

RF EXPOSURE

1. Regulation

According to §15.247(i), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. See § 1.1307(b)(1) of this Chapter.

Limits for Maximum Permissible Exposure: RF exposure is calculated.

Frequency Range	Electric Field Strength [V/m]	Magnetic Field Strength [A/m]	Power Density [mW/cm ²]	Averaging Time [minute]
Limits for General Population / Uncontrolled Exposure				
0.3 ~ 1.34	614	1.63	*(100)	30
1.34 ~ 30	824/f	2.19/f	*(180/f ²)	30
30 ~ 300	27.5	0.073	0.2	30
300 ~ 1 500	/	/	<u>f/1 500</u>	30
1 500 ~ 15 000	/	/	1	30

f=frequency in MHz, *= plane-wave equivalent power density

MPE (Maximum Permissible Exposure) Prediction

Predication of MPE limit at a given distance: Equation from KDB 447498 D01 General RF Exposure Guidance v06

$$S = PG/4\pi R^2 \quad (\Rightarrow R = \sqrt{PG/4\pi S})$$

S = power density [mW/cm²]

P = Power input to antenna [mW]

G = Power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna [cm]

2. RF Exposure Compliance Issue

The information should be included in the user's manual:

This appliance and its antenna must not be co-located or operation in conjunction with any other antenna or transmitter.

MPE Calculations : Module 1_GFSK

- Frequency Range : 903 MHz ~ 927 MHz
- Measured RF Maximum Output Power(Avg.) : -11.60 dBm
- Target Power & Tolerance -12.60 dBm & $\pm$ 1.00 dB
(Maximum : -11.60 dBm & Minimum : -13.60 dBm)
- Maximum Peak Antenna Gain : -1.00 dBi
- Maximum Output Power for the Calculation : -11.60 dBm

The EUT will only be used with a separation of 5 millimeters or lesser between the antenna and the body of the The MPE calculation for this exposure is shown below.

- EIRP = P + G = <u>-11.60</u> dBm + <u>-1.00</u> dBi = <u>-12.60</u> dBm = <u>0.05</u> mW	- NOTE P : Max tuneup Power (dBm) G : Maximum Peak Antenna Gain (dBi)
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Power Density at the specific separation

- S = EIRP / (4 X R²π) = 0.05 / (4 X 0.5² X π) = <u>0.017 492</u> mW/cm²	- NOTE S : Maximum Power Density (mW/cm²) EIRP : Equivalent Isotropic Radiated Power (mW) R : Distance to the center of the radiation of the antenna (<u>0.5</u> cm) Limit : 0.62 mW/cm² (927 MHz)
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MPE Calculations : Module 2_GFSK

- Frequency Range : 903 MHz ~ 927 MHz
- Measured RF Maximum Output Power(Avg.) : -11.76 dBm
- Target Power & Tolerance -12.75 dBm & $\pm$ 1.00 dB
(Maximum : -11.75 dBm & Minimum : -13.75 dBm)
- Maximum Peak Antenna Gain : -1.00 dBi
- Maximum Output Power for the Calculation : -11.75 dBm

The EUT will only be used with a separation of 5 millimeters or lesser between the antenna and the body of the The MPE calculation for this exposure is shown below.

- EIRP = P + G = <u>-11.75</u> dBm + <u>-1.00</u> dBi = <u>-12.75</u> dBm = <u>0.05</u> mW	- NOTE P : Max tuneup Power (dBm) G : Maximum Peak Antenna Gain (dBi)
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Power Density at the specific separation

- S = EIRP / (4 X R²π) = 0.05 / (4 X 0.5² X π) = <u>0.016 899</u> mW/cm²	- NOTE S : Maximum Power Density (mW/cm²) EIRP : Equivalent Isotropic Radiated Power (mW) R : Distance to the center of the radiation of the antenna (<u>0.5</u> cm) Limit : 0.62 mW/cm² (927 MHz)
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MPE Calculations : Module 3_GFSK

- Frequency Range : 903 MHz ~ 927 MHz
- Measured RF Maximum Output Power(Avg.) : -11.90 dBm
- Target Power & Tolerance -12.80 dBm & $\pm$ 1.00 dB
(Maximum : -11.80 dBm & Minimum : -13.80 dBm)
- Maximum Peak Antenna Gain : -1.00 dBi
- Maximum Output Power for the Calculation : -11.80 dBm

The EUT will only be used with a separation of 5 millimeters or lesser between the antenna and the body of the The MPE calculation for this exposure is shown below.

- EIRP = P + G = <u>-11.80</u> dBm + <u>-1.00</u> dBi = <u>-12.80</u> dBm = <u>0.05</u> mW	- NOTE P : Max tuneup Power (dBm) G : Maximum Peak Antenna Gain (dBi)
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Power Density at the specific separation

- S = EIRP / (4 X R²π) = 0.05 / (4 X 0.5² X π) = <u>0.016 705</u> mW/cm²	- NOTE S : Maximum Power Density (mW/cm²) EIRP : Equivalent Isotropic Radiated Power (mW) R : Distance to the center of the radiation of the antenna (<u>0.5</u> cm) Limit : 0.62 mW/cm² (927 MHz)
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MPE Calculations : Max simultaneous transmission MPE

Total Module 1 + Module 2 + Module 3

-Total EIRP = (0.05 + 0.05 + 0.05) mW = 0.15 mW	- NOTE Module 1 + Module 2 + Module 3 Module 1 = 0.05 mW Module 2 = 0.05 mW Module 3 = 0.05 mW
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Max simultaneous transmission MPE

-Total S = [(Module 1 Result(mW/cm²) / Limit(mW/cm²)) (Module 2 Result(mW/cm²) / Limit(mW/cm²)) (Module 3 Result(mW/cm²) / Limit(mW/cm²)) * 100] = [(0.01749 / 1) + (0.01690 / 1) + (0.01671 / 1)] * 100 = 5.10961 %	- NOTE Module 1 + Module 2 + Module 3 Module 1 = 0.01749 mW/cm² Module 2 = 0.01690 mW/cm² Module 3 = 0.01671 mW/cm² Distance to the center of the radiation of the antenna (<u>0.5</u> cm) Limit : ≤ 100 %
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Note1: Each transmitter signal has nothing to do with each other.