January 1999 doc.: IEEE 802.11-99/033

Transmit Modulation Accuracy

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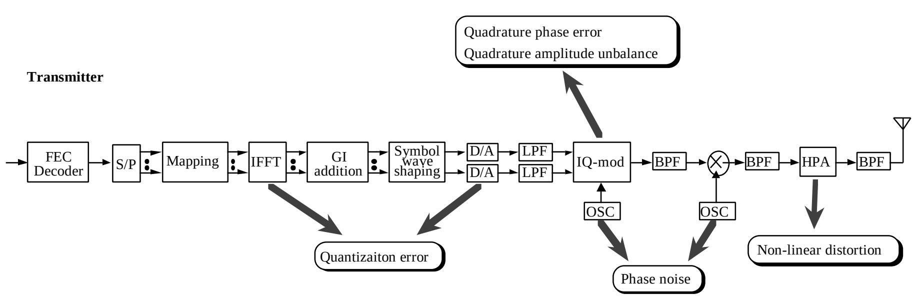
Considered degradation factors at transmitter



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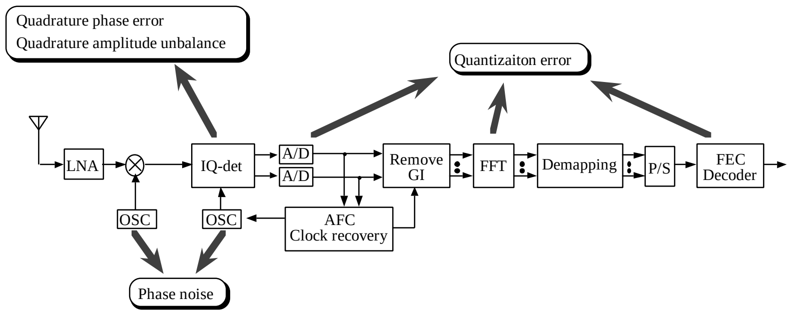
Considered degradation factors at receiver



Receiver

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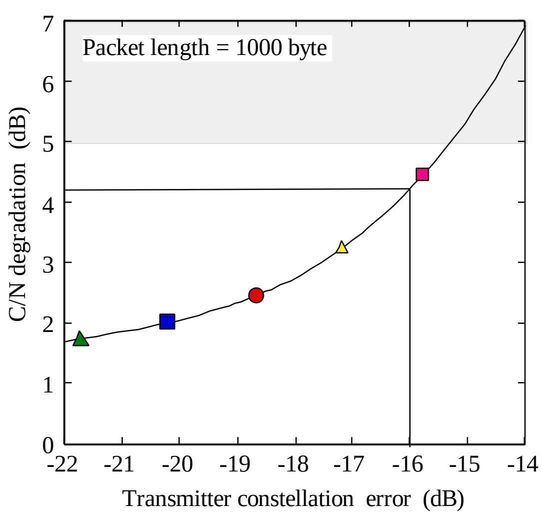
C/N degradation with degradation factor

(16QAM-OFDM Information data rate = 24 Mbit/s, Coding rate = 1/2)



C/N degradation versus Constellation error

Tx
- OBO = 3.7 dB (C.E. = -16.2 dB)
- 4.3 (-17.8 dB)
- 5.0 (-19.6 dB)
- 5.7 (-21.5 dB)
- 6.5 (-23.8 dB)

(Rapp model ($p_k = 2$))

QPE = 3° (C.E. = -31.4 dB)
QAU = 0.5 dB (-31.1 dB)
D/A resolution = 8 bit (-34.4 dB)
IFFT word length = 8 bit (-40.9 dB)
Phase noise = -23 dB (-37.7 dB)
(corner freq. = 5 kHz)

Rx

QPE = 3°
QAU = 0.5 dB
A/D resolution = 8 bit
FFT word length = 8 bit
Soft decision = 6 bit
Phase noise = -23 dB
(corner freq. = 5 kHz)

* QPE : Quadrature phase error
QAU : Quadrature amplitude unbalance

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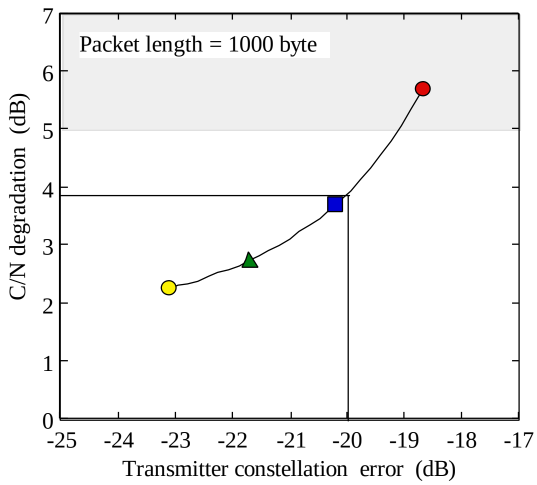
C/N degradation with degradation factor

