code

RF Exposure / Power Information

Code Corporation
14870 S Pony Express Road, Suite 200
Bluffdale, UT 84065

Product: CR2600 Family
CR2612_01 Handle Reader
CR2611_01 Palm Reader

§ 1.1310 Radiofrequency radiation exposure limits:

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE): Used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of § 2.1093. Further information on evaluating compliance with these limits can be found in the FCC's OST/OET Bulletin Number 65, ''Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to Radiofrequency Radiation''.

Table 1	Frequency Range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm²)	Ave time (minutes)
Limits for Occupational / Controlled Exposures	0.3 - 3.0	614	1.63	*(100)	6
	3.0 - 30	1842/f	4.89/f	*(900/f²)	6
	30 – 300	61.4	0.136	1.0	6
	300 – 1500	………………………	………………………	f/300	6
	1500 – 100,000	………………………	………………………	5	6

Table 2	Frequency Range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm²)	Ave time (minutes)
Limits for General Population / Uncontrolled Exposure	0.3 – 1.34	614	1.63	*(100)	30
	1.34 – 30	824/f	2.19/f	*(180/f²	30
	30 – 300	27.5	0.073	0.2	30
	300 – 1500	………………………	………………………	f/1500	30
	1500 – 100,000	………………………	………………………	1.0	30

f = frequency in MHz   * = Plane-wave equivalent power density

Table1: Apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/ controlled limits apply provided he or she is made aware of the potential for exposure.

Table 2: Apply in situations where the general public may be exposed, where persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure, or they cannot exercise control over their exposure.

Calculations:

The limit for radio frequency exposure for an uncontrolled environment is 1mW/cm^2 for the frequencies used in this device. The worst-cast antenna gain is used for the calculation below. The power density is calculated at 20 cm distance. Assume 100% duty cycle for this calculation.

$$Pd = (Pout * G) / (4 * \pi * r^2) \qquad or \qquad Pd = EIRP / (4 * \pi * r^2)$$

Where
Pd = power density in mW/cm^2
Pout = output power to antenna in mW
G = gain of antenna in linear scale
π = 3.1416
r = distance from transmitter in cm

Antenna type: Antenova A5839 Peak gain 2.1 dBi
Conducted power out from test report: 1.15 mW

Approximate EIRP 1.15 mW + 2.1 dBi = 3.25 mW

$$Pd = 3.25 / (4 * 3.1416 * 20^2) = .000646 \text{ mW/cm}^2$$

Conclusion:

The transmitter and antenna configuration calculated meets the maximum exposure requirement specified above.

Specific Absorption Rate limits:

Standalone SAR test exclusion

Per FCC publication 447498 D01, "General RF Exposure Guidance V05," SAR (Specific Absorption Rate) evaluation is not required when the SAR Exclusion Threshold is met. The 1-g and 10-g SAR Test Exclusion Thresholds for 100 MHz to 6 GHz at *test separation distances* ≤ 50 mm are determined by:

[(*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)] ·[√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR where:

- f(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

The device under test has the following specifications:

Rated RF Output Power: +3 dBm (Basic Data Rate)

+1 dBm (Enhanced Data Rate)

+4 dBm or 2.5 mW maximum (rounds to 3mW)

Measured Conducted RF Output Power: 1.15mW

Minimum test separation distance between user and antenna: 5mm
This separation distance occurs when the user places their hand on the case, directly over the location of the internal antenna. This is an expected use scenario for the reader because it can be used as a handheld device.

RF Channel Transmit Frequency: 2.40GHz to 2.478GHz

Calculations:

[(*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)] ·[√f(GHz)]

$$[(3)/(5)]*[\sqrt{2.478}] = 0.9$$

Note: To provide a worst-case scenario, this calculation uses the maximum rated power for the RF module. In actual use, the module is configured to transmit less than its maximum. A lower value, more representative of the actual configuration, can be calculated by using the measured conducted RF output power.

Conclusion:

The calculated value of 0.9 for this device meets the SAR test exclusion threshold of both the 3.0 limit for 1-g SAR and the 7.5 limit for 10-g extremity SAR. No SAR testing is required.