

# TEST REPORT

Test Report Reference: F101042E1

Equipment under Test / model name: cB-0926-02 inside cB-RWE231

FCC ID: PVH0926

IC: 5325A-0926

Serial Number: None

Applicant: connectBlue AB

Manufacturer: connectBlue AB

Test 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  
and  
Industry Canada Test site registration IC3469A-1 and  
FCC Test site registration number 90877

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## 1 IDENTIFICATION

### 1.1 APPLICANT

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	Malmö SE-211 19
Country:	Sweden
Name for contact purposes:	Mr. Martin Engdahl
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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:	12 April 2010
Start of test:	14 April 2010
End of test:	03 May 2010

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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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Test engineer: Thomas KÜHN  
Name

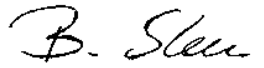


Signature

05 May 2010

Date

Test report checked: Bernd STEINER  
Name



Signature

05 May 2010

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

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

## 1.6 NORMATIVE REFERENCES

- [1] **ANSI C63.4-2009** 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** Radio Frequency Devices
- [3] **FCC Public Notice DA 00-705 (March 2000)**
- [4] **RSS-210 Issue 7 (June 2007)** Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment
- [5] **RSS-Gen Issue 2 (June 2007)** General Requirements and Information for the Certification of Radiocommunication Equipment
- [6] **Publication Number 913591 (March 2007)** Measurement of radiated emissions at the edge of the band for a Part 15 RF Device

## 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

Type of equipment: *	WLAN module inside 2.4 GHz Ethernet to WLAN Adapter					
Type designation / model name: *	cB-0926-02 inside cB-RWE231					
Hardware / software version: *	HW 2 / SW 2.0.0					
FCC ID: *	PVH0926					
IC: *	5235A-0926					
Antenna type: *	Integrated antenna (inside cB-RWE231) type Onboard 2400 CP					
Antenna gain: *	3.0 dBi					
Power supply (WLAN-unit): *	$U_{nom}=$	5.0 V DC	$U_{min}=$	3.3 V DC	$U_{max}=$	5.5 V DC
Power supply (cB-RWE231): *	$U_{nom}=$	24.0 V DC	$U_{min}=$	9.0 V DC	$U_{max}=$	30.0 V DC
Type of modulation: *	DSSS/OFDM					
Operating frequency range: *	2.412 to 2.462 GHz (11 channels with 5 MHz channel separation)					
Number of channels: *	11					
Temperature range: *	-30 °C to +65 °C					

\*: declared by the applicant

The following external I/O cables were used:

Cable	Length	Shielding	Connector	Connector name
DC in	2 m *	No	A-coded Male M12	Power
Digital input / output	2 m *	No	A-coded Male M12	Power
Ethernet	2 m *	Yes	D-coded Female M12	LAN
-	-	-	-	-

\*: Length during the test if no other specified.

### 2.1 PERIPHERY DEVICES

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

- A personal computer with a configuration-software was used. It was connected to Ethernet port of the EUT for setting the equipment into the necessary operation mode. During emission measurements the personal computer was placed outside the measuring environment.
- For the conducted emission measurement on AC mains an AC / DC adaptor type VANSON Mod. SMP-1000A 012 was used to supply the EUT with 24.0 V DC.

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### 3 OPERATIONAL STATES AND PHYSICAL BOUNDARIES

The EUT is intended to convert Ethernet to WLAN signals. All radiated tests were carried out with a sample with integral antenna (antenna integrated inside the cB-RWE231); conductive tests were carried out on the internal U.FL connector of the integrated WLAN module.

During the tests the EUT was mounted inside a cB-RWE231 and powered with 24.0 V DC. The operation mode was adjusted with the help of a configuration-software at a laptop computer, which was connected to the Ethernet interface of the cB-RWE231.

During the emission measurement on AC mains a communication link to a 2.4 GHz host was set up and with the software fping a ping was sent to the host from the personal computer at the Ethernet port of the EUT. Events on the digital input port were monitored over Ethernet on the personal computer.

The EUT contains also a 5 GHz WLAN-transceiver. Object of this test report is the 2.4 GHz WLAN-transceiver part of the cB-0926-02 only. The results of the measurements of the 5 GHz WLAN-transceiver part and the digital device (cB-RWE231) will be documented in separate test reports

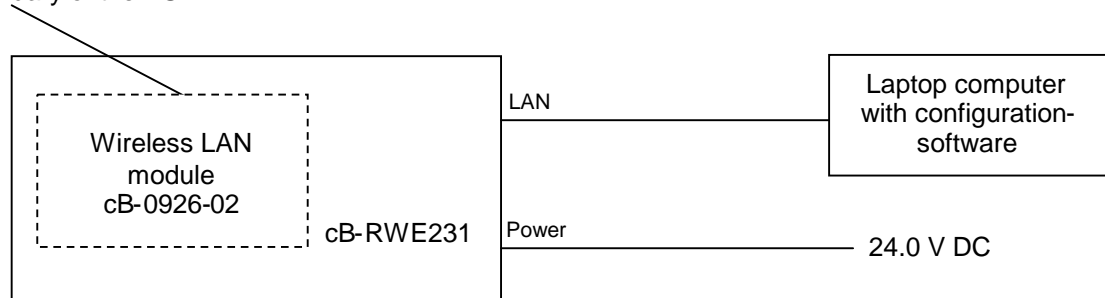
For adjusting the output power with the test software, a power setting of 90 was used during all tests.

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

The following operation modes were used during the tests:

Operation mode	Description of the operation mode
1	Continuous transmitting on 2412 MHz, g, b or n-mode, with all applicable data rates
2	Continuous transmitting on 2437 MHz, g, b or n-mode, with all applicable data rates
3	Continuous transmitting on 2462 MHz, g, b or n-mode, with all applicable data rates
4	Continuous receiving on 2412 MHz
5	Continuous receiving on 2437 MHz
6	Continuous receiving on 2462 MHz

Physical boundary of the EUT



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## 4 LIST OF MEASUREMENTS

Application	Frequency range [MHz]	FCC 47 CFR Part 15 section	RSS 210, Issue 7 [3] or RSS-Gen, Issue 2 [4]	Status	Refer page
6 dB bandwidth	General	15.247 (a) (2)	A8.2 (1) [3]	Passed	10 et seq. of F091568E1
Maximum peak output power	2400.0 – 2483.5	15.247 (b) (3), (4)	A8.4 (4) [3], 7.1.4 [4]	Passed	8 et seq.
Power spectral density	2400.0 – 2483.5	15.247 (e)	A8.2 (2) [3]	Passed	19 et seq. of F091568E1
Band edge compliance	2400.0 – 2483.5	15.247 (d)	A8.5 [3]	Passed	10 et seq.
Radiated emissions (transmitter)	30 – 25,000	15.205 (a) 15.209 (a)	A8.5 [3], 4.7 [4]	Passed	17 et seq.
Conducted emissions on supply line	0.15 – 30	15.207 (a)	7.2.2 [4]	Passed	59 et seq.
Radiated emissions (receiver)	30 – 12,500	-	2.6 [3], 7.2.3 [4]	Passed	Annex D

## 5 ADDITIONAL INFORMATION

The WLAN-transceiver of the cB-RWE231 is already tested under the test report reference F091568E1 and certified under FCC ID PVH0926 / IC 5235A-0926. The reason for this test report is a new antenna type used with this application. This antenna is integrated inside the host device. Due to this fact all measurements were carried out with the WLAN module mounted inside the cB-RWE231 and no carrier board was used. All radiated measurements and the conducted output power measurement were repeated and documented. All conducted measurement results were documented under test report reference F091568E1.

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## 6 TEST RESULTS

### 6.1 6 MAXIMUM PEAK OUTPUT POWER

#### 6.1.1 METHOD OF MEASUREMENT (MAXIMUM PEAK OUTPUT POWER)

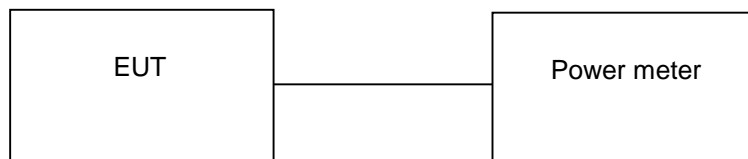
The calibration of the spectrum analyser has to be checked with the help of a known signal from a signal generator. The EUT has to be connected to the spectrum analyser via a low loss cable. If the EUT is not equipped with an antenna connector, a temporary antenna connector has to be installed. The EUT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





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## 6.1.2 TEST RESULTS (MAXIMUM PEAK OUTPUT POWER)

Ambient temperature	21 °C	Relative humidity	45 %
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Operation mode 1 to 3 g-mode with 6 Mbps data rate (worst case)				
Channel number	Channel frequency [MHz]	Maximum peak output power [dBm]	Antenna gain [dBi]	Peak power limit [dBm]
1	2412	19.9	3.0	30.0
6	2437	19.7	3.0	30.0
11	2462	19.6	3.0	30.0
Operation mode 1 to 3 b-mode with 6 Mbps data rate (worst case)				
Channel number	Channel frequency [MHz]	Maximum peak output power [dBm]	Antenna gain [dBi]	Peak power limit [dBm]
1	2412	19.9	3.0	30.0
6	2437	19.7	3.0	30.0
11	2462	19.6	3.0	30.0
Operation mode 1 to 3 n-mode with 6 Mbps data rate (worst case)				
Channel number	Channel frequency [MHz]	Maximum peak output power [dBm]	Antenna gain [dBi]	Peak power limit [dBm]
1	2412	20.0	3.0	30.0
6	2437	19.9	3.0	30.0
11	2462	19.7	3.0	30.0
Measurement uncertainty			+0.66 dB / -0.72 dB	

Test: Passed (output power measured in order to compare with the values measured for the original listing under test report reference F091568E1).

TEST EQUIPMENT USED FOR THE TEST:
46, 166, 167

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## **6.2 BAND-EDGE COMPLIANCE**

### **6.2.1 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 antenna, which causes the highest field strength on the wanted frequency.

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:  $\geq$  the resolution bandwidth.
- Sweep: Auto.
- Detector function: Peak.
- Trace mode: Max hold.

The same test set-up as used for the final radiated emission measurement shall be used (refer also subclause 6.3.1 of this test report). The measurements shall be carried out with using a resolution bandwidth of 100 kHz.

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. This frequency shall be measured with the EMI receiver as described in subclause 6.3.1 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.

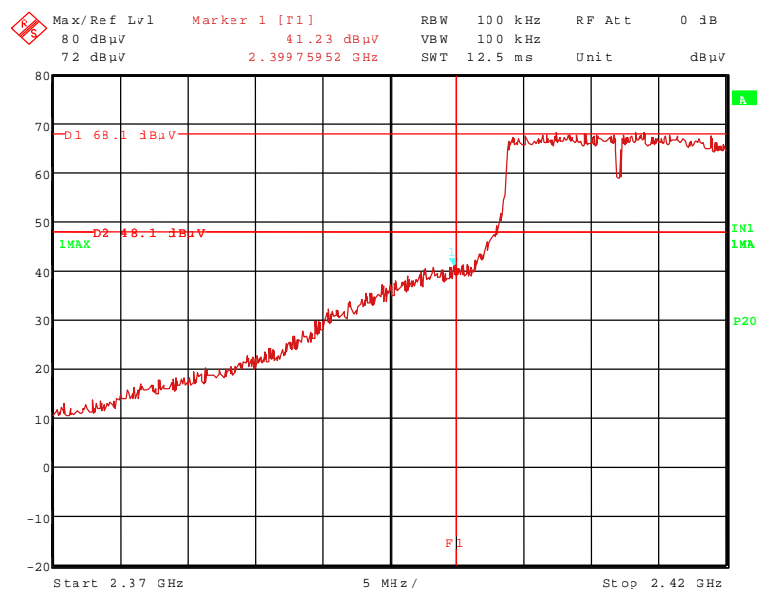
The plots at the next pages are showing radiated band-edge compliance with the worst case operation mode. The display line 1 (D1) in these plots represents the highest level within the assigned frequency band. The display line 2 (D2) represents the 20 dB offset to this highest level and shows the compliance with FCC 47 CFR Part 15.247 (d). The frequency line 1 (F1) shows the edge of the assigned frequency. The following tables are showing the results for the radiated band edge compliance for all applicable operation modes with the worst case data rate, causing the highest emissions at the band edges.

TEST REPORT REFERENCE: F101042E1

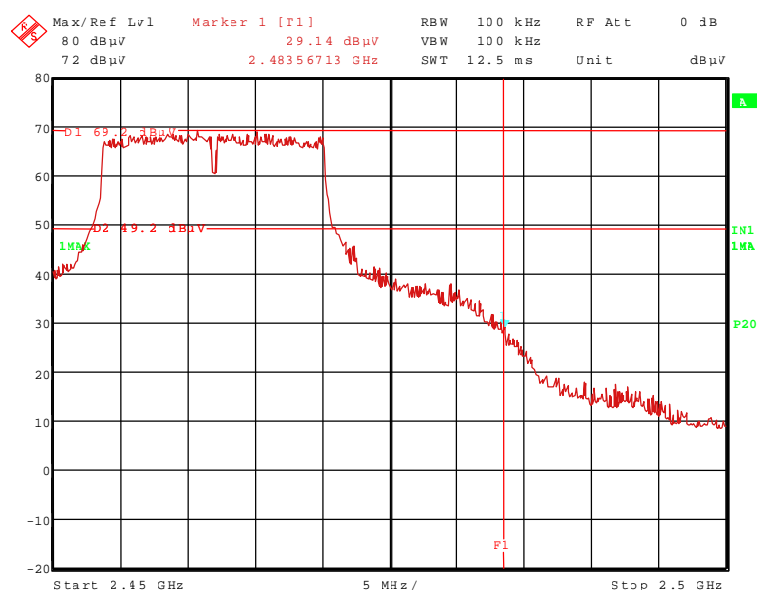
## 6.2.2 TEST RESULT (BAND-EDGE COMPLIANCE)

Ambient temperature	21 °C	Relative humidity	36 %
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101042 7.wmf: Radiated band-edge compliance, lower band edge, g-mode, 54 Mbps:

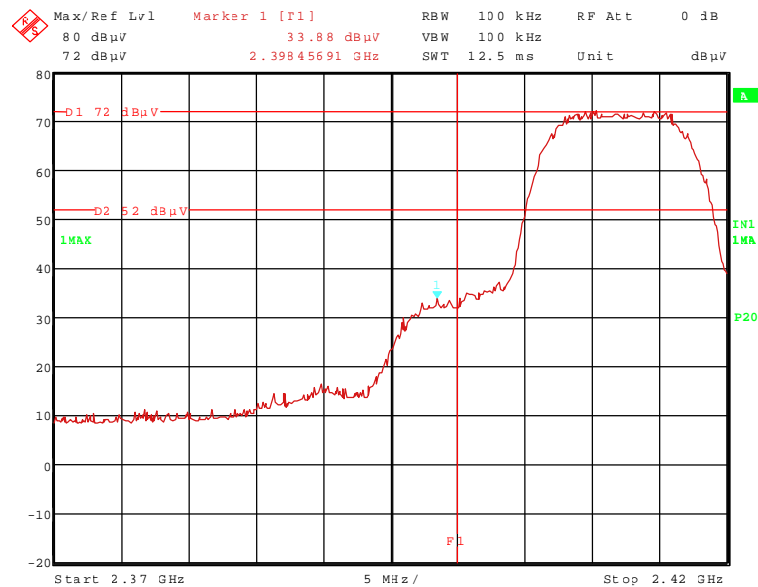


101042 10.wmf: Radiated band-edge compliance, upper band edge, g-mode, 54 Mbps:

