International Telecommunication Union

ITU-R

Radiocommunication Sector of ITU

Recommendation ITU-R SM.1836-0

(12/2007)

Test procedure for measuring the properties of the IF filter of radio monitoring receivers

SM Series

Spectrum management

International Telecommunication Union

Foreword

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Series of ITU-R Recommendations

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Series	Title
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P	Radiowave propagation
RA	Radio astronomy
RS	Remote sensing systems
S	Fixed-satellite service
SA	Space applications and meteorology
SF	Frequency sharing and coordination between fixed-satellite and fixed service systems
SM	**Spectrum management**
SNG	Satellite news gathering
TF	Time signals and frequency standards emissions
V	Vocabulary and related subjects

Note: *This ITU-R Recommendation was approved in English under the procedure detailed in Resolution ITU-R 1.*

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RECOMMENDATION ITU-R SM.1836-0*

Test procedure for measuring the properties of the IF filter of radio monitoring receivers

(2007)

Scope

This Recommendation belongs to a set of Recommendations describing the test methods to determine technical parameters of radio monitoring receivers that are important for the users of these receivers. When the described methods are followed by manufacturers, comparing different receivers is made easier. This Recommendation specifies a set of IF filter test procedures to determine the properties of the IF filter of a monitoring receiver. This test procedure definition is recommended to all the manufacturers, with the advantage for the users of such receivers that an easier and more objective assessment of product quality is possible.

Keywords

Test procedure, IF filter, radio monitoring receiver

The ITU Radiocommunication Assembly,

considering

a) that ITU-R has published the Typical recommended specifications for analogue and digital monitoring receivers in the ITU Handbook on Spectrum Monitoring (Edition 2011), but that nothing is said about the test procedures behind such specifications;

b) that the specification of the properties of an IF filter strongly depend on the test procedures applied;

c) that the IF filter quality not only depends on its nominal bandwidth but also on IF filter properties directly related to this bandwidth;

d) that the IF filter parameters have a direct influence on the suitability of a receiver to fulfil certain monitoring tasks, especially under real environment conditions (high-level signals in the spectra near to the tuned frequency);

e) that without a defined test procedure and a list of parameters to be measured, the IF filter quality cannot be assessed;

f) that a defined test procedure for IF filter quality must be independent of the receiver design;

g) that a well-defined test procedure for IF filter quality, if adopted by all the manufacturers of radio monitoring receivers, will have the advantage for the users of such receivers, that an easier and more objective assessment of products from different manufacturers is possible;

* Radiocommunication Study Group 1 made editorial amendments to this Recommendation in the years 2010 and 2019 in accordance with Resolution ITU-R 1.

h) that supplementary information about these IF filter quality measurements can be found in the Report ITU-R SM.2125 – Parameters of and measurement procedures on H/V/UHF monitoring receivers and stations;

j) that when comparing the performance between two receivers the nominal IF bandwidths and the shape factors of the IF filters are considered concurrently,

recommends

1 that the measurement method in Annex 1 should be used to determine the IF filter properties.

Annex 1

Test procedure for measuring the properties of the IF filter of radio monitoring receivers

1 General aspects

Two important IF filter parameters of a radio monitoring receiver are:

– the nominal bandwidth; and

– the shape factor.

2 Definition and measurement of the IF filter nominal bandwidth

The bandwidth of the IF filter of a monitoring receiver in ITU is defined as the –6 dB bandwidth but the same procedure can be used for other bandwidths such as –3 dB, too. For measuring this bandwidth a signal generator is connected to the antenna input of the receiver. The signal generator is then swept over a frequency range of:

$$f_c - BW_{IF} \text{ to } f_c + BW_{IF}$$

where:

f_c: centre frequency of the IF filter

BW_{IF}: specified bandwidth of the IF filter under test.

The frequency resolution of the sweep should be $BW_{IF}/100$ or better.

The frequency response of the filter is recorded. This can be done using the internal signal indicator of the receiver or a measurement receiver or spectrum analyser directly connected to the IF output of the IF amplifier containing the filter to be measured.

In both cases the readout resolution should be 0.1 dB, or better, and the measurement accuracy should be 0.5 dB, or better.

The −6 dB bandwidth is the bandwidth between the measurement points symmetrically around f_c where the amplitude response of the filter drops ≥ 6 dB at both points.

When digital IF output is available

The signal generator may deliver either a spread signal or many frequencies (a Dirac comb, for example) spaced of about $BW_{IF}/100$. The signal may cover a band over a frequency range of:

$$f_c - BW_{IF} \text{ to } f_c + BW_{IF}$$

where:

f_c: centre frequency of the IF filter

BW_{IF}: specified bandwidth of the IF filter under test.

The dynamic range of this signal must be better than 60 dB over the whole measurement band.

The digital stream containing the IF filter is recorded. The resulting amplitude resolution in this measurement procedure should be 0.1 dB, or better, and the frequency resolution should be $BW_{IF}/100$, or better. Measurement accuracy should be 0.5 dB, or better.

3 Definition and measurement of the shape factor

The shape factor is defined as the ratio of the −60 dB and −6 dB bandwidth ($BW_{IF\text{-}60}/BW_{IF\text{-}6}$, so an ideal rectangular filter has a shape factor of 1). When another bandwidth is used the shape factor is defined as the ratio of this bandwidth and the −60 dB bandwidth. Both bandwidths are determined using the method and measurement set-up described in Section 2 with the exception that the frequency scan range of the signal generator is increased.

Whenever the shape factor is specified in the data sheet without any additional information the ratio of −60 dB and −6 dB bandwidth is meant. Optional shape factor measurements using other bandwidth values or ratios have to be specified.