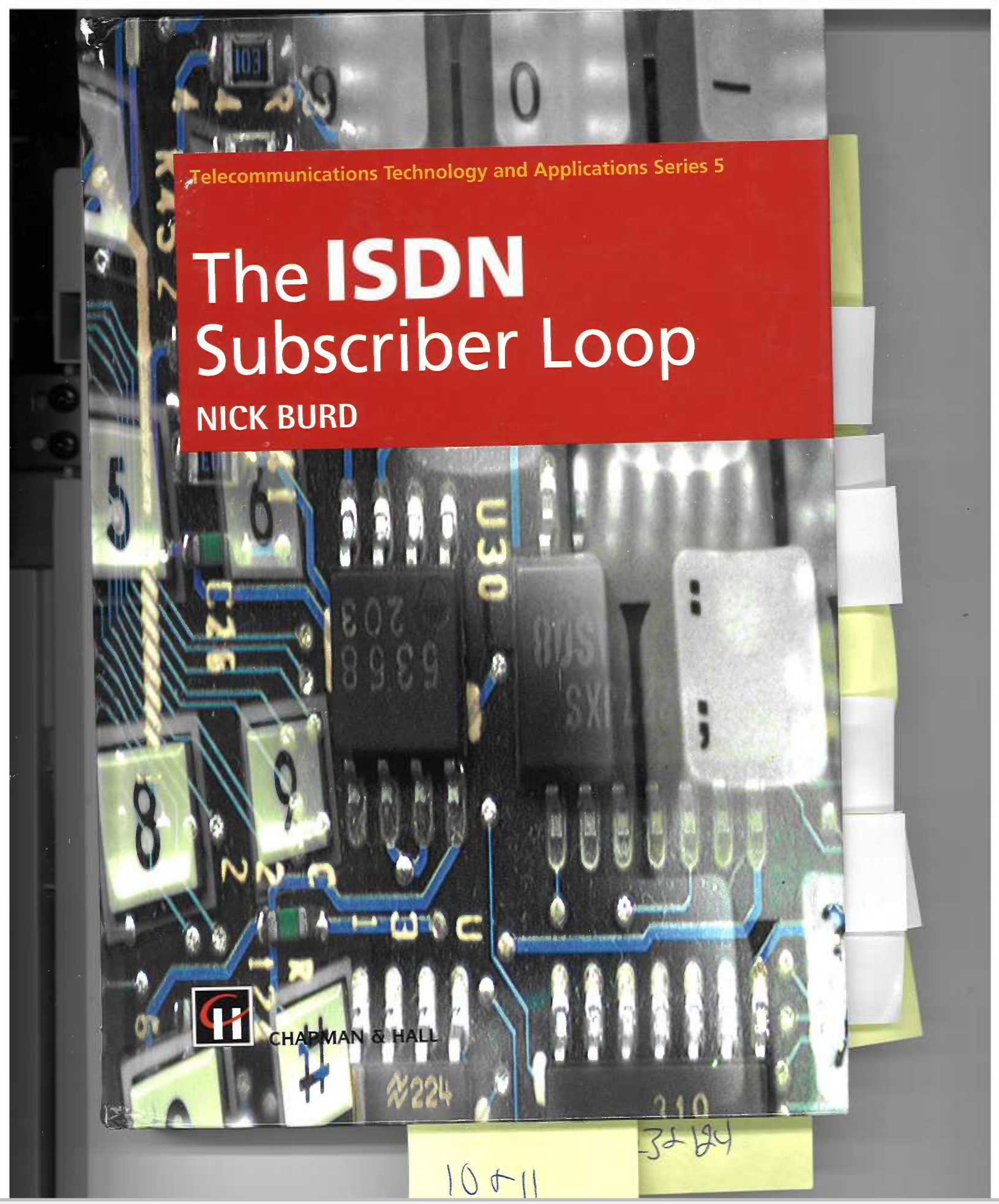

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terms of the operation and performance of the ISDN U transmission systems used in America and Europe.

In America, the NT1 is defined as customer premises equipment which is purchased and maintained by the user. The U interface may therefore be a user–network interface, and as such required standardization at an early stage in the deployment of ISDN to ensure equipment compatibility. The result is that ANSI has led the way in the standardization of the U interface through the ANSI T1.601 standard [6] which defines the use of a 2B1Q transmission system.

In Europe, the NT1 belongs to the network operator, and is installed at the time of subscription and subsequently maintained by the network operator. The user therefore never has direct access to the U interface, and instead connects to the ISDN through the S/T user–network interface.

European ISDNs use both the 2B1Q or 4B3T line code. Through ETSI, a technical recommendation ETR 080 [7] has been defined which covers the licensed use of both of these. The ETSI document exists only as a recommendation which may be adopted by European network operators, and is not an enforced standard in order to respect specific requirements that may exist in the European national networks which fall outside this recommendation. For example, the test loops and conditions which are defined for conformance testing of the U transceiver in different countries may be different in order to use reference loops which more closely represent the population of subscriber loops that exist within a network than do the test loops and conditions defined in the ETSI recommendation. (A further ETSI standard, prETS 300 297 [8], has also been generated for the digital section which is equivalent to G.960.)

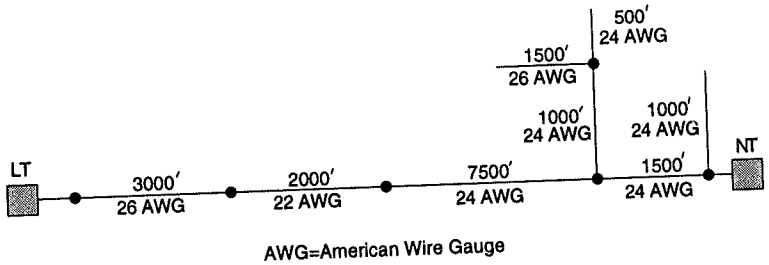
Three main differences between the ETSI and ANSI U transmission systems are their performance testing specifications, power supply configurations, and test and maintenance functions.

4.5.1 Performance testing

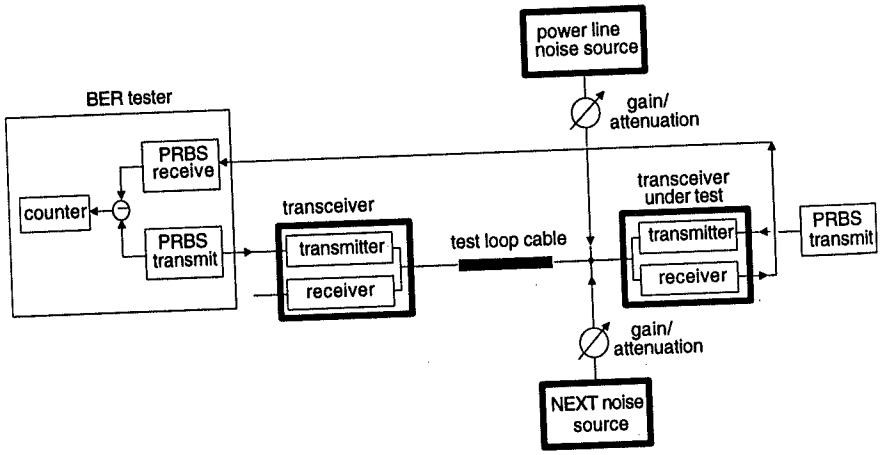
The U transmission standards and recommendations include test arrangements and procedures which are intended to be used to qualify the performance of LT and NT1 equipment for use in ISDN BRA subscriber loops. According to the requirements of the networks represented by the relevant standard or recommendation, a number of test subscriber loop cables are defined together with simulated noise sources whose signals are injected onto the cable to which the equipment under test is connected. After activation, a **pseudo-random binary sequence** (PRBS) test signal is used to simulate user information in the 2B+D channels and the **bit error rate** (BER) is measured by comparing the transmitted and received data streams.

The ANSI T1.601 standard specifies 12 mandatory test loops which are representative of the subscriber loops found in North America. A further three

optional test loops cover more demanding cases which are not so frequently found. The test loops are made up of different lengths of different types of cable with a total length of up to 18 000 feet (5.5 km). The test loops may also include up to three bridge taps. As an example, loop 14 of the ANSI loops is shown in Fig. 4.12a.



(a)



(b)

Fig. 4.12 The U transmission performance test system. (a) An example test loop (ANSI loop 14); (b) a typical test system.