

# Ethernet – základní měřicí úlohy

Praha  
16. dubna 2015

# 10/100/1000T/1000X

	<b>10Base2</b>	<b>10Base5</b>	<b>10BaseT</b>	<b>10BaseF</b>
<b>Media</b>	50-Ohm Coax	50-Ohm Coax	Cat 3, 4, 5 UTP, 2 pairs	Multimode Fiber (Single mode fiber)
<b>Max Segment length</b>	185 m	500 m	100 m	2,000m (10,000 m)
<b>Connector</b>	BNC	AUI	RJ45	SC/LC

	<b>100BaseTX</b>	<b>100BaseFX</b>	<b>100BaseFX</b>
<b>Media</b>	Cat 5 UTP 2 pairs	Multimode fiber	Single-mode fiber
<b>Max Seg. Len.</b>	100 m	2,000m	10,000 m
<b>Connector</b>	RJ45	SC/LC	SC/LC

	<b>1000BaseT</b>	<b>1000BaseSX</b>	<b>1000BaseLX</b>	<b>1000BaseZX</b>
<b>Media</b>	Cat 5E UTP 4 pairs	850 nm 62.5 or 50 µm Multimode fiber	1310 nm 50 µm Multimode Or 9 µm Single-mode fiber	1550 nm Single-mode fiber
<b>Max Seg. length</b>	100 m	500 m (50 µm) 220 m (62.5 µm)	10 km (SM) 550m (MM)	100 km
<b>Connector</b>	RJ45	SC /LC	SC/LC	SC/LC

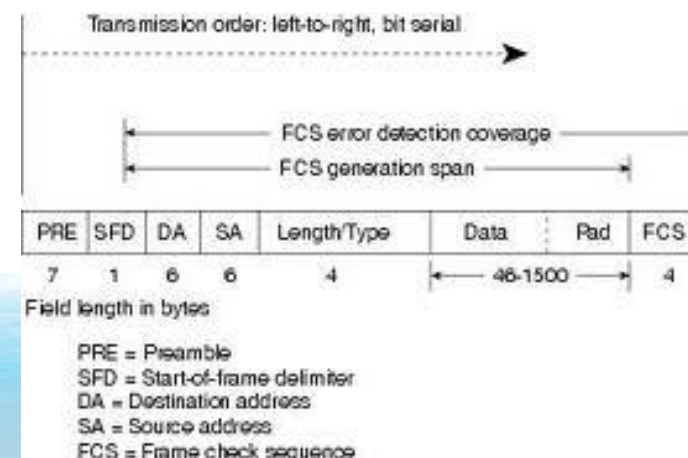
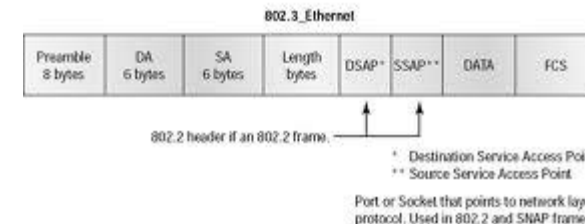
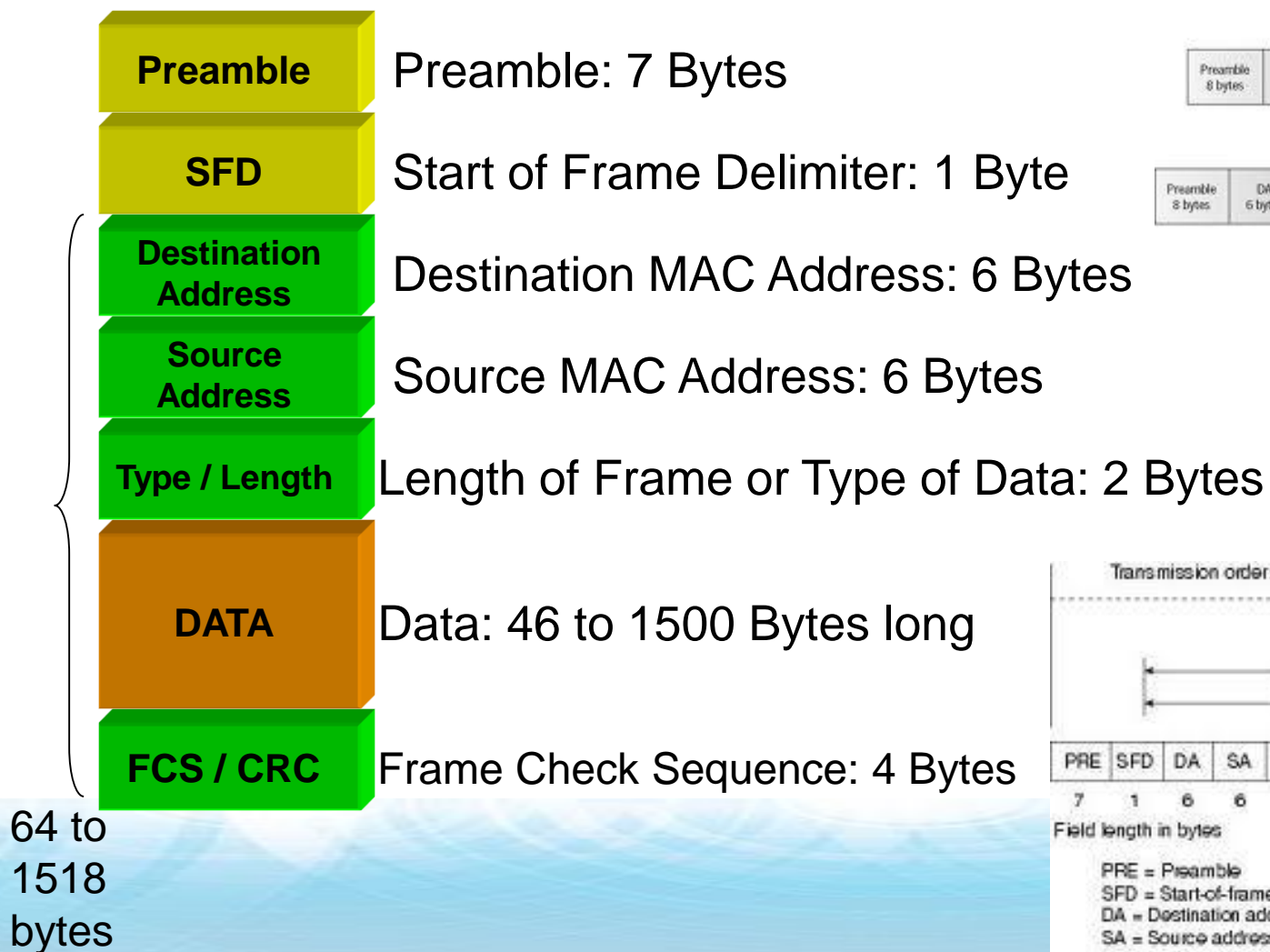
# 10G/40G/100G

	<b>10GBase-SR</b>	<b>10GBase-LR</b>	<b>10GBase-ER</b>	<b>10GBase-T</b>
<b>Media</b>	MM	SM	SM	Class E channel using category 6, Class Ea channel using 6a or 7 twisted pair
<b>Max Segment length</b>	26/82/300/400 m	10 km	40 km	55 m (Class E cat 6) 100 m (Class Ea cat 6a or 7)

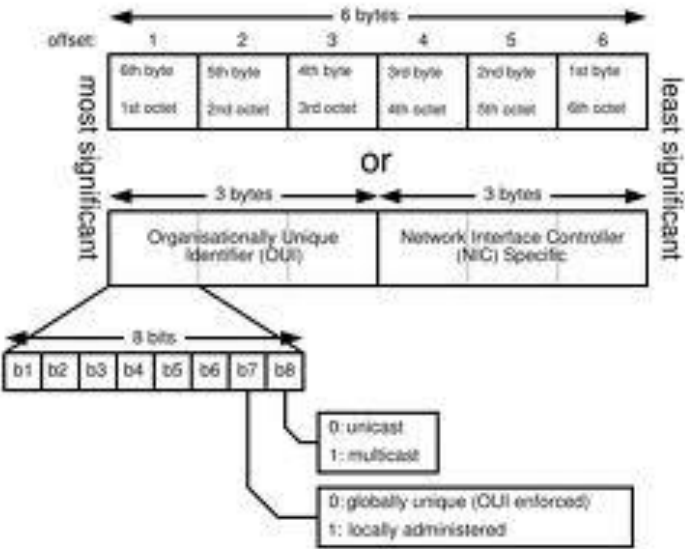
	<b>40GBase-SR4</b>	<b>40GBase-LR4</b>	<b>40GBase-ER4</b>	<b>40GBase-T</b>
<b>Media</b>	MM (OM3/OM4)	SM	SM	Cat 8
<b>Max Seg. Len.</b>	100/125 m	10 km	40 km	30m

	<b>100GBase-SR4/10</b>	<b>100GBase-LR4</b>	<b>100GBase-ER4</b>
<b>Media</b>	MM 850 nm	SM WDM 1295.56nm, 1300.05nm, 1304.59nm, 1309.14nm	SM WDM 1295.56nm, 1300.05nm, 1304.59nm, 1309.14nm
<b>Max Seg. Len.</b>		10 km	30-40 km