(16QAM-OFDM Information data rate = 36 Mbit/s, Coding rate = 3/4)



C/N degradation versus Constellation error

Tx
- ● OBO = 5.0 dB (C.E. = -19.6 dB)
- ■ 5.7 (-21.5 dB)
- ▲ 6.5 (-23.8 dB)
- ○ 7.4 (-26.3 dB)

(Rapp model ($p_k = 2$))

QPE = 3° (C.E. = -31.4 dB)
QAU = 0.5 dB (-31.1 dB)
D/A resolution = 8 bit (-34.4 dB)
IFFT word length = 8 bit (-40.9 dB)
Phase noise = -23 dB (-37.7 dB)
(corner freq. = 5 kHz)

Rx
QPE = 3°
QAU = 0.5 dB
A/D resolution = 8 bit
FFT word length = 8 bit
Soft decision = 6 bit
Phase noise = -23 dB
(corner freq. = 5 kHz)

* QPE : Quadrature phase error
QAU : Quadrature amplitude unbalance

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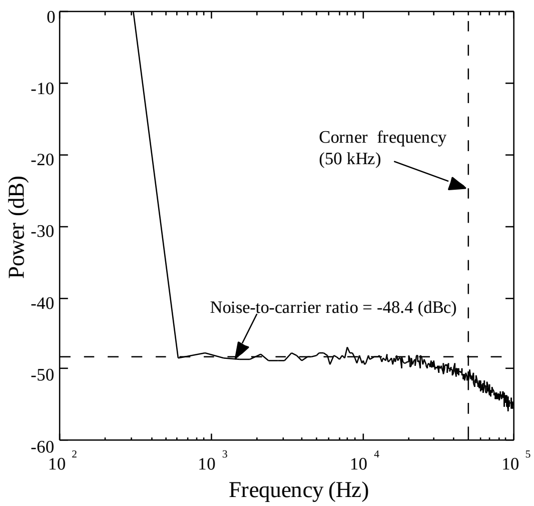
Conclusion

Proposed transmitter constellation error is shown below.

Allowed Relative Constellation Error versus Data Rate

Data Rate	Relative Constellation Error
24 Mbit/s	-16 dB
36 Mbit/s	-20 dB



Example of phase noise spectrum
at φ^2rms = -20 dB and F_c = 50 kHz

Phase noise model

$\exp(j\varphi_k) = \exp(j\varphi_{RMS}\, x_k)$

$x_{k+1} = x_k + \alpha(\beta N(0,1) - x_k)$

$x_0 = N(0,1)$

$\alpha = 2\pi F_c T_s$

$\beta^2 = (2/\alpha) - 1$

$\exp(j\varphi_k)$: Phase noise

Noise (mean value = 0, variance =1) : N(0,1)

Corner freq. : F_c = 50 kHz

Phase variance : φ^2_{RMS}

Sampling period : $T_s = 5.0 \times 10^{-8}$ (sec)

Resolution bandwidth = 305 Hz (24.8 dB)

Phase noise within coner frequency
= -48.4 - 24.8 = **-73.2** (dBc/Hz)

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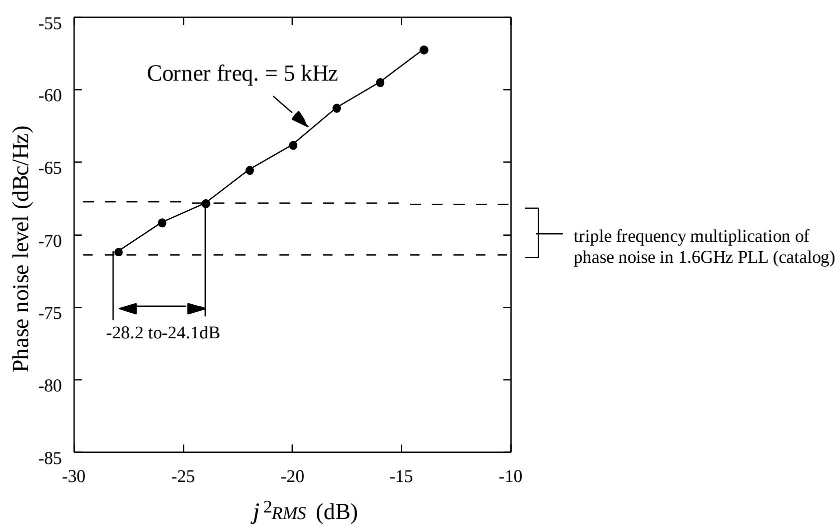

Phase noise level versus Phase variance

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