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% Matlab code to study the effect of phase and
magnitude imbalance of input
% signals on the output
% Apri 24, 2018
clear all; close all;
% Error terms that can be set by the user
magnErrdB = 0:0.1:4; %in dB
% magnErrdB = 4; %in dB
phaseErr = 0:1:20; %in degrees
sd_noise = 100e-6; %std dev of noise
% Convert dB magnErr to voltage level
magnErr = 10.^(magnErrdB/20);
% Coefficients
a0=0; %dc offset
% Coefficients of 2ndharmonics
a2=0.01;% DAC38RF83 HD2 is 54dBc at 9G for 2.6G
% a1=0.89;
% a2=0.01;
% a3=0.0007;
%input freq - does not affect calculations
fin = 100;
t = 0:1:2047;
%Input signals
k1=1;
k2=k1*magnErr;
%Each differential signal multiplied by the DAC
for j=1:length(phaseErr);
for i=1:length(magnErrdB);
y1 =0.5*k1*a2*(1-cos((t/2048)*2*pi*2*fin));
y2 =0.5*k2(i)*a2*(1-cos((t/2048)*2*pi*2*fin+2*(
pi/180)*phaseErr(j)));
%Output only amplitude error

z1=y1;
z2=y2;
% z = z1;
z = z1-z2;
noise = sd_noise*randn(1,length(z));
z = z + noise;
%  figure;
%  plot(t(1:80),1000*z1(1:80),t(1:80),1000*z2(1
:80),t(1:80),1000*z(1:80));
% title('Only Balun Amplitude unblance@4dB ');
% xlabel('Time');
% ylabel('Balun differential output ');
%Take the FFT
fft_y = fft(z/1024, 2048);% magnitu/1024 equal
to time domain
Pyy = 10*log10(fft_y.*conj(fft_y));
freq_axis = 0:1:1023;
% figure;
% plot(freq_axis, Pyy(1:1024));
% title('Frequency of the RFDAC output');
% xlabel('Frequency (Hz)');
% axis tight;
% Print fundamental and 2nd, 3rd harmonics
f = Pyy(101);
h2(j,i) = Pyy(201);
if i>=2
  hd2_deta_A(j,i)=h2(j,i)-h2(j,i-1);
end
end
end
figure;
grid on;
plot(magnErrdB,h2);
title('Balun Phase and Amplitude imbalance
@2.6G ');
xlabel('Balun amplitude  imbalance (dB)');
ylabel('HD2@0dBfs (dBc)');
axis tight;
grid on;
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