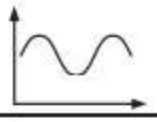
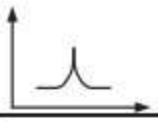
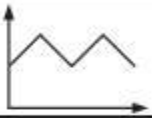
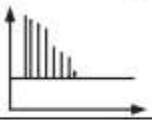
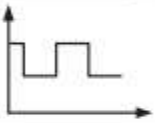
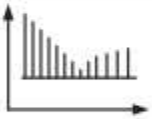
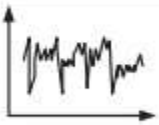
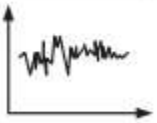
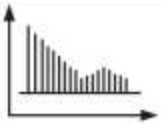
Waveform	Time domain	Frequency domain
Sinewave		
Triangle		
Sawtooth		
Rectangle		
Pulse		
Random noise		
Bandlimited noise		
Random binary sequence		

Time Domain

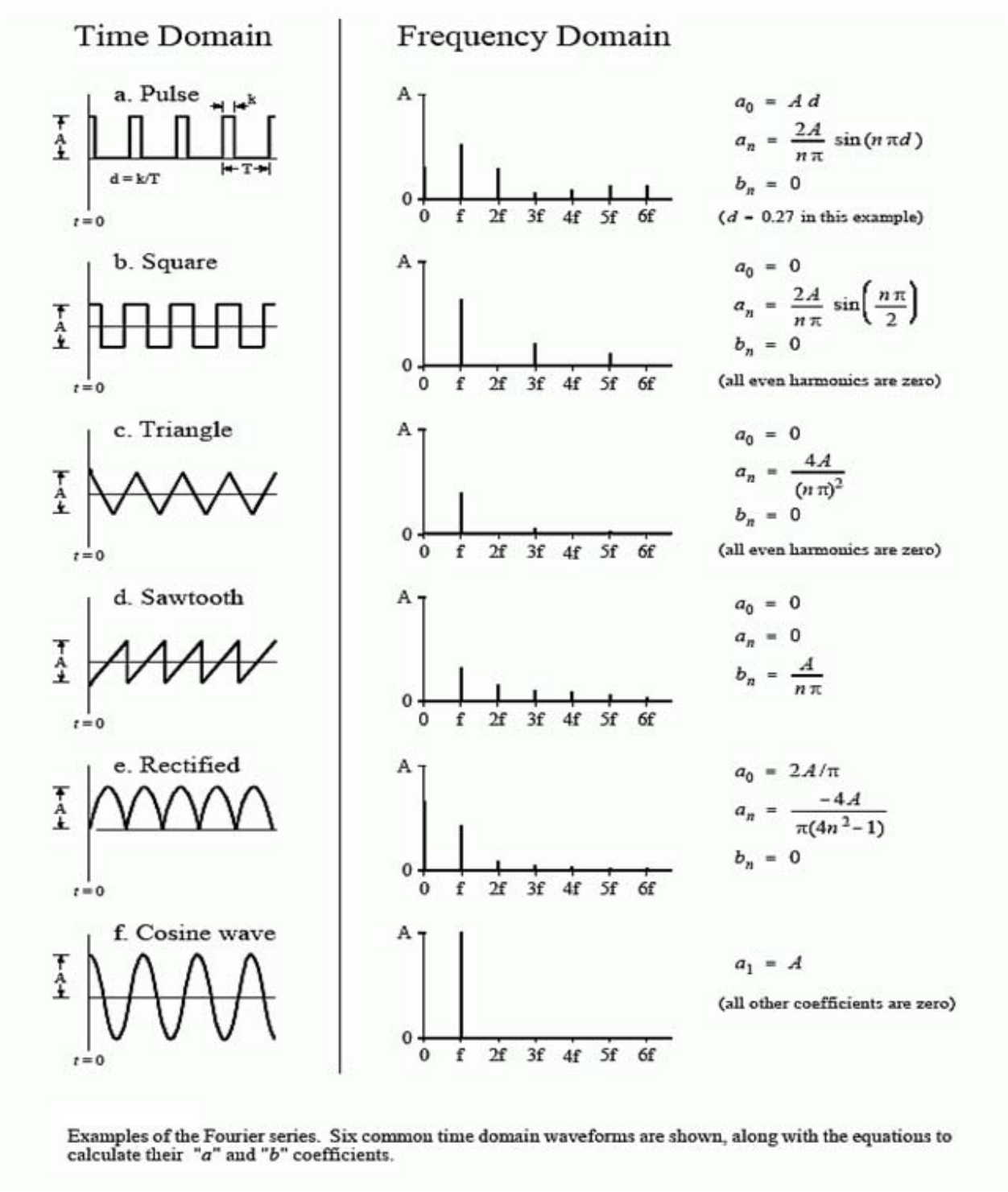
The **time domain** is the domain in which all the signals are represented. Time domain signal can be tested or verified with the use of oscilloscope.
In time domain signals are represented by amplitude on Y axis and time on X axis.

