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Submission Title: RoF-Based Terahertz Fronthaul for Mobile/Wireless Access Systems

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Abstract: The aim of this contribution is to provide configuration of Radio over Fiber (RoF) based terahertz fronthaul for mobile/wireless access systems.

Purpose: Informing 802.15.3d on RoF based terahertz technologies for fixed point-to-point link.

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RoF-Based Terahertz Fronthaul for Mobile/Wireless Access Systems

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New Elements of this Contribution

At the last IEEE802.15 meeting, the technologies of fronthaul for broadband mobile/wireless access systems were proposed using Radio over Fiber (RoF) (doc.: IEEE 802.15-0177-02-003d).

Newly developed elements for this contribution are as follows:

- Technical parameters of 300GHz-band high-gain antenna for THz transmitter.
- Block diagram of THz transmitter using Optical Sub-Harmonic IQ Mixer (O-SHIQM).
- Theoretical transmission distance of THz transceiver using high-gain antenna.

Definition of Fronthaul at ITU-T

3.2 Terms defined in this Supplement

This Supplement defines the following terms:

3.2.1 Mobile backhaul (MBH): *The connection among base stations and the other mobile network nodes*

3.2.2 Mobile backhaul link: *A link to establish a mobile backhaul*

3.2.3 Mobile fronthaul (MFH): *The connection between one and the other of separated radio transceiver functions within a base station*

3.2.4 Mobile fronthaul link: *A link to establish a mobile fronthaul*

Reference: “Proposal of definition of “mobile fronthaul” in G Suppl. RoF”, ITU-T Q2/15 Interim Meeting, D72, February 20, 2014.

Definition of Fronthaul at ITU-T

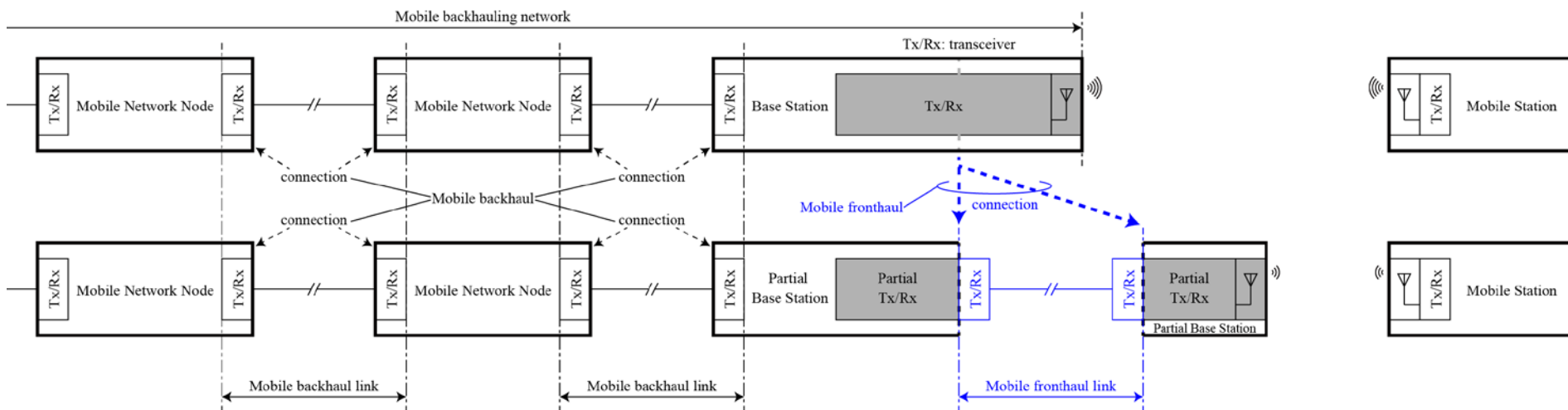
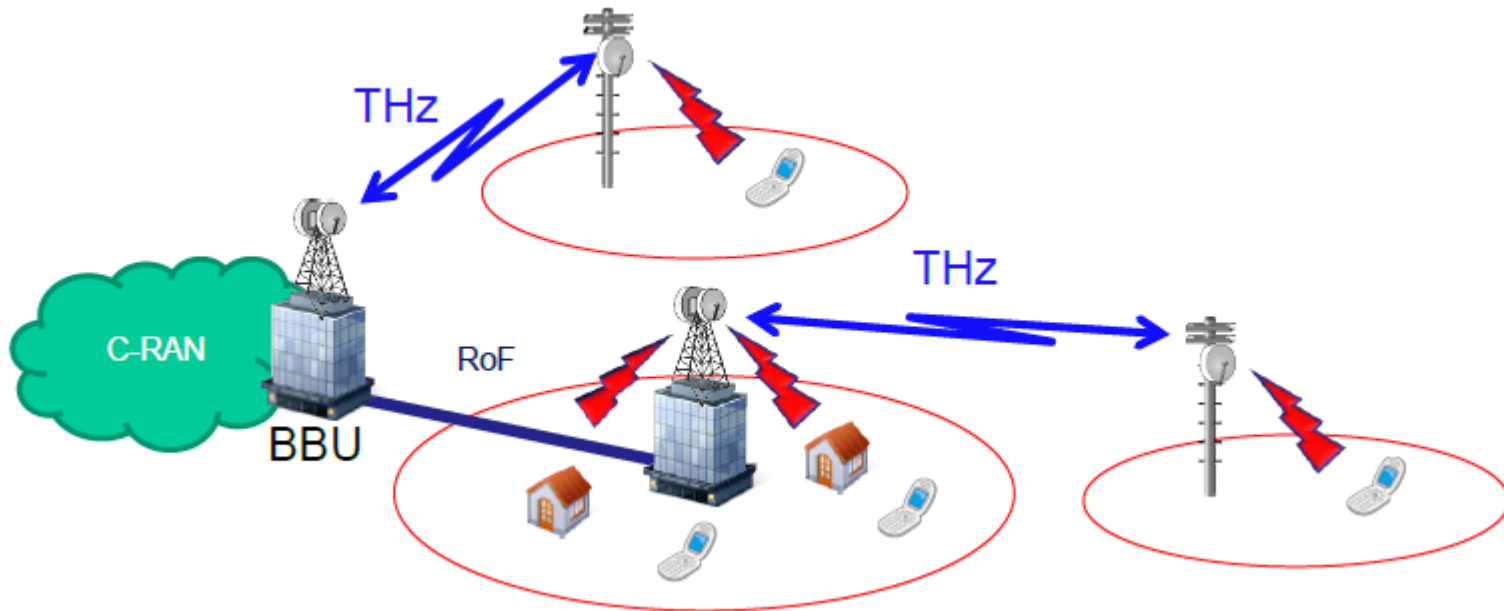


Fig. 2: Definition of “mobile fronthaul (MFH)” and “mobile fronthaul link”: (upper) conventional architecture, (lower) possible architecture with mobile fronthaul.

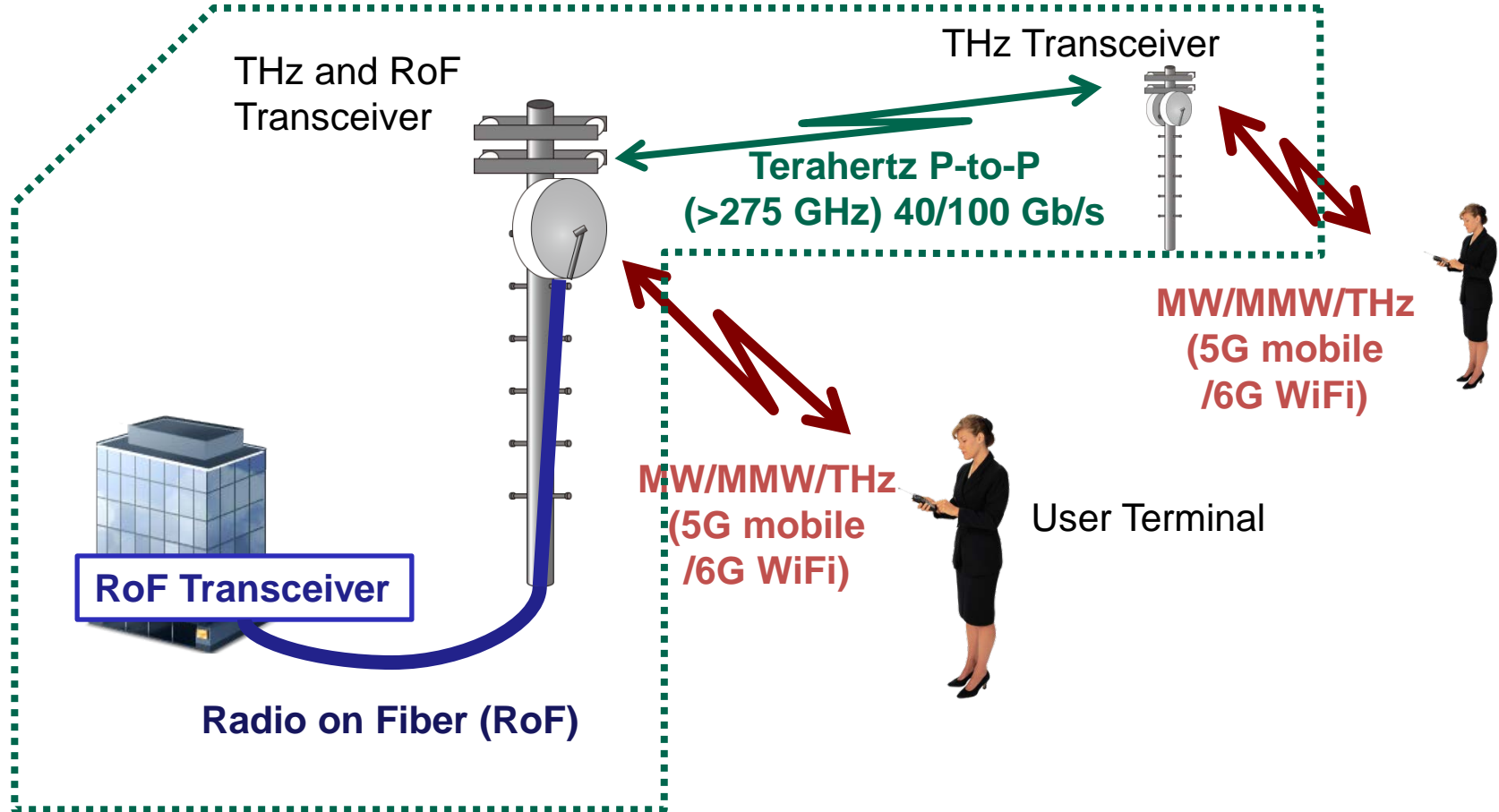
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Mobile/wireless access networks using RoF-based Terahertz Fronthaul



RoF-Based Terahertz Fronthaul

Base Station



Block Diagram of Fiber-Connected THz Transmitter

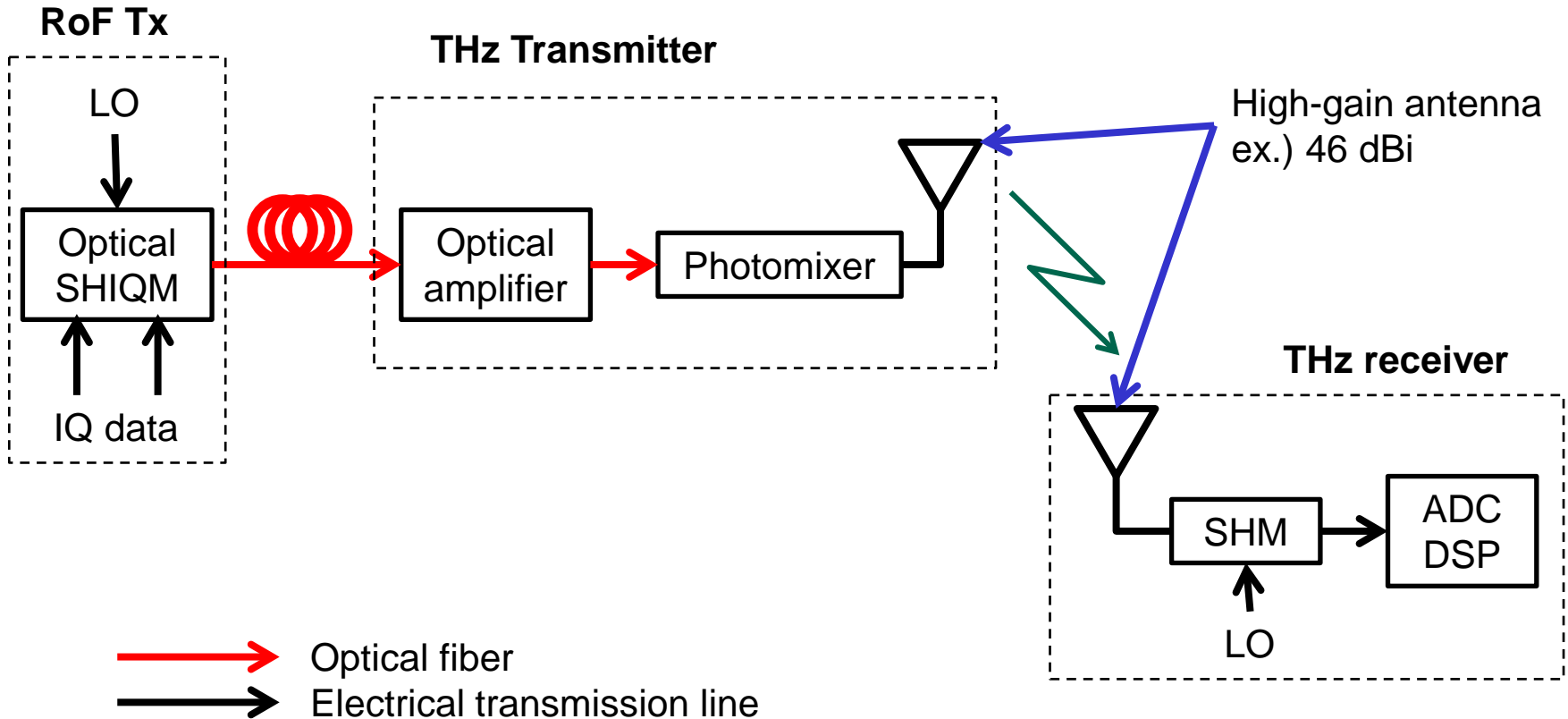
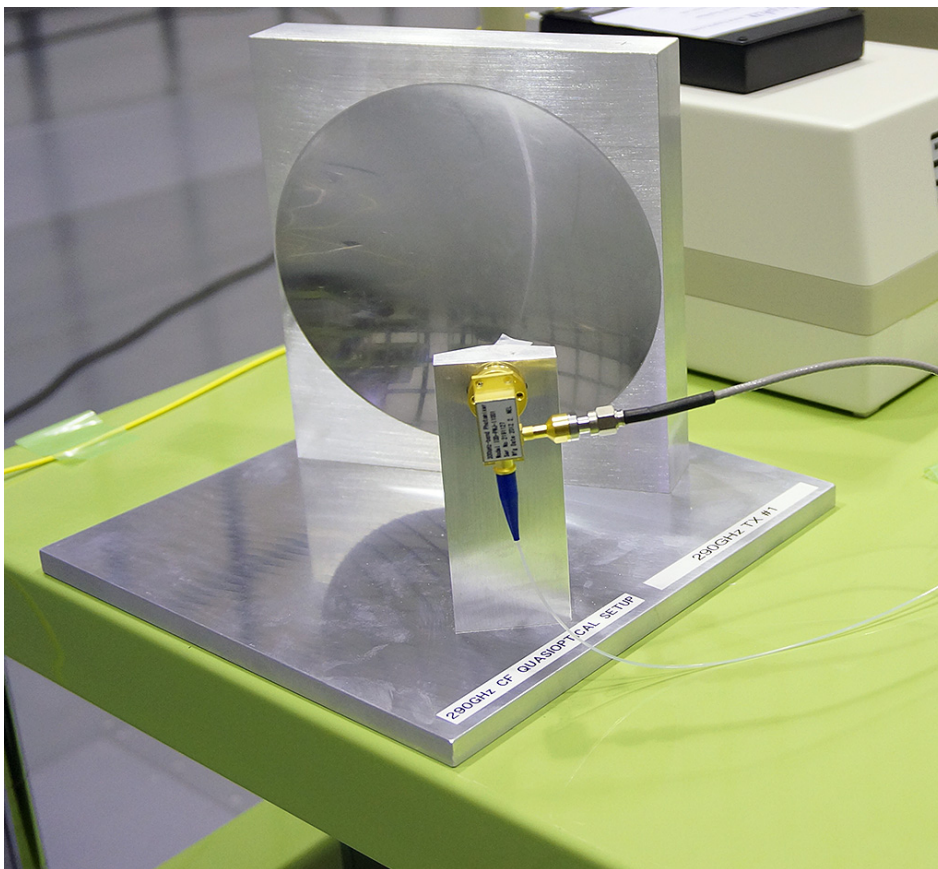
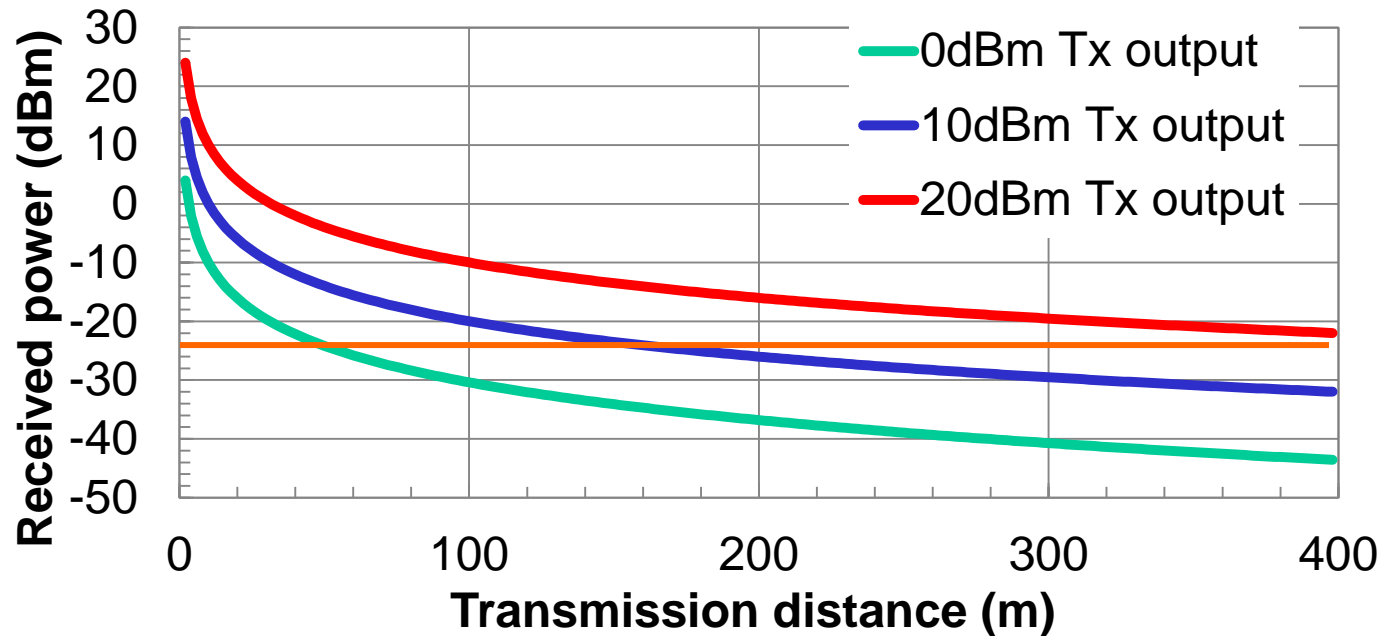


Photo of High-Gain Antenna for 300 GHz



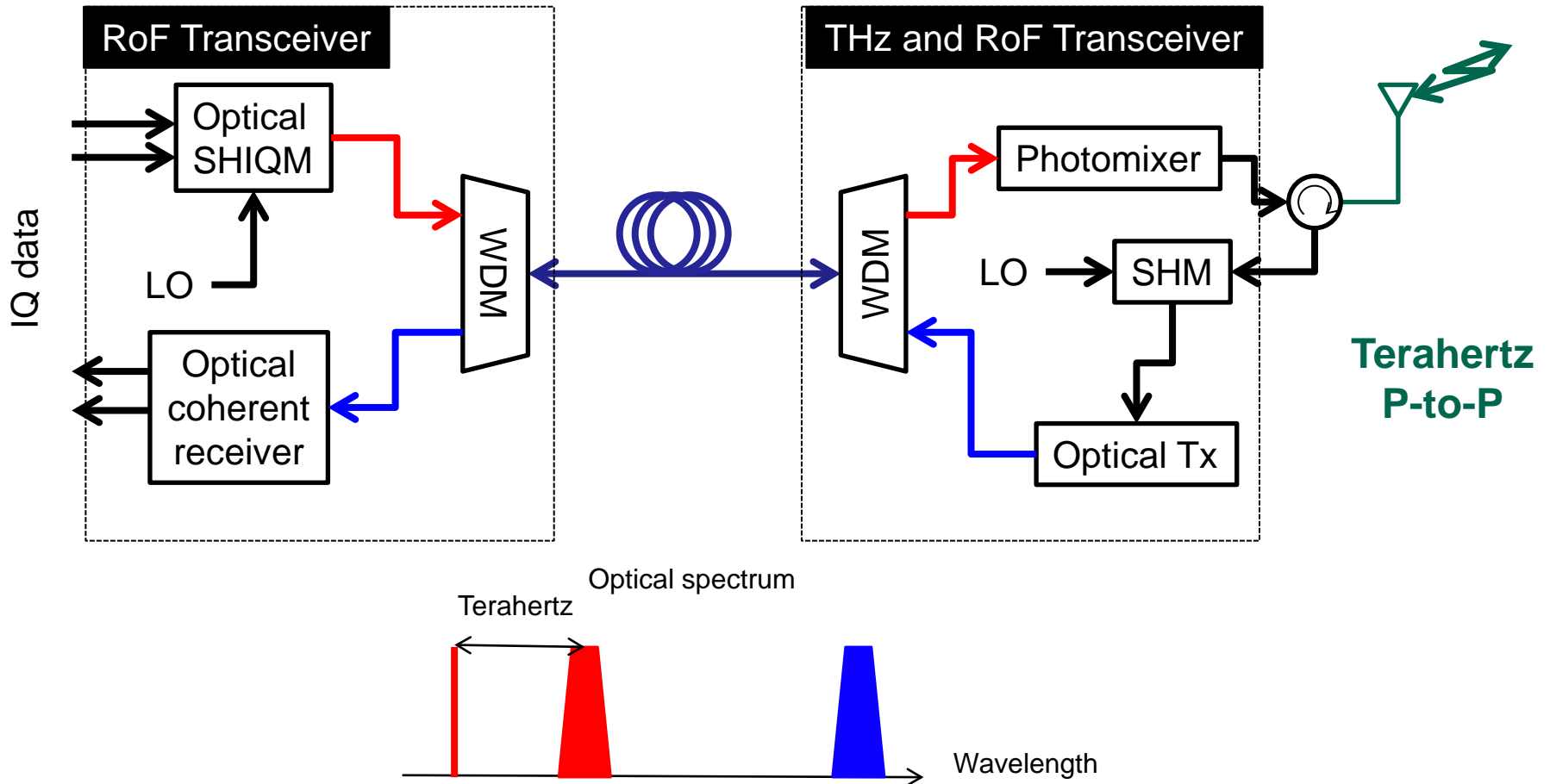
Offset parabolic antenna
Gain: 46 dBi@290 GHz

Estimated Transmission Distance using high-gain antennas (46 dBi)

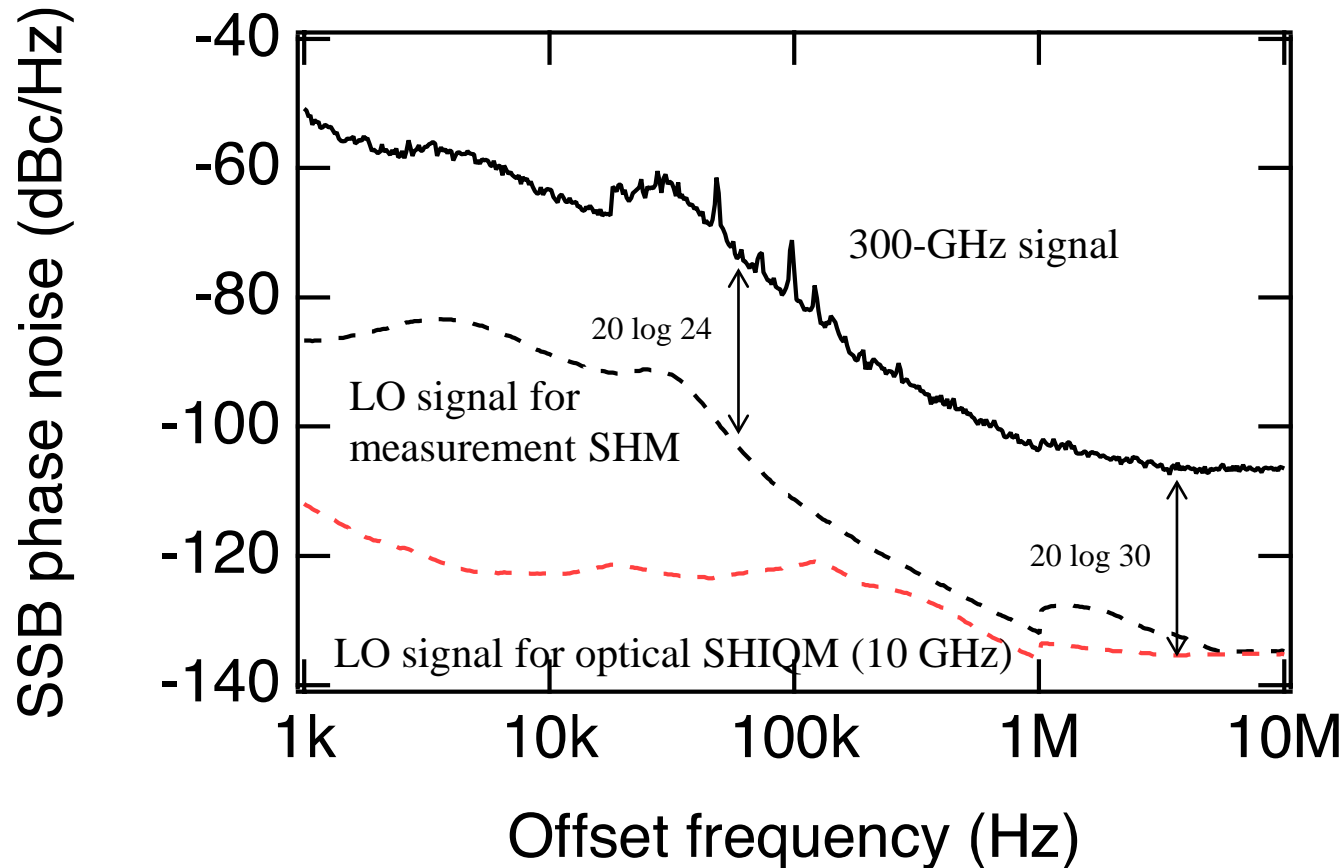


When the sensitivity was -25 dBm (corresponding photocurrent of 3.5 mA) in doc.:IEEE802.15-13-0653-00-0thz, possible transmission distance with 10 dBm output is approx. 150 m under atmospheric attenuation coefficient of 4 dB/km.

Block Diagram of Base Station



Observed SSB phase noise of 300-GHz sinusoidal signal using O-SHIQM*



SHIQM (Sub-harmonic IQ Mixer) was presented in the document: IEEE 802.15-14-0022-00-0thz

Summary and Discussion

- RoF-based terahertz fronthaul for broadband mobile/wireless access systems is proposed again using definition adopted by ITU-T SG15 Q2 meeting held on February 20, 2014..
- The THz radio transceiver functions of base station are connected through optical fiber cables.
- Optical sub-harmonic IQ mixer using Radio over Fiber technologies has a potential to transmit and distribute high-speed modulated THz signals to THz transceivers.
- Relatively large transmission of 300-GHz frequencies over 400 m is feasible using high-gain antennas.