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Enhancing Software Defined Radio for 5G mmWave

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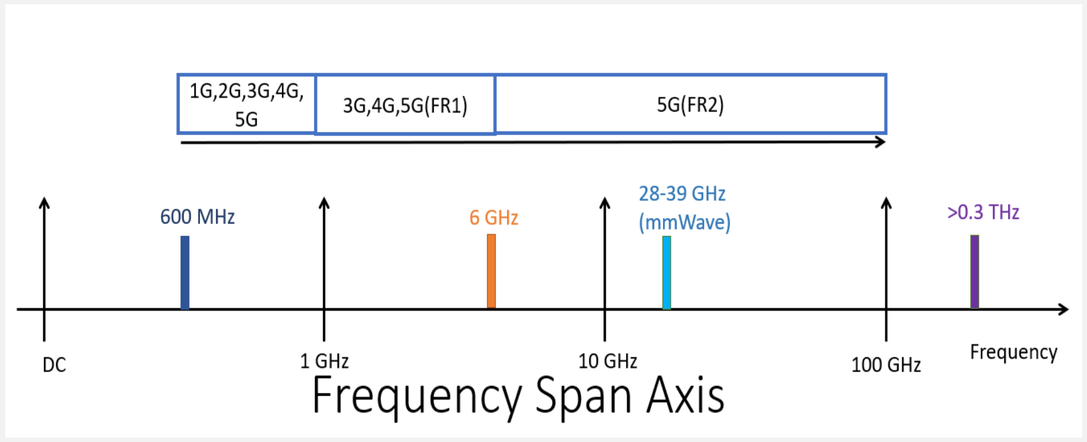
Introduction

To meet the demand for high-speed wireless communication in 5G, millimeter Wave (mmWave) communication is being seen as a promising candidate. Specifically, there has been a growing interest to use wider bandwidth like 800 MHz to achieve higher throughput projected for Fixed Wireless Access in 5G . With manifold increase in signal bandwidth, efficiency vs. linearity trade-off in power amplifiers (PA) has become even more critical

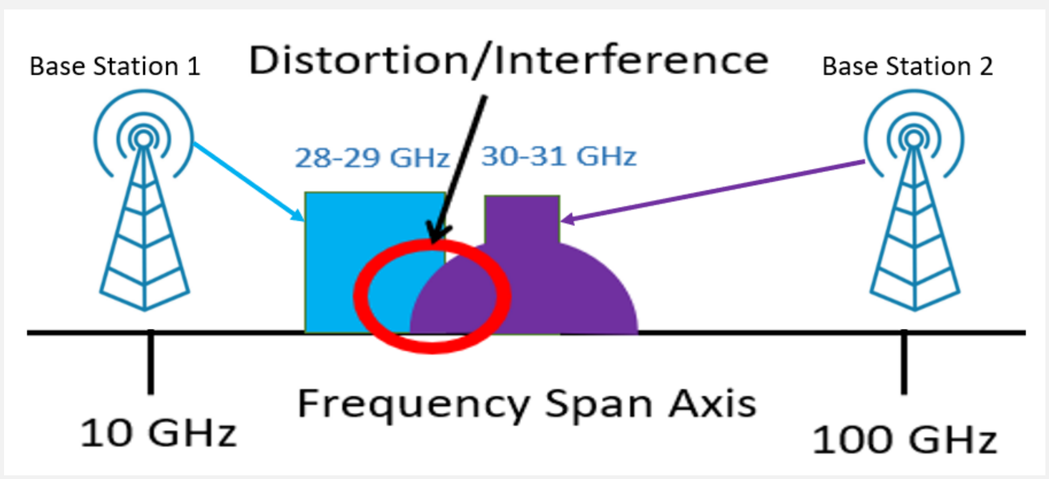


mmWave Pros and Cons

- High Data rate
- Reduces hardware size
- Extremely wide bandwidth
- Narrow beams
- Requires more intelligence
- Shorter Distance
- Efficiency
- Interference
- Distortion/Spectral regrowth

Problem Statement

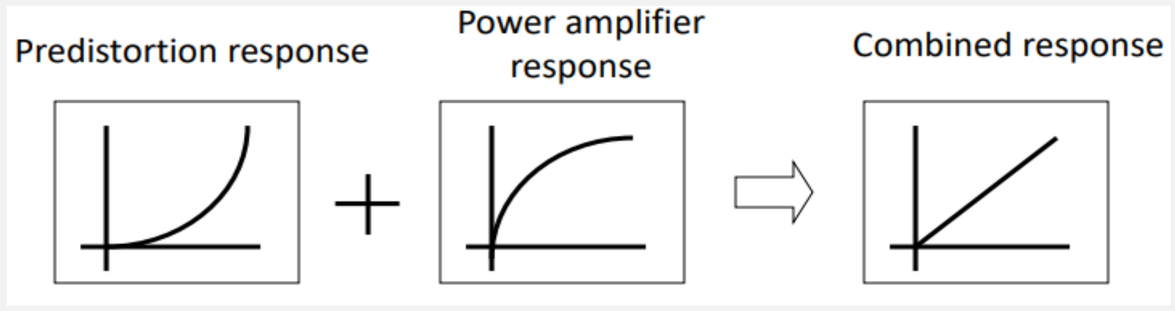
One of the problem which create interference in the adjacent channel and reduces the efficiency of the transmitter chain is due to the power amplifier. For increasing the efficiency, the power amplifiers needs to be driven in near saturation region, but it creates a spectral growth in out of frequency band of interest as shown in the figure.



This spectral regrowth will create interference with other channels. One of the way to eliminate the interference while increasing the efficiency is by Digital Pre-Distortion.