Frequency Domain

The **frequency domain** is useful to do more deeper analysis of the time domain signal. Frequency domain helps study frequency contents of the discrete time domain signals as well as continuous time domain signal. **The frequency domain signal can be analyzed with the use of spectrum analyzer.**

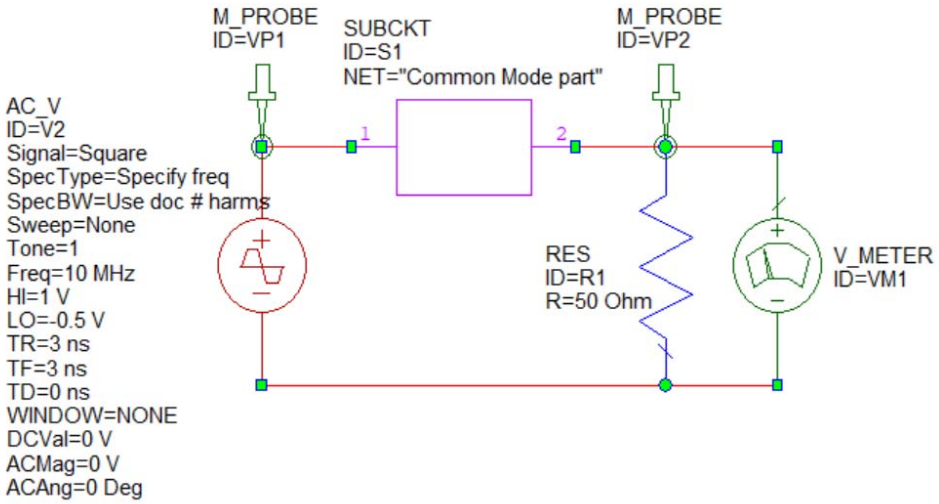
In frequency domain signals are represented by power (amplitude^2) on Y axis and frequency on X axis.

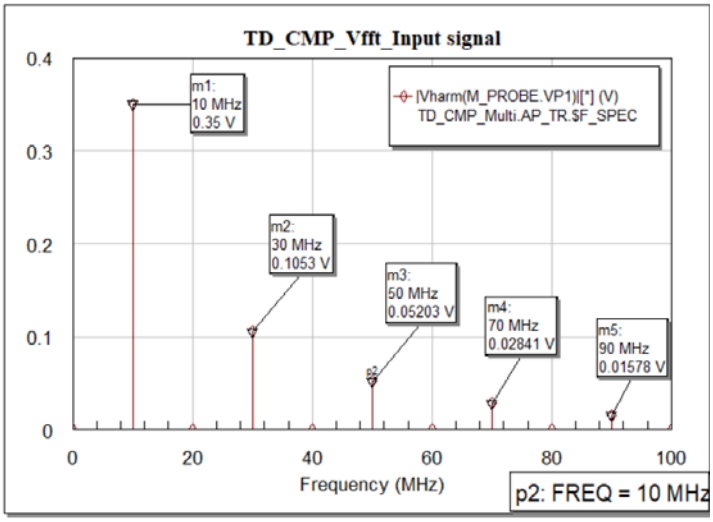
Time domain signal can be converted to Frequency domain signal with the use of Discrete Fourier Transform or Fast Fourier Transform (FFT).

