

TEST REPORT

Test Report Reference: F091568E2

Equipment under Test / model name: cB-0926-02 and cB-0926-03

FCC ID: PVH0926

IC: 5325A-0926

Serial Number: None

Applicant: connectBlue AB

Manufacturer: connectBlue AB

**Test Laboratory
(CAB)
accredited by
DATech in der TGA GmbH
in compliance with DIN EN ISO/IEC 17025
under the
Reg. No. DAT-P-105/99-21,
FCC Test site registration number 90877
and
Industry Canada Test site registration IC3469A-1 and
FCC Test site registration number 90877**

TEST REPORT REFERENCE: F091568E2

Contents:	Page
1 IDENTIFICATION	4
1.1 APPLICANT	4
1.2 MANUFACTURER	4
1.3 DATES	4
1.4 TEST LABORATORY	5
1.5 RESERVATION	5
1.6 NORMATIVE REFERENCES	5
1.7 TEST RESULTS	5
2 TECHNICAL DATA OF EQUIPMENT	6
2.1 PERIPHERY DEVICES	6
2.2 USED ANTENNAS	7
3 OPERATIONAL STATES AND PHYSICAL BOUNDARIES	8
4 LIST OF MEASUREMENTS	9
5 ADDITIONAL INFORMATION	9
6 TEST RESULTS	10
6.1 BANDWIDTH	10
6.1.1 METHOD OF MEASUREMENT (26 dB SPECTRUM AND 99 % BANDWIDTH)	10
6.1.2 TEST RESULTS (26 dB SPECTRUM AND 99 % BANDWIDTH)	11
6.2 MAXIMUM CONDUCTED OUTPUT POWER	16
6.2.1 METHOD OF MEASUREMENT (MAXIMUM CONDUCTED OUTPUT POWER)	16
6.2.2 TEST RESULTS (MAXIMUM CONDUCTED OUTPUT POWER)	17
6.3 PEAK POWER SPECTRAL DENSITY	22
6.3.1 METHOD OF MEASUREMENT (PEAK POWER SPECTRAL DENSITY)	22
6.3.2 TEST RESULTS (PEAK POWER SPECTRAL DENSITY)	23
6.4 PEAK EXCURSION	28
6.4.1 METHOD OF MEASUREMENT (PEAK EXCURSION)	28
6.4.2 TEST RESULTS (PEAK EXCURSION)	29
6.5 BAND-EDGE COMPLIANCE	34
6.5.1 METHOD OF MEASUREMENT (BAND-EDGE COMPLIANCE)	34
6.5.2 TEST RESULT (BAND-EDGE COMPLIANCE) with internal antenna	35
6.5.3 TEST RESULT (BAND-EDGE COMPLIANCE) a-mode with internal antenna	36
6.5.4 TEST RESULT (BAND-EDGE COMPLIANCE) n-mode with internal antenna	37
6.5.5 TEST RESULT (BAND-EDGE COMPLIANCE) with external patch antenna	38
6.5.6 TEST RESULT (BAND-EDGE COMPLIANCE) a-mode with external patch antenna	39
6.5.7 TEST RESULT (BAND-EDGE COMPLIANCE) n-mode with external patch antenna	40
6.5.8 TEST RESULT (BAND-EDGE COMPLIANCE) with external monopole antenna	41
6.5.9 TEST RESULT (BAND-EDGE COMPLIANCE) a-mode with external monopole antenna	42
6.5.10 TEST RESULT (BAND-EDGE COMPLIANCE) n-mode with external monopole antenna	43

TEST REPORT REFERENCE: F091568E2

Contents (continued):	Page
6.6 FREQUENCY STABILITY	44
6.6.1 METHOD OF MEASUREMENT (FREQUENCY STABILITY).....	44
6.6.2 TEST RESULT (FREQUENCY STABILITY).....	45
6.7 RADIATED EMISSIONS.....	46
6.7.1 METHOD OF MEASUREMENT (RADIATED EMISSIONS)	46
6.7.2 TEST RESULTS (RADIATED EMISSIONS) WITH INTERNAL ANTENNA	53
6.7.2.1 PRELIMINARY MEASUREMENT (9 kHz to 1 GHz)	53
6.7.2.2 PRELIMINARY MEASUREMENT (1 GHz to 40 GHz), a-mode, internal antenna	56
6.7.2.3 FINAL MEASUREMENT (30 MHz to 1 GHz) a-mode, internal antenna	63
6.7.2.4 FINAL MEASUREMENT (1 GHz to 40 GHz) a-mode, internal antenna	65
6.7.2.5 FINAL MEASUREMENT (1 GHz to 40 GHz) n-mode, internal antenna	66
6.7.3 TEST RESULTS (RADIATED EMISSIONS) WITH EXTERNAL PATCH ANTENNA.....	67
6.7.3.1 PRELIMINARY MEASUREMENT (9 kHz to 1 GHz)	67
6.7.3.2 PRELIMINARY MEASUREMENT (1 GHz to 40 GHz), n-mode, external patch antenna	70
6.7.3.3 FINAL MEASUREMENT (30 MHz to 1 GHz) a-mode, external patch antenna	77
6.7.3.4 FINAL MEASUREMENT (1 GHz to 40 GHz) a-mode, external patch antenna	79
6.7.3.5 FINAL MEASUREMENT (1 GHz to 40 GHz) n-mode, external patch antenna	80
6.7.4 TEST RESULTS (RADIATED EMISSIONS) WITH EXTERNAL MONOPOLE ANTENNA	81
6.7.4.1 PRELIMINARY MEASUREMENT (9 kHz to 1 GHz)	81
6.7.4.2 PRELIMINARY MEASUREMENT (1 GHz to 40 GHz), n-mode, external monopole antenna	84
6.7.4.3 FINAL MEASUREMENT (30 MHz to 1 GHz) a-mode, external monopole antenna	91
6.7.4.4 FINAL MEASUREMENT (1 GHz to 40 GHz) a-mode, external monopole antenna	93
6.7.4.5 FINAL MEASUREMENT (1 GHz to 25 GHz) n-mode, external monopole antenna	94
6.8 CONDUCTED EMISSIONS ON POWER SUPPLY LINES (150 kHz to 30 MHz).....	95
6.8.1 METHOD OF MEASUREMENT.....	95
6.8.2 TEST RESULTS (CONDUCTED EMISSIONS ON POWER SUPPLY LINES)	96
7 TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS.....	98
8 LIST OF ANNEXES	101

TEST REPORT REFERENCE: F091568E2

1 IDENTIFICATION

1.1 APPLICANT

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

1.2 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:	23 June 2009
Start of test:	23 June 2009
End of test:	23 October 2009

TEST REPORT REFERENCE: F091568E2

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**

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

Test engineer: Thomas KÜHN
Name

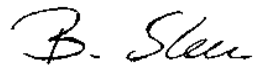


Signature

26 November 2009

Date

Test report checked: Bernd STEINER
Name



Signature

26 November 2009

Date

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

Stamp

1.5 RESERVATION

This test report is only valid in its original form.

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

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

1.6 NORMATIVE REFERENCES

- [1] **ANSI C63.4-2003** American National Standard for Methods of Measuring of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
- [2] **FCC CFR 47 Part 15** Radio Frequency Devices
- [3] **FCC Public Notice DA 02-2138 (August 2002)**
- [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.

TEST REPORT REFERENCE: F091568E2

2 TECHNICAL DATA OF EQUIPMENT

Type of equipment: *	a-, b-, g-, n-WLAN module				
Type designation / model name: *	cB-0926-02, cB-0926-03				
Hardware / software version: *	2.5 / 1.2				
FCC ID: *	PVH0926				
IC: *	5235A-0926				
Antenna type: *	<p>The antenna connectors are not mounted on versions with internal antenna.</p> <p>On versions intended for external antenna there are two Hirose U.FL connectors J4 = Rx & Tx, J5 = Rx only (diversity antenna)</p> <p>Refer table in clause 2.2</p>				
Antenna gain: *	Refer table in clause 2.2				
Power supply: *	U _{nom} =	5.0 V DC	U _{min} =	3.3 V DC	U _{max} = 5.5 V DC
Type of modulation: *	DSSS/OFDM				
Operating frequency range: *	5.18 to 5.24 GHz (4 channels with 20 MHz channel separation)				
Number of channels: *	4				
Temperature range: *	-30 °C to +85 °C				

*: declared by the applicant

The following external I/O cables were used:

Cable	Length	Shielding	Connector
DC in (carrier board)	2 m *	No	6.3 mm jack plug
RS 232 (carrier board)	2 m *	Yes	9 pole D-Sub connector

*: 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 temporary to the SPI (cB-0926-02) / SDIO (cB-0926-03) interface of the WLAN module via RS 232 interface of the PC and the adapter board, for setting the equipment into the necessary operation mode. During emission measurements the personal computer and the adapter board were disconnected.
- An adapter board type cB-0717-02 was used to connect the carrier board with the EUT with the RS 232 interface of the used PC.
- For the conducted emission measurement on AC mains an AC / DC adaptor type Mascot type 2121 was used to supply the EUT with 5.0 V DC.
- During all test the EUT's were mounted on a carrier board type cB-0903-03.

TEST REPORT REFERENCE: F091568E2

2.2 USED ANTENNAS

Model name*	Antenna type	Cable length / connector	Rated Antenna gain*
Fractus, FR05-S1-N-0-104	Internal SMD	-	+3.0
ProAnt, InSide-WLAN	Patch	10 cm / U.FL	+3.0
ProAnt, Ex-IT WLAN - SMA - RP-SMA	Monopole	SMA RSMA	+3.0

*: declared by the applicant

TEST REPORT REFERENCE: F091568E2

3 OPERATIONAL STATES AND PHYSICAL BOUNDARIES

The EUT is a WLAN module, which is intended to be used in several applications. All radiated tests were carried out with samples with integral antenna (cB-0926-02 No. 6 and cB-0926-03 No. 5) and samples with external antenna (cB-0926-02 No. 4 and cB-0926-03 No.10); conductive tests were carried out on the U.FL connector of the samples with external antenna port.

During all tests the EUT was powered with 5.0 V DC via the carrier board. The operation mode was adjusted with the help of a configuration-software on a laptop computer. For setting the equipment into the necessary operation mode, the computer was connected temporary to the SPI / SDIO interface of the WLAN module via RS 232 to the adapter board. After adjusting the required operation mode, the adaptor board could be removed.

The EUT contains also a 2.4 GHz b-, g- and n-mode WLAN. Object of this test report is the 5 GHz a- and n-mode WLAN only. The results of the measurements of the 2.4 GHz WLAN will be documented in a separate test report.

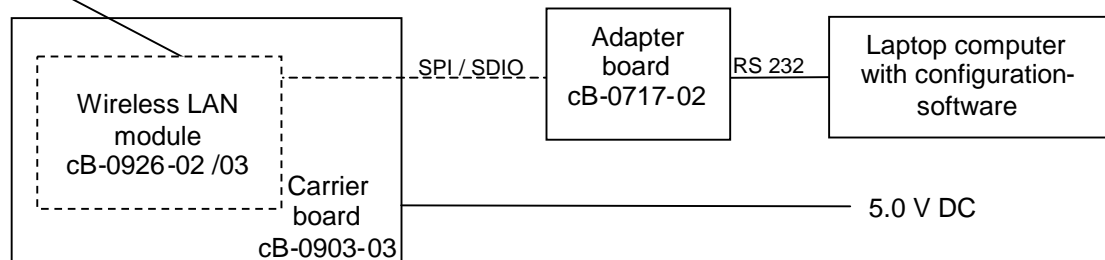
For adjusting the output power with the test software, a power setting of 50 was used during all tests.

During the tests, the EUTs were 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 5180 MHz, a- or n-mode, with all applicable data rates
2	Continuous transmitting on 5200 MHz, a- or n-mode, with all applicable data rates
3	Continuous transmitting on 5220 MHz, a- or n-mode, with all applicable data rates
4	Continuous transmitting on 5240 MHz, a- or n-mode, with all applicable data rates
5	Continuous receiving on 5180 MHz
6	Continuous receiving on 5200 MHz
7	Continuous receiving on 5220 MHz
8	Continuous receiving on 5240 MHz

Physical boundary of the EUT



TEST REPORT REFERENCE: F091568E2

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
26 dB spectrum bandwidth	5,150 – 5,250	15.407 (a)	A9.2 (1) [3]	Passed	10 et seq.
Maximum conducted output power	5,150 – 5,250	15.407 (a)	A9.2 (1) [3]	Passed	16 et seq.
Power spectral density	5,150 – 5,250	15.407 (a)	A9.2 (1) [3]	Passed	22 et seq.
Peak excursion	5,150 – 5,250	15.407 (a)	-	Passed	28 et seq.
Bandedge compliance	5,150 – 5,250	15.407 (b)	-	Passed	34 et seq.
Frequency stability	5,150 – 5,250	15.407 (g)	A9.5 (5) [3]	Passed	44 et seq.
Radiated emissions (transmitter)	30 – 40,000	15.209 (a) 15.407 (b)	A9.3 (1) [3], 4.7 [4]	Passed	44 et seq.
Conducted emissions on supply line	0.15 – 30	15.207 (a)	7.2.2 [4]	Passed	95 et seq.
Radiated emissions (receiver)	30 – 25,000	-	2.6 [3], 7.2.3 [4]	Passed	Annex D

5 ADDITIONAL INFORMATION

The EUT is intended to be used in different final applications. Therefore all radiated tests were carried out in three orthogonal directions to cover hand held applications. The results in this test report are showing the maximum of these three measurements. For the orientation during the test, please refer also the photographs in annex A of this test report.

The EUT is available with two different power supply circuits. The conducted emission measurement on the power supply line as well the radiated emission measurements were showing no noticeable difference between the variants. There for they were not documented separately.

Also the use of the SPI interface (cB-0926-02) shows no measurable difference to the use of the SDIO interface (cB-0926-03).

TEST REPORT REFERENCE: F091568E2

6 TEST RESULTS

6.1 BANDWIDTH

6.1.1 METHOD OF MEASUREMENT (26 dB SPECTRUM AND 99 % 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. In case of multiple antennas, a combiner shall be used to couple the signal to the spectrum analyser.

The following spectrum analyser settings shall be used:

- Span: App. 2 to 3 times the 26 dB bandwidth, centred on the actual channel.
- Resolution bandwidth: 300 kHz.
- Video bandwidth: 1 MHz.
- 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 26 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. Use the 99 % bandwidth measurement functionality of the spectrum analyser

The measurement will be performed on all channels.

Test set-up:

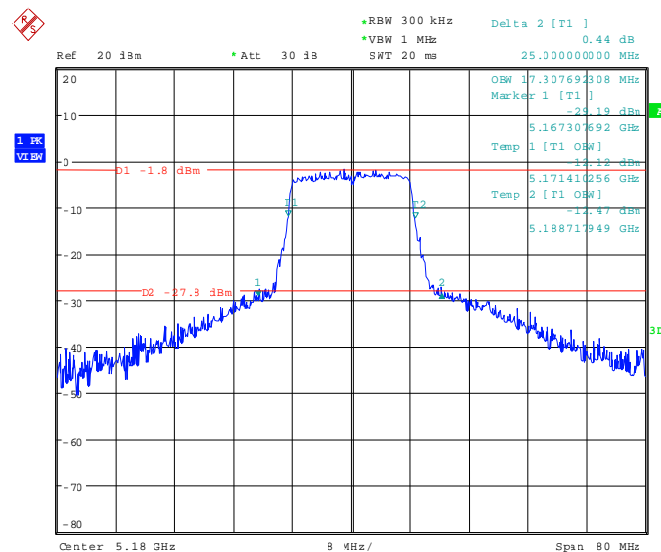


TEST REPORT REFERENCE: F091568E2

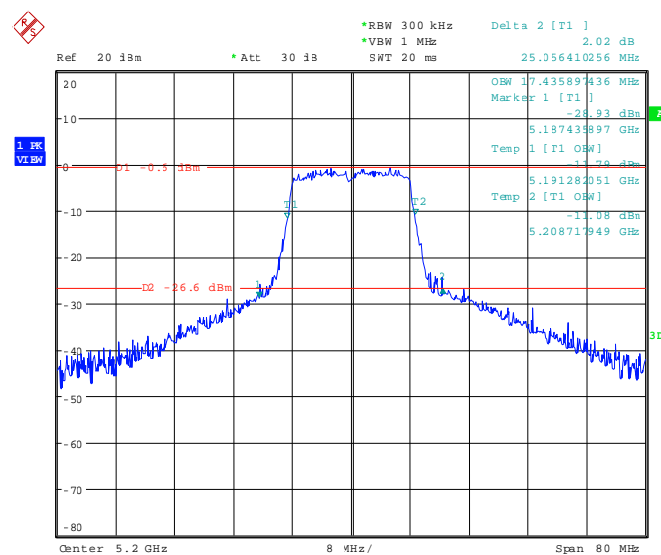
6.1.2 TEST RESULTS (26 dB SPECTRUM AND 99 % BANDWIDTH)

Ambient temperature	21 °C	Relative humidity	55 %
---------------------	-------	-------------------	------

91568_251.wmf: Bandwidth, operation mode 1, a-mode, 6 Mbps:

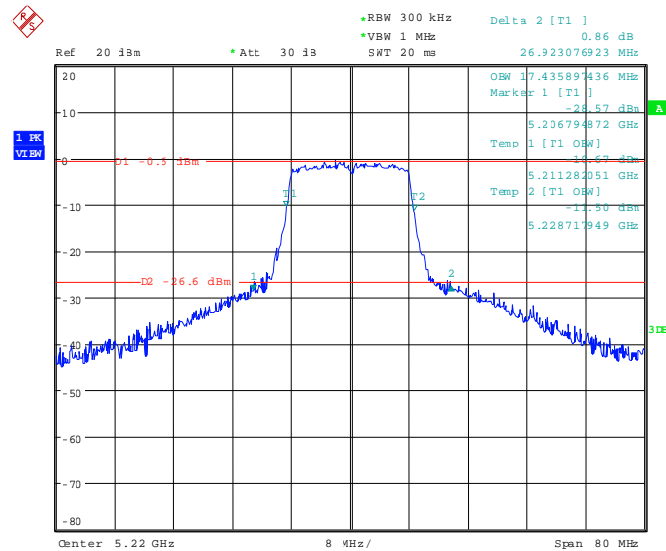


91568_252.wmf: Bandwidth, operation mode 2, a-mode, 6 Mbps:

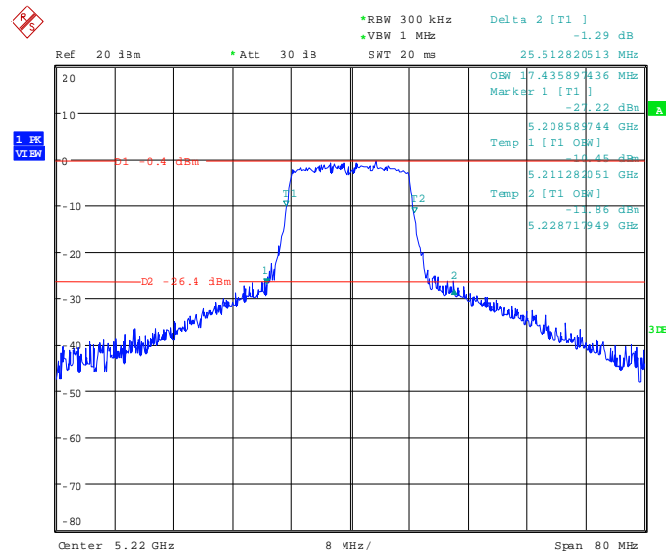


TEST REPORT REFERENCE: F091568E2

91568_253.wmf: Bandwidth, operation mode 3, a-mode, 6 Mbps:

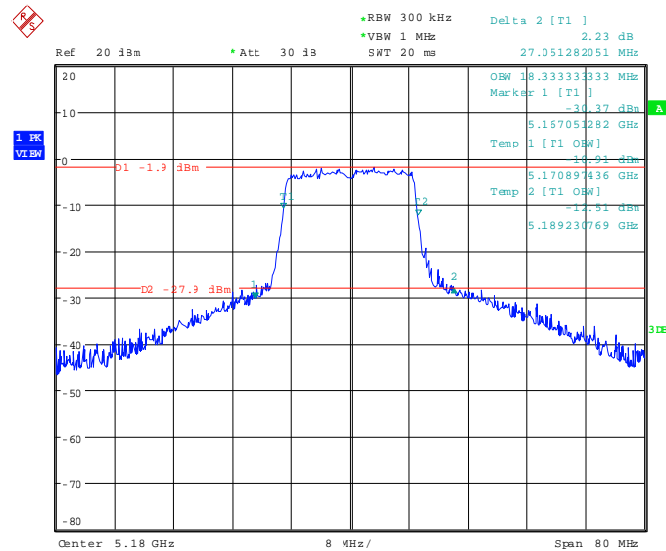


91568_254.wmf: Bandwidth, operation mode 4, a-mode, 6 Mbps:

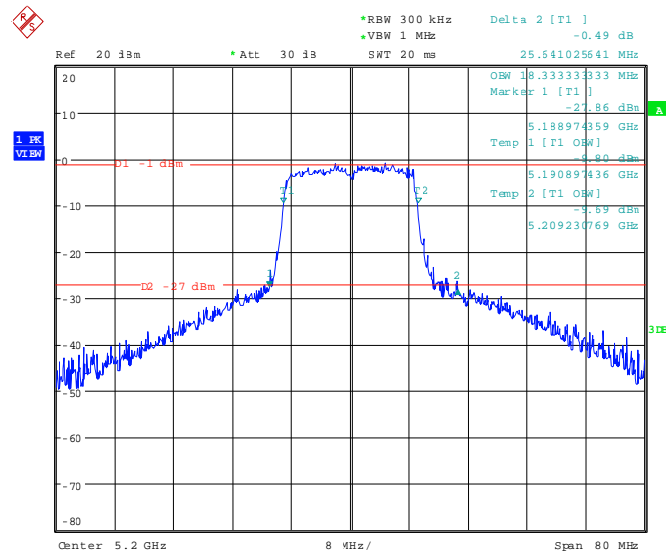


TEST REPORT REFERENCE: F091568E2

91568_255.wmf: Bandwidth, operation mode 1, n-mode, 6 Mbps:

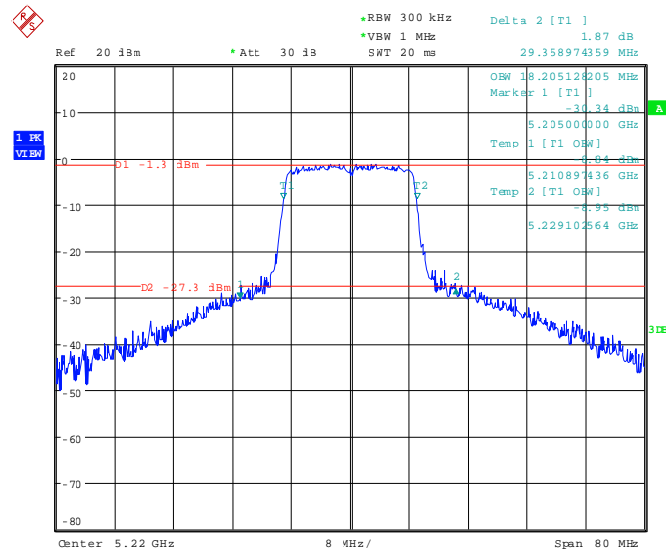


91568_256.wmf: Bandwidth, operation mode 2, n-mode, 6 Mbps:

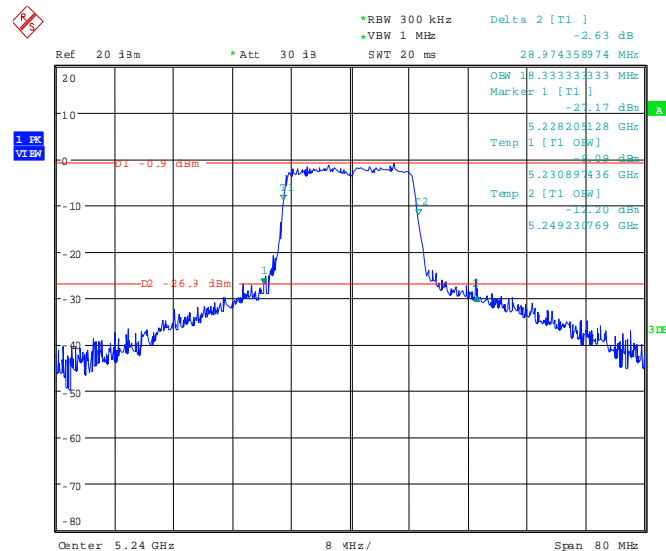


TEST REPORT REFERENCE: F091568E2

91568_257.wmf: Bandwidth, operation mode 3, n-mode, 6 Mbps:



91568_258.wmf: Bandwidth, operation mode 4, n-mode, 6 Mbps:



TEST REPORT REFERENCE: F091568E2

Operation mode 1 to 4 a-mode with 6 Mbps data rate (worst case)			
Channel number	Channel frequency [MHz]	26dB spectrum bandwidth [MHz]	99 % bandwidth [MHz]
36	5180	25.000000	17.307692
40	5200	25.056410	17.435897
44	5220	26.923077	17.435897
48	5240	25.512821	17.435897
Operation mode 1 to 4 n-mode with 6 Mbps data rate (worst case)			
Channel number	Channel frequency [MHz]	26dB spectrum bandwidth [MHz]	99 % bandwidth [MHz]
36	5180	27.051282	18.333333
40	5200	25.641027	18.333333
44	5220	29.358974	18.205128
48	5240	28.974359	18.333333
Measurement uncertainty		$< \pm 1 \cdot 10^{-7}$	

TEST EQUIPMENT USED FOR THE TEST:

75

TEST REPORT REFERENCE: F091568E2

6.2 MAXIMUM CONDUCTED OUTPUT POWER

6.2.1 METHOD OF MEASUREMENT (MAXIMUM CONDUCTED 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 transmitter shall work with its maximum data rate.

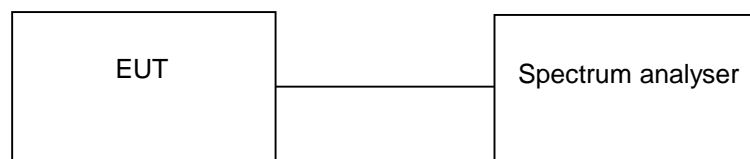
The following spectrum analyser settings shall be used:

- Span: Wide enough to encompass the entire emissions bandwidth (EBW) of the signal, centered on the actual channel.
- Resolution bandwidth: 1 MHz.
- Video bandwidth: 5 MHz.
- Sweep: Auto.
- Detector function: Sample
- Trace mode: Max hold.

Test will be performed in accordance with FCC Public Notice DA 02-2138, method 3. After trace stabilisation the marker shall be set on the signal peak. In case of multiple antennas, the measurement has to be repeated on each antenna port and the results have to be assumed.

The measurement will be performed on all channels.

