

Keysight Technologies

Simplifying Multi-Channel Measurement Synchronization

Using the Keysight U2020 X-Series USB peak power sensors
and P-Series power meters



Application Brief

Introduction

This application note applies to the following products from Keysight Technologies, Inc.:

- U2020 X-Series USB peak and average power sensor
- N1911/12A P-Series power meter

In many power measurement applications, users need to make multiple power measurements simultaneously. For example, some wireless technology standards require four channel power measurements be tested concurrently. As a result, the setup for multi-channel power measurement in manufacturing test systems demands plenty of space on the test rack in order to accommodate both the power meter and power sensors. This significantly increases the cost of a test system.

The Keysight U2020 X-Series USB peak power sensor provides maximum flexibility and ease-of-use, and measures power that is fully time-synchronized with external triggering via available Trig In and Trig Out ports on power sensors. Each product in the U2020 X-Series is a standalone sensor that operates without the need for a power meter or an external power supply. The sensors draw power from a USB port and do not need additional triggering modules to operate, making them portable and lightweight solution, thus save the space of manufacturing.

Alternatively, the bench-top Keysight N1911/12A P-Series power meters have capabilities similar to the U2020 X-Series USB peak power sensors. However their use is likely to require more rack space. For example, an N1912A P-Series power meter requires at least two rack units, and a two-channel P-Series power meter is needed in order to achieve four channel power measurements. Consequently, their use will increase the cost of a test system indirectly.

This application note demonstrates how multi-channel measurement synchronization is performed using the U2020 X-Series USB peak power sensors. For this example, a Keysight signal generator creates the GSM burst timeslot signal and measures the GSM timeslot burst signal concurrently using four USB peak power sensors.

Built-In Trigger In and Trigger Out

An external trigger enables accurate triggering of small signals close to the signal noise floor. The U2020 X-Series USB power sensors come with built-in trigger in/out connections. This feature allows the USB sensors to connect to an external trigger signal from a signal source or device-under-test via a standard BNC-to-SMB cable. This offers multi-channel power measurement capabilities, accuracy, and flexibility.

Test Configuration and SCPI Commands

Figures 1 and 2 illustrate the equipment configuration for multi-channel measurement synchronization. In Figure 1 four USB peak power sensors are used for measurement synchronization using the signal generator's Event 1 to trigger a daisy-chain that begins with the USB peak power sensor's Trigger In. The first sensor's Trigger Out is used to trigger the second sensor via the Trigger In port. Subsequently, the second sensor's Trigger Out triggers the third sensor via the Trigger In port. This process continues for all sensors. Figure 2 shows an alternative test configuration which also uses four USB peak power sensors for multi-channel measurement synchronization via the signal generator's Event 1.

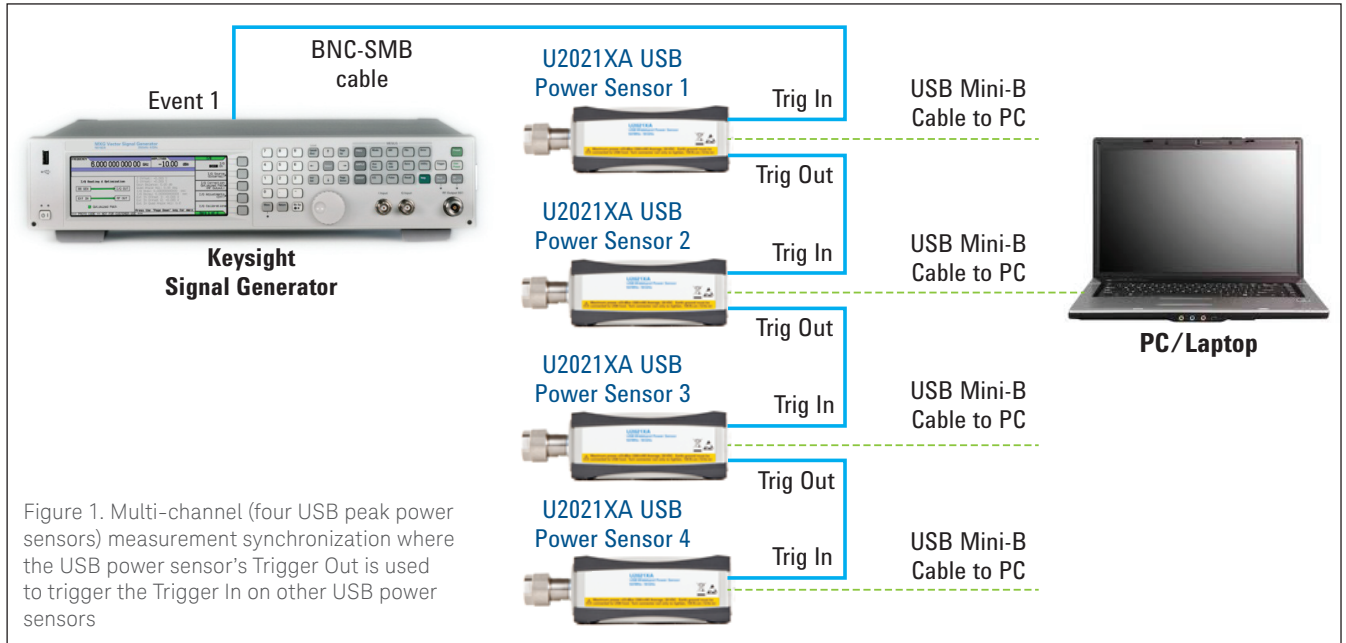


Figure 1. Multi-channel (four USB peak power sensors) measurement synchronization where the USB power sensor's Trigger Out is used to trigger the Trigger In on other USB power sensors

