Application NOTE

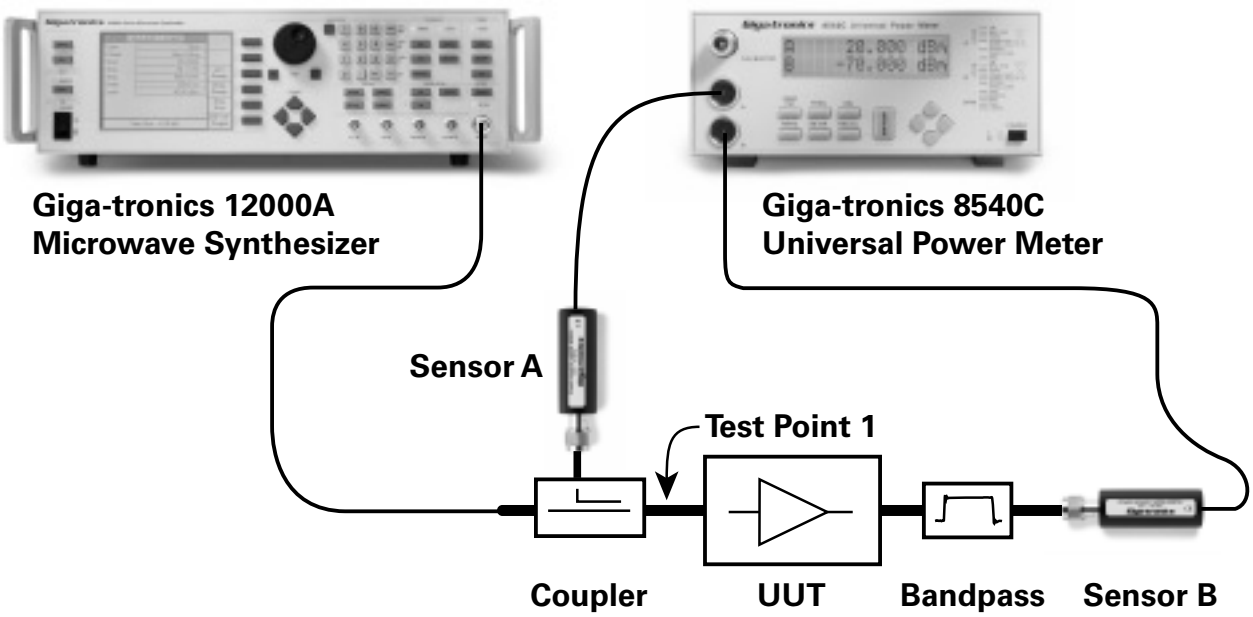
CHARACTERIZING AMPLIFIER GAIN COMPRESSION

OVERVIEW

When an RF or microwave application requires cascading several amplifiers in a system, gain compression performance of the individual amplifiers must be characterized. Cascading amplifiers improperly will result in poor gain performance (for a desired RF input power level), poor output power performance, and the generation of harmonics created by the cascaded amplifier operating in its non-linear power range.

One cost-effective method to determine the gain compression performance is to use a dual-channel Giga-tronics 8542C Universal Power Meter. This method determines gain compression by referencing the change in input power level to the change in output power level.

TEST SETUP



REQUIRED EQUIPMENT

A frequency synthesizer capable of providing enough power to drive an amplifier into gain compression (gain saturation is desirable), such as the high output power of the Giga-tronics 12000A Microwave Synthesizer.

Giga-tronics 8542C Universal Power Meter

80301A Sensors (2)

10 or 16 dB directional coupler

Band pass filter(s)

Miscellaneous cables and connectors

Giga-tronics Incorporated ■ 4650 Norris Canyon Road ■ San Ramon, California USA 94583 ■ Telephone: 925-328-4650 ■ Telefax: 925-328-4700

TEST PROCEDURE

1. Connect Sensor B to the throughline port of the coupler, test point 1.
2. Configure the top line of the power meter display for B/A (channel B referenced to A).
3. Configure the bottom line of the power meter display for channel A.
4. Apply a signal from the synthesizer and record the B/A value. Input this value to offset channel A. Use the measurement setup menu/offset and enter the channel A offset. After this is done, the B/A display should read 0.00 dB.
5. Remove sensor B from test point 1 and connect the UUT (unit under test), the bandpass filter, and sensor B as shown, and bias the UUT.

   Note: The input RF power level should be low enough to ensure that the UUT will not be in gain compression — ideally, 10 dB below the expected gain compression level. The bandpass filter is essential to the test setup because it ensures that harmonics generated by the UUT in compression do not introduce measurement errors.
6. Apply bias and RF to the amplifier. The B/A display (top line) will indicate gain of the amplifier and the A display (bottom line) will indicate the input RF power level. Record the B/A and A channel values.
7. Press the "REL" button located on the front panel of the power meter. Both lines of the display will read 0.00 dBr.
8. Slowly increase the RF power level of the synthesizer. The bottom line of the display (channel A) will begin to show a positive dBr value. Continue increasing the RF power until the top line of the display (relative B/A display) begins to show a negative value. This negative value is the indication that the amplifier is entering gain compression. Add the value of the lower display to the original channel A value. The new value is the RF input level (in dBm) where gain compression begins.
9. Repeat step 8, stopping at desired increments to characterize gain compression.

The Giga-tronics 8542C Universal Power Meter can be fully automated using this method to identify various levels of gain compression. This is especially useful when 0.25 dB or 0.1 dB compression values are needed to cascade several amplifiers into one amplifier chain.

Giga-tronics

Giga-tronics Incorporated ■ 4650 Norris Canyon Road ■ San Ramon, California USA 94583 ■ Telephone: 925-328-4650 ■ Telefax: 925-328-4700