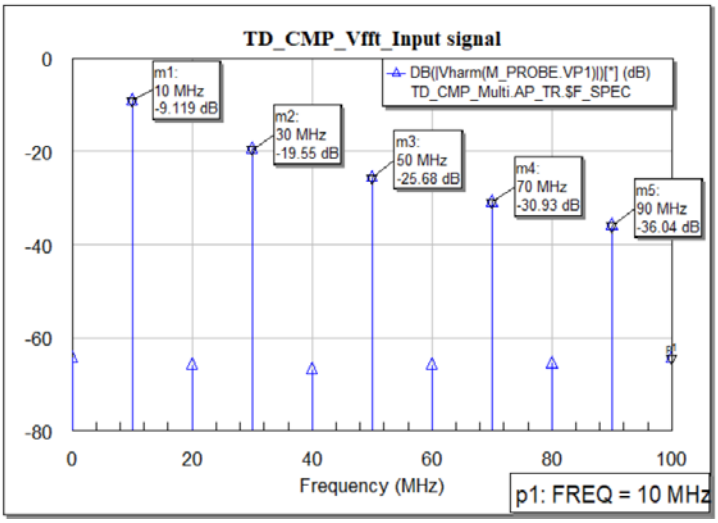


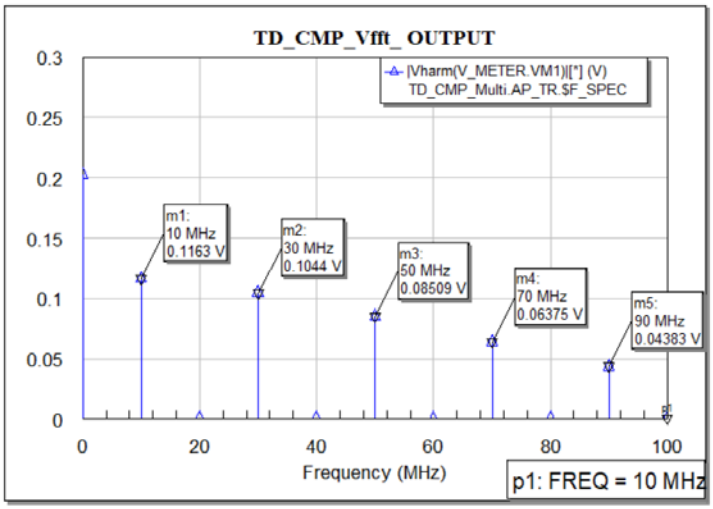
Examples of the Fourier series. Six common time domain waveforms are shown, along with the equations to calculate their "*a*" and "*b*" coefficients.

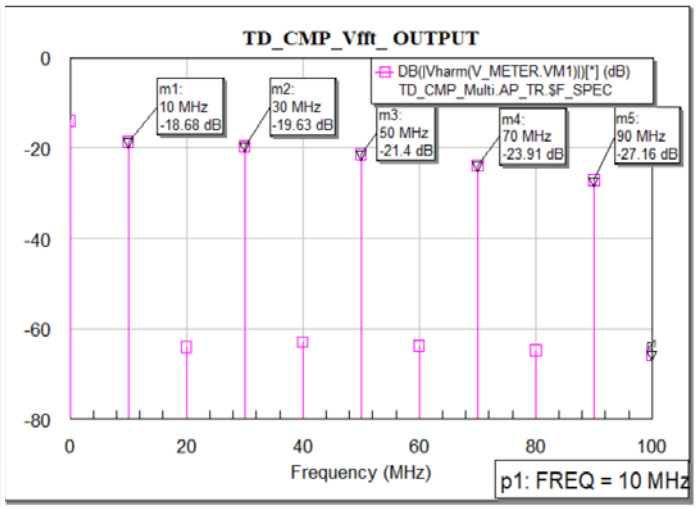
The time domain signal used in the Fourier series is *periodic* and *continuous*. Following figure shows several examples of continuous waveforms that repeat themselves from negative to positive infinity. Periodic signals have a frequency spectrum consisting of **harmonics**. For instance, if the time domain repeats at 10 Mhertz (a period of 1 microsecond), the frequency spectrum will contain a first harmonic at 10 Mhertz, a second harmonic at 20 Mhertz, a third harmonic at 30 Mhertz, and so forth. The first harmonic, i.e., the frequency that the time domain repeats itself, is also called the **fundamental frequency**. This means that the frequency spectrum can be viewed in two ways: (1) the frequency spectrum is *continuous*, but zero at all frequencies except the harmonics, or (2) the frequency spectrum is *discrete*, and only defined at the harmonic frequencies. In other words, the frequencies between the harmonics can be thought of as having a value of zero, or simply not existing. The important point is that they do not contribute to forming the time domain signal.

