

3GPP TSG RAN WG1 #106bis-e  
e-Meeting, October 11<sup>th</sup> – 19<sup>th</sup>, 2021

R1-2108958

AI: 8.1.5

Discussion on impact of cross-talk on UL performance

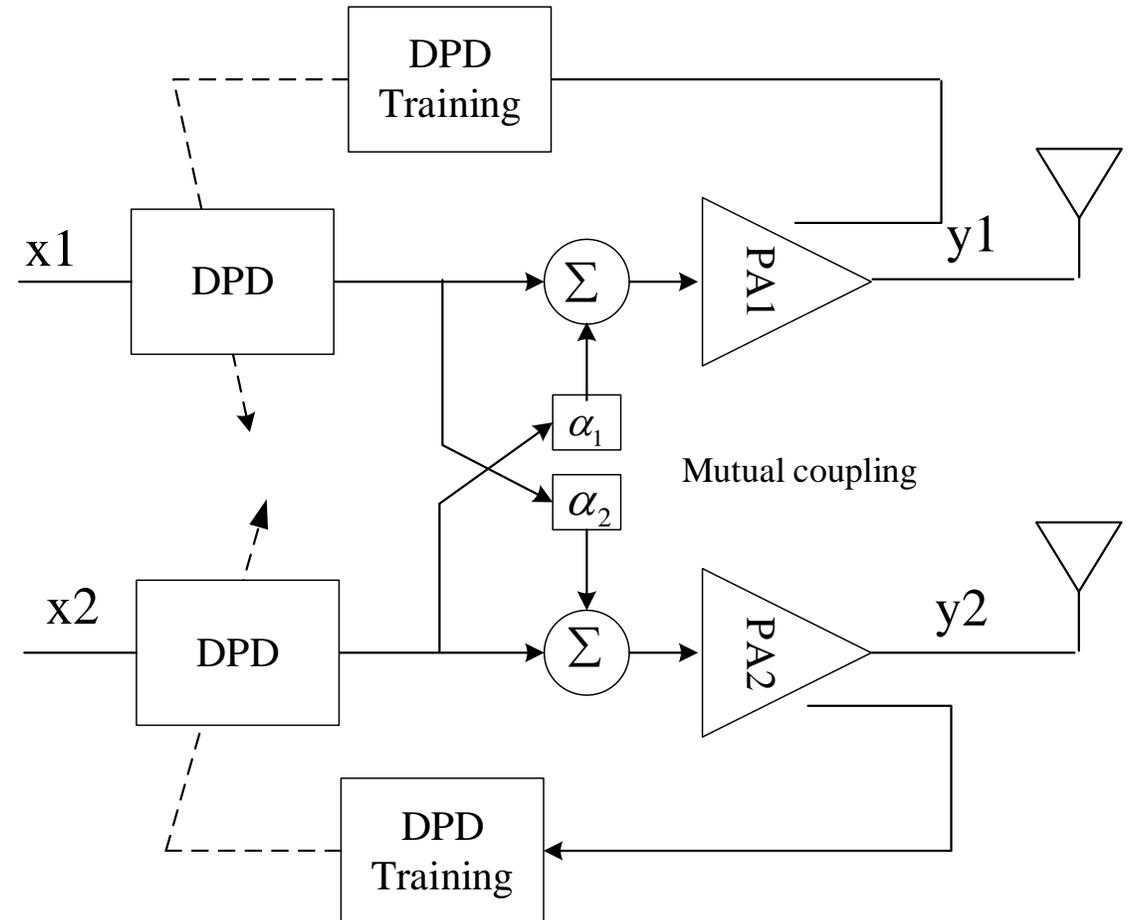
# Background

- Higher data rate can be acquired in MIMO communication system, and the throughput is usually subject to the wireless channel quality represented by SNR and wireless channel matrix rank or condition number represented by SINR of per layer which reveals the interference between layers.
- In real deployment, cross-talk between adjacent RF antennas would affect the transmission rank, which is not static, hence impacts UL performance in high SNR region.
- In the following few slides we present initial evaluations of different DPD schemes to tackle the issue of cross-talk at UE.

