RECOMMENDATION ITU-R SF.1585*

Example approach for determination of the composite area within which interference to fixed service stations from earth stations on board vessels when operating in motion near a coastline would need to be evaluated

(Questions ITU-R 226/9 and ITU-R 254/4)

(2002)

The ITU Radiocommunication Assembly,

considering

a) that the World Radiocommunication Conference (Istanbul, 2000) (WRC-2000) adopted Resolution 82 (WRC-2000) concerning provisions for earth stations on board vessels (ESVs) operating in the bands 3 700-4 200 MHz and 5 925-6 425 MHz;

b) that *resolves* 1 and 2 of that Resolution calls for ITU-R to urgently study regulatory, technical and operational constraints which would need to be applied to ESV operations, including those transmitting in the 14 GHz band;

c) that the use of ESVs will not require coordination when operating beyond a minimum distance from shore within which there is a potential for causing unacceptable interference to stations in the fixed service (FS);

d) that there is a need for ESVs operating within the minimum distance referred to in *considering* c) to not cause unacceptable interference to terrestrial stations;

e) that ESVs have preliminary technical characteristics such as those described in Recommendation ITU-R S.1587,

recommends

1 that Annex 1 may be used as an example approach to determine the composite area within which interference to fixed stations from proposed operations of in-motion ESVs should be evaluated.

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* This Recommendation should be brought to the attention of Radiocommunication Study Group 8 and the Special Committee.

ANNEX 1

Example approach for the determination of the composite area within which interference to FS stations from ESVs when operating in motion near a coastline needs to be evaluated

1 Introduction

ESVs are potential sources of interference for stations in the FS operating in the same band. This Annex describes a method that may be used by administrations to determine the appropriate areas within which the operation of ESVs must be coordinated with stations of the FS when that operation is within a distance from the shore, as defined in **draft new Recommendation ITU-R SF.[Doc. 4/95-9/154]** of any administration.

The potential interference effects from ESVs can be avoided by examining potential interference to receivers operating in the same frequency band located within the composite area determined for the motion of the ship near the coast. The use of particular frequencies may need to be avoided where the predicted worst-case interference to FS operations on such frequencies exceeds the specified interference criteria.

2 ESV operation close to shore

When vessels equipped with earth stations are operating close to shore, determination of the area within which unacceptable interference may occur is a critical step in the process to ensure that such unacceptable interference does not occur. Determination of this composite area requires knowledge of the limits of the position of the vessel as it approaches land, enters a port or harbour, and proceeds to the vessel's final stationary point at the dock or at anchor. Similar limitations must be defined for the ESV operations as the vessel leaves its stationary position in the port and proceeds to the open sea.

Maritime navigation regulations define the requirements for vessel motion within the sea-lanes and port channels. A vessel larger than 300 gross tonnage must stay within the area known as the sea-lanes as it approaches a port. Once inside a port or harbour, the vessel must follow the port channels to its final stationary position at the dock or mooring at a pre-designated stopping point. The sea-lanes and port channels are clearly marked on the water with buoys and other defined aids to navigation. They are also clearly designated on maritime charts published by local and international regulatory authorities.

Once within the sea-lanes leading to a port or harbour and the channels within that port, a vessel may not go outside the marked areas, nor may it stop or anchor at any point except as directed by the local authorities. These limitations on vessel motion define the extremes of position for all larger vessels, including those equipped with ESVs. These extremes of position (that is, the administration-mandated limits of permissible vessel motion) define the "operating contour" for all larger vessels operating in a particular port or harbour.

The information defining the maximum vessel operating area within a sea-lane or port channel is readily available from published maps, charts, and regulatory authorities. Identification of this mandatory operating contour, which cannot be violated by an ESV-equipped vessel, provides the basis for determining the area within which there is a potential for interference when near shore and thus defines the composite area within which coordination with FS stations needs to take place.

