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Test Report

Report Number:

F145298E8

Applicant:

u-blox Malmö AB

Manufacturer:

u-blox Malmö AB

Equipment under Test (EUT):

ODIN-W161

DAkkS
Deutsche
Akkreditierungsstelle
D-PL-17186-01-01
D-PL-17186-01-02
D-PL-17186-01-03

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 C63.10-2013** 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 (December 2014)** Radio Frequency Devices

[3] **Publication Number 789033 (June 2014)** UNII Meas Guidelines v01

[4] **RSS-210 Issue 8 (December 2010)** Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment

[5] **RSS-Gen Issue 4 (November 2014)** General Requirements for Compliance of Radio Apparatus

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:	Wolfgang KASALOWSKY Name	W. Kasalowsky Signature	25 June 2015 Date
Authorized reviewer:	Bernd STEINER Name	B. Stu Signature	25 June 2015 Date

RESERVATION

This test report is only valid in its original form.

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

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1 IDENTIFICATION

1.1 Applicant

Name:	u-blox Malmö AB
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Country:	Sweden
Name for contact purposes:	Mr. Mats ANDERSSON
Phone:	+ 46 40 63 07 100
Fax:	+ 46 40 23 71 37
eMail Address:	mats.andersson@u-blox.com
Applicant represented during the test by the following person:	None

1.2 Manufacturer

Name:	u-blox Malmö AB
Address:	Östra Varvsgatan 4, 5 tr, SE-211 75 Malmö
Country:	Sweden
Name for contact purposes:	Mr. Mats ANDERSSON
Phone:	+ 46 40 63 07 100
Fax:	+ 46 40 23 71 37
eMail Address:	mats.andersson@u-blox.com
Applicant represented during the test by the following person:	None

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: *	WLAN module
HVIN / Model name: *	ODIN-W161
FCC ID: *	KQ9-W161A
IC: *	1317A-W161A
Serial number: *	WLAN: 292006260209, 292006260218, 292006259621, 292006259601, 292006260221
PCB identifier: *	0953-03
Hardware version: *	3.1
Software version: *	cB-2282(wlan_pcti_release_1.0.13605)

Fulfills WLAN specification: *	IEEE, 802.11b, 802.11g, 802.11n, 802.11a					
Antenna type: *	Integral antenna					
	TE connectivity P/N: 1513164-1					
Antenna gain: *	4 dBi					
Antenna connector: *	temporary UFL connector for test purposes only					
Power supply - EUT	3.3 V DC					
Power supply Host	U_{nom}=	5 V DC	U_{min}=	3.6 V DC	U_{max}=	6 V DC
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, 5260 MHz to 5320 MHz, 5500 MHz to 5700 MHz, 5745 to 5825 MHz					
Number of channels: *	32					
Temperature range: *	-40 °C to +85 °C					
Lowest / highest Internal clock frequency: *	32768 Hz / 26.000 MHz					

* declared by the applicant.

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 52	RX:	5260 MHz	TX:	5260 MHz
Channel 56	RX:	5280 MHz	TX:	5280 MHz
Channel 60	RX:	5300 MHz	TX:	5300 MHz
Channel 64	RX:	5320 MHz	TX:	5320 MHz

Channel 100	RX:	5500 MHz	TX:	5500 MHz
Channel 104	RX:	5520 MHz	TX:	5520 MHz
Channel 108	RX:	5540 MHz	TX:	5540 MHz
Channel 112	RX:	5560 MHz	TX:	5560 MHz
Channel 116	RX:	5580 MHz	TX:	5580 MHz

Channel 132	RX:	5660 MHz	TX:	5660 MHz
Channel 136	RX:	5680 MHz	TX:	5680 MHz
Channel 140	RX:	5700 MHz	TX:	5700 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

The following external I/O cables were used:

Identification	Length
DC power cable	2 m *
RS232 cable	2 m *

*: Length during the test if not other specified.

1.5 Dates

Date of receipt of test sample:	03 September 2014
Start of test:	10 September 2014
End of test:	19 September 2014

2 OPERATIONAL STATES

The equipment under test (EUT) is a WLAN dual band module soldered on to a reference design board. The WLAN module is equipped with an integral antenna on the reference design board. The reference design board is connected to an adaptor board. A RS232 connector and the power supply connector are located at the adaptor board.

The tests were carried out with an unmodified sample of the EUT. Some tests were carried out conducted at the temporary UFL connector at the radio board. Other tests were carried out radiated with the integral antenna on the reference design.

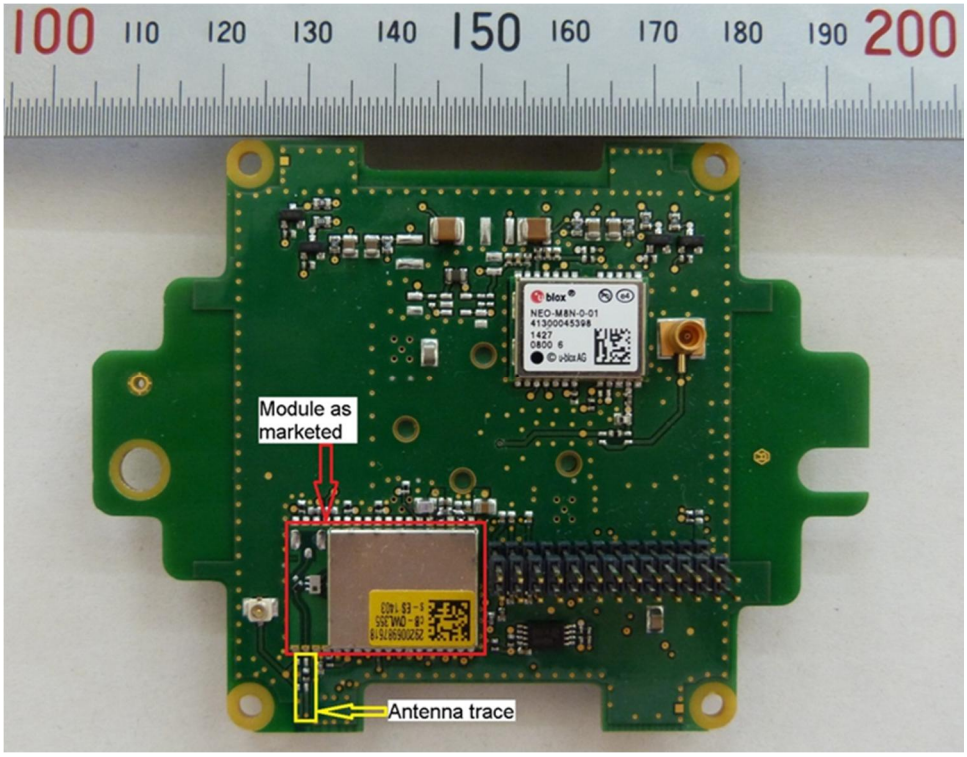
The adaptor board was connected via a RS232 connection to a laptop computer. With test software running on the laptop the operation mode as shown in the table below could be chosen.

During the tests, the test samples were powered with 5 V via the power supply connection of the adaptor board 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 5260 MHz	a	52	OFDM	6 MBit/s
5	Continuous transmitting on 5300 MHz	a	60	OFDM	6 MBit/s
6	Continuous transmitting on 5320 MHz	a	64	OFDM	6 MBit/s
7	Continuous transmitting on 5500 MHz	a	100	OFDM	6 MBit/s
8	Continuous transmitting on 5580 MHz	a	116	OFDM	6 MBit/s
9	Continuous transmitting on 5700 MHz	a	140	OFDM	6 MBit/s
10	Continuous transmitting on 5745 MHz	a	149	OFDM	6 MBit/s
11	Continuous transmitting on 5785 MHz	a	157	OFDM	6 MBit/s
12	Continuous transmitting on 5825 MHz	a	165	OFDM	6 MBit/s
13	Continuous transmitting on 5180 MHz	n20	36	OFDM	6.5 MBit/s
14	Continuous transmitting on 5200 MHz	n20	40	OFDM	6.5 MBit/s
15	Continuous transmitting on 5240 MHz	n20	48	OFDM	6.5 MBit/s
16	Continuous transmitting on 5260 MHz	n20	52	OFDM	6.5 MBit/s
17	Continuous transmitting on 5300 MHz	n20	60	OFDM	6.5 MBit/s
18	Continuous transmitting on 5320 MHz	n20	64	OFDM	6.5 MBit/s
19	Continuous transmitting on 5500 MHz	n20	100	OFDM	6.5 MBit/s
20	Continuous transmitting on 5580 MHz	n20	116	OFDM	6.5 MBit/s
21	Continuous transmitting on 5700 MHz	n20	140	OFDM	6.5 MBit/s
22	Continuous transmitting on 5745 MHz	n20	149	OFDM	6.5 MBit/s
23	Continuous transmitting on 5785 MHz	n20	157	OFDM	6.5 MBit/s
24	Continuous transmitting on 5825 MHz	n20	165	OFDM	6.5 MBit/s
25	Normal operation Mode with automatic channel selection from Access Points	-	-	OFDM	-

Physical boundaries of the ODIN-W161 and integral antenna on the reference design:



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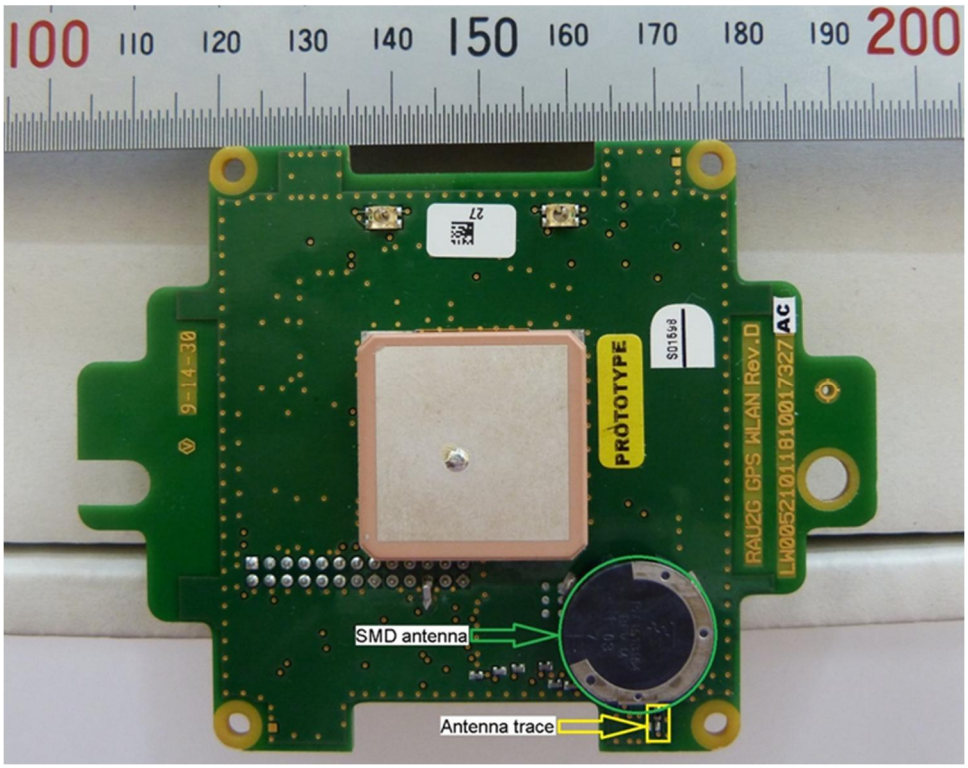
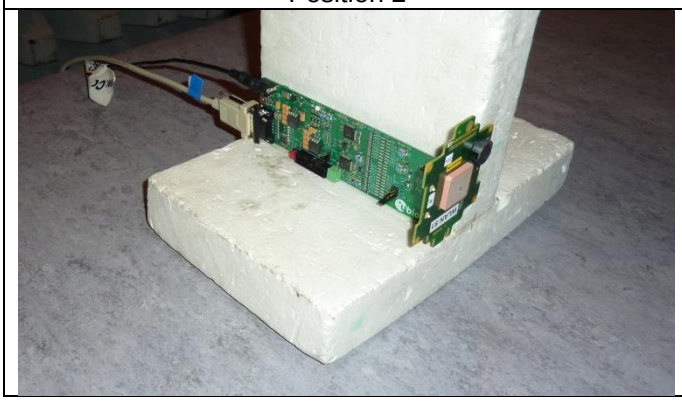


Table 1: Worst case test setup

Position 1	Position 3
	
Position 2	
	

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 following test modes were adjusted during the tests:

Test items	Operation mode
Maximum Conducted Output Power	1 - 24
Emission Bandwidth	1 - 18
Minimum Emission Bandwidth for the band 5.725 – 5.85 GHz	22 - 24
Maximum Power Spectral Density	1 - 24
Band Edge Compliance	1, 3, 4, 6, 7, 9, 10, 12, 13, 15, 16, 18, 19, 21, 22, 24
Maximum Unwanted Emissions	1 - 24
Conducted emission on power supply line	25

3 ADDITIONAL INFORMATION

The power was set to the values shown in the table below.

Channel	36 - 48	52 - 64	100	104 - 136	140	149 - 165
Power a/n20 modes (for 5 GHz)	13.5	16.0	15.0	14.5	13.0	18.0

This report contains the results of the EUT operating in the 5 GHz UNII band only.

4 OVERVIEW

Application	Frequency range [MHz]	FCC 47 CFR Part 15 section [2]	RSS 210, Issue 8 [4] or RSS-Gen, Issue 4 [5]	Status	Refer page
Maximum Conducted Output Power	5150 – 5250 5250 – 5350 5470 – 5725	15.407 (a)	A9.2 [4]	Passed	14 et seq
	5725 - 5850	15.407 (a)	-	Passed	
Emission Bandwidth	5150 – 5250 5250 – 5350 5470 – 5725	15.403 (i)	A9.2 [4]	Passed	16 et seq
	5725 - 5850	15.403 (i)	-	Passed	18 et seq
Maximum Power Spectral Density	5150 – 5250 5250 – 5350 5470 - 5725	15.407 (a)(5)	A9.2 [4]	Passed	20 et seq
	5725 - 5850	15.407 (a)(5)	-	Passed	23 et seq
Frequency Stability	5150 – 5250	15.407 (g)	A9.5 [4]	Passed	25 et seq
Band edge compliance	5150 – 5250 5250 – 5350 5470 - 5725	15.407 (b)	A8.5 [4]	Passed	27 et seq.
	5725 - 5850	15.407 (b)	-	Passed	31 et seq
Radiated emissions (transmitter)	0.009 - 40,000	15.407 (b) 15.205 (a) 15.209 (a)	8.9 [5], 2.5 [4]	Passed	37 et seq.
Conducted emissions on supply line	0.15 - 30	15.207 (a)	8.8 [5]	Passed	68 et seq.

5 TEST RESULTS

5.1 Maximum conducted output power

5.1.1 Method of measurement

The EUT has to be connected to the power meter via a low loss cable.

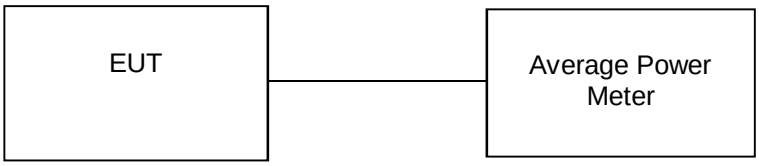
Acceptable measurement configurations

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 antenna gain is 4 dBi. Therefore no reduction of the power limit is necessary.

Operation Mode	Nominal Channel frequency	Antenna gain combined [dBi]	Maximum output power [dBm]	Margin [dB]	power limit [dBm]	Power limit calculated from 26 dB Bandwidth
1	5180 MHz	3	12.3	11.7	24	-
2	5200 MHz	3	13.1	10.9	24	-
3	5240 MHz	3	12.9	11.1	24	-
4	5260 MHz	3	15.2	8.8	24	26.48
5	5300 MHz	3	15.1	8.9	24	26.45
6	5320 MHz	3	13.8	10.2	24	25.67
7	5500 MHz	3	15.1	8.9	24	25.70
8	5580 MHz	3	14.6	9.4	24	26.63
9	5700 MHz	3	13.0	11.0	24	24.82
10	5745 MHZ	3	18.7	11.3	30	-
11	5785 MHz	3	18.8	11.2	30	-
12	5850 MHz	3	18.6	11.4	30	-
13	5180 MHz	3	12.2	11.8	24	-
14	5200 MHz	3	12.9	11.1	24	-
15	5240 MHz	3	12.9	11.1	24	-
16	5260 MHz	3	15.1	8.9	24	26.74
17	5300 MHz	3	15.1	8.9	24	26.65
18	5320 MHz	3	13.7	10.3	24	25.93
19	5500 MHz	3	14.5	9.5	24	25.67
20	5580 MHz	3	14.5	9.5	24	26.90
21	5700 MHz	3	12.8	11.2	24	25.05
22	5745 MHZ	3	18.7	11.3	30	-
23	5785 MHz	3	18.7	11.3	30	-
24	5850 MHz	3	18.6	11.4	30	-
Measurement uncertainty			+0.66 dB / -0.72 dB			

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
26, 27

5.2 Emission 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.1. 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 analyser. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

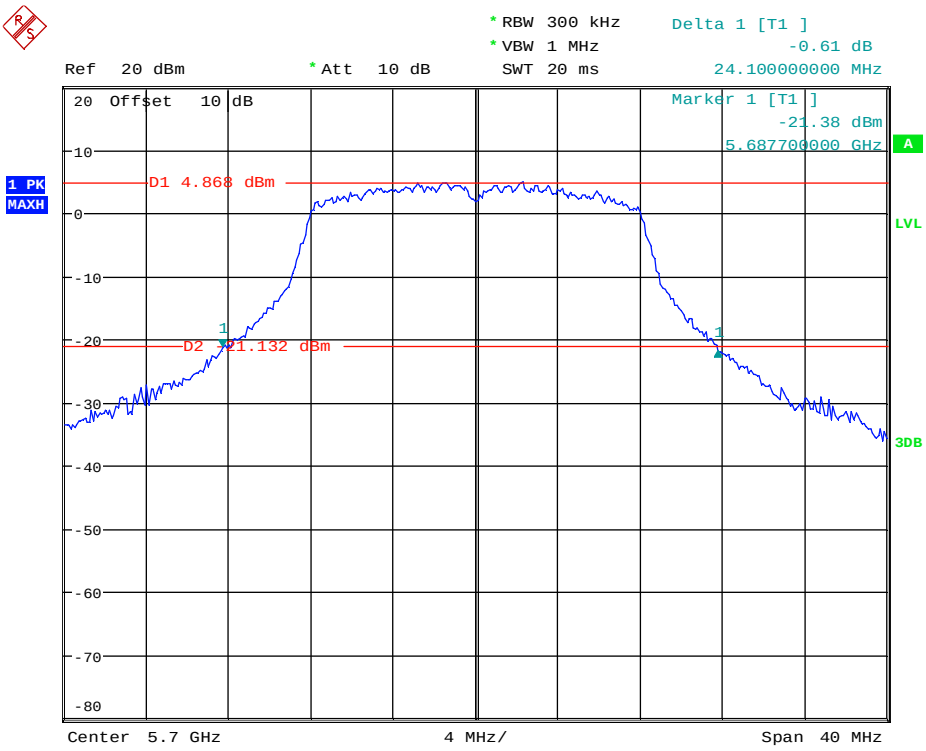
5.2.2 Test result

Ambient temperature	22 °C

Relative humidity	59 %

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

137117_26dB-BW_a_140: Emission Bandwidth (operation mode 9):



Operation Mode	Nominal Channel frequency [MHz]	26 dB Bandwidth [MHz]	Result
1	5180	25.100	Passed
2	5200	26.600	Passed
3	5240	26.000	Passed
4	5260	35.300	Passed
5	5300	35.100	Passed
6	5320	29.300	Passed
7	5500	28.300	Passed
8	5580	26.000	Passed
9	5700	24.100	Passed
13	5180	26.300	Passed
14	5200	28.800	Passed
15	5240	28.400	Passed
16	5260	37.500	Passed
17	5300	36.700	Passed
18	5320	31.100	Passed
19	5500	29.200	Passed
20	5580	27.600	Passed
21	5700	25.400	Passed
Measurement uncertainty		+0.66 dB / -0.72 dB	

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

7

5.3 Minimum Emission Bandwidth for the band 5.725 – 5.850 GHz

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 C.2. of document [3].

