PHOENIX TESTLAB
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Test Report

Report Number: F113483E1

Applicant:

Ziehl Abegg AG

Manufacturer:

Ziehl Abegg AG

Equipment under Test (EUT):

EM-W

Laboratory (CAB) accredited by
Deutsche Gesellschaft für Akkreditierung mbH
in compliance with DIN EN ISO/IEC 17025
under the Reg. No. DGA-PL-105/99-22,
FCC Test site registration number 90877

REFERENCES

[1] **ANSI C63.4-2009** 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.

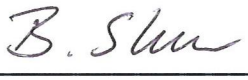
[2] **FCC CFR 47 Part 15 (August 2011)** Radio Frequency Devices

[3] **Publication Number 913591 (March 2007)** Measurement of radiated emissions at the edge of the band for a Part 15 RF device

[4] **558074 D01 DTS Meas Guidance v01 (January 2012)** Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

TEST RESULT

The requirements of the tests performed as shown in the overview (clause 4) were fulfilled by the equipment under test.
The complete test results are presented in the following.

	Name	Signature	Date
Test engineer:	Manuel BASTERT		14 June 2012
Authorized reviewer:	Bernd STEINER		14 June 2012

RESERVATION

This test report is only valid in its original form.

The test results herein refer only to the tested sample. PHOENIX TESTLAB GmbH is not responsible for any generalizations 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 NUMBER.

Contents: Page

1 IDENTIFICATION

1.1 Applicant

Name:	Ziehl Abegg AG
Address:	Heinz-Ziehl-Straße 74653 Künzelsau
Country:	Germany
Name for contact purposes:	Mr. Dirk NOWOSAD
Phone:	+49 (0) 7940 16-372
Fax:	+49 (0) 7940 16-200
Mail address:	dirk.nowosad@ziehl-abegg.de

1.2 Manufacturer

Name:	Ziehl Abegg AG
Address:	Heinz-Ziehl-Straße 74653 Künzelsau
Country:	Germany
Name for contact purposes:	Mr. Dirk NOWOSAD
Phone:	+49 (0) 7940 16-372
Fax:	+49 (0) 7940 16-200
Mail address:	dirk.nowosad@ziehl-abegg.de

1.3 Test laboratory

The tests were carried out at: **PHOENIX TESTLAB GmbH**
Königswinkel 10
32825 Blomberg
Germany

accredited by DGA Deutsche Gesellschaft für Akkreditierung mbH in compliance with DIN EN ISO/IEC 17025 under Reg. No. DGA-PL-105/99-22, FCC Test site registration number 90877 and Industry Canada Test site registration IC3469A-1.

1.4 EUT (Equipment Under Test)

Test object: *	Radio module
Type: *	EM-W
FCC ID: *	Z48-EMW
IC: *	9955A-EMW
Serial number: *	Engineering sample
PCB identifier: *	MOSI16
Hardware version: *	1136 / Index00
Software version: *	RFTESTMODE 1.0

1.5 Technical data of equipment

Antenna type: *	F antenna					
Antenna gain: *	2 dBi					
Rated output power: *	0 dBm					
Power supply: *	U_{nom} =	3.0 V_{DC}	U_{min} =	2.7 V_{DC}	U_{max} =	3.4 V_{DC}
Type of modulation: *	O-PSK					
Operating frequency: *	2400 to 2480 MHz					
Number of channels: *	16					
Temperature range: *	-25 °C to 85 °C					
Lowest / highest Internal clock frequency: *	16 MHz +/- 40 ppm					
Ancillary equipment:	Carrier board					

* declared by the applicant.

The following external I/O cables were used:

No cables are connectable to the EUT.

1.6 Dates

Date of receipt of test sample:	16 February 2012
Start of test:	17 February 2012
End of test:	14 March 2012

2 OPERATIONAL STATES

The EUT is a module intended to be used to control and maintenance Ziehl-Abegg fans. The module will be mounted into a terminal. The modules are used only for Ziehl-Abegg products.
To test the module the manufacturer provided a carrier board for power supply and to set the necessary parameters.

The module was supplied with 3.3 V_{DC}.

All tests were carried out with samples with integral antenna; no samples with temporary antenna connector were available.

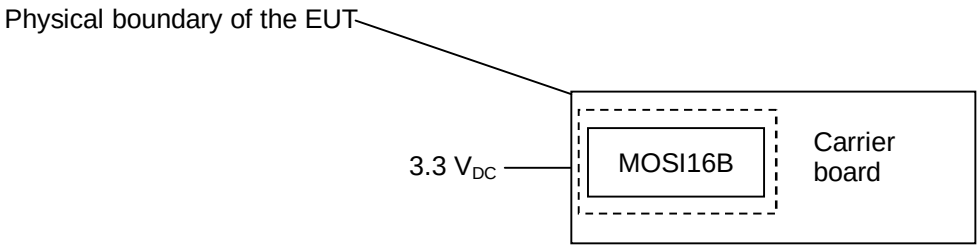
The tested samples were set into a test mode enabling continuous transmission with normal modulation with jumpers on the carrier board.

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

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

The following operation modes were used

Operation mode	Description of the operation mode	Modulation	Data rate / Mbps
1	Continuous transmitting on 2405 MHz	O-PSK	0.25 Mbps
2	Continuous transmitting on 2445 MHz	O-PSK	0.25 Mbps
3	Continuous transmitting on 2480 MHz	O-PSK	0.25 Mbps



3 ADDITIONAL INFORMATION

None.

4 OVERVIEW

Application	Frequency range [MHz]	FCC 47 CFR Part 15 section [2]	RSS 210, Issue 8 [4] or RSS-Gen, Issue 3 [5]	Status	Refer page
6 dB bandwidth	2400.0 - 2483.5	15.247 (a) (2)	A8.2 (a) [4]	Passed	8 et seq.
Maximum peak output power	2400.0 - 2483.5	15.247 (b) (3), (4)	A8.4 (4) [4]	Passed	11 et seq.
Power spectral density	2400.0 - 2483.5	15.247 (e)	A8.2 (b) [4]	Passed	15 et seq.
Band edge compliance	2400.0 - 2483.5	15.247 (d)	A8.5 [4]	Passed	7 et seq.
Radiated emissions (transmitter)	0.009 - 25,000	15.205 (a) 15.209 (a)	7.2.2 [5], 2.5 [4]	Passed	22 et seq.
Conducted emissions on supply line	0.15 - 30	15.207 (a)	7.2.4 [5]	Not applicable*	-

*) Battery powered device

5 TEST RESULTS

5.1 6 dB bandwidth

5.1.1 Method of measurement (6 dB 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.

Acceptable measurement configurations

The measurement procedures described herein are based on the use of an antenna-port conducted test configuration. However, in those cases where antenna-port conducted tests cannot be performed, then the use of a radiated measurement configuration is acceptable to demonstrate compliance to the various emissions limit requirements specified in §15.247. These procedures are equally applicable to either antenna-port conducted or radiated measurements.

If a radiated test configuration is used, then the measured field strength levels must be converted to equivalent conducted power levels for final comparison to the applicable emissions limit. See KDB Publication 412172 for guidance with respect to converting the measured field strength to EIRP. In order to determine the equivalent antenna-port conducted power from the EIRP, subtract the transmit antenna gain of the EUT (in dBi).

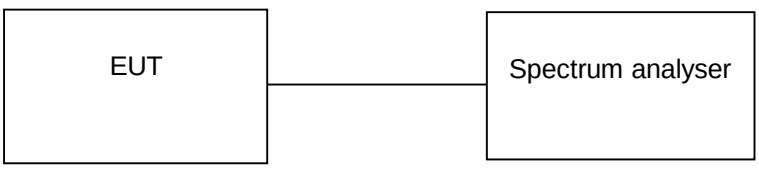
The following spectrum analyser settings shall be used:

- Span: App. 2 to 3 times the 6 dB bandwidth, centred on the actual channel.
- Resolution bandwidth: 1-5 % of the emission bandwidth.
- Video bandwidth: Three times 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 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:

