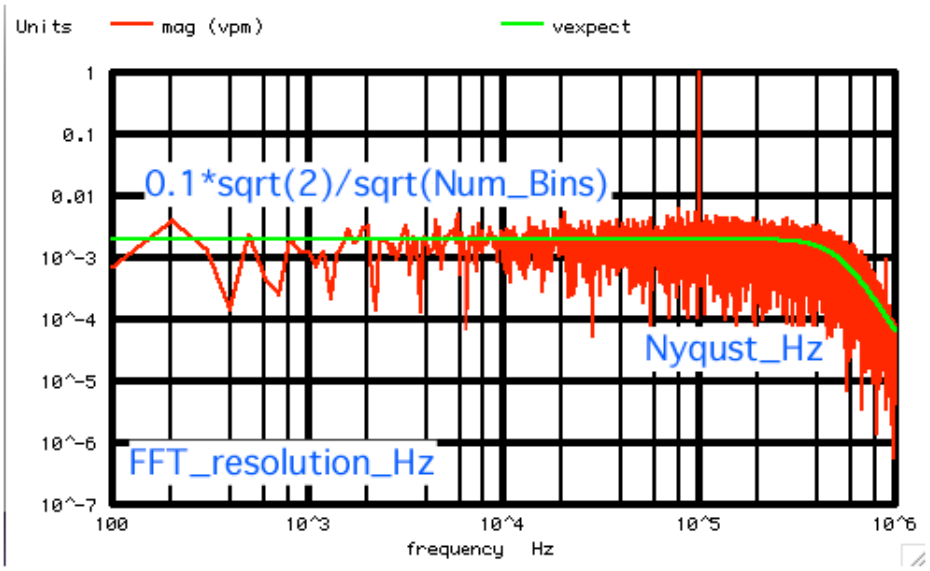
=====PREDICTING A RANDOM PM SPECTRUM=====



SIMPLE_RANDOM_PM_WAVEFORM_GENERATION

```
*=========Create_Signal==================
VTime       VTime  0       DC      0     PWL(     0       0     1       1)
Vfreq1      Vfreq1 0       DC      2
V1          V1     0       DC      0
BMOD        VMOD   0       V       = cos(6.2831853*2000*V(VTime))
BPM         VPM    0       V       = 1*cos(6.2831853*100k*V(VTime)+.1*V(V1))
BCOS        VCOS   0       V       = 1*cos(6.2831853*100k*V(VTime))
```

10%_pk radian Sinewave PM is 100% carrier with two 5% side bands.
The sidebands are synchronous (add up to 10% of carrier).
Random 10%_rms radian PM spreads out sqrt(2) more energy.
It is uniformly spread out over all the frequency bins.

```
=======================Want_10000_1us_steps================================
Total_Period_s =        0.01
Bin_Resolutio_Hz =      100
Sample_Period_s =       1E-06
Nyquist_Hz =            500000
Total_Bins =            5000
=======================Create_PWL_array_and_Index_and_Plot===============
=======================Add_.1Vrms_Noise_to_PWL_array=====================
=======================Find_Ave_Rms_pwl_1================================
RMS_level_Expect        .1    RMS_level_RM  0.10019
=======================Install_the_PWL_array=============================
=======================FFT_and_Plot_V2===================================
FFT_BandWidth_Hz=       1E+06
FFT_resolution_Hz=      100
vexpect flat noise=     .1*sqrt(2)/sqrt(5000)  which is 1.414m
```

```
====================MacSpiceCode=====================================
SIMPLE_RANDOM_PM_WAVEFORM_GENERATION
*=========Create_Signal==================
VTime       VTime  0       DC      0     PWL(     0       0     1       1)
Vfreq1      Vfreq1 0       DC      2
V1          V1     0       DC      0
BMOD        VMOD   0       V       = cos(6.2831853*2000*V(VTime))
BPM         VPM    0       V       = 1*cos(6.2831853*100k*V(VTime)+.1*V(V1))
```

```
BCOS      VCOS   0      V      = 1*cos(6.2831853*100k*V(VTime))

.control
*TRAN             TSTEP  TSTOP  TSTART TMAX   ?UIC?

echo              "=======================Want_1000_1us_steps================================
"
let n =           10000
let tstep =       1us
let period_t =    n*tstep
let Bin_Hz =      1/period_t
let nyquist =     .5/tstep
let binsTotal=    nyquist/Bin_Hz
echo              "Total_Period_s =       $&period_t"
echo              "Bin_Resolutio_Hz =     $&Bin_Hz"
echo              "Sample_Period_s =      $&tstep"
echo              "Nyquist_Hz =           $&nyquist"
echo              "Total_Bins =           $&binsTotal"
echo              "=======================Create_PWL_array_and_Index_and_Plot=============="
let pwl_1 =       vector(2*n)*tstep*0.5
let ii =          vector(2*$&n)
echo              "=======================Add_.1Vrms_Noise_to_PWL_array====================
"
let index =       0
repeat            $&n
let               pwl_1[1+2*index] = 1.414*(rnd(127)+rnd(127)+rnd(127)+rnd(127)+rnd(127)+
rnd(127)+rnd(127)+rnd(127)-507.5)/102.879
let index =       index + 1
end
echo              "=======================Find_Ave_Rms_pwl_1================================
==="
let averVal =     mean(pwl_1)
let noisAC =      pwl_1 - averVal
let RmsVal =      .1*sqrt(mean(noisAC* noisAC))
echo              "RMS_level_Expect       .1   RMS_level_RM  $&RmsVal  "
unlet averVal
unlet RmsVal

echo              "=======================Install_the_PWL_array============================="
alter             @v1[pwl] = pwl_1
tran              .1u    10m     0       .1u
set               pensize = 2
*plot              vpm vcos

echo              "=======================FFT_and_Plot_V2==================================
=="
linearize
let               FFT_BandWidth_Hz =      1meg
let               FFT_resolution_Hz =     100
echo              "FFT_BandWidth_Hz=      $&FFT_BandWidth_Hz"
echo              "FFT_resolution_Hz=     $&FFT_resolution_Hz"
set               specwindow=   "rectangular"
spec              $&FFT_resolution_Hz  $&FFT_BandWidth_Hz   $&FFT_resolution_Hz     v(vpm)
let vexpect =     (.1*sqrt(2)/sqrt(5000))/(1+(frequency/550k)*(frequency/500k)*(frequency/
500k)*(frequency/500k)*(frequency/500k))
plot              mag (vpm) vexpect loglog
let attenExpect   = sqrt(5000)/.707
echo              "vexpect dc should be   .1*sqrt(2)/sqrt(5000)  which is 1.414m "

*echo              "sqrt(5000)/.707 =       $&attenExpect"
.endc
.end
```

4.18.11_1.05PM

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