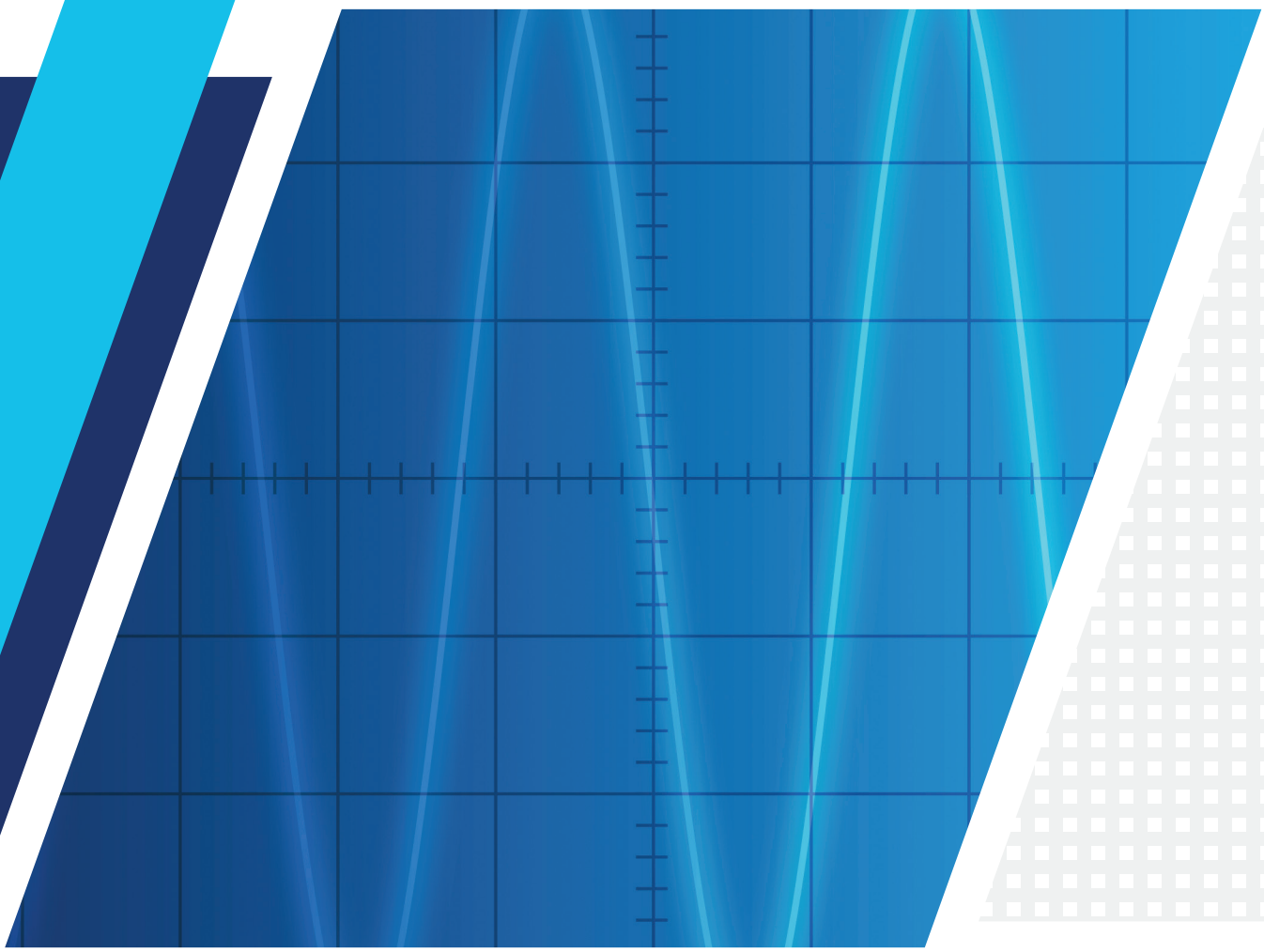
TECH NOTE



Power Measurement for Complex Modulations

Power Measurment for Complex Modulations

The model 43 wattmeter has been a staple for power measurement in two-way communication systems, providing accurate measurements for analog signals for more than 50 years. Modern communication techniques have changed the way signals are modulated so that they can carry more information while using less power. These complex modulation techniques utilize various methods for increasing the data rate or decreasing the required bandwidth.

