# NCT-T9201
# Coolteq®
# Flexible Development System for High Power PA Applications

**PD002546** **ADVANCE INFORMATION** **Product Description**

## Features

- **Multiple band operation (650 MHz to 2700 MHz) (optional 225 to 2700 MHz)**
- **Includes Coolteq.h ET modulator and cables**
- **Robust shielded case with integrated cooling**
- **Integrated waveform generation and capture using both Nujira-supplied standard waveforms and customer's own waveforms.**
- **PC-based signal analysis (AM-AM, AM-PM, ACLR)**
- **Digital predistortion (DPD) for optimum signal integrity and reduced out-of-channel emissions.**
- **Flexible Envelope Port (FEP) supports multiple modulator interfaces and applications**
- **User-upgradable firmware (via USB)**
- **Multiple user-selectable clock and trigger inputs and outputs for synchronizing with external test equipment**
- **Simultaneous RF signal capture from two locations, such as PA input and outputs.**
- **Operates from a single 12 V DC supply (universal AC adaptor supplied)**
- **OpenET-compliant Analogue and Parallel Digital Envelope Interfaces**

## Overview

Nujira's *Coolteq*® Flexible Development System combines a high-performance wideband hardware platform with the *Coolteq*® *DevSys* application software to provide a comprehensive and flexible environment for the evaluation and development of Coolteq Envelope Tracking Power Amplifiers.

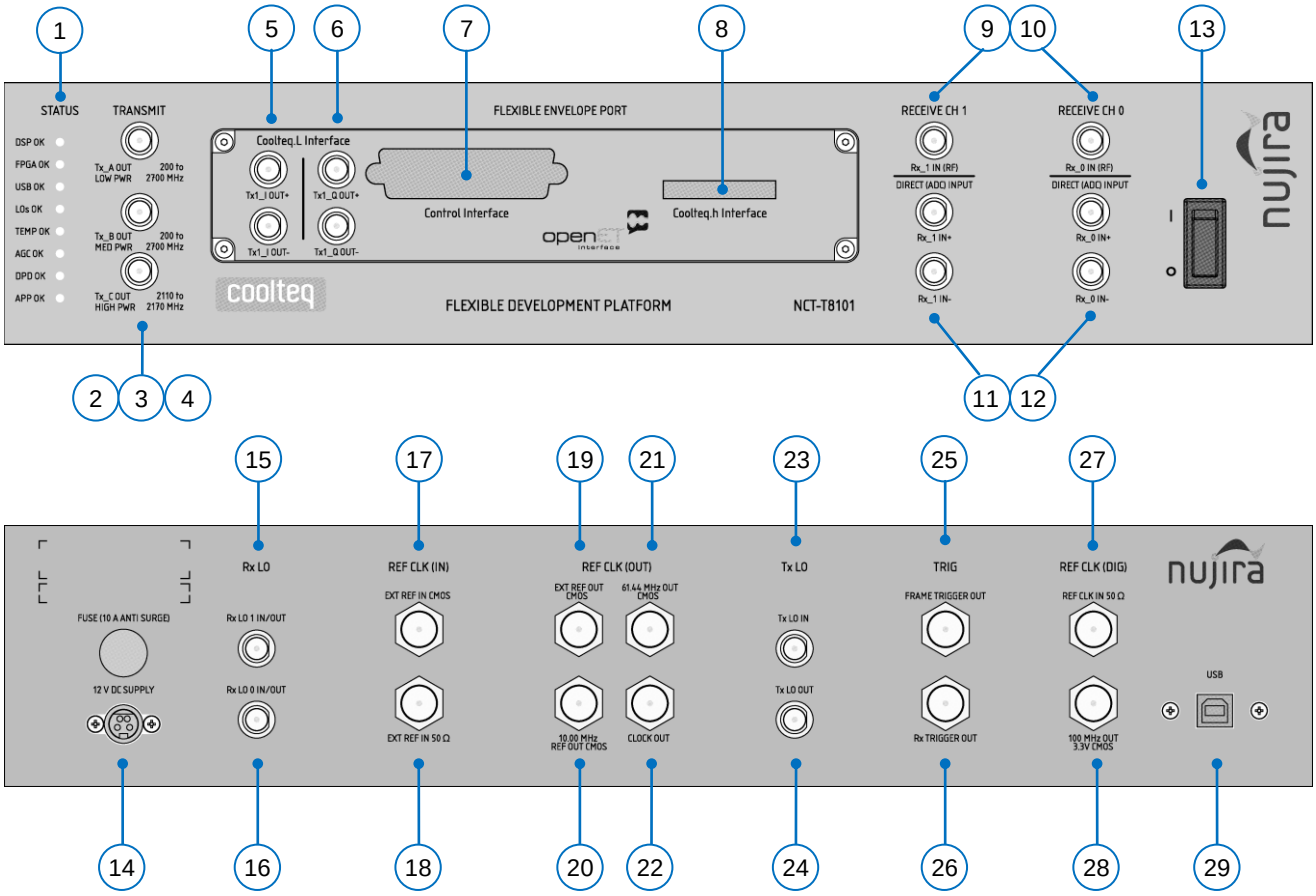
Systems can be configured for a wide range of high power applications including military communications, infrastructure basestations and digital TV transmitters.

