Test mode 6 autocorrelation improvement

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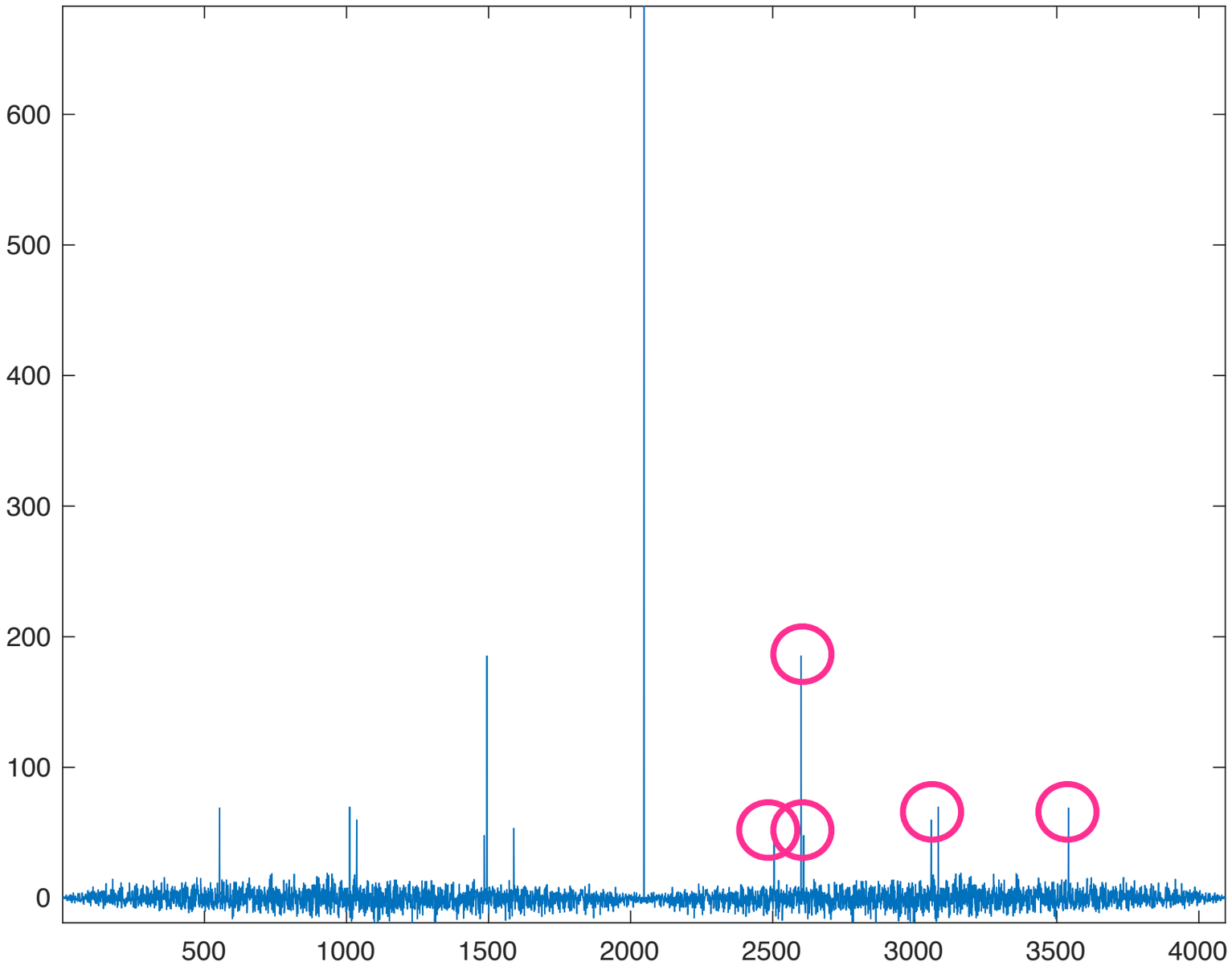
Current test mode 6 definition on P802.3bv/D3.1

- Autocorrelation of test mode 6 signal according to 115.5.6:



115.5.6 Test mode 6

When test mode 6 is enabled, the PMA shall transmit the sequence of symbols s_n generated by the scrambler generator polynomials per Equation (115–25) and Equation (115–26).

$$g_0(x) = 1 + x^9 + x^{11} \quad (115–25)$$

$$g_1(x) = 1 + x^7 + x^9 + x^{10} + x^{11} \quad (115–26)$$

The two maximum-length shift registers used to generate the sequences defined by these polynomials shall be updated once per symbol interval (nominally 1000/325 ns). The reset value of both shift registers shall be 0x7FF, so the content of both registers start aligned to all ones when the PHY is configured to generate the test mode 6 pattern.

