



science & innovation

Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA

MANAGEMENT AUTHORITY

The Minister of Science and Technology assigned the management of the Karoo Central Astronomy Advantage Areas (KCAAA) to the Astronomy Management Authority (AMA), which is the custodian of a permanent register for interested and affected stakeholders. AMA entered into a co-management agreement with the South African Radio Astronomy Observatory (SARAO) to restrict the radio frequency interference and electrical interference sources. SARAO is responsible for performing compliance assessment calculations, while AMA is responsible for issuing a permit with conditions.

CONTACT US

Mr Mere Kgampe

Director: Astronomy Management Authority

Cell: +2776 488 4776

Tel: +2712 843 6644

Website: <https://www.dst.gov.za/ama/>

E-mail: Mere.Kgampe@dst.gov.za

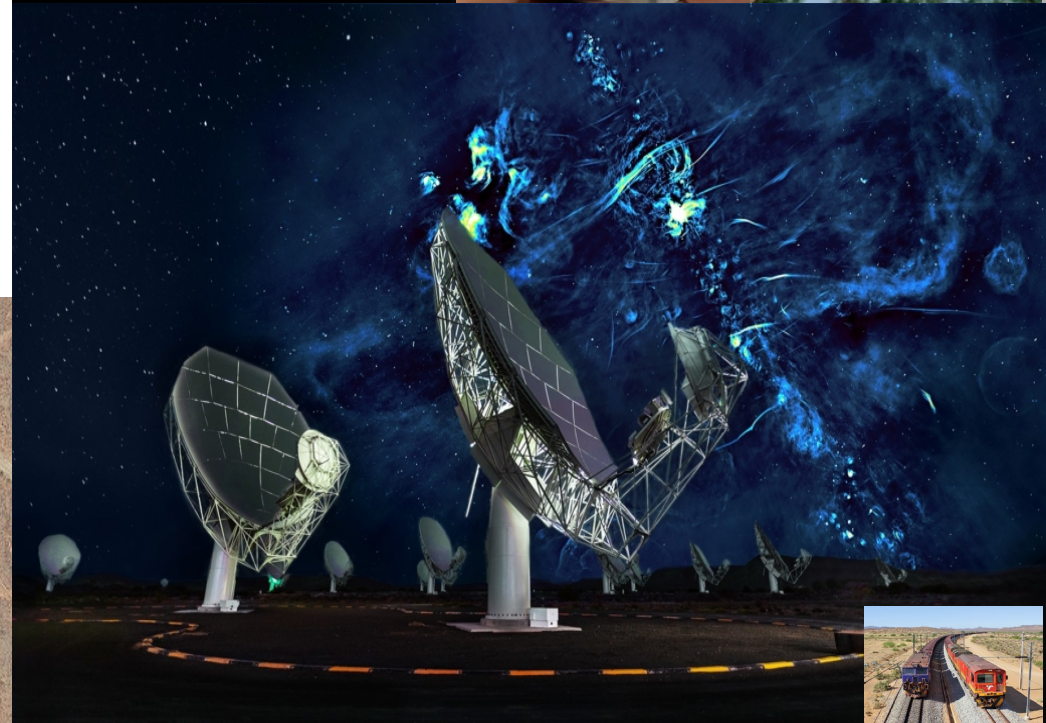
Address:

DSI Building (Building No. 53 CSIR South Gate Entrance)

Meiring Naudé Road, Brummeria

Private Bag X894, Pretoria, South Africa

BOOKLET ON REGULATIONS FOR THE PROTECTION OF THE KAROO CENTRAL ASTRONOMY ADVANTAGE AREAS



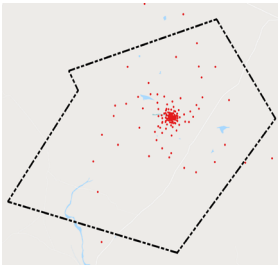


KAROO ASTRONOMY ADVANTAGE AREAS

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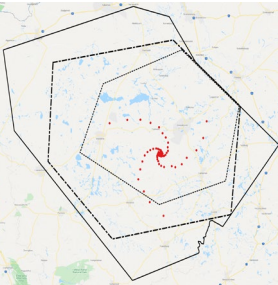
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Karoo Core Astronomy Advantage Area



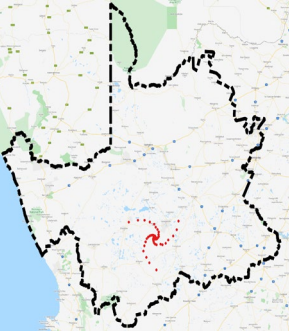
Karoo Core Astronomy Advantage Area is a physical area on which most of the instruments or telescope stations are located. The Core area contains the MeerKAT telescope and the densely populated core of the Square Kilometre Array telescope. The radio spectrum from 9kHz to 3000 GHz is reserved for radio astronomy and related scientific endeavours.

