IEEE P802.15
Wireless Personal Area Networks

Project	IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)
Title	Proposed Text on π/2 BPSK and (G) MSK description
Date Submitted	September, 11th, 2008
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Re:	
Abstract	IEEE 802.15 TG3c Comment Resolution CID#402 and # 610
Purpose	Suggested text on π/2 BPSK and (G) MSK description
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12.2.2.1.1 π/2 BPSK and Pre-coded (G)MSK

The $\pi/2$-shift BPSK ($\pi/2$ BPSK) modulation is a binary phase modulation scheme with $\pi/2$ phase shift counter-clockwise. Figure 189(a) shows the signal constellation of $\pi/2$ BPSK signals, and Figure 190(a) shows the $\pi/2$ BPSK modulator. The data chips $d_1, d_2, ..., d_N$, where $d_N=1$ or -1, at the output of PCES inserter shown in Figure 194 are mapped onto constellation points z_n as follows:

$$z_n = j^n \cdot d_n \quad n = 1, 2, ..., N,$$

where j denotes $\pi/2$ phase rotation. c_n in Figure 190(a) denotes a complex envelop of filtered $\pi/2$ BPSK signal. Note that the normalization factor is 1 for $\pi/2$ BPSK.

Pre-coded MSK/GMSK ((G)MSK) modulation is a continuous phase modulation scheme by applying differential pre-coding before the (G)MSK modulation. The differential pre-coding is defined by

$$a_n = d_n \cdot d_{n-1}, \quad n = 1, 2, ..., N,$$

where $d_0 = 1$. The differential pre-coded bits are then fed to the (G)MSK encoder. The waveform of (G)MSK shown in Figure 189(b), which is the output of the (G)MSK encoder c_n, is approximately equivalent to that of filtered $\pi/2$ BPSK, if an appropriate pulse shaping filter for $\pi/2$ BPSK is employed. This is further illustrated in Figure 190(b). The filtered waveform of each modulation signal shall satisfy transmit PSD mask as in 12.3.4.1.
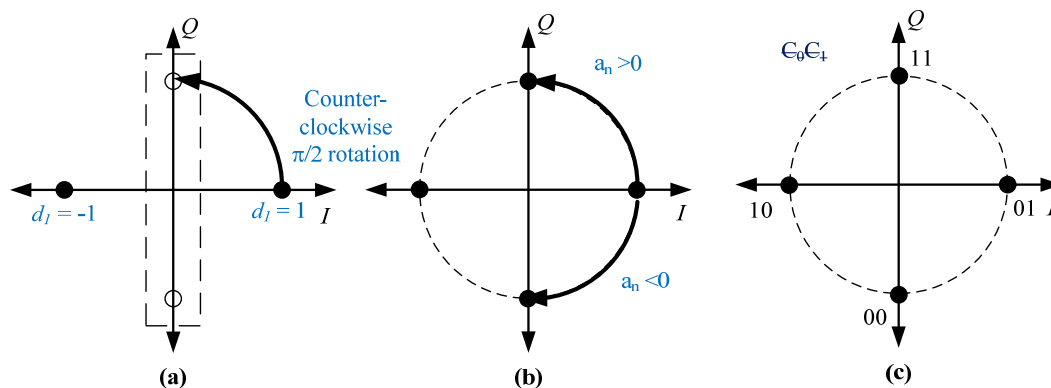

Figure 189—Constellation maps for modulation schemes: (a) π/2 BPSK, (b) pre-coded (G)MSK, (c) π/2 QPSK
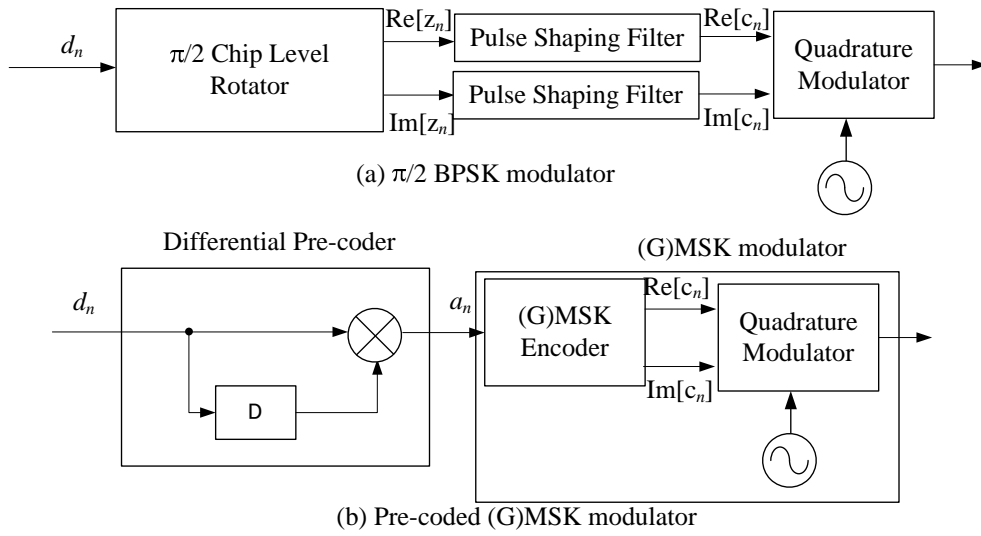
(a) π/2 BPSK modulator

(b) Pre-coded (G)MSK modulator

Figure 190—(a) π/2 BPSK modulator and (b) pre-coded (G)MSK modulator