IMPACT OF HELICOPTER DESIGN ON RADIATION PATTERN OF ITS ATNENNAS

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This paper considers as the helicopter body affects directional characteristics of antennas. The article takes into account the effect of antenna position to achieve the best results in terms of antenna performance. It examines the possibility of measurements on scale models of aircraft, Mi-8 model in 1:20 scale. To obtain reliable results of measurement we are using depolarization panel. This article contains three measurements, two measurements with different positioning of measuring antenna and a separate measurement of the antenna as a standard of measurement. An interesting result is significant loss in specific settings of the measuring antenna. The results obtained to better understand the impact of the shape of a helicopter fuselage on transmission characteristics of antennas. Achievements of the thesis can be considered for future adjustment mounting of antennas and their better possible configuration in order to achieve higher performance.

K e y w o r d s: helicopter, model, tail, antenna

1 INTRODUCTION

At present knowledge of the actual shape of the directional characteristics of antennas placed directly on the question of the aircraft avionics radio systems, which ultimately has an impact on flight safety. Another important factor is understanding the impact of the fuselage beam antennas which in the past often asked question is how best to spread the important antennas on aircraft that are of the highest performance and negate each other. This problem resolved knowledge directional characteristics of the antenna in relation to the shape of the fuselage.

Directional characteristics of the real aircraft is in some cases very difficult and sometimes impossible to measure, due to the complexity of the measure and the need for handling aircraft such as the flip belly up to measure the antennas mounted on the bottom of the aircraft. Therefore, at present, most of these measurements carried out on scale models of aircraft in different scales.

In this paper, I will take special case measuring radiation characteristics of antennas and to measure the scale model helicopter Mi-8 in 1:20 scale and at different distribution of antennas on the tail of the helicopter.

2 WORKPLACE

Attenuation chamber is not used, the measurement is made in the classic laboratory. The measured results, however, have sufficient information value for technical purposes and we have achieved very satisfactory results. The workplace configuration (Figure 1) is as followed: model and transmitting antenna is the centre of the panel away depolarization model 200 cm and a transmitting antenna is at a distance of 160 cm from each other. Due to the separation of the transmitting antenna and the model it was necessary to place a metal shield between them to prevent their mutual relation.

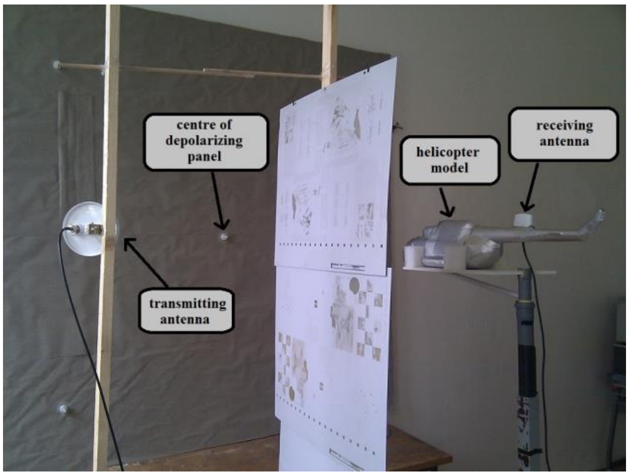

Figure 1: Workplace configuration

3 MEASUREMENTS OF THE IMPACT

This chapter describes the implementation and results of the measured antenna patterns on a scale model of helicopter Mi-8 feed. The aim was to evaluate the radiation characteristics of the antenna at its mounting in two positions on the tail of the helicopter model. From this perspective, reflect the impact of changes on the fuselage helicopter characteristics. One measurement was made with an antenna fixed to the top of the tail of the helicopter and the second measurement was with the antenna fixed to the bottom of the tail of the helicopter. Great emphasis was placed on taking the necessary administrative and fixed mounting the antenna on the tail of the helicopter, aerial edge should be flush with the base antenna that is an integral part of the tail to avoid distorted results.

Measuring antenna was tuned to 2.4 GHz frequency and thus it meets the requirement of reduced rates of our model helicopter which is reduced in scale 1:20. We assume that the antenna on a real helicopter Mi-8 operates at a frequency of 120 MHz. Measuring antenna for 2.4 GHz frequency band is shown in Figure 2.

Figure 2: Measuring antenna for 2,4GHz

There were three measurements:
- measurement of antenna fixed on the helicopter tail
- measurement of the antenna under the tail of the helicopter
- measuring the directional characteristics of the antenna itself as etalon

Each measurement we started thorough preparation work. It was the setting of the spectrum analyser to the operating frequency of 2.4 GHz and connection cables between the analyser and the corresponding transmitting and receiving antenna. At the same time transmitting antenna to adjust the horizontal position and steered the middle panel depolarization. Depolarization panel was prepared already from previous measurements. It was also important to involve attenuator transmitting antenna in order to set the desired attenuation. Model and linking it with the antenna on the tail and the RF cable that is plugged into the attenuator to a spectrum analyser placed on the prepared base swivel from 0 ° to 360 °. Position the model to 0 ° was always set exactly helicopter nose to the middle panel depolarization.

After this setup and tuned measuring means we proceeded to measure. The readings of attenuation are then entered and assigned a value of azimuth. We then model rotate clockwise in 5 ° and gradually we read value of attenuation. Thus, we proceeded in the range from 0 ° to 360 ° which we obtained 73 measurement results of different attenuation values. The next step was to obtain data to assign emission characteristics which are implemented in MS Excel.

3.1 Measurements with the antenna placed above the tail of helicopter

In this measurement, we proceed just as I mentioned in the measurement process. The result of this measurement is radiation pattern shown in Figure 3.

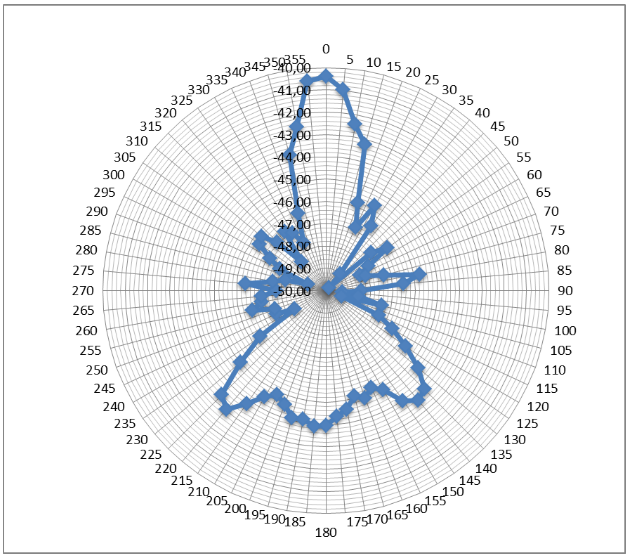

Figure 3: Radiation pattern of antenna placed above the tail of helicopter

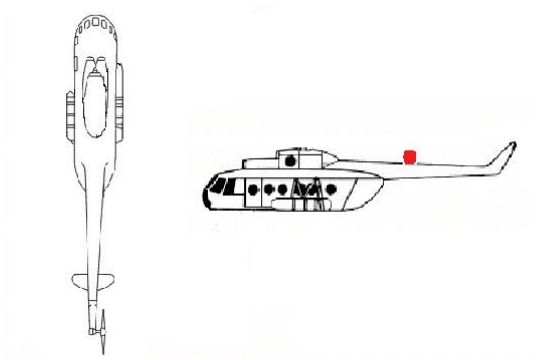

Figure 4: Schematic placement of antenna

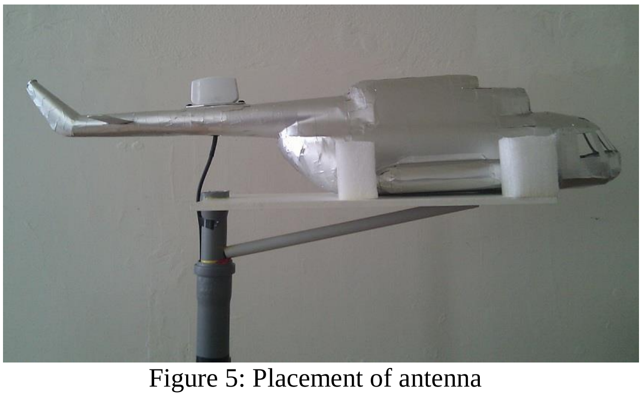

Figure 5: Placement of antenna

3.2 Measurements with the antenna placed under the tail of helicopter

When measuring, we do the same as mentioned in the measurement process. The result of this measurement is leaky characteristics shown in Figure 6.

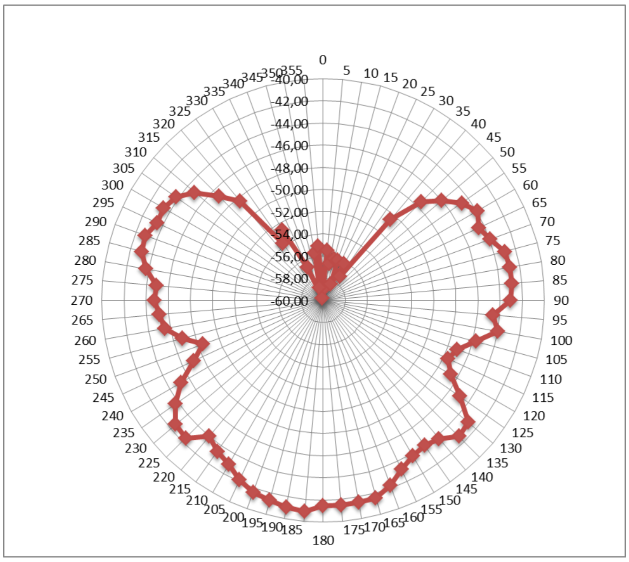

Figure 6: Radiation pattern of antenna placed under the tail of helicopter

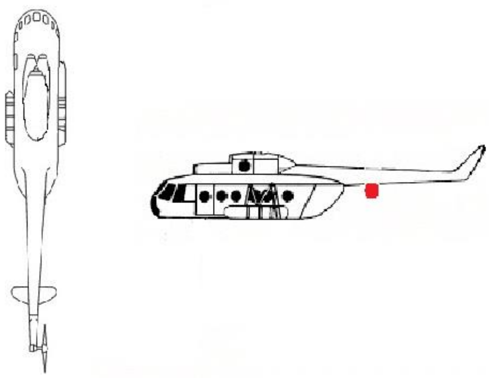

Figure 7: Schematic placement of antenna

Figure 8: Placement of antenna

3.3 Measurement of the antenna itself as etalon

For comparison with a reference standard radiation characteristics were measured and emission characteristics alone antenna model. In an ideal antenna and an ideal situation would be the result of perfect circular characteristics. However, the major adverse effects of temperature measuring workplace but also imperfection itself and its antenna ground plane are measured characteristic imperfect (Figure 9). In Figure 10 we can see the position of the antenna on artificial ground placed on the measuring stand ready to measure.

In this measurement, we proceed just as mentioned in the measurement process. The result of this measurement is leaky characteristic which is shown in Figure 9.

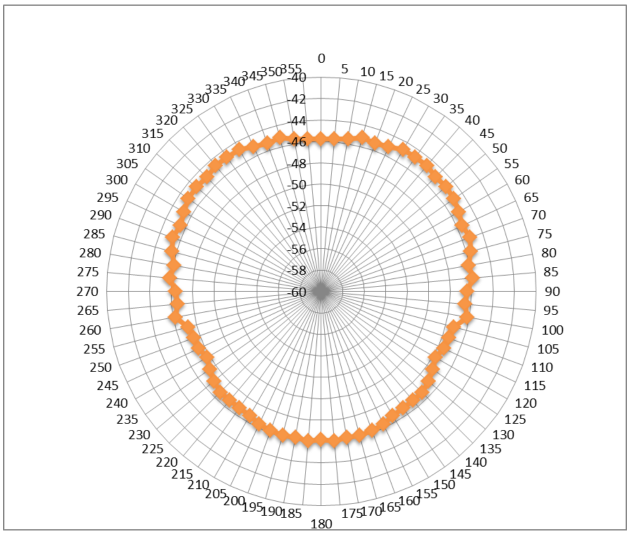

Figure 9: Radiation pattern of antenna itself

Figure 10: Placement of antenna

CONCLUSION

The aim of this work was to measure antenna radiation patterns on a scaled down model to confirm the assumptions of different attenuation performance of the antenna in different positions. Another important objective was the realization of the model helicopter Mi-8 in 1:20 scale which met all measurement requirements.

After drawing the radiation patterns at two positions (antenna up and antenna down on helicopter tail) and their mutual comparison we see higher efficiency when placing antenna above the helicopter tail and assumed lower efficiency when placing the antenna down the helicopter tail, as also higher attenuation in forward direction.

These achieved results point out to the fact that the helicopter model satisfies the conditions for the implementation of the measurement radiation characteristics and that its surface properties are those of a real helicopter.

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