

Test Report

Report Number: F134981E2

Applicant:

Hirschmann Automation and Control GmbH

Manufacturer:

Hirschmann Automation and Control GmbH

Equipment under Test (EUT):

EWLAN2

Laboratory accredited by
Deutsche Akkreditierungsstelle GmbH (DAkkS)
in compliance with DIN EN ISO/IEC 17025
under the Reg. No. D-PL-17186-01-02,
FCC Test site registration number 90877 and
Industry Canada Test site registration IC3469A-1



REFERENCES

- [1] **ANSI C63.4-2009** American National Standard for Methods of Measuring of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
- [2] **FCC CFR 47 Part 15 (September 2013)** Radio Frequency Devices
- [3] **Publication Number 789033 (April 2013)** UNII Meas Guidelines v01r03
- [4] **RSS-210 Issue 8 (December 2010)** Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment
- [5] **RSS-Gen Issue 3 (December 2010)** General Requirements and Information for the Certification of Radiocommunication Equipment
- [6] **Publication Number 662911 (May 2013)** Emission Testing of Transmitters with Multiple Outputs in the Same Band v02

TEST RESULT

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

The complete test results are presented in the following.

Test engineer:	<u>Paul NEUFELD</u> Name	<u></u> Signature	<u>18 December 2013</u> Date
Authorized reviewer:	<u>Bernd STEINER</u> Name	<u></u> Signature	<u>18 December 2013</u> Date

RESERVATION

This test report is only valid in its original form.

Any reproduction of its contents in extracts 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 NUMBER.

Contents:	Page
1 IDENTIFICATION	5
1.1 Applicant.....	5
1.2 Manufacturer.....	5
1.3 Test laboratory	5
1.4 EUT (Equipment Under Test)	6
1.5 Dates	8
2 OPERATIONAL STATES.....	8
3 ADDITIONAL INFORMATION.....	10
4 OVERVIEW	10
5 TEST RESULTS	11
5.1 Maximum conducted output power	11
5.1.1 Method of measurement.....	11
5.1.2 Test results	12
5.2 UNII Bandwidth	13
5.2.1 Method of measurement.....	13
5.2.2 Test result	14
5.2.2.1 Antenna Port 1	14
5.2.2.2 Antenna Port 2	15
5.2.2.3 Antenna Port 3	16
5.3 Peak Power Spectral Density	17
5.3.1 Method of measurement.....	17
5.3.2 Test result	18
5.3.2.1 Antenna Port 1	18
5.3.2.2 Antenna Port 2	19
5.3.2.3 Antenna Port 3	20
5.4 Peak Excursion	21
5.4.1 Method of measurement.....	21
5.4.2 Test result	22
5.4.2.1 Antenna Port 1	22
5.5 Frequency Stability.....	24
5.5.1 Method of measurement.....	24
5.5.2 Test result	25
5.6 Band-edge compliance.....	26
5.6.1 Method of measurement (band edges next to restricted bands (conducted))	26
5.6.2 Test result (band edges next to restricted bands (conducted))	27
5.6.2.1 Antenna port 1.....	27
5.6.2.1 Antenna port 2.....	29
5.6.2.1 Antenna port 3.....	31
5.7 Maximum unwanted emissions.....	33

5.7.1 Method of measurement (conducted emissions in the restricted bands).....	33
5.7.1.1 Field strength calculation.....	34
5.7.2 Method of measurement (conducted emissions in the unrestricted bands).....	35
5.7.2.1 Emission level measurement.....	35
5.7.3 Test results (conducted emissions).....	36
5.7.3.1 Emissions below 1 GHz.....	36
5.7.3.2 Antenna port 1.....	36
Antenna port 2.....	43
5.7.3.3 Antenna port 3.....	54
5.7.4 Method of measurement (radiated emissions)	61
5.7.5 Test results (radiated emissions) – cabinet emissions.....	64
5.7.5.1 Preliminary radiated emission measurement.....	64
5.7.5.2 Final radiated emission measurement	67
5.8 Conducted emissions on power supply lines (150 kHz to 30 MHz).....	68
5.8.1 Method of measurement.....	68
5.8.2 Test results (conducted emissions on power supply lines)	69
6 TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS.....	71
7 REPORT HISTORY	73
8 LIST OF ANNEXES	73

1 IDENTIFICATION

1.1 Applicant

Name:	Hirschmann Automation and Control GmbH
Address:	Stuttgarter Straße 45-51, 72654 Neckartenzlingen
Country:	Germany
Name for contact purposes:	Robert BINDER
Phone:	+49 7127 14 1750
Fax:	+49 7127 14 1600
eMail Address:	robert.binder@belden.com
Applicant represented during the test by the following person:	-

1.2 Manufacturer

Name:	Hirschmann Automation and Control GmbH
Address:	Stuttgarter Straße 45-51, 72654 Neckartenzlingen
Country:	Germany
Name for contact purposes:	Robert BINDER
Phone:	+49 7127 14 1750
Fax:	+49 7127 14 1600
eMail Address:	robert.binder@belden.com
Applicant represented during the test by the following person:	-

1.3 Test laboratory

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

accredited by Deutsche Akkreditierungsstelle GmbH (DAkkS) in compliance with DIN EN ISO/IEC 17025 under the Reg. No. D-PL-17186-01-02, FCC Test site registration number 90877 and Industry Canada Test site registration IC3469A-1.

1.4 EUT (Equipment Under Test)

Test object: *	Wireless LAN Module
Type: *	EWLAN2
FCC ID: *	U99EWLAN2
IC: *	4019A-EWLAN2
Serial number: *	837599005030603550
PCB identifier: *	742386001 G03
Hardware version: *	Z03S06
Software version: *	HiLCOS 8.60.024

Channel 01	RX:	2412 MHz	TX:	2412 MHz
Channel 02	RX:	2417 MHz	TX:	2417 MHz
Channel 03	RX:	2422 MHz	TX:	2422 MHz
Channel 04	RX:	2427 MHz	TX:	2427 MHz
Channel 05	RX:	2432 MHz	TX:	2432 MHz
Channel 06	RX:	2437 MHz	TX:	2437 MHz
Channel 07	RX:	2442 MHz	TX:	2442 MHz
Channel 08	RX:	2447 MHz	TX:	2447 MHz
Channel 09	RX:	2452 MHz	TX:	2452 MHz
Channel 10	RX:	2457 MHz	TX:	2457 MHz
Channel 11	RX:	2462 MHz	TX:	2462 MHz

Channel 36	RX:	5180 MHz	TX:	5180 MHz
Channel 40	RX:	5200 MHz	TX:	5200 MHz
Channel 44	RX:	5220 MHz	TX:	5220 MHz
Channel 48	RX:	5240 MHz	TX:	5240 MHz
Channel 38 (40 MHz)	RX:	5190 MHz	TX:	5190 MHz
Channel 46 (40 MHz)	RX:	5230 MHz	TX:	5230 MHz

Channel 149	RX:	5745 MHz	TX:	5745 MHz
Channel 153	RX:	5765 MHz	TX:	5765 MHz
Channel 157	RX:	5785 MHz	TX:	5785 MHz
Channel 161	RX:	5805 MHz	TX:	5805 MHz
Channel 165	RX:	5825 MHz	TX:	5825 MHz
Channel 151 (40 MHz)	RX:	5755 MHz	TX:	5755 MHz
Channel 159 (40 MHz)	RX:	5795 MHz	TX:	5795 MHz

Fulfills WLAN specification: *	IEEE, 802.11b, 802.11g, 802.11n, 802.11a					
Antenna type: *	See Table 1					
Antenna gain: *	See Table 1					
Antenna connector: *	See Table 1					
Power supply - EUT	3.3 V & 1.18 V					
Power supply Host (type W)	U _{nom} =	24 V DC	U _{min} =	18 V DC	U _{max} =	36 V DC
Power supply Host (type C)	U _{nom} =	24 - 48 V DC	U _{min} =	18 V DC	U _{max} =	60 V DC
Power supply Host (type K)	U _{nom} =	60 - 250 V DC	U _{min} =	48 V DC	U _{max} =	320 V DC
	U _{nom} =	110 - 230 V AC 50 – 60 Hz	U _{min} =	88 V AC 47 – 63 Hz	U _{max} =	265 V AC 47 – 63 Hz
Type of modulation: *	802.11a: OFDM 802.11b: CCK, DQPSK, DBPSK 802.11g: OFDM 802.11n: OFDM					
Operating frequency range: *	2412 MHz to 2462 MHz, 5180 MHz to 5240 MHz, 5745 to 5825 MHz					
Number of channels: *	6					
Temperature range: *	0 °C to +40 °C					
Lowest / highest Internal clock frequency: *	40 MHz / 5825 GHz					

* declared by the applicant.

Table 1 Antenna specifications

Antenna name	Manufacturer	Type	Comment	Gain [dBi]
BAT-ANT-N-3AGN-IP67	Joymax Electronics Co., Ltd.	Monopole	Connector: N male	2 @ 2,4 GHz 2 @ 5 GHz
BAT-ANT-RSMA-2AGN-R	Joymax Europe GbmH	Monopole	Connector: SMA Reverse male ,	3 @ 2,4 GHz 5 @ 5 GHz
BAT-ANT-N-MiMoDB-5N-IP65	Huber+Suhner	Patch Array	Connector: N male,	3.5 @ 2,4 GHz 5.5 @ 5 GHz
BAT-ANT-N-MiMo5-9N-IP65	Huber+Suhner	Patch	Connector: N male,	9 @ 5 GHz

The following external I/O cables were used:

Identification	Connector		Length
	EUT	Ancillary	
AC/DC Adapter	DC plug	-	2 m *
Ethernet cable	Ethernet plug	-	-
PCI Express cable	PCI Express plug	PCI Express plug	30 cm ^{*2}

*: Length during the test if no other specified.

*2 Cable connects EUT and host device.

1.5 Dates

Date of receipt of test sample:	09 December 2013
Start of test:	09 December 2013
End of test:	14 December 2013

2 OPERATIONAL STATES

The equipment under test (EUT) is a WLAN module with a PCI express interface and 3 antenna ports. To set this module into operation it was connected to a Hirschmann Belden BAT-R Access Point via ribbon cable with a length of 30 cm.

The tests were carried out with an unmodified sample of the EUT. Parts of the tests were carried out conducted at the antenna ports. If these tests did not pass, the measurements were repeated as radiated tests, with the dedicated antennas attached.

Additionally a radiated measurement of the housing emission was performed while the antenna ports are terminated symmetrically by 50 Ω resistors.

The BAT-R Access Point was connected via an Ethernet connection to a laptop computer. With a test-software running on the laptop the operation mode as seen in the table below could be chosen.

During the tests, the test samples were powered with 3.3 V and 1.28 V via PCI Express interface from the BAT-R Access-point. This Access-point was powered with 24 VDC from a laboratory power supply.

The following operation modes were identified as worst case condition and used during the tests:

Operation mode	Description of the operation mode	WLAN mode	WLAN channel	Modulation	Data rate / Mbps
1	Continuous transmitting on 5180 MHz	a	36	OFDM	6 MBit/s
2	Continuous transmitting on 5200 MHz	a	40	OFDM	6 MBit/s
3	Continuous transmitting on 5240 MHz	a	48	OFDM	6 MBit/s
4	Continuous transmitting on 5180 MHz	n 20 MHz	36	OFDM	6.5 MBit/s
5	Continuous transmitting on 5200 MHz	n 20 MHz	40	OFDM	6.5 MBit/s
6	Continuous transmitting on 5240 MHz	n 20 MHz	48	OFDM	6.5 MBit/s
7	Continuous transmitting on 5190 MHz	n 40 MHz	38	OFDM	13.5 MBit/s
8	Continuous transmitting on 5230 MHz	n 40 MHz	46	OFDM	13.5 MBit/s

Table 2 Worst case test setup



Preliminary tests were performed to find worst-case configuration and position. The radiated emission measurements were carried out in the orthogonal direction that emits the highest spurious emission levels.

The worst case configurations are shown in Table 2.

The following test modes were adjusted during the tests:

Test items	Operation mode
Maximum Peak Output Power	1 - 8
UNII Bandwidth	1 - 8
Peak Power Spectral Density	1 - 8
Peak Excursion	1 - 8
Frequency Stability	1
Band Edge Compliance	1, 3, 4, 6, 7, 8
Maximum Unwanted Emissions	1 - 8

3 ADDITIONAL INFORMATION

The country profile, used for the measurement, was "FCC-United-States". The power reduction was set to 0 during all tests.

The setting for antenna gain was set to 0 in all tests.

4 OVERVIEW

Application	Frequency range [MHz]	FCC 47 CFR Part 15 section [2]	RSS 210, Issue 8 [4] or RSS-Gen, Issue 3 [5]	Status	Refer page
Maximum Peak Output Power	5150 - 5250	15.407 (a)	A9.2 [4]	Passed	11 et seq
UNII Bandwidth	5150 - 5250	15.403 (i)	A9.2 [4]	Passed	13 et seq
Peak Power Spectral Density	5150 - 5250	15.407 (a)(5)	A9.2 [4]	Passed	17 et seq
Peak Excursion	5150 – 5250	15.407 (b)	A9.3 [4]	Passed	21 et seq
Frequency Stability	5150 – 5250	15.407 (g)	A9.5 [4]	Passed	24 et seq
Band edge compliance	5150 - 5250	15.407 (b)	A8.5 [4]	Passed	26 et seq.
Radiated emissions (transmitter)	0.009 - 40,000	15.407 (b) 15.205 (a) 15.209 (a)	7.2.2 [5], 2.5 [4]	Passed	33 et seq.
Conducted emissions on supply line	0.15 - 30	15.207 (a)	7.2.4 [5]	Passed	68 et seq.

5 TEST RESULTS

5.1 Maximum conducted output power

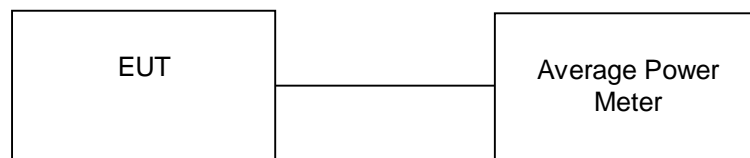
5.1.1 Method of measurement

The measurement procedures described herein are based on the use of an antenna-port conducted test configuration.

“Measurement using a power meter (PM)” was used for this test. The procedure is described in chapter E)3)a) of document [3].

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

Test set-up:



5.1.2 Test results

Ambient temperature	22 °C	Relative humidity	62 %
---------------------	-------	-------------------	------

The highest array gain is given for the BAT-ANT-N-MiMoDB-5N-IP65 antenna, which has a gain of 5.5 dBi, which results in an array gain of 10.3 dBi. Therefore the Peak power limit is reduced by 4.3 dB.

Operation Mode	Antenna gain combined [dBi]	Maximum average output power – port1 [dBm]	Maximum average output power – port2 [dBm]	Maximum average output power – port3 [dBm]	Maximum average output power – sum (all ports) [dBm]	Margin [dB]	Power limit [dBm]
1	10.3	7.0	-1.0	-1.5	8.1	6.9	12.7
2	10.3	6.7	-1.1	-1.0	8.0	7.0	12.7
3	10.3	6.6	-1.0	-1.0	7.9	7.1	12.7
4	10.3	6.7	-1.2	-1.3	7.9	7.1	12.7
5	10.3	7.1	-0.8	-1.3	8.3	6.7	12.7
6	10.3	6.3	-1.3	-1.4	7.6	7.4	12.7
7	10.3	6.2	-2.2	-1.6	7.4	7.6	12.7
8	10.3	5.3	-2.6	-1.7	6.6	8.4	12.7
Measurement uncertainty			+0.66 dB / -0.72 dB				

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

60, 61

5.2 UNII Bandwidth

5.2.1 Method of measurement

The relating measurements were carried out in a conducting manner. Therefore, the antenna connector was directly connected to a spectrum analyser. The measurement procedure refers to part C) of document [3].

- Set RBW = approximately 1% of the emission bandwidth.
- Set the VBW > RBW.
- Detector = Peak.
- Trace mode = max hold.
- Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

The measurements were carried out at each antenna port separately.

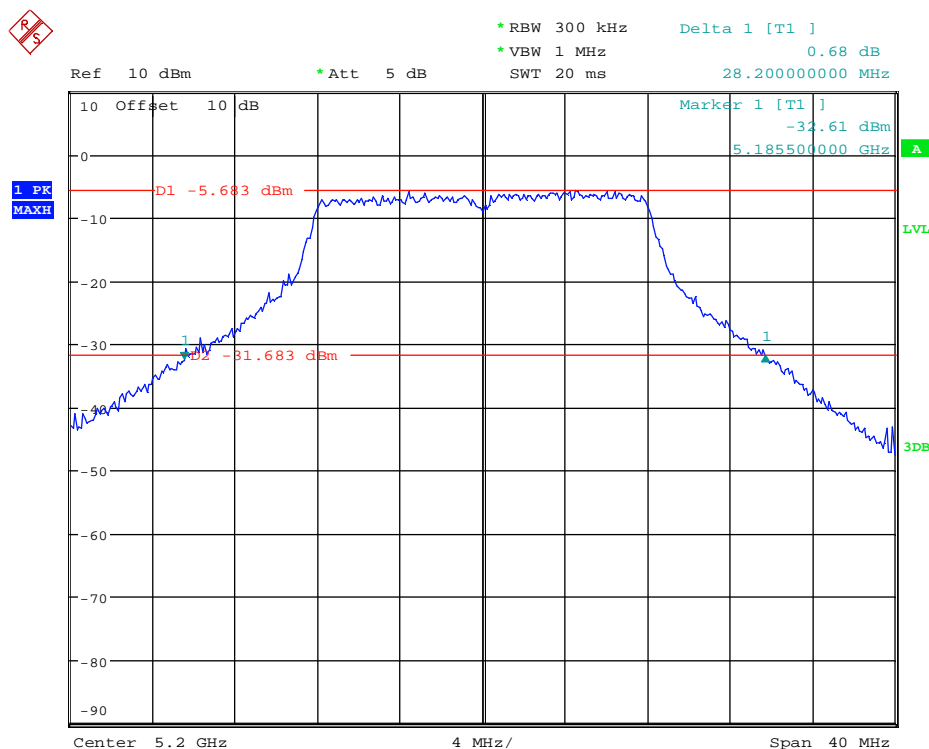
5.2.2 Test result

5.2.2.1 Antenna Port 1

Ambient temperature	22 °C	Relative humidity	60 %
---------------------	-------	-------------------	------

The following results were measured at antenna port 1 of the EUT. The plot shows an exemplary measurement result for the worst documented case. The other results are listed in the following table.

