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INTERNATIONAL MONITORING

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Introduction

Spectrum monitoring is one of the essential tools of spectrum management, in particular supporting frequency assignment and spectrum planning functions. Specifically, the goals of monitoring (not necessarily in priority order) are to:

- assist in the resolution of electromagnetic spectrum interference, whether on a local, regional or global scale;
- assist in ensuring an acceptable quality of radio and television reception by the general public;
- provide valuable monitoring data to an administration's spectrum management process concerning the actual use of frequencies and bands (e.g., channel occupancy and band congestion), verification of proper technical and operational characteristics of transmitted signals (license compliance), detection and identification of illegal transmitters and potential interferers, and the generation and verification of frequency records;
- provide valuable monitoring information for programmes organized by the ITU Radiocommunication Bureau (Bureau), for example in preparing reports to Radiocommunication Conferences, in seeking special assistance of administrations in eliminating harmful interference, in clearing out-of-band operations, or in assisting administrations in finding suitable frequencies.

Spectrum monitoring functions within a spectrum management system

A spectrum management system is built upon the reference database of users (licensees), equipment (RF, power) and stations (coordinates, identification, altitude above sea level, altitude above ground level, antenna gain, azimuth and elevation angles). A database also contains tasks and priorities according to importance (e.g. safety of life), decision-makers policy and interference complaints. Monitoring measurements deliver the frequency, occupancy, field strength, bandwidth, direction, polarization and modulation. The comparison of measurements to licences indicates the infringements, discrepancies and illegal stations. Monitoring results and licence data serve as a basis for records, reports, statistical data and analysis of services, such as broadcasting, mobile and fixed; their coverage and quality of service. In case of interference complaints, it is possible to investigate and identify the source of the emission, in view of enforcing clearance of unauthorized stations.

ITU-R activities on radio spectrum monitoring

Background and history

Already in 1930, in response to growing use of radiocommunications, the first regional monitoring station was opened in Brussels under the predecessor of the European Broadcasting Union. At the 1947 Atlantic City Conference, Article **18** of the Radio Regulations (RR) laid down the foundation of the international monitoring system. The corresponding current Article **16** of the RR has been in place since the 1998 Edition.

Historically speaking, it was the intensive use of the high frequency (HF) bands which gave rise to the setting up of numerous international monitoring stations. Monitoring of the HF bands is still an important task but special attention now also has to be paid to the VHF, UHF and SHF bands, in view of the constant increase in the demand for the use of these bands.

Despite the rapid development of technology, regulations still provide the main means of managing the radio-frequency spectrum for the benefit of all users. In addition to Article **16** at the international level, No. **3.14** of the RR urges administrations to arrange for frequent checks to be made of the emissions of stations under their jurisdiction, to ensure that these stations comply with the RR at the national level.

International Monitoring System

Article **16** of the RR contains the provisions governing the establishment and operation of the international monitoring system, involving monitoring stations that are designated as such by administrations. Participating stations may be operated by an administration, a public or private agency, a monitoring service established jointly by several countries or by an international organization.

A centralizing office must be designated by each administration, by a group of administrations in cases where a joint monitoring service has been set up, or by an international organization participating in international monitoring. Requests for monitoring information must be sent to the centralizing office, which then consolidates the monitoring results for transmission to the Bureau or other centralizing offices. In accordance with Article **20** of the RR, individual station details are published by the ITU in the List of International Monitoring Stations (also known as List VIII), together with the name of the centralizing office.

In addition, List VIII includes information about the different functions that each monitoring station is able to perform, both in the terrestrial and in the space radiocommunication services.

Global monitoring coverage

One of the main conditions for successful operation of the international monitoring system is uniform coverage of all parts of the world by monitoring stations adequately equipped and participating in ITU monitoring programmes. Resolution ITU-R 23-3 (2015) refers to the need for extension of the international monitoring system to a worldwide scale, as follows:

- “all administrations now participating in the international monitoring system, including for monitoring of space stations emission levels, should be urged to continue to do so to the maximum extent possible”;
- “administrations, which do not at present participate in the international monitoring system, should be urged to make monitoring facilities available to that system, in accordance with RR Article **16**”;

- “cooperation between monitoring stations of different administrations should be encouraged and improved with a view to exchanging monitoring information, ” including information related to space station emissions, and to settling harmful interference caused by transmitting stations that are difficult to identify or cannot be identified”;
- “administrations, located in those areas of the world where monitoring facilities are inadequate, should be urged to promote the establishment of monitoring stations for their own use and make them available for international monitoring, in accordance with RR Article 16”;
- “data supplied by the monitoring stations participating in the international monitoring system may be used by the Bureau to prepare summaries of useful monitoring data in application of RR Article 16”;
- “administrations with more advanced terrestrial and space monitoring systems [should be] urged to accept officials from other administrations to train them in the techniques of monitoring, direction finding and geolocation. Initial contact for training may be made to the appropriate centralizing office as incorporated in List VIII.”

Use of monitoring data by the Bureau

The Bureau plays an essential role in the operation of the international monitoring system by coordinating the organization of regular and special monitoring programmes, collecting and analysing the results and making the necessary arrangements for communicating them to administrations.

