

RECOMMENDATION ITU-R S.1064-1^{*,**}**Pointing accuracy as a design objective for earthward antennas
on board geostationary satellites in the fixed-satellite service**

(1994-1995)

The ITU Radiocommunication Assembly,

considering

- a) that antenna-beam pointing errors produce both a loss in orbit utilization and a change in antenna gain in the desired direction;
- b) that antenna-beam pointing errors obstruct efficient use of the radio frequency in multiple beams;
- c) that antenna-beam pointing errors are particularly significant for small coverages;
- d) that utilization of the beacon tracking technique is very beneficial for small coverages;
- e) that progress in the development on on-board sensors and control systems will result in improvements in pointing accuracy;
- f) that determining beam pointing accuracy is a function of a complex technical/economic trade-off;
- g) that the Radio Regulations (RR) contain geostationary-satellite pointing accuracy requirements in RR No. S22.19 and RR No. S22.20;
- h) that geostationary satellites are in operation with complex beam patterns and it is very difficult to apply those RR provisions to these patterns;
- j) that the pointing accuracy during station keeping and stabilization phases (0.2% of the time on average) is inevitably worse than in a normal mode,

recommends

1 that as a design objective the pointing direction of maximum radiation of any earthward beam of antennas on geostationary satellites shall be capable of being maintained within:

- 5% of the half-power beamwidth relative to nominal pointing direction; or
- 0.2° relative to the nominal pointing direction,

whichever is greater.

* This Recommendation should be brought to the attention of Radiocommunication Study Groups 6, 7 and 8.

** Radiocommunication Study Group 4 made editorial amendments to this Recommendation in 2001 in accordance with Resolution ITU-R 44 (RA-2000).

This *recommends* applies only to beamwidths of less than 5° and beams with complex patterns;

2 that, in the event that the beam is not rotationally symmetrical about the axis of maximum radiation, the tolerance in any plane containing this axis shall be related to the half power beamwidth in that plane;

3 that the following Notes will be considered as part of this Recommendation:

NOTE 1 – The pointing accuracy consists of four different factors:

- constant term,
- seasonal or long term,
- daily term,
- short term.

There are two methods to calculate the pointing error due to each of the above factors:

- root sum square (RSS) method, and
- linear sum method.

Provisionally, the sub-total error of each class should be estimated by the RSS method and the total pointing errors should be the sum of the sub-totals of each class.

The method of combining the above error sources is subject to further study.

NOTE 2 – The application of this Recommendation to antennas of geosynchronous satellites with slightly inclined orbits is subject to further study.

NOTE 3 – The definitions of beamwidth and reference pointing direction for different types of antennas need further study. Provisionally, in the case that the pointing direction of maximum radiation is difficult to specify, the direction to the centroid of the footprint of the antenna beam should be applied as the reference pointing direction.

NOTE 4 – The footprint (of an antenna beam on a specified surface) is defined as follows:

An area bounded by a contour on a specified surface formed by the intersection of the surface and that portion of the beam of an antenna above a specified minimum gain level, the orientation of the beam with respect to the surface being specified.

NOTE 5 – The method of calculating the centroid needs further study.

NOTE 6 – During station keeping manoeuvres and stabilization phases the pointing accuracies shall be capable of being maintained within:

- 7% of the half-power beamwidth relative to nominal pointing direction; or
- 0.3° relative to the nominal pointing direction,

whichever is greater.
