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| U.S. Radiocommunications Sector  Fact Sheet | | |
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| **Ref.** Question ITU-R 258/7  March 2024 Chairman’s Report  Document 7D/41-E Annex 14 | **Date:** August 15, 2024 | |
| **Document Title:** Updates to Working Document Towards a Preliminary Draft New Recommendation ITU-R RA.[GEOVLBI]: Guidance to Administrations regarding Geodetic Very Long Baseline Interferometry Networks | | |
| **Author(s)/Contributors(s):**  Sarah Marie Bruno, Johns Hopkins University  Jonathan Williams, NSF  Ashley VanderLey, NSF | | sbruno3@jhu.edu  jonwilli@nsf.gov  bevander@nsf.gov |
| **Purpose/Objective:** To provide relevant information and recommend protections for geodetic very long baseline interferometry networks. | | |
| **Abstract:** Following the adoption of the ITU-R Question 258/7 “Geodetic VLBI”, these updates to a working document towards a preliminary draft new recommendation describe Geodetic VLBI observations, which are required to deliver data products of utmost importance to a wide range of governmental, economic, societal and scientific purposes. This document recommends that administrations provide assistance in the protection of the stations of the International VLBI Service for Geodesy and Astrometry (IVS) in the frequency range between 2-14 GHz. | | |

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| Updates to Working Document Towards a Preliminary Draft New Recommendation ITU-R RA.[GEOVLBI]  **Guidance to Administrations regarding Geodetic Very Long Baseline Interferometry Networks** | |
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**Introduction**

Following the adoption of the ITU-R Question 258/7 “Geodetic VLBI”, these updates to a working document towards a preliminary draft new recommendation describe Geodetic VLBI observations, which are required to deliver data products of utmost importance to a wide range of governmental, economic, societal and scientific purposes.

This document recommends that administrations provide assistance in the protection of the stations of the International VLBI Service for Geodesy and Astrometry (IVS) in the frequency range between 2-14 GHz.

**Attachment**

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| WORKING DOCUMENT TOWARDS A PRELIMINARY DRAFT NEW RECOMMENDATION ITU-R RA.[GeoVLBI] | |
| Guidance to administrations regarding geodetic very long baseline interferometry networks | |

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Scope

This Recommendation describes Geodetic VLBI observations, which are required to deliver data products of utmost importance to a wide range of governmental, economic, societal, and scientific purposes, and recommends that administrations provide assistance in avoiding harmful interference to the stations of the International VLBI Service for Geodesy and Astrometry (IVS).

Keywords

Geodetic very long baseline interferometry (VLBI), radio astronomy service (RAS), VLBI global observing system (VGOS), geodesy, interference

Abbreviations/Glossary

IVS – International VLBI Service for Geodesy and Astrometry

RAS – Radio astronomy service

UN – United Nations

VGOS – VLBI Global Observing System

VLBI – Very Long Baseline Interferometry

Related ITU Recommendations, Reports

Recommendation [ITU-R M.1583-1](https://www.itu.int/rec/R-REC-M.1583/en) – *Interference calculations between non-geostationary mobile-satellite service or radionavigation-satellite service systems and radio astronomy telescope sites*

Recommendation [ITU-R M.2101-0](https://www.itu.int/rec/R-REC-M.2101/en) – *Modelling and simulation of IMT networks and systems for use in sharing and compatibility studies*

Recommendation [ITU-R P.452-17](https://www.itu.int/rec/R-REC-P.452/en) – *Prediction procedure for the evaluation of interference between stations on the surface of the Earth at frequencies above about 0.1 GHz*

Recommendation [ITU-R P.676-13](https://www.itu.int/rec/R-REC-P.676/en) – *Attenuation by atmospheric gases and related effects*

Recommendation [ITU-R P.2108-1](https://www.itu.int/rec/R-REC-P.2108/en) – *Prediction of clutter loss*

Recommendation [ITU-R P.2109-2](https://www.itu.int/rec/R-REC-P.2109/en) – *Prediction of building entry loss*

Recommendation [ITU-R RA.517-4](https://www.itu.int/rec/R-REC-RA.517/en) – *Protection of the radio astronomy service from transmitters operating in adjacent bands*

Recommendation [ITU-R RA.611-4](https://www.itu.int/rec/R-REC-RA.611/en) – *Protection of the radio astronomy service from spurious emissions*

Recommendation [ITU-R RA.769-2](https://www.itu.int/rec/R-REC-RA.769/en) – *Protection criteria used for radio astronomical measurements*

Recommendation [ITU-R RA.1031-3](https://www.itu.int/rec/R-REC-RA.1031/en) – *Protection of the radio astronomy service in frequency bands shared with active services*

Recommendation [ITU-R RA.1513-2](https://www.itu.int/rec/R-REC-RA.1513/en) – *Levels of data loss to radio astronomy observations and percentage-of-time criteria resulting from degradation by interference for frequency bands allocated to the radio astronomy service on a primary basis*

Recommendation [ITU-R RA.1631-0](https://www.itu.int/rec/R-REC-RA.1631/en) – *Reference radio astronomy antenna pattern to be used for compatibility analyses between non-GSO systems and radio astronomy service stations based on the epfd concept*

Recommendation [ITU-R RS.2066-0](https://www.itu.int/rec/R-REC-RS.2066/en) – *Protection of the radio astronomy service in the frequency band 10.6-10.7 GHz from unwanted emissions of synthetic aperture radars operating in the Earth exploration-satellite service (active) around 9 600 MHz*

Report [ITU-R RA.2131-0](https://www.itu.int/pub/R-REP-RA.2131) – *Supplementary information on the detrimental threshold levels of interference to radio astronomy observations in Recommendation ITU-R RA.769*

Report [ITU-R RA.2188-1](https://www.itu.int/pub/R-REP-RA.2188) – *Power flux-density and e.i.r.p. levels potentially damaging to radio astronomy receivers*

Report [ITU-R RA.2259-1](https://www.itu.int/pub/R-REP-RA.2259) – *Characteristics of radio quiet zones*

Report [ITU-R RA.2428-0](https://www.itu.int/pub/R-REP-RA.2428) – Parameters needed for the registration of distributed *radio astronomy systems*

Report [ITU-R RA.2507-0](https://www.itu.int/pub/R-REP-RA.2507) – *Technical and operational characteristics of the existing and planned Geodetic Very Long Baseline Interferometry*

The ITU Radiocommunication Assembly,

considering

*a)* that Very Long Baseline Interferometry (VLBI) is the most accurate measuring technique to determine positions in the universe and on Earth, and is therefore a fundamental tool for science and applications in radio astronomy and geodesy;

*b)* that Geodetic VLBI products are the Celestial Reference Frame, the Terrestrial Reference Frame, and the associated Earth orientation parameters such as the position of the rotational axis and the length-of-day. These are used for geodesy, the monitoring of Global Change, and the applications of space navigation and satellite orbit determination;

*c)* that Geodetic VLBI is realized by global networks of independent radio telescopes simultaneously observing cosmic radio sources on a daily basis;

*d)* that the frequency range 2-14 GHz is most favorable for Geodetic VLBI observations because of the physical properties of the atmosphere in this frequency range, and to meet the performance goals of the global geodetic observing system, a minimum of 32 channels, each with a bandwidth of 32 MHz, is required. Within this range allocations to the radio astronomy service include 2 655-2 670 MHz (secondary), 2 670-2 690 MHz (secondary), 2 690-2 700 MHz (primary), 4 800-4 990 MHz (secondary), 4 990-5 000 MHz (primary), 10 600-10 680 MHz (primary/shared), and 10 680-10 700 MHz (primary), which are not sufficient to meet the performance goals;

*e)* that VLBI network stations are increasingly exposed to emissions from terrestrial and spaceborne transmitters, which may degrade the performance of the observations and thus the quality of the geodetic data products;

*f)* that the Geodetic VLBI stations are part of a global network infrastructure which can only function if all stations in the network can observe at the same time and in the same frequency bands without being disturbed by harmful interference,

recognizing

*a)* that Geodetic VLBI stations are registered as RAS stations at the ITU-R;

*b)* that Report ITU-R RA.2507 contains technical and operational characteristics of existing and planned Geodetic VLBI systems, provides an operational overview of the worldwide network, and describes strategies to maximize system performance;

*c)* that Report ITU-R RA.2507 contains the threshold levels of interference detrimental to VLBI observation systems, which were derived from Recommendation ITU-R RA.769;

*d)* that ITU-R RA.2259 describes the characteristics of Radio Quiet Zones to secure the undisturbed observation of cosmic radiation,

noting

*a)* that Recommendation ITU-R TF.460-6 defines UT1 as UT0 corrected for the effects of small movements of the Earth relative to the axis of rotation (polar variation) and these movements are being observed by Geodetic VLBI;

*b)* that the further development of VLBI would benefit from administrations seeking to support observatories in research and development of methods of interference mitigation, including enhancing receiver resilience and data analysis techniques,

further noting

that the UN General Assembly Resolution 69/266 calls for maintenance of a global geodetic reference frame for sustainable development which requires Geodetic VLBI products (see also IAU General Assembly 2021 Resolution B1 and the IUGG General Assembly 2023 Resolution 1),

recommends

1 that administrations register their Geodetic VLBI sites as RAS stations with the ITU-R;

2 that administrations support the further development of VLBI and the benefits these observatories provide by implementing techniques to enhance interference mitigation, including support for work to enhance receiver resilience and data analysis;

3 that administrations should consider the radio frequency environment (time and spatial) and preferentially choose an existing site with prior coordination requirements, such as a national radio quiet zone, when planning or introducing new Geodetic VLBI stations and coordinate, as appropriate, with neighboring countries, and to minimize constraints on active services.