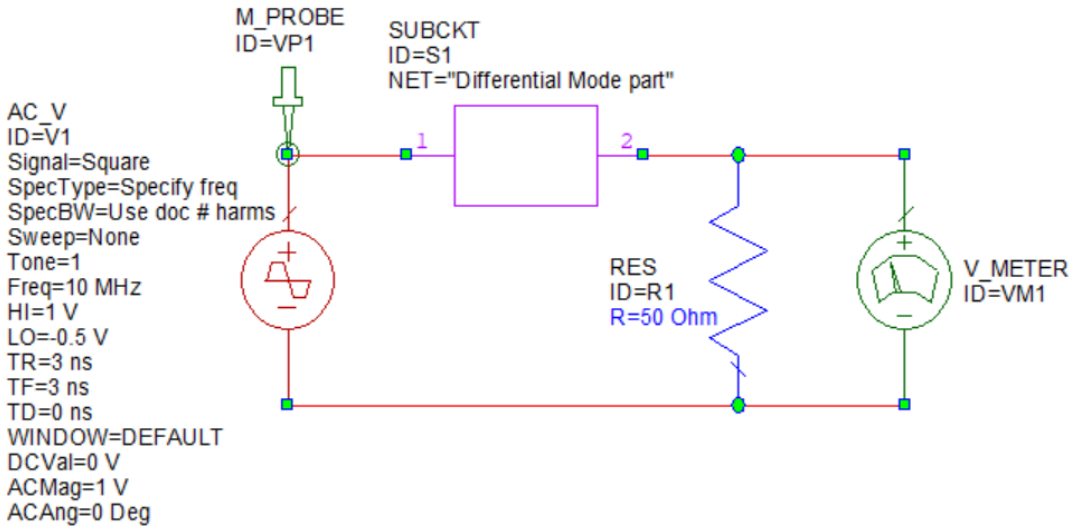

M_PROBE
ID=VP1
SUBCKT
ID=S1
NET="Common Mode part"
M_PROBE
ID=VP2
AC_V
ID=V2
Signal=Square
SpecType=Specify freq
SpecBW=Use doc # harms
Sweep=None
Tone=1
Freq=10 MHz
HI=1 V
LO=-0.5 V
TR=3 ns
TF=3 ns
TD=0 ns
WINDOW=NONE
DCVal=0 V
ACMag=0 V
ACAng=0 Deg
1
2
RES
ID=R1
R=50 Ohm
V_METER
ID=VM1

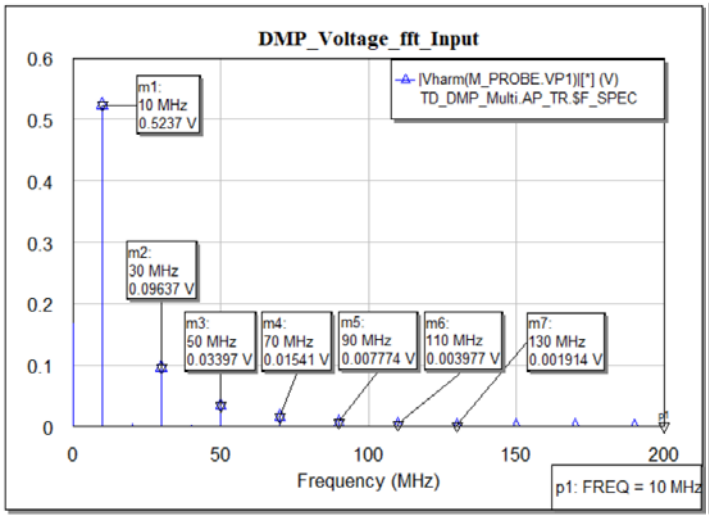

TD_CMP_Vfft_Input signal
|Vharm(M_PROBE.VP1)|[*] (V)
TD_CMP_Multi.AP_TR.$F_SPEC
m1: 10 MHz 0.35 V
m2: 30 MHz 0.1053 V
m3: 50 MHz 0.05203 V
m4: 70 MHz 0.02841 V
m5: 90 MHz 0.01578 V
Frequency (MHz)
p2: FREQ = 10 MHz

