



## Proposed National Standards for Radio Environment Protection of Radio Telescopes

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### Extended Abstract

The radio astronomy service (RAS) observations which detect extreme weak radio signals from the universe by using radio telescopes are vulnerable to the radio frequency interferences (RFI) from all kinds of man-made sources, whatever intentional or unintentional [1]. Radio telescopes are many orders of magnitude more sensitive than the receivers used for telecommunication, broadcasting, satellite and radionavigation services. In spite of various RFI elimination or mitigation methods, strong RFI in radio astronomy may cause data loss, worsen scientific results, and even trigger receiver saturation.

The past decade has seen rapid development in radio astronomical facilities in China. Several cutting-edge radio telescopes have been constructed and operated. For instance, the largest single-dish radio telescope 500-meter Aperture Spherical radio Telescope (FAST) in Guizhou province has detected more than 100 new pulsars and been formally operated at the beginning of 2020. A new 110-meter radio telescope (QTT), which features the world's biggest steerable telescope, is under construction in Xinjiang province. Meanwhile, due to the booming economy and society, especially the surging telecommunication services, the radio environments around the radio telescopes are getting worse. In order to protect the routine observations of the telescopes, five radio quiet zones (RQZs) have been established in China, including the RQZs with radius of 30 kilometers for FAST and QTT [2].

However, some misunderstandings and disputes still occur during the operation of RQZs and compatibility assessment between radio telescopes and other active radio services. Therefore, both astronomers and radio governors have realized that it is imperative to formulate associated national standards of RAS in China to ensure the protection of radio telescopes from RFIs and the enforcement of spectrum management.

Since 2019, the drafts of two national standards named Electromagnetic Environmental Protection Requirements and Measurement Methods for Radio Telescopes have been proposed. Based on ITU Radio Regulations, People's Republic of China Regulations on the Radio Frequency Allocation, the associated ITU Resolutions and recommendations like ITU-R Rec. RA.769, as well as the existing relevant national standards and regulations, the draft standard on protection requirements have been studied and harmful RFI thresholds have been given as the appendix in the bands from 30 MHz to 275 GHz. Moreover, the measures to share the RAS bands with other services have been suggested, such as the geographical separation. According to the methods for the SKA siting spectrum monitoring, the draft standard of the measurement methods have been developed in the bands from 70 MHz to 22 GHz. In this draft, two modes have been employed for the measurements. Mode 1 is to measure the radio environment in a short time to obtain RFI situation of the local radio environment as whole and identify relative strong RFIs. Mode 2 is proposed to detect and integrate RFIs data in a longer time so more details of RFIs, especially comparable weak RFIs, could be obtained.

The application of the two national standards has been submitted to the Standard Administration of P. R. C in December 2019 and is under approval procedure which shall take a long period. Meanwhile, the contents of the two draft standards keep continual elaborations.

### References

[1] "Handbook on Radio Astronomy (Third Edition)", *Radiocommunication Bureau*, 2013.

[2] Haiyan Zhang, "Protection Progress on Radio Astronomy Frequencies in China", *PROGRESS IN ASTRONOMY*, **35**(4), November 2017, pp. 473-480, doi: 10.3969/j.issn.1000-8349.2017.04.07