

## CT522-264-1ac2-1n LANforge WiFIRE 802.11a/b/g/n/ac wave-2 2 radio WiFi Traffic Generator Supporting 264 Virtual STA Interfaces

The CT522-264-1ac2-1n wireless traffic generator is an excellent choice for testing Access Points and other WiFi networks. The ath9k (a/b/g/n) chipset NICs can support up to 200 stations per radio. The ath10k (a/b/g/n/ac) chipset NICs can support up to 64 stations per radio. Each of the Virtual Stations has its own IP address, IP port space, MAC address and routing table. The Virtual Stations can be assigned to communicate to a particular Access Point, use a particular SSID, and Open or WPA/WPA2 authentication assigned. More advanced 802.1X authentication is also included. Each radio can be configured independently of the other. Transmit power and channel/frequency is configured on a per-radio basis. Most other settings are configurable per virtual station.

**There are one ath10k a/n/AC wave-2 and one ath9k a/b/g/n WiFi radios per CT522-264-1ac2-1n and multiple LANforge systems can be clustered together for even more realistic radio interference patterns and increased traffic generation capability.**

All virtual stations on the same radio must be on the same frequency, but as long as the protocol supports that frequency, the multiple protocols can be used concurrently. For instance, if the radio is configured for a 2.4Ghz channel, the stations can be /b, /g, /n, or /ax. If the radio is on a 5Ghz channel, the stations can be /a, /n, ac, or ax. The bandwidth can be configured for all protocols.

The Virtual Stations may be configured with all of the virtual interfaces on the same subnet, or different subnets, depending on the testing requirements. When used with something like VoIP, it allows all of the VoIP calls to use the standard IP ports (with one call per virtual interface).

The CT522-264-1ac2-1n is a small system with a quiet fan. It has 7 antenna. It will fit into a small travel bag or briefcase for easy portability. No additional hardware or software is required, but it is suggested that you manage the system using the LANforge GUI on a separate machine. The CT522-264-1ac2-1n can also be managed over a serial console in text mode or through a directly connected monitor, mouse and keyboard.

Performance reports (similar to CT523):

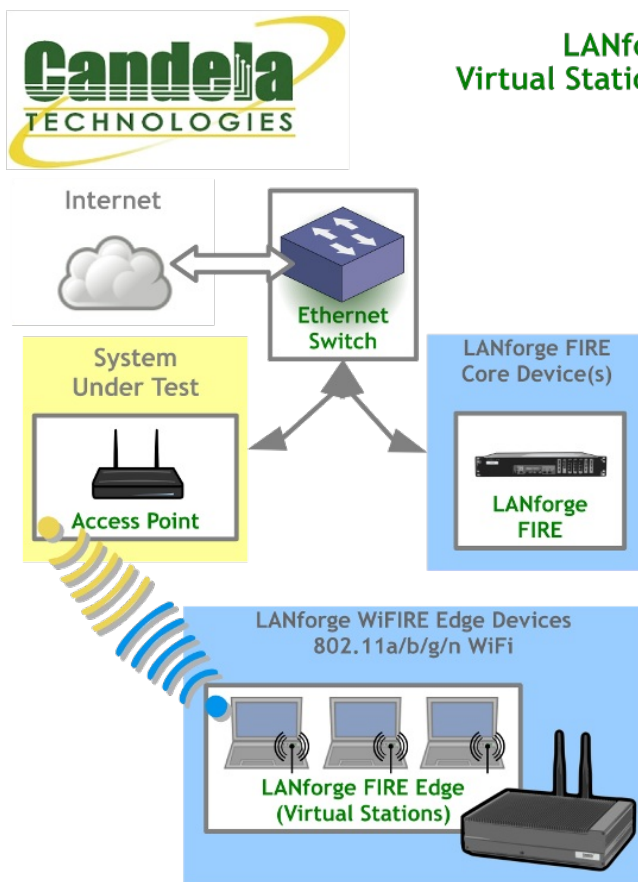
Open, wave2 4x4 | TCP-DL-30sta-open wave-1 3x3 | TCP-DL-30sta-wpa2 wave-1 3x3



Larger Images: [front](#) [back](#)

NOTE: This product may have a different hardware configuration than the system pictured above.  
Refer to your official quote for details.

