

Maximum Permissible Exposure (MPE) & Exposure evaluation

Report identification number: 1-6031/18-02-08

Certification numbers and labeling requirements for: eBox Smart	
FCC ID	2ASKCACCU105 UXS-SMR-3X4 (radar module)
IC number	-/-
HVIN (Hardware Version Identification Number)	-/-
PMN (Product Marketing Name)	-/-
FVIN (Firmware Version Identification Number)	-/-
HMN (Host Marketing Name)	-/-

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EUT technologies:

Technologies:	Max. AVG output power [dBm])*	Antenna gain [dBi])**	Max. EIRP [dBm]	Frequency range (MHz)
WLAN 802.11b	15 +/- 1.9	4.6	21.3	2450
WLAN 802.11g	15 +/- 1.9	4.6	21.3	2450
WLAN 802.11n	15 +/- 1.9	4.6	21.3	2450
BT Basic Rate	13 +/- 2	4.6	19.6	2450
BT BR-EDR (Pi/4 DPSK)	13 +/- 2	4.6	19.6	2450
Proximity Radar	unknown	unknown	20 +/-2	24100

)* declared by manufacturer according to tune-up info

)** measured values for UMTS/LTE, otherwise declared by manufacturer

Prediction of MPE limit at given distance - FCC

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

$$S = PG / 4\pi R^2$$

where: S = Power density

P = Power input to the antenna

G = Antenna gain

R = Distance to the center of radiation of the antenna

PG = Output Power including antenna gain

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)

Prediction: worst case

Collocation of all technologies		WLAN	BT	Radar	
	Frequency (MHz)	2412	2402	24100	
PG	Declared max. EIRP (dBm)	21.3	19.6	22.0	dBm
R	Distance	20	20	20	cm
S	MPE limit for uncontrolled exposure	1.00	1.00	1.00	mW/cm ²
	Calculated Power density:	0.03	0.02	0.03	mW/cm ²
	Calculated percentage of Limit:	2.69%	1.82%	3.15%	
Collocation:					
	Scenario: all transmitters active				
	Calculated percentage of Limit:	7.65%			

Note: This calculation represents a worst-case assumption with all radiating elements at the same place.

This prediction demonstrates the following:

The power density levels for FCC at a distance of 20 cm are below the maximum levels allowed by regulations.

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).

Prediction: worst case

Collocation of all technologies		WLAN	BT	Radar	
	Frequency	2412	2402	24100	MHz
R	Distance	20	20	20	cm
PG	Declared max. EIRP (dBm)	21.3	19.6	22	dBm
PG	Declared max. EIRP (mW)	134.9	91.2	158.5	mW
	Exclusion Limit from above:	2.68	2.68	5.00	W
	Calculated percentage of Limit:	5.03%	3.41%	3.17%	
Collocation:					
	Scenario: all transmitters active				
	Calculated percentage of Limit:	11.60%			

Note: This calculation represents a worst-case assumption with all radiating elements at the same place.

Conclusion: RF exposure evaluation is not required.

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