

PLC Preamble for IEEE P802.3bn EPoC Geneva, 15-19 July 2013

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PLC Preamble

- BPSK mapping: $0 \rightarrow +1, 1 \rightarrow -1$
- Preamble cyclically extended in frequency for 16, 32 and 64 subcarriers
- 2-D correlation sequence is separable, i.e. low hardware complexity:
 - Correlation in freq. direction first
 - Correlation in time direction next (moving average filter)
 - At each new symbol, reuse previously calculated freq. direction correlation. No need to recalculate all 56 samples (or 112 samples) 2-D correlation every time

4K FFT PLC Preamble

2-D TX Preamble Sequence

Subcarrier ↑

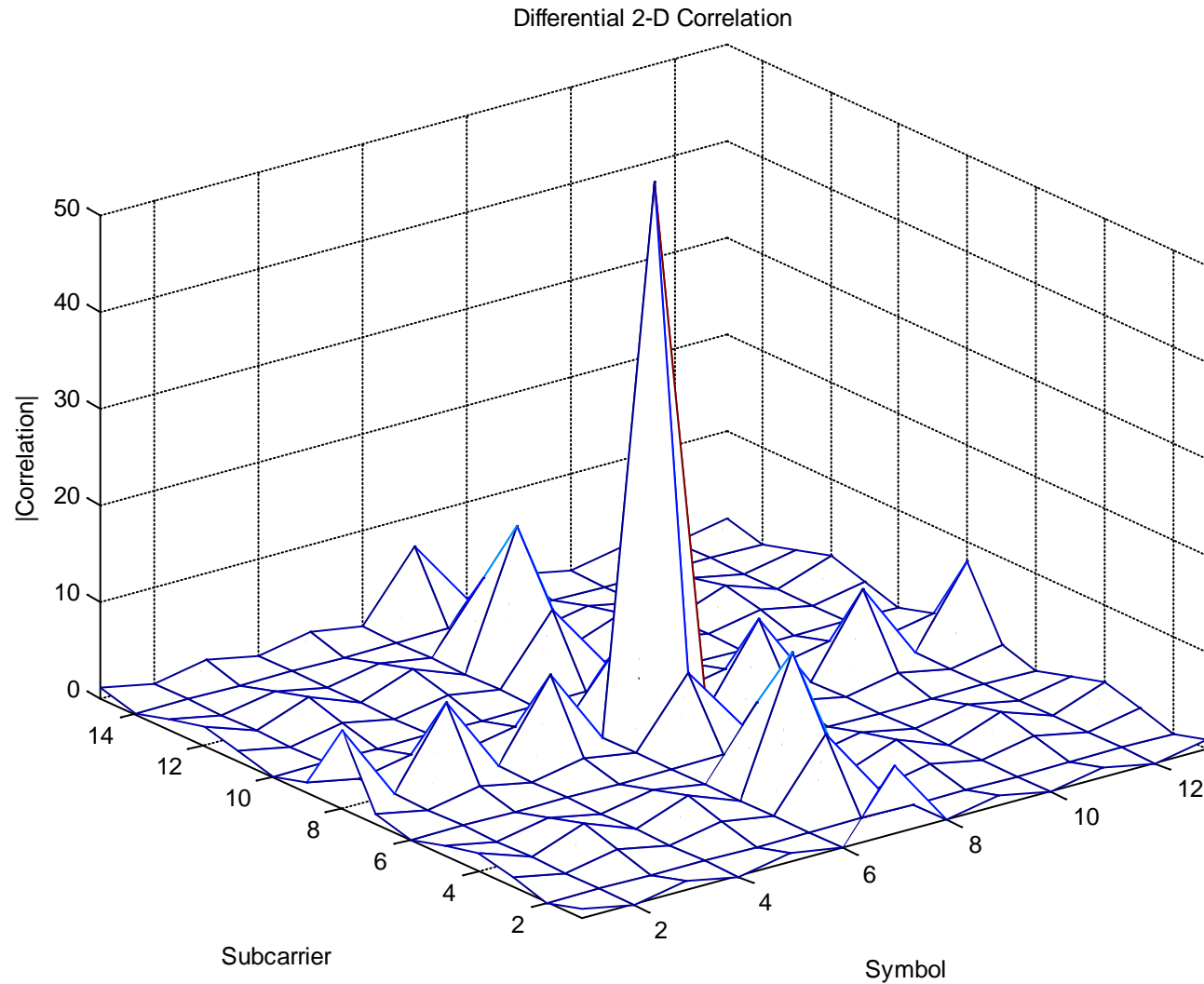
1	0	1	0	0	0	1	1
1	0	1	0	0	0	1	1
1	0	1	0	0	0	1	1
0	0	0	0	1	0	0	1
1	0	1	0	0	0	1	1
0	0	0	0	1	0	0	1
0	0	0	0	1	0	0	1
1	0	1	0	0	0	1	1

