RECOMMENDATION ITU-R SM.1392

ESSENTIAL REQUIREMENTS FOR A SPECTRUM MONITORING STATION FOR DEVELOPING COUNTRIES

(Question ITU-R 32/1)

(1999)

The ITU Radiocommunication Assembly,

considering

a) that the increasing use of radio services in the developing countries requires more efficient use of the radio-frequency spectrum;

b) that spectrum monitoring is important for the efficient use of the radio-frequency spectrum;

c) that Recommendation ITU-R SM.1050 defines the tasks of a monitoring service;

d) that it is necessary to specify the minimum requirements for monitoring stations of the developing countries so that they can take part in the International Monitoring System;

e) that spectrum monitoring is necessary to assist spectrum management in developing countries,

recommends

1 that monitoring stations in the developing countries should seek to apply the requirements described in Annex 1.

ANNEX 1

Introduction

To establish a fixed radio monitoring station requires the installation of a minimum amount of equipment, and should include: antennas, receivers, direction finding, measuring and signal analysis equipment. These should be supplemented by the addition of a process controller to provide automation, also mobile monitoring vehicles.

This monitoring system should have the ability to cover the range of frequencies considered necessary by each administration up to 2.7 GHz.

1 Basic requirements

1.1 Antenna and receivers

The choice of antennas and receivers will be determined by the range of frequencies required to be monitored by the station. To analyse the received emissions the panoramic display of IF spectrum signature is also essential.

Further information concerning other technical parameters of antennas or receivers can be found in §§ 2.5.1 and 2.5.2 of the Spectrum Monitoring Handbook.

1.2 Frequency measurement equipment

In order to accurately measure a received signal it is essential to have a frequency standard which permits measurement of the signal frequency, e.g. offset method.

The accuracy of the frequency standards should exceed the measured frequency tolerance by a factor of 10. Therefore, either a crystal or rubidium frequency standard could be used depending on the frequency measured. Their frequency stability is normally better than $1x10^{-9}$ and $1x10^{-11}$ respectively.

Recommendation ITU-R SM.377 and §§ 2.5.2.3 and 3.1.3.2 of the Spectrum Monitoring Handbook provide more details regarding the selection of method to provide frequency standards to a monitoring station.

1.3 Bandwidth measurement

Suitable spectrum analysers should be available at the monitoring station to enable bandwidth measurements by the β % as defined in RR S1.153 and the x dB method. Recommendation ITU-R SM.443 and §§ 2.5.2.5 and 3.4.2.1 of the Spectrum Monitoring Handbook describe this method in detail.

1.4 Field strength or power flux-density measurement equipment

A field strength measuring set consists of a calibrated antenna and a calibrated receiver with a stepped attenuator.

Modern field strength meters equipped with a calibrated antenna can measure the field strength directly by applying the antenna correction factor (including connecting cable) supplied by the manufacturer. It also is possible to perform the measurements with a calibrated receiver and special software.

Details of field strength or power flux-density measurements are given in Recommendation ITU-R SM.378 and §§ 2.5.2.4 and 3.2.1.4 of the Spectrum Monitoring Handbook.

1.5 Monitoring spectrum occupancy

To collect spectrum occupancy data, including signal level of individual channel, for frequency assignment purposes it is essential to make regular measurements. These measurements are normally performed by automation method. Automatic observations are generally made using synthesiser control receiver connected to a computer.

For more information see Recommendation ITU-R SM.182 and §§ 2.5.2.6 and 3.3.3 of the Spectrum Monitoring Handbook.

1.6 Identification and decoding equipment

The identification of radio signal is one of the most difficult tasks that the monitoring personnel have to perform. The difficulty is due to the many different types of modulation systems that are used, also that the transmission is of short duration and very infrequent.

Direction finding, frequency measurement, spectrum analysis and field strength measurement equipment are valuable aids for identification. Identification of telegraph transmissions is now made easier by the use of automatic telegraph decoder, which can measure transmission rates. It is always advisable to record the difficult emissions and complex transmission system, so that they can be played back as many times as required. There are also decoders available which can decode all principal types of modulation.

For more information see Recommendation ITU-R SM.1052 and §§ 2.5.2.7 and 3.7.2.1 of the Spectrum Monitoring Handbook.

1.7 Direction finder and location

A direction finder is a valuable tool for determining the transmitter interference location and also as an aid for identifying emission sources. Generally for VHF three bearings are needed to obtain a reasonably accurate fix. However, even one or two directional finders will provide useful information.

In the HF bands, the single station location (SSL) system with software allows determination of the geographical position of a transmitter with a single direction finder.

For more information see Recommendation ITU-R SM.854 and §§ 2.5.2.8, 3.6.3 and 3.6.4 of the Spectrum Monitoring Handbook.

2 Additional equipment

Although the equipment described in Section 1 above, will perform most of the necessary monitoring functions, certain additional items of equipment will permit more effective operation of a monitoring station and will expand its capability. These facilities include:

2.1 Mobile monitoring facility

Subject to the limitation of the vehicle size and the monitoring equipment's power consumption, it is considered to be practical to employ a mobile station to make all the measurements of emissions normally made at a fixed monitoring station. In practice mobile stations are especially more valuable for monitoring frequencies above 30 MHz. Mobile stations should be adequately equipped to perform necessary measurements as expected.

2.2 Automatic monitoring

To limit the number of operators in charge of monitoring and to have the capability of accessing data to enable fast and efficient use of the information, an automatic monitoring station in which a process controller controls all major functions through programmable equipment can be set up.

Although an administration can begin with a manually operating monitoring station or a partially automated station, they should keep in mind that the station would eventually become an automatic operation. Thus, equipment selected should have the capability for automation at a later date.

For more information see Recommendation ITU-R SM.182 and § 2.5.3 of the Spectrum Monitoring Handbook.