

# Wireless Modular Test & Development Platform

Design, Test, Verify & Prototype... All with the same tool



A New Class of Development Platform  
that is Designed to meet current RF & Wireless challenges  
for Education, Research & Industry.

C700

Wireless Modular Development & Verification platform is designed specifically to bring about speed and flexibility to FPGA & System Designers, allowing you to test your RF design without draining your time & resources integrating and troubleshooting RF boards.

Focus on your design code while the Platform takes care of Synchronization, LO Control, data communication and all other ancillary functions. Works out of the box. No time is wasted on setup integration, testbed creation or code re-design.

Build your system with readymade modules for Signal Generation and Vector Modulation, Signal Reception & Vector Demodulation, LO Generation and distribution, Onboard DSP (ARM & x86), Baseband Signal Processing FPGA and more. Modules are all Plug & Play and communicate together on the platform data bus allowing you to build complex and high channel count designs with speed and ease.

A truly modular architecture replaces conventional boards with the versatility required for innovation in MIMO and Multi-Channel applications. Modules or even entire units can be stacked and aggregated for large scale designs and easily connected to your PC for control, data I/O or as hardware in the loop for simulation.

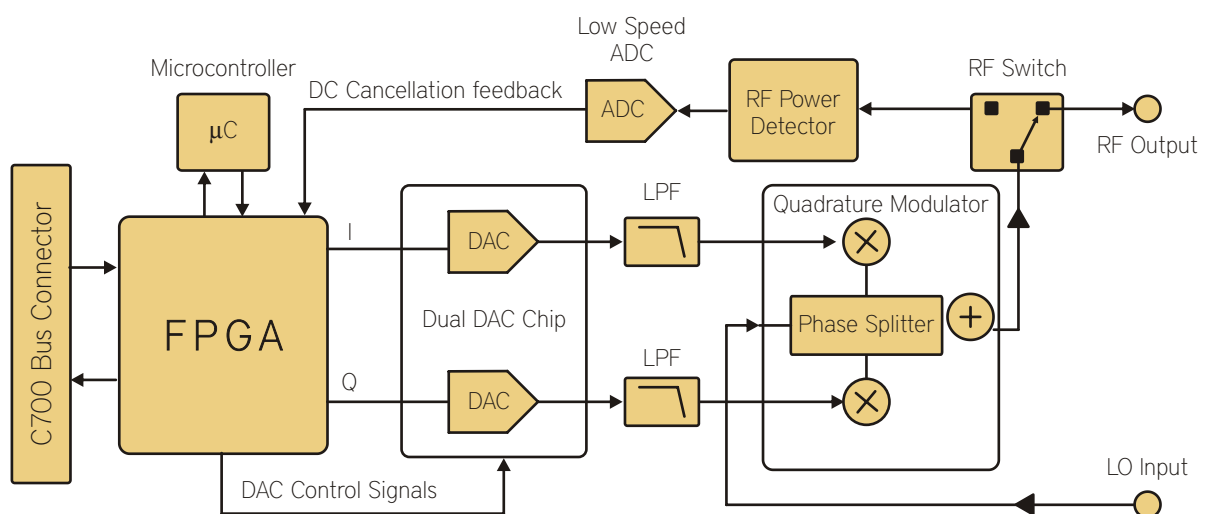
## Features

- Direct FPGA access - Custom user Code
- Supports Altera & Xilinx FPGAs & tools
- Coherent Multi Channel & MIMO ready
- Superior Phase Noise & SFDR performance
- Integrates with your design environment of choice:  
Matlab, LabVIEW, GNU Radio & more...
- Professional Design
- Accelerate your Time-to-Market
- Frequency range: 400 MHz to 6 GHz
- Wide IQ Bandwidth up to 40 MHz
- Digital I & Q with 16-bit resolution
- Analog, Digital & Arbitrary modulation
- Phase Noise -107 dBc/Hz @ 10 KHz
- Switching time < 10  $\mu$ s
- Cutting-edge RF Waveform generation with Modular architecture to meet numerous applications

## Design from your Comfort Zone

C700 goes all the way to help you focus on your job. The system can be fully programmed & controlled right from your design tool or system level simulation environment of choice (Matlab®, LabView®, GNU Radio... etc.) in addition to a multitude of programming languages (VHDL, C and many others). This allows reusing the same test bed during the design and prototyping phases completely eliminating inconsistency and guaranteeing a streamlined testing procedure thought the project lifecycle. No need to create new complex and expensive test bed for your prototype. Design engineers can easily move back and forth testing the code and the actual prototype side by side greatly accelerating debugging and design iteration.

