software delivered by the applicant was connected to the EUT via a Ethernet switch (NETGEAR ProSafe 5 Port 10/100 switch FS105 v2) and a EUT initiator (cB-0717-02). After adjusting the operating mode, the personal computer, the Ethernet switch and the EUT initiator were removed. To do this the test-engineer was instructed by the applicant.

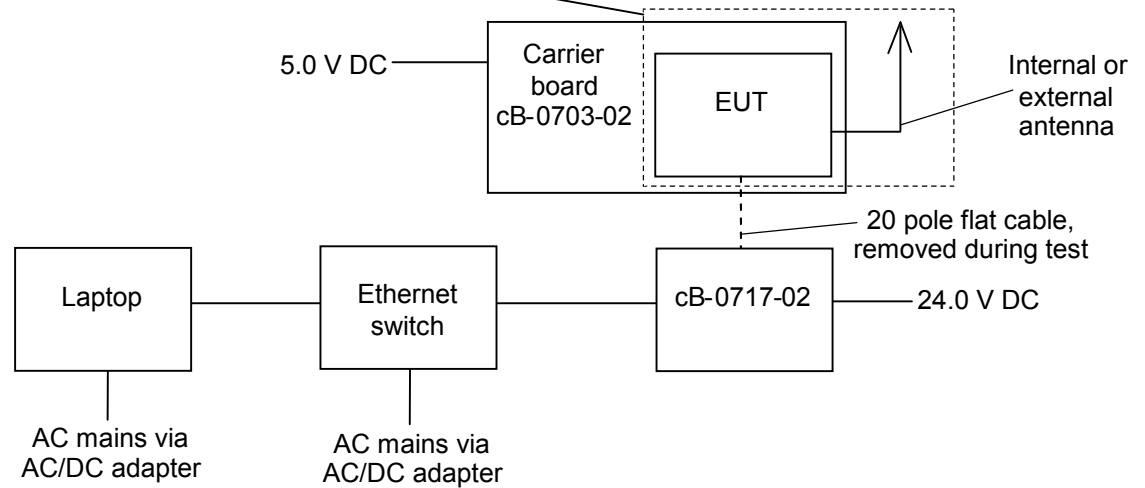
During the tests, the EUT was not labelled with a IC-label.

The following operation modes were used during the tests:

Operation mode	Description of the operation mode
1	Continuous transmitting on 2412 MHz
2	Continuous transmitting on 2437 MHz
3	Continuous transmitting on 2462 MHz
4	Continuous receiving on 2437 MHz

TEST REPORT REFERENCE: R60502_C Edition 1

Physical boundary of the EUT



4 APPLICATION OVERVIEW

Application	Frequency range [MHz]	RSS 210, Issue 6 [2] or RSS-Gen, Issue 1 [3]	Status	Refer page
6 dB bandwidth	General	A8.2 (1) [2]	Passed	9 et seq.
Maximum peak output power	2400.0 – 2483.5	A8.4 (4) [2], 7.1.4 [3]	Passed	13 et seq.
Power spectral density	2400.0 – 2483.5	A8.2 (2) [2]	Passed	15 et seq.
Band edge compliance	2400.0 – 2483.5	A8.5 [2]	Passed	19 et seq.
Radiated emissions (transmitter)	30 – 25,000	A8.5 [2], 4.7 [3]	Passed	21 et seq.
Conducted emissions on supply line	0.15 – 30	7.2.2 [3]	Passed	56 et seq.
Radiated emissions (receiver)	30 – 25,000	2.6 [2], 7.2.3 [3]	Passed	59 et seq.

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5 TEST RESULTS

5.1 BANDWIDTH

5.1.1 METHOD OF MEASUREMENT (BANDWIDTH)

The calibration of the spectrum analyser has to be checked with the help of a known signal from a signal generator. The EUT has to be connected to the spectrum analyser via a low loss cable. If the EUT is not equipped with an antenna connector, a temporary antenna connector has to be installed. The EUT has to be switched on, the transmitter shall work with its maximum data rate.

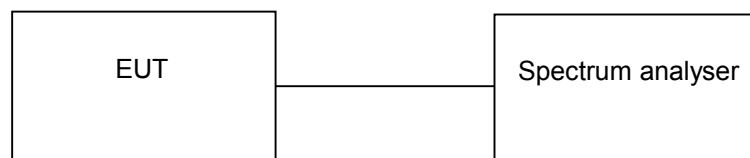
The following spectrum analyser settings shall be used:

- Span: App. 2 to 3 times the 6 dB bandwidth, centred on the actual channel.
- Resolution bandwidth: 100 kHz.
- Video bandwidth: 100 kHz.
- Sweep: Auto.
- Detector function: peak.
- Trace mode: Max hold.

After trace stabilisation the marker shall be set on the signal peak. The first display line has to be set on this value. The second display line has to be set 6 dB below the first line (or the peak marker). The frequency lines shall be set on the intersection points between the second display line and the measured curve.

The measurement will be performed at the upper, the lower end and the middle of the assigned frequency band.

Test set-up:

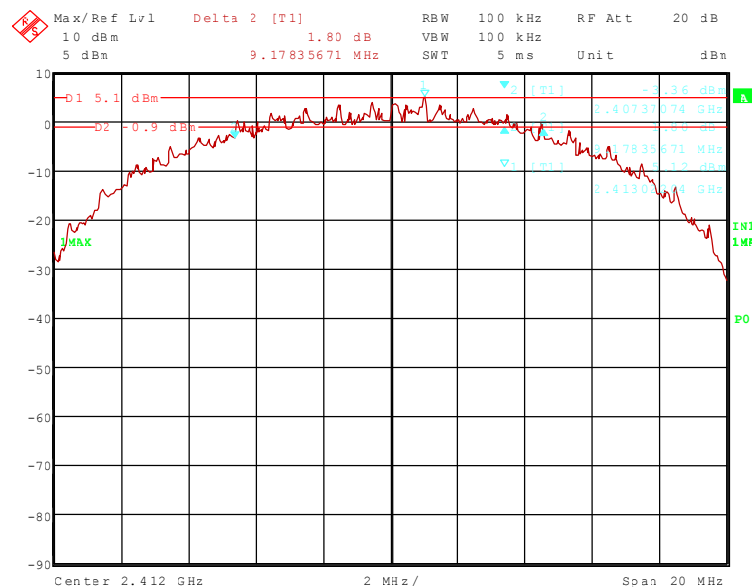


TEST REPORT REFERENCE: R60502_C Edition 1

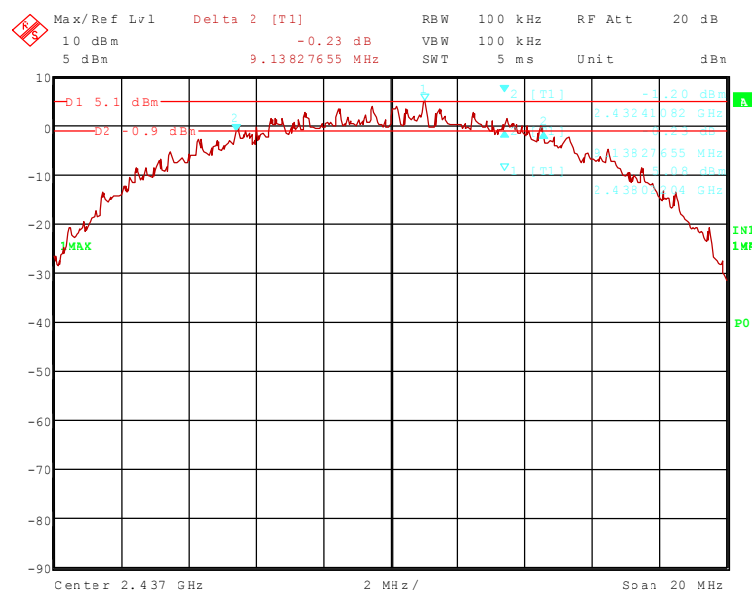
5.1.2 TEST RESULTS (BANDWIDTH)

Ambient temperature	20 °C	Relative humidity	35 %
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60502_63.wmf: (6 dB bandwidth at the lower end of the assigned frequency band):

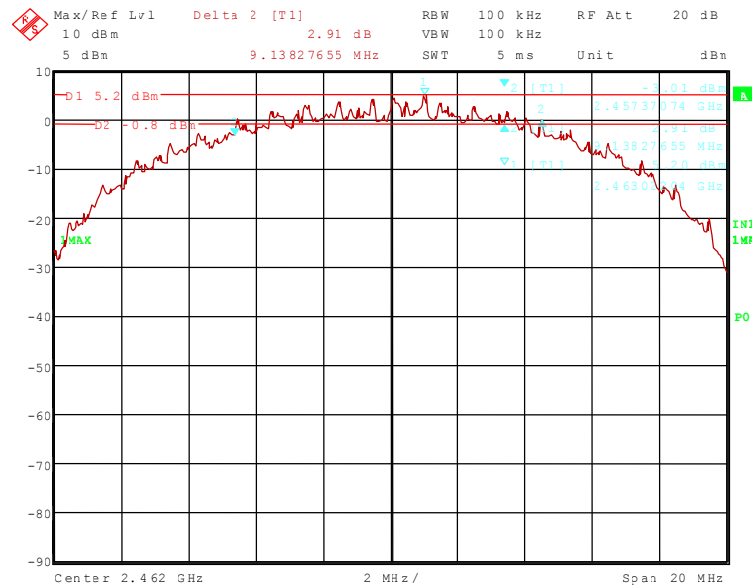


60502_66.wmf: (6 dB bandwidth at the middle of the assigned frequency band):



TEST REPORT REFERENCE: R60502_C Edition 1

60502_67.wmf: (6 dB bandwidth at the upper end of the assigned frequency band):



Channel number	Channel frequency [MHZ]	6dB bandwidth [MHZ]
1	2412	9.178
6	2437	9.138
11	2462	9.138

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

31, 46, 54

TEST REPORT REFERENCE: R60502_C Edition 1

5.2 MAXIMUM PEAK OUTPUT POWER

5.2.1 METHOD OF MEASUREMENT (MAXIMUM PEAK OUTPUT POWER)

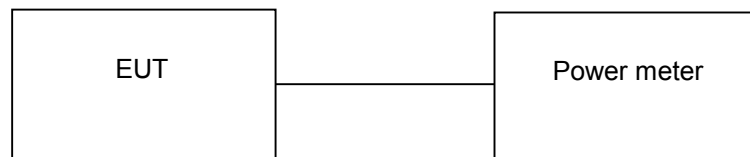
The calibration of the spectrum analyser has to be checked with the help of a known signal from a signal generator. The EUT has to be connected to the spectrum analyser via a low loss cable. If the EUT is not equipped with an antenna connector, a temporary antenna connector has to be installed. The EUT has to be switched on.

The following power meter settings shall be used:

- Filter No. auto.
- Measuring time 0.136 s to 26 s.
- Used peak sensor NRV –Z32.

The measurement will be performed at the upper and lower end and the middle of the assigned frequency band.

Test set-up:



TEST REPORT REFERENCE: R60502_C Edition 1

5.2.2 TEST RESULTS (MAXIMUM PEAK OUTPUT POWER)

Ambient temperature	21 °C	Relative humidity	61 %
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Channel number	Channel frequency [MHz]	Maximum peak output power [dBm]	Peak power limit [dBm]
1	2412	14.9	30.0
6	2437	15.1	30.0
11	2462	15.0	30.0
Measurement uncertainty			+0.66 dB / -0.72 dB

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

46, 54, 55

TEST REPORT REFERENCE: R60502_C Edition 1

5.3 POWER SPECTRAL DENSITY

5.3.1 METHOD OF MEASUREMENT (POWER SPECTRAL DENSITY)

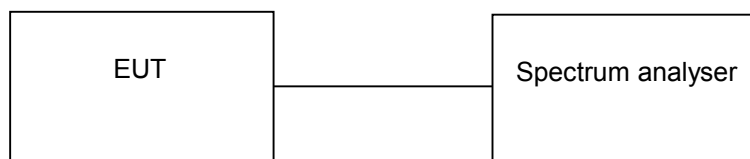
The calibration of the spectrum analyser has to be checked with the help of a known signal from a signal generator. The EUT has to be connected to the spectrum analyser via a low loss cable. If the EUT is not equipped with an antenna connector, a temporary antenna connector has to be installed.

The following spectrum analyser settings shall be used:

- Span: 1.5 MHz, centred on the actual channel.
- Resolution bandwidth: 3 kHz.
- Video bandwidth: 30 kHz.
- Sweep: 500 s.
- Detector function: peak.
- Trace mode: Max hold.

After trace stabilisation the marker shall be set on the signal peak. The indicated level is the power spectral density.

Test set-up:

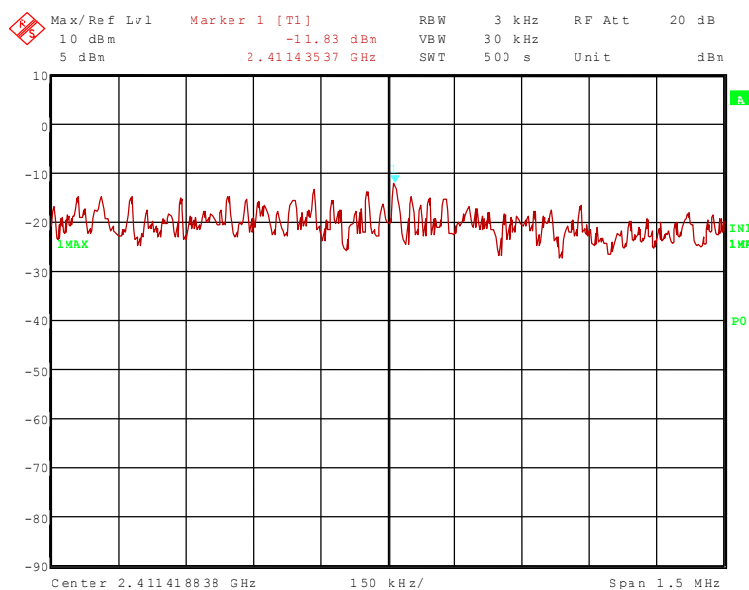


TEST REPORT REFERENCE: R60502_C Edition 1

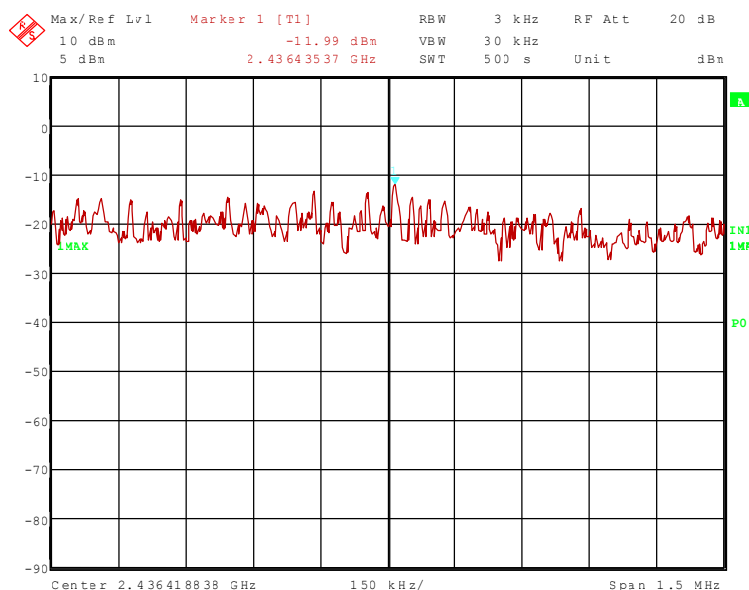
5.3.2 TEST RESULTS (POWER SPECTRAL DENSITY)

Ambient temperature	21 °C	Relative humidity	61 %
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60502_62.wmf (power spectral density (transmit on channel 1)):

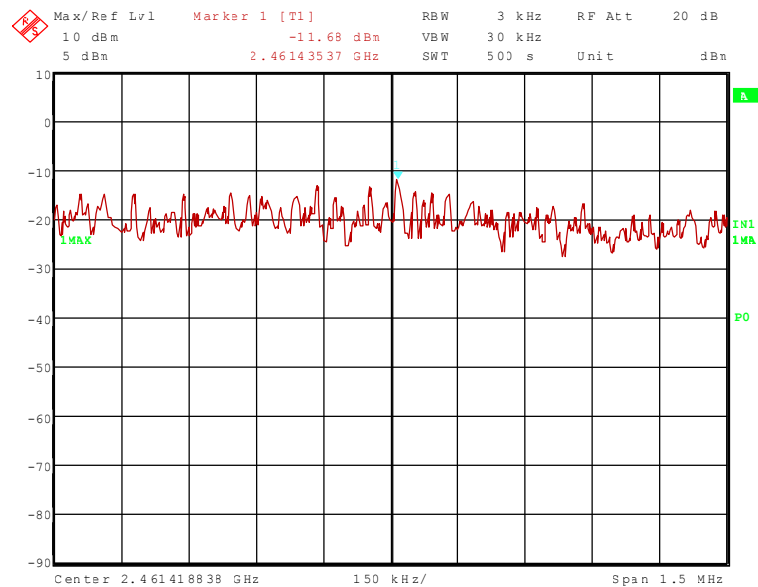


60502_61.wmf (power spectral density (transmit on channel 6)):



TEST REPORT REFERENCE: R60502_C Edition 1

60502_60.wmf (power spectral density (transmit on channel 11)):



Operation mode	Power spectral density [dBm / 3 kHz] *	Power spectral density limit [dBm / 3 kHz]
Transmit on channel 1	-10.9	8
Transmit on channel 6	-11.1	8
Transmit on channel 11	-10.8	8
Measurement uncertainty		+1.1 dB / -1.5 dB

* cable loss of 0.9 dB respected

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

31, 46, 54

TEST REPORT REFERENCE: R60502_C Edition 1

5.4 BAND-EDGE COMPLIANCE

5.4.1 METHOD OF MEASUREMENT (BAND-EDGE COMPLIANCE)

The calibration of the spectrum analyser has to be checked with the help of a known signal from a signal generator. The EUT has to be connected to the spectrum analyser via a low loss cable. If the EUT is not equipped with an antenna connector, a temporary antenna connector has to be installed.