Differential demodulated sequence

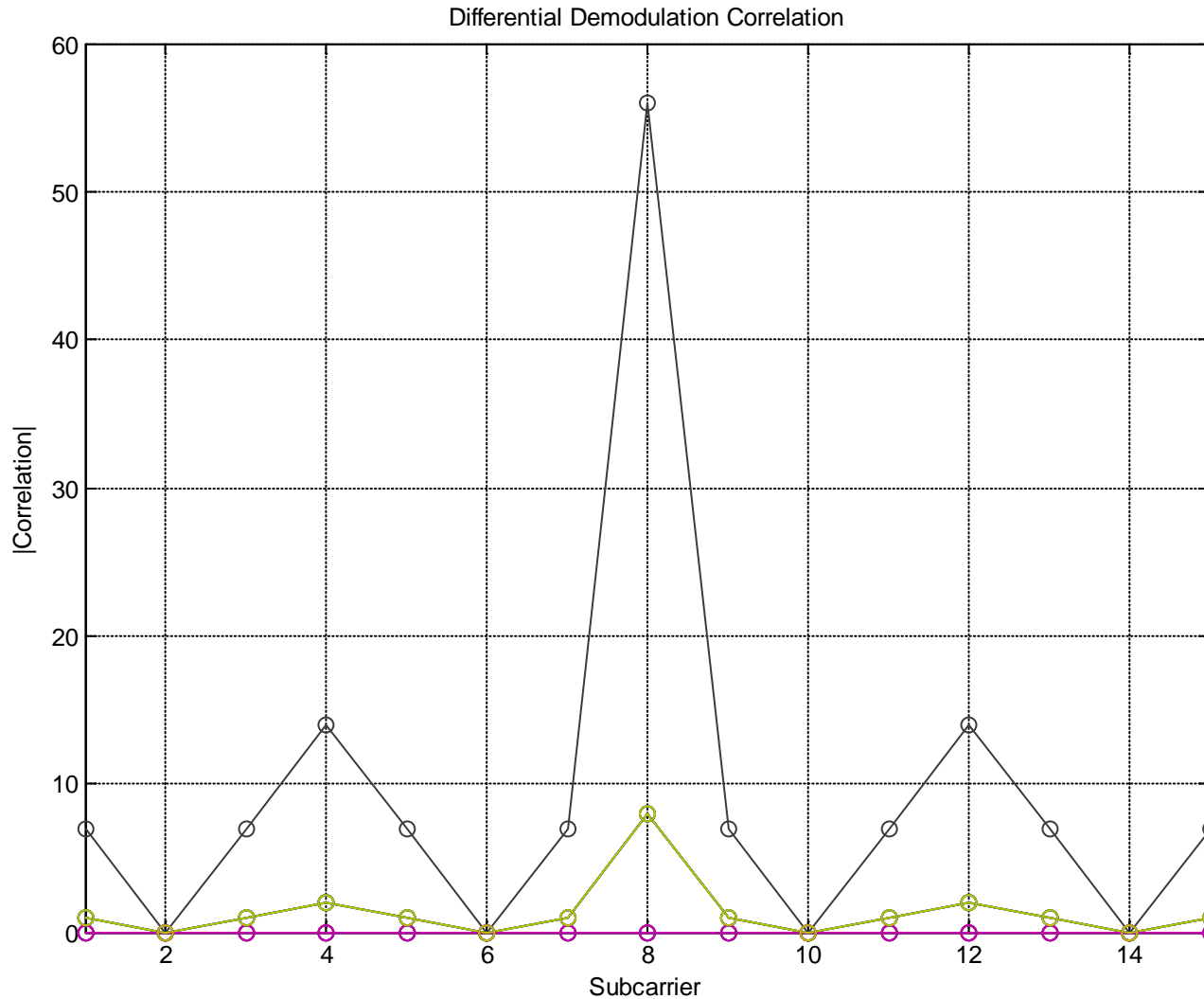
X	1	1	1	0	0	1	0
X	1	1	1	0	0	1	0
X	1	1	1	0	0	1	0
X	0	0	0	1	1	0	1
X	1	1	1	0	0	1	0
X	0	0	0	1	1	0	1
X	0	0	0	1	1	0	1
X	1	1	1	0	0	1	0

