



# NuDOG-301

## Portable 2-Port Gigabit Wirespeed Streams Generator & Network TAP

NuDOG-301 is a handheld test device with two Gigabit ports for Ethernet testing. The main functions of NuDOG-301 include multi-streams generation, TAP/Loopback test, and NIC.



### OVERVIEW

NuDOG-301 is a handheld device with two Gigabit ports for Ethernet testing. The main functions of NuDOG-301 include multi-streams generation, TAP/Loopback test, and NIC emulation.

Connecting NuDOG-301 to its mini-USB port makes it possible for system configurations and managements. NuDOG-301 is an ideal device for in-field testing. Moreover, NuDOG-301 has various test interface options (UTP ports, SFP ports, or Combo ports) available, providing diverse interface flexibilities for different testing scenarios.

NuDOG-301 can work along with a series of utility softwares that qualify industrial standards such as RFC-2889, RFC-2544, and QoS. With these utilities, NuDOG-301 is able to conduct throughput test, latency test, error filtering test, forwarding test, and so on. Utility softwares can provide a user-friendly interface for different test configurations when setting test parameters and criteria. More optional softwares are available for extended test requirements.

With these advantageous features, NuDOG-301 is your best partner for LAB researching and in-field troubleshooting.

### FEATURES & ADVANTAGES

- Hardware based wirespeed streams generation, analysis, network TAP and NIC
- High precision performance for measuring throughput, latency, packet loss and disordered sequence
- Wirespeed traffic capturing with programmable filter and trigger criteria
- RFC 2544 test suite
- RFC 2889 test suite
- Layer 1 and Layer 2 loopback test
- High precision 1 ppm temperature-compensated oscillator provides accurate clock speed to ensure the reliability of the tests.
- Injecting errors in transmitted traffic to simulate and test abnormal situations
- Real-time statistics for each port, including transmitted/received frame for VLAN, IPv4, IPv4 fragment, IPv4 extension, ICMP, ARP, total bytes/packets, CRC, IPCS error and over-and-under size frames
- User-friendly interface that supports various parameter configurations and meets various test requirements
- 512Mbits wirespeed packet capture buffer per port



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Messtechnik, die begeistert ...

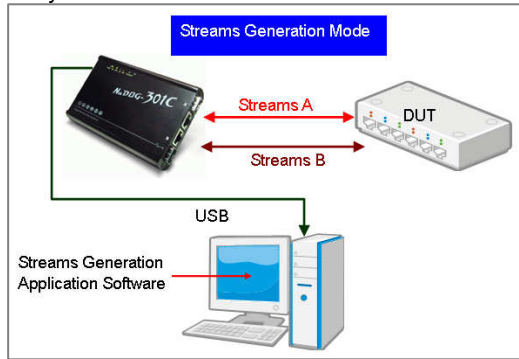


## APPLICATION IN DIFFERENT MODES

### ● Stream Generation Mode:

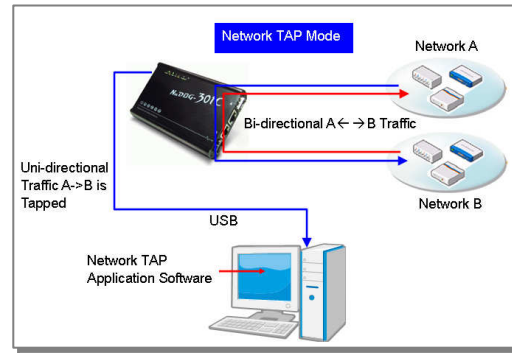
In Streams Generation mode, NuDOG-301 generates bi-directional network streams for test requirements as the illustration below.

Both NuDOG-301's Port A and Port B can generate and receive test streams. The test streams are sent and returned to the same NuDOG-301 for DUT (device under test) analysis.

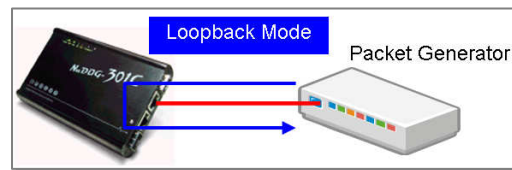


### ● TAP/Loopback Mode:

In TAP mode, NuDOG-301 can monitor any data that flows through it. Network TAP is a method of monitoring network's situation dynamically without interference. NuDOG-301 can tap bi-directional or uni-directional traffic from different sides (port A and port B) and also provides abundant packet counters. In Loopback mode, NuDOG-301 resends the incoming streams back to the source.



