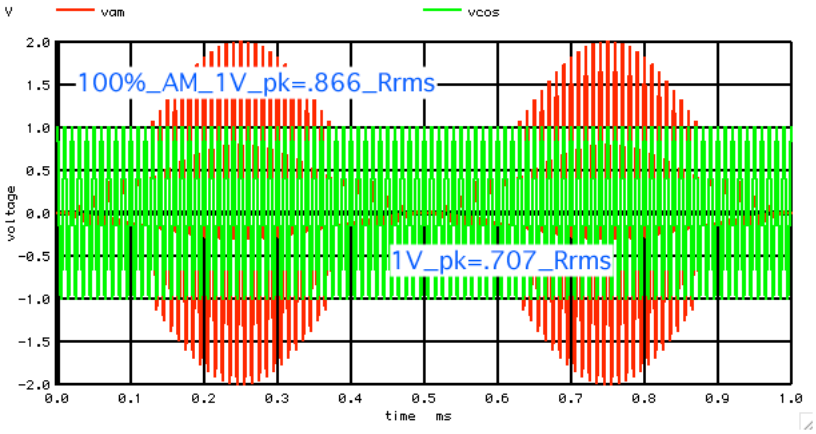
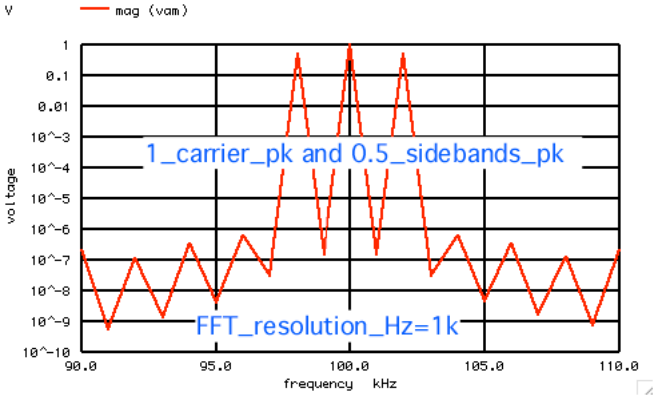
==========SIMPLE_AM_WAVEFORM_GENERATION==========

1) 100%_AM_1V_pk (This Spice version) = 1_carrier_pk and 0.5_sidebands_pk
2) Signal_rms = sqrt(2)*Signal_pk
3) 100%_AM_1V_pk (Spectrum RMS) = sqrt(1+.5^2+.5^2)/sqrt(2)_V_rms
4) FFT_resolution_Hz = 1/total_time_sec
5) Nyqust_Hz = 0.5/Sample_time_sec
6) Num_Bins for FFT = Nyqust_Hz/FFT_resolution_Hz





1) For this version of spice, 100%_AM_1V_pk signal produces a carrier signal with a magnitude of one with two 0.5 magnitude sidebands.
2) Note the rms value for a 1V_pk signal is .707V_rms, which can be calculated in spice.

```
======================Find_Ave_RmsCOS=====================================
RMS_level_Expect        .707    RMS_level_Cos   0.707494
======================Find_Ave_RmsAM======================================
RMS_level_Expect        .866    RMS_level_RM    0.86555
======================FFT_and_Plot_AM=====================================
FFT_BandWidth_Hz=       500000
FFT_resolution_Hz=      1000
Fundamental+sideband    0.999954 + 0.499976 + 0.499978
Total_RMS               1.22469
======================FFT_and_Plot_Vcos===================================
FFT_BandWidth_Hz=       500000
FFT_resolution_Hz=      1000
Fundamental+sideband    0.999954 + 6.25736E-07 + 5.03318E-07
Total_RMS               0.999954
```

3) The spectrum's rms value for a 100%_AM 1V_pk signal calculates to be 1.225V_rms.
4) One needs for instance 1 whole second to measure a signal to a 1Hz resolution.
5) At least two samples are needed to detect the presents of an AC signal.
   That is why Nyquist is half the sample rate.
6) FFT translate samples over time to bins of frequency. The bin's width is the FFT_resolution_Hz and the Maximum frequency is Nyqust_Hz

==========MacSpiceCode==========

SIMPLE_AM_WAVEFORM_GENERATION

```
*=========Create_Signal=================
VTime     VTime  0      DC      0    PWL(    0      0    1      1)
Vfreq1    Vfreq1 0      DC      2
BMOD      VMOD   0      V       = cos(6.2831853*2000*V(VTime))
BAM       VAM    0      V       = (1-V(VMOD))*cos(6.2831853*100k*V(VTime))
BCOS      VCOS   0      V       = 1*cos(6.2831853*100k*V(VTime))

.control
*TRAN             TSTEP  TSTOP  TSTART TMAX   ?UIC?
tran              .1u    1m     0       .1u
set               pensize = 2
```

```
plot              vam vcos
echo              "======================Find_Ave_RmsCOS======================================"
let averVal =     mean(vcos)
let noisAC =      vcos - averVal
let RmsVal =      sqrt(mean(noisAC* noisAC))
echo              "RMS_level_Expect       .707   RMS_level_Cos  $&RmsVal  "
unlet averVal
unlet RmsVal
echo              "======================Find_Ave_RmsAM======================================="
let averVal =     mean(VAM)
let noisAC =      VAM - averVal
let RmsVal =      sqrt(mean(noisAC* noisAC))
echo              "RMS_level_Expect       .866   RMS_level_RM  $&RmsVal  "
unlet averVal
unlet RmsVal
echo              "======================FFT_and_Plot_AM======================================="
linearize
let               FFT_BandWidth_Hz =      500k
let               FFT_resolution_Hz =     1k
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(vam)
plot              mag (vam) ylog xlimit 90k 110k
plot              mag (vam) ylog xlimit 95k 105k ylimit .1 1
let fund =        mag(vam[99])
let upsb =        mag(vam[101])
let lpsb =        mag(vam[97])
echo              "Fundamental+sideband   $&fund + $&upsb + $&lpsb "
let totalrms =    sqrt( fund*fund +upsb*upsb+ lpsb*lpsb)
echo              "Total_RMS      $&totalrms "
echo              "======================FFT_and_Plot_Vcos====================================="
destroy
let               FFT_BandWidth_Hz =      500k
let               FFT_resolution_Hz =     1k
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(vcos)
plot              mag (vcos) ylog xlimit 90k 110k
plot              mag (vcos) ylog xlimit 95k 105k ylimit .1 1
let fund =        mag(vcos[99])
let upsb =        mag(vcos[101])
let lpsb =        mag(vcos[97])
echo              "Fundamental+sideband   $&fund + $&upsb + $&lpsb "
let totalrms =    sqrt( fund*fund +upsb*upsb+ lpsb*lpsb)
echo              "Total_RMS      $&totalrms "

.endc
.end
```

4.4.11_11.55AM

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