

INTERNATIONAL STANDARD

IEC 61196-1

1995

AMENDMENT 1
1999-08

Amendment 1

Radio-frequency cables –

Part 1:

**Generic specification – General, definitions,
requirements and test methods**

Amendement 1

Câbles pour fréquences radioélectriques –

Partie 1:

*Spécification générique – Généralités, définitions,
prescriptions et méthodes d'essai*

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International Electrotechnical Commission
Telefax: +41 22 919 0300

3, rue de Varembé Geneva, Switzerland
e-mail: inmail@iec.ch

IEC web site <http://www.iec.ch>



Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE

V

For price, see current catalogue

FOREWORD

This amendment has been prepared by subcommittee 46A: Coaxial cables, of IEC technical committee 46: Cables, wires, waveguides, r.f. connectors, and accessories for communication and signalling.

The text of this amendment is based on the following documents:

FDIS	Report on voting
46A/349/FDIS	46A/355/RVD

Full information on the voting for approval of this amendment can be found in the report on voting indicated in the above table.

Page 15

3.2.3 Braiding formulae

In table 1, against Variable W , in the description column, replace " N_d " by " $N \times d$ ".

Page 17

3.2.3.2 Lay factor, K_L

Replace the existing equation by the following new equation:

$$K_L = \frac{1}{\cos \beta} \sqrt{1 + \pi^2 \times \frac{D_m^2}{L^2}}$$

3.2.3.3 Filling factor, q

Replace the existing equation by the following new equation:

$$q = \frac{n \times W}{2\pi \times D_m} \times \sqrt{1 + \pi^2 \times \frac{D_m^2}{L^2}}$$

Page 35

7.1.1 Sheath marking

Example:

In the first line of the example, replace "50 Ωm" by "50 Ω".

Page 41

9.1.5 Expression of results

Replace equation (1) by the following new equation:

$$\text{ovality (\%)} = \frac{2(D_1 - D_2)}{D_1 + D_2} \times 100 \quad (1)$$

Page 43

9.2.5 Expression of results

Replace equation (2) by the following new equation:

$$\text{eccentricity (\%)} = \frac{(T_{\max} - T_{\min})}{D} \times 100 \quad (2)$$

Page 47

10.1.2 Preparation of test specimen

In figures 1a, 1b and 1c, on page 49, replace the tolerance "± 10 mm" by "± 2 mm".

Page 49

10.1.3 Procedure

Replace, in the second line of the third paragraph, "10 mm/min" by "100 mm/min".

Replace, in figure 2c, on page 53, "Centre conductor" by "Outer conductor".

Page 55

10.2.4 Requirement

Replace the second sentence by the following:

The cable shall meet the electrical requirements specified in the relevant cable specification.

10.3.3 Procedure

Replace, in the first line of the first paragraph "...in accordance with test A of IEC 68-2-1..." by "...in accordance with IEC 60068-2-1, test Aa, ...".

Page 59

10.6.3 Procedure

Replace, in the third line of the first paragraph "...in accordance with test B of IEC 68-2-2..." by "...in accordance with IEC 60068-2-2, test Ba/Bb,...".

Page 61

10.7.3 Procedure

Replace, in the first line of the first paragraph "...in accordance with test B of IEC 68-2-2..." by "...in accordance with IEC 60068-2-2, test Ba,...".

Page 63

10.9.3 Procedure

Replace, in the first line of the first paragraph "...in accordance with test B of IEC 68-2-2..." by "...in accordance with IEC 60068-2-2, test Bb,...".

Page 69

11.1.5 Expression of results

Replace equation (3) by the following new equation:

$$R = \frac{R_m}{l \times \{1 + \rho \times (t - 20)\}} \quad \text{in } \Omega/\text{km} \quad (3)$$

Page 71

11.2.5 Expression of results

Replace, in equation (4), "in MΩ/km" by "in MΩ·km".