# Ethernet Frame Format



# MAC Address Format



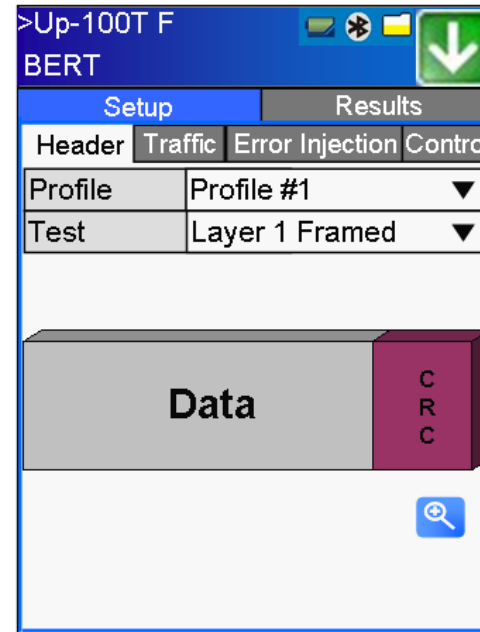
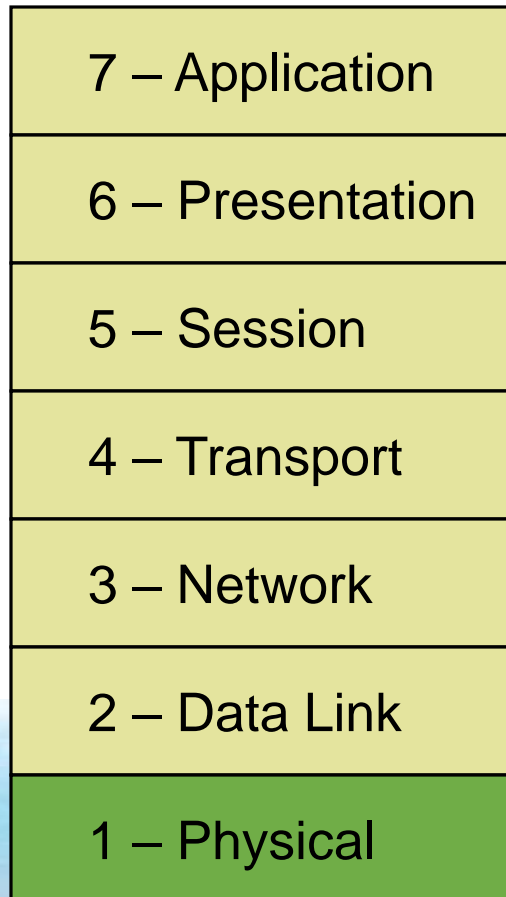
- MAC address = Unique hardware address associated with each device
- 6 Bytes long, represented in hexadecimal format

**00 - 00 - 00 - FF - FF - FF**

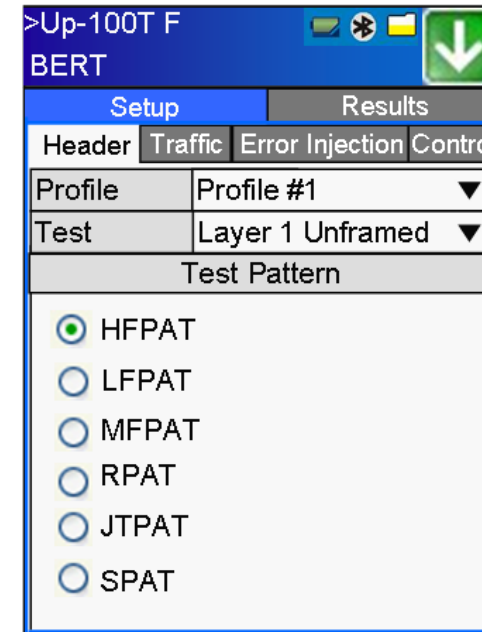
Assigned by IEEE to Vendor : 3 Bytes    User Value

- Source MAC Address = identifies who is sending the frame
- Destination MAC Address = identifies the station that should receive the frame

## Layer 1 (Physical Layer)



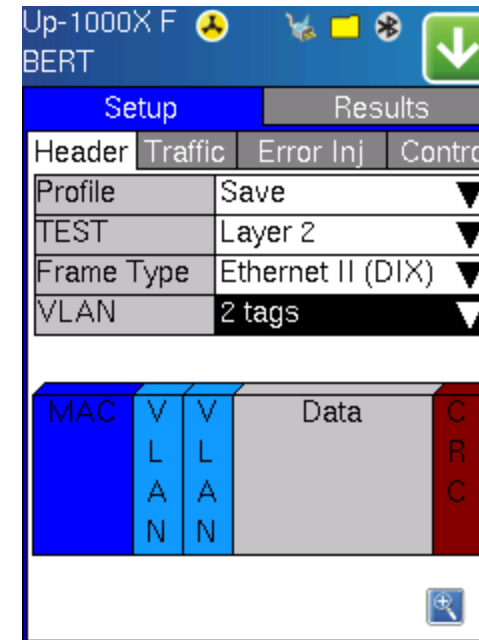
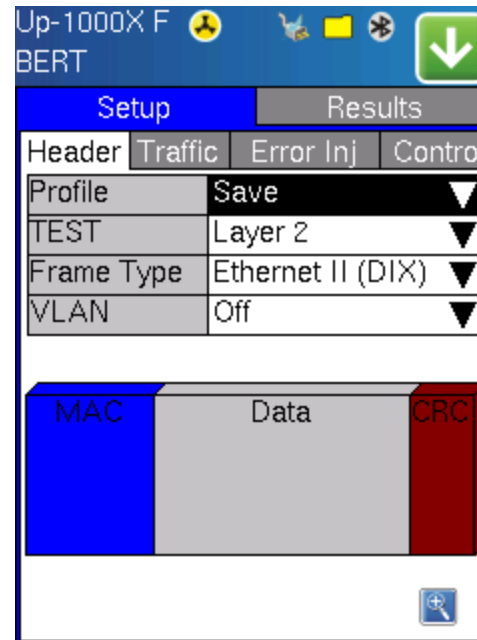
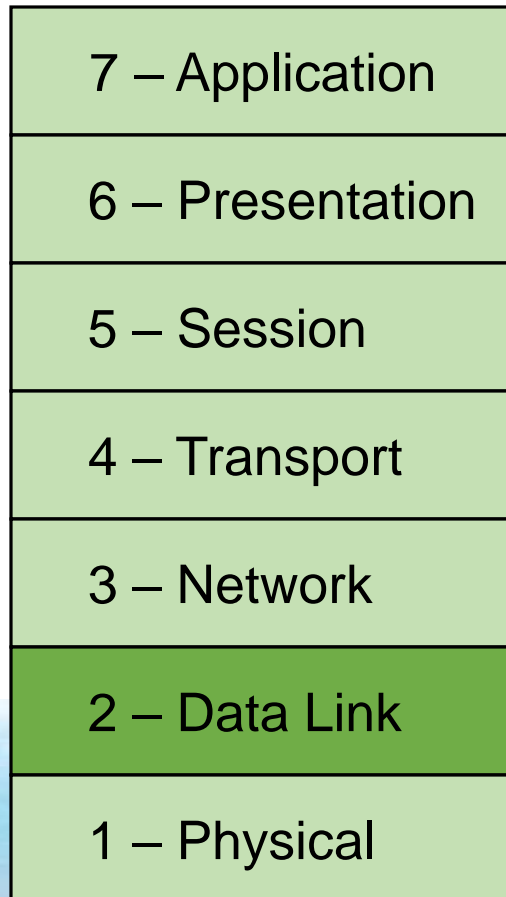
*Layer 1 Framed*



*Layer 1 Unframed*

- This is the Physical Layer. For example, the electrical/optical characteristics of the network