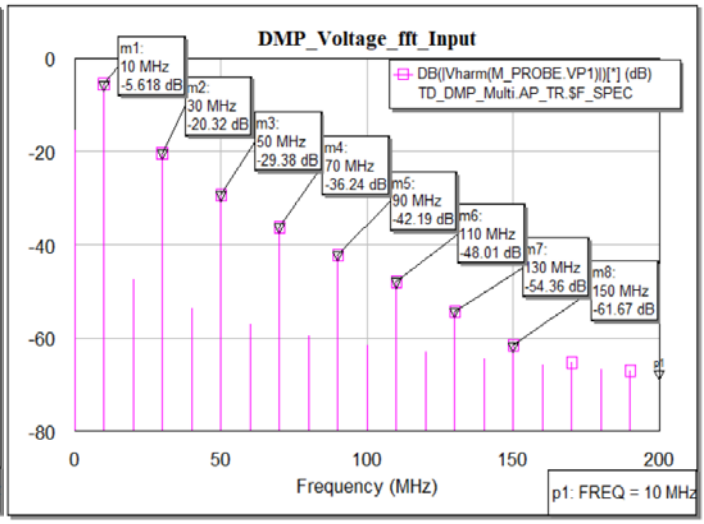

TD_CMP_Vfft_Input signal
DB(|Vharm(M_PROBE.VP1)|)[*] (dB)
TD_CMP_Multi.AP_TR.$F_SPEC
m1: 10 MHz -9.119 dB
m2: 30 MHz -19.55 dB
m3: 50 MHz -25.68 dB
m4: 70 MHz -30.93 dB
m5: 90 MHz -36.04 dB
Frequency (MHz)
p1: FREQ = 10 MHz

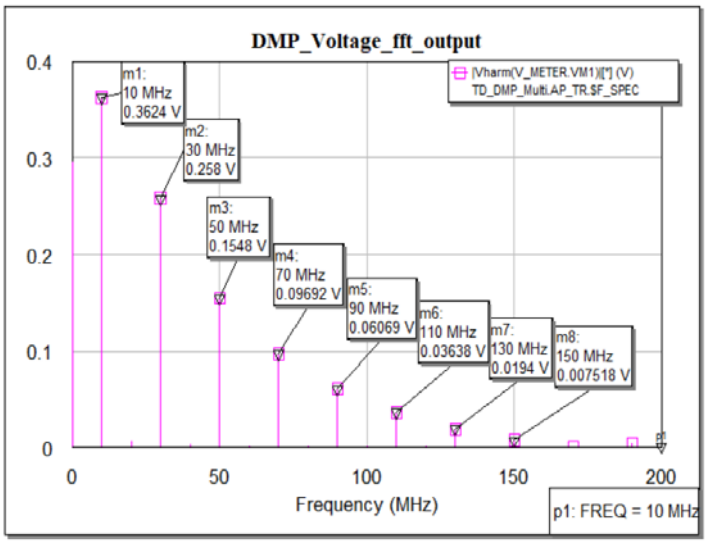

TD_CMP_Vfft_ OUTPUT
|Vharm(V_METER.VM1)|[*] (V)
TD_CMP_Multi.AP_TR.$F_SPEC
m1: 10 MHz 0.1163 V
m2: 30 MHz 0.1044 V
m3: 50 MHz 0.08509 V
m4: 70 MHz 0.06375 V
m5: 90 MHz 0.04383 V
Frequency (MHz)
p1: FREQ = 10 MHz

