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Methods of measurement for radio equipment used in the mobile services - Part 6: Selective-calling and data equipment

Methods of measurement for radio equipment used in the mobile services -- Part 6: Selective-calling and data equipment

Meßverfahren für Funkgeräte im beweglichen Funkdienst -- Teil 6: Selektivruf- und Dateneinrichtungen

Méthodes de mesure applicables au matériel de radiocommunication utilisé dans les services mobiles -- Partie 6: Matériel d'appel sélectif et matériel numérique

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ENGLISH VERSION

Methods of measurement for radio equipment used in the mobile services Part 6: Selective-calling and data equipment (IEC 489-6:1987 + A1:1989)

Méthodes de mesure applicables au matériel de radiocommunication utilisé dans les services mobiles Sixième partie: Matériel d'appel sélectif et matériel numérique (CEI 489-6:1987 + A1:1989)

Meßverfahren für Funkgerät im beweglichen Funkdienst Teil 6: Selektivruf- und Dateneinrichtungen (IEC 489-6:1987 + A1:1989)

This Harmonization Document was approved by CENELEC on 1992-09-15. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for implementation of this Harmonization Document on a national level.

Up-to-date lists and bibliographical references concerning national implementation may be obtained on application to the Central Secretariat or to any CENELEC member.

This Harmonization Document exists in three official versions (English, French, German).

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B-1050 Brussels

FOREWORD

The CENELEC questionnaire procedure, performed for finding out whether or not the International Standard IEC 489-6:1987 and its amendment 1:1989 could be accepted without textual changes, has shown that no common modifications were necessary for the acceptance as Harmonization Document.

The reference document was submitted to the CENELEC members for formal vote and was approved by CENELEC as HD 466.6 S2 on 15 September 1992.

The following dates were fixed:

- latest date of announcement of the HD at national level (doa) 1992-12-15

- latest date of publication of a harmonized national standard (dop) 1993-06-15

- latest date of withdrawal of conflicting national standards (dow) 1994-06-15

For products which have complied with HD 466.6 S1:1989 before 1994-06-15, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 1999-06-15.

Annexes designated "normative" are part of the body of the standard. In this standard, annex ZA is normative.

ENDORSEMENT NOTICE

The text of the International Standard IEC 489-6:1987 and its amendment 1:1989 was approved by CENELEC as a Harmonization Document without any modification.

ANNEX ZA (normative)

OTHER INTERNATIONAL PUBLICATIONS QUOTED IN THIS STANDARD WITH THE REFERENCES OF THE RELEVANT EUROPEAN PUBLICATIONS

When the international publication has been modified by CENELEC common modifications, indicated by (mod), the relevant EN/HD applies.

IEC Publication	Date	Title	EN/HD	Date
489-1 (mod)	1983	Methods of measurement for radio equipment used in the mobile services Part 1: General definitions and standard conditions of measurement	-	-
489-3	1979	Part 3: Receivers for A3 of F3 emission	-	-
489-5	1987	Part 5: Receivers employing single-sideband techniques (R3E, H3E or J3E)	HD 466.5 S1	1989
315-1	1970*	Methods of measurement on radio receivers for various classes of emission - Part 1: General conditions for measurements and measuring methods applying to several types of receivers	-	-
315-2	1971	Part 2: Measurements particularly related to the audio-frequency part of a receiver	-	-

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* IEC 315-1:1988 was harmonized as HD 560.1 S1:1990

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Méthodes de mesure applicables au matériel de radiocommunication utilisé dans les services mobiles

Sixième partie: Matériel d'appel sélectif et matériel numérique

Methods of measurement for radio equipment used in the mobile services

Part 6: Selective-calling and data equipment

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

METHODS OF MEASUREMENT FOR RADIO EQUIPMENT USED IN THE MOBILE SERVICES

Part 6: Selective-calling and data equipment

FOREWORD

1) The formal decisions or agreements of the IEC on technical matters, prepared by Technical Committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.

2) They have the form of recommendations for international use and they are accepted by the National Committees in that sense.

3) In order to promote international unification, the IEC expresses the wish that all National Committees should adopt the text of the IEC recommendation for their national rules in so far as national conditions will permit. Any divergence between the IEC recommendation and the corresponding national rules should, as far as possible, be clearly indicated in the latter.