The following spectrum analyser settings shall be used:

- Span: Wide enough to capture the peak level of the emission on the channel closest to the band-edge, as well as any modulation products, which fall outside the assigned frequency band.
- Resolution bandwidth: $\geq 1\%$ of the span, but not below 30 kHz.
- Video bandwidth: \geq the resolution bandwidth.
- Sweep: Auto.
- Detector function: Peak.
- Trace mode: Max hold.

After trace stabilisation the marker shall be set on the signal peak. The first display line has to be set on this value. The second display line has to be set 20 dB below the first line (or the peak marker). The frequency line shall be set on the edge of the assigned frequency band. Set the second marker on the emission at the band-edge, or on the highest modulation product outside of the band, if this level is higher than that at the band-edge. After this the difference between this emission level and the signal peak will be calculated. With the value of measured field strength of the signal peak and the calculated difference to the emission level, the level of the field strength of the emission will be calculated.

The measurement will be performed at the upper and lower end of the assigned frequency band.

Test set-up:

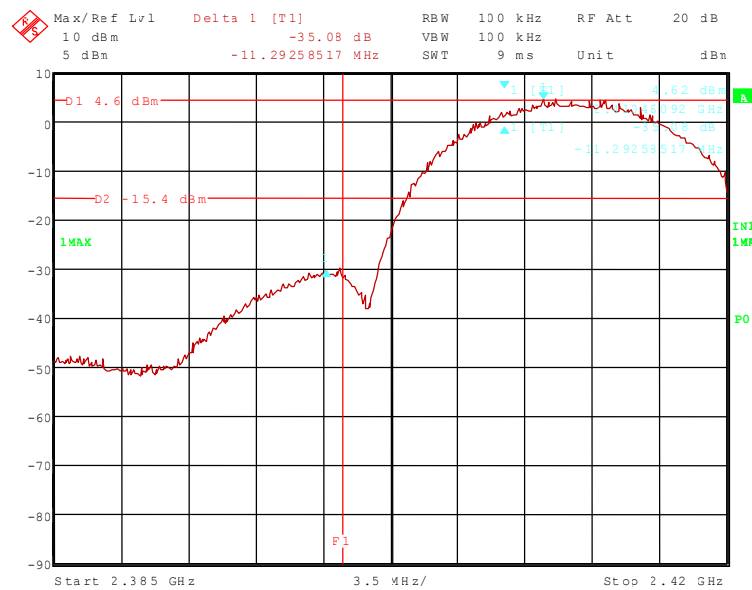


TEST REPORT REFERENCE: R60502_C Edition 1

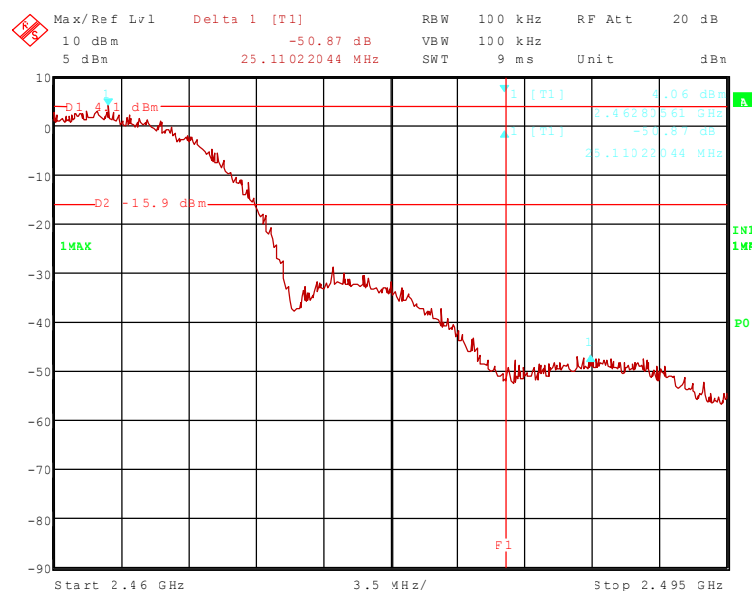
5.4.2 TEST RESULT (BAND-EDGE COMPLIANCE)

Ambient temperature	21 °C	Relative humidity	61 %
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60502_70.wmf (band-edge compliance, lower band edge):



60502_69.wmf (band-edge compliance, upper band edge):



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The plots on the page before are showing the band-edge compliance for the upper and lower band-edge. The display line 1 (D1) in these plots represents the highest level within the assigned frequency band. The display line 2 (D2) represents the 20 dB offset to this highest level and shows the compliance with RSS-210 A8.5. The frequency line 1 (F1) shows the edge of the assigned frequency.

Band-edge compliance				
Band-edge	Difference to the signal peak [dB]	Field strength of this signal peak [dBμV/m]	Field strength at the band edge [dBμV/m]	Limit [dBμV/m]
Upper	50.9	104.4	53.5	54.0
Lower	35.1	103.8	68.7	83.8
Measurement uncertainty			+2.2 dB / -3.6 dB	

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

31, 46, 54

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5.5 RADIATED EMISSIONS (TRANSMITTER)

5.5.1 METHOD OF MEASUREMENT (RADIATED EMISSIONS)

The radiated emission measurement is subdivided into three stages.

- A preliminary measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 30 MHz to 1 GHz.
- A final measurement carried out on an open area test site with reflecting ground plane and various antenna heights 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.

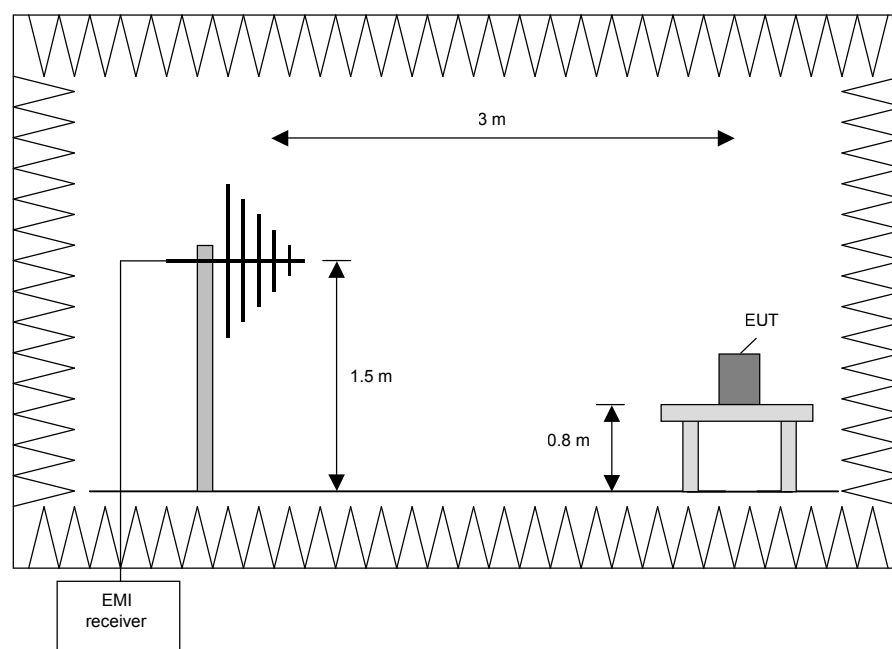
Preliminary measurement (30 MHz to 1 GHz)

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



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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:

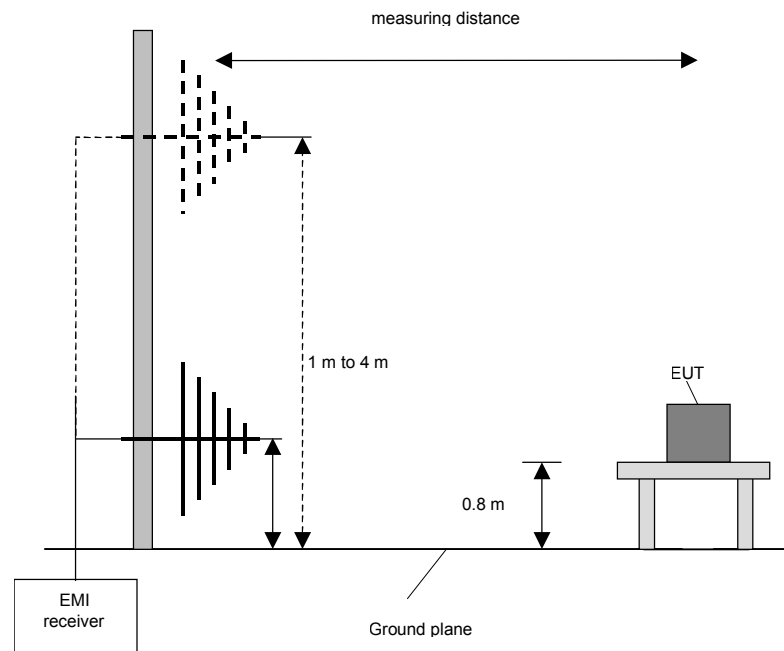
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Manipulate the system cables within the range to produce the maximum level of emission.
3. Rotate the EUT by 360 ° to maximize the detected signals.
4. Make a hardcopy of the spectrum.
5. Measure the frequency of the 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.

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 ° to 360 °, 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



TEST REPORT REFERENCE: R60502_C Edition 1

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 °.
- 2) Move the antenna from 1 m to 4 m and note the maximum value at each frequency.
- 3) Rotate the EUT by 45 ° and repeat 2) until an azimuth of 337 ° 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 +/- 1 m.
- 7) Set the antenna to the position where the maximum value is found.
- 8) Measure while moving the turntable +/- 45 °.
- 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.

Preliminary and final measurement (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

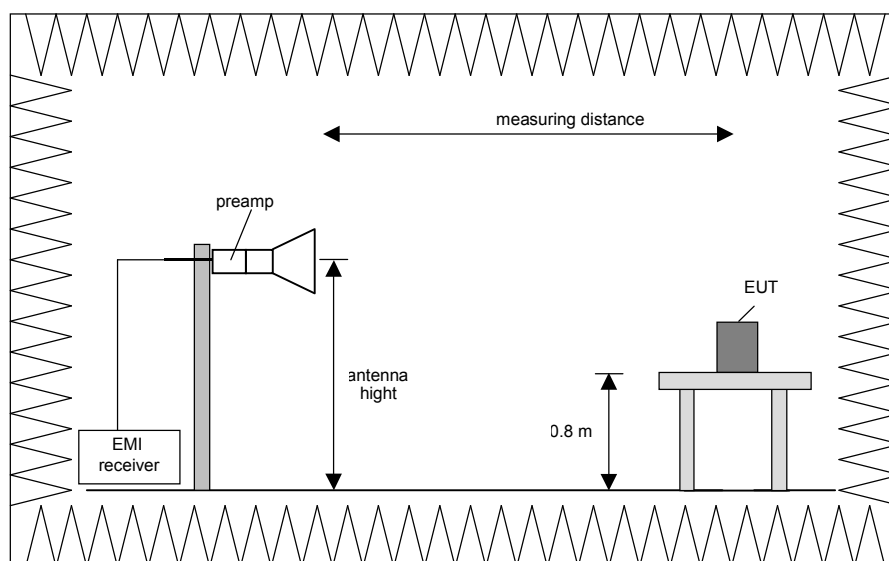
Final measurement (1 GHz to 25 GHz)

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.

TEST REPORT REFERENCE: R60502_C Edition 1

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



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.

TEST REPORT REFERENCE: R60502_C Edition 1

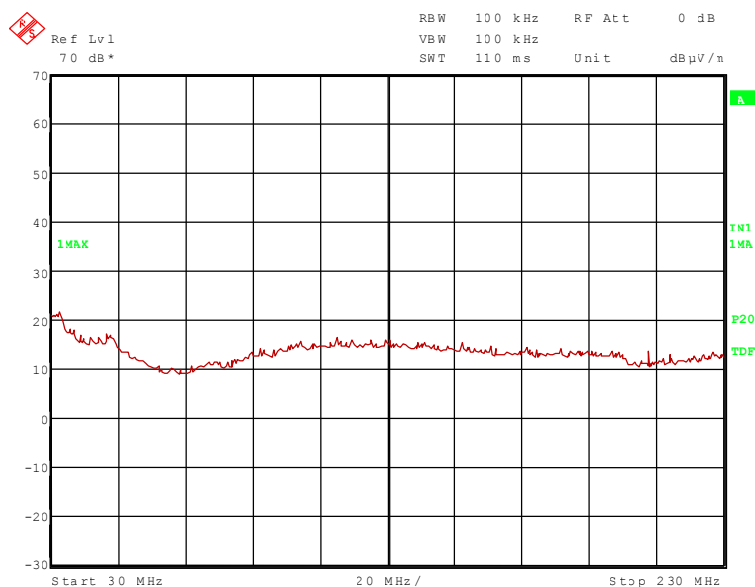
5.5.2 TEST RESULTS (RADIATED EMISSIONS)

5.5.2.1 PRELIMINARY MEASUREMENT WITH EXTERNAL PLANAR ANTENNA (30 MHz to 25 GHz)

Ambient temperature	20 °C	Relative humidity	60 %
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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:** Where not otherwise stated the test was carried out in test mode 2 of the EUT, because there was no difference to the other test modes. All results are shown in the following.
- Supply voltage:** During all measurements the EUT was supplied with 5.0 V DC via the carrier board.
- Remark:** As external antenna the SPA 2400/75/8/0/V was used, because of the highest gain of this antenna type. Additionally pre-tests have shown, that this antenna caused the highest spurious emissions of all planar antennas.

60502_58.wmf (30 MHz to 230 MHz):

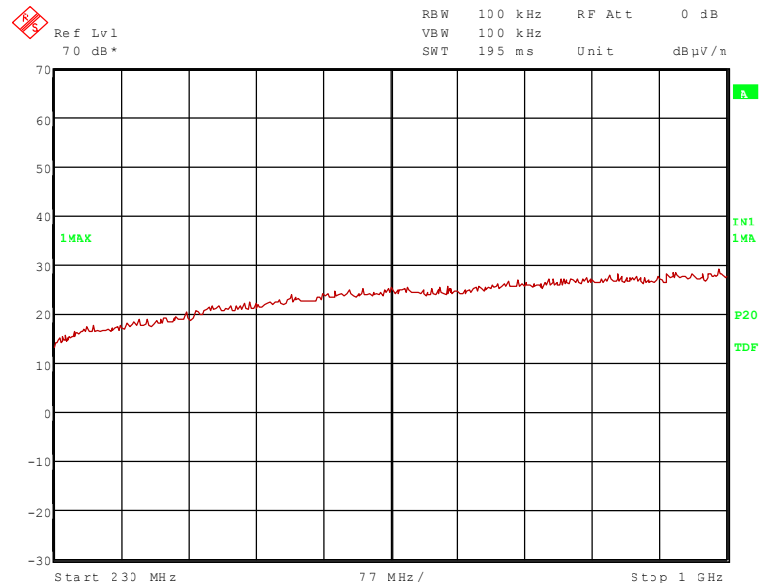


TEST EQUIPMENT USED FOR THE TEST:

29, 31 – 37, 39, 43, 46, 49 – 51, 54

TEST REPORT REFERENCE: R60502_C Edition 1

60502_59.wmf (230 MHz to 1 GHz):

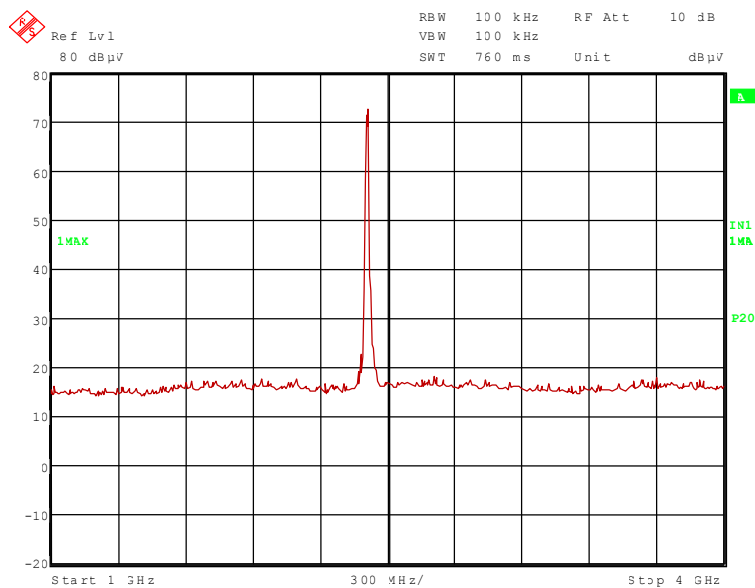


No significant frequencies above the noise floor of the system were found during the preliminary radiated emission test, so no measurements were carried out on the open area test site.