# Evaluation on impact of cross-talk in UL performance

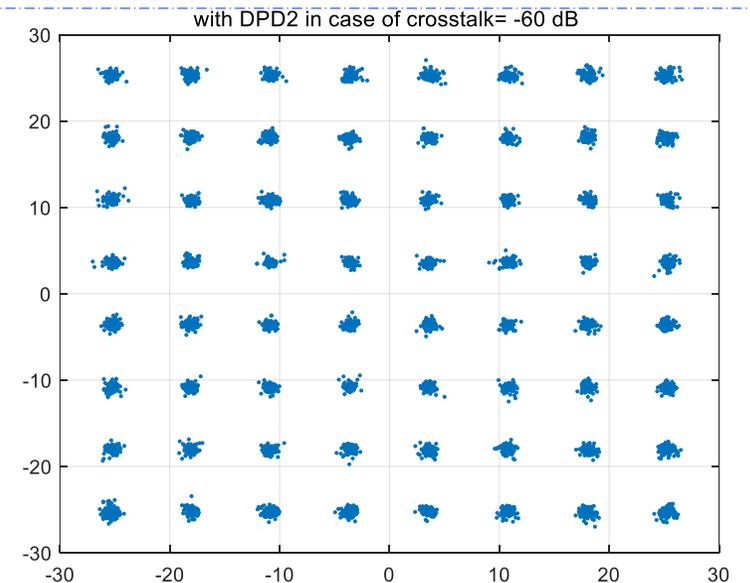
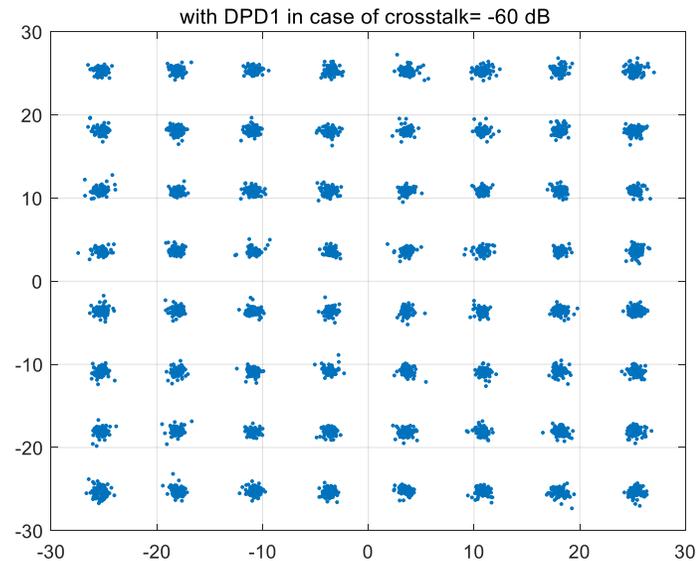