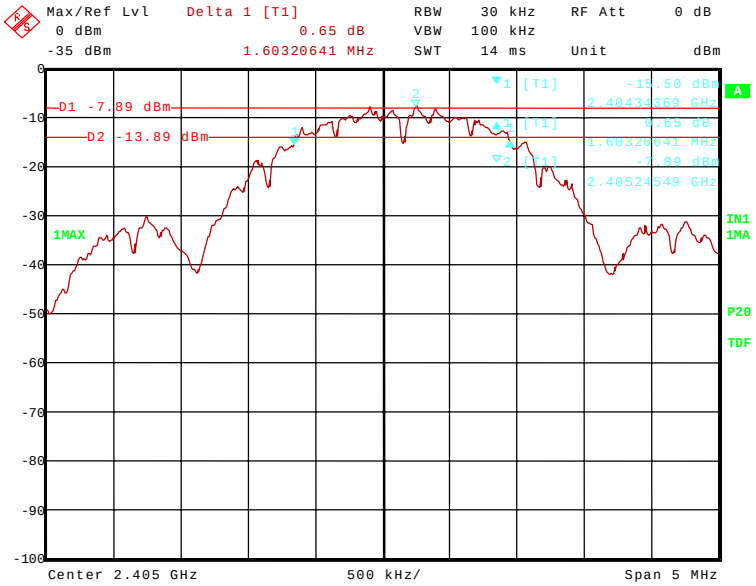


5.1.2 Test results (6 dB bandwidth)

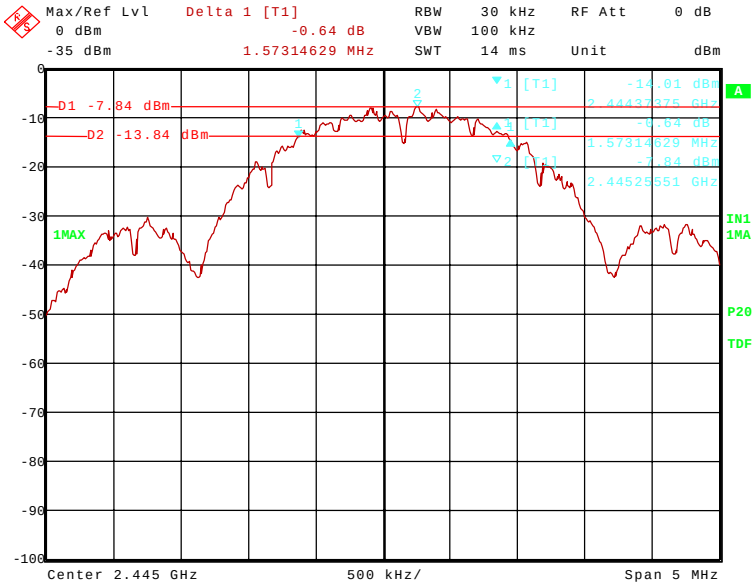
Ambient temperature	21 °C

Relative humidity	20 %

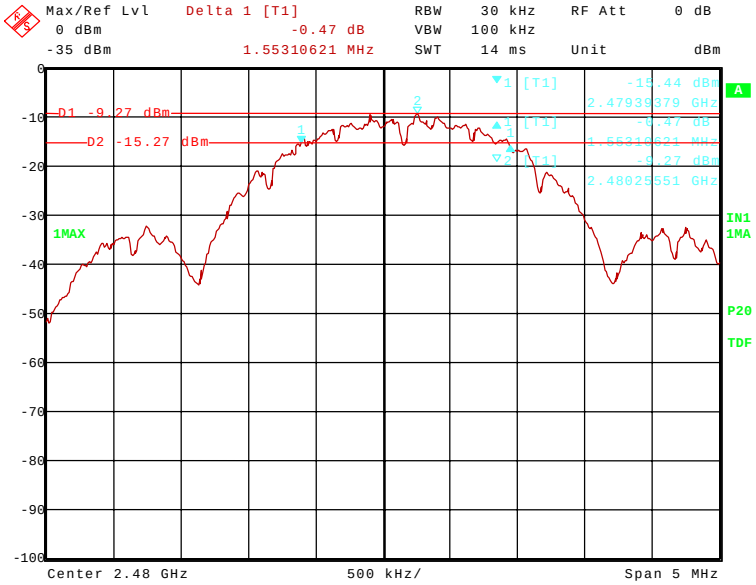
113483_17.wmf: 6 dB bandwidth (operation mode 1):



113483_16.wmf: 6 dB bandwidth (operation mode 2):



113483_15.wmf: 6 dB bandwidth (operation mode 3):



Operation mode 1 to 3			
Channel number	Channel frequency [MHz]	6 dB bandwidth [kHz]	Bandwidth limit [kHz]
0	2405	1603.206	>500 kHz
8	2445	1573.146	>500 kHz
15	2480	1553.106	>500 kHz
Measurement uncertainty		□ □ $1*10^{-7}$	

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

29, 31 – 34, 36, 43

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.

Acceptable measurement configurations

The measurement procedures described herein are based on the use of an antenna-port conducted test configuration. However, in those cases where antenna-port conducted tests cannot be performed, then the use of a radiated measurement configuration is acceptable to demonstrate compliance to the various emissions limit requirements specified in §15.247. These procedures are equally applicable to either antenna-port conducted or radiated measurements.

If a radiated test configuration is used, then the measured field strength levels must be converted to equivalent conducted power levels for final comparison to the applicable emissions limit. See KDB Publication 412172 for guidance with respect to converting the measured field strength to EIRP. In order to determine the equivalent antenna-port conducted power from the EIRP, subtract the transmit antenna gain of the EUT (in dBi).

Measurement procedure PK1:

The following spectrum analyser settings shall be used (available RBW is ≥ EBW):

- Span: Zero.
- Resolution bandwidth: RBW ≥ EBW.
- Video bandwidth: Three times the resolution bandwidth.
- Sweep: Auto.
- Detector function: peak.
- Trace mode: Max hold.
- Use marker function to determine the peak value

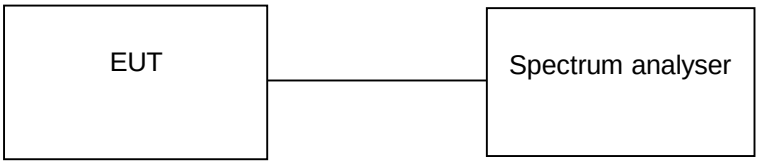
Measurement procedure PK2:

The following spectrum analyser settings shall be used (available RBW is < EBW):

- Span: 5-30 % > EBW.
- Resolution bandwidth: 1 MHz.
- Video bandwidth: 3 MHz.
- Sweep: Auto.
- Detector function: peak.
- Trace mode: Max hold.
- Use the spectrum analyser's integrated band power measurement function with band limits set equal to the EBW band edges.

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

Test set-up:

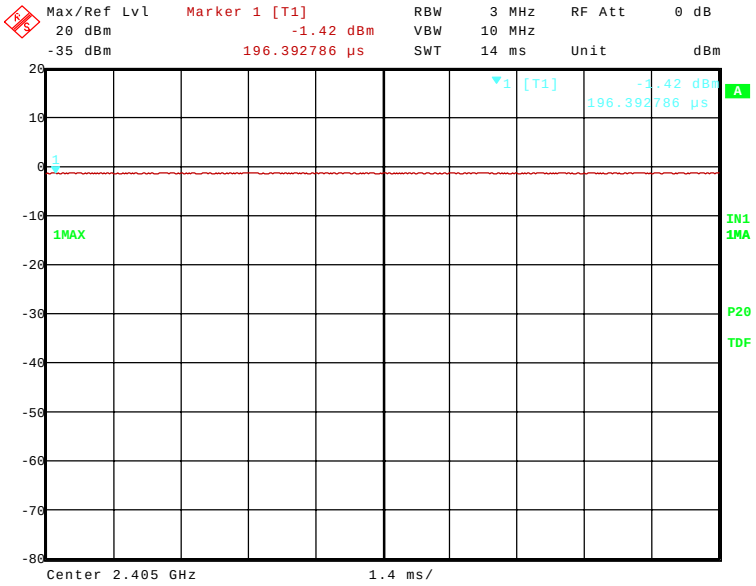


5.2.2 Test results (maximum peak output power)

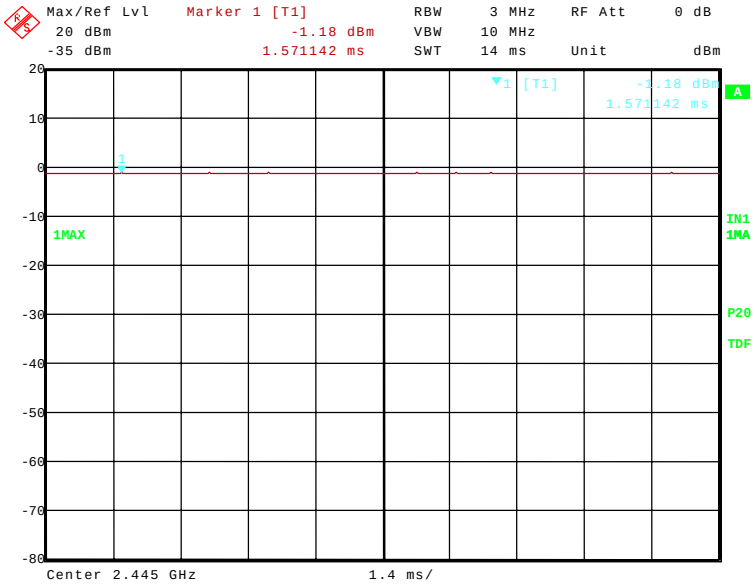
Ambient temperature	21 °C

Relative humidity	20 %

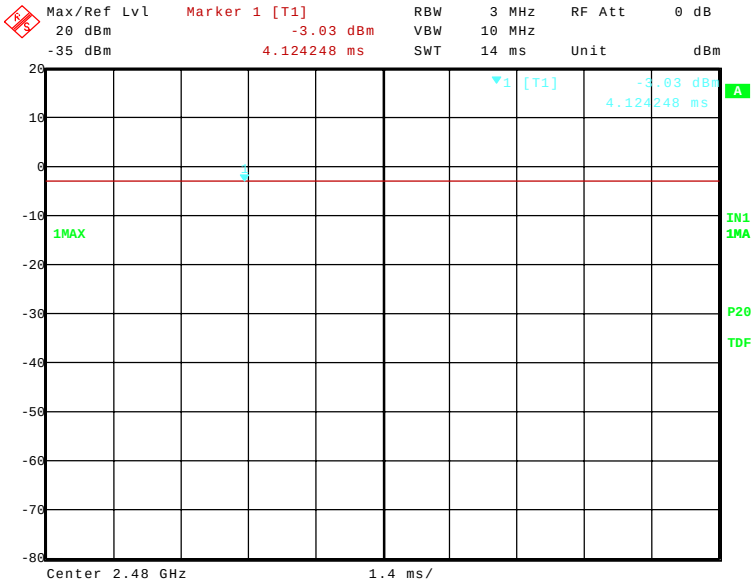
113483_18.wmf: Effective isotropic radiated power (EIRP) (operation mode 1):



113483_19.wmf: Effective isotropic radiated power (EIRP) (operation mode 2):



113483_20.wmf: Effective isotropic radiated power (EIRP) (operation mode 3):



Used measurement procedure: PK1					
Operation mode 1 to 3					
Channel number	Channel frequency [MHz]	Effective isotropic radiated power [dBm]	Antenna gain [dBi]	Maximum peak output power [dBm]	Peak power limit [dBm]
0	2405	-1.42	2	-3.42	30.0
8	2445	-1.18	2	-3.18	30.0
15	2480	-3.03	2	-5.03	30.0
Measurement uncertainty			+0.66 dB / -0.72 dB		

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

29, 31 – 34, 36, 43

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.