PREFACE

This standard has been prepared by Sub-Committee 12F: Equipment Used in the Mobile Services, of IEC Technical Committee No. 12: Radiocommunications.

This second edition replaces the first edition of IEC Publication 489-6 and its Supplements 489-6A and 489-6B.

The text of this standard is based on IEC Publications 489-6A and 489-6B and on the following documents:

Six Months' Rule	Reports on Voting	Two Months' Procedure	Report on Voting
12F(CO)75 12F(CO)76,76A 12F(CO)80 12F(CO)81 12F(CO)83,83A 12F(CO)112 12F(CO)113 12F(CO)118 12F(CO)121	12F(CO)98 12F(CO)91 12F(CO)99 12F(CO)100 12F(CO)103 12F(CO)124 12F(CO)125 12F(CO)129 12F(CO)130	12F(CO)101	12F(CO)108

Full information on the voting for the approval of this standard can be found in the Voting Reports indicated in the above table.

The following IEC publications are quoted in this standard:

Publications Nos. 489-1 (1983): Methods of Measurement for Radio Equipment Used in the Mobile Services, Part 1: General Definitions and Standard Conditions of Measurement.

489-3 (1979): Part 3: Receivers for A3 and F3 Emissions.

489-5 (1987): Part 5: Receivers Employing Single-sideband Techniques (R3E, H3E or J3E).

315-1 (1970): Methods of Measurement on Radio Receivers for Various Classes of Emission, Part 1: General Conditions for Measurements and Measuring Methods Applying to Several Types of Receivers.

315-2 (1971): Part 2: Measurements Particularly Related to the Audio-frequency Part of a Receiver.

METHODS OF MEASUREMENT FOR RADIO EQUIPMENT USED IN THE MOBILE SERVICES

Part 6: Selective-calling and data equipment

SECTION ONE — GENERAL

1. Scope

This standard refers specifically to mobile radio receivers having audio-frequency bandwidths (the receiver does not necessarily have an audio output) generally not exceeding 10 kHz for the reception of voice and other types of signals, using:

a) angle (Type G or F: phase or frequency) modulation, or

b) double-sideband amplitude (Type A) modulation with full carrier, or

c) single-sideband amplitude (Type H, J or R) modulation with full, reduced or suppressed carrier.

Selective calling is usually used to select one or a group of receivers by conditioning the receiver(s) to deliver a voice message or to activate an alarm.

Many receivers have an audio output as well as a selective-calling function. In such receivers, the radio-frequency parameters of adjacent radio-frequency signal selectivity, spurious response immunity, and intermodulation immunity are usually measured by using the methods of measurement in IEC Publications 489-3 and 489-5. Methods of measurement for the radio-frequency parameters required for selective calling are included in this standard to permit measurement of those parameters on receivers that do not have an audio output.

2. Object

The object of this standard is to standardize the definitions, conditions and methods of measurement used to ascertain the performance of selective-calling receiver-decoders (receivers operating in conjunction with decoders). To this end it is recognized that:

1) The decoder is sometimes built as an integral part of the radio receiver with inaccessible interface connections. This may prevent measurements being made on a receiver or decoder individually.

2) It is sometimes necessary to specify the performance of the receiver-decoder combination as though they were a single unit, even when the component parts are supplied by different manufacturers.

Since the equipment evaluated in this standard is used for selective calling, many of the radio-frequency parameters are evaluated in terms of selective-calling effectiveness.

To differentiate between the radio-frequency parameters measured in this standard and those measured in other parts of IEC Publication 489, the bracketed term (selective calling) is appended to the name of each parameter.

SECTION TWO — SUPPLEMENTARY DEFINITIONS AND CONDITIONS OF MEASUREMENT

3. Supplementary terms and definitions

For the purposes of this standard, the following supplementary terms and definitions apply.

3.1 *Standard calling probability*

An 80% probability of successful calling.

3.2 *Modulation depth*

For double-sided amplitude modulation, the modulation depth, in percent, is given by the following:

$$\text{Modulation depth} = \frac{(V_{max} - V_{min})}{(V_{max} + V_{min})} \times 100\%$$

where:
V_{max} is the peak-to-peak voltage at the crest of modulation
V_{min} is the peak-to-peak voltage at the valley of modulation

3.3 *Signal*

A physical phenomenon or characteristic quantity of such a phenomenon, whose time variation represents information.

3.4 *Coded signal*

That signal or group of signals that enables the performance of a unique calling function.