134981_26dB-BW_a_40.wmf: UNII-Bandwidth (operation mode 2):



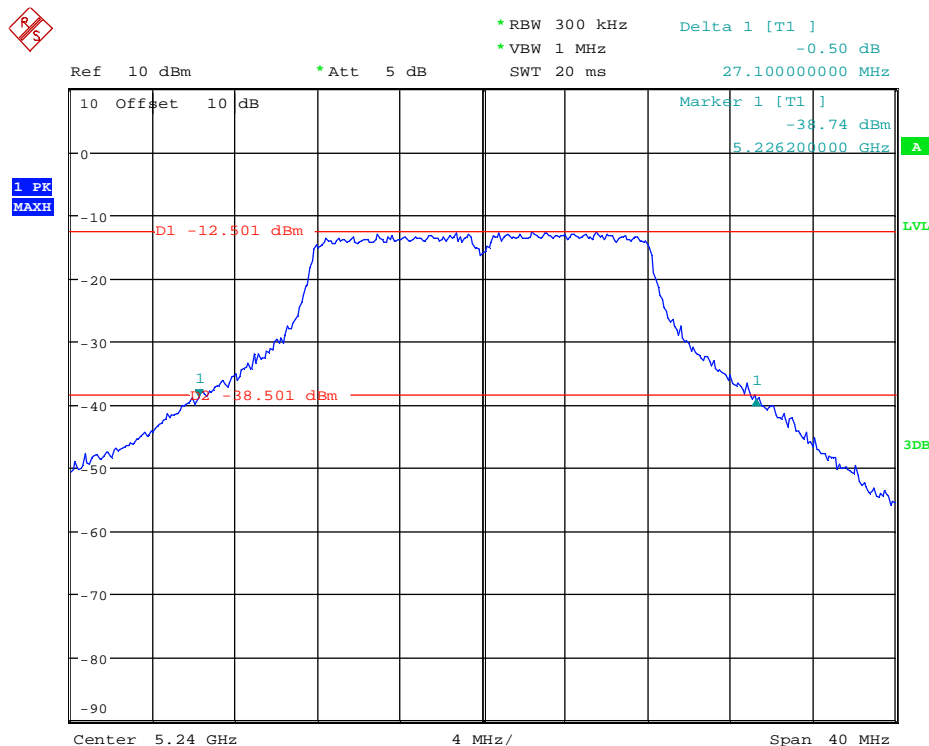
Operation Mode	Center Frequency [MHz]	Minimum 26-dB Bandwidth Limit [MHz]	26 dB Bandwidth [MHz]	Result
1	5180	0.5	28.300	Passed
2	5200	0.5	28.200	Passed
3	5240	0.5	27.800	Passed
4	5180	0.5	29.200	Passed
5	5200	0.5	29.200	Passed
6	5240	0.5	28.800	Passed
7	5190	0.5	51.000	Passed
8	5230	0.5	50.750	Passed
Measurement uncertainty		+0.66 dB / -0.72 dB		

5.2.2.2 Antenna Port 2

Ambient temperature	22 °C	Relative humidity	60 %
---------------------	-------	-------------------	------

The following results were measured at antenna port 2 of the EUT. The plot shows an exemplary measurement result for the worst documented case. The other results are listed in the following table.

134981 26dB-BW a 48.wmf: UNII-Bandwidth (operation mode 1):



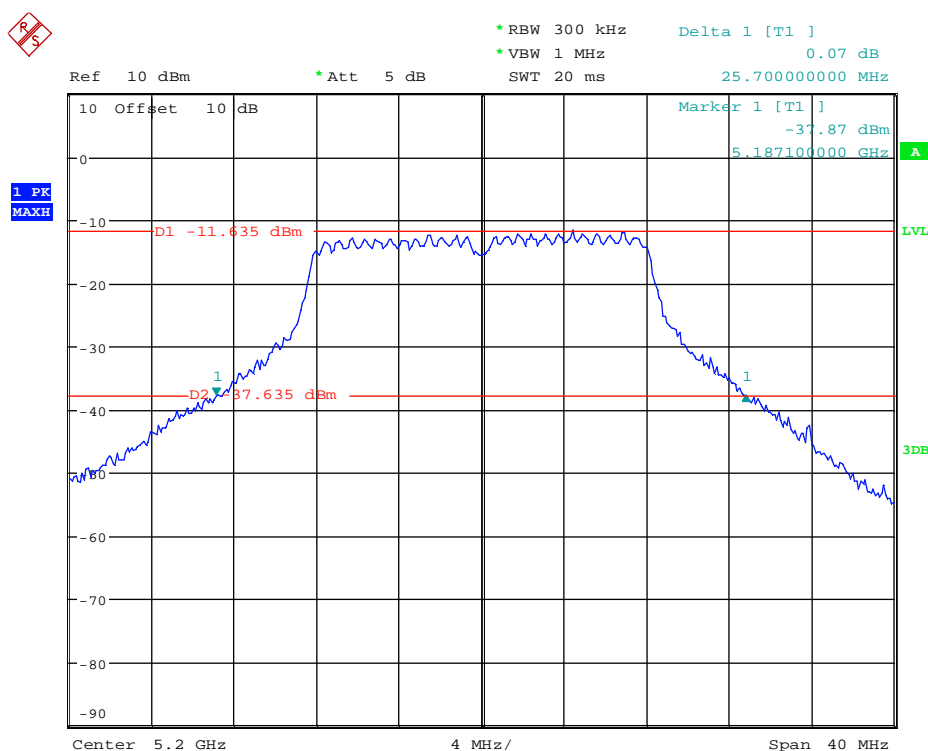
Operation Mode	Center Frequency [MHz]	Minimum 26-dB Bandwidth Limit [MHz]	26 dB Bandwidth [MHz]	Result
1	5180	0.5	26.800	Passed
2	5200	0.5	27.400	Passed
3	5240	0.5	27.100	Passed
4	5180	0.5	28.200	Passed
5	5200	0.5	27.800	Passed
6	5240	0.5	28.500	Passed
7	5190	0.5	48.750	Passed
8	5230	0.5	49.000	Passed
Measurement uncertainty		+0.66 dB / -0.72 dB		

5.2.2.3 Antenna Port 3

Ambient temperature	22 °C	Relative humidity	60 %
---------------------	-------	-------------------	------

The following results were measured at antenna port 3 of the EUT. The plot shows an exemplary measurement result for the worst documented case. The other results are listed in the following table.

134981 26dB-BW a 40.wmf:UNII-Bandwidth (operation mode 2):



Operation Mode	Center Frequency [MHz]	Minimum 26-dB Bandwidth Limit [MHz]	26 dB Bandwidth [MHz]	Result
1	5180	0.5	26.700	Passed
2	5200	0.5	25.700	Passed
3	5240	0.5	26.800	Passed
4	5180	0.5	28.000	Passed
5	5200	0.5	28.300	Passed
6	5240	0.5	28.000	Passed
7	5190	0.5	49.250	Passed
8	5230	0.5	49.500	Passed
Measurement uncertainty			+0.66 dB / -0.72 dB	

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

30

5.3 Peak Power Spectral Density

5.3.1 Method of measurement

The relating measurements were carried out in a conducting manner. Therefore, the antenna connector was directly connected to a spectrum analyser. The measurement procedure refers to part F) of document [3].

Method SA-1 was used for this measurement.

- Set span to encompass the entire 26-dB emission bandwidth (EBW) (or, alternatively, the entire 99% occupied bandwidth) of the signal.
- Set RBW = 1 MHz.
- Set VBW \geq 3 MHz.
- Number of points in sweep \geq 2 Span / RBW. (This ensures that bin-to-bin spacing is \leq RBW/2, so that narrowband signals are not lost between frequency bins.)
- Sweep time = auto.
- Detector = RMS (i.e., power averaging).
- Trace average at least 100 traces in power averaging (i.e., RMS) mode.
- The result is the PPSP.
- Set Marker to the peak of the spectrum.
- If duty cycle < 100 % add $10 \log(1/x)$, where x is the duty cycle, to the peak of the spectrum.

The measurements were carried out at each antenna port separately.

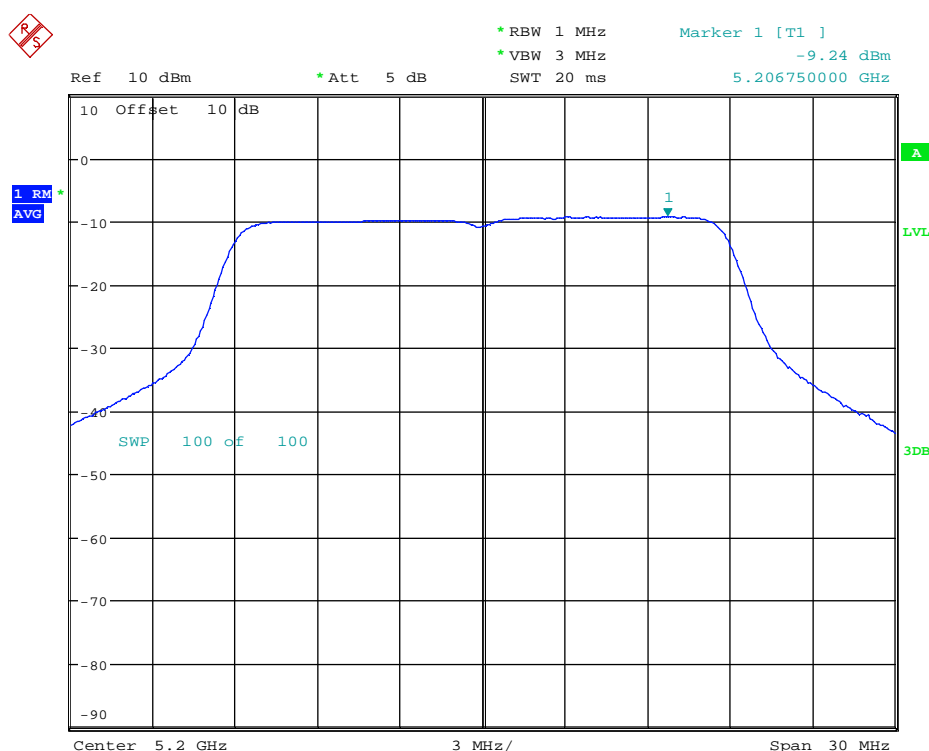
5.3.2 Test result

5.3.2.1 Antenna Port 1

Ambient temperature	22 °C	Relative humidity	60 %
---------------------	-------	-------------------	------

The following results were measured at antenna port 1 of the EUT. The plot shows an exemplary measurement result for the worst documented case. The other results are listed in the following table. The array sum for 3 antenna ports is an addition of 4.77 dB.

134981 PeakPwrSpecDens n20 40.wmf: power-spectral-density (operation mode 6):



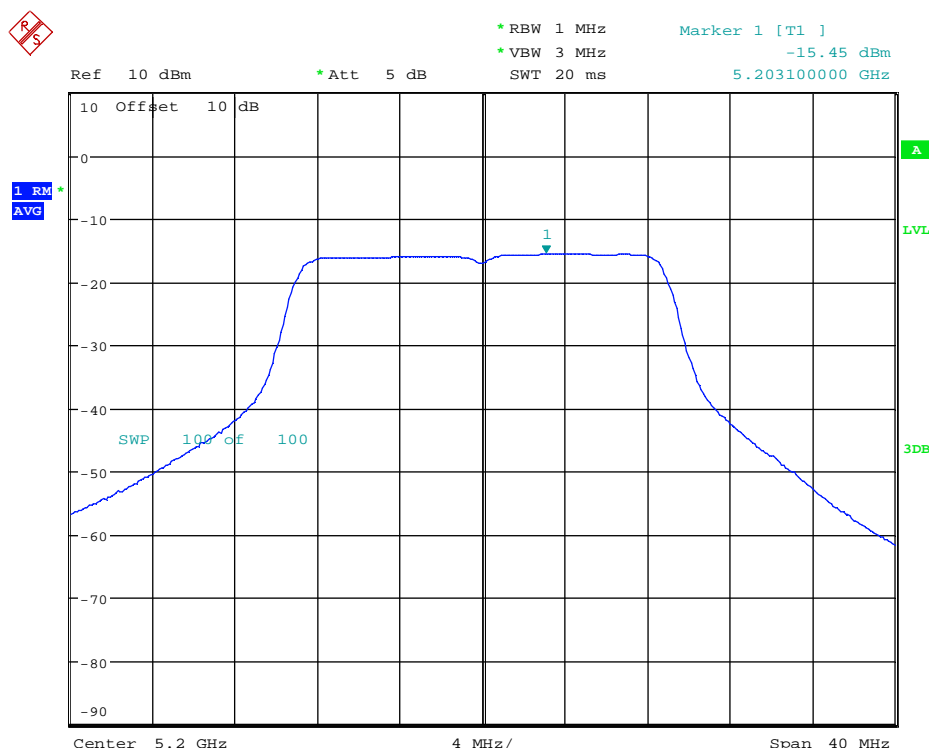
Operation Mode	Peak Frequency [MHz]	Peak Power Spectral Density Limit [dBm]	Peak Power Spectral Density Reading [dBm]	Array Gain [dB]	Peak Power Spectral Density Level [dBm]	Margin [dB]	Result
1	5177.450	4	-9.67	4.77	-4.90	8.90	Passed
2	5206.675	4	-9.55	4.77	-4.78	8.78	Passed
3	5243.000	4	-10.67	4.77	-5.90	9.90	Passed
4	5177.500	4	-9.21	4.77	-4.44	8.44	Passed
5	5206.750	4	-9.24	4.77	-4.47	8.47	Passed
6	5246.800	4	-8.91	4.77	-4.14	8.14	Passed
7	5206.950	4	-11.97	4.77	-7.20	11.20	Passed
8	5243.500	4	-12.60	4.77	-7.83	11.83	Passed
Measurement uncertainty			+0.66 dB / -0.72 dB				

5.3.2.2 Antenna Port 2

Ambient temperature	22 °C	Relative humidity	60 %
---------------------	-------	-------------------	------

The following results were measured at antenna port 2 of the EUT. The plot shows an exemplary measurement result for the worst documented case. The other results are listed in the following table. The array sum for 3 antenna ports is an addition of 4.77 dB.

134981_PeakPwrSpecDens_n20_40.wmf: power-spectral-density (operation mode 5):



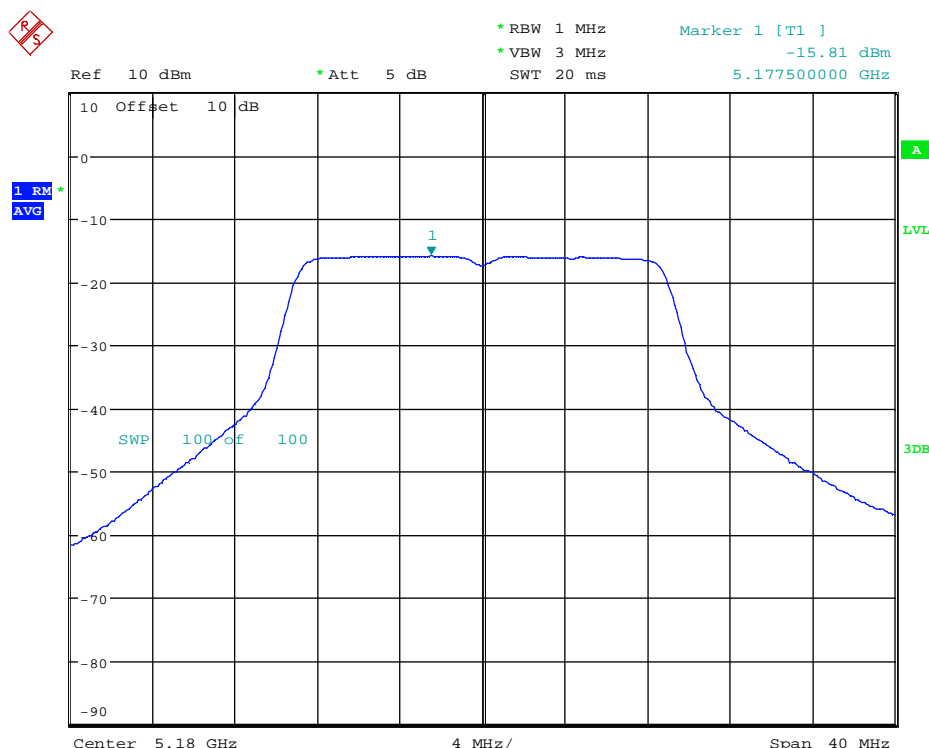
Operation Mode	Peak Frequency [MHz]	Peak Power Spectral Density Limit [dBm]	Peak Power Spectral Density Reading [dBm]	Array Gain [dB]	Peak Power Spectral Density Level [dBm]	Margin [dB]	Result
1	5177.375	4	-17.77	4.77	-13.00	17.00	Passed
2	5206.675	4	-16.34	4.77	-11.57	15.57	Passed
3	5243.000	4	-16.28	4.77	-11.51	15.51	Passed
4	5177.500	4	-15.73	4.77	-10.96	14.96	Passed
5	5203.100	4	-15.44	4.77	-10.67	14.67	Passed
6	5243.100	4	-15.83	4.77	-11.06	15.06	Passed
7	5203.500	4	-18.28	4.77	-13.51	17.51	Passed
8	5244.550	4	-18.87	4.77	-14.10	18.10	Passed
Measurement uncertainty			+0.66 dB / -0.72 dB				

5.3.2.3 Antenna Port 3

Ambient temperature	22 °C	Relative humidity	40 %
---------------------	-------	-------------------	------

The following results were measured at antenna port 3 of the EUT. The plot shows an exemplary measurement result for the worst documented case. The other results are listed in the following table. The array sum for 3 antenna ports is an addition of 4.77 dB.

134981_PeakPwrSpecDens_n20_36.wmf: power-spectral-density (operation mode 5):



Operation Mode	Peak Frequency [MHz]	Peak Power Spectral Density Limit [dBm]	Peak Power Spectral Density Reading [dBm]	Array Gain [dB]	Peak Power Spectral Density Level [dBm]	Margin [dB]	Result
1	5177.300	4	-18.08	4.77	-13.31	17.31	Passed
2	5206.600	4	-16.16	4.77	-11.39	15.39	Passed
3	5246.525	4	-17.43	4.77	-12.66	16.66	Passed
4	5177.500	4	-15.81	4.77	-11.04	15.04	Passed
5	5206.800	4	-16.02	4.77	-11.25	15.25	Passed
6	5246.800	4	-16.55	4.77	-11.78	15.78	Passed
7	5206.950	4	-18.14	4.77	-13.37	17.37	Passed
8	5243.350	4	-19.67	4.77	-14.90	18.90	Passed
Measurement uncertainty			+0.66 dB / -0.72 dB				

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

30

5.4 Peak Excursion

5.4.1 Method of measurement

The relating measurements were carried out in a conducting manner. Therefore, the antenna connector was directly connected to a spectrum analyser. The measurement procedure refers to part G) of document [3].

