



Reference Specification
for
Cable Modems (CM)
connected to the
Radio Frequency Interface
of the
High-speed Data-Over-Cable Systems
(DOCSIS 2.0)

IDA RS CM 3
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NOTICE

This Reference Specification is subject to review and revision.

Reference Specifications and Guides are informative documents, and are not used for type approval of customer equipment. They are either one of the following types of documents:

- i. Informative and interim documents on customer equipment standards which are yet to be adopted by the network operators and where standardisation is still in progress.**
- ii. Informative documents describing the network standards adopted by the Public Telecommunication Networks in Singapore.**

PART A INTRODUCTION

1. SCOPE

- 1.1** This Specification defines the second generation Radio Frequency Interface (RFI) requirements for high-speed data-over-cable systems. It is based on the ITU-T Recommendation J.122 (equivalent of the DOCSIS 2.0), which is using the same RF channel and is backward compatible with that of the J.112 (DOCSIS 1.0/1.1). The Specification describes the IP Cable Modem (CM) intended for use with interactive cable television services, offering a significant increase in upstream bandwidth capacity with wider channel, higher symbol rate and spectral efficiency. The CM is capable of supporting both synchronous CDMA and advanced TDMA coding with higher order modulation capabilities. This technology employed is more robust with regard to noise immunity, and has greater multi-path protection than that used in the J.112.
- 1.2** Three options for the physical layer technology are included in this Specification, which have equal status but are not required to inter-operate. One technology option is based on the downstream multi-programme television distribution using 6 MHz channelling, and supports upstream transmission in the region of 5 MHz to 42 MHz. The second technology option is based on a multi-programme television distribution using 8 MHz and supports upstream transmission in the region of 5 MHz to 65 MHz. The third technology option is based on 6 MHz channel spacing and supports upstream transmission in the region of 10 MHz to 55 MHz. The first of these options is defined in § 4, 6 and 7, whereas the second and third are defined by replacing the content of those sections with the content of Annex F or Annex J. Comparison with the DOCSIS RFI Specification (SP-RFIV2.0), commonly known as DOCSIS 2.0, is also provided.
- 1.3** The intent is to permit bi-directional transfer of Internet Protocol (IP) traffic between the cable system head-end and the customer premises, over all-coaxial or hybrid fibre-coax (HFC) cable network, shown in a simplified form in Figure 1-1.

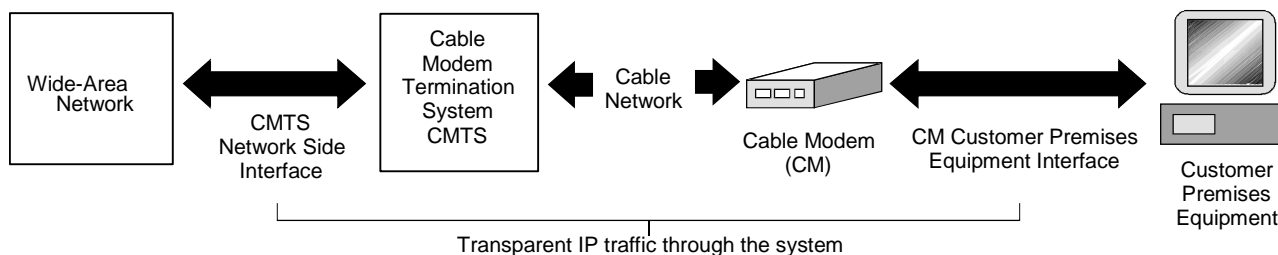


Figure 1-1/ITU-T Rec. J.122:
Transparent IP traffic through the data-over-cable system

2. GENERAL REQUIREMENTS

2.1 Power Supply

The equipment may be a.c. powered or d.c. powered. For an a.c. powered equipment, the Specification shall be complied with when operating from an a.c. mains supply of voltage, $230V \pm 10\%$ and frequency, $50 \text{ Hz} \pm 2\%$. Where external power supply is used, e.g. AC adaptor, it shall not affect the capability of the equipment to meet the Specification.

2.2 Identification of Equipment

The equipment shall be marked with the supplier or manufacturer's name or identification mark, and the supplier or manufacturer's model or type reference. The markings required shall be legible, indelible and readily visible.

2.3 Electrical Safety Requirements

The equipment shall be tested for compliance with the Singapore Standards SS 337¹ or the International Electrotechnical Commission IEC 60950 safety standard. The requirements in SS

¹ The safety standard includes, among others, protection of telecommunications network service personnel and users of other equipment connected to the network from hazards in the PLC equipment.

337/IEC 60950 that are applicable to the equipment (e.g. class of equipment, type of TNV circuit and types of components) shall be identified and complied with.

2.4 Electromagnetic Compatibility (EMC) Requirements

The equipment shall comply with the “EMC requirements for Telecommunication Equipment” (IDA TS EMC).

