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DAkkS
Deutsche
Akkreditierungsstelle
D-PL-12076-01-00

Maximum Permissible Exposure (MPE) & Exposure evaluation

Certification numbers and labeling requirements		
		Contains WLAN-stick:
FCC ID	YYRDISPB	PV7-WIBEAR11N
IC number	9357A-DISPB	7738-WB11NDF1
HVIN (Hardware Version Identification Number)	MXDisplay+	
PMN (Product Marketing Name)	MXDisplay+	
FVIN (Firmware Version Identification Number)	-/-	
HMN (Host Marketing Name)	-/-	

This test report is electronically signed and valid without handwriting signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

Document authorized:

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Lab manager
Radio Communications & EMC



EUT technologies:

The device is designed to carry 3 transmitters:

- RFID transmitter operating at 13.56 MHz
- Transmitter operating at 2400-2483.5 MHz
- Transmitter operating at 5150-5740 MHz

MX-Display+
 WLAN-module ELLA-W161 with
 antenna Antenova A10194
 WLAN-module ELLA-W161 with
 antenna Antenova A10194

For this consideration the max measured source based time averaged powers are:

Max. power for 13.56 MHz operation:	0.011 mW ERP	(-19.5 dBm / 55.9 dB μ V/m @ 30 m))
Max. power for 2.4 GHz operation:	63.1 mW EIRP	(18 dBm, acc. datasheet)
Max. power for 5 GHz operation:	31.6 mW EIRP	(15 dBm, acc. datasheet)

Including Tune-Up tolerance the relevant power level are:

Max. power for 13.56 MHz operation:	0.012 mW ERP	(Tune-Up tolerance: $\pm 10\%$)
Max. power for 2.4 GHz operation:	79.4 mW EIRP	(Tune-Up tolerance: ± 1 dB)
Max. power for 5 GHz operation:	39.8 mW EIRP	(Tune-Up tolerance: ± 1 dB)

Prediction of MPE limit at given distance - FCC

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{PG}{4\pi R^2}$$

where: S = Power density
 P = Power input to the antenna
 G = Antenna gain
 R = Distance to the center of radiation of the antenna

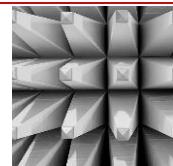
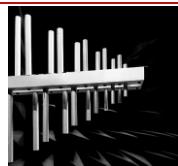
The table below is excerpted from Table 1B of 47 CFR 1.1310 titled "Limits for Maximum Permissible Exposure (MPE), Limits for General Population/Uncontrolled Exposure"

Frequency Range (MHz)	Power Density (mW/cm ²)	Averaging Time (minutes)
300 -1500	f/1500	30
1500 - 100000	1.0	30

where f = Frequency (MHz)

At a distance of 20 cm the calculated power density of the individual transmitter are:

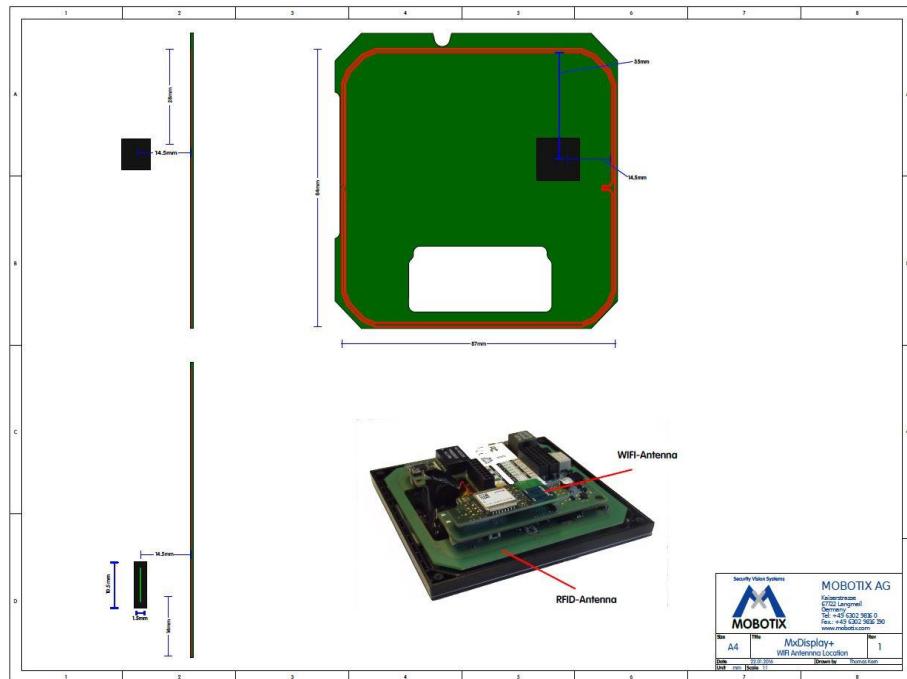
13.56 MHz transmitter:	0.00000239 mW/cm ²
2.4 GHz transmitter:	0.0158 mW/cm ²
5 GHz transmitter:	0.0079 mW/cm ²
13.56 MHz transmitter:	0.00 % of Maximum Permissible Exposure
2.4 GHz transmitter:	1.58 % of Maximum Permissible Exposure
5 GHz transmitter:	0.79 % of Maximum Permissible Exposure



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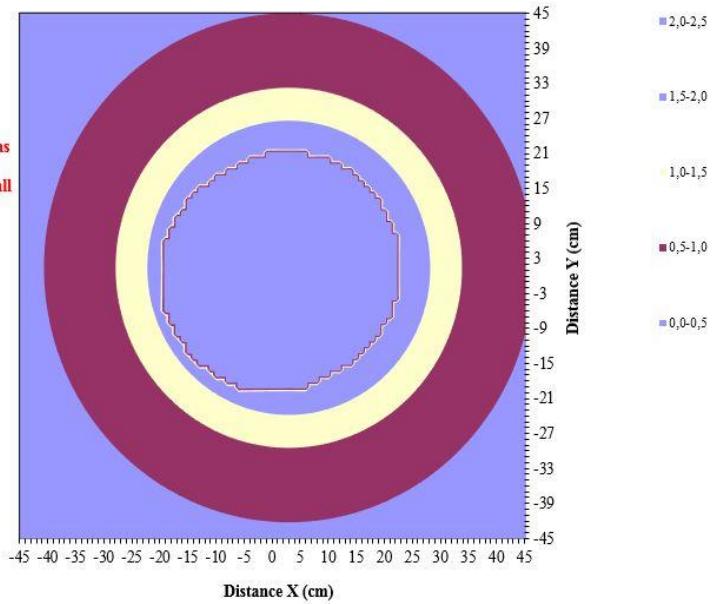
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For the simulation of the simultaneous transmission condition the following antenna separation distances were estimated. (see picture)



% MPE Contour

Note: The 0% contour surrounding the antennas identifies a 20 cm perimeter surrounding all active antennas



Result: The sum percentage for location that are at least 20 cm from any active antenna is **2.37%** and below the Limits for Maximum Permissible Exposure.



Prediction of MPE limit at given distance - IC

RSS-102, Issue 5, 2.5.2

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

Applicable limits for this application:

13.56 MHz transmitter:	1.0 W
2.4 GHz transmitter:	2.7 W
5 GHz transmitter:	4.4 W

Prediction: worst case

Max. power for 13.56 MHz operation:	0.012 mW ERP	(Tune-Up tolerance: $\pm 10\%$)
Max. power for 2.4 GHz operation:	79.4 mW EIRP	(Tune-Up tolerance: $\pm 1\text{ dB}$)
Max. power for 5 GHz operation:	39.8 mW EIRP	(Tune-Up tolerance: $\pm 1\text{ dB}$)

Technology	RFID	WLAN 2.4 GHz	WLAN 5 GHz
Max power	0.012 mW	0.0794 W	0.0398 W
Colocation	0.00 %	2.94 %	0.90 %

Conclusion: for applications where minimum distance to radiating element is 20cm Annex C of RSS-102 should be filled out.