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| **U.S. Radiocommunication Sector**  **Fact Sheet** | |
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| **Document Title:** Input toward Working document towards a preliminary draft revision of the Handbook on Radio Astronomy: Unintended electromagnetic radiation from spaceborne electrical devices (new section 4.7.6) | |
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| **Purpose/Objective:** To provide further updates and direction on this item | |
| **Abstract:** At the previous meeting of WP7D, work continued on this item with the U.S. as an active participant. Among the views noted on the output was that there is no definition of unintended electromagnetic radiation in the ITU-R Radio Regulations and action towards a Report or Recommendation would be immature.  This input is intended to characterize unintended electromagnetic radiation and its impacts on radio astronomy to serve as a foundation for future work.  Rather than starting a new report, the U.S. instead suggests a minor addition to the Handbook on Radio Astronomy. | |

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| Input toward Working document towards a preliminary draft REVISION of the Handbook on Radio Astronomy | |

**Unintended electromagnetic radiation from spaceborne electrical devices (new section 4.7.6)**

**Summary**

At the previous meeting of WP7D, work continued on this item with the U.S. as an active participant. Among the views noted on the output was that there is no definition of unintended electromagnetic radiation in the ITU-R Radio Regulations and action towards a Report or Recommendation would be immature.

This input is intended to suggest a new direction: including efforts to document unintended emission and radio astronomy in the ITU-R Handbook on Radio Astronomy.

**Attachment**

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| Source: ITU-R Handbook on Radio Astronomy, 3rd Edition | **Document 7D/XXX** |
| **XX September 2025** |
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| WORKING DOCUMENT TOWARDS A PRELIMINARY  DRAFT NEW SECTION OF THE HANDBOOK ON RADIO ASTRONOMY ITU-R RA.[UEMR]  **Unintended electromagnetic radiation from spaceborne electrical devices** | |

CHAPTER 4 Vulnerability of radio astronomy observations to interference........................................ 40

4.1 Introduction.................................................................................................................................... 40

4.2 Basic considerations in the calculation of interference levels....................................................... 40

4.2.1 Detrimental-level criterion for interference...................................................................... 40

4.2.2 Antenna response pattern.................................................................................................. 41

4.2.3 Averaging time (integration time).................................................................................... 42

4.2.4 Percentage of time lost to interference.............................................................................. 42

4.3 Sensitivity of radio astronomy systems and threshold values of detrimental interference............ 43

4.3.1 Theoretical considerations................................................................................................ 43

4.3.2 Estimates of sensitivity and detrimental interference levels............................................. 44

4.4 Response of interferometers and arrays to radio interference........................................................ 46

4.5 Pulsars............................................................................................................................................ 51

4.6 Achieved sensitivities.................................................................................................................... 51

4.7 Discussion of interference.............................................................................................................. 52

4.7.1 Interference levels............................................................................................................. 52

4.7.2 Interference from astronomical sources............................................................................ 52

4.7.3 Special considerations for transmitters on geostationary satellites................................... 52

4.7.4 Filtering............................................................................................................................. 54

4.7.5 Interference levels capable of damaging or saturating a radioastronomy receiver........... 54

4.7.6 Unintended electromagnetic radiation from spaceborne electrical devices...................... 54

4.8 Monte Carlo analysis..................................................................................................................... 55

**4.7.6 Unintended electromagnetic radiation from spaceborne electrical devices**

In early 2023, astronomers working with the Low Frequency Array (LOFAR) radio telescope reported detecting electromagnetic radiation at observing frequencies 110–188 MHz and argued that the likely source of radiation was electronics onboard from satellites.[[1]](#footnote-1) These measured electromagnetic signals were composed of both broad- and narrow-band (bandwidth < 12.2 kHz) features, which varied between satellites. The spectral power flux densities of these measured electromagnetic signals, as calculated from the authors’ observations and assumptions, exceeded the thresholds for radio astronomy systems determined in Recommendation ITU-R RA.769-2 by orders of magnitude.

This detection of unintended electromagnetic radiation (UEMR) presents a novel challenge. Although the UEMR may exceed established harmful interference thresholds at the radio telescope, the ITU-R only regulates emissions that are intentionally used for radiocommunication services. It is in the best interests of both radio astronomy and space-based services to better characterize the phenomenon, identify the sources, and explore means of mitigation. Radio astronomers are presently most interested in very sensitive observations in the VHF range for studying the Epoch of Reionization; given the propagation distances in this range, these are the most important frequencies for space-based services providers—including operators of large satellite constellations—to understand UEMR when designing and testing systems.

Typical sources of UEMR noise can be broadly categorized as switching power components (can impact 100 kHZ up to 100 MHz) or signal and compute nodes (higher speed switching nodes may generate interference in the 10s of MHz up to GHz range). Possible mitigation strategies can include hardware design decisions and software modifications.   
  
Hardware design decisions specifically include ensuring good, printed circuit board assembly (PCBA)-level filtering of power and signal paths, switching frequencies to avoid RAS bands, and good shielding of harnesses, integrated circuits, and PCBA enclosures. Software modifications could consider operational set points of power systems or switching frequencies. There is no one-size-fits-all solution, but a combination of these mitigations may be deployed to minimize the impact. It is imperative for astronomers to identify the key low frequency bands of interest and geographic locations of facilities conducting these observations for mitigations to be successful. Mitigation strategies developed during design of satellite systems may be paired with ground (anechoic chamber) and in-orbit measurements to verify success.

1. Di Vruno et al., Astronomy & Astrophysics 676, A75 (2023) [↑](#footnote-ref-1)