TERAPOD
Workshop Demonstration
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Innovations

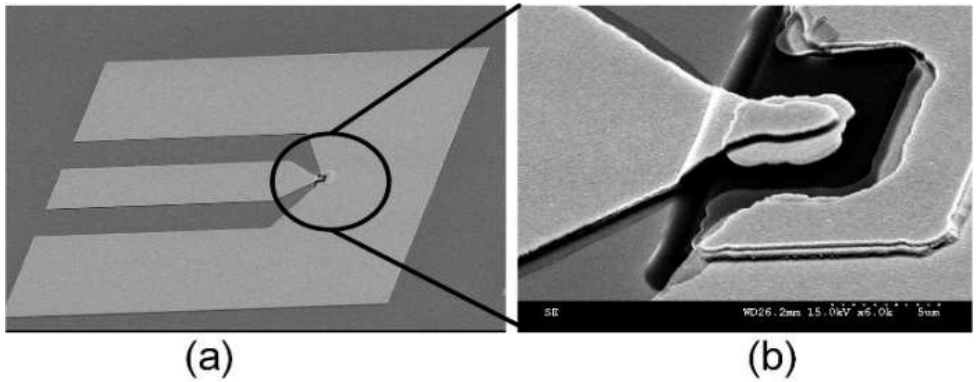
- Reliable, high power compact THz resonant tunneling diode (RTD) Tx
- High speed wireless link by using RTD Tranceiver

Sources: RTD

- RTD device technology

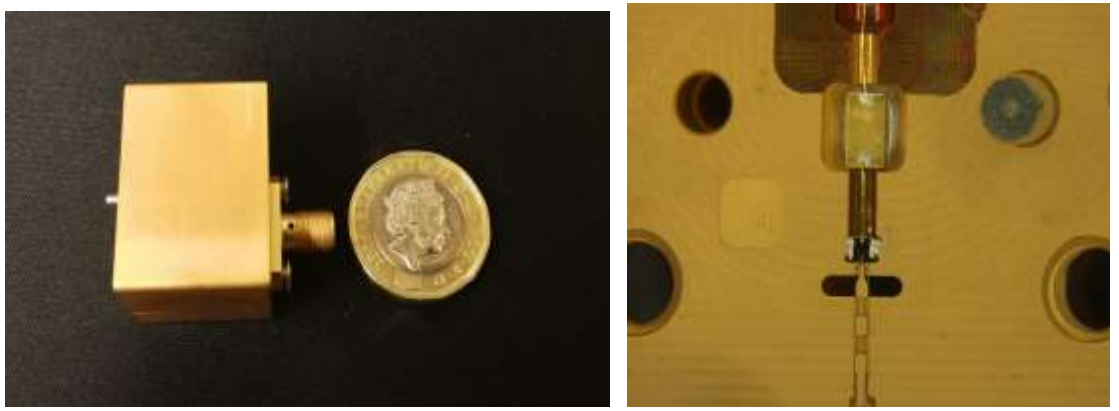
Resonant Tunneling Diode (RTD)

- Fastest solid-state electronic devices
  - 1.98 THz (0.4 μW) [1]
  - 260 GHz (1 mW), **Glasgow result** [2]



(a) Fabricated RTD device (b) The central device size is about 16 μm^2.

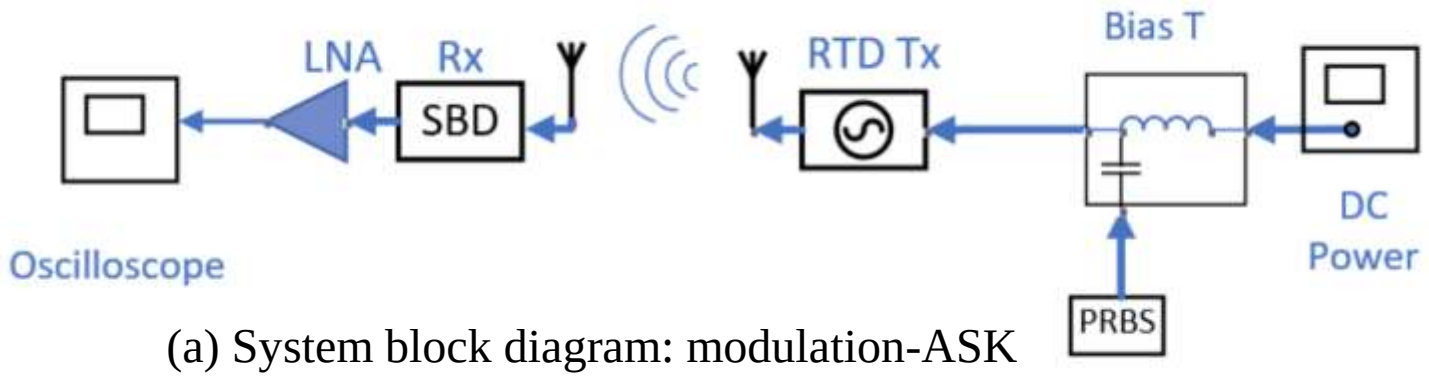
- RTD detector current responsivity can reach 300A/W.