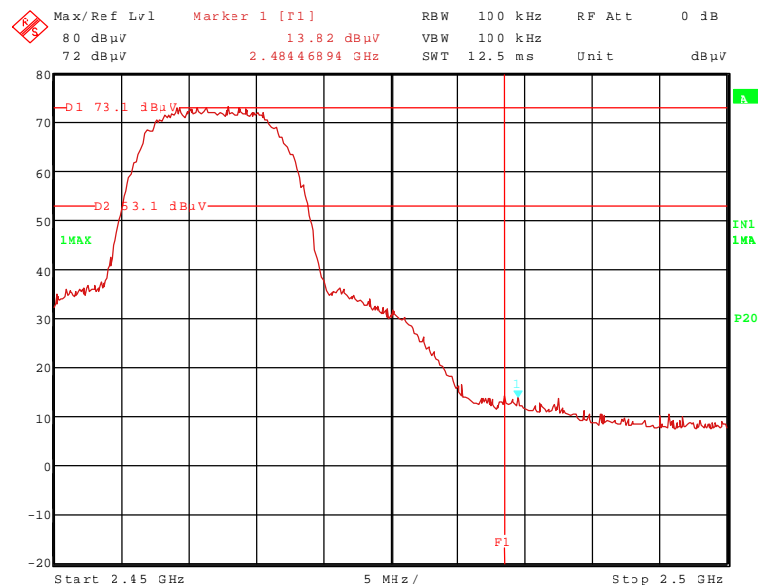


TEST REPORT REFERENCE: F101042E1

101042\_5.wmf: Radiated band-edge compliance, lower band edge, b-mode, 11 Mbps:

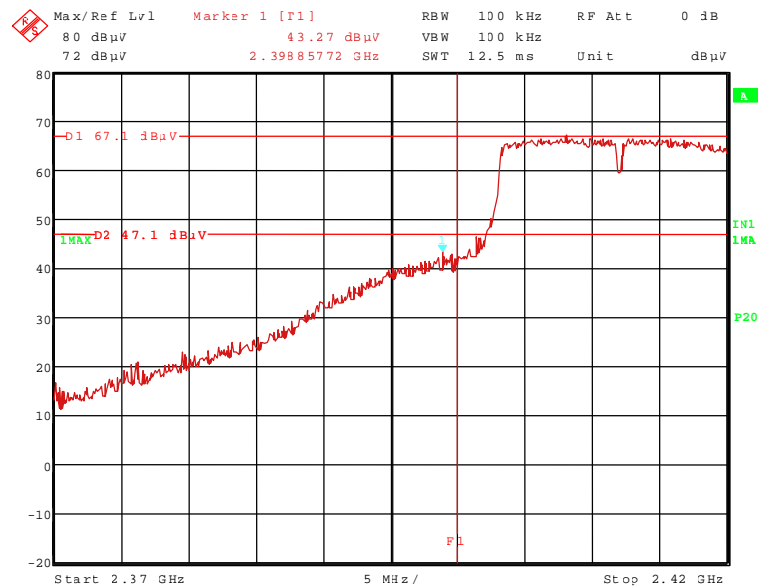


101042\_4.wmf: Radiated band-edge compliance, upper band edge, b-mode, 11 Mbps:

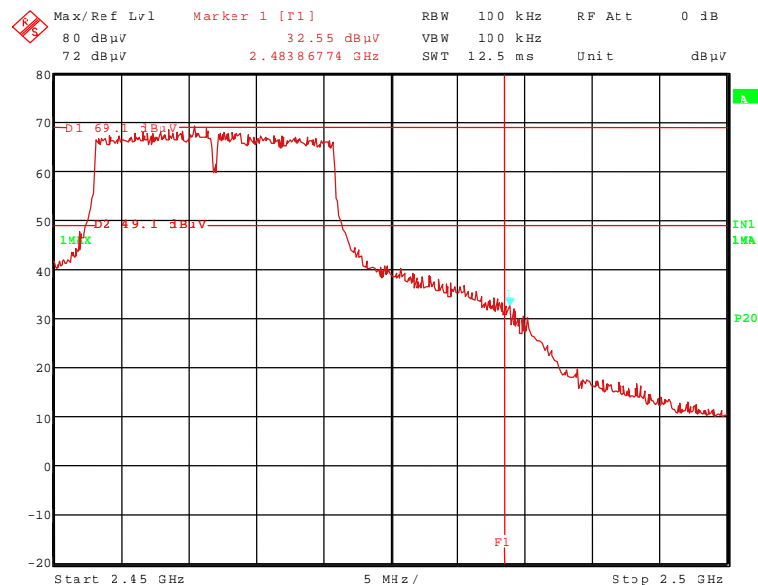


TEST REPORT REFERENCE: F101042E1

101042\_12.wmf: Radiated band-edge compliance, lower band edge, n-mode, 54 Mbps:



101042\_14.wmf: Radiated band-edge compliance, upper band edge, n-mode, 54 Mbps:



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### 6.2.3 TEST RESULT (BAND-EDGE COMPLIANCE) g-mode

Band-edge compliance (g-mode, 54 Mbps (worst case), lower band edge)										
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	108.5	-	-	76.0	28.8	0.0	3.7	150	Vert.	-
2.3998	72.8	88.5	15.7	40.3	28.8	0.0	3.7	150	Vert.	No
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	98.5	-	-	66.0	28.8	0.0	3.7	150	Vert.	-
2.3998	61.2	78.5	17.3	28.7	28.8	0.0	3.7	150	Vert.	No
Measurement uncertainty							+2.2 dB / -3.6 dB			

Band-edge compliance (g-mode, 54 Mbps (worst case), upper band edge)										
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	108.9	-	-	76.3	28.9	0.0	3.7	150	Hor.	-
2.4838	65.3	74.0	8.7	32.5	29.0	0.0	3.8	150	Hor.	Yes
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	98.8	-	-	66.2	28.9	0.0	3.7	150	Hor.	-
2.4835	50.9	54.0	3.1	18.1	29.0	0.0	3.8	150	Hor.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB			

Test: Passed

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## 6.2.4 TEST RESULT (BAND-EDGE COMPLIANCE) b-mode

Band-edge compliance (b-mode, 11 Mbps (worst case), lower band edge)										
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	110.9	-	-	78.4	28.8	0.0	3.7	150	Vert.	-
2.3984	74.3	90.9	16.6	41.8	28.8	0.0	3.7	150	Vert.	No
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	102.8	-	-	70.3	28.8	0.0	3.7	150	Vert.	-
2.3984	63.3	82.8	19.5	30.8	28.8	0.0	3.7	150	Vert.	No
Measurement uncertainty							+2.2 dB / -3.6 dB			

Band-edge compliance (b-mode, 11 Mbps (worst case), upper band edge)										
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	111.5	-	-	78.9	28.9	0.0	3.7	150	Hor.	-
2.4845	56.2	74.0	17.8	23.4	29.0	0.0	3.8	150	Hor.	Yes
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	103.5	-	-	70.9	28.9	0.0	3.7	150	Hor.	-
2.4845	42.5	54.0	11.5	9.7	29.0	0.0	3.8	150	Hor.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB			

Test: Passed

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## 6.2.5 TEST RESULT (BAND-EDGE COMPLIANCE) n-mode

Band-edge compliance (n-mode, 54 Mbps (worst case), lower band edge)										
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	108.7	-	-	76.2	28.8	0.0	3.7	150	Vert.	-
2.3985	73.1	88.7	15.6	40.6	28.8	0.0	3.7	150	Vert.	No
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	98.7	-	-	66.2	28.8	0.0	3.7	150	Vert.	-
2.3987	61.6	78.7	17.1	29.1	28.8	0.0	3.7	150	Vert.	No
Measurement uncertainty							+2.2 dB / -3.6 dB			

Band-edge compliance (n-mode, 54 Mbps (worst case), upper band edge)										
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	114.4	-	-	81.8	28.9	0.0	3.7	150	Hor.	-
2.4838	72.8	74.0	1.2	40.0	29.0	0.0	3.8	150	Hor.	Yes
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	80.1	-	-	47.5	28.9	0.0	3.7	150	Hor.	-
2.4838	41.3	54.0	12.7	8.5	29.0	0.0	3.8	150	Hor.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB			

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

29, 31 – 34, 36, 44



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## 6.3 RADIATED EMISSIONS

### 6.3.1 METHOD OF MEASUREMENT (RADIATED EMISSIONS)

The radiated emission measurement is subdivided into five stages.

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

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

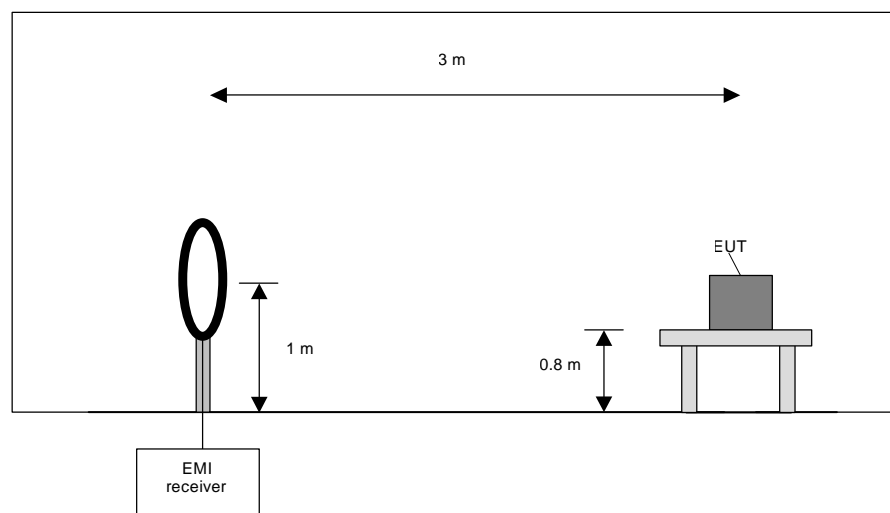
#### **Preliminary measurement (9 kHz to 30 MHz):**

In the first stage a preliminary measurement will be performed in a shielded room with a measuring distance of 3 meters. Tabletop devices will be 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 9 kHz to 30 MHz will be monitored with a spectrum analyser while the system and its cables will be manipulated to find out the configuration with the maximum emission levels if applicable. The EMI Receiver will be set to MAX Hold mode. The EUT and the measuring antenna will be rotated around their vertical axis to find the maximum emissions.

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

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



TEST REPORT REFERENCE: F101042E1

Preliminary measurement procedure:

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

The following procedure will be used:

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

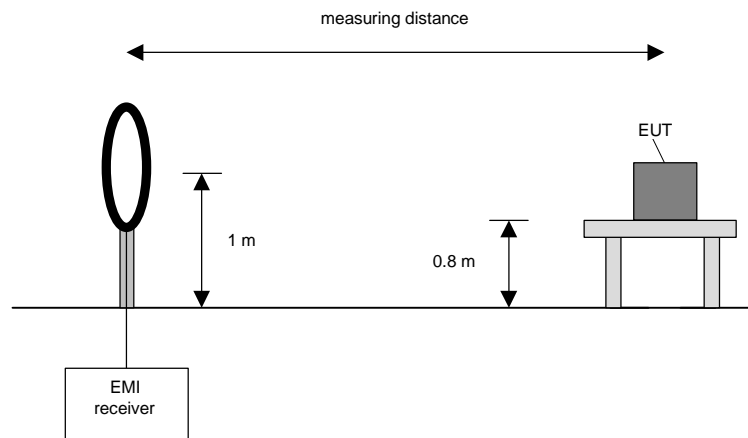
**Final measurement (9 kHz to 30 MHz):**

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

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

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

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



TEST REPORT REFERENCE: F101042E1

Final measurement procedure:

The following procedure will be used:

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

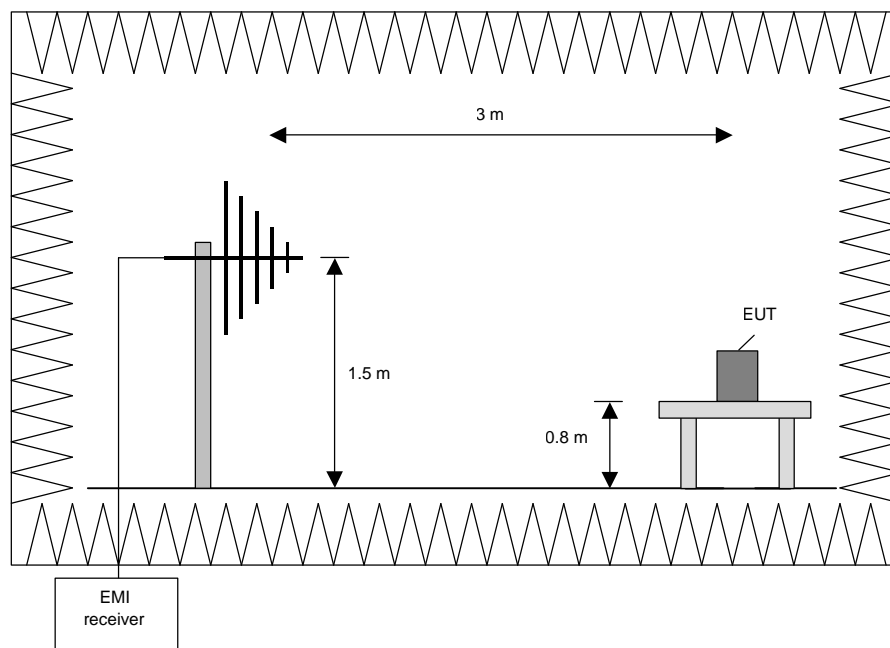
**Preliminary measurement (30 MHz to 1 GHz)**

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



TEST REPORT REFERENCE: F101042E1

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:

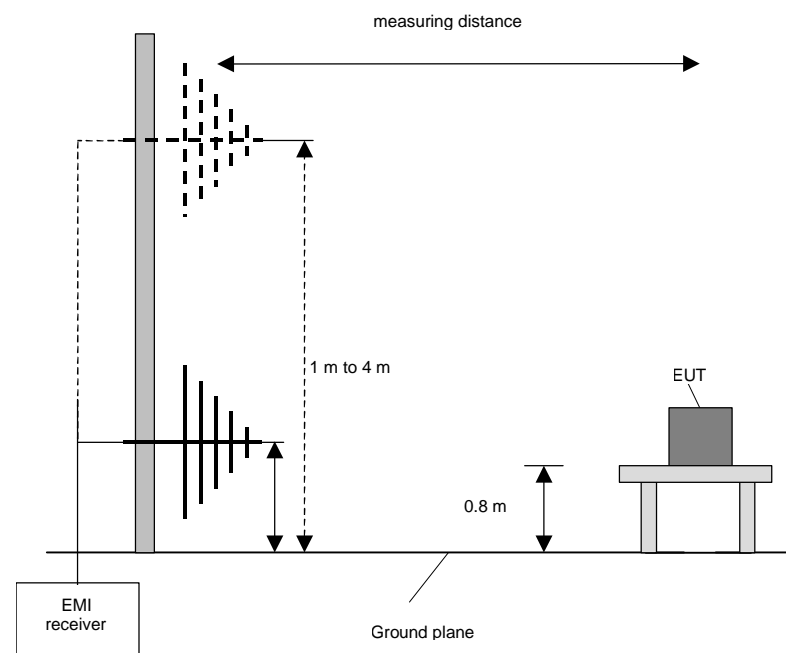
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Manipulate the system cables within the range to produce the maximum level of emission.
3. Rotate the EUT by 360 ° to maximize the detected signals.
4. Make a hardcopy of the spectrum.
5. Measure the frequency of the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



TEST REPORT REFERENCE: F101042E1

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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 25 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].

