Solution for Wireless Communication Tester

Application Introduction

As wireless communications, such as 4G LTE, Wi-Fi, and Bluetooth®, become increasingly integrated into our lives, the demands of their test bench increases too. In this article, we will discuss what a wireless communication tester is and how ADI's products fit in its signal chain.

In short, we can classify wireless communication testers into laboratory testers and production testers. Laboratory testers are fundamentally designed to support the design and system integration processes associated with the development of a phone, tablet, or laptop. In this role they may perform physical layer, signaling, and system-level tests.

The production test has a very different focus from lab testing. The emphasis in production is to accurately determine if the device under test (DUT) is working in the absolute minimum time. In production, the basic assumption is that the design is solid and it will perform as expected when assembled correctly. The emphasis in production testing is to find manufacturing defects and the variability typically associated with the analog components of the design. When implementing a production test solution, there will always be a conflict between test coverage and manufacturing throughput.

System Design Considerations

Ease of Configuration, Operation, Maintenance, and Upgrade

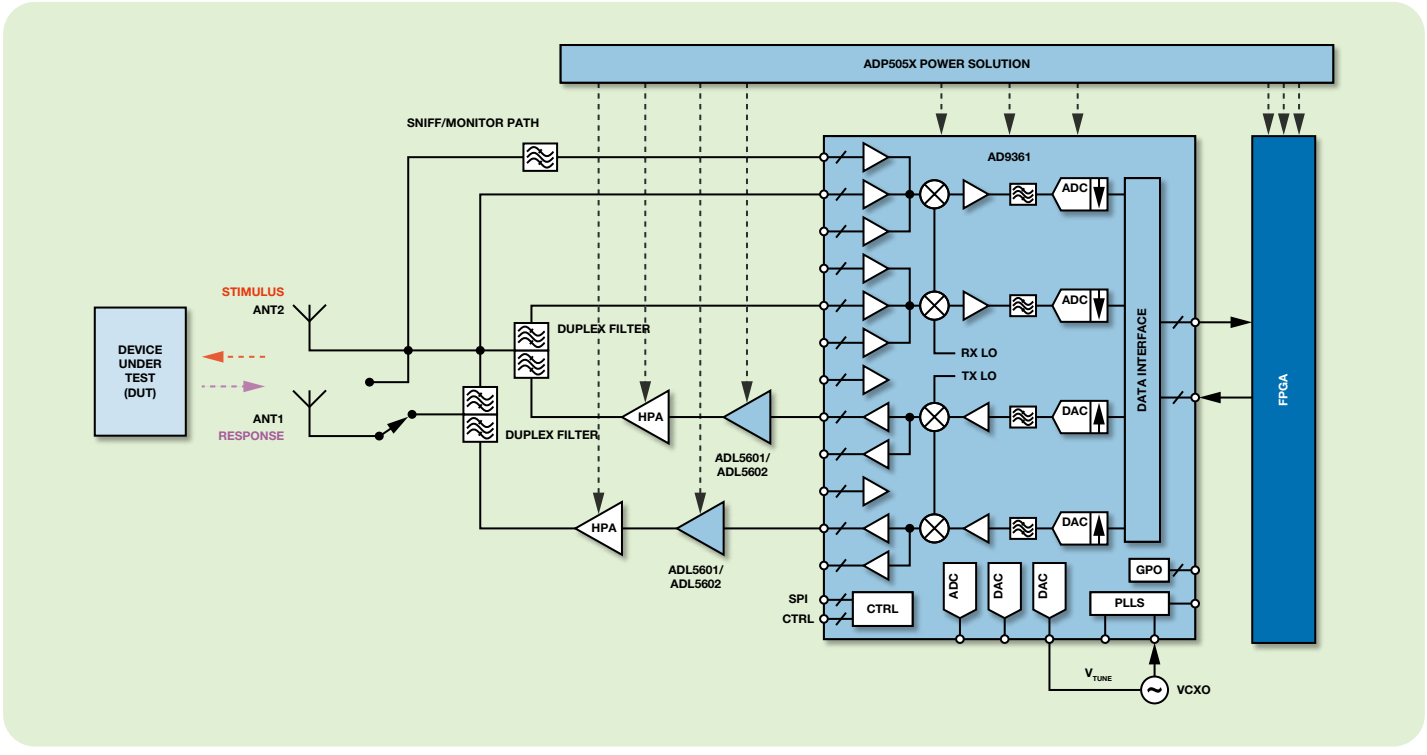
Factors such as easy configuration, operation, maintenance, and upgrading are important for all testers. However the DUT and the parameters to test vary. To deal with such a challenge, a common approach is to use a similar graphic user interface (GUI) for different hardware platforms in different testers. Moreover, if the same hardware platform can be used to cover all test requirements, it would be the best solution.

