

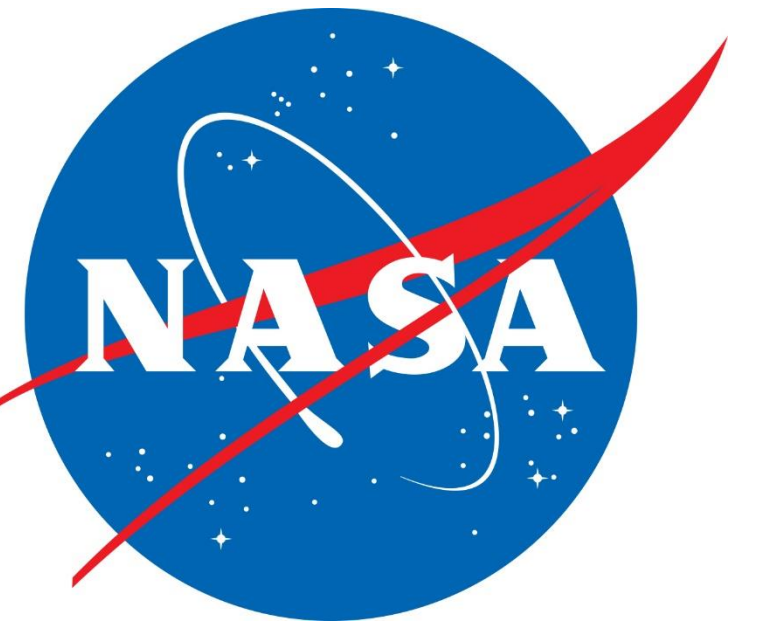


Characteristic of a digital correlation radiometer back-end with finite wordlength

