Radar Sensor in MM Wave Band for Farm Tractors

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Abstract–**The development of the sensor on the base of coherent radar for measuring of absolute velocity of farm tractors is discussed. The structural scheme, components design and data of the full-scale test are also presented as well as the recommendations concerning use of the sensor.**

Keywords–**radar, vehicle, Doppler frequency, spectrum**

I. Introduction

Improving of farm tractor efficiency is quite **topical** for agriculture in Ukraine. Our approach is intended to improve accuracy of farm tractor speed measurements, which permits to enlarge the productivity and fuel economy.

The problem is the subsidence of the soil under tractor wheels and it slippage that leads to large errors of speed measurements by traditional speedometer.

Therefore the development of contactless speedometer on the base of coherent solid state radar is of great **interest**. This will allow to optimize operation of the vehicle, which is important for economy of fuel and provide constant vehicle speed lead to **accuracy of sowing and spraying** in agricultural work.

II. Experimental Study

Radar speedometer was built on the base of well known scheme of homodyne transceiver which used IMPATT generator at 8 mm band. The transceiver uses mixer diode with point contact and rectangular horn as an antenna. The receiver bandwidth is about 2 kHz and power radiated is not less than 12 mW. Antenna gain is equals 21 dB, ADC used has 12 bits and the signals received were recorded on the digital device.

General view of the tractor unit with a sensor installed on the front of the frame is shown in Fig. 1.

Fig. 1. General viev of the tractor unit with a sensor

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The radar set is shown in Fig. 2, which includes power supply with the main amplifier, transceiver, cable that provides DC supply and the signal received as well as mounting device.

Fig. 2. General view of the radar set

The inclination angle varies in the range 30-80 deg and plane polarization is fixed in vertical and horizontal planes. As a result of the field experiments, we measured the spectral characteristics of signals reflected from a surface of various types, including: dirt roads, farm fields and etc. In Fig. 3 an example of the Doppler spectrum of the signals reflected is shown, which allows to calculate the average speed of the unit.

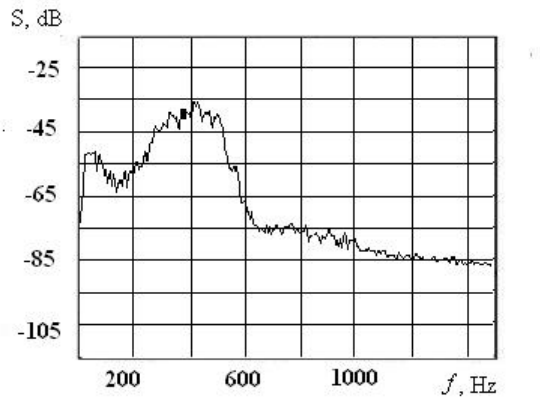

Fig.3 Doppler spectrum of the signals reflected from dry field

In the paper the data of field experiments is discussed and the recommendation concerning sensor application is made.

III. Conclusions

As it was shown the spectrum characteristics depend on peculiarities of the tractor movement, type of the underlying surface and the inclination angle of the radar antenna and polarization plane.

References

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