# Radio Quiet Reserves in South Africa

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The protected spectral bands allocated to Radio Astronomy by the ITU represent a very small fraction of the radio spectrum. Modern radio astronomy requires the ability to operate outside of these traditional spectral islands, both for continuum and spectral line observations. To improve the sensitivity of continuum observations there is a need to use ultra-wide bandwidths that extend well beyond the traditional band limits provided by the ITU regulations. The investigation of the early universe, in particular experiments related to probing the "Dark Ages" and the nature of dark matter and dark energy, requires the detection of highly redshifted spectral lines at frequencies well below the existing narrow protected bands bracketing the nominal line frequencies.

New-generation radio telescopes, such as Lofar, the SKA and the proposed South African wide-field array telescope, are designed to operate across extremely wide and continuous spectral ranges in order to pursue these new scientific goals. Mitigation technologies are being developed to allow scientific operation in an RFI hostile environment, but such techniques add significantly to the cost of the proposed telescopes, and inevitably limit the scope of the science output of the instruments. Successful operation of these instruments in the non-protected regions of the spectrum will require the identification of telescope sites that have intrinsically low levels of RFI. Such regions need to be identified and protected globally.

We have identified regions within the Northern Cape province of South Africa as candidate radio quiet reserves. An extensive and sensitive RFI monitoring campaign is underway to characterize the RFI environment in these areas, primarily to determine the suitability of the sites for the SKA telescope. The entire spectrum between 80 MHz and 26.5 GHz is monitored at all azimuth angles and both orthogonal linear polarizations. The equipment used for these measurements is described, as is the measurement strategy employed.

We present the results of the sensitive spectral monitoring observations completed to date and compare these measurements with the RFI environment predicted from a database of licensed transmitters maintained by the national telecommunications regulator (ICASA).

The establishment of radio quiet reserves requires the improvement and guaranteed preservation of the RFI environment within the reserve. New technologies, such as terrestrial digital broadcasting, mitigate spectral congestion and allow the reduction in transmitted signal power. Close cooperation with national and regional spectrum regulators is required to ensure the long-term integrity of the reserve area. We discuss technology roadmaps, spectral migration strategies and regulatory measures that South Africa is considering to protect areas identified as candidates for such reserves.