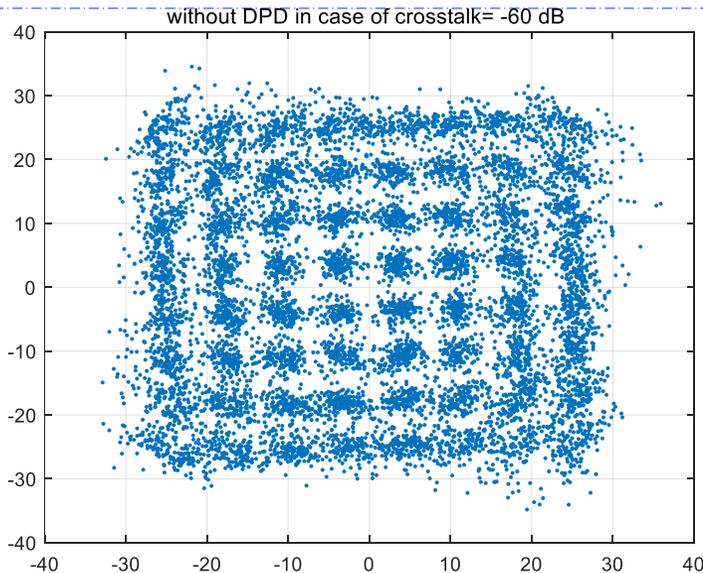
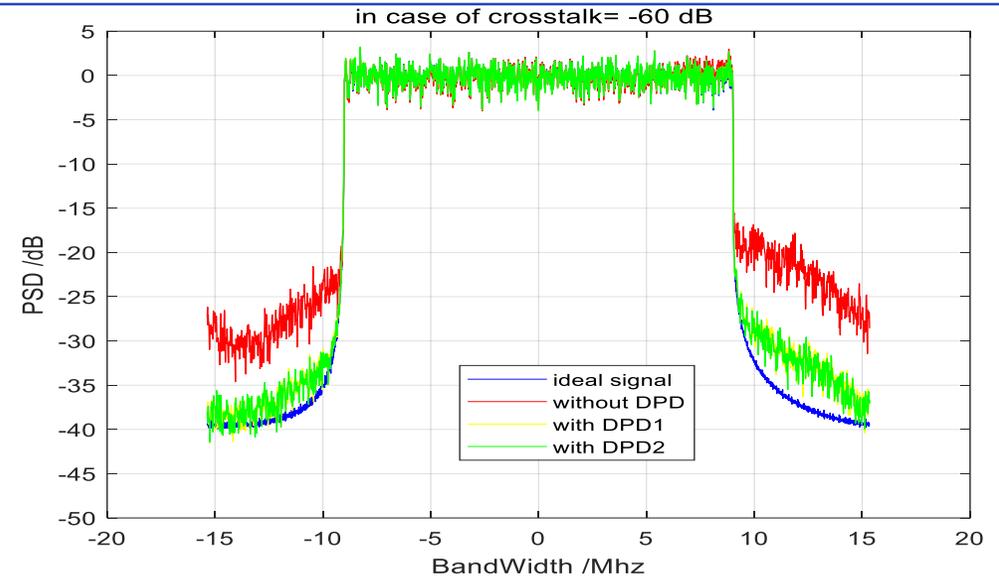
Two types of DPD with different training schemes are evaluated.

