TECHNICAL AND OPERATING CHARACTERISTICS OF CORDLESS TELEPHONES

(Question 71/8)

(1986-1990)

1. Introduction

In recent times, cordless telephones which can be connected into the public switched telephone network (PSTN) and have a small service area limited to a few hundred metres, have gained widespread popularity. To meet the growing demand for these cordless telephones, it would be advantageous to develop a system using multi-channel access techniques that does not rely on centralized traffic channel selection and provides efficient frequency utilization.

Part A of this Report deals with the general principles of cordless telephone systems using multi-channel access techniques, in particular, with the basic objective and technical characteristics which are important for their operation.

The major characteristics of some cordless telephone systems are given in Part B of this Report together with a brief description and other aspects of system operation.

PART A

1. Objectives

The basic objectives of the application are:

- that the radio spectrum be used efficiently;
- that a system of high subscriber capacity be realized;
- that simple and minature circuits be used to ensure that the weight and size of the equipment are compatible with ordinary telephones and that it can be provided economically;
- that the system provide good quality for public communication and that a flexible system of operation can be provided that does not require complicated frequency management;
- that the system provide as far as possible normal telephone features;
- that the system be provided security of call charges.

2. Technical and operational aspects

A cordless telephone system consists of two parts:

- a fixed part which is connected to the ordinary telephone network; and
- one or more portable sets.

The simplest version, called "cordless telephone" consists of one portable set and one fixed part connected to a subscriber line. More complex versions may encompass both public base stations ("telepoints") for access to the PSTN/ISDN and wireless PABXs.

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Each part uses multi-channel-access techniques and can individually perform the following operations:

- search for idle channels ;
- set up speech paths using the selected channel;
- check identification codes in the signals between the fixed part and the portable set in order to ensure that only associated units will lock to each other.

As a consequence, the following operation and management procedures can apply:

- in system operation, it is only necessary to manage the number of cordless telephone systems within the area determined by the distance at which interference occurs, while taking into account the subscriber capacity which is determined by the number of —— channels and the channel traffic;
- flexible operation can be provided, so as to permit the use of a greater number of portable sets than the subscriber capacity per zone, if the number of cordless telephones in use in the adjacent zones is small.

PART B

SYSTEMS BEING USED OR PLANNED IN THE NEAR FUTURE

1. Systems features

Cordless telephone systems employing frequency and/or time division multiple access techniques (FDMA/TDMA) have been developed in many countries.

A summary of major system specifications is given in Table I.

In Annexes I to IV the main features of four systems are described.

2. Conclusion

The technical basis and system features of cordless telephone systems using multi-channel access techniques which do not rely on a central system controller have been presented. The techniques described here would provide efficient frequency utilization, high subscriber capacity and flexible system operation.

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TABLE I - System characteristics

	System 1 (1)	System 2 (2) [CEPT, 1983]	System 3 (3) [BSI, 1987; DTI, 1987; DTI, 1989]	System 4 (4) [CCIR, 1986-90 ESPA, 1987] [STA, 1989]	System 5 (5) [ETSI, 1987-1991]
Class of emission	F1D, F2(A, B, C, D, N, X), F3E	F3E or G3E	F1EJT or G1EJT	F1W and F7W	F1W and F7W
Transmit frequency band (MHz):				Time division duplex:	Multi-carrier time division duplex:
- fixed part	380.2 - 381.3	959 - 960	864.1 - 868.1	862-866	1880-1900
- portable set	253.9 - 255.0	914 - 915	864.1 - 868.1	862-866	1880-1900
Radiofrequency channel spacing (kHz)	12.5	25	100	1000 (TDMA RF channels)	1728 (TDMA RF channels)
Number of speech channels	87 (adding two control channels)	40	40	8 or 16 (duplex time-slots per carrier)	12 (duplex time-slots per carrier)
Transmitted power, e.r.p. (mW):				Peak power over time-slot	Peak power over time-slot
- fixed part	max. 10 (Antenna input power)	max. 10	max. 10	max. 100	max. 250
- portable set	max. 10	max. 10	max. 10	max. 100, avg. < 6 (6)	max. 250
Typical service range (m):					
- indoor	50	50	40	40	30
- outdoor	100	200	200	200	200

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TABLE I (continued)

	System 1 (1)	System 2 (2) [CEPT, 1983]	System 3 (3) [BSI, 1987; DTI, 1987; DTI, 1989]	System 4 (4) [CCIR,1986-90 ESPA, 1987] [STA, 1989]	System 5 (5) [ETSI, 1987-1991]
Voice signals					
- type of modulation - processing	analogue	angular syllabic compandor CCITT Rec. 162 (suggested)	digital ADPCM	digital ADPCM or CVSDM	GMSK ADPCM or CVSDM
Audio signal-to-noise ratio (dB)	min. SINAD 20 dB(7)	(9)	(9)	(8)	(8)
Identification code	3×10^7 combinations	1×10^4 combinations	1.5×10^6 combinations	$> 10^7$ combinations	$> 10^7$ combinations
Minimum acceptable C/I ratio	(9)	(9)	(9)	(9)	(9)

1) System 1 is in use in Japan.
2) System 2 is used by several European countries.
3) System 3 is used in the United Kingdom and Finland.
4) System 4 is to be used in Sweden.
5) System 5 is the Digital European Cordless Telecommunications (DECT) system.
6) This average power assumes eight speech channels (duplex time-slots); for 16 speech channels (duplex time-slots), the power reduces proportionately.
7) Suggested value using an IEC Pub. 489-3 standard input-signal level of 10 μV.
8) Mean opinion score (MOS), when tested subjectively, shall not fall below the MOS of 32 kbit/s ADPCM as specified in CCITT Rec. G.721.
9) Values are required for this parameter; these may be dependent on the measurement method employed.

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ANNEX I

GENERAL DESCRIPTION OF SYSTEM 1

1. System configuration [RCR STANDARD , 1988]

The basic configuration of a cordless telephone system 1 employing the analogue multi-channel access technique is shown in Fig. 1.

This system does not use a central controller. In the system, two dedicated control channels are assigned.

Each cordless telephone itself performs the functions of searching for idle channels and setting up a speech path over the selected channel.

Fig. 2 shows the configurations of multi-function cordless telephone [Hattori *et al*., 1988].

The following types are typical examples.

1) Multi-terminal cordless telephone
2) Cordless key telephone
3) Multi-zone cordless telephone

2. Operational characteristics

2.1 *Identification code*

1) Only when its own identification code coincides between the fixed part and the portable set in the control channel, the fixed part and portable set shall switch to a speech channel. The length of the identification code shall be 25 bits.

2) Modulation methods and bit rates for an identification code are as follows:
Subcarrier MSK (Fast FSK): 1200, 2400, bps
Direct modulation: 600, 1200, 2400, 4800, bps

2.2 *Idle channel decision;*

Carrier sense shall be performed immediately before transmission and if more than 2μV is sensed, radio signal shall not be emitted.

2.3 *Occupied time of control channels*

Considering common use of dedicated control channels and easy introduction of sleep mode in portable sets, for originating calls from portable sets, occupied time shall be 1.3 second or less. For originating calls from fixed parts, occupied time shall be 4 seconds or less.

2.4 *Transmitter power-off on disconnection*

When disconnection is initiated, or when a radio signal is not received on any speech channel, the transmitter shall be turned off automatically.

2.5 *Transmitter power off in case of failure*

When a failure in the radio equipment causing continuous transmitter power in the control channel is found, the transmitter shall be automatically turned off within 60 seconds.

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