The Criteria, Procedure, and Classification of Traffic-Sensitive and Non-Traffic-Sensitive Components: A Case of CDMA Mobile System

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Since the introduction of competition in the telecommunication market due to the growth of the interconnection between heterogeneous networks, particularly fixed and mobile networks, the interconnection charge based on traffic-sensitive (TS) and non-traffic-sensitive (NTS) costs has become more important. Although there have been many studies of the public switched telephone network (PSTN), previous studies of TS and NTS costs in mobile networks are very few. In this paper, as a pilot study, we propose three criteria and a procedure for the classification of TS and NTS costs based on mobile systems. The three criteria are the following: function type, investment requirement, and main exhaust driver. Moreover, for a CDMA mobile system, strongly TS, strongly NTS, and mixed components are classified by the proposed criteria and procedure. The proposed criteria, procedure, and classification can provide a systematic and useful guideline to decide the scope of mobile facilities and to determine the terminating cost on mobile networks from fixed networks.

Keywords: Traffic-sensitive, non-traffic-sensitive, classification criteria, CDMA mobile system, interconnection, function type, investment requirement, main exhaust driver.

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I. Introduction

One of the most significant changes in the communications market in the 1990s has been the rapid spread of Internet and mobile phone services. There is a high prospect that by 2003 the number of mobile phone subscribers will exceed that of fixed-line subscribers and the volume of mobile call traffic will surpass fixed-phone traffic [1]. With the current increase in investment and demand for the mobile network, traffic between the fixed-line and mobile networks has greatly increased. Also, the calculation of the interconnection charge has become one of the most pressing issues among service providers and has become a cause for concern for regulatory authorities.

In several countries, the interconnection charge, particularly the termination tariff on mobile networks, is regulated on the basis of cost. Telecommunications users who want to have access to a network are not necessarily required to subscribe to that network. Using interconnection, they can send calls to and receive calls from networks they do not subscribe to, and only pay a usage charge with no fixed charge for the services that they have used.

Mobile networks have network features that differ from those of fixed networks. In mobile networks, there is no part for conveyance that is dedicated exclusively to the customer. In other words, there is little in mobile networks which are equivalent to the local loop in fixed networks like the public switched telephone network (PSTN). Therefore, the termination rate on mobile networks includes non-traffic-sensitive access costs (local loop equivalent) and/or coverage costs. This is one reason that termination rates for calls terminating on mobile networks in some countries appear to be unreasonably high. However, mobile networks require for their territory of coverage a minimum of facilities that is not driven by the volume of calls, either from their customers (outbound calls) or to their customers from other networks (inbound calls) [2]. For this reason, W. Neu [2] proposed that the cost of minimum coverage presence (MCP) should be included in the scope of *indirect costs* in the ITU-T Recommendation D.140, but detailed elements and the scope of MCP were not presented. According to the Director General of Telecommunications (DGT) of Oftel[1] [3], since the access cost has nothing to do with traffic volume, it is incongruent to recover it by termination rates. This so-called MCP is an element of non-traffic-sensitive access costs in mobile networks. Recently, the additional cost incurred by a mobile network operator in terminating a basic mobile call on its network has become a regulatory and economic issue. This additional cost is properly calculated using only the traffic or usage-sensitive costs. Costs associated with access or coverage are not relevant to the incremental cost of terminating a mobile call [4]. However, it is still technically and practically difficult to draw a distinction between traffic-sensitive (TS) and non-traffic-sensitive (NTS) facilities in mobile networks. This paper presents criteria in section III and a procedure in section IV for making a distinction between TS and NTS facilities in mobile networks. This also includes the classification of TS and NTS components for a CDMA mobile system in section IV and Appendix A.

II. TS and NTS Costs in Telecommunications Networks

In the telecommunications industry, there has been serious discussion of TS and NTS cost. Especially in the case of telephone service, the local loop cost with NTS has been covered with the long distance-call charges so as to keep the subscriber's monthly basic fee low. Since the cost of access subscribers was widely believed to be NTS and therefore, not part of the marginal cost of calling, its transfer to a charge violated the most elementary principle of efficient pricing [5]. Nonetheless, a failure in efficient price settlement seems to be irrelevant in the telephone service industry.

