NuTEA-551 OVERVIEW

NuTEA-551 is a network impairment device that impairs Ethernet network to emulate unstable network conditions, especially networks with complex topology, such as Internet in public network.

It is a compact, lightweight, and highly cost-effective device that provides the function to simulate Ethernet traffic impairment situation, such as CRC Error Packet, Packet Corruption, Packet Drop, Packet Order Exchanging (Re-order), Packet Duplicate, Delay, Jitter, Limiting Packet Transferring Rate and Packet Insertion. Variables regarding to these impairments can be set with accurate high-precision and apply for all kinds of Devices under Test (DUTs).

With functions mentioned above, NuTEA-551 is capable of emulating almost any possible error that could happen in real-world network environments. While developing network products, it is crucial to understand how these under developing products would perform or react when network errors occur. NuTEA-551's impairment emulating capabilities allow manufacturers to perform tests with their products in labs. Also, NuTEA-551 can emulate packet delay and packet jitter as well, and the packet delay/jitter time can be set in milliseconds (ms) or microseconds (μs).

NuTEA-551 provides a controllable blemish network environment for manufacturers to test their products' performances within lab network environments. With NuTEA-551's capability to set and change network impairment settings dynamically, it is easy for users to build a customized network environment for product demo or testing product's specific function.

Embedded with Voltage-Controlled Crystal Oscillator (VCXO), NuTEA-551 can be adjusted to match/jitter its PHY chip's frequency within the range of ±100 ppm via utility software.

Also, NuTEA-551 supports Maximum Impairment Limit, which allows users to set the number of times for error emulations with NuTEA-551's utility software or its front panel buttons.
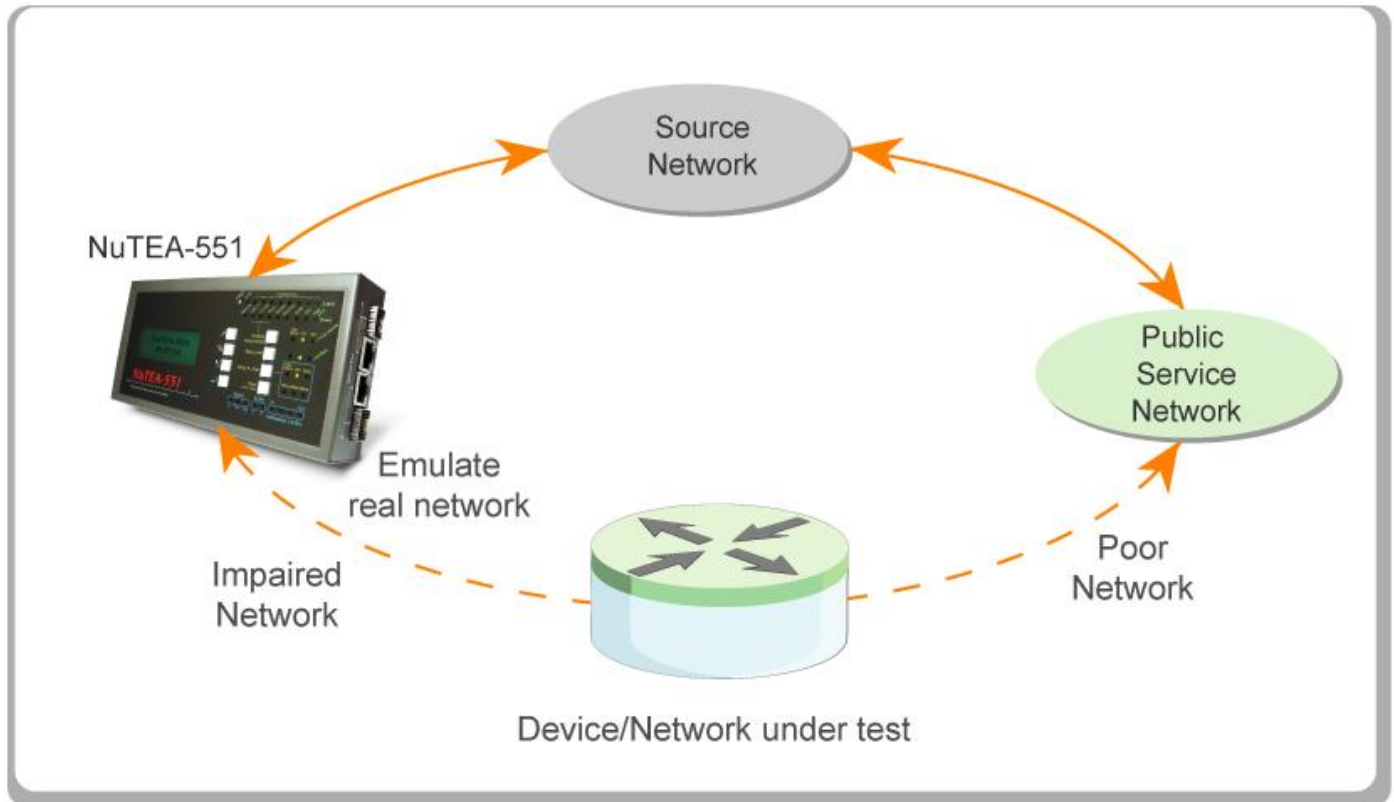
KEY BENEFITS