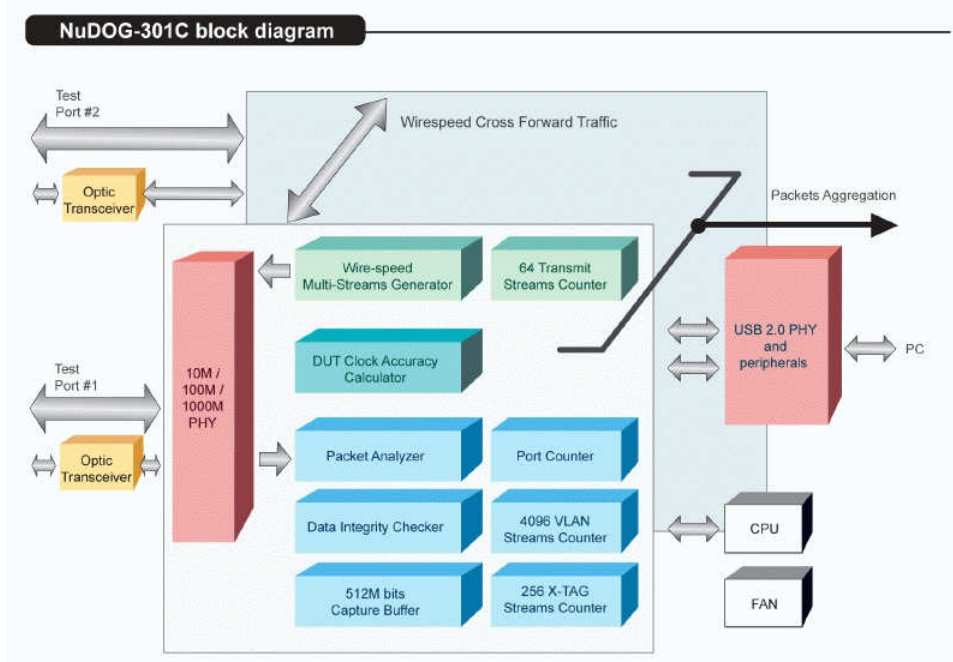
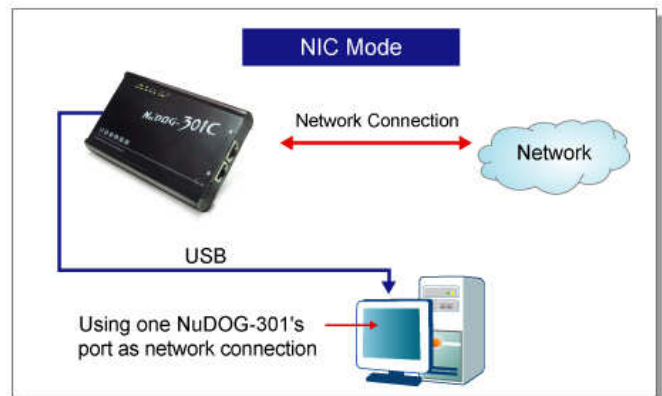
Tap Mode



Loopback Mode

### ● NIC Mode:

In this mode, NuDOG-301 simulates network interface card (NIC).





