Sango X7

4-channel broadband RF exciter

Rev. 3 — 16 January 2015

Application product brief

Introduction



The Sango X7 is a compact broadband 4-channel source/measurement instrument designed for standalone or PC-controlled PA characterisation, testing, and application development. To the successful Sango family of development tools, the X7 adds full 1 to 3200MHz frequency coverage, 5W output power per channel, and an easy-to-use front-panel GUI to make a truly general purpose instrument – while maintaining plug-in compatibility with existing Sango PA and Zmon modules.

Features

- 4 modular RF output channels
- 4 multi-interface (l²C/SPI/USB) remote measurement channels
- Low-noise 1 to 3200MHz synthesiser
- Per-channel -44 to +37dBm power range
- Flexible per-channel pulse/burst modulation
- Compact 2U half-rack instrument, integrated mains supply and air cooling
- Flexible per-channel remote measurement
 - Pulse-by-pulse impedance, power
 - Temperature, current, voltage
 - User-defined measurements
- Ethernet for control/monitor/FTP
- USB interfaces for PC control, flash drives, and RF power heads
- Full control through front-panel UI, 800 x 480 touchscreen colour LCD



Hardware description



The main board contains a high-performance ARM9 MCU used as the system controller, with an FPGA timing engine coprocessor managing all hard real-time signal generation and data acquisition. The MCU communicates with remote PA modules through USB interfaces, and the FPGA provides dedicated I²C and dual high-speed SPI interfaces for each remote impedance measurement subsystem. The MCU includes an LCD controller used to drive the front-panel 800 x 480 colour TFT LCD.

The main board also includes a high-performance 1-3200MHz frequency synthesiser. The synthesiser's low phase noise and high resolution are provided by a unique "rational approximation synthesis" technique that allows arbitrarily small channel spacing along with a high phase comparison frequency to avoid the noise and spurs associated with fractional-N synthesis. The synthesiser's 1500-3200MHz "top octave" may be divided by 2, 4, 8, or 16 for frequencies down to 100MHz; frequencies below that are generated directly by the DDS.

Each of the four RF output channels is housed in an easily-installed air-cooled aluminium module which mounts on edge on the main board with its two output connectors protruding through the rear panel. It contains an I/Q modulator (for phase control and edge-controlled RF gating), high-speed RF switch, step attenuator, and broadband GaN 5W driver, all controlled over a dedicated interface by the control board FPGA.

Power is provided by an agency-approved switching power supply, which generates 48VDC used directly by the GaN drivers. Other supply voltages are generated by low-noise synchronised switching regulators on the main board.

All components in the X7 are cooled by an internal fan, which pulls cool air through the side panels of the instrument and exhausts hot air through the rear panel.

4-channel broadband RF exciter

Specifications

RF characteristics	
number of channels	1-4 (modular construction allows for easy addition of channels)
output power	-44 to 37dBm (-44 to 20dBm below 30MHz), resolution 0.1dB [1]
phase reference output power	3dBm typical
power accuracy	±1dB, focussed calibration (including PA gain) to 0.1dB using Mini- Circuits USB power sensor plugged in to front panel
power settling time	≤ 10µs
pulse width	≥ 100ns
rise/fall time	selectable 30ns/300ns
frequency	1 to 3200MHz, resolution 4Hz
frequency settling time	≤ 1ms
frequency accuracy	±1ppm, internal reference
timebase input	1, 2, 5, or 10MHz ± 10ppm, -3 to 16dBm
timebase output	10MHz sine, 10dBm typical
harmonics	\leq -25dBc for power level \leq 30dBm
spurious signals	≤ -65dBc
phase noise	≤ -110dBc/Hz @ 10kHz offset ≤ -130dBc/Hz @ 1MHz offset referenced to 1GHz, scales by 6dB/octave to other frequencies
phase	360° range, resolution $\leq 1^{\circ}$ [1]
phase settling time	≤ 10µs
Pulse modulation	
timing engine	FPGA directly controls all aspects of triggering, timing, burst generation; power, frequency, and phase control; and Zmon data acquisition
timing resolution	100ns
pulse width	100ns to 1.6s [1]
pulse period	200ns to 1.6s [1]
number of pulses per burst	0 to 65535 [1]
burst start delay	0 to 1.6s [1]
trigger modes	internal generator; external edge (rising or falling) trigger; external gate (active high or low)
internal generator	1µs to 1.6s period; independent phase per channel

4-channel broadband RF exciter

Remote measurement & control	
measurement capabilities	load impedance, forward/reflected power, power calibration standard (using Zmon modules connected to high-speed SPI interface); PA temperature, drain voltage, load current (using standard existing circuits connected to I ² C interface); user-defined parameters
interfaces	independent I ² C, dual SPI, high-speed USB per channel
bias sources	4 sources; selectable LDMOS/GaN operating mode, 0 to 5V/-5 to 0V, 50mA, 1mV resolution, gated by RF on/off switch and interlock, may be gated by burst envelope; supplied on the PA measurement/ control (HDMI) jacks and (optionally) summed with the RF outputs
External interfaces	
RF output	N (female) per channel
phase reference output	SMA (female) per channel
PA measurement/control	HDMI type A carrying I ² C, 2x SPI, USB, bias per channel
LAN	100Mb/s Ethernet, ports 23 (primary control), 46 (secondary control/monitor), 21 (passive FTP for SD card access); RJ45
USB	1 x USB B (rear panel) for control by PC 2 x USB A (front panel) for flash memory, RF power sensor, etc.
timebase input/output	2 x BNC, 10MHz output, 1/2/5/10MHz input
trigger input	4 x BNC, TTL
sync input/output	2 x BNC, TTL
aux/console	DB9P, RS-232 for debugging and firmware updating, interlock
power	90 to 265VAC, 50-60Hz, ≤ 100W
Physical & environmental	
size	210 x 230 x 88mm (2U half-rack) with locking handle/stand
mass	≤ 5kg
operating temperature	0 to 55°C ambient
regulatory	CE-marked; in line with EN 61010-1 (safety), EN 55011 class B (EMI), EN 61000-3-2 (PFC), EN 60068-2-1, 2-6, 2-64 (environment)
User interface	
front panel control	all operating parameters can be viewed/modified from front panel (keypad and touchscreen LCD); optional USB mouse and keyboard
front panel monitor	real-time numeric and graphical monitoring of all parameters on all channels, limited only by 800 x 480 display resolution
PC control/monitor	full control and real-time monitoring from PC via USB or Ethernet

[1] Independently programmable per channel

Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner. The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice. No liability will be accepted by the publisher for any consequence of its use. Publication thereof does not convey nor imply any license under patent- or other industrial or intellectual property rights. This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from national authorities.

© NXP B.V. 2014. All rights reserved.

v2.11.0

For more information, please visit: http://www.nxp.com For sales office addresses, email to: salesaddresses@nxp.com

> Date of release: 16 January 2015 Document identifier: Sango X7 product brief