

FCC ID: DMOLSP500

IC ID: 2099A-LSP500

EMI - TEST REPORT

- FCC Part 15.247, RSS210 -

Test Report No. : T36407-00-03HS	09. July 2013
	Date of issue

Type / Model Name : LSP 500 PRO

Product Description : Wireless Integrated PA System

Applicant : Sennheiser electronic GmbH & Co. KG

Address : Am Labor 1

30900 WEDEMARK, GERMANY

Manufacturer : Sennheiser electronic GmbH & Co. KG

Address : Am Labor 1

30900 WEDEMARK, GERMANY

Licence holder : Sennheiser electronic GmbH & Co. KG

Address : Am Labor 1

30900 WEDEMARK, GERMANY

Test Result according to the standards listed in clause 1 test standards:	POSITIVE
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The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

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Attachment A see separate supplement

1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15, Subpart A - General (September, 2012)

Part 15, Subpart A, Section 15.31	Measurement standards
Part 15, Subpart A, Section 15.33	Frequency range of radiated measurements
Part 15, Subpart A, Section 15.35	Measurement detector functions and bandwidths

FCC Rules and Regulations Part 15, Subpart C - Intentional Radiators (September, 2012)

Part 15, Subpart C, Section 15.203	Antenna requirement
Part 15, Subpart C, Section 15.204	External radio frequency power amplifiers and antenna modifications
Part 15, Subpart C, Section 15.205	Restricted bands of operation
Part 15, Subpart C, Section 15.207	Conducted limits
Part 15, Subpart C, Section 15.209	Radiated emission limits, general requirements
Part 15, Subpart C, Section 15.247	Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz and 5725 - 5850 MHz

FCC Rules and Regulations Part 1, Subpart I - Procedures Implementing the National Environmental Policy Act of 1969

Part 1, Subpart I, Section 1.1310	Radiofrequency radiation exposure limits
Part 1, Subpart 2, Section 2.1093	Radiofrequency radiation exposure evaluation: portable device

OET Bulletin 65, 65A, 65B, 65C Edition 97-01, August 1997 – Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.

ANSI C63.4: 2003	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
ANSI C95.1: 2005	IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
CISPR 16-4-2: 2003	Uncertainty in EMC measurement
CISPR 22: 2005 EN 55022: 2006	Information technology equipment
KDB 558074 D01 v03	Guidance for performing compliance measurements on DTS operating under Section 15.247, April 9, 2013.

2 SUMMARY

2.1 Test result summary

WLAN device using digital modulation and operates in the 2400 MHz – 2483.5 MHz band:

FCC Rule Part	RSS Rule Part	Description	Result
15.207(a)	RSS Gen, 7.2.4.	AC power line conducted emissions	passed
15.247(a)(2)	RSS210, A8.2(a)	-6 dB EBW	passed
15.247(b)(3)	RSS-210, A8.4(4)	Peak power	passed
15.247(d)	RSS-210, A8.5	Out-of-band emission, radiated	passed
15.247(d)	RSS-Gen, 7.2.2	Emissions in restricted bands	passed
15.247(e)	RSS-210, A8.2(b)	PSD	passed
15.35(c)	RSS-Gen, 4.5	Pulsed operation	not applicable
15.247(i)	RSS 102, 2.5.2	MPE	passed
15.247(b)(4)	RSS-Gen, 7.1.2	Antenna requirement	passed
	RSS-Gen, 7.2.6	Transmitter frequency stability	not applicable
	RSS-Gen, 4.6.1	99 % Bandwidth	passed
OET Bulletin 65	RSS102, 3.2	Co-location, Co-transmission	passed

The mentioned RSS Rule Parts in the above table are related to:

RSS Gen, Issue 3, December 2010

RSS 210, Issue 8, December 2010

RSS 102, Issue 4, March 2010

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2.3 Final assessment

The equipment under test **fulfills** the EMI requirements cited in clause 1 test standards.

Date of receipt of test sample : acc. to storage records

Testing commenced on : 03 June 2013

Testing concluded on : 13 June 2013

Checked by:

Tested by:

Klaus Gegenfurtner
Dipl.-Ing.(FH)
Manager: Radio Group

Hermann Smetana
Dipl.-Ing.(FH)
Radio Senior Expert

3 EQUIPMENT UNDER TEST

3.1 Photo documentation of the EUT – Detailed photos see attachment A

3.2 Power supply system utilised

Power supply voltage, V_{nom} : 100 -240 VAC, optional 14.4 VDC, Lithium battery

3.3 Short description of the equipment under test (EUT)

The EUT is a professional portable speaker with Bluetooth-Interface for wireless connection with host devices and a WLAN-Interface for control the inputs, outputs, mixing and equalising functions. "Link in" and "Link out" are for interconnection devices with the same type for speaker groups. The speaker can optionally load 3 receivers for wireless microphones.

Number of tested samples: 2

Serial number: Radiated sample: 3502390873, conducted sample: 3163494347.

EUT operation mode:

The equipment under test was operated during the measurement under the following conditions:

- TX continuous mode, modulated

- RX continuous mode

EUT configuration:

(The CDF filled by the applicant can be viewed at the test laboratory.)

The following peripheral devices and interface cables were connected during the measurements:

- _____ Model : _____

- _____ Model : _____

- _____ Model : _____

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

mikes-testingpartners gmbh
Ohmstrasse 2-4
94342 STRASSKIRCHEN
GERMANY

4.2 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature: 15-35 °C

Humidity: 30-60 %

Atmospheric pressure: 86-106 kPa

4.3 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16-4-2 „Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements“ and is documented in the quality system acc. to DIN EN ISO/IEC 17025. For all measurements shown in this report, the measurement uncertainty of the test laboratory, mikes-testingpartners gmbh, is below the measurement uncertainty as defined by CISPR. Therefore, no special measures must be taken into consideration with regard to the limits according to CISPR. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

4.4 Measurement protocol for FCC and IC

4.4.1 General information

4.4.1.1 Test methodology

Conducted and radiated disturbance testing is performed according to the procedures set out by the International Special Committee on Radio Interference (CISPR) Publication 22, European Standard EN 55022 as shown under section 1 of this report.

The Open Area test site is a listed Open Site under the Canadian Test-Sites File-No:

IC 3009A-1

In compliance with RSS 210 testing for RSS compliance may be achieved by following the procedures set out in ANSI C63.4 and applying the CISPR 22 limits.

4.4.1.2 Justification

The equipment under test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral using the appropriate impedance characteristic or left unterminated. Where appropriate, cables are manually manipulated with respect to each other thus obtaining maximum disturbances from the unit.

4.4.1.3 Details of test procedures

The test methods used comply with CISPR Publication 22, EN 55022 - "Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement" and with ANSI C63.4 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". In compliance with 47 CFR Part 15 Subpart A, Section 15.38 testing for FCC compliance may be achieved by following the procedures set out in ANSI C63.4 and applying the CISPR 22 limits.

4.4.1.4 Conducted emission

The final level, expressed in dB μ V, is arrived at by taking the reading directly from the EMI receiver. This level is compared directly to the FCC limit or to the CISPR limit.

To convert between dB μ V and μ V, the following conversion formula apply:

$$\begin{aligned} \text{dB}\mu\text{V} &= 20 \cdot \log(\mu\text{V}) \\ \mu\text{V} &= 10^{(\text{dB}\mu\text{V}/20)} \end{aligned}$$

Conducted emissions on the 50 Hz and/or 60 Hz power interface of the EUT are measured in the frequency range of 150 kHz to 30 MHz. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection and a Line Impedance Stabilization Network (LISN) with 50 Ω / 50 μ H (CISPR 16) characteristics. Table top equipment is placed on a non-conducting table 80 centimetres above the floor and is positioned 40 centimetres from the vertical ground plane (wall) of the screen room. If the minimum limit margin of a peak mode measurement appears to be less than 20 dB, the emissions are remeasured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

4.5 Determination of worst case measurement conditions

Measurements are made in all three orthogonal axes and the settings of the EUT were changed to locate at which position and at what setting of the EUT produce the maximum of the emissions. For the further measurement the EUT is set in X position (position of normal use).

The tests are carried out in the following frequency band:

2400 MHz – 2483.5 MHz

Preliminary tests are performed to find the worst case mode from all possible combinations between available modulations and data rates. The maximum output power depends on used data rate.

The test software for the EUT provides free power setting (from 1 dBm to 20 dBm (P1 to P20) in 0.5 dB steps), the special test mode TX continuous mode, modulated. The EUT is set with test modulation to transmit data during the tests with a duty cycle (x) of nearly x = 1 from a packet generator.

Following channels and test modes has been selected for the final test as listed below:

WLAN	Available channel	Tested channels	Power setting	Modulation	Modulation type	Data rate
802.11b	1 to 11	1, 7, 11	P16	CCK	DBPSK	1 Mbps
802.11g	1 to 11	1, 7, 11	P16	OFDM	BPSK	6 Mbps

Conducted measurements are performed at antenna port of the module. Between the module port and the PCB antenna port a UFL to UFL cable (15 cm) is used. All measurements are related to the end of the UFL cable.

5 TEST CONDITIONS AND RESULTS

5.1 Conducted emissions

For test instruments and accessories used see section 6 Part A 4.

5.1.1 Description of the test location

Test location: Shielded Room S2

5.1.2 Photo documentation of the test set-up



5.1.3 Applicable standard

According to FCC Part 15, Section 15.207(a):

Except as shown in paragraphs (b) and (c) of this Section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the given limits.

5.1.4 Description of Measurement

The measurements are performed following the procedures set out in ANSI C63.4 described under item 4.4.3. If the minimum limit margin appears to be less than 20 dB with a peak mode measurement, the emissions are remeasured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

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5.1.5 Test result

Frequency range: 0.15 MHz - 30 MHz

Min. limit margin -7.6 dB at 0.17 MHz

Limit according to FCC Part 15, Section 15.207(a):

Frequency of Emission (MHz)	Conducted Limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency

The requirements are **FULFILLED**.**Remarks:** For detailed test result please refer to following test protocols

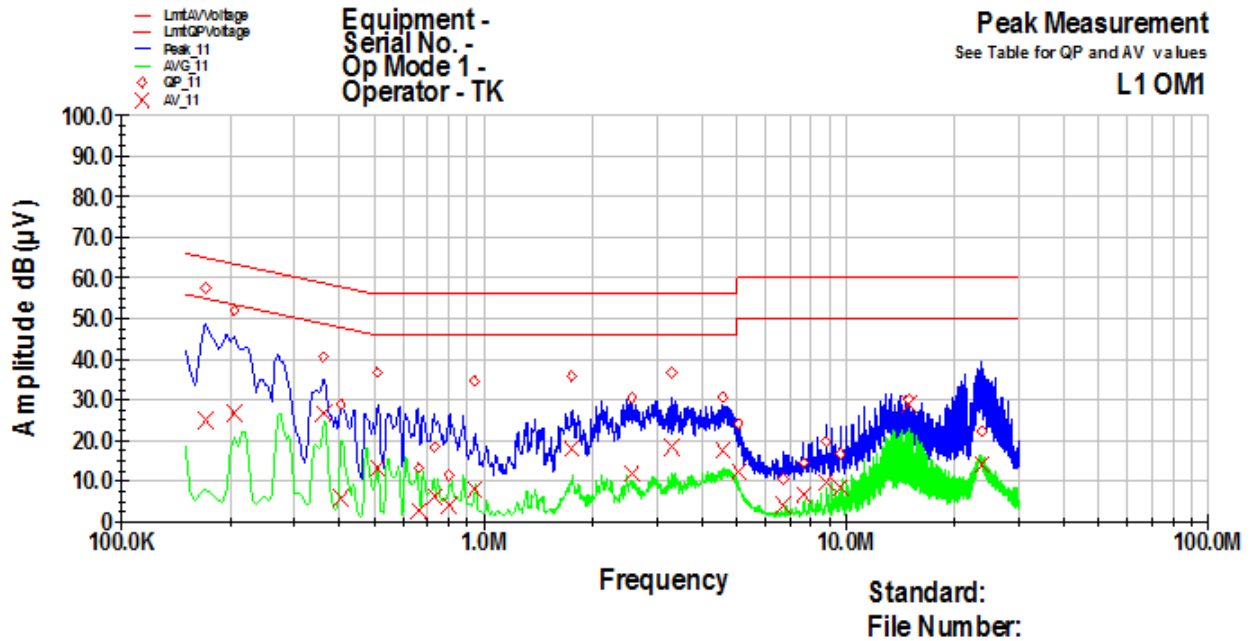
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5.1.6 Test protocol

Test point: L1
 Operation mode: TX continuous mode, modulated
 Remarks: Audio device 1/8 power

Result: passed



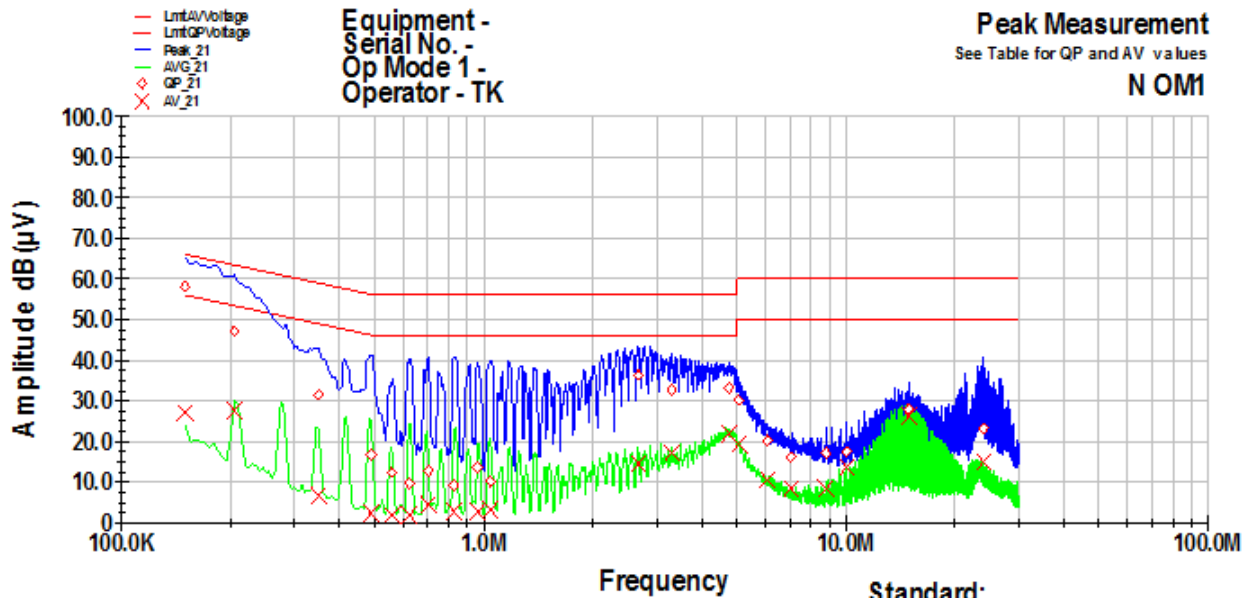
Frequency MHz	QP Level dB(µV)	QP Margin dB	QP Limit dB	AV Level dB(µV)	AV Margin dB	AV Limit dB
0.17	57.4	-7.6	65.0	24.9	-30.1	55.0
0.205	52.0	-11.4	63.4	26.6	-26.8	53.4
0.36	40.5	-18.2	58.7	26.6	-22.2	48.7
0.405	29.0	-28.7	57.8	5.9	-41.8	47.8
0.51	36.7	-19.3	56.0	13.0	-33.0	46.0
0.66	13.1	-42.9	56.0	2.9	-43.1	46.0
0.73	18.6	-37.4	56.0	6.2	-39.8	46.0
0.805	11.6	-44.5	56.0	4.0	-42.0	46.0
0.945	34.5	-21.5	56.0	8.0	-38.0	46.0
1.755	35.9	-20.1	56.0	17.9	-28.1	46.0
2.56	30.6	-25.4	56.0	11.9	-34.2	46.0
3.295	36.7	-19.3	56.0	18.7	-27.3	46.0
4.565	30.6	-25.4	56.0	17.5	-28.5	46.0
5.055	23.9	-36.1	60.0	12.4	-37.5	50.0
6.7	10.8	-49.2	60.0	4.0	-46.0	50.0
7.63	14.3	-45.7	60.0	6.7	-43.3	50.0
8.825	19.6	-40.4	60.0	9.9	-40.1	50.0
9.64	16.5	-43.5	60.0	8.3	-41.7	50.0
14.95	30.3	-29.7	60.0	28.9	-21.1	50.0
23.65	22.2	-37.8	60.0	14.0	-36.0	50.0

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Test point: N
 Operation mode: TX continuous mode, modulated
 Remarks: Audio device 1/8 power

Result: passed



Frequency MHz	QP Level dB(µV)	QP Margin dB	QP Limit dB	AV Level dB(µV)	AV Margin dB	AV Limit dB
0.15	58.0	-8.0	66.0	27.3	-28.7	56.0
0.205	47.1	-16.3	63.4	27.4	-26.0	53.4
0.35	31.5	-27.5	59.0	6.5	-42.5	49.0
0.49	16.9	-39.3	56.2	2.4	-43.8	46.2
0.56	12.4	-43.6	56.0	2.0	-44.0	46.0
0.625	9.8	-46.2	56.0	1.7	-44.3	46.0
0.705	12.9	-43.1	56.0	4.4	-41.6	46.0
0.83	9.1	-46.9	56.0	3.0	-43.0	46.0
0.96	13.5	-42.5	56.0	2.8	-43.3	46.0
1.045	10.3	-45.7	56.0	3.0	-43.0	46.0
2.665	36.3	-19.7	56.0	14.6	-31.4	46.0
3.3	32.9	-23.1	56.0	17.0	-29.0	46.0
4.74	33.4	-22.6	56.0	21.9	-24.1	46.0
5.03	30.1	-29.9	60.0	19.5	-30.5	50.0
6.06	20.0	-40.0	60.0	10.5	-39.5	50.0
7.08	16.3	-43.7	60.0	8.5	-41.5	50.0
8.82	17.1	-42.9	60.0	8.3	-41.7	50.0
10	17.6	-42.4	60.0	13.7	-36.3	50.0
14.95	27.9	-32.1	60.0	26.3	-23.7	50.0
23.895	23.2	-36.8	60.0	15.0	-35.0	50.0

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5.2 Emission bandwidth and occupied bandwidth

For test instruments and accessories used see section 6 Part MB.

