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High frequency / 5G and High Speed Data



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#### **High Speed Loopback Testing**

- Using external high-speed instruments opens new possibilities beyond BIST Loopback Testing
- However, Test Engineers using BIST Loopback testing for High Speed (HS) serial port testing may not be familiar with external instrument setups testing at 112Gbps PAM4



High-Speed Serial Testing Goes Beyond Loopback





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#### **Outline For This Presentation**

- Test Engineering challenges at higher speeds
- Instruments and components available for highspeed external testing
- Examples of high-speed external testing



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#### **Test Engineering challenges at higher speeds**

- Meet the performance needs of the device under test
- Seamless integration of high-speed instruments into the production tester platform
- Minimize test times
- Minimize test program development



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#### **Performance Criteria**

- 112 Gbps PAM4 Nyquist Frequency is 28 GHz
- Signals will attenuate at these frequencies
- Choose materials and devices to limit attenuation
- Choose instruments to correct attenuation effects



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#### **Performance Criteria**

- Minimize path distances from high speed Source/Measure instruments to DUT
- Reasonable test times for production wafer probe and final test
- At a minimum, use materials and devices with >40 GHz capability when Nyquist is 28 GHz
- Use high speed loadboard materials in the path
- Use high speed components Source/Measure Instruments, Bias Tees, Splitters, Switches
- Source & Measure Instruments compensate for high speed path channel losses

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#### Maintain reasonable test times

- Multisite capabilities
  - 32 high speed channels can accommodate quad site TIA device testing with four Tx/Rx per device
- Parallel measuring
  - Sampling scopes can sample all 32 differential channels in parallel
- Divide and conquer sampling and processing steps

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#### **BERT Throughput**

- 424 ms 1X setup time
- 1 sec settling time
- 80 ms measurement time





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#### Minimizing Test Program Development Leveraging industry recognized production tester

- High-speed instruments are programmed by Advantest Smartest GUI
- Fast Single-site to Multi-site conversion
- Smartest data logging and communication with other test flow tools – handlers, probers

China

Remote software/hardware control

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Used to test 112 Gbps devices with 26 GHz Nyquist

-50 GHz DSO

- -58 GBd PAM4 BERT
- -50 GHz Megtron6 laminates
- -44 GHz Bias Tees
- -40 GHz Splitters
- -60 GHz Switches

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#### Simultaneous Eye Diagram & BER using Broadband Splitters



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#### Conclusions

- Keep simple loopback, but add performance with external high-speed instruments for 112Gbps 56GBd PAM4 test coverage
- Leverage industry standard hardware, software and mechanical production package/probe testers
- Place high-speed instruments close to DUT that can compensate for high frequency attenuation
- Use high-speed Loadboard Materials, Bias Tees, Wideband Splitters, RF Switches

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