



KENURE DEVELOPMENTS LIMITED
THE COMPLETE DESIGN AND CONTRACT MANUFACTURE SERVICE
Registered Office: Springlakes Deadbrook Lane Aldershot Hampshire GU12 4UH
Tel: (01252) 338554 Fax:(01252) 329105
Registration No: 2265402
ISO 9001 GB13/87609

RF Exposure and Transmitter Power Considerations for the DataSend900

FCC ID: MS8C9G

The FCC requires that the calculated MPE be equal to or less than a given limit dependent on frequency at a distance of 20 cm from a device to the body of a user.

The transmitter operation for the DataSend900 covers the 902 MHz to 928 MHz ISM band. The DataSend900 also contains a 2G/3G WWAN modem (FCC ID: RI7HE910) using the GSM850 and PCS1900 operating bands.

The following FCC Rule Parts and procedures are applicable:

Part 1.1310 – Radiofrequency radiation exposure limits

Part 2.1091 – Radiofrequency radiation exposure evaluation: mobile devices

Part 15.247(b)(2) - The maximum peak conducted output power of the intentional radiator shall not exceed the following: For frequency hopping systems operating in the 902–928 MHz band: 1 watt for systems employing at least 50 hopping channels.

Part 15.247(b)(4) - The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi.

Part 22.913(a)(2)

The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

Part 24.232(c)

Mobile/ Portable stations are limited to 2 Watts EIRP peak power

KDB447498 D01 v05r02

Mobile and Portable Devices RF Exposure Procedures and Equipment Authorisation Policies

The MPE calculation as given in FCC OET Bulletin 65, page 19 is used to calculate the safe operating distance for the user.



KENURE DEVELOPMENTS LIMITED

THE COMPLETE DESIGN AND CONTRACT MANUFACTURE SERVICE
Registered Office: Springlakes Deadbrook Lane Aldershot Hampshire GU12 4UH
Tel: (01252) 338554 Fax:(01252) 329105
Registration No: 2265402
ISO 9001 GB13/87609

Maximum Transmitter Power Considerations

For ISM Band 902MHz to 928MHz

Maximum measured conducted transmitter power = 20.8 dBm (120 mW)

Maximum specified antenna gain = 2.15 dBi

$$\begin{aligned}\text{EIRP} &= 21.2 + 2.15 = 23.35 \text{ dBm} \\ &= 216 \text{ mW}\end{aligned}$$

Therefore the DataSend900 meets Part 15.247(b)(2) & 15.247(b)(4) conducted and de facto EIRP power limits (1 W and 4W respectively).

For GSM 850 MHz 2G Operation

Transmitter frequency range = 824.2 MHz to 848.8 MHz

Conducted power = 33.0 dBm (1995 mW)

Specified antenna gain = 2.0 dBi

$$\begin{aligned}\text{EIRP} &= 33.0 + 2.0 = 35.0 \text{ dBm} \\ &= 3162 \text{ mW}\end{aligned}$$

For Class 10 GPRS with 2 uplink timeslots, duty cycle = 25%

$$\text{EIRP}_{\text{eff}} = 3162/4 = 791 \text{ mW}$$

For GSM 850 MHz 3G Operation

Transmitter frequency range = 826.4 MHz to 846.4 MHz

Conducted power = 26.5 dBm (446 mW)

Specified antenna gain = 2.0 dBi

$$\begin{aligned}\text{EIRP} &= 26.5 + 2.0 = 28.5 \text{ dBm} \\ &= 708 \text{ mW}\end{aligned}$$

Therefore the DataSend900 meets Part 22.913(a)(2) power limits (ERP 7 Watts).

Also the categorical exclusion provision of FCC Part 2.1091(c) applies as $\text{ERP}_{\text{eff}} < 1.5\text{W}$ (with considerations of source based time averaging as per KDB 447498 Section 4.1(2))



KENURE DEVELOPMENTS LIMITED
THE COMPLETE DESIGN AND CONTRACT MANUFACTURE SERVICE
Registered Office: Springlakes Deadbrook Lane Aldershot Hampshire GU12 4UH
Tel: (01252) 338554 Fax:(01252) 329105
Registration No: 2265402
ISO 9001 GB13/87609

For PCS 1900 MHz 2G Operation

Transmitter frequency range = 1850.2 MHz to 1909.8 MHz

Conducted Power = 30.0 dBm (993 mW)

Specified antenna gain = 2.0 dBi

$$\text{EIRP} = 30.0 + 2.0 = 32.0$$

$$= 1585 \text{ mW}$$

For Class 10 GPRS with 2 uplink timeslots, duty cycle = 25%

$$\text{EIRP}_{\text{eff}} = 1585/4 = 396 \text{ mW}$$

For PCS 1900 MHz 3G Operation

Transmitter frequency range = 1852.4 MHz to 1907.6 MHz

Conducted power = 26.5 dBm (243 mW)

Specified antenna gain = 2.0 dBi

$$\text{EIRP} = 23.9 + 2.0 = 25.9 \text{ dBm}$$

$$= 389 \text{ mW}$$

Therefore the DataSend900 meets 24.232(c) power limits (EIRP 2 Watts).

