

GPRS USER DATA THROUGHPUT IN GSM

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Abstract

The paper deals with the special program utilization for testing of GPRS user data throughput in GSM. Block diagram of equipments interconnection for testing of dependence between user bit rate and carrier to interference ratio are introduced. The GPRS transmission was realized with help of base transceiver station, which is installed in laboratory on Institute of Radio Electronics, FEEC, Brno University of Technology.

1 Introduction

One of the main parameter of GPRS transmission is user bit rate. Its instantaneously value has variable quantity and depends mainly on channel distortion. The basic characterization of GPRS transmission is therefore dependence between user bit rate and carrier to interference ratio C/I. GPRS system uses one from four coding schemas (CS 1-4). Coding schema CS1 is the same as is used by GSM system. The other ones enable higher user bit rate but protection against distortion is less. Theoretical (ideal) dependencies between user bit rate and carrier to interference ratio for all coding schemas are introduced in Fig. 1.

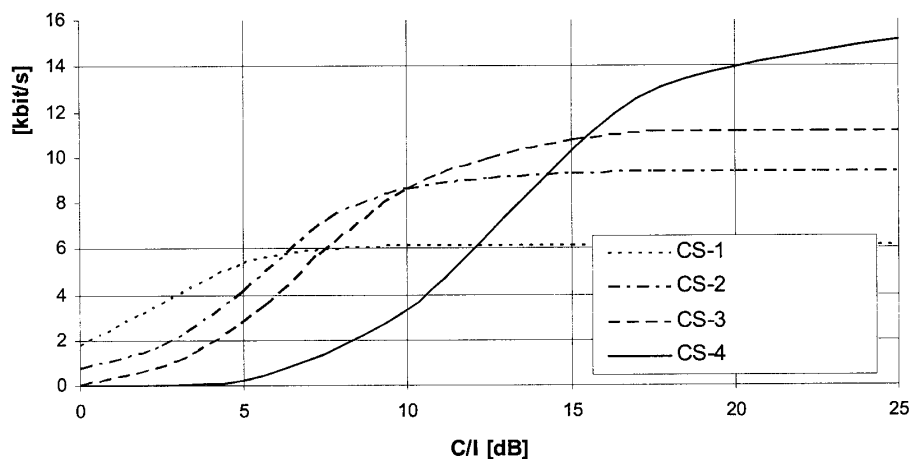


Fig. 1. Theoretical dependencies between user bit rate and carrier to interference ratio

2 Testing program

The program window contains four flags for different testing procedures: Ping Test, FTP Test, Dialup and AT Commands.

The Ping Test procedure enables time response testing of long-distance nodes. Input parameters: requests each cycle, received timeout, number of testing cycles (repeat) and delay between cycles. The node identification must be written to input field. Results (data and chart) can be saved to the file.

FTP Test procedure is used for download or upload some file from (to) the long-distance FTP server. Download (upload) can be start after determination of source and objective directories. Result of this test is average user bit rate.

Dialup procedure gives information about dial process. Results are displayed in dialup status monitor window.

AT commands are used for operating and control of modems, for example MC35 Siemens.

3 Block diagram

Block diagram of equipments interconnection is introduced in Fig. 2. For testing procedures were used:

- Base Transceiver Station BTS installed in laboratory of Wireless and Mobile Communications on Institute of Radio Electronics, FEEC, Brno University of Technology and connected to the T-Mobile network. Cell Identification CI 3391, ARFCN 107, BTS Motorola M-Cell 2 and transceiver TCU 900, 1 reserved GPRS TS.
- Attenuator for adjusting of desired signal level (C/I ratio). JFW Industries 50DR-046.
- Generator with unmodulated output signal as a source of spurious signal (distortion). SMT 03, Rohde & Schwarz. Necessary for setting C/I ratio (step 1dB).
- Circulator Motorola and load 714R 50Ω for sum of desired and undesired signals.
- Splitter Kathrein K63 22 62 1.
- Spectral analyser, R3132/62 Advantest for measuring the correct C/I value with precision $\pm 0,2\text{dB}$. All the cables and interconnections were pre-measured and calibrated.
- Mobile Station S55 Siemens (or Modem MC 35 Siemens) connected with PC (Windows 98) via RS 232 bus.