## Example Network Diagram



### LANforge WiFIRE Virtual Station Traffic Generator

LANforge WiFIRE supports 802.11 Virtual Stations and Access Points\*. To the System Under Test, it appears as if there are multiple PCs sitting inside the LANforge system generating independent traffic streams over Wireless NICs.

Many Virtual Station interfaces are supported per LANforge WiFIRE machine. LANforge can send traffic from one physical interface on the local machine to another interface on that same machine. Each physical and virtual interface can be configured on the same, or on different IP subnets.

In the configuration on the left, the LANforge FIRE Core can be one physical Ethernet interface and act as the server. The LANforge FIRE Edge can be the Virtual Station interfaces configured on the WiFi radio. Both interfaces can be on the same machine or multiple LANforge machines can be clustered together for increased traffic generation capacity.

\* All system support 802.11 a/b/g/n. Some systems support 802.11ac as well.

Candela Technologies Inc., 2417 Main Street, Suite 201, P.O. Box 3285, Ferndale, WA 98248, USA  
www.candelatech.com | sales@candelatech.com | +1 360 380 1618

## Quick Start Guide

1. Connect Management Ethernet port to Management network or management PC. If connecting directly to a PC, an Ethernet cross-over cable should be used.
2. Connect eth1 wired Ethernet interface to wired Ethernet interface on the AP or network under test. This usually is considered the 'server' side of the network.
3. The Client side of the network will be the Virtual Stations configured on the CT522-264-1ac2-1n WiFi NIC(s).
4. Connect power to standard US or European AC power source. If using external battery pack, then connect to that instead. Click button to power on the unit.
5. The CT522-264-1ac2-1n should now boot. If DHCP is enabled on the Management network, the CT522-

264-1ac2-1n will automatically acquire an IP address. If DHCP is not available, the IP address will be set to **192.168.1.101**.

6. Install the LANforge-GUI on a separate management PC or Laptop, or use VNC or remote-desktop programs to access the LANforge system directly. Windows, MAC-OS and Linux GUIs are supported: Select the correct one from the web page served from the LANforge system and install it.
7. Start the LANforge-GUI on the management PC and click the 'Discover' button. It should find the CT522-264-1ac2-1n appliance and add the IP address to the drop-down box in the Connect widget. Press 'Connect' and you will be connected to the CT522-264-1ac2-1n.
8. Select the Port Mgr tab in the GUI. Double-click on the device called 'wiphy0'. This is the Radio device, and should be configured for the correct, channel, country-code, etc. Next, select one or more of the Virtual Station interfaces and click 'Modify'. Enter the correct IP address information, SSID and WPA/WPA2 password (if Enabled). After applying these changes, the Virtual Station interface should associate with the AP and be ready to send traffic. You may create up to 264 Virtual Station interfaces per CT522-264-1ac2-1n with the 'Create' button.
9. Once the interfaces are configured correctly, you can click on the Layer 3, VOIP/RTP and other LANforge-FIRE related GUI tabs and configure/modify/start/stop particular traffic patterns that utilize the virtual stations and wired Ethernet interface. In most cases, you will want one of the FIRE endpoints to be on the wired interface and the other to be on the WiFi Virtual Station interface. It is also valid to generate traffic between two Virtual Station interfaces. The GUI Chamber View window provides some automated test suites. Contact support if you have suggestions for improvements.
10. Any GUI modifications take place immediately after you click 'Submit' or 'OK'.

---

Candela Technologies Inc., 2417 Main Street, Suite 201, P.O. Box 3285, Ferndale, WA 98248, USA  
www.candelatech.com | sales@candelatech.com | +1 360 380 1618

## LANforge WiFIRE Related Images

### Virtual Station Configuration Screen

sta2003 (jedway1) Configure Settings

Port Status Information

Current: LINK-UP GRO Authorized

Driver Info: Port Type: WIFI-STA Parent: wiphy0 wiphy0...