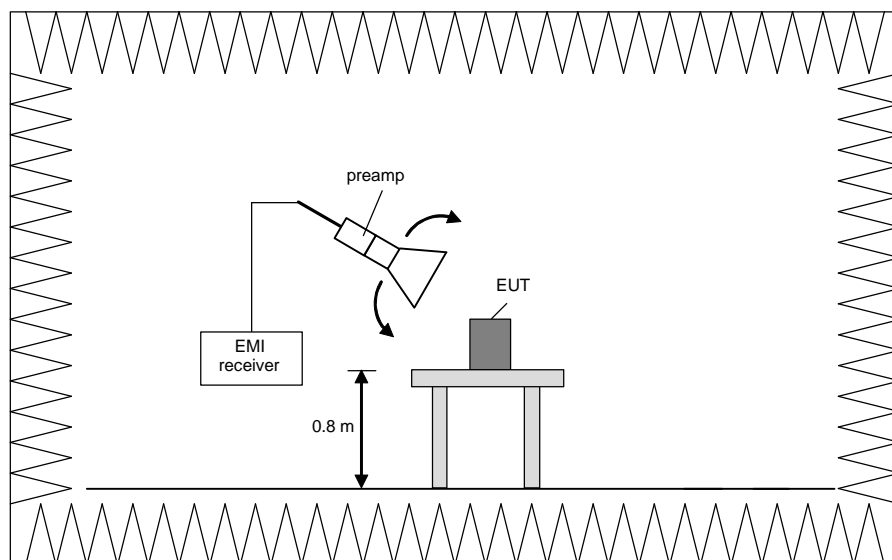
**Preliminary measurement (1 GHz to 25 GHz)**

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 and than 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 25 GHz	100 kHz

TEST REPORT REFERENCE: F101042E1

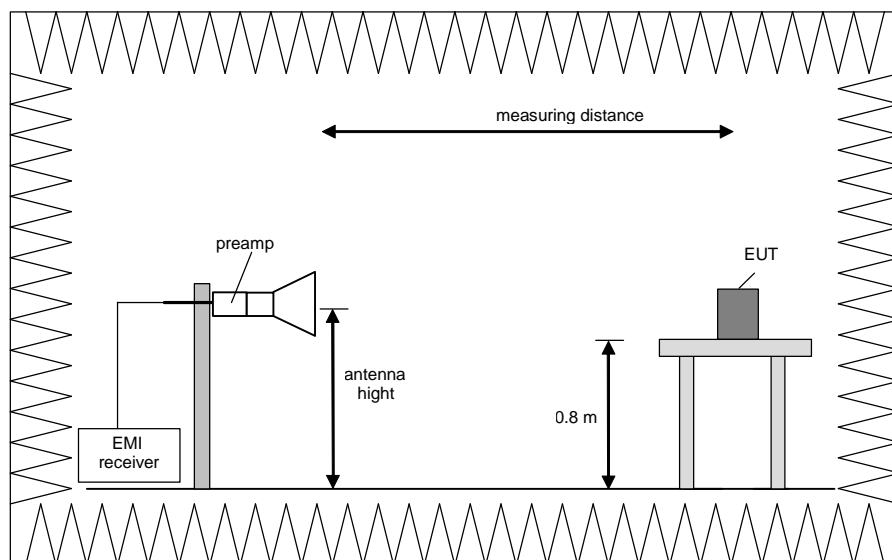


### **Final measurement (1 GHz to 25 GHz)**

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 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 25 GHz	1 MHz



TEST REPORT REFERENCE: F101042E1

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Procedure of measurement:

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

The following procedure will be used:

- 1) Monitor the frequency range at horizontal polarisation and 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 beamwidth.

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

TEST REPORT REFERENCE: F101042E1

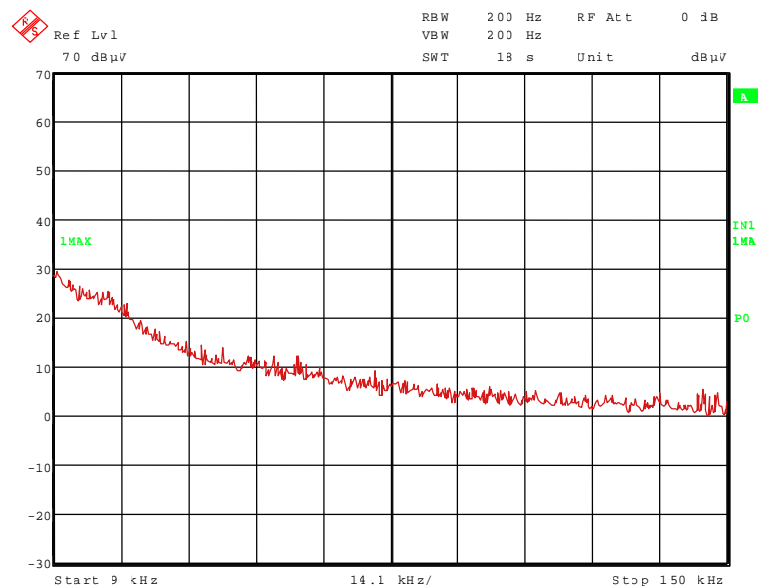
## 6.3.2 TEST RESULTS (RADIATED EMISSIONS)

### 6.3.2.1 PRELIMINARY MEASUREMENT (9 kHz to 1 GHz)

Ambient temperature	21 °C	Relative humidity	34 %
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Position of EUT:	The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.
Cable guide:	The cables of the EUT were fixed on the non-conducting table. For further information of the cable guide refer to the pictures in annex A of this test report.
Test record:	All results are shown in the following.
Supply voltage:	During all measurements the EUT was supplied with 24.0 V DC.
Remark:	As pre-tests have shown, the emissions in the frequency range 9 kHz to 1 GHz are not depending on the transmitter operation mode or frequency. Therefore, the emissions in this frequency range were measured only in b-mode with 11 Mbps and transmit in the middle of the assigned frequency range (operation mode 2).

101042\_25.wmf: Spurious emissions from 9 kHz to 150 kHz (b-mode, 11 Mbps, operation mode 2):

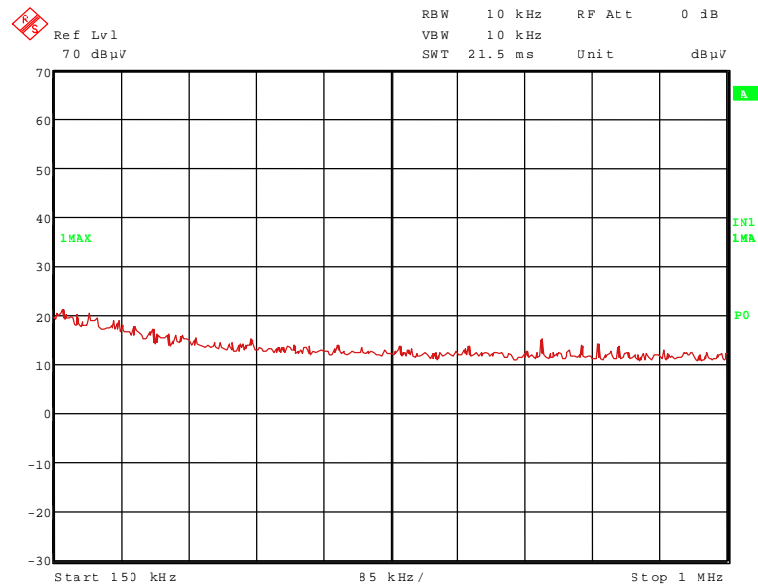


TEST EQUIPMENT USED FOR THE TEST:
29, 31 – 35, 43, 46, 55

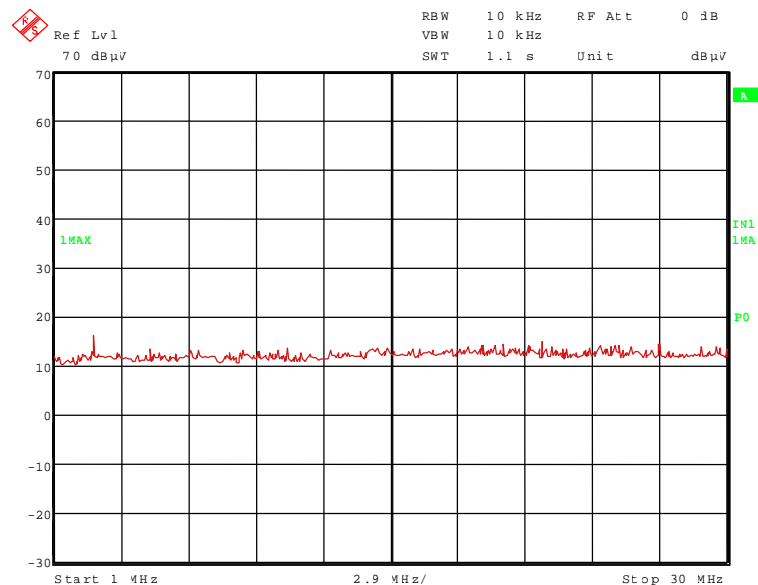


TEST REPORT REFERENCE: F101042E1

101042 26.wmf: Spurious emissions from 150 kHz to 1 MHz (b-mode, 11 Mbps, operation mode 2):



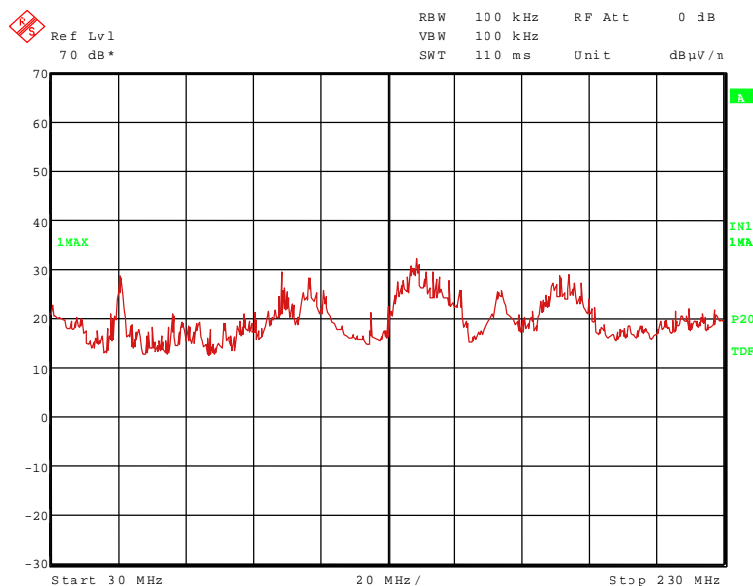
101042 27.wmf: Spurious emissions from 1 MHz to 30 MHz (b-mode, 11 Mbps, operation mode 2):



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

TEST REPORT REFERENCE: F101042E1

101042\_28.wmf: Spurious emissions from 30 MHz to 230 MHz (b-mode, 11 Mbps, operation mode 2):



101042\_29.wmf: Spurious emissions from 230 MHz to 1 GHz (b-mode, 11 Mbps, operation mode 2):



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

- 163.925 MHz and 250.000 MHz.

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

- 50.431 MHz, 98.467 MHz, 138.417 MHz, 183.733 MHz, 375.000 MHz, 500.000 MHz, 592.630 MHz, 625.000 MHz, 750.000 MHz and 875.000 MHz.

These frequencies have to be measured in a final measurement on an open area test-site. The results were presented in the following.

TEST REPORT REFERENCE: F101042E1

### 6.3.2.2 PRELIMINARY MEASUREMENT (1 GHz to 25 GHz), g-mode

Ambient temperature	21 °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.

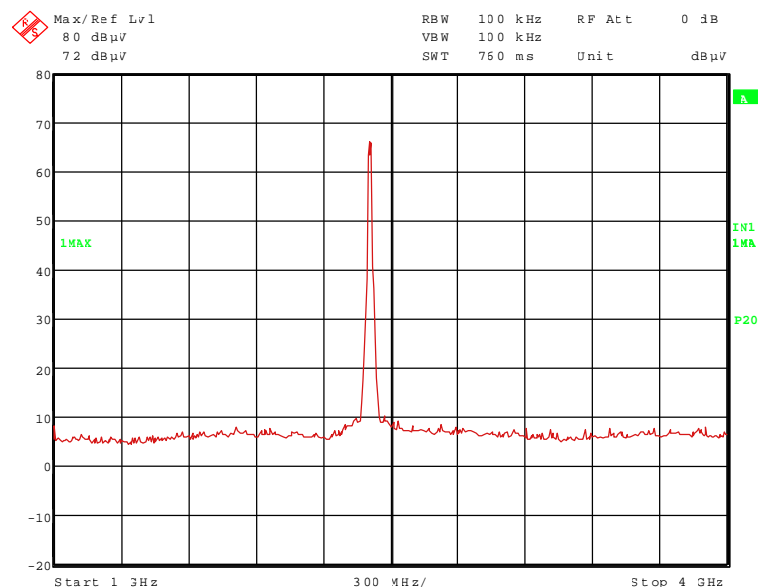
Test record: All results are shown in the following.

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

Remark: The plots at the next pages are showing radiated spurious emissions with the worst case data rate. The tables of the final measurements in the next clauses are showing the results for the radiated spurious emissions with the worst case data rate, causing the highest emission level.

