PCC.I/RES. 162 (XVI-10) [1]

METHODS FOR THE TESTING, ACCEPTANCE AND MAINTENANCE OF COPPER WIRE PAIRS FOR SUBSCRIBERS

The XVI Meeting of the Permanent Consultative Committee I: Telecommunications/Information and Communication Technologies (PCC.I),

CONSIDERING:

a) That advanced services and new technologies are essential tools for the Region's social and economic development;

b) That such services and technologies are in constant evolution and accordingly, we must continue to develop models of practical cases for consultation by the countries of the Region;

c) That Broadband Service is becoming part of the development of communications, which are essential for individual and community growth;

d) That use of Digital Subscriber Line (xDSL) technology is growing and promoting the development of new Internet applications; and

e) That it would be prudent to ensure that the network has been qualified with the metallic networks qualifying methodology Spectral Emulation Method (SEM), before using a metallic cable network for data transmission with xDSL technology,

RECOGNIZING:

a) That SEM may be applied to older networks designed to transport telephony services as well as to new metallic cable networks intended to support broadband Internet;

b) That application of SEM offers a qualifying methodology that give us measures of rate transmission supported by metallic cable networks installed; and

c) That ITU-T Study Group 5 has been developing standards in this area and has issued Recommendation L.75 "Test, Acceptance and Maintenance Methods of Copper Subscriber Pairs" in May 2008,

RESOLVES:

To endorse ITU-T Recommendation L.75 "Test, Acceptance and Maintenance Methods of Copper Subscriber Pairs" with no deletions, additions or modifications.

[1] CCP.I-TIC/doc. 1985/10

ANNEX TO RESOLUTION PCC.I/RES. 162 (XVI-10)

STANDARDS COORDINATION DOCUMENT

TEST, ACCEPTANCE AND MAINTENANCE METHODS OF COPPER SUBSCRIBER PAIRS - SPECTRAL EMULATION METHOD (SEM)

1. EXECUTIVE SUMMARY

The use of broadband Internet has increased in the last years. The transport technologies used to transmit data are Digital Subscriber Line – DSL – families (ex. ADSL, VDSL2, etc.). DSL signals share the same metallic cable network used by fixed telephony signals. Originally, this network was projected only for transmission of voice signals, but today xDSL is used for the transmission of data through the old telephony network. This network normally is very old and it suffered, throughout time, from operations and maintenances, therefore its initial transmission characteristics may have been modified, affecting the performance of the data transmission.

Then, before using a metallic cable network for data transmission with xDSL technology, it would be interesting to ensure that the network has been qualified for this purpose. Study Group 5 issued, in 2008, a metallic networks qualifying methodology for use of xDSL technology, before and after its installation in the access network. This methodology was approved by the International Telecommunications Union (ITU), where it was converted into L.75 Recommendation (05/2008): Test, acceptance and maintenance methods of copper subscriber pairs. The following summary information regarding Rec. L.75 was presented and discussed at the XV Meeting of CITEL PCC.I (September 2009; Bariloche, Argentina).

2. BASIC OBJECTIVE OF L.75 RECOMMENDATION

L.75 Recommendation describes a qualify methodology of metallic cable network for xDSL signals transport before and after the installation in the access network. This evaluation process is based on measurement of transmission rate obtained in the worse case of transmission in the network, i.e., when all the other pairs are being used for data transmission at the same time. This methodology of evaluation and qualification is known as Spectral Emulation Method (SEM), and may be applied to older networks designed to transport telephony services, as well as to new metallic cable networks intended to support broadband Internet.

The next sub items will present, briefly, the qualifying methodology for metallic cable network, as described in L.75 Recommendation (05/2008).

3. SEM OVERVIEW

SEM is based on Nyquist and Shannon Theories. The Nyquist Theory establishes that a digitized signal shall be recovered without distortions only when the sampling frequency is, at least, two times the maximum frequency of the transmitted signal. The following equation expresses the Nyquist Theory:

$C = 2.B.\log_2 n$

Where:

$B \rightarrow$ Bandwidth

C → Channel Capacity
n → number of simbols

Shannon, using the Nyquist Theory, established that the signal-to-noise ratio affects the channel transmission capacity. The equation below expresses the Shannon Theory:

$C = B.\log_2 (1 + S/N)$
Where: S/N → Signal-to-noise ratio.

In the SEM, one cable pair is chosen for the measurement of the transmission rate, noise power spectral density (N-PSD) and signal-to-noise ratio (S/N). This pair is called the victim pair (VP). The other cables are loaded with controlled xDSL signals, with limited power spectrum density, according to the xDSL technology under evaluation. This process is repeated, changing the VP, until all pairs have been measured.

4. EXAMPLE OF TEST PROCEDURE

Before installing any new cable on a network or xDSL signals in an existent network, all pairs should be tested to prevent detecting possible problems only after the system is installed. It is recommended that SEM be applied only to groups of up to 600 pairs.

The following test procedure is an example of SEM application:

1. Select one pair as VP. Feed the others pairs, at the near-end side, with non-coherent signals, with power spectrum density (PSD) limited according to the ITU Recommendation applicable to the xDSL technology under evaluation. At the other side, these pairs must be properly terminated with a resistive load, as indicated.
2. Connect one DSLAM port at the near-end side and a modem at the other side of the VP. This will be the pair under test.
3. Measure the highest TR and S/N in VP.
4. Shut off the DSLAM port and measure the N-PSD at the VP far-end side using a spectrum analyzer.
5. Repeat the steps above until all pairs have been measured.

5. CONCLUSIONS

The Working Group on Technology recommends that CITEL PCC.I-TIC endorses ITU-T Recommendation L.75 “Test, Acceptance and Maintenance Methods of Copper Subscriber Pairs” with no deletions, additions or modifications.

6. RESOURCE DOCUMENT

[1] ITU-T Recommendation L.75 “Test, Acceptance and Maintenance Methods of Copper Subscriber Pairs”.