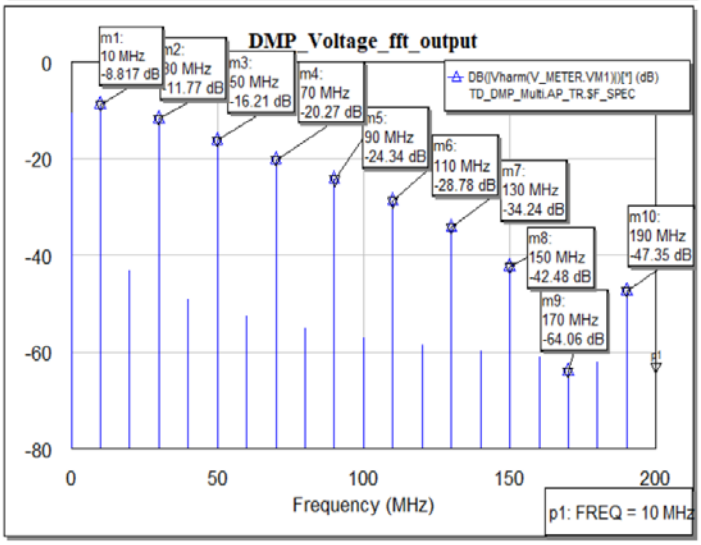

TD_CMP_Vfft_ OUTPUT
DB(|Vharm(V_METER.VM1)|)[*] (dB)
TD_CMP_Multi.AP_TR.$F_SPEC
m1: 10 MHz -18.68 dB
m2: 30 MHz -19.63 dB
m3: 50 MHz -21.4 dB
m4: 70 MHz -23.91 dB
m5: 90 MHz -27.16 dB
Frequency (MHz)
p1: FREQ = 10 MHz


M_PROBE
ID=VP1
SUBCKT
ID=S1
NET="Differential Mode part"
AC_V
ID=V1
Signal=Square
SpecType=Specify freq
SpecBW=Use doc # harms
Sweep=None
Tone=1
Freq=10 MHz
HI=1 V
LO=-0.5 V
TR=3 ns
TF=3 ns
TD=0 ns
WINDOW=DEFAULT
DCVal=0 V
ACMag=1 V
ACAng=0 Deg
1
2
RES
ID=R1
R=50 Ohm
V_METER
ID=VM1


DMP_Voltage_fft_Input
|Vharm(M_PROBE.VP1)|[*] (V)
TD_DMP_Multi.AP_TR.$F_SPEC
m1: 10 MHz 0.5237 V
m2: 30 MHz 0.09637 V
m3: 50 MHz 0.03397 V
m4: 70 MHz 0.01541 V
m5: 90 MHz 0.007774 V
m6: 110 MHz 0.003977 V
m7: 130 MHz 0.001914 V
Frequency (MHz)
p1: FREQ = 10 MHz


DMP_Voltage_fft_Input
DB(|Vharm(M_PROBE.VP1)|)[*] (dB)
TD_DMP_Multi.AP_TR.$F_SPEC
m1: 10 MHz -5.618 dB
m2: 30 MHz -20.32 dB
m3: 50 MHz -29.38 dB
m4: 70 MHz -36.24 dB
m5: 90 MHz -42.19 dB
m6: 110 MHz -48.01 dB
m7: 130 MHz -54.36 dB
m8: 150 MHz -61.67 dB
Frequency (MHz)
p1: FREQ = 10 MHz


DMP_Voltage_fft_output
|Vharm(V_METER.VM1)|[*] (V)
TD_DMP_Multi.AP_TR.$F_SPEC
m1: 10 MHz 0.3624 V
m2: 30 MHz 0.258 V
m3: 50 MHz 0.1548 V
m4: 70 MHz 0.09692 V
m5: 90 MHz 0.06069 V
m6: 110 MHz 0.03638 V
m7: 130 MHz 0.0194 V
m8: 150 MHz 0.007518 V
Frequency (MHz)
p1: FREQ = 10 MHz


DMP_Voltage_fft_output
DB(|Vharm(V_METER.VM1)|)[*] (dB)
TD_DMP_Multi.AP_TR.$F_SPEC
m1: 10 MHz -8.817 dB
m2: 30 MHz -11.77 dB
m3: 50 MHz -16.21 dB
m4: 70 MHz -20.27 dB
m5: 90 MHz -24.34 dB
m6: 110 MHz -28.78 dB
m7: 130 MHz -34.24 dB
m8: 150 MHz -42.48 dB
m9: 170 MHz -64.06 dB
m10: 190 MHz -47.35 dB
Frequency (MHz)
p1: FREQ = 10 MHz