5.2.1 Description of the test location

Test location: AREA4

5.2.2 Photo documentation of the test set-up



5.2.3 Applicable standard

According to FCC Part 15, Section 15.247(a)(2):

Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 – 2483.5 MHz and 5725 – 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

5.2.4 Description of Measurement

The bandwidth was measured at an amplitude level reduced from the reference level of a modulated channel by a ratio of -6 dB. The reference level is the level of the highest signal amplitude observed at the transmitter at either the fundamental frequency or the first order modulation products in all typical modes of operation, including the unmodulated carrier, even if atypical. An alternative is to use the bandwidth measurement of the analyser.

Spectrum analyser settings:

RBW: 100 kHz, VBW: 300 kHz, Detector: Peak, Sweep time: 5 s

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5.2.5 Test result

WLAN Standard 802.11b

Channel	Centre frequency (MHz)	6 dB bandwidth (MHz)	99% OBW (MHz)	Minimum limit (MHz)
1	2412	12.080	15.280	0.5
7	2432	12.080	15.280	0.5
11	2462	12.000	15.280	0.5

WLAN Standard 802.11g

Channel	Centre frequency (MHz)	6 dB bandwidth (MHz)	99% OBW (MHz)	Minimum limit (MHz)
1	2412	16.480	16.640	0.5
7	2432	16.240	16.560	0.5
11	2462	16.320	16.560	0.5

The requirements are **FULFILLED**.

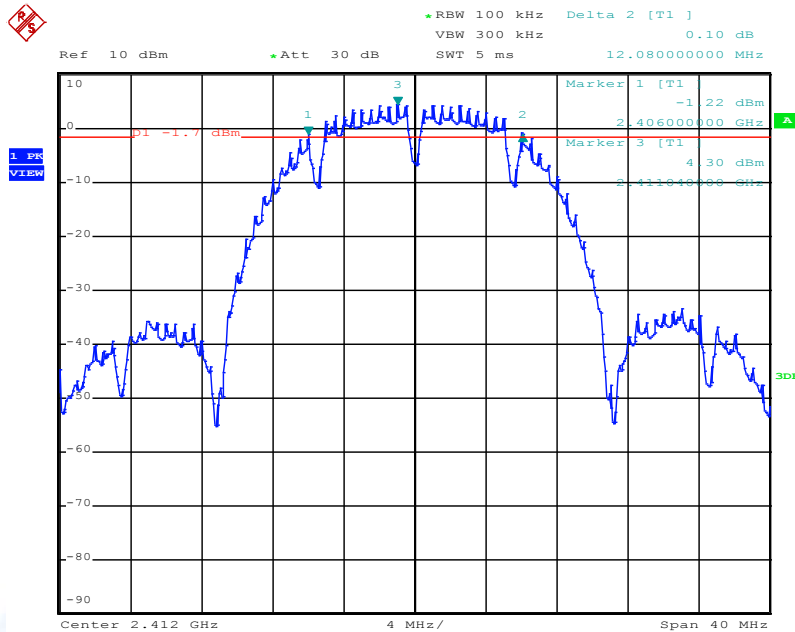
Remarks: For detailed test results please refer to following test protocols.

FCC ID: DMOLSP500

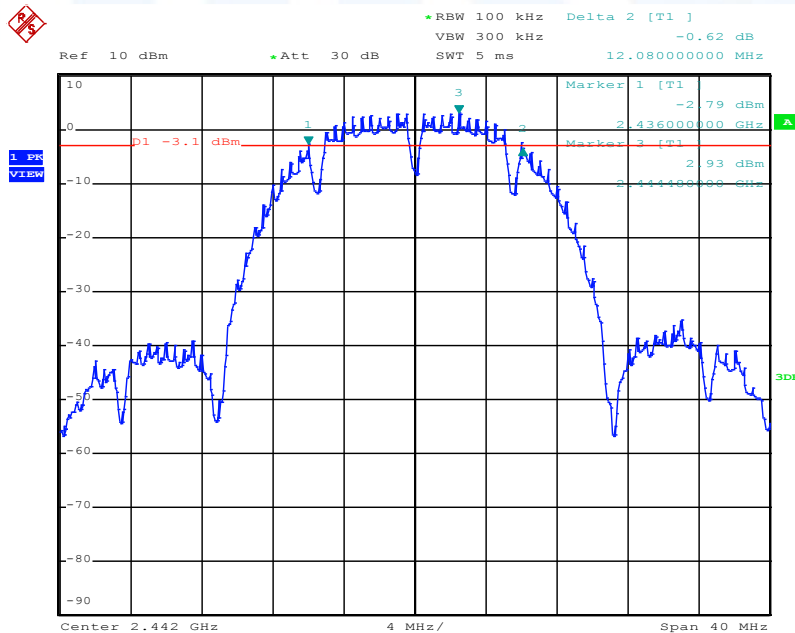
IC ID: 2099A-LSP500

5.2.6 Test protocols
EBW 6 dB:

802.11b, Channel 1 (2412 MHz)



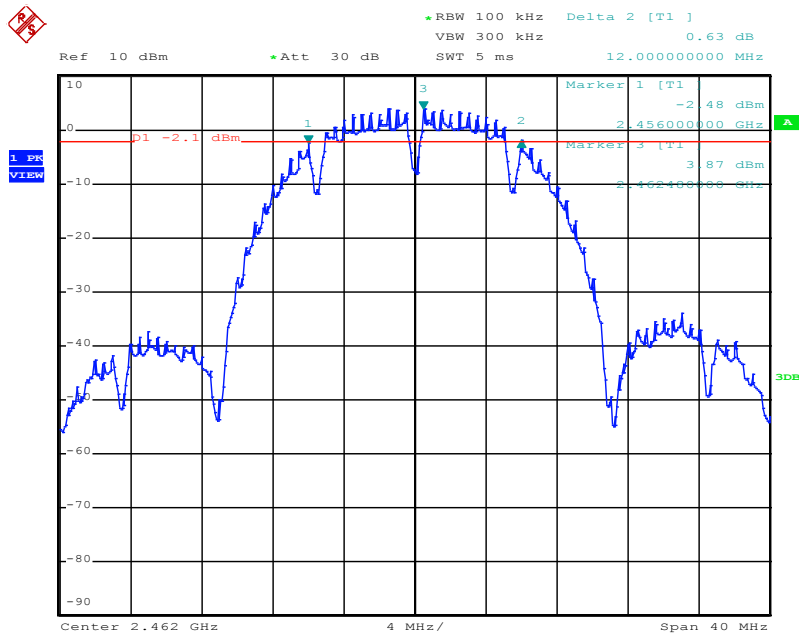
802.11b, Channel 7 (2442 MHz)



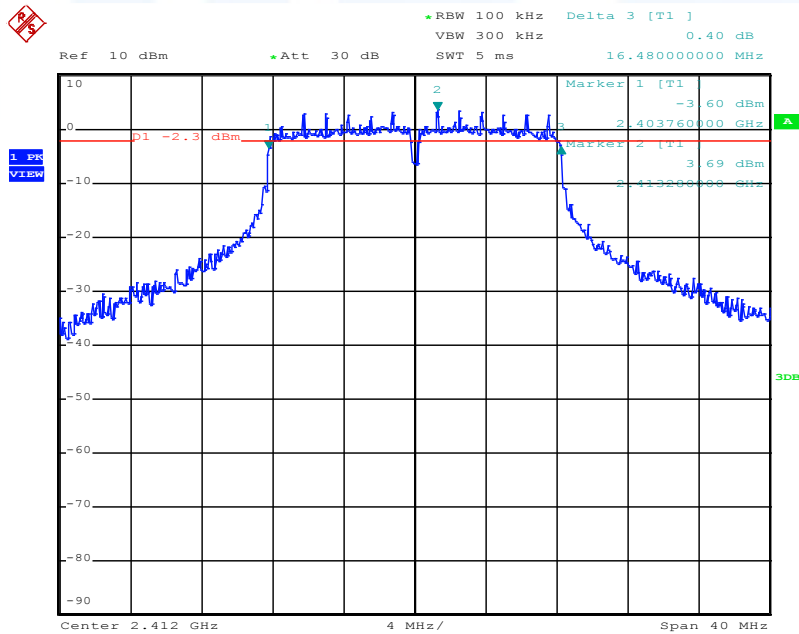
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802.11b, Channel 11 (2462 MHz)



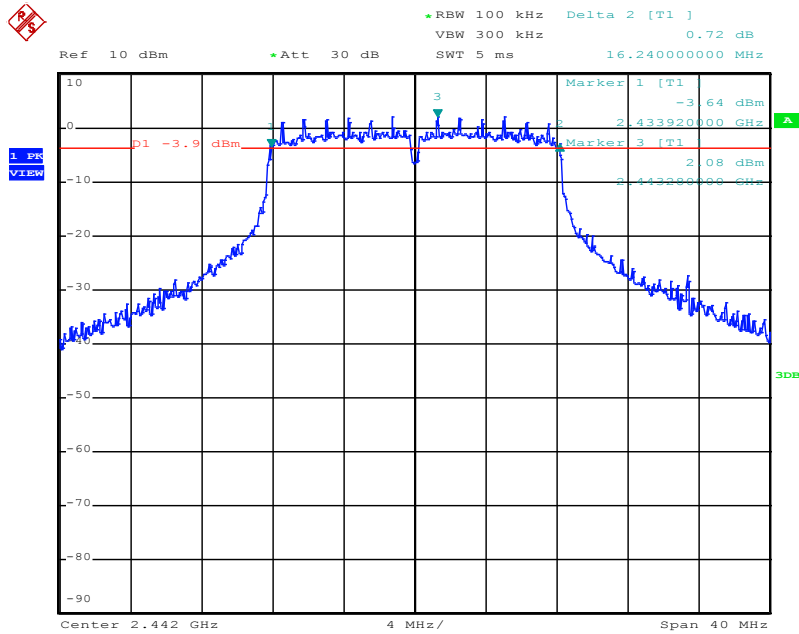
802.11g, Channel 1 (2412 MHz)



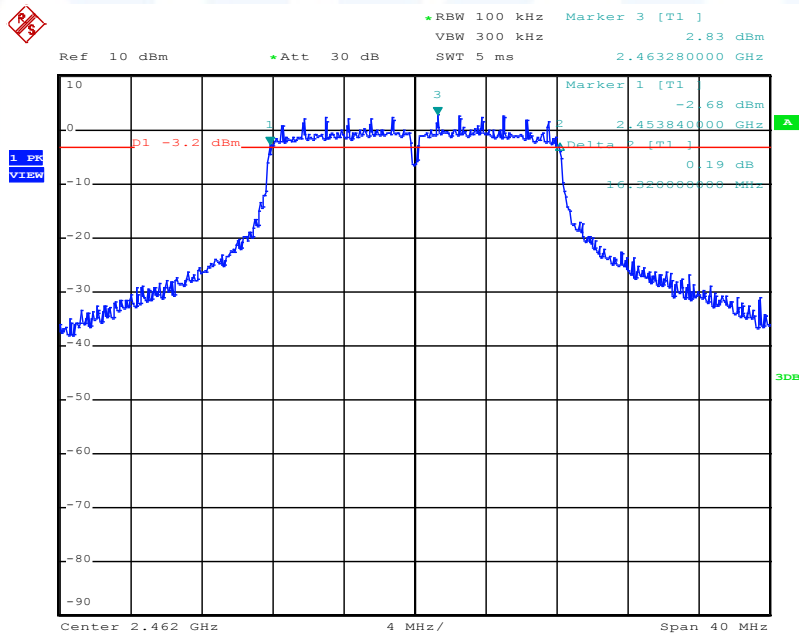
FCC ID: DMOLSP500

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802.11g, Channel 7 (2442 MHz)



802.11g, Channel 11 (2462 MHz)

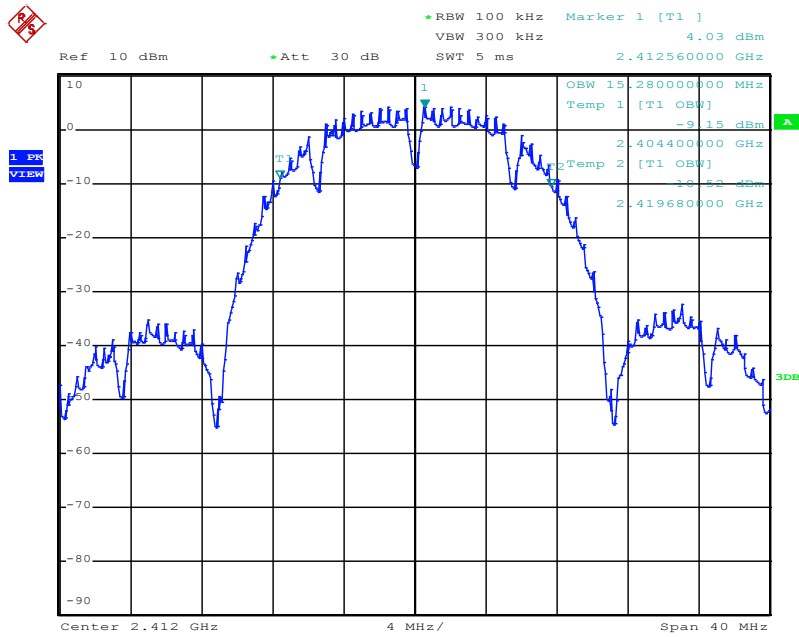


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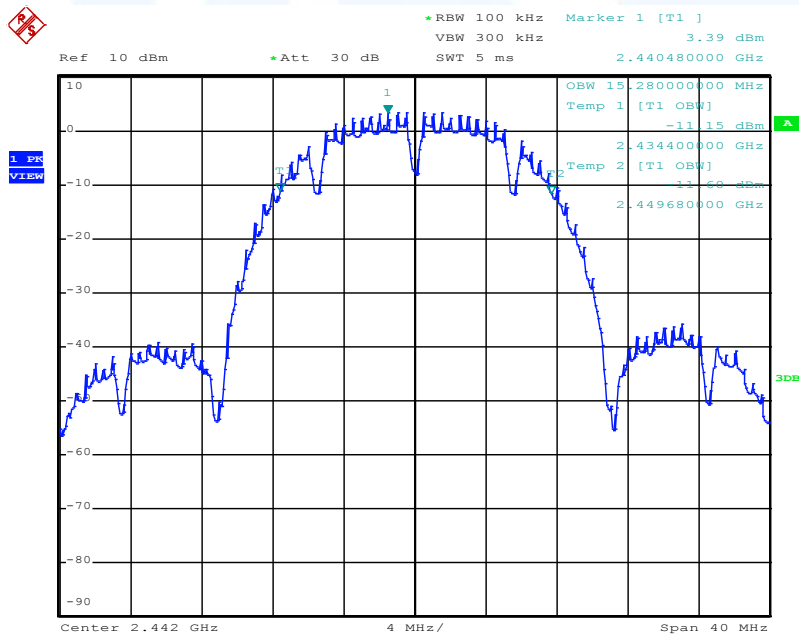
IC ID: 2099A-LSP500

OBW 99%:

802.11b, Channel 1 (2412 MHz)



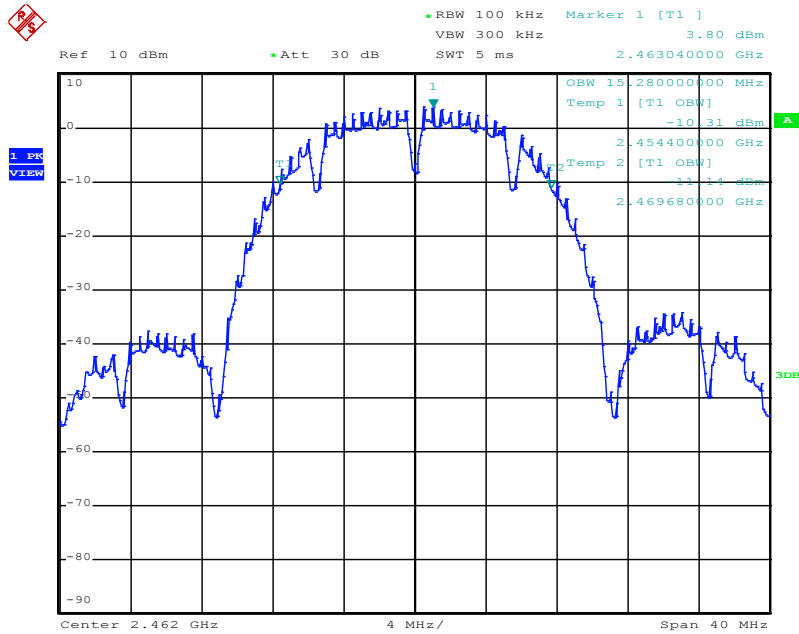
802.11b, Channel 7 (2442 MHz)



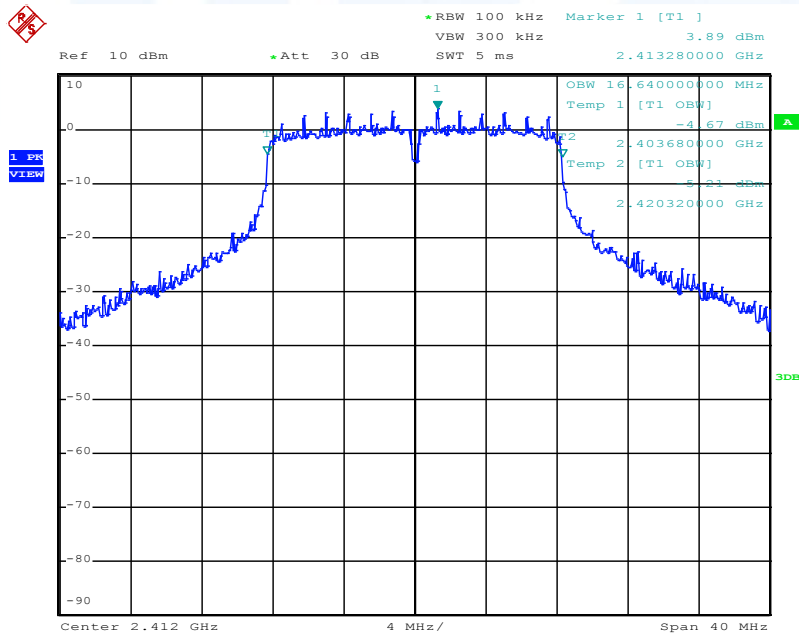
FCC ID: DMOLSP500

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802.11b, Channel 11 (2462 MHz)