3 Determination of the composite area

The determination of the composite area is carried out in two stages. The first is the determination of a set of areas at specific points within the ship's operating contour. The second is the development of the composite area from these individual point areas.

3.1 Determination of areas at specific points

After determining the operating contour from published maps, charts and regulatory authorities for a vessel operating near to shore, the next step is to determine the areas associated with a representative set of positions in or on the operating contour. These are the individual point areas. These individual areas are developed by determining the required coordination distance at a set of azimuth angles. The coordination distance is the distance from an earth station beyond which interference to or from a terrestrial station may be considered to be negligible.

These individual point coordination distances can be computed using the minimum permissible transmission loss methodology contained in Recommendation ITU-R SM.1448 – Determination of the coordination area around an earth station in the frequency bands between 100 MHz and 105 GHz, for fixed points in § 3.2.

The calculation of an accurate distance requires specific information about the operating characteristics of the ESV and the azimuth and elevation of the antenna for the satellite(s) to be used in that particular port. The operating parameters of the earth station do not change significantly as the vessel moves to a stationary position within the port or harbour and, therefore, a single set of parameters may be used to compute the minimum permissible transmission on a given azimuth loss for the entire operating contour within a specific port and when known the specific FS parameter values may also be used in developing the coordination distance.

However, the percentage of the path that is over water varies from 100% over water when the vessel is at the full coordination distance from the port to almost entirely over land when it is docked in the harbour. As the percentage of land in the path increases, the coordination distance will decrease.

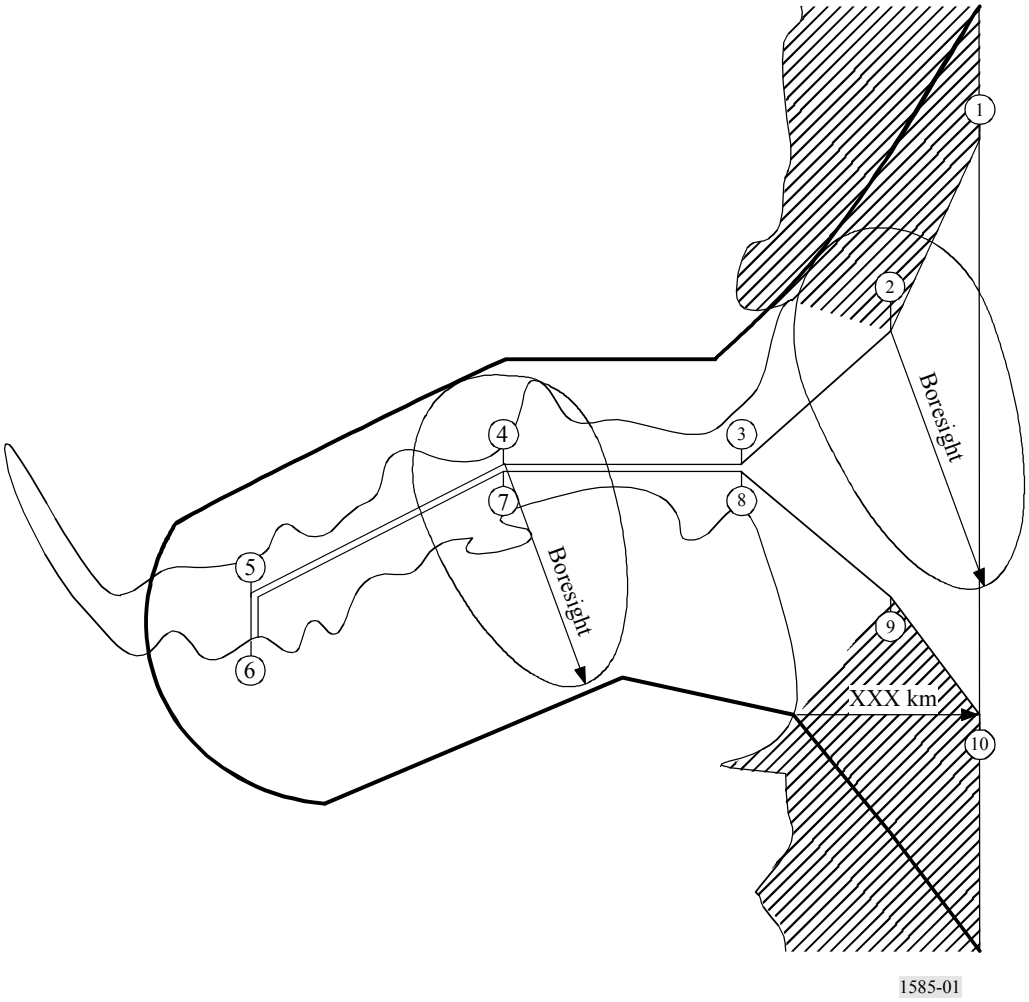
3.2 Determination of the composite area for coordination