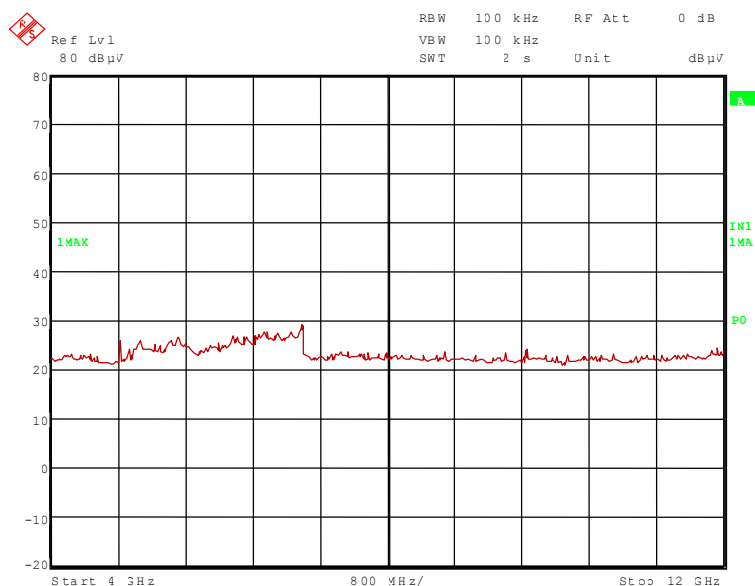
TEST REPORT REFERENCE: R60502_C Edition 1

Transmitter operates at the lower end of the assigned frequency band (operation mode 1)

60502_23.wmf (1 GHz to 4 GHz):

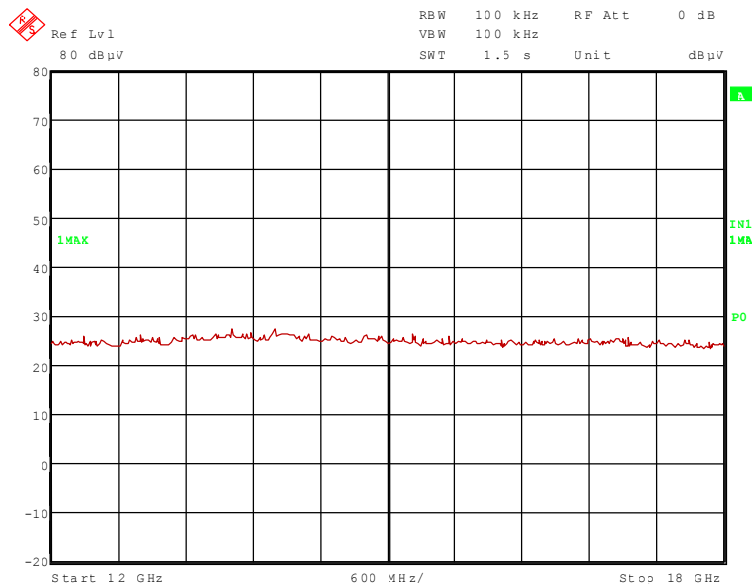


60502_26.wmf (4 GHz to 12 GHz):

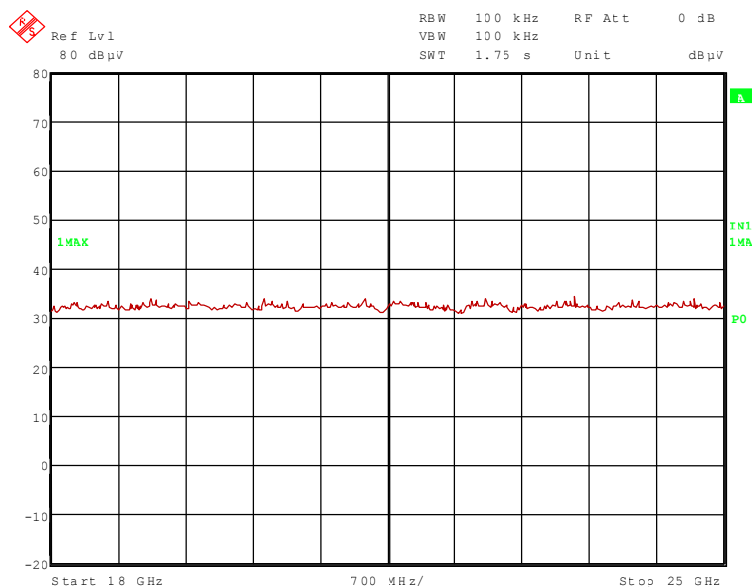


TEST REPORT REFERENCE: R60502_C Edition 1

60502_38.wmf (12 GHz to 18 GHz):



60502_45.wmf (18 GHz to 25 GHz):



The following frequency was found inside the restricted bands during the preliminary radiated emission test:

- 4.824 GHz.

The following frequency was found outside the restricted bands during the preliminary radiated emission test:

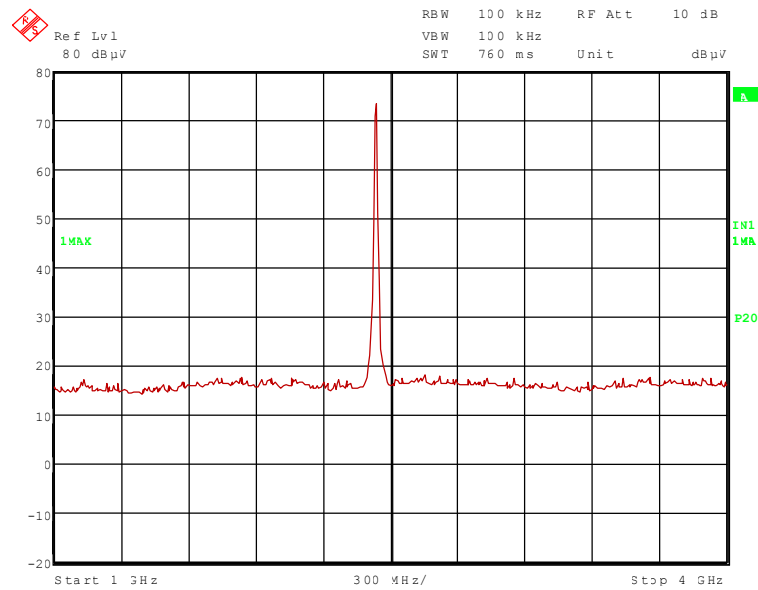
- 2.412 GHz.

These frequencies have to be measured in a final measurement. The results were presented in the following.

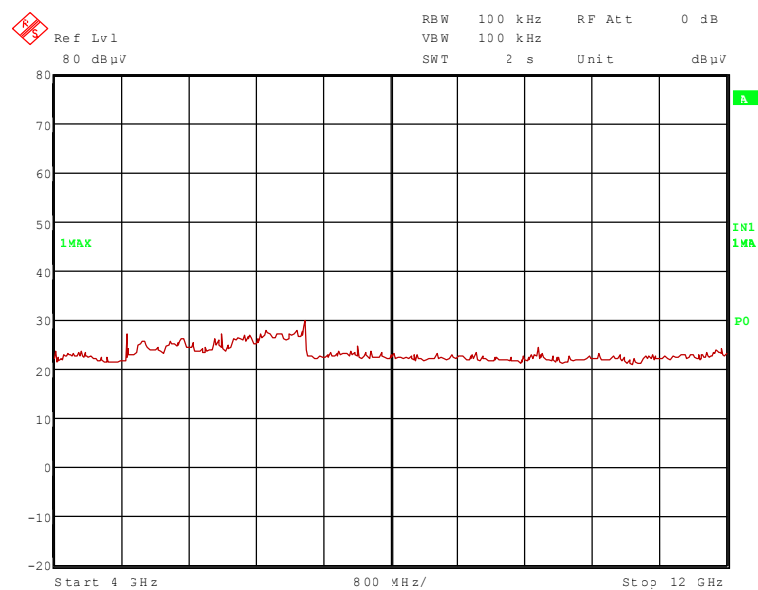
TEST REPORT REFERENCE: R60502_C Edition 1

Transmitter operates at the middle of the assigned frequency band (operation mode 2)

60502_22.wmf (1 GHz to 4 GHz):

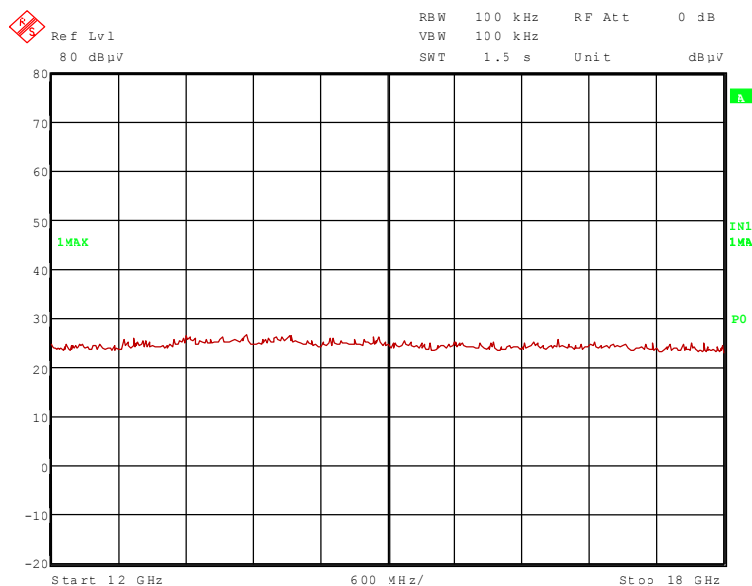


60502_27.wmf (4 GHz to 12 GHz):

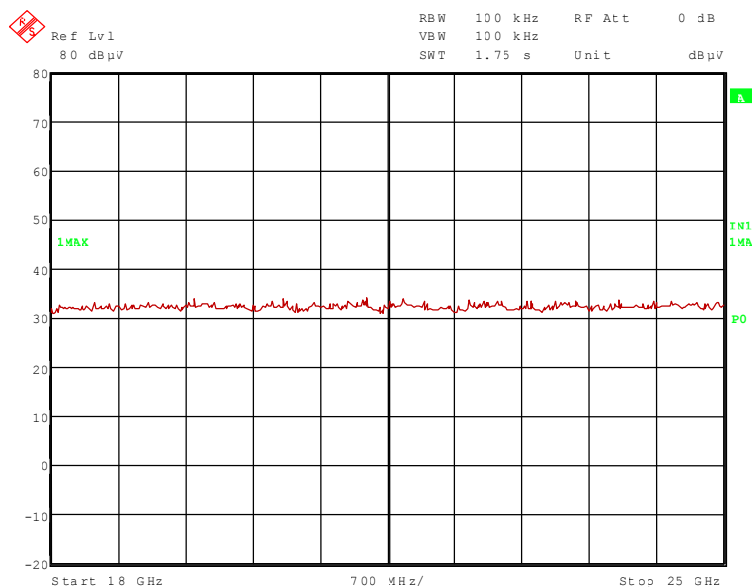


TEST REPORT REFERENCE: R60502_C Edition 1

60502_39.wmf (12 GHz to 18 GHz):



60502_44.wmf (18 GHz to 25 GHz):



The following frequency was found inside the restricted bands during the preliminary radiated emission test:

- 4.874 GHz.

The following frequency was found outside the restricted bands during the preliminary radiated emission test:

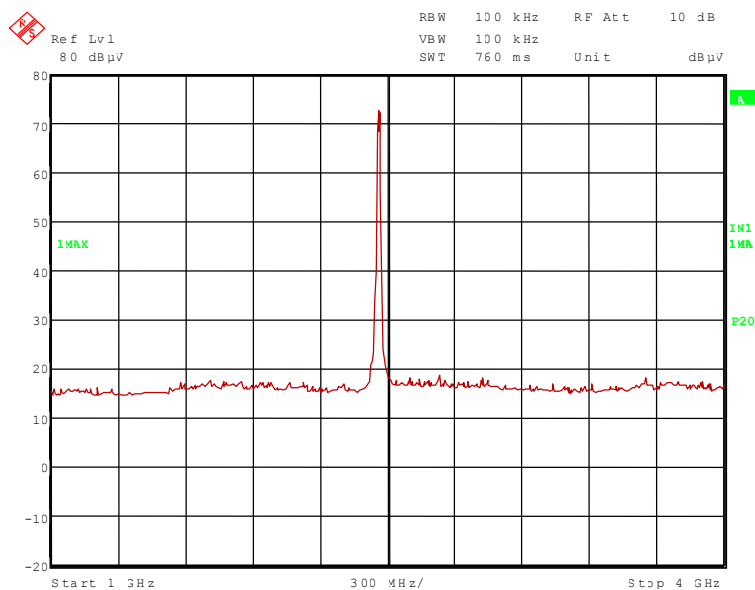
- 2.437 GHz.

These frequencies have to be measured in a final measurement. The results were presented in the following.

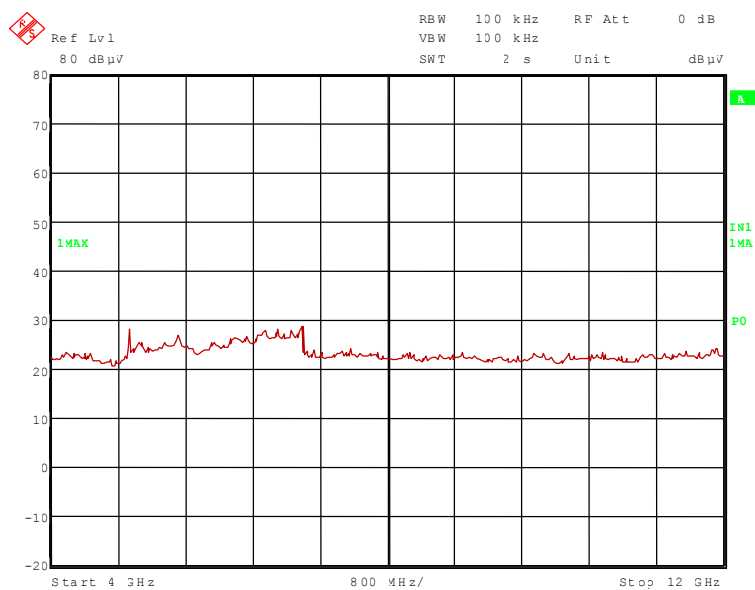
TEST REPORT REFERENCE: R60502_C Edition 1

Transmitter operates at the upper end of the assigned frequency band (operation mode 3)

60502_24.wmf (1 GHz to 4 GHz):

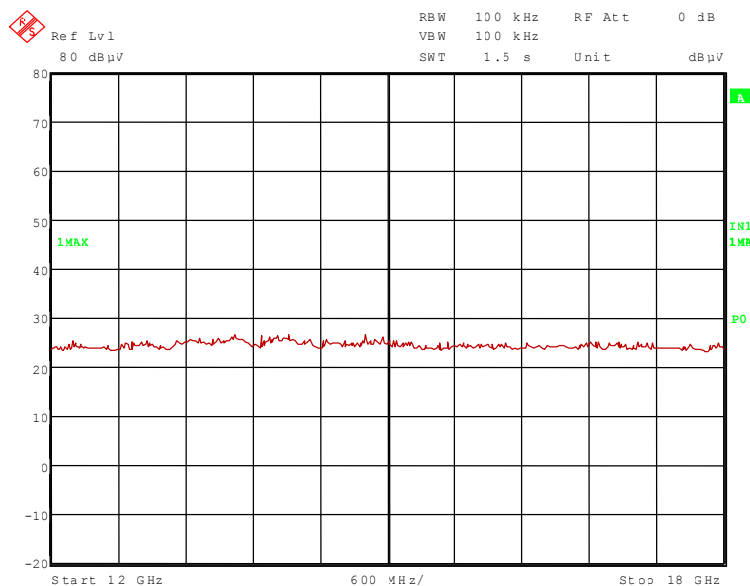


60502_25.wmf (4 GHz to 12 GHz):

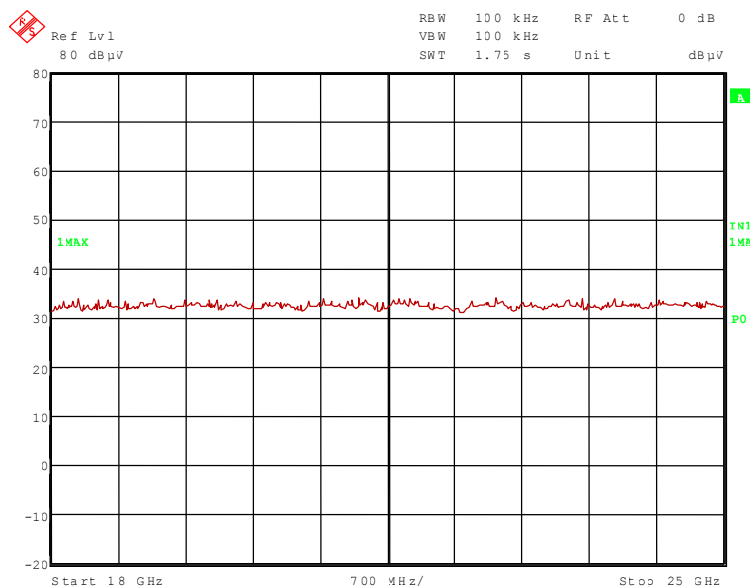


TEST REPORT REFERENCE: R60502_C Edition 1

60502_40.wmf (12 GHz to 18 GHz):



60502_41.wmf (18 GHz to 25 GHz):



The following frequency was found inside the restricted bands during the preliminary radiated emission test:

- 4.934 GHz.

The following frequency was found outside the restricted bands during the preliminary radiated emission test:

- 2.467 GHz.

These frequencies have to be measured in a final measurement. The results were presented in the following.

TEST REPORT REFERENCE: R60502_C Edition 1

5.5.2.2 FINAL MEASUREMENT WITH EXTERNAL PLANAR ANTENNA (1 GHz to 25 GHz)

Ambient temperature	20 °C	Relative humidity	60 %
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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.

Supply voltage: During all measurements the EUT was supplied with 5.0 V DC via the carrier board.

Resolution bandwidth: For all measurements a resolution bandwidth of 1 MHz was used.

Remark: As external antenna the SPA 2400/75/8/0/V was used, because of the highest gain of this antenna type. Additionally pre-tests have shown, that this antenna caused the highest spurious emissions of all planar antennas.

Transmitter operates at the lower end of the assigned frequency band (operation mode 1)

Result measured with the peak 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
2.412	111.1	-	-	79.8	28.5	0.0	2.8	150	Vert.	-
4.824	49.6	74.0	24.4	38.4	33.1	25.7	3.8	150	Hor.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Result 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
2.412	102.6	-	-	71.3	28.5	0.0	2.8	150	Vert.	-
4.824	34.6	54.0	19.4	23.4	33.1	25.7	3.8	150	Hor.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

TEST REPORT REFERENCE: R60502_C Edition 1

Transmitter operates at the middle of the assigned frequency band (operation mode 2)

Result measured with the peak 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
2.437	111.7	-	-	80.2	28.7	0.0	2.8	150	Vert.	-
4.874	49.7	74.0	24.3	38.2	33.4	25.7	3.8	150	Hor.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Result 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
2.437	103.2	-	-	71.7	28.7	0.0	2.8	150	Vert.	-
4.874	35.4	54.0	18.6	23.9	33.4	25.7	3.8	150	Hor.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Transmitter operates at the upper end of the assigned frequency band (operation mode 3)

Result measured with the peak 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
2.467	112.1	-	-	80.6	28.7	0.0	2.8	150	Vert.	-
4.934	54.6	74.0	19.4	42.9	33.5	25.6	3.8	150	Hor.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Result 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
2.467	103.4	-	-	71.9	28.7	0.0	2.8	150	Vert.	-
4.934	39.4	54.0	14.6	27.7	33.5	25.6	3.8	150	Hor.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

29, 31 – 37, 39, 43, 46, 49 – 51, 54

TEST REPORT REFERENCE: R60502_C Edition 1

5.5.2.3 PRELIMINARY MEASUREMENT WITH EXTERNAL MONOPOLE ANTENNA (30 MHz to 25 GHz)

Ambient temperature	20 °C	Relative humidity	60 %
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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.

