



Industry
Canada

Industrie
Canada

ICES-004
Issue 3
December 2001

Spectrum Management and Telecommunications Policy

Interference-Causing Equipment Standard

Alternating Current High Voltage Power Systems

Table of Contents

	Page
1. General	1
2. Definitions	2
3. Instrumentation	3
3.1 Radio Frequency Receivers	3
3.2 Antennas	3
4. Method of Measurement	3
4.1 General Requirements for Transmission Lines and Substations	3
4.2 Measurement Procedures for Transmission Lines	4
4.3 Measurement Procedures for Transmission Substations	5
4.4 Use of Correction Factors	5
5. Limits	5
5.1 Radiated Noise Limits for Transmission Lines and Transmission Substations	5
5.2 Radiated Noise Limits for Distribution Lines and Distribution Substations	6
6. Procedural Requirements	6
7. Reference Publication	6
Schedule I	7
Schedule II	8
Schedule III	9

1. General

- 1.1 This Interference-Causing Equipment Standard sets out the technical requirements for alternating current high voltage power systems. The effective date of this Standard is December 15, 2001.
- 1.2.1 Subject to subsections 1.2.2 and 1.2.3, Sections 3 to 7 apply to all alternating current high voltage power systems.
- 1.2.1.1 A transition period ending June 30, 2002 is provided, within which compliance with either ICES-004, Issue 3 or ICES-004, Issue 2 will be accepted. After that date, only compliance with ICES-004, Issue 3 will be accepted.
- 1.2.2 Sections 3 to 7 do not apply to:
- (a) underground power systems;
 - (b) radio noise associated with power line carrier current transmissions;
 - (c) a power system when it is operating temporarily under abnormal conditions; or
 - (d) high voltage direct current components of a power system where the design for the construction of the direct current components of the system was initiated before January 1, 1991.
- 1.2.3 (1) Sections 3 to 7 do not apply to transmission lines or transmission substations for which the owner has been granted a special permission by the Minister.
- (2) The Minister may grant a special permission where
- (a) the power system owner has presented a written application giving
 - (i) the reasons for the request;
 - (ii) an analysis based on sound engineering principles showing that the transmission line or transmission substation will not pose a significant risk to radiocommunication;
 - (iii) a guarantee of compliance with all the conditions the Minister may set in the special permission; and
 - (b) the Minister is satisfied that the transmission line or transmission substation will not pose a significant risk to radiocommunication.
- (3) The special permission is valid only if the transmission line or transmission substation complies with any conditions set out in the special permission.

- (4) The Minister may revoke or amend the special permission granted under subsection (2) at any time without prior notice.

2. Definitions

2.1 In this Standard,

"alteration" means

- (a) any change to the design parameters of an existing transmission line;
- (b) any addition of tap lines and corresponding transmission substations to existing transmissions lines; or
- (c) any change to existing transmission substations that could increase the level of radio noise being produced;

"alternating current high voltage power system" or "power system" means any generating station, substation or power line, or any combination thereof, that is operated under common management for the generation, transmission or distribution of alternating current electric power;

"ANSI" means the American National Standards Institute;

"CISPR" means the International Special Committee on Radio Interference;

"CSA" means the Canadian Standards Association;

"distribution line" means an overhead power line that operates at nominal phase-to-phase voltages from 1 kV to 75 kV;

"distribution substation" means a substation at which all power lines entering or leaving the substation are distribution lines;

"fair weather" means an atmospheric condition free of fog or precipitation within 10 km of the location at which measurements are taken;

"power line" means a transmission line or a distribution line;

"power system owner" means the person who owns, possesses or controls a power system;

"substation" means an assemblage of equipment, including switches, circuit breakers, buses, transformers and control devices, for the purpose of switching power circuits or transforming electric power from one voltage to another;

"tap line" means a transmission line that is less than 10 km long and that forms an addition or extension to an existing transmission line;

"transmission line" means an overhead power line that operates at nominal phase-to-phase voltages from 76 kV to 800 kV; and

"transmission substation" means a substation where at least one of the power lines entering the substation is a transmission line.

3. Instrumentation

3.1 Radio Frequency Receivers

3.1.1 Measurements shall be taken with a CISPR type radio frequency receiver that is designed and calibrated in accordance with CSA Standard C108.1.1-1977.

3.2 Antennas

3.2.1 The radio frequency receiver shall be connected to a calibrated rod or a calibrated loop antenna.

4. Method of Measurement

4.1 General Requirements for Transmission Lines and Substations

4.1.1 The radiated noise emissions produced by each transmission line and each transmission substation the design for the construction or alteration of which is initiated on or after January 1, 1991, shall be measured in accordance with this Standard within six months after being placed in operation.

