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Generic Requirements for CDMA2000 1x EV-DO Rev. A Access Network

GENERIC REQUIREMENTS

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History Sheet

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2.	**Generic Requirements of CDMA 2000 1x EV-DO system**	GR/EDO-01/01 JUN 2004	Issue 01

CONTENTS

REFERENCES

TEC Documents

GR/ANT-20/02.JAN2006	-	Base station Antennas in 824- 894MHz, 1880-1900 MHz and 1920-2170 MHz Frequency Bands
GR/FDR-12/02 JAN 2006	-	Feeder cable for 800 MHz (824-894) MHz & 1900MHz (1880-1900) MHz Frequency Bands
TEC/EMI/TEL-001/01/FEB-09	-	General Electromagnetic Compatibility requirements for Telecommunication Equipment

ITU –T Standards

E.770 (03/93)	-	Land mobile and fixed network interconnection traffic grade of service concept
E.800 (08/94)	-	Terms and definitions related to quality of service and network performance including dependability
M.3010 (02/00) with Amendment 1(2/03)	-	Principles for a telecommunications management network (TMN)
M-3020 (02/00)	-	TMN interface specification methodology.
Q.513 (03/93)	-	Digital exchange interface for operations, administration and maintenance
Z.301 to Z.341 (11/88)	-	Specifications pertaining Man-machine Language (MML)
Z.314 (11/88)	-	Character set and basic elements of MML
Z.322 (11/88)	-	Capabilities of visual display terminals

ITU-R Standards

M-1457 (12/03)	-	Detailed specifications of the radio interfaces of IMT-2000.

International Quality Standard

ISO-9001:2000	-	Quality Management System – Requirement

BIS Standards

IS 8437 (1993)	-	Guide on the effects of current passing through the human body (equivalent to IEC 60479-1 (1984).
IS 13252 (2003)	-	Safety of information technology equipment including electrical business equipment (equivalent to IEC publication 60950 (2001)

EIA/TIA/IS Standards

IS-835-B	-	cdma2000 Wireless IP Network Standard
IS-856 -A	-	cdma2000 High Rate Packet Data Air Interface Specification
IS-864	-	Recommended Minimum Performance Standards for cdma2000 High Rate Packet DataAccess Network Equipment
IS-866	-	Recommended Minimum Performance Standards for cdma2000 High Rate Packet DataAccess Terminal
IS-878	-	Inter-operability Specification (IOS) for High Rate Packet Data (HRPD) Network Access Interfaces
IS-890	-	Test Application Specification (TAS) for High Rate Packet Data Air Interface
IS-919	-	Signaling Conformance for cdma2000 High Rate Packet Data Air Interface
IS-925	-	Enhanced Subscriber Privacy for cdma2000 High Rate Packet Data

IETF Standards

RFC 3095	-	RObust Header Compression (ROHC): Framework and four profiles: RTP, UDP, ESP, and uncompressed
RFC 4815	-	Corrections and Clarifications to RFC 3095

3GPP2 Standards

A.S0008-0 v3.0 (2003/05)	-	Interoperability specification (IOS) for HRPD Access Network
A.S0008-A v3.0 (2008/10)	-	Interoperability specification (IOS) for HRPD Access Network-Rev A
A.S0008-C v2.0 (2009/01)		Interoperability Specification (IOS) for High Rate Packet Data (HRPD) Radio Access Network Interfaces with Session Control in the Access Network
X. S0011-006-C v3.0 (2006/11)	-	Cdma2000 Wireless IP Network Standard: Pre Paid Packet Data Service
X.S0011-006-D v2.0 (2008/11)		cdma2000 Wireless IP Network Standard: PrePaid Packet Data Service
C.S0010-C v 2.0(2006/02)	-	Recommended Minimum Performance Standards for cdma2000 Spread Spectrum Base Stations
C.S0024-A v3.0 (2006/09)	-	CDMA 2000 High Rate Packet Data Air Interface Specifications
C.S0029-0 v3.0 (2003/12)	-	Test Application Specification (TAS) for

		High Rate Packet Data Air Interface
C.S0032-0 v2.0 ((2004/01)	-	Recommended Minimum Performance Standard for CDMA 2000 for High Rate Packet Data Access Network
C.S0033-A v2.0 (2007/09)	-	Recommended Minimum Performance Standard for CDMA 2000 for High Rate Packet Data Access Terminal -Rev A
C.S0038-0 v1.0 (2002/04)	-	Signaling Conformance for cdma2000 High Rate Packet Data Networks
C.S0038-A v2.0 (2007/04)	-	Signaling Conformance for cdma2000 High Rate Packet Data Networks- Rev A
C.S0039-0 v2.0 (2006/08)	-	Enhanced subscriber privacy for CDMA2000 HRPD
P.S0001-B v2.0 (2004/10)	-	Cdma2000Wireless IP Network Standard
S.R0048-A v 4.0(2005/06)	-	Mobile Equipment Identifier (MEID)
C.S0063-A v2.0 (2007/4)	-	CDMA 2000 High Rate Packet Data Supplemental Services

Other standards

CISPR 22 (2003)	-	Limits and methods of measurement of radio disturbance characteristics of Information Technology Equipment"
EN55022	-	Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment, 1987
EN61000-4-2	-	Electrostatic Discharge Immunity Test
EN61000-4-3	-	Radiated RF Electromagnetic Field Immunity Test
EN61000-4-4	-	Electrical Fast Transients/Burst Immunity Test
EN61000-4-5	-	Surge Immunity Test
EN61000-4-6	-	Immunity to Conducted Disturbance Induced by RF Fields
IEC 60215 (1987)	-	Safety requirements of radio transmitting equipments (for Radio equipments only)
IEC 61000-4-2 (2001)	-	Testing and measurement techniques of electrostatic discharge immunity test.
IEC 61000-4-3 (2002)	-	Radiated RF electromagnetic field immunity test.
IEC 61000-4-4 (1995) (with amendments 1&2)	-	Electrical fast transients/burst immunity test.
IEC 61000-4-5 (2001)	-	Test & Measurement techniques for Surge immunity tests.
IEC 61000-4-6 (2001)	-	Basic Immunity standard.

Note: The version of the references mentioned above are the latest versions as available at the time of publication of this GR. All the references are subject to revision hence all the users (including tendering authority) are encouraged to investigate the possibility of applying the most recent edition of these references.

CHAPTER - 1

INTRODUCTION

1.1 General

This document contains the Generic Requirements (GR) of a CDMA 2000 1x EV-DO Rev. A Radio Access Network (RAN) consisting of Radio Node (RN) and Radio Network Controller (RNC) including Operations and Maintenance Centre (OMC), to provide Data services. The CDMA 2000 1x EV-DO is also referred to as CDMA2000 High Rate Packet Data (HRPD). The CDMA 2000 1x EV-DO standards are based on TIA/EIA (Telecom Industry Association/Electronic Industry Association, USA) standards and 3GPP2 (Third Generation Partnership Project 2) standards.

EV-DO Rev. A (TIA-856-A) is the first stage in a series of planned upgrades of the EV-DO standard. EV-DO Rev. A improves uplink and downlink performance, increases capacity, and adds support for low- latency applications such as VoIP, video telephony, and low-latency gaming. The improvements in Rev. A have increased the peak data rate in the forward link from 2.4 Mbit/s (Release 0) to 3.1 Mbit/s and in the reverse link from 153 kbit/s (Release 0) to 1.8 Mbit/s.

1.2 Scope

The requirements spelt out in this GR relate to the Access Network (AN) of CDMA2000 1x EV-DO Rev A Access Network (AN) supporting Access Terminals (AT) such as Fixed Wireless Terminals (FWT), Handheld terminals (Mobile), Network Interface Card or PC card to provide data service. It also specifies the requirements of OMC for the AN.

