

Test Report

Report Number:

F161629E1 2nd Version

Equipment under Test (EUT):

**WLAN module
SX-PCEAN2C**

Applicant:

PHOENIX CONTACT Electronics GmbH

Manufacturer:

PHOENIX CONTACT Electronics GmbH



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

References

- [1] **ANSI C63.10-2013**, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
- [2] **FCC CFR 47 Part 15 (April 2017)**, Radio Frequency Devices
- [2] **RSS-247 (March 2017)**, Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
- [2] **RSS-Gen Issue 4 (November 2014)**, General Requirements for Compliance of Radio Apparatus

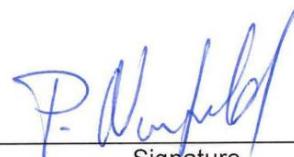
Test Result

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.

tested and
written by:

Paul NEUFELD

Name



18.04.2017

Date

Authorized
reviewer:

Bernd STEINER

Name



18.04.2017

Date

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1 Identification

1.1 Applicant

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Applicant represented during the test by the following person:	none

1.2 Manufacturer

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eMail Address:	apape@phoenixcontact.com
Applicant represented during the test by the following person:	none

1.3 Test Laboratory

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

Accredited by *Deutsche Akkreditierungsstelle GmbH* in compliance with
 DIN EN ISO/IEC 17025 under Reg. No. < **D-PL-17186-01-02** >.

1.4 EUT (Equipment Under Test)

Test object: *	WLAN module
Model / PMN: *	SX-PCEAN2
FCC ID: *	YG3-SXPCEAN2
IC Company number / UPN: *	4720B-SXPCEAN2
HVIN:*	SX-PCEAN2
HMN:*	WLAN 2101
Order number:*	Not applicable
Serial number: *	EUT 1: M7007690 (antenna port conducted measurements) EUT 2: M7019820 (radiated measurements)
PCB identifier: *	PW101650BX
Hardware version / FVIN: *	ZXE03263* ²
Software version (Radiated test mode): *	0.00.20_ALPHA_TX99
Software version (Final Version): *	1.00

* Declared by the applicant

² The manufacturer does not provide a hardware-version, but instead updates the order number of the WLAN module. Therefore the order number is submitted here.

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

Ancillary Equipment:

Evaluation Board:	9068231_02 by Phoenix Contact Electronics GmbH*
Cables:	Ethernet cable* Serial cable (USB-plug)* Power Supply cable*
USB to serial adapter	DIGITUS DA-70156 serial to USB adapter
Laptop:	Fujitsu S7220

*Provided by the applicant

1.5 Technical Data of Equipment

Fulfils WLAN specification: *	IEEE, 802.11b, 802.11g, 802.11n HT20 + HT40,					
Antenna type: *	Directional antenna (EUT ant port 0) Omnidirectional antenna (EUT ant port 1)					
Antenna name: *	2JZ0102 (EUT ant port 0) 2JZ0102 (EUT ant port 1)					
Antenna gain: *	5 dBi peak (EUT ant port 0) 2 dBi peak (EUT ant port 1) 3.8 dBi (Directional gain with ant. Port 0&1 combined – calculated according to ANSI C63.10 clause 14.4.3.2.4 b)					
Antenna connector: *	U.FL					
Power supply:	DC					
Supply voltage Evaluation Board:	$U_{\text{nom}} =$	24.0 V DC	$U_{\text{min}} =$	18.0 V DC	$U_{\text{max}} =$	32.0 V DC
Power supply:	DC					
Supply voltage WLAN module:	$U_{\text{nom}} =$	3.3 V DC	$U_{\text{min}} =$	2.805 V DC	$U_{\text{max}} =$	3.795 V DC
Type of modulation: *	802.11b: DSSS 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 MHz to 5825 MHz					
Number of channels: *	11 (802.11 b/g/n20), 7 (802.11n40)					
Temperature range: *	0 °C to 60 °C					
Lowest / highest internal clock frequency: *	32 kHz / 5825 MHz					

1.6 Dates

Date of receipt of test sample:	25.08.2016
Start of test:	25.08.2016
End of test:	07.12.2016

2 Operational States

The EUT is MIMO WLAN module for integration into various hosts. The EUT operates in the 2.4 GHz und 5 GHz bands. This test report shows the results of the 2.4 GHz band only.

The test modes were set using an ancillary laptop with software called “Atheros Radio Test 2 (artgui.exe)”, which was connected to the EUT via Ethernet connection.

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

Operation mode	Description of the operation mode	Antenna port	WLAN channel	WLAN mode	Data rate / Mbps
1	Continuous transmitting on 2412 MHz	0	1	802.11b	1 Mbps
2	Continuous transmitting on 2437 MHz	0	6	802.11b	1 Mbps
3	Continuous transmitting on 2462 MHz	0	11	802.11b	1 Mbps
4	Continuous transmitting on 2412 MHz	1	1	802.11b	1 Mbps
5	Continuous transmitting on 2437 MHz	1	6	802.11b	1 Mbps
6	Continuous transmitting on 2462 MHz	1	11	802.11b	1 Mbps
7	Continuous transmitting on 2412 MHz	0	1	802.11g	9 Mbps
8	Continuous transmitting on 2437 MHz	0	6	802.11g	9 Mbps
9	Continuous transmitting on 2462 MHz	0	11	802.11g	9 Mbps
10	Continuous transmitting on 2412 MHz	1	1	802.11g	9 Mbps
11	Continuous transmitting on 2437 MHz	1	6	802.11g	9 Mbps
12	Continuous transmitting on 2462 MHz	1	11	802.11g	9 Mbps
13	Continuous transmitting on 2412 MHz	0	1	802.11n20	6.5 Mbps
14	Continuous transmitting on 2437 MHz	0	6	802.11n20	6.5 Mbps
15	Continuous transmitting on 2462 MHz	0	11	802.11n20	6.5 Mbps
16	Continuous transmitting on 2412 MHz	1	1	802.11n20	6.5 Mbps
17	Continuous transmitting on 2437 MHz	1	6	802.11n20	6.5 Mbps
18	Continuous transmitting on 2462 MHz	1	11	802.11n20	6.5 Mbps
19	Continuous transmitting on 2412 MHz	0&1	1	802.11n20	6.5 Mbps
20	Continuous transmitting on 2437 MHz	0&1	6	802.11n20	6.5 Mbps
21	Continuous transmitting on 2462 MHz	0&1	11	802.11n20	6.5 Mbps
22	Continuous transmitting on 2422 MHz	0	3	802.11n40	13 Mbps
23	Continuous transmitting on 2437 MHz	0	6	802.11n40	13 Mbps
24	Continuous transmitting on 2452 MHz	0	9	802.11n40	13 Mbps

25	Continuous transmitting on 2422 MHz	1	3	802.11n40	13 Mbps
26	Continuous transmitting on 2437 MHz	1	6	802.11n40	13 Mbps
27	Continuous transmitting on 2452 MHz	1	9	802.11n40	13 Mbps
28	Continuous transmitting on 2422 MHz	0&1	3	802.11n40	13 Mbps
29	Continuous transmitting on 2437 MHz	0&1	6	802.11n40	13 Mbps
30	Continuous transmitting on 2452 MHz	0&1	9	802.11n40	13 Mbps

Power Settings for all measurements:

	ch. 1	ch. 2	ch. 3	ch. 4	ch. 5	ch. 6	ch. 7	ch. 8	ch. 9	ch. 10	ch. 11
802.11b	12.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	11.0
802.11g	13.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	11.5
802.11n20	11.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	13.0
802.11n40	5.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	3.5

3 Additional Information

All tests were performed with unmodified samples.

For the conducted tests, both antenna ports were calculated with 5 dBi antenna gain where applicable, since this is the worst case.

EUT:



4 Overview

Application	Frequency range [MHz]	FCC 47 CFR Part 15 section [2]	RSS-247 [3] or RSS-Gen, Issue 4 [4]	Status	Refer page
Maximum Peak Output Power	2400.0 - 2483.5	15.247 (b) (3), (4)	5.4 (2) [3]	Passed	10 et seq
DTS Bandwidth	2400.0 - 2483.5	15.247 (a) (2)	5.2 (1) [3]	Passed	12 et seq
Peak Power Spectral Density	2400.0 - 2483.5	15.247 (e)	5.2 (2) [3]	Passed	16 et seq
Band edge compliance	2400.0 - 2483.5	15.247 (d)	5.5 [3] 8.9 [4], 8.10 [4]	Passed	19 et seq.
Radiated emissions (transmitter)	0.009 – 26,500	15.247 (d) 15.205 (a) 15.209 (a)	5.5 [3] 8.9 [4], 8.10 [4]	Passed	31 et seq.
Conducted emissions on supply line	0.15 - 30	15.207 (a)	8.8 [4]	Passed	83 et seq.

5 Results

5.1 Duty cycle

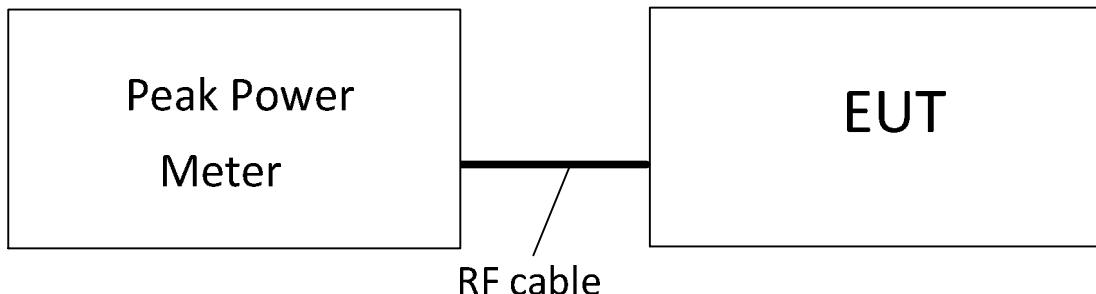
5.1.1 Method of measurement

All tests that include an average evaluation of the EUT were performed in a test mode in which the EUT transmits continuously. Therefore duty cycle correction was not necessary for all tests.

5.2 Maximum conducted output power

5.2.1 Method of measurement

The EUT was measured conducted at the antenna ports with the aid of a peak power meter.



Acceptable measurement configurations

Procedure 11.9.1.3 in [1] was used for the following test.

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall use a fast-responding diode detector.

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

5.2.2 Test results

Ambient temperature	22 °C	Relative humidity	62 %
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All antenna gains are below 6 dBi, therefore no conducted output limit reduction is necessary.

Operation mode	Frequency [MHz]	Conducted output power ant. port 0 [dBm]	Conducted output power ant. port 1 [dBm]	Conducted output power ant. port 0&1 combined [dBm]	EIRP power [dBm]	Limit [dBm]
1	2412	12.7			17.7	30
2	2437	14.8			19.8	30
3	2462	10.4			15.4	30
4	2412		12.3		14.3	30
5	2437		15.3		17.3	30
6	2462		10.8		12.8	30
7	2412	20.3			25.3	30
8	2437	22.4			27.4	30
9	2462	19.7			24.7	30
10	2412		20.5		22.5	30
11	2437		22.4		24.4	30
12	2462		18.8		20.8	30
13	2412	18.4			23.4	30
14	2437	21.6			26.6	30
15	2462	16.1			21.1	30
16	2412		18.6		20.6	30
17	2437		21.7		23.7	30
18	2462		16.5		18.5	30
19	2412	18.3	18.8	21.6	25.4	30
20	2437	21.5	21.6	24.6	28.4	30
21	2462	16.3	16.8	19.6	23.4	30
22	2422	9.8			14.8	30
23	2437	20.9			25.9	30
24	2452	3.9			8.9	30
25	2422		10.2		12.2	30
26	2437		21.2		23.2	30
27	2452		5.5		7.5	30
28	2422	9.5	10.8	13.2	17.0	30
29	2437	20.7	20.9	23.8	27.6	30
30	2452	3.4	5.3	7.5	11.3	30

Test: Passed

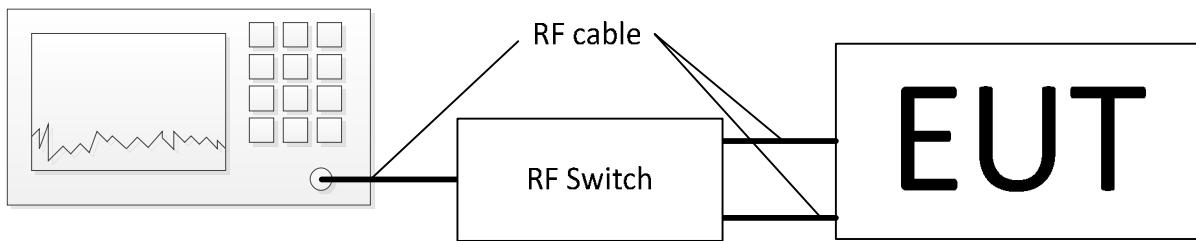
TEST EQUIPMENT USED FOR THE TEST:

60, 61

5.3 DTS Bandwidth

5.3.1 Method of measurement

The EUT was tested with a spectrum analyzer connected to the antenna ports via an RF switch.



For the test of antenna port 0 and 1 transmitting simultaneously, the traces of the individual antenna ports were summed in linear terms as described in 14.3.2.2 in document [1].

The measurement procedure refers to part 11.8.1 of document [1].

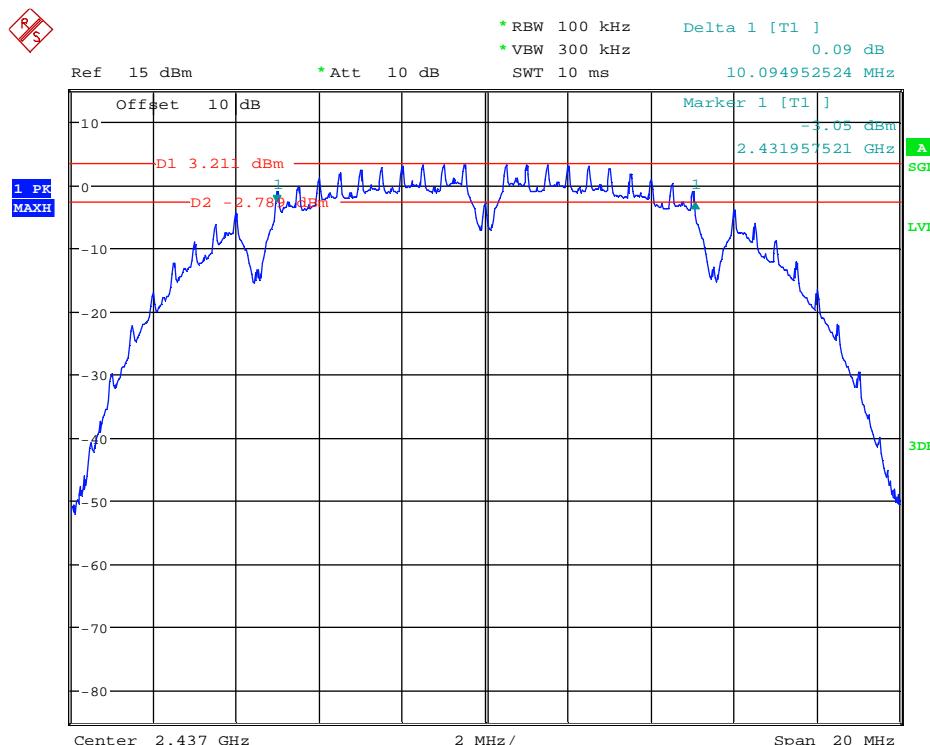
- Set RBW = 100 kHz.
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
- Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Allow the trace to stabilize.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (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

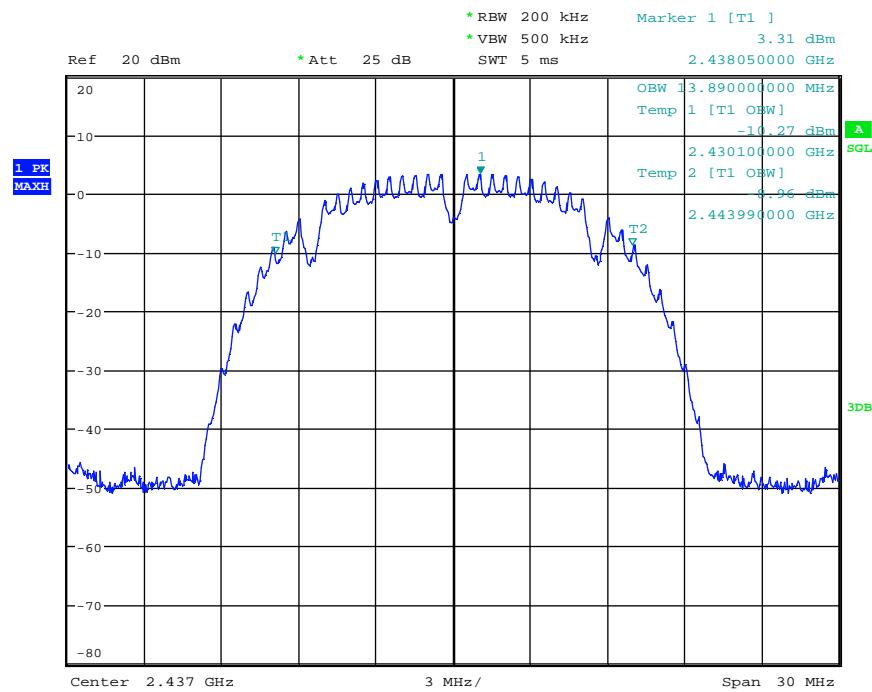
Ambient temperature	22 °C	Relative humidity	59 %
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The following results were measured at the antenna port of the EUT. The plot shows an exemplary measurement result for the worst documented case. The other results are listed in the following table.