## SPECIFICATIONS

Supported frame format	<ul style="list-style-type: none"><li>Ethernet Type II frame</li><li>IEEE 802.3 frame</li></ul>			
Speed and Link Mode  Auto Negotiation/Force Mode	NuDOG-301C	NuDOG-301F	NuDOG-301T	NuDOG-301B
	Combo (SFP+UTP) Port x 2 <b>UTP Port:</b> <ul style="list-style-type: none"><li>10/100 Mbps Half/Full Duplex</li><li>1000 Mbps Full Duplex</li></ul> <b>SFP Port:</b> <ul style="list-style-type: none"><li>1000 Mbps Full Duplex</li></ul>	SFP Port x 2 <ul style="list-style-type: none"><li>1000 Mbps Full Duplex</li></ul>	UTP Port x 2 <ul style="list-style-type: none"><li>10/100 Mbps Half/Full Duplex</li><li>1000 Mbps Full Duplex</li></ul>	UTP Port x 1 <ul style="list-style-type: none"><li>10/100 Mbps Half/Full Duplex</li><li>1000 Mbps Full Duplex</li></ul> SFP Port x 1 <ul style="list-style-type: none"><li>1000 Mbps Full Duplex</li></ul>
Application Mode  3 Modes Controlled by Utilities	SG (Stream Generation) Mode	TAP/Loopback Mode		NIC (Network Interface Card) Mode
	NuDOG-301 generates bi-directional network streams to DUT for tests required	NuDOG-301 monitors any data that flows through it and also provides loopback and abundant packet counters		NuDOG-301 simulate as an NIC connecting to the PC via USB port
Functional Specification	<ul style="list-style-type: none"><li>Active TAP without interfering monitored traffic</li><li>Variation of DA/SA and VLAN ID in increase, decrease, or random that can test the addressing capability of the DUT</li><li>Rapid-Matrix mode: Up to 32 base-streams</li><li>Frame length: Fixed from 64 ~16k bytes or random</li><li>Inter Frame Gap count: 96ns~1.073 Sec</li><li>Payload in frame: Specific payload or random pattern</li><li>Error Generation: CRC, Alignment, Dribble bits, Undersize frame, Oversize frame</li><li>Capturing Network events with SDFR (Self-Discover Filtering Rules)</li><li>2<sup>nd</sup> level CRC check and transmission sequence check</li><li>Support Jumbo Frame (up to 16K bytes)</li><li>Two capture buffer mode: 2KB packet length mode; 16KB packet length mode</li><li>Maximum packet length for loopback: 2K bytes</li><li>DUT oscillator measuring</li><li>Support 1 USC (Universal Stream Counter) with 128 streams</li></ul>			
Hardware Counter	<ul style="list-style-type: none"><li>Tx Packet, Tx Byte, Tx Rate, Rx Packet, Rx Byte, Rx Rate</li><li>Collision counter: Tx Collision, Tx Single Collision, Tx Multi Collision, Tx Excess Collision</li><li>Error counter: Dribble Error, Alignment Error, CRC Error , DI Error, IPCS Error, Error &amp; Loss Packet</li><li>Packet Size Statistics Counter: Under Size, 64, 65 -127, 128 -255, 256 -511, 512 -1023, 1024 -1522, Over Size</li><li>Layer 2 and Layer 3 Packet Counter: Broadcast, Multicast, Unicast, VLAN, IPv4, IPv4 Fragment, IPv4 Extension, ICMP, ARP, Pause.</li><li>Trigger Counter by SDFR</li></ul>			



## SPECIFICATIONS (Continued)

<b>Utility Softwares (Optional )</b>	<p>The following utility softwares are optional for working with NuDOG-301</p> <ul style="list-style-type: none"> <li>• DApps-NIC: NIC simulation suite</li> <li>• DApps-TAP: Ethernet TAP suite base on TAP, Layer 1 loopback and Layer 2 loopback mode with real streams counter and streams chart</li> <li>• DApps-SG: Control suite for multiple streams generator</li> <li>• DApps-2544: Test Suites for RFC 1242 and RFC 2544</li> <li>• DApps-2889: Test Suites for RFC 2285 and RFC 2889 (partial)</li> <li>• DApps-QoS: QoS testing based on VLAN item and IP/UDP item of Layer3</li> <li>• DApps-MPT: Automated Ethernet device batch tests for mass-production line or network device certifications in laboratories</li> </ul>			
<b>Interface</b>	NuDOG-301C	NuDOG-301F	NuDOG-301T	NuDOG-301B
	Combo(SFP+UTP)Port x 2	SFP Port x 2	UTP Port x 2	UTP Port x 1 SFP Port x 1
	<ul style="list-style-type: none"> <li>• Mini-USB 2.0 Port x 1</li> <li>• DC Power Jack</li> <li>• Diagnostic Port</li> </ul>			
<b>LED</b>	<ul style="list-style-type: none"> <li>• Power/Fail: Power status</li> <li>• Capture A: Capture mode for A port is activated</li> <li>• Capture B: Capture mode for B port is activated</li> <li>• USB: USB connection status</li> <li>• SG/TAP: Stream Generation in TAP/Loop Mode or NIC Mode</li> </ul>			
<b>Power Source</b>	<p>External Power Adapter</p> <ul style="list-style-type: none"> <li>• Input: AC 100 V ~ 240 V, 50 Hz ~ 60 Hz</li> <li>• Output: DC 12 V</li> </ul>			
<b>Temperature</b>	<ul style="list-style-type: none"> <li>• Operating: 0°C~ 40°C (32 °F~ 104 °F)</li> <li>• Storage: -10°C~ 70°C (14 °F~ 158 °F)</li> </ul>			
<b>Humidity (non-condensing)</b>	<ul style="list-style-type: none"> <li>• Operating: 0% ~ 85% RH</li> <li>• Storage: 0% ~ 85% RH</li> </ul>			
<b>Dimension</b>	125.8mm x 85mm x 27.5mm			