Acceptable measurement configurations

The measurement procedures described herein are based on the use of an antenna-port conducted test configuration. However, in those cases where antenna-port conducted tests cannot be performed, then the use of a radiated measurement configuration is acceptable to demonstrate compliance to the various emissions limit requirements specified in §15.247. These procedures are equally applicable to either antenna-port conducted or radiated measurements.

If a radiated test configuration is used, then the measured field strength levels must be converted to equivalent conducted power levels for final comparison to the applicable emissions limit. See KDB Publication 412172 for guidance with respect to converting the measured field strength to EIRP. In order to determine the equivalent antenna-port conducted power from the EIRP, subtract the transmit antenna gain of the EUT (in dBi).

Measurement procedure PKPS (use this procedure in case of maximum peak conducted output power used to demonstrate compliance):

The following spectrum analyser settings shall be used:

- Span: 5 – 30 % greater than the EBW.
- Resolution bandwidth: 100 kHz.
- Video bandwidth: 300 kHz.
- Sweep: Auto.
- Detector function: peak.
- Trace mode: Max hold.
- Use the peak marker to determine the maximuum power level in any 100 kHz band segment within the fundamental EBW.
- Scale the observed power level to an equivalent value in 3 kHz by adjusting the measured power by an bandwidth correction factor of -15.2 dB.

Measurement procedure AVGPSD (use this procedure in case of maximum average conducted output power used to demonstrate compliance):

The EUT must be configured to transmit continuously at full power over the measurement duration!

The following spectrum analyser settings shall be used:

- Span: 5 – 30 % greater than the EBW.
- Resolution bandwidth: 100 kHz.
- Video bandwidth: 300 kHz.
- Detector function: RMS.
- Trace mode: Single sweep.
- Ensure that the number of measurement points in the sweep ≥ 2 x span /RBW
- Sweep: ≥ 10 x number of measurement points in sweep x transmission symbol period
- Use the peak marker to determine the maximuum power level in any 100 kHz band segment within the fundamental EBW.
- Scale the observed power level to an equivalent value in 3 kHz by adjusting the measured power by an bandwidth correction factor of -15.2 dB.

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

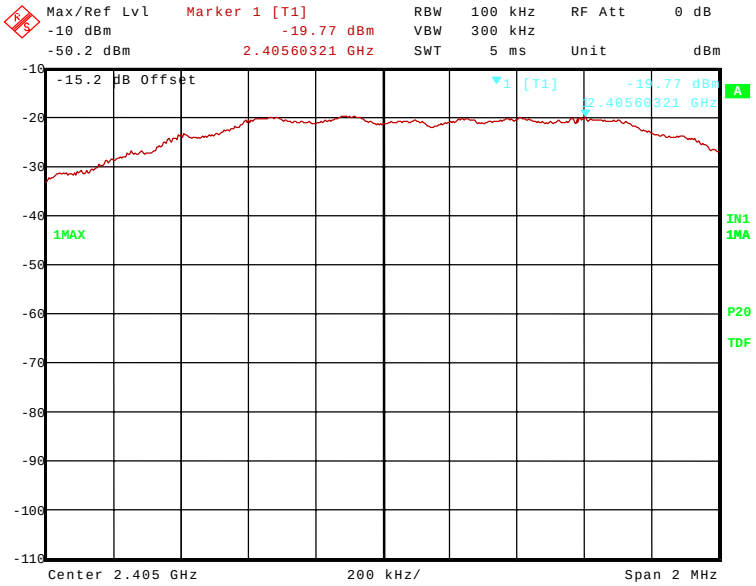
Test set-up:

5.3.2 Test results (power spectral density)

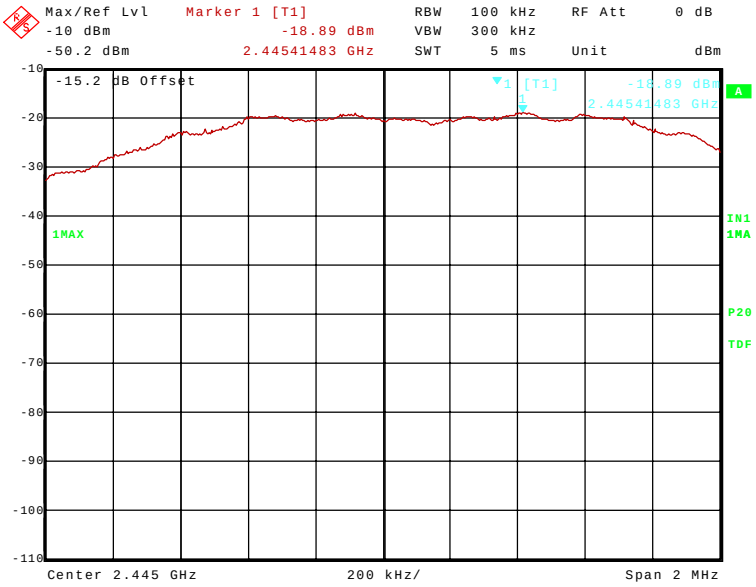
Ambient temperature	21 °C

Relative humidity	20 %

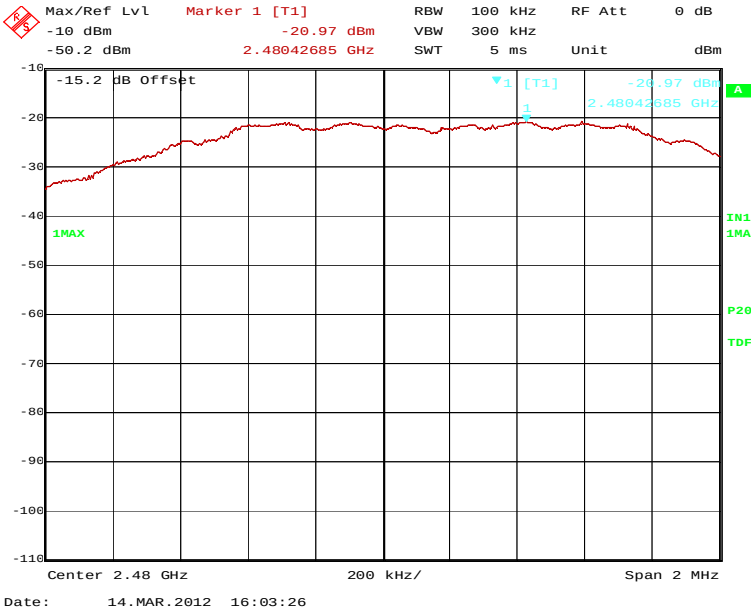
113483_23.wmf: Power spectral density (radiated) (operation mode 1):



113483_22.wmf: Power spectral density (radiated) (operation mode 2):



113483_21.wmf: Power spectral density (radiated) (operation mode 3):



Used measurement procedure: PKPSD					
Operation mode 1 to 3					
Channel number	Channel frequency [MHz]	Readings Power spectral density [dBm / 3 kHz)	Antenna gain [dBi]	Power spectral density [dBm / 3 kHz]	Power spectral density limit [dBm / 3 kHz]
0	2405	-19.77	2	-21.77	8.0
8	2445	-18.89	2	-20.89	8.0
15	2480	-20.97	2	-22.97	8.0
Measurement uncertainty			+1.1 dB / -1.5 dB		

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

29, 31 – 34, 36, 43

5.4 Band-edge compliance

5.4.1 Method of measurement (band-edge compliance (radiated))

The same test set-up as used for the final radiated emission measurement shall be used (refer also sub clause 5.3.1 of this test report). The measurements shall be carried out with using a resolution bandwidth of 100 kHz.

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: 100 kHz.
- Video bandwidth: □ the resolution bandwidth.
- Sweep: Auto.
- Detector function: Peak.
- Trace mode: Max hold.

Wait after trace stabilisation. The frequency line shall be set on the edge of the assigned frequency band. Set the 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. This frequency shall be measured with the EMI receiver as described in subclause 5.7.1 of this test report, but 100 kHz resolution bandwidth shall be used.

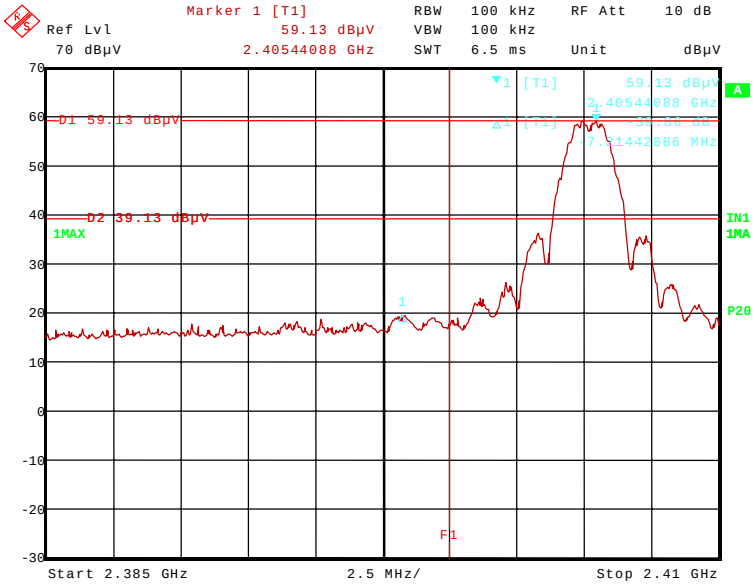
The measurement will be performed at the upper end of the assigned frequency band.

