PCC.II/RES. 35 (VIII-06) [1]

HARMFUL INTERFERENCE LOCATION METHODS IN THE REGION OF THE AMERICAS

The VIII Meeting of Permanent Consultative Committee II: Radiocommunications including Broadcasting,

CONSIDERING:

a) That at the VI Meeting of Permanent Consultative Committee II held in San José, Costa Rica, it was decided to establish a Sub-Working Group to draw up proposals aimed at resolving the problem of harmful interferences of unauthorized transmissions on satellite communication systems (PCC.II/DEC.41(VI-05));

b) That at the VII Meeting of Permanent Consultative Committee II held in Lima, Peru, a Work Plan was adopted for Dealing with Harmful Interferences on the Region's Satellite Systems (Resolution PCC.II/RES.31 (VII-06));

c) That the operation of satellite services must be free of harmful interferences coming from both "unauthorized" and "unintentional" transmissions;

d) That it is necessary to have procedures commonly recognized by the member Administrations of CITEL to detect and locate harmful interferences coming from "unauthorized" and "unintentional" emissions,

RECOGNIZING:

That satellite operators have methods and procedures to detect, locate, and eliminate harmful interferences,

TAKING INTO ACCOUNT:

That the methods mentioned in *recognizing* and used by satellite operators have proven their reliability and accuracy in detecting harmful interferences,

RESOLVES:

That the member Administrations of CITEL consider the methods to detect harmful interferences attached to the present Resolution as one of the current procedures for detecting harmful interferences.

INVITES:

The Region's satellite operators to propose other methodologies to detect harmful interferences.

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1 CCP.II-RADIO/doc. 1184/06 rev.1

ANNEX TO RESOLUTION PCC.II/RES. 35 (VIII-06)

HARMFUL INTERFERENCE LOCATION METHODS

In the process of identifying mainly unauthorized transmissions, the following techniques or methods can be used: geolocation and verification of transmissions, which are the most widely accepted and valid for satellite operators to identify the source generating these transmissions.

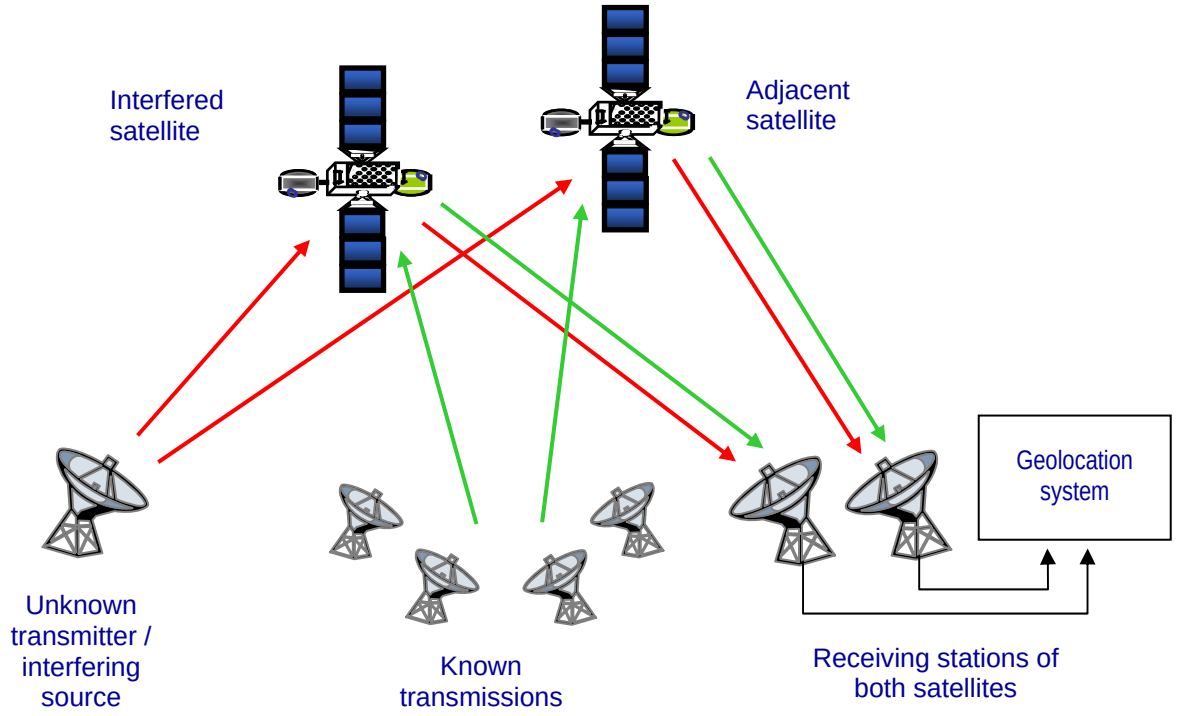
1. Geolocation

It is a technique that makes it possible to geographically locate a terrestrial station that is emitting a transmission to a specific satellite, whether an unauthorized transmission or, in general, some interference associated with breakdowns in station equipment or human error.