WLAN1100_ant1_6dB-BW_b_6-dB Bandwidth (operation mode 5):



WLAN1100_99%BW_b_6.wmf: 99 % Bandwidth (operation mode 2):



Operation Mode	Center Frequency [MHz]	Minimum 6-dB Bandwidth Limit [MHz]	6 dB Bandwidth [MHz]	99 % Bandwidth [MHz]	Result
1	2412	0.5	10.085	13.860	Passed
2	2437	0.5	10.105	13.890	Passed
3	2462	0.5	10.105	13.890	Passed
4	2412	0.5	10.105	13.890	Passed
5	2437	0.5	10.095	13.890	Passed
6	2462	0.5	10.095	13.890	Passed
7	2412	0.5	16.582	17.300	Passed
8	2437	0.5	16.582	17.300	Passed
9	2462	0.5	16.597	17.300	Passed
10	2412	0.5	16.582	17.350	Passed
11	2437	0.5	16.597	17.350	Passed
12	2462	0.5	16.597	17.300	Passed
13	2412	0.5	17.841	18.300	Passed
14	2437	0.5	17.856	18.400	Passed
15	2462	0.5	17.856	18.350	Passed
16	2412	0.5	17.856	18.350	Passed
17	2437	0.5	17.856	18.350	Passed
18	2462	0.5	17.796	18.400	Passed
19	2412	0.5	17.862	18.132	Passed
20	2437	0.5	17.892	18.132	Passed
21	2462	0.5	17.862	18.132	Passed
22	2422	0.5	36.582	39.360	Passed
23	2437	0.5	36.582	39.680	Passed
24	2452	0.5	36.582	39.600	Passed
25	2422	0.5	36.582	39.280	Passed
26	2437	0.5	36.582	39.280	Passed
27	2452	0.5	36.582	39.520	Passed
28	2422	0.5	36.582	39.161	Passed
29	2437	0.5	36.607	39.161	Passed
30	2452	0.5	36.607	39.321	Passed
Measurement uncertainty		+0.66 dB / -0.72 dB			

Test: Passed

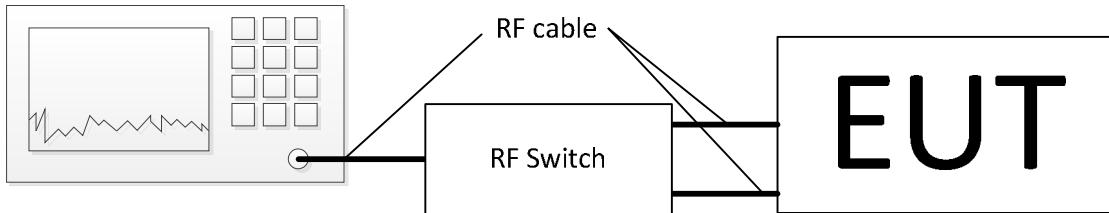
TEST EQUIPMENT USED FOR THE TEST:

6 – 10, 30

5.4 Peak Power Spectral Density

5.4.1 Method of measurement

The EUT was tested with a spectrum analyzer connected to the antenna ports via an RF switch.



For the test of antenna port 0 and 1 transmitting simultaneously, the traces of the individual antenna ports were summed in linear terms as described in 14.3.2.2 in document [1].

The measurement procedure refers to part 10.10.2 of document [1].

- Set analyser center frequency to DTS channel center frequency
- Set the span to 1.5 times the DTS bandwidth.
- Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- Set the VBW $\geq 3 \times \text{RBW}$.
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level within the RBW.
- If measured value exceeds limit, reduce RBW (not less than 3 kHz) and repeat.

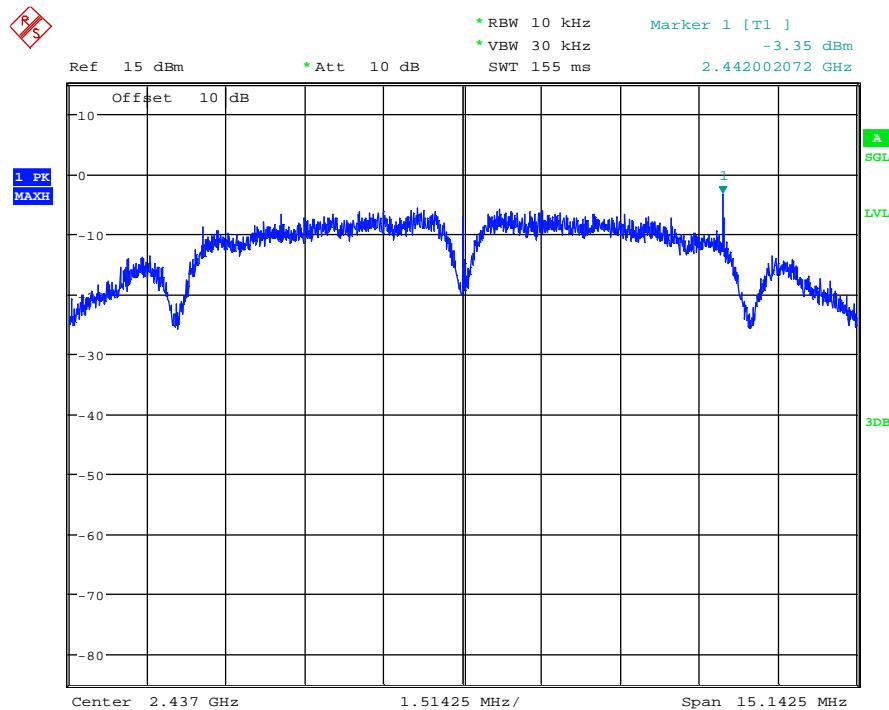
The measurement result in $[\text{dBmV/m}]$ was calculated to $[\text{dBm}]$ using the formula in chapter 11.12.2.2 e) in [1].

5.4.2 Test result

Ambient temperature	22 °C	Relative humidity	59 %
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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.

WLAN1100_ant1_PwrSpecDens_b_6.wmf: Power Spectral Density (operation mode 5):



Operation Mode	Peak Frequency [MHz]	Power Spectral Density Limit [dBm/3kHz]	Power Spectral Density Reading [dBm / 10 kHz]	Result
1	2412.504	8	-7.5	Passed
2	2436.399	8	-6.0	Passed
3	2462.500	8	-9.5	Passed
4	2407.998	8	-5.8	Passed
5	2442.002	8	-3.3	Passed
6	2462.505	8	-9.4	Passed
7	2407.876	8	-7.1	Passed
8	2440.502	8	-4.9	Passed
9	2469.504	8	-10.6	Passed
10	2408.876	8	-6.5	Passed
11	2438.006	8	-4.5	Passed
12	2462.005	8	-8.2	Passed
13	2418.249	8	-10.6	Passed
14	2444.782	8	-6.1	Passed
15	2465.750	8	-12.1	Passed
16	2418.810	8	-10.2	Passed
17	2441.727	8	-6.3	Passed
18	2468.804	8	-12.8	Passed
19	2417.608	8	-8.7	Passed
20	2442.003	8	-4.1	Passed
21	2465.602	8	-11.7	Passed
22	2426.724	8	-18.1	Passed
23	2453.252	8	-9.4	Passed
24	2461.353	8	-24.1	Passed
25	2438.532	8	-18.4	Passed
26	2430.335	8	-10.1	Passed
27	2440.751	8	-24.4	Passed
28	2433.252	8	-21.4	Passed
29	2434.504	8	-8.8	Passed
30	2434.799	8	-23.0	Passed
Measurement uncertainty			+0.66 dB / -0.72 dB	

Test: Passed

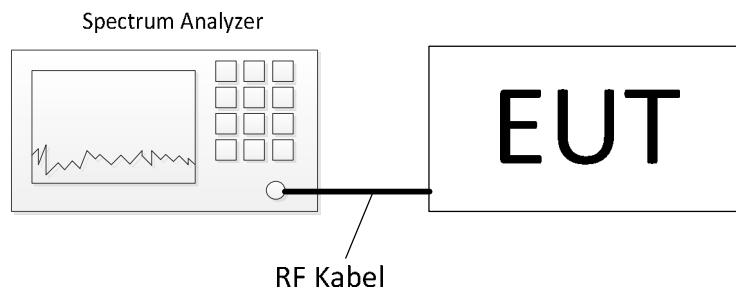
TEST EQUIPMENT USED FOR THE TEST:

6 – 10, 30

5.5 Band-edge compliance

5.5.1 Method of measurement (band edges next to unrestricted bands (conducted))

The EUT was tested with a spectrum analyzer connected to the antenna ports.



The relating measurements were carried out in a conducting manner. Therefore, the antenna connector was directly connected to a spectrum analyzer. The measurement procedure refers to part 11.11.2 and 11.11.3 of document [1].

Measurement Procedure Reference – Reference Level:

- RBW = 100 kHz.
- VBW \geq 300 kHz.
- Set the span to \geq 1.5 times the DTS Bandwidth.
- Detector = Peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilise.
- Use the peak marker function to determine the the maximum PSD level.

Measurement Procedure – Unwanted Emissions

- Set the center frequency and span to encompass the frequency range to be measured.
- RBW = 100 kHz.
- VBW \geq 300 kHz.
- Detector = Peak.
- Ensure that the number of measurement points \geq 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.

The measurement procedure at the band edges was simplified by performing the measurement in just one plot. Both, the in-band-emission and the unwanted emission were be encompassed by the span. After trace stabilization, the maximum peak was be determined by a peak detector and the value was marked by an appropriate limit line. The second limit line, which is 20 dB below the first, marks the limit for the emissions in the unrestricted band. A maximum-peak-detector marks the highest emission in the unrestricted band next to the band edge.

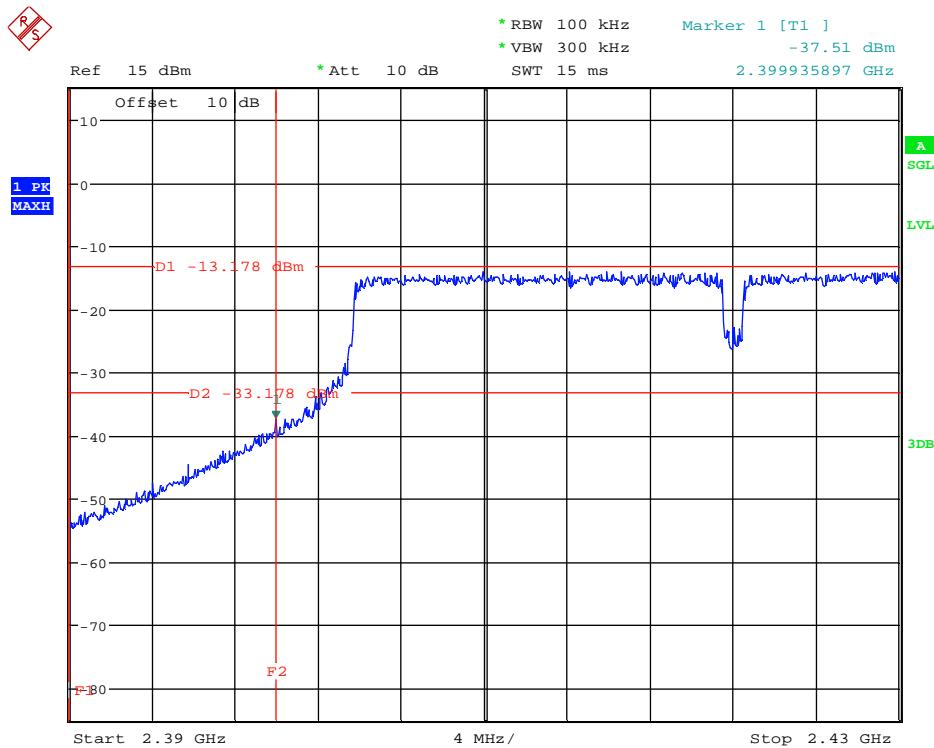
The measurements were performed at the lower end of the 2.4 GHz band.

5.5.2 Test result (band edges next to unrestricted bands (conducted))

Ambient temperature	22 °C	Relative humidity	59 %
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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.

WLAN1100_ant0&ant1_BandEdgeUnrestr_n40_1.wmf: conducted band-edge compliance (operation mode 28):



Operation mode	Antenna port	Emission Frequency [MHz]	Reference Level [dBm]	Limit [dBm]	Emission Level [dBm]	Margin [dB]	Result
1	0	2400.000	1.7	-18.3	-52.6	34.4	Passed
4	1	2400.000	2.5	-17.5	-48.4	30.9	Passed
7	0	2400.000	-0.0	-20.0	-30.1	10.1	Passed
10	1	2400.000	-0.8	-20.8	-28.9	8.2	Passed
13	0	2399.872	-3.3	-23.3	-31.6	8.3	Passed
16	1	2399.808	-2.4	-22.4	-31.0	8.5	Passed
19	0&1	2399.872	-2.9	-22.9	-31.8	8.9	Passed
22	0	2399.872	-12.3	-32.3	-36.8	4.5	Passed
25	1	2400.000	-12.0	-32.0	-35.9	3.9	Passed
28	0&1	2399.936	-13.2	-33.2	-36.6	3.4	Passed

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

6 – 10, 30

5.5.3 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 5.6.1 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 general limits specified in § 15.205.

The measurement was performed at the lower and the upper end of the 2.4 GHz band.

The calculation was performed with the following formula as described in chapter 11.12.2.2 e) in [1]:

$$E [\text{dBmV/m}] = EIRP [\text{dBm}] - 20\log(d) + 104.8 + G_{\text{Ant}} [\text{dBi}] + G_{\text{Array}} [\text{dB}] + Att_{\text{MeasCable}} [\text{dB}] + Att_{\text{RF-Switch}} [\text{dB}]$$

$E [\text{dBmV/m}]$ = Field Strength [dBuV/m]

$EIRP [\text{dBm}]$ = Reading [dBm]

d = measurement distance in m

$G_{\text{Ant}} [\text{dBi}]$ = Gain of the EUT antenna

$G_{\text{Array}} [\text{dB}]$ = Array Gain [in case of multiple transmitting antenna port]

$Att_{\text{MeasCable}} [\text{dB}]$ = Attenuation of the measurement cables

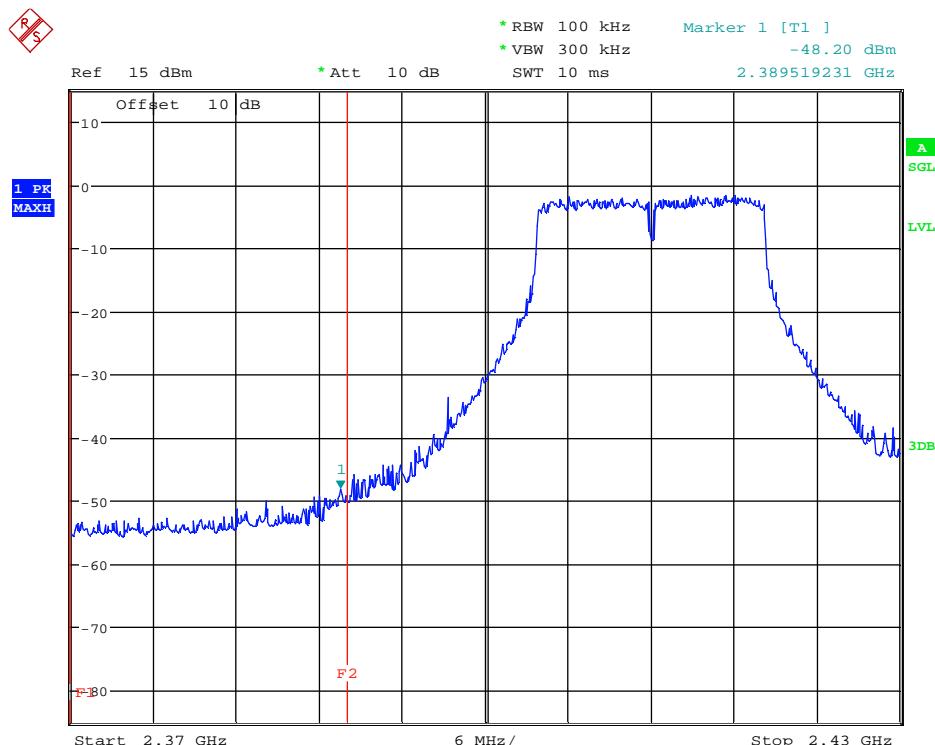
$Att_{\text{RF-Switch}} [\text{dB}]$ = Attenuation of the RF Switch

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

Ambient temperature	22 °C	Relative humidity	59 %
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The plot shows an exemplary measurement result for the worst documented case. The other results are listed in the following table.