1. DPD1: the coefficients of DPD is obtained by training PA assuming single-Tx, which does not take cross-talk into account.
2. DPD2: the coefficients of DPD is obtained by training PA assuming Multi-Tx, and the non-linear mutual coupling model and Memory Polynomial model for PA are integrated. Impacts of both cross-talk and non-ideal PA are compensated.



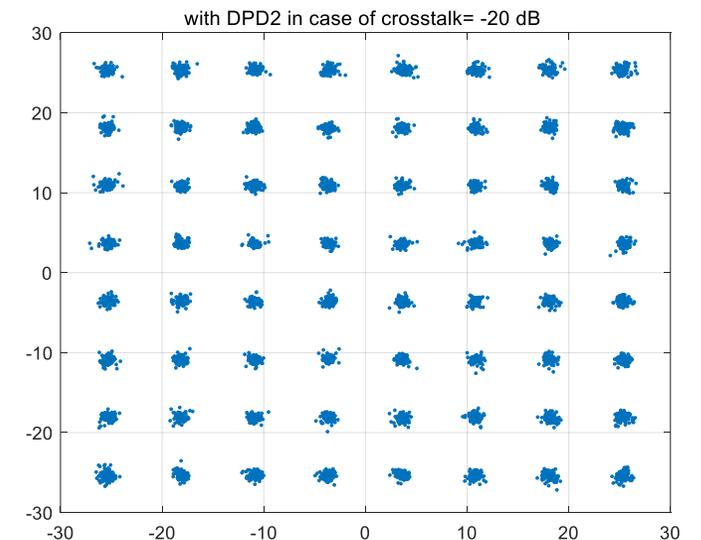