Under the two-part tariff scheme, usage fees should be charged as the price for using the communication service and those fees should be based on the variable costs of the communication network [6]. The cost factors leading to such variable costs are defined as TS. That is, TS cost is defined as the cost increasing according to usage traffic [5]. According to FCC [7], in the case of receiving traffic, usage-sensitive future-oriented economic cost is defined as the additional cost occurring due to the increase or decrease of service (or traffic). On the other hand, in a more technical approach, TS cost is defined as the cost occurring when the capacity of communications equipment is exhausted due to call volume [5].

NTS elements can be referred to as those communication network elements excluding the above defined concept of TS. This includes the fixed and basic fee excluding the usage fee under the two-part tariff scheme. NTS cost is defined as the cost unrelated to call volume but related to the number of subscribers [5]. In the case of fixed networks, NTS cost includes end-office switch elements (line cards, trunk cards, ports, and so on) and cost elements unrelated to call volume such as the local loop [7]. In the case of MCI, about 70% of its fixed network was considered NTS cost [8]. From a more technical point of view, the cost occurring when the capacity of communication equipment is exhausted due to factors excluding traffic is deemed NTS [4].

Mobile communication network structures and systems are technically different from those of fixed networks. Moreover, there have been insufficient studies on TS and NTS facilities in mobile telecommunication systems. But a cost-based terminating tariff (especially on mobile networks) is very important, and as a telecommunication regulatory issue, the identification and distinction of cost drivers and elements in mobile networks is more critical.

III. Classification Criteria for TS and NTS Components in Mobile Systems

In order to establish consent between the concerned parties such as regulators and fixed and mobile operators with regard to the classification of TS and NTS for each component of a mobile network, TS and NTS classification of each component should be considered in relation to the definition of TS and NTS costs. The features and functions of a mobile system should be understood in this respect; moreover, the classification for each component should be based on a set of consistent rules, which would ensure agreement among interested parties. Finally, the relation between the mobile system and its components should be fully considered. In terms of system, since an individual component may not be classified as either TS or NTS, its classification should be dependent upon an agreement among the interested parties.

1) Telecommunications regulatory organization of United Kingdom now is Ofcom.

In order to identify whether a facility or subsystem of the mobile system (terminology component instead of facility or subsystem) is TS or NTS, the following three criteria are presented: (i) a criterion based on the function type, (ii) a criterion based on the investment requirement, and (iii) a criterion based on the main exhaust driver.

The criterion based on function type rests on the fact that each component of the mobile system has its own peculiarly functional feature. The functions of the communications system are classified into six types (or elements) in this paper: access; transmission; switching; signaling; powering; and operations, administration, and maintenance (OAM).

According to ITU-T [9], [10], access is defined as the means by which a user is connected to a telecommunication network in order to use the services and/or facilities of that network. Transmission is defined as the action of conveying signals from one point to one or more other points. Switching is the process of interconnecting functional units, transmission channels or telecommunication circuits for as long as is required to convey signals. Signaling is defined as the exchange of information specifically concerned with the establishment and control of connections, and with management, of a telecommunication network. Powering is defined as a function with activation or deactivation of a system or part of a system. Finally, OAM consists of operation, administration, and maintenance of a system.

The first step is to determine whether each function is characteristically TS or NTS. In analyzing some of the defined functions it is difficult to draw a clear distinction between TS and NTS. For instance, it is appropriate for the billing function, which is included in OAM functions, to be classified as TS because there is a high possibility that the cost will vary according to user traffic. On the contrary, the system monitoring and management function, which is unrelated to user traffic, is close to NTS. This study therefore