Test set-up:



TEST REPORT REFERENCE: F091568E2

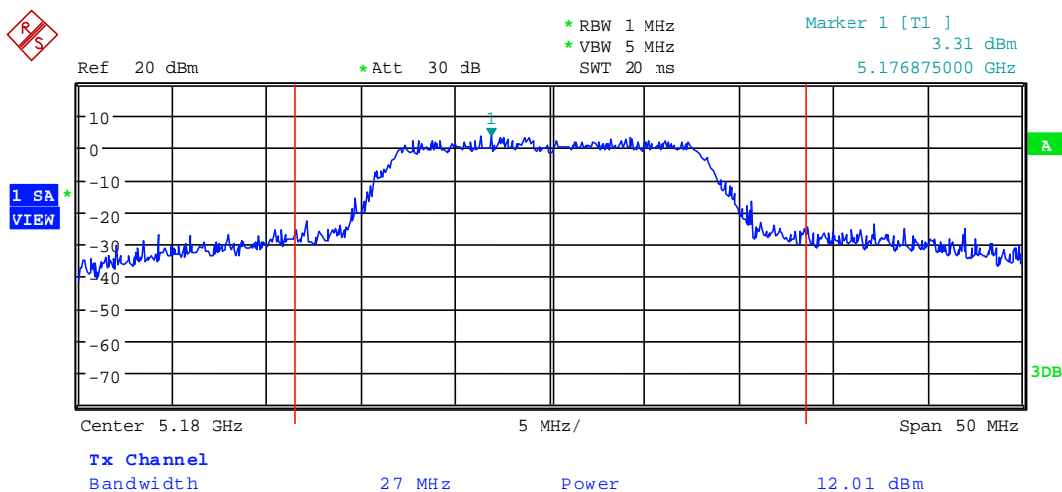
6.2.2 TEST RESULTS (MAXIMUM CONDUCTED OUTPUT POWER)

Ambient temperature	21 °C	Relative humidity	55 %
---------------------	-------	-------------------	------

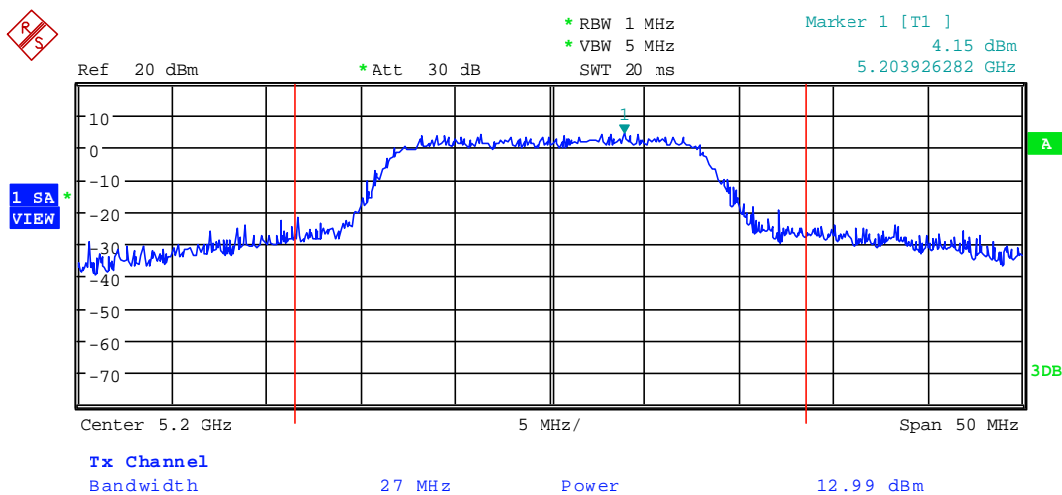
Measured with method 3

$T_{xon} = 200 \mu s$

91568_263.wmf: Maximum conducted output power, operation mode 1, a-mode, 6 Mbps:

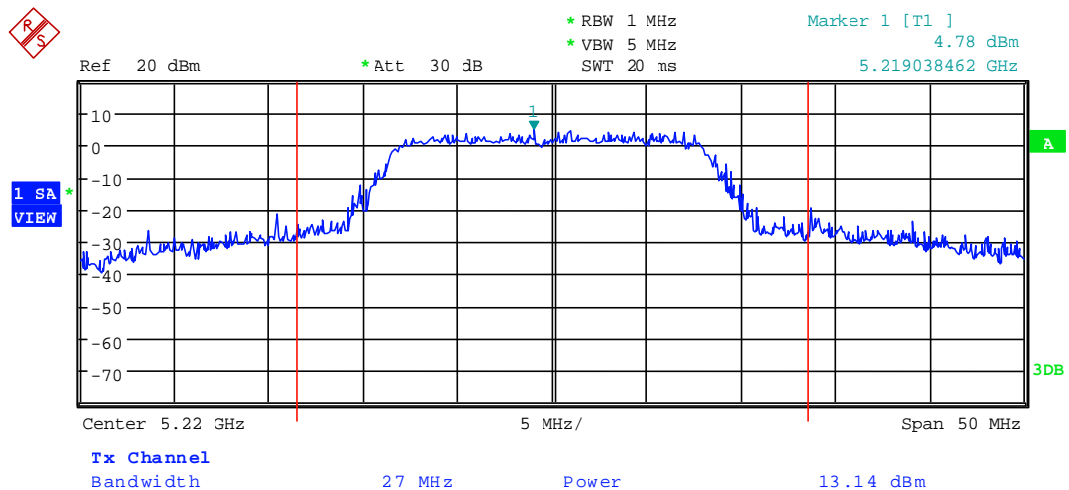


91568_264.wmf: Maximum conducted output power, operation mode 2, a-mode, 6 Mbps:

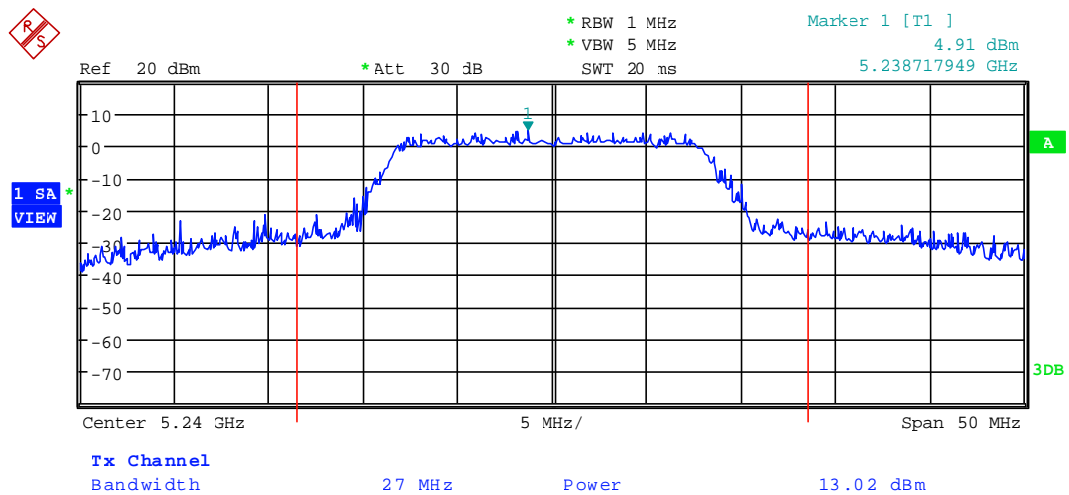


TEST REPORT REFERENCE: F091568E2

91568_265.wmf: Maximum conducted output power, operation mode 3, a-mode, 6 Mbps:

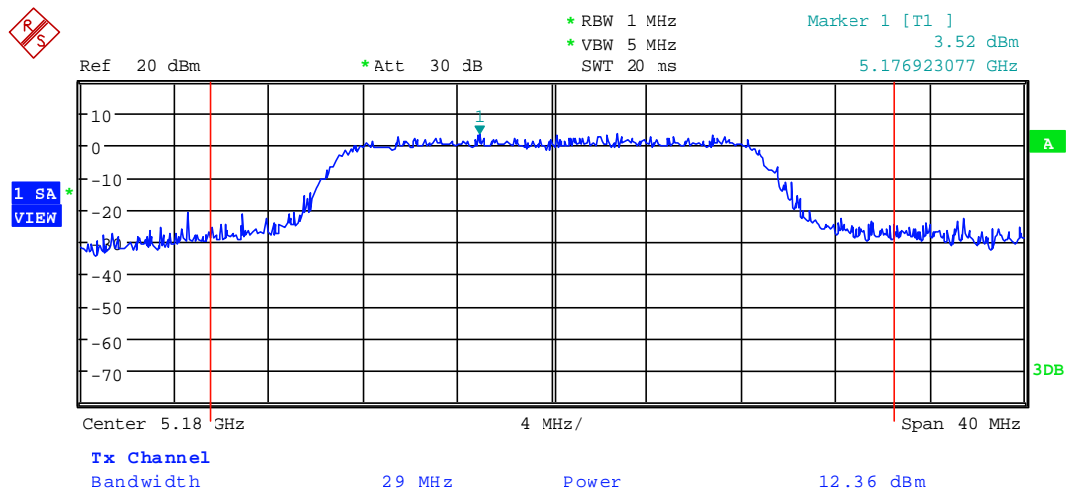


91568_266.wmf: Maximum conducted output power, operation mode 4, a-mode, 6 Mbps:

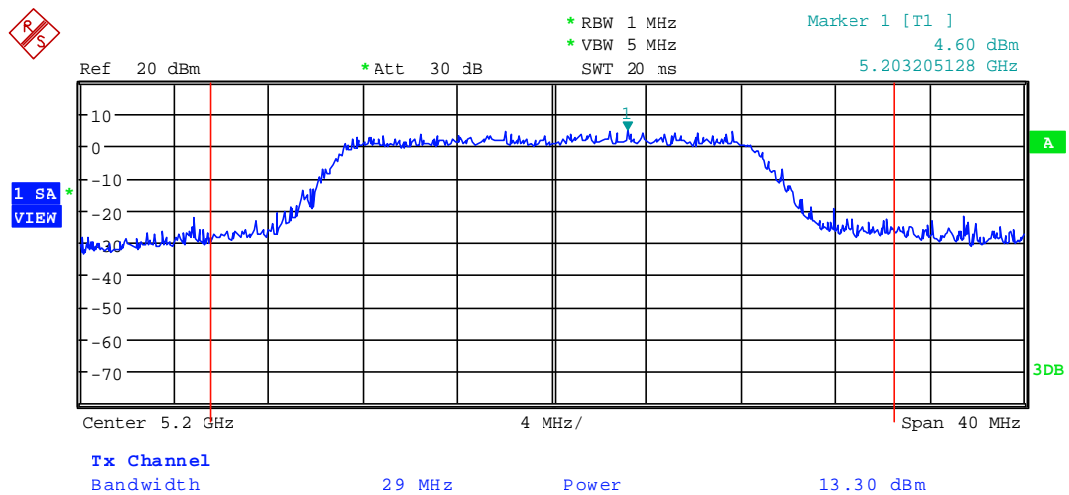


TEST REPORT REFERENCE: F091568E2

91568_262.wmf: Maximum conducted output power, operation mode 1, n-mode, 6 Mbps:

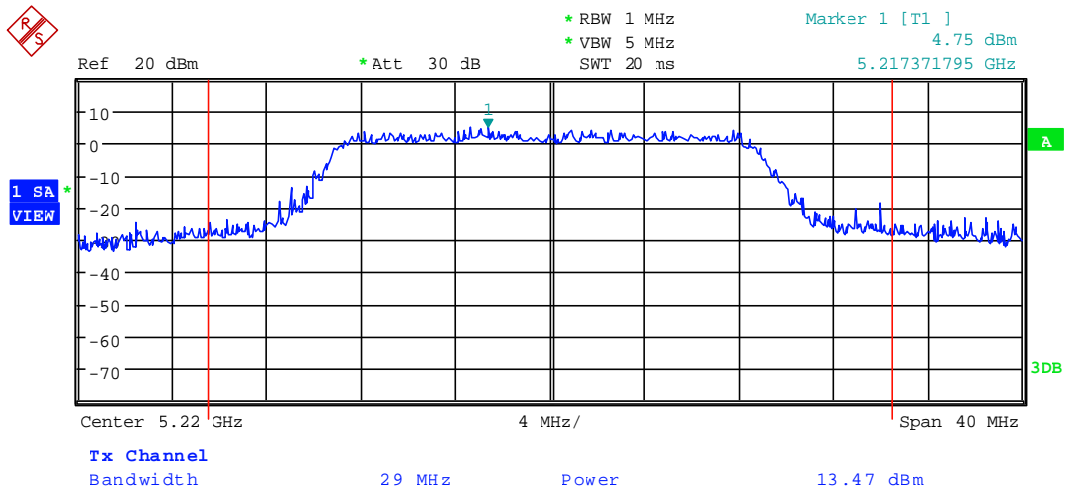


91568_261.wmf: Maximum conducted output power, operation mode 2, n-mode, 6 Mbps:

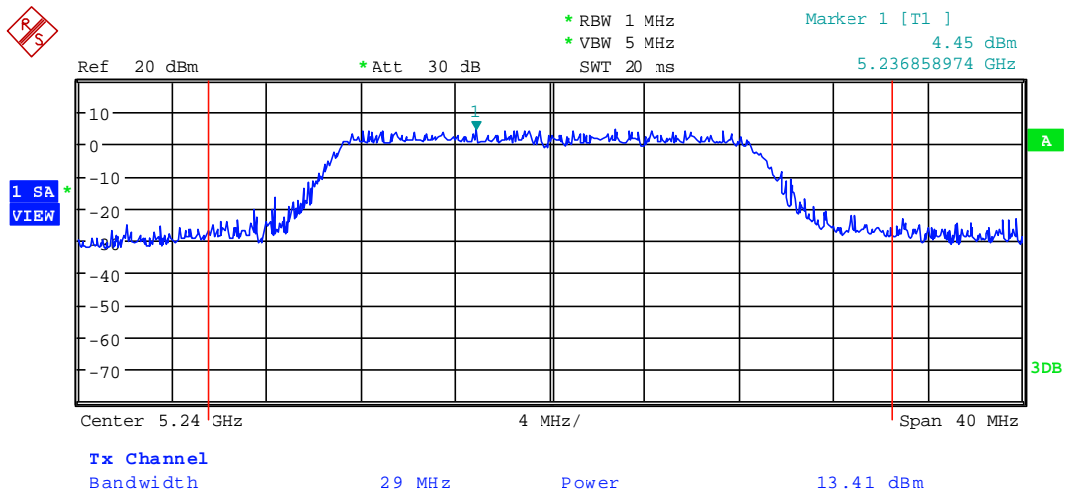


TEST REPORT REFERENCE: F091568E2

91568_260.wmf: Maximum conducted output power, operation mode 3, n-mode, 6 Mbps:



91568_259.wmf: Maximum conducted output power, operation mode 4, n-mode, 6 Mbps:



TEST REPORT REFERENCE: F091568E2

Operation mode 1 to 4 a-mode with 6 Mbps data rate (worst case)				
Channel number	Channel frequency [MHz]	Maximum conducted output power [dBm]	Antenna gain [dBi]	Limit [dBm]
36	5180	12.0	3.0	17.0
40	5200	13.0	3.0	17.0
44	5220	13.1	3.0	17.0
48	5240	13.0	3.0	17.0
Operation mode 1 to 4 n-mode with 6 Mbps data rate (worst case)				
Channel number	Channel frequency [MHz]	Maximum peak output power [dBm]	Antenna gain [dBi]	Limit [dBm]
36	5180	12.4	3.0	17.0
40	5200	13.3	3.0	17.0
44	5220	13.5	3.0	17.0
48	5240	13.4	3.0	17.0
Measurement uncertainty			+0.66 dB / -0.72 dB	

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
75

TEST REPORT REFERENCE: F091568E2

6.3 PEAK POWER SPECTRAL DENSITY

6.3.1 METHOD OF MEASUREMENT (PEAK 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. In case of multiple antennas, a combiner shall be used to couple the signal to the spectrum analyser.

The following spectrum analyser settings shall be used:

- Span: Wide enough to encompass the entire emissions bandwidth (EBW) of the signal.
- Resolution bandwidth: 1 MHz.
- Video bandwidth: 3 MHz.
- Sweep: Auto.
- Trace mode: Max hold.

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

Test set-up:



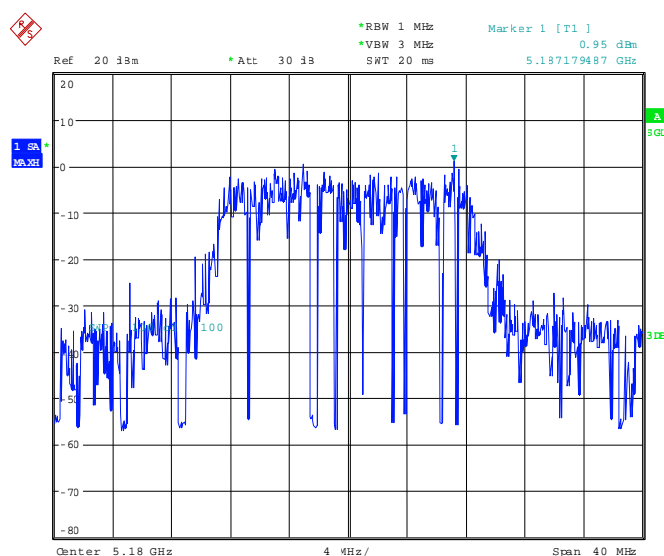
TEST REPORT REFERENCE: F091568E2

6.3.2 TEST RESULTS (PEAK POWER SPECTRAL DENSITY)

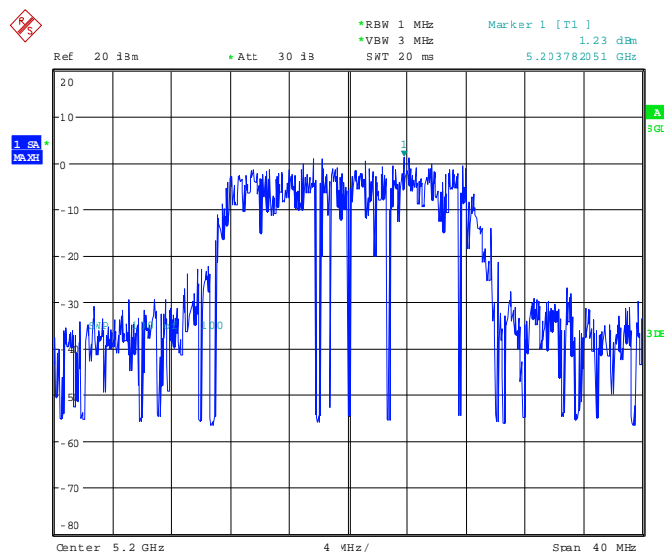
Ambient temperature	21 °C	Relative humidity	55 %
---------------------	-------	-------------------	------

Measured with method 2

91568_270.wmf: Peak power spectral density, operation mode 1, a-mode, 6 Mbps:

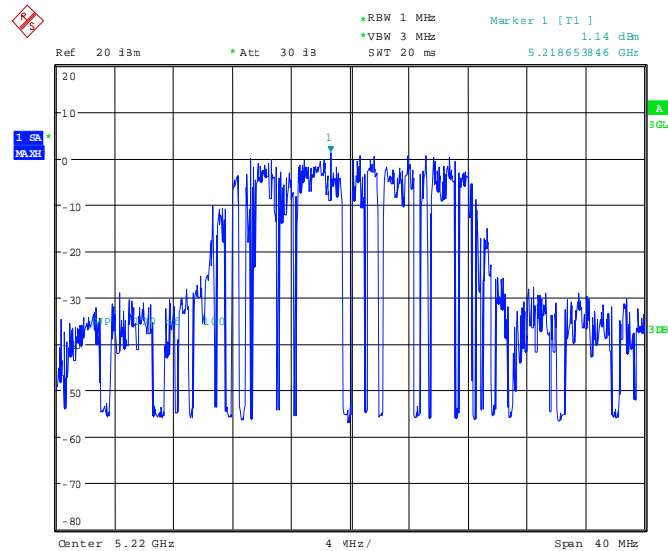


91568_269.wmf: Peak power spectral density, operation mode 2, a-mode, 6 Mbps:

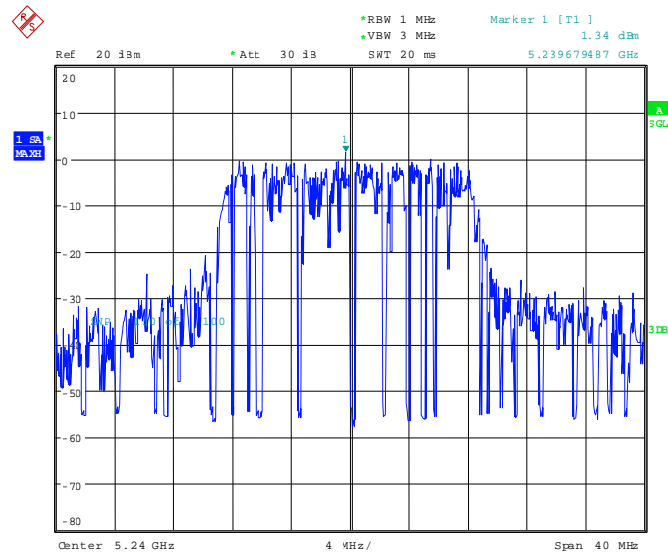


TEST REPORT REFERENCE: F091568E2

91568_268.wmf: Peak power spectral density, operation mode 3, a-mode, 6 Mbps:

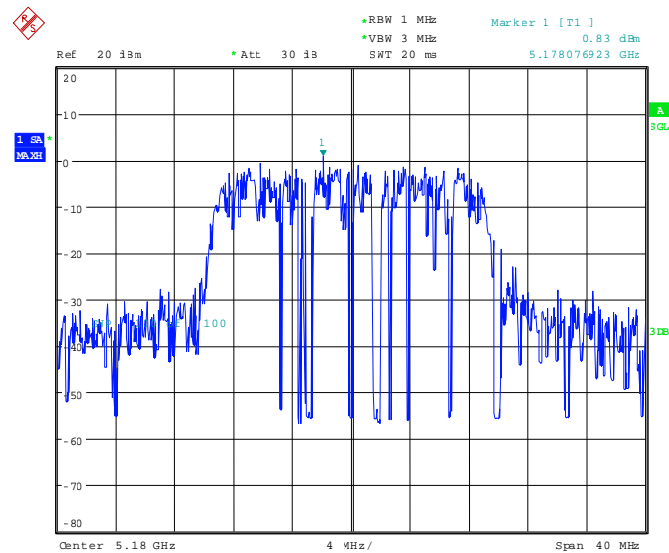


91568_267.wmf: Peak power spectral density, operation mode 4, a-mode, 6 Mbps:

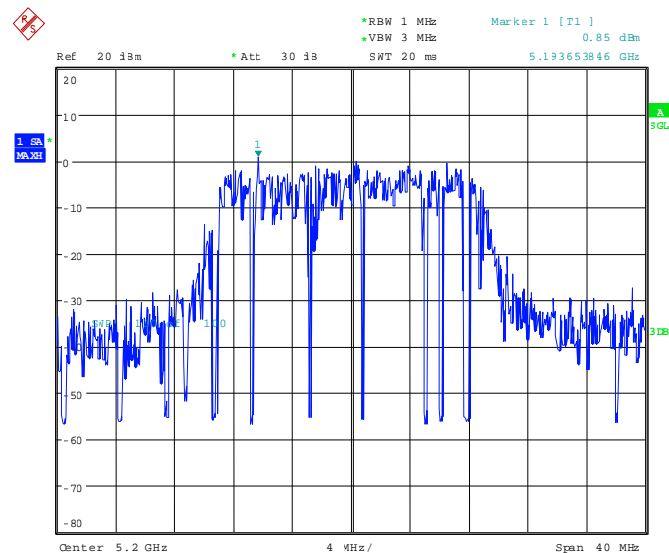


TEST REPORT REFERENCE: F091568E2

91568_271.wmf: Peak power spectral density, operation mode 1, n-mode, 6 Mbps:

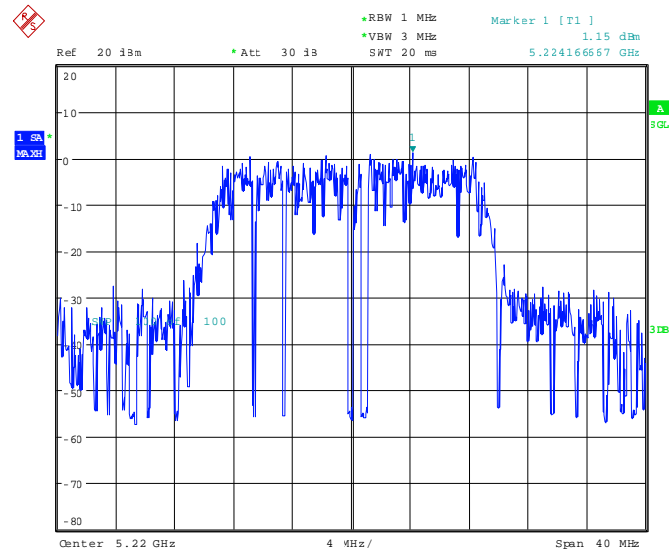


91568_272.wmf: Peak power spectral density, operation mode 2, n-mode, 6 Mbps:

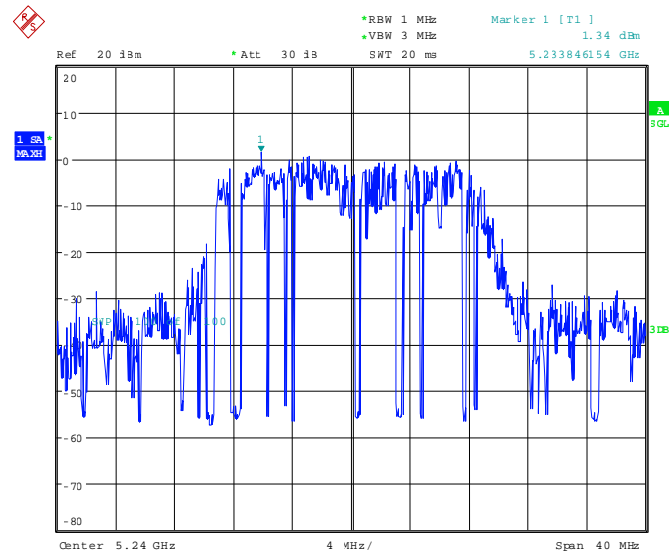


TEST REPORT REFERENCE: F091568E2

91568_273.wmf: Peak power spectral density, operation mode 3, n-mode, 6 Mbps:



91568_274.wmf: Peak power spectral density, operation mode 4, n-mode, 6 Mbps:



TEST REPORT REFERENCE: F091568E2

Operation mode 1 to 4 a-mode with 6 Mbps data rate (worst case)				
Channel number	Channel frequency [MHz]	Power spectral density [dBm / 1 MHz]	Antenna gain [dBi]	Power spectral density limit [dBm / 1 MHz]
36	5180	1.0	3.0	4.0
40	5200	1.2	3.0	4.0
44	5220	1.1	3.0	4.0
48	5240	1.3	3.0	4.0
Operation mode 1 to 4 n-mode with 6 Mbps data rate (worst case)				
Channel number	Channel frequency [MHz]	Power spectral density [dBm / 3 kHz]	Antenna gain [dBi]	Power spectral density limit [dBm / 3 kHz]
36	5180	0.8	3.0	4.0
40	5200	0.9	3.0	4.0
44	5220	1.2	3.0	4.0
48	5240	1.3	3.0	4.0
Measurement uncertainty			+1.1 dB / -1.5 dB	

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

75

TEST REPORT REFERENCE: F091568E2

6.4 PEAK EXCURSION

6.4.1 METHOD OF MEASUREMENT (PEAK EXCURSION)

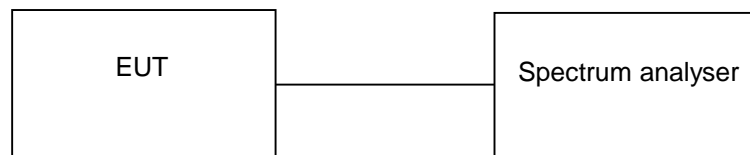
The calibration of the spectrum analyser has to be checked with the help of a known signal from a signal generator. The EUT has to be connected to the spectrum analyser via a low loss cable. If the EUT is not equipped with an antenna connector, a temporary antenna connector has to be installed. In case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

The following spectrum analyser settings shall be used:

- Span: Wide enough to encompass the entire emissions bandwidth (EBW) of the signal.
- Resolution bandwidth: 1 MHz (peak and average trace).
- Video bandwidth: 3 MHz (peak trace) / 300 kHz (average trace).
- Sweep: Auto.
- Detector function: Peak (peak trace) / sample (average trace).
- Trace mode: Max hold (for 60 s at least).