Also the categorical exclusion provision of FCC Part 2.1091(c) applies as $\text{EIRP}_{\text{eff}} < 3.0\text{W}$
(with considerations of source based time averaging as per KDB 447498 Section 4.1(2))



MPE Calculations

The MPE calculation as given in ANSI C95.1 is used to calculate the safe operating distance for the user.

$$S = \text{EIRP} / 4 \pi R^2$$

Where

S = Power density

EIRP = Effective Isotropic Radiated Power (EIRP = P x G)

P = Conducted Transmitter Power

G = Antenna Gain (relative to an isotropic radiator)

R = distance to the centre of radiation of the antenna (safe operating distance)

For ISM Band 902 MHz to 928 MHz

Values:

Transmitter frequency range = 902.3976 MHz to 927.3976 MHz

EIRP = 216 mW

R = 20 cm

Power Density Requirement

From table 1 (b) - Limits for General Population/ Uncontrolled Exposure of FCC Rule Part 1.1310 for ISM 915 MHz

$S = f / 1500 \text{ mW/cm}^2$ (f = operating frequency)

$S_{\text{req1}} = 902.3976 / 1500 = 0.60 \text{ mW/cm}^2$ (worst case)



KENURE DEVELOPMENTS LIMITED

THE COMPLETE DESIGN AND CONTRACT MANUFACTURE SERVICE
Registered Office: Springlakes Deadbrook Lane Aldershot Hampshire GU12 4UH
Tel: (01252) 338554 Fax:(01252) 329105
Registration No: 2265402
ISO 9001 GB13/87609

Calculation:

$$S = \text{EIRP} / 4 \pi R^2$$

$$S = 216 / (12.56 \times 20^2)$$

$$S = 216 / (5027)$$

$$S_1 = 0.043 \text{ mW/cm}^2 (<0.60 \text{ mW/cm}^2)$$

For GSM 850 MHz (Worst case 2G operation)

Values:

Transmitter frequency range = 824.2 MHz to 848.8 MHz

$\text{EIRP}_{\text{eff}} = 791 \text{ mW}$

$R = 20\text{cm}$

Power Density Requirement

From table 1 (b) - Limits for General Population/ Uncontrolled Exposure of FCC Rule Part 1.1310 for 850MHz

$$S = f / 1500 \text{ mW/cm}^2 \text{ (f = operating frequency)}$$

$$S_{\text{req2}} = 824.2 / 1500 = 0.55 \text{ mW/cm}^2 \text{ (worst case)}$$

Calculation:

$$S = \text{EIRP}_{\text{eff}} / 4 \pi R^2$$

$$S = 791 / (12.56 \times 20^2)$$

$$S = 791 / (5027)$$

$$S_2 = 0.16 \text{ mW/cm}^2 (<0.55 \text{ mW/cm}^2)$$



KENURE DEVELOPMENTS LIMITED
THE COMPLETE DESIGN AND CONTRACT MANUFACTURE SERVICE
Registered Office: Springlakes Deadbrook Lane Aldershot Hampshire GU12 4UH
Tel: (01252) 338554 Fax:(01252) 329105
Registration No: 2265402
ISO 9001 GB13/87609

For PCS 1900 MHz (Worst case 2G operation)

Values:

Transmitter frequency range = 1850.2 MHz to 1909.8 MHz

$EIRP_{eff} = 396 \text{ mW}$

$R = 20\text{cm}$

Power Density Requirement

From table 1 (b) - Limits for General Population/ Uncontrolled Exposure of
FCC Rule Part 1.1310 for 1900MHz

$$S_{req3} = 1.0 \text{ mW/cm}^2$$

Calculation:

$$S = EIRP_{eff} / 4 \pi R^2$$

$$S = 396 / (12.56 \times 20^2)$$

$$S = 396 / (5027)$$

$$S_3 = 0.079 \text{ mW/cm}^2 (<1.0 \text{ mW/cm}^2)$$



KENURE DEVELOPMENTS LIMITED
THE COMPLETE DESIGN AND CONTRACT MANUFACTURE SERVICE
Registered Office: Springlakes Deadbrook Lane Aldershot Hampshire GU12 4UH
Tel: (01252) 338554 Fax:(01252) 329105
Registration No: 2265402
ISO 9001 GB13/87609

KDB447498 D01 v05r02 Section 7.2 Simultaneous Transmission Considerations

Worst case summation of calculated MPE ratios for 902 MHz to 928 MHz ISM Band and GSM or PCS simultaneously transmitting transmitters.

$$\begin{aligned}\text{ie: } \sum \text{MPE}_{\text{ratios}} &= (S_1 / S_{\text{req1}}) + (S_2 / S_{\text{req2}}) \\ &= (0.043/0.60) + (0.16/0.55) \\ &= 0.072 + 0.291 = 0.363\end{aligned}$$

\sum of MPE ratios is <1.0 and therefore in accordance with KDB447498 Section 7.2 and simultaneous transmission test exclusion applies for the 902 MHz to 928 MHz ISM Band and GSM/ PCS transmitters.

Conclusion

The required 20 cm RF exposure limits for General Population/ Uncontrolled Exposure and the FCC Rule Part 15.247(b)(2), 22.913(a)(2) and 24.232(c) maximum transmitter power limits will not be exceeded for the DataSend900 using antennas having a maximum gain of 2.15 dBi and 2.0 dBi for the ISM and GSM antennas respectively.