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AEROSPACE RECOMMENDED PRACTICE

ARP 865

DEFINITIONS AND PROCEDURES FOR COMPUTING THE PERCEIVED NOISE LEVEL OF AIRCRAFT NOISE

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Revised

1. INTRODUCTION - The introduction of commercial jet aircraft operations, as well as the general increase in air traffic has resulted in an international concern over aircraft noise. In order to facilitate evaluation of the subjective response to aircraft noise, it is desirable to have a single number specification of the noise, based upon objective acoustic measurements, which relates to the subjective response.

At the present time it is advisable to specify this quantity only in terms of noise level and spectrum although it is recognized that additional factors, such as duration, frequency of occurence of noise, and the presence of pure tone components may be necessary to describe the total subjective reaction.

A number of different methods for quantifying the various subjective reactions to noise exist, such as loudness level, noise rating numbers, and perceived noise level. Recognizing that current practice in comparing aircraft noise levels is widely based on perceived noise level, this recommendation is based on that quantity. In the procedures to be described, perceived noise level in PNdB is computed from the spectral analysis of the aircraft noise, in octave bands of frequency.

2. Calculation of Perceived Noise Level in PNdB from Measured Noise Data

2.1 Explanation of Terms

2.1.1 Perceived Noise Level in PNdB - Perceived noise level of a given sound in PNdb is the result of a calculation as specified in paragraph 2.2.

NOTE: This procedure gives an approximation to the perceived noise level as determined by subjective experiment on a fundamental psycho-acoustical basis: namely that perceived noise level of a given sound is numerically equal to the sound pressure level of a reference sound that is judged by listeners to have the same perceived noisiness as the given sound, the reference sound being a band of random noise one octave in width centered on 1000 Hz (c/s).

2.1.2 Noy - A unit of perceived noisiness. The numerical value of the perceived noisiness of a sound within a given frequency band, in noys, is related to the band pressure levels. The relation is given in Figure 1 and in Tables I and II, which has been derived from subjective judgements of the relative noisiness of sounds (Ref. 1).

NOTE: In order to avoid confusion, attention is drawn to the fact that the noy values given here (Ref. 1) differ from those given in Refs. 2 and 3.

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References:

Ref. 1 - K. D. Kryter and K. S. Pearsons: Modification of Noy Table, JASA, Vol. 36, 1964, p. 394.

Ref. 2 - K. D. Kryter and K. S. Pearsons: Some effects of spectral content and duration on perceived noise level. JASA Vol. 35, 1963, pp. 866-886.

Ref. 3 - K. D. Kryter: Scaling human reactions to the sound from aircraft. JASA, Vol. 31, 1959, pp. 1415-1429.

2.2 Calculation procedure - Perceived noise level in PNdB is calculated according to the following procedure:

Step 1 - The maximum value of sound pressure level in each octave band is converted to a noy value by reference to Tables I or II, or Figure 1, by entering the tables or figure at the appropriate center frequency.

NOTE 1: It is recognized that, for aircraft noise, the individual maxima of sound pressure level do not necessarily occur at the same instant in time for the different frequency bands. However, the procedure recommended is a more practical and appropriate method for calculating perceived noise level in PNdB than measuring the sound pressure level in each octave band at some specified point in time.

NOTE 2: To determine the variation at a given point on the ground of the perceived noise level in PNdB of the sound from an operating aircraft, it is recommended that graphic recordings containing time markings be made of the sound pressure level in individual octave bands as a function of time. From these graphs PNdB values can be calculated from the octave band sound pressure levels taken at any given points in time.

The time of occurrence, with respect to some appropriate reference time, should be indicated for all PNdB values calculated by this procedure. The label "PNdB" without a reference time indicated should be used only for perceived noise levels calculated from maximum octave band levels as specified in Step 1, paragraph 2.2 above.

NOTE 3: Because the ordinates on a graph may become distorted during reproduction, it is preferable, when possible, to use Tables I or II instead of Figure 1 for converting band sound pressure level to noy values.

Step 2 - The noy values found in Step 1 are combined in the manner prescribed in the following formula:

$$\underline{N} = n_{max} + 0.3 \left(\sum n - n_{max} \right)$$

where n_{max} is the number of noys in the noisiest band and $\sum n$ is the sum of the noy values in all the bands.

