



Recommendation ITU-R SM.1268-5
(08/2019)

**Method of measuring the maximum
frequency deviation of FM broadcast
emissions at monitoring stations**

SM Series
Spectrum management



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Series	Title
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RA	Radio astronomy
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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.1268-5

**Method of measuring the maximum frequency deviation
of FM broadcast emissions at monitoring stations**

(1997-1999-2011-2014-2017-2019)

Scope

This Recommendation describes methods to measure deviation and multiplex power of FM broadcasting stations during normal programme operation and verify compliance with the conditions assumed by broadcast network planning procedures.

Keywords

FM broadcasting, frequency deviation, measurement, modulation power, monitoring

Related ITU Recommendations, Reports

Recommendation ITU-R BS.412.

NOTE – In every case, the latest edition of the Recommendation/Report in force should be used.

The ITU Radiocommunication Assembly,

considering

- a) that planning parameters of FM broadcasting networks are provided in Recommendation ITU-R BS.412;
- b) that protection ratios for the planning of broadcasting transmitter frequencies are based on a maximum frequency deviation of ± 75 kHz (or ± 50 kHz) and a maximum power of the modulation signal which does not exceed the power of a sinusoidal tone which causes a ± 19 kHz frequency deviation;
- c) that various broadcast transmissions exceed the maximum frequency deviation and/or modulation power owing to different types of programmes, additional components of the composite signal (e.g. radio data system (RDS)) and audio compression;
- d) that limitation of peak frequency deviation and modulation power is required owing to mutual protection of broadcast planning and the aeronautical radionavigation service in the frequency band above 108 MHz;
- e) that monitoring of broadcast emissions is necessary to prevent transmissions from exceeding a maximum frequency deviation and a maximum modulation power;
- f) that common measurement procedures are necessary in order to achieve mutual acceptance of measurement results by the parties concerned, e.g. frequency managers, monitoring services and broadcasters;
- g) that the number of broadcasting stations using additional signals as RDS and high speed data signals is increasing and these systems are highly sensitive to interference from adjacent channels,

recognizing

- a) that the method described in Annex 1 is a simple “go-no go” test based on a spectrum mask which cannot replace precise measurements of the frequency deviation;
- b) that the method described in Annex 1 cannot be applied on transmissions with 50 kHz peak deviation due to the fact that no appropriate spectrum mask is available;
- c) that the method described in Annex 2 is also applicable on transmissions with 50 kHz peak deviation,

recommends

- 1 that the method described in Annex 1 may be used as a verification to indicate whether the frequency deviation of an FM broadcasting station exceeds the limits;
- 2 that the method described in Annex 2 should be used when the values of the deviation and modulation power are required.

Annex 1

Simple spectrum mask based method to indicate the exceeding of frequency deviation limits

1 Requirements

For this measurement, any spectrum analyser and test receiver with analyser capabilities can be used.

2 Connection transmitter and spectrum analyser

With the aid of a measurement antenna.

3 Measurement conditions

- during three measurements of 5 min each, the transmitter to be judged should be modulated with a representative programme material for that particular transmitter. Additional measurements may be carried out to ensure that the programme material is truly representative;
- impulse interferences should not occur (for example interference from an ignition source);
- signal/interference + noise should be ≥ 50 dB.

4 Adjustments of the spectrum analyser

The spectrum analyser should be adjusted as follows:

- centre frequency (CF) = f_0 (carrier frequency of the transmitter);
- RBW 10 kHz (IF filter);
- VBW 10 kHz (video filter);

- span: 340 kHz;
- sweeptime: 340 ms (1 ms/kHz);
- max hold mode;
- input attenuation is dependent on input level.

Settings for digital signal processor (DSP) analysers will be different but should provide equivalent results.

5 Measurement instruction

- a) Record the transmitter signal over a 5 min period.
- b) Observation of the analyser and acoustic controls at the receiver should be used as a means to ensure that no measurement results are evaluated which have been distorted by impulse interference. For the same reason the measurement is repeated twice.
- c) Overlay the graphical measurement with the mask as described in § 7.
- d) The centre of the x-axis of the mask shall correspond with the centre frequency (f_0).
- e) Adjust the reference level so that the maximum amplitude of the measurement corresponds to 0 dB.
- f) Determine whether the measurement is within the limits of the mask.

6 Limits

If any of the measured spectra exceeds the mask, the transmitter deviation is assumed not to meet the requirements.

7 Mask construction

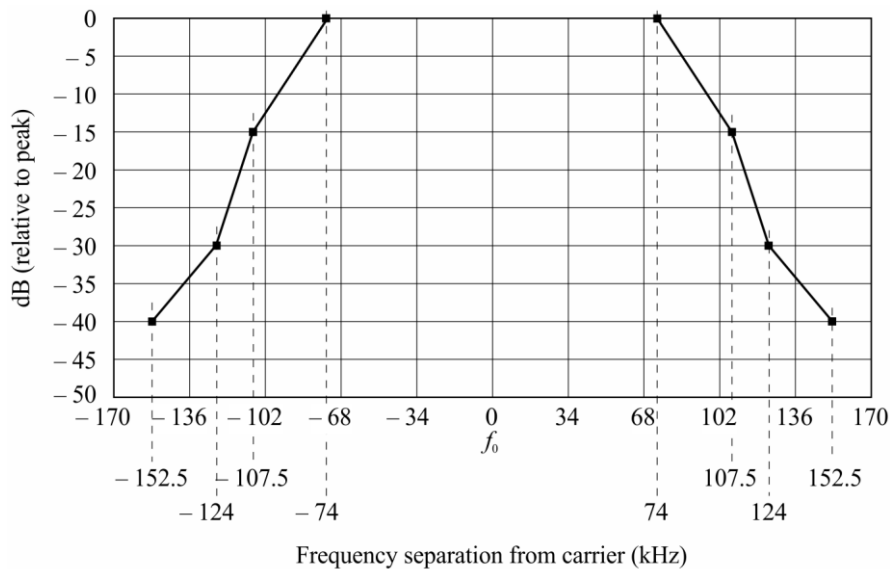
- a) The calibration of the mask should be consistent with the analyser settings.
- b) The centre of the x-axis is aligned to f_0 .
- c) The top of the y-axis corresponds with the 0 dB reference level.
- d) Straight lines connect the coordinates:

x-axis (kHz)	y-axis (dB)
$f_0 - 74$	0
$f_0 - 107.5$	-15
$f_0 - 124$	-30
$f_0 - 152.5$	-40

x-axis (kHz)	y-axis (dB)
$f_0 + 74$	0
$f_0 + 107.5$	-15
$f_0 + 124$	-30
$f_0 + 152.5$	-40

The graphic display of the table is shown in Fig. 1.

FIGURE 1
Shape of the mask



SM.1268-01

Annex 2

Method of measuring the maximum frequency deviation of FM broadcast emissions at monitoring stations

1 General

1.1 Definitions

Frequency deviation:

In the case of frequency modulation, the deviation of the frequency from the frequency of the unmodulated carrier f_0 .

Instantaneous deviation:

In the case of frequency modulation, the instantaneous deviation $\Delta f(t)$ is the difference between the instantaneous frequency at any given time (t) and the unmodulated carrier frequency (f_0). The instantaneous frequency is:

$$f(t) = f_0 + \Delta f(t)$$

Peak deviation:

In the case of frequency modulation, the peak deviation Δf is the absolute maximum of the difference between the unmodulated carrier frequency (f_0) and the instantaneous frequency $f(t)$.