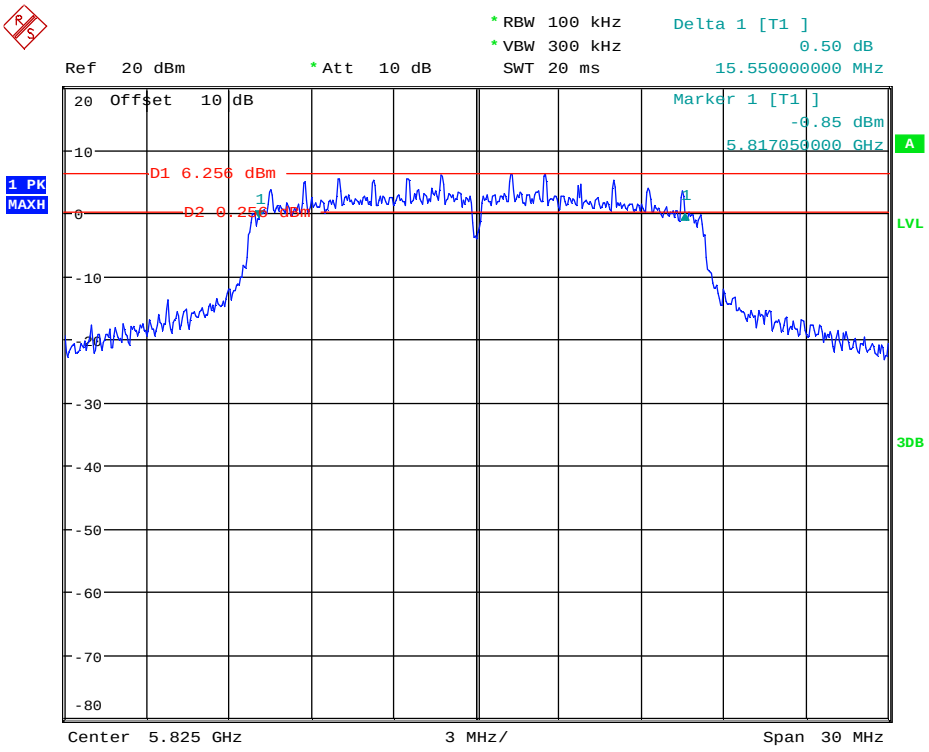
- Set RBW = 100 kHz.
- Set the video bandwidth (VBW) ≥ 3 x RBW.
- Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Allow the trace to stabilize.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

5.3.2 Test result

Ambient temperature	22 °C	Relative humidity	59 %

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

136117_6dB-BW_a_165.wmf: Emission Bandwidth (operation mode 3):



Operation Mode	Center Frequency [MHz]	Minimum 6-dB Bandwidth Limit [MHz]	6 dB Bandwidth [MHz]	Result
1	5745	0.5	15.500	Passed
2	5785	0.5	15.400	Passed
3	5825	0.5	15.550	Passed
4	5745	0.5	15.250	Passed
5	5785	0.5	15.250	Passed
6	5825	0.5	15.550	Passed
Measurement uncertainty		+0.66 dB / -0.72 dB		

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

7

5.4 Maximum Power Spectral Density

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 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 ≥ 3 MHz.
- Number of points in sweep ≥ 2 Span / RBW. (This ensures that bin-to-bin spacing is ≤ 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 PPSD.
- 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.

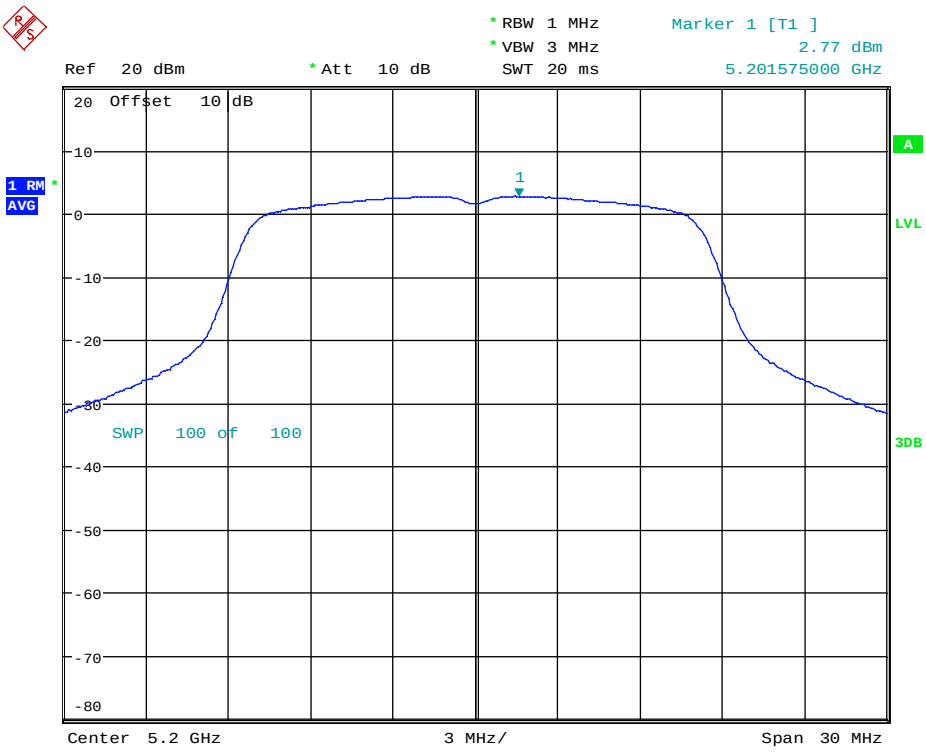
The measurements were carried out at each antenna port separately.

5.4.2 Test result

Ambient temperature	22 °C	Relative humidity	59 %

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

136117_PeakPwrSpecDens_a_40.wmf: Power Spectral Density (operation mode 2):



Operation Mode	Nominal Channel frequency [MHz]	Peak Frequency [MHz]	Power Spectral Density Reading [dBm / MHz]	Power Spectral Density Limit [dBm / MHz]	Margin [dB]	Result
1	5180	5181.650	1.91	11	9.09	Passed
2	5200	5201.575	2.78	11	8.22	Passed
3	5240	5238.350	2.56	11	8.44	Passed
4	5260	5261.500	4.63	11	6.37	Passed
5	5300	5298.575	4.31	11	6.69	Passed
6	5320	5318.575	3.04	11	7.96	Passed
7	5500	5498.575	3.84	11	7.16	Passed
8	5580	5578.575	4.39	11	6.61	Passed
9	5700	5698.500	1.70	11	9.30	Passed
13	5180	5181.400	1.55	11	9.45	Passed
14	5200	5198.700	2.49	11	8.51	Passed
15	5240	5238.600	2.35	11	8.65	Passed
16	5260	5258.600	4.51	11	6.49	Passed
17	5300	5298.400	4.16	11	6.84	Passed
18	5320	5321.600	2.87	11	8.13	Passed
19	5500	5498.500	4.11	11	6.98	Passed
20	5580	5578.300	4.16	11	6.84	Passed
21	5700	5698.500	1.34	11	9.66	Passed
Measurement uncertainty			+0.66 dB / -0.72 dB			

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
7

5.4.3 Method of measurement for the band 5.725 – 5.85 GHz

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.

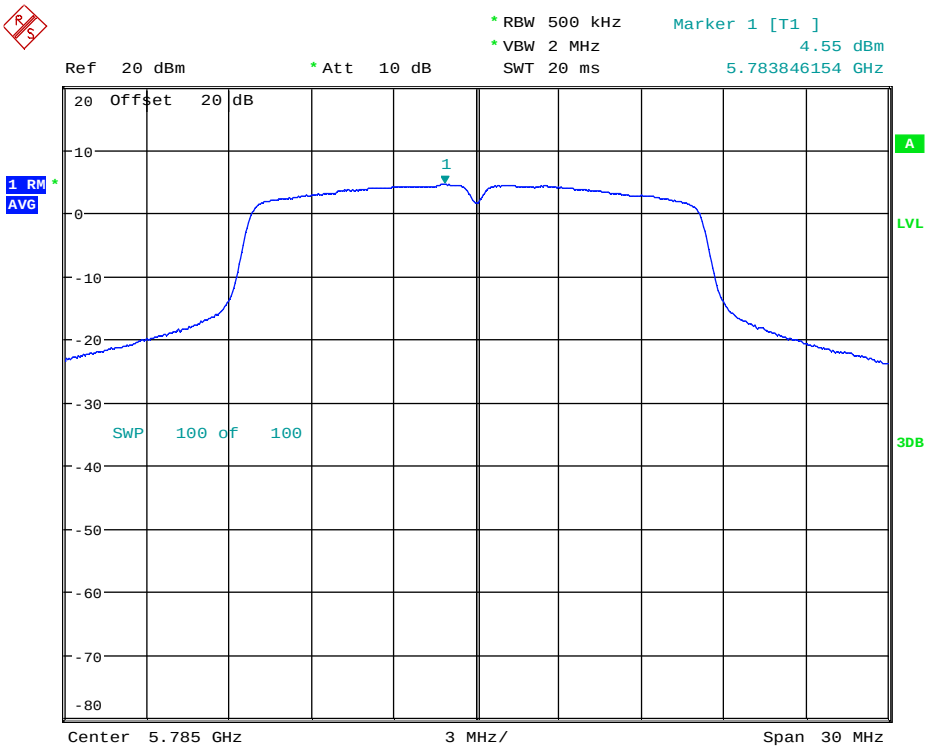
- Set span to encompass the entire 26-dB emission bandwidth (EBW) (or, alternatively, the entire 99% occupied bandwidth) of the signal.
- Set RBW = 500 kHz.
- Set VBW ≥ 1.5 MHz.
- Number of points in sweep ≥ 2 Span / RBW. (This ensures that bin-to-bin spacing is ≤ RBW/2, so that narrowband signals are 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 Maximum PSD over 500 kHz reference bandwith.
- 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.

5.4.4 Test result

Ambient temperature	21 °C	Relative humidity	44 %

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

145298_PSD_CH157_A_500K.wmf: Power Spectral Density (operation mode 11):



Operation Mode	Nominal Channel frequency [MHz]	Peak Frequency [MHz]	Power Spectral Density Reading [dBm / 500 kHz]	Power Spectral Density Limit [dBm / 500 kHz]	Margin [dB]	Result
10	5745	5743.365	4.33	30	25.67	Passed
11	5785	5783.846	4.55	30	25.45	Passed
12	5825	5823.654	4.31	30	25.69	Passed
22	5745	5743.510	4.23	30	25.77	Passed
23	5785	5783.846	4.21	30	25.79	Passed
24	5825	5823.798	3.97	30	26.03	Passed
Measurement uncertainty			+0.66 dB / -0.72 dB			

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

7

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:

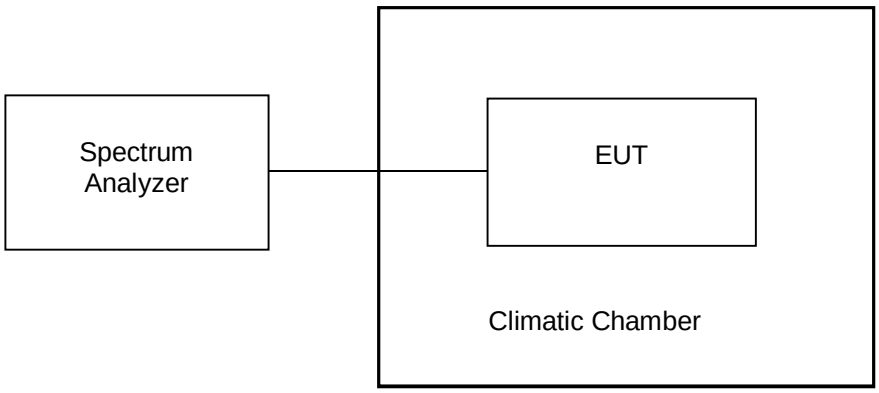
- Attenuation: Auto
- Center Frequency: channel frequency
- Span: 2 MHz
- RWB=VBW: 10 kHz
- Sweep Time: Auto

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 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
3 V	5199.997596	0.31	20	Passed
3.3 V	5199.995994	Reference	20	-
3.6 V	5199.998397	0.46	20	Passed
Measurement uncertainty		+0.66 dB / -0.72 dB		

Temperature [°C]	Measurement Frequency [MHz]	Frequency Deviation [ppm]	Limit [ppm]	Result
-40 °C	5200.002430	0.44	20	Passed
-30 °C	5200.003220	0.59	20	Passed
-20 °C	5200.003190	0.59	20	Passed
-10 °C	5200.002520	0.46	20	Passed
0 °C	5200.000080	-0.01	20	Passed
10 °C	5200.000530	0.08	20	Passed
20 °C	5200.000130	Reference	-	-
30 °C	5200.000080	-0.01	20	Passed
40 °C	5200.000930	0.15	20	Passed
50 °C	5200.000040	-0.02	20	Passed
60 °C	5199.999470	-0.13	20	Passed
70 °C	5199.999200	-0.18	20	Passed
80 °C	5200.001870	0.33	20	Passed
85 °C	5199.994110	-1.16	20	Passed
Measurement uncertainty		+0.66 dB / -0.72 dB		

TEST EQUIPMENT USED FOR THE TEST:
7, 31

5.6 Band-edge compliance

5.6.1 Method of measurement (band edges next to unrestricted bands)

The measurements were carried out in a radiated manner. The measurement procedure refers to part G2 and G3d of document [3].

Measurement Procedure – Unwanted Emissions

- Set the center frequency and span to encompass the frequency range to be measured.
- RBW = 1 MHz. (100 kHz for frequencies below 1 GHz)
- VBW ≥ 3 MHz. (300 kHz for frequencies below 1 GHz)
- Detector = Peak.
- Ensure that the number of measurement points ≥ span/RBW.
- Sweep time = auto couple.
- Trace Mode = max hold.
- Allow the trace to stabilise.
- Use the peak marker function to determine the maximum amplitude level.

Section G3d states, that unwanted Emissions within 2 MHz of the band edge may be measured using special band-edge techniques (the marker delta method or integration methods), provided that the 99% occupied bandwidth falls within the 2 MHz of the band edge. Otherwise all unwanted emissions measurements shall be performed using the standard methods.

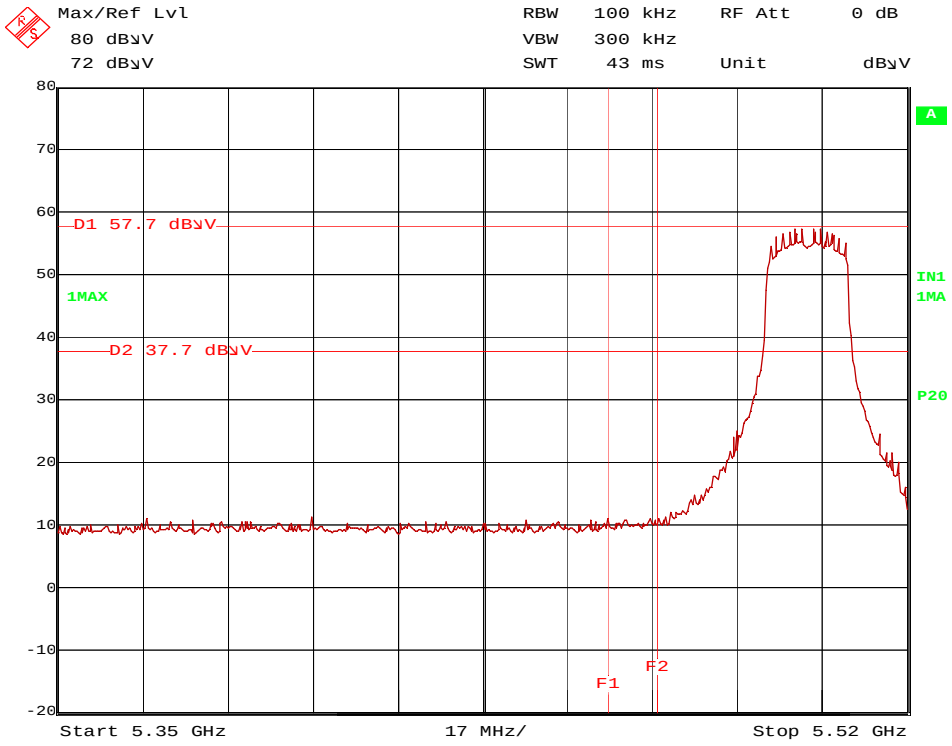
The measurements were performed at the lower and upper end of the 5.47 – 5.725 GHz band.