- Emulate network impairment situations for testing DUTs while building small network environment for users
- Testing DUT performance with impairment packet procession and validates packet completeness
- Reduce manufacturer's product developing and researching cost with less debugging time
- High performance with useful tool for checking product quality during production
- Emulate real network impairment situations such as:
  - Packet CRC Error
  - Packet Corrupt
  - Packet Drop
  - Packet Order Exchanging (Re-order)
  - Packet Duplicate
  - Packet Delay & Jitter
  - Data Transferring with Limited Rate
  - Packet Insertion
- Packet-base Impairment which uses the amount of packets as account standard
- Follow G.1050, the Network Model for Evaluating Multimedia Transmission Performance over Internet Protocol
- Utility software with setting options that allows users to set:
  - SDFR (Self-Discover Filtering Rules), a set of filtering rules including Destination Address, Source Address, VLAN, Destination IP, Source IP, Destination Port, and Source Port
  - 2 sets of Session Filter including Port A→Port B and Port B→Port A
- Embedded with Two RJ-45 & Fiber Combo Ports
- Supports RMON Counters
- Performing Configurations with Front Panel Buttons
- Utility software that runs under Windows® environment. When connecting NuTEA-551 with your PC via a Mini USB cable, it allows users to:
  - Setting NuTEA-551's impairment parameters
  - View counter reports and statistics chart
  - Upgrading NuTEA-551's firmware and FPGA

MAIN APPLICATIONS

- DUT Performance Testing and Analyzing
  - Conducting DUT Performance Tests in Emulated Network Environment
  - Various Embedded Packet Counters of NuTEA-551 for Checking DUT Counters' Reliability
- DUT Troubleshooting. With network which emulates public network with poor bandwidth, users can examine and see if the DUT has good network disaster recovery ability
- Validate and check if other test devices in mass production line are working properly or having the right settings, and capable of picking up faulty DUTs
- Emulating and building a real-world network environment for demonstration purposes
- Products aiming for Telecommunication Service Provider can use NuTEA-551 for functions examining and testing

SPECIFICATION

Interface Ports						
Port	**Network Ports**	**Network Port A**	➢ RJ45 Port × 1		➢ SFP Port × 1	
		Network Port B	➢ RJ45 Port × 1		➢ SFP Port × 1	
	Mini-USB Port		Mini USB Port for Firmware/FPGA Upgrading × 1			
	Power Jack		12V DC Power Jack × 1			