For instance, DMR and P25 phase 2 both use two slot TDMA in a 12.5 kHz channel while NXDN uses discrete 6.25 kHz channels using FDMA, and TETRA uses a four slot TDMA in a 25kHz channel as shown in Figure 1.

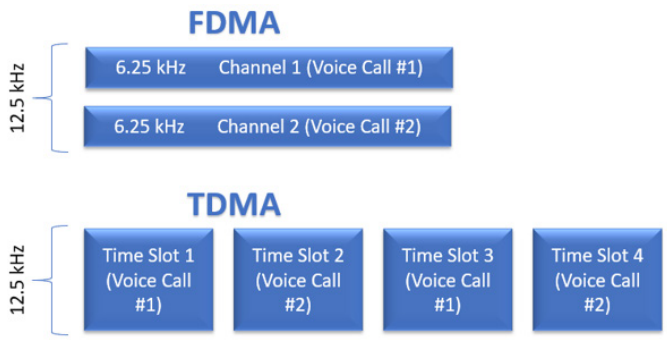


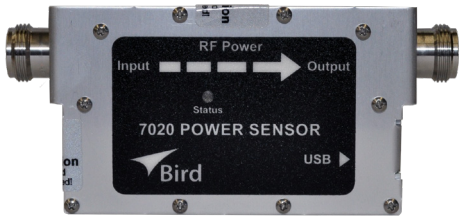
Figure 1

These signals use multiple time slots of data, taking turns using the bandwidth allocated to the channel. Since the switching occurs very fast, there is no apparent drop in quality but more calls can be made using one set of equipment (repeater, antenna, etc). In addition to adding a second call to the line, power consumption of a single call is reduced, as the second window is turned off and doesn't consume power. Due to the switching between the two calls, the envelope of the signal is not constant and thus average power measurement is not going to reflect the real output of the radio. However, peak power can be used as an accurate way to verify the output of the radio regardless of how many time slots are in use.

How do we measure these signals?

The 7020 uses a simple true average responding detector scheme that will measure nearly all types of modulation presented to it. This means that regardless of what type of RF signal is present (CW, burst, TDMA, FDMA, LTE, etc.), the 7020 will report the average power.

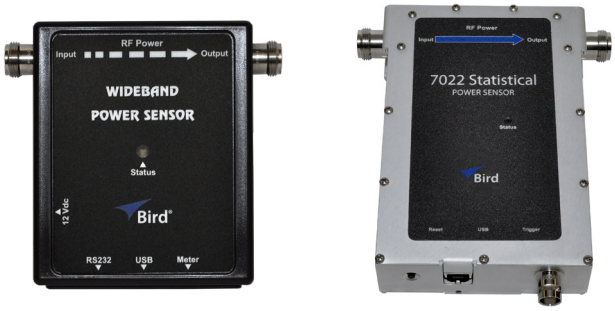
For example, if the signal is TDMA with 2 out of 8 slots active with a slot power of 100W, the 7020 will measure an average power of 25W (100W * 2 ÷ 8). The 7020 will not be able to measure the power in a single slot, because it is measuring the average power over time which includes the inactive slots as well as the active slots.



Bird 7020 series RF power sensor will accurately measure average power regardless of what type of RF signal is present (CW, burst, TDMA, FDMA, LTE, etc.)

If it is required to measure the power in a single slot, then a burst power measurement is needed, such as those provided by the Wideband Power Sensor family (5012D, 5016D, etc.). Actual transmitted power in a single time slot can be determined, but the other time slots must be off. There are also some limitations on how slow the burst repetition rate can be to make a good measurement.

The 7022 statistical power will also measure a single time slot. When using the 7022 sensor, place it in Time Domain Mode, and then set markers to the width of the desired time slot and the Limit Line can give you the amplitude.



Birds Wideband or Statistical Power sensors are well-suited for measurement of individual slot power in addition to average power.

It is important for those testing and maintaining radios with these new modulation and channel access methods, that the right power measurement tools are used in order to provide the best possible power measurement results.