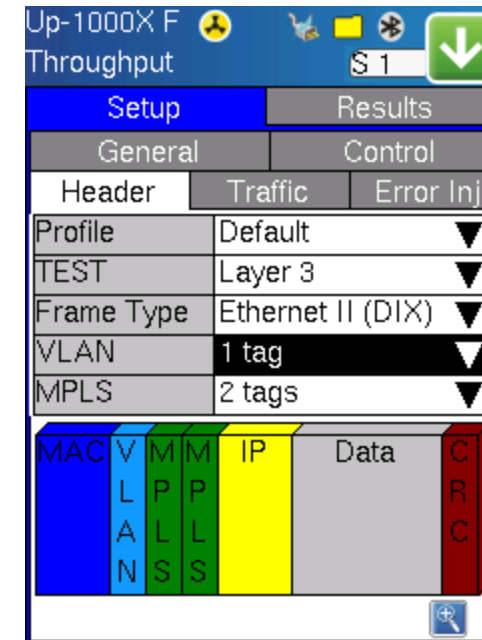
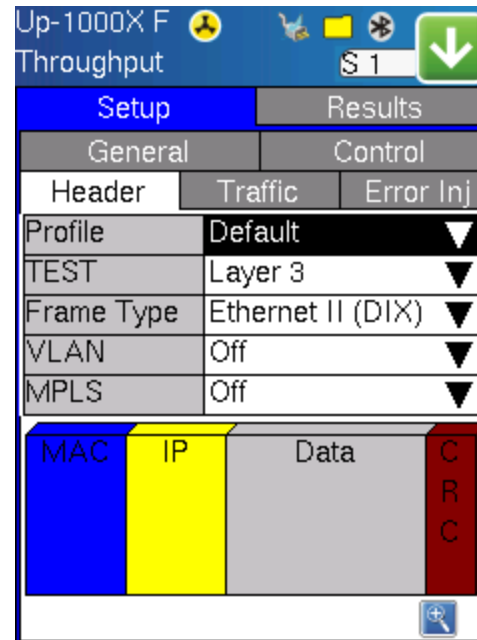
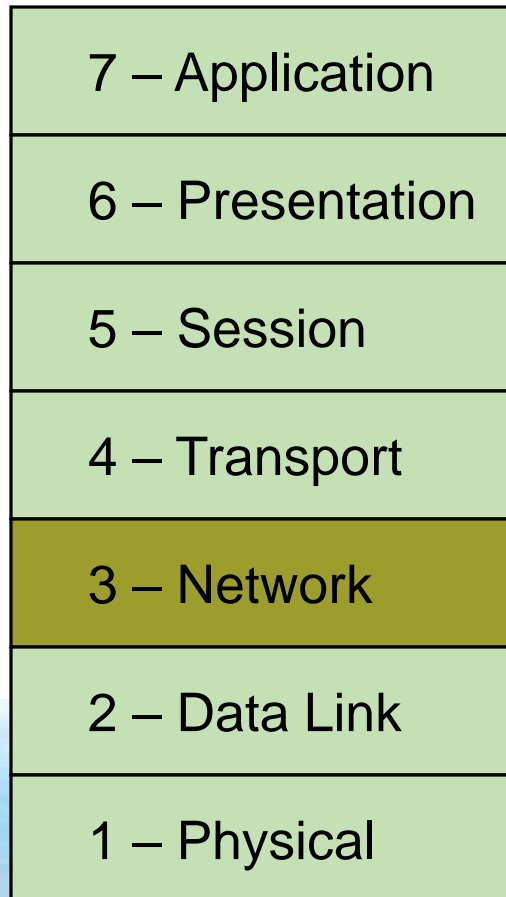
## Layer 2 (Mac Layer)



- This is known as the Data Link Layer. Protocols such as PPP, SLIP, HDLC and Ethernet/VLAN exist here.
- Pure Layer 2 Metro Ethernet networks fall in this category, e.g., Q-in-Q supported networks

# MX OSI Model (3)

## Layer 3 (IP Layer)

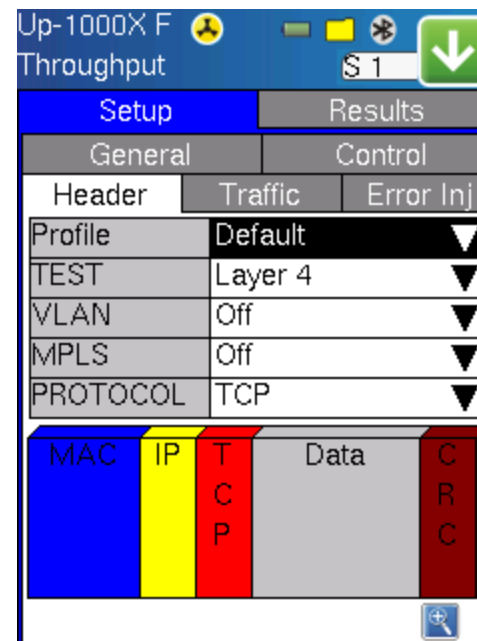
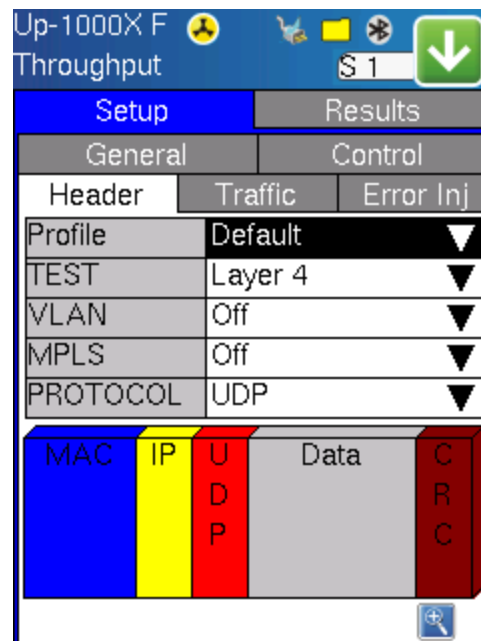


- This is the Network Layer. It provides a means to establish, maintain, and terminate network connections. The IP protocol exists here.
- For IP/MPLS networks, MPLS tags are also supported.



## Layer 4 (Transport Layer)

7 – Application
6 – Presentation
5 – Session
4 – Transport
3 – Network
2 – Data Link
1 – Physical

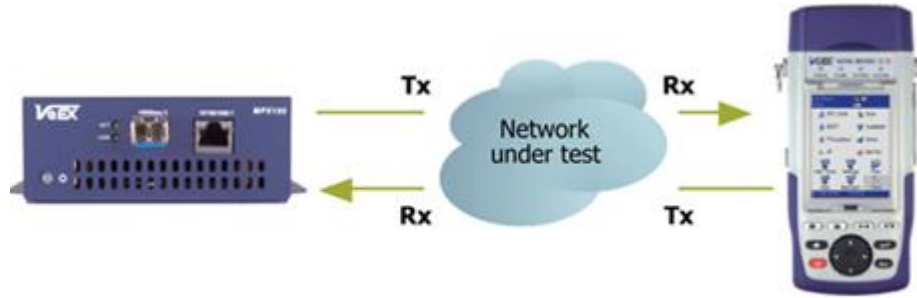


- The Transport Layer provides transparent transfer of data between end users, providing reliable data transfer services to the upper layers.
- UDP and TCP reside at this layer.

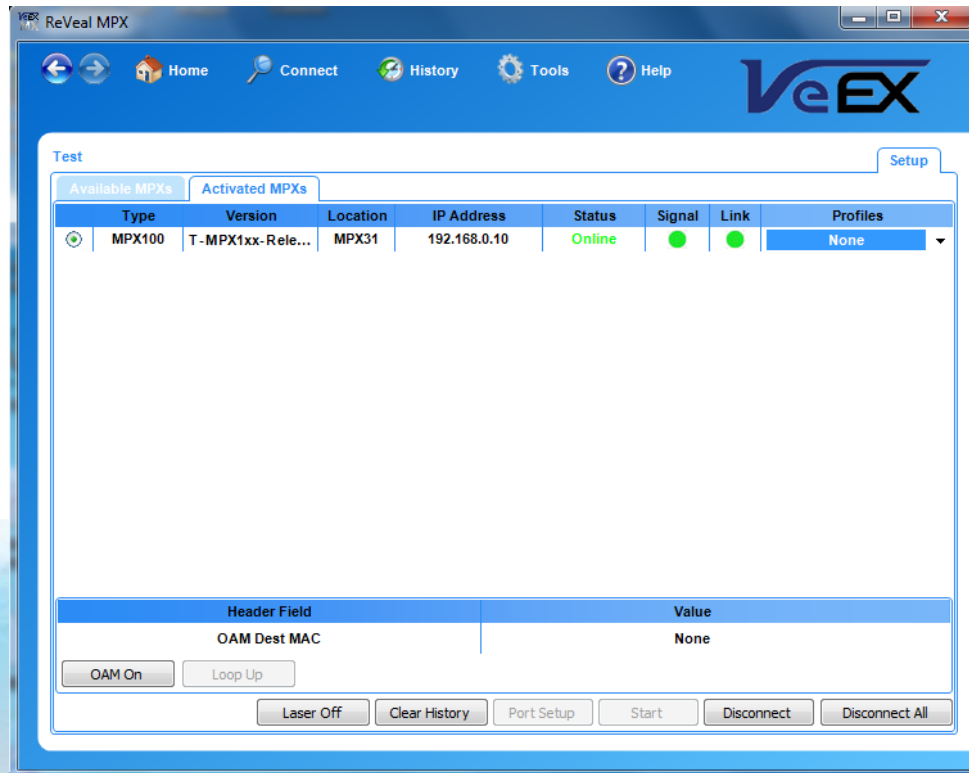
# Základní testy na Ethernetu

- BERT
- Throughput
- RFC 2544 / RFC 2544 Advance SLA
- V-SAM - Y.1564
- V-Perf (Stateful TCP – RFC 6349)

# Měření proti inteligentní smyčce



- Support Layer 1, 2, 3, and 4 loopbacks
- Configured via RS232 port or Ethernet port
- Remote responder mode with IP on test port



## X-LOOP (JDSU)

Layer 2 Loopback Control

Unicast mode

Broadcast mode

Layer 3 Loopback Control

Requires an IP in the Home/IP menu



- Layer 1 Unframed, Layer 1 Framed, Layer 2/3, Layer 4 (UDP)
- VLAN and MPLS support
- Traffic Profiles: Constant, Ramp, and Burst
- Frame Sizes: 64B to 9000B
- Test Patterns: High/Low/Mixed Frequency (Layer 1 Unframed), PRBS ( $2^{31}-1$ ,  $2^{23}-1$ ,  $2^{15}-1$ ,  $2^{11}-1$ ), CRPAT, CJPAT, CSPAT, All 1s, All 0s, User defined
- Error Injection: Bit, CRC, IP checksum

