Tecore, Inc.

QLJ4GRFN-005

Health Protection and Radiation Hazards

Revision 1.0

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1.0 INTRODUCTION

This document provides information regarding the assessment of Health Protection and Radiation Hazards expected from the QLJ4GRFN-005. The following calculations are presented to show that the QLJ4GRFN-005 is compliant to the MPE requirements as per FCC Rule Part § 1.1310.

2.0 RADIATION HAZARDS

2.1 ANTENNA RADIATION

The FCC Rule Part § 1.1310 Limits for Maximum Permissible Exposure (MPE) (General Population/Uncontrolled Exposure) are shown in Table 1 below.

Frequency Range (MHz)	MPE (S, mW/cm^2)
.3 – 1.34	*100
1.34 - 30	*180/f^2 (where f = frequency in MHz)
30 - 300	0.2
300 – 1500	f/1500 (where f = frequency in MHz)
1,500 – 100,000	1.0

Table 1 – Limits for Maximum Permissible Exposure (MPE) (General Population/Uncontrolled Exposure)

Antenna Radiation Calculation:

Considerations:

- HPA Configured for Maximum Transmit Power = 50 Watts
- Feeder Cable Loss = 0.5 dB (typical)
- Antenna Gain = 18 dBi (Highest Gain Possible)

The power delivered to the antenna is:

P = HPA_Power (2 x TX Ports) – Feeder Cable Loss = 47 dBm – 0.5 dB = 46.5 dBm (45 Watts)

The nominal output power per port is +43 dBm +/- 1 dB. The QLJ4GRFN-005 is configured in a 2x2 MIMO configuration, two TX ports broadcasting simultaneously, for an aggregate maximum transmission power output of +47 dBm (50 Watts).

G = 18 dBi = 63.1 (Numeric Gain)

The power density can be estimated by the following formula:

$S = (P*G)/4\pi R^2$

Where G is the antenna gain and R is the distance from the antenna

The Maximum Permissible Exposure (MPE) level for uncontrolled access locations is
$S = f/1500 = 894/1500 = 0.6\ mW/cm^2$

As a consequence, the safe distance approach can be calculated as,
R = 6.5 m

This is the distance at which the limit level will be reached in the main beam of the antenna.

Although the QLJ4GRFN-005 is a transportable product it does not have integral antennas and requires connection to a permanent or semi-permanent antenna system. The antenna used would be mounted on a tower or similar mounting structure 10s of meters in height and therefore would provide adequate safe distance to the general population. It should also be noted that exposures inside buildings can be expected to be reduced by at least 10 to 20 dB due to the attenuation caused by building material in the wall and roof of the building (source: KDB 447498).

Based on the above information the QLJ4GRFN-005 is compliant to the MPE requirements as per FCC Rule Part § 1.1310.

2.2 ADDITIONAL FCC REFERENCES

Gain (dBi)	Numeric Gain	Gain (dBi)	Numeric Gain
1	1.3	11	12.6
2	1.6	12	15.9
3	2.0	13	20.0
4	2.5	14	25.1
5	3.2	15	31.6
6	4.0	16	39.8
7	5.0	18	63.1
8	6.3	20	100.0
9	7.9	25	316.2
10	10.0	30	1000.0

Table 2 – Antenna Gain Conversion Chart