FCC §1.1307 (b) (1) & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 15.247 (i) and subpart 1.1307 (b)(1), 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

Limits for General Population/Uncontrolled Exposure

Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (Minutes)**
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
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

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

Result

Calculated Formulary:

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

S = power density (in appropriate units, e.g. mW/cm^2)
P = power input to the antenna (in appropriate units, e.g., mW).
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

The sample contain a Z-WAVE module (FCC ID: D87-ZM5304-U) which has been certified on 2013-08-23 by Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch. According the report RF130710C16, the max ERP was 92.9 dBuV/m on 908.42MHz, antenna gain was 1 dBi,
so the max output power= ERP-95.3-1+2.15= -1.25 dBm

Frequency (MHz)	Antenna Gain		max output power		Evaluation Distance (cm)	Power Density (mW/cm²)	MPE Limit (mW/cm²)
	(dBi)	(numeric)	(dBm)	(mW)			
908.4-916	1	1.26	-1.25	0.75	20	0.0002	0.61

For the sample which contain the LTE module 1(FCC ID: QIPELS31-V):

Frequency (MHz)	Antenna Gain		Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm²)	MPE Limit (mW/cm²)
	(dBi)	(numeric)	(dBm)	(mW)			
2412-2462	2	1.58	21.5	141.25	20	0.04	1.0
1710-1755	2	1.58	24	251.19	20	0.08	1.0
777-787	2	1.58	24	251.19	20	0.08	0.52

Note：LTE Data please refer to LTE module 1's FCC ID: QIPELS31-V which has been certified on 2015-12-16 by Shenzhen CETECOM Inc.

Simultaneous transmitting consideration for LTE & WIFI & Z-Wave:

$$\sum_i \frac{S_i}{S_{Limit,i}} = 0.04/1 + 0.08/0.52 + 0.0002/0.61 = 0.19 < 1.0$$

Note: To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

Result: Compliance

For the sample which contain the LTE module 2(FCC ID: N7NMC7355):

Mode	Frequency (MHz)	Antenna Gain		Conducted Power		Duty cycle	Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)				
WIFI	2412-2462	2	1.58	21.5	141.25	1.0	20	0.04	1.0
GPRS	824-849	2	1.58	33	1995.26	0.25	20	0.16	0.55
	1850-1910	2	1.58	30	1000.00	0.25	20	0.08	1.0
EDGE	824-849	2	1.58	28	630.96	0.25	20	0.05	0.55
	1850-1910	2	1.58	27	501.19	0.25	20	0.04	1.0
CDMA	824-849	2	1.58	25	316.23	1.0	20	0.10	0.55
	1850-1910	2	1.58	25	316.23	1.0	20	0.10	1.0
	817-824	2	1.58	25	316.23	1.0	20	0.10	0.54
UMTS	824-849	2	1.58	24	251.19	1.0	20	0.08	0.55
	1710-1755	2	1.58	24	251.19	1.0	20	0.08	1.0
	1850-1910	2	1.58	24	251.19	1.0	20	0.08	1.0
LTE	704-716	2	1.58	24	251.19	1.0	20	0.08	0.47
	777-787	2	1.58	24	251.19	1.0	20	0.08	0.52
	824-849	2	1.58	24	251.19	1.0	20	0.08	0.55
	1710-1755	2	1.58	24	251.19	1.0	20	0.08	1.0
	1850-1910	2	1.58	24	251.19	1.0	20	0.08	1.0
	1850-1915	2	1.58	24	251.19	1.0	20	0.08	1.0

Note：LTE Data please refer to LTE module 2's FCC ID: N7NMC7355 which has been certified on 2012-11-28 by UL VERIFICATION SERVICES, INC.

Simultaneous transmitting consideration for above table, the worst case is WIFI and GPRS 850 band and Z-Wave:

$$\sum_i \frac{S_i}{S_{Limit,i}} = 0.04/1 + 0.16/0.55 + 0.0002/0.61 = 0.33 < 1.0$$

Note: To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

Result: Compliance