5.4.2 Test result (band-edge compliance (radiated))

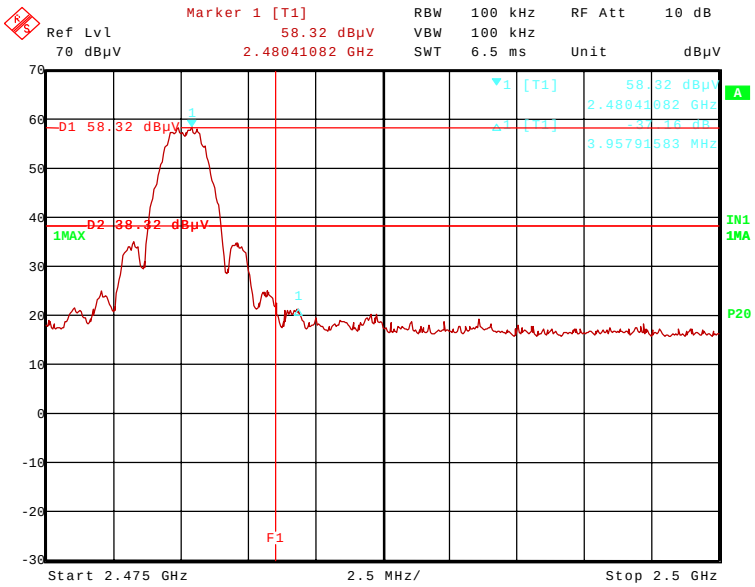
Ambient temperature	21 °C	Relative humidity	32 %

Operation mode: Continuous modulated transmission

113483_11.wmf: Radiated band-edge compliance at lower band edge:



113483_10.wmf: Radiated band-edge compliance at upper band edge:



Band-edge compliance (lower band edge)										
Result measured with the peak detector:										
Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Reading dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.405	93.8	-	-	61.8	28.3	0.0	3.7	150	Hor.	-
2.39832	30.2	74.0	43.8	24.7	28.3	26.5	3.7	150	Hor.	No
Result measured with the average detector:										
Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Reading dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.405	90.6	-	-	58.6	28.3	0.0	3.7	150	Hor.	-
2.39832	19.7	70.6	50.9	14.2	28.3	26.5	3.7	150	Hor.	No
Measurement uncertainty							+2.2 dB / -3.6 dB			

Band-edge compliance (upper band edge)										
Result measured with the peak detector:										
Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Reading dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.480	84.5	-	-	52.4	28.4	0.0	3.7	150	Hor.	-
2.39605	40.0	74.0	34.1	8.0	28.3	0.0	3.7	150	Hor.	No
Result measured with the average detector:										
Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Reading dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.433198	58.1	-	-	26.0	28.4	0.0	3.7	150	Hor.	-
2.39605	26.9	54.0	27.1	-5.1	28.3	0.0	3.7	150	Hor.	No
Measurement uncertainty							+2.2 dB / -3.6 dB			

Test: Passed

29, 31 – 34, 36, 43

5.5 Radiated emissions

5.5.1 Method of measurement (radiated emissions)

The radiated emission measurement is subdivided into four 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 side with reflecting ground plane and various antenna height in the frequency range 30 MHz to 1 GHz.
- A preliminary measurement carried out in a fully anechoic chamber with a variable antenna distance and height in the frequency range 1 GHz to 110 GHz.
- A final measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 1 GHz to 110 GHz.

All measurements will be carried out with the EUT working on the middle of the assigned frequency band.

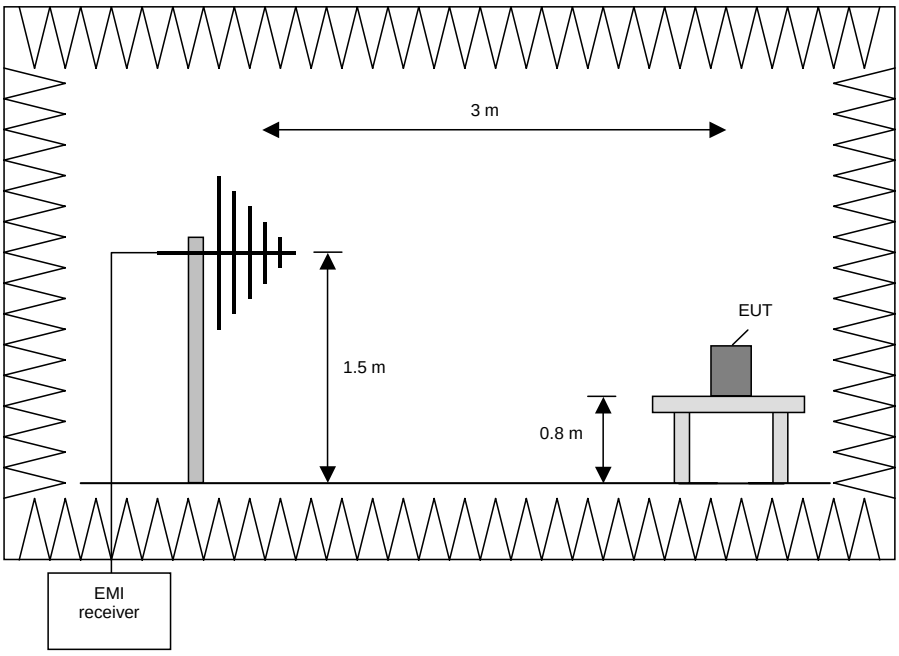
Preliminary measurement (30 MHz to 1 GHz)

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 C63.4-2009 [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:

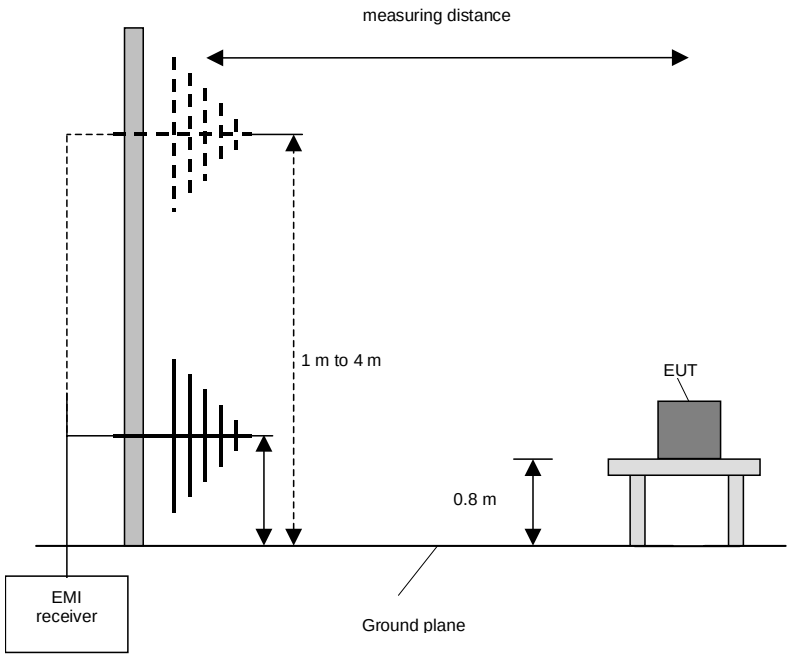
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Manipulate the system cables within the range to produce the maximum level of emission.
3. Rotate the EUT by 360 ° to maximize the detected signals.
4. Make a hardcopy of the spectrum.
5. Measure the frequency of the 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 (because of EUT is a module and might be used in a handheld equipment application).
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



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 (because of EUT is a module and might be used in a handheld equipment application).

Preliminary and final measurement (1 GHz to 110 GHz)

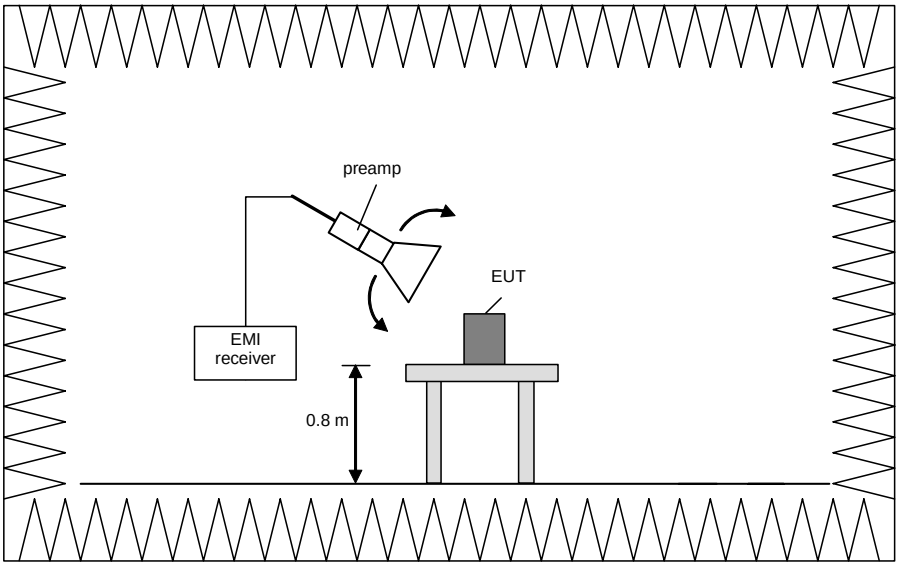
This measurement will be performed in a fully anechoic chamber. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices will be placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4-2009 [1].

Preliminary measurement (1 GHz to 110 GHz)

The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The spectrum analyser 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, the antenna close to the EUT and while moving the antenna over all sides of the EUT. With the spectrum analyser in CLEAR / WRITE mode the cone of the emission should be found. Then the measuring distance will be set to 3 m with the receiving antenna moving in this cone of emission. At this position the final measurement will be carried out.

