Extended Abstracts of the 1992 International Conference on Solid State Devices and Materials, Tsukuba, 1992, pp. 226-227

Microwave-Light-Microwave Transformation in Optical Line Based on Magnetooptical Modulator

Y.K.Fetisov, A.A.Klimov, V.L.Preobrazhensky
Moscow Institute of Radio Engineering, Electronics & Automation Vernadskogo 78, 117454 Moscow, Russia

Microwave-optical transmission lines are of greit interest now for their application in high-speed communication systems as well as in different microwave systems. Recently, at the previous SSDM Conference [1], we described some planar micromave magnetooptical modulators, based on waveguide-light (WL) interaction with magnetostatic waves (MSW) in ferrite films. which may be used in such transmission lines.

Herein we report on the realization of complete microwave-light-microwave transformation in optical line consisting of a semiconductor laser, a planar magnetooptical modulator and a semiconductor pin-diode. Tne modulator using collinear WL-MSW interaction was made on 8.7 mkm thikness yttrium-iron-garnet (YIG) epitaxial film. Tne solid-state GaAs-laser of 2 mW output power and 1.3mkm wavelength surved as a light source. Surface MSW were excited by a 100 mW power microwave signal in the f=3-5 GHz frequency range. A specially selected high-speed pin-diod, those frequency response is shown in Fig.1, was used for optical signal demodulation.

The input light beam coupled into the ferrite film was splited to three optical modes : incident TM-mode, TE-mode caused by a statical Faraday effect without any frequency shift and TE-mode created by a dynamic Faraday effect. The third one had a frequency modulation equal to the MSW frequency. Statically and dynamically transformed modes were collinear and quite similar as the modes of one TE-type. Two these modes were combined and intefered on the pin-diode window thus prowiding the conversion of frequency modulation to amplitude light modulation. As a result of a heterodyne effect a microwave signal appeared at the diod output.

Fig.2 shows the dependence of the diode output signal on microwave frequency f when Bragg conditions for WL-MSW interaction are satisfied (curve 2) and in the absence of microwaves (curve I). The transmission bandwidth obtained was equal to 20 MHz and signal to noise ratio was approximately 5 dB. Both these values may be improved sufficiently by using Bi-doped YIG film in modulator or by including of light amplifier in the transmission line. The operating interval of this line may practically reach 3-10 GHz.

1. Y.K.Fetisov,A.A.Klimov,V.L.Preobrazhensky. Extended Abstracts of SSDM'91, P.347-349.

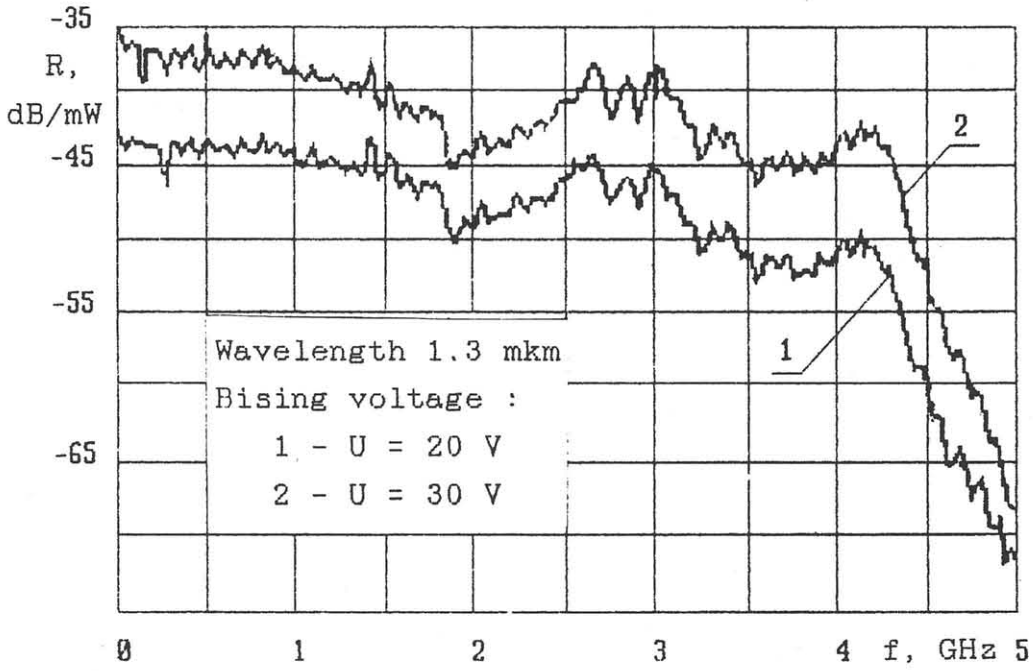

Fig.1 Frequency response of pin-diod.

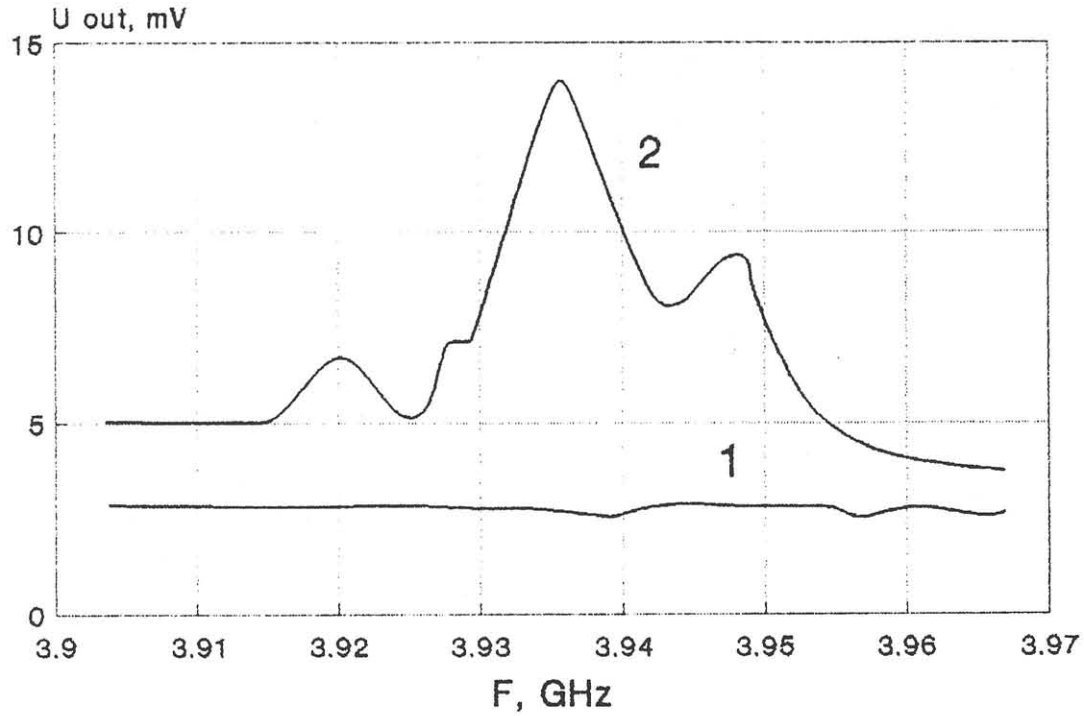

Fig 2. Frequency response of transmission line.