FORMULATION OF THE PROBLEM. Recently we reported about appearance of the X-band microwave (MW) effective surface resistance peak at $T \leq T_c$ when plotted as function of $T$ of thin FeSe$_{1-x}$Te$_x$ film ($x=0.7$) at parallel orientation of the MW magnetic field of the resonator near the surfaces of a thin film [1]. For the explanation the authors suggested the idea of the changing orientation of the MW magnetic field in the film at S-N phase transition. If the idea is true, the effect should depend on the film orientation in a resonator. Therefore it was naturally to study the surface impedance of FeSe$_{1-x}$Te$_x$ film as function of $T$ at different orientations of the film in the MW resonator.


Experimental technique and details

Sample under test: FeSe$_{1-x}$Te$_x$ film ($x=0.5$) of 100 nm thickness, substrate: single crystal CaF2 of 0.5mm thickness

Resonator with a “hot finger”: sapphire hollow cylinder in metal screen ($T=4.2$K), Fig. 1

Operation mode: H011

Temperature range: 3 – 22K

![Fig. 1. Parallel (II) and perpendicular (⊥) orientations of the FeSeTe film in MW H0 field of the resonator.](image1)

![Fig. 2. Inverse Q-factor corresponding to MW loss in superconductor for parallel (II) (blue) and perpendicular (⊥) (red) orientations of the FeSeTe film.](image2)

![Fig. 3. Comparison of theoretical model with $A_s(T)$-const and experimental data.](image3)

![Fig. 4. Distribution of H0 field with the film at (a) $T<<T_c$ and (b) $T\geq T_c$ (qualitative presentation).](image4)

**Conclusion:**
The observed feature of $Q(T)$ and effective $R_s\text{eff}(T)$ of thin SC film at ⊥ resonator H0 field near the film surfaces and $T\leq T_c$ can be explained by changing orientation of MW magnetic field within the film when $T$ rises to $T_c$. 