Step 3 - $\underline{N}$ is converted into perceived noise level in PNdB by the use of Table III which expresses the relation:

$\underline{N} = 2^{(X^p - 40)/10}$, where X is the value in PNdB.

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AIRCRAFT EXTERIOR NOISE MEASUREMENT

Table I - Noys as a Function of Sound Pressure Level

(preferred frequencies for octave band filters marked by heavy lines)

Band Center Frequency in Hz(c/s)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Lp	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10,000	12,500
29																			1.0	1.0					
30																		1.0	1.0	1.1					
31																		1.1	1.1	1.1	1.0				
32																	1.0	1.1	1.2	1.2	1.1				
33																	1.1	1.2	1.3	1.3	1.2	1.0			
34																1.0	1.2	1.3	1.4	1.4	1.3	1.1			
35																1.1	1.3	1.4	1.5	1.5	1.4	1.2			
36																1.2	1.3	1.5	1.6	1.6	1.5	1.4			
37																1.3	1.4	1.6	1.8	1.8	1.6	1.5	1.0		
38															1.0	1.3	1.5	1.8	1.9	1.9	1.7	1.6	1.1		
39															1.1	1.4	1.6	1.9	2.0	2.0	1.9	1.8	1.2		
40										1.0	1.0	1.0	1.0	1.0	1.2	1.5	1.7	2.0	2.2	2.2	2.0	1.9	1.4		
41										1.1	1.1	1.1	1.1	1.1	1.3	1.6	1.8	2.2	2.4	2.4	2.2	2.0	1.5	1.0	
42									1.0	1.1	1.1	1.1	1.1	1.1	1.3	1.7	2.0	2.4	2.6	2.6	2.4	2.2	1.7	1.1	
43									1.1	1.2	1.2	1.2	1.2	1.2	1.4	1.8	2.2	2.6	2.8	2.8	2.6	2.4	1.8	1.2	
44								1.0	1.1	1.3	1.3	1.3	1.3	1.3	1.5	2.0	2.4	2.8	3.0	3.0	2.8	2.6	2.0	1.4	
45								1.1	1.2	1.4	1.4	1.4	1.4	1.4	1.6	2.1	2.6	3.0	3.2	3.2	3.0	2.8	2.2	1.5	
46							1.0	1.2	1.3	1.5	1.5	1.5	1.5	1.5	1.7	2.3	2.8	3.2	3.4	3.4	3.2	3.0	2.4	1.7	1.0
47							1.1	1.3	1.4	1.6	1.6	1.6	1.6	1.6	1.8	2.4	3.0	3.4	3.6	3.6	3.4	3.2	2.6	1.8	1.1
48						1.0	1.2	1.4	1.5	1.7	1.7	1.7	1.7	1.7	2.0	2.6	3.2	3.6	3.9	3.9	3.6	3.4	2.8	2.0	1.2
49						1.1	1.3	1.5	1.6	1.9	1.9	1.9	1.9	1.9	2.1	2.8	3.4	3.9	4.1	4.1	3.9	3.6	3.0	2.2	1.4
50						1.2	1.4	1.6	1.7	2.0	2.0	2.0	2.0	2.0	2.3	3.0	3.6	4.1	4.4	4.4	4.1	3.9	3.2	2.4	1.5
51					1.0	1.3	1.5	1.7	1.9	2.1	2.1	2.1	2.1	2.1	2.4	3.2	3.9	4.4	4.7	4.7	4.4	4.1	3.4	2.6	1.7
52					1.1	1.4	1.6	1.9	2.0	2.3	2.3	2.3	2.3	2.3	2.6	3.5	4.1	4.7	5.0	5.0	4.7	4.4	3.6	2.8	1.8
53				1.0	1.2	1.5	1.7	2.0	2.1	2.5	2.5	2.5	2.5	2.5	2.8	3.7	4.4	5.0	5.3	5.3	5.0	4.7	3.9	3.0	2.0
54				1.1	1.3	1.6	1.9	2.1	2.3	2.6	2.6	2.6	2.6	2.6	3.0	4.0	4.7	5.3	5.7	5.7	5.3	5.0	4.1	3.2	2.2
55				1.2	1.4	1.7	2.0	2.3	2.4	2.8	2.8	2.8	2.8	2.8	3.2	4.3	5.0	5.7	6.1	6.1	5.7	5.3	4.4	3.5	2.3
56			1.0	1.3	1.5	1.9	2.2	2.4	2.6	3.0	3.0	3.0	3.0	3.0	3.5	4.6	5.3	6.1	6.5	6.5	6.1	5.7	4.7	3.7	2.5
57			1.1	1.4	1.7	2.0	2.4	2.6	2.8	3.2	3.2	3.2	3.2	3.2	3.7	5.0	5.7	6.5	7.0	7.0	6.5	6.1	5.0	4.0	2.8
58			1.2	1.5	1.8	2.2	2.6	2.8	3.0	3.5	3.5	3.5	3.5	3.5	4.0	5.3	6.1	7.0	7.5	7.5	7.0	6.5	5.3	4.3	3.0