4.1.1.1 When an alteration is made to the original transmission line or transmission substation, the transmission line or transmission substation with alteration must be tested within six months after the alteration, unless the power system owner can demonstrate by an analysis, based on sound engineering principles, that the transmission line or transmission substation with alteration would be unlikely to emit radio noise in excess of the limits prescribed in this Standard. When the cumulative effect of successive alterations is such that the limits are likely to be exceeded, the transmission line or transmission substation with alterations shall be tested within six months after the last alteration.

4.1.1.2 Notwithstanding Section 4.1.1.1, should the transmission line or transmission substation after alteration be found to cause unacceptable interference to radiocommunication, the owner shall immediately take corrective action. Documentation of the analysis on which the decision of whether to test the

transmission line or transmission substation with alteration was based shall be provided to Industry Canada upon request.

4.1.1.3 When an electrical utility constructs a new transmission line or transmission substation that is of the same design as an existing transmission line or transmission substation for which measurements demonstrating compliance with this Standard have been made and documented, the utility may choose to request a waiver from the measurement requirements for the new transmission line or transmission substation. The request for a waiver shall be made in consultation with the Industry Canada Regional Office.

4.1.1.4 The requirement to measure and document radiated noise from a transmission substation owned by an electrical utility is waived when the transmission substation is located within 300 metres of a large third party - owned industrial power switching facility. In these situations, it may be difficult to identify sources of radiated emissions yielding measurement results in excess of the limits. In such cases, the electrical utility shall consult with the Regional Office of Industry Canada prior to exercising discretion of waiver.

4.1.2 The radiated noise shall be measured in fair weather.

4.1.3 The frequency range from 0.15 MHz to 30 MHz shall be scanned and the values corrected as specified by subsection 4.4.2 to ensure that, at any frequency, there are no noise peaks exceeding the limits.

4.1.4 The antenna shall be placed at the height for which the combination of antenna and receiver has been calibrated.

4.1.5 Where a loop antenna is used it shall be rotated to the position that produces the maximum reading on the meter of the radio frequency receiver.

4.2 Measurement Procedures for Transmission Lines

4.2.1 The radiated noise shall be measured at points located near both ends and the middle of the transmission line and each of those points shall be:

- (a) at least 5 km from any transmission substation wherever possible;
- (b) at a sufficient distance from any metal fences or other reflecting objects and from any intersections with other power lines or communications lines to minimize the effects of any such objects or lines on the measurements; and
- (c) at a distance of 15 m from the vertical plane containing the nearest conductor or, where the measurement cannot be taken at a distance of 15 m, at the nearest convenient distance.

- 4.2.2 The antenna shall be placed along a horizontal axis that is in a plane perpendicular to the transmission line at the centre of a span.

4.3 Measurement Procedures for Transmission Substations

- 4.3.1 The radiated noise shall be measured along each of any two adjacent sides of the transmission substation and each of those measurements shall be taken at a sufficient distance from power lines and communication lines to minimize the effects of such lines on the measurements.

- 4.3.2 The antenna for the radio frequency receiver shall be placed:

- (a) at a point of maximum intensity of noise, as determined by preliminary rough measurements; and
- (b) at a distance of 15 m from the property limit of the transmission substation or, where the measurement cannot be taken at a distance of 15 m, at the nearest convenient distance.

4.4 Use of Correction Factors

- 4.4.1 Where measurements cannot be made at a lateral distance of 15 m, measurements shall be taken:

- (a) at the nearest convenient distance and corrected to 15 m using the curves of Schedule III; or
- (b) at distances that are greater and less than 15 m, using interpolation to determine the correct reading for a distance of 15 m.

- 4.4.2 All measured values shall be corrected to a reference frequency using Schedule II, with a reference frequency of 0.5 MHz.

5. Limits

The limits of radio noise set out in Sections 5.1 and 5.2 do not apply to an alternating current high voltage power system while it is being tested for compliance with this Standard.

5.1 Radiated Noise Limits for Transmission Lines and Transmission Substations

- 5.1.1 The maximum radiated noise that may be produced in the frequency band from 0.15 MHz to 30 MHz by a transmission line or a transmission substation in fair weather, as measured and corrected in accordance with Section 4 shall not exceed the values set out in Schedule I.

- 5.1.2 In the case of transmission substations where nominal phase-to-phase voltages fall within two or more of the ranges set out in the items of Schedule I, the limits for radiated noise in respect of the highest nominal phase-to-phase voltage range shall apply.

5.2 Radiated Noise Limits for Distribution Lines and Distribution Substations

- 5.2.1 Subject to subsection 5.2.2, no limit applies to the emissions of radiated radio noise from a distribution line or distribution substation.

- 5.2.2 Where the radiated radio noise from a distribution line or distribution substation causes interference to the reception of:

- (a) a Canadian broadcasting signal in the MF band that measures at least 54 dB μ V/m at the receiver suffering interference; or

- (b) any signal that is received in the performance of any other radio service,

the radiated noise shall be limited to the level at which the interference is eliminated.

6. Procedural Requirements

- 6.1 A record of the measurements and results shall be retained by the power system owner for a period of at least five years and made available for examination on the request of the Minister.

- 6.2 Because of the large size and extent of an alternating current high voltage power system, a requirement to attach to the power system a written notice or label indicating compliance with this Standard does not apply.

7. Reference Publication

- 7.1 This Standard refers to the following publication and, where such reference is made, it shall be to the edition listed below.

CSA Standard C108.1.1-1977 entitled *Electromagnetic Interference Measuring Instrument - C.I.S.P.R. Type*, published February, 1977 in the English language and January, 1982 in the French language.

Issued under the authority of
Industry Canada

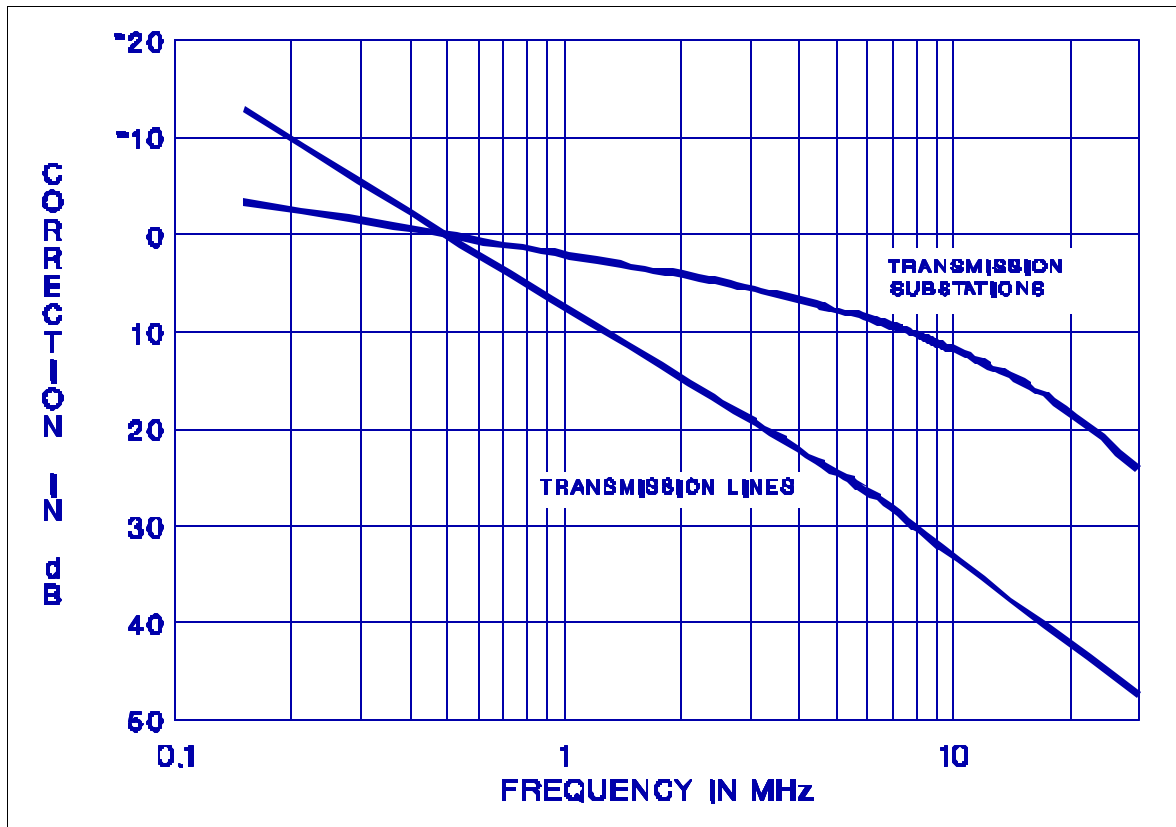
R.W. McCaughern
Director General
Spectrum Engineering