Karoo Central Astronomy Advantage Areas

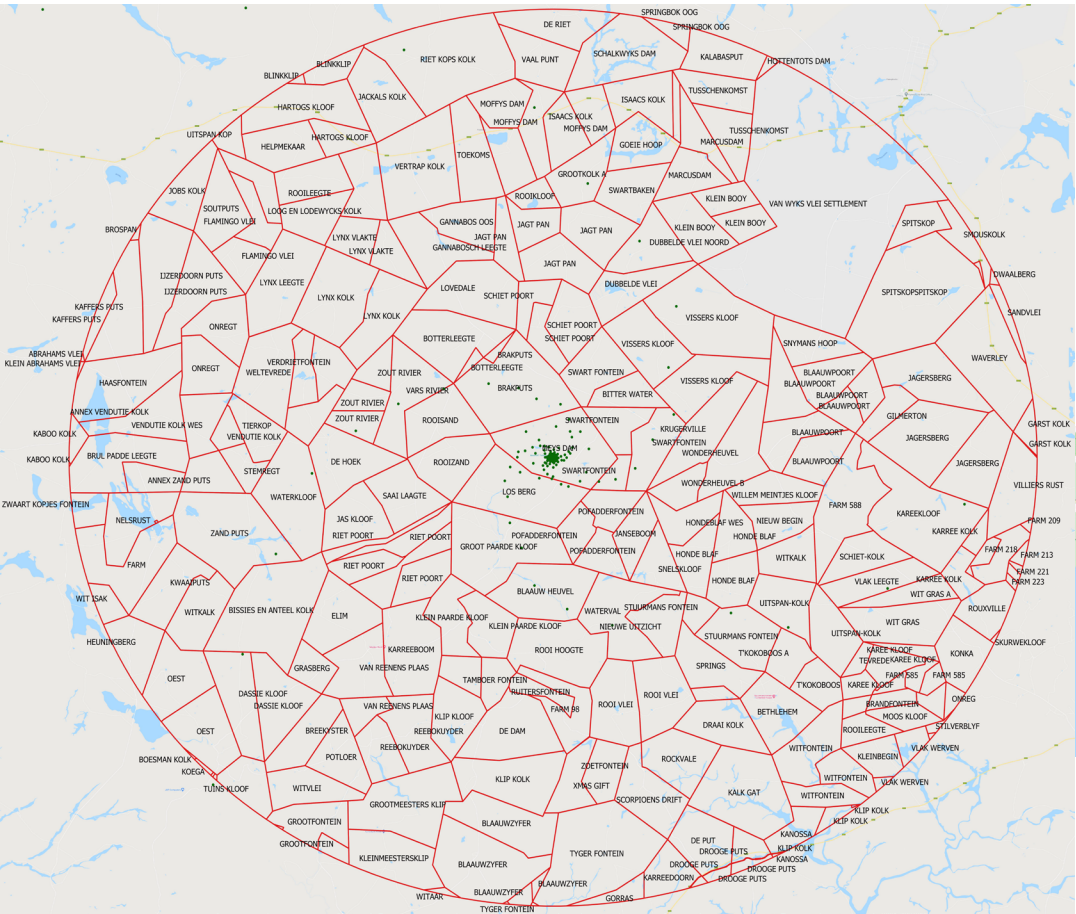


The Minister of Science and Technology applied restrictions on the Central area to the spectrum use that has detrimental impact on astronomy. The spectrum from 6 000 to 25 500 MHz is restricted in KCAAA3, while spectrum from 2 170 to 6 000 MHz is restricted in KCAAA2. The spectrum from 100 MHz to 2 170 MHz is restricted in the KCAAA1 for Electrical infrastructure and radio communication systems.

Karoo Coordinated Astronomy Advantage Area



The Minister of Science and Technology set standards in the Coordinated area to prevent detrimental impact on radio astronomy. Activities in the coordinated area comply with standards or conditions to avoid a detrimental impact on radio astronomy conditions in the Core and Central areas. The whole of the Northern Cape Province, excluding Sol Plaatje Municipality is declared for radio astronomy purposes.