After trace stabilisation the marker shall be set on the signal peak. Set the first marker on the peak of the peak trace. The second (delta) marker has to be set on the minimum of the average trace.

Test set-up:



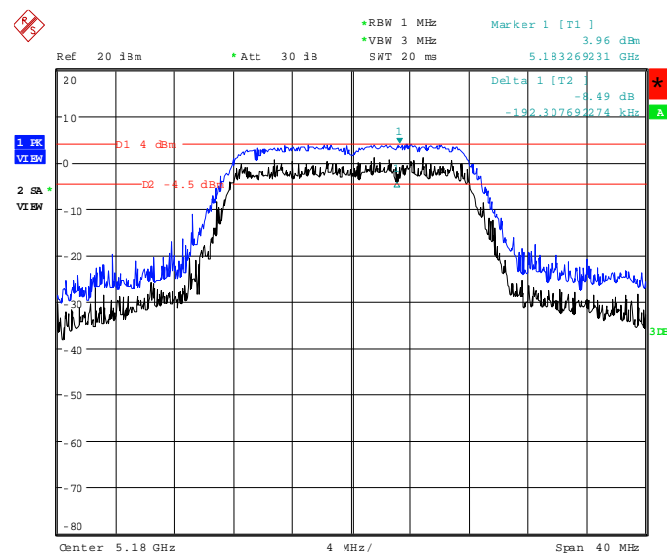
TEST REPORT REFERENCE: F091568E2

6.4.2 TEST RESULTS (PEAK EXCURSION)

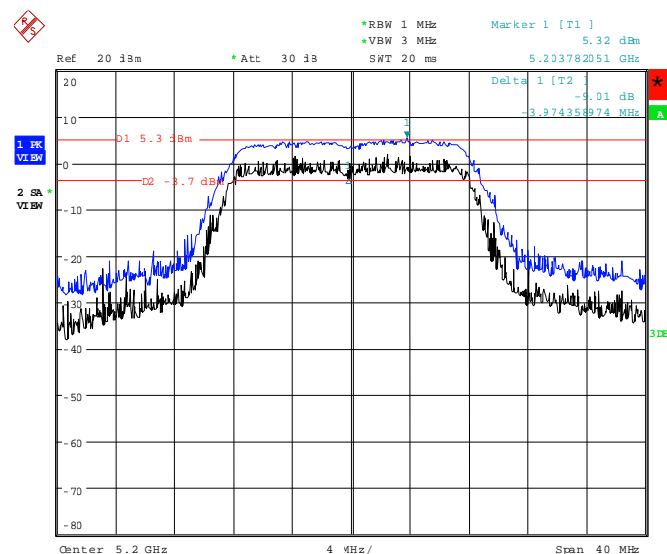
Ambient temperature	21 °C	Relative humidity	55 %
---------------------	-------	-------------------	------

$T_{\text{xon}} = 200 \mu\text{s}$

91568_279.wmf: Peak excursion measurement, operation mode 1, a-mode, 6 Mbps:

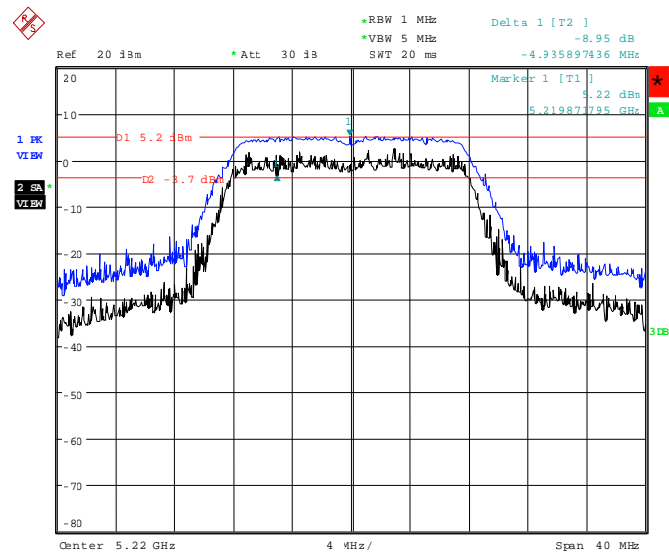


91568_280.wmf: Peak excursion measurement, operation mode 2, a-mode, 6 Mbps:

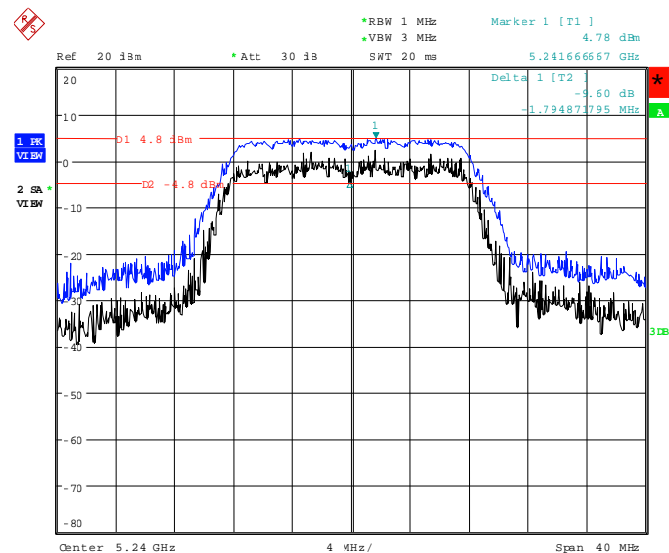


TEST REPORT REFERENCE: F091568E2

91568_281.wmf: Peak excursion measurement, operation mode 3, a-mode, 6 Mbps:

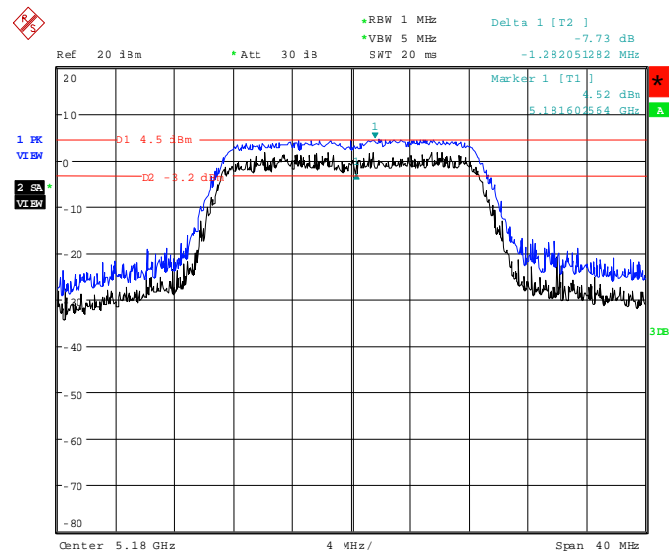


91568_282.wmf: Peak excursion measurement, operation mode 4, a-mode, 6 Mbps:

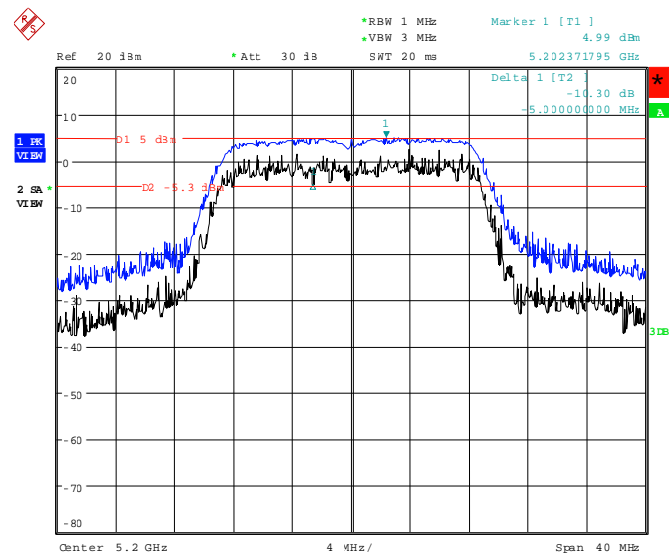


TEST REPORT REFERENCE: F091568E2

91568_278.wmf: Peak excursion measurement, operation mode 1, n-mode, 6 Mbps:

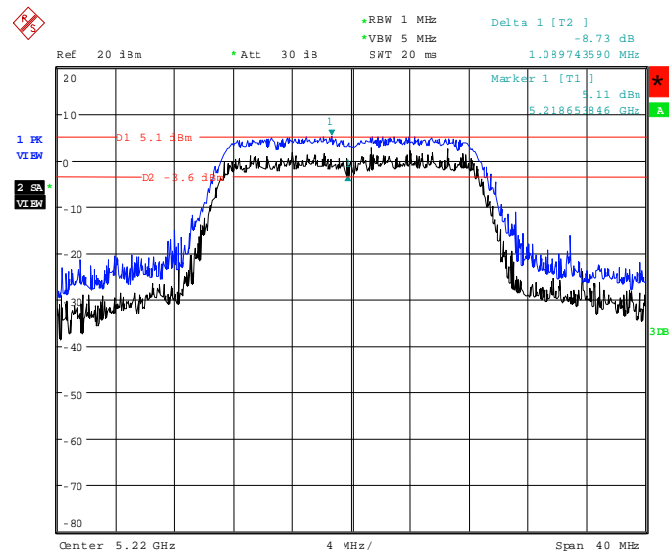


91568_277.wmf: Peak excursion measurement, operation mode 2, n-mode, 6 Mbps:

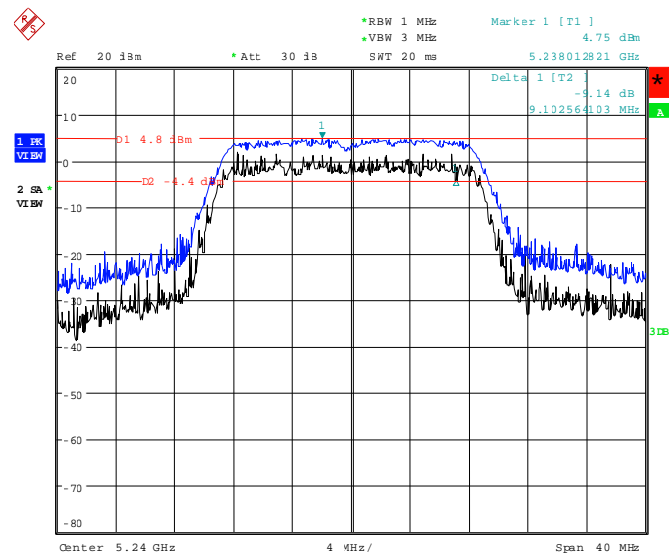


TEST REPORT REFERENCE: F091568E2

91568_276.wmf: Peak excursion measurement, operation mode 3, n-mode, 6 Mbps:



91568_275.wmf: Peak excursion measurement, operation mode 4, n-mode, 6 Mbps:



TEST REPORT REFERENCE: F091568E2

Operation mode 1 to 4 a-mode with 6 Mbps data rate (worst case)			
Channel number	Channel frequency [MHz]	Peak excursion [dB]	Peak excursion limit [dB]
36	5180	8.5	13.0
40	5200	9.0	13.0
44	5220	9.0	13.0
48	5240	9.6	13.0
Operation mode 1 to 4 n-mode with 6 Mbps data rate (worst case)			
Channel number	Channel frequency [MHz]	Peak excursion [dB]	Peak excursion limit [dB]
36	5180	7.7	13.0
40	5200	10.3	13.0
44	5220	8.7	13.0
48	5240	9.1	13.0
Measurement uncertainty			+1.1 dB / -1.5 dB

* cable loss of 0.9 dB respected

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
75

TEST REPORT REFERENCE: F091568E2

6.5 BAND-EDGE COMPLIANCE

6.5.1 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 6.7.1 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 6.7.1 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.

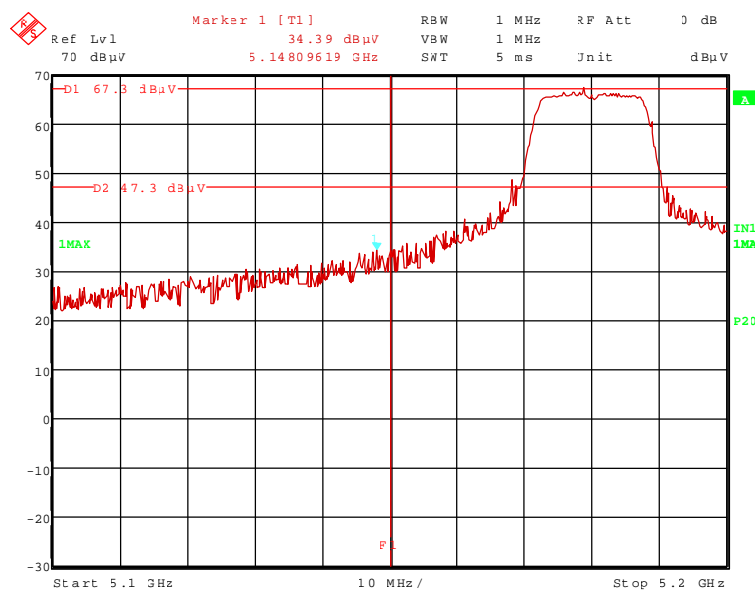
The plots at the next pages are showing radiated band-edge compliance with the worst case operation mode. The display line 1 (D1) in these plots represents the highest level within the assigned frequency band. The display line 2 (D2) represents the 20 dB offset to this highest level and shows the compliance 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: F091568E2

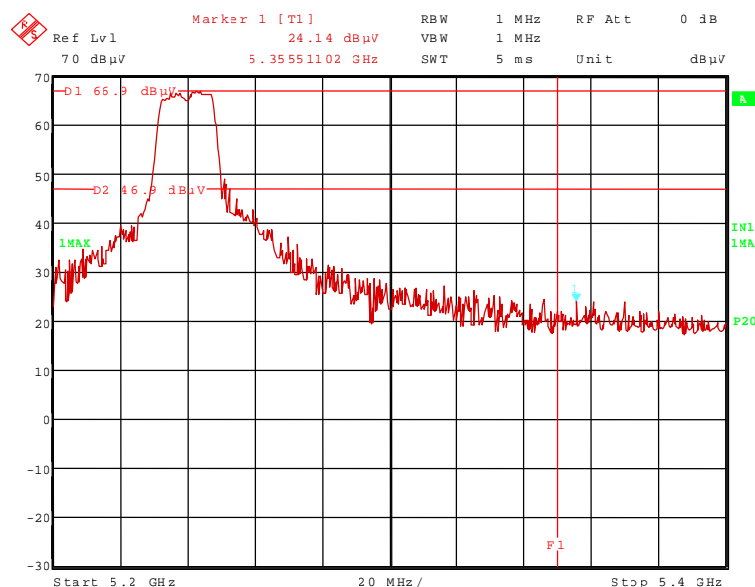
6.5.2 TEST RESULT (BAND-EDGE COMPLIANCE) with internal antenna

Ambient temperature	21 °C	Relative humidity	38 %
---------------------	-------	-------------------	------

91568_35.wmf: Radiated band-edge compliance, operation mode 1, a-mode, 54 Mbps:



91568_36.wmf: Radiated band-edge compliance, operation mode 4, a-mode, 54 Mbps:



TEST REPORT REFERENCE: F091568E2

6.5.3 TEST RESULT (BAND-EDGE COMPLIANCE) a-mode with internal antenna

Band-edge compliance (a-mode, 54 Mbps (worst case), 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
5.180	105.2	-	-	65.1	34.4	0.0	5.7	150	Hor.	-
5.1481	73.2	74.0	0.8	33.2	34.3	0.0	5.7	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
5.180	69.7	-	-	29.6	34.4	0.0	5.7	150	Hor.	-
5.1481	44.2	54.0	9.8	4.2	34.3	0.0	5.7	150	Hor.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB			

Band-edge compliance (a-mode, 54 Mbps (worst case), operation mode 4)										
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
5.240	105.9	-	-	65.7	34.4	0.0	5.8	150	Hor.	-
5.3554	62.4	74.0	11.6	22.0	34.6	0	5.8	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
5.240	70.1	-	-	29.9	34.4	0.0	5.8	150	Hor.	-
5.3554	45.2	54.0	8.8	4.8	34.6	0.0	5.8	150	Hor.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB			

Test: Passed

TEST REPORT REFERENCE: F091568E2

6.5.4 TEST RESULT (BAND-EDGE COMPLIANCE) n-mode with internal antenna

Band-edge compliance (n-mode, 6 Mbps (worst case), 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
5.180	105.2	-	-	65.1	34.4	0.0	5.7	150	Hor.	-
5.1493	71.7	74.0	2.3	31.8	34.3	0.0	5.6	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
5.180	69.2	-	-	29.1	34.4	0.0	5.7	150	Hor.	-
5.1493	44.5	54.0	9.5	4.6	34.3	0.0	5.6	150	Hor.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB			

Band-edge compliance (n-mode, 6 Mbps (worst case), operation mode 4)										
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
5.240	105.6	-	-	65.4	34.4	0.0	5.8	150	Hor.	-
5.3699	62.9	74.0	11.1	22.6	34.6	0.0	5.7	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
5.240	69.6	-	-	29.4	34.4	0.0	5.8	150	Hor.	-
5.3699	45.3	54.0	8.7	5.0	34.6	0.0	5.7	150	Hor.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB			

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

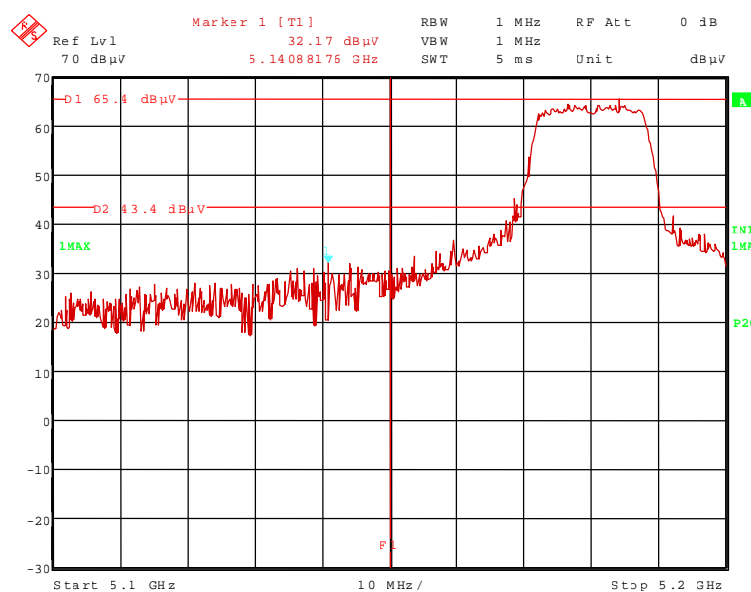
29, 31 – 34, 36, 44

TEST REPORT REFERENCE: F091568E2

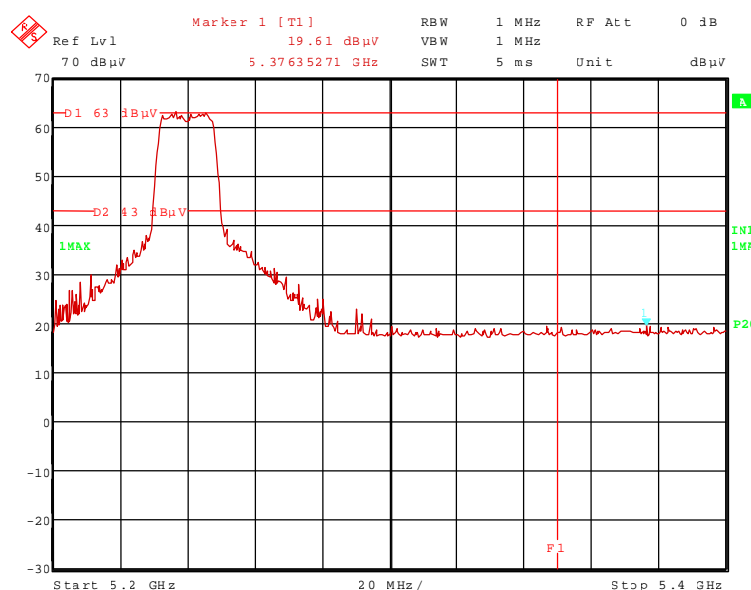
6.5.5 TEST RESULT (BAND-EDGE COMPLIANCE) with external patch antenna

Ambient temperature	21 °C	Relative humidity	38 %
---------------------	-------	-------------------	------

91568 143.wmf: Radiated band-edge compliance, operation mode 1, a-mode, 54 Mbps:



91568 144.wmf: Radiated band-edge compliance, operation mode 4, a-mode, 54 Mbps:



TEST REPORT REFERENCE: F091568E2

6.5.6 TEST RESULT (BAND-EDGE COMPLIANCE) a-mode with external patch antenna

As external patch antenna the InSide-WLAN antenna was used.

Band-edge compliance (a-mode, 54 Mbps (worst case), 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
5.180	103.6	-	-	63.5	34.4	0.0	5.7	150	Hor.	-
5.1409	70.9	74.0	3.1	31.0	34.3	0.0	5.6	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
5.180	69.4	-	-	29.3	34.4	0.0	5.7	150	Hor.	-
5.1409	44.0	54.0	10.0	4.1	34.3	0.0	5.6	150	Hor.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB			

Band-edge compliance (a-mode, 54 Mbps (worst case), operation mode 4)										
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
5.240	102.5	-	-	62.3	34.4	0.0	5.8	150	Hor.	-
5.3764	62.5	74.0	11.5	22.2	34.6	0.0	5.7	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
5.240	68.4	-	-	28.2	34.4	0.0	5.8	150	Hor.	-
5.3764	48.9	54.0	5.1	8.6	34.6	0.0	5.7	150	Hor.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB			

Test: Passed

TEST REPORT REFERENCE: F091568E2

6.5.7 TEST RESULT (BAND-EDGE COMPLIANCE) n-mode with external patch antenna

As external patch antenna the InSide-WLAN antenna was used.

Band-edge compliance (n-mode, 6 Mbps (worst case), 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
5.180	103.1	-	-	63.0	34.4	0.0	5.7	150	Hor.	-
5.1487	70.6	74.0	3.4	30.7	34.3	0.0	5.6	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
5.180	67.9	-	-	27.8	34.4	0.0	5.7	150	Hor.	-
5.1487	44.1	54.0	9.9	4.2	34.3	0.0	5.6	150	Hor.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB			

Band-edge compliance (n-mode, 6 Mbps (worst case), operation mode 4)										
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
5.240	102.4	-	-	62.2	34.4	0.0	5.8	150	Hor.	-
5.3711	59.2	74.0	14.8	18.9	34.6	0.0	5.7	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
5.240	68.6	-	-	28.4	34.4	0.0	5.8	150	Hor.	-
5.3711	45.4	54.0	8.6	5.1	34.6	0.0	5.7	150	Hor.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB			

Test: Passed

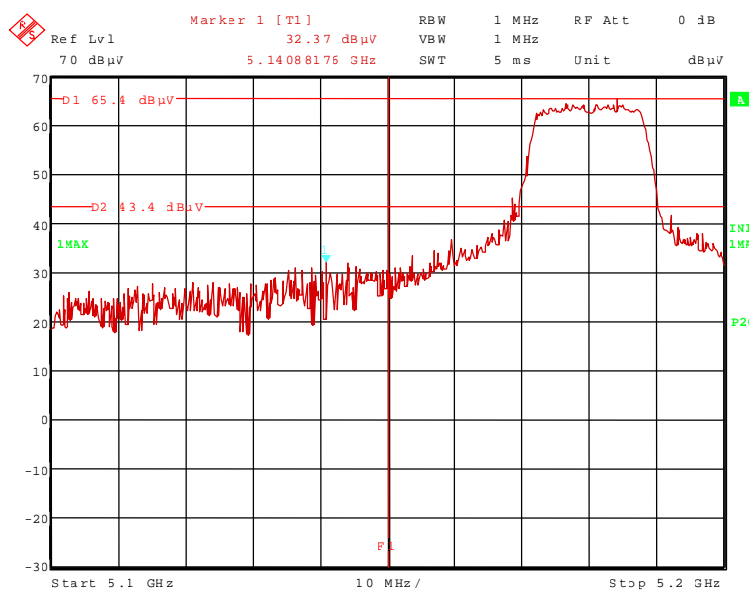
TEST EQUIPMENT USED FOR THE TEST:
29, 31 – 34, 36, 44

TEST REPORT REFERENCE: F091568E2

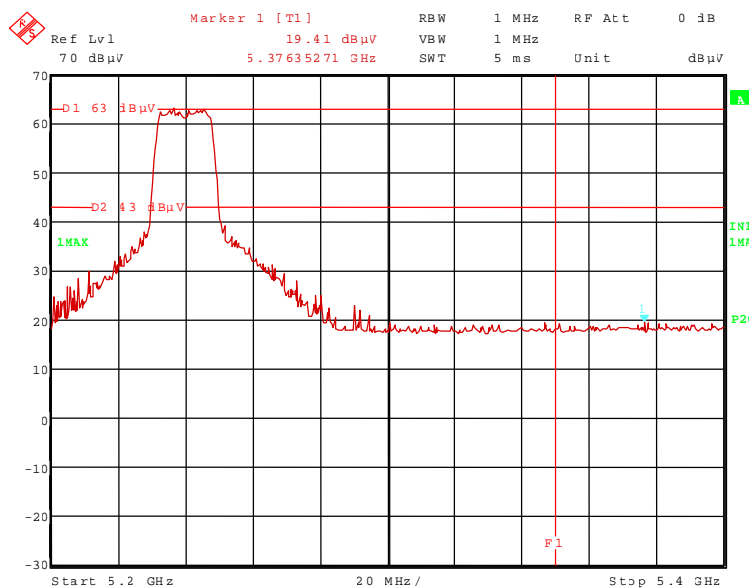
6.5.8 TEST RESULT (BAND-EDGE COMPLIANCE) with external monopole antenna

Ambient temperature	21 °C	Relative humidity	38 %
---------------------	-------	-------------------	------

91568_450.wmf: Radiated band-edge compliance, operation mode 1, a-mode, 54 Mbps:



91568_451.wmf: Radiated band-edge compliance, operation mode 4, a-mode, 54 Mbps:



TEST REPORT REFERENCE: F091568E2

6.5.9 TEST RESULT (BAND-EDGE COMPLIANCE) a-mode with external monopole antenna

As external patch antenna the Ex-IT WLAN-SMA 70-001 was used.

Band-edge compliance (a-mode, 54 Mbps (worst case), 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
5.180	103.6	-	-	63.5	34.4	0.0	5.7	150	Hor.	-
5.1409	71.3	74.0	2.7	31.4	34.3	0.0	5.6	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
5.180	69.4	-	-	29.3	34.4	0.0	5.7	150	Hor.	-
5.1409	44.4	54.0	9.6	4.5	34.3	0.0	5.6	150	Hor.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB			

Band-edge compliance (a-mode, 54 Mbps (worst case), operation mode 4)										
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
5.240	102.5	-	-	62.3	34.4	0.0	5.8	150	Hor.	-
5.3764	62.3	74.0	11.7	22.0	34.6	0.0	5.7	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
5.240	68.4	-	-	28.2	34.4	0.0	5.8	150	Hor.	-
5.3764	48.7	54.0	5.3	8.4	34.6	0.0	5.7	150	Hor.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB			

Test: Passed

TEST REPORT REFERENCE: F091568E2

6.5.10 TEST RESULT (BAND-EDGE COMPLIANCE) n-mode with external monopole antenna

As external patch antenna the Ex-IT WLAN-SMA 70-001 was used.