Testing each modulation mode on a single channel in a single operating band is sufficient to demonstrate compliance with the peak excursion requirement. (If all modulation modes are not available on a single channel in a single band, then testing must be extended to other channels and bands as needed to ensure that all modulation modes are tested.)

Tests must include all variations in signal structure, such as:

- (i) All signal types (e.g., direct sequence spread spectrum (DSSS) and OFDM);
- (ii) All modulation types (e.g., BPSK, QPSK, 16-QAM, 64-QAM, and 256-QAM);
- (iii) All bandwidth modes;
- (iv) All variations in signal parameters (e.g., changes in subcarrier spacing or number of subcarriers).

For a given signal structure, testing of multiple error-correction coding rates is not required (e.g., 1/2, 2/3, and 3/4 rate codes).

For MIMO devices, testing of a single output port is sufficient to demonstrate compliance with the peak excursion requirement. If a given signal structure can be exercised with various combinations of spatial multiplexing (such as different numbers of spatial streams), beamforming, and cyclic delay diversity, peak excursion tests are not required to include those variations.

Set the spectrum analyser or EMI receiver span to view the entire emission bandwidth.

Find the maximum of the peak-max-hold spectrum.

Set RBW = 1 MHz.

VBW \geq 3 MHz.

Detector = peak.

Trace mode = max-hold.

Allow the sweeps to continue until the trace stabilizes.

Use the peak search function to find the peak of the spectrum.

Use the procedure found under 5.3.1 to measure the PPSD. For this measurement the procedure SA-1 was used

Compute the ratio of the maximum of the peak-max-hold spectrum to the PPSD.

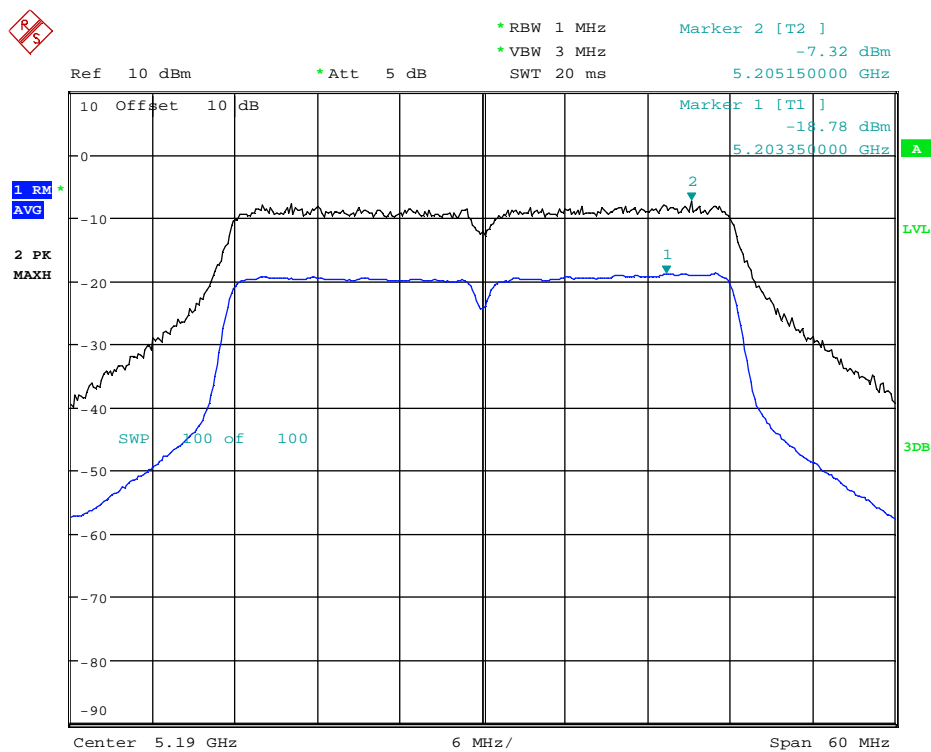
5.4.2 Test result

5.4.2.1 Antenna Port 1

Ambient temperature	22 °C	Relative humidity	60 %
---------------------	-------	-------------------	------

The following results were measured at antenna port 1 of the EUT. The plot shows an exemplary measurement result for the worst documented case. The other results are listed in the following table.

130254_PeakExc_an40-64QAM_36.wmf: peak excursion (operation mode 7)



WLAN channel	Signal type	Modulation	Peak Excursion [dB]	Limit [dB]	Margin [dB]	Result
36	a-mode	BPSK	10.88	13	2.12	Passed
36	a-mode	QPSK	10.47	13	2.53	Passed
36	a-mode	16-QAM	10.91	13	2.09	Passed
36	a-mode	64-QAM	10.70	13	2.30	Passed
36	n20	BPSK	10.57	13	2.43	Passed
36	n20	QPSK	10.89	13	2.11	Passed
36	n20	16-QAM	11.37	13	1.63	Passed
36	n20	64-QAM	11.11	13	1.89	Passed
36	n40	BPSK	10.80	13	2.20	Passed
36	n40	QPSK	10.82	13	2.18	Passed
36	n40	16-QAM	10.58	13	2.42	Passed
36	n40	64-QAM	11.45	13	1.55	Passed
Measurement uncertainty			+0.66 dB / -0.72 dB			

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

30

5.5 Frequency Stability

5.5.1 Method of measurement

The EUT is placed in a climatic chamber, which is able to adjust the temperature over the desired temperature range.

After reaching the desired temperature and an after an appropriate acclimatisation time, the EUT is turned on.

The nominal channel frequency is the measurement result with nominal supply power at 20 °C.

Spectrum analyzer settings:

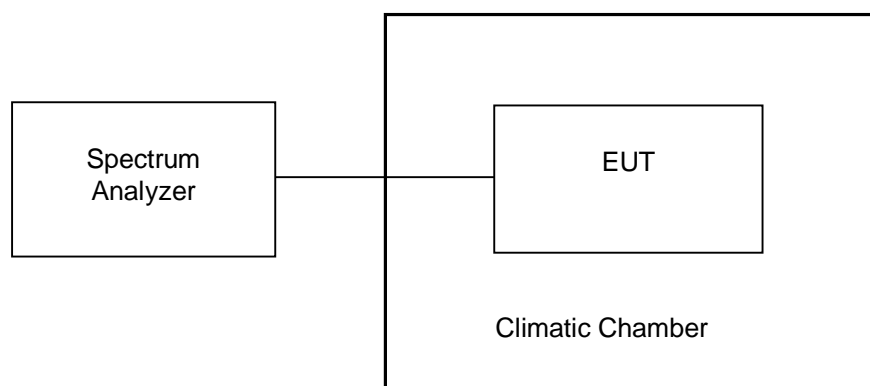
- Attenuation: Auto
- Center Frequency: channel frequency
- Span: 2 MHz
- RWB=VBW: 10 kHz
- Sweep Time: Auto

The frequency stability is testet at the minimum and maximum voltage, which is permitted by the manufacturer.

The frequency stability is testet at the minimum and maximum temperature, which is permitted by the manufacturer. But at least a temperature span from -30 °C – + 50 °C shall be covered.

The temperature is measured in 10 °C steps.

Test set-up:



5.5.2 Test result

The changes made from the original device (as described in the previous report) are not such, that the frequency stability is altered (It only would get better). The host device which handles the power supply is also the same. Therefore the tests are not repeated and the previous results are submitted below.

The EUT was set to transmit continuously in operation mode 4. The frequency was derived by observing a characteristic dip in the centre of the OFDM signal.

Voltage [V]	Measurement Frequency [MHz]	Frequency Deviation d [ppm]	Limit [ppm]	Result
18 V	5180.0465	4.48	20	Passed
24 V	5180.0224	Reference	20	-
32 V	5180.0417	3.73	20	Passed
Measurement uncertainty		+0.66 dB / -0.72 dB		

Temperature [°C]	Measurement Frequency [MHz]	Frequency Deviation [ppm]	Limit [ppm]	Result
-40 °C	5180.0545	6.20	20	Passed
-30 °C	5180.0513	5.58	20	Passed
-20 °C	5180.0882	12.70	20	Passed
-10 °C	5180.0785	10.83	20	Passed
0 °C	5180.0705	9.29	20	Passed
10 °C	5180.0561	6.51	20	Passed
20 °C	5180.0224	Reference	-	-
30 °C	5180.0192	-0.62	20	Passed
40 °C	5180.0112	-2.16	20	Passed
50 °C	5180.0112	-2.16	20	Passed
60 °C	5180.0801	11.14	20	Passed
70 °C	5180.0256	0.62	20	Passed
80 °C	5180.0785	10.8	20	Passed
Measurement uncertainty		+0.66 dB / -0.72 dB		

TEST EQUIPMENT USED FOR THE TEST:

30

5.6 Band-edge compliance

5.6.1 Method of measurement (band edges next to restricted bands (conducted))

The same test set-up as used for the final conducted emission measurement shall be used (refer also subclause 5.7.1 of this test report).

After trace stabilisation the marker shall be set on the signal peak. The frequency line shall be set on the edge of the assigned frequency band. Now 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. The level of the measured field strength shall be compared to the the general limits specified in § 15.205.

The measurement was performed at the lower end of the 5.15 – 5.25 GHz band.

If an emission fails the conducted test, the measurement will be repeated in a radiated manner.

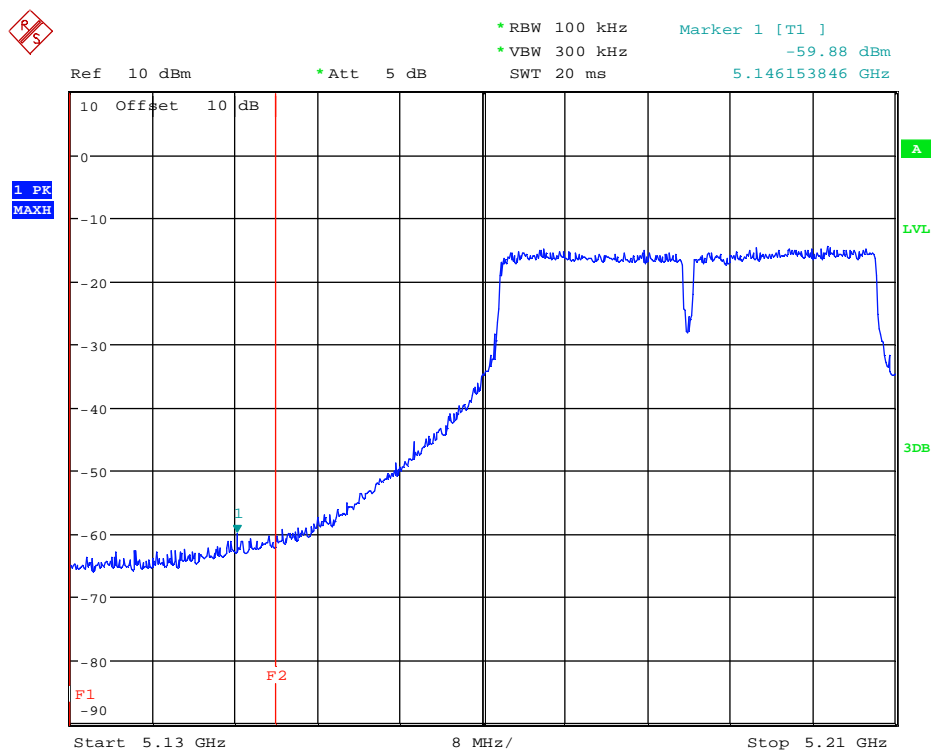
5.6.2 Test result (band edges next to restricted bands (conducted))

5.6.2.1 Antenna port 1

Ambient temperature	22 °C	Relative humidity	60 %
---------------------	-------	-------------------	------

The plot shows an exemplary measurement result for the worst documented case. The other results are listed in the following table.

130254_BandEdgeRestr_n40_36.wmf: conducted band-edge compliance (operation mode 7):



Band Edge Compliance, a-mode, channel 36 (Operation mode 1)						
Frequency [MHz]	Meas. Result [dBμV/m]	Max Peak Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5149.910	56.28	74	17.72	-53.98	15	Passed
Average Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Average Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5149.985	44.48	54	9.52	-65.78	15	Passed

Band Edge Compliance, a-mode, channel 36 (Operation mode 4)						
Frequency [MHz]	Meas. Result [dBμV/m]	Max Peak Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5149.754	57.64	74	16.36	-52.62	15	Passed
Average Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Average Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5149.904	44.99	54	9.01	-65.27	15	Passed

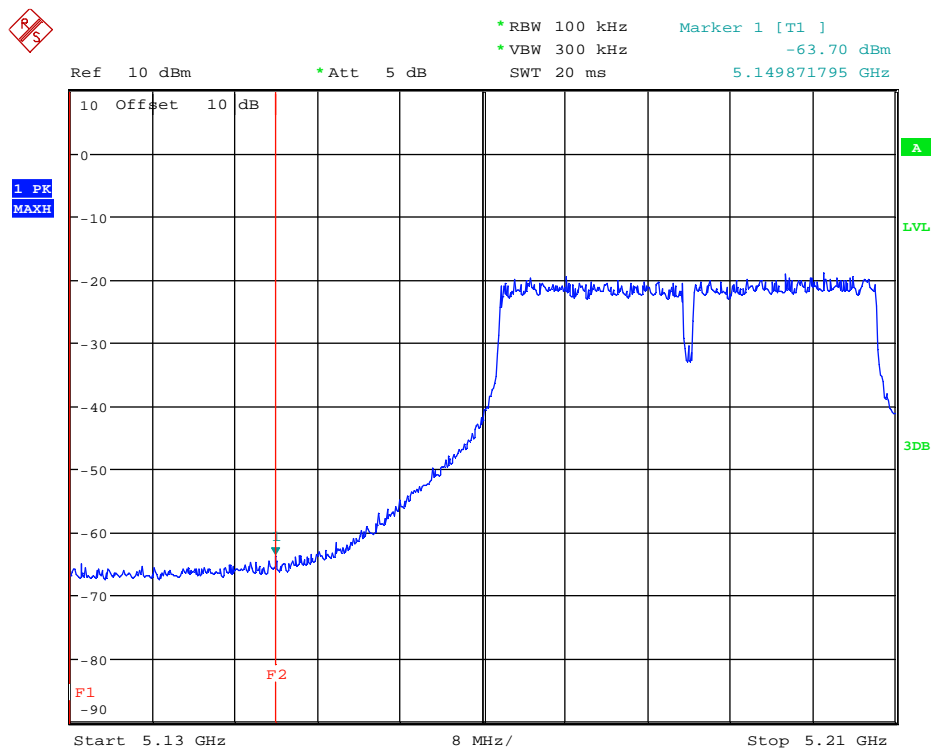
Band Edge Compliance, n40-mode, channel 38 (Operation mode 7)						
Frequency [MHz]	Meas. Result [dBμV/m]	Max Peak Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5149.829	64.02	74	9.98	-46.24	15	Passed
Average Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Average Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5149.904	49.11	54	4.89	-61.15	15	Passed

5.6.2.1 Antenna port 2

Ambient temperature	22 °C	Relative humidity	60 %
---------------------	-------	-------------------	------

The plot shows an exemplary measurement result for the worst documented case. The other results are listed in the following table.

134981 BandEdgeRestr_n40_36.wmf: conducted band-edge compliance (operation mode 7):



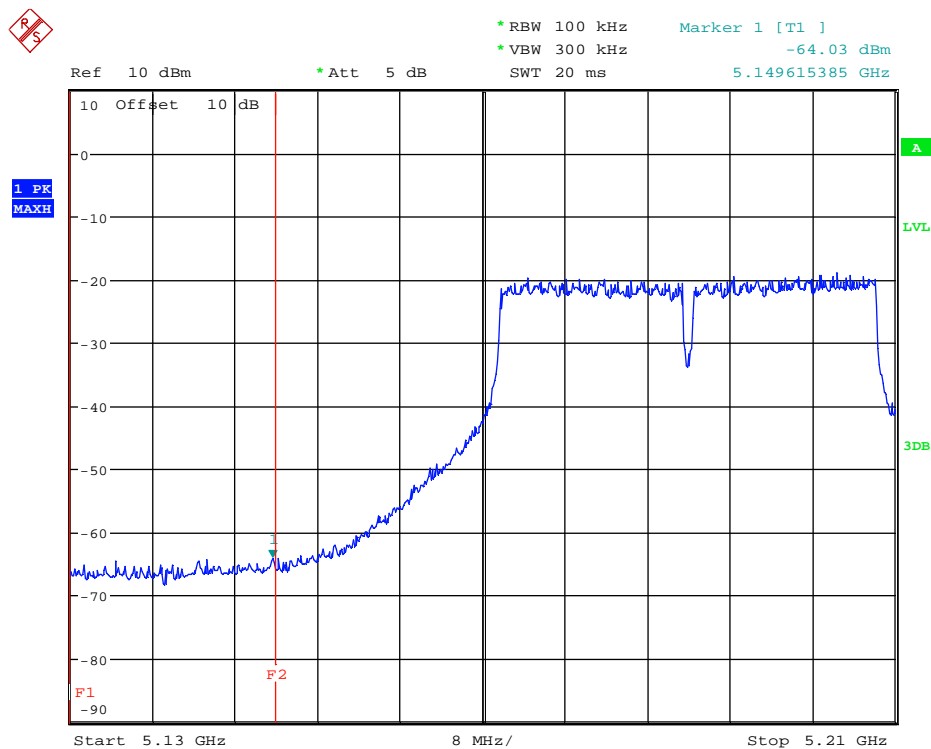
Band Edge Compliance, a-mode, channel 36 (Operation mode 1)						
Frequency [MHz]	Meas. Result [dBμV/m]	Max Peak Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5141.473	52.18	74	21.82	-58.08	15	Passed
Average Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Average Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5149.723	40.7	54	13.3	-69.56	15	Passed
Band Edge Compliance, n20-mode, channel 36 (Operation mode 4)						
Frequency [MHz]	Meas. Result [dBμV/m]	Max Peak Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5149.694	52.32	74	21.68	-57.94	15	Passed
Average Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Average Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5149.769	41.04	54	12.96	-69.22	15	Passed
Band Edge Compliance, n40-mode, channel 36 (Operation mode 7)						
Frequency [MHz]	Meas. Result [dBμV/m]	Max Peak Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5149.347	56.97	74	17.03	-53.29	15	Passed
Average Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Average Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5149.947	42.89	54	11.11	-67.37	15	Passed

5.6.2.1 Antenna port 3

Ambient temperature	22 °C	Relative humidity	60 %
---------------------	-------	-------------------	------

The plot shows an exemplary measurement result for the worst documented case. The other results are listed in the following table.