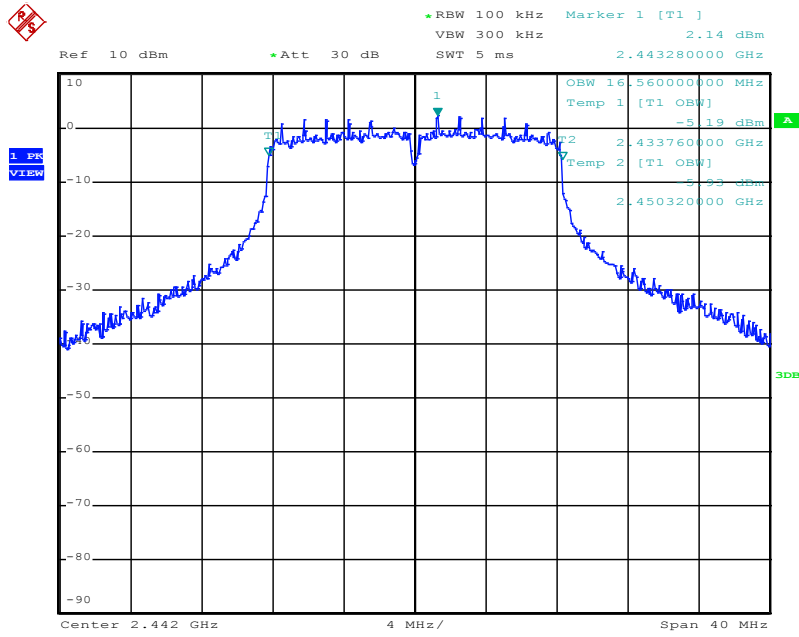
802.11g, Channel 1 (2412 MHz)



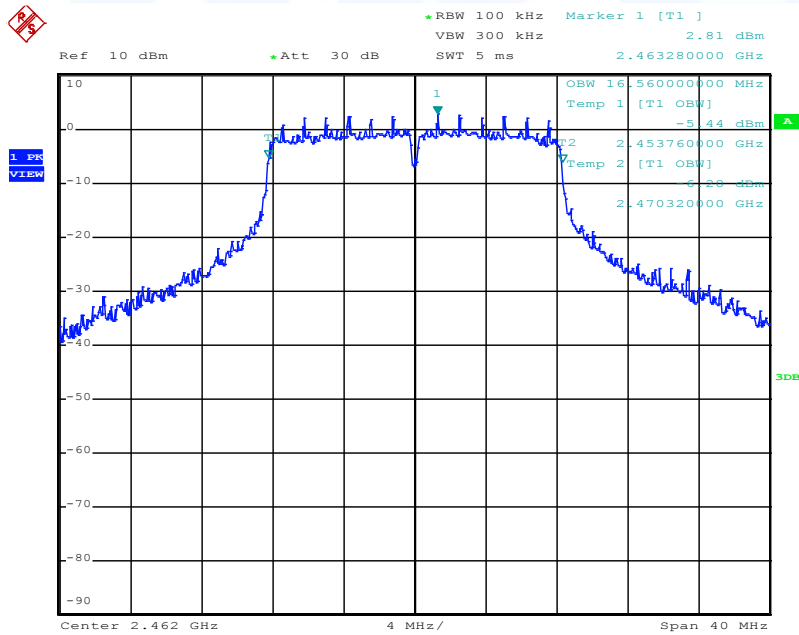
FCC ID: DMOLSP500

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802.11g, Channel 7 (2442 MHz)



802.11g, Channel 11 (2462 MHz)



FCC ID: DMOLSP500

IC ID: 2099A-LSP500

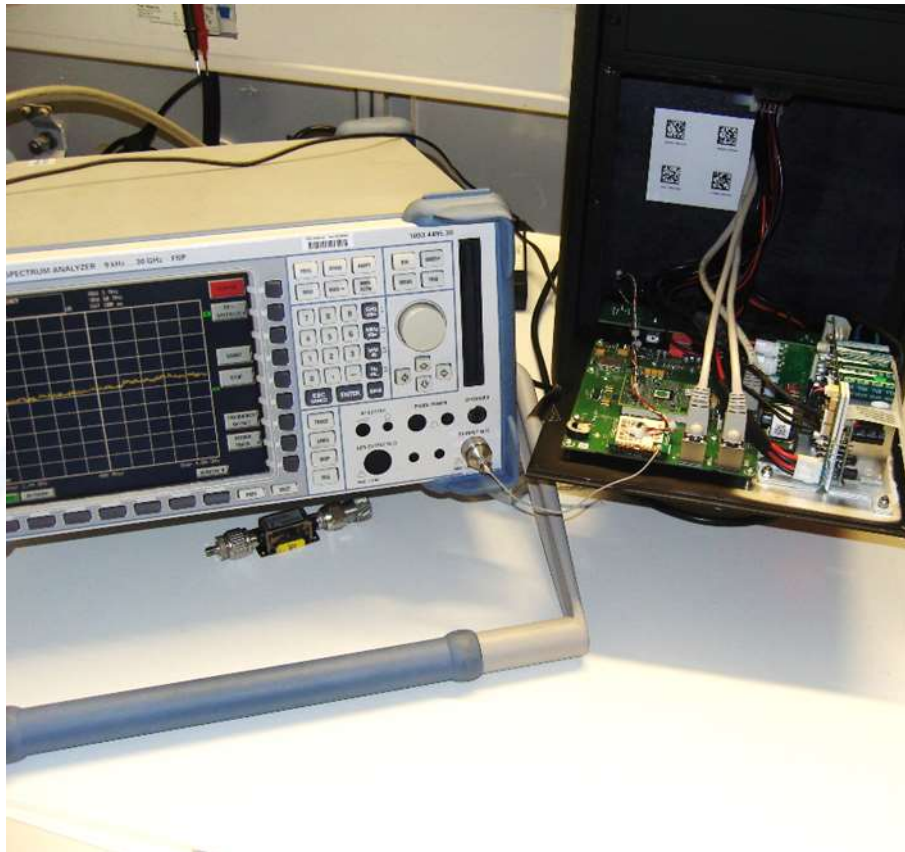
5.3 Maximum peak conducted output power

For test instruments and accessories used see section 6 Part CPC 3.

5.3.1 Description of the test location

Test location: AREA4

5.3.2 Photo documentation of the test set-up



5.3.3 Applicable standard

According to FCC Part 15, Section 15.247(b)(3):

For systems using digital modulation in the 2400-2483.5 MHz and 5725 – 5850 MHz bands, the maximum peak output power of the transmitter shall not exceed 1 Watt. The limit is based on transmitting antennas of directional gain that do not exceed 6 dBi.

5.3.4 Description of Measurement

The output power is measured using a spectrum analyser test method according KDB 558074, clause 10.2. The EUT is set while measuring in TX continuous mode with a duty cycle, $x = 1$.

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5.3.5 Test result

802.11b, 1 Mbps, 1 TX		Test results conducted		
Duty cycle: 100%				
		A [Pmax] (dBm)	Limit (dBm)	Margin (dB)
Lowest frequency: CH1				
T_{nom}	V_{nom}	17.5	30.0	-12.5
Middle frequency: CH7				
T_{nom}	V_{nom}	16.3	30.0	-13.7
Highest frequency: CH11				
T_{nom}	V_{nom}	16.7	30.0	-13.3

802.11g, 6 Mbps, 1 TX		Test results conducted		
Duty cycle: 100%				
		A [Pmax] (dBm)	Limit (dBm)	Margin (dB)
Lowest frequency: CH1				
T_{nom}	V_{nom}	19.1	30.0	-10.9
Middle frequency: CH7				
T_{nom}	V_{nom}	17.9	30.0	-12.1
Highest frequency: CH11				
T_{nom}	V_{nom}	19.0	30.0	-11.0

Peak power limit according to FCC Part 15, Section 15.247(b)(3):

Frequency (MHz)	Peak Power Limit	
	(dBm)	(Watt)
902-928	30	1.0
2400-2483.5	30	1.0
5725-5850	30	1.0

The requirements are **FULFILLED**.

Remarks:

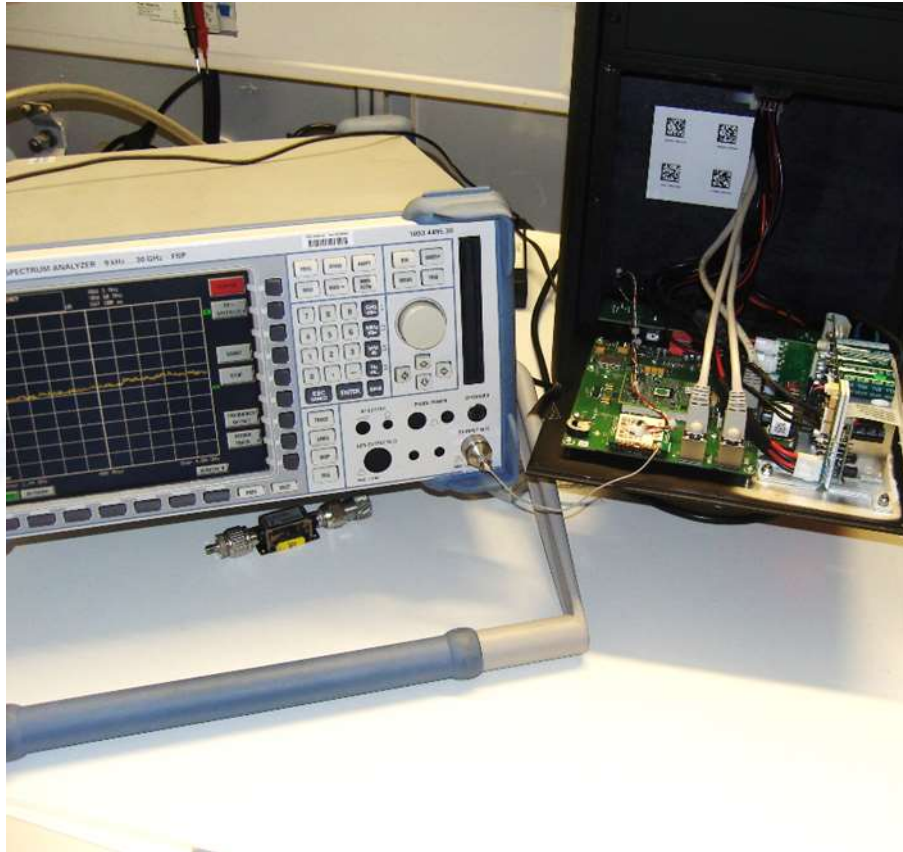
5.4 Out-of-band emission, conducted

For test instruments and accessories used see section 6 Part SEC 2 and SEC 3.

5.4.1 Description of the test location

Test location: AREA4

5.4.2 Photo documentation of the test set-up



5.4.3 Applicable standard

According to FCC Part 15, Section 15.247(d):

In any 100 kHz bandwidth outside the frequency bands 2400 – 2483.50 MHz and 5725 – 5850 MHz, the digitally modulated radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or an radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limit specified in Section 15.209(a) (see Section 15.205(c)).

5.4.4 Description of measurement

The spurious emissions are measured conducted using a spectrum analyser in a test setup following the procedures set out in KDB 558074 for DTS. The transmitter is set to the lowest operating frequency (CH1), the middle (CH7) and to the highest operating frequency (CH11). The frequency spectrum outside from the operating frequency range (2400 - 2483.5 MHz) is scanned for emissions that exceed the defined limit. The measurement is performed at normal test conditions in modulated TX continuous mode.

FCC ID: DMOLSP500

IC ID: 2099A-LSP500

Spectrum analyser search setting:

RBW: 100 kHz, VBW: 300 kHz, Detector: Max peak, Trace Mode: Max hold, Sweep time: 1 s

5.4.5 Test result

802.11b

Lowest frequency: CH1						
Test conditions: TX , P16, 1 Mbps						
Reference power level:					9.4 dBm	
			Test results			
Start <i>f</i>	Stop <i>f</i>	RBW	Maximum emission		Limit	Margin
(MHz)	(MHz)	(kHz)	(MHz)	(dBm)	(dBm)	(dB)
30	1000	100	783	-67.5	-10.6	-56.9
1000	2400	100	2397	-37.5	-10.6	-26.9
2483.5	5000	100	4824	-43.2	-10.6	-32.6
5000	15000	100	14979	-55.3	-10.6	-44.7
15000	25000	100	23975	-50.6	-10.6	-40.0
Measurement uncertainty				±3 dB		

Middle frequency: CH7						
Test conditions: TX , P16, 1 Mbps						
Reference power level:					9.4 dBm	
			Test results			
Start <i>f</i>	Stop <i>f</i>	RBW	Maximum emission		Limit	Margin
(MHz)	(MHz)	(kHz)	(MHz)	(dBm)	(dBm)	(dB)
30	1000	100	508	-69.7	-10.6	-59.1
1000	2400	100	2288	-56.7	-10.6	-46.1
2483.5	5000	100	4884	-43.7	-10.6	-33.1
5000	15000	100	14907	-55.2	-10.6	-44.6
15000	25000	100	23880	-50.6	-10.6	-40.0
Measurement uncertainty				±3 dB		

Highest frequency: CH11						
Test conditions: TX , P16, 1 Mbps						
Reference power level:					9.4 dBm	
			Test results			
Start <i>f</i>	Stop <i>f</i>	RBW	Maximum emission		Limit	Margin
(MHz)	(MHz)	(kHz)	(MHz)	(dBm)	(dBm)	(dB)
30	1000	100	88	-67.9	-10.6	-57.3
1000	2400	100	2288	-56.6	-10.6	-46.0
2483.5	5000	100	4924	-40.8	-10.6	-30.2
5000	15000	100	14906	-56.3	-10.6	-45.7
15000	25000	100	23935	-51.0	-10.6	-40.4
Measurement uncertainty				±3 dB		

FCC ID: DMOLSP500
IC ID: 2099A-LSP500
802.11g

Lowest frequency: CH1						
Test conditions: TX , P16, 6 Mbps						
Reference power level:					1.3 dBm	
			Test results			
Start <i>f</i>	Stop <i>f</i>	RBW	Maximum emission		Limit	Margin
(MHz)	(MHz)	(kHz)	(MHz)	(dBm)	(dBm)	(dB)
30	1000	100	783	-67.5	-18.7	-48.8
1000	2400	100	2399	-39.1	-18.7	-20.4
2483.5	5000	100	4824	-47.1	-18.7	-28.4
5000	15000	100	14967	-55.1	-18.7	-36.4
15000	25000	100	23896	-51.1	-18.7	-32.4
Measurement uncertainty				±3 dB		

Middle frequency: CH7						
Test conditions: TX , P16, 6 Mbps						
Reference power level:					1.3 dBm	
			Test results			
Start <i>f</i>	Stop <i>f</i>	RBW	Maximum emission		Limit	Margin
(MHz)	(MHz)	(kHz)	(MHz)	(dBm)	(dBm)	(dB)
30	1000	100	600	-68.3	-18.7	-49.6
1000	2400	100	2288	-56.2	-18.7	-37.5
2483.5	5000	100	4884	-45.8	-18.7	-27.1
5000	15000	100	14967	-55.8	-18.7	-37.1
15000	25000	100	23930	-50.9	-18.7	-32.2
Measurement uncertainty				±3 dB		

Highest frequency: CH11						
Test conditions: TX , P16, 6 Mbps						
Reference power level:					1.3 dBm	
			Test results			
Start <i>f</i>	Stop <i>f</i>	RBW	Maximum emission		Limit	Margin
(MHz)	(MHz)	(kHz)	(MHz)	(dBm)	(dBm)	(dB)
30	1000	100	276	-65.9	-18.7	-47.2
1000	2400	100	2288	-56.3	-18.7	-37.6
2483.5	5000	100	4924	-44.8	-18.7	-26.1
5000	15000	100	14974	-56.1	-18.7	-37.4
15000	25000	100	23920	-51.2	-18.7	-32.5
Measurement uncertainty				±3 dB		

FCC ID: DMOLSP500

IC ID: 2099A-LSP500

Limit according to FCC Part 15, Section 15.247(d):

In any 100 kHz bandwidth outside the frequency bands 2400 – 2483.50 MHz and 5725 – 5850 MHz, the digitally modulated radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or an radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required.

Frequency (MHz)	Spurious emission limit
Below 960	20 dB below the highest level of the desired power
Above 960	20 dB below the highest level of the desired power

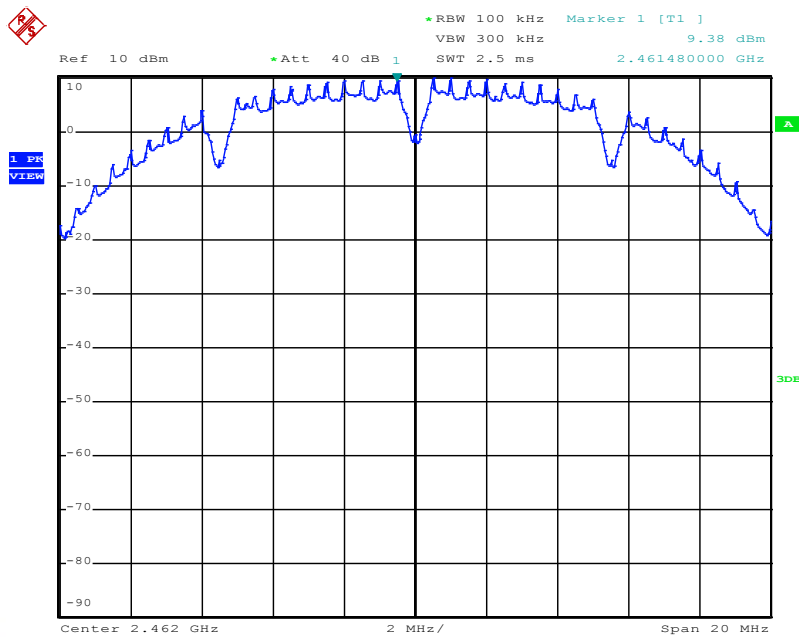
The requirements are **FULFILLED**.