5.6.2 Test result (band edges next to unrestricted bands (radiated))

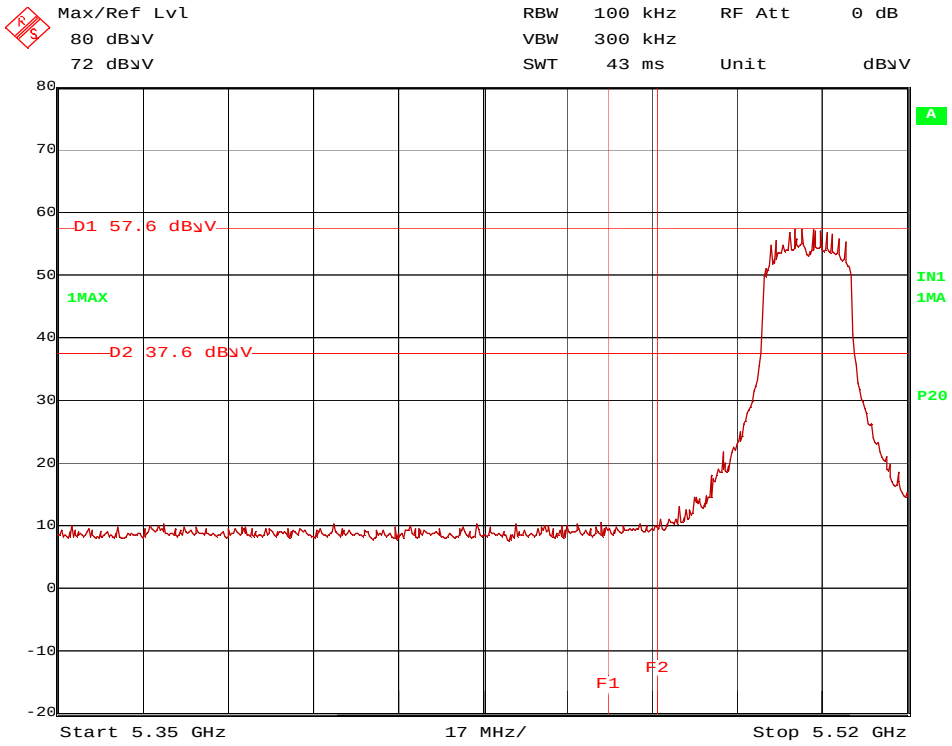
Ambient temperature	22 °C	Relative humidity	55 %

5.6.2.1 Results at the lower and upper end of the 5.47 – 5.725 GHz band

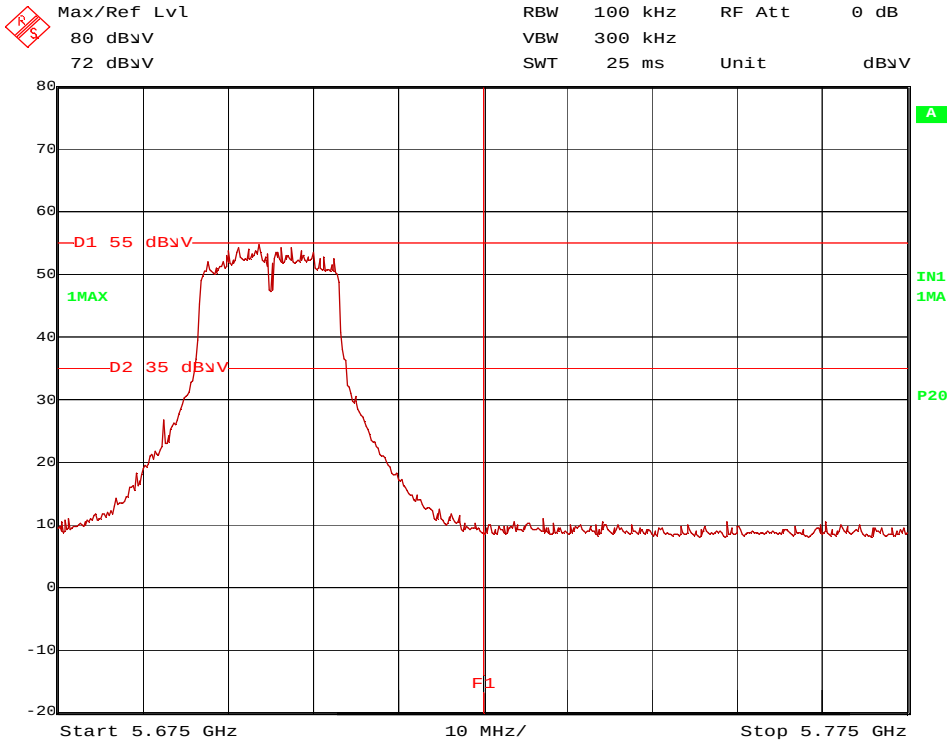
145298_S_bandedge_(un)restr_ch100_6Mbps.wmf: band-edge compliance (operation mode 7):



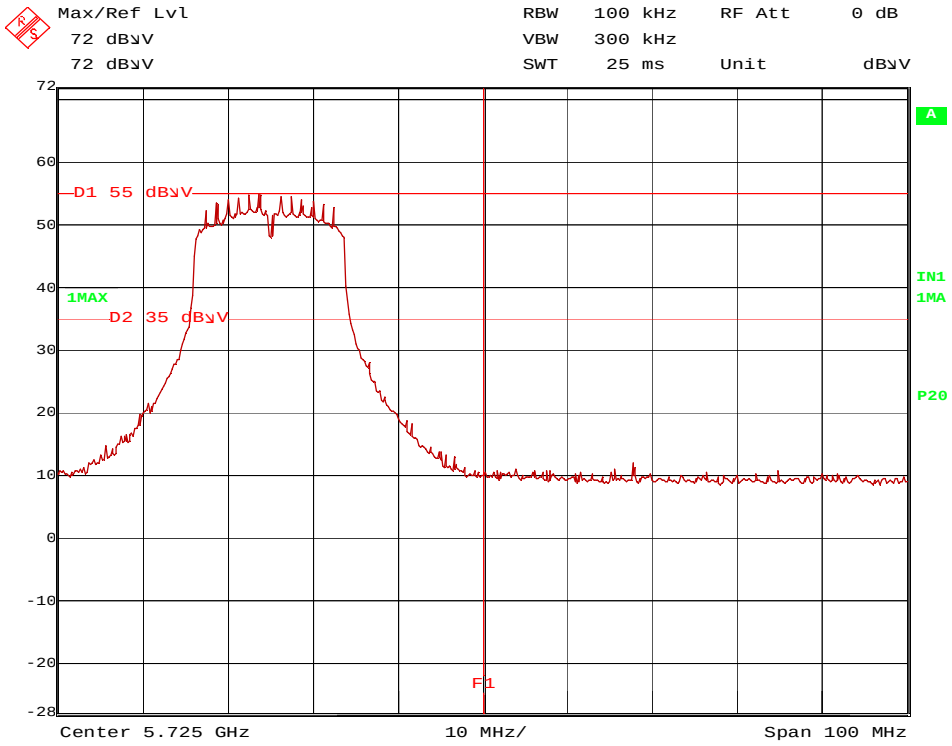
145298_S_bandedge_(un)restr_ch100_6,5Mbps.wmf: band-edge compliance (operation mode 16):



145298_S_bandedge_unrestr_ch140_6Mbps.wmf: band-edge compliance (operation mode 9):



145298_S_bandedge_unrestr_ch140_6,5Mbps.wmf: band-edge compliance (operation mode 18):



According to document [3] part G2d the measured field strength was converted to EIRP and compared to the limit of -27 dBm/MHz:

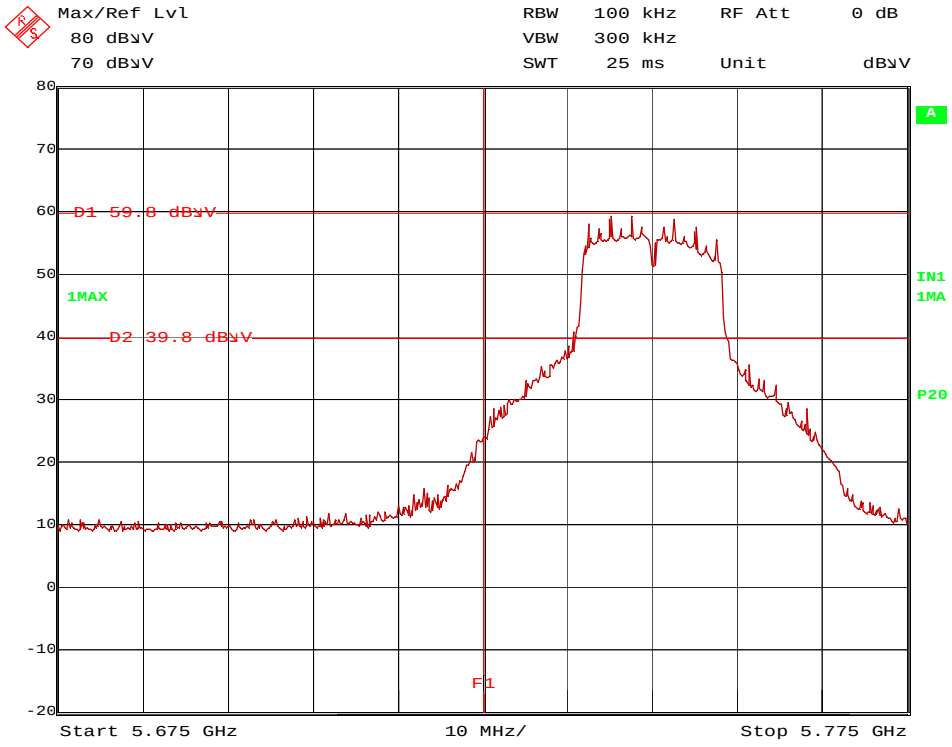
Operation Mode	WLAN channel	WLAN mode	Band-Edge	Unwanted Emission Frequency MHz	Unwanted Emission Value dBm	Limit dBm	Margin dB	Result
7	100	a	low	5466.9	-35.1	-27.0	8.1	Passed
9	140	a	low	5467.1	-34.3	-27.0	7.3	Passed
16	100	n20	high	5727.5	-35.5	-27.0	8.5	Passed
18	140	n20	high	5742.67	-34.6	-27.0	7.6	Passed
Measurement uncertainty				+2.2 dB / -3.6 dB				

Test: Passed

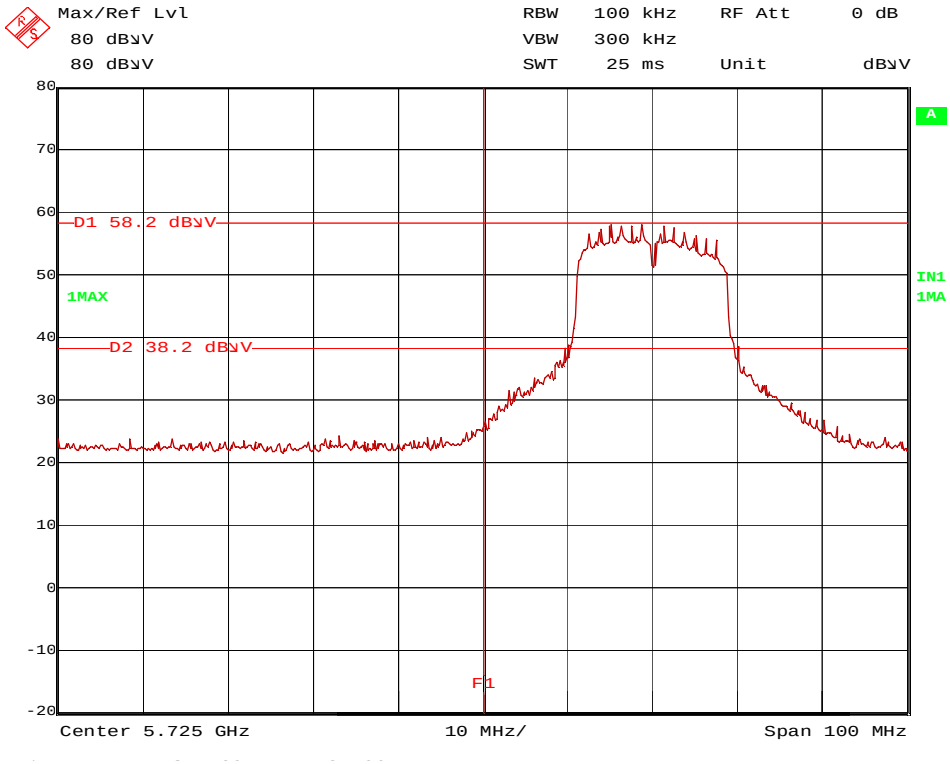
TEST EQUIPMENT USED FOR THE TEST:
6, 8 - 11, 13, 17, 18

5.6.2.2 Results at the lower and upper end of the 5.725 – 5.85 GHz band

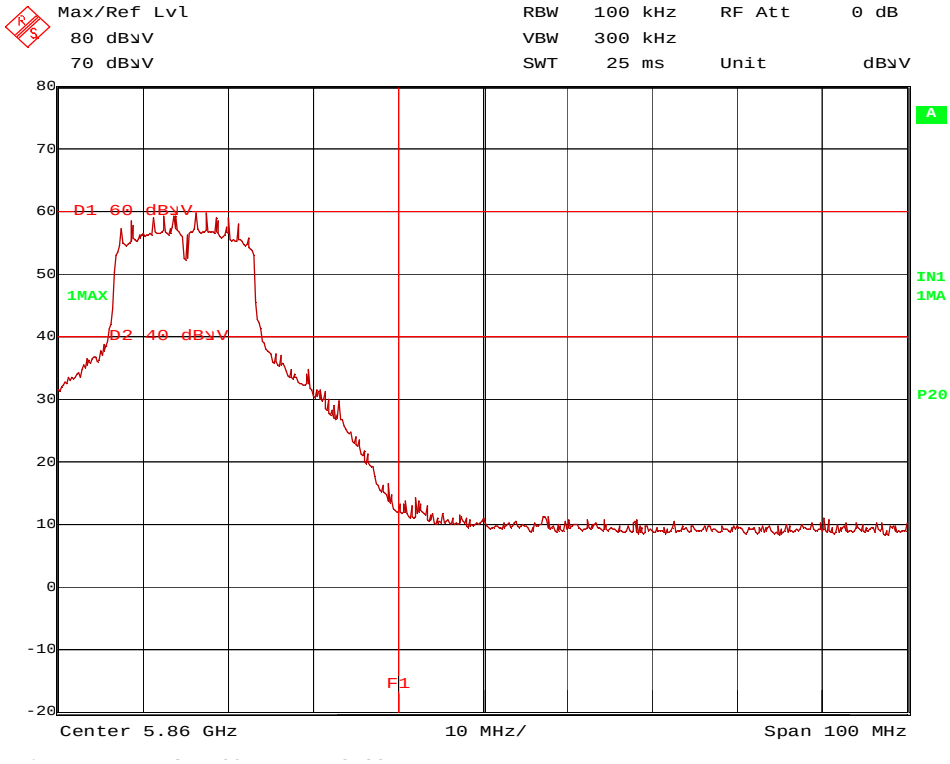
145298_S_bandedge_unrestr_ch149_6Mbps.wmf: band-edge compliance (operation mode 10):



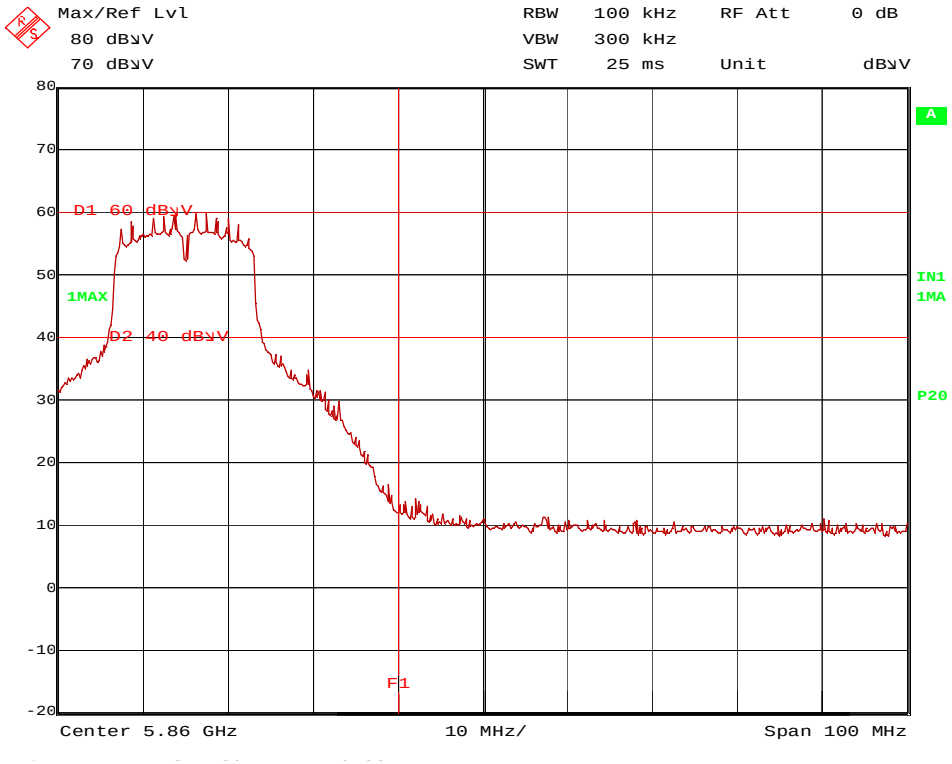
145298_S_bandedge_unrestr_ch149_6,5Mbps.wmf: band-edge compliance (operation mode 22):



145298_S_bandedge_unrestr_ch165_6Mbps.wmf: band-edge compliance(operation mode 12):



145298_S_bandedge_unrestr_ch165_6,5Mbps.wmf: band-edge compliance (operation mode 24):



According to document [3] part G2d the measured field strength was converted to EIRP and compared to the limit of -17 dBm/MHz (within the frequency range from the band edge to 10 MHz above or below the band edge):

Operation Mode	WLAN channel	WLAN mode	Band-Edge	Unwanted Emission Frequency MHz	Unwanted Emission Value dBm / MHz	Limit dBm / MHz	Margin dB	Result
7	149	a	low	5724.5	-19.6	-17.0	2.6	Passed
9	149	a	low	5724.5	-18.7	-17.0	1.7	Passed
16	157	n20	high	5850.5	-24.5	-17.0	7.5	Passed
18	157	n20	high	5859.0	-25.5	-17.0	8.5	Passed
Measurement uncertainty				+2.2 dB / -3.6 dB				

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
6, 8 - 11, 13, 17, 18

5.6.3 Method of measurement (band edges next to restricted bands (radiated))

The same test set-up as used for the radiated emission measurement shall be used (refer also subclause 5.6.1 of this test report).

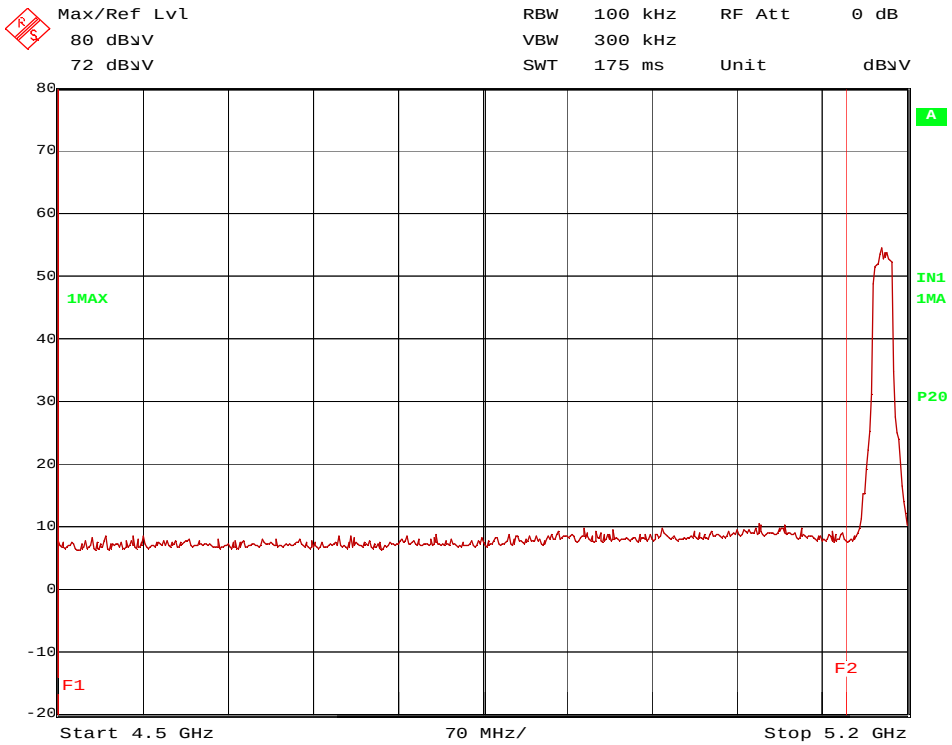
After trace stabilisation the marker shall be set on the signal peak. The frequency line shall be set on the edge of the assigned frequency band. Now set the second marker on the emission at the band-edge, or on the highest modulation product outside of the band, if this level is higher than that at 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 and upper end of the 5.15 – 5.25 GHz band.

