

Side-band Injection-Locking

60 GHz

Optical 60 GHz signal generation using side-band injection-locking of semiconductor lasers

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Abstract

Optical 60 GHz millimeter-wave (MMW) signal generation is demonstrated using side-band injection-locking method in the master/slave configuration, where two slave lasers are locked to two of the sidebands produced by the direct rf-modulation of a master laser. These two locked slave laser outputs beat each other in the photo-detection and produce the stable and very pure 60GHz signal.

microwave 가 side-band target
가 side-band
가 millimeter-wave band 2-(b)
(MMW) (SL; slave laser)가 lock SL
Intelligent Traffic System, Indoor Wireless 가 MMW
Communication, Remote Antenna, Beam Forming 가 MMW
carrier ML sideband
가 , , lock SL photo-detection beating
가 MMW electrical spectrum
fiber-optic MMW 가
가 [1-2]. MMW .
base station 가 2-(a) ML 10GHz (f_m) rf-source
가 가 peak 가 f_m optical spectrum .
가 center ± 3 peak SL
heterodyne , 2-(b) peak
sideband injection locking ML , f_m 6 60 GHz가
60 GHz .
MMW 1-(a) , 1-(a) rf-
master laser (ML) MMW sub- spectrum analyzer (RF-SA) 가
harmonic intensity 40 GHz , 1-(b)
modulation , frequency modulation Mach-Zehnder Modulator (MZM)
, 2-(a) ML photonic down-conversion

MZM 12 GHz
 conversion , 3
 36 GHz
 rf-spectrum
 analyzer resolution
 power fluctuation ± 0.5 dB

, side-band optical injection-locking
 MMW

Reference

- [1] L. Goldberg *et al.*, Elec. Lett.-19(13), 1983.
- [2] R.-P. Braun *et al.*, Elec. Lett.-32(7), 1996.

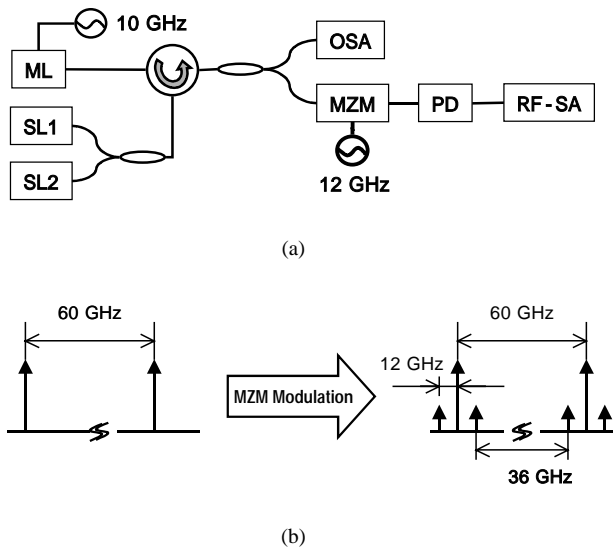


Fig. 1. Experimental setup (a) and photonic down-conversion via Mach-Zehnder modulator (b)

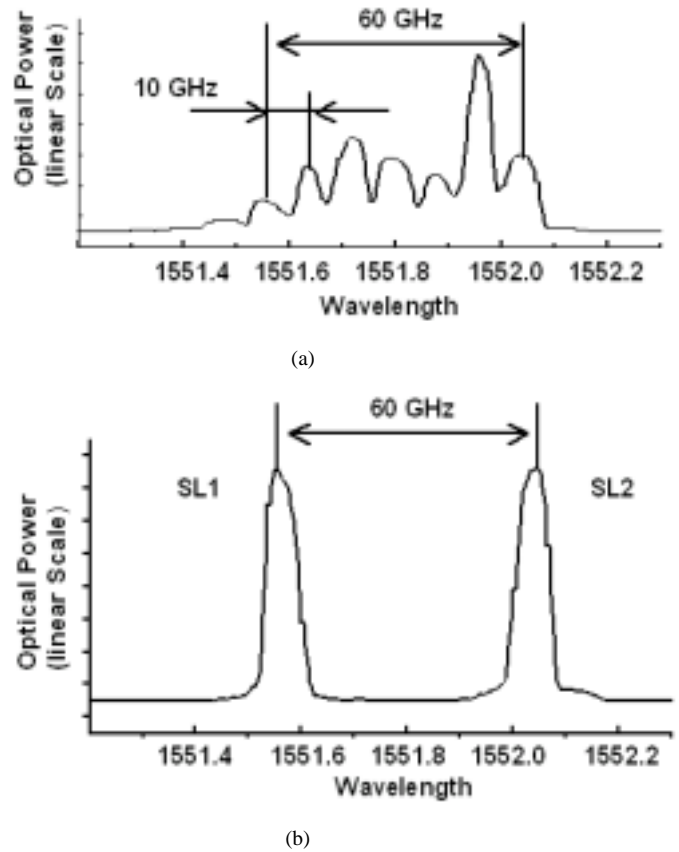


Fig. 2. Measured optical spectra. Direct-modulated ML (a) and two locked SL's (b)

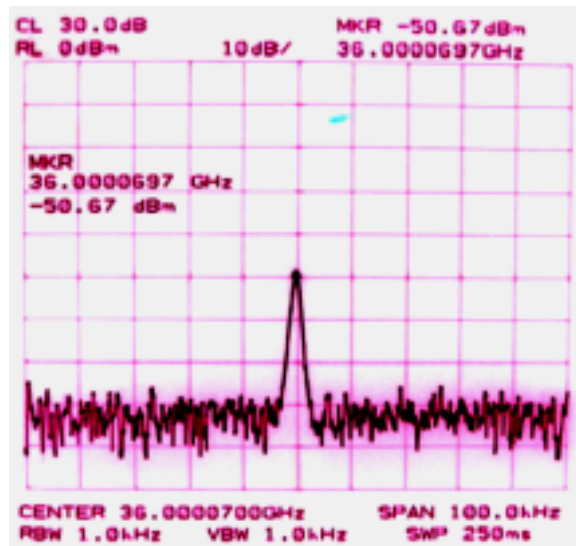


Fig. 3. Measured rf-spectrum of 60 GHz signal after photonic down-conversion by 24 GHz (see Fig. 1-(b)).