Digital Pre-Distortion

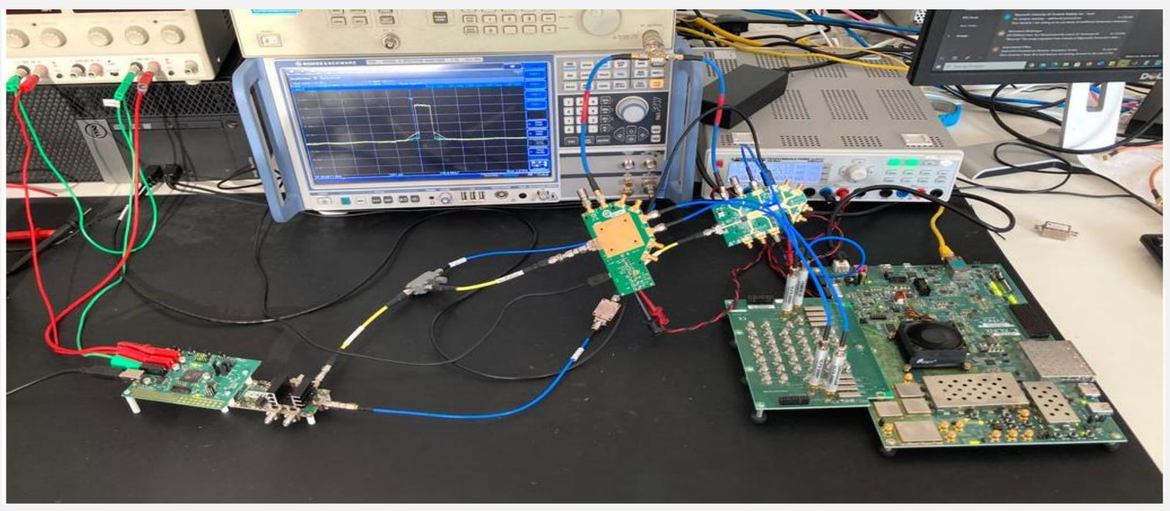
The basic idea behind digital predestination is to combine a two non- linear block to get a linear response from the power amplifier. Here the signal is being processed such that it creates an inverse response of the PA with the help of the input and output signal of the PA considering the order of non-linearity and memory depth. As you can see it in the block diagram where the AMAM curve of the predistorter is inverse to the PA response.

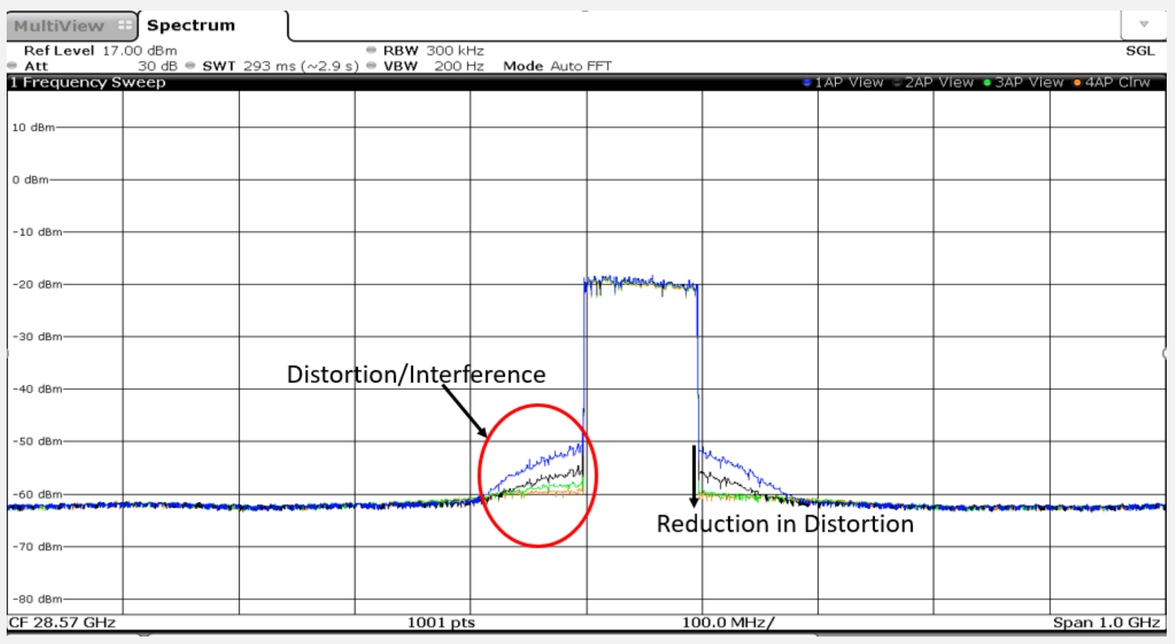


Power amplifier can be model using different method such as Volterra series, Memory polynomial, Memoryless polynomial etc. In this work, memory polynomial model as been taken as shown in the below equation

$$y_{\mathrm{GH}}(n) = \sum_{k=1}^{K} \sum_{m=0}^{M-1} a_{km} x^{k}(n-m).$$

Experimental Setup and Results





Morgan, D.R., Ma, Z., Kim, J., Zierdt, M.G. and Pastalan, J., 2006. A generalized memory polynomial model for digital predistortion of RF power amplifiers. *IEEE Transactions on signal processing*, *54*(10), pp.3852-3860.

Deb, S., Tanio, M., Hori, S., Tawa, N., Wada, Y. and Kunihiro, K., 2018, September. Band-limited digital predistortion with band-switching feedback architecture for 5g mmwave power amplifiers. In *2018 48th European Microwave Conference (EuMC)* (pp. 9-12). IEEE.

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