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

#### 101042\_6.wmf: Spurious emissions from 1 GHz to 4 GHz:

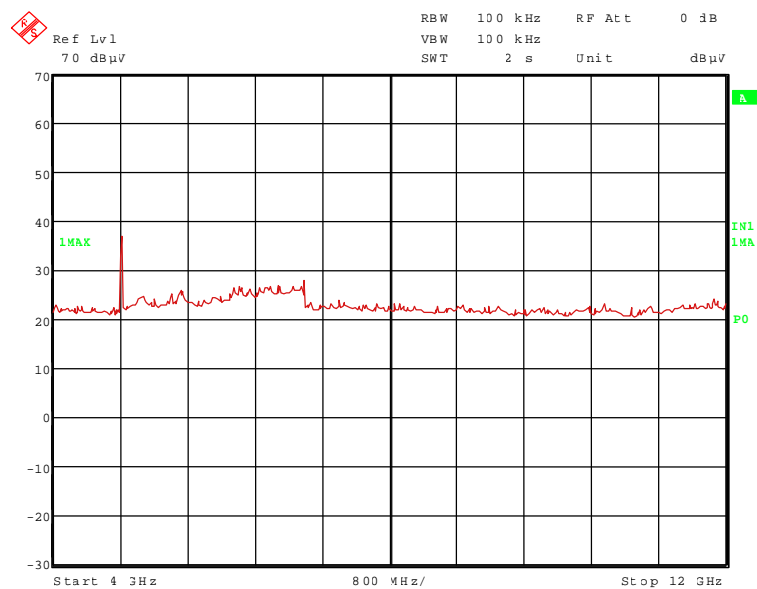


#### TEST EQUIPMENT USED FOR THE TEST:

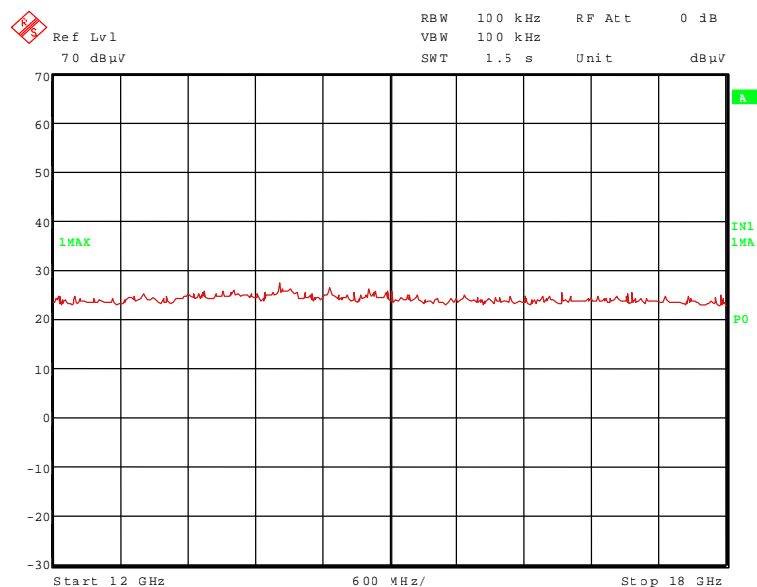
29, 31 – 34, 36, 37, 39, 44, 46, 49 – 51, 72

TEST REPORT REFERENCE: F101042E1

101042\_22.wmf: Spurious emissions from 4 GHz to 12 GHz:

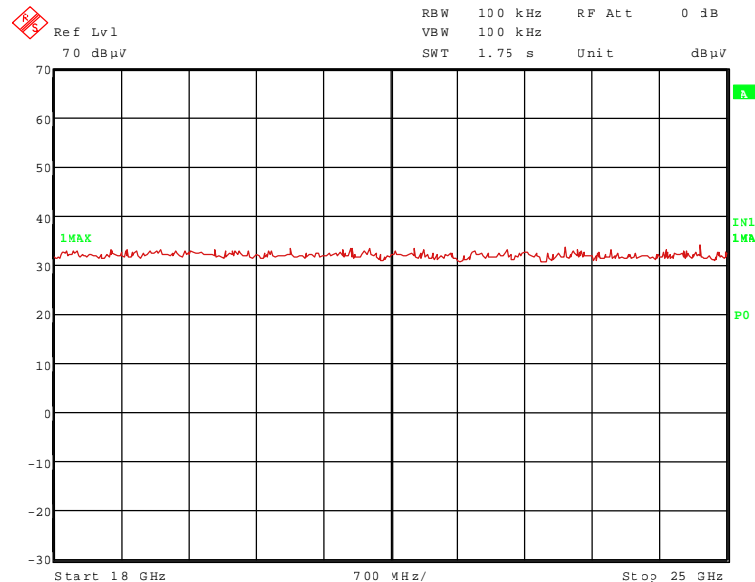


101042\_32.wmf: Spurious emissions from 12 GHz to 18 GHz:



TEST REPORT REFERENCE: F101042E1

101042\_37.wmf: Spurious emissions from 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:

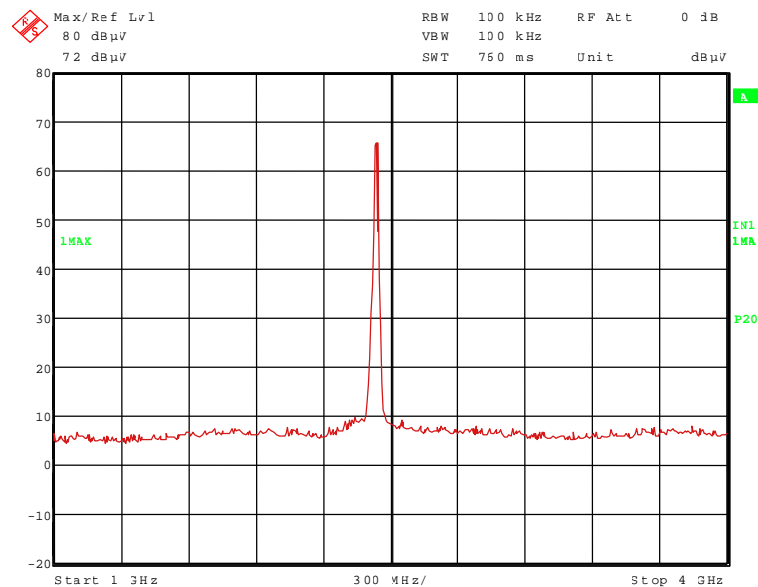
- 2.412 GHz.

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

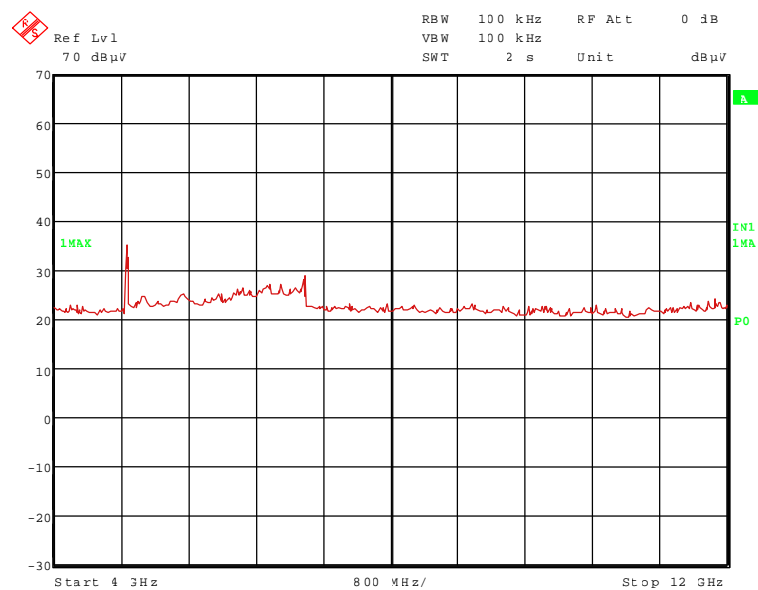
TEST REPORT REFERENCE: F101042E1

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

**101042\_8.wmf: Spurious emissions from 1 GHz to 4 GHz:**

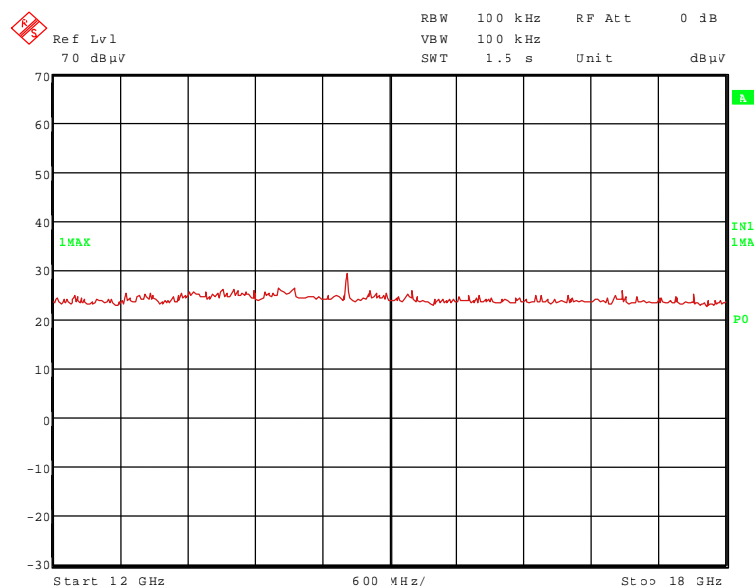


**101042\_23.wmf: Spurious emissions from 4 GHz to 12 GHz:**

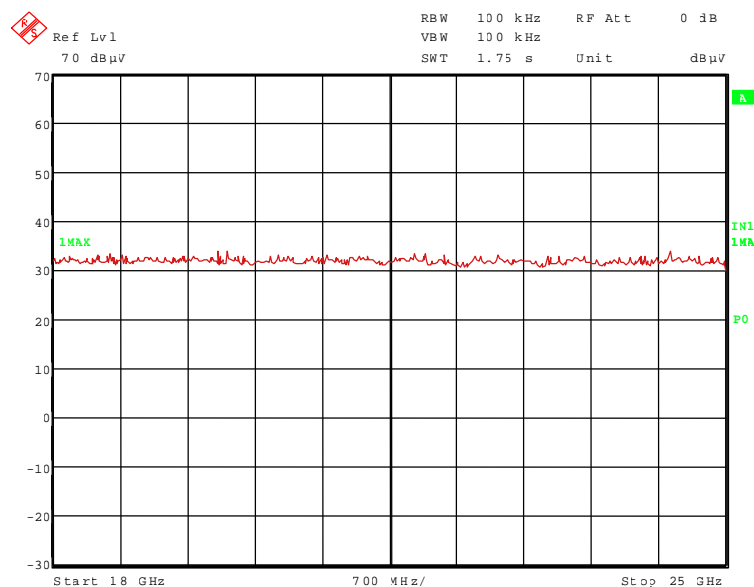


TEST REPORT REFERENCE: F101042E1

101042 33.wmf: Spurious emissions from 12 GHz to 18 GHz:



101042 36.wmf: Spurious emissions from 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 frequencies were found outside the restricted bands during the preliminary radiated emission test:

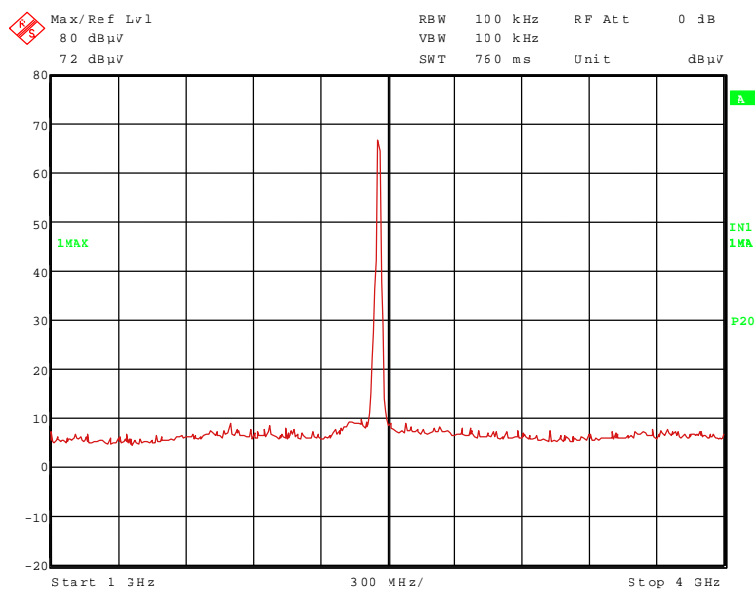
- 2.437 GHz and 14.622 GHz.

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

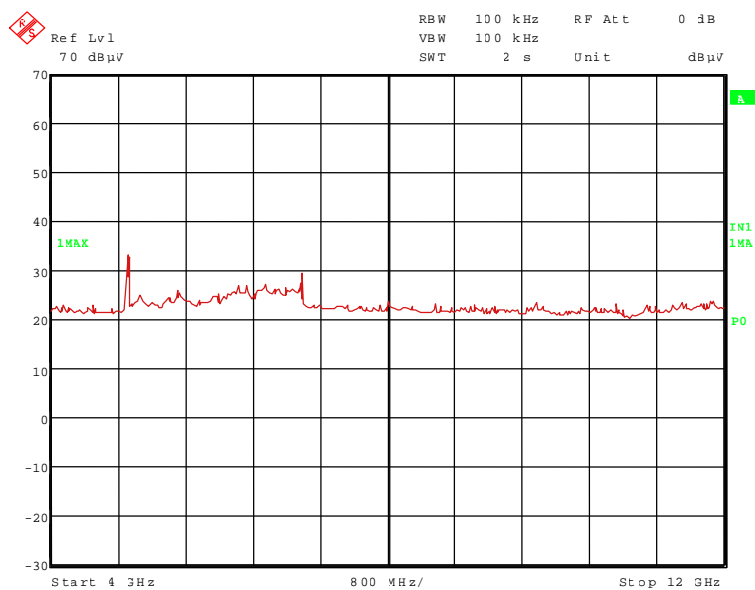
TEST REPORT REFERENCE: F101042E1

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

**101042\_9.wmf: Spurious emissions from 1 GHz to 4 GHz:**



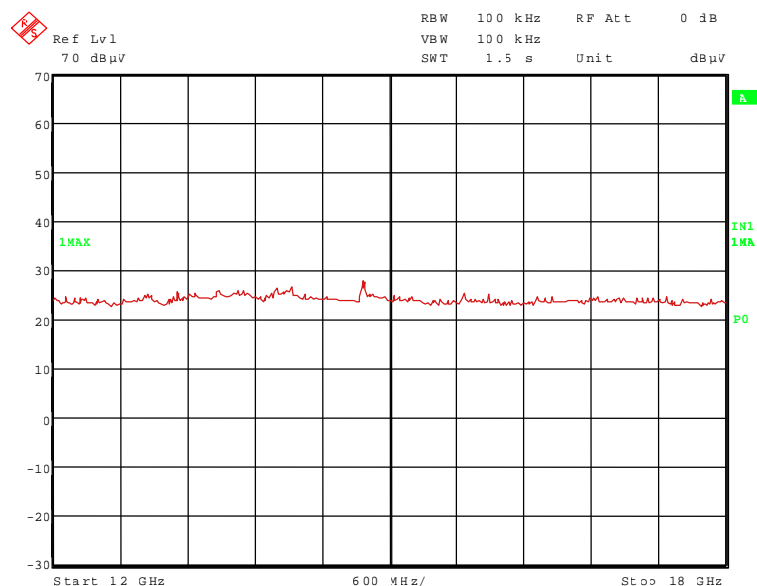
**101042\_24.wmf: Spurious emissions from 4 GHz to 12 GHz:**



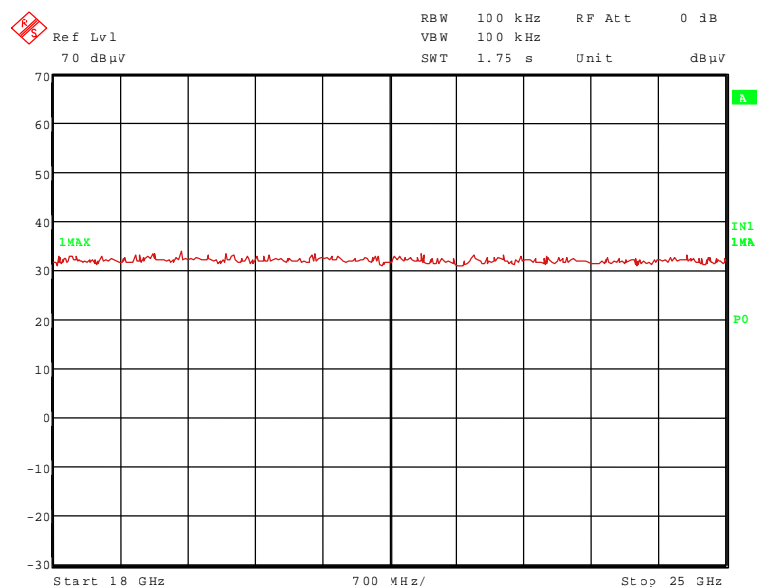


TEST REPORT REFERENCE: F101042E1

101042 34.wmf: Spurious emissions from 12 GHz to 18 GHz:



101042 35.wmf: Spurious emissions from 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 frequencies were found outside the restricted bands during the preliminary radiated emission test:

- 2.462 GHz and 14.772 GHz.