1.3 Generic Model

A generic model of a CDMA 2000 1x EV-DO Rev. A Access Network typically consists of:

a) Access Network (AN) consisting of Radio Node (RN) & Radio Network Controller (RNC)
b) Packet Core Network (PCN)
c) Operations and Maintenance Centre (OMC) of AN and PCN

Block schematic of the network is given in Annexure -I.

1.4 Various components of EV-DO Network

The following paragraphs describe the various components (under purview of this GR) of the generic model of the CDMA 2000 1x EV-DO Network.

(a) Radio Node (RN): It is a multiple circuit transceiver which shall radiate to cover a cell or a sector. It consists of radio modules, base band signal processor, network interface, antenna, feeder etc. It can be co-located with RNC or remotely located. RN shall include the functions related to channel coding/decoding, interleaving, encryption, frame building, modulation/demodulation, RF transceiver, antenna diversity, low noise amplification etc. as per CDMA 2000 1x EV-DO standards. The AN obtains the timing reference and positioning reference from the GPS system and hence the GPS receiver shall form an integral part of the RN along with other fixtures such as GPS antenna, cable etc. AN split mounting arrangements with tower mountable RF components such as PAs , LNAs, Filters etc. are also acceptable.

(b) Radio Network Controller (RNC): It is responsible for inter - connection between the RN and the PCN and it provides control and management for one or more RNs. It assigns traffic channels to individual users, monitors system performance and provides interface between the RN and the PCN. RNC performs the radio processing functions such as management of the radio resources, radio channel management, local connection management etc. It also processes information required for decision on handover of calls from one RN to another. RNC can be co-located with the PCN or remotely located. The Packet Control Function (PCF) shall form an integral part of RNC. The RNC, through the Packet Control Function shall provide support for packet accounting/charging function for the radio specific parameters.

(c) Operations and Maintenance Centre (OMC): The Operations and Maintenance Centre (OMC) allows the centralized operation of the various units in the system and the functions needed to maintain the sub systems. The OMC provides the dynamic monitoring and controlling of the network management functions for operation and maintenance.

1.5 System supporting both 1x and 1x Ev-DO

In case of CDMA system supporting both CDMA 2000 1x and 1x EV-DO, the functionalities (of AN) shall reside in equivalent equipment as given below:

- Access Network (AN) : Radio Network (RN)
- Radio Node (RN) : Base Transceivers Stations (BTS)
- Radio Node Controller (RNC) : Base Station Controller (BSC)

1.6 Applications

The EV-DO Rev. A apart from offering improved uplink and downlink performance, support low-latency and better QoS control mechanisms and hence following applications (not an exhaustive list) can be supported over EV-DO Rev.A networks :

- Voice over IP (VoIP)
- Push To Talk/Push To Media
- Video Telephony
- Multimedia Upload/Exchange
- Low-Latency Gaming
- High-Speed Web Browsing
- Video/Music Streaming/Downloads
- Multicasting.

CHAPTER 2

TECHNICAL REQUIREMENTS

2.1 **Standards Compliant:** The radio interface in terms of different layers for specific functions shall conform to the 3GPP2 C.S0024-A (IS-856-A) standard.

2.2 **Upgradation to Rev. B of EV-DO :** It shall be possible to upgrade the system to support CDMA 2000 1x EV-DO Rev B. Hardware & software changes required in RN and RNC for upgradation shall be indicated. Capability to support CDMA 2000 1x EV DO Rev. C in future shall be indicated.

2.3 **Backward compatible with existing EV-DO Rev. 0 networks**: It shall be fully backward compatible with the existing EV-DO Rev. 0 networks, thereby implying that any EV-DO Rev. 0 Remote Station (RS) must be able to place and receive calls from this system and any CDMA 2000 1x EV-DO Rev. A/Rev. 0 RS of this RAN is able to place and receive call for EV-DO Rev. 0 System.

2.4 **Compatible with CDMA 2000 1x packet services system:** The system shall be fully compatible with CDMA 2000 1x packet services system so that 1x /1xEV-DO AT (hybrid) is able to place and receive Packet Data call of CDMA 2000 1x network and terminal.

2.5 **Frequency band of operation:** The AN shall operate in the frequency band 824-844 MHz paired with 869-889 MHz or any other frequency band (as per 3GPP2) specified by the tendering authority. Possibility of operating in other spectrum bands (with radio upgrades only) shall be indicated.

2.6 **Operation in complete band:** It shall be able to operate in full frequency band (of 20 MHz) without any hardware & software upgrades. However, its operation shall be restricted to specified carrier/ bands as per the field deployment requirements.

2.7 **Frequency tuning:** Frequency tuning shall be possible, with-in the band as per clause 2.6 of this document, in the RN through Man-Machine command.

2.8 **Smooth bearer for features and services:** The RN shall provide smooth bearer for the features and services supported by the PCN, to which this radio network shall be connected, from end-to-end perspective. The radio network shall not become a bottleneck for the functionalities and services that are to be offered through the PCN.

2.9 Quality of Service:

(i) The System shall support quality of service (QoS) control mechanism as per 3GPP2 X.S0011 and IS-835D standard.
(ii) The System shall support both user-based and flow-based QoS.
(iii) The QoS and low-latency capabilities of the system shall support prioritization of the VoIP/video/picture flows to provide a richer media experience than offered by voice alone.
(iv) The System shall support Enhanced Multi-Flow Packet Applications as per 3GPP2 C.S00063 that differentiates flows, allowing Quality of Service (QoS).
(v) The System shall support Robust Header Compression (RoHC) as per IETF standards for VoIP header compression.
(vi) The System shall support Pilot Interference Cancellation (PIC).

2.10 Vocoders: The System shall support all the vocoders as per 3GPP2 standards including the EVRC, EVRC-B & EVRC Wide-Band (EVRC-WB). The EVRC-WB codec available with Rev. A VoIP has 16 kHz of frequency response and provides improved audio quality over standard 8k codecs.

2.11 Pooling of resources: Pooling of resources such as channel elements, Linear Power Amplifier (LPA), etc. shall be available.

2.12 Support for all Registration methods: The system shall have the capability to support all the registration methods specified in the 3GPP2 A.S0008-C C.S0024-A (IS-856-A) standard.

2.13 Radio Resource Management: As part of the Radio Resource Management functions, the system shall support the following:

a) Radio Congestion control algorithm that would monitor the availability of resources and take corrective action when a transition from the normal state to the congested state is detected, to avoid drifting into the overload state.
b) Load balancing across FA (Frequency Assignment)/ carriers.
c) **Scheduler:** The algorithm used for scheduling to allocate slots to the data users shall be as per 'Proportional Fairness Scheduling' as per Qualcomm documents. Details of any other scheduling algorithm, if supported, may also be provided, in which case it shall be possible to manually select the scheduling algorithm out of the scheduling algorithms supported by system.

2.14 Support of various types of Remote Stations: The EV-DO Rev.A, AN shall support all types of Remote Station (RS) which comply to 3GPP2 C.S0033-A.

2.15 **Hand-off Types :** Intra RNC, Inter RNC, Intra PDSN, Inter PDSN, 1x EV-DO to 1x and vice versa (for terminal supporting 1x and 1x EV-DO) shall be supported as per 3GPP2 standards. The action of switching a call in progress i.e. hand-off from one sector to another sector of same or adjacent RN operating on same channel number or different channel number of same or different RNC shall be automatic and smooth without the user noticing it. Continuous control of call quality shall be maintained automatically to get the optimum transmission quality.

2.16 **Power Control :** The system shall have power control between AT and RN automatically to get the optimum transmission quality as defined in the standards.

2.17 **Synchronization :** All RN / RNC digital transmission of the RN are to be referenced to a common CDMA system-wide Global Positioning System (GPS) time scale which is traceable to and synchronous with Universal Co-ordinated Time (UCT). BSC shall have the provision of Internal Clock for deriving the timing signal in case of failure of GPS link. It shall support "Hold Over Mode", the stability of which shall be equal to or better than 1x10E- 8 for at least 24 hours.

2.18 **Security:** Authentication and encryption shall be supported as per 3GPP2 C.S0024-A (IS-856-A) standard.

2.19 **Subscriber Privacy requirement:** The system may optionally comply with Enhanced Subscriber Privacy requirement as per IS-925 (3GPP2 C.S0039).

2.20 **Antenna:** The type & gain of RN antenna may be decided by the equipment supplier out of the different types of antenna listed in the TEC GR No. GR/ANT-20 for getting desired coverage and performance of the equipment subsequent to detailed RF survey and planning. Detailed specifications (technical as well as mechanical) shall be furnished by the equipment supplier.

2.21 **Feeder Cable:** Type of feeder cable (if applicable) and the length of the cable may be decided by the equipment supplier out of the different types of feeder cables listed in the TEC GR No. GR/FDR-12 for getting desired coverage and performance of the system. Detailed specifications (technical as well as mechanical) shall be furnished by equipment supplier.

2.22 **Interference to existing wireless networks:** The system shall not cause interference to the existing wireless networks (GSM, CDMA or any other wireless system). Details of provisions made by the supplier to comply with the clause shall be indicated.

2.23 **Backhaul between RN & RNC, RNC & RNC:** Back haul between Radio Node and RNC, RNC and RNC shall be IP based.

2.24 **Support for IPv4 and IPv6:** The system shall support IPv4. The roadmap for support of IPv6 may be specified by the supplier. However, the systems shall support the applications and terminals using IPv6.

2.25 **Performance standards for base stations:** The performance standards shall be as per 3GPP2 C.S0010 (IS-97) and 3GPP2 C.S0032 (IS-864).

2.26 **Mobility Functions :** It shall be possible to restrict the services of the subscriber within the sector, within the RN, within a Group of RNs, within RNC area, within a group of RNCs in a SDCA or any other area specified by tendering authority under the definition of "limited mobility" as specified by DOT from time to time. Applications of such a system could be in urban and rural area with fixed and mobile wireless terminals in zero mobility, limited mobility or full mobility environment. It may be possible to limit mobility in the system in a limited mobility scenario as per the definition of limited mobility as specified by the DOT.

2.27 **Test Application Specification:** The system shall comply with IS-890 (3GPP2 C.S0029) Test Application Specification (TAS) for High Rate Packet Data Air Interface.

2.28 **Support of prepaid packet data services:** It shall be possible to upgrade the system to support prepaid packet data services as per IS-835 (3GPP2 X. S0011-0060).

2.29 **Billing/Charging:** For the packet data service, the PCF shall provide support , to PCN, for packet accounting/charging function for the radio specific parameters (by providing information such as usage time, start accounting, stop accounting, data rate, etc.) and PCN shall provide support for packet accounting/charging function for the IP network specific parameters (packet accounting).

2.30 **Signalling Conformance:** The System shall comply with Signalling Conformance Specifications as per IS-919 (3GPP2 C.S0038) standard.

2.31 Traffic Management

2.31.1 In a multi Carrier operation, the radio subsystems must be capable of Traffic Management i.e. it shall be able to manage traffic across any Carrier that may be present in a particular sector. Traffic management is defined as the ability to balance traffic as follows:

i) Originate and terminate calls on or to any Carrier present in a sector.
ii) The ability to dynamically move a call in process from one Carrier to another Carrier that is on a separate frequency.

2.31.2 Load balancing during origination and termination:- The system shall implement a function that will allocate originations and terminations across the available Carriers.

2.35.3 The system shall have the ability to move users between Carriers during an active call on a dynamic basis. This will be done when the traffic on any particular channel exceeds the designed loading objectives and a user or users must be moved to another, less utilized frequency.

2.32 Support of all modes of DRC: The system shall support all modes of DRC as per IS-856 (3GPP2 C.S0024) for Access Terminal (AT), which can be Fixed Wireless Terminals (FWT), Integrated FWT, Handheld Terminal, Network Interface Card etc. complying with IS-866 (3GPP2 C.S0033).

2.33 MEID Support: The system shall support MEID feature as per 3GPP2 S.R0048-A.

2.34 Support of Multiple PDSN interface: The PCF (RNC) shall have the capability to support the interface with multiple PDSN (PCN).

2.35 Modularity : The RN shall have the capability of being modularly equipped with suitable configurations on multiple sectors at single location.

2.36 Micro/Macro Cell: RNs may be required for both Macro Cell applications as well as Micro Cell applications. The output power of the RN shall be modifiable to configure the RN as micro or pico RN depending on the capacity/ coverage needs.

2.37 Interfaces for the Packet Core Network: The AN shall support the interfaces required for the Packet Core Network (PCN) for 1x EV-DO REV. A System as mentioned in Chapter-4 of this document.

CHAPTER 3

OPERATIONS AND MAINTENANCE CENTRE (OMC)

3.1 General

The OMC allows the centralized operation of the various units in the system and the functions needed to maintain the sub systems. The OMC provides the dynamic monitoring and controlling of the network management functions for Operation and Maintenance (O&M). The OMC shall support Graphical User Interface (GUI) for operation and standard TMN interfaces as specified in ITU-T Rec. M-3010 & M-3020.

3.2 Objective of OMC

The overall objective of OMC is that neither equipment failure nor human error in the OMC implementation should render the OMC and /or the part of the network it supervises, out of service.

3.3 Redundancy, Scalability and interface to NMS

OMC shall be a carrier grade system with full redundancy and scalability. It shall be possible to have remote workstations with the OMC, with complete GUI tools for O & M of the system at the remote locations. It shall support north-bound interface like SNMP, Corba, TCP / IP, CMIP etc., to enable it to work with a remote NMS.

3.4 Functions of OMC

The Operation & Maintenance Centre (OMC) shall be capable of performing the following functions: -

(i) **Event/Alarm Management**: Alarms shall be presented to the operator via software programs and tools for easy presentation and interpretation, for easy maintenance and to locate faults of all managed elements of the network. Events shall be logged for future use.

(ii) **Configuration Management**: OMC shall provide real time configuration database access to manage the software loading and version tracking, support for addition, deletion and change of network element parameters.

(iii) **Performance Management**: OMC shall provide tools for the collection of statistics and call information into a database and logging file. Data shall be viewed using tabular or graphical reports on the GUI terminal.

(iv) **Security Management**: OMC shall provide password and login access to the system to prevent any unauthorized access to the system.

(v) **Fault Management**: OMC shall provide capability to query and change device states and provide control for system diagnostics. It shall be possible to monitor different protocols in real-time.

(vi) **Network statistics**: OMC shall provide data related to channel occupancy, rejected calls etc. with visual display of faulty elements of the network.

CHAPTER 4

INTERFACES

4.1 General

The system shall support interfaces as per IS-878 (3GPP2 A.S0008).

Full Technical details regarding implementation of interfaces (at each standard reference point) amongst different network elements as well as with other networks shall be provided by the supplier and no interface shall be proprietary in nature.

4.2 Interface between RN & RNC

It shall be as per IS-878 (3GPP2 A.S0008) and 3GPP2 C.S0024-A CDMA 2000 High Rate Packet Data Air Interface Specification.

4.3 Interface between AN & PCF

It shall be as per A8 & A9 interfaces as defined in IS-878 (3GPP2 A.S0008) standard, when the PCF is not embedded in the RNC.

4.4 Interface Between RNC (PCF) & PDSN

It shall be as per A10 & A11 interfaces as defined in IS-878 (3GPP2 A.S0008) standard.

4.5 Interface between AN & AN-AAA Server

It shall be as per A12 interface as defined in IS-878 (3GPP2 A.S0008) standard.

4.6 Interface between AN & AN

It shall be as per A13 interface as defined in IS-878 (3GPP2 A.S0008) standard.

4.7 Interface between PDSN & AAA Server (RADIUS interface)

This interface shall be based on the RADIUS protocol defined by RFC 2865 and RFC 2866. The RADIUS client shall reside in the PDSN. The physical/link connection shall be via the Access Network using 100BaseT / 1 Gbps Ethernet. The PDSN shall pass UDR onto AAA Server via this interface.

4.8 Interface between PDSN & HA/IP Network (Pi interface)

This interface shall support registration submitted by the Mobile/Mobile Proxy agent for Mobile IP/Proxy Mobile IP operation. The physical/link connection is via the Access Network using 100BaseT /1 Gbps Ethernet.

4.9 Interface between AN & OMC

Proper interface and interconnection shall be provided by equipment supplier and details furnished. It shall be possible to control multiple RNCs through a single OMC. Thus while the physical connection from the OMC to one RNC may be through LAN connectivity, connection to other remote RNCs shall be possible through WAN connectivity.

4.10 Interface between RN & AT

Air interface shall be as per EIA/TIA IS- 856(3GPP2 C.S0024-A) standard.

CHAPTER-5

GENERAL REQUIREMENTS

5.1 Engineering Requirements

5.1.1 Hardware

5.1.1.1 General

i. Compact and high-performance state-of-the-art hardware shall be used.
ii. All components used shall be of rugged construction and shall be suitably designated by a label or sign-writing.
iii. All necessary hardware and software required for redundancy shall be provided.
iv. The system hardware shall be modular in design to permit growth in small steps.
v. The variety of hardware modules and components used in the system shall be minimum.
vi. Design precautions shall be taken to minimize the possibility of equipment damage arising from the insertion of an electronic package into the wrong connector or the removal of any package from any connector.
vii. All components shall be rated for continuous operation of the system under the normal operating conditions. The circuits must also be designed so as to prevent damage to the other equipment under any condition of operating or any conditions of fault.
viii. All the components used are to be approved and qualified as per the procedures of the QA wing of purchaser. The source of procurement of components is also required to be submitted by the manufacturers.

5.1.1.2 Processors

(i) Adequate backup memory shall be provided. Direct memory access, with suitable safeguards, is preferred for information flow between the backup memories on the one and the main memories and the input/output devices on the other.
(ii) Provision shall be made to prevent the loss/alteration of memory contents due to power failures, improper operating procedures and the procedures for restoring the system to its normal state, etc.

5.1.1.3 Input-Output devices

(i) The communication facilities provided for exchange of information between the system and the maintenance and operating personnel shall include facilities for a system test and control and alarm indication.
(ii) Input/output terminals shall be capable of transmitting/receiving characters of a subset of the Alphabet No.5 as specified in ITU-T recommendation Z.314. The printing/display device shall print/display different graphic symbols for the digit zero and the capital letter O. The Input/Output terminal shall have the

English Keyboard. Capabilities of visual display terminals shall be as per ITU-T Recommendation Z-322. Terminal emulation software and any standard operating system shall be available in the PC.

(iii) Adequate number of man-machine interfaces shall be available to facilitate various types of system administrations listed.

(iv) If provision is made for monitoring from a remote terminal, it shall be ensured that the data links conform to the ITU-T Recommendation Q.513. Care shall be taken that the reliability of the data links does not, in any way affect the reliability of the system. Special provision shall also be made for transmission of a failure signal even when the system is unable to transmit an output message.

(v) A suitable alarm and display system shall be provided for a continuous indication of the system status. The alarm system shall also provide an alarm to indicate the failure of power supply to the alarm circuits themselves. Provision shall be available to extend indications to a Network Management Server.

(vi) On a fault condition the system shall identity the faulty sub-system automatically and takes it out of service. This shall automatically bring in the diagnostic programmes for diagnosis. In such cases the details of the sub-systems taken out for executing diagnostic programmes shall be printed out. Availability of Intelligent terminal (PC) to display the location of bay, shelf, PCB on the screen would be desirable. The dimensioning of processing capacity shall be such that the normal call processing is not effected due to invocation of any diagnostic program.

5.1.1.4 Equipment practice

(i) All cards of the same type and design shall be interchangeable without necessitating special adjustments.

(ii) All metal parts of frames, supports, etc. shall be mechanically rugged and constructed of corrosion resistant material or treated with anti-corrosive finish. All equipment shall have a tropical finish.

(iii) Suitable test access points and displays shall be provided for facilitating maintenance. Test access points shall preferably be located on the front side of the bay. All visual display devices shall be located in a position attracting immediate attention of the operating and maintenance personnel. Suitable extension boards shall be provided to facilitate access to components on a printed card.

(iv) The material used for all printed boards shall be expoxy or equivalent (FR4). It shall not buckle due to a load of the assembled board or due to temperature changes occurring under normal circuit operations.

(v) The supplier shall indicate whether printed board connectors are of edge type or plug-and-socket type. They shall not be easily damaged during replacements and removals. The contact particulars as well as life test performance on contact resistance for each type of connector shall be supplied.

(vi) All components and material used in the equipment shall be non inflammable or in absence of it, self-extinguishable. They shall be fully tropicalised.

(vii) The supplier shall indicate the various types of cables and wires used in the system. Detailed particulars of any special wires and cables like standardized coaxial, screened cable, etc. shall be furnished with their actual usage in the system.

(viii) The buses, if any, shall be suitably protected against electrical and magnetic interference from neighbouring systems (like electromechanical systems, fluorescent tubes, motors, etc). The supplier shall indicate the care taken in the design and location of the bus system for such interference.

(ix) The points for connecting the power supplies to the different plug-in cards shall be standardized and mechanically interchangeable. Otherwise suitable mechanical safeguards shall be provided to prevent damage due to accidental inter-change of cards.

(x) The supplier shall indicate the requirement at the external interface against induced voltages and currents due to lightning, high power system, etc.

(xi) The system shall provide for isolation and protection from accidental high voltage power contact.

5.1.2 Ease of Expansion

Expansion techniques of the equipment shall be easy, economical and shall not interrupt a working system. Expansion shall be possible when traffic increases due to increase in no. of subscribers or services offered in the area or when the geographical coverage is increased. The equipment shall be modular in construction permitting expansion, without any major hardware changes by simply adding shelves and modules.

5.1.3 Software

5.1.3.1 General

(i) The software shall be modular and structured.

(ii) The design of the software shall be such that the system is easy to handle both during installation and day-to-day operations as well as during expansions.

(iii) The functional modularity of the software shall permit introduction of changes wherever necessary with least impact on other modules.

(iv) The architecture of the software shall be open ended so that the growth and addition of new features can be handled in practice without any need of redesign of the software.

(v) Adequate flexibility shall be available to easily adopt changes in service features and facilities and technological evolution in hardware.

(vi) The design shall be such that propagation of software faults is contained.

(vii) The software shall provide sufficient checks to monitor the correct functioning of the system.

(viii) Test programs shall include fault tracing for detection and localization of system faults.

(ix) The normal operation of the system shall not be adversely affected while undertaking :

- (a) Extension to system (Hardware expansion)
- (b) Enhancement of system facilities.

(c) Correction to programs or functional blocks.

(x) The software supporting documentation shall be in English. Any update in the software at a later stage to overcome deficiencies of the system due to bugs, compatibility etc., shall be provided free of cost by the equipment supplier.

(xi) The equipment supplier shall undertake to supply on continuing basis all software updates. These updates may include new features and services and other maintenance updates. The software up-gradation shall be possible with minimum interruption to the service.

(xii) The equipment supplier shall provide any software modification necessary due to modification of software in the inter-working with other network elements.

(xiii) Provision shall be there to check checksum, software version, service version, operating version etc., through MML command.

(xiv) Facilities shall be in-built to ensure automatic system reconfiguration on detection of any major software fault.

(xv) The supplier shall have the facilities for software maintenance like software debugging, patch development, patch verification, patch implementation at sites, version control of software, document generation and repository of working versions.

5.1.3.2 Diagnostic programs to localize hardware faults

(i) On a faulty condition, the software shall provide for isolating the faulty sub-system and then automatically bring in the diagnostic programs for diagnostic purposes.

(ii) It shall preferably be possible to diagnose to single PCB level in at least 95% of the types of PCBs.

(iii) It should be possible to execute the diagnostics test modes in calendar.

5.1.4 Man-Machine Communication

5.1.4.1 GUI Based Communications: The system shall have GUI feature that offer the facility for configuration, provisioning, maintenance and operation related dialogue/communications.

5.1.4.2 Man-Machine Language (MML)

(i) Man-machine interface language shall be based on ITU-T Recommendations Z 301 to Z 341.

(ii) The Man-Machine Language (MML) shall be in English. Commands shall be English based and responses shall be in English.

(iii) The MML shall be easy to learn and to use, easy to input commands and to interpret outputs.

(iv) The MML shall contain Man-Machine Commands (MMC), outputs, control actions and procedures sufficient to ensure that all relevant functions for the operation, maintenance, installation and testing of the system can be performed.

(v) The MML shall have an open-ended structure such that any new function or requirement added will have no influence on the existing ones. The language structure shall be such that subsets can be created.

(vi) The character set used in the MML shall be a sub-set of the ITU-T alphabet No. 5 as recommended in ITU-T Z.314.

(vii) The command codes shall be function oriented. There shall be only one command per function. The codes shall be mnemonic. All the command codes in a particular application shall preferably consist of the same number of characters.

(viii) The output in response to input commands shall have the same format and use the same identifiers, codes, and labels, as the corresponding input command.

(ix) The MML shall provide facilities for canceling and aborting the execution of commands.

(x) The MML shall provide facilities for inputting the parameters, for a command, in any sequence and the optional parameters need to be inputted only when they are required. Screen editing facilities for modifying the commands and parameters shall be available.

5.1.4.3 Input/Output

(i) The input and output information shall be presented in a compact form.

(ii) The automatic output, not made in response to an input command shall:

a) Include the time and date.

b) Use standard telephone terminology. It is preferred if the automatic output is differentiated by colour or special characters from the output in response to an input command.

(iii) To facilitate filling and retrieval of recorded information in MML; the information shall be recorded on forms or pages with an identification header on top of each page with the date and time.

(iv) Special information shall be provided on priority printouts indicating emergent situations.

5.1.4.4 Man-machine dialogue

(i) The MMC shall offer the facility for a conversational mode of operation.

(ii) The MMC shall have facility for restricting the use of certain commands or procedures to certain staff/terminals.

(iii) Where several man-machine terminals are in use on a single system, a mechanism shall be available to avoid clashes.

(iv) The execution of any command shall not result in malfunctioning and/or over loading of the system. It shall also be ensured that the operator is not locked out by the system.

(v) The MMC shall be implemented in such a way that errors in commands or control actions shall not cause the system to stop or unduly alter the system configuration.

(vi) Command errors detected by the system shall be indicated by the output of error messages.

(vii) Possibility of priority messages to interrupt an input or output message of lower priority is desirable.

5.1.4.5 Checks and safeguards

Sufficient checks and safeguards shall be built into the implementation of the MMC so as to ensure reliable operation of the system.

5.1.5 Markings

(i) Equipment on the bay, whether of fixed or plug-in type, shall be suitably marked. Identification of type of cards in its connector shall be possible without necessitating its removal. Any plug-in component shall be marked with sufficient information for its complete identification.

(ii) The marking on the equipment and the cables shall be the same as that used on the schematic drawings, cabling lines etc., in the documentation supplied with the equipment.

(iii) All instructions, labels, or any other marking on the equipment shall be perfectly legible and in the English language.

(iv) Colour code used for power feeding bus-bars/cables and earth shall be identical for a given voltage throughout the equipment.

(v) Fuses shall have a suitable marking for the different ratings to enable easy identification and replacement.

(vi) Marking shall ensure easy traceability.

(vii) The plug-in units whose removal or insertion (while the equipment is in operation) might endanger the reliability or performance of the equipment - shall have suitable protection and caution marking.

(viii) Each sub-assembly shall be clearly marked to show its functions and circuit reference so that its complete description can be located in the handbook.

(ix) The components shall be marked with their schematic references so that they are identifiable from the component layout diagram in the handbook.

(x) All controls, switches, indicators etc. shall be clearly marked to show their circuit designations and functions.

(xi) Each terminal block and terminal shall be marked with an identifying code.

5.1.6 Cooling Arrangement

The equipment shall have necessary self cooling arrangement with or without in-built fan. The fan, if used, shall be a D.C. fan and shall be used in redundant configuration. The fan fail indication should be available in the alarm generation.

5.1.7 MTBF/MTTR

The MTBF and MTTR (predicted and observed values) figures shall be worked out by the equipment supplier and based on these figures, the maintenance spares for three years, shall have to be specified by equipment supplier.

5.1.8 Diagnostics/Testing

The equipment shall support diagnostic capabilities (which will run as background tasks) to verify the equipment's proper operation within the network. Built-in test capabilities shall be provided which will run at specific events or on demand. Health monitoring signals shall be continuously passed between the various modules to ensure the detection of any failure in a module. Individual channel element functionality shall be also be monitored to prevent call blocking due to a lack of channel element resources.

5.1.9 Field Proveness

The equipment shall be fully solid state, field proven and shall adopt latest state-of-the-art technology. The details of inter-operability with different vendors' network elements shall be provided. The tendering authority may specify this in terms of the equipment been field deployed commercially across multiple networks for a reasonable period of time and reasonable numbers of subscribers served and no. of services offered through the system.

5.1.10 Requirements of Outdoor Equipment

All outdoor equipment must be housed in robust, compact light weight weather proof cabinets and capable of mounting on suitable structure. The antenna cable shall extend out of the cabinet and be terminated externally in N-type or DIN type connectors. Suitable lightning protection shall be provided at the antenna ports. It shall be possible to install the BTS without opening the cabinet. The cabinets shall have a locking facility with a single master key for opening it.

5.1.11 Reliability

The equipment shall have reliability of 99.99.

5.2 Operational Requirements

5.2.1 Supervision

The RAN shall automatically supervise the status of different interfaces and functional modules and shall take corrective actions and raise alarms. It shall also have provision to quarry the status of interfaces and functional modules.

5.2.2 Alarm Indications

In case of all major alarms (any event that leads to system switch-over or service disruption) in the RAN, both audio and visual alarm indications shall be provided. In case of minor alarms in RAN, visual alarm indications shall be provided and provision of audio alarms is desirable. The provision to communicate the alarm through SMS/VMS, to a predefined number, shall be there.

5.2.3 No problem due to change in date/time/year etc.

The system hardware and software shall not pose any problem, due to changes in date and time caused by events such as leap year etc., in the normal functioning of the system.

5.3 Maintenance Requirement

(i) Maintenance philosophy is to replace faulty units after quick analysis of monitoring and alarm indications. Actual repair will be undertaken at a repair centre. The supplier shall ensure the repair of faulty equipment during and after warranty period.
(ii) It shall be possible to isolate Interface points for testing purposes.
(iii) The equipment shall have easy access for servicing and maintenance.
(iv) All important switches/controls on front panel shall be provided with suitable safeguards such as interlock system to avoid accidental operation by the maintenance personnel.
(v) Procedure for repair of equipment giving full details of testing instruments shall be provided by the equipment supplier. Test jigs, fixtures required for maintenance/repair shall also be provided.
(vi) Extensive facilities for testing, supervision and monitoring functions shall be provided for quick isolation and rectification of faults. These functions shall be performed by OMC. Any additional instruments required shall be provided by the equipment supplier with details.
(vii) The supplier shall provide information regarding the failure rate of the PCBs and accordingly supply number of spare cards depending on the size of the system, for a period of three years.
(viii) The maintenance spares supplied shall take into account the MTTR.

5.4 Power Supply

5.4.1 Power Supply unit

The power supply unit shall form an integral part of the equipment and shall have protection against input over-voltage, short circuit, input reverse polarity protection & shall have visual indication for input under voltage.

5.4.2 Input Supply

i) **Radio Node Controller (RNC) and Operations & Maintenance Centre (OMC)**: The system shall work satisfactorily for nominal input supply of -48 V DC over the voltage range of –44.4 V to –56.4 V.

ii) **Radio Node (RN):** The RN shall operate on either of the following power supply. The tendering authority shall indicate the type of power supply on which the equipment shall operate.
   a) Nominal input supply of -48 V DC over the voltage range of –44.4 V to –56.4 V.

b) Nominal input supply of 230 VAC over voltage ranges of 90-300 V and frequency range of 50 Hz $\pm$ 2Hz. In this case, the power system for conversion of DC to AC shall be provided by the supplier

5.4.3 Protection

The protection for input over voltage, under voltage, input reverse polarity and output short circuit protection shall be provided.

5.4.4 Power consumption

The equipment shall have low power consumption. The actual power consumption shall be specified by the supplier.

5.5 Protection

The equipment shall have adequate protection against lightning & power surges. All equipment shall have provision for grounding.

5.6 Safety Requirements

a. The operating personnel shall be protected against shock hazards as per IS 8437 (1993) – Guide on the effects of current passing through the human body (equivalent to IEC publications 60479-1 (1984).

b. The equipment shall conform to IS 13252 (2003) – Safety of information technology equipment including electrical business equipment (equivalent to IEC publication 60950 (2001) and IEC 60215 (1987) Safety requirements of radio transmitting equipments (for Radio equipments only)

The manufacturer/supplier shall submit a certificate from a standard test lab/accredited test lab in respect of compliance to these requirements.

5.7 General Electromagnetic Compatibility (EMC) Requirements: - The equipment shall conform to the EMC requirements as per the following standards and limits indicated therein. A test certificate and test report shall be furnished from a test agency.

a) Conducted and radiated emission *(applicable to telecom equipment)*:
Name of EMC Standard: "CISPR 22 (2005) with amendment 1 (2005) & amendment 2 (2006) - Limits and methods of measurement of radio disturbance characteristics of Information Technology Equipment".

Limits:-
i) To comply with Class A or B (to be mentioned in the GR / IR as per the specific requirement) of CISPR 22 (2005) with amendment 1 (2005) & amendment 2 (2006).

ii) The values of limits shall be as per TEC Standard No. TEC/EMI/TEL-001/01/FEB-09**.**

OR

Conducted and radiated emission (applicable to instruments such as power meter, frequency counter etc.):

Name of EMC Standard: "CISPR 11 {2004}- Industrial, scientific and medical (ISM) radio- frequency equipment-Electromagnetic disturbance characteristics- Limits and methods of measurement"

Limits :-
i) To comply with the category of Group 1 of Class A of CISPR 11 {2004}

ii) The values of limits shall be as per clause No. 8.5.2 of TEC Standard No. TEC/EMI/TEL-001/01/FEB-09**.**

b) Immunity to Electrostatic discharge:
Name of EMC Standard: IEC 61000-4-2 {2001) "Testing and measurement techniques of Electrostatic discharge immunity test".

Limits: -
i) Contact discharge level 2 {± 4 kV} or higher voltage;

ii) Air discharge level 3 {± 8 kV} or higher voltage;

c) Immunity to radiated RF:
Name of EMC Standard: IEC 61000-4-3 (2006) "Testing and measurement techniques-Radiated RF Electromagnetic Field Immunity test"

Limits:-
For Telecom Equipment and Telecom Terminal Equipment with Voice interface (s)

i) Under Test level 2 {Test field strength of 3 V/m} for general purposes in frequency range 80 MHz to 1000 MHz and

ii) Under test level 3 (10 V/m) for protection against digital radio telephones and other RF devices in frequency ranges 800 MHz to 960 MHz and 1.4 GHz to 6.0 GHz.

For Telecom Terminal Equipment without Voice interface (s)

Under Test level 2 {Test field strength of 3 V/m} for general purposes in frequency range 80 MHz to 1000 MHz and for protection against digital radio telephones and other RF devices in frequency ranges 800 MHz to 960 MHz and 1.4 GHz to 6.0 GHz.

d) Immunity to fast transients (burst):
Name of EMC Standard: IEC 61000- 4- 4 {2004) "Testing and measurement techniques of electrical fast transients/burst immunity test"

Limits:-
Test Level 2 i.e. a) 1 kV for AC/DC power lines; b) 0. 5 kV for signal / control / data / telecom lines;

e) Immunity to surges:

Name of EMC Standard: IEC 61000-4-5 (2005) "Testing & Measurement techniques for Surge immunity test"

Limits:-

i) For mains power input ports : (a)1.0 kV peak open circuit voltage for line to ground coupling (b) 0.5 kV peak open circuit voltage for line to line coupling

ii) For telecom ports : (a) 0.5 kV peak open circuit voltage for line to ground (b) 0.5 KV peak open circuit voltage for line to line coupling.

f) Immunity to conducted disturbance induced by Radio frequency fields:

Name of EMC Standard: IEC 61000-4-6 (2003) with amendment 1 (2004) & amd. 2 (2006) "Testing & measurement techniques-Immunity to conducted disturbances induced by radio- frequency fields "

Limits:-

Under the test level 2 {3 V r.m.s.}in the frequency range 150 kHz-80 MHz for AC / DC lines and Signal /Control/telecom lines.

g) Immunity to voltage dips & short interruptions (applicable to only ac mains power input ports, if any):

Name of EMC Standard: IEC 61000-4-11 (2004) "Testing & measurement techniques- voltage dips, short interruptions and voltage variations immunity tests"

Limits:-

i) a voltage dip corresponding to a reduction of the supply voltage of 30% for 500ms(i.e. 70 % supply voltage for 500 ms)

ii) a voltage dip corresponding to a reduction of the supply voltage of 60% for 200ms; (i.e. 40% supply voltage for 200ms) and

iii) a voltage interruption corresponding to a reduction of supply voltage of > 95% for 5s.

Note 1: Classification of the equipment:

Class B: Class B is a category of apparatus which satisfies the class B disturbance limits. Class B is intended primarily for use in the domestic environment and may include:

- Equipment with no fixed place of use; for example, portable equipment powered by built in batteries;
- Telecommunication terminal equipment powered by the telecommunication networks
- Personal computers and auxiliary connected equipment.

Please note that the domestic environment is an environment where the use of

broadcast radio and television receivers may be expected within a distance of 10 m of the apparatus connected.

Class A: Class A is a category of all other equipment, which satisfies the class A limits but not the class B limits.

Note 2: The test agency for EMC tests shall be an accredited agency and details of accreditation shall be submitted.

Alternatively EMC test report from a non-accredited test lab, which is audited by an accredited lab / accrediting authority for the availability of all the essential facilities (test equipment, test chamber, calibrations in order, test instructions, skilled personnel etc.), required for performing the tests according to the EMC test methods audited, may be acceptable.

However, such accredited lab / accrediting authority should take responsibility of the test results of the "non accredited lab" along with indication of period of such delegation and the submitted test report should be of such valid period of delegation. The audit report, mentioning above facts, should be provided along with EMC test report.

Note 3:- For checking compliance with the above EMC requirements, the method of measurements shall be in accordance with TEC Standard No. TEC/EMI/TEL-001/01/FEB-09 and the references mentioned therein unless otherwise specified specifically. Alternatively, corresponding relevant Euro Norms of the above IEC/CISPR standards are also acceptable subject to the condition that frequency range and test level are met as per above mentioned sub clauses (a) to (g) and TEC Standard No. TEC/EMI/TEL-001/01/FEB-09. The details of IEC/CISPR and their corresponding Euro Norms are as follows:

IEC/CISPR	**Euro Norm**
CISPR 11	EN 55011
CISPR 22	EN 55022
IEC 61000-4-2	EN 61000-4-2
IEC 61000-4-3	EN 61000-4-3
IEC 61000-4-4	EN 61000-4-4
IEC 61000-4-5	EN 61000-4-5
IEC 61000-4-6	EN 61000-4-6
IEC 61000-4-11	EN 61000-4-11

5.8 Reference to latest version of all documents/standards

The latest version of the references mentioned in this document, at the time of publication, is given in the 'References'. All the references are subject to revision hence all the users (including tendering authority) are encouraged to investigate the possibility of applying the most recent edition of these references.

Annexure-I

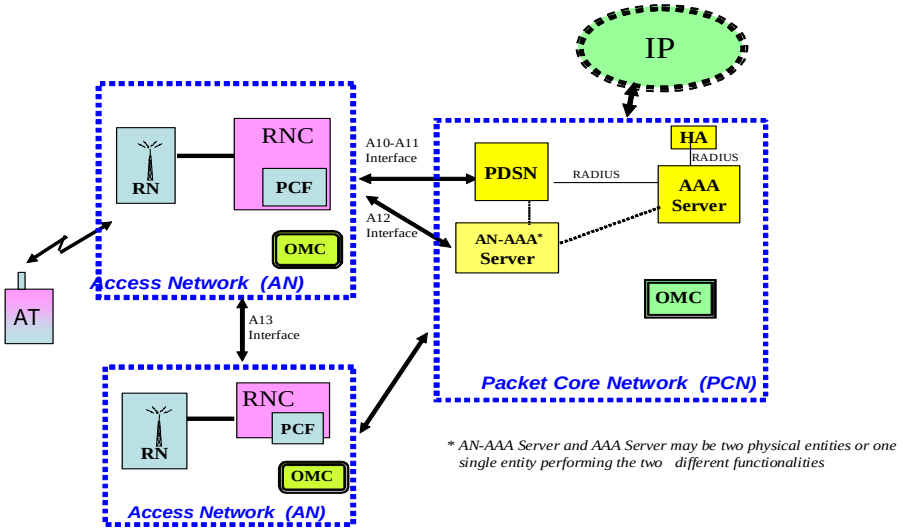

Figure 1 : Network architecture of CDMA 2000 1x EV-DO Rev. A Access Network

Annexure-II

Information for Tendering Authority

At the time of tendering the equipment, the tendering authority may take a decision on the following issues/points:

1. System Capacity and Dimensioning

The suggested capacity and dimensioning capabilities are given below which may be enhanced or reduced as per the requirement of the tendering authority and may be specified accordingly.

It may be noted that the capacity/calculations specified are only for illustration and for indoor macro AN/RNC type only. The values would change with the change in assumptions, type of AN/RNC and deployment requirements.

1.1 RNC

i) System capacity

I. Minimum capacity of RNC:

(i) Throughput : 200 Mbps scalable upto 550 Mbps
(ii) Number of simultaneous PPP sessions : 150 K upgradeable to 650 K
(iii) Number of simultaneous connections :
5K scalable to 20K
(iv) Number of carriers : Minimum 50 and scalable maximum up to 600 in steps of 100
(v) Terminating capacity in terms of Ethernet (towards RN) : At least 1FE per carrier and maximum up to 1GE per carrier
(vi) Terminating capacity in terms of Ethernet (towards PCN): It shall support the throughput/signalling towards PCN generated from RNCs connected to it.
(vii) Total terminating capacity for Ethernet links towards RN and PCN shall be indicated by the vendor. Restriction, if any, in configuring the Ethernet to a specific direction (towards RN/PCN), shall be indicated.

II. Capacity of RN:

(i) Average aggregated per sector throughput at RLP layer (under full queued condition for 3GPP2 call model & single antenna at AT side) : 620 Kbps
(ii) Number of simultaneous users to be specified as per the user profile.

III. Capacity of OMC Access Network:

OMC shall have capacity to support:
(i) Multiple RNCs scalable at least up to 5.

(ii) Number of carriers (3 sector per carrier): scaleable up to 360

1.2 Type, Numbers of RN required, No. of RF Carriers & No. of sectors supported, may be indicated as per the deployment plan and requirements. RN may be required for both Macro Cell applications as well as Micro Cell applications. The output power of the RN shall be modifiable to configure the RN as micro or pico RN depending on the capacity/ coverage needs. BTS may be of following types:

(a) Indoor RN
(b) Outdoor RN

1.3 Dimensioning: The equipment supplier shall provide engineering rules/guidelines for dimensioning the capacity of the network components.

2. The WPC has allocated the frequency band 824-844 MHz paired with 869-889 MHz at present. Any other frequency band (as per 3GPP2), allocated by WPC, may be specified, if required. (Refer Clause 2.5)

3. The tendering authority may check the commercial availability of equipment supporting Selective Multirate Vocoders (SMV), 4GV and EVRC-WB vocoder type and may specify the requirement of supporting SMV, 4GV and EVRC-WB accordingly. (Refer Clause 2.10)

4. The registration methods required to be supported in the equipment may be specified. (Refer Clause 2.12)

5. Interference to existing networks: Tendering authority may ask the vendor to provide details of provisions made by them to ensure that there is no interference with the existing systems, wherever necessary.

Tendering authority may get the actual RF survey and planning conducted prior to system planning for each site and may also identify the sites likely to cause interference with the already working wireless networks. It may also be indicated whether repeaters are required to be provide for coverage to the shadow regions/dark spots. (Refer Clause 2.22)

6. The types of interfaces as well as the number of such interfaces and ports may be indicated. (Refer Chapter 4)

7. **Field Proveness:** The tendering authority may mention the requirement of equipment being deployed in multiple countries and network & period of deployment. This may be mentioned as, “The equipment should have been field deployed commercially across multiple countries and network & for a reasonable period of time at least six months”. (Refer Clause 5.1.9)

8. The tendering authority shall indicate the type of power supply on which the equipment shall operate. It shall also indicate whether any external power plant, if required, will be part of it or not and its technical requirements. (Refer Clause 5.4.2)

9. Qualitative & Environmental requirements

9.1 The tendering authority may specify the following quality related requirements to be complied by the supplier:

a. Quality standards like ISO 9002 or ISO 9001: 2000 certification.
b. Guidelines/quality plan of the QA unit of purchaser for quality assurance, manufacturing, Marking and identification of the equipment, sub assemblies, PCBs etc.

9.2 The tendering authority may request the following quality related documentations/ requirements to be submitted by the supplier:

a. The quality plan describing the quality assurance system followed by the manufacturer.
b. The source of procurement of components
c. List of all the components for which second source is not available, shall be provided.

9.3 Environmental conditions

(i) The tendering authority may specify the requirements of environmental conditions that the system has to comply with, as specified in Quality Manual for relevant category of equipment.
(ii) Extreme environmental conditions under which the equipment is capable of short-term emergency operation without permanent damage may be indicated.

10. Redundancy

The tendering authority may consider and specify the following requirements for redundancy for indoor macro RN/RNC.

(i). The control equipment as well as Power Supply to be provided with 1+1 hot standby / N+1 mode redundancy.
(ii). The server may have minimum of CPUs with redundant data storage capabilities using standard RAID or Disk mirroring mechanisms.
(iii). All main control and processing modules cards may be hot- swappable.
(iv). Redundancy of links between RN/RNC and GPS receiver (along with other fixtures) if required, shall be indicated.

11. Dimensions, Weight & Mounting: The tendering authority may specify the dimensions and weight of the equipment and any specific requirements related to mounting/installation of the equipment.

12. Radio Resource Management: The FA may specify the scheduling algorithm required as per the availability & requirement e.g. Sector Throughput Optimization Scheduling,

Fixed-Weigh to Grade Users Scheduling, End user Experience Scheduling and QoS scheduler etc.

13. Documentation: The details of the document required along with relevant requirements like whether soft or hard copy or both, the language etc. may be specified. A brief description of the type of documents along with contents is given below for reference.

(i) System Description Documents

a) Overall system specification and description of hardware and software
b) Installation manuals and testing procedures. Installation manuals to be provided shall contain step by step process of installation of system.
c) Equipment layout drawings
d) Cabling and wiring diagrams
e) Detailed specification and description of all I/O devices.
f) Adjustment procedures, if there are any field adjustable units.
g) Spare parts catalog including information on individual component values, tolerances etc. enabling procurement from alternate sources.
h) Detailed description of software describing the principles, functions, interactions with hardware, structure of the program and data.
i) System Configuration manual.
j) Planning and system engineering documents.

(ii) System Operation Documents

a) Operating manual of the system
b) Maintenance manual.
c) Man-machine language manual.
d) Operation and maintenance manual for all I/O devices and auxiliary equipments.
e) Faulty location and trouble shooting instructions including fault dictionary.
f) Test procedures with auxiliary test equipments.
g) Emergency action procedures and alarm dictionary.

(iii) Training documents

Training manuals and documents necessary for organizing training in installation, operation and maintenance and repair of the system.

14. **Design Objectives**

The design objectives with regard to Quality of Service shall be as follows:

(i) Connection/session performance : Grade of Service (GOS) as per ITU-T Rec. E.770
(ii) Service retainability performance - shall be as per ITU-T Rec. E.800
(iii) Reliability performance - as per ITU-T Rec. E.800
(iv) Initial connection time for 1x EV-DO : 5-6 sec
(v) Any subsequent 1x EV-DO airlink connection : 1 sec (mobile initiated)

(vi) Average aggregated per sector throughput at RLP layer (under full queued condition for 3GPP2 call model & single antenna at AT side) : 600-750 Kbps

The system shall meet the above quality of service (QoS) requirements and the following Performance Parameters and throughput, in the design process as well as the equipment performance.

(i) Connection Origination Failure Rate : < 3 %
(ii) Connection Drop Rate : < 2%
(iii) Packet Drop Rate : <0.5%
(iv) TCP Window size : 64 kbytes
(v) Stationary throughput (measured as the aggregate data rate with 8 simultaneous users/sector scattered throughout the sectors) with antenna diversity shall be better than 1.32Mbps
(vi) Stationary single user throughput (average)
(a). One active user/sector : 2.4 Mbps
(b). 8 active users/sector : 250 kbps

15 Link calculations

Detailed Link calculations (based on scattered transmission for 90% Cell Edge Reliability and 96% Area Coverage) for meeting the required coverage shall be provided by the equipment supplier taking into account the interference/ fading that is likely to be encountered by the system. However the actual link calculations would be based on actual RF survey and planning conducted prior to system planning for each site. Based on the RF survey & planning, the sector wise coverage maps and detailed budget link calculations shall be provided for both the forward link and the reverse link.

Some of the typical parameters to be assumed for detailed link calculations are as follows:

- Antenna height at RN : 40 M
- Antenna height at wireless terminals : 1.3 meters
- Feeder Cable Loss (Total) : 3 dB
- Building penetration loss
  a. Dense Urban : 26 dB
  a. Urban : 20 dB
  b. Sub-urban : 16 dB
  c. Rural : 12 dB
- Value of Eb/No per sector antenna (Data at 38.4 kbps)
  - Mobile : 8.76 dB
  - Fixed : 6.5dB
- Body Loss - Mobile : 3 dB
  - Fixed : 1 dB
- RN Noise Figure : 5.0
- Mobile Noise Figure : 8 dB

- RN Thermal Noise : -174 dBm/Hz
- Vehicle Loss : 10 dB
- Soft Hand Off Gain (Reverse Link) : 4.1 dB
- Load Margin (70 %) : 5.0 dB
- Log Normal Std Dev : 8.0dB
- Differential Fade Margin : 2.1dB
- Packet Loss : 5%

GLOSSARY

3GPP2	Third Generation Partnership Project 2
AAA	Authentication, Authorization ,Accounting
AC	Alternating Current
AN	Access Network
AT	Access Terminal
BSC	Base Station Controller
CDMA	Code Division Multiple Access
CISPR	International Special Committee on Radio Interference
CMIP	Common Management Information Protocol
DC	Direct Current
DOT	Department of Telecommunications
DRC	Data Rate Control
Eb/No	Energy-per-Bit-to-Noise-Power
EIA	Electronic Industry Association
EMC	Electromagnetic Compatibility
Ev-DO	Evolution- Data Only (Data Optimized)
FA	Frequency Assignment
FWT	Fixed Wireless Terminal
GHz	Giga Hertz
GOS	Grade of Service
GPS	Global Positioning System
GR	Generic Requirements
GSM	Global System for Mobile Communication
GUI	Graphical User Interface
HA	Home Agent
I/O	Input /Output
IEC	International Electro-technical Commission
IS	Interim Standards
ITU-R	International Telecommunication Union-Radiocommunication
ITU-T	International Telecommunication Union- Telecommunication
kV	Kilo Volt
LAN	Local Area Network
LNA	Low Noise Amplifier
LPA	Linear Power Amplifier
MEID	Mobile Equipment Identifier
MMC	Man-Machine Commands
MML	Man-Machine Language
MTBF	Mean Time Between Failure
MTTR	Mean Time to Restore
NMS	Network Management System
OMC	Operation and Maintenance Centre
PA	Power Amplifier

PCB	Printed Card Board
PCF	Packet Control Function
PCN	Packet Core Network
PDSN	Packet Data Serving Node
PPP	Point to Point Protocol
QA	Quality Assurance
QoS	Quality of Service
RADIUS	Remote Authentication Dial In User Service
RF	Radio Frequency
RN	Radio Node
RNC	Radio Node Controller
R-P	RN-PDSN Interface
SNMP	Simple Network Management Protocol
TAS	Test Application Specification
TCP/IP	Transmission Control Protocol/Internet Protocol
TEC	Telecom Engineering Centre
TIA	Telecom Industry Association
TMN	Telecom Management Network
UCT	Universal Co-ordinated Time
WAN	Wide Area Network

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