Symbol →

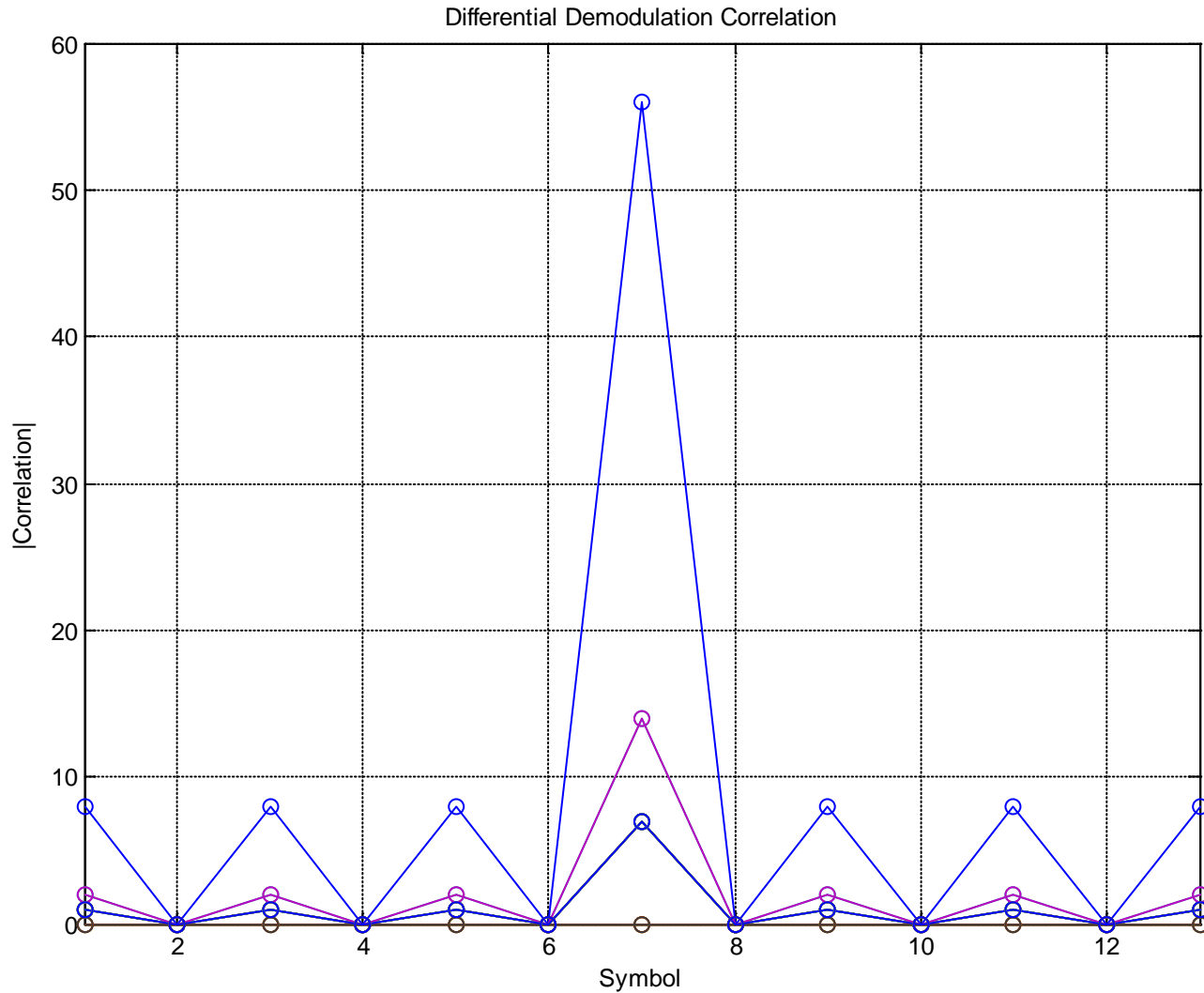
Differential 2-D Correlation



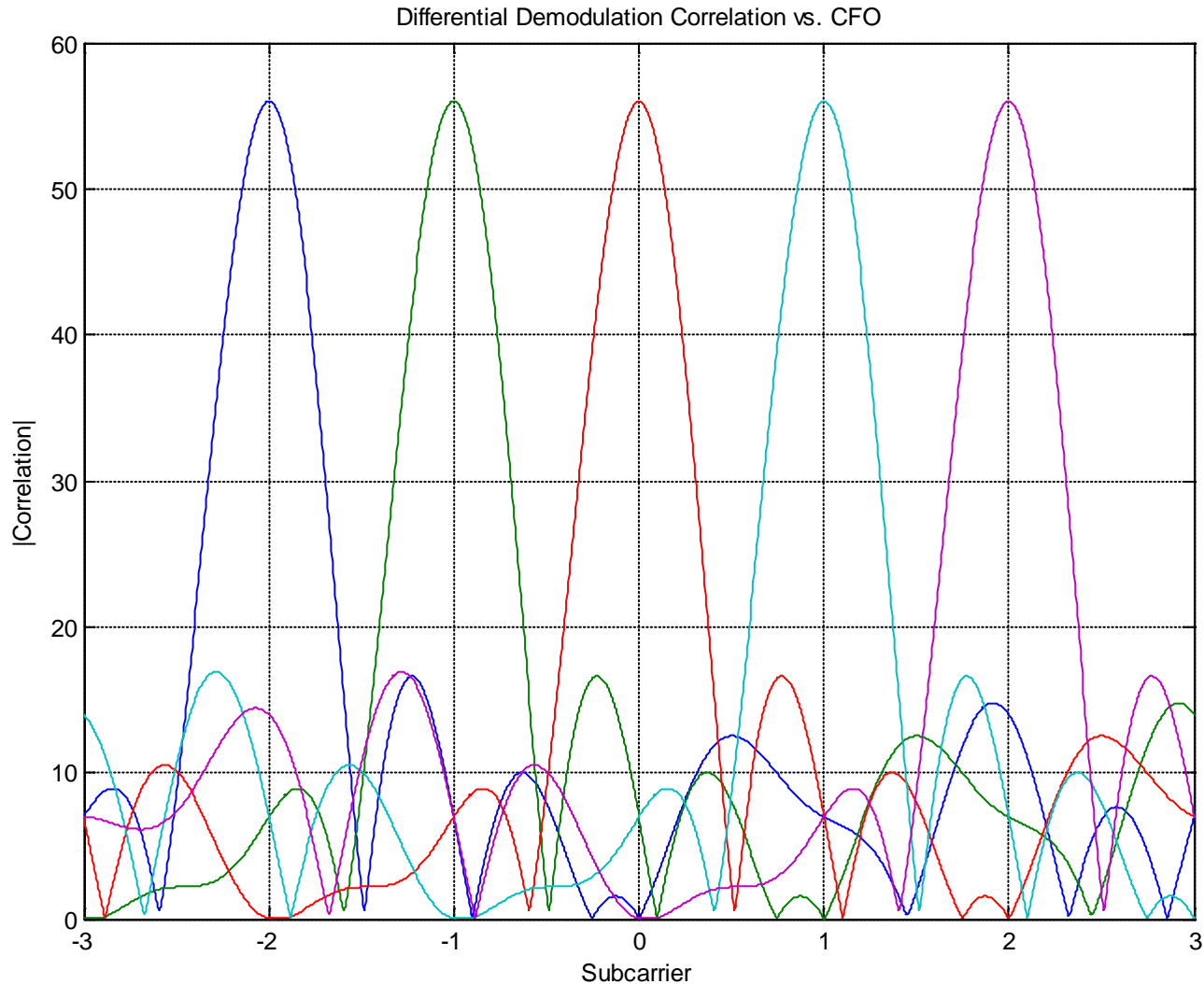
Differential Correlation, Subcarrier direction