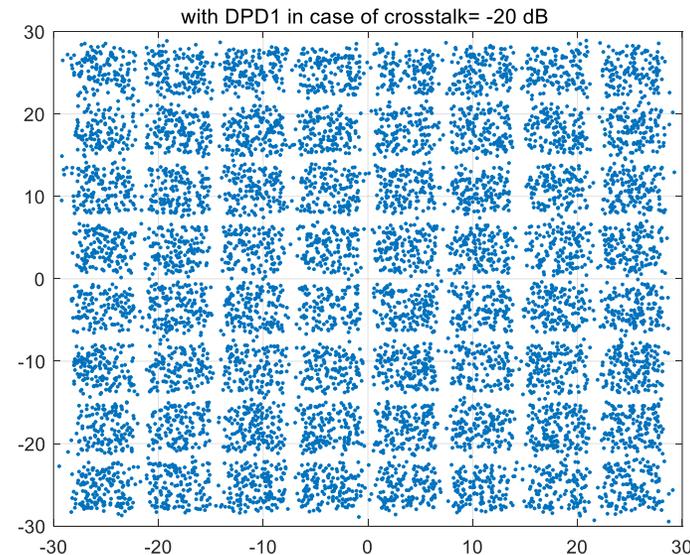
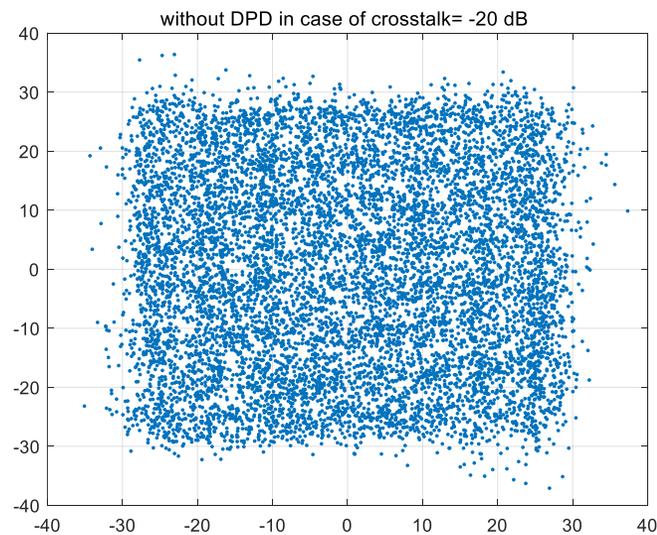
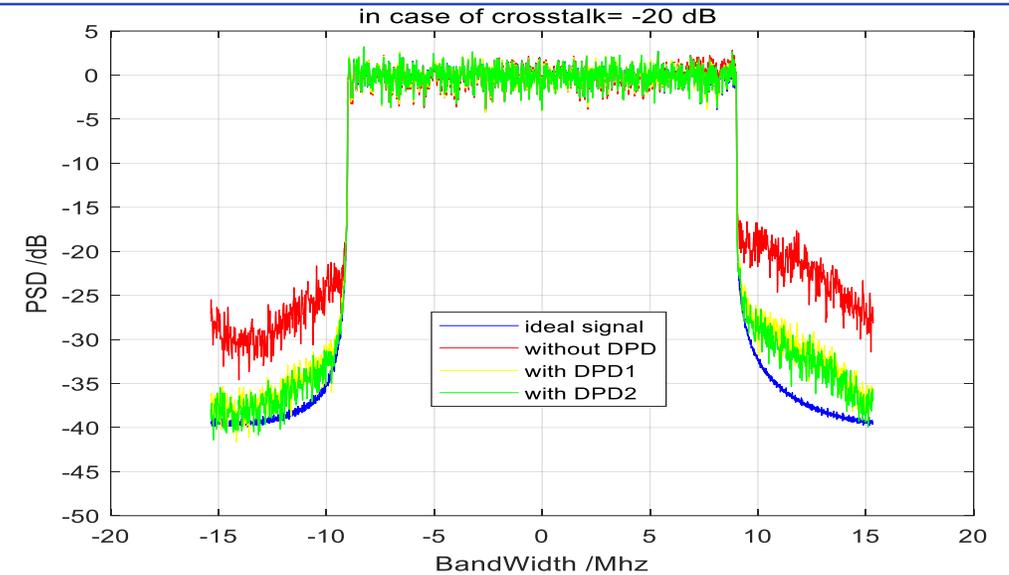
# Perfectly matched coefficient of DPD

**Coefficient=0.001 (cross-talk = -60dB):** same ALCR of PSD and same performance of QAM pattern are observed by different DPD processing, since the coefficient is so small that the impact of cross-talk is negligible.