WLAN1100_ant1_BandEdgeRestr_g_1.wmf: conducted band-edge compliance (operation mode 10):



Band Edge Compliance, b-mode, channel 1, antenna port 0 (Operation mode 1)							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
1	2379.228	55.2	74.0	18.8	-46.0	5.0	Passed
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
1	2383.923	43.6	54.0	10.4	-57.6	5.0	Passed
Measurement uncertainty				+0.66 dB / -0.72 dB			

Band Edge Compliance, b-mode, channel 11, antenna port 0 (Operation mode 3)							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
3	2499.870	60.1	74.0	13.9	-41.0	5.0	Passed
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
3	2499.855	51.4	54.0	2.6	-49.8	5.0	Passed
Measurement uncertainty				+0.66 dB / -0.72 dB			

Band Edge Compliance, b-mode, channel 1, antenna port 1 (Operation mode 4)							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
4	2374.137	56.6	74.0	17.4	-44.5	5.0	Passed
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
4	2376.072	45.2	54.0	8.8	-56.0	5.0	Passed
Measurement uncertainty				+0.66 dB / -0.72 dB			

Band Edge Compliance, b-mode, channel 11, antenna port 1 (Operation mode 6)							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
6	2499.605	57.2	74.0	16.8	-44.0	5.0	Passed
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
6	2499.745	47.6	54.0	6.4	-53.6	5.0	Passed
Measurement uncertainty				+0.66 dB / -0.72 dB			

Band Edge Compliance, g-mode, channel 1, antenna port 0 (Operation mode 7)							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
7	2373.410	58.9	74.0	15.1	-42.3	5.0	Passed
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
7	2374.065	47.7	54.0	6.3	-53.5	5.0	Passed
Measurement uncertainty				+0.66 dB / -0.72 dB			

Band Edge Compliance, g-mode, channel 11, antenna port 0 (Operation mode 9)							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
9	2499.710	60.0	74.0	14.0	-41.2	5.0	Passed
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
9	2499.905	51.6	54.0	2.4	-49.6	5.0	Passed
Measurement uncertainty				+0.66 dB / -0.72 dB			

Band Edge Compliance, g-mode, channel 1, antenna port 1 (Operation mode 10)							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
10	2389.574	72.0	74.0	2.0	-29.1	5.0	Passed
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
10	2389.864	51.1	54.0	2.9	-50.1	5.0	Passed
Measurement uncertainty				+0.66 dB / -0.72 dB			

Band Edge Compliance, g-mode, channel 11, antenna port 1 (Operation mode 12)							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
12	2499.930	59.6	74.0	14.4	-41.6	5.0	Passed
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
12	2499.745	48.7	54.0	5.3	-52.5	5.0	Passed
Measurement uncertainty				+0.66 dB / -0.72 dB			

Band Edge Compliance, n20-mode, channel 1, antenna port 0 (Operation mode 13)							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
13	2387.174	64.1	74.0	9.9	-37.0	5.0	Passed
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
13	2389.954	49.2	54.0	4.8	-51.9	5.0	Passed
Measurement uncertainty				+0.66 dB / -0.72 dB			

Band Edge Compliance, n20-mode, channel 11, antenna port 0 (Operation mode 15)							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
15	2499.625	60.4	74.0	13.6	-40.7	5.0	Passed
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
15	2499.850	51.6	54.0	2.4	-49.6	5.0	Passed
Measurement uncertainty				+0.66 dB / -0.72 dB			

Band Edge Compliance, n20-mode, channel 1, antenna port 1 (Operation mode 16)							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
16	2389.775	67.1	74.0	6.9	-34.0	5.0	Passed
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
16	2390.000	49.9	54.0	4.1	-51.3	5.0	Passed
Measurement uncertainty				+0.66 dB / -0.72 dB			

Band Edge Compliance, n20-mode, channel 11, antenna port 1 (Operation mode 18)							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
18	2499.960	57.6	74.0	16.4	-43.6	5.0	Passed
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
18	2499.980	47.6	54.0	6.4	-53.6	5.0	Passed
Measurement uncertainty				+0.66 dB / -0.72 dB			

Band Edge Compliance, n20-mode, channel 1, antenna port 0&1 (Operation mode 19)							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
19	2389.709	64.7	74.0	9.3	-35.3	3.8	Passed
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
19	2389.934	50.6	54.0	3.4	-49.4	3.8	Passed
Measurement uncertainty				+0.66 dB / -0.72 dB			

Band Edge Compliance, n20-mode, channel 11, antenna port 0&1 (Operation mode 21)							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
21	2499.675	60.2	74.0	13.8	-39.7	3.8	Passed
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
21	2499.860	50.1	54.0	3.9	-49.9	3.8	Passed
Measurement uncertainty				+0.66 dB / -0.72 dB			

Band Edge Compliance, n40-mode, channel 1, antenna port 0 (Operation mode 22)							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
22	2389.402	66.6	74.0	7.4	-34.6	5.0	Passed
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
22	2389.957	48.8	54.0	5.2	-52.4	5.0	Passed
Measurement uncertainty				+0.66 dB / -0.72 dB			

Band Edge Compliance, n40-mode, channel 11, antenna port 0 (Operation mode 24)							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
24	2499.740	58.6	74.0	15.4	-42.6	5.0	Passed
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
24	2499.945	49.3	54.0	4.7	-51.9	5.0	Passed
Measurement uncertainty				+0.66 dB / -0.72 dB			

Band Edge Compliance, n40-mode, channel 1, antenna port 1 (Operation mode 25)							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
25	2389.555	66.8	74.0	7.2	-34.4	5.0	Passed
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
25	2389.985	49.7	54.0	4.3	-51.5	5.0	Passed
Measurement uncertainty				+0.66 dB / -0.72 dB			

Band Edge Compliance, n40-mode, channel 11, antenna port 1 (Operation mode 27)							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
27	2483.600	65.4	74.0	8.6	-35.8	5.0	Passed
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
27	2483.540	45.6	54.0	8.4	-55.5	5.0	Passed
Measurement uncertainty				+0.66 dB / -0.72 dB			

Band Edge Compliance, n40-mode, channel 1, antenna port 0&1 (Operation mode 28)							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
28	2389.924	67.9	74.0	6.1	-32.1	3.8	Passed
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
28	2389.919	50.0	54.0	4.0	-50.0	3.8	Passed
Measurement uncertainty				+0.66 dB / -0.72 dB			

Band Edge Compliance, n40-mode, channel 11, antenna port 0&1 (Operation mode 30)							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
30	2499.768	59.7	74.0	14.3	-40.2	3.8	Passed
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
30	2499.958	50.5	54.0	3.5	-49.4	3.8	Passed
Measurement uncertainty				+0.66 dB / -0.72 dB			

Test: Passed

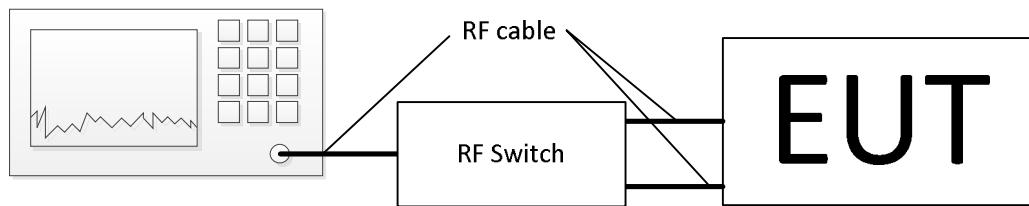
TEST EQUIPMENT USED FOR THE TEST:

6 – 10, 30

5.6 Maximum unwanted emissions

5.6.1 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 11.12.2.2 in document [1].

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

Procedure for average measurement: 11.12.2.5.2 – Trace averaging across ON and OFF times of the EUT transmissions followed by duty cycle correction:

If continuous transmission of the EUT ($D \geq 98\%$) cannot be achieved and the duty cycle is constant (duty cycle variations are less than $\pm 2\%$), then the following procedure shall be used:

- The EUT shall be configured to operate at the maximum achievable duty cycle.
- Measure the duty cycle D of the transmitter output signal as described in 11.6 in [1].
- Set the RBW = 1 MHz (unless otherwise specified).
- 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
- Sweep time = auto
- Perform a trace average of at least 100 traces
- Correct the resulting measurement value by adding the duty cycle correction value if applicable.

Peak measurement procedure: 11.12.2.4 in [1]

- Set the analyzer span to encompass the entire unwanted emission bandwidth.
- Set the RBW = specified in Table 1.
- 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 1 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

5.6.1.1 Limit calculations

The following general procedure is described in chapter 11.12.2.2 in [1].

- a) Measure the conducted output power (in dBm) using the detector specified by the appropriate regulatory agency (see 11.12.2.3 through 11.12.2.5 for guidance regarding measurement procedures for determining quasi-peak, peak, and average conducted output power, respectively).
- b) Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP (see 11.12.2.6 for guidance on determining the applicable antenna gain).
- c) Add the appropriate maximum ground reflection factor to the EIRP (6 dB for frequencies \leq 30 MHz; 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive; and 0 dB for frequencies $>$ 1000 MHz).
- d) For MIMO devices, measure the power of each chain and sum the EIRP of all chains in linear terms (i.e., watts and mW).
- e) Convert the resultant EIRP to an equivalent electric field strength using the following relationship:

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

where

E is the electric field strength in $\text{dB}\mu\text{V}/\text{m}$

$EIRP$ is the equivalent isotropically radiated power in dBm

d is the specified measurement distance in m

- f) Compare the resultant electric field strength level with the applicable regulatory limit.
- g) C Perform the radiated spurious emission test.

Chapter 14 in [1] states, that for transmitters with multiple outputs in the same band, summing of emissions and accounting for array gain have to be considered.

For the case that both antenna ports transmit continuously, both results were summed as linear values as described in 14.3.2.2 in document [1].

To account for directional gain which might occur in case of N transmit antennas in the test mode spatial multiplexing, which is the mode the EUT uses, the directional has to be calculated as:

$$10\log \left[\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{Ant}} g_{j,k} \right\}^2 / N_{Ant} \right]$$

Whereby

N_{SS} is the number of independent spatial streams of data.

N_{Ant} is the total number of antennas

$g_{j,k}$ is $10^{G_k/20}$ if the k th antenna is being fed by spatial stream j , or zero if it is not

G_k is the gain in dBi of the k th antenna

For the antennas of this EUT which have 5 and 2 dBi antenna gain, the combined antenna gain results in a value of 3.8 dBi directional antenna gain.

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

In any 100 kHz outside the authorized frequency band, the power shall be attenuated by 20 dB, compared to the highest in band power in any 100 kHz. This shall be demonstrated by using the peak power procedure. The reference level shall be measured using the procedure described in 5.6.2.1 and the emission level according to procedure 5.6.2.2. The procedures are based on chapter 11.11.2 and 11.11.3 in [1].

For the operation modes in which both antenna ports transmit simultaneously, the level of the both ports were summed in linear value for each frequency step. The applicable plots show the result of that sum.

5.6.2.1 Reference level measurement

- a) Set instrument center frequency to DTS channel center frequency.
- b) Set the span to ≥ 1.5 times the DTS bandwidth.
- c) Set the RBW = 100 kHz.
- d) Set the VBW $\geq 3 \times$ RBW.
- e) Detector = peak.
- f) Sweep time = auto couple.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the maximum PSD level.

5.6.2.2 Emission level measurement

- a) Set the center frequency and span to encompass frequency range to be measured.
- b) Set the RBW = 100 kHz.
- c) Set the VBW $\geq 3 \times$ RBW.
- d) Detector = peak.
- e) Ensure that the number of measurement points \geq span/RBW
- f) Sweep time = auto couple.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the maximum amplitude level.

5.6.3 Test results (conducted emissions)

5.6.3.1 Emissions below 1 GHz

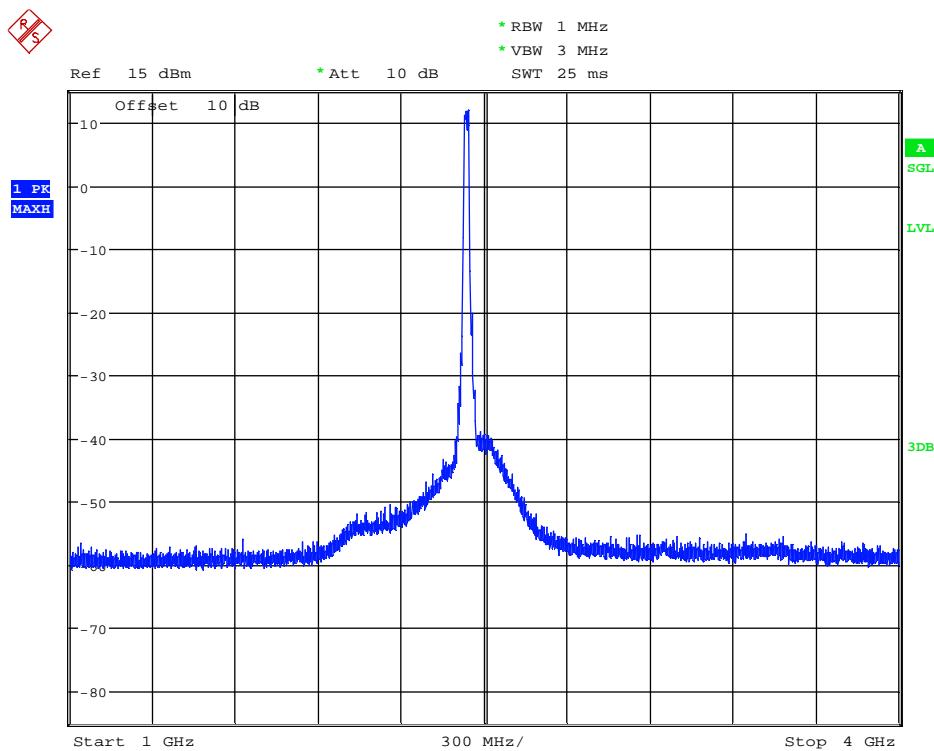
The emissions below 1 GHz were equal for all modulations, channels and data rates, therefore these emissions were only tested as radiated tests with the dedicated antennas.

5.6.3.2 Emissions above 1 GHz

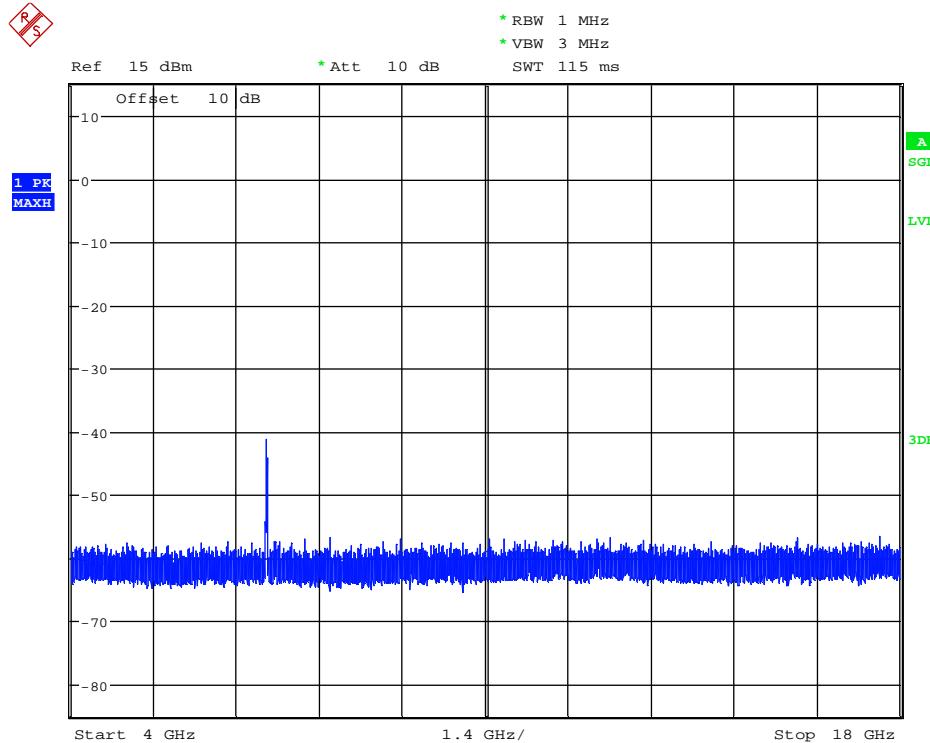
Ambient temperature	22 °C	Relative humidity	59 %
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The following results were measured at antenna port of the EUT. Only the plots for the worst case emissions are submitted below. The emissions that were failed during the conducted measurements were repeated as radiated measurements.