Remarks: For detailed test results please refer to following test protocols. Only the worst case of the plots
are listed.

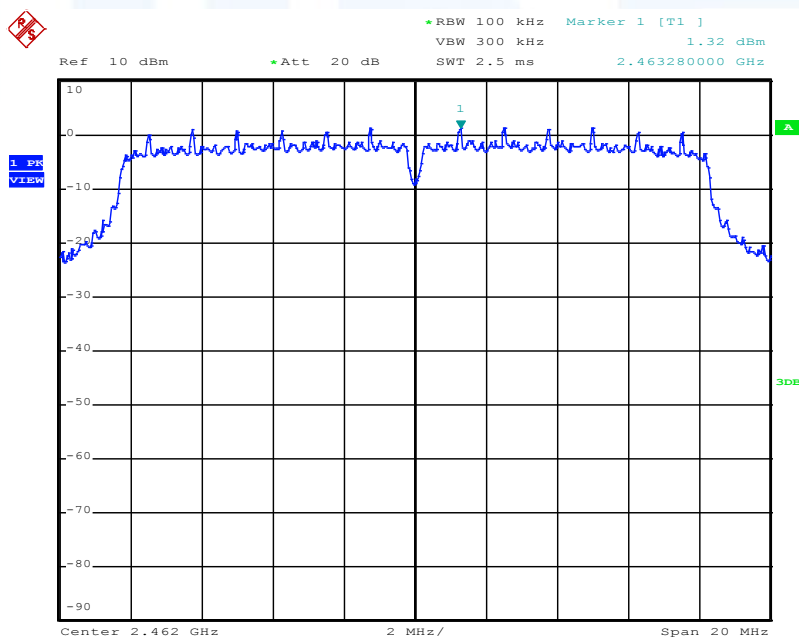


5.4.6 Test protocols

Determination of the reference level and limit 802.11b



Determination of the reference level and limit 802.11g

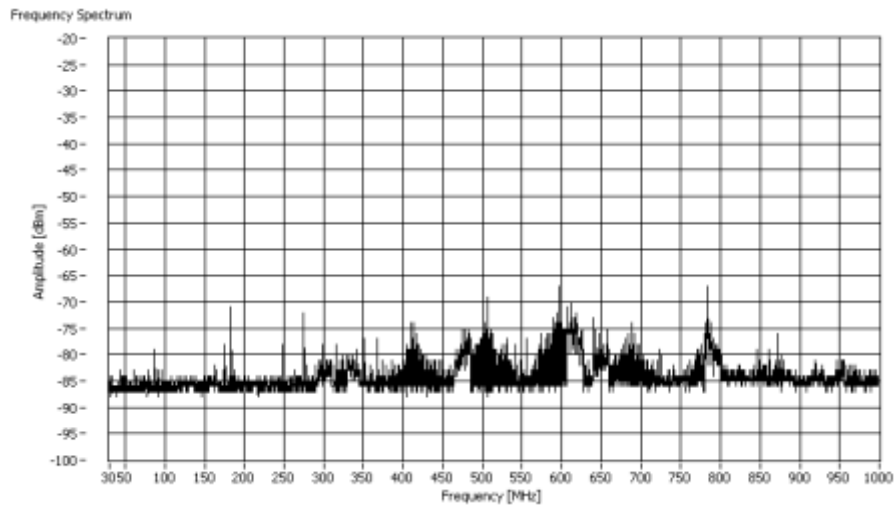


FCC ID: DMOLSP500

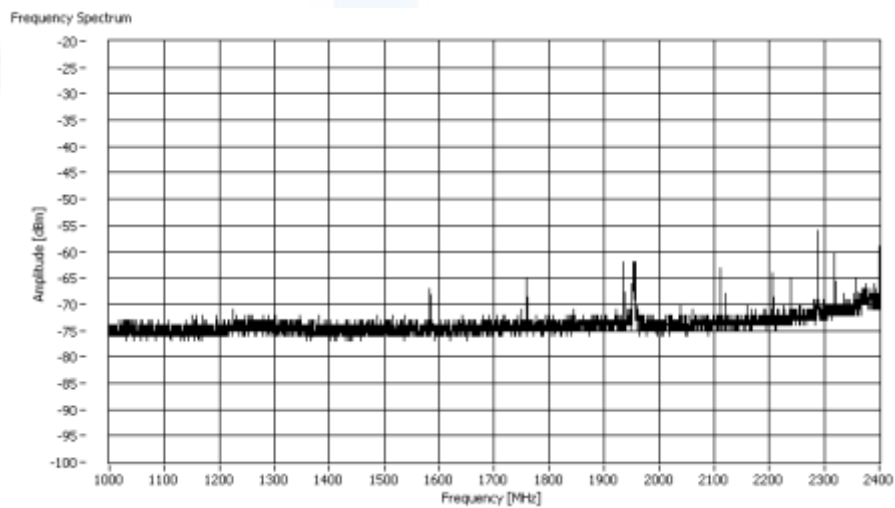
IC ID: 2099A-LSP500

Plots of spurious emissions conducted out of operating frequency bands (-20 dBc)
802.11b, Ch11

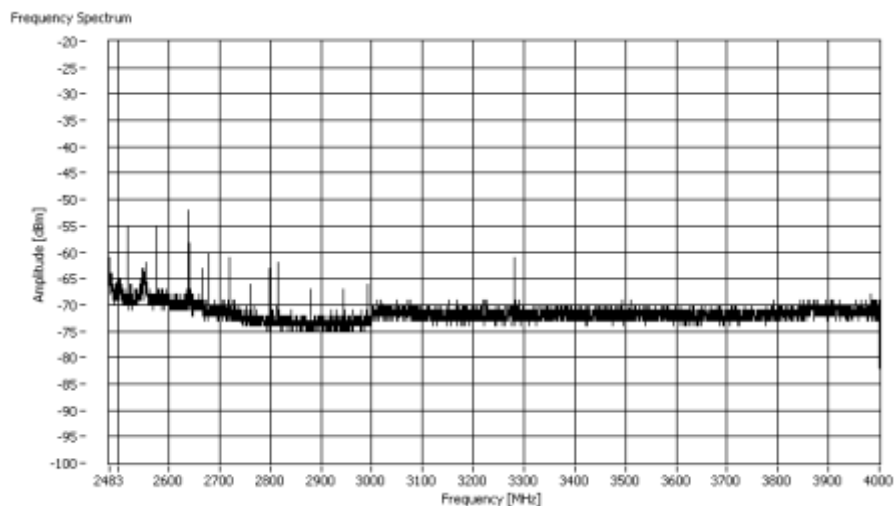
Spurious emissions conducted from 30 MHz to 1 GHz



Spurious emissions conducted from 1 GHz to 2.4 GHz



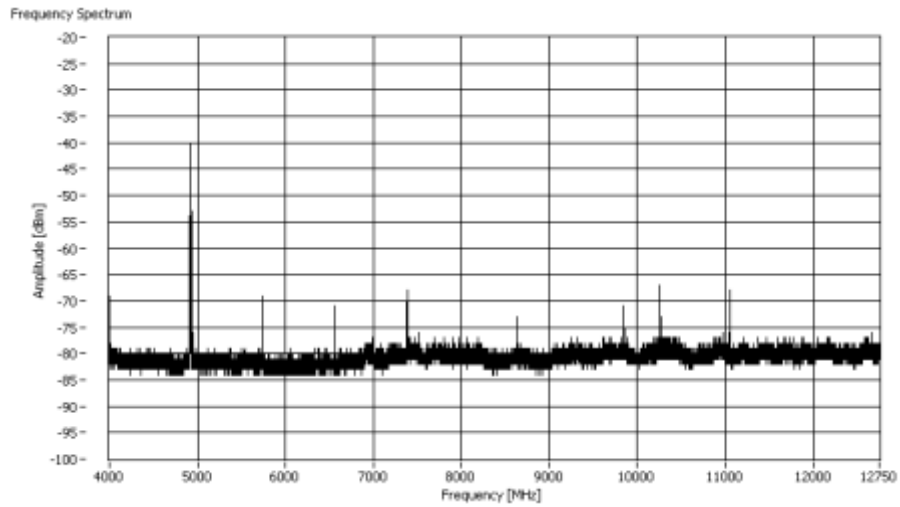
Spurious emissions conducted from 2.4835 GHz to 4 GHz



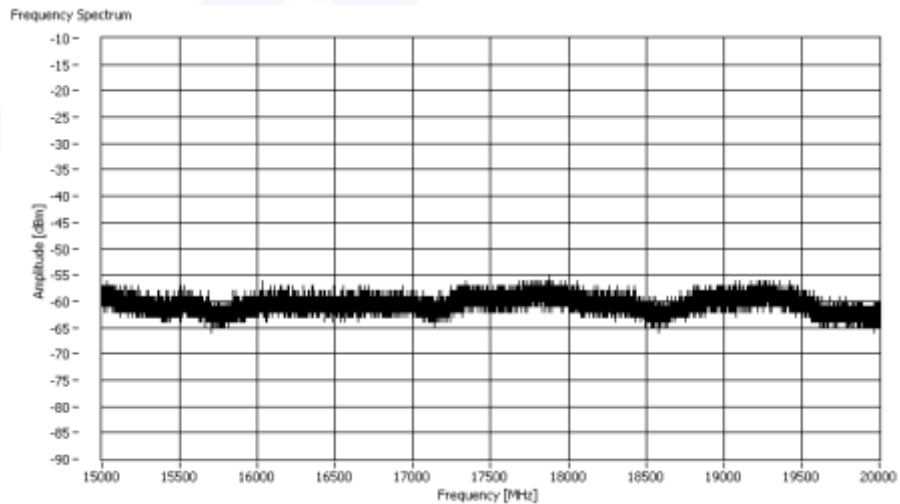
FCC ID: DMOLSP500

IC ID: 2099A-LSP500

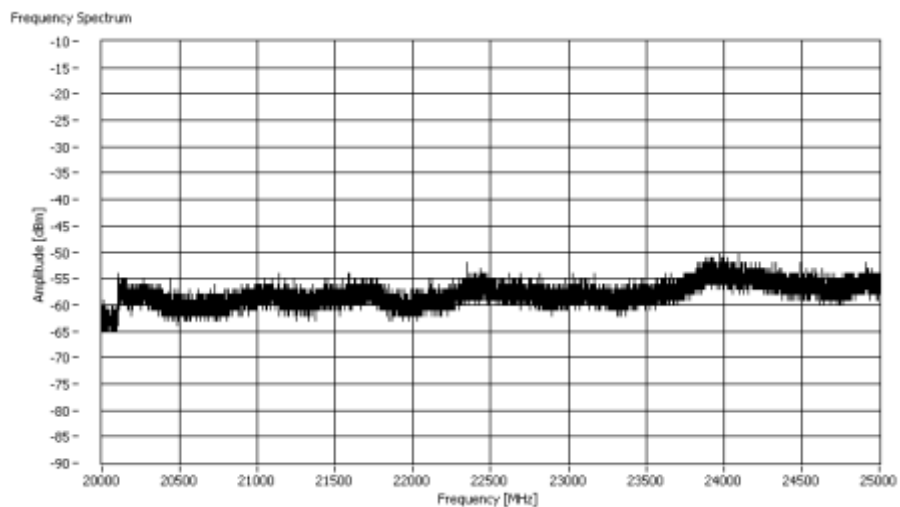
Spurious emissions conducted from 4 GHz to 12.750 GHz



Spurious emissions conducted from 12.750 GHz to 20 GHz



Spurious emissions conducted from 20 GHz to 25 GHz

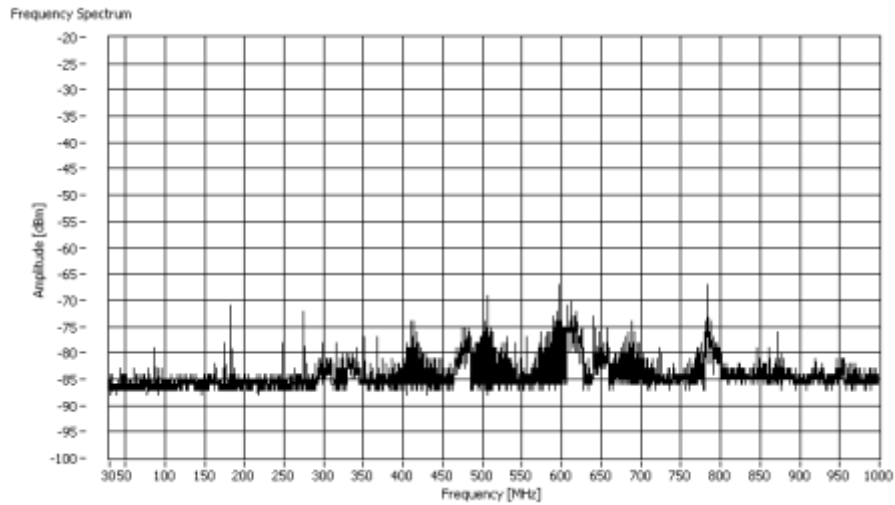


FCC ID: DMOLSP500

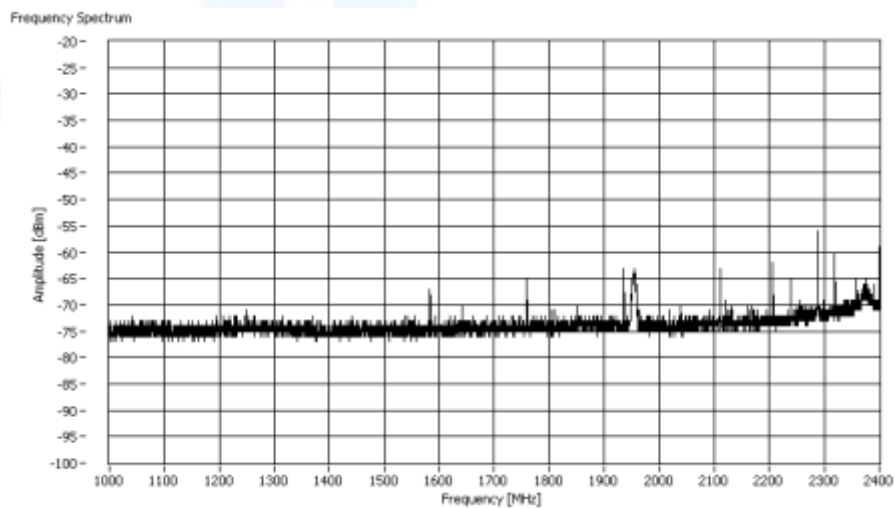
IC ID: 2099A-LSP500

802.11g, Ch11

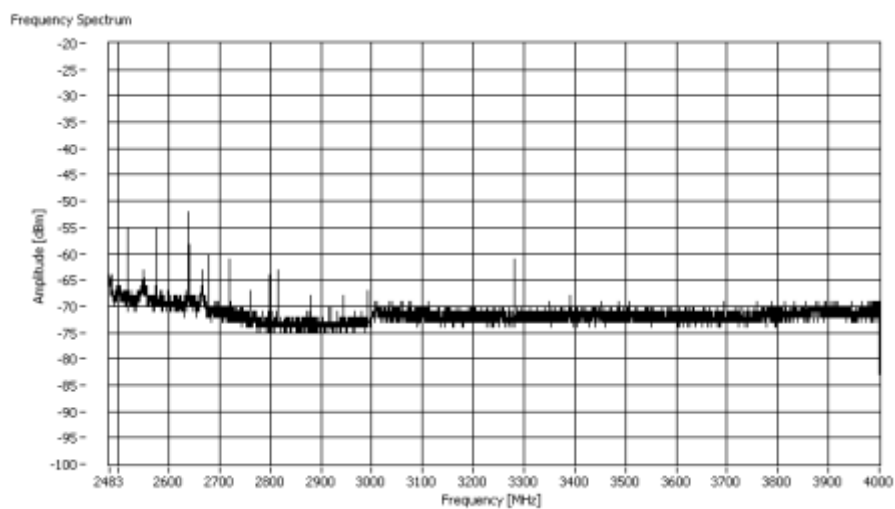
Spurious emissions conducted from 30 MHz to 1 GHz



Spurious emissions conducted from 1 GHz to 2.4 GHz



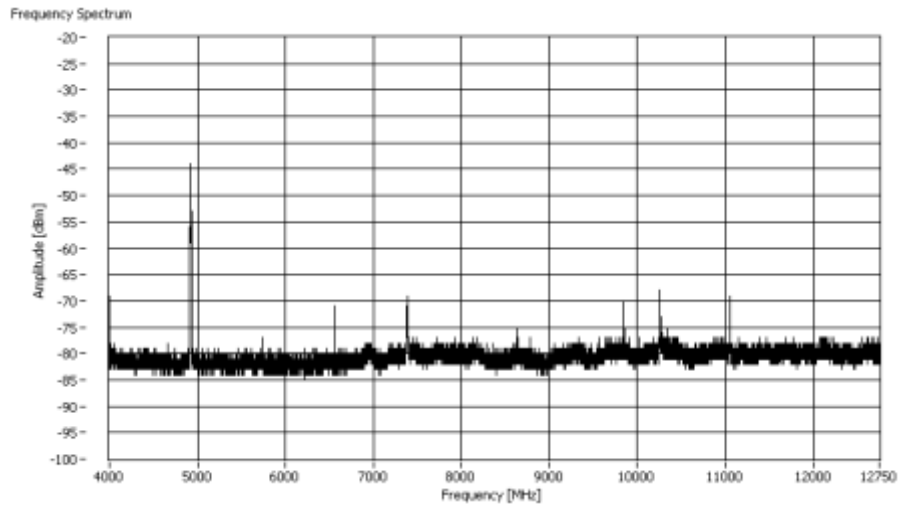
Spurious emissions conducted from 2.4835 GHz to 4 GHz