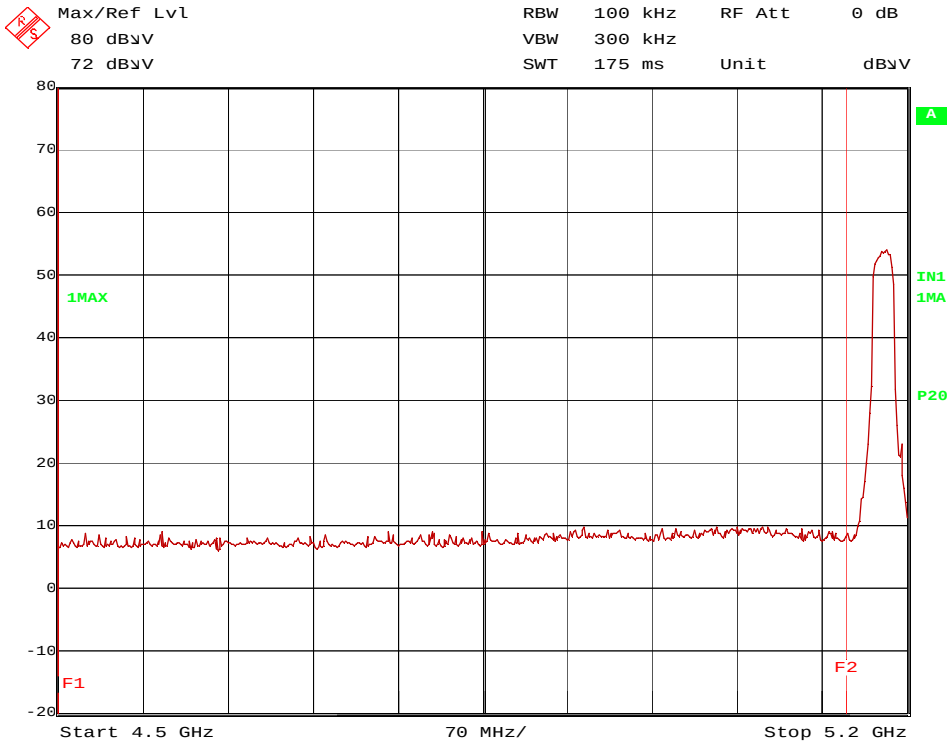
5.6.4 Test result (band edges next to restricted bands (radiated))

Ambient temperature	22 °C	Relative humidity	55 %

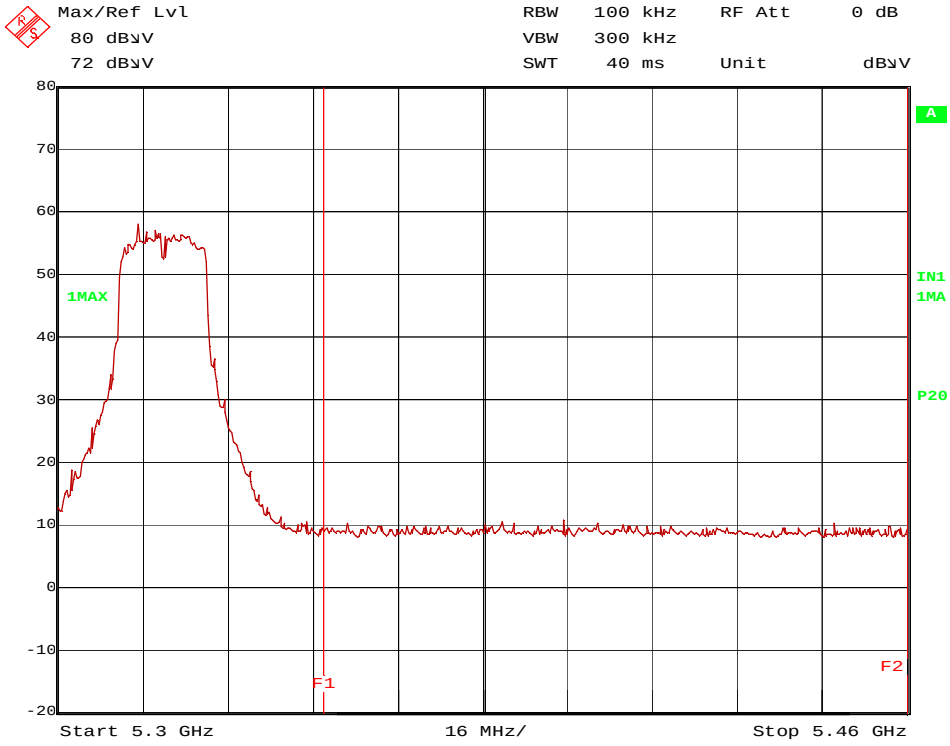
145298_S_bandedge_restr_ch36_6Mbps.wmf: band-edge compliance (operation mode 1):



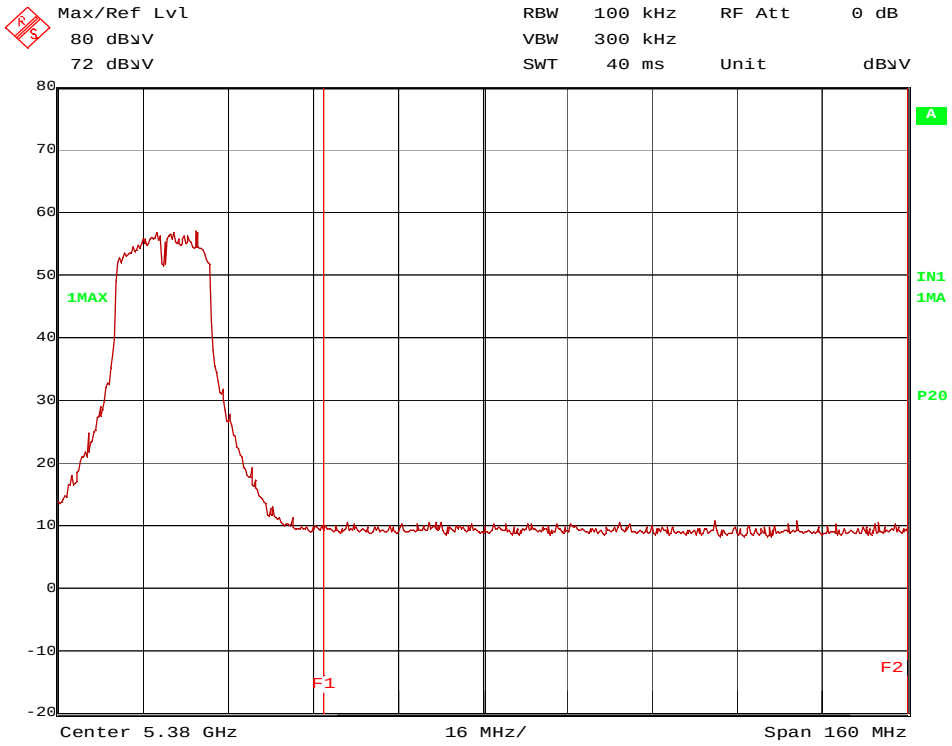
145298_S_bandedge_restr_ch36_6,5Mbps.wmf: band-edge compliance (operation mode 10):



145298_S_bandedge_restr_ch64_6Mbps.wmf: band-edge compliance (operation mode 6):



145298_S_bandedge_restr_ch64_6,5Mbps.wmf: band-edge compliance (operation mode 15):



Only noise was found in the restricted bands in above measurements. The maximum peak level in the restricted bands was 48,4 dBµV/m. This value is lower than the limit for average measurements. Therefore no final measurement was performed.

Frequency / MHz:	Result	Readings	Antenna factor	Preamp	Cable loss
			1/m		
Tx	dBµV/m	dBµV	dB	dB	dB
5396	48,4	10,0	33,8	0,0	4,6

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
6, 8 - 11, 13, 17, 18

5.7 Maximum unwanted emissions

5.7.1 Method of measurement (radiated emissions)

The radiated emission measurement is subdivided into four stages.

- A preliminary measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 30 MHz to 1 GHz.
- A final measurement carried out on an open area test side with reflecting ground plane and various antenna heights in the frequency range 30 MHz to 1 GHz.
- A preliminary measurement carried out in a fully anechoic chamber with a variable antenna distance and height in the frequency range 1 GHz to 110 GHz.
- A final measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 1 GHz to 110 GHz.

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

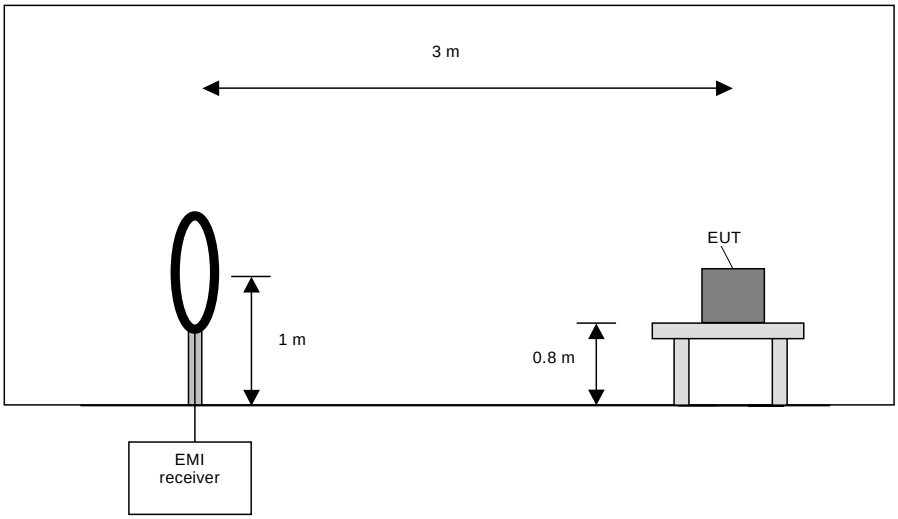
Preliminary measurement (9 kHz to 30 MHz):

In the first stage a preliminary measurement will be performed in a shielded room with a measuring distance of
3 meters. Tabletop devices will 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 setup of the Equipment under test will be in accordance to [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 found 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



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 (only if the EUT is a module or is used in a handheld application).
7) Rotate the measuring antenna and repeat steps 1) to 5).

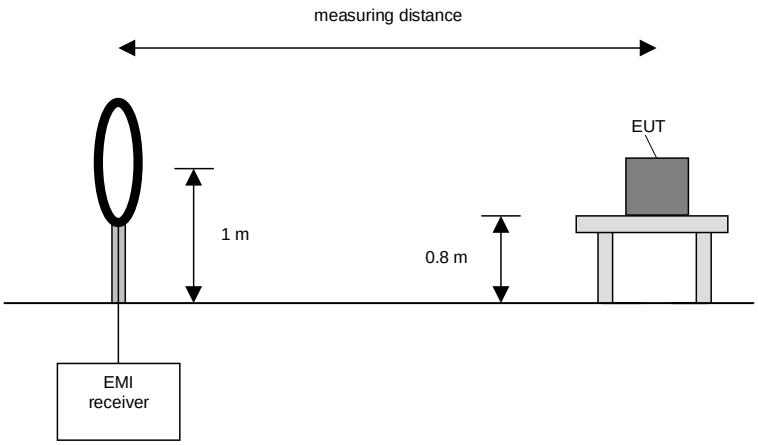
Final measurement (9 kHz to 30 MHz):

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 whichever is appropiate. 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 [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 to [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



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 (only if the EUT is a module or is used in a handheld application).

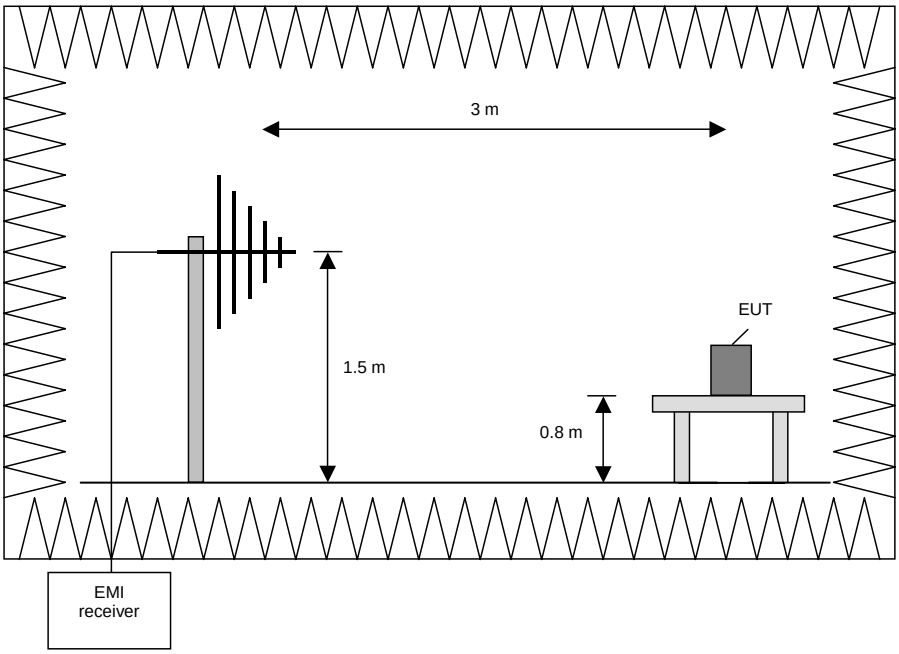
Preliminary measurement (30 MHz to 1 GHz)

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 setup of the Equipment under test will be in accordance to [1].

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

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

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



Procedure preliminary measurement:

Prescans were performed in the frequency range 30 MHz to 230 MHz and 230 MHz to 1 GHz.
The following procedure will be used:

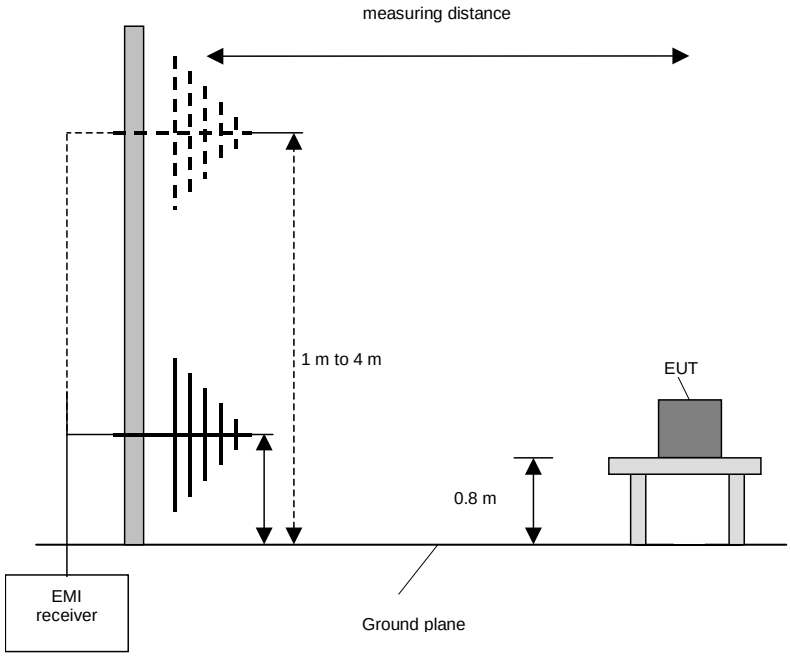
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Manipulate the system cables within the range to produce the maximum level of emission.
3. Rotate the EUT by 360 ° to maximize the detected signals.
4. Make a hardcopy of the spectrum.
5. Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
6. Repeat 1) to 4) for each orthogonal axes of the EUT (only if the EUT is a module or is used in a handheld application).
7. Repeat 1) to 5) with the vertical polarisation of the measuring antenna.

Final measurement (30 MHz to 1 GHz)

A final measurement on an open area test site will be performed on selected frequencies found in the preliminary measurement. During this test the EUT will be rotated in the range of 0 ° to 360 °, the measuring antenna will be set to horizontal and vertical polarisation and raised and lowered in the range from 1 m to 4 m to find the maximum level of emissions.

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

Frequency range	Resolution bandwidth
30 MHz to 1 GHz	120 kHz



Procedure final measurement:

The following procedure will be used:

1) Measure on the selected frequencies at an antenna height of 1 m and a EUT azimuth of 23 °.
2) Move the antenna from 1 m to 4 m and note the maximum value at each frequency.
3) Rotate the EUT by 45 ° and repeat 2) until an azimuth of 337 ° is reached.
4) Repeat 1) to 3) for the other orthogonal antenna polarization.
5) Move the antenna and the turntable to the position where the maximum value is detected.
6) Measure while moving the antenna slowly +/- 1 m.
7) Set the antenna to the position where the maximum value is found.
8) Measure while moving the turntable +/- 45 °.
9) Set the turntable to the azimuth where the maximum value is found.
10) Measure with Final detector (QP and AV) and note the value.
11) Repeat 5) to 10) for each frequency.
12) Repeat 1) to 11) for each orthogonal axes of the EUT (only if the EUT is a module or is used in a handheld application).

Preliminary and final measurement (1 GHz to 110 GHz)

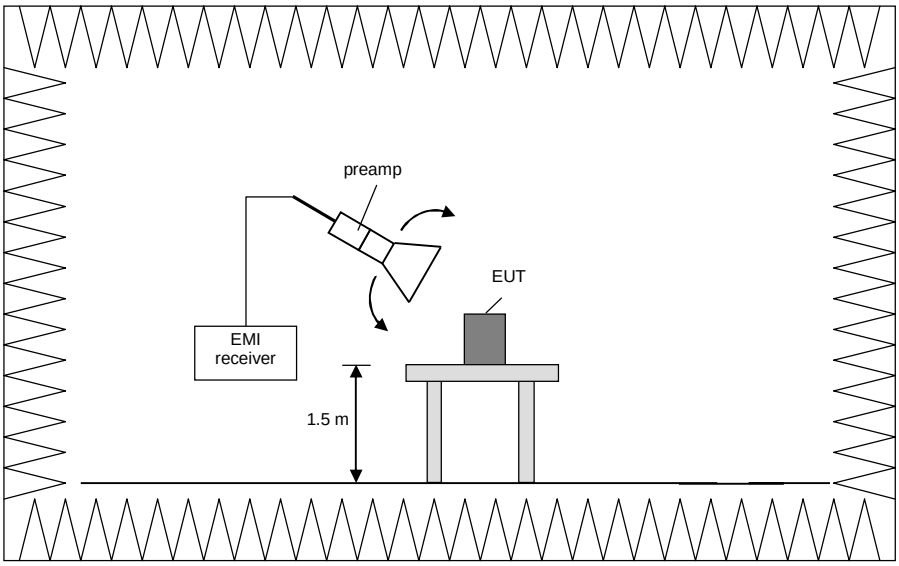
This measurement will be performed in a fully anechoic chamber. Tabletop devices will set up on a non-conducting support a height of 150 cm. Floor-standing devices will be placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.10-2013 [1].

