SLOVENSKI STANDARD
SIST EN 50492:2009/oprAA:2012

01-december-2012

Osnovni standard za terensko merjenje jakosti elektromagnetnega polja v zvezi z izpostavljenostjo ljudi v okolici baznih postaj

Basic standard for the in-situ measurement of electromagnetic field strength related to human exposure in the vicinity of base stations

Grundnorm für die Messung der elektromagnetischen Feldstärke am Aufstell- und Betriebsort von Basisstationen in Bezug auf die Sicherheit von in ihrer Nähe befindlichen Personen

Norme de base pour la mesure du champ électromagnétique sur site, en relation avec l’exposition du corps humain à proximité des stations de base

Ta slovenski standard je istoveten z: **EN 50492:2008/prAA:2012**

ICS:

17.220.20	Merjenje električnih in magnetnih veličin	Measurement of electrical and magnetic quantities
33.070.01	Mobilni servisi na splošno	Mobile services in general

SIST EN 50492:2009/oprAA:2012 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

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English version

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This draft amendment prAA, if approved, will modify the European Standard EN 50492:2008; it is submitted to CENELEC members for CENELEC enquiry.
Deadline for CENELEC: 2013-02-15.

It has been drawn up by CLC/TC 106X.

If this draft becomes an amendment, CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this amendment the status of a national standard without any alteration.

This draft amendment was established by CENELEC in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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CENELEC

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

Management Centre: Avenue Marnix 17, B - 1000 Brussels

Project: 23018

Ref. No. EN 50492:2008/prAA:2012 E

Foreword

This document (EN 50492:2008/prAA:2012) has been prepared by CLC/TC 106X "Electromagnetic fields in the human environment".

This document is currently submitted to the Enquiry.

Text of prAA to EN 50492:2008

Contents

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Annexes

Add the following new annex:

Annex L
(informative)

LTE measurements

L.1 General

Annex L describes methods to measure and extrapolate LTE exposure (FDD LTE). The proposed methods require classical radiofrequency (RF) measurement instruments: a basic spectrum analyzer or a dedicated decoder and an isotropic antenna.

LTE emissions consist of specific signals at specific time frequency allocations [1] [2]. This kind of dynamic time-frequency allocation is known as Orthogonal Frequency Division Multiple Access (OFDMA). See Figure L.1.

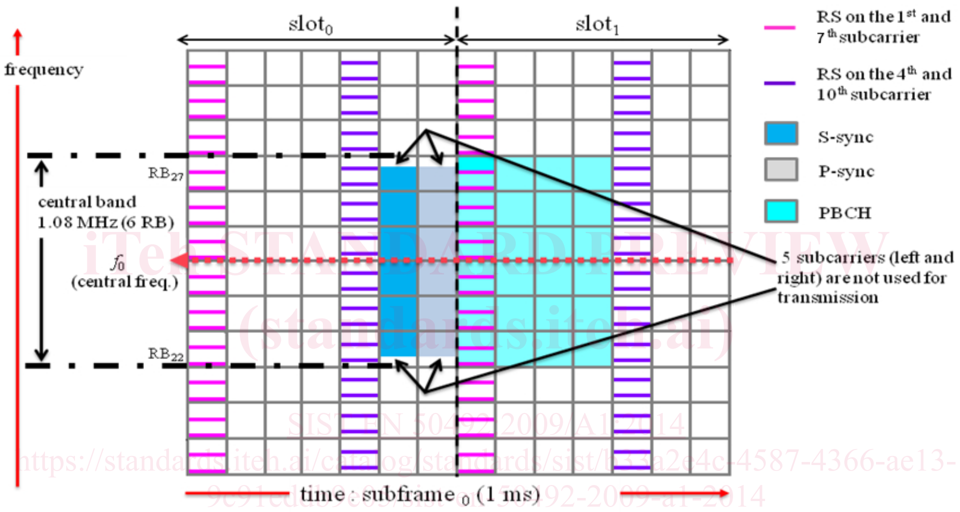

Figure L.1 – LTE time-frequency plan

As for other telecommunication signals, LTE signals are subject to time variations because of random fluctuations of the propagation medium and traffic variations. The extrapolation to the maximum traffic should be based on the measurement of a time independent channel. Due to the LTE specifications, the power of each time-frequency unitary element (66,7 µs, 15 kHz) in the LTE downlink signal is scalable from one kind of transmitted data to another. In addition, LTE downlink spectrum is totally flexible and may vary from 1,25 MHz to 20 MHz, and inside the spectrum, the power level may vary from one channel to another.

Two types of measurements are specified: the assessment of instantaneous LTE exposure levels and the assessment of maximum LTE exposure by extrapolation. For the instantaneous LTE exposure assessment, a basic spectrum analyser and suitable measurement probes are used. For the maximum LTE exposure two types of reproducible methods of electromagnetic field (EMF) exposure assessment of LTE signals, depending on the used measurement instrument, are described: one method, using a dedicated decoder, similar to existing methods that are based on pilot signals (see Clause 8) and another method using a basic spectrum analyzer.