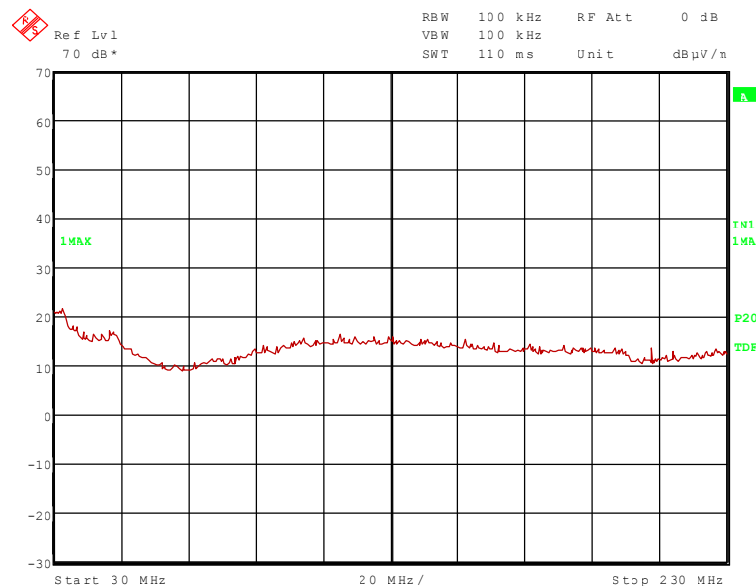
Cable guide: The cable of the EUT was fixed on the non-conducting table. For further information of the cable guide refer to the pictures in annex A of this test report.

Test record: Where not otherwise stated the test was carried out in test mode 2 of the EUT, because there was no difference to the other test modes. All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied with 5.0 V DC via the carrier board.

Remark: As external antenna the IG-103 was used, because of the highest gain of this antenna type. Additionally pre-tests have shown, that this antenna caused the highest spurious emissions of all monopole antennas.

60502_36.wmf (30 MHz to 230 MHz):

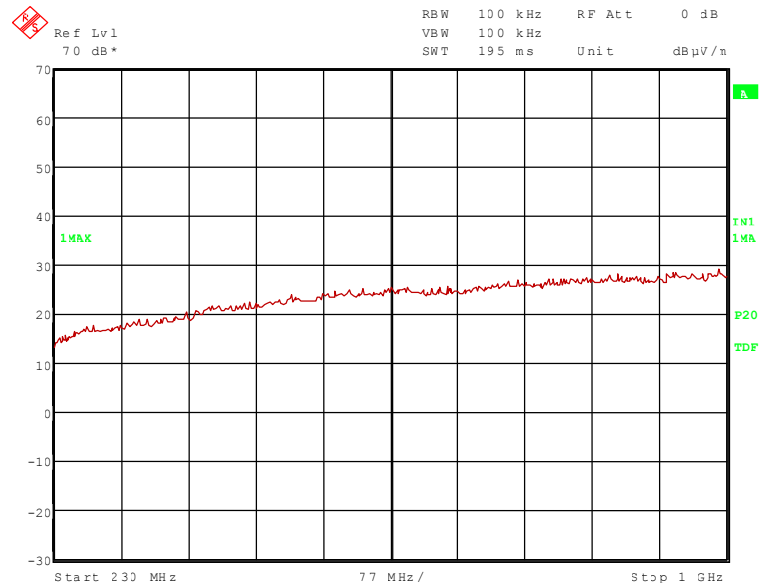


TEST EQUIPMENT USED FOR THE TEST:

29, 31 – 37, 39, 43, 46, 49 – 51, 54

TEST REPORT REFERENCE: R60502_C Edition 1

60502_37.wmf (230 MHz to 1 GHz):

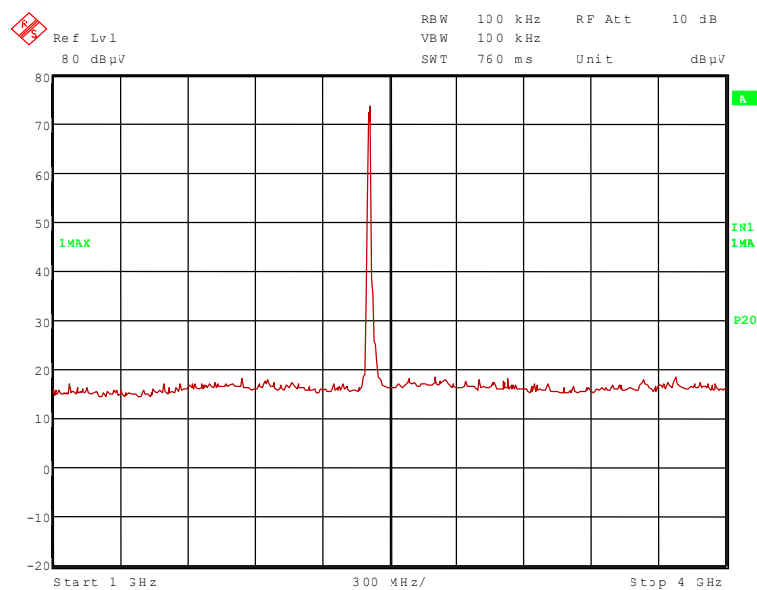


No significant frequencies above the noise floor of the system were found during the preliminary radiated emission test, so no measurements were carried out on the open area test site.

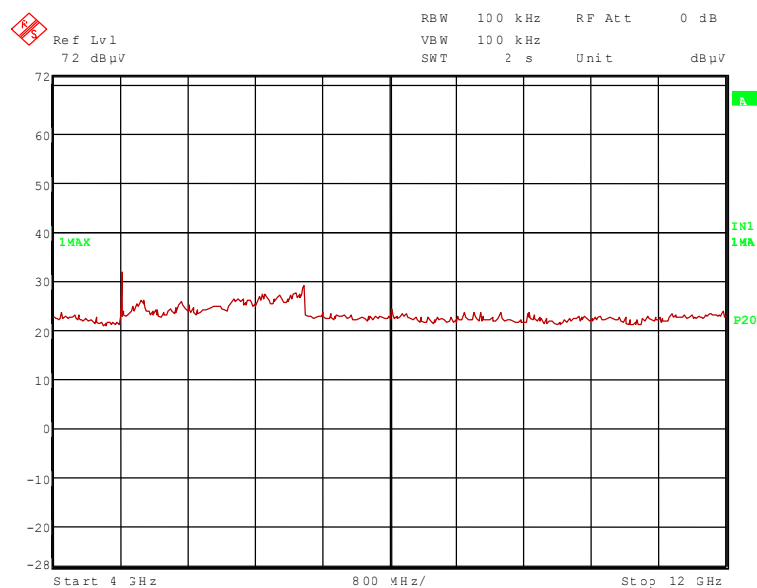
TEST REPORT REFERENCE: R60502_C Edition 1

Transmitter operates at the lower end of the assigned frequency band (operation mode 1)

60502_33.wmf (1 GHz to 4 GHz):

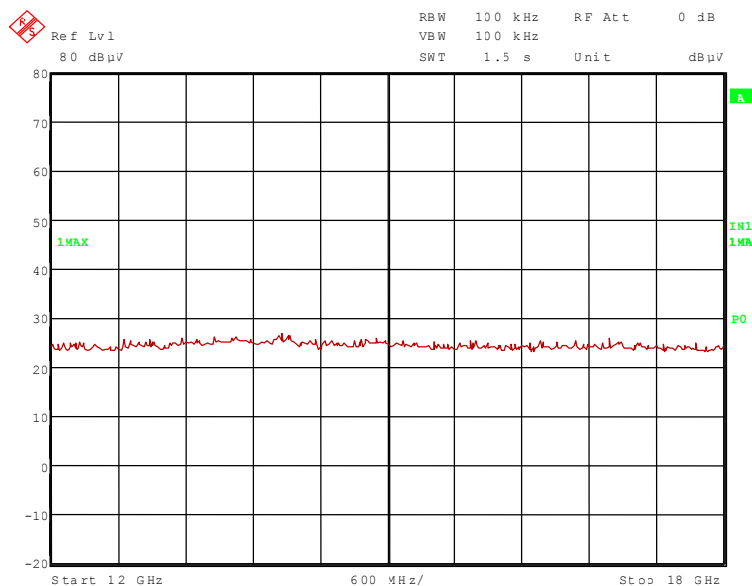


60502_30.wmf (4 GHz to 12 GHz):

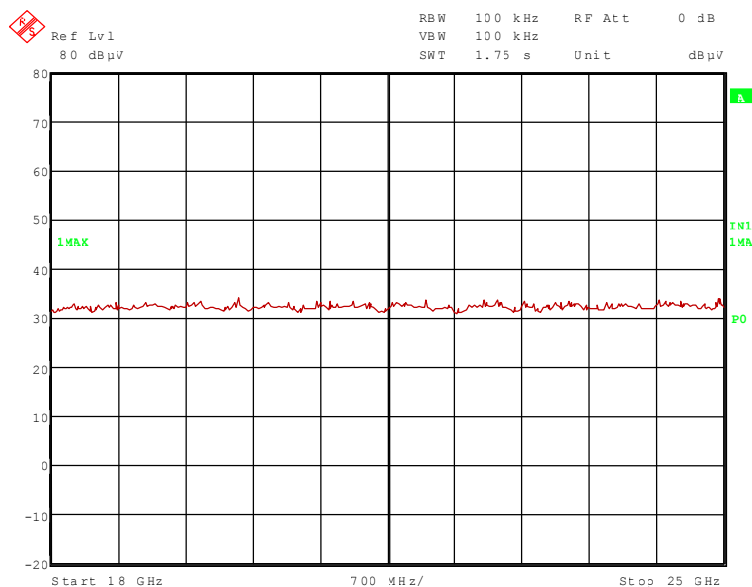


TEST REPORT REFERENCE: R60502_C Edition 1

60502_47.wmf (12 GHz to 18 GHz):



60502_46.wmf (18 GHz to 25 GHz):



The following frequency was found inside the restricted bands during the preliminary radiated emission test:

- 4.824 GHz.

The following frequency was found outside the restricted bands during the preliminary radiated emission test:

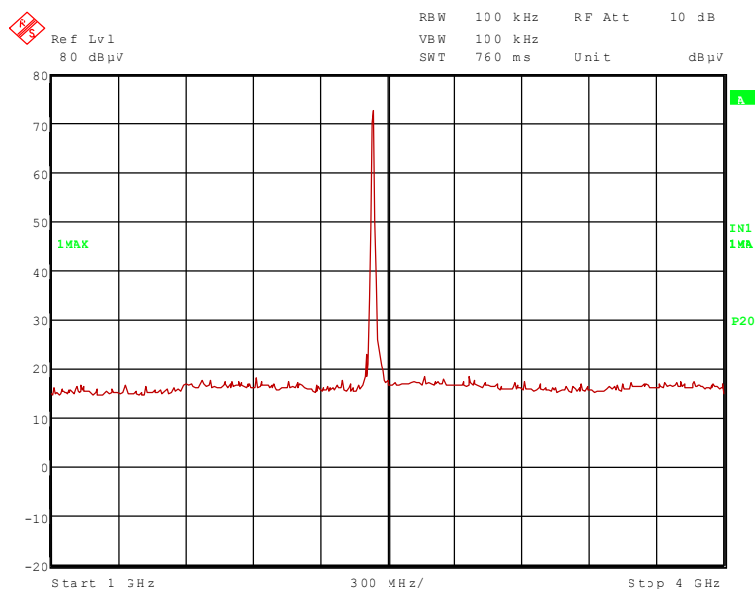
- 2.412 GHz.

These frequencies have to be measured in a final measurement. The results were presented in the following.

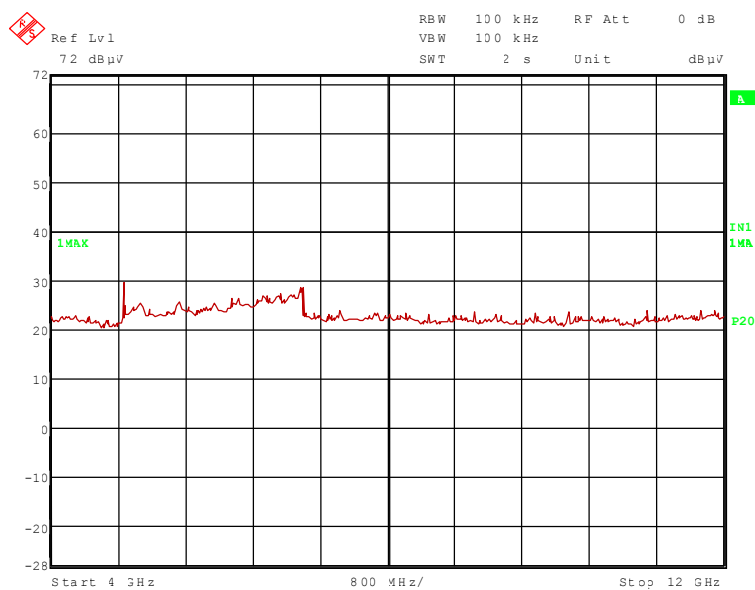
TEST REPORT REFERENCE: R60502_C Edition 1

Transmitter operates at the middle of the assigned frequency band (operation mode 2)

60502_34.wmf (1 GHz to 4 GHz):

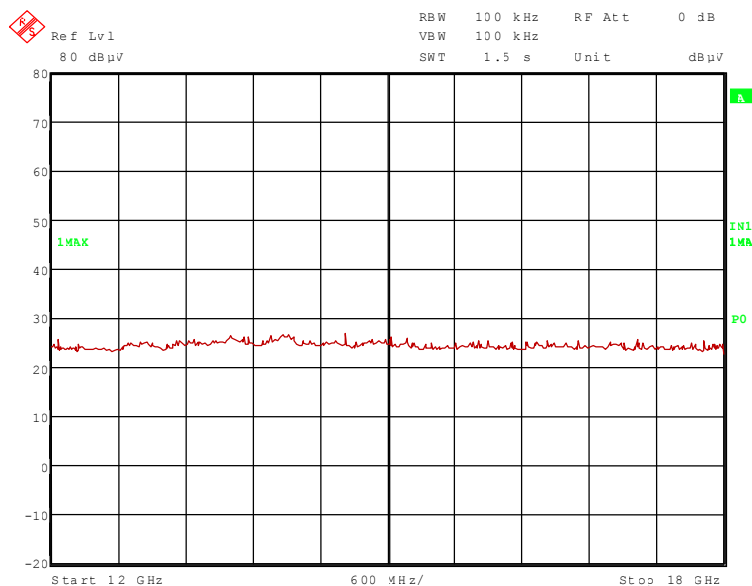


60502_32.wmf (4 GHz to 12 GHz):

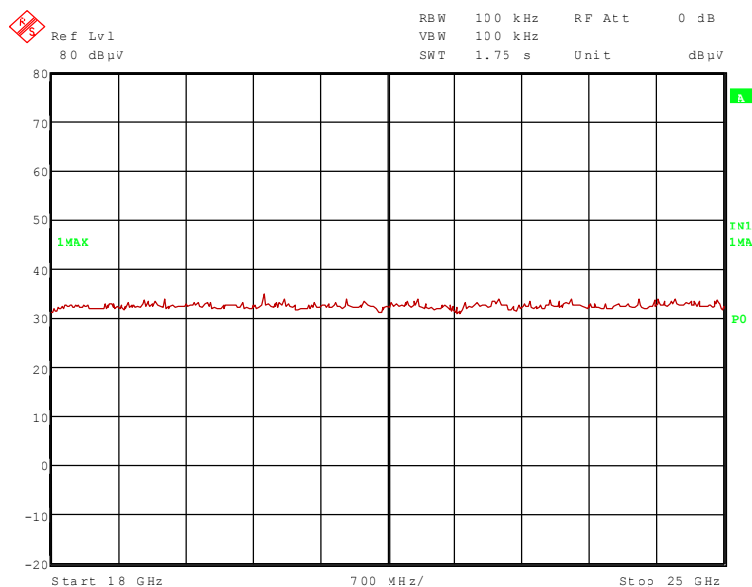


TEST REPORT REFERENCE: R60502_C Edition 1

60502_48.wmf (12 GHz to 18 GHz):



60502_49.wmf (18 GHz to 25 GHz):



The following frequency was found inside the restricted bands during the preliminary radiated emission test:

- 4.874 GHz.

The following frequency was found outside the restricted bands during the preliminary radiated emission test:

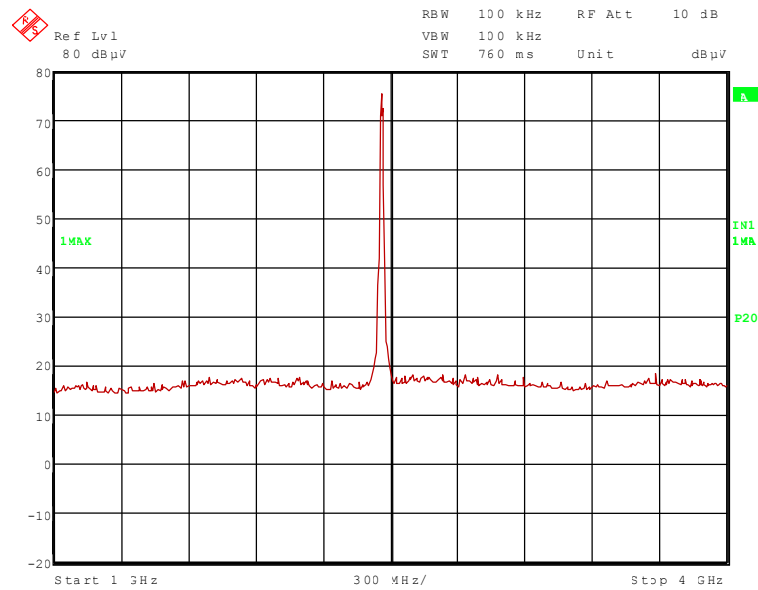
- 2.437 GHz.

These frequencies have to be measured in a final measurement. The results were presented in the following.