Up-100T F  
BERT

Setup Results

Header	Traffic	Error Inj	Control
Profile	Save		
Test	Layer 3		
Frame Type	Ethernet II (DIX)		
VLAN	2 tags		
MPLS	1 tag		
MAC	V	V	M
	L	L	P
	A	A	L
	N	N	S
			IP
			Data
			C
			R
			C

Up-1000X F  
BERT

Setup Results-Running

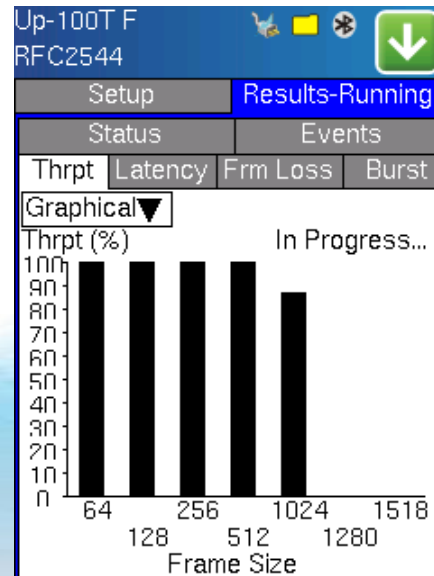
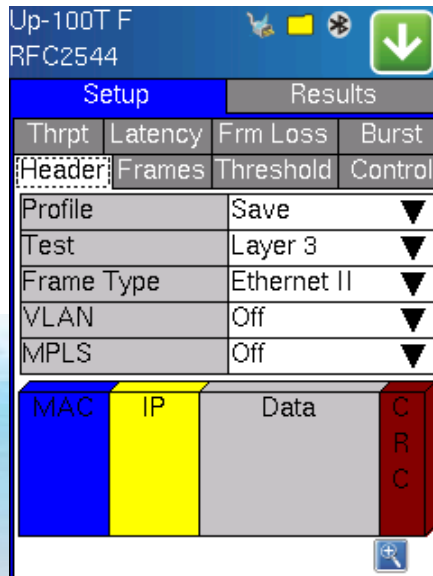
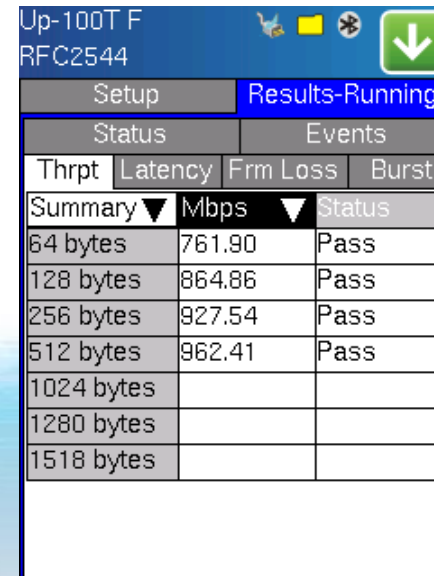
Traffic	Delay	Rates
Summary	Errors	Alarms
Events		
ST:00:31:05	ET:00:00:14	
	TX	RX
Line Rate	1000.00M	1000.00M
Framed Rate	987.06M	987.07M
Data Rate	954.72M	954.72M
Utilization	100.00%	100.00%
# of Bytes	1.68E+09	1.68E+09
Opt Power	-6.1dBm	-7.2dBm

Up-1000X F  
BERT

Setup Results-Running

Traffic	Delay	Rates
Summary	Errors	Alarms
Events		
ST:00:29:56	ET:00:00:19	
	TX	RX
Line Rate	1000.00M	1000.00M
Framed Rate	987.06M	987.07M
Data Rate	954.72M	954.71M
Utilization	100.00%	100.00%
# of Bytes	2.30E+09	2.30E+09
Opt Power	-6.1dBm	-7.2dBm

- Layer 2 and Layer 3
- Frame Sizes: 64B, 128B, 256B, 512B, 1024B, 1280B, 1518B, and two user defined sizes up to 9000B
- Thresholds: Pass/Fail indicator if enabled
- Loopback Control: Manual or Automatic. If Automatic, the loop up/down commands will be sent at the start and end of the test
- Throughput: Maximum throughput rate of the link under test
- Latency (Round Trip Delay): Total time for a frame to travel from source to destination to source
- Frame Loss: % frames not received
- Burst (Back-to-Back): Number of frames successfully transmitted/received at line rate

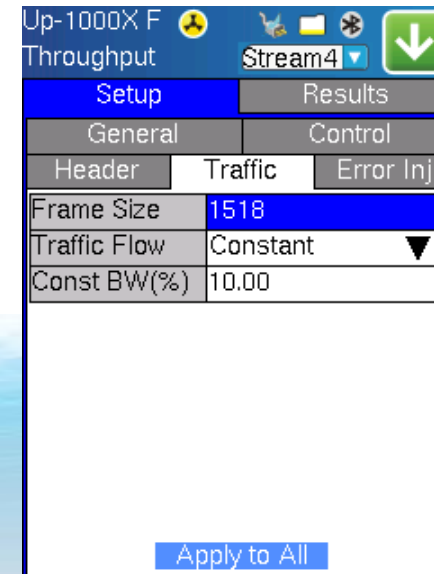
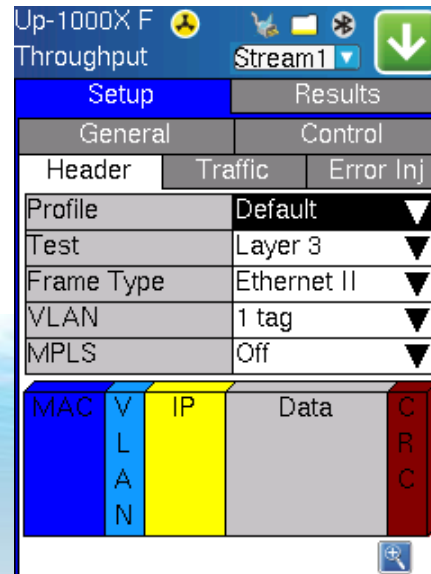
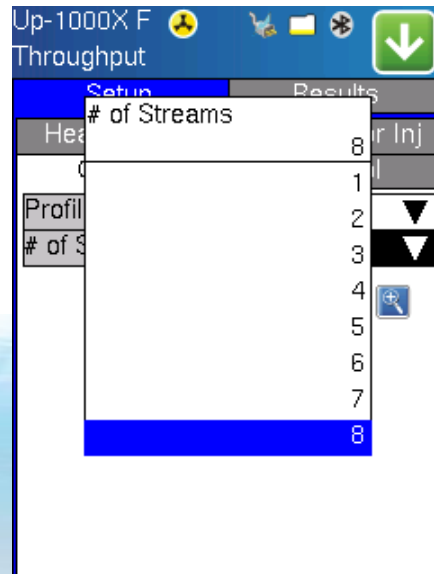



Setup		Results-Running	
Status	Events		
Thrpt	Latency	Frm Loss	Burst
Summary	Mbps		Status
64 bytes	761.90		Pass
128 bytes	864.86		Pass
256 bytes	927.54		Pass
512 bytes	962.41		Pass
1024 bytes			
1280 bytes			
1518 bytes			

- RFC2544 is still used widely to test a single Ethernet service by many operators and service providers.
- Eventually adopted by the industry as a de-facto standard to test Ethernet services. Still widely used, but now being replaced by Y.1564

# Multiple Streams (1)

- Layer 2, Layer 3, and Layer 4 throughput testing
- Up to 8 independently configured streams: % of bandwidth, frame size, traffic profile, and header per stream
- Same configuration parameters as in BERT
- Multiple stream testing is needed for end-to-end multi-services performance testing
- Also used for verifying the performance and configuration of network equipment queue processing



# Multiple Streams (2)

- Received traffic presented as aggregate statistics for a quick and global view of the performance parameters
- Received traffic presented as per stream statistics for in-depth analysis of the results
- A stream summary view along with the frame size and traffic type distribution parameters give a global statistics view
- Per stream statistics like throughput rate, utilization%, frame loss, and round trip delay give the user an in-depth look of the performance for each stream transmitted/received

- for long term testing and troubleshooting, the Multiple Streams feature, is very helpful due to the detailed number of statistics provided per stream; frame loss, out of sequence frames, round trip delay, frame rates, frame size distribution, etc.

