IN-VEHICLE NETWORKS:
AUTOMOTIVE SERDES ALLIANCE

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Make ideas real

AUTOMOTIVE SERDES ALLIANCE (ASA)



- Alliance was established in 2019
  - ASA Motion Link (ASA-ML) v1.0 released in 2020
  - ASA-ML v2.1, released in 2025
- Over 25 OEMs implement GMSL in their vehicles
- Up to 15 m Coaxial and 10 m SDP channels with up to 4 inline connectors
- Downlink line rates up to 16 Gbps per lanes (64 Gbps aggregate)
- Uplink data rates greater than 100 Mbps

Source: https://auto-serdes.org/about-us/

ASA VS. ASA-ML

ASA Automotive SerDes Alliance

THE ALLIANCE

- Non-profit alliance · founded 2019 · Munich
- Founders: BMW, Continental, Broadcom, Fraunhofer IIS, NXP
- Members: OEMs, Tier-1s, chipmakers, connector vendors (Nearly 200 members)
- Goal: one interoperable asymmetric-SerDes standard

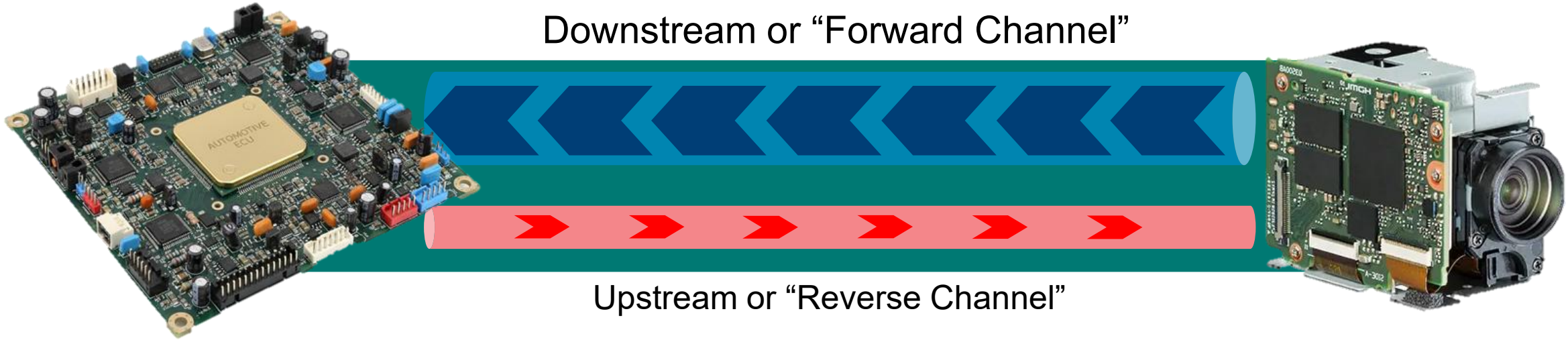
publishes

ASA-ML ASA Motion Link

THE STANDARD

- The transceiver spec ASA publishes
- Asymmetric SerDes: PHY, data-link & transport
- Fast downlink + slow uplink → less power, simpler
- v1.0 (2020) 1.7–13 Gbps · v2.1(2025) asymmetric-SerDes standard

ASA TERMINOLOGY + DATA RATE



Downstream Traffic					Upstream Traffic				
Speed Grade	Line Rate (Gbps)	Modulation	Baud Rate (GBd)	Data Rate (Gbps)	Speed Grade	Line Rate (Gbps)	Modulation	Baud Rate (GBd)	Payload Data Rate (Mbps)
SG1	2	PAM2	2	>1.8	SG1	2	PAM2	2	50
SG2	4		4	>3.6	SG2	4		4	100
SG3	8		8	>6.4					
SG4	12	PAM4	6	>9.7					
SG5	16		8	>13					

TIME DIVISION DUPLEXING

- Bi-directional but Half-Duplex
  - Only one TX active at a time
- Downstream burst and Upstream burst are always the same length, regardless of operating speed grade
  - Baud rate dictates effective throughput

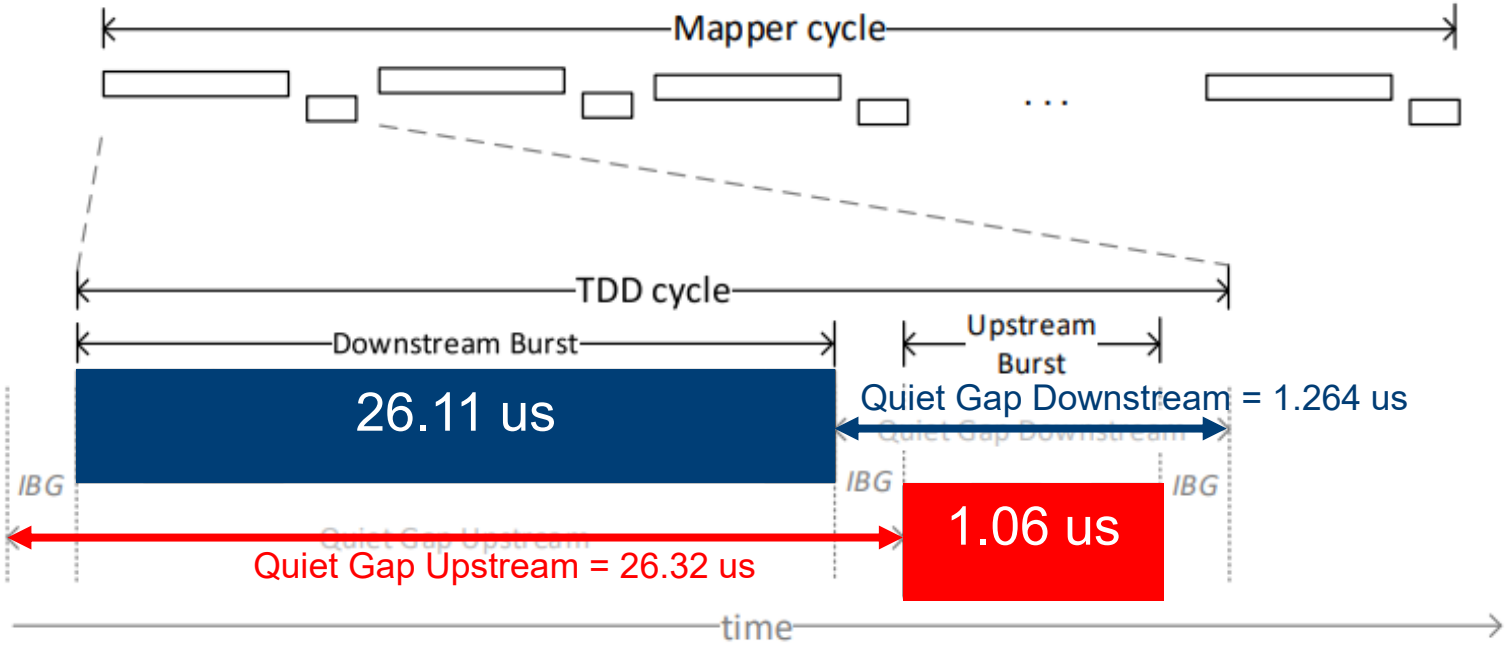


Figure 2-2: Overview of ASA half-duplexing Physical Layer and time-division Data Link Layer access

ASA_TPMA_TX_01 TRANSMITTER LINEARITY

PMA Transmit Compliance 5.1.1

TEST CONFIGURATION

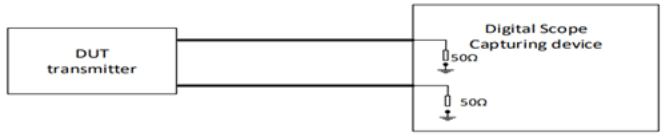
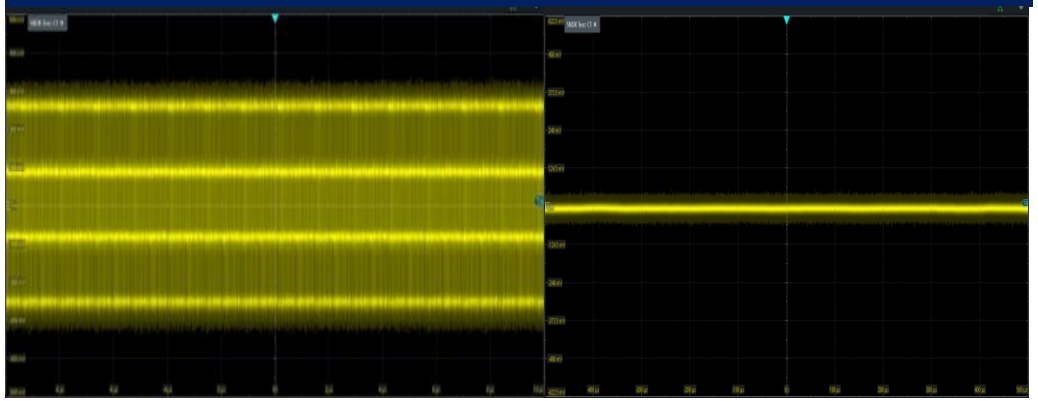


Figure 4-28: Transmitter test fixture 1 for transmitter droop and linearity measurements

MEASUREMENT / RESULT



OBJECTIVE

Verify TX linearity and SNDR at DUT MDI output.

Compare useful signal against distortion and noise.

PATTERN / METHOD

PRBS13Q at DUT MDI output

Record pattern 16 times oversampling M ≥ 7.

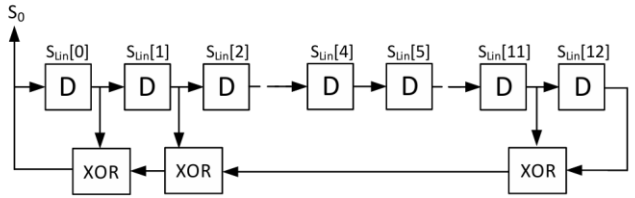


Figure 4-29: PRBS13 pattern generator

LIMIT

SG4 / SG5 SNDR > 38 dB.

Noise floor capture is used for comparison.

ASA_TPMA_TX_02 TRANSMITTER DROOP

PMA Transmit Compliance 5.1.2

TEST CONFIGURATION

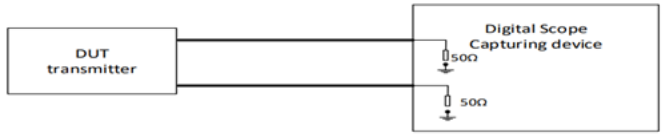
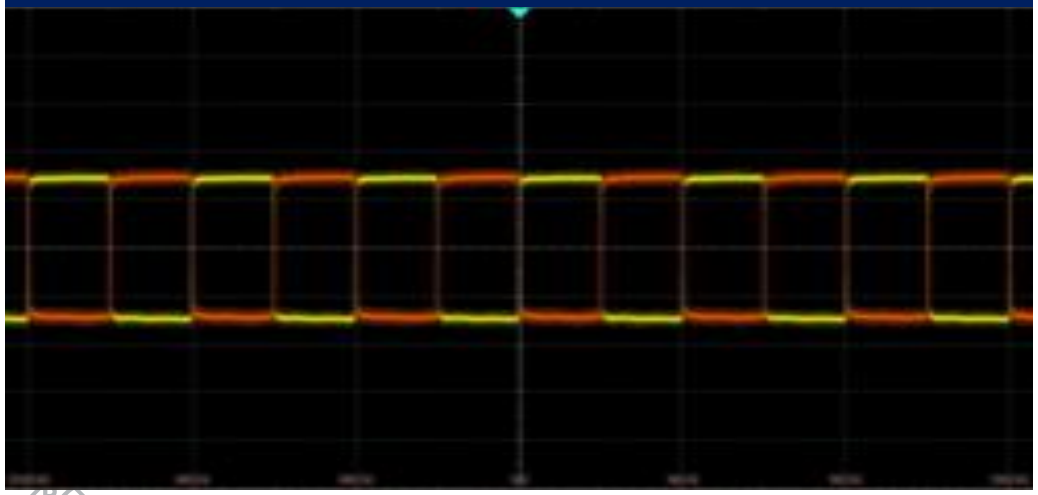


Figure 4-28: Transmitter test fixture 1 for transmitter droop and linearity measurements

MEASUREMENT / RESULT



OBJECTIVE

Check low-frequency droop under long same-polarity symbol runs.

Confirm baseline does not shift too much.

PATTERN / METHOD

160 × S {+1}, then 160 × S {–1}.

Vinit: 4 ns; Vfin: 16 ns after zero crossing.

LIMIT

Positive and negative droop < 32%.

Startup-triggered run time: 10 ms.

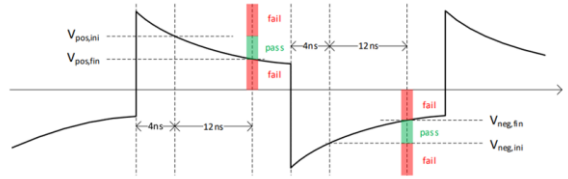
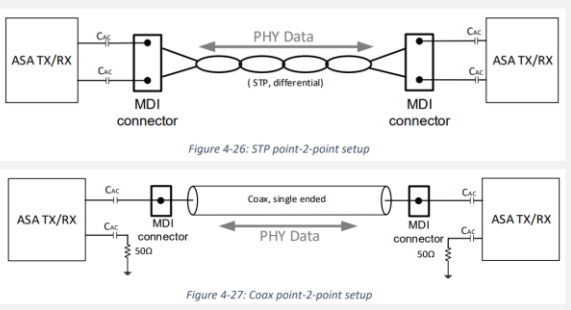


Figure 5-1: Droop test pattern and measurement points

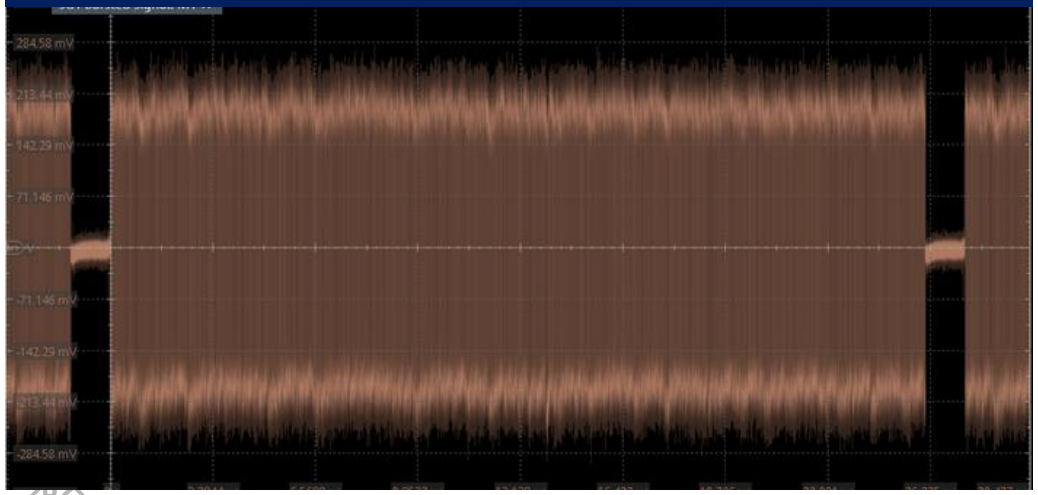
ASA_TPMA_TX_03 PSD AND POWER LEVEL

PMA Transmit Compliance 5.1.3

TEST CONFIGURATION



MEASUREMENT / RESULT



OBJECTIVE

Verify TX spectrum and total power.

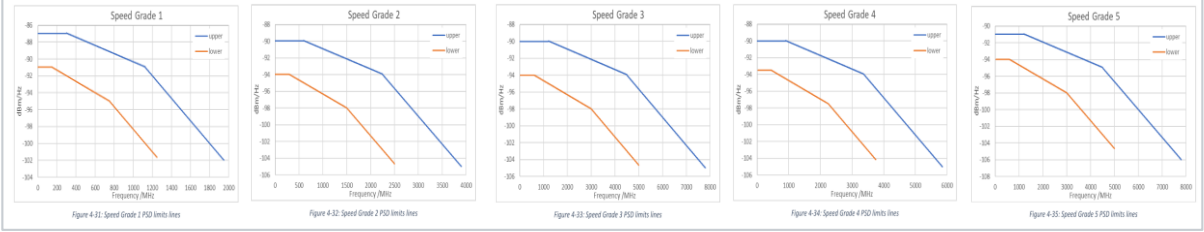
Check emission stays within PSD mask.

PATTERN / METHOD

Normal Mode at target speed grade.

Crop TDD burst → FFT → PSD → transmit power.

LIMIT



ASA_TPMA_TX_04 SHORT-TERM CLOCK PHASE STABILITY

PMA Transmit Compliance 5.1.4

TEST CONFIGURATION

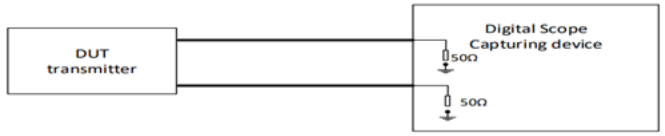
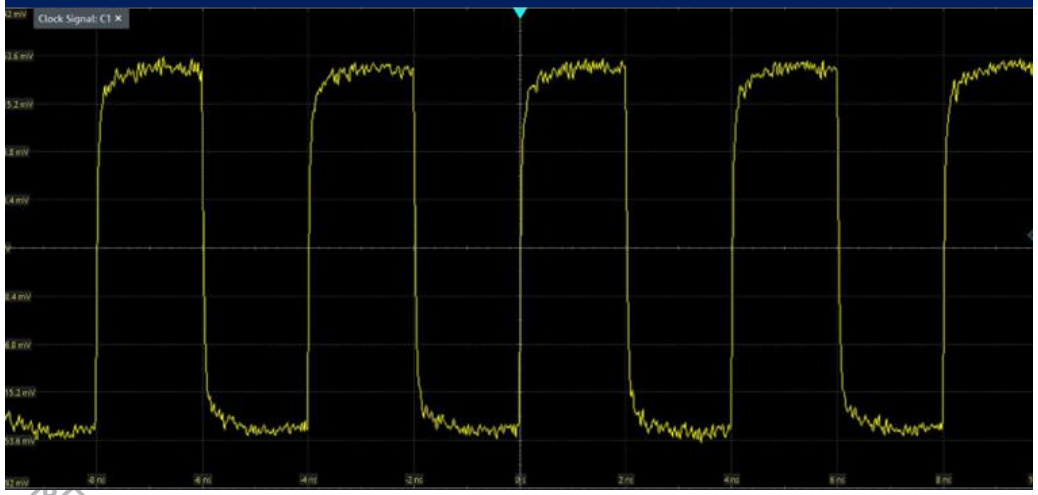


Figure 4-28: Transmitter test fixture 1 for transmitter droop and linearity measurements

MEASUREMENT / RESULT



OBJECTIVE

Verify short-term TX clock jitter at MDI.

Measure TIE against ideal timing reference.

PATTERN / METHOD

250 MHz clock-like waveform

16× S {+1}, then 16 × S {–1}

Vinit: 4 ns; Vfin: 16 ns after zero crossing.

LIMIT

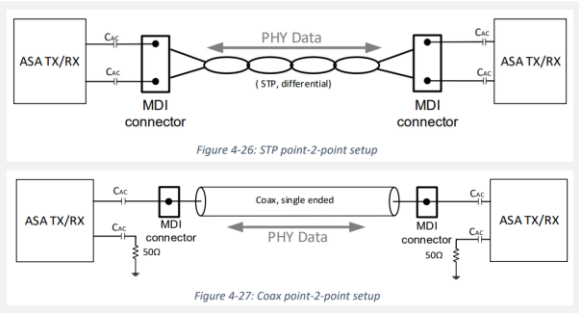
Peak-to-peak TIE limit is speed-grade dependent per Section 4.4.2.

SG1	SG2	SG3	SG4	SG5
< 100 ps	< 50 ps	< 25 ps	< 16.66 ps	< 12.5 ps

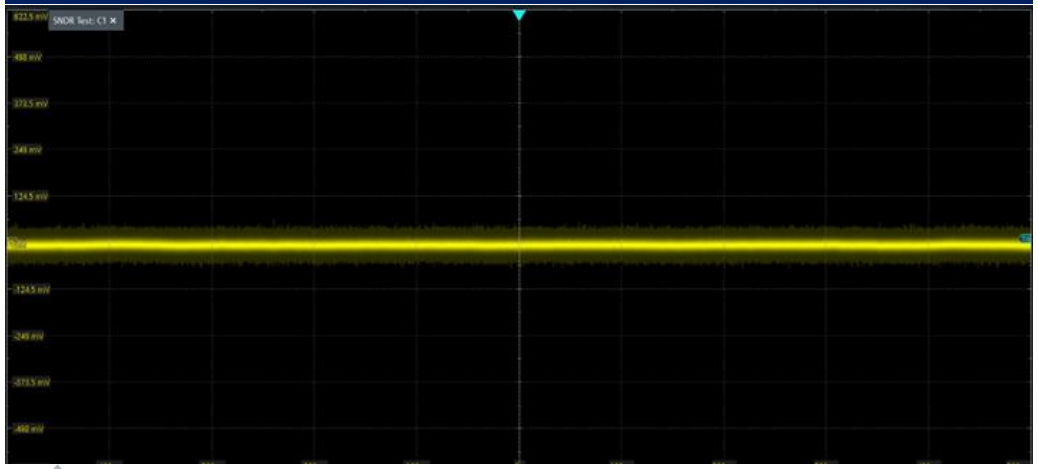
ASA_TPMA_TX_05 TRANSMITTER DISABLED

PMA Transmit Compliance 5.1.5

TEST CONFIGURATION



MEASUREMENT / RESULT



OBJECTIVE

Verify residual output when TX is disabled.

Ensure disabled transmitter does not leak excessive power.

PATTERN / METHOD

Measure transmit power into 100 Ω load

Frequency range: 1 MHz to 5 GHz

LIMIT

Residual transmit power < -24 dBm rms

ASA_TPMA_TX_06 TRANSMITTER CLOCK PRECISION

PMA Transmit Compliance 5.1.6

TEST CONFIGURATION

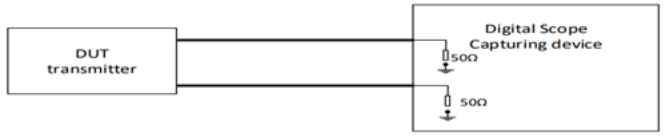
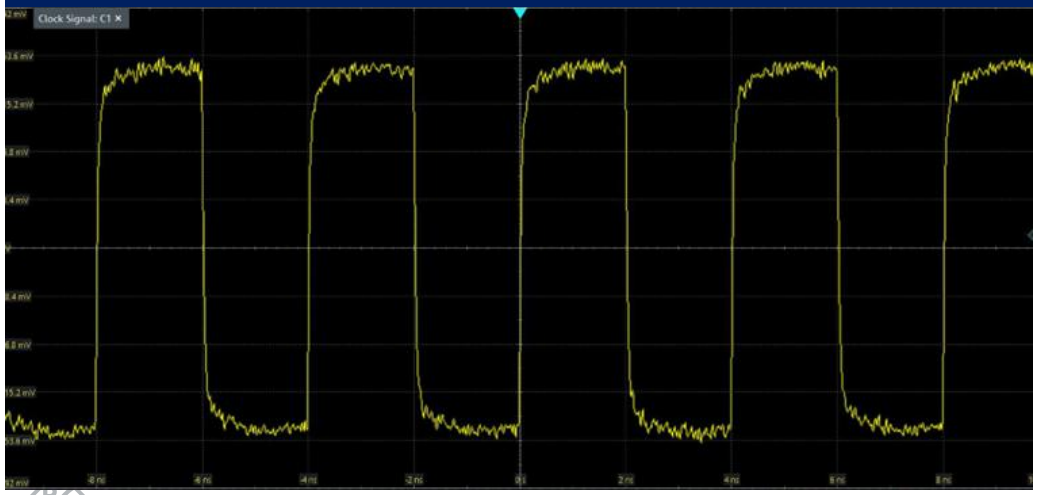


Figure 4-28: Transmitter test fixture 1 for transmitter droop and linearity measurements

MEASUREMENT / RESULT



OBJECTIVE

Verify short-term TX clock jitter at MDI.

Measure TIE against ideal timing reference.

PATTERN / METHOD

250 MHz clock-like waveform

16× S {+1}, then 16 × S {–1}

32.436 µs non-overlapping segments; ≥ 100 segments

LIMIT

Baud-rate clock = 8000 × S MHz ±100 ppm.

	SG1	SG2	SG3	SG4	SG5
Baud rate	**2 GHz**	**4 GHz**	**8 GHz**	**6 GHz**	**8 GHz**
±100ppm	±200 kHz	±400 kHz	±800 kHz	±600 kHz	±800 kHz

TEST SOLUTIONS FOR ASA-ML

R&S SPLUS-K105

ASA-ML Compliance Test Software

- Automated ASA-ML testing for SG1 to SG5
- Covers transmitter PMA and MDI tests
- Step-by-step wizard and comprehensive reports

R&S RTP Oscilloscope

Signal Integrity & Debug Platform

- Automated PMA transmitter characterization
- Data eye view with jitter and noise decomposition
- Advanced eye analysis with 16 Gbit/s HW-CDR

VNA + SI Options

MDI Return Loss & Debug Extension

- Network analyzer support for MDI return-loss tests
- VNA bandwidth from 5 MHz to 5 GHz
- Deembedding, embedding and equalization options