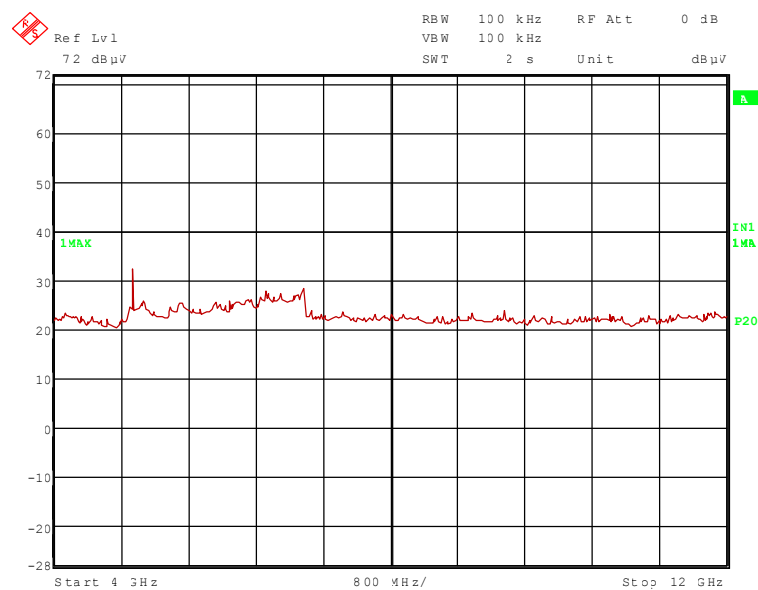
TEST REPORT REFERENCE: R60502_C Edition 1

Transmitter operates at the upper end of the assigned frequency band (operation mode 3)

60502_35.wmf (1 GHz to 4 GHz):

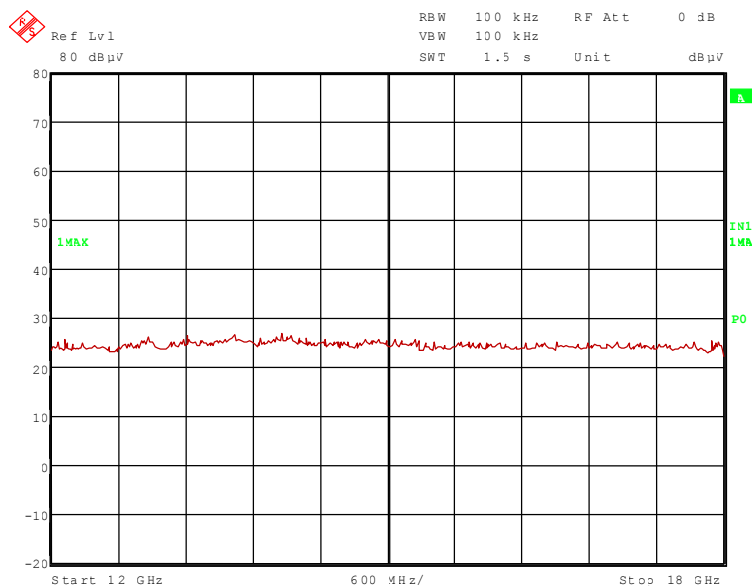


60502_31.wmf (4 GHz to 12 GHz):

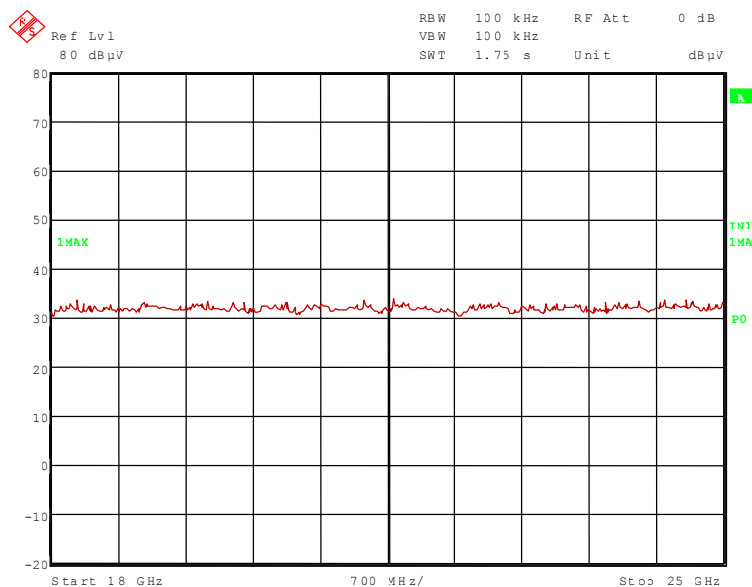


TEST REPORT REFERENCE: R60502_C Edition 1

60502_51.wmf (12 GHz to 18 GHz):



60502_50.wmf (18 GHz to 25 GHz):



The following frequencies were found inside the restricted bands during the preliminary radiated emission test:

- 4.924 GHz.

The following frequency was found outside the restricted bands during the preliminary radiated emission test:

- 2.462 GHz.

These frequencies have to be measured in a final measurement. The results were presented in the following.

TEST REPORT REFERENCE: R60502_C Edition 1

5.5.2.4 FINAL MEASUREMENT WITH EXTERNAL MONOPOLE ANTENNA (1 GHz to 25 GHz)

Ambient temperature	20 °C	Relative humidity	60 %
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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.

Supply voltage: During all measurements the EUT was supplied with 5.0 V DC via the carrier board.

Resolution bandwidth: For all measurements a resolution bandwidth of 1 MHz was used.

Remark: As external antenna the IG-103 was used, because of the highest gain of this antenna type. Additionally pre-tests have shown, that this antenna caused the highest spurious emissions of all monopole antennas.

Transmitter operates at the lower end of the assigned frequency band (operation mode 1)

Result measured with the peak 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
2.412	112.4	-	-	81.1	28.5	0.0	2.8	150	Vert.	-
4.824	55.2	74.0	18.8	44.0	33.1	25.7	3.8	150	Vert.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Result 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
2.412	103.8	-	-	72.5	28.5	0.0	2.8	150	Vert.	-
4.824	40.2	54.0	13.8	29.0	33.1	25.7	3.8	150	Vert.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

TEST REPORT REFERENCE: R60502_C Edition 1

Transmitter operates at the middle of the assigned frequency band (operation mode 2)

Result measured with the peak 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
2.437	113.3	-	-	81.8	28.7	0.0	2.8	150	Vert.	-
4.874	53.9	74.0	20.1	42.4	33.4	25.7	3.8	150	Vert.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Result 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
2.437	104.7	-	-	73.2	28.7	0.0	2.8	150	Vert.	-
4.874	38.5	54.0	15.5	27.0	33.4	25.7	3.8	150	Vert.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Transmitter operates at the upper end of the assigned frequency band (operation mode 3)

Result measured with the peak 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
2.462	113.2	-	-	81.7	28.7	0.0	2.8	150		-
4.924	53.8	74.0	20.2	42.1	33.5	25.6	3.8	150	Vert.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Result 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
2.462	104.4	-	-	72.9	28.7	0.0	2.8	150		-
4.924	38.7	54.0	15.3	27.0	33.5	25.6	3.8	150	Hor.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

29, 31 – 37, 39, 43, 46, 49 – 51, 54

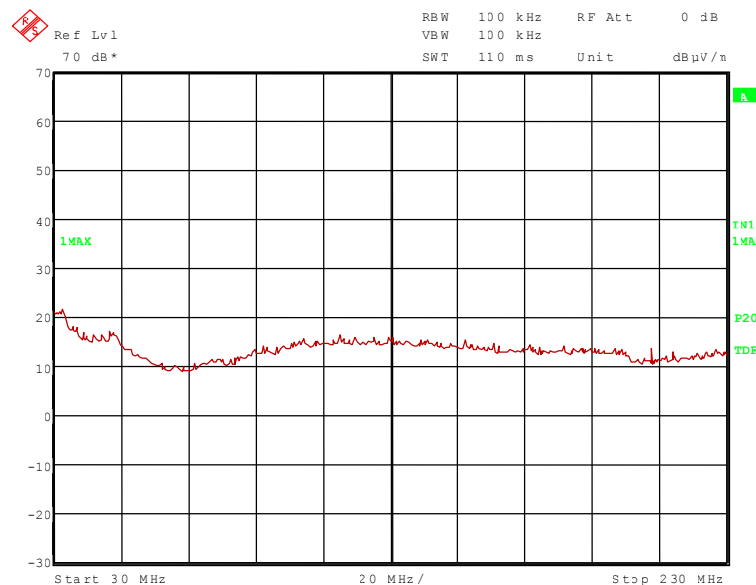
TEST REPORT REFERENCE: R60502_C Edition 1

5.5.2.5 PRELIMINARY MEASUREMENT WITH INTERNAL ANTENNA (30 MHz to 25 GHz)

Ambient temperature	20 °C	Relative humidity	60 %
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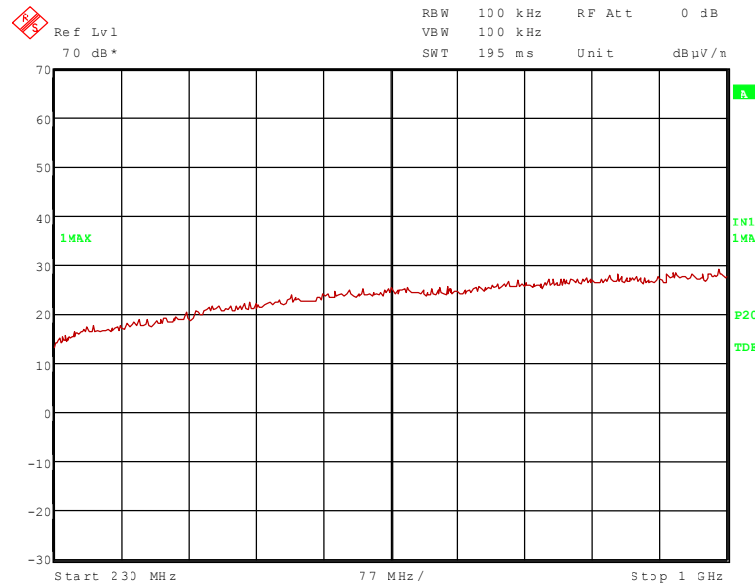
- Position of EUT:** The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.
- Cable guide:** The cable of the EUT was fixed on the non-conducting table. For further information of the cable guide refer to the pictures in annex A of this test report.
- Test record:** Where not otherwise stated the test was carried out in test mode 2 of the EUT, because there was no difference to the other test modes. All results are shown in the following.
- Supply voltage:** During all measurements the EUT was supplied with 5.0 V DC via the carrier board.

60502_12.wmf (30 MHz to 230 MHz):



TEST REPORT REFERENCE: R60502_C Edition 1

60502_13.wmf (230 MHz to 1 GHz):



No significant emissions above the noise floor found during the preliminary emission test. So no final test has to be carried out on an open area test site.

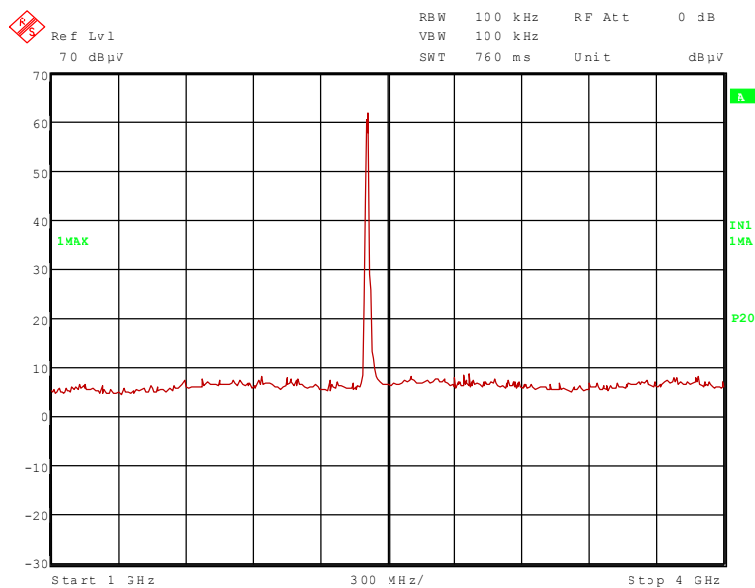
TEST EQUIPMENT USED FOR THE TEST:

29, 31 – 37, 39, 43, 46, 49 – 51, 54

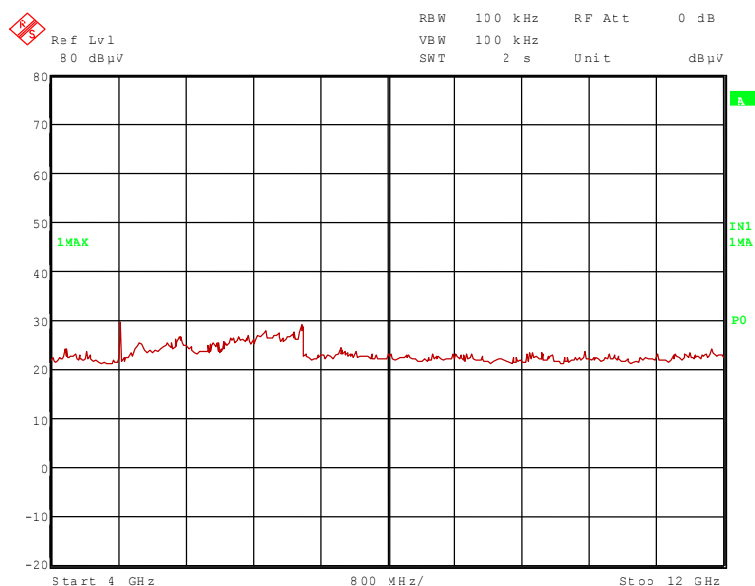
TEST REPORT REFERENCE: R60502_C Edition 1

Transmitter operates at the lower end of the assigned frequency band (operation mode 1)

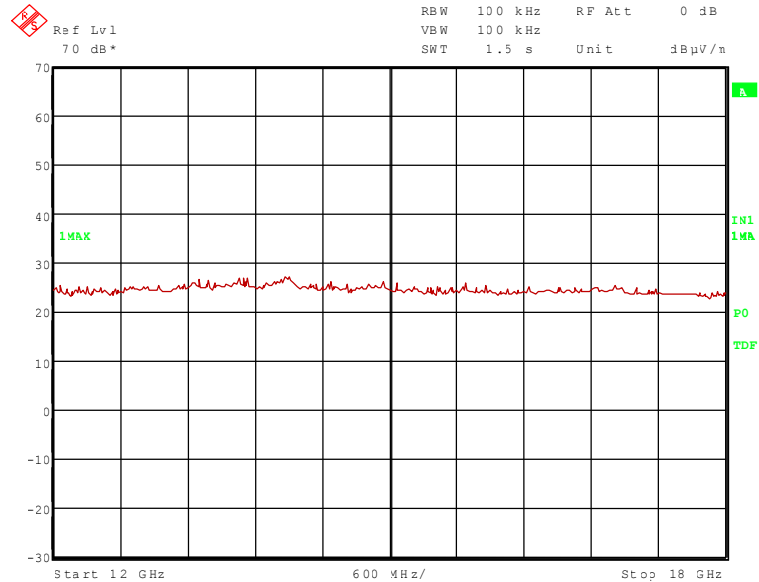
60502_1.wmf (1 GHz to 4 GHz):



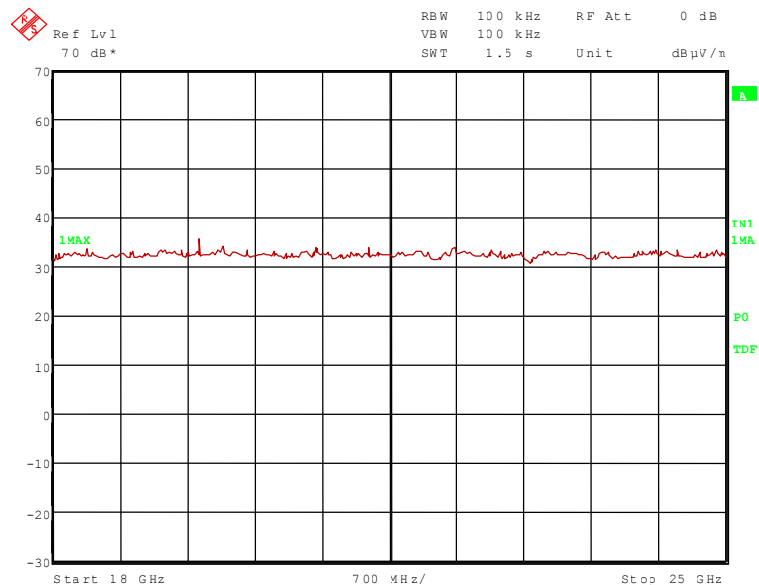
60502_6.wmf (4 GHz to 12 GHz):



60502_15.wmf (12 GHz to 18 GHz):



60502_20.wmf (18 GHz to 25 GHz):



The following frequencies were found inside the restricted bands during the preliminary radiated emission test:

- 4.824 GHz and 19.296 GHz.

The following frequency was found outside the restricted bands during the preliminary radiated emission test:

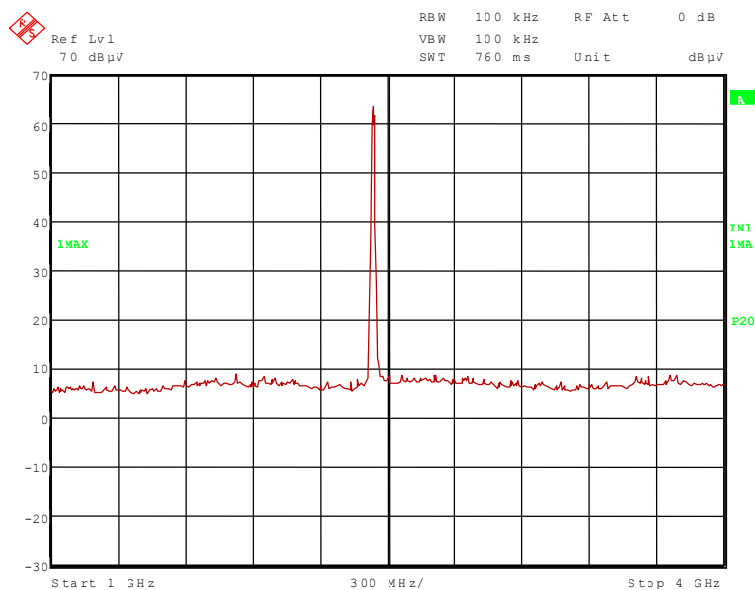
- 2.412 GHz.