134981 BandEdgeRestr_n40_36.wmf: conducted band-edge compliance (operation mode 7):



Band Edge Compliance, a-mode, channel 36 (Operation mode 1)						
Frequency [MHz]	Meas. Result [dBμV/m]	Max Peak Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5134.306	52.97	74	21.03	-57.29	15	Passed
Average Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Average Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5148.706	40.76	54	13.24	-69.5	15	Passed

Band Edge Compliance, n20-mode, channel 36 (Operation mode 4)						
Frequency [MHz]	Meas. Result [dBμV/m]	Max Peak Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5143.998	51.9	74	22.1	-58.36	15	Passed
Average Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Average Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5149.623	41.15	54	12.85	-69.11	15	Passed

Band Edge Compliance, n40-mode, channel 36 (Operation mode 7)						
Frequency [MHz]	Meas. Result [dBμV/m]	Max Peak Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5149.690	56.1	74	17.9	-54.16	15	Passed
Average Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Average Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5149.990	42.86	54	11.14	-67.4	15	Passed

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

30

5.7 Maximum unwanted emissions

5.7.1 Method of measurement (conducted emissions in the restricted bands)

The relating measurements were carried out in a conducting manner. Therefore, the antenna connector was directly mounted to a spectrum analyser. The measurement procedure refers to part H in [3].

If emissions were detected during the preliminary measurements, they were measured using the following measurement procedures:

Procedure for average measurement: H)6) – Trace averaging with continuous EUT transmission at full power:

The following method is valid if the EUT transmits continuously (duty cycle $\geq 98\%$)

- Set the RBW = 1 MHz.
- Set the VBW $\geq 3 \times$ RBW.
- Detector = power average (RMS).
- Ensure that the number of measurement points in the sweep to $\geq 2 \times$ (span/RBW).
- Averaging type = power (i.e., RMS)
- Sweep time = auto
- Perform a trace average of at least 100 traces

Peak measurement procedure: H5

- Set the analyzer span to encompass the entire unwanted emission bandwidth.
- Set the RBW = specified in Table 3.
- Set the VBW \geq RBW.
- Set sweep time = auto.
- Detector = peak.
- Trace mode = max hold.
- Allow the trace to stabilize.
- Use the peak marker function to determine the peak power over the emission bandwidth.

Table 3 RBW as a function of frequency

Frequency	RBW
9-150 kHz	200-300 Hz
0.15-30 MHz	9-10 kHz
30-1000 MHz	100-120 kHz
> 1000 MHz	1 MHz

The measurements were carried out at each antenna port.

If an emission fails the conducted test, the measurement will be repeated in a radiated manner.

5.7.1.1 Field strength calculation

The following general procedure is described in chapter H)1)d) of [3].

- a) Measure the conducted output power (in dBm) using the procedures described in 5.7.1.
- b) Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level
- c) Add the appropriate maximum ground reflections factor to the EIRP level (6 dB for frequencies \leq , 30 MHz, 4.7 for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for frequencies $>$ 1000 MHz)
- d) For devices with multiple antenna ports, measure the power of each individual chain and sum the EIRP of all chains in linear terms (e.g., Watts, mW)
- e) Convert the resultant level to an equivalent electric field strength using the following relationships:

$$E. = EIRP - 20 \log(d) + 104.8 \quad (1)$$

Where:

E. = electric field strength, in dB μ V/m

EIRP = equivalent isotropic radiated power, in dBm

d = specified measurement distance, in meters

- f) Compare the resultant electric field strength to the applicable limit

Document [6] state, that for transmitters with multiple outputs in the same band, summing of emissions and accounting for array gain have to be considered.

For combining emissions from multiple outputs, the spurious emissions at each output have to be measured and $10 \log(N)$ has to be added to the resulting value, whereby N refers to the number of outputs.

To account for directional gain which might occur in case of N transmit antennas, the directional gain has to be calculated as

$$G_{Dir} = G_{Ant} + 10 \log(N) dBi ,$$

whereby N is the number of antennas.

For the actual EUT the highest combination of antenna gain and used number of ports results in an additional value, added to the conducted spurious emission level, of 10 dB. Whereby the antenna has a gain of 5.5 dBi and the number of used ports is 3.

5.7.2 Method of measurement (conducted emissions in the unrestricted bands)

The measurement was performed as described in H)2) in document [3].

5.7.2.1 Emission level measurement

- a) Set the center frequency and span to encompass frequency range to be measured.
- b) RBW = 1 MHz.
- c) VBW \geq 3 MHz.
- d) Detector = Peak.
- e) Sweep time = auto.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- h) Use the peak marker function to determine the maximum amplitude level.

The limit of -27 dBm/MHz was specified in 15.407 (b) (1)

5.7.3 Test results (conducted emissions)

5.7.3.1 Emissions below 1 GHz

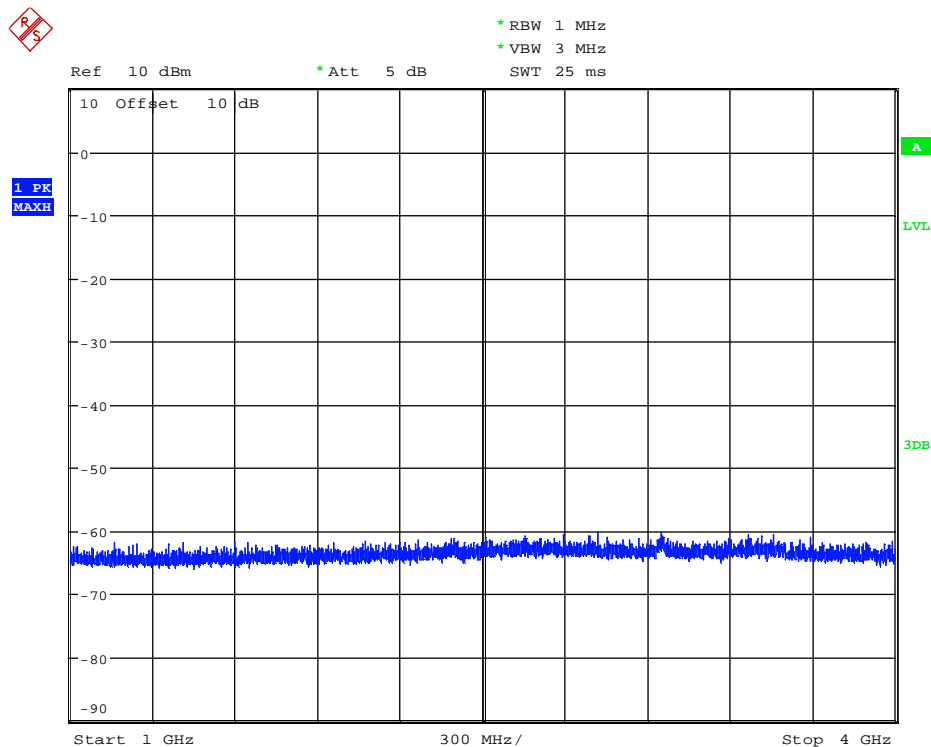
The signals below 1 GHz were measured and compared to the results in the test report F134981E2. No differences were found between the two measurements, therefore no new plots and results are submitted below.

5.7.3.2 Antenna port 1

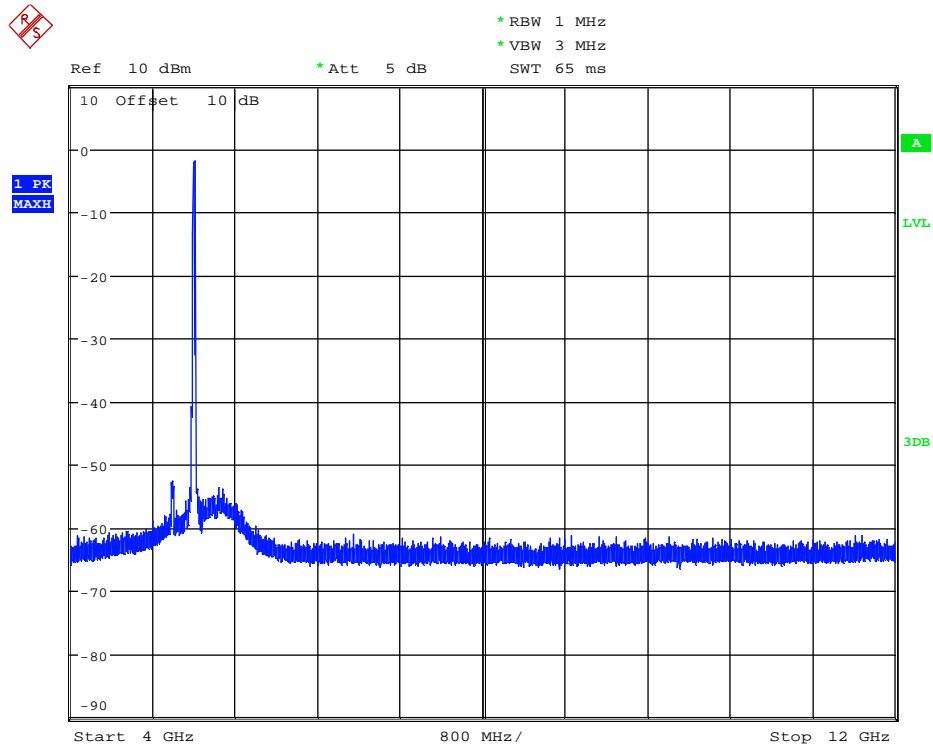
Ambient temperature	22 °C	Relative humidity	60 %
---------------------	-------	-------------------	------

The following results were measured at antenna port 1 of the EUT. The plots shows exemplary measurement results for the worst documented case. The other results are listed in the following table.

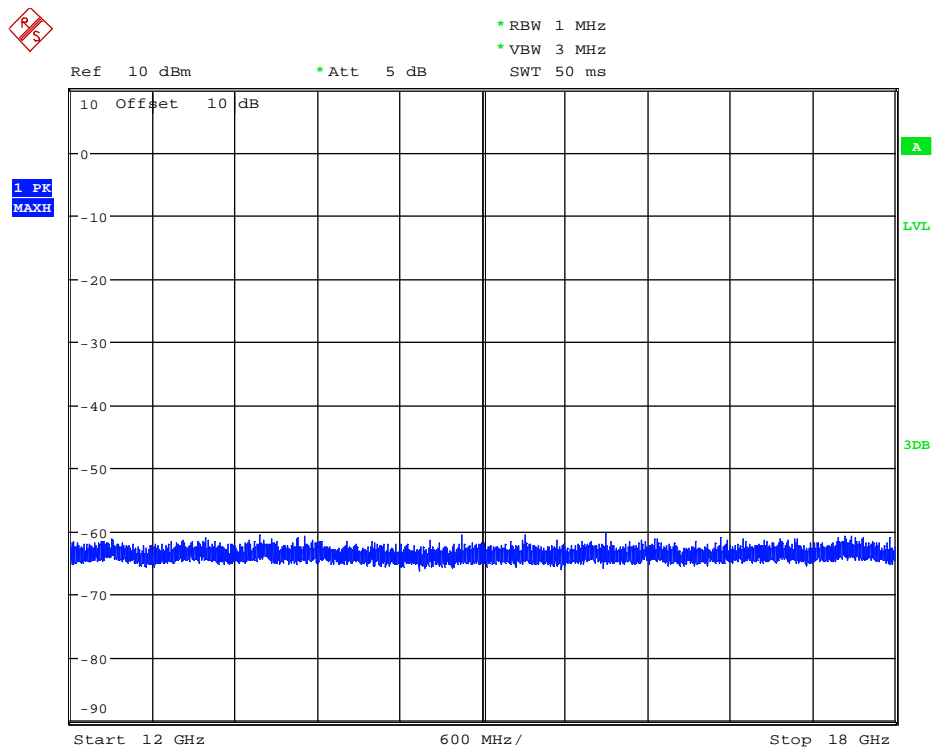
134981 SpurEmiss1-4G a 40.wmf: conducted spurious emissions (operation mode 2):



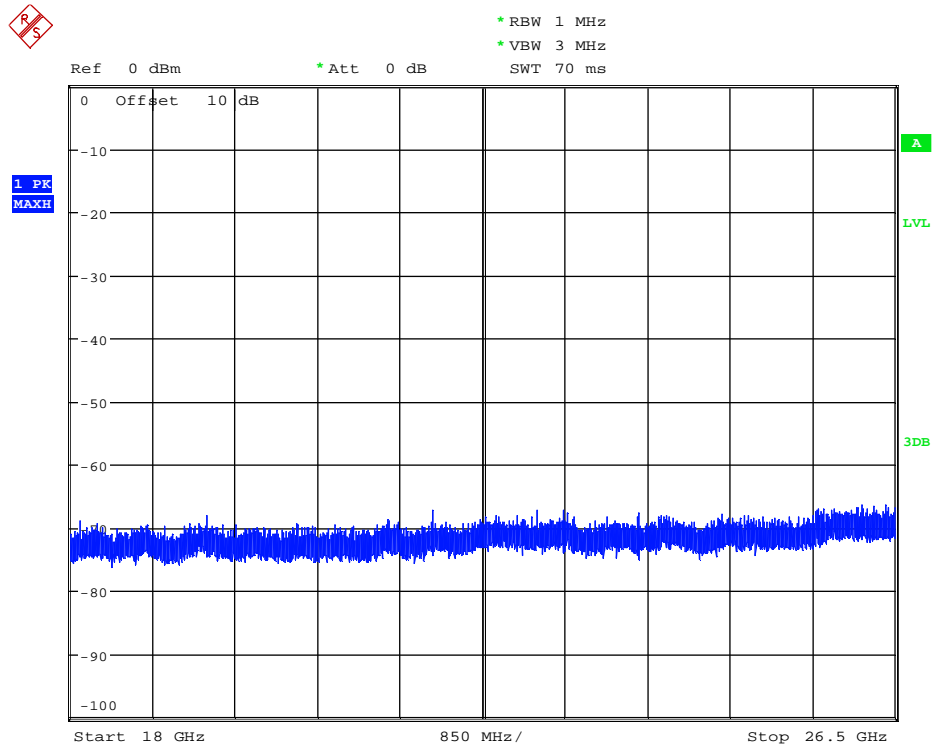
134981_SpurEmiss4-12G_a_40.wmf: conducted spurious emissions (operation mode 2):



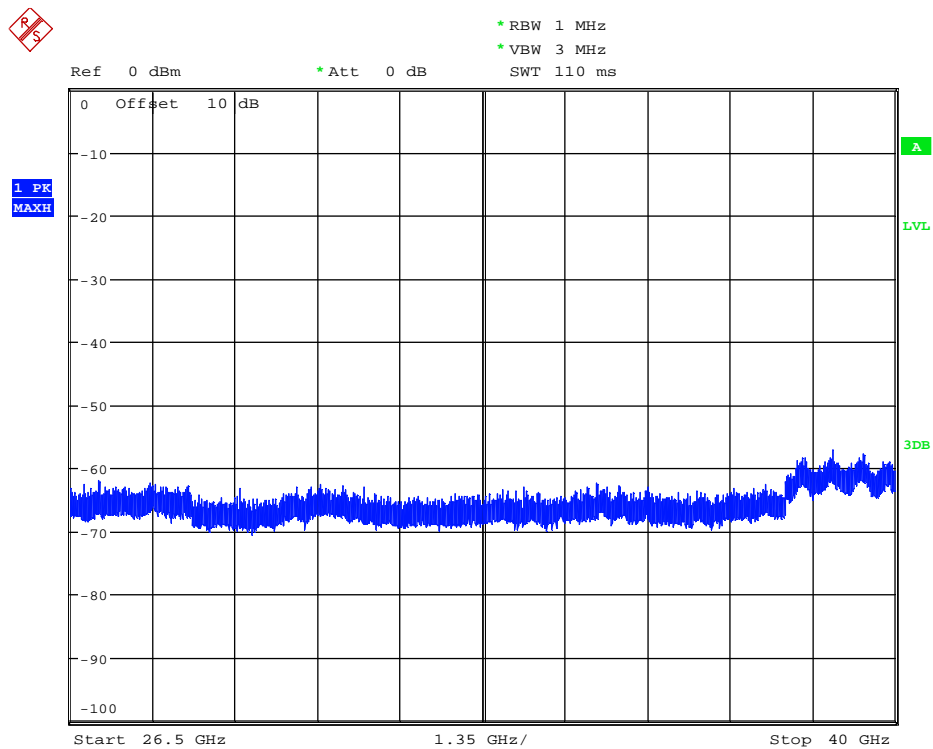
134981_SpurEmiss12-18G_a_40.wmf: conducted spurious emissions (operation mode 2):



134981_SpurEmiss18-26,5G_a_40.wmf: conducted spurious emissions (operation mode 2):



134981_SpurEmiss26,5-40G_a_40.wmf: conducted spurious emissions (operation mode 2):



Spurious Emissions, a-mode, channel 36 (Operation mode 1)						
Peak Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Max Peak Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
3635.100	50.13	74	23.87	-60.13	15	Passed
4981.700	58.52	74	15.48	-51.74	15	Passed
5424.100	57.93	74	16.07	-52.33	15	Passed
Average Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Average Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
3642.250	38.71	54	15.29	-71.55	15	Passed
4979.775	44.12	54	9.88	-66.14	15	Passed
5418.100	45.54	54	8.46	-64.72	15	Passed
Emissions in the non-restricted Bands						
Frequency [MHz]	Meas. Result [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]	Result		
5266.800	-61.64	-27.00	34.64	Passed		

Spurious Emissions, a-mode, channel 40 (Operation mode 2)						
Peak Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Max Peak Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5098.650	54.83	74	19.17	-55.43	15	Passed
5440.225	57.13	74	16.87	-53.13	15	Passed
Average Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Average Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5102.850	42.83	54	11.17	-67.43	15	Passed
5440.050	45.67	54	8.33	-64.59	15	Passed
Emissions in the non-restricted Bands						
Frequency [MHz]	Meas. Result [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]	Result		
3498.725	-65.03	-27.00	38.03	Passed		
5286.175	-62.29	-27.00	35.29	Passed		
5482.100	-61.85	-27.00	34.85	Passed		