Up-1000X F Throughput

Setup		Results-Running	
Global		Per Stream	
Traffic	Alarms	Delay	Errors
Aggregate	Stream	Summary	Events
ST:05:43:13		ET:00:00:20	
	TX		RX
Line Rate	1000.00M		1000.00M
Framed Rate	944.17M		944.17M
Data Rate	826.93M		826.93M
Utilization	100.00%		100.00%
Total Frames	6505153		6505153
Bad Frames	0		0
Opt Power	-6.1dBm		-7.4dBm

MX100+/120+ Metro Expert

Up-1000X F Throughput

Traffic Distribution Details		
Frames	Traffic Type	Frame Size
Distribution	#	%
<64B	0	0
64-127B	4230449	43
128-255B	2401065	25
256-511B	1287527	13
512-1023B	667966	7
1024-1279B	340381	3
1280-1518B	735457	8
>1518B	78793	1

OK

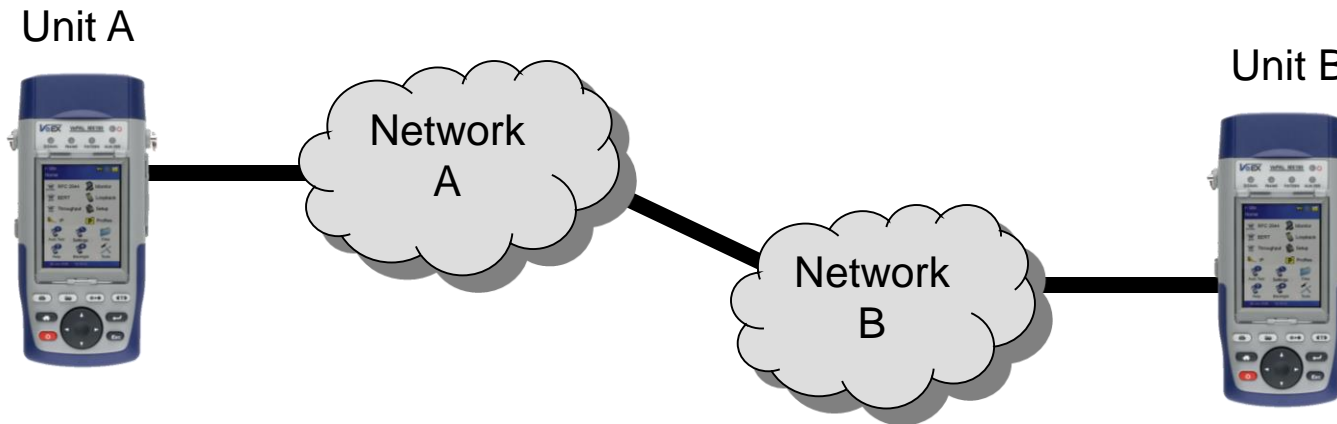
Up-1000X F Throughput Stream1

Setup		Results-Running	
Global		Per Stream	
Traffic	Events	Delay	
Summary	Errors	Rates	
ST:05:50:40		ET:00:00:19	
	TX		RX
Framed Rate	76.19M		76.19M
Data Rate	30.95M		30.95M
Utilization	10.00%		10.00%
Total Frames	2270375		2270375
Bad Frames	0		0



# Routed Testing?

Are the units in two separate IP subnets?



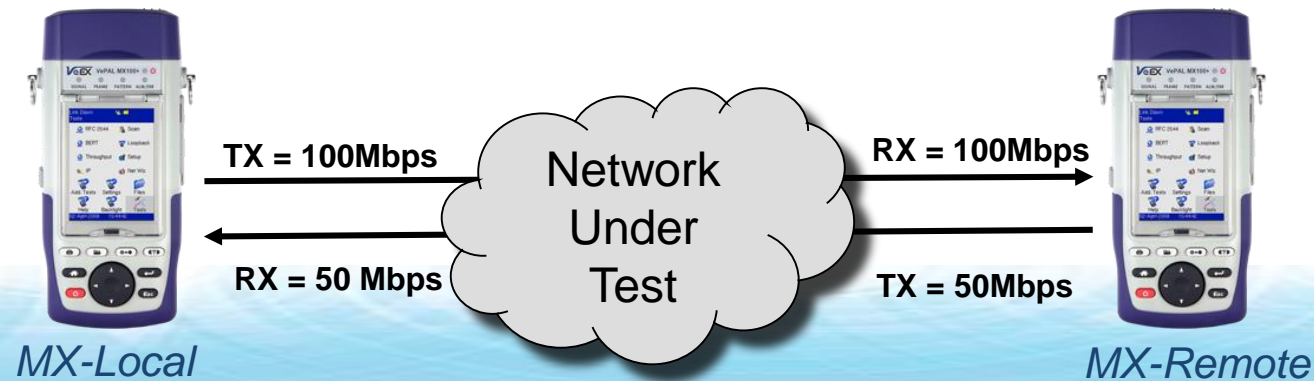
- MAC Destination = Local Gateway MAC (Gateway of Network A)
- IP Destination = IP Source of Unit B

- MAC Destination = Local Gateway MAC (Gateway of Network B)
- IP Destination = IP Source of Unit A



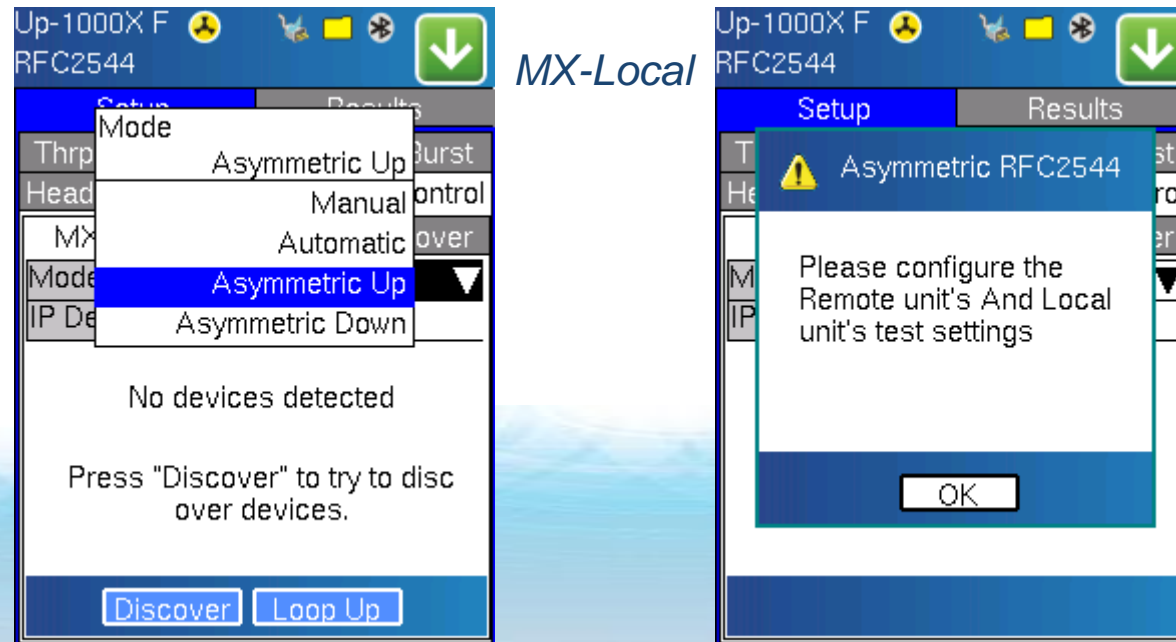
# Asymetrické RFC 2544

- Využití u tras s rozdílným Down a Up
- Nastavení z jednoho místa (blízký a vzdálený konec) výsledky se stahují do jednoho zařízení
- Proměření obou směrů



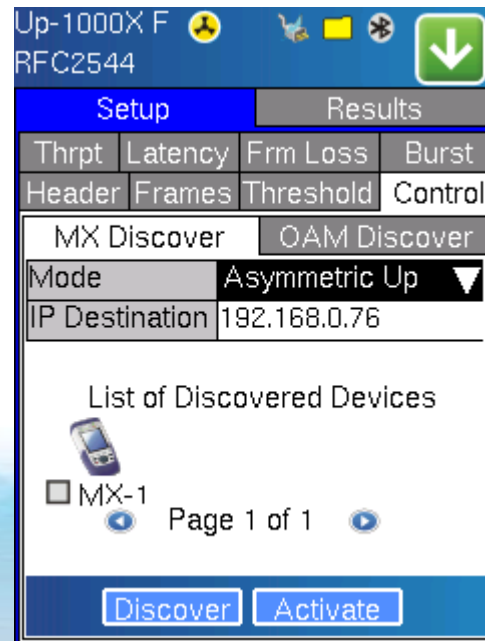
## Step 2: MX-Local Asymmetric Mode

- On MX-Local go to Home/RFC2544
- In the Control menu, select Asymmetric Up to test the Upstream (Local to Remote)
- Select Asymmetric Down to test the Downstream (Remote to Local)
- Once the direction is selected, an information box appears reminding the user to configure the Remote and Local test profiles.



## Step 3: Discovery of MX-Remote

- If the MX-Remote is in the same IP Subnet as MX-Local, MX-Local can discover MX-Remote
- Press Discover and wait a few seconds
- Select the discovered MX (MX-Remote): when the discovered device is selected, the IP address is automatically populated in the IP Destination field above



*MX-Local*



## Step 4: Header Configuration

- Configure the MAC Header for both MX-Local and MX-Remote
  - Note: The configuration is all done from MX-Local
- From the AsymMode pull down menu select the Local or Remote unit for configuration
- The default values for the Remote MACs are all zeros. Make sure that the correct MACs are configured.
- Remote MAC source (00-18-63-00-01-40) = Local MAC Destination
- Remote MAC Destination (00-18-63-00-04-C3) = Local MAC Source

*MX-Local*

Header Configuration	
IP	RX Filter
Summary	
MAC	
AsymMode	Local ▼
MAC Source	00-18-63-00-04-C3
MAC Dest.	00-18-63-00-01-40
Ethernet Type	0800-IP ▼

Default MAC Src

OK ARP ARP GW

*MX-Local: Configuring MX-Remote*

Header Configuration	
IP	RX Filter
Summary	
MAC	
AsymMode	Remote ▼
MAC Source	00-00-00-00-00-00
MAC Dest.	00-00-00-00-00-00
Ethernet Type	0800-IP ▼