Port Configurables

Standard Configuration

Advanced Configuration

Misc Configuration

Corruptions

Custom WiFi

Enable

Set IF Down

Set MAC

Set TX Q Len

Set MTU

Set Offload

Set PROMISC

Services

HTTP

FTP

RADIUS

Low Level

PROMISC

TSO Enabled

UFO Enabled

GSO Enabled

LRO Enabled

GRO Enabled

General Interface Settings

Down

Aux-Mgt

DHCP-IPv6

DHCP Release

DHCP Vendor ID: None

DHCP-IPv4

Secondary-IPs

DHCP Client ID: None

DNS Servers: BLANK

Peer IP: NA

IP Address: 0.0.0.0

Global IPv6: AUTO

IP Mask: 0.0.0.0

Link IPv6: AUTO

Gateway IP: 0.0.0.0

IPv6 GW: AUTO

Alias:

MTU: 1500

MAC Addr: 04:f0:21:5e:2a:ab

TX Q Len: 1000

Rpt Timer: fast (3 s)

WiFi Bridge: NONE

WiFi Settings

SSID: jedway2-wpa2-2000

AP: DEFAULT

Key/Phrase: jedway2-wpa2-2000

Mode: 802.11abgn-AC

Freq/Channel: 5260/52

Rate: OS Default

WPA

WPA2

WEP

Disable HT40

Enable VHT160

Disable SGI

Print

Display

Probe

Display Scan

Sync

Apply

OK

Cancel

## Layer 3 (Ethernet, UDP, TCP) Connections



LANforge Manager Version(5.2.13)

Control Reporting Tear-Off Info Plugins

Stop All Restart Manager Refresh HELP

Attenuators File-I/O Layer-4 Test Mgr Test Group Resource Mgr Event Log Alerts Port Mgr Messages

Status Layer-3 L3 Endps WanLinks

Rpt Timer: fast (1 s) Go Test Manager all Select All Start Stop Quiesce Clear

View 0 - 200 Go Display Create Modify Delete

Cross Connects for Selected Test Manager

| Name    | Type   | State | Pkt Rx A → B | Pkt Rx A ← B | Rate A → B | Rate A ← B | Rx Drop % A | Rx Drop % B | Drop Pkts A | Drop Pkts B | Avg RTT |
|---------|--------|-------|--------------|--------------|------------|------------|-------------|-------------|-------------|-------------|---------|
| xcdx-1  | LF/UDP | Run   | 17,294       | 17,549       | 9,998,239  | 9,997,437  | 0           | 0           | 0           | 0           | 1       |
| xcdx-10 | LF/UDP | Run   | 17,377       | 17,716       | 9,997,632  | 9,996,340  | 0           | 0           | 0           | 0           | 0       |
| xcdx-2  | LF/UDP | Run   | 17,548       | 17,802       | 9,997,351  | 9,996,964  | 0           | 0           | 0           | 0           | 0       |
| xcdx-3  | LF/UDP | Run   | 17,633       | 17,802       | 9,997,891  | 9,996,964  | 0           | 0           | 0           | 0           | 0       |
| xcdx-4  | LF/UDP | Run   | 17,633       | 17,802       | 9,997,891  | 9,996,964  | 0           | 0           | 0           | 0           | 1       |
| xcdx-5  | LF/UDP | Run   | 17,718       | 17,036       | 9,997,947  | 9,992,326  | 0           | 0           | 0           | 0           | 1       |
| xcdx-6  | LF/UDP | Run   | 17,718       | 17,044       | 9,997,947  | 9,997,018  | 0           | 0           | 0           | 0           | 1       |
| xcdx-7  | LF/UDP | Run   | 17,718       | 17,044       | 9,997,947  | 9,997,018  | 0           | 0           | 0           | 0           | 1       |
| xcdx-8  | LF/UDP | Run   | 17,718       | 17,044       | 9,997,947  | 9,997,516  | 0           | 0           | 0           | 0           | 1       |