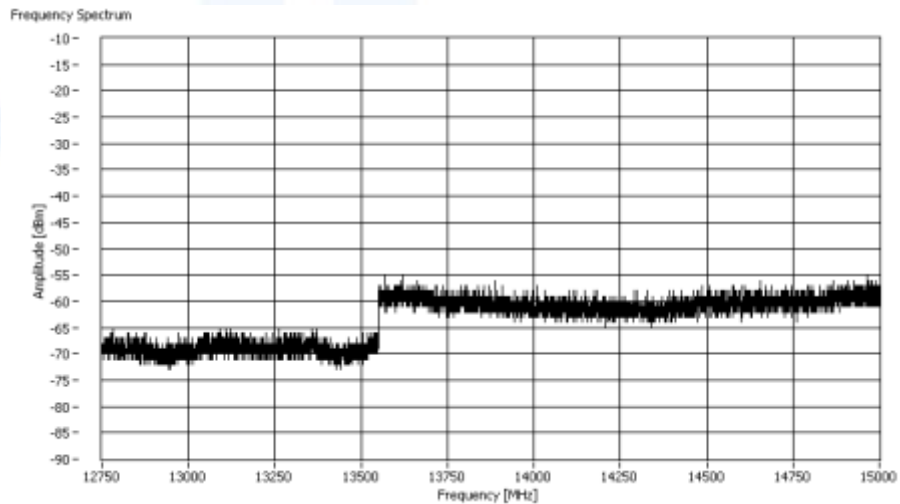
FCC ID: DMOLSP500

IC ID: 2099A-LSP500

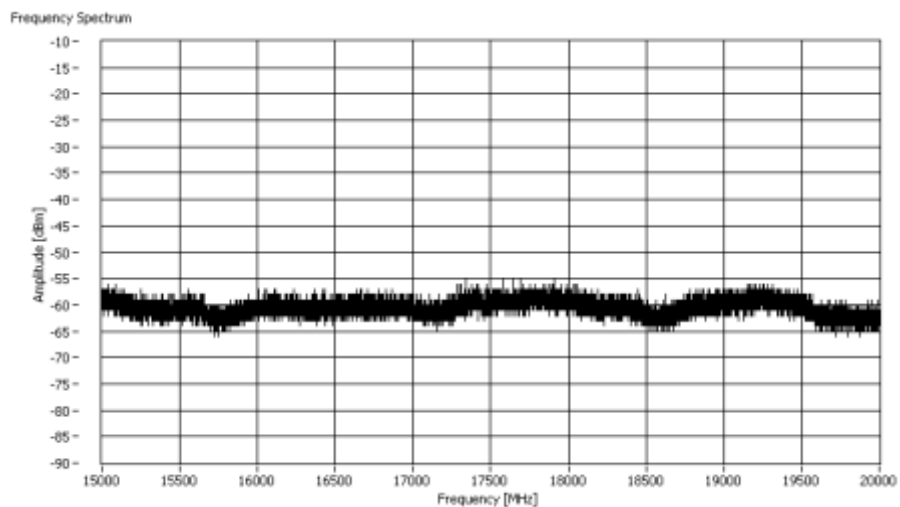
Spurious emissions conducted from 4 GHz to 12.75 GHz



Spurious emissions conducted from 12.75 GHz to 15 GHz



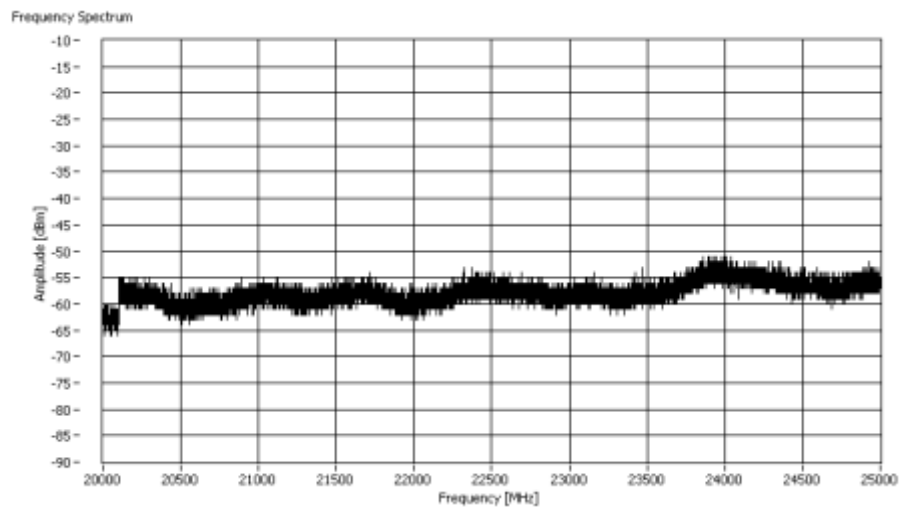
Spurious emissions conducted from 15 GHz to 20 GHz



FCC ID: DMOLSP500

IC ID: 2099A-LSP500

Spurious emissions conducted from 20 GHz to 25 GHz



mikes

5.5 Out-of-band emission, radiated (cabinet radiation)

For test instruments and accessories used see section 6 Part SER 1, SER 2, SER 3.

5.5.1 Description of the test location

Test location: OATS 1
Test location: Anechoic chamber 2
Test distance: 3 m

5.5.2 Photo documentation of the test set-up

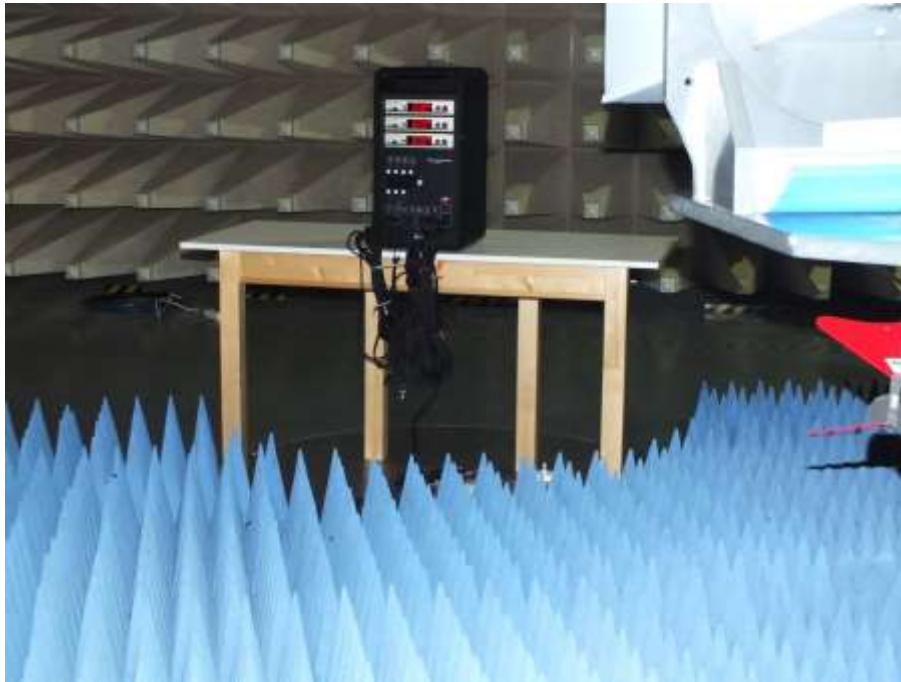
Open area test site



Open area test site



Anechoic chamber



5.5.3 Applicable standard

According to FCC Part 15, Section 15.247(d):

In any 100 kHz bandwidth outside the frequency bands 2400 – 2483.50 MHz and 5725 – 5850 MHz, the digitally modulated radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or an radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limit specified in Section 15.209(a) (see Section 15.205(c)).

5.5.4 Description of Measurement

The radiated power of the spurious emission from the EUT cabinet is measured with terminated antenna connector in a test setup following the procedures set out in KDB 558074 D01. If the emission level of the EUT in peak mode complies with the general average limit then testing will be stopped and peak values of the EUT will be reported, otherwise the emission will be measured in average mode again and reported.

EMI receiver settings: $f < 1$ GHz:

9 kHz $< f < 150$ kHz: RBW: 200 Hz;

150 kHz $< f < 30$ MHz: RBW: 9 kHz;

30 MHz $< f < 1000$ MHz: RBW: 120 kHz;

Spectrum analyser settings $f > 1$ GHz:

RBW: 1 MHz, VBW: 3 MHz, Detector: Max peak, Trace: Max hold, Sweep: Auto;

5.5.5 Test result radiated emissions

9 kHz $< f < 1000$ MHz:

For all kinds of modulation no emission could be detected within 20 dB to the limit.

FCC ID: DMOLSP500

IC ID: 2099A-LSP500

1000 MHz < f < 25000 MHz:

802.11b

Lowest frequency: CH1						
Test conditions: TX , P16, 1 Mbps						
Peak measurement			Test results			
Start f	Stop f	RBW	Maximum emission		AV Limit	Margin
(MHz)	(MHz)	(kHz)	(MHz)	(dBµV/m)	(dBµV/m)	(dB)
1000	2400	100	1376.0	43.4	54.0	-10.6
2483.5	5000	100	3294.0	46.5	54.0	-7.5
5000	15000	100	4824.0	38.4	54.0	-15.6
15000	25000	100	16438.0	40.4	54.0	-13.6
Measurement uncertainty				±6 dB		

Middle frequency: CH7						
Test conditions: TX , P16, 1 Mbps						
Peak measurement			Test results			
Start f	Stop f	RBW	Maximum emission		AV Limit	Margin
(MHz)	(MHz)	(kHz)	(MHz)	(dBµV/m)	(dBµV/m)	(dB)
1000	2400	100	1194.0	44.1	54.0	-9.9
2483.5	5000	100	4884.0	37.5	54.0	-16.5
5000	15000	100	11741.0	38.0	54.0	-16.0
15000	25000	100	17804.0	39.1	54.0	-14.9
Measurement uncertainty				±6 dB		

Highest frequency: CH11						
Test conditions: TX , P16, 1 Mbps						
Peak measurement			Test results			
Start f	Stop f	RBW	Maximum emission		AV Limit	Margin
(MHz)	(MHz)	(kHz)	(MHz)	(dBµV/m)	(dBµV/m)	(dB)
1000	2400	100	1055.0	43.2	54.0	-10.8
2483.5	5000	100	4924.0	40.2	54.0	-13.8
5000	15000	100	13000.0	43.1	54.0	-10.9
15000	25000	100	16482.0	39.3	54.0	-14.7
Measurement uncertainty				±6 dB		

802.11g

Lowest frequency: CH1						
Test conditions: TX , P16, 1 Mbps						
Peak measurement			Test results			
Start f	Stop f	RBW	Maximum emission		AV Limit	Margin
(MHz)	(MHz)	(kHz)	(MHz)	(dBµV/m)	(dBµV/m)	(dB)
1000	2400	100	1067.0	43.6	54.0	-10.4
2483.5	5000	100	3135.0	47.2	54.0	-6.8
5000	15000	100	11943.0	38.3	54.0	-15.7
15000	25000	100	17741.0	39.5	54.0	-14.5
Measurement uncertainty				±6 dB		

FCC ID: DMOLSP500

IC ID: 2099A-LSP500

Middle frequency: CH7						
Test conditions: TX , P16, 1 Mbps						
Peak measurement			Test results			
Start <i>f</i>	Stop <i>f</i>	RBW	Maximum emission		AV Limit	Margin
(MHz)	(MHz)	(kHz)	(MHz)	(dB μ V/m)	(dB μ V/m)	(dB)
1000	2400	100	1900.0	44.3	54.0	-9.7
2483.5	5000	100	3057.0	46.8	54.0	-7.2
5000	15000	100	11662.0	37.8	54.0	-16.2
15000	25000	100	15694.0	39.8	54.0	-14.2
Measurement uncertainty				±6 dB		

Highest frequency: CH11						
Test conditions: TX , P16, 1 Mbps						
Peak measurement			Test results			
Start <i>f</i>	Stop <i>f</i>	RBW	Maximum emission		AV Limit	Margin
(MHz)	(MHz)	(kHz)	(MHz)	(dB μ V/m)	(dB μ V/m)	(dB)
1000	2400	100	1891.0	43.7	54.0	-10.3
2483.5	5000	100	3686.0	46.0	54.0	-8.0
5000	15000	100	11965.0	37.9	54.0	-16.1
15000	25000	100	16495.0	39.6	54.0	-14.4
Measurement uncertainty				±6 dB		

Radiated limits according to FCC Part 15 Section 15.209(a) for spurious emissions which fall in restricted bands:

Frequency (MHz)	Field strength of spurious emissions		Measurement distance (metres)
	(μ V/m)	dB(μ V/m)	
0.009-0.490	2400/F (kHz)		300
0.490-1.705	24000/F (kHz)		30
1.705-30	30	29.5	30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

The requirements are **FULFILLED**.

Remarks: All emissions not reported are more than 20 dB below the specified limit.

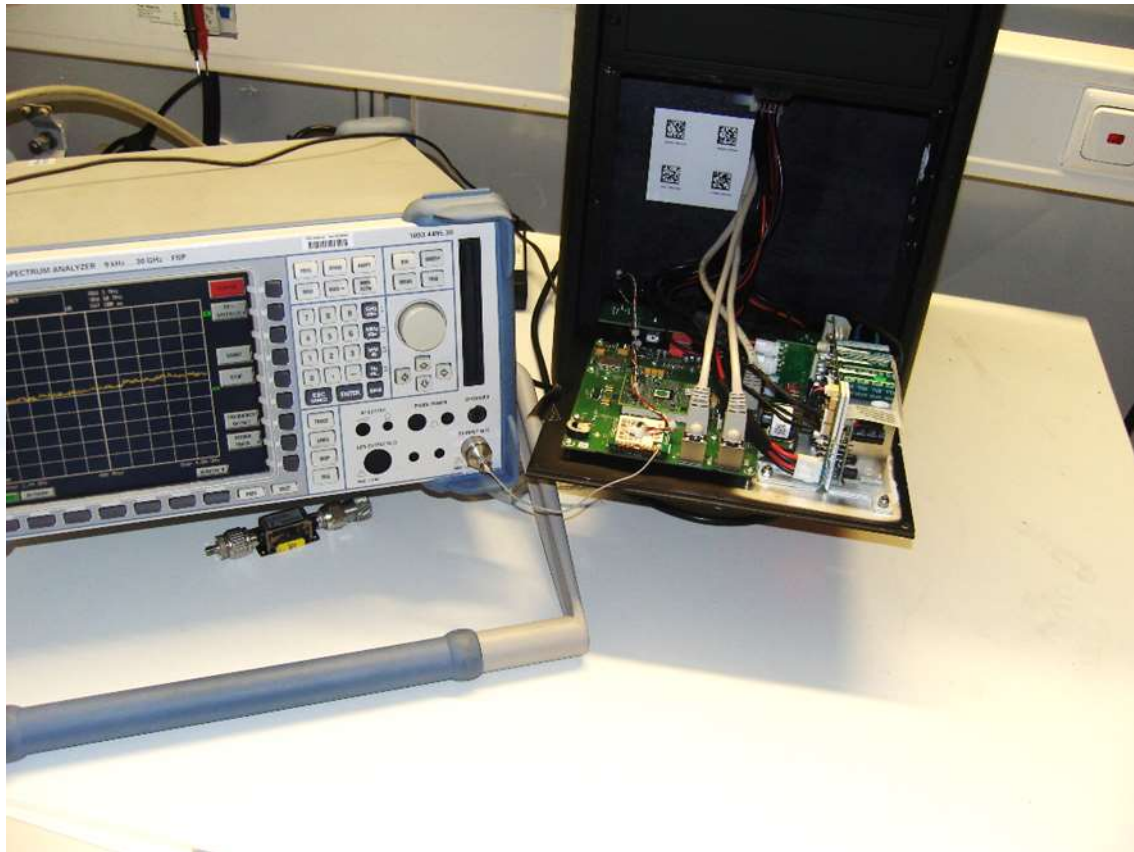
5.6 Out-of-band emission in restricted bands, conducted

For test instruments and accessories used see section 6 Part SEC 3.

5.6.1 Description of the test location

Test location: AREA4

5.6.1 Photo documentation of the test set-up



5.6.2 Applicable standard

According to FCC Part 15, Section 15.247(d):

In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limit specified in Section 15.209(a) (see Section 15.205(c)).

5.6.3 Description of Measurement

The spurious emissions falling in the restricted bands are measured conducted using a spectrum analyser in a test setup following the procedures set out in KDB 558074 D01. The conducted limit in EIRP is calculated according KDB 558074 D01 to the absolute radiated limit. The measurement is performed at normal test conditions in modulated TX continuous mode.

Spectrum analyser settings:

9 kHz < f < 150 kHz:	RBW: 300 Hz,	VBW: 1 kHz,	Detector: Max peak,	Trace Mode: Max hold
150 kHz < f < 30 MHz:	RBW: 10 kHz,	VBW: 30 kHz,	Detector: Max peak,	Trace Mode: Max hold
30 MHz < f < 1000 MHz:	RBW: 100 kHz,	VBW: 300 kHz,	Detector: Max peak,	Trace Mode: Max hold
f > 1000 MHz:	RBW: 1 MHz,	VBW: 3 MHz,	Detector: Max peak,	Trace Mode: Max hold

5.6.4 Determination of the requirement for measuring the restricted bands:

Restricted band 2310 – 2390 MHz: Is next to the operating band, has to be measured.
 Restricted band 2483.5 – 2500 MHz: Is next to the operating band, has to be measured.
 Restricted band 2655 – 2900 MHz: Is next to the operating band, has to be measured for RSS.
 Restricted band 4500 – 5150 MHz: Harmonics of the carrier may appear. The spurious emission measurement under item 5.5 shows harmonics at 4824 – 4924 MHz has to be measured.
 Restricted band 5350 – 5460 MHz: No Harmonics, no other emission, no requirement to measure.
 Restricted band 7250 – 7750 MHz: Harmonics of the carrier may appear. The spurious emission measurement under item 5.5 shows harmonics, has to be measured.
 Higher restricted bands: No Harmonics, no other emission, no requirement to measure.