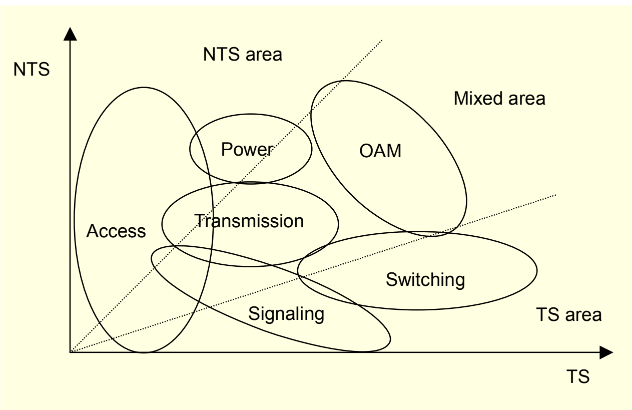

Fig. 1. Domain of function types over TS and NTS.

uses a three-dimensional classification which includes the concepts of a *TS area*, an *NTS area*, and a *mixed area*. The mixed area concept can include both TS and NTS features from the perspective of functions in mobile systems.

Figure 1 illustrates the domain of function types of the mobile system as classified into TS, NTS, and mixed areas. Actually this figure is a qualitative result[2)] of discussions of experts, economists, and managers related to mobile technology and interconnections policy in Korea. The other two criteria were also determined in this way. The range of TS and NTS for each function can be changed and corrected by the operator, country, or regulator in technology-specific cases. It is a typical example of the domain of function types over TS and NTS.

The second criterion based on investment requirement is classified according to whether the facility extension investment requirement is due to an increase in user traffic or to the coverage of the minimal service area. As a rule, facility extension (additions to existing facility, upgrades, and so on) based on increases in traffic is close to TS, while the access of new subscribers to the service is close to NTS. Figure 2 illustrates the range of TS and NTS for the two elements.

Finally, the third criterion based on the main exhaust driver is the most technical approach among the three criteria. It consists of identifying elements exhausting the capacity of each component and classifying them as either TS or NTS. The elements exhausting the main facilities of the mobile network are classified into six types in this study: minutes of use (MOU), busy hour call attempt (BHCA), cell sites/sectors, facility exhaust, number of managed facilities, and no exhaust. Among them, MOU and BHCA are mainly related to traffic and are close to TS. The subsystem management element

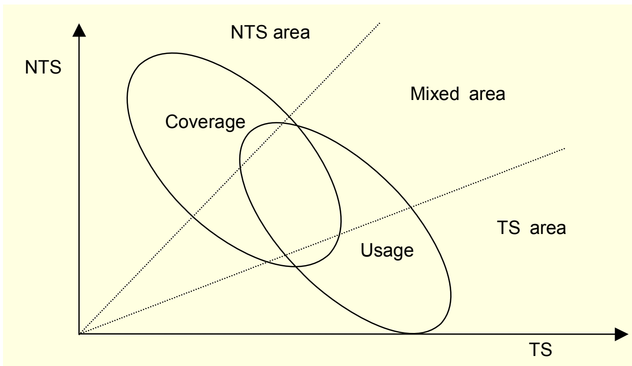

Fig. 2. Domain of investment requirement over TS and NTS.

2) The necessity of quantitative analysis to distinguish the borders between the NTS area and the mixed area, and between the mixed area and the TS area was brought up in discussion with related experts, but it is very difficult work and would require much time and expense, so it remains as a possible further study.

for monitoring and controlling the traffic path is also to some degree traffic-sensitive. On the contrary, the service cell or sector element, which is exhausted to provide users in the service use area with mobility guarantee and always-on access, is close to NTS. The facility exhaust element occurring according to the aging of facilities themselves belongs to the mixed area because some cases are related to traffic management while others are not. A summary is shown in Fig. 3. Based on the three classification criteria and main elements in each criterion, each component of the mobile network is classified into one of three types as *strongly TS*, *strongly NTS*, or *mixed feature*.

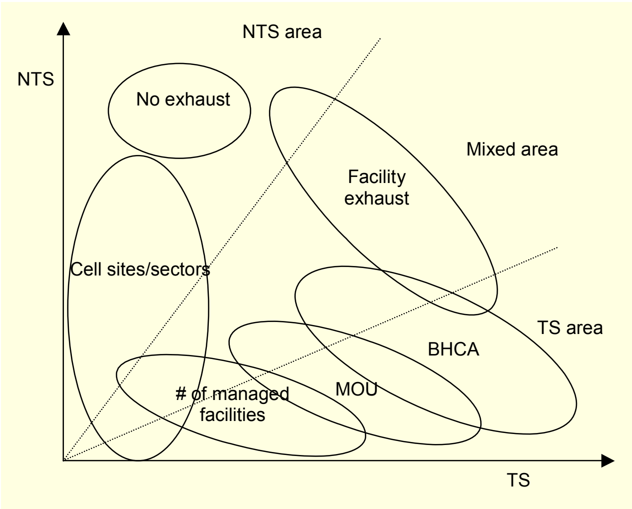

Fig. 3. Domain of main exhaust drivers over TS and NTS.

IV. Classification of TS and NTS on a CDMA Mobile System

1. Classification Procedure

Figure 4 shows the classification procedure applied to a mobile system according to TS and NTS classification criteria which are presented in this paper. First, an analysis of each mobile subsystem is carried out; second, the mapping of each element in terms of the three classification criteria on the system components is carried out through a discussion with several relevant experts[3]. Then, if all elements of the three criteria mapped onto a given component belong to the TS area, it is categorized as

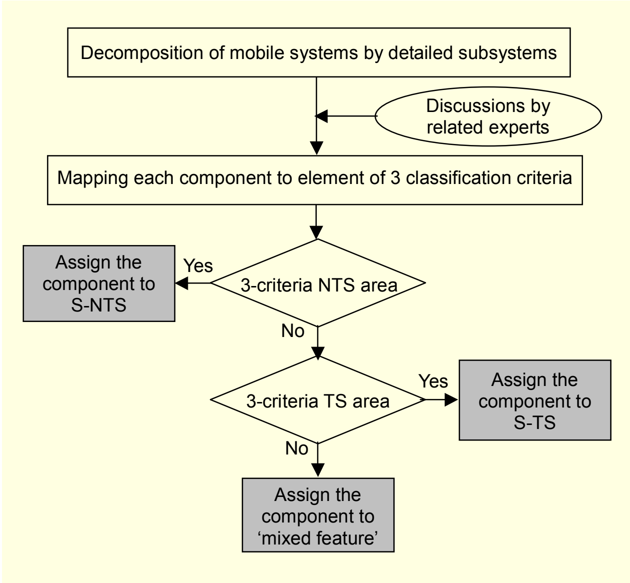

Fig. 4. The classification procedure of TS and NTS on mobile systems.

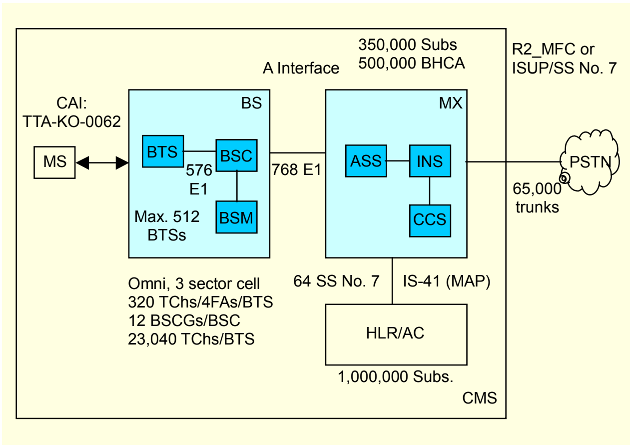

Fig. 5. CMS architecture [11].

strongly TS (S-TS). If all elements of the three criteria mapped onto the component belong to the NTS area, it is categorized as strongly NTS (S-NTS), and the other cases are categorized as mixed feature.

2. Decomposition of a CDMA Mobile System

The first step in the TS and NTS classification of a mobile system is to select a suitable system and decompose it. The target mobile system which was decomposed in this study is the CDMA mobile system, or CMS (see Appendix B). CMS is a CDMA-based digital cellular infrastructure derived from IS-95, which was developed by Electronics and Telecommunications Research Institute (ETRI), Korea. ETRI developed CMS as a test-bed in 1994. It consists of MS, BS

3) We had two formal discussions with several experts of CDMA technology and telecommunication economic fields: first, to list components and examine their functions in each subsystem BTS, BSC, MSC and HLR/AC; second, to apply corresponding elements of criteria to decomposed components of CDMA subsystems.

Table 1. The levels of CMS configuration management.

Level	Definition	Example
System	Set of subsystems that implements the functions of mobile service, which is possible to design independently and its interface with other system is standardized	CMS
Subsystem	HW and SW that has physical structure and independent function	MS, BS, MX
Block	Component of the lowest subsystem which has a hierarchical tree.	RF, BIN, CCP, TSB
Unit/PBA	Component of block and the lowest level of independent configuration management	HAPU, HINA

Table 2. An example of classification based on the three criteria.

Components	Function type	Investment requirement	Exhaust driver	Classification
Receiver card	Access	Coverage	Cell sites/sector	S-NTS
Upconverter	Access	Coverage	Cell sites/sector	S-NTS
Channel card	Access	Coverage	BHCA	Mixed feature
SXOA	Access	Coverage	# of CE	Mixed feature
Space switch	Switching	Usage	BHCA	S-TS
FEP	Signaling	Usage	BHCA	S-TS

(composed of BTS, BSC, and BSM), MX (composed of MSC and VLR), and HLR/AC as shown in Fig. 5 [11], [12]. Furthermore, each subsystem consists of several modules with particular functions that can be decomposed.

The levels of CMS configuration management are summarized in Table 1. CMS configuration management is composed of the subsystems MS, BS, MX, and HLR. Each subsystem is composed of subcomponents or blocks, and each block is composed of units or PBAs, which are at the lowest level of configuration management [13].

In this paper the decomposition of CMS for TS and NTS classification of the system hardware is carried out basically at the level of unit or PBA. However, the BSM and HLR are decomposed only on the hardware platform because those are mainly dependent on software due to their functional and system peculiarity. Some facilities which cannot be decomposed (tower, antenna, spectrum, wire lines between subsystems, and so on) are considered to be decomposed components because they cannot be broken down further. The BCP and BIN, which are a unique processor and router in the BTS respectively, are decomposed at the block level. In this way, and in discussion with several mobile experts, the BTS and BSC were decomposed into 13 components, the MX into 22 components, and the HLR/AC into 5 components. All components and their main functions in each CMS subsystem are described in Appendix A.

3. Classification of TS and NTS Applied to CMS

By the proposed classification procedure, every component in CMS is classified according to the elements of the three classification criteria. Table 2 shows the resulting classification of the receiver card, the upconverter, the analog common card (ACC) in the BTS, of the SXOA in the BSC, of the space switch in the MX, and of FEP in HLR.

In Table 2, the receiver card, which belongs to the RF unit in the BTS, mainly performs the function of down-conversion from UHF to an IF of 4.95 MHz while the up-converter card performs the opposite function. In addition, the main function of the ACC, which belong to the digital unit in the BTS, is as follows: The I and Q outputs are converted to analog through a set of digital-to-analog converters and filters in the forward link, and vice versa in the backward link [14]. Most functions of every component in the BTS are to connect customers to the mobile system, that is, they are access type; the main driver is to extend or update the components of the BTS and is to cover the service area, that is, it depends on the number of customers and is coverage type. In the main exhaust driver, the receiver card and upconverter have a feature of cell/sites because their capacity in certain cells is limited, so over call is denied automatically. In the case of the ACC, however, since it is exhausted as it processes call attempts, the main exhaust driver of the ACC is the BHCA in the mixed area. By the proposed procedure, the receiver card and upconverter components are classified as S-NTS, and the ACC is classified as mixed.

In the case of the SXOA component of the BSC, which supports soft handoff by selecting the BTS, it transcodes between 64 kbps PCM and variable rate vocode data [14]. Its main functions are signal format conversion and signal handling to connect to the core facility of the mobile network so that those are classified as an access type. The extension and upgrade of this component depends on the numbers of the BTS and subscribers so it is considered coverage type, but its channel elements are included in the mixed area because the extension and upgrade of channel elements depends on call attempts. Thus SXOA is classified as mixed feature.

Finally, the space switch in the MX interconnects a number of time switches and switches a time slot in one stream with a time slot in another stream [16], [17]. The FEP in HLR processes the message transfer part, signaling connection control part, and the transaction capability application part of the CCS No. 7 [13], [14]. These functions are switching and signaling type respectively. Their additional investment is mainly caused by increase of call traffic and attempts. Because the space switch works in proportion to the number of call attempts and the FEP processes the low level part of the CCS. No.7 for the routing information of the receiver, the exhaust driver of the space switch and that of FEP are mapped onto the BHCA. Therefore, since all elements of the three criteria mapped onto the space switch and the FEP are included in the TS area they are classified as S-TS.

In this way, based on the classification criteria and procedure, all decomposed components of the CDMA mobile system are classified as S-TS, S-NTS and mixed feature (see Appendix A). The main result of TS and NTS classification on the CMS is as follows. Based on three classification criteria, the RF unit and the digital unit in BTS were classified as S-NTS and mixed respectively (see Table A1 of Appendix A). The BSC subsystem was classified as mixed (see Table A2 of Appendix A). Most of the MX components were classified as S-TS and some as mixed (see Table A3 of Appendix A). The HLR was close to S-TS excluding some components because it is susceptible to the subscriber's call attempts (see Table A4 of Appendix A). Seven other components were similarly classified (see Table A5 of Appendix A).

V. Conclusion

In this pilot study, we proposed the classification criteria and procedure to distinguish between TS and NTS facilities in mobile telecommunication systems. Furthermore, we have classified the components of the Korean CDMA mobile system into three types–S-TS, S-NTS, and mixed by the proposed criteria and procedure. Considering the fact that terminating charges on mobile networks from fixed networks is emerging as a critical issue in the telecommunication regulatory field, this study is a useful reference to help set the cost scope of access charges between fixed and mobile networks. For example, when a detailed account of facilities and the scope of minimum coverage presence in a mobile network is necessary, this gives a systematic guideline to determine them because the proposed criteria and procedure are based on economic rationale as well as the technical characteristics of the mobile system. Furthermore, the criteria and procedure have another advantage in that they can be applied to most mobile technologies like AMPS, CDMA, GSM, TDMA, and so on.

However, this study produces several limitations for further study because our approach was based on a rather technical and theoretical perspective based on related experts' discussions rather than economic and empirical application. First, there is a possible difficulty in applying the proposed approach to the practical field of the interconnection market because the CDMA system in this study may not be the same as the mobile operator's facilities. Second, in order to establish more robust classification criteria, a quantitative analysis to distinguish the borders between the NTS area and the mixed area, and between the mixed area and the TS area is required. These limitations, practically speaking, may create a difficulty in calculating the interconnection charge. Third, and most importantly, negotiation between operators and regulators to practically implement the results of this paper in the actual interconnection market would be necessary, but in this paper there is no prior consultation procedure among them. If the interested parties related to the interconnection market reach a consensus concerning the necessity for classification criteria and procedure for TS and NTS components of mobile networks similar to those used in fixed networks, these limitations will be resolved through further research. Moreover, we expect that our propositions will be practically useful in the regulating procedure of determining costs (which includes an economic and an engineering model) for interconnection charges between mobile and fixed operators which is carried out periodically.

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Appendix A. TS and NTS Classification of Components on the CMS (CDMA Mobile System)

Table A1. TS and NTS classification of BTS components.