Package includes an ET modulator, plus associated cabling and hardware, ready for direct connection to an ET PA. Application-specific PAs are not included, but may be provided separately by Nujira or its partners (specified at order placement; lead time is subject to availability).

The FDP includes a Flexible Envelope Port (FEP), enabling support for a range of analogue and digital interfaces for ET modulators, in both Nujira-proprietary and openET formats.

Multiple connections are brought out to the front and rear panels, enabling software selection of a range of options, including internal or external local oscillators, frequency references and alternative transmit (Tx) and capture (Rx) paths.

Prior to shipment, each FDP is configured with application-specific FPGA and DSP firmware, fitted with the appropriate FEB (Flexible Envelope Board), and is calibrated for operation in the appropriate sub-bands. The complete platform includes the NCT-T8101 chassis and the NCT-T8301 FEB.




## Front Panel Connections:

| | |
|---|---|
| 1 | LED Status Indication Panel |
| 2 | Low Power wideband RF Output (SMA) ⚠ |
| 3 | Medium Power wideband RF Output (SMA) ⚠ |
| 4 | High Power 2100 MHz band RF Output (SMA) ⚠ |
| 5, 6 | Balanced outputs for analogue envelope control or external quadrature modulator (4 x SMA) |
| 7 | Auxiliary control interface (50-way D connector) |
| 8 | Coolteq.h control and data interface (ERNI) |
| 9 | Receive Ch. 1 RF (SMA) |
| 10 | Receive Ch. 0 RF (SMA) |
| 11 | Receive Ch. 1 Direct ADC input (2 x SMA) |
| 12 | Receive Ch. 0 Direct ADC input (2 x SMA) |
| 13 | DC On/Off switch and power indicator |