59			1.3	1.7	2.0	2.4	2.8	3.0	3.2	3.7	3.7	3.7	3.7	3.7	4.3	5.7	6.5	7.5	8.0	8.0	7.5	7.0	5.7	4.6	3.3
60		1.0	1.4	1.8	2.2	2.6	3.0	3.2	3.5	4.0	4.0	4.0	4.0	4.0	4.6	6.1	7.0	6.0	8.7	8.7	8.0	7.5	6.1	5.0	3.6
61		1.1	1.5	2.0	2.4	2.8	3.2	3.5	3.7	4.3	4.3	4.3	4.3	4.3	5.0	6.5	7.5	8.7	9.3	9.3	8.7	8.0	6.5	5.3	3.9
62		1.2	1.7	2.2	2.6	3.0	3.5	3.7	4.0	4.6	4.6	4.6	4.6	4.6	5.3	7.0	8.0	9.3	10	10	9.3	8.7	7.0	5.7	4.2
63		1.3	1.8	2.4	2.8	3.2	3.7	4.0	4.3	4.9	4.9	4.9	4.9	4.9	5.7	7.5	8.7	10	11	11	10	9.3	7.5	6.1	4.6
64	1.0	1.5	2.0	2.6	3.0	3.5	4.0	4.3	4.6	5.3	5.3	5.3	5.3	5.3	6.1	8.0	9.3	11	11	11	11	10	8.0	6.5	5.0
65	1.1	1.6	2.2	2.8	3.2	3.7	4.3	4.6	5.0	5.7	5.7	5.7	5.7	5.7	6.5	8.7	10	11	12	12	11	11	8.7	7.0	5.3
66	1.2	1.8	2.4	3.0	3.5	4.0	4.6	5.0	5.4	6.1	6.1	6.1	6.1	6.1	7.0	9.3	11	12	13	13	12	11	9.3	7.5	5.7
67	1.4	2.0	2.6	3.3	3.7	4.3	5.0	5.4	5.9	6.5	6.5	6.5	6.5	6.5	7.5	10	11	13	14	14	13	12	10	8.0	6.1
68	1.6	2.2	2.8	3.6	4.0	4.6	5.4	5.9	6.4	7.0	7.0	7.0	7.0	7.0	8.0	11	12	14	15	15	14	13	11	8.7	6.5
69	1.8	2.3	3.0	3.9	4.3	5.0	5.9	6.4	6.9	7.5	7.5	7.5	7.5	7.5	8.7	71	13	15	16	16	15	14	11	9.3	7.0
70	2.0	2.5	3.3	4.2	4.6	5.4	6.4	6.9	7.5	8.0	8.0	8.0	8.0	8.0	9.3	12	14	16	17	17	16	15	12	10	7.5
71	2.2	2.8	3.6	4.6	5.0	5.9	6.9	7.5	8.0	8.6	8.6	8.6	8.6	8.6	10	13	15	17	19	19	17	16	13	11	8.0
72	2.3	3.0	3.9	5.0	5.4	6.4	7.5	8.0	8.7	9.2	9.2	9.2	9.2	9.2	11	14	16	19	20	20	19	17	14	11	8.7
73	2.5	3.3	4.2	5.4	5.9	6.9	8.0	8.7	9.3	9.8	9.8	9.8	9.8	9.6	11	15	17	20	21	21	20	19	15	12	9.3
74	2.8	3.7	4.6	5.9	6.4	7.5	8.7	9.3	10	10.6	10.6	10.6	10.6	10.6	12	16	19	21	23	23	21	20	16	13	10
75	3.0	4.1	5.0	6.4	6.9	8.0	9.3	10	11	11.3	11.3	11.3	11.3	11.3	13	17	20	23	24	24	23	21	17	14	11
76	3.3	4.5	5.4	6.9	7.5	8.7	10	11	11	12	12	12	12	12	14	19	21	24	26	26	24	23	19	15	11
77	3.7	5.0	5.9	7.5	8.3	9.3	11	11	12	13	13	13	13	13	15	20	23	26	28	28	26	24	20	16	12
78	4.1	5.4	6.4	8.3	9.1	10	11	12	13	14	14	14	14	14	16	21	24	28	30	30	28	26	21	17	13
79	4.5	5.9	6.9	9.1	10	11	12	13	14	15	15	15	15	15	17	23	26	30	32	32	30	28	23	19	14
80	5.0	6.4	7.5	10	11	11	13	14	15	16	16	16	16	16	19	24	28	32	35	35	32	30	24	20	15
81	5.5	6.9	8.3	11	11	12	14	15	16	17	17	17	17	17	20	26	30	35	37	37	35	32	26	21	16
82	6.1	7.5	9.1	11	12	13	15	16	17	18	18	18	16	16	21	28	32	37	40	40	37	35	28	23	17
83	6.8	8.3	10	12	13	14	16	17	19	20	20	20	20	20	23	30	35	40	42	42	40	37	30	24	19
84	7.5	9.1	12	13	14	15	17	19	20	21	21	21	21	21	24	32	37	42	45	45	42	40	32	26	20
85	8.3	10	13	14	15	16	19	20	21	23	23	23	23	23	26	35	40	45	47	47	45	42	35	28	21
86	9.1	12	13	15	16	17	20	21	23	24	24	24	24	24	28	37	42	47	50	50	47	45	37	30	23
87	10	13	14	16	17	19	21	23	24	26	26	26	26	26	30	40	45	50	55	55	50	47	40	32	24
88	11	13	15	17	19	20	23	24	26	28	28	28	28	28	32	42	47	55	60	60	55	50	42	35	26
89	12	14	16	19	20	21	24	26	28	30	30	30	30	30	35	45	50	60	63	63	60	55	45	37	28