These frequencies have to be measured in a final measurement. The results were presented in the following.

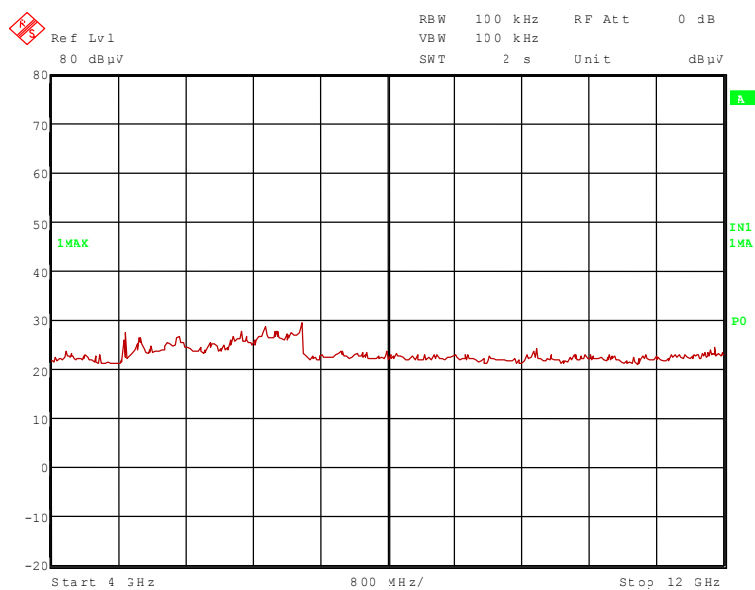
TEST REPORT REFERENCE: R60502_C Edition 1

Transmitter operates at the middle of the assigned frequency band (operation mode 2)

60502_2.wmf (1 GHz to 4 GHz):

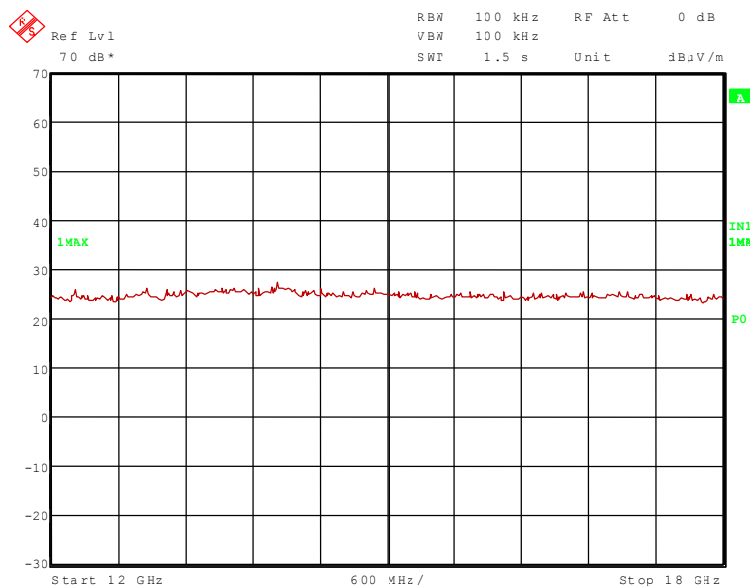


60502_5.wmf (4 GHz to 12 GHz):

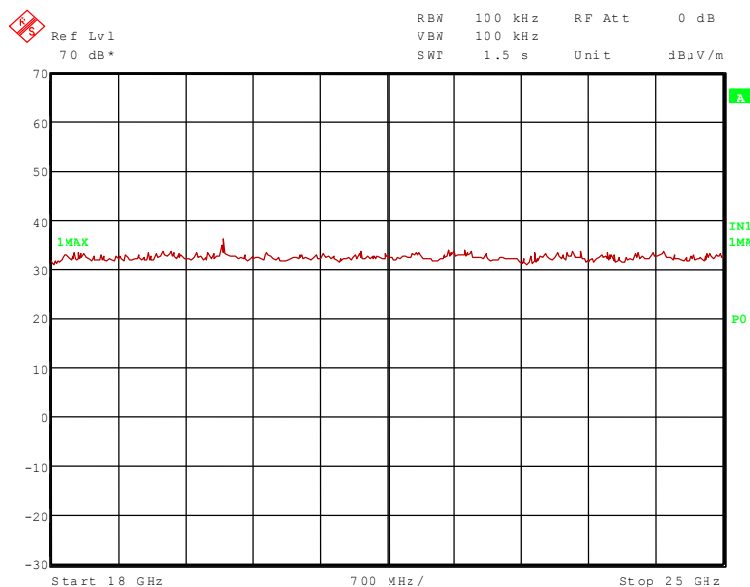


TEST REPORT REFERENCE: R60502_C Edition 1

60502_16.wmf (12 GHz to 18 GHz):



60502_19.wmf (18 GHz to 25 GHz):



The following frequencies were found inside the restricted bands during the preliminary radiated emission test:

- 4.874 GHz and 19.496 GHz.

The following frequency was found outside the restricted bands during the preliminary radiated emission test:

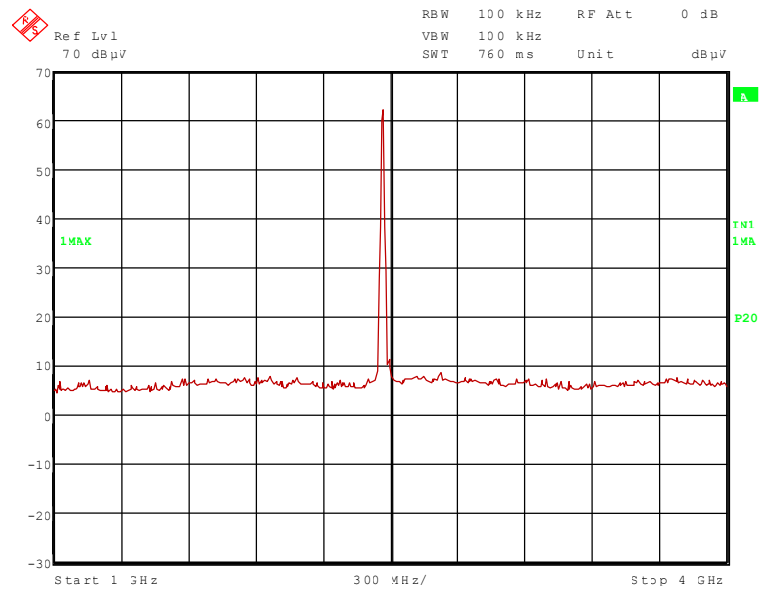
- 2.437 GHz.

These frequencies have to be measured in a final measurement. The results were presented in the following.

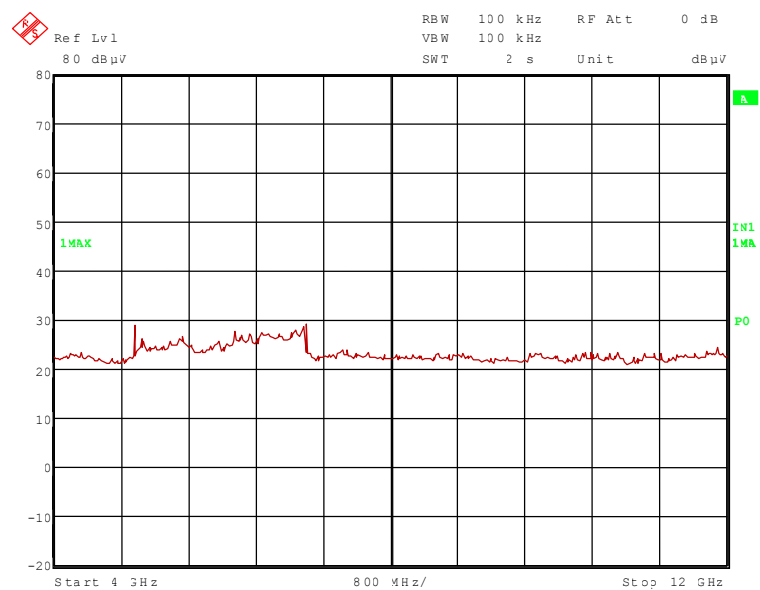
TEST REPORT REFERENCE: R60502_C Edition 1

Transmitter operates at the upper end of the assigned frequency band (operation mode 3)

60502_3.wmf (1 GHz to 4 GHz):

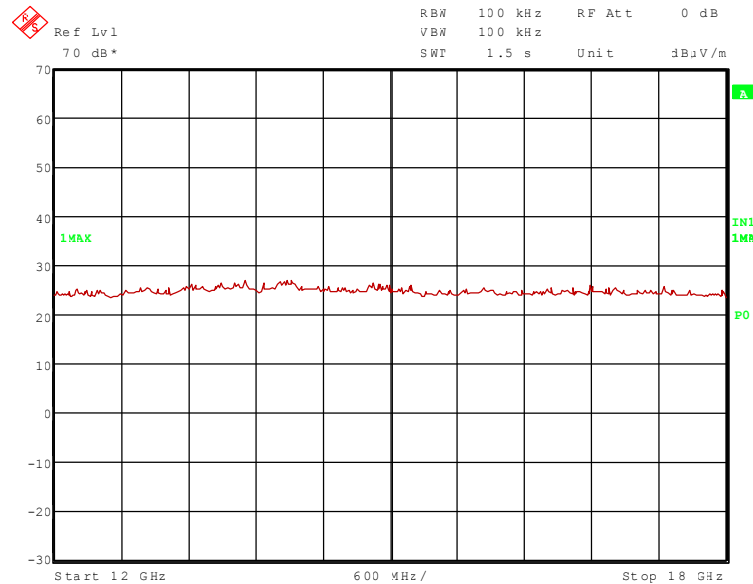


60502_4.wmf (4 GHz to 12 GHz):

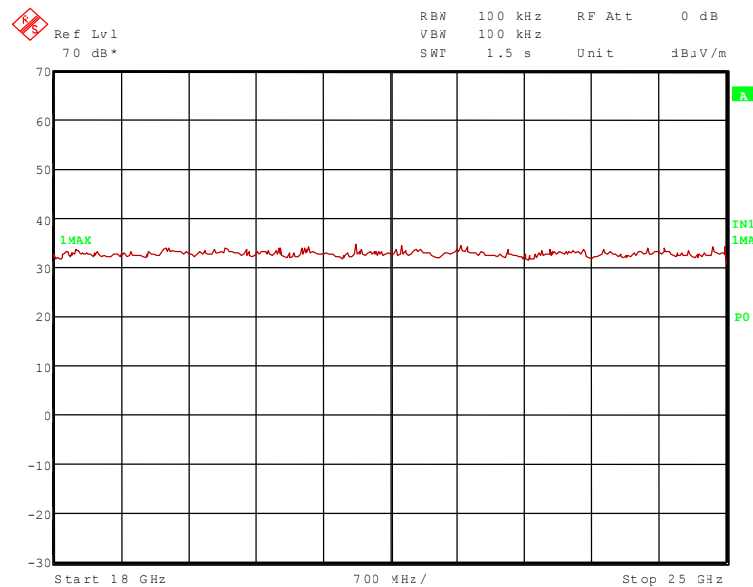


TEST REPORT REFERENCE: R60502_C Edition 1

60502_17.wmf (12 GHz to 18 GHz):



60502_18.wmf (18 GHz to 25 GHz):



The following frequency was found inside the restricted bands during the preliminary radiated emission test:

- 4.924 GHz.

The following frequency was found outside the restricted bands during the preliminary radiated emission test:

- 2.462 GHz.

These frequencies have to be measured in a final measurement. The results were presented in the following.

TEST REPORT REFERENCE: R60502_C Edition 1

5.5.2.6 FINAL MEASUREMENT WITH INTERNAL ANTENNA (1 GHz to 25 GHz)

Ambient temperature	20 °C	Relative humidity	60 %
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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.

Supply voltage: During all measurements the EUT was supplied with 5.0 V DC via the carrier board.

Resolution bandwidth: For all measurements a resolution bandwidth of 1 MHz was used.

Transmitter operates at the lower end of the assigned frequency band (operation mode 1)

Result measured with the peak 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
2.412	104.6	-	-	73.3	28.5	0.0	2.8	150	Hor.	-
4.824	50.3	74.0	23.7	39.1	33.1	25.7	3.8	150	Vert.	Yes
19.296	48.2	74.0	25.8	46.6	37.0	37.0	1.6	100	Hor.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Result 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
2.412	96.1	-	-	64.8	28.5	0.0	2.8	150	Hor.	-
4.824	39.5	54.0	14.5	28.3	33.1	25.7	3.8	150	Vert.	Yes
19.296	36.9	54.0	17.1	35.3	37.0	37.0	1.6	100	Hor.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

TEST REPORT REFERENCE: R60502_C Edition 1

Transmitter operates at the middle of the assigned frequency band (operation mode 2)

Result measured with the peak 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
2.437	105.0	-	-	73.5	28.7	0.0	2.8	150	Hor.	-
4.874	52.9	74.0	21.1	41.4	33.4	25.7	3.8	150	Hor.	Yes
19.496	47.7	74.0	26.3	46.1	37.0	37.0	1.6	100	Hor.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Result 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
2.437	96.6	-	-	65.1	28.7	0.0	2.8	150	Hor.	-
4.874	37.3	54.0	16.7	25.8	33.4	25.7	3.8	150	Hor.	Yes
19.496	37.5	54.0	16.5	35.9	37.0	37.0	1.6	100	Hor.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

TEST REPORT REFERENCE: R60502_C Edition 1

Transmitter operates at the upper end of the assigned frequency band (operation mode 3)

Result measured with the peak detector:

Frequency GHz	Corr. value dB μ V/m	Limit dB μ V/m	Margin dB	Readings dB μ V	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.462	105.1	-	-	73.6	28.7	0.0	2.8	150	Hor.	-
4.924	52.1	74.0	21.9	40.4	33.5	25.6	3.8	150	Vert.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Result measured with the average detector:

Frequency GHz	Corr. value dB μ V/m	Limit dB μ V/m	Margin dB	Readings dB μ V	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.462	96.6	-	-	65.1	28.7	0.0	2.8	150	Hor.	-
4.924	36.8	54.0	17.2	25.1	33.5	25.6	3.8	150	Vert.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

29, 31 – 37, 39, 43, 46, 49 – 51, 54

TEST REPORT REFERENCE: R60502_C Edition 1

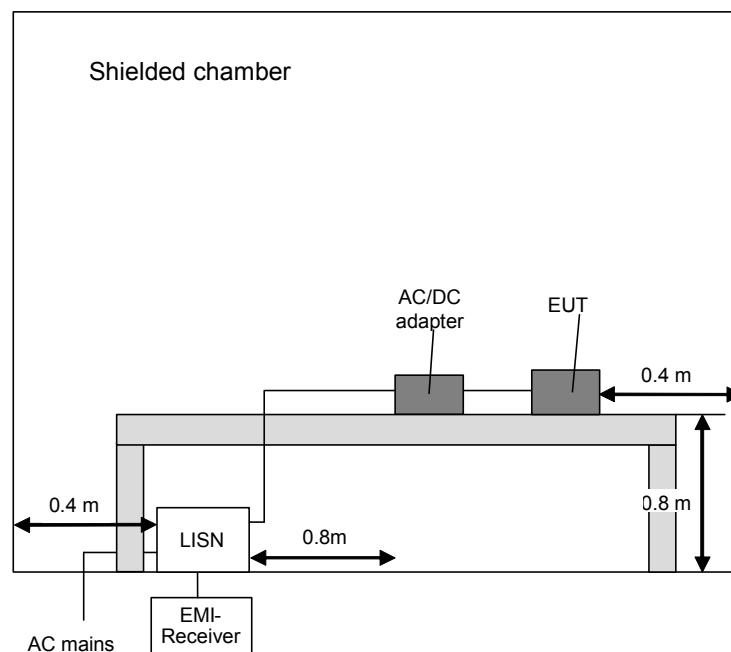
5.6 CONDUCTED EMISSIONS ON POWER SUPPLY LINES (150 kHz to 30 MHz)

5.6.1 METHOD OF MEASUREMENT

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 appropriate 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



TEST REPORT REFERENCE: R60502_C Edition 1

5.6.2 TEST RESULTS (CONDUCTED EMISSIONS ON POWER SUPPLY LINES)

Ambient temperature	20 °C	Relative humidity	43 %
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Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 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 via the carrier board and the mascot AC/DC adaptor.