Logged in to: 192.168.100.26:4002 as: Admin

## Layer 3 Create/Modify Screen

udp-se - Create/Modify Cross Connect

Display Sync Batch-Create Apply OK Cancel

1 Cross-Connect

CX Name: udp-se

CX Type: LANforge / UDP

Resource: 1 (brent-6port) 1 (brent-6port)

Port: 1 (eth0) 2 (eth1)

Min Tx Rate: New Modem (56 Kbps) New Modem (56 Kbps)

Max Tx Rate: Same Same

Min PDU Size: AUTO AUTO

Max PDU Size: Same Same

IP ToS: Best Effort (0) Best Effort (0)

Pkts To Send: Infinite Infinite

2 Report Timer: default (5 s)

Endpoint A Endpoint B

Pld Pattern: increasing increasing

Min IP Port: AUTO AUTO

Max IP Port: Same Same

Min Duration: Forever Forever

Max Duration: Same Same

Min Reconn: 0 (0 ms) 0 (0 ms)

Max Reconn: Same Same

Multi-Conn: Normal (0) Normal (0)

Script Script

Thresholds Thresholds

3 Cross-Connect

Test Manager: default\_tm

Quiesce: 3 (3 sec)

IP Addr: AUTO AUTO

Replay File: ☐ ☐

Loop: ☐ ☐

Dest Mac: ☒ ☒

Filename:

Dest MAC: <custom> <custom>

4 Endpoint A Endpoint B

Snd Buff Size: OS Default OS Default

Rcv Buff Size: OS Default OS Default

Send Bad FCS: zero (0%) zero (0%)

Src MAC: 00:00:00:00:00:00 00:00:00:00:00:00

Use-Proxy: ☐ ☐

Proxy Addr: 0.0.0.0 0.0.0.0

Proxy Port: 0 0

Socket Priority: 0 0

Payload Payload

5 Endpoint A Endpoint B

Conn Timeout: 10s (10 s) 10s (10 s)

TCP MSS: OS Default OS Default

Endpoint A Endpoint B

Do Checksum: ☐ ☐

UnManaged: ☐ ☐

Duration Quiesce: ☐ ☐

Quiesce-After-Range: ☐ ☐

TCP\_NODELAY: ☐ ☐

Concurrent IP Adrs: ☐ ☐

Clear-Port-On-Start: ☐ ☐

Linear-IP-Ports: ☐ ☐

Endp Name: udp-se-A udp-se-B

## Software Features

- Supports real-world protocols:
  - Layer 2: Raw-Ethernet.
  - 802.1Q VLANs.
  - PPPoE: Integrated PPPoE support.