Table I Noys as a Function of Sound Pressure Level - Cont'd

Band Center Frequency in Hz(c/s)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Lp	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10,000	12,500
90	14	15	17	20	21	23	26	28	30	32	32	32	32	32	37	47	55	63	67	67	63	60	47	40	30
91	15	16	19	21	23	24	28	30	32	34	34	34	34	34	40	50	60	67	71	71	67	63	50	42	32
92	16	17	20	23	24	26	30	32	35	37	37	37	37	37	42	55	63	71	75	71	71	67	55	45	35
93	17	19	21	24	28	28	32	35	37	39	39	39	39	39	45	60	67	75	80	80	75	71	60	47	37
94	19	20	23	26	28	30	35	37	40	42	42	42	42	42	47	63	71	80	86	86	80	75	63	50	40
95	20	21	24	28	30	32	37	40	42	45	45	45	45	45	50	67	75	86	93	93	86	80	67	55	43
96	21	23	26	30	32	35	40	42	45	49	49	49	49	49	55	71	80	93	100	100	93	86	71	60	46
97	23	24	28	32	35	37	42	45	47	52	52	52	52	52	60	75	86	100	108	108	100	93	75	63	50
98	24	26	30	35	37	40	45	47	50	56	56	56	56	56	64	80	93	108	116	116	108	100	80	67	55
99	26	28	32	37	40	42	47	50	55	60	60	60	60	60	69	86	100	116	125	125	116	108	86	71	60
100	28	30	35	40	42	45	50	55	60	64	64	64	64	64	74	93	108	125	133	133	125	116	93	75	63
101	30	32	37	42	45	47	55	60	64	69	69	69	69	69	79	100	116	133	142	142	133	125	100	80	67
102	32	35	40	45	47	50	60	64	69	74	74	74	74	74	84	108	125	142	150	150	142	133	108	86	71
103	35	37	42	47	50	55	64	69	74	79	79	79	79	79	81	116	133	150	162	162	150	142	116	93	75
104	37	40	45	50	55	60	69	74	79	84	84	84	84	84	97	125	142	162	173	173	162	150	125	100	80
105	40	42	47	55	60	64	74	79	84	91	91	91	91	91	104	133	150	173	186	186	173	162	133	108	66
106	42	45	50	60	64	69	79	84	91	97	97	97	97	97	111	142	162	186	200	200	186	173	142	116	93
107	45	47	55	64	69	74	84	91	97	104	104	104	104	104	119	150	173	200	215	215	200	186	150	125	100
108	47	50	60	69	74	79	91	97	104	111	111	111	111	111	128	162	186	215	232	232	215	200	162	133	108
109	50	55	64	74	79	84	97	104	111	119	119	119	119	119	137	173	200	232	250	250	232	215	173	142	116
110	55	60	69	79	84	91	104	111	119	128	128	128	128	128	147	186	215	250	266	266	250	232	186	150	125
111	60	64	74	84	91	97	111	119	128	137	137	137	137	137	158	200	232	266	284	284	266	250	200	162	133
112	64	69	79	91	97	104	119	128	137	147	147	147	147	147	169	215	250	284	300	300	284	266	215	173	142
113	69	74	84	97	104	111	128	137	147	158	158	158	158	158	181	232	266	300	324	324	300	284	232	186	150
114	74	79	91	104	111	119	137	147	158	169	169	169	169	169	194	250	284	324	346	346	324	300	250	200	162
115	79	84	97	111	119	128	147	158	169	181	181	181	181	181	208	266	300	346	372	372	346	324	266	215	173
116	84	91	104	119	128	137	158	169	181	194	194	194	194	194	223	284	324	372	400	400	372	346	284	232	186
117	91	97	111	128	137	147	169	181	194	208	208	208	208	208	239	300	346	400	430	430	400	372	300	250	200
118	97	104	119	137	147	158	181	194	208	223	223	223	223	223	256	324	372	430	464	464	430	400	324	266	215
119	104	111	128	147	158	169	194	208	223	239	239	239	239	239	274	346	400	464	500	500	464	430	346	284	232
120	111	119	137	158	169	181	208	223	239	256	256	256	256	256	294	372	430	500	532	532	500	464	372	300	250
121	119	128	147	169	181	194	223	239	256	274	274	274	274	274	315	400	464	532	568	568	532	500	400	324	266
122	128	137	158	181	194	208	239	256	274	294	294	294	294	294	338	430	500	568	600	600	568	532	430	346	284
123	137	147	169	194	208	223	256	274	294	315	315	315	315	315	362	464	532	600	648	648	600	568	464	372	300
124	147	158	181	208	223	239	274	294	315	338	338	338	338	338	388	500	568	648	692	692	648	600	500	400	324
125	158	169	194	223	239	256	294	315	338	362	362	362	362	362	416	532	600	692	744	744	692	648	532	430	346
126	169	181	208	239	256	274	315	338	362	388	388	388	388	388	446	568	648	744	800	800	744	692	568	464	372
127	181	194	223	256	274	294	338	362	388	416	416	416	416	416	478	600	692	800	860	860	800	744	600	500	400
128	194	208	239	274	294	315	362	388	416	446	446	446	446	446	512	648	744	860	928	928	860	800	648	532	430
129	208	223	256	294	315	338	388	416	446	478	478	478	478	478	549	692	800	928	1000	1000	928	860	692	568	464
130	223	239	274	315	338	362	416	446	478	512	512	512	512	512	588	744	860	1000	1064	1064	1000	928	744	600	500
131	239	256	294	338	362	388	446	478	512	549	549	549	549	549	630	800	928	1064	1136	1136	1064	1000	800	648	532
132	256	274	315	362	388	416	478	512	549	588	588	588	588	588	676	860	1000	1136	1200	1200	1136	1064	860	692	568
133	274	294	338	388	416	446	512	549	588	630	630	630	630	630	724	928	1064	1200	1296	1296	1200	1136	928	744	600
134	294	315	362	416	446	478	549	588	630	676	676	676	676	676	776	1000	1136	1296	1384	1384	1296	1200	1000	800	648
135	315	338	388	446	478	512	588	630	676	724	724	724	724	724	832	1064	1200	1384	1488	1488	1384	1296	1064	860	692
136	338	362	416	478	512	549	630	676	724	776	776	776	776	776	891	1136	1296	1488	1600	1600	1488	1384	1136	928	744
137	362	388	446	512	549	588	676	724	776	832	832	832	832	832	955	1200	1384	1600	1720	1720	1600	1488	1200	1000	800
138	388	416	478	549	588	630	724	776	832	891	991	891	891	891	1024	1296	1488	1720	1856	1856	1720	1600	1296	1064	860
139	416	446	512	588	630	676	776	832	891	955	955	955	955	955	1098	1384	1600	1856	2000	2000	1856	1720	1384	1136	928
140	446	478	549	630	676	724	832	891	955	1024	1024	1024	1024	1024	1176	1488	1720	2000			2000	1856	1488	1200	1000
141	478	512	588	676	724	776	891	955	1024	1098	1098	1098	1098	1098	1261	1600	1856					2000	1600	1296	1064
142	512	549	630	724	776	832	955	1024	1098	1176	1176	1176	1176	1176	1351	1720	2000						1720	1384	1136
143	549	588	676	776	832	891	1024	1098	1176	1261	1261	1261	1261	1261	1448	1856							1856	1488	1200
144	588	630	724	832	891	955	1098	1176	1261	1351	1351	1351	1351	1351	1552	2000							2000	1600	1296
145	630	676	776	891	955	1024	1176	1261	1351	1448	1448	1448	1448	1448	1663									1720	1384
146	676	724	832	955	1024	1098	1261	1351	1448	1552	1552	1552	1552	1552	1783									1856	1488
147	724	776	891	1024	1098	1176	1351	1448	1552	1663	1663	1663	1663	1663	1911									2000	1600
148	776	832	955	1098	1176	1261	1448	1552	1663	1783	1783	1783	1783	1783											1720
149	832	891	1024	1176	1261	1351	1552	1663	1783	1911	1911	1911	1911	1911											2000
150	891	955	1098	1261	1351	1448	1663	1783	1911																

ARP 865	Issued 10-15-64 Revised	DEFINITIONS AND PROCEDURES FOR COMPUTING THE PERCEIVED NOISE LEVEL OF AIRCRAFT NOISE

Table II - Noys as a Function of Sound Pressure Level

Frequency Band Limits in Hz(c/s)

Band Center Frequency in Hz(c/s)

	37.5–75	75–150	150–300	300–600	600–1200	1200–2400	2400–4800	4,800–10,000
Lp	53	106	212	425	850	1700	3400	6800
29							1.0	
30							1.1	
31							1.2	
32							1.2	
33						1.0	1.3	
34						1.1	1.4	1.0
35						1.2	1.5	1.1
36						1.3	1.6	1.2
37						1.3	1.8	1.4
38						1.4	1.9	1.5
39						1.5	2.0	1.6
40				1.0	1.0	1.6	2.2	1.8
41				1.1	1.1	1.7	2.4	1.9
42				1.1	1.1	1.8	2.6	2.0
43				1.2	1.2	2.0	2.8	2.2
44				1.3	1.3	2.1	3.0	2.4
45				1.4	1.4	2.3	3.2	2.6
46			1.0	1.5	1.5	2.4	3.4	2.8
47			1.1	1.6	1.6	2.6	3.6	3.0
48			1.2	1.7	1.7	2.8	3.9	3.2
49			1.3	1.9	1.9	3.0	4.1	3.4
50			1.4	2.0	2.0	3.2	4.4	3.6
51			1.5	2.1	2.1	3.5	4.7	3.9
52		1.0	1.6	2.3	2.3	3.7	5.0	4.1
53		1.0	1.7	2.5	2.5	4.0	5.3	4.4
54		1.1	1.9	2.6	2.6	4.3	5.7	4.7
55		1.2	2.0	2.8	2.8	4.6	6.1	5.0
56		1.3	2.2	3.0	3.0	5.0	6.5	5.3
57		1.4	2.4	3.2	3.2	5.3	7.0	5.7
58		1.5	2.6	3.5	3.5	5.7	7.5	6.1
59		1.7	2.8	3.7	3.7	6.1	8.0	6.5
60		1.8	3.0	4.0	4.0	6.5	8.7	7.0
61		2.0	3.2	4.3	4.3	7.0	9.3	7.5
62		2.2	3.5	4.6	4.6	7.5	10	8.0
63	1.0	2.4	3.7	4.9	4.9	8.0	11	8.7
64	1.1	2.6	4.0	5.3	5.3	8.7	11	9.3
65	1.2	2.8	4.3	5.7	5.7	9.3	12	10
66	1.4	3.0	4.6	6.1	6.1	10	13	11
67	1.6	3.3	5.0	6.5	6.5	11	14	11
68	1.8	3.6	5.4	7.0	7.0	11	15	12
69	2.0	3.9	5.9	7.5	7.5	12	16	13
70	2.2	4.2	6.4	8.0	8.0	13	17	14
71	2.3	4.6	6.9	8.6	8.6	14	19	15
72	2.5	5.0	7.5	9.2	9.2	15	20	16
73	2.8	5.4	8.0	9.8	9.8	16	21	17
74	3.0	5.9	8.7	10.6	10.6	17	23	19
75	3.3	6.4	9.3	11.3	11.3	19	24	20
76	3.7	6.9	10	12	12	20	26	21
77	4.1	7.5	11	13	13	21	28	23
78	4.5	8.3	11	14	14	23	30	24
79	5.0	9.1	12	15	15	24	32	26
80	5.5	10	13	16	16	26	35	28
81	6.1	11	14	17	17	28	37	30
82	6.8	11	15	18	18	30	40	32
83	7.5	12	16	20	20	32	42	35
84	8.3	13	17	21	21	35	45	37
85	9.1	14	19	23	23	37	47	40
86	10	15	20	24	24	40	50	42
87	12	16	21	26	26	42	55	45
88	13	17	23	28	28	45	60	47
89	13	19	24	30	30	47	63	50

	37.5–75	75–150	150–300	300–600	600–1200	1200–2400	2400–4800	4,800–10,000
Lp	53	106	212	425	850	1700	3400	6800
90	14	20	26	32	32	50	67	55
91	15	21	28	34	34	55	71	60
92	16	23	30	37	37	60	75	63
93	17	24	32	39	39	63	80	67
94	19	26	35	42	42	67	86	71
95	20	28	37	45	45	71	93	75
96	21	30	40	49	49	75	100	80
97	23	32	42	52	52	80	108	86
98	24	35	45	56	56	86	116	93
99	26	37	47	60	60	93	125	100
100	28	40	50	64	64	100	133	108
101	30	42	55	69	69	108	142	116
102	32	45	60	74	74	116	150	125
103	35	47	64	79	79	125	162	133
104	37	50	69	84	84	133	173	142
105	40	55	74	91	91	142	186	150
106	42	60	79	97	97	150	200	162
107	45	64	84	104	104	162	215	173
108	47	69	91	111	111	173	232	186
109	50	74	97	119	119	186	250	200
110	55	79	104	128	128	200	266	215
111	60	84	111	137	137	215	284	232
112	64	91	119	147	147	232	300	250
113	69	97	128	158	158	250	324	266
114	74	104	137	169	169	266	346	284
115	79	111	147	181	181	284	372	300
116	84	119	158	194	194	300	400	324
117	91	128	169	208	208	324	430	346
118	97	137	181	223	223	346	464	372
119	104	147	194	239	239	372	500	400
120	111	158	208	256	256	400	532	430
121	119	169	223	274	274	430	568	464
122	128	181	239	294	294	464	600	500
123	137	194	256	315	315	500	648	532
124	147	208	274	338	338	532	692	568
125	158	223	294	362	362	568	744	600
126	169	239	315	388	388	600	800	648
127	181	256	338	416	416	648	860	692
128	194	274	362	446	446	692	928	744
129	208	294	388	478	478	744	1000	800
130	223	315	416	512	512	800	1064	860
131	239	338	446	549	549	860	1136	928
132	256	362	478	588	588	928	1200	1000
133	274	388	512	630	630	1000	1296	1064
134	294	416	549	676	676	1064	1384	1136
135	315	446	588	724	724	1136	1488	1200
136	338	478	630	776	776	1200	1600	1296
137	362	512	676	832	832	1296	1720	1384
138	388	549	724	891	891	1384	1856	1488
139	416	588	776	955	955	1488	2000	1600
140	446	630	832	1024	1024	1600		1720
141	478	676	891	1098	1098	1720		1856
142	512	724	955	1176	1176	1856		2000
143	549	776	1024	1261	1261	2000		
144	588	832	1098	1351	1351			
145	630	891	1176	1448	1448			
146	676	955	1261	1552	1552			
147	724	1024	1351	1663	1663			
148	776	1098	1448	1783	1783			
149	832	1176	1552	1911	1911			
150	891	1261	1663					