Spurious Emissions, a-mode, channel 48 (Operation mode 3)						
Peak Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Max Peak Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5103.075	56.08	74	17.92	-54.18	15	Passed
5435.825	56.93	74	17.07	-53.33	15	Passed
Average Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Average Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5104.675	42.64	54	11.36	-67.62	15	Passed
5439.725	44.98	54	9.02	-65.28	15	Passed
Emissions in the non-restricted Bands						
Frequency [MHz]	Meas. Result [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]	Result		
3370.525	-65.01	-27.00	38.01	Passed		
5494.125	-62.44	-27.00	35.44	Passed		

Spurious Emissions, n20-mode, channel 36 (Operation mode 4)						
Peak Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Max Peak Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
4980.600	57.95	74	16.05	-52.31	15	Passed
5422.275	58.05	74	15.95	-52.21	15	Passed
Average Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Average Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
4980.125	44.03	54	9.97	-66.23	15	Passed
5418.950	45.6	54	8.4	-64.66	15	Passed
Emissions in the non-restricted Bands						
Frequency [MHz]	Meas. Result [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]	Result		
3569.425	-65.31	-27.00	38.31	Passed		
5253.875	-62.20	-27.00	35.20	Passed		

Spurious Emissions, n20-mode, channel 40 (Operation mode 5)						
Peak Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Max Peak Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
4980.300	58.08	74	15.92	-52.18	15	Passed
4995.550	58.5	74	15.5	-51.76	15	Passed
5385.325	57.06	74	16.94	-53.2	15	Passed
Average Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Average Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
4982.300	44.05	54	9.95	-66.21	15	Passed
4997.600	44.37	54	9.63	-65.89	15	Passed
5383.750	44.95	54	9.05	-65.31	15	Passed
Emissions in the non-restricted Bands						
Frequency [MHz]	Meas. Result [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]	Result		
3244.725	-64.98	-27.00	37.98	Passed		
5345.975	-62.46	-27.00	35.46	Passed		

Spurious Emissions, n20-mode, channel 48 (Operation mode 6)						
Peak Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Max Peak Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5098.500	54.42	74	19.58	-55.84	15	Passed
4979.950	58.13	74	15.87	-52.13	15	Passed
5362.750	57.64	74	16.36	-52.62	15	Passed
Average Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Average Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5103.300	42.82	54	11.18	-67.44	15	Passed
4982.375	44.13	54	9.87	-66.13	15	Passed
5361.325	44.99	54	9.01	-65.27	15	Passed
Emissions in the non-restricted Bands						
Frequency [MHz]	Meas. Result [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]	Result		
3522.050	-65.29	-27.00	38.29	Passed		
5542.500	-62.33	-27.00	35.33	Passed		

Spurious Emissions, n40-mode, channel 36 (Operation mode 7)						
Peak Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Max Peak Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
3886.100	49.39	74	24.61	-60.87	15	Passed
4996.975	58.47	74	15.53	-51.79	15	Passed
5436.025	57.12	74	16.88	-53.14	15	Passed
Average Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Average Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
3882.525	38.5	54	15.5	-71.76	15	Passed
4997.550	44.37	54	9.63	-65.89	15	Passed
5439.350	45.21	54	8.79	-65.05	15	Passed
Emissions in the non-restricted Bands						
Frequency [MHz]	Meas. Result [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]	Result		
5341.075	-61.77	-27.00	34.77	Passed		

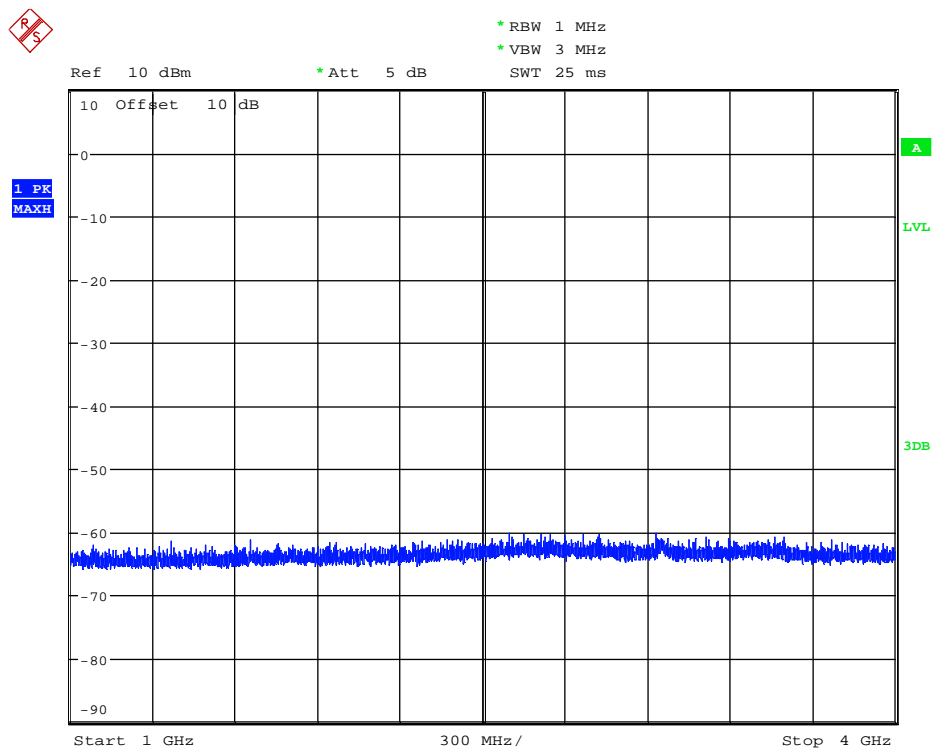
Spurious Emissions, n40-mode, channel 48 (Operation mode 8)						
Peak Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Max Peak Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
4994.375	58.75	74	15.25	-51.51	15	Passed
4977.950	58.85	74	15.15	-51.41	15	Passed
5379.200	57.35	74	16.65	-52.91	15	Passed
Average Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Average Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
4997.450	44.4	54	9.6	-65.86	15	Passed
4983.500	44.19	54	9.81	-66.07	15	Passed
5378.600	44.91	54	9.09	-65.35	15	Passed
Emissions in the non-restricted Bands						
Frequency [MHz]	Meas. Result [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]	Result		
4436.225	-64.14	-27.00	37.14	Passed		

Antenna port 2

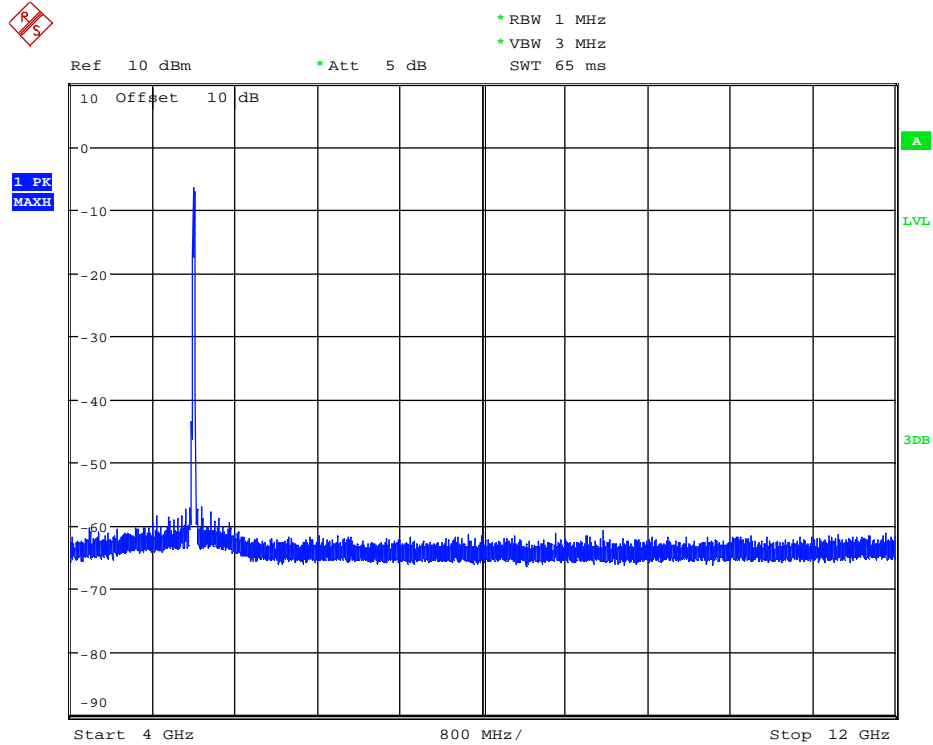
Ambient temperature	22 °C	Relative humidity	60 %
---------------------	-------	-------------------	------

The following results were measured at antenna port 2 of the EUT. The plots shows exemplary measurement results for the worst documented case. The other results are listed in the following table.

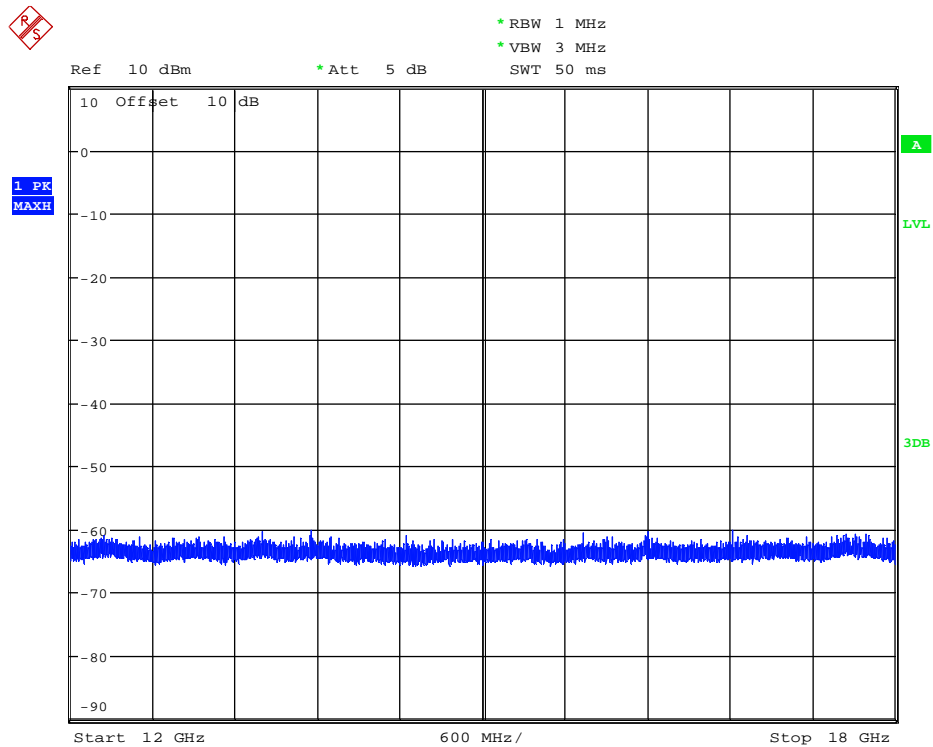
134981 SpurEmiss1-4G n20 40.wmf: conducted spurious emissions (operation mode 5):



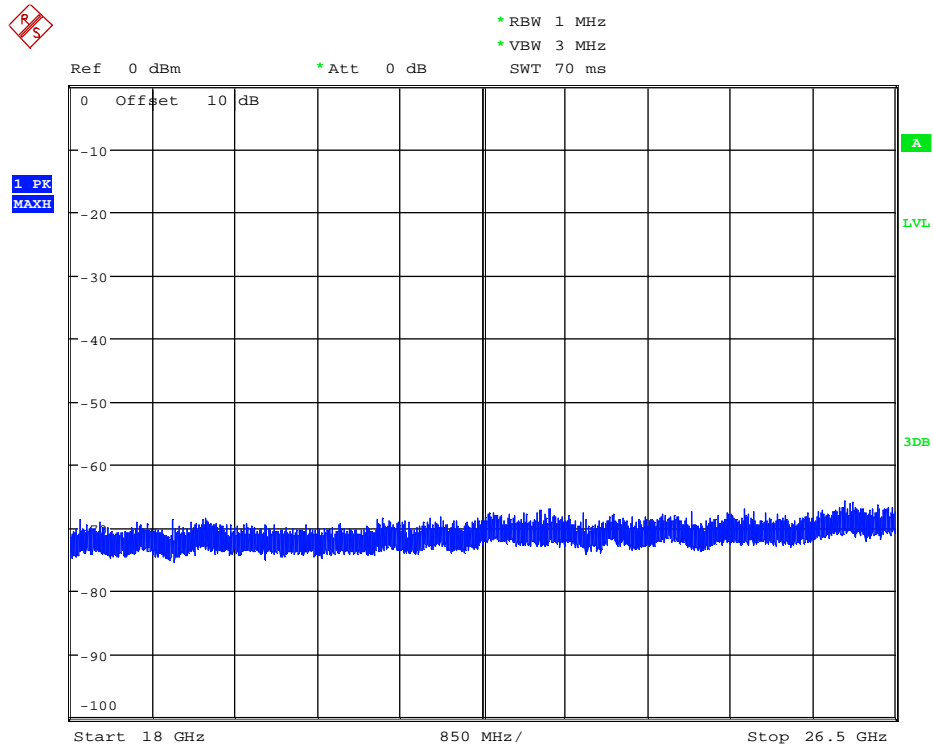
134981_SpurEmiss4-12G_n20_40.wmf: conducted spurious emissions (operation mode 5):



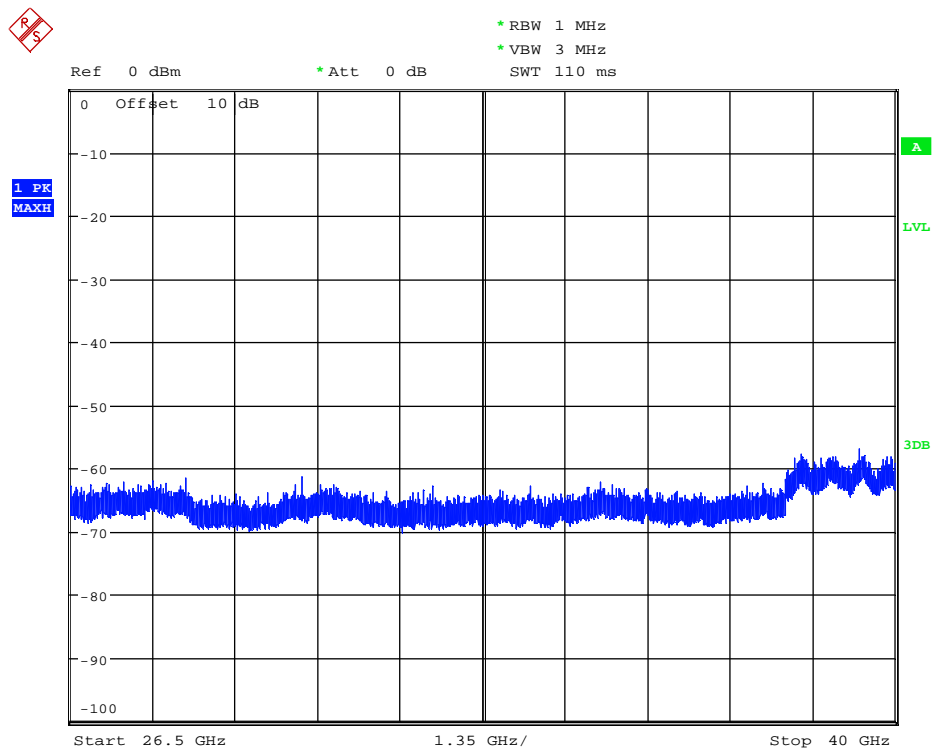
134981_SpurEmiss12-18G_n20_40.wmf: conducted spurious emissions (operation mode 5):



134981_SpurEmiss18-26,5G_n20_40.wmf: conducted spurious emissions (operation mode 5):



134981_SpurEmiss26,5-40G_n20_40.wmf: conducted spurious emissions (operation mode 5):



Spurious Emissions, a-mode, channel 36 (Operation mode 1)						
Peak Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Max Peak Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5039.950	54.81	74	19.19	-55.45	15	Passed
5079.950	54.99	74	19.01	-55.27	15	Passed
4959.900	54.89	74	19.11	-55.37	15	Passed
4799.900	54.10	74	19.90	-56.16	15	Passed
5359.900	55.31	74	18.69	-54.95	15	Passed
5439.900	53.89	74	20.11	-56.37	15	Passed
5399.900	53.22	74	20.78	-57.04	15	Passed
Average Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Average Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5039.950	46.88	54	7.12	-63.38	15	Passed
5079.950	46.86	54	7.14	-63.40	15	Passed
4959.900	46.48	54	7.52	-63.78	15	Passed
4799.900	45.57	54	8.43	-64.69	15	Passed
5359.900	47.80	54	6.20	-62.46	15	Passed
5439.900	44.36	54	9.64	-65.90	15	Passed
5399.900	43.00	54	11.00	-67.26	15	Passed
Emissions in the non-restricted Bands						
Frequency [MHz]	Meas. Result [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]	Result		
3393.500	-65.24	-27.00	38.24	Passed		
5279.900	-57.99	-27.00	30.99	Passed		
5319.950	-62.67	-27.00	35.67	Passed		

Spurious Emissions, a-mode, channel 40 (Operation mode 2)						
Peak Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Max Peak Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5079.950	55.22	74	18.78	-55.04	15	Passed
5039.900	54.55	74	19.45	-55.71	15	Passed
4959.900	54.47	74	19.53	-55.79	15	Passed
4799.900	53.63	74	20.37	-56.63	15	Passed
5359.850	55.36	74	18.64	-54.90	15	Passed
5439.900	54.19	74	19.81	-56.07	15	Passed
5399.900	53.77	74	20.23	-56.49	15	Passed
Average Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Average Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5079.950	45.54	54	8.46	-64.72	15	Passed
5039.900	46.15	54	7.85	-64.11	15	Passed
4959.900	45.76	54	8.24	-64.50	15	Passed
4799.900	44.61	54	9.39	-65.65	15	Passed
5359.850	47.32	54	6.68	-62.94	15	Passed
5439.900	44.57	54	9.43	-65.69	15	Passed
5399.900	43.14	54	10.86	-67.12	15	Passed
Emissions in the non-restricted Bands						
Frequency [MHz]	Meas. Result [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]	Result		
3232.050	-65.30	-27.00	38.30	Passed		
5279.900	-58.79	-27.00	31.79	Passed		

