

## 5.4 Maximum Permissible Exposure (MPE)

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

### 5.4.1 Description of the test location

Test location: AREA4

### 5.4.2 Applicable standard

According to FCC Part 15 Subpart 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 C95.1-1992, "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 1.1310 and the criteria to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in FCC 1.1307(b).

### 5.4.3 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, which is a far field assumption and the known maximum gain of the antenna, the maximum MPE at a defined distance away from the product, can be calculated.

$$\text{Friis transmission formula: } P_d = \frac{P_{out} * G}{4 * \pi * r^2}$$

where

$P_d$  = power density in mW/cm<sup>2</sup>

$P_{out}$  = output power to antenna in mW

G = gain of antenna (linear scale)

r = distance between antenna and observation point (cm)

#### 5.4.4 Test result

##### Technology 802.11b

Channel No.	Frequency (MHz)	Max Power Output to Antenna		Antenna gain (dBi)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
		(dBm)	(mW)			
1	2412	19.9	97.7	3	0.039	1.0
6	2437	20.1	102.3	3	0.041	1.0
11	2462	19.4	87.1	3	0.035	1.0

##### Technology 802.11g

Channel No.	Frequency (MHz)	Max Power Output to Antenna		Antenna gain (dBi)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
		(dBm)	(mW)			
1	2412	16.4	43.7	3	0.017	1.0
6	2437	16.6	45.7	3	0.018	1.0
11	2462	16.3	42.7	3	0.017	1.0

##### Technology 802.11a

Channel No.	Frequency (MHz)	Max Power Output to Antenna		Antenna gain (dBi)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
		(dBm)	(mW)			
149	5745	14.3	26.9	5	0.017	1.0
157	5785	13.9	24.5	5	0.015	1.0
165	5825	14.1	25.7	5	0.016	1.0

# Limits for Maximum Permissible Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	Averaging Time (minutes)
<b>(A) Limits for Occupational / Controlled Exposure</b>				
0.3 – 3.0	614	1.63	100	6
3.0 – 30	1842/f	4.89/f	900/f <sup>2</sup>	6
30 - 300	61.4	0.163	1.0	6
300-1500	---	---	f/300	6
1500-100000	---	---	5.0	6
<b>(B) Limits for General Population / Uncontrolled Exposure</b>				
0.3 – 3.0	614	1.63	100	30
3.0 – 30	824/f	2.19/f	180/ f <sup>2</sup>	30
30 - 300	27.5	0.073	0.2	30
300-1500	---	---	f/1500	30
1500-100000	---	---	1.0	30

f = Frequency in MHz

## 5.4.5 Compliance regarding Co-location and Co-transmission

**Applicable standard:** ANSI/IEEE C95.1-1999, "IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz", Clause 4.1.1. e):

For mixed or broadband fields at a number of frequencies for which there are different values of the MPE, the fraction of the MPE (in terms of E, H, or power density (S)) occurred within each frequency interval should be determined and the sum of all such fractions should not exceed unity (1.0, or 100 % in terms of percentage).

1. MPE of WLAN-Module:  $P_d = 0.041 \text{ mW/cm}^2$   
Limit:  $1 \text{ mW/cm}^2$   
Fraction of MPE: 4.1%
2. MPE of ERM Module: The fieldstrength radiated by the ERM Module is too small to be considered.

The requirements are **FULFILLED**.

**Remarks:** The MPE limit is reached at 2.11 cm or further to the transmitting antenna. Because the antenna is inside the MP and its diameter is 30 cm, no RF exposure warnings will be used with the EuT.  
For the test result of RFID Module please refer to Test report T34492-00-00AA  
(mikes-testingpartners gmbh)



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### 5.4.1 Description of the test location

Test location: AREA4

### 5.4.2 Applicable standard

According to FCC Part 15 Subpart 15.407 (f): U-NII devices are subject to the radio frequency radiation exposure requirements specified in §§ 1.1307 (b), 2.1091 and 2.1093 of this chapter, as appropriate.

The test methods used comply with ANSI/IEEE C95.1-1992, "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 1.1310 and the criteria to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in FCC 1.1307(b).

### 5.4.3 Description of Measurement

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$$\text{Friis transmission formula: } P_d = \frac{P_{out} * G}{4 * \pi * r^2}$$

where

$P_d$  = power density in mW/cm<sup>2</sup>

$P_{out}$  = output power to antenna in mW

G = gain of antenna (linear scale)

r = distance between antenna and observation point (cm)

### 5.4.4 Test result

Channel No.	Frequency (MHz)	Max Power Output to Antenna (dBm) (mW)		Antenna gain (dBi)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
36	5180	15.9	37.3	5.0	0.024	1.0
40	5200	16.1	35.4	5.0	0.026	1.0
48	5240	15.8	31.3	5.0	0.024	1.0

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0.3 – 3.0	614	1.63	100	30
3.0 – 30	824/f	2.19/f	180/ f <sup>2</sup>	30
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300-1500	---	---	f/1500	30
1500-100000	---	---	1.0	30

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1. MPE of WLAN Module:  $P_d = 0.026 \text{ mW/cm}^2$   
Limit:  $1 \text{ mW/cm}^2$   
Fraction of MPE: 2.6 %
2. MPE of ERM Module: The fieldstrength radiated by the ERM Module is too small to be considered.

The requirements are **FULFILLED**.

**Remarks:** The MPE limit is reached at 1.72 cm or further to the transmitting antenna. Because the antenna is inside the MP and its diameter is 30 cm, no RF exposure warnings will be used with the EuT.  
For the test result of RFID Module please refer to Test report T34492-00-00AA  
(mikes-testingpartners gmbh)