

RF Exposure evaluation

The “SiteSage” Z-Wave Module, Model 950-000018 is a very low RF Power device, and therefore is exempt from RF exposure evaluation. However in normal operation it is plugged into the Gateway 950-000012G device (see photo below) which contains WiFi and MiWi radios (both 2.4 GHz) with relatively high RF power. Therefore the “SiteSage” Z-Wave Module, Model 950-000018 is co-located with other transmitters, and RF exposure evaluation must be addressed.



The combination of 950-000018 and 950-000012G is intended to be used in a mobile configuration – at least 20 cm from the user or nearby person.

RF Exposure evaluation for multi-transmitter product procedures

In mobile exposure conditions, simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on the calculated power density, is ≤ 1.0 , i.e.

$$\sum_{i=1}^n \frac{S_i}{(MPE)_i} \leq 1$$

Where S_i is the Power Density on the given distance for $i=1, 2, 3, \dots, n$,

n – number of antennas transmitting simultaneously,

$(MPE)_i$ is the Limit of MPE for the given transmitting frequency.

The $\frac{S_i}{(MPE)_i}$ is the MPE ratio of power density to MPE limit of each antenna, determined at the minimum test separation distance required by the operating configurations and exposure conditions of the host device.

Calculation of Power Density at a given distance

Power Density ($S \text{ mW/cm}^2$) is calculated as

$$S = \frac{EIRP}{4\pi d^2}$$

Where $EIRP$ – Average Equivalent Isotropic Radiated Power (in mW),

$$EIRP = P_a \times G$$

$$P_a = P \times DC$$

DC – Source-based Duty Cycle (numeric)

G – Gain of the antenna in the direction of interest relative to an isotropic radiator (numeric),

d – Distance to the center of radiation of the antenna (in cm).

The following calculation of RF exposure compliance is performed:

Number of transmitter	FCC ID	Power input to antenna	Maximum antenna gain	EIRP	DC	Power Density (S _i) at 20 cm	Frequency Range	Technology	MPE limit *	$\frac{S_i}{(MPE)_i}$
1 **	W70MRF24WG0MAMB	393 mW	2.0 dBi/1.6	629 mW	100% (1.0)	0.125	2.4 GHz	802.11b/g	1.0	0.125
2 **	OA3MRF24J40MB	-	-	111 mW	100% (1.0)	0.022	2.4 GHz	802.15.4	1.0	0.022
3 ***	Z4P-950-000018			0.006 mW	100% (1.0)	$\sim 10^{-6}$	908.4 MHz	Z-Wave	0.6	$\sim 10^{-5}$
										Total 0.15

* Limit for Occupational /uncontrolled environment

** Transmitter inside the Module 950-000012G

*** Transmitter inside the Model 950-000018

$$\sum_{i=1}^n \frac{S_i}{(MPE)_i} = 0.15$$

Since the result is less than 1, FCC and IC requirements for RF Exposure are met for Occupational /uncontrolled environment.