Spurious Emissions, a-mode, channel 48 (Operation mode 3)						
Peak Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Max Peak Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
3724.600	49.62	74	24.38	-60.64	15	Passed
4073.250	49.57	74	24.43	-60.69	15	Passed
4959.475	53.82	74	20.18	-56.44	15	Passed
5079.800	53.52	74	20.48	-56.74	15	Passed
5039.875	54.41	74	19.59	-55.85	15	Passed
4799.950	52.61	74	21.39	-57.65	15	Passed
4839.950	53.04	74	20.96	-57.22	15	Passed
5359.625	55.36	74	18.64	-54.90	15	Passed
5439.600	53.42	74	20.58	-56.84	15	Passed
Average Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Average Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
3723.475	38.62	54	15.38	-71.64	15	Passed
4079.900	38.80	54	15.20	-71.46	15	Passed
4959.900	45.77	54	8.23	-64.49	15	Passed
5079.875	45.16	54	8.84	-65.10	15	Passed
5039.900	45.90	54	8.10	-64.36	15	Passed
4799.825	44.08	54	9.92	-66.18	15	Passed
4839.875	45.06	54	8.94	-65.20	15	Passed
5359.875	47.24	54	6.76	-63.02	15	Passed
5439.900	44.03	54	9.97	-66.23	15	Passed
Emissions in the non-restricted Bands						
Frequency [MHz]	Meas. Result [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]	Result		
5279.950	-60.17	-27.00	33.17	Passed		
5479.925	-62.56	-27.00	35.56	Passed		

Spurious Emissions, n20-mode, channel 36 (Operation mode 4)						
Peak Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Max Peak Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
4333.500	50.25	74	23.75	-60.01	15	Passed
5079.900	54.46	74	19.54	-55.80	15	Passed
5119.950	55.43	74	18.57	-54.83	15	Passed
4959.900	54.52	74	19.48	-55.74	15	Passed
4839.900	53.59	74	20.41	-56.67	15	Passed
4799.900	53.40	74	20.60	-56.86	15	Passed
4719.850	52.59	74	21.41	-57.67	15	Passed
5359.900	55.30	74	18.70	-54.96	15	Passed
5439.900	54.00	74	20.00	-56.26	15	Passed
5399.900	53.82	74	20.18	-56.44	15	Passed
Average Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Average Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
4333.500	38.77	54	15.23	-71.49	15	Passed
5079.900	45.14	54	8.86	-65.12	15	Passed
5119.950	47.41	54	6.59	-62.85	15	Passed
4959.900	45.78	54	8.22	-64.48	15	Passed
4839.900	45.02	54	8.98	-65.24	15	Passed
4799.900	44.46	54	9.54	-65.8	15	Passed
4719.850	42.9	54	11.1	-67.36	15	Passed
5359.900	47.30	54	6.70	-62.96	15	Passed
5439.900	43.98	54	10.02	-66.28	15	Passed
5399.900	43.44	54	10.56	-66.82	15	Passed
Emissions in the non-restricted Bands						
Frequency [MHz]	Meas. Result [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]	Result		
5279.900	-58.74	-27.00	31.74	Passed		

Spurious Emissions, n20-mode, channel 40 (Operation mode 5)						
Peak Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Max Peak Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
3731.850	49.84	74	24.16	-60.42	15	Passed
5119.900	55.97	74	18.03	-54.29	15	Passed
5039.950	54.79	74	19.21	-55.47	15	Passed
4799.900	53.39	74	20.61	-56.87	15	Passed
5079.950	54.55	74	19.45	-55.71	15	Passed
4999.950	54.27	74	19.73	-55.99	15	Passed
5359.900	55.00	74	19.00	-55.26	15	Passed
5439.850	54.03	74	19.97	-56.23	15	Passed
5399.850	53.87	74	20.13	-56.39	15	Passed
Average Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Average Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
3731.850	38.59	54	15.41	-71.67	15	Passed
5119.900	47.96	54	6.04	-62.30	15	Passed
5039.950	45.80	54	8.20	-64.46	15	Passed
4799.900	44.02	54	9.98	-66.24	15	Passed
5079.950	44.73	54	9.27	-65.53	15	Passed
4999.950	45.23	54	8.77	-65.03	15	Passed
5359.900	46.96	54	7.04	-63.30	15	Passed
5439.850	44.49	54	9.51	-65.77	15	Passed
5399.850	43.43	54	10.57	-66.83	15	Passed
Emissions in the non-restricted Bands						
Frequency [MHz]	Meas. Result [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]	Result		
5279.900	-59.37	-27.00	32.37	Passed		

Spurious Emissions, n20-mode, channel 48 (Operation mode 6)						
Peak Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dB μ V/m]	Max Peak Limit [dB μ V/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5119.975	55.44	74	18.56	-54.82	15	Passed
5040.025	53.59	74	20.41	-56.67	15	Passed
5079.875	53.38	74	20.62	-56.88	15	Passed
4840.025	53.15	74	20.85	-57.11	15	Passed
4999.800	53.18	74	20.82	-57.08	15	Passed
5360.025	54.51	74	19.49	-55.75	15	Passed
5439.925	52.89	74	21.11	-57.37	15	Passed
5399.975	53.08	74	20.92	-57.18	15	Passed
Average Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dB μ V/m]	Average Limit [dB μ V/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5119.900	47.57	54	6.43	-62.69	15	Passed
5039.950	45.69	54	8.31	-64.57	15	Passed
5079.950	44.63	54	9.37	-65.63	15	Passed
4839.875	45.11	54	8.89	-65.15	15	Passed
4999.875	44.97	54	9.03	-65.29	15	Passed
5359.900	47.12	54	6.88	-63.14	15	Passed
5439.850	44.15	54	9.85	-66.11	15	Passed
5399.875	43.49	54	10.51	-66.77	15	Passed
Emissions in the non-restricted Bands						
Frequency [MHz]	Meas. Result [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]	Result		
3234.400	-65.05	-27.00	38.05	Passed		
5279.900	-59.76	-27.00	32.76	Passed		

Spurious Emissions, n40-mode, channel 38 (Operation mode 7)						
Peak Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Max Peak Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5039.900	54.90	74	19.10	-55.36	15	Passed
5079.950	54.22	74	19.78	-56.04	15	Passed
4959.900	54.19	74	19.81	-56.07	15	Passed
5119.950	55.88	74	18.12	-54.38	15	Passed
4799.850	53.89	74	20.11	-56.37	15	Passed
4839.900	53.97	74	20.03	-56.29	15	Passed
5359.900	55.47	74	18.53	-54.79	15	Passed
5439.900	53.85	74	20.15	-56.41	15	Passed
5399.900	54.04	74	19.96	-56.22	15	Passed
Average Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Average Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5039.900	45.97	54	8.03	-64.29	15	Passed
5079.950	44.97	54	9.03	-65.29	15	Passed
4959.900	45.46	54	8.54	-64.80	15	Passed
5119.950	47.80	54	6.20	-62.46	15	Passed
4799.850	44.11	54	9.89	-66.15	15	Passed
4839.900	45.06	54	8.94	-65.20	15	Passed
5359.900	47.03	54	6.97	-63.23	15	Passed
5439.900	44.02	54	9.98	-66.24	15	Passed
5399.900	43.57	54	10.43	-66.69	15	Passed
Emissions in the non-restricted Bands						
Frequency [MHz]	Meas. Result [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]	Result		
3143.850	-64.77	-27.00	37.77	Passed		
5279.900	-59.51	-27.00	32.51	Passed		

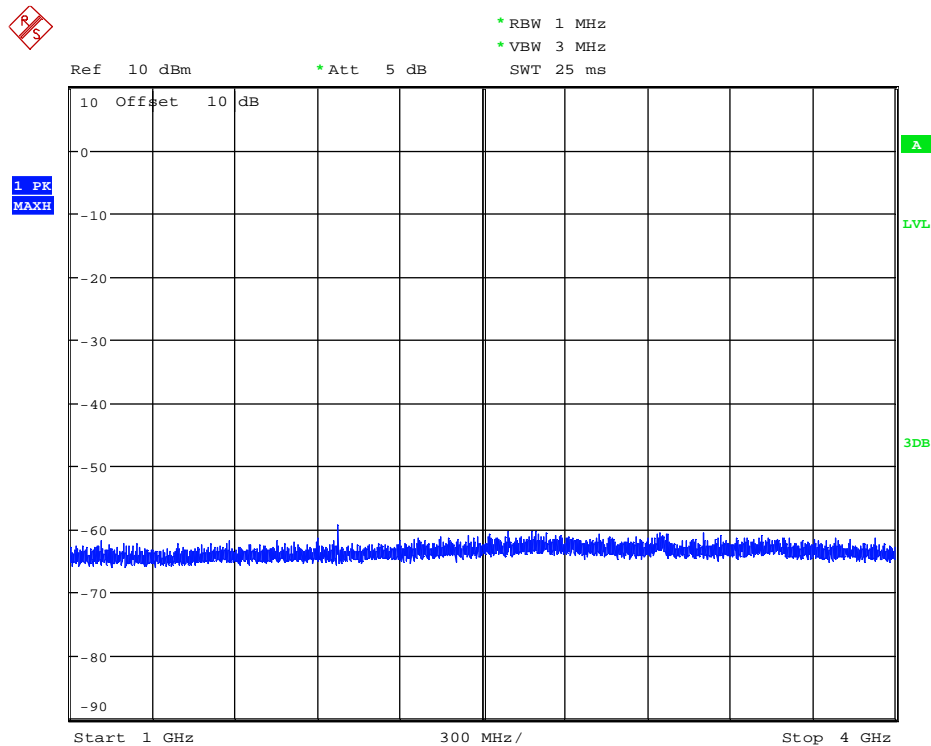
Spurious Emissions, n40-mode, channel 46 (Operation mode 8)						
Peak Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Max Peak Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5119.950	54.91	74	19.09	-55.35	15	Passed
4959.925	53.23	74	20.77	-57.03	15	Passed
5039.575	53.74	74	20.26	-56.52	15	Passed
4839.975	53.64	74	20.36	-56.62	15	Passed
5079.925	53.2	74	20.8	-57.06	15	Passed
5359.875	55.23	74	18.77	-55.03	15	Passed
5439.725	53.11	74	20.89	-57.15	15	Passed
Average Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Average Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5119.850	47.59	54	6.41	-62.67	15	Passed
4959.900	45.06	54	8.94	-65.2	15	Passed
5039.875	45.68	54	8.32	-64.58	15	Passed
4839.900	45.06	54	8.94	-65.2	15	Passed
5079.900	44.44	54	9.56	-65.82	15	Passed
5359.875	46.94	54	7.06	-63.32	15	Passed
5439.875	44.06	54	9.94	-66.2	15	Passed
Emissions in the non-restricted Bands						
Frequency [MHz]	Meas. Result [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]	Result		
3239.250	-64.94	-27.00	37.94	Passed		
5279.925	-60.30	-27.00	33.30	Passed		
5319.900	-62.13	-27.00	35.13	Passed		

5.7.3.3 Antenna port 3

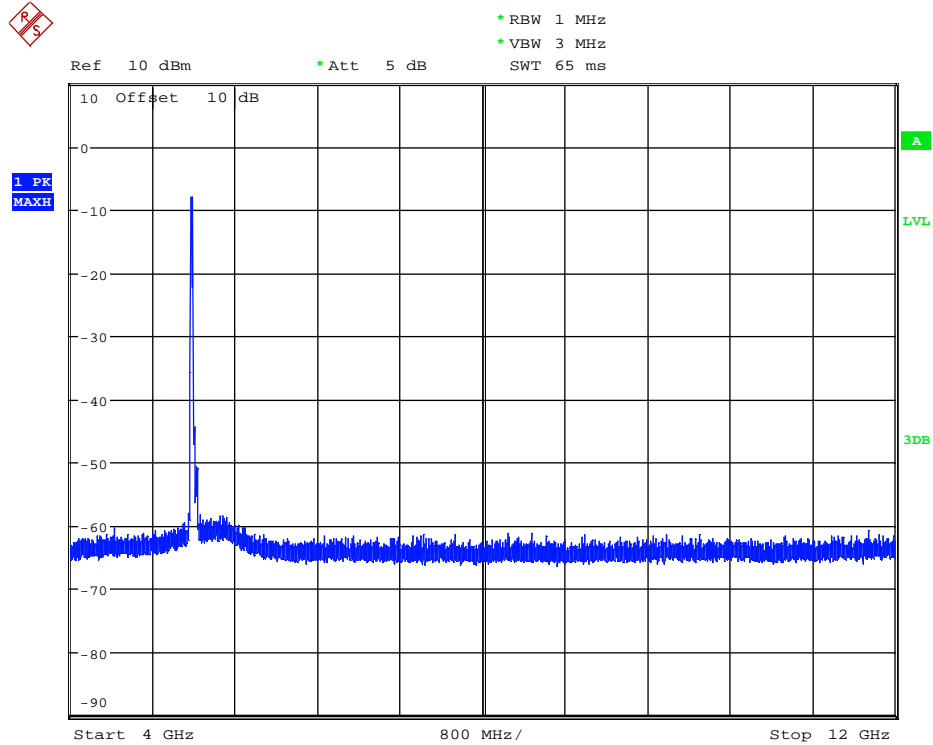
Ambient temperature	22 °C	Relative humidity	60 %
---------------------	-------	-------------------	------

The following results were measured at antenna port 3 of the EUT. The plots shows exemplary measurement results for the worst documented case. The other results are listed in the following table.

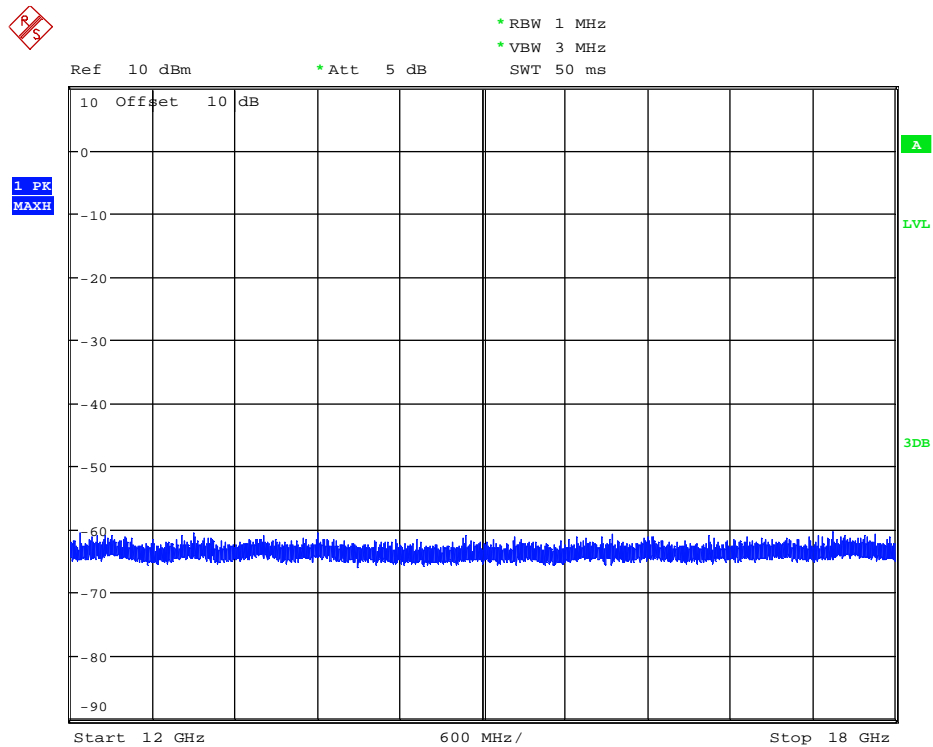
134981 SpurEmiss1-4G n20 36.wmf: conducted spurious emissions (operation mode 4):



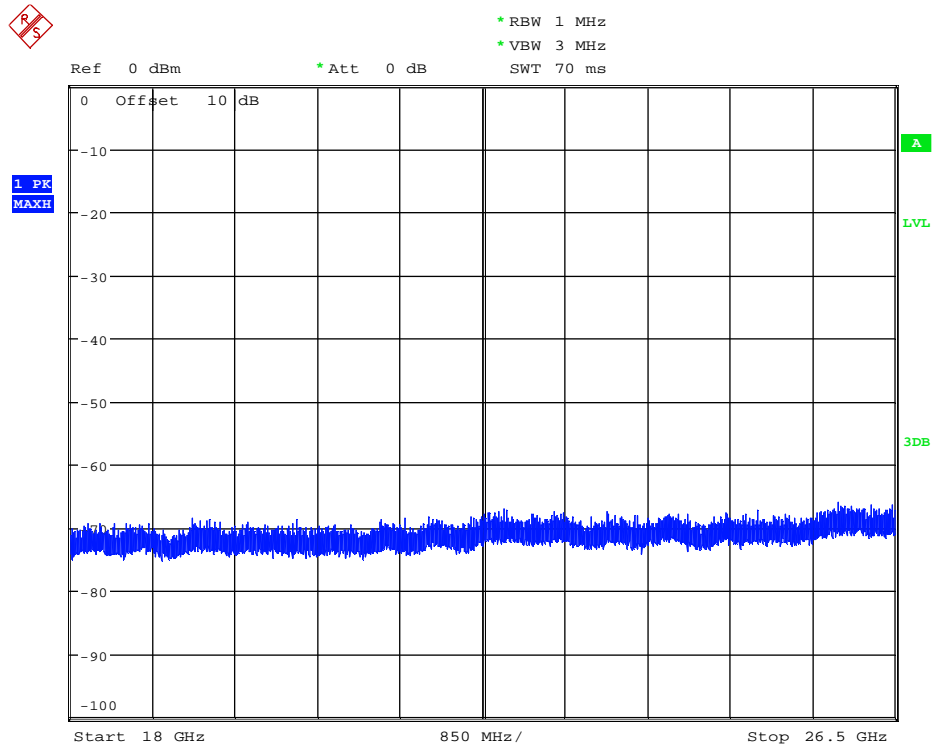
134981_SpurEmiss4-12G_n20_36.wmf: conducted spurious emissions (operation mode 4):