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 26.5 GHz	100 kHz
26.5 GHz to 40 GHz	100 kHz
40 GHz to 60 GHz	100 kHz
50 GHz to 75 GHz	100 kHz
75 GHz to 110 GHz	100 kHz

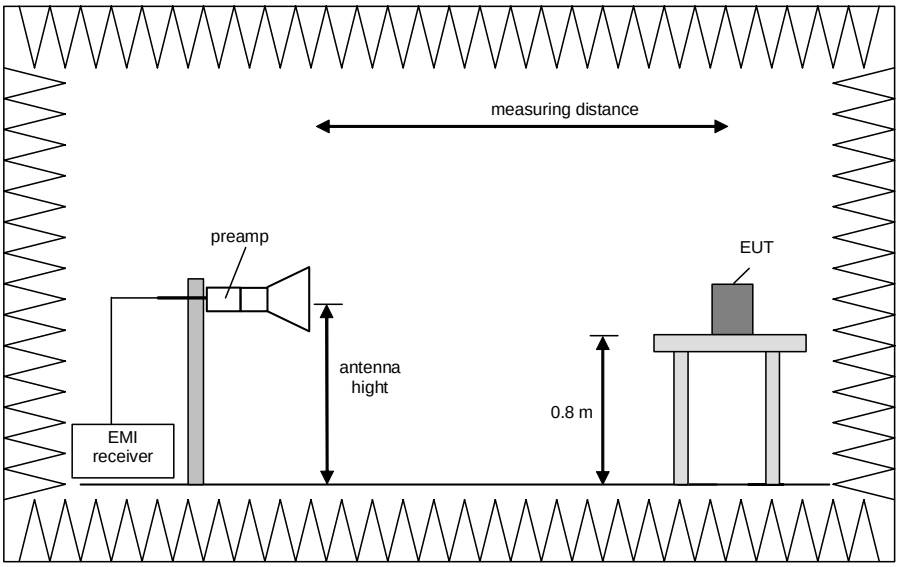


Final measurement (1 GHz to 110 GHz)

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 peak and average 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 ° in order to have the antenna inside the cone of radiation.

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 26.5 GHz	1 MHz
26.5 GHz to 40 GHz	1 MHz
40 GHz to 60 GHz	1 MHz
50 GHz to 75 GHz	1 MHz
75 GHz to 110 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, 18 GHz to 26.5 GHz, 26.5 GHz to 40 GHz, 40 GHz to 60 GHz, 60 GHz to 75 GHz and 75 GHz to 110 GHz.
The following procedure will be used:

1) Monitor the frequency range at horizontal polarisation and move the antenna over all sides of the EUT (if necessary move the EUT to another orthogonal axis).
2) Change the antenna polarisation and repeat 1) with vertical polarisation.
3) Make a hardcopy of the spectrum.
4) Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
5) Change the analyser mode to Clear / Write and found the cone of emission.
6) Rotate and move the EUT, so that the measuring distance can be enlarged to 3 m and the antenna will be still inside the cone of emission.
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) for the next antenna spot if the EUT is larger than the antenna beam width.

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

5.5.2 Test results (radiated emissions)

5.5.2.1 Preliminary emission measurement (1 MHz to 25 GHz)

Ambient temperature	20 °C	Relative humidity	32 %

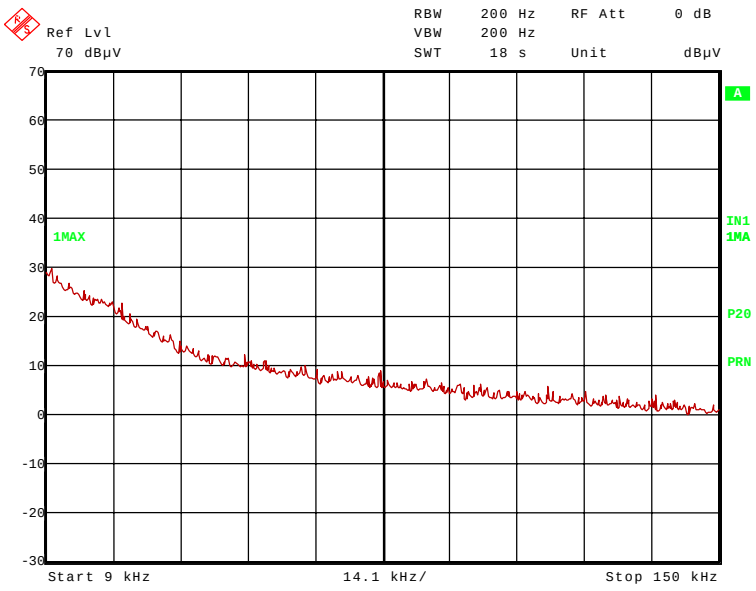
Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.

Cable guide: No cables were connectable to the EUT. For detail information of test set-up refer to the pictures in annex A of this test report.

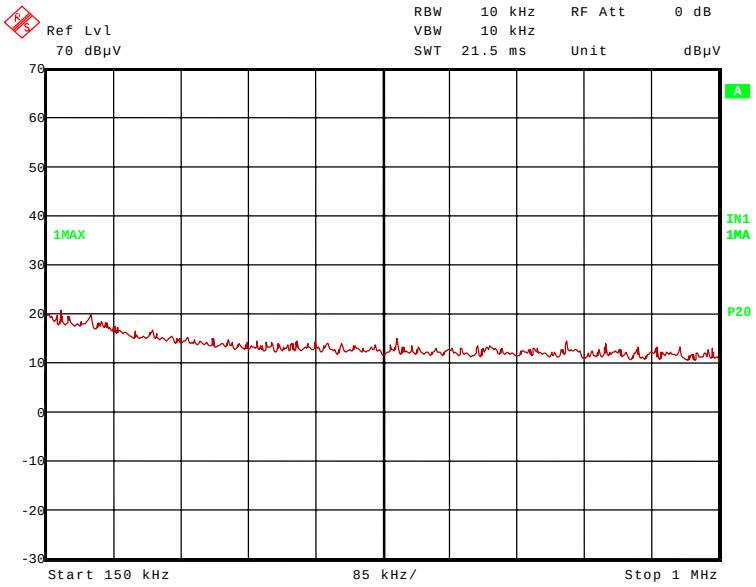
Test record: All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied 3.3 V_{DC}.

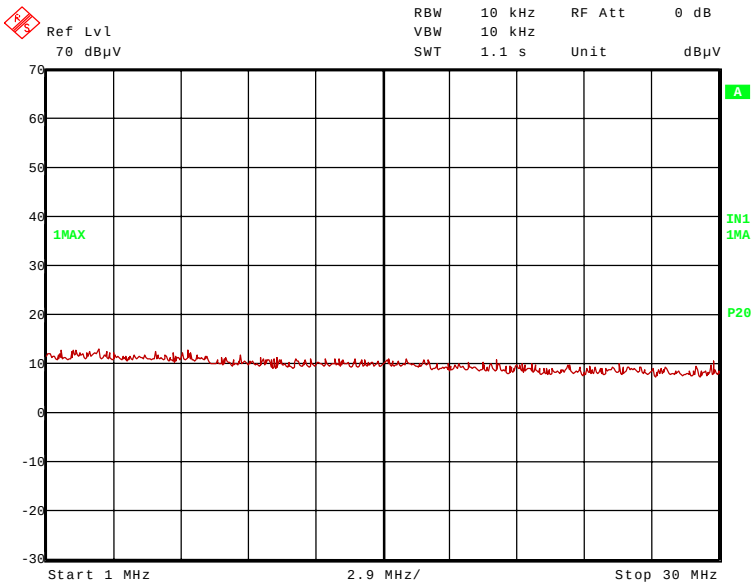
113483_24.wmf: (9 kHz to 150 kHz)



113483_25.wmf: (150 kHz to 1 MHz)



113483_26.wmf: (1 MHz to 30 MHz)

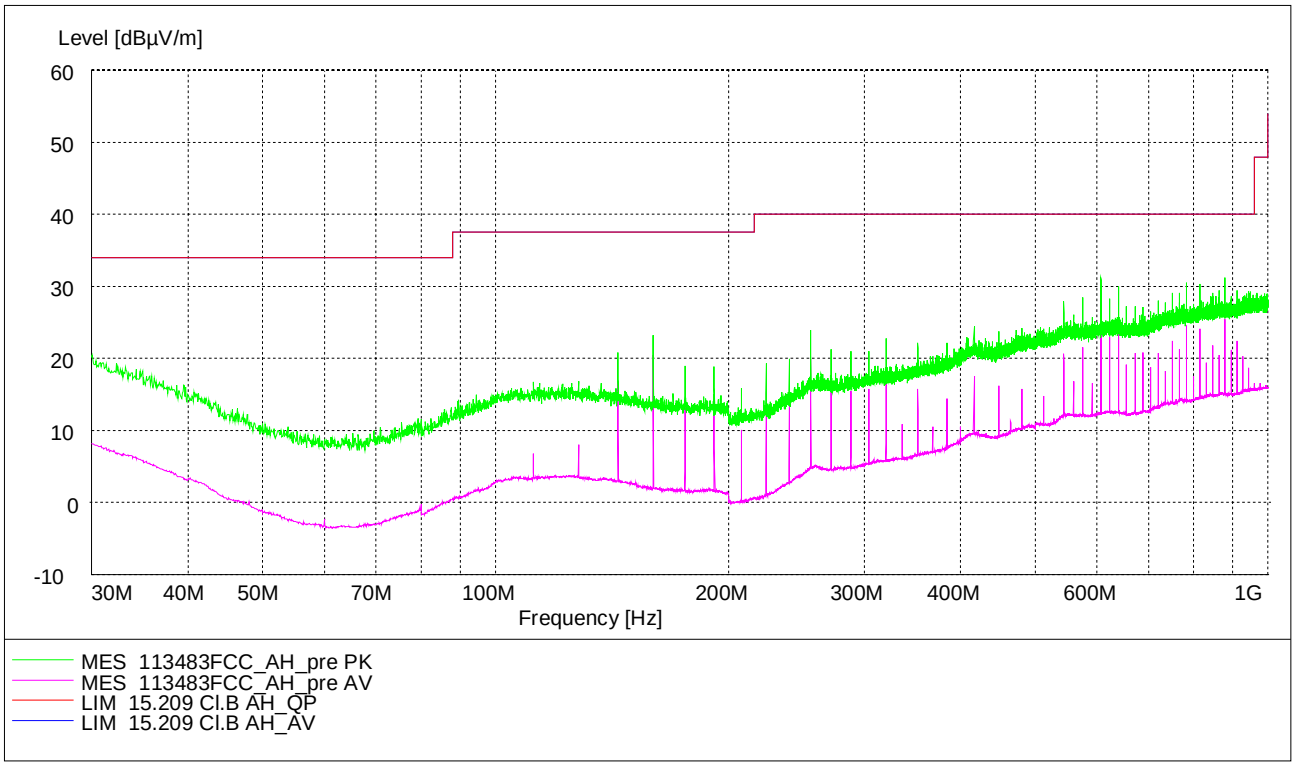


No significant frequencies above the noise floor of the system were found during the preliminary radiated emission test, so no measurements were carried out on the outdoor test site.