System Status & Testing Result Feedback Interface						
LCD	**Information Displayed**		**4 × 20 (Characters) LCD Screen**			
		Impair Parameters	➢ CRC Error ➢ Packet Corruption ➢ Packet Drop	➢ Packet Reorder ➢ Packet Duplication ➢ Packet Delay	➢ Packet Jitter ➢ Rate Limit ➢ Packet Insertion	
		Statistic Counters	➢ Port A	➢ Port B	➢ Port A and B	
		Media Setting	➢ Auto All	➢ Force 100M Full	➢ Force 10M Full	
		Filter Setting	➢ Port A to B	➢ Port B to A	➢ Port A to/from B	
		System Setting	NuTEA-551 Buzzer ON/OFF			
		System Information	Displaying NuTEA-551's System Information Including **Temperature** and **Fan RPM**			
		Restore Defaults	Restore All Settings of NuTEA-551 to Default Value			

LEDs						
LEDs	**General System Information**					
	➢ Power		➢ SYS		➢ Remote	
	Impairments					
	A → B **B → A**	➢ CRC Error ➢ Corrupt ➢ Drop	➢ Reorder ➢ Duplicate ➢ Delay	➢ Jitter ➢ Rate Limit ➢ Insertion		
	1% by Packets					
	➢ User Define		➢ Off		➢ On	
	50 Mbps					
	➢ User Define		➢ Off		➢ On	
	Delay & Jitter					
	➢ User Define ➢ Off		➢ 50 ms ➢ 100 ms		➢ 250 ms ➢ 300 ms	
	Speed					
	➢ 10 Mbps		➢ 100 Mbps		➢ 1000Mbps	
	Buffer					
	➢ A			➢ B		
	Utilization (A+B)					
	Utilization (A+B) is displayed via **4** LEDs, ranging from 0% to 100%					

Buttons								
Operation Buttons (Left Side)	➢ 🔧		➢ ▲/+		➢ ▼/-		➢ ↵	
Configuration Buttons (Right Side)	➢ General Impairments		➢ Rate Limit		➢ Delay & Jitter		➢ Clear	

Impairment & Delay Emulation			
Functions	**Filtering rules**	**Resolution**	**Capability**
CRC Error Event	Yes	1/65536	
Drop Packet Event	Yes	1/65536	
Data Corruption Event	Yes	1/65536	
Re-order Packet Event	Yes	1/65536	
Duplication Event	Yes	1/65536	
Delay	Yes	40ns	1 Gigabits
Jitter	Yes	40ns	
Rate Limit	Per Port	0.1 Mbps	
Insertion	Per Port	0.1 pps	
Link Fail	Per Port	3s	

Hardware			
Temperature	➢ Operating: 0ºC~ 40ºC (32ºF~ 104ºF)		➢ Storage: 0ºC~ 50ºC (32ºF~ 122ºF)
Humidity (non-condensing)	➢ Operating: 0% ~ 85% RH		➢ Storage: 0% ~ 85% RH
Dimension	175 mm x 85.9 mm x 32.6 mm		
Net Weight	Approx. 500g		

TECHNICAL TERM & APPLICATION

Effect of Impairment
Drop Packet
Ethernet is a family of frame-based computer networking technologies. Frames are transmitted via different devices and media. After the transmission via different media and devices, some of frames might be lost. For layer 2 switching mode of OSI model, packet is the same as frame.

CRC Error Packet
At the tail of a packet, it keeps a checksum value to verify the correctness of the packet when it is received. If the checksum value is not correct that can verify the correctness of the packet, we call it CRC Error Packet.

Packet Corruption
For some reason intentionally or unintentionally, the content of packet is modified, owing to poor transmission or manual interference.

Packet Re-Order
All of frame/packet should be transmitted sequentially, and it is able to reunite to complete data at destination device. If the frame/packet sent goes different routes, it might be possible that later packet arriving destination earlier, so the sequence of packet is changed, owing to poor device or manual interference.

Duplicate Packet
Packet is transmitted one by one via network device. For some reason, the destination had received the packet, however the sending side does not received the acknowledgement, so packet is resent and duplicated packet is generated.