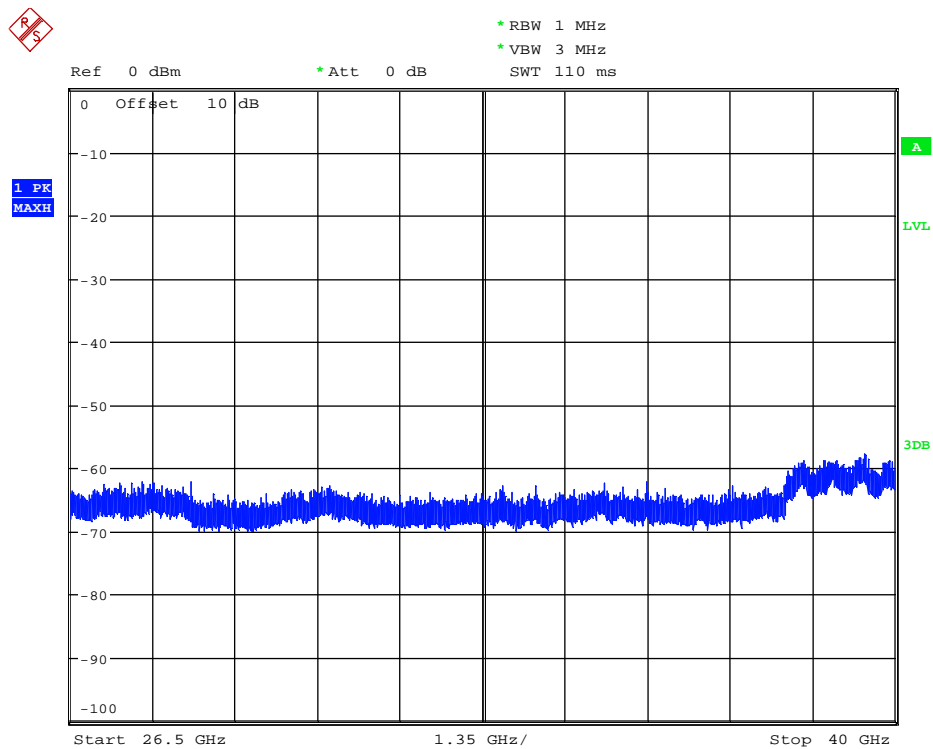
134981_SpurEmiss12-18G_n20_36.wmf: conducted spurious emissions (operation mode 5):



134981_SpurEmiss18-26,5G_n20_36.wmf: conducted spurious emissions (operation mode 5):



134981_SpurEmiss26,5-40G_n20_36.wmf: conducted spurious emissions (operation mode 5):



Spurious Emissions, a-mode, channel 36 (Operation mode 1)						
Peak Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Max Peak Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
3723.600	49.88	74	24.12	-60.38	15	Passed
4752.100	49.98	74	24.02	-60.28	15	Passed
5440.400	53.69	74	20.31	-56.57	15	Passed
Average Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Average Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
3730.525	38.62	54	15.38	-71.64	15	Passed
4751.775	38.97	54	15.03	-71.29	15	Passed
5439.925	43.56	54	10.44	-66.7	15	Passed
Emissions in the non-restricted Bands						
Frequency [MHz]	Meas. Result [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]	Result		
5279.925	-63.12	-27.00	36.12	Passed		
5323.025	-64.06	-27.00	37.06	Passed		
5479.925	-61.58	-27.00	34.58	Passed		
5639.175	-64.87	-27.00	37.87	Passed		

Spurious Emissions, a-mode, channel 40 (Operation mode 2)						
Peak Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Max Peak Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
4335.275	50.41	74	23.59	-59.85	15	Passed
4950.625	51.29	74	22.71	-58.97	15	Passed
5399.600	53.8	74	20.2	-56.46	15	Passed
Average Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Average Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
4341.675	38.87	54	15.13	-71.39	15	Passed
4958.650	39.55	54	14.45	-70.71	15	Passed
5399.850	44.4	54	9.6	-65.86	15	Passed
Emissions in the non-restricted Bands						
Frequency [MHz]	Meas. Result [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]	Result		
5279.950	-62.75	-27.00	35.75	Passed		
5479.950	-61.06	-27.00	34.06	Passed		

Spurious Emissions, a-mode, channel 48 (Operation mode 3)						
Peak Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Max Peak Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
3692.350	50.02	74	23.98	-60.24	15	Passed
4914.075	51.31	74	22.69	-58.95	15	Passed
5439.475	52.92	74	21.08	-57.34	15	Passed
Average Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Average Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
3693.125	38.72	54	15.28	-71.54	15	Passed
4919.775	39.34	54	14.66	-70.92	15	Passed
5439.875	42.17	54	11.83	-68.09	15	Passed
Emissions in the non-restricted Bands						
Frequency [MHz]	Meas. Result [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]	Result		
5279.925	-63.17	-27.00	36.17	Passed		

Spurious Emissions, n20-mode, channel 36 (Operation mode 4)						
Peak Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Max Peak Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
3648.150	49.95	74	24.05	-60.31	15	Passed
4564.650	50.45	74	23.55	-59.81	15	Passed
5359.825	54.37	74	19.63	-55.89	15	Passed
Average Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Average Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
3647.675	38.73	54	15.27	-71.53	15	Passed
4559.850	39.04	54	14.96	-71.22	15	Passed
5359.850	44.68	54	9.32	-65.58	15	Passed
Emissions in the non-restricted Bands						
Frequency [MHz]	Meas. Result [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]	Result		
5279.900	-64.11	-27.00	37.11	Passed		
5599.925	-63.40	-27.00	36.40	Passed		

Spurious Emissions, n20-mode, channel 40 (Operation mode 5)						
Peak Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Max Peak Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
4585.250	51.31	74	22.69	-58.95	15	Passed
5399.575	53.98	74	20.02	-56.28	15	Passed
Average Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Average Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
4587.400	38.99	54	15.01	-71.27	15	Passed
5399.875	44.51	54	9.49	-65.75	15	Passed
Emissions in the non-restricted Bands						
Frequency [MHz]	Meas. Result [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]	Result		
3089.100	-65.10	-27.00	38.10	Passed		
5284.325	-63.87	-27.00	36.87	Passed		
5479.900	-61.53	-27.00	34.53	Passed		

Spurious Emissions, n20-mode, channel 48 (Operation mode 6)						
Peak Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Max Peak Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
4697.225	50.31	74	23.69	-59.95	15	Passed
5399.950	53.99	74	20.01	-56.27	15	Passed
Average Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Average Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
4696.075	38.93	54	15.07	-71.33	15	Passed
5399.900	44.36	54	9.64	-65.9	15	Passed
Emissions in the non-restricted Bands						
Frequency [MHz]	Meas. Result [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]	Result		
4482.925	-65.18	-27.00	38.18	Passed		
5479.925	-61.68	-27.00	34.68	Passed		

Spurious Emissions, n40-mode, channel 38 (Operation mode 7)						
Peak Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Max Peak Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
3831.225	50.4	74	23.6	-59.86	15	Passed
5035.675	51.66	74	22.34	-58.6	15	Passed
Average Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Average Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
3828.525	38.62	54	15.38	-71.64	15	Passed
5039.875	40.36	54	13.64	-69.9	15	Passed
Emissions in the non-restricted Bands						
Frequency [MHz]	Meas. Result [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]	Result		
5318.825	-64.71	-27.00	37.71	Passed		
5479.900	-61.15	-27.00	34.15	Passed		

Spurious Emissions, n40-mode, channel 46 (Operation mode 8)						
Peak Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Max Peak Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5077.700	51.95	74	22.05	-58.31	15	Passed
5400.100	54.2	74	19.8	-56.06	15	Passed
Average Emission – Restricted Band						
Frequency [MHz]	Meas. Result [dBμV/m]	Average Limit [dBμV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5079.600	40.56	54	13.44	-69.7	15	Passed
5399.875	44.13	54	9.87	-66.13	15	Passed
Emissions in the non-restricted Bands						
Frequency [MHz]	Meas. Result [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]	Result		
3597.200	-64.49	-27.00	37.49	Passed		
5479.900	-61.09	-27.00	34.09	Passed		
5679.900	-62.89	-27.00	35.89	Passed		

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

30, 80

5.7.4 Method of measurement (radiated emissions)

The radiated emission measurement is subdivided into four stages.

- A preliminary measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 30 MHz to 1 GHz.
- A final measurement carried out on an open area test 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 110 GHz.
- A final measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 1 GHz to 110 GHz.

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

Preliminary and final measurement (1 GHz to 110 GHz)

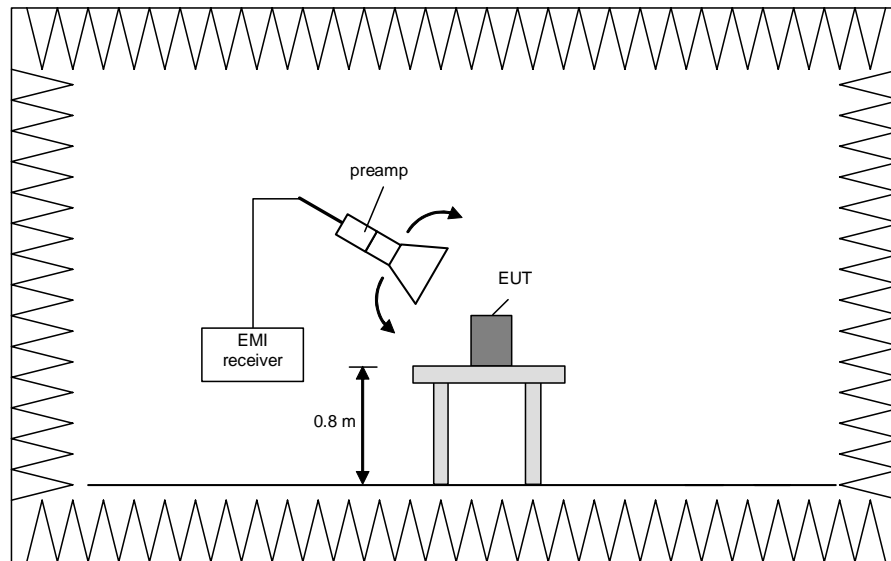
This measurement will be performed in a fully anechoic chamber. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices will be placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance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

Preliminary measurement (1 GHz to 110 GHz)

The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The spectrum analyser set to MAX Hold mode and a resolution bandwidth of 100 kHz. The measurement will be performed in horizontal and vertical polarisation of the measuring antenna, the antenna close to the EUT and while moving the antenna over all sides of the EUT. With the spectrum analyser in CLEAR / WRITE mode the cone of the emission should be found and then the measuring distance will be set to 3 m with the receiving antenna moving in this cone of emission. At this position the final measurement will be carried out.

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

Frequency range	Resolution bandwidth
1 GHz to 4 GHz	100 kHz
4 GHz to 12 GHz	100 kHz
12 GHz to 18 GHz	100 kHz
18 GHz to 26.5 GHz	100 kHz
26.5 GHz to 40 GHz	100 kHz
40 GHz to 60 GHz	100 kHz
50 GHz to 75 GHz	100 kHz
75 GHz to 110 GHz	100 kHz

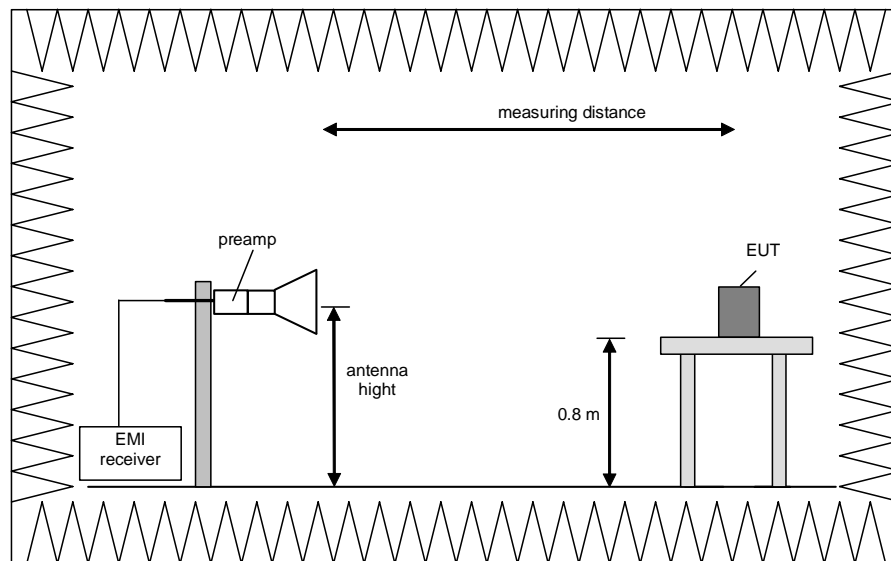


Final measurement (1 GHz to 110 GHz)

The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The EMI Receiver set to peak and average mode and a resolution bandwidth of 1 MHz. The measurement will be performed in horizontal and vertical polarisation of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 ° to 360 ° in order to have the antenna inside the cone of radiation.

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

Frequency range	Resolution bandwidth
1 GHz to 4 GHz	1 MHz
4 GHz to 12 GHz	1 MHz
12 GHz to 18 GHz	1 MHz
18 GHz to 26.5 GHz	1 MHz
26.5 GHz to 40 GHz	1 MHz
40 GHz to 60 GHz	1 MHz
50 GHz to 75 GHz	1 MHz
75 GHz to 110 GHz	1 MHz



Procedure of measurement:

The measurements were performed in the frequency range 1 GHz to 4 GHz, 4 GHz to 12 GHz, 12 GHz to 18 GHz, 18 GHz to 26.5 GHz, 26.5 GHz to 40 GHz, 40 GHz to 60 GHz, 60 GHz to 75 GHz and 75 GHz to 110 GHz.

The following procedure will be used:

- 1) Monitor the frequency range at horizontal polarisation and move the antenna over all sides of the EUT (if necessary move the EUT to another orthogonal axis).
- 2) Change the antenna polarisation and repeat 1) with vertical polarisation.
- 3) Make a hardcopy of the spectrum.
- 4) Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
- 5) Change the analyser mode to Clear / Write and found the cone of emission.
- 6) Rotate and move the EUT, so that the measuring distance can be enlarged to 3 m and the antenna will be still inside the cone of emission.
- 7) Measure the level of the detected frequency with the correct resolution bandwidth, with the antenna polarisation and azimuth and the peak and average detector, which causes the maximum emission.
- 8) Repeat steps 1) to 7) for the next antenna spot if the EUT is larger than the antenna beamwidth.

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

5.7.5 Test results (radiated emissions) – cabinet emissions

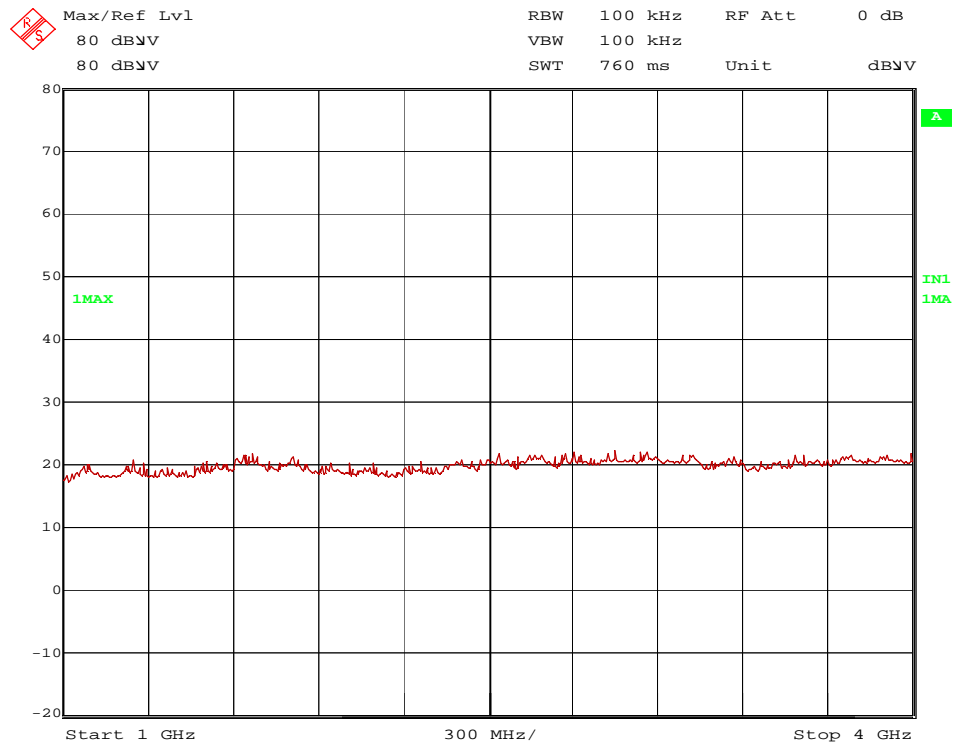
5.7.5.1 Preliminary radiated emission measurement

Ambient temperature	22 °C	Relative humidity	59 %
---------------------	-------	-------------------	------

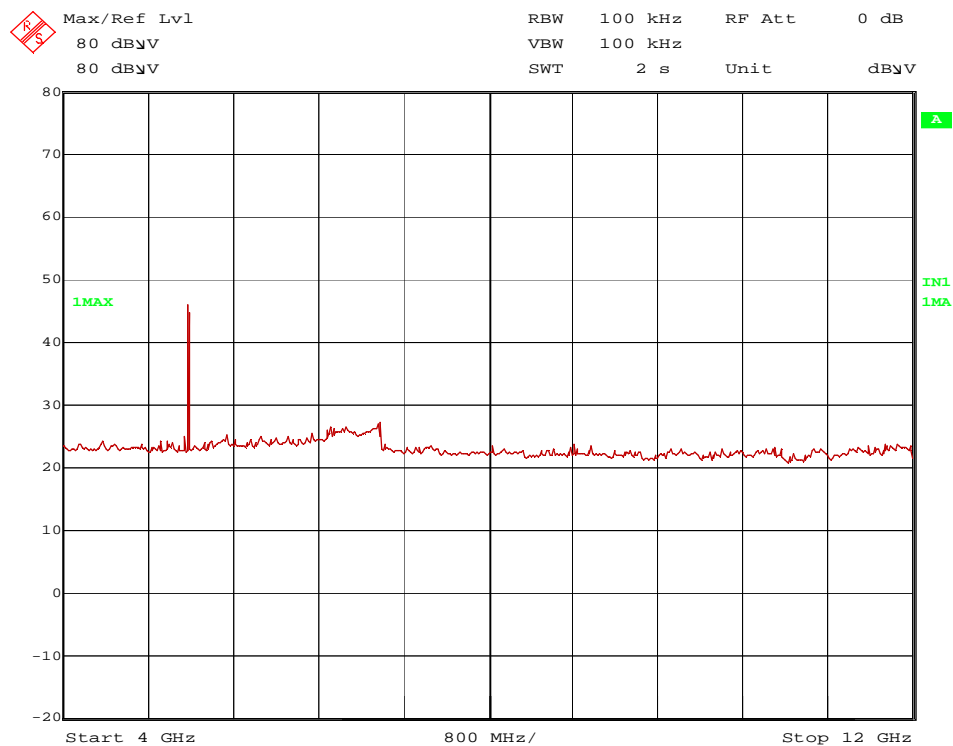
- Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.
- Cable guide: For detail information of test set-up and the cable guide refer to the pictures in Table 2.
- Test record: All results are shown in the following.
- Supply voltage: During all measurements the host of the EUT was powered with 24 V via an AC/DC Adapter.
- Remark: Document [3] states in 12.2.1, that in case of conducted measurements, additional radiated cabinet emission measurements must be performed. The measurements were performed at the worst case modulation, namely 802.11n20 mode with at channel 36, 40 and 48.
- Because no emissions were found emitting from the housing, a randomly selected series of plot is submitted for every frequency range above 1 GHz in the preliminary results.
- The emissions below 1 GHz were measured and compared to the test report F134981E3. Because no changes occurred compared to the original test report, the relating results are not documented in this report.