Preliminary measurement (1 GHz to 110 GHz)

The frequency range will be divided into different sub ranges depending on 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

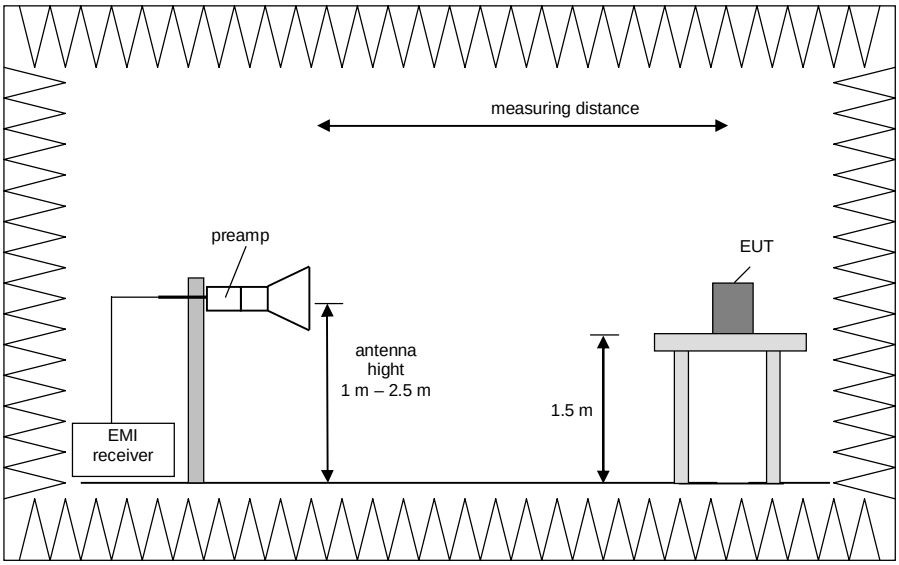


Final measurement (1 GHz to 110 GHz)

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.

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

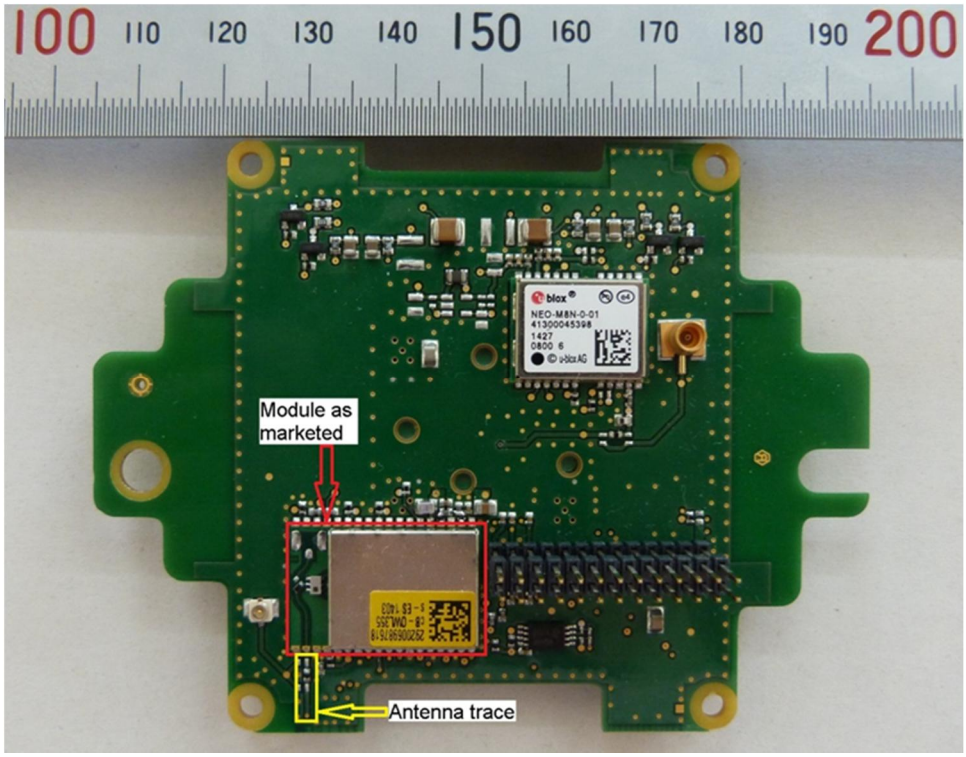
5.7.2 Test results (radiated emissions)

5.7.2.1 Preliminary radiated emission measurement

Ambient temperature	21 °C	Relative humidity	51 %

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 Physical boundaries of the ODIN-W161 and integral antenna on the reference design:



…

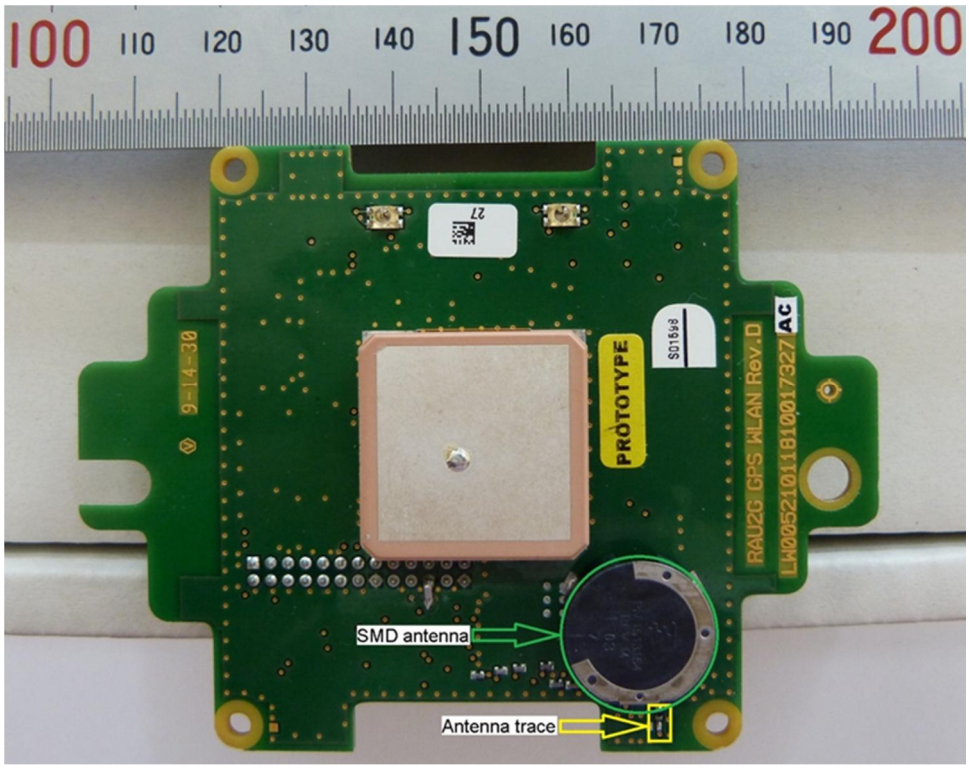
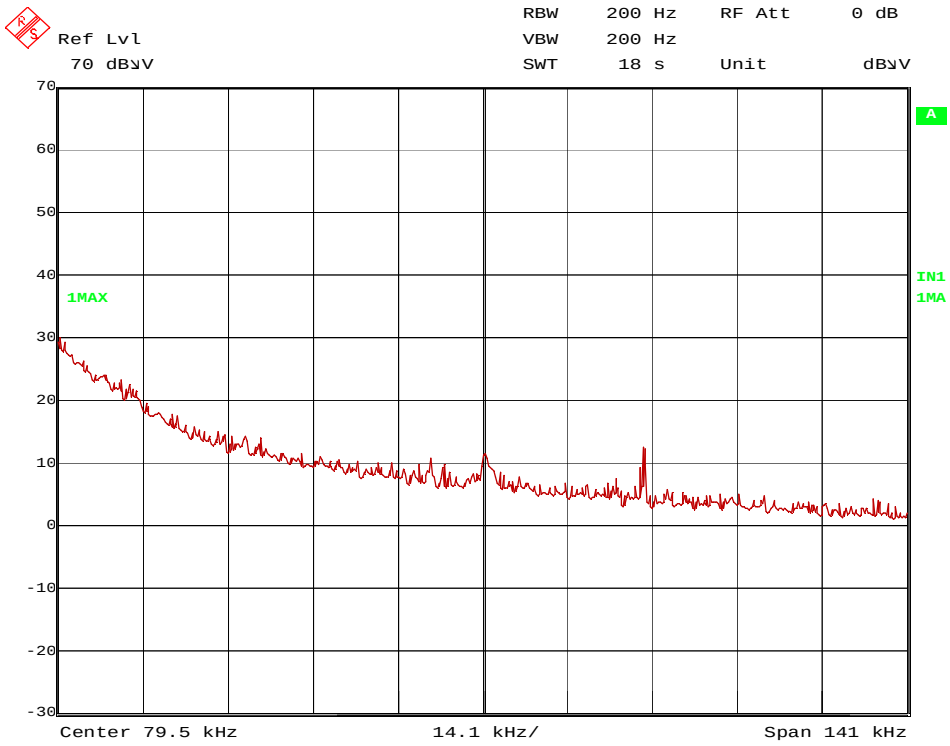

SMD antenna
Antenna trace
PROTOTYPE
RAU2G GPS WLAN Rev.D

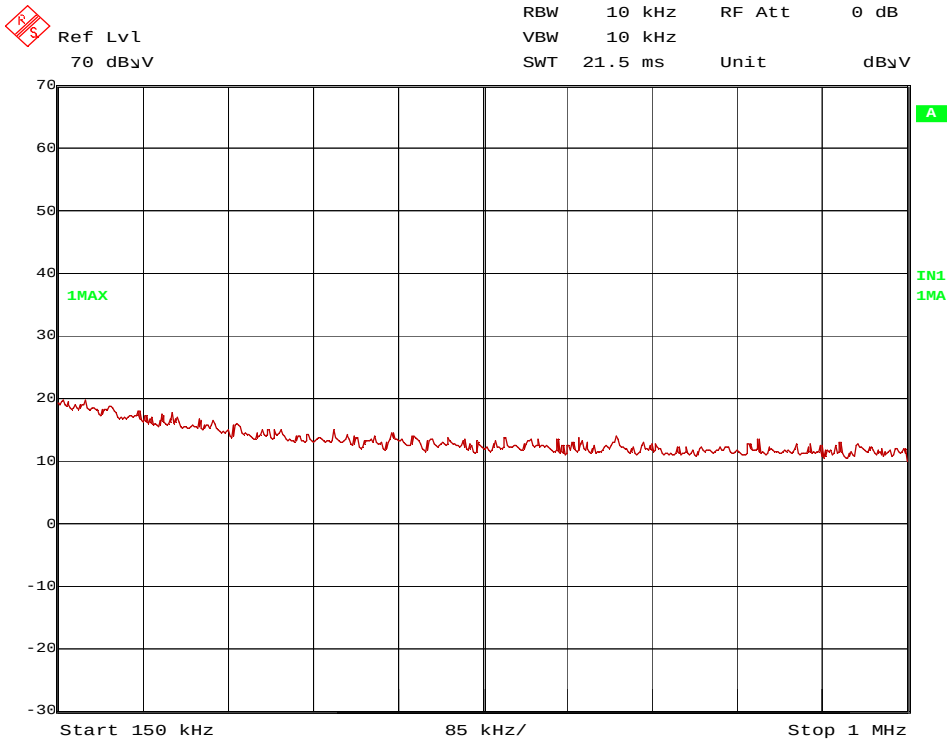
Table 1 and annex A.

Test record:	All results are shown in the following.
Supply voltage:	During all measurements the host of the EUT was powered with 5 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 802.11n mode at channel 36, 40, 48, 52, 60, 64, 100, 116 and 140. Only the plots of the worst case emissions are submitted for every frequency range above 1 GHz in the preliminary results. The Emissions below 1 GHz were similar for all antenna ports, transmit frequencies, modulation schemes and data rates. Therefore only the results of an exemplary test case are submitted below.

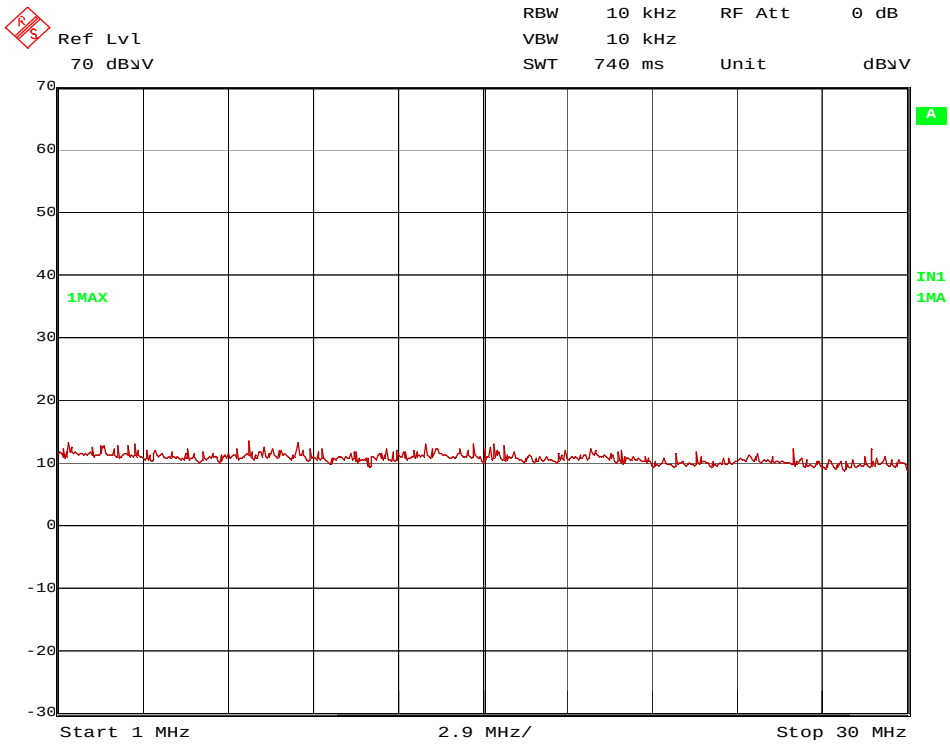
145298_S_9-150k_WLAN.wmf: Spurious emissions from 9 kHz to 150 kHz:



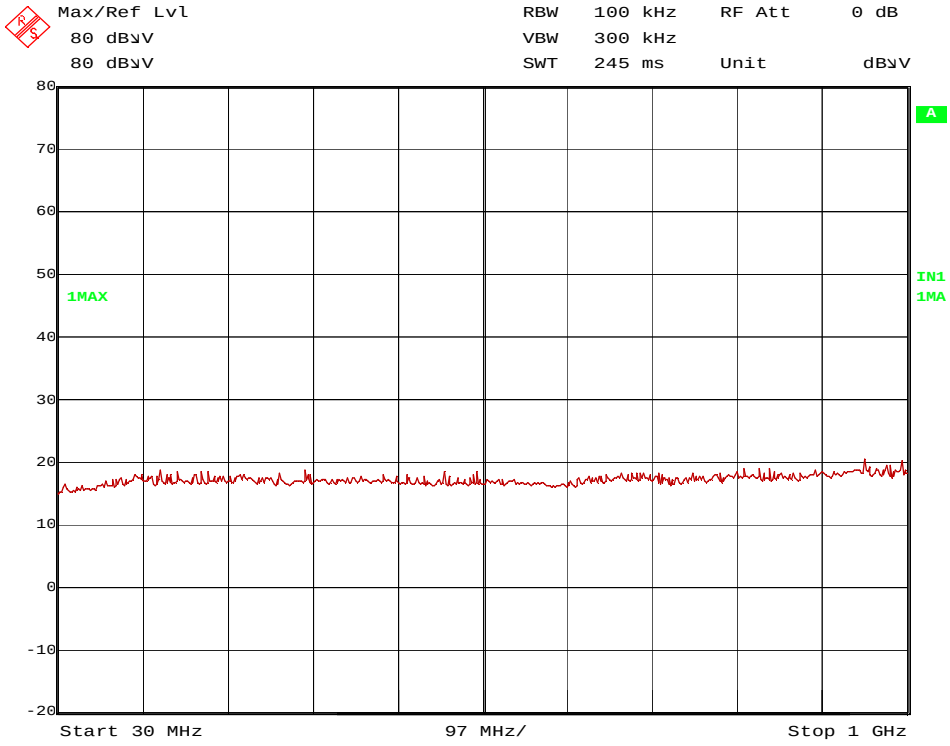
145298_S_150k-1M_WLAN.wmf: Spurious emissions from 150 kHz to 1 MHz:



145298_S_1-30M_WLAN: Spurious emissions from 1 MHz to 30 MHz:

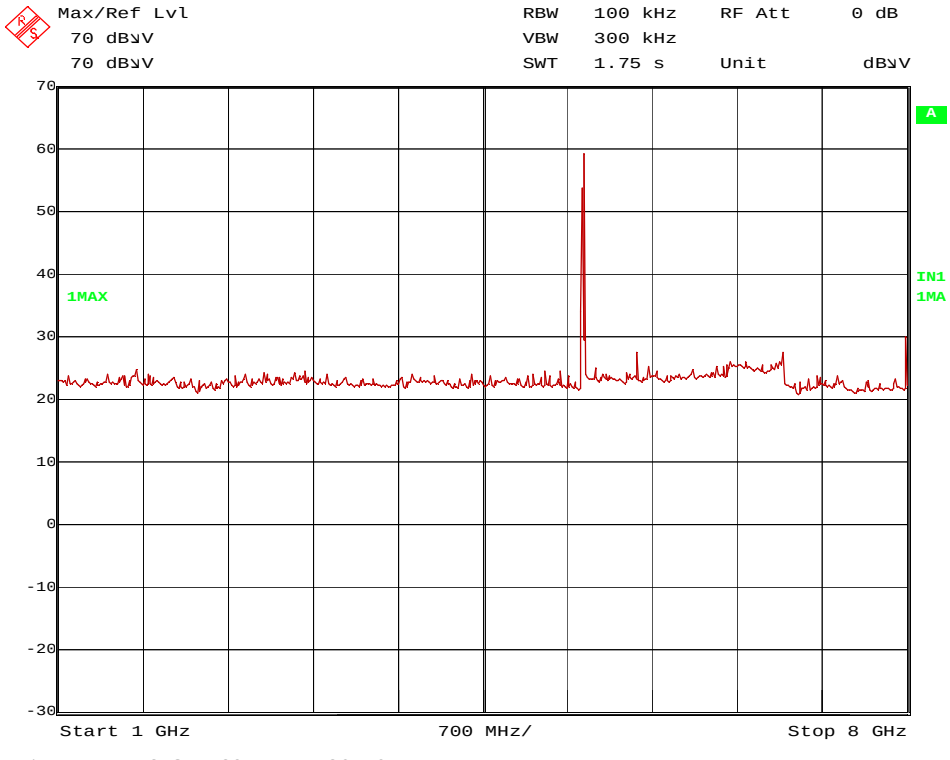


145298_S_30M-1G_WLAN.wmf: Spurious emissions from 30 MHz to 1 GHz:

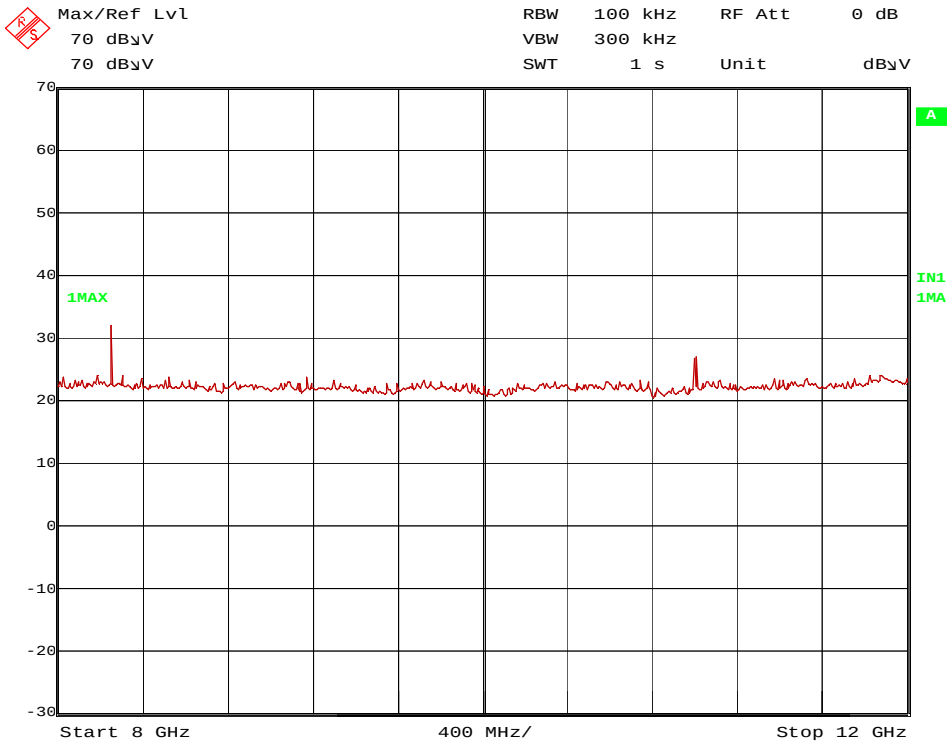


5.7.2.1.1 Results for the 5.15 - .5.25 GHz, 5.25 – 5.35 GHz and 5.47 .- 5.725 GHz bands

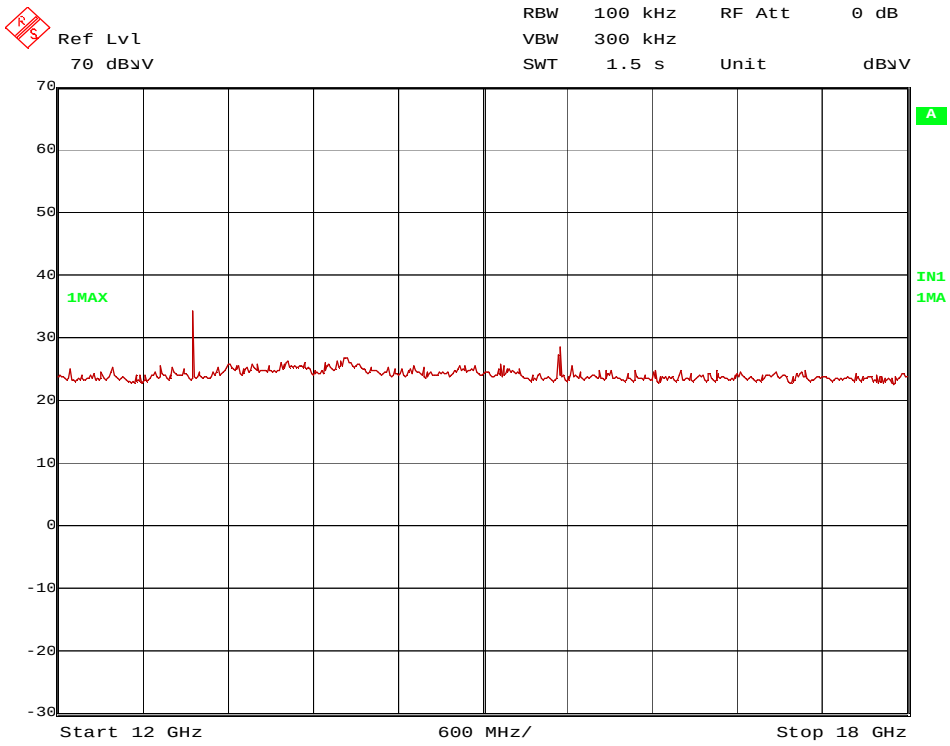
145298_S_1-8G_WLAN_ch64.wmf: Spurious emissions from 1 GHz to 8 GHz (operation mode 18):



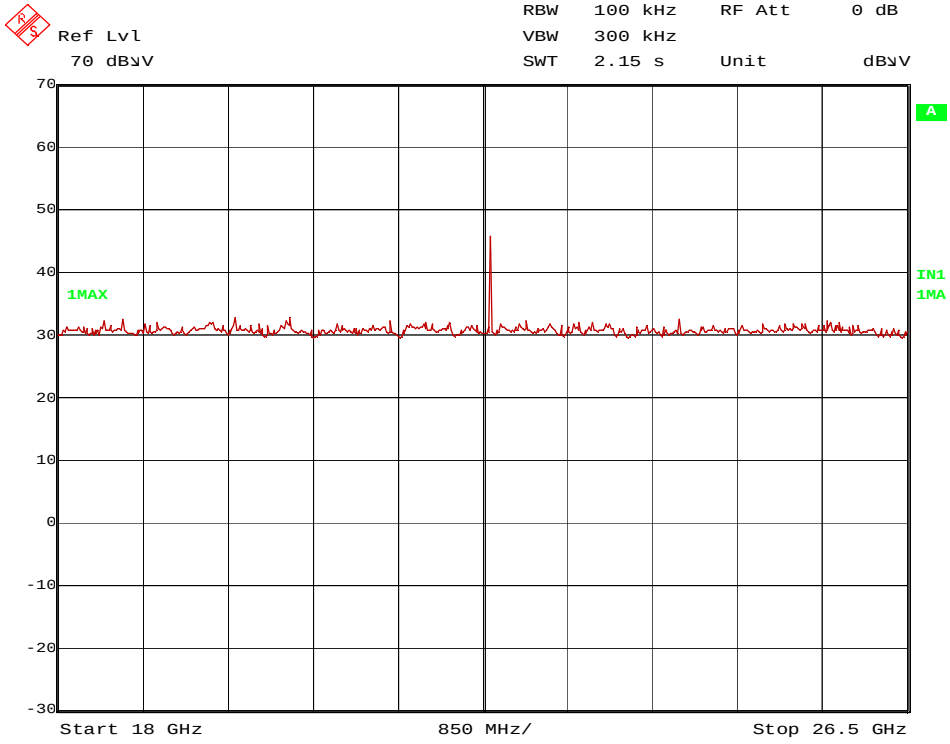
145298_S_8-12G_WLAN_ch100.wmf: Spurious emissions from 8 GHz to 12 GHz (operation mode 19):



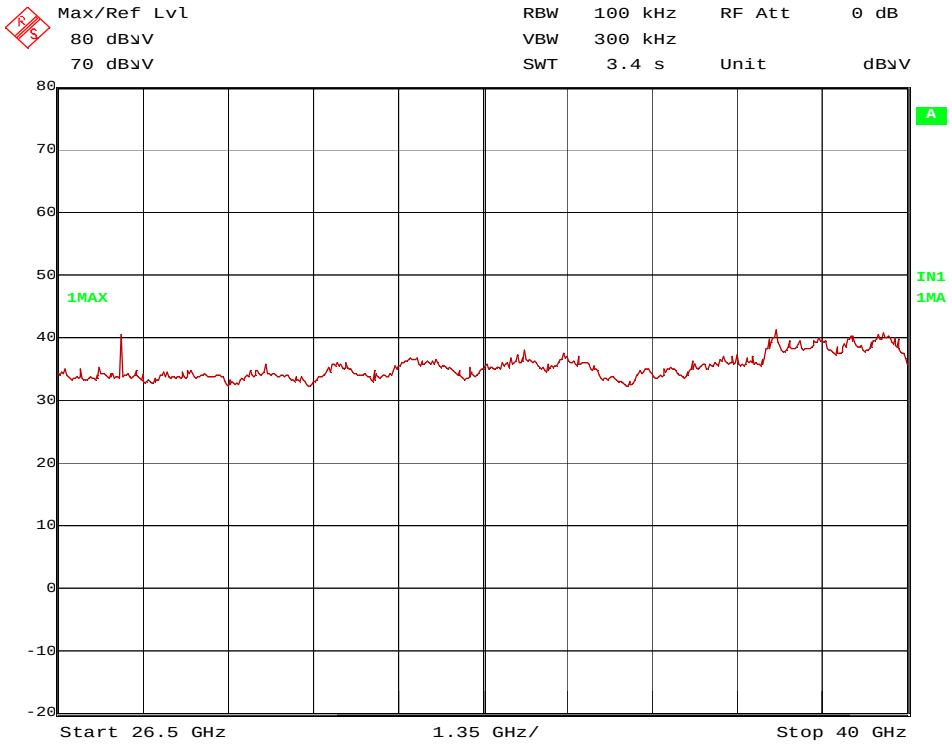
145298_S_12-18G_WLAN_ch36.wmf: Spurious emissions from 12 to 18 GHz (operation mode 13):



145298_S_18-26,5G_WLAN_ch116.wmf: Spurious emissions from 18 – 26.5 GHz (operation mode 20):



145298_S2_26,5-40G_WLAN_ch100.wmf: Spurious emissions from 26.5 – 40 GHz (operation mode 19):



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

- 8250 MHz, 8370 MHz, 10640 MHz, 11160 MHz, 11400 MHz, 13250 MHz, 13300 MHz, 15540 MHz, 15600 MHz, 15720 MHz, 15780 MHz, 15900 MHz, 15960 MHz, 21040 MHz, 21200 MHz, 21280 MHz, 22320 MHz, 22800 MHz, 31560 MHz, 31800 MHz.

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

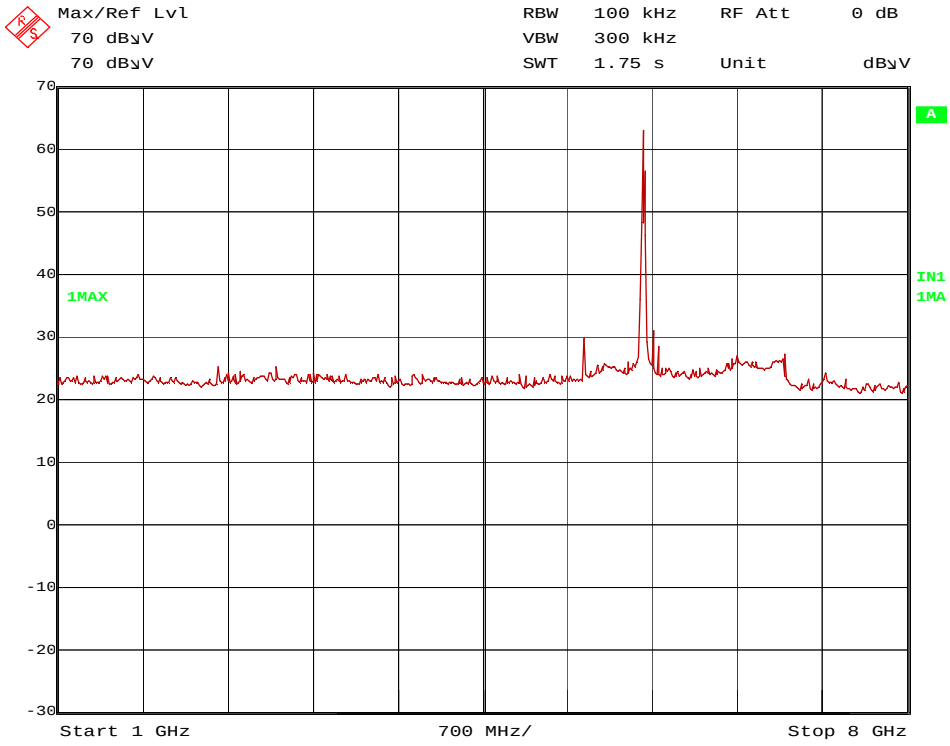
- 5231 MHz, 5344 MHz, 5612 MHz, 5633 MHz, 5677 MHz, 5698 MHz, 5741 MHz, 5763 MHz, 5844 MHz, 6056 MHz, 7770 MHz, 7800 MHz, 7860 MHz, 7890 MHz, 7950v, 7980 MHz, 8550 MHz, 10360 MHz, 10400 MHz, 10480 MHz, 10520 MHz, 12950 MHz, 13100 MHz, 13150 MHz, 14250 MHz, 16500 MHz, 16740 MHz, 17100 MHz, 22000 MHz, 25900 MHz, 26000 MHz, 26200 MHz, 26300 MHz, 26500 MHz, 26600 MHz, 27500 MHz, 28500 MHz, 27900 MHz, 31080 MHz, 33000 MHz, 33480 MHz, 34200 MHz

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

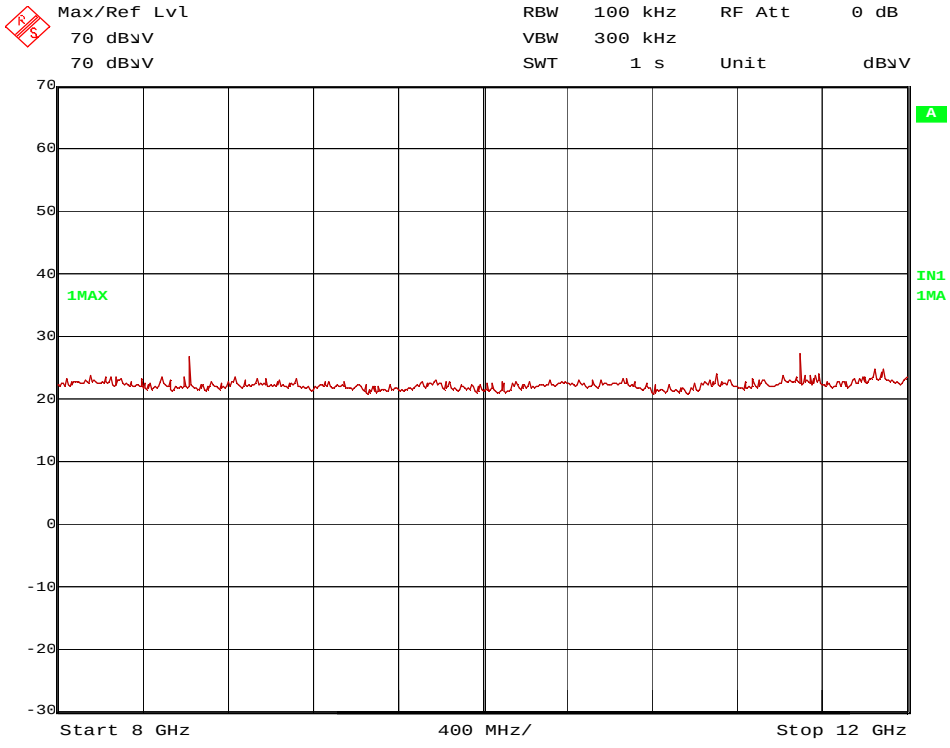
TEST EQUIPMENT USED FOR THE TEST:
6, 8 - 25, 29, 32, 33

5.7.2.1.2 Results for the 5.725 – 5.85 GHz band

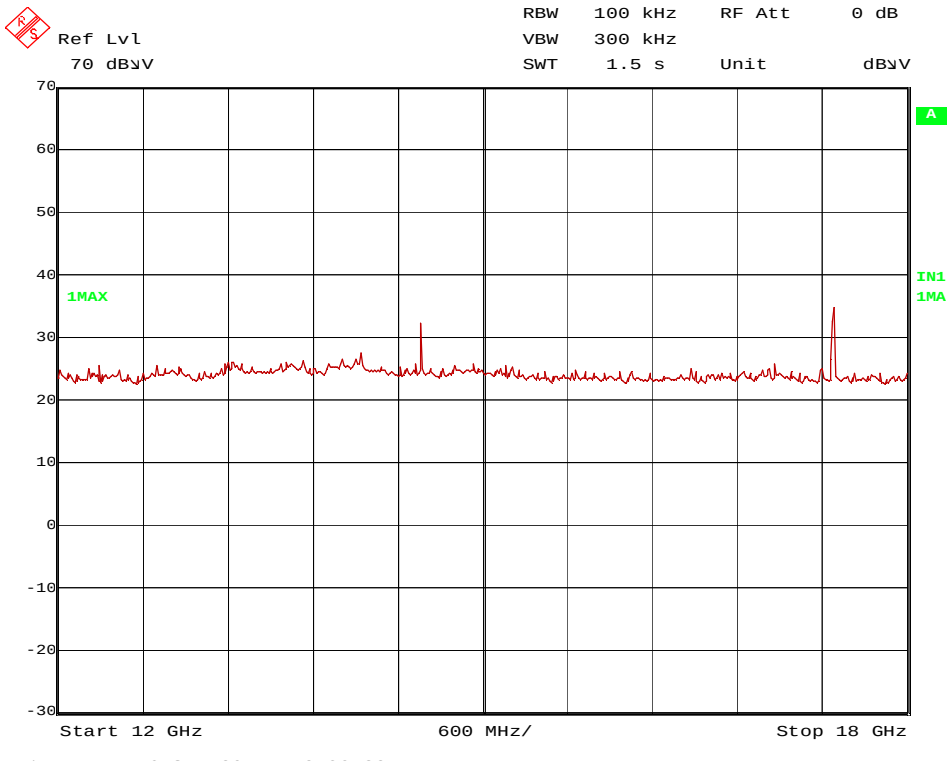
145298_S_1-8G_WLAN_ch165.wmf: Spurious emissions from 1 GHz to 8 GHz (operation mode 24):



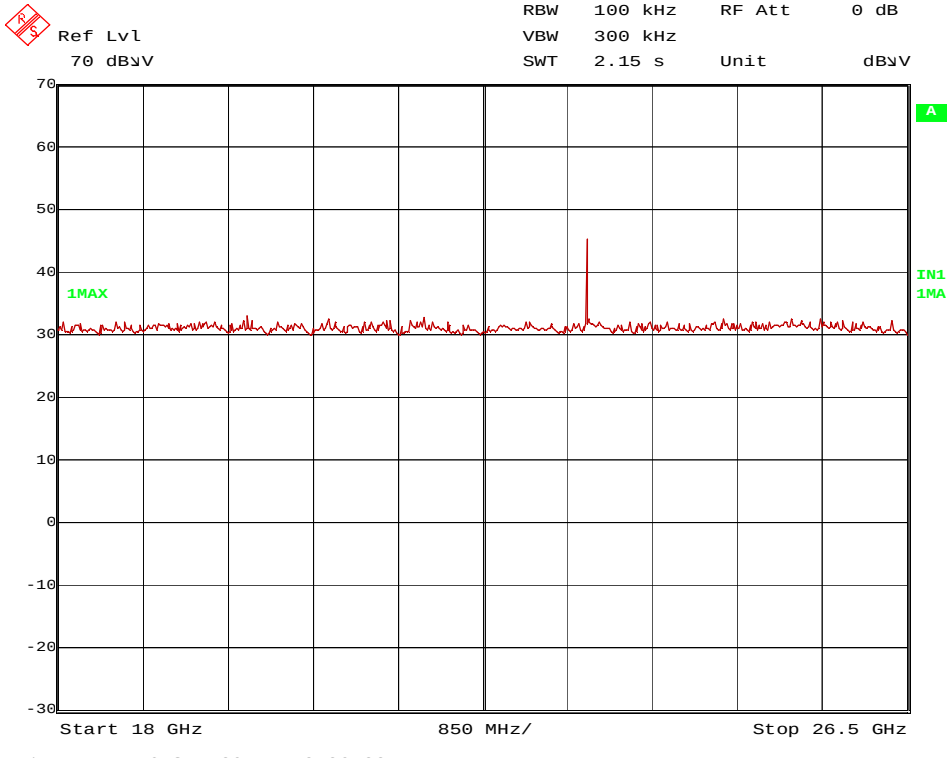
145298_S_8-12G_WLAN_ch149.wmf: Spurious emissions from 8 GHz to 12 GHz (operation mode 22):



