

Advanced AN/LT

Advanced Auto-Negotiation & Link Training Analysis



SOLUTION TRACK

Key Features

- Fully compliant AN/LT link-partner
- Capture, decode and analysis of AN/LT protocol
- Link training of local & remote transmit equalizer
- Automatic and interactive (single step) AN/LT protocol execution
- Full protocol trace log analysis
- Suitable for Z800qx Freya 2 port & Z400qx Thor 2 port traffic generation modules
- Controlled through XenaManager 3 software and XOA open-source, Python-based test automation framework
- Requires Xena Release 106 (or later) and XenaManager 3

The AN and LT protocols are essential for overcoming demanding signal-integrity challenges and establishing high-speed Ethernet links over electrical connections.

The Advanced AN/LT Solution Track is designed for developers of high-speed Ethernet interconnect devices - such as PHYs, ASICs, and active cables - who need to verify performance, ensure reliable interoperability, and debug AN/LT implementations.

The **Advanced AN/LT Solution Track** extends the capabilities of the Z400qx Thor and Z800qx Freya modules to provide enhanced control, full capture, detailed debugging, and comprehensive logging features for both Auto-Negotiation (AN) & Link Training (LT).

These features provide far deeper visibility and more advanced testing than that offered by the standard XenaManager 3 functionality.

By providing enhanced tools for analysis and protocol insight, this Solution Track enables the Z400qx Thor and Z800qx Freya traffic generators train the remote link-partner's transmit equalizer and can also be trained by the remote link-partner as the local device.

This helps engineers identify issues earlier, accelerate development cycles, and validate device behavior with greater confidence under realistic operating conditions.

Auto Negotiation Technology & FEC abilities

- Configurable advertised technology and FEC abilities and viewing of link partner's

Link Training of remote transmitter

- Automatic or interactive generation of LT Coeff commands
- Display and validate the incoming responses
- Monitor the impact on the local receiver performance

Link Training the local transmitter

- Display and validate the incoming LT Coeff commands
- Display the generated responses
- Ignore or apply the Coeffs to the local transmitter

Protocol trace log analysis

- Full AN/LT protocol communication trace log for all lanes, between Xena tester and DUT.

ABOUT SOLUTION TRACKS

Solution Tracks add advanced features and functionalities for specialized test scenarios to the already extensive list of core features available on Xena systems. Solution Tracks do not require any hardware update to the module they are installed on, and one module can support multiple Solution Tracks. Solution Tracks are dynamic, with new features and enhancements being added over time as demand and technology evolves. These features and enhancements are included in the general software updates and will be available as long as the module is covered by a valid warranty.



Advanced AN/LT Analysis Solution Track

Auto-Negotiation Status

State: All good Duration: 0,000 sec HCD negotiation fails: 0 Rx Tx

HCD technology: 800GBASE-CR8/KR8 FEC result: RS FEC KP FEC negotiation fails: 0 Link Codewords 0 0

Pause mode: No pause Successful runs: 0 Timeouts: 0 Next-Page messages 0 0

Allow send empty next page Loss of sync: 0 Unformatted pages 0 0

Advertised Abilities

Technology abilities

- 1.6TBASE-CR8/KR8
- 800GBASE-CR4/KR4
- 800GBASE-CR8/KR8
- 800G-ETC-CR8/KR8
- 400GBASE-CR2/KR2
- 400GBASE-CR4/KR4
- 400G-ETC-CR2/KR2
- 200GBASE-CR1/KR1
- 200GBASE-CR2/KR2
- 200GBASE-CR4/KR4
- 100GBASE-CR1/KR1
- 100GBASE-CR2/KR2

FEC capabilities

- RS FEC Int
- 25G FC-FEC Request
- 10G RS-FEC Request
- 10G FC-FEC Ability

Pause capability

- No pause
- Symmetric
- Asymmetric

Link Partner Abilities

Technology abilities

- 1.6TBASE-CR8/KR8
- 800GBASE-CR4/KR4
- 800GBASE-CR8/KR8
- 800G-ETC-CR8/KR8
- 400GBASE-CR2/KR2
- 400GBASE-CR4/KR4
- 400G-ETC-CR2/KR2
- 200GBASE-CR1/KR1
- 200GBASE-CR2/KR2
- 200GBASE-CR4/KR4
- 100GBASE-CR1/KR1
- 100GBASE-CR2/KR2

FEC capabilities

- RS FEC Int
- 25G FC-FEC Request
- 10G RS-FEC Request
- 10G FC-FEC Ability

Pause capability

- No pause
- Symmetric
- Asymmetric

Test of Auto Negotiation (AN) with configuration of Advertised Technology Abilities and visibility into Link Partner Advertised Technology Abilities. AN results presented including Highest Common Denominator

Auto-Negotiation Status

Time (µSec) Lane Process Rx/Tx Data Type Lock Control Status Summary

Time (µSec)	Lane	Process	Rx/Tx	Data	Type	Lock	Control	Status	Summary
6,688	0	Aneg			AnegStart				Auto-Negotiation started
6,770	0	Aneg	→	0x010000078001	AnegBpTx				
6,793	0	Aneg	←	0x010000028001	AnegBpRx				
74,238	0	Aneg	→	0x010000078001	AnegBpTx				Ability/Detect: Base Page
74,279	0	Aneg	←	0x010000028001	AnegBpRx				Ability/Detect: Base Page
74,304	0	Aneg	→	0x01000007C041	AnegBpTx				Acknowledge/Detect: Base Page
74,437	0	Aneg	←	0x01000002C041	AnegBpRx				Acknowledge/Detect: Base Page
74,487	0	Aneg	→	0x04DF033A805	AnegHpTx				NextPage/Walk: Next Page
74,709	0	Aneg	←	0x04DF033A805	AnegHpRx				NextPage/Walk: Next Page
74,818	0	Aneg	→	0x04DF033E805	AnegHpTx				NextPage/Walk: Next Page
74,883	0	Aneg	←	0x04DF033E805	AnegHpRx				NextPage/Walk: Next Page
75,063	0	Aneg	→	0x00000002023	AnegHpTx				NextPage/Walk: Next Page
75,082	0	Aneg	←	0x00000002023	AnegHpRx				NextPage/Walk: Next Page
79,951	0	Aneg	←	0x00000004203	AnegHpRx				NextPage/Walk: Next Page
80,257	0	Aneg	→	0x00000004203	AnegHpTx				
80,230	0	Lt			LtStart				Link Training started
80,263	1	Lt			LtStart				Link Training started
80,296	2	Lt			LtStart				Link Training started
80,329	3	Lt			LtStart				Link Training started
80,361	4	Lt			LtStart				Link Training started
80,394	5	Lt			LtStart				Link Training started
80,427	6	Lt			LtStart				Link Training started
80,459	7	Lt			LtStart				Link Training started
130,263	0	Lt	→	0x00000000	LtFrameTx				c(t) Hold

Time: 1183156, Count: 65535

Field	Value	Field	Value
Control Field	0x0200	Status Field	0x0428
Initial condition request:	D0 : Individual coefficient control	Receiver ready:	D1 : Training completed
Modulation and precoding request:	D2 : PAM4	Modulation and precoding status:	D2 : PAM4
Coefficient select:	D0 : c(t)	Receiver frame lock:	D1 : Frame boundaries identified
Coefficient request:	D0 : Hold	Initial condition status:	D0 : Not updated
		Pause:	D0 : 0x0
		Coefficient select echo:	D5 : c(-3)

Detailed insight to Auto Negotiation (AN) protocol sent between Xena tester and DUT



Advanced AN/LT Analysis Solution Track

Configuration
 Out-of-Sync preset:
 IEEE Current

Tx Equalizer Tap Initial Condition Configuration
 Selected SerDes: 0 Apply to all SerDes Reset all Presets

Initial condition	c(-3)	c(-2)	c(-1)	c(0)	c(1)	Request
Preset 1	0	0	0	87	0	Accept
Preset 2	0	0	0	43	0	Accept
Preset 3	0	0	7	65	0	Accept
Preset 4	0	4	17	66	0	Accept
Preset 5	2	7	22	56	0	Accept
Preset LOS	0	0	0	87	0	Accept

Coefficient Ranges
 Selected SerDes: 0 Apply to all SerDes

Coefficient	Min	Max	Response
c(-1)	0	31	Auto
c(-3)	0	8	Auto
c(-2)	0	14	Auto
c(0)	42	87	Auto
c(1)	0	21	Auto

Advanced configuration of LT Preset parameters

Port Properties
 Reservation: Release Restart after link toggle: Auto-Negotiation and Link Training actions: Auto-Neg: Off
 Sync status: In sync Restart after LT failure: Allow AN loopback: LT Auto AN Link train: Manual
 L2 traffic status: Traffic off Enable AN loopback: LT Manual LT Manual PMA pattern: Off
 Enable Tx output: Enable LT timeout: AN & LT Auto AN & LT Manual

Manual Link Training
 Selected SerDes: All

Modulation request:	Command	Argument	Flags	Result
Pam4	Send		Done	Success
Preset1	Send		Done	Success
c(0)	Send		Done	Success
c(1)	Send		Done	Success
c(-1)	Send		Done	Success
c(-2)	Send		Done	Success
c(-3)	Send		Done	Success

Link status

SerDes	Mode	Status	Duration	Preceding (Tx/Rx)	Local	Remote	Lost	Error	Over	Total bits	Error bits	Bit error rate
0	On	Trained	84.773 ms	Off/Off	Locked	Locked	0	0	0	2.402e09	1.21e+05	5.050e-05
1	On	Trained	84.798 ms	Off/Off	Locked	Locked	0	0	0	2.399e09	1.31e+05	4.613e-05
2	On	Trained	84.773 ms	Off/Off	Locked	Locked	0	0	0	2.402e09	4.61e+04	1.917e-05
3	On	Trained	84.798 ms	Off/Off	Locked	Locked	0	0	0	2.403e09	2.39e+05	9.959e-05
4	On	Trained	84.773 ms	Off/Off	Locked	Locked	0	0	0	2.402e09	1.82e+04	7.569e-06
5	On	Trained	84.773 ms	Off/Off	Locked	Locked	0	0	0	2.402e09	6.39e+05	2.659e-04
6	On	Trained	85.674 ms	Off/Off	Locked	Locked	0	0	0	2.402e09	3.85e+04	1.523e-05
7	On	Trained	84.788 ms	Off/Off	Locked	Locked	0	0	0	2.402e09	6.25e+04	2.602e-05

Interactive mode allowing manual execution of LT protocol between Xena tester and DUT

Time (µSec)	Lane	Process	Ru/Tx	Data	Type	Lock	Control	Status	Summary
1,108,882	4	Lt	←	0x02008A30	LsFrameRx	●		Coeff. status: NotUpdate.	
1,158,662	4	Lt	→	0x02140A00	LsFrameTx	●	Coeff. req: Decrement.		
1,158,797	4	Lt	←	0x02008A81	LsFrameRx	●		Coeff. status: Updated.	
1,158,864	4	Lt	→	0x02180A80	LsFrameTx	●	Coeff. req: Hold.		
1,158,958	4	Lt	←	0x02008A30	LsFrameRx	●		Coeff. status: NotUpdate.	
1,208,712	4	Lt	→	0x02190A00	LsFrameTx	●	Coeff. req: Increment.		
1,208,847	4	Lt	←	0x02008A81	LsFrameRx	●		Coeff. status: Updated.	
1,208,914	4	Lt	→	0x02180A80	LsFrameTx	●	Coeff. req: Hold.		
1,209,008	4	Lt	←	0x02008A30	LsFrameRx	●		Coeff. status: NotUpdate.	
1,258,776	4	Lt	→	0x02140A00	LsFrameTx	●	Coeff. sel: Cn3, Coeff. req: Decrem		
1,258,871	4	Lt	←	0x02008A28	LsFrameRx	●		Coeff. select echo: Cn3.	
1,258,968	4	Lt	←	0x02008A99	LsFrameRx	●		Coeff. status: Updated.	
1,259,033	4	Lt	→	0x02140A80	LsFrameTx	●	Coeff. req: Hold.		
1,259,128	4	Lt	←	0x02008A28	LsFrameRx	●		Coeff. status: NotUpdate.	
1,308,780	4	Lt	→	0x02190A00	LsFrameTx	●	Coeff. req: Increment.		
1,308,915	4	Lt	←	0x02008A99	LsFrameRx	●		Coeff. status: Updated.	
1,308,981	4	Lt	→	0x02140A80	LsFrameTx	●	Coeff. req: Hold.		
1,309,076	4	Lt	←	0x02008A28	LsFrameRx	●		Coeff. status: NotUpdate.	
1,358,828	4	Lt	→	0x02190A00	LsFrameTx	●	Coeff. req: Increment.		
1,358,923	4	Lt	←	0x02008A4A	LsFrameRx	●		Coeff. status: CoefficientAtLimit.	
1,358,988	4	Lt	→	0x02140A80	LsFrameTx	●	Coeff. req: Hold.		
1,359,083	4	Lt	←	0x02008A28	LsFrameRx	●		Coeff. status: NotUpdate.	
1,408,818	4	Lt	→	LtSigResult	LtSigResult	●			
1,408,923	4	Lt	→	0x02148A00	LsFrameTx	●		Rx TrainingCompleted.	

Detailed insight to Link Training (LT) protocol sent between Xena tester and DUT

Easy Deployment Process

Solution Tracks are perpetual feature packs enabling advanced features on modules and underlying ports. When a Solution Track is ordered the extra features will be activated at the time of shipment. In the near future it will be possible to activate Solution Tracks on existing modules via XenaManager 3. Please note that activating Solution Tracks requires that the system is running Xena Release 106 or later.

Ordering Information

Product Description

Solution Track for Advanced Auto Negotiation and Link Training Analysis on Thor-400G-7S-2P
 Solution Track for Advanced Auto Negotiation and Link Training Analysis on Freya-800G-4S-2P

Product Code

ST-Thor-400G-7S-2P-ANLT
 ST-Freya-800G-4S-2P-ANLT



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