The Quantum Dual Band HyperQ Node conduct high-resolution, wide azimuth seismic surveys run on a rechargeable Li-ion battery pack for outdoor use.

Quantum Dual Band HyperQ Node is evaluated for RF radiation exposure according to the provisions of FCC §2.1091, MPE guidelines identified in FCC §1.1310 and FCC KDB 447498:2015.

Limits for General Population/Uncontrolled Exposure: 47 CFR 1.1310 Table 1 (B)

The maximum exposure level to the public from the RF power of the EUT shall not exceed a power density, S as per the respective limits in Table 1 below, at a distance, d, of 20 cm (Mobile condition) from the EUT.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm2)	Averaging 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
300-1,500			f/1500	30
1,500-100,000			1.0	30
Where *f* is in MHz			*Plane-wave equivalent power density	

Therefore:

MPE for Quantum HyperQ node from 902.3 MHz to 908.5 MHz. The worst-case scenario for **LoRa Radio is at 902.3 MHz** is

S = 0.6015 mW/cm^2, for General Population/Uncontrolled Exposure

And for BLE radio is

S = 1 mW/cm^2, for General Population/Uncontrolled Exposure

LoRa RF conducted power measurement and antenna gain as per ETC test reports i27e24a224_DTS & DSS are reported below. The worst-case value is in highlighted below

TX	Frequency (MHz)	Max Conducted RF Output after Duty Cycle correct factors (dBm)	Max. antenna gain (dBi)	EIRP (dBm)	EIRP (mW)
LoRa 125 KHz FHSS	902.3	17.4	-3.0	14.4	27.54
	905.3	17.3	-3.0	14.3	26.92
	908.5	17.1	-3.0	14.2	26.30
BLE	2402	0.15	-0.0	0.15	1.04
	2440	-0.27	-0.0	-0.27	0.94
	2480	-0.38	-0.0	-0.38	0.92
Maximum output power limitation for BLE		6	-0.0	6	3.98
Maximum output power limitation for LoRa		22	-3.0	19	79.43

Note: The BLE and LoRa radios can operate simultaneously.

Conclusion

Using worst case scenario with **maximum output power**, the highest measured EIRP or [P*G(numeric gain)] value for both radio using max output power limitation

BLE transmitter: 3.98 mW
LoRa transmitter: 79.43 mW

Total Transmit Power (simultaneous transmit condition): BLE Transmitter power + LoRa transmitter power
: **3.98 mW + 79.43 mW**
: **83.41 mW**

Total Transmit Power (simultaneous transmit condition) rounded up: **84 mW**

Using the highest total transmitted power at a distance of 20 cm in the equation below:

$$\mathbf{S = EIRP / (4 \pi R^2)}$$

Where: S, power density in 'mW/cm^2'
EIRP, Effective Isotropic Radiated Power in 'mW'
R, distance to the center of the radiation of the antenna in 'cm'

The RF exposure from the radio is less than the limit specified as shown below and meets the exemption criteria.

$S\ (mW/cm^2) = (84\ mW) / (4 \times \pi \times 20^2)$

$S = 0.016711269\ mW/cm^2$ <<< $0.6015\ mW/cm^2$ (max limit)

Rounded up **$S = 0.017\ mW/cm^2$ <<<<<<<<<<<<<<< $0.6015\ mW/cm^2$ (max limit)**

To determine the minimum safe distance

$R = \sqrt{[EIRP / (4\pi S)]}$

$R = \sqrt{[84 / (4\pi \times 0.6015)]}$

$R = 3.333626158$ cm

Rounded up $R = 3.4$ cm

The manufacturer manual specified a minimum safe distance of **20 cm**.