Packet Delay & Jitter
Delays may occur during packet/frame transmission in real world network environments. Also, these time periods of data transmission delays may vary, and are usually referred as jitters.
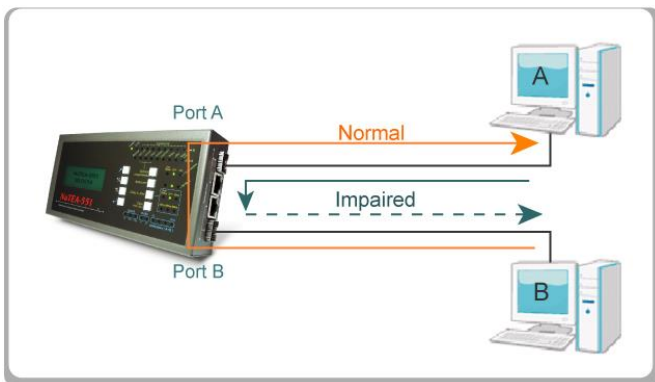
Packet Insertion
During the test, some packets generated by DUTs or other devices will be inserted.

Direction of Impairment
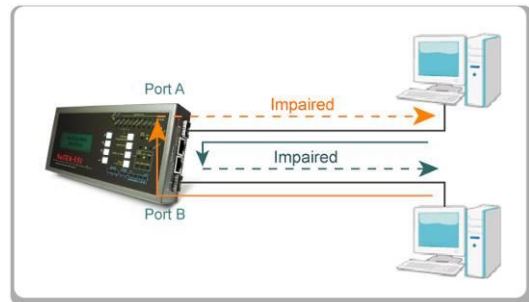### Two Ways Impairment (Default)
The illustration below shows the concept of impaired network. It is an example that normal network is impaired.

Data streams both way that flow through this machine is impaired.

One Way Impairment (User Define)
The illustration below impairs network flow from port A to B only. There is no influence on the network from port B to A
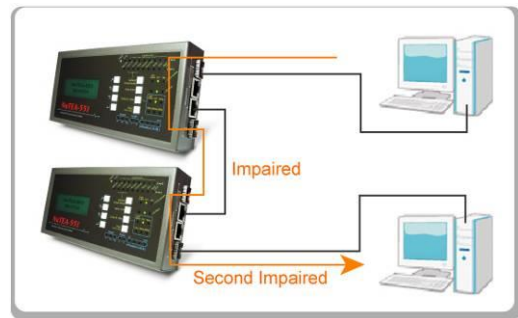

Operator can activate impairment by button with user define selections

Impairment from Multiple Devices
If a single unit of this machine is not enough to generate the impairment environment required, you can connect it in serial or in parallel to create any kinds of possible impairment structure.
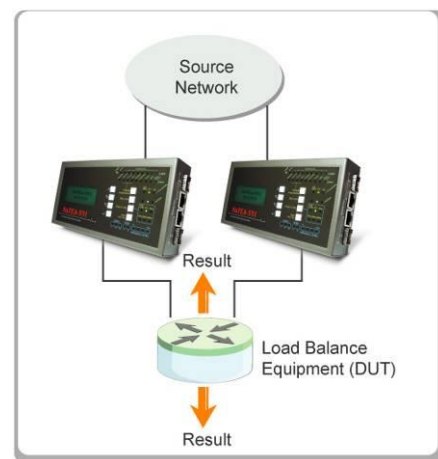
In Serial
NuTEA-551 can be cascaded for multiple impairments.

In Parallel
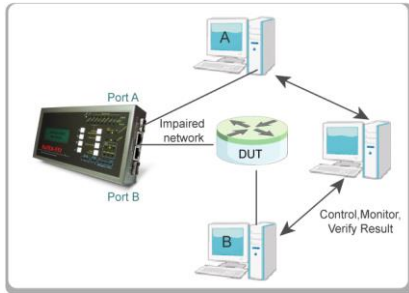NuTEA-551 can be connected in parallel to emulate impairment from different source network.

Test and Examination for Lab or Project Bidding

Good network device should have correct reaction on the network data streams that flow through it. For a good device, it not only deals with normal network data streams without problem, it should also perform well if the network is under poor condition.

Poor network is common seen in public service network. However, it does not happen often in your office or lab. To ensure the design of network device in your Lab has correct reaction on poor network condition, create a poor network environment to test is required.
Buyer of bidding project also can verify if the equipment purchased meets the specification.