Excellent Performance and Rich Functionality

Beyond basic design and trouble shooting, the testers may be operated in complex interference, fading, and handoff scenarios and explore every nuance of a standard. So excellent performance and rich functionality are also critical.

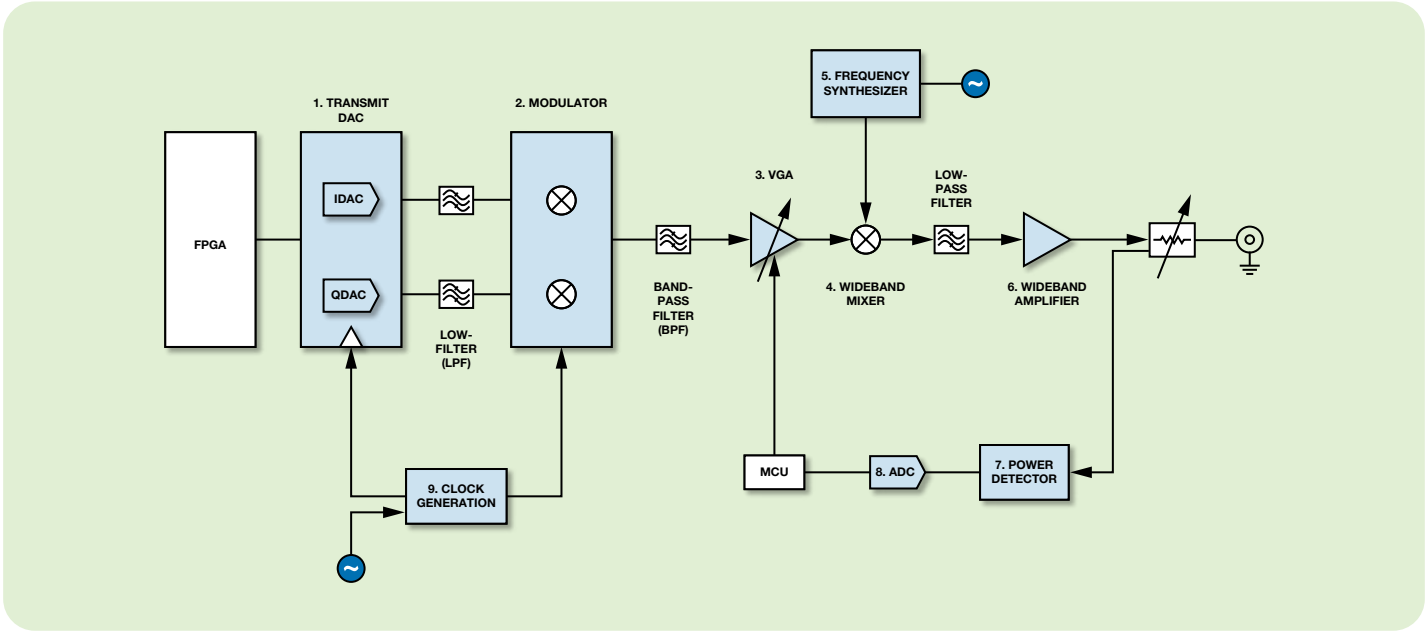
Solutions from ADI

A wireless communication test bench includes source (stimulus to the DUT) and measurement (response from the DUT). Below is an example implemented by ADI's RF Agile Transceiver,™ AD9361, which can cover all LTE channel bandwidths with integrated power solution, ADP505x, and RF/IF gain block, ADL5601/ADL5602.



