

Maximum Permissible Exposure (MPE) & Exposure evaluation

Report identification number: 1-3523/21-01-12 MPE (FCC_ISED)

Certification numbers and labeling requirements	
FCC ID	ZMF-TU600B
ISED number	9746A-TU600B
HVIN (Hardware Version Identification Number)	TU600-21, TU600-22, TU600-25
PMN (Product Marketing Name)	Trackunit
FVIN (Firmware Version Identification Number)	-/-
HMN (Host Marketing Name)	-/-

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EUT technologies:

Technologies:	Max. EIRP declared by customer
E GPRS 850 MHz	24.0 dBm $\pm$ 2.0dB
PCS 1900 MHz	21.0 dBm $\pm$ 2.0dB
LTE FDD 2 Cat M1/Cat NB1 1900 MHz	21.0 dBm $\pm$ 2.0dB
LTE FDD 4 Cat M1/Cat NB1 1750 MHz	21.0 dBm $\pm$ 2.0dB
LTE FDD 5 Cat M1/Cat NB1 850 MHz	21.0 dBm $\pm$ 2.0dB
LTE FDD 12 Cat M1/Cat NB1 700 MHz	21.0 dBm $\pm$ 2.0dB
LTE FDD 13 Cat M1/Cat NB1 700 MHz	21.0 dBm $\pm$ 2.0dB
LTE FDD 25 Cat M1/Cat NB1 1900 MHz	21.0 dBm $\pm$ 2.0dB
LTE FDD 26 Cat M1/Cat NB1 850 MHz	21.0 dBm $\pm$ 2.0dB
LTE FDD 66 Cat M1/Cat NB1 900 MHz	21.0 dBm $\pm$ 2.0dB
LTE FDD 71 Cat M1/Cat NB1 600 MHz	21.0 dBm $\pm$ 2.0dB
LTE FDD 85 Cat M1/Cat NB1 700 MHz	21.0 dBm $\pm$ 2.0dB
BT LE 2450 MHz	2.8 dBm Peak Cond.

NOTE: The device is capable of using either LTE Cat M1 or LTE-NB IoT. As the Maximum Output power levels for both technologies are the same for the calculation below the technology is referred as LTE FDD x.

Collocation overview:

Active scenario: Technology	1	2	3	4
E GPRS / LTE	x		x	
BT LE	x	x		

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

Technologies:		E GPRS	LTE	LTE	BT LE	
	Frequency (MHz)	850	600	1900	2450	
PG	Declared max power (EIRP)	26	23	23	2.8	dBm
R	Distance	20	20	20	20	cm
S	MPE limit for uncontrolled exposure	0.567	0.400	1	1	mW/cm ²
	Calculated Power density:	0.0792	0.0397	0.0397	0.0004	mW/cm ²
	Calculated percentage of Limit:	13.98%	9.93%	3.97%	0.04%	
Collocation:						
	Scenario 1: BT LE + E GPRS / LTE	14.02%				
	Calculated percentage of Limit:					

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 - ISED

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

		E GPRS	LTE	LTE	BT LE	
	Frequency	850	600	1900	2450	MHz
R	Distance	20	20	20	20	cm
PG	Maximum EIRP	26	23	23	2.8	dBm
PG	Maximum EIRP	398.1	199.5	199.5	1.9	mW
	Exclusion Limit from above:	1.32	1.04	2.28	2.71	W
	Calculated percentage of Limit:	30.25%	19.24%	8.75%	0.07%	
Collocation:						
	Scenario 1: BT LE + E GPRS / LTE					
	Calculated percentage of Limit:	30.32%				

Conclusion: RF exposure evaluation is not required.