## GENERAL DESCRIPTION OF NuDOG-301

NuDOG-301 series include 4 different models with different port interfaces (Combo, SFP and UTP ports). With LED indicators, interface, and utility softwares that can run on PCs, users can connect NuDOG-301 series with the DUT and perform various tests.

### NuDOG-301C



❶ LED indicator	❹ SFP Port A
❷ USB Port	❺ UTP Port A
❸ Power Jack	❻ UTP Port B
❹ Fan	❼ SFP Port B
❺ Diagnostic Port	

### NuDOG-301 Series Interface Ports

	SFP Port	UTP Port
NuDOG-301C	2*	2*
NuDOG-301T	N/A	2
NuDOG-301F	2	N/A
NuDOG-301B	1	1

\* NuDOG-301C has 2 Combo Ports (1 SFP Port + 1 UTP Port)



## UTILITY SOFTWARES (OPTIONAL)

### ***DApps-TAP: Network TAP/Loopback Utility***

For NuDOG-301, all data streams between two network ports can be duplicated and sent to PC via mini USB port for monitoring and analyzing. The user can specify conditions to filter the packets wanted with DApps-TAP application software. It reduces USB port's network traffic and also cuts down PC resource consumption while dealing with large quantity of packets.

### ***DApps-SG: Control Suite for Multiple Streams Generator***

DApps-SG provides a powerful and sophisticated virtual front control panel to manage this device. Two test ports can be configured independently with parameters to define multiple streams and capture capabilities. Traffic for various network protocols can be customized, transmitted, and received on each port. Comprehensive statistics give users an in-depth analysis of the DUT performance.

### ***DApps-NIC: Network Interface Card Simulation Suite***

NuDOG-301 has a mini-USB port for PC connection. In addition to network TAP, system control and system upgrade functions. NuDOG-301 can also be used as a network interface card. With control software and NuDOG-301's hardware conversion, network data streams can flow between NuDOG-301's USB and network port.

### ***DApps-2544: Test Suit Based on RFC-2544***

DApps-2544 is a user-friendly and automatic test suite based on industry-standard RFC-2544. It generates and analyzes packets to evaluate the Throughput performances, Latency, Packet Loss, and Back-to-Back of Ethernet switches or routers via this device. The real-time test results display and customized report provide an effective way when examining the DUT.

### ***DApps-2889: Test Suit Based on RFC-2889***

DApps-2889 is a user-friendly and automatic test suite based on industry-standard RFC-2889 (partial) to test the DUT. RFC 2889 provides methodology for benchmarking for local area network (LAN) switching devices, forwarding performance, congestion control, latency, address handling and filtering. It extends the methodology already defined for benchmarking network interconnecting devices in RFC 2544.

### ***DApps-MPT: Automatic batch tests for Ethernet device***

DApps-MPT is an accurate and efficient software suite for mass-production scale test or batch network test. Various packet generation and reception testing items could be configured to pre-defined testing modes. The utility of DApps-MPT can load testing models easily. All simple and visualized results and detailed testing logs are available to access upon demand. DApps-MPT is a powerful and convenient tool to apply on this device.

