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## MEASURES FOR ELECTROMAGNETIC SAFETY OF RADIO TECHNICAL OBJECTS OF CIVIL AVIATION

*Summary. In the work the level of electromagnetic radiation of radio engineering objects of civil aviation is analyzed and proposals to minimize the influence of the aerodrome radio equipment on the airport staff are provided.*

*Аннотация. В работе проводится анализ уровней электромагнитного излучения радиотехнических объектов гражданской авиации и предоставляются предложения по минимизации влияния радиотехнических средств аэродрома на персонал.*

*Анотация. В роботі проводиться аналіз рівнів електромагнітного випромінювання радіотехнічних об'єктів цивільної авіації та надаються пропозиції по мінімізації впливу радіотехнічних засобів аеродрому на персонал.*

**Introduction.** Constant growth of the electromagnetic load on the environment caused by the development of energy infrastructure, networks of wireless communications, radio technical equipment of civil aviation, etc., requires determining the values of electromagnetic fields and radiation of individual objects, evaluating of their impact on the public, staff and different buildings, allocating the areas of restrictions of people stay. It is provided with Sanitary Control measures for sources of electromagnetic fields. Such supervision is based on real sanitary norms and rules based on the results of research in this area. Ones of the main factors of impact on workers are electromagnetic fields and radiation of almost the whole frequency spectrum that require a careful investigation of their numerical values and determine the conditions to minimize them.

**Actuality of the problem.** Sanitary norms and rules are obligatory for all ministries and other central executive bodies, enterprises, institutions and organizations regardless of subordination and ownership, citizens, that design, produce, operate and service equipment, facilities, appliances, equipment, etc., that are sources of electromagnetic fields (EMF); that develop and implement measures to reduce the harmful effects of EMF on workers. The maximum permissible level (MPL) is based on the principle of presence of the limit of harmful effects of EMF. For MPL EMF usually use such values, that in condition of daily irradiation (with standard for the source of radiation regime) doesn't cause diseases or deviations in health of the population without limitation of gender and age.

The state sanitary norms and rules at work with sources of EMF [1] establish the requirements for workers engaged in the manufacture, operation, maintenance and repair of equipment, that is a source of constant electromagnetic fields and electromagnetic radiation in the frequency range of 50.0 Hz to 300.0 GHz.

**Aim of the work** is to identify whether there is excess of maximum permissible levels of radio technical of the aerodrome and providing proposals to minimize their impact..

**Basic material.** Sources of radiation of electromagnetic energy at the Antonov aerodrome (Kyiv), according to the AIP and the Instruction on execution of flights [2] (Table. 1) are such radio means of flight:

- drive distant radio beacon DDRB-15;
- drive distant radio beacon DDRB -33;
- near the drive radio beacon NDRB-15;
- near the drive radio beacon NDRB-33;
- landing system LS-80 GRM-15;
- landing system LS-GRM-33;
- landing system LS-80 KPM-15;
- landing system LS-80 KPM-33;
- direction-finder ARP-75

and surveillance radiolocator 1RL139-2 (P-37), airport radiolocator DRL-6M2 and accurate landing radiolocator RP-4G.

*Table 1*

**Radio navigation equipment and facilities of of landing**

Type of facility, category ILS/MLS the magnetic declination for VOR/ILS/MLS	Denotation	Frequency	Work hours	The coordinates of the transmitting antenna
1	2	3	4	5
LMM 15	C	257.00 KHZ	HS	503733N 0301029E
LMM 33	O	286.00 KHZ	HS	503452N 0301230E
LMM 15	LC	534.00 KHZ	HS	503902N 0300921E
LMM 33	GO	590.00 KHZ	HS	503329N 0301330E
LLZ ILS 33 CAT 1	IGO	108.70 MHZ	HS	503714N 0301043E
GP		330.50 MHZ	HS	503532N 0301207E
MM		75.00 MHZ	HS	503452N 0301230E
OM		75.00 MHZ	HS	503329N 0301330E
LLZ ILS 15 CAT 1	ILC	111.90 MHZ	HS	503508N 0301218E
GP		331.10 MHZ	HS	503657N 0301104E
MM		75.00 MHZ	HS	503733N 0301029E