The composite area within which ESV operated in-motion near a coast can be determined using, for example, the procedures given in Recommendation ITU-R SM.1448 and a knowledge of the operating contour for that specific port. In addition, it is necessary to identify a set of break points along the operating contour representing the limits of vessel position and where the sea-lanes and

port channels change direction. A coordination distance is then computed for all azimuths around these break points to determine the coordination area for a specific break point. These are the circled numbers in Fig. 1.

FIGURE 1

Example overall composite area



The coordination areas computed for each break point can be drawn on a chart containing the relevant operating contour or generated by a computerized graphical information system using the same principles. Figure 1 shows an example of such coordination areas.

In Fig. 1, the operating contour is represented by the funnel-shaped figure that leads from the open ocean into the harbour. The break points of the operating contour are numbered in a systematic fashion as shown in Fig. 1. The operating contour starts at the minimum distance from shore where the level of interference to FS systems is not expected to exceed permissible levels. This would include islands, man-made offshore structures and peninsulas, if applicable. If the coastline is highly irregular (i.e. with deviations greater than 10 km of the entrance to the port), then a series of straight-line segments may be used, each one drawn at a distance from the nearest point of land.

It will often be the case that the distance from the shore to the last sea-lane marker, called the outer marker, is less than the distance beyond which coordination is not necessary. Beyond the outer marker ships may proceed in any direction that may be safely navigated. Therefore, in such cases the operating contour must be extended from the outer marker to the limit in such a fashion as to include all possible routes that ships with ESVs can and will use. Moreover, the limits of the operating contour thus extended must be clearly marked on the chart so that the limits of the area considered in the coordination procedure are easily understood.

Figure 1 gives an example of this procedure. In this Figure break points numbered ② and ⑨ are the outer markers of the sea-lanes. The operating contour has been extended to break points numbered ① and ⑩. The crosshatched area outside the limits of the operating contour indicates that the use of the ESV has not been examined for potential interference in this area. Therefore, the ESV may not be used if the ship uses an approach route to the port that is outside of the indicated operating contour.

As mentioned previously, the numbered points along the operating contour are the break points where the individual coordination areas have been calculated. Two such example coordination areas are shown at break points number ② and ④. In both cases the coordination area is larger along the boresight of the antenna pointing towards the satellite(s) to be used by the ESV. At break point number ② the transmission path is mostly over water and, therefore, the coordination area for this point is larger than the coordination area at break point number ④ where the transmission paths are mostly over land. The extremes of the individual coordination areas for all of the points are then joined to form the composite area for the ESV as it moves within the distance beyond which coordination is not required to the stationary position in the harbour. (Where multiple paths exist from the port to the open sea, select the points that enclose the greatest area (i.e. the points that are the greatest distance from the channels and sea-lanes in the direction of land) so as to be sure to include the full coordination distance for any possible position of the vessel within the operating contour.)

The area enclosed by this boundary and the outer boundary line is the composite area of an ESV for a specific port or harbour within which coordination with fixed stations needs to take place.