Differential Correlation, Symbol direction

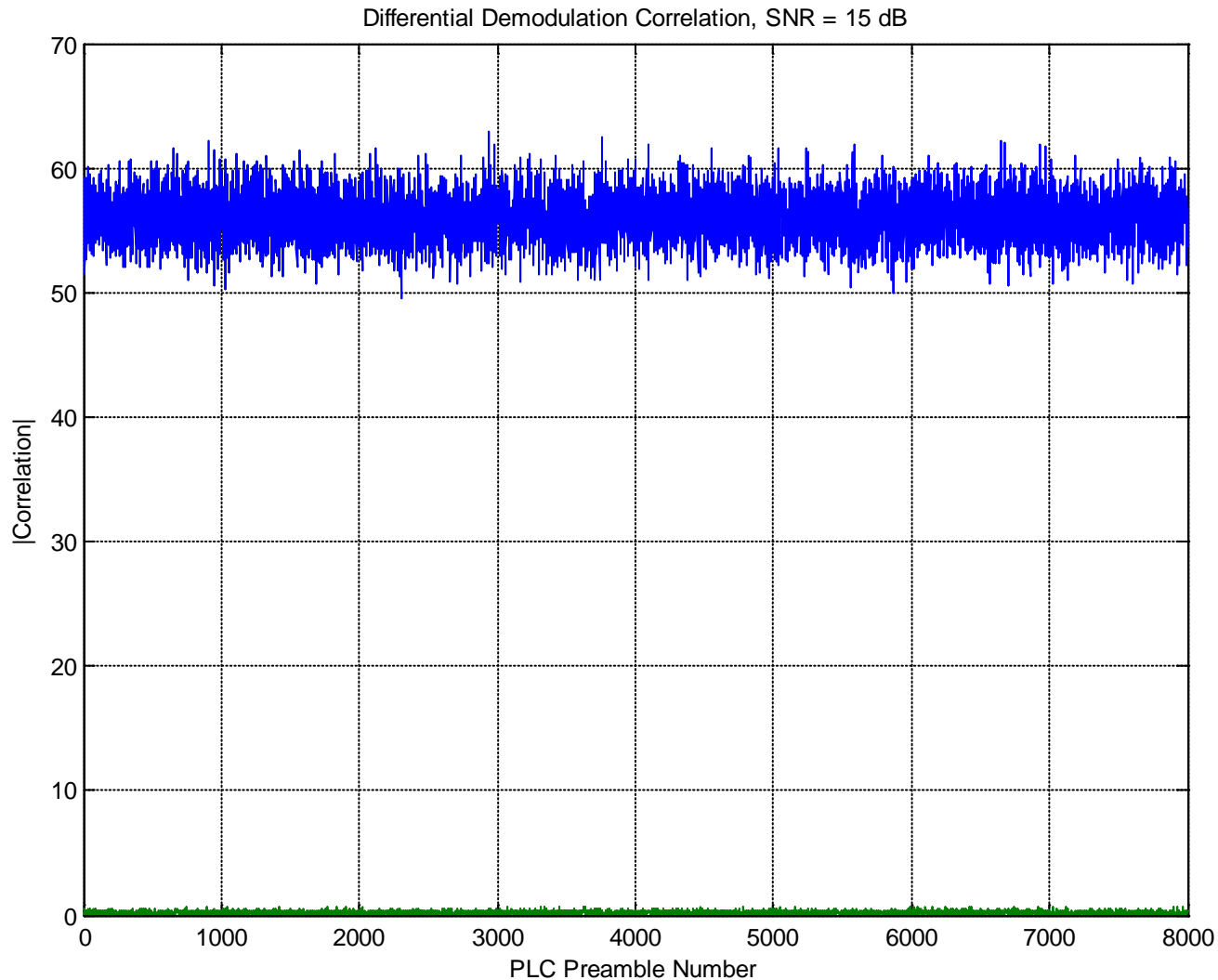


Differentially Demodulated Parallel Correlator vs. CFO

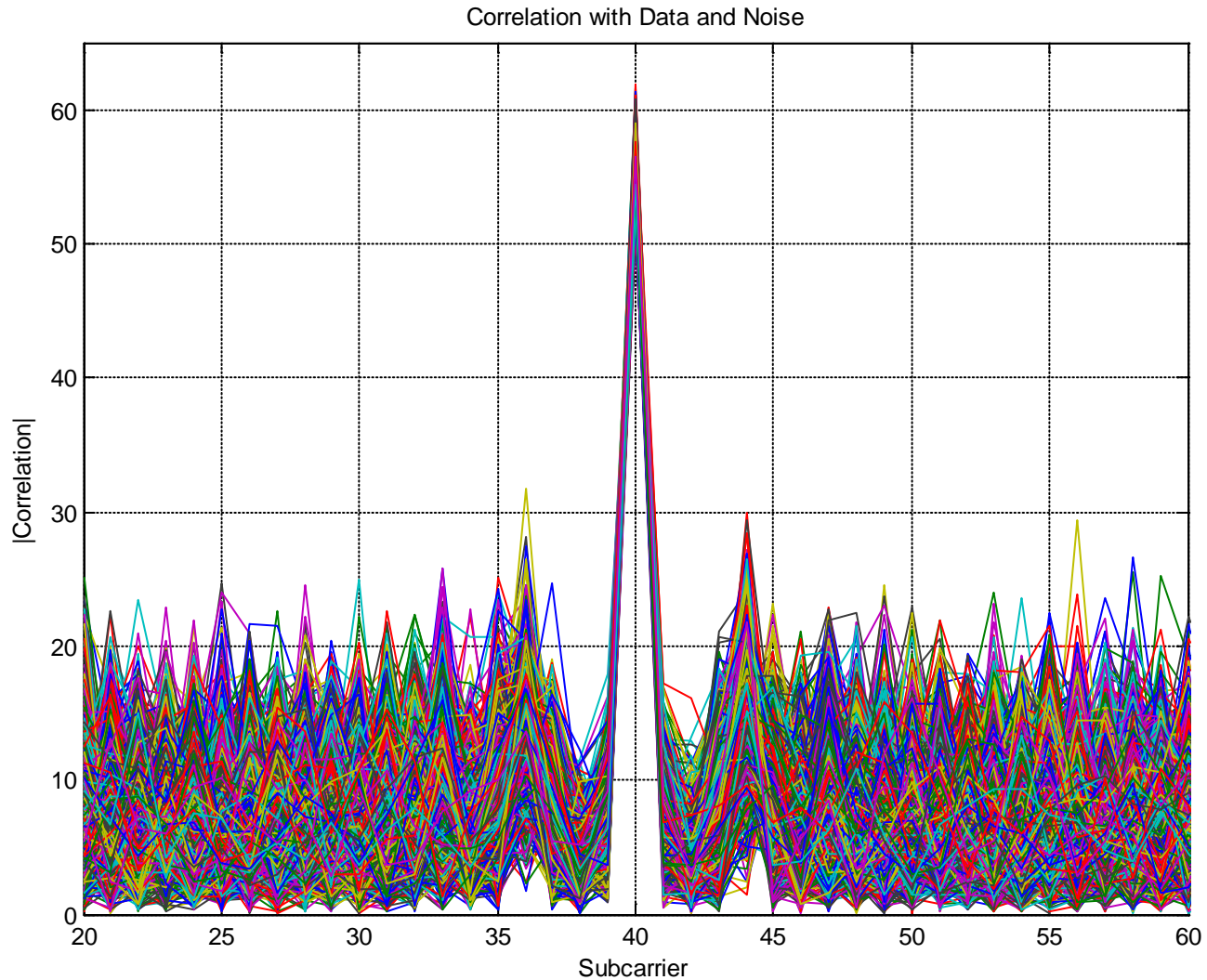