In the illustration figure above, a good DUT should have correct reaction on impaired network and the computer A and B should get all data correctly. In addition, If A & B get all data correctly, does it fit the performance or recovery action required.
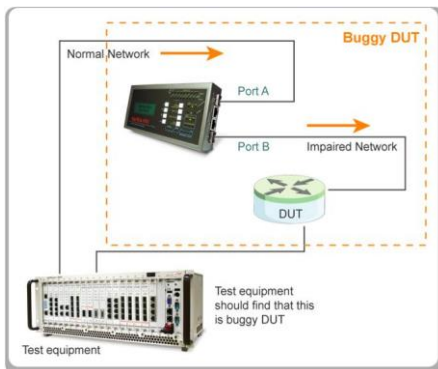
Calibration on Test Equipment for Mass Production

It always has quality control for mass production product, nevertheless, poor or abnormal network products still sold in market after it has passed the quality control examination.
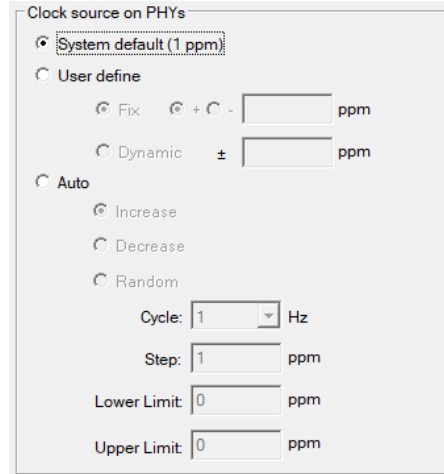
For some cases, it is because manufacturer seldom or never calibrates the test equipment. If test equipment is not correctly calibrated or configured, it may not examine the poor or problem network products.

By the combination of the network product manufactured and this machine, operator can emulate a product with poor condition or problem. Use test equipment to test this combination, test equipment should find that there is problem on this combination. If the test machine is not able to find it, then calibrate or re-configure the test equipment is required.

The illustration below shows the connection to calibrate the test machine.

PHY OSC Clock

Embedded with Voltage-Controlled Crystal Oscillator (VCXO), NuTEA-551 can be adjusted to match/jitter its PHY chip's frequency within the range of **±100** ppm via utility software as shown in the figure above.

NuTEA-551's PHY chip frequency can be set as the following:
➢ **System Default:** NuTEA-551 PHY OSC Clock's frequency is set to 1 ppm.
➢ **User Define (Fix):** NuTEA-551 PHY OSC Clock's frequency will be set to the frequency you've set here.
➢ **User Define (Dynamic):** NuTEA-551 PHY OSC Clock's frequency will jitter within the range set here.
➢ **Auto:** Increase, Decrease, or Random.

SDFR

SDFR (Self-Discover Filtering Rules) is a technology that makes packet capturing/filtering over Ethernet easy and convenient.

SDFR's User- friendly interface can display values such as Source IP, Destination IP and so on. All these values (one single value or a specific range of values) can be input directly without calculating mask.

All captured packets are displayed in real-time without intervening network flow, and SDFR values can be changed dynamically during capture procedure.
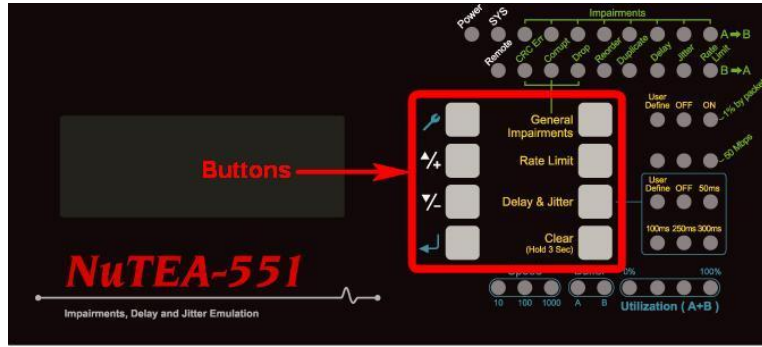
SDFR parameters include filter of Layer 2 Destination MAC Address, Source MAC Address, VLAN ID, Layer 3 Destination IP Address, Source IP Address, Destination Port, and Source Port. Each filter is independent and can be activated in any combinations.