3. REFERENCES

ITU-T Rec. J.122 (12/2002)	Second generation transmission systems for interactive cable television services – IP cable modems
SP-RFIV2.0-I04-030730	Data-Over-Cable Service Interface Specifications (DOCSIS) – Radio Frequency Interface Specification
IDA TS EMC (Mar 2000)	EMC Requirements for Telecommunication Equipment (http://www.ida.gov.sg under Policy & Regulation)
IEC 60950 1999-04	International Electrotechnical Commission – Safety of Information Technology Equipment
SS 337: 2001	Singapore Standards – Safety of Information Technology Equipment

4. ABBREVIATIONS

ARP	Address Resolution Protocol
A-TDMA	DOCSIS 2.0 TDMA mode (as distinguished from DOCSIS 1.x TDMA)
CM	Cable Modem
CMTS	Cable Modem Termination System
CMTS-NSI	Cable Modem Termination System - Network Side Interface
CMCI	Cable Modem to CPE Interface
CPE	Customer Premises Equipment
DCC	Dynamic Channel Change
DHCP	Dynamic Host Configuration Protocol
HRC	Harmonic Related Carrier
HFC	Hybrid Fibre/Coax System
ICMP	Internet Control Message Protocol
IGMP	Internet Group Management Protocol
IRC	Incremental Related Carriers
IP	Internet Protocol
LLC	Logical Link Control procedure
MAC	Media Access Control procedure
MPEG	Moving Picture Experts Group
PMD	Physical Media Dependent Sublayer
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase-Shift Keying
S-CDMA	Synchronous Code-Division Multiple Access
SNMP	Simple Network Management Protocol
SNAP	Subnetwork Access Protocol

TFTP	Trivial File-Transfer Protocol
TCP	Transmission Control Protocol
TC	Transmission Convergence Sublayer
TDMA	Time-Division Multiple Access
TFTP	Trivial File-Transfer Protocol

NOTE

The following notations are used in the Specification:

- CR Conformance requirement defines features and functions that must be supported at minimum.
- M Mandatory requirement is where the equipment implementation shall conform to those clauses in that section relating to the operation of the equipment.
- O Optional requirement means it is optional whether equipment implements that function but if function is implemented, it shall conform to the clauses in that section relating to the operation of the equipment.
- NA Not Applicable is where the requirements specified in that section on the equipment shall not be applicable for attachment.
- GID The section provides General Information and Definitions.

PART B IP CABLE MODEM SPECIFICATIONS

TABLE 1: SCOPE AND PURPOSE				
TITLE	ITU-T REC J.122	DOCSIS SP RFlv2.0	COMMENTS	CR
SCOPE AND PURPOSE	1	1		GID
Scope	1.1	1.1		GID
Requirements	1.2	1.2		GID
Background	1.3	1.3		GID
Service goals	1.3.1	1.3.1		GID
Reference architecture	1.3.2	1.3.2		GID
Categories of interface specification	1.3.3	1.3.3		GID
Statement of compatibility	1.3.4	1.3.4	Note 1	M
Conventions for this Rec.	1.4	1.4		GID
REFERENCES (Normative & Informative)	2	2		GID
GLOSSARY (Informative)	3	3		GID
<p>Note 1 This document specifies an interface, commonly referred to as DOCSIS 2.0, which is the second generation of the interface specified in [DOCSIS9], [DOCSIS11] and [DOCSIS12], commonly referred to as DOCSIS 1.X. DOCSIS 2.0 must be backward and forward compatible with equipment built to previous Recommendation J.112. DOCSIS 2.0 compliant CM must interoperate seamlessly with DOCSIS 1.X CMTS. DOCSIS 2.0 compliant CMTS must seamlessly support DOCSIS 1.X CM.</p>				

TABLE 2: FUNCTIONAL ASSUMPTIONS				
TITLE	ITU-T REC J.122	DOCSIS SP RFlv2.0	COMMENTS	CR
FUNCTIONAL ASSUMPTIONS	4	4		GID
Broadband access network	4.1	4.1		GID
Equipment assumptions	4.2	4.2	Heading	–
Frequency plan	4.2.1	4.2.1		GID
Compatibility with other services	4.2.2	4.2.2		M
Fault isolation impact on other users	4.2.3	4.2.3		M
Cable System Terminal Devices	4.2.4	4.2.4	The CM MUST meet and SHOULD exceed all applicable regulations for Cable System Terminal Devices and Cable ready Consumer Equipment as defined in FCC Part 15 and Part 76.	M
RF channel assumptions	4.3	4.3		M
Transmission downstream	4.3.1	4.3.1		M
Transmission upstream	4.3.2	4.3.2		M
Availability	4.3.2.1	4.3.2.1	Typically >99%	GID
Transmission Levels	4.4	4.4		M
Frequency Inversion	4.5	4.5		M

TABLE 3: COMMUNICATION PROTOCOLS				
TITLE	ITU-T REC J.122	DOCSIS SP RFIv2.0	COMMENTS	CR
COMMUNICATION PROTOCOLS	5	5		GID
Protocol stack	5.1	5.1		M
CM and CMTS as hosts	5.1.1	5.1.1	The CM MUST function as IP hosts.	M
			The CM MUST support IP and ARP over DIX link-layer framing.	M
			The CM MAY transmit frames that are smaller than the DIX 64 byte minimum on an upstream channel.	O
			The CM MAY also support IP and ARP over SNAP framing.	O
			The CM also MUST function as LLC hosts.	M
			The CM MUST respond appropriately to TEST and XID requests.	M
Data forwarding through the CM and CMTS	5.1.2	5.1.2	Heading	–
General	5.1.2.1	5.1.2.1	Data forwarding through the CM is link-layer transparent bridging as shown in Figure 5.2/ITU-T Rec.122.	M
			Forwarding of IP traffic MUST be supported.	M
			The ability to restrict the network layer to a single protocol such as IP MUST be supported.	M
			The 802.1d spanning tree protocol with the modifications described in Annex E/ITU-T Rec. J.122 may be supported by CMs intended for residential use.	O
			CMs intended for commercial user MUST support the 802.1d spanning tree protocol.	M
			CMs MUST include the ability to filter 802.1d BPDUs.	M
CMTS forwarding rules	5.1.2.2	5.1.2.2		GID
CM forwarding rules	5.1.2.3	5.1.2.3	Data forwarding through the CM is link-layer bridging.	M
CPE MAC address acquisition	5.1.2.3.1	5.1.2.3.1		M
Forwarding	5.1.2.3.2	5.1.2.3.2		M

