**Filtering High Frequency Amplifier Noise**

The measurement of Class-D and other PWM or Delta-Sigma digital modulator type output stage amplifiers often presents a problem due to high frequency switching noise components. These high frequency components can obstruct the measurement of typical in-band 20-20kHz measurements.

Many of these amplifiers have limited high frequency filtering of their own, and many analyzers or other measuring instrumentation have no or insufficient filtering to remove the passband effects of these strong high frequency out-of-band components. The LF280™ offers a steep 80kHz 8th order passive lowpass filter to remove these unwanted high frequency components and enable accurate in-band amplifier response measurements.

**High Performance Filters**

The LF280™ is constructed entirely of the latest high linearity ultra high permeability gapped Ferrite inductors and Polypropylene capacitors for the ultimate in stability, high frequency performance, reduction of high frequency loss, and maximum linearity. The LF280™ utilizes a unique topology of identical component values to greatly reduce component sensitivity and produce a highly stable response with maximum passband flatness.

**Precision Attenuators**

A common problem with any passive filter is loading by the external cable capacitance or analyzer/meter input circuitry which can alter the passband response.

**Features & Capabilities**

- Dual Precision Passive 8th Order 80kHz Lowpass Filters
- Dual Precision 30dB Attenuators with 6dB Steps
- Dual Channel Single Ended or Mono Bridged Differential Mode
- High Power Capability: 90VRMS/Chan or 180VRMS/Bridged
- Very Flat Passband Response, ±0.05dB to 40kHz
- Very High Stopband Response, >70dB above 240kHz
- Very High Linearity at High Signal Levels
- Low Sensitivity to Cable/Analyzer Loading
- Constant Output Impedance, 330 Ohms/Ch
- Dual 5-Way Binding Post Amplifier Connectors
- Dual BNC and XLR Output Signal Connectors
- Short Circuit Output Protection
- Efficient High Performance Low Cost Design
- Small Size: 1.8 x 4.0 x 7.0 Inches (46 x 101 x 178 mm) 2 lbs

The LF280™ provides a precision R2R ladder attenuator which effectively removes the effects of external device loading, and provides a constant low output impedance regardless of the attenuation selected. For attenuation levels of -12dB or lower the effects of any external device loading are effectively eliminated.

An additional advantage of the precision attenuator is to reduce signal levels fed to other measuring devices which may not be capable of handling the very large signals produced from high power amplifiers.
**Amplifier Measurements**
The LF280™ provides a combination of powerful features to facilitate filtered measurements of amplifier signals spanning a wide variety of configurations and various test equipment capabilities. With any passive filter the loading imposed by connection cables and meter/analyzer inputs can potentially alter the precision frequency response of the LF280™ filters. Most meters and analyzers often have 100-500pF of input capacitance contained within their input stage circuitry. Many cables contain 100pF/Ft capacitance. This capacitance loading will affect the precise passband response of the LF280™.

To obtain maximum passband flatness the LF280™ attenuator provides a means of isolating the external equipment and cables from affecting the LF280™ filter response. Attenuation levels of -12dB or higher will effectively eliminate any external loading on the LF280™ filters by external cables and meter/analyzer circuitry. When accurate passband flatness is required, attenuation levels of -12dB or higher should be employed.

**Single Channel Measurements**
General measurements for amplifiers with single channel output modes require only a single filter channel of the LF280™. In this case the Red/Blk terminals of the amplifier channel are connected to the Red/Blk input terminals of one channel of the LF280™. The dummy load for the amplifier is connected directly to the amplifier Red/Blk terminals as well.

The unbalanced BNC output of the LF280™ is can be fed to an unbalanced or balance input on the meter/analyzer. The single channel filter mode provides a maximum input signal range up to 90Vrms.

**Bridged Channel Measurements**
Measurements for amplifiers with bridged channel modes can be easily handled using the dual filters of the LF280™. In this case the Red/Red terminals of both amplifier channels are connected to the Red/Red input terminals of the LF280™. The dummy load for the amplifier is connected directly to the amplifier Red/Red terminals as well. The Black terminals of the amplifier and LF280™ may or may not need to be connected, depending on the equipment behavior and bench grounding characteristics involved.

The balanced XLR output of the LF280™ is fed to a balanced input on the meter/analyzer. The dual filter bridged mode provides a maximum input signal range up to 180Vrms.

**High Power Single Channel Measurements**
For amplifiers with extremely high single channel output levels, the dual filters of the LF280™ can be used in series to divide the amplitude between both filters. This provides a maximum input signal range up to 180Vrms.

In this mode the Red/Blk channel outputs from the amplifier channel are fed to both the Red/Red input terminals of the LF280™. The dummy load for the channel is connected directly to the amplifier Red/Blk terminals as well. The balanced output XLR is used and fed to the meter/analyzer.

The common mode rejection capabilities of the meter/analyzer at high frequencies can be of critical importance to obtain maximum dynamic range and accuracy of the measurements. In some cases floating the meter/analyzer ground may be required to obtain sufficient CMR at the frequencies of interest.
## Typical Specifications

### General
- **Configuration**: Dual Single Channel, Mono Bridged Mode
- **Max Input Single Ended**: 90VRMS / Channel
- **Max Input Bridged Mode**: 180VRMS / Bridged

### Filters
- **Circuit Structure**: 8th Order Passive Lowpass
- **Circuit Components**: Gapped High Mu Ferrite Inductors & Polypropylene Capacitors
- **Filter Response**: 80kHz Butterworth-6dB
- **Insertion Loss**: -0.06dB @ 1kHz
- **Passband Flatness**: ±0.05dB, 0Hz-40kHz
- **Stopband Attenuation**: >70dB >240kHz
- **Distortion**: < 0.003% < 20kHz @ +22dBm
- **Group Delay**: 10μSec < 20kHz
- **Input Impedance**: 930 Ohms / Chan (±2%)
- **Output Impedance**: 330 Ohms / Chan (±2%)

### Attenuators
- **Circuit Structure**: R2R Ladder
- **Accuracy**: ±0.02dB
- **Attenuation**:
  - 0.00dB (Full Amplitude)
  - 0.02dB (1/2 Amplitude)
  - 1.04dB (1/4 Amplitude)
  - 4.06dB (1/8 Amplitude)
  - 24.08dB (1/16 Amplitude)
  - 30.10dB (1/32 Amplitude)

### Physical
- **Input Connectors**: Dual 5-Way Binding Posts 0.75 Inch
- **Output Connectors**: Dual BNC and Balanced XLR
- **Length**: 7.0 Inches (178mm)
- **Width**: 4.0 Inches (102mm)
- **Height**: 1.8 Inches (46mm)
- **Weight**: 2 lbs (1kg)
- **Material**: Steel 16ga
- **Finish**: Textured Black Polane

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