

## CT521a-264-1ac-1n Economy LANforge WiFIRE 802.11a/b/g/n/ac 2 radio WiFi Traffic Generator Supporting 264 Virtual STA Interfaces

The CT521a-264-1ac-1n wireless traffic generator is an excellent choice for testing Access Points and other WiFi networks. The CT521a-264-1ac-1n uses a modified Wireless driver for WiFi NICs based on the Qualcomm/Atheros chipset. 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/b/g/n/ac and one ath9k a/b/g/n WiFi radios per CT521a-264-1ac-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 /ac. If the radio is on a 5Ghz channel, the stations can be /a, /n or /ac. The bandwidth can be configured for all protocols. For 802.11n and 802.11AC, configuring the MCS rates also determines the number of spatial streams (1x1, 2x2, 3x3, 4x4, etc.).

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 CT521a-264-1ac-1n has no fans and is silent. It has 6 antenna. It will fit into a small travel bag or briefcase for easy portability. The system should be managed with the LANforge-GUI software installed on a laptop or PC. The CT521a-264-1ac-1n can also be managed over a serial console in text mode. Maximum throughput for the CT521a-264-1ac-1n is about 350Mbps and is bound by the relatively weak CPU. For faster systems, consider the CT523, CT524, and CT525 chassis.

Performance reports:

UDP Hunt OPEN | UDP Hunt WPA2 | WiFi-Capacity Open TCP | WiFi-Capacity WPA2 TCP | WiFi-Capacity Open UDP | WiFi-Capacity WPA2 UDP





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

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# Example Network Diagram



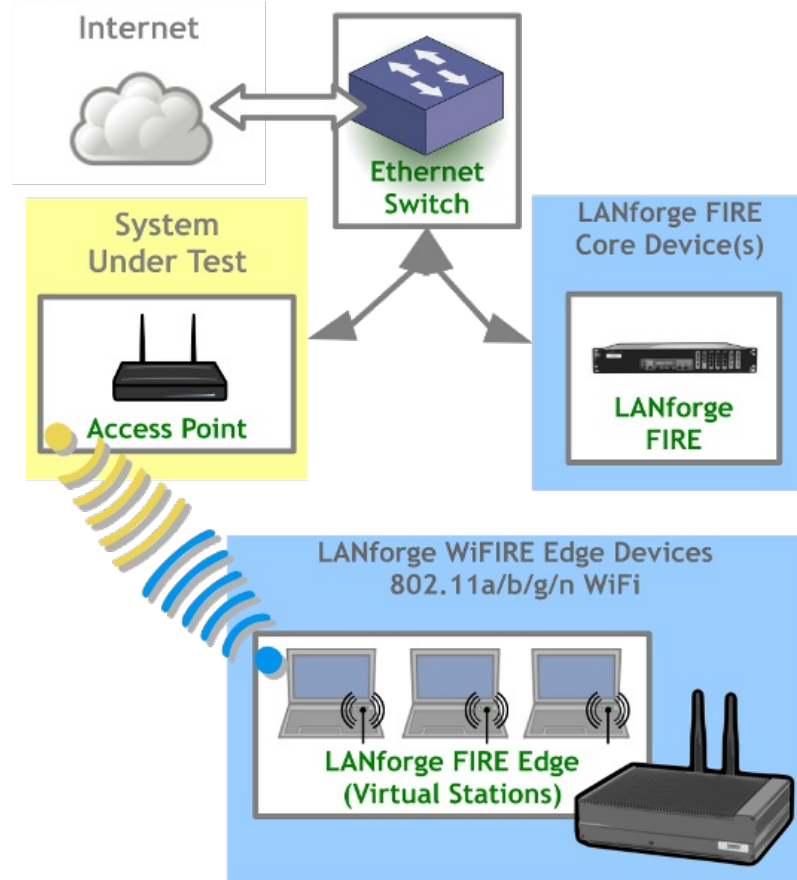
## LANforge WiFIRE Virtual Station Traffic Generator

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.



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## 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 CT521a-264-1ac-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.
5. Install the LANforge-GUI on a separate management PC or Laptop. Windows and Linux GUIs are supported: Select the correct one from the CDROM or Candela Technologies Download page and install it. The CT521a-264-1ac-1n appliance has a web server that also provides the LANforge GUIs.
6. The CT521a-264-1ac-1n should now boot. If DHCP is enabled on the Management network, the CT521a-264-1ac-1n will automatically acquire an IP address. If DHCP is not available, the IP address will be set to **192.168.1.101** by the LANforge scripts.
7. Start the LANforge-GUI on the management PC and click the 'Discover' button. It should find the CT521a-264-1ac-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 CT521a-264-1ac-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 CT521a-264-1ac-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 Plugins menu (and right-click on some tables) provides some plugins to do automated testing and reporting. Contact support if you have suggestions for improvements.
10. Any GUI modifications take place immediately after you click 'Submit'.