The firmware natively supports programming the FPGA with custom HDL code through direct JTAG access. This allows developers to use separate design environments for HDL development and for system level testing simultaneously and independently.



Platform gives developers the ability of generating complex baseband I/Q signals through VHDL programming of its fully configurable FPGA blocks then Vector Modulate them to an RF Carrier up to 6 GHz. Similarly for the receive chains HDL Developers can easily implement system functions inside the FPGA and (optionally) use the connected PC for pre/post processing

## All testing tools built-in

The RF characteristics of the platform outperforms traditional Test & Measurement Equipment of its class, enabling the use of Modules as general purpose test equipment or even fully optimized automated test station. VSM and VSD modules can function as standalone or integrated:

- Arbitrary Vector Signal Generator
- Spectrum/Signal Analyzer
- Vector Network Analyzer
- Channel Emulator

Replace expensive and complicated measurement benches with testing tools that are fully integrated with your testbed and design environment.

## Modules for every function

Platform is designed to help developers to build complete systems using Plug & Play modules. The chassis & base unit system modules handle all support functions without requiring any user intervention. Functions like timing and synchronization, control signals and data transfer are all managed by the platform in the background allowing the user to focus on the task at hand. The chassis and base unit act as a communication backplane (700 Mbit/sec) for all the modules as well as clock and power distribution network. The chassis accommodates the modules and is dimensioned according to the required configuration (up to 32 Slots/chassis are supported, several chassis can be cascaded for even higher channel counts). Different modules are available to represent the different functions and subsystems usually found in modern wireless designs:

- Vector Signal Modulation RF Modules
- Vector Signal De-Modulation RF Modules
- Coherent LO Generation Modules
- ARM On-Board Processing Modules
- FPGA On-Board Processing Modules
- Intel x86 On-Board Processing Modules
- Embedded  $\mu$ Controller Module

This allows the user to completely model the system under test on the Wireless platform.

## Altera & Xilinx FPGA chip selection

RF Modules come standard with an Altera Cyclone III / Cyclone IV FPGA Chip. However, different FPGA selections are available to best fit the target application. Selections include FPGA chips from the following families:

- Altera® Cyclone (III / IV / V)
- Altera® Stratix
- Altera® Arria
- Xilinx® Spartan
- Xilinx® Zynq
- Xilinx® Virtex

The Firmware is designed to take minimal FPGA resources freeing up all the logic and fabric for the user code. Direct JTAG access to the FPGA gives the user the unique opportunity to develop and debug using any software tool of their choice without any limitations imposed by the platform.

## Radio System typical applications

Research and Education of:

- SDR, Cognitive Radio
- MIMO , massive MIMO, and other wireless technologies
- FMCW and similar Radars
- UWB applications
- Laboratory Vector Signal Generator/Analyzer
- Wireless researches for Life science
- Radio monitoring
- Radio positioning and localization
- DPD (Digital pre-distortion) researches
- Multi-channel phase coherent; Direction Finders, Passive Radars
- Phased array antenna measurements and study
- Ad-hoc networks
- Several other complex radio systems



## Customize it to your need

Need high RF Power? Better Sensitivity? Developing for a specific FPGA chip? The customization services are intended for developers who want to tailor their development platform to their applications and move from development to deployment in one smooth step. RF modules can be fit with a wide selection of FPGA & SoC chips from Altera® & Xilinx® for maximum versatility. Moreover, different RF front-ends and entire RF subsystems can be incorporated (or custom designed) within the module in order to best match it to your target system. This is a unique feature to the platform that eliminates any inconsistency arising from hardware change.