TEST EQUIPMENT USED FOR THE TEST:

29, 31 – 37, 39, 43, 44, 46, 49 – 51, 58

Title:	Preliminary emission measurement according to FCC part 15.247
EUT:	MOSI16B
Manufacturer:	Ziehl-Abegg AG
Operating Condition:	Continuous modulated transmission @ 2445 MHz
Test site:	Fully anechoic chamber M20; PHOENIX TESTLAB GmbH
Operator:	M. Bastert
Test Specification:	Supplied with 3.3 V_{DC}



In this case it was necessary to carry out subsequent measurements on the open area test site. The results are presented in clause 5.5.2.2.

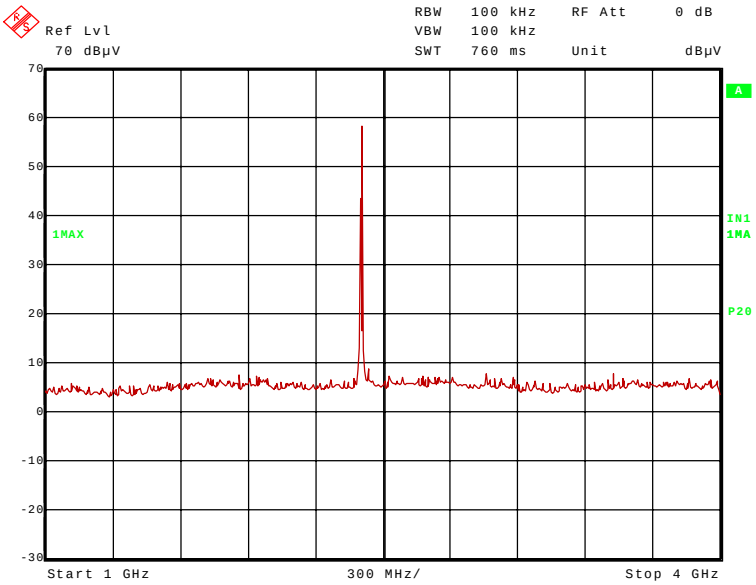
Test result: Passed.

TEST EQUIPMENT USED FOR THE TEST:

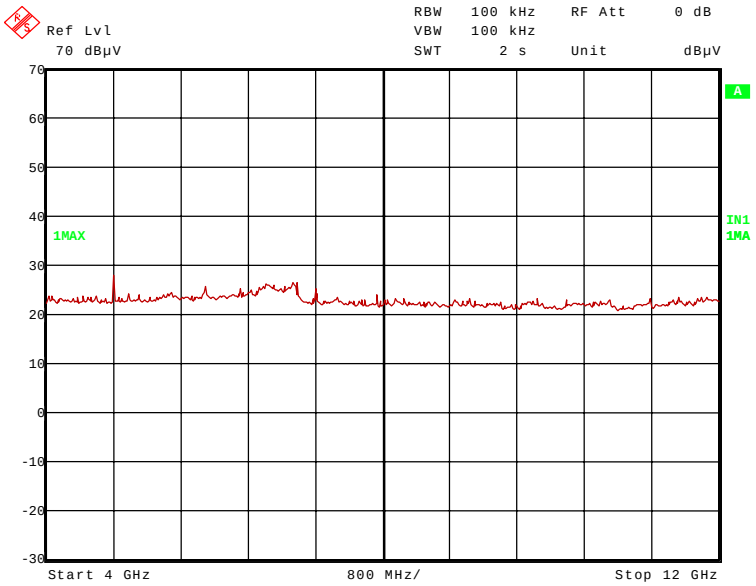
29, 31 – 35

Operation mode 1 (TX at the lower band edge)

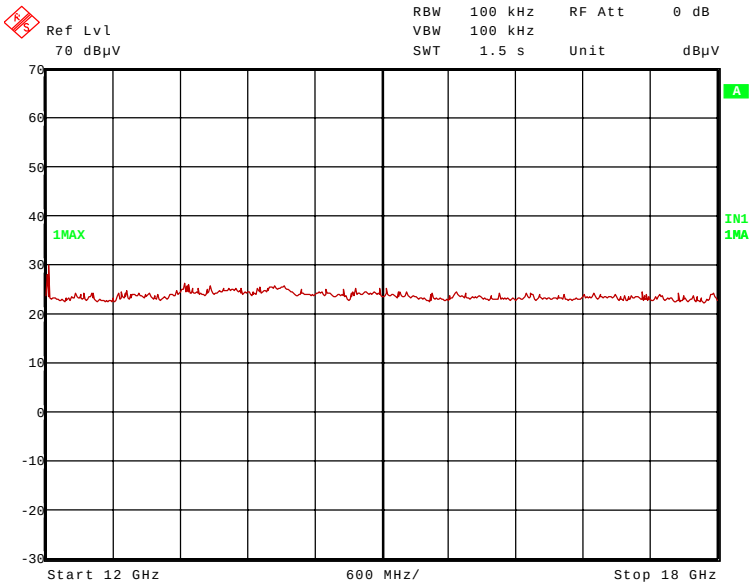
113483_12.wmf (1 GHz to 4 GHz):



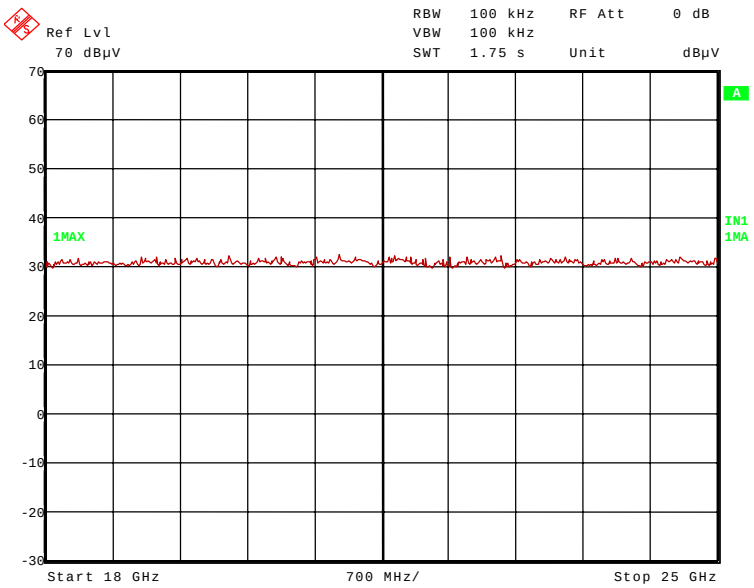
113483_13.wmf (4 GHz to 12 GHz):



113483_3.wmf (12 GHz to 18 GHz):



113483_4.wmf (18 GHz to 25 GHz):



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

- 4810 MHz and 12025 MHz.

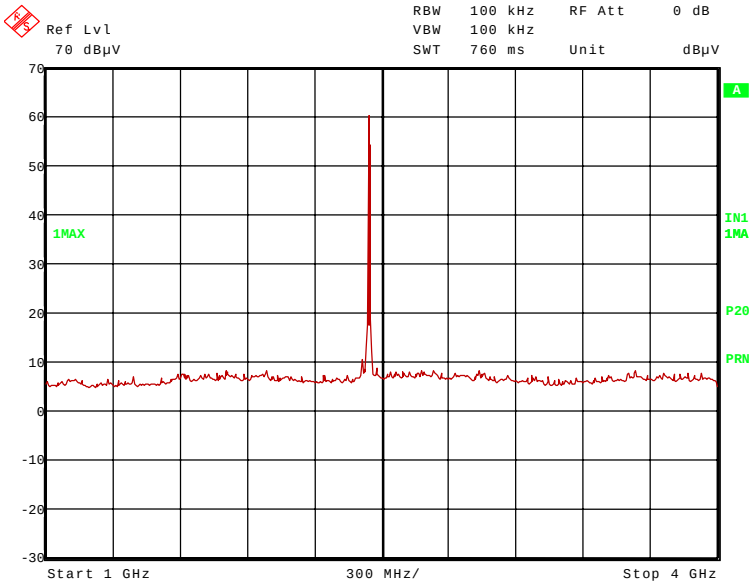
The following frequency was found outside the restricted bands during the preliminary radiated emission test:

- 2405 MHz.

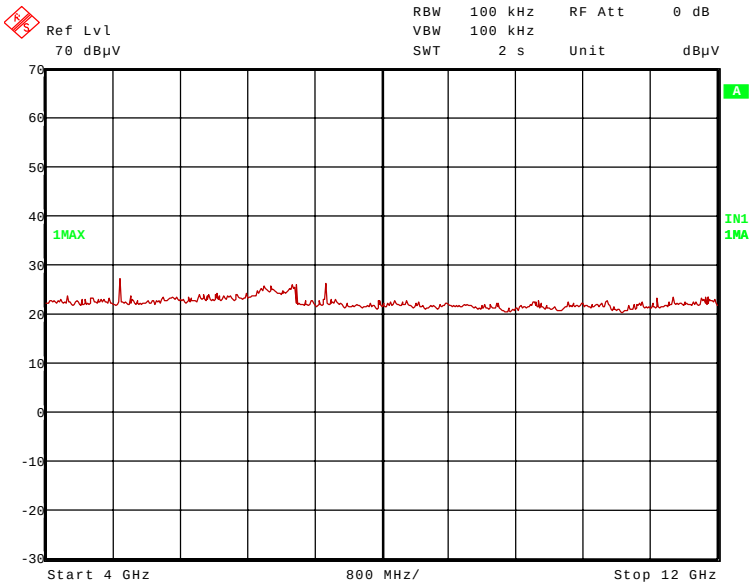
These frequencies have to be measured in a final measurement. The results are presented in the following.