5.6.5 Test result

Standard 802.11b:

PK-measurement								
Lowest frequency: CH1								
Test conditions: TX ,P16, 1Mbps								
Chain1			Test results					
Start f	Stop f	RBW	Maximum emission		G _{out}	E	Limit	Margin
(MHz)	(MHz)	(kHz)	(MHz)	(dBm)	(dBi)	(dBµV/m)	(dBµV/m)	(dB)
2310	2390	1000	2389.6	-51.1	3.0	47.2	74.0	-26.8
2483.5	2500	1000	2499.7	-52.6	3.0	45.6	74.0	-28.4
2655	2900	1000	2759.9	-51.8	3.0	46.5	74.0	-27.5
4500	5150	1000	4824.0	-42.1	3.0	56.2	75.0	-18.8
7250	7750	1000	7252.7	-64.9	3.0	33.4	74.0	-40.6
Measurement uncertainty					±3 dB			

PK-measurement								
Middle frequency: CH7								
Test conditions: TX ,P16, 1Mbps								
Chain1			Test results					
Start f	Stop f	RBW	Maximum emission		G _{out}	E	Limit	Margin
(MHz)	(MHz)	(kHz)	(MHz)	(dBm)	(dBi)	(dBµV/m)	(dBµV/m)	(dB)
2310	2390	1000	2353	-53	3.0	45.1	74.0	-28.9
2484	2500	1000	2485	-54	3.0	43.8	74.0	-30.2
2655	2900	1000	2680	-54	3.0	43.8	74.0	-30.2
4500	5150	1000	4884	-42	4.0	57.3	75.0	-17.7
7250	7750	1000	7330	-61	5.0	38.8	76.0	-37.2
Measurement uncertainty					±3 dB			

PK-measurement								
Highest frequency: CH11								
Test conditions: TX ,P16, 1Mbps								
			Test results					
Start f	Stop f	RBW	Maximum emission		G _{out}	E	Limit	Margin
(MHz)	(MHz)	(kHz)	(MHz)	(dBm)	(dBi)	(dBµV/m)	(dBµV/m)	(dB)
2310	2390	1000	2376.0	-54.3	3.0	44.0	74.0	-30.0
2484	2500	1000	2484.3	-51.0	3.0	47.2	74.0	-26.8
2655	2900	1000	2759.7	-54.7	3.0	43.6	74.0	-30.4
4500	5150	1000	4923.8	-39.6	3.0	58.7	75.0	-16.3
7250	7750	1000	7388.0	-60.3	3.0	38.0	76.0	-38.0
Measurement uncertainty					±3 dB			

FCC ID: DMOLSP500

IC ID: 2099A-LSP500

Standard 802.11g:

PK-measurement								
Lowest frequency: CH1								
Test conditions: TX ,P16, 6Mbps								
Chain1			Test results					
Start f	Stop f	RBW	Maximum emission		G _{out}	E	Limit	Margin
(MHz)	(MHz)	(kHz)	(MHz)	(dBm)	(dBi)	(dBμV/m)	(dBμV/m)	(dB)
2310	2390	1000	2389.4	-27.5	3.0	70.7	74.0	-3.3
2483.5	2500	1000	2497.7	-48.6	3.0	49.6	74.0	-24.4
2655	2900	1000	2680.1	-47.4	3.0	50.8	74.0	-23.2
4500	5150	1000	4829.2	-39.0	3.0	59.2	75.0	-15.8
7250	7750	1000	7251.9	-52.7	3.0	45.5	76.0	-30.5
Measurement uncertainty					±3 dB			

PK-measurement								
Middle frequency: CH7								
Test conditions: TX ,P16, 6Mbps								
Chain1			Test results					
Start f	Stop f	RBW	Maximum emission		G _{out}	E	Limit	Margin
(MHz)	(MHz)	(kHz)	(MHz)	(dBm)	(dBi)	(dBμV/m)	(dBμV/m)	(dB)
2310	2390	1000	2353.3	-53.2	3.0	45.1	74.0	-28.9
2483.5	2500	1000	2484.9	-54.4	3.0	43.8	74.0	-30.2
2655	2900	1000	2680.1	-54.4	3.0	43.8	74.0	-30.2
4500	5150	1000	4883.9	-41.9	4.0	57.3	75.0	-17.7
7250	7750	1000	7329.5	-61.4	5.0	38.8	76.0	-37.2
Measurement uncertainty					±3 dB			

PK-measurement								
Highest frequency: CH11								
Test conditions: TX ,P16, 6Mbps								
Chain1			Test results					
Start f	Stop f	RBW	Maximum emission		G _{out}	E	Limit	Margin
(MHz)	(MHz)	(kHz)	(MHz)	(dBm)	(dBi)	(dBμV/m)	(dBμV/m)	(dB)
2310	2390	1000	2320	-49	3.0	49.2	74.0	-24.8
2483.5	2500	1000	2484	-24	3.0	73.8	74.0	-0.2
2655	2900	1000	2667	-47	3.0	51.4	74.0	-22.6
4500	5150	1000	4926	-35	3.0	62.9	75.0	-12.1
7250	7750	1000	7393	-49	3.0	49.0	76.0	-27.0
Measurement uncertainty					±3 dB			

Limit according to FCC Part 15, Section 15.247(d):

Attenuation below the general limits specified in Section 15.209(a) is not required.

Calculation formula:

$$E = \text{EIRP} - 20 \log(d) + 104.8;$$

E: Field strength (dBμV/m);

Factor 4.7 dB is taken into account for adjusting the ground reflection for emissions > 30 MHz and ≥ 1000 MHz.

FCC ID: DMOLSP500

IC ID: 2099A-LSP500

Radiated limits according to FCC Part 15 Section 15.209(a) for spurious emissions which fall in restricted bands:

Frequency (MHz)	Field strength of spurious emissions		Measurement distance (metres)
	(μ V/m)	dB(μ V/m)	
0.009-0.490	2400/F (kHz)		300
0.490-1.705	24000/F (kHz)		30
1.705-30	30	29.5	30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

Restricted bands of operation:

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	399.9 – 410	4.5 – 5.15
0.495 – 0.505	16.69475 – 16.69525	608 – 614	5.35 – 5.46
2.1735 – 2.1905	16.80425 – 16.80475	960 – 1240	7.25 – 7.75
4.125 – 4.128	25.5 – 25.67	1300 – 1427	8.025 – 8.5
4.17725 – 4.17775	37.5 – 38.25	1435 – 1626.5	9.0 – 9.2
4.20725 – 4.20775	73 – 74.6	1645.5 – 1646.5	9.3 – 9.5
6.215 – 6.218	74.8 – 75.2	1660 – 1710	10.6 – 12.7
6.26775 – 6.26825	108 – 121.94	1718.8 – 1722.2	13.25 – 13.4
6.31175 – 6.31225	123 – 138	2200 – 2300	14.47 – 14.5
8.291 – 8.294	149.9 – 150.05	2310 – 2390	15.35 – 16.2
8.362 – 8.366	156.52475 – 156.52525	2483.5 – 2500	17.7 – 21.4
8.37625 – 8.38675	156.7 – 156.9	2690 – 2900	22.01 – 23.12
8.41425 – 8.41475	162.0125 – 167.17	3260 – 3267	23.6 – 24.0
12.29 – 12.293	167.72 – 173.2	3332 – 3339	31.2 – 31.8
12.51975 – 12.52025	240 – 285	3345.8 – 3358	36.43 – 36.5
12.57675 – 12.57725	322 – 335.4	3600 – 4400	Above 38.6

The requirements are **FULFILLED**.

Remarks: Re-measurement for values within 20 dB to the peak limit is done radiated.

5.7 Out-of-band emission in restricted bands, radiated

For test instruments and accessories used see section 6 Part SER 3.

5.7.1 Description of the test location

Test location: Anechoic chamber 2
 Test distance: 3 m

5.7.2 Photo documentation of the test set-up



5.7.3 Applicable standard

According to FCC Part 15, Section 15.247(d):

In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limit specified in Section 15.209(a) (see Section 15.205(c)).

5.7.4 Description of Measurement

The spurious emissions falling in the restricted bands are measured radiated using a spectrum analyser in a test setup following the procedures set out in ANSI C63. The measurement is performed at normal test conditions in modulated TX continuous mode. The observed spurious emissions falling into restricted bands are measured again under the provisions of Section 15.209(a).

Spectrum analyser settings:

Peak:

9 kHz < f < 150 kHz:	RBW: 300 Hz,	VBW: 1 kHz,	Detector: Max peak,	Trace Mode: Max hold
150 kHz < f < 30 MHz:	RBW: 10 kHz,	VBW: 30 kHz,	Detector: Max peak,	Trace Mode: Max hold
30 MHz < f < 1000 MHz:	RBW: 100 kHz,	VBW: 300 kHz,	Detector: Max peak,	Trace Mode: Max hold
f > 1000 MHz:	RBW: 1 MHz,	VBW: 3 MHz,	Detector: Max peak,	Trace Mode: Max hold
AV: f > 1000 MHz:	RBW: 1 MHz,	VBW: 10 Hz,	Detector: Max peak,	Trace Mode: Max hold

5.7.5 Test result

Standard 802.11b

PK-measurement						
Lowest frequency: CH1						
Test conditions: TX ,P16, 1Mbps						
			Test results			
Start <i>f</i>	Stop <i>f</i>	RBW	Maximum emission		Limit	Margin
(MHz)	(MHz)	(kHz)	(MHz)	(dBμV/m)	(dBμV/m)	(dB)
4500	5150	1000	4656	44.1	74.0	-29.9
Measurement uncertainty				±6 dB		

PK-measurement						
Middle frequency: CH7						
Test conditions: TX ,P16, 1Mbps						
			Test results			
Start <i>f</i>	Stop <i>f</i>	RBW	Maximum emission		Limit	Margin
(MHz)	(MHz)	(kHz)	(MHz)	(dBμV/m)	(dBμV/m)	(dB)
4500	5150	1000	4883	49.9	74.0	-24.1
Measurement uncertainty				±6 dB		

PK-measurement						
Highest frequency: CH11						
Test conditions: TX ,P16, 1Mbps						
			Test results			
Start <i>f</i>	Stop <i>f</i>	RBW	Maximum emission		Limit	Margin
(MHz)	(MHz)	(kHz)	(MHz)	(dBμV/m)	(dBμV/m)	(dB)
4500	5150	1000	4925	45.0	74.0	-29.0
Measurement uncertainty				±6 dB		

Standard 802.11g

PK-measurement						
Lowest frequency: CH1						
Test conditions: TX ,P16, 6Mbps						
			Test results			
Start <i>f</i>	Stop <i>f</i>	RBW	Maximum emission		Limit	Margin
(MHz)	(MHz)	(kHz)	(MHz)	(dBμV/m)	(dBμV/m)	(dB)
2310	2390	1000	2389	67.5	74.0	-6.5
4500	5150	1000	4930	43.6	74.0	-30.4
Measurement uncertainty				±6 dB		

AV-measurement						
Lowest frequency: CH1						
Test conditions: TX ,P16, 6Mbps						
			Test results			
Start <i>f</i>	Stop <i>f</i>	RBW	Maximum emission		Limit	Margin
(MHz)	(MHz)	(kHz)	(MHz)	(dBμV/m)	(dBμV/m)	(dB)
2310	2390	1000	2390	47.7	54.0	-6.3
Measurement uncertainty				±6 dB		

FCC ID: DMOLSP500

IC ID: 2099A-LSP500

PK-measurement						
Middle frequency: CH7						
Test conditions: TX ,P16, 6Mbps						
			Test results			
Start <i>f</i>	Stop <i>f</i>	RBW	Maximum emission		Limit	Margin
(MHz)	(MHz)	(kHz)	(MHz)	(dB μ V/m)	(dB μ V/m)	(dB)
4500	5150	1000	4891	50.4	74.0	-23.6
Measurement uncertainty				±6 dB		

PK-measurement						
Highest frequency: CH11						
Test conditions: TX ,P16, 6Mbps						
			Test results			
Start <i>f</i>	Stop <i>f</i>	RBW	Maximum emission		Limit	Margin
(MHz)	(MHz)	(kHz)	(MHz)	(dB μ V/m)	(dB μ V/m)	(dB)
2483.5	2500	1000	2484	68.6	74.0	-5.4
4500	5150	1000	4923	45.0	74.0	-29.0
Measurement uncertainty				±6 dB		

AV-measurement						
Highest frequency: CH11						
Test conditions: TX ,P16, 6Mbps						
			Test results			
Start <i>f</i>	Stop <i>f</i>	RBW	Maximum emission		Limit	Margin
(MHz)	(MHz)	(kHz)	(MHz)	(dB μ V/m)	(dB μ V/m)	(dB)
2483.5	2500	1000	2484	46.7	54.0	-7.3
Measurement uncertainty				±6 dB		

Limit according to FCC Part 15, Section 15.247(d):
 Attenuation below the general limits specified in Section 15.209(a) is not required.

Radiated limits according to FCC Part 15 Section 15.209(a) for spurious emissions which fall in restricted bands:

Frequency (MHz)	Field strength of spurious emissions		Measurement distance (metres)
	(μ V/m)	dB(μ V/m)	
0.009-0.490	2400/F (kHz)		300
0.490-1.705	24000/F (kHz)		30
1.705-30	30	29.5	30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

The requirements are **FULFILLED**.

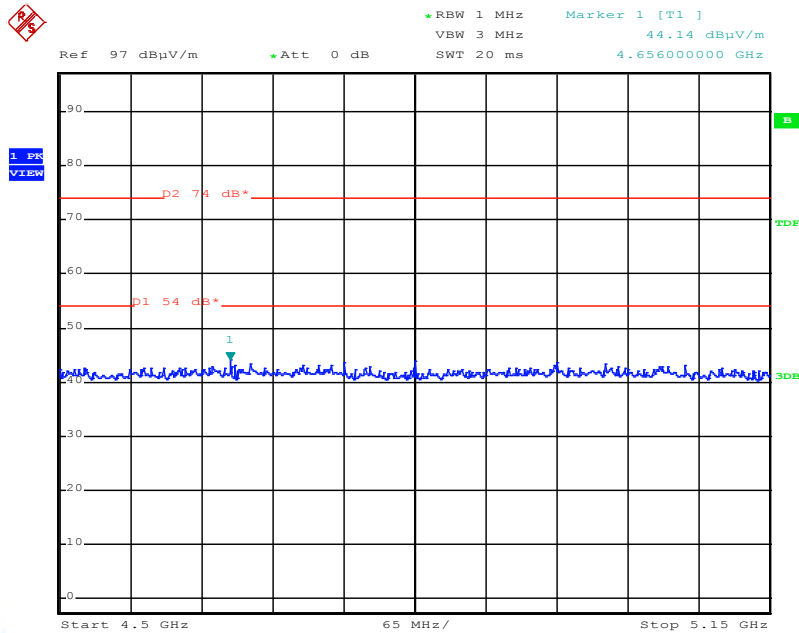
Remarks: For detailed test results please refer to following test protocols.

FCC ID: DMOLSP500

IC ID: 2099A-LSP500

5.7.6 Test protocol
Standard 802.11b
Channel 1, 2412 MHz

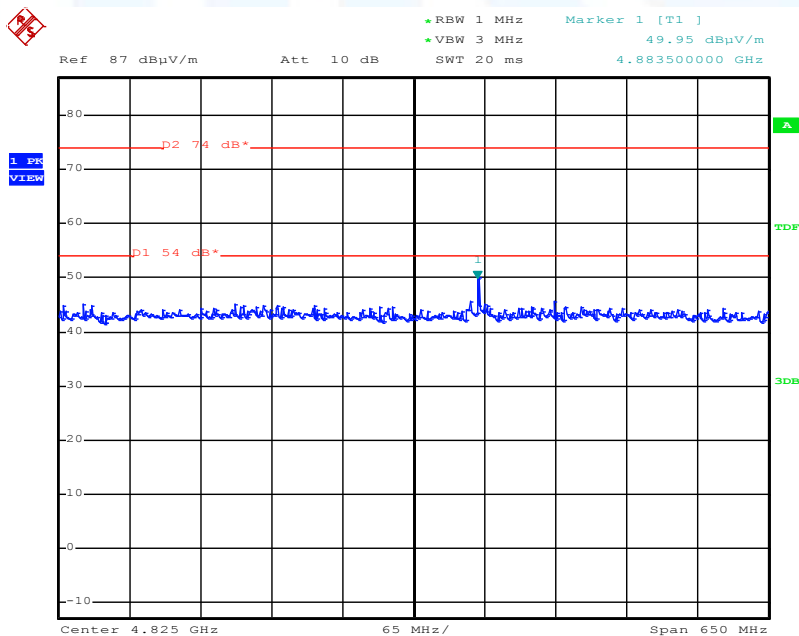
Peak-measurement



No need for AV-measurement.

Channel 7, 2442 MHz

Peak-measurement



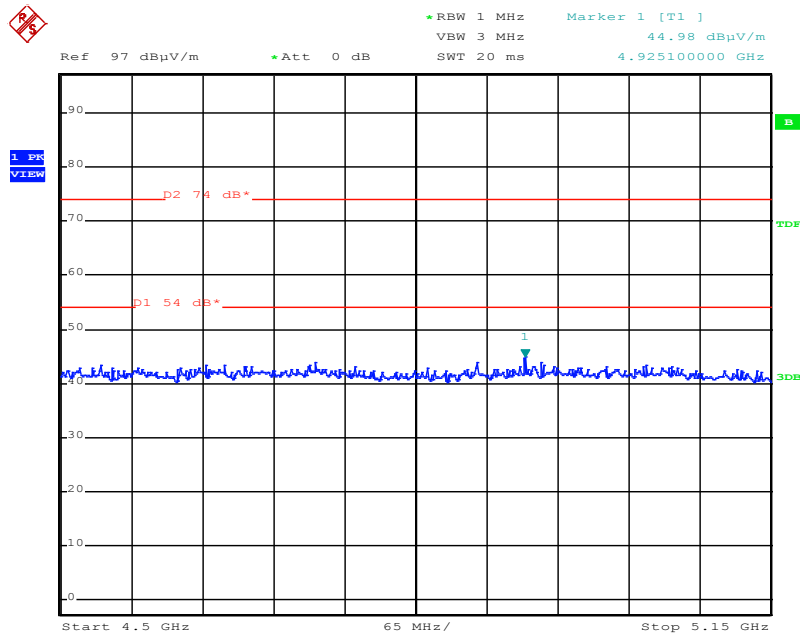
No need for AV-measurement.