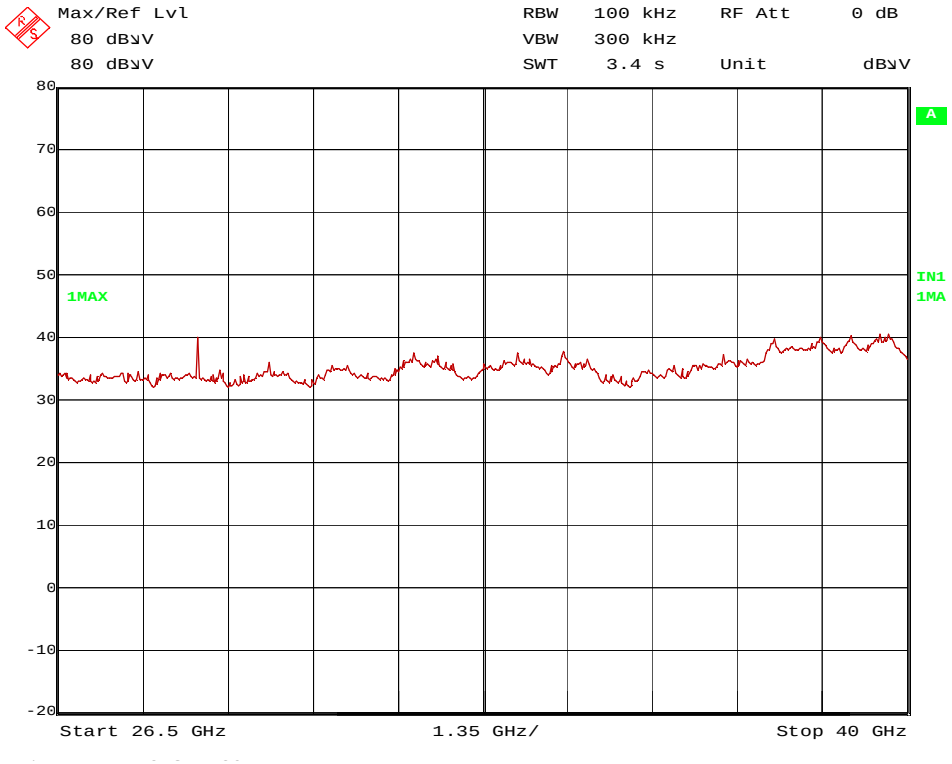
145298_S_12-18G_WLAN_ch165.wmf: Spurious emissions from 12 to 18 GHz (operation mode 24):



145298_S_18-26,5G_WLAN_ch165.wmf: Spurious emissions from 18 – 26.5 GHz (operation mode 24):



145298_#23_26,5-40G_WLAN_ch165.wmf: Spurious emissions from 26.5 - 40GHz (operation mode 24):



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

- 11570 MHz, 22980 MHz

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

- 17235.MHz, 17355 MHz, 17475 MHz, 23140 MHz, 23300 MHz, 28725 MHz, 28925 MHz, 29125 MHz

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

TEST EQUIPMENT USED FOR THE TEST:
6, 8 - 25, 29, 32, 33

5.7.2.2 Final radiated emission measurement (9 kHz to 1 GHz)

No emissions could be found in the final measurement on the open area test site, therefore no results for the final measurements are submitted.

5.7.2.3 Final radiated emission measurement (1 GHz to 40 GHz)

Ambient temperature	22 °C	Relative humidity	55 %

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.
Test record:	All results are shown in the following.
Supply voltage:	During all measurements the host of the EUT was powered with 5 V via an laboratory power supply..
Resolution bandwidth:	For all measurements a resolution bandwidth of 1 MHz was used.
Additional information:	For simplification, all values were compared to the restricted band limits. Position 2 was found to have the worst case spurious emissions.

Transmitter operates at the lower end of the assigned frequency band (operation mode 13)

Result measured with the peak detector:

Frequency MHz	Meas. Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restricted Band?
5612	49.7	74.0	24.3	35.5	34.0	24.5	4.7	150	Hor.	No
7770	53.5	74.0	20.5	35.0	36.2	24.1	6.5	150	Vert.	No
10360	56.0	74.0	18.0	34.4	37.6	23.6	7.6	150	Hor.	No
12950	48.9	74.0	25.1	38.5	33.6	26.4	3.2	150	Hor.	No
15540	46.7	74.0	27.3	37.1	33.7	27.8	3.7	150	Hor.	Yes
20720	52.7	74.0	21.3	48.8	37.1	37.7	4.4	150	Vert.	Yes
25900	46.2	74.0	27.8	43.1	37.2	38.9	4.9	150	Hor.	No
31080	50.8	74.0	23.2	36.0	40.7	28.8	2.9	150	Vert.	No
Measurement uncertainty				+2.2 dB / -3.6 dB						

Result measured with the average detector:

Frequency MHz	Meas. Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restricted Band?
5612	42.3	54.0	11.7	28.1	34.0	24.5	4.7	150	Hor.	No
7770	47.3	54.0	6.7	28.8	36.2	24.1	6.5	150	Vert.	No
10360	48.3	54.0	5.7	26.7	37.6	23.6	7.6	150	Hor.	No
12950	44.6	54.0	9.4	34.2	33.6	26.4	3.2	150	Hor.	No
15540	38.2	54.0	15.8	28.6	33.7	27.8	3.7	150	Hor.	Yes
20720	49.5	54.0	4.5	45.6	37.1	37.7	4.4	150	Vert.	Yes
25900	38.2	54.0	15.8	35.1	37.2	38.9	4.9	150	Hor.	No
31080	52.6	54.0	11.4	27.8	40.7	28.8	2.9	150	Vert.	No
Measurement uncertainty				+2.2 dB / -3.6 dB						

Transmitter operates at the lower end of the assigned frequency band (operation mode 16)

Result measured with the peak detector:

Frequency MHz	Meas. Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restricted Band?
5698	49.1	74.0	24.9	35.0	33.8	24.5	4.8	150	Vert.	No
7890	53.7	74.0	20.3	35.5	36.3	23.9	5.8	150	Vert.	No
10520	54.4	74.0	19.6	33.7	37.6	23.5	6.7	150	Hor.	No
13150	47.1	74.0	26.9	36.8	33.6	26.6	3.2	150	Hor.	No
15780	51.0	74.0	23.0	41.2	33.8	27.7	3.7	150	Vert.	Yes
21040	53.4	74.0	20.6	50.0	37.1	37.9	4.3	150	Hor.	Yes
26300	54.7	74.0	19.3	43.2	37.3	30.9	5.0	150	Vert.	No
31560	50.5	74.0	23.5	34.5	40.6	27.6	3.0	150	Vert.	Yes
Measurement uncertainty				+2.2 dB / -3.6 dB						

Result measured with the average detector:

Frequency MHz	Meas. Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restricted Band?
5698	40.1	54.0	13.9	26.0	33.8	24.5	4.8	150	Vert.	No
7890	47.5	54.0	6.5	29.3	36.3	23.9	5.8	150	Vert.	No
10520	46.9	54.0	7.1	26.2	37.6	23.5	6.7	150	Hor.	No
13150	41.0	54.0	13.0	30.7	33.6	26.6	3.2	150	Hor.	No
15780	37.1	54.0	16.9	27.3	33.8	27.7	3.7	150	Vert.	Yes
21040	50.6	54.0	3.4	47.2	37.1	37.9	4.3	150	Hor.	Yes
26300	47.2	54.0	6.8	35.7	37.3	30.9	5.0	150	Vert.	No
31560	41.3	54.0	12.7	25.3	40.6	27.6	3.0	150	Vert.	Yes
Measurement uncertainty				+2.2 dB / -3.6 dB						

Transmitter operates at the lower end of the assigned frequency band (operation mode 19)

Result measured with the peak detector:

Frequency MHz	Meas. Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restricted Band?
5844	49.1	74.0	24.9	34.8	33.9	24.4	4.9	150	Vert.	No
8250	56.1	74.0	17.9	37.3	36.8	23.9	5.9	150	Hor.	Yes
10640	52.8	74.0	21.2	31.7	38.0	23.7	6.7	150	Vert.	Yes
16500	48.6	74.0	25.4	39.1	33.8	28.1	3.8	150	Hor.	No
22000	52.0	74.0	22.0	48.1	37.2	37.8	4.5	150	Vert.	No
27500	48.7	74.0	25.3	35.9	40.7	30.3	2.4	150	Hor.	No
33000	51.5	74.0	22.5	33.9	40.7	26.4	3.3	150	Hor.	No
Measurement uncertainty				+2.2 dB / -3.6 dB						

Result measured with the average detector:

Frequency MHz	Meas. Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restricted Band?
5844	40.1	54.0	13.9	25.8	33.9	24.4	4.9	150	Vert.	No
8250	51.1	54.0	2.9	32.3	36.8	23.9	5.9	150	Hor.	Yes
10640	39.2	54.0	14.8	18.1	38.0	23.7	6.7	150	Vert.	Yes
16500	37.1	54.0	16.9	27.6	33.8	28.1	3.8	150	Hor.	No
22000	48.7	54.0	5.3	44.8	37.2	37.8	4.5	150	Vert.	No
27500	41.1	54.0	12.9	28.3	40.7	30.3	2.4	150	Hor.	No
33000	39.4	54.0	14.6	21.8	40.7	26.4	3.3	150	Hor.	No
Measurement uncertainty				+2.2 dB / -3.6 dB						

Transmitter operates at the lower end of the assigned frequency band (operation mode 22)

Result measured with the peak detector:

Frequency MHz	Meas. Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
5266	51.0	74.0	23.0	37.5	33.7	24.8	4.6	150	Hor.	No
8618	54.7	74.0	19.3	34.9	37.3	23.5	6.0	150	Vert.	No
11490	56.2	74.0	17.8	33.9	38.8	23.4	6.9	150	Vert.	Yes
14363	47.8	74.0	26.2	37.6	33.7	27.0	3.4	150	Hor.	No
17235	54.4	74.0	19.6	45.3	33.8	28.6	4.0	150	Vert.	No
22980	53.3	74.0	20.7	49.6	37.2	38.1	4.6	150	Vert.	Yes
28725	48.9	74.0	25.1	35.9	40.6	30.2	2.6	150	Hor.	No
Measurement uncertainty				+2.2 dB / -3.6 dB						

Result measured with the average detector:

Frequency MHz	Meas. Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
5266	43.9	54.0	10.1	30.4	33.7	24.8	4.6	150	Hor.	No
8618	46.2	54.0	7.8	26.4	37.3	23.5	6.0	150	Vert.	No
11490	48.5	54.0	5.5	26.2	38.8	23.4	6.9	150	Vert.	Yes
14363	41.7	54.0	12.3	31.5	33.7	27.0	3.4	150	Vert.	No
17235	40.7	54.0	13.3	31.6	33.8	28.6	4.0	150	Hor.	No
22980	49.5	54.0	4.5	45.8	37.2	38.1	4.6	150	Hor.	Yes
28725	41.4	54.0	12.6	28.4	40.6	30.2	2.6	150	Hor.	No
Measurement uncertainty				+2.2 dB / -3.6 dB						

Transmitter operates at the middle of the assigned frequency band (operation mode 14)

Result measured with the peak detector:

Frequency MHz	Meas. Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restricted Band?
5633	49.9	74.0	24.1	36.1	33.9	24.9	4.8	150	Hor.	No
7800	53.7	74.0	20.3	35.3	36.2	23.5	5.7	150	Vert.	No
10400	55.0	74.0	19.0	34.3	37.6	23.6	6.7	150	Hor.	No
13000	48.1	74.0	25.9	37.7	33.6	26.5	3.3	150	Hor.	No
15600	46.0	74.0	28.0	36.4	33.7	27.9	3.8	150	Hor.	Yes
20800	52.9	74.0	21.1	49.2	37.1	37.7	4.3	150	Hor.	Yes
26000	55.0	74.0	19.0	43.5	37.2	30.7	5.0	150	Vert.	No
31200	50.5	74.0	23.5	35.6	40.7	28.4	2.7	150	Vert.	Yes
Measurement uncertainty				+2.2 dB / -3.6 dB						

Result measured with the average detector:

Frequency MHz	Meas. Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restricted Band?
5633	41.4	54.0	12.6	27.6	33.9	24.9	4.8	150	5633	41.4
7800	47.6	54.0	6.4	29.2	36.2	23.5	5.7	150	7800	47.6
10400	47.3	54.0	6.7	26.6	37.6	23.6	6.7	150	10400	47.3
13000	43.2	54.0	10.8	32.8	33.6	26.5	3.3	150	13000	43.2
15600	37.8	54.0	16.2	28.2	33.7	27.9	3.8	150	15600	37.8
20800	49.7	54.0	4.3	46.0	37.1	37.7	4.3	150	20800	49.7
26000	47.0	54.0	7.0	35.5	37.2	30.7	5.0	150	26000	47.0
31200	42.4	54.0	11.6	27.5	40.7	28.4	2.7	150	31200	42.4
Measurement uncertainty				+2.2 dB / -3.6 dB						

Transmitter operates at the middle of the assigned frequency band (operation mode 17)

Result measured with the peak detector:

Frequency MHz	Meas. Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restricted Band?
5741	48.5	74.0	25.5	34.3	33.8	24.4	4.8	150	Vert.	No
7950	53.6	74.0	20.4	34.9	36.5	23.5	5.8	150	Vert.	No
10520	54.4	74.0	19.6	33.7	37.6	23.5	6.7	150	Hor.	No
13250	46.6	74.0	27.4	36.3	33.6	26.5	3.2	150	Hor.	Yes
15900	53.2	74.0	20.8	43.4	33.8	27.6	3.6	150	Vert.	Yes
21200	54.6	74.0	19.4	50.9	37.1	37.8	4.4	150	Hor.	Yes
26500	58.2	74.0	15.8	43.5	40.6	30.8	4.9	150	Vert.	No
31800	51.0	74.0	23.0	35.0	40.6	27.5	2.9	150	Vert.	Yes
Measurement uncertainty				+2.2 dB / -3.6 dB						

Result measured with the average detector:

Frequency MHz	Meas. Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restricted Band?
5741	37.9	54.0	16.1	23.7	33.8	24.4	4.8	150	Vert.	No
7950	47.6	54.0	6.4	28.9	36.5	23.5	5.8	150	Vert.	No
10520	46.9	54.0	7.1	26.2	37.6	23.5	6.7	150	Hor.	No
13250	39.4	54.0	14.6	29.1	33.6	26.5	3.2	150	Hor.	Yes
15900	39.6	54.0	14.4	29.8	33.8	27.6	3.6	150	Vert.	Yes
21200	51.5	54.0	2.5	47.8	37.1	37.8	4.4	150	Hor.	Yes
26500	51.3	54.0	2.7	36.6	40.6	30.8	4.9	150	Vert.	No
31800	40.8	54.0	13.2	24.8	40.6	27.5	2.9	150	Vert.	Yes
Measurement uncertainty				+2.2 dB / -3.6 dB						

Transmitter operates at the middle of the assigned frequency band (operation mode 20)

Result measured with the peak detector:

Frequency MHz	Meas. Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restricted Band?
5231	49.9	74.0	24.1	36.9	33.7	25.3	4.5	150	Hor.	No
8370	55.2	74.0	18.8	36.3	36.9	24.0	5.9	150	Hor.	Yes
11160	55.6	74.0	18.4	34.1	38.4	23.8	7.0	150	Vert.	Yes
16740	53.6	74.0	20.4	44.6	33.8	28.6	3.9	150	Vert.	No
22320	52.8	74.0	21.2	48.8	37.2	37.7	4.5	150	Vert.	Yes
27900	48.8	74.0	25.2	35.5	40.6	30.1	2.8	150	Hor.	No
33480	53.1	74.0	20.9	35.1	40.7	26.0	3.3	150	Hor.	No
Measurement uncertainty				+2.2 dB / -3.6 dB						

Result measured with the average detector:

Frequency MHz	Meas. Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restricted Band?
5231	42.3	54.0	11.7	29.3	33.7	25.3	4.5	150	Hor.	No
8370	49.4	54.0	4.6	30.5	36.9	24.0	5.9	150	Hor.	Yes
11160	47.8	54.0	6.2	26.3	38.4	23.8	7.0	150	Vert.	Yes
16740	38.5	54.0	15.5	29.5	33.8	28.6	3.9	150	Vert.	No
22320	49.6	54.0	4.4	45.6	37.2	37.7	4.5	150	Vert.	Yes
27900	41.2	54.0	12.8	27.9	40.6	30.1	2.8	150	Hor.	No
33480	40.8	54.0	13.2	22.8	40.7	26.0	3.3	150	Hor.	No
Measurement uncertainty				+2.2 dB / -3.6 dB						

Transmitter operates at the middle of the assigned frequency band (operation mode 23)

Result measured with the peak detector:

Frequency MHz	Meas. Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
5303	51.2	74.0	22.8	38.1	33.6	25.1	4.6	150	Hor.	No
8678	54.0	74.0	20.0	34.1	37.4	23.5	6.1	150	Vert.	No
11570	55.6	74.0	18.4	33.5	38.9	23.7	6.9	150	Hor.	Yes
14463	47.8	74.0	26.2	37.5	33.7	26.9	3.5	150	Hor.	No
17355	56.5	74.0	17.5	47.1	33.9	28.4	3.9	150	Vert.	No
23140	53.0	74.0	21.0	49.1	37.2	37.8	4.6	150	Vert.	No
28925	48.4	74.0	25.6	35.1	40.6	30.3	3.0	150	Hor.	No
Measurement uncertainty				+2.2 dB / -3.6 dB						

Result measured with the average detector:

Frequency MHz	Meas. Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
5303	44.0	54.0	10.0	30.9	33.6	25.1	4.6	150	Hor.	No
8678	45.5	54.0	8.5	25.6	37.4	23.5	6.1	150	Vert.	No
11570	47.2	54.0	6.8	25.1	38.9	23.7	6.9	150	Hor.	Yes
14463	41.5	54.0	12.5	31.2	33.7	26.9	3.5	150	Hor.	No
17355	42.6	54.0	11.4	33.2	33.9	28.4	3.9	150	Vert.	No
23140	49.4	54.0	4.6	45.5	37.2	37.8	4.6	150	Vert.	No
28925	40.3	54.0	13.7	27.0	40.6	30.3	3.0	150	Hor.	No
Measurement uncertainty				+2.2 dB / -3.6 dB						