# Perfectly matched coefficient of DPD

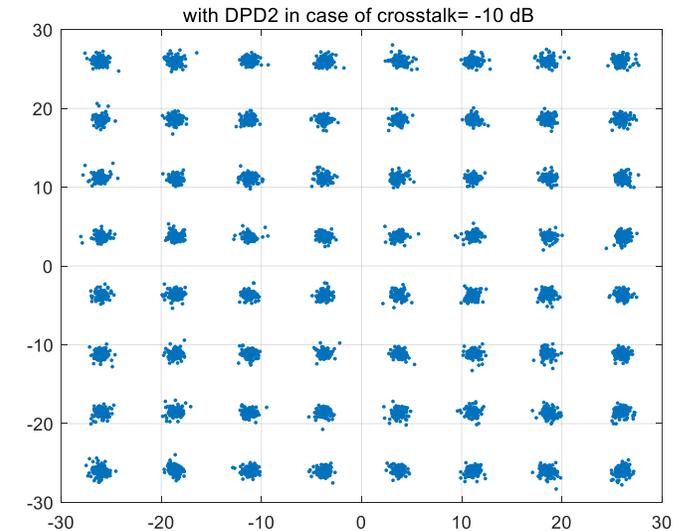
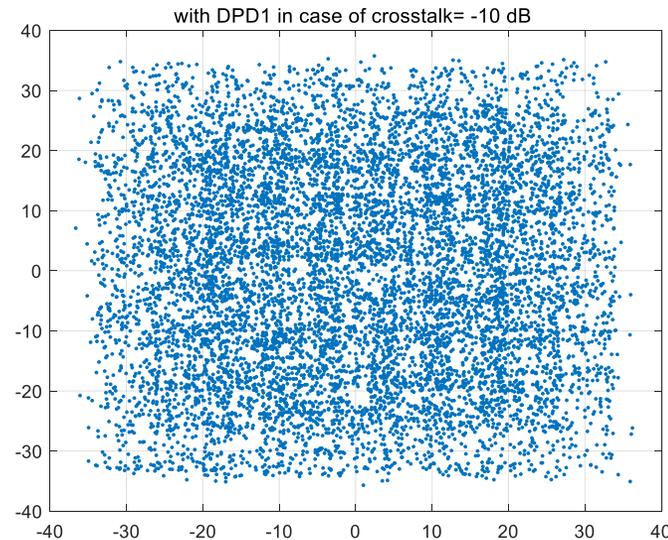
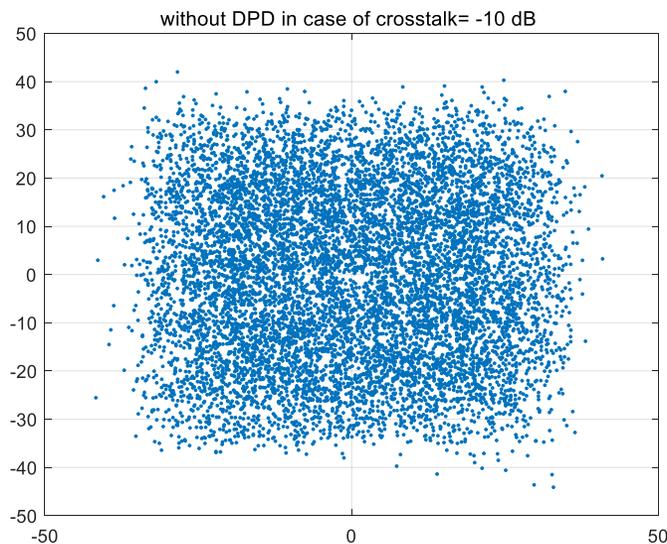
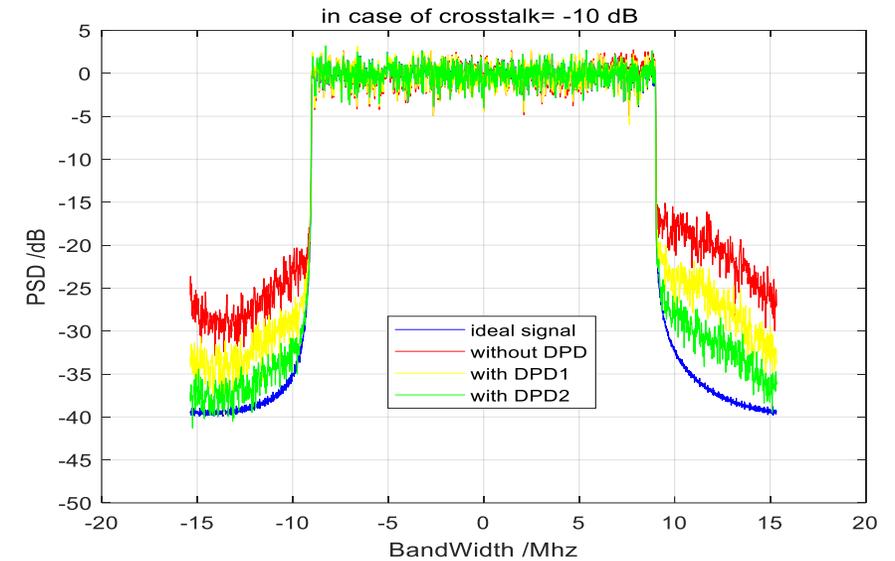
**Coefficient=0.1 (cross-talk = -20dB):** similar ACLR of PSD are observed by different DPD processing, but the performance of QAM is different, DPD2 is better than DPD1 since cross-talk is effectively compensated by DPD2.



