APPENDIX A: RF EXPOSURE COMPLIANCE

FCC Rules and Regulations Part 1.1307, 1.1310, 2.1091, 2.1093:

1. General Information:

FCCID: GU6WJSX2000

Environment: General Population/Uncontrolled Exposure
Device category: Mobile per Part 2.1091
Modulation Type/Mode: FHSS

2. Operating Configurations and Test Conditions:

2.1 Antenna Type(s):

Antenna	Type	Gain (dBi)	Numeric Gain
Dipole	Dipole	-12	0.06

Frequency Range	Frequency Tolerance (ppm)	Emission Designator
902-928	N/A	N/A

Duty Cycle Calculation: 0.062ms (pulse width) / 100 ms = 0.62 and 10 log (62%) = -2.1 dB

Output Power (Worst Case)	Time averaging as an inherent property (100 % Duty Cycle) (W)	Time averaging as an inherent property (62 % Duty Cycle, -2.1 dB) (W)
EIRP	0.002 (2.5 dBm)	0.001 (0.4 dBm)
Conducted	0.028 (14.5 dBm)	0.017 (12.4 dBm)

3. MPE Calculation:

The maximum distance from the antenna at which MPE is met or exceeded, is calculated from the equation relating field strength E in V/m, transmit power P in Watts, transmit antenna numeric gain G, and separation distance in meters:

The Electric field generated for a 1mW/cm^2 exposure (S) is calculated as follows:

$$S = \frac{E^2}{Z}$$

where: S = Power density
E = Electric field
Z = Impedance.

$$E(V/m) = \sqrt{S \times Z} \qquad 1 \text{ mW/cm}^2 = 10 \text{ W/m}^2$$

The impedance of free space is 337 ohms, where E and H fields are perpendicular.

Thus:

$E(V/m) = \sqrt{10 \times 377}$ = 61.4 V/m

MPE Calculation:
The maximum distance, from the antenna at which MPE is met or exceeded, is calculated from the equation relating field strength E in V/m, transmit power P in Watts, transmit antenna numeric gain G, and separation distance in meters above and solving for d below:

$$E(V/m) = \frac{\sqrt{30 \times P \times G}}{d} \quad \text{and} \quad d = \frac{\sqrt{30 \times P \times G}}{E(V/m)} \quad \text{Power density:} \quad P_d(mW/cm^2) = \frac{E^2}{3770}$$

The limit for general population/uncontrolled exposure environment above 1500MHz is 1 mW/cm^2.

SEPARATION DISTANCE:

Separation Distance	Antenna Gain (-12 dBi)	Duty Cycle (%)
	Numeric gain 0.06	
Conducted Power (Watt, worst case)	(cm)	
0.017	0.3	62
0.028	0.4	100.0

Calculations:

100% duty cycle = $0.4cm = \frac{\sqrt{30 \times 0.028 \times 0.06}}{61.4}$

62% duty cycle = $0.3cm = \frac{\sqrt{30 \times 0.017 \times 0.06}}{61.4}$

$$S = \frac{P \times G}{4 \times \pi \times d^2}$$

Where:
S= Power density
P=Transmitter conducted power in watts
G=Numeric gain
D=distance to radiation center

Fundamental Operating Frequency: 902-928 MHz
Measured conducted power: 0.028W (14.5 dBm)
Antenna Gain = -12 dBi; Numeric Gain = 0.06

At 100% Duty Cycle (conducted power worst case)

$S = 28 \times 0.06/4 \times \pi \times 20^2 = 0.0003$ mW/ cm^2 at 20 cm

At 62 % Duty Cycle (conducted power worst case)

$S = 17 \times 0.06/4 \times \pi \times 20^2 = 0.0002$ mW/ cm^2 at 20 cm

Antenna Gain = -12 dBi Conducted Power (mW) = 28	
Separation Distance	
Power Density Limit	**Calculated Power density at 20 cm distance**
1 mW/cm^2	0.0003 mW/ cm^2

CONCLUSION:
The device complies with the MPE requirements by providing a safe separation distance between the antenna, including any radiating structure, and any persons.

Proposed RF exposure safety information to include in User's Manual:

CAUTION: Antenna Installation Requirement
The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.