Schedule I

**Maximum Field Intensity of Radio Noise Produced by
Transmission Lines and Transmission Substations
in the Frequency Range 0.15 to 30 Megahertz**

Column I		Column II
Range of Nominal Phase-to-phase Voltage (kV)		Radio noise field intensity limits at lateral distance of 15 m (dB μ V/m)
Item		Measuring instrument conforming to CSA Standard C108.1.1-1977
1.	76-200	49
2.	201-300	53
3.	301-400	56
4.	401-600	60
5.	601-800	63

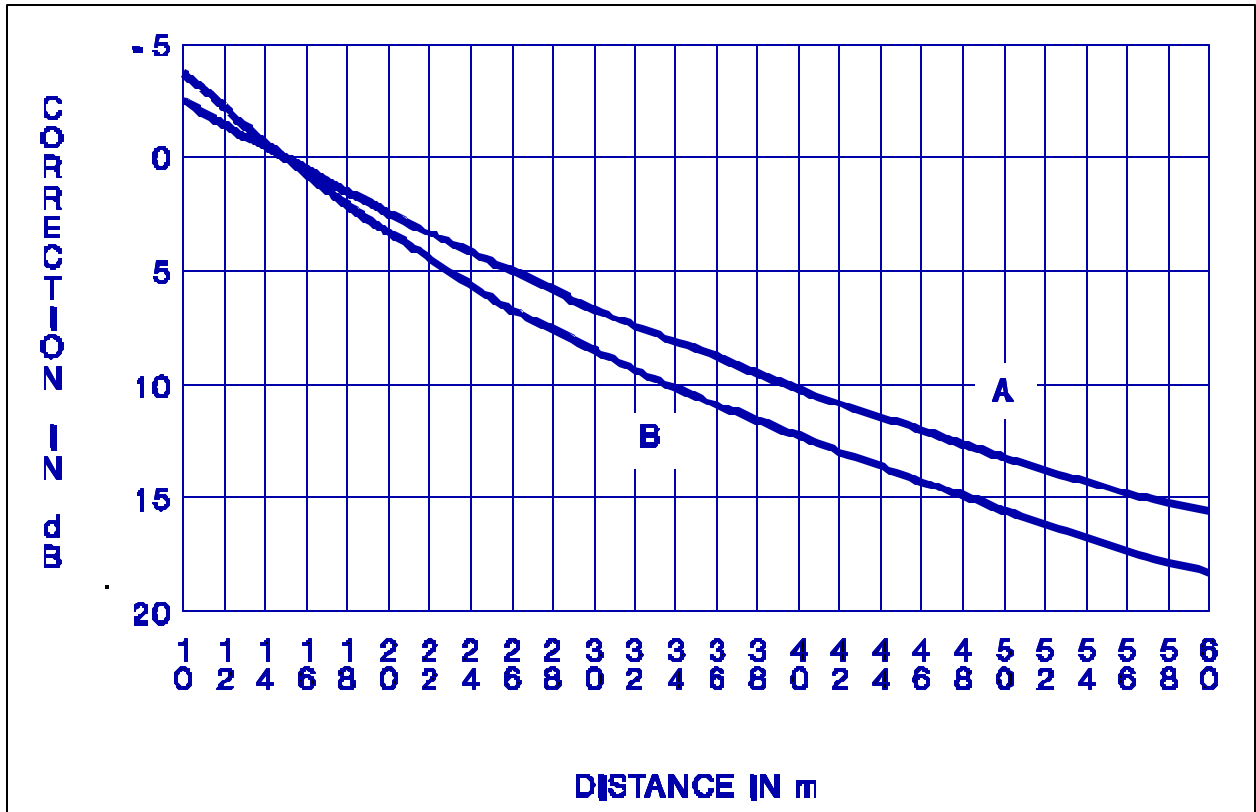
Schedule II



Correction factor for frequencies other than 0.5 MHz, to be added to the measured value, when measuring instrument conforms with CSA Standard C108.1.1-1977.

The ordinate represents the correction factor to be added to the measured value.

Schedule III



Correction factor for lateral distances other than 15 metres, where

A = Transmission line with lowest conductor 15 metres above ground;

B = Transmission line with lowest conductor 9 metres above ground, also transmission substations;

the abscissa represents the lateral distance from nearest conductor, or from substation boundary, in metres; and

the ordinate represents the correction factor to be added to the measured value.