Measurement uncertainty: +3.6 dB / -4.5 dB

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

EUT: WLAN module

Manufacturer: connectBlue AB

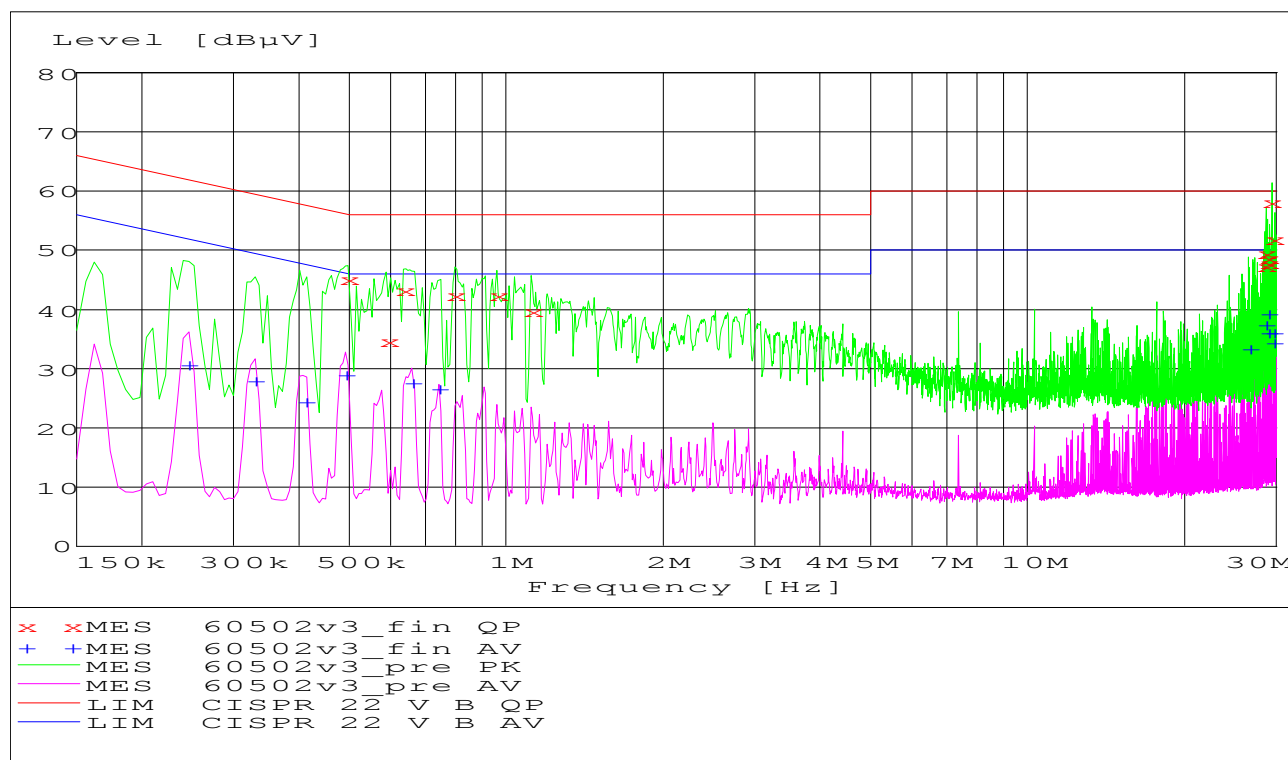
Operating Condition: produce_echo running

Test site: PHOENIX TEST-LAB Blomberg M4

Operator: Th. KÜHN

Test Specification: with MASCOT AC Adapter

Comment: Fibre optics / Ethernet converter were used for decoupling



Data record name: 60502v3

TEST REPORT REFERENCE: R60502_C Edition 1

Result measured with the quasipeak detector:

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

Frequency MHz	Level dBμV	Transducer dB	Limit dBμV	Margin dB	Line	PE
0.499740	45.30	0.8	56.0	10.7	L1	FLO
0.590820	34.90	0.8	56.0	21.1	L1	FLO
0.642390	43.50	0.8	56.0	12.5	N	FLO
0.799800	42.70	0.7	56.0	13.3	N	FLO
0.961530	42.70	0.8	56.0	13.3	N	FLO
1.119120	40.00	0.7	56.0	16.0	N	FLO
28.574790	49.70	3.2	60.0	10.3	L1	FLO
28.770270	47.60	3.2	60.0	12.4	N	FLO
28.931460	47.70	3.3	60.0	12.3	N	FLO
29.130990	48.80	3.3	60.0	11.2	L1	FLO
29.490450	58.20	3.3	60.0	1.8	L1	FLO
29.852520	51.80	3.2	60.0	8.2	L1	FLO

Data record name: 60502v3_fin QP

Result measured with the average detector:

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

Frequency MHz	Level dBμV	Transducer dB	Limit dBμV	Margin dB	Line	PE
0.245760	30.80	0.9	51.9	21.1	L1	FLO
0.328920	28.00	0.9	49.5	21.5	L1	FLO
0.410460	24.70	0.9	47.6	22.9	L1	FLO
0.494070	28.80	0.8	46.1	17.3	L1	FLO
0.660840	27.70	0.8	46.0	18.3	L1	FLO
0.744990	26.60	0.8	46.0	19.4	L1	FLO
26.609730	33.50	3.0	50.0	16.5	N	FLO
28.685850	37.60	3.2	50.0	12.4	L1	FLO
29.113260	36.30	3.3	50.0	13.7	L1	FLO
29.234400	39.30	3.3	50.0	10.7	L1	FLO
29.784300	34.60	3.3	50.0	15.4	L1	FLO
29.906790	36.10	3.2	50.0	13.9	L1	FLO

Data record name: 60502v3_fin AV

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

1 – 3, 5, 6

TEST REPORT REFERENCE: R60502_C Edition 1

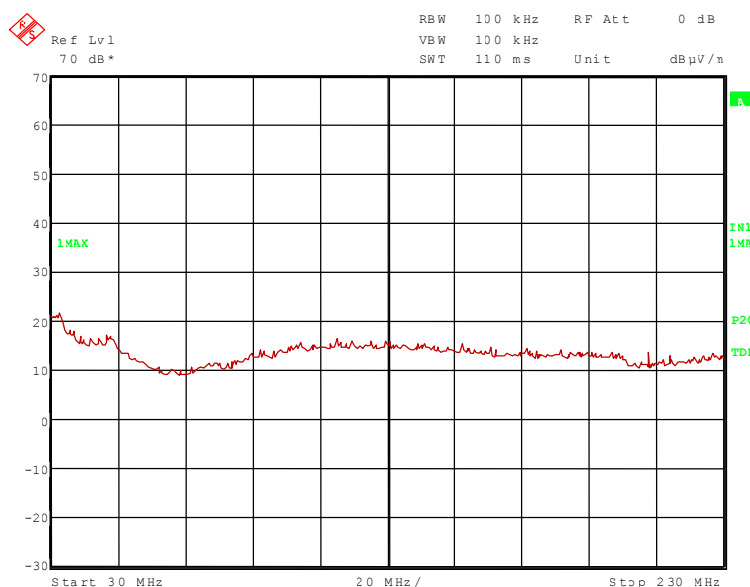
5.7 RADIATED EMISSIONS (RECEIVER)

5.7.1 PRELIMINARY MEASUREMENT WITH EXTERNAL PLANAR ANTENNA (30 MHz to 25 GHz)

Ambient temperature	20 °C	Relative humidity	45 %
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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. Where not otherwise stated the test was carried out in test mode 7 of the EUT, because there was no difference to the other test modes.
Supply voltage:	During all measurements the EUT was supplied with 5.0 V DC via the carrier board.
Remark:	As external antenna the SPA 2400/75/8/0/V was used, because of the highest gain of this antenna type. Additionally pre-tests have shown, that this antenna caused the highest spurious emissions of all planar antennas.

60502_56.wmf (30 MHz to 230 MHz):

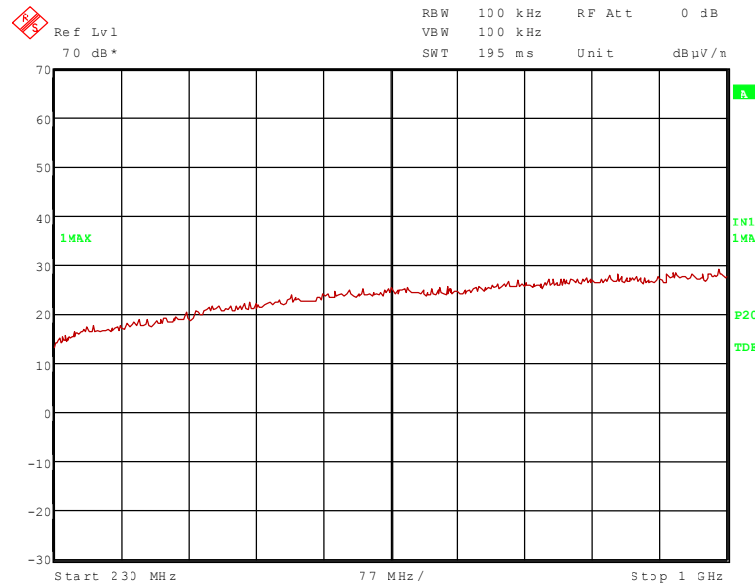


TEST EQUIPMENT USED FOR THE TEST:

29, 31 – 37, 39, 43, 46, 49 – 51, 54

TEST REPORT REFERENCE: R60502_C Edition 1

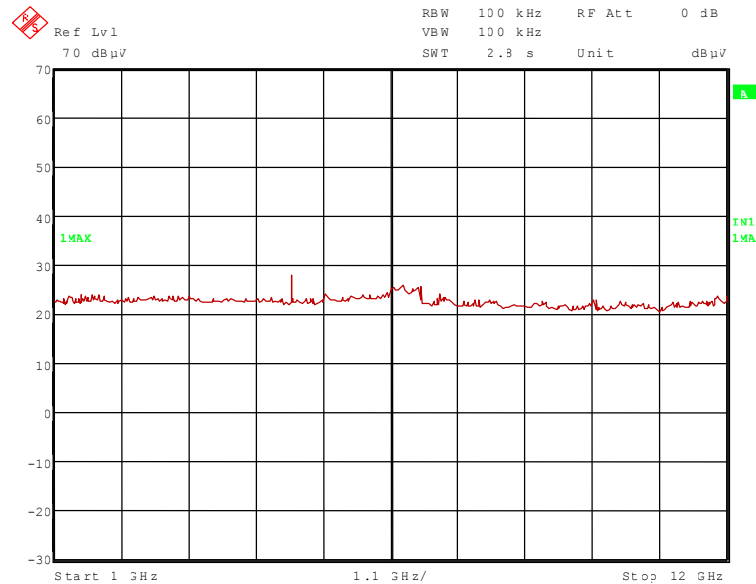
60502_57.wmf (230 MHz to 1 GHz):



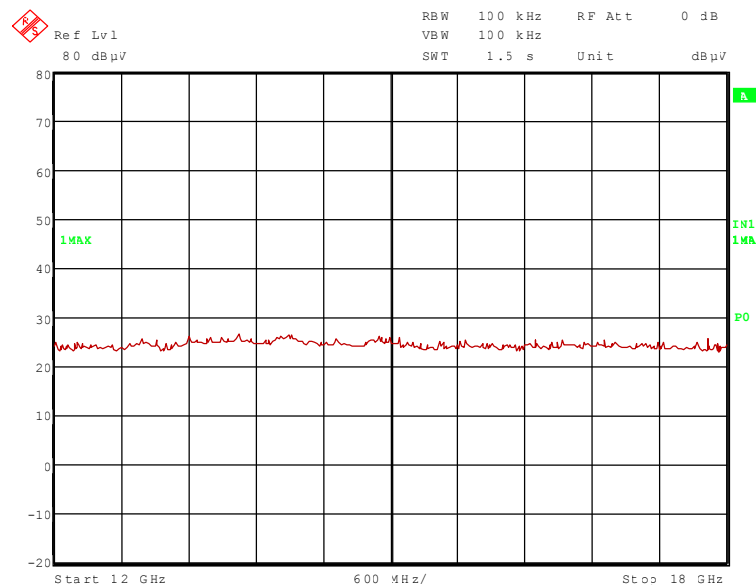
No significant frequencies above the noise floor of the system were found during the preliminary radiated emission test, so no measurements were carried out the open area test site.

TEST REPORT REFERENCE: R60502_C Edition 1

60502_28.wmf (1 GHz to 12 GHz):

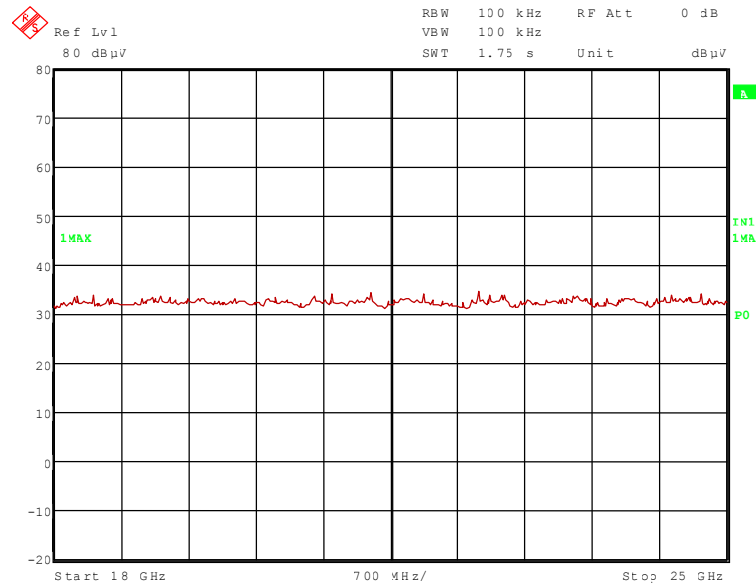


60502_42.wmf (12 GHz to 18 GHz):



TEST REPORT REFERENCE: R60502_C Edition 1

60502_43.wmf (18 GHz to 25 GHz):



The following frequency was found during the preliminary radiated emission measurement:

- 4.874 GHz.

This frequency has to be measured in a final measurement. The results were presented in the following.

TEST REPORT REFERENCE: R60502_C Edition 1

5.7.2 FINAL MEASUREMENT WITH EXTERNAL PLANAR ANTENNA (1 GHz to 25 GHz)

Ambient temperature	19 °C	Relative humidity	36 %
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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. Where not otherwise stated the test was carried out in test mode 7 of the EUT, because there was no difference to the other test modes.
- Supply voltage:** During all measurements the EUT was supplied with 5.0 V DC via the carrier board.
- Resolution bandwidth:** For all measurements a resolution bandwidth of 1 MHz was used.
- Remark:** As external antenna the SPA 2400/75/8/0/V was used, because of the highest gain of this antenna type. Additionally pre-tests have shown that this antenna caused the highest spurious emissions of all planar antennas.

Result measured with the peak 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.
4.874	45.7	74.0	28.3	34.2	33.4	25.7	3.8	150	Hor.

Result 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.
4.874	38.8	54.0	15.2	27.3	33.4	25.7	3.8	150	Hor.

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

29, 31 – 37, 39, 43, 46, 49 – 51, 54

TEST REPORT REFERENCE: R60502_C Edition 1

5.7.3 PRELIMINARY MEASUREMENT WITH EXTERNAL MONOPOLE ANTENNA (30 MHz to 25 GHz)

Ambient temperature	20 °C	Relative humidity	45 %
---------------------	-------	-------------------	------

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.

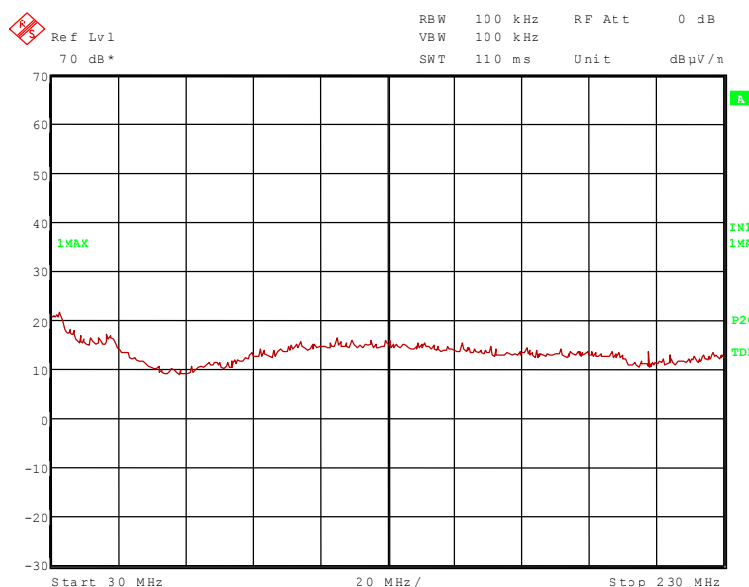
Cable guide: The cable of the EUT was fixed on the non-conducting table. For further information of the cable guide refer to the pictures in annex A of this test report.

Test record: All results are shown in the following. Where not otherwise stated the test was carried out in test mode 7 of the EUT, because there was no difference to the other test modes.

Supply voltage: During all measurements the EUT was supplied with 5.0 V DC via the carrier board.

Remark: As external antenna the IG-103 was used, because of the highest gain of this antenna type. Additionally pre-tests have shown that this antenna caused the highest spurious emissions of all monopole antennas.

60502_54.wmf (30 MHz to 230 MHz):

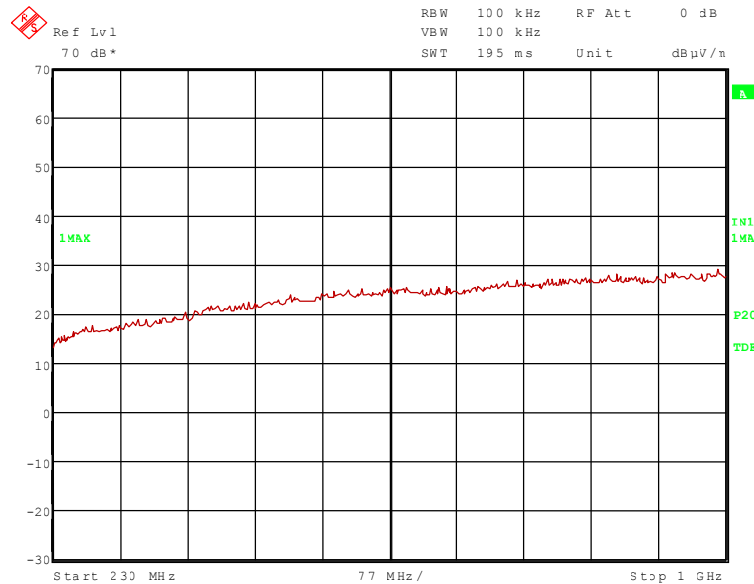


TEST EQUIPMENT USED FOR THE TEST:

29, 31 – 37, 39, 43, 46, 49 – 51, 54

TEST REPORT REFERENCE: R60502_C Edition 1

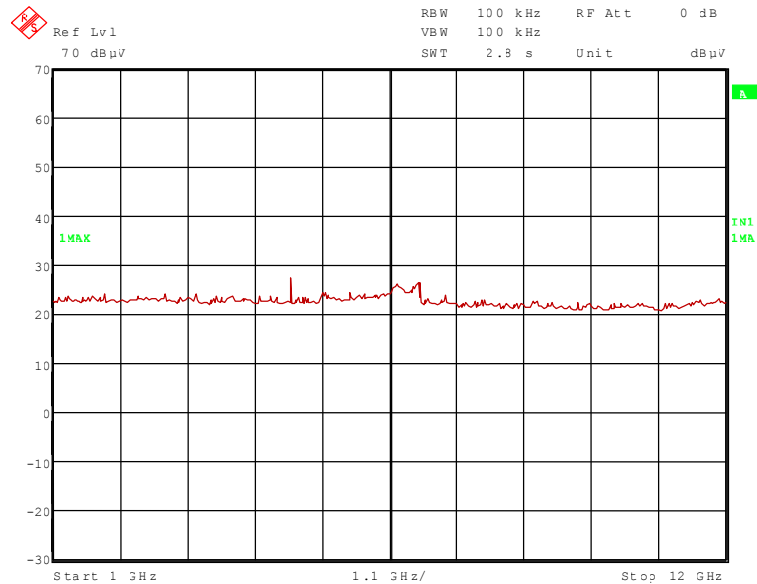
60502_55.wmf (230 MHz to 1 GHz):



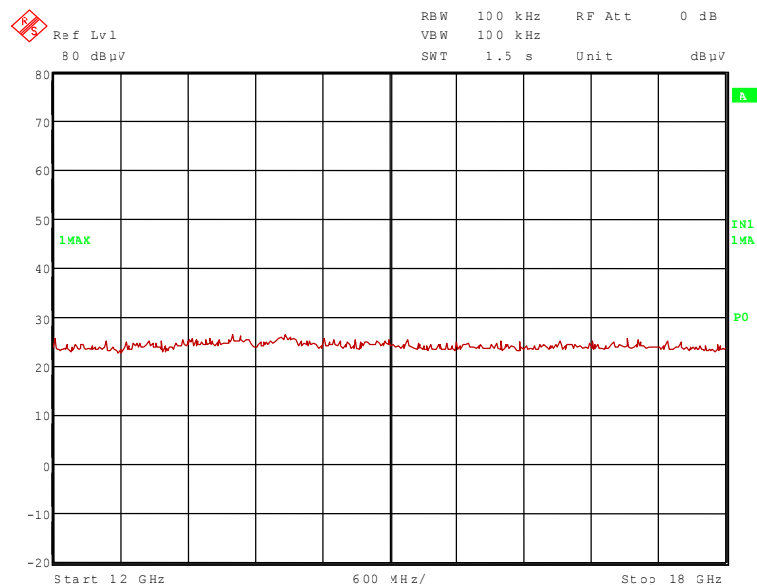
No significant frequencies above the noise floor of the system were found during the preliminary radiated emission test, so no measurements were carried out the open area test site.