Band-edge compliance (n-mode, 6 Mbps (worst case), 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
5.180	103.1	-	-	63.0	34.4	0.0	5.7	150	Hor.	-
5.1487	65.4	74.0	8.6	31.1	34.3	0.0	5.6	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
5.180	67.9	-	-	27.8	34.4	0.0	5.7	150	Hor.	-
5.1487	44.5	54.0	9.5	4.6	34.3	0.0	5.6	150	Hor.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB			

Band-edge compliance (n-mode, 6 Mbps (worst case), operation mode 4)										
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
5.240	102.4	-	-	62.2	34.4	0.0	5.8	150	Hor.	-
5.3711	59.0	74.0	15.0	18.7	34.6	0.0	5.7	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
5.240	68.6	-	-	28.4	34.4	0.0	5.8	150	Hor.	-
5.3711	45.6	54.0	8.4	5.3	34.6	0.0	5.7	150	Hor.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB			

Test: Passed

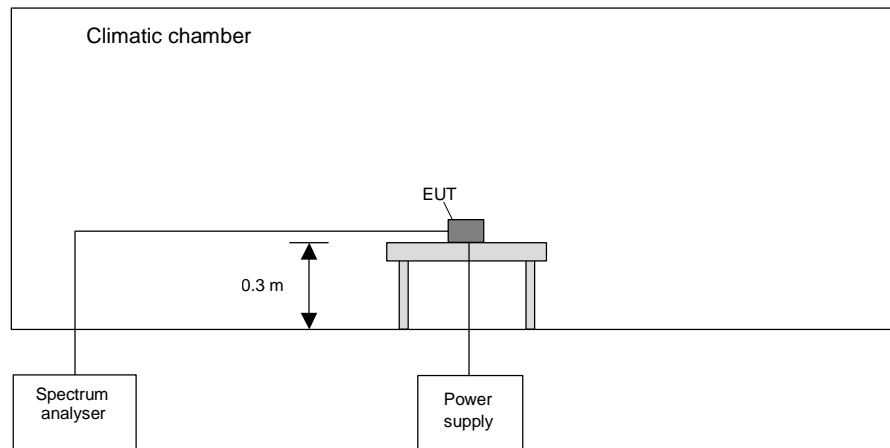
TEST EQUIPMENT USED FOR THE TEST:

29, 31 – 34, 36, 44

TEST REPORT REFERENCE: F091568E2

6.6 FREQUENCY STABILITY

6.6.1 METHOD OF MEASUREMENT (FREQUENCY STABILITY)



The following procedure will be used:

- 1) Place the EUT in the climatic chamber.
- 2) Switch on the EUT and check the correct function and the settings of the spectrum analyser.
- 3) Switch off the EUT and tune the climatic chamber to the maximum operation temperature of the EUT. Wait until the thermal balance is obtained.
- 4) Switch the EUT on and record the frequencies at start-up and 2, 5 and 10 minutes after powering on.
- 5) Switch off the EUT and tune the climatic chamber to a operation temperature range of the EUT in ten-degree steps. Wait until the thermal balance is obtained for every step.
- 6) Switch the EUT on and record the frequencies at start-up and 2, 5 and 10 minutes after powering on.
- 7) Repeat 6) with the minimum and the maximum of the supply voltage at 20 °C.
- 8) Repeat 6) with the next temperature step until the minimum operation temperature of the EUT is reached.
- 9) Document the worst case frequency error for every step with the corresponding time after switch on.

TEST REPORT REFERENCE: F091568E2

6.6.2 TEST RESULT (FREQUENCY STABILITY)

Ambient temperature:	20 °C	Relative humidity:	55 %
----------------------	-------	--------------------	------

Test set-up: For this test the EUT was fixed on a wooden table inside the climatic chamber.

Cable guide: For further information of the cable guide refer to the pictures in annex A of this test report.

Frequency stability (a-mode, without modulation, operation mode 1)						
Temperature	Supply voltage	Minutes after switch on	Frequency [GHz]	Allowed tolerance	Measured tolerance	Result
85 °C	5.0 V DC	10	5.180103365	±20 ppm	+19.95 ppm	Passed
80° C	5.0 V DC	10	5.180078165	±20 ppm	+15.09 ppm	Passed
70° C	5.0 V DC	10	5.180001864	±20 ppm	+0.36 ppm	Passed
60° C	5.0 V DC	10	5.179972456	±20 ppm	-5.32 ppm	Passed
50° C	5.0 V DC	10	5.179947583	±20 ppm	-10.12 ppm	Passed
40° C	5.0 V DC	10	5.179935296	±20 ppm	-12.50 ppm	Passed
30° C	5.0 V DC	10	5.179933742	±20 ppm	-12.79 ppm	Passed
20 °C	3.3 V DC	10	5.179945858	±20 ppm	-10.45 ppm	Passed
	5.0 V DC	10	5.179940232	±20 ppm	-11.54 ppm	Passed
	5.5 V DC	10	5.179933991	±20 ppm	-12.74 ppm	Passed
10° C	5.0 V DC	10	5.179947074	±20 ppm	-10.22 ppm	Passed
0° C	5.0 V DC	5	5.179956642	±20 ppm	-8.37 ppm	Passed
-10° C	5.0 V DC	5	5.179968795	±20 ppm	-6.02 ppm	Passed
-20° C	5.0 V DC	5	5.179967278	±20 ppm	-6.32 ppm	Passed
-30° C	5.0 V DC	2	5.179967949	±20 ppm	-6.19 ppm	Passed
Frequency stability (a-mode, without modulation, operation mode 4)						
Temperature	Supply voltage	Minutes after switch on	Frequency [GHz]	Allowed tolerance	Measured tolerance	Result
85 °C	5.0 V DC	10	5.240104536	±20 ppm	19.95 ppm	Passed
80° C	5.0 V DC	10	5.240036119	±20 ppm	6.89 ppm	Passed
70° C	5.0 V DC	10	5.240012052	±20 ppm	2.30 ppm	Passed
60° C	5.0 V DC	10	5.239972819	±20 ppm	-5.19 ppm	Passed
50° C	5.0 V DC	10	5.239944321	±20 ppm	-10.63 ppm	Passed
40° C	5.0 V DC	10	5.239934795	±20 ppm	-12.44 ppm	Passed
30° C	5.0 V DC	10	5.239931240	±20 ppm	-13.12 ppm	Passed
20 °C	3.3 V DC	10	5.239934693	±20 ppm	-12.46 ppm	Passed
	5.0 V DC	10	5.239933556	±20 ppm	-12.68 ppm	Passed
	5.5 V DC	10	5.239931314	±20 ppm	-13.11 ppm	Passed
10° C	5.0 V DC	10	5.239949000	±20 ppm	-9.73 ppm	Passed
0° C	5.0 V DC	5	5.239958597	±20 ppm	-7.90 ppm	Passed
-10° C	5.0 V DC	5	5.239964243	±20 ppm	-6.82 ppm	Passed
-20° C	5.0 V DC	5	5.239965942	±20 ppm	-6.50 ppm	Passed
-30° C	5.0 V DC	2	5.239965545	±20 ppm	-6.58 ppm	Passed
Measurement uncertainty				< ± 1*10 ⁻⁷		

Test result: Passed

TEST EQUIPMENT USED FOR THE TEST:
75, 58, 59, 61

TEST REPORT REFERENCE: F091568E2

6.7 RADIATED EMISSIONS

6.7.1 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 40 GHz.
- A final measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 1 GHz to 40 GHz.

All measurements will be carried out with the EUT working on the upper and lower edge of the assigned frequency band.

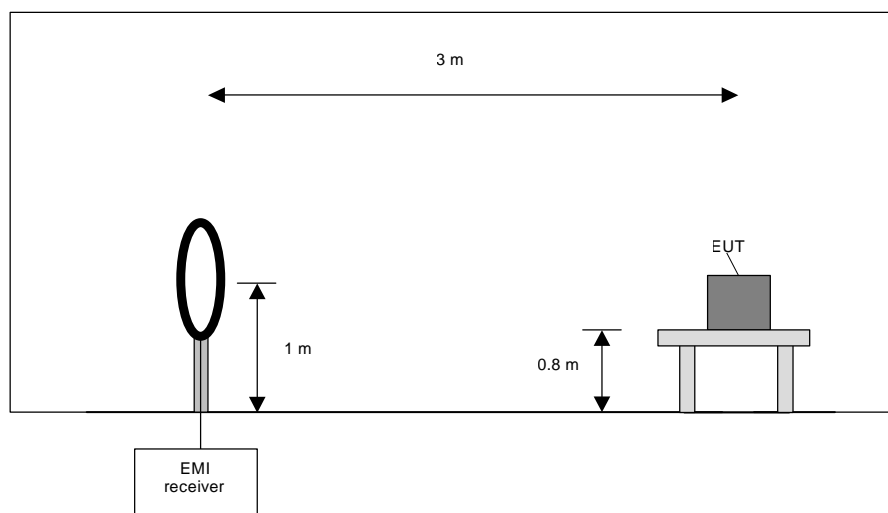
Preliminary measurement (9 kHz to 30 MHz):

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 C63.4-2003 [1].

The frequency range 9 kHz to 30 MHz will be monitored with a spectrum analyser while the system and its cables will be manipulated to find out the configuration with the maximum emission levels if applicable. The EMI Receiver will be set to MAX Hold mode. The EUT and the measuring antenna will be rotated around their vertical axis to 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: F091568E2

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).

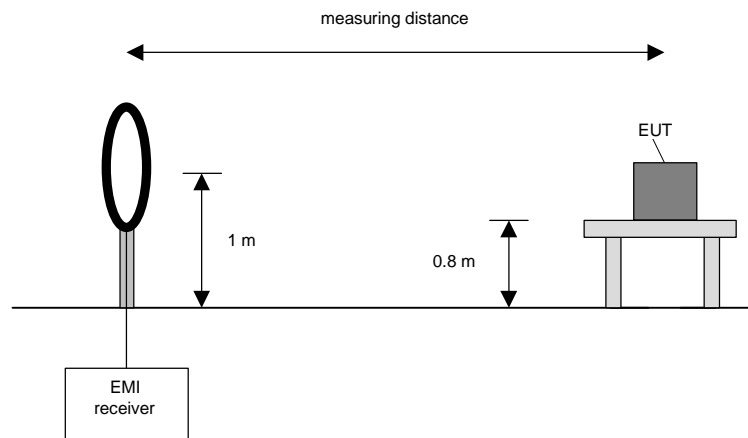
Final measurement (9 kHz to 30 MHz):

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: F091568E2

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).

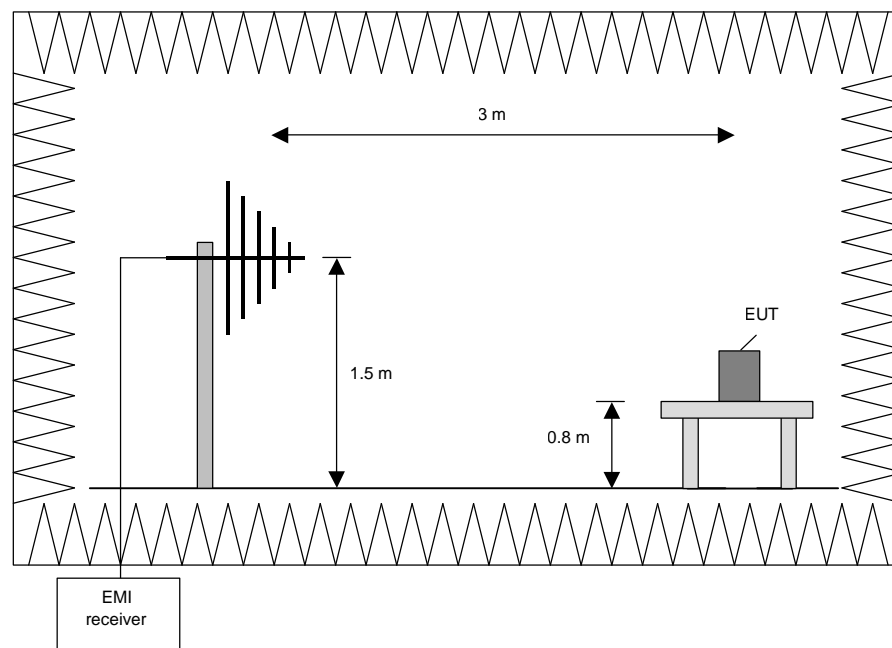
Preliminary measurement (30 MHz to 1 GHz)

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 C63.4-2003 [1].

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

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

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



TEST REPORT REFERENCE: F091568E2

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:

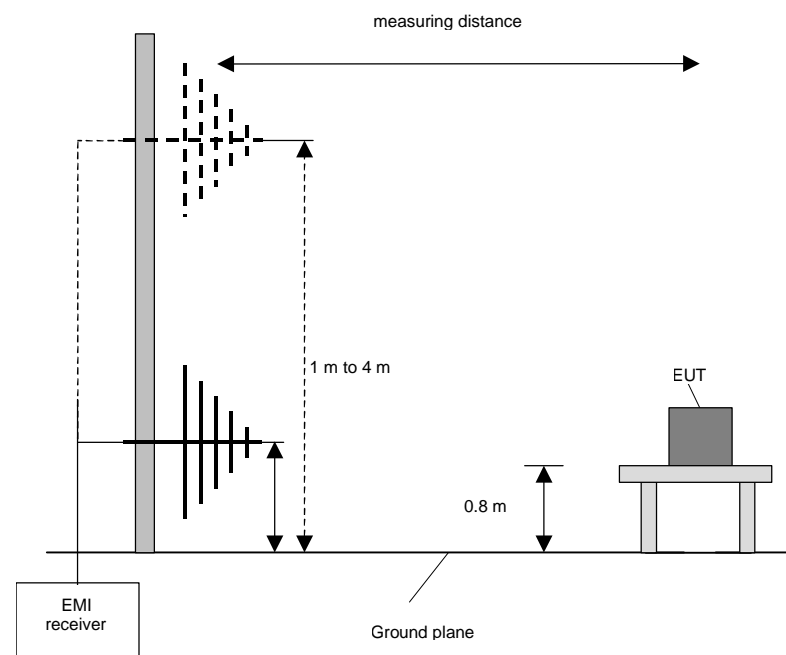
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Manipulate the system cables within the range to produce the maximum level of emission.
3. Rotate the EUT by 360 ° to maximize the detected signals.
4. Make a hardcopy of the spectrum.
5. Measure the frequency of the 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: F091568E2

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 40 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 C63.4-2003 [1].

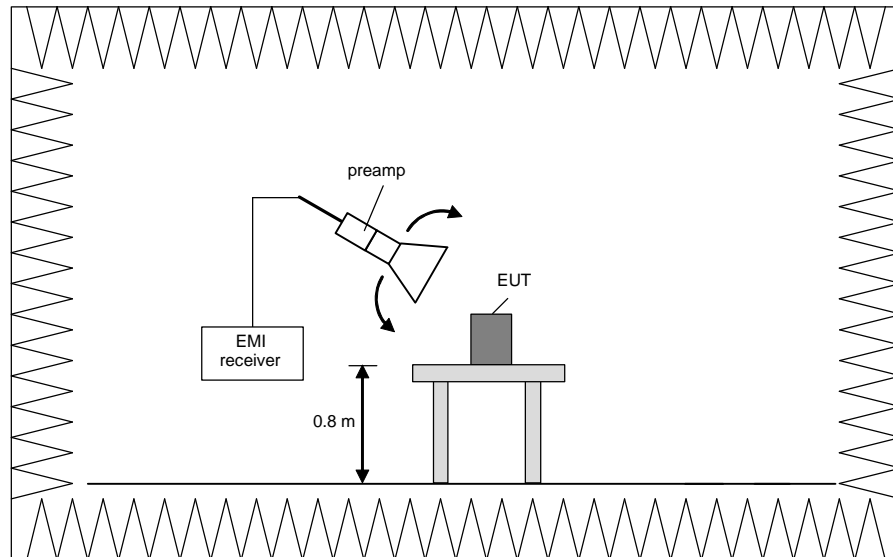
Preliminary measurement (1 GHz to 40 GHz)

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 1 MHz. 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 level of the spurious emission will be noted.

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

TEST REPORT REFERENCE: F091568E2

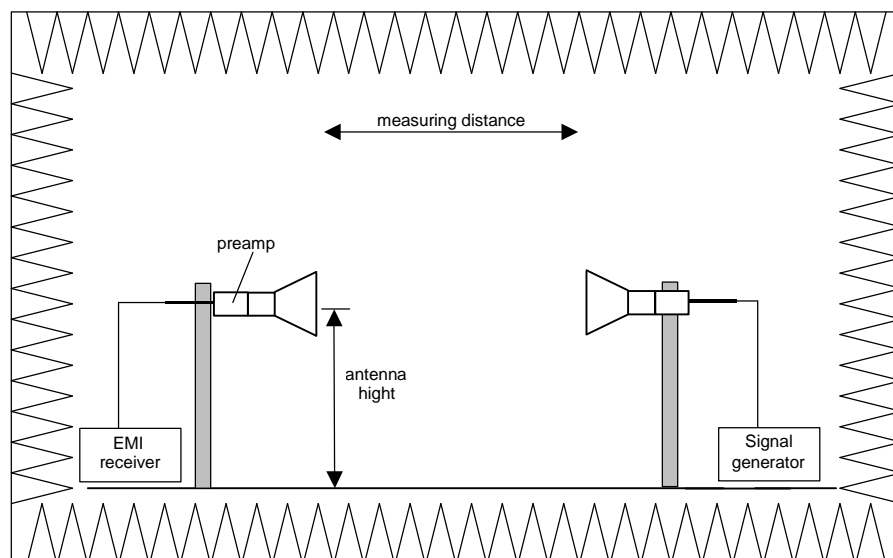


Final measurement (1 GHz to 40 GHz)

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



TEST REPORT REFERENCE: F091568E2

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 and 26.5 GHz to 40 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 peak detector, which causes the maximum emission. Note the level and the frequency of the emission.
- 8) Repeat steps 1) to 7) for the next antenna spot if the EUT is larger than the antenna beamwidth.
- 9) Replace the EUT by a known substitution antenna and a signal generator and set the frequency of the signal generator to the noted frequency.
- 10) Increase the signal generator level until the noted value is reached. Note the level of the signal generator minus the cable attenuation as level of the spurious emission.

Step 1) to 8) are defined as preliminary measurement.

TEST REPORT REFERENCE: F091568E2

6.7.2 TEST RESULTS (RADIATED EMISSIONS) WITH INTERNAL ANTENNA

6.7.2.1 PRELIMINARY MEASUREMENT (9 kHz to 1 GHz)

Ambient temperature	21 °C	Relative humidity	36 %
---------------------	-------	-------------------	------

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.

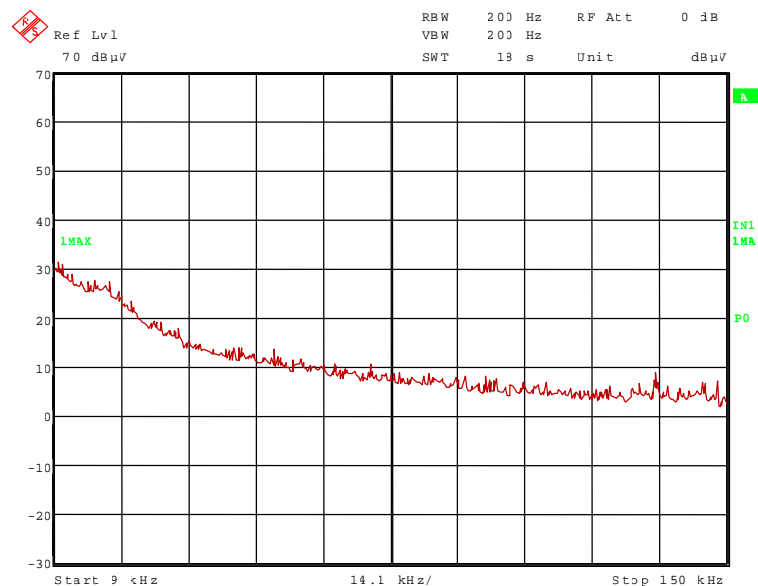
Cable guide: The cables of the EUT were fixed on the non-conducting table. For further information of the cable guide refer to the pictures in annex A of this test report.

Test record: All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied with 5.0 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 a-mode with 6 Mbps and transmit in the middle of the assigned frequency range (operation mode 2).

91568_452.wmf: Spurious emissions from 9 kHz to 150 kHz (a-mode, 6 Mbps, operation mode 2):

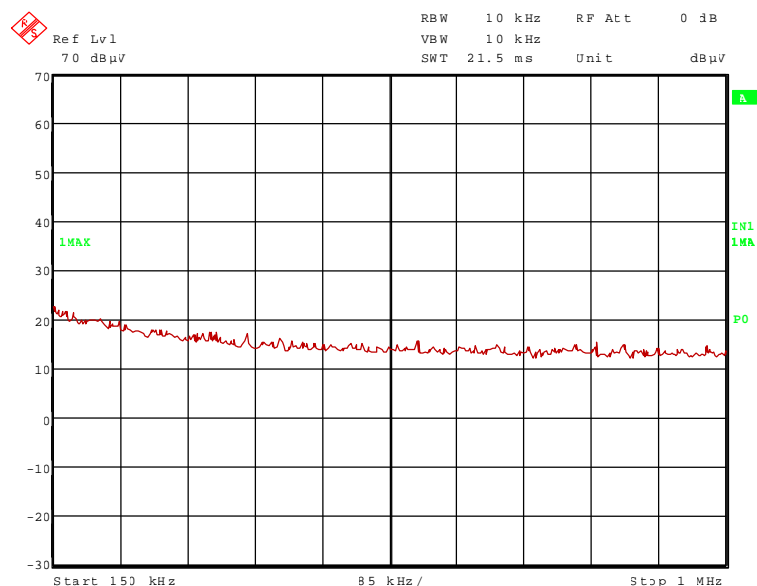


TEST EQUIPMENT USED FOR THE TEST:

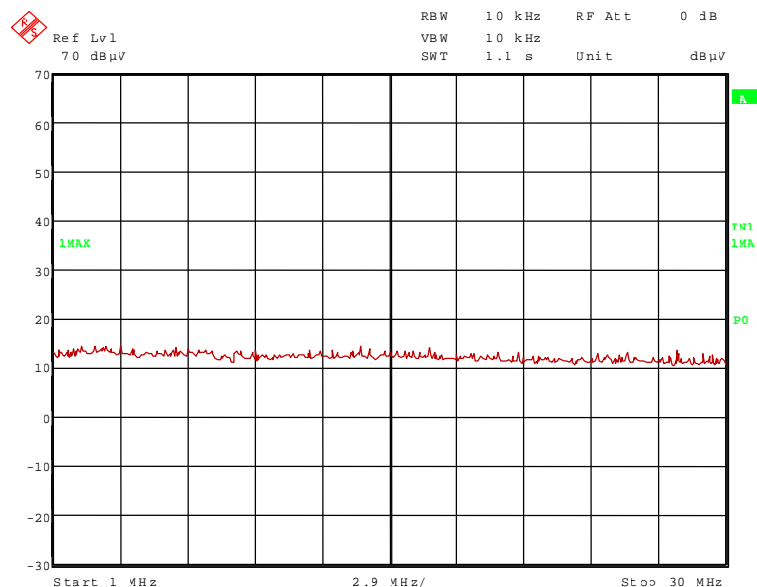
29, 31 – 35, 43, 46, 55

TEST REPORT REFERENCE: F091568E2

91568_453.wmf: Spurious emissions from 150 kHz to 1 MHz (a-mode, 6 Mbps, operation mode 2):



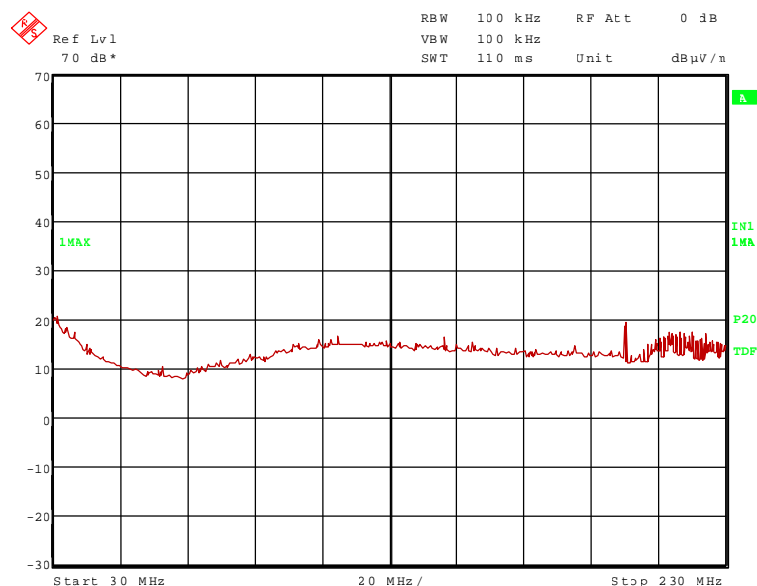
91568_454.wmf: Spurious emissions from 1 MHz to 30 MHz (a-mode, 6 Mbps, operation mode 2):



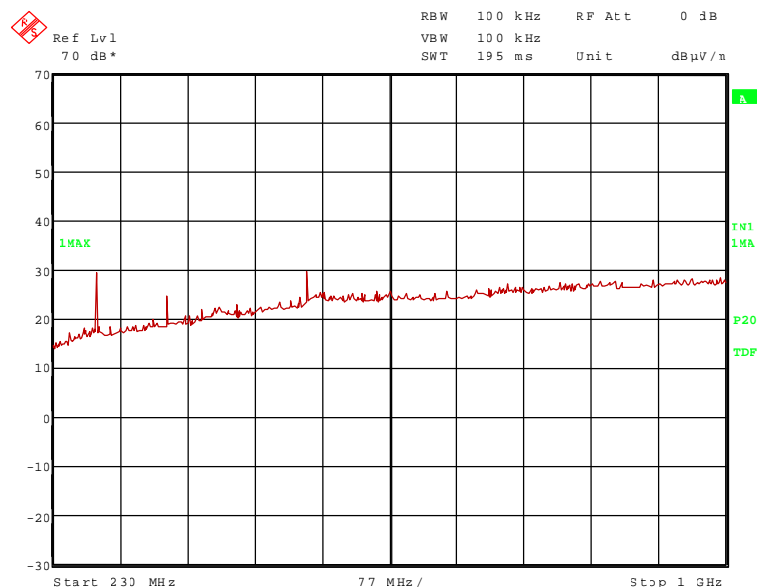
No significant frequencies above the noise floor of the system were found during the preliminary radiated emission test inside this frequency range, so no measurements were carried out on the outdoor test site.

