

Monitoring and Measuring IP Media Networks

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IP SHOWCASE THEATER AT NAB – APRIL 8-11, 2019

Media Networking Monitoring

- Video ST 2110-20
 - Multicast Address, Port, Payload Type
- Audio ST 2110-30
 - Multicast Address, Port, Payload Type
- Data ST 2110-40
 - Multicast Address, Port, Payload Type
- SMPTE 2059-2 PTP Profile
 - 239.20.xxx.xxx, 50020, 96
 - 239.30.xxx.xxx, 50030, 97
 - 239.40.xxx.xxx 50040, 100
- Domain, Message Rates

Need some strategy for identification of flows

Troubleshooting Basics

IP Session		Run Time: 0d, 00:57:30	Running
LAYER 1/2	VIDEO	PTP	
LAYER 1			
✓	10GbE Link	OK	
	SFP Loss Of Signal (LOS)	OK	
LAYER 2		STATUS	ERR SECS
✓	Lock	OK	1
!	CRC Error	OK	3426
LAYER 2 METRICS			
	Rx Bytes	1,408,158,634,085	
	Rx BER High	0	
	Rx CRC Errors	5,657,972	
	Rx Frames Ok	1,106,878,671	
	Rx Frames Errored	5,664,593	
	Rx Undersize Packets	0	
	Rx Oversize Packets	0	
	Tx Bytes	9,810	
	Tx Frames Ok	195	
	Tx Frames Errored	0	

- Check Cables
 - Single or Multi Mode
- Check SFPs
 - 1G, 10G, 850nm, 1310nm
- Check Port
 - Up or Down



IP Status – Checking Addresses

IP Status Run Time: 0d, 00:04:24

Port 1: OK
 Total: 1.319 Gb/s

ID	PORT	PROTOCOL	BITRATE	PAYLD	DEST IP	SOURCE IP	DEST MAC
✓ 1	1	S2110.20	1.309 Gb/s	96	239.27.8.76:50020	10.10.2.8:50020	01:00:5e:1b...
✓ 2	1	S2110.30	9.68 Mb/s	97	239.37.8.76:50030	10.10.2.8:50030	01:00:5e:25...
✓ 3	1	PTP_Gen	15.41 kb/s	--	224.0.1.129:320	2.2.2.2:320	01:00:5e:00...
✓ 4	1	PTP_Evt	5.759 kb/s	--	224.0.1.129:319	2.2.2.2:319	01:00:5e:00...
✓ 8	1	PTP_Gen	1.167 kb/s	--	224.0.1.129:320	192.168.40.4:320	01:00:5e:00...
	--	Other Level 3	0b/s	--	--	--	--
✓ 5	2	PTP_Gen	9.278 kb/s	--	224.0.1.129:320	2.2.2.2:320	01:00:5e:00...
✓ 6	2	PTP_Evt	5.759 kb/s	--	224.0.1.129:319	2.2.2.2:319	01:00:5e:00...
✓ 7	2	PTP_Gen	1.167 kb/s	--	224.0.1.129:320	192.168.40.4:320	01:00:5e:00...
	--	Other Level 3	0b/s	--	--	--	--

INPUT: 2110
1080i 59.94
REF: PTP:127 ✓
VID/REF: Locked

AUD: PPPP PPPP
RTC: 2018-10-30 14:12:21

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prism-ae-30

Messages

- Check Following
 - Bitrate
 - Payload
 - Addresses
 - PTP Domain
 - Sequence Errors
 - RTP Clock
 - RTP Marker Frequency

Checking Syntax of decoded streams



The screenshot shows the Tektronix IP Status and IP Session interface. The IP Status section displays a table of stream details, and the IP Session section shows a detailed view of the selected stream's syntax.

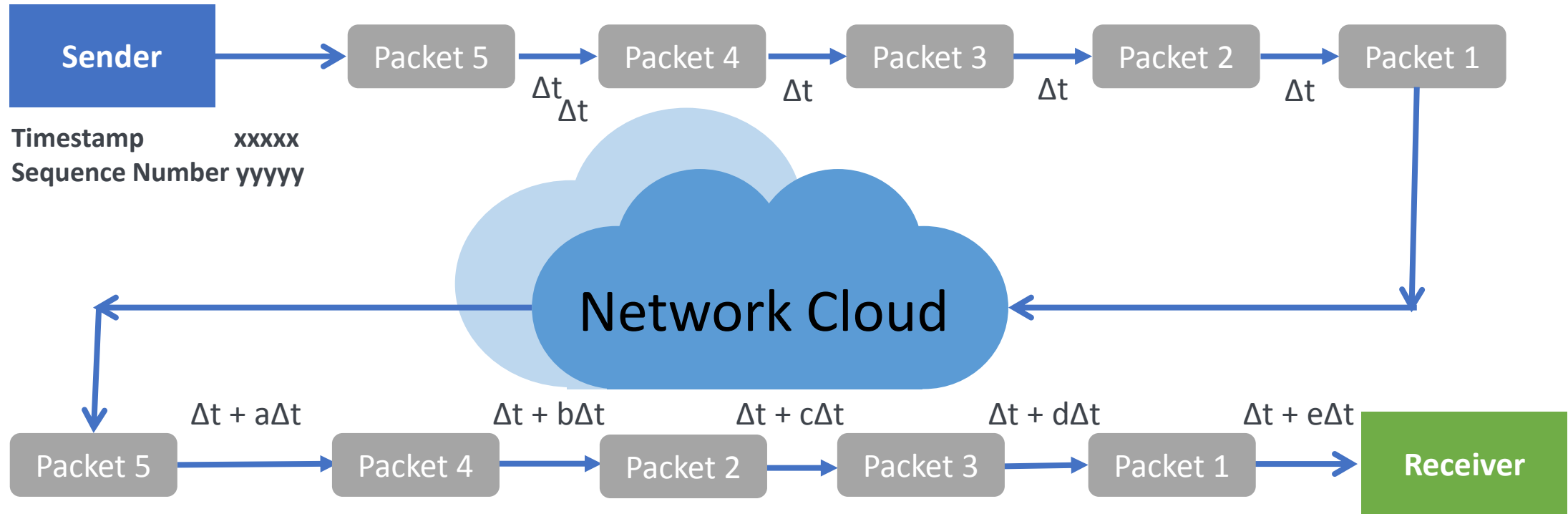
ID	PORT	PROTOCOL	BITRATE	PAYLD	DEST IP	SOI
1	1	S2110.20	1.305 Gb/s	96	239.27.8.76:50020	10.1
2	1	S2110.30	9.68 Mb/s	97	239.37.8.76:50030	10.1
3	1	PTP_Gen	16.73 kb/s	--	224.0.1.129:320	2.2
4	1	PTP_Evt	5.76 kb/s	--	224.0.1.129:319	2.2
8	1	PTP_Gen	1.167 kb/s	--	224.0.1.129:320	192
--	--	UDP	0b/s	--	--	--
--	--	Other Level 3	0b/s	--	--	--
5	2	PTP_Gen	9.28 kb/s	--	224.0.1.129:320	2.2
6	2	PTP_Evt	5.759 kb/s	--	224.0.1.129:319	2.2
7	2	PTP_Gen	1.167 kb/s	--	224.0.1.129:320	192
--	--	Other Level 3	0b/s	--	--	--

LAYER 1/2	VIDEO	AUDIO	DATA	PTP	NMOS
L3 IP					
Source Addr			10.10.2.8		
Destination Addr			239.27.8.76		
L4 UDP					
Source Port			50020		
Destination Port			50020		
L5 RTP					
Version			2		
Padding			false		
Extension			false		
CSRC			0		
Marker			0		
Marker Bit Frequency			59.79 Hz		
Payload type			96		
Sequence Number			0x3181		
Time Stamp			2853462985		
SSRC			0x00000000		
Interface Sampling Frequency Error			OK		

- Check Following
 - Layer 5 RTP
 - Marker Bit
 - Payload Type
 - Sequence No.
 - Time Stamp

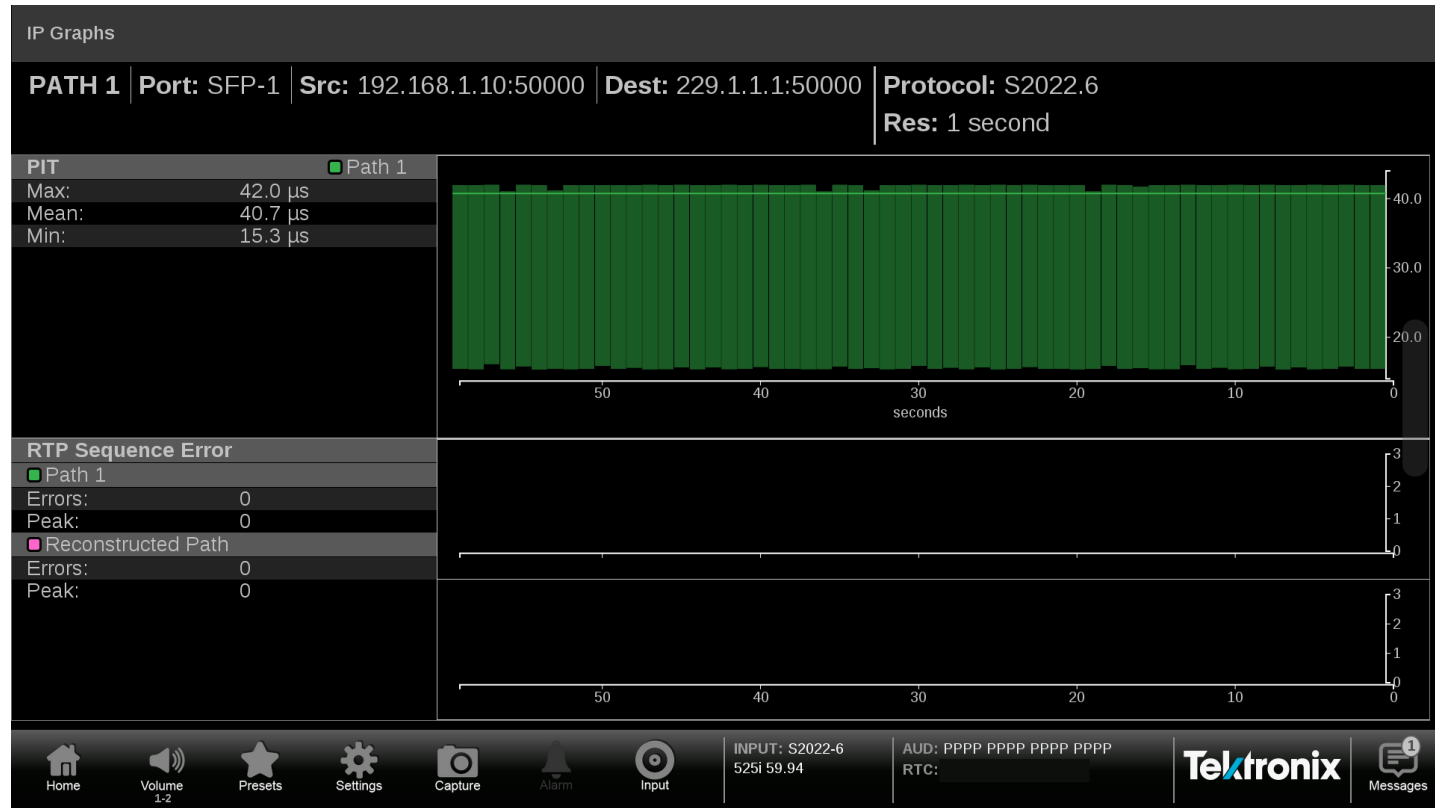
- Can Video & Audio be decoded?

Packet Transmission



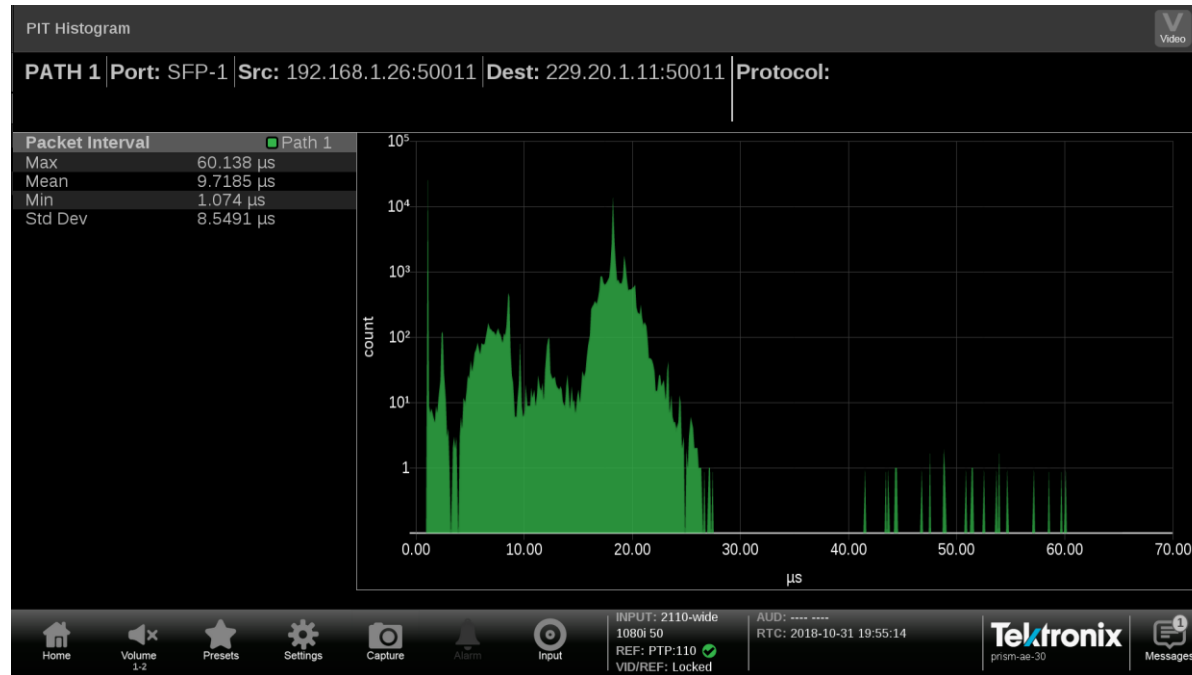
- Asynchronous streams can produce jitter or out of order packets

Packet Interarrival Time (PIT)



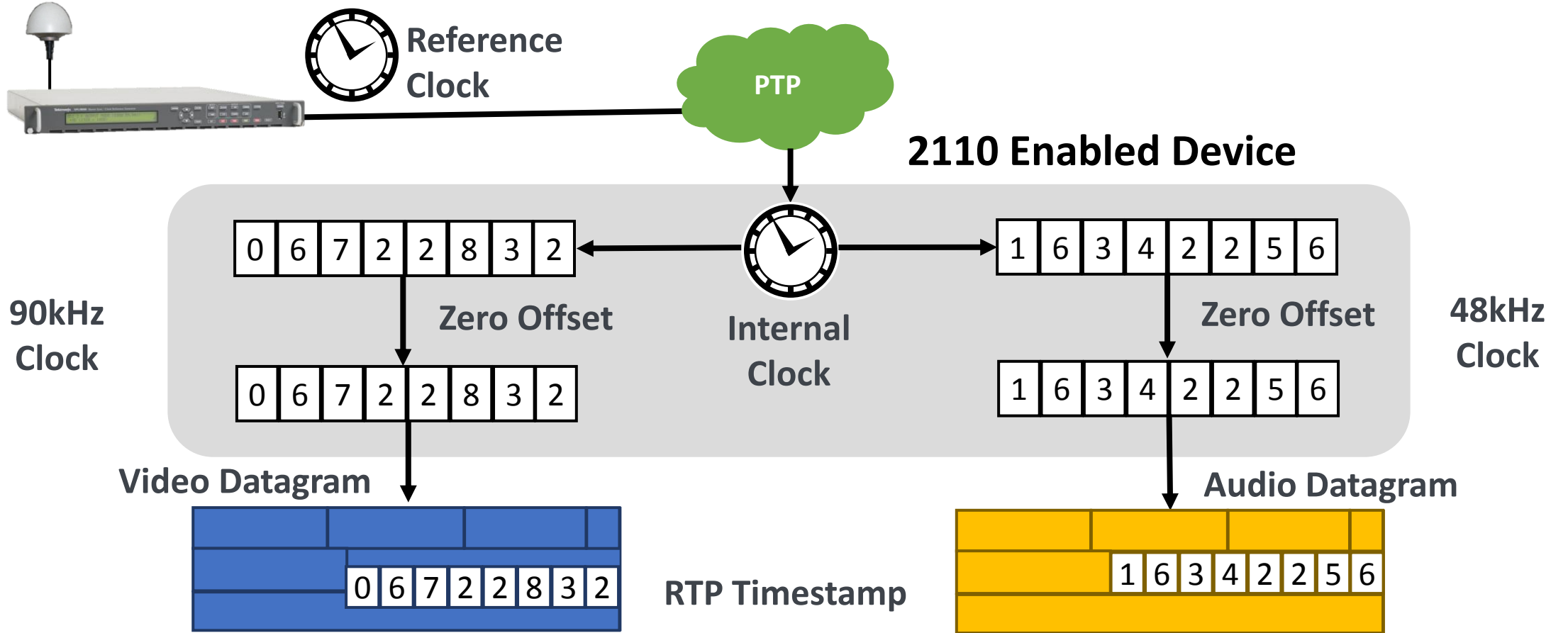
- Monitor packet arrival time
- Determine out of order packets
- Determine Reconstructed Path Errors

PIT Histogram



- Characteristic signature of device
- Narrow Linear
- Gapped
- Wide Linear

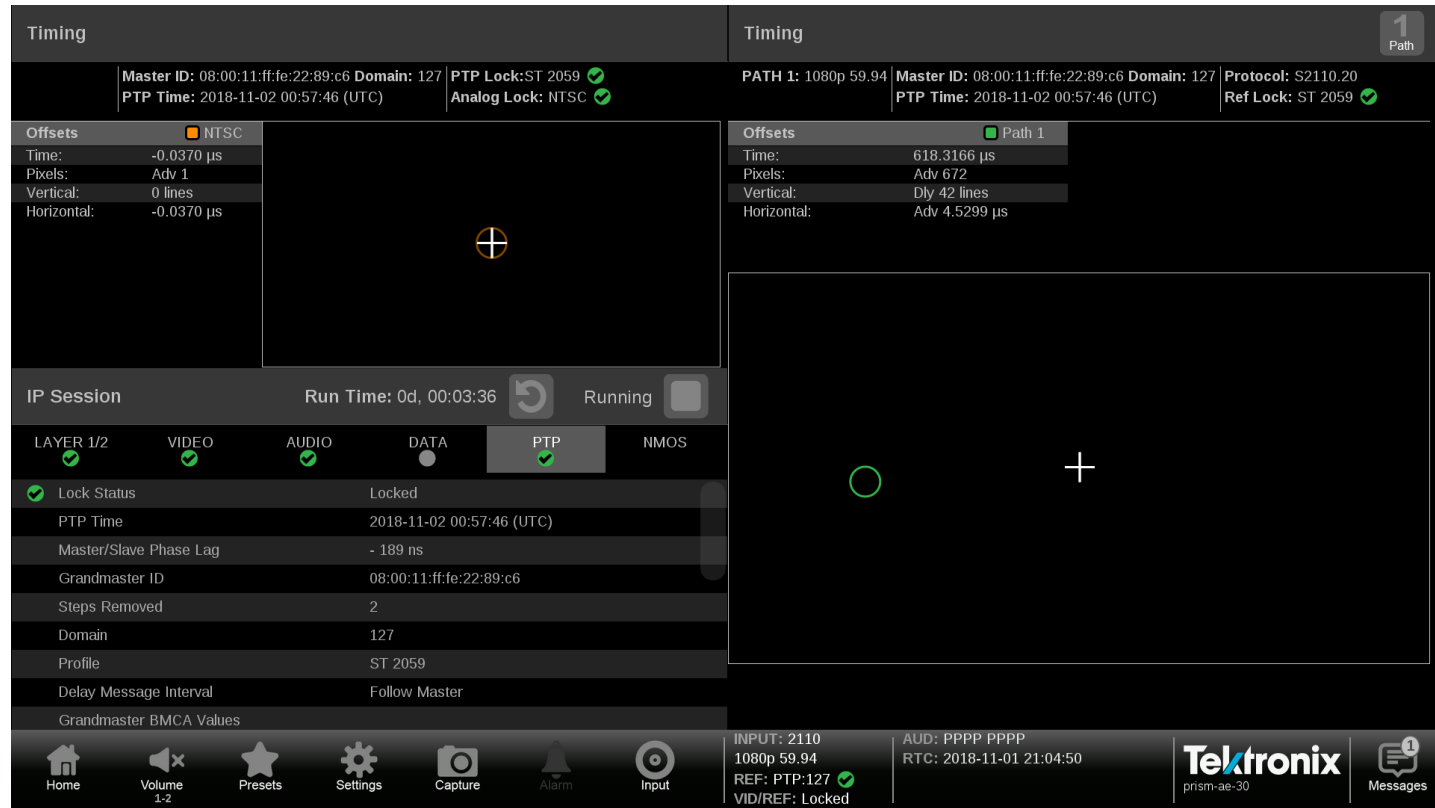
ST 2110 Stream Timing



ST 2110 Stream Timing

DST	Info	Line Number	Extended Sequence Number	Sequence number	Timestamp	Marker
239.21.10.10	PT=DynamicRTP-Type-96, SSRC=0x0, Seq=1259, Time=2116195125	537	0x005e	1259	2116195125	False
239.21.10.10	PT=DynamicRTP-Type-96, SSRC=0x0, Seq=1260, Time=2116195125	537,538	0x005e	1260	2116195125	False
239.21.10.10	PT=DynamicRTP-Type-96, SSRC=0x0, Seq=1261, Time=2116195125	538	0x005e	1261	2116195125	False
239.21.10.10	PT=DynamicRTP-Type-96, SSRC=0x0, Seq=1262, Time=2116195125	538	0x005e	1262	2116195125	False
239.21.10.10	PT=DynamicRTP-Type-96, SSRC=0x0, Seq=1263, Time=2116195125	538	0x005e	1263	2116195125	False
239.21.10.10	PT=DynamicRTP-Type-96, SSRC=0x0, Seq=1264, Time=2116195125	538,539	0x005e	1264	2116195125	False
239.21.10.10	PT=DynamicRTP-Type-96, SSRC=0x0, Seq=1265, Time=2116195125	539	0x005e	1265	2116195125	False
239.21.10.10	PT=DynamicRTP-Type-96, SSRC=0x0, Seq=1266, Time=2116195125	539	0x005e	1266	2116195125	False
239.21.10.10	PT=DynamicRTP-Type-96, SSRC=0x0, Seq=1267, Time=2116195125	539	0x005e	1267	2116195125	False
239.21.10.10	PT=DynamicRTP-Type-96, SSRC=0x0, Seq=1268, Time=2116195125, Mark	539	0x005e	1268	2116195125	True
239.21.10.10	PT=DynamicRTP-Type-96, SSRC=0x0, Seq=1269, Time=2116196600	0	0x005e	1269	2116196600	False
239.21.10.10	PT=DynamicRTP-Type-96, SSRC=0x0, Seq=1270, Time=2116196600	0	0x005e	1270	2116196600	False
239.21.10.10	PT=DynamicRTP-Type-96, SSRC=0x0, Seq=1271, Time=2116196600	0	0x005e	1271	2116196600	False
239.21.10.10	PT=DynamicRTP-Type-96, SSRC=0x0, Seq=1272, Time=2116196600	0,1	0x005e	1272	2116196600	False
239.21.10.10	PT=DynamicRTP-Type-96, SSRC=0x0, Seq=1273, Time=2116196600	1	0x005e	1273	2116196600	False
239.21.10.10	PT=DynamicRTP-Type-96, SSRC=0x0, Seq=1274, Time=2116196600	1	0x005e	1274	2116196600	False
239.21.10.10	PT=DynamicRTP-Type-96, SSRC=0x0, Seq=1275, Time=2116196600	1	0x005e	1275	2116196600	False
239.21.10.10	PT=DynamicRTP-Type-96, SSRC=0x0, Seq=1276, Time=2116196600	1,2	0x005e	1276	2116196600	False
239.21.10.10	PT=DynamicRTP-Type-96, SSRC=0x0, Seq=1277, Time=2116196600	2	0x005e	1277	2116196600	False
239.21.10.10	PT=DynamicRTP-Type-96, SSRC=0x0, Seq=1278, Time=2116196600	2	0x005e	1278	2116196600	False
239.21.10.10	PT=DynamicRTP-Type-96, SSRC=0x0, Seq=1279, Time=2116196600	2	0x005e	1279	2116196600	False
239.21.10.10	PT=DynamicRTP-Type-96, SSRC=0x0, Seq=1280, Time=2116196600	2,3	0x005e	1280	2116196600	False
239.21.10.10	PT=DynamicRTP-Type-96, SSRC=0x0, Seq=1281, Time=2116196600	3	0x005e	1281	2116196600	False
239.21.10.10	PT=DynamicRTP-Type-96, SSRC=0x0, Seq=1282, Time=2116196600	3	0x005e	1282	2116196600	False
239.21.10.10	PT=DynamicRTP-Type-96, SSRC=0x0, Seq=1283, Time=2116196600	3	0x005e	1283	2116196600	False

Timing Display

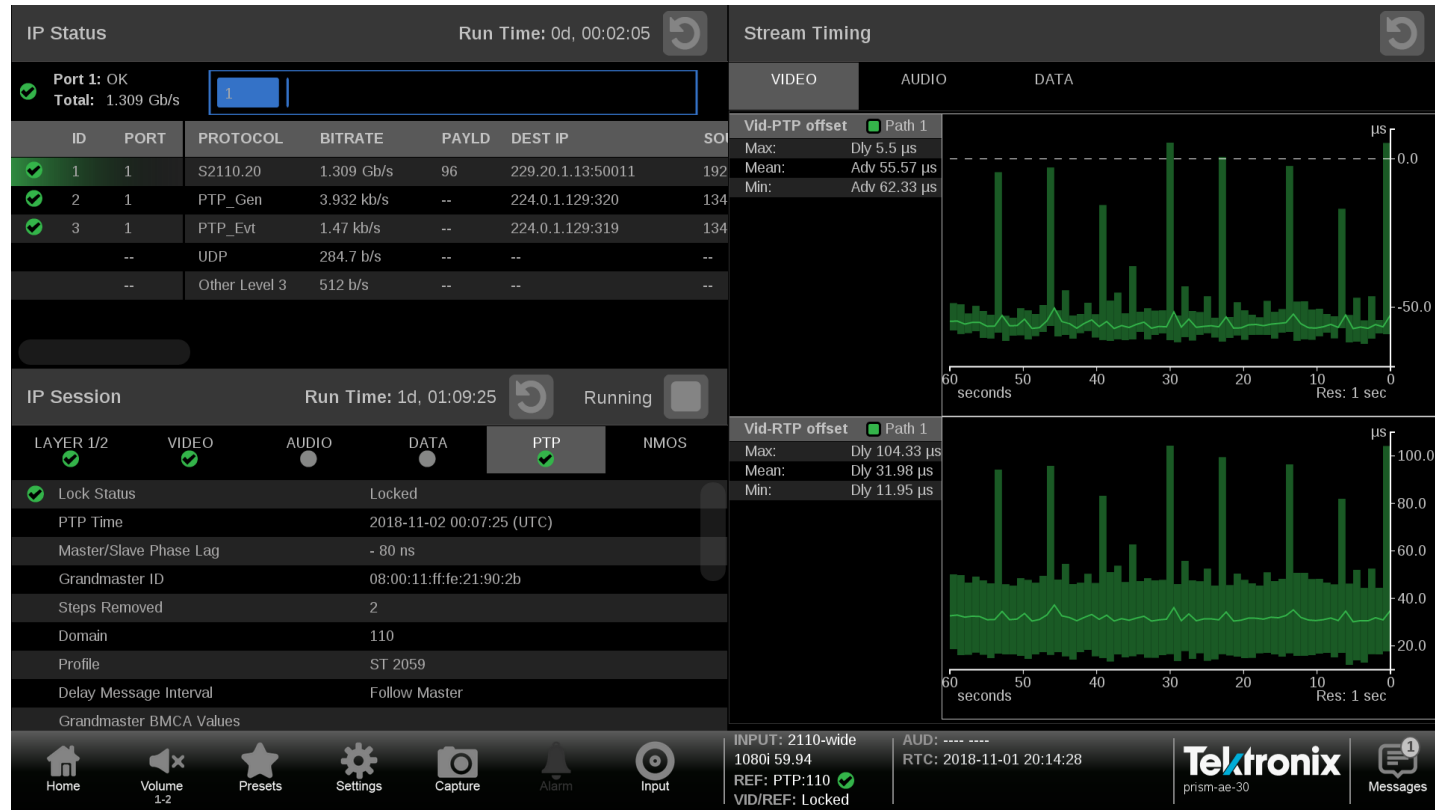


The screenshot displays the Timing Display interface with the following information:

- Left Panel (NTSC):**
 - Master ID: 08:00:11:ff:fe:22:89:c6 Domain: 127
 - PTP Lock: ST 2059 ✓
 - Analog Lock: NTSC ✓
 - PTP Time: 2018-11-02 00:57:46 (UTC)
 - Offsets: NTSC
 - Time: -0.0370 μ s
 - Pixels: Adv 1
 - Vertical: 0 lines
 - Horizontal: -0.0370 μ s
- Right Panel (Path 1):**
 - PATH 1: 1080p 59.94
 - Master ID: 08:00:11:ff:fe:22:89:c6 Domain: 127
 - Protocol: S2110.20
 - PTP Time: 2018-11-02 00:57:46 (UTC)
 - Ref Lock: ST 2059 ✓
 - Offsets: Path 1
 - Time: 618.3166 μ s
 - Pixels: Adv 672
 - Vertical: Dly 42 lines
 - Horizontal: Adv 4.5299 μ s
- IP Session:**
 - Run Time: 0d, 00:03:36
 - Running
 - LAYER 1/2: VIDEO ✓
 - AUDIO ✓
 - DATA
 - PTP ✓
 - NMOS
 - Lock Status: Locked
 - PTP Time: 2018-11-02 00:57:46 (UTC)
 - Master/Slave Phase Lag: -189 ns
 - Grandmaster ID: 08:00:11:ff:fe:22:89:c6
 - Steps Removed: 2
 - Domain: 127
 - Profile: ST 2059
 - Delay Message Interval: Follow Master
 - Grandmaster BMCA Values
- Bottom Bar:**
 - Home, Volume 1-2, Presets, Settings, Capture, Alarm, Input
 - INPUT: 2110 1080p 59.94
 - REF: PTP:127 ✓
 - VID/REF: Locked
 - AUD: PPPP PPPP
 - RTC: 2018-11-01 21:04:50
 - Tektronix prism-ae-30
 - Messages

- Check PTP Lock
- Compare IP video input to PTP
- Can compare analog reference to PTP

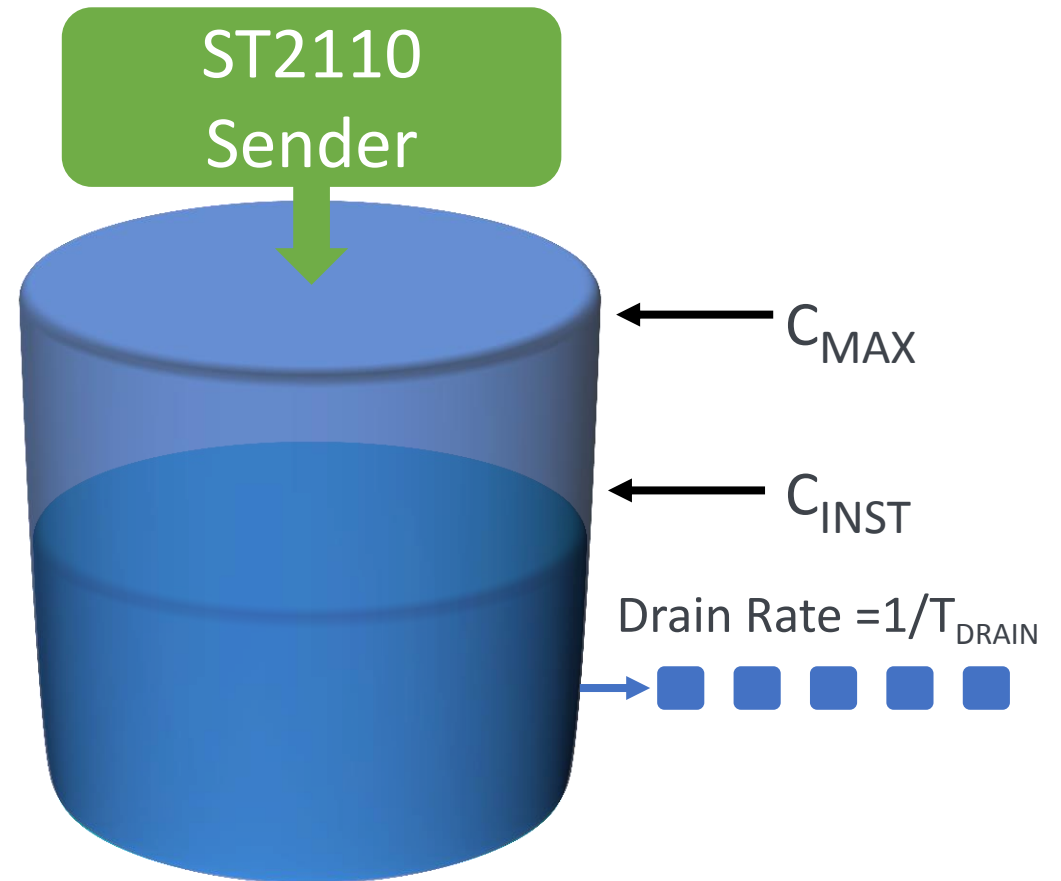
Stream Timing Measurement



- Vid PTP offset
 - Timing of video as received against PTP
- Vid RTP offset
 - Timing of video as received relative to embedded RTP timestamp

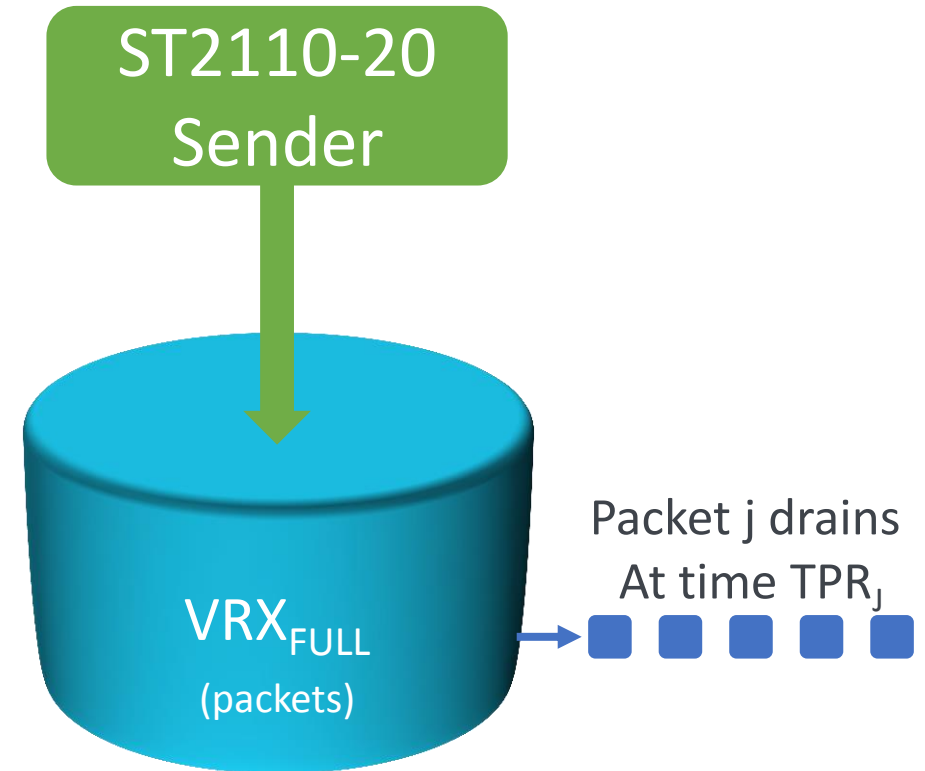
Network Compatibility Model - Sender

- Sender Packet enters a leaky bucket of infinite capacity
- The bucket drains a packet every T_{DRAIN} seconds if a packet is available
- C_{INST} instantaneous number of packets in the bucket, should never exceed C_{MAX}



Virtual Receiver Buffer Model

- Packets from Sender enter a leaky bucket of capacity VRX_{FULL}
- Packets enter and leave instantaneously
- VRX_{FULL} bucket drain packet j at the Packet Read Schedule TPR_j
- Sender shall ensure bucket does not overflow
- Sender shall ensure packet j is available no later than TPR_j does not underflow



ST 2110-21: Types of Senders

- Narrow (N):

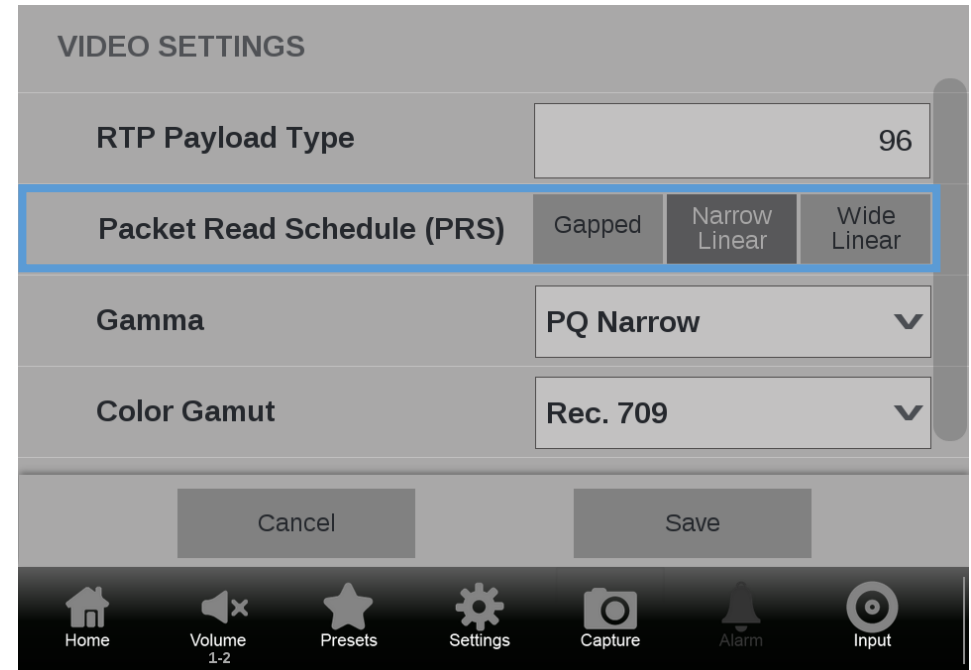
$$C_{\max} = 4$$
$$VRX_{\text{Full}} = 8$$

- Narrow Linear (NL):

$$C_{\max} = 4$$
$$VRX_{\text{Full}} = 8$$

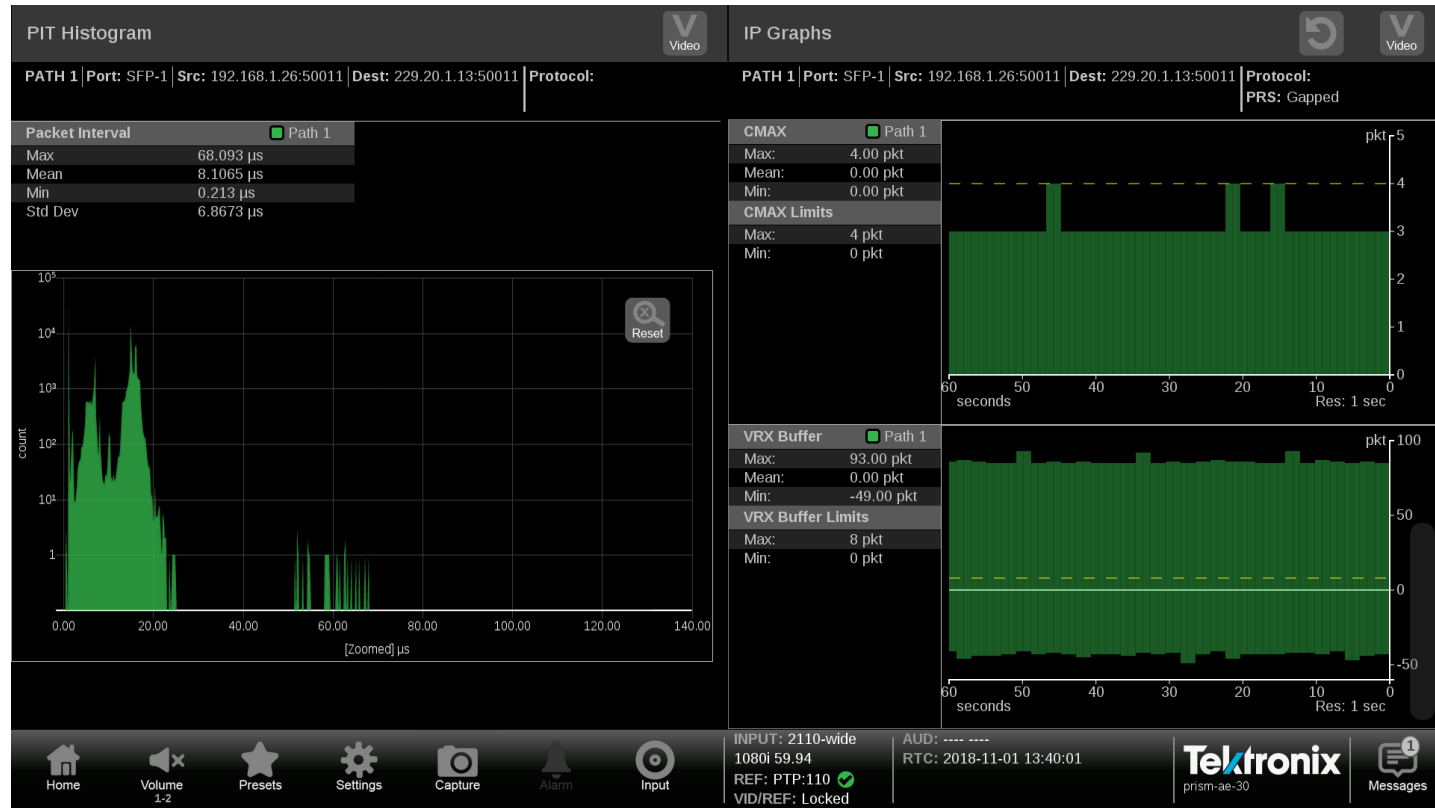
- Wide (W):

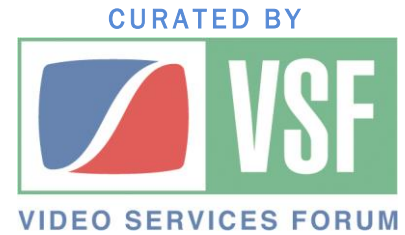
$$C_{\max} = 16$$
$$VRX_{\text{Full}} = 720$$



Wide - Linear

- Do we have a problem ?
- Packet Read Schedule ?
- Needs to be changed to Wide Linear
- Meets requirements for Wide Linear





Thank You

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