



Maximum Permissible Exposure (MPE) & Exposure evaluation

Report identification number: 1-9462/19-02-01 MPE (FCC_ISED)

Certification numbers and labeling requirements	
FCC ID	RFD-CRS111
ISED number	3177A-CRS111
HVIN (Hardware Version Identification Number)	CRS111
PMN (Product Marketing Name)	CRS111
FVIN (Firmware Version Identification Number)	-/-
HMN (Host Marketing Name)	-/-

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Document History:

Version	Applied Changes	Date of Release
	Initial Release	2019-12-03

EUT technologies:

Technologies:	Max. measured avg. EIRP: [dBm]*	Max. measured avg. conducted output power* [dBm]	Resulting Antenna gain [dBi]	Declared Maximum Conducted** [dBm]	Resulting max. EIRP (decl. max. cond. + calc. ant gain) [dBm]
GSM 850 (@848.8 MHz)	34.3	31.2	3.1	33.25	27.35 (time based)
PCS 1900 (@1850.2 MHz)	29.5	29.0	0.5	30.2	21.7 (time based)
UMTS FDD II (@1907.6 MHz)	22.5	21.9	0.6	24.5	25.1
UMTS FDD IV (@1752.6 MHz)	21.1	21.5	-0.4	24.5	24.1
UMTS FDD V (@846.6 MHz)	22.4	21.5	0.9	24.5	25.4
LTE FDD 2 (@1907.5 MHz)	22.8	22.5	0.3	24.0	24.3
LTE FDD 4 (@1754.3 MHz)	21.4	21.8	-0.4	24.0	23.6
LTE FDD 5 (@846.5 MHz)	24.8	23.9	0.9	24.0	24.9
LTE FDD 7 (@2567.5 MHz)	23.5	21.8	1.7	24.0	25.7
LTE FDD 17 (@711.0 MHz)	24.6	22.4	2.0	24.0	26.0
ISM band (@912 MHz)	15.4	--	--	--	15.4

*): measured slotted peak power for GSM/PCS, averaged max. RMS power for UMTS, LTE, and ISM 900MHz.

**): taken from module report: FCC ID: XPYTOBYL200
 ISED number: 8595A-TOBYL200
 RF Exposure and Maximum ERP/EIRP Assessment
MDE_UBLOX_1408_MPEa Rev3 (7Layers)

NOTE:

GSM and UMTS results taken from CTC Advanced GmbH report 1-8036/19-01-02.

LTE results taken from CTC Advanced GmbH Report 1-8036/19-01-08.

ISM band results taken from CTC Advanced GmbH report 1-8036/19-01-03.

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 7	ISM	
	Frequency (MHz)	848.8	2567.5	912.0	
PG	Declared max power (EIRP)	27.35	25.7	15.4	dBm
R	Distance	20	20	20	cm
S	MPE limit for uncontrolled exposure	0.57	1	1	mW/cm ²
	Calculated Power density:	0.11	0.07	0.01	mW/cm ²
	Calculated percentage of Limit:	19.11%	7.40%	0.69%	
Collocation:					
	Scenario 1: GSM 850 + ISM	19.80%			
	Calculated percentage of Limit:				
	Scenario 2: LTE + ISM	8.09%			
	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 $4.49/f^{0.5} \text{ W}$ (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 $1.31 \times 10^{-2} f^{0.6834} \text{ W}$ (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	LTE FDD 7	ISM band	
	Frequency	848.8	2567.5	912	MHz
R	Distance	20	20	20	cm
PG	Maximum EIRP	27.35	25.7	15.4	dBm
PG	Maximum EIRP	543.3	371.5	34.7	mW
	Exclusion Limit from above:	1.31	2.80	1.38	W
	Calculated percentage of Limit:	41.32%	13.26%	2.51%	
	Collocation:				
	Scenario 1: GSM 850 + ISM Calculated percentage of Limit:	43.83%			
	Scenario 2: LTE + ISM Calculated percentage of Limit:	15.77%			

Conclusion: RF exposure evaluation is not required.