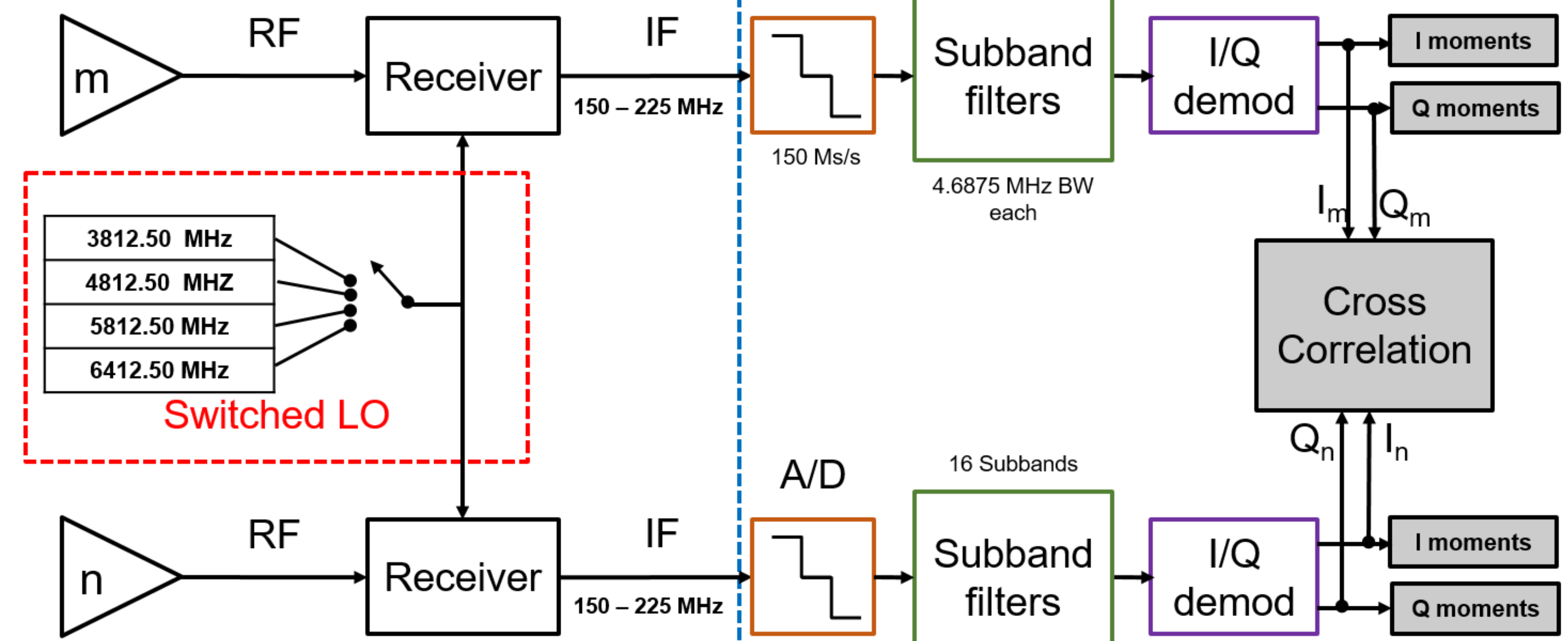
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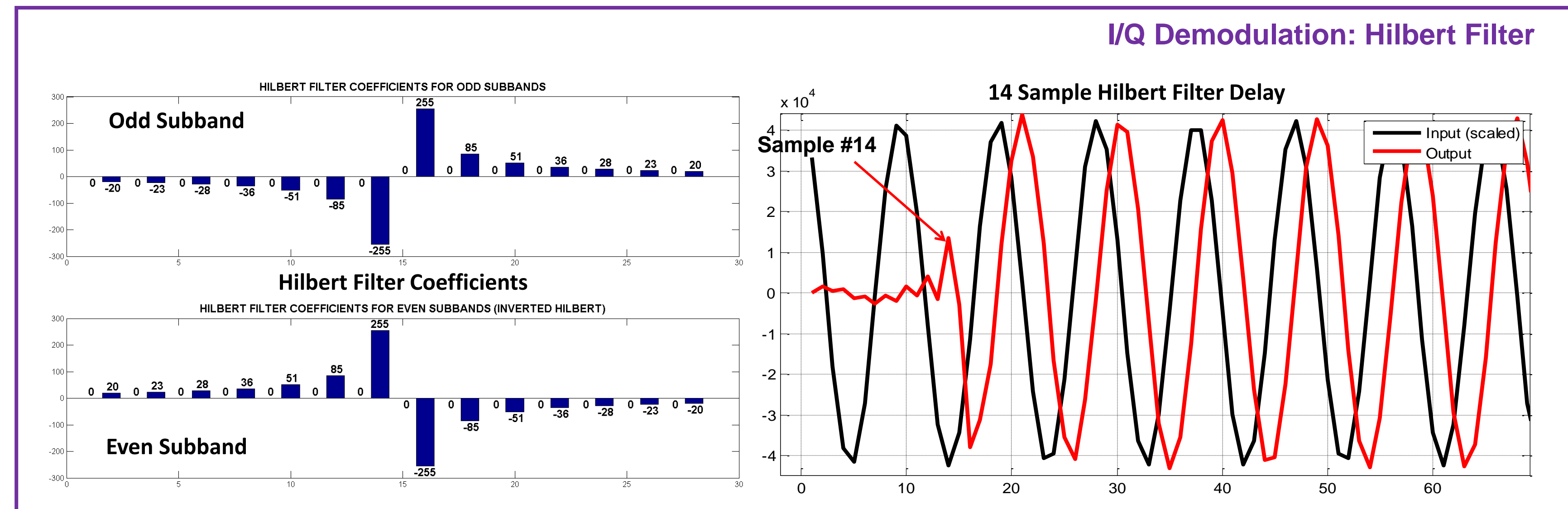