Transmitter operates at the upper end of the assigned frequency band (operation mode 15)

Result measured with the peak detector:

Frequency MHz	Meas. Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restricted Band?
5677	49.6	74.0	24.4	35.5	33.8	24.3	4.7	150	Vert.	No
7860	53.8	74.0	20.2	35.2	36.3	23.5	5.8	150	Vert.	No
10480	54.5	74.0	19.5	34.1	37.5	23.7	6.6	150	Hor.	No
13100	47.7	74.0	26.3	37.1	33.6	26.3	3.3	150	Hor.	No
15720	48.2	74.0	25.8	38.6	33.7	27.8	3.6	150	Hor.	Yes
20960	48.9	74.0	25.1	49.6	37.1	37.8	0.0	150	Hor.	Yes
26200	50.1	74.0	23.9	43.8	37.2	30.9	0.0	150	Vert.	No
31440	48.0	74.0	26.0	35.0	40.7	27.7	0.0	150	Vert.	Yes
Measurement uncertainty				+2.2 dB / -3.6 dB						

Result measured with the average detector:

Frequency MHz	Meas. Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restricted Band?
5677	40.2	54.0	13.8	26.1	33.8	24.3	4.7	150	Vert.	No
7860	47.5	54.0	6.5	28.9	36.3	23.5	5.8	150	Vert.	No
10480	46.8	54.0	7.2	26.4	37.5	23.7	6.6	150	Hor.	No
13100	41.2	54.0	12.8	30.6	33.6	26.3	3.3	150	Hor.	No
15720	37.8	54.0	16.2	28.2	33.7	27.8	3.6	150	Hor.	Yes
20960	45.9	54.0	8.1	46.6	37.1	37.8	0.0	150	Hor.	Yes
26200	41.8	54.0	12.2	35.5	37.2	30.9	0.0	150	Hor.	No
31440	39.7	54.0	14.3	26.7	40.7	27.7	0.0	150	Vert.	Yes
Measurement uncertainty				+2.2 dB / -3.6 dB						

Transmitter operates at the upper end of the assigned frequency band (operation mode 18)

Result measured with the peak detector:

Frequency MHz	Meas. Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restricted Band?
5763	48.1	74.0	25.9	33.7	33.8	24.2	4.9	150	Vert.	No
7980	54.8	74.0	19.2	36.4	36.6	24.0	5.8	150	Vert.	No
10640	55.4	74.0	18.6	34.3	38.0	23.7	6.7	150	Hor.	Yes
13300	46.9	74.0	27.1	36.5	33.6	26.3	3.2	150	Hor.	Yes
15960	51.4	74.0	22.6	41.6	33.8	27.7	3.7	150	Vert.	Yes
21280	54.8	74.0	19.2	51.0	37.2	37.8	4.4	150	Hor.	Yes
26600	50.0	74.0	24.0	37.5	40.6	30.7	2.6	150	Vert.	No
Measurement uncertainty				+2.2 dB / -3.6 dB						

Result measured with the average detector:

Frequency MHz	Meas. Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restricted Band?
5763	38.5	54.0	15.5	24.1	33.8	24.2	4.9	150	Vert.	No
7980	49.2	54.0	4.8	30.8	36.6	24.0	5.8	150	Vert.	No
10640	47.8	54.0	6.2	26.7	38.0	23.7	6.7	150	Hor.	Yes
13300	39.6	54.0	14.4	29.2	33.6	26.3	3.2	150	Hor.	Yes
15960	37.1	54.0	16.9	27.3	33.8	27.7	3.7	150	Vert.	Yes
21280	52.2	54.0	1.8	48.4	37.2	37.8	4.4	150	Hor.	Yes
26600	43.0	54.0	11.0	30.5	40.6	30.7	2.6	150	Vert.	No
Measurement uncertainty				+2.2 dB / -3.6 dB						

Transmitter operates at the upper end of the assigned frequency band (operation mode 21)

Result measured with the peak detector:

Frequency MHz	Meas. Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restricted Band?
5344	51.6	74.0	22.4	37.9	33.7	24.5	4.5	150	Hor.	No
6056	50.9	74.0	23.1	36.2	34.4	24.7	5.0	150	Vert.	No
8550	57.2	74.0	16.8	37.3	37.2	23.3	6.0	150	Hor.	No
11400	56.6	74.0	17.4	34.7	38.6	23.6	6.9	150	Vert.	Yes
17100	46.5	74.0	27.5	37.1	33.8	28.3	3.9	150	Vert.	No
14250	48.5	74.0	25.5	38.2	33.7	26.8	3.4	150	Hor.	No
22800	52.8	74.0	21.2	48.7	37.2	37.8	4.7	150	Hor.	Yes
28500	48.4	74.0	25.6	35.3	40.6	30.3	2.8	150	Hor.	No
34200	52.9	74.0	21.1	35.0	40.7	26.0	3.2	150	Hor.	No
Measurement uncertainty				+2.2 dB / -3.6 dB						

Result measured with the average detector:

Frequency MHz	Meas. Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restricted Band?
5344	44.6	54.0	9.4	30.9	33.7	24.5	4.5	150	Hor.	No
6056	39.8	54.0	14.2	25.1	34.4	24.7	5.0	150	Vert.	No
8550	47.2	54.0	6.8	27.3	37.2	23.3	6.0	150	Hor.	No
11400	48.1	54.0	5.9	26.2	38.6	23.6	6.9	150	Vert.	Yes
17100	37.0	54.0	17.0	27.6	33.8	28.3	3.9	150	Vert.	No
14250	40.7	54.0	13.3	30.4	33.7	26.8	3.4	150	Hor.	No
22800	49.5	54.0	4.5	45.4	37.2	37.8	4.7	150	Hor.	Yes
28500	39.9	54.0	14.1	26.8	40.6	30.3	2.8	150	Hor.	No
34200	41.0	54.0	13.0	23.1	40.7	26.0	3.2	150	Hor.	No
Measurement uncertainty				+2.2 dB / -3.6 dB						

Transmitter operates at the upper end of the assigned frequency band (operation mode 24)

Result measured with the peak detector:

Frequency MHz	Meas. Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
5340	52.9	74.0	21.1	39.3	33.7	24.7	4.6	150	Hor.	No
8738	54.4	74.0	19.6	33.7	37.4	23.7	7.0	150	Hor.	No
11650	55.4	74.0	18.6	33.4	39.1	24.0	6.9	150	Hor.	Yes
14563	47.5	74.0	26.5	37.3	33.7	26.9	3.4	150	Hor.	No
17475	55.0	74.0	19.0	45.3	33.9	28.0	3.9	150	Vert.	No
23300	54.0	74.0	20.0	50.0	37.2	37.9	4.7	150	Vert.	No
29125	48.8	74.0	25.2	35.8	40.6	30.3	2.7	150	Hor.	No
Measurement uncertainty				+2.2 dB / -3.6 dB						

Result measured with the average detector:

Frequency MHz	Meas. Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
5340	45.8	54.0	8.2	32.2	33.7	24.7	4.6	150	Hor.	No
8738	44.6	54.0	9.4	23.9	37.4	23.7	7.0	150	Hor.	No
11650	45.8	54.0	8.2	23.8	39.1	24.0	6.9	150	Hor.	Yes
14563	41.8	54.0	12.2	31.6	33.7	26.9	3.4	150	Hor.	No
17475	42.1	54.0	11.9	32.4	33.9	28.0	3.9	150	Vert.	No
23300	50.3	54.0	3.7	46.3	37.2	37.9	4.7	150	Vert.	No
29125	40.8	54.0	13.2	27.8	40.6	30.3	2.7	150	Hor.	No
Measurement uncertainty				+2.2 dB / -3.6 dB						

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
6, 8 - 15, 17 – 25, 32, 33

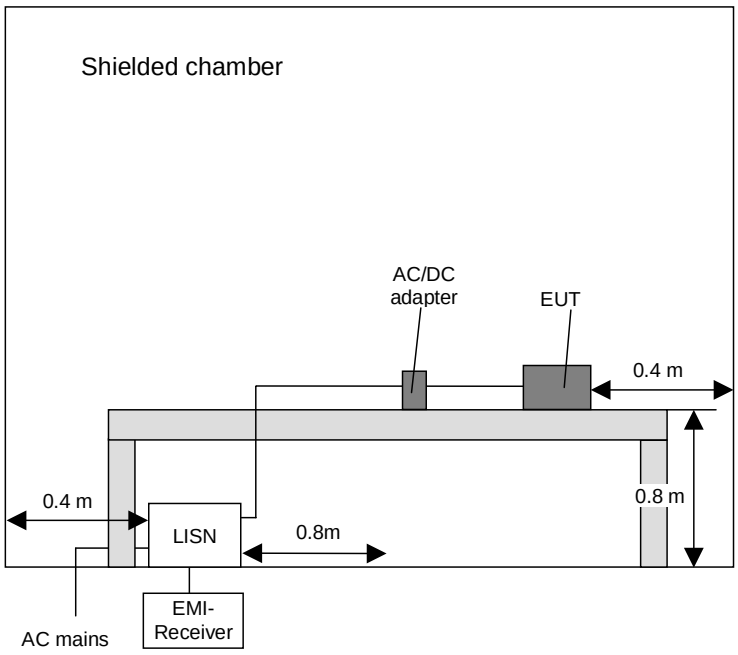
5.8 Conducted emissions on power supply lines (150 kHz to 30 MHz)

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 setup 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	52 %

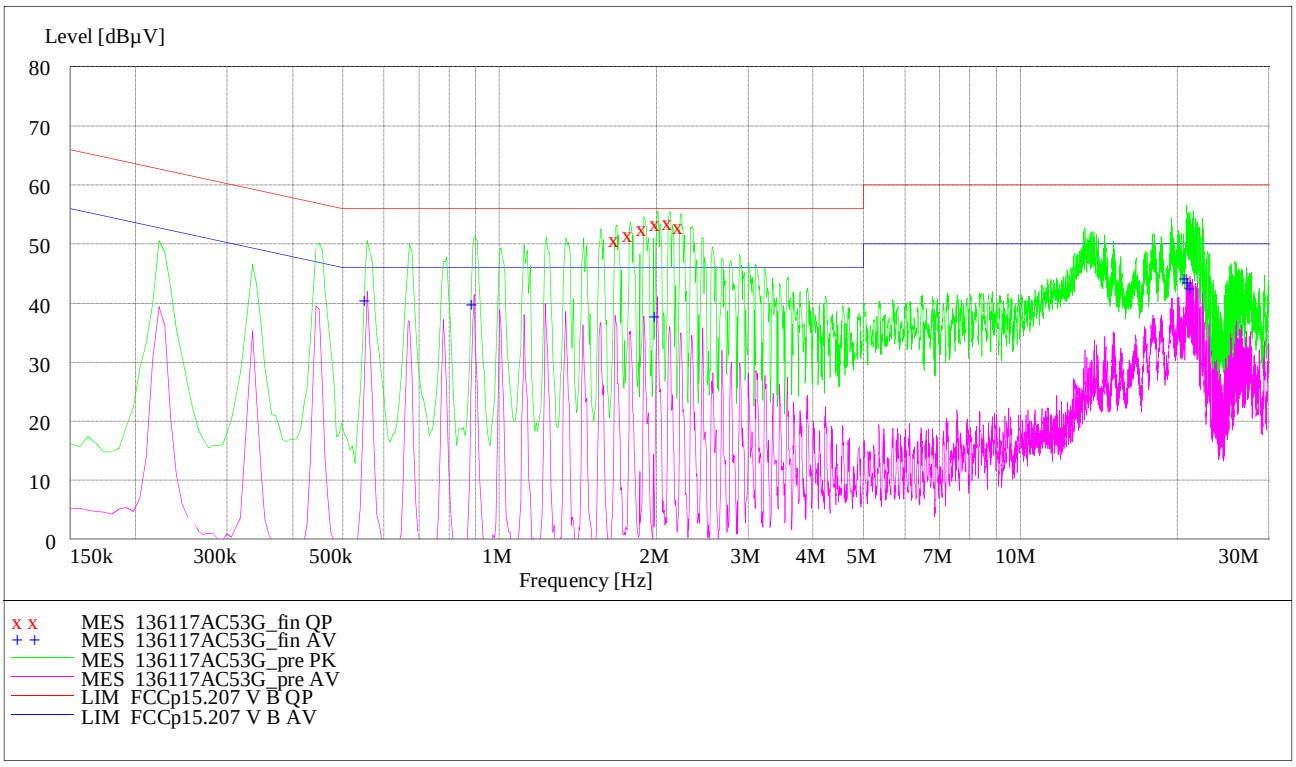
Position of EUT: For the test the EUT were plugged into a laptop PC via a RS232 cable. The EUT was set to continuous transmission on channel 60 (n20 mode, 6.5 Mbps, PWR: 16 dBm, operation mode 14) by the laptop PC.
The laptop PC with the inserted EUT was set-up on a non-conducting table of a height of 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: Measurement performed with US 120V/60Hz. For the test a power supply type 2121 from Mascot was used.

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 +.



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

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
1.680000	51.00	0.7	56.0	5.0	L1	GND
1.788000	51.90	0.7	56.0	4.1	L1	FLO
1.896000	52.70	0.7	56.0	3.3	L1	FLO
2.010000	53.70	0.8	56.0	2.3	L1	GND
2.124000	53.80	0.8	56.0	2.2	L1	FLO
2.232000	53.30	0.8	56.0	2.7	L1	FLO

Result measured with the average detector (marked by a +):

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.558000	40.70	0.9	46.0	5.3	L1	GND
0.894000	40.10	0.7	46.0	5.9	L1	GND
2.004000	38.00	0.8	46.0	8.0	L1	GND
20.916000	44.50	2.5	50.0	5.5	N	FLO
21.174000	43.70	2.5	50.0	6.3	L1	GND
21.420000	42.80	2.5	50.0	7.2	L1	GND

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
1 – 5

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	03/21/2014	03/2016
3	LISN	NSLK8128	Schwarzbeck	8128155	480058	12/20/2013	12/2014
4	High pass filter	HR 0.13-5ENN	FSY Microwave Inc.	DC 0109 SN 002	480340	Weekly verification (system cal.)	
5	EMI Software	ES-K1	Rohde & Schwarz	-	480111	-	-
6	Fully anechoic chamber M20	-	Albatross Projects	B83107-E2439-T232	480303	Weekly verification (system cal.)	
7	Spectrum analyser	FSU	Rohde & Schwarz	200125	480956	07/15/2013	07/2015
8	Measuring receiver	ESI 40	Rohde & Schwarz	100064	480355	02/26/2014	02/2016
9	Controller	MCU	Maturo	MCU/043/971107	480832	-	-
10	Turntable	DS420HE	Deisel	420/620/80	480315	-	-
11	Antenna support	AS615P	Deisel	615/310	480187	-	-
12	Antenna	CBL6112 B	Chase	2688	480328	04/14/2014	04/2017
13	Antenna	3115 A	EMCO	9609-4918	480183	11/10/2014	11/2017
14	Standard Gain Horn 11.9 GHz – 18 GHz	18240-20	Flann Microwave	483	480294	Six month verification (system cal.)	
15	Standard Gain Horn 17.9 GHz – 26.7 GHz	20240-20	Flann Microwave	411	480297	Six month verification (system cal.)	
16	Standard Gain Horn Antenne 26.4 – 40.1 GHz	22240-20	Flann Microwave	469	480229	Six month verification (system cal.)	
17	RF-cable No. 3	Sucoflex 106B	Huber&Suhner	0563/6B / Kabel 3	480670	Weekly verification (system cal.)	
18	RF-cable No. 40	Sucoflex 106B	Huber&Suhner	0708/6B / Kabel 40	481330	Weekly verification (system cal.)	
19	RF-cable No. 36	Sucoflex 106B	Huber&Suhner	500003/6B / Kabel 36-	481680	Weekly verification (system cal.)	
20	RF-cable 1 m	KPS-1533-400-KPS	Insulated Wire	-	480300	Six month verification (system cal.)	
21	RF-cable 2 m	KPS-1533-800-KPS	Insulated Wire		480302	Six month verification (system cal.)	
22	Preamplifier	JS3-00101200-23-5A	Miteq	681851	480337	Six month verification (system cal.)	
23	Preamplifier	JS3-12001800-16-5A	Miteq	571667	480343	Six month verification (system cal.)	
24	Preamplifier	JS3-18002600-20-5A	Miteq	658697	480342	Six month verification (system cal.)	
25	Loop antenna	HFH2-Z2	Rohde & Schwarz	832609/014	480059	02/18/2014	02/2016
26	Power Meter	NRVD	Rohde & Schwarz	833697/030	480589	07/2013	07/2015
27	Power Sensor	NRV-Z2	Rohde & Schwarz	844854/003	480194	02/25/2014	02/2016
28	4 GHz High Pass Filter	WHKX4.0/18G-8SS	Wainwright Instruments	1	480587	Weekly verification (system cal.)	
29	Single Control Unit	SCU	Maturo GmbH	SCU/006/971107	480831	Calibration not necessary	
30	High-pass Filter	H26G40G1	Microwave Circuits. Inc.	33471	480593	Six month verification (system cal.)	
31	Temperature Test Chamber	MK 240	Binder	05-79022	480462	02/18/2014	08/2015
32	High pass Filter	WHKX8.0/18G-8SS	Wainwright Instruments		480586	12 month verification	

33	Tuneable band reject	WRCJ5100/5850-20/50-8SSK	Wainwright Instruments		480681	12 month verification
34	Band reject filter	WRCTF2402/2480-2399/2483-35/12+9EE	Wainwright Instruments		480748	12 month verification

7 REPORT HISTORY

Report Number	Date	Comment
F145298E8	25 June 2015	Document created

8 LIST OF ANNEXES

ANNEX A TEST SET-UP PHOTOS 7 pages

145298_18.jpg: Test setup - Radiated emission (fully anechoic chamber)
145298_19.jpg: Test setup - Radiated emission (fully anechoic chamber)
145298_20.jpg: Test setup - Radiated emission (fully anechoic chamber)
145298_21.jpg: Test setup - Radiated emission (fully anechoic chamber)
145298_22.jpg: Test setup - Radiated emission (fully anechoic chamber)
145298_23.jpg: Test setup – Preliminary measurement 9 kHz to 30 MHz (fully anechoic chamber)
145298_32.jpg: Test setup – conducted emissions on power supply lines

ANNEX B EXTERNAL PHOTOS 2 pages

145298_26.jpg: Adaptor Board + Reference Design – 3D View
145298_27.jpg: Adaptor Board – Top View
145298_28.jpg: Adaptor Board – Bottom View
145298_07.jpg: Adaptor Board – Connectors

ANNEX C INTERNAL PHOTOS 5 pages

145298_24.jpg: EUT - top view, with shielding
145298_25.jpg: EUT - top view, shielding removed
145298_10.jpg: EUT – bottom view
145298_29.jpg: Reference Design with EUT– Top View
145298_30.jpg: Reference Design with EUT– Detail Top View
145298_33.jpg: Reference Design with integral Antenna– Bottom View
145298_34.jpg: Reference Design with EUT– Detail Bottom View