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

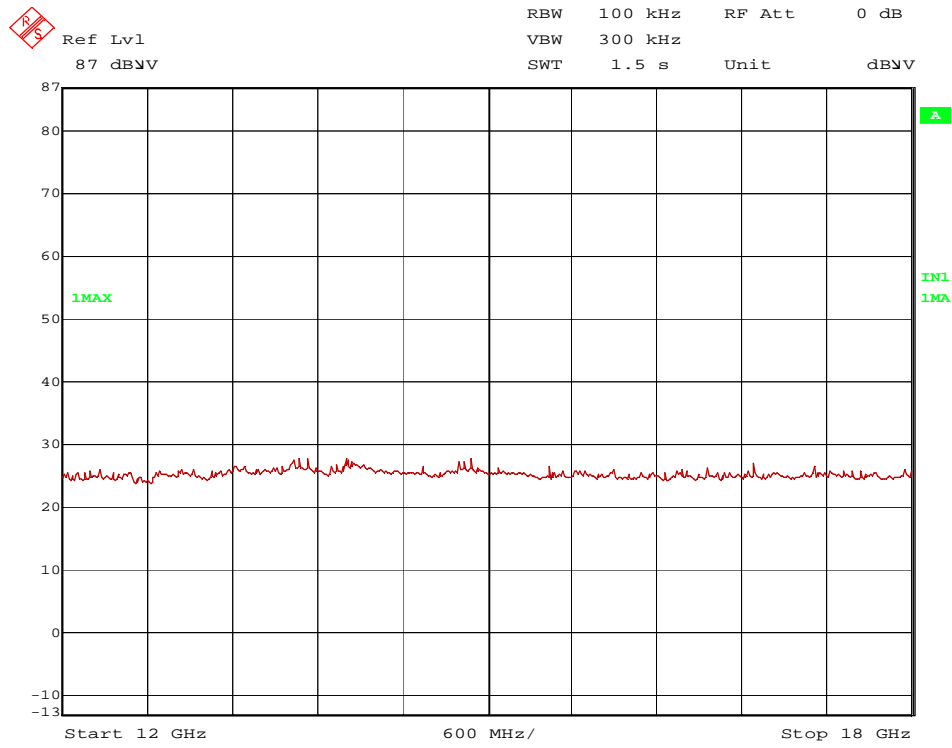
134981_n20_ch36_1-4G.wmf: Spurious emissions from 1 GHz to 4 GHz (operation mode 4):



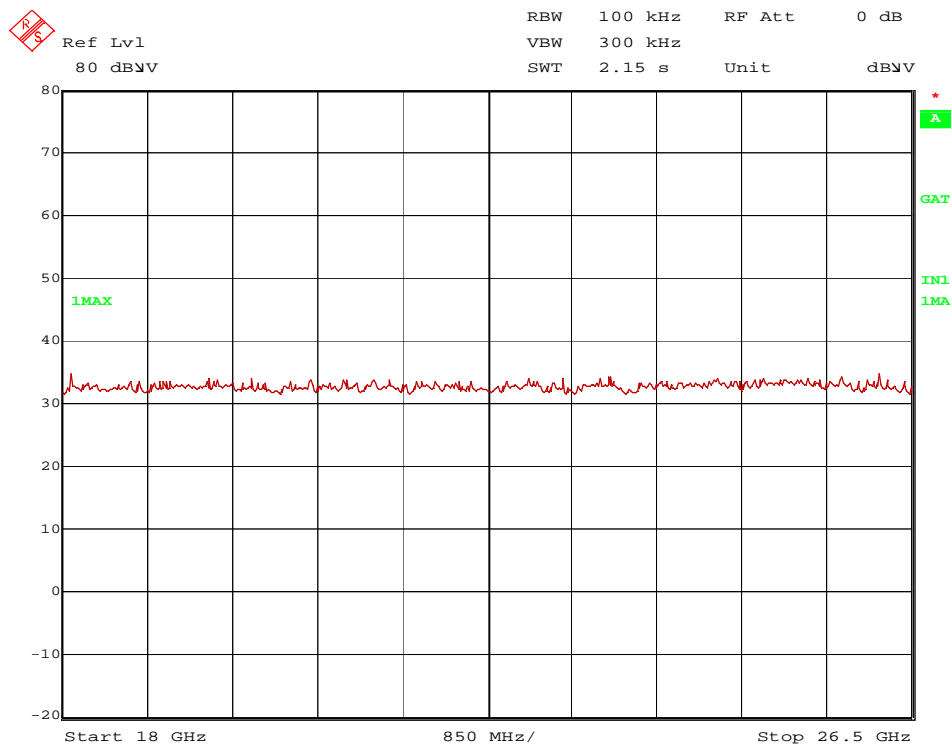
134981_n20_ch36_4-12G.wmf: Spurious emissions from 4 GHz to 12 GHz (operation mode 4):



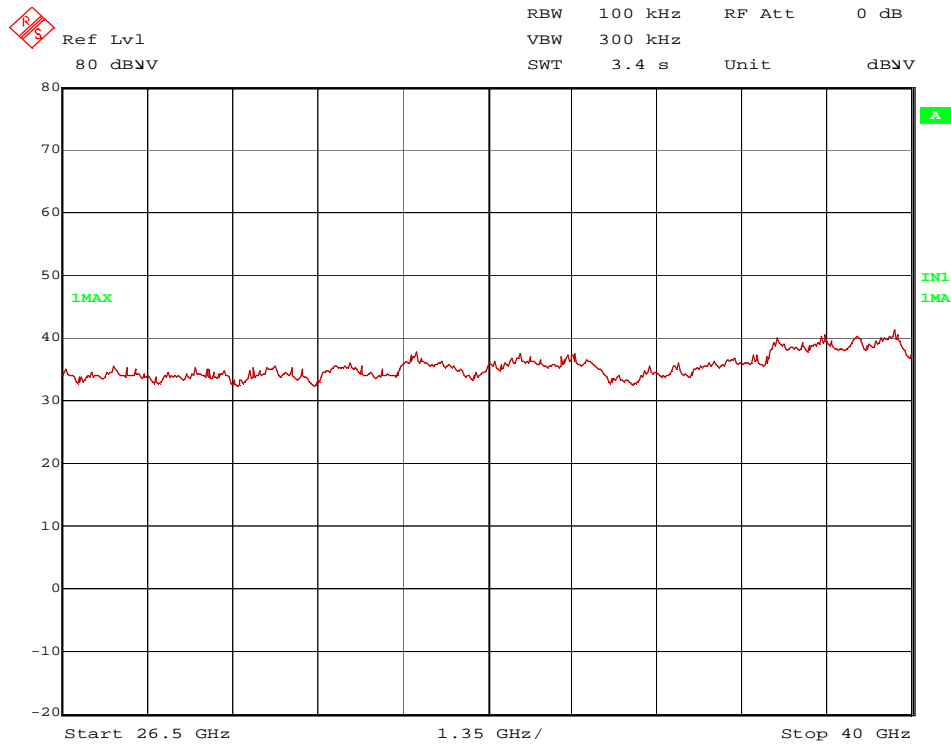
254_04.wmf: Spurious emissions from 12 GHz – 18 GHz (operation mode 4):



981_12.wmf: Spurious emissions from 18 GHz – 26.5 GHz (operation mode 4):



981_13.wmf: Spurious emissions from 26.5 GHz – 40 GHz (operation mode 4):



No spurious emissions were found during the preliminary measurements, therefor no final measurements were performed

TEST EQUIPMENT USED FOR THE TEST:
29, 31 – 37, 39 - 44, 46, 49 – 51, 55, 72, 73

5.7.5.2 Final radiated emission measurement

Because there was no spurious emission found during the preliminary measurement no final measurement was performed.

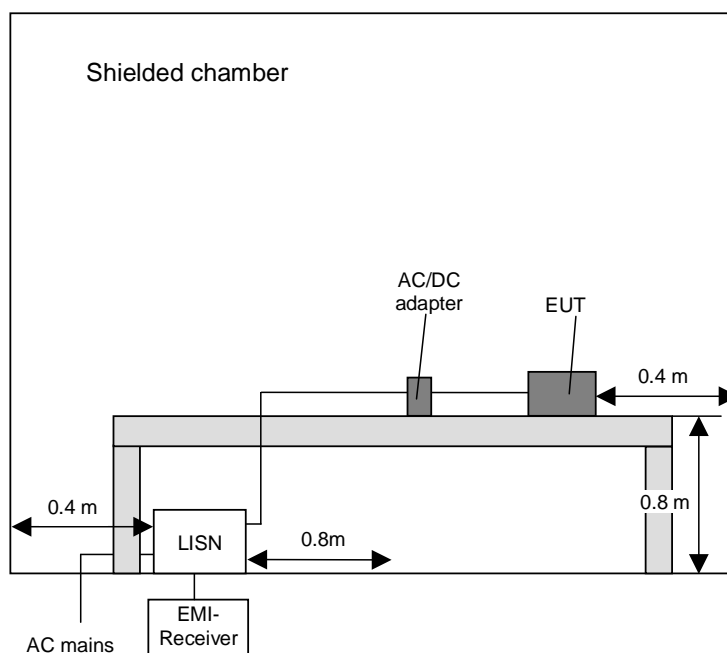
5.8 Conducted emissions on power supply lines (150 kHz to 30 MHz)

5.8.1 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 C63.4-2009 [1].

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

Frequency range	Resolution bandwidth
150 kHz to 30 MHz	9 kHz



5.8.2 Test results (conducted emissions on power supply lines)

Ambient temperature	20 °C	Relative humidity	27 %
---------------------	-------	-------------------	------

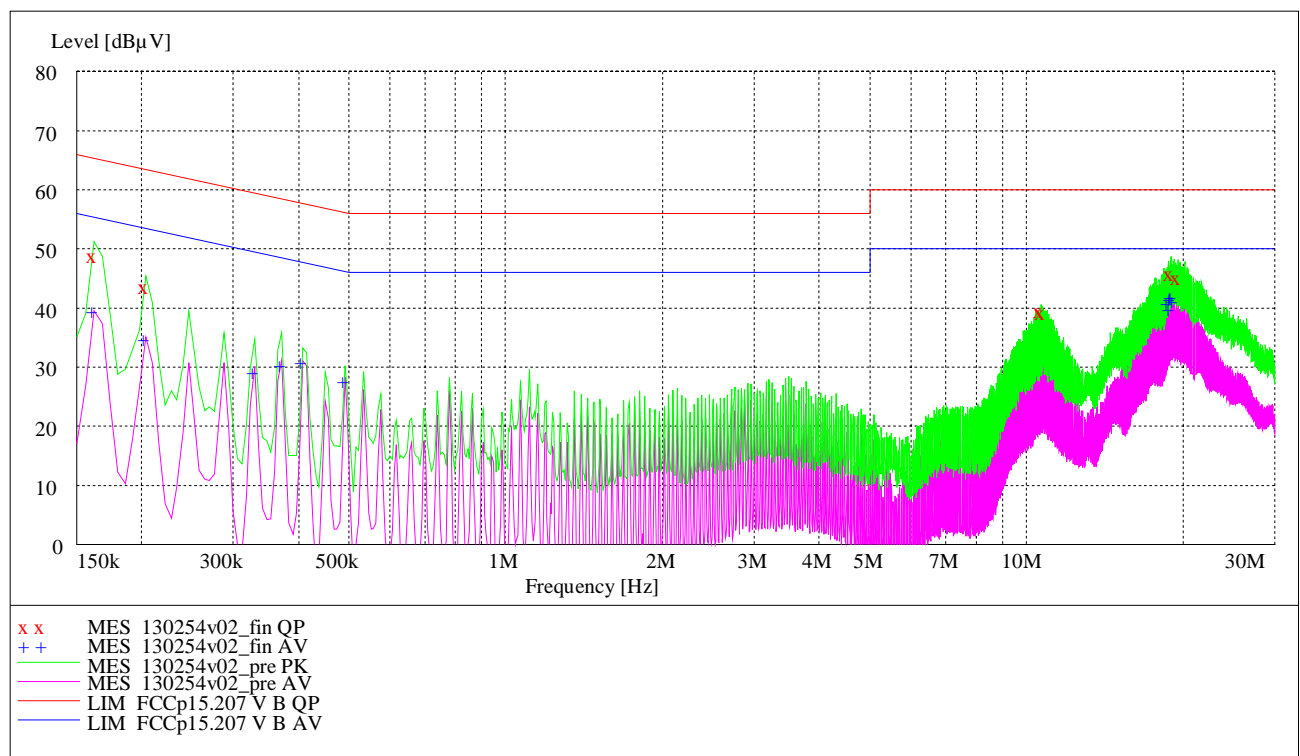
Position of EUT: For the test the EUT together with the basic unit were connected to a laptop PC via an Ethernet cable. To emulate a real use case, a connection between the laptop PC another laptop PC connected wireless to the Access Point was established. To emulate real traffic, an iperf stream was send from one laptop PC to the other. The laptop PC and the EUT were set-up on a non-conducting table of a height of 0.8 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.

Test record: All results are shown in the following.

Supply voltage: The changes on the module were such, that the conducted emissions were not influenced. Therefor the measurement was not repeated, but the previous results are submitted below.

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: 130254v02

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

Frequency MHz	Level dB μ V	Transducer dB	Limit dB μ V	Margin dB	Line	PE
0.162000	49.30	1.5	65.4	16.1	N	FLO
0.204000	44.00	1.0	63.4	19.4	L1	FLO
10.680000	39.80	1.4	60.0	20.2	N	GND
10.722000	39.60	1.4	60.0	20.4	N	GND
18.978000	46.30	2.3	60.0	13.7	L1	GND
19.554000	45.60	2.4	60.0	14.4	L1	FLO

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

1 – 4, 20

6 TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

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	ESIB 26	Rohde & Schwarz	1088.7490	481182	03/09/2012	03/2014
4	High pass filter	HR 0.13- 5ENN	FSY Microwave Inc.	DC 0109 SN 002	480340	Weekly verification (system cal.)	
14	Open area test site	-	Phoenix Test-Lab	-	480085	Weekly verification (system cal.)	
15	Measuring receiver	ESIB7	Rohde & Schwarz	100304	480521	02/15/2012	02/2014
16	Controller	HD100	Deisel	100/670	480139	-	-
17	Turntable	DS420HE	Deisel	420/620/80	480087	-	-
18	Antenna support	MA240-0	Inn-Co GmbH	MA240- 0/030/6600603	480086	-	-
19	Antenna	CBL6111 D	Chase	25761	480894	09/28/2011	09/2014
20	EMI Software	ES-K1	Rohde & Schwarz	-	480111	-	-
29	Fully anechoic chamber M20	-	Albatross Projects	B83107-E2439-T232	480303	Weekly verification (system cal.)	
30	Spectrum analyser	FSU	Rohde & Schwarz	200125	480956	02/15/2012	02/2014
31	Measuring receiver	ESI 40	Rohde & Schwarz	100064	480355	02/13/2012	02/2014
32	Controller	MCU	Maturo	MCU/043/971107	480832	-	-
33	Turntable	DS420HE	Deisel	420/620/80	480315	-	-
34	Antenna support	AS615P	Deisel	615/310	480187	-	-
35	Antenna	CBL6112 B	Chase	2688	480328	04/21/2011	04/2014
36	Antenna	3115 A	EMCO	9609-4918	480183	11/09/2011	11/2014
37	Standard Gain Horn 11.9 GHz – 18 GHz	18240-20	Flann Microwave	483	480294	Six month verification (system cal.)	
39	Standard Gain Horn 17.9 GHz – 26.7 GHz	20240-20	Flann Microwave	411	480297	Six month verification (system cal.)	
40	Standard Gain Horn Antenne 26.4 – 40.1 GHz	22240-20	Flann Microwave	469	480229	Six month verification (system cal.)	
41	RF-cable No. 3	Sucoflex 106B	Huber&Suhner	0563/6B / Kabel 3	480670	Weekly verification (system cal.)	
42	RF-cable No. 40	Sucoflex 106B	Huber&Suhner	0708/6B / Kabel 40	481330	Weekly verification (system cal.)	
43	RF-cable No. 30	RTK 081	Rosenberger	-	410141	Weekly verification (system cal.)	
44	RF-cable No. 31	RTK 081	Rosenberger	-	410142	Weekly verification (system cal.)	
46	RF-cable 1 m	KPS-1533- 400-KPS	Insulated Wire	-	480301	Six month verification (system cal.)	
49	Preamplifier	JS3- 00101200- 23-5A	Miteq	681851	480337	Six month verification (system cal.)	
50	Preamplifier	JS3- 12001800- 16-5A	Miteq	571667	480343	Six month verification (system cal.)	

51	Preamplifier	JS3-18002600-20-5A	Miteq	658697	480342	Six month verification (system cal.)	
55	Loop antenna	HFH2-Z2	Rohde & Schwarz	832609/014	480059	02/16/2012	02/2014
60	Power Meter	NRVD	Rohde & Schwarz	833697/030	480589	02/15/2012	02/2014
61	Thermal Power Sensor	NRV-Z51	Rohde & Schwarz	825948/004	480247	07/15/2013	07/2014
72	4 GHz High Pass Filter	WHKX4.0/18 G-8SS	Wainwright Instruments	1	480587	Weekly verification (system cal.)	
73	Single Control Unit	SCU	Maturo GmbH	SCU/006/971107	480831	Calibration not necessary	
80	High-pass Filter	H26G40G1	Microwave Circuits, Inc.	33471	480593	Six month verification (system cal.)	