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

TEST REPORT REFERENCE: F101042E1

### 6.3.2.3 PRELIMINARY MEASUREMENT (1 GHz to 25 GHz), b-mode

Ambient temperature	21 °C	Relative humidity	34 %
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Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.

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

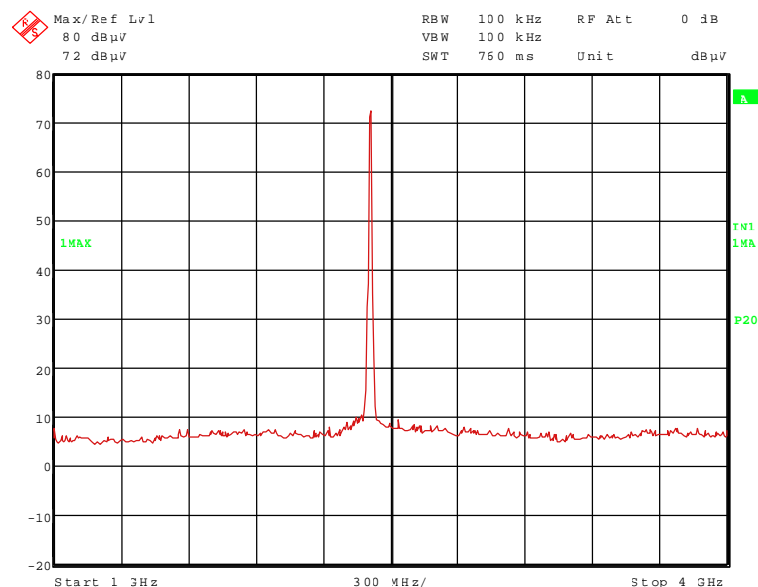
Test record: All results are shown in the following.

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

Remark: The plots at the next pages are showing radiated spurious emissions with the worst case data rate. The tables of the final measurements in the next clauses are showing the results for the radiated spurious emissions with the worst case data rate, causing the highest emission level.

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

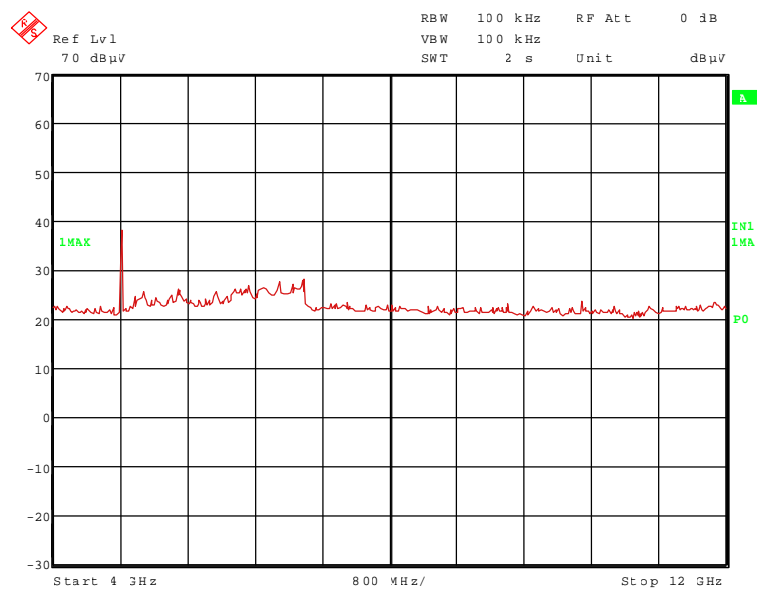
#### 101042\_1.wmf: Spurious emissions from 1 GHz to 4 GHz:



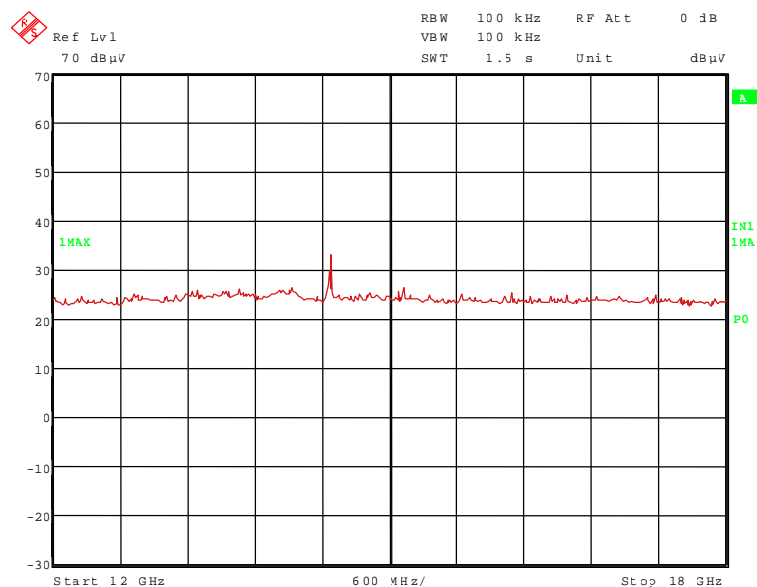
TEST EQUIPMENT USED FOR THE TEST:
29, 31 – 34, 36, 37, 39, 44, 46, 49 – 51, 72

TEST REPORT REFERENCE: F101042E1

101042 19.wmf: Spurious emissions from 4 GHz to 12 GHz:

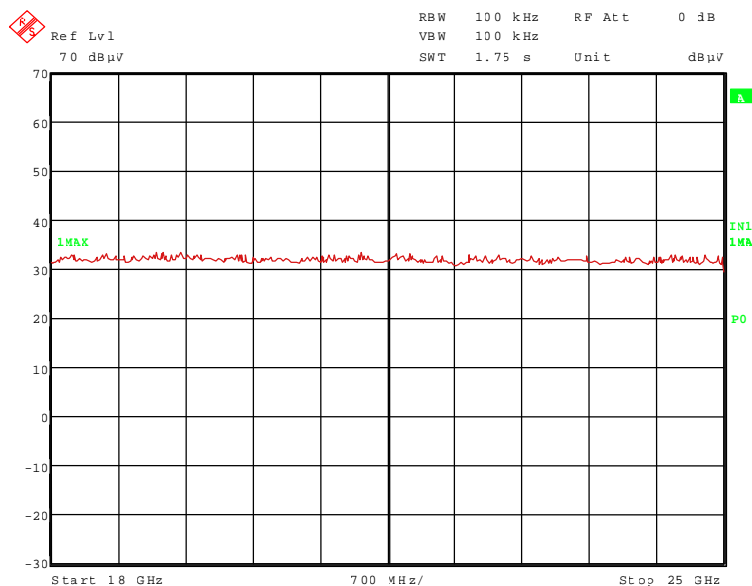


101042 43.wmf: Spurious emissions from 12 GHz to 18 GHz:



TEST REPORT REFERENCE: F101042E1

101042\_38.wmf: Spurious emissions from 18 GHz to 25 GHz:



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

- 4.824 GHz and 14.472 GHz.

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

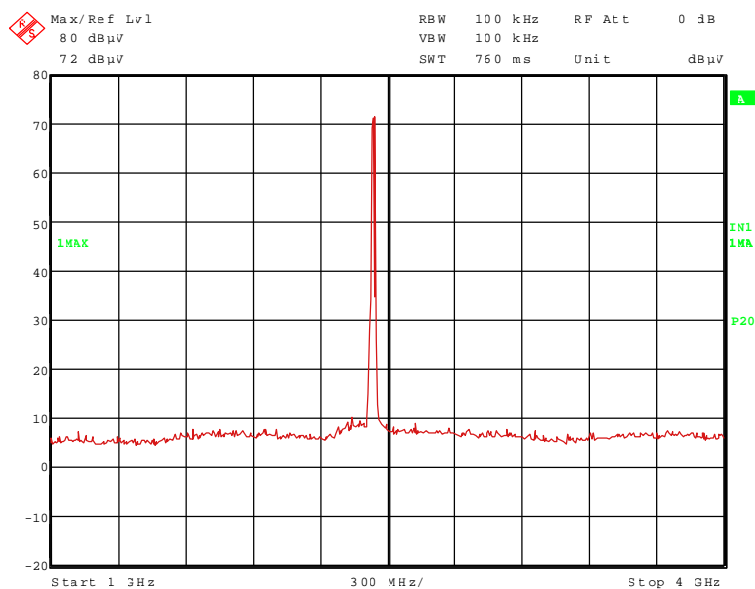
- 2.412 GHz.

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

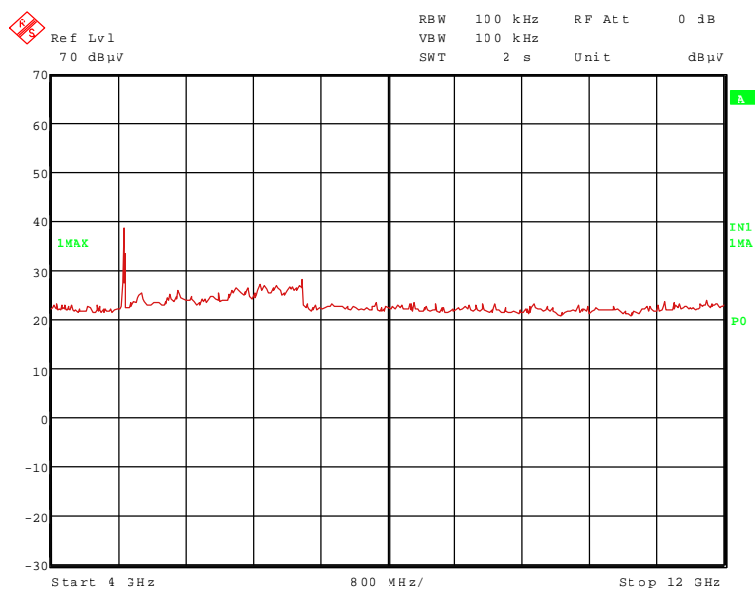
TEST REPORT REFERENCE: F101042E1

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

**101042\_2.wmf: Spurious emissions from 1 GHz to 4 GHz:**

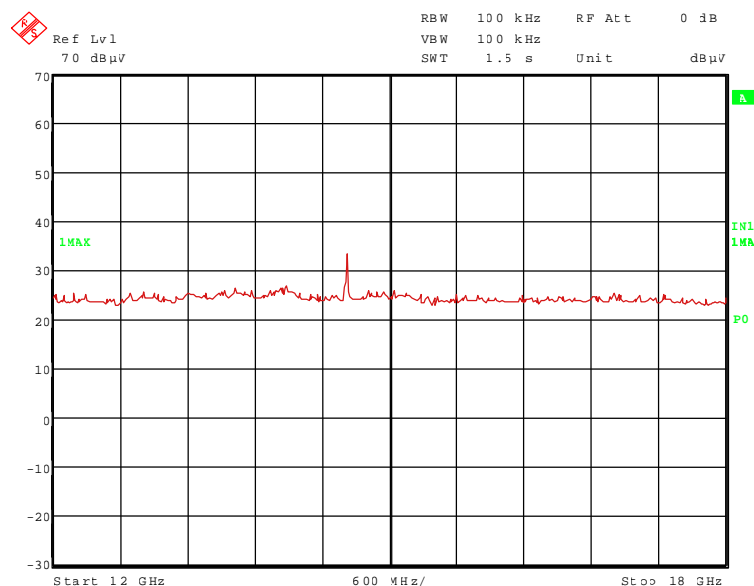


**101042\_20.wmf: Spurious emissions from 4 GHz to 12 GHz:**

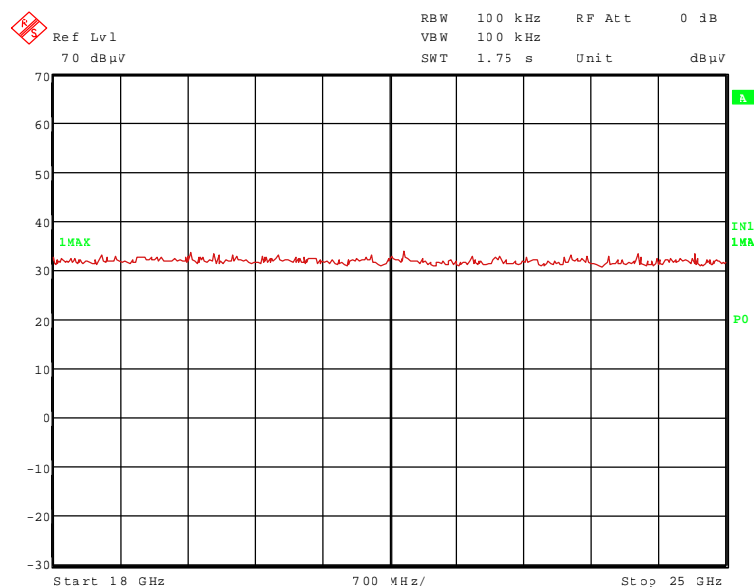


TEST REPORT REFERENCE: F101042E1

101042\_42.wmf: Spurious emissions from 12 GHz to 18 GHz:



101042\_39.wmf: Spurious emissions from 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 frequencies were found outside the restricted bands during the preliminary radiated emission test:

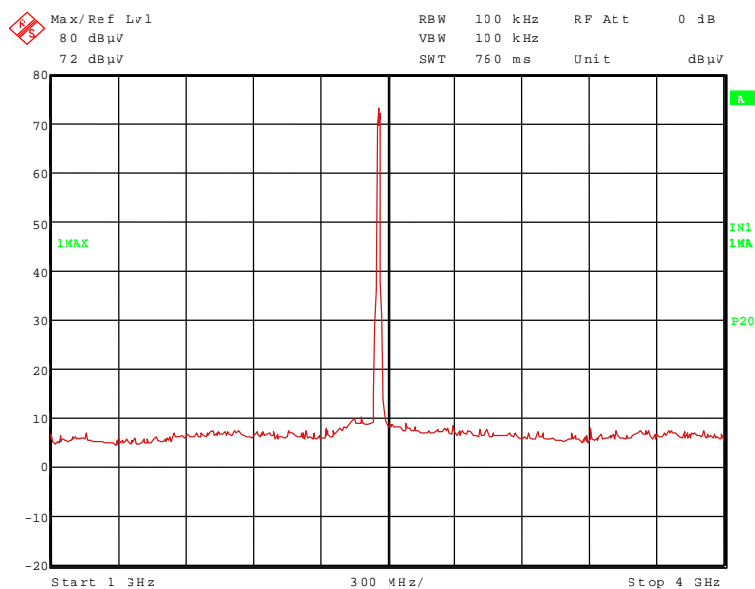
- 2.437 GHz and 14.622 GHz.