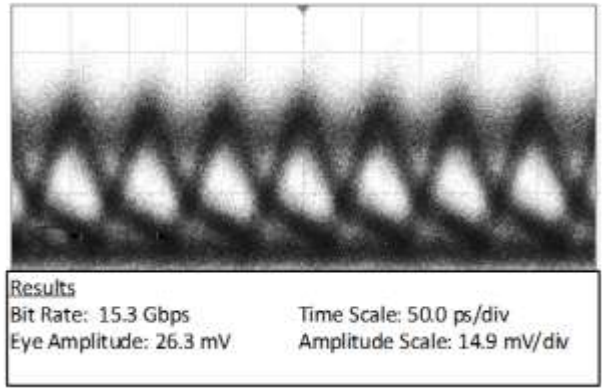
(c) W band package of RTD device (d) Inside of the package

[1] Izumi *et al*. "1.98 THz resonant-tunneling-diode oscillator with reduced conduction loss by thick antenna electrode", IRMWW-THz (2017) 17259158
[2] Al-Khalidi*, et al*, "Resonant Tunnelling Diode Terahertz Sources with up to 1 mW Output Power in the J-Band", IEEE Trans on Terahertz Science and Technology (2019)

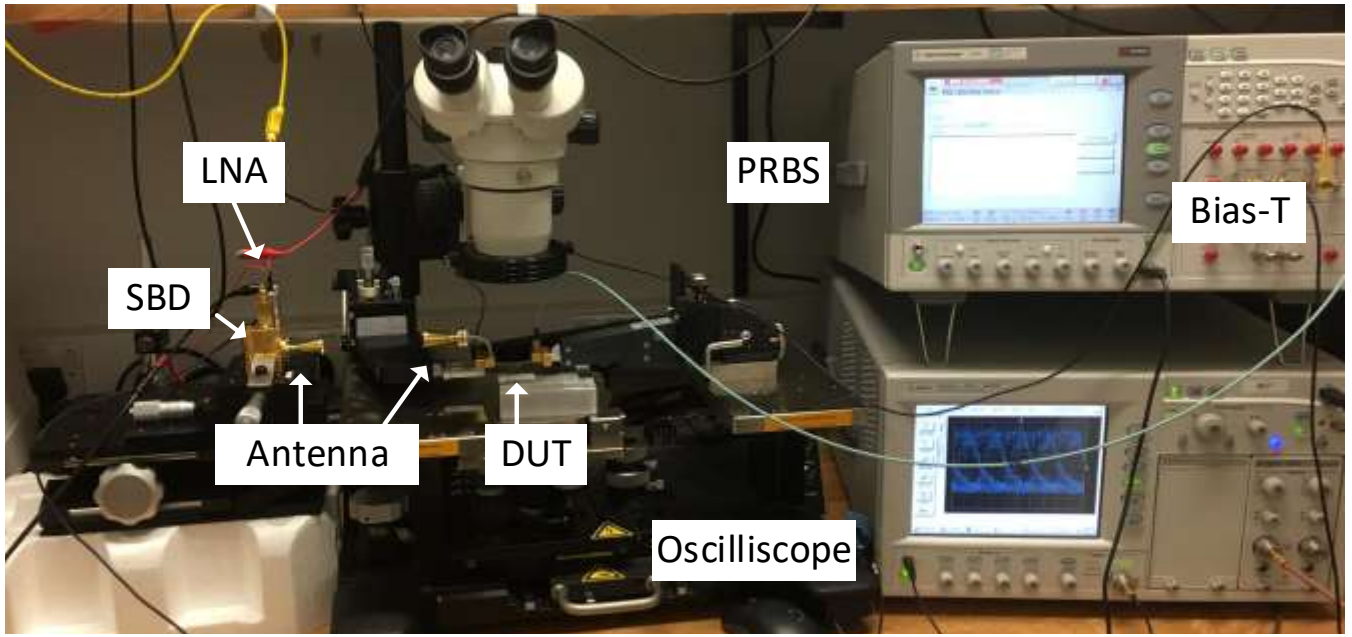
THz link level-RTD benchtop experiment



(a) System block diagram: modulation-ASK



15 Gbps; 0.5m range



(b) Lab experiment setup: W-band (@84 GHz) RTD Tx

BER
Up to 5 Gbps------1.0×10^{-6}
15 Gbps-----4.1×10^{-3}

[1] J. Wang, A. Al-Khalidi , L. Wang, R. Morariu, A. Ofiare and E. Wasige, " 15-Gb/s 50-cm Wireless Link Using a High-Power Compact III–V 84-GHz Transmitter, " IEEE Transactions on Microwave Theory and Techniques, vol. 66, no. 11, pp. 4698-4705, Nov. 2018.