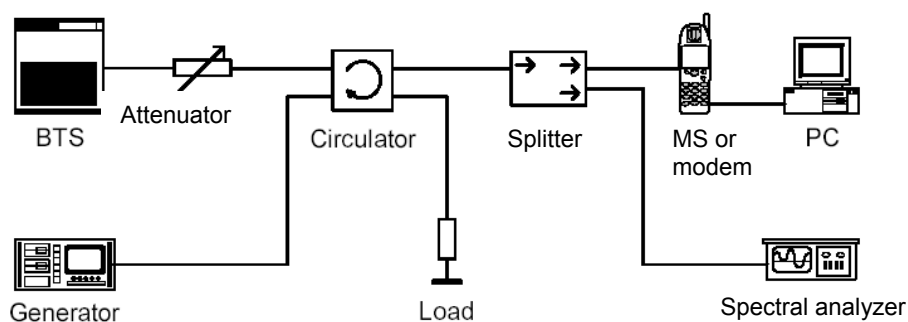


Fig. 2. Block diagram of equipments interconnection

4 Result examples

The result of Ping Test is presented in Fig. 3. Input parameters are showed on the right up in window. The node identification is written to the input field (172.20.27.245). After start,

the diagram shows the delay (total transmission time) for whole cycle. The result chart can be saved or cleared.

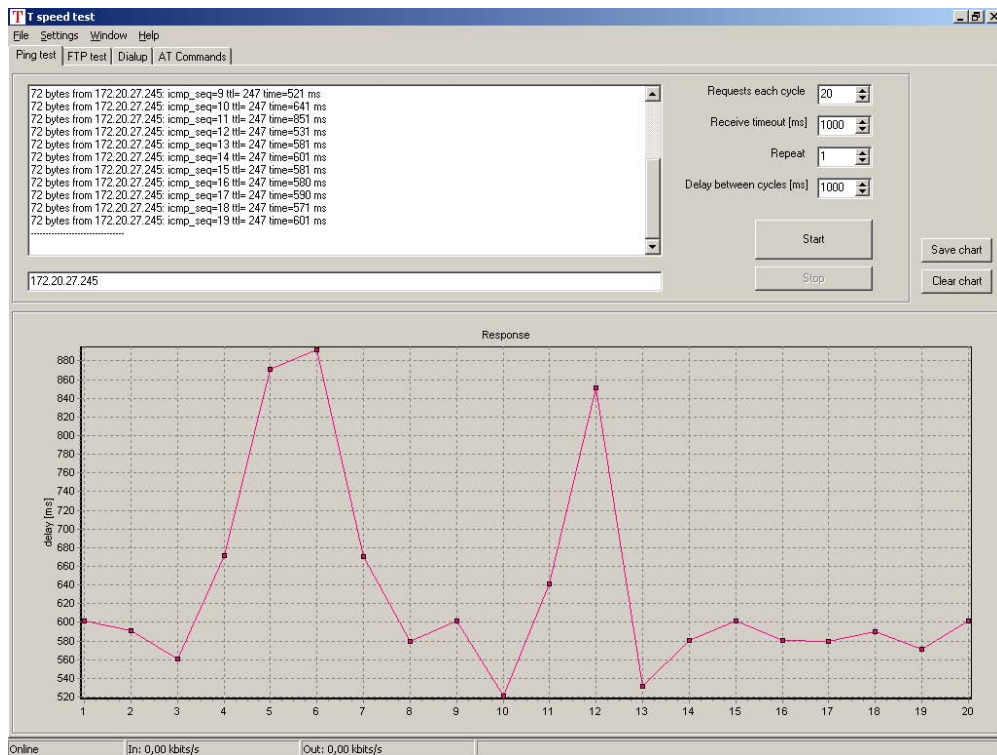


Fig. 3. Ping Test result window

For CS1-CS2 network configuration, the dependence between user bit rate and carrier to interference ratio (C/I) was also tested. C/I was changed from value 5 dB to 10 dB (step 1 dB), as parameter. For every value C/I, 10 attempts of GPRS transmission was performed. From user bit rate results, the average value was calculated. The result dependence is presented in Fig. 4.

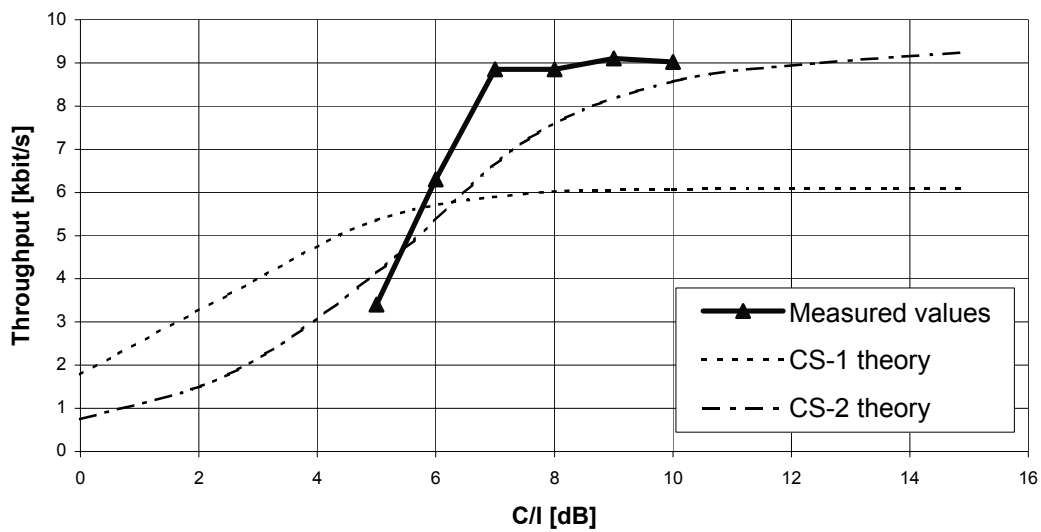


Fig. 4. GPRS data throughput in GSM for different C/I

Very important results were obtained from comparison of constant and impulse interference for the same C/I ratio. For 1/5 impulse interference was C/I equal 13 dB (14,2 kbit/s). For 1/15 impulse interference was C/I equal 14,3 dB (14,5 kbit/s). The 1/5 impulse spurious causes 2,8 x slower user data throughput than constant value, 1/15 spurious more than 1,7x slower data throughput for CS1-CS4 coding scheme usage. The main decreasing is caused by delay of coding scheme switching from CS4 to CS1 and back. Especially high interference environment and weak averaging process for the bad frequency plan can cause the high drop in GPRS data rate transmission. The result dependence is presented in Fig. 5.

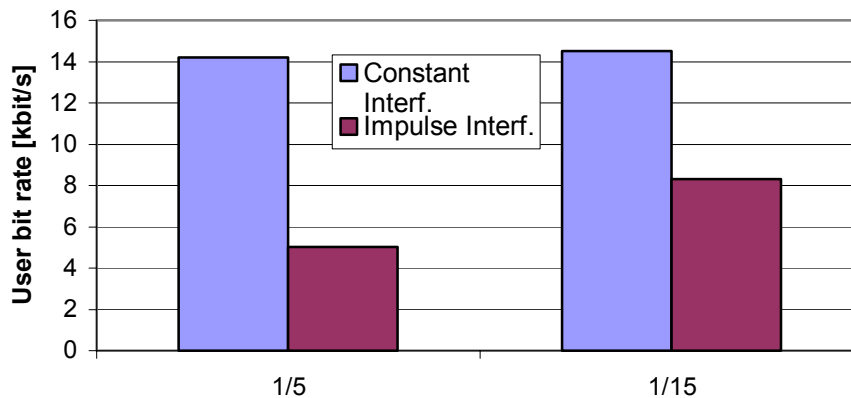


Fig. 5. Constant interference versus impulse interference 1/5 and 1/15

5 Conclusion

There was developed very useful software for GPRS user data, which can use each GSM mobile phone or modem, runs with Win98 or Win2000. In this paper the new testing program and its applications are introduced. The results of testing in real mobile network are also presented.

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