## Professional IP Design Services

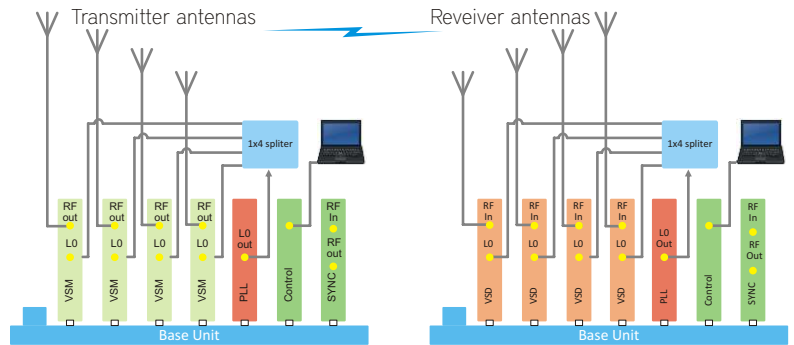
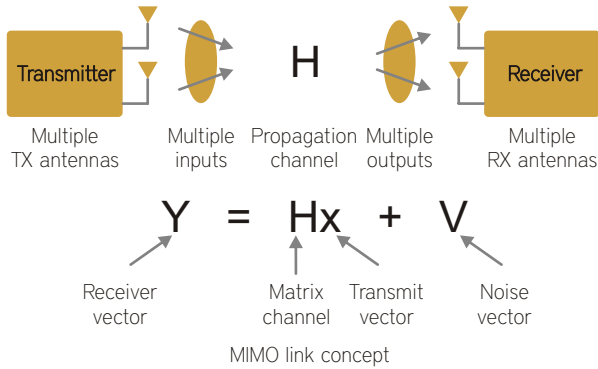
Developing on the platform gives you exclusive access to our IP design team. Benefit from our years of experience creating IPs for Wireless Communications, DSP, Military Communications, Electronic Warfare as well as Aerospace & Defense Applications. Our IP design team can actively contribute to your design building HDL & Embedded blocks as per your requirement or help you during the prototyping & testing phases creating custom test beds or ancillary system blocks to test your design end-to-end.

## PCB Design & Prototyping Services

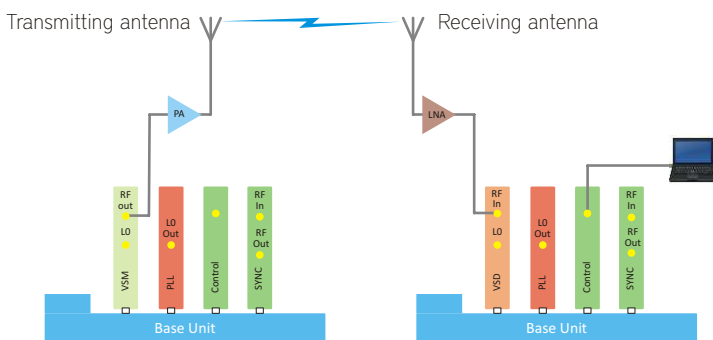
Bring your code to life with our Prototyping services to transform your design into a standalone prototype with all the required logic, chips and RF modules integrated into a single professionally designed PCB that will be manufactured, tested and delivered right to your doorstep complete with packaging and UI/UX development services designed to best showcase your work.

## Possible Configurations

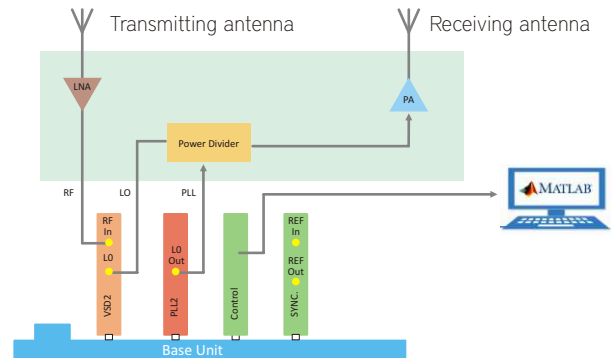
MIMO Testbed (Development Platform) based on Wireless Platform: In this setup, two C700 systems will be employed to build a 4 x 4 MIMO TX and RX stations with a 40 MHz real time bandwidth. Beside a lot of other applications, the platform can be defined as a scalable MIMO system with a common clock and shared local oscillator to fulfil phase coherence requirements. The system can be configured to investigate the performance of MIMO algorithms and channel models and it is easily upgradeable to higher order of channels.