## Rear Panel Connections:

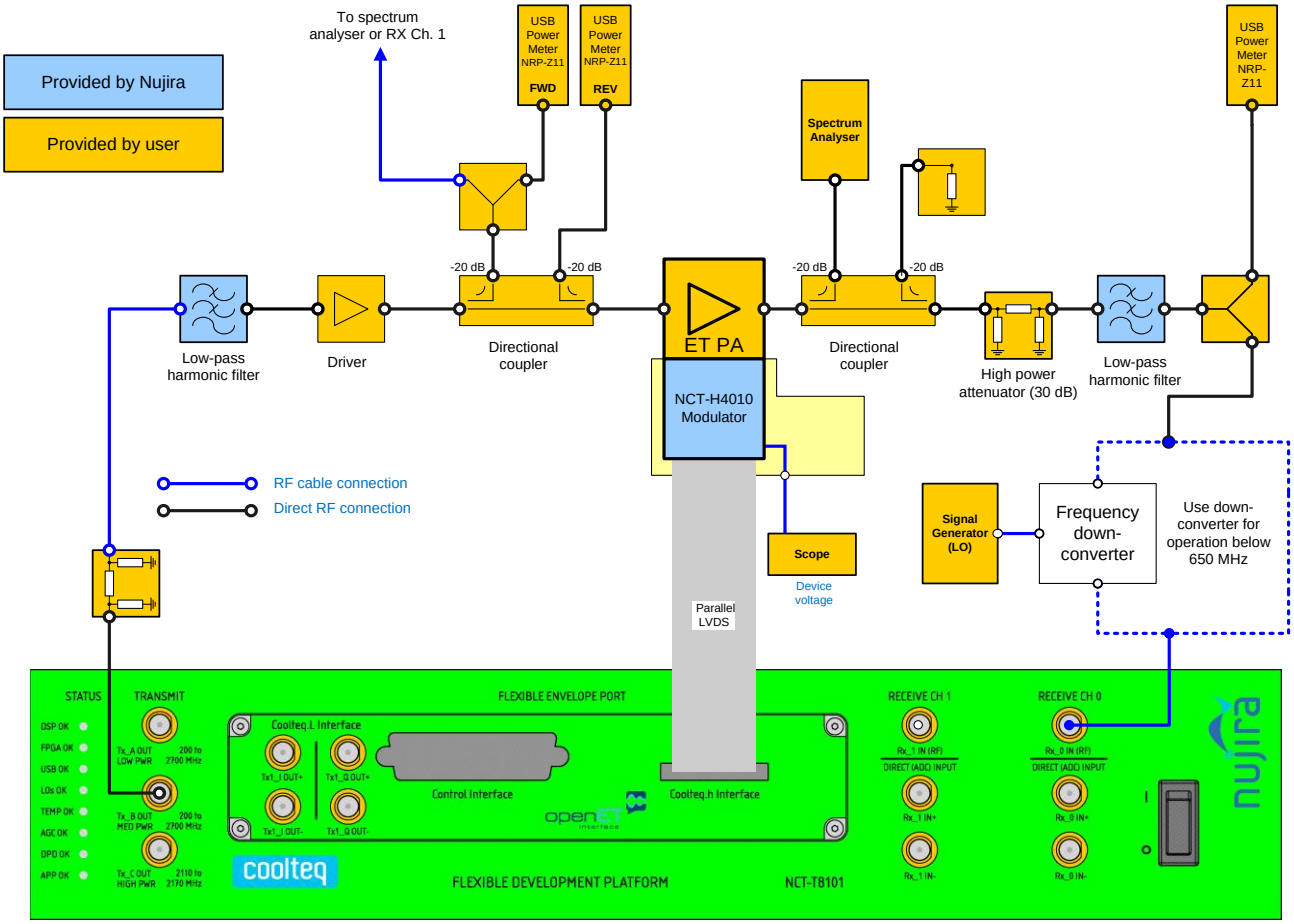
| | |
|---|---|
| 14 | DC Power Input Socket (4-pin mini DIN) and fuse |
| 15, 16 | Rx LO 1 & Rx LO 0 Outputs / External Inputs (2 x SMA) ⚠ |
| 17, 18 | 10 MHz CMOS or 50 Ω Reference Inputs (2 x BNC) |
| 19 | CMOS Reference clock output (BNC) |
| 20 | 10.00 MHz reference clock output (BNC) |
| 21 | 61.44 / 30.72 MHz reference clock output (BNC) |
| 22 | Programmable external clock output (BNC) |
| 23, 24 | Tx LO Input and outputs (2 x SMA) ⚠ |
| 25, 26 | Frame and Rx trigger capture outputs (2 x BNC) |
| 27 | Digital master clock reference input (BNC) |
| 28 | 100 MHz digital clock reference output (BNC) |
| 29 | USB 2.0 Hi-Speed host PC control connector (Type B) |

⚠ When not in use, the rear-panel Rx LO 1 In/Out and Rx LO 0 in/out connections MUST be terminated with 50 Ω loads (supplied).

