CIRCULAR POLARIZATION ANTENNA FOR CW V-BAND RADAR

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Abstract

Practical realization of the circular polarization antenna for CW V-band radar is described.

Keywords: Antenna, radar, orthomode transducer, circular polarization.

1. INTRODUCTION

Millimeter wave CW radars are used extensively in such systems, as velocity measuring instruments, level gauges, tunneling machinery working in dust or vapor conditions, metal teeming equipment, etc.

Interrogation signal of circular polarization allows to minimize the handicapes caused by surrounding objects and is especially effective at work in a rain. CW radar antenna design meets some difficulties. Modern mm-wave ferrite devices frequently do not provide a demanded level of isolation. It forces to use separate aerials for Tx and Rx ports [1].

2. MAIN PART

The aim was to develop the antenna system of circular polarization with an isolation between orthogonal channels at least 10dB better, than V-band circulator. The aerial is intended for a muzzle velocity radar with the common antenna for Tx and Rx channels.

The aerial is constructed under the two-mirror scheme with shifted focal axis of main reflector and elliptic moving line of subreflector [2] The pointed shape of a subreflector provides a small natural level of reflections and, as consequence, the good matching with a horn source.

Due to more uniform aperture field distribution antenna has a little bit greater aperture efficiency in comparison with classical Cassegrein design, at the same time a level of aperture sidelobes is a little bit grater. It is possible even to consider the last factor useful as at stand-alone use of muzzle velocity radar the axis of the main lobe of antenna pattern does not coincide with a plane of shooting, measurements on an initial site of a trajectory happen on lateral radiation.

Antenna layout is shown in Fig.1

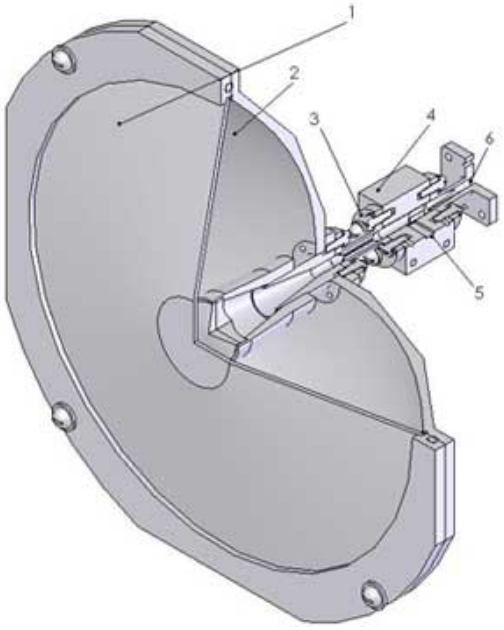

Fig. 1. Antenna section 1-radom; 2-main reflector; 3- polarizer; 4 – orthomode transducer; 5- Rx port; 6- Tx port.

At appropriate quality of manufacturing the orthomode transducer's isolation may be better than 35 dB in a few percent bandwidth with the round waveguide loaded with matched termination. However it is not enough, as any reflection in antenna feeder behind a polarizer is parasitic and after double wave mode transformation by polarizer comes back not in the Tx port, but in the Rx port. Therefore, the special attention is given to questions of antenna matching, and also to nonreflecting radom design.

The basic characteristics of the antenna:

- main reflector diameter 160 mm;
- Gain 38 dBi;
- main lobe half power beamwidth 2 deg;
- circular polarization axial ratio 0,2 dB max;
- Rx & Tx ports isolation 28 dB min;
- fused quartz textile epoxy composite radom loses 0.3 dB max.

3. CONCLUSION

Antenna has passed successful tests as a part of muzzle velocity radar system (Fig.2).

Fig. 2. Muzzle Velocity Radar System

REFERENCES

1. Detection Radar Systems. Ukrspetstechnika. http://ust.com.ua/main.php?mode=rls&lang=eng&f=1
2. I.L. Lee, "Improvements in or relating to microwave aerials," *U.K. Patent. 973 583*, Oct. 1964.