Components of BTS		Function	Function type	Req.	Exhaust driver	Classification
RF unit	Rx front end unit	Reverse signal filtering and sampling	Access	Cov.	Cell sites/sectors	S-NTS
	Tx front end unit	Forward signal filtering and sampling	Access	Cov.	Cell sites/sectors	S-NTS
	Receiver card	Downconversion from RF to IF	Access	Cov.	Cell sites/sectors	S-NTS
	Upconverter	Upconversion from IF to RF	Access	Cov.	Cell sites/sectors	S-NTS
	Distribution shelf	Distributes the received signal to digital unit	Access	Cov.	Cell sites/sectors	S-NTS
	HPA shelf	Power amplification of signal for transmitting	Access	Cov.	Cell sites/sectors	S-NTS
	GPS receiver	Receives the reference clock	Access	Cov.	BTS exhaust	S-NTS
Digital unit	TFC	Generates the system clock and monitors the status of SIC	Access	Cov.	BHCA, BTS exhaust	Mixed
	SIC	Combines the baseband forward link signals and upconverts them to IF	Access	Cov.	Sectors	Mixed
	ACC	Digital-to-analog conversion of the forward link signals and analog-to-digital conversion of the reverse link signals	Access	Cov.	BHCA	Mixed
	CC	CC consists of two CEs and each CE carries out required CDMA signal processing for the forward channels and reverse channels	Access	Cov.	BHCA	Mixed
BIN		Traffic packet routing between CE and CIS	Access	Cov.	BHCA	Mixed
BCP		Controls the BTS and assigns the radio resources (frequency, frame offset)	Access	Cov.	BTS exhaust	Mixed

Table A2. TS and NTS classification of BSC compenents.

Components of BSC		Function	Function type	Req.	Exhaust driver	Classification
CIN	HINA	Provides 8 nodes and each node switches message packets	Access	Cov.	BHCA	Mixed
	HIPA	Monitors and manages all node of HINA	Access	Cov.	BHCA	Mixed
	LITA/LIEA	Link interface board (8 E1/T1)	Access	Cov.	BHCA	Mixed
TSB	SXIA	Controls and manages SXOA	Access	Cov.	BHCA	Mixed
	SXOA	Selecting BTS and traffic transcoding (Q_CELP $\leftrightarrow$ PCM)	Access	Cov.	# of CE	Mixed
CCP	MPMA	Execution of OS and application program	Access	Cov.	BHCA	Mixed
	PCCA	Connects IPC unit of MSC	Trans.	Cov.	BHCA	Mixed
	SBIA	Provides interfacing function for the message packet with CIN	Trans.	Cov.	BHCA	Mixed
	DCCA	Provides a duplication control for the CCP	Access	Cov.	BHCA	Mixed
BSM	Commercial workstation	Program downloading for the control processors at initialization phase and status management for control processors and equipment device of BS	OAM	Cov.	BHCA	Mixed
	Input and output device	Inputs and outputs the information for system operation	OAM	Cov.	BHCA	Mixed
	CIS interface card	Interfaces with HINA of CIN	Trans.	Cov.	BHCA	Mixed
	Hard disk	Auxiliary memory device	OAM	Cov.	BHCA	Mixed

Table A3. TS and NTS classification of MX components.

Components of TDX-10 MX		Function	Function type	Req.	Exhaust driver	Classification
CCS	LRP	Location registration and update	Access	Usa.	Moving	Mixed
	OMP	Operation and maintenance	OAM	Usa.	Processor exhaust	Mixed
	MMP	Controls input and output for interface with operator	OAM	Usa.	Processor exhaust	Mixed
	MTU	Magnetic tape unit for accounting, operating information	OAM	Usa.	BHCA/ MOU	Mixed
	Disk	Storage unit for generic program and data	OAM	Usa.	No	Mixed
	CIPCU	Central inter processor communication unit	Trans.	Usa.	Processor exhaust	Mixed
INS	NES	System clock generation and distribution for network synchronization	Switch	Usa.	Switch exhaust	Mixed
	SSW	Space switch	Switch	Usa.	BHCA	S-TS
	SSP	Space switch processor	Switch	Usa.	BHCA	S-TS
	INMP	Maintenance of INS	OAM	Usa.	BHCA	S-TS
	INP	Searches and manages interconnection network in space switch	Switch	Usa.	BHCA	S-TS
	NTP	Number translation	Switch	Usa.	BHCA	S-TS
	CDL	Optic link between racks	Trans.	Usa.	BHCA	S-TS
	IIPCU	INS inter processor communication unit	Trans.	Usa.	BHCA	S-TS
ASS	DCI	Digital CEPT1 interface	Trans.	Usa.	BHCA	S-TS
	TSL	Time switches and links	Switch	Usa.	BHCA	S-TS
	LSI	Local service interface	Access	Usa.	BHCA	S-TS
	BLIP	Base station link interface processor	Trans.	Usa.	BHCA	S-TS
	TSP	Time switch processor	Switch	Usa.	BHCA	S-TS
	LSP	Local service processor	OAM	Usa.	Processor exhaust	S-TS
	ASMP	Operation and maintenance in ASS	OAM	Usa.	Processor exhaust	S-TS
	ASP	Access switching processor for call handling	Switch	Usa.	Switch exhaust	S-TS