Correlator @ $F = \{-2, -1, 0, +1, +2\}$

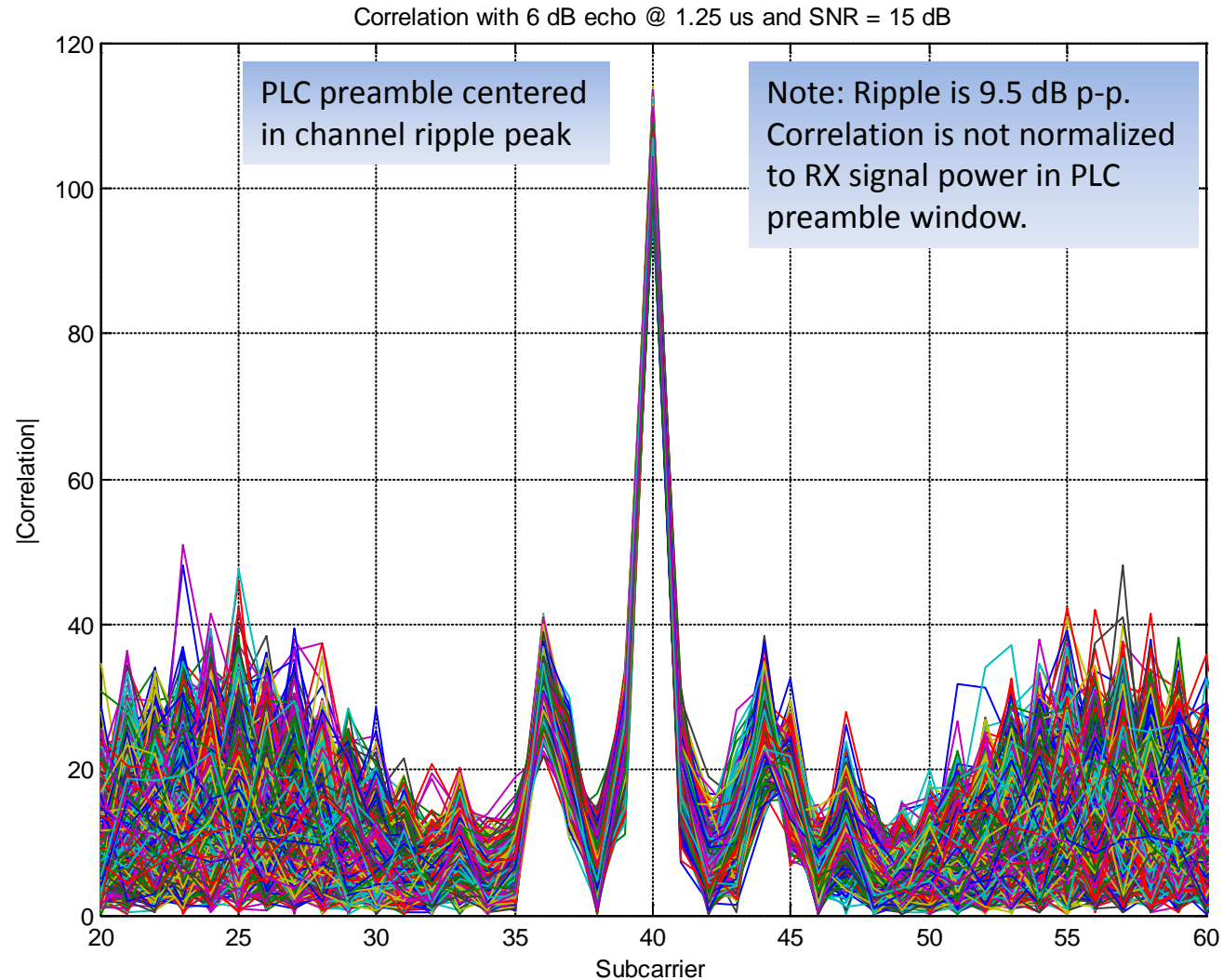
Differentially Demodulated Correlator, Peak and Noise, SNR = 15 dB