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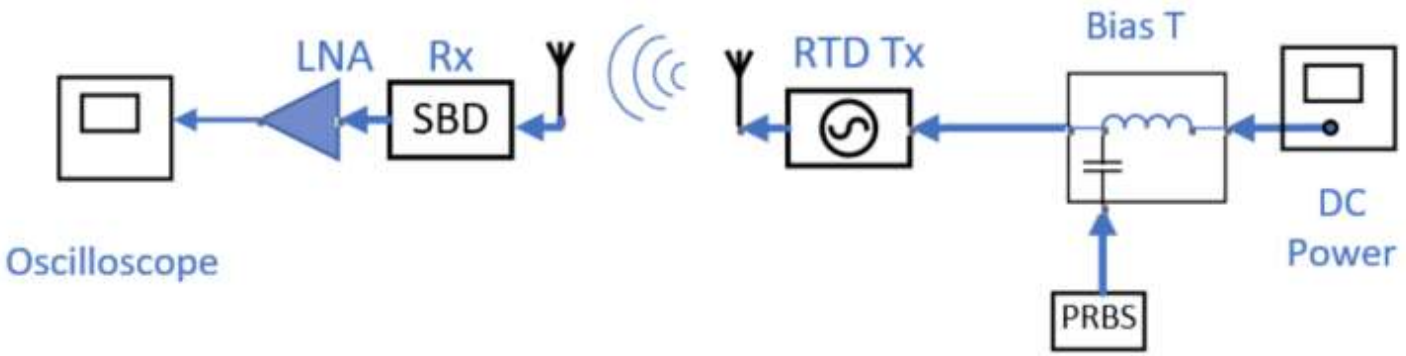
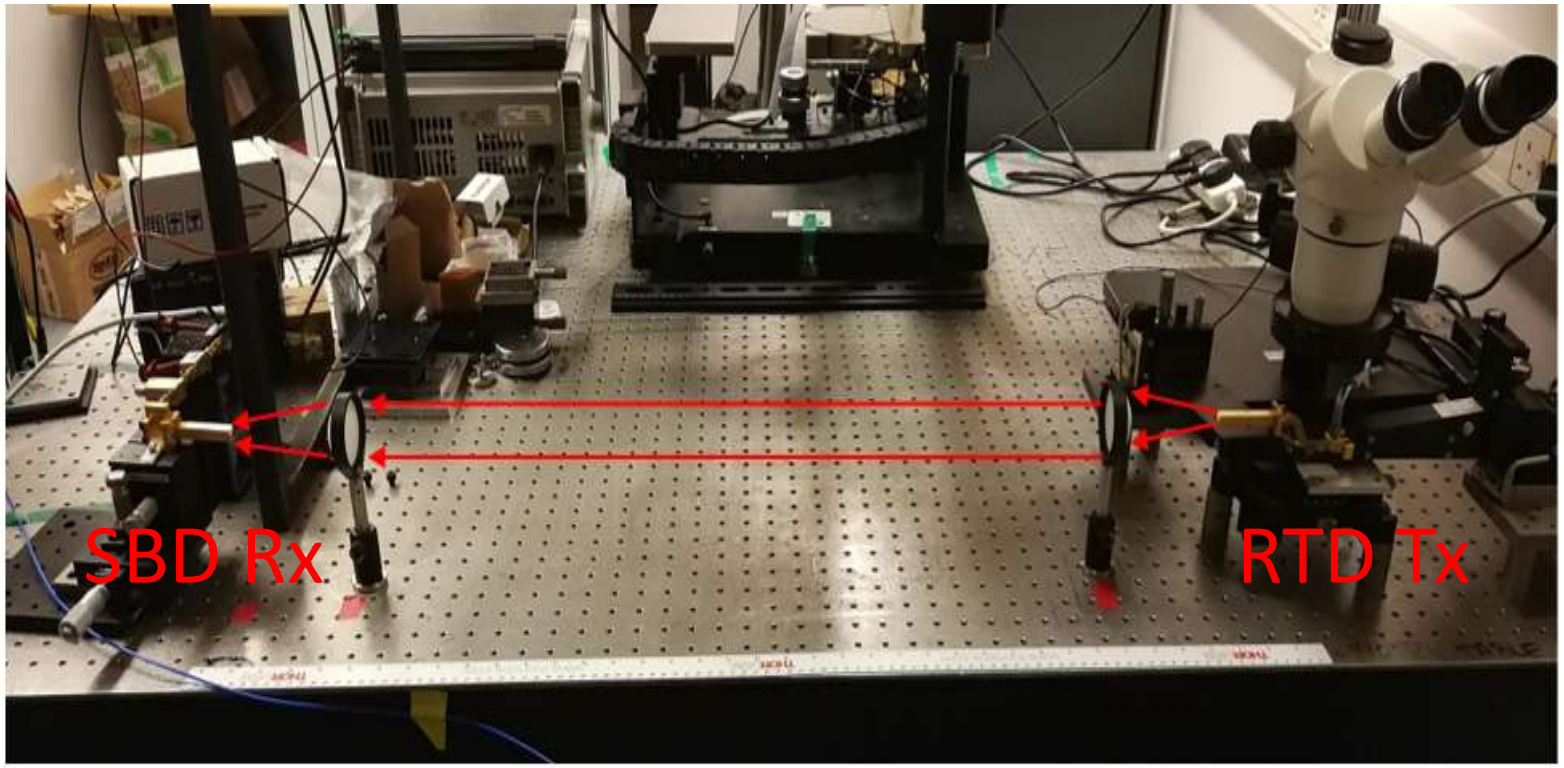
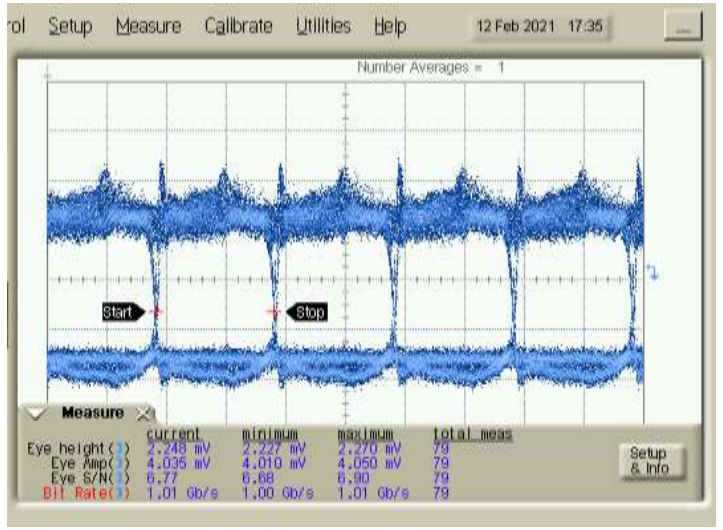
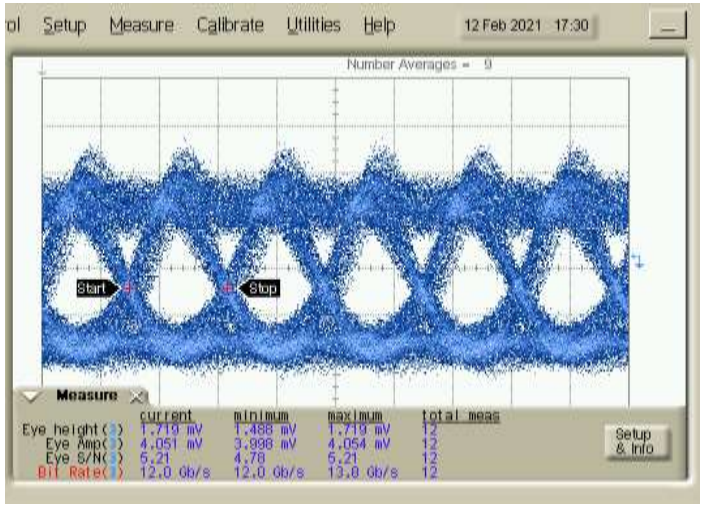
THz link level-RTD benchtop experiment-J band







1Gbps @1 meters distance (error free)



12Gbps @1 meters distance (error free)

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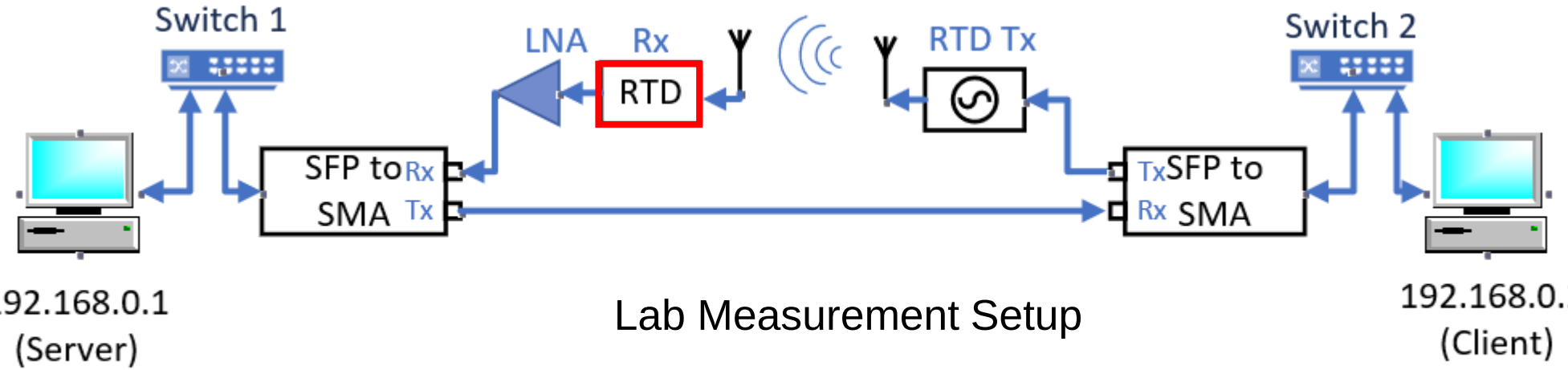
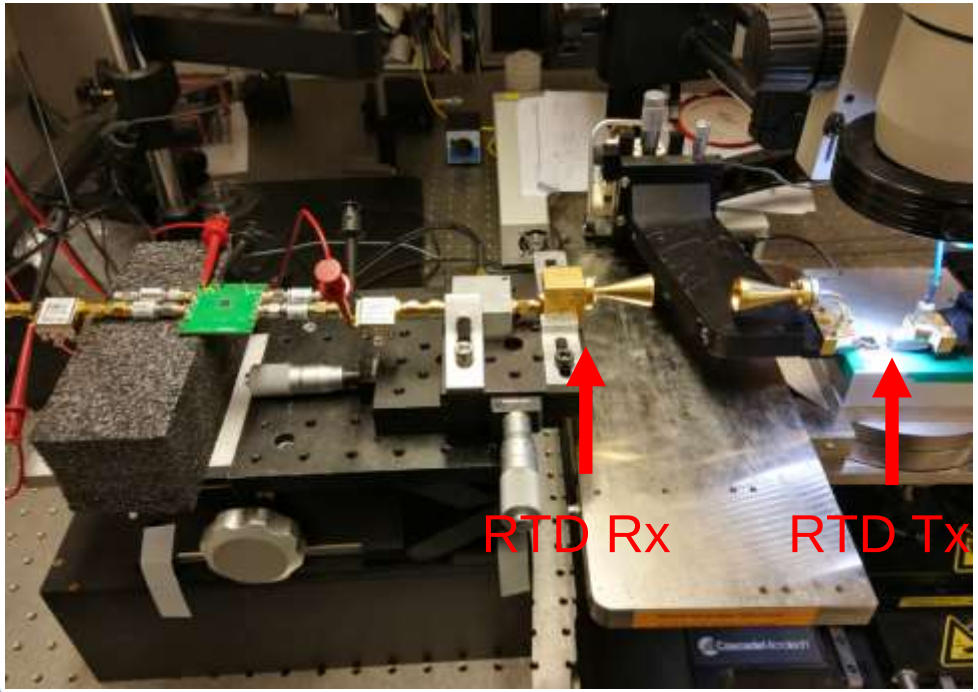
THz link level-RTD benchtop experiment-W band