⚠ For optimum flatness and level accuracy, unused Tx ports & the Tx LO port should be terminated with 50 Ω loads (supplied).

The RF accessory pack (supplied) includes pairs of 500 MHz, 1 GHz and 2 GHz low pass filters for reduction of transmit and capture path harmonics, 50 Ω terminations (5), a 'thru' termination for oscilloscope triggering, and a frequency reference loopback cable, plus two spare fuses. RF cables are not included.

## *Example Application: High power, wideband PA Development*




### Flexible Development System

- Creates a reference environment for PA development and modulator integration lifecycle
- Transmit coverage from 225 MHz to 2700 MHz, with option to extend above 2700 MHz (external hardware required)
- Receive (capture) coverage from 650 MHz to 2700 MHz, with option to extend to down to 225 MHz or above 2700 MHz (external hardware required)
- Includes standard waveforms. Users can easily create their own application-specific waveforms
- 10 MHz reference clock input/output for synchronising with external test equipment
- Captures and displays AM:AM and AM:PM responses and distortion characteristics of PAs
- Simultaneous dual-location RF signal capture allows comparison at PA input and output.

### Modulator accessory pack + NCT-H4010 modulator

- Includes LVDS cable for direct connection of modulator to FDP front panel.
- Includes fixed drain board, which allows performance comparison with fixed DC supply to device. Includes clamps for easy swapping of modulators and fixed drain boards
- Allows detailed device characterisation of wideband high-power PAs under Envelope Tracking conditions
- Modulators can be pre-programmed for 112 Msps or 122.88 Msps operation. Contact Nujira for other sample rates.

## *Specifications- Flexible Development System*

| RF Signal Generation | | |
|---|---|---|
| Tx Frequency Bands | Low Power RF Out<br>Medium Power RF Out<br>High Power RF Out | 225 to 2700 MHz (-20 dBm, 6.5 dB PAPR)<br>225 to 2700 MHz (-6 dBm, 6.5 dB PAPR)<br>2110 to 2170 MHz (+8 dBm, 6.5 dB PAPR) |
| ACLR | | >65 dB |
| Tx Sample Rates | 3GPP (standard)<br>WiMAX (optional)<br>Custom | 122.88 Msps and 245.76 Msps<br>112 Msps<br>96 to 250 Msps |
| Max Tx Sequence Length | | 32 Mwords (273 ms@ 122.88 Msps) |

| Envelope Signal Generation: LVDS | | |
|---|---|---|
| Format | | OpenET Digital Class 1<br>Parallel LVDS 16-bit I+Q |
| Envelope Sample Rates | 3GPP (standard)<br>WiMAX (optional)<br>Custom | 122.88 Msps<br>112 Msps<br>96 to 125 Msps |

| Envelope / Baseband Signal Generation: Analogue | | |
|---|---|---|
| Format | Differential | 2 x OpenET Analogue, up to 16-bit precision OR<br>2 x analogue for external I-Q modulator |
| Output swing<br>Output impedance<br>Common mode voltage | Maximum<br><br>Programmable | 900 $mV_{p-p}$ (differential into balanced 100 Ω load)<br>100 Ω differential<br>0 V to +1.3 V (12-bit resolution) |
| Signal bandwidth | | 98 MHz per side, 196 MHz with complex I-Q modulator (245.76 Msps) |

| RF Signal Analysis (receiver) | | |
|---|---|---|
| Frequency range | RF input<br>RF direct<br>ADC input | 650* to 2700 MHz (selectable IF filters)<br>DC to 250 MHz (RF mixer and IF filters bypassed)<br>DC to >1000 MHz (direct input to ADC) |
| IF bandwidth (3 dB) | Narrowband<br>Wideband | 20 to 360 MHz<br>20 to 520 MHz |
| Sampling | | 14-bits at 245.76 Msps (307.20 MHz IF)<br>14-bits at 368.64 Msps (276.48 MHz IF) |