Operation mode 2 (TX in the middle of the frequency band)

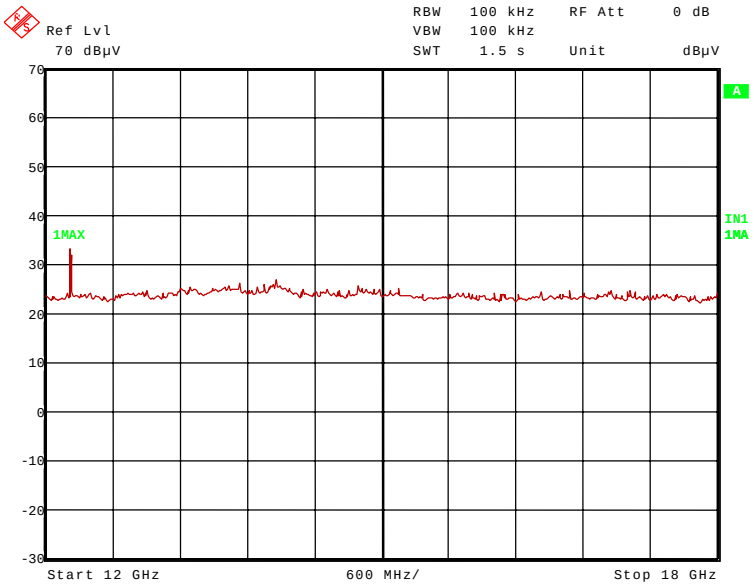
113483_1.wmf (1 GHz to 4 GHz):



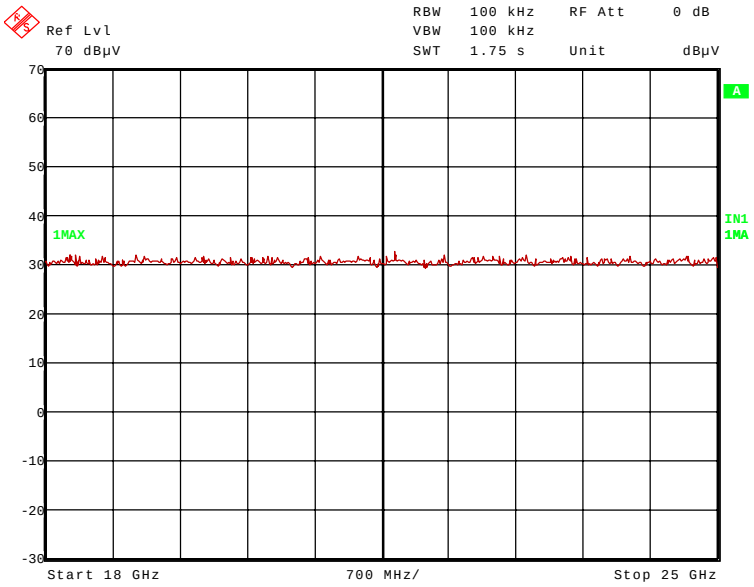
113483_2.wmf (4 GHz to 12 GHz):



113483_6.wmf (12 GHz to 18 GHz):



113483_5.wmf (18 GHz to 25 GHz):



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

- 4890 MHz and 12225 MHz.

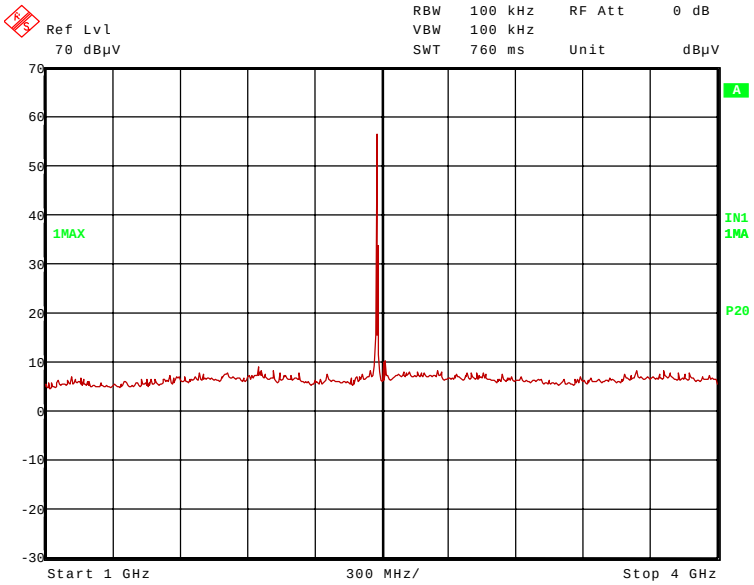
The following frequency was found outside the restricted bands during the preliminary radiated emission test:

- 2445 MHz.

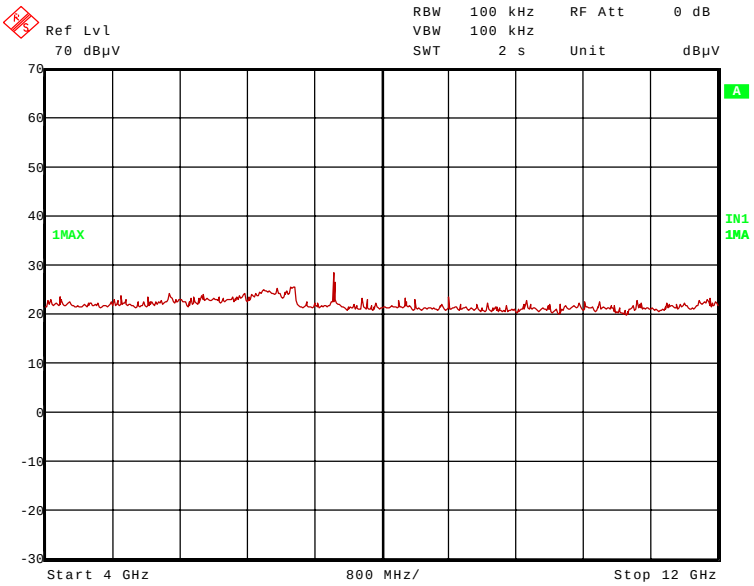
These frequencies have to be measured in a final measurement. The results were presented in the following.

Operation mode 3 (TX at the upper band edge)

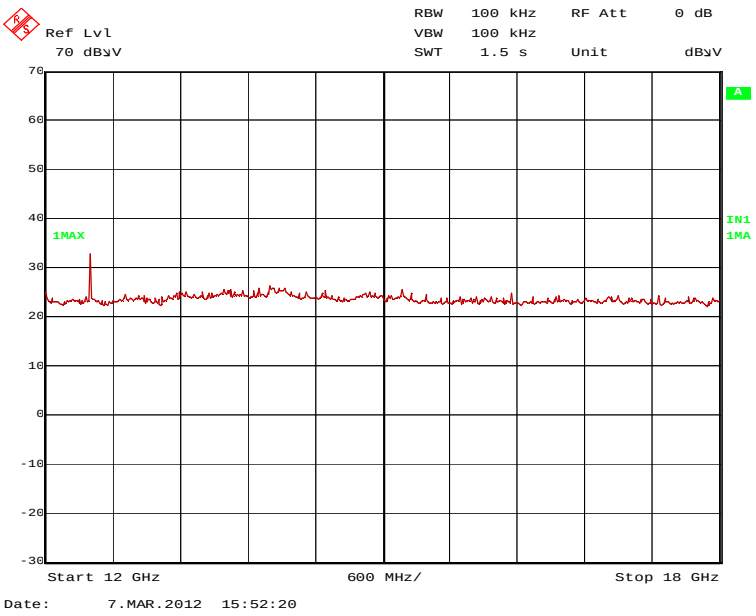
113483_9.wmf (1 GHz to 4 GHz):



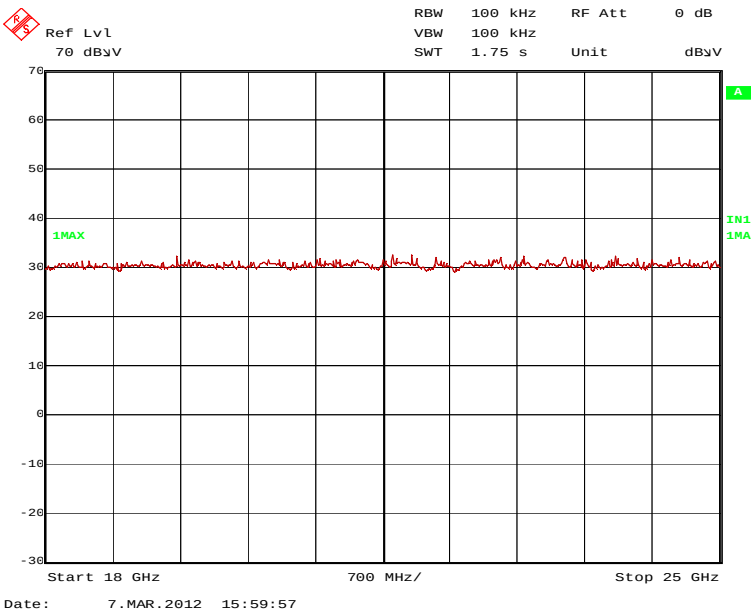
113483_14.wmf (4 GHz to 12 GHz):



113483_7.wmf (12 GHz to 18 GHz):



113483_8.wmf (18 GHz to 25 GHz):



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

- 7440 MHz and 12400 MHz.

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

- 2480 MHz.