11.3.3 Preparation of test specimen

Replace the equations in the note by the following new equation:

$$C = \frac{C_m \times \beta \times l}{\tan(\beta \times l)} \quad \text{with} \quad \beta \times l = 2\pi \times \frac{l \times f}{3 \times 10^5 \times v_r}$$

Page 73

11.3.4.2 Screened twin cable (two terminal method)

Replace equation (5) by the following new equation:

$$\text{capacitance} = \frac{C_a + C_b}{2} - \frac{C_c}{4} \quad (5)$$

11.3.4.3 Screened twin cable (three terminal method)

Replace equation (6) by the following new equation:

$$\text{capacitance} = \frac{C_e \times C_f}{C_e + C_f} \quad (6)$$

Page 75

11.3.4.5 Capacitance unbalance of screened twin cables (three terminal method)

Replace equation (8) by the following new equation:

$$\text{capacitance unbalance} = \frac{100(C_e - C_f)}{C_d \left[\frac{C_e \times C_f}{C_e + C_f} \right]} \text{ in \% (corrected)} \quad (8)$$

11.4.4 Procedure

Replace, in the first paragraph, "...in accordance with test Na and Nb of IEC 68-2-14", by "...in accordance with IEC 60068-2-14, test Nb".

Replace, in the third line of the second paragraph, "...at the end of each step" by "...at the end of each cycle".

Page 93

11.10.5.2 Procedure

Replace, after equation (17), "where l is in metres, $l \leq n \leq 10$ " by "where l is in metres".

Page 99

11.10.7 Electrical length and phase delay

Replace equation (24) by the following new equation:

$$\frac{\Delta L_e}{L_e} \approx \frac{4}{D_{3,e} \times \sqrt{f}} \leq 10^{-3} \quad (24)$$

Page 101

11.11.2.2 Temperature coefficient of phase constant

In equation (26), replace "CT" by " t_c ".

Page 103

11.11.5.1 Layout

In figure 11, item 3, attenuator, replace " ≥ 10 dBm" by " ≥ 10 dB".

Page 105

11.11.5.3 Expression of results

Replace, in the penultimate paragraph, "The sign of $\delta b_{\text{tot}} / b$ or TC is positive..." by "The sign of $\delta b_{\text{tot}} / b$ or t_c is positive..."

Page 109

11.11.6.3 Expression of results

In equation (30), replace “TC” by “t_c”.

Page 111

11.11.7.3 Expression of results

In equation (32), replace “CT” by “t_c”.

Page 115

11.12.3 Layout

In figure 14, item 1, sweep generator, delete “30 MHz to 1 000 MHz”.

Page 117

11.12.5.3 Accuracy of measurement

In the third sentence of the second paragraph, on page 119, replace “...over as wide a frequency range as possible” by “...over a frequency range as wide as possible”.

Page 119

11.12.6 Procedure

Replace, on page 121, equation (42) by the following new equation:

$$n \geq \frac{3(f_2 - f_1) I}{150 \times v_r} \quad (42)$$

Page 133

11.13.7.2 Procedure

In the first line, delete the word “when”.

Replace the second line by “for an open-circuited test specimen when”.

Replace the fourth line by “for a short-circuited test specimen when”.

Page 135

11.13.7.3 Expression of results

Replace equation (52) by the following new equation:

$$\Delta f = (f_{n,2} - f_{n,1}) / (n_2 - n_1) \quad (52)$$

Replace equation (53) by the following new equation:

$$\alpha = \frac{8,686 \times \delta f \times \pi}{2 \times \Delta f \times (1 + 0,002 \times (t - 20))} \times \frac{100}{l} \text{ in dB/100 m at } 20 \text{ }^\circ\text{C} \quad (53)$$

Replace equation (54) by the following new equation:

$$l = \frac{150 \times v_r}{\Delta f} \text{ in metres} \quad (54)$$

where Δf is in megahertz (MHz).