Delay & Jitter

NuTEA-551 can emulate Packet Delay and Packet Jitter with its utility software, as shown in the figure above. The Delay/Jitter Time can be set in milliseconds (ms) or microseconds (μs).

OPERATION OF NuTEA-551

Control & Perform Tests via NuTEA-551 Front Panel Buttons

All impairment parameters can be view via NuTEA-551's front panel. Also, you can enable General Impairments, set Rate Limit and Delay & Jitter, or clear all Statistic Counters stored in NuTEA-551 as well.

Operation Buttons (4 buttons located on the left side)

Label	Description
🔧	Enter the Main Menu(*) or return to the previous Menu
▲/+	Move the select cursor up
▼/-	Move the select cursor down
↵	Execute the selected selection

Configuration Buttons (4 buttons located on the right side)

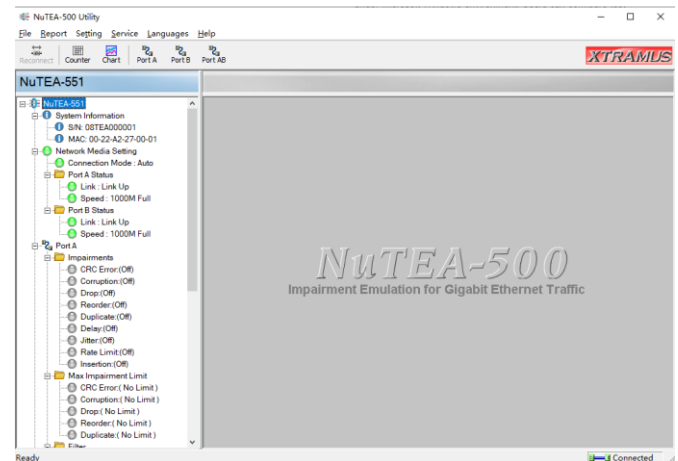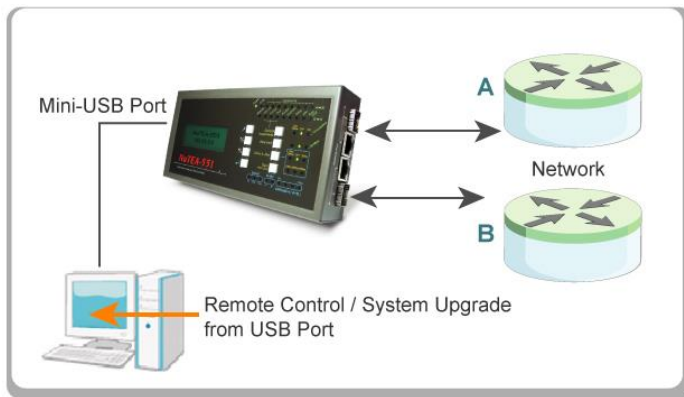| Label	Function Description
General Impairments	Enable general impairments including CRC Error, Packet Corrupt, and Packet Drop. You can apply your settings too.
Rate Limit	Set packet transferring rate limit
Delay & Jitter	Set delay and jitter time
Clear	Press this button and hold it for 3 seconds to clear all statistic counters stored in NuTEA-551

Control via NuTEA-551 Utility

NuTEA-551 comes with configuration utility software that runs under Microsoft Windows environment. Users can configure test parameter for NuTEA-551 via USB port with Windows interface, collect test log and upgrade system firmware.

Mini-USB connector cable mentioned above is an industrial standard USB cable with standard male USB connector and standard male mini-USB connector at each side.

NuTEA-551 comes with a GUI (graphic user interface) utility for the configuration. By connecting NuTEA-551 with PC via its Management Port, users can configure the test parameters, download testing logs and upgrade firmware.

All parameters can be configured here, including **Impairment Parameters**, **Max Impairment Limit**, **Network Media Setting**, **Filter Setting**, and **PHY OSC Clock**.

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