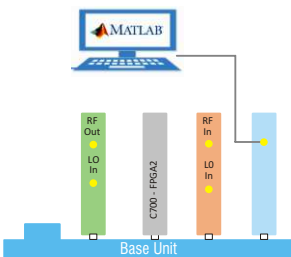
### FMCW Radar



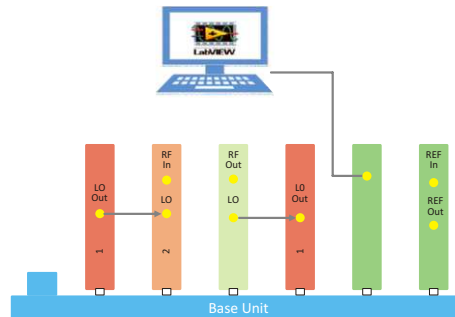
### Channel Sounder



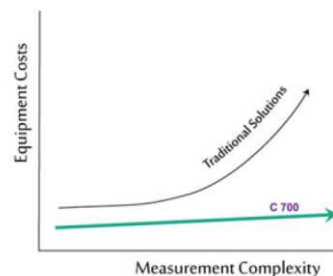
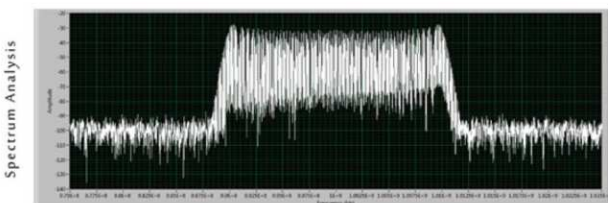
### Channel Emulator