If no frequency information about the present LTE channels is available, the LTE downlink bandwidth should first be determined using a spectrum analyser in frequency mode and a peak detector. In this way, the frequency information and LTE bandwidth can best be determined.

L.2 Maximum LTE exposure

L.2.1 Introduction

L.2 describes two methods to assess the maximum exposure level. Both methods are acceptable but, in case of selective fading, the method using dedicated decoder is recommended.

L.2.2 Method using a dedicated decoder

As extrapolation method, the reference signal *RS* and synchronization signal *S-SYNC* are measured and extrapolated to the maximum value with an extrapolation factor. The influence of the traffic load and output power of the base station on in-situ *RS*, *S-SYNC*, *P-SYNC*, *PBCH* signals are lower than 1 dB for all power and traffic load settings, showing that these signals can be used for the extrapolation method. For this method, dedicated LTE equipment or LTE analyzers are needed.

To estimate the maximum exposure level (E_{max}) of the LTE signal at each measurement location, Formula (L.1) is used:

$$E_{\text{max}} = \sqrt{\frac{n_{\text{RS}}}{BF}} \cdot \sqrt{E^2_{\text{RS\_ANT1}} + E^2_{\text{RS\_ANT2}}} \text{ (V/m)} \qquad \text{(L.1)}$$

$E_{\text{RS\_ANT1}}$ and $E_{\text{RS\_ANT2}}$ are the measured electric field values of the reference signal *RS for each antenna*, n_{RS} the ratio of the maximum total output power at the base station to the power of the reference signal *RS* at the base station and *BF* is the power boosting factor (see Figure L.2). n_{RS} corresponds to the number of subcarriers and is provided by the network operator or can be calculated theoretically (assuming that the power of the *RS* subcarriers are at the same power level as the other subcarriers, see Table 1).

Table L.1 – Theoretical extrapolation factor, n_{RS} as function of the bandwidth, assuming all subcarriers are at the same power level

Bandwidth MHz	Total number of resource blocks (12 subcarriers per symbol)	n_{RS} = Maximum total output power/P_{RS}	n_{RS} dB
1,4	6	72	18,57
3	15	180	22,55
5	25	300	24,77
10	50	600	27,78
15	75	900	29,54
20	100	1 200	30,79

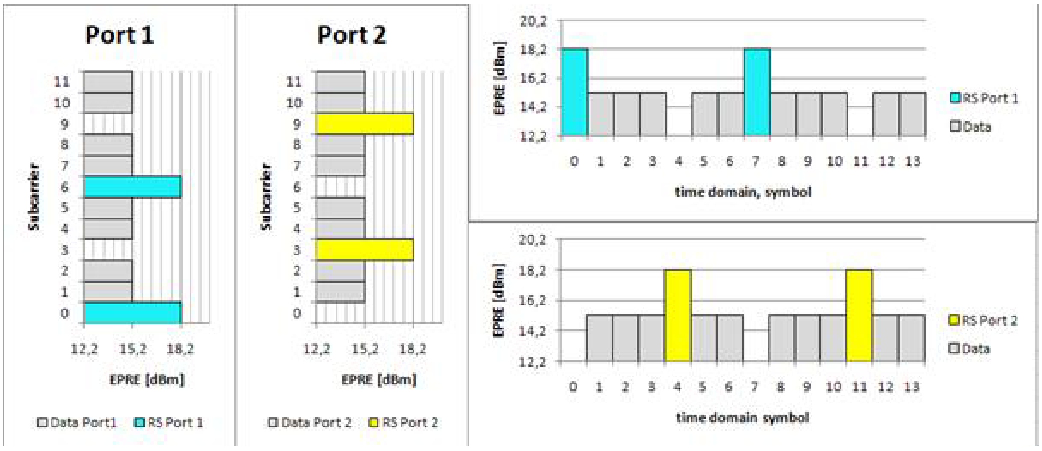

Figure L.2 – Power of *RS* subcarriers is often higher because of an existing boosting factor *BF*, specific to each network operator

L.2.3 Method using a basic spectrum analyzer

Using a basic spectrum analyzer, the power of the reference signals (*RS*) cannot be detected since they have generally the smallest power.

To overcome this issue avoid requirements of previous knowledge on band occupation or service characteristics, the broadcast channel (*PBCH*) [1] power, which is relatively strong (Figure L.3), can be measured. *PBCH* is transmitted with same characteristics regardless of configuration or service bandwidth and always spans about 1 MHz over the emission frequency f_0 .

