Improved Method of Interference Detection to Satellite Earth Station by Radio Sensor in Spectrum Sharing

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1. Introduction

We have clarified the requirements for radio wave sensors on the assumption of a monitoring system using radio wave sensors in frequency sharing between satellite communications and terrestrial systems[1]. In this paper, we proposed an improved algorithm for sensor layout design, and clarified that false alarms can be greatly suppressed while maintaining the correct detection rate, which leads to an improvement in the use of new systems.

2. Systm Model

As an improvement of [1], the sensor arrangement was reviewed and the sensor selection algorithm was improved. The system model is shown in Fig.1. The sensor arrangement is a grid arrangement in order to increase the flexibility of sensor selection, and the sensor to be used is selected from the grid arrangement. The flowchart of the sensor selection algorithm is shown in Fig.2. It was improved so that multiple radio wave sensors are combined and selected so that interference can always be detected. The number of sensors can be reduced by selecting the sensor with the largest number of correct detections.

In this method, evaluation is made by sensor detection sensitivity and false alarm rate. The sensor detection sensitivity is calculated by dividing the number of correct detections by all transmission points of the mobile terminal. The false alarm rate is calculated by dividing the number of false alarms at the selected sensor by all transmission points of the mobile terminal.

3. Simulation Results

In the simulation, terminals that transmit interference waves are installed on the road that passes by the Misasa Deep Space Station to be protected. The cumulative interference of two terminals, one that moves on the road and the other that does not move, is considered. Sensor selection is performed using the conventional method of [1] and this improved algorithm. The simulation specifications are the same as those of [1].

The simulation results are shown. The sensor detection sensitivity of both the conventional method and the improved method is 100% in all conditions.Next, the results of the false alarm rate are shown. When the sensor sensitivity threshold is set to -117 [dBm], the conventional method is 80.6%, while the improved method is 8.3%, an improvement of about 1/10.

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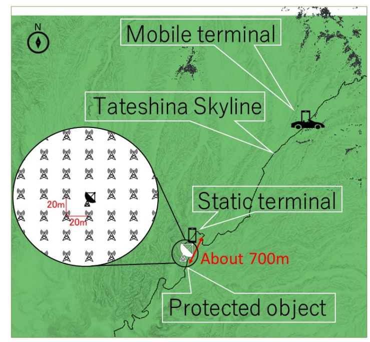

Fig. 1 System model

Table 1 Simulation Parameters

	Transmitter	Protection target	Sensors
Transmission power	23[dBm]	-	-
Allowable Interference Power	-	−173 [dBm/100MHz]	-
Transceive point interval	50[m]	-	5〜100[m]
Height above ground	2[m]		
Center frequency	32[GHz]		
Frequency Bandwidth	100[MHz]		
Reflections	6[times]		
Transmissions	1[time]		
Diffractions	2[times]		

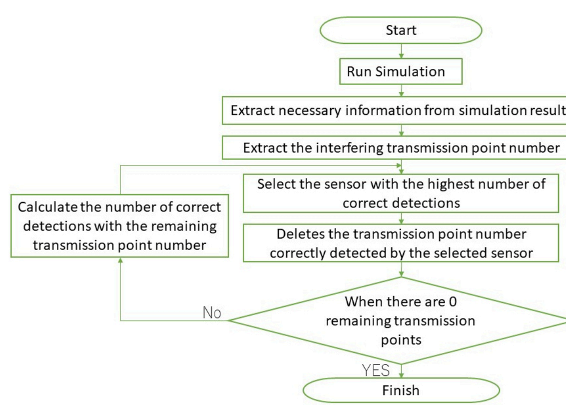

Fig. 2 Flow chart

References

[1] T.Obata, et al. ”Radio Sensor Detection of Interference to Satellite Earth Station in Frequency Spectrum Sharing”, ICUFN2023