TEST REPORT REFERENCE: F091568E2

91568 318.wmf: Spurious emissions from 30 MHz to 230 MHz (a-mode, 6 Mbps, operation mode 2):



91568 317.wmf: Spurious emissions from 230 MHz to 1 GHz (a-mode, 6 Mbps, operation mode 2):



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

- 200.000 MHz, 280.000 MHz and 520.000 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: F091568E2

6.7.2.2 PRELIMINARY MEASUREMENT (1 GHz to 40 GHz), a-mode, internal antenna

Ambient temperature	21 °C	Relative humidity	40 %
---------------------	-------	-------------------	------

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

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

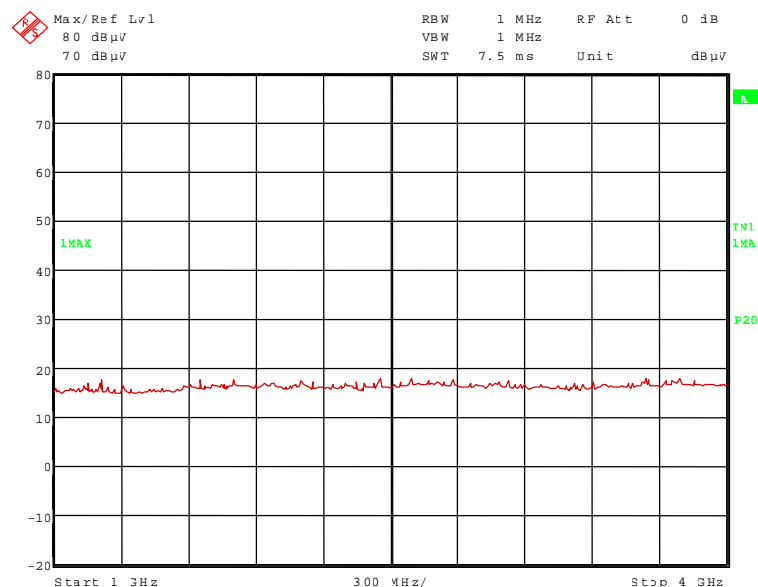
Test record: All results are shown in the following.

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

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

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

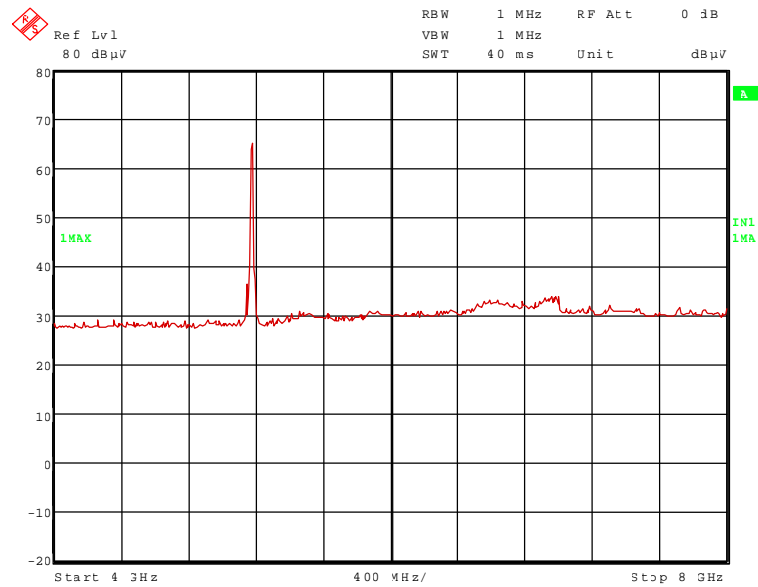
91568_26.wmf: Spurious emissions from 1 GHz to 4 GHz (a-mode, 6 Mbps):



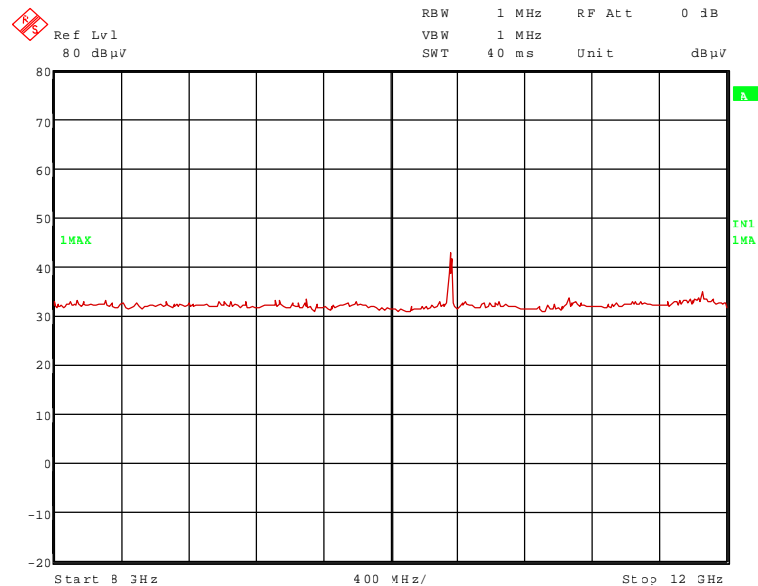
TEST EQUIPMENT USED FOR THE TEST:
29, 31 – 42, 44, 46, 49 – 52, 56, 57, 74, 102

TEST REPORT REFERENCE: F091568E2

91568 31.wmf: Spurious emissions from 4 GHz to 8 GHz (b-mode, 6 Mbps):

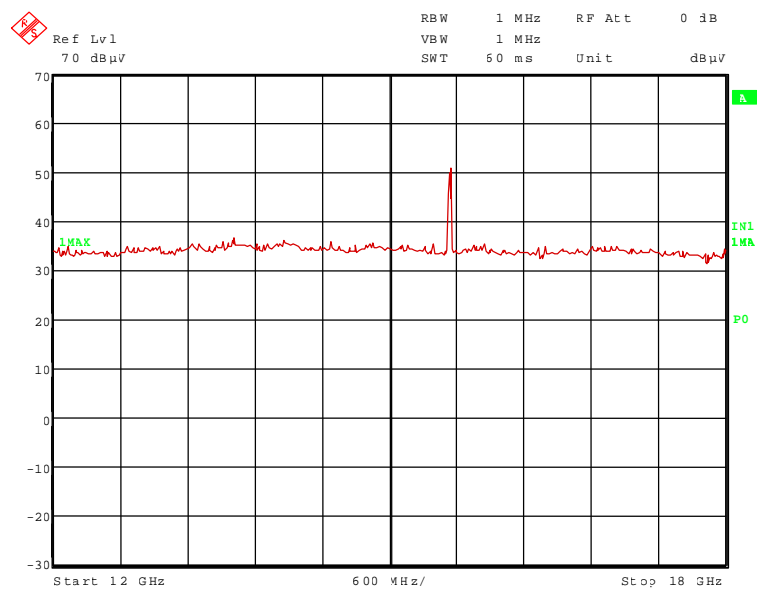


91568 33.wmf: Spurious emissions from 8 GHz to 12 GHz (a-mode, 6 Mbps):

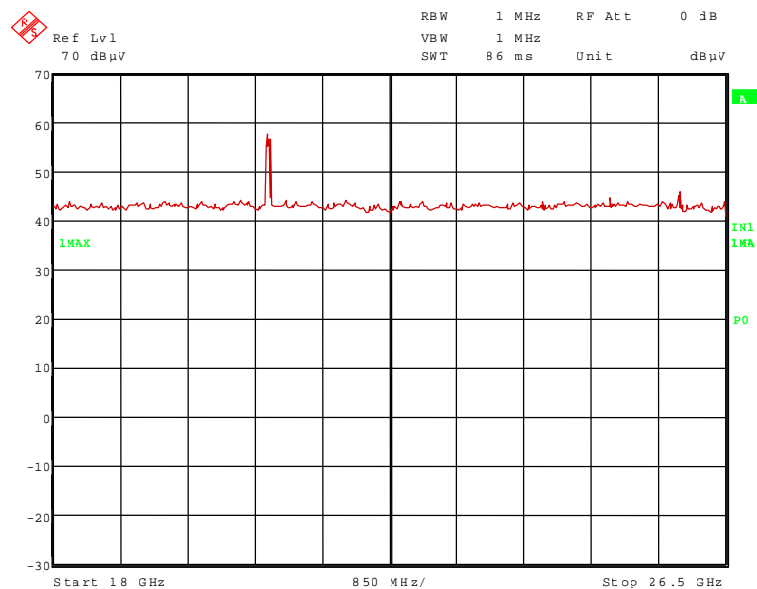


TEST REPORT REFERENCE: F091568E2

91568_60.wmf: Spurious emissions from 12 GHz to 18 GHz (a-mode, 6 Mbps):

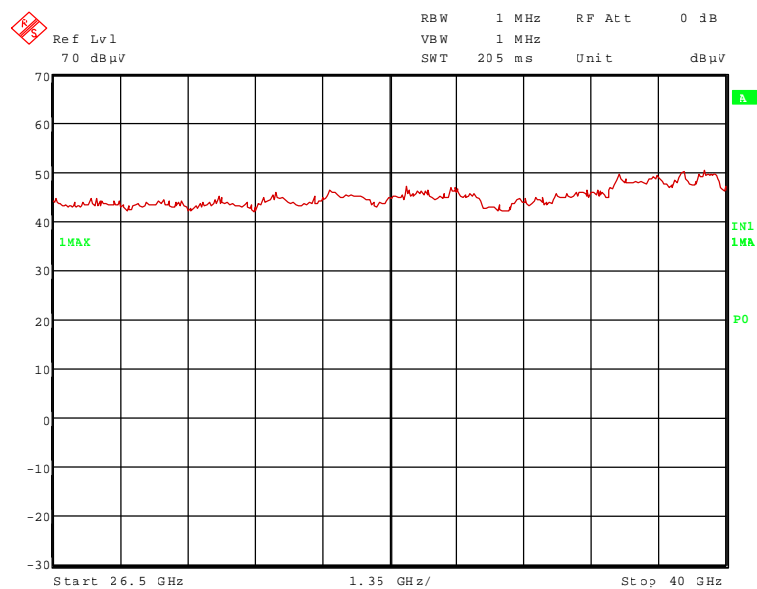


91568_61.wmf: Spurious emissions from 18 GHz to 26.5 GHz (a-mode, 6 Mbps):



TEST REPORT REFERENCE: F091568E2

91568 62.wmf: Spurious emissions from 26.5 GHz to 40 GHz (a-mode, 6 Mbps):



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

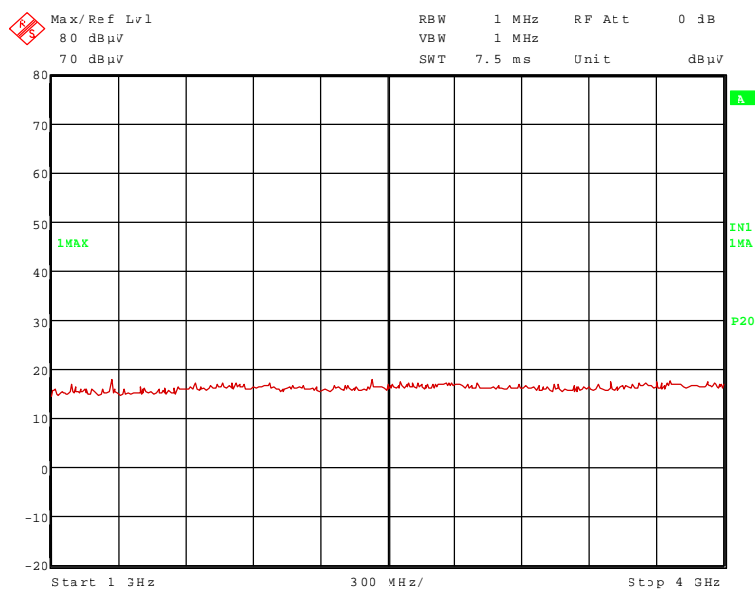
- 5.180 GHz, 10.360 GHz, 15.540 GHz and 20.720 GHz.

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

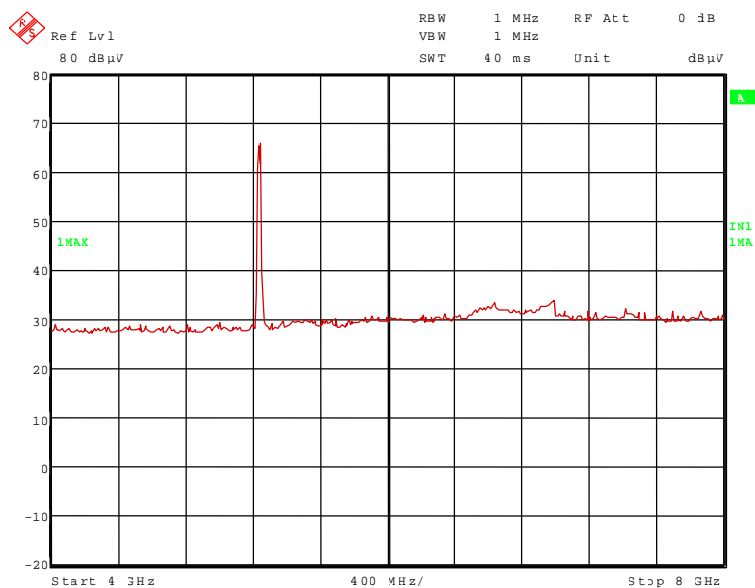
TEST REPORT REFERENCE: F091568E2

Transmitter operates at the upper end of the assigned frequency band (operation mode 4)

91568 15.wmf: Spurious emissions from 1 GHz to 4 GHz (a-mode, 6 Mbps):

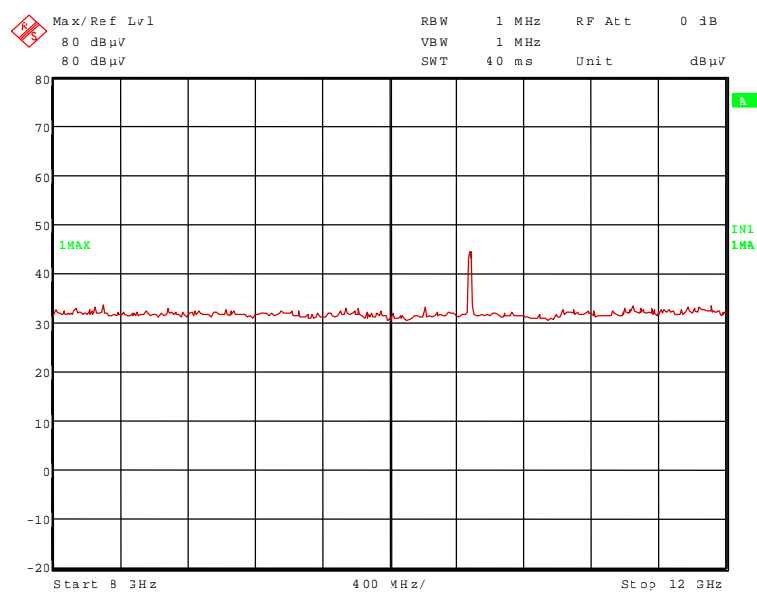


91568 29.wmf: Spurious emissions from 4 GHz to 8 GHz (a-mode, 6 Mbps):

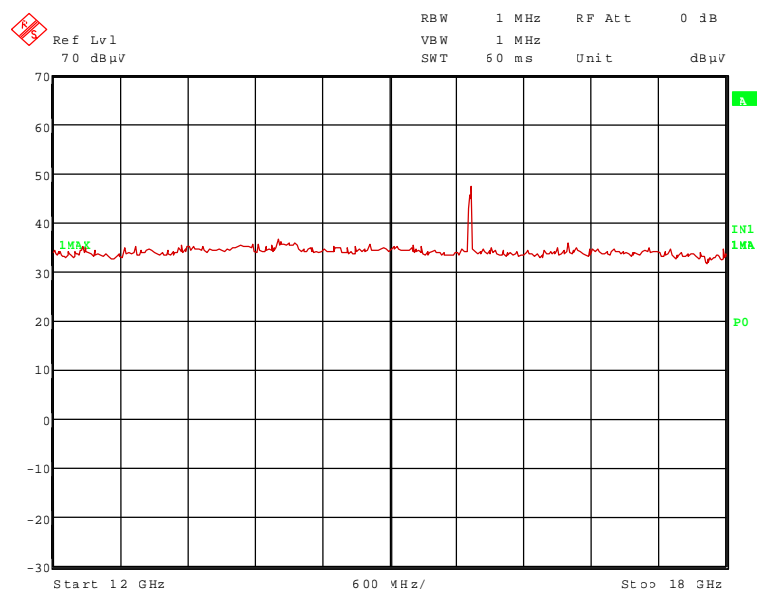


TEST REPORT REFERENCE: F091568E2

91568 32.wmf: Spurious emissions from 8 GHz to 12 GHz (a-mode, 6 Mbps):

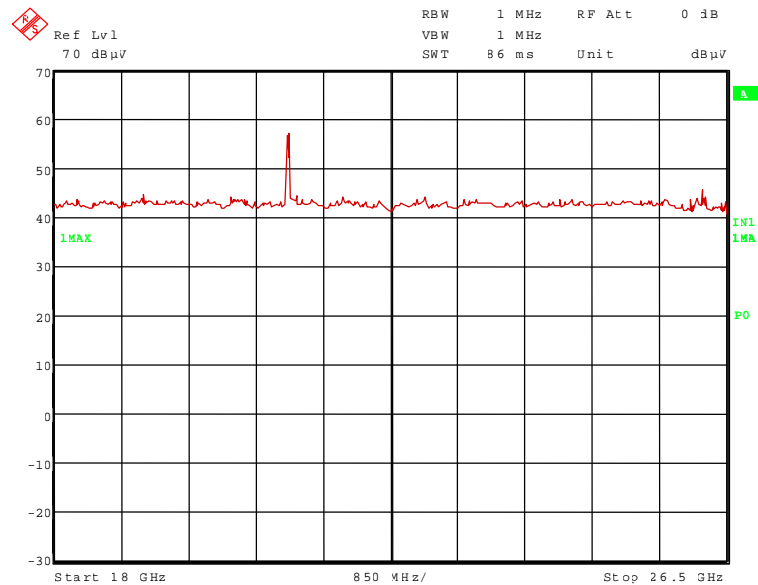


91568 65.wmf: Spurious emissions from 12 GHz to 18 GHz (a-mode, 6 Mbps):

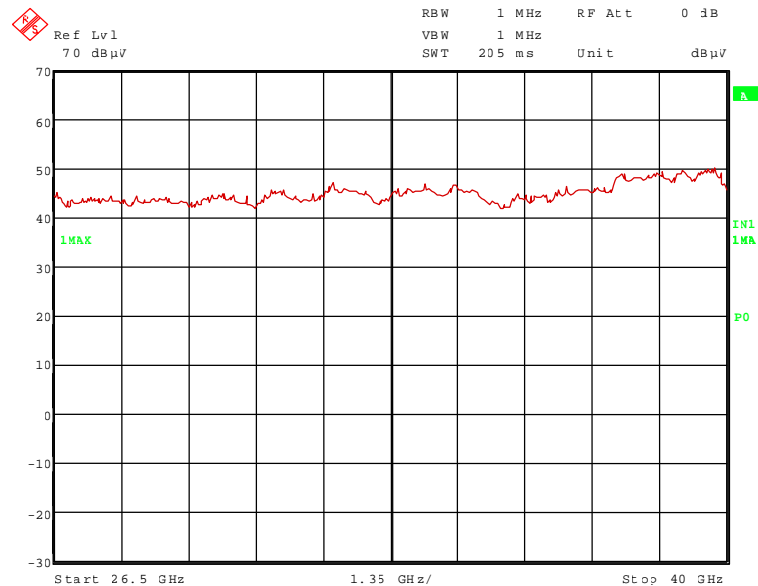


TEST REPORT REFERENCE: F091568E2

91568_64.wmf: Spurious emissions from 18 GHz to 26.5 GHz (a-mode, 6 Mbps):



91568_63.wmf: Spurious emissions from 26.5 GHz to 40 GHz (a-mode, 6 Mbps):



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

- 5.240 GHz, 10.480 GHz, 15.720 GHz, 20.960 GHz and 26.200 GHz.

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

TEST REPORT REFERENCE: F091568E2

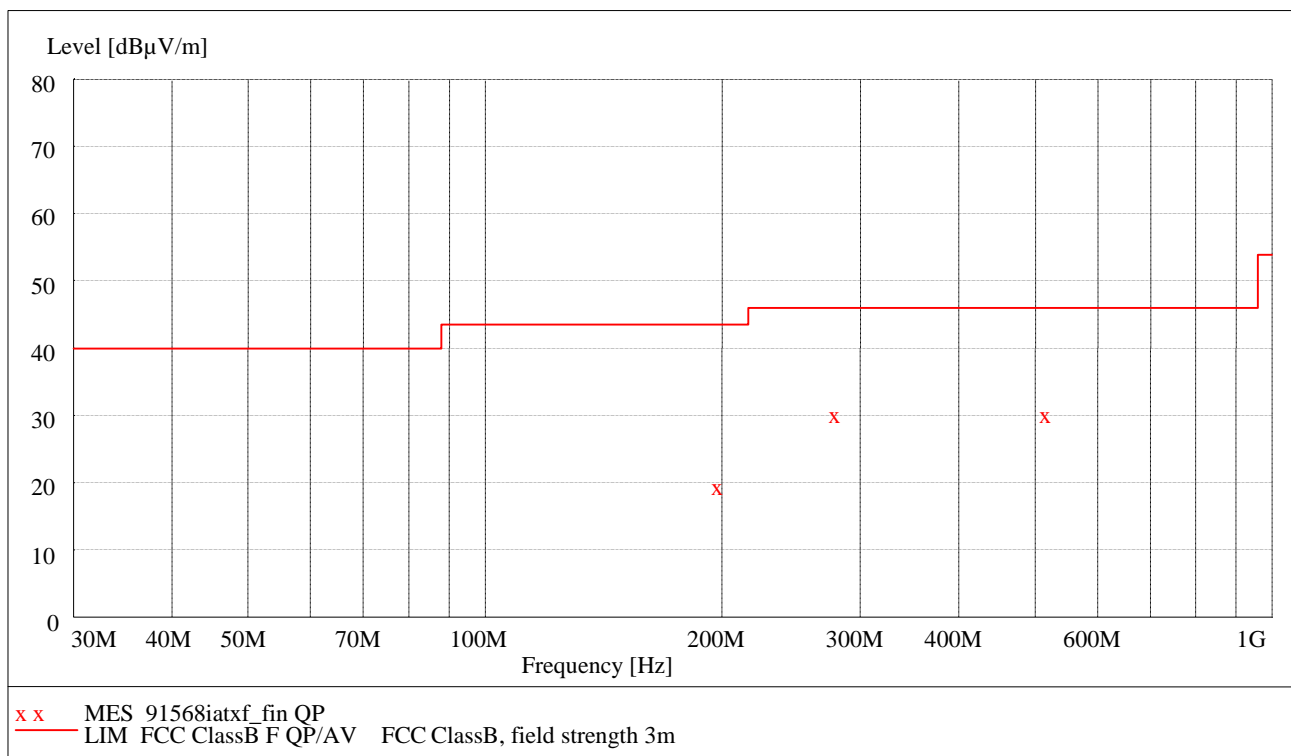
6.7.2.3 FINAL MEASUREMENT (30 MHz to 1 GHz) a-mode, internal antenna

Ambient temperature	21 °C	Relative humidity	45 %
---------------------	-------	-------------------	------

- Position of EUT:** The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.
- Cable guide:** 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 5.0 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: 91568iatxf

TEST REPORT REFERENCE: F091568E2

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									
Frequency MHz	Result dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor dB/m	Cable loss dB	Height cm	Azimuth deg	Pol.
200.000	20.3	43.5	23.2	9.9	8.9	1.5	100.0	68.0	Vert.
520.000	30.8	46.0	15.2	10.5	17.7	2.6	150.0	158.0	Hor.
280.000	30.8	46.0	15.2	16.3	12.6	1.9	100.0	112.0	Hor.
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: F091568E2

6.7.2.4 FINAL MEASUREMENT (1 GHz to 40 GHz) a-mode, internal antenna

Ambient temperature	21 °C	Relative humidity	40 %
---------------------	-------	-------------------	------

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 5.0 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)

Frequency GHz	Emission level dBm	Limit dBm	Margin dB	Polarisation
5.180	8.3	carrier	-	Horizontal
10.360	-30.9	-27.0	3.9	Vertical
15.540	-35.2	-27.0	8.2	Vertical
20.720	-32.1	-27.0	5.1	Vertical
Measurement uncertainty			+2.2 dB / -3.6 dB	

Transmitter operates at the upper end of the assigned frequency band (operation mode 4)

Frequency GHz	Emission level dBm	Limit dBm	Margin dB	Polarisation
5.240	8.5	carrier	-	Horizontal
10.480	-27.6	-27.0	0.6	Vertical
15.720	-39.4	-27.0	12.4	Vertical
20.960	-32.6	-27.0	5.6	Horizontal
26.200	-46.2	-27.0	19.2	Horizontal
Measurement uncertainty			+2.2 dB / -3.6 dB	

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
29, 31 – 42, 44, 46, 49 – 52, 56, 57, 74, 102

TEST REPORT REFERENCE: F091568E2

6.7.2.5 FINAL MEASUREMENT (1 GHz to 40 GHz) n-mode, internal antenna

Ambient temperature	21 °C	Relative humidity	40 %
---------------------	-------	-------------------	------

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 5.0 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)

Frequency GHz	Emission level dBm	Limit dBm	Margin dB	Polarisation
5.180	8.3	carrier	-	Horizontal
10.360	-32.2	-27.0	5.2	Vertical
15.540	-37.8	-27.0	10.8	Horizontal
20.900	-30.5	-27.0	3.5	Horizontal
25.900	-44.4	-27.0	17.4	Horizontal
Measurement uncertainty			+2.2 dB / -3.6 dB	

Transmitter operates at the upper end of the assigned frequency band (operation mode 4)

Frequency GHz	Emission level dBm	Limit dBm	Margin dB	Polarisation
5.240	8.5	carrier	-	Horizontal
10.480	-28.7	-27.0	1.7	Vertical
15.720	-36.9	-27.0	9.9	Vertical
20.960	-32.6	-27.0	5.6	Horizontal
26.200	-46.5	-27.0	19.5	Horizontal
Measurement uncertainty			+2.2 dB / -3.6 dB	

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
29, 31 – 42, 44, 46, 49 – 52, 56, 57, 74, 102

TEST REPORT REFERENCE: F091568E2

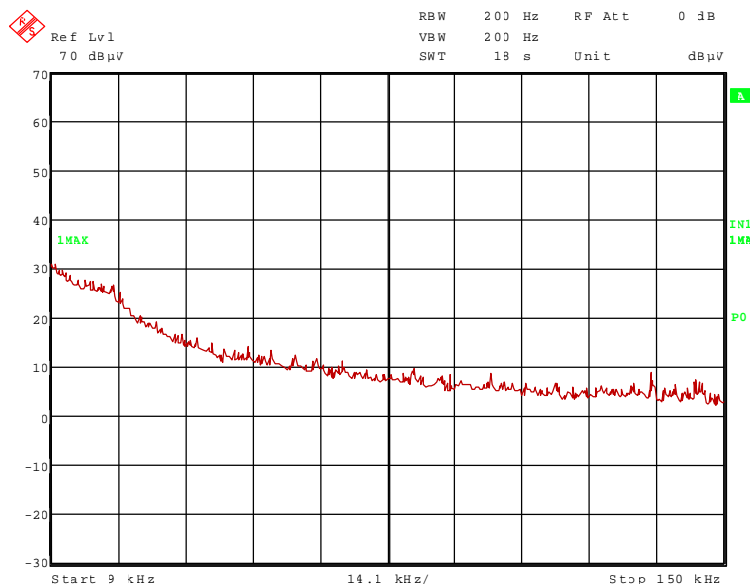
6.7.3 TEST RESULTS (RADIATED EMISSIONS) WITH EXTERNAL PATCH ANTENNA

6.7.3.1 PRELIMINARY MEASUREMENT (9 kHz to 1 GHz)

Ambient temperature	21 °C	Relative humidity	39 %
---------------------	-------	-------------------	------

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 5.0 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 a-mode with 6 Mbps and transmit in the middle of the assigned frequency range (operation mode 2). As external patch antenna the InSide-WLAN antenna was used.

91568_334.wmf: Spurious emissions from 9 kHz to 150 kHz (a-mode, 6 Mbps, operation mode 2):

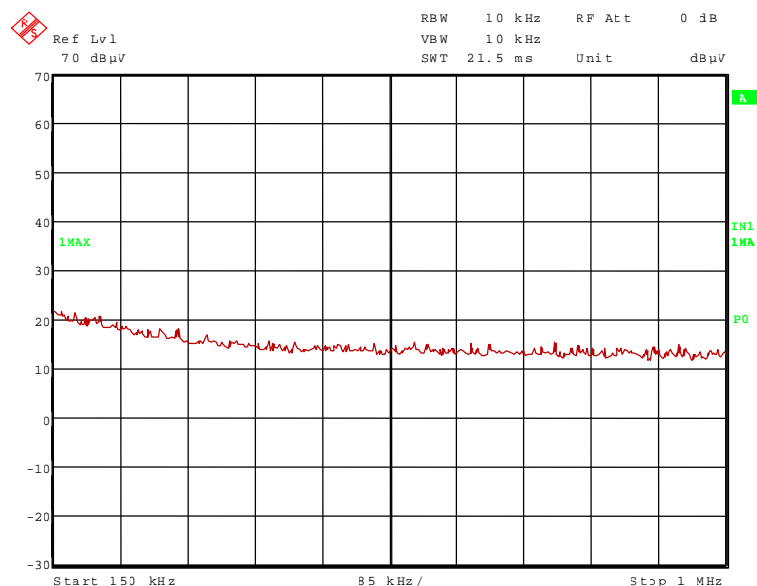


TEST EQUIPMENT USED FOR THE TEST:

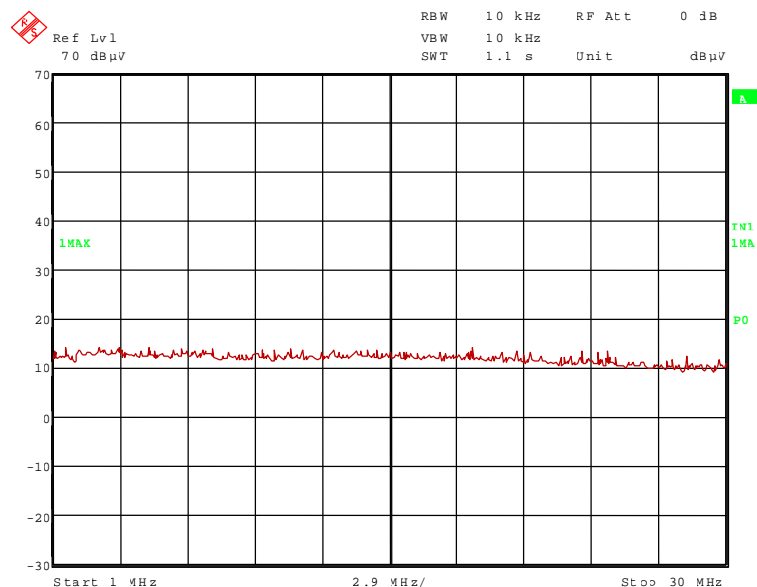
29, 31 – 35, 43, 46, 55

TEST REPORT REFERENCE: F091568E2

91568_333.wmf: Spurious emissions from 150 kHz to 1 MHz (a-mode, 6 Mbps, operation mode 2):



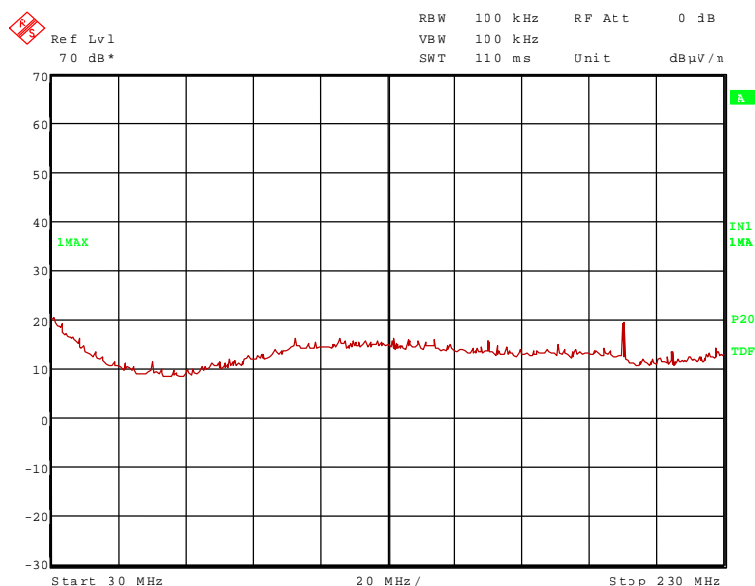
91568_332.wmf: Spurious emissions from 1 MHz to 30 MHz (a-mode, 6 Mbps, operation mode 2):



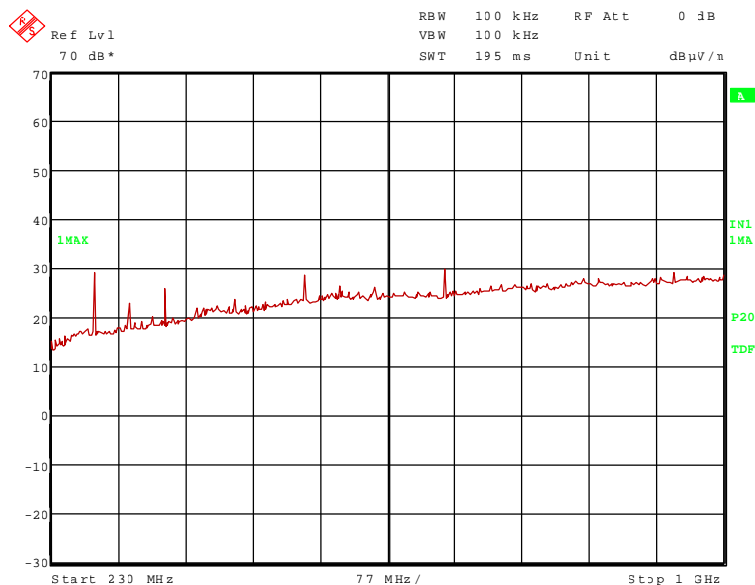
No significant frequencies above the noise floor of the system were found during the preliminary radiated emission test inside this frequency range, so no measurements were carried out on the outdoor test site.

TEST REPORT REFERENCE: F091568E2

91568 313.wmf: Spurious emissions from 30 MHz to 230 MHz (a-mode, 6 Mbps, operation mode 2):



91568 314.wmf: Spurious emissions from 230 MHz to 1 GHz (a-mode, 6 Mbps, operation mode 2):



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

- 200.000 MHz, 280.000 MHz and 680.000MHz.

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: F091568E2

6.7.3.2 PRELIMINARY MEASUREMENT (1 GHz to 40 GHz), n-mode, external patch antenna

Ambient temperature	21 °C	Relative humidity	39 %
---------------------	-------	-------------------	------

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

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

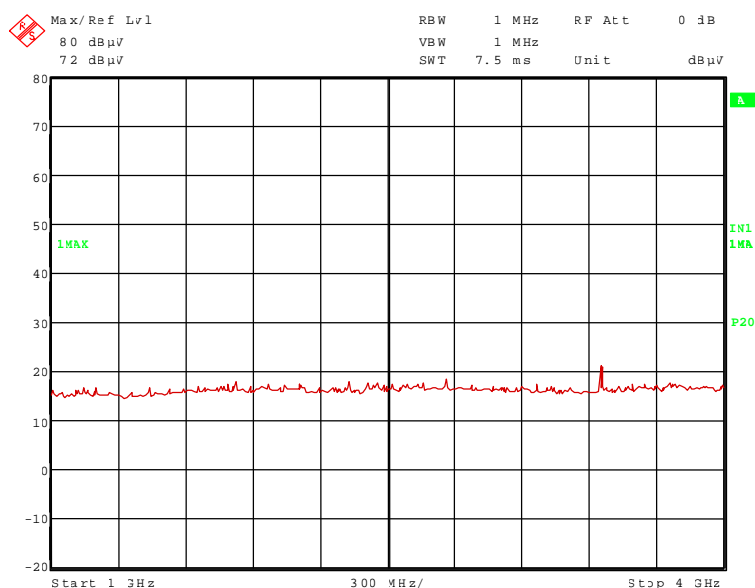
Test record: All results are shown in the following.

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

Remark: The plots at the next pages are showing radiated spurious emissions with the worst case operation mode. The tables of the final measurements in the next clauses are showing the results for the radiated spurious emissions for all applicable operation modes with the worst case data rate. As external patch antenna the InSide-WLAN antenna was used.

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

91568_137.wmf: Spurious emissions from 1 GHz to 4 GHz (n-mode, 6 Mbps, operation mode 1):

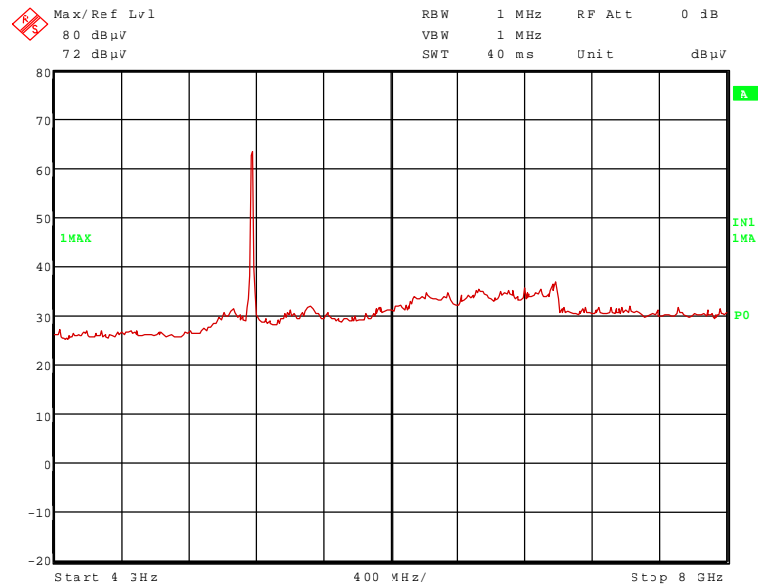


TEST EQUIPMENT USED FOR THE TEST:

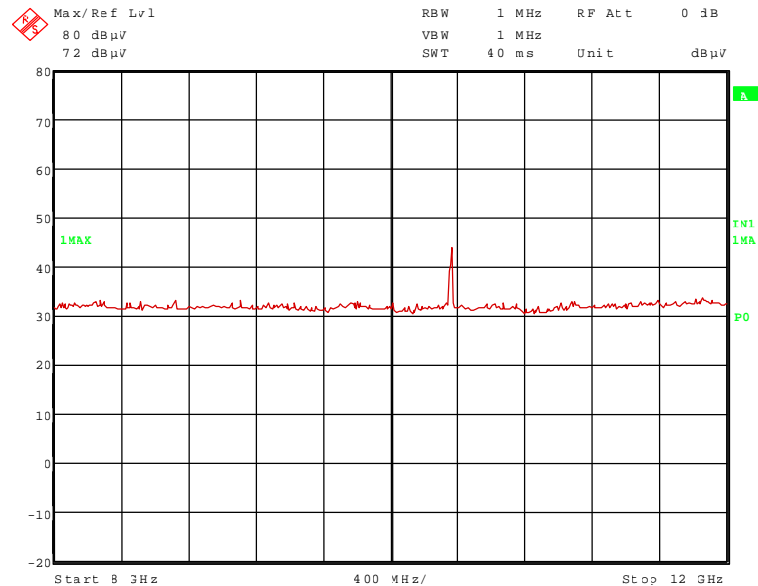
29, 31 – 42, 44, 46, 49 – 52, 56, 57, 74, 102

TEST REPORT REFERENCE: F091568E2

91568 138.wmf: Spurious emissions from 4 GHz to 8 GHz (n-mode, 6 Mbps, operation mode 1):

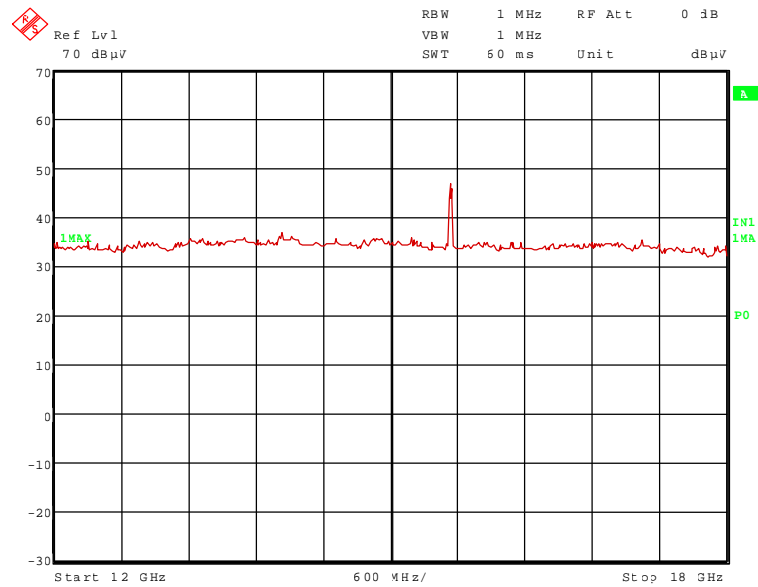


91568 142.wmf: Spurious emissions from 8 GHz to 12 GHz (n-mode, 6 Mbps, operation mode 1):

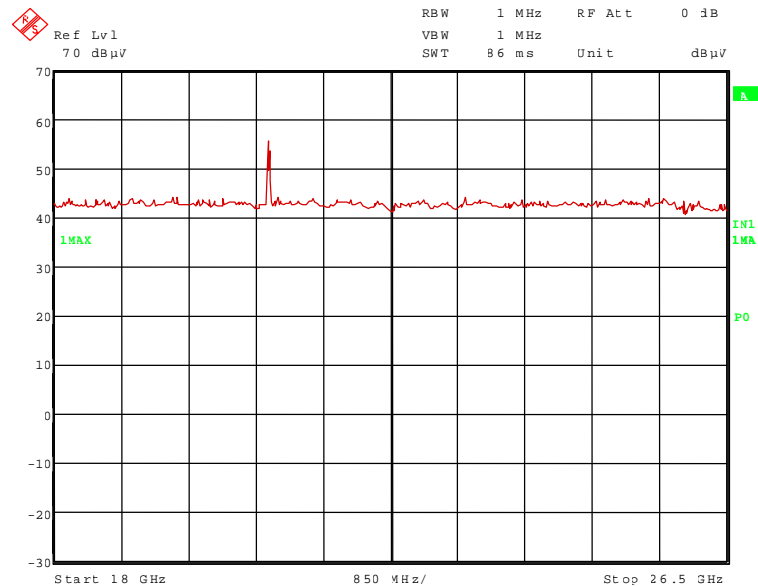


TEST REPORT REFERENCE: F091568E2

91568 148.wmf: Spurious emissions from 12 GHz to 18 GHz (n-mode, 6 Mbps, operation mode 1):

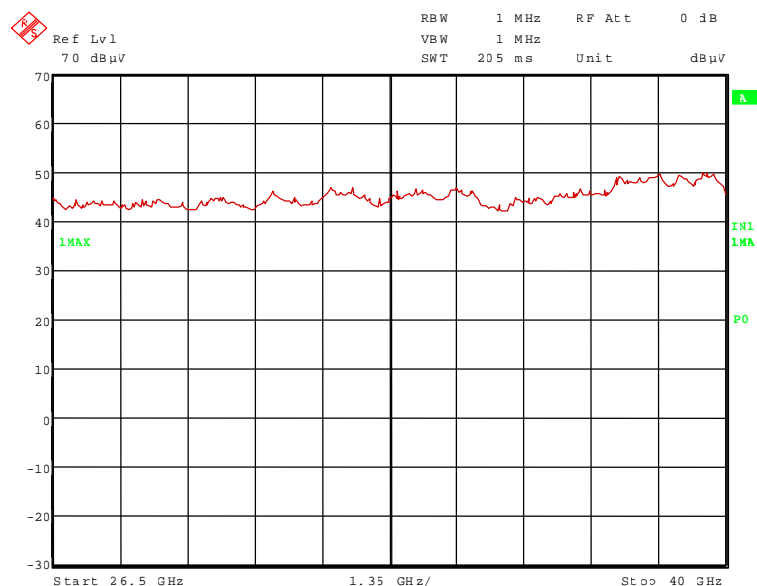


91568 149.wmf: Spurious emissions from 18 GHz to 26.5 GHz (n-mode, 6 Mbps, operation mode 1):



TEST REPORT REFERENCE: F091568E2

91568 152.wmf: Spurious emissions from 26.5 GHz to 40 GHz (n-mode, 6 Mbps, operation mode 1):



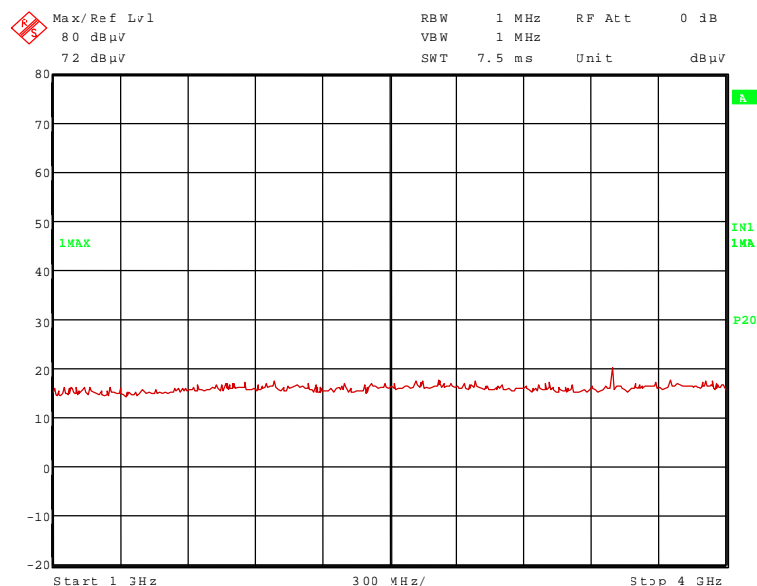
The following frequencies were found during the preliminary radiated emission test:

- 3.453 GHz, 5.180 GHz, 10.360 GHz, 15.540 GHz and 20.900 GHz.

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

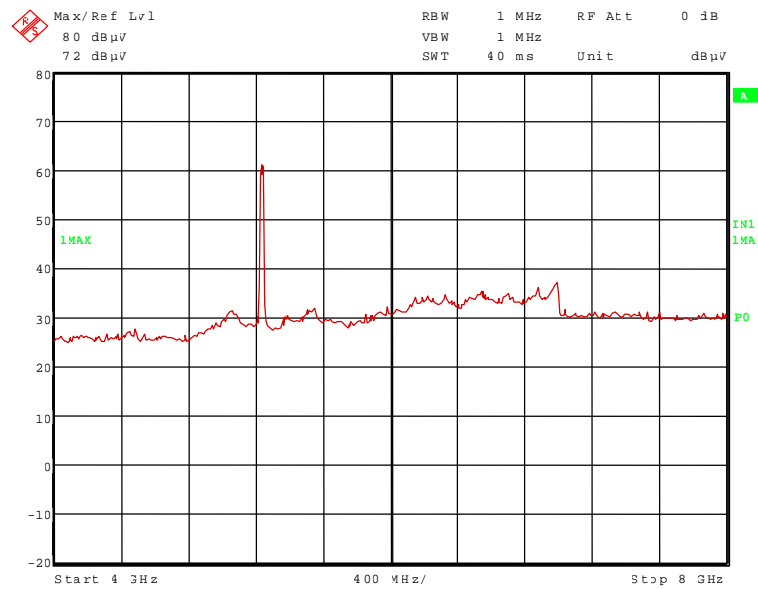
Transmitter operates at the upper end of the assigned frequency band (operation mode 4)

91568 139.wmf: Spurious emissions from 1 GHz to 4 GHz (n-mode, 6 Mbps, operation mode 4):

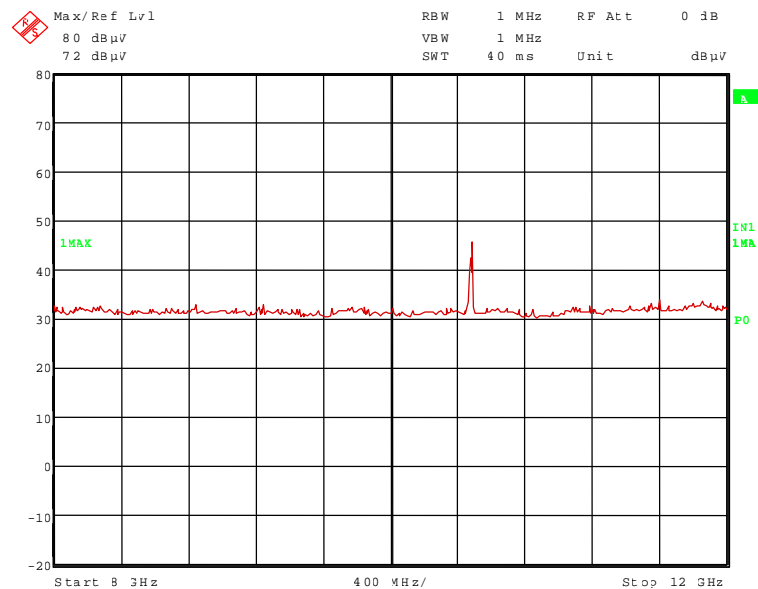


TEST REPORT REFERENCE: F091568E2

91568 140.wmf: Spurious emissions from 4 GHz to 8 GHz (n-mode, 6 Mbps, operation mode 4):

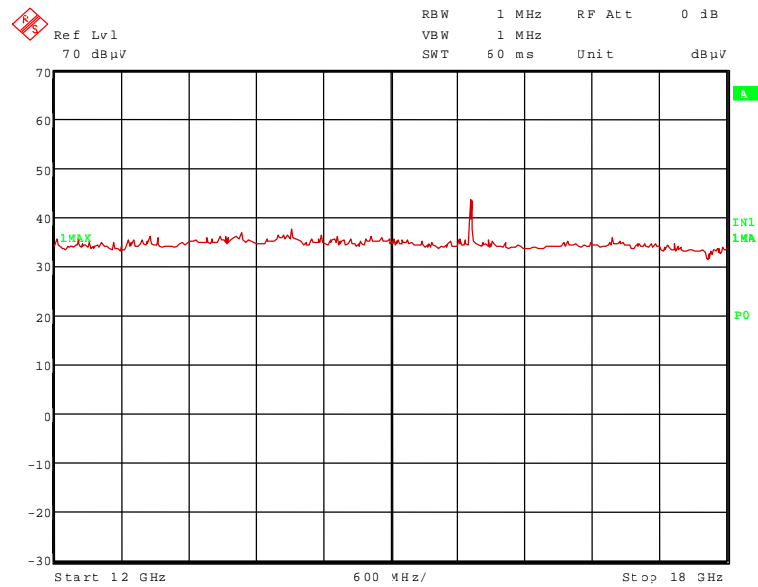


91568 141.wmf: Spurious emissions from 8 GHz to 12 GHz (n-mode, 6 Mbps, operation mode 4):

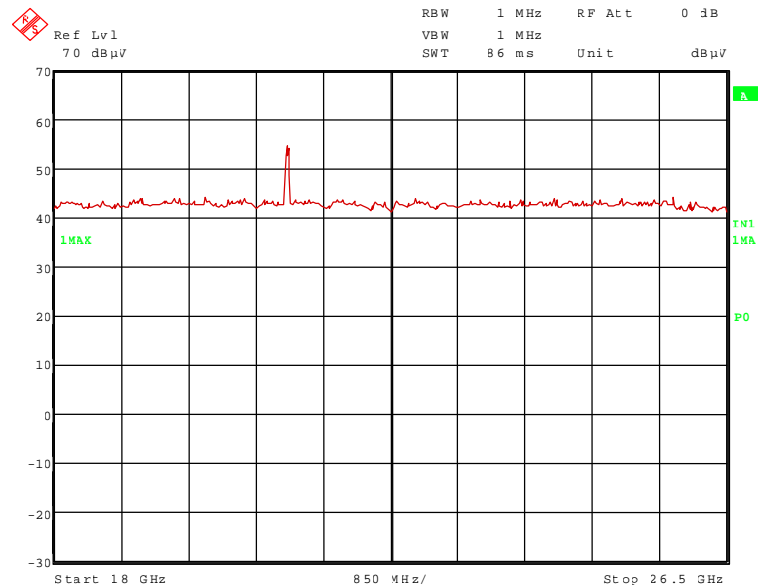


TEST REPORT REFERENCE: F091568E2

91568_147.wmf: Spurious emissions from 12 GHz to 18 GHz (n-mode, 6 Mbps, operation mode 4):

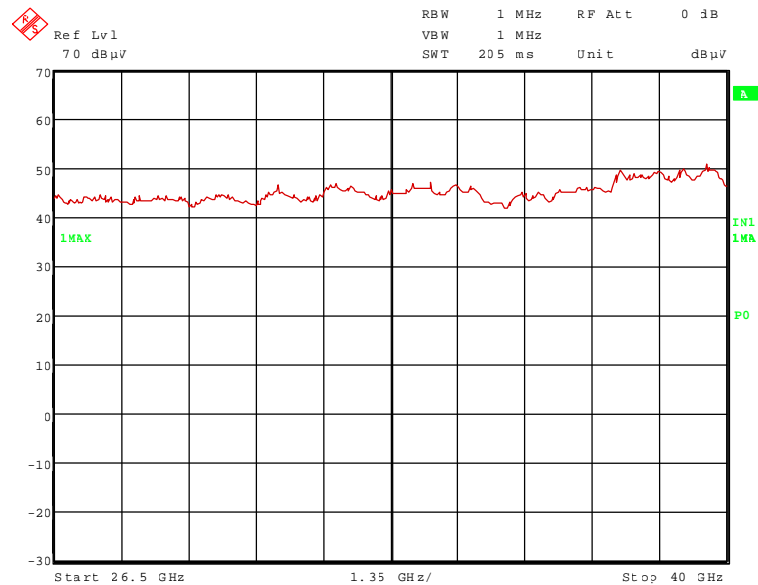


91568_150.wmf: Spurious emissions from 18 GHz to 26.5 GHz (n-mode, 6 Mbps, operation mode 4):



TEST REPORT REFERENCE: F091568E2

91568 151.wmf: Spurious emissions from 26.5 GHz to 40 GHz (n-mode, 6 Mbps, operation mode 4):



The following frequencies were during the preliminary radiated emission test:

- 3.493 GHz, 5.240 GHz, 10.480 GHz, 15.720 GHz and 20.960 GHz.

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

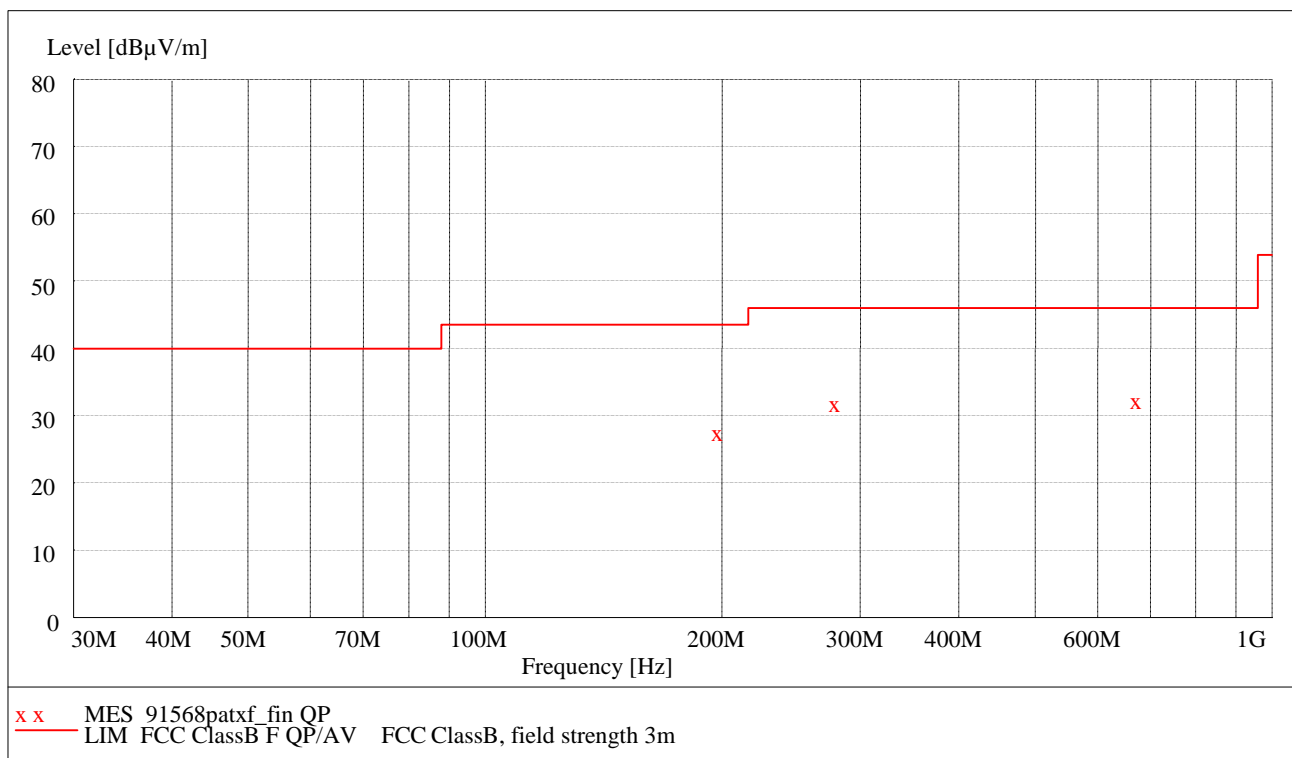
TEST REPORT REFERENCE: F091568E2

6.7.3.3 FINAL MEASUREMENT (30 MHz to 1 GHz) a-mode, external patch antenna

Ambient temperature	21 °C	Relative humidity	45 %
---------------------	-------	-------------------	------

- Position of EUT:** The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.
- Cable guide:** 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 5.0 DC.
- Test record:** The test was carried out in test mode 2 (a-mode with 6 Mbps) of the EUT, because there was no difference to the other test modes. As external patch antenna the InSide-WLAN antenna was used.
- 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: 91568patxf

TEST REPORT REFERENCE: F091568E2

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									
Frequency MHz	Result dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor dB/m	Cable loss dB	Height cm	Azimuth deg	Pol.
200.000	28.0	43.5	15.5	17.6	8.9	1.5	100.0	23.0	Vert.
680.000	32.0	46.0	13.3	9.3	19.8	2.9	100.0	23.0	Vert.
280.000	32.4	46.0	13.6	17.9	12.6	1.9	100.0	112.0	Hor.
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: F091568E2

6.7.3.4 FINAL MEASUREMENT (1 GHz to 40 GHz) a-mode, external patch antenna

Ambient temperature	21 °C	Relative humidity	39 %
---------------------	-------	-------------------	------

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 5.0 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. As external patch antenna the InSide-WLAN antenna was used.

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

Frequency GHz	Emission level dBm	Limit dBm	Margin dB	Polarisation
3.453	-37.5	-27.0	10.5	Horizontal
5.180	8.8	carrier	-	Horizontal
10.360	-32.3	-27.0	5.3	Vertical
15.540	-38.3	-27.0	11.3	Vertical
20.720	-33.6	-27.0	6.6	Vertical
Measurement uncertainty			+2.2 dB / -3.6 dB	

Transmitter operates at the upper end of the assigned frequency band (operation mode 4)

Frequency GHz	Emission level dBm	Limit dBm	Margin dB	Polarisation
3.493	-38.2	-27.0	11.2	Horizontal
5.240	7.3	carrier	-	Horizontal
10.480	-28.4	-27.0	1.4	Vertical
15.720	-40.9	-27.0	13.9	Vertical
20.960	-36.2	-27.0	9.2	Horizontal
Measurement uncertainty			+2.2 dB / -3.6 dB	

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
29, 31 – 42, 44, 46, 49 – 52, 56, 57, 74, 102

TEST REPORT REFERENCE: F091568E2

6.7.3.5 FINAL MEASUREMENT (1 GHz to 40 GHz) n-mode, external patch antenna

Ambient temperature	21 °C	Relative humidity	39 %
---------------------	-------	-------------------	------

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 5.0 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. As external patch antenna the InSide-WLAN antenna was used.

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

Frequency GHz	Emission level dBm	Limit dBm	Margin dB	Polarisation
3.453	-38.0	-27.0 dBm	11.0	Horizontal
5.180	7.9	carrier	-	Horizontal
10.360	-28.3	-27.0 dBm	1.3	Vertical
15.540	-39.4	-27.0 dBm	12.4	Horizontal
20.900	-34.3	-27.0 dBm	7.3	Horizontal
Measurement uncertainty			+2.2 dB / -3.6 dB	

Transmitter operates at the upper end of the assigned frequency band (operation mode 4)

Frequency GHz	Emission level dBm	Limit dBm	Margin dB	Polarisation
3.493	-38.8	-27.0 dBm	11.8	Horizontal
5.240	7.3	carrier	-	Horizontal
10.480	-27.3	-27.0 dBm	0.3	Vertical
15.720	-42.0	-27.0 dBm	15.0	Vertical
20.960	-37.8	-27.0 dBm	10.8	Horizontal
Measurement uncertainty			+2.2 dB / -3.6 dB	

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
29, 31 – 42, 44, 46, 49 – 52, 56, 57, 74, 102

TEST REPORT REFERENCE: F091568E2

6.7.4 TEST RESULTS (RADIATED EMISSIONS) WITH EXTERNAL MONOPOLE ANTENNA

6.7.4.1 PRELIMINARY MEASUREMENT (9 kHz to 1 GHz)

Ambient temperature	21 °C	Relative humidity	43 %
---------------------	-------	-------------------	------

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.

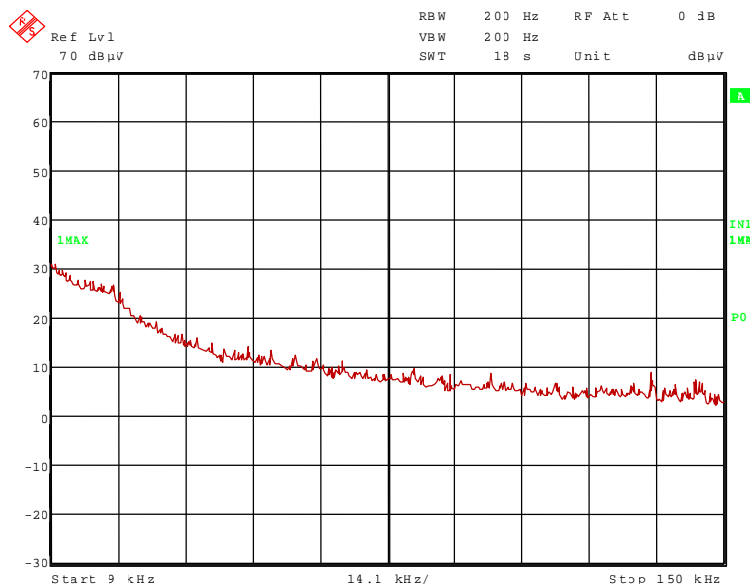
Cable guide: The cables of the EUT were fixed on the non-conducting table. For further information of the cable guide refer to the pictures in annex A of this test report.

Test record: All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied with 5.0 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 a-mode with 6 Mbps and transmit in the middle of the assigned frequency range (operation mode 2). As external monopole antenna the Ex-IT WLAN-SMA 70-001 with a 10 cm antenna cable was used.

91568_455.wmf: Spurious emissions from 9 kHz to 150 kHz (a-mode, 6 Mbps, operation mode 2):

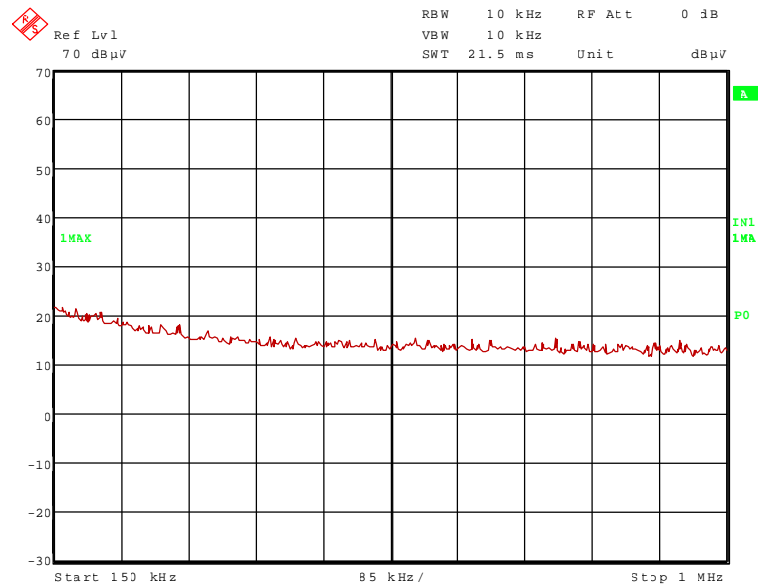


TEST EQUIPMENT USED FOR THE TEST:

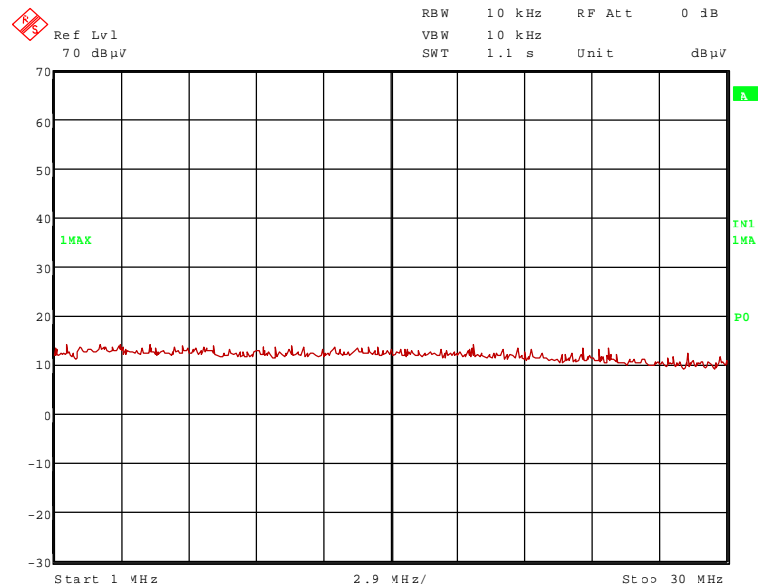
29, 31 – 35, 43, 46, 55

TEST REPORT REFERENCE: F091568E2

91568 456.wmf: Spurious emissions from 150 kHz to 1 MHz (a-mode, 6 Mbps, operation mode 2):



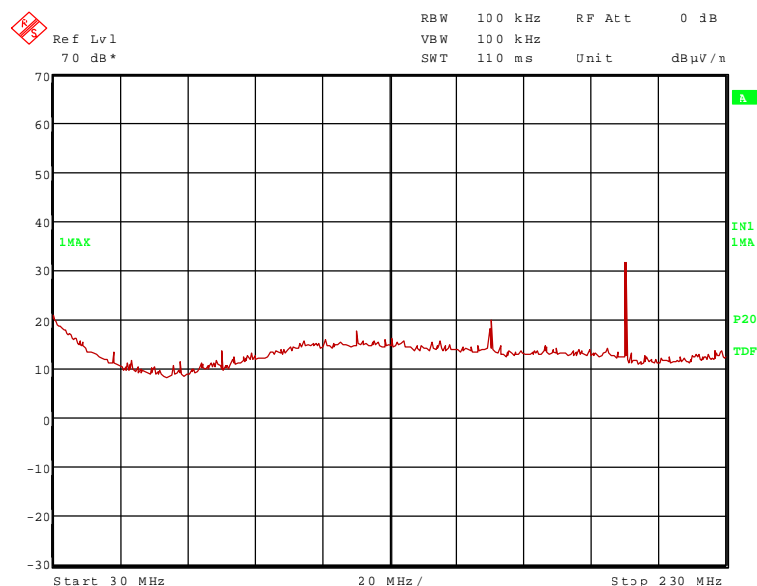
91568 457.wmf: Spurious emissions from 1 MHz to 30 MHz (a-mode, 6 Mbps, operation mode 2):



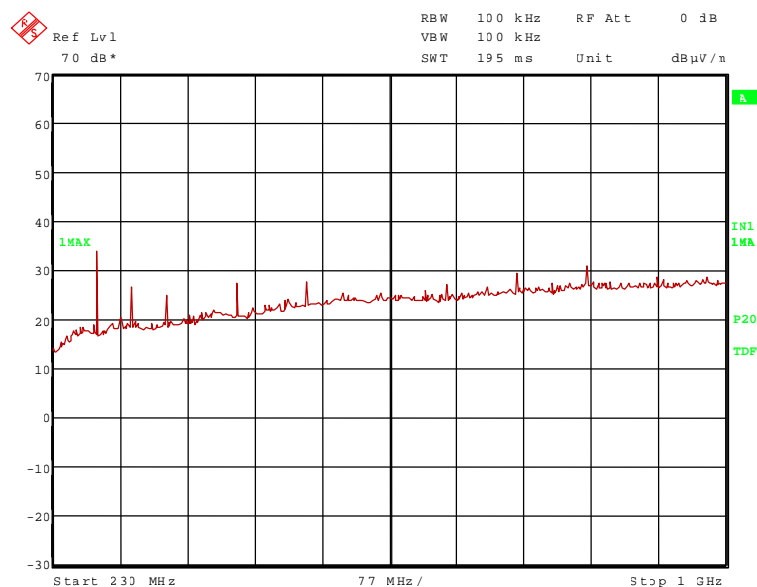
No significant frequencies above the noise floor of the system were found during the preliminary radiated emission test inside this frequency range, so no measurements were carried out on the outdoor test site.

TEST REPORT REFERENCE: F091568E2

91568 458.wmf: Spurious emissions from 30 MHz to 230 MHz (a-mode, 6 Mbps, operation mode 2):



91568 459.wmf: Spurious emissions from 230 MHz to 1 GHz (a-mode, 6 Mbps, operation mode 2):



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

- 280.000 MHz, 80.000 MHz, 160.000 MHz, 200.000 MHz, 440.000 MHz and 840.000 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: F091568E2

6.7.4.2 PRELIMINARY MEASUREMENT (1 GHz to 40 GHz), n-mode, external monopole antenna

Ambient temperature	21 °C	Relative humidity	43 %
---------------------	-------	-------------------	------

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

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

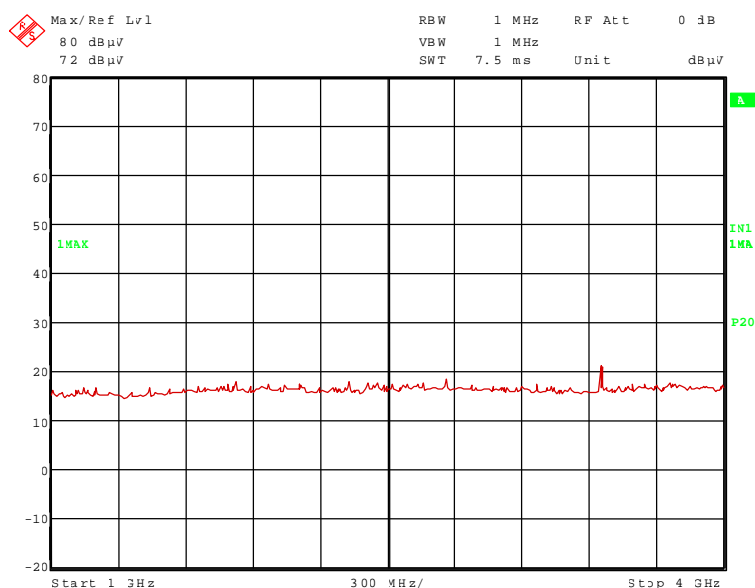
Test record: All results are shown in the following.

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

Remark: The plots at the next pages are showing radiated spurious emissions with the worst case operation mode. The tables of the final measurements in the next clauses are showing the results for the radiated spurious emissions for all applicable operation modes with the worst case data rate. As external monopole antenna the Ex-IT WLAN-SMA 70-001 with a 10 cm antenna cable was used.

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

91568_460.wmf: Spurious emissions from 1 GHz to 4 GHz (n-mode, 6 Mbps, operation mode 1):

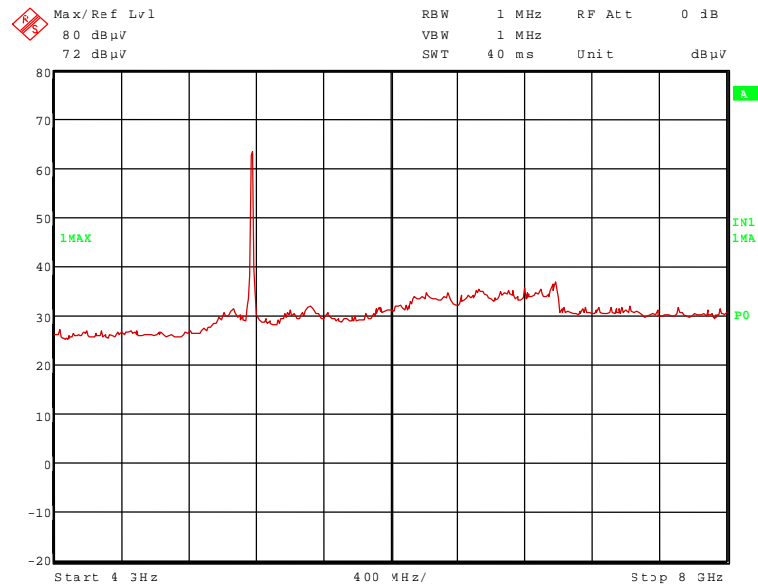


TEST EQUIPMENT USED FOR THE TEST:

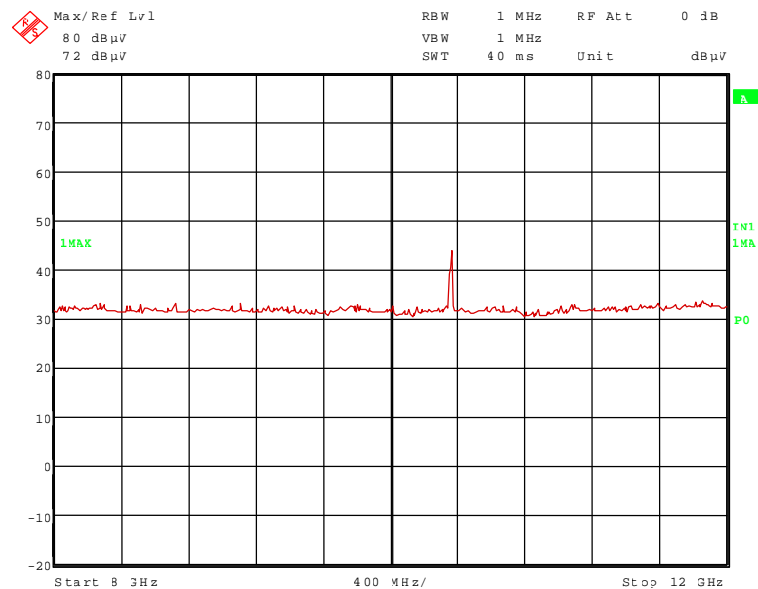
29, 31 – 42, 44, 46, 49 – 52, 56, 57, 74, 102

TEST REPORT REFERENCE: F091568E2

91568_463.wmf: Spurious emissions from 4 GHz to 8 GHz (n-mode, 6 Mbps, operation mode 1):

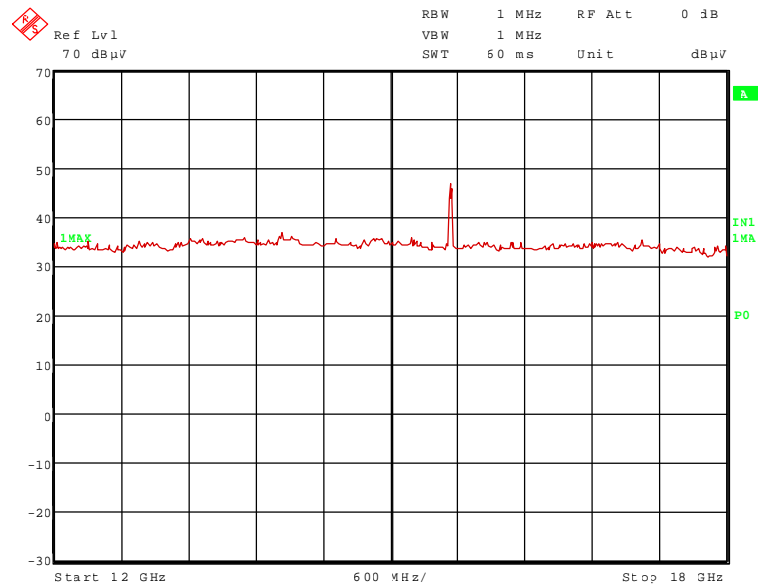


91568_464.wmf: Spurious emissions from 8 GHz to 12 GHz (n-mode, 6 Mbps, operation mode 1):

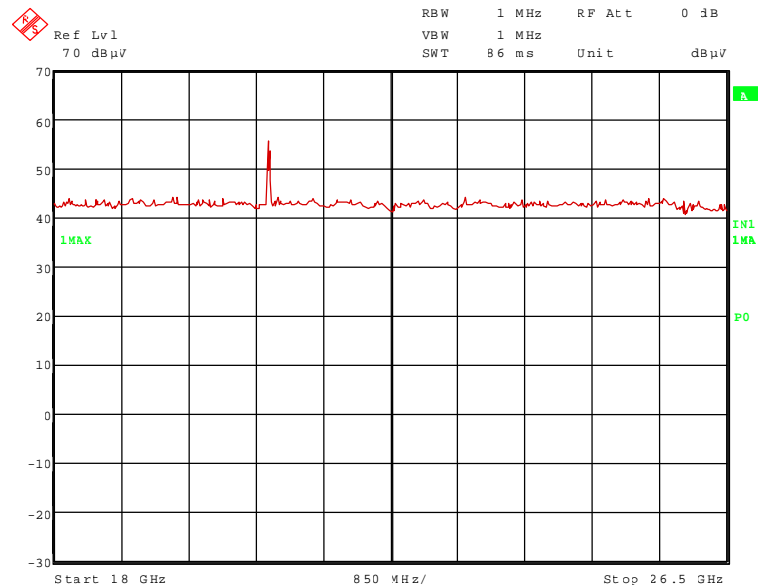


TEST REPORT REFERENCE: F091568E2

91568_467.wmf: Spurious emissions from 12 GHz to 18 GHz (n-mode, 6 Mbps, operation mode 1):

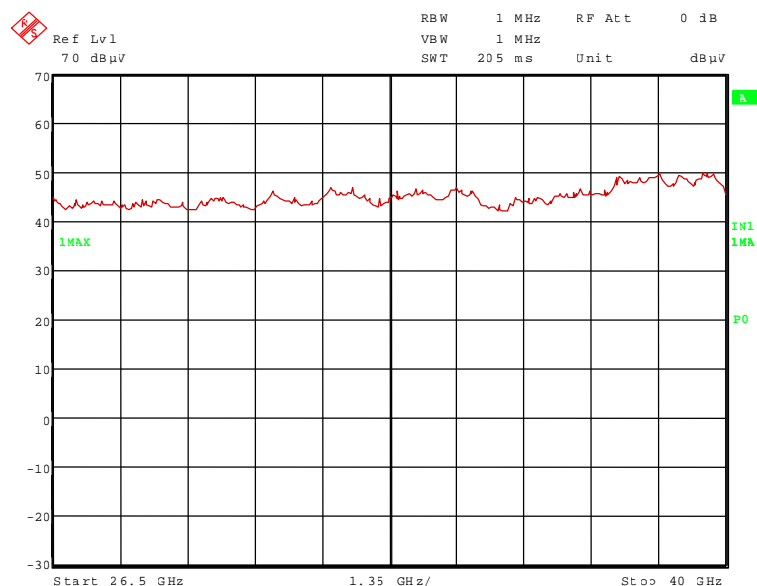


91568_468.wmf: Spurious emissions from 18 GHz to 26.5 GHz (n-mode, 6 Mbps, operation mode 1):



TEST REPORT REFERENCE: F091568E2

91568 471.wmf: Spurious emissions from 26.5 GHz to 40 GHz (n-mode, 6 Mbps, operation mode 1):



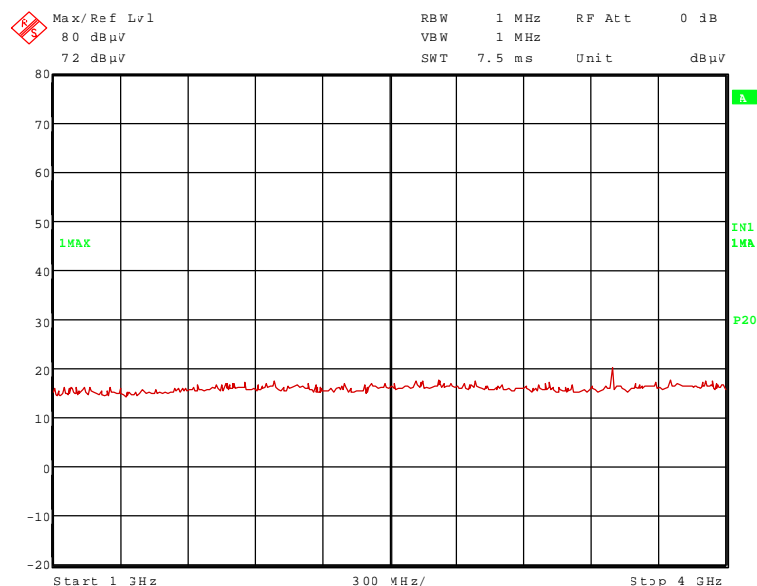
The following frequencies were found during the preliminary radiated emission test:

- 3.453 GHz, 5.180 GHz, 10.360 GHz, 15.540 GHz and 20.900 GHz.