OM		75.00 MHZ	HS	503902N 0300921E
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There has been a sanitary certification of radiation sources at the aerodrome Antonov (Kyiv). The results of calculation and measuring are given in sanitary passports of radiation sources of electromagnetic energy of radio engineering equipment providing flights to the surrounding areas at the height of 2 meters from the ground at a distance L meters from the center of fundamentals of transmitting antennas. These results showed the following levels of tension H and the surface density of electromagnetic energy (for radio engineering methods of support of in the territory of flight airfield) electromagnetic fields:

	<b>Source of radiation</b>	<b>H, V/m</b>	<b>L, m</b>	<b>MPL</b>
-	DDRB -149 (drive distant radio beacon)	5780-0,62	0-100	15 V/m
-	DDRB -329 (drive distant radio beacon)	5780-0,62	0-100	15 V/m
-	NDRB--149 (near the drive radio beacon)	4470-0,15	0-100	25 V/m
-	NDRB--329 (near the drive radio beacon)	9020-0,5	0-100	25 V/m
-	R-140 (radio communication station «Polosa»)	146-1,12	0-200	3 V/m
-	radio engineering methods of support of in the territory of flight airfield	46360-0,01 mW / cm <sup>2</sup>	0-5000	ORL – 15 mW / cm <sup>2</sup> other - 2,5 mW /cm <sup>2</sup>
-	SP-80M (KRM)	1,77-0,2	0-400	3 V/m
-	SP-80M (GRM)	9,0-0,16	0-400	2,5 kW/ cm <sup>2</sup>

So on the certain distance these levels exceed maximum permissible level for existing radiation sources.

### **Conclusions and prospects for research.**

Must be set due to the excess of the MPL for radio engineering methods of support of flight at the airport Antonov (Kyiv):

- for DDRB-15 sanitary protection zone (SPZ) in the form of an ellipse with axis 33 m and 45 m (counting from the canvas antenna);
- for DDRB -33 sanitary protection zone (SPZ) in the form of an ellipse with axis 34 m and 47 m (counting from the canvas antenna);
- for NDRB-15 sanitary protection zone (SPZ) in the form of an ellipse with axis 47 m and 50 m (counting from the canvas antenna);
- for NDRB-33 sanitary protection zone (SPZ) in the form of an ellipse with axis 42 m and 48 m (counting from the canvas antenna);
- for SP-80 [10] sanitary protection zone with a radius 18 m;

- for radio communication station R-140 („Polosa”) sanitary protection zone (SPZ) in the form of an ellipse with axis 40 m and 80 m (counting from the canvas antenna);
- for ORL P-37 sanitary protection zone with a radius 130 m;
- for RSBN-4N sanitary protection zone with a radius 64 m;
- for RSP -6M2 sanitary protection zone with a radius 190 m;
- for RP-4G sanitary protection zone with a radius 2065 m in azimuth 149 and 329 degrees in the sector of  $\pm 16$  degrees from the direction of the main azimuth;
- for SP-80M [11] KRM sanitary protection zone with a radius 25 m, for GRM SPZ is absent.

For near-field radiation intensity the levels of EMF is generated by radiating T-shaped antenna which does not depend on the height above the ground, so the need to establish building limitation zones (BLZ) around is absent.

For near-field radiation intensity the levels of EMF is generated by radiating antenna of the radio communication station R-140 «Polosa»), is maximum directly on the ground, so the need to establish BLZ around the station R-140 is absent..

BLZ also absent for RSBN-4N, RSP -6M2 and RP-4G.

BLZ is set for: ORL P-37 for buildings height 5 m and radius of 770 m, height 7m and radius of 900m, height 15m and radius of 1250m, height 25m and radius of 1575 m.

BLZ is set for: SP-80M KRM for house with height higher than 15m and radius of 26 m, and house with height lower than of 15m BLZ is absent.

Existing living buildings are not subjects for sanitary protection zones and zones of building limitation.

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