# Perfectly matched coefficient of DPD

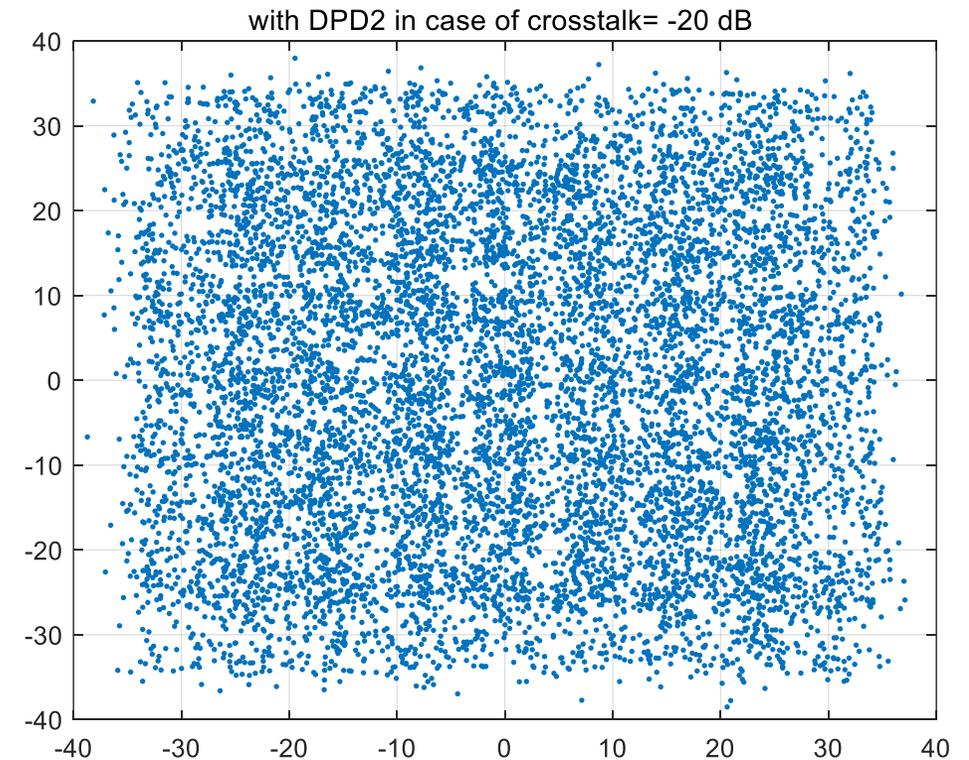
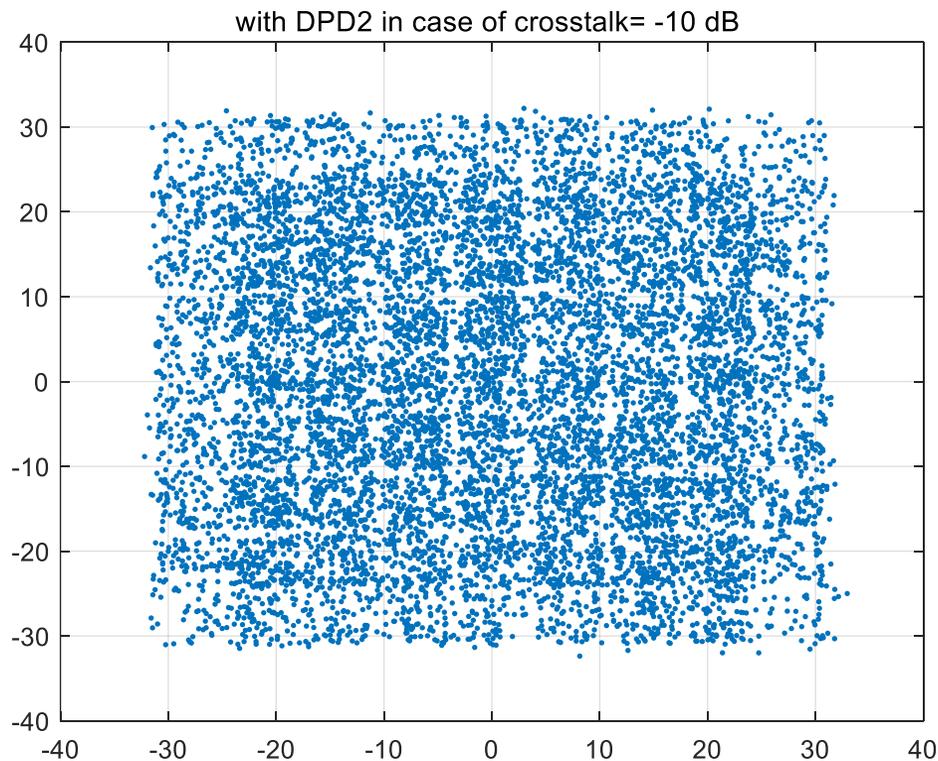
**Coefficient=0.3162 (cross-talk = -10dB):** both ACLR of PSD and the performance of QAM are different, DPD2 is better than DPD1 since cross-talk is effectively compensated by DPD2.

-10dB cross-talk between RF chains is typical scenario in UE implementation!



# Mismatched coefficient of DPD

Considering the cross-talk is not static in real implementation, mismatched DPD coefficients with real cross-talk between RF chains are evaluated. In left figure, the DPD2 coefficients trained for crosstalk(-20dB) is applied to crosstalk of (-10dB); while in right figure, the DPD2 coefficients trained for crosstalk(-10dB) is applied to crosstalk of (-20dB). It can be observed that mismatched DPD coefficients cannot work.



## Conclusion



In typical UE implementation crosstalk between UL RF chains is  $\sim 10\text{dB}$ , and typically is not static, UL performance degrades significantly if not properly compensated.

THANK YOU.

谢谢。