### ***DApps-QoS: QoS Testing covering Layer 2 & Layer 3***

Network QoS (quality of service) is a way to classify the transmission priority of packets while the volume of to-be-transmitted packets is beyond the Ethernet switch or router's throughput capability. Packets with higher priorities are processed and transmitted first. For Ethernet frame, each packets can be tagged with a VLAN ID and CoS (class of service), and Layer 3 IP/UDP packets are marked according to the type of service they need. For Ethernet switch or router that supports QoS, packets with higher CoS priority should be transmitted first if network traffic is congested. DApps-QoS can limit acceptable network traffic at receiving port, analyze the traffic distribution of packets with different priority received from DUT (router or switch), and test the performance of Layer 3 Router, Switch with QoS function.



## TECHNICAL TERMS

NuDOG-301 is an all-purpose handheld network test device that has many innovative technologies.

### Rapid-Matrix

Rapid-Matrix, especially designed by Xtramus for generating multi-stream traffic per port simultaneously, is used to verify functions and performance of Gigabit Ethernet devices/solutions/networks.

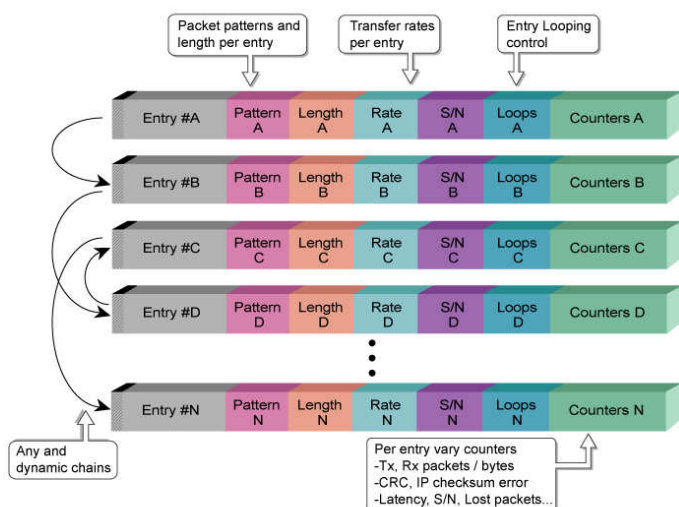
#### Features & Advantages

Rapid-Matrix is a technology that can generate multi-stream traffic simultaneously with different kinds of frames containing almost any required protocol headers, tags and payload for each port

In traditional network test procedures, testing different functions sequentially always takes lots of time, and if the test equipment is not sufficient enough, cost of time will be high. Unlike traditional test procedures in other test equipments, Rapid-Matrix technique activates multi-task test to DUTs simultaneously. This mechanism also synchronizes the test procedure to all DUTs under test; hence, the test duration of a multi task test for all DUTs is predictable and the test duration is reduced dramatically.

#### Generate up to 32 Streams Per Port

Rapid-Matrix consists of 32 individual entries for each port. Each entry has its own independent settings for a unique data stream. Multiple entries can be correlated to compose a complicated data stream.



### Advanced Test of Functionality/ Performance with X-TAG

X-TAG, Xtramus' proprietary 12-byte embedded tag, is located at 45th~56th bytes of each testing frames generated by Rapid-Matrix for multi-stream tests.

X-TAGs are used as stream tags to provide fundamental information for collecting statistics of multi-stream traffic. Advanced tests like latency, packet loss, and packet sequence miss can be interpreted by X-TAG.

X-TAG consists of Header, Version, Operation Mode, Frame Type, Slot Number, Stream Counter, Packet Serial Number and Timestamp. X-TAG Stream Counter offers test data such as byte count, packet count, packet loss, packet sequence error count, IP checksum error count and latency.

### SDFR

#### Self-Discover Filtering Rules

SDFR is a technique that makes capturing or filtering over Ethernet easy and convenient

- User- friendly interface that display values such as source IP, destination IP and other criteria for filtering. All these values can be input directly without calculating mask.
- SDFR parameters include filter of Layer 2 Destination MAC Address, Source MAC Address, VLAN ID, Layer 3 Destination IP Address, Source IP Address, Destination Port, and Source Port. Each filter is independent and can be activated in any combinations.
- SDFR values can be a single value or a range of values between specified values. All packets that meet the criteria will be captured
- Multiple filter condition can be activated easily by just clicking different options.
- Displaying captured packet in real-time without interfering the network flow.

