



Maximum Permissible Exposure (MPE) & Exposure evaluation

Report identification number: 1-7390/18-01-12 MPE (FCC_ISED)

Certification numbers and labeling requirements	
FCC ID	ZMF-TU600
ISED number	9746A-TU600
HVIN (Hardware Version Identification Number)	TU600-1, TU600-2, TU600-3, TU600-4, TU600-5, TU600-6, TU600-7, TU600-8, TU600-9
PMN (Product Marketing Name)	Trackunit
FVIN (Firmware Version Identification Number)	-/-
HMN (Host Marketing Name)	-/-

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Document authorised:



Alexander Hnatovskiy
Lab Manager
Radio Communications & EMC



Marco Scigliano
Testing Manager
Radio Communications & EMC

EUT technologies:

Technologies:	Max. AVG output power* [dBm]	Frequency range (MHz)
GSM 850	26.0	835
GSM 1900	23.0	1900
LTE FDD 2	25.0	1900
LTE FDD 4	25.0	1750
LTE FDD 5	25.0	835
LTE FDD 12	25.0	710
LTE FDD 13	25.0	780
LTE FDD 26	25.0	850
BT BR-EDR (GFSK)	10.0	2450
BT BR-EDR (8 DPSK)	10.0	2450
BT LE	10.0	2450

)* 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

Technologies:		GSM 850	LTE FDD 12	LTE FDD 26	LTE FDD 2	BT	
	Frequency (MHz)	835	710	850	1900	2450	
PG	Declared max power (EIRP, Ant.Gain 0dB)	26.0	25.0	25.0	25.0	10.0	dBm
R	Distance	20	20	20	20	20	cm
S	MPE limit for uncontrolled exposure	0.56	0.47	0.57	1	1	mW/cm ²
	Calculated Power density:	0.08	0.06	0.06	0.06	0.00	mW/cm ²
	Calculated percentage of Limit:	14.23%	13.30%	11.11%	6.29%	0.20%	
Collocation:							
	Scenario 1: GSM 850 + BT 2.4 MHz Calculated percentage of Limit:	14.43%					
	Scenario 2: LTE FDD 12 + BT 2.4 MHz Calculated percentage of Limit:	13.50%					
	Scenario 3: LTE FDD 26 + BT 2.4 MHz Calculated percentage of Limit:	11.31%					
	Scenario 3: LTE FDD 2 + BT 2.4 MHz Calculated percentage of Limit:	6.49%					

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

		GSM 850	GSM 1900	LTE FDD 12	LTE FDD 2	BT	
	Frequency	835	1900	710	1900	2450	MHz
R	Distance	20	20	20	20	20	cm
PG	Maximum EIRP (Ant.Gain 0dBi)	26	23	25	25	10	dBm
PG	Maximum EIRP (Ant.Gain 0dB)	398.1	199.5	316.2	316.2	10.0	mW
	Exclusion Limit from above:	1.30	2.28	1.16	2.28	2.71	W
	Calculated percentage of Limit:	30.62%	8.75%	27.18%	13.87%	0.37%	
	Collocation:						
	Scenario 1: GSM 850 + BT 2.4 MHz Calculated percentage of Limit:	30.99%					
	Scenario 2: GSM 1900 + BT 2.4 MHz Calculated percentage of Limit:	9.12%					
	Scenario 3: LTE FDD 12 + BT 2.4 MHz Calculated percentage of Limit:	27.54%					
	Scenario 4: LTE FDD 2 + BT 2.4 MHz Calculated percentage of Limit:	14.24%					