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

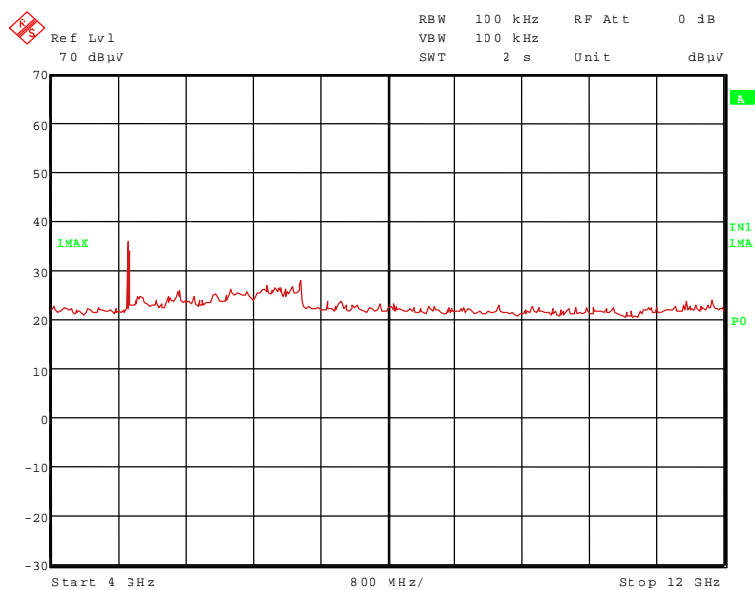
TEST REPORT REFERENCE: F101042E1

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

**101042 3.wmf: Spurious emissions from 1 GHz to 4 GHz:**

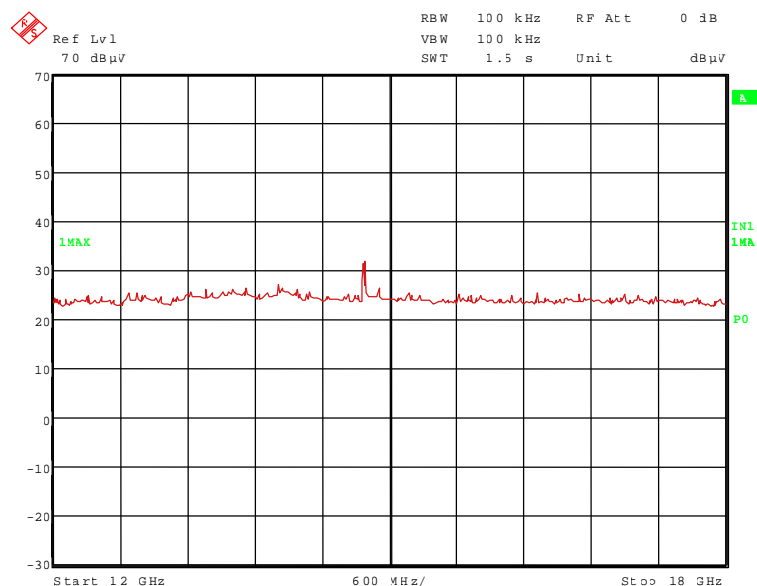


**101042 21.wmf: Spurious emissions from 4 GHz to 12 GHz:**

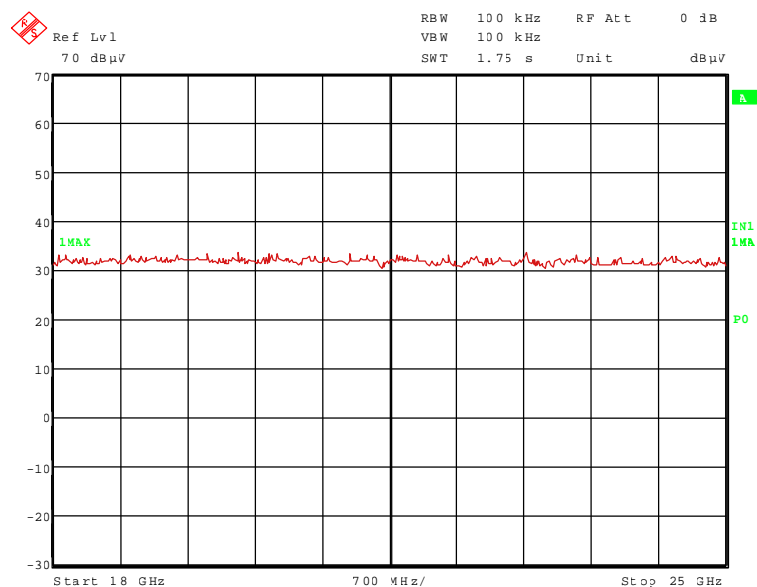


TEST REPORT REFERENCE: F101042E1

101042 41.wmf: Spurious emissions from 12 GHz to 18 GHz:



101042 40.wmf: Spurious emissions from 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 frequencies were found outside the restricted bands during the preliminary radiated emission test:

- 2.462 GHz and 14.772 GHz.

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



TEST REPORT REFERENCE: F101042E1

#### 6.3.2.4 PRELIMINARY MEASUREMENT (1 GHz to 25 GHz), n-mode

Ambient temperature	20 °C	Relative humidity	35 %
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Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.

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

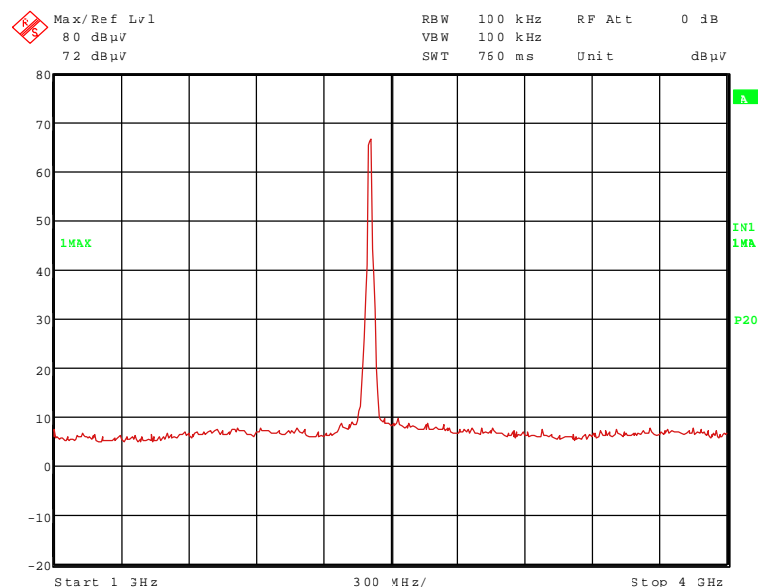
Test record: All results are shown in the following.

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

Remark: The plots at the next pages are showing radiated spurious emissions with the worst case data rate. The tables of the final measurements in the next clauses are showing the results for the radiated spurious emissions with the worst case data rate, causing the highest emission level.

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

101042\_11.wmf: Spurious emissions from 1 GHz to 4 GHz:

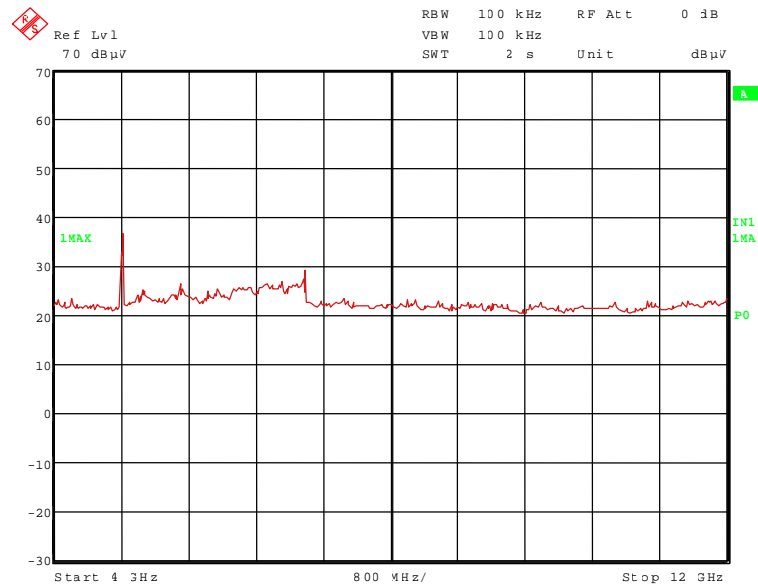


TEST EQUIPMENT USED FOR THE TEST:

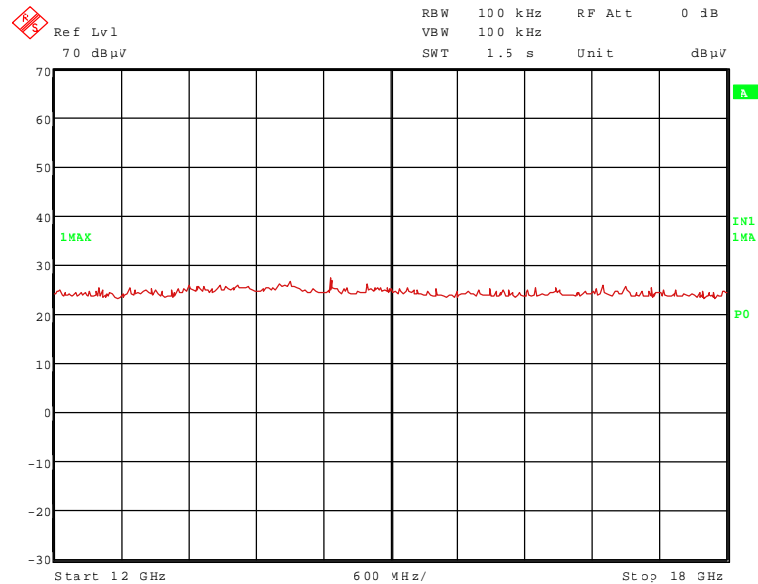
29, 31 – 34, 36, 37, 39, 44, 46, 49 – 51, 72

TEST REPORT REFERENCE: F101042E1

101042 18.wmf: Spurious emissions from 4 GHz to 12 GHz:

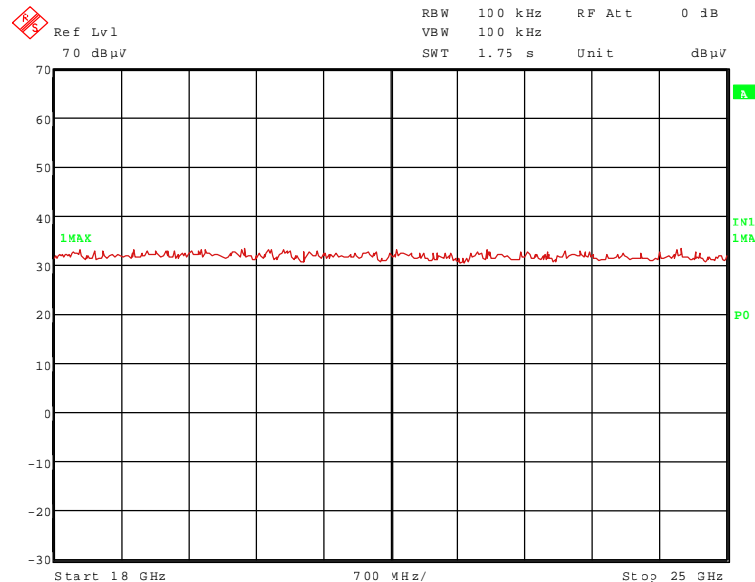


101042 44.wmf: Spurious emissions from 12 GHz to 18 GHz:



TEST REPORT REFERENCE: F101042E1

101042\_49.wmf: Spurious emissions from 18 GHz to 25 GHz:



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

- 4.824 GHz and 14.472 GHz.

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

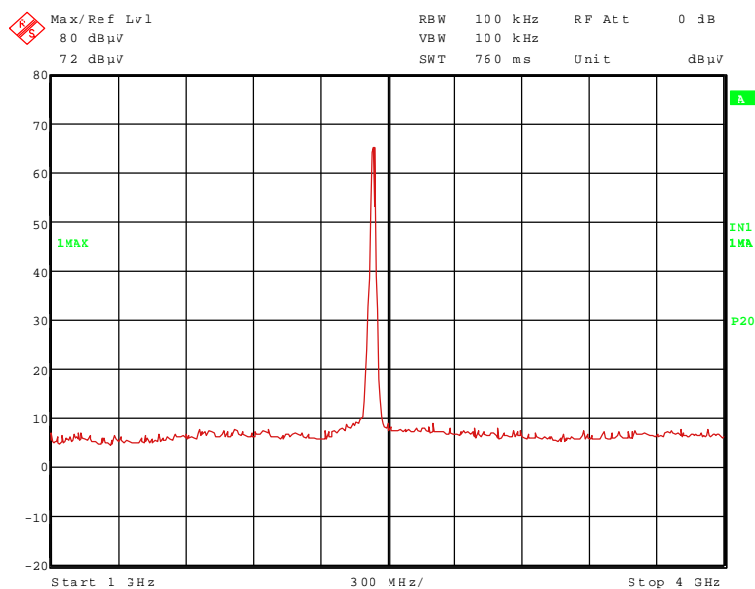
- 2.412 GHz.

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

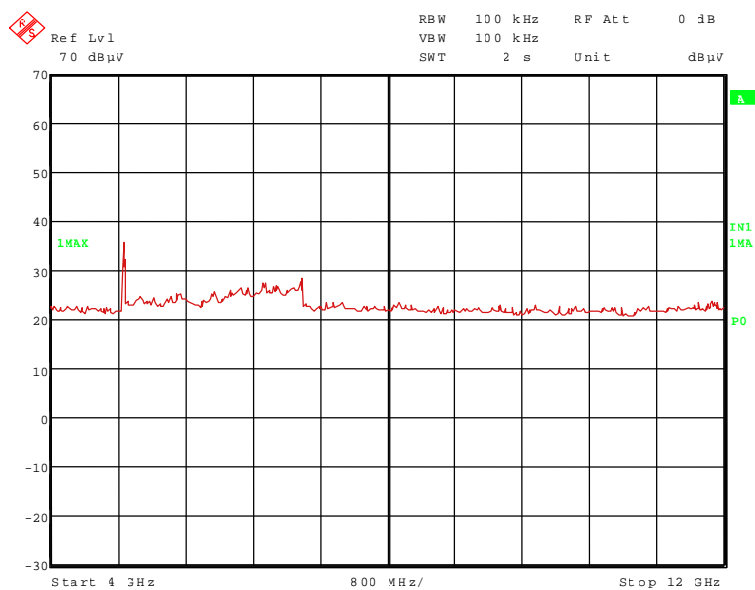
TEST REPORT REFERENCE: F101042E1

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

**101042 15.wmf: Spurious emissions from 1 GHz to 4 GHz:**

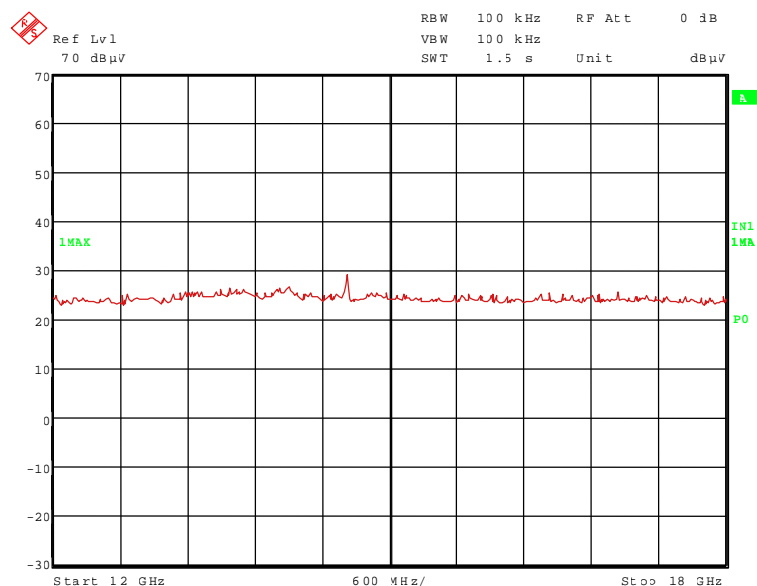


**101042 16.wmf: Spurious emissions from 4 GHz to 12 GHz:**

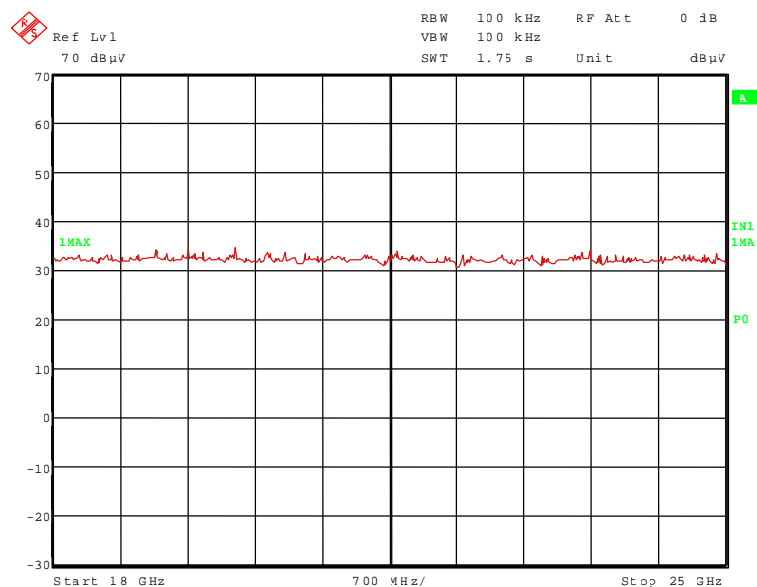


TEST REPORT REFERENCE: F101042E1

101042\_45.wmf: Spurious emissions from 12 GHz to 18 GHz:



101042\_48.wmf: Spurious emissions from 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 frequencies were found outside the restricted bands during the preliminary radiated emission test:

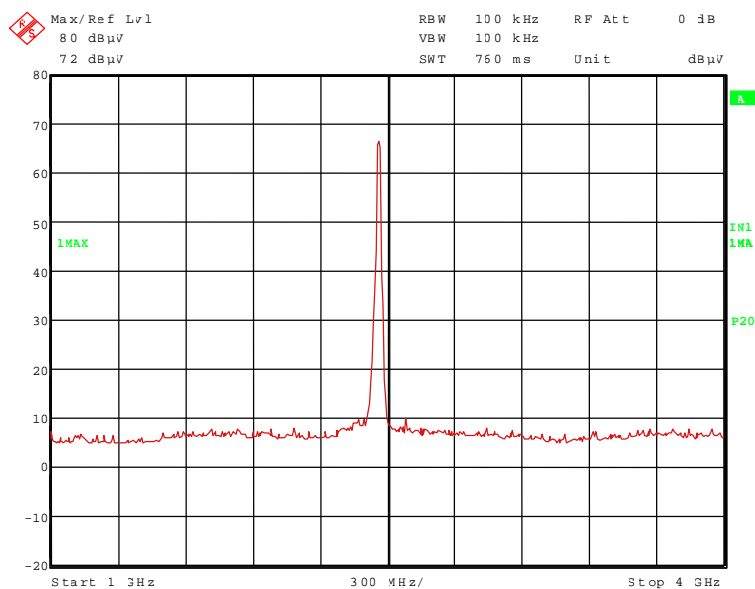
- 2.437 GHz and 14.622 GHz.

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

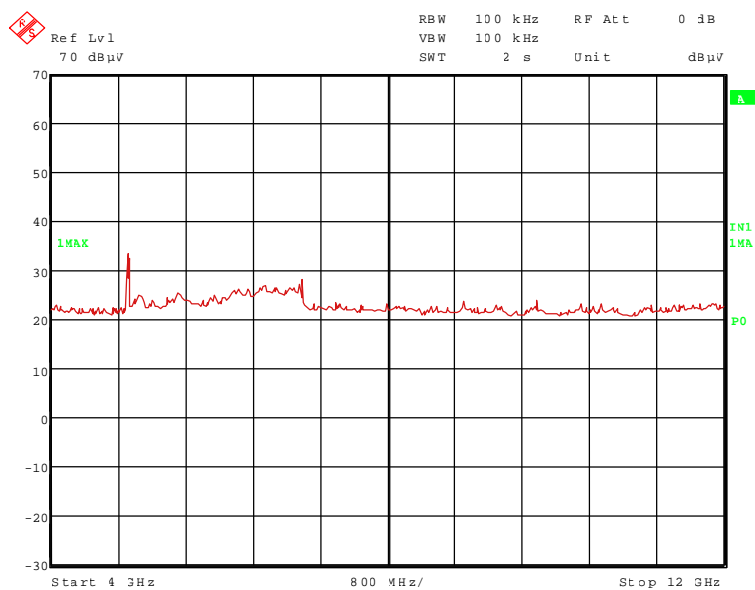
TEST REPORT REFERENCE: F101042E1

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

**101042\_13.wmf: Spurious emissions from 1 GHz to 4 GHz:**

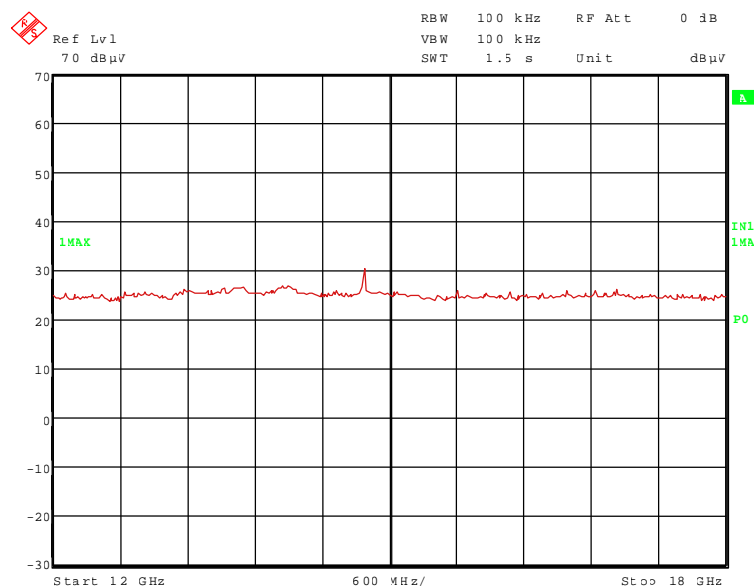


**101042\_17.wmf: Spurious emissions from 4 GHz to 12 GHz:**

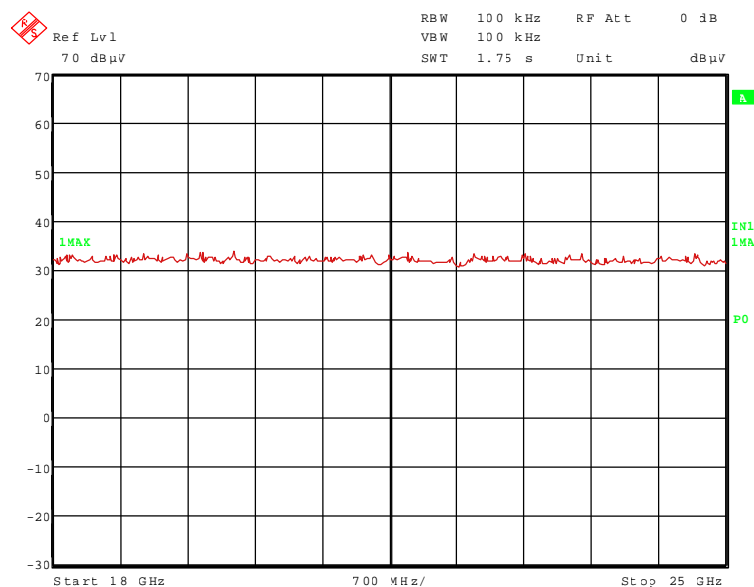


TEST REPORT REFERENCE: F101042E1

101042\_46.wmf: Spurious emissions from 12 GHz to 18 GHz:



101042\_47.wmf: Spurious emissions from 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 frequencies were found outside the restricted bands during the preliminary radiated emission test:

- 2.462 GHz and 14.772 GHz.

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

TEST REPORT REFERENCE: F101042E1

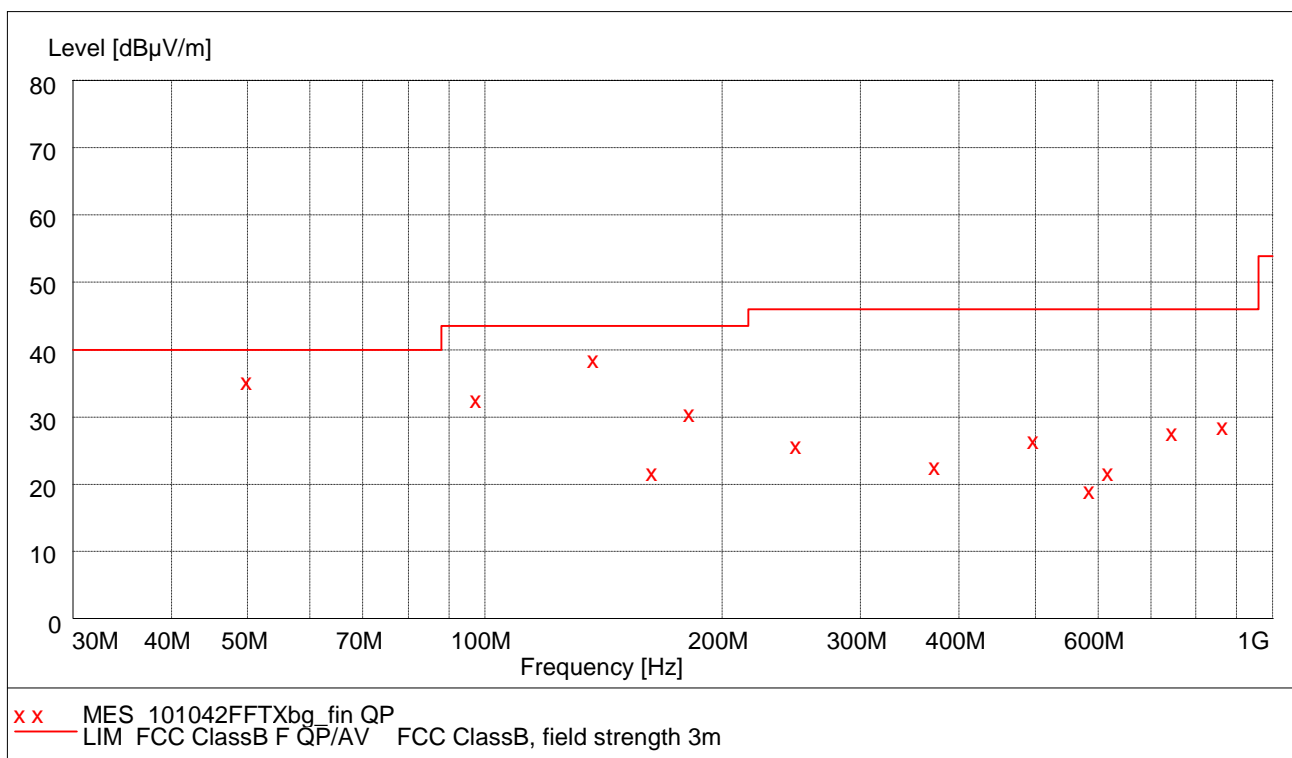
### 6.3.2.5 FINAL MEASUREMENT (30 MHz to 1 GHz) b-mode

Ambient temperature	21 °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:** For detail information of test set-up and the cable guide refer to the pictures in annex A of this test report.
- Supply voltage:** During all measurements the EUT was supplied with 24.0 V DC.
- Test record:** The test was carried out in test mode 2 (b-mode with 11 Mbps) of the EUT, because there was no difference to the other test modes.
- Resolution bandwidth:** For all measurements a resolution bandwidth of 120 kHz was used.
- Test results:** The test results were calculated with the following formula:  

$$\text{Result [dB}\mu\text{V/m]} = \text{reading [dB}\mu\text{V]} + \text{cable loss [dB]} + \text{antenna factor [dB/m]}$$

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 an x are the measured results of the standard subsequent measurement on the open area test site.



Data record name: 101042TXbg



TEST REPORT REFERENCE: F101042E1

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 3 m measuring distance.

The measurement time with the quasi-peak measuring detector is 1 second.

**Result measured with the quasipeak detector:**  
(These values are marked in the diagram by an x)

Spurious emissions outside restricted bands									
Frequency MHz	Result dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor dB/m	Cable loss dB	Height cm	Azimuth deg	Pol.
50.431	35.8	40.0	4.2	26.1	8.9	0.8	100.0	158.0	Vert.
98.467	33.0	43.5	10.5	21.2	10.7	1.1	175.0	292.0	Hor.
138.417	39.1	43.5	4.4	25.8	12.0	1.3	200.0	112.0	Hor.
183.733	31.0	43.5	12.5	20.3	9.2	1.5	100.0	113.0	Vert.
375.000	23.0	46.0	23.0	6.0	14.8	2.2	150.0	248.0	Vert.
500.000	27.1	46.0	18.9	7.2	17.4	2.5	100.0	113.0	Vert.
592.630	19.7	46.0	26.3	-2.2	19.1	2.8	200.0	248.0	Vert.
625.000	22.6	46.0	23.4	0.1	19.7	2.8	100.0	158.0	Vert.
750.000	28.2	46.0	17.8	3.4	21.7	3.1	150.0	158.0	Vert.
875.000	29.1	46.0	16.9	3.6	22.1	3.4	100.0	203.0	Vert.
Spurious emissions in restricted bands									
Frequency MHz	Result dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor dB/m	Cable loss dB	Height cm	Azimuth deg	Pol.
163.925	22.4	43.5	21.1	10.1	10.9	1.4	100.0	203.0	Vert.
250.000	26.5	46.0	19.5	12.6	12.1	1.8	150.0	203.0	Vert.
Measurement uncertainty				+2.2 dB / -3.6 dB					

The test results were calculated with the following formula:

Result [dBμV/m] = reading [dBμV] + cable loss [dB] + antenna factor [dB/m]

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

14 – 20

TEST REPORT REFERENCE: F101042E1

### 6.3.2.6 FINAL MEASUREMENT (1 GHz to 25 GHz) g-mode

Ambient temperature	20 °C	Relative humidity	33 %
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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.

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

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

Remark: The worst case data rate for this measurement was 6 Mbps.