Replace, on page 137, equation (57) by the following new equation:

$$\alpha = \frac{868,6}{l \times (1 + 0,002 \times (t - 20))} \times \ln \left(\sqrt{1 + \sin(b)} + \sin^2(b) \right) \quad (57)$$

Page 141

11.16.2 Definitions

Replace, in the first line of the second paragraph, "...at the cable end plus the pulse attenuation..." by "...at the cable end minus the pulse attenuation...".

Page 143

11.16.4.1 Approximately sine squared pulse

Replace, in the second paragraph, "is the velocity ratio..." by "is the nominal relative velocity ..."

Page 149

11.19.2 Definition

Replace equation (67) by the following new equation:

$$P_{u,\max} \approx U_0^2 / Z \quad (67)$$

Page 151

11.19.4.3 Test methods

In figure 28, on page 159, replace, in both the title and the X axis, “Power gain P_3/P_1 dB” by “Power gain P_R/P_1 dB”.

Replace “ $a_k - a_{k,opt}$ ” by “ $a_k = a_{k,opt}$ ”.

Replace “ $a_k = a_{k,opt} + 3$ dB” by “ $a_k = a_{k,opt} \pm 3$ dB”.

Replace “ $a_k = a_{k,opt} + 6$ dB” by “ $a_k = a_{k,opt} \pm 6$ dB”.

Page 161

After equations (73) and (74), under “where”, add “L is the series inductance”.

Replace equation (75) by the following new equation:

$$U = \frac{U_0 \times Z}{(b \times Z_0) + Z(\tan \delta_L + \frac{a}{b})} \tag{75}$$

Page 163

Replace the line above equation (76) by the following:

“When at resonance $\omega^2 LC = 1$, with ω as the radian frequency, then the test voltage U is defined as:”

Under equation (76), delete the two lines “and when at resonance $\omega^2 LC = 1$ ” and “with ω as the radian frequency”.

Replace, in equation (77), “ $Z_0 = Z$ et $L/C = Z^2 / a$ ” by “ $Z_0 = Z$ and $L/C = Z^2/a$ ”.

Page 165

Replace equation (79), including the text “The maximum test current, I is defined as:” and the explanatory text under “where” by the following:

When at resonance $1/\omega C = \omega L$ (79)

where

ω is the radian frequency;

C is the parallel capacitance;

L is the inductance of the test specimen.

Page 167

Replace equations (80), (81) and (82), including the text "At resonance", by the following:

$$1/\omega C = Z (2\pi l_e/\lambda_o) \quad (80)$$

$$1/\omega C = Z \times b \quad (81)$$

then, the maximum test current I is defined as:

$$I = \frac{U_o}{(b \times Z) + Z_o(\tan \delta_c + \frac{a}{b})} \quad (82)$$

Replace the explanatory text under "where" by the following:

l_e is the electrical length of the test specimen;

λ_o is the wavelength in free space at the test frequency;

U_o is the open-circuit voltage of the generator;

Z is the nominal characteristic impedance of the test specimen;

b is the phase shift of the test specimen, in radians;

a is the attenuation of the test specimen, in nepers;

δ_c is the loss angle of the parallel capacitance;

Z_o is the internal impedance of the generator.

Page 169

Replace, after equation (85), "v_r is the velocity ratio of the test specimen" by "v_r is the nominal relative velocity of the test specimen".

Page 171

Replace equation (89) by the following new equation:

$$\frac{P_{d3}}{P_{d1}} = \frac{\alpha_3(1 + 0,002 \times (T_{1,max} - T_a)) + 0,5 \times \alpha_2}{\alpha_1(1 + 0,002 \times (T_{1,max} - T_a)) + 0,5 \times \alpha_2} \quad (89)$$

Under the equation, delete "η₃ is the temperature coefficient of the outer conductor material".

Page 173

Replace equation (92) by the following new equation:

$$\alpha_T = \alpha_1(1 + 0,002 \times (T_{1,max} - T_a)) + \alpha_2 + \alpha_3(1 + 0,002 \times (T_{1,max} - T_a)) \quad (92)$$

11.19.5.2 Conversion formula for power rating versus frequency

Replace, on page 175, equation (97) by the following new equation:

$$Y = \frac{\alpha_T(f_1)}{\alpha_T(f_2)} \times \frac{\alpha_{1T}(f_2) + 0,5 \times \alpha_2(f_2)}{\alpha_{1T}(f_1) + 0,5 \times \alpha_2(f_1)} \quad (97)$$

Under the equation, replace "T" by "T_a".

Page 177

12.1.2.1 Electrically short cable lengths

In the note, replace "(λ is 300/√ε_r)" by "(λ = $\frac{300}{\sqrt{\epsilon_r} \times f}$)".

12.1.2.2 Electrically long cable lengths

In figure 34, on page 179, replace "Test section l α D" by "Test section L".

Replace equation (100) by the following new equation:

$$Z_{TE} = \max |Z_E \pm Z_T| \quad (100)$$

Replace equation (101) by the following new equation:

$$T_n = \frac{U_{2n} / \sqrt{Z_{02}}}{U_1 / \sqrt{Z_{01}}} = \frac{I_{2n} \times \sqrt{Z_{02}}}{I_1 \times \sqrt{Z_{01}}} \quad (101)$$

Replace equation (102) by the following new equation:

$$T_f = \frac{U_{2f} / \sqrt{Z_{02}}}{U_1 / \sqrt{Z_{01}}} = \frac{I_{2f} \times \sqrt{Z_{02}}}{I_1 \times \sqrt{Z_{01}}} \quad (102)$$

Page 181

12.1.4 Test set-up

Replace, on page 193, the second sentence of the third paragraph by the following:

For measurements in the range >1 GHz, the reflection factor of the feeding circuit including the launcher should be ≤0,1.

12.1.5 Preparation of the test specimen (cable under test)

In the first line of the second paragraph, replace "(N, SKA)" by "(N, SMA)".

Page 195

12.1.6.2 Uncontrolled currents

In the first sentence, replace "Special care in required..." by "Special care is required..."

Page 199

12.1.8 Expression of results

Replace "Under consideration." by the following new text:

From the test results above, both the effective transfer impedance Z_{TE} and screening attenuation a_s can be calculated:

as defined: $Z_{TE_{nf}} = |Z_F \pm Z_T| \rightarrow Z_{TE} = \max(Z_{TE_n}; Z_{TE_f})$

$$a) \quad Z_{TE_{nf}} \approx \frac{2}{L} \times \sqrt{Z_{01} \times Z_{02}} \times Env(T_{nf}) \times \left(1 + \frac{\pi \times f \times L}{v_{\pm}}\right) \quad (121)$$

where

$Env(T_{nf})$ is the envelope of the near-end/far-end coupling function;

L is the length of the cable under test (CUT).

$$T_{nf} = 10^{-A_T/20} \quad (122)$$

$$v_{\pm} = \frac{v_1 \times v_2}{|v_2 \pm v_1|} \quad (123)$$

where

+ = near end and - = far end;

v_1 is the phase velocity in the primary circuit;

v_2 is the phase velocity in the secondary circuit.

$A_T = A_s - (A_c/2) - (A_i/2)$ (see figure 58)

NOTE - When $Z_T \gg Z_F$, then $Z_T \approx Z_{TE}$, either near-end (T_n, v_+) or far-end (T_f, v_-) data may be used.

For practical purposes, it is preferable to use near-end measurement data for frequencies less than 30 MHz.

If $Z_T \gg Z_F$ then Z_T can be calculated by using the simplified procedure shown in figure 58, equation (131).

$$b) \quad a_s = -20 \log_{10}(\max[Env\{T_n\}; Env\{T_f\}]) \quad (124)$$

The screening attenuation a_s shall also be presented in the normalized conditions $|\Delta v/v_1| = 10\%$ and $Z_2 = 150 \Omega$:

$$a_s(10\%/150\Omega) \approx -20 \log_{10} \left(\frac{Z_{TE} \times 11 \times v_1}{2\pi f \times \sqrt{Z_{01} \times 150\Omega}} \right) \quad (125)$$