APPENDIX A: RF EXPOSURE COMPLIANCE

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

1. General Information:

FCCID: O6YUTS-FSU811
Environment: General Population/Uncontrolled Exposure
Device category: Mobile per Part 2.1091
Modulation Type/Mode: PHS (TDMA-TDD)

2. Operating Configurations and Test Conditions:

2.1 Antenna Type(s):

Antenna	Type	Gain (dBi)	Numeric Gain
Whip	Omni	2.5	1.78
Rod	Omni	4.5	2.82
65° Directional	Patch	10	10

Frequency Range	Frequency Tolerance (ppm)	Emission Designator
1880.15-1909.85	1.7	263KDXW

10 dBi Antenna

Output Power (Worst Case)	Time averaging as an inherent property (100 % Duty Cycle) (W)	Time averaging as an inherent property (12.1 % Duty Cycle, -9.2 dB) (W)
EIRP	0.120 (20.8 dBm)	0.015 (11.6 dBm)
Conducted	0.060 (17.8 dBm)	0.007 (8.6 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 [A]	**Antenna Gain (dBi)**	**Duty Cycle (%)**
	10	
Power[B] (Watt)	(cm)	
0.007	2.3	12.1
0.060	7	100.0

Calculations:

12.1% duty cycle = $0.023m = \frac{\sqrt{30 \times 0.007 \times 10}}{61.4}$

100% duty cycle = $0.07m = \frac{\sqrt{30 \times 0.060 \times 10}}{61.4}$

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

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

Fundamental Operating Frequency: 1880.15-1909.85 MHz
Maximum Rated Output Power: 80mW
Measured conducted power: 0.060W (17.8 dBm)
Antenna Gain = 10 dBi; Numeric Gain = 10

At 100% Duty Cycle

$S = 60 \times 10/4 \times \pi \times 20^2 = 0.119$ mW/ cm^2 at 20 cm

At 12.1 % Duty Cycle

$S = 7 \times 10/4 \times \pi \times 20^2 = 0.01$ mW/ cm^2 at 20 cm

Antenna Gain = 10 dBi Conducted Power (mW) = 60	
Separation Distance	
Power Density Limit	Calculated Power density at 20 cm distance
1 mW/cm^2	0.119 mW/ cm^2

Notes:
[A] = Distances are calculated for the largest (worst-case) separation distance as applicable
[B] = Measured radiated output power EIRP

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.

Duty Cycle Calculation: 0.6ms / 4.96 ms = 0.121 and 10 log (12.1%) = -9.2 dB