### 6GHz Vector Signal Generator/Analyzer+Arbitrary Waveform Generator



## RF Test, Measurement & Automation



## General Specifications

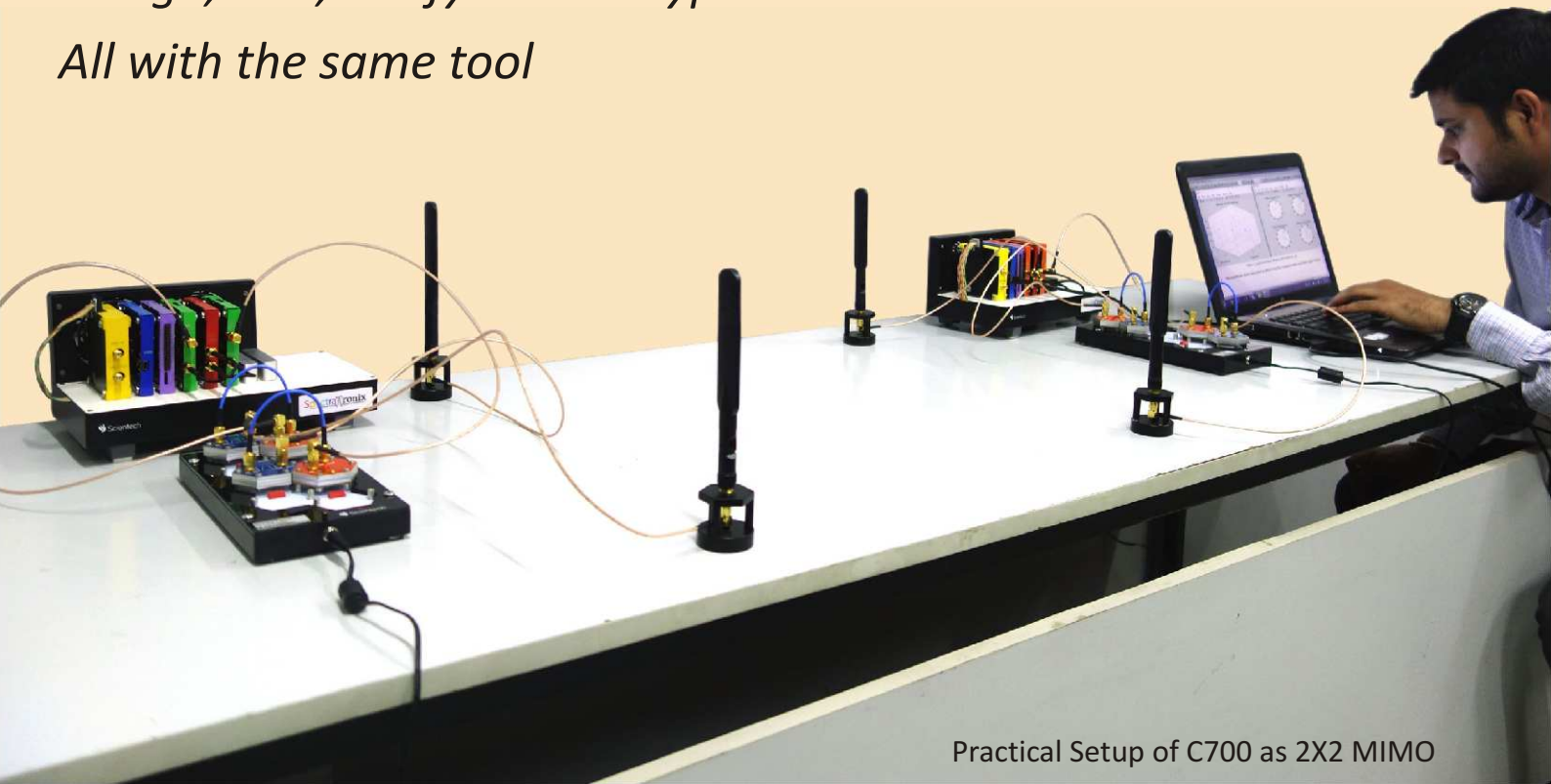
Frequency range	:	0.4 GHz to 6 GHz
Frequency accuracy	:	$1 \times 10^{-7}$ (Warm-up time 1 minute)
Frequency resolution	:	$\leq 1$ MHz (1 Hz with VSM or VSD modules)
Number of channels	:	Scalable from 1 to 1000
IQ resolution	:	16 bits
Bandwidth	:	40 MHz / (More bandwidth is achievable through channel aggregation)
Bus speed	:	700 Mbps (Per single chassis)
Number of slot / chassis	:	5, 8, 16 or 32
Reference signals	:	10 MHz IN, 10 MHz OUT
Internal oscillator	:	OCXO
System clock	:	50 MHz
System controller	:	USB2, Embedded AVR
FPGA		
FPGA Configuration	:	Downloadable via JTAG port
Standard FPGA Chips	:	Cyclone III, Cyclone IV, and more available
RF Specs (Generator/Transmitter modules)		
Phase noise	:	$< -107$ dBc/Hz @ 10 KHz from 1 GHz carrier
Amplitude accuracy	:	$< 0.5$ dB (Typical 0.2 dB)
Switching time	:	$< 10$ us (within 160 MHz from LO frequency)
RF output power	:	-37 dBm to -7 dBm. Overrange -87 dBm to -7 dBm (Optional amplifiers/attenuators available)
RF Specs (Demodulator/Receiver modules)		
Max. RF input level	:	$\leq 12$ dBm
SFDR	:	$> 70$ dB
Sensitivity	:	$< -90$ dBm (Optional low noise amplifiers available)
Amplitude accuracy	:	$< 0.5$ dB (Typical 0.2 dB)
Image rejection	:	$> 40$ dB (Optional 80 dB. Refer to UDC modules specifications)
Physical characteristics		
System housing	:	Mini, Orchestra, and Field housing
Power Supply	:	9-18 VDC (optional AC power supply integrated in system housing)
System cooling (Optional)	:	Forced air
Operating temperature	:	+0 °C to +50 °C
Operating Humidity	:	$< 95\%$ rel. humidity
ROHS	:	All C700 components are ROHS Compliant