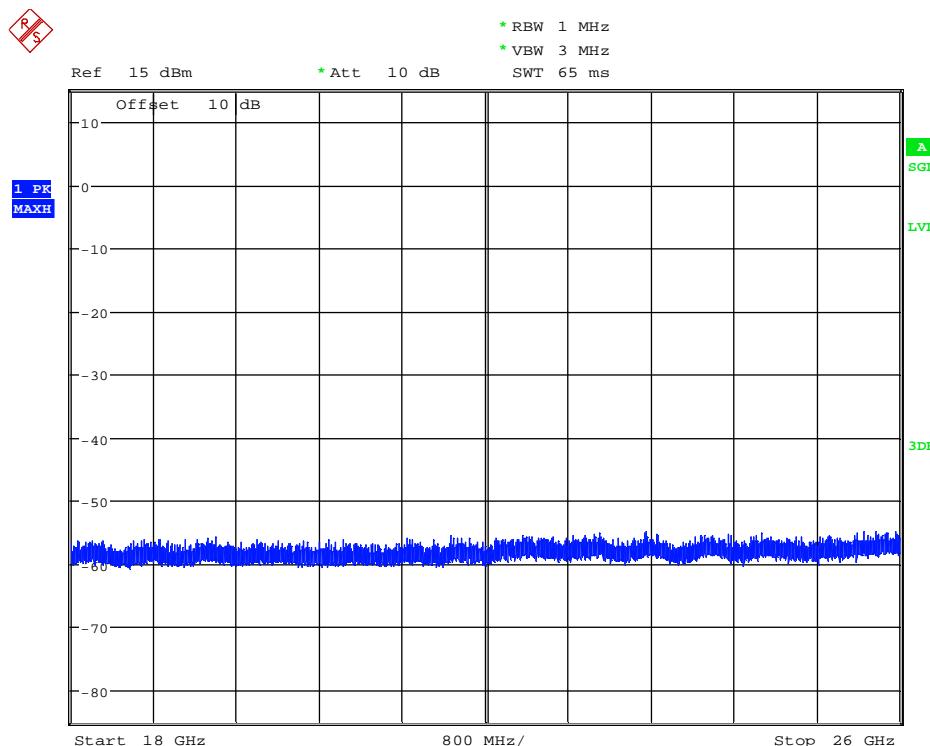
WLAN1100_ant0_SpurEmiss1-4G_g_6.wmf: conducted spurious emissions (operation mode 8):



WLAN1100_ant0_SpurEmiss4-18G_g_6.wmf: conducted spurious emissions (operation mode 8):



WLAN1100_ant0_SpurEmiss18-26G_g_6.wmf: conducted spurious emissions (operation mode 8):



Spurious Emissions, b-mode, channel 1, antenna port 0 (Operation mode 1)							
Peak Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
1	2370.010	54.8	74.0	19.2	-46.4	5.0	Passed
1	2499.409	60.6	74.0	13.4	-40.6	5.0	Passed
1	2490.300	59.8	74.0	14.2	-41.3	5.0	Passed
Average Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
1	2369.430	43.0	54.0	11.0	-58.1	5.0	Passed
1	2499.919	51.8	54.0	2.2	-49.3	5.0	Passed
1	2493.980	48.2	54.0	5.8	-52.9	5.0	Passed
Emissions in the non-restricted Bands							
Operation Mode	Frequency [MHz]	Reading [dBm]	Limit [dBm]	Margin [dB]	Result		
1	2413.010	1.6	-	-	-		
1	7236.440	-57.5	-18.4	39.2	Passed		
Measurement uncertainty			+0.66 dB / -0.72 dB				

Spurious Emissions, b-mode, channel 6, antenna port 0 (Operation mode 2)							
Peak Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
2	2288.030	54.0	74.0	20.0	-47.1	5.0	Passed
2	2499.819	60.9	74.0	13.1	-40.3	5.0	Passed
2	2486.598	60.4	74.0	13.6	-40.7	5.0	Passed
2	7311.890	54.6	74.0	19.4	-47.7	5.0	Passed
Average Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
2	2287.950	44.9	54.0	9.1	-56.3	5.0	Passed
2	2499.859	51.7	54.0	2.3	-49.4	5.0	Passed
2	2483.988	48.3	54.0	5.7	-52.9	5.0	Passed
2	7312.020	47.1	54.0	6.9	-55.2	5.0	Passed
Emissions in the non-restricted Bands							
Operation Mode	Frequency [MHz]	Reading [dBm]	Limit [dBm]	Margin [dB]	Result		
1	2436.000	3.6	-	-	-		
1	2394.900	-54.4	-16.4	37.9	Passed		
Measurement uncertainty			+0.66 dB / -0.72 dB				

Spurious Emissions, b-mode, channel 11, antenna port 0 (Operation mode 3)							
Peak Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
3	2375.130	56.3	74.0	17.7	-44.9	5.0	Passed
3	2288.080	52.3	74.0	21.7	-48.8	5.0	Passed
3	2347.670	54.7	74.0	19.3	-46.5	5.0	Passed
3	7388.460	51.2	74.0	22.8	-51.2	5.0	Passed
Average Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
3	2375.010	45.2	54.0	8.8	-55.9	5.0	Passed
3	2288.000	42.7	54.0	11.3	-58.5	5.0	Passed
3	2345.870	42.0	54.0	12.0	-59.2	5.0	Passed
3	7386.930	41.9	54.0	12.1	-60.4	5.0	Passed
Emissions in the non-restricted Bands							
Operation Mode	Frequency [MHz]	Reading [dBm]	Limit [dBm]	Margin [dB]	Result		
3	2463.010	-0.6	-	-	-		
3	2499.950	-47.7	-20.6	27.1	Passed		
Measurement uncertainty			+0.66 dB / -0.72 dB				

Spurious Emissions, b-mode, channel 1, antenna port 1 (Operation mode 4)							
Peak Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
4	2287.880	56.0	74.0	18.0	-45.2	5.0	Passed
4	2359.580	56.5	74.0	17.5	-44.6	5.0	Passed
4	2319.990	55.1	74.0	18.9	-46.0	5.0	Passed
Average Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
4	2287.960	50.1	54.0	3.9	-51.1	5.0	Passed
4	2360.040	47.5	54.0	6.5	-53.7	5.0	Passed
4	2319.980	46.4	54.0	7.6	-54.7	5.0	Passed
Emissions in the non-restricted Bands							
Operation Mode	Frequency [MHz]	Reading [dBm]	Limit [dBm]	Margin [dB]	Result		
4	2413.500	2.3	-	-	Passed		
4	2112.020	-53.8	-17.7	36.1	Passed		
4	2520.007	-50.8	-17.7	33.0	Passed		
4	2560.009	-53.8	-17.7	36.1	Passed		
4	7235.440	-55.1	-17.7	37.4	Passed		
Measurement uncertainty			+0.66 dB / -0.72 dB				

Spurious Emissions, b-mode, channel 6, antenna port 1 (Operation mode 5)							
Peak Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5	2360.020	58.5	74.0	15.5	-42.6	5.0	Passed
5	2288.210	55.5	74.0	18.5	-45.6	5.0	Passed
5	2319.960	55.9	74.0	18.1	-45.2	5.0	Passed
5	2499.599	58.7	74.0	15.3	-42.4	5.0	Passed
5	7311.100	55.9	74.0	18.1	-46.5	5.0	Passed
Average Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
5	2360.100	49.4	54.0	4.6	-51.8	5.0	Passed
5	2287.980	49.0	54.0	5.0	-52.1	5.0	Passed
5	2320.030	46.6	54.0	7.4	-54.5	5.0	Passed
5	2499.969	48.2	54.0	5.8	-52.9	5.0	Passed
5	7311.860	48.3	54.0	5.7	-54.0	5.0	Passed
Emissions in the non-restricted Bands							
Operation Mode	Frequency [MHz]	Reading [dBm]	Limit [dBm]	Margin [dB]	Result		
5	2438.500	4.0	-	-	Passed		
5	2519.997	-49.3	-16.0	33.3	Passed		
Measurement uncertainty			+0.66 dB / -0.72 dB				

Spurious Emissions, b-mode, channel 11, antenna port 1 (Operation mode 6)							
Peak Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
6	2287.840	55.4	74.0	18.6	-45.7	5.0	Passed
6	2359.740	56.5	74.0	17.5	-44.7	5.0	Passed
6	2319.780	54.5	74.0	19.5	-46.7	5.0	Passed
6	7385.290	51.1	74.0	22.9	-51.3	5.0	Passed
Average Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
6	2287.980	49.8	54.0	4.2	-51.4	5.0	Passed
6	2359.980	47.8	54.0	6.2	-53.3	5.0	Passed
6	2320.050	45.9	54.0	8.1	-55.3	5.0	Passed
6	7384.920	41.6	54.0	12.4	-60.7	5.0	Passed
Emissions in the non-restricted Bands							
Operation Mode	Frequency [MHz]	Reading [dBm]	Limit [dBm]	Margin [dB]	Result		
6	2460.500	-0.3	-	-	Passed		
6	2112.000	-54.0	-20.3	33.7	Passed		
6	2519.990	-49.6	-20.3	29.3	Passed		
6	2560.030	-54.3	-20.3	34.0	Passed		
Measurement uncertainty			+0.66 dB / -0.72 dB				

Spurious Emissions, g-mode, channel 1, antenna port 0 (Operation mode 7)							
Peak Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
7	2287.330	58.0	74.0	16.0	-43.2	5.0	Passed
7	2499.868	62.8	74.0	11.2	-38.1	5.0	Passed
7							Passed
Average Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
7	2288.040	47.8	54.0	6.2	-53.3	5.0	Passed
7	2499.988	53.0	54.0	1.0	-47.9	5.0	Passed
7							Passed
Emissions in the non-restricted Bands							
Operation Mode	Frequency [MHz]	Reading [dBm]	Limit [dBm]	Margin [dB]	Result		
7	2415.520	-0.4	-	-	Passed		
7	2509.436	-48.2	-20.4	27.8	Passed		
7	7233.520	-53.9	-19.6	34.3	Passed		
Measurement uncertainty			+0.66 dB / -0.72 dB				

Spurious Emissions, g-mode, channel 6, antenna port 0 (Operation mode 8)							
Peak Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
8	2287.970	56.8	74.0	17.2	-44.4	5.0	Passed
8	2384.730	61.1	74.0	12.9	-40.0	5.0	Passed
8	2499.788	64.2	74.0	9.8	-37.0	5.0	Passed
8	7314.180	71.6	74.0	2.4	-30.7	5.0	Passed
Average Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
8	2287.930	48.3	54.0	5.7	-52.8	5.0	Passed
8	2375.020	48.8	54.0	5.2	-52.4	5.0	Passed
8	2499.908	53.7	54.0	0.3	-47.5	5.0	Passed
8	7313.340	49.7	54.0	4.3	-52.7	5.0	Passed
Emissions in the non-restricted Bands							
Operation Mode	Frequency [MHz]	Reading [dBm]	Limit [dBm]	Margin [dB]	Result		
8	2440.890	1.6	-	-	-		
8	2404.890	-47.4	-18.4	29.0	Passed		
Measurement uncertainty			+0.66 dB / -0.72 dB				

Spurious Emissions, g-mode, channel 11, antenna port 0 (Operation mode 9)							
Peak Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
9	2288.050	53.3	74.0	20.7	-47.9	5.0	Passed
9	7389.770	60.8	74.0	13.2	-41.6	5.0	Passed
Average Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
9	2288.010	44.3	54.0	9.7	-56.9	5.0	Passed
9	7388.840	41.6	54.0	12.4	-60.8	5.0	Passed
Emissions in the non-restricted Bands							
No emissions found							
Measurement uncertainty			+0.66 dB / -0.72 dB				

Spurious Emissions, g-mode, channel 1, antenna port 1 (Operation mode 10)							
Peak Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
10	2364.900	60.0	74.0	14.0	-41.1	5.0	Passed
10	2319.760	57.7	74.0	16.3	-43.5	5.0	Passed
10	2499.409	61.0	74.0	13.0	-40.2	5.0	Passed
Average Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
10	2360.000	50.3	54.0	3.7	-50.8	5.0	Passed
10	2319.880	47.9	54.0	6.1	-53.3	5.0	Passed
10	2499.779	50.4	54.0	3.6	-50.7	5.0	Passed
Emissions in the non-restricted Bands							
Operation Mode	Frequency [MHz]	Reading [dBm]	Limit [dBm]	Margin [dB]	Result		
10	2416.140	-0.5	-	-	-		
10	2520.007	-47.7	-20.5	27.2	Passed		
10	7235.780	-52.6	-20.5	32.1	Passed		
Measurement uncertainty			+0.66 dB / -0.72 dB				

Spurious Emissions, g-mode, channel 6, antenna port 1 (Operation mode 11)							
Peak Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
11	2362.720	61.3	74.0	12.7	-39.8	5.0	Passed
11	2320.160	58.5	74.0	15.5	-42.6	5.0	Passed
11	2499.969	63.0	74.0	11.0	-38.1	5.0	Passed
11	7318.600	69.8	74.0	4.2	-32.5	5.0	Passed
Average Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
11	2359.910	51.0	54.0	3.0	-50.1	5.0	Passed
11	2320.030	48.3	54.0	5.7	-52.9	5.0	Passed
11	2499.989	51.1	54.0	2.9	-50.1	5.0	Passed
11	7311.240	49.5	54.0	4.5	-52.9	5.0	Passed
Emissions in the non-restricted Bands							
Operation Mode	Frequency [MHz]	Reading [dBm]	Limit [dBm]	Margin [dB]	Result		
11	2432.380	1.7	-	-	-		
11	2400.010	-44.7	-18.3	26.4	Passed		
11	2520.007	-48.1	-18.3	29.8	Passed		
Measurement uncertainty			+0.66 dB / -0.72 dB				

Spurious Emissions, g-mode, channel 11, antenna port 1 (Operation mode 12)							
Peak Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
12	2359.830	57.7	74.0	16.3	-43.4	5.0	Passed
12	2319.930	55.6	74.0	18.4	-45.6	5.0	Passed
12	7386.980	59.7	74.0	14.3	-42.7	5.0	Passed
Average Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
12	2360.010	48.5	54.0	5.5	-52.6	5.0	Passed
12	2320.000	46.6	54.0	7.4	-54.6	5.0	Passed
12	7386.200	41.1	54.0	12.9	-61.2	5.0	Passed
Emissions in the non-restricted Bands							
Operation Mode	Frequency [MHz]	Reading [dBm]	Limit [dBm]	Margin [dB]	Result		
12	2458.490	-3.8	-	-	-		
12	2400.010	-48.5	-23.8	24.7	Passed		
12	2520.000	-49.2	-23.8	25.5	Passed		
12	2560.020	-53.5	-23.8	29.8	Passed		
Measurement uncertainty			+0.66 dB / -0.72 dB				

Spurious Emissions, n20-mode, channel 1, antenna port 0 (Operation mode 13)							
Peak Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
13	2288.220	57.0	74.0	17.0	-44.1	5.0	Passed
13	2499.798	64.0	74.0	10.0	-37.1	5.0	Passed
13	2486.490	62.6	74.0	11.4	-38.5	5.0	Passed
13	7313.960	69.0	74.0	5.0	-33.4	5.0	Passed
Average Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
13	2288.070	48.5	54.0	5.5	-52.7	5.0	Passed
13	2499.788	53.0	54.0	1.0	-48.1	5.0	Passed
13	2484.780	51.0	54.0	3.0	-50.1	5.0	Passed
13	7312.700	46.8	54.0	7.2	-55.5	5.0	Passed
Emissions in the non-restricted Bands							
Operation Mode	Frequency [MHz]	Reading [dBm]	Limit [dBm]	Margin [dB]	Result		
13	2441.560	0.9	-	-	-		
13	2507.996	-49.3	-19.1	30.2	Passed		
Measurement uncertainty			+0.66 dB / -0.72 dB				

Spurious Emissions, n20-mode, channel 6, antenna port 0 (Operation mode 14)														
Peak Emission – Restricted Band														
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result							
14	2288.540	56.7	74.0	17.3	-44.4	5.0	Passed							
14	2499.598	63.4	74.0	10.6	-37.8	5.0	Passed							
14	7304.670	66.9	74.0	7.1	-35.5	5.0	Passed							
Average Emission – Restricted Band														
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result							
14	2287.950	48.4	54.0	5.6	-52.7	5.0	Passed							
14	2499.928	52.9	54.0	1.1	-48.2	5.0	Passed							
14	7306.580	46.0	54.0	8.0	-56.4	5.0	Passed							
Emissions in the non-restricted Bands														
Operation Mode	Frequency [MHz]	Reading [dBm]		Limit [dBm]	Margin [dB]		Result							
14	2441.560	0.9		-	-		-							
14	2507.996	-49.3		-19.1	30.2		Passed							
Measurement uncertainty			+0.66 dB / -0.72 dB											
Spurious Emissions, n20-mode, channel 11, antenna port 0 (Operation mode 15)														
Peak Emission – Restricted Band														
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result							
15	2287.910	53.5	74.0	20.5	-47.7	5.0	Passed							
15	2499.540	60.2	74.0	13.8	-41.0	5.0	Passed							
15	7389.500	57.9	74.0	16.1	-44.4	5.0	Passed							
Average Emission – Restricted Band														
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result							
15	2287.940	44.4	54.0	9.6	-56.7	5.0	Passed							
15	2499.960	51.4	54.0	2.6	-49.8	5.0	Passed							
15	7389.560	39.9	54.0	14.1	-62.5	5.0	Passed							
Emissions in the non-restricted Bands														
No emissions found														
Measurement uncertainty			+0.66 dB / -0.72 dB											

Spurious Emissions, n20-mode, channel 1, antenna port 1 (Operation mode 16)							
Peak Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
16	2360.080	60.0	74.0	14.0	-41.2	5.0	Passed
16	2320.050	57.4	74.0	16.6	-43.8	5.0	Passed
16	2497.348	61.1	74.0	12.9	-40.0	5.0	Passed
Average Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
16	2359.880	50.2	54.0	3.8	-50.9	5.0	Passed
16	2319.950	48.1	54.0	5.9	-53.1	5.0	Passed
16	2499.878	50.4	54.0	3.6	-50.7	5.0	Passed
Emissions in the non-restricted Bands							
Operation Mode	Frequency [MHz]	Reading [dBm]	Limit [dBm]	Margin [dB]	Result		
16	2416.610	-2.8	-	-	-		
16	2519.997	-47.8	17.2	65.0	Passed		
16	7237.890	-55.8	17.2	73.0	Passed		
Measurement uncertainty			+0.66 dB / -0.72 dB				

Spurious Emissions, n20-mode, channel 6, antenna port 1 (Operation mode 17)							
Peak Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
17	2360.460	60.2	74.0	13.8	-41.0	5.0	Passed
17	2319.900	57.8	74.0	16.2	-43.4	5.0	Passed
17	2495.339	60.7	74.0	13.3	-40.5	5.0	Passed
17	7316.530	67.6	74.0	6.4	-34.7	5.0	Passed
Average Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
17	2359.910	50.5	54.0	3.5	-50.7	5.0	Passed
17	2319.990	48.0	54.0	6.0	-53.1	5.0	Passed
17	2499.969	50.5	54.0	3.5	-50.7	5.0	Passed
17	7313.480	47.1	54.0	6.9	-55.3	5.0	Passed
Emissions in the non-restricted Bands							
Operation Mode	Frequency [MHz]	Reading [dBm]	Limit [dBm]	Margin [dB]	Result		
17	2437.550	0.7	-	-	-		
17	2400.000	-46.0	-19.3	26.7	Passed		
17	2520.017	-48.5	-19.3	29.1	Passed		
Measurement uncertainty			+0.66 dB / -0.72 dB				