4. Layer 3: IPv4, IPv6, UDP/IP, IGMP Multicast UDP, TCP/IP.
  5. Layer 4-7: FTP, HTTP, HTTPS, TFTP, SFTP, SCP
  6. 802.11a/b/g/n Wireless Station (up to 200 per machine).
  7. 802.11a/n/ac wave-2 5Ghz Wireless Station (up to 64 per machine, one MU-MIMO per wave-2 radio).
  8. Layer 4-7: TELNET, PING, DNS, SMTP, NMAP (via add-on script).
  9. File-IO: NFSv3, NFSv4, CIFS, iSCSI.
2. Supports up to 1000 concurrent TCP connections with base license package.
  3. The CT522-264-1ac2-1n is able to push around 1.2Gbps using the 802.11AC wave-2 radio, depending on the protocols mix, wireless mode and environment, and speed of the network under test. Supports at least 60 VoIP (SIP, RTP) calls if appropriate licenses are purchased.  
**Performance results (this system performs similar to the CT523): Open, wave2 4x4 | TCP-DL-30sta-open wave-1 3x3 | TCP-DL-30sta-wpa2 wave-1 3x3**
  4. Supports real-world compliance with ARP protocol.
  5. Supports ToS (QoS) settings for TCP/IP and UDP/IP connections.
  6. Uses publicly available Linux and Windows network stacks for increased standards compliance.
  7. Utilizes **libcurl** for FTP, HTTP and HTTPS (SSL), TFTP and SCP protocols.
  8. Supports file system test endpoints (NFS, CIFS, and iSCSI file systems, too!). File system mounts can use the virtual interface feature for advanced testing of file server applications.
  9. Supports custom command-line programs, such as telnet, SMTP, and ping.
  10. Comprehensive traffic reports include: Packet Transmit Rate, Packet Receive Rate, Packet Drop %, Transmit Bytes, Receive Bytes, Latency, Jitter, various Ethernet driver level counters, and much more.
  11. Supports generation of reports that are ready to be imported into your favorite spread-sheet.
  12. Allows packet sniffing and network protocol decoding with the integrated **Wireshark** protocol sniffer.
  13. GUI runs as Java application on Linux, MAC and Microsoft Operating Systems (among others).
  14. GUI can run remotely, even over low-bandwidth links to accommodate the needs of the users.
  15. Central management application can manage multiple units, tests, and testers simultaneously.
  16. Includes easy built-in scripting for iterating through rates and packet sizes, with automated reporting. Also supports scriptable command line interface (telnet) which can be used to automate test scenarios. Perl libraries and example scripts are provided!
  17. Automatic discovery of LANforge data generators simplifies configuration of LANforge test equipment.
  18. LANforge traffic generation/management software is supported on Linux and MS Windows.

---

Candela Technologies Inc., 2417 Main Street, Suite 201, P.O. Box 3285, Ferndale, WA 98248, USA  
www.candelatech.com | sales@candelatech.com | +1 360 380 1618

## Hardware Specification

1. High-End Appliance with quiet fan.

2. Operating System: Fedora Linux with customized 64-bit Linux kernel.
3. Six 1Gbps Ethernet ports, room for two wifi NICs
4. Intel Core i5-6300U CPU @ 2.40GHz processor.
5. RJ45 Serial console (115200 8 N 1) for console management & initial configuration.
6. DisplayPort, USB ports for desktop usage.
7. 4 GB RAM.
8. 120+ GB Solid State Hard Drive.
9. Larger storage drives available.
10. 12v 5AMP external power supply (brick).
11. Weight: 4 lbs
12. Dimensions: 6 x 7.5 x 2.5 inches    Metric: 153 x 190 x 63 mm.
13. Operating Temperature: -0 ~ 40°C.
14. Certification: CE Emission, FCC Class A, RoHS

List Price: \$23,850    List Price with 1 Year support (17%): \$27,904

---

## Additional Feature Upgrades

Unless otherwise noted in the product description, these features usually cost extra:

- WanPaths (LANforge-ICE feature set)
- Virtual Interfaces: MAC-VLANs, 802.1Q VLANs, WiFi stations, etc
- FIRE Connections: Base FIRE license includes 1000 active connections.
- **WiFi RF Attenuator**: Adjust WiFi signal strength in a controllable manner.
- **RF Noise generator**: Generate modulated WiFi RF noise.
- **RF Noise / Radar Simulator**: Simulate RADAR pulses and other non-modulated RF noise.
- **SMA RF Cable Bundle**: Used to cable LANforge WiFIRE radios to device-under-test.
- LANforge-ICE Network Emulation.
- VOIP: Each concurrent call over the included package requires a license.
- **VoIP-Mobile Audio Quality Testing using POLQA/PESQ.**
- **Mobile-Mobile Audio Quality Testing using POLQA/PESQ.**
- Armageddon: Each pair of ports requires a license if not already included.
- **RF Chambers for WiFi testing.**
- External battery pack: 12+ hours for CT520, CT523, CT92X and other platforms.

---

Candela Technologies Inc., 2417 Main Street, Suite 201, P.O. Box 3285, Ferndale, WA 98248, USA  
www.candelatech.com | sales@candelatech.com | +1 360 380 1618

Last modified: Wed Jun 11 17:34:00 PDT 2025