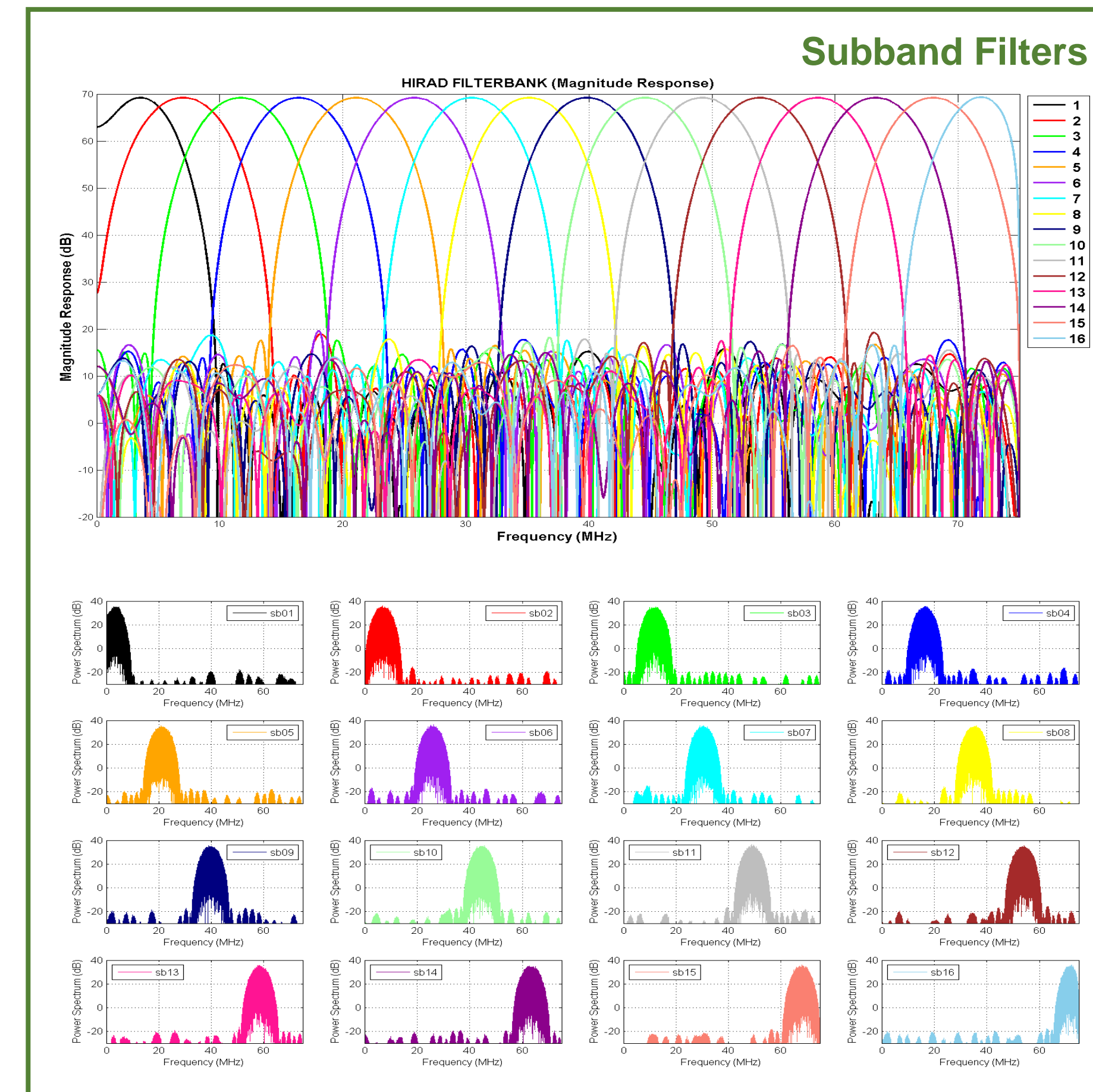
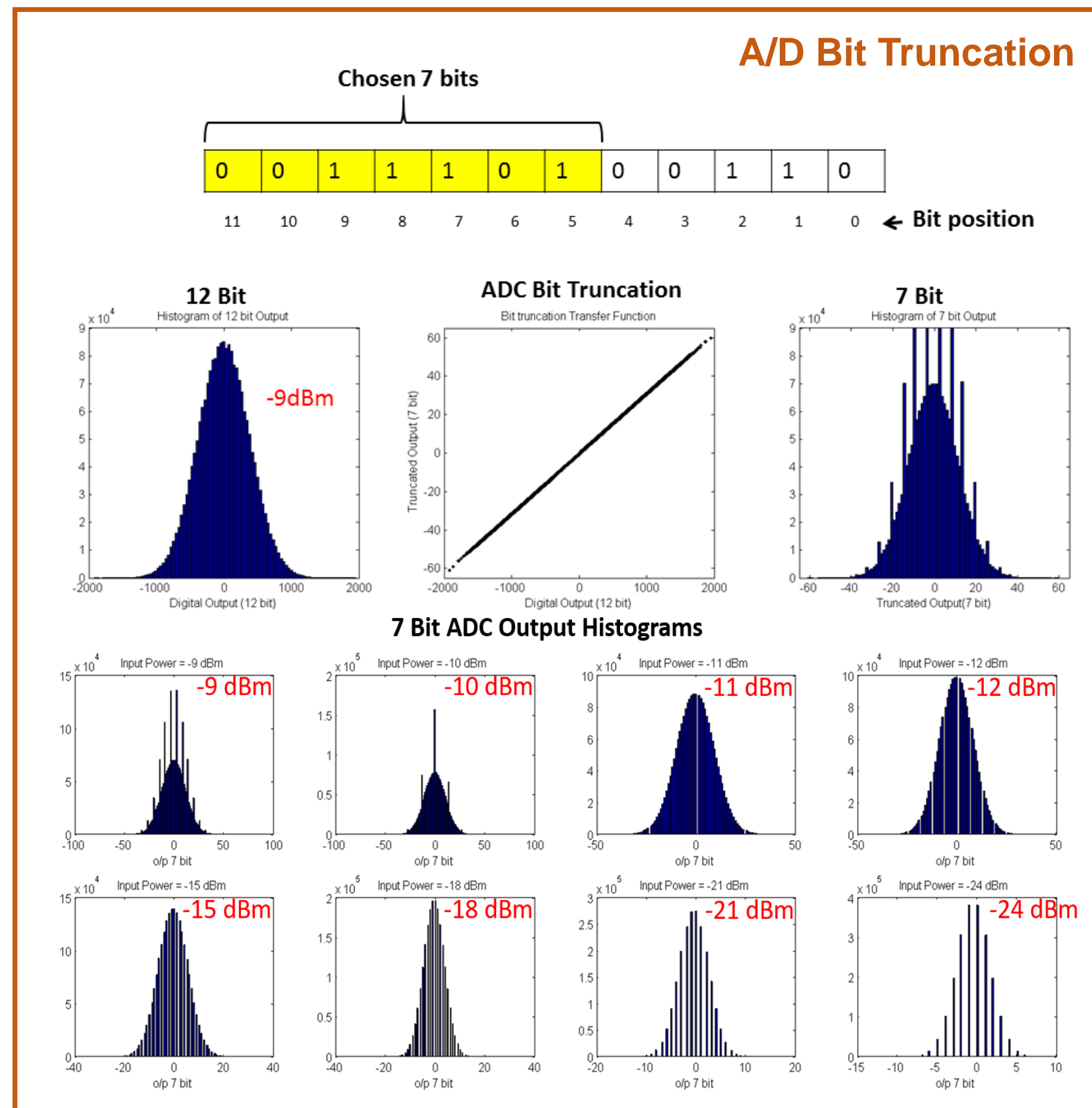
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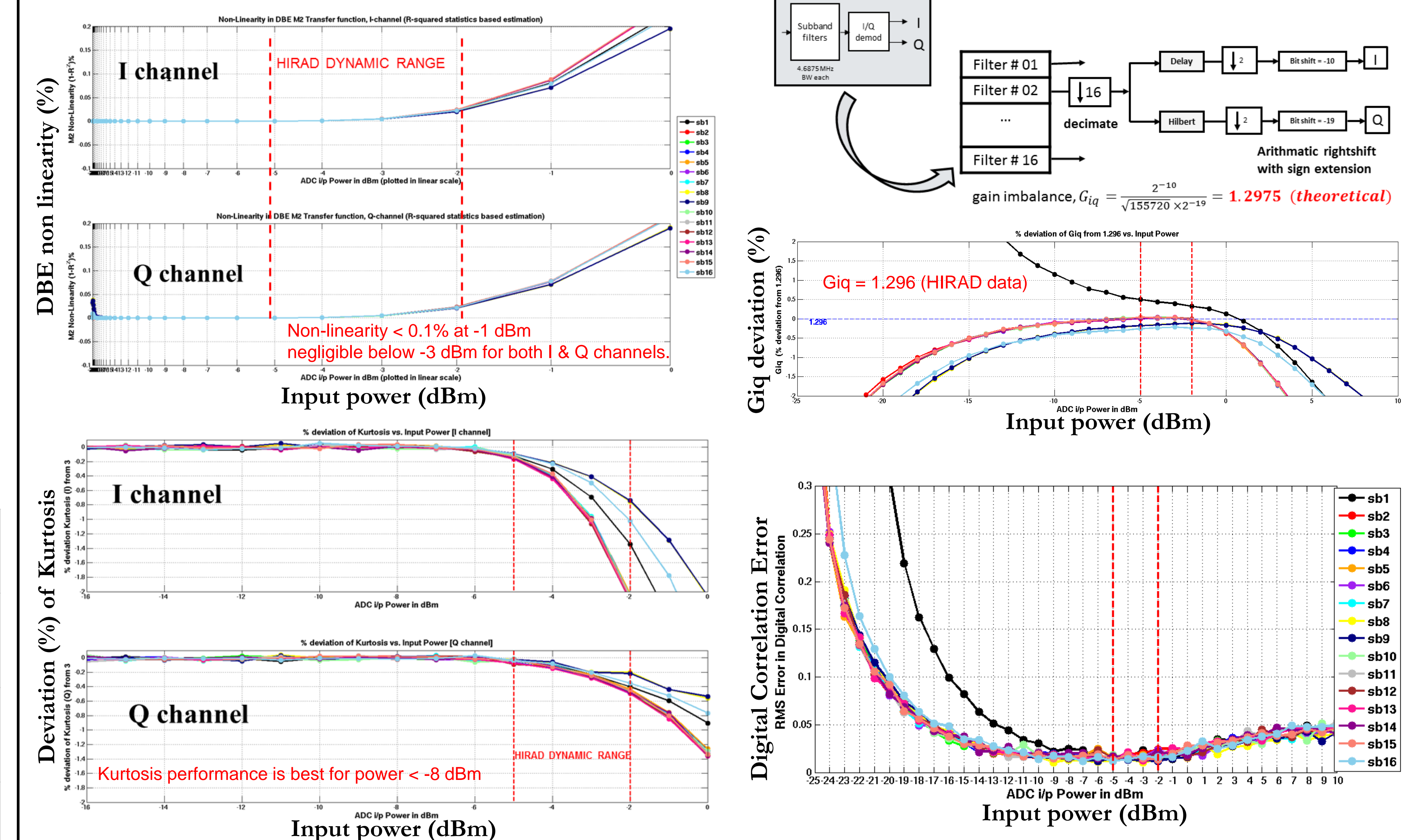
1. Introduction

- Digital Signal Processing offers many practical advantages in microwave radiometer systems
- interferometric, polarimetric and/or spectrometric measurements
- Typically include: A/D converter, Filters, I/Q demodulators, moment computation etc.