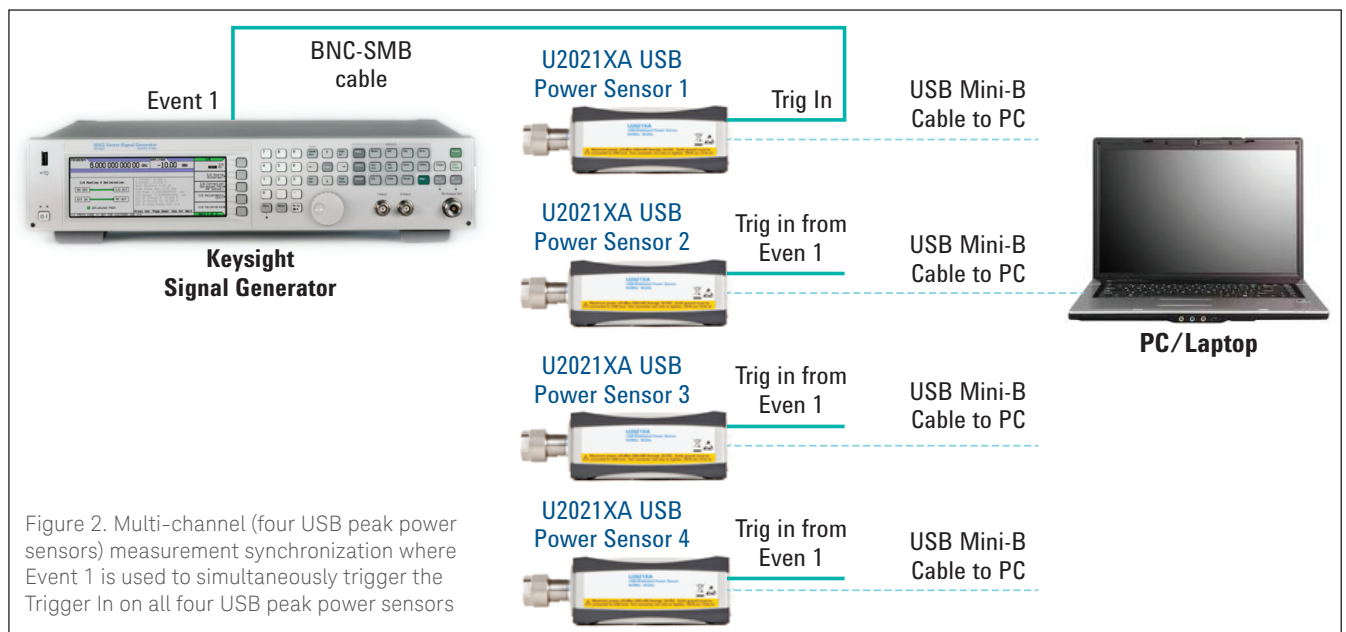


Figure 2. Multi-channel (four USB peak power sensors) measurement synchronization where Event 1 is used to simultaneously trigger the Trigger In on all four USB peak power sensors

SCPI	Description
Keysight ESG/MXG/EXG signal generator	
SYST:PRES	Preset the instrument to its default settings
FREQ 1GHZ	Set the frequency to 1 GHz (example)
POW:LEVEL 0DBM	Set the output power to 0 dBm (example)
OUTP:MOD:STAT ON	Turn on the modulation signal
OUTP:STAT ON	Turn on RF output
For ESG signal generator only	
SOUR:RAD:GSM:STAT ON	Recall the GSM burst signal waveform (example)
SOUR:RAD:GSM:BURST:STAT ON	Turn on GSM burst signal waveform
For MXG/EXG signal generator only	
SOUR:RAD:ARB:WAV \”WFM1:GSM_BURST_WFM\”	Recall the GSM burst signal waveform (example)
*OPC?	Wait for the operation to complete. Return 1 means the operation completed
SOUR:RAD:ARB:STAT ON	Turn on GSM burst signal waveform
ROUT:CONN:EVENT1 M2	Set the triggering event to Event1
Keysight U2020XA Series USB peak power sensor – power sensor 1, 2, 3, and 4	
SYST:PRES	Preset the instrument to its default settings
SENS:FREQ 1GHZ	Set the frequency to 1 GHz
SENS:AVER:SDET OFF	Turn off the step detector
SENS:DET:FUNC NORMAL	Set the measurement to Normal mode for burst signal power measurement
TRIG:SOUR EXTERNAL	Set the triggering source to “EXTERNAL” Note: If triggering source is “INTERNAL”, use the SCPI: TRIG:SEQ:LEVEL -20 (for example -20 dBm)
SENS:SWEEP:OFFSET:TIME 80u	Set the offset time duration of the burst signal upon triggering to 80 μs (example)
SENS:SWEEP:TIME 447u	Set the sweep time duration of the burst signal to 447 μs (example)
SENS:AVER:COUNT 1	Set the average count to 1 (example)
SENS:MRATE FAST	Set the measurement rate to Fast mode to improve the measurement speed. The speed mode default is Normal
CALC:FEED \”POW:AVER ON SWEEP\”	Set the input measurement mode to time-gated average power (example)
INIT:CONT OFF	Set to single trigger mode. In this mode, return the measurement using INIT + FETCH? (instead of READ?)
OUTPUT:TRIGGER 1	Enable the trigger output signal Note: Execute this command for power sensor 1, 2, and 3 only if the USB power sensor’s Trigger Out is used to trigger the Trigger In on other USB power sensors (Figure 1) There is no need to execute this command for power sensors 1, 2, 3, and 4 if the signal generator’s Event 1 is used to simultaneously trigger the Trigger In on all four USB peak power sensors (Figure 2)
INIT	Initialize the measurement in wait-for-trigger mode
FETCH?	Querying time-gated average power

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