The bits stored in the shift register at a particular time n are denoted $Scr0_n[10:0]$ for the scrambler defined per Equation (115–25). At each symbol period this shift register is advanced by one bit and one new bit represented by $Scr0_n[0]$ is generated. Bits $Scr0_n[8]$ and $Scr0_n[10]$ are exclusive OR'd together to generate the next $Scr0_n[0]$ bit.

The bits stored in the shift register at a particular time n are denoted $Scr1_n[10:0]$ for the scrambler defined per Equation (115–26). At each symbol period this shift register is advanced by one bit and one new bit

represented by $Scr1_n[0]$ is generated. Bits $Scr1_n[10]$, $Scr1_n[9]$, $Scr1_n[8]$, and $Scr1_n[6]$ are exclusive OR'd together to generate the next $Scr1_n[0]$ bit.

The bit sequences $x00_n$, $x01_n$, $x02_n$, and $x03_n$ generated from combinations of bits of the two scramblers shall be used to generate the PAM16 symbols, $y0_n$, according to Equation (115–27).

$$\begin{aligned} x00_n &= Scr1_n[0] \\ x01_n &= Scr1_n[1] \wedge Scr0_n[4] \\ x02_n &= Scr1_n[2] \wedge Scr0_n[9] \\ x03_n &= Scr1_n[0] \wedge Scr0_n[10] \\ y0_n &= x00_n + 2 \times x01_n + 4 \times x02_n + 8 \times x03_n \end{aligned} \tag{115–27}$$

The bit sequences $x10_n$, $x11_n$, $x12_n$, and $x13_n$ generated from combinations of bits of the two scramblers shall be used to generate the PAM16 symbols, $y1_n$, according to Equation (115–28).

$$\begin{aligned} x10_n &= Scr0_n[0] \\ x11_n &= Scr0_n[1] \wedge Scr1_n[4] \\ x12_n &= Scr0_n[2] \wedge Scr1_n[9] \\ x13_n &= Scr0_n[0] \wedge Scr1_n[10] \\ y1_n &= x10_n + 2 \times x11_n + 4 \times x12_n + 8 \times x13_n \end{aligned} \tag{115–28}$$

From $y0_n$ and $y1_n$, the PAM256 symbols s_n shall be generated according to Equation (115–29). The transmitter shall time the transmit symbols s_n from its local symbol clock.

$$s_n = \frac{1}{256}(2 \times (16 \times y0_n + y1_n) - 255) \tag{115–29}$$

Proposal for P802.3bv/D3.2 - Matlab code

```
% Generate the reference test signal pattern for test mode 6
function tm6 = tm6gen()
  Ns = 2^11 - 1;

  scr1 = lfsrgen([1 9 11],      Ns, '7FF').';
  scr2 = lfsrgen([1 7 9 10 11], Ns, '7FF').';

  x1 = [circshift(scr2, 0), ...
        mod((circshift(scr2, 1) + circshift(scr1, 4)),  2), ...
        mod((circshift(scr2, 2) + circshift(scr1, 9)),  2), ...
        mod((circshift(scr2, 0) + circshift(scr1, 10)), 2)];

  y1 = x1(:,1) + 2*x1(:,2) + 4*x1(:,3) + 8*x1(:,4);

  x2 = [circshift(scr1, 0), ...
        mod((circshift(scr1, 1) + circshift(scr2, 4)),  2), ...
        mod((circshift(scr1, 2) + circshift(scr2, 9)),  2), ...
        mod((circshift(scr1, 0) + circshift(scr2, 10)), 2)];

  y2 = x2(:,1) + 2*x2(:,2) + 4*x2(:,3) + 8*x2(:,4);

  tm6 = ((2*(16*y1 + y2) - 255)/256).';
end
```

Proposal for P802.3bv/D3.2 - autocorrelation

- Autocorrelation of proposed improved test mode 6 signal: