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Russian Federation

PROPOSED MODIFICATION TO THE PRELIMINARY DRAFT NEW SECTION 5 “FEATURES OF THE NECESSARY BANDWIDTH” OF RECOMMENDATION ITU-R SM.328-11

Spectra and bandwidth of emissions

Introductory remarks

Annex 11 to the Chair’s Report of Working Party (WP) 1A on the meeting of the Group in 2023 (Document 1A/277 dated 12/06/2023) contains a preliminary draft revision of Recommendation ITU-R SM.328-11 – *Spectra and bandwidth of emissions*. The preliminary draft of the new section 5 “Features of the necessary bandwidth” proposes to indicate that this bandwidth is a system characteristic of the signal transmission path from the transmitter to the receiver, i.e. applies to both the transmitter and the receiver.

In support of this proposal it is possible to indicate the following historical fact. In the Radio Regulations that were approved by the 1948 WRC in Atlantic City (<https://search.itu.int/history/HistoryDigitalCollectionDocLibrary/4.62.43.en.100.pdf>), the concept of the “necessary bandwidth” did not yet appear in the list of terms. However, the introductory text of Appendix 5 of this Regulation “Band of Frequencies Required for Certain Types of Radiocommunication” (page 229-E), which preceded the table of values of the bandwidth for various classes of emissions, was presented as follows:

“The width of the frequency band which is necessary in the overall system, including both the transmitter and the receiver, for the proper reproduction at the receiver of the desired information, does not necessarily indicate the interfering characteristics of an emission.

For the determination of this necessary bandwidth, the following table may be considered as a guide.”

This means that even at the inception of this term in the ITU Radio Regulations, it was considered in relation to the entire radio communication system from transmitter to receiver, i.e. for the entire signal transmission path; in other words, it was initially given a systemic character.

It seems appropriate to make reference to this historical fact in the preliminary draft of the new section 5 of Recommendation ITU-R SM.328-11.

Proposals for modification of the preliminary draft of the new section 5 of Recommendation ITU-R SM.328-11 are given in the Annex. Proposed new text, including minor editorial changes, is highlighted **in turquoise**.

ANNEX

5 Features of the necessary bandwidth

That the necessary bandwidth differs from the occupied and x dB bandwidths. If the latter bandwidths directly characterize the emission spectrum of the transmitter, then the necessary bandwidth is a system characteristic and represents parameters of the entire radio channel from the transmitter modulator to the receiver demodulator. In the definition of the necessary bandwidth (No. 1.152 of the RR, ~~see above~~), it is not directly related to the emission spectrum, but it is related to the spectrum only indirectly through the class of emission which in its turn characterizes the emission spectrum only in ~~very general terms~~ a very broad sense.

If, for example, for a certain specific class of emission the IF path band of the receiver is narrower than the relevant necessary bandwidth, the quality of the signal at the reception will be reduced, similarly, to some extent, as it would happen in the case of emission narrower than "optimal" at the transmitter output (see Figure 1). If the radio channel contains repeaters, the width of the through-pass frequency response of each repeater, in order to avoid distortions, should not be less than the necessary bandwidth, that is fulfilled by all operating radio lines.

In support of the above, the following historical fact can be pointed out. In the Radio Regulations of Atlantic City, 1948, the "necessary bandwidth" concept has not yet appeared in the list of terms. However, Appendix 5 of this Radio Regulations "Band of Frequencies Required for Certain Types of Radiocommunication" (p. 229), which preceded the table of values of the necessary bandwidths for various classes of emission, began with the following text:

"The width of the frequency band which is necessary in the overall system, including both the transmitter and the receiver, for the proper reproduction at the receiver of the desired information, does not necessarily indicate the interfering characteristics of an emission. For the determination of this necessary bandwidth, the following table may be considered as a guide."

This means that even at the origin of this term in the ITU Radio Regulations, it was considered in relation to the entire system from the transmitter to the receiver, i.e. for the entire signal transmission path. In other words, it was initially given a systemic character.

~~Precisely, because~~ Exactly due to the fact that the necessary bandwidth is a system characteristic, it, unlike the occupied and x dB bandwidths, cannot be directly counted on the emission spectrum of the transmitter. The reconciliation of the necessary bandwidth and the emission spectrum can only be made indirectly as follows. The value of the necessary bandwidth is calculated by the formula for the class of emission in question in accordance with Recommendations ITU-R SM.1138 and ITU-R SM.853 or Report ITU-R SM.2048 (where the class of emission in question is presented). Then the obtained value is superimposed on the emission spectrum and this determines the initial points of out-of-band emissions at both sides of the spectrum (see Figure 1). Based on these points, the relative powers of out-of-band emissions are determined by integration, the obtained data are compared with the normalized value of $\beta/2\%$ for this class of emission (usually $\beta/2 = 0.5\%$), and by this it can be concluded whether the emission is "optimal". Due to the complexity of this process measurements of occupied or x dB bandwidths are used in practice in accordance with their definitions.