Default MAC Src

OK ARP ARP GW

Header Configuration	
IP	RX Filter
Summary	
MAC	
AsymMode	Remote ▼
MAC Source	00-18-63-00-01-40
MAC Dest.	00-18-63-00-04-C3
Ethernet Type	0800-IP ▼

Default MAC Src

OK ARP ARP GW

## Step 5: Header Configuration (2)

- Configure the IP Header for both MX-Local and MX-Remote
  - Note: The configuration is all done from MX-Local
- From the AsymmetricMode pull down menu, select the Local or Remote unit for configuration
- The default values for the Remote IPs are all zeros. Make sure that the correct IPs are configured.
- Remote IP source (192.168.0.20) = Local IP Destination
- Remote IP Destination (192.168.0.10) = Local IP Source

*MX-Local*

Header Configuration	
Summary	MAC
IP	RX Filter
Asymmetric Mod	Local ▼
IP Src Addr	192.168.1.10
IP Dest Addr	192.168.1.10
IP TOS	Legacy TOS ▼
Precedence	000-Routine ▼
TOS Values	0000-Normal ▼
TTL	128
Frag. Offset	0
Protocol	UDP - 0x11 ▼

OK ARP ARP GW

*MX-Local: Configuring MX-Remote*

Header Configuration	
Summary	MAC
IP	RX Filter
Asymmetric Mod	Remote ▼
IP Src Addr	0.0.0.0
IP Dest Addr	0.0.0.0
IP TOS	Legacy TOS ▼
Precedence	000-Routine ▼
TOS Values	0000-Normal ▼
TTL	128
Frag. Offset	0
Protocol	UDP - 0x11 ▼

OK ARP ARP GW

Header Configuration	
Summary	MAC
IP	RX Filter
Asymmetric Mod	Remote ▼
IP Src Addr	192.168.0.20
IP Dest Addr	192.168.0.10
IP TOS	Legacy TOS ▼
Precedence	000-Routine ▼
TOS Values	0000-Normal ▼
TTL	128
Frag. Offset	0
Protocol	UDP - 0x11 ▼

OK ARP ARP GW

## Step 6: RFC 2544 Tests Configuration

- The configuration is the same as before.
- Select the test frames, enable/disable thresholds, and configure the Throughput, Frame Loss, and Burst tests settings
- The settings configured in the Frames, Threshold, Throughput, Frame Loss, and Burst tabs all apply to the direction that was selected in the Control tab; Asymmetric Up (Local to Remote) or Asymmetric Down (Remote to Local)
- Note: The Latency/roundtrip delay test is not available in Asymmetric Mode.

### *MX-Local*

Up-1000X F  
RFC2544

Setup		Results	
Header	Frames	Threshold	Control
Thrpt	Latency	Frm Loss	Burst
MAX Rate	100.00	%	▼
Resolution	1.00%		
Duration	5 seconds		
Enable Test <input checked="" type="checkbox"/>			

Up-1000X F  
RFC2544

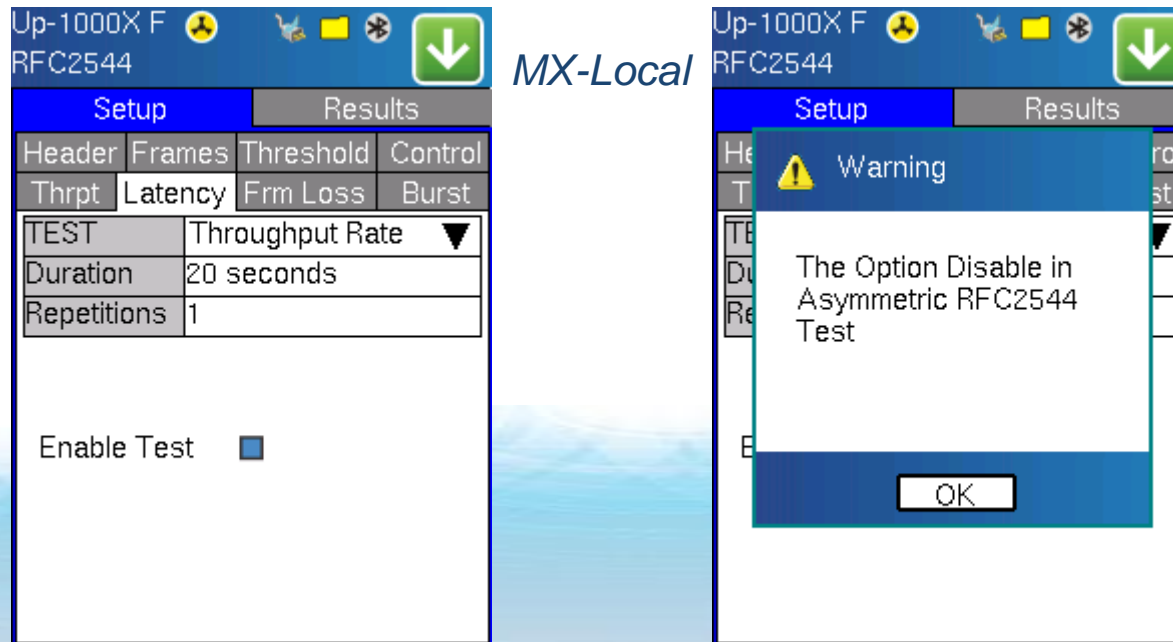
Setup		Results	
Header	Frames	Threshold	Control
Thrpt	Latency	Frm Loss	Burst
MAX Rate	100.00	%	▼
Step Size	10.00%		
Duration	5 seconds		
Enable Test <input checked="" type="checkbox"/>			

Up-1000X F  
RFC2544

Setup		Results	
Header	Frames	Threshold	Control
Thrpt	Latency	Frm Loss	Burst
MAX Rate	100.00	%	▼
Min Duration	2 seconds		
Max Duration	10		
Repetitions	1		
Enable Test <input checked="" type="checkbox"/>			

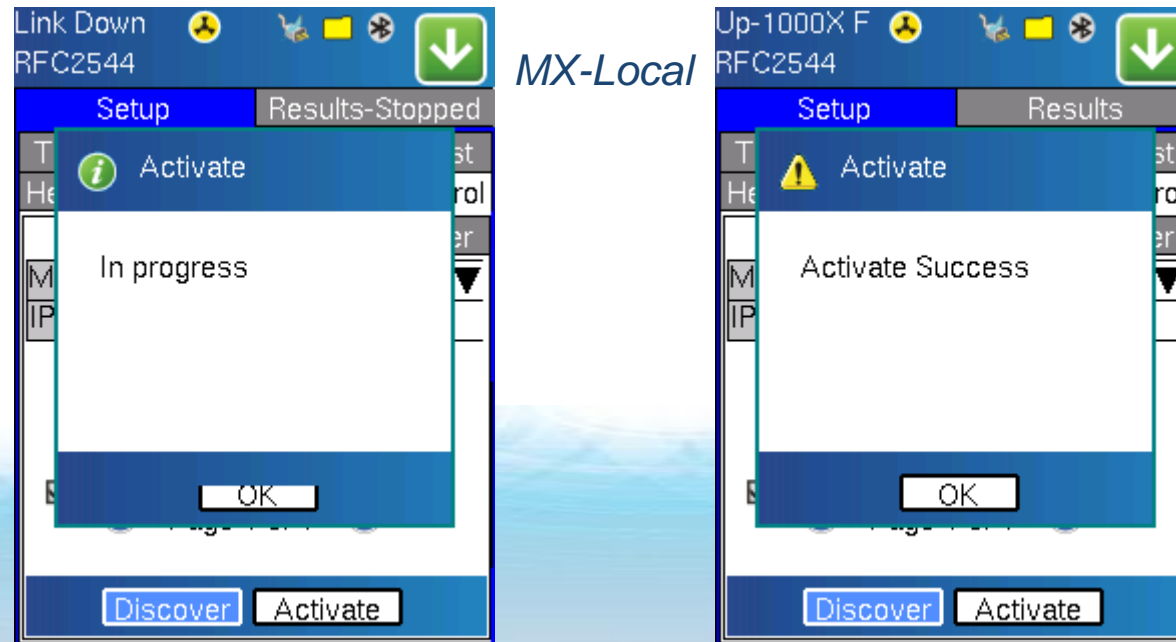
## Step 6 (continued)

- If the user tries to enable the Latency test by selecting the “Enable Test” box, the information box will appear.



## Step 7: Activate the Remote MX

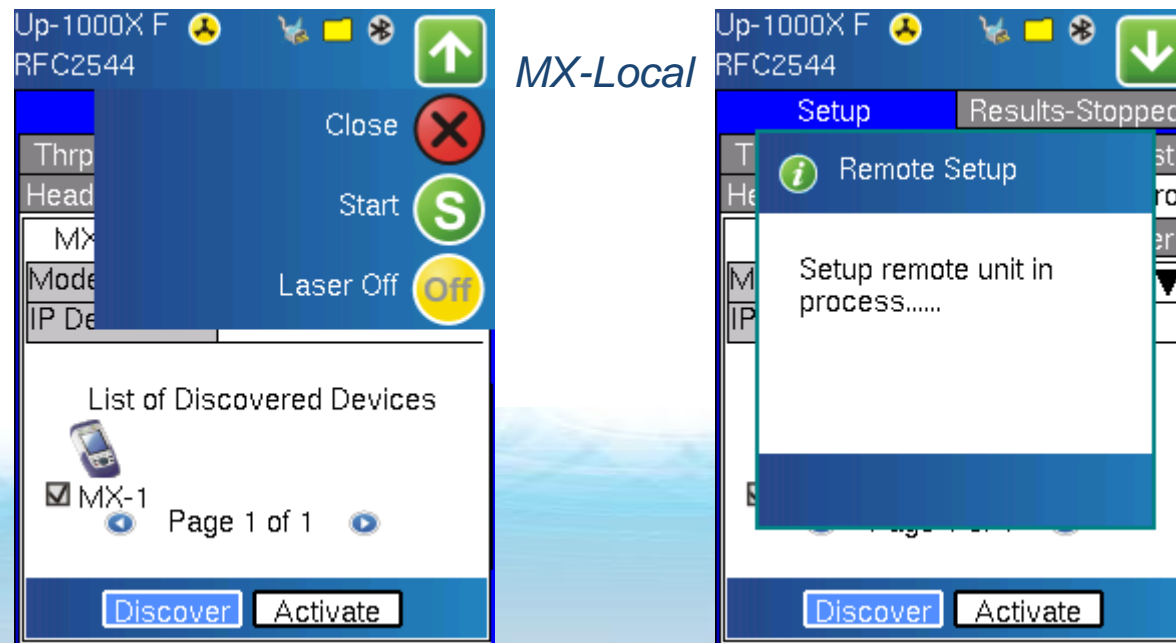
- Now that both the Local and Remote MXs have been configured properly (from the control unit, MX-Local) the user is ready to start the test.
- First the MX-Remote unit must be activated for asymmetric testing. NOTE: This is like sending a remote loopback command.
- Press the Activate button. Once the remote unit has been activated for asymmetric testing, the “Activate Success” message appears.





## Step 8: Start the Test

- Now that the remote unit has been Activated, the user can now start the test.
- Press Start from the pull down menu; the Remote settings that were configured are loaded to MX-Remote. While the remote unit is being configured, the information message appears above
- When MX-Local is done configuring MX-Remote, the RFC2544 test will start.



# Y.1564 Introduction



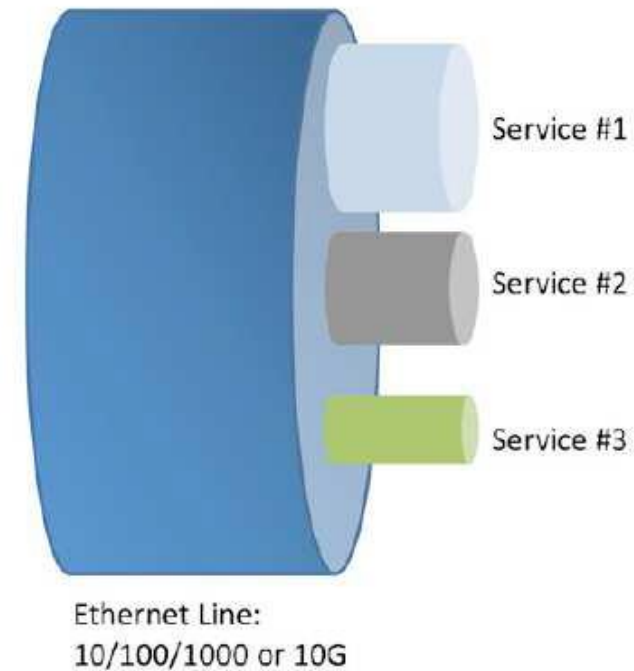
- ITU-T Y.1564 defines an out-of-service test methodology
  - Service Activation Test Methodology (SAM)
  - Users can assess the proper configuration and performance of an Ethernet service prior to customer delivery.
  - In particular, Y.1564 is aimed at addressing and solving the deficiencies of RFC 2544
- Benefits to the User
  - Total test time is drastically reduced - Services are being tested over a longer duration simultaneously, and all the SLA parameters are also measured simultaneously.
  - Results reporting - clear and simple “Pass/Fail” indication in Green/Red. This is for each test, each service, with a global indication.

# Y.1564 versus RFC2544

	RFC2544	Y.1564
Key Test Objective	Device performance	Network Service verification/activation
Service validation	One service at a time	Multiple services simultaneously
Throughput	Yes	Yes
Latency	Yes	Yes
Frame Loss	Yes	Yes
Burstability	Yes	Yes
Packet Jitter	No	Yes
Multiple Streams	No	Yes
Test Duration	Long (serialized test procedure)	Short ( simultaneous test/service)
Test Result	Link performance limit	Related to SLA, fast, simple, Pass/Fail

# Y.1564 SAM

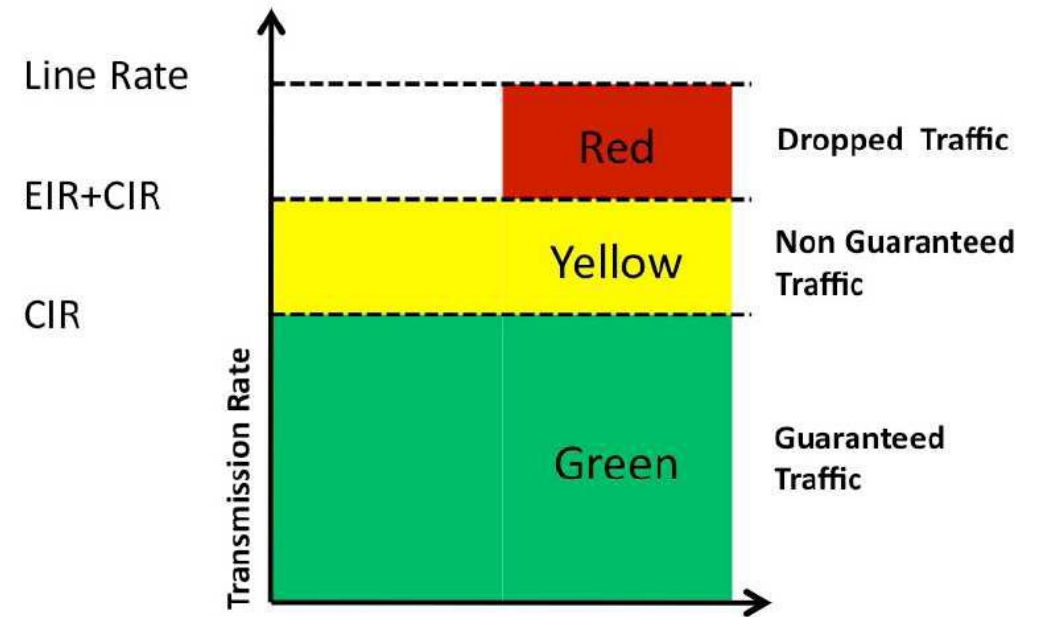
- Na rozdíl od RFC 2544, SAM navržen pro testování služby než linky
- Různé rychlosti Ethernetu → EVC (Ethernet Virtual Connection)
- Bandwidth + SLA parametry → Service Acceptance Criteria (SAC)
- Frame Delay Variation (packet) jitter (real time hlas a video)
- RFC 2544 test jeden po jednom
- SAM testování všech služeb současně



# Y.1564 Bandwidth profil

Kolik dat může zákazník přenášet + priority

- CIR - Committed Information Rate  
= Garantovaná max. rychlost bez zahazování + QoS
- EIR – Excess Information Rate  
= Max rychlost nad CIR – best effort – přetížení sítě → zahozeno
- Red zone – nad CIR+EIR → Zahozeno



# General Test Setup

The screenshot shows the 'General' tab of the V-SAM test setup. The interface includes a sidebar with 'LED'S', 'Tools', 'Utilities', and 'Files'. The main area is divided into 'Setup' and 'Results' sections. The 'Setup' section contains a 'General' sub-tab with the following configuration:

- V-SAM Profile: Default
- # of Services: 8
- Service Configuration Test:
- Service Performance Test:
- Test Type: Simple CIR
- Duration: 15min

Below this is a summary table of service configurations:

Service #	Service Name	CIR (Mbps)	EIR (Mbps)	Traffic Policing	CBS (KB)	EBS (KB)
<input checked="" type="checkbox"/> 1	Service 1	100.000	0.000	Yes	-	-
<input checked="" type="checkbox"/> 2	Service 2	100.000	0.000	Yes	-	-
<input checked="" type="checkbox"/> 3	Service 3	100.000	0.000	Yes	-	-
<input checked="" type="checkbox"/> 4	Service 4	100.000	0.000	Yes	-	-
<input checked="" type="checkbox"/> 5	Service 5	100.000	0.000	Yes	-	-
<input checked="" type="checkbox"/> 6	Service 6	100.000	0.000	Yes	-	-
<input checked="" type="checkbox"/> 7	Service 7	100.000	0.000	Yes	-	-
<input checked="" type="checkbox"/> 8	Service 8	100.000	0.000	Yes	-	-

At the bottom of the 'Setup' section, it displays: Total IR(CIR+EIR):800.000Mbps(810.540Mbps ULR) and Page 1 of 2. On the right side, there are 'Start', 'MX Discover', and 'Control' buttons. The status bar at the bottom shows 'Cu P1', '27-07-2011 01:27:07', and 'Test Mode'.

Callout boxes provide additional information:

- Select # of Services:** Up to 8 on 1GE interface, Up to 10 on 10GE interface.
- Committed Information Rate Test setup:** Points to the 'Simple CIR' test type selection.
- Service Configuration and Performance Tests can be enabled independently:** Points to the checkboxes for 'Service Configuration Test' and 'Service Performance Test'.
- Summary table of Service configuration:** Points to the table of service configurations.
- Loopback control And OAM loopback control:** Points to the 'MX Discover' and 'Control' buttons.

**Service Configuration Test Duration:** If Simple is selected, user can configure the value in seconds.  
**Service Performance Test Duration:** Selections are 15min, 30 min, 1hr, 2hr, 24hr, or user defined

# CIR Test Setup

Select CIR Test type and duration

Cu P1 Link Down - Not Started  
>Home->V-SAM->CIR Test Configuration

**CIR Test Configuration**

Simple Test  Step Load Test  Simple and Step Load Test

Starts the tests at the CIR. Starts the test below the CIR and continues in steps until it reaches the CIR. Step Load Test is only performed if the Simple Validation test fails.

**Step Load Test Configuration**

Step Time: 5 seconds

Step	Value(% of CIR)
1	25
2	50
3	75
4	100

Tap on table to modify

Start

MX Discover

Control

Cu P1 27-07-2011 01:27:57 Test Mode

# of Steps: Default number of steps is 4  
Step Time: Default is 5 seconds.

# Test Frame Header Setup

Select Service to configure

Layer 2 through Layer 4  
test traffic

Copy Test  
frame setup

Cu P1 Link Down - Not Started  
>Home->V-SAM

LED'S  
Tools  
Utilities  
Files

Setup Results

General Services

Header		Service Attributes		Summary	
Service #	1	Service Layer	Layer 2		
Service Name	Service 1	Frame Type	Ethernet II(DIX)		
Frame Size Type	Fixed	VLAN	Off		
Frame Size	1518	MPLS	Off		

MAC Data CRC

Tap on graph to edit

Copy

Start

MX Discover

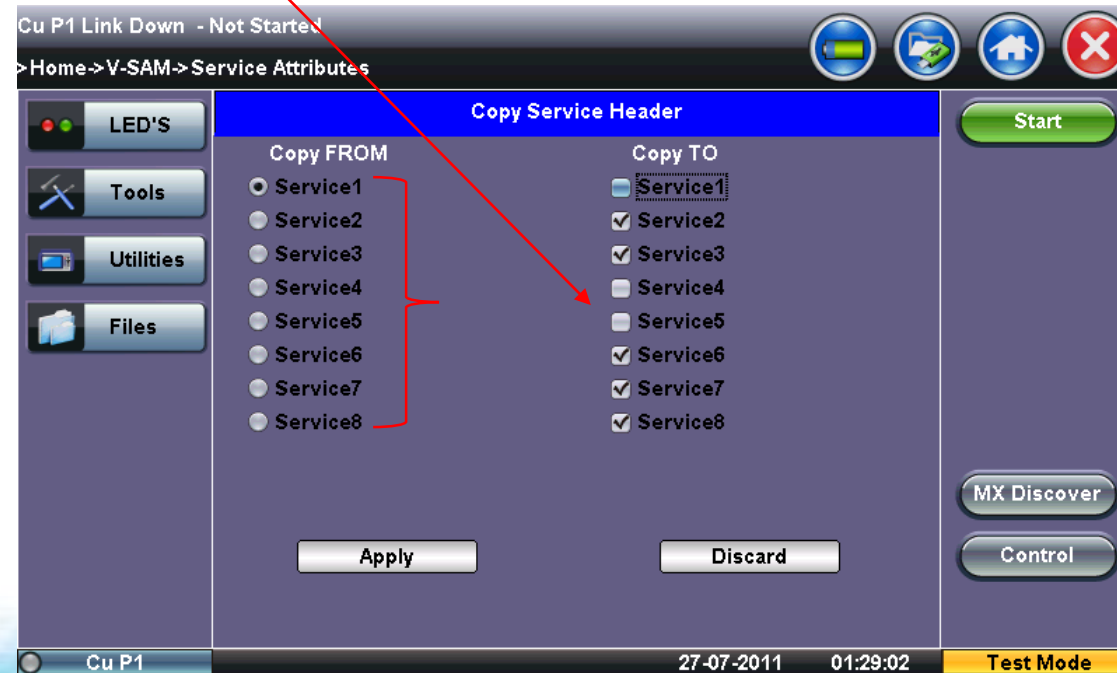
Control

Cu P1 27-07-2011 01:28:26 Test Mode



# Copying Service Profiles

Frame configuration can be copied between services



# Service Attributes Setup

CIR, EIR, and Traffic Policing testing can be enabled independently.  
(EBS/CBS future)

Service Acceptance Thresholds can be configured and enabled independently

Bandwidth Profile Parameters			ServiceAcceptance Parameters		
<input checked="" type="checkbox"/> CIR	100.000	IR Mbps	<input checked="" type="checkbox"/> FLR	0.1	%
<input checked="" type="checkbox"/> EIR	0.000	IR Mbps	<input checked="" type="checkbox"/> FTD	10.000	ms
<input type="checkbox"/> CBS	20.000	KB	<input type="checkbox"/> IFDV	1.000	ms
<input type="checkbox"/> EBS	20.000	KB	<input type="checkbox"/> AVAIL	99.9	%

Color Aware Service: Enable  
Traffic Policing Test: Enable

**Note:**

**CBS:** Max # of frames able to be sent (bytes) with a min IFG (Inter Frame Gap) at the interface line rate above the CIR.

**EBS:** Max # of frames able to be sent (bytes) with a min IFG at the interface line rate above the EIR.

# Configuration/Setup Summary

Table summarizing frame configuration for all services

The screenshot shows the V-SAM configuration interface. The window title is "Cu P1 Link Down - Not Started". The breadcrumb is ">Home->V-SAM". The interface has a sidebar with "LED'S", "Tools", "Utilities", and "Files". The main area is divided into "Setup" and "Results" tabs. Under "Setup", there are "General" and "Services" sub-tabs. The "Services" sub-tab is active, showing a table with columns "Service#", "MAC Source", and "MAC Dest.". The table contains 8 rows of data. To the right of the table are buttons for "Start", "MX Discover", and "Control". At the bottom, there is a status bar with "Cu P1", "27-07-2011", "01:29:39", and "Test Mode".

Service#	MAC Source	MAC Dest.
1	00-18-63-00-0C-40	00-1E-90-A0-57-3C
2	00-18-63-00-0C-40	00-1E-90-A0-57-3C
3	00-18-63-00-0C-40	00-1E-90-A0-57-3C
4	00-18-63-00-0C-40	00-1E-90-A0-57-3C
5	00-18-63-00-0C-40	00-1E-90-A0-57-3C
6	00-18-63-00-0C-40	00-1E-90-A0-57-3C
7	00-18-63-00-0C-40	00-1E-90-A0-57-3C
8	00-18-63-00-0C-40	00-1E-90-A0-57-3C

## V-Perf (RFC 6349 Stateful TCP)

- Zákazník si stěžuje na rychlost stahování souborů / funkčnost služeb (http, ftp)
- Poskytovatel provedl testy L2 / L3 testy pro měření propustnosti (RFC 2544, Y.1564) služeb a potřebuje nástroj pro důkaz výkonu TCP
- TCP může být ovlivněno:
  - SW
  - HW
  - nastavením (TCP window size), jiné aplikace na stejném serveru, špatně nastavený buffer, kvůli aplikaci traffic - policing zahazují pakety → degradace

## Měření propustnosti TCP

Setup	Status	Ping	Trace Route
Web/FTP	ARPWiz	VoIP	<b>TCP</b>
Setup		Results	
Profile	Default		
TCP Mode	Server		
IP Local	192.168.0.1		
TCP Port	13873		
Window Size (bytes)	2048		
Window Scaling	ON		
Test Time (secs)	60		

Start

Cu P1 2014-11-07 10:27:02 Test Mode

Cu P1 Link UP 1000T F -- 192.168.0.1

> Home->IP(Cu P1)

Setup	Status	Ping	Trace Route
Web/FTP	ARPWiz	VoIP	<b>TCP</b>
Setup		Results	
Profile	Default		
TCP Mode	Client		
IP Destination	192.168.0.101		
TCP Port	13873		
Window Size (bytes)	2048		
Window Scaling	ON		
Test Time (secs)	60		

Start

Cu P1 2014-11-07 10:28:06 Test Mode

## Měření propustnosti FTP a HTTP

Cu P1 Link UP 100T F -- 10.0.0.5

>Home->IP(Cu P1)

LEDs	Setup	Status	Ping	Trace Route
	Web/FTP	ARPWiz	VoIP	TCP

Tools

Utilities

Files

Setup	Result
Mode	FTP
FTP Mode	Download
Profile	ftp_hke_eu
Transfer Mode	Passive and Active
Address	ftp.hke.eu
File/Path	/test1.pdf
User Name	ftp_client.hke_eu
Password	

Disconnect

Start

List Files

Cu P1 2014-11-06 17:49:08 Test Mode

Cu P1 Link UP 1000T F -- 192.168.1.101

>Home->IP(Cu P1)

LEDs	Setup	Status	Ping	Trace Route
	Web/FTP	ARPWiz	VoIP	TCP

Tools

Utilities

Files

Setup	Result
Mode	Web
Web Mode	Browser
Profile	Default
Address	http://www.hke.cz
JavaScript	Off
Proxy Server	Off

Disconnect

Browse

Cu P1 2014-11-06 17:33:14 Test Mode