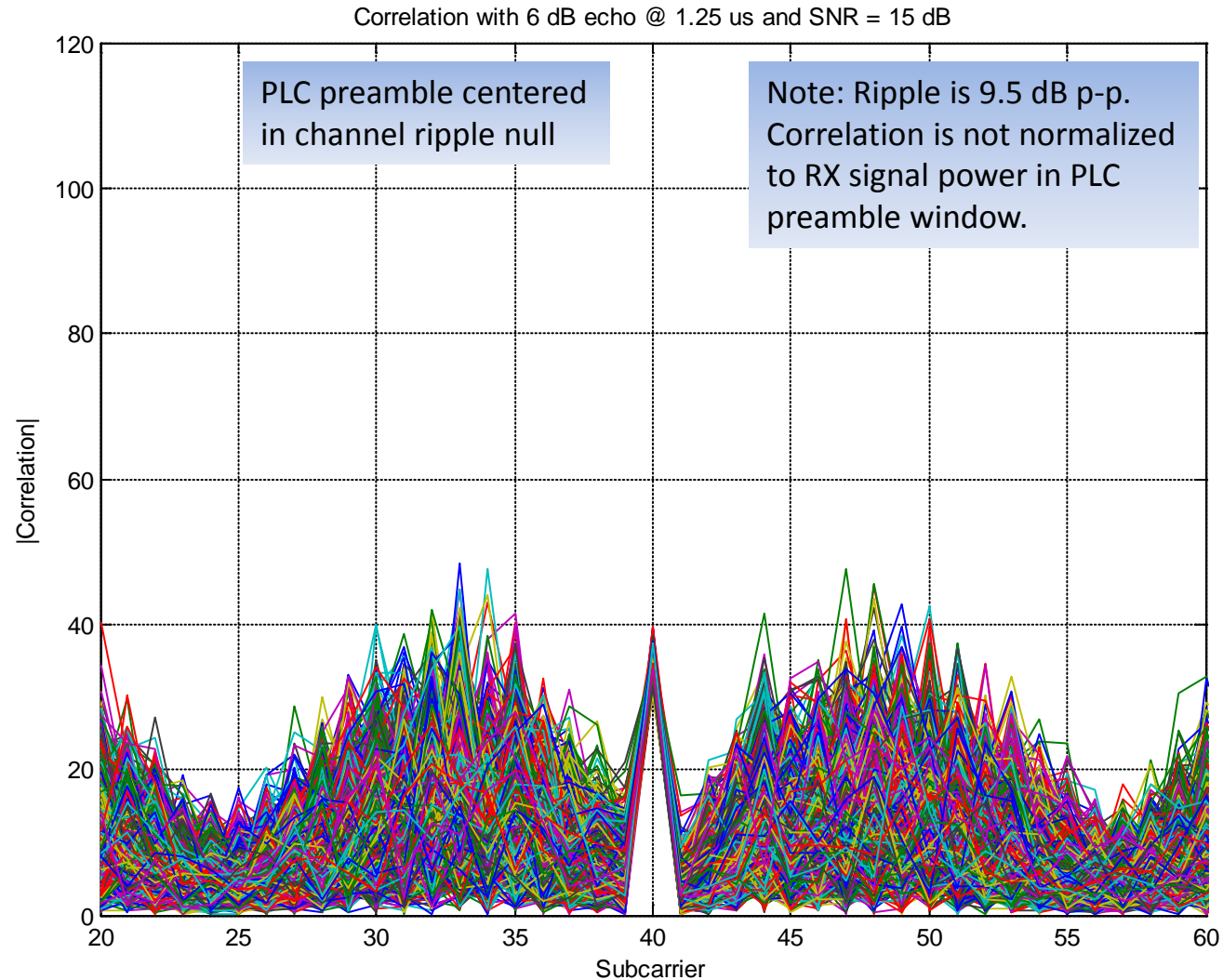
PLC Correlation with adjacent QAM subcarriers, SNR = 15 dB



PLC Correlation with adjacent QAM, SNR = 15 dB, -6 dBc echo @ 1.25 us.



PLC Correlation with adjacent QAM, SNR = 15 dB, -6 dBc echo @ 1.25 us.



