HOW TO USE THE MODEL 845 SERIES TRIGGER SYSTEM TO PERFORM EXTREMELY FAST DIGITAL SWEEPS

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This application note focuses on how to program and run fast frequency (or generalized list) sweeps using the Model 845 Series signal generators with the fast switching option FS.

The Model 845 Series (or the Model 855 Series multi-channel) signal generators with option FS allow extremely fast sweeps that, in combination with the trigger system, can generate very accurate and fast frequency and power ramps. In contrast to traditional analog sweeps, fast digital sweeps can be synchronized at any time during the sweep and yield precise frequencies throughout the sweep.

INTRODUCTION

The Model 845 Series and Model 855 series of signal generators can be programmed to execute sweeps by either the BNC graphical user interface (GUI) or by directly using the SCPI commands.

In this application note, we describe the configuration for a frequency sweep with the following parameters:

- Linear sweep from 1 to 12 GHz in total 10 steps
- Execute entire sweep once on every external trigger rising edge
- Frequencies shall be switched every 50 us
- An output trigger shall provide a "signal valid" indication by changing to HIGH whenever the transient is completed and the signal becomes valid

TRIG OUT now remains high until t=50 μs is reached and switching to the next frequency is initiated. Within τ_{inv} the switching transient is completed and TRIG OUT goes high again. The new frequency / power pair remain stable until t=150 μs is reached. TRIG OUT goes low for a second time and the next frequency / power pair is programmed.

Note that the transient time τ_{invN} and the valid time τ_{valN} can vary from point to point, but the step time τ_{step} (=τ_{invN}+τ_{valN})between frequencies is always 50 μs.

In particular, for the first frequency of the sweep, τ_{inv1} is zero and the τ_{val1} is 50 μs. TRIG OUT can be used to precisely synchronize sweeps to any external equipment.

KEY SPECIFICATIONS:

- -90 TO +13 DBM POWER OUTPUT (PE MODEL)

- -90 TO +23 DBM POWER OUTPUT (HP MODEL)

- DOWN TO 10 µS FREQUENCY SWITCHING TIME

- VERY LOW SSB PHASE NOISE

- POWERFUL TRIGGER AND SWEEPING MODES

- AVAILABLE ON ALL 845 PLATFORMS (BENCH, RACK, MODULE 12, 20, 26 GHz)

Sweep Configuration

We configure this sweep in three steps:

1. Configure Trigger
Trigger input

TRIG:SEQ:TYPE	POIN
TRIG:SEQ:SOUR	EXT
TRIG:SEQ:DEL	0
TRIG:SEQ:SLOP	POS
TRIG:SEQ:ECO	1

Trigger output

TRIG:OUTP:MODE	VAL

2. Configure Sweep

SOUR:SWE:COUN	1
SOUR:SWE:DWEL	50e-6
SOUR:SWE:DEL	0
SOUR:SWE:SPAC	LIN
SOUR:SWE:POIN	10
SOUR:SWE:STAR	1e9
SOUR:SWE:STOP	12e9
SOUR:FREQ:MODE	SWE

3. Arm trigger

|	
INIT:CONT	ON
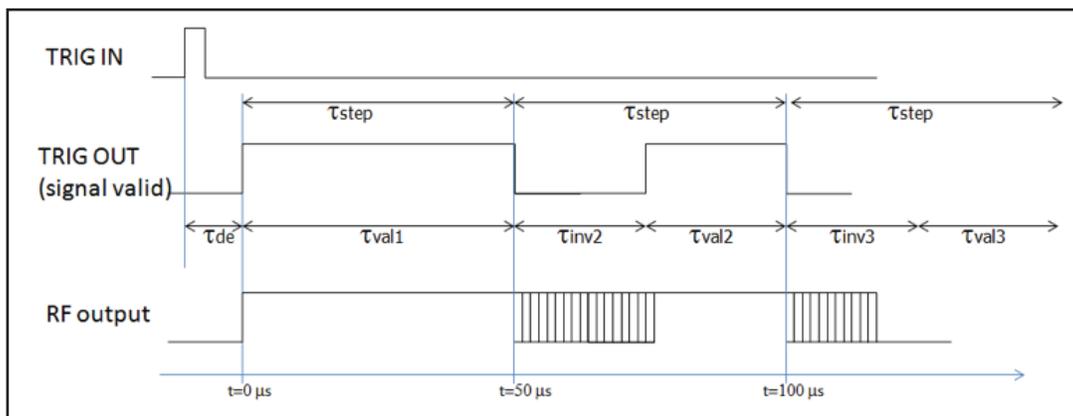
Figure 1: Timing diagram

GRAPHICAL USER INTERFACE (GUI) SETUP

In the GUI, the setup is straightforward. First, we configure the trigger system to wait for rising edge and run the entire sweep upon trigger.

We switch to the TRIGGER tab of the GUI as shown in Figure 2. We set trigger mode to "Repeat", Trigger source to "External Trigger", Trigger Edge to "Rising", and Trigger Parameter to "Execute complete List". In the trigger output setting we set "Valid"

APPLICATIONS:

• ATE

• R&D LOW NOISE SIGNAL SOURCE

• PRODUCTION TESTING (INDUSTRY-LEADING SWITCHING TIMES; HIGH DYNAMIC RANGE)

• SERVICE AND MAINTENANCE (BATTERY OPERATION)

• SIGNAL SIMULATION (RADAR, WIMAX, UWB)

• AEROSPACE AND DEFENSE (PULSE MODULATOR, CHIRPS)
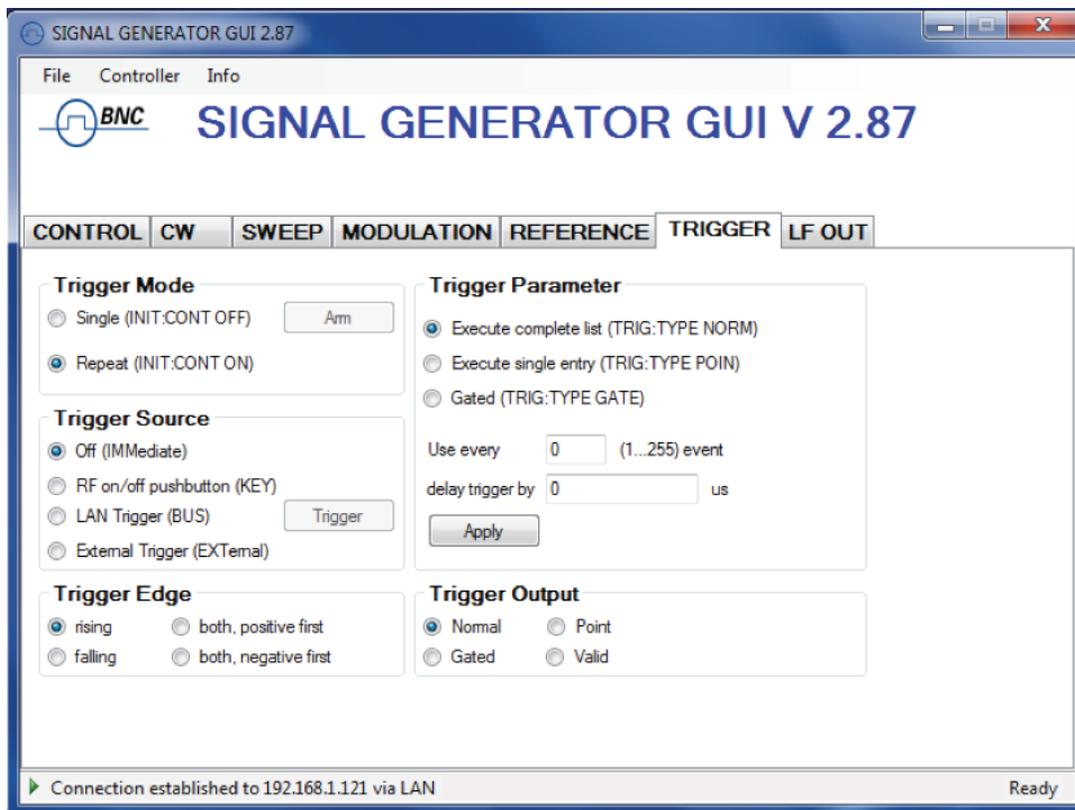
Figure 2: GUI trigger settings.

GRAPHICAL USER INTERFACE (GUI) SETUP CONTINUED...

Next, we switch to the SWEEP tab of the GUI as shown in Figure 3.

We set the start frequency to 1 GHz, and stop frequency to 12 GHz. The number of repetitions of the sweep we set to 1, number of points to 10, "Dwell time" to 0.05 ms, disable the "Auto" and set the "Off time" to 0 ms.

We can chose for the ALC (automatic level control) to operate in "on" or "hold" mode.

We can start the sweep with the "on/off" button on the left.
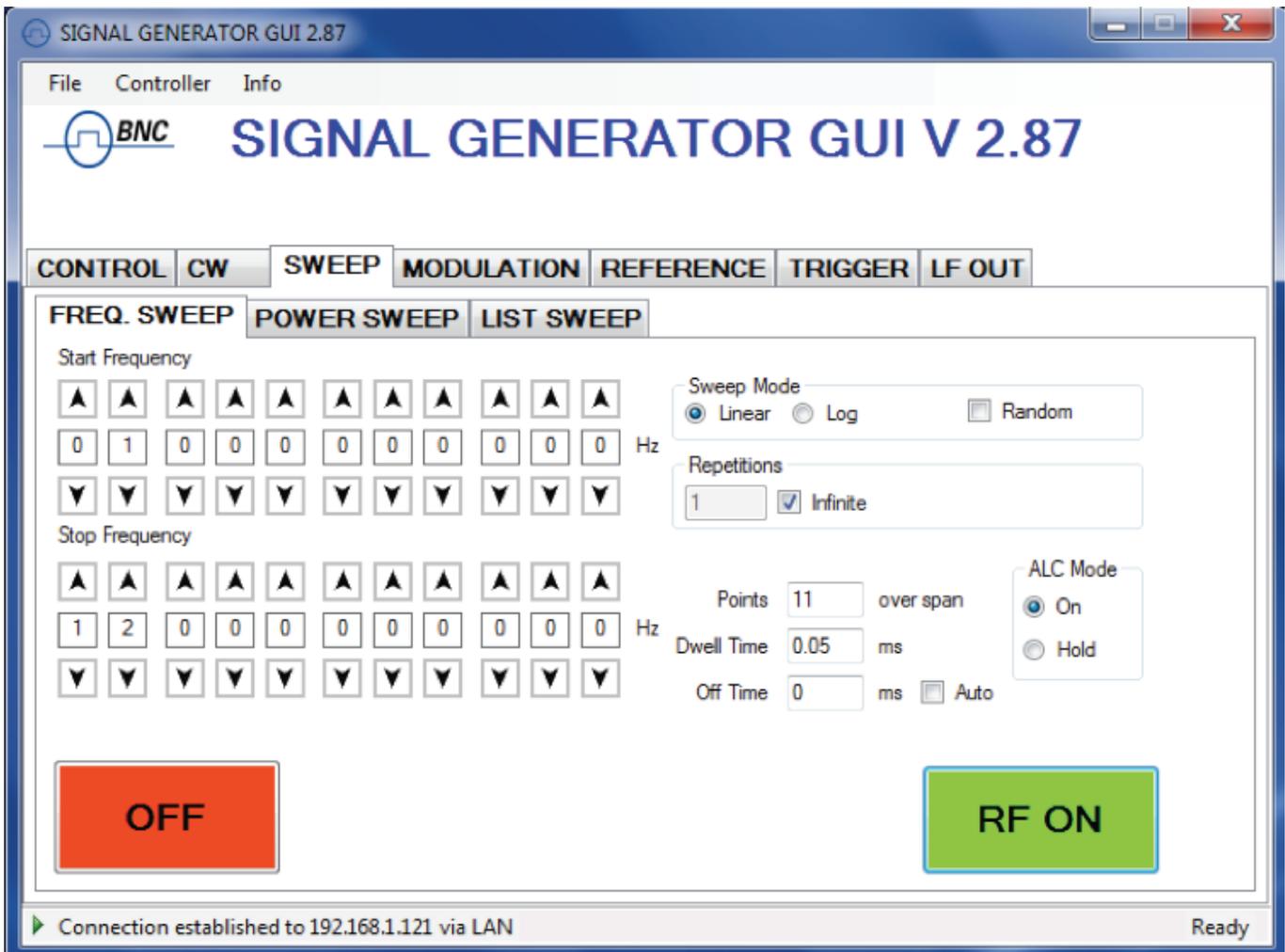
Figure 3: GUI sweep settings

MEASUREMENT RESULTS

Figure 4 shows the time domain measurements of the sweep. TRIG IN is applied approx every 990 microseconds from an external source (red trace).

Upon the rising edge, the "signal valid" (green trace) goes high almost instantly, indicating that first frequency RF (blue trace) is stable. After the ten consecutive frequencies, "signal valid" does low a last time and remains low unit a new sweep starts upon new trigger rising edge.
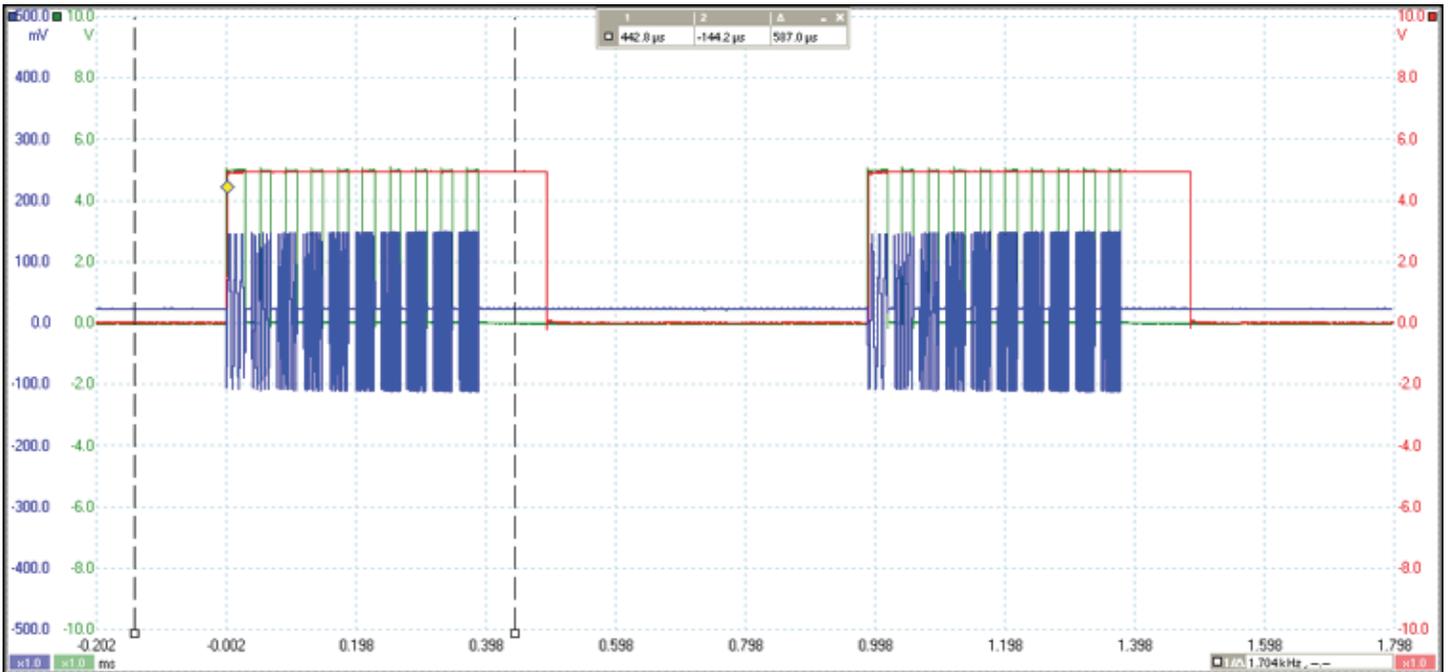

Figure 2: 10 point sweep with 50 µs step time.

CONCLUSION

The option FS for the MODEL 845 SERIES allows extremely fast and precise digital sweeps that can be well synchronized to external equipment using input and output trigger.

ALL BENCHTOP MODEL FEATURES:

• LAN/USB/GPIB REMOTE CONTROL WITH SCPI 1999 COMMAND SET

• COMPLIMENTARY POWERFUL & EASY TO USE GUI

• COMPACT, ROBUST, LIGHTWEIGHT, PORTABLE & RUGGED DESIGN

• SEALED, FAN-LESS, ENCLOSURE (LOW POWER CONSUMPTION)

• INTERNAL RECHARGEABLE BATTERY OPTIONS

• FIELD CARRYING CASE AVAILABLE

• SINGLE AND DOUBLE RACKMOUNTS AVAILABLE

INDUSTRY COMPARISON
RF / MICROWAVE SIGNAL GENERATORS
3 GHz, 6 GHz, 12 GHz, 20 GHz & 26.5 GHz AVAILABLE

EQUIPMENT	MODEL 845-20	KEYSIGHT MXG N5183A	KEYSIGHT E8257D PSG W/ OPTIONS	R&S SMB B120L W/ OPTIONS
FREQ. RANGE RESOLUTION	100 kHz-20.5 GHz 0.001 Hz	250 kHz -20 GHz 0.01 Hz	250 kHz -20 GHz 0.01 Hz	100 kHz -20 GHz 0.001 Hz
SWITCHING SPEED OPTION FS	0.2 ms 0.03 ms	5 MS (1.15 ms OPTION UNZ)	9 ms	3 ms
POWER RANGE OPTION PE3 OPTION HP RESOLUTION	-30 TO +20 dBm -190 TO +13 dBm -20 TO +26 dBm 0.01 dB	-90 TO +7 dBm 0.01 dB	-135 TO +15 DBM 0.01 dB	-20 TO +22 DBM 0.01 dB
PHASE NOISE 10G OCXO OPTION LN	-108 dBc/Hz < 0.1 ppm -117 DBC/Hz 0.01 ppm	-98 dBc/Hz < 1 ppm	-115 dBc/Hz < 0.05 ppm	-108 dBc/Hz < 0.1 ppm
MODULATIONS	AM/FM/PM/PULSE TRAINS/CHIRPS	OPTIONAL	OPTIONAL	OPTIONAL
EXTRAS	PORTABLE INTERNAL BATTERY	-	-	-
WEIGHT, SIZE POWER CONSUMP.	2.5 kg < 15 W	12.8 kgs 250 W	22 kgs 250 W	6.9 kgs >90 W
LIST PRICE	$17,000.00 USD	$42,000.00 USD	$68,000.00 USD	$51,000.00 USD