Spurious Emissions, n20-mode, channel 11, antenna port 1 (Operation mode 18)							
Peak Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
18	2359.610	56.6	74.0	17.4	-44.5	5.0	Passed
18	2319.740	54.5	74.0	19.5	-46.7	5.0	Passed
18	2499.310	57.3	74.0	16.7	-43.9	5.0	Passed
18	7380.930	57.3	74.0	16.7	-45.0	5.0	Passed
Average Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
18	2360.050	47.7	54.0	6.3	-53.4	5.0	Passed
18	2320.030	46.0	54.0	8.0	-55.1	5.0	Passed
18	2499.860	47.5	54.0	6.5	-53.7	5.0	Passed
18	7381.720	39.7	54.0	14.3	-62.7	5.0	Passed
Emissions in the non-restricted Bands							
Operation Mode	Frequency [MHz]	Reading [dBm]	Limit [dBm]	Margin [dB]	Result		
18	2457.540	-5.1	-	-	-		
18	2399.970	-48.8	14.9	63.7	Passed		
Measurement uncertainty			+0.66 dB / -0.72 dB				

Spurious Emissions, n20-mode, channel 1, antenna port 0&1 (Operation mode 19)							
Peak Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
19	2287.900	58.4	74.0	15.6	-41.6	3.8	Passed
19	2364.800	60.3	74.0	13.7	-39.6	3.8	Passed
19	2495.420	63.6	74.0	10.4	-36.4	3.8	Passed
Average Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
19	2287.990	51.6	54.0	2.4	-48.4	3.8	Passed
19	2360.000	50.4	54.0	3.6	-49.5	3.8	Passed
19	2499.930	52.9	54.0	1.1	-47.1	3.8	Passed
Emissions in the non-restricted Bands							
Operation Mode	Frequency [MHz]	Reading [dBm]	Limit [dBm]	Margin [dB]	Result		
19	2413.380	0.0	-	-	-		
19	2515.060	-46.5	-20.0	26.5	Passed		
19	7234.180	-54.0	-20.0	34.0	Passed		
Measurement uncertainty			+0.66 dB / -0.72 dB				

Spurious Emissions, n20-mode, channel 6, antenna port 0&1 (Operation mode 20)							
Peak Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
20	2287.830	58.7	74.0	15.3	-41.2	3.8	Passed
20	2355.180	60.8	74.0	13.2	-39.1	3.8	Passed
20	2499.580	63.1	74.0	10.9	-36.9	3.8	Passed
20	7307.280	63.8	74.0	10.2	-37.4	3.8	Passed
Average Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
20	2287.990	51.6	54.0	2.4	-48.3	3.8	Passed
20	2356.940	50.7	54.0	3.3	-49.3	3.8	Passed
20	2499.860	52.7	54.0	1.3	-47.2	3.8	Passed
20	7312.920	45.8	54.0	8.2	-55.4	3.8	Passed
Emissions in the non-restricted Bands							
Operation Mode	Frequency [MHz]	Reading [dBm]	Limit [dBm]	Margin [dB]	Result		
20	2440.750	3.8	-	-	-		
20	1935.990	-53.0	-16.2	36.7	Passed		
20	2521.080	-46.7	-16.2	30.5	Passed		
Measurement uncertainty			+0.66 dB / -0.72 dB				

Spurious Emissions, n20-mode, channel 11, antenna port 0&1 (Operation mode 21)										
Peak Emission – Restricted Band										
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result			
21	2287.960	56.2	74.0	17.8	-43.7	3.8	Passed			
21	2361.110	57.1	74.0	16.9	-42.9	3.8	Passed			
21	2287.920	56.4	74.0	17.6	-43.6	3.8	Passed			
21	2499.850	59.8	74.0	14.2	-40.2	3.8	Passed			
21	7391.550	57.7	74.0	16.3	-43.5	3.8	Passed			
Average Emission – Restricted Band										
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result			
21	2287.890	49.7	54.0	4.3	-50.2	3.8	Passed			
21	2364.930	47.8	54.0	6.2	-52.2	3.8	Passed			
21	2288.010	49.7	54.0	4.3	-50.2	3.8	Passed			
21	2499.890	50.9	54.0	3.1	-49.1	3.8	Passed			
21	7388.270	41.6	54.0	12.4	-59.6	3.8	Passed			
Emissions in the non-restricted Bands										
Operation Mode	Frequency [MHz]	Reading [dBm]	Limit [dBm]	Margin [dB]	Result					
No emissions found										
Measurement uncertainty			+0.66 dB / -0.72 dB							

Spurious Emissions, n40-mode, channel 3, antenna port 0 (Operation mode 22)							
Peak Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
22	2287.910	53.0	74.0	21.0	-48.2	5.0	Passed
22	2499.798	60.1	74.0	13.9	-41.1	5.0	Passed
Average Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
22	2287.950	43.4	54.0	10.6	-57.8	5.0	Passed
22	2499.988	51.4	54.0	2.6	-49.7	5.0	Passed
Emissions in the non-restricted Bands							
No emissions found							
Measurement uncertainty			+0.66 dB / -0.72 dB				

Spurious Emissions, n40-mode, channel 6, antenna port 0 (Operation mode 23)							
Peak Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
23	2287.660	55.0	74.0	19.0	-46.1	5.0	Passed
23	2495.519	67.5	74.0	6.5	-33.6	5.0	Passed
23	2492.468	69.9	74.0	4.1	-31.3	5.0	Passed
23	7324.920	63.2	74.0	10.8	-39.2	5.0	Passed
Average Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
23	2287.860	45.6	54.0	8.4	-55.5	5.0	Passed
23	2499.969	53.3	54.0	0.7	-47.8	5.0	Passed
23	2499.898	53.4	54.0	0.6	-47.8	5.0	Passed
23	7319.600	44.6	54.0	9.4	-57.8	5.0	Passed
Emissions in the non-restricted Bands							
Operation Mode	Frequency [MHz]	Reading [dBm]	Limit [dBm]	Margin [dB]	Result		
23	2440.200	-2.8	-	-	-		
23	2399.770	-41.9	17.2	59.1	Passed		
Measurement uncertainty			+0.66 dB / -0.72 dB				

Spurious Emissions, n40-mode, channel 9, antenna port 0 (Operation mode 24)							
Peak Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
24	2287.990	51.4	74.0	22.6	-49.8	5.0	Passed
Average Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
24	2288.060	43.0	54.0	11.0	-58.2	5.0	Passed
Emissions in the non-restricted Bands							
Operation Mode	Frequency [MHz]	Reading [dBm]		Limit [dBm]	Margin [dB]	Result	
24	2456.280	-17.5		-	-	-	
24	2499.960	-48.6		2.5	51.2	Passed	
Measurement uncertainty			+0.66 dB / -0.72 dB				

Spurious Emissions, n40-mode, channel 3, antenna port 1 (Operation mode 25)							
Peak Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
25	2359.840	57.0	74.0	17.0	-44.1	5.0	Passed
25	2280.120	52.4	74.0	21.6	-48.8	5.0	Passed
25	2320.470	54.2	74.0	19.8	-47.0	5.0	Passed
25	2239.770	51.2	74.0	22.8	-50.0	5.0	Passed
25	2499.458	57.8	74.0	16.2	-43.4	5.0	Passed
Average Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
25	2359.930	47.8	54.0	6.2	-53.4	5.0	Passed
25	2279.910	42.9	54.0	11.1	-58.2	5.0	Passed
25	2320.050	46.1	54.0	7.9	-55.1	5.0	Passed
25	2239.870	42.7	54.0	11.3	-58.4	5.0	Passed
25	2499.848	47.3	54.0	6.7	-53.9	5.0	Passed
Emissions in the non-restricted Bands							
Operation Mode	Frequency [MHz]	Reading [dBm]		Limit [dBm]	Margin [dB]	Result	
25	2417.430	-11.9		-	-	-	
25	2519.997	-50.5		8.1	58.5	Passed	
25	2599.977	-54.6		8.1	62.7	Passed	
Measurement uncertainty			+0.66 dB / -0.72 dB				

Spurious Emissions, n40-mode, channel 6, antenna port 1 (Operation mode 26)							
Peak Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
26	2364.430	65.7	74.0	8.3	-35.5	5.0	Passed
26	2320.370	57.5	74.0	16.5	-43.6	5.0	Passed
26	2280.070	55.3	74.0	18.7	-45.9	5.0	Passed
26	2498.168	65.2	74.0	8.8	-35.9	5.0	Passed
26	7323.940	60.2	74.0	13.8	-42.1	5.0	Passed
Average Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
26	2359.870	50.4	54.0	3.6	-50.8	5.0	Passed
26	2319.990	48.0	54.0	6.0	-53.2	5.0	Passed
26	2279.960	44.5	54.0	9.5	-56.6	5.0	Passed
26	2499.918	50.8	54.0	3.2	-50.3	5.0	Passed
26	7320.860	42.7	54.0	11.3	-59.7	5.0	Passed
Emissions in the non-restricted Bands							
Operation Mode	Frequency [MHz]	Reading [dBm]	Limit [dBm]	Margin [dB]	Result		
26	2440.340	-2.8	-	-	-		
26	2403.670	-40.5	-22.8	17.7	Passed		
26	2520.017	-48.1	-22.8	25.3	Passed		
Measurement uncertainty			+0.66 dB / -0.72 dB				

Spurious Emissions, n40-mode, channel 9, antenna port 1 (Operation mode 27)							
Peak Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
27	2359.820	55.0	74.0	19.0	-46.1	5.0	Passed
27	2319.880	53.7	74.0	20.3	-47.5	5.0	Passed
Average Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
27	2359.980	46.9	54.0	7.1	-54.2	5.0	Passed
27	2319.960	45.8	54.0	8.2	-55.4	5.0	Passed
Emissions in the non-restricted Bands							
Operation Mode	Frequency [MHz]	Reading [dBm]	Limit [dBm]	Margin [dB]	Result		
27	2456.190	-17.1	-	-	-		
27	2400.010	-49.2	-37.1	12.0	Passed		
27	2519.990	-50.4	-37.1	13.3	Passed		
27	2560.000	-55.1	-37.1	18.0	Passed		
Measurement uncertainty			+0.66 dB / -0.72 dB				

Spurious Emissions, n40-mode, channel 3, antenna port 0&1 (Operation mode 28)							
Peak Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
28	2362.530	57.2	74.0	16.8	-42.7	3.8	Passed
28	2287.860	56.4	74.0	17.6	-43.6	3.8	Passed
28	2319.830	55.0	74.0	19.0	-45.0	3.8	Passed
28	2499.988	60.4	74.0	13.6	-39.5	3.8	Passed
Average Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
28	2359.880	47.8	54.0	6.2	-52.2	3.8	Passed
28	2288.030	49.5	54.0	4.5	-50.5	3.8	Passed
28	2324.050	45.1	54.0	8.9	-54.8	3.8	Passed
28	2499.908	50.8	54.0	3.2	-49.2	3.8	Passed
Emissions in the non-restricted Bands							
Operation Mode	Frequency [MHz]	Reading [dBm]	Limit [dBm]	Margin [dB]	Result		
28	2463.980	-46.5	-	-	-		
28	2516.297	-48.7	-26.5	22.2	Passed		
28	2598.817	-52.4	-26.5	25.9	Passed		
Measurement uncertainty			+0.66 dB / -0.72 dB				

Spurious Emissions, n40-mode, channel 6, antenna port 0&1 (Operation mode 29)							
Peak Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
29	2495.518	66.0	74.0	8.0	-34.0	3.8	Passed
29	2288.150	58.3	74.0	15.7	-41.6	3.8	Passed
29	2364.600	62.2	74.0	11.8	-37.8	3.8	Passed
29	2322.880	58.8	74.0	15.2	-41.1	3.8	Passed
29	2282.390	56.1	74.0	17.9	-43.8	3.8	Passed
29	7316.200	58.1	74.0	15.9	-43.0	3.8	Passed
Average Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
29	2499.878	52.8	54.0	1.2	-47.1	3.8	Passed
29	2287.960	50.8	54.0	3.2	-49.1	3.8	Passed
29	2364.240	50.7	54.0	3.3	-49.3	3.8	Passed
29	2324.140	46.9	54.0	7.1	-53.1	3.8	Passed
29	2284.910	45.7	54.0	8.3	-54.3	3.8	Passed
29	7318.550	42.7	54.0	11.3	-58.5	3.8	Passed
Emissions in the non-restricted Bands							
Operation Mode	Frequency [MHz]	Reading [dBm]	Limit [dBm]	Margin [dB]	Result		
29	2441.180	-1.4	-	-	-		
29	2479.100	-40.9	18.6	59.6	Passed		
29	2517.207	-46.4	18.6	65.1	Passed		
29	2399.780	-42.9	18.6	61.5	Passed		
Measurement uncertainty			+0.66 dB / -0.72 dB				

Spurious Emissions, n40-mode, channel 9, antenna port 0&1 (Operation mode 30)							
Peak Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
30	2287.770	55.9	74.0	18.1	-44.1	3.8	Passed
30	2361.250	55.2	74.0	18.8	-44.8	3.8	Passed
30	2319.450	53.2	74.0	20.8	-46.8	3.8	Passed
Average Emission – Restricted Band							
Operation Mode	Frequency [MHz]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Reading [dBm]	Antenna Gain + Array Gain [dBi]	Result
30	2287.970	50.5	54.0	3.5	-49.5	3.8	Passed
30	2360.030	47.0	54.0	7.0	-53.0	3.8	Passed
30	2320.050	43.9	54.0	10.1	-56.1	3.8	Passed
Emissions in the non-restricted Bands							
Operation Mode	Frequency [MHz]	Reading [dBm]	Limit [dBm]	Margin [dB]	Result		
30	2447.550	-15.6	-	-	-		
30	2399.920	-51.0	-35.6	15.4	Passed		
30	2111.980	-51.7	-35.6	16.1	Passed		
30	2520.020	-49.7	-35.6	14.2	Passed		
30	2599.060	-53.2	-35.6	17.7	Passed		
Measurement uncertainty			+0.66 dB / -0.72 dB				

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

6 – 10, 30

5.6.4 Method of measurement (radiated emissions)

The radiated emission measurement is subdivided into five stages.

- A preliminary measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 9 kHz to 1 GHz.
- A final measurement carried out on an outdoor test side without reflecting ground plane and a fixed antenna height in the frequency range 9 kHz to 30 MHz.
- A final measurement carried out on an open area test side with reflecting ground plane and various antenna height in the frequency range 30 MHz to 1 GHz.
- A preliminary measurement carried out in a fully anechoic chamber with a variable antenna distance and height in the frequency range 1 GHz to 25 / 40 GHz.
- A final measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 1 GHz to 25 / 40 GHz.

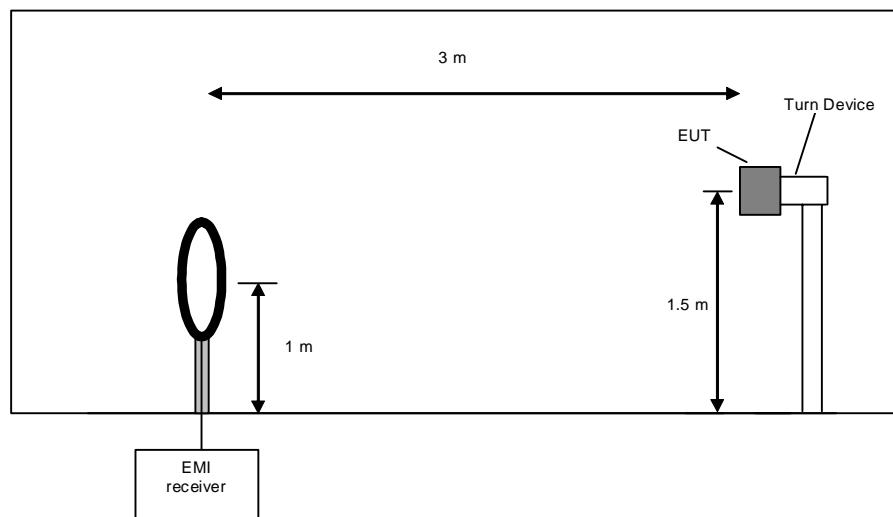
Preliminary measurement (9 kHz to 30 MHz):

In the first stage a preliminary measurement will be performed in a shielded room with a measuring distance of 3 meters. Tabletop and modular devices will set up on a EUT turn device on a height of 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 analyzer 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 polarization and a EUT azimuth of 0 °.
- 2) Manipulate the system cables within the range to produce the maximum level of emission.
- 3) Rotate the EUT by 360 ° to maximize the detected signals.
- 4) Make a hardcopy of the spectrum.
- 5) Measure the frequencies of highest detected emission with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
- 6) Repeat steps 1) to 5) with the other orthogonal axes of the EUT (because of EUT is a module and might be used in a handheld equipment application).
- 7) Rotate the measuring antenna and repeat steps 1) to 5).