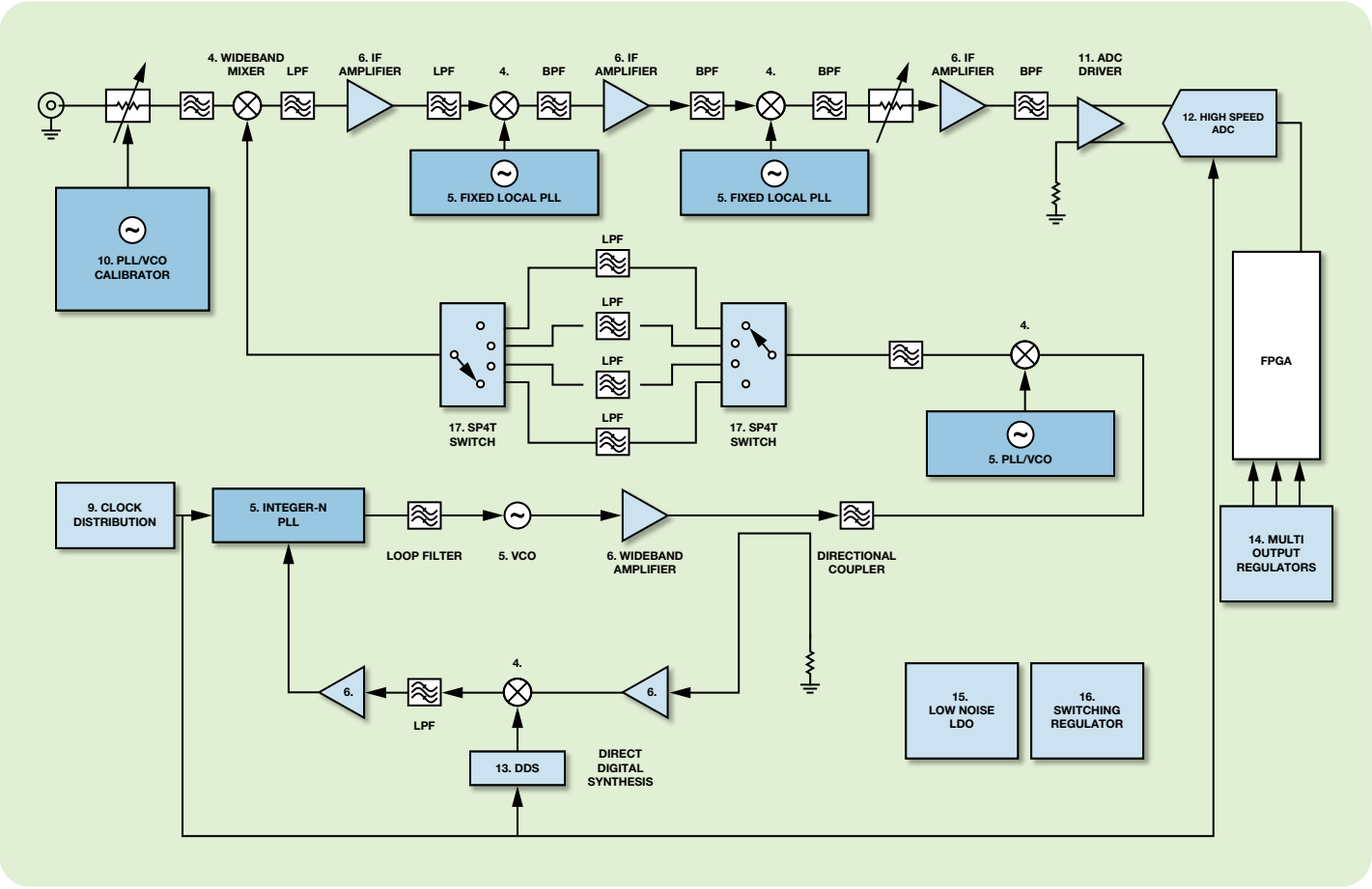
System Block Diagram

1. Source unit: it can be multiple kHz to GHz output RF signal generators for sinusoidal/AM/FM outputs or RF vector signal generators for QAM output. A typical block diagram is shown below.



1. Transmit DAC	2. Modulator	3. VGA	4. Wideband Mixer	5. Frequency Synthesizer	6. Wideband Amplifier	7. Power Detector	8. ADC	9. Clock Generation
AD9122/ AD9125/ AD9142A/ AD9779A/ AD9144	ADL5375/ ADL5385/ ADL5386/ ADRF6720	ADL5240/ ADL5243/ ADL5246	ADL5350/ ADL5801	ADF4106/ ADF4107/ ADF4108/ ADF41020/ ADF4155/ ADF4159	ADL5541/ ADL5542	ADL5902/ ADL5906/ ADL5519/ AD8317/ AD8318	AD7091R/ ADuC7020	AD9524/ AD9525/ ADCLK954

2. Measurement unit: it is kHz to GHz input signal analysis or network analysis. Signal analysis displays amplitude versus frequency and can include the demodulation to display the constellation of a QAM signal. Vector analysis measures amplitude vs. bandwidth and s-parameters. A typical block diagram is shown below.