- Error Sources: Quantization, Hilbert filter ripples, bit truncation/finite wordlength
- A simulator is developed to predict end-to-end performance

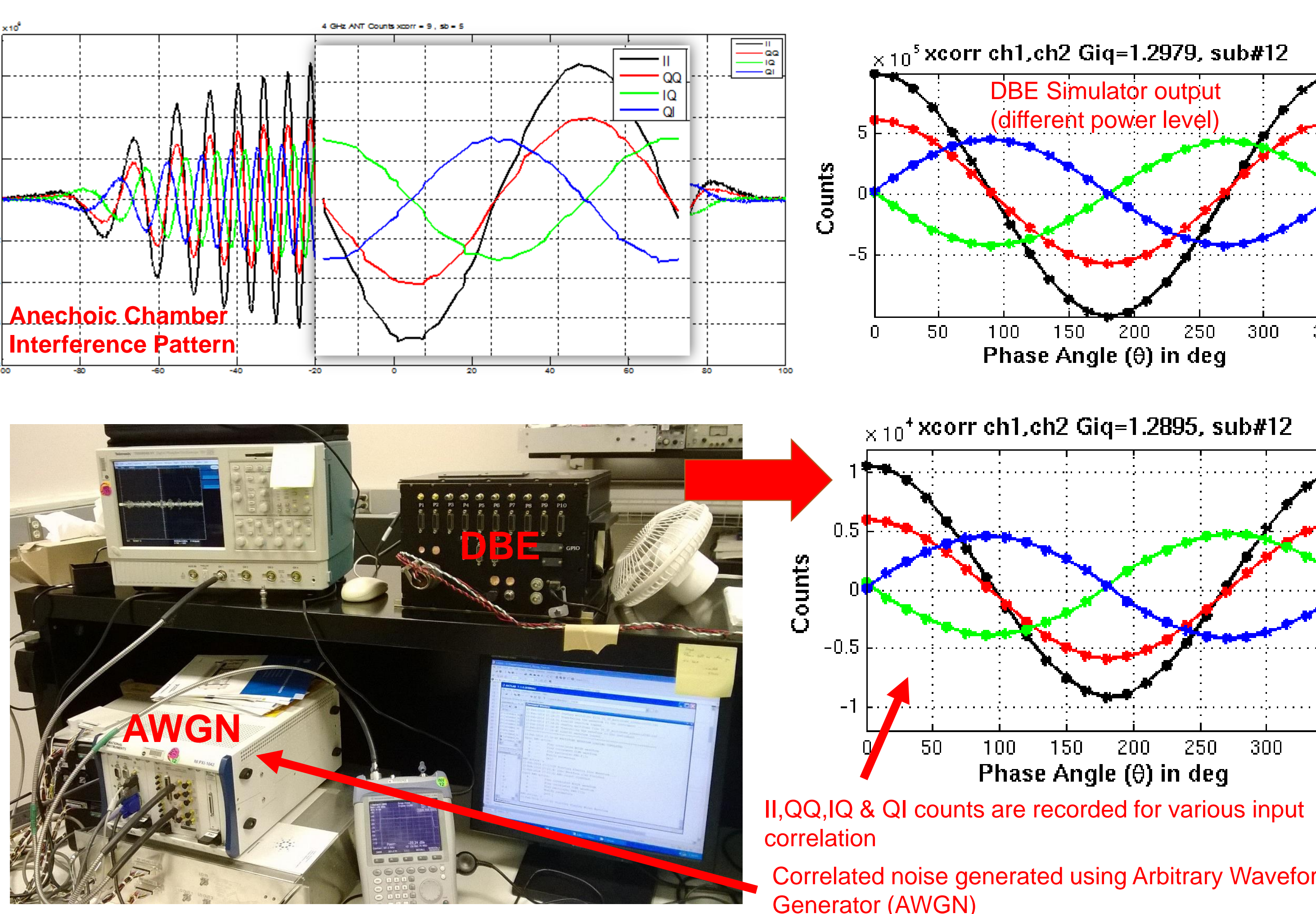
Digital Back End (DBE) Details (Based on Hurricane Imaging Radiometer)

ADC	<ul style="list-style-type: none">150-225 MHz IF signal, sampled @ $F_s = 150$ MS/s with 12 bit resolution7 bit selected using arithmetic right shift with sign extension
Subband Filter	<ul style="list-style-type: none">16 bandpass FIR filters, BW = 75MHz/16 = 4.6875 MHzFilter order: 64, input/output: 7/22 bit, filter coeffs : 9 bitOutput subsampled @ $F_s/16$; Even subband spectral flip
Hilbert Filter	<ul style="list-style-type: none">Order 27, running @ $F_s/16 = 9.3750$ MS/sinput/output: 22/35 bit, filter coeffs : 9 bitOutput subsampled by half (4.6875 MS/s) & 7 bits selected