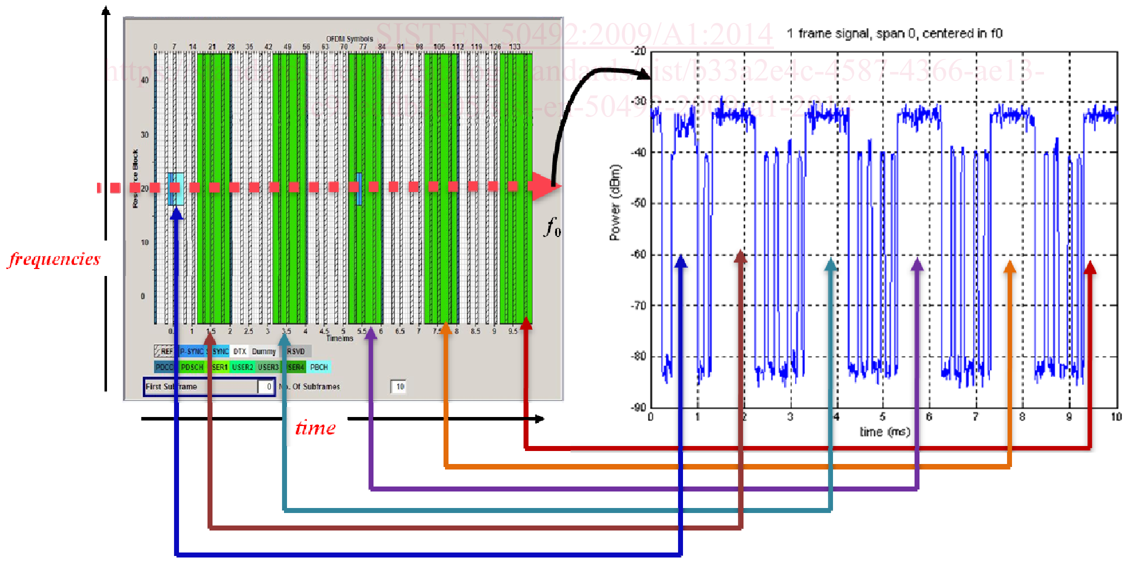

Figure L.3 – LTE spectrum: *PBCH* power higher than *RS* power

The *PBCH* power should be measured using the following setup on a spectrum analyzer (SA):

– the centre frequency of the spectrum analyser equal to the centre frequency of the LTE signal;

– a frequency span set to zero (scope mode) in order to measure the received time signal at the downlink emission frequency;

– a resolution bandwidth (RBW) of 1 MHz to integrate the signal over the *PBCH* spectral spread;

– a sweep time about equal to the multiplication of number of display points of the SA and the symbol duration of about 70 µs, in order to obtain an integration time close to the symbol duration of each pixel on the screen of the SA, e.g. a sweep of about 70 ms over 1 000 measurement points (or equivalent ratio for instruments with lower resolution)

– an r.m.s. (root-mean-square) detector combined to a maximum hold of 20 s to measure the peak power that will correspond to the estimated *PBCH* power $\hat{P}_{\mathrm{PBCH}}$.

NOTE The maximum power has to be effectively allocated to the *PBCH* channel in order to use the r.m.s. detector.

To estimate the maximum exposure level (E_{max}) of the LTE signal at each measurement location, Formula (L.2) is used:

$$E_{\mathrm{max}} = \sqrt{n_{\mathrm{PBCH}}}.E_{\mathrm{PBCH}}\,(\mathrm{V/m}) \qquad \text{(L.2)}$$

E_{PBCH} is the electric field value of the *PBCH* signal and n_{PBCH} is the ratio of the maximum total output power at the base station to the power of the *PBCH* signal at the base station. n_{PBCH} is the number of subcarriers divided by 72 and can be provided by the network operator or can be calculated theoretically.

L.3 Instantaneous LTE exposure assessment

L.3 concerns optimal settings for the assessment of momentary or instantaneous LTE exposure.

A spectrum analyzer (SA) and suitable field probes are needed. The setup for narrowband measurements enables the most accurate assessment of in-situ exposure from various sources.

The spectrum analyzer settings have a huge influence on the measurement results and it is very important to specify these to determine the optimal settings to check compliance of LTE signals with the ICNIRP guidelines. The following optimal settings to perform exposure assessment of LTE are proposed in [3]: r.m.s. detector, resolution bandwidth RBW = 1 MHz, sweep time SWT = 20 s, and appropriate selection of the frequency span e.g., 50 MHz. These settings have been determined and tested in-lab and in-situ [3].

Bibliography

Add the following references:

[1] 3GPP TS36.201, “*LTE Physical Layer - General Description*” 3GPP TSG RAN, v9.1.0, March 2010.

[2] 3GPP TS36.211, "*Physical Channels and Modulation*," 3GPP TSG RAN, v9.1.0, March 2010.

[3] W. Joseph, L. Verloock, F. Goeminne, G. Vermeeren, and L. Martens, “*Assessment of general public exposure to LTE and RF sources present in an urban environment*”, Bioelectromagnetics, vol. 31, no. 7, pp. 576-579, 2010.