Table A4. TS and NTS classification of HLR components.

Components of HLR	Function	Function type	Req.	Exhaust driver	Classification
T1/E1 multiplexer	T1/E1 interfaces with MSC	Trans.	Usa.	BHCA	Mixed
FEP	Processing SCCP, TCAP, and MTP of CCS No.7	Signaling	Usa.	BHCA	S-TS
BEP	Processing ASE of CCS No.7	Signaling	Usa.	BHCA	S-TS
HLR DB	Storage unit for mobile subscribers	OAM	Cov.	-	Mixed
OMP	System operation and maintenance	OAM	Usa.	Workstation exhaust	Mixed

Table A5. TS and NTS classification of other components.

Other components	Function	Function type	Req.	Exhaust driver	Classification
Tower	Equipment for supporting antennas	Access	Cov.	Cell sites/sectors	S-NTS
Antennas	3 transmit and 6receive antennas	Access	Cov.	Cell sites/sectors	S-NTS
Spectrum license	Transmission medium	Access	Cov.	No	S-NTS
Spectrum clearing	RF relocation	Access	Cov.	No	S-NTS
MDF	Transmission, aggregation	Transport	Usa.	BHCA	S-TS
Backhaul	Transmission between BTS and BSC	Transport	Usa.	MOU	S-TS
AC	Identification, DB	Access	Cov.	Workstation exhaust	Mixed

Appendix 2. Abbreviations

AC	Authentication Center	HPA	High Power Amplifier
ACC	Analog Common Card	LITA/LIEA	Link Interface T1 Assembly/ Link Interface E1 Assembly
ASE	Application Service Element	MDF	Main Distribution Frame
BCP	BTS Control Processor	MOU	Minutes Of Use
BEP	Back End Processor	MPMA	Main Processor and Memory Assembly
BHCA	Busy Hour Call Attempt	MSC	Mobile Switching Center
BIN	BTS Interconnection Network	MTP	Message Transfer Part
BS	Base Station	MX	Mobile eXchange
BSC	Base Station Controller	NTS	Non-Traffic-Sensitive
BSM	Base Station Manager	OAM	Operation, Administrations and Maintenance
BTS	Base Transceiver Station	OMP	Operation and Maintenance Processor
CC	Channel Card	PBA	Printed-Circuit Board Assembly
CCP	Call Control Processor	PCCA	Processor Communication Control Board Assembly
CCS	Common Channel Signaling	SBIA	Signaling Bus Interface Assembly
CE	Channel Element	SCCP	Signaling Connection Control Part
CIN	CDMA Interconnection Network	SIC	Sector Interface Card
CMS	CDMA Mobile System	SXIA	Selector and Transcoder Interface Assembly
DCCA	Deuplex Communication Control Board Assembly	SXOA	Selector and Transcoder Assembly
FEP	Front End Processor	TCAP	Transaction Capability Application Part
GPS	Global Positioning System	TFC	Timing-Frequency Reference Card
HINA	High Capacity IPC Node Board Assembly	TS	Traffic-Sensitive
HIPA	High Capacity IPC Processor Assembly	TSB	Transcoder and Selector Bank
HLR	Home Location Register	VLR	Visitor Location Resister

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