FCC ID: DMOLSP500

IC ID: 2099A-LSP500

Channel 11, 2462 MHz

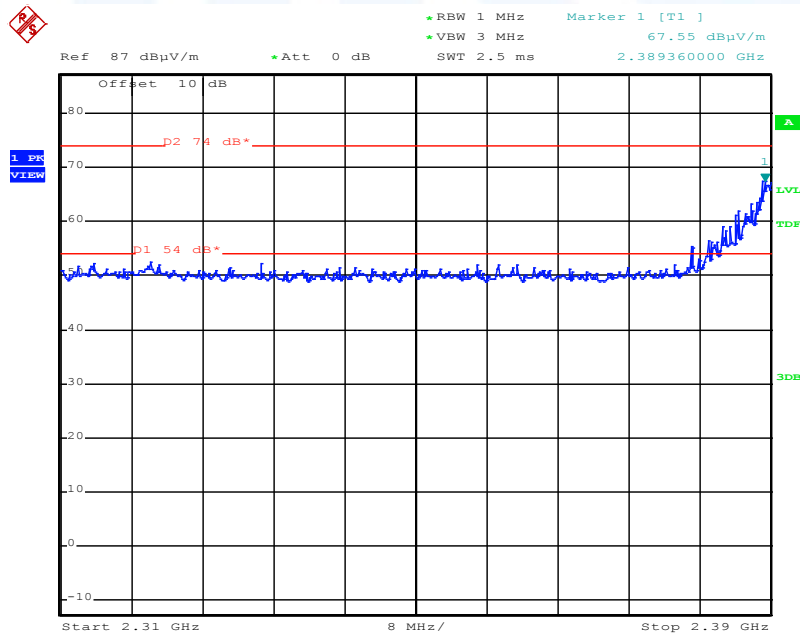
Peak-measurement



No need for AV-measurement.

Standard 802.11g
Channel 1, 2412 MHz

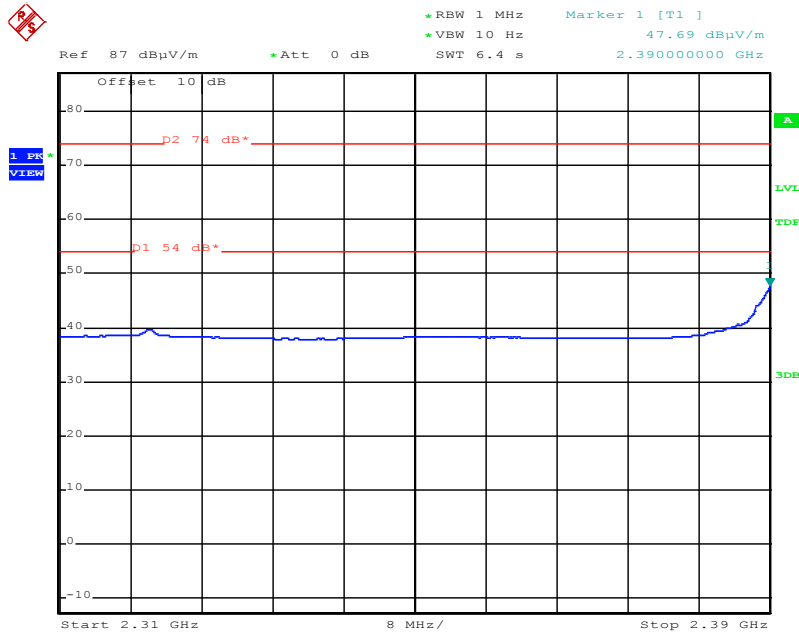
Peak-measurement



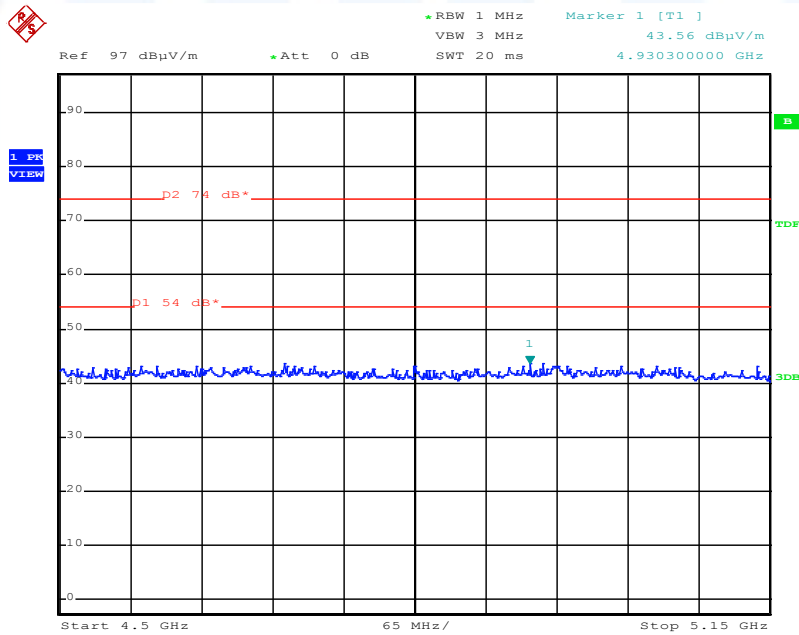
FCC ID: DMOLSP500

IC ID: 2099A-LSP500

AV-measurement



Peak-measurement



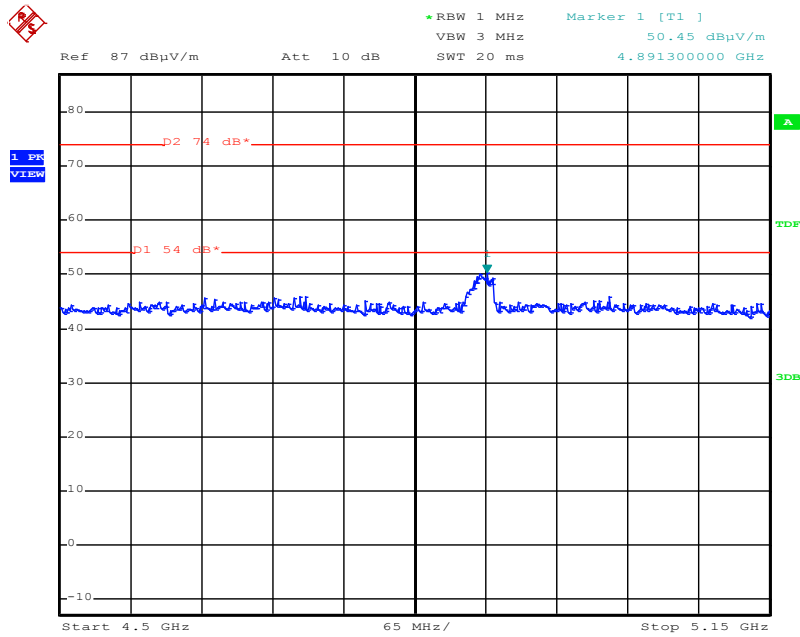
No need for AV-measurement.

FCC ID: DMOLSP500

IC ID: 2099A-LSP500

Channel 7, 2442 MHz

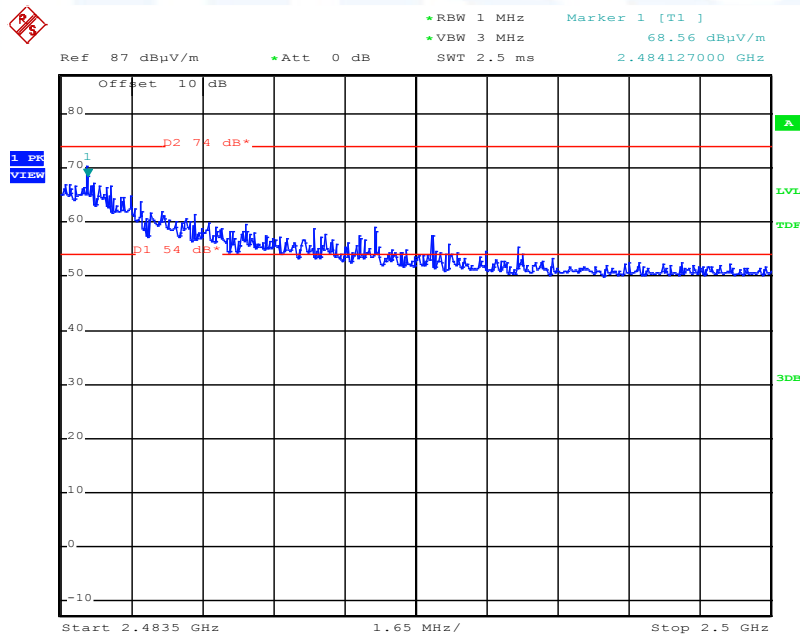
Peak-measurement



No need for AV-measurement.

Channel 11, 2462 MHz

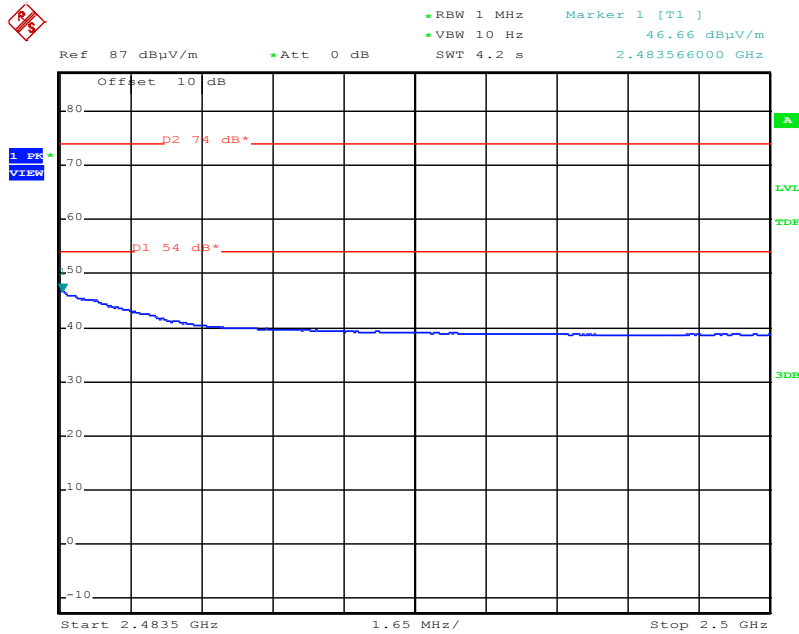
Peak-measurement



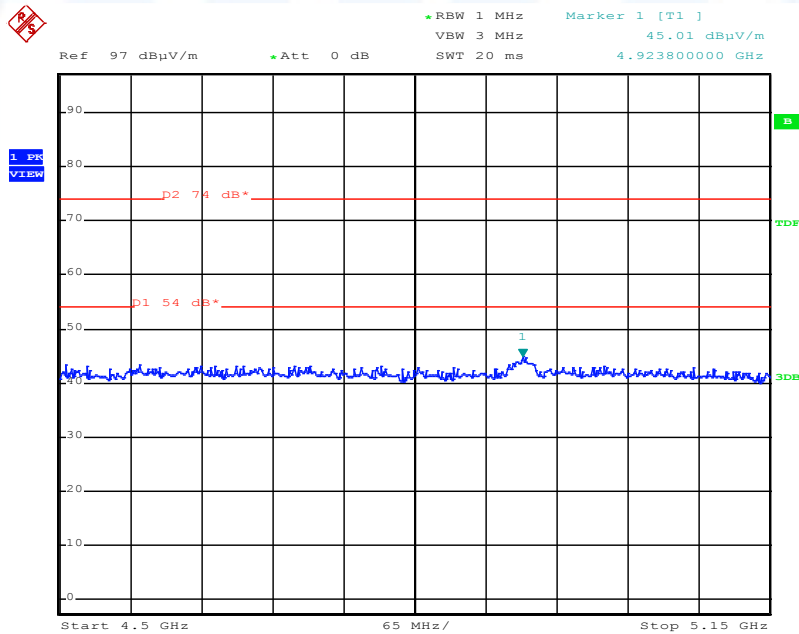
FCC ID: DMOLSP500

IC ID: 2099A-LSP500

AV-measurement



Peak-measurement



No need for AV-measurement.

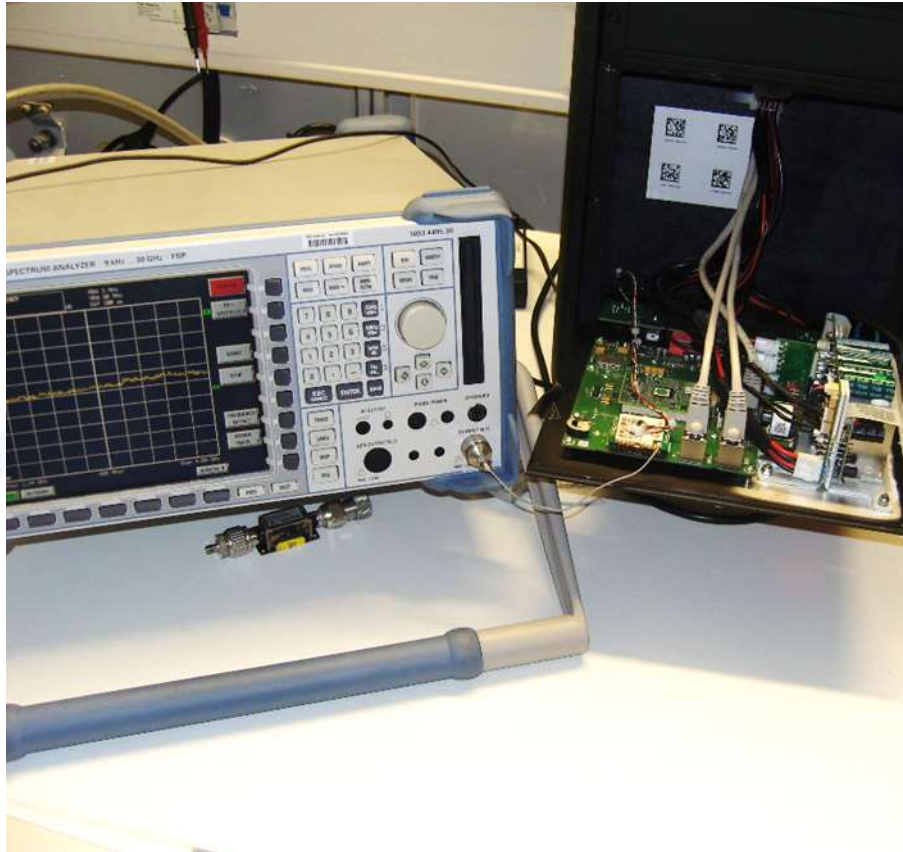
5.8 Power spectral density

For test instruments and accessories used see section 6 Part CPC 3.

5.8.1 Description of the test location

Test location: AREA4

5.8.2 Photo documentation of the test set-up



5.8.3 Applicable standard

According to FCC Part 15, Section 15.247(e):

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

5.8.4 Description of Measurement

The measurement is performed using the procedure set out in KDB-558074. The power measurement was done using a spectrum analyser with the PKPSD method. Therefore the PSD is measured as PKPSD. The max peak was located and zoomed in with the spectrum analyser. The zoom is done with the following settings.

Spectrum analyser settings:

RBW: 3 kHz, VBW: 10 kHz, Detector: peak, Sweep time: auto, Trace mode: max hold.

5.8.5 Test result

WLAN Standard 802.11b

802.11b, 1 Mbps, 1 TX		Test results conducted		
Duty cycle: 100%				
		PD [Pmax] (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Lowest frequency: CH1				
T_{nom}	V_{nom}	-5.0	8.0	-13.0
Middle frequency: CH7				
T_{nom}	V_{nom}	-4.2	8.0	-12.2
Highest frequency: CH11				
T_{nom}	V_{nom}	-3.5	8.0	-11.5

WLAN Standard 802.11g

802.11g, 6 Mbps, 1 TX		Test results conducted		
Duty cycle: 100%				
		PD [Pmax] (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Lowest frequency: CH1				
T_{nom}	V_{nom}	-9.8	8.0	-17.8
Middle frequency: CH7				
T_{nom}	V_{nom}	-10.6	8.0	-18.6
Highest frequency: CH11				
T_{nom}	V_{nom}	-11.4	8.0	-19.4

Power spectral density limit according to FCC Part 15, Section 15.247(e):

Frequency (MHz)	Power spectral density limit
	(dBm/3 kHz)
2400 - 2483.5	8

The requirements are **FULFILLED**.

Remarks: For detailed test results please refer to following test protocols.