## List of Innovative Modules

Base Unit	:	BU-xxi
Synchronization Module	:	SYNC1
Master Controller Module (Embedded)	:	AVR1
Slave Controller Module (Embedded)	:	AVR1s
Master ARM Controller Module (Embedded)	:	ARM
USB2 Communication Module	:	USB2
PLL Module (100MHz to 6 GHz)	:	PLL1
PLL Module (100MHz to 6 GHz); 2 LO outputs, -107 dBc phase noise @1 GHz, 10 KHz offset	:	PLL1e
PLL Module (4 GHz to 8 GHz)	:	PLL2
PLL Module (6 GHz to 12 GHz)	:	PLL3
PLL Module (10 GHz to 18 GHz)	:	PLL4
Vector Signal Generator / Transmitter (0.4 to 6 GHz)	:	VSM1
Vector Signal Demodulator / Receiver (0.7 to 2.7 GHz)	:	VSD1
Vector Signal Demodulator / Receiver (0.4 to 6 GHz)	:	VSD2
Options & Accessories		
Up/Down Converters	:	UDC-xii
System housing for field applications	:	Field-xxiii
System housing for laboratory applications; 8 slots	:	Orchestra
Compact system housing; 5 slots	:	Mini
All system housing include cooling system and AC/DC power supply		
1 MB RAM (system module )	:	MEM1
Other Accessories		
External Down Converter 10-2500 MHz	:	RXFE1
External Up/Down Converter 10-2000 MHz	:	TXFE1
Power Amplifier, 10 Watt, 0.6 to 3 GHz, 30 dB gain	:	ZGT-06302-40-X
4 channel amplifier, 18 dBm (@ 2GHz) ,0.5 to 6 GHz	:	PA4-0560-18-18
LNA , 0.6 to 4 GHz, > 20 dB gain	:	LNA-0640-3.6-20
Multi-band omnidirectional antenna; 0 dBi gain.	:	A-M210
Power splitter/combiner, 8 way, 20-6000 MHz,	:	PS108-0260
Phase stable low loss cable assembly, SMA-male	:	CSS-03p-xx
RF adapter SMA female to N-male	:	AD-SN-6
Synchronization cable for multi system; 4 way	:	CS-4
RF switch, 1*4 , 0.4 to 4 GHz	:	RS104-0460

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Practical Setup of C700 as 2X2 MIMO

# Bee Wave

Ideal Rapid Prototyping Solution for any RF & Microwave Laboratory

Innovative RF Modules -

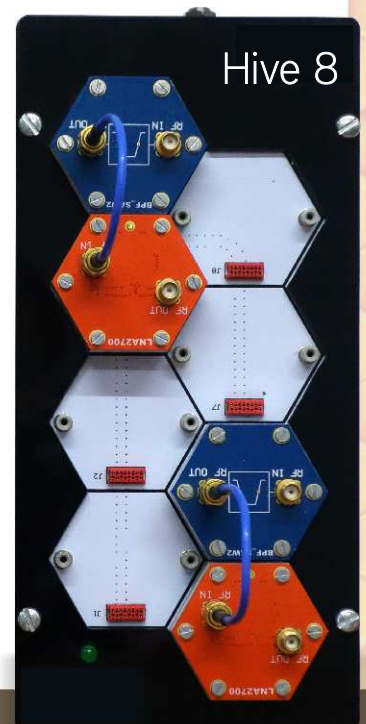
- Hive8 - Base unit for 8 modules
- Hive20 - Base unit for 20 modules
- 10 MHz reference Clock Generator
- 6 GHz Gain Block
- Low Noise Amplifier 700-2700 MHz
- 6 GHz Variable Attenuator
- 1 GHz Variable Gain Amplifier
- 2.7 GHz Variable Gain Amplifier
- 6 GHz Variable Gain Amplifier
- RF Mixer
- RF Switch SPDT
- RF Switch SP4T
- 6 GHz Local Oscillator
- Ceramic Band Pass Filter
- SAW filter
- Filter Bank module
- Low Pass Filter
- 6 GHz Directional Coupler
- USB Communication with PC

## Optional

Handheld Spectrum Analyzer  
400 to 2700 MHz



Handheld RF Source  
300 to 3000 MHz



Subject to Change

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