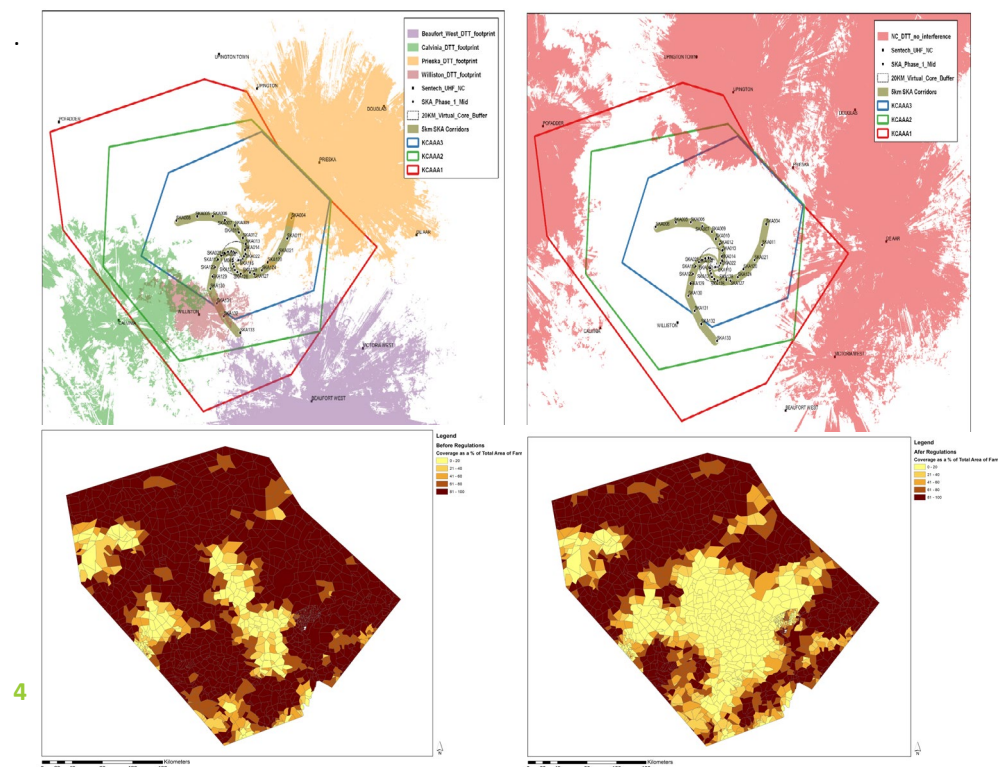




ADMINISTRATION OF KCAAA REGULATIONS

The Minister published on the AMA website a list of radio frequency spectrum bands that may be used in the KCAAA to provide wireless radio communication services and forms required to implement the regulations. The AMA is responsible for performing the compliance assessment for each radio transmission and electrical emission prior to issuing a permit for the radio communication systems or electrical infrastructure.

The compliance assessment is done using a computer modelling system to determine the interference level at each telescope station. When radio transmitter parameters or electrical equipment specification is known, a computer modelling system identifies signal levels that cause interference and signal levels that do not cause interference. In the event of a dispute between the applicant and AMA on the validity of results calculated using a computer modelling system, a decision may be made on the feasibility of conducting onsite measurements. The party raising a dispute is liable for the costs of onsite measurements unless the measurement outcome proves the dispute was valid, which will therefore result in sharing all costs equally.



PERMIT APPLICATION FORMS

Form 2: Permit application for radio communications

This form is used if the applicant would require the management authority to perform the compliance assessment for radio communications systems. Form 2 may be submitted by radio spectrum licence holders or persons using unlicensed spectrum within 50KM radius from the SKA virtual centre.

Form 5: Permit application for electrical equipment

This form is used if the applicant would require the management authority to perform the compliance assessment for electrical equipment or electrical infrastructure. Form 5 may be submitted for electrical infrastructures such as renewable energy facilities or electrical equipment such as microwave oven.

Form 1 and 3: Permit application of competent person

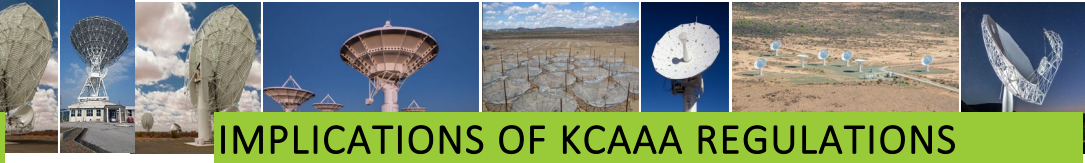
Form 1 may be submitted when a person knowledgeable in radio frequency interference calculation decides to apply for accreditation that will enable the applicant to perform the compliance assessment and submit Form 3 permit application. For every radio transmitter or electrical equipment, the received signal level at each telescope station may be calculated in terms of dBm. The received signal level at the SKA virtual centre is required to comply with SARAS level at around (minus) -200 dBm, while the received signal level at each telescope station is required to be at (minus) -100 dBm to prevent saturation.

Form 4: Financial compensation for loss suffered

Minister of Science and Technology made provision for compensation if a person suffer financial loss solely as a result of compliance with KCAAA regulations.