FCC ID: DMOLSP500

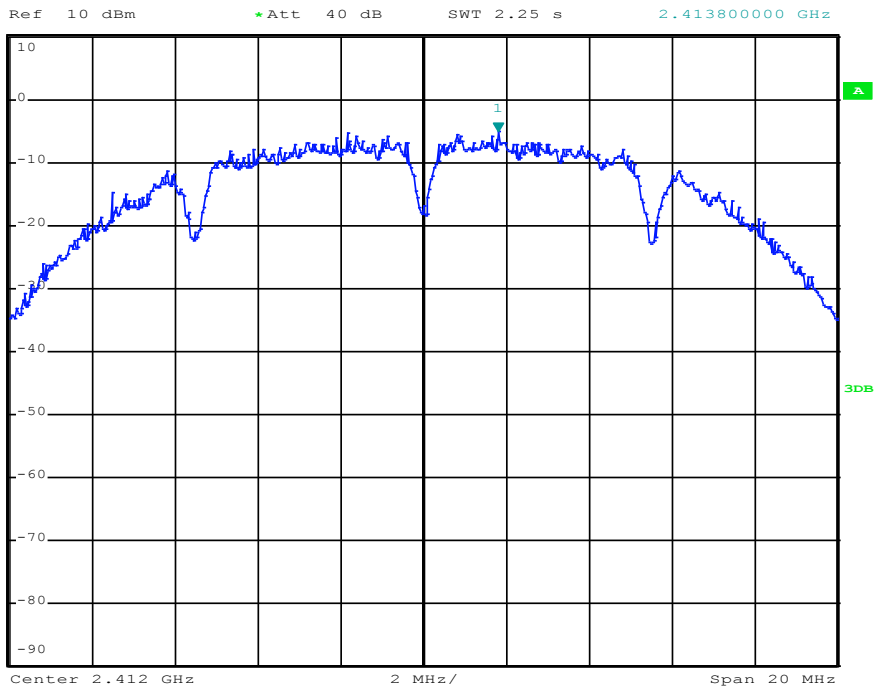
IC ID: 2099A-LSP500

Power spectral density plots

802.11b Channel 1 (2412 MHz)



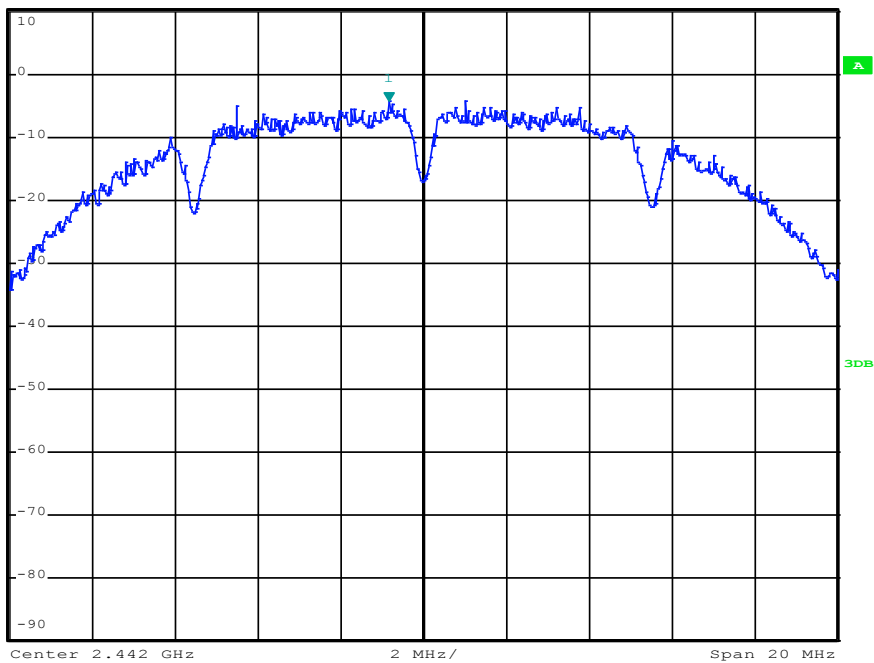
*RBW 3 kHz Marker 1 [T1]
 VBW 10 kHz -5.00 dBm
 SWT 2.25 s 2.41380000 GHz



802.11b Channel 7 (2442 MHz)



*RBW 3 kHz Marker 1 [T1]
 VBW 10 kHz -4.23 dBm
 SWT 2.25 s 2.441160000 GHz



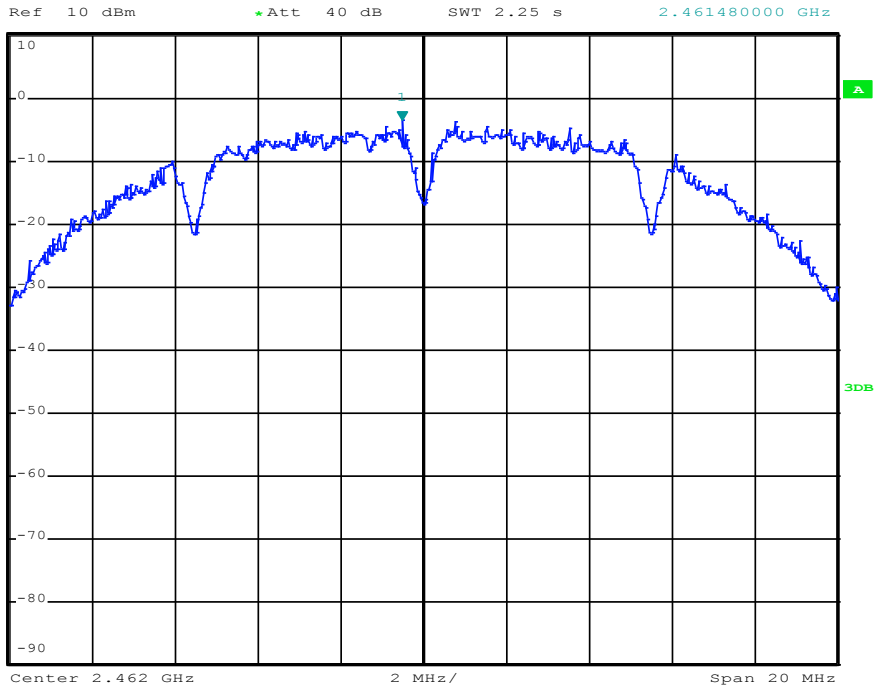
FCC ID: DMOLSP500

IC ID: 2099A-LSP500

802.11b Channel 11 (2462 MHz)



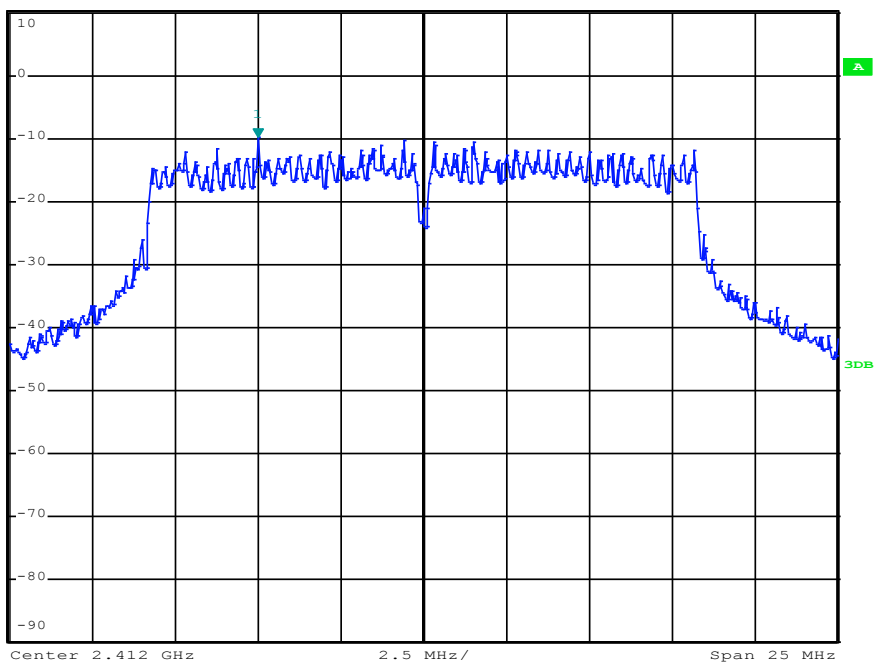
*RBW 3 kHz Marker 1 [T1]
 VBW 10 kHz -3.47 dBm
 *Att 40 dB SWT 2.25 s 2.461480000 GHz



802.11g Channel 1 (2412 MHz)



*RBW 3 kHz Marker 1 [T1]
 VBW 10 kHz -9.78 dBm
 *Att 40 dB SWT 2.8 s 2.407000000 GHz



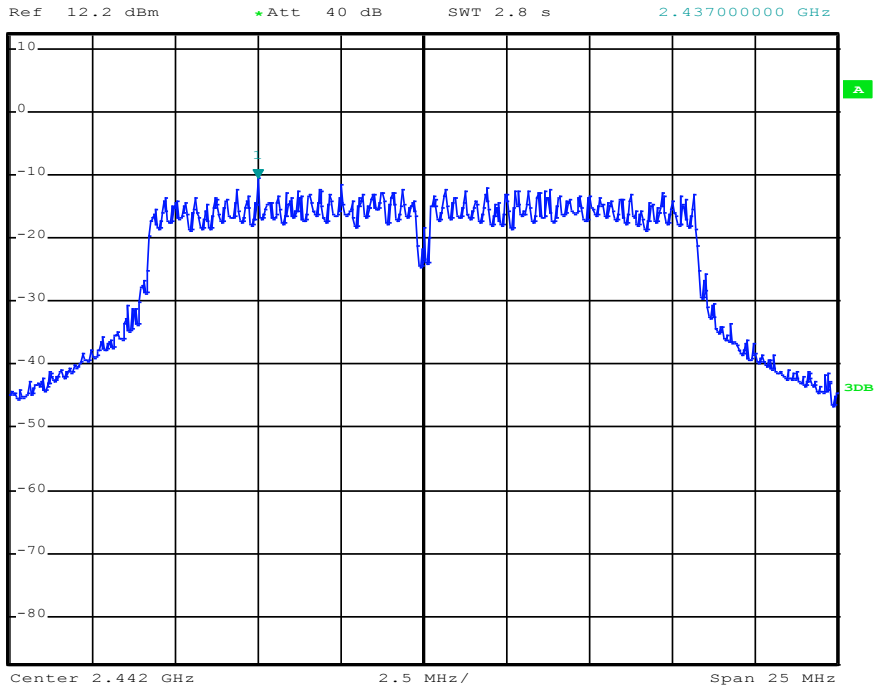
FCC ID: DMOLSP500

IC ID: 2099A-LSP500

802.11g Channel 7 (2442 MHz)



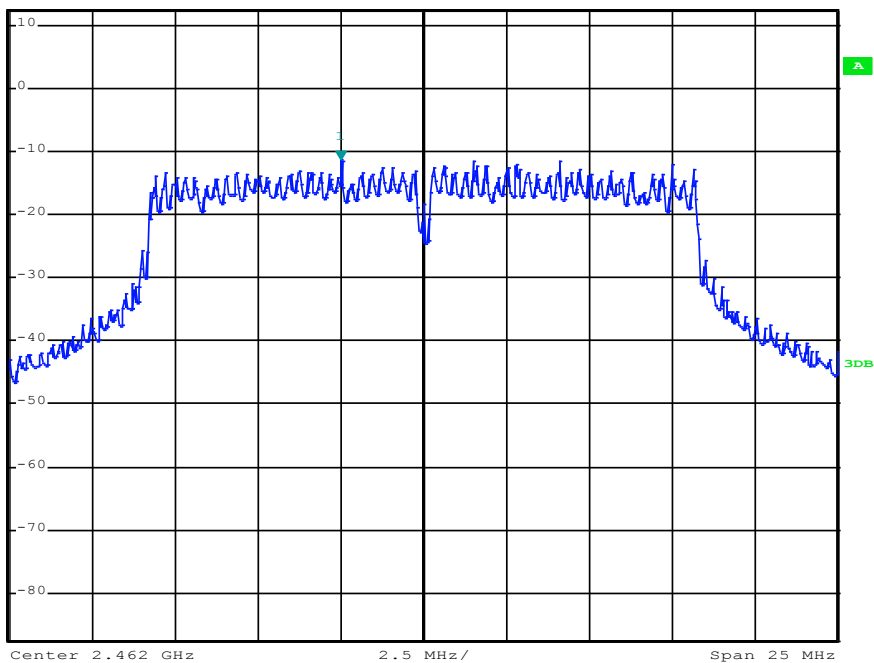
*RBW 3 kHz Marker 1 [T1]
 VBW 10 kHz -10.61 dBm
 SWT 2.8 s 2.437000000 GHz



802.11g Channel 11 (2462 MHz)



*RBW 3 kHz Marker 1 [T1]
 VBW 10 kHz -11.36 dBm
 SWT 2.8 s 2.459500000 GHz



5.9 Maximum permissible exposure (MPE)

For test instruments and accessories used see section 6 Part **CPC 3**.

5.9.1 Description of the test location

Test location: AREA4

5.9.2 Applicable standard

According to FCC Part 15, Section 15.247(i):

Systems operating under the provisions of this section shall be operated in a manner that the public is not exposed to radio frequency energy levels in excess of the Commission’s guidelines.

The test methods used comply with ANSI/IEEE C95.1, “IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz”.

This test report shows the compliance with the limits for Maximum Permissible Exposure (MPE) specified in FCC Part 1, Section 1.1310 and the criteria to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in FCC Part 1, Section 1.1307(b).

5.9.3 Description of Measurement

The maximum total power input to the antenna has been measured conducted as described in clause 5.3 of this document. Through the Friis transmission formula, the known maximum gain of the antenna and the maximum power, can be calculated the MPE in a defined distance away from the product.

Friis transmission formula:

$$P_d = \frac{P_{out} * G}{4 * \pi * r^2}$$

Where:

P_d = power density (mW/cm²)

P_{out} = output power to antenna (mW)

G = gain of antenna (linear scale)

r = distance between antenna and observation point (cm)

According to FCC Rules 47CFR 2.1093(b) the EUT is not a portable device. The EUT is designed to be used that radiating structures are 20 cm outside of the body of the user. (r = 20 cm)

5.9.4 Test result

WLAN Standard 802.11b

Channel No.	Power	A (dBm)	Antgain (dBi)	A (mW)	G linear	P (W)	S (mW/cm ²)	Limit S _{eq} (mW/cm ²)
1	P16	17.5	3.0	56.23	2.00	0.1122	0.0223	1.0
7	P16	16.3	3.0	42.66	2.00	0.0851	0.0169	1.0
11	P16	16.7	3.0	46.77	2.00	0.0933	0.0186	1.0

WLAN Standard 802.11g

Channel No.	Power	A (dBm)	Antgain (dBi)	A (mW)	G linear	P (W)	S (mW/cm ²)	Limit S _{eq} (mW/cm ²)
1	P16	19.1	3.0	81.28	2.00	0.1622	0.0323	1.0
7	P16	17.9	3.0	61.66	2.00	0.1230	0.0245	1.0
11	P16	19.0	3.0	79.43	2.00	0.1585	0.0315	1.0

FCC ID: DMOLSP500

IC ID: 2099A-LSP500

Limits for maximum permissible exposure (MPE):

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(B) Limits for General Population / Uncontrolled Exposure				
0.3 – 3.0	614	1.63	100	30
3.0 – 30	824/ <i>f</i>	2.19/ <i>f</i>	180/ <i>f</i> ²	30
30 - 300	27.5	0.073	0.2	30
300-1500	---	---	<i>f</i> /1500	30
1500-100000	---	---	1.0	30

f = Frequency in MHz

The requirements are **FULFILLED**.

Remarks:

mikes

5.10 Co-location and Co-transmission

Applicable standard:

OET Bulletin 65, Edition 97-01, Section 2: Multiple-transmitter sites and Complex Environments

The FCC's MPE limits vary with frequency. Therefore, in mixed or broadband RF fields where several sources and frequencies are involved, the fraction of the recommended limit (in terms of power density or square of the electric or magnetic field strength) incurred within each frequency interval should be determined, and the sum of all fractional contributions should not exceed 1.0, or 100 % in terms of percentage.

- | | |
|-------------------------------|---|
| 1. MPE of WLAN: | $P_d = 0.03 \text{ mW/cm}^2$
Limit: 1.0 mW/cm^2
Fraction of MPE: 3.0 % |
| 2. MPE of Bluetooth: | $P_d = 0.0001 \text{ mW/cm}^2$
Limit: 1.0 mW/cm^2
Fraction of MPE: 0.01 % |
| 3. Sum of total power density | $P_{d1} + P_{d2} = 3.0 + 0.01 = 3.01 \% < 100 \%$ |

The requirements are **FULFILLED**.

Remarks:

5.11 Antenna application

5.11.1 Applicable standard

According to FCC Part 15C, Section 15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit that broken antennas can be replaced by the user, but the use of a standard antenna jack is prohibited.

The EUT has an integrated antenna. No other antenna can be used with the device.

All supplied antennas meet the requirements of part 15.203 and 15.204.

5.11.2 Antenna requirements

According to FCC Part 15C, Section 15.247(b)(4):

The conducted output power limit specified in paragraph (b) of 15.247 is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from intentional radiator shall be reduced below the stated values in paragraph (b)(1), (b)(2) and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The output power has not to be reduced using the antenna type WID2452.

Defacto EIRP-Limit: $P_{out} = 30 - (G_x - 6)$;

Antenna	G _x (dBi)	Cond. limit (dBm)	max. G (dBi)	A _{max} [P16] (dBm)	Limit P _{out} (dBm)	Reduction (dB)	P set
WID2452	3.0	30.0	6.0	19.1	33.0	-13.9	2.4 GHz P16

6 USED TEST EQUIPMENT AND ACCESSORIES

All test instruments used are calibrated and verified regularly. The calibration history is available on request.

Test ID	Model Type	Equipment No.	Next Calib.	Last Calib.	Next Verif.	Last Verif.
A 4	ESHS 30	02-02/03-05-002	11/07/2013	11/07/2012		
	NNLK 8129	02-02/20-05-001	22/07/2013	22/01/2013		
	ESH 2 - Z 5	02-02/20-05-004	06/06/2015	06/06/2013	06/12/2013	06/06/2013
	N-4000-BNC	02-02/50-05-138				
	N-1500-N	02-02/50-05-140				
	ESH 3 - Z 2	02-02/50-05-155	05/10/2013	05/04/2013		
	SP 103 /3.5-60	02-02/50-05-182				
CPC 3	FSP 30	02-02/11-05-001	18/10/2013	18/10/2012		
SEC 1-3	FSP 30	02-02/11-05-001	18/10/2013	18/10/2012		
SER 1	FMZB 1516	01-02/24-01-018	14/02/2014	14/02/2013		
	ESCI	02-02/03-05-005	03/12/2013	03/12/2012		
	S10162-B	02-02/50-05-031				
	KK-EF393-21N-16	02-02/50-05-033				
	NW-2000-NB	02-02/50-05-113				
SER 2	ESVS 30	02-02/03-05-006	26/06/2013	26/06/2012		
	VULB 9168	02-02/24-05-005	11/04/2014	11/04/2013	11/10/2013	11/04/2013
	S10162-B	02-02/50-05-031				
	NW-2000-NB	02-02/50-05-113				
	KK-EF393/U-16N-21N20 m	02-02/50-12-018				
SER 3	FSP 30	02-02/11-05-001	18/10/2013	18/10/2012		
	AMF-4F-04001200-15-10P	02-02/17-05-004				
	AFS5-12001800-18-10P-6	02-02/17-06-002				
	3117	02-02/24-05-009	04/04/2014	04/04/2013		
	R1 _ 18 - 40 GHz	02-02/30-09-002	08/01/2014	08/01/2013		
	WHJS 1000-10EE	02-02/50-05-070				
	Sucoflex N-1000-SMA	02-02/50-05-072				
	Sucoflex N-1600-SMA	02-02/50-05-073				
	Sucoflex N-2000-SMA	02-02/50-05-075				
	WHK 3.0/18G-10EF	02-02/50-05-180				