Value of SDFR and filter criteria can be changed dynamically during capture procedure.



## Streams Counter

This counter displays statistics of multi-streams traffic.

Each individual stream's counter for a single port is very essential data to analyze DUT's multi-streams traffic performances.

Based on X-TAG and VLAN for each ports and system, the streams counter shows its related counters (such as Packet counts, Bytes, S/N Error, Packet Loss, Latency and Transmission Rate in Mbps) as illustrated below.

X-TAG Streams Counter

The diagram illustrates the Streams Counter for a network port. It is divided into two main sections: 'Transmitting Side' and 'Receiving side'.

**Transmitting Side:** This section shows a table with three columns: 'Transmit Streams', 'Packets', and 'Bytes'. It lists data for streams N', N'+1, and N'+2, with a row of asterisks indicating further data.

**Receiving side:** This section shows a table with seven columns: 'Received Streams', 'Packets', 'Bytes', 'S/N Error', 'Packet Loss', 'Latency', and 'Rate (Mbps)'. It lists data for streams N', N'+1, and N'+2, with a row of asterisks indicating further data.

A bracket on the left side of the diagram groups both tables under the label 'Streams Counter (per network port)'.

Transmitting Side		
Transmit Streams	Packets	Bytes
N'	2,445	500,991
N'+1	90,343	7,103,151
N'+2	88,672	8,092,043
*****		

Receiving side						
Received Streams	Packets	Bytes	S/N Error	Packet Loss	Latency	Rate (Mbps)
N'	9,320	710,573	13	0	3.2 us	1.3
N'+1	41,117	5,900,988	3	1	4.5 us	17.2
N'+2	15,095	18,678,003	87	21	4.4 us	25.8
*****						

### Features & Advantages

#### ➤ Wirespeed Performance:

The performance of Multi-stream Counter can support up to wirespeed (100% utilization of Gigabit Ethernet traffic). Receiving frames are processed in real time.

#### ➤ Flexible Protocol Support:

Several often-used protocols (like IPv4) are served as pre-defined patterns for Multi-stream Counter's trigger conditions. Multi-stream Counter also supports user-defined patterns by SDFR. Proprietary protocols or private headers/ tags can also be triggered by Multi-stream Counter based on user- SDFR.

#### ➤ Pre-filtering to Trigger Designated Packets:

Multi-stream Counter can correlate with filtering. Incoming packets will be filtered first. Only packets meet filtering criteria are forwarded to Multi-stream Counter. Filtering options are very flexible in order to meet different testing requirements. Several default parameters are available for frequently-used protocols such as IPv4 and etc. User defined triggers are also supported for custom testing requirements.

## Network TAP

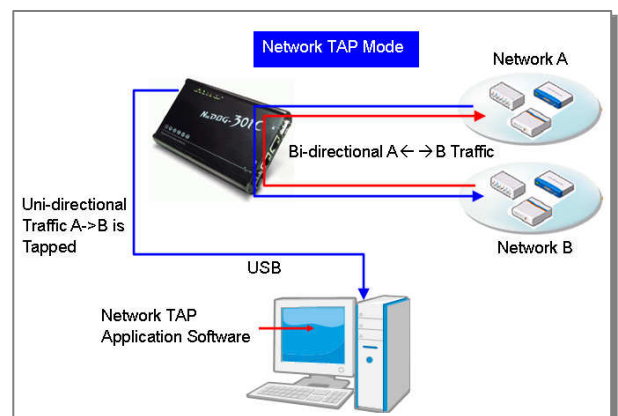
Network TAP is a way to monitor the network without interfere the running network. All data streams between point A and B can be duplicated and sent to PC for analysis. Application tool DApps-TAP and NuDOG-301 can be installed on PC for network analysis.

### Active TAP

Normal TAP only redirects all traffic flow between two locations into the PC and analyzes the traffic. If the traffic flow is at its peak, it is possible that the PC won't be able to deal with heavy traffic.