3.5 *Standard coded test signal (SCTS)*

For the purpose of these measurements, the standard coded test signal shall be defined in the equipment specification and will usually be generated by an encoder of the type associated with the decoder under test. The parameters of the coded test signal (e.g., frequencies, pulse duration, pulse timing, etc.) shall have tolerances small enough to ensure that the results are not significantly influenced by them.

In addition to any other parameters, the equipment specification shall define the appropriate values for the permissible:

- maximum usable modulation depth of Type A modulation, or
- frequency/phase deviation of Type G or F modulation, or
- amplitude relationships between the carrier and the sidebands produced by Type H or R modulation.

3.6 *Coding system*

A system that permits the transmission of unique information from one point to another. Present techniques include phase coding, pulse coding, frequency coding and a combination of these.

3.7 *Encoder*

The apparatus in a selective-calling system that generates the coded signal for transmission.

3.8 *Decoder*

The apparatus in a selective-calling system which is intended to respond exclusively to a specific coded signal.

3.9 *Alarm*

In a selective-calling system, an alarm is any indication that any or all receivers and their associated decoders have received their intended coded signals.

Note. — The alarm may be a lamp, a "bleep" generated within the decoder, a vibrator, or only the opening of a mute or squelch circuit. The latter is usually indicated by an increase in the residual noise level at the output of the receiver.

3.10 *Selective-calling system*

A system whereby the transmission of a signal code from a station enables another predetermined station or group of stations to be called exclusively.

3.11 *Standard unwanted signal*

If the wanted signal has Type A modulation, then the standard unwanted signal should be modulated with 400 Hz at the modulation depth of 60%.

If the wanted signal has Type F or G modulation, then the standard unwanted signal should be modulated with 400 Hz at 60% of the maximum permissible frequency deviation.

For all other types of modulation of the wanted signal, the standard unwanted signal is not modulated.

3.12 *Selective-calling equipment*

Apparatus consisting of at least an encoder, decoder and the power supplies for the operation of the equipment.

If it is not possible to isolate the associated transmitter and receiver circuits from the encoder and decoder, they shall be considered as part of the selective-calling system.

3.13 *Radio pager*

A small radio receiver-decoder, which provides an alarm following reception of a selective call. It is intended to be worn on a person and usually has an integral antenna.

4. Standard test conditions

Unless otherwise stated, measurements shall be performed under the general test conditions stated in IEC Publication 489-1 and the supplementary test conditions given below:

5. Supplementary test conditions

5.1 *Receiver-decoder having an integral antenna*

A receiver having an integral antenna requires different measurement arrangements from a receiver having antenna terminals. Therefore, all measurements on receivers having integral antennas, except those measurements to determine average radiation sensitivity (selective calling) and spurious response immunity (selective calling), will be made in a suitable radio-frequency coupling device (RFCD). The RFCD may be a radio-frequency test fixture or a specific configuration of striplines or waveguides.

The method of measurement will be the same whether the input signal level recorded is that introduced at the receiver antenna terminals or the RFCD input terminals.

It should be noted that the measurement for RFCD reference sensitivity (selective calling) is identical to the measurement of reference sensitivity (selective calling); therefore, when the measurement of RFCD reference sensitivity (selective calling) is required, the measurement in Clause 8 should be used. An RFCD reference sensitivity (selective calling) measurement is necessary for determining many parameter values (see Clauses 8, 9, 12, 13, 14 and 15) when the receiver-decoder is measured in an RFCD.

Notes 1. — The measurements for sensitivity (selective calling) and measurements involving an unwanted signal, noise and variation of signal amplitude have been designed for non-automatic use; the number of trials in these measurements has been reduced to the minimum required to obtain the necessary accuracy. Various automatic measurement procedures may be used, but it is not proposed that they be standardized in this standard at this time.