8K FFT PLC Preamble

2-D TX Preamble Sequence

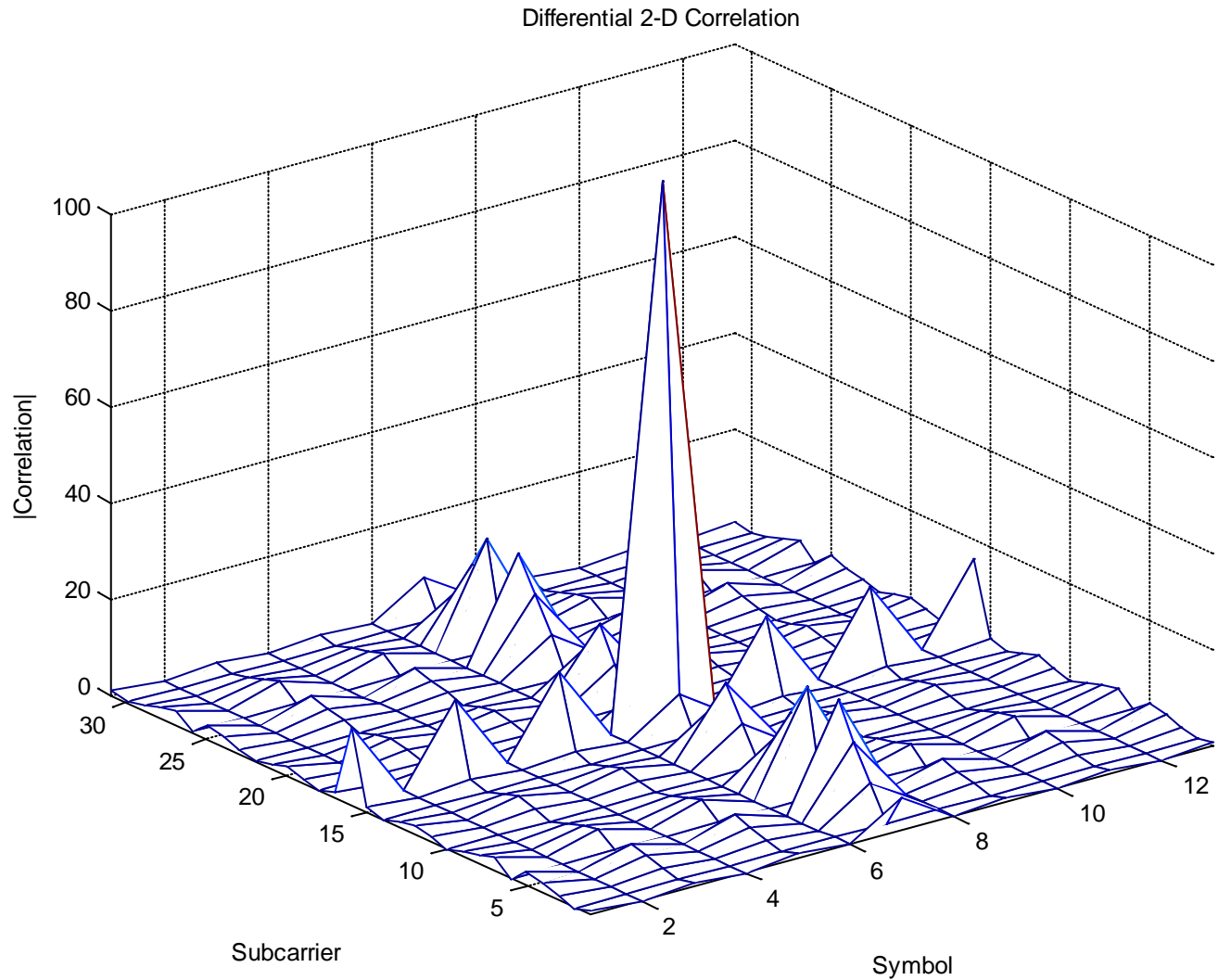
1	0	1	0	0	0	1	1
1	0	1	0	0	0	1	1
1	0	1	0	0	0	1	1
1	0	1	0	0	0	1	1
0	0	0	0	1	0	0	1
1	0	1	0	0	0	1	1
0	0	0	0	1	0	0	1
1	0	1	0	0	0	1	1
1	0	1	0	0	0	1	1
0	0	0	0	1	0	0	1
0	0	0	0	1	0	0	1
1	0	1	0	0	0	1	1
0	0	0	0	1	0	0	1
0	0	0	0	1	0	0	1
0	0	0	0	1	0	0	1
1	0	1	0	0	0	1	1