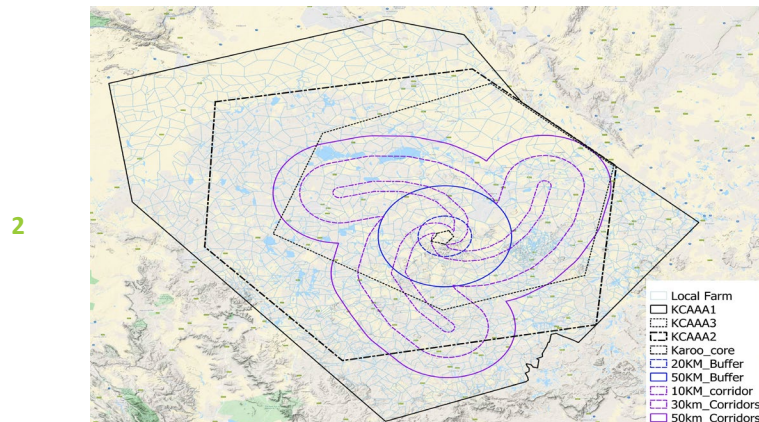
Form 1, Form 2, Form 3, Form 4 or Form 5 may be submitted for the purpose specified. The AMA perform the assessment and provide further clarification before deciding on the outcomes. Positive outcome end the workflow process, while negative outcomes make allowance for corrections until positive results.





Radio astronomy activities undertaken on the surface of the earth are sensitive to radio frequency interference, regardless of the part of earth selected. When radio frequency transmissions from the earth bounce back from the moon, it implies that there is manmade radio frequency interference on the side of the moon that faces the earth. The dark side of the moon, which is the part of the moon that faces away from earth might be safe from radio frequency interference until humankind start deploying radio transmitters or radio emission sources in the direction that face the dark side of the moon. Until telescopes are deployed on the dark side of the moon, it is still necessary to select the location on earth that is suitable for radio astronomy activities and protecting that area using regulations so that radio astronomy observation may continue. The Northern Cape Province in South Africa, excluding Sol Plaatje Municipality, was identified to be suitable for the mid-frequency Square Kilometre Array (SKA) telescope.

The Astronomy Geographic Advantage Act (No. 21 of 2007) is the legislation enacted in South Africa to modify the spectrum management procedures in the protected area for the purpose of reducing interference with the telescope. The declaration for Karoo Central Astronomy Advantage Areas (KCAAAAs) was made through Government Gazette number 37434 on 12 March 2014 and the Regulations were published in the Government Gazette No. 39939 of 23 November 2015 for public consultation. Professor JCW van Rooyen SC, the chair of public consultation meetings in Pretoria and Carnarvon on the 13 and 20 October 2016, advised the Minister of Science and Technology to promulgate the final regulations, as published on 15 December 2017 and thus became operational on 15 December 2018. Karoo Core is a type of a Radio Quiet Zone (RQZ) where no transmitters are allowed, while KCAAA1, KCAAA2 and KCAAA3 are types of RQZ that allow radio transmissions as long as the received signal level at any of the telescope station does not exceed a pre-determined interference threshold.



To protect radio astronomy observation undertaken by MeerKAT or SKA telescope:

- The Karoo area has natural terrain shielding such as hills and valleys,
- Legislation and Regulations promulgated include limitation to Radio Frequency Interference (RFI) levels and Electromagnetic Interference (EMI) levels,
- The National Policy control the spectrum use to improve spectrum efficiency,
- Monitoring and maintenance of radio signals at the level specified in the Permit conditions for authorized radio transmissions or electrical emissions.

KCAAA Regulations are limited to what is reasonably necessary to protect the scientific integrity of radio astronomy as a priority and other human rights are protected in so far as reasonably possible. The financial cost suffered by anyone due to KCAAA Regulations is refunded by the Minister of Science and Technology. Regulations protect astronomy activities from intentional transmitters and unintentional emission. Intentional radiators are radio emissions for the purpose of radio communication that are controlled by granting a permit for radio apparatus such as cellular phone networks or Wireless computer networks (Wi-Fi). Unintentional radiators produce radio frequency noise as a by-product of the function which is not radio communication, such as microwave ovens, ignition of vehicles, power lines, and electrical or electronic equipment.

Regulations maximise continuous clean spectrum in the frequency band from 100 MHz to 25 500 MHz, minimise the impact of RFI or EMI that exceed the South African Radio Astronomy Service (SARAS) Protection levels, and avoid interference that exceed the saturation level. SARAS protection level at the range from – 150 dBm to – 200 dBm is more stringent than saturation level of (minus) – 100 dBm. Radio transmitters are required to comply with the saturation level at each remote telescope in the SKA spiral arm and SARAS level at the SKA virtual centre. Electromagnetic emission from electrical equipment is required to comply with the SARAS level at the SKA infrastructure territory. The SARAS protection level and Saturation level is below the normal usable signal level for radio communication services. The required signal level at each telescope location is not useable for radio communications services.