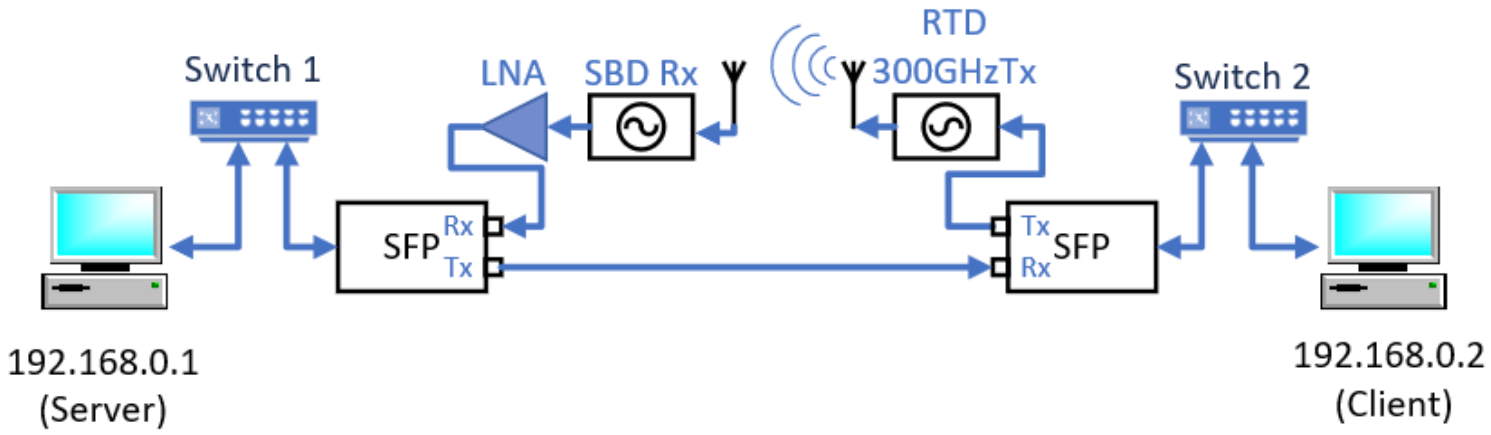


Lab Measurement Setup



Reliable (lost package<0.18%) 1Gbps wireless link (20cm) using W-band RTD transceiver was demonstrated

THz link level-RTD benchtop experiment-J band




```
Accepted connection from 192.168.3.2, port 36304
[  5] local 192.168.3.1 port 5201 connected to 192.168.3.2 port 43572
[ ID] Interval           Transfer     Bandwidth       Jitter    Lost/Total Datagrams
[  5]   0.00-1.00   sec   102 MBytes   856 Mbits/sec  0.021 ms  0/13055 (0%)
[  5]   1.00-2.00   sec   113 MBytes   951 Mbits/sec  0.107 ms  0/14506 (0%)
[  5]   2.00-3.00   sec   113 MBytes   951 Mbits/sec  0.043 ms  0/14506 (0%)
[  5]   3.00-4.00   sec   113 MBytes   951 Mbits/sec  0.112 ms  0/14506 (0%)
[  5]   4.00-5.00   sec   113 MBytes   951 Mbits/sec  0.039 ms  0/14507 (0%)
[  5]   5.00-6.00   sec   113 MBytes   951 Mbits/sec  0.107 ms  0/14506 (0%)
[  5]   6.00-7.00   sec   113 MBytes   951 Mbits/sec  0.046 ms  0/14506 (0%)
[  5]   7.00-8.00   sec   113 MBytes   951 Mbits/sec  0.115 ms  0/14506 (0%)
[  5]   8.00-9.00   sec   113 MBytes   951 Mbits/sec  0.063 ms  0/14506 (0%)
[  5]   9.00-10.00  sec   113 MBytes   951 Mbits/sec  0.115 ms  0/14506 (0%)
[  5]  10.00-10.00  sec   112 KBytes   836 Mbits/sec  0.114 ms  0/14 (0%)
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bandwidth       Jitter    Lost/Total Datagrams
[  5]   0.00-10.00  sec  0.00 Bytes  0.00 bits/sec  0.114 ms  0/143624 (0%)
```

Screenshot shows zero package loss when transmitting 1Gbps @60 cm distance.

Thankyou for your attention!

The real-time demonstration start now!

1080P60 (3Gbps 80 cm)

HD video transmission