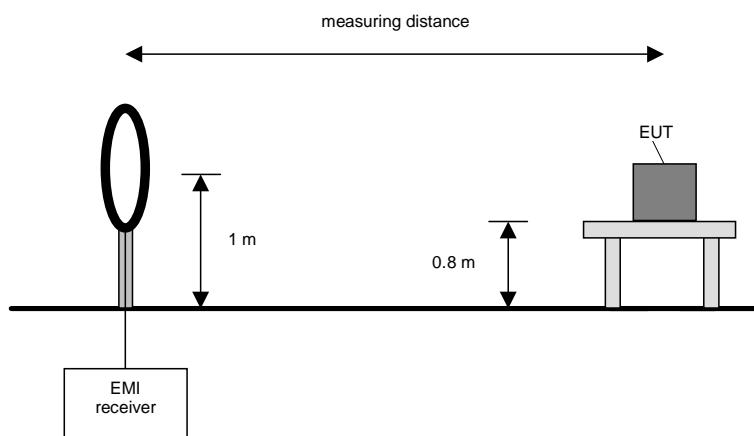
Final measurement (9 kHz to 30 MHz):

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

On the frequencies, which were detected during the preliminary measurements, 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 (if the EUT is a module and might be used in a handheld equipment application).

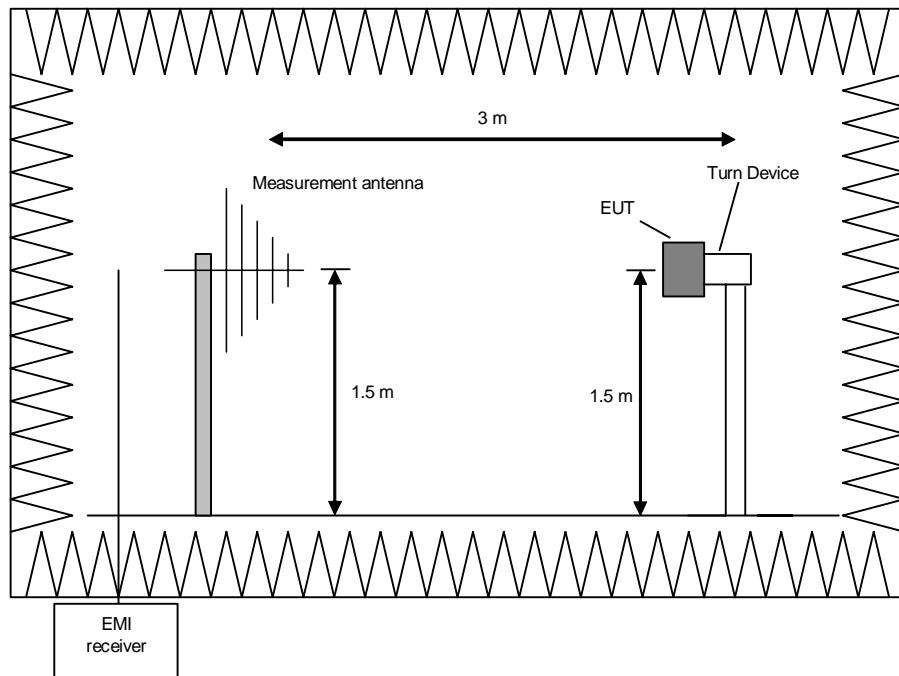
Preliminary measurement (30 MHz to 1 GHz)

In the first stage a preliminary measurement will be performed in a fully anechoic chamber with a measuring distance of 3 meter. Table top devices will set up on a non-conducting turn device on the height of 1.5m. 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 [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 °. This measurement is repeated after raising the EUT in 30° steps according 6.6.5.4 in [1].

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. Repeat 1) to 3) with the vertical polarisation of the measuring antenna.
5. Make a hardcopy of the spectrum.
6. Repeat 1) to 5) with the EUT raised by an angle of 30° (60°, 90°, 120° and 150°) according to 6.6.5.4 in [1].
7. Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.

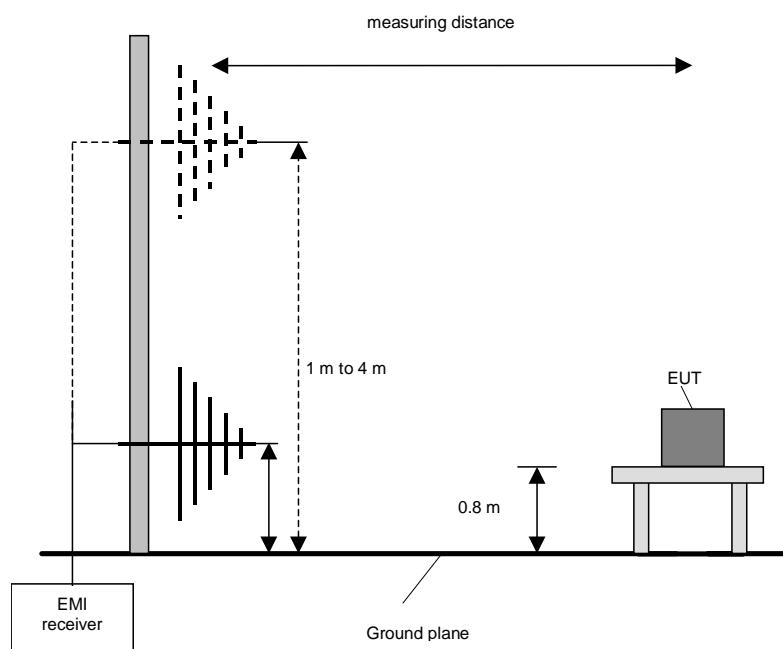
Final measurement (30 MHz to 1 GHz)

A final measurement on an open area test site will be performed on selected frequencies found in the preliminary measurement.

During this test the EUT will be rotated in the range of 0 ° to 360 °, the measuring antenna will be set to horizontal and vertical polarisation and raised and lowered in the range from 1 m to 4 m to find the maximum level of emissions.

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

Frequency range	Resolution bandwidth
30 MHz to 1 GHz	120 kHz



Procedure final measurement:

The following procedure will be used:

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

Preliminary and final measurement (1 GHz to 40 GHz)

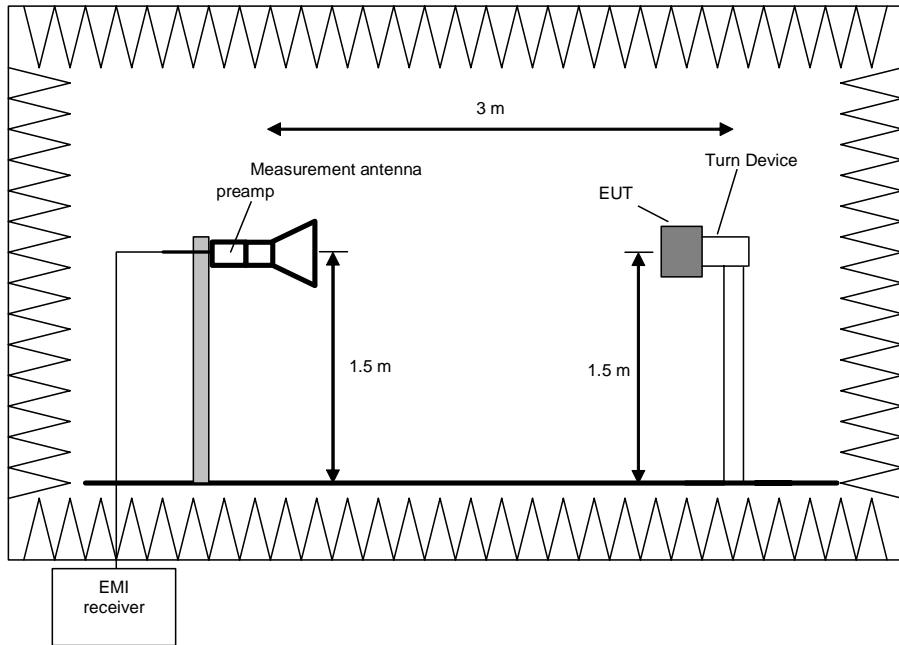
This measurement will be performed in a fully anechoic chamber. Table top devices will set up on a non-conducting turn device on the height of 1.5m. The set-up of the Equipment under test will be in accordance to [1].

Preliminary measurement (1 GHz to 40 GHz)

The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The spectrum analyser set to MAX Hold mode and a resolution bandwidth of 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 °. This measurement is repeated after raising the EUT in 30° steps according 6.6.5.4 in [1].

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

Frequency range	Resolution bandwidth
1 GHz to 4 GHz	100 kHz
4 GHz to 12 GHz	100 kHz
12 GHz to 18 GHz	100 kHz
18 GHz to 25 / 26.5 GHz	100 kHz
26.5 GHz to 40 GHz	100 kHz



Procedure preliminary measurement:

Prescans were performed in the frequency range 1 to 40 GHz.

The following procedure will be used:

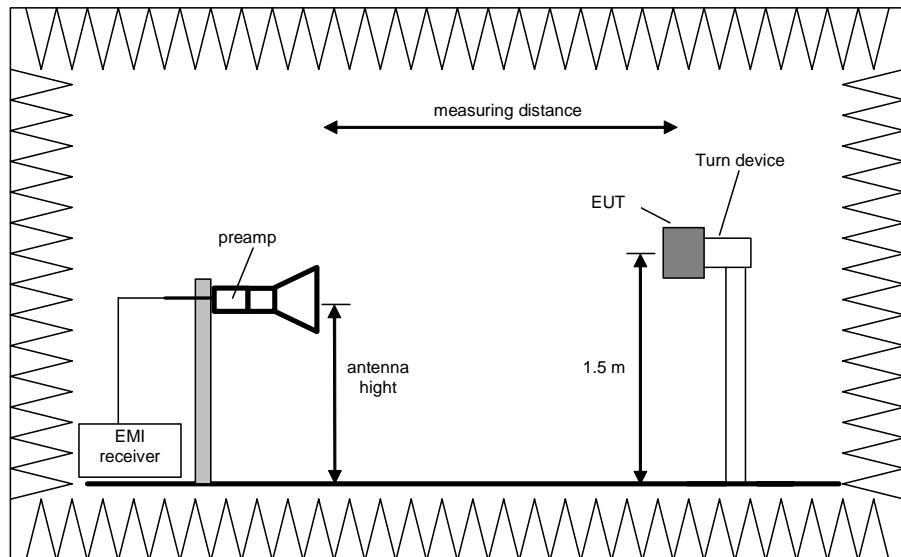
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Rotate the EUT by 360° to maximize the detected signals.
3. Repeat 1) to 2) with the vertical polarisation of the measuring antenna.
4. Make a hardcopy of the spectrum.
5. Repeat 1) to 4) with the EUT raised by an angle of 30° (60°, 90°, 120° and 150°) according to 6.6.5.4 in [1].
6. Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
7. The measurement antenna polarisation, with the according EUT position (Turntable and Turn device) which produces the highest emission for each frequency will be used for the final measurement. The six closest values to the applicable limit will be used for the final measurement.

Final measurement (1 GHz to 25 GHz)

The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The EMI Receiver set to peak and average mode and a resolution bandwidth of 1 MHz. The measurement will be performed by rotating the turntable through 0 to 360° in the worst-case EUT orientation which was obtained during the preliminary measurements.

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

Frequency range	Resolution bandwidth
1 GHz to 4 GHz	1 MHz
4 GHz to 12 GHz	1 MHz
12 GHz to 18 GHz	1 MHz
18 GHz to 25 / 26.5 GHz	1 MHz
26.5 GHz to 40 GHz	1 MHz



Procedure of measurement:

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

The following procedure will be used:

- 1) Set the turntable and the turn device to obtain the worst-case emission for the first frequency identified in the preliminary measurements.
- 2) Set the measurement antenna polarisation to the orientation with the highest emission for the first frequency identified in the preliminary measurements.
- 3) Set the spectrum analyser to EMI mode with peak and average detector activated.
- 4) Rotate the turntable from 0° to 360° to find the EUT angle that produces the highest emissions.
- 5) Note the highest displayed peak and average values
- 6) Repeat the steps 1) to 5) for each frequency detected during the preliminary measurements.

5.6.5 Test results (radiated emissions) – Emissions with dedicated antennas

5.6.5.1 Preliminary radiated emission measurement

Ambient temperature	21 °C	Relative humidity	51 %
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Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m or an EUT turn device of a height of 1.5 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 Testsetup Foto annex.

Test record: All results are shown in the following.

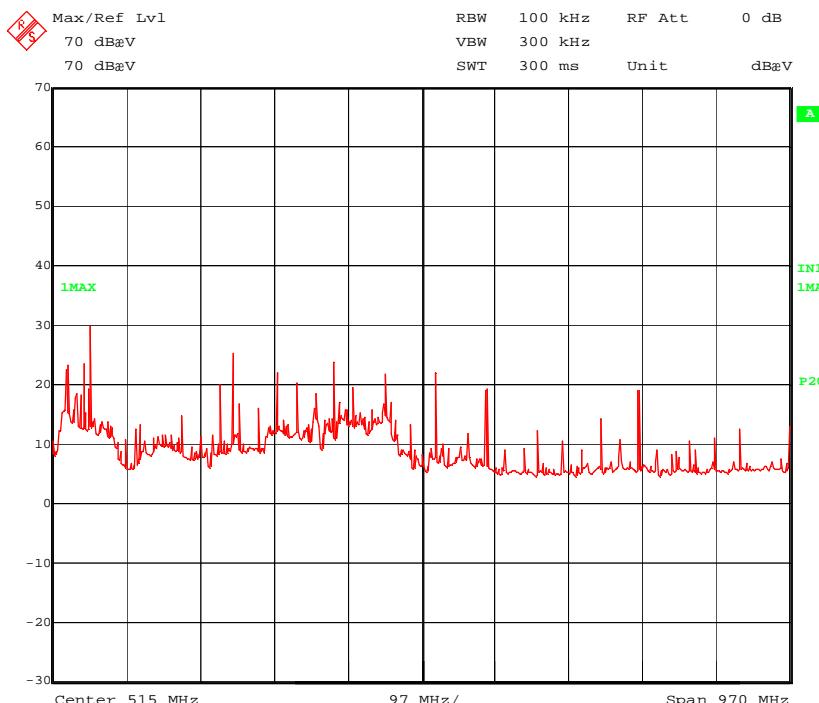
Supply voltage: During all measurements the host of the EUT was powered with 24 V DC via an laboratory power supply.

Remark: Document [1] states in 11.12.2.1, that in case of conducted measurements, additional radiated cabinet emission measurements must be performed. The measurements were performed at the worst case modulations for each frequency range.

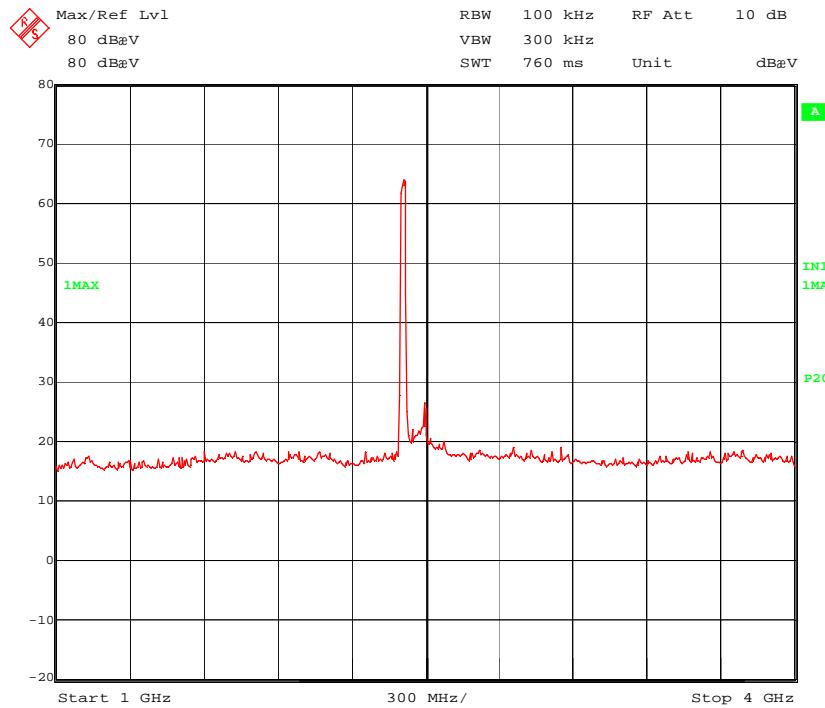
No emissions up to 20 dB to the limit were found below 30 MHz, therefore only the plots of the worst case emissions are submitted for every frequency range above 30 GHz in the preliminary results.

The Emissions below 1 GHz were equal for all antenna ports, transmit frequencies, modulation schemes and data rates. Therefore only the results of an exemplary test case are submitted below.

