NATIONAL RADIO SYSTEMS COMMITTEE

THIS IS AN OUTDATED VERSION

NRSC-2
Emission Limitation for AM Broadcast Transmission
June, 1988

NAB: 1771 N Street NW,
Washington DC 20036
Tel: 202-429-5346 Fax: 202-775-4981

CEA: 2500 Wilson Boulevard,
Arlington VA 22201
Tel: 703-907-7660 Fax: 703-907-8113

Co–sponsored by the Consumer Electronics Association and the National Association of Broadcasters
http://www.nrscstandards.org

NOTICE

NRSC Standards, Bulletins and other technical publications are designed to serve the public interest through eliminating misunderstandings between manufacturers and purchasers, facilitating interchangeability and improvement of products, and assisting the purchaser in selecting and obtaining with minimum delay the proper product for his particular need. Existence of such Standards, Bulletins and other technical publications shall not in any respect preclude any member or nonmember of the Consumer Electronics Association (CEA) or the National Association of Broadcasters (NAB) from manufacturing or selling products not conforming to such Standards, Bulletins or other technical publications, nor shall the existence of such Standards, Bulletins and other technical publications preclude their voluntary use by those other than CEA or NAB members, whether the standard is to be used either domestically or internationally.

Standards, Bulletins and other technical publications are adopted by the NRSC in accordance with the NRSC patent policy. By such action, CEA and NAB do not assume any liability to any patent owner, nor do they assume any obligation whatever to parties adopting the Standard, Bulletin or other technical publication.

Note: The user's attention is called to the possibility that compliance with this standard may require use of an invention covered by patent rights.

By publication of this standard, no position is taken with respect to the validity of this claim or of any patent rights in connection therewith. The patent holder has, however, filed a statement of willingness to grant a license under these rights on reasonable and nondiscriminatory terms and conditions to applicants desiring to obtain such a license. Details may be obtained from the publisher.

This NRSC Standard is considered to have International Standardization implication, but the International Electrotechnical Commission activity has not progressed to the point where a valid comparison between the NRSC Standard and the IEC document can be made.

This Standard does not purport to address all safety problems associated with its use or all applicable regulatory requirements. It is the responsibility of the user of this Standard to establish appropriate safety and health practices and to determine the applicability of regulatory limitations before its use.

Published by

Technology & Standards Department
2500 Wilson Boulevard
Arlington, VA 22201

Science and Technology Department
1771 N Street, NW
Washington, DC 20036

PLEASE!

DON'T VIOLATE
THE
LAW!

TABLE OF CONTENTS

EMISSION LIMITATION FOR AM BROADCAST TRANSMISSION
(NRSC Voluntary Standard No. NRSC-2)

§ 1. Scope.

The National Radio Systems Committee (NRSC) is a joint committee composed of all interested parties including representatives of AM broadcast stations, AM receiver manufacturers, and broadcast equipment suppliers. This document describes an interim[1] voluntary national standard that specifies radio-frequency spectrum occupancy for AM broadcast stations. The standard applies to both AM monophonic and AM stereo transmissions. Compliance with the standard is strictly voluntary. To the NRSC's knowledge, no industry group or entity is or will be adversely affected by issuance of this document. Every effort has been made to inform and accommodate any and all interested parties. The NRSC believes that implementation of this standard will lead to reduced AM interference, thus providing increased service for all AM stations and an increase in quality of service to present and future AM listeners.

§ 2. Introduction.

On January 10, 1987, the NRSC authorized the National Association of Broadcasters and the Electronic Industries Association to publish an interim voluntary national standard specifying AM preemphasis, AM deemphasis and a 10 kHz AM audio bandwidth (Standard No. NRSC-1). The NRSC-1 audio standard applies to the audio signals that are intended to modulate the AM transmitter. Its purpose is to reduce second-adjacent channel interference by band limiting AM stations to a nominal

[1]The standard is described as "interim" until the test methods contained within the document can be fully verified through field tests. In addition, field test data of "splatter monitor" technology will be evaluated to determine the correlation between results obtained with such devices and the methods described within this document (see § 5.).

20 kHz occupied radio-frequency (RF) bandwidth (twice the 10 kHz audio bandwidth presented to the transmitter's modulation circuits). Implementation of the NRSC-1 audio standard alone largely achieves this purpose. However, there remain characteristics of the AM transmission process that may cause the RF occupied bandwidth to exceed a nominal 20 kHz. This document accommodates these transmission characteristics. It is in two Sections. Section 3 is a voluntary standard maximum RF occupied bandwidth of AM broadcast transmissions. Section 4 consists of a voluntary RF occupied bandwidth testing and control standard designed to insure repeatability and consistency of RF occupied bandwidth test measurements.

§ 3. RF Maximum Occupied Bandwidth Specification.

§ 3.1. Purpose. The purpose of an RF maximum occupied bandwidth specification is to control modulation products, desired or undesired, that fall outside the specified RF occupied bandwidth.

§ 3.2. Maximum Occupied Bandwidth. The maximum occupied RF bandwidth voluntary standard represents the maximum peak output of a swept-frequency spectrum analyzer IF over a minimum ten minute period.[2] The specification encompasses all spectral components caused by direct programming and all ancillary or data communications. AM broadcast stations shall occupy spectrum according to the following maximum specifications:

(see next page)

[2]It is recognized that the output of the spectrum analyzer depends on the shape of the analyzer's IF filters.

Table 1

Frequency Band Relative to Carrier (+/- kHz)	Attenuation Relative to Carrier (dB)
0 to 10	0
10 to 20	greater than -25[3]
20 to 30	greater than -35
30 to 60	greater than -(5 + 1 dB/kHz) from carrier[4]
60 to 75	-65[4]
above 75	-80[4]

(See Figures 1 and 1A (solid line) attached).

§ 3.3. Measurement Procedure.

§ 3.3.1. Use of Ordinary Program Material. Measurements of AM station spectrum occupancy shall be conducted using ordinary program material. All audio processing used in the AM station shall be in normal operating modes. The audio signal input to the AM transmitter shall conform to the NRSC audio standard adopted January 10, 1987.

§ 3.3.1.1. Use of Audio Tones. Sweeping a transmission system with audio tones is a widely accepted and respected method for gauging spectrum occupancy and for troubleshooting and adjusting AM transmission systems. The NRSC endorses audio tones for these purposes, but urges caution in the use and selection of audio tones particularly with AM stereo transmission.[5] It should be noted, however, that it is

[3]Note: the slope of occupied bandwidth in the transition region between 10 and 11 kHz is expected to parallel the NRSC-1 audio standard. Accordingly, attenuation levels in the region shall be 6 dB greater than described in the audio standard to adjust for carrier level reference.

[4]For carrier power levels between 50 and 5000 Watts, the maximum limit shall be $-(43 + 10 \log P_W)$ dB (where P_W is the carrier power in Watts) or as indicated in Table 1 and/or the attached Figure 1, whichever is lesser attenuation. For carrier power levels below 50 Watts, a -60 dBC maximum limit shall be used.

[5]The manufacturer of the particular AM stereo system employed should be consulted for the appropriate tone frequencies/modulation levels for "worst-case" condition testing.

difficult to infer the dynamic response of a transmission system while observing it in a steady-state condition.

§ 3.3.2. Use of Spectrum Analyzer. A suitable swept-frequency RF spectrum analyzer shall be used to measure compliance with the NRSC RF occupied bandwidth specification. The analyzer shall measure the over-the-air RF spectrum occupancy as perceived in the far field (i.e., at least 10 wavelengths from the antenna center). Some caution should be used in measuring spectrum occupancy with directional antennas.[6]

The analyzer's setup shall consist of:

a. 300 Hz resolution bandwidth.
b. 5, 10, or 20 kHz/horizontal division (as appropriate).
c. 10 dB/vertical division.
d. Reference: carrier peak.
e. Peak Hold: 10 minute duration minimum.
f. No Video Filter.

§ 4. RF Occupied Bandwidth Testing and Control Standard.

§ 4.1. Purpose. The NRSC recognizes that for the purposes of troubleshooting, design, and adjustment it may be desirable to use an occupied bandwidth emission standard that is coupled to a standard test signal and measurement procedure. This second measurement technique can also be utilized by transmitter manufacturers and broadcasters to provide results that may be directly correlated with each other. For these purposes, the NRSC proposes the following interim voluntary national test and control standard:

§ 4.2. Maximum Occupied Bandwidth. The RF occupied bandwidth test and control standard is a stored peak specification. With the standard test signals and measurement procedures specified below, AM stations shall occupy a maximum RF bandwidth that conforms to the following maximum specifications:

---

[6] *See* Klein, *Modulation, Overmodulation, and Occupied Bandwidth: Recommendations for the AM Broadcast Industry* (NAB, September 11, 1986) at 18-23.

Table 2

Frequency Band Relative to Carrier (+/- kHz)	Attenuation Relative to Carrier (dB)
0 to 10	0
10 to 13.5	Minimum is defined by a line with endpoints found at -25 dB/10 kHz and -35 dB/13.5 kHz[7]
13.5 to 54.5	Minimum is defined by a line with endpoints found at -35 dB/13.5 kHz and -65 dB/54.5 kHz[8]
54.5 to 75	-65[8]
above 75	-80[8]

(See Figures 1 and 1A (dotted line) attached).

§ 4.3. Measurement Procedure.

§ 4.3.1. Standard Noise Test. Measurements of AM station spectrum occupancy shall be conducted using a standard noise test signal described in the January 10, 1987 NRSC audio standard.[9] All audio processing employed in the AM station or test configuration shall be in a normal operating mode. The audio signal input to the AM transmitter shall conform to the NRSC audio standard adopted January 10, 1987.

§ 4.3.1.1. Monophonic conditions. The noise source is unmodified.

§ 4.3.1.2. Stereophonic conditions. Two independent but equivalently designed USASI-weighted noise sources are employed. Pulsing of the sources is controlled by a single control signal. The pulsed output of one noise generator is defined as L+R (mono, sum information) where the other is attenuated by 3 dB to

---

[7]See footnote 3.

[8]For carrier power levels between 50 and 5000 Watts, the maximum limit shall be $-(43 + 10 \log P_W)$ dB (where P_W is the carrier power in Watts) or as indicated in Table 2 and/or the attached Figure 1, whichever is lesser attenuation. For carrier power levels below 50 Watts, a -60 dBC maximum limit shall be used.

[9]*See National Radio Systems Committee, Interim Voluntary National Standard (NRSC-1).* § 6.3.2 and Figures 4, 5, and 6 (January 10, 1987).

provide L-R (stereo, difference information). The signals are then matrixed to provide left and right channel information to be applied to the audio input terminals of the stereophonic audio processor employed.[10] See Figure 2 (attached).

§ 4.3.2. Use of Spectrum Analyzer. A suitable swept-frequency RF spectrum analyzer shall be used to measure compliance with the NRSC RF occupied bandwidth testing and control standard. The analyzer's setup shall consist of:

a. 300 Hz resolution bandwidth.
b. 5, 10, or 20 kHz/horizontal division (as appropriate).
c. 10 dB/vertical division.
d. Reference: carrier peak.
e. Peak Hold: 10 minute duration minimum.
f. No video filter.

§ 5. Splatter Monitor. It is understood that the NRSC does not anticipate a Spectrum Analyzer will be available for mask standard measurements in most AM radio stations. However, the current development of a low cost "splatter monitor" device may allow economical continuous monitoring of compliance with RF mask characteristics.

Such a device accommodates the following factors: (1) NRSC deemphasis, and (2) amplitude detection of in-phase and quadrature signal components found in the defined stopband region.

As these devices are evaluated and correlated with current spectrum analysis measurement techniques, a determination shall be made by the NRSC with respect to possible modification of RF mask compliance measurement methods.

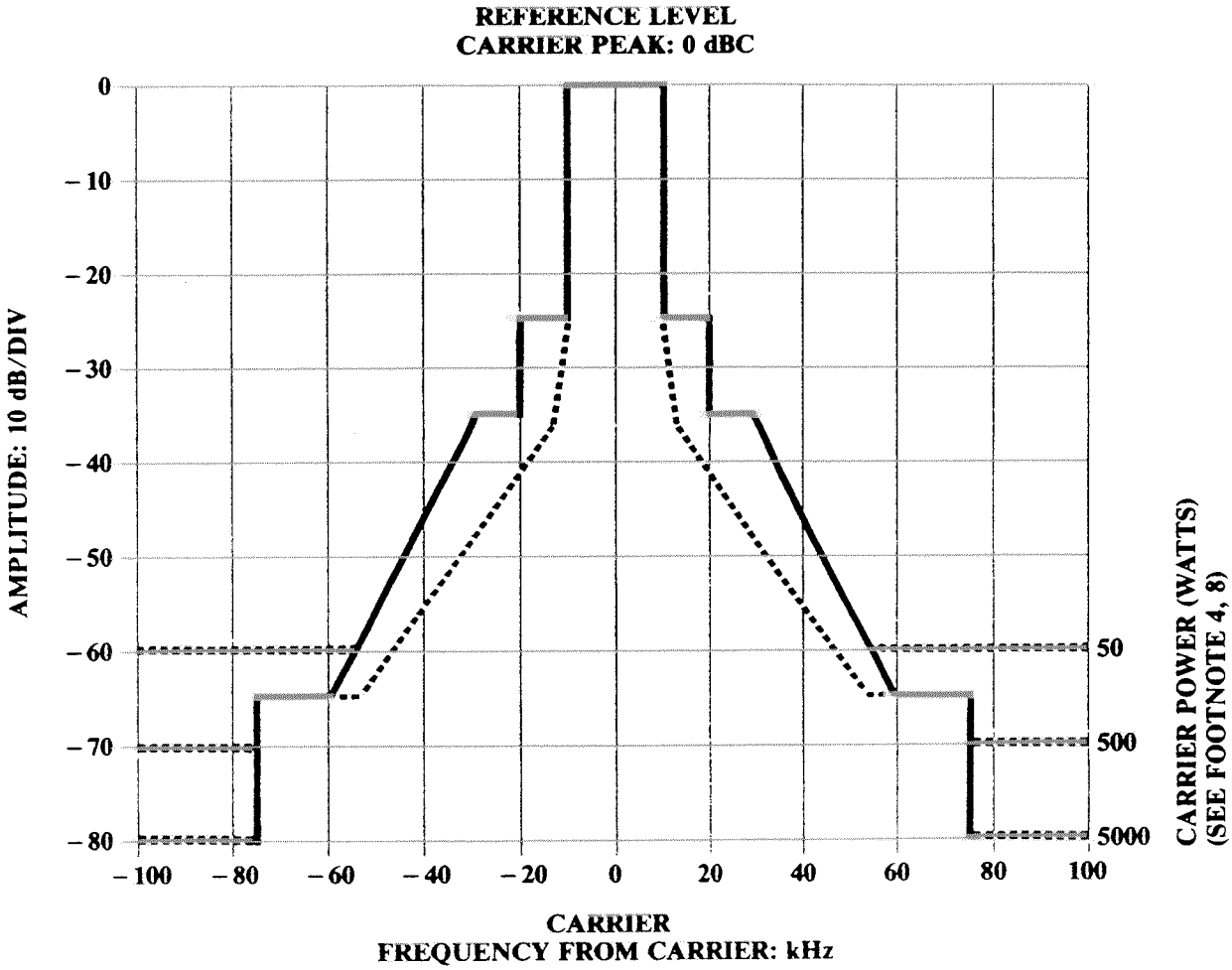
§ 6. Effective Date. **June 1, 1988.**

§§§§

[10]The signal provided by the audio processor to the transmitter left and right audio input terminals shall not exceed single channel modulation limits as dictated by the constraints of the particular stereo system employed.

FIGURE 1

AM BROADCAST
RF EMISSION LIMITS



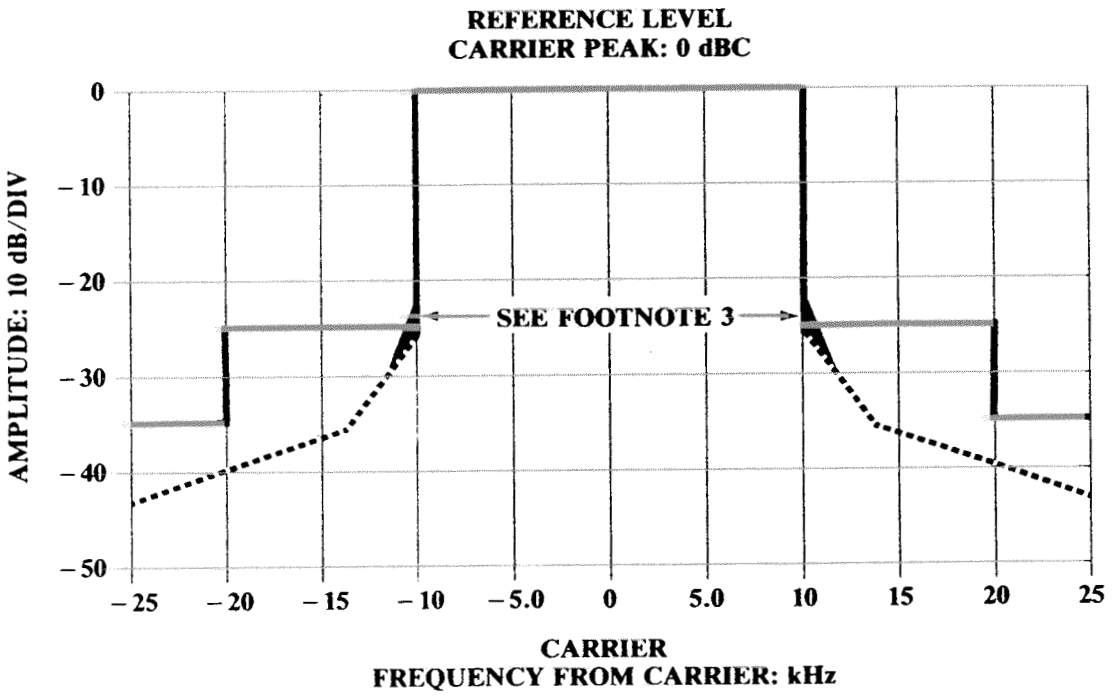
MAXIMUM LIMITS

TEST LIMITS

FIGURE 1 A

AM BROADCAST
RF EMISSION LIMITS

(EXPANDED SCALE)



——— MAXIMUM LIMITS

- - - - - - - - TEST LIMITS

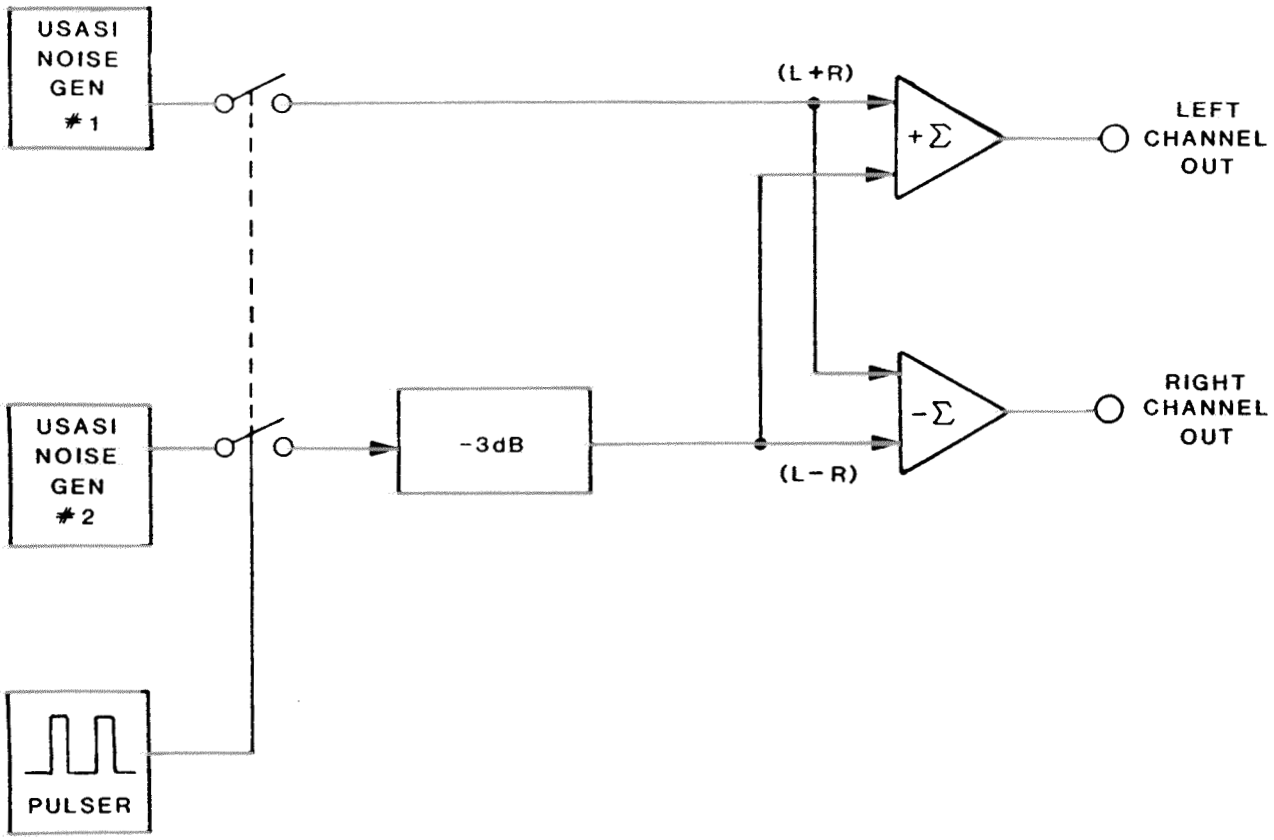


FIGURE 2: NOISE GENERATOR FOR A 3dB (L+R) TO (L-R) RATIO
(See § 4.3.1.2.)

NRSC Document Improvement Proposal

If in the review or use of this document a potential change appears needed for safety, health or technical reasons, please fill in the appropriate information below and email, mail or fax to:

National Radio Systems Committee
c/o Consumer Electronics Association
Technology & Standards Department
2500 Wilson Blvd.
Arlington, VA 22201
FAX: 703 907-7693
standards@ce.org

Document No.	Document Title:
Submitter's Name: Submitter's Company:	Telephone No.: FAX No.: e-mail:
Address:	
Urgency of Change: _____ Immediate _____ At next revision	
Problem Area: a. Clause Number and/or Drawing: b. Recommended Changes: c. Reason/Rationale for Recommendation:	
Additional Remarks:	
Signature:	Date:
FOR NRSC USE ONLY Date forwarded to NAB Science & Technology: Responsible Committee: Co-chairmen: Date comments forwarded to committee co-chairmen:	


NAB
BROADCASTERS


CEA
Consumer Electronics Association