# Single-carrier

is a function of time, even for QPSK because of pulse shaping:

is the “nominal” magnitude.

Consider the QPSK constellation:

Instantaneous power is

Average and peak powers are

PAPRs are

Both average and peak BB powers are boosted by 3dB compared to I/Q, so PAPR is the same. When converting from BB to RF, peak power remains the same but average power drops by 3dB due to the cosine term, so RF PAPR is 3dB higher than BB PAPR.

# OFDM

For simplicity, consider one tone.

Instantaneous power is

Average and peak powers are

PAPRs are

As in single-carrier, the cosine term drops average power by 3dB, so average I/Q and RF powers are 3dB lower than BB power. Peak is always the same, so I/Q and RF PAPR is 3dB higher than BB PAPR.

In practice, the difference between I/Q and BB PAPR is usually less than 3dB.