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## **LANforge WiFIRE Related Images**

### **Virtual Station Configuration Screen**



sta1 (brent-521) Configure Settings

Port Status Information

Current: LINK-DOWN GRO NONE

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

Port Configurables

Standard Configuration

Advanced Configuration

Misc Configuration

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: 00:0e:8e:6f:81:f8
 TX Q Len: 1000
 Rpt Timer: medium (8 s)
 WiFi Bridge: NONE

WiFi Settings

SSID: brenttest-523
 AP: DEFAULT
 Key/Phrase: mypasswd
 Mode: 8 (8)
 Freq/Channel: 2437/6
 Rate: OS Default
 ☐ WPA
 ☒ WPA2
 ☐ OSEN
 ☐ WEP
 ☐ Disable HT40
 ☐ Disable SGI

Print

View Details

Probe

Display Scan

Sync

Apply

OK

Cancel

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

LANforge Manager Version(5.2.13)

ControlReportingTear-OffInfoPlugins

Stop AllRestart ManagerRefreshHELP

AttenuatorsFile-IOLayer-4Test MgrTest GroupResource MgrEvent LogAlertsPort MgrMessages

StatusLayer-3L3 EndpsWanLinks

Rpt Timer:fast (1 s)GoTest Managerall

Select AllStartStopQuiesceClear

View0 - 200GoDisplayCreateModifyDelete

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

+ - All Display Sync Batch-Create Apply OK Cancel

**1**

Cross-Connect

CX Name: udp-se

CX Type: LANforge / UDP

Endpoint A	Endpoint B
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**

Cross-Connect

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)

Endpoint A	Endpoint B
IP Addr: AUTO	AUTO
<input type="checkbox"/> Replay File	<input type="checkbox"/> Replay File
<input type="checkbox"/> Loop	<input type="checkbox"/> Loop
<input checked="" type="checkbox"/> Dest Mac	<input checked="" type="checkbox"/> 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
<input type="checkbox"/> Use-Proxy	<input type="checkbox"/> 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
<input type="checkbox"/> Do Checksum	<input type="checkbox"/> Do Checksum
<input type="checkbox"/> UnManaged	<input type="checkbox"/> UnManaged
<input type="checkbox"/> Duration Quiesce	<input type="checkbox"/> Duration Quiesce
<input type="checkbox"/> Quiesce-After-Range	<input type="checkbox"/> Quiesce-After-Range
<input type="checkbox"/> TCP_NODELAY	<input type="checkbox"/> TCP_NODELAY
<input type="checkbox"/> Concurrent IP Addrs	<input type="checkbox"/> Concurrent IP Addrs
<input type="checkbox"/> Clear-Port-On-Start	<input type="checkbox"/> Clear-Port-On-Start
<input type="checkbox"/> Linear-IP-Ports	<input type="checkbox"/> 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.
  - Layer 3: IPv4, IPv6, UDP/IP, IGMP Multicast UDP, TCP/IP.
  - Layer 4: FTP, HTTP, HTTPS, TFTP, SFTP, SCP
  - 802.11a/b/g/n Wireless Station (up to 200 per machine).



7. 802.11a/b/g/n/ac Wireless Station (up to 64 per machine).
  8. Layer 4: 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 CT521a-264-1ac-1n is able to push up to about 350Mbps through an AP, depending on the protocols mix, wireless mode and environment, and speed of the network under test. Supports at least 20 VoIP (SIP, RTP) calls if appropriate licenses are purchased. This system is CPU limited, but the affordable price makes it easier to afford multiple units to spread around the network-under-test for greater combined throughput. Consider the CT523, CT524, and CT525 for more powerful systems. (
 

**Performance results: UDP Hunt OPEN | UDP Hunt WPA2 | WiFi-Capacity Open TCP | WiFi-Capacity WPA2 TCP | WiFi-Capacity Open UDP | WiFi-Capacity WPA2 UDP**

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  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.

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## Hardware Specification

1. Affordable Appliance with no fans.
2. Operating System: Fedora Linux with customized 64-bit Linux kernel.
3. Three 1Gbps Ethernet ports, room for two wifi NICs
4. One Atheros/Qualcomm 802.11a/b/g/n/ac 3x3 MIMO and one Atheros/Qualcomm 802.11a/b/g/n 3x3 MIMO NIC with three external antenna each. Supports up to 264 virtual stations (200 per a/b/g/n radio and 64 per a/b/g/n/ac radio).
5. Antenna-to-Radio association: See labels on chassis.
6. AMD GX-412TC quad-core 1GHz processor.
7. DB9 Serial console (115200 8 N 1) for console management & initial configuration.
8. 4 GB RAM.
9. 30+ GB Solid State mSata storage Drive.
10. Larger storage drives available.
11. 12v 2AMP external power supply (brick).
12. Weight: 2 lbs
13. Dimensions: 7 x 7 x 1 inches Metric: 170 x 170 x 30 mm.
14. Operating Temperature: -20 ~ 45°C.
15. Certification: CE Emission, FCC Class A, RoHS

List Price: \$7,500    List Price with 1 Year support (17%): \$8,775

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## 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 / Radar Simulator**: Simulate RADAR pulses and other 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.
- Armageddon: Each pair of ports requires a license if not already included.
- External battery pack: 12+ hours for CT520, CT523, CT92X and other platforms.

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