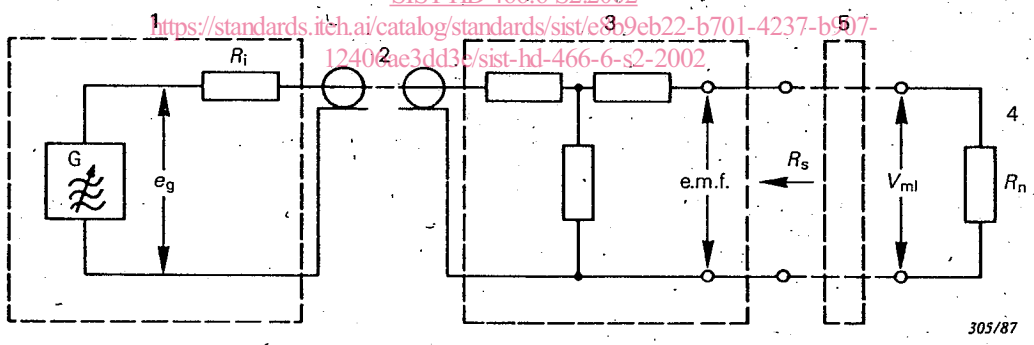
2. — The measurements in this standard can be used for continous signal (e.g., continuous tone controlled squelch systems) provided that a time for the operation of the decoder is specified (e.g. 300 ms).

3. — The measurement of spurious response immunity (selective calling) for receivers having integral antenna is under consideration.

5.2 *Input-signal arrangements for testing receivers equipped with suitable antenna terminals*

The nominal radio-frequency input impedance (R_n) is that value stated by the manufacturer for which the equipment performance will be optimum when connected to an antenna of the same impedance.

The input-signal level should preferably be expressed as: the electromotive force (e.m.f.) present at the output of the unterminated input-signal source (e.m.f. of Figure 1), when the input-signal source impedance (R_s) is equal to the nominal radio-frequency input impedance (R_n) of the receiver.



1 = radio-frequency signal generator with source impedance R_i
2 = transmission line
3 = impedance matching network (pad)
4 = nominal input impedance of receiver: R_n
5 = artificial antenna (where required)
R_s = impedance of the input signal source

FIG. 1. — Input-signal source test arrangement.

Alternatively, the input-signal level may be expressed as the matched-load voltage (V_{ml}) measured across an impedance having a value equal to R_n, when the source impedance (R_s) is equal to the nominal radio-frequency input impedance (R_n).

The matched-load voltage (V_{ml}) is one-half the value of the e.m.f.

When the meter that indicates the value of e_g is not in close proximity to the receiver input terminals, the transmission line loss shall be taken into account in addition to the loss of the impedance matching network.

5.2.1 *Input-signal source for receivers requiring a specified source resistance*

This sub-clause applies to receivers which are connected to the antenna by means of a transmission line (which is synonymous with "feeder line").

The input-signal source shall consist of a radio-frequency signal generator, a transmission line, and an impedance matching network (pad) placed as close as practicable to the receiver under test (see Figure 1, page 15).

5.2.2 *Input-signal source for receivers tested with the aid of an artificial antenna*

This sub-clause applies to receivers intended to operate with an antenna having a complex impedance.

The input-signal source shall consist of a radio-frequency signal generator, a transmission line, an impedance matching network and an artificial antenna. The characteristics of the artificial antenna shall be specified by the manufacturer of the receiver.

5.2.3 *Receivers tested with the aid of an artificial antenna*

The input-signal level is the e.m.f. of the source connected to the input terminals of an artificial antenna. It should be expressed in μV or dB (μV).

5.3 *Input-signal level*

5.3.1 *Input signal type characteristics*

In this standard the input-signal level of the wanted and the unwanted signals shall be expressed in terms of r.m.s. values as follows:

- for angle (Type G or F: phase or frequency) modulation, including frequency-shift and phase-shift modulation or keying: the r.m.s. voltage of the signal, either modulated or unmodulated;
- for on-off modulation, or keying of a sinusoidal carrier which may or may not be modulated with an additional signal: the r.m.s. voltage of the continuous carrier, without modulation;
- for double-sideband amplitude (Type A) modulation with full carrier: the r.m.s. voltage of the unmodulated carrier;
- for single-sideband amplitude (Type H, J or R) modulation with full, reduced or suppressed carrier: the r.m.s. value of a sinusoidal voltage, the peak value of which is equal to the amplitude of one radio-frequency cycle at the crest of the envelope of the modulated wave.

The input-signal levels may be expressed in μV or dB (μV) and shall be determined in accordance with Sub-clause 5.2.

5.3.2 *Receivers having a specified source resistance*

The presentation of results should state whether the electromotive force of the source or the matched-load voltage (V_{ml}) has been recorded, for example, 2 μV (e.m.f.) or 1 μV (m.l). The source resistance (R_s) should be stated. (See Figure 1.)