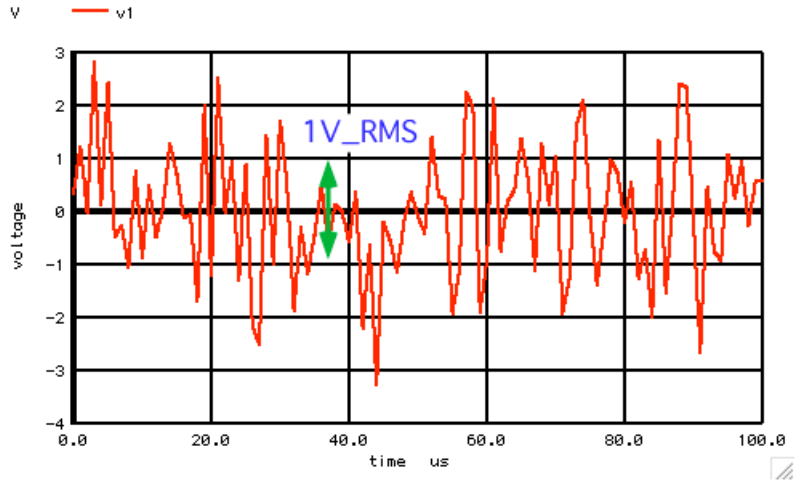
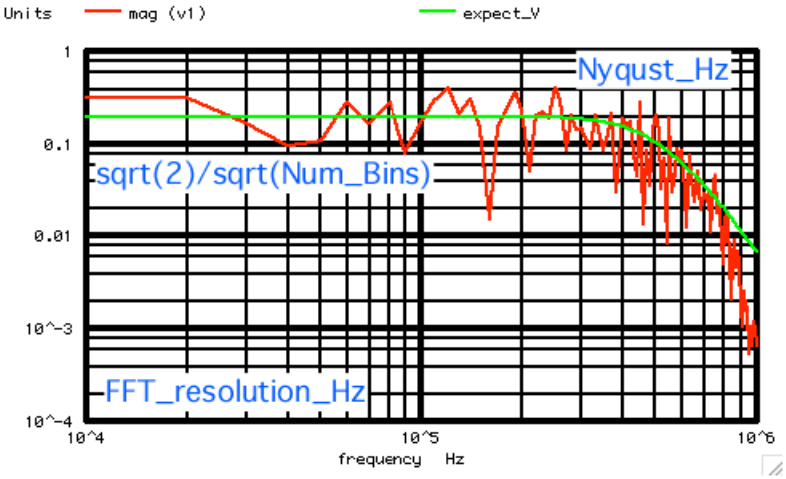
=====SAMPLING RANDOM SIGNAL=====

A 1V rms random signal will sample evenly over Nyquist.
Nyquist is half the sample rate frequency.





The sample frequency does nothing to the RMS value of noise.
It only spreads the energy out equally over Nyquist.

```
======================Want_100_1us_steps================================
Total_Period_s =        0.0001
Bin_Resolutio_Hz =      10000
Sample_Period_s =       1E-06
Nyquist_Hz =            500000
======================Create_PWL_array_and_Index_and_Plot==============
======================Add_1Vrms_Noise_to_PWL_array=====================
======================Install_the_PWL_array============================
======================Run_and_Plot=====================================
======================Find_Ave_Rms=====================================
Average_level_Expect    0     Average_level -0.00406862
RMS_level_Expect        1     RMS_level      1.05424
======================FFT_and_Plot=====================================
FFT_BandWidth_Hz=       1E+06
FFT_resolution_Hz=      10000
======================done=============================================
```

A 1us sample rate over 100us total time gives a 500KHz Nqyuist
Bin resolution for 100us is 10Khz.
So the number of bins within Nqyuist is 50.

This FFT displays 1V_peak signals at one.
So the expected uniform noise level for 1V rms should be sqrt(2)/sqrt(Num_Bins)

The expected 3dB point should be 500KHz.

```
====================MacSpiceCode=====================================
```

Arbritary_waveform_generation

```
*================Need_A_voltage_Source_to_alter====================="
V1                V1      0       0     dc
.control
set               pensize = 2
echo              "======================Want_100_1us_steps=============================="
let n =           100
let tstep =       1us
let period_t =    n*tstep
let Bin_Hz =      1/period_t
let nyquist =     .5/tstep
echo              "Total_Period_s =       $&period_t"
echo              "Bin_Resolutio_Hz =     $&Bin_Hz"
echo              "Sample_Period_s =      $&tstep"
echo              "Nyquist_Hz =           $&nyquist"
echo              "======================Create_PWL_array_and_Index_and_Plot=============="
let pwl_1 =       vector(2*n)*tstep*0.5
let ii =          vector(2*$&n)
*plot             pwl_1  vs ii
echo              "======================Add_1Vrms_Noise_to_PWL_array====================="
let index =       0
repeat            $&n
let               pwl_1[1+2*index] = 1.2*(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              "======================Install_the_PWL_array============================"
alter             @v1[pwl] = pwl_1
echo              "======================Run_and_Plot======================================"
let period_s =    tstep/2
let trans_per =   tstep/20
tran              $&trans_per $&period_t   0  $&trans_per
*echo             "run here"
plot              v1
*plot             v(V1) pointplot
echo              "======================Find_Ave_Rms======================================"
let averVal =     mean(v1)
let noisAC =      v1 - averVal
let RmsVal =      sqrt(mean(noisAC* noisAC))
echo              "Average_level_Expect   0    Average_level $&averVal "
echo              "RMS_level_Expect       1    RMS_level     $&RmsVal  "
unlet averVal
unlet RmsVal
echo              "======================FFT_and_Plot======================================"
linearize
let               FFT_BandWidth_Hz =      1Meg
let               FFT_resolution_Hz =     10k
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(v1)
let expect_V =    (sqrt(2)/sqrt(500k/10k))/(1+(frequency/550k)*(frequency/500k)*(frequency/500k)*(frequency/
500k)*(frequency/500k))
plot              mag (v1) expect_V loglog
echo              "==================done=============================================="
.endc
.end
```

4.18.11_1.36PM
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