TEST REPORT REFERENCE: R60502_C Edition 1

60502_29.wmf (1 GHz to 12 GHz):

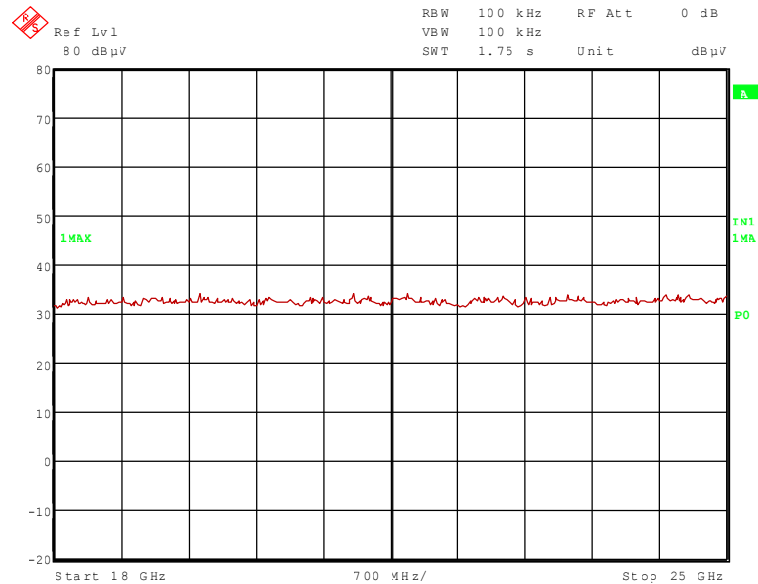


60502_52.wmf (12 GHz to 18 GHz):



TEST REPORT REFERENCE: R60502_C Edition 1

60502_53.wmf (18 GHz to 25 GHz):



The following frequency was found during the preliminary radiated emission measurement:

- 4.874 GHz.

This frequency has to be measured in a final measurement. The results were presented in the following.

TEST REPORT REFERENCE: R60502_C Edition 1

5.7.4 FINAL MEASUREMENT WITH EXTERNAL MONOPOLE ANTENNA (1 GHz to 25 GHz)

Ambient temperature	19 °C	Relative humidity	36 %
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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. Where not otherwise stated the test was carried out in test mode 7 of the EUT, because there was no difference to the other test modes.

Supply voltage: During all measurements the EUT was supplied with 5.0 V DC via the carrier board.

Resolution bandwidth: For all measurements a resolution bandwidth of 1 MHz was used.

Remark: As external antenna the IG-103 was used, because of the highest gain of this antenna type. Additionally pre-tests have shown that this antenna caused the highest spurious emissions of all monopole antennas.

Result measured with the peak 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.
4.874	45.3	74.0	28.3	33.8	33.4	25.7	3.8	150	Hor.

Result 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.
4.874	38.8	54.0	15.2	27.3	33.4	25.7	3.8	150	Hor.

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

29, 31 – 37, 39, 43, 46, 49 – 51, 54

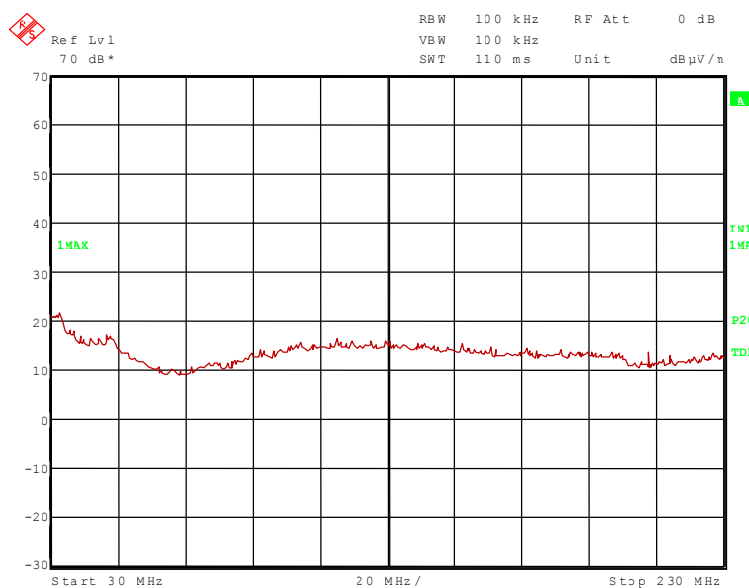
TEST REPORT REFERENCE: R60502_C Edition 1

5.7.5 PRELIMINARY MEASUREMENT WITH INTERNAL ANTENNA (30 MHz to 25 GHz)

Ambient temperature	19 °C	Relative humidity	36 %
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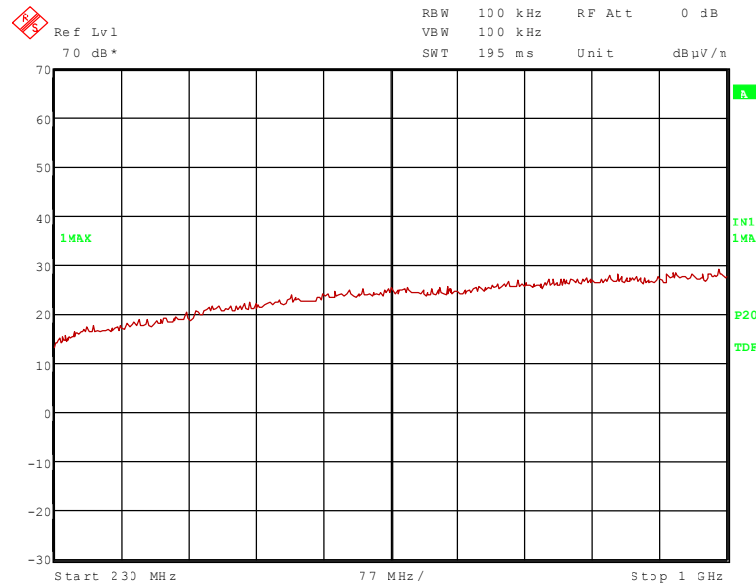
- Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.
- Cable guide: The cable of the EUT was fixed on the non-conducting table. For further information of the cable guide refer to the pictures in annex A of this test report.
- Test record: All results are shown in the following. Where not otherwise stated the test was carried out in test mode 7 of the EUT, because there was no difference to the other test modes.
- Supply voltage: During all measurements the EUT was supplied with 5.0 V DC via the carrier board.

60502_8.wmf (30 MHz to 230 MHz):



TEST REPORT REFERENCE: R60502_C Edition 1

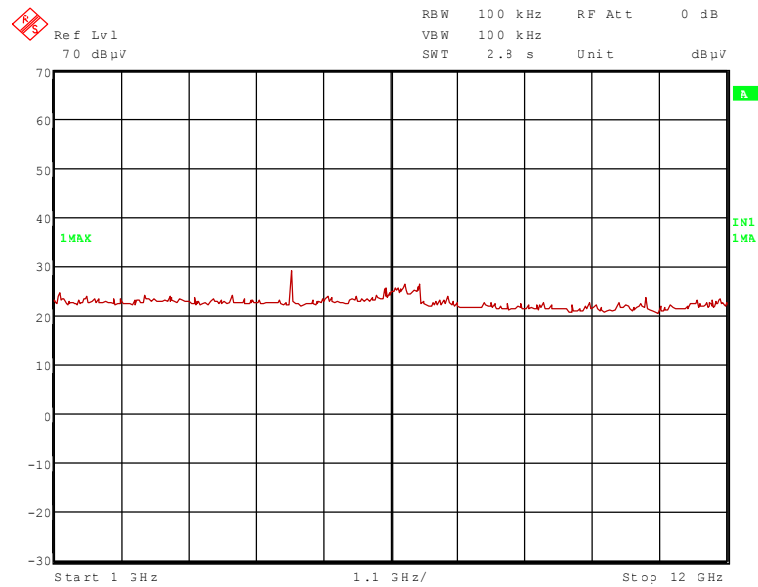
60502_9.wmf (230 MHz to 1 GHz):



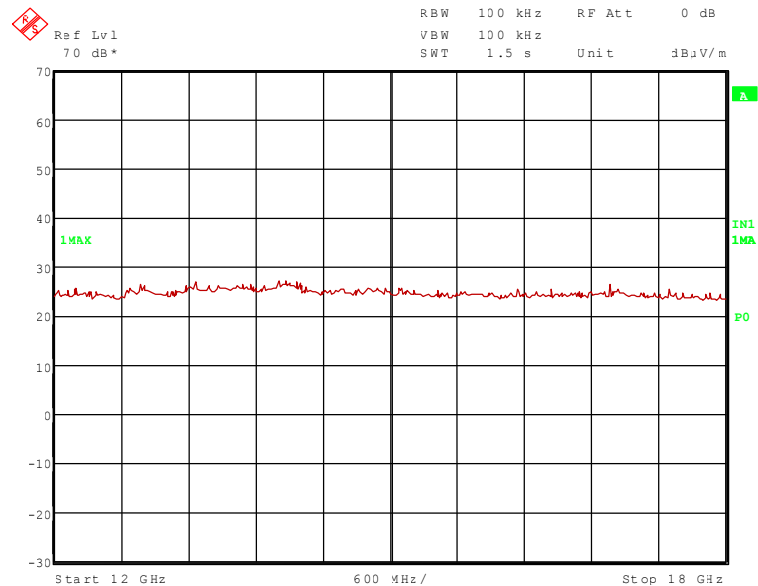
No significant emissions above the noise floor found during the preliminary emission test. So no final test has to be carried out on an open area test site.

TEST REPORT REFERENCE: R60502_C Edition 1

60502_7.wmf (1 GHz to 12 GHz):

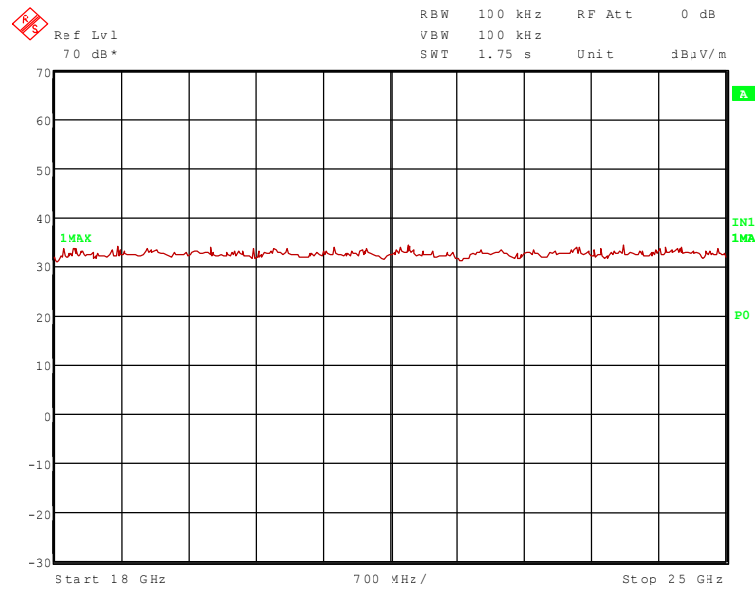


60502_14.wmf (12 GHz to 18 GHz):



TEST REPORT REFERENCE: R60502_C Edition 1

60502_21.wmf (18 GHz to 25 GHz):



The following frequency was found during the preliminary radiated emission measurement:

- 4.874 GHz.

This frequency has to be measured in a final measurement. The results were presented in the following.

TEST REPORT REFERENCE: R60502_C Edition 1

5.7.6 FINAL MEASUREMENT WITH INTERNAL ANTENNA (1 GHz to 25 GHz)

Ambient temperature	19 °C	Relative humidity	36 %
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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. Where not otherwise stated the test was carried out in test mode 7 of the EUT, because there was no difference to the other test modes.
- Supply voltage: During all measurements the EUT was supplied with 5.0 V DC via the carrier board.
- Resolution bandwidth: For all measurements a resolution bandwidth of 1 MHz was used.

Result measured with the peak 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.
4.874	46.1	74.0	27.9	34.6	33.4	25.7	3.8	150	Hor.

Result 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.
4.874	38.2	54.0	15.8	26.7	33.4	25.7	3.8	150	Hor.

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

29, 31 – 37, 39, 43, 46, 49 – 51, 54

TEST REPORT REFERENCE: R60502_C Edition 1

6 TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

TEST REPORT REFERENCE: R60502_C Edition 1

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: R60502_C Edition 1

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	Standard Gain Horn 11.9GHz – 18GHZ	18240-20	Flann Microwave	483	480294
38	Standard Gain Horn 11.9GHz – 18GHZ	18240-20	Flann Microwave	482	480295
39	Standard Gain Horn 17.9GHz – 26.7GHZ	20240-20	Flann Microwave	411	480297
40	Standard Gain Horn 17.9GHz – 26.7GHZ	20240-20	Flann Microwave	410	480296
41	Standard Gain Horn 26.4GHz – 40.1GHZ	22240-20	Flann Microwave	469	480299

TEST REPORT REFERENCE: R60502_C Edition 1

No.	Test equipment	Type	Manufacturer	Serial No.	PM-No
42	Standard Gain Horn 26.4GHz – 40.1GHz	22240-20	Flann Microwave	468	480298
43	RF-cable No. 30	RTK 081	Rosenberger	-	410141
44	RF-cable No. 31	RTK 081	Rosenberger	-	410142
45	RF-cable 1m	KPS-1533- 400-KPS	Insulated Wire	-	480300
46	RF-cable 1m	KPS-1533- 400-KPS	Insulated Wire	-	480301
47	RF-cable 2m	KPS-1533- 400-KPS	Insulated Wire	-	480302
48	RF-cable No. 5	RTK 081	Rosenberger		410097
49	Preamplifier	JS3- 00101200- 23-5A	Miteq	681851	480337
50	Preamplifier	JS3- 12001800- 16-5A	Miteq	571667	480343
51	Preamplifier	JS3- 18002600- 20-5A	Miteq	658697	480342
52	Preamplifier	JS3- 26004000- 25-5A	Miteq	563593	480344
53	EMI Software	ES-K1	Rohde & Schwarz	-	480111

Ancillary equipment used for testing					
No.	Test equipment	Type	Manufacturer	Serial No.	PM-No
54	Power supply	TOE 8852	Toellner	51712	480233
55	Peak Power Sensor	NRV-Z32	Rohde & Schwarz	849745/016	480551
-	-	-	-	-	-
-	-	-	-	-	-

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

TEST REPORT REFERENCE: R60502_C Edition 1

7 LIST OF ANNEXES

Annex A	Photographs of the test set-ups:	7 pages
	cB-OWLAN211bx-02 with external monopole antenna, test set-up fully anechoic chamber	60502_15.jpg
	cB-OWLAN211bx-02 with external planar antenna, test set-up fully anechoic chamber	60502_4.jpg
	cB-OWLAN211bi-02 with internal antenna, test set-up fully anechoic chamber	60502_13.jpg
	cB-OWLAN211bx-02 with external monopole antenna, test set-up fully anechoic chamber	60502_1.jpg
	cB-OWLAN211bx-02 with external planar antenna, test set-up fully anechoic chamber	60502_6.jpg
	cB-OWLAN211bi-02 with internal antenna, test set-up fully anechoic chamber	60502_5.jpg
	cB-OWLAN211bx-02 test set-up conducted emission measurement	60502_22.jpg
ANNEX B	INTERNAL PHOTOGRAPHS OF THE TEST SAMPLE:	7 pages
	cB-OWLAN211bx-02 (sample for external antenna), top view	60502_c.jpg
	cB-OWLAN211bi-02 (sample with internal antenna), top view	60502_h.jpg
	cB-OWLAN211bx-02 / cB-OWLAN211bi-02, bottom view	60502_b.jpg
	cB-0703-02, carrier board with cB-OWLAN211bx-02, top view	60502_g.jpg
	cB-0703-02, carrier board, top view	60502_f.jpg
	cB-0703-02, carrier board, bottom view	60502_e.jpg
	EUT initiator, top view	60502_a.jpg
ANNEX C	EXTERNAL PHOTOGRAPHS OF THE TEST SAMPLE:	- pages
	Because the EUT is a module, which is intended to be implemented inside a final application, no external photographs were available	