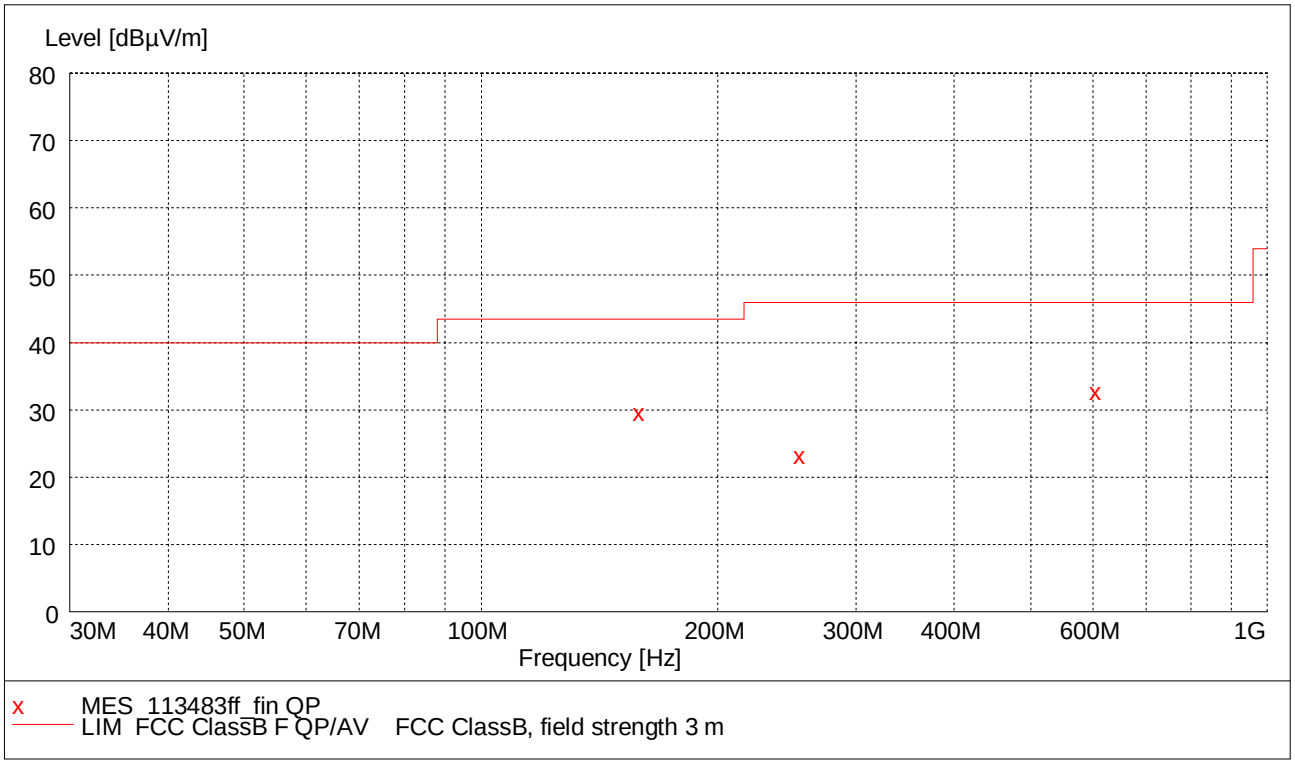
These frequencies have to be measured in a final measurement. The results were presented in the following.

5.5.2.2 Final radiated emission measurement (30 MHz to 25 GHz)

Ambient temperature	20 °C	Relative humidity	32 %

Title:	Final measurement on open area test site
EUT:	MOSI16
Manufacturer:	Ziehl-Abegg AG
Operating Condition:	Continuous transmission
Test site:	PHOENIX TESTLAB GmbH; Open area test site M6
Operator:	M. Bastert
Comment:	Supplied with 3.3 V_{DC}

The measured points and the limit line in the following diagram refer to the standard measurement of the emitted interference in compliance with the above mentioned standard. The measured points marked with “x” are the measured results of the standard subsequent measurement on the open area test site.



The results of the standard subsequent measurement on the open area test site are indicated in the table below. The limits as well as the measured results (levels) refer to the above mentioned standard while taking account of the specified requirements for a 10 m measuring distance.

Result measured with the quasipeak detector (marked by an x):

Frequency MHz	Level dBµV/m	Transducer dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
160.000000	30.00	13.3	43.5	13.5	144.0	0.00	HORIZONTAL
256.000000	23.60	15.2	46.0	22.4	100.0	194.00	HORIZONTAL
608.000000	33.00	23.2	46.0	13.0	100.0	180.00	VERTICAL

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: No cables were connectable to the EUT. For detail information of test set up 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 3.3 V_{DC}.

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

Operation mode 1 (Transmission at the lower band edge of the assigned frequency band)

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
2.405	93.8	-	-	61.8	28.3	0.0	3.7	150	Hor.	-
12.025	43.8	74.0	30.2	33.6	33.6	25.9	2.5	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
2.405	90.6	-	-	58.6	28.3	0.0	3.7	150	Hor.	-
12.025	30.9	54.0	23.1	20.7	33.6	25.9	2.5	150	Hor.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Operation mode 2 (Transmission in the middle of the assigned frequency band)

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
2.445	96.7	-	-	64.6	28.4	0.0	3.7	150	Vert.	-
4.890	43.8	74.0	30.2	31.4	32.8	25.7	5.3	150	Vert.	Yes
12.225	45.1	74.0	28.9	34.9	33.6	25.9	2.5	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
2.445	93.4	-	-	61.3	28.4	0.0	3.7	150	Vert.	-
4.890	31.8	54.0	22.2	19.4	32.8	25.7	5.3	150	Vert.	Yes
12.225	31.5	54.0	22.5	21.3	33.6	25.9	2.5	150	Vert.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Operation mode 3 (Transmission at the upper end of the assigned frequency band)

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
2.480	92.8	-	-	60.5	28.5	0.0	3.8	150	Vert.	-
7.440	51.8	74.0	22.2	33.2	36.3	24.5	6.8	150	Vert.	Yes
12.400	45.7	74.0	28.3	35.4	33.7	25.9	2.5	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
2.480	89.6	-	-	57.3	28.5	0.0	3.8	150	Vert.	-
7.440	38.8	54.0	15.2	20.2	36.3	24.5	6.8	150	Vert.	Yes
12.400	31.2	54.0	22.8	20.9	33.7	25.9	2.5	150	Vert.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
14- 20, 29 31 - 34, 36, 37, 39, 44, 46, 49 - 51, 72

6 TEST EQUIPMENT AND ANCILLARIES

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal. due
1	Shielded chamber M4	-	Siemens AG	B83117-S1-X158	480088	Weekly verification (system cal.)	
2	EMI Receiver	ESIB 26	Rohde & Schwarz	1088.7490	481182	03/09/2012	03/2014
3	LISN	NSLK8128	Schwarzbeck	8128161	480138	12/13/2011	12/2012
4	High pass filter	HR 0.13-5ENN	FSY Microwave Inc.	DC 0109 SN 002	480340	Weekly verification (system cal.)	
14	Open area test site	-	Phoenix Test-Lab	-	480085	Weekly verification (system cal.)	
15	Measuring receiver	ESIB7	Rohde & Schwarz	100304	480521	02/15/2012	02/2014
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 D	Chase	25761	480894	09/28/2011	09/2014
20	EMI Software	ES-K1	Rohde & Schwarz	-	480111	-	-
26	Test fixture	-	Phoenix Test-Lab	-	410160	Weekly verification (system cal.)	
29	Fully anechoic chamber M20	-	Albatross Projects	B83107-E2439-T232	480303	Weekly verification (system cal.)	
30	Spectrum analyser	FSU	Rohde & Schwarz	200125	480956	02/15/2012	02/2014
31	Measuring receiver	ESI 40	Rohde & Schwarz	100064	480355	02/13/2012	02/2014
32	Controller	MCU	Maturo	MCU/043/971107	480832	-	-
33	Turntable	DS420HE	Deisel	420/620/80	480315	-	-
34	Antenna support	AS615P	Deisel	615/310	480187	-	-
35	Antenna	CBL6112 B	Chase	2688	480328	04/21/2011	04/2014
36	Antenna	3115 A	EMCO	9609-4918	480183	11/09/2011	11/2014
37	Standard Gain Horn 11.9 GHz – 18 GHz	18240-20	Flann Microwave	483	480294	Six month verification (system cal.)	
39	Standard Gain Horn 17.9 GHz – 26.7 GHz	20240-20	Flann Microwave	411	480297	Six month verification (system cal.)	
43	RF-cable No. 36	Sucoflex 106B	Suhner	0522/6B	480571	Weekly verification (system cal.)	
44	RF-cable No. 31	RTK 081	Rosenberger	-	410142	Weekly verification (system cal.)	
46	RF-cable 1 m	KPS-1533-400-KPS	Insulated Wire	-	480301	Six month verification (system cal.)	
49	Preamplifier	JS3-00101200-23-5A	Miteq	681851	480337	Six month verification (system cal.)	
50	Preamplifier	JS3-12001800-16-5A	Miteq	571667	480343	Six month verification (system cal.)	
51	Preamplifier	JS3-18002600-20-5A	Miteq	658697	480342	Six month verification (system cal.)	
55	Loop antenna	HFH2-Z2	Rohde & Schwarz	832609/014	480059	02/16/2012	02/2014
72	4 GHz High Pass Filter	WHKX4.0/18G-8SS	Wainwright Instruments	1	480587	Weekly verification (system cal.)	

7 REPORT HISTORY

Report Number	Date	Comment
F113483E1	14 June 2012	Document created

8 LIST OF ANNEXES

ANNEX A TEST SETUP PHOTOS 6 pages

113483_1.jpg	Test setup fully anechoic chamber
113483_2.jpg	Test setup fully anechoic chamber
113483_3.jpg	Test setup fully anechoic chamber
113483_4.jpg	Test setup fully anechoic chamber
113483_5.jpg	Test setup fully anechoic chamber
113483_6.jpg	Test setup open area test site

ANNEX B INTERNAL PHOTOGRAPHS 4 pages

113483_9.jpg	MOSI16B, top view
113483_10.jpg	MOSI16B, bottom view
113483_7.jpg	MOSI16B mounted on carrier board, top view
113483_8.jpg	Carrier board, bottom view