* The lower frequency limit can optionally be extended to 225 MHz. Please contact Nujira or KCB for details.

| Mechanical and Environmental | | |
|---|---|---|
| Switches | | Power |
| Power Supply | | 12 V DC, 85 W maximum<br>AC adaptor included (100 to 240V, 50/60 Hz, 150 W) |
| Operating Temperature (full compliance) | | 20 to 30°C |
| Compliance | | EN60950; UL 94 V-2; EN55022 / CISPR22 5.2, CISPR22 6 / FCC part 15, sub-part B; E N55024 / CISPR24, CISPR25, CISPR26 |
| Mechanical | Housing | Aluminium Instrument Case |
| | Dimensions | 88(h) x 483(w) x 350(d) mm |
| | Weight | 6.7 kg excluding PSU, 7.8 kg with PSU |
| | Cooling | Internal speed-controlled fans (<55 dBA) |

## *System Control and DevSys Application Software*

| | | |
|---|---|---|
| Front Panel Indicators | DC Power | Rocker switch (green LED) |
| | Status Indication (red/green LEDs) | DSP OK, FPGA OK, USB activity, LO lock,<br>Temperature OK, AGC locked, Application running OK<br>DPD loop locked (DPD is not supported on NCT-T8901 version) |
| PC Requirements | Processor | Minimum 2 GHz, multi-core preferred |
| | RAM[1] | 2 GB minimum, 3 GB preferred |
| | Available disk space | 2 GB minimum |
| | USB | 1 x USB 2.0 port for control and firmware upgrade (cable supplied) |
| Operating Systems | Supported | Windows® 7 (32-bit), Windows® XP (SP3) |
| | Unsupported[2] | Windows® Vista® |
| | Not-compatible | Windows® 7 / Vista (64-bit) – Contact Nujira for details of availability |
| MATLAB® Versions[3] | Supported | R2010a/b, R2011a |
| | Unsupported[2] | R2008a/b, R2009a/b |
| | Not-compatible[4] | R2007b and earlier |
| | Toolboxes required | Signal Processing Toolbox |
| | | Instrument Control Toolbox (optional, but recommended - required for automated oscilloscope captures) |
| Standard Features | | Modulator Control and Monitoring<br>Test Signal Library<br>Spectral Measurement<br>Envelope Creation<br>ACLR Measurement<br>AM-AM, AM-PM Visualisation<br>Self-Test |

Note 1: 3 GB RAM is required for long waveform support, but is recommended for all applications and waveform lengths.

Note 2: Unsupported versions may work, but Nujira provides no warranty or support.

Note 3: A standalone application build, with full DevSys functionality, is provided for users without MATLAB®. The use of MATLAB® enables additional flexibility, including user-defined algorithm blocks, FDP control from MATLAB via a low-level API (DLL), or use of automated test scripts via a high-level API. Please contact Nujira for details.

Note 4: Not-compatible versions are known not to work and must not be used.

## Contact Information Commercial Applications

Nujira Limited
Building 1010
Cambourne Business Park
Cambourne, Cambridge
CB23 6DP
United Kingdom

Tel: +44 (0) 1223 597900
Fax: +44 (0) 1223 597972

Email: info@nujira.com
Internet: www.nujira.com

## Contact Information US DoD Applications

KCB Signal Solutions
900 Mount Laurel Circle
Shirley, MA 01464
USA

Tel: +1 978 425 6351
Fax: +1 978 425 0403

Email: info@kcbsolutions.com