Measurement of a lightwave antenna and its application to a MEMS antenna

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Lightwave antennas shown in Fig. 1 are required in inter-satellite communications, laser radars, and optical data processing systems. The compatibility of lightwave antennas to a system should be specified by antenna parameters: radiation pattern, matching or reflection coefficient, antenna gain, etc. Conventional telescopes are designed to achieve imaging without distortion or to focus obliquely incident and off-axis rays to specified narrow regions. Such optical instruments are sometimes difficult to satisfy system requirements. On the other hand, the measurements of lightwave antennas are quite different from those of microwave antennas due to short wavelengths.

This paper describes the way of measurement as for the far field radiation pattern (FFP), gain, and the transitivity of small iradiated portions. Radiation patterns in the microwave region are measured at a far distance, or measured at a near distance and then converted to FFP. As the measuring distance is limited in a laboratory or even outdoors due to the turbulent atmosphere, the Fourier transform method as shown in Fig 2 is more suitable in the lightwave region. The equivalence of FFP to the focal region distribution will be clarified on the basis of diffraction theory.

The antenna gain is measured by comparing its received power with that of a reference antenna whose gain is known. In the microwave region, the reference antenna is a half wavelength dipole or a standard horn depending the gain of AUT. But in the lightwave region, those reference antennas are not realized at the moment, and unsuitable for the an AUT with much gain. Instead, an aperture antenna with a uniform field distribution is suitable as a reference antenna. The measurement method will be described.

As a lightwave antenna was manufactured using MEMS technologies as a trial, the above-mentioned measurements have been applied. The experimental results will be also presented in this paper.

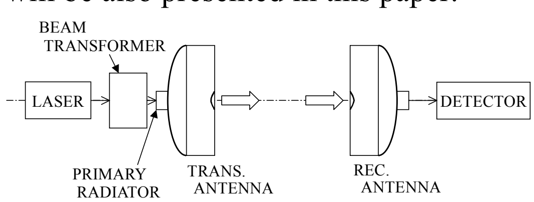

Fig.1 Lightwave communication system with lightwave antennas.

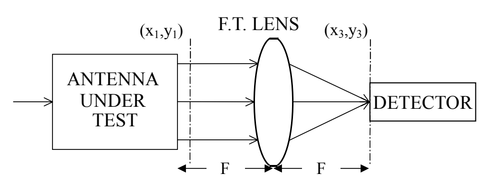

Fig. 2 Far field measurement with a Fourier transformation lens.