TABLE 3: COMMUNICATION PROTOCOLS (CONTINUED)				
TITLE	ITU-T REC J.122	DOCSIS SP RFiv2.0	COMMENTS	CR
The MAC Forwarder	5.2	5.2		GID
Rules for data-link layer of forwarding	5.2.1	5.2.1		GID
Network Layer	5.3	5.3		GID
Requirements for IGMP management	5.3.1	5.3.1	Heading	–
CMTS rules	5.3.1.1	5.3.1.1		GID
CM rules	5.3.1.2	5.3.1.2	CM MUST support IGMP following the cable specific rules.	M
Above the Network Layer	5.4	5.4		M
Data Link Layer	5.5	5.5		GID
LLC sublayer	5.5.1	5.5.1		M
Link-layer security sublayer	5.5.2	5.5.2		M
MAC sublayer	5.5.3	5.5.3		GID
Physical Layer	5.6	5.6		GID
Downstream transmission convergence sublayer	5.6.1	5.6.1		GID
PMD sublayer	5.6.2	5.6.2		GID

TABLE 4: PHYSICAL MEDIA DEPENDENT SUBLAYER SPECIFICATION				
TITLE	ITU-T REC J.122	DOCSIS SP RFIV2.0	COMMENTS	CR
PHYSICAL MEDIA DEPENDENT SUBLAYER SPECIFICATION	6	6	Heading	-
Scope	6.1	6.1		GID
Upstream	6.2	6.2	Heading	-
Overview	6.2.1	6.2.1		M
Signal Processing Requirements	6.2.2	6.2.2		M
Modulation Formats	6.2.3	6.2.3		M
R-S Encode	6.2.4	6.2.4		M
R-S Frame Structure	6.2.5	6.2.5		M
TDMA Byte Interleaver	6.2.6	6.2.6		M
Scrambler (Randomizer)	6.2.7	6.2.7		M
TCM Encoder	6.2.8	6.2.8	In the S-CDMA mode, the CM must support TCM.	M
Preamble Prepend	6.2.9	6.2.9		M
Modulation Rates	6.2.10	6.2.10		M
S-CDMA Framing and Interleaver	6.2.11	6.2.11		M
S-CDMA Framing	6.2.12	6.2.12		M
Symbol Mapping	6.2.13	6.2.13		M
S-CDMA Spreader	6.2.14	6.2.14		M
Transmit Pre-Equalizer	6.2.15	6.2.15		M
Spectral Shaping	6.2.16	6.2.16		M
Relative Processing Delays	6.2.17	6.2.17		M
Transmit Power Requirements	6.2.18	6.2.18		M
Burst Profiles	6.2.19	6.2.19		M
Burst Timing Convention	6.2.20	6.2.20		M
Fidelity Requirements	6.2.21	6.2.21		M
Upstream Demodulator Input Power Characteristics	6.2.22	6.2.22		M
Upstream Electrical Output from the CM	6.2.23	6.2.23		M
Downstream	6.3	6.3	Heading	-
Downstream Protocol	6.3.1	6.3.1		M
Scalable Interleaving to Support Low Latency	6.3.2	6.3.2		M
Downstream Frequency Plan	6.3.3	6.3.3		O
CMTS Output Electrical	6.3.4	6.3.4		GID

TABLE 4: PHYSICAL MEDIA DEPENDENT SUBLAYER SPECIFICATION (CONTINUED)				
TITLE	ITU-T REC J.122	DOCSIS SP RFiv2.0	COMMENTS	CR
Downstream Electrical Input to CM	6.3.5	6.3.5		M
CM BER Performance	6.3.6	6.3.6		M
CMTS Timestamp Jitter	6.3.7	6.3.7		GID
CMTS Clock Generation	6.3.8	6.3.8		GID
CMTS Downstream Symbol Clock Jitter for Synchronous Operation	6.3.9	6.3.9		GID
CMTS Downstream Symbol Clock Drift for Synchronous Operation	6.3.10	6.3.10		GID

TABLE 5: DOWNSTREAM TRANSMISSION CONVERGENCE SUBLAYER				
TITLE	ITU-T REC J.122	DOCSIS SP RFiv2.0	COMMENTS	CR
DOWNSTREAM TRANSMISSION CONVERGENCE SUBLAYER	7	7	Heading	–
Introduction	7.1	7.1		GID
MPEG Packet Format	7.2	7.2		M
MPEG Header for DOCSIS Data- Over-Cable	7.3	7.3		M
MPEG Payload for DOCSIS Data- Over-Cable	7.4	7.4		M
Interaction with the MAC Sublayer	7.5	7.5		M
Interaction with the Physical Layer	7.6	7.6		M
MPEG Header Synchronization and Recovery	7.7	7.7		O

TABLE 6: MEDIA ACCESS CONTROL SPECIFICATION				
TITLE	ITU-T REC J.122	DOCSIS SP RFIV2.0	COMMENTS	CR
MEDIA ACCESS CONTROL SPECIFICATION	8	8	Heading	–
Introduction	8.1	8.1	Heading	–
Overview	8.1.1	8.1.1		GID
Definitions	8.1.2	8.1.2	Heading	–
MAC-Sublayer Domain	8.1.2.1	8.1.2.1		GID
MAC Service Access Point	8.1.2.2	8.1.2.2		GID
Service Flows	8.1.2.3	8.1.2.3		M
Upstream Intervals, Mini-Slots and 6.25-Microsecond Increments	8.1.2.4	8.1.2.4		GID
TDMA mode	8.1.2.4.1	8.1.2.4.1		GID
S-CDMA mode	8.1.2.4.2	8.1.2.4.2		GID
MAC Frame	8.1.2.5	8.1.2.5		GID
Logical Upstream Channels	8.1.2.6	8.1.2.6		GID
Future Use	8.1.3	8.1.3		M
MAC Frame Formats	8.2	8.2	Heading	–
Generic MAC Frame Format	8.2.1	8.2.1		GID
PMD Overhead	8.2.1.1	8.2.1.1		GID
MAC Frame Transport	8.2.1.2	8.2.1.2		GID
Ordering of Bits and Octets	8.2.1.3	8.2.1.3		M
Representing Negative Numbers	8.2.1.3.1	8.2.1.3.1		M
Type-Length-Value Fields	8.2.1.3.2	8.2.1.3.2		M
MAC Header Format	8.2.1.4	8.2.1.4		M
Data PDU	8.2.1.5	8.2.1.5	The MAC Header MAY be followed by a Data PDU.	O
			All CMs MUST use the length in the MAC Header to skip over any reserved data.	M
Packet-Based MAC Frames	8.2.2	8.2.2	Heading	–
Variable-Length Packets	8.2.2.1	8.2.2.1		M
ATM Cell MAC Frames	8.2.3	8.2.3		M
Reserved PDU MAC Frames	8.2.4	8.2.4		M
MAC-Specific Headers	8.2.5	8.2.5		GID
Timing Header	8.2.5.1	8.2.5.1		M
MAC Management Header	8.2.5.2	8.2.5.2		M
Request Frame	8.2.5.3	8.2.5.3		M
Fragmentation Header	8.2.5.4	8.2.5.4		M
Concatenation Header	8.2.5.5	8.2.5.5		M

TABLE 6: MEDIA ACCESS CONTROL SPECIFICATION (CONTINUED)				
TITLE	ITU-T REC J.122	DOCSIS SP RFiv2.0	COMMENTS	CR
Extended MAC Headers	8.2.6	8.2.6		M
Piggyback Requests	8.2.6.1	8.2.6.1		O
Fragmentation Extended Header	8.2.6.2	8.2.6.2		M
Service Flow Extended Header	8.2.6.3	8.2.6.3		GID
Payload Header Suppression Header	8.2.6.3.1	8.2.6.3.1		M
Unsolicited Grant Synchronization Header	8.2.6.3.2	8.2.6.3.2		O
Fragmented MAC Frames	8.2.7	8.2.7		M
Considerations for Concatenated Packets and Fragmentation	8.2.7.1	8.2.7.1		M
Error-Handling	8.2.8	8.2.8	For every MAC transmission, The HCS MUST be verified. When a bad HCS is detected, the MAC Header and any payload MUST be dropped.	M
			For Packet PDU transmissions, a bad CRC MAY be detected. Packet PDU MUST be dropped, but any pertinent information in the MAC Header MAY be used.	O
Error Recovery During Fragmentation	8.2.8.1	8.2.8.1		GID
Error Codes and Messages	8.2.8.2	8.2.8.2		M
MAC Management Messages	8.3	8.3	Heading	–
MAC Management Message Header	8.3.1	8.3.1		M
Time Synchronization (SYNC)	8.3.2	8.3.2		M
Upstream Channel Descriptor (UCD)	8.3.3	8.3.3		M
Upstream Bandwidth Allocation Map (MAP)	8.3.4	8.3.4		M
Ranging Request (RNG-REQ)	8.3.5	8.3.5		M
Ranging Response (RNG-RSP)	8.3.6	8.3.6		M
Registration Request (REG-REQ)	8.3.7	8.3.7		M
Registration Response (REG-RSP)	8.3.8	8.3.8		M
Registration Acknowledge (REG-ACK)	8.3.9	8.3.9		M

TABLE 6: MEDIA ACCESS CONTROL SPECIFICATION (CONTINUED)				
TITLE	ITU-T REC J.122	DOCSIS SP RFiv2.0	COMMENTS	CR
Upstream Channel Change Request (UCC-REQ)	8.3.10	8.3.10	May be transmitted by CMTS	GID
Upstream Channel Change Response (UCC-RSP)	8.3.11	8.3.11		M
Dynamic Service Addition – Request (DSA-REQ)	8.3.12	8.3.12		O
Dynamic Service Addition – Response (DSA-RSP)	8.3.13	8.3.13		M
Dynamic Service Addition – Acknowledge (DSA-ACK)	8.3.14	8.3.14		M
Dynamic Service Change – Request (DSC-REQ)	8.3.15	8.3.15		O
Dynamic Service Change – Response (DSC-RSP)	8.3.16	8.3.16		M
Dynamic Service Change – Acknowledge (DSC-ACK)	8.3.17	8.3.17		M
Dynamic Service Deletion – Request (DSD-REQ)	8.3.18	8.3.18		O
Dynamic Service Deletion – Request (DSD-RSP)	8.3.19	8.3.19		M
Dynamic Channel Change – Request (DCC-REQ)	8.3.20	8.3.20		GID
Dynamic Channel Change – Response (DCC-RSP)	8.3.21	8.3.21		O
Dynamic Channel Change – Acknowledge (DCC-ACK)	8.3.22	8.3.22		GID
Device Class Identification Request (DCI-REQ)	8.3.23	8.3.23		O
Device Class Identification Response (DCI-RSP)	8.3.24	8.3.24	Transmitted by CMTS in response to a received DCI-REQ.	GID
Upstream Transmitter Disable (UP-DIS) MAC Management Message	8.3.25	8.3.25		O
Initial Ranging Request (INIT-RNG-REQ)	8.3.26	8.3.26		M
Test Request (TST-REQ)	–	8.3.27		–

TABLE 7: MEDIA ACCESS CONTROL PROTOCOL OPERATION				
TITLE	ITU-T REC J.122	DOCSIS SP RFIV2.0	COMMENTS	CR
MEDIA ACCESS CONTROL PROTOCOL OPERATION	9	9	Heading	–
Upstream Bandwidth Allocation	9.1	9.1	The CM MUST time its transmission so that the CMTS receives it in the time reference specified.	M
			CMTS MAY issue requests to the CMTS for upstream bandwidth.	O
The Allocation Map MAC Management Message	9.1.1	9.1.1		GID
Information Elements	9.1.2	9.1.2		M
The Request IE	9.1.2.1	9.1.2.1		M
The Request/Data IE	9.1.2.2	9.1.2.2		M
The Initial Maintenance IE	9.1.2.3	9.1.2.3		M
The Station Maintenance IE	9.1.2.4	9.1.2.4		M
Short and Long Data Grant IEs	9.1.2.5	9.1.2.5		M
Data Acknowledge IE	9.1.2.6	9.1.2.6		M
Expansion IE	9.1.2.7	9.1.2.7		M
Null IE	9.1.2.8	9.1.2.8		M
Advanced PHY Short and Long Data Grant IEs	9.1.2.9	9.1.2.9		M
Advanced PHY Unsolicited Grant IE	9.1.2.10	9.1.2.10		M
Requests	9.1.3	9.1.3		M
Information Element Feature Usage Summary	9.1.4	9.1.4		GID
Map Transmission and Timing	9.1.5	9.1.5		M
Protocol Example	9.1.6	9.1.6		M
MAP Generation Example - Two Logical Upstreams	9.1.7	9.1.7		M
Support for Multiple Channels	9.2	9.2	Vendors MAY choose to offer various combinations of upstream and downstream channels within one MAC service access point	O

TABLE 7: MEDIA ACCESS CONTROL PROTOCOL OPERATION (CONTINUED)				
TITLE	ITU-T REC J.122	DOCSIS SP RFIV2.0	COMMENTS	CR
Timing and Synchronisation	9.3	9.3		GID
Global Timing Reference	9.3.1	9.3.1		M
CM Channel Acquisition	9.3.2	9.3.2		M
Ranging	9.3.3	9.3.3		M
Timing Units and Relationships	9.3.4	9.3.4		GID
Upstream Transmission and Contention Resolution	9.4	9.4		GID
Contention Resolution Overview	9.4.1	9.4.1		M
Transmit Opportunities	9.4.2	9.4.2		M
CM Bandwidth Utilization	9.4.3	9.4.3		M
Data Link Encryption Support	9.5	9.5		GID
MAC Messages	9.5.1	9.5.1		M
Framing	9.5.2	9.5.2		M

TABLE 8: QUALITY OF SERVICE & FRAGMENTATION				
TITLE	ITU-T REC J.122	DOCSIS SP RFIv2.0	COMMENTS	CR
Quality of Service & Fragmentation	10	10		GID
Theory of Operation	10.1	10.1		GID
Concepts	10.1.1	10.1.1	Heading	–
Service Flows	10.1.1.1	10.1.1.1		GID
Classifiers	10.1.1.2	10.1.1.2		GID
Object Model	10.1.2	10.1.2		GID
Service Classes	10.1.3	10.1.3		GID
Authorization	10.1.4	10.1.4		GID
Types of Service Flows	10.1.5	10.1.5		GID
Provisioned Service Flows	10.1.5.1	10.1.5.1		GID
Admitted Service Flows	10.1.5.2	10.1.5.2		GID
Active Service Flows	10.1.5.3	10.1.5.3		GID
Service Flows and Classifiers	10.1.6	10.1.6		GID
Policy-Based Classification and Service Classes	10.1.6.1	10.1.6.1		GID
General Operation	10.1.7	10.1.7	Heading	–
Static Operation	10.1.7.1	10.1.7.1		GID
Dynamic Service Flow Creation – CM initiated	10.1.7.2	10.1.7.2		GID
Dynamic Service Flow Creation – CMTS initiated	10.1.7.3	10.1.7.3		GID
Dynamic Service Flow Modification and Deletion	10.1.7.4	10.1.7.4		GID
Upstream Service Flow Scheduling Services	10.2	10.2		GID
Unsolicited Grant Service	10.2.1	10.2.1		M
Real-Time Polling Service	10.2.2	10.2.2		M
Unsolicited Grant Service with Activity Detection	10.2.3	10.2.3		M
Non-Real-Time Poling Service	10.2.4	10.2.4		M
Best Effort Service	10.2.5	10.2.5		
Other Services	10.2.6	10.2.6	Heading	–
Committed Information Rate	10.2.6.1	10.2.6.1		M
Parameter Applicability for Upstream Service Scheduling	10.2.7	10.2.7		M
CM Transmit Behaviour	10.2.8	10.2.8		M

TABLE 8: QUALITY OF SERVICE & FRAGMENTATION (CONTINUED)				
TITLE	ITU-T REC J.122	DOCSIS SP RFIV2.0	COMMENTS	CR
Fragmentation	10.3	10.3		GID
CM Fragmentation Support	10.3.1	10.3.1		M
Fragmentation Rules	10.3.1.1	10.3.1.1		M
CMTS Fragmentation Support	10.3.2	10.3.2		GID
Multiple Grant Mode	10.3.2.1	10.3.2.1		GID
Piggyback Mode	10.3.2.2	10.3.2.2		GID
Fragmentation Example	10.3.3	10.3.3	Heading	–
Single Packet Fragmentation	10.3.3.1	10.3.3.1		M
Concatenated Packet Fragmentation	10.3.3.2	10.3.3.2		M
Payload Header Suppression	10.4	10.4		GID
Overview	10.4.1	10.4.1		GID
Example Applications	10.4.2	10.4.2		GID
Operation	10.4.3	10.4.3		GID
Signalling	10.4.4	10.4.4		GID
Payload Header Suppression Examples	10.4.5	10.4.5	Heading	–
Upstream Example	10.4.5.1	10.4.5.1		GID
Downstream Example	10.4.5.2	10.4.5.2		GID

TABLE 9: CABLE MODEM - CMTS INTERACTION				
TITLE	ITU-T REC J.122	DOCSIS SP RFIv2.0	COMMENTS	CR
Cable Modem – CMTS Interaction	11	11		GID
CMTS Initialization	11.1	11.1		GID
Cable Modem Initialization	11.2	11.2		M
Scanning and Synchronisation to Downstream	11.2.1	11.2.1		M
Obtain Upstream Parameters	11.2.2	11.2.2		M
Message Flows During Scanning and Upstream Parameter Acquisition	11.2.3	11.2.3	These messages are addressed to all CMs.	M
Ranging and Automatic Adjustments	11.2.4	11.2.4		M
Ranging Parameter Adjustment	11.2.4.1	11.2.4.1		M
Device Class identification	11.2.5	11.2.5		O
Establish IP Connectivity	11.2.6	11.2.6		M
Establish Time of Day	11.2.7	11.2.7		M
Transfer Operational Parameters	11.2.8	11.2.8		M
Registration	11.2.9	11.2.9		M
Baseline Privacy Initialisation	11.2.10	11.2.10		M
Service IDs During CM Initialization	11.2.11	11.2.11		M
Multiple-Channel Support	11.2.12	11.2.12		M
Standard Operation	11.3	11.3	Heading	–
Periodic Signal Level Adjustment	11.3.1	11.3.1		M
Changing Upstream Burst Parameters	11.3.2	11.3.2		M
Changing Upstream Channels	11.3.3	11.3.3		M
Dynamic Service	11.4	11.4		O
Dynamic Service Flow State Transitions	11.4.1	11.4.1		GID
Dynamic Service Addition	11.4.2	11.4.2	Heading	–
CM Initiated Dynamic Service Addition	11.4.2.1	11.4.2.1		O
CMTS Initiated Dynamic Service Addition	11.4.2.2	11.4.2.2		GID
Dynamic Service Addition State Transition Diagrams	11.4.2.3	11.4.2.3		GID

TABLE 9 : CABLE MODEM - CMTS INTERACTION (CONTINUED)				
TITLE	ITU-T REC J.122	DOCSIS SP RFiv2.0	COMMENTS	CR
Dynamic Service Change	11.4.3	11.4.3		O
CM Initiated Dynamic Service Change	11.4.3.1	11.4.3.1		GID
CMTS Initiated Dynamic Service Change	11.4.3.2	11.4.3.2		GID
Dynamic Service Change State Transition Diagrams	11.4.3.3	11.4.3.3		GID
Dynamic Service Deletion	11.4.4	11.4.4		O
CM Initiated Dynamic Service Deletion	11.4.4.1	11.4.4.1		GID
CMTS Initiated Dynamic Service Deletion	11.4.4.2	11.4.4.2		GID
Dynamic Service Deletion State Transition Diagrams	11.4.4.3	11.4.4.3		GID
Dynamically Changing Downstream and/or Upstream Channels	11.4.5	11.4.5	Heading	–
DCC General Operation	11.4.5.1	11.4.5.1		GID
DCC Exception Conditions	11.4.5.2	11.4.5.2		GID
Near-Seamless Channel Change	11.4.5.3	11.4.5.3		GID
Example Operation	11.4.5.4	11.4.5.4		GID
Fault Detection and Recovery	11.5	11.5		M
Prevention of Unauthorised Transmissions	11.5.1	11.5.1		M

TABLE 10: SUPPORTING FUTURE NEW CABLE MODEM CAPABILITIES				
TITLE	ITU-T REC J.122	DOCSIS SP RFiv2.0	COMMENTS	CR
Supporting Future New Cable Modem Capabilities	12	12	Heading	–
Downloading Cable Modem Operating Software	12.1	12.1		M

ANNEXES & APPENDICES				
TITLE	ITU-T REC J.122	DOCSIS SP RFIV2.0	COMMENTS	CR
Well-known Addresses	Annex A	Annex A	Heading	–
MAC Addresses	A.1	A.1		M
MAC Service IDs	A.2	A.2		M
MPEG PID	A.3	A.3		M
Parameters and Constants	Annex B	Annex B	Parameters and constants defined for the CM MUST be implemented.	M
Common Radio Frequency Interface Encoding	Annex C	Annex C		GID
Encoding for Configuration and MAC-Layer Messaging	C.1	C.1	The following configuration settings MUST be supported by all CMs which are compliant with this specification.	M
Configuration File and Registration Settings	C.1.1	C.1.1	These settings are found in the configuration file and if present, MUST be forwarded by the CM to the CMTS in the Registration Request.	M
Downstream Frequency Configuration Setting	C.1.1.1	C.1.1.1		M
Upstream Frequency Configuration Setting	C.1.1.2	C.1.1.2		M
Network Access Control Object	C.1.1.3	C.1.1.3		M
DOCSIS 1.0 Class of Service Configuration Setting	C.1.1.4	C.1.1.4		M
CM Message Integrity Check (MIC) Configuration Setting	C.1.1.5	C.1.1.5		M
CMTS Message Integrity Check (MIC) Configuration Setting	C.1.1.6	C.1.1.6		M
Maximum Number of CPEs	C.1.1.7	C.1.1.7		M
TFTP Server Timestamp	C.1.1.8	C.1.1.8		M
TFTP Server Provisioned Modem Address	C.1.1.9	C.1.1.9		M
Upstream Packet Classification Configuration Setting	C.1.1.10	C.1.1.10		M
Downstream Packet Classification Configuration Setting	C.1.1.11	C.1.1.11		M
Upstream Service Flows Encoding	C.1.1.12	C.1.1.12		M
Downstream Service Flows Encoding	C.1.1.13	C.1.1.13		M
Payload Header Suppression	C.1.1.14	C.1.1.14		M
Maximum Number of Classifiers	C.1.1.15	C.1.1.15		M

ANNEXES & APPENDICES (CONTINUED)				
TITLE	ITU-T REC J.122	DOCSIS SP RFIV2.0	COMMENTS	CR
Privacy Enable	C.1.1.16	C.1.1.16		M
Vendor-Specific Information	C.1.1.17	C.1.1.17		M
Subscriber Management TLVs	C.1.1.18	C.1.1.18		M
Enable 2.0 Mode	C.1.1.19	C.1.1.19		M
Enable Test Modes	C.1.1.20	C.1.1.20		M
Configuration-File-Specific Settings	C.1.2	C.1.2		M
End-of-Data Marker	C.1.2.1	C.1.2.1		M
Pad Configuration Setting	C.1.2.2	C.1.2.2		M
Software Upgrade Filename	C.1.2.3	C.1.2.3		M
SNMP Write-Access Control	C.1.2.4	C.1.2.4		M
SNMP MIB Object	C.1.2.5	C.1.2.5		M
CPE Ethernet MAC Address	C.1.2.6	C.1.2.6		M
Software Upgrade TFTP Server	C.1.2.7	C.1.2.7		M
SNMPV3 Kickstart Value	C.1.2.8	C.1.2.8		M
Manufacturer Code Verification Certificate	C.1.2.9	C.1.2.9		M
Co-signer Code Verification Certificate	C.1.2.10	C.1.2.10		M
SNMPv3 Notification Receiver	C.1.2.10	C.1.2.10		M
Registration-Request/Response- Specific Encoding	C.1.3	C.1.3	These encodings are not found in the configuration file, but are included in the Registration Request. The CM MUST include Modem Capabilities Encoding in its Registration Request.	M
Modem Capabilities Encoding	C.1.3.1	C.1.3.1		M
Vendor ID Encoding	C.1.3.2	C.1.3.2		M
Modem IP Address	C.1.3.3	C.1.3.3		M
Service(s) Not Available Response	C.1.3.4	C.1.3.4		M
Vendor-Specific Capabilities	C.1.3.5	C.1.3.5		M
Dynamic-Service-Message- Specific Encoding	C.1.4	C.1.4		M
HMAC-Digest	C.1.4.1	C.1.4.1		M
Authorization Block	C.1.4.2	C.1.4.2		M
Key Sequence Number	C.1.4.3	C.1.4.3		M

ANNEXES & APPENDICES (CONTINUED)				
TITLE	ITU-T REC J.122	DOCSIS SP RFiv2.0	COMMENTS	CR
Quality-of-Service-Related Encoding	C.2	C.2	Heading	–
Packet Classification Encoding	C.2.1	C.2.1		M
Upstream Packet Classification Encoding	C.2.1.1	C.2.1.1		M
Downstream Packet Classification Encoding	C.2.1.2	C.2.1.2		M
General Packet Classifier Encoding	C.2.1.3	C.2.1.3		M
Classifier Error Encoding	C.2.1.4	C.2.1.4		M
Ethernet LLC Packet Classification Encoding	C.2.1.6	C.2.1.6		M
IEEE 802.1P/Q Packet Classification Encoding	C.2.1.7	C.2.1.7		M
Service Flow Encoding	C.2.2	C.2.2		M
Upstream Service Flow Encoding	C.2.2.1	C.2.2.1		M
Downstream Service Flow Encoding	C.2.2.2	C.2.2.2		M
General Service Flow Encoding	C.2.2.3	C.2.2.3		M
Service Flow Error Encoding	C.2.2.4	C.2.2.4		M
Common Upstream and Downstream Quality-of-Service Parameter Encoding	C.2.2.5	C.2.2.5		M
Upstream-Specific QoS Parameter Encoding	C.2.2.6	C.2.2.6		M
Downstream-Specific QoS Parameter Encoding	C.2.2.7	C.2.2.7		M
Payload Header Suppression	C.2.2.8	C.2.2.8		M
Payload Header Suppression Error Encoding	C.2.2.9	C.2.2.9		M
Payload Header Suppression Rule Encoding	C.2.2.10	C.2.2.10		M
Encoding for Other Interfaces	C.3	C.3	Heading	–
Telephone Settings Option	C.3.1	C.3.1		O
Baseline Privacy Configuration Settings Option	C.3.2	C.3.2		O

ANNEXES & APPENDICES (CONTINUED)				
TITLE	ITU-T REC J.122	DOCSIS SP RFiv2.0	COMMENTS	CR
Confirmation Codes	C.4	C.4		M
Confirmation Codes for Dynamic Channel Change	C.4.1	C.4.1		GID
Confirmation Codes for Major Errors	C.4.2	C.4.2		GID
CM Configuration Interface Specification	Annex D	Annex D	Heading	–
CM IP Addressing	D.1	D.1	Heading	–
DHCP Fields used by the CM	D.1.1	D.1.1		M
CM Configuration	D.2	D.2	Heading	–
CM Binary Configuration File Format	D.2.1	D.2.1		M
Configuration File Settings	D.2.2	D.2.2	The following configuration settings MUST be supported by all CMs:	M
			<ul style="list-style-type: none"> – Downstream Frequency Configuration Setting – Upstream Channel ID Configuration Setting – Network Access Configuration Setting – End Configuration Setting – Maximum Number of CPEs 	
			The rest of the configuration settings are optional. Except for the “Telephone Settings Option” and “Vendor-Specific Configuration Settings”, a configuration setting must be supported if it is present in the configuration file.	O
Configuration File Creation	D.2.3	D.2.3		M
CM MIC Calculation	D.2.3.1	D.2.3.1		M
Configuration Verification	D.3	D.3		GID
CMTS MIC Calculation	D.3.1	D.3.1		M

ANNEXES & APPENDICES (CONTINUED)				
TITLE	ITU-T REC J.122	DOCSIS SP RFIV2.0	COMMENTS	CR
The Data-Over-Cable Spanning Tree Protocol	Annex E	Annex E		M
European Specification Additions	Annex F	Annex F	Note 1	O
DOCSIS 2.0 and 1.0/1.1 Interoperability	Annex G	Annex G	Heading (Note 2)	M
General Interoperability Issues	G.1	G.1		GID
Provisioning	G.1.1	G.1.1		M
Registration	G.1.2	G.1.2		GID
Dynamic Service Establishment	G.1.3	G.1.3		GID
Fragmentation	G.1.4	G.1.4		GID
Multicast Support	G.1.5	G.1.5		M
Upstream Channel Change	G.1.6	G.1.6		GID
Hybrid Devices	G.2	G.2		GID
DOCS 2.0 TDMA Interoperability	G.3	G.3		M
DOCS 2.0 S-CDMA Interoperability	G.4	G.4		M
The DOCS MAC/PHY Interface (DMPI)	Annex H	Annex H		O
(Set aside)	Annex I	Annex I		–
Japan Specification Additions	Annex J	–	Note 1	O
MAC Service Definition	Appendix I	Appendix I		GID
Example Preamble Sequence	Appendix II	Appendix II		GID
Multiple Upstream Channel	Appendix III	Appendix III		GID
DOCS Transmission and Contention Resolution	Appendix IV	Appendix IV		GID
IGMP Example	Appendix V	Appendix V		M
Unsolicited Grant Services	Appendix VI	Appendix VI		M
S-CDMA Framing	Appendix VII	Appendix VII		GID
Ambient Temperature and Wind Loading Effects	Appendix VIII	Appendix VIII		GID
Bibliography	Appendix IX	Appendix IX		GID
<p>Note 1 This Annex applies to another technology option, and describes the physical layer specifications required for the European/Japanese cable modems. Requirements are "M" if the technology option is selected.</p> <p>Note 2 It is necessary for a DOCS 2.0 CM to function like a 1.0 CM when interoperating with a 1.0 CMTS and to function like a 1.1 CM when interoperating with a 1.1 CMTS.</p>				