10. PLL/VCO Calibrator	11. ADC Driver	12. High Speed ADC	13. Direct Digital Synthesis	14. Multi Output Regulators	15. Low Noise LDO	16. Switching Regulator	17. SP4T Switch
ADF4355-2/ ADF4351/ADF4350	ADL5565/ADA4930/ ADA4937/ADA4961	AD9680/AD9625	AD9912/AD9956	ADP5052/ADP5050/ ADP5041	ADM7150/ADP1755/ ADP150	ADP2386	ADG904

Notes: the signal chains above are representative of wireless communication tester design. The technical requirements of the blocks vary, but the products listed in the table below are representative of ADI's solutions that meet some of those requirements

Main Products

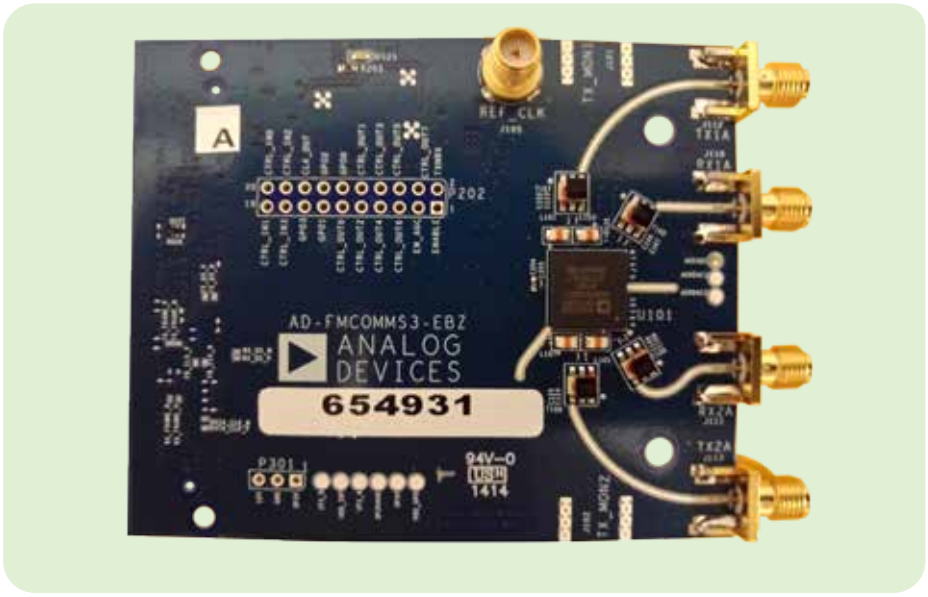
Part Number	Description	Benefits
Agile RF Transceivers		
AD9361	2 receiver channels, 2 transmitter channels, 70 MHz to 6 GHz tunable RF bandwidth, 200 kHz to 56 MHz programmable channel bandwidth	Complete RF Tx/Rx signal chain in a software configurable IC; common reprogrammable wideband radio platform; meets 3G/4G wireless standards
AD9364	1 receiver channels, 1 transmitter channels, 70 MHz to 6 GHz tunable RF bandwidth, 200 kHz to 56 MHz programmable channel bandwidth	Complete RF Tx/Rx signal chain in a software configurable IC; common reprogrammable wideband radio platform; meets 3G/4G wireless standards
Low Noise LDO		
ADM7150	Input voltage range 4.5 V to 16 V, 800 mA maximum current rating, fixed output voltage options, 1.5 V to 5 V	Ultralow noise 1.2 μV rms at V_{OUT} = 5 V from 100 Hz to 100 kHz; high PSRR, 100 dB from 1 kHz to 100 kHz, for V_{OUT} = 5 V

Products (Continued)