Active TAP handles all packet flows through the TAP device. NuDOG-301 is an Active TAP device that has these functions:

- Packet trigger: Configure a criteria or content of packet that will be filter out for analysis.
- Filter: Packet data that fits certain criteria is redirect to the USB TAP port.
- Packet capture: Packet data that fits certain content or criteria is captured and saved to the memory buffer of NuDOG-301.
- Comprehensive real-time statistics: Frames with varied size, packets, and certain error are all recorded in the real-time statistics counter.
- Selectable packet redirect mode: Different from Aggregate, NuDOG-301 can also redirect uni-directional packets back to its own single USB port.





## 2<sup>nd</sup> Level CRC (Data Integrity) Check

2<sup>nd</sup> level CRC (Cyclic Redundancy Check Code) Check, an advanced data integrity check function, is the checksum computed based on the contents of the frame from the offset through the end of the data field, inclusive. If data is corrupted by DUT and FCS is affected by the error data, 2<sup>nd</sup> level CRC check will serve as the checksum. Any mismatches of transmitted and received packets are recorded as error of 2<sup>nd</sup> Level CRC (Data Integrity) check.

DA	SA	Type	Data	2 <sup>nd</sup> Level CRC	CRC
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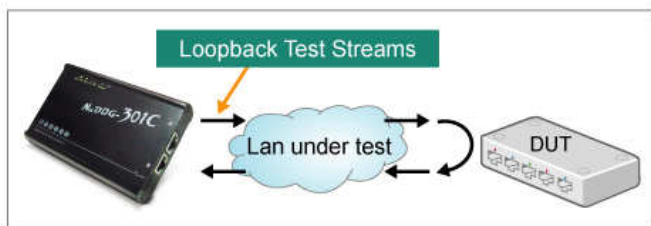
- Layer 1 loopback Mode: NuDOG-301 works as a signal reflector equipped with a signal tester, receiving and reflecting physical signal back to the same physical layer port. Layer 1 loopback mode is widely used for signal quality or cable test.
- Layer 2 loopback Mode: NuDOG-301 works as a frame reflector equipped with an Ethernet tester. NuDOG-301 will receive incoming Ethernet frames, swap DA/SA, recalculate Ethernet CRC, and resend revised frames to the receiving port. However, frames categorized as broadcast, multicast or null DA (destination address) will not be resend. Layer 2 loopback mode is mainly used for frame-based data integrity test.

## Loopback Test

Loopback test is widely used for testing data stream integrity, network cable and connection signal quality through network transmission. For either cable quality or data integrity loopback test, NuDOG-301 can act as a testing traffic generator or a signal/data reflector.

### Layer 2 BERT (Bit Error Rate Test)

In Layer 2 BERT, testing data streams comprising Ethernet frames, which carries BERT pattern as payload, are generated and transmitted across NUT (Network under Test) and DUT. These testing data streams will be sent back to their original source for data corruption comparisons.



## DUT Oscillator Measuring

With high precision 1 ppm temperature-compensated oscillator, NuDOG-301 can generate network stream with precise frequency to DUT, or measure the frequency of DUT's oscillator for controlling speed of network stream. By using DApps-SG application software, the user can evaluate and measure if DUT's oscillator frequency is either faster or slower than the standard speed in ppm scale. The user can also use it as a standard to judge the test results. NuDOG-301 is embedded with advanced clock reprocessing circuits for measuring DUT clock via Ethernet connection. With built-in, high precision, 1 ppm temperature-compensated oscillator and advanced clock measurement circuit design, NuDOG-301 is capable of performing preliminary clock tests for measuring DUT clock accuracy.

### Loopback (layer 1 or layer 2) Function Modes

At loopback mode, NuDOG-301 acts as a reflector, resending incoming signal and frames back to the receiving port.



## RELATED PRODUCTS

### NuDOG-101T

Handheld Ethernet Testing Device with 2 UTP Ports



### NuDOG-101B

Handheld Ethernet Testing Device with 1 UTP Port & 1 POF Port



### NuDOG-101P

Handheld Ethernet Testing Device with 2 POF\* Ports



\* POF: Plastic Optical Fiber

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