ANSI S1.4A-1985 (Amdt. to ANSI S1.4-1983)

AMERICAN NATIONAL STANDARD
Specification for Sound Level Meters
ANSI S1.4A-1985 AMENDMENT to ANSI S1.4-1983

This amendment to ANSI S1.4-1983 was approved by Accredited Standards Committee S1, Acoustics, under Chairmanship of Dr. T. F. W. Embleton, and by the American National Standards Institute (ANSI). The Secretariat of Accredited Standards Committee S1 is held by the Acoustical Society of America. The date of the ANSI approval of this Amendment is 26 June 1985.

Dr. G. S. K. Wong, Individual Expert on Accredited Standards Committee S1, assisted Standards Committee S1 in preparation of this amendment (ANSI S1.4A-1985) to ANSI S1.4-1983.

CONTENTS

0 INTRODUCTION

The use of A-weighting for analyzing acoustical signals has been standardized since the early 1930s. Various sound level meter standards[1,2] have provided specifications and tolerances on the frequency response of the A-weighting up to 20 kHz. For measurements of short-duration transient signals, it has been shown[3] that the uncertainty allowed in the A-weighted frequency response in the region above 16 kHz leads to an error which may exceed the intended tolerances for the measurement of A-weighted sound level by a precision (type 1) sound level meter. The intent of this amendment is: (a) to specify the electrical design goal for the relative response characteristics of the A-weighted frequency response up to 100 kHz and (b) to specify type 0 and type 1 tolerance limits on relative electrical response for frequencies between 16 kHz and 100 kHz.

The frequency range over which an instrument complies with the specification for A-weighting shall be stated by the manufacturer in the Instruction Manual, and, if practical, labeled on the instrument.

For some acoustical measurements it is undesirable for the instrument to respond to sound at frequencies above about 10 kHz to 20 kHz, i.e., beyond the normal range of human hearing. If the instrument does not provide a high-frequency cutoff at such frequencies, the user may need to employ additional narrow-band filters or filters with cutoff frequencies which are determined by the specific application.

1 DESIGN GOAL

The design goals of the random incidence relative response level for A-frequency weighting are tabulated from 10 Hz to 20 kHz in Table IV of ANSI S1.4-1983. That table is repeated, for completeness, as Table AI(a) of this amendment. The electrical design goal of the A-weighted frequency response is given in Table AI(b) for nominal frequencies to 100 kHz.

2 TOLERANCE LIMITS

Acoustical tolerance limits from 10 Hz to 20 kHz, given in Table V of ANSI S1.4-1983, are not changed; the limits are repeated here in Table AII(a) for type 0 and type 1 instruments. Electrical tolerance limits for type 0 and type 1 are given in Table AII(b) for frequencies from 16 kHz to 100 kHz.

Electrical tests to demonstrate conformance with the requirements of this amendment may be carried out by use of sinusoidal electrical signals with an equivalent electrical impendence substituted for the microphone.

3 REFERENCES

[1]American National Standard Specification for Sound Level Meters, ANSI S1.4-1983.

[2]"Sound Level Meters," International Electrotechnical Commission, Publication 651(1979).

[3]G. S. K. Wong, "Influence of A-weighting tolerances and frequency-band limits on level measurements," J. Acoust. Soc. Am. 68, 1578–1583 (1980).

TABLE AI. Relative frequency response for A-weighting.

(a) Random incidence relative response level for A-weighting

Nominal frequency[a] Hz	Exact frequency[a] Hz	A-weighting dB
10	10.00	− 70.4
12.5	12.59	− 63.4
16	15.85	− 56.7
20	19.95	− 50.5
25	25.12	− 44.7
31.5	31.62	− 39.4
40	39.81	− 34.6
50	50.12	− 30.2
63	63.10	− 26.2
80	79.43	− 22.5
100	100.0	− 19.1
125	125.9	− 16.1
160	158.5	− 13.4
200	199.5	− 10.9
250	251.2	− 8.6
315	316.2	− 6.6
400	398.1	− 4.8
500	501.2	− 3.2
630	631.0	− 1.9
800	794.3	− 0.8
1000	1000	0
1250	1259	+ 0.6
1600	1585	+ 1.0
2000	1995	+ 1.2
2500	2512	+ 1.3
3150	3162	+ 1.2
4000	3981	+ 1.0
5000	5012	+ 0.5
6300	6310	− 0.1
8000	7943	− 1.1
10 000	10 000	− 2.5
12 500	12 590	− 4.3
16 000	15 850	− 6.6
20 000	19 950	− 9.3

(b) Electrical response level relative to that at 1000 Hz for A-weighting

1000	1000	0
16 000	15 850	− 6.6
20 000	19 950	− 9.3
25 000	25 120	− 12.4
31 500	31 620	− 15.8
40 000	39 810	− 19.3
50 000	50 120	− 23.1
63 000	63 100	− 26.9
80 000	79 430	− 30.8
100 000	100 000	− 34.7

[a] Nominal frequencies are as specified in ANSI S1.6-1984 [A revision of S1.6-1967 (R1976)], American National Standard Preferred Frequencies, Frequency Levels, and Band Numbers for Acoustical Measurements. Exact frequencies are given above to four significant figures and are calculated from frequency equals $10^{0.1N}$, where N is an integer band number from 10 to 50 (1 hertz corresponds to $N = 0$).

TABLE AII. Tolerance limits on relative frequency response for A-weighting.

(a) Tolerance limits on relative response levels for sound at random incidence measured on an instrument's calibration range

Nominal frequency Hz	Type 0 dB	Type 1 dB
10	+ 2, − 5	± 4
12.5	+ 2, − 4	± 3.5
16	+ 2, − 3	± 3
20	± 2	± 2.5
25	± 1.5	± 2
31.5	± 1	± 1.5
40	± 1	± 1.5
50	± 1	± 1
63	± 1	± 1
80	± 1	± 1
100	± 0.7	± 1
125	± 0.7	± 1
160	± 0.7	± 1
200	± 0.7	± 1
250	± 0.7	± 1
315	± 0.7	± 1
400	± 0.7	± 1
500	± 0.7	± 1
630	± 0.7	± 1
800	± 0.7	± 1
1000	± 0.7	± 1
1250	± 0.7	± 1
1600	± 0.7	± 1
2000	± 0.7	± 1
2500	± 0.7	± 1
3150	± 0.7	± 1
4000	± 0.7	± 1
5000	± 1	± 1.5
6300	+ 1, − 1.5	+ 1.5, − 2
8000	+ 1, − 2	+ 1.5, − 3
10 000	+ 2, − 3	+ 2, − 4
12 500	+ 2, − 3	+ 3, − 6
16 000	+ 2, − 3	+ 3, − ∞
20 000	+ 2, − 3	+ 3, − ∞

(b) Tolerance limits on electrical relative response level for A-weighting measured when the instrument is set on its calibration range (defined in Sec. 2.14 of ANSI S1.4-1983).

16 000	+ 2, − 3	+ 3, − 7.4
20 000	+ 2, − 3	+ 3, − 8.7
25 000	+ 2.4, − 4.5	+ 3.5, − 9.6
31 500	+ 2.8, − 6.2	+ 4.3, − 10.7
40 000	+ 3.3, − 7.9	+ 5, − 11.7
50 000	+ 4.1, − 9.3	+ 6, − 12.8
63 000	+ 4.9, − 10.9	+ 6.9, − 13.9
80 000	+ 5.1, − 12.2	+ 7.9, − 15.2
100 000	+ 5.6, − 14.3	+ 8.9, − 16.8