Part Number	Description	Benefits
Multi Output Regulator		
ADP5052	CH1 and CH2 are programmable 1.2 A/2 A/4 A synchronous buck regulators with low side FET drivers; CH3 and CH4 are 1.2 A buck regulators; CH5 is 200 mA LDO	Wide input range, 4.5 V to 15 V; adjustable switching frequency, phase shift, and current limit; parallel CH1/CH2 to deliver up to 8 A single output
Wideband Synthesizer with Integrated VCO		
ADF4355-2	Fractional-N or integer-N synthesizer, frequency range 35 MHz to 4400 MHz, VCO output frequency 2200 MHz to 4400 MHz	Very low noise VCO, –142 dBc/–142 Hz at 1 MHz offset at 1.8 GHz output; PFD frequency to 125 MHz
Power Detector		
ADL5902	100 MHz to 9 GHz rms-to-dc conversion, 65 dB single-ended input range, ±0.5 dB temperature stability, linear-in-dB output	No balun or external input tuning required; waveform and modulation independent; pin compatible with AD8363, TruPwr™ detector
I/Q Modulator and Voltage Variable Attenuator (VVA) and Power Detector		
ADL5386	50 MHz to 2.2 GHz operation, –160 dBm/–160Hz noise floor at 300 MHz, 11 dBm P1 dB at 300 MHz	Integrated VVA, log detector, and standalone temperature sensor; Tx DAC-compatible baseband inputs
High Speed ADC		
AD9680	Dual channel, 14-bit, 1 GSPS, lowest noise density of –154 dB Fs/–154 Hz, configurable JESD204B interface	Programmable buffered input; wide full power bandwidth, IF ≤ 2 GHz; 4 wideband decimation filter and NCO blocks
Low Jitter Clock Generation and Distribution		
AD9522	12 LVDS/24 CMOS output, 1 differential or 2 single-ended inputs	Low phase noise PLL. On-chip VCO or external 3.3 V/5 V VCO/VCXO up to 2.4 GHz
Precision ADC for Gain Control and Calibration		
AD7091R	12-bit, 1 MSPS, 1.3 mW power dissipation at 1 MSPS	Accurate ac-to-dc performance, ±1 LSB INL, ±0.9 LSB DNL, 69dB SNR, 4.5 ppm/°C V_{REF} (typical)
Precision DAC for Gain Control and Calibration		
AD5683R/ AD5682R/ AD5681R	Tiny 16-bit/14-bit/12-bit DAC, total unadjusted error 0.06% of full scale range	Low drift 2 ppm/°C V_{REF} (typical); low glitch 0.1 nV-sec; selectable output span, 2.5 V or 5 V

Demo System

The AD-FMCOMMS3-EBZ is an FMC board for the AD9361, a highly integrated RF Agile Transceiver. The purpose of the AD-FMCOMMS3-EBZ is to provide an RF platform to software developers and system architects who want a single platform that operates over a much wider tuning range (70 MHz to 6 GHz).



- Introduction
- Quick start guides
  - Linux on ZC702, ZC706, ZED
- Hardware (including schematics)
  - Functional overview and specifications
  - Characteristics and performance
  - Configuration options
- Reference HDL design
  - Digital interface timing validation
- Software
  - Basic IQ datafiles
  - Datafiles
  - Filters
  - Linux
  - No-OS drivers

Design Resources

Analog Devices WiKi Site —wiki.analog.com

- *AD-FMCOMMS3-EBZ reference design—wiki.analog.com/resources/eval/user-guides/ad-fmcomms3-ebz*
- *AD-FMCOMMS2-EBZ reference design—wiki.analog.com/resources/eval/user-guides/ad-fmcomms2-ebz*
- *AD-FMCOMMS4-EBZ reference design—wiki.analog.com/resources/eval/user-guides/ad-fmcomms4-ebz*
- *AD-FMCOMMS1-EBZ reference design—wiki.analog.com/resources/eval/user-guides/ad-fmcomms1-ebz*

Analog Devices Engineer Zone—ez.analog.com

- *Wideband RF transceivers—https://ez.analog.com/community/wide-band-rf-transceivers*
- *RF components—https://ez.analog.com/community/rf*
- *FPGA reference designs—https://ez.analog.com/community/fpga*

Design Tools

- **ADIsimPower**: design power circuits in 3 easy steps: part selection, design and optimize, simulate—*www.analog.com/en/power-management/products/pmp_ADIsimPower_DesignCenter/fca.html*
- **ADIsimPLL**: PLL loop filter design—*https://form.analog.com/Form_Pages/RFComms/ADISimPll.aspx*
- **ADIsimADC**: ADI modeling, link to customer's models in MATLAB.—*www.analog.com/en/converters-tools/adc-tools/topic.html*

News and Press Releases

Analog Devices completes acquisition of Hittite. The ADI RF and microwave portfolio now spans the entire frequency spectrum, enabling more complete solutions for customers. For more details, please visit:

www.analog.com/en/press-release/7_22_2014_ADI_Completes_Acquisition_Of_Hittite/press.html

To view additional resources, tools, and product information, please visit:

instrumentation.analog.com/en/segment/im.html

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