Appendix A Calculation Of Effective Radiated Power From Radiated Field Strength

In order to determine the transmit power from an intentional radiator with no external antenna it is necessary to use the radiated field strength. The calculation uses the following formula:

$$E = \frac{\sqrt{(30.P.G)}}{d}$$

Where:

E is the radiated field strength in V/m;
P is the power transmitted in Watts;
G is the gain of the transmit antenna;
d is the distance from the transmitter at which field strength E was recorded

Rearranging gives:

$$P = \frac{E^2.d^2}{30.G}$$

Converting to logarithmic units (multiplication becomes addition, division becomes subtraction) gives:

$$P\ dB(W) = E\ dB(V/m) + 20\log10\ (d) - 10\log_{10}(30) - 10\log_{10}\ (G).$$

For the purposes of calculating the effective radiated power the unit under test is assumed to have unity gain (i.e. 0dB). so:

$$P\ dB(W) = E\ dB(V/m) + 20\log10\ (d) - 10\log_{10}(30)$$

To convert dBm to dB(W) subtract 30, to convert dB(µV/m) to dB(V/m) subtract 120, giving:

$$P\ dBm - 30 = E\ dB(\mu V/m) - 120 + 20\log10\ (d) - 10\log_{10}(30)$$

Substitute for $10\log_{10}(30)$ gives

$$P\ dBm - 30 = E\ dB(\mu V/m) - 120 + 20\log10\ (d) - 14.77$$

For d = 3m the final calculation is:

$$P\ dBm = E\ dB(\mu V/m) - 120 + 9.5 - 14.77 + 30$$

$P\ dBm = E\ dB(\mu V/m) - 95.27$

If the unit has an antenna of gain GdB attached when taking the field strength measurement then you adjust the value of P above by subtracting G.

Note: 1 Watt = 30 dBm