#### 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	108.5	-	-	76.0	28.8	0.0	3.7	150	Vert.	-
4.824	59.8	74.0	14.2	46.5	33.7	25.7	5.3	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	98.5	-	-	66.0	28.8	0.0	3.7	150	Vert.	-
4.824	45.8	54.0	8.2	32.5	33.7	25.7	5.3	150	Hor.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

TEST REPORT REFERENCE: F101042E1

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

**Result measured with the peak detector:**

Frequency GHz	Corr. value dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB	Readings dB $\mu$ V	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.437	107.0	-	-	74.5	28.8	0.0	3.7	150	Hor.	-
4.874	59.4	74.0	14.6	46.1	33.8	25.7	5.2	150	Hor.	Yes
14.622	49.9	87.0	37.1	40.3	33.7	26.6	2.5	100	Hor.	No
Measurement uncertainty						+2.2 dB / -3.6 dB				

**Result measured with the average detector:**

Frequency GHz	Corr. value dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB	Readings dB $\mu$ V	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.437	98.1	-	-	65.6	28.8	0.0	3.7	150	Hor.	-
4.874	45.5	54.0	8.5	32.2	33.8	25.7	5.2	150	Hor.	Yes
14.622	35.7	78.1	42.4	26.1	33.7	26.6	2.5	100	Hor.	No
Measurement uncertainty						+2.2 dB / -3.6 dB				

TEST REPORT REFERENCE: F101042E1

**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	108.8	-	-	76.2	28.9	0.0	3.7	150	Hor.	-
4.924	57.4	74.0	16.6	43.8	33.9	25.6	5.3	150	Hor.	Yes
14.772	49.5	88.8	39.3	40.0	33.7	26.7	2.5	100	Hor.	No
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	99.2	-	-	66.6	28.9	0.0	3.7	150	Hor.	-
4.924	43.9	54.0	10.1	30.3	33.9	25.6	5.3	150	Hor.	Yes
14.772	35.3	79.2	43.9	25.8	33.7	26.7	2.5	100	Hor.	No
Measurement uncertainty						+2.2 dB / -3.6 dB				

Test: Passed

**TEST EQUIPMENT USED FOR THE TEST:**

29, 31 – 34, 36, 37, 39, 44, 46, 49 – 51, 72

TEST REPORT REFERENCE: F101042E1

### 6.3.2.7 FINAL MEASUREMENT (1 GHz to 25 GHz) b-mode

Ambient temperature	21 °C	Relative humidity	34 %
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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.

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

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

Remark: The worst case data rate for this measurement was 11 Mbps.

#### 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	110.9	-	-	78.4	28.8	0.0	3.7	150	Vert.	-
4.824	62.6	74.0	11.4	49.3	33.7	25.7	5.3	150	Hor.	Yes
14.472	53.7	74.0	20.3	44.0	33.7	26.5	2.5	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	102.8	-	-	70.3	28.8	0.0	3.7	150	Vert.	-
4.824	48.2	54.0	5.8	34.9	33.7	25.7	5.3	150	Hor.	Yes
14.472	38.3	54.0	15.7	28.6	33.7	26.5	2.5	100	Hor.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

TEST REPORT REFERENCE: F101042E1

**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	110.0	-	-	77.5	28.8	0.0	3.7	150	Hor.	-
4.874	61.5	74.0	12.5	48.2	33.8	25.7	5.2	150	Hor.	Yes
14.622	55.1	90.0	34.9	45.5	33.7	26.6	2.5	100	Hor.	No
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	102.0	-	-	69.5	28.8	0.0	3.7	150	Hor.	-
4.874	47.2	54.0	6.8	33.9	33.8	25.7	5.2	150	Hor.	Yes
14.622	40.5	82.0	41.5	30.9	33.7	26.6	2.5	100	Hor.	No
Measurement uncertainty						+2.2 dB / -3.6 dB				

TEST REPORT REFERENCE: F101042E1

**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	111.5	-	-	78.9	28.9	0.0	3.7	150	Hor.	-
4.924	61.1	74.0	12.9	47.5	33.9	25.6	5.3	150	Hor.	Yes
14.772	54.3	91.5	37.2	44.8	33.7	26.7	2.5	100	Hor.	No
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	103.5	-	-	70.9	28.9	0.0	3.7	150	Hor.	-
4.924	47.5	54.0	6.5	33.9	33.9	25.6	5.3	150	Hor.	Yes
14.772	40.3	83.5	43.2	30.8	33.7	26.7	2.5	100	Hor.	No
Measurement uncertainty						+2.2 dB / -3.6 dB				

Test: Passed

**TEST EQUIPMENT USED FOR THE TEST:**

29, 31 – 34, 36, 37, 39, 44, 46, 49 – 51, 72

TEST REPORT REFERENCE: F101042E1

### 6.3.2.8 FINAL MEASUREMENT (1 GHz to 25 GHz) n-mode

Ambient temperature	20 °C	Relative humidity	33 %
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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.

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

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

Remark: The worst case data rate for this measurement was 6 Mbps.

#### 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	108.7	-	-	76.2	28.8	0.0	3.7	150	Vert.	-
4.824	59.5	74.0	14.5	46.2	33.7	25.7	5.3	150	Hor.	Yes
14.472	48.2	74.0	25.8	38.5	33.7	26.5	2.5	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	98.7	-	-	66.2	28.8	0.0	3.7	150	Vert.	-
4.824	45.7	54.0	8.3	32.4	33.7	25.7	5.3	150	Hor.	Yes
14.472	33.8	54.0	20.2	24.1	33.7	26.5	2.5	100	Hor.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				



TEST REPORT REFERENCE: F101042E1

**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	107.5	-	-	75.0	28.8	0.0	3.7	150	Hor.	-
4.874	58.4	74.0	15.6	45.1	33.8	25.7	5.2	150	Hor.	Yes
14.622	50.1	87.5	37.4	40.5	33.7	26.6	2.5	100	Hor.	No
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	97.3	-	-	64.8	28.8	0.0	3.7	150	Hor.	-
4.874	44.8	54.0	9.2	31.5	33.8	25.7	5.2	150	Hor.	Yes
14.622	35.5	77.3	41.8	25.9	33.7	26.6	2.5	100	Hor.	No
Measurement uncertainty						+2.2 dB / -3.6 dB				

TEST REPORT REFERENCE: F101042E1

**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	108.9	-	-	76.3	28.9	0.0	3.7	150	Hor.	-
4.924	57.4	74.0	16.6	43.8	33.9	25.6	5.3	150	Hor.	Yes
14.772	50.1	88.9	38.8	40.6	33.7	26.7	2.5	100	Hor.	No
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	98.8	-	-	66.2	28.9	0.0	3.7	150	Hor.	-
4.924	43.7	54.0	10.3	30.1	33.9	25.6	5.3	150	Hor.	Yes
14.772	35.5	78.8	43.3	26.0	33.7	26.7	2.5	100	Hor.	No
Measurement uncertainty						+2.2 dB / -3.6 dB				

Test: Passed

**TEST EQUIPMENT USED FOR THE TEST:**

29, 31 – 34, 36, 37, 39, 44, 46, 49 – 51, 72

TEST REPORT REFERENCE: F101042E1

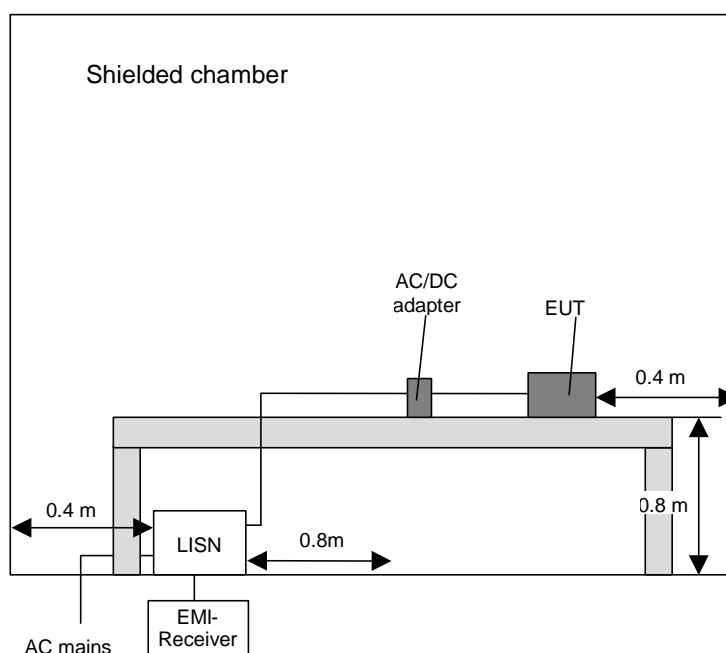
## 6.4 CONDUCTED EMISSIONS ON POWER SUPPLY LINES (150 kHz to 30 MHz)

### 6.4.1 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 C63.4-2009 [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: F101042E1

## 6.4.2 TEST RESULTS (CONDUCTED EMISSIONS ON POWER SUPPLY LINES)

Ambient temperature	21 °C	Relative humidity	45 %
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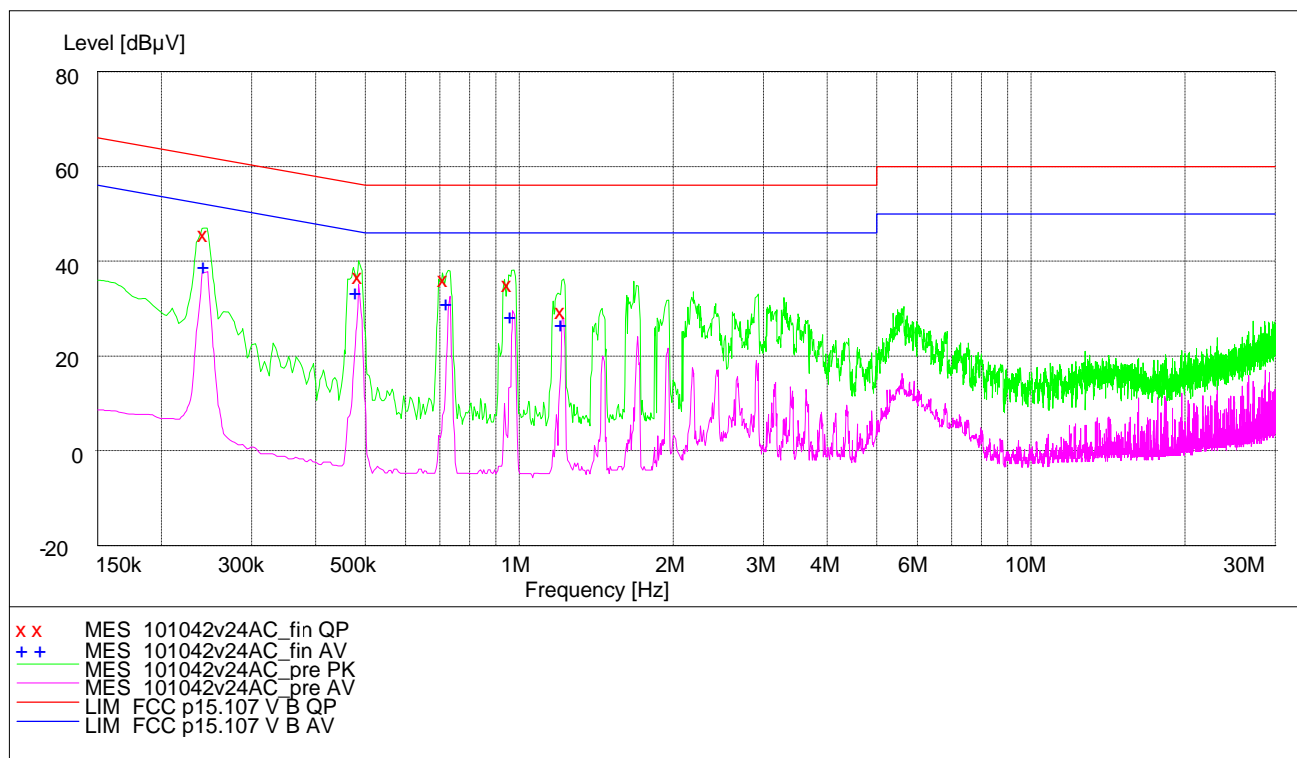
Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m.

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 the measurement the EUT was supplied 24.0 V DC by an AC / DC adaptor type VANSON Mod. SMP-1000A 012. The EUT transmits in fping mode, because there was no difference to the other test modes.

The curves in the diagram only represent for each frequency point the maximum measured value of all preliminary measurements which were made for each power supply line. The top measured curve represents the peak measurement and the bottom measured curve the average measurement. The quasi-peak measured points are marked by an x and the average measured points by an +.



Data record name: 101042v24AC

TEST REPORT REFERENCE: F101042E1

### Result measured with the peak detector:

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

Frequency MHz	Level dB $\mu$ V	Transducer dB	Limit dB $\mu$ V	Margin dB	Line	PE
0.243600	46.6	0.9	62.0	15.4	N	FLO
0.491100	37.3	0.8	56.1	18.8	N	FLO
0.725100	36.9	0.8	56.0	19.1	N	FLO
0.965400	36.0	0.8	56.0	20.0	L1	FLO
1.226400	30.0	0.7	56.0	26.0	L1	FLO
Measurement uncertainty				+3.6 dB / -4.5 dB		

Data record name: 101042v24AC\_fin\_QP

### Result measured with the average detector:

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

Frequency MHz	Level dB $\mu$ V	Transducer dB	Limit dB $\mu$ V	Margin dB	Line	PE
0.243600	39.6	0.9	52.0	12.4	N	FLO
0.486600	34.3	0.8	46.2	11.9	N	FLO
0.728700	32.0	0.8	46.0	14.0	N	FLO
0.972600	29.4	0.8	46.0	16.6	L1	FLO
1.214700	27.3	0.7	46.0	18.7	N	FLO
Measurement uncertainty				+3.6 dB / -4.5 dB		

Data record name: 101042v24AC\_fin\_AV

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

1 – 3, 5, 6

TEST REPORT REFERENCE: F101042E1

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

TEST REPORT REFERENCE: F101042E1

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal. due
1	Shielded chamber M47	-	Albatross Projects	B83117-C6439-T262 -	480662	Weekly verification (system cal.)	
2	EMI Receiver	ESIB26	Rohde & Schwarz	100292	481182	02/08/2010	02/2012
3	LISN	ESH2-Z5	Rohde & Schwarz	879675/037	580006	08/14/2009	08/2010
5	High pass filter	HR 0.13-5ENN	FSY Microwave Inc.	DC 0109 SN 002	480340	Weekly verification (system cal.)	
6	EMI-Software	ES-K1	Rohde & Schwarz	-	480111	Not applicable	
14	Open area test site	-	Phoenix Test-Lab	-	480085	Weekly verification	
15	Measuring receiver	ESIB7	Rohde & Schwarz	100304	480521	03/15/2010	03/2012
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	08/01/2007	08/2012
20	EMI Software	ES-K1	Rohde & Schwarz	-	480111	-	-
29	Fully anechoic chamber M20	-	Albatross Projects	B83107-E2439-T232	480303	Weekly verification	
31	Measuring receiver	ESI 40	Rohde & Schwarz	100064	480355	03/17/2010	03/2012
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	10/11/2005	10/2010
36	Antenna	3115 A	EMCO	9609-4918	480183	04/11/2008	11/2013
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	Huber + Suhner	0522/6B	480571	Weekly verification	
44	RF-cable No. 31	RTK 081	Rosenberger	-	410142	Weekly verification	
46	RF-cable 1m	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	03/10/2010	03/2013
72	4 GHz High Pass Filter	WHKX4.0/18G-8SS	Wainwright Instruments	1	480587	Weekly verification	
166	Power Meter	NRVD	Rohde & Schwarz	833697/030	480589	03/17/2010	03/2012
167	Peak Power Sensor	NRV-Z32	Rohde & Schwarz	849745/016	480551	03/16/2010	03/2012

TEST REPORT REFERENCE: F101042E1

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## 8 LIST OF ANNEXES

<b>ANNEX A</b>	<b>PHOTOGRAPHS OF THE TEST SET-UPS:</b>	<b>7 pages</b>
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	cB-RWE231, main PCB, bottom view	101042_e.jpg
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