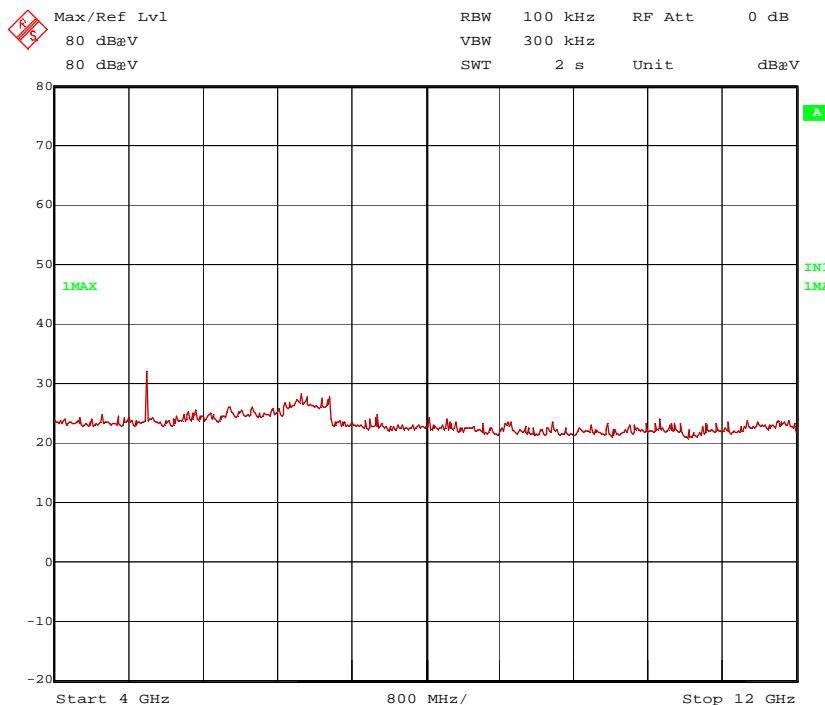
151496_1M_ch1_1-4G_120°.wmf: Spurious emissions from 30 MHz to 1 GHz (operation mode 1):



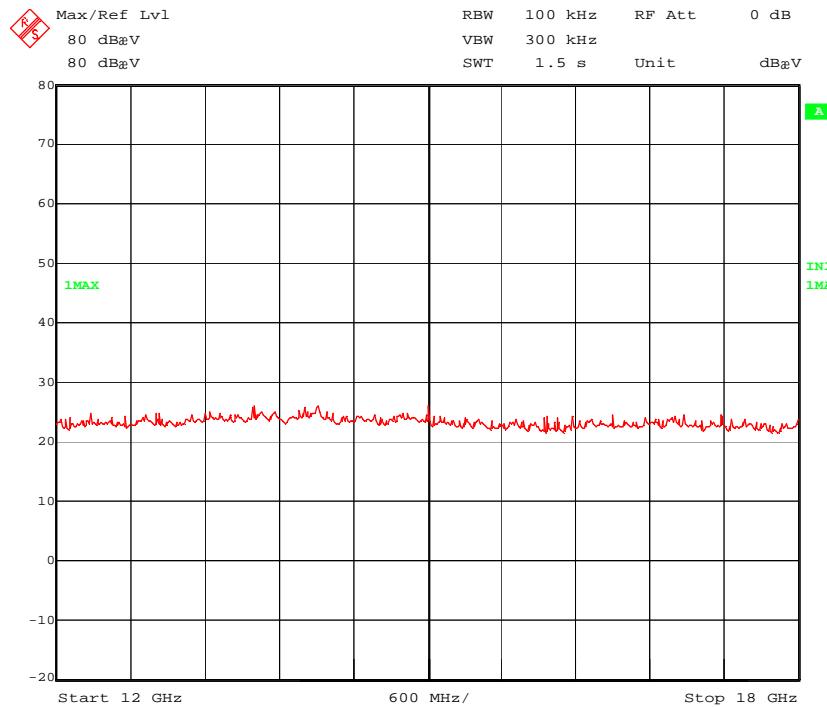
161224 ch1 n20-mode MCS0 11,5dBm ant0 90°.wmf: Spurious emissions from 1 GHz to 4 GHz (operation mode 14):



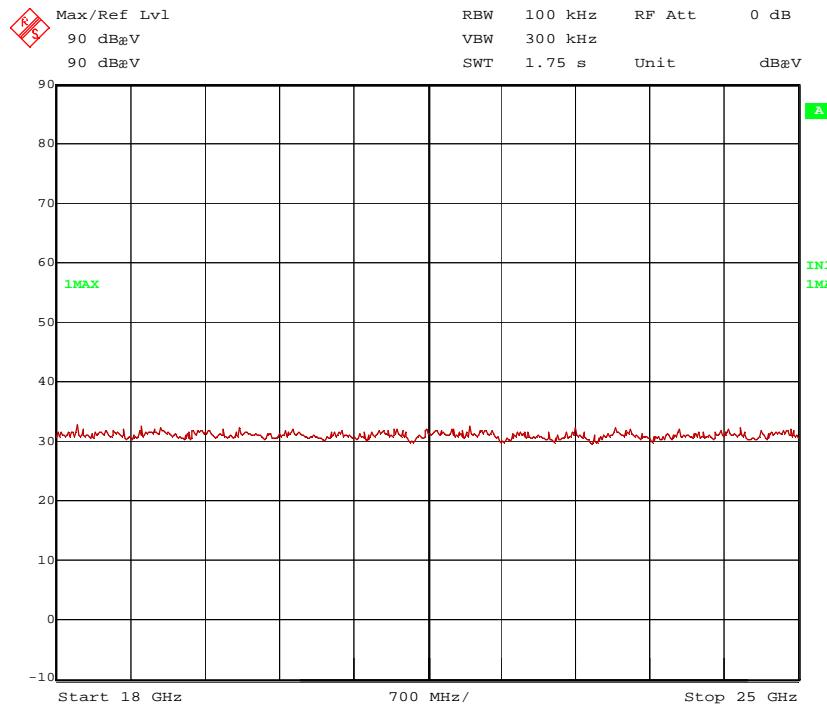
161224 ch6 g-mode ant0 4-12G 120°.wmf: Spurious emissions from 4 GHz to 12 GHz (operation mode 8):



161629_n20-mode_ch6_12-18G_hor_0°.wmf: Spurious emissions from 12 to 18 GHz (operation mode 14):



161224_ch1_n20_18-25G_ant0_Ver.wmf: Spurious emissions from 18 – 25 GHz (operation mode 14):



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

- 73.740, 266.674, 400.000, 2499.9 and 5000 MHz .

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

- 49.173, 466.660 and 533.336 MHz.

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

TEST EQUIPMENT USED FOR THE TEST:
29, 31 – 39, 41 – 51, 72

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

Ambient temperature	22 °C	Relative humidity	55 %
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Position of EUT: The EUT was set-up on table with the height of 0.8 m.

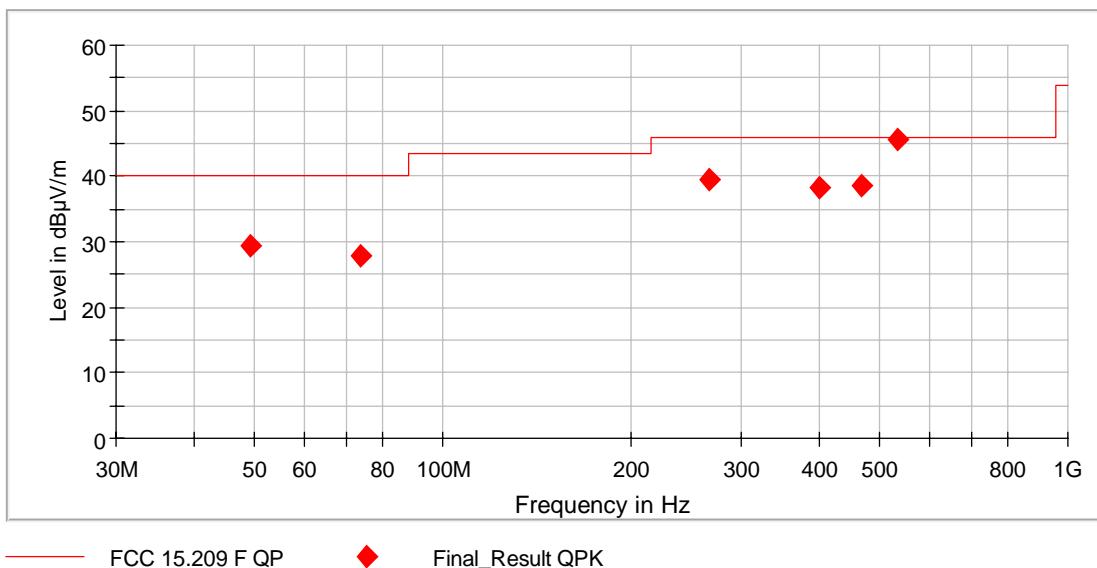
Cable guide: For detail information of test set-up and the cable guide refer to the pictures in test setup photos.

Test record: All results are shown in the following.

Supply voltage: During all measurements the host of the EUT was powered with 24 V DC via a laboratory power supply.

Resolution bandwidth: For all measurements a resolution bandwidth of 100 kHz was used.

Additional information: All emissions below 30 MHz were more than 20 dB to the limit line, therefore no results are submitted below.



Final_Result

Frequency [MHz]	QuasiPeak [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Meas. Time [ms]	Bandwidth [kHz]	Height [cm]	Pol	Azimuth [deg]	Corr. [dB]
49.173	29.42	40.00	10.58	1000.0	120.000	106.0	V	148.0	16.9
73.740	27.79	40.00	12.21	1000.0	120.000	150.0	V	328.0	14.8
266.674	39.39	46.00	6.61	1000.0	120.000	103.0	H	288.0	21.3
400.000	38.28	46.00	7.72	1000.0	120.000	103.0	H	285.0	25.4
466.660	38.64	46.00	7.36	1000.0	120.000	120.0	V	233.0	26.9
533.336	45.56	46.00	0.44	1000.0	120.000	101.0	V	154.0	28.6
Measurement uncertainty					+2.2 dB / -3.6 dB				

5.6.5.3 Final radiated emission measurement (1 GHz to 25 GHz)

Ambient temperature	22 °C	Relative humidity	55 %
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Position of EUT: The EUT was set-up on an EUT turn device of a height of 1.5 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 test setup photos.

Test record: All results are shown in the following.

Supply voltage: During all measurements the host of the EUT was powered with 24 V DC 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.

5.6.5.3.1 Only transmit chain 0 operating (Spurious Emissions)

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

Result measured with the peak detector:

Frequency [MHz]	Meas. Result [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Readings [dB μ V]	Antenna factor [1/m]	Preamp [dB]	Cable loss [dB]	TT angle	EUT angle	Pol.
2499.9	62.3	74.0	11.7	30.8	28.5	0.0	3.0	359°	0°	Vert.
Measurement uncertainty					+2.2 dB / -3.6 dB					

Result measured with the average detector:

Frequency [MHz]	Meas. Result [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Readings [dB μ V]	Antenna factor [1/m]	Preamp [dB]	Cable loss [dB]	TT angle	EUT angle	Pol.
2499.9	53.4	54.0	0.6	21.9	28.5	0.0	3.0	15°	0°	Vert.
Measurement uncertainty					+2.2 dB / -3.6 dB					

Transmitter operates at the lower end of the assigned frequency band (operation mode 7)

Result measured with the peak detector:

Frequency [MHz]	Meas. Result [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Readings [dB μ V]	Antenna factor [1/m]	Preamp [dB]	Cable loss [dB]	TT angle	EUT angle	Pol.
2499.5	60.8	74.0	13.2	29.3	28.5	0.0	3.0	7°	90°	Hor.
5000.0	50.1	74.0	23.9	37.3	33.1	24.8	4.5	79°	120°	Vert.
7236.0	48.6	74.0	25.4	31.7	35.8	24.4	5.5	247°	120°	Vert.
Measurement uncertainty					+2.2 dB / -3.6 dB					

Result measured with the average detector:

Frequency [MHz]	Meas. Result [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Readings [dB μ V]	Antenna factor [1/m]	Preamp [dB]	Cable loss [dB]	TT angle	EUT angle	Pol.
2499.5	50.0	54.0	4.0	18.5	28.5	0.0	3.0	358°	90°	Hor.
5000.0	44.0	54.0	10.0	31.2	33.1	24.8	4.5	90°	120°	Vert.
7236.0	35.0	54.0	19.0	18.1	35.8	24.4	5.5	123°	120°	Vert.
Measurement uncertainty					+2.2 dB / -3.6 dB					

Transmitter operates at the middle of the assigned frequency band (operation mode 8)

Result measured with the peak detector:

Frequency [MHz]	Meas. Result [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Readings [dB μ V]	Antenna factor [1/m]	Preamp [dB]	Cable loss [dB]	TT angle	EUT angle	Pol.
2499.5	61.9	74.0	12.1	30.4	28.5	0.0	3.0	0°	90°	Hor.
5000.0	49.8	74.0	24.2	36.9	33.1	24.8	4.5	94°	120°	Vert.
Measurement uncertainty					+2.2 dB / -3.6 dB					

Result measured with the average detector:

Frequency [MHz]	Meas. Result [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Readings [dB μ V]	Antenna factor [1/m]	Preamp [dB]	Cable loss [dB]	TT angle	EUT angle	Pol.
2499.5	50.2	54.0	3.8	18.7	28.5	0.0	3.0	0°	90°	Hor.
5000.0	44.1	54.0	9.9	31.2	33.1	24.8	4.5	94°	120°	Vert.
Measurement uncertainty					+2.2 dB / -3.6 dB					

Transmitter operates at the upper end of the assigned frequency band (operation mode 9)

Result measured with the peak detector:

Frequency [MHz]	Meas. Result [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Readings [dB μ V]	Antenna factor [1/m]	Preamp [dB]	Cable loss [dB]	TT angle	EUT angle	Pol.
2499.5	61.9	74.0	12.1	30.4	28.5	0.0	3.0	0°	90°	Hor.
5000.0	49.8	74.0	24.2	36.9	33.1	24.8	4.5	94°	120°	Vert.
Measurement uncertainty					+2.2 dB / -3.6 dB					

Result measured with the average detector:

Frequency [MHz]	Meas. Result [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Readings [dB μ V]	Antenna factor [1/m]	Preamp [dB]	Cable loss [dB]	TT angle	EUT angle	Pol.
2499.5	50.2	54.0	3.8	18.7	28.5	0.0	3.0	0°	90°	Hor.
5000.0	44.1	54.0	9.9	31.2	33.1	24.8	4.5	94°	120°	Vert.
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 [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Readings [dB μ V]	Antenna factor [1/m]	Preamp [dB]	Cable loss [dB]	TT angle	EUT angle	Pol.
2499.9	64.1	74.0	9.9	32.6	28.5	0.0	3.0	12°	90°	Vert.
Measurement uncertainty					+2.2 dB / -3.6 dB					

Result measured with the average detector:

Frequency [MHz]	Meas. Result [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Readings [dB μ V]	Antenna factor [1/m]	Preamp [dB]	Cable loss [dB]	TT angle	EUT angle	Pol.
2499.9	53.8	54.0	0.2	22.3	28.5	0.0	3.0	9°	90°	Vert.
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 [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Readings [dB μ V]	Antenna factor [1/m]	Preamp [dB]	Cable loss [dB]	TT angle	EUT angle	Pol.
2377.7	58.1	74.0	15.9	26.6	28.5	0.0	3.0	358°	90°	Hor.
Measurement uncertainty					+2.2 dB / -3.6 dB					

Result measured with the average detector:

Frequency [MHz]	Meas. Result [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Readings [dB μ V]	Antenna factor [1/m]	Preamp [dB]	Cable loss [dB]	TT angle	EUT angle	Pol.
2377.7	44.6	54.0	9.4	13.1	28.5	0.0	3.0	8°	90°	Hor.
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 [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Readings [dB μ V]	Antenna factor [1/m]	Preamp [dB]	Cable loss [dB]	TT angle	EUT angle	Pol.
2499.9	64.1	74.0	9.9	32.6	28.5	0.0	3.0	8°	0°	Vert.
Measurement uncertainty					+2.2 dB / -3.6 dB					

Result measured with the average detector:

Frequency [MHz]	Meas. Result [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Readings [dB μ V]	Antenna factor [1/m]	Preamp [dB]	Cable loss [dB]	TT angle	EUT angle	Pol.
2499.9	53.8	54.0	0.2	22.3	28.5	0.0	3.0	14°	0°	Vert.
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 [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Readings [dB μ V]	Antenna factor [1/m]	Preamp [dB]	Cable loss [dB]	TT angle	EUT angle	Pol.
2499.5	61.4	74.0	12.6	29.9	28.5	0.0	3.0	360°	90°	Hor.
Measurement uncertainty					+2.2 dB / -3.6 dB					

Result measured with the average detector:

Frequency [MHz]	Meas. Result [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Readings [dB μ V]	Antenna factor [1/m]	Preamp [dB]	Cable loss [dB]	TT angle	EUT angle	Pol.
2499.5	50.0	54.0	4.0	18.5	28.5	0.0	3.0	360°	90°	Hor.
Measurement uncertainty					+2.2 dB / -3.6 dB					

5.6.5.3.2 Only transmit chain 0 operating (Emissions at the band-edges)

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

Result measured with the peak detector:

Frequency [MHz]	Meas. Result [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Readings [dB μ V]	Antenna factor [1/m]	Preamp [dB]	Cable loss [dB]	TT angle	EUT angle	Pol.
2377.7	58.1	74.0	15.9	26.6	28.5	0.0	3.0	358°	90°	Hor.
Measurement uncertainty					+2.2 dB / -3.6 dB					

Result measured with the average detector:

Frequency [MHz]	Meas. Result [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Readings [dB μ V]	Antenna factor [1/m]	Preamp [dB]	Cable loss [dB]	TT angle	EUT angle	Pol.
2377.7	44.6	54.0	9.4	13.1	28.5	0.0	3.0	8°	90°	Hor.
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 [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Readings [dB μ V]	Antenna factor [1/m]	Preamp [dB]	Cable loss [dB]	TT angle	EUT angle	Pol.
2499.5	61.4	74.0	12.6	29.9	28.5	0.0	3.0	360°	90°	Hor.
Measurement uncertainty					+2.2 dB / -3.6 dB					

Result measured with the average detector:

Frequency [MHz]	Meas. Result [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Readings [dB μ V]	Antenna factor [1/m]	Preamp [dB]	Cable loss [dB]	TT angle	EUT angle	Pol.
2499.5	50.0	54.0	4.0	18.5	28.5	0.0	3.0	360°	90°	Hor.
Measurement uncertainty					+2.2 dB / -3.6 dB					