The result of this geolocation is generated in terms of latitude and longitude with an accuracy that is typically under 10 km, that is, the terrestrial station that is transmitting the geolocated signal is generally less than 10 km away from the coordinates obtained in the geolocation process.

This technique was scientifically developed more than 20 years ago and is used by the main satellite operators internationally, and it has proven its high degree of reliability in many different cases.

The following diagram illustrates the concept of this technique of geolocation, as described below:



The unknown transmitter antenna is aimed at the interfered satellite, transmitting most of its energy through the main lobe and a smaller part of its energy through the side lobes, which reaches adjacent satellites at a very low level.

When the original signal is transmitted to two satellites that are located in different orbital positions (the interfered satellite and the adjacent satellite), the signal travels different distances to reach the two adjacent terrestrial stations to simulate one single monitoring point indicated on the diagram as "Receiving stations of both satellites," which involves a time difference of arrival (TDOA) on the order of µs.

Likewise, the signal experiences a frequency difference of arrival (FDOA) on the order of Hz, which is shown by the Doppler effect generated between the two satellites.

These parameters, TDOA and FDOA, are processed in the geolocation system and are represented by two lines that, depending on the satellites used, intersect in an area inside the interfered satellite's coverage, thus tracing an ellipse with central geographical coordinates that indicate the zone where the terrestrial station that is transmitting the unknown signal is located.

To achieve this, known signals have to be used to compare them with the unknown signal, and by a series of triangulations that the geolocation system itself processes, the corresponding ellipse, indicated below, can be obtained:

2. Verification of transmission of possible sources of harmful interferences

Once the ellipse has been obtained, there is a point of departure inside the satellite coverage to find the interference, and the following step by the satellite operator to try to find the source generating this interference is to contact its customers in the zone to check their transmissions.

In most cases of accidental interferences because of equipment breakdown or human errors, it is probable that contact by phone and maybe testing by switching the equipment off and on may identify the station that generates the interference in order to subsequently take the relevant remedial actions.

Nevertheless, in the case of unauthorized transmission being dealt with here, it is difficult to contact by phone the responsible person in the terrestrial station because the operator of the terrestrial station shall not accept any responsibility.

Once the above has been accomplished, the satellite operators shall report it to the Regulator and shall draw up a solution strategy, investigating the origin of said unauthorized transmission. The Regulator shall use its own search methods, with the participation of the affected satellite operator, who shall be able to provide technical assistance and human resources with specialized brigades in detecting harmful interferences.

Verification via horn antennas

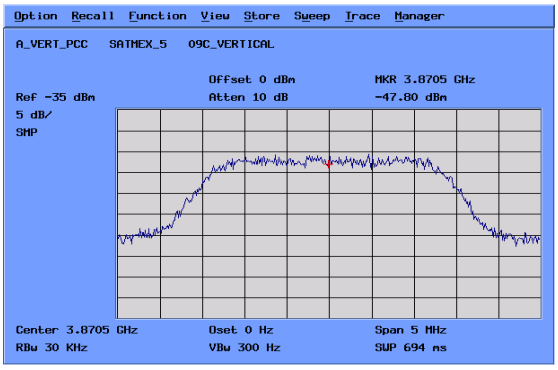
In some cases, transmissions from a terrestrial station can be verified without any physical connection to the station's ascending chain, including the possibility of obtaining samples from said transmissions although from a location outside the station's facilities.

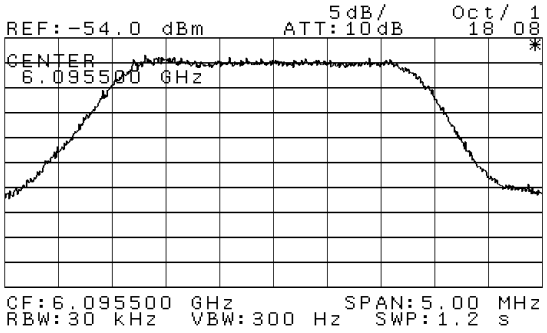
This method is illustrated and described below:

This method uses a spectrum analyzer and a horn antenna operating in the frequency range of interest, which for this type of verification would be the transmission frequency to the satellite in the corresponding operation band.

The idea is to be sufficiently close to the transmitting antenna, whether by land or by air, to be able to receive the uplink frequency of the interfering carrier or signal that is present on the satellite and that is monitored on the downlink frequency by the satellite operator.

By comparing the spectrum form of the interfering carrier or signal observed in this verification of transmissions with the reference chart of the satellite downlink, one can be sure that it is the transmitting station that one is looking for:





Conclusions

The transmission geolocation and verification methods described in the present document are reliable enough to help identify the source generating unauthorized transmissions and interferences by radiofrequency on satellite communications.