Assisting in clearance of unauthorized or out-of-band operations

The Bureau organizes special monitoring campaigns on an ad-hoc basis with the purpose of identifying unauthorized or out-of-band operations and encouraging administrations to take the necessary action to eliminate said emissions.

Such campaigns usually concern bands allocated to safety services, and generally last for one week. During a campaign, the Bureau requests Administrations to intensively monitor the bands concerned, collecting data as explained in a BR Circular Letter. After consolidating the collected data, if the Bureau is able to determine with reasonable certainty that the operating unauthorized or out-of-band station is under the jurisdiction of a particular administration, it will draw the attention of the latter to the reported operation and to the interference potential of such emissions to safety services.

Assistance to administrations in cases of harmful interference

Pursuant to RR Article 15, an administration may request the assistance of the Bureau in resolving cases of harmful interference. To that end, the Bureau may use two types of international monitoring data, obtained by organizing special programmes often involving just a few monitoring stations.

One type of data concerns the identification and location of possible sources of harmful interference. In this case, the Bureau will request those administrations that have monitoring stations suitably equipped and located to make the necessary observations and measurements, in view of determining the location of the interfering stations. Once the Bureau has identified the administration under whose jurisdiction the station appears to be operating, the responsible administration is contacted in order to ensure timely elimination of such interference.

The other type of data is field strength measurements of the interfering station, needed when there is uncertainty as to the degree of harmful interference experienced, or if specific criteria in the RR or an ITU-R Recommendation might apply. In such cases, the Bureau will request the assistance of

administrations whose monitoring stations are suitably located and equipped to make the appropriate measurements.

Guidance to administrations in selecting frequencies

If requested by an administration pursuant to RR No. 7.6, the Bureau will use the data recorded in the Master Register and monitoring data received in the context of regular or special monitoring programmes in order to identify potential frequencies that could be assigned to stations in the fixed or mobile services.

Special attention is given to cases where replacement frequencies are needed for the regular operation of stations in the aeronautical or maritime mobile service due to unresolved cases of harmful interference.

Preparation for radiocommunication conferences

During preparations for a radiocommunication conference, in view of changes in the Table of Frequency Allocations, the Bureau may organize special monitoring campaigns designed to supplement the data in the Master Register. Results are submitted to the conference in the form of a report so that it may evaluate the impact of the proposed changes in spectrum use.

Equally, a radiocommunication conference may instruct the Bureau to organise special monitoring campaigns in order to obtain data concerning the use of a specific part of the spectrum and/or to support studies concerning interference caused to safety communications, to be further analysed by a subsequent conference.

Regular Monitoring Programme

Already after the Atlantic City Radio Conference in 1947, the ITU started a regular monitoring programme in the HF bands between 2 850 and 28 000 kHz. Since 1953, summaries of monitoring data have been published on a regular basis. Starting from 1999, the Bureau has been publishing reports of monitoring data received from administrations on the ITU website at <http://www.itu.int/en/ITU-R/terrestrial/monitoring/Pages/Regular.aspx>. The corresponding electronic files can be downloaded free of charge.

The main objectives of the regular monitoring programmes of the International Monitoring System can be summarized as follows:

- to assemble information on spectrum utilization at the location of the monitoring stations and to derive there from an indication of how the spectrum is used;
- to identify stations whose emissions are not in conformity with RR No. 16.8;
- when requested by a radiocommunication conference, to assemble information on the use of the bands exclusively allocated to specific services (i.e. broadcasting, maritime, aeronautical) for consideration by appropriate, future radiocommunication conferences;
- to provide administrations, which do not have monitoring facilities, with information for frequency management purposes in the HF bands

Special Monitoring Programmes

Pursuant to Resolution 205 (Rev.WRC-12), a special monitoring campaign has been in progress since 1987 in the 406-406.1 MHz band allocated exclusively to satellite emergency position-indicating radio beacons (EPRIB) used in the COSPAS/SARSAT programme. Statistics about the number of interfering emissions that have been detected and further suppressed are published in the BR annual reports and the reports are also made available at <http://www.itu.int/en/ITU-R/terrestrial/monitoring/Pages/Res205.aspx>. The Bureau has recently put into service an online

database query facility for the consolidated data relative to Resolution 205, accessible at <http://www.itu.int/net4/ITU-R/terrestrial/res205/default.aspx>.

Conclusions

As demands on spectrum increase through the introduction of new services, so increases the importance spectrum monitoring. Hence, although they already have a long history, both the regular HF band monitoring programme, especially with regards to safety services (i.e. Maritime, Aeronautical, Radionavigation), and the special 406-406.1 MHz band programme continue to be improved with better data gathering as well as data analysis. Administrations not yet participating in these monitoring programmes have everything to gain by taking part in collaboration and exchange of information and knowledge within the international monitoring system. In the same spirit, ITU-R Working Party 1C, is very active in pursuing various approaches to improving the state of the art in spectrum monitoring.

Further Reading

ITU-R Handbook on Spectrum Monitoring, 2011 edition (<http://www.itu.int/pub/R-HDB-23>)

ITU-R Study Group 1 Working Party 1C (WP 1C) - Spectrum monitoring
(<http://www.itu.int/en/ITU-R/study-groups/rsg1/rwp1c/Pages/default.aspx>)