Moment/Cross-Corr.	<ul style="list-style-type: none">Computed using 7 bit words

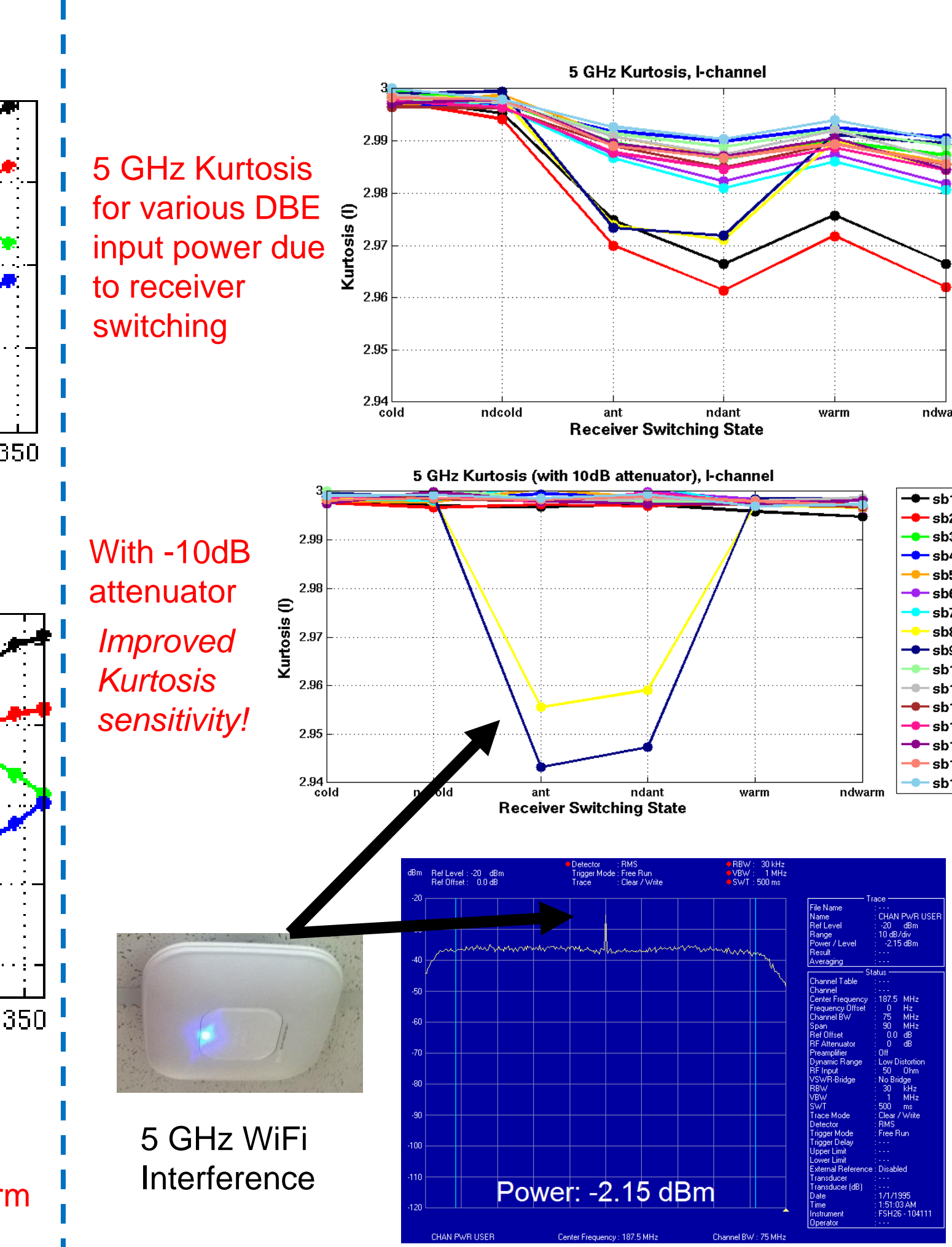
2. Simulation Results



3. Lab Tests



(a) Cross-correlation



4. Summary

- Performance of a radiometer DBE is analyzed. The particular design corresponds to the DBE of the airborne Hurricane Imaging Radiometer
- A computer simulator is developed to analyze effect of input power on various DBE output products
- 2nd moment non-linearity is found to be negligible in the expected input signal dynamic range
- Observed scaling between I and Q channels and the scaling among cross-correlation signals are verified by the simulator
- Kurtosis sensitivity can be improved by lowering the input power – predicted by the simulator and verified in the lab