5.6.5.3.3 Only transmit chain 1 operating (Emissions at the band-edges)

Transmitter operates at the lower end of the assigned frequency band (operation mode 25)

Result measured with the peak detector:

Frequency [MHz]	Meas. Result [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Readings [dB μ V]	Antenna factor [1/m]	Preamp [dB]	Cable loss [dB]	TT angle	EUT angle	Pol.
2388.8	58.5	74.0	15.5	27.2	28.3	0.0	3.0	248°	30°	Vert.
Measurement uncertainty					+2.2 dB / -3.6 dB					

Result measured with the average detector:

Frequency [MHz]	Meas. Result [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Readings [dB μ V]	Antenna factor [1/m]	Preamp [dB]	Cable loss [dB]	TT angle	EUT angle	Pol.
2388.8	44.8	54.0	9.2	13.5	28.3	0.0	3.0	263°	30°	Vert.
Measurement uncertainty					+2.2 dB / -3.6 dB					

Transmitter operates at the upper end of the assigned frequency band (operation mode 27)

Result measured with the peak detector:

Frequency [MHz]	Meas. Result [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Readings [dB μ V]	Antenna factor [1/m]	Preamp [dB]	Cable loss [dB]	TT angle	EUT angle	Pol.
2499.5	59.3	74.0	14.7	27.8	28.5	0.0	3.0	214°	30°	Vert.
Measurement uncertainty					+2.2 dB / -3.6 dB					

Result measured with the average detector:

Frequency [MHz]	Meas. Result [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Readings [dB μ V]	Antenna factor [1/m]	Preamp [dB]	Cable loss [dB]	TT angle	EUT angle	Pol.
2499.5	48.1	54.0	5.9	16.6	28.5	0.0	3.0	222°	30°	Vert.
Measurement uncertainty					+2.2 dB / -3.6 dB					

5.6.5.3.4 Transmit on chain 0 & chain 1 simultaneously (Spurious Emissions)

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

Result measured with the peak detector:

Frequency [MHz]	Meas. Result [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Readings [dB μ V]	Antenna factor [1/m]	Preamp [dB]	Cable loss [dB]	TT angle	EUT angle	Pol.	
2288.1	59.1	74.0	14.9	28.4	27.8	0.0	2.9	7°	0°	Hor.	
2499.5	62.8	74.0	11.2	31.3	28.5	0.0	3.0	0°	90°	Hor.	
5000.0	49.5	74.0	24.5	36.7	33.1	24.8	4.5	71°	120°	Vert.	
Measurement uncertainty						+2.2 dB / -3.6 dB					

Result measured with the average detector:

Frequency [MHz]	Meas. Result [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Readings [dB μ V]	Antenna factor [1/m]	Preamp [dB]	Cable loss [dB]	TT angle	EUT angle	Pol.	
2288.1	49.5	54.0	4.5	18.8	27.8	0.0	2.9	19°	0°	Hor.	
2499.5	50.4	54.0	3.6	18.9	28.5	0.0	3.0	0°	90°	Hor.	
5000.0	43.5	54.0	10.5	30.7	33.1	24.8	4.5	86°	120°	Vert.	
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 [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Readings [dB μ V]	Antenna factor [1/m]	Preamp [dB]	Cable loss [dB]	TT angle	EUT angle	Pol.
1600.0	54.5	74.0	19.5	26.8	25.3	0.0	2.4	2°	0°	Hor.
2288.0	59.4	74.0	14.6	28.7	27.8	0.0	2.9	0°	0°	Hor.
2499.5	62.7	74.0	11.3	31.2	28.5	0.0	3.0	94°	90°	Vert.
5000.0	50.0	74.0	24.0	37.2	33.1	24.8	4.5	77°	120°	Vert.
Measurement uncertainty					+2.2 dB / -3.6 dB					

Result measured with the average detector:

Frequency [MHz]	Meas. Result [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Readings [dB μ V]	Antenna factor [1/m]	Preamp [dB]	Cable loss [dB]	TT angle	EUT angle	Pol.
1600.0	42.7	54.0	11.3	15.0	25.3	0.0	2.4	20°	0°	Hor.
2288.0	49.3	54.0	4.7	18.6	27.8	0.0	2.9	12°	0°	Hor.
2499.5	50.5	54.0	3.5	19.0	28.5	0.0	3.0	249°	90°	Hor.
5000.0	43.5	54.0	10.5	30.7	33.1	24.8	4.5	87°	120°	Vert.
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 [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Readings [dB μ V]	Antenna factor [1/m]	Preamp [dB]	Cable loss [dB]	TT angle	EUT angle	Pol.
2499.5	60.8	74.0	13.2	29.3	28.5	0.0	3.0	12°	90°	Hor.
5000.0	50.0	74.0	24.0	37.2	33.1	24.8	4.5	86°	120°	Vert.
Measurement uncertainty					+2.2 dB / -3.6 dB					

Result measured with the average detector:

Frequency [MHz]	Meas. Result [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Readings [dB μ V]	Antenna factor [1/m]	Preamp [dB]	Cable loss [dB]	TT angle	EUT angle	Pol.
2499.5	49.4	54.0	4.6	17.9	28.5	0.0	3.0	3°	90°	Hor.
5000.0	43.5	54.0	10.5	30.7	33.1	24.8	4.5	86°	120°	Vert.
Measurement uncertainty					+2.2 dB / -3.6 dB					

5.6.5.3.5 Transmit on chain 0 & chain 1 simultaneously (Emissions at the band-edges)

Transmitter operates at the lower end of the assigned frequency band (operation mode 28)

Result measured with the peak detector:

Frequency [MHz]	Meas. Result [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Readings [dB μ V]	Antenna factor [1/m]	Preamp [dB]	Cable loss [dB]	TT angle	EUT angle	Pol.
2389.4	60.5	74.0	13.5	29.2	28.3	0.0	3.0	360°	90°	Hor.
Measurement uncertainty					+2.2 dB / -3.6 dB					

Result measured with the average detector:

Frequency [MHz]	Meas. Result [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Readings [dB μ V]	Antenna factor [1/m]	Preamp [dB]	Cable loss [dB]	TT angle	EUT angle	Pol.
2389.4	45.5	54.0	8.5	14.2	28.3	0.0	3.0	12°	90°	Hor.
Measurement uncertainty					+2.2 dB / -3.6 dB					

Transmitter operates at the upper end of the assigned frequency band (operation mode 30)

Result measured with the peak detector:

Frequency [MHz]	Meas. Result [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Readings [dB μ V]	Antenna factor [1/m]	Preamp [dB]	Cable loss [dB]	TT angle	EUT angle	Pol.
2499.5	60.1	74.0	13.9	28.6	28.5	0.0	3.0	10°	90°	Vert.
Measurement uncertainty					+2.2 dB / -3.6 dB					

Result measured with the average detector:

Frequency [MHz]	Meas. Result [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Readings [dB μ V]	Antenna factor [1/m]	Preamp [dB]	Cable loss [dB]	TT angle	EUT angle	Pol.
2499.5	48.9	54.0	5.1	17.4	28.5	0.0	3.0	0°	90°	Vert.
Measurement uncertainty					+2.2 dB / -3.6 dB					

TEST EQUIPMENT USED FOR THE TEST:

29, 31 – 39, 41 – 51, 72

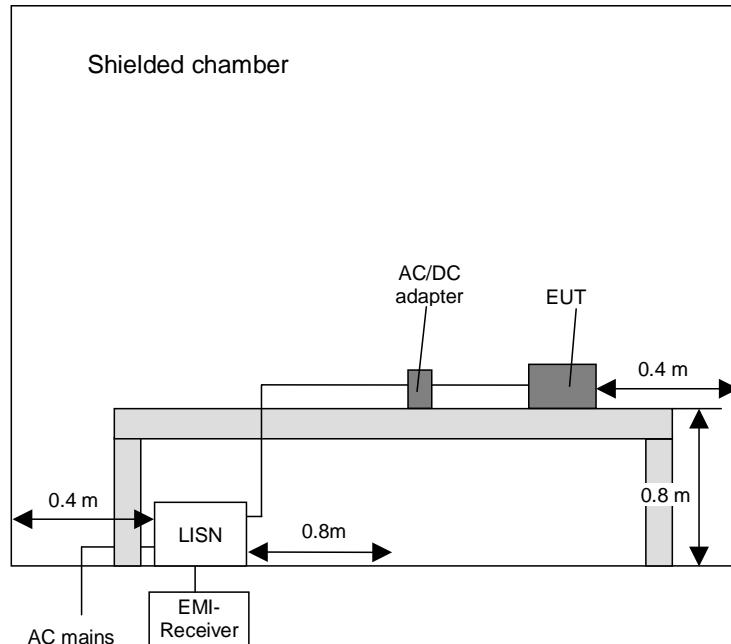
5.7 Conducted emissions on power supply lines (150 kHz to 30 MHz)

5.7.1 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 appropriate limit, this emission will be measured with the average and quasi-peak detector on all lines.

Frequency range	Resolution bandwidth
150 kHz to 30 MHz	9 kHz



5.7.2 Test results (conducted emissions on power supply lines)

Ambient temperature	20 °C	Relative humidity	52 %
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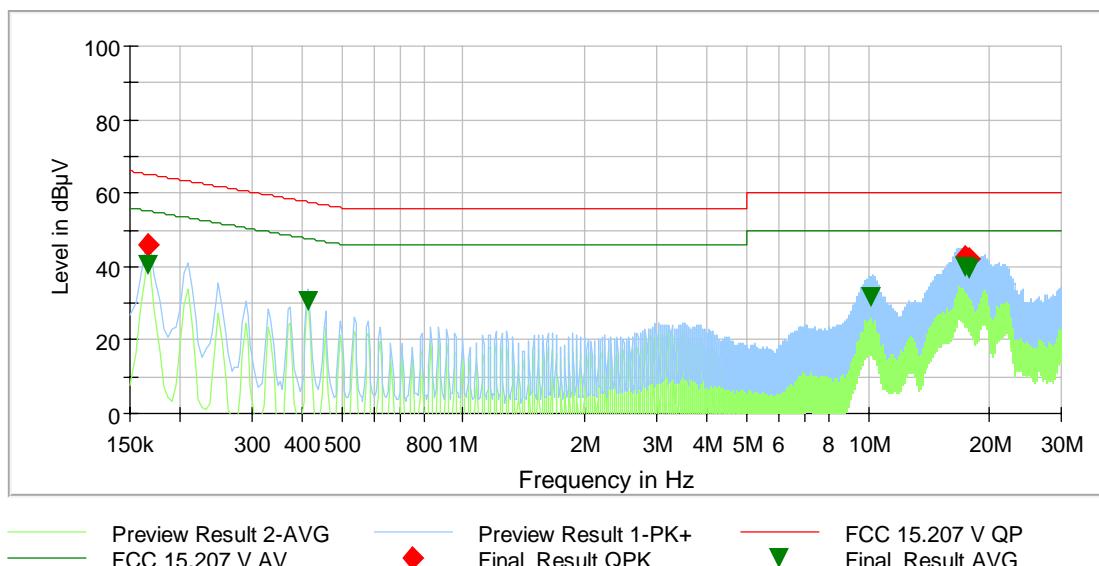
Position of EUT: For the test the EUT was powered by an typical AC/DC power supply. The EUT was set into test-mode with continuous transmission on channel 6 with MCS8 modulation on both transmit chains. This mode was found to be the worst case. The laptop PC with the inserted EUT and the AC/DC power supply 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: Measurement performed with US 120V/60Hz. For the test a power supply type "MINI-PS-100-240AC/24DC/1.3" from PHOENIX CONTACT GmbH & Co. KG 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 "♦" and the average measured points by "▼".



Final_Result

Frequency (MHz)	QuasiPeak (dB μ V)	Average (dB μ V)	Limit (dB μ V)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	PE	Corr. (dB)
0.165300	46.07	---	65.19	19.12	5000.0	9.000	N	GND	9.8
0.165300	---	40.58	55.19	14.61	5000.0	9.000	L1	FLO	9.8
0.414600	---	30.63	47.56	16.93	5000.0	9.000	L1	GND	9.9
10.191300	---	31.75	50.00	18.25	5000.0	9.000	N	FLO	10.6
17.277900	42.71	---	60.00	17.29	5000.0	9.000	L1	GND	10.8
17.440800	---	39.72	50.00	10.28	5000.0	9.000	L1	FLO	10.9
17.813400	---	39.31	50.00	10.69	5000.0	9.000	L1	FLO	10.9
17.815200	41.84	---	60.00	18.16	5000.0	9.000	L1	FLO	10.9

TEST EQUIPMENT USED FOR THE TEST:

1 - 5

6 Test Equipment

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	15.02.2016	15.02.2018
3	LISN	NSLK8128	Schwarzbeck	8128155	480058	16.02.2016	16.02.2018
4	Transient Filter Limiter	CFL 9206A	Teseq GmbH	38268	481982	Weekly verification (system cal.)	
5	EMI Software	EMC32	Rohde & Schwarz	100061	481022	-	-
6	RF-Switch	87104D	Agilent Technologies	ATO-66369 MY52310550	482395	Annual verification (system cal.)	
7	Attenuator / Switch Driver	11713B	Agilent Technologies	-	482148	-	-
8	HF-Cable	Sucoflex 104	Huber+Suhner	517406	482391	Annual verification (system cal.)	
9	HF-Cable	Sucoflex 104	Huber+Suhner	517402	482392	Annual verification (system cal.)	
10	HF-Cable	Sucoflex 104	Huber+Suhner	517407	482394	Annual verification (system cal.)	
29	Fully anechoic chamber M20	-	Albatross Projects	B83107-E2439-T232	480303	Weekly verification (system cal.)	
30	Spectrum analyzer	FSU	Rohde & Schwarz	200125	480956	17.02.2016	17.02.2017
31	Measuring receiver	ESI 40	Rohde & Schwarz	100064	480355	16.04.2016	16.04.2017
32	Controller	MCU	Maturo	MCU/043/971107	480832	-	-
33	Turntable	DS420HE	Deisel	420/620/80	480315	-	-
34	Antenna support	AS615P	Deisel	615/310	480187	-	-
36	Antenna	3115 A	EMCO	9609-4918	480183	10.11.2014	10.11.2017
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	480299	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	Loop antenna	HFH2-Z2	Rohde & Schwarz	832609/014	480059	29.02.2016	29.02.2018
44	Antenna	CBL6112 B	Chase	2688	480328	14.04.2014	14.04.2017
46	RF-cable 2 m	KPS-1533-800-KPS	Insulated Wire	-	480302	Six month verification (system cal.)	
47	RF-cable No. 38	Sucoflex 106B	Huber&Suhner	0709/6B / Kabel 38	481328	Weekly verification (system cal.)	

49	Preamplifier	JS3-00101200-23-5A	Miteq	681851	480337	18.02.2016	18.02.2018
50	Preamplifier	JS3-12001800-16-5A	Miteq	571667	480343	18.02.2016	18.02.2018
51	Preamplifier	JS3-18002600-20-5A	Miteq	658697	480342	17.02.2016	17.02.2018
60	Power Meter	NRVD	Rohde & Schwarz	833697/030	480589	18.02.2016	18.02.2018
61	Peak Power Sensor	NRV-Z32	Rohde & Schwarz	849745/016	480551	18.02.2016	18.02.2018
72	4 GHz High Pass Filter	WHKX4.0/18 G-8SS	Wainwright Instruments	1	480587	Weekly verification (system cal.)	

7 Report History

Report Number	Date	Comment
F161629E1	10.02.2017	Initial Test Report
F161629E1 2 nd Version	13.04.2017	Update RSS-247 Version, 99% Bandwidth added, Change of caption 161629_06 in Annex A

8 List of Annexes

ANNEX A TEST SETUP PHOTOS 9 pages

161629_01.jpg	Test setup – antenna-port conducted emissions
161629_10.jpg	Test setup – frequency stability (only 15.407)
161629_02.jpg	Test setup fully anechoic chamber
161629_03.jpg	Test setup fully anechoic chamber
161629_04.jpg	Test setup fully anechoic chamber
161629_05.jpg	Test setup fully anechoic chamber
161629_06.jpg	Test setup open area test site
161629_07.jpg	Test setup fully anechoic chamber
161629_08.jpg	Test setup fully anechoic chamber
161629_09.jpg	Test setup power line conducted emissions

ANNEX B**INTERNAL PHOTOS**

11 pages

161629_11.jpg	EUT 1 in evaluation application – 3D top view 1
161629_12.jpg	EUT 1 in evaluation application – 3D top view 2
161629_13.jpg	EUT 1 in evaluation application – bottom view
161629_14.jpg	EUT 1 in evaluation application – inside view
161629_15.jpg	Evaluation board – back view
161629_16.jpg	EUT 1 on evaluation board – front view
161629_19.jpg	EUT 2 on evaluation board with 2JZ0102 antenna – front view
161629_20.jpg	Evaluation board with 2JZ0102 antenna – back view
161629_21.jpg	EUT 2 on evaluation board – front view
161629_25.jpg	Ancillary equipment – serial to USB cable
161629_26.jpg	Ancillary equipment – AC/DC converter for power line conducted test

ANNEX C**RESULTS**

5 pages

161629_18.jpg	EUT 1 – top view
161629_17.jpg	EUT 1 – bottom view
161629_24.jpg	EUT 2 – top view
161629_23.jpg	EUT 2 – bottom view
161629_30.jpg	EUT – top view without shielding