Rosenberger

IEEE 1000BASE-T1
Connector vibration test results

Thomas Müller, Simon Huber, Christian Maier (Rosenberger)

Channel measurements
Outline

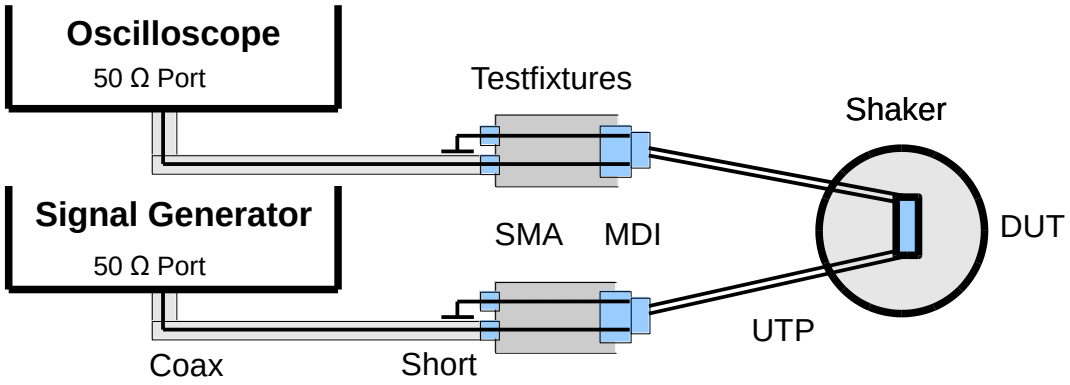
- Connector under vibration measurement setup
- Test results
- Possible reasons for the results
- Conclusion

Connector under vibration
Measurement setup

Rosenberger

- Usual setups e.g. LV-214 standard aims at detecting interruptions of 1 µs or longer while the contact resistance exceeds 7 Ohm
- Automotive connectors fulfil these or similar test (e.g. US-CAR or OEM specific, see Gardner_3bp_01a_0514.pdf)
- Several connectors are wired in series to increase the probability for detect an event
- The usual setup is not optimised in terms of RF performance for very high RF frequencies, e.g. no reference impedance

Connector under vibration
Measurement setup



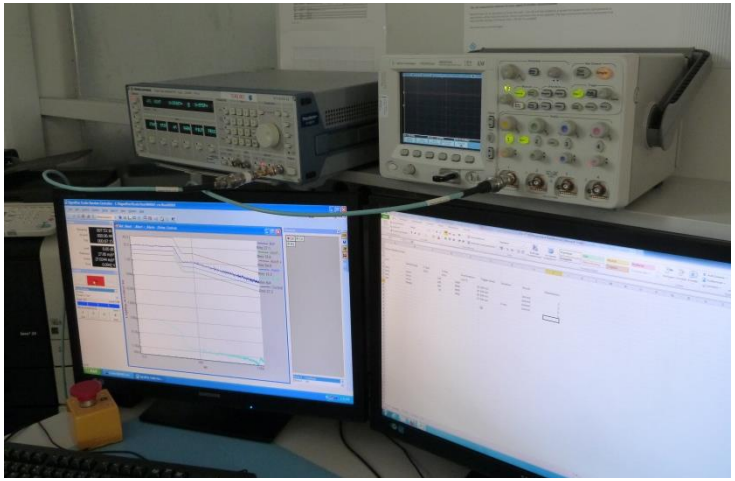
- Measurement setup provides 50 Ohm system with termination at both ends
- 0.5 V DC test signal is generated by means of RF signal generator with RF output
- Interruptions are triggered on falling edges with Oscilloscope (Agilent DSO6104A, 1 GHz, 4 GSa/s)
- 1 ns rise time ~ Bandwith 350 MHz

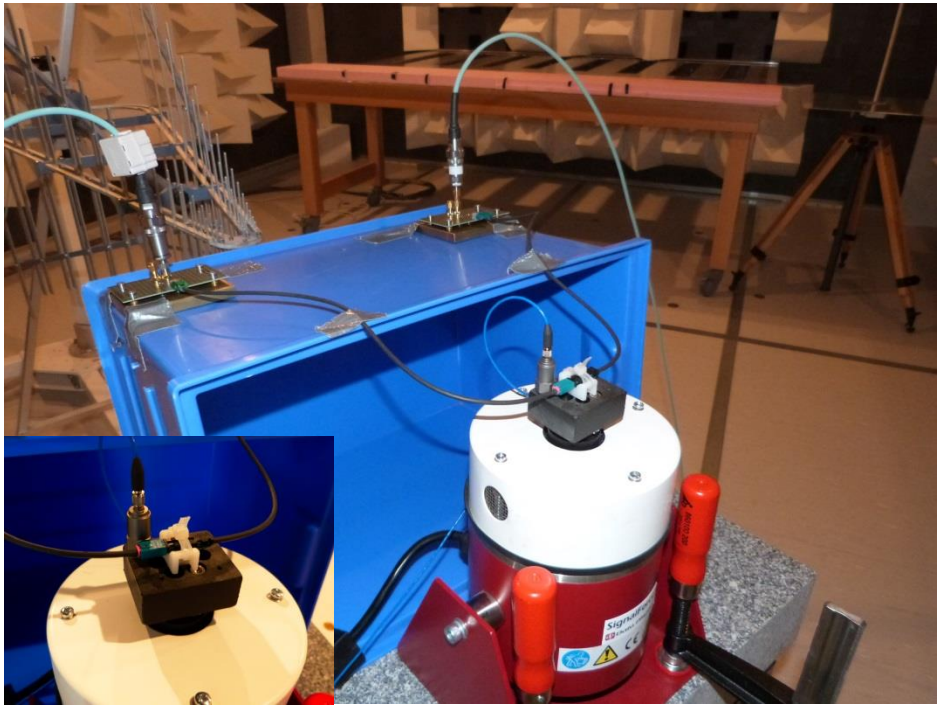
  -> sufficient to detect nano second interruptions

Connector under vibration
Measurement setup

Rosenberger

- EMC chamber due to transient interference
- Measurement fixtures SMA to MTD connector

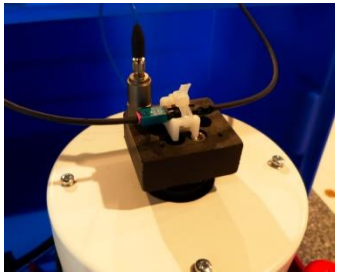


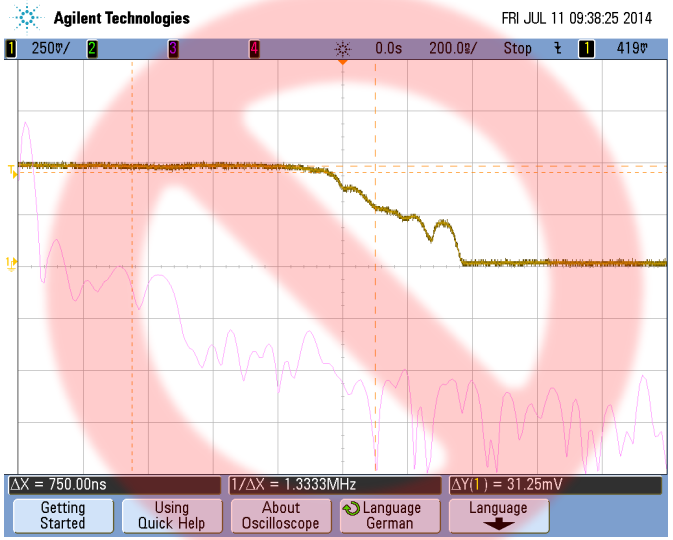


- Test over several hours in three axes according to LV-214 (severity level for watertight regions) and
- Sinus sweep with 60 m/s^2 up to 6 kHz to detect resonances

Connector under vibration
Test results

- Video of LV-214 vibration test





example of unmating process

- **No Interruptions Detected !**

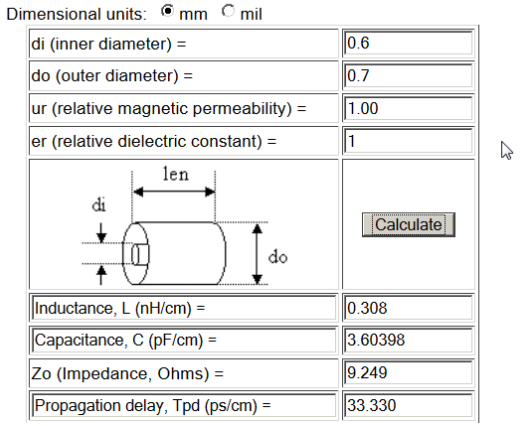
Some considerations why interruptions in the nano-second range are not an issue:

- The vibration excitation frequency spectrum is far from the length of interruptions we are looking for:

  e.g. 100 ns: f = 1 / T = 1 / 100 ns = 10 MHz

  excitation according to LV-214 goes up to max. 2 kHz

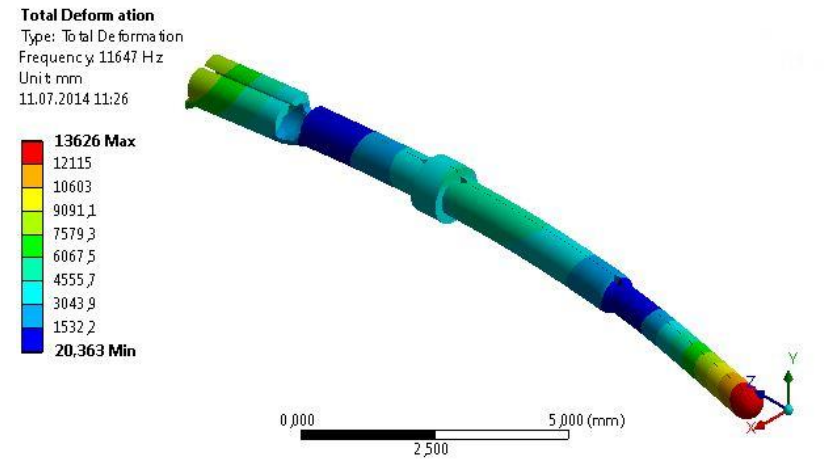
- Even if there would be an open, there is a small parallel capacitance in the interface, allowing very high frequencies to pass

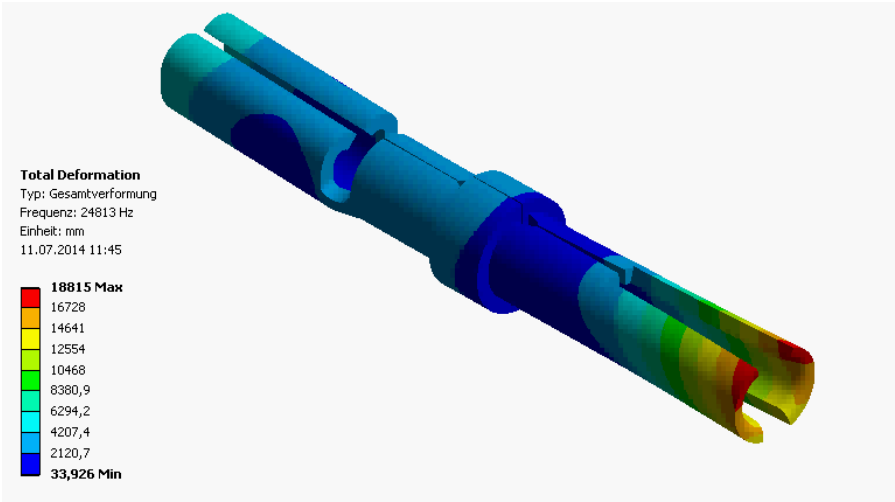


Connector under vibration
Possible reasons

Rosenberger

- Mechanical modal analysis of the contacts shows, that the lowest resonant frequencies of the single parts of the connector are above 10 kHz
- Connector provides a very good relationship between contact force, mechanical length and weight
- Within round contacts the pin will always make contact to one of the latches even if deflected from nominal position





- Within the described test scenario, no contact interruptions were observed.