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

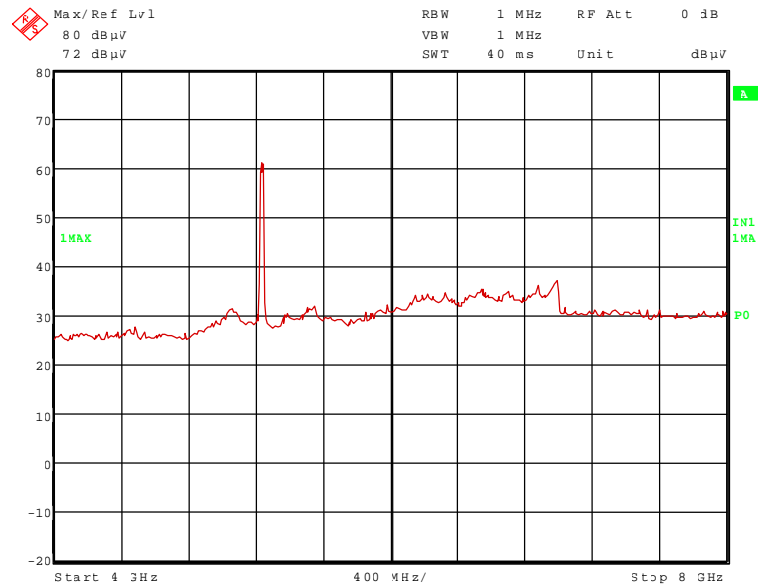
Transmitter operates at the upper end of the assigned frequency band (operation mode 4)

91568 461.wmf: Spurious emissions from 1 GHz to 4 GHz (n-mode, 6 Mbps, operation mode 4):

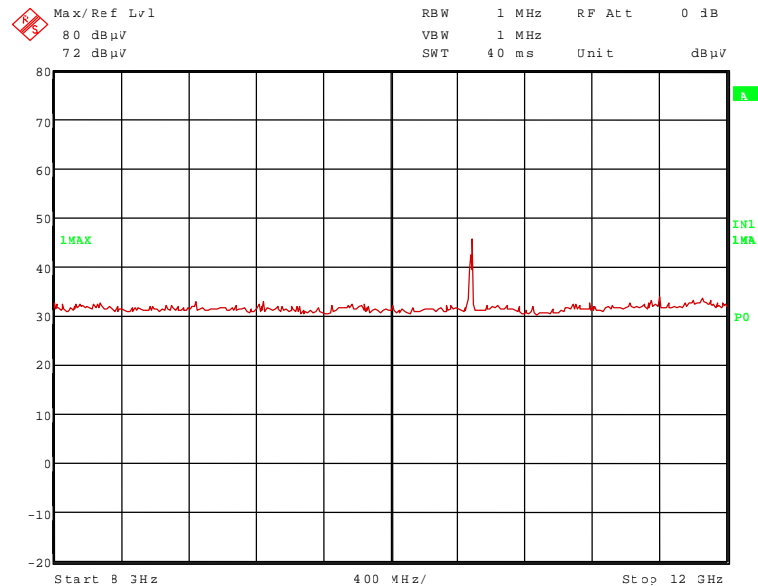


TEST REPORT REFERENCE: F091568E2

91568_462.wmf: Spurious emissions from 4 GHz to 8 GHz (n-mode, 6 Mbps, operation mode 4):

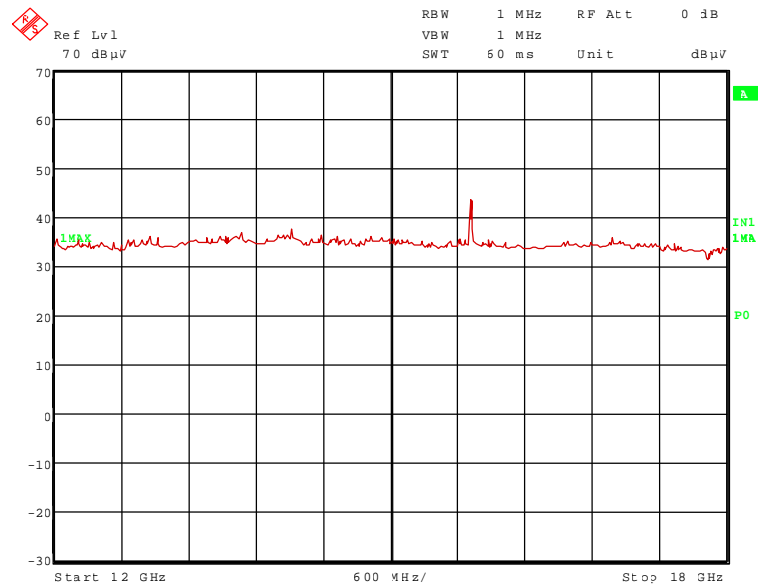


91568_465.wmf: Spurious emissions from 8 GHz to 12 GHz (n-mode, 6 Mbps, operation mode 4):

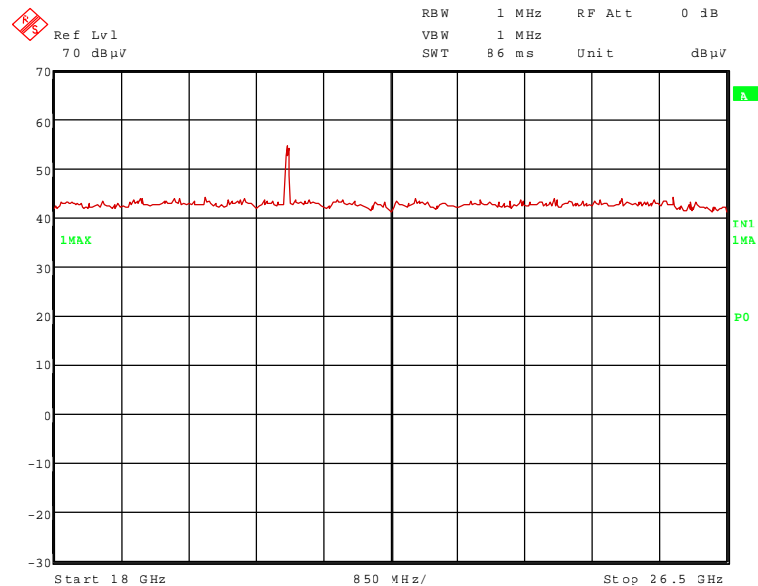


TEST REPORT REFERENCE: F091568E2

91568_466.wmf: Spurious emissions from 12 GHz to 18 GHz (n-mode, 6 Mbps, operation mode 4):

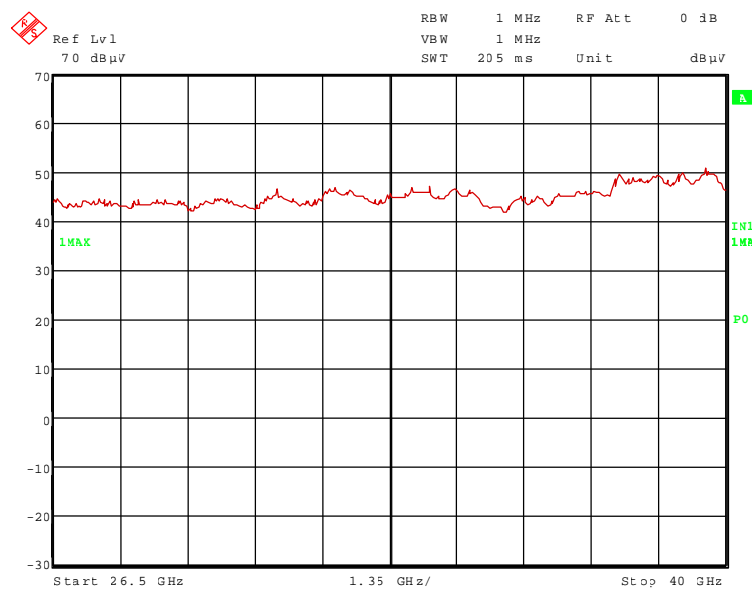


91568_469.wmf: Spurious emissions from 18 GHz to 26.5 GHz (n-mode, 6 Mbps, operation mode 4):



TEST REPORT REFERENCE: F091568E2

91568_470.wmf: Spurious emissions from 26.5 GHz to 40 GHz (n-mode, 6 Mbps, operation mode 4):



The following frequencies were during the preliminary radiated emission test:

- 3.493 GHz, 5.240 GHz, 10.480 GHz, 15.720 GHz and 20.960 GHz.

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

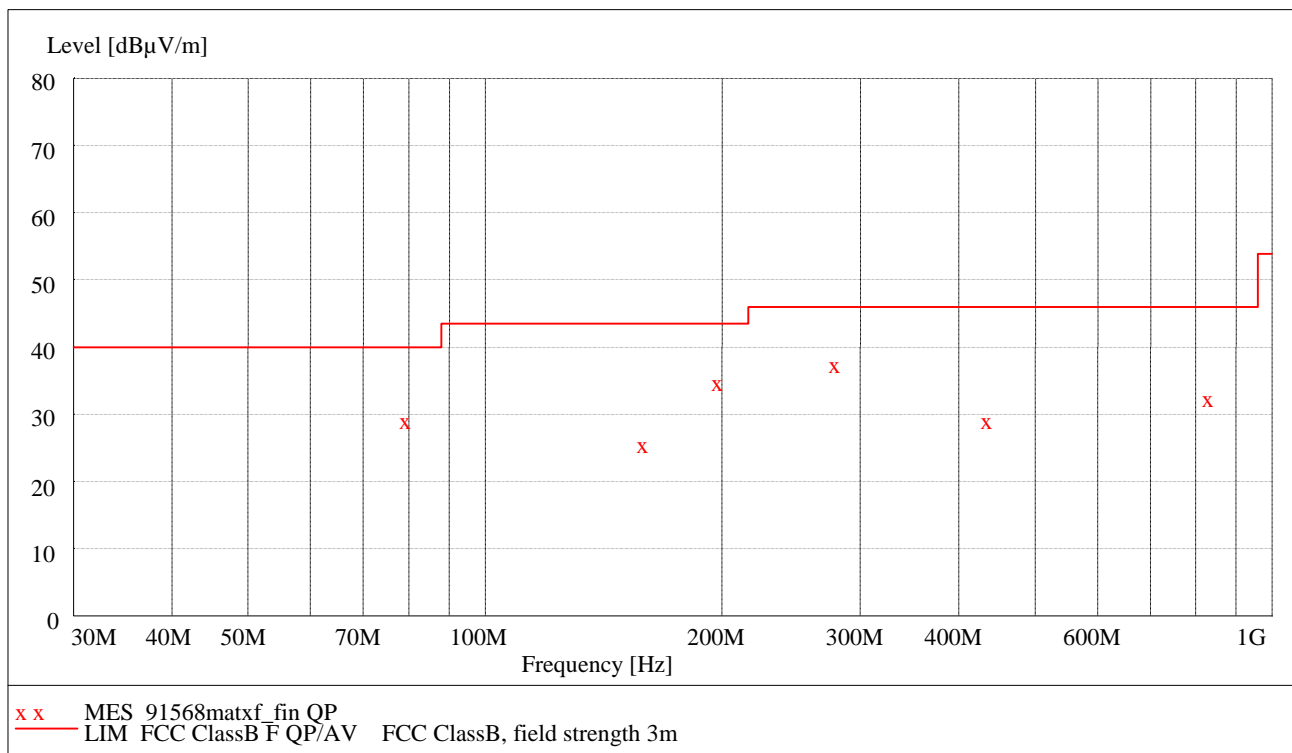
TEST REPORT REFERENCE: F091568E2

6.7.4.3 FINAL MEASUREMENT (30 MHz to 1 GHz) a-mode, external monopole antenna

Ambient temperature	21 °C	Relative humidity	45 %
---------------------	-------	-------------------	------

Position of EUT:	The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.
Cable guide:	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 5.0 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. As external monopole antenna the Ex-IT WLAN-SMA 70-001 with a 10 cm antenna cable was used.
Resolution bandwidth:	For all measurements a resolution bandwidth of 120 kHz was used.
Test results:	<p>The test results were calculated with the following formula:</p> $\text{Result [dB}\mu\text{V/m]} = \text{reading [dB}\mu\text{V]} + \text{cable loss [dB]} + \text{antenna factor [dB/m]}$

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: 91568matxf

TEST REPORT REFERENCE: F091568E2

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									
Frequency	Result	Limit	Margin	Readings	Antenna factor	Cable loss	Height	Azimuth	Pol.
MHz	dBμV/m	dBμV/m	dB	dBμV	dB/m	dB	cm	deg	
80.000	29.8	40.0	10.2	20.6	8.2	1.0	150.0	112.0	Vert.
160.000	26.1	43.5	17.4	13.5	11.1	1.5	150.0	68.0	Hor.
200.000	35.5	43.5	8.0	25.1	8.9	1.5	100.0	23.0	Vert.
440.000	29.8	46.0	16.2	11.0	16.4	2.4	200.0	157.0	Hor.
840.000	33.0	46.0	13.0	7.1	22.7	3.2	200.0	23.0	Vert.
280.000	38.1	46.0	7.9	23.6	12.6	1.9	100.0	112.0	Hor.
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: F091568E2

6.7.4.4 FINAL MEASUREMENT (1 GHz to 40 GHz) a-mode, external monopole antenna

Ambient temperature	21 °C	Relative humidity	42 %
---------------------	-------	-------------------	------

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 5.0 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. As external monopole antenna the Ex-IT WLAN-SMA 70-001 with a 10 cm antenna cable was used.

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

Frequency GHz	Emission level dBm	Limit dBm	Margin dB	Polarisation
3.453	-37.4	-27.0	10.4	Horizontal
5.180	8.8	carrier	-	Horizontal
10.360	-32.4	-27.0	5.4	Vertical
15.540	-38.5	-27.0	11.5	Vertical
20.720	-33.7	-27.0	6.7	Vertical
Measurement uncertainty			+2.2 dB / -3.6 dB	

Transmitter operates at the upper end of the assigned frequency band (operation mode 4)

Frequency GHz	Emission level dBm	Limit dBm	Margin dB	Polarisation
3.493	-38.4	-27.0	11.4	Horizontal
5.240	7.3	carrier	-	Horizontal
10.480	-28.6	-27.0	1.6	Vertical
15.720	-41.1	-27.0	14.1	Vertical
20.960	-36.3	-27.0	9.3	Horizontal
Measurement uncertainty			+2.2 dB / -3.6 dB	

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
29, 31 – 42, 44, 46, 49 – 52, 56, 57, 74, 102

TEST REPORT REFERENCE: F091568E2

6.7.4.5 FINAL MEASUREMENT (1 GHz to 25 GHz) n-mode, external monopole antenna

Ambient temperature	21 °C	Relative humidity	42 %
---------------------	-------	-------------------	------

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 5.0 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. As external monopole antenna the Ex-IT WLAN-SMA 70-001 with a 10 cm antenna cable was used.

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

Frequency GHz	Emission level dBm	Limit dBm	Margin dB	Polarisation
3.453	-37.9	-27.0 dBm	10.9	Horizontal
5.180	7.9	carrier	-	Horizontal
10.360	-28.2	-27.0 dBm	1.2	Vertical
15.540	-39.3	-27.0 dBm	12.3	Horizontal
20.900	-34.0	-27.0 dBm	7.0	Horizontal
Measurement uncertainty			+2.2 dB / -3.6 dB	

Transmitter operates at the upper end of the assigned frequency band (operation mode 4)

Frequency GHz	Emission level dBm	Limit dBm	Margin dB	Polarisation
3.493	-38.6	-27.0 dBm	11.6	Horizontal
5.240	7.3	carrier	-	Horizontal
10.480	-27.2	-27.0 dBm	0.2	Vertical
15.720	-42.2	-27.0 dBm	15.2	Vertical
20.960	-37.5	-27.0 dBm	10.5	Horizontal
Measurement uncertainty			+2.2 dB / -3.6 dB	

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
29, 31 – 42, 44, 46, 49 – 52, 56, 57, 74, 102

TEST REPORT REFERENCE: F091568E2

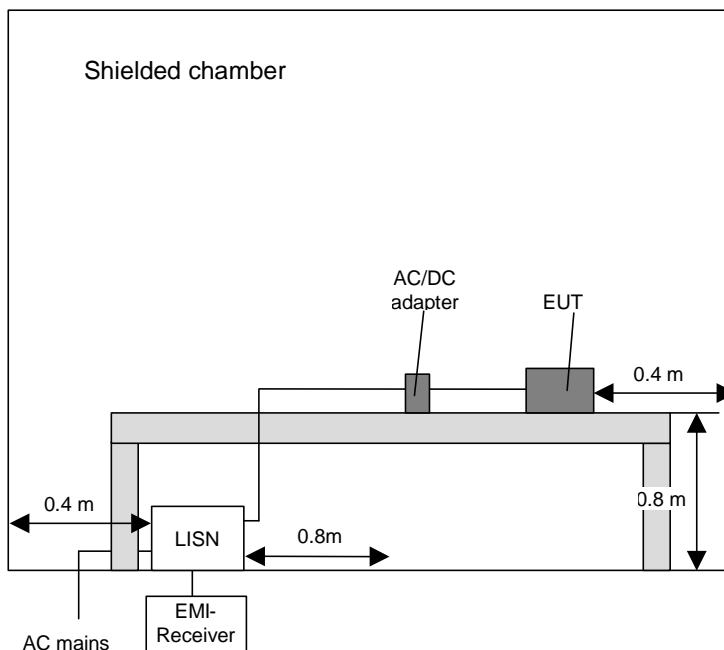
6.8 CONDUCTED EMISSIONS ON POWER SUPPLY LINES (150 kHz to 30 MHz)

6.8.1 METHOD OF MEASUREMENT

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

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

Frequency range	Resolution bandwidth
150 kHz to 30 MHz	9 kHz



TEST REPORT REFERENCE: F091568E2

6.8.2 TEST RESULTS (CONDUCTED EMISSIONS ON POWER SUPPLY LINES)

Ambient temperature	21 °C	Relative humidity	62 %
---------------------	-------	-------------------	------

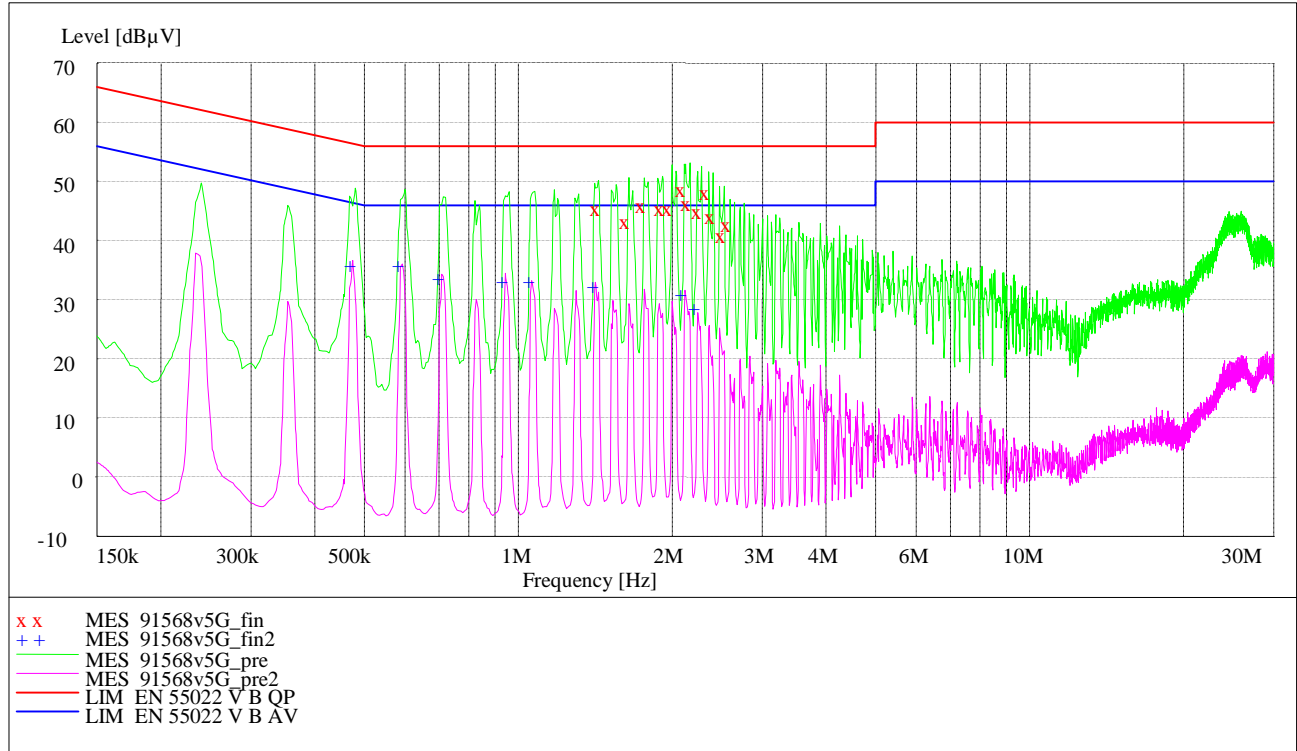
Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m.

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 5.0 V DC by an AC / DC adaptor Mascot type 2121. The EUT transmits in a-mode with 54 Mbps, 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: 91568v5G

TEST REPORT REFERENCE: F091568E2

Result measured with the peak detector:

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

Frequency MHz	Level dBμV	Transducer dB	Limit dBμV	Margin dB	Line	PE
1.439700	46.1	0.3	56.0	9.9	L1	FLO
1.646700	44.1	0.2	56.0	11.9	L1	GND
1.764600	46.4	0.2	56.0	9.6	L1	FLO
1.921200	46.2	0.4	56.0	9.8	L1	GND
2.000400	46.0	0.4	56.0	10.0	L1	FLO
2.120100	49.4	0.4	56.0	6.6	L1	FLO
2.163300	47.0	0.5	56.0	9.0	L1	FLO
2.283900	45.5	0.5	56.0	10.5	L1	FLO
2.359500	48.7	0.5	56.0	7.3	L1	FLO
2.406300	44.7	0.5	56.0	11.3	L1	FLO
2.525100	41.7	0.5	56.0	14.3	L1	FLO
2.595300	43.3	0.5	56.0	12.7	L1	FLO
Measurement uncertainty				+3.6 dB / -4.5 dB		

Data record name: 91568v5G_fin

Result measured with the average detector:

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

Frequency MHz	Level dBμV	Transducer dB	Limit dBμV	Margin dB	Line	PE
0.474000	36.5	0.2	46.0	9.9	L1	FLO
0.592800	36.6	0.1	46.0	9.4	L1	GND
0.711600	34.6	0.1	46.0	11.4	L1	GND
0.946500	34.1	0.1	46.0	11.9	L1	FLO
1.064400	33.7	0.1	46.0	12.3	L1	GND
1.418100	33.1	0.3	46.0	12.9	L1	GND
2.124600	31.7	0.5	46.0	14.3	L1	FLO
2.246100	29.3	0.5	46.0	16.7	L1	GND
Measurement uncertainty				+3.6 dB / -4.5 dB		

Data record name: 91568v5G_fin2

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

1 – 3, 5, 6

TEST REPORT REFERENCE: F091568E2

7 TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

TEST REPORT REFERENCE: F091568E2

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	ESCS 30	Rohde & Schwarz	834489/011	580007	02/27/2008	EMI Receiver
3	LISN	ESH2-Z5	Rohde & Schwarz	879675/037	580006	06/14/2009	LISN
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	02/26/2008	02/2010
16	Controller	MCU	Maturo	MCU/043/971107	480832	-	-
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	02/25/2008	02/2010
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.)	
38	Standard Gain Horn 11.9 GHz – 18 GHz	18240-20	Flann Microwave	482	480295	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.)	
40	Standard Gain Horn 17.9 GHz – 26.7 GHz	20240-20	Flann Microwave	410	480296	Six month verification (system cal.)	
41	Standard Gain Horn 26.4 GHz – 40.1 GHz	22240-20	Flann Microwave	469	480299	Six month verification (system cal.)	
42	Standard Gain Horn 26.4 GHz – 40.1 GHz	22240-20	Flann Microwave	468	480298	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.)	

TEST REPORT REFERENCE: F091568E2

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal. due
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.)	
52	Preamplifier	JS3-26004000-25-5A	Miteq	563593	480344	Six month verification (system cal.)	
55	Loop antenna	HFH2-Z2	Rohde & Schwarz	832609/014	480059	02/19/2008	02/2013
56	Horn Antenna	3115 B	EMCO	9609-4922	480184	09/11/2008	09/2013
57	Signal generator	83650L	Agilent	3844A00554	480333	02/26/2008	02/2010
58	RF-cable 2m	KPS-1533-400-KPS	Insulated Wire	-	480302	Weekly verification	
59	Power supply	TOE 8752	Toellner	31566	480010	10/21/2009	10/2011
61	Climatic chamber	MK 240	BINDER	05-79022	480462	07/01/2009	01/2011
74	High Pass Filter	WHKX8.0/18 G-8SS	Wainwright Instruments GmbH	4	480586	Weekly verification	
75	Spectrum analyser	FSU	Rohde & Schwarz	200125	480956	02/04/2009	02/2011
102	RF-cable No. 2	RTK 081	Rosenberger	-	410094	Weekly verification	

TEST REPORT REFERENCE: F091568E2

8 LIST OF ANNEXES

ANNEX A	PHOTOGRAPHS OF THE TEST SET-UPS:	10 pages
	cB-0926-02 / cB-0926-03, test set-up fully anechoic chamber, Pos. 1	91568_3.jpg
	cB-0926-02 / cB-0926-03, test set-up fully anechoic chamber, Pos. 2	91568_42.jpg
	cB-0926-02 / cB-0926-03, test set-up fully anechoic chamber, Pos. 3	91568_36.jpg
	cB-0926-02 / cB-0926-03, test set-up fully anechoic chamber, Pos. 1	91568_4.jpg
	cB-0926-02 / cB-0926-03, test set-up fully anechoic chamber	91568_35.jpg
	cB-0926-02 / cB-0926-03, test set-up fully anechoic chamber	91568_5.jpg
	cB-0926-02 / cB-0926-03, test set-up fully anechoic chamber	91568_45.jpg
	cB-0926-02 / cB-0926-03, test set-up open area test-site	91568_50.jpg
	cB-0926-02 / cB-0926-03, test set-up conducted emission measurement	91568_30.jpg
	cB-0926-02 / cB-0926-03, test set-up climatic chamber	91568_21.jpg
ANNEX B	EXTERNAL PHOTOGRAPHS OF THE TEST SAMPLE:	- pages
	Because the EUT is a module, which will be implemented into a final application, no external photographs were available.	
ANNEX C	INTERNAL PHOTOGRAPHS OF THE TEST SAMPLE:	14 pages
	cB-0926-02, PCB with internal antenna, top view	91568_a.jpg
	cB-0926-02, PCB with internal antenna, top view, cover removed	91568_c.jpg
	cB-0926-02, PCB with antenna connectors, top view	91568_h.jpg
	cB-0926-02, PCB with antenna connectors, top view, cover removed	91568_j.jpg
	cB-0926-02, PCB, bottom view	91568_i.jpg
	cB-0926-03, PCB with internal antenna, top view	91568_d.jpg
	cB-0926-03, PCB with internal antenna, top view, cover removed	91568_f.jpg
	cB-0926-03, PCB with antenna connectors, top view	91568_k.jpg
	cB-0926-0, PCB with antenna connectors, top view, cover removed	91568_m.jpg
	cB-0926-03, PCB, bottom view	91568_l.jpg
	cB-0903-03, carrier board, top view	91568_n.jpg
	cB-0903-03, carrier board, bottom view	91568_o.jpg
	cB-0717-2, adapter board, top view	91568_q.jpg
	cB-0717-02, adapter board, bottom view	91568_p.jpg
ANNEX D	ADDITIONAL RESULTS FOR INDUSTRY CANADA:	31 pages