

CT524-328-2ac2-1n-10g LANforge WiFIRE 802.11a/b/g/n/ac 4x4 MU-MIMO 3 radio WiFi Traffic Generator Supporting 328 Virtual STA Interfaces

The CT524-328-2ac2-1n-10g wireless traffic generator is an excellent choice for testing Access Points and other WiFi networks. The CT524-328-2ac2-1n-10g 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 two ath10k a/b/g/n/ac 4x4 MU-MIMO and one ath9k a/b/g/n WiFi radios per CT524-328-2ac2-1n-10g 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 CT524-328-2ac2-1n-10g has quiet fans and is relatively small. It has 11 antenna. 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 CT524-328-2ac2-1n-10g can also be managed over a serial console in text mode or through a directly connected monitor, mouse and keyboard.



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

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



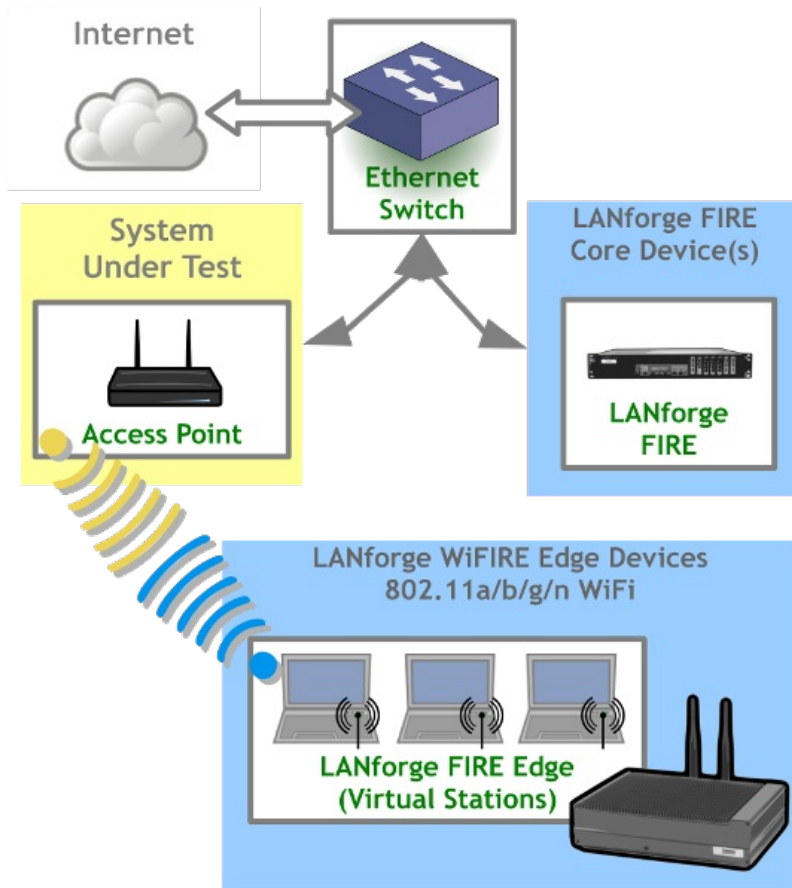
LANforge WiFIRE Virtual Station Traffic Generator

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 CT524-328-2ac2-1n-10g 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 CT524-328-2ac2-1n-10g appliance has a web server that also provides the LANforge GUIs.
6. The CT524-328-2ac2-1n-10g should now boot. If DHCP is enabled on the Management network, the CT524-328-2ac2-1n-10g 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 CT524-328-2ac2-1n-10g appliance and add the IP address to the drop-down box in the Connect widget. Press 'Connect' and you will be connected to the CT524-328-2ac2-1n-10g.
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 328 Virtual Station interfaces per CT524-328-2ac2-1n-10g 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
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)

Control Reporting Tear-Off Info Plugins

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 4x4 Wireless Stations (up to 128 per machine). Each /AC radio supports only one MU-MIMO station.
 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 CT524-328-2ac2-1n-10g is able to push 900+Mbps through an AP, 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. When all two ath10k a/b/g/n/ac 4x4 MU-MIMO and one ath9k a/b/g/n radios are configured on different channels, combined maximum upload speed exceeds 1Gbps. More powerful, and more portable systems, are also available.
 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.

Hardware Specification

1. High-End Portable system with quiet fans..
2. Operating System: Fedora Linux with customized 64-bit Linux kernel.
3. Two 1Gbps Ethernet ports, room for four wifi NICs, 2/4 port 1G or 10G Ethernet
4. Two Atheros/Qualcomm 802.11a/b/g/n/ac 4x4 MU-MIMO and one Atheros/Qualcomm 802.11a/b/g/n 3x3 MIMO NIC with three external antenna each. Each MU-MIMO NIC can support no more than one station when configured for MU-MIMO. Supports up to 328 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. 2-port 10-Gbps fiber (short-range) Ethernet NIC included.
7. 802.11AC NIC supports up to 4x4 MCS-10 (1733Mbps encoding rate)
8. 802.11a/b/g/n NIC supports up to 3x3 MCS-23 (450Mbps encoding rate)
9. Intel E3-1245v5 3.5GHz processor.
10. DB9 Serial console (115200 8 N 1) for console management & initial configuration.
11. VGA, USB ports for desktop usage.
12. 16 GB RAM.
13. 40+ GB Solid State Hard Drive.
14. Larger storage drives available.
15. Internal power-supply.
16. Weight: 12 lbs
17. Dimensions: 15 x 13.25 x 4 inches Metric: 381 x 337 x 102 mm.
18. AC Power supply: 100-240v
19. Operating Temperature: -20 ~ 55°C.
20. Certification: RoHS

21. Product launch: Q4, 2016. Supported through at least Q4 2020.

List Price: \$37,195 List Price with 1 Year support (17%): \$43,518

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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