8K FFT PLC Preamble

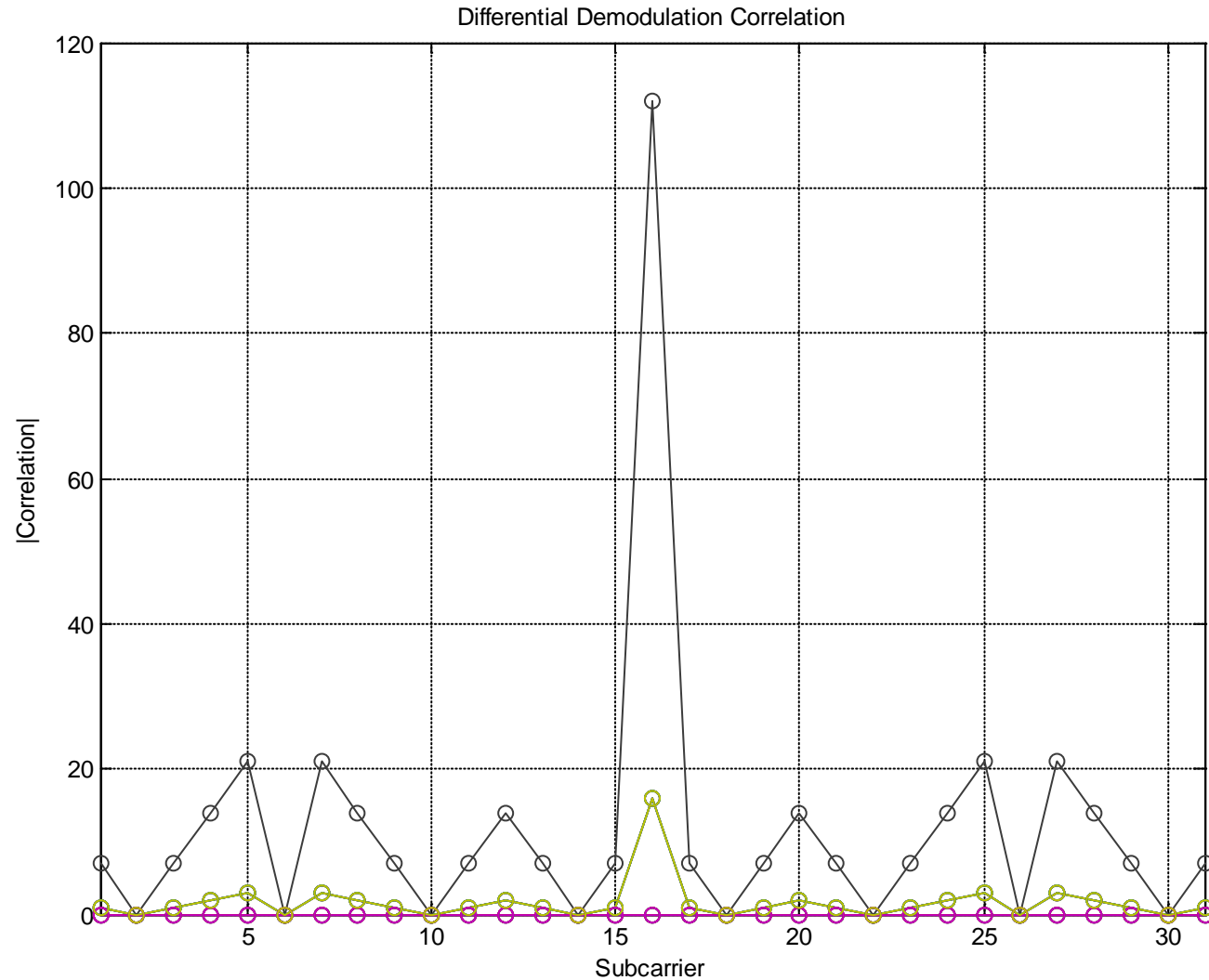
Differential demodulated sequence

X	1	1	1	0	0	1	0
X	1	1	1	0	0	1	0
X	1	1	1	0	0	1	0
X	1	1	1	0	0	1	0
X	0	0	0	1	1	0	1
X	1	1	1	0	0	1	0
X	0	0	0	1	1	0	1
X	1	1	1	0	0	1	0
X	1	1	1	0	0	1	0
X	0	0	0	1	1	0	1
X	0	0	0	1	1	0	1
X	1	1	1	0	0	1	0
X	0	0	0	1	1	0	1
X	0	0	0	1	1	0	1
X	0	0	0	1	1	0	1
X	1	1	1	0	0	1	0

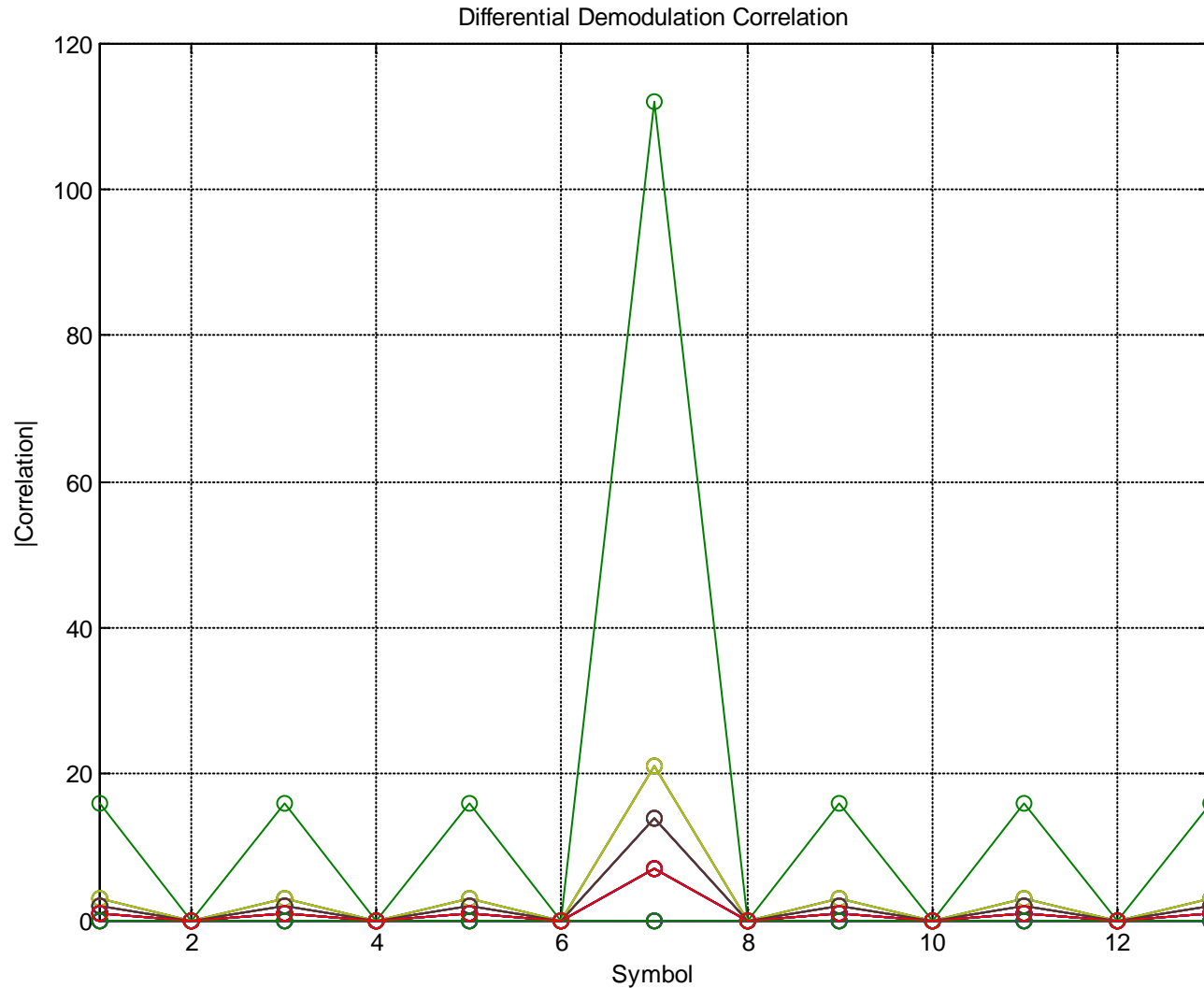
Differential 2-D Correlation



Differential Correlation, Subcarrier direction



Differential Correlation, Symbol direction



Conclusion

- A base Preamble sequence for each FFT with good correlation properties for differential demodulation is shown
- 2-D preamble is separable for CM RX correlation reducing hardware complexity without degrading correlation properties
- Ability to detect the PLC preamble at very low SNR
 - SNR < 10 dB
- Good performance in presence of strong multipath

Proposed Motion

Move to:

Accept the proposed PLC preamble, Pages 2, 3, 12, and 13, for inclusion in the PHY Link baseline.

Technical motion $\geq 75\%$

Yes:

No:

Abstain: