Products: SMIQ

Fast Remote Control for R&S SMIQ Vector Signal Generators

Application Note

Short setting times are among the most important criteria when it comes to choosing the right signal generator, especially in production. With its extremely short setting times for frequency (<3 ms) and level (<2.5 ms), the R&S SMIQ Vector Signal Generator family easily meets the requirement. In addition, SMIQ provides two special modes where setting times can be further reduced, Fast Restore mode and List Mode.

This Application Note decribes both modes and gives some application examples.

ROHDE&SCHWARZ

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Contents

1 Overview

Short setting times are among the most important criteria when it comes to choosing the right signal generator, especially in production. With its extremely short setting times for frequency (<3 ms) and level (<2.5 ms), the R&S SMIQ Vector Signal Generator family is best suited to meet the requirement. In addition, SMIQ provides two special modes where the setting times can be further reduced.

The Fast Restore mode is a special feature for remote controlling the generator. Device settings can be saved and recalled very quickly via the IEC/IEEE bus using special commands. The Fast Restore commands directly address the instrument modules, the database of the SMIQ is bypassed, leading to a very high setup speed. Frequency and level settings can be performed in less than 800 µs. The Fast Restore mode is not restricted to frequency and level settings; nearly all RF and general device parameters can be set.

The LIST mode provides even faster frequency and level settings (<500 µs[1]). A sequence of freely selectable frequency and level points can be executed, either automatically or triggered by an external device or the internal baseband section. Triggering via the IEC/IEEE bus is also supported.

This Application Note explains both the Fast Restore mode and the LIST mode, and gives some application examples.

2 SMIQ Fast Restore Mode

Working principle

Device settings can be saved and recalled very quickly via the IEC/IEEE bus using the commands described below. Up to 4000 memory locations are available, depending on the SMIQ version and the options installed.

In contrast to the normal SAVE/RECALL function, only the setting data of the modules is stored in the Fast Restore mode. Restoring by means of the ':SYSTem:SREStore' or '!..' command has an immediate effect on the modules. The database (which stores all entries and delivers the display data) is bypassed. The result is a very high setup speed.

The Fast Restore commands have an effect on almost all RF and general device settings (see Table 2.1)

[1] For f > 3.3 GHz the setting time is less than 700 µs.

Table 2.1: Device settings in Fast Restore mode.

Device settings supported by Fast Restore:	**Device settings not supported by Fast Restore:**
• Frequency including reference oscillator • Level including mech. switched attenuator, user correction and ALC modes • Analog modulation • Vector modulation • Switch-on/off digital modulation, ARB mode or digital standards • Switch on/off fading, noise or distortion • LF generator and LF output	• baseband signal of digital modulation and digital standards • Settings for fading, noise and distortion • Functions not affecting the RF output signal, eg commands under `:SYSTem:...` or `:UNIT:...` (except for `SYSTem:PRESet`) • Sweep • List mode • Memory sequence

Fast Restore does not affect the baseband modules. If a baseband module is switched on before using RESTORE commands, it will remain on until it is explicitly switched off by a normal IEC/IEEE command. Fast Restore can however switch from CW to modulated signals and back by turning on or off the I/Q modulator, without setting baseband modules. So it is possible to change baseband settings with normal commands and then use the same RESTORE settings again. This works with 3GPP, IS-95 downlink, ARB mode and vector modulation, for example. GSM/EDGE, however, requres different RESTORE states because the powerramping is done partly by RF modules, as is the case for all modulations where powerramping (indicated by PRAMP) is active.

Operation

Commands

:SYSTem:SSAVe 1...n *(n being the number of available memory locations)*

Saves the current device setting at the memory location indicated.

:SYSTem:SREStore 1...n *(n being the number of available memory locations)*

Loads a device status that was stored using the `:SYSTem:SSAVe` command (RESTORE).

! <least significant byte> <most significant byte>

This command has the same effect as the `:SYSTem:SREStore` command. The setting time however is 300 µs shorter. It is optimized for highest speed and does not comply with the SCPI syntax regulations. Exactly 3 bytes are transmitted including the `'!'` (which is the identifier of this command). With the last byte, EOI has to be activated as delimiter.

The memory location is binary-coded in the 2 bytes indicated.

Example:

RESTORE at memory location 268 (-> 010C hex) corresponds to the following binary command:

0010 0001 0000 1100 0000 0001

'!' hex 0C hex 01

Binary-coded bytes usually cannot be written as printable ASCII characters. When programmed in C, the above command has the following form:

```
char sendstring[3] = {'!', 0x0C, 0x01}
```

In BASIC, the command string to be output is as follows:

```
'!' + CHR$(12) + CHR$(1)
```

(The pros for CHR$ are decimal numbers, therefore 12 for 0C hex.)

Since binary-coded bytes can also have the value of the LF (line feed) character which is interpreted as a delimiter, switch over to 'only EOI' as delimiter by selecting '`:SYSTem:COMMunicate:GPIB:LTERminator EOI`' prior to using this command.

Call-up and termination of operating mode

After a RESTORE, the database no longer reflects the device setting which means that

- the displayed values are no longer relevant,
- the desired result is not obtained by a query of setup values.
- normal setting commands may not be executed properly

It is therefore recommended either to use the *RST command or to store the device setting prior to using the first RESTORE command by means of the `:SYSTem:SSAVe n` command and to restore it after the last RESTORE command using `:SYSTEM:SRESTore n`. The database and the device setting will then match again.

No other commands are required to activate or deactivate this mode.

Alternative use with other IEC/IEEE-Bus commands

The alternative use of the RESTORE commands (`':SYSTem:SREStore'` or `'!..'`) and normal IEC/IEEE-bus commands is

- useful with digital modulation:

  First, the baseband signal is configured by means of normal commands and digital modulation is switched on. Then, digital modulation can be switched on/off using the RESTORE commands.
- possible for all commands that do not affect the RF output signal (eg `:SYSTem:...`, `:UNIT:...`),
- normally not possible for all the functions listed in the left column of Table 2.1.

In case of doubt, we recommend testing.

Synchronization signal

In Fast Restore mode a synchronization signal is available at the rear-panel BLANK connector to synchronize other devices.

The BLANK signal is high during settling of the RF output signal and low in the settled state. The BLANK polarity can be changed in the menu UTILITIES → AUX I/O.

Additional recommendations

- If the mechanically switched attenuator is switched over by a RESTORE command, the setting time increases by 15 ms. This can be avoided by setting attenuator mode FIXED or ELECTRONIC for interruption-free level setting prior to storing the setting. To get the desired level setting range, set the level to the highest desired value in attenuator mode AUTO, then switch to attenuator mode FIXED or ELECTRONIC (`:OUTPut:AMODe FIXed` or `ELECtronic`). For details of the SMIQ's level setting modes see reference [4].
- The time for switching on or off I/Q modulation can also be decreased using the fast I/Q transition mode (`:SOURce:DM:IQ:TRAN FAST`). In this mode the I/Q modulator is never switched off, the CW signal is generated by a baseband signal with constant voltage (U_I = 0.5 V, U_Q = 0 V). As the spectral purity of the CW signal is slightly decreased, this mode should only be used when fast transitions between I/Q modulated and CW signals are required. The fast transition mode works with VECTOR MOD, DIGITAL MOD and DIGITAL STD (standards). However, the mode makes no sense when changing the baseband signal takes more time than switching the I/Q modulator, as for example with WCDMA/3GPP or ARB mode. Note that the fast I/Q transition mode requires a baseband module to be set, which is only possible with normal IEC/IEEE commands. In most cases RESTORE commands will be faster than the fast I/Q transition mode.
- Since the module setting depends on the temperature of the unit, any temperature variation of more than 5°C should be avoided between storage and call-up, to ensure the accuracy of the unit.

Application examples

Switching between CW and modulated (WCDMA/3GPP)

Problem:

Provide a WCDMA/3GPP signal and afterwards a CW signal in the 3GPP downlink band (e.g. an interfering signal for a receiver test). The generator shall step through the entire band in 5 MHz steps. The signal level shall be –10 dBm.

Note: Options SMIQB20, SMIQB11 and SMIQB45 are required for this example.

Solution:

The most time-consuming process is the calculation of the 3GPP signal. Without Fast Restore, this has to be done every time the 3GPP state is switched on. Therefore it is our goal to do this calculation only once. We first save the Fast Restore states with CW signals. Afterwards we calculate the 3GPP signal with normal IEC/IEEE commands and save the Fast Restore states with the modulation active. Then we run through the frequencies and switch between CW and 3GPP signals with RESTORE commands. This does not change the 3GPP state, only the I/Q modulator is switched on or off. Therefore we avoid the time-consuming recalculation of the 3GPP signal. As the initial baseband state (3GPP) is on, we should also terminate with a 3GPP signal running.

The commands for the entire procedure are as follows:

Command	Remarks
	Preparation
*RST;*CLS	Sets the instrument to a defined state. Note that *RST switches off the RF output.
:SOUR:POW –10	Sets the RF level to –10 dBm
:OUTP:AMOD FIX	Sets attenuator mode FIXED, for uninterrupted level settings in a range of 20 dB. Prevents attenuator switching when the modulation is turned on or off.
:SOUR:POW:ALC OFF :SOUR:POW:ALC:SEAR OFF	Sets ALC mode TABLE. Recommended for uninterrupted level setting
:SOUR:W3GP:SETT:TMOD:BST M1CH64	Sets the parameters for the 3GPP test model
:SOUR:FREQ 2.1125E9	Sets the carrier frequency to 2112.5 MHz (lower end of the 3GPP downlink band)
:OUTP:STAT ON	The RF output has to be switched on before storing the Fast Restore states. (*RST sets the output to OFF)
:SYST:SSAV 1	Saves the first CW setting
:SOUR:FREQ 2.1175e9	Sets the carrier frequency to 2117.5 MHz
:SYST:SSAV 2	Saves the second CW setting
	(continue)
:SOUR FREQ 2.1675e9	Sets the carrier frequency to 2167.5 MHz (upper end of the 3GPP downlink band)
:SYST:SSAV 12	Saves the last CW setting
:SOUR:FREQ 2.1125e9	Sets the carrier frequency to 2112.5 MHz (lower end of the 3GPP downlink band)
:SOUR:W3GP:STAT ON	Calculates and turns on the 3GPP signal
:SYST:SSAV 13	Saves the first 3GPP signal setting (2112.5 MHz)
:SOUR:FREQ 2.1175e9	Sets the carrier frequency to 2117.5 MHz
:SYST:SSAV 14	Saves the second 3GPP signal setting (2117.5 MHz)
	(continue)
:SOUR:FREQ 2.1675e9	Sets the carrier frequency to 2167.5 MHz (upper end of the 3GPP downlink band)
:SYST:SSAV 24	Saves the last setting with 3GPP on
:SOUR:FREQ 2.1125e9 :SYST:SSAV 25	Sets the initial (and final) state. This is useful to match user interface and hardware state after running a Fast Restore sequence. Note that the modulation is active in this state.
	Running the sequence
:SYST:SRES 1 :SYST:SRES 2 :SYST:SRES 12	Runs through the CW states (I/Q modulator off) state 1 state 2 ... state 12
:SYST:SRES 13	Runs through the states with 3GPP signal (I/Q modulator on) state 13

:SYST:SRES 24 :SYST:SRES 25	... state 24 initial state

The following settings (among others) are stored in the Fast Restore states:

1	2.1125 GHz; -10 dBm; I/Q modulator off
2	2.1175 GHz; -10 dBm; I/Q modulator off
...	
12	2.1675 GHz; -10 dBm, I/Q modulator off
13	2.1125 GHz; -10 dBm; I/Q modulator on
14	2.1175 GHz; -10 dBm; I/Q modulator on
...	
24	2.1675 GHz; -10 dBm, I/Q modulator on
25	2.1125 GHz; -10 dBm; I/Q modulator on

Note: the Fast Restore states can be restored in any order. You should only terminate the sequence with a Fast restore state where the I/Q modulator is switched on, in this case state 25.

Switching between different digital modulations and CW

Problem:

Same as before, this time with an additional run with a cdmaOne (IS-95) signal.

Note: Options SMIQB20, SMIQB11, SMIQB42 and SMIQB45 are required for this example.

Solution:

Similar to example 1. To add the IS-95 signal, we use additional normal IEC/IEEE commands.

Command	**Remarks**
	Preparation
*RST;*CLS	Sets the instrument to a defined state. Note that *RST switches off the RF output.
:SOUR:POW –10	Sets the RF level to –10 dBm
:OUTP:AMOD FIX	Sets attenuator mode FIXED, for uninterrupted level settings in a range of 20 dB. Prevents attenuator switching when the modulation is turned on or off.
:SOUR:POW:ALC OFF :SOUR:POW:ALC:SEAR OFF	Sets ALC mode TABLE. Recommended for uninterrupted level setting
:SOUR:W3GP:SETT:TMOD:BST M1CH64	Sets the parameters for the 3GPP test model
:SOUR:IS95:MODE FLIN18 :SOUR:IS95:PRES	Sets the parameters for the cdmaOne signal (in this case a predefined 9 code channel scenario)
:SOUR:FREQ 2.1125E9	Sets the carrier frequency to 2112.5 MHz (lower end of the 3GPP downlink band)
:OUTP:STAT ON	The RF output has to be switched on before storing the Fast Restore states. (*RST sets the output to OFF)

:SYST:SSAV 1	Saves the first CW setting
:SOUR:FREQ 2.1175e9	Sets the carrier frequency to 2117.5 MHz
:SYST:SSAV 2	Saves the second CW setting
	(continue)
:SOUR FREQ 2.1675e9	Sets the carrier frequency to 2167.5 MHz (upper end of the 3GPP downlink band)
:SYST:SSAV 12	Saves the last CW setting
:SOUR:FREQ 2.1125e9	Sets the carrier frequency to 2112.5 MHz (lower end of the 3GPP downlink band)
:SOUR:W3GP:STAT ON	Calculates and turns on the 3GPP signal
:SYST:SSAV 13	Saves the first 3GPP signal setting (2112.5 MHz)
:SOUR:FREQ 2.1175e9	Sets the carrier frequency to 2117.5 MHz
:SYST:SSAV 14	Saves the second 3GPP signal setting (2117.5 MHz)
	(continue)
:SOUR:FREQ 2.1675e9	Sets the carrier frequency to 2167.5 MHz (upper end of the 3GPP downlink band)
:SYST:SSAV 24	Saves the last setting with 3GPP on
	As we mix normal and RESTORE commands, it is better to terminate with a *RST command. Therefore we do not save an initial state.
	Running the sequence
:SYST:SRES 1 :SYST:SRES 2 :SYST:SRES 12	Runs through the CW states (I/Q modulator off) state 1 state 2 ... state 12
:SYST:SRES 13 :SYST:SRES 24	Runs through the states with 3GPP signal (I/Q modulator on) state 13 ... state 24
:SOUR:IS95:STAT ON	Switches on the cdmaOne signal. The 3GPP signal is turned off automatically.
:SYST:SRES 13 :SYST:SRES 24	Runs through the states with cdmaOne signal (I/Q modulator on) state 13 ... state 24
*RST;*CLS	Resets the unit to make sure that database and device settings match again.

3 SMIQ List Mode

Working principle

A sequence of predefined frequency and level points is executed in LIST mode, similar to a sweep. In contrast to a sweep, a list with freely selectable pairs of values (frequency and level) can be generated. The specified range of the frequency comprises the entire adjustable frequency range of the instrument. The specified range of the level covers a 90 dB range. If the permissible variation range is exceeded, the level accuracy decreases. If the level range exceeds 20 dB, SMIQ switches to attenuator mode ELECTRONIC. Otherwise, attenuator mode FIXED is used.

Stepping through the list can be triggered by an external TTL signal. The LIST mode allows even faster level or frequency variations than the Fast Restore mode. However, LIST mode includes only the parameters RF level and RF frequency.

Operation

Creating a list

Up to 10 lists can be created. The total number of possible list entries in all lists depends on the SMIQ version and the options installed. The number of remaining entries is indicated in the menu LIST → FUNCTION → EDIT/VIEW. The command :SOUR:LIST:FREE? returns two values, first the free memory (in numbers of entries), then the number of entries already used.

Each list is identified by a separate name and selected via this name. Each list consists of a frequency, power and dwell content. The dwell time is set once per list. The number of entries for frequency and level must be equal. However, if a parameter has just one value throughout the entire list, it is sufficient to set this value once.

Note: After generating, modifying or changing a list in the LIST mode, the LEARN function must be executed to ensure that the new settings are transferred to the hardware (IEC-bus short command: `LIST:LEAR`*).*

Table 3.1 LIST mode; Example of a list

Index	Frequency	Level
0001	100 MHz	0 dBm
0002	575 MHz	13 dBm
0003	235 MHz	7 dBm
:	:	:
0100	333 MHz	5 dBm
:	:	:

Running LIST mode

The following LIST-operating modes are available:

AUTO Run from the beginning to the end of the list with automatic restart at the beginning. If another mode was activated prior to the AUTO operating mode, continuation is made from the current index.

IEC/IEEE-bus commands:

```
:SOUR:FREQ:MODE LIST
:SOUR:LIST:MODE AUTO
:TRIG:LIST:SOUR AUTO
```

SINGLE Single run from the beginning to the end of the list. If SINGLE is selected, the run is manually executed with the function EXECUTE SINGLE LIST ▶.

IEC/IEEE-bus commands:

```
:SOUR:FREQ:MODE LIST
:SOUR:LIST:MODE AUTO
:TRIG:LIST:SOUR SING
```

STEP Step-by-step manual processing of the list. Activating STEP stops a list running and the cursor wraps to the indication value of CURRENT INDEX. The list can now be controlled upwards or downwards in discrete steps using the rotary knob or the numeric keys.

IEC/IEEE-bus commands:

```
:SOUR:FREQ:MODE LIST
:SOUR:LIST:MODE STEP
:TRIG:LIST:SOUR SING
```

The first two commands set the operating mode to STEP. Every command `:TRIG:LIST:SOUR SING` leads to the next position of the list.

EXT-SINGLE Single run from the beginning to the end of the list as with SINGLE, but triggered by an external trigger signal (TRIGGER input on the rear panel, see below).

IEC/IEEE-bus commands:

```
:SOUR:FREQ:MODE LIST;
:SOUR:LIST:MODE AUTO
:TRIG:LIST:SOUR EXT
```

EXT-STEP Step-by-step run by means of the external trigger signal (TRIGGER input on the rear panel, see below). Each trigger event triggers a single step.

IEC/IEEE-bus commands:

```
:SOUR:FREQ:MODE LIST
:SOUR:LIST:MODE STEP
:TRIG:LIST:SOUR EXT
```

HOP Step-by-step run by means of the internal trigger signal of the data generator (see also Section 'Internal Modulation Data and Control Signals from Lists' and Section 'Menu DIGITAL STANDARD - GSM'). Each trigger event triggers a single step.

IEC/IEEE-bus commands:

```
:SOUR:FREQ:MODE LIST
:SOUR:LIST:MODE STEP
:TRIG:LIST:SOUR HOP
```

OFF Operating mode LIST is switched off.

IEC/IEEE-bus command:

```
:SOUR:FREQ:MODE CW
```

Note: The minimum step time of 1 ms must not be violated in modes EXT-STEP and HOP either. With fading switched on, the minimum step time is increased to 3 ms, in case of Lognormal fading it is increased to 50 ms.

TRIGGER input and BLANK output are available at the rear of the instrument for synchronization with other instruments.

TRIGGER An external signal at this input triggers the LIST mode in operating modes EXT-SINGLE and EXT-STEP. The polarity of the active trigger edge can be set in the UTILITIES - AUX I/O - EXT TRIG SLOPE menu.

BLANK This output supplies a signal (0 V/5 V) to blank the settling process by means of pulse modulation or AM. The signal can also be used to synchronize other instruments. The polarity of the signal can be set in the UTILITIES - AUX I/O - BLANK POLARITY menu.

MARKER At the first step of the LIST mode, this output provides an approx. 200 µs trigger signal immediately after blanking. At small DWELL times, this signal can be used for an accurate synchronization to trigger other devices and shows the first stable output frequency. The delay to the fed-in signal at the TRIGGER input for EXT-SINGLE or EXT-STEP is 1.5 to 2 ms and has a jitter of 0.5 ms.

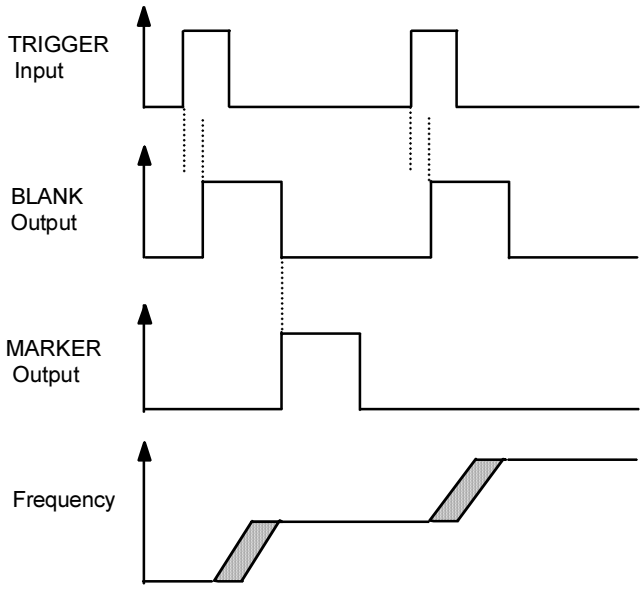

Fig. 3.1: MARKER and BLANK signals in LIST mode. In this example the list contains different frequencies and is operated in EXT STEP mode. Every signal at the TRIGGER input makes the SMIQ step to the next list entry (= next frequency). The BLANK signal is high during the frequency transitions until the target frequency is settled. The MARKER signal appears once when the state of the first list entry is reached and stable.

Application examples

Fast level sweep in a 90 dB range

Problem:

Sweep a CW signal at 2 GHz once from 0 dBm to –90 dBm and backwards in 10 dB steps, the step time is 3 ms. This is not possible with the normal level sweep, where the minimum step time is 10 ms.

Solution:

Set the attenuator mode to ELECTRONIC to get 90 dB noninterrupting level setting range. The levels are stored in a list, then the list mode is run in SINGLE mode with 3 ms dwell time.

The commands for the entire procedure are as follows:

Command	**Remarks**
`*RST;*CLS`	Sets the instrument to a defined state. Note that *RST switches off the RF output.
`:SOUR:FREQ 2E9`	Sets the carrier frequency to 2 GHz
`:SOUR:POW 0`	Sets the RF level to 0 dBm. To obtain a level setting range from –90 dBm to 0 dBm in attenuator mode ELECTRONIC, this command has to be sent before switching to ELECTRONIC mode.
`:OUTP:AMOD ELEC`	Sets attenuator mode ELECTRONIC. This leads to uninterrupted level settings in a range of 90 dB. It also prevents switching of the attenuator when the modulation is turned on or off. *Note that setting attenuator mode ELECTRONIC automatically sets the ALC mode to TABLE.*

	Therefore the next two commands are not necessary in principle.
:SOUR:POW:ALC OFF :SOUR:POW:ALC:SEAR OFF	Sets ALC mode TABLE. Recommended for uninterrupted level setting
:SOUR:POW:ALC:TABL? :CAL:LATT?	To ensure highest level accuracy in attenuator mode ELECTRONIC, these self-calibrating routines should be called up at the beginning and after temperature variations of more than 5 degrees.
*WAI	Ensures that the next command is only executed after the calibration is complete. Alternative: check status with *OPC?
:SOUR:LIST:SEL 'LEVSWP'	Selects the list called LEVSWP. If there is no list of this name, a new list is created.
:SOUR:LIST:FREQ 2GHz	Generates the frequency entries
:SOUR:LIST DWEL 3e-3	Sets the dwell time to 3 ms
:SOUR:LIST:POW 0dBm, -10dBm, -20dBm, -30dBm, -40dBm, -50dBm, -60dBm, -70dBm, -80dBm, -90dBm, -80dBm, -70dBm, -60dBm, -50dBm, -40dBm, -30dBm, -20dBm, -10dBm, 0dBm	Generates the level entries
:OUTP:STAT ON	The RF output has to be switched on before learning the list. (*RST sets the output to OFF:)
:SOUR:LIST:LEAR	Determines the hardware setting of the entire list. This command has to be sent after every change of the list.
:SOUR:FREQ:MODE LIST :SOUR:LIST:MODE AUTO :TRIG:LIST:SOUR SING	Activates list mode in SINGLE mode. The instrument now waits for a trigger command. Note that SMIQ sets the frequency and level values of the last list entry in this waiting state. The first list state is not set until a trigger event is received.
:TRIG:LIST:IMM	Runs the list once.
:SOUR:FREQ:MODE CW	Switches off the list mode. *Note: Always leave list mode before changing other hardware parameters.*

Frequency hopping with GSM/EDGE

Problem:

Generate a GSM frame with an EDGE burst in timeslot 0, all other time slots off. After transmission of the burst, hop to a different frequency. For simplicity, we use only two frequencies here and only one RF level (-10 dBm).

Solution:

Set the GSM frame in Digital Standard GSM/EDGE. Activate a hop trigger at the end of timeslot 0. Then run the list mode in HOP mode.

Note: Options SMIQB11 and SMIQB20 are required for this example.

Command	Remarks
`*RST;*CLS`	Sets the instrument to a defined state. Note that *RST switches off the RF output.
`:SOUR:FREQ 890.2E6`	Sets the carrier frequency to 890.2 MHz
`:SOUR:POW -10dBm`	Sets the RF level to -10 dBm.
`:SOUR:GSM:SLOT0:TYPE EDGE`	Timeslot 0 is set to an EDGE burst. Note that the *RST value for timeslots 1 to 7 is off, so only timeslot 0 has to be configured here.
`:SOUR:GSM:SLOT0:HOPP:TRIG ON`	Activates the HOP trigger at the end of timeslot 0.
`:SOUR:GSM:SEQ AAUT`	Sets GSM to ARMED AUTO mode, i.e. the GSM signal is not output until a trigger event is received. The baseband generator is held at the first symbol of the frame. This will produce a CW signal at the RF output as soon as the RF is switched on. *Note: If your application requires that there is no signal present before the list mode is started, you should activate timeslot 1 instead of timeslot 0 in the GSM frame. If you need the timeslot 0 parameters (e.g. TSC), change the TSC in timeslot 1 (see SMIQ user manual for details.)*
`:SOUR:GSM:STAT ON`	Activates the GSM/EDGE system.
`:SOUR:LIST:SEL 'GSMHOP'`	Selects the list called LEVSWP. If there is no list of this name, a new list is created.
`:SOUR:LIST:FREQ 890.2MHz, 890.8MHz`	Generates two frequency entries with 600 kHz spacing
`:SOUR:LIST:POW -10dBm`	Generates the level entry
`:OUTP:STAT ON`	The RF output has to be switched on before learning the list. (*RST sets the output to OFF)
`:SOUR:LIST:LEAR`	Determines the hardware setting of the entire list. This command has to be sent after every change of the list.

`:SOUR:FREQ:MODE LIST`
`:SOUR:LIST:MODE STEP`
`:TRIG:LIST:SOUR HOP`
	Activates list mode in HOP mode. The instrument now waits for the hop trigger from the GSM/EDGE system. Each trigger event causes a step to the next list entry. Note that SMIQ sets the frequency and level values of the last list entry in this waiting state. The first list state is not set until a trigger event is received. This will not happen until the GSM/EDGE system is started.

`:TRIG:DM:IMM`	Starts the GSM/EDGE system.
`:SOUR:FREQ:MODE CW`	Switches off the list mode. Always leave the list mode before changing other hardware parameters.

4 References

[1] Vector Signal Generator SMIQ, Operating Manual, PD 1125.5610.12, Rohde & Schwarz (2002)

[2] WCDMA Signal Generator Solutions by Rohde & Schwarz, Application Note 1GP39, Rohde & Schwarz (2000)

[3] 3GPP Base Station Tests with Vector Signal Generator SMIQ, Application Note 1GP41, Rohde & Schwarz (2001)

[4] Level Accuracy and Electronic Level Settings of SMIQ, Application Note 1GP42, Rohde & Schwarz (2001)

5 Ordering information

Vector Signal Generator:		
SMIQ02B	300 kHz to 2.2 GHz	1125.5555.02
SMIQ03B	300 kHz to 3.3 GHz	1125.5555.03
SMIQ04B	300 kHz to 4.4 GHz	1125.5555.04
SMIQ06B	300 kHz to 6.4 GHz	1125.5555.06
SMIQ03HD	300 kHz to 3.3 GHz	1125.5555.33
SMIQ06ATE	300 kHz to 6.4 GHz	1125.5555.26
Options:		
SMIQB11	Data Generator	1085.4502.04
SMIQB12	Memory Extension	1085.2800.04
SMIQB14	Fading Simulator	1085.4002.02
SMIQB15	Second Fading Simulator for two channel or 12 path fading	1085.4402.02
SMIQB17	Noise Generator and Distortion Simulator	1104.9000.02
SMIQB20	Modulation Coder	1125.5190.02
SMIQB21	BER Measurement	1125.5490.02
SMIQB42	Digital Standard IS-95	1104.7936.02
SMIQB45	Digital Standard WCDMA (3GPP)	1104.8232.02
SMIQB47	Low ACP for CDMA and WCDMA	1125.5090.02
SMIQB48	Extended Functions for WCDMA (3GPP)	1105.0587.02
SMIQB49	Extended Fading Functions for WCDMA (3GPP)	1105.1083.02
SMIQB51	Digital Standard GPS	1105.1831.02
SMIQB60	Arbitrary Waveform Generator incl. WinIQSIM™	1136.4390.02
SMIQ-K8	TETRA T1 Simulator	1136.4290.02
WinIQSIM™ Options:		
SMIQK11	Digital Standard IS-95 (option SMIQB60 required)	1105.0287.02
SMIQK12	Digital Standard cdma2000 (option SMIQB60 required)	1105.0435.02
SMIQK13	Digital Standard WCDMA Mode TDD (3GPP) (option SMIQB60 required)	1105.1231.02
SMIQK14	Digital Standard TD-SCDMA (option SMIQB60 required)	1105.1383.02
SMIQK15	OFDM Signal Generation (option SMIQB60 required)	1105.1531.02
SMIQK16	Digital Standard IEEE 802.11b (option SMIQB60 required)	1154.7700.02
SMIQK17	Digital Standard 1xEV-DO (option SMIQB60 required)	1154.7800.02
SMIQK18	Digital Standard IEEE 802.11a (option SMIQB60 required)	1154.7952.02

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